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Operation and Maintenance Report January 2008 to December 2008 McCormick and Baxter Superfund Site Portland, Oregon

Prepared for Oregon Department of Environmental Quality

May 22, 2009
15670-03/Task 9

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GSI Water Solutions, Inc.

HARTCROWSER

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ACRONYMS

ACB	Articulated Concrete Block
ACLs	Alternate Concentration Limits
AWQC	Ambient Water Quality Criteria
BES	Bureau of Environmental Services
BNRB	Burlington Northern Railroad Bridge
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
Clearwater	Clearwater Environmental Services, Inc
COC	Contaminant of Concern
cPAHs	Carcinogenic Polynuclear Aromatic Hydrocarbons
DEQ	Oregon Department of Environmental Quality
DHS	Oregon Department of Human Services
DNAPL	dense non-aqueous phase liquid
DQO	data quality objectives
E&E	Ecology and Environment, Inc.
EPA	United States Environmental Protection Agency
FWDA	Former Waste Disposal Area
GPS	geographic positioning system
GSI	GSI Water Solutions, Inc.
IGA	Intergovernmental Agreement
LNAPL	light non-aqueous phase liquid
LWG	Lower Willamette Group
McCormick & Baxter	McCormick & Baxter Creosoting Company
MCL	Primary Drinking Water Standard Maximum Contaminant Level
MDL	method detection limit
NAPL	non-aqueous phase liquid
NAVD	North American Vertical Datum
NOAA Fisheries	National Oceanic and Atmospheric Marine Fisheries Service
NPDWR	National Primary Drinking Water Regulations
NPL	National Priorities List

ACRONYMS (CONTINUED)

NRWQC	National Recommended Water Quality Criteria
O&M	Operation and Maintenance
PCDD/Fs	polychlorodibenzo-p-dioxin/furans
PAHs	polynuclear aromatic hydrocarbons
PCP	pentachlorophenol
PSU	Portland State University
RCM	reactive core mat
ROD	Record of Decision
Site	McCormick & Baxter Creosoting Company Site
SPME	solid phase micro-extraction
TCDD TEQ	2,3,7,8-Tetrachlorodibenzo-p-dioxin toxic equivalency quotient
TDS	total dissolved solids
TFA	Tank Farm Area
UCL	upper confidence limit
UP	University of Portland
UT	University of Texas
WC	Willamette Cove

OPERATION AND MAINTENANCE REPORT
JANUARY 2008 TO DECEMBER 2008
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 and Baxter Superfund Site (Site), located in Portland, Multnomah County, Oregon, between January 1, 2008, and December 31, 2008. The location of the Site is shown on Figure 1. Figure 2 presents the Site layout and features and Figure 3 presents the Site layout with surface elevations. Figure 4 presents historical Non-Aqueous Phase Liquid (NAPL) distribution, Figure 5 presents current Site use restrictions, and Figure 6 presents historical contaminant areas. This report has been prepared by DEQ's contractor team, Hart Crowser and GSI Water Solutions, Inc. (GSI).

The DEQ is conducting O&M activities according to the October 2007 Draft O&M Plan prepared by the DEQ (DEQ, 2007). The October 2007 Draft 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/GSI, 2008) specifies the sampling and monitoring procedures, quality assurance and quality control, technical information, and data necessary for implementing O&M activities.

This O&M Report documents the operation, monitoring, and maintenance activities that occurred in 2008. The O&M performance standards and activities are provided in Section 2; the non-sampling O&M activities are summarized in Section 3; and the O&M sampling activities are summarized in Section 4. Section 4.4 summarizes the preliminary results of the ebullition and sheen investigation and Section 5 discusses planned activities for 2009. Detailed presentations of these O&M activities are provided in the following appendices:

Appendix A is the Groundwater and NAPL Assessment;

Appendix B is the Site Observation and Activity Summary;

Appendix C is the Vegetation Survival Assessment;

Appendix D is the Surface, Inter-armoring, and Sub-armoring Water Assessment;

Appendix E is the Infiltration Pond MW-59s Groundwater Quality Assessment;

Appendix F is the Crawfish Sampling Assessment;

Appendix G is the Ebullition and Sheen Investigation Summary; and

Appendix H is the Updated Site-Wide Record Drawings.

The O&M Report has been provided to the DEQ in hard copy and in electronic format on digital video disc (DVD). It should be noted that the DVD contains material not provided in the hard copy report including: full laboratory analytical reports, statistical analysis, and diver video images from sampling efforts.

O&M activities were implemented primarily by DEQ's contractor, Hart Crowser, and their teaming partner GSI Water Solutions (under subcontract to Hart Crowser). Hart Crowser also used the following subcontractors for support of site activities including Clearwater Environmental Services, Inc (Clearwater) for routine operation, monitoring, and maintenance activities including NAPL gauging and extraction, site inspections, and Ebullition and Sheen Investigation assistance; OTAK, Inc. for Site surveying; and Global Diving, Inc. and Northwest Underwater Construction, LLC, for surface water/inter-armoring/sub-armoring sampling support. The DEQ also maintained intergovernmental agreements with the City of Portland for vegetation planting and maintenance and Portland State University for biodegradation studies, as well as an interstate agreement with the University of Texas for performance studies on organoclay and specialized porewater sampling.

Key personnel for implementation of O&M activities included:

Scott Manzano: Oregon DEQ Project Officer;

Steve Campbell: Oregon DEQ Contract Officer;

Rick Ernst: Hart Crowser Program Manager;

Heidi Blischke: GSI Technical Manager; and

Tim Skrotzki: Hart Crowser Site Manager.

2.0 OPERATION AND MAINTENANCE PERFORMANCE STANDARDS AND ACTIVITIES

As discussed in Section 1, the DEQ is conducting O&M activities according to a Draft O&M Plan prepared by the DEQ. Performance standards and activities of the October 2007 Draft O&M Plan (DEQ, 2007) are described below.

2.1 Soil Remedy

The soil remedy has been fully implemented since September 2005 and consists of removing highly contaminated soils and capping the entire upland portion of the site. Soils beneath the soil cap remain contaminated with arsenic, pentachlorophenol (PCP), polynuclear aromatic hydrocarbons (PAHs), dioxins, and NAPL, thereby requiring the need for long-term monitoring and maintenance. The performance standards for the soil cap, determined in the Record of Decision and specified in the October 2007 Draft O&M Plan, are as follows:

- Maintain contaminant concentrations in surface soil below the following risk-based clean-up 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 (cPAHs) - 1 mg/kg; and
  - Dioxins/furans - 0.00004 mg/kg.
- Maintain the topsoil layer to within 50 percent of its design specification:
  - Area over impermeable geomembrane cap - maintain thickness of at least 6 inches; and
  - All areas except over impermeable geomembrane cap - maintain thickness of at least 12 inches.
- Minimize infiltration of rainwater within the subsurface barrier wall by maintaining a subsurface stormwater conveyance system.
- Minimize stormwater erosion and surface water ponding 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 (NOAA, 2004).

Monitoring activities for the soil cap (including the riparian zone) include visual inspections of the cap surface, stormwater conveyance system, security fencing, and warning signs. The soil cap is designed to be generally maintenance free, except for maintaining the native vegetation. Routine maintenance includes irrigation of native vegetation through summer of 2009, manual removal of invasive plants, and targeted application of herbicides. Non-routine maintenance may include repairs of the fence, replacement of warning signs, repairs of the gravel roads, filling of potential animal burrows, removal of sediment from manholes and replanting of unsuccessful trees and shrubs. The

frequency of these O&M activities over the first five years of O&M is provided in Table 1.

2.2 Sediment Remedy

The sediment remedy has been fully implemented since 2005 and consists of capping 23 acres of contaminated sediments within the Willamette River. Sediments beneath the sediment cap remain contaminated with arsenic, PCP, PAHs, dioxins, and NAPL, thereby requiring the need for long-term monitoring and maintenance. The performance standards for the sediment cap, determined in the ROD and specified in the October 2007 Draft O&M Plan, are as follows:

- Maintain contaminant concentrations in surface sediments 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;
  - cPAHs - 2 mg/kg, dry weight;
  - Dioxins/furans - 8×10^{-3} mg/kg, dry weight; and
  - Protection of benthic organisms based on sediment bioassay tests, resulting in impaired survival and growth (i.e., weight).
- Prevent visible discharge of creosote to the Willamette River.
- Minimize releases of contaminants 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;

[1] One of the Remedial Action Objectives for groundwater in the ROD is to "prevent groundwater discharges to the Willamette River that contain dissolved contaminants that would result in contaminant concentrations within the river in excess of background concentrations or in excess of water quality criteria for aquatic organisms. The 1996 AWQCs are listed as those were the criteria at the time of the ROD.

- Total Carcinogenic PAHs - 0.031 µg/l; and
- Dioxins/furans - 1×10^{-5} nanograms per liter.

- Maintain the armoring layer to within 50 percent of the design specification:
  - 6-inch rock armoring - maintain thickness of at least 6 inches.
  - 12-inch rock armoring - maintain thickness of at least 7.5 inches.
  - 24-inch rock armoring - maintain thickness of at least 12 inches.
- Maintain uniformity and continuity of articulated concrete block armoring.
- Maintain at least 20 percent excess sorption capacity of the organoclay cap.

The AWQC values listed above are those values in effect at the time of the ROD (EPA 1996); however, since completion of the ROD, the AWQC values have been updated. During meetings in August 2007 between stakeholders (DEQ, EPA, NOAA, Warm Springs Tribe, and Yakama Tribe), it was agreed that for comparison purposes, five benchmarks would be included in analytical results summary tables in this 2008 O&M Report: (1) two AWQCs in effect at the time the ROD was issued (1996 criteria for chronic effects to aquatic life and for human health based on fish consumption); (2) two current 2007 National Recommended Water Quality Criteria (NRWQCs) [one for chronic effects to aquatic life and one for human health (consumption of organisms)]; and (3) current Maximum Contaminant Levels (MCLs). Although these benchmarks have been included in this 2008 O&M Report for comparison purposes, the 1996 AWQC values are the regulatory criteria for the Site unless the ROD is amended.

Monitoring activities for the sediment cap include visual inspections of near shore areas and may include aerial photography of the shoreline during extreme low river stages (late September or early October), multi-beam bathymetric surveys and side-scan sonar surveys of deeper areas, and diver inspections of areas of concern identified from the bathymetry and sonar surveys. Monitoring activities also include collection of samples from surface water, inter-armoring water, sub-armoring water, organoclay cores, and crayfish. Organoclay cores were collected in 2006 and again in 2008. It is not expected that they will be collected again in 2010 as described in the October 2007 Draft O&M Plan. Although the sediment cap is designed to be generally maintenance free, unplanned or non-routine maintenance may include: the replacement of warning buoys, placement of additional armoring due to erosion, and placement of additional organoclay if new releases of creosote are discovered or if the existing organoclay becomes saturated with creosote. The frequency of these O&M activities over the first five years of O&M is provided in Table 2.

2.3 Groundwater Remedy

The Groundwater remedy has been fully implemented since October 2003 and consists of NAPL recovery and a subsurface barrier wall. Groundwater both within and outside of the subsurface barrier wall remains contaminated with metals, PCP, PAHs, dioxins, and NAPL, thereby requiring the need for long-term monitoring and maintenance. The performance standards for the subsurface barrier wall and NAPL recovery are as follows.

- Continue to recover NAPL from outside the subsurface barrier wall until recovery rates become minimal, alternative pumping strategies have been examined and/or field tested with poor results, and remaining NAPL does not pose a threat to the Willamette River and its sediments.
- Maintain contaminant concentrations in shallow, downgradient compliance wells (or sediment pore water) below Alternate Concentration Limits (ACLs) set forth in the ROD[2]:
  - Arsenic (III) - 1,000 µg/l;
  - Chromium (III) - 1,000 µg/l;
  - Copper -1,000 µg/l;
  - Zinc - 1,000 µg/l;
  - Pentachlorophenol - 5,000 µg/l;
  - Total PAHs - 43,000 µg/L: and
  - Dioxins/furans - 0.2 ng/L.
- For reference purposes, groundwater data is compared with current Primary Drinking Water MCLs:
  - Arsenic - 0.01 mg/L;
  - Chromium - 0.1 mg/L;
  - Copper - 1.30 mg/L
  - Zonc - 5.00 mg/L;
  - Pentachlorophenol - 1 µg/L; and

[2] The ROD initially specified site-specific ACLs for the Site. EPA has determined that ACLs are not valid as substitutes for Primary Drinking Water Standard Maximum Contaminant Levels (MCLs) in groundwater. Invalidation of ACLs also affects whether the groundwater RAOs derived from the provisions in CERCLA for using ACLs remain valid for the Site. As a result of this determination, the DEQ and EPA anticipate that: 1) groundwater standards for the Site will be established following a rigorous analysis of Site conditions and all relevant data; and 2) (assuming MCLs cannot be met) the application of a waiver pursuant to Section 122(d)(4) of CERCLA for MCLs to comply with the threshold criterion (meeting ARARs) for all remedies implemented pursuant to any final CERCLA ROD. Issues associated with use of ACLs at this Site are further discussed in Section VIII and IX of the Second Five-Year Review Report.

- Benzo (a) pyrene - 0.2 µg/L.

- Minimize the transport of NAPL and communication of groundwater zones across the subsurface barrier wall.
- Minimize further vertical migration of creosote to the deep groundwater aquifer.
- 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.

Monitoring activities for the groundwater remedy include groundwater elevation monitoring and groundwater sampling. Routine maintenance of equipment and providing for Site utility service are also included as elements of groundwater O&M. The frequency of these O&M activities through September 30, 2011, is provided in Table 3.

3.0 NON-SAMPLING OPERATION AND MAINTENANCE ACTIVITIES SUMMARY

As discussed in Section 1, the DEQ is conducting O&M activities according to a Draft O&M Plan prepared by DEQ. Performance standards and activities of the October 2007 Draft O&M Plan (DEQ, 2007) are described below. More detailed presentations of the non-sampling O&M activities are provided in the following appendices:

- Appendix A is the Groundwater and NAPL Assessment;
- Appendix B is the Site Observation and Activity Summary; and
- Appendix C is the Vegetation Survival Assessment

3.1 NAPL Recovery and Thickness Assessment

To assess the performance of the barrier wall and soil cap, periodic well gauging, NAPL measurement, and NAPL extraction were performed. During the reporting period (January 1, 2008 through December 31, 2008), NAPL was monitored weekly in eight Site wells and quarterly in the remaining wells on site. Extraction was performed only in wells located outside the barrier wall that contained sufficient NAPL to warrant extraction.

Light non-aqueous phase liquids (LNAPL) was detected in seven wells during the reporting period (MW-Ds, EW-9s, EW-10s, EW-15s, EW-18s, EW-23s, and MW-56s). Four of the seven wells (EW-15s, EW-18s, EW-23s, and MW-56s) are located within the barrier wall; therefore, no LNAPL was extracted from these wells. Well MW-56 showed an increase in LNAPL thickness post barrier wall installation, but has stabilized in thickness the past 2 years. The other three wells within the barrier wall that contain LNAPL have remained stable in LNAPL thickness over the same period of time.

Outside the barrier wall, a trace (0.01 foot) of LNAPL was detected in wells EW-9s and MW-Ds during one measuring event on March 25, 2008. LNAPL has also been measured between 0.01 and 3.04 feet in well EW-10s. However, when extraction was attempted, no LNAPL was present in the bailer; and therefore, no LNAPL was recovered in 2008.

Dense non-aqueous phase liquid (DNAPL) was measured in six wells during the reporting period (MW-20i, MW-Ds, MW-Gs, MW-22i, EW-8s, and EW-18s). Three of the wells are located within the barrier wall (MW-22i, EW-8s and EW-18s); therefore, no DNAPL was extracted from these wells. Of the three wells located outside the barrier wall, DNAPL was recovered weekly from MW-20i and intermittently from MW-Ds and MW-Gs. Approximately 57 gallons of DNAPL with groundwater was extracted from the Site in 2008, bringing the total volume of NAPL extracted at Site to approximately 6,260 gallons.

The effort required to recover approximately 1 gallon of NAPL per week from the Site is significant. The NAPL migration assessment contained in the *Post Remedial Action Conceptual Site Model for NAPL Transport* (GSI, 2007) and EPA's review concluded that the NAPL is not likely migrating to the Willamette River. Based on the small volume of NAPL recovery, this activity should be reconsidered. As creosote is not likely to migrate to surface water, monitoring only should be conducted to assess whether the thicknesses of NAPL in monitoring wells MW-20i, MW-Ds, and MW-Gs increases above the apparent equilibrium with the residual creosote present in the formation adjacent to the well.

3.2 Groundwater Flow Direction and Gradient Assessment

Manual measurements of static groundwater levels were conducted during low tide on March 5, 2008; June 18, 2008; September 30, 2008; and December 16, 2008. Shallow groundwater elevation and gradient during this reporting period at the Site are generally consistent with conditions observed during previous reporting periods. Horizontal gradients are the greatest during periods of high precipitation and decrease during periods of low precipitation. Groundwater

flow inside the barrier wall remains relatively flat, while outside the wall, shallow groundwater flow is diverted around the barrier wall to the northwest and south.

The barrier wall is clearly isolating the shallow groundwater inside from outside the barrier wall based on the independent groundwater elevations, flow directions, and gradients inside versus outside the barrier wall. With installation of the impermeable soil cap, the elevation differences inside versus outside the barrier wall have further increased indicting a significant decrease in rainwater entering the barrier wall area. The only locations where precipitation can enter the barrier wall area are through the riparian area and between the impermeable soil cap liner and the top of the barrier wall. The groundwater elevation inside the barrier wall continues to decrease in elevation relative to the shallow groundwater elevation upgradient of the barrier wall as it approaches equilibrium with the Willamette River. This is evidenced by the reversal in gradient direction observed inside the barrier wall when the Willamette River was at its peak stage (greater than 15 feet NAVD88) in June.

Seasonal changes in gradients are apparent and consistent with previous reporting periods. In March, the higher shallow groundwater elevation upgradient of the barrier wall was at 20.5 feet NAVD88 and dropped throughout the year to a low of 15.22 feet NAVD88 in December. Inside the barrier wall, the shallow groundwater elevation was between 11.5 and 14.4 feet NAVD88 in March with a gradient to the east. In June, the shallow groundwater elevation inside the barrier wall ranged from 11.22 to 15.97 NAVD88 with the gradient to the west. In September, the shallow groundwater elevation inside the barrier wall ranged from 10.18 to 13.59 feet NAVD88 with the gradient to the east and similarly in December the elevation ranged from 9.98 to 12.59 feet NAVD88 with an easterly gradient. The Willamette River stage was highest in June at 15.97 feet NAVD88 and lowest in September at 6.21 feet NAVD88. The river stage was unseasonably low in December at 7.76 feet NAVD88.

Prior to installation of the impermeable cap, the elevation difference outside versus inside at the bluff side of the barrier wall averaged 1 foot. After installation, elevation differences have increased to as much as 5 to 6 feet. As the shallow groundwater inside the barrier wall equilibrates with the Willamette River stage, this separation between the upgradient side of the barrier wall and inside the barrier wall should become stable, varying seasonally as the groundwater and river levels change.

Groundwater level data was collected using pressure transducers that monitored groundwater level fluctuations on a half-hour basis at select monitoring wells surrounding the barrier wall. Hydrographs based on transducer data were prepared for selected monitoring well clusters (MW-36/37, MW40s/41s,

MW-44/45, MW-52/53) inside and outside the barrier wall. Transducers were placed in these wells to monitor the water level differences between inside and outside the barrier wall to assess the barrier wall performance. Under stable river conditions, vertical groundwater gradient figures indicate that gradients are generally downward during low tide and high tide inside the barrier wall in the former Waste Disposal Area (FWDA) and former Tank Farm Area (TFA), with the exception of an upward gradient during high tide in the former TFA.

Transducers were installed in wells EW-1s and EW-15s to understand the shallow groundwater table fluctuation within the barrier well. A muted response to the Willamette River stage is noted in the interior transducer data. EW-1s transducer data frequently shows approximately 0.5 foot fluctuations that may represent the escape of gas from beneath the soil cap.

Based on the observations made through the 2008 reporting period, the barrier wall and impermeable soil cap are functioning as intended to divert groundwater flow and rainwater infiltration around NAPL source areas contained within the barrier wall. NAPL does not appear to be increasing significantly in any of the monitoring wells inside or outside the barrier wall, and the overall rate of extraction of NAPL is stable. It should be noted that NAPL collection approaches have changed over time, in terms of pumping approaches and the number of wells from which NAPL is extracted. However, as NAPL extraction rates stabilize, the overall strategy for collecting NAPL from the Site may warrant re-evaluation, taking into consideration the total volume of NAPL anticipated to remain at the Site and the potential for future migration of residual NAPL.

At this time, it is anticipated that future O&M activities will be conducted in accordance with the *Draft Final Operation and Maintenance Plan* (DEQ, 2007), including groundwater gauging and NAPL extraction activities.

3.3 Site Observation and Activity Summary

Tables 1 and 2 outline the planned inspections for the soil and sediment caps, respectively, through September 2011. In 2008, Hart Crowser subcontracted with Clearwater Environmental to perform routine O&M activities, including site-wide inspections. During the months of July, August, and September 2008, sediment cap inspections were performed on a weekly basis; sediment cap inspections were performed on a monthly basis during the remainder of the reporting period. Soil cap inspections were performed on a monthly basis during the reporting period. Additional Site inspections were performed during monthly Site meetings, sampling events, and other miscellaneous Site visits.

During the reporting period, sheen was observed regularly from approximately late June to October, but not observed during the remainder of the period. A comprehensive effort to identify the source and mechanism of the shoreline sheen was conducted as part of the Ebullition and Sheen Investigation (preliminary results are presented in Appendix G).

In general, sediment cap and soil cap inspections revealed few changes or areas of concern with the exception of the subsidence occurring in the upland cap. A comprehensive survey was conducted of the upland cap in August 2008 after finding that the outer casing on MW-23d dropped approximately 6 inches relative to the inner casing. This survey revealed that an area of the upland cap has subsided up to 1 foot over an area coincidental with buried wood debris beneath the soil cap. It is suspected that a combination of degradation of buried wood debris coupled with lowering shallow groundwater dewatering inside the barrier wall is the primary cause of the subsidence. The impermeable cap stormwater drainage system has been checked by video camera and is working as designed. A number of actions have been recommended to further define the rate and mechanism of subsidence, including additional surveying and sampling gas from EW-1s.

Sand covers much of the shoreline, and there are significant amounts of large woody debris that have accumulated along the shoreline and create wildlife habitat. Wildlife commonly seen at the Site includes Canada geese, blue herons, ospreys, bald eagles, squirrels, and rabbits; and coyotes are seen occasionally. Community members use the shoreline frequently for recreation, most commonly for walking dogs. A few instances of vandalism to the Site (e.g., fence damage) and littering have occurred.

Site inspections and observations resulted in several non-routine maintenance activities in addition to routine activities. Non-routine activities included repairing fences, removing treated timber, cutting stainless steel Articulated Concrete Block (ACB) cable loops (trip hazards), repairing the turf reinforcement mat, operating the irrigation system, repairing an overhead security light, placing additional gravel along perimeters roadways, and replacing monitoring well monuments. It is anticipated that Site inspections and maintenance activities will continue as described in the *Draft Final Operation and Maintenance Plan* (DEQ, 2007) with the addition of upland cap subsidence monitoring.

3.4 Vegetation Survival Assessment

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 at the Site. The IGA is scheduled

to end June 2009; DEQ may extend the IGA for an additional year. The initially planting in February 2006 has now completed a third growing season.

The Site has five planting areas: (1) upper riparian, (2) lower riparian, (3) natural tree and shrub planting area, (4) swale and pond planting, and (5) the impermeable soil cap. Overall, Site re-vegetation has performed above expectations and has met the performance standard of the IGA. The current plant inventories for the five planting areas are as follows:

- In the upper riparian area (3.6 acres), there are currently 960 plants per acre of the woody species: 490 shrubs and 470 trees.
- In the lower riparian area (2.1 acres), there are currently 950 plants per acre: 457 shrubs and 493 trees. In February 2008, 500 additional alder trees were inter-planted in this area to ensure that the performance standards for cover are met for this area.
- In the natural tree and shrub planting area (1.1 acres), there are currently 1643 plants per acre: 1343 scrubs and 300 trees. In the swale and pond planting area (4.2 acres), there are currently 543 plants per acre: 500 scrubs and 43 trees. In the impermeable soil cap area (7 acres), no woody species have been planted. Initially hydroseeding in 2005 (DEQ contractor - grass and wildflower species), and subsequent reseeding in 2007 (BES - fescue species) has maintained adequate ground cover for this area.

Noxious weed control remains a problem for the Site, the degree of weed presence will determine the long term vegetation management requirements more than any other single factor. Establishing a solid herbaceous cover and periodic reseeding will limit the spread of noxious weeds.

Maintenance requirements for the irrigation system have increased significantly over this past season. The battery-operated controllers are not as reliable as the electrical equivalent, and additional expenses have been incurred to replace malfunctioning controllers in the spring and early summer of 2008. Irrigation system activities for 2008 include:

- Drained and winterized the system in fall 2008;
- Inspected entire system to identify, mark and map any freeze or other types of damage in spring 2009;
- Repaired any freeze damage in spring of 2009; and
- Replaced and repaired all malfunctioning or worn battery operated irrigation controllers.

3.5 Updated Site-Wide Record Drawings

As a result of the subsidence observed in the upland soil cap, the entire upland Site was professionally surveyed in August 2008. In addition, during the summer ebullition and sheen investigation, Organoclay Mat #2 was surveyed using GPS and adjusted on the drawing accordingly. One of the boulder clusters was found to be mapped in the wrong spot on the previous drawings. It was resurveyed using GPS. The record drawing depicting sediment cap and upland cap features was updated, and is provided as Attachment H to this report. For the upland portion of the map, only the topography was adjusted. Locations of the wells, buildings and other features are based on the previous survey conducted by David Evans and Associates in 2005.

4.0 SAMPLING ACTIVITIES SUMMARY

This section provides a brief summary of the O&M activities listed in Tables 2 and 3 pertaining to sampling requirements at the Site. These sampling events included sampling: surface water, inter-armoring water, and sub-armoring water; and the infiltration pond monitoring well MW-59s. Additional investigation was performed as part of the ebullition and sheen investigation in response to sheen occurrences at the Site. The preliminary results of the ebullition and sheen investigation are included in this report.

More detailed presentations of these O&M activities related to sampling are provided in the following Attachments:

- Appendix D is the Surface Water, Inter-armoring Water, and Sub-armoring Water Assessment;
- Appendix E is the Infiltration Pond MW-59s Groundwater Quality Assessment;
- Appendix F is the Crawfish Sampling Assessment; and
- Appendix G is the Ebullition and Sheen Investigation.

Supplemental information for these activities is provided in electronic format on the O&M Report CD.

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

Seven rounds of post cap construction surface water/inter-armoring water/sub-armoring water sampling have been conducted: Fall 2005, Spring 2006, Fall

2006, Spring 2007, Fall 2007, Spring 2008 and Fall 2008. Pre-cap construction surface water/pore water sampling took place in 2002 and 2003. Appendix D contains the *Surface Water, Inter-Armoring Water, and Sub-Armoring Water Assessment,* which describes sampling methodology, sampling results, summaries, and references for the 2008 events, as well as a summary of results from previous sampling events conducted in 2002, 2003, 2005, 2006, and 2007. Beginning in 2005, sampling activities were conducted in the fall and spring of each year to evaluate post sediment cap construction water quality conditions under both low-river and high-river conditions.

Samples taken in 2005, 2006, 2007, and 2008 included the collection of water contained in the sand layer of the sediment cap (above the original sediments but beneath the overlying armoring layer), hence the term sub-armoring water samples. Samples taken in 2002 and 2003 were collected from the existing sediments and are referred to as porewater samples. Beginning in 2006, a third sampling zone (the armor layer itself) was included and is referred to as inter-armoring water.

For each sampling event, analytical results obtained from the laboratory were tabulated by location and media. A series of statistical parameters were used to summarize the data and were provided for each media (i.e., surface water, inter-armoring water, and sub-armoring water) and each sampling event (i.e., Fall 2002, Fall 2003, Fall 2005, Spring 2006, Fall 2006, Spring 2007, Fall 2007, Spring 2008, and Fall 2008). The parameters include the following:

- Number of Samples;
- Detection Frequency;
- Maximum Detected Concentration;
- Location of Maximum;
- Mean Concentration;
- Data Distribution; and
- 95% Upper Confidence Limit (UCL) on the Mean (95% UCL).

The summary statistics for each sampling event are provided in Attachment D.

During the 2008 sampling events, samples were analyzed for site contaminants of concern (COCs), including both total and dissolved metals (arsenic, chromium, copper, and zinc), PAHs, PCP, and total dissolved solids (TDS). Analytical results were compared against a group of water quality guidelines including AWQCs referenced in the 1996 ROD, as well as current NRWQCs

and National Primary Drinking Regulations (NPDWRs) established by the EPA. These guidelines are collectively referred to as comparison criteria.

4.1.1 Surface Water Sampling Results

During 2008, there were no detections of carcinogenic PAHs (cPAHs) in surface water. The maximum concentration of total PAHs detected in Spring 2008 was 0.148 µg/L and in Fall 2008 was 3.98 µg/L. This is higher than the maximum inter-armoring water concentration although well below comparison criteria for PAHs. The slightly higher concentration in surface water reflects lateral discharge of groundwater from the bank with low-level dissolved PAHs.

Total metals and dissolved metals were detected in most of the samples collected during 2008, which is to be expected because they are naturally occurring in soil and sediment. For total metals, arsenic was not detected in the Spring; however, the method detection limit (MDL) (a mean of 0.0003 mg/L) exceeds the corresponding comparison criterion of 0.00014 mg/L. It does not exceed the ROD comparison standard of 0.19 mg/L. In Fall 2008, arsenic was detected in 91 percent of the surface water samples (mainly because the method detection [0.00018 mg/L] was lower than in the Spring). The mean concentration was 0.0005 mg/L with a 95%UCL of 0.00063 mg/L. Chromium, copper, and zinc did not have any exceedences of comparison criteria for total metals. Dissolved metals were not evaluated in relation to any comparison criteria. PCP was not detected above the MDLs in any of the surface water samples collected during Spring or Fall 2008, and the MDL was below comparison criteria.

4.1.2 Inter-armoring Water Sampling Results

During 2008 there were no detections of cPAHs in inter-armoring water. The maximum concentration of total PAHs detected in Spring 2008 was 0.126 µg/L and 0.757 µg/L in Fall 2008. No PAHs exceeded comparison criteria.

Total metals and dissolved metals were detected in most of the samples collected during 2008, which is to be expected because they are naturally occurring in soil and sediment. For total metals, the arsenic MDLs exceeded the corresponding comparison criterion of 0.00014 mg/L. The mean concentration for arsenic, in the 5 percent of samples where it was detected, in Spring 2008 was 0.0004 mg/L. The mean concentration for arsenic, in the 95 percent of samples where it was detected, in Fall 2008 was 0.0008 mg/L. Zinc exceeded the corresponding comparison criterion of 0.11 mg/L in one sample in Spring 2008 and copper exceeded the corresponding comparison criterion of 0.009 mg/L in two samples in the Fall. Total chromium did not exceed its

corresponding comparison criterion in 2008. Dissolved metals were not evaluated in relation to any comparison criteria. PCP was not detected above the MDLs in any of the inter-armoring water samples collected during Spring or Fall 2008 and the method detection limit was below the comparison criteria.

4.1.3 Sub-armoring Water Sampling Results

During 2008, four samples in the Fall and two samples in the Spring exceeded their corresponding comparison criteria of 0.031 µg/L for cPAHs in sub-armoring water. The maximum cPAH exceedance was in Spring 2008 at Location 16 (0.462 µg/L). The maximum concentration of total PAHs detected in Spring 2008 was 253.3 µg/L and in Fall 2008 was 161 µg/L.

Total metals and dissolved metals were detected in most of the samples collected during 2008, which is to be expected as they are naturally occurring in soil and sediment. For total metals, arsenic MDLs exceeded the corresponding comparison criterion of 0.00014 mg/L. The mean concentration for arsenic, in the 95 percent of samples where it was detected, in Spring 2008 was 0.0090 mg/L. The mean concentration for arsenic, in the 100 percent of samples where it was detected, in Fall 2008 was 0.0091 mg/L. Copper exceeded its corresponding comparison criterion of 0.009 mg/L in one sample in Fall 2008. Chromium and zinc did not exceed their corresponding comparison criteria for total metals. Dissolved metals were not evaluated in relation to any comparison criteria. PCP was not detected above the method detection limits in any of the sub-armoring water samples collected during Spring or Fall 2008.

In summary, COC concentrations in surface water and inter-armoring water are generally below comparison criteria with the exception of arsenic, for which the comparison criteria is below the detection limit, and the few other exceedences described above. In general, COC concentrations in the sub-armoring water are below comparison criteria with a few exceptions. Concentration trends are stable or decreasing when compared to samples collected from 2005 through 2007. Based on water sampling from the surface water, inter-armoring, and sub-armoring, the sediment cap appears to be performing as designed and protecting surface water.

4.2 Infiltration Pond MW-59s Groundwater Quality Assessment

In 2005, a soil cap was installed at the Site as part of the soil remedy. One component of the soil cap was an infiltration pond constructed at the southwestern 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 in 2005 to monitor changes in contaminant levels in

groundwater. As specified in the draft O&M Plan (DEQ, 2007), 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 five samples have been collected from MW-59s to date, since after four samples it was not clear whether there was an increasing trend present in the data.

During the five sampling events, total arsenic concentrations in three of the four events exceeded the MCL of 0.01 mg/L. All other detections for metals and PAHs were below the corresponding MCLs (where such MCLs exist). No PCP was detected during the five sampling events.

Based on 2008 sampling results, it appears that metals concentrations are increasing, although still below MCLs, with the exception of total arsenic. However, PAH concentrations are generally similar to 2007 levels. Although metals concentrations have increased compared with previous levels, there is not enough data to support a clear pattern regarding the potential for subsurface contaminants to be mobilized by the infiltration pond.

Annual sampling of MW-59s until 2010 (two additional sampling events) would provide a more comprehensive data set to show trends in contaminant levels over time as a result of Site conditions

4.3 Crayfish Sampling Assessment

Crayfish were collected from four areas during the September 2008 sampling event: the former TFA, FWDA, Burlington Northern Railroad Bridge, and the Willamette Cove (WC). There were sufficient samples to analyze all parameters for whole crayfish composites and, in two areas; there were sufficient samples to also analyze the edible muscle tissue for polychlorodibenzo-p-dioxin/furans (PCDD/Fs). Samples were analyzed for PCDD/Fs, PAHs, PCP, total metals, and percent lipids.

The 2,3,7,8-TCDD TEQ concentration in crayfish tissue since 2003 for each location sampled at the Site was compared to the Health Advisory Criteria and the mean LWG Portland Harbor concentration. In 2003, two locations were above the health advisory criteria for dioxin in crayfish of 0.9 ng/kg. Since the sediment cap was installed, no samples have exceeded the health advisory criteria. In comparison, the Lower Willamette Group (LWG) Portland Harbor mean of 1.58 (ng/kg)-wet 2,3,7,8-TCDD TEQ is nearly double the Oregon Department of Human Services (DHS) health advisory criteria of 0.9 ng/kg, further demonstrating the performance of the sediment cap in reducing PCDD/Fs availability to crayfish.

Metal concentrations in crayfish are generally similar to pre-cap concentrations and similar to LWG data for Portland Harbor.

Total PAH concentrations in crayfish from the Site since the sediment cap was installed are lower than the mean for LWG Portland Harbor and lower than pre-cap concentrations with the exception of crayfish sampled from the TFA in 2006. Therefore, PAHs in crayfish from the Site, similar to PCDD/Fs, have also declined since the sediment cap was constructed.

An additional crayfish sampling event is planned for September/October 2010. However, since the concentrations for PCDD/Fs are consistently below the Health Advisory Criteria, no additional crayfish sampling is recommended. We recommend that the DHS remove the Health Advisory for the McCormick and Baxter Site for crayfish harvesting.

4.4 Ebullition and Sheen Investigation Summary

The ebullition and sheen investigation was conducted in response to sheen occurring in late summer and fall at the Site. In addition, the persistent ebullition observed brought into question whether ebullition could be a significant pathway for contaminant migration. The investigation was performed in general accordance with the August 16, 2008, *Ebullition and Sheen Investigation Work Plan* (Hart Crowser/GSI, 2008). The field investigation activities were completed between August 25, 2008, and September 11, 2008 (monitoring for sheens was performed from July through October 2008).

4.4.1 Objectives

Significant quantities of gas are generated by the degradation of organic matter in contaminated sediments at the Site. The release of this gas (ebullition) is observed in surface water where high PAH concentrations in sediment and/or NAPL-contaminated sediments were capped. In addition, the degradation of organic matter (wood waste) within the sediment most likely contributes to the ebullition observed at the Site, especially outside of the sediment cap footprint where creosote-related contaminant concentrations are minimal.

Ebullition occurs primarily at low river levels (i.e., late summer and fall, and is most prolific during low tide) in the nearshore environment. In areas of the sediment cap where granular organoclay was not placed, the gas release periodically has resulted in transport of NAPL to the overlying surface water, resulting in sheen bursts. These areas have been capped with reactive core mats filled with organoclay.

Occasional sheens that do not appear to be associated with ebullition are observed along the shoreline in late summer/early fall. More frequent displays of sheen occur in late summer/early fall along the shoreward side of the organoclay mats in the TFA and over the granular organoclay along the WC shoreline. Detailed descriptions of the ebullition and shoreline sheens are provided in the *O&M Report October 2005 through December 2006* (E&E, 2007), the *Post Remedial Action Conceptual Site Model for NAPL Transport* (GSI, 2007), and the *O&M Report January 2007 through December 2007* (E&E, 2008). The overarching goal of the ebullition and sheen investigation activities was to determine if the sediment cap remedy is protective, or whether additional remedial measures are required. The objectives of this investigation were to determine:

- if the ebullition observed at the Site creates a significant contaminant transport pathway through the sediment cap;
- if the organoclay mats are performing as designed;
- if the granular organoclay is breaking down and if that will adversely affect the longevity of the sediment cap life; and
- the source and nature of the sheen, and risk posed to receptors.

Data from the ebullition and sheen investigation activities were evaluated to address the following:

- Gas mitigation pathway under Organoclay Mat #2;
- Origin and mechanism of sheen observed at the Site, post-sediment cap construction;
- Nature and significance of sheen occurrence;
- Origin(s) and mechanism of the ebullition pathway;
- Significance of ebullition in contaminant transport of NAPL and dissolved-phase constituents;
- Performance of granular organoclay and organoclay mats; and
- Biological degradation of NAPL and other identified constituents.

4.4.2 Field and Sampling Objectives

Sheen Surveys. Sheen surveys were conducted to understand their extent, frequency, and seasonality. The surveys also provided information regarding sheen significance (frequency, extent, trends, etc.) compared to previous years.

Conditions present during sheen observation (river level, rising vs. falling tide, time of day, temperature, sheen description), and potential association with site conditions (presence of a creosote odor or discharging groundwater) were noted during the surveys.

Ebullition Surveys. Ebullition surveys were conducted to determine the locations and timing of ebullition, and to collect supporting information to site the flux chamber locations and resulting data to determine if ebullition is a potentially significant contaminant pathway. A general estimate of ebullition rate per foot was determined by measuring the gas production rate for specific ebullition pathways, estimating the number pathways in a given area, then calculating the rate of gas production per square foot in a given area.

Sediment Cores. Exploratory sediment cores provided input regarding placement of the solid phase micro-extraction (SPMEs) and selection of cores for the University of Texas (UT) organoclay performance and Portland State University (PSU) degradation studies. Select sediment samples from the cores were analyzed for Site COCs. Exploratory sediment cores in conjunction with the analytical data from select cores also provide input to understanding contaminant distribution along the riverbank in the WC and the former TFA; specifically, the distribution of residual creosote in the bank that may have migrated into the cap sand, and residual creosote in the bank that may be sufficient to cause shoreline sheen. These data will be supplemented with the analytical information from the UT SPMEs. In addition, the cores provided sediment and capping material for the PSU degradation study that will determine gas generation per layer (native sediment, organoclay, or cap sand), and whether organoclay may be supplying material to enhance degradation or is being degraded itself. Finally, cores were used to provide material for UT regarding the organoclay performance and sediment quality adjacent to the SPMEs.

Porewater Samples. Porewater sample were collected with both SPMEs and Henry Samplers. Porewater samples collected via SPMEs will be used to understand the three-dimensional distribution of PAH contamination. The data will allow us to understand whether (1) sheen detected along the bank of the former TFA and WC is migrating upward through the sediment cap because of ebullition or tidal pumping and potentially producing a sheen, (2) lateral advective NAPL migration from the bank into and through the cap sand is producing a sheen along the bank, or (3) the sheen is not related to Site contamination by these mechanisms.

Porewater samples collected for the PSU study using Henry Samplers will provide critical geochemical information to understand conditions under which degradation is occurring.

Porewater samples collected using Henry Samplers from select locations in association with the SPMEs will provide a comparison of the collection methodology. This comparison in porewater sampling technology will be important as the methodology for future compliance monitoring is established when the Site moves into O&M.

Porewater grab samples collected using Henry Samplers along the riverbank and adjacent to Organoclay Mat #2 will provide data regarding the potential for contaminant transport through the sediment cap material.

Flux Chamber Samples. Gas and water samples collected from the flux chambers will provide evidence to determine whether ebullition creates a significant contaminant transport pathway through the sediment cap.

Organoclay Mat Pullback at Organoclay Mat #2 and Sample Collection. CETCO and UT collected samples from the northwest corner of organoclay Mat #2 for testing. UT is conducting Hexane Extractable Material analysis on the mat to ascertain the degree of NAPL contamination of the mat organoclay. CETCO conducted adsorptive capacity and permeability testing on a mat sample in their laboratory. The results will demonstrate whether the organoclay mats have maintained their sorptive capacity after 2 years in the river, and whether gas is capable of passing through or bypassing the organoclay mats.

SPME data was also collected at three corners of Mat #2 to compare contaminant concentrations in the cap sand surrounding the mat to concentrations in the sediment cap in surrounding areas (using the semi-annual sub-armoring data and porewater data collected via Henry Samplers for comparison). Porewater collected using Henry Samplers also provide data regarding the performance of the organoclay mats.

Sheen Analysis and Photomicrographs. Sheen data and photomicrographs were used to interpret the nature of the sheen. Sheen samples were also collected and analyzed for total organic carbon, TPH with and without silica gel cleanup, and PAHs. Dr. Alexander, a microbiology professor from University of Portland (UP) collected and provided an interpretation of the sheen samples from the WC and the TFA to determine whether the sheen was bacterial in nature.

4.4.3 Preliminary Ebullition and Sheen Investigation Conclusions

The preliminary conclusions of the investigation follow the Data Quality Objectives (DQOs) provided in the *Ebullition and Sheen Investigation Work Plan* (Hart Crowser/GSI, 2008) included in Appendix G. They consider field observations and the data compiled to date. Work underway at PSU and UT

will add additional understanding to whether the sediment cap is protective. A complete report of the ebullition and sheen investigation will be prepared for the 2009 Annual Report.

The following section presents the five ebullition and sheen investigation DQOs and preliminary conclusions.

DQO #1: Determine whether the sediment cap is protective of surface water; specifically in the areas of concern. Determine whether the sediment cap is effective in preventing NAPL seeps to the river.

Preliminary Conclusions for DQO #1: Porewater data collected from the cap sand (greater than 18 inches below the sediment cap surface) along the shoreline in the WC are below comparison criteria. Porewater samples collected from the shoreline of the TFA and south of the TFA were generally non-detect or below comparison criteria for PAHs, with the exception of some low level cPAH detections exceeding comparison criteria in porewater from PW-22 and PW-28 located shoreward of the granular organoclay. The cPAH concentrations in these samples were 0.0971 µg/L (PW-22) and 0.2154 µg/L (PW-28) and total PAH concentrations were 0.6749 µg/L and 0.5756 µg/L, respectively. Porewater concentrations in the cap sand between the bank and the native sediment in the bank in the TFA would be expected to have significantly higher concentrations of PAHs if sheen were migrating from residual creosote in the bank though the cap sand into surface water.

One other porewater sample collected in the TFA contained low level cPAH concentrations; PW-32 where cPAHs were detected at 0.115 µg/L. Total PAHs in the porewater samples ranged from not detected to 77 µg/L.

These low level concentrations would not be expected to result in shoreline sheen. In addition, the low level cPAHs detected in the porewater within the cap sand is from 8 to 10 inches into the cap sand which is over 1.5 feet below the surface water interface when the armoring thickness is taken into account.

Samples collected from sediment cap sand material in select locations from the WC and TFA were analyzed for PAHs. Results indicated that the samples were below ROD sediment cleanup goals and DEQ's sediment bioaccumulation screening level values (DEQ, 2007). Samples collected from the native sediment beneath the sediment cap material were elevated as expected, demonstrating the ability of the sediment cap to attenuate PAHs. There was no visual/field evidence in the sediment cores of NAPL migration through or into the sand cap.

Sheen was frequently observed across the shoreline in areas where residual creosote is known to be present beneath the sediment cap, in areas where there has been no evidence of residual creosote, and along the shoreline of the Triangle Park property, south of the Site. The sheens in all of these areas have common characteristics: iridescent, blocky, and does not re-coalesce when disturbed. The fact that it does not re-coalesce when disturbed indicates a bacterial sheen. Photomicrographs of the sheen taken by UP also suggest that there are bacteria in the sheen. Sheen samples collected in the WC and the TFA do not contain elevated PAHs concentration above the adjacent surface water, and are significantly lower than sampling data from pre-cap sheens. In general, observed sheens were odorless. However, there appears to be a naphthalene odor associated with sheen in the WC. This odor may be associated with upland groundwater discharging over the sediment cap, and not related to observed sheen. The odor is present in late summer when the river levels drop and the upland groundwater levels are still high, suggesting that the odor may be associated with low levels of dissolved naphthalene in groundwater.

Dioxin concentrations in from crayfish sampling in 2006 and 2008 are below the DHS health advisory level, and well below the average for Portland Harbor. This information supports the position that the sediment cap is protective of surface water.

DQO #2: Determine whether or not degradation is breaking down the organoclay, and if so, determine how/whether it significantly affects the life of the organoclay as it pertains to the Site.

Preliminary Conclusions for DQO #2: Ebullition has been observed along the Site shoreline, and several hundred feet beyond the shoreline in the Willamette River. Ebullition is more prevalent in the mid-to-late summer when river levels are low, and occurs over a longer period of time in the two areas where granular organoclay was placed. The "amount" of ebullition accounted for from survey gas production rates, flux chamber gas production, and the preliminary PSU laboratory results show that ebullition in areas of granular organoclay is significantly higher than in other sediment cap areas (or cap layers, i.e. cap sand and native sediment).

UT preliminary results suggest that the capacity of the organoclay to sorb NAPL has not decreased and the available capacity remains high. Although there appears to be material within the organoclay that stimulates methanogenesis and increases the rate of ebullition, it does not appear to be adversely affecting the capacity or longevity of the organoclay to sorb NAPL and dissolved PAHs.

Results from the flux chamber sampling also support the preliminary conclusion that the granular organoclay is performing as designed. The PAH concentrations in water from flux chambers located overtop of the granular organoclay in the TFA were below the comparison criteria with the exception of water from flux chamber FC-5G where chrysene measured at 0.058 µg/L exceeded the comparison criteria (0.018 µg/L). No other water samples from the 6 flux chambers placed overtop of the granular organoclay in the TFA exceeded any comparison criteria. The flux chambers in the WC were placed just outside of the organoclay footprint because of low Willamette River levels.

DQO #3: Determine whether the ebullition is a significant contaminant migration pathway through the sediment cap.

Preliminary Conclusions for DQO #3: Two co-located flux chambers were placed in 10 locations. In each location, one flux chamber was placed over an ebullition pathway and the other adjacent where no ebullition was observed. During the course of the sampling event, one set of flux chambers "washed away" and therefore, water and gas samples were collected from nine co-located chambers.

Gas was only collected from the chambers placed over the ebullition pathways. Generally, gas collected from flux chambers placed overtop granular organoclay contained high relative concentrations of methane while gas generated outside the organoclay footprint included a lower ratio of methane to other gases. This suggests that methanogenesis is the primary process occurring within the granular organoclay, and other degradation processes, including methanogenesis, are occurring elsewhere.

Porewater from each flux chamber was collected daily for four days through an XAD column. Analytical results of porewater collected from flux chambers placed over ebullition locations have higher concentrations of COCs relative to porewater collected from adjacent chambers. However, with the exception of at FC-5G where chrysene was measured at 0.058 µg/L, which is slightly above the comparison criteria of 0.018 µg/L, all porewater concentrations are below comparison criteria. .The total cPAHs from FC-01G exceeded the ROD comparison criteria of 0.031mg/L; however, none of the individual cPAHs in that sample exceeded the individual comparison criteria for cPAHs. The porewater results in general, resulted in elevated high molecular PAHs than low molecular PAHs, suggesting that ebullition serves as a pathway for particulate matter and less so for dissolved constituents in porewater.

The results of the gas and water sampling indicate that ebullition creates a preferential pathway for contaminant migration but not a significant pathway threatening the protectiveness of the sediment cap.

DQO #4: Determine whether gas is passing through the organoclay mats or accumulating beneath the mats.

Preliminary Conclusions for DQO #4: The ebullition survey did not demonstrate that ebullition was significantly greater in water surrounding the mats. The rates of ebullition were relatively low overtop and surrounding the organoclay mats. Ebullition was noted from the northeast corner of organoclay Mat #2. However, when pulling back the corner to collect a sample, the sand placed over the rock armoring beneath the mat was noticeably missing; the sand had apparently been washed into the rock armoring, providing a higher permeability material directly beneath that area of the mat. Dependent on the extend of this sand washing beneath Mat #2, a preferential pathway for gas to migrate toward the edges of mat in lieu of migration through the mat is created. Visual inspection of the back side of the pulled back corner of the mat did not reveal any staining or signs that suggest contamination is penetrating the mat. No visual sign of sheens associated with the ebullition surrounding the mats was observed.

Three porewater samples were collected along the riverward side of the mat (described as locations PW-16a and b, PW-17, and PW-32 in Appendix G). At location PW-32 (southern edge of the mat), cPAHs were detected at a concentration (0.115 µg/L) above the ROD criteria for human health fish consumption of 0.031 µg/L. The geologic log for the nearby boring collected during the investigation shows that the sand and armoring portion of the cap are mixed and only 1.5 feet thick instead of the 3-foot combined design thickness.

At Location 16, the western corner of Mat #2, porewater was sampled from above the mat and from below the mat. Concentrations above the mat were significantly lower than those below the mat suggesting that the mat is performing as expected. Additional porewater samples collected around the mat did not contain elevated PAHs. In summary, the mats appear to be performing as designed. However, in the northern area of Mat#2, the sand placed directly beneath the mat appears to have mixed into the armoring, leaving a higher permeability zone directly beneath the mat.

DQO #5: Determine origin of sheen and whether sheen poses a threat to the environment.

Preliminary Conclusions for DQO #5:

The resulting data from the samples collected for DQO#1 provide a strong argument that periodically observed shoreline sheen is not the result of PAHs migration through the sediment cap at the site. Porewater samples collected from the cap sand material in multiple locations in the TFA and the WC riverbank, downgradient from the most likely source of a potential residual creosote source, did not provide evidence that the origin and nature of the sheen is associated with contamination from the Site.

PAH concentrations in the four samples collected in July 2008 are significantly lower than concentrations that would be indicative of, or produce, sheen. Concentrations of the surface water with sheen were similar to the adjacent surface water without sheen and, in one case, the concentration in the surface water without sheen was higher than the concentration of the surface water with sheen. There were no detections of total petroleum hydrocarbons in the sheen samples or adjacent surface water samples.

Dr. Alexander, a microbiology professor from UP, collected sheen samples from four locations for a microscopic interpretation. He believes the sheen is biological and not chemical in nature. Again, the sheen is blocky in appearance and does not re-coalesce when disturbed to further support an arguement that the sheens are biological in nature.

The lines of evidence compiled thus far suggest that the shoreline sheens observed along the riverbank in the summer and early fall are not a result of contaminant (creosote) migration through the sediment cap resulting in sheen.

5.0 SUMMARY AND PLANNED ACTIVITIES FOR 2009

Table 4 summarizes the planned O&M activities for 2009. Tasks correspond to O&M activities outlined in Tables 1, 2, and 3. Since 2006, inspection of habitat enhancement features has been added to the inspection task for the sediment cap.

No sediment cap multi-beam bathymetric and side-scan sonar surveys or diver inspections of deep water, are scheduled for 2009. However, should severe river conditions or indication of significant alteration or damage to the cap be observed, these tasks may need to be performed during the reporting period, at the direction of DEQ.

Sampling of MW-59s has been completed. However, because no clear pattern has developed to either support or deny the potential for subsurface

contaminants to be mobilized by the upland cap infiltration pond, and because PAHs were detected in the most recent samples collected from MW-59s after no previous detections, a definitive determination cannot be made. Annual monitoring through 2010 is recommended.

Although the ebullition and sheen investigation demonstrated that the sheen is not related to the residual creosote remaining beneath the sediment cap or in the upland, additional sheen identification assessment will occur during the summer of 2009. The assessment will involve collecting only sheen using a glass wool or similar material, and conducting analytical testing to determine the chemical make-up of the sheen. Surface water samples will be collected at the same time to understand the difference between the surface water and the sheen material. The scope of the investigation is under development.

6.0 REFERENCES

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Tables

Table 1: Description and Frequency of Soil Cap O&M Activities through September 30, 2011	
O&M Activity	**Frequency**
Inspections: • Cap surface • Stormwater conveyance system • Security fencing • Warning signs	 • Monthly • Monthly • Monthly • Monthly
Routine Maintenance: • Irrigation of Native Vegetation • Manual removal of invasive plants • Targeted application of herbicides	 • Summer 2009 (if needed irrigation will continue beyond 2009) • Annually, if necessary • Biannually (April and September), if necessary
Non-Routine Maintenance – such as: • Repairs of fence • Replacement of warning signs • Repairs of gravel roads • Filling of potential animal burrow into the earthen cap • Remove sediment from manholes • Replanting unsuccessful trees and shrubs • Subsidence Observations	 • As needed • As needed • As needed • As needed • As needed • As needed • As needed

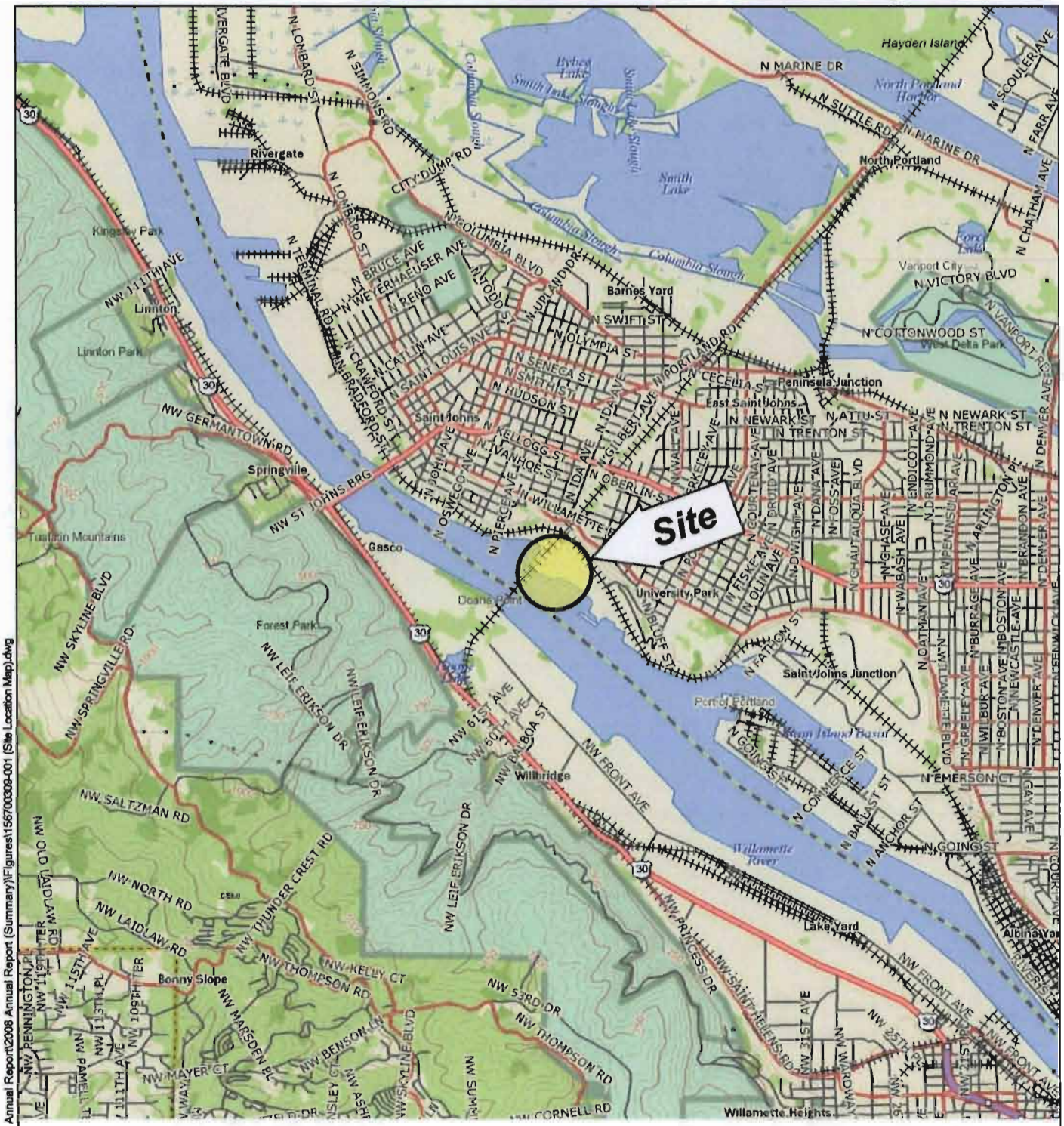
Table 2: Description and Frequency of Sediment Cap O&M Activities through September 30, 2011	
O&M Activity	**Frequency**
Inspections: • Warning buoys • Near shore areas • Habitat enhancement features • Multibeam bathymetric surveys • Side-scan sonar surveys • Diver inspections of deep water	• Monthly • Weekly (August - October) otherwise monthly • Yearly • Spring 2010 or as needed • Spring 2010 or as needed • Spring 2010 or as needed
Sampling: • Surface water, inter-armoring water, and sub-armoring water • Organoclay cores	• Semiannually (March and September each year through 2010) • October 2010*
Non-Routine Maintenance – such as: • Replacement of buoys • Additional armoring placement • Additional organoclay capping	• As needed • As needed • As needed

* Organoclay cores were collected in 2006 and 2008. It is not expected that they will be collected again in 2010.

Table 3: Description and Frequency of Groundwater O&M Activities through September 30, 2011	
O&M Activity	**Frequency**
NAPL Recovery: • Gauging and extraction of exterior wells • Gauging of interior wells	• Weekly, until otherwise determined • Quarterly
Groundwater Monitoring: • Downloading continuous water level data loggers • Manual water level measurements	• Quarterly • Quarterly
Groundwater Sampling: • Site-wide	• Spring 2010
Routine Maintenance of Equipment: • Interface probes, pumps, vehicle, data loggers/transducers, etc.	• As needed
Utility Services: • Water, electric, phone, alarm, solid waste, toilet	• Continuous

Table 4: Schedule of Activities for January 2009 through December 2009	
Task	**Schedule**
Soil and Sediment Cap inspections. (contractor)	Monthly January 2009 through July 2009, weekly August 2009 through October 2009, monthly November 2009 and December 2009.
Habitat enhancement inspection.	September 2009.
Sediment Cap multibeam bathymetric and side-scan sonar surveys; diver inspections of deep water.	Next scheduled is Spring 2010, unless otherwise needed.
Irrigation of native vegetation.	Summer 2009.
Manual removal of invasive plants.	If necessary to suppress invasive plant growth.
Targeted application of herbicides.	April and September 2009, if necessary to suppress invasive plant growth.
Maintenance of equipment.	Ongoing as needed.
Non-routine maintenance.	As needed.
Surface/Inter-Armoring/Sub-Armoring Water Sampling.	March and September 2009.
MW-59s Sampling.	August 2009 and 2010.
NAPL recovery exterior wells.	Gauged weekly, recovery as criterion is met.
NAPL recovery interior wells.	Gauged quarterly, no recovery.
Groundwater elevation monitoring.	March, June, September, and December 2009.
Utility Services.	Continuous.

Figures



0 4,000 8,000

Scale in Feet

N

McCormick and Baxter Superfund Site
6900 N Edgewater Street, Portland, Oregon

Site Location Map

5/09

HARTCROWSER

GSI Water Solutions, Inc.

Figure
1

Source: DeLorme Topo USA®.

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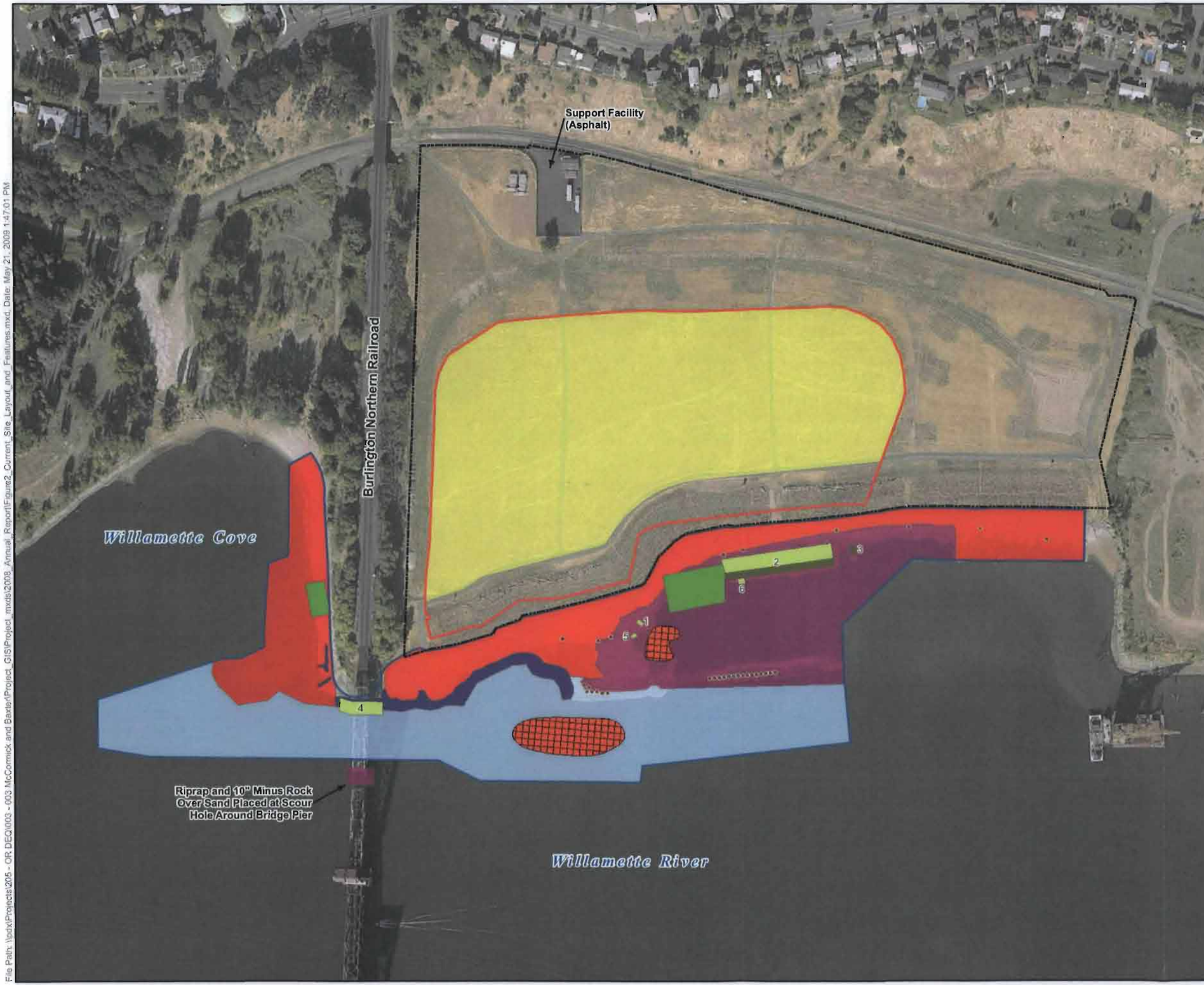


LEGEND

- Subsurface Barrier Wall
- Sediment Cap Boundary
- Organoclay Granular
- Organoclay Mats (Double)
- Organoclay Mats (Single)
- Hot Spot Treatment (thickened sand layer)
- Boulder Clusters
- Riprap Armor
- Articulated Concrete Block
- 6-inch Minus Rock Armor
- 10-inch 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

5/09

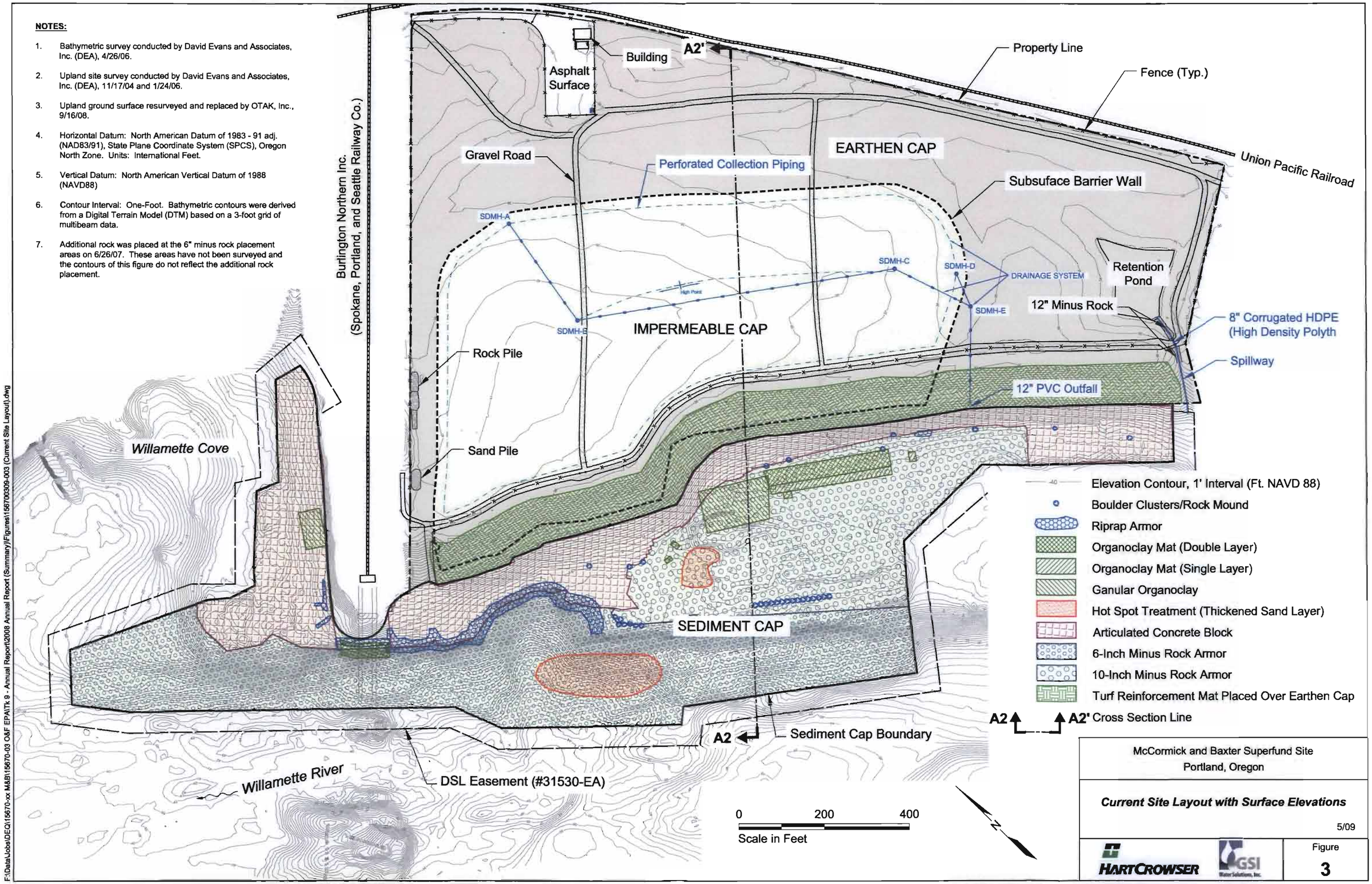
HARTCROWSER GSI Water Solutions, Inc.

Figure
2

File Path: \\pdx\Projects\205 - OR DEQ\003 - 003 McCormick and Baxter\Project_GIS\Project_mxds\2008_Annual_Report\Figure2_Current_Site_Layout_and_Features.mxd, Date: May 21, 2009 1:47:01 PM

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: One-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

5/09

HARTCROWSER GSI Water Solutions, Inc.

Figure
3

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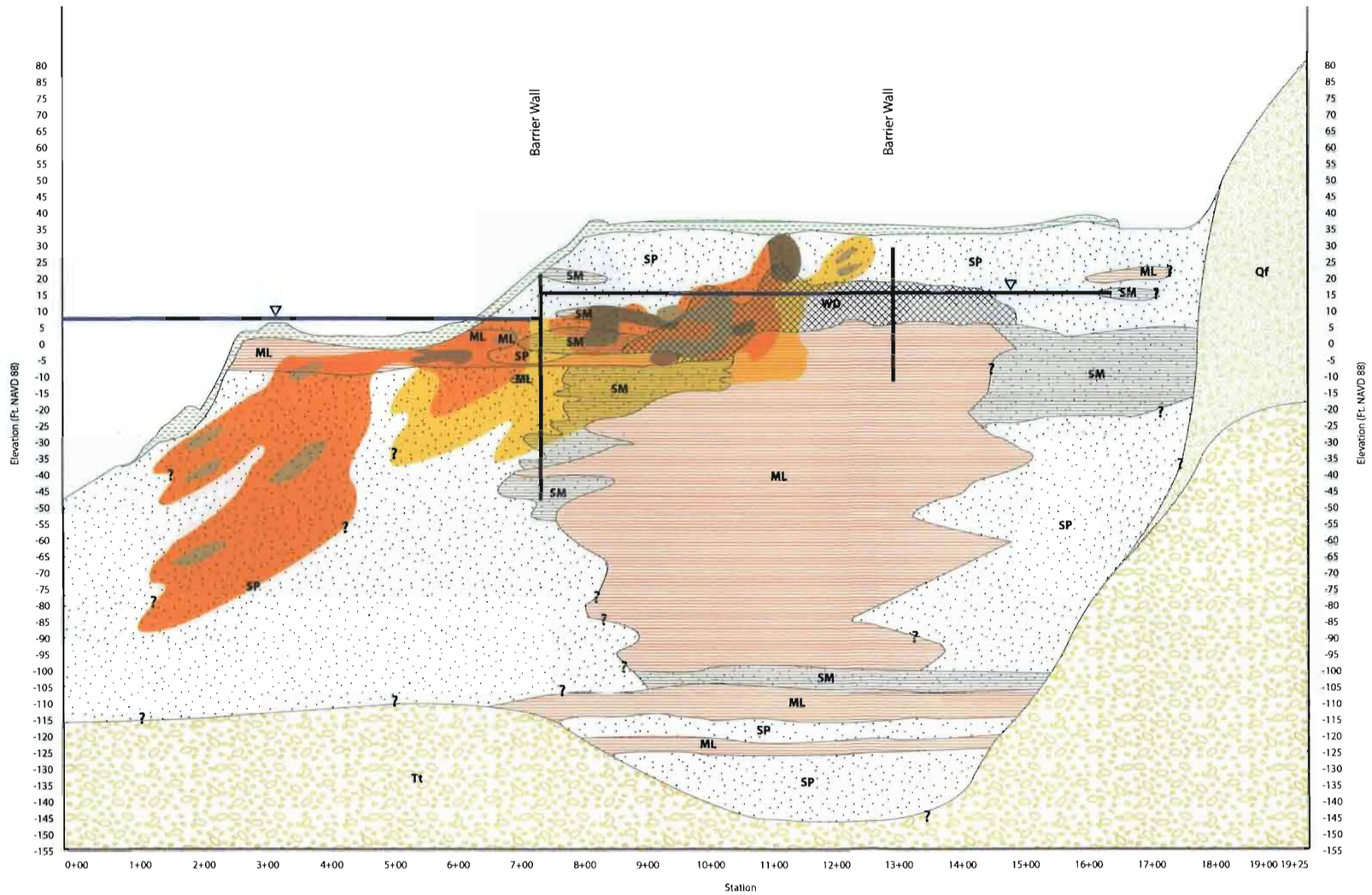


LEGEND

- SP- Sand, Fine to Medium, Poorly Graded
- SM- Silt Sand, or Thin Interbeds of Silt and Sand
- ML- Clayey Silt or Silty Clay
- WD- Wood Debris, Chips or Sawdust Occasionally
- Qf- Catastrophic Flood Deposits Consisteing of Gravels and Sands
- Tt-Troutdale Formation
- Sediment/Soil Cap
- Approximate Shallow Groundwater Level July 23, 2004- Taken from Contour Data
- Creosote Odor
- Strong Creosote Odor
- Heavy Sheen
- Saturated

Horizontal Scale in Feet
0 200 400
0 40 80
Vertical Scale in Feet
Vertical Exaggeration = 5x

McCormick and Baxter Superfund Site
Portland, Oregon

Historic NAPL Distribution Cross Section A2-A2'

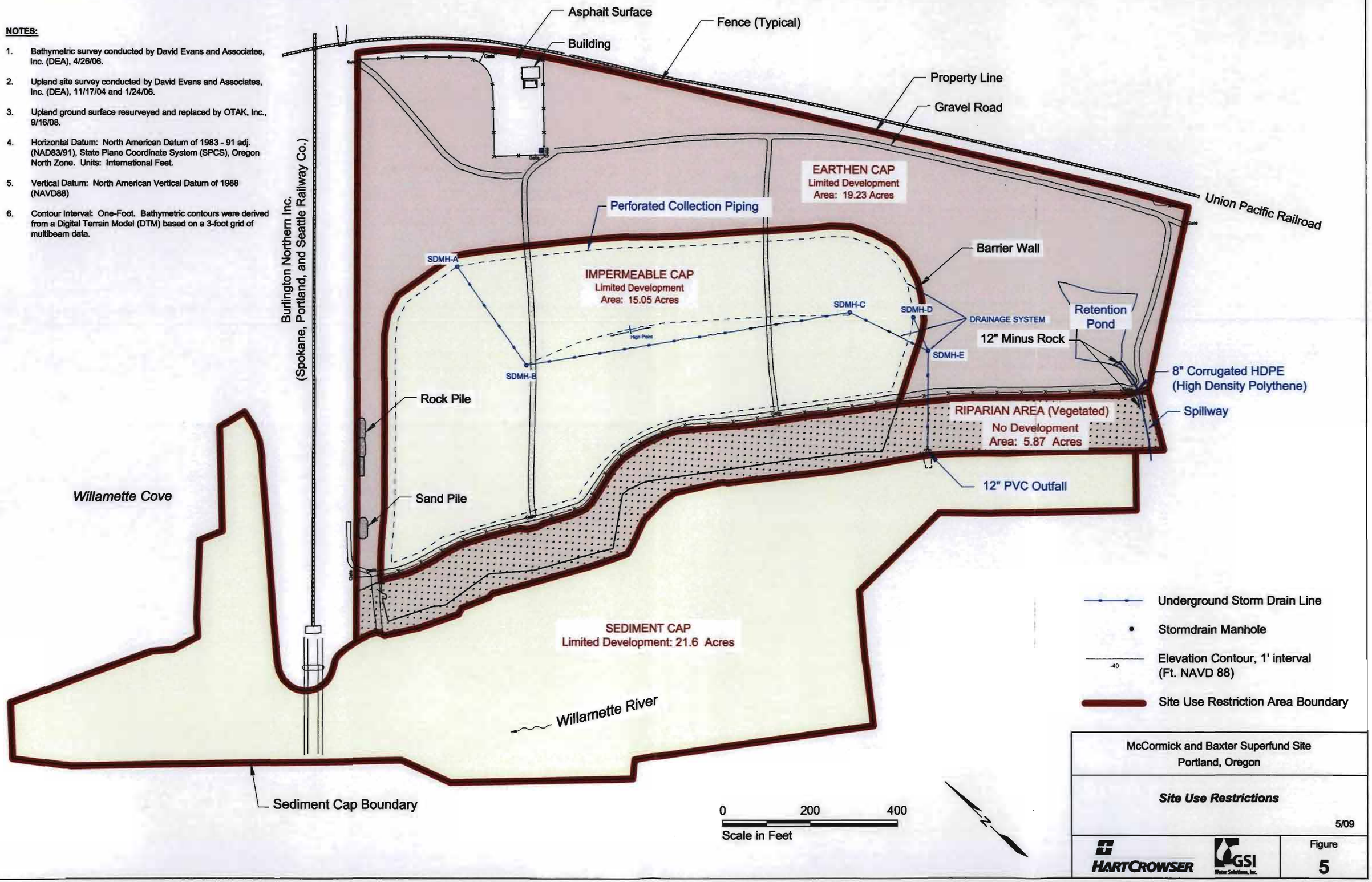
5/09

HARTCROWSER GSI

Figure
4

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: One-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 Use Restrictions

5/09

HARTCROWSER | GSI Water Solutions, Inc.

Figure
5

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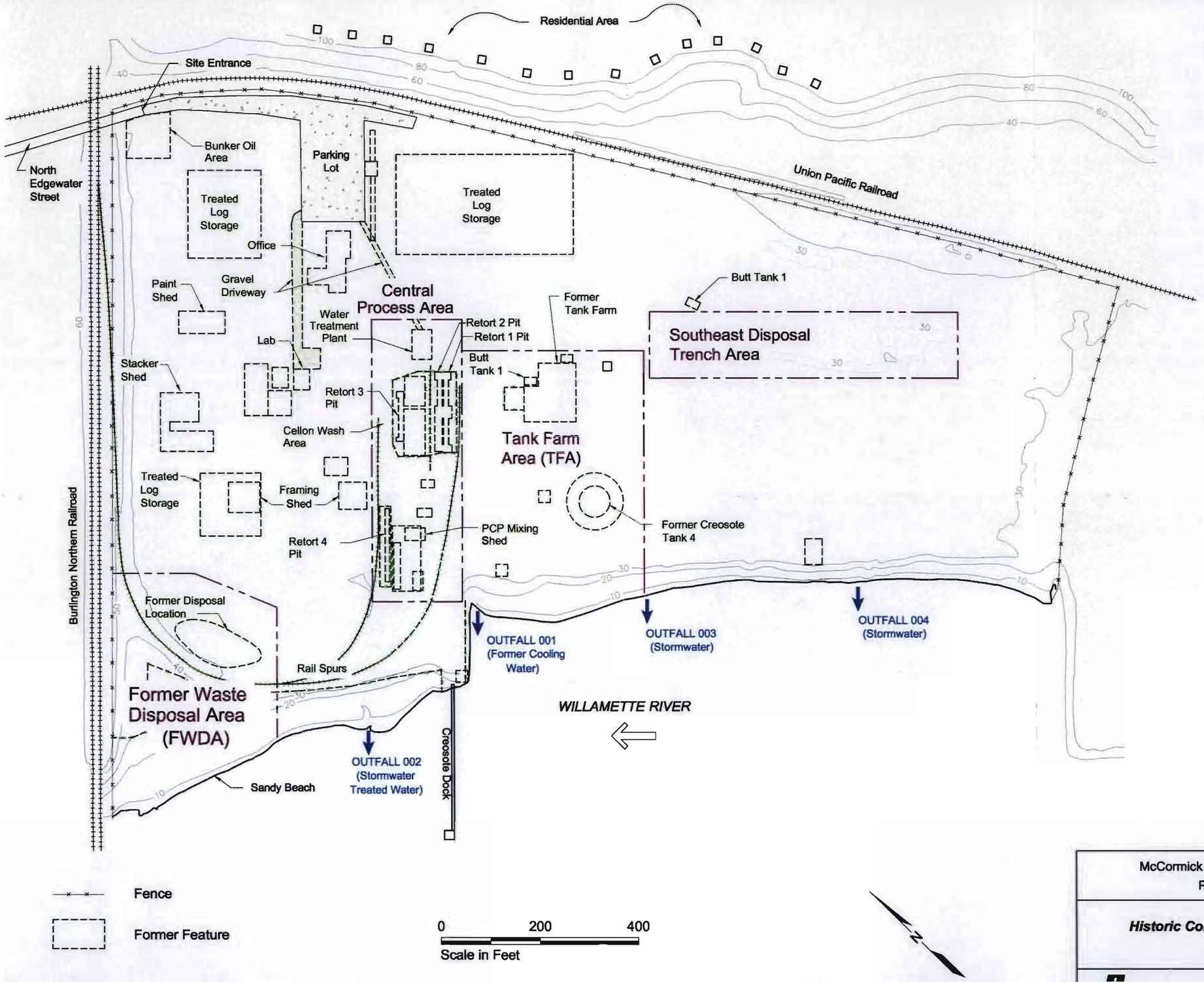

McCormick and Baxter Superfund Site
Portland, Oregon

Historic Contaminant Source Areas

5/09

HARTCROWSER GSI Water Solutions, Inc.

Figure 6

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APPENDIX A
GROUNDWATER AND NAPL MONITORING

OPERATION AND MAINTENANCE REPORT
JANUARY 2008 THROUGH DECEMBER 2008

Hart Crowser/GSI
15670-03/Task 9 May 22, 2009

APPENDIX A
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ACRONYMS

DEQ	Oregon Department of Environmental Quality
DNAPL	dense nonaqueous phase liquid
ft/ft	foot per foot
FWDA	Former Waste Disposal Area
GSI	GSI Water Solutions, Inc.
LNAPL	light nonaqueous phase liquid
MCL	Primary Drinking Water Standard Maximum Contaminant Level
NAPL	nonaqueous phase liquid
NAVD	North American Vertical Datum
O&M	Operation and Maintenance
Site	McCormick & Baxter Superfund Site
TFA	Tank Farm Area

APPENDIX A
GROUNDWATER AND NAPL MONITORING
OPERATION AND MAINTENANCE REPORT
JANUARY 2008 THROUGH DECEMBER 2008
MCCORMICK & BAXTER SUPERFUND SITE

1.0 INTRODUCTION

Appendix A to the *January 2008 through December 2008 Operation and Maintenance (O&M) Report* (O&M Report) presents the nonaqueous phase liquid (NAPL) measurement and extraction results and groundwater elevation and gradient information collected at the McCormick & Baxter Superfund Site (Site) for the period from January 1, 2008, through December 31, 2008. The location of the Site, Site layout, and surface elevations are presented in Figures 1 through 3 in the O&M Report.

2.0 NAPL MEASUREMENTS AND EXTRACTIONS

NAPL monitoring at the Site is used to evaluate the functional performance of the barrier wall and sediment cap, and to document NAPL removal relative to the groundwater remedial action objective: to contain the NAPL plumes, prevent ongoing discharges of NAPL to the Willamette River, and minimize further contamination of the intermediate and deep aquifers.

2.1 Field Activities

Clearwater Environmental Services, under subcontract to Hart Crowser, conducts NAPL gauging weekly at eight monitoring wells, located outside the barrier wall, that historically have contained NAPL. NAPL gauging is also conducted quarterly in conjunction with water level measurements on the 74 onsite wells and 5 offsite wells on the adjacent Burlington Northern and Metro (Willamette Cove area) properties (Figure A-1). Quarterly NAPL gauging events were conducted on March 5, 2008; June 18, 2008; September 30, 2008; and December 16, 2008.

As discussed above, weekly NAPL measurements are recorded at eight Site wells located outside the barrier wall in the Former Waste Disposal Area (FWDA) including: EW-2s, EW-9s, EW-10s, EW-19s, MW-20i, MW-34i, MW-Ds, and MW-Gs. NAPL was detected in five (EW-9s, EW-10s, MW-20i, MW-Ds, and MW-Gs) of the eight wells gauged weekly, and seven (EW-8s, EW-15s, EW-18s, EW-23s, MW-10r, MW-22i, and MW-56s) of the remaining wells gauged quarterly during this reporting period. Figures A-2 through A-5 show the

locations of wells that contained light nonaqueous phase liquid (LNAPL) and/or dense nonaqueous phase liquid (DNAPL) and NAPL thickness measurements for the first through fourth quarters, respectively. Tables A-1 through A-4 provide quarterly NAPL gauging measurements. Figures A-6 through A-16 show the NAPL thickness in individual wells over time.

During the weekly NAPL gauging event, if individual wells meet the NAPL extraction criteria, then NAPL extraction is conducted. NAPL extraction criteria are:

- Minimum of 0.4 foot thickness of LNAPL;
- Minimum of 1.5 feet thickness of DNAPL; and
- The well is located outside the barrier wall.

LNAPL is extracted using a bailer, and DNAPL is extracted using a submersible pump. Extraction is not conducted at wells located within the barrier wall that contain NAPL.

Tables A-5 through A-8 list, for the first through fourth quarters, the weekly NAPL thickness measurements, estimated extraction volumes including water and NAPL (based on depth in a 5-gallon bucket) for wells meeting the extraction criteria, and total NAPL extracted during extended periods based on drum gauging.

2.2 LNAPL Observations

During the weekly NAPL gauging outside the barrier wall, the thickness of LNAPL was measured in well EW-10s at 0.01 foot to 3.04 feet. Typically, the thickness was recorded as less than 0.5 feet. LNAPL extraction was attempted in EW-10s when the thickness measured was greater than 0.4 feet; however, no LNAPL was present in the bailer used to collect the product. Figure A-6 shows a plot of NAPL thickness since 2001 in EW-10s. The LNAPL thickness is fairly consistent over time at less than 0.5 foot with periodic variances in LNAPL thickness. As with the other monitoring wells, LNAPL thickness is generally greater when the groundwater elevation is low due to gravity drainage of LNAPL in the vadose zone. In general, LNAPL does not appear to be increasing in thickness in EW-10s.

LNAPL also was measured at 0.01 foot in wells EW-9s and MW-Ds on March 25, 2008. Historically, there is virtually no LNAPL accumulation in these wells over time, as shown on Figures A-7 and A-8.

During the quarterly monitoring events, when the entire suite of existing wells is measured, LNAPL was routinely detected in the following wells within the barrier wall: EW-15s (0.85 foot to 3.95 feet), EW-18s (zero feet to 1.79 feet), EW-23s (0.15 foot to 3.9 feet), and MW-56s (0.25 foot to 2.23 feet). Figures A-9 through A-12 show the thickness of LNAPL in these wells versus time. EW-15s, EW-18s, and EW-23s show consistent NAPL thicknesses over time. The LNAPL thickness is greatest when the water table (groundwater elevation) is low. Well MW-56s shows an increase in LNAPL thickness in the few years after installation of the barrier wall in 2003. However, in the past 2 years, the thickness in this well appears to be stable.

2.3 DNAPL Observations

DNAPL was regularly detected during weekly gauging of three FWDA wells (MW-20i, MW-Ds, and MW-Gs) outside the barrier wall. In the first quarter of 2008, DNAPL thickness was measured from a minimum of 0.06 foot in well MW-Gs to 7.76 feet in well MW-20i. Extraction was warranted 98 percent of the time for well MW-20i, 44 percent for well MW-Ds, and 29 percent for well MW-Gs. Approximately 0.5 foot of DNAPL was measured during each of 3 weeks in March 2008 in well EW-9s, but DNAPL was not detected before or afterward in that well. Figures A-8, A-13 and A-14 show DNAPL thickness versus time for MW-Ds, MW-20i and MW-Gs, respectively. DNAPL thickness in these wells is fairly consistent, which may be the result of ongoing DNAPL recovery. Well MW-20i recovers sufficiently on a weekly basis, while wells MW-Ds and MW-Gs usually take a few weeks for the DNAPL to recover to a thickness great enough to extract. The amount of recovered DNAPL from MW-20i increased during the last quarter of 2008.

During the more comprehensive quarterly fluid level monitoring, DNAPL was detected each quarter within the barrier wall near the former Tank Farm Area (TFA) in wells MW-22i and EW-8s, and periodically in well EW-18s (see Figures A-2 through A-5). Figure A-10 shows the DNAPL thickness versus time for EW-18s. DNAPL first entered this well between March and June of 2008, was measured at approximately two feet in thickness in September 2008, and was not detected when monitored in December 2008.

Figure A-15 shows the DNAPL thickness versus time for MW-22i. DNAPL was measured in well MW-22i at 6.31 feet, 6.31 feet, zero feet, and 6.16 feet during the first through fourth quarters, respectively. DNAPL also was detected in MW-22i during all four quarters of 2007. Before 2007, DNAPL was reported in MW-22i from 1997 to 2000. In July 2007, because the DNAPL was new in the well and the odor seemed to be more of a petroleum hydrocarbon odor than a creosote odor to the field staff, Clearwater Environmental used a bailer to extract

liquid from the bottom of the well to determine the nature of the DNAPL. The extracted liquid appeared to be water with globules of DNAPL (with creosote odor) interspersed throughout. Because the thickness in the well continued be measured as feet of DNAPL, approximately five gallons of liquid was bailed from the bottom of the well again in 2008. After settling, the liquid was determined to be primarily water. Again, the DNAPL appeared to be in pin-sized globules with a creosote odor, rather than a distinct layer, suggesting that DNAPL thicknesses measured during the monitoring period may not accurately reflect the amount of DNAPL in the well. Because MW-22i is within the barrier wall, no further extractions have been conducted.

Figure A-16 presents the DNAPL thickness versus time for EW-8s. The thickness of DNAPL in EW-8s has fluctuated between zero to 6 feet; the prevalent thickness DNAPL measured in this well is approximately 2 feet. DNAPL was at 13.51 feet on June 18, 2008. This appears to be an erroneous measurement since the measurements before and after were consistent with the prevalent thickness of approximately 2 feet. It is probable that the measuring tape was read 10 feet off and the thickness should be 3.51 feet of DNAPL.

Both DNAPL and LNAPL have been measured in wells EW-10s and EW-9s (Figures A-6 and A-7, respectively). Well EW-10s had a short lived accumulation of DNAPL (up to 2 ft.) in 2005 but no DNAPL has been detected since 2005. DNAPL was also measured in Well EW-9s until May 2008.

2.4 NAPL Extraction Summary

LNAPL was not recovered from any wells at the Site in 2008 and, with the possible exception of MW-56s, does not appear to be increasing in thickness, either inside or outside the barrier wall.

Approximately 57 gallons of DNAPL were extracted from the Site from January 1 through December 31, 2008. Historical cumulative NAPL extraction is presented in Table A-9, and shown graphically on Figure A-17. Between February 1993 and December 31, 2008, approximately 6,260 gallons of NAPL have been extracted from Site wells. The amount of DNAPL recovered from wells outside the barrier wall was similar to calendar year 2007. The bulk of the DNAPL was recovered from MW-20i. Relatively small amounts of DNAPL were extracted from MW-Ds and MW-Gs.

3.0 QUARTERLY GROUNDWATER MONITORING

Quarterly groundwater monitoring generally consists of (1) manual water level gauging from 79 monitoring wells located at the Site and on the adjacent Burlington Northern and Metro (Willamette Cove area) properties, and (2) collecting continuous automated transducer data from a subset of the wells. Groundwater monitoring data provide information about the impact of the barrier wall and impermeable sediment cap on groundwater flow at the Site.

3.1 Water Level Measurements

Quarterly manual measurements of static groundwater levels were conducted on March 5, 2008; June 18, 2008; September 30, 2008; and December 16, 2008; during low tide. Based on the manually measured groundwater levels, shallow groundwater elevation contour maps were developed for each of the four quarters (Figures A-18 through A-21, respectively). The groundwater elevation data for each quarterly monitoring event are included in Tables A-1 through A-4, respectively.

Groundwater level data were collected using pressure transducers that monitored groundwater level fluctuations on a 30-minute basis at select monitoring wells surrounding the barrier wall for the entire monitoring period. Most of these wells (14 of 18 wells) are located along the riverfront portion of the barrier wall, in well clusters MW-36, MW-37, MW-44, and MW-45, and the shallow well in clusters MW-40 and MW-41. Each of these well clusters has a shallow, intermediate and deep well. Transducers also were installed in upland wells MW-52s and MW-53s to see the difference in groundwater elevations inside and upgradient of the barrier wall. The transducers in wells EW-1s and EW-15s were recently installed on October 1, 2008, with the objective of understanding the shallow groundwater table fluctuation within the barrier wall.

Hydrographs were prepared using the transducer data for monitoring wells inside and outside the barrier wall as shown on Figures A-22 through A-31. The hydrographs compare water-level elevations inside the barrier wall versus water-level elevations outside the barrier wall, river elevation, and precipitation data.

Multiple hydrographs were prepared for the paired well clusters MW-36/MW-37 and MW-44/MW-45. Figure A-22 shows a comprehensive hydrograph of groundwater for well clusters MW-36 and MW-37 and river elevations from October 2003, when transducers initially were installed after construction of the barrier wall, to December 16, 2008. Additional detail is provided in Figures A-23 and A-24, which show the 2008 data and a subset of data for a 20-day period in November 2008. Similarly, historic and annual hydrographs for well

clusters MW-44 and MW-45 have been prepared and are presented as Figures A-25 and A-26, respectively. To show more detail and compare trends between the high and low flow periods, Figures A-27 and A-28 were created to present select 10- to 15-day periods during the months of June and October 2008.

Historical hydrographs have been prepared for the shallow well pairs MW-40/MW-41, MW-52s/MW-53s, and EW-1s/EW-15s, and are presented as Figures A-29, A-30, and A-31, respectively.

River stage data were recorded on a 30-minute basis from U.S. Geological Survey station number 14211720, located on the upstream side of the Morrison Bridge, and corrected to river stage adjacent to the Site [(Morrison Bridge data)-(0.1 ft)]. River stage elevation data were collected relative to the Portland River Datum and are corrected to NAVD88 (+5.001 feet).

3.2 Shallow Groundwater Flow Direction and Horizontal Gradients

As shown in the shallow groundwater contour maps (Figures A-18 through A-21), the shallow horizontal groundwater gradient within the barrier wall is independent of the gradient outside the barrier wall demonstrating that the barrier wall has effectively cut off the connection between the shallow groundwater zone inside the barrier wall from the shallow groundwater zone outside the barrier wall. Shallow groundwater elevations at the bluff side of the barrier wall are lower inside the barrier wall while shallow groundwater elevations toward the river are lower outside the barrier wall than inside the barrier wall.

Since the installation of the barrier wall in 2003, elevation differences inside versus outside the barrier wall have increased. The upland groundwater elevations are higher outside of the barrier wall due to the impediment, which deflects groundwater flow horizontally around the barrier wall from upland areas. Prior to the barrier wall construction, the groundwater gradient followed natural conditions. After the barrier wall construction and prior to installation of the impermeable soil cap, the elevation differences between the exterior upland shallow well MW-53s, and its interior counterpart MW-52s fluctuated from approximately 0.25 foot to 2 feet (Figure A-30). The elevation differences inside verses outside the barrier wall have further increased since the installation of the impermeable soil cap in late 2005, indicating a significant reduction in rainwater entering the barrier wall area through the riparian area and a small amount of precipitation infiltrating between the edge of the impermeable sediment cap liner and the top of the barrier wall. After installation of the sediment cap, the difference in groundwater elevations between MW-53s and MW-52s increased to a range of 2 to 6 feet. In late winter, the difference in elevation between the interior and exterior wells reaches its maximum separation of about 5 to 6 feet.

Alternatively, the separation between the interior and exterior wells is reduced to about 2 to 3 feet.

The shallow groundwater horizontal gradient inside the barrier wall is typically flat (approximately 0.002 foot/foot [ft/ft]) compared to the shallow horizontal gradient (ranging from 0.002 ft/ft to 0.007 ft/ft) outside the barrier wall. Outside the barrier wall, shallow groundwater flow is diverted around the barrier wall toward Willamette Cove and the Willamette River. This is consistent with previous reporting periods. Generally, under low flow conditions in the Willamette River, the horizontal groundwater gradient inside the barrier wall is west, toward the FWDA. The groundwater contour maps for the third and fourth quarters (Figures A-18, A-20, and A-21, respectively) confirm the westerly groundwater gradient. Transducers were installed in two interior shallow wells (EW-1s and MW-15s) in October 2008. The transducer data, presented in Figure A-31, confirm that there is a westerly gradient of approximately 0.0017 ft/ft toward MW-15s during the December 2008 sampling event. Comparing groundwater elevations between these two points in future monitoring events will be useful in determining trends in the hydraulic gradient within the barrier wall.

A reversal in gradient within the barrier wall was observed in June 2008, when the Willamette River was at its peak stage (greater than 15 feet NAVD88). Because of an anomalously high groundwater elevation reading in well EW-1s that is believed to be erroneous, this data point has been excluded from contouring on Figure A-19. With this elevated reading from EW-1s excluded, the gradient within the well is relatively flat, but sloping toward the northeast corner of the barrier wall. Since a transducer was installed in EW-1s on October 1, 2008, there has been no indication during storm events of a groundwater mound (Figure A-31) confirming the conclusion that the measurement in June at EW-1s was erroneous. The frequent fluctuations in EW-1s, as shown on Figure A-31, are thought to be caused by methane gas escaping from the degradation of the wood debris buried at the site escaping through EW-1s. See Appendix B regarding the upland subsidence for further explanation.

3.3 Vertical Gradients

Vertical gradients inside and outside the barrier wall along the Willamette River are best observed in monitoring well clusters MW-36/MW-37 and MW-44/MW-45. The hydrographs for these wells (Figures A-22 through A-28) indicate that the intermediate and deep zones of the aquifer are highly influenced by fluctuations in the river levels. The intermediate and deep zones both inside and outside of the barrier wall closely mimic the river stage both in elevation and timing with a small vertical gradient that varies between upward and downward with the tidal changes. The exterior shallow wells experience about a quarter

cycle delay from river fluctuations and have a dampened amplitude in comparison with the deeper wells.

Closer inspection of Figure A-24 or A-28, for monitoring well clusters MW-36/ MW-37 and MW-44/MW-45, reveals that there is a reversal in the vertical hydraulic gradient outside the barrier wall every time the tide advances or retreats and the river levels change. Because the shallow exterior wells have a higher groundwater elevation during low tide and low river stage events, there is a downward vertical gradient during this time. In contrast, the gradient is upward during high tide. This indicates that groundwater gradient outside the barrier wall switches between an upward and downward gradient about two times per day during the low flow season. However, as the peak discharge in the river increases, the intermediate and deeper water levels in well cluster MW-37 raise faster than the shallow zones and the gradient in this vicinity is primarily upward. This effect does not hold true for well cluster MW-45 because the shallow water levels rise faster during the peak flow events so that there is a net downward gradient despite the rising water levels.

In contrast to the deeper zones and the shallow exterior wells, it is clear that the hydraulic connection between the shallow zone and deeper zones within and upgradient of the barrier wall is minimal and, where present, is retarded. While the shallow interior wells experience some minor cyclic tidal variations and generally follow the major trends in the river, the response is dampened and delayed compared to the intermediate and deep wells inside the barrier wall where a strong downward gradient is typical. Given the apparent discontinuity (low vertical hydraulic conductivity) between the shallow and deeper zones, the relatively strong downward gradient within the barrier wall is not indicative of significant groundwater flow to the deeper zones. Similarly an apparent upward gradient may result from semi-confined conditions at depth rather than the upwelling of water under unconfined conditions. Figures A-22 to A-29 show that the shallow reversal in gradient within the barrier wall occurs only when the Willamette River experiences peak flow conditions and has an elevation greater than about 13 feet NAVD88.

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. This is likely because the sediment cap was designed to divert precipitation so that little infiltration occurs within the barrier wall. Although infiltration downgradient of the barrier wall occurs, the groundwater responses are minimal and muted in comparison to responses in variations of the river stage. The shallow zone upgradient or cross-gradient from the barrier wall appears to react subtly to precipitation and is less connected to the river

because of the barrier wall, which is sealed into the underlying silt. One location where infiltration is thought to have significant influence on the groundwater elevations and flow paths is in the infiltration pond that receives diverted runoff from the sediment cap. Figures A-18 through A-21 show a slight groundwater mound in this area east of the sediment cap, which induces a radial, and slightly downward, groundwater gradient.

The net vertical gradients between the shallow and intermediate, intermediate and deep, and shallow and deep zones have been calculated for 2008 and are presented in Table A-10. In all wells, the net annual vertical gradient is downward between the shallow zone and the intermediate and deep zones. As would be expected, the downward gradient is greater inside the barrier wall (MW-36 and MW-44 clusters) since the shallow groundwater elevation inside the barrier wall continues to be elevated as compared to the River elevation. The net vertical gradient outside the barrier wall is smaller while still downward between the shallow zone and intermediate and deep zones. The net vertical gradient is upward between the intermediate and deep zone in wells MW-37, MW-44, and MW-45, which likely indicates that these deeper zones are under confining pressures.

4.0 SUMMARY

During the monitoring period, there was not sufficient accumulation of LNAPL to warrant extraction from wells outside the barrier wall. DNAPL was extracted from three wells located outside the barrier wall in the FWDA. Approximately 57 gallons of liquid (DNAPL/water mixture), primarily from MW-20i, were extracted during the monitoring period, corresponding to an estimated 57.3 gallons of DNAPL.

Shallow groundwater elevation and gradient during the 2008 reporting period at the Site are generally consistent with conditions observed during previous reporting periods. Horizontal gradients are the greatest during periods of high precipitation and decrease during periods of low precipitation. Groundwater flow inside the barrier wall remains flat and generally to the west, while outside the wall, shallow groundwater flow is diverted around the barrier wall to the northwest and south. The shallow water levels within the barrier wall are approaching the elevation of the Willamette River and are in hydraulic connection with the river.

Under stable river conditions, vertical groundwater gradient figures indicate that gradients are generally downward during low tide and high tide inside the

barrier wall in the FWDA and former TFA, with the exception of an upward gradient during high tide in the former TFA.

Based on the observations made through the 2008 reporting period, it appears that the barrier wall and impermeable soil cap are functioning as designed: groundwater flow and rainwater infiltration are diverted around source areas contained within the barrier wall, and NAPL contained within the barrier wall is prohibited from migrating to the Willamette River. NAPL does not appear to be increasing significantly in any of the monitoring wells and the overall rate of extraction of NAPL appears to be stable. It should be noted that NAPL collection approaches have changed over time, in terms of pumping approaches and the number of wells from which NAPL is extracted. However, as NAPL extraction rates stabilize, the overall strategy for collecting NAPL from the Site may warrant re-evaluation, taking into consideration the total volume of NAPL anticipated to remain at the Site and the potential for future migration of residual NAPL.

At this time, it is anticipated that future O&M activities will be conducted in accordance with the *Draft Final Operation and Maintenance Plan* (DEQ, 2007), including groundwater gauging and NAPL extraction activities.

5.0 REFERENCES

DEQ, 2007. *Draft Final Operation and Maintenance Plan, McCormick & Baxter Creosoting Company Superfund Site Portland, Oregon, ORD00020603.* March 2007.

GSI, 2007. *Post Remedial Action Conceptual Site Model for NAPL Transport, McCormick & Baxter Creosoting Company, Portland, Oregon.* October 2007.

Table A-1 - Groundwater and NAPL Elevations: March 5, 2008
McCormick and Baxter Superfund Site
Portland, Oregon

Well ID	Time	Measuring Point Elevation (ft NAVD88)	Depth to LNAPL (ft)	Depth to water (ft)	Depth to DNAPL (ft)	Well TD Elevation (ft NAVD88)	LNAPL Elevation (ft NAVD88)	LNAPL Thickness (ft)	DNAPL Thickness (ft)	Groundwater Elevation LNAPL Corrected (ft NAVD88)
EW-10s	9:21	29.52	20.32	20.35	ND	-13.2	9.20	0.03		9.20
EW-15s	10:14	43.12	31.28	32.13	ND	-5.55	11.84	0.85		11.83
EW-18s	10:29	40.82	27.21	27.23	ND	-3.92	13.61	0.02		13.61
EW-19s	9:15	26.06	ND	16.91	ND	-4.19				9.15
EW-1s	10:37	41.41	ND	26.93	ND	-6.57				14.48
EW-23s	10:06	38.63	26.37	30.21	ND	-1.67	12.26	3.84		12.19
EW-2s	9:52	42.48	ND	32.26	ND	-4.24				10.22
EW-8s	10:45	40.57	ND	26.92	52.86	-14.23			1.94	13.65
EW-9s	9:49	40.83	30.95	30.96	45.71	-5.62	9.88	0.01		9.88
MW-10r	10:05	42.01	ND	28.55	ND	1.46				13.46
MW-15s	9:45	43.30	ND	30.84	ND	5.02				12.46
MW-17s	9:55	41.35	ND	28.37	ND	1.21				12.98
MW-18s	8:50	43.18	ND	33.10	ND	-3.28				10.08
MW-1r	11:34	38.19	ND	25.69	ND	-14.2				12.50
MW-20i	9:40	41.55	ND	32.55	66.96	-33.25			7.84	9.00
MW-22i	9:25	42.35	ND	32.84	52.72	-16.68			6.31	9.51
MW-23d	NM	41.68	NM	NM	NM	-147.26				NM
MW-2s	10:22	38.37	ND	25.18	ND	0.19				13.19
MW-32i	10:35	39.37	ND	27.4	ND	-23.24				11.97
MW-34i	9:12	32.75	ND	23.64	ND	-52.47				9.11
MW-35r	9:00	32.27	ND	21.7	ND	-9.1				10.57
MW-36d	9:05	30.52	ND	21.51	ND	-57.25				9.01
MW-36i	9:03	30.26	ND	21.19	ND	-23.16				9.07
MW-36s	9:00	30.83	ND	19.4	ND	1.7				11.43
MW-37d	9:10	26.15	ND	17.14	ND	-57.31				9.01
MW-37i	9:08	25.99	ND	16.94	ND	-22.22				9.05
MW-37s	9:07	24.97	ND	15.95	ND	-4.04				9.02
MW-38d	9:22	31.92	ND	22.86	ND	-56.8				9.06
MW-38i	9:24	32.18	ND	23.03	ND	-21.81				9.15
MW-38s	9:26	32.38	ND	20.74	ND	1.08				11.64
MW-39d	9:13	29.89	ND	20.84	ND	-57.27				9.05
MW-39i	9:15	30.20	ND	21.16	ND	-22.54				9.04
MW-39s	9:19	29.85	ND	20.73	ND	0.1				9.12
MW-3s	10:19	30.65	ND	13.56	ND	-0.18				17.09
MW-40d	9:23	29.00	ND	19.72	ND	-58.56				9.28
MW-40i	9:19	28.49	ND	19.59	ND	-22.47				8.90
MW-40s	9:16	28.35	ND	16.26	ND	1.56				12.09
MW-41d	9:44	27.49	ND	18.48	ND	-57.89				9.01
MW-41i	9:39	27.17	ND	18.11	ND	-23.85				9.06
MW-41s	9:36	27.49	ND	18.99	ND	0.39				8.50
MW-42d	9:45	32.24	ND	23.24	ND	-56.68				9.00
MW-42i	9:46	32.71	ND	23.71	ND	-21.2				9.00
MW-42s	9:48	32.39	ND	19.12	ND	5.35				13.27
MW-43d	9:55	28.37	ND	19.38	ND	-57.45				8.99
MW-43i	9:52	30.36	ND	21.35	ND	-22.37				9.01
MW-43s	9:50	31.08	ND	22.13	ND	4.07				8.95
MW-44d	10:00	29.37	ND	20.32	ND	-57.59				9.05
MW-44i	10:01	29.62	ND	20.30	ND	-22.69				9.32
MW-44s	10:03	29.71	ND	16.08	ND	0.54				13.63
MW-45d	10:08	27.94	ND	18.86	ND	-58.59				9.08
MW-45i	10:10	28.05	ND	18.97	ND	-22.56				9.08
MW-45s	10:05	28.23	ND	19.13	ND	-0.1				9.10
MW-46s	10:15	35.58	ND	21.87	ND	3.83				13.71
MW-47s	10:13	35.57	ND	25.70	ND	4.43				9.87
MW-48s	10:40	38.96	ND	24.78	ND	2.55				14.18
MW-49s	10:37	37.78	ND	17.05	ND	1.86				20.73
MW-50s	10:10	39.49	ND	25.46	ND	3.82				14.03
MW-51s	10:18	39.68	ND	19.34	ND	4.37				20.34
MW-52s	10:28	40.80	ND	27.42	ND	-0.3				13.38
MW-53s	10:25	40.58	ND	21.46	ND	-0.43				19.12
MW-54s	9:38	41.86	ND	28.54	ND	5.48				13.32
MW-55s	9:35	41.14	ND	25.65	ND	5.21				15.49
MW-56s	10:22	43.52	31.45	32.10	ND	6.2	12.07	0.65		12.06

Table A-1 - Groundwater and NAPL Elevations: March 5, 2008
McCormick and Baxter Superfund Site
Portland, Oregon

Well ID	Time	Measuring Point Elevation (ft NAVD88)	Depth to LNAPL (ft)	Depth to water (ft)	Depth to DNAPL (ft)	Well TD Elevation (ft NAVD88)	LNAPL Elevation (ft NAVD88)	LNAPL Thickness (ft)	DNAPL Thickness (ft)	Groundwater Elevation LNAPL Corrected (ft NAVD88)
MW-57s	9:40	42.12	ND	31.28	ND	5.92				10.84
MW-58d	8:55	41.43	ND	32.41	ND	-48.14				9.02
MW-58i	8:45	40.99	ND	31.9	ND	-14.19				9.09
MW-58s	8:50	41.51	ND	32.41	ND	5.24				9.10
MW-59s	10:25	35.76	ND	19.09	ND	-0.9				16.67
MW-60d	8:57	40.15	ND	31.08	ND	-80.3				9.07
MW-61s	9:15	43.67	ND	27.44	ND	2.3				16.23
MW-62i	9:50	42.71	ND	33.7	ND	-21.3				9.01
MW-7 WC	9:05	36.69	ND	23.84	ND	-0.31				12.85
MW-As	10:50	39.33	ND	20.44	ND	9.81				18.89
MW-Ds	9:58	43.02	ND	33.05	36.55	4.24			2.23	9.97
MW-Gs	9:28	40.33	ND	30.80	43.79	-4.52			1.06	9.53
MW-Ks	9:30	44.23	ND	27.44	ND	1.96				16.79
MW-Os	10:18	41.02	ND	20.68	ND	-4.42				20.34
PW-1d	10:22	44.07	ND	32.11	ND	-93.45				11.96
PW-2d	10:15	41.85	ND	29.88	ND	-58.98				11.97

ND = not detected NM = not measured LNAPL specific gravity estimated as 0.981 g/cm3

Table A-2 - Groundwater and NAPL Elevations: June 18, 2008
McCormick and Baxter Superfund Site
Portland, Oregon

Well ID	Time	Measuring Point Elevation (ft NAVD88)	Depth to LNAPL (ft)	Depth to water (ft)	Depth to DNAPL (ft)	Well TD Elevation (ft NAVD88)	LNAPL Elevation (ft NAVD88)	LNAPL Thickness (ft)	DNAPL thickness (feet)	Groundwater Elevation LNAPL Corrected (ft NAVD88)
EW-10s	14:40	29.52	13.82	14.35	ND	-13.2	15.70	0.53		15.69
EW-15s	15:14	43.12	28.25	29.30	ND	-5.55	14.87	1.05		14.85
EW-18s	15:38	40.82	ND	26.62	43.11	-3.92			1.63	14.20
EW-19s	14:36	26.06	ND	10.46	ND	-4.19				15.60
EW-1s	14:30	41.41	ND	23.01	ND	-6.57				18.40
EW-23s	15:00	38.63	22.66	22.81	ND	-1.67	15.97	0.15		15.97
EW-2s	14:53	42.48	ND	26.85	ND	-4.24				15.63
EW-8s	15:21	40.57	ND	26.35	41.29	-14.23			13.51	14.22
EW-9s	14:50	40.83	ND	25.30	ND	-5.62				15.53
MW-10r	15:49	42.01	ND	27.74	ND	1.46				14.27
MW-15s	15:22	43.30	ND	18	ND	5.02				25.30
MW-17s	15:35	41.35	ND	26.8	ND	1.21				14.55
MW-18s	17:00	43.18	ND	27.60	ND	-3.28				15.58
MW-1r	14:55	38.19	ND	21.25	ND	-14.2				16.94
MW-20i	14:48	41.55	ND	25.72	ND	-33.25				15.83
MW-22i	15:40	42.35	ND	26.59	52.72	-16.68			6.31	15.76
MW-23d	15:55	41.68	ND	27.75	ND	-147.26				13.93
MW-2s	16:16	38.37	ND	23.76	ND	0.19				14.61
MW-32i	16:26	39.37	ND	24.56	ND	-23.24				14.81
MW-34i	15:38	32.75	ND	16.84	ND	-52.47				15.91
MW-35r	14:45	32.27	ND	16.36	ND	-9.1				15.91
MW-36d	14:06	30.52	ND	14.71	ND	-57.25				15.81
MW-36i	14:03	30.26	ND	14.49	ND	-23.16				15.77
MW-36s	14:00	30.83	ND	15.91	ND	1.7				14.92
MW-37d	14:20	26.15	ND	10.33	ND	-57.31				15.82
MW-37i	14:14	25.99	ND	10.12	ND	-22.22				15.87
MW-37s	14:10	24.97	ND	9.29	ND	-4.04				15.68
MW-38d	14:24	31.92	ND	16.12	ND	-56.8				15.80
MW-38i	14:23	32.18	ND	16.34	ND	-21.81				15.84
MW-38s	14:22	32.38	ND	17.58	ND	1.08				14.80
MW-39d	14:30	29.89	ND	14.11	ND	-57.27				15.78
MW-39i	14:28	30.20	ND	14.38	ND	-22.54				15.82
MW-39s	14:26	29.85	ND	14.37	ND	0.1				15.48
MW-3s	16:10	30.65	ND	13.22	ND	-0.18				17.43
MW-40d	14:42	29.00	ND	12.98	ND	-58.56				16.02
MW-40i	14:40	28.49	ND	13.02	ND	-22.47				15.47
MW-40s	14:34	28.35	ND	13.69	ND	1.56				14.66
MW-41d	14:55	27.49	ND	11.72	ND	-57.89				15.77
MW-41i	14:50	27.17	ND	11.38	ND	-23.85				15.79
MW-41s	14:45	27.49	ND	12.45	ND	0.39				15.04
MW-42d	15:10	32.24	ND	16.53	ND	-56.68				15.71
MW-42i	15:05	32.71	ND	17.00	ND	-21.2				15.71
MW-42s	15:00	32.39	ND	18.07	ND	5.35				14.32
MW-43d	15:20	28.37	ND	12.63	ND	-57.45				15.74
MW-43i	15:15	30.36	ND	14.64	ND	-22.37				15.72
MW-43s	15:13	31.08	ND	15.46	ND	4.07				15.62
MW-44d	15:33	29.37	ND	13.61	ND	-57.59				15.76
MW-44i	15:30	29.62	ND	13.95	ND	-22.69				15.67
MW-44s	15:26	29.71	ND	15.49	ND	0.54				14.22
MW-45d	15:50	27.94	ND	12.18	ND	-58.59				15.76
MW-45i	15:45	28.05	ND	12.31	ND	-22.56				15.74
MW-45s	15:38	28.23	ND	12.69	ND	-0.1				15.54
MW-46s	15:53	35.58	ND	21.41	ND	3.83				14.17

Table A-2 - Groundwater and NAPL Elevations: June 18, 2008
McCormick and Baxter Superfund Site
Portland, Oregon

Well ID	Time	Measuring Point Elevation (ft NAVD88)	Depth to LNAPL (ft)	Depth to water (ft)	Depth to DNAPL (ft)	Well TD Elevation (ft NAVD88)	LNAPL Elevation (ft NAVD88)	LNAPL Thickness (ft)	DNAPL thickness (feet)	Groundwater Elevation LNAPL Corrected (ft NAVD88)
MW-47s	15:55	35.57	ND	20.01	ND	4.43				15.56
MW-48s	16:26	38.96	ND	27.74	ND	2.55				11.22
MW-49s	16:20	37.78	ND	19.25	ND	1.86				18.53
MW-50s	15:58	39.49	ND	25.33	ND	3.82				14.16
MW-51s	16:00	39.68	ND	21.3	ND	4.37				18.38
MW-52s	16:21	40.80	ND	26.6	ND	-0.3				14.20
MW-53s	16:20	40.58	ND	22.54	ND	-0.43				18.04
MW-54s	15:15	41.86	ND	27.54	ND	5.48				14.32
MW-55s	15:14	41.14	ND	24.12	ND	5.21				17.02
MW-56s	15:31	43.52	28.74	28.99	ND	6.2	14.78	0.25		14.78
MW-57s	15:17	42.12	ND	26.06	ND	5.92				16.06
MW-58d	14:49	41.43	ND	25.6	ND	-48.14				15.83
MW-58i	14:52	40.99	ND	25	ND	-14.19				15.99
MW-58s	14:51	41.51	ND	25.92	ND	5.24				15.59
MW-59s	17:10	35.76	ND	18.39	ND	-0.9				17.37
MW-60d	17:04	40.15	ND	24.24	ND	-80.3				15.91
MW-61s	14:58	43.67	ND	26.4	ND	2.3				17.27
MW-62i	15:29	42.71	ND	26.8	ND	-21.3				15.91
MW-7 WC	14:41	36.69	ND	20.55	ND	-0.31				16.14
MW-As	16:30	39.33	ND	21.5	ND	9.81				17.83
MW-Ds	15:27	43.02	ND	27.41	36.74	4.24			2.04	15.61
MW-Gs	14:44	40.33	ND	24.73	43.79	-4.52			1.06	15.60
MW-Ks	15:05	44.23	ND	26.84	ND	1.96				17.39
MW-Os	16:06	41.02	ND	22.66	ND	-4.42				18.36
PW-1d	16:10	44.07	ND	29.31	ND	-93.45				14.76
PW-2d	16:10	41.85	ND	27.16	ND	-58.98				14.69

ND = not detected NM = not measured LNAPL specific gravity estimated as 0.981 g/cm3

Table A-3 - Groundwater and NAPL Elevations: September 30, 2008
McCormick and Baxter Superfund Site
Portland, Oregon

Well ID	Time	Measuring Point Elevation (ft NAVD88)	Depth to LNAPL (ft)	Depth to water (ft)	Depth to DNAPL (ft)	Well TD Elevation (ft NAVD88)	LNAPL Elevation (ft NAVD88)	LNAPL Thickness (ft)	DNAPL Thickness (ft)	Groundwater Elevation LNAPL Corrected (ft NAVD88)
EW-10s	14:29	29.43	ND	22.46	ND	-13.2				6.97
EW-15s	14:55	43.01	32.50	36.45	ND	-5.55	10.51	3.95		10.43
EW-18s	15:27	40.74	27.84	28.04	43.11	-3.92	12.90	0.20	1.55	12.90
EW-19s	14:26	25.94	ND	18.26	ND	-4.19				7.68
EW-1s	15:32	40.34	ND	27.31	43.94	-6.57				13.03
EW-23s	14:50	37.61	27.34	31.24	ND	-1.67	10.27	3.90		10.20
EW-2s	15:06	42.37	ND	34.46	ND	-4.24				7.91
EW-8s	15:01	40.48	ND	27.77	52.10	-14.23			2.61	12.71
EW-9s	14:34	40.75	ND	32.76	ND	-5.62				7.99
MW-10r	16:30	41.85	ND	28.98	ND	1.46				12.87
MW-15s	16:06	43.25	ND	30.80	ND	5.02				12.45
MW-17s	14:27	41.25	ND	29.12	ND	1.21				12.13
MW-18s	14:26	43.14	ND	34.90	ND	-3.28				8.24
MW-1r	14:20	37.63	ND	ND	ND	-14.2				10.72
MW-20i	14:39	41.44	ND	34.98	69.76	-33.25			4.93	6.47
MW-22i	16:20	42.28	ND	34.95	ND	-16.68				7.33
MW-23d	16:36	41.06	ND	33.30	ND	-147.26				7.76
MW-2s	15:58	38.26	ND	26.81	ND	0.19				11.45
MW-32i	16:55	39.34	ND	28.41	ND	-23.24				10.93
MW-34i	14:36	32.66	ND	26.20	ND	-52.47				6.46
MW-35r	15:00	32.27	ND	DRY	ND	-9.1				NA
MW-36d	14:39	30.45	ND	23.99	ND	-57.25				6.46
MW-36i	14:37	30.18	ND	23.66	ND	-23.16				6.52
MW-36s	14:35	30.74	ND	20.56	ND	1.7				10.18
MW-37d	14:41	26.05	ND	19.65	ND	-57.31				6.40
MW-37i	14:43	25.88	ND	19.46	ND	-22.22				6.42
MW-37s	14:45	24.86	ND	17.47	ND	-4.04				7.39
MW-38d	14:48	31.84	ND	25.31	ND	-56.8				6.53
MW-38i	14:50	32.06	ND	25.42	ND	-21.81				6.64
MW-38s	14:51	32.31	ND	21.81	ND	1.08				10.50
MW-39d	14:52	29.83	ND	23.30	ND	-57.27				6.53
MW-39i	14:55	30.08	ND	23.60	ND	-22.54				6.48
MW-39s	14:56	29.75	ND	21.99	ND	0.1				7.76
MW-3s	15:49	30.61	ND	17.01	ND	-0.18				13.60
MW-40d	14:59	28.67	ND	22.10	ND	-58.56				6.57
MW-40i	15:01	28.73	ND	21.85	ND	-22.47				6.88
MW-40s	15:03	28.33	ND	17.40	ND	1.56				10.93
MW-41d	15:08	27.43	ND	20.87	ND	-57.89				6.56
MW-41i	15:07	27.10	ND	20.52	ND	-23.85				6.58
MW-41s	15:09	27.78	ND	20.08	ND	0.39				7.70
MW-42d	15:12	32.20	ND	25.59	ND	-56.68				6.61
MW-42i	15:14	32.67	ND	26.04	ND	-21.2				6.63
MW-42s	15:15	32.37	ND	19.85	ND	5.35				12.52
MW-43d	15:20	28.33	ND	21.70	ND	-57.45				6.63
MW-43i	15:18	30.31	ND	23.69	ND	-22.37				6.62
MW-43s	15:17	31.05	ND	23.80	ND	4.07				7.25
MW-44d	15:25	29.64	ND	22.57	ND	-57.59				7.07
MW-44i	15:29	29.31	ND	22.21	ND	-22.69				7.10
MW-44s	15:27	29.57	ND	16.75	ND	0.54				12.82
MW-45d	15:33	27.88	ND	21.08	ND	-58.59				6.80
MW-45i	15:31	27.99	ND	21.17	ND	-22.56				6.82
MW-45s	15:35	28.17	ND	20.49	ND	-0.1				7.68
MW-46s	15:40	35.51	ND	22.58	ND	3.83				12.93
MW-47s	15:42	35.50	ND	27.61	ND	4.43				7.89
MW-48s	16:07	38.68	ND	25.09	ND	2.55				13.59
MW-49s	16:04	37.55	ND	21.17	ND	1.86				16.38
MW-50s	16:11	39.25	ND	25.91	ND	3.82				13.34
MW-51s	16:13	39.53	ND	23.10	ND	4.37				16.43
MW-52s	17:12	40.70	ND	25.05	ND	-0.3				15.65
MW-53s	17:14	40.44	ND	27.93	ND	-0.43				12.51
MW-54s	15:58	41.78	ND	29.10	ND	5.48				12.68
MW-55s	15:52	41.04	ND	28.90	ND	5.21				12.14
MW-56s	15:11	43.49	32.51	34.74	ND	6.2	10.98	2.23		10.94
MW-57s	16:00	42.04	ND	33.23	ND	5.92				8.81
MW-58d	15:10	41.43	ND	34.88	ND	-48.14				6.55

Table A-3 - Groundwater and NAPL Elevations: September 30, 2008
McCormick and Baxter Superfund Site
Portland, Oregon

Well ID	Time	Measuring Point Elevation (ft NAVD88)	Depth to LNAPL (ft)	Depth to water (ft)	Depth to DNAPL (ft)	Well TD Elevation (ft NAVD88)	LNAPL Elevation (ft NAVD88)	LNAPL Thickness (ft)	DNAPL Thickness (ft)	Groundwater Elevation LNAPL Corrected (ft NAVD88)
MW-58i	15:18	40.99	ND	34.55	ND	-14.19				6.44
MW-58s	15:13	41.51	ND	33.92	ND	5.24				7.59
MW-59s	16:45	35.90	ND	22.79	ND	-0.9				13.11
MW-60d	14:30	40.05	ND	33.53	ND	-80.3				6.52
MW-61s	15:50	43.61	ND	31.11	ND	2.3				12.50
MW-62i	19:30	42.61	ND	36.05	ND	-21.3				6.56
MW-7 WC	14:50	36.69	ND	26.49	ND	-0.31				10.2
MW-As	17:01	39.27	ND	22.95	ND	9.81				16.32
MW-Ds	15:19	42.90	ND	34.86	36.23	4.24			2.43	8.04
MW-Gs	14:43	40.17	ND	32.37	42.84	-4.52			1.85	7.80
MW-Ks	15:45	44.14	ND	31.25	ND	1.96				12.89
MW-Os	16:23	40.93	ND	24.40	ND	-4.42				16.53
PW-1d	16:30	44.02	ND	33.12	ND	-93.45				10.90
PW-2d	16:19	41.79	ND	30.90	ND	-58.98				10.89

ND = not detected NM = not measured LNAPL specific gravity estimated as 0.981 g/cm3

Table A-4 - Groundwater and NAPL Elevations: December 16, 2008
McCormick and Baxter Superfund Site
Portland, Oregon

Well ID	Time	Measuring Point Elevation (ft NAVD88)	Depth to LNAPL (ft)	Depth to water (ft)	Depth to DNAPL (ft)	Well TD Elevation (ft NAVD88)	LNAPL Elevation (ft NAVD88)	LNAPL Thickness (ft)	DNAPL Thickness (ft)	Groundwater Elevation LNAPL Corrected (ft NAVD88)
EW-10s	14:12	29.43	20.90	21.10	ND	-13.2	8.53	0.20		8.53
EW-15s	14:47	43.01	32.71	35.86	ND	-5.55	10.30	3.15		10.24
EW-18s	14:58	40.74	28.11	29.90	ND	-3.92	12.63	1.79		12.60
EW-19s	13:04	25.94	ND	16.10	ND	-4.19				9.09
EW-1s		40.34				-6.57				NA
EW-23s	14:42	37.61	27.60	31.21	ND	-1.67	10.01	3.61		9.94
EW-2s	14:25	42.37	ND	31.70	ND	-4.24				10.67
EW-8s	14:52	40.48	ND	28.77	53.31	-14.23			1.40	11.71
EW-9s	14:28	40.75	ND	32.52	ND	-5.62				8.23
MW-10r	14:23	41.85	30.24	30.25	ND	1.46	11.61	0.01		11.61
MW-15s	13:51	43.25	ND	DRY	ND	5.02				NA
MW-17s	15:28	41.25	ND	30.02	ND	1.21				11.23
MW-18s	13:49	43.14	ND	34.02	ND	-3.28				9.12
MW-1r	13:31	37.63	ND	23.33	ND	-14.2				14.30
MW-20i	14:22	41.44	ND	33.16	69.11	-33.25			5.58	8.28
MW-22i	15:05	42.28	ND	33.37	52.80	-16.68			6.16	9.28
MW-23d	15:09	41.06	ND	33.52	ND	-147.26				7.51
MW-2s	15:48	38.26	ND	27.55	ND	0.19				10.71
MW-32i	16:31	39.34	ND	29.01	ND	-23.24				10.33
MW-34i	15:19	32.66	ND	24.67	ND	-52.47				7.99
MW-35r		32.27	Wellhead Frozen Shut During Guaging Event							NA
MW-36d	14:05	30.45	ND	22.03	ND	-57.25				8.42
MW-36i	14:03	30.18	ND	21.72	ND	-23.16				8.46
MW-36s	14:00	30.74	ND	20.58	ND	1.7				10.16
MW-37d	14:11	26.05	ND	17.73	ND	-57.31				8.32
MW-37i	14:09	25.88	ND	17.56	ND	-22.22				8.32
MW-37s	14:07	24.86	ND	15.91	ND	-4.04				8.95
MW-38d	14:15	31.84	ND	23.43	ND	-56.8				8.41
MW-38i	14:17	32.06	ND	23.49	ND	-21.81				8.57
MW-38s	14:19	32.31	ND	22.00	ND	1.08				10.31
MW-39d	14:23	29.83	ND	21.49	ND	-57.27				8.34
MW-39i	14:26	30.08	ND	21.73	ND	-22.54				8.35
MW-39s	14:28	29.75	ND	20.65	ND	0.1				9.10
MW-3s	15:35	30.61	ND	17.91	ND	-0.18				12.70
MW-40d	14:38	28.67	ND	20.32	ND	-58.56				8.35
MW-40i	14:36	28.73	ND	20.04	ND	-22.47				8.69
MW-40s	14:34	28.33	ND	17.55	ND	1.56				10.78
MW-41d	14:44	27.43	ND	18.99	ND	-57.89				8.44
MW-41i	14:42	27.10	ND	18.70	ND	-23.85				8.40
MW-41s	14:40	27.78	ND	18.69	ND	0.39				9.09
MW-42d	14:53	32.20	ND	23.94	ND	-56.68				8.26
MW-42i	14:55	32.67	ND	24.35	ND	-21.2				8.32
MW-42s	14:58	32.37	ND	20.80	ND	5.35				11.57
MW-43d	15:04	28.33	ND	20.06	ND	-57.45				8.27
MW-43i	15:02	30.31	ND	21.98	ND	-22.37				8.33
MW-43s	15:00	31.05	ND	22.22	ND	4.07				8.83
MW-44d	15:12	29.64	ND	21.01	ND	-57.59				8.63
MW-44i	15:10	29.31	ND	20.76	ND	-22.69				8.55
MW-44s	15:08	29.57	ND	17.79	ND	0.54				11.78
MW-45d	15:19	27.88	ND	19.56	ND	-58.59				8.32
MW-45i	15:17	27.99	ND	19.54	ND	-22.56				8.45
MW-45s	15:15	28.17	ND	19.14	ND	-0.1				9.03
MW-46s	15:23	35.51	ND	23.60	ND	3.83				11.91
MW-47s	15:28	35.50	ND	25.60	ND	4.43				9.90
MW-48s	15:57	38.68	ND	26.09	ND	2.55				12.59
MW-49s	15:55	37.55	ND	22.44	ND	1.86				15.11
MW-50s	15:06	39.25	ND	26.91	ND	3.82				12.34
MW-51s	15:03	39.53	ND	24.31	ND	4.37				15.22
MW-52s	14:38	40.70	ND	26.40	ND	-0.3				14.30
MW-53s	14:36	40.44	ND	29.05	ND	-0.43				11.39
MW-54s	14:04	41.78	ND	30.16	ND	5.48				11.62
MW-55s	14:01	41.04	ND	29.70	ND	5.21				11.34
MW-56s	14:32	43.49	32.10	33.64	ND	6.2	11.39	1.54		11.36
MW-57s	13:58	42.04	ND	32.60	ND	5.92				9.44
MW-58d		41.43	Wellhead Frozen Shut During Guaging Event							NA

Table A-4 - Groundwater and NAPL Elevations: December 16, 2008
McCormick and Baxter Superfund Site
Portland, Oregon

Well ID	Time	Measuring Point Elevation (ft NAVD88)	Depth to LNAPL (ft)	Depth to water (ft)	Depth to DNAPL (ft)	Well TD Elevation (ft NAVD88)	LNAPL Elevation (ft NAVD88)	LNAPL Thickness (ft)	DNAPL Thickness (ft)	Groundwater Elevation LNAPL Corrected (ft NAVD88)
MW-58i		40.99	Wellhead Frozen Shut During Guaging Event							NA
MW-58s		41.51	Wellhead Frozen Shut During Guaging Event							NA
MW-59s		35.90	Wellhead Frozen Shut During Guaging Event							NA
MW-60d	13:55	40.05	ND	31.56	ND	-80.3				8.49
MW-61s	16:21	43.61	ND	32.60	ND	2.3				11.01
MW-62i	15:24	42.61	ND	34.60	ND	-21.3				8.01
MW-7 WC	15:42	36.69	ND	26.65	ND	-0.31				10.04
MW-As	16:33	39.27	23.30	23.31	ND	9.81	15.97	0.01		15.97
MW-Ds	14:30	42.90	ND	33.92	37.51	4.24			1.15	8.98
MW-Gs	14:15	40.17	ND	31.14	42.30	-4.52			2.39	9.03
MW-Ks	14:08	44.14	ND	32.94	ND	1.96				11.20
MW-Os	15:00	40.93	ND	25.90	ND	-4.42				15.03
PW-1d	14:43	44.02	ND	33.71	ND	-93.45				10.31
PW-2d	14:52	41.79	ND	31.45	ND	-58.98				10.34

ND = not detected NM = not measured LNAPL specific gravity estimated as 0.981 g/cm3

Table A-5 - LNAPL and DNAPL Measurement Summary: March 5, 2008
McCormick and Baxter Superfund Site
Portland, Oregon

Date Measured	Well Number	Thickness (feet)	Extracted (Gallons) Based on Visual Observation (water + NAPL)[a]
LNAPL			
03/25/08	EW-9s	0.01	0.0
01/07/08	EW-10s	0.07	0.0
01/16/08	EW-10s	0.01	0.0
01/25/08	EW-10s	0.49[b]	0.0
01/30/08	EW-10s	0.1	0.0
02/21/08	EW-10s	0.48[b]	0.0
02/25/08	EW-10s	0.44[b]	0.0
03/03/08	EW-10s	0.25	0.0
03/11/08	EW-10s	0.1	0.0
03/21/08	EW-10s	0.16	0.0
03/25/08	EW-10s	0.11	0.0
03/25/08	MW-Ds	0.01	0.0
DNAPL			
03/11/08	EW-9s	0.47	0.0
03/21/08	EW-9s	0.5	0.0
03/25/08	EW-9s	0.52	0.0
01/07/08	MW-20i	7.46	2.5
01/16/08	MW-20i	5.13	2.5
01/25/08	MW-20i	5.89	2.5
01/30/08	MW-20i	6.46	2.0
02/21/08	MW-20i	7.00	2.8
02/25/08	MW-20i	6.85	2.5
03/03/08	MW-20i	7.26	3.0
03/11/08	MW-20i	7.76	2.0
03/21/08	MW-20i	5.05	2.3
03/25/08	MW-20i	2.89	2.1
01/07/08	MW-Ds	2.51	0.5
01/16/08	MW-Ds	1.69	1.0
01/25/08	MW-Ds	1.16	0.0
01/30/08	MW-Ds	0.91	0.0
02/21/08	MW-Ds	1.83	1.0
02/25/08	MW-Ds	1.78	1.0
03/03/08	MW-Ds	1.22	0.0
03/11/08	MW-Ds	1.67	0.7
03/21/08	MW-Ds	1.88	1.3
03/25/08	MW-Ds	1.06	0.0
01/07/08	MW-Gs	1.48	0.0
01/16/08	MW-Gs	1.27	0.0
01/25/08	MW-Gs	1.73	1.0
02/21/08	MW-Gs	1.51	0.8
02/25/08	MW-Gs	1.43	0.0
03/03/08	MW-Gs	1.34	0.0
03/11/08	MW-Gs	1.69	0.7
03/21/08	MW-Gs	3.03	1.3
03/25/08	MW-Gs	0.06	0.0
Total Water and NAPL Extracted			**33.24**

Notes:
Extraction Criteria: minimum of 0.4 feet for LNAPL and 1.5 feet for DNAPL.
[a] Extracted volume based on visual observations at time of extraction for water + NAPL.
[b] Although measured thickness warranted extraction, no LNAPL was present in the bailer during extraction. May be an issue with LNAPL adhering to probe and continuing to read as LNAPL through the uppermost portion of the water column in the well; as a result over estimating the thickness of LNAPL in the well.

Table A-6 - LNAPL and DNAPL Measurement Summary: June 18, 2008
McCormick and Baxter Superfund Site
Portland, Oregon

Date Measured	Well Number	Thickness (feet)	Extracted (Gallons) Based on Visual Observation (water + NAPL)[a]
LNAPL			
04/03/08	EW-10s	0.26	0.0
04/07/08	EW-10s	0.28	0.0
04/13/08	EW-10s	0.05	0.0
04/30/08	EW-10s	0.41[b]	0.0
05/05/08	EW-10s	0.15	0.0
05/16/08	EW-10s	3.04[b]	0.0
05/22/08	EW-10s	0.35	0.0
05/28/08	EW-10s	0.45[b]	0.0
06/02/08	EW-10s	0.57[b]	0.0
06/12/08	EW-10s	0.29	0.0
06/18/08	EW-10s	0.43[b]	0.0
06/27/08	EW-10s	0.38	0.0
DNAPL			
04/03/08	MW-20i	3.95	2.5
04/07/08	MW-20i	2.26	2.1
04/13/08	MW-20i	3.16	2.5
04/30/08	MW-20i	6.15	2.8
05/05/08	MW-20i	3.99	2.5
05/16/08	MW-20i	7.40	3.0
05/22/08	MW-20i	3.98	1.2
05/28/08	MW-20i	2.95	2.0
06/02/08	MW-20i	4.95	3.0
06/12/08	MW-20i	6.79	2.5
06/18/08	MW-20i	4.45	2.5
06/27/08	MW-20i	3.61	2.8
04/03/08	MW-Ds	1.60	1.3
04/07/08	MW-Ds	0.80	0.0
04/13/08	MW-Ds	1.66	1.3
04/30/08	MW-Ds	1.26	0.0
05/05/08	MW-Ds	1.61	1.5
05/22/08	MW-Ds	0.90	0.0
05/28/08	MW-Ds	1.21	0.0
06/02/08	MW-Ds	2.00	1.0
06/12/08	MW-Ds	0.80	0.0
06/18/08	MW-Ds	1.41	0.0
06/27/08	MW-Ds	1.91	1.0
04/03/08	MW-Gs	0.07	0.0
04/07/08	MW-Gs	0.08	0.0
04/13/08	MW-Gs	0.38	0.0
04/30/08	MW-Gs	1.13	0.0
05/16/08	MW-Gs	2.33	1.0
05/22/08	MW-Gs	1.03	0.0
05/28/08	MW-Gs	1.32	0.0
06/02/08	MW-Gs	0.87	0.0
06/12/08	MW-Gs	2.73	1.0
06/18/08	MW-Gs	0.98	0.0
Total Water and NAPL Extracted			**37.27**

Notes:
Extraction Criteria: minimum of 0.4 feet for LNAPL and 1.5 feet for DNAPL.
[a] Extracted volume based on visual observations at time of extraction for water + NAPL.
[b] Although measured thickness warranted extraction, no LNAPL was present in the bailer during extraction. May be an issue with LNAPL adhering to probe and continuing to read as LNAPL through the uppermost portion of the water column in the well; as a result over estimating the thickness of LNAPL in the well.

Table A-7 - LNAPL and DNAPL Measurement Summary: September 30, 2008
McCormick and Baxter Superfund Site
Portland, Oregon

Date Measured	Well Number	Thickness (feet)	Extracted (Gallons) Based on Visual Observation (water + NAPL)[a]
LNAPL			
07/01/08	EW-10s	0.50[b]	0.0
07/07/08	EW-10s	0.26	0.0
07/16/08	EW-10s	0.58[b]	0.0
07/21/08	EW-10s	0.65[b]	0.0
07/28/08	EW-10s	0.99[b]	0.0
08/11/08	EW-10s	1.75[b]	0.0
09/09/08	EW-10s	1.75[b]	0.0
DNAPL			
07/01/08	MW-20i	2.77	2.5
07/07/08	MW-20i	2.40	2.3
07/16/08	MW-20i	3.60	2.0
07/21/08	MW-20i	3.05	2.3
07/28/08	MW-20i	5.02	3.0
08/04/08	MW-20i	4.76	2.0
08/11/08	MW-20i	3.86	2.3
09/09/08	MW-20i	6.69	2.8
09/17/08	MW-20i	3.97	2.0
09/25/08	MW-20i	3.61	2.3
09/30/08	MW-20i	4.36	0.0
07/01/08	MW-Ds	1.96	1.5
07/07/08	MW-Ds	0.70	0.0
07/16/08	MW-Ds	0.93	0.0
07/21/08	MW-Ds	1.76	1.5
07/28/08	MW-Ds	2.34	1.0
08/04/08	MW-Ds	4.76	1.3
08/11/08	MW-Ds	2.15	1.5
09/09/08	MW-Ds	0.40	0.0
09/17/08	MW-Ds	0.34	0.0
09/25/08	MW-Ds	0.54	0.0
09/30/08	MW-Ds	0.44	0.0
07/01/08	MW-Gs	2.08[c]	0.0
07/07/08	MW-Gs	0.99	0.0
07/16/08	MW-Gs	1.78	1.0
07/21/08	MW-Gs	0.48	0.0
07/28/08	MW-Gs	0.12	0.0
08/04/08	MW-Gs	1.00	0.0
08/11/08	MW-Gs	0.58	0.0
09/09/08	MW-Gs	0.91	0.0
09/17/08	MW-Gs	0.17	0.0
09/25/08	MW-Gs	1.89	1.0
Total Water and NAPL Extracted			**32.00**

Notes:
Extraction Criteria: minimum of 0.4 feet for LNAPL and 1.5 feet for DNAPL.
[a] Extracted volume based on visual observations at time of extraction for water + NAPL.
[b] Although measured thickness warranted extraction, no LNAPL was present in the bailer during extraction. May be an issue with LNAPL adhering to probe and continuing to read as LNAPL through the uppermost portion of the water column in the well; as a result over estimating the thickness of LNAPL in the well.
[c] Although thickness warranted extraction, no DNAPL was recovered when pumped.

Table A-8 - LNAPL and DNAPL Measurement Summary: December 16, 2008
McCormick and Baxter Superfund Site
Portland, Oregon

Date Measured	Well Number	Thickness (feet)	Extracted (Gallons) Based on Visual Observation (water + NAPL)[a]
LNAPL			
11/24/08	EW-10s	0.12	0.0
12/03/08	EW-10s	0.22[b]	0.0
12/11/08	EW-10s	0.90[b]	0.0
DNAPL			
10/14/08	MW-20i	6.86	2.8
10/22/08	MW-20i	5.86	3.0
10/31/08	MW-20i	6.16	3.0
11/04/08	MW-20i	6.86	2.8
11/10/08	MW-20i	7.26	3.3
11/19/08	MW-20i	6.32	3.8
11/24/08	MW-20i	3.06	2.3
12/03/08	MW-20i	4.12	3.8
12/11/08	MW-20i	5.24	3.3
10/14/08	MW-Ds	1.53	1.5
10/22/08	MW-Ds	0.53	0.0
10/31/08	MW-Ds	0.70	0.0
11/04/08	MW-Ds	0.73	0.0
11/10/08	MW-Ds	1.83	1.5
11/19/08	MW-Ds	0.34	0.0
11/24/08	MW-Ds	0.43	0.0
12/03/08	MW-Ds	0.22	0.0
12/11/08	MW-Ds	0.20	0.0
10/14/08	MW-Gs	0.82	0.0
10/22/08	MW-Gs	1.20	0.0
10/31/08	MW-Gs	1.96	1.3
11/04/08	MW-Gs	0.77	0.0
11/10/08	MW-Gs	1.07	0.0
11/19/08	MW-Gs	2.09	1.5
11/24/08	MW-Gs	0.78	0.0
12/03/08	MW-Gs	0.82	0.0
Total Water and NAPL Extracted			**33.50**

Notes:
Extraction Criteria: minimum of 0.4 feet for LNAPL and 1.5 feet for DNAPL.
[a] Extracted volume based on visual observations at time of extraction for water + NAPL.
[b] Although measured thickness warranted extraction, no LNAPL was present in the bailer during extraction. May be an issue with LNAPL adhering to probe and continuing to read as LNAPL through the uppermost portion of the water column in the well; as a result over estimating the thickness of LNAPL in the well.

Table A-9 - Cumulative NAPL Extraction Summary
McCormick and Baxter Superfund Site
Portland, Oregon

Date	Manual NAPL Extracted (DNAPL + LNAPL)	Total Monthly Treatment System NAPL Extracted (DNAPL & LNAPL)	Monthly Total NAPL Extracted (gallons)	Total NAPL Extracted (gallons)
Pre-Barrier Wall Extraction Volumes				
Jun-89			0	0
Feb-93			1097	1097
Feb-95			1021	2118
Dec-95	31.03	0	31.03	2149
Jan-96	20.8	0	20.8	2170
Feb-96	52.4	0	52.4	2222
Mar-96	66.05	0	66.05	2288
Apr-96	35.87	0	35.87	2324
May-96	23.36	0	23.36	2348
Jun-96	31.68	0	31.68	2379
Jul-96	29.8	0	29.8	2409
Aug-96	73.02	0	73.02	2482
Sep-96	33.5	0	33.5	2516
Oct-96	43.8	0	43.8	2559
Nov-96	39	0	39	2598
Dec-96	25.3	0	25.3	2624
Jan-97	40.36	0	40.36	2664
Feb-97	31.04	0	31.04	2695
Mar-97	34.18	0	34.18	2729
Apr-97	32.04	0	32.04	2761
May-97	8.64	0	8.64	2770
Jun-97	11.6	0	11.6	2781
Jul-97	28.29	0	28.29	2810
Aug-97	52.33	0	52.33	2862
Sep-97	38.9	0	38.9	2901
Oct-97	32.3	0	32.3	2933
Nov-97	53.8	0	53.8	2987
Dec-97	53.3	0	53.3	3040
Jan-98	33.17	112.32	145.49	3186
Feb-98	27.05	5.9	32.95	3219
Mar-98	51.1	3.83	54.93	3274
Apr-98	33.37	7.67	41.04	3315
May-98	31.45	7.67	39.12	3354
Jun-98	12.08	7.67	19.75	3374
Jul-98	9.34	8.11	17.45	3391
Aug-98	14.95	8.11	23.06	3414
Sep-98	14.17	8.11	22.28	3436
Oct-98	16	8.11	24.11	3461
Nov-98	11.3	8.11	19.41	3480
Dec-98	5.2	16.15	21.35	3501
Jan-99	15.28	0	15.28	3517
Feb-99	14.12	0	14.12	3531
Mar-99	47.74	0	47.74	3578
Apr-99	7.44	0	7.44	3586
May-99	12.82	0	12.82	3599
Jun-99	10.7	0	10.7	3609
Jul-99	6.6	7.85	14.45	3624
Aug-99	13.84	7.85	21.69	3646
Sep-99	35.88	7.85	43.73	3689
Oct-99	6.85	7.85	14.7	3704
Nov-99	7.47	7.85	15.32	3719
Dec-99	2.15	7.85	10	3729
Jan-00	3.46	21.17	24.63	3754
Feb-00	1.75	21.17	22.92	3777
Mar-00	0.98	21.17	22.15	3799
Apr-00	1.05	21.17	22.22	3821
May-00	1.9	21.17	23.07	3844
Jun-00	0.41	21.17	21.58	3866
Jul-00	14.5	21.7	36.2	3902
Aug-00	25.36	21.7	47.06	3949

Table A-9 - Cumulative NAPL Extraction Summary
McCormick and Baxter Superfund Site
Portland, Oregon

Date	Manual NAPL Extracted (DNAPL + LNAPL)	Total Monthly Treatment System NAPL Extracted (DNAPL & LNAPL)	Monthly Total NAPL Extracted (gallons)	Total NAPL Extracted (gallons)
Sep-00	21.83	21.6	43.43	3993
Oct-00	18.63	0	18.63	4011
Nov-00	17.38	0	17.38	4029
Dec-00	1.53	0	1.53	4030
Jan-01	4.09	0	4.09	4034
Feb-01	0.56	0	0.56	4035
Mar-01	2.64	0	2.64	4037
Apr-01	4.19	0	4.19	4042
May-01	1.36	0	1.36	4043
Jun-01	0.41	0	0.41	4043
Jul-01	0.64	0	0.64	4044
Aug-01	1.15	0	1.15	4045
Sep-01	0	0	0	4045
Oct-01	0	0	0	4045
Nov-01	5.98	0	5.98	4051
Dec-01	0.519	0	0.519	4052
Jan-02	0.46	0	0.46	4052
Feb-02	19.28	0	19.28	4071
Mar-02	18.66	0	18.66	4090
Apr-02	0.31	0	0.31	4090
May-02	5.065	0	5.065	4095
Jun-02	0	0	0	4095
Jul-02	13.81	0	13.81	4109
Aug-02	11.59	0	11.59	4121
Sep-02	8.76	0	8.76	4130
Oct-02	12.34	0	12.34	4142
Nov-02	10.19	0	10.19	4152
Dec-02	0.851	0	0.851	4153
Jan-03	1.514	0	1.514	4154
Feb-03	7.45	0	7.45	4162
Mar-03	1.73	0	1.73	4164
Apr-03	0	0	0	4164
May-03	0	0	0	4164
Jun-03	0	0	0	4164
Jul-03	0	0	0	4164
Aug-03	0	0	0	4164
Sep-03	0	0	0	4164
Oct-03	0	0	0	4164
Nov-03	10	0	10	4174
Feb-04	79.5	0	79.5	4253
Mar-04	94.5	0	94.5	4348
Post Barrier Wall Extraction Volume				
Apr-04	118.33	0	118.33	4466
May-04	163.6	0	163.6	4630
Jun-04	165.6	0	165.6	4795
Jul-04	103.3	0	103.3	4898
Aug-04	127	34.1	161.1	5060
Sep-04	98.4	32.84	131.24	5191
Oct-04	50.2	28.76	78.96	5270
Nov-04	61.44	34.3	95.74	5366
Dec-04	59.12	23.51	82.63	5448
Jan-05	49.1	24.1	73.2	5521
Feb-05	83.86	0	83.86	5605
Mar-05	132.7	0	132.7	5738
Apr-05	131.2	0	131.2	5869
May-05	66.2	0	66.2	5935
June-05 through Oct-05	45	0	45	5980
Nov-05	5.16	0	5.16	5985
Dec-05	12.33	0	12.33	5998
Jan-06	13.43	0	13.43	6011

Table A-9 - Cumulative NAPL Extraction Summary
McCormick and Baxter Superfund Site
Portland, Oregon

Date	Manual NAPL Extracted (DNAPL + LNAPL)	Total Monthly Treatment System NAPL Extracted (DNAPL & LNAPL)	Monthly Total NAPL Extracted (gallons)	Total NAPL Extracted (gallons)
Feb-06	14.68	0	14.68	6026
Mar-06	17.17	0	17.17	6043
Apr-06	13.24	0	13.24	6056
May-06	19.43	0	19.43	6076
Jun-06	16.72	0	16.72	6092
Jul-06	14.98	0	14.98	6107
Aug-06	27.37	0	27.37	6135
Sep-06	12.19	0	12.19	6147
October 06 through December 06	9.93	0	9.93	6157
January 07 through March 07	10.5	0	10.5	6167
April 07 through June 07	14.86	0	14.86	6182
July 07 through September 07	10.08	0	10.08	6192
October 07 through December 07	9.93	0	9.93	6202
January 08 through February 08	4.5	0	4.5	6207
March 08 through Mid-June 08	19.7	0	19.7	6227
Mid-June 08 through July 08	13.9	0	13.9	6240
August 08 through November 08	19.2	0	19.2	6260
Total Extracted Volume				6260

Note:
NAPL volume was estimated as 62% of the drum volume each measuring period. This calculation assumes that water comprises 38% of the drum volume, although the actual quantity varies from about 10% to over 50%.

Table A-10 - Net Annual Vertical Gradients in Monitoring Well Clusters: 2008
McCormick and Baxter Superfund Site
Portland, Oregon

Monitoring Well Cluster ID	Net Annual Gradient		
	From shallow to intermediate zone	From intermediate to deep zone	From shallow to deep zone
MW-36	-0.0543	-0.0023	-0.0266
MW-37	-0.0070	0.0006	-0.0022
MW-44	-0.1079	0.0035	-0.0470
MW-45	-0.0084	0.0025	-0.0022

Note:

Negative values indicate a net downward hydraulic gradient and positive values indicate a net upward hydraulic gradient.

LEGEND

- Groundwater Monitoring Wells with Transducers
- All Other Groundwater Monitoring Wells
- 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

5/09

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Figure
A-1

File Path: P:\205 - OR DEQ\003 - 003 McCormick and Baxter\Project_GIS\Project_mxds\2008_Annual_Report\FigureA-1_Monitoring_Well_Location_Map.mxd, Date: May 21, 2009 1:48:46 PM

LEGEND

Groundwater Monitoring Wells (Depth to LNAPL or DNAPL)

- Wells with LNAPL
- Wells with DNAPL
- Wells with LNAPL and 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 March 5, 2008 Sampling Event

5/09

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Figure **A-2**

File Path: P:\205 - OR DEQ\003 - 003 McCormick and Baxter\Project_GIS\Project_mxds\2008_Annual_Report\FigureA-2_LNAPL_and_DNAPL_Map_March5_2008.mxd, Date: May 21, 2009 1:50:56 PM

LEGEND

Groundwater Monitoring Wells (Depth to 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 15, 2008 Sampling Event

5/09

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Figure **A-3**

File Path: P:\205 - OR DEQ\003 - 003 McCormick and Baxter\Project_GIS\Project_mxds\2008_Annual_Report\FigureA-3_LNAPL_and_DNAPL_Map_June18_2008.mxd, Date: May 21, 2009 1:53:37 PM

LEGEND

Groundwater Monitoring Wells (Depth to LNAPL or DNAPL)

- Wells with LNAPL
- Wells with DNAPL
- Wells with LNAPL and 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 September 30, 2008 Sampling Event

5/09

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Figure
A-4

File Path: P:\205 - OR DEQ\003 - 003 McCormick and Baxter\Project_GIS\Project_mxds\2008_Annual_Report\FigureA-4_LNAPL_and_DNAPL_Map_Sept30_2008.mxd, Date: May 21, 2009 2:06:02 PM

LEGEND

Groundwater Monitoring Wells (Depth to 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 December 16, 2008 Sampling Event

5/09

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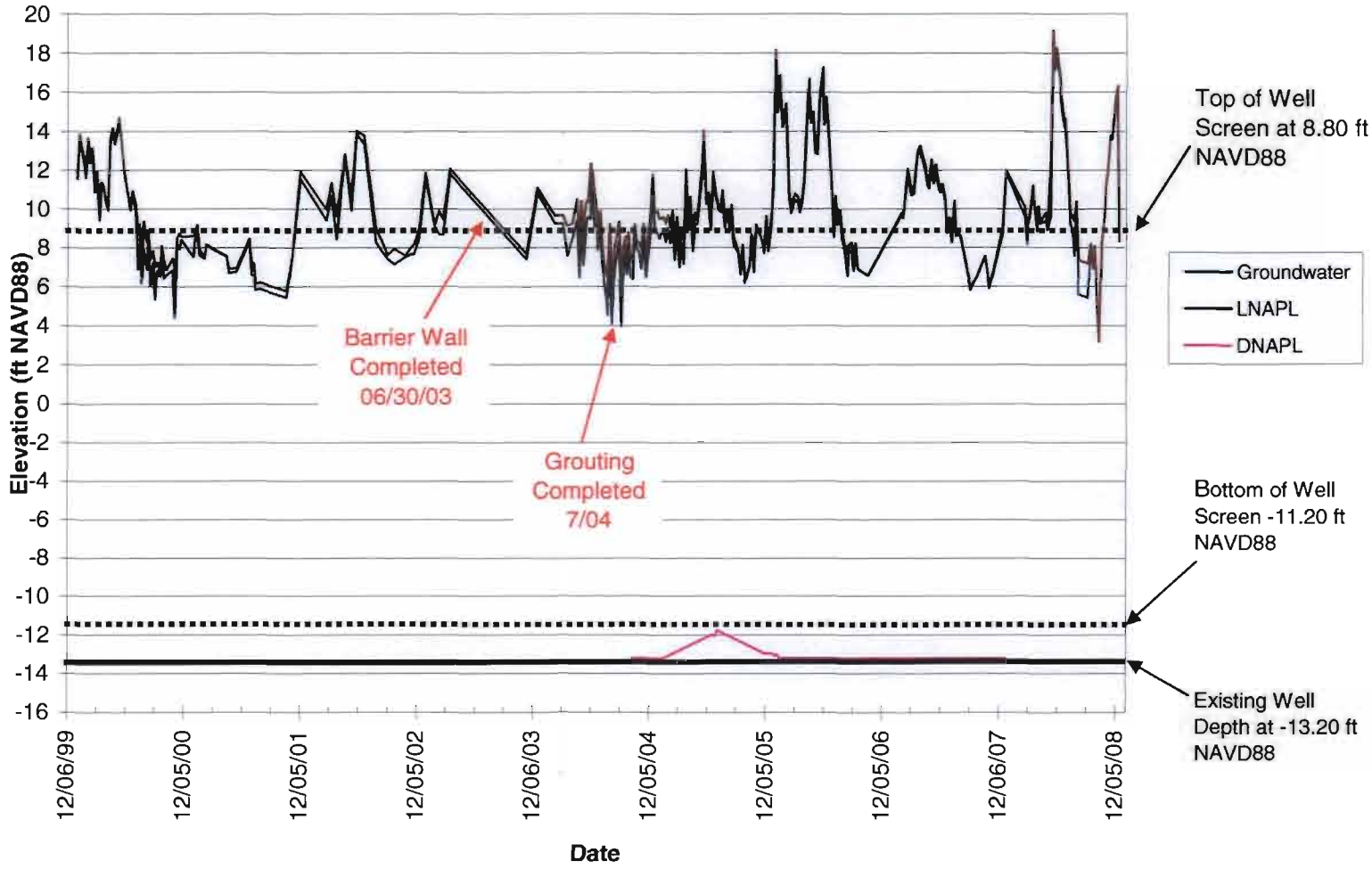
Figure **A-5**

File Path: \\pdx\projects\205 - OR DEQ\003 - 003 McCormick and Baxter\Project_GIS\Project_mxds\2008_Annual_Report\FigureA-5_LNAPL_and_DNAPL_Map_Dec16_2008.mxd, Date: February 24, 2009 1:52:44 PM



McCormick and Baxter Superfund Site
Portland, Oregon

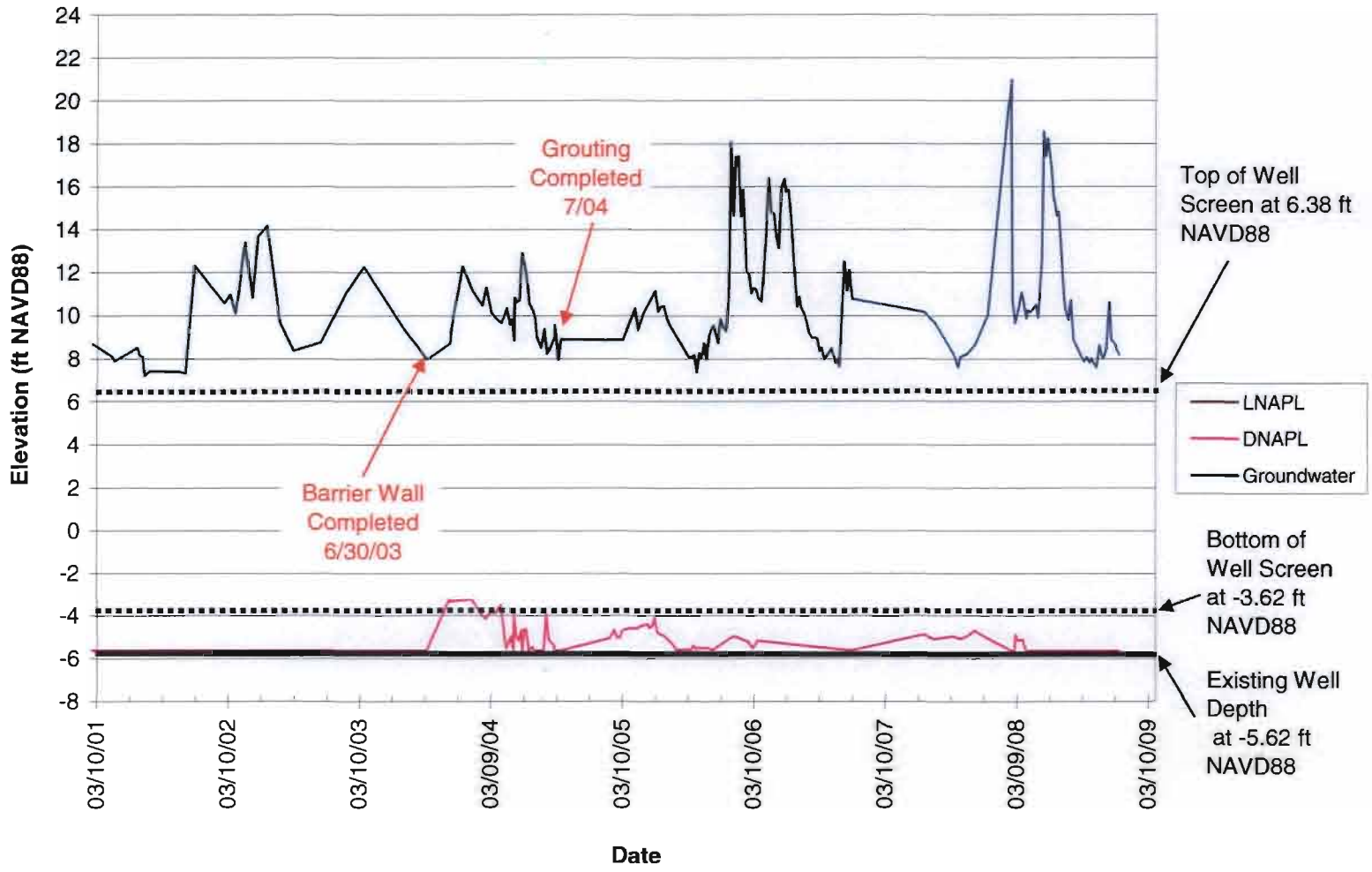
NAPL Thickness Plot for Well EW-10s

5/09

Figure **A-6**

HARTCROWSER

GSI Water Solutions, Inc.



McCormick and Baxter Superfund Site
Portland, Oregon

NAPL Thickness Plot for Well EW-9s

5/09

Figure **A-7**

HARTCROWSER

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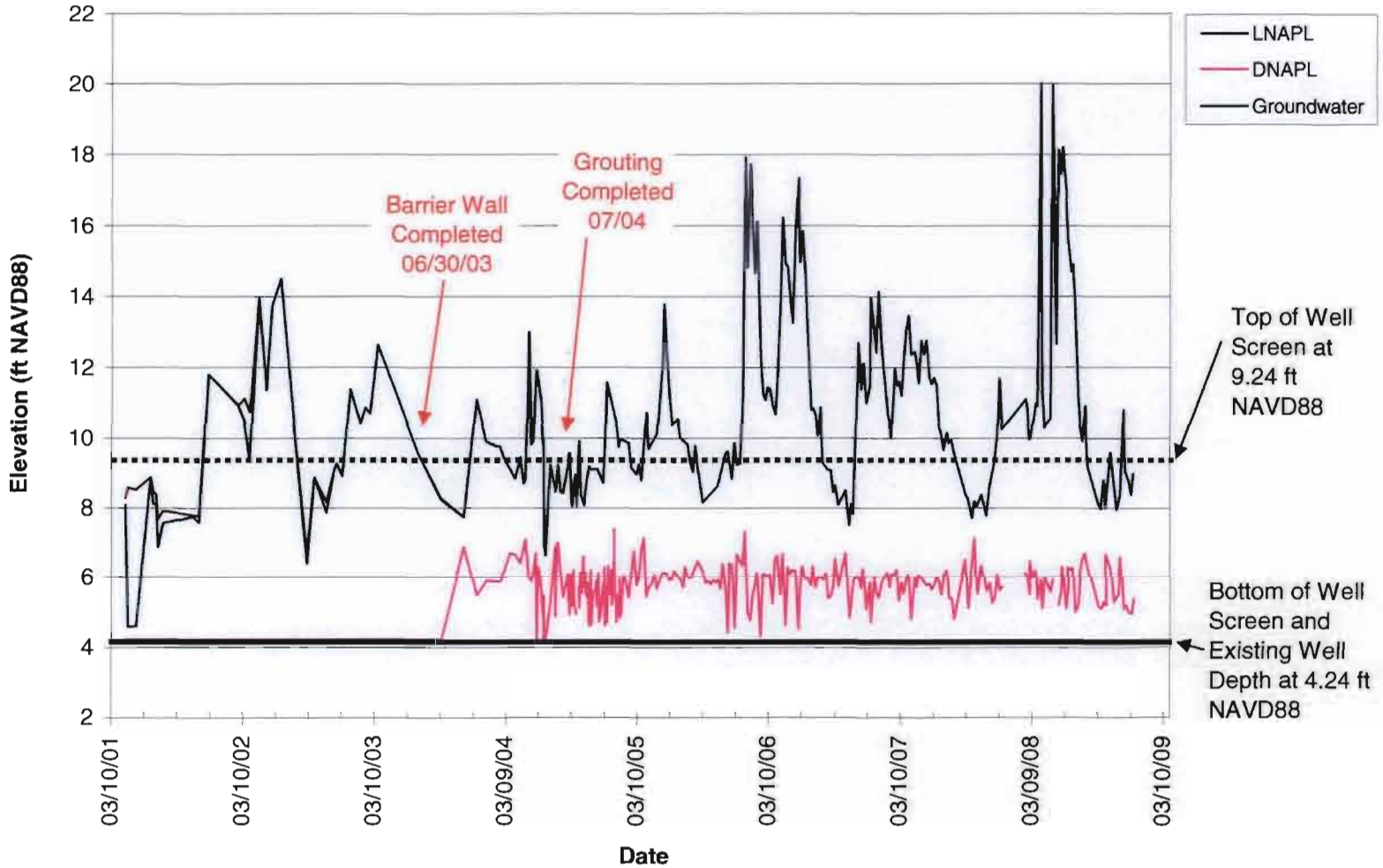


McCormick and Baxter Superfund Site
Portland, Oregon

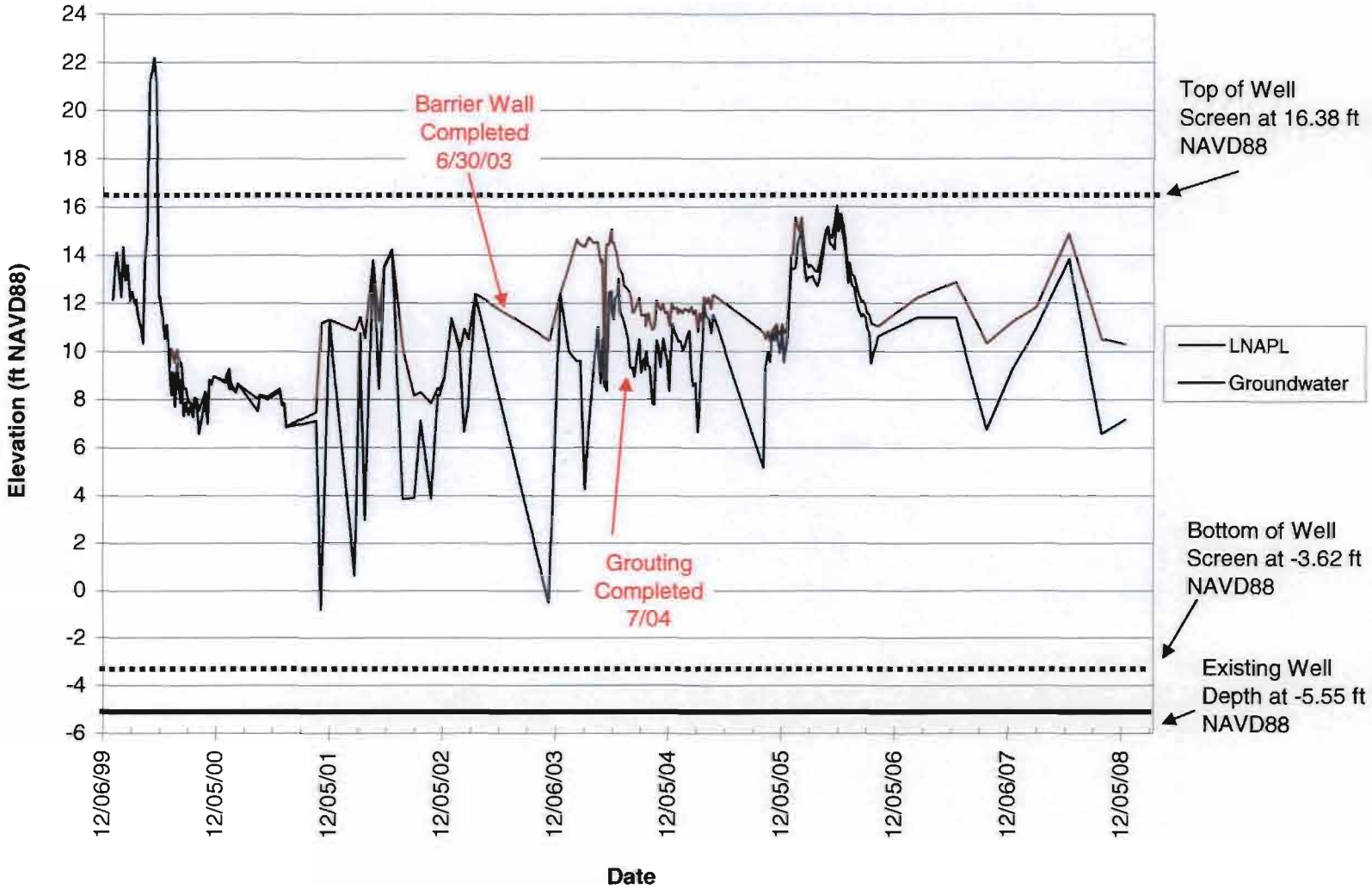
NAPL Thickness Plot for Well MW-Ds

5/09

Figure **A-8**

HARTCROWSER

GSI Water Solutions, Inc.



McCormick and Baxter Superfund Site
Portland, Oregon

NAPL Thickness Plot for Well EW-15s

5/09

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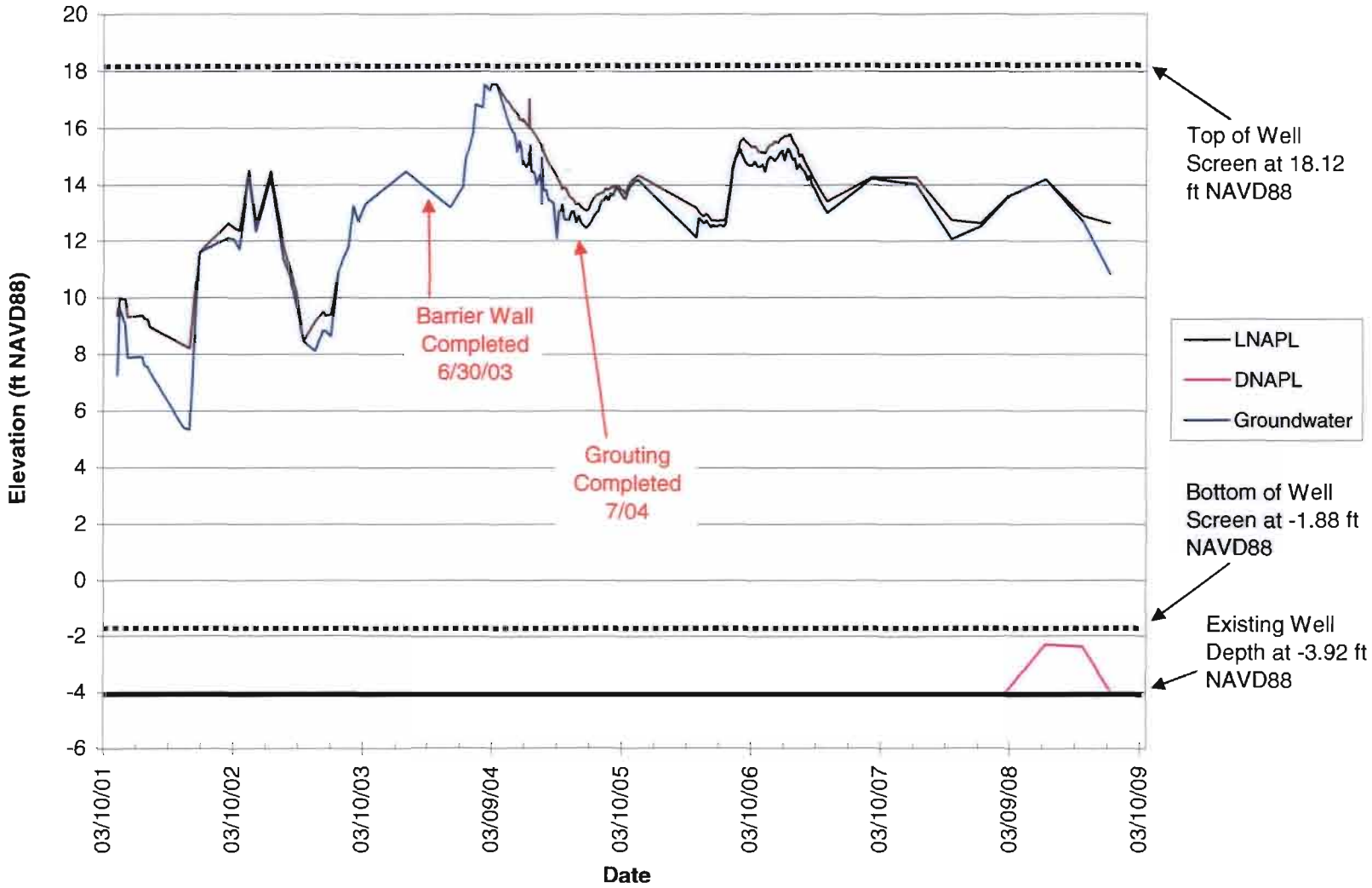
Figure **A-9**



McCormick and Baxter Superfund Site
Portland, Oregon

NAPL Thickness Plot for Well EW-18s

5/09

Figure **A-10**

HARTCROWSER

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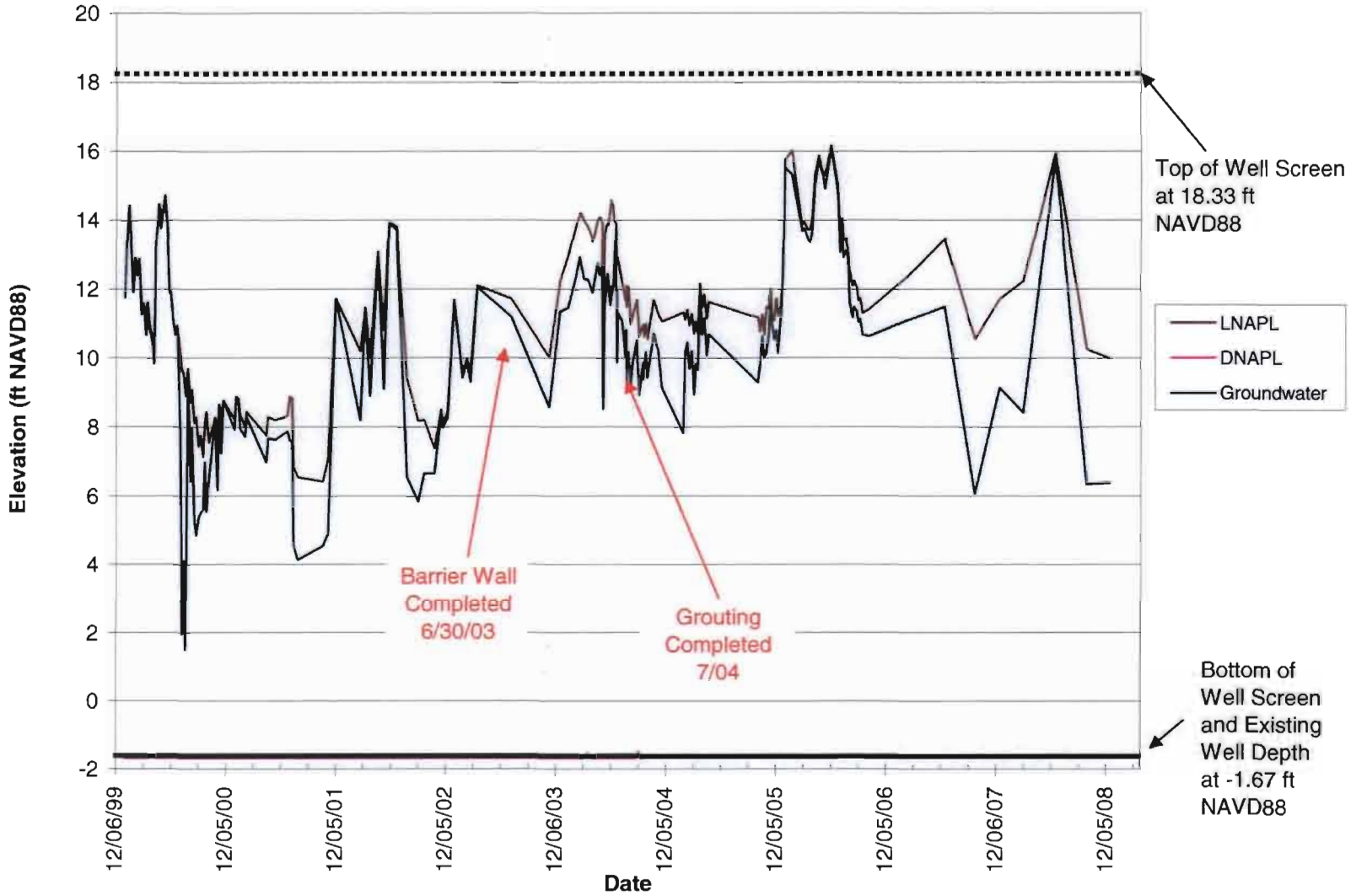


McCormick and Baxter Superfund Site
Portland, Oregon

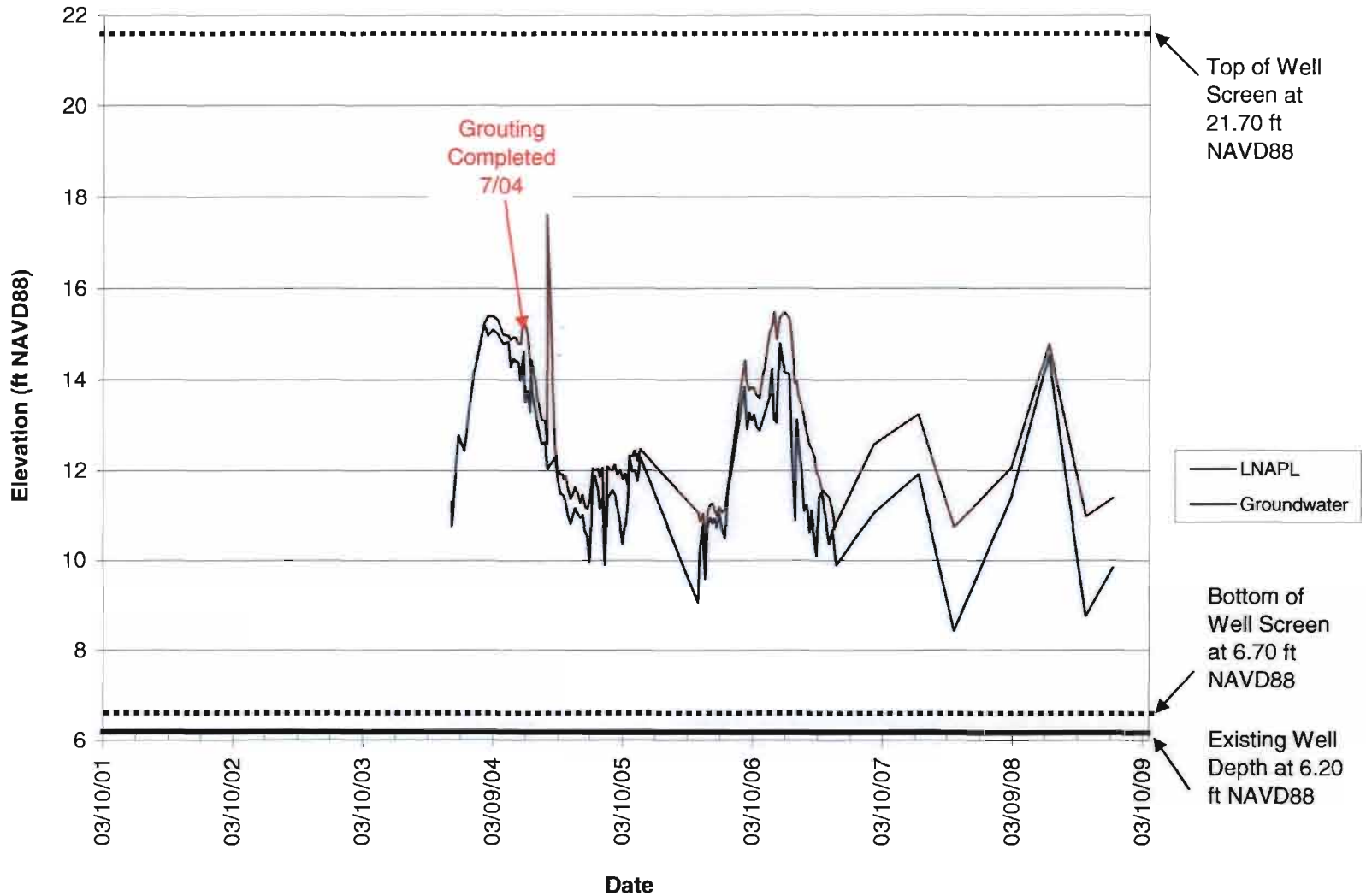
NAPL Thickness Plot for Well EW-23s

5/09

Figure **A-11**

HARTCROWSER

GSI Water Solutions, Inc.



McCormick and Baxter Superfund Site
Portland, Oregon

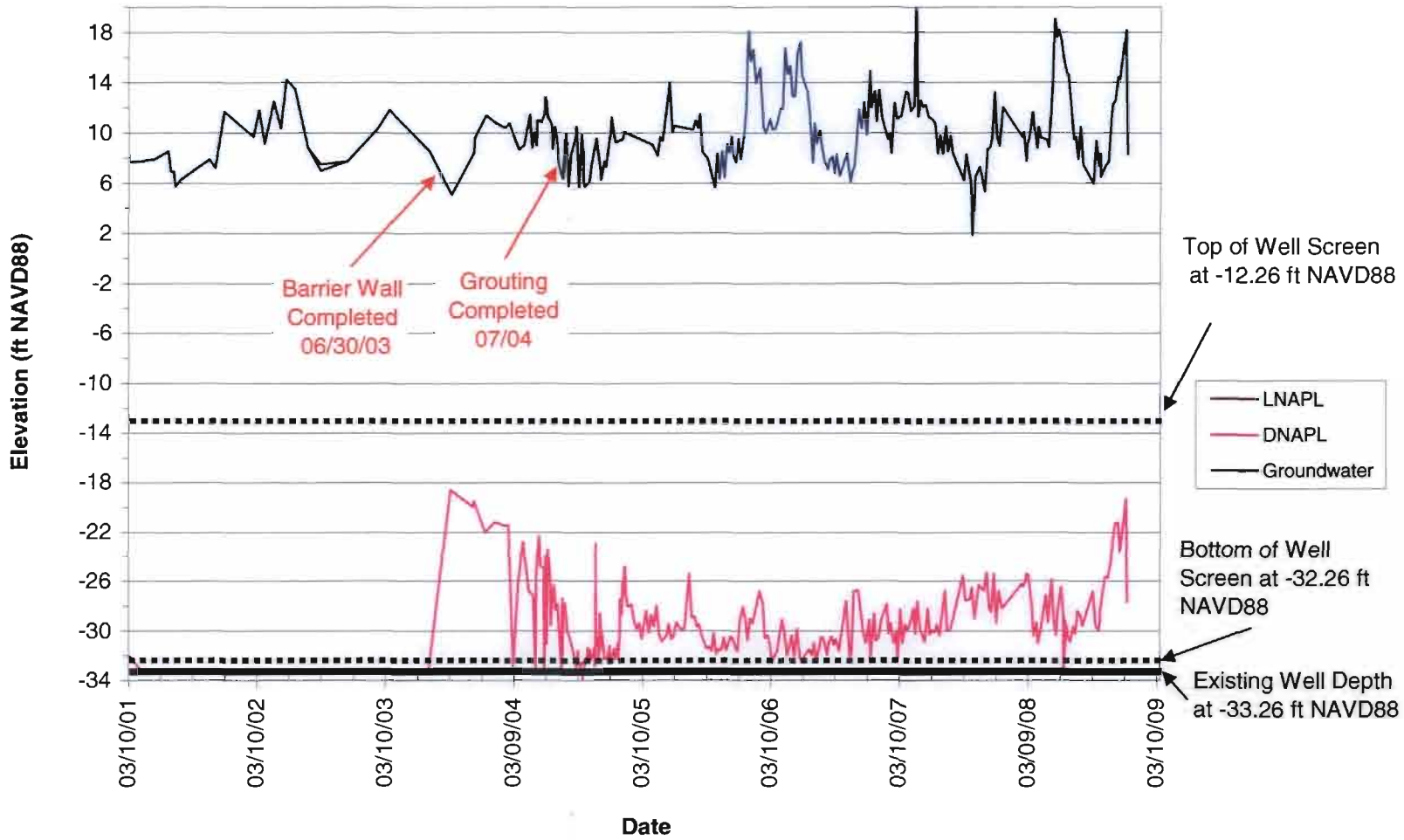
NAPL Thickness Plot for Well MW-56s

5/09

Figure **A-12**

HARTCROWSER

GSI Water Solutions, Inc.



McCormick and Baxter Superfund Site
Portland, Oregon

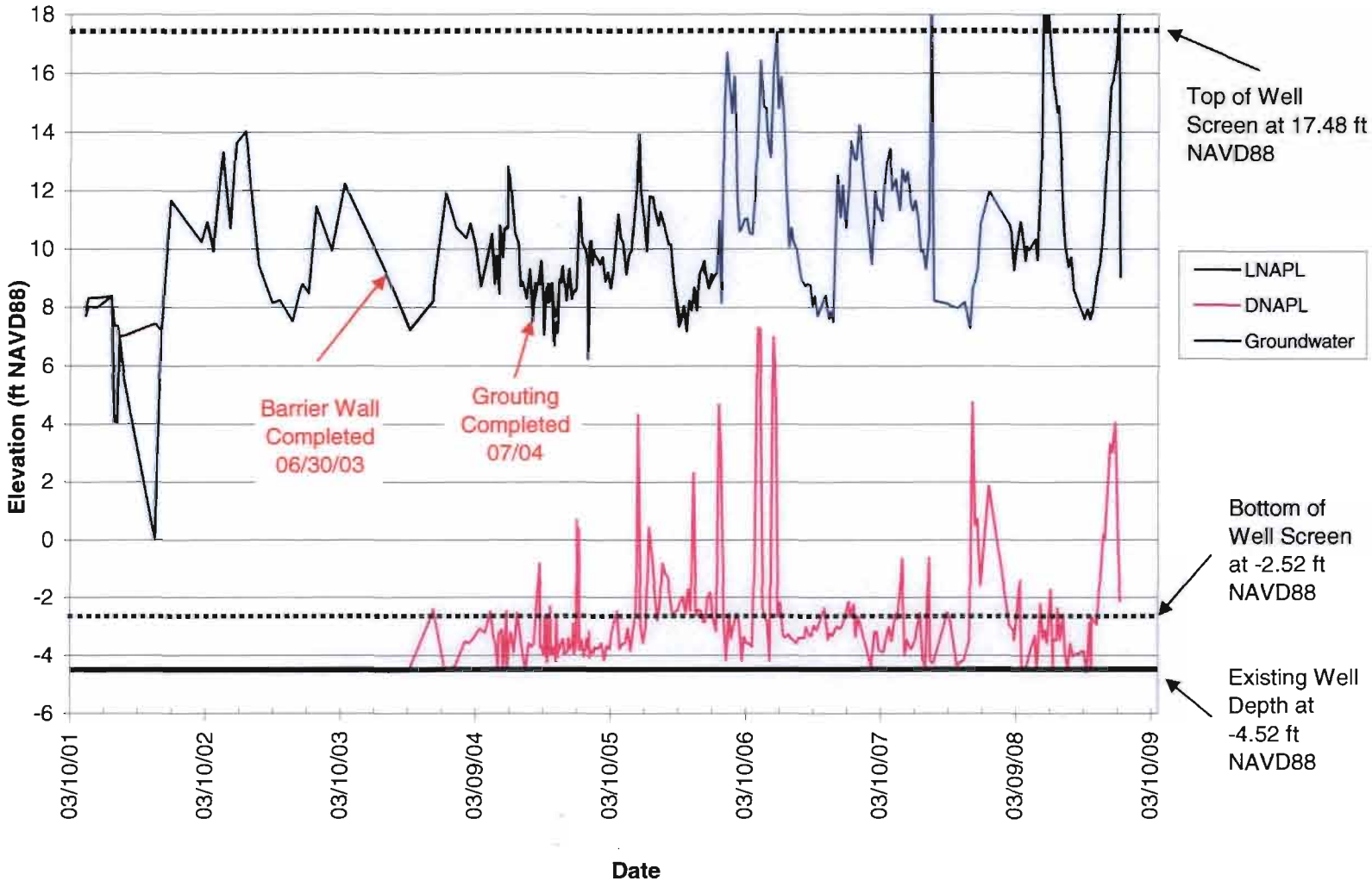
NAPL Thickness Plot for Well MW-20i

5/09

HARTCROWSER

GSI Water Solutions, Inc.

Figure **A-13**



McCormick and Baxter Superfund Site
Portland, Oregon

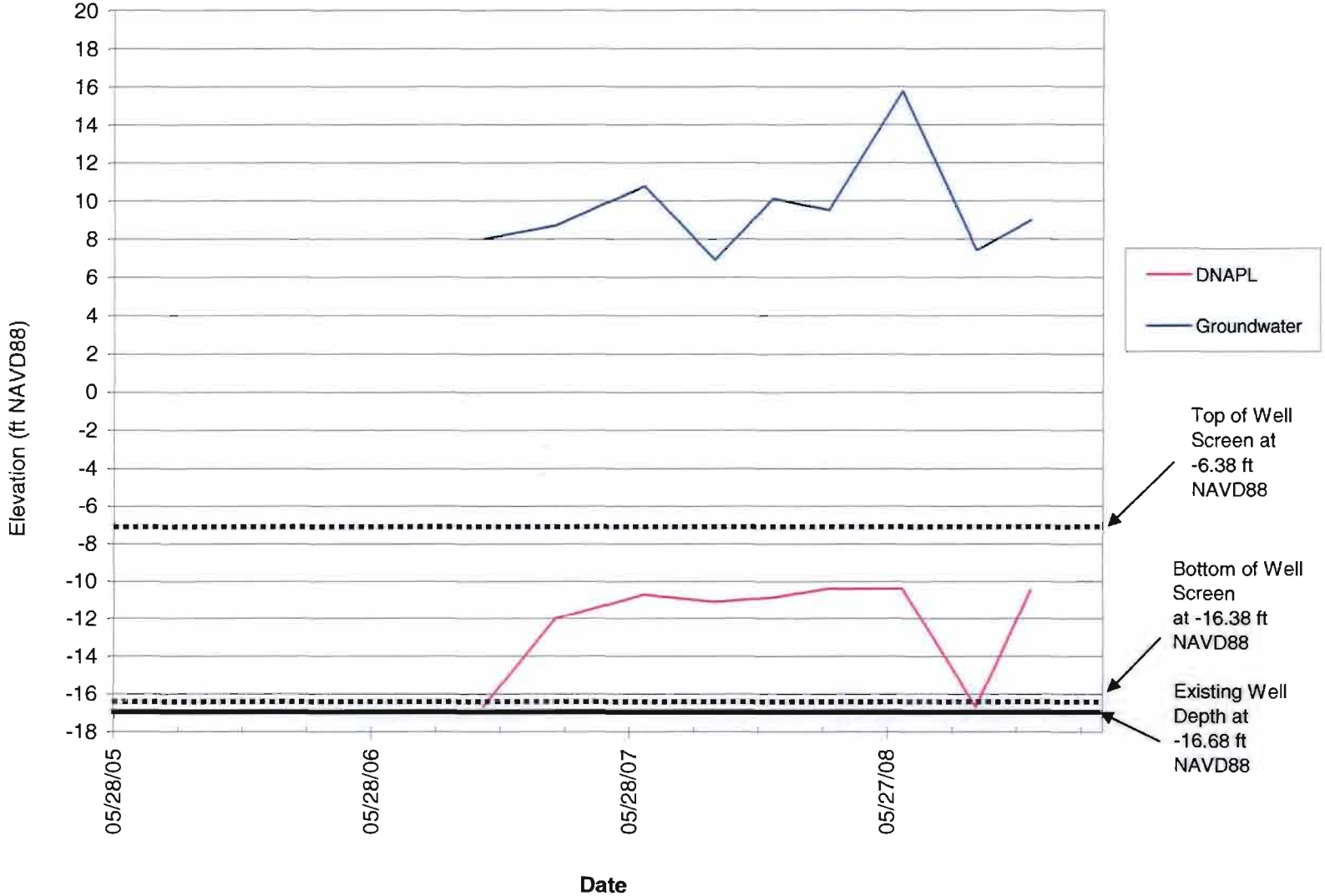
NAPL Thickness Plot for Well MW-Gs

5/09

Figure **A-14**

HARTCROWSER

GSI Water Solutions, Inc.



McCormick and Baxter Superfund Site
Portland, Oregon

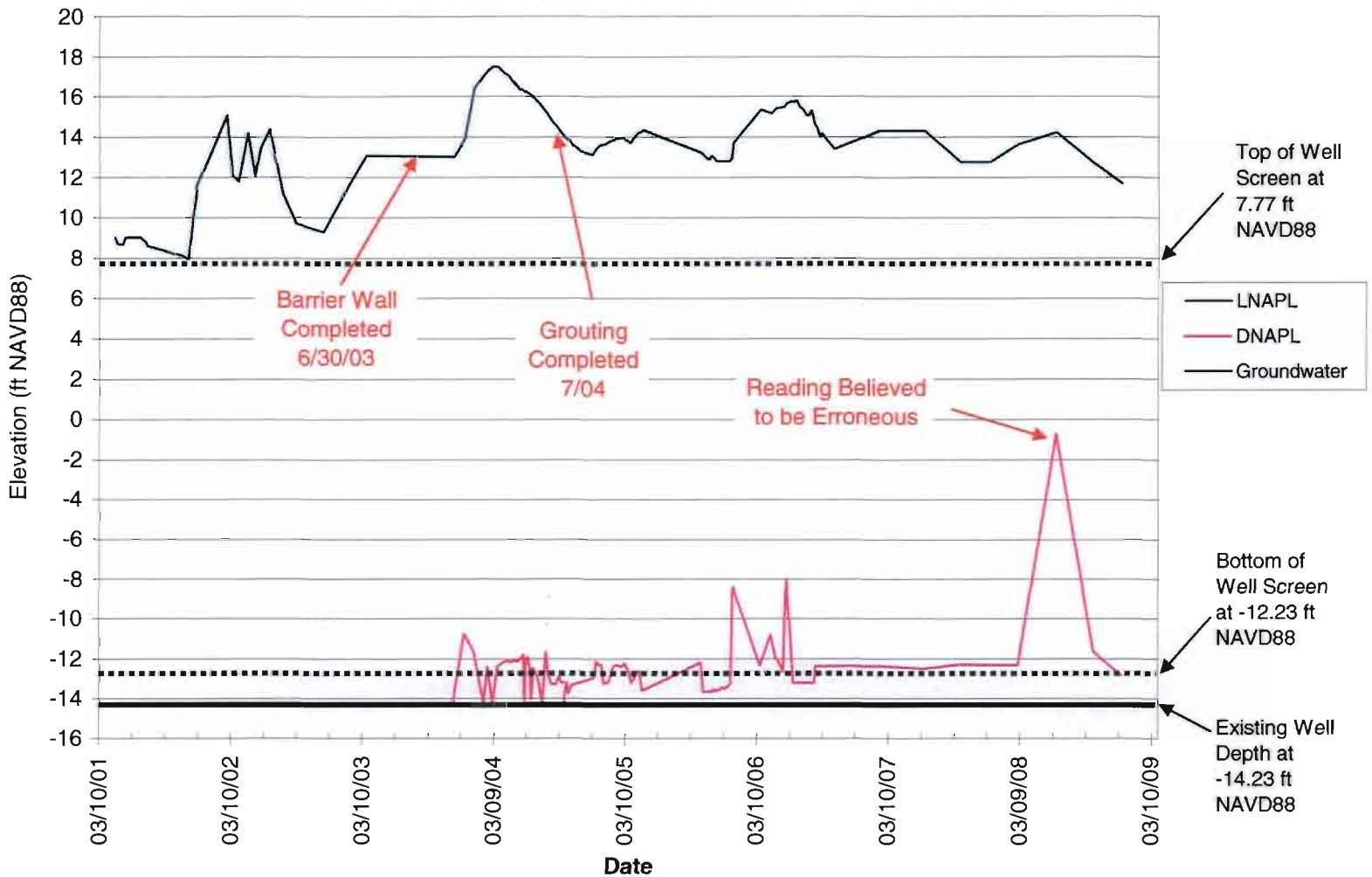
NAPL Thickness Plot for Well MW-22i

5/09

HARTCROWSER

GSI Water Solutions, Inc.

Figure **A-15**



McCormick and Baxter Superfund Site
Portland, Oregon

NAPL Thickness Plot for Well EW-8s

5/09

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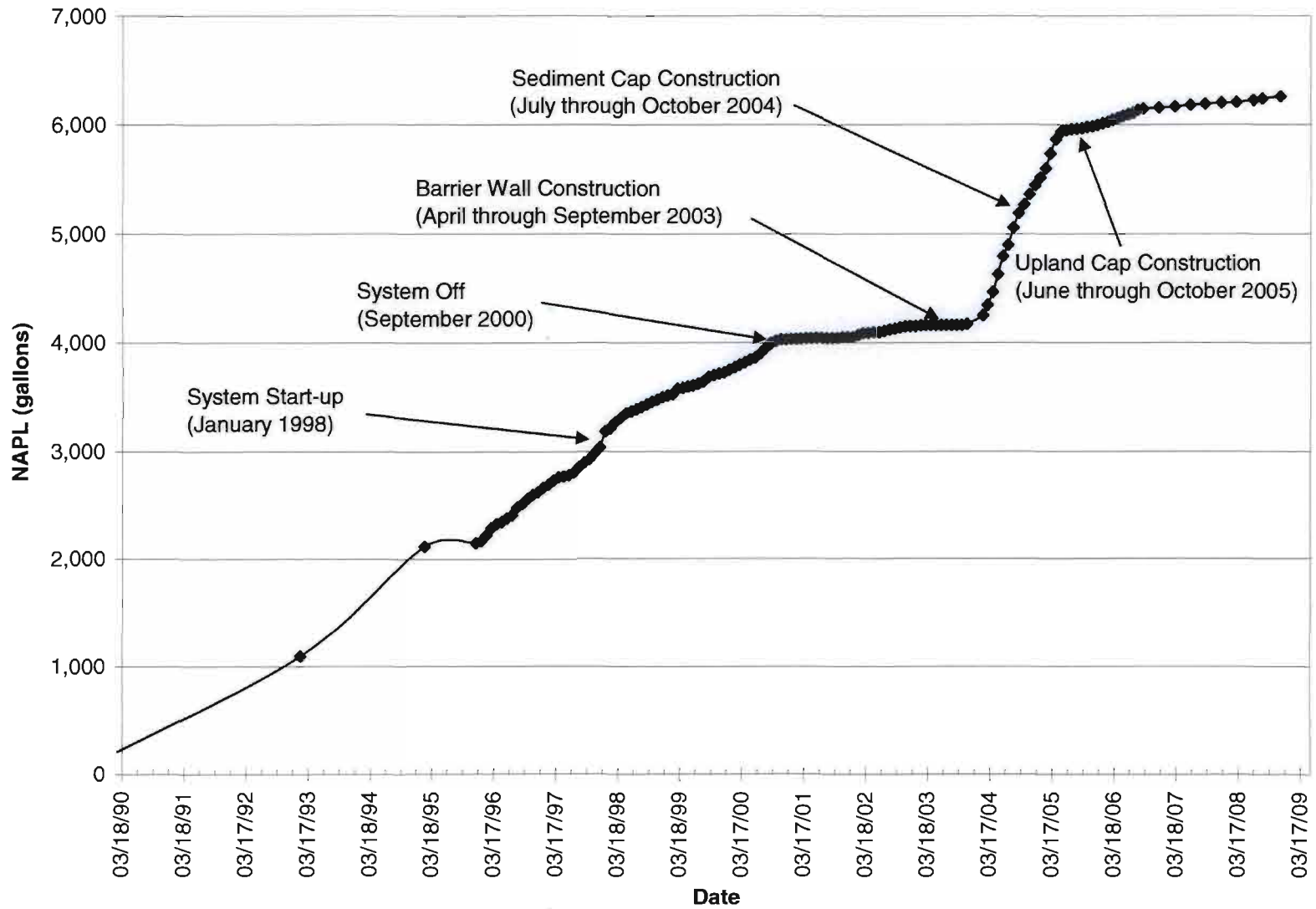
GSI Water Solutions, Inc.

Figure **A-16**



McCormick and Baxter Superfund Site
Portland, Oregon

Cumulative NAPL Recovery

5/09

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GSI Water Solutions, Inc.

Figure

A-17

LEGEND

- Groundwater Monitoring Wells (Groundwater Elevation)
- Groundwater Elevation Contours (dashed where inferred)
- Willamette River Level During Sampling Event (8.71 feet)
- Subsurface Barrier Wall

NOTES:

1) All elevations shown exist in NAVD88
2) Aerial photo taken on September 22, 2006
3) Water levels measured between 8:45 and 11:34
4) Willamette River low tide at 10:30 at 8.71 feet NAVD88

0 200 400

Scale in feet

McCormick and Baxter Superfund Site
Portland, Oregon

Groundwater Contour Map for March 5, 2008 Sampling Event

5/09

HARTCROWSER GSI Water Solutions, Inc.

Figure **A-18**

File Path: P:\205 - OR DEQ\003 - 003 McCormick and Baxter\Project_GIS\Project_mxds\2008_Annual_Report\FigureA-18_GW_Contour_Map_March5_2008.mxd, Date: May 21, 2009 2:05:14 PM

LEGEND

- Groundwater Monitoring Wells (Groundwater Elevation)
- Groundwater Elevation Contours (dashed where inferred)
- Willamette River Level During Sampling Event (15.93 feet)
- Subsurface Barrier Wall

NOTES:

1) * Groundwater elevations noted in italics but not contoured:
   MW-15s: flocculant prevented accurate water level measurement
   EW-1s: reading inconsistent with historical data
2) All elevations shown exist in NAVD88
3) Aerial photo taken on September 22, 2006
4) Water levels measured between 14:00 and 17:10
5) Willamette River low tide at 14:00 at 15.93 feet NAVD88

0 200 400
Scale in feet

McCormick and Baxter Superfund Site
Portland, Oregon

Groundwater Contour Map for June 18, 2008 Sampling Event

5/09

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Figure **A-19**

File Path: P:\205 - OR\LEQ\003 - 003 McCormick and Baxter\Project GIS\Project mxds\2008 Annual Report\FigureA-19 GW Contour Map June18 2008.mxd Date: May 21, 2009 2:06:42 PM

LEGEND

- Groundwater Monitoring Wells (Groundwater Elevation)
- Groundwater Elevation Contours (dashed where inferred)
- Willamette River Level During Sampling Event (6.21 feet)
- Subsurface Barrier Wall

NOTES:

1) All elevations shown in NAVD88
2) Aerial photo taken on September 22, 2006
3) Water levels measured between 14:20 and 19:30
4) Willamette River low tide at 15:00 at 6.21 feet NAVD88

0 200 400

Scale in feet

McCormick and Baxter Superfund Site
Portland, Oregon

Groundwater Contour Map for September 30, 2008 Sampling Event

5/09

HARTCROWSER GSI Water Solutions, Inc.

Figure **A-20**

File Path: P:\205 - OR DEQ\003 - 003 McCormick and Baxter\Project_GIS\Project_mxds\2008_Annual_Report\FigureA-20_GW_Contour_Map_Sept30_2008.mxd, Date: May 21, 2009 2:05:25 PM

LEGEND

- Groundwater Monitoring Wells (Groundwater Elevation)
- Groundwater Elevation Contours (dashed where inferred)
- Willamette River Level During Sampling Event (8.98 feet)
- Subsurface Barrier Wall

NOTES:

1) * Groundwater elevations noted in italics but not contoured: MW-15s: reading inconsistent with historical data
2) All elevations shown in NAVD88
3) Aerial photo taken on September 22, 2006
4) Water levels measured between 13:04 and 16:33
5) Willamette River low tide at 16:00 at 7.76 feet NAVD88

0 200 400

Scale in feet

McCormick and Baxter Superfund Site
Portland, Oregon

Groundwater Contour Map for December 16, 2008 Sampling Event

5/09

HARTCROWSER GSI Water Solutions, Inc.

Figure **A-21**

File Path: P:\205 - OR DEQ\003 - 003 McCormick and Baxter\Project_GIS\Project_mxds\2008_Annual_Report\FigureA-21_GW_Contour_Map_Dec16_2008.mxd, Date: May 21, 2009 2:14:16 PM

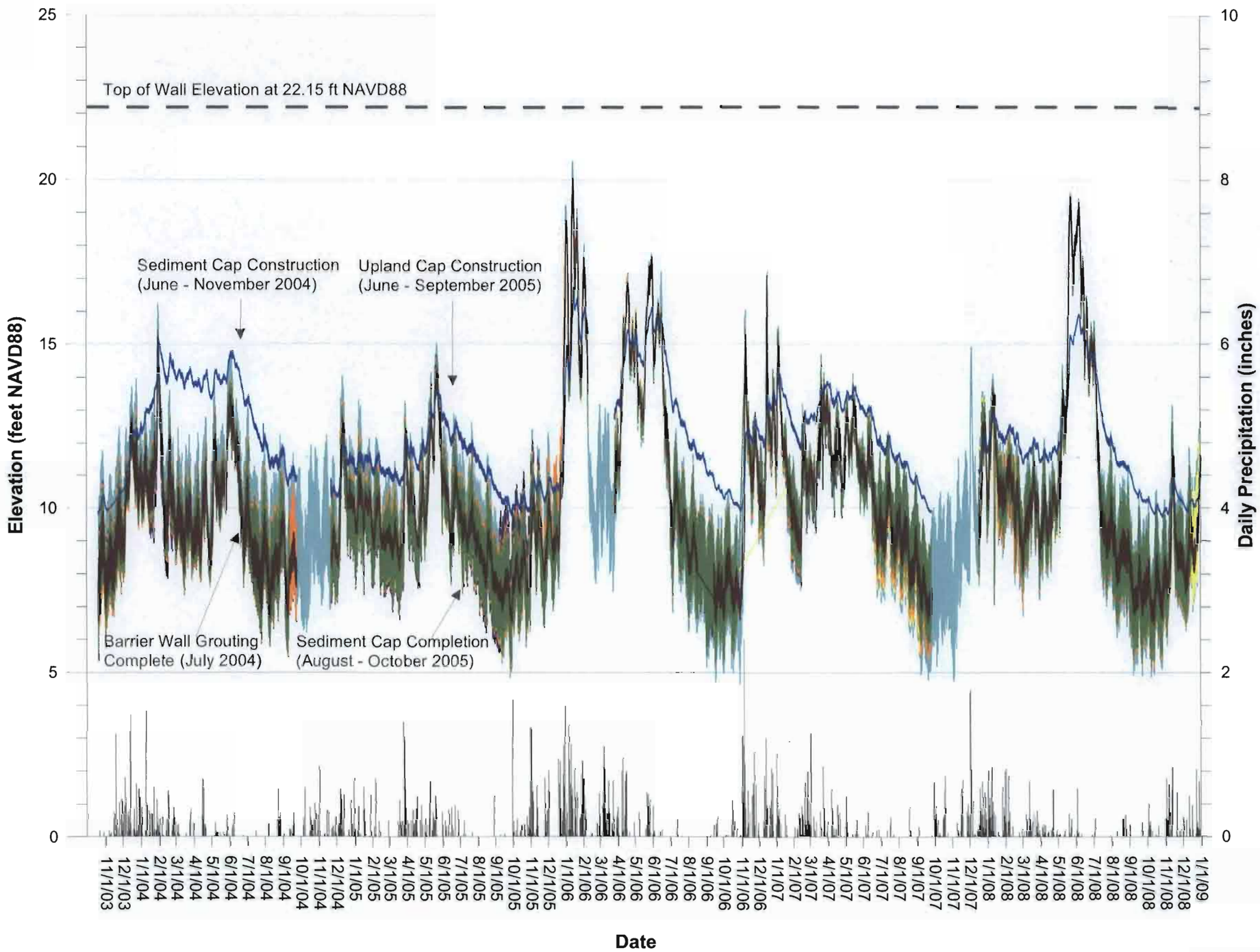


Figure A-22:
Post-Barrier Wall Groundwater Elevations in Monitoring Wells MW-36 and MW-37
McCormick and Baxter Superfund Site
Portland, OR

LEGEND

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

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 damaged transducer was not collecting accurate pressure readings.

HARTCROWSER

GSI Water Solutions, Inc.

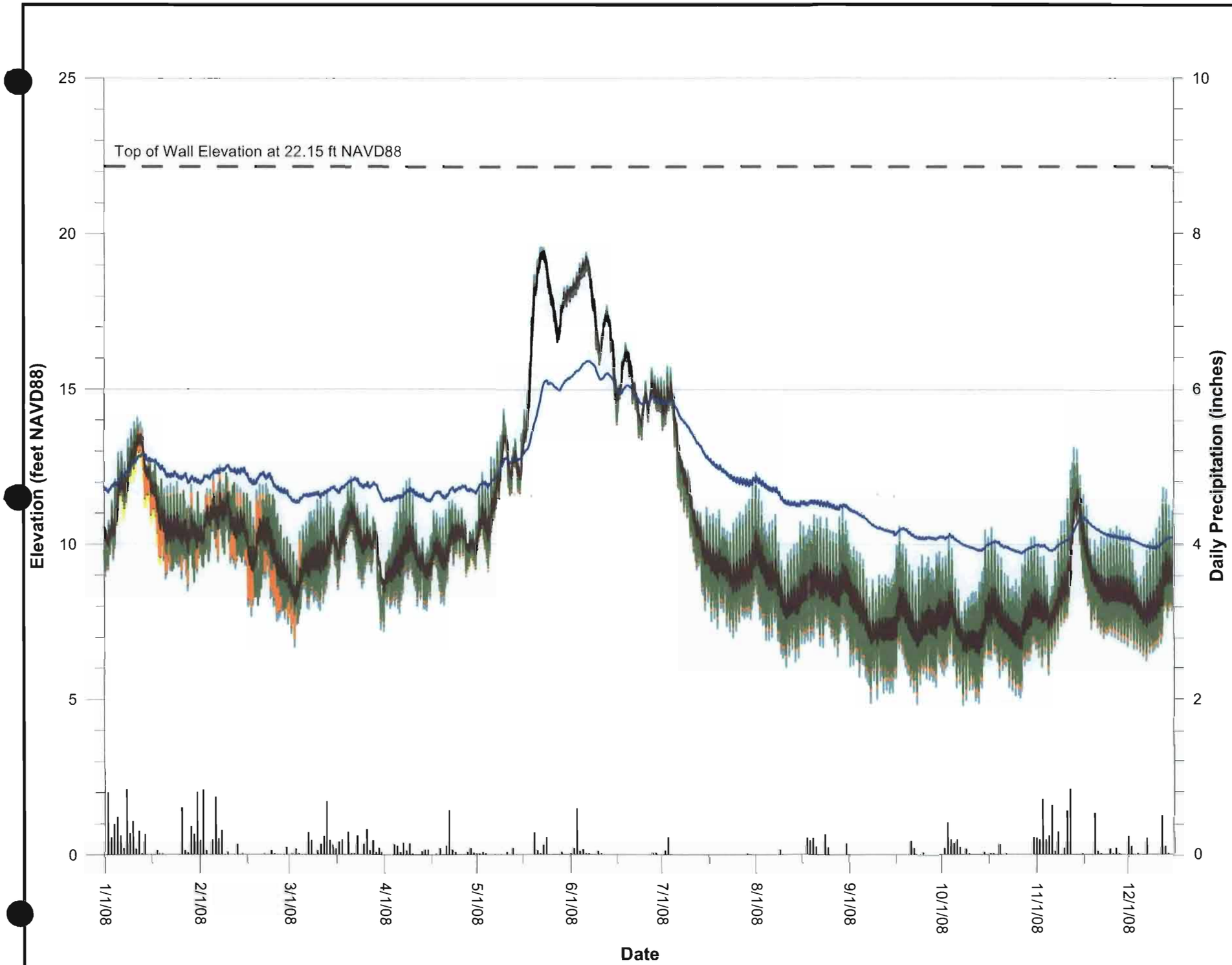


Figure A-23:
2008 Groundwater Elevations in Monitoring Wells MW-36 and MW-37
McCormick and Baxter Superfund Site
Portland, OR

LEGEND

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

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 damaged transducer was not collecting accurate pressure readings.

HARTCROWSER

GSI Water Solutions, Inc.

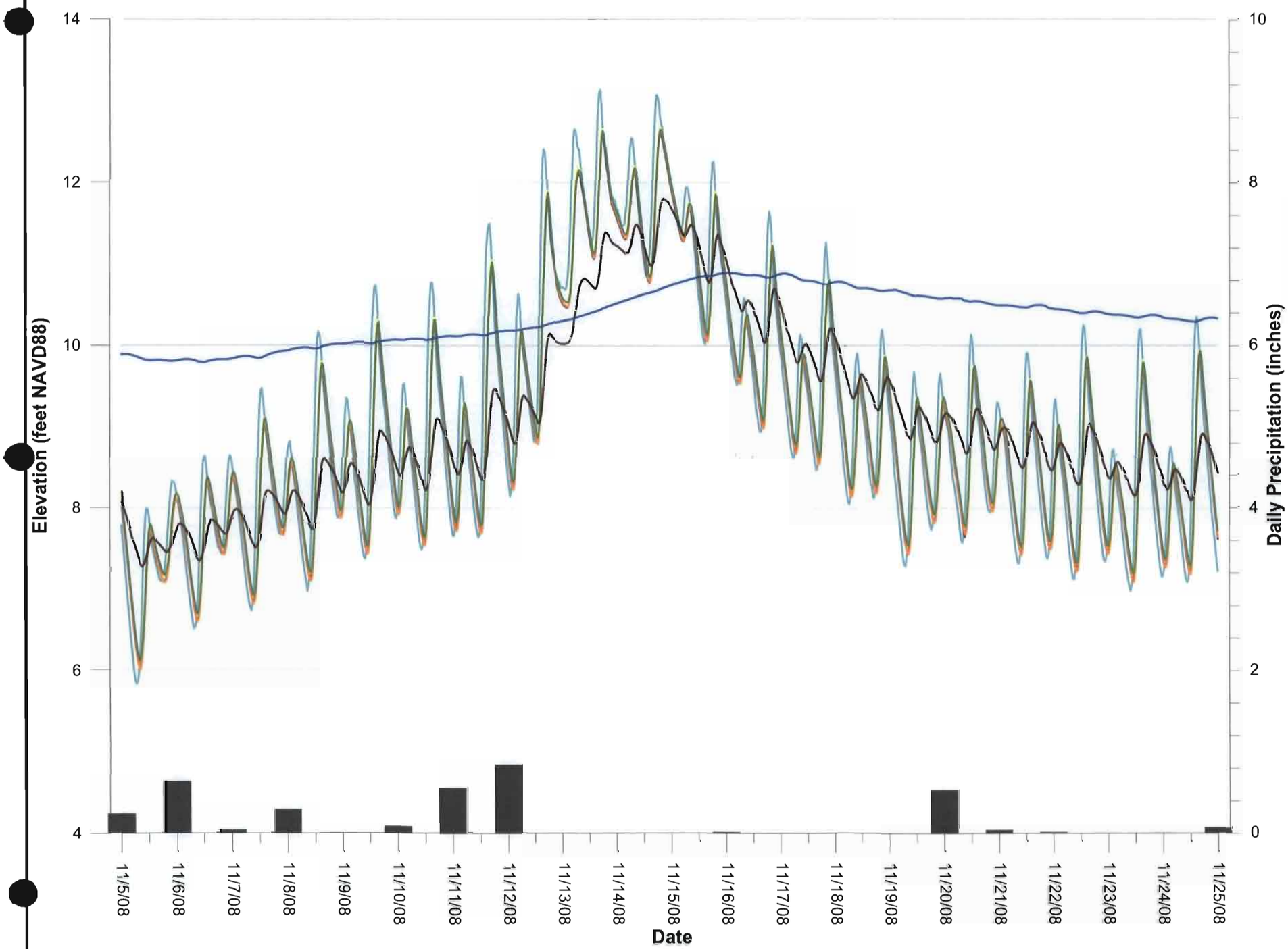


Figure A-24:
November 2008 - Groundwater Elevations in Monitoring Wells MW-36 and MW-37
McCormick and Baxter Superfund Site
Portland, OR

LEGEND

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

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

HARTCROWSER

GSI Water Solutions, Inc.

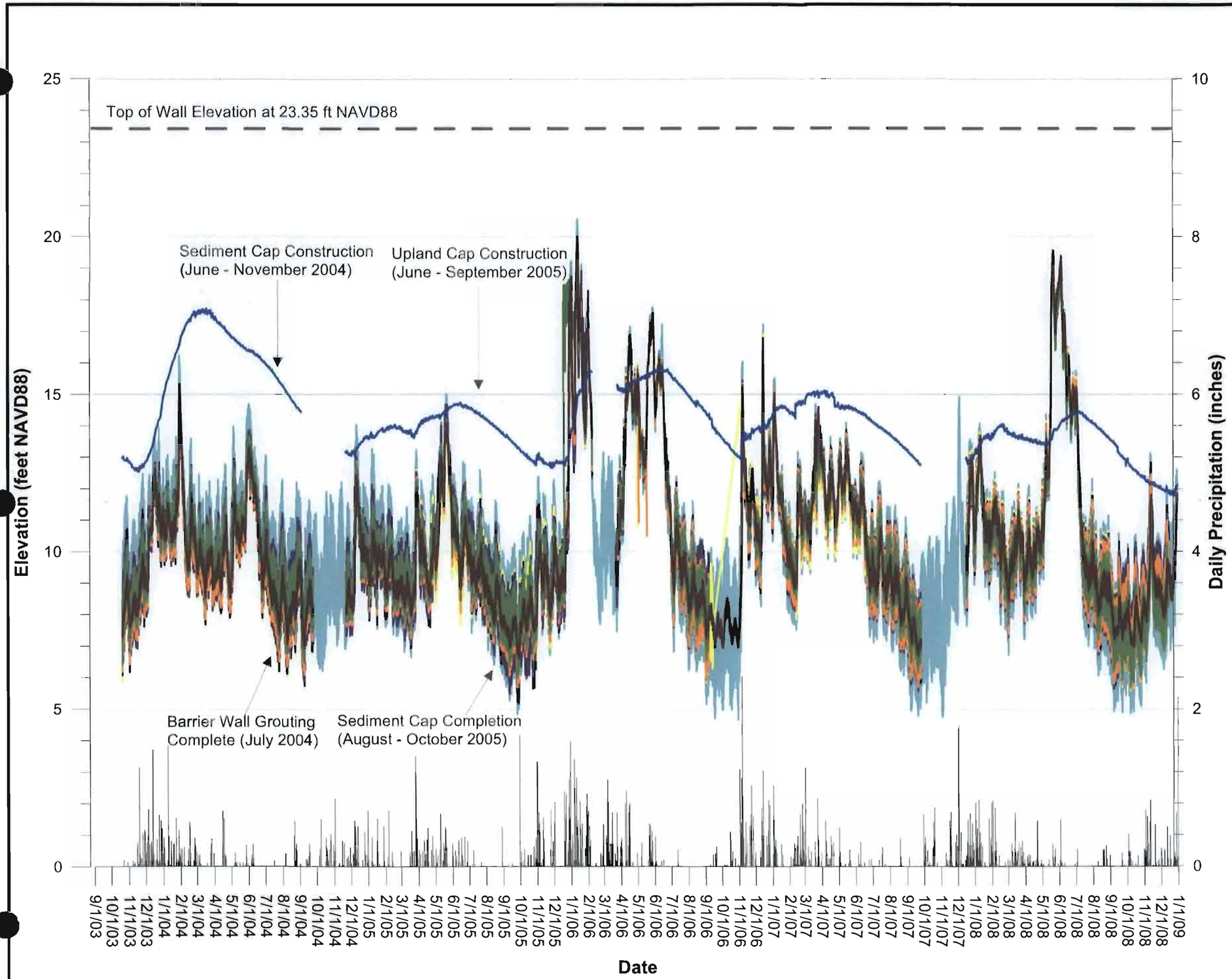


Figure A-25:
Post-Barrier Wall Groundwater Elevations in Monitoring Wells MW-44 and MW-45
McCormick and Baxter Superfund Site
Portland, OR

LEGEND

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

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 damaged transducer was not collecting accurate pressure readings.

HARTCROWSER

GSI Water Solutions, Inc.

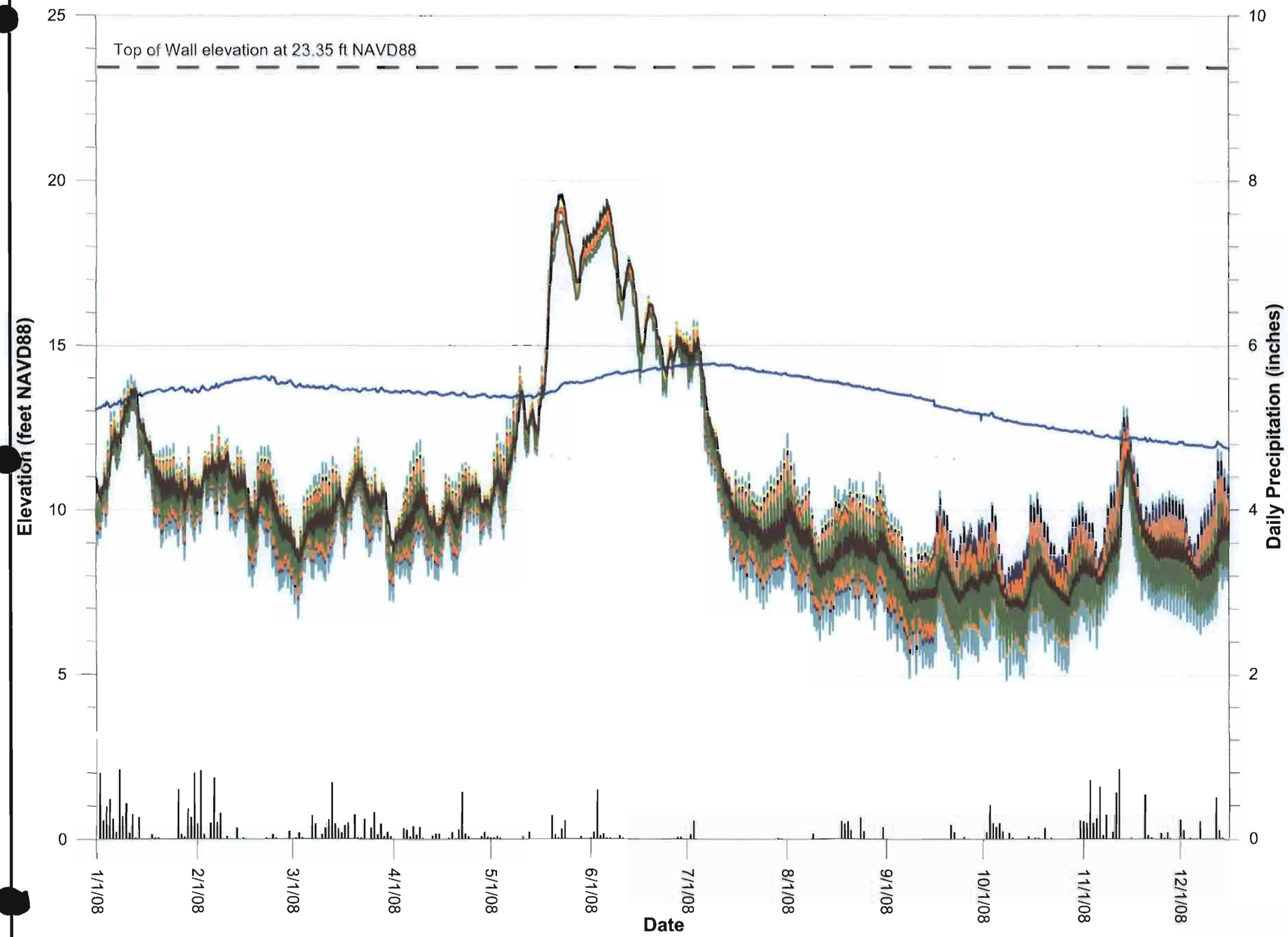


Figure A-26:
2008 Groundwater Elevations in Monitoring Wells MW-44 and MW-45
McCormick and Baxter Superfund Site
Portland, OR

LEGEND

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

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

HARTCROWSER

GSI Water Solutions, Inc.

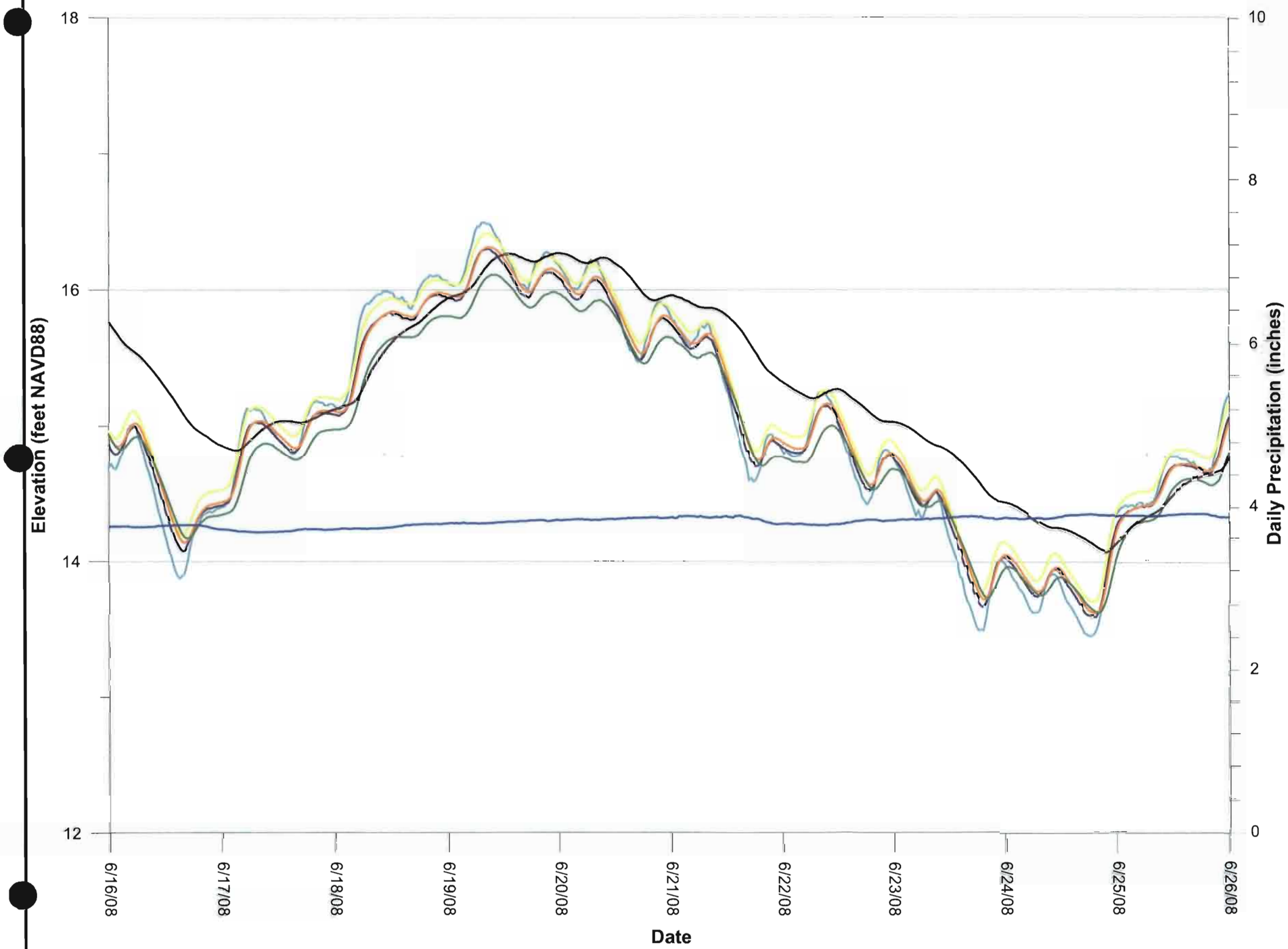


Figure A-27: High Flow Detail
2008 Groundwater Elevations
in Monitoring Wells MW-44 and MW-45
McCormick and Baxter Superfund Site
Portland, OR

LEGEND

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

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

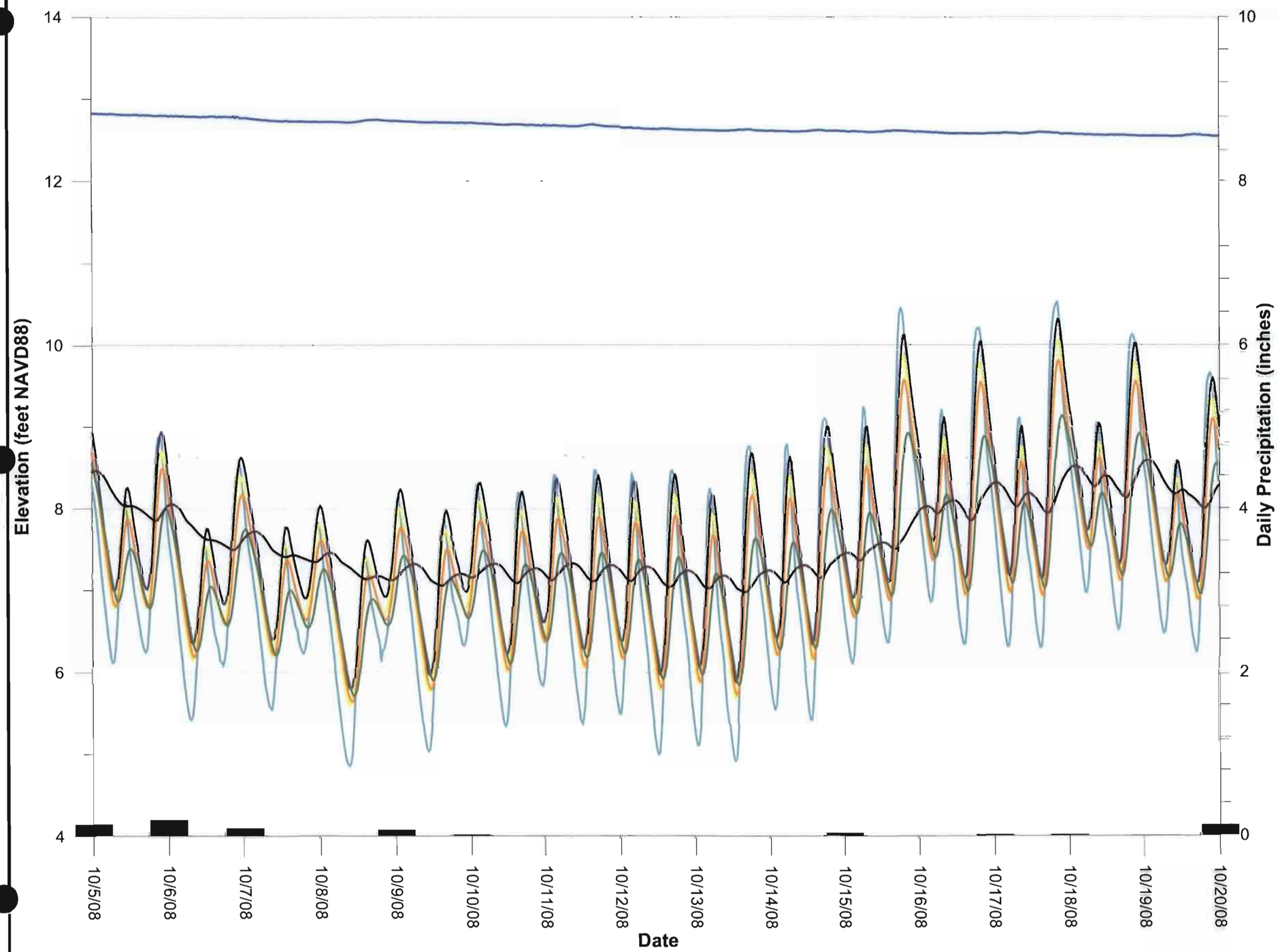
Top of barrier wall (not shown) is 23.35 ft NAVD88.

There was no precipitation recorded during this time period.

HARTCROWSER

GSI Water Solutions, Inc.

Figure A-28: Low Flow Detail
2008 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 Data

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

Top of barrier wall (not shown) is 23.35 ft NAVD88.

HARTCROWSER

GSI Water Solutions, Inc.

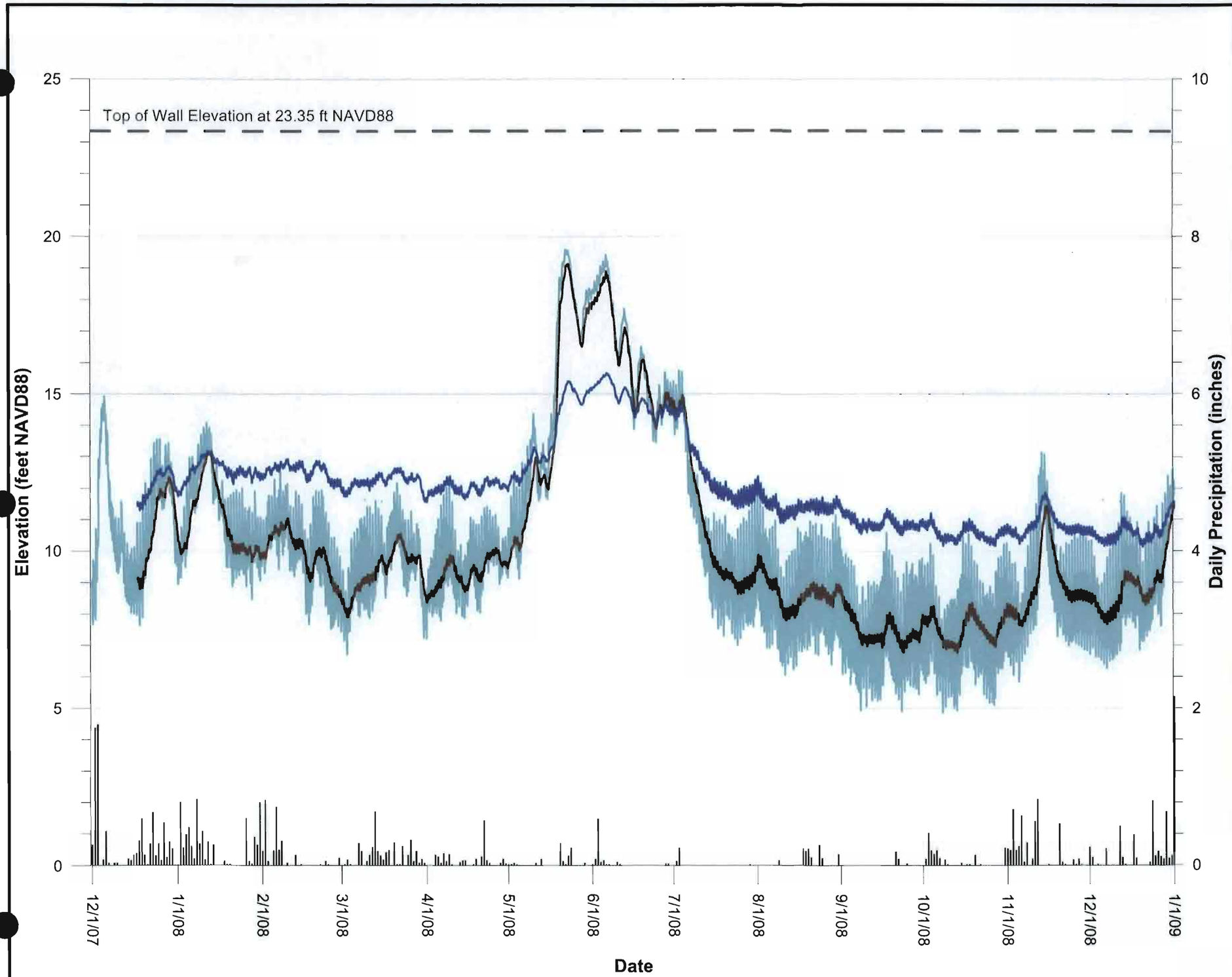


Figure A-29:
Post-Barrier Wall Groundwater Elevations
Monitoring Wells MW-40s and MW-41s
McCormick and Baxter Superfund Site
Portland, OR

LEGEND

- MW-40s (Interior)
- MW-41s (Exterior)
- River
- Precipitation Data

Note: MW-40s is located inside the barrier wall and MW-37s is located outside the barrier wall.

HARTCROWSER

GSI Water Solutions, Inc.

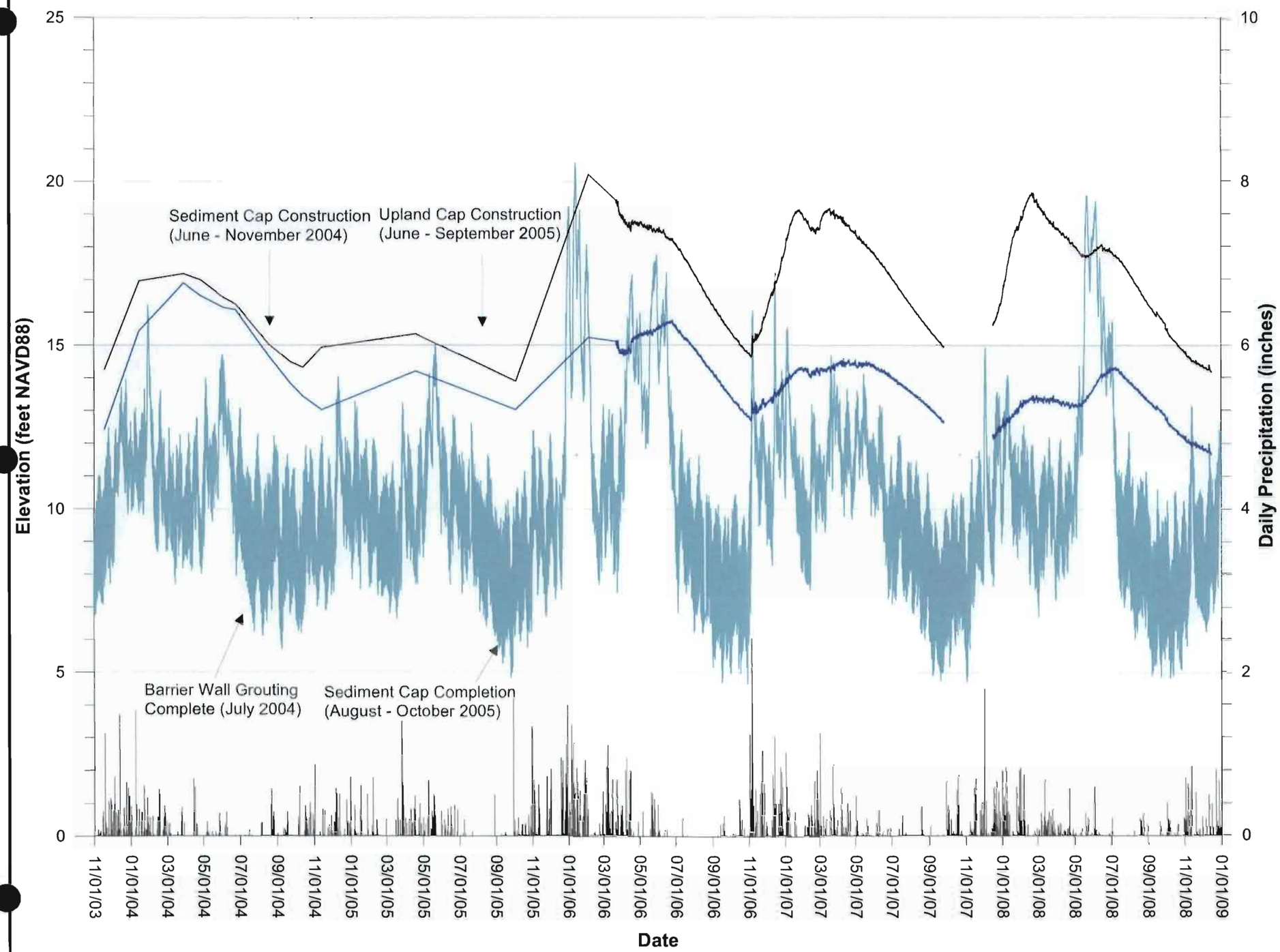


Figure A-30:
Post-Barrier Wall Groundwater Elevations
Monitoring Wells MW-52s and MW-53s
McCormick and Baxter Superfund Site
Portland, OR

LEGEND

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

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 damaged transducer was not collecting accurate pressure readings.

HARTCROWSER

GSI Water Solutions, Inc.

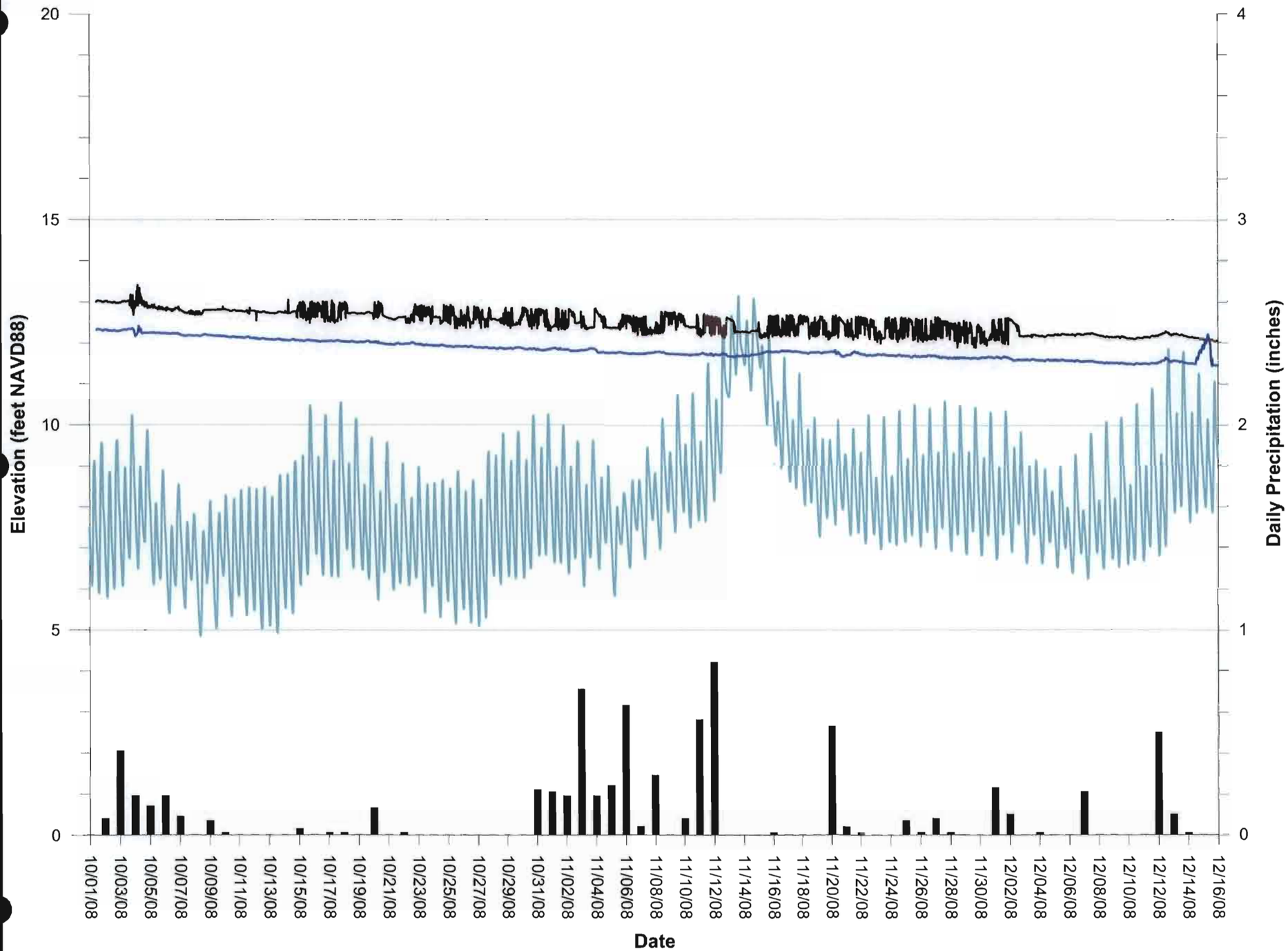


Figure A-31:
2008 Groundwater Elevations
Monitoring Wells MW-15s and EW-1s
McCormick and Baxter Superfund Site
Portland, OR

LEGEND

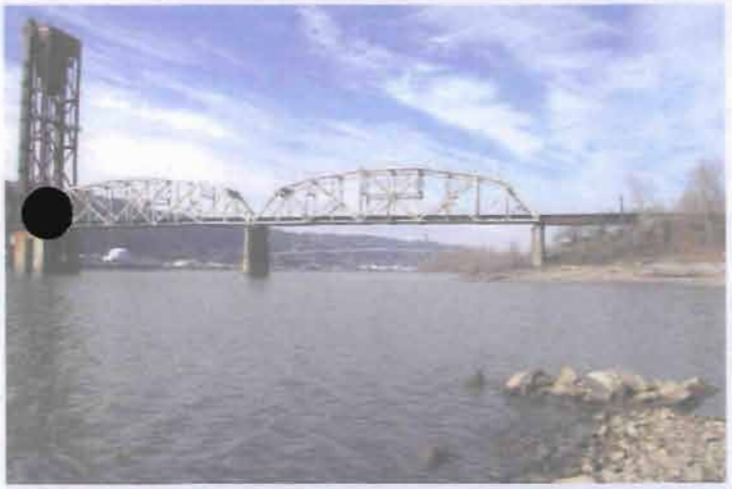
- EW-1s (Interior)
- MW-15s (Interior)
- River
- Precipitation Data

Note: Monitoring wells EW-1s and MW-15s are located inside the barrier wall.

HARTCROWSER

GSI Water Solutions, Inc.

Appendix B



APPENDIX B
SITE OPERATION AND ACTIVITY SUMMARY

OPERATION AND MAINTENANCE REPORT
JANUARY 2008 THROUGH DECEMBER 2008

Hart Crowser/GSI
15670-03/Task 9 May 22, 2009

APPENDIX B
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B-2 Habitat Enhancement Conditions
B-3 Difference in Topography Upland Cap Survey 2005 vs 2008

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A Site Activity Log (DVD)
B Soil Cap Observations (DVD)
C Sediment Cap Observations (DVD)
D Monthly Meeting Summaries (DVD)
E Photograph Documentation
F Technical Memorandum - Articulated Concrete Block Cover (DVD)
G Waste Disposal Documentation (DVD)

ACRONYMS

ACB	articulated concrete block
BNRB	Burlington Northern Railroad Bridge
City	City of Portland
Clearwater	Clearwater Environmental Services, Inc.
DEQ	Oregon Department of Environmental Quality
GSI	GSI Water Solutions, Inc.
NAPL	nonaqueous phase liquid
O&M	Operation and Maintenance
P&B	Parsons and Binckerhoff
Site	McCormick & Baxter Superfund Site

APPENDIX B
SITE OBSERVATION AND ACTIVITY SUMMARY
OPERATION AND MAINTENANCE REPORT
JANUARY 2008 THROUGH DECEMBER 2008
MCCORMICK AND BAXTER SUPERFUND SITE

1.0 INTRODUCTION

Appendix B to the *January 2008 through December 2008 Operation and Maintenance (O&M) Report* (O&M Report) presents a summary of observation and maintenance activities at the McCormick & Baxter Superfund Site (Site) for the reporting period from January 1, 2008, through December 31, 2008. Attachments A through G provide detailed information about the activities.

2.0 SITE OBSERVATIONS

Site observations and maintenance activities were conducted according to the *Draft Final Operation and Maintenance Plan* (DEQ, 2007). From mid-July through October 2008, sediment cap inspections were performed on a weekly basis; during the remainder of 2008, sediment cap inspections were performed on a monthly basis. Soil cap inspections were performed on a monthly basis during 2008. These weekly and monthly inspections are considered routine inspections, and are documented in observation forms developed for the Site. Attachment A provides a Site Activity Log, which lists each visitor to the Site and the purpose of the visit. Attachments B and C contain the routine inspection observation forms for the soil cap and sediment cap, respectively. Routine inspections were performed by Clearwater Environmental Services, Inc. (Clearwater), the O&M subcontractor to Hart Crowser for the Site. Site inspections also were performed during monthly Site meetings and miscellaneous Site visits. The observations from monthly Site meetings are documented in the monthly meeting minutes, which are included as Attachment D. Attachment E contains photographic documentation. Observations of interest from the routine inspections and monthly site meetings are summarized on Figure B-1. Miscellaneous Site visit observations of interest were documented in field notes and are summarized in this report.

2.1 Sediment Cap Observations

The sediment cap was inspected 26 times in 2008. The inspections were conducted in conjunction with routine inspections during monthly Site meetings, ebullition and sheen investigation activities; and surface, inter-

armoring, and sub-armoring water sampling. Sediment cap inspection documentation is included in Attachment C. Inspections were more frequent during the low-water period from mid-July through October 2008. Sections 2.1.1 through 2.1.4 below describe sediment cap observations regarding sheen, habitat enhancement features and wildlife, sediment cap features, and vandalism and/or trespassing.

2.1.1 Sheen Observations

Sheen was observed during most Site inspections from July 15, 2008, through September 24, 2008. The frequency of Site inspections during this period was increased to track and attempt to determine the origin of the sheen in conjunction with the Ebullition and Sheen Investigation. Observation details are included in Appendix G – Ebullition and Sheen Investigation of the O&M Annual Report including the date, location, and description of the sheen for each sheen occurrence. Locations of sheen observed in 2008 are presented on Figure B-1.

2.1.2 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. This section provides observations regarding the condition of these features, as well as additional enhancement features, such as large woody debris, along the shoreline and in the riparian area above the shoreline. A habitat enhancement survey was conducted by Hart Crowser on October 20, 2008. Figure B-2 shows the distribution of sand and woody debris observed along the shoreline, the location of boulder clusters and the location of wildlife paths that were installed in late September 2007.

As indicated on Figure B-2, sand remains in place over a large portion of the Site. Along the northern extent an approximate 120-foot long gap exists where sand was placed on the ACB in 2005. Sand was generally placed along the entire length of the shoreline during the 2005 Sediment Cap construction activities. More ACB is exposed toward the southern end of the Site where the bank slope is steeper. ACB is also exposed in Willamette Cove. A Sediment Stability Assessment prepared by Parsons and Binckerhoff (P&B) Ports and Marine Inc. (P&B Ports and Marine, 2003) indicated sand washes away along steep sloped portions of the site and becomes deposited in preferential locations such as flat areas with low velocity. Sand erosion along the shoreline in 2008 generally follow the Two-Dimensional Hydraulic Model results from the 2003 Sediment Stability Assessment. Similar to what was observed in 2007, sand appears to be accumulating on the eastern side of the reef that forms the

embayment. Sand deposition is also occurring at the northern end of the shoreline near the Burlington Northern Railroad Bridge.

Large woody debris has accumulated along the entire length of the shoreline. Most was deposited near the top of the ACB in late June following unusually early hot weather, substantial snow melt, and high river levels. The green turf reinforcement matting was exposed in some areas by the high river levels during that time, and required reconnection to the ACB. Three areas of the shoreline appear to accumulate woody debris at a greater rate then others: at the south end of the shoreline near the City of Portland outfall, along the shoreline near the TFA, and at the north end of the Site near the Burlington Northern Railroad Bridge (BNRB).

Boulder clusters remain in place, as shown on Figure B-2, and the record drawings in Appendix H. The boulder clusters were incorrectly located on previous record drawings; the locations of the clusters have been revised for this report.

Gosling paths were constructed in late September 2007 at four locations shown on Figure B-2. High river levels from snow melt in June 2008 removed much of the 4-inch-minus gravel from the surface of the ACB used to construct the gosling paths; however, the 4-inch-minus gravel has remained in the ACB voids. The Sediment Stability Assessment indicated 5-inch minus or greater is required to prevent erosion along steep portions of the shoreline (P&B Ports and Marine, 2003).

Numerous wildlife species were observed at the Site in 2008. Most frequently observed were various birds, including Canada geese, gulls, pigeons, blue herons, and ospreys. In the Willamette River, juvenile fish, clams, and crayfish were common.

A small animal burrow was identified at the top of the ACB near the southern end of the Site in 2007 and was monitored in 2008; no increase in burrow depth or use has been observed.

2.1.3 Sediment Cap Features

In general, the sediment cap remains unchanged. Several broken or cracked ACBs have been observed; likely the result of damage from impacting logs during high water events. During routine inspections in conjunction with monthly meetings, several gaps between ACB mat seams were noted where sand has been washed away. DEQ is planning to cover the ACB with 4-inch-minus gravel to fill these gaps and the ACB voids for long term maintenance and

safety. A Technical Memorandum has been prepared to describe this activity and is included as Attachment F in this Appendix.

Five buoys mark the outer boundary of the sediment cap to warn of potential underwater hazards; two are located in Willamette Cove, and three are located south of the BNRB. In 2008, three buoys were moved from their original positions and two are missing; the result of high river levels and debris contact with anchor lines. The three remaining buoys were relocated on April 14, 2008 by West Coast Marine Cleaning, Inc. after river levels dropped and the amount of floating debris had decreased. Permanent buoy placement is planned for Spring 2009.

2.1.4 Vandalism and Trespassing

The shoreline along the Site and in Willamette Cove is accessible, and is often used by public for various forms of recreation. Throughout 2008, trash and graffiti were observed along the shoreline and in Willamette Cove. In the summer of 2008, a transient shelter was discovered among large woody debris that had washed ashore. During subsequent inspections, no occupants were observed and the shelter was left in place because it posed no threat to the integrity of the cap. In November 2008, the shelter washed away.

2.2 Soil Cap Observations

The soil cap was inspected 14 times between in 2008. The inspections were conducted in conjunction with routine inspections during monthly Site meetings, and miscellaneous Site visits for maintenance purposes. Sections 2.2.1 and 2.2.2 below describe soil cap observations regarding wildlife and vandalism and/or trespassing.

2.2.1 Wildlife

The upland soil cap provides habitat for rabbits, ground squirrels, Canada geese, several species of birds, and coyotes (likely). A coyote has apparently been burrowing under the southwest fence along the perimeter road to enter the Site. Additional gravel was place along the south perimeter road was re-graveled during the week of September 12, 2008, to fill in the burrows and gaps beneath the fence line. Animal burrows have subsequently been observed in random locations along the perimeter road, and are filled in with gravel as soon as possible.

Ground squirrel burrows were observed at several locations south of the Site trailers. Ground squirrels are common to the general vicinity of the area, and

their burrows typically extend from 1 to 3 feet underground. There are unconfirmed instances of burrowing deeper where large colonies inhabit a burrow network (Larson, 2007). Ground squirrels prefer hillsides and low earth banks, sometimes using structures such as trees and boulders for cover. It appears the ground squirrels are using the surplus ACB that is stacked north of the trailers as habitat. It also appears the squirrels are creating a burrow network below the asphalt entrance road to the north gate at the Site.

A previous study conducted on the effect of rodent burrowing on a sediment cap over a contaminated dried lake bed found that rodents and plants compromised the integrity of the cap (Anderson, 2007). There are no indications that any of the borrows exist below the depth of the soil cap, and therefore do not pose a concern that the integrity of the soil cap has been compromised. Continued monitoring of the burrows is recommended; no aggressive action to remove burrowing animals or to fill in the burrows is planned at this time.

2.2.2 Vandalism and Trespassing

A gate at the top of North Edgewater Road marks the entrance to the Site and Willamette Cove property. The gate is locked with a series of locks and chain to provide access to two railroads, DEQ, and other agencies that require access to this area. The locks and chain on the gate were cut numerous times in 2008 by other agency and railroad personnel or by people who wanted to gain vehicle access to Willamette Cove and/or dump trash (assumed). Although an ongoing nuisance, these breaches of North Edgewater Road gate did not affect the security of the Site because of the surrounding fence, lighting, and alarm system.

In 2008, four security instances required follow-up activities.

- In early April 2008, a University of Portland security guard reported the southeast gate for the fencing surrounding the Site was left open. This was reported at the same time Hart Crowser staff were sampling late into the evening to complete surface, sub-armoring, and inter-armoring water sample collection. No indications of trespassing were observed when Hart Crowser staff completed the sampling.
- A suspicious pipe/explosive device was observed near the southern soil cap boundary on April 14, 2008. The City of Portland (City) Police Department was notified; the department's Explosive Disposal Unit confirmed that the pipe was a pipe bomb and destroyed the device on April 15, 2008. It appears the pipe was thrown onto the Site from outside the south perimeter fence.

- Hart Crowser was notified on October 26, 2008, by Phillips Alarm Company, that the motion detector on Trailer No. 2 activated the alarm system at the Site. Tim Skrotzki and Jeff Bigsby of Hart Crowser inspected the Site, found no evidence of a break-in or vandalism, and determined it was a false alarm. Hart Crowser was notified, on October 29, 2008, that the motion detector on Trailer No. 2 again activated the alarm at the Site. Brian Block of Hart Crowser and the City of Portland Police Department checked the alarm, and determined it was a false alarm. Phillips Alarm Company inspected the alarm system on October 31, 2008, and did not encounter any problems. To eliminate future false alarms with this sensor, the motion detector on Trailer No. 2 was deactivated. All other alarm sensors, including door and window sensors on Trailer No. 1, Trailer No. 2, and the storage shed, are still active.
- The southeast gate was damaged in late September 2008. It appears someone tried to break through the gate using a vehicle; however, the gate remained intact. Gate and fencing repairs were completed on November 12, 2008.

2.3 Soil Cap Subsidence

During the monthly site inspection on March 2008, it was apparent that the well monument lid on MW-23d no longer fit securely on the outer well casing. Three months later, during the June monthly inspection, the inner casing of MW-23d was observed to be approximately 4 inches higher than the outer casing. On August 8, 2008, Stratus Corporation, a licensed well repair contractor, removed approximately 7 inches of the inner well casing to allow the monument lid to fit again.

Following the June inspection, a preliminary relative survey of was conducted by Hart Crowser to measure the elevation differences between MW-23d and four nearby wells. Comparing these relative differences to the elevations of the same wells surveyed in 2005, it was obvious that differential settling had occurred in the general vicinity of MW-23d. DEQ subsequently directed Hart Crowser/GSI to resurvey the entire upland soil cap and well elevations, and make recommendations to address potential drainage system problems associated with the impermeable cap.

The survey was conducted by OTAK Survey Services, Inc., and shows that a portion of the upland cap, coincidental with buried wood debris in the vicinity of MW23-d, has subsided up to 0.8 feet. A differencing map showing the topography comparison from the OTAK survey and the survey conducted by David Evans and Associates in 2005 is included as Figure B-3.

The results of the survey and recommendations were provided to DEQ in a Technical Memorandum dated January 27, 2007. The results suggest that the subsidence has not likely or yet caused the stormwater discharge piping for the impermeable cap to break as evidenced by the continued discharge of stormwater from the outflow piping, connectivity of the piping to the manholes, and lack of groundwater mound in the vicinity of EW-1 (which is centered over the area of subsidence and adjacent to the stormwater piping and MW-23d). The subsidence appears to be continuing as evidenced by the additional measured change in elevation between the inner and outer casing in MW-23d, warmer water temperature measured in EW-1s relative to other wells, and apparent gas emissions from EW-1s based on transducer data. Continued settling will likely cause considerable damage to the integrity of the stormwater drainage system underlying the impermeable impermeable cap.

The subsidence may be caused, in part, by degradation of the wood debris located beneath the cap in the general vicinity of MW-23d. The decline in shallow groundwater elevation within the barrier wall may also be contributing to the subsidence; however, as the groundwater within the barrier wall approaches equilibrium with the river, continued declines in water levels is expected to cease. A number of actions have been recommended and are now being conducted to further define the rate and mechanism of subsidence including:

- Continued monitoring of the relative difference between the inner and outer casing on MW-23d;
- Monthly surveying at specified locations in the vicinity of greatest subsidence for a period of 6 months;
- Continued transducer monitoring in MW-15s and EW-1s to monitor to look for groundwater mounding and groundwater temperature differences;
- Surveying the stormwater pipe between manholes B and C to determine whether there is standing water in the pipe and/or if there are any breaks or cracks present in the pipe;
- Continued monitoring of the stormwater discharge in manholes and at the stormwater outfall to verify flow from stormwater drainage system; and
- EW-1s gas evaluation to determine the composition of the gas.

3.0 MAINTENANCE ACTIVITIES

Maintenance activities in 2008 at the Site were performed by Clearwater. Activities ranged from weekly maintenance of pumps and regulators to non-routine tasks such as fence repairs and organoclay mat installation for the sheen

investigation work conducted August and September. In addition to activities performed by Clearwater, non-routine maintenance activities were performed by Moen Machinery Company, the City of Portland, Portland Electric, Equipco Services, and WasteXpress. The following section discusses routine maintenance tasks and non-routine tasks performed in 2008. Site support services, such as phone, alarm, solid waste, and wastewater were provided by Qwest, Phillips, Trashco Services, and Schulz-Clearwater Sanitation, respectively.

3.1 Routine Maintenance

On a regular basis, Clearwater performed maintenance on the pumps, compressor, regulators, lines, oil interface meter (used to perform NAPL gauging and extraction), and the Site vehicle (Kubota). Regular maintenance is crucial for keeping the equipment in proper working order, and to avoid activity delays. During the reporting period, the oil interface meter was sent to Equipco Services to repair the measuring tap; however, it was determined to be more cost effective to replace the meter itself. An oil interface meter was rented for the month of June until the new meter was purchased in late June 2008. Moen Machinery Company provides maintenance services for the Site vehicle. During the reporting period, the Site vehicle received a transmission overhaul, windshield latches, and the recommended annual inspection and maintenance.

Routine maintenance was also provided for the Site vegetation management plan, conducted by the City of Portland. Prior to the winter of 2007-2008, the irrigation system was turned off and drained to prevent freeze damage, which also required removal of the pressure reducing valve from the site fire hydrant. In June 2008, the pressure reducing valve was re-installed by Clearwater and the irrigation system was re-commissioned. The City of Portland performed inspections along the system to check for freeze or other damage, repaired any damage, and began operating the system when weather conditions warranted irrigation. In November 2008, the irrigation system was de-commissioned again and the pressure reducing valve was removed.

3.2 Non-routine Maintenance Activities

Clearwater and other service providers also performed non-routine maintenance activities that are typically action items from monthly meetings or in response to Site observations.

On September 5 and September 12, 2008, Clearwater removed treated timbers that had washed up along the shoreline during high water to minimize the potential for the timbers to contaminate Site sediments. Other shoreline debris and a damaged portion of Burlington Northern Railroad fencing were also

removed. Clearwater used an excavator to load the debris into a dump truck, then transported the material to the Hillsboro Landfill.

The support facility area is illuminated at night by an overhead security light located near the shop building. Because of the height of the security light, Portland General Electric was called to the Site to replace a burned out bulb in October 2008.

NAPL extracted from wells, wastewater generated during groundwater monitoring, and solid waste generated during NAPL collection and measurement activities were removed for offsite disposal by WasteXpress on June 12, 2008. Three, 55-gallon drums of NAPL and purged wastewater, and two totes were removed for disposal as hazardous waste. Documentation for this activity is provided in Attachment G.

The well monuments for monitoring wells MW-58s, MW-58i, and MW-58d in the Willamette Cove were repaired on August 8, 2008, because the well monument lid bolts had been stripped. Stratus Corporation, a licensed well installation contractor, removed and replaced the entire well monument for each well. Tamper-proof bolts were used to secure the well covers. A new monument lid with tamper-proof bolts also was placed on monitoring well MW-35r, and approximately 7 inches of the inner well casing was removed from monitoring well MW-23d.

4.0 SUMMARY

In 2008, sheen was frequently observed in several locations along the shoreline at the Site from approximately late June to October 2008. Shoreline sheen was not observed at the Site at any other time in 2008. A comprehensive effort to identify the source and mechanism of the sheen were conducted as part of the Ebullition and Sheen Investigation (preliminary results of which are presented in Appendix G of this report).

In general, the sediment cap and the upland soil cap inspections revealed few unexpected changes or areas of concern with the exception of the subsidence occurring in the upland cap. The general vicinity of upland soil cap subsidence is coincidental with subsurface wood debris. It is likely that degradation of the wood debris coupled with the decrease in groundwater elevation inside the barrier wall are contributing to the subsidence in this vicinity. Continued monitoring of the upland soil cap subsidence is being conducted.

Sand covers the ACB over much of the shoreline, and there are significant amounts of large woody debris that have accumulated to help create wildlife habitat. Wildlife commonly seen at the Site includes Canada geese, blue herons, ospreys, crawfish, squirrels, and rabbits; evidence of coyotes has also been observed. The general public, frequent the shoreline for recreation, most commonly walking dogs. A few instances of vandalism to the Site (e.g., fence damage), and littering have occurred.

Site inspections and observations resulted in several non-routine maintenance activities in addition to routine activities. Non-routine activities included repairing fences, removing treated timber, operating the irrigation system, repairing the overhead security light, placing additional gravel along perimeters roadways, and replacing monitoring well monuments. It is anticipated that Site inspections and maintenance activities will continue as described in the *Draft Final Operation and Maintenance Plan* (DEQ, 2007).

5.0 REFERENCES

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DEQ, 2007. *Draft Final Operation and Maintenance Plan, McCormick & Baxter Creosoting Company Superfund Site Portland, Oregon.* March 2007.

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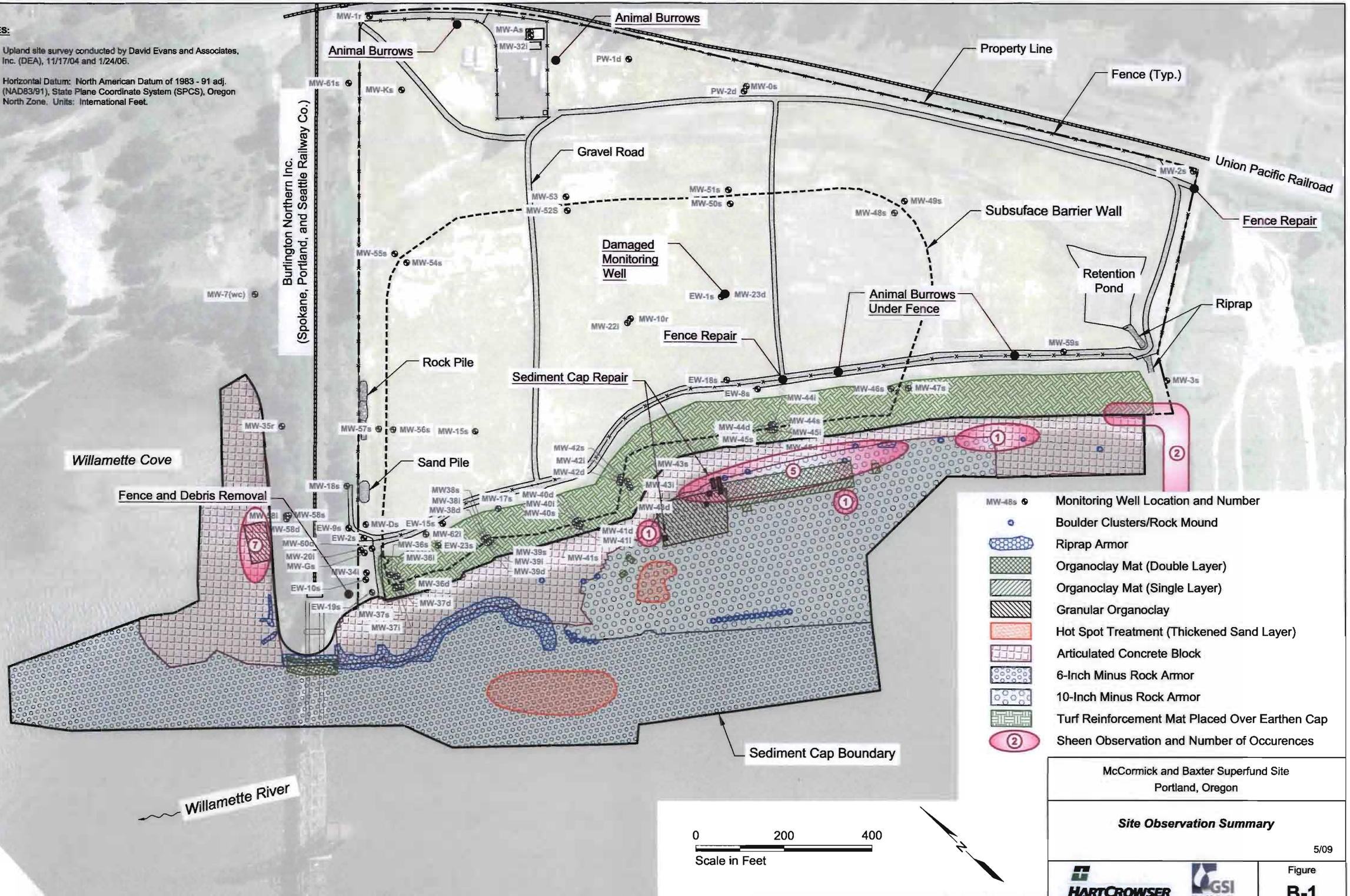
NOTES:

1. Upland site survey conducted by David Evans and Associates, Inc. (DEA), 11/17/04 and 1/24/06.
2. Horizontal Datum: North American Datum of 1983 - 91 adj. (NAD83/91), State Plane Coordinate System (SPCS), Oregon North Zone. Units: International Feet.



McCormick and Baxter Superfund Site
Portland, Oregon

Site Observation Summary

5/09

HARTCROWSER GSI Water Solutions, Inc.

Figure
B-1

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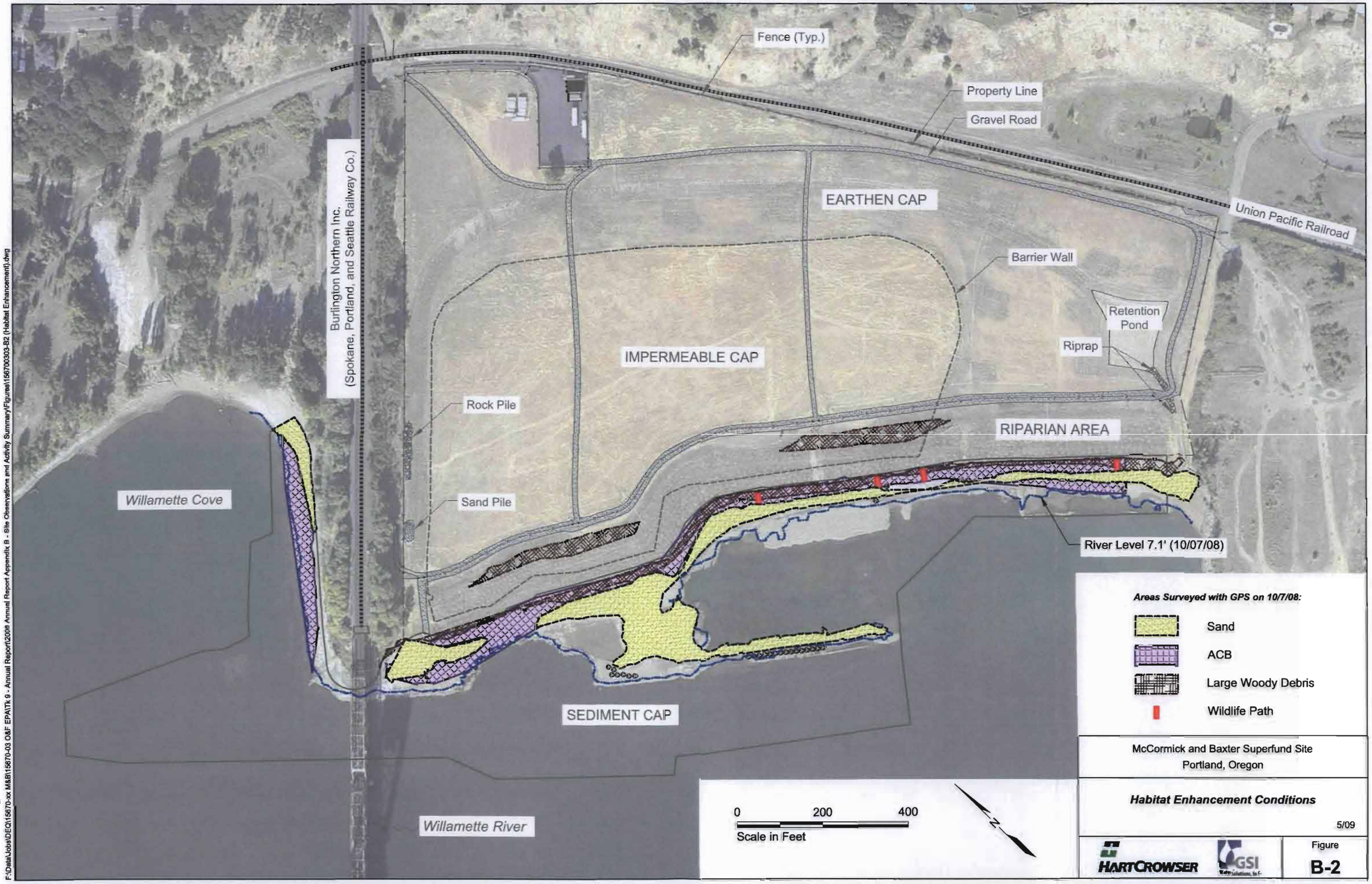

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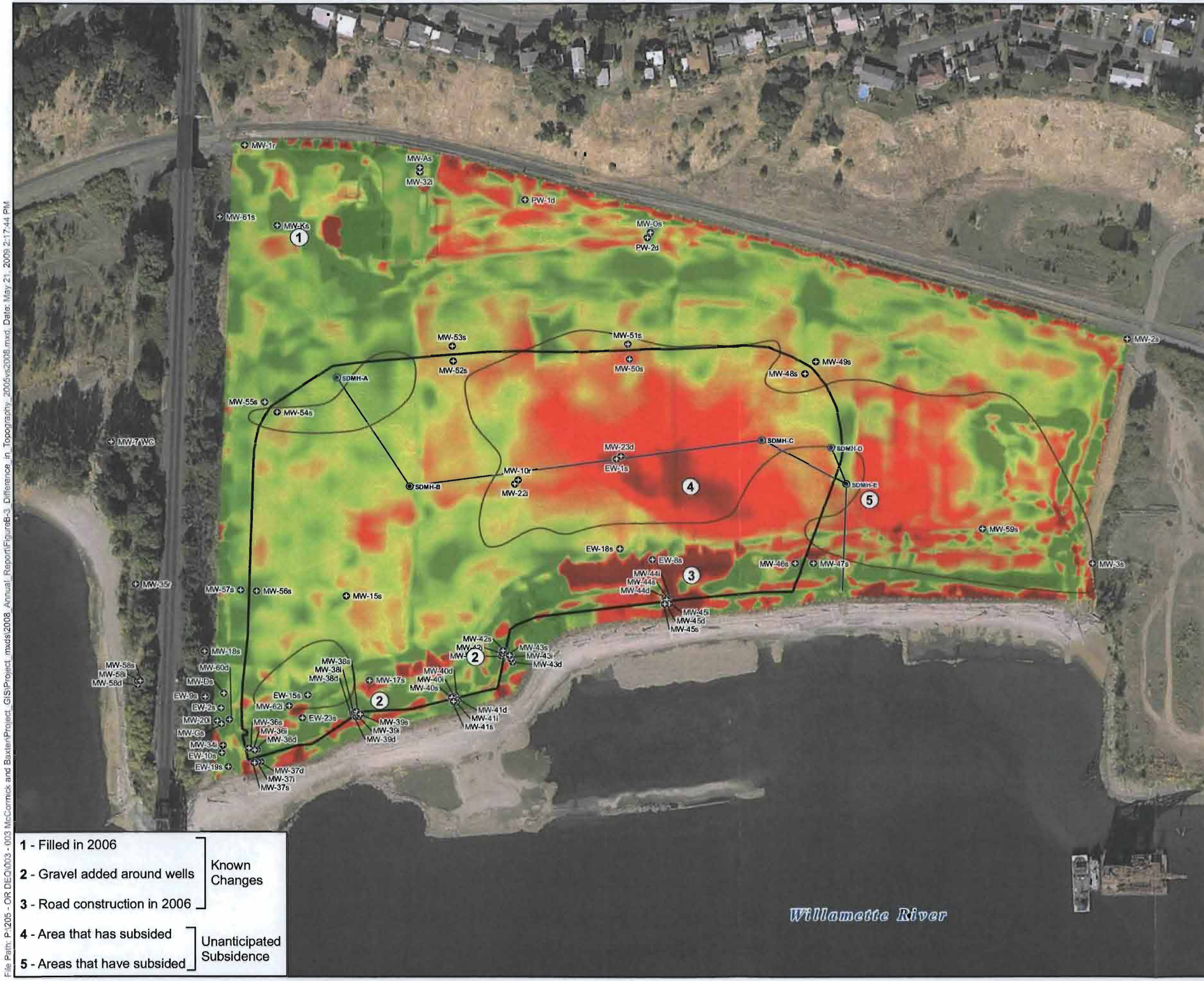

1 - Filled in 2006
2 - Gravel added around wells
3 - Road construction in 2006
Known Changes

4 - Area that has subsided
5 - Areas that have subsided
Unanticipated Subsidence

LEGEND

Difference in Topography

-2 feet (Maximum Loss)

+2 feet (Maximum Gain)

Site Features

- Groundwater Monitoring Wells
- Stormwater Discharge Manhole
- Stormwater Discharge Pipeline
- Areas of Wood Debris
- Subsurface Barrier Wall

NOTE: Aerial photo taken on September 22, 2006

0 200 400
Scale in feet

McCormick and Baxter Superfund Site
Portland, Oregon

Difference in Topography
Upland Cap Survey 2005 vs 2008

5/09

HARTCROWSER GSI Water Solutions, Inc.

Figure
B-3

File Path: P:\205 - OR DEQ\003 - 003 McCormick and Baxter\Project_GIS\Project_mxds\2008_Annual_Report\FigureB-3_Difference_in_Topography_2005vs2008.mxd, Date: May 21, 2009 2:17:44 PM

ATTACHMENT A
SITE ACTIVITY LOG

Included only on the O&M Report DVD

ATTACHMENT B
SOIL CAP OBSERVATIONS

Included only on the O&M Report DVD

ATTACHMENT C
SEDIMENT CAP OBSERVATIONS

Included only on the O&M Report DVD

ATTACHMENT D
MONTHLY MEETING SUMMARIES

Included only on the O&M Report DVD

ATTACHMENT E
PHOTOGRAPH DOCUMENTATION

OPERATION AND MAINTENANCE REPORT
JANUARY 2008 TO DECEMBER 2008
MCCORMICK AND BAXTER CREOSOTING COMPANY SUPERFUND SITE
PORTLAND, OREGON

Photograph 1 – TFA area with established vegetation and wildlife.
Photograph taken looking northwest (December 2008).

Photograph 2 – Soil cap stormwater discharge pipe.
Photograph taken looking east (December 2008).

Photograph 3 – Gosling path washed away by high water with rock remaining in voids. Photograph taken looking north (December 2008).

Photograph 4 – Wood debris accumulation along shoreline. Photograph taken looking north (December 2008).

Photograph 5 – Wood and fence debris removed in September 2008.
Photograph taken looking north (August 2008).

Photograph 6 – Damaged monitoring wellhead MW-23d due to subsidence.
Photograph taken June 2008. Well repaired August 2008.

Photograph 7 – Damaged monitoring well MW-23d. Photograph taken looking south (June 2008).

Photograph 8 – Ground squirrel burrow south of office trailers (June 2008).

Photograph 9 – Southeast corner fence repair including new concrete For center post and hinges welded to corner post. Photograph taken looking east (November 2008).

Photograph 10 – Evidence of wildlife droppings (likely coyote) at the site. Burrows under fence also observed (September 2008).

ATTACHMENT F
TECHNICAL MEMORANDUM – ACB COVER

Included only on the O&M Report DVD

ATTACHMENT G
WASTE DISPOSAL DOCUMENTATION

Included only on the O&M Report DVD

Appendix C.

APPENDIX C
VEGETATION SURVIVAL ASSESSMENT

OPERATION AND MAINTENANCE REPORT
JANUARY 2008 THROUGH DECEMBER 2008

Hart Crowser/GSI
15670-03/Task 9 May 22, 2009

CITY OF PORTLAND
ENVIRONMENTAL SERVICES
1120 SW Fifth Avenue, Room 1000, Portland, Oregon 97204 ▪ Dan Saltzman, Commissioner ▪ Dean Marriott, Director

Background

The City of Portland, Bureau of Environmental Services (BES) entered into an Intergovernmental Agreement (IGA) with the Oregon Department of Environmental Quality (DEQ) to provide vegetation planning and vegetation management services at the McCormick and Baxter Superfund site located in North Portland. The revegetation project planning 'and the site was planted in February 2006'.The installed plant materials have now completed the third growing season. In February 2008' the lower riparian component was inter-planted with 500 alder trees.

The potential for problems with noxious weeds continues to remain very high for this property. The degree of noxious weed presence will determine the longer term vegetation management requirements more than any other single factor. Many of the adjacent off-site areas have severe noxious weed problems, including scotch broom on the rail road grade and butterfly bush from the Triangle Park industrial property. In addition spotted and diffuse knapweeds are now present on the project. We continue to use a preventative noxious weed control approach, this is part of an ongoing effort to prevent and control the spread of noxious weed species on this property.

Establishment of a solid herbaceous cover is another part of our approach to limit establishment and spread of noxious weeds. To this point additional seeding (see list below of species seeded) has been applied each year to build and maintain a full vegetative cover on the project site, especially in the areas that did not have any woody plant material specified in the IGA.

Site Component	Treatment Acres	Festuca rubra commutata	Collomia grandiflora	Coreopsis atkinsoniana	Eriophyllum lanatum	Gilia capitata	Grindelia integrifolia	Iris tenax	Lotus pursh	Lupinus polyphyllus	Prunella vulgaris	Sisyrinchium angustifolium	Total lbs.
M & B 2006 - swales & Natural Tree/Shrub	15	300	5	25	9	2	50	2	8	10	20	1	432
M & B 2007 - Impermeable Soil Cap	10	125	0	0	0	1	0	0	10		0	0	136
TOTALS:		425	5	25	9	3	50	2	18	10	20	1	568

In November 2007' Festuca romeri and a few selected wildflower species were sown on a portion of the impermeable soil cap in part as a test to compare these two Fescues side by side. Spring 2008' monitoring should indicate if the more expensive Festuca romeri is any better than the Festuca Rubra 'commutate'. Overall diversity and density of the grasses on this droughty component continues to improve. No additional seeding was needed on the other vegetative components this year, all other areas have very good grass and herbaceous plant establishment.

Soils are another area of concern; the organic mater is very low in much of the imported top soils present on this site. We added a bone-meal based product, Nutri-fiber, as a mulch on a large portion of the swale, to see if this helps build soil nutrition. Overall the establishment of vegetation is better in areas where the soil appears to be less compacted, and or has deeper fills, examples include east of the maintenance road and just south of the office. These areas have taller stands of grasses, and better growth rates for the woody plantings.

Mice or voles also are a concern but with the exception of some damage to the grand fir seedlings, there still has been only moderate damage to the other plantings. Effective rodent control measures are limited to monitoring and inter-planting if necessary. We have also continued to monitor for beaver damage, none has been detected. Wire beaver guard caging can be installed if it is determined necessary.

Management Approach for the Next Growing Season

Assess plant survival in fall 2009'

Determine if additional planting and seeding is necessary; set a threshold survival rate or decide by consensus.

Question to consider when determining future management approach

- Are future uses likely to include the plantings that have been installed.
- The level of funding available to sustain the landscape that has been developed.
- What level of landscape is DEQ required to create and maintain.
  (The existing landscape could be maintained at current standard or allowed to move towards a less developed or maintained state, similar to the better areas at the adjacent Willamette Cove.)

Vegetative Components

Upper Riparian 18.7 to 30.0 NGDV (3.6 acres)

General Observations

In the last vegetation assessment we noted the greater size and vigor woody plants planted adjacent to placed driftwood, at the top of the slope, compared to the other woody plants at McCormick & Baxter. It was also stated that the alder grew much faster than any of the other types of trees. Approximately 500 additional alder trees have been added to the lower riparian in response to the previous success of this tree species. Knapweeds, thistles and yellow mustard need to be managed; a combination of herbicide spot spraying and manual pulling has been effective to date. Clover, native and non-native grasses have continued to increase replacing the lupine and wildflower mix that dominated originally. The groundcover component continues to shift towards both native and non-native grasses and clover; most of these species are not invasive or overly-competitive and are doing a good job of preventing erosion and invasive species encroachment.

Performance Standards per IGA

- Plant 820 trees and 829 shrubs per acre
- 80% survival after one year, at the end of the initial growing season. Achieved as recorded in 2006 Monitoring Report.
- Invasive species less than 10% of all plants by year five; 2011.
- 80% herbaceous and shrub cover after five years; October 2011.
- 30% canopy closure after five years; October 2011.
- Minimum of 8 shrub species and 3 tree species present, no species to exceed 50% of the total stem count.

Monitored Status and Recommendations as of October 2008'

- Woody species; currently there are 960 plants per acre, 490 shrubs and 470 trees. We have met the original goals for this component, 8 species of shrubs and 3 species of trees.
- The site should be able to achieve 30% canopy closure by October 2011, the end of the specified 5 year period.
- Herbaceous; knapweeds, scotch broom and thistle are somewhat of a concern but they will continue to be closely monitored and controlled.
- Yellow mustard has been nearly eliminated from the site.
- Monitor and continue spot treat small infestations of noxious weeds before they spread.

Volunteer Planting Area (1-2 acres)

This area is monitored as part of the Upper Riparian Component, there is no significant difference between this area and the adjacent Riparian area. The upper riparian goals have been met as applied to this component. (A separate monitor form has been provided).

Lower Riparian 16.6 to 18.7 NGDV (2.1 acres)

General Observations

Drought and high winter/spring river levels limit the planting area for this component. When the water levels finally recede in early summer this component becomes droughty very quickly. The original irrigation system that was proposed and installed does not adequately supplement the moisture needed. The irrigation system on the northern end of this component was extended in winter 2008' to provide addition coverage. This is the same area that we also installed 500 additional alder trees. The quick growth typical of this species and the shade that they provide should help ensure that we meet our performance standards for this component.

The groundcovers have shifted from herbaceous species towards clover and both native and non-native grasses. Most of the non-natives are not invasive; the weed species of concern are the same as the Upper Riparian component - knapweeds, and thistles, with the addition of butterfly bush. The combination of herbicide spot spraying and manual pulling has again been effective on this portion of the site.

Performance Standards per IGA

- Plant 540 trees and 1,100 shrubs per acre.
- 80% survival after one year. (Note: achieved, and provided in 2006 monitoring report.)
- Invasive species less than 10% of all plants by year five; Fall 2011.
- 80% herbaceous and shrub cover after five years; Fall 2011.
- Minimum of 9 shrub species and 3 tree species, no species to exceed 50% of the total stem count.
- 30% canopy closure after five years; Fall 2011.

Monitored Status and Recommendations as of October 2008:

- Currently there are 950 plants per acre, 457 shrubs and 493 trees.
- Monitor and protect both planted and natural seedlings to encourage 30% canopy closure by the end of five years; fall 2011.
- Herbaceous cover was measured at 72% with an additional 20% of cover comprised of grass thatch, leaf litter and woody debris. Only 8% was classified as bare ground.
- Knapweeds, scotch broom, and thistle are a concern but have been successfully controlled. Continue to monitor and spot treat these relatively small infestations to prevent spread and reduce cover.

Natural Tree and Shrub Planting Area (1.1 acres)

General Observations
Survival of the madrone, oak, ponderosa pine and hawthorn are all excellent.
Birds-foot trefoil has diminished while Grindellia has increased.

Performance Standards per IGA

- Plant a total of 625 plants per acre.
- 70% survival after one year, October 25, 2006.
- Invasive species less than 10% of all plants by year five; Fall 2011.
- 90% herbaceous and shrub cover after five years; Fall 2011.

Monitored Status and Recommendations as of October 2007:

- Woody plant survival rate was greater than 100% of the original planted density.
- Final planting density was increased to over 2,000 plants per acre in anticipation of high mortality in this component, survival has been better than initially expected.
- Herbaceous cover is 83% with an additional 15% of cover from thatch, leaf litter and woody debris.
- Additional wildflowers have been sown in the Natural Shrub and Tree section of this project. (see list on page 1)
- Monitor and spot treat small infestations of noxious weeds before they can spread. Thistle and some tansy ragweed are the weeds of greatest concern.

Swale and Pond Planting (4.2 acres)

General Observations
In the previous report, herbaceous species, notably Spanish clover and birdsfoot trefoil were taller than many of the smaller planted shrubs, but the shrubs are establishing well and might even benefit from the shade and nitrogen fixation provided by theses species. This past growing season both have declined and other desirable species including Grindelia integrifolia or "Gumweed" have increased. The other clovers in the Swale and Pond Planting are also contributing to soil fertility with little or no adverse effect on the woody plant materials. Thistles are a concern but under control, Scotch broom and butterfly bush both problems noted last year have been reduced to a very low levels. Alder and cottonwood seedlings are naturally regenerating in this area.

Performance Standards per IGA

- Plant 1,640 shrubs per acre including willow live stakes. (Piper & Sitka willow constituted the bulk of the live stakes in addition to 250 red osier dogwood.)
- 80% survival after one year, fall 2006. Achieved as recorded in 2006 monitoring report.
- Invasive species less than 10% of all plants by 2011.
- 90% herbaceous and shrub cover after five years, 2011.
- A total of 5 shrub species (no tree species); no species to exceed 50% of the total stem count.

Monitored Status and Recommendations as of October 2007:

- Woody shrubs, five species of shrubs are present and doing well
- Live stake survival was not as successful as the bare-root component, but will be more than adequate to establish a good willow shrub cover.
- In the pond portion of this component the live stakes survived exceptionally well but the herbaceous cover is poor due to sandy soil.
- Herbaceous cover was measured at nearly 100%, very little bare ground is present. Additional wildflowers have been sown in this part of the project.
- Monitor and perform preventive noxious weed control

Impermeable Soil Cap (7 acres)

General Observations

This area has not been part of the BES formally monitored components for this project because no woody species were designated for this area, only grasses and wildflower or herbaceous species were planted. However, BES has been maintaining this area from the time that the rest of the site was planted. Additional sowing of grasses including the test of Festuca rubra 'commutata' verses Festuca romeri has been applied to this area as well.

Initially the hydro-seeded (by DEQ contractors, not BES) grass and wildflower species survived very well on this component. Invasive or noxious weeds were not a problem in the first growing season, fall 2005. At the end of the second growing season, fall 2006, BES staff observed a rapid decline in the vigor of the hydro-seeded species, especially the slender hairgrass. Soil pH, soil nutrition, and species selection could all be factors in this trend. The active drainage system may also hasten the drought period for this area, which is extremely dry by early to mid summer.

As the grasses have declined, invasive weed species have started to colonize this area including: sweet clover (*Melilotus alba*), various knapweeds, scotch broom, thistles and skeletonweed. BES has actively controlled these highly invasive species with a combination of herbicide applications and mechanical removal. This effort has been very successful to date.

BES reseeded this component in fall 2007 with *Festuca rubra* v. commutata (chewings fescue) and *Festuca roemerii* (Roemer's fescue) as replacement species for the original hydro-seeded species. BES will continue to monitor this area for species shift and invasive weed encroachment. The noxious weed population has declined over the early 2008 growing season. Additional grass and herbaceous species could be sown in this area if needed.

Irrigation System Status

Maintenance requirements for the irrigation system have increased significantly over this past season. The battery operated controllers are not as reliable as the electrical equivalent, and additional expenses have been incured to replace malfunctioning controllers in the spring and early summer of 2008. Recent irrigation system activities include:

- Drained and winterized the system in fall 2008'
- Annual inspection of entire system to identify, mark and map any freeze or other types of damage in spring 09'.
- Repair any freeze damage in spring of 2009'
- Replace and repair all malfunctioning or worn battery operated irrigation controllers.
- Consider using another type or brand of controller to operate valves.

McCormick & Baxter Site Acres: **43.00** Site #: **1667** Watershed: **WR**

Component: **Upper Riparian** CompontAc: **3.60** MonitorYr: **Yr3** Date: **10/24/2008**

Observations

Lower Riparian Performance Standard: 80% survival of planted species after on year, in a year of normal precipitation and 80% herbaceous cover after five years. 1640 plants per acre (planned). 1649 plants per acre planted. Currently 960 plants per acre (470 trees and 490 shrubs) survived. Herbaceous species and leaf litter cover is 92%, it is a good balance of native and non-invasive grasses. Leaf litter, thatch and bare ground represents 20% of the cover. 9 tree species well above planned goal and 8 shrub species. The planting schematic included three shrubs in a row and one tree. Rabbit damage was observed on several plants.

Recommendations

Combined diversity of shrubs and trees is very good. Large woody debris has improved the alder on this portion of the site, should be able to achieve canopy goals, water 1 more year to help achieve this result.

Woody Species Plants Per Acre

# of Plots 10

Species	CommonName	PlantType	Alive	Natural	Total	Mortality
Cornus sericea	Red-Osier Dogwood	SHRUB	50	0	50	40
Lonicera involucrata	Black Twinberry	SHRUB	30	0	30	0
Physocarpus capitatus	Pacific Ninebark	SHRUB	40	0	40	60
Ribes sanguineum	Red Currant	SHRUB	20	0	20	0
Rosa nutkana var.	Nootka Rose	SHRUB	30	0	30	0
Rosa pisocarpa	Swamp Rose	SHRUB	180	0	180	10
Sambucus cerulea	Blue Elderberry	SHRUB	30	0	30	0
mphoricarpos albus	Common Snowberry	SHRUB	110	0	110	40
		TOTALS	**490**	**0**	**490**	**150**

Species	CommonName	PlantType	Alive	Natural	Total	Mortality
Abies grandis	Grand Fir	TREE	70	0	70	100
Acer macrophyllum	Big-leaf Maple	TREE	70	0	70	50
Alnus rubra	Red Alder	TREE	50	0	50	40
Arbutus menziesii	Madrone	TREE	20	0	20	0
Crataegus suksdorfii	Black Hawthorn	TREE	60	0	60	10
Fraxinus latifolia	Oregon Ash	TREE	120	0	120	40
Malus fusca	Western Crabapple	TREE	10	0	10	10
Quercus garryana	Garry Oak	TREE	30	0	30	0
Thuja plicata	Western Red Cedar	TREE	40	0	40	0
		TOTALS	**470**	**0**	**470**	**250**
		GRAND TOTALS	**960**	**0**	**960**	**400**

Ground Cover Summary

of Plots = 10

Species	CommonName:	Origin	SpeciesCove	SpeciesCom	SpeciesFrequenc

McCormick & Baxter

Site Acres: **43.00** Site #: **1667** Watershed: **WR**

Component: **Upper Riparian** CompontAc: **3.60** MonitorYr: **Yr3** Date: **10/24/2008**

Agrostis stolonifera	Creeping Bent Grass	EXOTIC	13%	14%	100%
Festuca rubra var.	Red Fescue-grass	EXOTIC	6%	6%	80%
Cirsium arvense	Canada Thistle	EXOTIC	6%	6%	70%
Cirsium sp.	Thistle sp.	EXOTIC	5%	5%	50%
Brassicaceae spp.	Unidentiable Mustard	EXOTIC	0%	0%	10%
		EXOTIC TOTAL	**30%**	**32%**	

Species	CommonName:	Origin	SpeciesCove	SpeciesCom	SpeciesFrequenc
Holodiscus discolor	Ocean-spray	NATIVE	18%	19%	90%
Deschampsia elongata	Slender Hairgrass	NATIVE	11%	11%	80%
Equisetum arvense	Common Horsetail	NATIVE	6%	7%	50%
Epilobium ciliatum	Common Willow-weed	NATIVE	5%	5%	40%
Agrostis exarata	Spike Bentgrass	NATIVE	2%	2%	10%
Lupinus polyphyllus	Large-leaved Lupine	NATIVE	1%	1%	30%
Lupinus rivularis	Stream Lupine	NATIVE	1%	1%	20%
		NATIVE TOTAL	**42%**	**46%**	

Species	CommonName:	Origin	SpeciesCove	SpeciesCom	SpeciesFrequenc
Grass Thatch	Grass Thatch	OTHER	12%	13%	90%
Coarse Woody Debris	Coarse Woody Debris	OTHER	5%	5%	40%
Leaf Litter	Leaf Litter	OTHER	3%	4%	80%
		OTHER TOTAL	**20%**	**22%**	

Completed Treats

Treatment	Qnty	Units	Completion Date
Proj Mngt WRP	12	hr	1/15/2009
Proj Mngt WRP	24	hr	10/24/2008
Labor WRP	12	hr	10/14/2008
Proj Mngt WRP	25	hr	8/1/2008
Spray Hourly	24	Hr	7/28/2008
Spray WRP	25	hr	7/1/2008
Manual Labor	24	Hr	5/8/2008
Materials	1.5	tons	5/8/2008
Spray Hourly	43	Hr	5/5/2008
Manual Labor	36	Hr	4/16/2008
Bamboo Lg (Mtrl)	4	thous	4/16/2008
Bamboo Lg (Mtrl)	0.5	thous	2/14/2008
Bamboo Sm (Mtrl)	0.5	thous	2/14/2008
Tubes (Mtrl)	0.5	thous	2/14/2008
Native Plants (Mtrl)	0.5	thous	2/14/2008
Hourly Planting	21	Hr	2/14/2008

Scheduled Treats

Treatment	Qnty	Units	Scheduled Date
Note	1	ea	4/1/2008
Note	1	ea	6/1/2008
Spray WRP	20	hr	11/1/2008
Labor WRP	43	hr	4/1/2009
Spray WRP	40	hr	5/1/2009
Spray WRP	40	hr	6/1/2009
Spray Maint	43	Ac	6/1/2009
Cut Maint	10	Ac	6/15/2009

McCormick & Baxter Site Acres: **43.00** Site #: **1667** Watershed: **WR**

Component: **Volunteer** CompontAc: **0.00** MonitorYr: **Yr3** Date: **10/24/2008**

Observations

Volunteer Area: performance goal was 80% survival of planted species after on year. 1640 plants per acre planned but over 3000 plants per acre were planted. Currently, there are 2,229 plants per acre (400 trees and 1,829 shrubs) with over 100% survival rate of planned densities. Herbaceous species cover is 95%. Very little bare soil is present. The native component is 46%. About half of the non-native portion is sheep fescue, it was sown as a practical alternative to the native red fescue, most of the remainder is clover. The only species of concern was Canadian thistle at 1%.

Recommendations

Continue to monitor and treat Canada thistle and knapweed if present. Maintain staking and other plant protection methods as needed.

Woody Species Plants Per Acre

# of Plots 7

Species	CommonName	PlantType	Alive	Natural	Total	Mortality
Holodiscus discolor	Ocean-spray	SHRUB	71	0	71	0
Mahonia aquifolium	Oregon Grape	SHRUB	29	0	29	14
Ribes sanguineum	Red Currant	SHRUB	186	0	186	86
Rosa nutkana var.	Nootka Rose	SHRUB	429	0	429	114
Rosa pisocarpa	Swamp Rose	SHRUB	657	0	657	71
Symphoricarpos albus	Common Snowberry	SHRUB	457	0	457	57
		TOTALS	**1829**	**0**	**1829**	**343**

Species	CommonName	PlantType	Alive	Natural	Total	Mortality
Alnus rubra	Red Alder	TREE	0	0	0	14
Arbutus menziesii	Madrone	TREE	43	0	43	0
Crataegus suksdorfii	Black Hawthorn	TREE	214	0	214	43
Pinus ponderosa	Ponderosa Pine	TREE	14	0	14	0
Quercus garryana	Garry Oak	TREE	57	0	57	14
Rhamnus purshiana	Cascara	TREE	71	0	71	0
		TOTALS	**400**	**0**	**400**	**71**
		GRAND TOTALS	**2229**	**0**	**2229**	**414**

Ground Cover Summary

of Plots = 7

Species	CommonName:	Origin	SpeciesCove	SpeciesCom	SpeciesFrequenc
Festuca rubra var.	Red Fescue-grass	EXOTIC	26%	27%	100%
Trifolium spp.	Unidentifiable Clover	EXOTIC	18%	19%	100%
Agrostis stolonifera	Creeping Bent Grass	EXOTIC	4%	4%	71%
Cirsium arvense	Canada Thistle	EXOTIC	1%	1%	29%
		EXOTIC TOTAL	**49%**	**50%**	

McCormick & Baxter

Site Acres: **43.00** Site #: **1667** Watershed: **WR**

Component: **Volunteer** CompontAc: **0.00** MonitorYr: **Yr3** Date: **10/24/2008**

Species	CommonName:	Origin	SpeciesCove	SpeciesCom	SpeciesFrequenc
Bromus carinatus	California Brome-grass	NATIVE	11%	11%	86%
Agrostis exarata	Spike Bentgrass	NATIVE	11%	11%	71%
Solidago canadensis	Canada Goldenrod	NATIVE	7%	7%	71%
Holodiscus discolor	Ocean-spray	NATIVE	5%	6%	71%
Deschampsia elongata	Slender Hairgrass	NATIVE	5%	5%	57%
Prunella vulgaris	Heal-all	NATIVE	4%	4%	100%
Elymus glaucus	Blue Wildrye	NATIVE	2%	2%	14%
Grindelia integrifolia	Entire-leafed Gumweed	NATIVE	0%	0%	14%
Coreopsis tinctora var.	Columbia Tickseed	NATIVE	0%	0%	14%
		NATIVE TOTAL	**46%**	**48%**	

Completed Treats

Treatment	Qnty	Units	Completion Date
Proj Mngt WRP	12	hr	1/15/2009
Proj Mngt WRP	24	hr	10/24/2008
Labor WRP	12	hr	10/14/2008
Proj Mngt WRP	25	hr	8/1/2008
Spray Hourly	24	Hr	7/28/2008
Spray WRP	25	hr	7/1/2008
Manual Labor	24	Hr	5/8/2008
Materials	1.5	tons	5/8/2008
Spray Hourly	43	Hr	5/5/2008
Manual Labor	36	Hr	4/16/2008
Bamboo Lg (Mtrl)	4	thous	4/16/2008
Bamboo Lg (Mtrl)	0.5	thous	2/14/2008
Bamboo Sm (Mtrl)	0.5	thous	2/14/2008
Tubes (Mtrl)	0.5	thous	2/14/2008
Native Plants (Mtrl)	0.5	thous	2/14/2008
Hourly Planting	21	Hr	2/14/2008

Scheduled Treats

Treatment	Qnty	Units	Scheduled Date
Note	1	ea	4/1/2008
Note	1	ea	6/1/2008
Spray WRP	20	hr	11/1/2008
Labor WRP	43	hr	4/1/2009
Spray WRP	40	hr	5/1/2009
Spray WRP	40	hr	6/1/2009
Spray Maint	43	Ac	6/1/2009
Cut Maint	10	Ac	6/15/2009

McCormick & Baxter Site Acres: **43.00** Site #: **1667** Watershed: **WR**

Component: **Lower Riparian** CompontAc: **2.10** MonitorYr: **Yr3** Date: **10/24/2008**

Observations

Lower Riparian Performance Standard: 80% survival of planted species after on year, in a year of normal precipitation and 80% herbaceous cover after five years. 1640 plants per acre (planned). 1647 plants per acre planted. Currently 950 plants per acre (493 trees and 457 shrubs) survived. Herbaceous species cover is 93%, dominated by non-invasive grasses. Some native grasses & forbs present, (18%). Leaf litter, thatch and bare ground represents 15% of the cover. 7 tree species well above planned goal, 6 shrub species a little below the goal.

Recommendations

Future interplanting of shrubs could be considered but combined divirsity of shrubs and trees is very good. Alder were added and should help achieve canopy goals, water 1 more year to help achieve this result. Overseed with native grasses to balance predominence of non-native but tolerable existing grass cover.

Woody Species Plants Per Acre

# of Plots 14

Species	CommonName	PlantType	Alive	Natural	Total	Mortality
Lonicera involucrata	Black Twinberry	SHRUB	50	0	50	7
Physocarpus capitatus	Pacific Ninebark	SHRUB	50	0	50	14
Rosa nutkana var.	Nootka Rose	SHRUB	129	0	129	0
Rosa pisocarpa	Swamp Rose	SHRUB	43	0	43	0
Spiraea douglasii	Douglas's Spiraea	SHRUB	171	0	171	29
Symphoricarpos albus	Common Snowberry	SHRUB	14	0	14	7
		TOTALS	**457**	**0**	**457**	**57**

Species	CommonName	PlantType	Alive	Natural	Total	Mortality
Acer macrophyllum	Big-leaf Maple	TREE	36	0	36	14
Alnus rubra	Red Alder	TREE	29	0	29	57
Arbutus menziesii	Madrone	TREE	7	0	7	0
Crataegus suksdorfii	Black Hawthorn	TREE	179	0	179	14
Fraxinus latifolia	Oregon Ash	TREE	143	0	143	29
Populus balsamifera	Black Cottonwood	TREE	7	0	7	0
Rhamnus purshiana	Cascara	TREE	93	0	93	29
Unknown	Unknown	TREE	0	0	0	64
		TOTALS	**493**	**0**	**493**	**207**
		GRAND TOTALS	**950**	**0**	**950**	**264**

Ground Cover Summary

of Plots = 14

Species	CommonName:	Origin	SpeciesCove	SpeciesCom	SpeciesFrequenc
Agrostis stolonifera	Creeping Bent Grass	EXOTIC	17%	18%	57%
Cirsium arvense	Canada Thistle	EXOTIC	6%	7%	71%
Festuca rubra var.	Red Fescue-grass	EXOTIC	3%	3%	71%
Rumex crispus	Curly Dock	EXOTIC	3%	3%	7%

McCormick & Baxter

Site Acres: **43.00** Site #: **1667** Watershed: **WR**

Component: **Lower Riparian** CompontAc: **2.10** MonitorYr: **Yr3** Date: **10/24/2008**

Centaurea diffusa	Diffuse Knapweed	EXOTIC	1%	1%	14%
Brassicaceae spp.	Unidentiable Mustard	EXOTIC	0%	0%	7%
		EXOTIC TOTAL	**29%**	**32%**	

Species	CommonName:	Origin	SpeciesCove	SpeciesCom	SpeciesFrequenc
Deschampsia elongata	Slender Hairgrass	NATIVE	11%	12%	100%
Holodiscus discolor	Ocean-spray	NATIVE	8%	8%	71%
Epilobium ciliatum	Common Willow-weed	NATIVE	7%	7%	29%
Solidago canadensis	Canada Goldenrod	NATIVE	7%	7%	50%
Oenothera biennis	Evening Primrose	NATIVE	5%	5%	50%
Equisetum arvense	Common Horsetail	NATIVE	3%	4%	64%
Bromus carinatus	California Brome-grass	NATIVE	1%	1%	7%
Lupinus rivularis	Stream Lupine	NATIVE	1%	1%	21%
Lupinus polyphyllus	Large-leaved Lupine	NATIVE	0%	0%	14%
		NATIVE TOTAL	**43%**	**46%**	

Species	CommonName:	Origin	SpeciesCove	SpeciesCom	SpeciesFrequenc
Grass Thatch	Grass Thatch	OTHER	17%	18%	86%
Bare Ground	Bare Ground	OTHER	2%	2%	21%
Leaf Litter	Leaf Litter	OTHER	2%	2%	79%
		OTHER TOTAL	**21%**	**23%**	

Completed Treats

Treatment	Qnty	Units	Completion Date
Proj Mngt WRP	12	hr	1/15/2009
Proj Mngt WRP	24	hr	10/24/2008
Labor WRP	12	hr	10/14/2008
Proj Mngt WRP	25	hr	8/1/2008
Spray Hourly	24	Hr	7/28/2008
Spray WRP	25	hr	7/1/2008
Manual Labor	24	Hr	5/8/2008
Materials	1.5	tons	5/8/2008
Spray Hourly	43	Hr	5/5/2008
Manual Labor	36	Hr	4/16/2008
Bamboo Lg (Mtrl)	4	thous	4/16/2008
Bamboo Lg (Mtrl)	0.5	thous	2/14/2008
Bamboo Sm (Mtrl)	0.5	thous	2/14/2008
Tubes (Mtrl)	0.5	thous	2/14/2008
Native Plants (Mtrl)	0.5	thous	2/14/2008
Hourly Planting	21	Hr	2/14/2008

Scheduled Treats

Treatment	Qnty	Units	Scheduled Date
Note	1	ea	4/1/2008
Note	1	ea	6/1/2008
Spray WRP	20	hr	11/1/2008
Labor WRP	43	hr	4/1/2009
Spray WRP	40	hr	5/1/2009
Spray WRP	40	hr	6/1/2009
Spray Maint	43	Ac	6/1/2009
Cut Maint	10	Ac	6/15/2009

McCormick & Baxter Site Acres: **43.00** Site #: **1667** Watershed: **WR**

Component: **Natural Tree and** CompontAc: **1.10** MonitorYr: **Yr3** Date: **10/24/2008**

Observations

Natural Tree/Shrub Area Performance Standard: 70% survival of planted species after five years and 90% herbaceous cover after one year. 625 plants per acre (planned). Over 2,00 plants per acre originaly planted. Currently 1,643 plants per acre (300 trees and 1343 shrubs) have survived. 100% survival rate of planned densities achieved. Herbaceous species and leaf litter cover is 98%. Deschampsia grasses dominated the 1st year, have now migrated towards non-native but tolerable species including nitrogen fixing clovers and trefoil. The plants are in clusters of three shrubs and one tree.

Recommendations

Fertilized about half of this component, both shrub growth and fescue grass species increased. Area doing well, monitor for rodent damage, continue to control invasive species before they become established.

Woody Species Plants Per Acre

# of Plots 7

Species	CommonName	PlantType	Alive	Natural	Total	Mortality
Cornus sericea	Red-Osier Dogwood	SHRUB	14	0	14	29
Holodiscus discolor	Ocean-spray	SHRUB	43	0	43	0
Mahonia aquifolium	Oregon Grape	SHRUB	243	0	243	114
Ribes sanguineum	Red Currant	SHRUB	114	0	114	14
Rosa nutkana var.	Nootka Rose	SHRUB	643	0	643	0
Symphoricarpos albus	Common Snowberry	SHRUB	286	0	286	14
		TOTALS	**1343**	**0**	**1343**	**171**

Species	CommonName	PlantType	Alive	Natural	Total	Mortality
Amelanchier alnifolia	Western	TREE	14	0	14	0
Arbutus menziesii	Madrone	TREE	100	0	100	29
Crataegus suksdorfii	Black Hawthorn	TREE	14	0	14	0
Pinus ponderosa	Ponderosa Pine	TREE	71	0	71	0
Quercus garryana	Garry Oak	TREE	100	0	100	0
Unknown	Unknown	TREE	0	0	0	257
		TOTALS	**300**	**0**	**300**	**286**
		GRAND TOTALS	**1643**	**0**	**1643**	**457**

Ground Cover Summary

of Plots = 7

Species	CommonName:	Origin	SpeciesCove	SpeciesCom	SpeciesFrequenc
Agrostis stolonifera	Creeping Bent Grass	EXOTIC	28%	28%	71%
Festuca rubra var.	Red Fescue-grass	EXOTIC	25%	26%	100%
Trifolium spp.	Unidentifiable Clover	EXOTIC	12%	12%	71%
Lotus corniculatus	Bird's Foot Trefoil	EXOTIC	1%	1%	29%
		EXOTIC TOTAL	**65%**	**67%**	

McCormick & Baxter

Site Acres: **43.00** Site #: **1667** Watershed: **WR**

Component: **Natural Tree and** CompontAc: **1.10** MonitorYr: **Yr3** Date: **10/24/2008**

Species	CommonName:	Origin	SpeciesCove	SpeciesCom	SpeciesFrequenc
Holodiscus discolor	Ocean-spray	NATIVE	6%	6%	43%
Agrostis exarata	Spike Bentgrass	NATIVE	4%	4%	29%
Solidago canadensis	Canada Goldenrod	NATIVE	3%	3%	57%
Equisetum arvense	Common Horsetail	NATIVE	1%	1%	43%
Epilobium ciliatum	Common Willow-weed	NATIVE	1%	1%	43%
Deschampsia elongata	Slender Hairgrass	NATIVE	1%	1%	43%
Bromus carinatus	California Brome-grass	NATIVE	1%	1%	29%
		NATIVE TOTAL	**18%**	**18%**	

Species	CommonName:	Origin	SpeciesCove	SpeciesCom	SpeciesFrequenc
Grass Thatch	Grass Thatch	OTHER	11%	12%	100%
Leaf Litter	Leaf Litter	OTHER	3%	3%	100%
Bare Ground	Bare Ground	OTHER	1%	1%	43%
		OTHER TOTAL	**15%**	**15%**	

Completed Treats

Treatment	Qnty	Units	Completion Date
Proj Mngt WRP	12	hr	1/15/2009
Proj Mngt WRP	24	hr	10/24/2008
Labor WRP	12	hr	10/14/2008
Proj Mngt WRP	25	hr	8/1/2008
Spray Hourly	24	Hr	7/28/2008
Spray WRP	25	hr	7/1/2008
Manual Labor	24	Hr	5/8/2008
Materials	1.5	tons	5/8/2008
Spray Hourly	43	Hr	5/5/2008
Manual Labor	36	Hr	4/16/2008
Bamboo Lg (Mtrl)	4	thous	4/16/2008
Bamboo Lg (Mtrl)	0.5	thous	2/14/2008
Bamboo Sm (Mtrl)	0.5	thous	2/14/2008
Tubes (Mtrl)	0.5	thous	2/14/2008
Native Plants (Mtrl)	0.5	thous	2/14/2008
Hourly Planting	21	Hr	2/14/2008

Scheduled Treats

Treatment	Qnty	Units	Scheduled Date
Note	1	ea	4/1/2008
Note	1	ea	6/1/2008
Spray WRP	20	hr	11/1/2008
Labor WRP	43	hr	4/1/2009
Spray WRP	40	hr	5/1/2009
Spray WRP	40	hr	6/1/2009
Spray Maint	43	Ac	6/1/2009
Cut Maint	10	Ac	6/15/2009

McCormick & Baxter Site Acres: **43.00** Site #: **1667** Watershed: **WR**

Component: **Swale and Pond** CompontAc: **4.20** MonitorYr: **Yr3** Date: **10/24/2008**

Observations

Red alder and black cottonwood volunteer seedlings are establishing on portions of thiscomponent. Five species of shrubs plus and 90% herbaceous cover after 5yrs id the goal for the component. Currently there are 5 shrub species and 90% herbaceous cover. The plants are grouped in clusters of three cuttings or three shrubs. The spike bentgrass is performing well in wetter depressions.

Recommendations

The butterfly bush, thistle and scotch broom will need monitored and treated.

Woody Species Plants Per Acre

# of Plots 14

Species	CommonName	PlantType	Alive	Natural	Total	Mortality
Cornus sericea	Red-Osier Dogwood	SHRUB	79	0	79	79
Rosa gymnocarpa	Baldhip Rose	SHRUB	14	0	14	0
Rosa nutkana var.	Nootka Rose	SHRUB	186	0	186	0
Spiraea douglasii	Douglas's Spiraea	SHRUB	179	0	179	14
Symphoricarpos albus	Common Snowberry	SHRUB	43	0	43	21
		TOTALS	**500**	**0**	**500**	**114**

Species	CommonName	PlantType	Alive	Natural	Total	Mortality
Amelanchier alnifolia	Western	TREE	29	0	29	0
Pinus ponderosa	Ponderosa Pine	TREE	7	0	7	0
Populus balsamifera	Black Cottonwood	TREE	7	0	7	0
Quercus garryana	Garry Oak	TREE	0	0	0	7
Unknown	Unknown	TREE	0	0	0	21
		TOTALS	**43**	**0**	**43**	**29**
		GRAND TOTALS	**543**	**0**	**543**	**143**

Ground Cover Summary

of Plots = 14

Species	CommonName:	Origin	SpeciesCove	SpeciesCom	SpeciesFrequenc
Trifolium spp.	Unidentifiable Clover	EXOTIC	35%	32%	79%
Agrostis stolonifera	Creeping Bent Grass	EXOTIC	11%	10%	71%
Lotus corniculatus	Bird's Foot Trefoil	EXOTIC	5%	4%	57%
Festuca rubra var.	Red Fescue-grass	EXOTIC	4%	4%	57%
		EXOTIC TOTAL	**54%**	**50%**	

McCormick & Baxter

Site Acres: **43.00** Site #: **1667** Watershed: **WR**

Component: **Swale and Pond** CompontAc: **4.20** MonitorYr: **Yr3** Date: **10/24/2008**

Species	CommonName:	Origin	SpeciesCove	SpeciesCom	SpeciesFrequenc
Prunella vulgaris	Heal-all	NATIVE	13%	12%	64%
Grindelia integrifolia	Entire-leafed Gumweed	NATIVE	11%	10%	93%
Deschampsia elongata	Slender Hairgrass	NATIVE	10%	9%	93%
Agrostis exarata	Spike Bentgrass	NATIVE	7%	6%	64%
Lupinus rivularis	Stream Lupine	NATIVE	2%	2%	21%
Bromus carinatus	California Brome-grass	NATIVE	1%	1%	14%
Holodiscus discolor	Ocean-spray	NATIVE	1%	0%	21%
Lupinus polyphyllus	Large-leaved Lupine	NATIVE	0%	0%	14%
Coreopsis tinctora var.	Columbia Tickseed	NATIVE	0%	0%	7%
		NATIVE TOTAL	**46%**	**42%**	

Species	CommonName:	Origin	SpeciesCove	SpeciesCom	SpeciesFrequenc
Grass Thatch	Grass Thatch	OTHER	4%	4%	50%
Bare Ground	Bare Ground	OTHER	3%	3%	43%
Leaf Litter	Leaf Litter	OTHER	1%	1%	36%
		OTHER TOTAL	**8%**	**7%**	

Completed Treats

Treatment	Qnty	Units	Completion Date
Proj Mngt WRP	12	hr	1/15/2009
Proj Mngt WRP	24	hr	10/24/2008
Labor WRP	12	hr	10/14/2008
Proj Mngt WRP	25	hr	8/1/2008
Spray Hourly	24	Hr	7/28/2008
Spray WRP	25	hr	7/1/2008
Manual Labor	24	Hr	5/8/2008
Materials	1.5	tons	5/8/2008
Spray Hourly	43	Hr	5/5/2008
Manual Labor	36	Hr	4/16/2008
Bamboo Lg (Mtrl)	4	thous	4/16/2008
Bamboo Lg (Mtrl)	0.5	thous	2/14/2008
Bamboo Sm (Mtrl)	0.5	thous	2/14/2008
Tubes (Mtrl)	0.5	thous	2/14/2008
Native Plants (Mtrl)	0.5	thous	2/14/2008
Hourly Planting	21	Hr	2/14/2008

Scheduled Treats

Treatment	Qnty	Units	Scheduled Date
Note	1	ea	4/1/2008
Note	1	ea	6/1/2008
Spray WRP	20	hr	11/1/2008
Labor WRP	43	hr	4/1/2009
Spray WRP	40	hr	5/1/2009
Spray WRP	40	hr	6/1/2009
Spray Maint	43	Ac	6/1/2009
Cut Maint	10	Ac	6/15/2009

Appendix D

APPENDIX D
SURFACE, INTER-ARMORING, AND SUB-ARMORING WATER QUALITY ASSESSMENT

OPERATION AND MAINTENANCE REPORT
JANUARY 2008 THROUGH DECEMBER 2008

Hart Crowser/GSI
15670-03/Task 9 May 22, 2009

APPENDIX D
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ACRONYMS

AWQC	ambient water quality criteria
cfs	cubic feet per second
COCs	contaminants of concern
cPAHs	carcinogenic polynuclear aromatic hydrocarbons
DEQ	Oregon Department of Environmental Quality
DI	de-ionized water
DO	dissolved oxygen
E&E	Ecology & Environment, Inc.
EPA	United States Environmental Protection Agency
GSI	GSI Water Solutions, Inc.
HPAHs	high molecular weight polynuclear aromatic hydrocarbons
LPAHs	low molecular weight polynuclear aromatic hydrocarbons
McCormick & Baxter	McCormick & Baxter Creosoting Company
MCL	maximum contaminant level
MDL	method detection limit
MRL	method reporting limit
µg/L	micrograms per liter
mg/L	milligrams per liter
NPDWR	National Primary Drinking Water Regulations
NRWQC	National Recommended Water Quality Criteria
O&M	operation and maintenance
ORP	oxidation reduction potential
PAHs	polynuclear aromatic hydrocarbons
PCP	pentachlorophenol
QC	quality control
ROD	Record of Decision
Site	McCormick & Baxter Superfund Site
TestAmerica	TestAmerica Analytical Testing Corp.
TDS	total dissolved solids

ACRONYMS (CONTINUED)

TSS	total suspended solids
TFA	tank farm area
TPAHs	total polynuclear aromatic hydrocarbons
UCL	upper confidence limit

APPENDIX D
SURFACE, INTER-ARMORING, AND SUB-ARMORING WATER ASSESSMENT OPERATION AND MAINTENANCE REPORT JANUARY 2008 THROUGH DECEMBER 2008 MCCORMICK AND BAXTER SUPERFUND SITE

1.0 INTRODUCTION

Appendix D to the January 2008 through December 2008 Operation and Maintenance (O&M) Report summarizes the sampling activities and analytical results for the Spring and Fall 2008 surface, inter-armoring, and sub-armoring water sampling events at the McCormick and Baxter Superfund Site (Site) in Portland, Oregon. Analytical results for water sampling events conducted in 2002, 2003, 2005, 2006, and 2007 are also included in the form of plots and summary tables. The location of the Site, Site layout, and surface elevations are shown in Figures 1 through 3 in the main section of the O&M Report. The Fall 2005 to 2008 sampling events were conducted in general accordance with the *2005 Surface Water and Transition-Zone Water Sampling and Analysis Plan* (E&E, 2005), and *Revised O&M Manual* (Hart Crowser/GSI, 2008).

1.1 Sampling Program

The surface, inter-armoring, and sub-armoring water sampling objectives are described in the Draft O&M Plan (DEQ, 2007). Sampling activities for the Spring and Fall 2008 sampling events took place from: March 31, 2008, through April 4, 2008; and September 15 through 23, 2008, respectively. Surface water for Location 12 was recollected on September 29, 2008, due to sample bottle breakage by the laboratory TestAmerica Analytical Testing Corporation (TestAmerica) during analysis.

Water samples were analyzed for the site contaminants of concern (COCs). COCs include:

- Polynuclear aromatic hydrocarbons (PAHs);
- Pentachlorophenol (PCP); and
- Metals (arsenic, chromium, copper, and zinc).

Sampling activities are conducted in the Fall and Spring of each year (beginning in Fall 2005) to collect surface water and sub-armoring water (sand cap layer) samples for use in evaluating post-sediment cap construction water quality conditions under both low-river (Fall) and high-river (Spring) conditions. The

Spring river level was not significantly higher than in Fall; however, the discharge volume and stream velocity are both significantly higher.

During the first post-sediment cap sampling event in Fall 2005, sampling terminology included surface water and porewater and/or transition zone water. The latter term has been replaced by sub-armoring water, which denotes samples collected from within the placed cap sand overlying the original sediments. In 2006, the third sampling interval that was added was originally termed "flux chamber" after the design of the sampling equipment, which resembles a flux chamber sampling device. This interval has been renamed inter-armoring water, which denotes water samples collected from within the armoring overlying the sediment cap. The use of the term 'flux chamber' for denoting the sample was dropped because sample collection does not provide a measurement of flux (e.g., groundwater entering the river).

1.2 Report Organization

Following this introduction (Section 1), the appendix is organized as follows:

- **Section 2, Sampling Methodology.** This section presents specific sampling methodologies.
- **Section 3, Sampling Results.** This section presents the sampling analytical program, summary of sampling results, review of data quality, a statistical comparison of sampling results, and a summary of river hydraulics in Spring and Fall 2008.
- **Section 4, Summary.** This section presents a summary of the sediment cap monitoring activities to date and a discussion of planned sampling activities.
- **Section 5, References.**

Tables and figures are included in individual sections at the end of the text portion of the appendix. The following attachments supplement the text and are included as electronic files on the attached DVD:

- **Attachment A.** This attachment contains a photographic log of sampling activities during the Spring and Fall 2008 sampling events.
- **Attachment B.** This attachment contains a copy of the TestAmerica certified laboratory analytical data, including data validation of laboratory data for the Spring 2008 sampling event.
- **Attachment C.** This attachment contains a copy of the TestAmerica certified laboratory analytical data, including data validation of laboratory data for the Fall 2008 sampling event.

- **Attachment D.** This attachment contains a copy of the Global Diving Spring 2008 and NW Underwater Construction Fall 2008 sampling video.

2.0 SAMPLING METHODOLOGY

This section presents the sampling methodology employed during the Spring and Fall 2008 sampling events. Sampling was conducted in accordance with the Revised O&M Manual (Hart Crowser/GSI 2008). Sampling methodologies for surface, inter-armoring and sub-armoring water samples are described below.

2.1 Methodology

During the Spring and Fall 2008 sampling events, surface, inter-armoring, and sub-armoring water samples were collected from 22 co-located sampling locations. These sampling locations were within the boundary of the sediment cap. Two surface water samples were collected outside of the sediment cap limits, one upriver and one downriver. Generally, sampling locations from the Spring and Fall 2008 events mirrored those of the previous sampling events since 2005. Details regarding the sampling methodology for the 2005 through 2007 sampling events can be found in the *Surface, Inter-armoring, and Sub-Armoring Water Quality Assessment Report, March 2007* (E&E, 2007).

During the Spring and Fall 2008 sampling events, divers assisted in collecting samples only in deeper water, while near-shore samples were collected by the Hart Crowser/GSI sampling team. Global Diving and Salvage, Inc., a diving subcontractor to Hart Crowser, assisted in collecting water samples from deeper water locations in Spring 2008 and NW Underwater Construction, Inc., under subcontract to Hart Crowser, assisted in Fall 2008. Video of the diver-assisted samples was taken and is available on DVD in Appendix D.

2.1.1 Surface Water Sampling

During the Spring and Fall 2008 sampling events, surface water samples were collected at 24 locations. Prior to the Spring 2007 sampling event, surface water samples in deep water were collected from a boat using a stainless steel bomb sampler. Beginning with the Spring 2007 sampling event, methodology for surface water samples was changed to using a peristaltic pump. This addresses several concerns regarding volatilization of certain organic compounds, as well as to decrease the time needed to collect a sample. The tubing is secured approximately one foot above the bottom of a weighted rope, which is then slowly lowered to the bottom of the river. Once in place, the tubing is connected to a peristaltic pump used to purge the surface water and

collect the sample. A new length of polyethylene tubing is used at each sampling location thus eliminating the need for decontamination and minimizing the possibility for cross contamination. In shallower water the tubing to the peristaltic pump was manually held about a foot off the bottom to collect the surface water sample. In 2007, the shallow surface water samples were collected by dipping the sampling jars into the surface water and allowing them to fill at approximately 1 foot from the bottom.

The peristaltic pump collection method reduces turbulence and/or aeration of the samples by eliminating pouring, as encountered while transferring the contents of the bomb sampler into the sample bottle. This minimizes the opportunity for certain organic compounds to volatilize during collection. Sample bottles were completely filled, leaving no headspace to further hinder volatilization. This method also reduced the amount of time required to collect a sample by creating an uninterrupted supply of water to fill the required sample bottles. Following collection, samples are placed on ice and stored in a cooler for transport to the laboratory.

2.1.2 Inter-Armoring Sampling

During the Spring and Fall 2008 sampling events, inter-armoring sampling devices were deployed at 22 locations. The inter-armoring sampling device is placed directly on top of the armor and then pushed down into the armor layer to allow collection of water from the pore spaces between the armoring of the sediment cap. The main chamber is constructed from the bottom one-third of a 33-gallon plastic container. The chamber is attached to small diameter polyethylene tubing using a "quick connect" fitting, which connects to the peristaltic pump used to purge the sample chamber and extract the sample. As the sampling device is placed, a 2-inch diameter rubber stopper is pulled to allow air and surface water to pass through the chamber as it is pushed to the target depth. Once in place, the rubber stopper is reinserted prior to sampling. The purpose of the rubber stopper is to allow air and surface water to escape during placement of the sampling device. A peristaltic pump is used to purge the chamber for 1 minute at a low flow rate prior to collecting the sample. Field parameters are collected at the beginning and end of sample collection for each sample. Following collection, samples are placed on ice and stored in a cooler for transport to the laboratory.

2.1.3 Sub-Armoring Sampling

Sub-armoring water samples were co-located with surface-water sample locations and inter-armoring sampling locations within the sediment cap. The

sub-armoring samples were collected from approximately 6-inches beneath the armoring layer within the sand layer of the sediment cap.

Sub-armoring water sampling is conducted using tubing connected to a PushPoint® mini-piezometer probe developed and sold by MHE Products (commonly known as Henry Samplers). These probes are constructed of stainless steel, and are easily decontaminated, reusable, and have been used on similar sites throughout the country to obtain the same type of data. The probes are made of small-diameter, 316 stainless steel, and have a screened zone that consists of a series of interlaced machined slots which form a short-screened zone with approximately 20 percent open area. The probe used in this sampling had an overall length of 36 inches and a screen length of approximately 1 inch. These devices are pushed into the sediment to the desired depth using a twisting motion. Then an internal guard rod is removed from the probe body, and tubing is attached to the end of the probe. In general, the desired depth is approximately 6 inches into the sand cap beneath the overlying armoring (rock or articulated concrete block).

Tubing is attached to the probe and porewater purged using a battery-powered peristaltic pump. During purging, water quality parameters are monitored until they stabilize as described in the O&M Manual. Following collection, samples are placed on ice and stored in a cooler for transport to the laboratory.

2.1.4 Water Quality Parameters

Water quality parameters are recorded in conjunction with the collection of each water sample. A Horiba U22 or YSI 6600 V2-4 Sonde multiparameter meter with a flow through cell were utilized to monitor surface water, inter-armoring water and sub-armoring water conditions during the 2008 sampling events. One set of parameters was recorded prior to collection of a surface water sample; three sets of parameters were recorded during the collection of each inter-armoring and sub-armoring sample. The first (initial) set of parameters was recorded immediately after pumping was initiated, and the second set of parameters was recorded after conditions stabilized and before the sample was collected (approximately 1 minute after the initial set during inter-armoring water sampling). The third (final) set of parameters was recorded upon completion of the sample collection. The initial and final sets of parameters are presented in Table D-1 and D-2. Each set of parameters consisted of the following:

- Temperature;
- Dissolved oxygen (DO);
- Oxidation reduction potential (ORP);

- Specific conductance (Conductivity);
- pH; and
- Turbidity (Spring only).

2.2 Quality Control Sampling

During the Spring and Fall 2008 events, Quality Control (QC) samples were collected including Matrix Spike and Matrix Spike Duplicate (MS/MSD) samples for every group of 20 primary samples or fewer submitted to the laboratory for analysis. Blind duplicate samples were also collected at a rate of one duplicate for every group of 20 primary samples.

One equipment rinsate blank was collected for each type of sampling equipment used. The samples were collected at the end of each sampling event. Laboratory-supplied de-ionized (DI) water was used as the water source of the samples. Rinsate samples were collected from the inter-armoring sampling device by pouring DI water into an inverted decontaminated inter-armoring sampling device. Sample bottles were filled by holding the uncapped bottles under the stream of water being discharged through the quick connect valve. The equipment rinsate blank for the Henry Sampler was collected by placing the screened end of the sampling device in a container of DI water and pumping into the sample jars using the peristaltic pump. These samples were collected in a manner consistent with other samples, in that no headspace was left in the sampling containers and upon collection, sample containers were labeled, sealed in plastic bubble wrap bags, and placed on ice in a cooler for transport to the contract laboratory by the laboratory courier.

2.3 Modifications to Methodology

Deviations from the Revised O&M Manual for the Spring and Fall 2008 events are described below.

During the Spring 2008 event, the following deviations occurred:

- The sampling device tubing for Location 16 inter-armoring sample separated from the sampling device. The tubing was re-attached by the diver and a second round of purging and measurement of field parameters was completed prior to sampling.
- Total suspended solids (TSS) and total dissolved solids (TDS) were added to the laboratory requests for Fall 2008 event. TSS and TDS are not required by the O&M Plan; however, they are valuable in understanding whether concentrations of metals and PAHs are primarily associated with particulate

matter or dissolved in water. They have been periodically measured in previous events.

During the Fall 2008 event, the following deviations from the O&M Plan occurred:

- The sampling device for Location 14 inter-armoring sample shifted during sampling; visible turbidity was noted in the tubing while the sample was being collected.
- The Location 6 inter-armoring sampling device silted up during purging. The sampling device was reset and a second round of purging and measurement of field parameters were collected prior to sampling.
- Sample Locations 25 and 26 were located roughly 50 feet to the southwest from the O&M planned locations, because the planned locations were not under water. A similar relocation occurred at Location 19, which was moved 20 feet southwest.
- At Locations 25 and 26, the rock armoring was too thick to completely penetrate; therefore, the sub-armoring samples were collected from the greatest depth that could be achieved with the equipment, which was still in the rock armoring layer rather than the underlying sand layer.
- Due to bottle breakage at TestAmerica, the Fall 2008 surface water sample for Location 12 was recollected on September 29, 2008.

3.0 SAMPLING RESULTS

This section describes the analytical results for samples collected during the Spring and Fall 2008 sampling events. Analytical results for COCs identified in the Record of Decision (ROD) (EPA, 1996) for the site were compared to the 1996 ROD Ambient Water Quality Criteria (AWQCs), the most recent EPA National Recommended Water Quality Criteria (NRWQCs) (EPA, 2007a) and the most recent EPA National Primary Drinking Water Regulations (NPDWRs) (EPA, 2007b). 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) - 0.074 mg/L
- Copper - 0.009 mg/L
- Zinc - 0.110 mg/L
- PCP - 1 microgram per liter (µg/L)

- Acenaphthene - 520 µg/L
- Anthracene - 40,000 µg/L
- Fluoranthene - 54 µg/L
- Fluorene - 5,300 µg/L
- Naphthalene - 620 µg/L
- Pyrene - 4,000 µg/L
- Total cPAHs - 0.031 µg/L
- Benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenzo(a,h)anthracene, and ideno(1,2,3-cd) pyrene - 0.018 µg/L each.

The comparison criteria allow for site-specific adjustments to their standard table values. PCP can be adjusted for site-specific pH; chromium, copper, and zinc can be adjusted for hardness. Tables D-1 through D-5 reflect adjustments to PCP to reflect site pH, but the metals criteria have not been revised to reflect site-specific hardness. The hardness of the Willamette River 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 based on a hardness of 100 mg/L is used. It is recommended that Site-specific hardness analysis of the surface water, inter-armoring, and sub-armoring zones be conducted in the upcoming sampling events. This will allow hardness conversions for comparison criteria to be conducted for each zone in the future. For surface water, if the NRWQC for chronic aquatic water were adjusted for hardness, the values would be 0.0238 mg/L for chromium III, 0.0027 mg/L for copper and 0.0365 mg/L for zinc. The comparison criteria are based on carcinogenic risk level of 10^{-6}. The criteria listed above for zinc, acenaphthene, fluoranthene, naphthalene, and total cPAHs are based on AWQCs in place in 1996. The criteria listed above for PCP represents the NPDWR maximum contaminant level (MCL). The criteria listed above for zinc is based on the AWQC in place in 1996. In 1996, AWQCs for metals were based on total metal concentrations. The criteria listed above for arsenic, chromium, and copper are based on the NRWQCs in place in 2007, which were developed for dissolved metals.

The results presented in Tables D-1 through D-5, which represent total metals concentrations, are compared with NRWQCs for dissolved metals, as agreed upon with EPA. Dissolved metal concentration is a more accurate and appropriate analysis when comparing to NRWQCs, and therefore, are also

analyzed and reported. Appropriate adjustments to the comparison criteria will be made when compliance criteria and methodology are determined.

3.1 Sample Analysis

Upon collection, sample containers were labeled, sealed in plastic bubble wrap bags, and placed on ice in a cooler for transport to the contract laboratory by the laboratory courier. Analytical services were provided by TestAmerica in Beaverton, Oregon. Chain-of-custody procedures were followed from sample collection to analysis. Samples were analyzed for:

- PAHs and PCP using EPA Method 8270-SIM (using ultra low-level detection limits);
- Total arsenic, copper, chromium, and zinc using EPA Method 6020;
- Dissolved arsenic, copper, chromium, and zinc using EPA Method 6020-diss (field filtered using a 0.45-micron filter);
- TDS using SM 2540C (Fall only); and
- TSS using SM 2540D (Fall only).

3.2 Analytical Results

Analytical summary tables for PAHs, PCP, total and dissolved metals for surface water, inter-armoring, and sub-armoring water samples from the Spring and Fall 2008 sampling events are summarized in Tables D-1 and D-2. TSS and TDS concentrations are provided for the Fall 2008 data in Table D-2. Copies of the laboratory analytical reports and data review summary reports for Spring and Fall 2008 events are included as Attachments B and C, respectively, on the attached O&M Report DVD. Where concentrations are reported as not detected, it means that the constituent was not detected above the method detection limit (MDL).

Water samples were collected from 24 surface water locations and 22 subsurface locations in both the Spring and Fall 2008 events. Fall analytical results have two dates for the surface water sample collected from Location 12 because the sample collected for PAH analysis broke at the TestAmerica lab, and had to be collected again.

Total cPAH results for each sampling event are shown on Figures D-3 through D-8; naphthalene results for each sampling event are shown on Figures D-9 through D-14; and copper results for each event are shown on Figures D-15 through D-20. Figures 21 through 29 present the temporal concentration trends

for mean concentrations of total arsenic and copper; total PAHs; total cPAHs; and for select analytes at select individual locations.

3.2.1 Rinsate Blank Results

Four rinsate blanks were collected during each of the Fall and Spring 2008 events; two from the Henry samplers used to collect sub-armoring samples and two from inter-armoring sampling devices. The results are presented in Tables D-1 and D-2 (Spring and Fall results, respectively). The rinsate blanks were analyzed for PAHs and total metals. Dissolved metals were analyzed for the rinsate blanks from the Henry Sampler, but not for the rinsate blanks from the inter-armoring sampling device.

In the Spring sampling event, two rinsate blanks were collected from Henry Samplers after sampling Location 2, and after sampling Location 5. Values for dissolved zinc (estimated because the value was between the method detection limit and reporting limit) and naphthalene at Location 2 were 0.00073 mg/L and 0.0765 µg/L, respectively. Values for dissolved zinc (estimated because they were between the reporting limit and the method detection limit) and naphthalene at Location 5 were 0.000577 and 0.0407 µg/L respectively.

Two rinsate blanks were also collected in the Spring from the inter-armoring sampling devices after sampling Location 4, and after sampling Location 13. The inter-armoring device rinsate blanks were analyzed for PAHs and total metals. They were not analyzed for dissolved metals because it was assumed that any residual contamination after decontamination would be in particulate form. Naphthalene was the only analyte detected, from both locations, at 0.0342 µg/L and 0.038 µg/L, from Location 4 and Location 13, respectively.

In the Fall sampling event, two rinsate blanks were collected from Henry Samplers after sampling at Location 9, and after sampling Location 13. Total chromium was the only metal detected at 0.00092 mg/L (after sampling Location 9). Naphthalene was detected in the rinsate blanks from both locations, at 0.0616 µg/L and 0.0486 µg/L and phenanthrene was detected at 0.0131µg/L and 0.0136 µg/L, Location 9 and Location 13, respectively. Two rinsate blanks were also collected from the inter-armoring sampling devices after sampling at Location 5, and after sampling Location 20. No metals were detected in the rinsate blank collected after sampling Location 20, while arsenic and copper were estimated at 0.000209 mg/L and 0.00166 mg/L, respectively, in the rinsate blank collected after sampling Location 5. Naphthalene was detected at 0.0895 µg/L and
0.0344 µg/L in the rinsate blanks collected after sampling Locations 5 and 20, respectively. Phenanthrene was also detected at 0.0136 mg/L in the rinsate blank collected after sampling Location 5 and detected at 0.025 mg/L in the rinsate blank collected after sampling Location 20.

The Spring and Fall 2008 sampling event results were compared to the rinsate blank results. Samples with detections of a specific contaminant that are less than five times the detection in the rinsate blank were qualified as non-detect (U). None of the samples collected during the Spring event needed to be qualified because of rinsate blank detections. For the Fall event, chromium detections in samples MBSA0908-13 and MBSA0908-13D (Location 13) were qualified as U due to the chromium values in the rinsate blank.

3.2.2 Surface Water Sampling Results

During the Spring 2008 event, 26 surface water samples were collected from 24 locations including two duplicates (MBSW0408-08D from Location 8, MBSW0408-12D from Location 12) and two background samples from Location 1 and Location 27 (upstream and downstream, respectively). Of these samples, four had detectable concentrations of PAHs, PCP was not detected in any of the samples, and all had detectable concentrations of at least one total and dissolved metal.

During the Fall 2008 event, 26 surface water samples were collected from 24 locations including two duplicates (MBSW0908-05D from Location 5 and MBSW0908-13D from Location 13). Of these samples, three samples had detectable PAHs, none of the samples had detections of PCP, and all had detectable concentrations of dissolved and total metals. The upstream and downstream control samples had low level detections of total and dissolved metals but no detectable PAHs or PCP. Analytical results for surface water samples are summarized in Tables D-1 and D-2 and are discussed below.

PAH Results. Total cPAH results for surface water samples are shown on Figure D-3 (Spring) and D-4 (Fall). Figures D-9 and D-10 show the sampling locations where naphthalene was detected in Spring and Fall surface water samples, respectively.

In the Spring 2008 event, no detectable cPAH concentrations were reported. Four samples had measurable concentrations of low molecular weight PAHs (LPAHs). MBSW0408-02 (Location 2) had detections of acenaphthene (0.0661 µg/L), fluorene (0.0237J µg/L), and napthalene (0.0343 µg/L). Willamette Cove sample MBSW0408-13 had detections of acenaphthylene (0.0561 µg/L), fluorene (0.0192J µg/L), and naphthalene (0.044 µg/L). Two samples collected within the former tank farm area (TFA) had detections: 0.0166J µg/L napthalene at MBSW0408-17, and slightly higher detections at MBSW0408-25 included acenaphthene (0.0397 µg/L), fluorene (0.0144J µg/L), and napthalene (0.0934 µg/L). These PAH detections were below sediment cap performance standards, and also below the comparison criteria.

In the Fall 2008 event, no detectable cPAH concentrations were reported (Figure D-4). The highest total PAH (TPAH) results occurred in MBSW0908-26 at 3.98 µg/L. LPAHs detected at Location 26 include acenaphthene (0.704 µg/L), fluorene (0.262 µg/L), naphthalene (2.93 µg/L), and phenanthrene (0.0566 µg/L). One high molecular weight PAH (HPAH), fluoranthene, was detected at 0.0239 µg/L. PAHs were also detected at low concentrations in surface water from Locations 12 and 25. These low level PAH detections occur in relatively shallow water at nearshore sampling locations in Willamette Cove (MBSW0908-12, MBSW0408-13) and in the TFA (MBSW0408-17, MBSW0408-25, MBSW0908-25, MBSW0908-26) and near the southeast edge of the site (MBSW0408-02). Relatively low surface water LPAH detections in these areas likely reflect lateral discharge of groundwater from upland areas. In addition, the interarmoring samples at these locations typically showed lower concentrations than the surface water concentrations, suggesting the contaminants are not migrating upward through the sediment cap.

PCP Results. PCP was not detected above the MDLs in any of the surface water samples collected during the Spring 2008 or Fall 2008 sampling events. The MDL for PCP ranged from 0.236 to 0.243 µg/L.

Total Metals. Total metals analysis was conducted for arsenic, chromium, copper, and zinc. In Spring 2008, chromium and copper were the most commonly detected metals and were reported in 17 surface water samples. In Fall 2008, copper was the most commonly detected metal and was found in 22 of 25 surface water samples.

Arsenic was not detected in the Spring 2008 surface water samples; the MDL of 0.000664 mg/L exceeds the comparison criteria of 0.00014 mg/L. In Fall 2008, arsenic was detected at 19 locations at concentrations ranging from 0.000199 mg/L (multiple locations) to 0.00132 mg/L (Location 26). The laboratory was able to achieve a lower MDL in the Fall (0.00018 mg/L) than in the Spring (0.000664 mg/L). This was the reason for the additional number of detections in the Fall. All reported arsenic concentrations in 2008 were flagged by the laboratory indicating the reported values are estimated values between the MDL and MRL. The reported concentrations exceeded the comparison criteria of 0.00014 mg/L. Arsenic was also detected in Fall 2008 at the upstream ambient surface water sample Location (Location 1, 0.00066 mg/L) but not at the downstream Location 27.

In Spring 2008, total chromium was detected in 17 locations at concentrations ranging up to 0.00097 mg/L at Location 18 located in the TFA. In Fall 2008, eight sample locations had reported detections of total chromium ranging from up to 0.00257 mg/L from Location 13, located in Willamette Cove. Reported

chromium concentrations in 2008 surface water samples were well below the corresponding comparison criteria of 0.074 mg/L.

Total copper concentrations ranged up to 0.00283 mg/L Spring 2008 (Location 25) and 0.00282 mg/L in Fall 2008 (Location 18). In Spring 2008, total copper was detected in 17 of 22 surface water samples; all locations had copper detections in the Fall 2008 sampling event. Reported copper concentrations in 2008 did not exceed the corresponding comparison criteria of 0.009 mg/L. Total copper results for surface water are shown in Figures D-15 (Spring) and D-16 (Fall). Copper was also detected in the background surface water samples collected from Location 1 in Spring 2008 and Locations 1 and 27 in Fall 2008. The highest detection was 0.00173 mg/L at Location 1, collected in Spring 2008.

Total zinc concentrations ranged up to 0.0125 mg/L and 0.0111 mg/L in Spring 2008 and Fall 2008, respectively. Reported zinc concentrations in 2008 did not exceed the corresponding sediment cap performance goal of 0.11 mg/L.

Dissolved Metals. In Spring 2008 there were no detections of dissolved arsenic in surface water samples. Dissolved copper was detected in 64 percent of samples, with the highest reported concentration of 0.00455 mg/L identified at Location 13. Dissolved chromium and zinc were detected in 45 and 36 percent of samples, respectively. In Fall 2008, dissolved zinc was detected in all surface water samples collected. Arsenic and copper were detected in 86 and 82 percent of samples, respectively, and chromium was below MDLs.

3.2.3 Inter-Armoring Water Sampling Results

During the Spring 2008 sampling event, 24 inter-armoring water samples were collected from 22 locations, including two duplicate samples (MBIA0408-12D and MBIA0408-13D from Locations 12 and 13, respectively). Four of the 24 samples had detectable amounts of PAHs (none carcinogenic), none of the samples had detectable levels of PCP, and all the samples had detectable concentrations of total metals and dissolved metals except arsenic.

During the Fall 2008 sampling event, 23 inter-armoring water samples were collected from 22 locations including one duplicate sample (MBIA0908-13D from Location 13). Of the 22 locations, all had detectable quantities of dissolved and total metals, four had detections of total PAHs (no carcinogenic PAHs were detected), and PCP was not detected at the MDL. Analytical results for inter-armoring samples are summarized in Tables D-1 and D-2, and are discussed below.

PAH Results. Total cPAH results for inter-armoring water samples are shown on Figures D-5 (Spring) and D-6 (Fall). Figures D-11 and D-12 illustrate naphthalene results for inter-armoring water samples for Spring and Fall 2008 sampling events, respectively. No cPAHs were detected in inter-armor samples collected during both Spring or Fall 2008 sampling events.

In Spring 2008, seven inter-armoring water samples had detections of LPAHs only. Naphthalene was the most commonly detected PAH constituent, occurring in six of the seven samples. Where detected, naphthalene was well below the sediment cap performance standard of 620 µg/L. A maximum PAH concentration of 0.126 µg/L was detected at Location 2 near the southeast site boundary and closest to the adjacent stormwater drainage. The next highest PAH concentration was reported from the sample collected at Location 12 (Willamette Cove) at 0.0889 µg/L. MDLs ranged from 0.0118 µg/L to 0.246 µg/L.

Four samples collected in the Fall 2008 event had detections of TPAHs. The highest TPAH concentration (0.757 µg/L) was detected at Location 26.

PCP Results. During the Spring 2008 and Fall 2008 sampling events, PCP was not detected above the MDL in the inter-armoring samples. The MDL ranged from 0.236 to 0.243 µg/L.

Total Metals. Inter-armoring samples were analyzed for total arsenic, chromium, copper, and zinc. In Spring 2008, chromium and copper were the most commonly detected metals, reported in 20 and 18 inter-armoring samples, respectively. In Fall 2008, both copper and zinc were detected in all 22 samples, and arsenic was detected in 21 samples. Total copper results at Location 14 (0.0236 mg/L) exceeded the co-located sub-armor sample (0.00334 mg/L); according to field notes, the inter-armor sampling device shifted while collecting the sample and turbidity was noted in the tubing. This is reflected in the elevated TSS (580 mg/L) which resulted in an elevated total metals relative to dissolved metals concentrations for the same sample.

Arsenic was detected in one Spring 2008 inter-armor sample collected from Location 14 at 0.00078 mg/L; MDLs ranged from 0.00064 to 0.000664 mg/L and exceeded the comparison criteria of 0.00014 mg/L. In the Fall 2008 event, arsenic was detected in 21 of 22 samples at concentrations with the highest concentration of 0.00257 mg/L at Location 14 (turbid sample, see above); the next highest detection was at Location 18 (0.00215 mg/L), near the TFA. All reported arsenic concentrations exceeded the comparison criteria of 0.000014 mg/L.

Chromium was detected in approximately 91 percent of the samples collected during the Spring 2008 sampling event at concentrations ranging up to a maximum concentration of 0.00229 mg/L at Location 14. In the Fall 2008 sampling event, chromium was detected in 59 percent of the samples collected, and ranged up to 0.0109 mg/L at Location 14 (turbid sample; see above). Reported chromium concentrations did not exceed the corresponding comparison criteria of 0.074 mg/L.

Copper was detected in 18 of the 22 sampling locations during the Spring 2008 event at concentrations ranging up to 0.00528 mg/L at Location 7. Total copper results for inter-armoring water samples are shown on Figures D-17 and D-18. None of the Spring 2008 inter-armoring detections exceeded the comparison criteria. During the Fall 2008 sampling event, copper was detected in all samples collected, and ranged in concentration from 0.00138 mg/L (Location 26) to 0.0236 mg/L at Location 14. Sample results from Locations 5 and 14 exceeded the comparison criteria of 0.009 mg/L during the Fall 2008 event.

Zinc was detected in approximately 27 percent of the samples collected during the Spring 2008 sampling event at concentrations ranging up to a maximum concentration of 0.172 mg/L at Location 9 near the TFA. During the Fall 2008 sampling event, zinc was detected in 17 samples and ranged in concentration up to 0.0580 mg/L at Location 14. Reported zinc concentrations did not exceed the corresponding comparison criteria of 0.11 mg/L.

Dissolved Metals. During the Spring 2008 sampling event, copper and chromium were the most commonly detected dissolved metals, occurring in 13 and 10 (respectively) of the 22 inter-armoring water samples collected. Copper was detected in 8 samples, and arsenic was not detected. During the Fall 2008 sampling event, arsenic and zinc were detected most frequently, occurring in 18 and 16 of the inter-armoring water samples, respectively. Copper was detected in 15 samples, and chromium was not detected.

3.2.4 Sub-Armoring Water Sampling Results

In the Spring 2008 sampling event, 23 sub-armoring water samples were collected from 22 Locations including one duplicate sample (MBSA0408-05D at Location 5). Of these samples, two had detectable concentrations of cPAHs and none had concentrations of PCP above the MDL, and all had detectable concentrations of at least one total and one dissolved metal.

In the Fall 2008 sampling event, 23 samples were collected from 22 Locations including one duplicate sample (MBSA0908-13D at Location 13). Of the 22 samples, each of the four total metals was detected at 14 locations, cPAHs were

detected at four locations, PCP was not detected, and dissolved chromium was not detected. Analytical results for sub-armoring water samples are summarized in Tables D-1 and D-2 and are discussed below.

PAH Results. Total cPAH results for sub-armoring samples are shown on Figures D-7 and D-8. Figures D-13 and D-14 show naphthalene concentrations in sub-armoring water samples results from the Spring and Fall sampling events, respectively.

In the Spring 2008 sampling event, detectable cPAH concentrations were reported in two of the 22 sub-armoring water samples collected (Location 9 at 0.1288 mg/L, and Location16 at 0.462 mg/L). Total cPAHs from these two locations exceed the comparison criteria of 0.031 µg/L.

In the Fall 2008 sampling event, detectable cPAH concentrations were reported in four of the 22 sub-armoring water samples collected (Locations 6, 7, 8, and 9). All four detected locations exceed the comparison criteria of 0.031 µg/L. The most frequently-reported cPAH constituents were benzo(a)anthracene and chrysene, present in all four samples. Location 9 had the highest TPAH result for the Fall 2008 event, with a concentration of 161 µg/L. Naphthalene accounted for 83.5 µg/L of the total. The TSS in three of the four samples (Locations 6, 8, and 9) was elevated, suggesting a higher amount of particulate matter to which HPAHs can adsorb.

PCP Results. PCP was not detected above the MDL in any of the sub-armoring samples collected in 2008. The MDL ranged from 0.236 to 0.240 µg/L.

Total Metals. Sub-armoring samples were analyzed for total arsenic, chromium, copper, and zinc. Arsenic was the most commonly detected metal in sub-armoring samples and was reported in 95 percent of the samples collected during the Spring 2008 sampling event and in all of the samples collected during the Fall 2008 sampling event. The next most common detection in the Spring event was zinc, reported in 64 percent of the sub-armor samples. In Fall 2008, copper was the second-most commonly reported metal, detected in 86 percent of all samples.

In Spring 2008, arsenic is the only metal detected in any sample that exceeded the comparison criteria of 0.00041 mg/L. The maximum arsenic detection occurred near the former TFA (Location 9, 0.0296 mg/L). The mean arsenic concentration was 0.00896 mg/L. In the Fall 2008 samples, arsenic exceeds the comparison criteria of 0.00014 mg/L in all samples with the highest concentration (0.0806 mg/L) at Location 5. The mean concentration of arsenic was 0.00913 mg/L.

Chromium was detected in 55 percent of the samples in the Spring and 6 4 percent in the Fall, the maximum concentration was 0.00122 mg/L for Spring and 0.00577 mg/Lfor the Fall. No comparison criteria were exceeded.

Copper was detected in 45 percent of the samples in the Spring and in 86 percent of the samples in the Fall. The maximum copper concentration in the Spring was 0.00421 mg/L and 0.0135 mg/L in the Fall. Copper exceeded the comparison criteria of 0.009 mg/L at one location (Location 4, 0.0135 mg/L) in the Fall. Copper did not exceed comparison criteria in any samples in the Spring.

Zinc was detected in 64% of the samples in the Spring and in the Fall. The maximum concentration in the Spring was 0.0219 mg/L and in the Fall was 0.0328 mg/L. No samples exceeded comparison criteria for zinc in either the Spring or the Fall.

Dissolved Metals. Dissolved arsenic was reported in 95 percent of the Spring 2008 sub-armor samples and all Fall 2008 samples. Chromium, copper, and zinc were all present in roughly half the Spring 2008 sub-armoring samples. Copper and zinc were detected in approximately one third to one half of the samples; dissolved chromium was not detected in Fall 2008 sampling event.

Dissolved metals detected in the sub-armoring water samples are naturally occurring in the surrounding soil and sediment. Elevated TSS has historically been compared with elevated total metals detections as the metals adsorb readily to particulate matter. In the Fall 2008 analysis, TSS was highest site-wide at Location 4 (2,100 mg/L), which also had the maximum total metals concentrations for chromium, copper, and zinc (0.00577mg/L, 0.0135 mg/L, and 0.0328 mg/L, respectively).

3.3 Water Quality Parameters

Water quality parameters (temperature, specific conductance, DO, ORP, pH and turbidity [as available]), recorded during the collection, were reviewed to identify any correlations between sample types and locations. Generally, water temperatures in the Fall 2008 event were approximately 10°C warmer than those collected in the Spring 2008 event. Water temperature did not vary greatly between sample types (surface, inter-armoring, and sub-armoring water). In both Spring and Fall 2008 events, values for specific conductance were similar between surface water and inter-armoring water samples; however, sub-armoring samples tended to be an order of magnitude higher at the same location as would be expected of groundwater/porewater. DO exhibited a five- to ten-fold increase from between sub-armoring water to surface/inter-armoring water. Typical DO values for sub-armoring water range from 0.5 mg/L to 2.0

mg/L. Similar to DO and specific conductance, pH also exhibits similar values when comparing co-located surface water and inter-armoring water against sub-armoring water. The sub-armoring water typically has a pH which is 1 to 2 pH units lower than the corresponding surface water/inter-armoring water. In general, water quality parameters collected from co-located surface water and inter-armoring water are often similar, while sub-armoring water is different.

3.4 Data Review

All data presented in this report has been reviewed by a Hart Crowser chemist to determine data quality and usability. In this review, the following criteria were evaluated:

- Sample receipt temperatures;
- Holding times;
- Method blank samples;
- Matrix spike samples;
- Laboratory control samples;
- Duplicate samples;
- Surrogate spike recoveries; and
- Rinsate blank samples.

Conclusions and recommendations pertaining to the overall usefulness of the laboratory data are summarized in the Quality Assurance Report located in Attachments B and C with the analytical data for the sampling event. Data reviewed for this report were assessed to be valid for their intended use with minor qualifications.

3.5 Statistical Analysis

Data collected during the Spring and Fall 2008 sampling events have been summarized and organized using several statistical methods. Data are tabulated by sampling event and media (surface, inter-armoring or sub-armoring water). Results for PAHs were totalized into four types: LPAHs, HPAHs, cPAHs, and TPAHs.

3.5.1 Statistical Parameters

A series of statistical parameters were used to summarize the data and were provided for each media (i.e., surface, inter-armoring, and sub-armoring water) and each sampling event (i.e., Fall 2002, Fall 2003, Fall 2005, Spring 2006, Fall

2006, Spring 2007, Fall 2007, Spring 2008, and Fall 2008). The parameters include the following:

- Number of Samples;
- Detection Frequency;
- Maximum Detected Concentration;
- Location of Maximum;
- Mean Concentration;
- Data Distribution; and
- 95% Upper Confidence Limit on the Mean (95% UCL).

Samples resulting in all PAH constituents below MDLs, were totalized by adding one half of the MDL for each constituent being summed. If a sample resulted in detectable concentrations for any PAH constituent, only the detections were summed for that total. We recognize that this may lead to data bias; however, consistency with the previous methodology was considered more important in comparing the 2008 data to historical data. Historical statistics were not recalculated.

The summary statistics for Spring and Fall 2008 are provided in Tables D-1 and D-2. Summary statistics for historic sampling events and 2008 events are provided in Tables D-3 (surface water), D-4 (inter-armoring), and D-5 (sub-armoring). The methodology used to calculate these statistics are provided in this section and are consistent with previous years' methodology. Background or reference samples (upstream and downstream samples collected outside the cap footprint) were not included in the statistical analysis.

The number of samples, detection frequency, maximum detected concentration, and location of maximum were determined by standard means using Microsoft Excel functions. Duplicate results were not included in the calculation of number of samples or detection frequency. In the summary tables, if an analyte was not detected in any sample for the media and year combination, the detection frequency was shown as 0%, the maximum detected concentration was indicated as ND (not detected), and the location of maximum concentration was indicated as NA (not applicable).

Additional processing of the data was necessary to calculate the mean concentration, data distribution, and 95% UCL: non-detected analyte concentrations were represented using half the method detection limit. Duplicate sample datasets were reduced to "worst-case" scenarios, extracting

the highest concentration from the paired duplicate. The maximum detected concentration or maximum detection limit for non-detected results between a duplicate sample and original were used to calculate the statistical parameters.

Data distribution and the 95% UCL were calculated using EPA's ProUCL Version 4.00.02 (EPA, 2009). Non-detects and duplicates were included in the analysis as mentioned above. Within ProUCL, the UCL for each analyte was calculated for all UCL types at the 0.95 confidence coefficient. The number of bootstrap runs was set to the default of 2000. The ProUCL output includes raw statistics (mean, maximum, standard deviation, etc.), results of each distribution test, and recommendations for distribution and 95% UCL. The method for calculating data distribution and 95% UCL and for determining the recommended values is presented in ProUCL Technical Guide (EPA, 2009).

In cases where few detections were present in the data set (i.e., 19 of 22 are non-detect) the recommended UCL was a non-parametric 99% statistic, resulting in a higher value than is likely to be reflected at the station; a second non-parametric 95% value was substituted (Standard Bootstrap Method). This is consistent with historic methodology. *Note that conducting statistics on the data sets with predominantly non-detects or all non-detects result in means and UCLs that are not very meaningful. For these locations that have so few detections, the methods of applying distributions, such as the maximum likelihood estimation (MLE) or the regression on order statistics (ROS), to the non-detect values are also not applicable (Helsel, 2005). Although statistical methods may not be completely valid, general trends can be observed in the statistical results as described below.*

3.5.2 Statistical Results

Summary tables and graphs were developed to show results from multiple sampling events. Tables D-3 through D-5 summarize the statistical results from pre- and post-capping sampling events for surface, inter-armoring, and sub-armoring water. The mean for sampling events from 2002 through 2008 for total arsenic, total copper, TPAHs and cPAHs are presented on Figures D-21 through D-23a, respectively. These contaminants were selected because:

- TPAH provides an overall indication of contaminant reduction and trends. Acenaphthalene, Fluoranthene, and naphthalene also have ROD required performance standards (520 mg/L, 54 mg/L, and 620 mg/L, respectively). These are not individually plotted.

- Total cPAH is a ROD required performance standard (0.031 µg/L total cPAHs); the results will be considered to determine overall remedy protectiveness
- Arsenic, Chromium, Copper, and Zinc have ROD required performance standards (0.19 mg/L, 0.21 mg/L, 0.012 mg/L, and 0.11 mg/L, respectively), the results will be used to determine the overall protectiveness. Arsenic and copper were selected for presentation because they have a higher frequency of detections above or near the comparison criteria.

Each graph shows data from surface, inter-armoring, and sub-armoring water samples. Select graphs are presented in a log scale in addition to the linear scale.

Data is also graphically depicted for selected sample locations to show changes in contaminant concentrations over time from 2002 through 2008. Figures D-24 through D-26 show total arsenic and copper concentrations for samples collected from Locations 12, 4, and 10, respectively. These locations were agreed upon by EPA because they are in locations where detections in the sub-armor sand have had consistent detections of PAHs. Figures D-28 through D-29 show total cPAH and total PAH concentrations for Locations 12, 10, and 4, respectively.

3.5.3 Comparison of Statistical Results

The mean concentration and 95% UCL were compared over time to evaluate overall contaminant concentration trends. The mean concentrations for total metals (arsenic, chromium, copper, and zinc) remained relatively stable between Fall 2002 and Fall 2008 in the three media. Sub-armoring samples are consistently higher in concentration than the inter-armoring and surface water samples. Metal concentrations appear to be consistent with background concentrations and have not changed significantly since installation of the sediment cap.

PCP was detected in surface water during the 2002 sampling event but has not been detected in subsequent sampling events. PCP was detected at low levels, well below comparison criteria, in Fall 2006 in the inter-armoring samples; however, it was not detected again in the 2007 and 2008 events.

Carcinogenic PAHs appear to be fairly stable, with the exception of elevated concentrations in 2002 and 2005. The inter-armoring and surface water have been primarily non-detect for cPAHs since the cap was installed (Figures D-22 and D-22a; Tables D-3 and D-4). The reduction between the sub-armoring samples and the surface water and inter-armoring samples indicate that the

sediment cap is functioning as designed. Carcinogenic PAHs have not been detected since the Spring 2006 sampling event in surface water and since Fall 2006 in the inter-armoring samples.

Total PAHs in the inter-armoring and surface water have remained stable since installation of the sediment cap. TPAHs are regularly higher in the inter-armoring samples in the Fall than in the Spring. River levels and discharge volumes are lower during the Fall time periods. Concentrations of TPAHs in the sub-armoring samples are consistently about an order of magnitude more than the surface water and inter-armoring samples. The sub-armoring sample concentrations have a slight decreasing trend since the sediment cap was installed.

A significant influence on the surface water data came from a single sample (SED 6) collected during the 2002 sampling event. Sample SED 6 contained 61.5 µg/L TPAHs. This result significantly skewed the data set. When SED 6 was removed from the data set, the mean and 95% UCL varied less than 0.2 µg/L from the remaining data sets. Statistical data sets for surface water are summarized in Table D-3. For 2002, data sets are presented with and without SED 6 data.

3.6 Willamette River Hydraulics

Discharge data for the Willamette River are presented on Figures D-30 (Spring 2008) and D-31 (Fall 2008); stream elevation data is presented in Figures D-32 (Spring 2008) and D-33 (Fall 2008); and stream velocity data are presented on Figures D-34 (Spring 2008) and D-35 (Fall 2008). The primary hydraulic differences between Fall and Spring sampling events are higher river levels, flow, and muted diurnal variation during Spring. During the Spring 2008 sampling event, river elevations ranged from between 7.5 and 9.5 feet NAVD88. During the Fall 2008 sampling event, elevations ranged between 5 and 10 feet NAVD88. During the Spring 2008 event, river discharge averaged roughly 40,000 cubic feet per second (cfs), ranging from 10,000 to 50,000 cfs, while discharge rates during the Fall 2008 sampling event were considerably lower, averaging about 20,000 cfs, with a range from -50,000 to 30,000 cfs. Additionally, discharge rates and stream velocities were often negative on a daily basis, resulting in reverse flow and potentially more stagnant conditions during fall sampling events. These hydraulic differences appear to generally result in higher COC concentrations in the Fall than observed in the Spring.

4.0 SUMMARY

Surface water and sub-armoring water sampling events have been conducted since the installation of the sediment cap at the McCormick and Baxter Site: Fall 2005, Spring and Fall 2006, Spring and Fall 2007, and Spring and Fall 2008. Additional sampling of inter-armoring water was added to monitor sediment cap performance in Spring 2006. Sampling conducted in 2002 and 2003 represents pre-sediment cap conditions and did not include inter-armoring or sub-armoring sampling. Porewater samples were collected in 2002. Sampling activities were conducted in general accordance with the *2005 Surface Water and Transition-Zone Water Sampling and Analysis Plan* (E&E, 2005), and *Revised O&M Manual* (Hart Crowser/GSI, 2008). Depending on field conditions, samples have been collected from the same 24 sampling locations since the sediment cap construction was complete.

Samples were analyzed for site-specific COCs, including both total and dissolved metals (arsenic, chromium, copper, and zinc), PAHs, and PCP. Sample analysis was provided by TestAmerica under separate contract with the Oregon DEQ. Analytical results were compared against a group of water quality guidelines including AWQCs established in the 1996 ROD, and NRWQCs and NPDWRs established by the EPA. These guidelines are collectively referred to as comparison criteria. Of the site COCs, comparison criteria have been developed for total metals, PCP, acenaphthene, anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)flouranthene, benzo(k)fluoranthene, chrysene, dibenzo(a,h)anthracene, fluoranthene, fluorene, ideno(1,2,3-cd)pyrene, naphthalene, pyrene, and total cPAHs.

Based on the post-sediment cap construction water sampling, trends and preliminary conclusions can be suggested, to include:

- Metal concentrations in sub-armoring samples are stable and consistent in sampled locations across the sediment cap, suggesting contaminant concentrations reflect background values
- Contaminant concentrations from surface water and inter-armoring water are consistently below both performance and comparison criteria, except for arsenic, a background contaminant
- PAH contaminant concentrations are higher in samples collected from Fall sampling but are consistently below comparison criteria

Table D-6 summarizes the exceedances of the lowest comparison criteria for post-sediment cap data. In Spring 2008 there were no exceedances of

comparison criteria in surface water and in Fall 2008, arsenic exceeded its criterion at multiple locations because the analytical method detection limit was greater than the comparison criterion. In the inter-armoring in Spring 2008, there was one exceedance each for arsenic and zinc. In Fall 2008, there were 21 exceedances for arsenic and two for zinc. Sub-armoring samples show more exceedances; however, the rates of exceedances and concentrations have remained consistent since installation of the sediment cap.

Maximum detections are summarized for select analytes in Table D-7. In general, the maximum detected concentrations are be relatively stable since installation of the sediment cap; particularly concentrations of metals. Several maximum surface water PAH contaminant concentrations vary from Spring compared to Fall; a strong correlation exists between TPAHs and naphthalene from Spring 2006 through Fall 2008. Table D-8 presents the detection frequencies by year and media. The detection frequency for TPAHs is lower than in previous years with the exception of Spring 2007. For inter-armoring sampling, the detection frequency for TPAH is also lower than in previous years with the exception of Spring 2007. The detection frequency for TPAH in the sub-armoring appears to be consistent with previous years.

Arsenic is consistently detected in all media with the exception of Spring 2008, which may be associated with high river discharge volumes. Chromium and zinc are detected less frequently in 2008 in surface water and inter-armoring water than in previous years while chromium detection frequencies have remained consistent. All metals appear to remain fairly consistent in detection frequency in all sub-armoring water sampling locations suggesting that the metals are primarily naturally occurring, and not due to Site contamination.

Detection frequencies increase with depth. Surface water detection of TPAHs between Fall 2005 through 2008 ranged from 19 to 68 percent, while sub-armoring water detections ranged from 68 to 91 percent. Detection frequencies for total metals were generally much higher than PAHs as would be expected as the metals are naturally occurring; however, no discernable pattern was observed between sampling events. This suggests that the presence of the metals are primarily due to naturally occurring metals and not associated with the metals contamination associated with the wood treating products used at the Site.

COC concentrations in surface water and inter-armoring water are below comparison criteria with the exception of arsenic for which the comparison criterion is below the method detection limit for arsenic. In general, COC concentrations in the sub-armoring water are below comparison criteria with a few exceptions. Concentration trends are stable or decreasing. Based on water

sampling from the surface water, inter-armoring and sub-armoring, the sediment cap appears to be protective.

5.0 REFERENCES

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Table D-1
Surface, Inter-Armoring, and Sub-Armoring Water Data: Spring 2008
McCormick and Baxter Superfund Site
Portland, Oregon

		Sediment Cap Performance Goals		Comparison Criteria			Surface Water Statistics						
		McCormick & Baxter Record of Decision, 1996, Ambient Water Quality Criteria (AWQCs)		EPA Current, 2007, National Recommended Water Quality Criteria (NRWQCs)		EPA National Primary Drinking Water Regulations (NPDWRs)							
CONTAMINANT OF CONCERN		Aquatic Life (chronic)[1]	Human Health (fish consumption only)[1]	Aquatic Life (chronic)[2]	Human Health (consumption of organism only)[2]	Maximum Contaminant Levels (MCLs)[3]	**Number of Samples**	**Detection Frequency**	**Max Detection**	**Max Location**	**Mean Conc.**	**Data Distribution**	**95% UCL Value**
Dissolved Metals (mg/L)													
Arsenic							22	0%	ND	NA	0.0003	--	--
Chromium (III)							22	45%	0.000319	Location 26	0.0001	NP	0.00019
Copper							22	64%	0.00455	Location 13	0.0011	NP	0.00195
Zinc							22	36%	0.0136	Location 25	0.0027	Normal	0.00371
Total Metals (mg/L)													
Arsenic		0.19		0.15	0.00014	0.01	22	0%	ND	NA	0.0003	--	--
Chromium (III)		0.21		0.074		0.1	22	77%	0.00097	Location 18	0.0004	NP	0.00063
Copper		0.012		0.009			22	77%	0.00348	Location 12	0.0012	Normal	0.00124
Zinc		0.11		0.12	26		22	9%	0.0125	Location 25	0.0031	Normal	0.00403
Pentachlorophenol (µg/L)		13		11	3	1	22	0%	ND	NA	0.1197	Normal	0.120
Polynuclear aromatic hydrocarbons (µg/L)													
Acenaphthene	L	520			990		22	14%	0.0661	Location 2	0.0125	NP	0.0287
Acenaphthylene	L						22	0%	ND	NA	0.0060	Normal	0.006
Anthracene	L				40,000		22	0%	ND	NA	0.0060	Normal	0.006
Benzo (a) anthracene	H, C				0.018		22	0%	ND	NA	0.0060	Normal	0.006
Benzo (a) pyrene	H, C				0.018	0.2	22	0%	ND	NA	0.0060	Normal	0.006
Benzo (b) fluoranthene	H, C				0.018		22	0%	ND	NA	0.0060	Normal	0.006
Benzo (ghi) perylene	H, C						22	0%	ND	NA	0.0060	Normal	0.006
Benzo (k) fluoranthene	H, C				0.018		22	0%	ND	NA	0.0060	Normal	0.006
Chrysene	H, C				0.018		22	0%	ND	NA	0.0060	Normal	0.006
Dibenzo (a,h) anthracene	H, C				0.018		22	0%	ND	NA	0.0120	Normal	0.012
Fluoranthene	H		54		140		22	0%	ND	NA	0.0060	Normal	0.006
Fluorene	L				5300		22	14%	0.0237	Location 2	0.0078	Normal	0.00964
Indeno (1,2,3-cd) pyrene	H, C				0.018		22	0%	ND	NA	0.0060	Normal	0.006
Naphthalene	L	620					22	18%	0.0934	Location 25	0.0135	Normal	0.0324
Phenanthrene	L						22	0%	ND	NA	0.0060	Normal	0.006
Pyrene	H				4,000		22	0%	ND	NA	0.0060	Normal	0.006
Total LPAHs							22	18%	0.1475	Location 25	0.0332	Normal	0.0702
Total HPAHs							22	0%	ND	NA	0.0329	Normal	0.033
Total CPAHs			0.031				22	0%	ND	NA	0.0269	Normal	0.027
Total PAHs							22	18%	0.1475	Location 25	0.0601	Normal	0.0715
Field Parameters (pre-/post-sample)													
Temperature (°C)													
Specific Conductance (mS/cm)													
Dissolved Oxygen (mg/L)													
pH													
Oxidation Reduction Potential (mV)													
Turbidity (NTU)													
Total Dissolved Solids (mg/L)													

Please refer to notes on last page of this table.

Table D-1
Surface, Inter-Armoring, and Sub-Armoring Water Data: Spring 2008
McCormick and Baxter Superfund Site
Portland, Oregon

		Inter-Armoring Water Statistics							Sub-Armoring Water Statistics						
CONTAMINANT OF CONCERN		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		22	0%	ND	NA	0.00033	--	--	22	95%	0.03980	Location 9	0.01085	Gamma	0.01730
Chromium (III)		22	45%	0.00174	Location 2	0.00018	NP	0.00051	22	50%	0.00225	Location 5	0.00026	NP	0.00070
Copper		22	59%	0.00889	Location 5	0.00159	NP	0.00334	22	45%	0.00228	Location 15	0.00057	NP	0.00168
Zinc		22	36%	0.00446	Location 8	0.00255	Normal	0.00274	22	50%	0.02480	Location 2	0.00647	NP	0.01240
Total Metals (mg/L)															
Arsenic		22	5%	0.00078	Location 14	0.00035	Normal	0.00039	22	95%	0.02960	Location 9	0.00896	Gamma	0.01400
Chromium (III)		22	91%	0.00229	Location 14	0.00063	Lognormal	0.00079	22	55%	0.00122	Location 12	0.00034	NP	0.00108
Copper		22	82%	0.00528	Location 7	0.00190	Gamma	0.00234	22	45%	0.00421	Location 17	0.00072	NP	0.00293
Zinc		22	27%	0.17200	Location 9	0.01170	NP	0.08790	22	64%	0.02190	Location 2	0.00773	NP	0.01320
Pentachlorophenol (µg/L)		22	0%	ND	NA	0.1198	Normal	0.12	22	0%	ND	NA	0.1200	Normal	0.12
Polynuclear aromatic hydrocarbons (µg/L)															
Acenaphthene	L	22	14%	0.0582	Location 2	0.0107	NP	0.0233	22	73%	50.5	Location 9	7.0345	Gamma	18.92
Acenaphthylene	L	22	0%	ND	NA	0.0060	Normal	0.00601	22	18%	0.0647	Location 5	0.0255	NP	0.0927
Anthracene	L	22	0%	ND	NA	0.0060	Normal	0.00601	22	50%	1.27	Location 9	0.1168	NP	0.723
Benzo (a) anthracene	H, C	22	0%	ND	NA	0.0060	Normal	0.00601	22	9%	0.176	Location 16	0.0163	NP	0.0514
Benzo (a) pyrene	H, C	22	0%	ND	NA	0.0060	Normal	0.00601	22	5%	0.0375	Location 16	0.0074	Normal	0.0101
Benzo (b) fluoranthene	H, C	22	0%	ND	NA	0.0060	Normal	0.00601	22	5%	0.0458	Location 16	0.0078	Normal	0.0112
Benzo (ghi) perylene	H, C	22	0%	ND	NA	0.0060	Normal	0.00601	22	5%	0.0131	Location 16	0.0063	Normal	0.00693
Benzo (k) fluoranthene	H, C	22	0%	ND	NA	0.0060	Normal	0.00601	22	5%	0.0437	Location 16	0.0077	Normal	0.0109
Chrysene	H, C	22	0%	ND	NA	0.0060	Normal	0.00601	22	9%	0.146	Location 16	0.0151	NP	0.0447
Dibenzo (a,h) anthracene	H, C	22	0%	ND	NA	0.0120	Normal	0.012	22	0%	ND	NA	0.0120	Normal	0.012
Fluoranthene	H	22	0%	ND	NA	0.0060	Normal	0.00601	22	64%	2.16	Location 9	0.2574	NP	1.474
Fluorene	L	22	9%	0.0157	Location 2	0.0067	Normal	0.00767	22	64%	18.9	Location 9	2.1990	NP	12.6
Indeno (1,2,3-cd) pyrene	H, C	22	0%	ND	NA	0.0060	Normal	0.00601	22	0%	ND	NA	0.0060	Normal	0.00602
Naphthalene	L	22	27%	0.0521	Location 2	0.0112	NP	0.0218	22	41%	232	Location 5	12.1678	NP	117.3
Phenanthrene	L	22	0%	ND	NA	0.0060	Normal	0.00601	22	41%	13.1	Location 9	1.1353	NP	7.508
Pyrene	H	22	0%	ND	NA	0.0060	Normal	0.00601	22	59%	1.06	Location 9	0.1554	NP	0.815
Total LPAHs		22	32%	0.126	Location 2	0.0267	NP	0.0519	22	77%	253.2	Location 5	22.6085	Gamma	65.77
Total HPAHs		22	0%	ND	NA	0.0329	Normal	0.0331	22	68%	3.3488	Location 9	0.4423	NP	2.26
Total CPAHs		22	0%	ND	NA	0.0270	Normal	0.027	22	9%	0.4621	Location 16	0.0514	NP	0.139
Total PAHs		22	32%	0.126	Location 2	0.0483	NP	0.0712	22	86%	253.3	Location 5	23.0767	Gamma	63.68
Field Parameters (pre-/post-sample)															
Temperature (°C)															
Specific Conductance (mS/cm)															
Dissolved Oxygen (mg/L)															
pH															
Oxidation Reduction Potential (mV)															
Turbidity (NTU)															
Total Dissolved Solids (mg/L)															

Please refer to notes on last page of this table.

Table D-1
Surface, Inter-Armoring, and Sub-Armoring Water Data: Spring 2008
McCormick and Baxter Superfund Site
Portland, Oregon

SAMPLE LOCATION		Location 01		Location 02				Location 03						Location 04					
Sample Type		Surface Water		Surface Water		Inter-Armoring		Sub-Armoring	Surface Water		Inter-Armoring		Sub-Armoring	Surface Water		Inter-Armoring		Sub-Armoring	
Sample ID		MBSW0408-01		MBSW0408-02		MBIA0408-02		MBSA0408-02	MBSW0408-03		MBIA0408-03		MBSA0408-03	MBSW0408-04		MBIA0408-04		MBSA0408-04	
Sample Date		3/31/2008		3/31/2008		3/31/2008		3/31/2008	4/4/2008		4/4/2008		4/4/2008	4/3/2008		4/3/2008		4/3/2008	
Sample Time		14:30		14:55		15:20		15:35	8:55		9:10		10:30	11:05		11:30		12:00	
CONTAMINANT OF CONCERN																			
Dissolved Metals (mg/L)																			
Arsenic		0.000664	U	0.000664	U	0.000664	U	**0.0165**	0.000664	U	0.000664	U	**0.0194**	0.000664	U	0.000664	U	**0.0163**	
Chromium (III)		0.000121	U	0.000121	U	**0.00174**		**0.000246**	J	**0.000228**	J	**0.000176**	J	0.000121	U	0.000121	U	**0.000924**	J
Copper		**0.000724**	J	**0.000734**	J	**0.00146**	J	0.000133	U	0.002	U	0.002	U	0.000133	U	**0.000554**	J	**0.000721**	J	**0.000583**	J
Zinc		**0.00136**	J	**0.00132**	J	**0.00324**	J	**0.0248**		0.005	U	0.005	U	0.005	U	**0.00155**	J	**0.00249**	J	**0.0123**	
Total Metals (mg/L)																			
Arsenic		0.000664	UJ	0.000664	UJ	0.000664	UJ	0.0156	0.000664	UJ	0.000664	UJ	0.0184	0.000664	UJ	0.000664	UJ	0.0123	
Chromium (III)		0.001	U	0.001	U	0.001	U	0.001	U	0.000121	U	**0.000201**	J	**0.000338**	J	**0.00035**	J	**0.0009**	J	**0.0002**	J
Copper		**0.00173**	J	**0.00094**	J	**0.00151**	J	0.000133	U	**0.000765**	J	**0.000949**	J	**0.00158**	J	**0.00058**	J	**0.00193**	J	0.000133	U
Zinc		0.005	U	0.005	U	0.005	U	**0.0219**		0.005	U	0.005	U	**0.00769**		0.005	U	0.005	U	**0.00845**	
Pentachlorophenol (µg/L)		0.238	U	0.238	U	0.238	U	0.238	U	**0.242**	UJ	**0.24**	UJ	**0.244**	UJ	0.238	U	0.238	U	0.238	U
Polynuclear aromatic hydrocarbons (µg/L)																			
Acenaphthene	L	0.0119	U	**0.0661**		**0.0582**		**1.69**		0.0121	U	0.012	U	**0.0662**		0.0119	U	0.0119	U	**0.0196**	J
Acenaphthylene	L	0.0119	U	0.0119	U	0.0119	U	0.0119	U	0.0121	U	0.012	U	0.0122	U	0.0119	U	0.0119	U	0.0119	U
Anthracene	L	0.0119	U	0.0119	U	0.0119	U	**0.0603**		0.0121	U	0.012	U	0.0122	U	0.0119	U	0.0119	U	0.0119	U
Benzo (a) anthracene	H, C	0.0119	U	0.0119	U	0.0119	U	0.0119	U	0.0121	U	0.012	U	0.0122	U	0.0119	U	0.0119	U	0.0119	U
Benzo (a) pyrene	H, C	0.0119	U	0.0119	U	0.0119	U	0.0119	U	**0.0121**	UJ	**0.012**	UJ	**0.0122**	UJ	0.0119	U	0.0119	U	0.0119	U
Benzo (b) fluoranthene	H, C	0.0119	U	0.0119	U	0.0119	U	0.0119	U	0.0121	U	0.012	U	0.0122	U	0.0119	U	0.0119	U	0.0119	U
Benzo (ghi) perylene	H, C	0.0119	U	0.0119	U	0.0119	U	0.0119	U	0.0121	U	0.012	U	0.0122	U	0.0119	U	0.0119	U	0.0119	U
Benzo (k) fluoranthene	H, C	0.0119	U	0.0119	U	0.0119	U	0.0119	U	0.0121	U	0.012	U	0.0122	U	0.0119	U	0.0119	U	0.0119	U
Chrysene	H, C	0.0119	U	0.0119	U	0.0119	U	0.0119	U	0.0121	U	0.012	U	0.0122	U	0.0119	U	0.0119	U	0.0119	U
Dibenzo (a,h) anthracene	H, C	0.0238	U	0.0238	U	0.0238	U	0.0238	U	0.0242	U	0.024	U	0.0244	U	0.0238	U	0.0238	U	0.0238	U
Fluoranthene	H	0.0119	U	0.0119	U	0.0119	U	**0.119**		0.0121	U	0.012	U	**0.0265**		0.0119	U	0.0119	U	**0.0327**	
Fluorene	L	0.0119	U	**0.0237**	J	**0.0157**	J	**0.384**		0.0121	U	0.012	U	**0.0125**	J	0.0119	U	0.0119	U	**0.0294**	
Indeno (1,2,3-cd) pyrene	H, C	0.0119	U	0.0119	U	0.0119	U	0.0119	U	0.0121	U	0.012	U	0.0122	U	0.0119	U	0.0119	U	0.0119	U
Naphthalene	L	0.0119	U	**0.0343**		**0.0521**		0.0119	U	0.0121	U	0.012	U	**0.420**		0.0119	U	0.0119	U	0.0119	U
Phenanthrene	L	0.0119	U	0.0119	U	0.0119	U	**0.328**		0.0121	U	0.012	U	0.0122	U	0.0119	U	0.0119	U	0.0119	U
Pyrene	H	0.0119	U	0.0119	U	0.0119	U	**0.0452**		0.0121	U	0.012	U	**0.0205**	J	0.0119	U	0.0119	U	**0.0205**	J
Total LPAHs		0.0357	U	**0.124**		**0.126**		**2.46**		0.0363	U	0.0360	U	**0.499**		0.0357	U	0.0357	U	**0.0490**	
Total HPAHs		0.0655	U	0.0655	U	0.0655	U	**0.1642**		0.067	U	0.0660	U	**0.027**		0.0655	U	0.0655	U	**0.0532**	
Total CPAHs		0.0536	U	0.0536	UJ	0.0536	UJ	0.0536	UJ	0.05445	UJ	0.0540	UJ	0.055	UJ	0.0536	UJ	0.0536	UJ	0.0536	UJ
Total PAHs		0.101	U	**0.124**		**0.126**		**2.63**		0.10285	U	0.1020	U	**0.546**		0.1012	U	0.1012	U	**0.1022**	
Field Parameters (pre-/post-sample)																			
Temperature (°C)		8.47 / 8.41		10.42 / 9.90		9.11 / 9.24		8.94 / 9.14		7.62 / 7.76		7.71 / 7.66		7.85 / 8.07		8.73 / 8.58		9.30 / 9.22		9.24 / 9.80	
Specific Conductance (mS/cm)		0.081 / 0.076		0.087 / 0.083		0.086 / 0.083		0.773 / 0.762		0.108 / 0.086		0.085 / 0.085		0.363 / 0.331		0.079 / 0.079		0.079 / 0.079		1.490 / 1.490	
Dissolved Oxygen (mg/L)		10.03 / 10.47		11.11 / 11.24		10.35 / 10.73		2.32 / 1.12		7.39 / 10.18		10.41 / 10.39		1.77 / 1.75		10.39 / 10.97		10.13 / 10.81		4.34 / 3.71	
pH		7.83 / 7.78		7.71 / 7.36		7.38 / 7.47		6.62 / 6.90		7.58 / 7.40		7.71 / 7.53		6.71 / 6.79		7.69 / 7.76		7.54 / 7.56		7.09 / 7.42	
Oxidation Reduction Potential (mV)		39 / 63		43 / 50		54 / 58		-23 / -42		20 / 31		32 / 45		6 / -17		-7 / 15		41 / 54		-39 / -70	
Turbidity (NTU)		30.4 / 25.2		21.3 / 25.5		48.7 / 44.5		47.4 / 60.7		57.4 / 31.8		29.1 / 27.2		59.4 / 47.2		21.4 / 23.6		68.2 / 50.8		7.7 / 13.1	
Total Dissolved Solids (mg/L)		0.1 / 0.1		0.1 / 0.1		0.1 / 0.1		0.5 / 0.5		0.1 / 0.1		0.1 / 0.1		0.2 / 0.2		0.1 / 0.1		0.1 / 0.1		1.0 / 1.0	

Please refer to notes on last page of this table.

Table D-1
Surface, Inter-Armoring, and Sub-Armoring Water Data: Spring 2008
McCormick and Baxter Superfund Site
Portland, Oregon

SAMPLE LOCATION		Location 05				Location 06			Location 07		
Sample Type		Surface Water	Inter-Armoring	Sub-Armoring	Sub-Armoring	Surface Water	Inter-Armoring	Sub-Armoring	Surface Water	Inter-Armoring	Sub-Armoring
Sample ID		MBSW0408-05	MBIA0408-05	MBSA0408-05	MBSA0408-05D	MBSW0408-06	MBIA0408-06	MBSA0408-06	MBSW0408-07	MBIA0408-07	MBSA0408-07
Sample Date		4/3/2008	4/3/2008	4/3/2008	4/3/2008	4/1/2008	4/1/2008	4/1/2008	4/1/2008	4/1/2008	4/1/2008
Sample Time		12:30	12:50	13:15	13:15	8:00	8:20	9:00	9:45	10:15	10:45
CONTAMINANT OF CONCERN											
Dissolved Metals (mg/L)											
Arsenic		0.000664 U	0.000664 U	**0.0183**	**0.018**	0.000664 U	0.000664 U	**0.00742**	0.000664 U	0.000664 U	**0.00238**
Chromium (III)		0.000121 U	0.000121 U	**0.00225**	**0.00111**	**0.00018** J	0.000121 U	0.000121 U	**0.00013** J	**0.00015** J	**0.00013** J
Copper		**0.000962** J	**0.00889**	**0.000715** J	**0.000721** J	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U
Zinc		**0.00184** J	**0.00215** J	**0.00954**	**0.0104**	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U
Total Metals (mg/L)											
Arsenic		0.000664 U	0.000664 U	0.0125	0.013	0.000664 U	0.000664 U	0.00756	0.000664 U	0.000664 U	0.00245
Chromium (III)		**0.00041** J	**0.00147**	**0.00017** J	**0.00025** J	**0.00052** J	**0.00044** J	0.000121 U	**0.0005** J	**0.00096** J	**0.00027** J
Copper		**0.00059** J	**0.00285**	0.000133 U	0.000133 U	0.002 U	0.002 U	0.000133 U	0.002 U	**0.00528**	**0.00031** J
Zinc		0.005 U	**0.00643**	**0.0074**	**0.00734**	0.005 U	0.005 U	0.005 U	0.005 U	**0.00879**	**0.00725**
Pentachlorophenol (µg/L)		0.238 U	0.238 U	**0.243** UJ	0.239 U	0.24 U	0.24 U	0.24 U	0.24 U	0.24 U	0.24 U
Polynuclear aromatic hydrocarbons (µg/L)											
Acenaphthene	L	0.0119 U	0.0119 U	**7.77**	**16.9**	0.012 U	0.012 U	**0.64**	0.012 U	0.012 U	**3.25**
Acenaphthylene	L	0.0119 U	0.0119 U	0.0364 U	**0.0647**	0.012 U	0.012 U	0.0601 U	0.012 U	0.012 U	**0.0325**
Anthracene	L	0.0119 U	0.0119 U	**0.0126** J	**0.0283**	0.012 U	0.012 U	0.012 U	0.012 U	0.012 U	**0.0558**
Benzo (a) anthracene	H, C	0.0119 U	0.0119 U	0.0121 U	0.012 U	0.012 U	0.012 U	0.012 U	0.012 U	0.012 U	0.012 U
Benzo (a) pyrene	H, C	0.0119 U	0.0119 U	**0.0121** UJ	0.012 U	0.012 U	0.012 U	0.012 U	0.012 U	0.012 U	0.012 U
Benzo (b) fluoranthene	H, C	0.0119 U	0.0119 U	0.0121 U	0.012 U	0.012 U	0.012 U	0.012 U	0.012 U	0.012 U	0.012 U
Benzo (ghi) perylene	H, C	0.0119 U	0.0119 U	0.0121 U	0.012 U	0.012 U	0.012 U	0.012 U	0.012 U	0.012 U	0.012 U
Benzo (k) fluoranthene	H, C	0.0119 U	0.0119 U	0.0121 U	0.012 U	0.012 U	0.012 U	0.012 U	0.012 U	0.012 U	0.012 U
Chrysene	H, C	0.0119 U	0.0119 U	0.0121 U	0.012 U	0.012 U	0.012 U	0.012 U	0.012 U	0.012 U	0.012 U
Dibenzo (a,h) anthracene	H, C	0.0238 U	0.0238 U	0.0243 U	0.0239 U	0.024 U	0.024 U	0.024 U	0.024 U	0.024 U	0.024 U
Fluoranthene	H	0.0119 U	0.0119 U	**0.0212** J	**0.0422**	0.012 U	0.012 U	0.012 U	0.012 U	0.012 U	**1.31**
Fluorene	L	0.0119 U	0.0119 U	**1.57**	**3.92**	0.012 U	0.012 U	0.0601 U	0.012 U	0.012 U	**0.162**
Indeno (1,2,3-cd) pyrene	H, C	0.0119 U	0.0119 U	0.0121 U	0.012 U	0.012 U	0.012 U	0.012 U	0.012 U	0.012 U	0.012 U
Naphthalene	L	0.0119 U	0.0119 U	**83.3**	**232**	0.012 U	0.012 U	**0.0138** J	0.012 U	0.012 U	0.0601 U
Phenanthrene	L	0.0119 U	0.0119 U	**0.115**	**0.314**	0.012 U	0.012 U	0.012 U	0.012 U	0.012 U	0.012 U
Pyrene	H	0.0119 U	0.0119 U	**0.013** J	**0.0262**	0.012 U	0.012 U	0.012 U	0.012 U	0.012 U	**0.596**
Total LPAHs		0.0357 U	0.0357 U	**92.77**	**253.2**	0.0360 U	0.0360 U	**0.7139**	0.0360 U	0.0360 U	**3.500**
Total HPAHs		0.0655 U	0.0655 U	**0.0342** J	**0.0684**	0.0660 U	0.0660 U	0.0660 U	0.0660 U	0.0660 U	**1.906**
Total CPAHs		0.0536 U	0.0536 U	0.0545 U	0.05395 U	0.0540 U	0.0540 U	0.0540 U	0.0540 U	0.0540 U	0.0540 U
Total PAHs		0.1012 U	0.1012 U	**92.80**	**253.3**	0.1020 U	0.1020 U	**0.7139**	0.1020 U	0.1020 U	**5.256**
Field Parameters (pre-/post-sample)											
Temperature (°C)		8.20 / 8.64	8.94 / 8.71	9.23 / 9.98	NA	6.89 / 6.60	6.56 / 6.59	6.47 / 6.83	6.57 / 6.69	6.60 / 6.87	7.23 / 7.45
Specific Conductance (mS/cm)		0.079 / 0.079	0.079 / 0.079	1.77 / 1.77	NA	0.078 / 0.078	0.078 / 0.077	0.741 / 0.712	0.079 / 0.078	0.078 / 0.079	0.224 / 0.228
Dissolved Oxygen (mg/L)		10.47 / 10.41	10.53 / 10.71	1.42 / 0.74	NA	11.08 / 10.73	10.86 / 10.91	0.84 / 0.81	9.98 / 10.21	10.40 / 10.52	0.23 / 1.19
pH		8.05 / 7.85	7.69 / 7.77	6.95 / 7.21	NA	7.71 / 7.51	7.40 / 7.43	7.07 / 7.14	7.77 / 7.66	7.64 / 7.54	7.32 / 7.35
Oxidation Reduction Potential (mV)		-46 / -6	20 / 32	-43 / -77	NA	109 / 112	106 / 103	-36 / -58	-29 / 18	47 / 61	28 / 8
Turbidity (NTU)		20.8 / 21.6	140 / 50.8	30.9 / 63.5	NA	33.1 / 25.8	125 / 52.8	105 / 113	135 / 132	171 / 91.2	6.7 / 4.5
Total Dissolved Solids (mg/L)		0.1 / 0.1	0.1 / 0.1	1.1 / 1.1	NA	0.1 / 0.1	0.1 / 0.1	0.5 / 0.5	0.1 / 0.1	0.1 / 0.1	0.1 / 0.2

Please refer to notes on last page of this table.

Table D-1
Surface, Inter-Armoring, and Sub-Armoring Water Data: Spring 2008
McCormick and Baxter Superfund Site
Portland, Oregon

SAMPLE LOCATION		Location 08				Location 09			Location 10		
Sample Type		Surface Water	Surface Water	Inter-Armoring	Sub-Armoring	Surface Water	Inter-Armoring	Sub-Armoring	Surface Water	Inter-Armoring	Sub-Armoring
Sample ID		MBSW0408-08	MBSW0408-08D	MBIA0408-08	MBSA0408-08	MBSW0408-09	MBIA0408-09	MBSA0408-09	MBSW0408-10	MBIA0408-10	MBSA0408-10
Sample Date		4/3/2008	4/3/2008	4/3/2008	4/3/2008	4/2/2008	4/2/2008	4/2/2008	4/2/2008	4/2/2008	4/2/2008
Sample Time		8:05	8:05	8:55	9:10	15:15	15:40	16:05	8:10	8:30	8:55
CONTAMINANT OF CONCERN											
Dissolved Metals (mg/L)											
Arsenic		0.000664 U	0.000664 U	0.000664 U	**0.00178**	0.000664 U	0.000664 U	**0.0398**	0.000664 U	0.000664 U	**0.00529**
Chromium (III)		0.000121 U	0.000121 U	0.000121 U	**0.000239** J	0.000121 U	0.000121 U	**0.00028** J	0.000121 U	0.000121 U	0.000121 U
Copper		0.002 U	**0.000519** J	**0.00105** J	**0.000591** J	**0.000515** J	**0.00126** J	**0.000459** J	**0.000999** J	**0.00127** J	**0.000557** J
Zinc		0.005 U	**0.00121** J	**0.00446** J	**0.00971**	0.005 U	0.005 U	**0.00613**	0.005 U	0.005 U	0.005 U
Total Metals (mg/L)											
Arsenic		0.000664 U	0.000664 U	0.000664 U	0.00132	0.000664 U	0.000664 U	0.0296	0.000664 U	0.000664 U	0.00437
Chromium (III)		**0.00048** J	**0.00046** J	**0.00054** J	0.000121 U	**0.000389** J	**0.000468** J	**0.000452** J	**0.00047** J	**0.000489** J	**0.000312** J
Copper		**0.00082** J	**0.00077** J	**0.00119** J	0.000133 U	**0.00096** J	**0.00271**	0.000133 U	**0.000985** J	**0.00256**	**0.00113** J
Zinc		0.005 U	0.005 U	0.005 U	**0.00717**	**0.00648**	0.172	**0.00655**	0.005 U	0.005 U	0.005 U
Pentachlorophenol (µg/L)		0.238 U	0.239 U	0.238 U	0.239 U	0.238 U	0.24 U	0.243 U	0.238 U	0.24 U	0.24 U
Polynuclear aromatic hydrocarbons (µg/L)											
Acenaphthene	L	0.0119 U	0.012 U	0.0119 U	**6.05**	**0.0119** UJ	0.012 U	**50.5**	0.0119 U	0.012 U	**9.51**
Acenaphthylene	L	0.0119 U	0.012 U	0.0119 U	**0.0302**	**0.0119** UJ	0.012 U	0.243 U	0.0119 U	0.012 U	0.0361 U
Anthracene	L	0.0119 U	0.012 U	0.0119 U	0.012 U	**0.0119** UJ	0.012 U	**1.27**	0.0119 U	0.012 U	**0.125**
Benzo (a) anthracene	H, C	0.0119 U	0.012 U	0.0119 U	0.012 U	**0.0119** UJ	0.012 U	0.0633	0.0119 U	0.012 U	0.012 U
Benzo (a) pyrene	H, C	0.0119 U	0.012 U	0.0119 U	0.012 U	**0.0119** UJ	0.012 U	0.0121 U	0.0119 U	0.012 U	0.012 U
Benzo (b) fluoranthene	H, C	0.0119 U	0.012 U	0.0119 U	0.012 U	**0.0119** UJ	0.012 U	0.0121 U	0.0119 U	0.012 U	0.012 U
Benzo (ghi) perylene	H, C	0.0119 U	0.012 U	0.0119 U	0.012 U	**0.0119** UJ	0.012 U	0.0121 U	0.0119 U	0.012 U	0.012 U
Benzo (k) fluoranthene	H, C	0.0119 U	0.012 U	0.0119 U	0.012 U	**0.0119** UJ	0.012 U	0.0121 U	0.0119 U	0.012 U	0.012 U
Chrysene	H, C	0.0119 U	0.012 U	0.0119 U	0.012 U	**0.0119** UJ	0.012 U	0.0655	0.0119 U	0.012 U	0.012 U
Dibenzo (a,h) anthracene	H, C	0.0238 U	0.0239 U	0.0238 U	0.0239 U	**0.0238** UJ	0.024 U	0.0243 U	0.0238 U	0.024 U	0.024 U
Fluoranthene	H	0.0119 U	0.012 U	0.0119 U	**0.0312**	**0.0119** UJ	0.012 U	**2.16**	0.0119 U	0.012 U	**0.063**
Fluorene	L	0.0119 U	0.012 U	0.0119 U	0.0239 U	**0.0119** UJ	0.012 U	**18.9**	0.0119 U	0.012 U	**2.75**
Indeno (1,2,3-cd) pyrene	H, C	0.0119 U	0.012 U	0.0119 U	0.012 U	**0.0119** UJ	0.012 U	0.0121 U	0.0119 U	0.012 U	0.012 U
Naphthalene	L	0.0119 U	0.012 U	0.0119 U	0.0718 U	**0.0119** UJ	0.012 U	**31.6**	0.0119 U	0.012 U	**1.17**
Phenanthrene	L	0.0119 U	0.012 U	0.0119 U	**0.0128** J	**0.0119** UJ	0.012 U	**13.1**	0.0119 U	0.012 U	**1.52**
Pyrene	H	0.0119 U	0.012 U	0.0119 U	**0.0125** J	**0.0119** UJ	0.012 U	**1.06**	0.0119 U	0.012 U	**0.0287**
Total LPAHs		0.0357 U	0.0360 U	0.0357 U	**6.093**	**0.0357** UJ	0.0360 U	**115.4**	0.0357 U	0.0360 U	**15.08**
Total HPAHs		0.0655 U	0.0660 U	0.0655 U	**0.044**	**0.0655** UJ	0.0660 U	**3.349**	0.0655 U	0.0660 U	**0.0917**
Total CPAHs		0.0536 U	0.0540 U	0.0536 U	0.054 U	**0.0536** UJ	0.0540 U	0.1288	0.0536 U	0.0540 U	0.0540 U
Total PAHs		0.1012 U	0.1020 U	0.1012 U	**6.137**	**0.1012** UJ	0.1020 U	**118.7**	0.1012 U	0.1020 U	**15.17**
Field Parameters (pre-/post-sample)											
Temperature (°C)		7.70 / 8.06	NA	8.02 / 8.06	8.20 / 8.38	8.00 / 8.08	8.14 / 8.92	8.93 / 9.17	7.10 / 7.11	6.87 / 7.14	6.96 / 7.02
Specific Conductance (mS/cm)		0.079 / 0.080	NA	0.079 / 0.079	0.710 / 0.707	0.079 / 0.079	0.079 / 0.079	1.300 / 1.280	0.078 / 0.078	0.078 / 0.078	0.297 / 0.266
Dissolved Oxygen (mg/L)		10.58 / 11.00	NA	10.23 / 10.63	0.92 / 0.76	10.56 / 10.50	10.34 / 10.98	0.80 / 0.60	10.60 / 10.62	10.52 / 10.90	0.52 / 0.59
pH		7.96 / 7.95	NA	7.65 / 7.66	7.08 / 7.32	7.72 / 7.59	7.57 / 7.74	7.15 / 7.71	7.67 / 7.57	7.57 / 7.43	6.90 / 7.18
Oxidation Reduction Potential (mV)		93 / 72	NA	92 / 93	112 / 73	-4 / 14	30 / 39	-47 / -94	103 / 103	102 / 102	-3 / -33
Turbidity (NTU)		24.0 / 36.0	NA	72.8 / 46.0	15.9 / 10.2	19.8 / 20.4	180 / 62.3	114 / 113	23.5 / 27.6	64.8 / 29.6	39.6 / 32.5
Total Dissolved Solids (mg/L)		0.1 / 0.1	NA	0.1 / 0.1	0.5 / 0.5	0.1 / 0.1	0.1 / 0.1	0.8 / 0.8	0.1 / 0.1	0.1 / 0.1	0.2 / 0.2

Please refer to notes on last page of this table.

Table D-1
Surface, Inter-Armoring, and Sub-Armoring Water Data: Spring 2008
McCormick and Baxter Superfund Site
Portland, Oregon

SAMPLE LOCATION		Location 11			Location 12				Location 13			
Sample Type		Surface Water	Inter-Armoring	Sub-Armoring	Surface Water	Surface Water	Inter-Armoring	Sub-Armoring	Surface Water	Inter-Armoring	Inter-Armoring	Sub-Armoring
Sample ID		MBSW0408-11	MBIA0408-11	MBSA0408-11	MBSW0408-12	MBSW0408-12D	MBIA0408-12	MBSA0408-12	MBSW0408-13	MBIA0408-13	MBIA0408-13D	MBSA0408-13
Sample Date		3/31/2008	3/31/2008	3/31/2008	4/2/2008	4/2/2008	4/2/2008	4/2/2008	4/1/2008	4/1/2008	4/1/2008	4/1/2008
Sample Time		11:55	12:25	12:55	13:50	13:50	14:20	14:50	15:40	15:50	15:50	16:45
CONTAMINANT OF CONCERN												
Dissolved Metals (mg/L)												
Arsenic		0.000664 U	0.000664 U	**0.00112**	0.000664 U	0.000664 U	0.000664 U	**0.0316**	0.000664 U	0.000664 U	0.000664 U	**0.00108**
Chromium (III)		0.000121 U	0.000121 U	0.000121 U	0.000121 U	0.000121 U	0.000121 U	**0.000121** J	**0.00019** J	0.000121 U	**0.00016** J	0.000121 U
Copper		**0.000403** J	**0.000831** J	0.000133 U	**0.00165** J	**0.000758** J	**0.000964** J	**0.000286** J	**0.00455**	**0.00538**	**0.00089** J	**0.00054** J
Zinc		**0.00188** J	**0.00191** J	**0.00824**	0.005 U	0.005 U	0.005 U	**0.00564**	0.005 U	**0.00214** J	**0.00202** J	**0.001** J
Total Metals (mg/L)												
Arsenic		0.000664 U	0.000664 U	0.00136	0.000664 U	0.000664 U	0.000664 U	0.024	0.000664 U	0.000664 U	0.000664 U	0.001
Chromium (III)		0.001 U	0.001 U	0.000121 U	**0.000405** J	**0.00049** J	**0.000413** J	**0.00122**	**0.00052** J	**0.00039** J	**0.00062** J	0.000121 U
Copper		**0.00118** J	**0.00105** J	**0.00017** J	**0.000817** J	**0.00348**	**0.000926** J	**0.00106** J	0.002 U	0.002 U	0.002 U	0.000133 U
Zinc		0.005 U	0.005 U	**0.0125**	0.005 U	0.005 U	0.005 U	**0.0207**	0.005 U	0.005 U	0.005 U	0.005 U
Pentachlorophenol (µg/L)		0.238 U	0.238 U	0.238 U	0.239 U	0.24 U	0.242 U	0.245 U	0.24 U	0.24 U	0.24 U	0.24 U
Polynuclear aromatic hydrocarbons (µg/L)												
Acenaphthene	L	0.0119 U	0.0119 U	0.0119 U	0.0120 U	0.0120 U	**0.0441**	**0.366**	**0.0561**	0.012 U	0.012 U	0.012 U
Acenaphthylene	L	0.0119 U	0.0119 U	0.0119 U	0.0120 U	0.0120 U	0.0121 U	0.0123 U	0.012 U	0.012 U	0.012 U	0.012 U
Anthracene	L	0.0119 U	0.0119 U	0.0119 U	0.0120 U	0.0120 U	0.0121 U	**0.0281**	0.012 U	0.012 U	0.012 U	0.012 U
Benzo (a) anthracene	H, C	0.0119 U	0.0119 U	0.0119 U	0.0120 U	0.0120 U	0.0121 U	0.0123 U	0.012 U	0.012 U	0.012 U	0.012 U
Benzo (a) pyrene	H, C	0.0119 U	0.0119 U	0.0119 U	0.0120 U	0.0120 U	0.0121 U	0.0123 U	0.012 U	0.012 U	0.012 U	0.012 U
Benzo (b) fluoranthene	H, C	0.0119 U	0.0119 U	0.0119 U	0.0120 U	0.0120 U	0.0121 U	0.0123 U	0.012 U	0.012 U	0.012 U	0.012 U
Benzo (ghi) perylene	H, C	0.0119 U	0.0119 U	0.0119 U	0.0120 U	0.0120 U	0.0121 U	0.0123 U	0.012 U	0.012 U	0.012 U	0.012 U
Benzo (k) fluoranthene	H, C	0.0119 U	0.0119 U	0.0119 U	0.0120 U	0.0120 U	0.0121 U	0.0123 U	0.012 U	0.012 U	0.012 U	0.012 U
Chrysene	H, C	0.0119 U	0.0119 U	0.0119 U	0.0120 U	0.0120 U	0.0121 U	0.0123 U	0.012 U	0.012 U	0.012 U	0.012 U
Dibenzo (a,h) anthracene	H, C	0.0238 U	0.0238 U	0.0238 U	0.0239 U	0.024 U	0.0242 U	0.0245 U	0.024 U	0.024 U	0.024 U	0.024 U
Fluoranthene	H	0.0119 U	0.0119 U	0.0119 U	0.0120 U	0.0120 U	0.0121 U	**0.0162** J	0.012 U	0.012 U	0.012 U	0.012 U
Fluorene	L	0.0119 U	0.0119 U	0.0119 U	0.0120 U	0.0120 U	**0.0124** J	**0.17**	**0.0192** J	0.012 U	0.012 U	0.012 U
Indeno (1,2,3-cd) pyrene	H, C	0.0119 U	0.0119 U	0.0119 U	0.0120 U	0.0120 U	0.0121 U	0.0123 U	0.012 U	0.012 U	0.012 U	0.012 U
Naphthalene	L	0.0119 U	0.0119 U	0.0119 U	0.0120 U	0.0120 U	**0.0324**	0.0368 U	**0.044**	0.012 U	0.012 U	**0.0157** J
Phenanthrene	L	0.0119 U	0.0119 U	0.0119 U	0.0120 U	0.0120 U	0.0121 U	**0.249**	0.012 U	0.012 U	0.012 U	0.012 U
Pyrene	H	0.0119 U	0.0119 U	**0.0193** J	0.0120 U	0.0120 U	0.0121 U	**0.0138** J	0.012 U	0.012 U	0.012 U	0.012 U
Total LPAHs		0.0357 U	0.0357 U	0.0357 U	0.0360 U	0.0360 U	**0.0889** J	**0.03**	**0.1193** J	0.0360 U	0.0360 U	**0.0157** J
Total HPAHs		0.0655 U	0.0655 U	**0.0193** J	0.0660 U	0.0660 U	0.0666 U	**0.8131** J	0.066 U	0.0660 U	0.0660 U	0.0660 U
Total CPAHs		0.0536 U	0.0536 U	0.05355 U	0.0540 U	0.0540 U	0.0545 U	0.0553 U	0.054 U	0.0540 U	0.0540 U	0.0540 U
Total PAHs		0.1012 U	0.1012 U	**0.0193** J	0.1020 U	0.1020 U	**0.0889** J	**0.8431** J	**0.1193** J	0.1020 U	0.1020 U	**0.0157** J
Field Parameters (pre-/post-sample)												
Temperature (°C)		7.47 / 7.37	7.19 / 7.69	8.06 / 8.35	8.39 / 8.67	NA	9.01 / 9.10	10.07 / 9.93	9.93 / 10.04	9.47 / 9.69	NA	11.0 / 11.05
Specific Conductance (mS/cm)		0.079 / 0.081	0.077 / 0.077	0.607 / 0.612	0.079 / 0.079	NA	0.079 / 0.079	0.628 / 0.631	0.080 / 0.079	0.080 / 0.080	NA	0.473 / 0.476
Dissolved Oxygen (mg/L)		7.69 / 12.4	10.90 / 10.64	1.591 / 1.421	10.53 / 10.63	NA	10.21 / 10.42	2.46 / 1.27	10.34 / 10.38	9.94 / 10.36	NA	0.29 / 1.01
pH		7.76 / 7.35	8.06 / 7.84	7.40 / 7.40	7.40 / 7.61	NA	7.69 / 7.51	6.88 / 7.21	7.57 / 7.57	7.42 / 7.50	NA	6.80 / 7.07
Oxidation Reduction Potential (mV)		-15 / 41	42 / 55	46 / 28	79 / 71	NA	68 / 76	-15 / -71	-17 / 11	21 / 50	NA	-37 / -71
Turbidity (NTU)		131 / 14.6	29.0 / 19.0	5.9 / 2.1	22.3 / 40.1	NA	53.8 / 65.6	66.0 / 76.6	24.4 / 34.9	23.4 / 40.2	NA	8.3 / 11.7
Total Dissolved Solids (mg/L)		0.1 / 0.1	0.1 / 0.1	0.4 / 0.4	0.1 / 0.1	NA	0.1 / 0.1	0.4 / 0.4	0.1 / 0.1	0.1 / 0.1	NA	0.3 / 0.3

Please refer to notes on last page of this table.

Table D-1
Surface, Inter-Armoring, and Sub-Armoring Water Data: Spring 2008
McCormick and Baxter Superfund Site
Portland, Oregon

SAMPLE LOCATION		Location 14			Location 15			Location 16		
Sample Type		Surface Water	Inter-Armoring	Sub-Armoring	Surface Water	Inter-Armoring	Sub-Armoring	Surface Water	Inter-Armoring	Sub-Armoring
Sample ID		MBSW0408-14	MBIA0408-14	MBSA0408-14	MBSW0408-15	MBIA0408-15	MBSA0408-15	MBSW0408-16	MBIA0408-16	MBSA0408-16
Sample Date		3/31/2008	3/31/2008	3/31/2008	4/2/2008	4/2/2008	4/2/2008	4/1/2008	4/1/2008	4/1/2008
Sample Time		9:30	9:50	11:30	10:40	11:00	12:20	11:20	12:30	13:05
CONTAMINANT OF CONCERN										
Dissolved Metals (mg/L)										
Arsenic		0.000664 U	0.000664 U	**0.0152**	0.000664 U	0.000664 U	0.000664 U	0.000664 U	0.000664 U	**0.01**
Chromium (III)		0.000121 U	0.000121 U	0.000121 U	0.000121 U	0.000121 U	0.000121 U	**0.00014** J	**0.00016** J	**0.00017** J
Copper		**0.000573** J	**0.000977** J	0.000133 U	**0.000943** J	**0.00114** J	**0.00228**	0.002 U	0.002 U	0.000133 U
Zinc		**0.00132** J	**0.00193** J	**0.00828**	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U
Total Metals (mg/L)										
Arsenic		0.000664 U	**0.00078** J	**0.0142**	0.000664 U	0.000664 U	0.000664 U	0.000664 U	0.000664 U	**0.00924**
Chromium (III)		0.001 U	**0.00229**	0.001 U	**0.00056** J	**0.000549** J	**0.00121**	**0.0004** J	**0.0006** J	**0.00081** J
Copper		**0.00125** J	**0.00455**	0.000133 U	**0.000906** J	**0.0026**	**0.00243**	0.002 U	0.002 U	0.002 U
Zinc		0.005 U	**0.0107**	**0.00847**	0.005 U	0.005 U	**0.00591**	0.005 U	0.005 U	0.005 U
Pentachlorophenol (µg/L)		0.238 U	0.238 U	0.238 U	0.242 U	0.246 U	0.239 U	0.24 U	0.24 U	0.24 U
Polynuclear aromatic hydrocarbons (µg/L)										
Acenaphthene	L	0.0119 U	0.0119 U	**1.9**	0.0121 U	0.0123 U	**0.0671**	0.012 U	0.012 U	**24.6**
Acenaphthylene	L	0.0119 U	0.0119 U	0.0238 U	0.0121 U	0.0123 U	0.012 U	0.012 U	0.012 U	0.0962 U
Anthracene	L	0.0119 U	0.0119 U	**0.0571**	0.0121 U	0.0123 U	0.012 U	0.012 U	0.012 U	**0.516**
Benzo (a) anthracene	H, C	0.0119 U	0.0119 U	0.0119 U	0.0121 U	0.0123 U	0.012 U	0.012 U	0.012 U	0.176
Benzo (a) pyrene	H, C	0.0119 U	0.0119 U	0.0119 U	0.0121 U	0.0123 U	0.012 U	0.012 U	0.012 U	0.0375
Benzo (b) fluoranthene	H, C	0.0119 U	0.0119 U	0.0119 U	0.0121 U	0.0123 U	0.012 U	0.012 U	0.012 U	0.0458
Benzo (ghi) perylene	H, C	0.0119 U	0.0119 U	0.0119 U	0.0121 U	0.0123 U	0.012 U	0.012 U	0.012 U	0.0131 J
Benzo (k) fluoranthene	H, C	0.0119 U	0.0119 U	0.0119 U	0.0121 U	0.0123 U	0.012 U	0.012 U	0.012 U	0.0437
Chrysene	H, C	0.0119 U	0.0119 U	0.0119 U	0.0121 U	0.0123 U	0.012 U	0.012 U	0.012 U	**0.146**
Dibenzo (a,h) anthracene	H, C	0.0238 U	0.0238 U	0.0238 U	0.0242 U	0.0246 U	0.0239 U	0.024 U	0.024 U	0.024 U
Fluoranthene	H	0.0119 U	0.0119 U	**0.151**	0.0121 U	0.0123 U	0.012 U	0.012 U	0.012 U	**1.37**
Fluorene	L	0.0119 U	0.0119 U	**0.693**	0.0121 U	0.0123 U	**0.0148** J	0.012 U	0.012 U	**8.46**
Indeno (1,2,3-cd) pyrene	H, C	0.0119 U	0.0119 U	0.0119 U	0.0121 U	0.0123 U	0.012 U	0.012 U	0.012 U	0.012 U
Naphthalene	L	0.0119 U	0.0119 U	**0.115**	0.0121 U	**0.0147** J	0.012 U	0.012 U	0.012 U	0.192 U
Phenanthrene	L	0.0119 U	0.0119 U	**0.895**	0.0121 U	0.0123 U	0.012 U	0.012 U	0.012 U	**6.1**
Pyrene	H	0.0119 U	0.0119 U	**0.0741**	0.0121 U	0.0123 U	0.012 U	0.012 U	0.012 U	**0.835**
Total LPAHs		0.0357 U	0.0357 U	**3.660**	0.0363 U	**0.0147** J	**0.0819**	0.0360 U	0.0360 U	**39.68**
Total HPAHs		0.0655 U	0.0655 U	**0.2251**	0.0666 U	0.0677 U	0.0660 U	0.0660 U	0.0660 U	**1.832**
Total CPAHs		0.0536 U	0.0536 U	0.05365 U	0.0545 U	0.0554 U	0.0540 U	0.0540 U	0.0540 U	0.4621 J
Total PAHs		0.1012 U	0.1012 U	**3.885**	0.1029 U	**0.0147** J	**0.0819**	0.1020 U	0.1020 U	**42.34**
Field Parameters (pre-/post-sample)										
Temperature (°C)		7.14 / 7.14	7.30 / 7.30	8.02 / 7.82	7.30 / 7.26	7.47 / 9.49	7.82 / 8.40	7.60 / 7.54	8.10 / 7.92	8.75 / 9.59
Specific Conductance (mS/cm)		0.080 / 0.081	0.081 / 0.081	1.269 / 1.184	0.079 / 0.079	0.079 / 0.080	0.111 / 0.103	0.077 / 0.077	0.077 / 0.077	1.046 / 1.058
Dissolved Oxygen (mg/L)		11.15 / 12.28	10.30 / 10.55	2.42 / 0.8	10.78 / 10.91	10.08 / 10.76	1.69 / 2.00	10.39 / 10.56	10.21 / 10.34	0.49 / 0.47
pH		7.85 / 7.77	7.51 / 8.11	7.18 / 7.68	7.90 / 7.62	7.95 / 7.73	7.36 / 7.09	7.76 / 7.70	7.62 / 7.64	6.70 / 7.06
Oxidation Reduction Potential (mV)		84 / 90	65 / 61	-36 / -39	48 / 57	39 / 73	82 / 81	45 / 62	82 / 82	-32 / -58
Turbidity (NTU)		31.6 / 20.7	295 / 103	58.3 / 88.8	20.6 / 21.4	25.7 / 27.0	127 / 123	35.2 / 39.6	52.5 / 36.0	112 / 104
Total Dissolved Solids (mg/L)		0.1 / 0.1	0.4 / 0.1	0.8 / 0.8	0.1 / 0.1	0.1 / 0.1	0.1 / 0.1	0.1 / 0.1	0.1 / 0.1	0.7 / 0.7

Please refer to notes on last page of this table.

Table D-1
Surface, Inter-Armoring, and Sub-Armoring Water Data: Spring 2008
McCormick and Baxter Superfund Site
Portland, Oregon

SAMPLE LOCATION		Location 17			Location 18			Location 19		
Sample Type		Surface Water	Inter-Armoring	Sub-Armoring	Surface Water	Inter-Armoring	Sub-Armoring	Surface Water	Inter-Armoring	Sub-Armoring
Sample ID		MBSW0408-17	MBIA0408-17	MBSA0408-17	MBSW0408-18	MBIA0408-18	MBSA0408-18	MBSW0408-19	MBIA0408-19	MBSA0408-19
Sample Date		4/4/2008	4/4/2008	4/4/2008	4/3/2008	4/3/2008	4/3/2008	4/4/2008	4/4/2008	4/4/2008
Sample Time		11:00	11:15	11:32	9:45	10:00	10:20	11:52	12:12	12:25
CONTAMINANT OF CONCERN										
Dissolved Metals (mg/L)										
Arsenic		0.000664 U	0.000664 U	**0.00111**	0.000664 U	0.000664 U	**0.0338**	0.000664 U	0.000664 U	**0.00383**
Chromium (III)		**0.000186** J	**0.000246** J	0.000121 U	0.000121 U	0.000121 U	**0.000213** J	**0.000172** J	**0.000199** J	0.000121 U
Copper		**0.00254**	0.002 U	0.002 U	**0.000483** J	**0.000774** J	**0.000385** J	0.002 U	0.002 U	0.002 U
Zinc		0.005 U	0.005 U	0.005 U	**0.00196** J	**0.00273** J	**0.0221**	0.005 U	0.005 U	**0.00628**
Total Metals (mg/L)										
Arsenic		0.000664 U	0.000664 U	**0.0013**	0.000664 U	0.000664 U	**0.0256**	0.000664 U	0.000664 U	**0.00326**
Chromium (III)		0.000121 U	**0.000249** J	**0.000556** J	**0.00097** J	**0.00056** J	0.000121 U	**0.000164** J	**0.000252** J	0.000121 U
Copper		**0.000809** J	**0.00181** J	**0.00421**	**0.00189** J	**0.00144** J	0.000133 U	**0.00109** J	**0.00161** J	**0.000425** J
Zinc		0.005 U	0.005 U	**0.0144**	0.005 U	0.005 U	**0.0163**	0.005 U	0.005 U	**0.0054**
Pentachlorophenol (µg/L)		**0.243** UJ	**0.24** UJ	**0.24** UJ	0.238 U	0.238 U	0.238 U	**0.24** UJ	**0.238** UJ	0.24 U
Polynuclear aromatic hydrocarbons (µg/L)										
Acenaphthene	L	0.0121 U	0.0120 U	0.0120 U	0.0119 U	**0.0194** J	**37.8**	0.0120 U	0.0119 U	0.0120 U
Acenaphthylene	L	0.0121 U	0.0120 U	0.0120 U	0.0119 U	0.0119 U	0.19 U	0.0120 U	0.0119 U	0.0120 U
Anthracene	L	0.0121 U	0.0120 U	0.0120 U	0.0119 U	0.0119 U	**0.33**	0.0120 U	0.0119 U	0.0120 U
Benzo (a) anthracene	H, C	0.0121 U	0.0120 U	0.0120 U	0.0119 U	0.0119 U	0.0119 U	0.0120 U	0.0119 U	0.0120 U
Benzo (a) pyrene	H, C	**0.0121** UJ	**0.0120** UJ	**0.0120** UJ	0.0119 U	0.0119 U	0.0119 U	**0.0120** UJ	**0.0119** UJ	**0.0120** UJ
Benzo (b) fluoranthene	H, C	0.0121 U	0.0120 U	0.0120 U	0.0119 U	0.0119 U	0.0119 U	0.0120 U	0.0119 U	0.0120 U
Benzo (ghi) perylene	H, C	0.0121 U	0.0120 U	0.0120 U	0.0119 U	0.0119 U	0.0119 U	0.0120 U	0.0119 U	0.0120 U
Benzo (k) fluoranthene	H, C	0.0121 U	0.0120 U	0.0120 U	0.0119 U	0.0119 U	0.0119 U	0.0120 U	0.0119 U	0.0120 U
Chrysene	H, C	0.0121 U	0.0120 U	0.0120 U	0.0119 U	0.0119 U	0.0119 U	0.0120 U	0.0119 U	0.0120 U
Dibenzo (a,h) anthracene	H, C	0.0243 U	0.024 U	0.024 U	0.0238 U	0.0238 U	0.0238 U	0.0240 U	0.0238 U	0.0240 U
Fluoranthene	H	0.0121 U	0.0120 U	**0.0285**	0.0119 U	0.0119 U	**0.249**	0.0120 U	0.0119 U	0.0120 U
Fluorene	L	0.0121 U	0.0120 U	0.0120 U	0.0119 U	0.0119 U	**12.6**	0.0120 U	0.0119 U	0.0120 U
Indeno (1,2,3-cd) pyrene	H, C	0.0121 U	0.0120 U	0.0120 U	0.0119 U	0.0119 U	0.0119 U	0.0120 U	0.0119 U	0.0120 U
Naphthalene	L	**0.0166** J	**0.0235** J	0.0120 U	0.0119 U	0.0119 U	**2.09**	0.0120 U	0.0119 U	0.0120 U
Phenanthrene	L	0.0121 U	0.0120 U	0.0120 U	0.0119 U	0.0119 U	**2.38**	0.0120 U	0.0119 U	0.0120 U
Pyrene	H	0.0121 U	0.0120 U	0.0120 U	0.0119 U	0.0119 U	**0.614**	0.0120 U	0.0119 U	0.0120 U
Total LPAHs		**0.0166** J	**0.0235** J	0.0360 U	0.0357 U	**0.0194** J	**55.20**	0.0360 U	0.0357 U	0.0360 U
Total HPAHs		0.0666 U	0.0660 U	**0.0285**	0.0655 U	0.0655 U	**0.8630**	0.0660 U	0.0655 U	0.0660 U
Total CPAHs		0.0545 U	0.0540 U	0.0540 U	0.0536 U	0.0536 U	0.0536 U	0.0540 U	0.0536 U	0.0540 U
Total PAHs		**0.0166** J	**0.0235** J	**0.0285**	0.1012 U	**0.0194** J	**56.06**	0.1020 U	0.1012 U	0.1020 U
Field Parameters (pre-/post-sample)										
Temperature (°C)		8.45 / 8.92	8.84 / 8.96	9.25 / 9.77	7.62 / 7.65	7.64 / 7.71	8.21 / 8.39	12.17 / 12.35	11.37 / 11.35	9.42 / 9.64
Specific Conductance (mS/cm)		0.084 / 0.084	0.085 / 0.085	0.196 / 0.163	0.080 / 0.079	0.081 / 0.088	0.762 / 0.744	0.085 / 0.085	0.084 / 0.084	0.191 / 0.190
Dissolved Oxygen (mg/L)		10.52 / 10.61	10.54 / 10.60	2.78 / 0.60	10.42 / 10.91	10.69 / 10.69	2.97 / 2.71	11.36 / 11.57	10.88 / 11.02	0.75 / 0.40
pH		7.32 / 7.42	7.35 / 7.45	7.22 / 7.53	8.15 / 7.81	7.84 / 7.70	6.83 / 7.19	8.05 / 8.07	8.17 / 8.25	7.60 / 7.36
Oxidation Reduction Potential (mV)		-1 / 7	17 / 23	29 / 21	46 / 65	68 / 76	-24 / -59	2 / 7	16 / 22	46 / 48
Turbidity (NTU)		25.3 / 29.8	73.3 / 61.0	58.9 / 72.8	34.6 / 35.9	99.3 / 26.3	12.0 / 18.5	25.5 / 28.3	41.4 / 28.86	15.0 / 15.9
Total Dissolved Solids (mg/L)		0.1 / 0.1	0.1 / 0.1	0.1 / 0.1	0.1 / 0.1	0.1 / 0.1	0.5 / 0.5	0.1 / 0.1	0.1 / 0.1	0.1 / 0.1

Please refer to notes on last page of this table.

Table D-1
Surface, Inter-Armoring, and Sub-Armoring Water Data: Spring 2008
McCormick and Baxter Superfund Site
Portland, Oregon

SAMPLE LOCATION		Location 20			Location 21			Location 25		
Sample Type		Surface Water	Inter-Armoring	Sub-Armoring	Surface Water	Inter-Armoring	Sub-Armoring	Surface Water	Inter-Armoring	Sub-Armoring
Sample ID		MBSW0408-20	MBIA0408-20	MBSA0408-20	MBSW0408-21	MBIA0408-21	MBSA0408-21	MBSW0408-25	MBIA0408-25	MBSA0408-25
Sample Date		4/2/2008	4/2/2008	4/2/2008	4/1/2008	4/1/2008	4/1/2008	4/3/2008	4/3/2008	4/3/2008
Sample Time		9:25	9:50	10:10	14:30	14:55	15:15	16:45	17:12	17:55
CONTAMINANT OF CONCERN										
Dissolved Metals (mg/L)										
Arsenic		0.000664 U	0.000664 U	**0.00112**	0.000664 U	0.000664 U	**0.00733**	0.000664 U	0.000664 U	**0.000807** J
Chromium (III)		0.000121 U	0.000121 U	0.000121 U	**0.00018** J	**0.00015** J	**0.00013** J	**0.000185** J	**0.000134** J	**0.00025** J
Copper		**0.0013** J	**0.00127** J	**0.000685** J	0.002 U	0.002 U	0.000133 U	0.002 U	0.002 U	0.002 U
Zinc		0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	**0.0136**	0.005 U	0.005 U
Total Metals (mg/L)										
Arsenic		0.000664 U	0.000664 U	**0.000988** J	0.000664 U	0.000664 U	**0.00695**	0.000664 U	0.000664 U	**0.00076** J
Chromium (III)		**0.000396** J	**0.000473** J	**0.000226** J	**0.00039** J	**0.00044** J	**0.0002** J	**0.000864** J	**0.000354** J	0.000121 U
Copper		**0.000899** J	**0.000972** J	**0.00117** J	0.002 U	0.002 U	0.000133 U	**0.00283**	**0.00189** J	**0.00173** J
Zinc		0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	**0.0125**	**0.0128**	0.005 U
Pentachlorophenol (µg/L)		0.238 U	0.238 U	0.24 U	0.24 U	0.244 U	0.24 U	**0.238** UJ	**0.238** UJ	**0.236** UJ
Polynuclear aromatic hydrocarbons (µg/L)										
Acenaphthene	L	0.0119 U	0.0119 U	**1.32**	0.012 U	0.0122 U	**0.0436**	**0.0397**	0.0119 U	0.0118 U
Acenaphthylene	L	0.0119 U	0.0119 U	**0.0366**	0.012 U	0.0122 U	0.012 U	0.0119 U	0.0119 U	0.0118 U
Anthracene	L	0.0119 U	0.0119 U	**0.0156** J	0.012 U	0.0122 U	**0.0182** J	0.0119 U	0.0119 U	0.0118 U
Benzo (a) anthracene	H, C	0.0119 U	0.0119 U	0.012 U	0.012 U	0.0122 U	0.012 U	0.0119 U	0.0119 U	0.0118 U
Benzo (a) pyrene	H, C	0.0119 U	0.0119 U	0.012 U	0.012 U	0.0122 U	0.012 U	**0.0119** UJ	**0.0119** UJ	**0.0118** UJ
Benzo (b) fluoranthene	H, C	0.0119 U	0.0119 U	0.012 U	0.012 U	0.0122 U	0.012 U	0.0119 U	0.0119 U	0.0118 U
Benzo (ghi) perylene	H, C	0.0119 U	0.0119 U	0.012 U	0.012 U	0.0122 U	0.012 U	0.0119 U	0.0119 U	0.0118 U
Benzo (k) fluoranthene	H, C	0.0119 U	0.0119 U	0.012 U	0.012 U	0.0122 U	0.012 U	0.0119 U	0.0119 U	0.0118 U
Chrysene	H, C	0.0119 U	0.0119 U	0.012 U	0.012 U	0.0122 U	0.012 U	0.0119 U	0.0119 U	0.0118 U
Dibenzo (a,h) anthracene	H, C	0.0238 U	0.0238 U	0.024 U	0.024 U	0.0244 U	0.024 U	0.0238 U	0.0238 U	0.0236 U
Fluoranthene	H	0.0119 U	0.0119 U	**0.0156** J	0.012 U	0.0122 U	0.012 U	0.0119 U	0.0119 U	0.0118 U
Fluorene	L	0.0119 U	0.0119 U	**0.191**	0.012 U	0.0122 U	**0.0135** J	**0.0144** J	0.0119 U	0.0118 U
Indeno (1,2,3-cd) pyrene	H, C	0.0119 U	0.0119 U	0.012 U	0.012 U	0.0122 U	0.012 U	0.0119 U	0.0119 U	0.0118 U
Naphthalene	L	0.0119 U	0.0119 U	**0.0339**	0.012 U	**0.0143** J	0.012 U	**0.0934**	**0.0139** J	0.0118 U
Phenanthrene	L	0.0119 U	0.0119 U	0.012 U	0.012 U	0.0122 U	0.012 U	0.0119 U	0.0119 U	0.0118 U
Pyrene	H	0.0119 U	0.0119 U	0.012 U	0.012 U	0.0122 U	0.012 U	0.0119 U	0.0119 U	0.0118 U
Total LPAHs		0.0357 U	0.0357 U	**1.597** J	0.0360 U	**0.0143** J	**0.0753** J	**0.1475** J	**0.0139** J	0.0354 U
Total HPAHs		0.0655 U	0.0655 U	**0.0156** J	0.0660 U	0.0671 U	0.0660 U	0.0655 U	0.0655 U	0.0649 U
Total CPAHs		0.0536 U	0.0536 U	0.0540 U	0.0540 U	0.0549 U	0.0540 U	0.0536 U	0.0536 U	0.0531 U
Total PAHs		0.1012 U	0.1012 U	**1.613** J	0.1020 U	**0.0143** J	**0.0753** J	**0.1475** J	**0.0139** J	0.1003 U
Field Parameters (pre-/post-sample)										
Temperature (°C)		7.01 / 7.00	7.08	7.33 / 7.40	8.70 / 8.73	10.44 / 11.85	11.44 / 11.41	19384 / 14.08	13.94 / 13.72	10.93 / 11.06
Specific Conductance (mS/cm)		0.079 / 0.079	0.079	0.268 / 0.266	0.079 / 0.079	0.196 / 0.114	0.719 / 0.723	0.085 / 0.078	0.077 / 0.077	0.091 / 0.089
Dissolved Oxygen (mg/L)		10.19 / 11.08	10.79	0.57 / 0.60	10.44 / 10.46	7.14 / 7.54	1.24 / 1.21	8.95 / 11.47	11.64 / 9.94	5.38 / 4.97
pH		7.47 / 7.36	7.6	7.11 / 7.12	7.56 / 7.55	7.03 / 7.37	6.77 / 7.17	8.27 / 8.33	8.47 / 7.99	7.43 / 7.17
Oxidation Reduction Potential (mV)		10 /19	27	57 / 60	45 / 52	15 / 9	-37 / -71	54 / 72	70 / 79	101 / 117
Turbidity (NTU)		23.5 / 24.0	52.4	52.4 / 36.6	21.4 / 23.8	72.6 / 48.3	7.8 / 8.2	32.1 / 42.3	116 / 110	101 / 114
Total Dissolved Solids (mg/L)		0.1 / 0.1	0.1	0.2 / 0.2	0.1 / 0.1	0.1 / 0.1	0.5 / 0.5	0.1 / 0.1	0.1 / 0.1	0.1 / 0.1

Please refer to notes on last page of this table.

Table D-1
Surface, Inter-Armoring, and Sub-Armoring Water Data: Spring 2008
McCormick and Baxter Superfund Site
Portland, Oregon

SAMPLE LOCATION		Location 26			Location 27	Location 02	Location 04	Location 05	Location 13
Sample Type		Surface Water	Inter-Armoring	Sub-Armoring	Surface Water	Sub-Armoring	Inter-Armoring	Sub-Armoring	Inter-Armoring
Sample ID		MBSW0408-26	MBIA0408-26	MBSA0408-26	MBSW0408-27	MBSA0408-02R	MBIA0408-04R	MBSA0408-05R	MBIA0408-13R
Sample Date		4/4/2008	4/4/2008	4/4/2008	3/31/2008	3/31/2008	4/3/2008	4/3/2008	4/1/2008
Sample Time		7:50	8:10	8:30	9:05	16:30	14:45	14:50	17:30
CONTAMINANT OF CONCERN									
Dissolved Metals (mg/L)									
Arsenic		0.000664 U	0.000664 U	**0.00417**	0.000664 U	0.000664 U		0.000664 U	
Chromium (III)		**0.000319** J	**0.000179** J	0.000121 U	0.000121 U	0.000121 U		0.000121 U	
Copper		0.002 U	0.002 U	0.000133 U	**0.000448** J	0.000133 U		0.000133 U	
Zinc		0.005 U	0.005 U	0.005 U	**0.00135** J	**0.00073** J		**0.000577** J	
Total Metals (mg/L)									
Arsenic		0.000664 UJ	0.000664 U	0.00359	0.000664 U	0.000664 U	0.000664 U	0.000664 U	0.000664 U
Chromium (III)		**0.000195** J	**0.000599** J	0.000121 U	0.001 U	0.000121 U	0.000121 U	0.000121 U	0.000121 U
Copper		**0.000851** J	**0.00198** J	0.000133 U	**0.00111** J	0.000133 U	0.000133 U	0.000133 U	0.000133 U
Zinc		0.005 U	**0.00673**	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U
Pentachlorophenol (µg/L)		**0.24** UJ	**0.239** UJ	**0.24** UJ	0.238 U	0.238 U	0.238 U	0.238 U	0.245 U
Polynuclear aromatic hydrocarbons (µg/L)									
Acenaphthene	L	0.0120 U	0.0120 U	0.0120 U	0.0119 U	0.0119 U	0.0119 U	0.0119 U	0.0123 U
Acenaphthylene	L	0.0120 U	0.0120 U	0.0120 U	0.0119 U	0.0119 U	0.0119 U	0.0119 U	0.0123 U
Anthracene	L	0.0120 U	0.0120 U	0.0120 U	0.0119 U	0.0119 U	0.0119 U	0.0119 U	0.0123 U
Benzo (a) anthracene	H, C	0.0120 U	0.0120 U	0.0120 U	0.0119 U	0.0119 U	0.0119 U	0.0119 U	0.0123 U
Benzo (a) pyrene	H, C	**0.0120** UJ	**0.0120** UJ	**0.0120** UJ	0.0119 U	0.0119 U	0.0119 U	0.0119 U	0.0123 U
Benzo (b) fluoranthene	H, C	0.0120 U	0.0120 U	0.0120 U	0.0119 U	0.0119 U	0.0119 U	0.0119 U	0.0123 U
Benzo (ghi) perylene	H, C	0.0120 U	0.0120 U	0.0120 U	0.0119 U	0.0119 U	0.0119 U	0.0119 U	0.0123 U
Benzo (k) fluoranthene	H, C	0.0120 U	0.0120 U	0.0120 U	0.0119 U	0.0119 U	0.0119 U	0.0119 U	0.0123 U
Chrysene	H, C	0.0120 U	0.0120 U	0.0120 U	0.0119 U	0.0119 U	0.0119 U	0.0119 U	0.0123 U
Dibenzo (a,h) anthracene	H, C	0.0240 U	0.0239 U	0.0240 U	0.0238 U	0.0238 U	0.0238 U	0.0238 U	0.0245 U
Fluoranthene	H	0.0120 U	0.0120 U	0.0120 U	0.0119 U	0.0119 U	0.0119 U	0.0119 U	0.0123 U
Fluorene	L	0.0120 U	0.0120 U	0.0120 U	0.0119 U	0.0119 U	0.0119 U	0.0119 U	0.0123 U
Indeno (1,2,3-cd) pyrene	H, C	0.0120 U	0.0120 U	0.0120 U	0.0119 U	0.0119 U	0.0119 U	0.0119 U	0.0123 U
Naphthalene	L	0.0120 U	0.0120 U	0.0120 U	0.0119 U	**0.0765**	**0.0342**	**0.0407**	**0.038**
Phenanthrene	L	0.0120 U	0.0120 U	0.0120 U	0.0119 U	0.0119 U	0.0119 U	0.0119 U	0.0123 U
Pyrene	H	0.0120 U	0.0120 U	0.0120 U	0.0119 U	0.0119 U	0.0119 U	0.0119 U	0.0123 U
Total LPAHs		0.0360 U	0.0360 U	0.0360 U	0.0357 U	**0.0765**	**0.0342**	**0.0407**	**0.0380**
Total HPAHs		0.0660 U	0.0660 U	0.0660 U	0.0655 U	0.0655 U	0.0655 U	0.0655 U	0.0676 U
Total CPAHs		0.0540 U	0.0540 U	0.0540 U	0.0536 U	0.0536 U	0.0536 U	0.0536 U	0.0553 U
Total PAHs		0.1020 U	0.1020 U	0.1020 U	0.1012 U	0.1335 U	**0.0342**	**0.0407**	**0.0380**
Field Parameters (pre-/post-sample)									
Temperature (°C)		8.00 / 8.01	7.98 / 8.00	8.35 / 8.31	7.24 / 7.56	NA	NA	NA	NA
Specific Conductance (mS/cm)		0.087 / 0.087	0.086 / 0.086	0.164 / 0.165	0.080 / 0.081	NA	NA	NA	NA
Dissolved Oxygen (mg/L)		10.09 / 10.00	10.19 / 10.62	0.77 / 0.65	11.00 / 11.11	NA	NA	NA	NA
pH		8.11 / 7.89	7.80 / 7.74	7.36 / 7.50	8.07 / 8.45	NA	NA	NA	NA
Oxidation Reduction Potential (mV)		82 / 89	92 / 90	77 / 26	93 / 70	NA	NA	NA	NA
Turbidity (NTU)		24.2 / 27.6	42.1 / 43.6	25.8 / 29.9	17.4 / 18.4	NA	NA	NA	NA
Total Dissolved Solids (mg/L)		0.1 / 0.1	0.1 / 0.1	0.1 / 0.1	0.1 / 0.1	NA	NA	NA	NA

Please refer to notes on last page of this table.

Table D-1
Surface, Inter-Armoring, and Sub-Armoring Water Data: Spring 2008
McCormick and Baxter Superfund Site
Portland, Oregon

Notes:

[1] The 1996 Record of Decision (ROD) specifies the remedial action objects 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 federal and state Ambient Water Quality Criteria (AWQCs).

[2] National Recommended Water Quality Criteria (NRWQCs) published as of August 15, 2007, are included for comparison (see http://www.epa.gov/waterscience/criteria/wqcriteria.html). The current publication includes criteria revisions published in 2002 National Recommended Water Quality Criteria: 2002 table (EPA-822-R-02-047) and 2003 Revised human Health Water Quality Criteria (EPA-822-F-03-012). Note that the aquatic life chronic criteria for pentachlorophenol has been adjusted to site-specific pH (7.5, representing a mid-range of the pH values measured in surface water at the site), and therefore differs from the standard table value. Criteria for metals (Cr, Cu, Zn) have not been adjusted for site-specific hardness. Carcinogenic risk-based numbers reflect a carcinogenicity risk of 10^{-6}.

[3] National Primary Drinking Water Regulations Maximum Contaminant Levels (MCLs) promulgated as of August 15, 2007, are included for comparison (see http://www.epa.gov/safewater/contaminants/index.html#primary).

The number of significant figures presented in the table do not reflect true accuracy presented by the laboratory results. Data should only retain 3 significant figures. Due to statistical evaluation using Microsoft Excel, additional significant figures may be shown.

The dissolved oxygen level meter was not always functioning correctly as noted by the readings that exceed 10 mg/L.

AWQC	Ambient Water Quality Criteria
C	Carcinogenic PAH (CPAH)
H	High Molecular Weight PAH (HPAH)
L	Low Molecular Weight PAH (LPAH)
J	Estimated Value
MCL	Drinking Water Maximum Contaminant Levels
MDL	Method Detection Limit
mg/L	milligrams per liter
PAH	Polynuclear aromatic hydrocarbons
ROD	Record of Decision
U	Value Below MDL (value represents MDL)
µg/L	micrograms per liter
Gamma	Gamma Distribution
NP	Non-parametric Distribution
NA	Not Available

Bold	Indicates Analyte was detected, but does not exceed the most stringent criteria.
shaded	Indicates a value less than the MDL where the MDL exceeds the stringent sediment cap performance goal or comparison criteria. Used in 2007 and 2008 data tables.
Inverse	Indicates results that exceed the lowest (most stringent) of the sediment cap performance goals or comparison criteria.

Table D-2
Surface, Inter-Armoring, and Sub-Armoring Water Data: Fall 2008
McCormick and Baxter Superfund Site
Portland, Oregon

		Sediment Cap Performance Goals		Comparison Criteria			Surface Water Statistics						
		McCormick & Baxter Record of Decision, 1996, Ambient Water Quality Criteria (AWQCs)		EPA Current, 2007, National Recommended Water Quality Criteria (NRWQCs)		EPA National Primary Drinking Water Regulations (NPDWRs)							
CONTAMINANT OF CONCERN		Aquatic Life (chronic)[1]	Human Health (fish consumption only)[1]	Aquatic Life (chronic)[2]	Human Health (consumption of organism only)[2]	Maximum Contaminant Levels (MCLs)[3]	**Number of Samples**	**Detection Frequency**	**Max Detection**	**Max Location**	**Mean Conc.**	**Data Distribution**	**95% UCL Value**
Total Dissolved Solids (mg/L)							22	100%	90.0	Locations 4,6,12,16,and 17	79.5	Normal	82.4
Total Suspended Solids (mg/L)							22	100%	19.2	Location 4	8.47	Normal	9.97
Dissolved Metals (mg/L)													
Arsenic							22	86%	0.0018	Location 26	0.000375	Log	0.00051
Chromium (III)							22	5%	ND	NA	0.000183	Normal	0.00026
Copper							22	64%	0.00403	Location 13	0.000725	Log	0.00173
Zinc							22	23%	0.00437	Location 10	0.00265	Normal	0.00484
Total Metals (mg/L)													
Arsenic		0.19		0.15	0.00014	0.01	22	91%	0.00132	Location 26	0.000505	Gamma	0.00063
Chromium (III)		0.21		0.074		0.1	22	36%	0.00257	Location 13	0.000549	NP	0.00115
Copper		0.012		0.009			22	100%	0.00282	Location 18	0.00113	Gamma	0.00131
Zinc		0.11		0.12	26		22	27%	0.0111	Location 26	0.00399	Normal	0.00635
Pentachlorophenol (µg/L)		13		11	3	1	22	0%	ND	NA	0.12455	Normal	0.135
Polynuclear aromatic hydrocarbons (µg/L)													
Acenaphthene	L	520			990		22	14%	0.704	Location 26	0.0442	NP	0.36
Acenaphthylene	L						22	0%	ND	NA	0.00596	Normal	0.00597
Anthracene	L				40,000		22	0%	ND	NA	0.00596	Normal	0.00597
Benzo (a) anthracene	H, C				0.018		22	0%	ND	NA	0.00596	Normal	0.00597
Benzo (a) pyrene	H, C				0.018	0.2	22	0%	ND	NA	0.00596	Normal	0.00597
Benzo (b) fluoranthene	H, C				0.018		22	0%	ND	NA	0.00596	Normal	0.00597
Benzo (ghi) perylene	H, C						22	0%	ND	NA	0.00596	Normal	0.00597
Benzo (k) fluoranthene	H, C				0.018		22	0%	ND	NA	0.00596	Normal	0.00597
Chrysene	H, C				0.018		22	0%	ND	NA	0.00596	Normal	0.00597
Dibenzo (a,h) anthracene	H, C				0.018		22	0%	ND	NA	0.0119	Normal	0.0119
Fluoranthene	H		54		140		22	5%	0.0239	Location 26	0.00678	Normal	0.00832
Fluorene	L				5300		22	14%	0.262	Location 26	0.0192	NP	0.0698
Indeno (1,2,3-cd) pyrene	H, C				0.018		22	0%	ND	NA	0.00596	Normal	0.00597
Naphthalene	L	620					22	9%	2.93	Location 26	0.154	NP	0.368
Phenanthrene	L						22	5%	0.0566	Location 26	0.00827	Normal	0.0126
Pyrene	H				4,000		22	0%	ND	NA	0.00596	Normal	0.00597
Total LPAHs							22	14%	3.95	Location 26	0.220	NP	0.509
Total HPAHs							22	5%	0.0239	Location 26	0.0323	Normal	0.033
Total CPAHs			0.031				22	0%	ND	NA	0.0269	Normal	0.027
Total PAHs							22	14%	3.98	Location 26	0.249	NP	0.544
Field Parameters (pre-/post-sample)													
Temperature (°C)													
Specific Conductance (mS/cm)													
Dissolved Oxygen (mg/L)													
pH													
Oxidation Reduction Potential (mV)													
Turbidity (NTU)													

Please refer to notes at end of this table.

Table D-2
Surface, Inter-Armoring, and Sub-Armoring Water Data: Fall 2008
McCormick and Baxter Superfund Site
Portland, Oregon

		Inter-Armoring Water Statistics							Sub-Armoring Water Statistics						
CONTAMINANT OF CONCERN		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
Total Dissolved Solids (mg/L)		22	100%	90.0	Location 6	79.5	Normal	82.2	22	100%	880	Location 5	195	NP	367
Total Suspended Solids (mg/L)		22	100%	580	Location 14	54.3	Gamma	99.3	22	95%	2100	Location 4	162	Gamma	329
Dissolved Metals (mg/L)															
Arsenic		22	82%	0.00203	Location 18	0.000423	Gamma	0.000580	22	100%	0.07520	Location 5	0.00895	Gamma	0.01600
Chromium (III)		22	0%	ND	NA	0.000175	–	–	22	0%	ND	NA	0.000175	NA	–
Copper		22	68%	0.00219	Location 8	0.00106	Normal	0.00155	22	32%	0.00182	Location 19	0.000547	NP	0.00093
Zinc		22	77%	0.01130	Location 25	0.00540	Normal	0.00680	22	45%	0.01900	Location 16	0.00439	Normal	0.00696
Total Metals (mg/L)															
Arsenic		22	95%	0.00257	Location 14	0.000823	Gamma	0.00109	22	100%	0.08060	Location 5	0.00913	Gamma	0.01560
Chromium (III)		22	55%	0.01090	Location 14	0.00144	NP	0.00228	22	64%	0.00577	Location 4	0.000826	Gamma	0.00124
Copper		22	100%	0.02360	Location 14	0.00375	Normal	0.00835	22	86%	0.01350	Location 4	0.00215	Gamma	0.00328
Zinc		22	77%	0.05800	Location 14	0.0109	Normal	0.02200	22	64%	0.03280	Location 4	0.00820	NP	0.01540
Pentachlorophenol (µg/L)		22	0%	ND	NA	0.119	Normal	0.119	22	0%	ND	NA	0.119	Normal	0.119
Polynuclear aromatic hydrocarbons (µg/L)															
Acenaphthene	L	22	18%	0.184	Location 26	0.0213	NP	0.0363	22	59%	48	Location 12	7.81	NP	12.87
Acenaphthylene	L	22	0%	ND	NA	0.00596	Normal	0.00598	22	5%	0.569	Location 12	0.0429	NP	0.0851
Anthracene	L	22	0%	ND	NA	0.00596	Normal	0.00598	22	36%	1.52	Location 9	0.137	NP	0.254
Benzo (a) anthracene	H, C	22	0%	ND	NA	0.00596	Normal	0.00598	22	18%	0.0912	Location 9	0.0158	NP	0.0388
Benzo (a) pyrene	H, C	22	0%	ND	NA	0.00596	Normal	0.00598	22	9%	0.0321	Location 8	0.0075	Normal	0.00983
Benzo (b) fluoranthene	H, C	22	0%	ND	NA	0.00596	Normal	0.00598	22	14%	0.0368	Location 8	0.0084	Normal	0.0112
Benzo (ghi) perylene	H, C	22	0%	ND	NA	0.00596	Normal	0.00598	22	5%	0.0242	Location 8	0.0068	Normal	0.00835
Benzo (k) fluoranthene	H, C	22	0%	ND	NA	0.00596	Normal	0.00598	22	14%	0.0267	Location 8	0.0076	Normal	0.00946
Chrysene	H, C	22	0%	ND	NA	0.00596	Normal	0.00598	22	18%	0.0986	Location 9	0.0173	NP	0.042
Dibenzo (a,h) anthracene	H, C	22	0%	ND	NA	0.0119	Normal	0.0119	22	0%	ND	NA	0.0119	Normal	0.0119
Fluoranthene	H	22	5%	0.017	Location 7	0.00646	Normal	0.00741	22	41%	2.19	Location 9	0.240	NP	0.428
Fluorene	L	22	14%	0.0692	Location 26	0.0107	NP	0.0247	22	55%	17.7	Location 9	2.63	NP	4.346
Indeno (1,2,3-cd) pyrene	H, C	22	0%	ND	NA	0.00596	Normal	0.00598	22	5%	0.0202	Location 8	0.00660	Normal	0.00783
Naphthalene	L	22	14%	0.488	Location 26	0.0312	NP	0.25	22	55%	83.5	Location 9	4.79	NP	10.86
Phenanthrene	L	22	5%	0.0154	Location 26	0.0064	Normal	0.0072	22	36%	13.7	Location 9	1.205	NP	2.337
Pyrene	H	22	5%	0.0181	Location 7	0.0065	Normal	0.00756	22	36%	1.39	Location 9	0.152	NP	0.271
Total LPAHs		22	18%	0.757	Location 26	0.0633	NP	0.211	22	64%	157	Location 9	16.58	NP	72.54
Total HPAHs		22	5%	0.0351	Location 7	0.0328	Normal	0.033	22	41%	3.8	Location 9	0.437	NP	0.772
Total CPAHs		22	0%	ND	NA	0.0270	Normal	0.114	22	18%	0.218	Location 9	0.0552	NP	0.114
Total PAHs		22	18%	0.757	Location 26	0.0917	NP	29.97	22	68%	161	Location 9	17.01	NP	29.78
Field Parameters (pre-/post-sample)															
Temperature (°C)															
Specific Conductance (mS/cm)															
Dissolved Oxygen (mg/L)															
pH															
Oxidation Reduction Potential (mV)															
Turbidity (NTU)															

Please refer to notes at end of this table.

Table D-2
Surface, Inter-Armoring, and Sub-Armoring Water Data: Fall 2008
McCormick and Baxter Superfund Site
Portland, Oregon

SAMPLE LOCATION		Location 01		Location 02				Location 03						Location 04					
Sample Type		Surface Water		Surface Water		Inter-Armoring		Sub-Armoring		Surface Water		Inter-Armoring		Sub-Armoring		Surface Water		Inter-Armoring		Sub-Armoring	
Sample ID		MBSW0908-01		MBSW0908-02		MBIA0908-02		MBSA0908-02		MBSW0908-03		MBIA0908-03		MBSA0908-03		MBSW0908-04		MBIA0908-04		MBSA0908-04	
Sample Date		9/17/2008		9/19/2008		9/19/2008		9/19/2008		9/19/2008		9/19/2008		9/19/2008		9/17/2008		9/17/2008		9/17/2008	
Sample Time		17:27		12:55		13:00		13:30		11:10		11:25		11:35		10:15		10:30		10:25	
CONTAMINANT OF CONCERN																					
Total Dissolved Solids (mg/L)		100		80		80		400		80		80		110		90		80		130	
Total Suspended Solids (mg/L)		7.71		11.4		1.92		86		7.49		27.7		9.46		19.2		62.5		2,100	
Dissolved Metals (mg/L)																					
Arsenic		**0.000257**	J	**0.000272**	J	**0.000232**	J	**0.0235**		**0.000347**	J	**0.000274**	J	**0.00434**		**0.000225**	J	**0.000249**	J	**0.00272**	
Chromium (III)		0.00035	U	0.00035	U	0.00035	U	0.00035	U	0.00035	U	0.00035	U	0.00035	U	0.00035	U	0.00035	U	0.00035	U
Copper		0.002	U	**0.000373**	J	**0.000989**	J	0.00027	U	**0.000353**	J	**0.00108**	J	**0.000582**	J	0.002	U	0.002	U	0.002	U
Zinc		0.005	U	0.005	U	**0.00586**		0.005	U	0.005	U	**0.00783**		**0.0081**		0.005	U	**0.00599**		0.005	U
Total Metals (mg/L)																					
Arsenic		0.00066		0.00041		0.00041		0.0229		0.00055		0.00059		0.00485		0.000509		0.00073		0.00503	
Chromium (III)		**0.00066**	J	**0.00117**	J	**0.00243**		**0.00045**	J	0.00035	U	**0.00076**	J	0.00035	U	0.00035	U	0.002	U	**0.00577**	
Copper		**0.00109**	J	**0.00101**	J	**0.00203**		**0.00102**	J	**0.00149**	J	**0.00191**	J	**0.00161**	J	**0.00159**	J	**0.00355**		0.0135	
Zinc		0.005	U	0.005	U	**0.00754**		0.005	U	0.005	U	**0.00743**		**0.01**		**0.00735**		**0.00863**		**0.0328**	
Pentachlorophenol (µg/L)		0.238	U	0.238	U	0.238	U	0.239	U	0.238	U	0.238	U	0.238	U	0.239	U	0.24	U	0.24	U
Polynuclear aromatic hydrocarbons (µg/L)																					
Acenaphthene	L	0.0119	U	0.0119	U	0.0119	U	**1.23**		0.0119	U	0.0119	U	**0.308**		0.012	U	0.012	U	0.012	U
Acenaphthylene	L	0.0119	U	0.0119	U	0.0119	U	0.012	U	0.0119	U	0.0119	U	0.0119	U	0.012	U	0.012	U	0.012	U
Anthracene	L	0.0119	U	0.0119	U	0.0119	U	**0.0202**	J	0.0119	U	0.0119	U	0.0119	U	0.012	U	0.012	U	0.012	U
Benzo (a) anthracene	H, C	0.0119	U	0.0119	U	0.0119	U	0.012	U	0.0119	U	0.0119	U	0.0119	U	0.012	U	0.012	U	0.012	U
Benzo (a) pyrene	H, C	0.0119	U	0.0119	U	0.0119	U	0.012	U	0.0119	U	0.0119	U	0.0119	U	0.012	U	0.012	U	0.012	U
Benzo (b) fluoranthene	H, C	0.0119	U	0.0119	U	0.0119	U	0.012	U	0.0119	U	0.0119	U	0.0119	U	0.012	U	0.012	U	0.012	U
Benzo (ghi) perylene	H, C	0.0119	U	0.0119	U	0.0119	U	0.012	U	0.0119	U	0.0119	U	0.0119	U	0.012	U	0.012	U	0.012	U
Benzo (k) fluoranthene	H, C	0.0119	U	0.0119	U	0.0119	U	0.012	U	0.0119	U	0.0119	U	0.0119	U	0.012	U	0.012	U	0.012	U
Chrysene	H, C	0.0119	U	0.0119	U	0.0119	U	0.012	U	0.0119	U	0.0119	U	0.0119	U	0.012	U	0.012	U	0.012	U
Dibenzo (a,h) anthracene	H, C	0.0238	U	0.0238	U	0.0238	U	0.0239	U	0.0238	U	0.0238	U	0.0238	U	0.0239	U	0.024	U	0.024	U
Fluoranthene	H	0.0119	U	0.0119	U	0.0119	U	0.012	U	0.0119	U	0.0119	U	**0.0148**	J	0.012	U	0.012	U	0.012	U
Fluorene	L	0.0119	U	0.0119	U	0.0119	U	**0.211**		0.0119	U	0.0119	U	**0.0739**		0.012	U	0.012	U	0.012	U
Indeno (1,2,3-cd) pyrene	H, C	0.0119	U	0.0119	U	0.0119	U	0.012	U	0.0119	U	0.0119	U	0.0119	U	0.012	U	0.012	U	0.012	U
Naphthalene	L	0.0119	U	0.0119	U	0.0119	U	**0.0247**		0.0119	U	0.0119	U	**0.0262**		0.012	U	0.012	U	0.012	U
Phenanthrene	L	0.0119	U	0.0119	U	0.0119	U	**0.0172**	J	0.0119	U	0.0119	U	0.0119	U	0.012	U	0.012	U	0.012	U
Pyrene	H	0.0119	U	0.0119	U	0.0119	U	0.012	U	0.0119	U	0.0119	U	0.0119	U	0.012	U	0.012	U	0.012	U
Total LPAHs		0.0357	U	0.0357	U	0.0357	U	**1.50**		0.0357	U	0.0357	U	**0.4080**		0.0360	U	0.0360	U	0.0360	U
Total HPAHs		0.0650	U	0.0650	U	0.0650	U	0.0660	U	0.065	U	0.0650	U	**0.0148**		0.0660	U	0.0660	U	0.0660	U
Total CPAHs		0.0540	U	0.0540	U	0.0540	U	0.0540	U	0.054	U	0.0540	U	0.0540	U	0.0540	U	0.0540	U	0.0540	U
Total PAHs		0.1010	U	0.1010	U	0.1010	U	**1.50**		0.101	U	0.1010	U	**0.4230**		0.1020	U	0.1020	U	0.1020	U
Field Parameters (pre-/post-sample)																					
Temperature (°C)		20.3		20.44		21.77 / 22.55		21.09 / 22.84		18.67		18.66 / 18.71		18.61 / 19.05		19.03		19.17 / 18.86		18.7 / 19.75	
Specific Conductance (mS/cm)		0.16		0.08		0.085 / 0.123		0.687 / 6.695		0.082		0.089 / 0.093		0.111 / 0.126		0.144		0.161 / 0.16		0.21 / 0.262	
Dissolved Oxygen (mg/L)		8.56		10.38		70.8 / 7.89		0.97 / 1.08		9.66		8.65 / 8.72		1.53 / 3.42		8.2		6.2 / 6.29		2.83 / 2.93	
pH		7.47		7.55		7.32 / 7.12		6.38 / 6.41		8.06		7.71 / 6.93		6.26 / 6.32		6.95		7.18 / 6.66		7.04 / 6.66	
Oxidation Reduction Potential (mV)		-4.8		-60.8		-47 / -35.4		-79 / -82.5		167.2		-69.4 / 90.4		74.7 / 46.3		13.5		-31.4 / -31		-64 / -40.9	
Turbidity (NTU)		NA		NA		NA		NA		NA		NA		NA		NA		NA		NA	

Please refer to notes at end of this table.

Table D-2
Surface, Inter-Armoring, and Sub-Armoring Water Data: Fall 2008
McCormick and Baxter Superfund Site
Portland, Oregon

SAMPLE LOCATION		Location 05				Location 06			Location 07		
Sample Type		**Surface Water**	**Surface Water**	**Inter-Armoring**	**Sub-Armoring**	**Surface Water**	**Inter-Armoring**	**Sub-Armoring**	**Surface Water**	**Inter-Armoring**	**Sub-Armoring**
Sample ID		**MBSW0908-05**	**MBSW0908-05D**	**MBIA0908-05**	**MBSA0908-05**	**MBSW0908-06**	**MBIA0908-06**	**MBSA0908-06**	**MBSW0908-07**	**MBIA0908-07**	**MBSA0908-07**
Sample Date		**9/17/2008**	**9/17/2008**	**9/17/2008**	**9/17/2008**	**9/17/2008**	**9/17/2008**	**9/17/2008**	**9/17/2008**	**9/17/2008**	**9/17/2008**
Sample Time		**8:10**	**8:10**	**9:00**	**9:10**	**15:30**	**16:25**	**16:00**	**12:00**	**12:20**	**12:27**
CONTAMINANT OF CONCERN											
Total Dissolved Solids (mg/L)		80	80	80	880	90	90	350	80	90	120
Total Suspended Solids (mg/L)		9.62	11.6	136	155	3.83	32.1	230	7.68	13.9	9.58
Dissolved Metals (mg/L)											
Arsenic		**0.000367** J	**0.000285** J	**0.000548** J	**0.0752**	**0.000221** J	**0.000293** J	**0.0257**	**0.000236** J	**0.000288** J	**0.00642**
Chromium (III)		0.00035 U	0.00035 U	0.00035 U	0.00035 U	0.00035 U	0.00035 U	0.00035 U	0.00035 U	0.00035 U	0.00035 U
Copper		0.002 U	0.002 U	0.002 U	0.00027 U	0.00027 U	0.002 U	0.002 U	0.002 U	0.002 U	0.00027 U
Zinc		0.005 U	0.005 U	0.005 U	**0.00764**	0.005 U	0.005 U	0.005 U	0.005 U	**0.00542**	0.005 U
Total Metals (mg/L)											
Arsenic		0.00076	0.000596	0.00145	0.0806	0.000336	0.00098	0.0237	0.000389	0.000395	0.0057
Chromium (III)		**0.0009** J	0.00035 U	**0.00306**	**0.000505** J	0.00035 U	**0.00145** J	**0.00284**	0.00035 U	0.00035 U	0.00035 U
Copper		**0.00116** J	**0.00136** J	0.0113	**0.000978** J	**0.000419** J	**0.00195** J	**0.0065**	**0.00114** J	**0.00145** J	0.00027 U
Zinc		0.005 U	**0.00531**	0.025 U	**0.013**	0.005 U	0.005 U	**0.0221**	**0.0101**	**0.0136**	0.005 U
Pentachlorophenol (µg/L)		0.239 U	0.237 U	0.239 U	0.24 U	0.239 U	0.238 U	0.238 U	0.24 U	0.24 U	0.239 U
Polynuclear aromatic hydrocarbons (µg/L)											
Acenaphthene	L	0.012 U	0.0118 U	0.012 U	**35.7**	0.012 U	0.0119 U	**24.8**	0.012 U	**0.032**	**11.3**
Acenaphthylene	L	0.012 U	0.0118 U	0.012 U	0.0841 U	0.012 U	0.0119 U	0.0833 U	0.012 U	0.012 U	0.0598 U
Anthracene	L	0.012 U	0.0118 U	0.012 U	**0.515**	0.012 U	0.0119 U	**0.594**	0.012 U	0.012 U	0.0248
Benzo (a) anthracene	H, C	0.012 U	0.0118 U	0.012 U	0.012 U	0.012 U	0.0119 U	0.0705	0.012 U	0.012 U	0.0647
Benzo (a) pyrene	H, C	0.012 U	0.0118 U	0.012 U	0.012 U	0.012 U	0.0119 U	**0.0144** J	0.012 U	0.012 U	0.012 U
Benzo (b) fluoranthene	H, C	0.012 U	0.0118 U	0.012 U	0.012 U	0.012 U	0.0119 U	0.0198	0.012 U	0.012 U	0.012 U
Benzo (ghi) perylene	H, C	0.012 U	0.0118 U	0.012 U	0.012 U	0.012 U	0.0119 U	0.0119 U	0.012 U	0.012 U	0.012 U
Benzo (k) fluoranthene	H, C	0.012 U	0.0118 U	0.012 U	0.012 U	0.012 U	0.0119 U	**0.0138** J	0.012 U	0.012 U	0.012 U
Chrysene	H, C	0.012 U	0.0118 U	0.012 U	0.012 U	0.012 U	0.0119 U	0.0776	0.012 U	0.012 U	0.0627
Dibenzo (a,h) anthracene	H, C	0.0239 U	0.0237 U	0.0239 U	0.024 U	0.0239 U	0.0238 U	0.0238 U	0.024 U	0.024 U	0.0239 U
Fluoranthene	H	0.012 U	0.0118 U	0.012 U	**0.0625**	0.012 U	0.0119 U	**1.5**	0.012 U	**0.017** J	**0.578**
Fluorene	L	0.012 U	0.0118 U	0.012 U	**13.0**	0.012 U	0.0119 U	**7.03**	0.012 U	0.012 U	**2.9**
Indeno (1,2,3-cd) pyrene	H, C	0.012 U	0.0118 U	0.012 U	0.012 U	0.012 U	0.0119 U	0.0119 U	0.012 U	0.012 U	0.012 U
Naphthalene	L	0.012 U	0.0118 U	0.012 U	**0.317**	0.012 U	0.0119 U	0.0952 U	0.012 U	**0.0128** J	**4.87**
Phenanthrene	L	0.012 U	0.0118 U	0.012 U	**4.49**	0.012 U	0.0119 U	**6.98**	0.012 U	0.012 U	0.012 U
Pyrene	H	0.012 U	0.0118 U	0.012 U	**0.0316**	0.012 U	0.0119 U	**0.91**	0.012 U	**0.0181** J	**0.531**
Total LPAHs		0.0360 U	0.0354 U	0.0360 U	**54.0**	0.0360 U	0.0357 U	**39.4000**	0.0360 U	**0.0448**	**19.1**
Total HPAHs		0.0660 U	0.0650 U	0.0660 U	**0.0941**	0.0660 U	0.0650 U	**2.6100**	0.0660 U	**0.0351**	**1.2400**
Total CPAHs		0.0540 U	0.0530 U	0.0540 U	0.054 U	0.0540 U	0.0540 U	0.1960	0.0540 U	0.0540 U	0.1270
Total PAHs		0.1020 U	0.1000 U	0.1020 U	**54.1**	0.1020 U	0.1010 U	**42.0000**	0.1020 U	**0.0799**	**20.3**
Field Parameters (pre-/post-sample)											
Temperature (°C)		18.75	NA	18.65 / 19.07	18.61 / 19.08	19.8	20.66 / 20.27	20.22 / 20.41	20.08	20.45 / 20.43	19.92 / 20.45
Specific Conductance (mS/cm)		0.16	NA	0.178 / 0.76	1.49 / 1.409	0.139	0.172 / 0.178	0.604 / 0.678	0.134	0.159 / 0.179	0.143 / 0.201
Dissolved Oxygen (mg/L)		8.32	NA	4.8 / 4.67	1.71 / 1.9	8.91	4.01 / 7.51	1.15 / 0.75	8.4	6.59 / 6.01	1.64 / 0.93
pH		5.91	NA	5.91 / 6.81	6.76 / 6.5	7.48	7.61 / 7.45	8.12 / 7.84	7.31	7.59 / 7.43	7.46 / 7.38
Oxidation Reduction Potential (mV)		53	NA	54.5 / -52.3	-125.3 / -105.4	10.5	-50.5 / -33.6	-112.3 / -105.5	17	-24.3 / -32.9	-49.4 / -61.6
Turbidity (NTU)		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Please refer to notes at end of this table.

Table D-2
Surface, Inter-Armoring, and Sub-Armoring Water Data: Fall 2008
McCormick and Baxter Superfund Site
Portland, Oregon

SAMPLE LOCATION		Location 08			Location 09			Location 10		
Sample Type		Surface Water	Inter-Armoring	Sub-Armoring	Surface Water	Inter-Armoring	Sub-Armoring	Surface Water	Inter-Armoring	Sub-Armoring
Sample ID		MBSW0908-08	MBIA0908-08	MBSA0908-08	MBSW0908-09	MBIA0908-09	MBSA0908-09	MBSW0908-10	MBIA0908-10	MBSA0908-10
Sample Date		9/16/2008	9/16/2008	9/16/2008	9/16/2008	9/16/2008	9/16/2008	9/15/2008	9/15/2008	9/15/2008
Sample Time		15:15	15:50	16:00	13:25	14:20	14:30	14:30	15:15	15:25
CONTAMINANT OF CONCERN										
Total Dissolved Solids (mg/L)		70	70	80	80	70	180	70	70	150
Total Suspended Solids (mg/L)		11.3	5.56	137	13.4	50.2	151	7.71	64	28.5
Dissolved Metals (mg/L)										
Arsenic		**0.000344** J	**0.00021** J	**0.000191** J	**0.000304** J	0.00018 U	**0.0104**	0.00018 U	0.00018 U	**0.00546**
Chromium (III)		0.00035 U	0.00035 U	0.00035 U	0.00035 U	0.00035 U	0.00035 U	0.00035 U	0.00035 U	0.00035 U
Copper		**0.00041** J	**0.00219**	**0.000983** J	**0.000392** J	**0.00123** J	0.00027 U	**0.000282** J	**0.00113** J	0.00027 U
Zinc		0.005 U	**0.00681**	0.005 U	0.005 U	0.005 U	0.005 U	**0.00473** J	**0.00682**	**0.00229** J
Total Metals (mg/L)										
Arsenic		0.000453	0.000401	0.0005	0.000647	0.00113	0.0109	0.000018 U	0.000399	0.00472
Chromium (III)		0.00035 U	0.00035 U	**0.000623** J	0.00035 U	**0.00172** J	0.00035 U	0.00035 U	0.00035 U	0.00035 U
Copper		**0.001** J	**0.00223**	**0.00176** J	**0.00113** J	**0.00412**	**0.00113** J	**0.000847** J	**0.00326**	0.00027 U
Zinc		0.005 U	**0.00597**	**0.00562**	0.005 U	**0.01**	0.025 U	0.005 U	**0.011**	0.005 U
Pentachlorophenol (µg/L)		0.238 U	0.238 U	0.24 U	0.238 U	0.238 U	0.238 U	0.238 U	0.238 U	0.238 U
Polynuclear aromatic hydrocarbons (µg/L)										
Acenaphthene	L	0.0119 U	0.0119 U	0.012 U	0.0119 U	0.0119 U	**41**	0.0119 U	0.0119 U	**6.56**
Acenaphthylene	L	0.0119 U	0.0119 U	0.012 U	0.0119 U	0.0119 U	0.298 U	0.0119 U	0.0119 U	0.0357 U
Anthracene	L	0.0119 U	0.0119 U	0.012 U	0.0119 U	0.0119 U	**1.52**	0.0119 U	0.0119 U	**0.163**
Benzo (a) anthracene	H, C	0.0119 U	0.0119 U	**0.014** J	0.0119 U	0.0119 U	0.0912	0.0119 U	0.0119 U	0.0119 U
Benzo (a) pyrene	H, C	0.0119 U	0.0119 U	**0.0321**	0.0119 U	0.0119 U	0.0119 U	0.0119 U	0.0119 U	0.0119 U
Benzo (b) fluoranthene	H, C	0.0119 U	0.0119 U	**0.0368**	0.0119 U	0.0119 U	**0.0152** J	0.0119 U	0.0119 U	0.0119 U
Benzo (ghi) perylene	H, C	0.0119 U	0.0119 U	**0.0242**	0.0119 U	0.0119 U	0.0119 U	0.0119 U	0.0119 U	0.0119 U
Benzo (k) fluoranthene	H, C	0.0119 U	0.0119 U	**0.0267**	0.0119 U	0.0119 U	**0.013** J	0.0119 U	0.0119 U	0.0119 U
Chrysene	H, C	0.0119 U	0.0119 U	**0.0337**	0.0119 U	0.0119 U	0.0986	0.0119 U	0.0119 U	0.0119 U
Dibenzo (a,h) anthracene	H, C	0.0238 U	0.0238 U	0.024 U	0.0238 U	0.0238 U	0.0238 U	0.0238 U	0.0238 U	0.0238 U
Fluoranthene	H	0.0119 U	0.0119 U	**0.0272**	0.0119 U	0.0119 U	**2.19**	0.0119 U	0.0119 U	**0.385**
Fluorene	L	0.0119 U	0.0119 U	0.012 U	0.0119 U	0.0119 U	**17.7**	0.0119 U	0.0119 U	**2.74**
Indeno (1,2,3-cd) pyrene	H, C	0.0119 U	0.0119 U	**0.0202** J	0.0119 U	0.0119 U	0.0119 U	0.0119 U	0.0119 U	0.0119 U
Naphthalene	L	0.0119 U	0.0119 U	0.012 U	0.0119 U	0.0119 U	**83.5**	0.0119 U	0.0119 U	**15.9**
Phenanthrene	L	0.0119 U	0.0119 U	0.012 U	0.0119 U	0.0119 U	**13.7**	0.0119 U	0.0119 U	**0.698**
Pyrene	H	0.0119 U	0.0119 U	**0.029**	0.0119 U	0.0119 U	**1.39**	0.0119 U	0.0119 U	**0.21**
Total LPAHs		0.0357 U	0.0357 U	0.0360 U	0.0357 U	0.0357 U	**157.0**	0.0357 U	0.0357 U	**26.1**
Total HPAHs		0.0650 U	0.0650 U	**0.2440**	0.0650 U	0.0650 U	**3.8000**	0.0650 U	0.0650 U	**0.5950**
Total CPAHs		0.0540 U	0.0540 U	0.1880	0.0540 U	0.0540 U	0.2180	0.0540 U	0.0540 U	0.0540 U
Total PAHs		0.1010 U	0.1010 U	**0.2440**	0.1010 U	0.1010 U	**161.0**	0.1010 U	0.1010 U	**26.7**
Field Parameters (pre-/post-sample)										
Temperature (°C)		20.95	21.37 / 21.67	21.04 / 21.05	20.16	20.49 / 21.04	21.33 / 21.86	21.06	21.61 / 21.81	22.54 / 22.38
Specific Conductance (mS/cm)		0.119	0.122 / 0.123	0.13 / 0.131	0.116	0.125 / 0.119	0.474 / 0.414	0.128	0.129 / 0.129	0.288 / 0.251
Dissolved Oxygen (mg/L)		6.99	6.2 / 6.76	2.53 / 2.33	7.2	5.96 / 6.43	1.06 / 1.39	7.21	6.44 / 6.25	1.00 / 3.65
pH		6.25	6.09 / 5.94	5.68 / 5.66	6.08	6.15 / 6.12	6.61 / 6.24	6.69	6.76 / 6.78	7.29 / 7.00
Oxidation Reduction Potential (mV)		41.9	93.6 / 111.6	113.3 / 122.4	66.5	36.5 / -2.7	-67.6 / -67.5	46.5	48.3 / 16.5	-87 / -57
Turbidity (NTU)		NA	NA	NA	NA	NA	NA	NA	NA	NA

Please refer to notes at end of this table.

Table D-2
Surface, Inter-Armoring, and Sub-Armoring Water Data: Fall 2008
McCormick and Baxter Superfund Site
Portland, Oregon

		Location 11			Location 12			Location 13			
		Surface Water	Inter-Armoring	Sub-Armoring	Surface Water	Inter-Armoring	Sub-Armoring	Surface Water	Surface Water	Inter-Armoring	Inter-Armoring
		MBSW0908-11	MBIA0908-11	MBSA0908-11	MBSW0908-12	MBIA0908-12	MBSA0908-12	MBSW0908-13	MBSW0908-13D	MBIA0908-13	MBIA0908-13D
		9/16/2008	9/16/2008	9/16/2008	9/18/2008	9/18/2008	9/18/2008	9/18/2008	9/18/2008	9/18/2008	9/18/2008
		9:10	9:55	10:05	11:45	12:00	11:50	8:45	8:45	9:10	9:10
CONTAMINANT OF CONCERN											
Total Dissolved Solids (mg/L)		70	70	120	90	90	110	80	80	80	80
Total Suspended Solids (mg/L)		7.72	5.78	64.8	5.5	1.89	5.46	5.64	5.49	1.95	1.84
Dissolved Metals (mg/L)											
Arsenic		**0.000316** J	**0.000509** J	**0.00177**	**0.00066** J	**0.00059** J	**0.00934**	**0.000231** J	**0.000254** J	**0.000234** J	**0.000289** J
Chromium (III)		0.00035 U	0.00035 U	0.00035 U	0.00035 U	0.00035 U	0.00035 U	0.00035 U	0.00035 U	0.00035 U	0.00035 U
Copper		**0.000617** J	**0.00144** J	0.00027 U	0.00027 U	**0.00029** J	0.00027 U	0.00027 U	**0.000403** J	**0.00108** J	**0.000771** J
Zinc		0.005 U	**0.0094**	0.005 U	**0.00126** J	**0.00258** J	**0.00222** J	0.005 U	0.005 U	**0.0078**	**0.00727**
Total Metals (mg/L)											
Arsenic		0.000939	0.000472	0.00174	0.00051	0.00163	0.00923	0.00048	0.00045	0.00047	0.00038
Chromium (III)		**0.000428** J	0.00035 U	**0.000621** J	**0.00162** J	0.00035 U	0.00035 U	**0.00257**	**0.00204**	**0.00227**	**0.00244**
Copper		**0.00128** J	**0.0016** J	**0.00205**	**0.00083** J	**0.00153** J	**0.00084** J	**0.00126** J	**0.00101** J	**0.00156** J	**0.00143** J
Zinc		0.005 U	**0.00511**	**0.00743**	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	**0.00616**	**0.00668**
Pentachlorophenol (µg/L)		0.238 U	0.238 U	0.238 U	0.238 U	0.239 U	0.237 U	0.238 U	0.238 U	0.238 U	0.238 U
Polynuclear aromatic hydrocarbons (µg/L)											
Acenaphthene	L	0.0119 U	0.0119 U	0.0119 U	**0.0846**	**0.1270**	**48.0000**	0.0119 U	0.0119 U	0.0119 U	0.0119 U
Acenaphthylene	L	0.0119 U	0.0119 U	0.0119 U	0.0119 U	0.0120 U	**0.5690**	0.0119 U	0.0119 U	0.0119 U	0.0119 U
Anthracene	L	0.0119 U	0.0119 U	0.0119 U	0.0119 U	0.0120 U	**0.0560**	0.0119 U	0.0119 U	0.0119 U	0.0119 U
Benzo (a) anthracene	H, C	0.0119 U	0.0119 U	0.0119 U	0.0119 U	0.0120 U	0.0118 U	0.0119 U	0.0119 U	0.0119 U	0.0119 U
Benzo (a) pyrene	H, C	0.0119 U	0.0119 U	0.0119 U	0.0119 U	0.0120 U	0.0118 U	0.0119 U	0.0119 U	0.0119 U	0.0119 U
Benzo (b) fluoranthene	H, C	0.0119 U	0.0119 U	0.0119 U	0.0119 U	0.0120 U	0.0118 U	0.0119 U	0.0119 U	0.0119 U	0.0119 U
Benzo (ghi) perylene	H, C	0.0119 U	0.0119 U	0.0119 U	0.0119 U	0.0120 U	0.0118 U	0.0119 U	0.0119 U	0.0119 U	0.0119 U
Benzo (k) fluoranthene	H, C	0.0119 U	0.0119 U	0.0119 U	0.0119 U	0.0120 U	0.0118 U	0.0119 U	0.0119 U	0.0119 U	0.0119 U
Chrysene	H, C	0.0119 U	0.0119 U	0.0119 U	0.0119 U	0.0120 U	0.0118 U	0.0119 U	0.0119 U	0.0119 U	0.0119 U
Dibenzo (a,h) anthracene	H, C	0.0238 U	0.0238 U	0.0238 U	0.0238 U	0.0239 U	0.0237 U	0.0238 U	0.0238 U	0.0238 U	0.0238 U
Fluoranthene	H	0.0119 U	0.0119 U	0.0119 U	0.0119 U	0.0120 U	**0.0599**	0.0119 U	0.0119 U	0.0119 U	0.0119 U
Fluorene	L	0.0119 U	0.0119 U	0.0119 U	**0.0219** J	**0.0412**	**13.1000**	0.0119 U	0.0119 U	0.0119 U	0.0119 U
Indeno (1,2,3-cd) pyrene	H, C	0.0119 U	0.0119 U	0.0119 U	0.0119 U	0.0120 U	0.0118 U	0.0119 U	0.0119 U	0.0119 U	0.0119 U
Naphthalene	L	0.0119 U	0.0119 U	0.0119 U	0.0119 U	0.0120 U	**0.3490**	0.0119 U	0.0119 U	0.0119 U	0.0119 U
Phenanthrene	L	0.0119 U	0.0119 U	0.0119 U	0.0119 U	0.0120 U	**0.3220**	0.0119 U	0.0119 U	0.0119 U	0.0119 U
Pyrene	H	0.0119 U	0.0119 U	0.0119 U	0.0119 U	0.0120 U	**0.0396**	0.0119 U	0.0119 U	0.0119 U	0.0119 U
Total LPAHs		0.0357 U	0.0357 U	0.0357 U	**0.1065**	**0.1680**	**62.4**	0.0357 U	0.0357 U	0.0357 U	0.0357 U
Total HPAHs		0.0650 U	0.0650 U	0.0650 U	0.06545 U	0.0660 U	**0.0995**	0.0650 U	0.0650 U	0.065 U	0.0650 U
Total CPAHs		0.0540 U	0.0540 U	0.0540 U	0.05355 U	0.0540 U	0.0530 U	0.0540 U	0.0540 U	0.054 U	0.0540 U
Total PAHs		0.1010 U	0.1010 U	0.1010 U	**0.1065**	**0.1680**	**62.5**	0.1010 U	0.1010 U	0.101 U	0.1010 U
Field Parameters (pre-/post-sample)											
Temperature (°C)		19.69	19.69 / 20.29	20.05 / 20.43	18.97	18.82 / 18.87	18.85 / 18.88	18.27	NA	18.23 / 18.19	NA
Specific Conductance (mS/cm)		0.116	0.116 / 0.117	0.184 / 0.183	1.099	3.92 / 4.23	3.96 / 4.29	0.2	NA	0.397 / 0.355	NA
Dissolved Oxygen (mg/L)		6.93	6.93 / 6.79	1.41 / 1.75	7.99	6.07 / 6.08	0.81 / 0.77	8.48	NA	6.4 / 6.35	NA
pH		2:38	6.11 / 5.92	6.37 / 6.19	7.22	7.23 / 7.2	7.31 / 7	7.45	NA	7.32 / 4.91	NA
Oxidation Reduction Potential (mV)		65.6	65.6 / 47.4	-13.9 / -24.7	-13.3	-47.7 / -42.3	-64.3 / -36.3	7.7	NA	-15.1 / -17.8	NA
Turbidity (NTU)		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Please refer to notes at end of this table.

Table D-2
Surface, Inter-Armoring, and Sub-Armoring Water Data: Fall 2008
McCormick and Baxter Superfund Site
Portland, Oregon

SAMPLE LOCATION		Location 13		Location 14			Location 15			Location 16		
Sample Type		**Sub-Armoring**	**Sub-Armoring**	**Surface Water**	**Inter-Armoring**	**Sub-Armoring**	**Surface Water**	**Inter-Armoring**	**Sub-Armoring**	**Surface Water**	**Inter-Armoring**	**Sub-Armoring**
Sample ID		**MBSA0908-13**	**MBSA0908-13D**	**MBSW0908-14**	**MBIA0908-14**	**MBSA0908-14**	**MBSW0908-15**	**MBIA0908-15**	**MBSA0908-15**	**MBSW0908-16**	**MBIA0908-16**	**MBSA0908-16**
Sample Date		**9/18/2008**	**9/18/2008**	**9/15/2008**	**9/15/2008**	**9/15/2008**	**9/16/2008**	**9/16/2008**	**9/16/2008**	**9/17/2008**	**9/17/2008**	**9/17/2008**
Sample Time		**9:30**	**9:30**	**9:30**	**10:00**	**11:00**	**11:10**	**11:45**	**12:00**	**13:33**	**14:10**	**14:25**
CONTAMINANT OF CONCERN												
Total Dissolved Solids (mg/L)		180	180	70	70	100	70	80	110	90	90	470
Total Suspended Solids (mg/L)		15	15	11.5	580	24.1	7.27	105	60.6	13.6	11.4	14.5
Dissolved Metals (mg/L)												
Arsenic		**0.000696** J	**0.000742** J	0.00018 U	**0.000423** J	**0.000432** J	**0.000456** J	**0.000278** J	**0.0175**	**0.000253** J	**0.000271** J	**0.00146**
Chromium (III)		0.00035 U	0.00035 U	0.00035 U	0.00035 U	0.00035 U	0.00035 U	0.00035 U	0.00035 U	0.00035 U	0.00035 U	0.00035 U
Copper		0.00027 U	0.00027 U	**0.000306** J	0.00027 U	**0.000428** J	**0.000281** J	**0.00081** J	0.00027 U	0.00027 U	0.002 U	0.002 U
Zinc		0.005 U	0.005 U	**0.00131** J	**0.000826** J	**0.00335** J	0.005 U	0.005 U	0.005 U	0.005 U	**0.00547**	**0.019**
Total Metals (mg/L)												
Arsenic		0.00121	0.00115	0.00018 U	0.00257	0.00205	0.000436	0.00115	0.0147	0.00042	0.00042	0.00138
Chromium (III)		0.00091 U	0.00089 U	0.00035 U	**0.0109**	**0.000502** J	0.00035 U	**0.00272**	0.00035 U	0.00035 U	0.00035 U	0.00035 U
Copper		**0.00188** J	**0.00174** J	**0.00084** J	0.0236	**0.00334**	**0.000843** J	**0.00612**	**0.000317** J	**0.000803** J	**0.00225**	0.00027 U
Zinc		0.005 U	0.005 U	0.005 U	**0.058**	**0.00772**	0.005 U	**0.0177**	0.005 U	0.005 U	**0.00629**	**0.0162**
Pentachlorophenol (µg/L)		0.238 U	0.238 U	0.238 U	0.238 U	0.238 U	0.238 U	0.238 U	0.238 U	0.239 U	0.239 U	0.24 U
Polynuclear aromatic hydrocarbons (µg/L)												
Acenaphthene	L	**1.53**	**1.74**	0.0119 U	0.0119 U	0.0119 U	0.0119 U	0.0119 U	**0.623**	0.012 U	0.012 U	0.012 U
Acenaphthylene	L	0.0119 U	0.0119 U	0.0119 U	0.0119 U	0.0119 U	0.0119 U	0.0119 U	0.0119 U	0.012 U	0.012 U	0.012 U
Anthracene	L	0.0119 U	0.0119 U	0.0119 U	0.0119 U	0.0119 U	0.0119 U	0.0119 U	**0.035**	0.012 U	0.012 U	0.012 U
Benzo (a) anthracene	H, C	0.0119 U	0.0119 U	0.0119 U	0.0119 U	0.0119 U	0.0119 U	0.0119 U	0.0119 U	0.012 U	0.012 U	0.012 U
Benzo (a) pyrene	H, C	0.0119 U	0.0119 U	0.0119 U	0.0119 U	0.0119 U	0.0119 U	0.0119 U	0.0119 U	0.012 U	0.012 U	0.012 U
Benzo (b) fluoranthene	H, C	0.0119 U	0.0119 U	0.0119 U	0.0119 U	0.0119 U	0.0119 U	0.0119 U	0.0119 U	0.012 U	0.012 U	0.012 U
Benzo (ghi) perylene	H, C	0.0119 U	0.0119 U	0.0119 U	0.0119 U	0.0119 U	0.0119 U	0.0119 U	0.0119 U	0.012 U	0.012 U	0.012 U
Benzo (k) fluoranthene	H, C	0.0119 U	0.0119 U	0.0119 U	0.0119 U	0.0119 U	0.0119 U	0.0119 U	0.0119 U	0.012 U	0.012 U	0.012 U
Chrysene	H, C	0.0119 U	0.0119 U	0.0119 U	0.0119 U	0.0119 U	0.0119 U	0.0119 U	0.0119 U	0.012 U	0.012 U	0.012 U
Dibenzo (a,h) anthracene	H, C	0.0238 U	0.0238 U	0.0238 U	0.0238 U	0.0238 U	0.0238 U	0.0238 U	0.0238 U	0.0239 U	0.0239 U	0.024 U
Fluoranthene	H	0.0119 U	0.0119 U	0.0119 U	0.0119 U	0.0119 U	0.0119 U	0.0119 U	0.0119 U	0.012 U	0.012 U	0.012 U
Fluorene	L	**0.123**	**0.149**	0.0119 U	0.0119 U	0.0119 U	0.0119 U	0.0119 U	**0.506**	0.012 U	0.012 U	0.012 U
Indeno (1,2,3-cd) pyrene	H, C	0.0119 U	0.0119 U	0.0119 U	0.0119 U	0.0119 U	0.0119 U	0.0119 U	0.0119 U	0.012 U	0.012 U	0.012 U
Naphthalene	L	**0.144**	**0.171**	0.0119 U	0.0119 U	0.0119 U	0.0119 U	0.0119 U	**0.0134** J	0.012 U	0.012 U	0.0962 U
Phenanthrene	L	**0.0475**	**0.054**	0.0119 U	0.0119 U	0.0119 U	0.0119 U	0.0119 U	**0.17**	0.012 U	0.012 U	0.012 U
Pyrene	H	0.0119 U	0.0119 U	0.0119 U	0.0119 U	0.0119 U	0.0119 U	0.0119 U	0.0119 U	0.012 U	0.012 U	0.012 U
Total LPAHs		**1.8400**	**2.1100**	0.0357 U	0.0357 U	0.0357 U	0.0357 U	0.0357 U	**1.3500**	0.0360 U	0.0360 U	0.0781 U
Total HPAHs		0.0650 U	0.0650 U	0.0650 U	0.0650 U	0.065 U	0.0650 U	0.0650 U	0.0650 U	0.0660 U	0.0660 U	0.0660 U
Total CPAHs		0.0540 U	0.0540 U	0.0540 U	0.0540 U	0.054 U	0.0540 U	0.0540 U	0.0540 U	0.0540 U	0.0540 U	0.0540 U
Total PAHs		**1.8400**	**2.1100**	0.1010 U	0.1010 U	0.101 U	0.1010 U	0.1010 U	**1.3500**	0.1020 U	0.1020 U	0.1440 U
Field Parameters (pre-/post-sample)												
Temperature (°C)		18.22 / 18.25	NA	19.5	20.08 / 20.97	20.94 / 21.55	20.29	20.24 / 20.86	20.35 / 20.57	19.81	20.63 / 20.69	20.21 / 20.59
Specific Conductance (mS/cm)		0.52 / 0.519	NA	0.138	0.285 / 0.150*	0.161 / 0.176	0.118	0.115 / 0.114	0.149 / 0.175	0.14	0.157 / 0.165	0.715 / 0.756
Dissolved Oxygen (mg/L)		1.26 / 1.19	NA	13.28	7 / 5	2.56 / 1.21	7.07	6.28 / 6.4	0.75 / 0.82	8.4	7 / 6.86	1.1 / 0.98
pH		6.94 / 6.96	NA	6.24	6.51 / 6.43	6.7 / 7.15	6.13	5.94 / 6.19	6.68 / 6.82	7.43	7.21 / 7.6	6.93 / 6.93
Oxidation Reduction Potential (mV)		-41.4 / -51.5	NA	206	60 / 48.7	19.8 / -32.2	86.6	56.9 / 44.8	-34.4 / -37.2	33.3	9.3 / -8.2	14.3 / 13.3
Turbidity (NTU)		NA	NA	1.3	NA	NA	NA	NA	NA	NA	NA	NA

Please refer to notes at end of this table.

Table D-2
Surface, Inter-Armoring, and Sub-Armoring Water Data: Fall 2008
McCormick and Baxter Superfund Site
Portland, Oregon

SAMPLE LOCATION		Location 17			Location 18			Location 19		
Sample Type		**Surface Water**	**Inter-Armoring**	**Sub-Armoring**	**Surface Water**	**Inter-Armoring**	**Sub-Armoring**	**Surface Water**	**Inter-Armoring**	**Sub-Armoring**
Sample ID		**MBSW0908-17**	**MBIA0908-17**	**MBSA0908-17**	**MBSW0908-18**	**MBIA0908-18**	**MBSA0908-18**	**MBSW0908-19**	**MBIA0908-19**	**MBSA0908-19**
Sample Date		**9/18/2008**	**9/18/2008**	**9/18/2008**	**9/19/2008**	**9/19/2008**	**9/19/2008**	**9/19/2008**	**9/19/2008**	**9/19/2008**
Sample Time		**12:45**	**12:55**	**13:00**	**8:10**	**8:30**	**8:40**	**9:50**	**10:00**	**10:05**
CONTAMINANT OF CONCERN										
Total Dissolved Solids (mg/L)		90	90	110	70	80	100	80	80	100
Total Suspended Solids (mg/L)		9.43	45.7	5.68	3.84	18.6	0.596 U	3.77	1.9	9.4
Dissolved Metals (mg/L)										
Arsenic		**0.00062** J	**0.0009** J	**0.00425**	**0.000224** J	**0.00203**	**0.000338** J	**0.000267** J	0.00018 U	**0.00116**
Chromium (III)		0.00035 U	0.00035 U	0.00035 U	0.00035 U	0.00035 U	0.00035 U	0.00035 U	0.00035 U	0.00035 U
Copper		0.00027 U	**0.00082** J	0.00027 U	0.002 U	0.002 U	**0.0014** J	**0.000821** J	**0.00152** J	**0.00182** J
Zinc		**0.00195** J	**0.00593**	**0.00522**	0.005 U	**0.00555**	0.005 U	0.005 U	**0.00606**	0.005 U
Total Metals (mg/L)										
Arsenic		0.00054	0.0008	0.00383	0.00039	0.00215	0.00042	0.00035	0.00021	0.00125
Chromium (III)		0.00035 U	0.00035 U	0.00035 U	0.00035 U	**0.00058** J	**0.0007** J	**0.00056** J	**0.00059** J	**0.00088** J
Copper		**0.00152** J	**0.00324**	**0.00114** J	**0.00282**	**0.00205**	**0.00276**	**0.00119** J	**0.00217**	**0.00211**
Zinc		**0.00608**	**0.0108**	**0.00987**	**0.00543**	0.005 U	**0.00589**	0.005 U	0.005 U	0.005 U
Pentachlorophenol (µg/L)		0.236 U	0.237 U	0.238 U	0.238 U	0.238 U	0.238 U	0.238 U	0.238 U	0.238 U
Polynuclear aromatic hydrocarbons (µg/L)										
Acenaphthene	L	0.0118 U	0.0118 U	**0.2230**	0.0119 U	0.0119 U	0.0119 U	0.0119 U	0.0119 U	0.0119 U
Acenaphthylene	L	0.0118 U	0.0118 U	0.0119 U	0.0119 U	0.0119 U	0.0119 U	0.0119 U	0.0119 U	0.0119 U
Anthracene	L	0.0118 U	0.0118 U	0.0119 U	0.0119 U	0.0119 U	0.0119 U	0.0119 U	0.0119 U	0.0119 U
Benzo (a) anthracene	H, C	0.0118 U	0.0118 U	0.0119 U	0.0119 U	0.0119 U	0.0119 U	0.0119 U	0.0119 U	0.0119 U
Benzo (a) pyrene	H, C	0.0118 U	0.0118 U	0.0119 U	0.0119 U	0.0119 U	0.0119 U	0.0119 U	0.0119 U	0.0119 U
Benzo (b) fluoranthene	H, C	0.0118 U	0.0118 U	0.0119 U	0.0119 U	0.0119 U	0.0119 U	0.0119 U	0.0119 U	0.0119 U
Benzo (ghi) perylene	H, C	0.0118 U	0.0118 U	0.0119 U	0.0119 U	0.0119 U	0.0119 U	0.0119 U	0.0119 U	0.0119 U
Benzo (k) fluoranthene	H, C	0.0118 U	0.0118 U	0.0119 U	0.0119 U	0.0119 U	0.0119 U	0.0119 U	0.0119 U	0.0119 U
Chrysene	H, C	0.0118 U	0.0118 U	0.0119 U	0.0119 U	0.0119 U	0.0119 U	0.0119 U	0.0119 U	0.0119 U
Dibenzo (a,h) anthracene	H, C	0.0236 U	0.0237 U	0.0238 U	0.0238 U	0.0238 U	0.0238 U	0.0238 U	0.0238 U	0.0238 U
Fluoranthene	H	0.0118 U	0.0118 U	**0.3820**	0.0119 U	0.0119 U	0.0119 U	0.0119 U	0.0119 U	0.0119 U
Fluorene	L	0.0118 U	0.0118 U	**0.3540**	0.0119 U	0.0119 U	0.0119 U	0.0119 U	0.0119 U	0.0119 U
Indeno (1,2,3-cd) pyrene	H, C	0.0118 U	0.0118 U	0.0119 U	0.0119 U	0.0119 U	0.0119 U	0.0119 U	0.0119 U	0.0119 U
Naphthalene	L	0.0118 U	0.0118 U	0.0119 U	0.0119 U	0.0119 U	0.0119 U	0.0119 U	0.0119 U	0.0119 U
Phenanthrene	L	0.0118 U	0.0118 U	0.0119 U	0.0119 U	0.0119 U	0.0119 U	0.0119 U	0.0119 U	0.0119 U
Pyrene	H	0.0118 U	0.0118 U	**0.1120**	0.0119 U	0.0119 U	0.0119 U	0.0119 U	0.0119 U	0.0119 U
Total LPAHs		0.0354 U	0.0354 U	**0.5770**	0.0357 U	0.0357 U	0.0357 U	0.0357 U	0.0357 U	0.0357 U
Total HPAHs		0.0649 U	0.0650 U	**0.4940**	0.0650 U	0.0650 U	0.0650 U	0.0650 U	0.0650 U	0.0650 U
Total CPAHs		0.0531 U	0.0530 U	0.0540 U	0.0540 U	0.0540 U	0.0540 U	0.0540 U	0.0540 U	0.0540 U
Total PAHs		0.1000 U	0.1000 U	**1.0700**	0.1010 U	0.1010 U	0.1010 U	0.1010 U	0.1010 U	0.1010 U
Field Parameters (pre-/post-sample)										
Temperature (°C)		19.3	19.33	18.14 / 19.22	17.91	17.48 / 17.82	18.08 / 18.01	17.6	17.2 / 17.4	17.1 / 17.3
Specific Conductance (mS/cm)		0.01206	0.04245	0.04304 / 0.04339	0.083	0.162 / 0.17	NA / 0.209	0.248	0.407 / 0.102	0.43 / 0.428
Dissolved Oxygen (mg/L)		8.96	7.8	1.12 / 0.86	6.76	6.37 / 6.35	5.61 / 5.77	NA	NA	NA
pH		7.16	7.25	7.22 / 7.13	7.03	6.9 / 6.92	7.17 / 7.2	7.39	7.08 / 6.55	6.58 / 6.49
Oxidation Reduction Potential (mV)		-26.7	-31	-31.4 / -25.3	58.5	46.7 / 46.5	48.5 / 49.9	193	179 / 179	160 / 192
Turbidity (NTU)		NA	NA	NA	NA	NA	NA	NA	NA	NA

Please refer to notes at end of this table.

Table D-2
Surface, Inter-Armoring, and Sub-Armoring Water Data: Fall 2008
McCormick and Baxter Superfund Site
Portland, Oregon

SAMPLE LOCATION		Location 20			Location 21			Location 25		
Sample Type		**Surface Water**	**Inter-Armoring**	**Sub-Armoring**	**Surface Water**	**Inter-Armoring**	**Sub-Armoring**	**Surface Water**	**Inter-Armoring**	**Sub-Armoring**
Sample ID		**MBSW0908-20**	**MBIA0908-20**	**MBSA0908-20**	**MBSW0908-21**	**MBIA0908-21**	**MBSA0908-21**	**MBSW0908-25**	**MBIA0908-25**	**MBSA0908-25**
Sample Date		**9/15/2008**	**9/15/2008**	**9/15/2008**	**9/18/2008**	**9/18/2008**	**9/18/2008**	**9/23/2008**	**9/23/2008**	**9/23/2008**
Sample Time		**13:00**	**13:30**	**13:40**	**10:35**	**10:50**	**10:45**	**14:00**	**14:17**	**14:45**
CONTAMINANT OF CONCERN										
Total Dissolved Solids (mg/L)		70	70	130	80	80	150	80	80	90
Total Suspended Solids (mg/L)		11.5	11.5	123	3.72	3.77	207	3.7	9.4	128
Dissolved Metals (mg/L)										
Arsenic		0.00018 U	0.00018 U	**0.00344**	**0.000221** J	**0.000182** J	**0.00165**	**0.0006** J	**0.00053** J	**0.00043** J
Chromium (III)		0.00035 U	0.00035 U	0.00035 U	0.00035 U	0.00035 U	0.00035 U	0.00035 U	0.00035 U	0.00035 U
Copper		**0.000277** J	**0.000754** J	0.00027 U	**0.000378** J	**0.000997** J	0.00027 U	**0.00068** J	**0.00136** J	**0.00101** J
Zinc		**0.00152** J	**0.00354** J	**0.00256** J	0.005 U	**0.00918**	**0.00551**	0.005 U	**0.0113**	0.005 U
Total Metals (mg/L)										
Arsenic		0.000199	0.000018 U	0.00313	0.00045	0.00041	0.00161	0.000846	0.000498	0.00059
Chromium (III)		0.00035 U	0.00035 U	**0.00112** J	**0.00168** J	**0.00205**	**0.00042** J	**0.000516** J	**0.000393** J	**0.001** J
Copper		**0.000796** J	**0.00156** J	**0.00128** J	**0.00092** J	**0.00148** J	**0.0005** J	**0.00096** J	**0.0022**	**0.00276**
Zinc		0.005 U	**0.00557**	0.005 U	0.005 U	**0.0164**	**0.00525**	0.005 U	**0.0156**	**0.00696**
Pentachlorophenol (µg/L)		0.238 U	0.238 U	0.238 U	0.239 U	0.239 U	0.238 U	0.24 U	0.243 U	0.238 U
Polynuclear aromatic hydrocarbons (µg/L)										
Acenaphthene	L	0.0119 U	0.0119 U	**0.350**	0.012 U	0.012 U	0.0119 U	**0.0700**	**0.0176** J	**0.0225** J
Acenaphthylene	L	0.0119 U	0.0119 U	0.0119 U	0.012 U	0.012 U	0.0119 U	0.0120 U	0.0121 U	0.0119 U
Anthracene	L	0.0119 U	0.0119 U	0.0119 U	0.012 U	0.012 U	0.0119 U	0.0120 U	0.0121 U	0.0119 U
Benzo (a) anthracene	H, C	0.0119 U	0.0119 U	0.0119 U	0.012 U	0.012 U	0.0119 U	0.0120 U	0.0121 U	0.0119 U
Benzo (a) pyrene	H, C	0.0119 U	0.0119 U	0.0119 U	0.012 U	0.012 U	0.0119 U	0.0120 U	0.0121 U	0.0119 U
Benzo (b) fluoranthene	H, C	0.0119 U	0.0119 U	0.0119 U	0.012 U	0.012 U	0.0119 U	0.0120 U	0.0121 U	0.0119 U
Benzo (ghi) perylene	H, C	0.0119 U	0.0119 U	0.0119 U	0.012 U	0.012 U	0.0119 U	0.0120 U	0.0121 U	0.0119 U
Benzo (k) fluoranthene	H, C	0.0119 U	0.0119 U	0.0119 U	0.012 U	0.012 U	0.0119 U	0.0120 U	0.0121 U	0.0119 U
Chrysene	H, C	0.0119 U	0.0119 U	0.0119 U	0.012 U	0.012 U	0.0119 U	0.0120 U	0.0121 U	0.0119 U
Dibenzo (a,h) anthracene	H, C	0.0238 U	0.0238 U	0.0238 U	0.0239 U	0.0239 U	0.0238 U	0.0240 U	0.0243 U	0.0238 U
Fluoranthene	H	0.0119 U	0.0119 U	0.0119 U	0.012 U	0.012 U	0.0119 U	0.0120 U	0.0121 U	0.0119 U
Fluorene	L	0.0119 U	0.0119 U	**0.0815**	0.012 U	0.012 U	0.0119 U	**0.0246**	**0.0122** J	0.0119 U
Indeno (1,2,3-cd) pyrene	H, C	0.0119 U	0.0119 U	0.0119 U	0.012 U	0.012 U	0.0119 U	0.0120 U	0.0121 U	0.0119 U
Naphthalene	L	0.0119 U	0.0119 U	**0.0158** J	0.012 U	0.012 U	0.0119 U	**0.3420**	**0.0725**	**0.0874**
Phenanthrene	L	0.0119 U	0.0119 U	0.0119 U	0.012 U	0.012 U	0.0119 U	0.0120 U	0.0121 U	0.0119 U
Pyrene	H	0.0119 U	0.0119 U	0.0119 U	0.012 U	0.012 U	0.0119 U	0.0120 U	0.0121 U	0.0119 U
Total LPAHs		0.0357 U	0.0357 U	**0.4470**	0.0360 U	0.0360 U	0.0357 U	**0.4370**	**0.1020**	**0.1100**
Total HPAHs		0.0650 U	0.0650 U	0.0650 U	0.0660 U	0.0660 U	0.0650 U	0.0660 U	0.0666 U	0.0650 U
Total CPAHs		0.0540 U	0.0540 U	0.0540 U	0.0540 U	0.0540 U	0.0540 U	0.0540 U	0.0545 U	0.0540 U
Total PAHs		0.1010 U	0.1010 U	**0.4470**	0.1020 U	0.1020 U	0.1010 U	**0.4370**	**0.1020**	**0.1100**
Field Parameters (pre-/post-sample)										
Temperature (°C)		20.76	20.81 / 21.3	20.46 / 21.03	18.76	18.72 / 18.68	18.39 / 18.42	18.19	18.01 / 18.1	18.3 / 18.29
Specific Conductance (mS/cm)		0.134	0.157 / 0.15	0.178 / 0.179	0.01152	0.03865 / 0.03874	0.04447 / 0.04476	0.091	0.109 / 0.113	0.158 / 0.161
Dissolved Oxygen (mg/L)		8.88	6.97 / 6.66	1.27 / 2.4	7.8	7.33 / 6.77	0.78 / 0.86	7.96	4.91 / 4.96	0.96 / 0.88
pH		6.59	6.71 / 6.82	6.72 / 6.72	6.81	7.23 / 7.15	7.33 / 7.04	7.88	7.59 / 7.44	7.01 / 7.07
Oxidation Reduction Potential (mV)		70.5	52.7 / 44	8.7 / -18.3	6.8	-43.6 / -40.6	-71.9 / -57.5	66.6	15.1 / 9.8	-15.1 / -17.7
Turbidity (NTU)		NA	NA	NA	NA	NA	NA	29.9	NA	NA

Please refer to notes at end of this table.

Table D-2
Surface, Inter-Armoring, and Sub-Armoring Water Data: Fall 2008
McCormick and Baxter Superfund Site
Portland, Oregon

SAMPLE LOCATION		Location 26			Location 27	Location 05	Location 09	Location 13	Location 20
Sample Type		Surface Water	Inter-Armoring	Sub-Armoring	Surface Water	Inter-Armoring	Sub-Armoring	Sub-Armoring	Inter-Armoring
Sample ID		MBSW0908-26	MBIA0908-26	MBSA0908-26	MBSW0908-27	MBIA0908-05R	MBSA0908-09R	MBSA0908-13R	MBIA0908-20R
Sample Date		9/23/2008	9/23/2008	9/23/2008	9/15/2008	9/17/2008	9/16/2008	9/18/2008	9/15/2008
Sample Time		13:37	14:45	14:12	12:00	19:00	17:30	14:00	17:45
CONTAMINANT OF CONCERN									
Total Dissolved Solids (mg/L)		90	80	120	70				
Total Suspended Solids (mg/L)		5.47	3.57	9.11	7.45				
Dissolved Metals (mg/L)									
Arsenic		**0.0018** J	**0.00084** J	**0.00042** J	0.00018 U		0.00018 U	0.0009 U	
Chromium (III)		0.00035 U	0.00035 U	0.00035 U	0.00035 U		0.00035 U	0.00035 U	
Copper		**0.00121** J	**0.00152** J	**0.00119** J	**0.000469** J		0.00027 U	0.00027 U	
Zinc		0.005 U	0.005 U	**0.00824**	**0.00264** J		0.005 U	0.0035 U	
Total Metals (mg/L)									
Arsenic		0.00132	0.000754	0.00071	0.00018 U	0.000209	0.00018 U	0.00018 U	0.00018 U
Chromium (III)		0.00035 U	0.00035 U	**0.000436** J	0.00035 U	0.00035 U	0.00035 U	**0.00092** J	0.00035 U
Copper		**0.000882** J	**0.00138** J	**0.00132** J	**0.00054** J	**0.00166** J	0.00027 U	0.00027 U	0.00027 U
Zinc		**0.0111**	0.005 U	**0.00945**	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U
Pentachlorophenol (µg/L)		0.237 U	0.236 U	0.236 U	0.238 U	0.236 U	0.237 U	0.238 U	0.238 U
Polynuclear aromatic hydrocarbons (µg/L)									
Acenaphthene	L	**0.7040**	**0.1840**	0.0118 U	0.0119 U	0.0118 U	0.0118 U	0.0119 U	**0.0153** J
Acenaphthylene	L	0.0118 U	0.0118 U	0.0118 U	0.0119 U	0.0118 U	0.0118 U	0.0119 U	0.0119 U
Anthracene	L	0.0118 U	0.0118 U	0.0118 U	0.0119 U	0.0118 U	0.0118 U	0.0119 U	0.0119 U
Benzo (a) anthracene	H, C	0.0118 U	0.0118 U	0.0118 U	0.0119 U	0.0118 U	0.0118 U	0.0119 U	0.0119 U
Benzo (a) pyrene	H, C	0.0118 U	0.0118 U	0.0118 U	0.0119 U	0.0118 U	0.0118 U	0.0119 U	0.0119 U
Benzo (b) fluoranthene	H, C	0.0118 U	0.0118 U	0.0118 U	0.0119 U	0.0118 U	0.0118 U	0.0119 U	0.0119 U
Benzo (ghi) perylene	H, C	0.0118 U	0.0118 U	0.0118 U	0.0119 U	0.0118 U	0.0118 U	0.0119 U	0.0119 U
Benzo (k) fluoranthene	H, C	0.0118 U	0.0118 U	0.0118 U	0.0119 U	0.0118 U	0.0118 U	0.0119 U	0.0119 U
Chrysene	H, C	0.0118 U	0.0118 U	0.0118 U	0.0119 U	0.0118 U	0.0118 U	0.0119 U	0.0119 U
Dibenzo (a,h) anthracene	H, C	0.0237 U	0.0236 U	0.0236 U	0.0238 U	0.0236 U	0.0237 U	0.0238 U	0.0238 U
Fluoranthene	H	**0.0239**	0.0118 U	0.0118 U	0.0119 U	0.0118 U	0.0118 U	0.0119 U	0.0119 U
Fluorene	L	**0.2620**	**0.0692**	0.0118 U	0.0119 U	0.0118 U	0.0118 U	0.0119 U	0.0238 U
Indeno (1,2,3-cd) pyrene	H, C	0.0118 U	0.0118 U	0.0118 U	0.0119 U	0.0118 U	0.0118 U	0.0119 U	0.0119 U
Naphthalene	L	**2.9300**	**0.4880**	**0.0235** J	0.0119 U	**0.0895**	**0.0616**	**0.0486**	**0.0344**
Phenanthrene	L	**0.0566**	**0.0154** J	0.0118 U	0.0119 U	**0.0136** J	**0.0131** J	**0.0136** J	**0.0251**
Pyrene	H	0.0118 U	0.0118 U	0.0118 U	0.0119 U	0.0118 U	0.0118 U	0.0119 U	0.0119 U
Total LPAHs		**3.9500**	**0.7570**	**0.0235**	0.0357 U	**0.1030**	**0.0747**	**0.0622**	**0.0748**
Total HPAHs		**0.0239**	0.0649 U	0.0649 U	0.0650 U	0.0649 U	0.0650 U	0.0650 U	0.0650 U
Total CPAHs		0.0530 U	0.0531 U	0.0531 U	0.0540 U	0.0531 U	0.0530 U	0.0540 U	0.0540 U
Total PAHs		**3.9800**	**0.7570**	**0.0235**	0.1010 U	**0.1030**	**0.0747**	**0.0622**	**0.0748**
Field Parameters (pre-/post-sample)									
Temperature (°C)		18.01	17.92 / 18.11	17.86 / 17.91	20.35	NA	NA	NA	NA
Specific Conductance (mS/cm)		0.078	0.123 / 0.118	0.147 / 0.149	0.146	NA	NA	NA	NA
Dissolved Oxygen (mg/L)		0.01	0.44 / 0.39	0.24 / 0.19	2.06	NA	NA	NA	NA
pH		7.23	7.03 / 7.6	6.9 / 6.88	6.51	NA	NA	NA	NA
Oxidation Reduction Potential (mV)		53	29.6 / 25.5	-14.4 / -15	72	NA	NA	NA	NA
Turbidity (NTU)		25.9	NA	NA	NA	NA	NA	NA	NA

Please refer to notes at end of this table.

Table D-2
Surface, Inter-Armoring, and Sub-Armoring Water Data: Fall 2008
McCormick and Baxter Superfund Site
Portland, Oregon

Notes:

[1] The 1996 Record of Decision (ROD) specifies the remedial action objects 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 federal and state Ambient Water Quality Criteria (AWQCs).

[2] National Recommended Water Quality Criteria (NRWQCs) published as of August 15, 2007, are included for comparison (see http://www.epa.gov/waterscience/criteria/wqcriteria.html). The current publication includes criteria revisions published in 2002 National Recommended Water Quality Criteria: 2002 table (EPA-822-R-02-047) and 2003 Revised human Health Water Quality Criteria (EPA-822-F-03-012). Note that the aquatic life chronic criteria for pentachlorophenol has been adjusted to site-specific pH (7.5, representing a mid-range of the pH values measured in surface water at the site), and therefore differs from the standard table value. Criteria for metals (Cr, Cu, Zn) have not been adjusted for site-specific hardness. Carcinogenic risk-based numbers reflect a carcinogenicity risk of 10^{-6}.

[3] National Primary Drinking Water Regulations Maximum Contaminant Levels (MCLs) promulgated as of August 15, 2007, are included for comparison (see http://www.epa.gov/safewater/contaminants/index.html#primary).

The number of significant figures presented in the table do not reflect true accuracy presented by the laboratory results. Data should only retain 3 significant figures. Due to statistical evaluation using Microsoft Excel, additional significant figures may be shown.

AWQC	Ambient Water Quality Criteria
C	Carcinogenic PAH (CPAH)
CCC	Criterion Continuous Concentration
H	High Molecular Weight PAH (HPAH)
J	Estimated Value
L	Low Molecular Weight PAH (LPAH)
MCL	Drinking Water Maximum Contaminant Levels
MDL	Method Detection Limit
mg/L	milligrams per liter
PAH	Polyanuclear romatic hydrocarbons
ROD	Record of Decision
U	Value Below MDL (value represents MDL)
µg/L	micrograms per liter
Gamma	Gamma Distribution
NP	Non-parametric Distribution
Max	Maximum Concentration
NA	Not Available
*	Ambient water with turbidity entered sampling apparatus during collection.

Bold Indicates Analyte was detected, but does not exceed the most stringent criteria.

shaded Indicates a value less than the MDL where the MDL exceeds the stringent sediment cap performance goal or comparison criteria. Only used in 2007 and 2008 data tables.

Inverse Indicates results that exceed the lowest (most stringent) of the sediment cap performance goals or comparison criteria.

Table D-3
Summary of Surface Water Data
McCormick and Baxter Superfund Site
Portland, Oregon

Sample Event		McCormick & Baxter Record of Decision, 1996, Ambient Water Quality Criteria (AWQCs)		EPA Current, 2007, National Recommended Water Quality Criteria (NRWQCs)		EPA National Primary Drinking Water Regulations (NPDWRs)	Surface Water Fall 2002 - With Sample SED 6						
Contaminant of Concern		Aquatic Life (chronic)[1]	Human Health (fish consumption only)[1]	Aquatic Life (chronic)[2]	Human Health (consumption of organism only)[2]	Maximum Contaminant Levels (MCLs)[3]	**Number of Samples**	**Detection Frequency**	**Max Detection**	**Max Location**	**Mean Conc.**	**Data Distribution**	**95% UCL**
Total Suspended Solids (mg/L)							--	--	--	--	--	--	--
Dissolved Organic Carbon (mg/L)							--	--	--	--	--	--	--
Dissolved Metals (mg/L)													
Arsenic							--	--	--	--	--	--	--
Chromium							--	--	--	--	--	--	--
Copper							--	--	--	--	--	--	--
Zinc							--	--	--	--	--	--	--
Total Metals (mg/L)													
Arsenic		0.19		0.15	0.00014	0.01	15	27%	0.0011	SED-6	0.0003	NP	0.0005
Chromium		0.21		0.074		0.1	15	33%	0.0021	SED-8	0.0006	NP	0.0010
Copper		0.012		0.009			15	100%	0.0209	SED-7	0.0046	Gamma	0.0158
Zinc		0.11		0.12	26		15	100%	0.0181	SED-9	0.0049	NP	0.0083
Pentachlorophenol (µg/L)		13		15	3	1	**15**	**0.4**	**0.079**	**SED-3**	**0.0684**	**NP**	**0.1233**
Polynuclear Aromatic Hydrocarbons (PAHs) (µg/L)													
Acenaphthene	L	520			990		15	13%	9.8	SED-6	0.6634	NP	7.157
Acenaphthylene	L						15	7%	0.042	SED-6	0.0127	NP	0.0167
Anthracene	L				40,000		15	7%	3.8	SED-6	0.2632	NP	2.777
Benzo[a]anthracene	H, C				0.018		15	27%	1.5	SED-6	0.1140	NP	1.099
Benzo[b]fluoranthene	H, C				0.018	0.2	15	7%	0.77	SED-6	0.0612	NP	0.5650
Benzo[k]fluoranthene	H				0.018		15	7%	0.39	SED-6	0.0359	NP	0.1461
Benzo[a]pyrene	H, C						15	7%	0.44	SED-6	0.0441	NP	0.1674
Benzo[g,h,i]perylene	H, C				0.018		15	7%	0.087	SED-6	0.0157	NP	0.0379
Chrysene	H, C				0.018		15	27%	1.2	SED-6	0.0941	NP	0.8803
Dibenzo[a,h]anthracene	H, C				0.018		15	20%	0.093	SED-6	0.0282	NP	0.0374
Fluoranthene	H		54		140		15	60%	11.9	SED-6	0.8068	NP	8.691
Fluorene	L				5300		6	0%	ND	N/A	0.0120	NP	0.0123
Ideno[1,2,3-cd]pyrene	H, C				0.018		15	7%	0.13	SED-6	0.0234	NP	0.0568
Naphthalene	L	620					15	7%	3.3	SED-6	0.2299	NP	2.412
Phenanthrene	L						15	33%	22.7	SED-6	1.524	NP	16.574
Pyrene	H				4,000		15	33%	5.3	SED-6	0.3645	NP	3.872
Total LPAHs							15	33%	39.6	SED-6	2.664	NP	28.915
Total HPAHs							15	60%	21.8	SED-6	1.482	NP	15.922
Total Carcinogenic PAHs			0.031				15	20%	4.22	SED-6	0.3270	NP	3.093
Total PAHs							15	53%	61.5	SED-6	4.163	NP	44.911

Please refer to notes on last page of this table.

Table D-3
Summary of Surface Water Data
McCormick and Baxter Superfund Site
Portland, Oregon

Sample Event		Surface Water Fall 2002 - Without Sample SED-6							Surface Water Fall 2003						
Contaminant of Concern		**Number of Samples**	**Detection Frequency**	**Max Detection**	**Max Location**	**Mean Conc.**	**Data Distribution**	**95% UCL**	**Number of Samples**	**Detection Frequency**	**Max Detection**	**Max Location**	**Mean Conc.**	**Data Distribution**	**95% UCL**
Total Suspended Solids (mg/L)		--	--	--	--	--	--	--	21	100%	180	MBSWGB0326	22.33	NP	112.54
Dissolved Organic Carbon (mg/L)		--	--	--	--	--	--	--	21	100%	3.33	MBSWGB0312	2.2195	Gamma	2.3462
Dissolved Metals (mg/L)															
Arsenic		--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chromium		--	--	--	--	--	--	--	--	--	--	--	--	--	--
Copper		--	--	--	--	--	--	--	--	--	--	--	--	--	--
Zinc		--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total Metals (mg/L)															
Arsenic		14	21%	0.94	SED-8 (ug/L)	0.2756	NP	0.4395	21	81%	0.00206	MBSWGB0326	0.0010	Normal	0.0012
Chromium		14	36%	2.1	SED-8 (ug/L)	0.5683	NP	0.9701	21	100%	0.00547	MBSWGB0326	0.0024	NP	0.0027
Copper		14	100%	20.9	SED-7 (ug/L)	4.7286	Gamma	18.1255	21	100%	0.0211	MBSWGB0315	0.0035	NP	0.0079
Zinc		14	100%	18.1	SED-9 (ug/L)	4.5853	NP	9.5572	21	100%	0.0199	MBSWGB0326	0.0072	NP	0.0088
Pentachlorophenol (µg/L)		**14**	**0.357142857**	**0.079**	**SED-3 (ug/L)**	**0.0677**	**Max**	**0.0790**	21	0%	ND	N/A	0.0340	NP	0.0784
Polynuclear Aromatic Hydrocarbons (PAHs) (µg/L)															
Acenaphthene	L	14	7%	0.013	SED-8 (ug/L)	0.0108	NP	0.0115	21	0%	ND	N/A	0.0060	NP	0.0060
Acenaphthylene	L	14	0%	ND	N/A	0.0106	NP	0.0112	21	0%	ND	N/A	0.0060	NP	0.0060
Anthracene	L	14	0%	ND	N/A	0.0106	NP	0.0112	21	0%	ND	N/A	0.0060	NP	0.0060
Benzo[a]anthracene	H, C	14	21%	0.036	SED-1 (ug/L)	0.0150	Gamma	0.0195	21	0%	ND	N/A	0.0024	Normal	0.0024
Benzo[b]fluoranthene	H, C	14	0%	ND	N/A	0.0106	NP	0.0112	21	5%	0.00806	MBSWGB0309	0.0027	NP	0.0032
Benzo[k]fluoranthene	H	14	0%	ND	N/A	0.0106	NP	0.0112	21	5%	0.00806	MBSWGB0309	0.0027	NP	0.0032
Benzo[a]pyrene	H, C	14	0%	ND	N/A	0.0158	NP	0.0174	21	5%	0.00239	MBSWGB0301	0.0012	NP	0.0014
Benzo[g,h,i]perylene	H, C	14	0%	ND	N/A	0.0106	NP	0.0112	21	0%	ND	N/A	0.0060	NP	0.0060
Chrysene	H, C	14	21%	0.036	SED-1 (ug/L)	0.0151	Gamma	0.0195	21	5%	0.0121	MBSWGB0309	0.0028	NP	0.0037
Dibenzo[a,h]anthracene	H, C	14	14%	0.037	SED-2 (ug/L)	0.0235	Gamma	0.0265	21	0%	ND	N/A	0.0027	NP	0.0064
Fluoranthene	H	14	57%	0.032	SED-3 (ug/L)	0.0144	Gamma	0.0192	21	19%	0.0783	MBSWGB0309	0.0073	NP	0.0438
Fluorene	L	6	0%	ND	N/A	0.0120	NP	0.0123	21	5%	0.0125	MBSWGB0309	0.0063	NP	0.0069
Ideno[1,2,3-cd]pyrene	H, C	14	0%	ND	N/A	0.0158	NP	0.0174	21	0%	ND	N/A	0.0027	NP	0.0064
Naphthalene	L	14	0%	ND	N/A	0.0106	NP	0.0112	21	0%	ND	N/A	0.0073	Max	0.0240
Phenanthrene	L	14	29%	0.018	SED-1 (ug/L)	0.0114	Gamma	0.0125	21	5%	0.116	MBSWGB0309	0.0112	NP	0.0340
Pyrene	H	14	29%	0.018	SED-1 (ug/L)	0.0120	Gamma	0.0132	21	33%	2.58	MBSWGB0324	0.1269	NP	1.3475
Total LPAHs		14	29%	0.013	SED-3 AND	0.0253	Max	0.0130	21	5%	0.116	MBSWGB0309	0.0231	NP	0.0319
Total HPAHs		14	57%	0.074	SED-9 (ug/L)	0.0308	Normal	0.0400	21	43%	0.16625	MBSWGB0309	0.0183	NP	0.0932
Total Carcinogenic PAHs		14	14%	0.045	SED-9 (ug/L)	0.0490	Normal	0.0546	21	5%	0.10085	MBSWGB0309	0.0143	NP	0.0333
Total PAHs		14	57%	0.0827	SED-9 (ug/L)	0.0621	Max	0.0827	21	43%	0.28225	MBSWGB0309	0.0325	NP	0.1599

Please refer to notes on last page of this table.

Table D-3
Summary of Surface Water Data
McCormick and Baxter Superfund Site
Portland, Oregon

Sample Event		Surface Water Fall 2005						
Contaminant of Concern		**Number of Samples**	**Detection Frequency**	**Max Detection**	**Max Location**	**Mean Conc.**	**Data Distribution**	**95% UCL**
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
Dissolved Metals (mg/L)								
Arsenic		26	46%	0.000978	MBSWGB05-18	0.0004	NP	0.0006
Chromium		26	0%	ND	NA	0.0004	NA	NA
Copper		26	81%	0.0112	MBSWGB05-13	0.0014	NP	0.0031
Zinc		26	85%	0.00979	MBSWGB05-13	0.0036	Gamma	0.0046
Total Metals (mg/L)								
Arsenic		26	100%	0.00142	MBSWGB05-04	0.0008	Gamma	0.0008
Chromium		26	0%	ND	NA	0.0004	NP	0.0004
Copper		26	81%	0.00283	MBSWGB05-32	0.0010	NP	0.0012
Zinc		26	88%	0.00843	MBSWGB05-32	0.0031	NP	0.0046
Pentachlorophenol (µg/L)		26	0%	ND	NA	0.1745	NP	0.2866
Polynuclear Aromatic Hydrocarbons (PAHs) (µg/L)								
Acenaphthene	L	26	19%	0.0972	MBSWGB05-17	0.0168	NP	0.0356
Acenaphthylene	L	26	0%	ND	NA	0.0087	NP	0.0143
Anthracene	L	26	0%	ND	NA	0.0087	NP	0.0143
Benzo[a]anthracene	H, C	26	0%	ND	NA	0.0087	NP	0.0143
Benzo[b]fluoranthene	H, C	26	0%	ND	NA	0.0087	NP	0.0143
Benzo[k]fluoranthene	H	26	0%	ND	NA	0.0087	NP	0.0143
Benzo[a]pyrene	H, C	26	0%	ND	NA	0.0087	NP	0.0143
Benzo[g,h,i]perylene	H, C	26	0%	ND	NA	0.0087	NP	0.0143
Chrysene	H, C	26	0%	ND	NA	0.0087	NP	0.0143
Dibenzo[a,h]anthracene	H, C	26	0%	ND	NA	0.0174	NP	0.0287
Fluoranthene	H	26	0%	ND	NA	0.0087	NP	0.0143
Fluorene	L	26	8%	0.0234	MBSWGB05-17	0.0098	NP	0.0159
Ideno[1,2,3-cd]pyrene	H, C	26	0%	ND	NA	0.0087	NP	0.0143
Naphthalene	L	26	15%	0.911	MBSWGB05-17	0.0663	NP	0.0444
Phenanthrene	L	26	4%	0.0129	MBSWGB05-17	0.0090	Max	0.0129
Pyrene	H	26	0%	ND	NA	0.0087	NP	0.0143
Total LPAHs		26	19%	1.0445	MBSWGB05-17	0.0931	NP	0.5196
Total HPAHs		26	4%	0.0132	MBSWGB05-32	0.0460	Max	0.0132
Total Carcinogenic PAHs		26	0%	ND	NA	0.0414	NP	0.0666
Total PAHs		26	19%	1.10505	MBSWGB05-17	0.1437	NP	0.3230

Please refer to notes on last page of this table.

Table D-3
Summary of Surface Water Data
McCormick and Baxter Superfund Site
Portland, Oregon

Sample Event		Surface Water Spring 2006							Surface Water Fall 2006						
Contaminant of Concern		**Number of Samples**	**Detection Frequency**	**Max Detection**	**Max Location**	**Mean Conc.**	**Data Distribution**	**95% UCL**	**Number of Samples**	**Detection Frequency**	**Max Detection**	**Max Location**	**Mean Conc.**	**Data Distribution**	**95% UCL**
Total Suspended Solids (mg/L)		–	–	–	–	–	–	–	22	95%	20	Location 19	5.6905	Lognormal	7.2709
Dissolved Organic Carbon (mg/L)		–	–	–	–	–	–	–	–	–	–	–	–	–	–
Dissolved Metals (mg/L)															
Arsenic		–	–	–	–	–	–	–	21	95%	0.00061	Location 18	0.0004	NP	0.0005
Chromium		–	–	–	–	–	–	–	21	52%	0.00013	Location 11	0.0001	NP	0.0001
Copper		–	–	–	–	–	–	–	21	100%	0.00132	Location 25	0.0007	NP	0.0008
Zinc		–	–	–	–	–	–	–	21	71%	0.00487	Location 11	0.0028	NP	0.0068
Total Metals (mg/L)															
Arsenic		23	22%	0.00233	Location 25	0.0006	NP	0.0011	22	95%	0.00071	Location 25	0.0005	Gamma	0.0005
Chromium		23	74%	0.00455	Location 14	0.0010	NP	0.0036	22	64%	0.00234	Location 3	0.0003	NP	0.0007
Copper		23	74%	0.0168	Location 18	0.0040	Max	0.0168	22	100%	0.00344	Location 3	0.0011	NP	0.0014
Zinc		23	87%	0.04	Location 25	0.0082	NP	0.0291	22	27%	0.00482	Location 7	0.0016	NP	0.0028
Pentachlorophenol (µg/L)		23	0%	ND	NA	0.1197	NP	0.1203	22	0%	ND	NA	0.1239	Normal	0.1249
Polynuclear Aromatic Hydrocarbons (PAHs) (µg/L)															
Acenaphthene	L	23	0%	ND	NA	0.0060	NP	0.0060	22	23%	0.166	Location 25	0.0190	NP	0.0534
Acenaphthylene	L	23	0%	ND	NA	0.0060	NP	0.0060	22	5%	0.0126	Location 4	0.0065	NP	0.0070
Anthracene	L	23	0%	ND	NA	0.0060	NP	0.0060	22	5%	0.0126	Location 4	0.0065	NP	0.0070
Benzo[a]anthracene	H, C	23	0%	ND	NA	0.0060	NP	0.0060	22	5%	0.0126	Location 4	0.0065	NP	0.0070
Benzo[b]fluoranthene	H, C	23	4%	0.0124	Location 13	0.0063	NP	0.0068	22	5%	0.0126	Location 4	0.0065	NP	0.0070
Benzo[k]fluoranthene	H	23	4%	0.0119	Location 13	0.0063	NP	0.0067	22	0%	ND	NA	0.0062	Normal	0.0062
Benzo[a]pyrene	H, C	23	4%	0.0146	Location 13	0.0064	NP	0.0071	22	0%	ND	NA	0.0062	Normal	0.0062
Benzo[g,h,i]perylene	H, C	23	0%	0.0062	Location 12	0.0060	NP	0.0060	22	0%	ND	NA	0.0062	Normal	0.0062
Chrysene	H, C	23	9%	0.0195	Location 25	0.0069	NP	0.0082	22	5%	0.0126	Location 4	0.0065	NP	0.0070
Dibenzo[a,h]anthracene	H, C	23	0%	ND	NA	0.0120	NP	0.0120	22	0%	ND	NA	0.0124	Normal	0.0125
Fluoranthene	H	23	9%	0.0396	Location 25	0.0085	NP	0.0162	22	5%	0.0143	Location 14	0.0066	NP	0.0073
Fluorene	L	23	0%	ND	NA	0.0060	NP	0.0060	22	9%	0.062	Location 25	0.0098	NP	0.0215
Ideno[1,2,3-cd]pyrene	H, C	23	0%	ND	NA	0.0060	NP	0.0060	22	0%	ND	NA	0.0062	Normal	0.0062
Naphthalene	L	23	26%	0.19	Location 25	0.0173	NP	0.0523	22	18%	0.93	Location 25	0.0873	NP	0.6179
Phenanthrene	L	23	4%	0.0159	Location 13	0.0064	NP	0.0072	22	9%	0.0295	Location 25	0.0075	NP	0.0096
Pyrene	H	23	13%	0.0319	Location 25	0.0082	NP	0.0104	22	9%	0.0128	Location 14	0.0068	NP	0.0075
Total LPAHs		23	26%	0.19	Location 25	0.0269	NP	0.0600	22	18%	1.1875	Location 25	0.1160	NP	0.7602
Total HPAHs		23	13%	0.1066	Location 13	0.0404	NP	0.0473	22	0%	ND	NA	0.0340	Normal	0.0343
Total Carcinogenic PAHs		23	9%	0.053	Location 13	0.0278	NP	0.0298	22	0%	ND	NA	0.0279	Normal	0.0281
Total PAHs		23	30%	0.281	Location 25	0.0582	NP	0.1093	22	23%	1.1875	Location 25	0.1224	NP	0.7621

Please refer to notes on last page of this table.

Table D-3
Summary of Surface Water Data
McCormick and Baxter Superfund Site
Portland, Oregon

Sample Event		Surface Water Spring 2007							Surface Water Fall 2007						
Contaminant of Concern		**Number of Samples**	**Detection Frequency**	**Max Detection**	**Max Location**	**Mean Conc.**	**Data Distribution**	**95% UCL**	**Number of Samples**	**Detection Frequency**	**Max Detection**	**Max Location**	**Mean Conc.**	**Data Distribution**	**95% UCL**
Total Suspended Solids (mg/L)		23	100%	12	Location 6	7.2609	Normal	8.4000	22	91%	86	Location 25	19.0427	Log	36.4492
Dissolved Organic Carbon (mg/L)		--	--	--	--	--	--	--	--	--	--	--	--	--	--
Dissolved Metals (mg/L)															
Arsenic		23	83%	0.00004	Location 10	0.0000	NP	0.0003	22	9%	0.000967	Location 17	0.0004	NP	0.0005
Chromium		23	100%	0.00039	Location 10	0.0004	Normal	0.0004	22	0%	ND	NA	0.0001	--	--
Copper		23	100%	0.00053	Location 10	0.0005	NP	0.0007	22	95%	0.00103	Location 25	0.0007	Normal	0.0072
Zinc		23	83%	0.00158	Location 10	0.0003	NP	0.0120	22	73%	0.0058	Location 2	0.0024	NP	0.0036
Total Metals (mg/L)															
Arsenic		23	100%	0.00041	Location 6	0.0003	Normal	0.0003	22	100%	0.00143	Location 17	0.0007	NP	0.0010
Chromium		23	52%	0.00165	Location 26	0.0004	NP	0.0015	22	55%	0.000825	Location 10	0.0003	Log	0.0004
Copper		23	100%	0.00315	Location 19	0.0014	NP	0.0016	22	86%	0.00223	Location 12	0.0012	Normal	0.0014
Zinc		23	35%	0.0216	Location 20	0.0028	NP	0.0068	22	68%	0.00445	Location 12	0.0027	Max	0.0045
Pentachlorophenol (µg/L)		23	0%	ND	N/A	0.1229	NP	0.1234	22	0%	ND	NA	0.1189	NP	0.1191
Polynuclear Aromatic Hydrocarbons (PAHs) (µg/L)															
Acenaphthene	L	23	0%	ND	N/A	0.0061	NP	0.0062	22	45%	0.411	Location 12	0.0681	NP	0.3359
Acenaphthylene	L	23	0%	ND	N/A	0.0061	NP	0.0062	22	9%	0.0581	Location 17	0.0088	NP	0.0192
Anthracene	L	23	0%	ND	N/A	0.0061	NP	0.0062	22	0%	ND	NA	0.0059	NP	0.0059
Benzo[a]anthracene	H, C	23	0%	ND	N/A	0.0061	NP	0.0062	22	0%	ND	NA	0.0059	NP	0.0059
Benzo[b]fluoranthene	H, C	23	0%	ND	N/A	0.0061	NP	0.0062	22	0%	ND	NA	0.0059	NP	0.0059
Benzo[k]fluoranthene	H	23	0%	ND	N/A	0.0061	NP	0.0062	22	0%	ND	NA	0.0059	NP	0.0059
Benzo[a]pyrene	H, C	23	0%	ND	N/A	0.0061	NP	0.0062	22	0%	ND	NA	0.0059	NP	0.0059
Benzo[g,h,i]perylene	H, C	23	0%	ND	N/A	0.0061	NP	0.0062	22	0%	ND	NA	0.0059	NP	0.0059
Chrysene	H, C	23	0%	ND	N/A	0.0061	NP	0.0062	22	0%	ND	NA	0.0059	NP	0.0059
Dibenzo[a,h]anthracene	H, C	23	0%	ND	N/A	0.0123	NP	0.0123	22	0%	ND	NA	0.0119	NP	0.0119
Fluoranthene	H	23	4%	0.0133	Location 19	0.0065	NP	0.0070	22	14%	0.0286	Location 12	0.0084	NP	0.0109
Fluorene	L	23	0%	ND	N/A	0.0061	NP	0.0062	22	27%	0.254	Location 17	0.0295	NP	0.1574
Ideno[1,2,3-cd]pyrene	H, C	23	0%	ND	N/A	0.0061	NP	0.0062	22	0%	ND	NA	0.0059	NP	0.0059
Naphthalene	L	23	0%	ND	N/A	0.0064	NP	0.0069	22	50%	1.33	Location 7	0.1937	NP	1.025
Phenanthrene	L	23	0%	ND	N/A	0.0061	NP	0.0062	22	23%	0.073	Location 17	0.0148	NP	0.0319
Pyrene	H	23	0%	ND	N/A	0.0061	NP	0.0062	22	14%	0.0277	Location 12	0.0083	NP	0.0108
Total LPAHs		23	0%	ND	N/A	0.0186	NP	0.0188	22	68%	1.9901	Location 17	0.2972	NP	1.462
Total HPAHs		23	4%	0.034375	Location 3	0.0329	Max	0.0344	22	14%	0.0563	Location 12	0.0345	NP	0.0369
Total Carcinogenic PAHs		23	0%	ND	N/A	0.0276	NP	0.0277	22	0%	ND	NA	0.0267	NP	0.0268
Total PAHs		23	4%	0.0553	Location 7	0.0507	NP	0.0533	22	68%	1.9901	Location 17	0.3141	NP	1.467

Please refer to notes on last page of this table.

Table D-3
Summary of Surface Water Data
McCormick and Baxter Superfund Site
Portland, Oregon

Sample Event		Surface Water Spring 2008							Surface Water Fall 2008						
Contaminant of Concern		**Number of Samples**	**Detection Frequency**	**Max Detection**	**Max Location**	**Mean Conc.**	**Data Distribution**	**95% UCL**	**Number of Samples**	**Detection Frequency**	**Max Detection**	**Max Location**	**Mean Conc.**	**Data Distribution**	**95% UCL**
Total Suspended Solids (mg/L)															
Dissolved Organic Carbon (mg/L)		--	--	--	--	--	--	--	--	--	--	--	--	--	--
Dissolved Metals (mg/L)															
Arsenic		22	0%	ND	NA	0.0003	--	--	22	86%	0.0018	Location 26	0.0004	Log	0.0005
Chromium		22	45%	0.000319	Location 26	0.0001	NP	0.0002	22	5%	ND	NA	0.0002	Normal	0.0003
Copper		22	64%	0.00455	Location 13	0.0011	NP	0.0020	22	82%	0.00403	Location 13	0.0009	Log	0.0017
Zinc		22	36%	0.0136	Location 25	0.0027	Normal	0.0037	22	100%	0.00437	Location 10	0.0044	Normal	0.0048
Total Metals (mg/L)															
Arsenic		22	0%	ND	NA	0.0003	--	--	22	91%	0.00132	Location 26	0.0005	Gamma	0.0006
Chromium		22	77%	0.00097	Location 18	0.0004	NP	0.0006	22	36%	0.00257	Location 13	0.0005	NP	0.0012
Copper		22	77%	0.00348	Location 12	0.0011	Normal	0.0012	22	100%	0.00282	Location 18	0.0011	Gamma	0.0013
Zinc		22	9%	0.0125	Location 25	0.0031	Normal	0.0040	22	100%	0.0111	Location 26	0.0057	Normal	0.0064
Pentachlorophenol (µg/L)		22	0%	ND	NA	0.1196	Normal	0.1200	22	0%	ND	NA	0.1245	Normal	0.1350
Polynuclear Aromatic Hydrocarbons (PAHs) (µg/L)															
Acenaphthene	L	22	14%	0.0661	Location 2	0.0125	NP	0.0287	22	14%	0.704	Location 26	0.0442	NP	0.3600
Acenaphthylene	L	22	0%	ND	NA	0.0060	Normal	0.0060	22	0%	ND	NA	0.0060	Normal	0.0060
Anthracene	L	22	0%	ND	NA	0.0060	Normal	0.0060	22	0%	ND	NA	0.0060	Normal	0.0060
Benzo[a]anthracene	H, C	22	0%	ND	NA	0.0060	Normal	0.0060	22	0%	ND	NA	0.0060	Normal	0.0060
Benzo[b]fluoranthene	H, C	22	0%	ND	NA	0.0060	Normal	0.0060	22	0%	ND	NA	0.0060	Normal	0.0060
Benzo[k]fluoranthene	H	22	0%	ND	NA	0.0060	Normal	0.0060	22	0%	ND	NA	0.0060	Normal	0.0060
Benzo[a]pyrene	H, C	22	0%	ND	NA	0.0060	Normal	0.0060	22	0%	ND	NA	0.0060	Normal	0.0060
Benzo[g,h,i]perylene	H, C	22	0%	ND	NA	0.0060	Normal	0.0060	22	0%	ND	NA	0.0060	Normal	0.0060
Chrysene	H, C	22	0%	ND	NA	0.0060	Normal	0.0060	22	0%	ND	NA	0.0060	Normal	0.0060
Dibenzo[a,h]anthracene	H, C	22	0%	ND	NA	0.0120	Normal	0.0120	22	0%	ND	NA	0.0119	Normal	0.0119
Fluoranthene	H	22	0%	ND	NA	0.0060	Normal	0.0060	22	5%	0.0239	Location 26	0.0068	Normal	0.0083
Fluorene	L	22	14%	0.0237	Location 2	0.0078	Normal	0.0096	22	14%	0.262	Location 26	0.0192	NP	0.0698
Ideno[1,2,3-cd]pyrene	H, C	22	0%	ND	NA	0.0060	Normal	0.0060	22	0%	ND	NA	0.0060	Normal	0.0060
Naphthalene	L	22	18%	0.0934	Location 25	0.0135	Normal	0.0324	22	9%	2.93	Location 26	0.1541	NP	0.3680
Phenanthrene	L	22	0%	ND	NA	0.0060	Normal	0.0060	22	5%	0.0566	Location 26	0.0083	Normal	0.0126
Pyrene	H	22	0%	ND	NA	0.0060	Normal	0.0060	22	0%	ND	NA	0.0060	Normal	0.0060
Total LPAHs		22	18%	0.1475	Location 25	0.0332	Normal	0.0702	22	14%	3.95	Location 26	0.2197	NP	0.5090
Total HPAHs		22	0%	ND	NA	0.0329	Normal	0.0330	22	5%	0.0239	Location 26	0.0323	Normal	0.0330
Total Carcinogenic PAHs		22	0%	ND	NA	0.0269	Normal	0.0270	22	0%	ND	NA	0.0269	Normal	0.0270
Total PAHs		22	18%	0.1475	Location 25	0.0601	Normal	0.0715	22	14%	3.98	Location 26	0.2493	NP	0.5440

Please refer to notes on last page of this table.

Table D-3
Summary of Surface Water Data
McCormick and Baxter Superfund Site
Portland, Oregon

Notes:

[1] The 1996 Record of Decision (ROD) specifies the remedial action objects 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 federal and state Ambient Water Quality Criteria (AWQCs).

[2] National Recommended Water Quality Criteria (NRWQCs) published as of August 15, 2007, are included for comparison (see http://www.epa.gov/waterscience/criteria/wqcriteria.html). The current publication includes criteria revisions published in 2002 National Recommended Water Quality Criteria: 2002 table (EPA-822-R-02-047) and 2003 Revised human Health Water Quality Criteria (EPA-822-F-03-012). Note that the aquatic life chronic criteria for pentachlorophenol has been adjusted to site-specific pH (7.5, representing a mid-range of the pH values measured in surface water at the site), and therefore differs from the standard table value. Criteria for metals (Cr, Cu, Zn) have not been adjusted for site-specific hardness. Carcinogenic risk-based numbers reflect a carcinogenicity risk of 10^{-6}.

[3] National Primary Drinking Water Regulations Maximum Contaminant Levels (MCLs) promulgated as of August 15, 2007, are included for comparison (see http://www.epa.gov/safewater/contaminants/index.html#primary).

The number of significant figures presented in the table do not reflect true accuracy presented by the laboratory results. Data should only retain 3 significant figures. Due to statistical evaluation using Microsoft Excel, additional significant figures may be shown.

C = Carcinogenic PAH
Gamma = Gamma Distribution
H = High Molecular Weight PAH (HPAH)
J = Estimated Value
L = Low Molecular Weight PAH (LPAH)
mg/L = milligrams per liter
MRL = Method Reporting Limit.
NA = Not Available
ND = Not Detected
NP = Nonparametric Distribution
U = Value Below MDL (value represents MDL)
µg/L = micrograms per liter
-- = Not Sampled

Table D-4
Summary of Inter-Armoring Data
McCormick and Baxter Superfund Site
Portland, Oregon

Sample Event		McCormick & Baxter Record of Decision, 1996, Ambient Water Quality Criteria (AWQCs)		EPA Current, 2007, National Recommended Water Quality Criteria (NRWQCs)		EPA National Primary Drinking Water Regulations (NPDWRs)	Inter-Armoring Water Spring 2006						
Contaminant of Concern		Aquatic Life (chronic)[1]	Human Health (fish consumption only)[1]	Aquatic Life (chronic)[2]	Human Health (consumption of organism only)[2]	Maximum Contaminant Levels (MCLs)[3]	**Number of Samples**	**Detection Frequency**	**Max Detection**	**Max Location**	**Mean Conc.**	**Data Distribution**	**95% UCL**
Total Metals (mg/L)													
Arsenic		0.19		0.15	0.00014	0.01	23	30%	0.00493	Location 5	0.0012	NP	0.0023
Chromium		0.21		0.074		0.1	23	43%	0.0105	Location 12	0.0008	NP	0.0053
Copper		0.012		0.009			23	96%	0.0168	Location 12	0.0026	NP	0.0056
Zinc		0.11		0.12	26		23	78%	0.0392	Location 12	0.0069	NP	0.0154
Pentachlorophenol (µg/L)		13		15	3	1	22	0%	ND	NA	0.1200	NP	0.1203
Polynuclear Aromatic Hydrocarbons (PAHs) (µg/L)													
Acenaphthene	L	520			990		22	32%	3.65	Location 5	0.3208	NP	2.323
Acenaphthylene	L						22	5%	0.0736	Location 10	0.0093	NP	0.0227
Anthracene	L				40,000		22	5%	0.199	Location 5	0.0148	NP	0.0530
Benzo[a]anthracene	H, C				0.018		22	5%	0.0134	Location 5	0.0063	NP	0.0070
Benzo[b]fluoranthene	H, C				0.018	0.2	22	0%	ND	NA	0.0060	NP	0.0060
Benzo[k]fluoranthene	H				0.018		22	0%	ND	NA	0.0060	NP	0.0060
Benzo[a]pyrene	H, C						22	0%	ND	NA	0.0060	NP	0.0060
Benzo[g,h,i]perylene	H, C				0.018		22	0%	ND	NA	0.0060	NP	0.0060
Chrysene	H, C				0.018		22	5%	0.0186	Location 5	0.0066	NP	0.0077
Dibenzo[a,h]anthracene	H, C				0.018		22	0%	ND	NA	0.0120	NP	0.0120
Fluoranthene	H		54		140		22	5%	0.253	Location 5	0.0172	NP	0.0662
Fluorene	L				5300		22	9%	1.99	Location 5	0.0981	NP	0.9947
Ideno[1,2,3-cd]pyrene	H, C				0.018		22	0%	ND	NA	0.0060	NP	0.0060
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				4,000		22	5%	0.138	Location 5	0.0120	NP	0.0382
Total LPAHs							22	55%	8.699	Location 5	0.5929	NP	4.652
Total HPAHs							22	5%	0.423	Location 5	0.0536	NP	0.1303
Total Carcinogenic PAHs			0.031				22	5%	0.032	Location 5	0.0272	NP	0.0277
Total PAHs							22	55%	9.122	Location 5	0.6271	NP	4.858

Please refer to notes on last page of this table.

Table D-4
Summary of Inter-Armoring Data
McCormick and Baxter Superfund Site
Portland, Oregon

Sample Event		Inter-Armoring Water Fall 2006							Inter-Armoring Water Spring 2007						
Contaminant of Concern		**Number of Samples**	**Detection Frequency**	**Max Detection**	**Max Location**	**Mean Conc.**	**Data Distribution**	**95% UCL**	**Number of Samples**	**Detection Frequency**	**Max Detection**	**Max Location**	**Mean Conc.**	**Data Distribution**	**95% UCL**
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
Chromium		22	64%	0.00216	Location 3	0.0004	NP	0.0015	23	13%	0.0227	Location 5	0.0020	Gamma	0.0040
Copper		22	100%	0.00435	Location 20	0.0017	Lognormal	0.0022	23	100%	0.037	Location 5	0.0053	NP	0.0124
Zinc		22	45%	0.0147	Location 17	0.0032	NP	0.0113	23	4%	0.03325	Location 5	0.0051	NP	0.0205
Pentachlorophenol (µg/L)		22	14%	0.25	Location 6	0.1351	NP	0.1495	23	0%	ND	N/A	0.1228	NP	0.1233
Polynuclear Aromatic Hydrocarbons (PAHs) (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
Acenaphthylene	L	22	18%	0.0506	Location 20	0.0088	NP	0.0126	23	0%	ND	N/A	0.0061	NP	0.0062
Anthracene	L	22	14%	0.0161	Location 20	0.0070	NP	0.0080	23	0%	ND	N/A	0.0061	NP	0.0062
Benzo[a]anthracene	H, C	22	14%	0.0187	Location 5	0.0070	NP	0.0082	23	0%	ND	N/A	0.0061	NP	0.0062
Benzo[b]fluoranthene	H, C	22	14%	0.0125	Location 6	0.0067	NP	0.0075	23	0%	ND	N/A	0.0061	NP	0.0062
Benzo[k]fluoranthene	H	22	14%	0.0136	Location 5	0.0068	NP	0.0076	23	0%	ND	N/A	0.0061	NP	0.0062
Benzo[a]pyrene	H, C	22	14%	0.0125	Location 6	0.0067	NP	0.0075	23	0%	ND	N/A	0.0061	NP	0.0062
Benzo[g,h,i]perylene	H, C	22	9%	0.0125	Location 6	0.0065	NP	0.0070	23	0%	ND	N/A	0.0061	NP	0.0062
Chrysene	H, C	22	14%	0.0236	Location 5	0.0073	NP	0.0088	23	0%	ND	N/A	0.0061	NP	0.0062
Dibenzo[a,h]anthracene	H, C	22	9%	0.025	Location 6	0.0129	NP	0.0140	23	0%	ND	N/A	0.0123	NP	0.0123
Fluoranthene	H	22	18%	0.111	Location 5	0.0123	NP	0.0333	23	0%	ND	N/A	0.0061	NP	0.0062
Fluorene	L	22	18%	0.398	Location 20	0.0282	NP	0.2078	23	9%	0.0345	Location 20	0.0078	NP	0.0101
Ideno[1,2,3-cd]pyrene	H, C	22	9%	0.0125	Location 6	0.0065	NP	0.0070	23	0%	ND	N/A	0.0061	NP	0.0062
Naphthalene	L	22	36%	2.08	Location 20	0.1364	NP	1.095	23	0%	ND	N/A	0.0066	NP	0.0074
Phenanthrene	L	22	14%	0.147	Location 20	0.0185	NP	0.0557	23	0%	ND	N/A	0.0061	NP	0.0062
Pyrene	H	22	23%	0.0601	Location 5	0.0099	NP	0.0208	23	0%	ND	N/A	0.0061	NP	0.0062
Total LPAHs		22	36%	4.5017	Location 20	0.2704	NP	2.313	23	17%	0.1495	Location 20	0.0263	NP	0.0524
Total HPAHs		22	18%	0.227	Location 5	0.0425	NP	0.0591	23	0%	ND	N/A	0.0339	NP	0.0342
Total Carcinogenic PAHs		22	9%	0.0559	Location 5	0.0291	NP	0.0315	23	0%	ND	N/A	0.0276	Normal	0.0277
Total PAHs		22	41%	4.5469	Location 20	0.2869	NP	2.362	23	17%	0.1495	Location 20	0.0542	NP	0.0631

Please refer to notes on last page of this table.

Table D-4
Summary of Inter-Armoring Data
McCormick and Baxter Superfund Site
Portland, Oregon

Sample Event		Inter-Armoring Water Fall 2007						
Contaminant of Concern		**Number of Samples**	**Detection Frequency**	**Max Detection**	**Max Location**	**Mean Conc.**	**Data Distribution**	**95% UCL**
Total Metals (mg/L)								
Arsenic		22	100%	0.00202	Location 13	0.0010	Normal	0.0012
Chromium		22	55%	0.00456	Location 16	0.0009	Gamma	0.0014
Copper		22	86%	0.00858	Location 16	0.0025	Gamma	0.0033
Zinc		22	64%	0.0222	Location 16	0.0068	Gamma	0.0093
Pentachlorophenol (µg/L)		22	0%	ND	N/A	0.1140	Max	0.1190
Polynuclear Aromatic Hydrocarbons (PAHs) (µg/L)								
Acenaphthene	L	22	0%	ND	N/A	0.0280	NP	0.1253
Acenaphthylene	L	22	9%	0.0673	Location 17	0.0091	NP	0.0213
Anthracene	L	22	0%	ND	N/A	0.0059	NP	0.0059
Benzo[a]anthracene	H, C	22	0%	ND	N/A	0.0059	NP	0.0059
Benzo[b]fluoranthene	H, C	22	0%	ND	N/A	0.0059	NP	0.0059
Benzo[k]fluoranthene	H	22	0%	ND	N/A	0.0059	NP	0.0059
Benzo[a]pyrene	H, C	22	0%	ND	N/A	0.0059	NP	0.0059
Benzo[g,h,i]perylene	H, C	22	0%	ND	N/A	0.0059	NP	0.0059
Chrysene	H, C	22	0%	ND	N/A	0.0059	NP	0.0059
Dibenzo[a,h]anthracene	H, C	22	0%	ND	N/A	0.0119	NP	0.0119
Fluoranthene	H	22	32%	0.0173	Location 10	0.0084	NP	0.0098
Fluorene	L	22	0%	ND	N/A	0.0149	NP	0.0373
Ideno[1,2,3-cd]pyrene	H, C	22	0%	ND	N/A	0.0059	NP	0.0059
Naphthalene	L	22	0%	ND	N/A	0.0474	NP	0.2511
Phenanthrene	L	22	0%	ND	N/A	0.0089	NP	0.0201
Pyrene	H	22	5%	0.0141	Location 10	0.0063	NP	0.0070
Total LPAHs		22	9%	0.2481	Location 4	0.0408	NP	0.0896
Total HPAHs		22	32%	0.032725	Location 3	0.0271	NP	0.0303
Total Carcinogenic PAHs		22	0%	ND	N/A	0.0267	NP	0.0268
Total PAHs		22	36%	0.142575	Location 12	0.0470	NP	0.0762

Please refer to notes on last page of this table.

Table D-4
Summary of Inter-Armoring Data
McCormick and Baxter Superfund Site
Portland, Oregon

Sample Event		Inter-Armoring Water Spring 2008							Inter-Armoring Water Fall 2008						
Contaminant of Concern		**Number of Samples**	**Detection Frequency**	**Max Detection**	**Max Location**	**Mean Conc.**	**Data Distribution**	**95% UCL**	**Number of Samples**	**Detection Frequency**	**Max Detection**	**Max Location**	**Mean Conc.**	**Data Distribution**	**95% UCL**
Total Metals (mg/L)															
Arsenic		22	5%	0.00078	Location 14	0.0004	Normal	0.0004	22	95%	0.00257	Location 14	0.0008	Gamma	0.0011
Chromium		22	91%	0.00229	Location 14	0.0006	Lognormal	0.0008	22	55%	0.0109	Location 14	0.0014	NP	0.0023
Copper		22	82%	0.00528	Location 7	0.0019	Gamma	0.0023	22	100%	0.0236	Location 14	0.0038	Normal	0.0084
Zinc		22	27%	0.172	Location 9	0.0117	NP	0.0879	22	77%	0.058	Location 14	0.0109	Normal	0.0220
Pentachlorophenol (µg/L)		22	0%	ND	NA	0.1198	Normal	0.1200	22	0%	ND	NA	0.1192	Normal	0.1190
Polynuclear Aromatic Hydrocarbons (PAHs) (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
Acenaphthylene	L	22	0%	ND	NA	0.0060	Normal	0.0060	22	0%	ND	NA	0.0060	Normal	0.0060
Anthracene	L	22	0%	ND	NA	0.0060	Normal	0.0060	22	0%	ND	NA	0.0060	Normal	0.0060
Benzo[a]anthracene	H, C	22	0%	ND	NA	0.0060	Normal	0.0060	22	0%	ND	NA	0.0060	Normal	0.0060
Benzo[b]fluoranthene	H, C	22	0%	ND	NA	0.0060	Normal	0.0060	22	0%	ND	NA	0.0060	Normal	0.0060
Benzo[k]fluoranthene	H	22	0%	ND	NA	0.0060	Normal	0.0060	22	0%	ND	NA	0.0060	Normal	0.0060
Benzo[a]pyrene	H, C	22	0%	ND	NA	0.0060	Normal	0.0060	22	0%	ND	NA	0.0060	Normal	0.0060
Benzo[g,h,i]perylene	H, C	22	0%	ND	NA	0.0060	Normal	0.0060	22	0%	ND	NA	0.0060	Normal	0.0060
Chrysene	H, C	22	0%	ND	NA	0.0060	Normal	0.0060	22	0%	ND	NA	0.0060	Normal	0.0060
Dibenzo[a,h]anthracene	H, C	22	0%	ND	NA	0.0120	Normal	0.0120	22	0%	ND	NA	0.0119	Normal	0.0119
Fluoranthene	H	22	0%	ND	NA	0.0060	Normal	0.0060	22	5%	0.017	Location 7	0.0065	Normal	0.0074
Fluorene	L	22	9%	0.0157	Location 2	0.0067	Normal	0.0077	22	14%	0.0692	Location 26	0.0107	NP	0.0247
Ideno[1,2,3-cd]pyrene	H, C	22	0%	ND	NA	0.0060	Normal	0.0060	22	0%	ND	NA	0.0060	Normal	0.0060
Naphthalene	L	22	27%	0.0521	Location 2	0.0112	NP	0.0218	22	14%	0.488	Location 26	0.0312	NP	0.2500
Phenanthrene	L	22	0%	ND	NA	0.0060	Normal	0.0060	22	5%	0.0154	Location 26	0.0064	Normal	0.0072
Pyrene	H	22	0%	ND	NA	0.0060	Normal	0.0060	22	5%	0.0181	Location 7	0.0065	Normal	0.0076
Total LPAHs		22	32%	0.126	Location 2	0.0267	NP	0.0519	22	18%	0.757	Location 26	0.0633	NP	0.2110
Total HPAHs		22	0%	ND	NA	0.0329	Normal	0.0331	22	5%	0.0351	Location 7	0.0328	Normal	0.0330
Total Carcinogenic PAHs		22	0%	ND	NA	0.0270	Normal	0.0270	22	0%	ND	NA	0.0270	Normal	0.1140
Total PAHs		22	32%	0.126	Location 2	0.0483	NP	0.0712	22	18%	0.757	Location 26	0.0917	NP	29.9700

Please refer to notes on last page of this table.

Table D-4
Summary of Inter-armoring Data
McCormick and Baxter Superfund Site
Portland, Oregon

Notes:

[1] The 1996 Record of Decision (ROD) specifies the remedial action objects 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 federal and state Ambient Water Quality Criteria (AWQCs).

[2] National Recommended Water Quality Criteria (NRWQCs) published as of August 15, 2007, are included for comparison (see http://www.epa.gov/waterscience/criteria/wqcriteria.html). The current publication includes criteria revisions published in 2002 National Recommended Water Quality Criteria: 2002 table (EPA-822-R-02-047) and 2003 Revised human Health Water Quality Criteria (EPA-822-F-03-012). Note that the aquatic life chronic criteria for pentachlorophenol has been adjusted to site-specific pH (7.5, representing a mid-range of the pH values measured in surface water at the site), and therefore differs from the standard table value. Criteria for metals (Cr, Cu, Zn) have not been adjusted for site-specific hardness. Carcinogenic risk-based numbers reflect a carcinogenicity risk of 10^{-6}.

[3] National Primary Drinking Water Regulations Maximum Contaminant Levels (MCLs) promulgated as of August 15, 2007, are included for comparison (see http://www.epa.gov/safewater/contaminants/index.html#primary).

The number of significant figures presented in the table do not reflect true accuracy presented by the laboratory results. Data should only retain 3 significant figures. Due to statistical evaluation using Microsoft Excel, additional significant figures may be shown.

C = Carcinogenic PAH
Gamma = Gamma Distribution
H = High Molecular Weight PAH (HPAH)
J = Estimated Value
L = Low Molecular Weight PAH (LPAH)
mg/L = milligrams per liter
MRL = Method Reporting Limit.
NA = Not Available
ND = Not Detected
NP = Nonparametric Distribution
U = Value Below MDL (value represents MDL)
µg/L = micrograms per liter
-- = Not Sampled

Table D-5
Summary of Sub-Armoring Water Data
McCormick and Baxter Superfund Site
Portland, Oregon

Sample Event		McCormick & Baxter Record of Decision, 1996, Ambient Water Quality Criteria (AWQCs)		EPA Current, 2007, National Recommended Water Quality Criteria (NRWQCs)		EPA National Primary Drinking Water Regulations (NPDWRs)	Sub-Armoring Water Fall 2005						
Contaminant of Concern		Aquatic Life (chronic)[1]	Human Health (fish consumption only)[1]	Aquatic Life (chronic)[2]	Human Health (consumption of organism only)[2]	Maximum Contaminant Levels (MCLs)[3]	**Number of Samples**	**Detection Frequency**	**Max Detection**	**Max Location**	**Mean Conc.**	**Data Distribution**	**95% UCL Value**
Total Metals (mg/L)													
Arsenic		0.19		0.15	0.00014	0.01	23	100%	0.0332	MBPWPR05-26	0.0053	Gamma	0.0084
Chromium		0.21		0.074		0.1	23	39%	0.0144	MBPWPR05-09	0.0014	NP	0.0041
Copper		0.012		0.009			23	70%	0.0282	MBPWPR05-	0.0027	NP	0.0146
Zinc		0.11		0.12	26		23	100%	0.113	MBPWPR05-	0.0202	Gamma	0.0280
Pentachlorophenol (µg/L)		13		15	3	1	23	4%	0.469	17	0.8562	Max	0.4690
Polynuclear Aromatic Hydrocarbons (PAHs) (µg/L)													
Acenaphthene	L	520			990		23	57%	131	MBPWPR05-	16.983	NP	32.650
Acenaphthylene	L						23	13%	1.22	MBPWPR05-	0.1160	NP	0.6744
Anthracene	L				40,000		23	39%	3.42	MBPWPR05-	0.5349	NP	2.876
Benzo[a]anthracene	H, C				0.018		23	17%	0.959	MBPWPR05-	0.0668	NP	0.4855
Benzo[b]fluoranthene	H, C				0.018	0.2	23	4%	0.284	MBPWPR05-	0.0216	NP	0.0747
Benzo[k]fluoranthene	H				0.018		23	9%	0.355	MBPWPR05-	0.0251	NP	0.1764
Benzo[a]pyrene	H, C						23	0%	ND	NA	0.0146	NP	0.0392
Benzo[g,h,i]perylene	H, C				0.018		23	4%	0.369	MBPWPR05-	0.0252	NP	0.1828
Chrysene	H, C				0.018		23	22%	1.05	MBPWPR05-	0.0713	NP	0.5283
Dibenzo[a,h]anthracene	H, C				0.018		23	0%	ND	NA	0.0337	NP	0.0856
Fluoranthene	H		54		140		23	61%	7.4	MBPWPR05-	0.8853	NP	5.259
Fluorene	L				5300		23	61%	53.9	MBPWPR05-	5.861	NP	11.587
Ideno[1,2,3-cd]pyrene	H, C				0.018		23	0%	ND	NA	0.0146	NP	0.0392
Naphthalene	L	620					23	61%	772	MBPWPR05-	74.567	NP	521.887
Phenanthrene	L						23	61%	41	MBPWPR05-	4.796	NP	8.902
Pyrene	H				4,000		23	65%	4.49	MBPWPR05-	0.5216	NP	3.190
Total LPAHs							23	78%	885.57	MBPWPR05-	102.767	NP	545.396
Total HPAHs							23	65%	14.257	MBPWPR05-	1.581	NP	9.607
Total Carcinogenic PAHs			0.031				23	22%	3.017	MBPWPR05-09	0.2156	NP	1.5174
Total PAHs							23	78%	885.78	MBPWPR05-10	104.336	NP	551.021

Please refer to notes on last page of this table.

Table D-5
Summary of Sub-Armoring Water Data
McCormick and Baxter Superfund Site
Portland, Oregon

Sample Event		Sub-Armoring Water Spring 2006							Sub-Armoring Water Fall 2006						
Contaminant of Concern		**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**
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
Pentachlorophenol (µg/L)		23	4%	18.5	Location 6	0.9662	NP	8.9097	22	14%	0.25	Location 6	0.1409	NP	0.1578
Polynuclear Aromatic Hydrocarbons (PAHs) (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	NP	0.1582	22	14%	3.27	Location 17	0.3053	NP	2.292
Anthracene	L	23	61%	0.709	Location 5	0.1116	NP	0.5145	22	50%	0.458	Location 9	0.0616	NP	0.2992
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[b]fluoranthene	H, C	23	9%	0.06	Location 16	0.0099	NP	0.0210	22	9%	0.0125	Location 4	0.0068	NP	0.0075
Benzo[k]fluoranthene	H	23	9%	0.0894	Location 5	0.0130	NP	0.0314	22	9%	0.0125	Location 6	0.0068	NP	0.0075
Benzo[a]pyrene	H, C	23	0%	ND	NA	0.0086	NP	0.0130	22	9%	0.0187	Location 17	0.0070	NP	0.0082
Benzo[g,h,i]perylene	H, C	23	0%	ND	NA	0.0084	NP	0.0128	22	14%	0.0125	Location 4	0.0070	NP	0.0079
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	NP	0.0255	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	NP	0.0128	22	5%	0.0144	Location 17	0.0066	NP	0.0073
Naphthalene	L	23	74%	726	Location 16	47.516	NP	296.574	22	73%	229	Location 5	13.323	NP	118.152
Phenanthrene	L	23	52%	6.91	Location 5	0.6117	NP	4.1800	22	59%	6.4	Location 17	0.5388	NP	3.735
Pyrene	H	23	48%	0.716	Location 7	0.1075	NP	0.5059	22	68%	3.14	Location 7	0.2309	NP	1.663
Total LPAHs		23	87%	738.2	Location 16	52.836	Max	738.200	22	91%	232.325	Location 5	18.450	Gamma	50.966
Total HPAHs		23	65%	2.4248	Location 7	0.3749	NP	1.744	22	64%	13.6453	Location 7	0.8769	NP	7.032
Total Carcinogenic PAHs		23	22%	0.3217	Location 5	0.0556	NP	0.1279	22	23%	0.1053	Location 7	0.0349	NP	0.0428
Total PAHs		23	91%	738.2	Location 16	53.119	Max	738.200	22	91%	232.3679	Location 5	19.315	Gamma	51.650

Please refer to notes on last page of this table.

Table D-5
Summary of Sub-Armoring Water Data
McCormick and Baxter Superfund Site
Portland, Oregon

Sample Event		Sub-Armoring Water Spring 2007							Sub-Armoring Water Fall 2007						
Contaminant of Concern		**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**
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
Pentachlorophenol (µg/L)		23	0%	ND	N/A	0.3854	NP	1.5275	22	5%	3.27	Location 16	0.2621	NP	0.8864
Polynuclear Aromatic Hydrocarbons (PAHs) (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	0.6670	22	18%	1.14	Location 9	0.1284	NP	0.6988
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[b]fluoranthene	H, C	23	4%	0.3065	Location 5	0.0199	NP	0.0767	22	0%	0.00595	Location 4	0.0059	NP	0.0059
Benzo[k]fluoranthene	H	23	4%	0.3065	Location 5	0.0200	NP	0.0769	22	5%	0.0128	Location 7	0.0062	NP	0.0068
Benzo[a]pyrene	H, C	23	4%	0.3065	Location 5	0.0204	NP	0.0773	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	NP	0.0771	22	0%	0.00595	Location 4	0.0059	NP	0.0059
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	NP	0.1538	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	NP	0.0774	22	0%	0.00595	Location 4	0.0059	NP	0.0059
Naphthalene	L	23	30%	848	Location 5	69.124	NP	150.020	22	18%	407	Location 16	24.132	NP	325.094
Phenanthrene	L	23	39%	17	Location 5	0.9896	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	0.6575	22	36%	5.53	Location 7	0.3260	NP	2.810
Total LPAHs		23	87%	928.12	Location 5	80.496	NP	161.801	22	59%	445.89	Location 16	38.918	Gamma	105.283
Total HPAHs		23	57%	4.1375	Location 7	0.2928	NP	2.089	22	45%	18.0468	Location 7	0.9974	NP	9.097
Total Carcinogenic PAHs		23	13%	1.38025	Location 5	0.0972	NP	0.3538	22	18%	0.1658	Location 7	0.0345	NP	0.0646
Total PAHs		23	91%	929.17	Location 5	80.780	NP	163.051	22	73%	445.89	Location 16	39.880	Gamma	105.233

Please refer to notes on last page of this table.

Table D-5
Summary of Sub-Armoring Water Data
McCormick and Baxter Superfund Site
Portland, Oregon

Sample Event		Sub-Armoring Water Spring 2008							Sub-Armoring Water Fall 2008						
Contaminant of Concern		**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**
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
Pentachlorophenol (µg/L)		22	0%	ND	NA	0.1200	Normal	0.1200	22	0%	ND	NA	0.1192	Normal	0.1190
Polynuclear Aromatic Hydrocarbons (PAHs) (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	NP	0.0851
Anthracene	L	22	50%	1.27	Location 9	0.1168	NP	0.7230	22	36%	1.52	Location 9	0.1369	NP	0.2540
Benzo[a]anthracene	H, C	22	9%	0.176	Location 16	0.0163	NP	0.0514	22	18%	0.0912	Location 9	0.0158	NP	0.0388
Benzo[b]fluoranthene	H, C	22	5%	0.0375	Location 16	0.0074	Normal	0.0101	22	9%	0.0321	Location 8	0.0075	Normal	0.0098
Benzo[k]fluoranthene	H	22	5%	0.0458	Location 16	0.0078	Normal	0.0112	22	14%	0.0368	Location 8	0.0084	Normal	0.0112
Benzo[a]pyrene	H, C	22	5%	0.0131	Location 16	0.0063	Normal	0.0069	22	5%	0.0242	Location 8	0.0068	Normal	0.0084
Benzo[g,h,i]perylene	H, C	22	5%	0.0437	Location 16	0.0077	Normal	0.0109	22	14%	0.0267	Location 8	0.0076	Normal	0.0095
Chrysene	H, C	22	9%	0.146	Location 16	0.0151	NP	0.0447	22	18%	0.0986	Location 9	0.0173	NP	0.0420
Dibenzo[a,h]anthracene	H, C	22	0%	ND	NA	0.0120	Normal	0.0120	22	0%	ND	NA	0.0119	Normal	0.0119
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	Normal	0.0060	22	5%	0.0202	Location 8	0.0066	Normal	0.0078
Naphthalene	L	22	41%	232	Location 5	12.168	NP	117.300	22	55%	83.5	Location 9	4.793	NP	10.860
Phenanthrene	L	22	41%	13.1	Location 9	1.1353	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	0.8150	22	36%	1.39	Location 9	0.1517	NP	0.271
Total LPAHs		22	77%	253.2	Location 5	22.609	Gamma	65.770	22	64%	157	Location 9	16.577	NP	72.540
Total HPAHs		22	68%	3.3488	Location 9	0.4423	NP	2.260	22	41%	3.8	Location 9	0.4371	NP	0.772
Total Carcinogenic PAHs		22	9%	0.4621	Location 16	0.0514	NP	0.1390	22	18%	0.218	Location 9	0.0552	NP	0.1140
Total PAHs		22	86%	253.3	Location 5	23.077	Gamma	63.680	22	68%	161	Location 9	17.012		29.780

Please refer to notes on last page of this table.

Table D-5
Summary of Sub-armoring Data
McCormick and Baxter Superfund Site
Portland, Oregon

Notes:

[1] The 1996 Record of Decision (ROD) specifies the remedial action objects 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 federal and state Ambient Water Quality Criteria (AWQCs).

[2] National Recommended Water Quality Criteria (NRWQCs) published as of August 15, 2007, are included for comparison (see http://www.epa.gov/waterscience/criteria/wqcriteria.html). The current publication includes criteria revisions published in 2002 National Recommended Water Quality Criteria: 2002 table (EPA-822-R-02-047) and 2003 Revised human Health Water Quality Criteria (EPA-822-F-03-012). Note that the aquatic life chronic criteria for pentachlorophenol has been adjusted to site-specific pH (7.5, representing a mid-range of the pH values measured in surface water at the site), and therefore differs from the standard table value. Criteria for metals (Cr, Cu, Zn) have not been adjusted for site-specific hardness. Carcinogenic risk-based numbers reflect a carcinogenicity risk of 10^{-6}.

[3] National Primary Drinking Water Regulations Maximum Contaminant Levels (MCLs) promulgated as of August 15, 2007, are included for comparison (see http://www.epa.gov/safewater/contaminants/index.html#primary).

The number of significant figures presented in the table do not reflect true accuracy presented by the laboratory results. Data should only retain 3 significant figures. Due to statistical evaluation using Microsoft Excel, additional significant figures may be shown.

C = Carcinogenic PAH
Gamma = Gamma Distribution
H = High Molecular Weight PAH (HPAH)
J = Estimated Value
L = Low Molecular Weight PAH (LPAH)
mg/L = milligrams per liter
MRL = Method Reporting Limit.
NA = Not Available
ND = Not Detected
NP = Nonparametric Distribution
U = Value Below MDL (value represents MDL)
µg/L = micrograms per liter
-- = Not Sampled

Table D-6
Comparison Criteria Exceedance Summary 2005 - 2008
McCormick and Baxter Superfund Site
Portland, Oregon

Analyte	Comparison Criteria	2005			
		Surface Water		Sub-armoring Water	
		Total Exceedances	Sampling Location	Total Exceedances	Sampling Location
Arsenic	0.00014 mg/L	25	All	25	All
Chromium	0.074 mg/L				
Copper	0.009 mg/L			1	9
Zinc	0.11 mg/L			1	9
PCP	1 µg/L				
Acenaphthene	520 µg/L				
Anthracene	40,000 µg/L				
Benzo (a) anthracene	0.018 µg/L			4	7, 9, 20, 26
Benzo (a) pyrene	0.018 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
Dibenzo (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	

Please refer to notes on last page of this table.

Table D-6
Comparison Criteria Exceedance Summary 2005 - 2008
McCormick and Baxter Superfund Site
Portland, Oregon

Analyte	Comparison Criteria	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
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
Chromium	0.074 mg/L												
Copper	0.009 mg/L	3	9, 18, 27	1	12	4	11, 14, 15, 19						
Zinc	0.11 mg/L												
PCP	1 µg/L												
Acenaphthene	520 µg/L												
Anthracene	40,000 µg/L												
Benzo (a) anthracene	0.018 µg/L					3	5, 7, 9			1	5		
Benzo (a) pyrene	0.018 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		
Dibenzo (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			

Please refer to notes on last page of this table.

Table D-6
Comparison Criteria Exceedance Summary 2005 - 2008
McCormick and Baxter Superfund Site
Portland, Oregon

Analyte	Comparison Criteria	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
Arsenic	0.00014 mg/L	25	All	3	3, 5, 21	23	All	12	Multiple	18	Multiple	22	All
Chromium	0.074 mg/L												
Copper	0.009 mg/L			4	4, 5, 6, 21	2	12, 15						
Zinc	0.11 mg/L												
PCP	1 µg/L											1	16
Acenaphthene	520 µg/L												
Anthracene	40,000 µg/L												
Benzo (a) anthracene	0.018 µg/L					2	7, 12					2	7, 10
Benzo (a) pyrene	0.018 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
Dibenzo (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	

Please refer to notes on last page of this table.

Table D-6
Comparison Criteria Exceedance Summary 2005 - 2008
McCormick and Baxter Superfund Site
Portland, Oregon

Analyte	Comparison Criteria	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
Arsenic	0.00014 mg/L			1	14	21	All but 15	22	Multiple	21	All but 20		
Chromium	0.074 mg/L												
Copper	0.009 mg/L									2	5, 14	1	4
Zinc	0.11 mg/L			1	9								
PCP	1 µg/L												
Acenaphthene	520 µg/L												
Anthracene	40,000 µg/L												
Benzo (a) anthracene	0.018 µg/L					2	9, 16					3	6, 7, 8
Benzo (a) pyrene	0.018 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
Dibenzo (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	

Notes:
AWQCs = Ambient Water Quality Criteria (1996)
Comparison Criteria = Most conservative values from AWQCs, NRWQCs, and NPDWRs
mg/L = milligrams per liter
NPDWRs = National Primary Drinking Water Regulations
NRWQCs = National Recommended Water Quality Criteria
µg/L = micrograms per liter
PCP = Pentachlorophenol
CPAH = Carcinogenic Polynuclear Aromatic Hydrocarbons

Table D-7
Maximum Concentration Summary
McCormick and Baxter Superfund Site
Portland, Oregon

Sampling Event	Maximum Detected Concentration								
	2002	2003	2005	Spring 2006	Fall 2006	Spring 2007	Fall 2007	Spring 2008	Fall 2008
Surface Water									
Arsenic mg/L	0.001	0.002	0.001	0.002	0.007	0.0004	0.001	ND	0.001
Chromium mg/L	0.002	0.005	ND	0.005	0.002	0.002	0.001	0.00097	0.003
Copper mg/L	0.021	0.021	0.003	0.017	0.003	0.003	0.002	0.00283	0.003
Zinc mg/L	0.018	0.019	0.008	0.040	0.005	0.022	0.004	0.0125	0.011
PCP µg/L	0.079	NA	ND	ND	ND	ND	ND	ND	ND
Acenaphthene µg/L	9.800	ND	0.097	ND	0.166	0.013	0.411	0.066	0.704
Fluoranthene µg/L	11.900	0.078	ND	0.040	0.014	0.013	0.027	ND	0.024
Naphthalene µg/L	3.300	ND	0.911	0.190	0.930	0.025	1.330	0.093	2.930
Total CPAHs µg/L	4.220	0.101	ND	0.053	ND	ND	ND	ND	ND
Total PAHs µg/L	61.500	0.282	1.044	0.281	1.188	0.111	1.990	0.148	3.980
Inter-Armoring Water									
Arsenic mg/L	--	--	--	0.005	0.002	0.007	0.020	0.00078	0.003
Chromium mg/L	--	--	--	0.011	0.002	0.023	0.005	0.002	0.011
Copper mg/L	--	--	--	0.017	0.004	0.037	0.009	0.005	0.024
Zinc mg/L	--	--	--	0.039	0.015	0.067	0.022	0.172	0.058
PCP µg/L	--	--	--	ND	0.250	ND	ND	ND	ND
Acenaphthene µg/L	--	--	--	3.650	1.810	0.115	ND	0.058	0.184
Fluoranthene µg/L	--	--	--	0.253	0.111	ND	0.017	ND	0.017
Naphthalene µg/L	--	--	--	1.130	2.080	ND	ND	0.052	ND
Total CPAHs µg/L	--	--	--	0.032	0.056	ND	ND	ND	ND
Total PAHs µg/L	--	--	--	9.122	4.457	0.150	0.081	0.126	0.757
Sub-Armoring Water									
Arsenic mg/L	--	--	0.033	0.037	0.039	0.052	0.032	0.030	0.081
Chromium mg/L	--	--	0.014	0.017	0.001	0.003	0.001	0.001	0.006
Copper mg/L	--	--	0.028	0.035	0.003	0.544	0.005	0.004	0.014
Zinc mg/L	--	--	0.113	0.388	0.026	0.053	0.036	0.022	0.033
PCP µg/L	--	--	0.469	18.500	0.250	ND	3.270	ND	ND
Acenaphthene µg/L	--	--	131.000	22.100	19.000	47.500	67.600	50.5	48.0
Fluoranthene µg/L	--	--	7.400	1.670	10.400	2.750	12.200	2.16	2.19
Naphthalene µg/L	--	--	772.000	726.000	229.000	848.000	407.000	232	4.79
Total CPAHs µg/L	--	--	3.017	0.322	0.105	0.211	0.166	0.462	0.218
Total PAHs µg/L	--	--	885.000	738.000	232.000	929.150	445.890	253	161

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

Table D-8
Detection Frequency Summary
McCormick and Baxter Superfund Site
Portland, Oregon

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

Notes:
Metals refer to Total fraction
PAH = Polynuclear Aromatic Hydrocarbons
-- Not Sampled

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LEGEND

- Spring 2008 Sample Locations

Site Features

- Subsurface Barrier Wall
- Sediment Cap Boundary
- Organoclay Granular
- Organoclay Mats (Double)
- Organoclay Mats (Single)
- Hot Spot Treatment (thickened sand layer)
- Boulder Clusters
- Willamette River Level During Sampling Event (8.00 feet)

NOTES:

1) All elevations shown in NAVD88
2) Aerial photo taken on September 22, 2006
3) Average low tide during sampling period (March 31, 2009 to April 4, 2009) was 8 feet NAVD88

0 250 500

Scale in feet

McCormick and Baxter Superfund Site
Portland, Oregon

Sample Location Map
Spring 2008 Sampling Event

5/09

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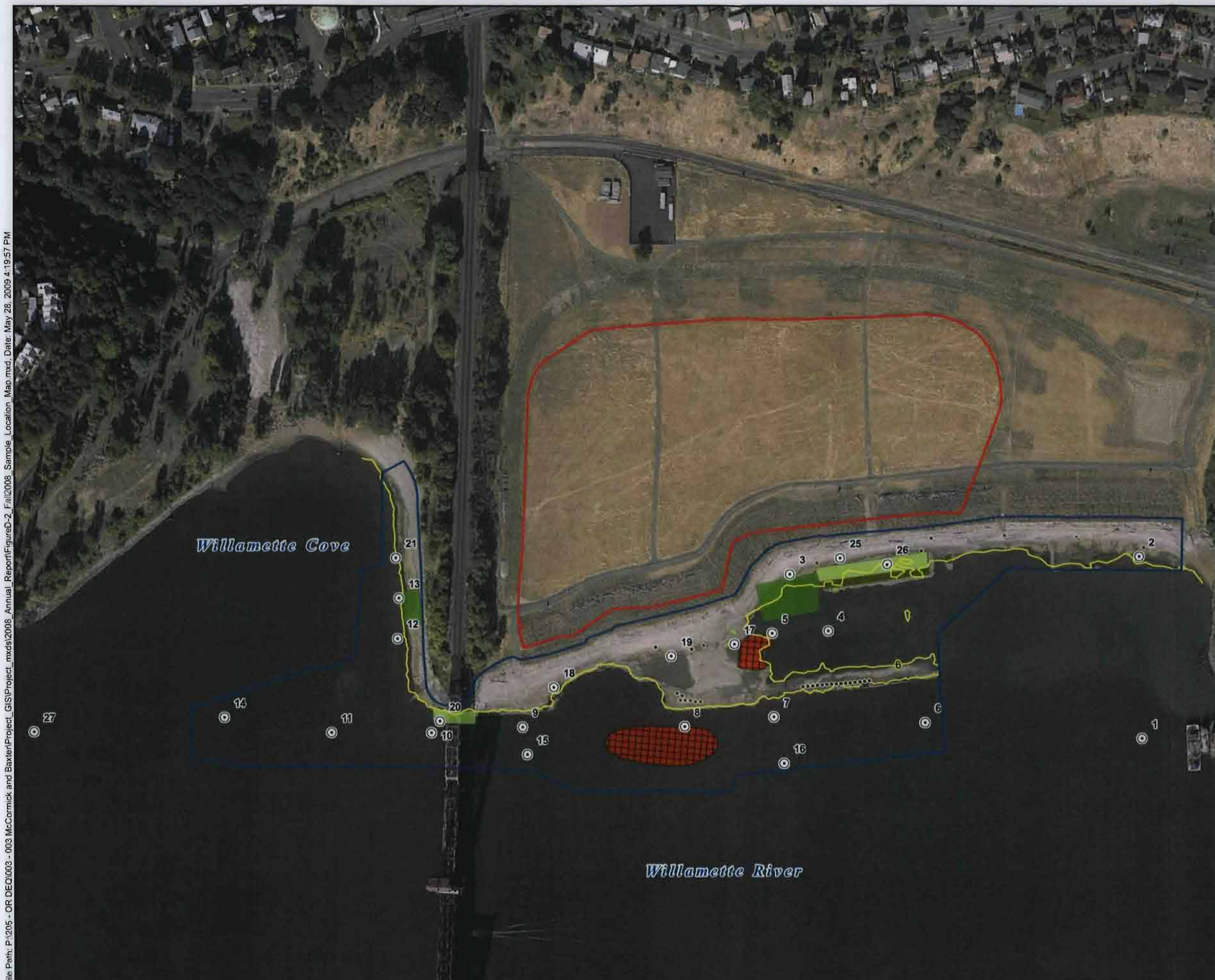
Figure
D-1



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LEGEND

- Fall 2008 Sample Locations

Site Features

- Subsurface Barrier Wall
- Sediment Cap Boundary
- Organoclay Granular
- Organoclay Mats (Double)
- Organoclay Mats (Single)
- Hot Spot Treatment (thickened sand layer)
- Boulder Clusters
- Willamette River Level During Sampling Event (6.00 feet)

NOTES:

1) All elevations shown in NAVD88
2) Aerial photo taken on September 22, 2006
3) Average low tide during sampling period (September 15, 2009 to September 23, 2009) was 6 feet NAVD88

0 250 500

Scale in feet

McCormick and Baxter Superfund Site
Portland, Oregon

Sample Location Map
Fall 2008 Sampling Event

5/09

HARTCROWSER GSI Water Solutions, Inc.

Figure
D-2

LEGEND

Sample Results

- Non-detect < 0.031 ug/L[1,2]
- Non-detect > 0.031 ug/L[1,2]
- < 0.031 ug/L[1]
- 0.031- 0.31 ug/L
- 0.31- 3.1 ug/L
- > 3.1 ug/L

Site Features

- Subsurface Barrier Wall
- Sediment Cap Boundary
- Organoclay Granular
- Organoclay Mats (Double)
- Organoclay Mats (Single)
- Hot Spot Treatment (thickened sand layer)
- Boulder Clusters
- Willamette River Level During Sampling Event (8.00 feet)

REFERENCE INFORMATION:

1) Reference criteria of 0.031 ug/L represents the 1996 ROD AWQC for human health (fish consumption only) for total cPAHs.
2) For cPAHs, the individual detection limits are typically below the 2007 NRWQCs for human health (consumption of organism only). However, the cumulative values, calculated with 1/2 detection limit values for each cPAH not detected, exceed the 1996 total cPAH reference criteria of 0.031 ug/L. Refer to summary tables for individual detection limits and results.

NOTES:

1) All elevations shown in NAVD88
2) Aerial photo taken on September 22, 2006
3) Average low tide during sampling period (March 31, 2009 to April 4, 2009) was 8 feet NAVD88

0 250 500

Scale in feet

McCormick and Baxter Superfund Site
Portland, Oregon

Spring 2008 cPAHs Surface Water Sample Results

5/09

HARTCROWSER GSI Water Solutions, Inc.

Figure
D-3

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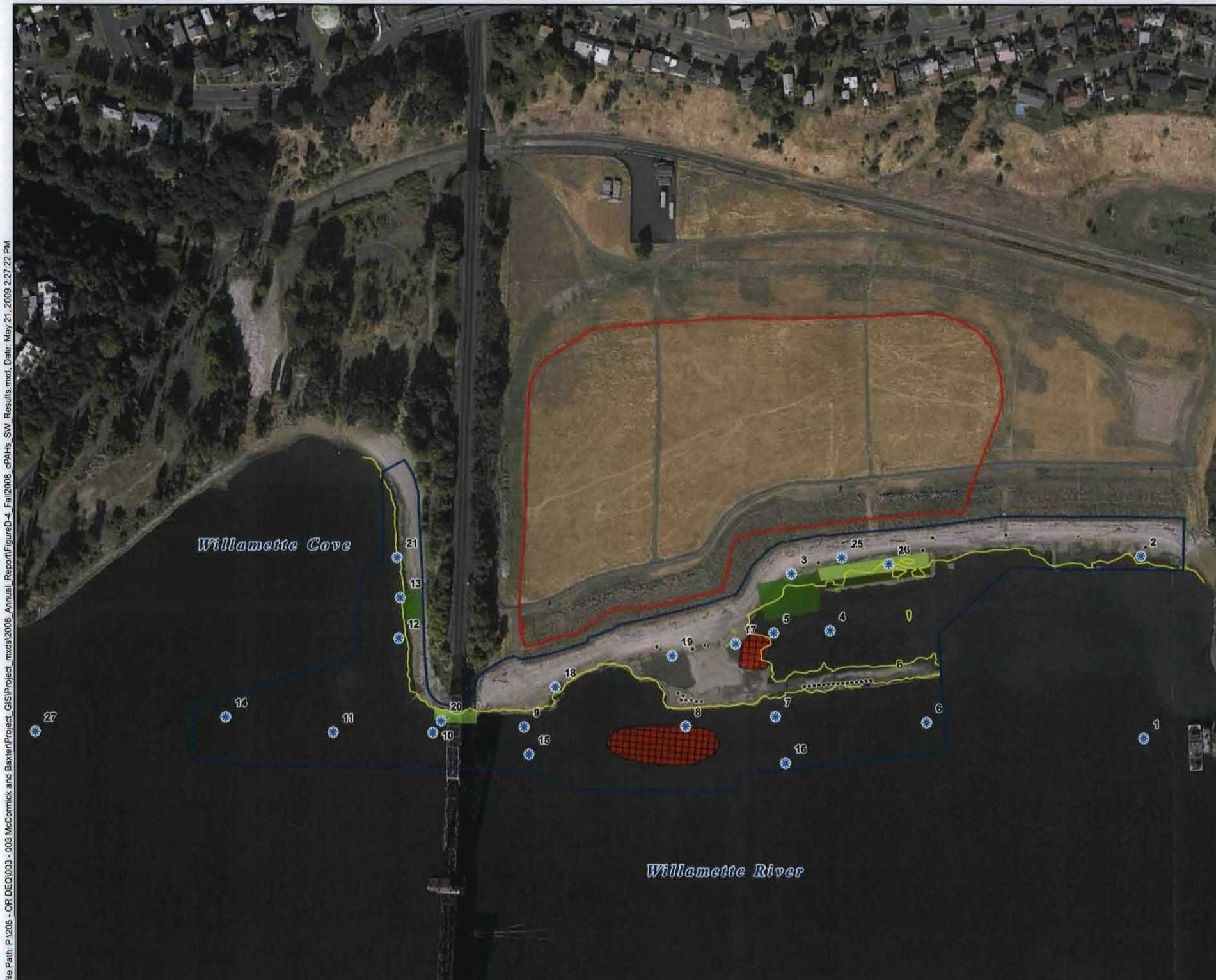

LEGEND

Sample Results

- Non-detect < 0.031 ug/L[1,2]
- Non-detect > 0.031 ug/L[1,2]
- < 0.031 ug/L[1]
- 0.031- 0.31 ug/L
- 0.31- 3.1 ug/L
- > 3.1 ug/L

Site Features

- Subsurface Barrier Wall
- Sediment Cap Boundary
- Organoclay Granular
- Organoclay Mats (Double)
- Organoclay Mats (Single)
- Hot Spot Treatment (thickened sand layer)
- Boulder Clusters
- Willamette River Level During Sampling Event (6.00 feet)

REFERENCE INFORMATION:

1) Reference criteria of 0.031 ug/L represents the 1996 ROD AWQC for human health (fish consumption only) for total cPAHs.

2) For cPAHs, the individual detection limits are typically below the 2007 NRWQCs for human health (consumption of organism only). However, the cumulative values, calculated with 1/2 detection limit values for each cPAH not detected, exceed the 1996 total cPAH reference criteria of 0.031 ug/L. Refer to summary tables for individual detection limits and results.

NOTES:

1) All elevations shown in NAVD88
2) Aerial photo taken on September 22, 2006
3) Average low tide during sampling period (September 15, 2009 to September 23, 2009) was 6 feet NAVD88

0 250 500

Scale in feet

McCormick and Baxter Superfund Site
Portland, Oregon

Fall 2008 cPAHs Surface Water Sample Results

5/09

HARTCROWSER GSI Water Solutions, Inc.

Figure **D-4**

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LEGEND

Sample Results

- Non-detect < 0.031 ug/L[1,2]
- Non-detect > 0.031 ug/L[1,2]
- < 0.031 ug/L[1]
- 0.031- 0.31 ug/L
- 0.31- 3.1 ug/L
- > 3.1 ug/L

Site Features

- Subsurface Barrier Wall
- Sediment Cap Boundary
- Organoclay Granular
- Organoclay Mats (Double)
- Organoclay Mats (Single)
- Hot Spot Treatment (thickened sand layer)
- Boulder Clusters
- Willamette River Level During Sampling Event (8.00 feet)

REFERENCE INFORMATION:

1) Reference criteria of 0.031 ug/L represents the 1996 ROD AWQC for human health (fish consumption only) for total cPAHs.
2) For cPAHs, the individual detection limits are typically below the 2007 NRWQCs for human health (consumption of organism only). However, the cumulative values, calculated with 1/2 detection limit values for each cPAH not detected, exceed the 1996 total cPAH reference criteria of 0.031 ug/L. Refer to summary tables for individual detection limits and results.

NOTES:

1) All elevations shown in NAVD88
2) Aerial photo taken on September 22, 2006
3) Average low tide during sampling period (March 31, 2009 to April 4, 2009) was 8 feet NAVD88

0 250 500

Scale in feet

McCormick and Baxter Superfund Site
Portland, Oregon

Spring 2008 cPAHs Inter-Armoring Water Sample Results

5/09

HARTCROWSER GSI Water Solutions, Inc.

Figure **D-5**

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LEGEND

Sample Results

- Non-detect < 0.031 ug/L[1,2]
- Non-detect > 0.031 ug/L[1,2]
- < 0.031 ug/L[1]
- 0.031- 0.31 ug/L
- 0.31- 3.1 ug/L
- > 3.1 ug/L

Site Features

- Subsurface Barrier Wall
- Sediment Cap Boundary
- Organoclay Granular
- Organoclay Mats (Double)
- Organoclay Mats (Single)
- Hot Spot Treatment (thickened sand layer)
- Boulder Clusters
- Willamette River Level During Sampling Event (6.00 feet)

REFERENCE INFORMATION:

1) Reference criteria of 0.031 ug/L represents the 1996 ROD AWQC for human health (fish consumption only) for total cPAHs.
2) For cPAHs, the individual detection limits are typically below the 2007 NRWQCs for human health (consumption of organism only). However, the cumulative values, calculated with 1/2 detection limit values for each cPAH not detected, exceed the 1996 total cPAH reference criteria of 0.031 ug/L. Refer to summary tables for individual detection limits and results.

NOTES:

1) All elevations shown in NAVD88
2) Aerial photo taken on September 22, 2006
3) Average low tide during sampling period (September 15, 2009 to September 23, 2009) was 6 feet NAVD88

0 250 500

Scale in feet

McCormick and Baxter Superfund Site
Portland, Oregon

Fall 2008 cPAHs Inter-Armoring Water Sample Results

5/09

HARTCROWSER GSI Water Solutions, Inc.

Figure **D-6**

File Path: P:\205 - OR DEQ\003 - 003 McCormick and Baxter\Project_GIS\Project_mxds\2008_Annual_Report\FigureD-6_Fall2008_cPAHs_IA_Results.mxd, Date: May 21, 2009 2:31:58 PM

LEGEND

Sample Results

- Non-detect < 0.031 ug/L[1,2]
- Non-detect > 0.031 ug/L[1,2]
- < 0.031 ug/L[1]
- 0.031- 0.31 ug/L
- 0.31- 3.1 ug/L
- > 3.1 ug/L

Site Features

- Subsurface Barrier Wall
- Sediment Cap Boundary
- Organoclay Granular
- Organoclay Mats (Double)
- Organoclay Mats (Single)
- Hot Spot Treatment (thickened sand layer)
- Boulder Clusters
- Willamette River Level During Sampling Event (8.00 feet)

REFERENCE INFORMATION:

1) Reference criteria of 0.031 ug/L represents the 1996 ROD AWQC for human health (fish consumption only) for total cPAHs.
2) For cPAHs, the individual detection limits are typically below the 2007 NRWQCs for human health (consumption of organism only). However, the cumulative values, calculated with 1/2 detection limit values for each cPAH not detected, exceed the 1996 total cPAH reference criteria of 0.031 ug/L. Refer to summary tables for individual detection limits and results.
3) No inter-armoring or sub-armoring samples are collected from some locations 1 and 27, as they are outside of the cap boundary.

NOTES:

1) All elevations shown in NAVD88
2) Aerial photo taken on September 22, 2006
3) Average low tide during sampling period (March 31, 2009 to April 4, 2009) was 8 feet NAVD88

0 250 500

Scale in feet

McCormick and Baxter Superfund Site
Portland, Oregon

Spring 2008 cPAHs Sub-Armoring Water Sample Results

5/09

HARTCROWSER GSI Water Solutions, Inc.

Figure
D-7

File Path: P:\205 - OR DEQ\003 - 003 McCormick and Baxter\Project_GIS\Project_mxds\2009_Annual_Report\FiguresD-7_Spring2009_cPAHs_SA_Results.mxd, Date: May 21, 2009 2:33:19 PM

LEGEND

Sample Results

- Non-detect < 0.031 ug/L[1,2]
- Non-detect > 0.031 ug/L[1,2]
- < 0.031 ug/L[1]
- 0.031- 0.31 ug/L
- 0.31- 3.1 ug/L
- > 3.1 ug/L

Site Features

- Subsurface Barrier Wall
- Sediment Cap Boundary
- Organoclay Granular
- Organoclay Mats (Double)
- Organoclay Mats (Single)
- Hot Spot Treatment (thickened sand layer)
- Boulder Clusters
- Willamette River Level During Sampling Event (6.00 feet)

REFERENCE INFORMATION:

1) Reference criteria of 0.031 ug/L represents the 1996 ROD AWQC for human health (fish consumption only) for total cPAHs.
2) For cPAHs, the individual detection limits are typically below the 2007 NRWQCs for human health (consumption of organism only). However, the cumulative values, calculated with 1/2 detection limit values for each cPAH not detected, exceed the 1996 total cPAH reference criteria of 0.031 ug/L. Refer to summary tables for individual detection limits and results.
3) No inter-armoring or sub-armoring samples are collected from some locations 1 and 27, as they are outside of the cap boundary.

NOTES:

1) All elevations shown in NAVD88
2) Aerial photo taken on September 22, 2006
3) Average low tide during sampling period (September 15, 2009 to September 23, 2009) was 6 feet NAVD88

0 250 500

Scale in feet

McCormick and Baxter Superfund Site
Portland, Oregon

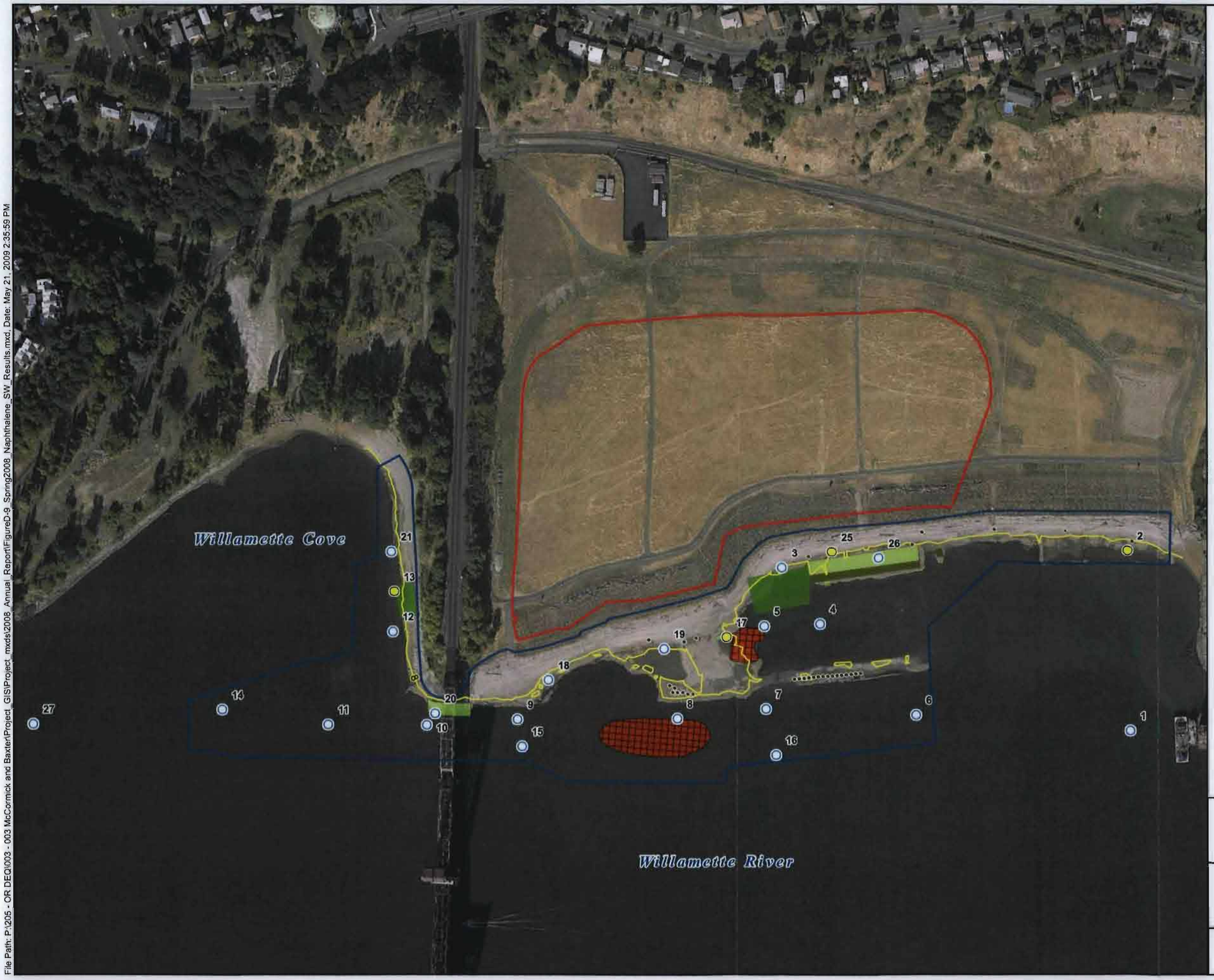
Fall 2008 cPAHs Sub-Armoring Water Sample Results

5/09

HARTCROWSER GSI Water Solutions, Inc.

Figure **D-8**

File Path: P:\205 - OR DEQ\003 - 003 McCormick and Baxter\Project_GIS\Project_mxds\2008_Annual_Report\FigureD-8_Fall2008_cPAHs_SA_Results.mxd, Date: May 21, 2009 2:34:39 PM



File Path: P:\205 - OR DEQ\003 - 003 McCormick and Baxter\Project_GIS\Project_mxds\2008_Annual_Report\FigureD-9_Spring2008_Naphthalene_SW_Results.mxd, Date: May 21, 2009 2:35:59 PM

LEGEND

Sample Results

- Non-detect
- < 620 ug/L
- 620 - 6,200 ug/L
- 6,200 - 62,000 ug/L
- > 62,000 ug/L

Site Features

- Subsurface Barrier Wall
- Sediment Cap Boundary
- Organoclay Granular
- Organoclay Mats (Double)
- Organoclay Mats (Single)
- Hot Spot Treatment (thickened sand layer)
- Boulder Clusters
- Willamette River Level During Sampling Event (8.00 feet)

REFERENCE INFORMATION:

1) Reference criteria of 620 ug/L represents the 1996 ROD AWQC for Human Health (fish consumption).

NOTES:

1) All elevations shown in NAVD88
2) Aerial photo taken on September 22, 2006
3) Average low tide during sampling period (March 31, 2009 to April 4, 2009) was 8 feet NAVD88

0 250 500

Scale in feet

McCormick and Baxter Superfund Site
Portland, Oregon

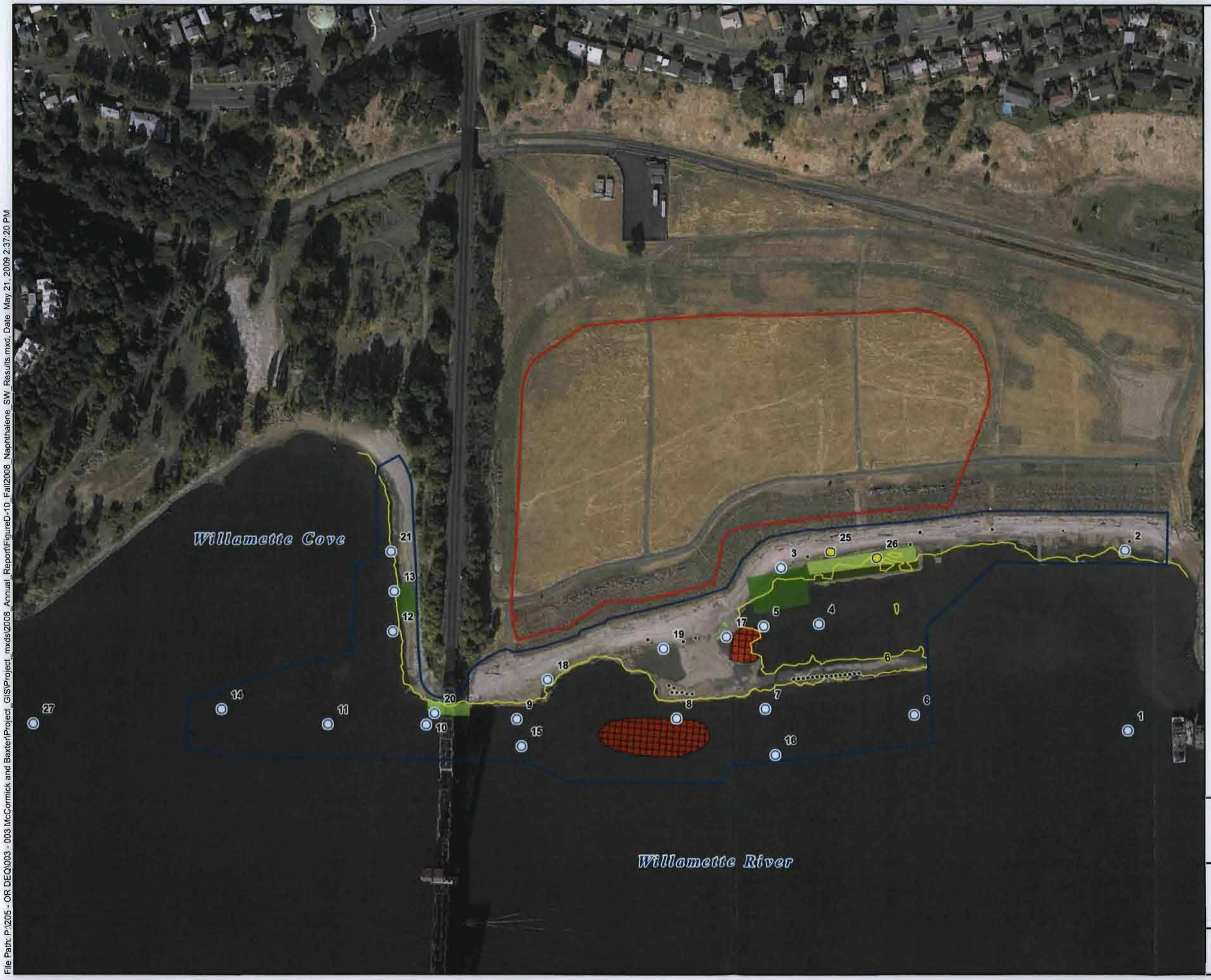
Spring 2008 Naphthalene Surface Water Sample Results

5/09

HARTCROWSER GSi Water Solutions, Inc.

Figure

D-9



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LEGEND

Sample Results

- Non-detect
- < 620 ug/L
- 620 - 6,200 ug/L
- 6,200 - 62,000 ug/L
- > 62,000 ug/L

Site Features

- Subsurface Barrier Wall
- Sediment Cap Boundary
- Organoclay Granular
- Organoclay Mats (Double)
- Organoclay Mats (Single)
- Hot Spot Treatment (thickened sand layer)
- Boulder Clusters
- Willamette River Level During Sampling Event (6.00 feet)

REFERENCE INFORMATION:

1) Reference criteria of 620 ug/L represents the 1996 ROD AWQC for Human Health (fish consumption).

NOTES:

1) All elevations shown in NAVD88
2) Aerial photo taken on September 22, 2006
3) Average low tide during sampling period (September 15, 2009 to September 23, 2009) was 6 feet NAVD88

0 250 500

Scale in feet

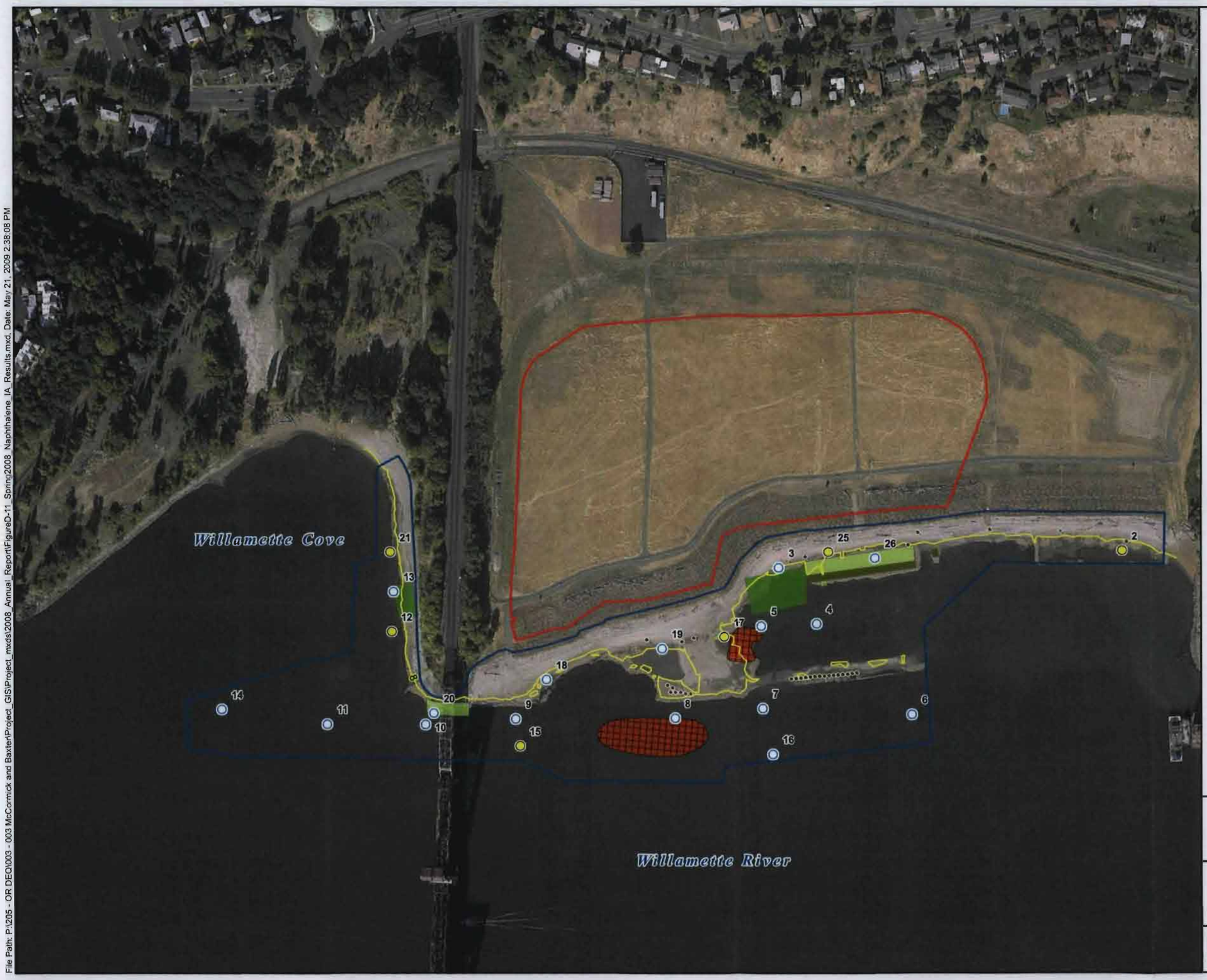
McCormick and Baxter Superfund Site
Portland, Oregon

Fall 2008 Naphthalene Surface Water Sample Results

5/09

HARTCROWSER GSI Water Solutions, Inc.

Figure
D-10



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LEGEND

Sample Results

- Non-detect
- < 620 ug/L
- 620 - 6,200 ug/L
- 6,200 - 62,000 ug/L
- > 62,000 ug/L

Site Features

- Subsurface Barrier Wall
- Sediment Cap Boundary
- Organoclay Granular
- Organoclay Mats (Double)
- Organoclay Mats (Single)
- Hot Spot Treatment (thickened sand layer)
- Boulder Clusters
- Willamette River Level During Sampling Event (8.00 feet)

REFERENCE INFORMATION:

1) Reference criteria of 620 ug/L represents the 1996 ROD AWQC for Human Health (fish consumption).
2) No inter-armoring or sub-armoring samples are collected from sample locations 1 and 27, as they are outside of the cap boundary.

NOTES:

1) All elevations shown in NAVD88
2) Aerial photo taken on September 22, 2006
3) Average low tide during sampling period (March 31, 2009 to April 4, 2009) was 8 feet NAVD88

0 250 500

Scale in feet

McCormick and Baxter Superfund Site
Portland, Oregon

Spring 2008 Naphthalene Inter-Armoring Water Sample Results

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HARTCROWSER

GSI Water Solutions, Inc.

Figure

D-11

File Path: P:\205 - OR DEQ\003 - 003 McCormick and Baxter\Project_GIS\Project_mxds\2008_Annual_Report\FigureD-12_Fall2008_Naphthalene_IA_Results.mxd; Date: May 21, 2009 2:40:01 PM

LEGEND

Sample Results

- Non-detect
- < 620 ug/L
- 620 - 6,200 ug/L
- 6,200 - 62,000 ug/L
- > 62,000 ug/L

Site Features

- Subsurface Barrier Wall
- Sediment Cap Boundary
- Organoclay Granular
- Organoclay Mats (Double)
- Organoclay Mats (Single)
- Hot Spot Treatment (thickened sand layer)
- Boulder Clusters
- Willamette River Level During Sampling Event (6.00 feet)

REFERENCE INFORMATION:

1) Reference criteria of 620 ug/L represents the 1996 ROD AWQC for Human Health (fish consumption).
2) No inter-armoring or sub-armoring samples are collected from sample locations 1 and 27, as they are outside of the cap boundary.

NOTES:

1) All elevations shown in NAVD88
2) Aerial photo taken on September 22, 2006
3) Average low tide during sampling period (September 15, 2009 to September 23, 2009) was 6 feet NAVD88

0 250 500

Scale in feet

McCormick and Baxter Superfund Site
Portland, Oregon

Fall 2008 Naphthalene Inter-Armoring Water Sample Results

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HARTCROWSER GSI Water Solutions, Inc.

Figure
D-12

LEGEND

Sample Results

- Non-detect
- < 620 ug/L
- 620 - 6,200 ug/L
- 6,200 - 62,000 ug/L
- > 62,000 ug/L

Site Features

- Subsurface Barrier Wall
- Sediment Cap Boundary
- Organoclay Granular
- Organoclay Mats (Double)
- Organoclay Mats (Single)
- Hot Spot Treatment (thickened sand layer)
- Boulder Clusters
- Willamette River Level During Sampling Event (8.00 feet)

REFERENCE INFORMATION:

1) Reference criteria of 620 ug/L represents the 1996 ROD AWQC for Human Health (fish consumption).
2) No inter-armoring or sub-armoring samples are collected from sample locations 1 and 27, as they are outside of the cap boundary.

NOTES:

1) All elevations shown in NAVD88
2) Aerial photo taken on September 22, 2006
3) Average low tide during sampling period (March 31, 2009 to April 4, 2009) was 8 feet NAVD88

0 250 500

Scale in feet

McCormick and Baxter Superfund Site
Portland, Oregon

Spring 2008 Naphthalene Sub-Armoring Water Sample Results

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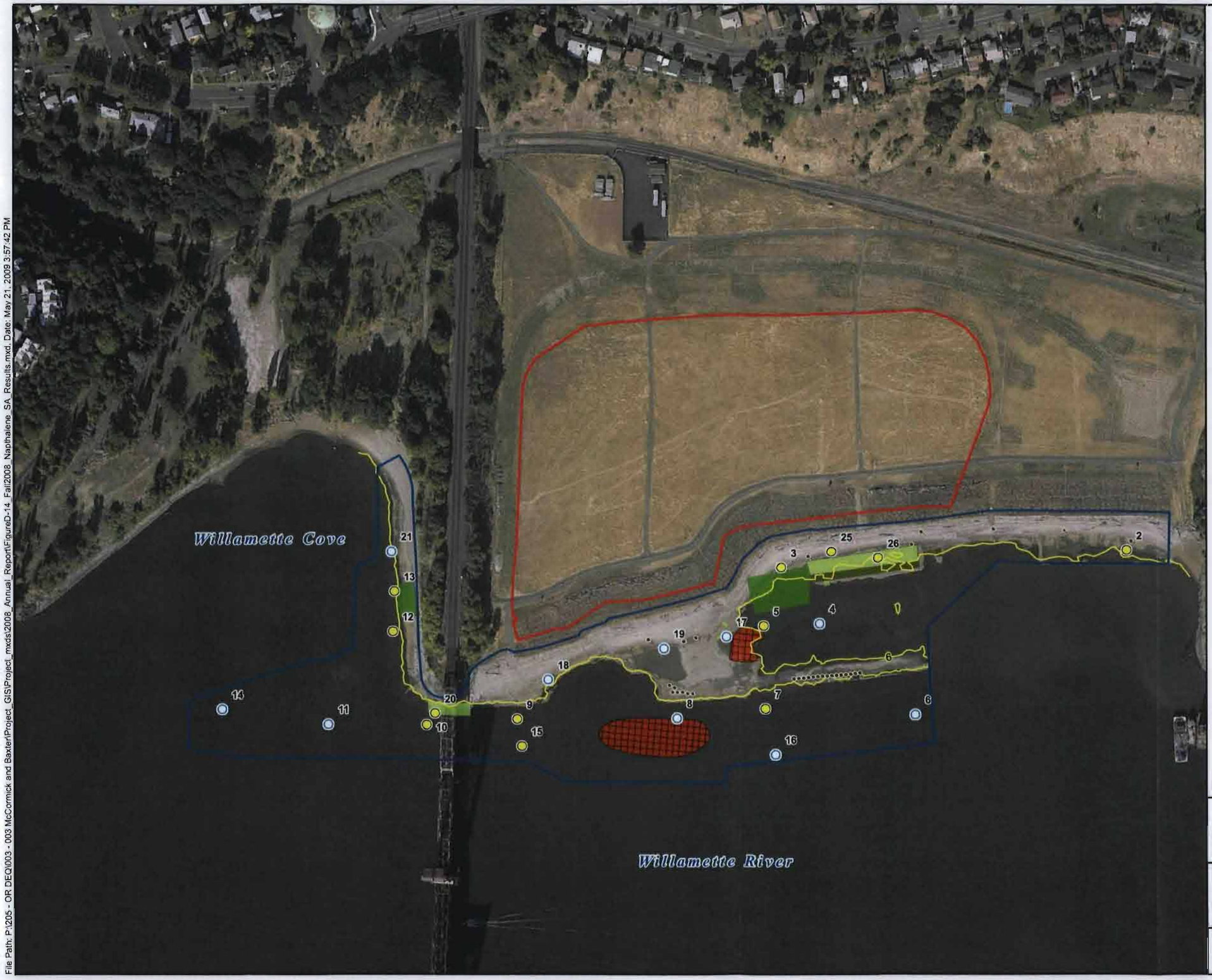
GSI Water Solutions, Inc.

Figure

D-13

File Path: P:\205 - OR DEQ\003 - 003 McCormick and Baxter\Project_GIS\Project_mxds\2008_Annual_Report\FigureD-13_Spring2008_Naphthalene_SA_Results.mxd, Date: May 21, 2009 2:41:25 PM



File Path: P:\205 - OR DEQ\003 - 003 McCormick and Baxter\Project_GIS\Project_mxds\2008_Annual_Report\FigureD-14_Fall2008_Napthalene_SA_Results.mxd, Date: May 21, 2009 3:57:42 PM

LEGEND

Sample Results

- Non-detect
- < 620 ug/L
- 620 - 6,200 ug/L
- 6,200 - 62,000 ug/L
- > 62,000 ug/L

Site Features

- Subsurface Barrier Wall
- Sediment Cap Boundary
- Organoclay Granular
- Organoclay Mats (Double)
- Organoclay Mats (Single)
- Hot Spot Treatment (thickened sand layer)
- Boulder Clusters
- Willamette River Level During Sampling Event (6.00 feet)

REFERENCE INFORMATION:

1) Reference criteria of 620 ug/L represents the 1996 ROD AWQC for Human Health (fish consumption).
2) No inter-armoring or sub-armoring samples are collected from sample locations 1 and 27, as they are outside of the cap boundary.

NOTES:

1) All elevations shown in NAVD88
2) Aerial photo taken on September 22, 2006
3) Average low tide during sampling period (September 15, 2009 to September 23, 2009) was 6 feet NAVD88

0 250 500

Scale in feet

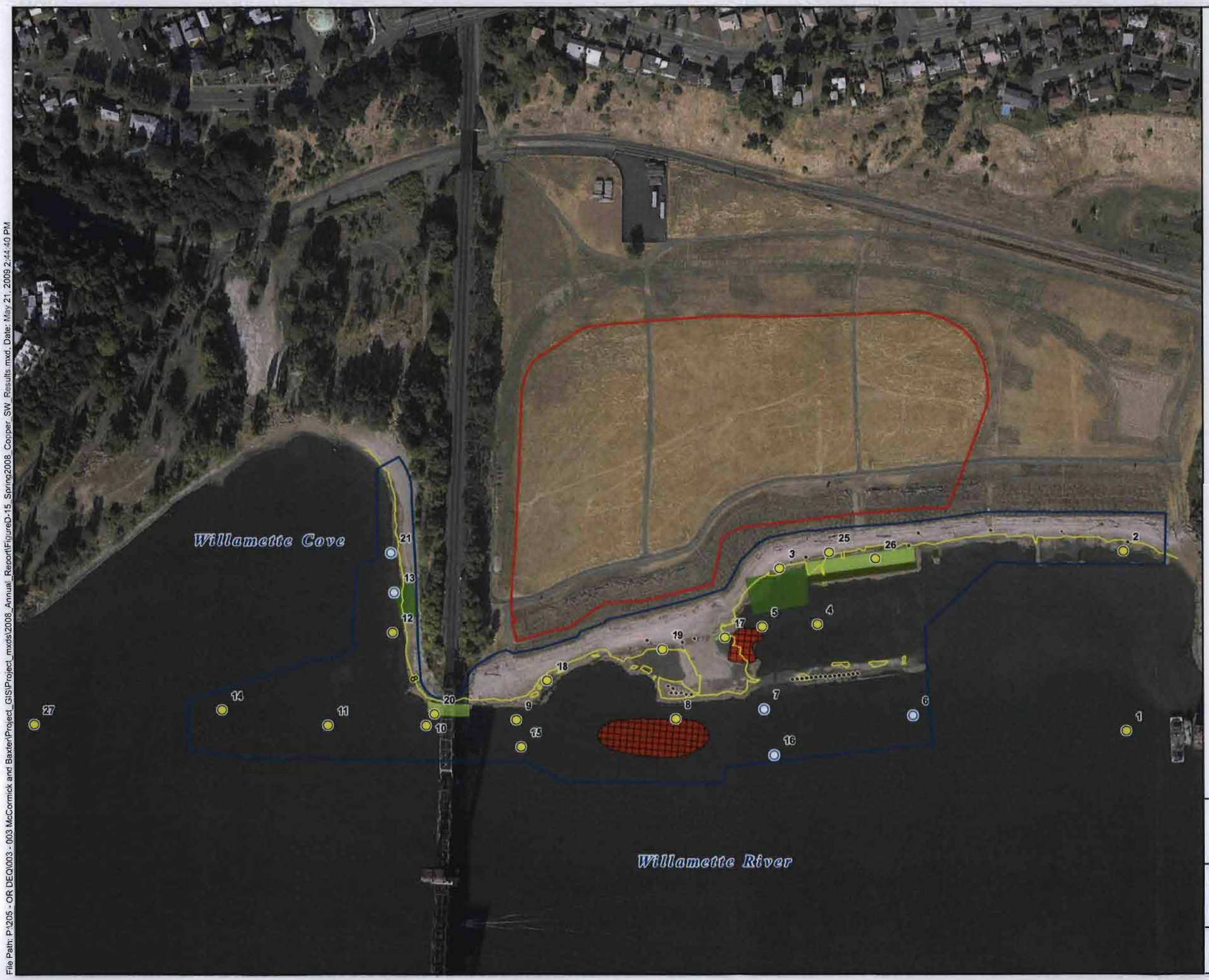
McCormick and Baxter Superfund Site
Portland, Oregon

Fall 2008 Naphthalene Sub-Armoring Water Sample Results

5/09

HARTCROWSER GSI Water Solutions, Inc.

Figure
D-14



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LEGEND

Sample Results

- Non-detect
- < 0.009 mg/L
- 0.009 - 0.09 mg/L
- 0.09 - 0.9 mg/L
- > 0.9 mg/L

Site Features

- Subsurface Barrier Wall
- Sediment Cap Boundary
- Organoclay Granular
- Organoclay Mats (Double)
- Organoclay Mats (Single)
- Hot Spot Treatment (thickened sand layer)
- Boulder Clusters
- Willamette River Level During Sampling Event (8.00 feet)

REFERENCE INFORMATION:

1) Reference criteria of .0009 mg/L represents the 2007 NRWQCs for the aquatic life (chronic).

NOTES:

1) All elevations shown in NAVD88
2) Aerial photo taken on September 22, 2006
3) Average low tide during sampling period (March 31, 2009 to April 4, 2009) was 8 feet NAVD88

0 250 500

Scale in feet

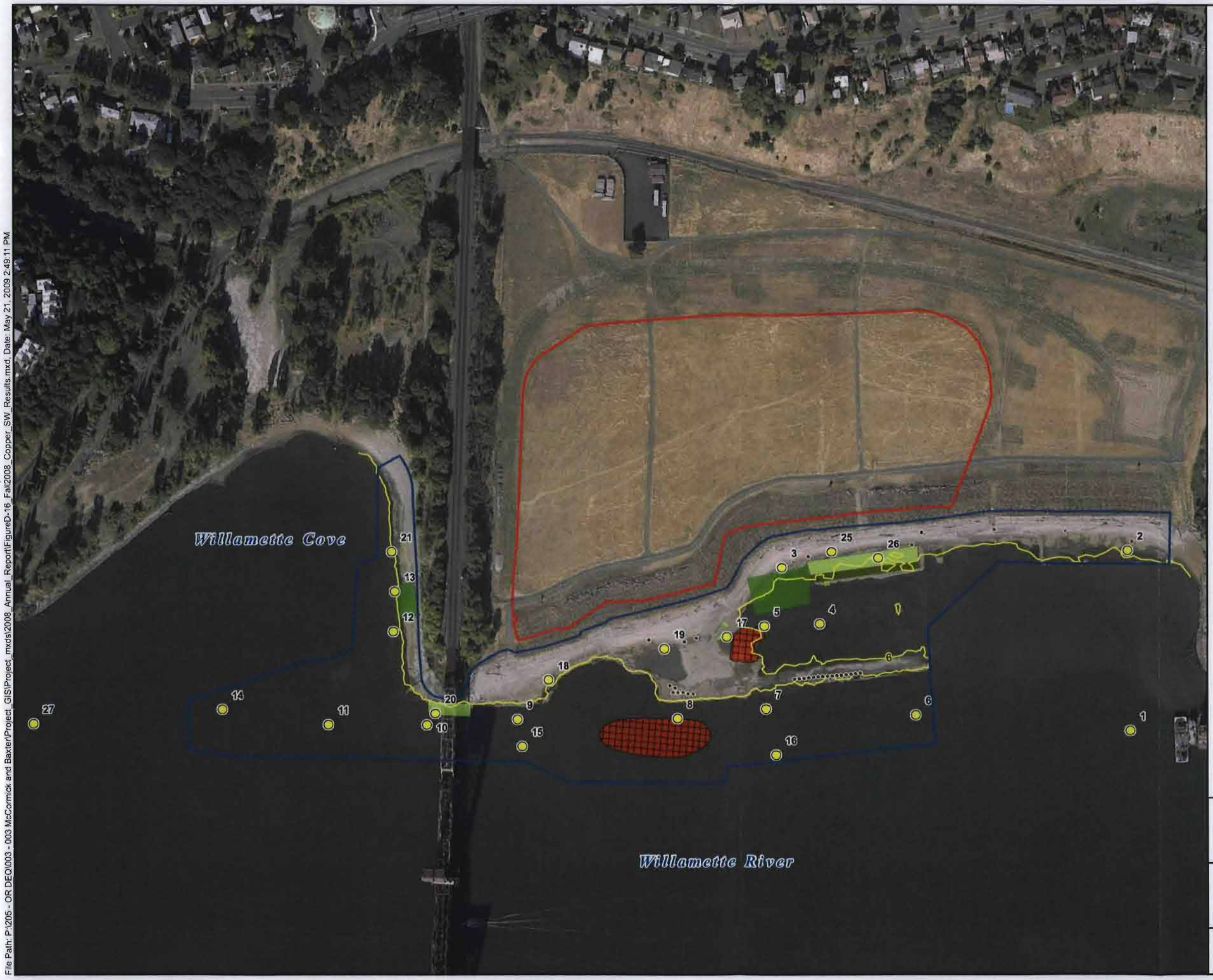
McCormick and Baxter Superfund Site
Portland, Oregon

Spring 2008 Copper Surface Water Sample Results

5/09

HARTCROWSER GSI Water Solutions, Inc.

Figure
D-15



File Path: P:\205 - OR DEQ\003 - 003 McCormick and Baxter\Project_GIS\Project_mxds\2008_Annual_Report\FigureD-16_Fall2008_Copper_SW_Results.mxd, Date: May 21, 2009 2:49:11 PM

LEGEND

Sample Results

- Non-detect
- < 0.009 mg/L
- 0.009 - 0.09 mg/L
- 0.09 - 0.9 mg/L
- > 0.9 mg/L

Site Features

- Subsurface Barrier Wall
- Sediment Cap Boundary
- Organoclay Granular
- Organoclay Mats (Double)
- Organoclay Mats (Single)
- Hot Spot Treatment (thickened sand layer)
- Boulder Clusters
- Willamette River Level During Sampling Event (6.00 feet)

REFERENCE INFORMATION:

1) Reference criteria of .0009 mg/L represents the 2007 NRWQCs for the aquatic life (chronic).

NOTES:

1) All elevations shown in NAVD88
2) Aerial photo taken on September 22, 2006
3) Average low tide during sampling period (September 15, 2009 to September 23, 2009) was 6 feet NAVD88

0 250 500

Scale in feet

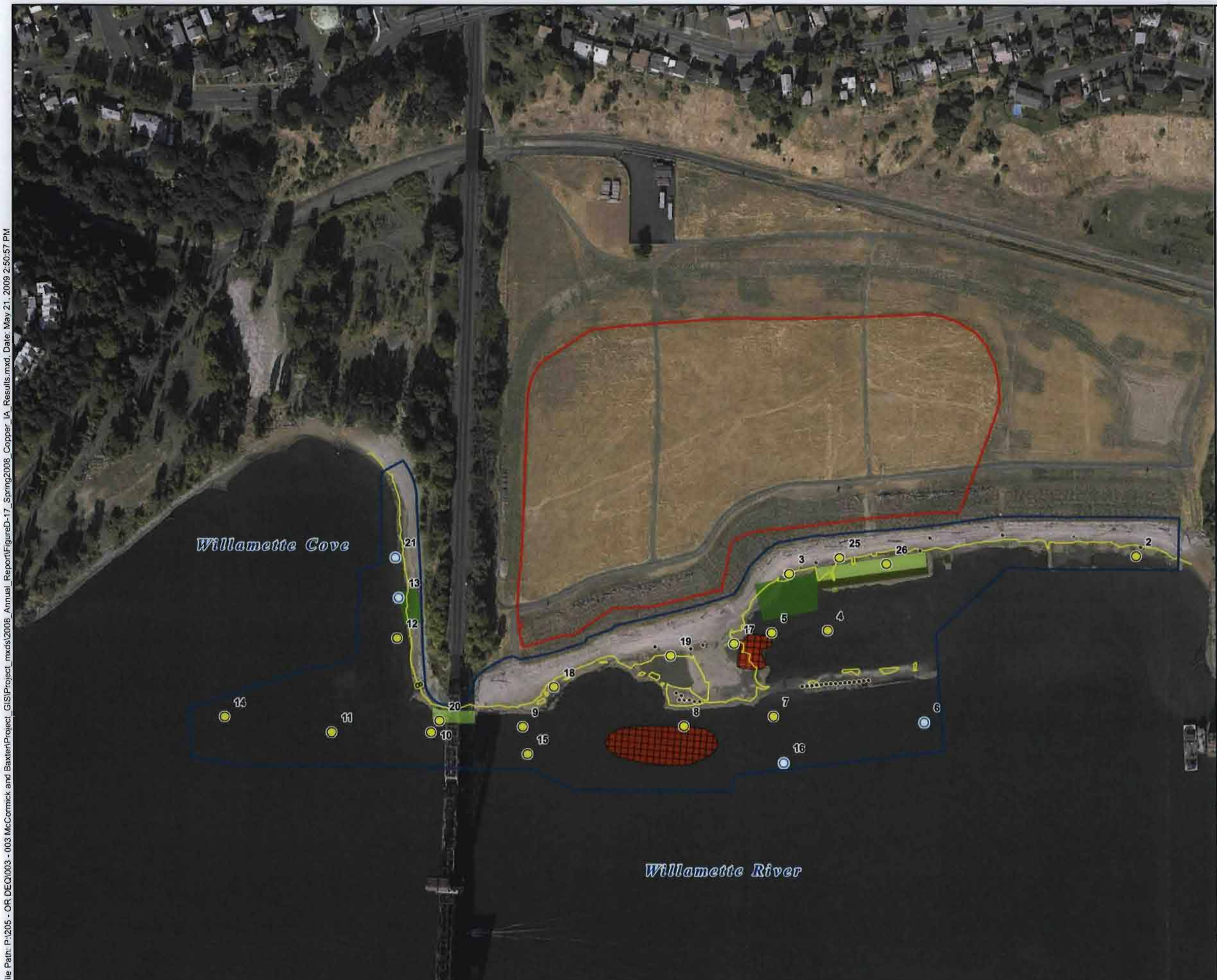
McCormick and Baxter Superfund Site
Portland, Oregon

Fall 2008 Copper Surface Water Sample Results

5/09

HARTCROWSER GSI Water Solutions, Inc.

Figure
D-16



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LEGEND

Sample Results

- Non-detect
- < 0.009 mg/L
- 0.009 - 0.09 mg/L
- 0.09 - 0.9 mg/L
- > 0.9 mg/L

Site Features

- Subsurface Barrier Wall
- Sediment Cap Boundary
- Organoclay Granular
- Organoclay Mats (Double)
- Organoclay Mats (Single)
- Hot Spot Treatment (thickened sand layer)
- Boulder Clusters
- Willamette River Level During Sampling Event (8.00 feet)

REFERENCE INFORMATION:

1) Reference criteria of .0009 mg/L represents the 2007 NRWQCs for the aquatic life (chronic).
2) No inter-armoring or sub-armoring samples are collected from sample locations 1 and 27, as they are outside of the cap boundary.

NOTES:

1) All elevations shown in NAVD88
2) Aerial photo taken on September 22, 2006
3) Average low tide during sampling period (March 31, 2009 to April 4, 2009) was 8 feet NAVD88

0 250 500

Scale in feet

McCormick and Baxter Superfund Site
Portland, Oregon

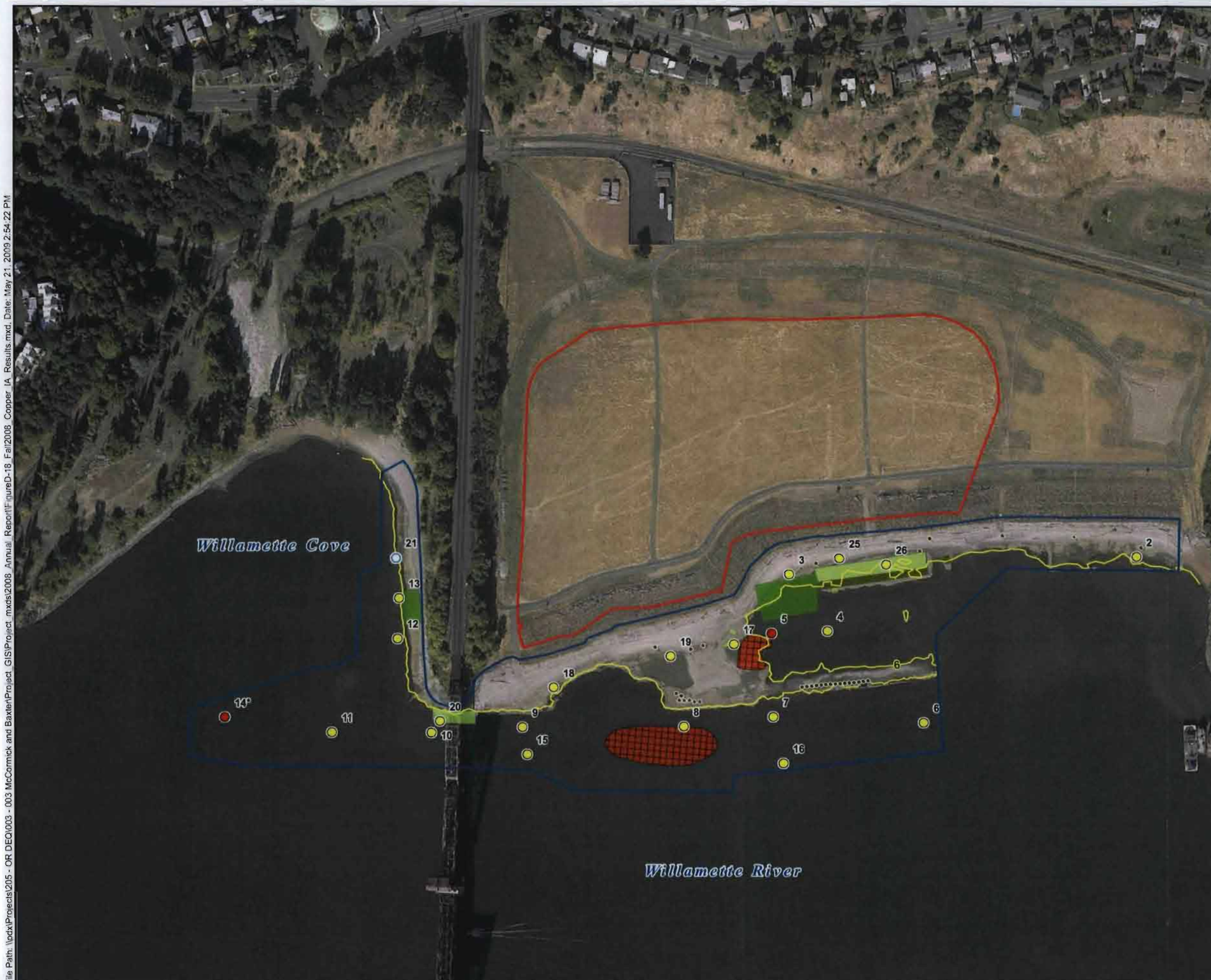
Spring 2008 Copper Inter-Armoring Water Sample Results

5/09

HARTCROWSER

GSI Water Solutions, Inc.

Figure
D-17



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LEGEND

Sample Results

- Non-detect
- < 0.009 mg/L
- 0.009 - 0.09 mg/L
- 0.09 - 0.9 mg/L
- > 0.9 mg/L

Site Features

- Subsurface Barrier Wall
- Sediment Cap Boundary
- Organoclay Granular
- Organoclay Mats (Double)
- Organoclay Mats (Single)
- Hot Spot Treatment (thickened sand layer)
- Boulder Clusters
- Willamette River Level During Sampling Event (6.00 feet)

REFERENCE INFORMATION:

1) Reference criteria of .0009 mg/L represents the 2007 NRWQCs for the aquatic life (chronic).
2) No inter-armoring or sub-armoring samples are collected from sample locations 1 and 27, as they are outside of the cap boundary.

NOTES:

1) * Flux chamber drifted while collecting MBIA0908-14; turbid sample noted
2) All elevations shown in NAVD88
3) Aerial photo taken on September 22, 2006
4) Average low tide during sampling period (September 15, 2009 to September 23, 2009) was 6 feet NAVD88

0 250 500

Scale in feet

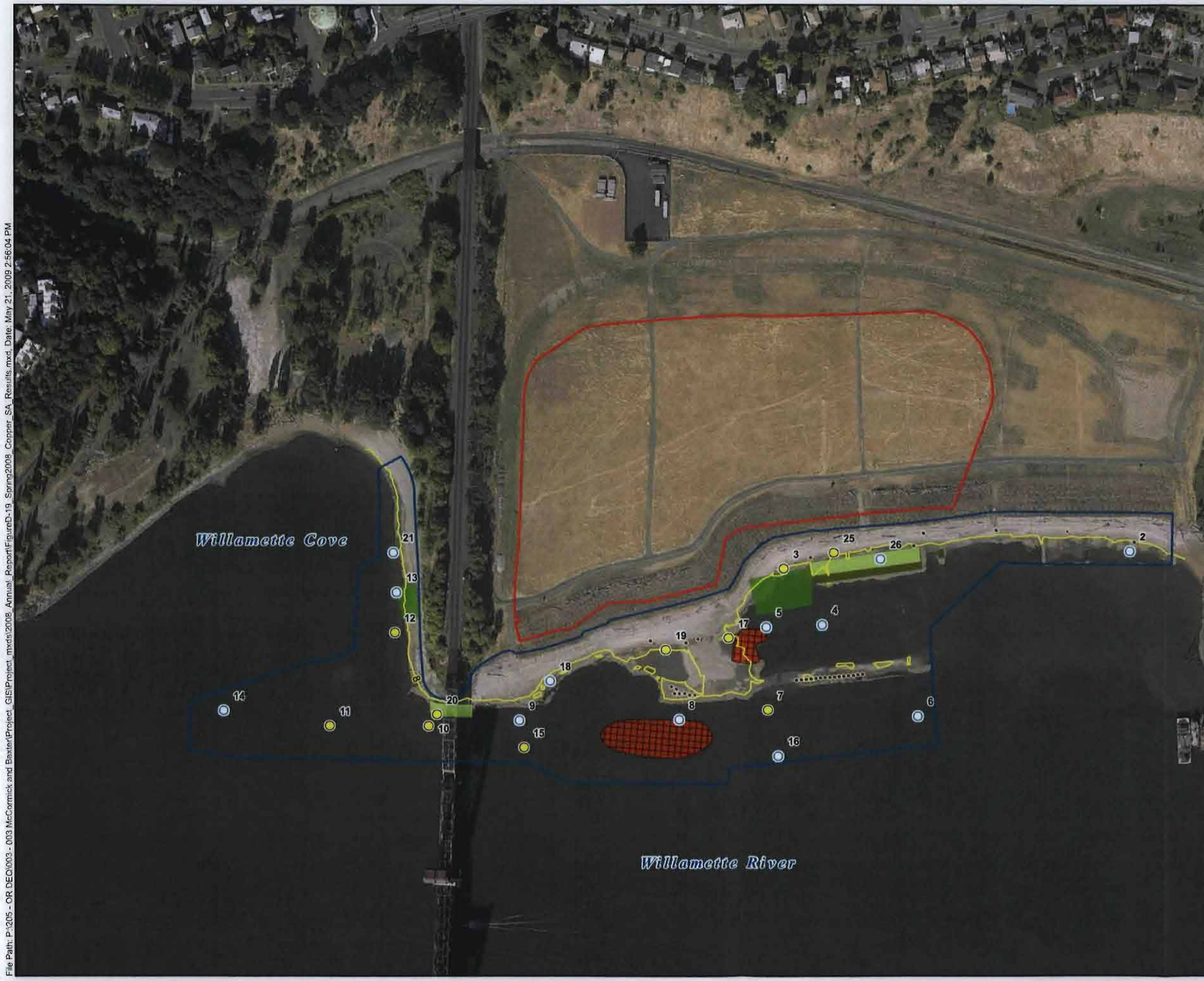
McCormick and Baxter Superfund Site
Portland, Oregon

Fall 2008 Copper Inter-Armoring Water Sample Results

5/09

HARTCROWSER GSI Water Solutions, Inc.

Figure **D-18**



File Path: P:\205 - OR DEQ\003 - 003 McCormick and Baxter\Project_GIS\Project_mxds\2008_Annual_Report\FigureD-19_Spring2008_Copper_SA_Results.mxd, Date: May 21, 2009 2:56:04 PM

LEGEND

Sample Results

- Non-detect
- < 0.009 mg/L
- 0.009 - 0.09 mg/L
- 0.09 - 0.9 mg/L
- > 0.9 mg/L

Site Features

- Subsurface Barrier Wall
- Sediment Cap Boundary
- Organoclay Granular
- Organoclay Mats (Double)
- Organoclay Mats (Single)
- Hot Spot Treatment (thickened sand layer)
- Boulder Clusters
- Willamette River Level During Sampling Event (8.00 feet)

REFERENCE INFORMATION:

1) Reference criteria of .0009 mg/L represents the 2007 NRWQCs for the aquatic life (chronic).
2) No inter-armoring or sub-armoring samples are collected from sample locations 1 and 27, as they are outside of the cap boundary.

NOTES:

1) All elevations shown in NAVD88
2) Aerial photo taken on September 22, 2006
3) Average low tide during sampling period (March 31, 2009 to April 4, 2009) was 8 feet NAVD88

0 250 500

Scale in feet

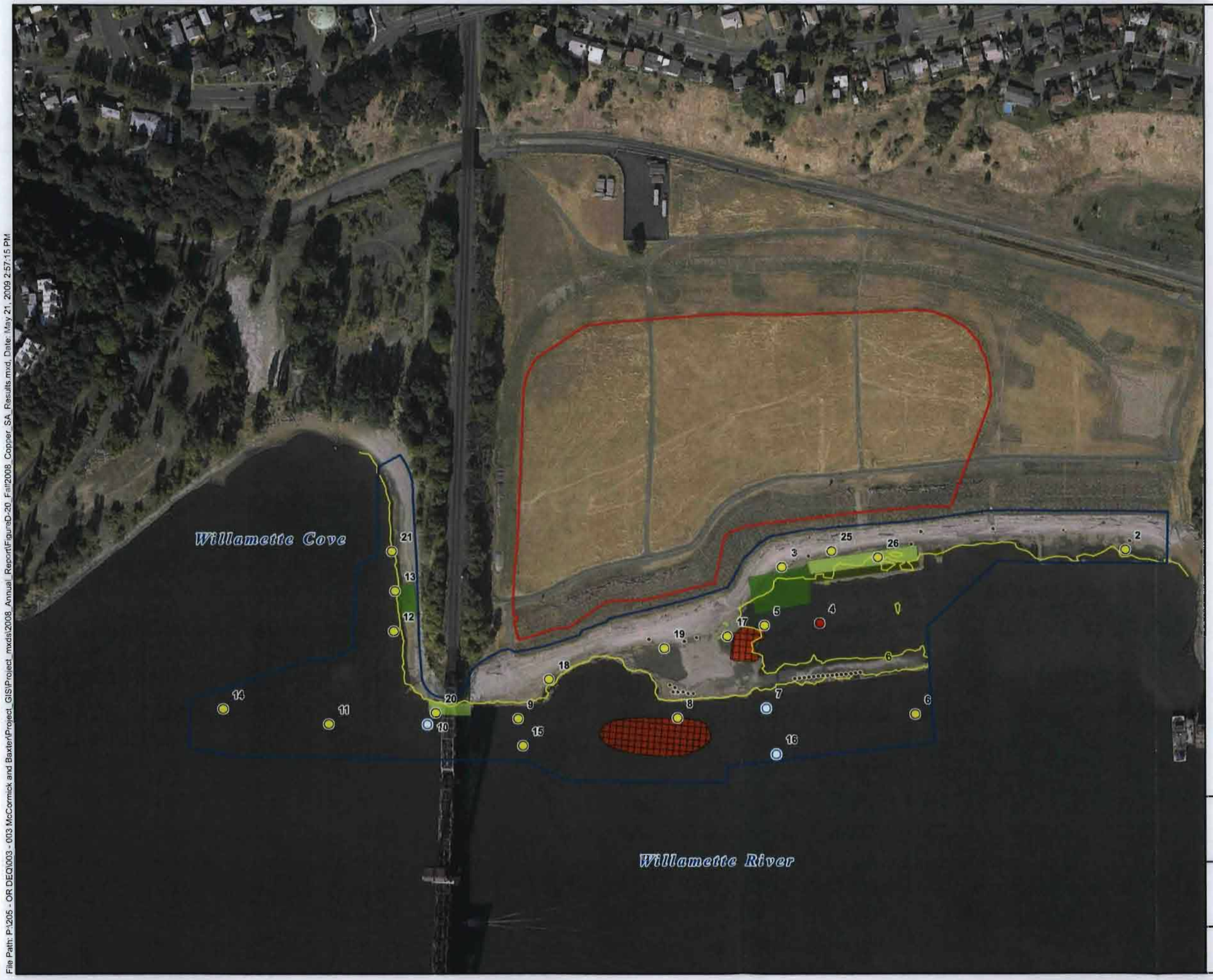
McCormick and Baxter Superfund Site
Portland, Oregon

Spring 2008 Copper Sub-Armoring Water Sample Results

5/09

HARTCROWSER GSI Water Solutions, Inc.

Figure
D-19



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LEGEND

Sample Results

- Non-detect
- < 0.009 mg/L
- 0.009 - 0.09 mg/L
- 0.09 - 0.9 mg/L
- > 0.9 mg/L

Site Features

- Subsurface Barrier Wall
- Sediment Cap Boundary
- Organoclay Granular
- Organoclay Mats (Double)
- Organoclay Mats (Single)
- Hot Spot Treatment (thickened sand layer)
- Boulder Clusters
- Willamette River Level During Sampling Event (6.00 feet)

REFERENCE INFORMATION:

1) Reference criteria of .0009 mg/L represents the 2007 NRWQCs for the aquatic life (chronic).
2) No inter-armoring or sub-armoring samples are collected from sample locations 1 and 27, as they are outside of the cap boundary.

NOTES:

1) All elevations shown in NAVD88
2) Aerial photo taken on September 22, 2006
3) Average low tide during sampling period (September 15, 2009 to September 23, 2009) was 6 feet NAVD88

0 250 500

Scale in feet

McCormick and Baxter Superfund Site
Portland, Oregon

Fall 2008 Copper Sub-Armoring Water Sample Results

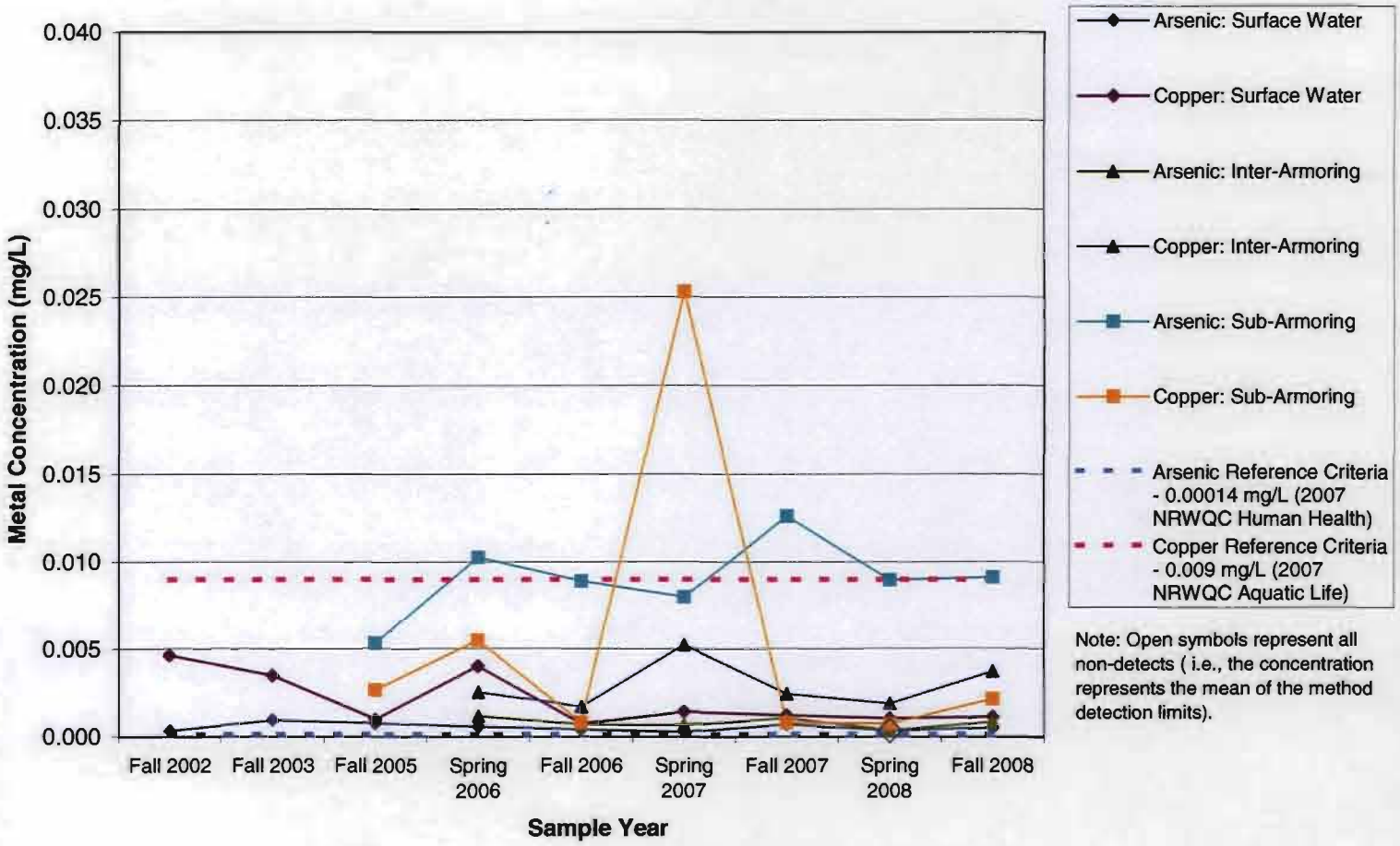
5/09

HARTCROWSER

GSI Water Solutions, Inc.

Figure

D-20



Note: Open symbols represent all non-detects (i.e., the concentration represents the mean of the method detection limits).

McCormick and Baxter Superfund Site
Portland, Oregon

Mean Concentration for Total Arsenic and Total Copper in Surface, Inter-Armoring, and Sub-Armoring Samples

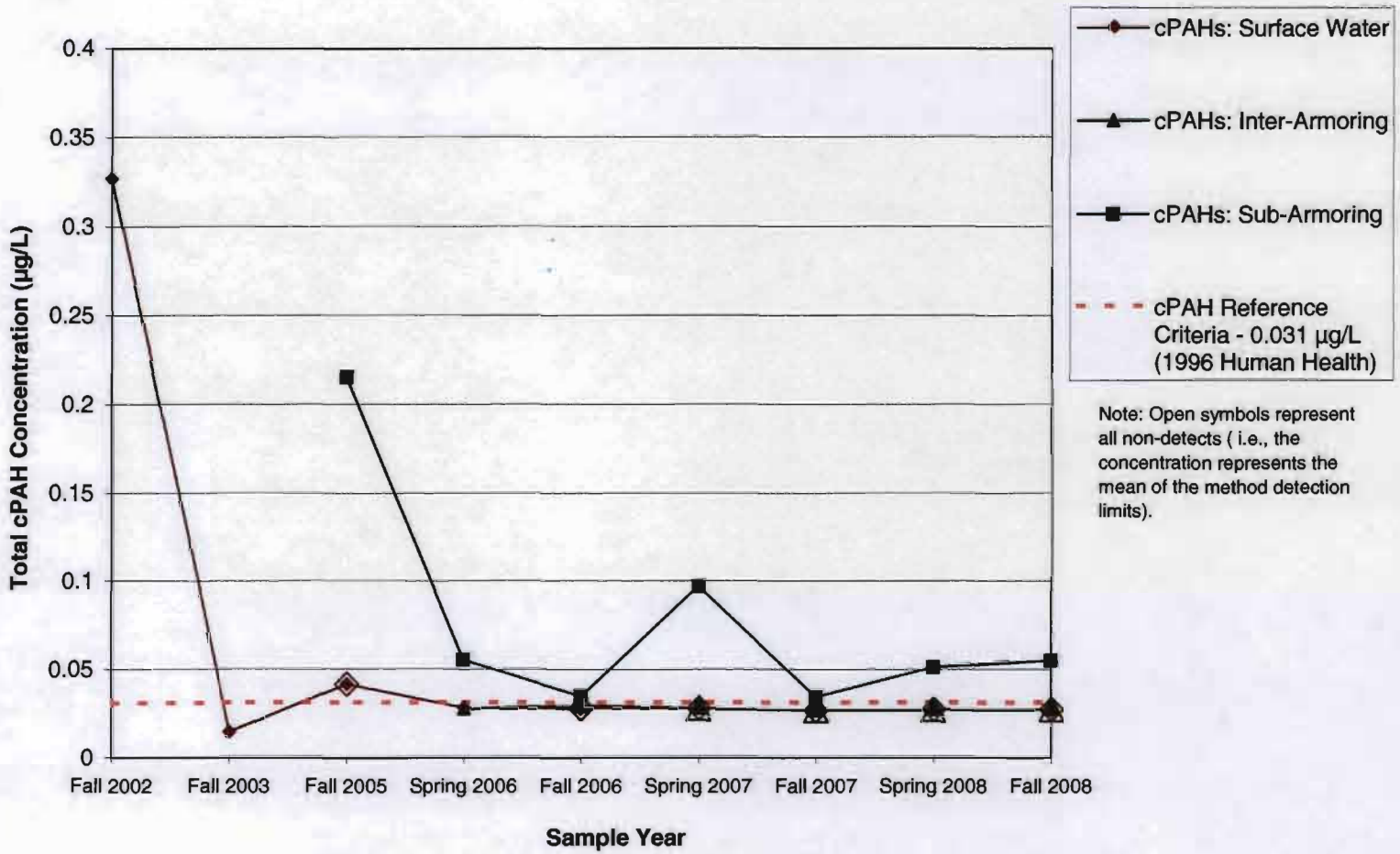
5/09

HARTCROWSER

GSI Water Solutions, Inc.

Figure

D-21



Note: Open symbols represent all non-detects (i.e., the concentration represents the mean of the method detection limits).

McCormick and Baxter Superfund Site
Portland, Oregon

Mean Concentrations for Total cPAHs in Surface, Inter-Armoring, and Sub-Armoring Water Samples

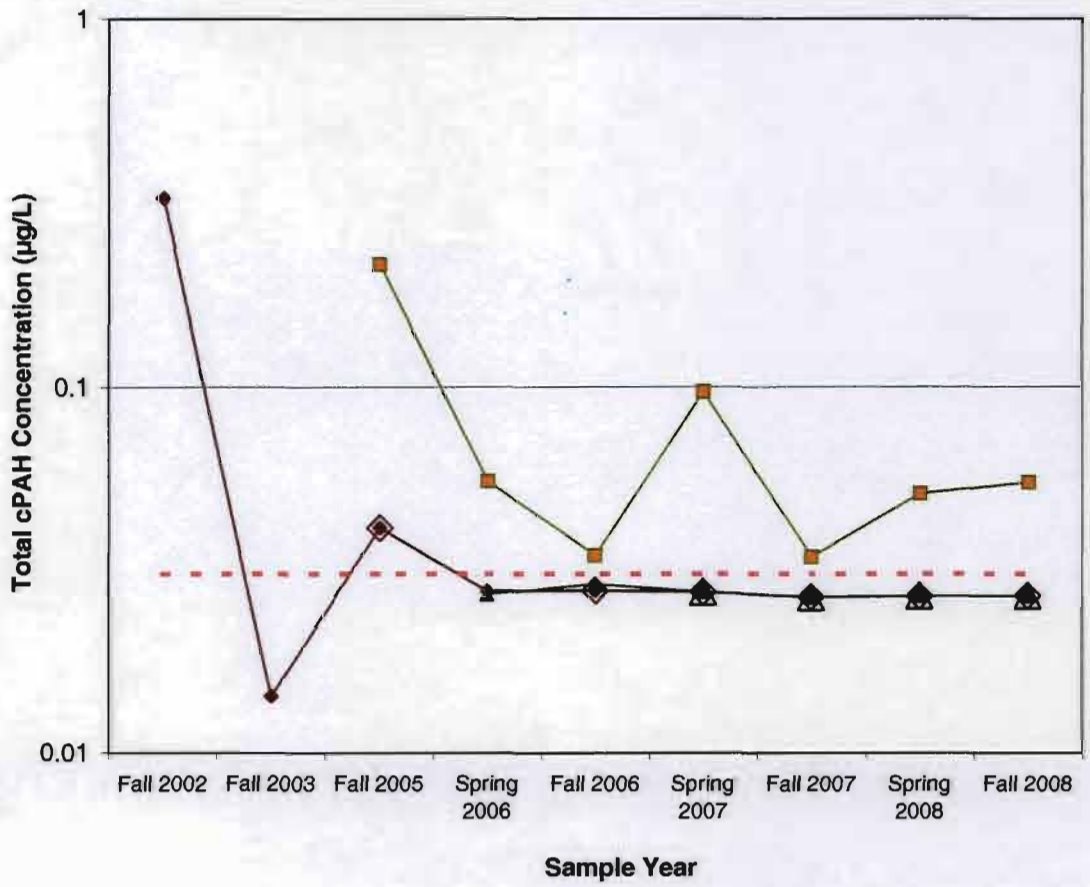
5/09

HARTCROWSER

GSI Water Solutions, Inc.

Figure

D-22



cPAHs: Surface Water

cPAHs: Inter-Armoring

cPAHs: Sub-Armoring

cPAH Reference Criteria - 0.031 µg/L (1996 Human Health)

Note: Open symbols represent all non-detects (i.e., the concentration represents the mean of the method detection limits).

McCormick and Baxter Superfund Site
Portland, Oregon

Mean Concentrations for Total cPAHs in Surface, Inter-Armoring, and Sub-Armoring Water Samples (log scale)

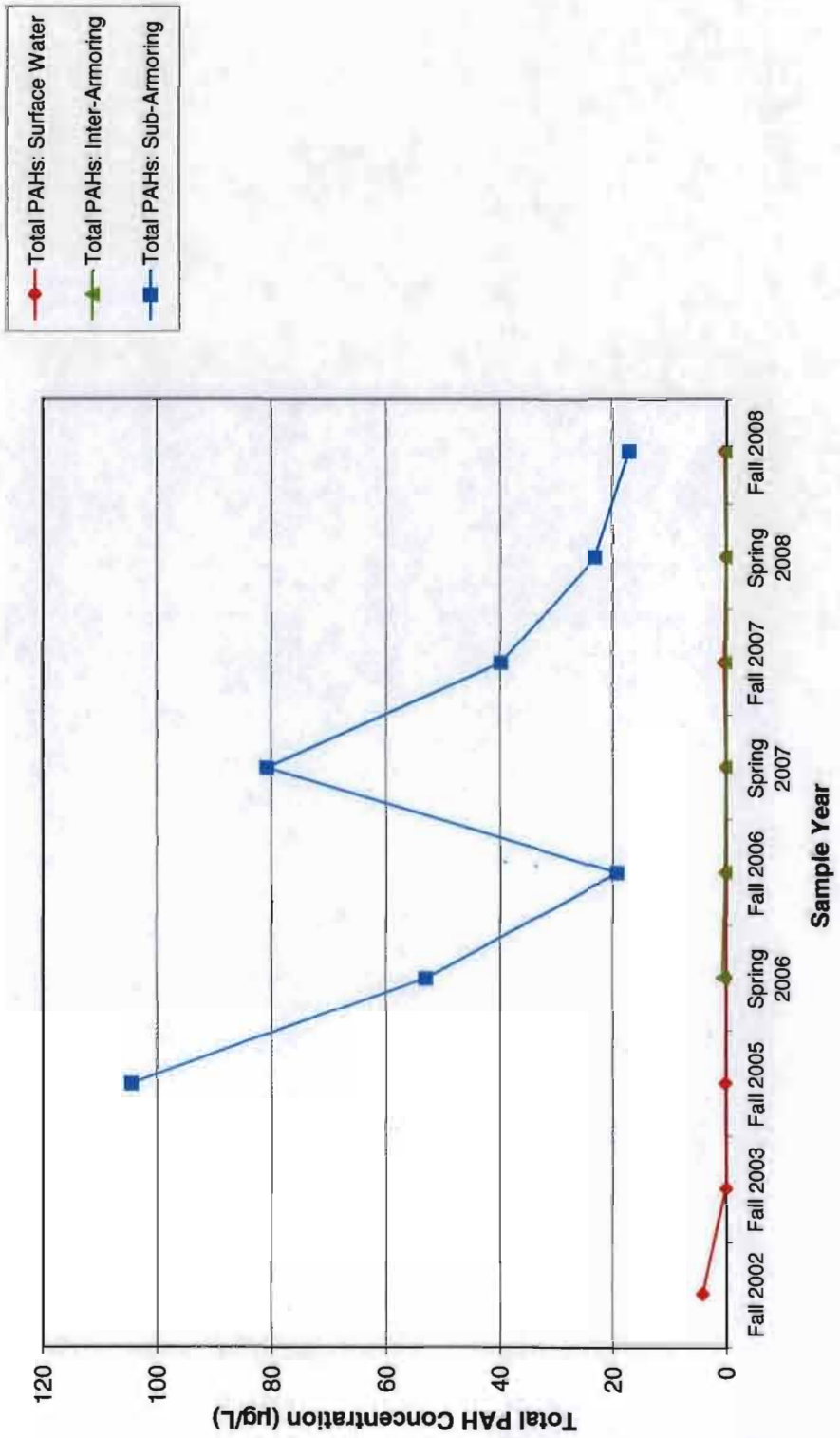
5/09

HARTCROWSER

GSI Water Solutions, Inc.

Figure

D-22a



McCormick and Baxter Superfund Site
Portland, Oregon

Concentrations for Total PAHs in Surface, Inter-Armoring, and Sub-Armoring Water Samples

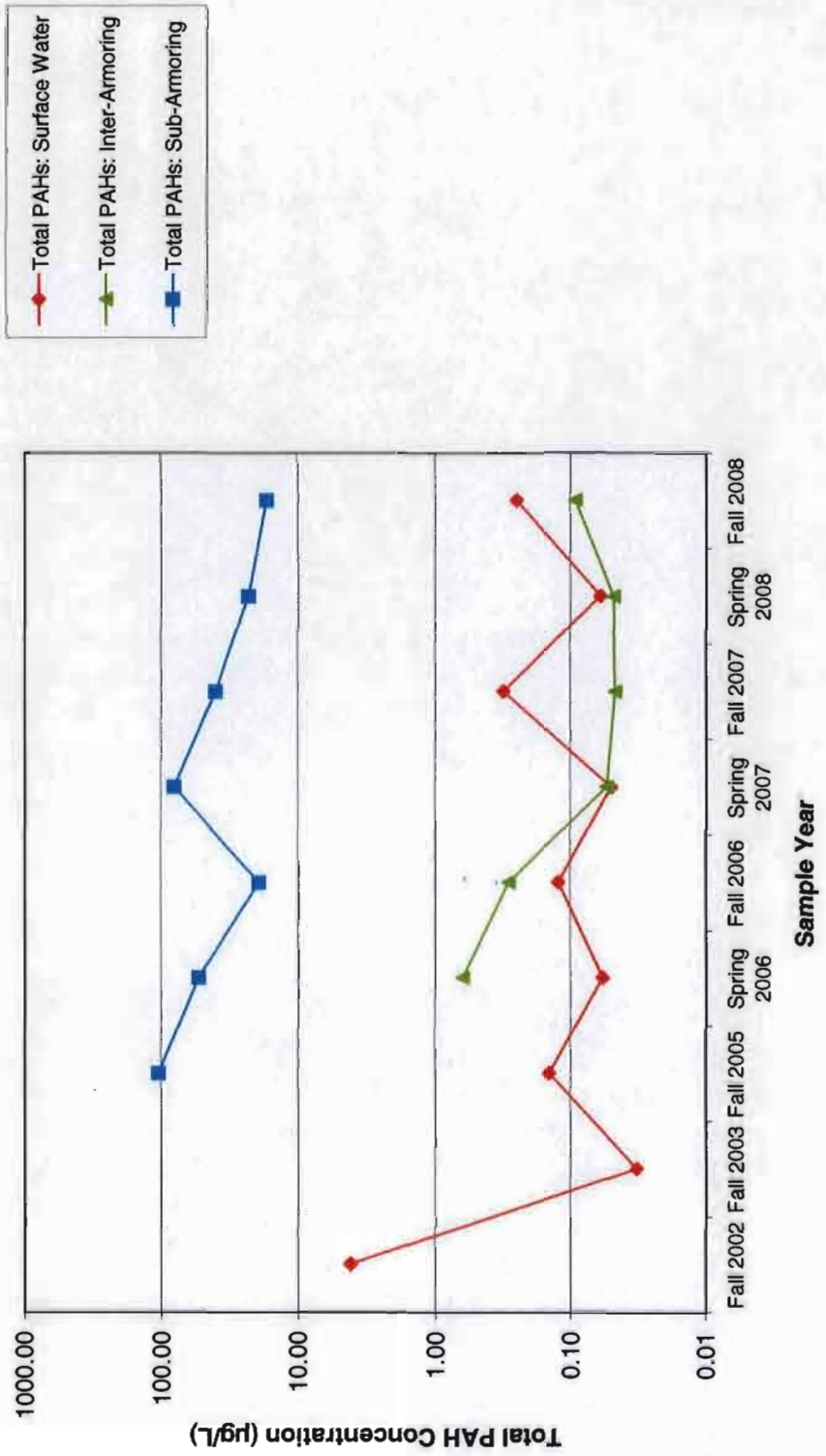
5/09

HARTCROWSER

GSI Water Solutions, Inc.

Figure

D-23



McCormick and Baxter Superfund Site
Portland, Oregon

Mean Concentrations for Total PAHs in Surface, Inter-Armoring, and Sub-Armoring Water Samples (Log Scale)

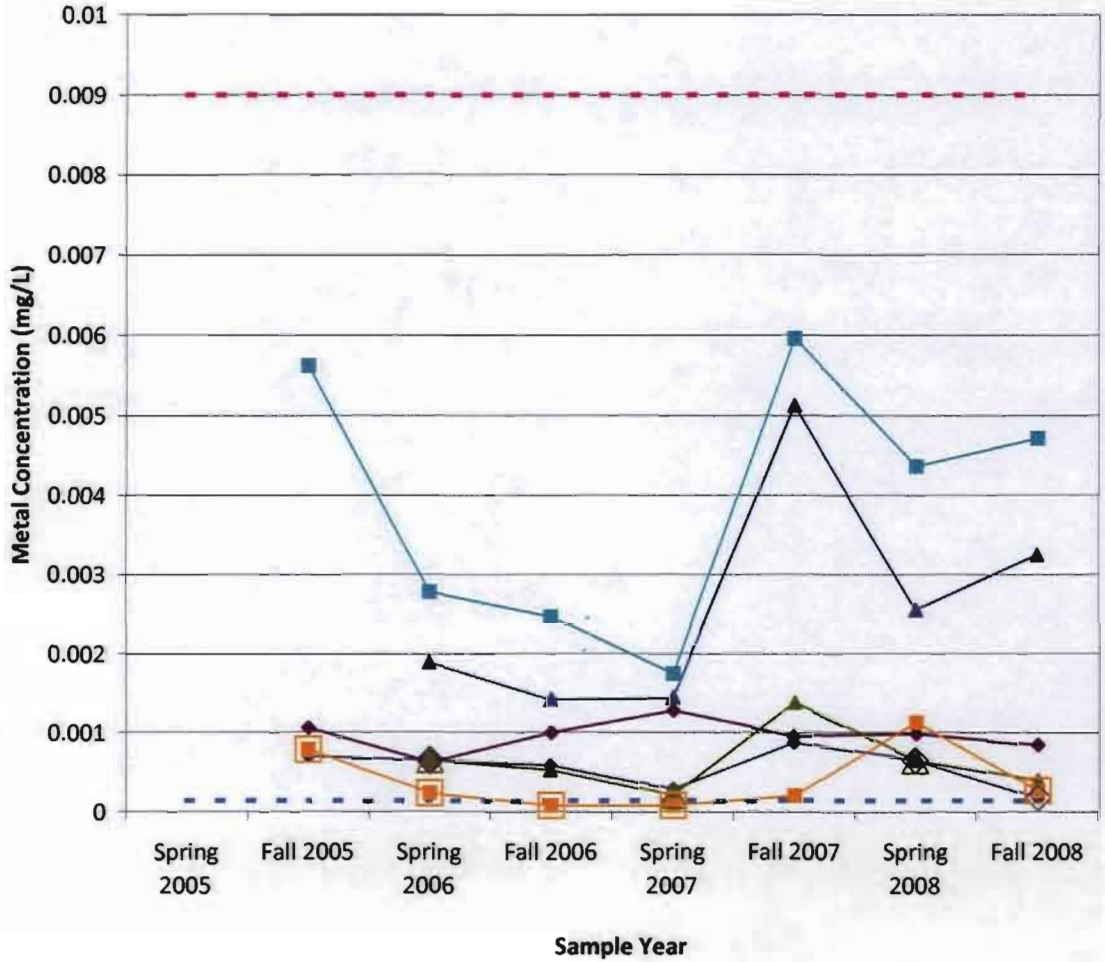
5/09

HARTCROWSER

GSI Water Solutions, Inc.

Figure

D-23a



- Arsenic: Surface Water
- Copper: Surface Water
- Arsenic: Inter-Armoring
- Copper: Inter-Armoring
- Arsenic: Sub-Armoring
- Copper: Sub-Armoring
- Arsenic Reference Criteria - 0.00014 mg/L (2007 NRWQC Human Health)
- Copper Reference Criteria - 0.009 mg/L (2007 NRWQC Aquatic Life)

Note: Open symbols represent all non detects (i.e., the concentration represents the mean of the method detection limits).

McCormick and Baxter Superfund Site
Portland, Oregon

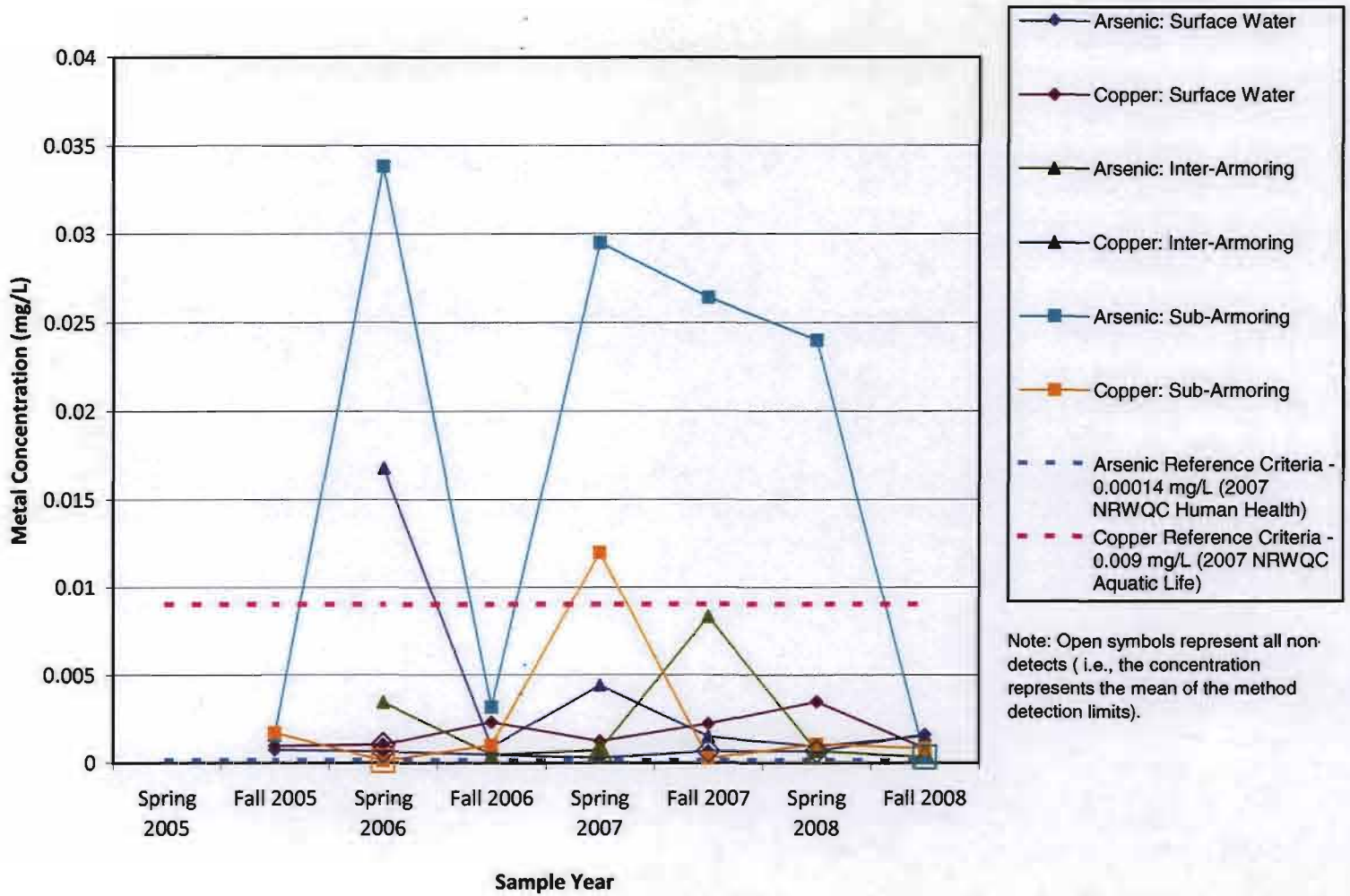
Location 10 Concentrations for Total Arsenic and Copper in Surface, Inter-Armoring, and Sub-Armoring Water Samples

5/09

Figure **D-24**

HARTCROWSER

GSI Water Solutions, Inc.



Note: Open symbols represent all non-detects (i.e., the concentration represents the mean of the method detection limits).

McCormick and Baxter Superfund Site
Portland, Oregon

Location 12 Concentrations for Total Arsenic and Copper in Surface, Inter-Armoring, and Sub-Armoring Water Samples

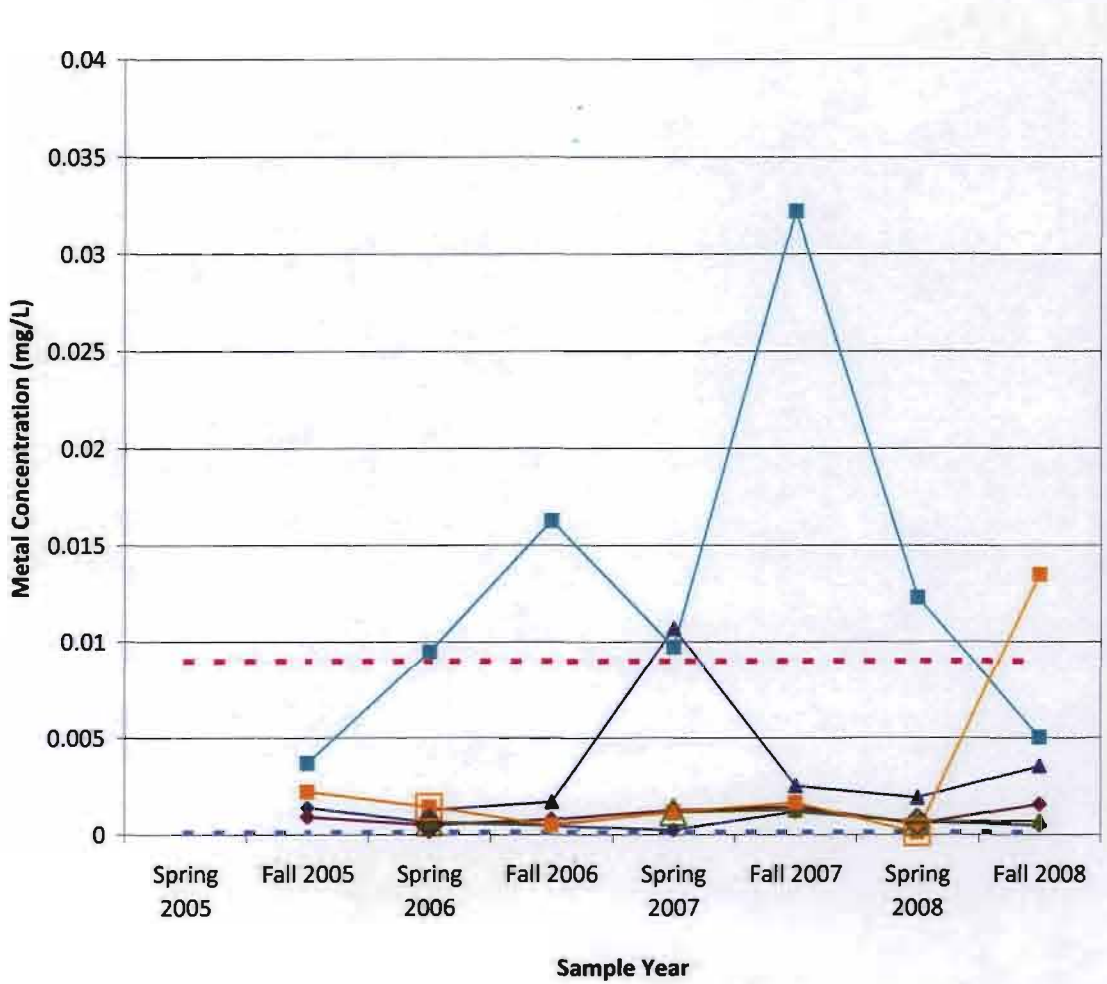
5/09

HARTCROWSER

GSI Water Solutions, Inc.

Figure

D-25



Arsenic: Surface Water

Copper: Surface Water

Arsenic: Inter-Armoring

Copper: Inter-Armoring

Arsenic: Sub-Armoring

Copper: Sub-Armoring

Arsenic Reference Criteria - 0.00014 mg/L (2007 NRWQC Human Health)

Copper Reference Criteria - 0.009 mg/L (2007 NRWQC Aquatic Life)

Note: Open symbols represent all non detects (i.e., the concentration represents the mean of the method detection limits).

McCormick and Baxter Superfund Site
Portland, Oregon

Location 4 Concentrations for Total Arsenic and Copper in Surface, Inter-Armoring, and Sub-Armoring Water Samples

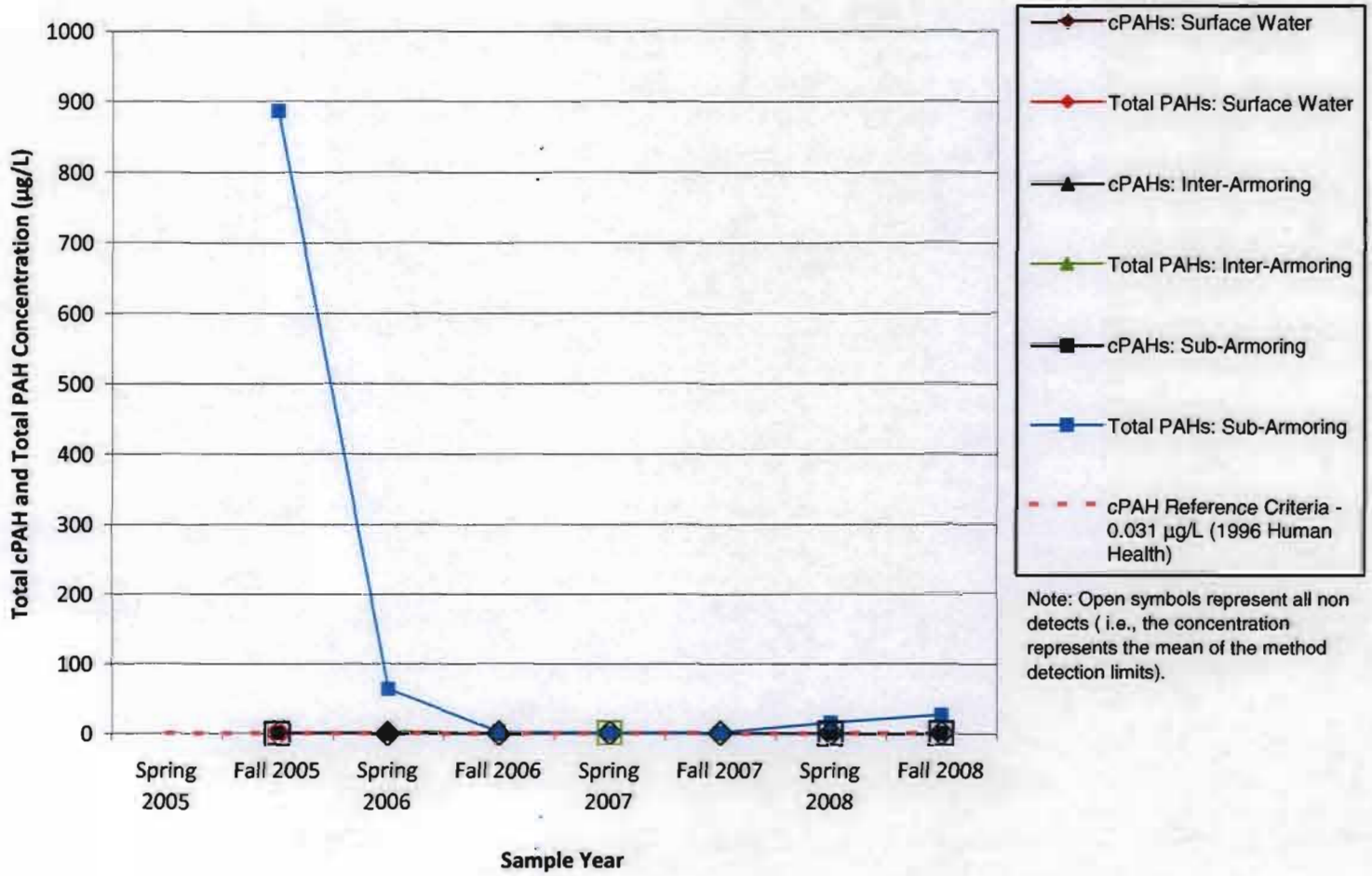
5/09

Figure

D-26

HARTCROWSER

GSI Water Solutions, Inc.



Note: Open symbols represent all non detects (i.e., the concentration represents the mean of the method detection limits).

McCormick and Baxter Superfund Site
Portland, Oregon

Location 10 Concentrations for Total cPAHs and Total PAHs in Surface, Inter-Armoring, and Sub-Armoring Water Samples

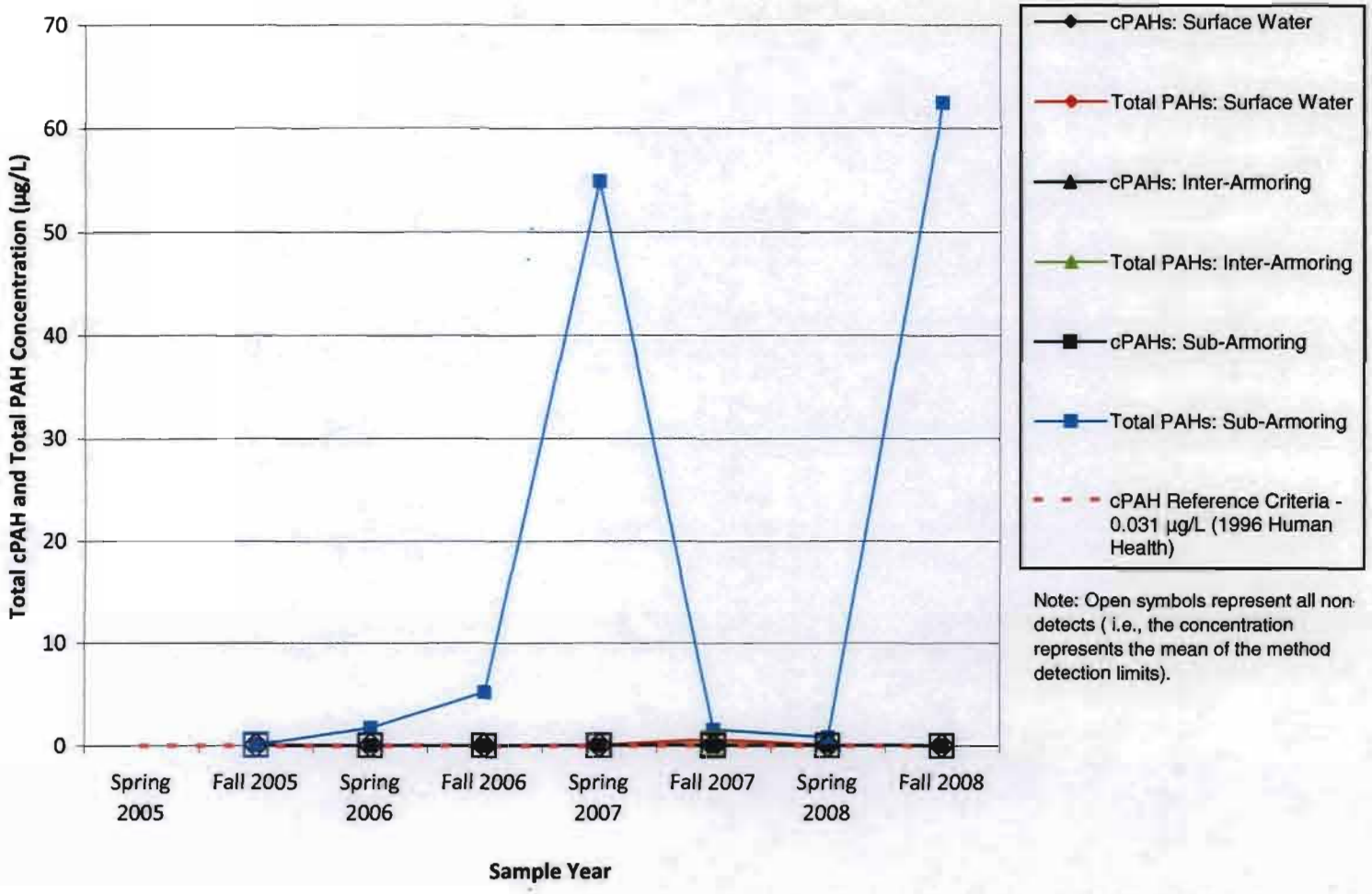
5/09

HARTCROWSER

GSI Water Solutions, Inc.

Figure

D-27



Note: Open symbols represent all non detects (i.e., the concentration represents the mean of the method detection limits).

McCormick and Baxter Superfund Site
Portland, Oregon

Location 12 Concentrations for Total cPAHs and Total PAHs in Surface, Inter-Armoring, and Sub-Armoring Water Samples

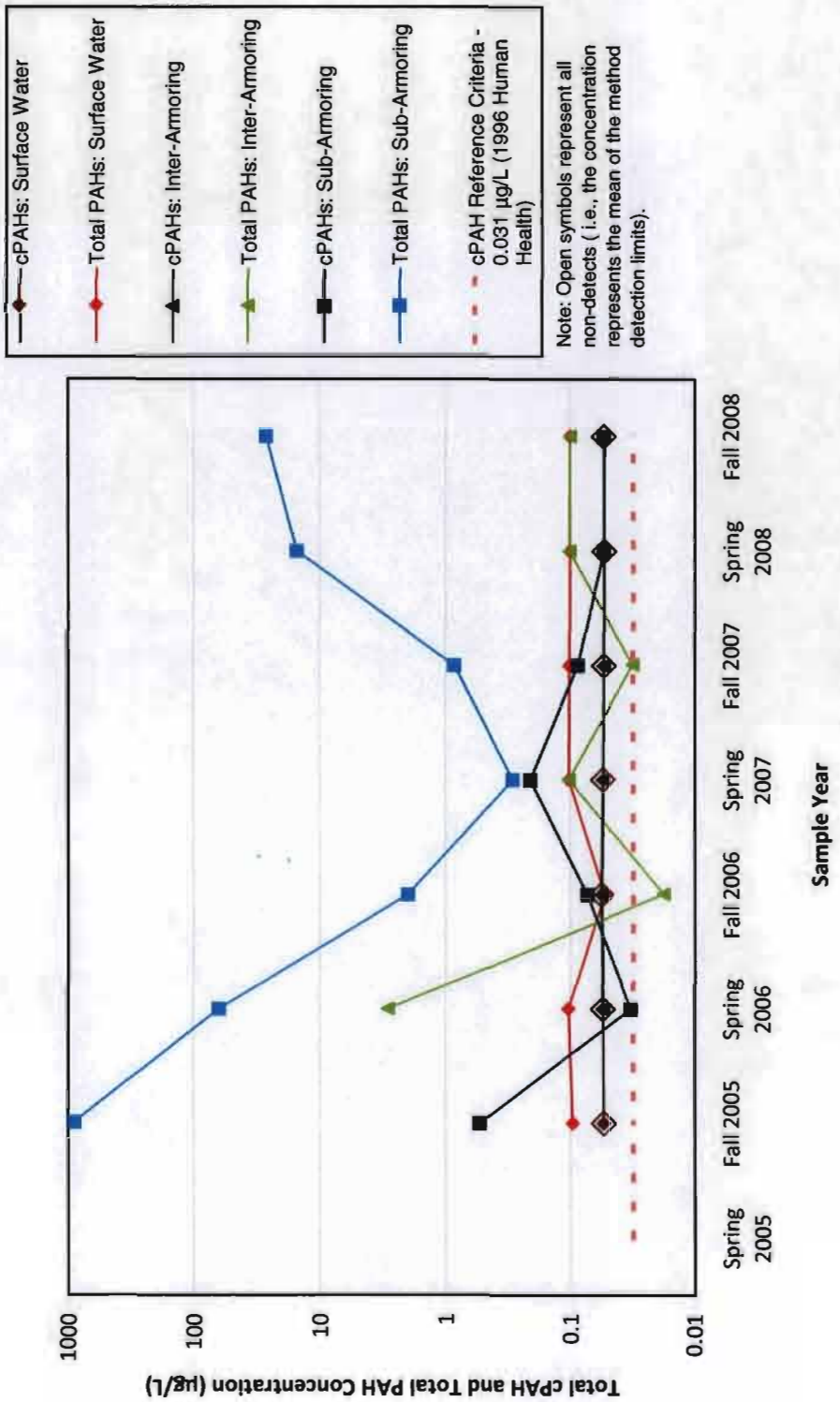
5/09

HARTCROWSER

GSI Water Solutions, Inc.

Figure

D-28



McCormick and Baxter Superfund Site
Portland, Oregon

Location 10 Concentrations for Total cPAHs and Total PAHs in Surface, Inter-Armoring, and Sub-Armoring Water Samples (Log Scale)

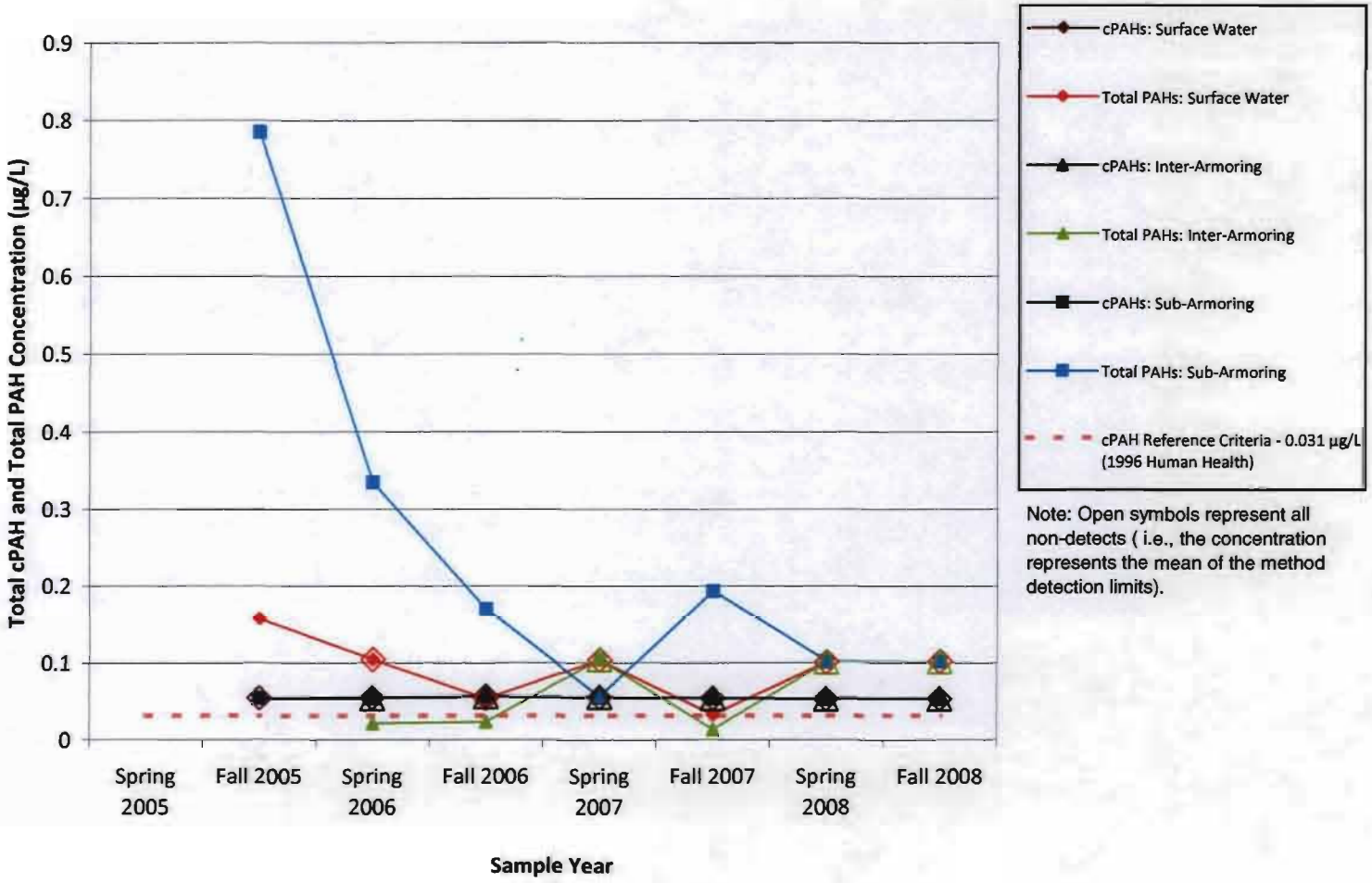
5/09

HARTCROWSER

GSI Water Solutions, Inc.

Figure

D-28a



Note: Open symbols represent all non-detects (i.e., the concentration represents the mean of the method detection limits).

McCormick and Baxter Superfund Site
Portland, Oregon

Location 4 Concentrations for Total cPAHs and Total PAHs in Surface, Inter-Armoring, and Sub-Armoring Water Samples

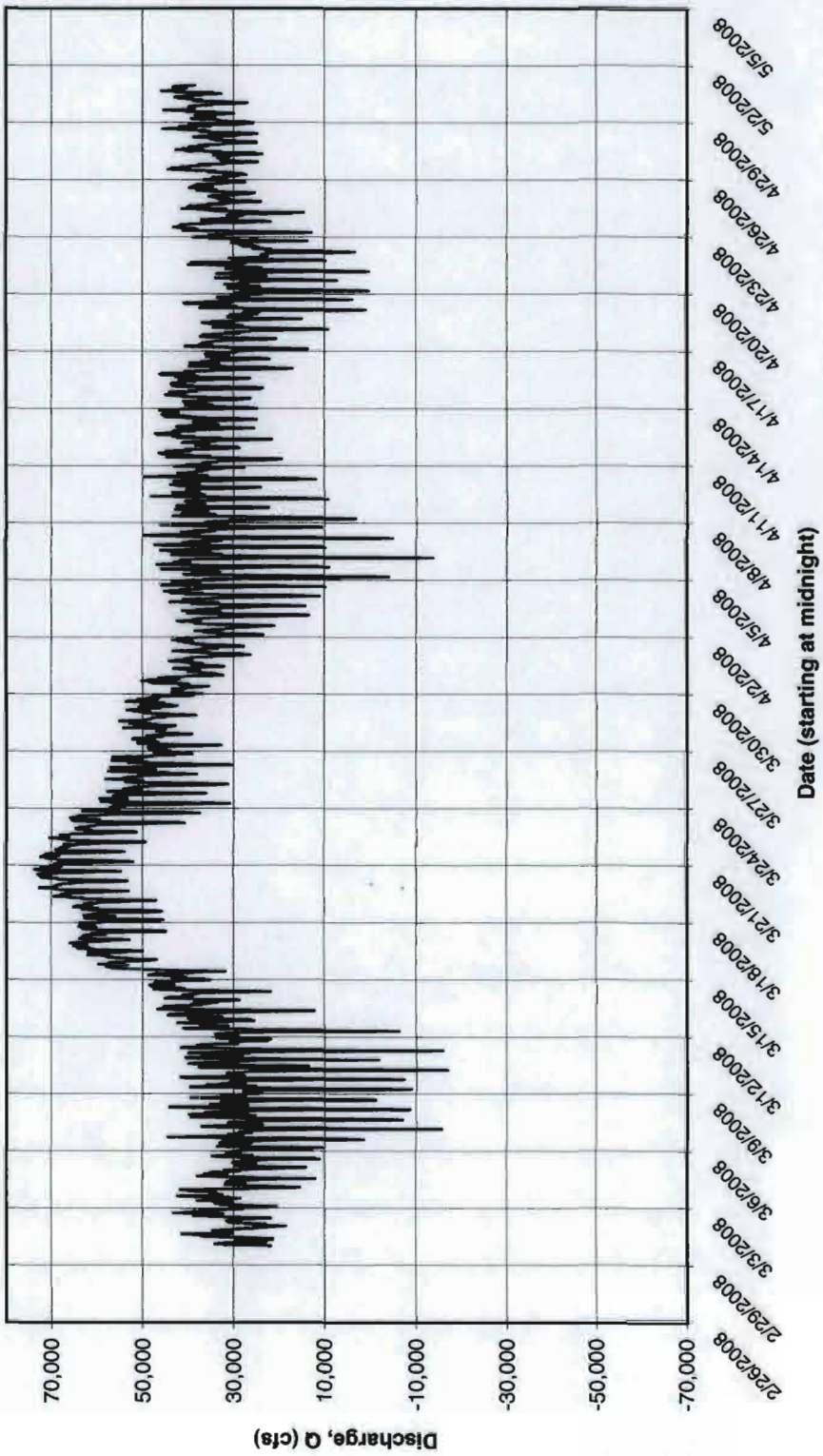
5/09

HARTCROWSER

GSI Water Solutions, Inc.

Figure

D-29



McCormick and Baxter Superfund Site
Portland, Oregon

Discharge Rate Willamette River at Portland, OR (Morrison Bridge) Spring 2008

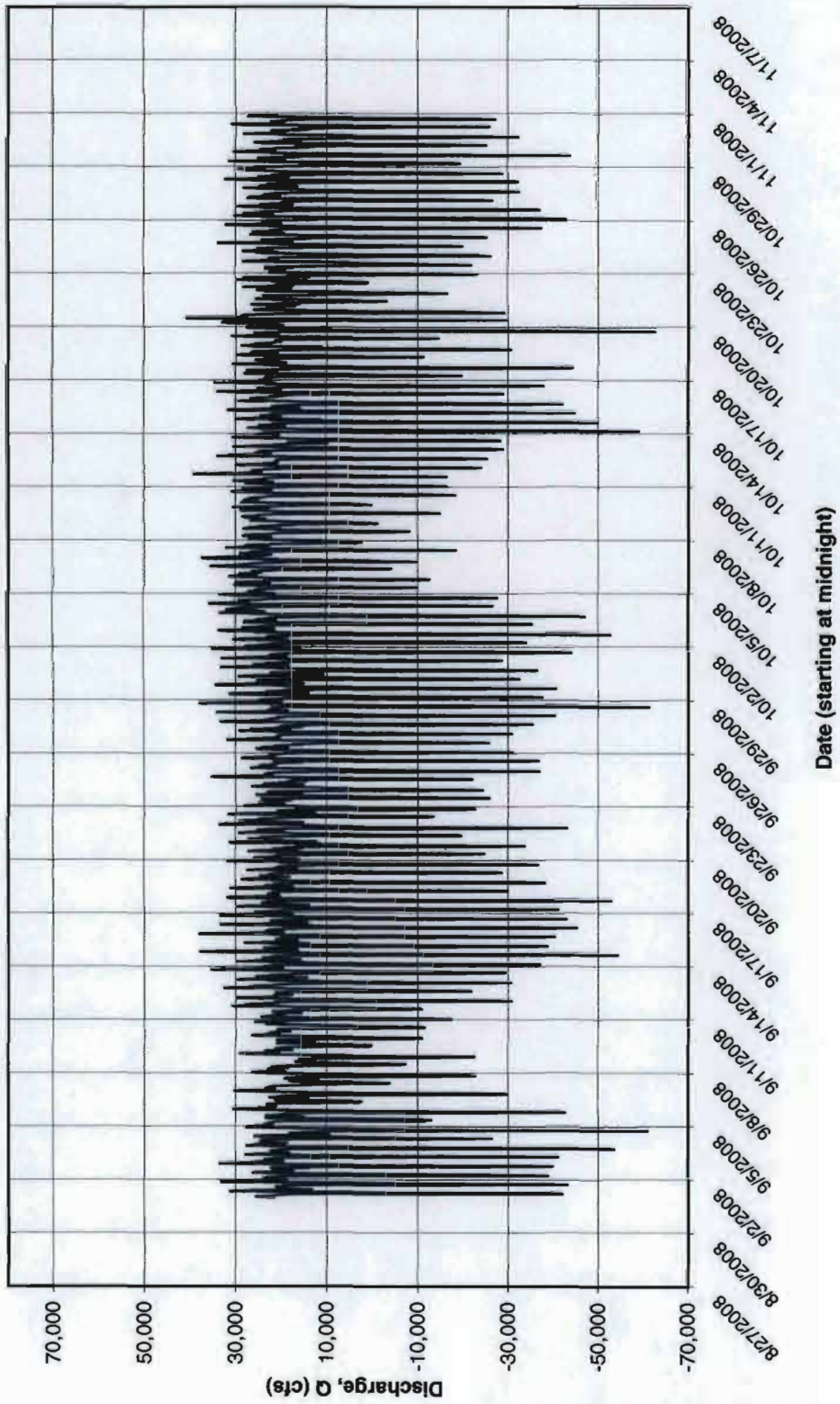
5/09

HARTCROWSER

GSI Water Solutions, Inc.

Figure

D-30



McCormick and Baxter Superfund Site
Portland, Oregon

Discharge Rate Willamette River at Portland, OR (Morrison Bridge) Fall 2008

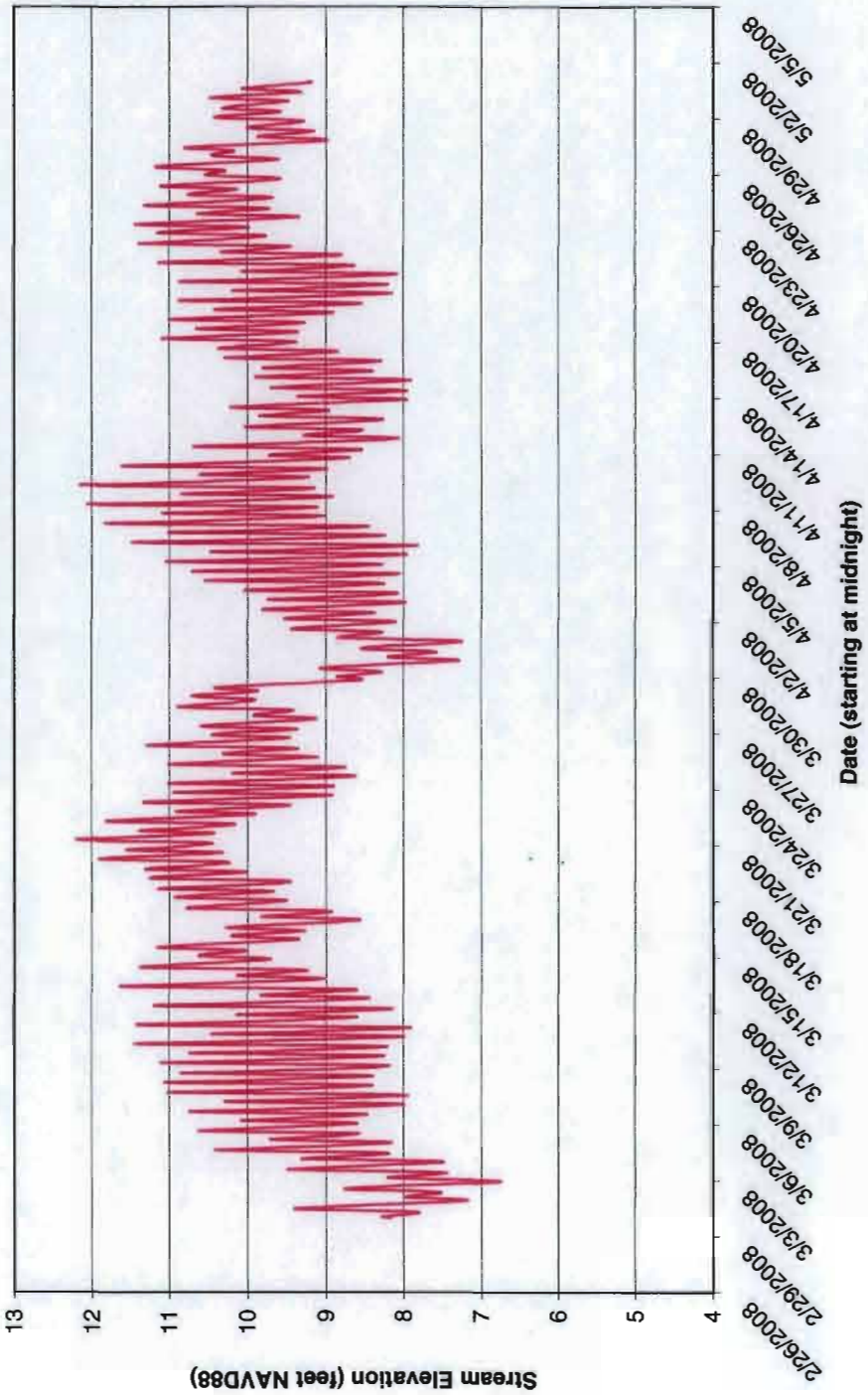
5/09

HARTCROWSER

GSI Water Solutions, Inc.

Figure

D-31



McCormick and Baxter Superfund Site
Portland, Oregon

Stream Elevation Willamette River at Portland, OR (Morrison Bridge) Spring 2008

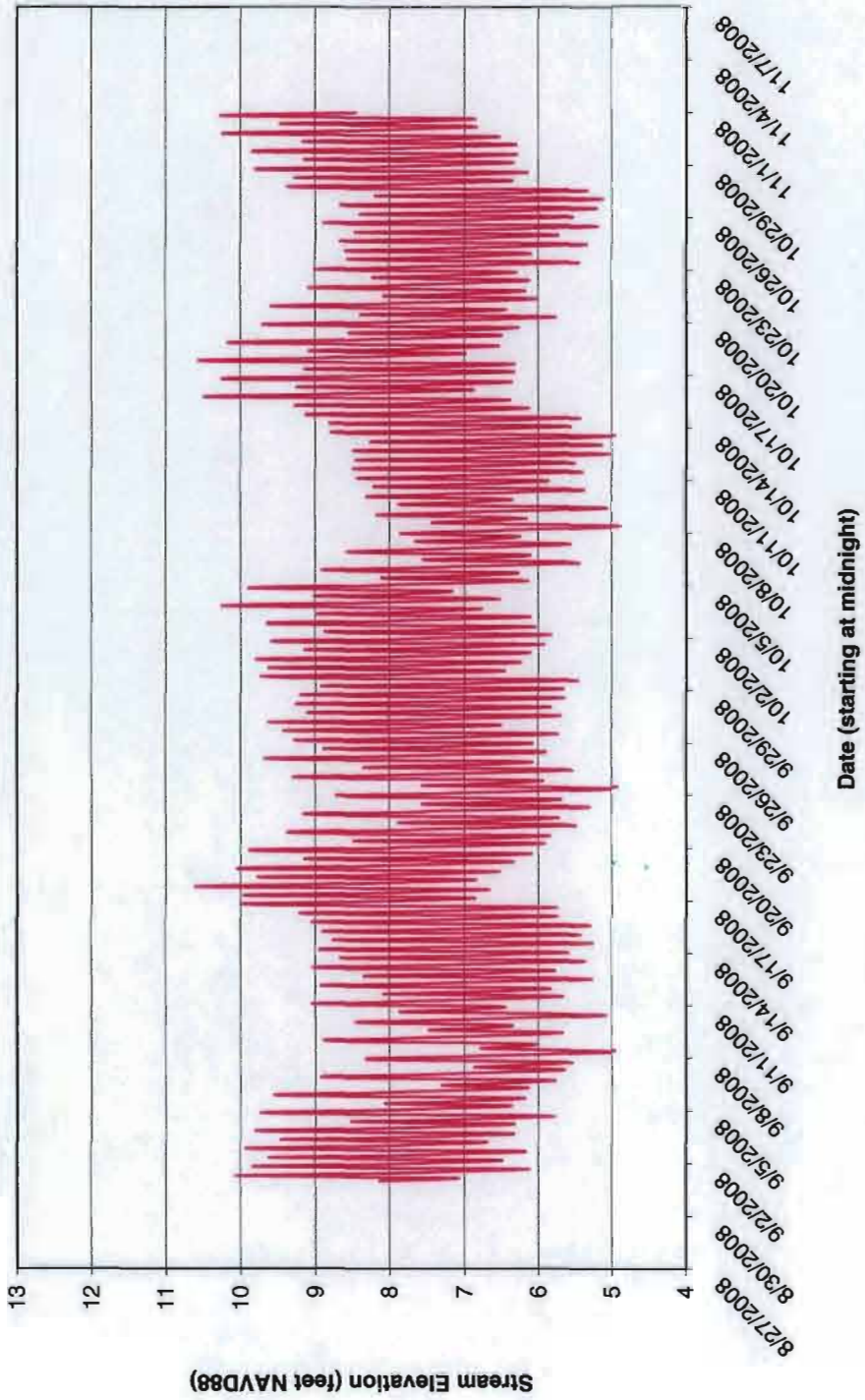
5/09

HARTCROWSER

GSI Water Solutions, Inc.

Figure

D-32



McCormick and Baxter Superfund Site
Portland, Oregon

Stream Elevation Willamette River at Portland, OR (Morrison Bridge) Fall 2008

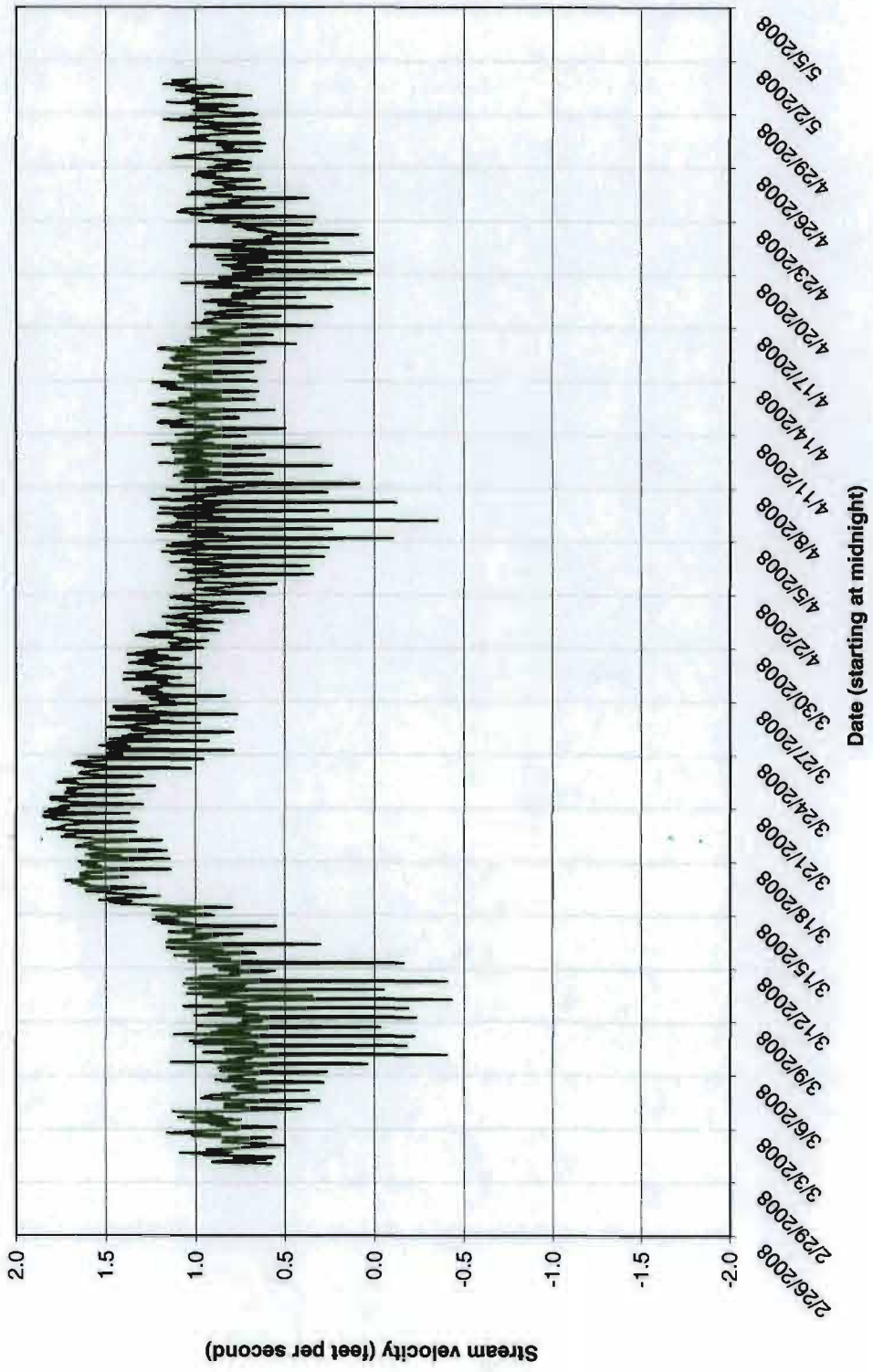
5/09

HARTCROWSER

GSI Water Solutions, Inc.

Figure

D-33



McCormick and Baxter Superfund Site
Portland, Oregon

Stream Velocity Willamette River at Portland, OR (Morrison Bridge) Spring 2008

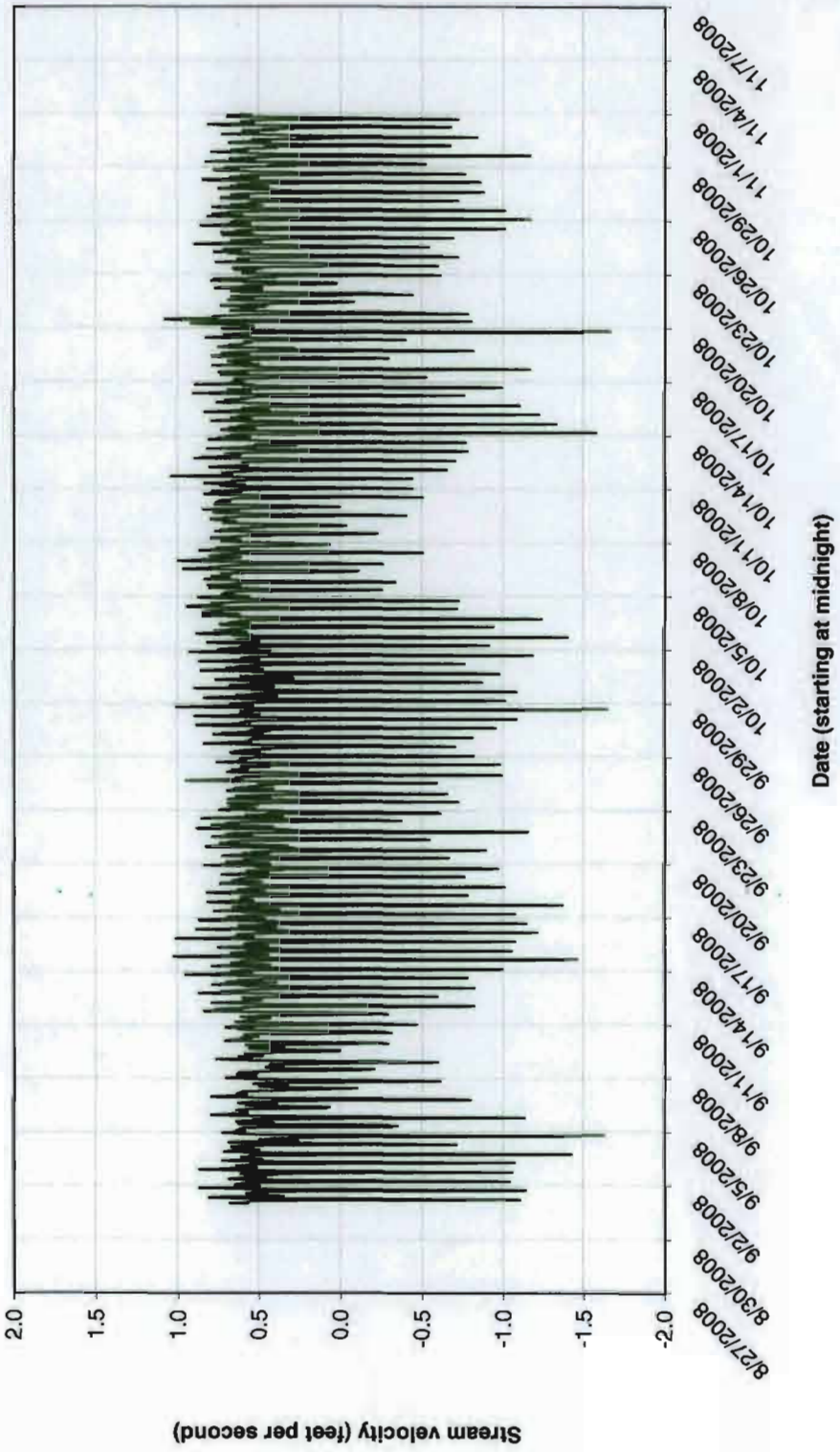
5/09

HARTCROWSER

GSI Water Solutions, Inc.

Figure

D-34



McCormick and Baxter Superfund Site
Portland, Oregon

Stream Velocity Willamette River at Portland, OR (Morrison Bridge) Fall 2008

5/09

HARTCROWSER

GSI Water Solutions, Inc.

Figure

D-35

ATTACHMENT A
PHOTOGRAPH DOCUMENTATION

OPERATION AND MAINTENANCE REPORT
JANUARY 2008 TO DECEMBER 2008
MCCORMICK AND BAXTER CREOSOTING COMPANY SUPERFUND SITE
PORTLAND, OREGON

Photograph 1 – Surface, inter-armoring, and sub-armoring water sampling using low-flow peristaltic pumps with a multi-parameter probe.

Photograph 2 – Samples field filtered using peristaltic pump and a 0.45 micron filter for dissolved metals analysis.

Photograph 3 – Northwest Underwater Construction diving vessel. Photograph taken looking northwest.

Photograph 4 – Northwest Underwater Construction preparing for dive.

Photograph 5 – Inter-armoring sampling device tied to diver line with weight for delivery to diver.

Photograph 6 – Sub-armoring sampling using Henry sampler from shoreline.

ATTACHMENT B
LABORATORY ANALYTICAL REPORTS AND QA MEMORANDA FOR SURFACE, INTER-ARMORING, AND SUB-ARMORING WATER SPRING 2008 SAMPLING EVENT

Included only on the O&M Report DVD

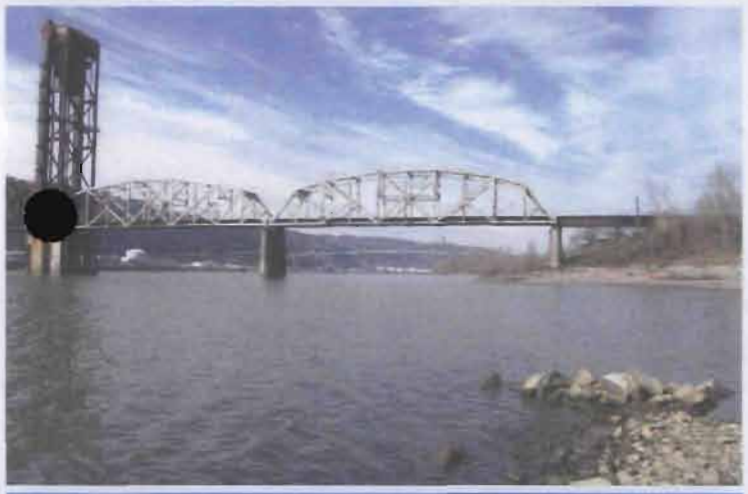
ATTACHMENT C
LABORATORY ANALYTICAL REPORTS AND QA MEMORANDA FOR SURFACE, INTER-ARMORING, AND SUB-ARMORING WATER FALL 2008 SAMPLING EVENT

Included only on the O&M Report DVD

ATTACHMENT D
GLOBAL DIVING SPRING 2008 AND NW CONSTRUCTION FALL 2008 SAMPLING VIDEOS

Included only on the O&M Report DVD

Appendix E



APPENDIX E
CRAYFISH SAMPLING ASSESSMENT

OPERATION AND MAINTENANCE REPORT
JANUARY 2008 THROUGH DECEMBER 2008

Hart Crowser/GSI
15670-03/Task 9 May 22, 2009

APPENDIX E
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2.1 Crayfish Sampling Locations and Nomenclature	E-2
2.2 Crayfish Sample Collection	E-2
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E-1 Crayfish Sample Dates and Locations - 2008
E-2 Crayfish Sample Results: Dioxins/Furans
E-3 Crayfish Sample Results: Metals
E-4 Crayfish Sample Results: Pentachlorophenol/PAHs

FIGURES

E-1 Crayfish Sample Locations
E-2 2,3,7,8-TCDD Dioxin TEQ Concentration in Crayfish Tissue
E-3 Total PAH Concentration in Crayfish Tissue

ATTACHMENTS

A Laboratory Analytical Reports for Crayfish Sampling (DVD)
B Data Validated Laboratory Analytical Reports for Crayfish Sampling (DVD)
C Data Validation Review (DVD)

ACRONYMS

BNRB	Burlington Northern Railroad Bridge
DEQ	Oregon Department of Environmental Quality
DHS	Oregon Department of Human Services
E&E	Ecology & Environment, Inc.
FWDA	Former Waste Disposal Area
HpCDD	hepta-chlorodibenzo-*p*-dioxins
HpCDF	hepta-chlorodibenzofurans
HxCDD	hexa-chlorodibenzo-*p*-dioxins
HxCDF	hexa-chlorodibenzofurans
ID	identification
LWG	Lower Willamette Group
O&M	Operation and Maintenance
OCDD	octa-chlorodibenzo-*p*-dioxins
OCDF	octa-chlorodibenzofurans
Pace	Pace Analytical Services
PAH	polynuclear aromatic hydrocarbon
PCDD	polychlorodibenzo-p-dioxin
PCDF	polychlorodibenzofuran
PeCDD	penta-chlorodibenzo-*p*-dioxins
PeCDF	penta-chlorodibenzofurans
PCP	pentachlorophenol
SAP	sampling and analysis plan
Site	McCormick & Baxter Superfund Site
TCDD	tetra-chlorodibenzo-*p*-dioxins
TCDF	tetra-chlorodibenzofurans
TEF	Toxic Equivalent Factor
TEQ	Toxic Equivalent
TestAmerica	TestAmerica Analytical Testing Corporation
TFA	Tank Farm Area
WC	Willamette Cove
WHO	World Health Organization

APPENDIX E
CRAYFISH SAMPLING ASSESSMENT
OPERATION AND MAINTENANCE REPORT
JANUARY 2008 THROUGH DECEMBER 2008
MCCORMICK AND BAXTER SUPERFUND SITE

1.0 INTRODUCTION

Appendix E to the *January 2008 through December 2008 Operation and Maintenance (O&M) Report* presents the assessment for crayfish collected from four locations overlying the McCormick & Baxter Superfund Site (Site) sediment cap. The crayfish were collected by Hart Crowser, Inc., and GSI Water Solutions, Inc., between September 19 and October 1, 2008. The crayfish were analyzed for polynuclear aromatic hydrocarbons (PAH), pentachlorophenol (PCP), total metals (arsenic, chromium, copper, and zinc), dioxins, furans, and percent lipid content by the laboratory at Pace Analytical Services (Pace) through the Oregon Department of Environmental Quality's (DEQ) contract with TestAmerica Analytical Testing Corporation (TestAmerica). The location of the Site, Site layout, and surface elevations are shown on Figures 1 through 3 in the main section of the O&M Report.

The 2008 crayfish collection and analysis were conducted in general accordance with the *Sampling and Analysis Plan for Crayfish* (SAP) prepared by Ecology & Environment, Inc. (E&E, 2006). Sampling sites were selected based on prior sampling locations, areas of highest known subsurface contaminant concentrations, and generally to provide a representative distribution over the entire sediment cap footprint. The crayfish sampling locations are shown on Figure E-1. These locations include the former Tank Farm Area (TFA), the Former Waste Disposal Area (FWDA), the Willamette Cove (WC) area, and the Burlington Northern Railroad Bridge (BNRB) area. Figure E-1 also shows the locations of previous crayfish sampling conducted in 1991, 2003, and 2006.

The purpose of the September 2008 crayfish assessment is to provide the Oregon Department of Human Services (DHS) with data to reevaluate a health advisory in effect since July 2, 1991, for commercial harvesting of crayfish in the Willamette River near the Site. The advisory states that "Crayfish taken within 1,000 feet of the property lines of the Site located south of the BNRB in Portland Harbor should not be eaten" (DHS, 2006). This health advisory was issued by DHS as a result of visual observations and limited testing of river sediments in the immediate vicinity of the Site, and the potential for uptake of these contaminants by crayfish. These concerns were confirmed when crayfish

samples were collected by DEQ in September 1991 as part of the remedial investigation of the Site (PTI, 1992).

2.0 SAMPLING METHODOLOGY

This section describes the crayfish sampling methodology used during the Fall of 2008. Sampling was conducted in accordance with the October 2006 SAP (E&E, 2006), except as noted below.

2.1 Crayfish Sampling Locations and Nomenclature

Sampling sites were selected based on prior sampling locations, areas of highest subsurface contaminant concentrations, and generally to provide a representative distribution over the entire sediment cap footprint, as shown on Figure E-1. Samples collected as part of the 2008 sampling events employed the following numbering scheme for sample identification (ID).

- The first two letters of the sample ID represent the site location (e.g., "MB" for McCormick & Baxter).
- The third and fourth letters represent the sample matrix (e.g., "CF" for Crayfish).
- The last four digits of the sample ID represent the year and sample number, respectively (e.g., "08-01" for 2008 sample number 01).

For example, sample MBCF08-01 identifies a McCormick & Baxter crayfish grab sample collected at the first location during the Fall 2008 sampling event. A sample location and identification key is presented on Figure E-1.

2.2 Crayfish Sample Collection

Crayfish were collected using baited crayfish traps deployed from a small boat. Two crayfish traps were placed in each of the four locations shown on Figure E-1. Each crayfish trap consisted of a symmetrical two-piece metal mesh cylinder cage. The cage is designed to rest on the bottom of the river. At both ends of the cage, there is an approximately 2-inch-diameter concave opening designed to allow the crayfish access to the bait in the center of the cage. Once inside the cage, the crayfish are unable to escape through the openings. Before deployment, lead weights were secured to the outside of each trap to prevent strong river currents from moving the traps. Also, each trap was tied to a rope and small float for retrieval.

During the Fall 2008 sampling event, the traps were deployed on multiple occasions, as shown in Table E-1, to obtain sufficient crayfish for the desired analysis. After experimentation with chicken livers and bacon between September 17 and September 24, 2008, salmon heads were used and found to be more effective in luring crayfish into the cages.

The traps were deployed and retrieved a total of five times between September 17 and September 30, 2008. The dates of deployment and retrieval are summarized in Table E-1.

The traps were placed in varying water depths depending on location as follows:

- TFA: 4 to 15 feet
- FWDA: 10 to 20 feet
- BNRB: 15 to 40 feet
- WC: 6 to 12 feet

After each trap was retrieved, crayfish caught in a given area were tallied and placed into a Ziploc bag. The bags were marked with the sampling location, weighed, and then frozen. Upon completion of sampling, samples were placed in a cooler on ice for transport to TestAmerica in Beaverton, Oregon, for whole body and tissue homogenization and analysis. Seventeen crayfish samples were submitted to the laboratory on September 26, 2008, and 19 crayfish were submitted on October 2, 2008.

Samples were analyzed by Pace, on behalf of TestAmerica under contract to DEQ. Dioxins/furans were analyzed by Pace facilities in Minneapolis, Minnesota, while metals and semivolatile organic compounds were analyzed by Pace facilities in Green Bay, Wisconsin. The laboratory data package is provided in Attachment E-1. A chemist from Hart Crowser validated the data. The validated data and data validation review are provided in Attachments E-2 and E-3, respectively.

Analysis was performed for the following constituents:

- PAHs and PCP by EPA SW-846 Method 8270-SIM
- Total metals (arsenic, chromium, copper, and zinc), by EPA SW-846 Method 6020
- Polychlorodibenzo-*p*-dioxins (PCDD) and polychlorodibenzofurans (PCDF), by a modified version of EPA Method 1613B

- Percent moisture reportable by ASTM D2974-87
- Percent lipid content by Pace Lipid

3.0 SAMPLING RESULTS

Table E-2 provides a summary of dioxin/furan results from the 2008 crayfish sampling, as well as sample results from 1991, 2003, and 2006 crayfish sampling (E&E, 2004; E&E, 2007; E&E, 2008). The 1991 and 2003 sampling events occurred prior to installation of the sediment cap. PCDD/F homologs are represented by tetra-, penta-, hexa-, hepta-, and octa-chlorodibenzo-*p*-dioxins (TCDD, PeCDD, HxCDD, HpCDD, and OCDD, respectively) and tetra-, penta-, hexa-, hepta-, and octa-chlorodibenzofurans (TCDF, PeCDF, HxCDF, HpCDF, and OCDF, respectively). Results are expressed in terms of 2,3,7,8-TCDD by applying the World Health Organization (WHO) 2005 mammalian TEFs (Van den Berg, et. al., 2006) to the individual isomers and calculating a final 2,3,7,8-TCDD TEQ concentration.

Table E-2 provides the results for dioxin/furans detected in crayfish for both whole body and edible tissue (when available) from crayfish collected in 2008, 2006, 2003, and 1991. Figure E-2 shows a graphical comparison of the whole body 2,3,7,8-TCDD TEQ by area for 2008, 2006, and 2003. 1991 data are not included as they were only analyzed for edible tissue and are not directly comparable. Dioxins/furans were detected in all four whole body composites and two edible tissue samples with 2,3,7,8-TCDD TEQs ranging from 0.004 nanogram per kilogram (ng/kg)-wet weight basis (wet) to 0.346 ng/kg-wet. The whole body 2,3,7,8-TCDD TEQ average for the Fall 2008 sampling event is 0.308 mg/kg-wet while in October 2006, it was 0.10 ng/kg-wet. When compared to the 2003 (before installation of the sediment cap), whole body 2,3,7,8-TCDD TEQ average of 1.1 ng/kg-wet, both the 2006 and 2008 samples show near order of magnitude reduction in concentration. There was sufficient sample at two locations in 2008 to analyze edible muscle tissue (tails). The average for the edible tissue 2,3,7,8-TCDD TEQ in 2008 was 0.0508 ng/kg-wet, while in 1991, the edible muscle tissue average was 4.2 ng/kg-wet. This represents a significant reduction in dioxins in the crayfish since installation of the sediment cap.

Figure E-2 shows the clear reduction in dioxin/furan concentrations in crayfish between pre-cap data from 2003 and post-cap data from 2006 and 2008 with all post-cap concentrations in crayfish below the Health Advisory Criteria of 0.9 ng/kg. In addition, when compared to the Lower Willamette Group (LWG) Portland Harbor data (Integral et. al., 2006; Integral, 2008), where 19 samples of

whole body crayfish were collected and analyzed, the McCormick & Baxter 2006 and 2008 results are lower. The mean 2,3,7,8-TCDD TEQ concentration for LWG Portland Harbor was 1.58 ng/kg-wet, which is more comparable to the McCormick & Baxter pre-sediment cap 2003 whole body 2,3,7,8-TCDD TEQ average of 1.1 ng/kg-wet (Integral, 2004).

Table E-3 provides a summary of metals results from the 2008 crayfish sampling, as well as sample results from 1991, 2003, and 2006 crayfish sampling. There was not sufficient sample to analyze edible muscle tissue samples for metals. For the whole body composite crayfish samples collected in 2008, arsenic was detected in all four samples at concentrations ranging from 0.38 to 0.49 mg/kg-wet weight basis. Chromium was not detected in any of the four composites at detection limits ranging from 0.16 to 0.84 mg/kg. Copper was detected in all four composites at concentrations ranging from 20.1 to 27.1 mg/kg-wet. Zinc was detected in all four composites at concentrations ranging from 24.5 to 26.4 mg/kg. Metals concentrations in crayfish are similar to the 2006 data with the exception of chromium not being detected in 2008. The results of metals concentrations are similar to the LWG Portland Harbor crayfish data for arsenic (Portland Harbor mean of 0.344 mg/kg-wet with a range of 0.235 to 0.5 mg/kg-wet, Integral et. al., 2006; Integral, 2008), chromium (LWG Portland Harbor ranged from not detected at 0.09 mg/kg-wet to estimated at 0.09 mg/kg-wet), and copper (LWG Portland Harbor ranged from 10.4 to 20.2 mg/kg-wet with a mean of 14.8 mg/kg-wet). Zinc concentrations appear slightly elevated, compared to the LWG Portland Harbor range of estimated concentrations from 13.7 to 20.3 mg/kg-wet with a mean of 17 mg/kg-wet.

Table E-4 provides a summary of PCP and PAH results from the 2008 crayfish sampling, as well as sample results from 1991, 2003, and 2006 crayfish sampling. PAHs were detected in all four of the composite samples. Figure E-3 provides a graphical comparison of the 2003, 2006, and 2008 total PAH concentrations in whole body crayfish composites. The 2003 data was reported in dry-weight and was converted based on moisture content to a wet-weight basis for the comparison. Total PAH concentrations ranged from an estimated 3.8 micrograms per kilogram (µg/kg)-wet to 10.5 µg/kg-wet. Carcinogenic PAHs were estimated in two of the four composite samples at concentrations of 0.31 and 0.35 µg/kg-wet. PCP was not detected in any of the samples. The 2008 PAH results are similar to the 2006 PAH results with the exception of one 2006 outlier collected from the TFA (MBCFGB06-01) which contained elevated concentrations of naphthalene. Both the 2006 and 2008 data results for PAHs are consistently below the 2003 pre-cap concentrations (when converted from dry-weight to wet-weight), with the exception of the 2006 outlier discussed above. 2008 PAH results are lower than the LWG Portland Harbor mean total PAH concentration in crayfish of 71.2 µg/kg-wet; however, of the 36 LWG

Portland Harbor samples analyzed for PAHs, only 12 had detectable PAH concentrations (Integral et. al., 2006; Integral, 2008).

4.0 SUMMARY

Crayfish were collected from four areas during the September 2008 sampling event: the former TFA, FWDA, BNRR, and Willamette Cove. There were sufficient crayfish volume to analyze all parameters for whole crayfish composites and, in two areas, there were sufficient crayfish volume to also analyze the edible muscle tissue for PCDD/Fs. Samples were collected to evaluate dioxin/furan concentrations in crayfish as they relate to commercially harvested crayfish adjacent to the Site. Samples were analyzed for dioxin/furans, PAHs, PCP, total metals, and percent lipids.

Figure E-2 shows the 2,3,7,8-TCDD TEQ concentration in crayfish tissue since 2003 for each location sampled at the Site, the Health Advisory Criteria, and the mean LWG Portland Harbor concentration. In 2003, two locations were above the health advisory criteria for dioxin in crayfish of 0.9 ng/kg. Since the sediment cap was installed, no samples have exceeded the health advisory criteria. The LWG Portland Harbor mean of 1.58 (ng/kg)-wet 2,3,7,8-TCDD TEQ is nearly double the DHS health advisory criteria of 0.9 ng/kg further demonstrating the performance of the sediment cap in reducing PCDD/F availability to crayfish.

Metal concentrations in crayfish are generally similar to pre-cap concentrations and similar to LWG data for Portland Harbor.

A comparison of whole body crayfish composite samples for total PAHs is shown on Figure E-3. Total PAH concentrations in crayfish from the Site since the sediment cap was emplaced are lower than the mean for LWG Portland Harbor and lower than pre-cap concentrations with the exception of crayfish sampled from the TFA in 2006. Thus, it appears that PAHs in crayfish from the Site have also declined since the sediment cap was constructed.

An additional crayfish sampling event is planned for September/October 2010. However, since the concentrations for PCDD/Fs are consistently below the Health Advisory Criteria, no additional crayfish sampling is recommended.

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Table E-1 - Crayfish Sample Dates and Locations - 2008
McCormick and Baxter Superfund Site
Portland, Oregon

Sample Location	Former Tank Farm Area					Former Waste Disposal Area					BNRR Railroad Bridge					Willamette Cove				
Sample Number	MBCFGB08-01					MBCFGB08-02					MBCFGB08-03					MBCFGB08-04				
Date Deployed	9/17/2008	9/23/2008	9/24/2008	9/29/2008	9/30/2008	9/17/2008	9/23/2008	9/24/2008	9/29/2008	9/30/2008	9/17/2008	9/23/2008	9/24/2008	9/29/2008	9/30/2008	9/17/2008	9/23/2008	9/24/2008	9/29/2008	9/30/2008
Date Retrieved	9/19/2008	9/24/2008	9/25/2008	9/30/2008	10/1/2008	9/19/2008	9/24/2008	9/25/2008	9/30/2008	10/1/2008	9/19/2008	9/24/2008	9/25/2008	9/30/2008	10/1/2008	9/19/2008	9/24/2008	9/25/2008	9/30/2008	10/1/2008
Bait Used	A	A	A	B	B	A	A	A	B	B	A	A	A	B	B	A	A	A	B	B
Crayfish Caught	1	1	0	2	2	0	2	3	3	1	0	3	0	10	0	0	4	2	1	0
Total Number of Crayfish Caught per Area					**6**					**9**					**13**					**7**
Total Weight of Crayfish Caught per Area (grams)					**25**					**34**					**38**					**25**

Notes:
A = Chicken livers and bacon
B = Salmon heads

Table E-2 - Crayfish Sample Results: Dioxins/Furans
McCormick and Baxter Superfund Site
Portland, Oregon

Sample Year	September 2008 (Whole Body)								September 2008 (Edible Tissue)			
Sample ID	**MBCFGB08-01**		**MBCFGB08-02**		**MBCFGB08-03**		**MBCFGB08-04**		**MBCFGB08-02-EDIBLE**		**MBCFGB08-03-EDIBLE**	
Sample Location	**Former Tank Farm Area**		**Former Waste Disposal Area**		**BNRR Railroad Bridge**		**Willamette Cove**		**Former Waste Disposal Area**		**BNRR Railroad Bridge**	
Solids (percent)	26.4		28.3		32.3		26.4					
Lipids (percent)	0.54		0.6		1.2		0.69					
Dioxins/furans (ng/kg-wet)												
2,3,7,8-TCDD	0.061	I	0.065	U	0.088	J	0.069	J	0.120	U	0.086	U
1,2,3,7,8-PeCDD	0.170	U	0.160	J	0.120	U	0.150	I	0.310	U	0.330	U
1,2,3,4,7,8-HxCDD	0.046	I	0.071	U	0.053	U	0.050	U	0.130	U	0.064	U
1,2,3,6,7,8-HxCDD	0.230	J	0.230	J	0.170	J	0.083	J	0.083	U	0.100	U
1,2,3,7,8,9-HxCDD	0.082	I	0.072	U	0.060	U	0.045	U	0.097	U	0.088	J
1,2,3,4,6,7,8-HpCDD	2.60		1.000	J	0.840	J	0.800	J	0.370	I	0.640	J
OCDD	26.0		8.10		6.40		6.00	U	1.60	U	3.80	U
2,3,7,8-TCDF	0.240	I	0.370	J	0.520		0.340	I	0.110	U	0.180	J
1,2,3,7,8-PeCDF	0.590	E	2.50	E	1.80	E	2.20	E	0.940	E	0.130	U
2,3,4,7,8-PeCDF	0.180	I	0.200	J	0.460	J	0.190	J	0.220	U	0.160	J
1,2,3,4,7,8-HxCDF	0.083	I	0.100	I	0.320	J	0.130	J	0.092	U	0.100	U
1,2,3,6,7,8-HxCDF	0.046	U	0.053	I	0.049	U	0.022	U	0.085	U	0.150	J
2,3,4,6,7,8-HxCDF	0.062	J	0.067	J	0.059	I	0.034	J	0.064	U	0.096	U
1,2,3,7,8,9-HxCDF	0.057	U	0.035	U	0.050	U	0.025	U	0.120	U	0.070	U
1,2,3,4,6,7,8-HpCDF	0.300	U	0.120	U	0.140	U	0.140	U	0.076	U	0.073	U
1,2,3,4,7,8,9-HpCDF	0.061	I	0.034	U	0.054	U	0.043	U	0.088	U	0.075	U
OCDF	0.720	U	0.250	U	0.190	U	0.300	U	0.230	U	0.300	U
2,3,7,8-TCDD TEQ[1]	0.224		0.316		0.345		0.346		0.004		0.097	
Average TEQ at Site	**September 2008 (Whole Body) = 0.308**								**Edible Tissue = 0.0508**			

Please refer to notes on last page of this table.

Table E-2 - Crayfish Sample Results: Dioxins/Furans
McCormick and Baxter Superfund Site
Portland, Oregon

Sample Year	October 2006 (Whole Body)									
Sample ID	**MBCFGB06-01**		**MBCFG06-02**		**MBCFG06-03**		**MBCFG06-04**		**MBCFG06-05**	
Sample Location	**Former Tank Farm Area**		**Former Waste Disposal Area**		**BNRR Railroad Bridge**		**Willamette Cove**		**Bait Sample**	
Solids (percent)										
Lipids (percent)	0.90		1.17		0.86		0.6		18.1	
Dioxins/furans (ng/kg-wet)										
2,3,7,8-TCDD	0.40	U	0.39	U	0.40	U	0.40	U	0.51	UJ
1,2,3,7,8-PeCDD	2.00	U	2.00	U	2.00	U	2.00	U	2.00	UJ
1,2,3,4,7,8-HxCDD	2.00	U	2.00	U	2.00	U	2.00	U	2.00	UJ
1,2,3,6,7,8-HxCDD	2.00	U	2.00	U	2.00	U	2.00	U	2.00	UJ
1,2,3,7,8,9-HxCDD	2.00	U	2.00	U	2.00	U	2.00	U	2.00	UJ
1,2,3,4,6,7,8-HpCDD	15.00		2.00	U	3.20	J	2.00	U	2.00	UJ
OCDD	180.00		10.00		34.00		8.00		6.10	J
2,3,7,8-TCDF	0.43	J	0.39	U	0.58		0.41		0.92	J
1,2,3,7,8-PeCDF	2.00	U	2.00	U	2.00	U	2.00	U	2.00	UJ
2,3,4,7,8-PeCDF	2.00	U	2.00	U	2.00	U	2.00	U	2.00	UJ
1,2,3,4,7,8-HxCDF	2.00	U	2.00	U	2.00	U	2.00	U	2.00	UJ
1,2,3,6,7,8-HxCDF	2.00	U	2.00	U	2.00	U	2.00	U	2.00	UJ
2,3,4,6,7,8-HxCDF	2.00	U	2.00	U	2.00	U	2.00	U	2.00	UJ
1,2,3,7,8,9-HxCDF	2.00	U	2.00	U	2.00	U	2.00	U	2.00	UJ
1,2,3,4,6,7,8-HpCDF	2.00	U	2.00	U	2.00	U	2.00	U	2.00	UJ
1,2,3,4,7,8,9-HpCDF	2.00	U	2.00	U	2.00	U	2.00	U	2.00	UJ
OCDF	4.00	U	3.90	U	4.00	U	4.00	U	3.90	UJ
2,3,7,8-TCDD TEQ[1]	0.247		0.003		0.10		0.04		0.09	J
Average TEQ at Site	**October 2006 (Whole Body) =**						**0.10**			

Please refer to notes on last page of this table.

Table E-2 - Crayfish Sample Results: Dioxins/Furans
McCormick and Baxter Superfund Site
Portland, Oregon

Sample Year	October 2003 (Whole Body)							
Sample ID	**MBCFGB03-01**		**MBCFGB03-02**		**MBCFGB03-03**		**MBCFGB03-04**	
Sample Location	**Southern Embayment**		**Former Tank Farm Area**		**Former Waste Disposal Area**		**Willamette Cove**	
Solids (percent)	18.94		21.12		21.42		19.97	
Lipids (percent)	6.1		6.5		5.6		7.0	
Dioxins/furans (ng/kg-wet)								
2,3,7,8-TCDD	0.42	U	0.4	U	0.11	U	0.3	U
1,2,3,7,8-PeCDD	1.1	U	0.62	U	0.23	U	0.5	U
1,2,3,4,7,8-HxCDD	0.43	U	0.29	U	0.15	U	0.2	U
1,2,3,6,7,8-HxCDD	3.2	J	1.4	U	0.67	U	1.2	U
1,2,3,7,8,9-HxCDD	1.0	U	0.44	U	0.26	U	0.4	U
1,2,3,4,6,7,8-HpCDD	73		24		13		30	
OCDD	530		200		110		160	
2,3,7,8-TCDF	5.7		1.5		0.46	U	8.4	
1,2,3,7,8-PeCDF	2.9	J	1.1	U	0.4	U	3.3	J
2,3,4,7,8-PeCDF	2.0	U	1.4	U	0.57	U	2.6	J
1,2,3,4,7,8-HxCDF	1.5	U	1.4	U	0.69	U	1.1	U
1,2,3,6,7,8-HxCDF	0.52	U	0.54	U	0.19	U	0.4	U
2,3,4,6,7,8-HxCDF	0.29	U	0.21	U	0.1	U	0.2	U
1,2,3,7,8,9-HxCDF	0.12	U	0.12	U	0.095	U	0.1	U
1,2,3,4,6,7,8-HpCDF	2.6	J	1.2	U	0.68	U	1.0	U
1,2,3,4,7,8,9-HpCDF	0.17	U	0.23	U	0.14	U	0.1	U
OCDF	9	J	1.4	U	1.3	U	1.2	U
2,3,7,8-TCDD TEQ[1]	1.9		0.45		0.16		2.1	
Average TEQ at Site	**October 2003 (Whole Body) = 1.1**							

Please refer to notes on last page of this table.

Table E-2 - Crayfish Sample Results: Dioxins/Furans
McCormick and Baxter Superfund Site
Portland, Oregon

Sample Year	September 1991 (Edible Muscle Tissue)											
Sample ID	**BI-1**		**BI-2**		**BI-3**		**BI-4**		**BI-5**		**BI-6**	
Sample Location	**Former Tank Farm Area (Creosote Dock)**		**Former Waste Disposal Area**		**Willamette Cove**		**S. Embayment (Upstream Edge of Site)**		**Reference Location (Downstream)**		**Reference Location (Upstream - Wilsonville)**	
Solids (percent)												
Lipids (percent)	0.37		0.41		0.42		0.28		0.38		0.29	
Dioxins/furans (ng/kg-wet)												
2,3,7,8-TCDD	1.6		0.60	J	0.32	J	1.9		0.77	J	0.36	J
1,2,3,7,8-PeCDD	3.1		0.75		0.39	J	3.2		0.97		0.41	
1,2,3,4,7,8-HxCDD	0.79		0.22	J	0.16	J	0.90		0.28		0.20	U
1,2,3,6,7,8-HxCDD	3.7		1.0		0.81		4.2		1.2		0.54	J
1,2,3,7,8,9-HxCDD	1.6	J	0.37	J	0.18	J	1.5	J	0.48	J	0.27	J
1,2,3,4,6,7,8-HpCDD	15	J	4.2		3.2		12		4.0		1.4	
OCDD	71	J	23	J	17	J	45	J	20	J	5.9	J
2,3,7,8-TCDF	2.2	J	1.0	J	0.78	J	1.2	J	1.0	J	0.79	J
1,2,3,7,8-PeCDF	1.9		0.71		0.55		1.1		0.68		0.26	
2,3,4,7,8-PeCDF	2.0		0.72		0.63		1.2		0.83		0.26	J
1,2,3,4,7,8-HxCDF	2.2		1.3		0.89		1.3		1.1		0.27	J
1,2,3,6,7,8-HxCDF	0.49		0.23		0.17		0.33		0.26		0.15	
2,3,4,6,7,8-HxCDF	0.53	J	0.25	J	0.26	J	0.26	J	0.36	J	0.33	
1,2,3,7,8,9-HxCDF	0.14		0.1	U	0.06	U	0.20	U	0.20	U	0.10	U
1,2,3,4,6,7,8-HpCDF	1.5		0.51	J	0.23		0.66		0.4		0.21	J
1,2,3,4,7,8,9-HpCDF	0.17		0.01	U	0.09	U	0.30	U	0.20	U	0.20	U
OCDF	2.3	J	0.55	J	0.10	U	0.97		0.4		0.33	J
2,3,7,8-TCDD TEQ[1]	6.7		2.1		1.3		6.6		2.5		1.1	
Average TEQ at Site	**September 1991 (Edible Muscle Tissue) = 4.2**											

Notes:
1 - 2,3,7,8-TCDD TEQ was calculated using mammalian/human TEFs presented in Van den Berg et al. (2005).
U and E flags excluded from TEF calculations based on conversation with Hart Crowser project chemist.
E = PCDE Interference
I = Interference present
J = Estimated value
ng/kg = nanograms per kilogram
TEQ = Toxicity Equivalency
U = Undetected
TCDF = Tetrachlorodibenzofuran
HpCDD = Heptachlorodibenzo-p-dioxin
HpCDF = Heptachlorodibenzofuran
HxCDD = Hexachlorodibenzo-p-dioxin
HxCDF = Hexachlorodibenzofuran
OCDD = Octachlorodibenzo-p-dioxin
OCDF = Octachlorodibenzofuran
PeCDD = Pentachlorodibenzo-p-dioxin
PeCDF = Pentachlorodibenzofuran
TCDD = Tetrachlorodibenzo-p-dioxin

Table E-3 - Crayfish Sample Results: Metals
McCormick and Baxter Superfund Site
Portland, Oregon

Sample Year	September 2008 (Whole Body)							
Sample ID	MBCFGB08-01		MBCFGB08-02		MBCFGB08-03		MBCFGB08-04	
Sample Location	Former Tank Farm Area		Former Waste Disposal Area		BNRR Railroad Bridge		Willamette Cove	
Metals (mg/kg-wet)								
Arsenic	0.38		0.49		0.47		0.41	
Chromium	0.84	U	0.22	U	0.16	U	0.34	U
Copper	21.7		20.1		27.1		22.2	
Zinc	25.9		26.2		26.4		24.5	

Please refer to notes on last page of this table.

Table E-3 - Crayfish Sample Results: Metals
McCormick and Baxter Superfund Site
Portland, Oregon

Sample Year	October 2006 (Whole Body)				
Sample ID	**MBCFGB06-01**	**MBCFGB06-02**	**MBCFGB06-03**	**MBCFGB06-04**	**MBCFGB06-05**
Sample Location	**Former Tank Farm Area**	**Former Waste Disposal Area**	**BNRR Railroad Bridge**	**Willamette Cove**	**Bait Sample**
Metals (mg/kg-wet)					
Arsenic	0.30	0.31	0.24	0.29	0.76
Chromium	0.17	0.12	0.18	0.20	0.12
Copper	31	23	22	14	0.62
Zinc	23	22	22	17	9.4

Please refer to notes on last page of this table.

Table E-3 - Crayfish Sample Results: Metals
McCormick and Baxter Superfund Site
Portland, Oregon

Sample Year	October 2003 (Whole Body)							
Sample ID	MBCFGB03-01		MBCFGB03-02		MBCFGB03-03		MBCFGB03-04	
Sample Location	Southern Embayment		Former Tank Farm Area		Former Waste Disposal Area		Willamette Cove	
Metals (mg/kg-dry)								
Arsenic	2.26	U	1.75	U	2.12	U	2.11	U
Chromium	2.86	J	3.32	J	2.55	J	3.59	J
Copper	86.7		96.9		66.0		78.9	
Zinc	76.8		68.2		71.9		74.0	

Please refer to notes on last page of this table.

Table E-3 - Crayfish Sample Results: Metals
McCormick and Baxter Superfund Site
Portland, Oregon

Sample Year	September 1991 (Edible Muscle Tissue)											
Sample ID	BI-1		BI-2		BI-3		BI-4		BI-5		BI-6	
Sample Location	Former Tank Farm Area (Creosote Dock)		Former Waste Disposal Area		Willamette Cove		S. Embayment (Upstream Edge of Site)		Reference Location (Downstream)		Reference Location (Upstream - Wilsonville)	
Metals (mg/kg-dry)												
Arsenic	0.14	EM	0.14	EM	0.17	E	0.14	E	0.15	E	0.24	E
Chromium	0.86	M	0.92	M	1.6		1.3		0.50		0.48	
Copper	12	M	11	M	12		11		13		9.4	
Zinc	15	M	14	M	14		14		14		14	

Notes:
E = Estimated value
EM = Estimated mean result of replicate samples
J = Estimated value
M = Mean from replicate samples
mg/kg = milligrams per kilogram
U = Undetected

Table E-4 - Crayfish Sample Results: Pentachlorophenol/PAHs
McCormick and Baxter Superfund Site
Portland, Oregon

Sample Year		September 2008 (Whole Body)							
Sample ID		MBCFGB08-01		MBCFGB08-02		MBCFGB08-03		MBCFGB08-04	
Sample Location									
Pentachlorophenol (µg/kg - wet)		99.3	U	99.3	U	99.3	U	99.3	U
Polynuclear Aromatic Hydrocarbons (PAHs) (µg/kg - wet)									
Acenaphthene	L	2.1		1.8		2.1		2.4	J
Acenaphthylene	L	0.25	U	0.25	U	0.25	J	0.25	UJ
Anthracene	L	0.27	U	0.27	U	0.27	U	0.27	UJ
Benzo[a]anthracene	H, C	0.26	U	0.26	U	0.26	U	0.26	UJ
Benzo[b]fluoranthene	H, C	0.28	U	0.28	U	0.28	U	0.28	UJ
Benzo[k]fluoranthene	H, C	0.23	U	0.23	U	0.23	U	0.23	UJ
Benzo[b&k]fluoranthene	H, C								
Benzo[a]pyrene	H, C	0.17	U	0.31	J	0.17	U	0.17	UJ
Benzo[g,h,i]perylene	H, C	0.30	U	0.3	U	0.3	U	0.3	UJ
Chrysene	H, C	0.27	U	0.27	U	0.27	U	0.35	J
Dibenzo[a,h]anthracene	H, C	0.43	U	0.43	U	0.43	U	0.43	UJ
Fluoranthene	H	1.7	U	1.7	U	1.7	U	1.7	UJ
Fluorene	L	1.50	J	1.3	J	1.2	J	1.0	J
Indeno[1,2,3-cd]pyrene	H, C	0.32	U	0.32	U	0.32	U	0.32	UJ
Naphthalene	L	5.0		1.7	U	4		1.7	UJ
Phenanthrene	L	1.9		2.0		1.8		1.7	UJ
Pyrene	H	1.7	U	1.7	U	1.7	U	1.7	UJ
Total LPAHs[1]		9.0		5.1		9.4		3.4	J
Total HPAHs[1]		2.8	U	0.31	J	2.8	U	0.35	J
Total Carcinogenic PAHs[1]		1.1	U	0.31	J	1.1	U	0.35	J
Total PAHs[1]		10.5		5.4		9.4		3.8	J

Please refer to notes on last page of this table.

Table E-4 - Crayfish Sample Results: Pentachlorophenol/PAHs
McCormick and Baxter Superfund Site
Portland, Oregon

Sample Year		September 2006 (Whole Body)							
Sample ID		**MBCFGB06-01**		**MBCFGB06-02**		**MBCFGB06-03**		**MBCFGB06-04**	
Sample Location									
Pentachlorophenol (µg/kg - wet)		460	UJ	460	UJ	460	UJ	460	UJ
Polynuclear Aromatic Hydrocarbons (PAHs) (µg/kg - wet)									
Acenaphthene	L	13.0	J	2.0	J	0.49	J	0.41	J
Acenaphthylene	L	0.65	UJ	0.65	UJ	0.65	UJ	0.65	UJ
Anthracene	L	1.5	J	0.61	UJ	0.61	UJ	0.61	UJ
Benzo[a]anthracene	H, C	1.1	J	0.75	UJ	0.75	UJ	0.75	UJ
Benzo[b]fluoranthene	H, C	3.2	J	0.68	UJ	0.68	UJ	0.68	UJ
Benzo[k]fluoranthene	H, C	1.4	J	0.54	UJ	0.54	UJ	0.54	UJ
Benzo[a]pyrene	H, C	1.1	J	0.4	UJ	0.84	UJ	0.84	UJ
Benzo[g,h,i]perylene	H, C	0.95	J	0.66	UJ	0.66	UJ	0.66	UJ
Chrysene	H, C	2.1	J	0.62	UJ	0.79	J	0.62	UJ
Dibenzo[a,h]anthracene	H, C	0.63	UJ	0.63	UJ	0.63	UJ	0.63	UJ
Fluoranthene	H	6.0	UJ	0.91	J	1.4	J	0.74	J
Fluorene	L	5.80	UJ	0.76	J	0.38	UJ	0.38	UJ
Indeno[1,2,3-cd]pyrene	H, C	0.82	J	0.63	UJ	0.63	UJ	0.63	UJ
Naphthalene	L	70.0	J	3.0	J	1.6	J	1.5	J
Phenanthrene	L	5.5	J	1.1	J	1.2	J	0.87	J
Pyrene	H	5.0	UJ	0.68	J	1.1	J	0.71	J
Total LPAHs[1]		90.0	J	6.9	J	3.3	J	2.78	J
Total HPAHs[1]		10.7	J	1.59	J	3.29	J	1.45	J
Total Carcinogenic PAHs[1]		10.7	J	2.455	J	0.79	UJ	2.68	UJ
Total PAHs[1]		100.7	J	8.5	J	6.6	J	4.2	J

Please refer to notes on last page of this table.

Table E-4 - Crayfish Sample Results: Pentachlorophenol/PAHs
McCormick and Baxter Superfund Site
Portland, Oregon

Sample Year		October 2003[2] (Whole Body)							
Sample ID		MBCFGB03-01		MBCFGB03-02		MBCFGB03-03		MBCFGB03-04	
Sample Location		Southern		Former Tank		Former Waste		Willamette Cove	
Pentachlorophenol (µg/kg - dry)									
Polynuclear Aromatic Hydrocarbons (PAHs) (µg/kg - dry)									
Acenaphthene	L	36.7	U	47	J	37.7	U	43	U
Acenaphthylene	L	36.7	U	39.4	U	37.7	U	43	U
Anthracene	L	36.7	U	39.4	U	37.7	U	43	U
Benzo[a]anthracene	H, C	14.7	U	15.8	U	15.1	U	17.2	U
Benzo[b]fluoranthene	H, C								
Benzo[k]fluoranthene	H, C								
Benzo[b&k]fluoranthene	H, C	14.7	U	15.8	U	15.1	U	17.2	U
Benzo[a]pyrene	H, C	7.33	U	7.88	U	7.54	U	8.59	U
Benzo[g,h,i]perylene	H, C	36.7	U	39.4	U	37.7	U	43	U
Chrysene	H, C	14.7	U	15.8	U	15.1	U	17.2	U
Dibenzo[a,h]anthracene	H, C	7.33	U	7.88	U	7.54	U	8.59	U
Fluoranthene	H	11.1	J	48.5		25.2		24.9	
Fluorene	L	36.7	U	39.4	U	37.7	U	43	U
Indeno[1,2,3-cd]pyrene	H, C	7.33	U	7.88	U	7.54	U	8.59	U
Naphthalene	L	73.3	U	78.8	U	75.4	U	85.9	U
Phenanthrene	L	36.7	U	61.3	J	97.8		46.7	J
Pyrene	H	20.1		42.7		69.0		22.8	
Total LPAHs[1]		128.4	U	108		97.8		46.7	
Total HPAHs[1]		31.2		91.2		94.2		47.7	
Total Carcinogenic PAHs[1]		51.4	U	55.2	U	52.8	U	60.2	U
Total PAHs[1]		31.2		199		192		94.4	

Please refer to notes on last page of this table.

Table E-4 - Crayfish Sample Results: Pentachlorophenol/PAHs
McCormick and Baxter Superfund Site
Portland, Oregon

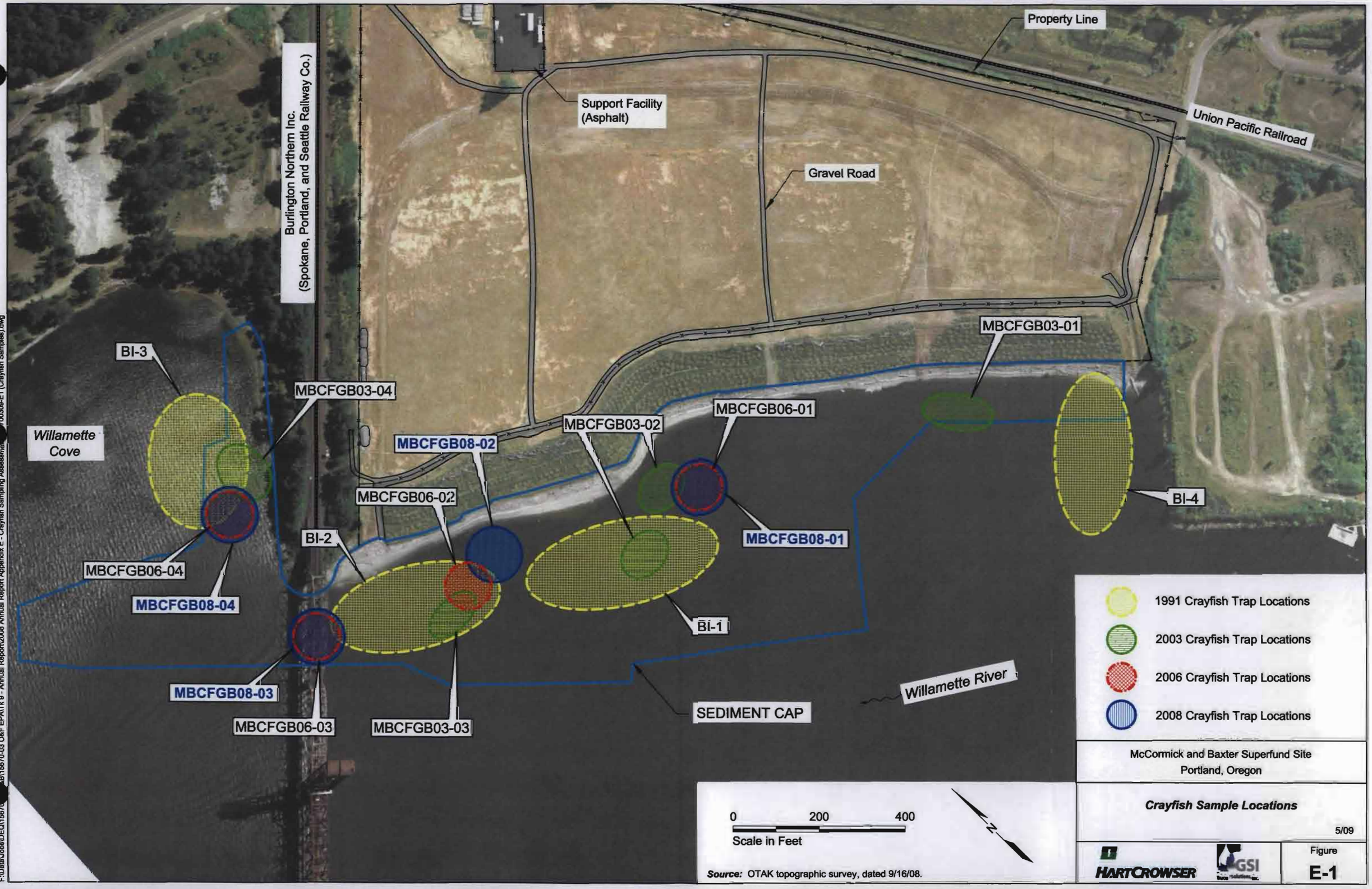
Sample Year		September 1991 (Edible Muscle Tissue)											
Sample ID		**BI-1**		**BI-2**		**BI-3**		**BI-4**		**BI-5**		**BI-6**	
Sample Location		**Former Tank**		**Former Waste**		**Willamette Cove**		**S. Embayment**		**Reference**		**Reference**	
Pentachlorophenol (µg/kg - wet)		100	UE	100	U	100	UE	100	UE	100	UE	100	U
Polynuclear Aromatic Hydrocarbons (PAHs) (µg/kg - wet)													
Acenaphthene	L	21		20	U	20	U	20	U	20	U	20	U
Acenaphthylene	L	20	U	20	U	20	U	20	U	20	U	20	U
Anthracene	L	20	U	20	U	20	U	20	U	20	U	20	U
Benzo[a]anthracene	H, C	20	U	20	U	20	U	20	U	20	U	20	U
Benzo[b]fluoranthene	H, C												
Benzo[k]fluoranthene	H, C												
Benzo[b&k]fluoranthene	H, C	20	U	20	U	20	U	20	U	20	U	20	U
Benzo[a]pyrene	H, C	20	U	20	U	20	U	20	U	20	U	20	U
Benzo[g,h,i]perylene	H, C	20	U	20	U	20	U	20	U	20	U	20	U
Chrysene	H, C	20	U	20	U	20	U	20	U	20	U	20	U
Dibenzo[a,h]anthracene	H, C	20	U	20	U	20	U	20	U	20	U	20	U
Fluoranthene	H	20	U	20	U	20	U	20	U	20	U	20	U
Fluorene	L	20	U	20	U	20	U	20	U	20	U	20	U
Indeno[1,2,3-cd]pyrene	H, C	20	U	20	U	20	U	20	U	20	U	20	U
Naphthalene	L	26		20	U	43		20	U	57		30	M
Phenanthrene	L	20	U	20	U	20	U	20	U	20	U	20	U
Pyrene	H	20	U	20	U	20	U	20	U	20	U	20	U
Total LPAHs[1]		47		60	U	43		60	U	57		30	
Total HPAHs[1]		90	U	90	U	90	U	90	U	90	U	90	U
Total Carcinogenic PAHs[1]		70	U	60	U	60	U	60	U	60	U	60	U
Total PAHs[1]		47		150	U	43		150	U	57		30	

Notes:

µg/kg = micrograms per kilogram
Blank = Not analyzed
C = Carcinogenic PAH
H = High molecular weight PAH (HPAH)
J = Estimate value
L = Low molecular weight PAH (LPAH)
M = Mean of replicate samples
MRL = Method Reporting Limit

1 - For non-detected Total LPAHs, HPAHs, Carcinogenic PAHs, and Total PAHs the detection limit was calculated as a sum of 1/2 the detection limits from the individual compounds. Note these values are different than what was presented in the 1991 dataset.

Estimated detection limit
UJ = Undetected. Value is the estimated detection limit.
U = Undetected



Source: OTAK topographic survey, dated 9/16/08.

McCormick and Baxter Superfund Site
Portland, Oregon

Crayfish Sample Locations

5/09

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Figure
E-1

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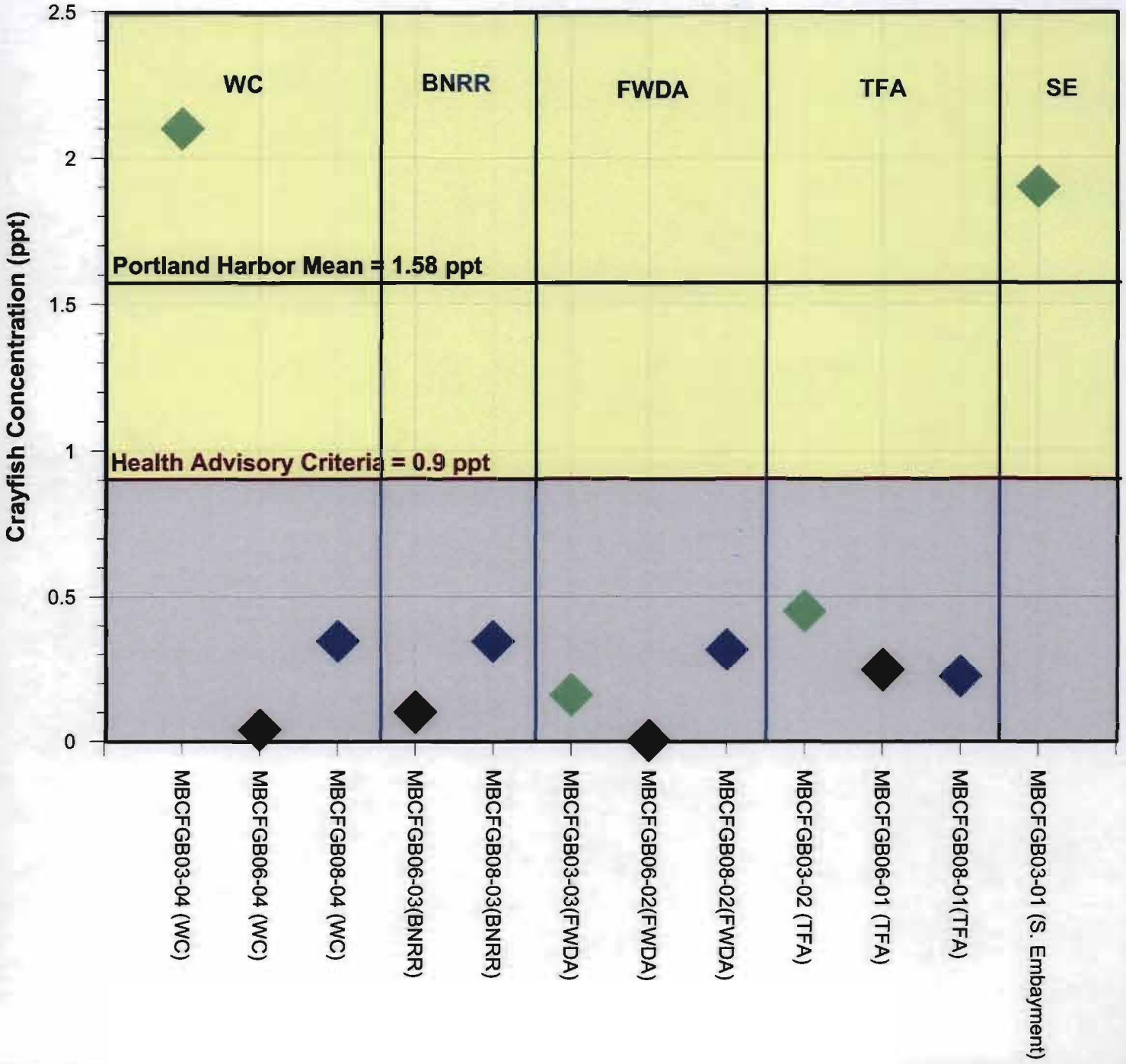

Figure E-2:
2,3,7,8-TCDD TEQ Concentration in Crayfish Tissue
McCormick and Baxter Superfund Site
Portland, OR

Dioxin TEQ Sample Date
- 2003
- 2006
- 2008

Date Modified: February 2009

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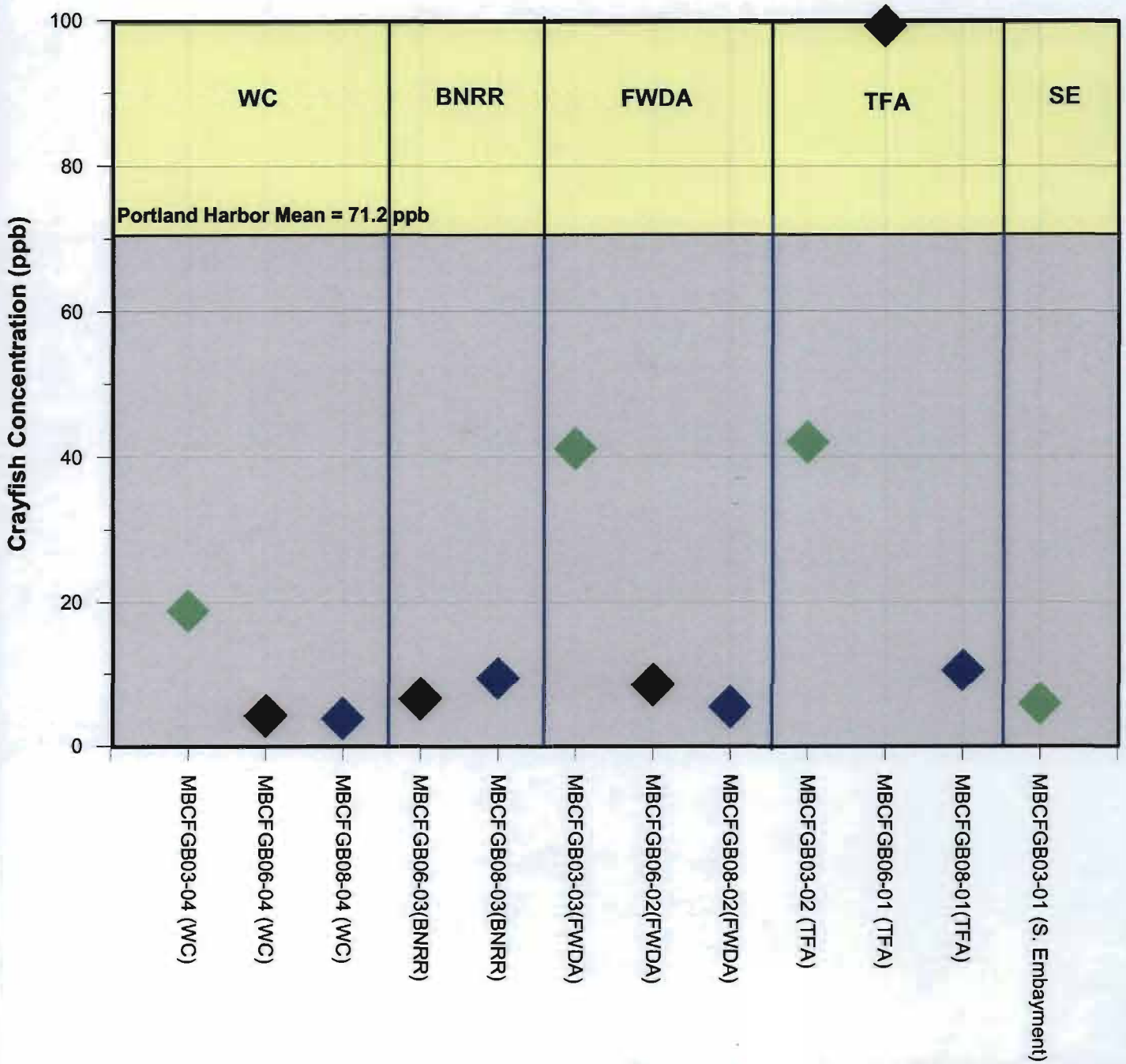

Figure E-3:
Total PAH Concentration in Crayfish Tissue
McCormick and Baxter Superfund Site
Portland, OR

Total PAH Sample Date
- 2003
- 2006
- 2008

Date Modified: February 2009

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ATTACHMENT A
LABORATORY ANALYTICAL REPORTS FOR CRAYFISH SAMPLING

Included only on the O&M Report DVD

ATTACHMENT B
DATA VALIDATED LABORATORY ANALYTICAL REPORTS FOR CRAYFISH SAMPLING

Included only on the O&M Report DVD

ATTACHMENT C
DATA VALIDATION REVIEW

Included only on the O&M Report DVD

Appendix F

APPENDIX F
INFILTRATION POND MW-59s
GROUNDWATER QUALITY ASSESSMENT

OPERATION AND MAINTENANCE REPORT
JANUARY 2008 THROUGH DECEMBER 2008

Hart Crowser/GSI
15670-03/Task 9 May 22, 2009

APPENDIX F
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TABLE

F-1 Groundwater Analytical Results: MW-59s

FIGURE

F-1 Groundwater Monitoring Well MW-59s and Infiltration Pond Location Map

ATTACHMENT

A Laboratory Analytical Reports for Quarterly MW-59s Sampling (DVD)

ACRONYMS

ACL	Alternate Concentration Limits
COC	contaminant of concern
DEQ	Oregon Department of Environmental Quality
DO	dissolved oxygen
E&E	Ecology & Environment, Inc.
EPA	U.S. Environmental Protection Agency
HPAH	high molecular weight polynuclear aromatic hydrocarbons
LPAH	low molecular weight polynuclear aromatic hydrocarbons
lpm	liters per minute
McCormick and Baxter	McCormick and Baxter Creosoting Company
MCL	Primary Drinking Water Standard Maximum Contaminant Levels
mg/L	milligram per liter
mS/cm	milliSiemens/centimeter
NAPL	nonaqueous phase liquid
NTU	nephelometric turbidity unit
O&M	Operation and Maintenance
ORP	oxidation reduction potential
PAH	polynuclear aromatic hydrocarbons
PCP	pentachlorophenol
ROD	Record of Decision
SEC	specific electrical conductance
Site	McCormick and Baxter Superfund Site
µg/L	microgram per liter

APPENDIX F
INFILTRATION POND GROUNDWATER QUALITY ASSESSMENT
OPERATION AND MAINTENANCE REPORT
JANUARY 2008 THROUGH DECEMBER 2008
MCCORMICK AND BAXTER SUPERFUND SITE

1.0 INTRODUCTION

This Appendix to the *January 2008 through December 2008 Operation and Maintenance (O&M) Report* summarizes Summer 2008 groundwater sampling activities and analytical results for the groundwater 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 through 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 in 2005 to monitor contaminant levels in groundwater. Figure F-1 shows the location of monitoring well MW-59s relative to the infiltration pond and the drainage ditch which lead to the infiltration pond. During storm events, stormwater from the upland soil cap, excluding the area within the barrier wall which has an independent drainage system, drains to the infiltration pond. During typical precipitation events, stormwater infiltrates directly without appreciable runoff reaching the infiltration pond.

Originally, as specified in the *Draft Final Operation and Maintenance Plan* (DEQ, 2007), groundwater samples were to be collected during four quarters from MW-59s to evaluate the potential for subsurface contaminants to be mobilized by the infiltration pond. To date, five groundwater samples have been collected from MW-59s (during April 2006, November 2006, February 2007, October 2007, and August 2008). The fifth groundwater sampling event was conducted because the concentrations from the previous 4 sampling events did not provide a clear understanding of whether or not contaminant concentrations were increasing or stable in groundwater downgradient from the infiltration pond. The decision to sample MW-59s again was made during the August 2008 technical team meeting.

Samples were analyzed for the groundwater contaminants of concern (COCs) as identified in the *Record of Decision* (EPA, 1996). COCs include:

- Metals (arsenic, chromium, copper, and zinc);
- Polynuclear aromatic hydrocarbons (PAH); and
- Pentachlorophenol (PCP).

2.0 SAMPLING METHODOLOGY, HANDLING, AND ANALYSIS

This section describes the methodology for sampling monitoring well MW-59s on August 21, 2008. The sampling methodology for previous sampling events are described in Attachment I of the *Operation and Maintenance Report (October 2005 through December 2006)* (E&E, 2007). The following sections describe the sampling methodology, sample handling procedures, and laboratory analyses.

2.1 Sample Methodology

Groundwater samples were collected from monitoring well MW-59s using a variable-speed peristaltic pump. The pump intake was lowered into the screened interval of the well so that water withdrawn was representative of the aquifer. The initial pumping rate was set at no more than 0.5 liter per minute (lpm) and slowly increased such that drawdown in the well 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, specific electrical conductance (SEC), temperature, oxidation reduction potential (ORP), dissolved oxygen (DO), and turbidity.

Disposable polyethylene tubing was used to collect the groundwater samples. A minimum of one tubing volume (including the volume of water in the pump and the flow-through cell) was purged before recording water quality parameters. Field water quality parameters were recorded in approximately 5-minute intervals for the remainder of the purge. The final field water quality parameters are included in Table F-1.

Purge water was collected in a 5-gallon bucket and transferred to a 55-gallon steel drum containing other Site purge water for appropriate disposal. Collection proceeded after water quality parameters had stabilized to within the following criteria: pH +/- 0.1 pH units, SEC +/- 3% milliSiemens/centimeter (mS/cm); ORP +/- 10 millivolts; turbidity +/- 10 nephelometric turbidity units (NTUs); DO: +/- 0.3 milligrams per liter (mg/L). After parameters had stabilized, groundwater samples were collected directly from the pump tubing into sample containers.

2.2 Sample Handling and Analysis

Upon collection, samples were labeled, sealed in plastic bags, and placed on ice in a cooler for transport to the contract laboratory. Analytical services were provided by TestAmerica Analytical Testing Corporation in Beaverton, Oregon, 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, and zinc) by EPA Method 6020; and
- PAHs and PCP by EPA Method 8270-SIM.

3.0 SAMPLING RESULTS

This section describes the analytical results for groundwater samples collected for the five sampling events. Laboratory results from August 2008 are provided in Attachment A. A summary of analytical results from the August 2008 and four previous sampling events are presented in Table F-1.

Alternate Concentration Limits (ACL) were established in the *Record of Decision* (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 any site. Therefore, MCLs are provided as a "point of reference" in Table F-1 until the ROD is amended with appropriate protective levels for groundwater at the Site.

3.1 Total Metals

Groundwater from MW-59s was analyzed for total arsenic, chromium, copper, and zinc by EPA Method 6020. The results for August 2008 are summarized below.

Total arsenic concentration in groundwater was reported as 0.0301 mg/L. During the Spring 2006 Site-wide groundwater sampling event, arsenic was detected in 72 of the 79 Site wells at concentrations ranging from <0.000664 to

0.145 mg/L in groundwater from monitoring wells without nonaqueous phase liquid (NAPL). Total arsenic in MW-59s has gradually increased since the Spring 2006 sampling event.

Total chromium concentration was reported as 0.0466 mg/L. During the Spring 2006 Site-wide groundwater sampling, chromium was detected in groundwater from 72 of the 79 Site wells with concentrations ranging from <0.0006 to 0.0635 from monitoring wells without NAPL. Total chromium in MW-59s has gradually increased since the Spring 2006 sampling event.

Total copper concentration was reported as 0.0584 mg/L. During the Spring 2006 Site-wide groundwater sampling, copper was detected in 67 of the 79 Site wells at concentrations ranging from <0.0003 to 0.023 mg/L from monitoring wells without NAPL. The concentration in August 2008 (0.0584 mg/L) is 1 to 2 orders of magnitude higher than the previous four sampling events and higher than the maximum Site concentration in groundwater from wells without NAPL in 2006; however, the concentration is still well below the MCL for copper of 1.3 mg/L.

Total zinc concentration was reported as 0.140 mg/L. During the Spring 2006 Site-wide groundwater sampling, zinc was detected in 49 of the 79 Site wells at concentrations ranging from <0.0014 to 0.034 mg/L in monitoring wells without NAPL. The zinc concentration increased 1.5 orders of magnitude relative to previous sampling events and is higher than that detected in groundwater during the 2006 sampling at the Site; however, levels are still well below the MCL of 5.0 mg/L.

Total metal concentrations are closely associated with turbidity as metals strongly adsorb to particulate matter. The groundwater sample collected in August 2008 had higher turbidity than previous sampling events. Although higher than desired for groundwater sampling, the turbidity in August 2008 sampling did not change more than 10 NTUs in the last 15 minutes of purging. Therefore, according to protocol, the groundwater sample was collected. The increase in total metals concentrations in August 2008 is likely attributable to the high turbidity of the groundwater sample.

3.2 Pentachlorophenol

Groundwater samples were analyzed for PCP by EPA Method 8270-SIM. PCP was not detected above the laboratory method limit of 0.238 microgram per liter (µg/L) in groundwater from monitoring well MW-59s during the August 2008 sampling event and was also not detected above low level detection limits

in the three previous events for which PCP was analyzed. PCP was not analyzed for in April 2006.

3.3 Polynuclear Aromatic Hydrocarbons

Groundwater samples were analyzed for PAHs by EPA Method 8270-SIM. The method reporting limits for PAHs ranged from 0.0119 µg/L to 0.0476 µg/L. During the August 2008 sampling event, anthracene and phenanthrene were detected at concentrations of 0.0396 µg/L and 0.0357 µg/L, respectively. No other PAHs were detected in August 2008 in groundwater from MW-59s.

The last two sampling events, October 2007 and August 2008, had lower detection limits and a few low molecular weight PAHs (LPAHs) were detected at low concentrations. It does not appear that there is an increasing trend in PAH concentrations in MW-59s.

4.0 SUMMARY

During 2008, concentrations for arsenic, chromium, copper, and zinc increased compared to previous sampling events. Arsenic concentrations increased slightly from 2007 levels; and chromium, copper, and zinc increased roughly an order of magnitude from 2007 levels. This appears to correlate with the higher turbidity of the sample. One would expect the same correlation to turbidity for high molecular weight PAHs (HPAHs); however, no HPAHs were detected. PCP was not detected during any of the sampling events. Two LPAHs were detected at low levels in August 2008. PAHs detected in August 2008 were lower than the levels detected in October 2007. PAHs were not detected during the first three sampling events; however, the detection limit for PAHs was higher during these events.

In the August 2008 Technical Team meeting, a decision was made to sample monitoring well MW-59s on an annual basis through 2010. Although metals concentrations have increased compared with previous levels, there is not enough data to support a clear pattern regarding the potential for subsurface contaminants to be mobilized by the infiltration pond.

Continued sampling of monitoring well MW-59s would provide a more comprehensive data set to show trends in contaminant levels over time. We recommend ongoing sampling of MW-59s annually until 2010 (two additional sampling events) to observe whether there is a trend developing as a result of Site conditions.

5.0 REFERENCES

E&E, 2007. *Operation and Maintenance Report (October 2005 through December 2006), McCormick & Baxter Creosoting Company, Portland, Oregon.* March 2007.

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.

EPA, 1996. *Record of Decision, McCormick and Baxter Creosoting Company, Portland, Oregon.* March 1996.

Table F-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)	
Sample Date			4/26/2006		11/3/2006		2/28/2007		10/3/2007		8/21/2008	
Sample Time			18:01		14:47		12:00		9:58		9:50	
Well Depth			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**	
Chromium		0.10	**0.0011**		**0.0015**		**0.00319**		**0.00474**		**0.0466**	
Copper		1.30	**0.0005**	J	**0.0011**	J	**0.000520**	J	**0.00107**	J	**0.0584**	
Zinc		5.00	**0.0056**		**0.0075**		**0.00707**		**0.00845**		**0.140**	
PAHs (µg/L)												
Acenaphthene	L		0.0472	U	0.0500	U	0.0495	U	0.0119	U	0.0476	U
Acenaphthylene	L		0.0472	U	0.0500	U	0.0495	U	0.0119	U	0.0476	U
Anthracene	L		0.0472	U	0.0500	U	0.0495	U	**0.0121**	J	**0.0397**	
Benzo (a) anthracene	H, C		0.0472	U	0.0500	U	0.0495	U	0.0119	U	0.0119	U
Benzo (a) pyrene	H, C	0.2	0.0472	U	0.0500	U	0.0495	U	0.0119	U	0.0119	U
Benzo (b) fluoranthene	H, C		0.0472	U	0.0500	U	0.0495	U	0.0119	U	0.0119	U
Benzo (k) fluoranthene	H, C		0.0472	U	0.0500	U	0.0495	U	0.0119	U	0.0119	U
Benzo (ghi) perylene	H, C		0.0472	U	0.0500	U	0.0495	U	0.0119	U	0.0119	U
Chrysene	H, C		0.0472	U	0.0500	U	0.0495	U	0.0119	U	0.0119	U
Dibenzo (a,h) anthracene	H, C		0.0943	U	0.1000	U	0.0990	U	0.0238	U	0.0238	U
Fluoranthene	H		0.0472	U	0.0500	U	0.0495	U	0.0119	U	0.0119	U
Fluorene	L		0.0472	U	0.0500	U	0.0495	U	0.0119	U	0.0476	U
Indeno (1,2,3-cd) pyrene	H, C		0.0472	U	0.0500	U	0.0495	U	0.0119	U	0.0119	U
Naphthalene	L		0.0472	U	0.0500	U	0.0495	U	**0.257**		0.0119	U
Pentachlorophenol	L		NA		1.0000	U	0.9900	U	0.238	U	0.238	U
Phenanthrene	L		0.0472	U	0.0500	U	0.0495	U	**0.0259**		**0.0357**	
Pyrene	H		0.0472	U	0.0500	U	0.0495	U	0.0119	U	0.0119	U
Total LPAHs			0.1416	U	0.6500	U	0.6435	U	**0.2950**	J	**0.0754**	
Total HPAHs			0.2596	U	0.2750	U	0.2723	U	0.0655	U	0.0655	U
Total Carcinogenic PAHs			0.2124	U	0.2250	U	0.2228	U	0.0536	U	0.0536	U
Total PAHs			0.4012	U	0.9250	U	0.9158	U	0.3605	U	0.1408	U
FIELD PARAMETERS												
Groundwater Elevation (ft NAVD88)			**17.10**		**12.01**		**16.52**		**23.73**		**14.63**	
Temperature (°C)			**14.60**		**14.02**		**10.51**		**14.43**		**15.21**	
Oxidation Reduction Potential (mV)			**-20.00**		**13.60**		**44.7**		**-19.50**		**-15.69**	
pH			**5.94**		**5.77**		**5.89**		**5.90**		**6.09**	
Specific Conductance (mS/cm)			**0.54**		**0.36**		**0.264**		**0.52**		**0.559**	
Turbidity (NTU)			**40.80**		**11.60**		**3.42**		**9.15**		**78.70**	
Dissolved Oxygen (mg/L)			**0.00**		**0.40**		**0.7**		**0.32**		**0.78**	

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).
L = Low Molecular Weight PAH (LPAH).
PAH = polynuclear aromatic hydrocarbon

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
NTU = nephelometric turbidity unit

LEGEND

- Groundwater Monitoring Wells
- Infiltration Pond
- 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 MW-59s and Infiltration Pond Location Map

5/09

HARTCROWSER GSI Water Solutions, Inc.

Figure
F-1

File Path: P:\205 - OR DEQ\003 - 003 McCormick and Baxter\Project_GIS\Project_mxds\2008_Annual_Report\FigureF-1_GW_Monitoring_Well_MW-59s_Location_Map.mxd, Date: May 21, 2009 2:58:33 PM

ATTACHMENT A
LABORATORY ANALYTICAL REPORTS FOR QUARTERLY MW-59S SAMPLING

Included only on the O&M Report DVD

Appendix G

APPENDIX G
EBULLITION AND SHEEN INVESTIGATION SUMMARY

OPERATION AND MAINTENANCE REPORT
JANUARY 2008 THROUGH DECEMBER 2008

Hart Crowser/GSI
15670-03/Task 9 May 22, 2009

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F Technical Memorandum: NAPL flux Assessment of Beach Seeps in Willamette Cove (DVD)

ACRONYMS

ACB	articulated concrete blocks
bgs	below ground surface
BNRR	Burlington Northern Railroad
Clearwater	Clearwater Environmental Services, Inc.
cm	centimeter
COC	contaminant of concern
cPAH	carcinogenic PAH
DEQ	Oregon Department of Environmental Quality
DQO	data quality objective
E&E	Ecology and Environment, Inc.
EPA	U.S. Environmental Protection Agency
FWDA	former waste disposal area
GPS	geographic positioning system
GSI	GSI Water Solutions, Inc.
HC	Hart Crowser
HPAH	high molecular weight polynuclear aromatic hydrocarbons
LNAPL	light nonaqueous phase liquid
LPAH	low molecular weight polynuclear aromatic hydrocarbons
µg/L	micrograms per liter
mg/L	milligrams per liter
NAPL	nonaqueous phase liquid
NAVD88	North America Vertical Datum, 1988
NRWQC	National Recommended Water Quality Criteria
O&M	Operation and Maintenance
ORP	oxidation reduction potential
OWRD	Oregon Department of Water Resources
PAH	polynuclear aromatic hydrocarbon
PCP	pentachlorophenol
ppb	parts per billion

ACRONYMS (CONTINUED)

PPE	personal protective equipment
PSU	Portland State University
RCM	reactive core mat
ROD	record of decision
QA/QC	quality assurance/quality control
Site	McCormick and Baxter Superfund Site
SPME	solid phase micro-extraction
TestAmerica	TestAmerica Analytical Testing Corporation
TFA	Tank Farm Area
TOC	total organic carbon
TPH	total petroleum hydrocarbons
UP	University of Portland
UT	University of Texas
WC	Willamette Cove

APPENDIX G
EBULLITION AND SHEEN INVESTIGATION SUMMARY
OPERATION AND MAINTENANCE REPORT
JANUARY 2008 THROUGH DECEMBER 2008
MCCORMICK AND BAXTER SUPERFUND SITE

1.0 INTRODUCTION

Appendix G to the *January 2008 through December 2008 Operation and Maintenance (O&M) Report* summarizes the sampling activities and analytical results for the ebullition and sheen investigation completed at the McCormick and Baxter Superfund Site (Site) in Portland, Oregon. The Oregon Department of Environmental Quality (DEQ) directed Hart Crowser/GSI Water Solutions, Inc. (GSI), to perform this investigation to assess ebullition and sheen observed along a portion of the Willamette River shoreline of the Site. This investigation included observations for ebullition and sheen and sampling and analysis of sheen, sediment, porewater, gas, and organoclay mat material. These activities consisted of the following:

- Weekly shoreline sheen observations for 4 months;
- Two ebullition surveys in the Tank Farm Area (TFA) and Willamette Cove (WC);
- 32 push probes for sediment sampling and analysis in the TFA and WC;
- 12 solid phase micro-extraction (SPMEs) samplers for porewater analysis in the TFA and WC;
- 16 Henry Samplers for porewater sampling and analysis in the TFA and WC;
- 9 co-located flux chambers for water/gas analysis in the TFA and WC; and
- Organoclay Mat #2 sample collection for testing.

The investigation was conducted as part of the Sediment and Groundwater Operational and Functional activities and funded by the DEQ through a Cooperative Agreement with U.S. Environmental Protection Agency (EPA). The location of the Site, Site layout, and surface elevations are on Figures 1 through 3 in the main section of the O&M Report.

1.1 Objectives

Significant quantities of gas are generated by the degradation of organic matter in contaminated sediments beneath the sediment cap at the Site. The release of

this gas (ebullition) from the sediment into the overlying water column is observed in areas where high polynuclear aromatic hydrocarbon (PAH) concentrations in sediment and/or nonaqueous-phase liquid (NAPL)-contaminated sediments were capped. There is also a large amount of wood waste in the sediments in the river adjacent to the Site. The degradation of this organic matter (wood waste) likely contributes significantly to the ebullition observed at the Site, especially outside of the sediment cap footprint where creosote-related contaminant concentrations are minimal.

Ebullition occurs primarily at low river levels (i.e., late summer and fall, and is most prolific during low tide) in the nearshore environment. The implications of the gas generation and subsequent release of contaminants from sediments are not completely understood (Yuan, 2007; Yuan et al., 2008; Yuan and Reible, 2009 in review). A schematic of potential contaminant migration pathways as a result of ebullition is presented on Figure G-1. In areas of the sediment cap where granular organoclay was not placed, the gas release periodically has resulted in transport of NAPL to the overlying surface water, resulting in sheen bursts. These areas have been capped with reactive core mats filled with organoclay (organoclay mats) (Figure G-2).

Occasional sheens that do not appear to be associated with ebullition are observed along the shoreline of the Site in late summer/early fall. More frequent displays of sheen occur in late summer/early fall along the shoreward side of the organoclay mats in the former TFA, and over the granular organoclay along the WC shoreline. Detailed descriptions of the ebullition and shoreline sheens are provided in the *O&M Report October 2005 through December 2006* (E&E, 2007), the *Post Remedial Action Conceptual Site Model for NAPL Transport* (GSI, 2007), and the *O&M Report January 2007 through December 2007* (E&E, 2008).

The overarching goal of the ebullition and sheen investigation activities was to determine if the sediment cap remedy is protective, or whether additional remedial measures are required. The objectives of this investigation were to:

- Determine if the ebullition observed at the Site is a significant contaminant transport pathway through the sediment cap;
- Determine if the organoclay mats are performing as designed;
- Determine if the granular organoclay is breaking down and if that will adversely affect the longevity of the sediment cap life; and
- Determine the source and nature of the sheen and the risk posed to receptors.

Data from the ebullition and sheen investigation activities were evaluated to address the following:

- Gas mitigation pathway under Organoclay Mat #2;
- Origin and mechanism of sheen observed at the Site post-sediment-cap construction;
- Nature and significance of sheen occurrence;
- Origin(s) and mechanism of the ebullition pathway;
- Significance of ebullition in contaminant transport of NAPL and dissolved-phase constituents;
- Performance of granular organoclay and organoclay mats; and
- Biological degradation of NAPL and other identified constituents.

1.2 Scope of Work

To accomplish the above objectives, we performed investigation activities in general accordance with the August 16, 2008, *Ebullition and Sheen Investigation Work Plan* (Hart Crowser/GSI, 2008b). Ebullition and sheen investigation activities were completed between August 25, 2008, and September 11, 2008. Additionally, weekly sheen observations were conducted from July 10, 2008, through October 21, 2008.

These activities consisted of the following:

- Weekly sheen observations;
- Sediment cores and sediment sampling;
- Porewater sampling events;
- Documenting and mapping the areal extent of ebullition over the sediment cap;
- Documenting the seasonality of ebullition;
- Gas and water sampling from flux chambers;
- University of Texas (UT) SPME sampling activities; and
- Portland State University (PSU) biodegradation sampling activities

The ongoing portions of the study that UT and PSU are conducting will not be completed until June and August 2009, respectively. Preliminary results were received in mid-April for both studies; however, these results are not reported in this annual report as the annual report was already in DEQ review when the preliminary results were received. This report summarizes sampling activities

completed during late summer 2008; presents the sampling results conducted by HC/GSI; and preliminary conclusions based on available results. The remainder of the results will be presented in the 2009 O&M annual Report. A more complete report will be issued after the UT and PSU analytical studies are completed.

Photographic documentation is included as Attachment A. Attachment B contains the raw and validated laboratory data and the Data Quality Assurance Memoranda (DVD). Attachment C contains the boring logs for the sediment cores. Attachment D provides the photomicrographs opinion e-mails from Dr. Alexander/University of Portland (UP) (DVD). Attachment E provides CETCO's (organoclay manufacturer) results for the oil adsorptive capacity and permittivity of a sample collected from Organoclay Mat #2 (DVD). Sampling locations are presented on Figures G-2, G-2a, and G-2b.

2.0 DATA QUALITY OBJECTIVES FOR THE EBULLITION AND SHEEN INVESTIGATION

The data quality objective (DQO) process for this investigation followed the EPA document, *Guidance for the Data Quality Objectives Process* (EPA, 2000). The DQO process is an important tool to guide the type, quantity, and quality of data needed to support project decisions. The DQOs were developed before the *Ebullition and Sheen Investigation Work Plan* (Hart Crowser/GSI, 2008b) to understand the data collection requirements needed to meet the objectives.

2.1 Data Quality Objectives

The primary focus of this report is to support a determination that the sediment cap is protective, based on post-cap assessment of ebullition and sheen in isolated areas of the cap. The DQOs for this ebullition and sheen investigation are presented in Table G-1 and were developed during a series of brain-storming sessions that included GSI; Hart Crowser; PSU; DEQ; TestAmerica Analytical Corporation (TestAmerica) of Beaverton, Oregon (DEQ subcontracted laboratory); and CETCO chemists. Dr. Danny Reible (UT) also provided input on sampling methods and locations. In addition, some of the sample methods were revised on the basis of input during the annual project team meeting on August 6, 2008. Table G-1 summarizes the questions and data needs to make decisions, and expected outcomes based on the data collected.

The objectives for the field and sampling activities are summarized below. The location and number of samples and cores, and the analytical approach were developed to obtain sufficient data to make decisions regarding the

protectiveness of the sediment cap. Based on field observations during the field effort, locations were altered or additional sampling locations were selected to optimize the design. Decisions in the field were made by the GSI project manager in conjunction with the DEQ project manager. Detailed sampling methodology and procedures are summarized in Section 3 of this report.

Detailed scopes of work for the PSU and UT field and laboratory studies are provided in Appendix D and Appendix E of the *Ebullition and Sheen Investigation Work Plan* (Hart Crowser/GSI, 2008b). Field sampling and laboratory study approaches for the PSU study are provided in Section 5 of this report.

2.2 Field and Sampling Objectives

Sheen Surveys. Sheen surveys were conducted to understand their extent, frequency, and seasonality. The surveys also provided information regarding sheen significance (frequency, extent, trends, etc.) compared to previous years. In addition, the surveys account for conditions present during sheen observation, such as river level, rising vs. falling tide, time of day, temperature, sheen description, and potential association with site conditions, such as the presence of a creosote odor or discharging groundwater.

Ebullition Surveys. Ebullition surveys were conducted to determine the locations and timing of ebullition, and to collect supporting information to site the flux chamber locations. A general estimate of ebullition rate per square foot was determined by measuring the gas production rate for specific ebullition pathways, estimating the number of pathways in a given area, then calculating the rate of gas production per square foot in a given area. This ebullition survey rate data and rate data from gas production in the flux chambers were used to assist in determining if ebullition is a potentially significant contaminant pathway.

Sediment Cores. Exploratory sediment cores provided input regarding placement of the SPMEs and selection of cores for the UT organoclay performance and PSU degradation studies. Select sediment samples from the cores were analyzed for Site contaminants of concern (COCs). Exploratory sediment cores, in conjunction with the analytical data from select cores, also provided input to understanding contaminant distribution along the riverbank in the WC and the former TFA; specifically, whether there is residual creosote in the bank that may have migrated into the cap sand and/or is capable of causing shoreline sheen. These data will be supplemented with the analytical information from the UT SPMEs. In addition, the cores provided sediment and capping material for the PSU degradation study that will determine gas generation per layer (native sediment, organoclay, or cap sand), and whether organoclay may be supplying material to enhance degradation or is being

degraded itself. Finally, cores were used to provide material for UT regarding the organoclay performance and sediment quality adjacent to the SPMEs.

Porewater Samples. Porewater samples were collected with both SPMEs and Henry Samplers. Porewater samples collected via SPMEs will be used to understand the three-dimensional distribution of PAH contamination. The data will allow us to understand whether (1) sheen detected along the bank of the TFA and the WC is migrating upward through the sediment cap because of ebullition or tidal pumping and potentially producing a sheen, (2) lateral advective NAPL migration from the bank into and through the cap sand is producing a sheen along the bank, or (3) the sheen is not related to Site contamination by these mechanisms.

Porewater samples collected for the PSU study using Henry Samplers will provide critical geochemical information to understand conditions under which degradation is occurring.

Porewater samples collected using Henry Samplers from select locations in association with the SPMEs will provide a comparison of the collection methodology. This comparison in porewater sampling technology will be important as the methodology for future compliance monitoring is established when the Site moves into O&M.

Porewater grab samples collected using Henry Samplers along the riverbank and adjacent to Organoclay Mat #2 will provide data regarding the potential for contaminant transport through the sediment cap material.

Flux Chamber Samples. Gas and water samples collected from the flux chambers will provide sufficient data to determine whether ebullition creates a significant contaminant transport pathway through the sediment cap.

Organoclay Mat Pullback at Organoclay Mat #2 and Sample Collection. CETCO collected a sample of the Reactive Core Mat (RCM), referred to as organoclay mat in this report, from the northwest corner of Mat #2. CETCO conducted adsorptive capacity and permeability testing on the mat samples in their laboratory. The results will demonstrate whether the organoclay mats have maintained their sorptive capacity after two years in the river, and whether gas is capable of passing through or bypassing the reactive core mats.

SPME data was also collected at two corners of Mat #2 to compare contaminant concentrations in the cap sand surrounding the mat to concentrations in the sediment cap in surrounding areas (using the semi-annual sub-armoring data for

comparison). Porewater collected using Henry Samplers also provide data regarding the performance of the reactive core mats.

Sheen Analysis and Photomicrographs. Sheen data and photomicrographs were used to interpret the nature of the sheen. Sheen samples were also collected and analyzed for total organic carbon , total petroleum hydrocarbons (TPH) and PAHs. Dr. Alexander, a microbiology professor from UP collected and provided an interpretation of the sheen samples collected from the Willamette Cove and the TFA to determine whether the sheen was bacterial in nature.

2.3 Quality Assurance and Quality Control

Generally, samples were collected and analyzed in accordance with the quality assurance/quality control (QA/QC) procedures presented in the *O&M Manual* (Hart Crowser/GSI, 2008a). The *O&M Manual* presents a detailed discussion of the QA/QC objectives and procedures. A summary is provided below.

QA/QC Objectives. The general QA objectives for this project were to develop and implement procedures for obtaining and evaluating data of a specified quality that could be used to assess whether PAHs are breaking through the sediment cap in isolated areas at concentrations that could produce a sheen or exceed record of decision (ROD) sediment goals. PAH and pentachlorophenol (PCP) concentrations were compared to reference criteria presented in Appendix D of the O&M Report. The detection limits, where feasible, were low enough to compare to the reference criteria. However, the method detection limit for arsenic in water was typically above the lowest reference criteria of 0.00014 mg/L. The method detection limit for arsenic was ranged from 0.0006 through 0.00089 mg/L.

Field QA/QC. Because this was an investigative study and not compliance monitoring, limited field QC samples were collected. During fieldwork, decontaminated or disposable sampling equipment was used to minimize or eliminate cross-contamination. Rinsate blanks were collected from decontaminated sampling equipment on a daily basis when re-usable equipment was used. Samples were labeled with sample-specific identifying information. Chain of custody was maintained at all times.

Laboratory QA/QC. The laboratory also performed QC analyses (e.g., matrix spikes and method blanks) per the requirements of the analytical method. Detection limits were consistent with industry standards and, when practicable, below or comparable to promulgated regulatory standards, unless raised because of high analyte concentrations in the sample or matrix effects. A

summary of laboratory QA/QC review and data validation is provided as Attachment B on the CD.

3.0 INVESTIGATION AND SAMPLING METHODOLOGY

This section presents the sampling methodology employed during the ebullition and sheen investigation. Investigation activities were conducted from July 10, 2008, through October 21, 2008.

3.1 Investigation Activities

Several sheen investigation activities were conducted in conjunction with the larger sample collection effort that began in late August, 2008. Sheen survey activities began the week of July 10, 2008, and extended through October 21, 2008, until no sheen was observed for three consecutive weeks. On July 16 and 17, 2008, sheens in both water and sediment were sampled in response to sheen observed on the shoreline on July 14, 2008. UP collected sheen samples on August 28, 2008, for observation under a microscope to determine whether bacteria were present. The first ebullition survey was conducted on July 31, 2008, with an additional survey completed on September 12, 2008.

Following the completion of the *Ebullition and Sheen Investigation Work Plan* (Hart Crowser/GSI, 2008b), sample collection locations were identified at the Site by HC/GSI and DEQ. Select articulated concrete blocks (ACB) were marked for removal on August 19, 2008, to enable coring at the Site. Between August 20 and 25, 2008, Clearwater Environmental Services, Inc. (Clearwater), the O&M contractor for the Site under subcontract to Hart Crowser, removed ACBs and loosely set new ACBs back in place so that the locations were ready for coring, which began on August 25, 2008. In addition, the rock armoring in the former TFA was laid back using a backhoe in the areas targeted for coring. The rock armoring was placed adjacent to the boring locations such that the drill rig could approach the area without difficulty. Photographs of the ebullition and sheen investigation activities are included as Attachment A.

Push probe services were conducted by Cascade Drilling of Clackamas, Oregon, from August 25 through 27, 2008. Cores were completed in the WC on August 25, 2008, and cores in the former TFA were advanced on August 26-27, 2008. Multiple cores were collected from locations as described in the work plan and as determined in the field by DEQ and Hart Crowser/GSI. SPMEs were placed in the WC on August 26, 2008, and in the former TFA after completion of the drilling, on the afternoon of August 27, 2008.

Porewater sampling via Henry Samplers began in the WC on August 27, 2008, after the drilling had been completed. Porewater sampling in the former TFA began on August 29, 2008, after the drilling had been completed, but before the rock armoring was placed back over the sand and organoclay cap. After one week in place, the SPMEs were removed on September 3, 2008, and shipped to UT. The flux chambers were set on September 4 and 5, 2008. Water was collected daily from each chamber through the XAD (highly sorptive resin) cartridge from September 7 through 10, 2008. Gas samples were collected from the flux chambers on September 10, 11, and 14, 2008.

Granular organoclay and organoclay mats were placed in areas needing repair due to puncturing of the sediment cap during coring. The rock armoring and ACB blocks were returned to their appropriate locations on September 14 and 15, 2008.

3.2 Sample Management

Ebullition and sheen investigation activities included sampling for sediment, porewater, surface water, and gas. During each sampling event, clean sample containers were provided by TestAmerica ready for sample collection, including preservative, if required. A sample label was affixed to each sample container and was marked with a unique sample number. Samples were placed in a cooler with ice until transported to the laboratory for analysis. Chain of custody was maintained at all times.

Porewater, sediment, and surface water samples for the ebullition and sheen investigation were labeled in accordance with the following sample nomenclature chart.

Sample Nomenclature – Ebullition and Sheen Investigation

Digits	Description	Code	Code Description
1 and 2	Site Location	MB	McCormick & Baxter
3 and 4	Matrix	SD/PW/SW	Sediment/Porewater/Surface Water
5 and 6	Year	08	2008
7 and 8	Sample location	01	Location 1
9	Depth	1.5 - 2.0	Depth in Feet
Example: MBSD0801-1.5-2.0 - Sediment sample collected from location 1 in 2008 at 1.5 to 2.0 feet below ground surface at the McCormick & Baxter site.			

Additional sediment cores were collected in the field, capped, and provided to PSU and UT for their laboratory testing. Sediment cores for PSU and UT research were labeled with the following information:

- Boring identification;
- Depth;
- Date; and
- Top and bottom.

Porewater and SPME samples also were collected for PSU and UT. These samples were labeled with sample identification including location, depth of sample, and date. These were not specifically labeled in accordance with the sampling nomenclature for the Site.

3.3 Sheen Surveys and Sampling

Sheen surveys along the shoreline were initiated in early July 2008, after the Willamette River level dropped below approximately 3 feet North America Vertical Datum, 1988 (NAVD88), and were completed through late October 2008, following 3 consecutive weeks without sheen observations. Sheen observations were recorded weekly during low tide and are summarized in Table G-2. The surveys were conducted according to the *O&M Manual* sheen observation methodology (Hart Crowser/GSI, 2008a). Weekly sheen observations also are presented on Figure G-3.

Sheen samples were collected from the WC on July 16, 2008, and from the former TFA shoreward of Organoclay Mat #2, along the shoreline adjacent to the McCormick and Baxter outfall, and near the City of Portland outfall areas on July 17, 2008 (locations shown on Figure G-3). Where present, sheen was collected from the sediment and from the surface water, in addition to a surface water sample proximal to the sheen. Locations with sheen on water were sampled by submerging the sample container directly below the area of sheen, removing the cap, and allowing the container to fill with only surface water containing sheen to the extent practical. Background ambient water locations were sampled by submerging the sample container approximately 1 foot below surface water in a nearby area without sheen, removing the cap, and allowing the container to fill. Sediment with sheen was collected using a stainless steel spoon scraping the thin sediment layer with sheen. Sheen samples were submitted to TestAmerica for analysis of the following constituents:

- PAHs and PCP by EPA Method 8270-SIM;
- Hydrocarbon identification by Northwest Method NWTPH-HCID; and
- Total organic carbon (TOC) by EPA Method 415.1.

Additional sheen samples were collected by UP on August 28, 2008. These samples were placed onto slides and observed under a microscope to determine if bacteria were present.

3.4 Ebullition Surveys

Ebullition surveys were conducted via kayak on July 31 and September 12, 2008. Survey activities included locating and mapping ebullition pathways and measuring gas production rates for individual ebullition pathways. Each survey was conducted during a falling tide within a few hours of low tide (i.e., when ebullition is expected to be at its maximum). Ebullition is most frequent at low tide and decreases rapidly with the incoming tide. Ebullition pathways were mapped using a Trimble Geo XT Geographic Positioning System (GPS) Unit (+/- 1 meter accuracy). Locations were not labeled individually, but were mapped via geographic information system according to date of survey.

Rate of ebullition was measured by filling a clear 1-liter bottle with water and allowing the bubbles to displace the water for a known time period. The volume displaced divided by the time provides the gas production rate for an individual ebullition pathway. This rate gave us a general idea of the upper end of the ebullition rate as these tests were conducted in locations where bubbling was frequent and measureable while conducting the ebullition survey from the kayak. A better rate was established from the flux chambers described in Section 4.3.

Recorded observations related to the ebullition, include: describing the odor of the gas; whether sheens are present; and influences that affect the amount of ebullition, such as temperature, river level, and wave action. Where the ebullition rate was too slow to reasonably measure with the 1-liter bottle while maintaining the location with the kayak, a rough estimate of frequency of bubbling was recorded, including documenting whether the bubble pathways in an area appear to be continuous, intermittent, or irregular. "Continuous" means bubbles appear within seconds of one another; "intermittent" means bubble groups appear within a period of 5 minutes or less; and "irregular" means no additional bubbles were observed for more than 5 minutes in a given location. Ebullition observations, including estimate of the rate of gas release per area, are described in Section 4.1 of this report.

3.5 Sediment Cores

Sediment and organoclay cores were advanced between August 25 and August 27, 2008, by Cascade Drilling using a track-mounted push probe. Sediment cores were collected in the granular organoclay areas as well as along the shoreline where sheens have been observed. Two cores also were collected in a background

location on the southern end of the Site. Core locations were determined using a hand-held Trimble Geo XT GPS Unit. Core locations are shown on Figures G-2, G2a, and G-2b, and boring logs are presented in Attachment C.

3.5.1 Core Methodology and Sample Description

Before coring, Clearwater removed rock armoring using a backhoe or selected ACB blocks using a skid steer. Cores were then collected using a 3-inch-diameter probe rod with a thin-walled acetate liner. The push-probe sampling procedure involved driving the soil sampler using a combination of hydraulic pressure and mechanical hammer blows. After driving the sampler 4 feet, it was removed from the hole, and the sample core was removed. The sampler was then prepared for driving the next 4-foot-depth sample interval. The acetate liners of the cores were cut open using a utility knife. After the cores were logged, selected portions of the core were transferred to sampling jars, and labeled according to Section 3.1 Sample Management. Core logs include the following:

- Thickness of the cap sand layer, nature of the cap sand material, field evidence of contamination;
- Organoclay cap sand and sediment contacts, location, and nature of contacts;
- Thickness of the granular organoclay layer, nature of the organoclay, field evidence of contamination; and
- Nature of native sediment, field evidence of contamination.

Field evidence of NAPL in cores was logged using the following nomenclature:

- No Visible Evidence: No visible evidence of oil in the soil sample.
- Sheen: Visible staining on soil. Can be visible as mottling or in bands. Typically associated with fine-grained soils.
    - Slight Sheen: Light colorless film, spotty to globular; spread is irregular, not rapid; areas of no sheen remain on water surface; film dissipates rapidly.
    - Moderate Sheen: Light to heavy film, may have some color or iridescence, globular to stringy; spread is irregular to flowing; few remaining areas of no sheen on water surface.
    - Heavy Sheen: Heavy colorful film with iridescence, stringy in appearance; spread is rapid, with sheen flowing off sample; most of the water surface is covered by sheen, sheen does not dissipate.
- Coating: Visible coating on grains. Typically associated with coarse-grained soils.

- Oil-Wetted: Visible wetting of soil sample.
- Free-Oil: Oil runs from sampler.

3.5.2 Core Locations in Willamette Cove

Ten push-probe locations (MBSD08-01 through MBSD08-10 [SD-1 through SD-10]) were completed along the WC shoreline up to 8 feet below ground surface (bgs). WC push-probe locations are shown on Figure G-2a.

Two of the locations (SD-1 and SD-2) were selected to obtain samples for the PSU research on the organoclay: SD-1 was completed adjacent to the granular organoclay and SD-2 was completed through the granular organoclay. Extra cores were collected at these locations to obtain sufficient sample material for the PSU research.

Six exploratory cores were completed along the top of the WC shoreline (base of the railroad embankment) across the width of area where sheen has been observed. The purpose was to determine whether there is residual creosote is present to produce the sheen observed overtop of the sediment cap. The six borings also were used to determine the location for the SPME transect. The SPME transect was placed from location SD-3 shoreward, based on the highest visual evidence of creosote contamination in the SD-3 core. As part of the SPME transect, push-probes locations SD-5 and SD-10 were completed riverward from location SD-03. Extra cores were advanced for PSU and UT research purposes at locations SD-2, SD-3, SD-5, and SD-10. PSU cores were taken directly to the PSU laboratory for appropriate storage. Cores collected for UT were placed on ice and shipped overnight to their laboratory.

3.5.3 Core Locations in Former Tank Farm Area

In the former TFA, a total of 22 push-probe locations (MBSD08-11 through MBSD08-32 [SD-11 through SD-32]) were completed, including two background cores (SD-11 and SD-31) along the southern portion of the shoreline. Cores were advanced up to 12 feet bgs. Former TFA and background locations described below are shown on Figure G-2b.

Fourteen exploratory cores were completed shoreward of the former TFA bulk granular organoclay footprint and Organoclay Mat #2 (SD-12, SD-18, SD-19, SD-20, SD-21, SD-25, SD-30, SD-29, SD-23, SD-28, SD-22, SD-27, SD-24 and SD-OC Mat2 NE). Based on historic sheen observation and previous investigation, these cores were advanced in the area most likely to encounter evidence of residual creosote contamination. Two transects from the riverbank

toward the shore were placed in the former TFA. One transect was placed just northwest of Organoclay Mat #2, including SD-28, SD-23, and SD-15. The second transect was placed farther to the northwest, including SD-27, SD-22, and SD-14. Three exploratory cores (SD-16, SD-17, and SD-32) were completed outside the riverward edge of Organoclay Mat #2 and five exploratory cores were completed upland from bulk granular organoclay and above and beneath Mat #2 to determine the characteristics of the cap material and whether contamination has entered the cap sand. Extra cores for UT research were collected from locations SD-13, SD-15, SD-22, SD-23, SD-24, SD-27, and SD-28. Extra core samples also were collected for PSU research from locations SD-11, SD-13, and SD-15 within the granular organoclay.

3.5.4 Sediment Analytical Methodology

Sediment samples from select locations and depths were collected for laboratory testing to be conducted by UT and PSU. Additional sediment samples were collected from select core locations identified by Hart Crowser/GSI and the DEQ project manager, and analyzed for the following constituents by TestAmerica.:

- PAHs and PCP by EPA Method 8270-SIM (ultra low level detection); and
- Total metals (arsenic, chromium, copper, and zinc) by EPA Method 6020.

Select sediment samples also were analyzed for TOC by the Lloyd Kahn Method.

3.6 Porewater Sampling

Porewater samples were collected using SPMEs (UT) and Henry Samplers. In general, porewater samples were co-located with core locations.

3.6.1 Porewater Samples Collected via SPMEs

Porewater samples were collected via SPMEs for the UT research. SPMEs locations and placement were directed by Dr. Reible (UT) and are shown on Figures G-2, G-2a, and G-2b. SPME locations were located using a hand-held Trimble Geo XT GPS Unit. The samplers are modified-Henry Samplers, 45 centimeters (cm) long, with SPME absorbent fibers built into the Henry Sampler. Before SPME placement, rock armoring and/or ACB were removed and the SPMEs were pushed into place such that all SPME segments were situated beneath the water table.

Three SPME samplers (SPME-WC-1 through SPME-WC-3) were placed along the SD-3, SD-10, and SD-5 transect in the WC. In the former TFA, three SPME

samplers were placed along both transects in the granular organoclay area. SPME-OC-1 through SPME-OC-3 follow the SD-14, SD-22, and SD-27 transect, and SPME-M1 through SPME-M-3 follow the SD-15, SD-23, and SD-28 transect. Two SPMEs (SPME-OUTER-N and SPME-OUTER-S) were placed at the edges of the riverward side of Organoclay Mat #2 and one SPME (SPME-IM-1) was placed upland of Organoclay Mat #2. The 45 cm of SPME fibers were cut every 5 centimeters resulting in 9 samples per SMPE location. The SMPE samples will be analyzed for low level PAHs. The SPME data will provide a vertical delineation of PAHs to assist in determining whether there is significant contamination migrating vertical through tidal pumping or groundwater recharge or laterally through groundwater discharge through the sediment cap in areas where sheen has been observed.

3.6.2 Porewater Samples Collected via Henry Samplers

Porewater samples using a Henry Sampler were collected adjacent to the cores collected for PSU; adjacent to select SPME samplers, in locations surrounding Organoclay Mat #2; adjacent to sediment cores; and adjacent to select cores along the riverbank as shown on Figure G-2b. Porewater locations were mapped using a hand-held Trimble Geo XT GPS Unit. The screen of each Henry Sampler was placed approximately 6 to 10 inches into the cap sand, with the exception of PW08-01-60, PW08-02-50, PW-16b, PSU-5-36, PW0813-36, and PW0815-40, which were targeted to collect from below the cap sand.

Porewater sampling nomenclature matches those of the sediment sampling, so that MBPW08-01 was sampled at or near MBSD08-01, MBPW08-02 was sampled at or near MBSD08-02, etc. One background porewater sample was collected along the southern shoreline at location MBPW08-31.

Porewater samples were collected from the WC at locations MBPW08-01, MBPW08-02, MBPW08-04, and MBPW08-10, as shown on Figure G-2a. Two porewater samples were collected at locations MBPW08-01 and MBPW08-02: one sample from within the cap sand and one sample from below the cap material in native sediment. One porewater sample was collected from the other 4 locations in the WC at approximately 10 inches into the cap sand.

Seven porewater samples (MBPW08-22 through MBPW08-28) were collected in the former TFA shoreward of the granular organoclay footprint. These samples were to assess whether contamination migrates from the bank at concentrations capable of causing sheen to develop. Three sets of porewater samples were collected from within the granular organoclay area at various depths to determine the effectiveness of the granular organoclay cap. Porewater samples were collected at 12 and 36 inches at location MBPW08-13, at 8 and 40 inches

at location MBPW08-15, and at 12 and 36 inches at location PSU-5 (PSU research samples). It is uncertain whether these samples were collected from the base of the organoclay or from within native sediment.

Four porewater samples (MBPW08-12, MBPW08-18, MBPW08-20, and MBPW08-21) were collected upland from Organoclay Mat #2, again to assess whether contamination is coming from the bank at concentrations capable of causing sheen to develop. Four porewater samples (MBPW08-16A, MBPW08-16B, MBPW08-17, and MBPW08-32) were collected from the riverside of Organoclay Mat #2 for delineation of contamination outside Organoclay Mat #2.

Porewater samples were collected after drilling was completed and before rock armoring was replaced. Collection of porewater samples followed the protocol set forth in the *O&M Manual* (Hart Crowser/GSI, 2008a) and are summarized below. The Henry Samplers were pushed into the sediment cap or native sediment to the desired depth using a twisting motion. When the desired depth was reached, the internal guard rod was removed from the probe body and tubing was attached to the end of the probe. After tubing was attached to the Henry Sampler, it was pumped using a peristaltic pump at the lowest flow rate achievable. Field parameters were measured using YSI 556 or Uriba U-22 Multi Parameter System with a flow through cell for pH, conductivity, turbidity, dissolved oxygen (DO), temperature, and oxidation reduction potential (ORP). One set of field parameter measurements was recorded before collection of the porewater sample, another after field parameters had stabilized, and a final set after the porewater sample had been collected. Field parameters of the surface water adjacent to the porewater sampling locations also were measured.

Porewater samples were submitted to TestAmerica for analysis of the following constituents:

- PAHs and PCP by EPA Method 8270-SIM (ultra low level detection); and
- Total metals (arsenic, chromium, copper, and zinc) by EPA Method 6020.

Selected porewater samples to be used by PSU also were analyzed for the following list of general chemistry parameters. The general chemistry results will be reported and discussed in the PSU report.

- Total iron by SM3500-Fe
- Dissolved iron by SM3500-Fe D
- Major cations by EPA Method 200.7

- Dissolved organic carbon by EPA Method 415.1
- Total organic carbon by EPA Method 415.1/5310C
- Total suspended solids EPA Method 160.1
- Total dissolved solids EPA Method 161.2
- Sulfide by EPA Method 376.2
- Sulfate by EPA Method 300.3
- Carbon dioxide by SM 4500-C
- Chloride by EPA Method 300.0
- Nitrate-nitrogen by EPA Method 300.1
- Nitrite-nitrogen by EPA Method 300.2
- Bicarbonate alkalinity by SM2320B
- Carbonate alkalinity by SM2320B
- Hydroxide alkalinity by SM2320B
- Total alkalinity by SM2320B
- Methane by GC/FID

3.7 Flux Chamber Sampling

Nine co-located flux chambers were sampled including two from the WC, six in the former TFA, and one background along the southern end of the Site. Flux chamber locations are shown on Figures G-2, G-2a, and G-2b. For each set of flux chambers, one labeled with "G" was set in sediment cap armoring above an ebullition (gas bubble) pathway and the other labeled with "NG" was set immediately adjacent in the sediment cap armoring where no ebullition was observed. Ten co-located flux chamber locations were originally placed; however, one co-located set of flux chambers (FC-2) was not sampled because one of the flux chambers (FC-2) was stolen or swept into the river by the current. Flux chamber water and gas samples were labeled according to the following chart.

Sample Nomenclature – Flux Chamber

Digits	Description	Code	Code Description
1 and 2	Site Location	WC/TFA	Willamette Cove/Tank Farm Area
3 and 4	Sample Type	FC	Flux Chamber
5	Sample Location	1	Location 1
6 and 7	Pathway	G/NG	Gas/No Gas
8	Matrix	W/G	Water/Gas
Example: WCFC-1G-W – Water sample collected from flux chamber at location 1 above an ebullition (gas) pathway in Willamette Cove.			

In the WC, flux chambers at location FC-1 were set outside the granular organoclay area to assess ebullition outside the granular organoclay cap. To assess ebullition above the granular organoclay cap, flux chambers at location FC-3 were planned within the granular organoclay; however, because of low river levels, the FC-3 flux chambers were set just outside the granular organoclay cap. Figure G-2a shows the WC locations for co-located flux chambers FC-1 and FC-3. No flux chambers were placed overtop of the organoclay footprint in WC because the river had already dropped to a level outside the organoclay area.

Three co-located flux chambers (locations FC-4 through FC-6) were set in the former TFA granular organoclay area where ebullition is most prolific. Two co-located flux chambers (locations FC-8 and FC-9) were placed on the riverside of Organoclay Mat #2 to assess ebullition pathways on the riverside of Organoclay Mat #2. One co-located set of flux chambers (FC-7) was set along the boulder cluster riverward from the granular organoclay to assess ebullition outside of the organoclay footprint, but within the embayment where ebullition is frequent. The last set of flux chambers (location FC-10) was set to the south of Organoclay Mat #2, where native sediment concentrations were elevated, but there is no residual creosote. This location was considered a background location relative. Figure G-2b shows the former TFA locations for co-located flux chambers.

3.7.1 Water Sampling from Flux Chambers

A time-series water sample was collected and pumped through an XAD column that averages the potential contaminant impact from ebullition during a 4-day period. This method also allows low-level detections to be achieved while assuring that the flux chamber porewater sample is not diluted by short-circuiting surface water because of the small volume of water pumped daily. The XAD columns were used to allow low-level detection of PAHs; however, the method was not capable of analyzing for PCP and also not capable of analyzing reliably for naphthalene.

Figure G-4 shows a schematic of the flux chamber. The depth of the flux chamber side was approximately 1 foot, to attempt to provide sufficient area beneath the chamber to accumulate water discharging through the sediment cap. The center of the chamber was constructed with a valved water sampling port with a 4-inch fitting extending into the flux chamber. Tubing was attached to each flux chamber and pumped using a peristaltic pump at a very low rate to prevent short-circuiting surface water. Photographs documenting flux chamber sampling are included in Attachment A. The water was pumped through the XAD column (highly absorbent resin used in organic sampling) assigned to that specific flux chamber. Porewater that accumulated in the chamber was sampled

daily for 4 days and pumped from each of the co-located chambers through their associated XAD column simultaneously. Sampling occurred near low tide, when the vertical gradient was expected to be upward. Up to 3 liters of water were pumped during each daily sampling event, depending on the low tide river elevation. If the river level was too low, less water was available to be pumped; however, each day an equal amount of water was pumped from each co-located flux chamber. A total of 12 liters was pumped through flux chambers at locations FC-1, FC-3, FC-7, and FC-8; a total of 10 liters was pumped through flux chambers at locations FC-4, FC-5, FC-6, and FC-9; and a total of 11 liters was pumped through the flux chambers at location FC-10.

3.7.2 Gas Sampling from Flux Chambers

Each chamber was fitted with a one-way gas release valve on the highest edge of the chamber. Between daily sampling events, the water port was closed and the one-way gas valve remained open to allow gas to exit the flux chamber. The flux chambers were placed at an angle, approximately 6 to 8 inches into the sediment cap armoring to allow gas to accumulate near the highest edge of the chamber. Ebullition pathway flux chambers also were fitted with a gas sample valve, located on the highest edge of the chamber. To allow the flow of gas through the flux chamber during water sampling, gas sampling was conducted after the XAD water sampling was completed.

To prepare for the gas sampling after water sampling was complete, the one-way gas release valve was closed to allow gas accumulation in the chamber. Tubing was attached to the gas sampling valve and a peristaltic pump was used to pump gas into tedlar bags. The tedlar bags had a 3.8-liter capacity. Four of the locations generated enough gas to fill the bags after less than one day of having the gas valve closed. For the other locations, gas accumulated slower and had to be collected daily until sufficient gas was obtained for the analyses. Gas was pumped through the tubing by the peristaltic pump until water was observed in the tubing. Pumping was stopped before the water entered the tedlar bag because water transferred to the Summa canisters will ruin both the canister and the gas sample. The gas valve was closed and, if the tedlar bag was not filled, additional gas was recovered on the following day. Summa canisters are a more reliable method of transporting gas samples to the laboratory than in tedlar bags where degradation of the gas from exposure to sunlight can alter the sample composition. The Summa canisters were submitted to TestAmerica, for analysis of the following constituents:

- Volatile organic compounds (VOCs) by EPA Method TO-15; and
- Methane, oxygen, and carbon dioxide by ASTM Method D-1916.

PAHs were not included in the gas analysis as they will primarily be present in the water. PAHs will preferentially partition into the water phase while VOCs will more readily remain in the gaseous phase. PAHs were analyzed in the water from the flux chambers.

3.8 Organoclay Mat #2 Sample Collection

The rock armoring and sand over a small section of Organoclay Mat #2 was removed using a backhoe operated by Clearwater. The organoclay mat was laid back and examined for signs of NAPL staining and overall integrity. A portion of the mat (2 feet by 2 feet) was cut out, sealed in plastic, and provided to CETCO for absorptive capacity and gas permeability testing. A similar sized portion of mat was provided to UT for gas permeability testing. Following removal of the mat sections, new organoclay mat was placed in the same location, and the sand and armoring replaced.

3.9 Investigation-Derived Waste

Investigation-derived waste included soil cuttings from excess core material, decontamination water, and personnel protective equipment (PPE). Soil cuttings and decontamination water were placed in 55-gallon drums and stored onsite pending disposal. PPE was placed in existing disposal receptacles (wranglers) and stored onsite pending disposal.

3.10 Post-Coring Abandonment

Procedures for abandonment of the core holes are important so that a preferential pathway through the sediment does not occur after coring. It was important to use organoclay in all areas where creosote potentially could enter the sediment cap because bentonite is not compatible with creosote. The Oregon Department of Water Resources (OWRD) permitted a variance to use organoclay to abandon the core holes only within the cap area where organoclay previously was present because organoclay is not on the approved list for abandonment materials. OWRD required that core holes, outside of where organoclay already was present in the sediment cap, be abandoned with bentonite chips. Therefore, locations within the footprint of the organoclay were abandoned with granular organoclay, including a few locations adjacent to the organoclay footprint, while other locations were abandoned with bentonite chips. Attachment D contains a table that summarizes the abandonment methodology for core location. Figure G-2 and G-2b show the locations where sediment cap repair was conducted.

In the WC, the core holes were capped further using a patch of organoclay mat before replacing the ACB. New ACBs, painted fluorescent orange with the sample location number stenciled in black, were used to replace the ACBs that had been broken out. This will allow for easy future identification of the coring locations in the areas where ACBs are present.

In the former TFA, many core locations were located well above the river level and outside of the organoclay footprint. These core holes were abandoned using bentonite chips to the surface. Where ACBs had been broken and removed for coring, new ACBs were set in place and painted with location numbers. In locations below the river elevation in the former TFA, core holes SD-13, SD-14 and SD-15 were abandoned using granular organoclay; however, the core holes often caved in before organoclay could be added. Because this was a concern regarding proper abandonment of the core hole, a backhoe was used to scrap the armoring back and 10-foot by 10-foot organoclay mats were placed on the cap sand. An approximately 6-inch-deep layer of sand, followed by approximately 1-foot-deep layer of rock armoring, were placed over the organoclay mat.

Trenches were excavated to remove the armoring and access the sand and granular organoclay portions of the cap in the former TFA west of Organoclay Mat #2. During coring activities, sheen appeared in the trenches and was observed seeping from the native sediment encountered at the shoreward end of the trench. The trenches were repaired by pouring an approximately 2-inch-thick layer of granular organoclay into the trench and spreading it evenly. The granular organoclay was covered with approximately 1 foot of sand followed by replacing the armoring/sand mixture that was present before trenching.

These disturbed areas from the investigation will be closely observed for sheen during the Summer 2009 to ensure that abandonment procedures were adequate and have not diminished the effectiveness of the sediment cap.

4.0 SAMPLING RESULTS

This section describes the analytical results for samples collected during the ebullition and sheen investigation activities from July 10, 2008, through October 21, 2008. Section 3, above, provides a summary of analytical testing requirements for each sampling event. The following subsections provide sampling results, organized by sample type and constituent. Laboratory results, validated data reports, and the QA/QC reviews are provided in Attachment B.

4.1 Sheen Observations and Sampling Results

Sheen was observed weekly, sampled from both sediment and surface water in July 2008, and assessed under the microscope by Dr. David Alexander, professor of microbiology at UP. The results of these sheen investigations are summarized below.

4.1.1 Sheen Observations

Sheen was observed during most site inspections from July 15 through September 24, 2008. Weekly sheen observations are summarized on Figure G-3 and Table G-2. The frequency of Site inspections during this period was increased to monitor location and frequency of sheen occurrence. Below are the details regarding the date, location, and description of individual sheen occurrences. Figure G-3 shows the locations where sheens have been observed, number of occurrences, and locations of the organoclay mats for reference.

- July 15, 2008 – During the July 2008 monthly site inspection, a moderate sheen was observed in the WC along the ACB in the area of the granular organoclay (Photographs 1 through 4, Attachment A). A creosote odor was present in the sediment associated with the sheen; however, it is not clear whether the odor came from discharging groundwater, the sheen, or the sediment. Naphthalene odor is detectable in water by humans at concentrations as low as 21 μg/L (Spectrum Chemical Fact Sheet). The sheen was limited to the shoreline above the elevation of the Willamette River. The sheen had a blocky appearance, see Photographs 1 and 2 in Attachment A. Sheen appeared to be biological due to its blocky appearance and inability to re-coalesce when disturbed. Potential sources of biological sheen are the presence of iron, decomposition of organic matter, or the presence of certain bacteria. The sheen had no odor. It was observed in the beach area near the City of Portland outfall, the upland cap outfall, and the former TFA. Similar to sheen observed in the WC, sheen in these areas was limited to the shoreline above the elevation of the Willamette River. Ebullition was observed (without sheen) in the former TFA, in the area with granular organoclay, also from beneath the northern shoreline corner of Organoclay Mat # 2, in the river over the footprint of granular organoclay, and away from the upland area along the shoreline where the sheen was present. No sheen associated with the ebullition was observed.
- July 22, 2008 – On July 22, a bacterial sheen was observed in the WC along the ACB in the area of the granular organoclay, City of Portland outfall, the upland cap outfall, and the former TFA. Sheen broke when disturbed and did not re-coalesce, which is more characteristic of a biological sheen than oil

sheen. No odor was associated with the sheen. Sheen in these areas was limited to the shoreline above the elevation of the Willamette River. The sheen appeared to be associated with groundwater discharge, and was limited to the shoreline above the elevation of the Willamette River. Ebullition was observed in the TFA and the WC areas. No sheen associated with the ebullition was observed.

- August 8, 2008 – During upland well repair activities, a slight sheen was observed in pools of stagnant water along the organoclay mats in the former TFA. Sheen appeared to be biological and was without odor. A source for the sheen was not observed. Ebullition was observed in the TFA and Willamette Cove areas. No sheen associated with the ebullition was observed.
- August 19, 2008 – During the August 2008 monthly site inspection, a biological sheen was observed in the WC along the ACB in the area of the granular organoclay. The sheen did not re-coalesce when broken, and no odor was associated with the sheen. However, the sheen appeared to be associated with groundwater discharge, and was limited to the shoreline above the elevation of the Willamette River. Ebullition was observed in the TFA and Willamette Cove areas. No sheen associated with the ebullition was observed.
- August 26, 2008 – During ebullition and sheen investigation activities, a moderate sheen with creosote odor was observed in the WC along the ACB in the area of the granular organoclay and in the former TFA granular organoclay area. Oily sheen was observed following push-probe sampling in known areas of contaminated sediments. Sheen also was observed in trenches within the former TFA created for the sampling effort. Sheen was absorbed using absorbent pads and generally did not return following the activities. Areas at which sheen appeared during investigation activities were backfilled with granular organoclay. This sheen clearly was related to residual creosote contamination in the native sediment and re-coalesced upon disturbance as would be expected for an oil-related sheen.
- September 4, 2008 – During ebullition and sheen investigation activities, a slight sheen associated with ebullition with creosote odor was observed along the west edge of the former TFA granular organoclay area. Push probes were completed in this area as part of the ebullition and sheen investigation. The area subsequently was over-excavated during low-tide and backfilled with organoclay mats, as described in Section 3.10. Sheen associated with ebullition was not observed following repair activities. Sheen with no odor also was observed in the WC along the ACB in the area of the granular organoclay. The sheen appeared to be biological, based on its blocky appearance and inability to re-coalesce.

- September 10, 2008 – During ebullition and sheen investigation activities, a slight sheen was observed in the WC along the ACB in the area of the granular organoclay and throughout the former TFA. Sheen appeared to be biological, and no odor was associated with the sheen. The sheen appeared to be associated with groundwater discharge, and was limited to the shoreline above the elevation of the Willamette River. Ebullition was observed in the TFA and Willamette Cove areas. No sheen associated with the ebullition was observed.
- September 24, 2008 – During crawfish sampling activities, a moderate sheen was observed in the WC, from shoreline to 30 feet into the cove. Sheen extended from the Burlington Northern Railroad (BNRR) Bridge to the northern edge of the granular organoclay. Sheen appeared to be biological and without odor, and was not readily visible unless viewed from an angle that allowed sunlight to reflect from the sheen to reveal its presence. No sheen was observed above the shoreline. A source for the sheen was not observed. Ebullition was observed in the TFA and Willamette Cove areas. No sheen associated with the ebullition was observed.

In general, sheen was observed in multiple locations along the shoreline near the City of Portland outfall, the upland cap outfall, former TFA, and WC areas. No sheen was observed in the former waste disposal area (FWDA). The sheen was limited to the shoreline above the elevation of the Willamette River; except on September 24, 2008, when sheen was observed on the water surface in the WC, but no source was observed. No sheen was observed in the FWDA. The sheen observed at the site appeared to be a thin film and blocky rather than the multi-colored (i.e., rainbow) sheen typically associated with oil. Sampling events were performed on July 16, 2008, in an effort to identify the source and mechanism. The results are summarized below. While ebullition was prominent throughout the summer and fall, no sheen associated with ebullition was observed in 2008.

4.1.2 Analytical Sheen Sample Results

Sheen was sampled in July 2008 in four locations along the shoreline as shown on Figure G-3. Sheen results are summarized in Table G-3. PAH results are shown on Figure G-5. Analytical laboratory results, validated data, and the QA/QC review are provided in Attachment B of this report.

One sheen sample was collected from the WC. The sheen was present within an ACB, both floating on water and in sediment where the water table had dropped below the sediment. A sample of the sediment with sheen showed no detection of PAHs (<18 µg/L), where as the sample of sheen associated with water within an ACB showed low level detections of acenaphthene, fluorene,

and naphthalene at 0.478 µg/L, 0.106 µg/L, and 1.01 µg/L, respectively. Ambient surface water collected from approximately 5 feet from the location where sheen was present contained acenaphthalene and fluorene at 0.43 µg/L and 0.135 µg/L, respectively. The concentrations associated with the sheen are at or below the surface water ambient concentrations suggesting that the sheen is not associated with PAH or creosote contamination.

Along the former TFA, one sheen sample location was targeted between Organoclay Mat #2 and the riverbank. The sediment with sheen sample in this location contained benzo(b)fluoranthene at 18.6 micrograms per kilogram (µg/kg), chrysene at 30.4 µg/kg, fluoranthene at 49 µg/kg, phenanthrene at 26.5 µg/kg, and pyrene at 37 µg/kg. The surface water sample with sheen had no detections of TPH or PAHs and the ambient surface water adjacent to the sheen contained acenaphthene at 0.126 µg/L and naphthalene at 0.283 µg/L. No TPH was detected in the ambient surface water sample. The ambient surface water sample contained higher concentrations of PAHs than the surface water with sheen, indicating that the sheen does not contain PAH concentrations above that observed in nearby surface water. The sediment sample contained low level PAHs in sediment, which is 2 orders of magnitude below the total cPAHs ROD Cleanup Goal of 2,000 µg/kg and well below concentrations (100s mg/kg) and no TPH detections.

A sample of sediment with sheen was collected from a location along the riverbank between Organoclay Mat #2 and the City of Portland stormwater outfall. This is a location where sheen frequently has been observed. The sediment sample contained 160 µg/kg acenaphthene and 44.8 µg/kg fluoranthene. The ambient surface water sample adjacent to the sediment contained acenaphthene at 0.155 µg/L. A surface water sample with sheen was not observed and therefore, not collected at this location. These concentrations are well below concentration expected to be present in a sheen produced by creosote from the Site.

The fourth sheen sample (sediment with sheen) was collected in the area encompassing the southern end of the Site and the City of Portland outfall adjacent to the Triangle Park site. The sediment sample contained benzo(b) fluoranthene (26.5 µg/kg), benzo(k) fluoranthene (18.3 µg/kg), chrysene (26.9 µg/kg), fluoranthene (58.4 µg/kg), and pyrene (46.6 µg/kg). The surface water with sheen sample contained acenaphthene at 0.153 µg/L and the ambient surface water sample contained acenaphthene at 0.328 µg/L. The surface water with sheen and ambient samples were very similar, suggesting that the sheen is not creosote contamination in the form of sheen migrating from the bank. These low level concentrations more likely are associated with the low-

level dissolved phase PAHs in groundwater that discharges from the Site, and therefore, are present in ambient surface water.

From the HCID testing, TPH was only detected in one sample (MBSD0708-COS – the surface water with sheen sample collected from adjacent to the City Outfall) (Table G-3). TPH was not detected in any of the other sheen or ambient water samples. MBSD0708-COS was analyzed for TPH-gasoline and TPH-diesel based on the HCID testing. TPH-gasoline was not detected at a detection limit of 80 µg/L and TPH-diesel was detected at 7.54 mg/L and at 7.44 mg/L after silica gel cleanup suggesting that the TPH-diesel is related to diesel range hydrocarbons. In 2003, a study of the TPH concentration associated with the Site creosote sheen bursts was investigated. Results are included in Attachment F. It shows the concentration of TPH associated with a creosote sheen burst to be 2,500 mg/ml of sheen. The post-sediment cap sheen concentrations from the samples collected from the Site in 2008 are not indicative of a creosote sheen.

Figure G-6 compares sheen concentrations in surface water samples collected from 2007 and 2008 with ambient surface water samples and semi-annual sampling event data. Figure G-6 shows that the samples with sheen do not have greater concentrations of PAHs than other samples. If the sheen were associated with creosote contamination, the PAH concentrations in samples containing sheen would expected to be higher. During the semi-annual sampling, when sheens are not present, similar concentrations of low molecular weight PAHs are present in surface water due, in part, to low levels of PAHs in groundwater discharging from the site. These concentrations, as described in Appendix D of the O&M Report, are well below comparison criteria.

In summary, the analytical samples of sheen do not suggest that the sheen is associated with creosote migrating from the Site. It is more likely that low level dissolved PAHs in water partition into the organic sheen resulting in similar concentrations between the sheen and the adjacent surface water.

4.1.3 Photomicrographs of the Sheen

Dr. Alexander, at UP, sampled sheen from the Site on August 27, 2008. He stated that the sheen appeared to be a biofilm and not oily residue. Specifically in reference to sheen collected from the WC, where creosote odor has been present coincident with the sheen, Dr. Alexander observed irregularly shaped, flocculent material that appeared to have bacterial cells embedded in it. He said that although he does not have biofilm experience; in his opinion, the sheen looked more biological than chemical under the microscope. Photomicrographs of the sheen are presented in Attachment D attached as a DVD to this report. Dr. Ron Wasowski, also at UP, agreed with Dr. Alexander's conclusion that the

sheen is likely biological in nature and not a hydrocarbon or oily sheen (see e-mails in Attachment D).

4.2 Ebullition Observations

Ebullition was observed during most site inspections from July 15, 2008, through September 24, 2008. Figures G-7 and G-8 show the results of the ebullition surveys conducted on July 31, 2008, and September 12, 2008, respectively. No sheens were observed in association with ebullition.

On July 31, 2008, an ebullition survey was conducted primarily over the granular organoclay areas in the WC and the former TFA (Figure G-7). The river was calm, which facilitated ebullition observation. The day was sunny with cool temperatures. The high tide was 11.9 feet NAVD88 and occurred at 5 a.m., and low tide river level was 8.2 feet NAVD88 and occurred at 3 p.m. The survey was conducted during an outgoing tide between 11 a.m. and 3 p.m.

In the WC, ebullition occurred primarily in a line paralleling the shoreline near the low tide level and almost solely over where granular organoclay is present. The gas emitted a strong hydrogen sulfide (rotten egg) odor.

In the former TFA, the ebullition primarily centered over the organoclay with a clear line of bubbles at the edge of the organoclay. Occasional ebullition was observed outside of the granular organoclay footprints. In those areas, the ebullition appeared to be controlled by river depth and the gas bubble bursts were less frequent. The ebullition over the granular organoclay was frequent, with an average rate of production at each bubble pathway approximately 0.15 liter/minute close to low tide, when gas production is the highest. This average is based on 10 measurements made during each of the ebullition surveys. Because the survey was conducted near low tide and during the time of year when the river has dropped such that ebullition is regularly present within the organoclay footprints, this value represents the high-end rate for ebullition within that general timeframe. This value provides a general idea of the higher ebullition rate at the site and should not be used to predict the amount of gas generated at the site. Outside of the granular organoclay, the gas production rate was much slower and less consistent, with bursts of fewer and smaller gas bubbles at intervals between 1 and 10 minutes (approximate rate range of 0.01 to 0.001 liter/minute). Outside of the granular organoclay footprint, it was more difficult to find locations where the rate could reliably be measured; therefore, this rate represents the higher end of ebullition rate outside of the granular organoclay footprint. These rates are only presented for comparison purposes and not to be used in quantitative calculations.

A second ebullition survey was conducted on September 12, 2008 (Figure G-8). The river was calm, and the day was sunny and warm. High tide was at 3:30 a.m., at a river level of 8.9 feet NAVD88. At low tide, which was at 1 p.m., the river level was at 5.25 feet NAVD88. The survey was conducted on an outgoing tide between 10 a.m. and 1 p.m. This survey was very different than the survey in July 2008 because ebullition was much more pervasive in the river. The river level was 3 feet lower in September 2008 than in July 2008, and the temperature was warmer.

Figure G-5 shows the results of the September 12, 2008, ebullition survey. Ebullition in the WC was less frequent than in the former TFA and centered just riverward of the granular organoclay. The entire footprint of granular organoclay in the WC was above the river level where ebullition could not be observed. The ebullition rate in the WC, where present, was approximately 0.1 liter/minute based on 5 measurements from locations where bubbling was frequent.

There was limited ebullition beneath the BNRR Bridge, where it has been observed in the past. No sheen was observed related to the ebullition. In the former TFA and toward the southern end of the Site, ebullition was frequent and widespread. Ebullition over the organoclay did not appear to be more frequent than in other areas of the embayment. The approximate rate of ebullition was 0.15 liter/minute based on measurements from 8 locations where bubbling was frequent. Ebullition also was observed toward the Triangle Park property and well out into the river; however, the survey was restricted to nearshore. Ebullition rates outside the embayment were slower, at approximately 0.05 liter/minute based on measurements at 2 locations where bubbling was frequent enough to measure.

No additional ebullition surveys were conducted. However, after the river levels came back up in early November 2008, ebullition became very sparse and was observed only directly over the granular organoclay footprints at rates approximating 0.005 liter/minute. These ebullition rates reported are based on field measurements from bubble pathways where ebullition was frequent enough to measure and were taken during the low tide period when ebullition is most frequent. Thus, they represent the upper end of ebullition rate for these areas and time periods. They should not be used in quantitatively determining gas production at the Site. They are reported to emphasize the differences in rates between areas with granular organoclay and areas outside of the granular organoclay footprint.

4.3 Flux Chamber Sampling Results

Flux chamber locations are shown on Figures G-2, G-2a, and G-2b. As described in Section 3.6, at each location, one chamber was placed over an ebullition pathway and another chamber was placed adjacent where there was no ebullition pathway observed. Gas was sampled from the flux chambers placed over the ebullition pathway, and water was sampled from both flux chambers. Table G-4 presents the analytical data for the gas and water samples from the flux chambers. Laboratory data and QA/QC reports are included in Attachment B.

4.3.1 Methane, Carbon Dioxide, Carbon Monoxide, and Oxygen Results

Carbon monoxide was not present in any samples. Methane, carbon dioxide, and oxygen were present in all samples, with the exception of two samples where the gas measured was primarily oxygen at percentages that reflect atmospheric levels. Gas sample FC-1 from the WC contained 28 percent oxygen and 2.6 percent methane with no carbon dioxide detected. Gas sample FC-9, located shoreward of Organoclay Mat #2, contained 25 percent oxygen and no other gases. The total percentages of constituents in the gas from these two samples were 25 percent and 30.6 percent, respectively. The percent oxygen (near that in atmosphere air) in these two samples suggest that the gas sampling seals on these flux chambers leaked, allowing atmospheric air to bypass the gas sampling valve. It is assumed that the remaining unaccounted percentage in those samples would be nitrogen because atmospheric air is approximately 70 percent nitrogen.

In the remaining seven samples, three of the four gases analyzed (carbon dioxide, carbon monoxide, oxygen, and methane) ranged from 55.8 percent to 125 percent. The largest percentage of the total gas in the samples was methane while carbon monoxide was not detected in any of the samples. In the former TFA over the organoclay, the total percentage of constituents accounted for ranged from 91.3 percent to 125 percent, suggesting that the gas is primarily composed of methane with lesser amounts of carbon dioxide and oxygen (i.e., there is not another significant gas present in these samples). In the WC, the total percent accounted for was 53.2 percent, suggesting a significant percentage of another gas is present. During the ebullition survey, there was a strong rotten egg odor to the gas, indicative of hydrogen sulfide leading to an assumption that the unaccounted gas present in the WC may be hydrogen sulfide.

In gas samples FC-4 through FC-6, located overtop of the organoclay in the TFA, methane comprised the larger percentile of gas detected. In gas sample FC-7, collected within the embayment in the former TFA, methane was also the larger percentage of gas present at 61 percent. However, in FC-7, a larger percentage

of carbon dioxide was present (9.2 percent) relative to that observed in the samples located over the organoclay, samples FC-4 through FC-6 (1.8 percent to 4.3 percent carbon dioxide, respectively). Carbon dioxide also was present at higher percentages in samples FC-8 and FC-10 (13 percent and 9.3 percent, respectively) while methane was present at a lower percentage (36 percent and 45 percent, respectively).

The gas samples collected over the former TFA organoclay footprint contained higher percentages of methane (76 percent to 110 percent over the organoclay footprint versus 36 percent to 61 percent outside the organoclay footprint). Preliminary results of the PSU study indicate that the organoclay layer is producing more methane gas than the native sediment or cap sand layers. This suggests that within the granular organoclay layer, methanogenesis is the primary biological process occurring, while in the cap sand and/or native sediment, other processes that produce carbon dioxide, and perhaps hydrogen sulfide, also are occurring.

In summary, the presence of methane gas is an indication of methanogenesis. Other gases present outside the organoclay footprint suggest that other degradation processes are occurring in the sediment cap sand and/or native sediment.

4.3.2 VOC in Gas Results

VOCs detected in the gas samples included 1,2,4-trichlorobenzene; 1,2,4-trimethylbenzene; 1,3,5-trimethylbenzene; benzene; ethylbenzene; xylenes; and toluene at concentrations ranging from <2 parts per billion (ppb) (v/v) to 49 ppb (v/v). The range in ambient air is between <2 ppb (v/v) to approximately 20 ppb (v/v) (Pankow *et al*, 2003). It is suspected that these constituents partitioned into the gas from the porewater and surface water.

4.3.3 Gas Production Rate

Gas production rates were estimated for the nine ebullition pathways covered by flux chambers. The gas release valves were closed the day before sampling. Gas was collected the following day using a peristaltic pump to draw the gas into the tedlar bag. The estimated amount of gas collected in the tedlar bag divided by the hours since the gas valve was closed was used to estimate the gas production of the ebullition pathways. Because this rate is from the gas generated over an entire day, covering two tidal cycles, it is considered a better estimate of the gas production rate for a given bubble pathway than the rates estimated during the ebullition survey.

Estimated Ebullition Ratios. At locations FC-4, FC-5, FC-6, FC-1, and FC-9, the amount of gas available in the flux chambers after approximately 18 hours, easily filled the tedlar bag (3.8 liters). Locations FC-1 and FC-9 apparently leaked because the composition of the gas resembled atmospheric percentages. Data from these two flux chambers was therefore not used in estimating gas production rates from ebullition. Locations FC-4, FC-5, and FC-6, each located over the granular organoclay in the former TFA (see Figure G-2b), produced more than 0.2 liter/hour (3.8 liters gas/18 hours). Location FC-5 was tested for production again after the gas valve was closed for 3 hours. There was sufficient gas to fill the tedlar bag after the 3 hours. This test was conducted near low tide when ebullition rates are highest. The rate for gas production from the ebullition pathway at location FC-5 was more than 1.25 liters/hour (3.8 liters/3 hours). This is consistent with the production measured during the ebullition survey where 0.15 liter/minute (or 9 liters/hour) gas production from one ebullition pathway was measured at the peak time of production (summer month at low tide coupled with low river stage). Because this rate occurs only within hours of low tide, during the warmer months, and at lower river stages, it is not considered to be representative of ebullition production within the organoclay. Given the above gas measurement, one can estimate that gas production within the footprint of the organoclay is approximately 5 liters/day per ebullition pathway (0.2 liters per hour 24 hours/day). This occurs within the granular organoclay footprints for approximately 5 months of the year. During the other months of the year, ebullition rates are only a small fraction of this rate.

The remaining locations took several days to partially fill a 4-liter tedlar bag with rates varying between 1.2 to 2.5 liters collected over a 3-day-period. This resulted in ebullition rates between 0.4 and 0.8 liter/day. Outside of the organoclay footprint, ebullition is most prominent in August, September, and October. Thus, these rates are considered representative of the approximately three months when ebullition is prominent at the Site. Outside of the organoclay footprint, ebullition basically ceases in the winter and spring months when the temperatures are cooler and the river stage is higher.

Attempting to make a comparison to literature values, a rate per square meter was estimated on the basis of the approximate number of ebullition pathways observed within a given area.

Ebullition within the Granular Organoclay Footprint: As described above, the flux chambers within the granular organoclay footprint in the former TFA collected more than 4 liters of gas in 18 hours or approximately 5 liters/day. The number of pathways counted within the granular organoclay footprint in the former TFA was approximately 100 on July 31, 2008. During the September 12, 2008, we counted about 50 pathways over about half the granular organoclay

footprint area (since the other half was above the river level where gas bubbling is not readily visible) (Figures G-7 and G-8). Because of the abundant gas pathways, the visual survey cannot account for all of the ebullition pathways. We estimate that we accounted for approximately 1/5 and maybe a few as 1/10 of the pathways. The area of the TFA granular organoclay is approximately 850 m^2.

Given these estimates, the calculation proceeds:

> 5 liters gas per pathway/day * 500 pathways = 2500 liters of gas produced from within the organoclay footprint per day
>
> and,
>
> 2,500 liters gas per day/850 m^2 = 2.9 liters gas per m^2 per day.

If the number of pathways within the organoclay footprint is 1,000, then the rate would be doubled. Thus, for the ebullition pathways within the granular organoclay footprints, the rate for the summer/fall months is estimated between 2.5 and 5 liters/m^2-day.

Ebullition Outside of the Granular Organoclay Footprint: Gas from the the flux chambers outside of the granular organoclay footprint took significantly longer to collect in (and only partially fill) a 3.8-liter tedlar bag. As estimated above, the rate per flowpath ranged between 0.4 to 0.8 liters per day gas from flux chambers placed overtop ebullition pathways located outside of the granular organoclay footprint. When the ebullition is most frequent in August, September, and October, the number of pathways in a given area is fewer than within the organoclay footprint area. Based on the number of pathways measured during the ebullition survey, we estimated that there are approximately 50 to 100 pathways within an 850 m^2 area (purposely chose same area for comparison purposes). Using these estimates, results in a daily gas production rate range from 0.02 to 0.09 liters gas per square meter per day in areas of the sediment cap where there is no granular organoclay.

Yuan and Reible (2009, in review) report ebullition rates ranging from $3x10^{-4}$ to 2.64 liters/m^2-day because of different site conditions. The ebullition rate outside of the organoclay footprint falls within this range. The lower estimates for ebullition rates over the granular organoclay are at the high end of the literature range, while the higher estimate exceeds the range.

4.3.4 Flux Chamber XAD Water Sample Results

Section 3.7 describes how water samples were collected from the flux chambers. The XAD columns were analyzed for the mass of PAHs. The mass

was converted to a concentration (µg/L) in water by dividing the PAH mass by the liters of water pumped through the XAD column. PAHs were detected in each sample.

The total low molecular weight PAHs (LPAHs) detected in water from the flux chambers placed over gas pathways ranged from 0.089 µg/L to 97.0 µg/L with a median of 1.298 µg/L while the range of total LPAHs in water from the flux chambers, located where no gas pathway was observed, ranged from 0.107 µg/L to 7.05 µg/L with a median of 1.004 µg/L.

The total high molecular weight (HPAHs) detected in water from the flux chambers placed over gas pathways ranged from 0.0139 µg/L to 0.137 µg/L with a median of 0.0211 µg/L while the range of total HPAHs in water from the flux chambers, located where no gas pathway was observed, ranged from 0.0071 µg/L to 0.0736 µg/L with a median of 0.0121 µg/L.

PAHs detected for both LPAHs and HPAHs are consistently higher in water from the flux chambers with a gas pathway relative to chambers placed where no gas pathway was observed. Total LPAHs by individual locations are only 1.2 to 21 times higher in water from the flux chambers located over ebullition pathways than in water from the flux chambers where no gas pathways were observed. Total HPAHs by individual locations are 1.5 to 277 times higher than the chamber placed where no gas pathways were observed. Because HPAHs are more likely to be associated with particulate matter via adsorption, this difference in ratios suggests that the gas pathways act more as a pathway for particulate matter than for porewater (where LPAHs are more likely to be present dissolved in water). The cPAH concentrations in water from FC-1G and FC-5G (0.07067 µg/L and 0.0667 µg/L, respectively) exceed the ROD sediment cap performance goal (0.031 µg/L); however, this ambient water quality goal is based on cPAHs dissolved in water, while the above data suggest that the cPAHs may be sorbed to particulate matter. The ambient water quality criteria that are used as the comparison criteria are based on constituents dissolved in water.

In general, although PAH concentrations were higher in water from the flux chambers located overtop of ebullition pathways, the PAH concentrations detected in water from the flux chambers are generally below comparison criteria.

4.4 Sediment Sampling Results

Thirty-three cores were advanced as follows: along the shoreline in the WC (10 cores), near the former TFA (21 cores), and at the upgradient end of the Site (2 cores). From these cores, several sediment samples were selected jointly by

DEQ and the Hart Crowser/GSI team for laboratory analysis. The laboratory data, validated data, and QA/QC memorandum are provided as Attachment B to this report. Table G-5 summarizes the sediment sampling results and provides a comparison to the ROD cleanup goals for sediment. Figures G-9 through G-12 present cross sections constructed from the boring logs with the sediment and porewater concentrations for cPAHs and total PAHs shown as an inset table. Locations for the cross sections are shown on Figure G-2.

4.4.1 Sediment Sample Results from Willamette Cove

In the WC, sediment samples were collected from cores SD-03 (two depths), SD-04, SD-09, and SD-10 (Figure G-2a). Two samples were collected from cap sand material: SD-03 from 6 to 12 inches into the cap sand; and SD-04 from 1.7 to 2 feet below the ACB. At SD-03, total PAHs were estimated (J-flagged) at 41.18 µg/kg with no cPAHs detected. At SD-04, total PAHs were estimated at 200.18 µg/kg and cPAHs estimated at 52.27 µg/kg. At SD-10, a sample was collected from 2.7 to 3.1 feet below the ACB. This sample was from native sediment at the base of the boring where there was a slight sheen and creosote odor. Total PAHs were detected at 213.44 µg/kg with cPAHs comprising 111.54 µg/kg of the total. Two deeper samples into clearly contaminated native sediment were collected from SD-03 and SD-09; PAHs and PCP were significantly higher with cPAHs exceeding the ROD sediment cleanup goal of 2,000 µg/kg. The significant reduction in concentrations from the native sediment into the cap sand (i.e., SD-03 shown on Figures G-9 and G-10) show the effectiveness of the cap in the WC in preventing contact with contaminated sediments.

With the additional core information, the cross sections were updated from the Ebullition and Sheen Work Plan to show a revised depiction of residual creosote distribution. Visual signs of creosote contamination were not observed between 5 and 10 feet NAVD88 (i.e., upper portions of the cores) from along the BNRR bank.

One hypothesis had been that the sheen observed within the ACB along the shoreline in the WC is the result of sheen associated with the groundwater that was migrating over and through the sediment cap. The sediment analytical and field observations are not supportive of contaminated groundwater with sheen migrating through the cap. There was no visual evidence of creosote contamination in the upper portions of the cores and PAH concentrations in sediment were too low to be indicative of creosote migrating through the sediment cap material.

4.4.2 Sediment Sample Results from the Former TFA

In the former TFA, sediment samples were analyzed from cores SD-17, SD-18 (two depths), SD-20 (two depths), SD-21, SD-25 (two depths), SD-26 (two depths), SD-20, and SD-31. Only two samples exceeded the ROD sediment cleanup goal for cPAH, of 2,000 µg/kg: SD-18 at the base of the cap sand; and in native sediment beneath the cap sand in SD-20. At SD-18, the analytical results do not correlate with the visual description of the cap sand, described as no sheen and no odor, while the native material beneath the cap sand contained visual sheen and creosote odor. In addition, the porewater sample collected at the SD-18 location did not contain detectable PAHs. The above information suggests that the jarred sample contained material from the native sediment.

Typically, where samples were collected from two depths at the same location, the analytical results from cap sand samples were an order of magnitude lower than the native sediment samples (see results for SD-20, SD-25, and SD-26). The cap sand material from SD-25 contained cPAHs at 165.42 µg/kg; however, the sample was collected from just a few inches above the contact with the native sediment, where the cPAH concentration was 1,632.5 µg/kg. SD-17 contained a slightly higher concentration at the top of the cap sand relative to the base of the cap sand. This may reflect sorption of PAHs from groundwater discharging laterally through the sediment cap. Ultimately, the sediment concentrations within the sediment cap material are over an order of magnitude below the ROD sediment cleanup criteria and were not at concentrations indicative of creosote migrating, even as a sheen, through the sediment cap material.

4.5 Porewater Sampling Results

Porewater was collected from 23 locations co-located with selected core locations (Figures G-2, G-2a, and G-2b). Porewater was analyzed for COCs including PAH and total and dissolved arsenic, copper, chromium, and zinc. Selected locations associated with the PSU biological degradation work were analyzed for geochemical parameters. The laboratory data, validated data, and QA/QC memorandum are provided as Attachment B to this report. Table G-6 summarizes the porewater sampling results for total and dissolved metals, PAHs, and field parameters. The porewater is compared to the sediment cap performance and comparison criteria, which currently are used for comparison of the surface water, interarmoring water, and subarmoring water on a semiannual basis. The geochemical data results will be reported and discussed in the Final Ebullition and Sheen report in conjunction with the PSU degradation results. Figures G-9 through G-12 present cross sections constructed from the boring logs and the sediment and porewater concentrations for cPAHs and total

PAHs. Locations for the cross sections are shown on Figure G-2. Figures G-13 through G-15 present the porewater data for total PAHs on the Site map.

4.5.1 Porewater Results for Willamette Cove

In the WC, porewater was collected from four locations. PCP was not detected in any of the WC porewater samples. PAHs and metals results are discussed below.

Two locations (PW-04 and PW-10, see Figure G-13) were along the bank at a depth where porewater would be present in the cap sand material. No cPAHs were detected, and total PAHs, composed primarily of low molecular weight PAHs) were below 2.5 µg/L in these locations. Low molecular weight PAHs (LPAHs) are present in the groundwater discharging from the site; it is reasonable to conclude that these low level PAH concentrations in porewater also reflect discharging groundwater in these locations. These concentrations in porewater are not indicative of concentrations capable of creating a sheen (see Technical Memorandum in Attachment F).

Porewater samples from two depths were collected adjacent to SD-2. Cores were collected from this location for the PSU and UT research on the effectiveness of the organoclay. Two porewater depths were targeted for analysis to support the PSU research, one in the cap sand and the other beneath the organoclay. No cPAHs were detected in the porewater from the cap sand, but were detected at 0.51 µg/L in the native sediment beneath the organoclay. Total PAHs were detected at a higher concentration in the cap sand (516 µg/L) compared to the native sediment (157.44 µg/L). The high cap sand concentrations in this location are primarily driven by naphthalene and acenaphthene, which are prevalent in upland groundwater and likely are representative of groundwater discharging from the upland portion of the Site. One would expect LPAHs dissolved in porewater because these lighter molecular weight constituents have a higher solubility limit, do not sorb readily, and are more mobile in groundwater. The high molecular weight PAHs (HPAHs) typically sorb to soil or sediment and do not migrate far in groundwater and are typically found in porewater near residual creosote. The porewater collected from the native sediment contained higher concentrations of the HPAHs because the porewater was in direct contact with residual creosote at SD-02.

The last porewater sampling location in Willamette Cove was outside the organoclay footprint adjacent to SD-01. Again, two depths were collected, one from the cap sand and the other from beneath the cap sand in the native sediment. Results for cPAHs were similar, with no detected cPAHs in the porewater from the sediment cap and 0.15 µg/L cPAHs within the porewater

from the native sediment. Total PAHs were detected at 9.49 µg/L in porewater from the cap sand and at 286.76 µg/L in porewater from the native sediment.

Of the total metals analyzed (arsenic, chromium, copper, and zinc), none was detected above the ROD sediment cap performance goals. Arsenic was detected above the National Recommended Water Quality Criteria (NRWQC) comparison criterion for human health consumption of organisms of 0.00014 mg/L in all porewater samples. Arsenic concentrations ranged from 0.00528 mg/L to 0.0109 mg/L, which is consistent with concentrations observed within the subarmoring (or cap sand) across the Site during the semiannual sampling. The arsenic concentration in surface water from the WC was 0.006 mg/L.

In summary, concentrations of PAHs in the porewater from the WC cap sand did not exceed the ROD sediment cap performance standards. In addition, the concentrations of PAHs are not indicative of concentrations that would be present in a sheen or present in creosote that could produce a sheen. It appears that groundwater with low level LPAHs is discharging into the cap sand from the upland portion of the Site, and not vertically upward through the sediment cap. Groundwater has been observed discharging from the bank; and no sheen has been observed discharging or migrating with the groundwater. Although sheen has been observed at the same time as discharging groundwater, a direct correlation has not been determined, and appears to be unlikely. The low-level concentrations of naphthalene, acenaphthene, and other LPAHs detected at PW-02 would not be expected to migrate through the organoclay portion of the sediment cap. These porewater results are consistent with the results of the surface water, interarmoring water, and subarmoring water sampling conducted on a semi-annual basis where periodically concentrations of LPAHs are detected in surface water at greater concentrations than in the interarmoring or subarmoring water samples. This suggests groundwater with low level PAHs is discharging from the upland portion of the Site, and is not the result of PAHs migrating upward through the sediment cap. The low level porewater concentrations are well below ROD sediment cap performance standards and the risk-based concentrations used for comparison purposes, and are also well below concentrations capable of generating a sheen or expected to be associated with a creosote sheen.

4.5.2 Porewater Results from the Former Tank Farm Area

In the former TFA, porewater was collected from 18 locations, four of which had porewater collected from two depths, resulting in 22 porewater samples. PCP was detected in porewater from location PW-13 (0.544 µg/L) and PW-32 (0.437 µg/L). These concentrations are well below the ROD performance standard of 13 µg/L.

Carcinogenic PAHs exceeded the comparison criteria of 0.031 µg/L in four locations: PW-16B beneath the organoclay mat (0.107 µg/L); PW-22 (0.0971 µg/L) and PW-28 (0.2153 µg/L), both shoreward of the granular organoclay; and PW-32 (0.115 µg/L) at the southern corner of Organoclay Mat #2. The porewater concentrations collected from the cap sand at PW-18 (co-located with the SD-18 sediment core shoreward of Organoclay Mat #2) did not contain PAHs above detection limits. This sample had elevated sediment concentrations; however, as discussed in the sediment section above, this sample likely contained native material because the sample was collected from near the base of the cap sand.

Porewater samples collected from locations within the granular organoclay footprint were collected from two depths, one depth from the sand and armoring portion of the cap and the other depth from between 36 and 40 inches below the top of the cap material. It is uncertain at what layer within the sediment cap or whether these samples were collected from beneath the sediment cap. Based on the low level cPAH detections, it is suspected that they were collected from the top of the native sediment. The sample from PSU-5 at 12 inches into the sediment cap contained 1,080 µg/L total PAHs with no cPAHs detected. The sample from PSU-5 at 36 inches into the sediment cap contained 6,900 µg/L total PAHs, comprised primarily of low molecular weight PAHs and chrysene (a cPAH) at 0.0209 µg/L. At location 13, the shallow porewater sample (12 inches into sediment cap) contained 10.1 µg/L of total PAHs comprised primarily of naphthalene with no cPAHs detected. The deeper sample contained only 0.988 µg/L total PAHs. This could be reflective of porewater from the base of the organoclay while the shallow sample may be reflective of groundwater discharging from the upland bank between the barrier wall and river. Porewater from the shallow depth at Location 15 contained 1.08 µg/L total PAHs with chrysene detected at 0.0149 µg/L but no other cPAHs. The deeper porewater sample at this location contained 7,259 µg/L total PAHs with no cPAHs detected. In general, PAH concentrations in porewater within the granular organoclay were low and not indicative of concentrations associated with sheens. Similar to the groundwater migration in the WC, it appears that groundwater with low level LPAHs may be discharging laterally through the cap, resulting in higher LPAH concentrations in porewater within the upper portion of the sediment cap.

Porewater samples PW-16A and PW-16B collected from directly above the Organoclay Mat #2 and directly below the mat, respectively, show a two order-of-magnitude decrease in PAH concentrations (0.0274 and 2.354 µg/L total PAHs, respectively), suggesting that the mat is functioning as designed. In addition, the porewater sample from beneath the mat contained 0.107 µg/L cPAHs comprised of four different cPAHs while the porewater sample collected overlying the mat contained no cPAHs.

PW-32 was collected from the southern edge of the mat, outside of the mat footprint at approximately 8 inches beneath the sediment cap surface. Porewater from this location contained slightly elevated total PAHs (77.12 µg/L) with cPAHs making up 0.115 µg/L. The sediment cap description from the nearby SD-32 showed 1.5 feet of sediment cap material composed of mixed sand and armoring. This is an area where during semiannual sampling, the energy from the sampling boat prop wash caused residual creosote to migrate through the sediment cap producing sheen bursts on the water table.

From the porewater samples collected from along the bank shoreward of the granular organoclay and Organoclay Mat #2, it appears that some low level concentrations may be migrating via groundwater from the bank into the sediment cap, as shown by the low level cPAH concentrations in porewater from PW-22 and PW-28; however, not at concentrations expected to produce a sheen. Other samples collected from the cap sand that are located downgradient from where residual creosote is known to exist in the bank (PW-23, PW-24, PW-25, PW-26, and PW-27) did not contain cPAHs above the detection limit, and if PAHs were detected, they were detected at very low concentrations. Whether the concentrations detected in PW-22 and PW-28 migrated laterally from the bank or upward through the cap should be resolved by the SPME data. These data will give a profile of PAH contamination in porewater with depth.

Of the total metals analyzed (arsenic, chromium, copper, and zinc), none was detected above comparison criteria. In all porewater samples, arsenic was detected above the NRWQC comparison criterion for human health consumption of organisms of 0.00014 mg/L. Arsenic concentrations ranged from 0.00068 mg/L to 0.0384 mg/L, which is consistent with semiannual subarmoring concentrations observed across the Site.

In summary, porewater samples from the former TFA suggest:

- Low level LPAH concentrations near the surface within the sand portion of the cap are the result of lateral groundwater discharge
- Results are consistent with semi-annual sampling results
- There does not appear to be a connection between contamination present beneath the sediment cap and the observed sheens
- Data supports that cap is functioning and performing as designed
- Although porewater concentrations were higher associated with areas of ebullition, the concentrations were generally below comparison values. HPAHs tended to be higher associated with the ebullition pathways, suggesting that the gas channels act more as a pathway for particulate

matter than for dissolved phase transport. This could be caused by gas bubbles moving particulates upward through the channels while the vertical hydraulic gradient may not be conducive for porewater migration for mobilization of dissolved contituents.

5.0 PSU RESEARCH – METHODOLOGY AND PRELIMINARY RESULTS

During the August 2008 sampling event, additional core and porewater samples were collected in the Willamette River to assist in understanding potential sources of gas production noted at the Site. The primary focus for this study is to determine the relationship between PAH site contaminants and organoclay as it relates to microbial gas production. To assist in determining this, a combination of laboratory analysis and microcosm studies are being performed. Laboratory analysis will be performed for both core and porewater samples at multiple locations. Laboratory microcosm testing currently is underway to improve understanding of the conditions and mechanisms of ebullition formation in contaminated sediment (surface and native), granular organoclay, and sediment cap sand. Initial results are not complete, and therefore not included or discussed in this report. This section describes the scope of the PSU sampling and study. Each evaluation component is described below.

5. 1 Core Sample Collection

Of the 32 locations where cores were collected, additional core material for the PSU research was collected from five locations (SD-01, SD-02, SD-13, SD-14, and SD-11) as shown on Figure G-2b. The cores contained material from the characteristic layers of the sediment cap. These layers include surface sediment, the cap sand, organoclay (if applicable), and the underlying contaminated sediments. The five soil core locations are described below.

- WC Soil Core – Core surface sediments, native sand, and cap sand. This sample is referred to as Location 1 (SD-01) and is co-located with porewater sample MBPW0801.
- WC Soil Core – Core surface sediments, native sand, bulk organoclay, and cap sand. This sample is referred to as Location 2 (SD-02) and is co-located with porewater sample MBPW0802.
- Former TFA Soil Core – Core contains surface sediments, native sand, bulk organoclay, and cap sand. This sample is referred to as Location 13 (SD-13) and is co-located with porewater sample MWPW0813.

- Former TFA Soil Core – Core contains surface sediments, native sand, and cap sand. This sample is referred to as Location 14 (SD-14) and is co-located with MBPW0815.
- Background Sample Soil Core – Core contains surface sediments and native sand understood to be outside the area of contamination. This sample is referred to as BKGD and was collected from the same location as SD-11.

Soil cores were collected using push-probe techniques and polyvinyl chloride sleeves. Upon retrieval, the sleeve ends were immediately capped to minimize introduction of oxygen. The sleeves then were placed on ice and transported daily back to PSU. Upon receipt, the cores were immediately cut into sub-sections, placed into air-tight AMMO boxes, and flushed with nitrogen to maintain anoxic conditions. All sub-section cores then were refrigerated until further sample processing was completed.

5.2 Porewater Sample Collection

Porewater samples were collected to assess anaerobic metabolites indicative of PAH degradation. Determining whether, and to what degree PAHs are being metabolized may provide additional insight into the source of ebullition. Samples were collected from native sediment, granular organoclay, and sediment cap sand consistent with standard porewater sampling methodology for the Site. Following collection, samples were acidified with 50 percent hydrochloric acid, immediately placed into cold storage, and transferred to PSU daily. Samples were kept refrigerated until further processing. The sample locations and names are listed below.

- Location 1 – MBPW0801-60 (from native sediment).
- Location 2 – MBPW0802-6 and MBPW0802-50 (cap sand and native sediment, respectively).
- Location 13 – MBPW0813-36 (within organoclay or at base of cap sand).
- Location 5 – PSU0805-36 (within organoclay or at base of cap sand).

5.3 Laboratory Analysis

Porewater samples were analyzed by TestAmerica, as described in Section 4.5, for total and dissolved arsenic, chromium, copper, and zinc; PCP; and PAHs. The porewater samples listed above and a few select additional porewater samples were analyzed by TestAmerica for general chemistry parameters as described in Section 3. PSU is conducting additional sediment and porewater laboratory

analysis for the sediment core and porewater samples collected by the PSU team. These analyses are designed to assess where microbes live and what they are metabolizing. A summary of the analytical tests is provided below.

Methanogenic Diversity. Some sub-sectioned soil cores collected from the Willamette River will be probed using molecular tools to help quantify the presence of methanogens at the site. By comparing the location and number of genes specific to methanogenic bacteria, this analysis seeks to determine where the methanogenic bacteria are residing. Because of different conditions, this may vary from special location to soil/cap makeup. Samples for this analysis are being held in cold storage (-80 degrees Centigrade) pending molecular analyses. The sub-sections available for analysis from each location are described below.

- Location 1 - Cap sand; native sediment/sand (WC SD-01).
- Location 2 - Cap sand; cap sand and organoclay; organoclay; organoclay and native sediment/sand; native sediment/sand (WC SD-02).
- Location 13 - Cap sand; cap sand and organoclay; organoclay; organoclay and native sediment/sand; native sediment/sand (TFA SD-13).
- Location 14 - Cap sand; native sediment/sand; organoclay (TFA SD-14).
- BKGD - Native sediment/sand (SD-11).

PAH Metabolism. Porewater samples will be analyzed for metabolic intermediate products associated with known PAH breakdown pathways. These pathways, along with other data, will help determine if the primary ebullition source could be PAH-fueled methanogenesis. PAH metabolic intermediates are different between anaerobic and aerobic pathways. Methanogenesis occurs only under strong anaerobic conditions, so anaerobic metabolites would have to be present in high concentrations for ebullition to be fueled primarily by PAH metabolism.

5.4 Laboratory Microcosm Studies

The microcosm studies include comparing methanogenic activity (methanogenesis) between soil core sub-sections and evaluating organoclay metabolism. The laboratory microcosm studies are being conducted at PSU. Each microcosm is described below.

Methanogenesis. The sub-sectioned cores and porewater collected from the Site were used to construct microcosms for methane analysis. To increase the rate of gas production, microcosms are kept at ambient room temperature (approximately 21 degrees Centigrade) instead of colder river-temperature. Methane production from each sub-sectioned core is quantified using gas

chromatography. The results will determine in which layer of the sediment cap methanogenesis is occurring. Testing for each sub-section is being performed in triplicate to account for any unforeseeable variations. Sterile controls are being employed to ensure cross-contamination or other error is not affecting results. Methane quantification is being performed for the samples listed below.

- Location 1 - Cap sand; native sediments/sand.
- Location 2 - Cap sand; native sediments/sand; organoclay.
- Location 13 - Cap sand; native sediments/sand; organoclay.
- Location 14 - Cap sand; native sediments/sand.
- BKGD - native sediments/sand.

Organoclay Metabolism Assessment. Methanogenesis quantification from soil core sections and additional laboratory microcosm studies are being conducted to directly assess whether organoclay can support methane production. To do this, several grams of native sediment and organoclay capping material from Location 13 were used to inoculate suspensions of fresh CETCO and Aquatechnologies organoclay capping material. To help assess process control, three controls were used: (1) organoclay alone and native sediment, (2) organoclay without addition of fresh organoclay, and (3) plain clay without the surfactant. Microcosms will be kept in sulfate-reducing to methanogenic conditions to approximate conditions under which ebullition formation is assumed to occur. Each test condition is being performed in duplicate to further improve process control and help assess variability within the microcosm test.

Because of the typically cooperative relationship between sulfate-reducing and methanogenic bacteria, sulfate reduction and methane production analyses are both included in this assessment. Sulfate concentration changes are being quantified through ion chromatography, and methane production is being quantified through gas chromatography. Concentration changes in these two analytes will be cross-referenced against the mass of initially added organoclay. This will help assess relative microbial activity that fresh organoclay may support based on site-specific microbes.

6.0 ORGANOCLAY MAT OIL ADSORPTION AND PERMEABILITY TESTING

To understand whether the capacity of the organoclay mats after two years in the field retain sufficient oil capacity and permeability to perform as designed, CETCO conducted the following testing on the organoclay mat sample exhumed from the Site on August 26, 2008:

- Oil adsorption capacity test per CETCO test method. CETCO certified that fresh organoclay has a minimum 0.5 lb oil/lb organoclay adsorption capacity.
- Permeability test per ASTM D4491/D2434. CETCO certifies that fresh organoclay reactive core mat (RCM) has a minimum permeability of 1×10^3 cm/s.

The results are in Attachment E and indicate that the RCM still has significant adsorption capacity and that the permeability is still high.

7.0 PRELIMINARY CONCLUSIONS

Preliminary conclusions are based on the objectives presented in the DQOs. These preliminary conclusions consider field observations and the data compiled from the ebullition and sheen investigation to date. Work underway at PSU and UT will provide additional information to help determine if the sediment cap is protective. A complete report of the ebullition and sheen investigation will be prepared for the 2009 Annual Report.

The following presents the five DQOs, and preliminary conclusions.

DQO #1: Determine whether the sediment cap is protective of surface water; specifically in the areas of concern. Determine whether the sediment cap is effective in preventing NAPL seeps to the river.

Preliminary Conclusions for DQO #1: Figures G-2, G-2a, and G-2b show the sampling locations. Porewater data collected from the cap sand along the shoreline in the WC are below ROD and risk-based comparison criteria (Figure G-13 and Table G-6 present porewater data). Porewater samples collected from the shoreline of the TFA and south of the TFA were generally non-detect or below comparison criteria for PAHs, with the exception of some low level cPAH detections exceeding comparison criteria in porewater from PW-22 and PW-28 located shoreward of the granular organoclay. The cPAH concentrations in these samples were 0.0971 µg/L (PW-22) and 0.2154 µg/L (PW-28) and total PAH concentrations were 0.6749 µg/L and 0.5756 µg/L, respectively (Figures G-14 and G-15 and Table G-6). Porewater concentrations in the cap sand between the bank and the native sediment in the bank in the TFA would be expected to have significantly higher concentrations of PAHs if sheen were migrating from residual creosote in the bank though the cap sand into surface water.

One other porewater sample collected in the TFA contained low level cPAH concentrations; PW-32 where cPAHs were detected at 0.115 µg/L. Total PAHs in the porewater samples ranged from not detected to 77 µg/L.

These low level concentrations would not be expected to result in shoreline sheen. In addition, the low level cPAHs detected in the porewater within the cap sand is from 8 to 10 inches into the cap sand which is over 1.5 feet below the surface water interface when the armoring thickness is taken into account.

Samples collected of sediment cap sand material in select locations from the WC and TFA were analyzed for PAHs. Results indicated that the samples were below ROD sediment cleanup goals and DEQ's sediment bioaccumulation screening level values (DEQ, 2007). Samples collected from the native sediment beneath the sediment cap material were elevated as expected, demonstrating the ability of the sediment cap to attenuate PAHs.

Sheen was frequently observed across the shoreline in areas where residual creosote is known to be present beneath the sediment cap, in areas where there has been no evidence of residual creosote, and along the shoreline of the Triangle Park property, south of the Site. The sheens in all of these areas have common characteristics: iridescent, blocky, and does not re-coalesce when disturbed. The fact that it does not re-coalesce when disturbed indicates a bacterial sheen. Photomicrographs of the sheen taken by UP also suggest that there are bacteria in the sheen. Sheen samples collected in the WC and the TFA do not contain elevated PAHs concentration above the adjacent surface water, and are significantly lower than sampling data from pre-cap sheens. In general, observed sheens were odorless. However, there appears to be a naphthalene odor associated with sheen in WC. This odor may be associated with upland groundwater discharging over the sediment cap, and not related to observed sheen. This odor is present in late summer when the river levels drop and the upland groundwater levels are still high.

Dioxin concentrations from crayfish sampling in 2006 and 2008 are below the Oregon Department of Human Services health advisory level, and well below the average for Portland Harbor. This information supports the position that the sediment cap is protective of surface water.

DQO #2: Determine whether or not the degradation is breaking down the organoclay, and if so, determine how/whether it significantly affects the life of the organoclay as it pertains to the Site.

Preliminary Conclusions for DQO #2: Ebullition has been observed along the Site shoreline, and several hundred feet beyond the shoreline in the Willamette

River. Ebullition is more prevalent in the mid-to-late summer when river levels are low, and occurs over a longer period of time in the two areas where granular organoclay was placed. The "amount" of ebullition accounted for from survey gas production rates, flux chamber gas production, and the preliminary PSU laboratory results show that ebullition in areas of granular organoclay is significantly higher than in other sediment cap areas (or cap layers, i.e. cap sand and native sediment).

UT preliminary results suggest that the capacity of the organoclay to sorb NAPL has not decreased and the available capacity remains high. Although there appears to be material within the organoclay that stimulates methanogenesis and increases the rate of ebullition, it does not appear to be adversely affecting the capacity or longevity of the organoclay to sorb NAPL and dissolved PAHs.

Results from the flux chamber sampling also support the preliminary conclusion that the granular organoclay is performing as designed. The PAH concentrations in water from flux chambers located overtop of the granular organoclay in the TFA were below the comparison criteria with the exception of water from FC-5G where chrysene measured at 0.058 µg/L exceeded the comparison criteria (0.018 µg/L). No other water samples from the 6 flux chambers placed overtop of the granular organoclay in the TFA exceeded any comparison criteria. The flux chambers in Willamette Cove were placed just outside of the organoclay footprint because of low Willamette River levels.

DQO #3: Determine whether the ebullition is a significant contaminant migration pathway through the sediment cap.

Preliminary Conclusions for DQO #3: Two co-located flux chambers were placed in 10 locations. In each location, one flux chamber was placed over an ebullition pathway and the other adjacent where no ebullition was observed. During the course of the sampling event, one set of flux chambers "washed away" and therefore, water and gas samples were collected from nine co-located chambers.

Gas was only collected from the chambers placed over the ebullition pathways. Generally, gas collected from flux chambers placed overtop granular organoclay contained high relative concentrations of methane, while gas generated outside the organoclay footprint included a lower ratio of methane to other gases. This suggests that methanogenesis is the primary process occurring within the granular organoclay, and other degradation processes, including methanogenesis, are occurring elsewhere.

Porewater from each flux chamber was collected daily for four days through an XAD column. Analytical results of porewater collected from flux chambers placed over ebullition locations have higher concentrations of COCs relative to porewater collected from adjacent chambers. However, with the exception of at FC-5G where chrysene was measured at 0.058 µg/L, which is slightly above the comparison criteria, all porewater concentrations are well below comparison criteria. The total cPAHs from FC-01G exceeded the ROD comparison criteria of 0.031µg/L; however, none of the individual cPAHs in that sample exceeded the individual comparison criteria for cPAHs.

The results of the gas and water sampling indicate that ebullition creates a preferential pathway for contaminant migration but not a significant pathway threatening the protectiveness of the sediment cap.

DQO #4: Determine whether gas is passing through the organoclay mats or accumulating beneath the mats.

Preliminary Conclusions for DQO #4: The ebullition survey did not demonstrate that ebullition was significantly greater in water surrounding the mats. The rates of ebullition were relatively low overtop and surrounding the organoclay mats. Ebullition was noted from the northeast corner of organoclay Mat #2. However, when pulling back the corner to collect a sample, the sand placed over the rock armoring beneath the mat was noticeably missing; the sand had apparently been washed into the rock armoring, providing a higher permeability material directly beneath that area of the mat. Dependent on the extend of this sand washing beneath Mat #2, a preferential pathway for gas to migrate toward the edges of mat in lieu of migration through the mat is created. Visual inspection of the back side pulled back corner of the mat did not reveal any staining or signs that suggest contamination is penetrating the mat. No visual sign of sheens associated with the ebullition surrounding the mats was observed.

Three porewater samples were collected along the riverward side of the mat (described as locations PW-16a and b, PW-17, and PW-32 in Appendix G). At location PW-32 (southern edge of the mat) cPAHs were detected at a concentration (0.115 µg/L) above the ROD criteria for human health fish consumption of 0.031 µg/L. The geologic log for the nearby boring collected during the investigation shows that the sand and armoring portion of the cap are mixed and only 1.5 feet thick instead of the 3-foot combined design thickness.

At Location 16, the western corner of Mat #2, porewater was sampled from above the mat and from below the mat. Concentrations above the mat were significantly lower than those below the mat suggesting that the mat is performing as expected. Additional porewater samples collected around the

mat did not contain elevated PAHs. In summary, the mats appear to be performing as designed. However, in the northern area of Mat#2, the sand placed directly beneath the mat appears to have mixed into the armoring, leaving a higher permeability zone directly beneath the mat.

DQO #5: Determine origin of sheen and whether sheen poses a threat to the environment.

Preliminary Conclusions for DQO #5:

The resulting data from the samples collected for DQO#1 provide a strong argument that periodically observed shoreline sheen is not the result of PAHs migration through the sediment cap at the site. Porewater samples collected from the cap sand material in multiple locations in the TFA and the WC riverbank, downgradient from the most likely source of a potential residual creosote source, did not provide evidence that the origin and nature of the sheen is associated with contamination from the Site.

PAH concentrations in the four samples collected in July 2008 are significantly lower than concentrations that would be indicative of, or produce, sheen. Concentrations of the surface water with sheen were similar to the adjacent surface water without sheen and, in one case, the concentration in the surface water without sheen was higher than the concentration of the surface water with sheen. There were no detections of TPH in the sheen samples or adjacent surface water samples.

Dr. Alexander, a microbiology professor from UP, collected sheen samples from four locations for a microscopic interpretation. His believes the sheen is biological, and not chemical in nature. Again, the sheen is blocky in appearance and does not re-coalesce when disturbed to further support an arguement that the sheens are biological in nature.

The lines of evidence compiled thus far suggest that the shoreline sheens observed along the riverbank in the summer and early fall are not a result of contaminant (creosote) migration through the sediment cap resulting in sheen.

8.0 REFERENCES

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Table G-1
Data Quality Objectives
McCormick and Baxter Superfund Site
Portland, Oregon

Statement of Problem	Decision	Inputs to Decision	Boundaries	Decision Rule	Limits on the Decision Errors	Optimize the Design
Based on recent observation of sheen along the shoreline and prolific ebullition, it is uncertain whether the sediment cap is protective.	Determine whether the sediment cap is protective of surface water; specifically in the areas of concern. Determine whether the sediment cap is effective in preventing NAPL seeps to the river.	1) Surface water and inter-armoring porewater sampling data 2002 through present. 2) Sheen sampling data. 3) Crayfish data collected as part of the O&M activities. 4) 2008 investigation data as described below, which address specific concerns to be resolved.	Surface water, inter-armoring, and sub-armoring sampling from within the cap boundary conducted semi-annually since the cap was installed; upgradient and downgradient surface water data since cap was installed; analytical data from sheen samples collected from along the M&B shoreline overtop of the cap. Additional data and information collected as part of the ebullition and sheen investigation.	If concentrations exceed reference criteria in the surface water or inter-armoring water over an area of concern (former TFA/Willamette Cove); it is possible that the sediment cap is not protective in those isolated areas. The team will review the data and make a recommendation regarding protectiveness and whether additional remedial measures should be implemented. If concentrations in surface water and inter-armoring do not exceed reference criteria in areas of concern (former TFA and Willamette Cove), and contaminant distribution does not suggest that contaminants are entering the sediment cap at concentration that will penetrate the cap, then the cap will be considered protective of human health and the environment.	Few surface water samples are collected across a large capped area; not necessarily targeting areas where sheen or ebullition has been observed. However, the distribution of O&M surface water, inter-armoring, and sub-armoring water sampling locations is targeted to areas of groundwater discharge, native sediment hot spots, near shore potential seeps, with few ambient sampling locations. Detection limits for analytical sampling will be those currently available by the analytical laboratory conducting the analyses. The goal will be to acheive low enough detection limits to compare to reference criteria. Sufficient volume for the flux chamber sampling is required to obtain low enough detection limits to analyze organic constituents in the gas samples and low level PAHs in porewater. The flux chambers must have sufficient volume in the chamber so that surface water bypass does not occur during sampling.	Collect samples from the surface water, within the sediment cap, and native sediment to determine contaminant pathways and significance of contaminant flux to the surface water. Detailed methods are described below in each specific problem description. Determine the area of impact (i.e., sheen extent and timing, ebullition extent and timing), should impact be discovered, to understand overall effect on protectiveness of the sediment cap.
The ebullition appears to occur primarily on top of and surrounding the areas where granular organoclay is present in the sediment cap. Gas voids were observed at the top of the organoclay/bottom of the cap sand in cores collected from the organoclay areas in 2006. It is uncertain whether the increase in ebullition over the granular organoclay is related to breakdown of the organoclay.	Determine whether the degradation is breaking down the organoclay, and if so, determine how/whether it significantly affects the life of the organoclay as it pertains to McCormick and Baxter.	1) Porewater and sediment samples (cores) from distinct layers within and beneath the sediment cap to determine which zone produces the most gas via anaerobic microbial activity. (PSU) 2) Porewater samples collected via Henry samplers to determine PAHs concentrations, geochemical parameters, and putative metabolites produced by the anaerobic degradation of PAHs. (PSU) 3) CETCO analysis of fresh versus field organoclay (from the mats) to determine whether the the size of the organoclay molecule has decreased (i.e., degraded). 4) Organoclay capacity after 2 years in field.	Granular organoclay and organoclay mats; data collected from previous and current studies.	If the organoclay molecule is smaller than the fresh organoclay, thus assumed to have been degraded, then additional work may be required to determine the rate and capacity of the organoclay. If the zone of gas generation is occurring within the organoclay, then contaminant transport form the underlying native sediments is not an issue. If putative metabolites of PAHs are detected, then, at a minimum, degradation of PAHs is occurring.	Because this is a lab-based experiment, rates of degradation in the field may be different from rates observed in the lab. Because the granular organoclay is situated above the most contaminated areas of the sediment, then that, in itself, would make the sediment more reducing and perhaps have a higher activity of methanogenesis. Because we do not have a temporal measurement of methane production in the sediments before and after the application of organoclay, this may not be possible to determine.	Data collection will be optimized by collecting cores befpre selecting cores for the degradation study. This will ensure cores with native sediment contamination are selected.
UT research on McCormick and Baxter and other research based on the literature review suggest that ebullition is a potential contaminant transport pathway through the sediment cap. The research also suggests that the ebullition contaminant transport pathway is insignificant relative to normal advective flow through a sediment cap. It is uncertain whether the ebullition observed at the Site is a potentially significant contaminant transport pathway through the sediment cap.	Determine whether the ebullition is a significant contaminant migration pathway through the sediment cap.	1) Co-located gas and porewater sampling in areas with ebullition. 2) O&M surface water, inter-armoring, and sub-armoring water sampling conducted semi-annually since sediment cap installation. 3) Laboratory studies on gas facilitated contaminant transport using M&B site materials conducted in 2006. 4) Ebullition surveys to understand distribution and frequency.	Areas with ebullition within the cap boundary. Historic data since cap installation and summer/fall 2008 data.	If the co-located samples suggest that there is locally significant gas-facilitated contaminant transport through the sediment cap, then additional remedial actions or monitoring may be required.	Not all ebullition pathways can be evaluted, thus 10 locations will be selected. Flux chamber co-located pairs will be placed in areas of frequent ebullition and one pair will be placed in a background area where no ebullition is present. The goal is to have a statistically valid number of locations to validate the significance of the results.	Locations will be selected on the basis of known areas of sediment contamination underlying the sediment cap. These are the locations where gas-facilitated transport would be expected to be observed. A background location will be selected for one of the flux chamber pairs.
Based on field observations, it appears that ebullition is more prominent surrounding Organoclay Mat #2 and infrequent ebullition has been observed migrating through the mats. No sheens have been observed to be associated with this ebullition. It is uncertain whether the organoclay mats are performing as designed (i.e., is gas passing through the mats or preferentially migrating to the edges of the mats?).	Determine whether gas is passing through the organoclay mats or accumulating beneath the mats.	1) Ebullition survey. 2) Use a backhoe to remove the armoring and sand from overtop a small area on the Organocly Mat #2. Collect a porewater sample from directly beneath the organoclay mat using a Henry sampler. Manually lay the organoclay mat back to look for physical signs of gas accumulation, such as a large bubbles emitting from the sides of the mat and/or gas voids present beneath the mat. Look for signs of NAPL staining beneath organoclay mats. 3) Surface water, inter-armoring, and subarmoring water samples from locations overlying the mats, 4) SPME sample collected directly outside of the mat footprint to determine whether placement of the mat has caused contaminants to migrate into the sediment cap by the loading from the mat placement. (UT) 5) Laboratory loading of a organoclay mat over native contaminated sediment to simulate armoring loading while passing gas through to examine contaminant release. (UT)	Organoclay Mat #2.	If gas is passing through the mats, and there is no sign of gas accumulation beneath the mats; then mats are functioning as designed in regards to gas passing through the mats. If there are signs of NAPL staining beneath the mats, and the NAPL does not appear to be migrating laterally along the mat, then the mats are functioning as designed in regards to preventing NAPL as sheen migration through the mats. If gas has accumulated beneath the mats and preferential pathways of gas migrating toward the edges of the mats in the underlying sand are observed, or NAPL accumulation is observed, then the mats may not be functioning as designed. If the laboratory loading studies show that gas is not passing through the mats, then the mats may not be functioning as designed or the gas migrating to the edge of the mat may be the result of placement of the mat, not the perfarmance of the mat.	There is not currently a protectiveness issue, even if gas is migrating to the edge of the mats, as no sheens have been observed associated with ebullition surrounding the mats. A decision on whether the mats are functioning properly will be based on a number of observations estimating whether we should anticipate NAPL accumulation undeneath the mat that potentially could cause sediment cap performance issues in the future.	Based on observation made when the organoclay mat is pulled back at the edge - additional sampling may be proposed.
Sheens have been observed in the former TFA and Willamette Cove areas that appear to be associated with the discharge of groundwater from the riverbank. Additional sheens have been observed along the riverbank between Organoclay Mat #2 and the City of Portland outfall. There is no clear association for these sheens, they appear randomly during a falling tide. The source/nature of the sheens is unknown and it is uncertain whether the sheens pose a significant risk to the environment.	Determine origin of sheen and whether sheen poses a threat to the environment. Analytical concentrations for contaminants of concern (PAHs, PCP, As, Cu, Cr, and Zn).	1) Microscope study to determine whether any of the sheens are bacterial. 2) SPME and porewater sampling along transects within the shoreline. Samples will be collected at 6-inch depth intervals with analysis of PAHs, PCP, and As, Cu, Cr, and Zn. Field parameters of conductivity, DO, temperature, pH, turbidity, and Eh will be recorded for the porewater samples collected via Henry's samplers. 3) Weekly sheen survey. 4) Sheen sampling.	Former TFA, Willamette Shoreline, and Willamette Cove areas.	If the sheens are microbial; then sheens may not be significant and no action will be taken. If sheens are composed of PAHs or their breakdown products at concentrations above reference criteria, then the significance will be evaluated with the project team and a decision made regarding additional remedial action measures.	1) There may be multiple sources of the sheen. 2) Analytically, it can be difficult to differentiate between the sheen and the groundwater discharging from the riverbank.	Porewater from multiple depths and locations will be evaluated to better understand the potential contaminant migration into the sediment cap.

Notes:

NAPL = nonaqueous phase liquid
PAH = polynuclear aromatic hydrocarbon
M&B = McCormick and Baxter
O&M = operatons and maintenance
Site = McCormick and Baxter Superfund Site

TFA = Tank Farm Area
Zn = zinc
PCP = pentachlorophenol
AS = arsenic
Cu = copper

SPME = solid phase microextraction
DO = dissolved oxygen
UT = University of Texas
PSU - Portland State University

Table G-2
Weekly Sheen Observations
McCormick and Baxter Superfund Site
Portland, Oregon

Sheen Inspection Date	Willamette Cove	Former Tank Farm Area	Former Waste Disposal Area	M&B Stormwater Discharge Area	City Stormwater Discharge Area	Notes (on ebullition)
10-Jul-08	NS	NS	NS	NS	NS	Moderate ebullition, no odor.
15-Jul-08	MS, slight odor	NS	NS	NS	BS, no odor	Little to no ebullition, no odor.
22-Jul-08	BS, no odor	BS, no odor	NS	BS, no odor	BS, no odor	No odor.
31-Jul-08	NS	NS	NS	NS	NS	Ebullition observed in TFA and WC. No odor.
8-Aug-08	NS	BS, no odor	NS	NS	NS	Ebullition observed in TFA and WC. No odor.
13-Aug-08	BS, no odor	NS	NS	NS	NS	Moderate ebullition in TFA and WC. No odor.
19-Aug-08	BS, no odor	NS	NS	NS	NS	Ebullition observed in TFA and WC. No odor.
26-Aug-08	SS, Sheen observed in trench locations with creosote like odor during push probe activities for Sheen and Ebullition Study	SS, Sheen observed in trench locations with creosote like odor during push probe activities for Sheen and Ebullition Study	NS	NS	NS	Ebullition observed in TFA and WC. No odor.
4-Sep-08	BS, no odor	SS, Sheen observed with ebullition, slight creosote like odor in area of a push probe location for Sheen and Ebullition Study. This area has been subsequently repaired with granular organoclay.	NS	NS	NS	Ebullition observed in TFA and WC. No odor.
10-Sep-08	BS, no odor	BS	NS	NS	NS	Ebullition observed in TFA and WC. No odor.
15-Sep-08	NS	NS	NS	NS	NS	Ebullition observed in TFA and WC, no odor
24-Sep-08	BS, no odor, Sheen observed from shoreline up to 30 feet into the Willamette Cove.	NS	NS	NS	NS	Ebullition observed in TFA and WC. No odor.
30-Sep-08	NS	NS	NS	NS	NS	Ebullition observed in TFA. No odor.
13-Oct-08	NS	NS	NS	NS	NS	No ebullition observed.
21-Oct-08	NS	NS	NS	NS	NS	No ebullition observed.

Notes:
NS = no sheen
SS = Slight Sheen
MS = moderate sheen
BS = biological sheen
TFA = Tank Farm Area
WC = Willamette Cove
Shading = Observed Sheen

Table G-3
Sheen Sampling Data: July 2008
McCormick and Baxter Superfund Site
Portland, Oregon

SAMPLE LOCATION		Sediment Cap Performance Goals		Comparison Criteria			Willamette Cove			Near City of Portland Outfall			Between OC Matts and City of Portland Outfall			Tank Farm Area Shoreward of OC Mats	
Sample Type		McCormick & Baxter Record of Decision, 1996, Ambient Water Quality Criteria (AWQCs)		EPA Current, 2007, National Recommended Water Quality Criteria (NRWQCs)		EPA National Primary Drinking Water Regulations (NPDWRs)	Sediment with sheen	Surface water with sheen	Surface water 5 feet from sheen	Sediment with sheen	Surface water with sheen	Surface water 5 feet from sheen	Sediment with sheen	Surface water with sheen	Surface water 5 feet from sheen	Sediment with sheen	Surface water 5 feet from sheen
Sample ID							MBSD0708-WCS	MBSD0708-WCS	MBSD0708-WCA	MBSD0708-COS	MBSD0708-COS	MBSD0708-COA	MBSD0708-TFS	MBSD0708-TFS	MBSD0708-TFA	MBSD0708-MBS	MBSD0708-MBA
Sample Date							7/16/2008	7/16/2008	7/16/2008	7/17/2008	7/17/2008	7/17/2008	7/16/2008	7/16/2008	7/16/2008	7/16/2008	7/16/2008
Sample Time							15:00	15:00	15:20	15:15	14:50	15:00	15:55	15:30	15:45	15:00	15:20
		Aquatic Life (chronic)[1]	Human Health (fish consumption only)[1]	Aquatic Life (chronic)[2]	Human Health (consumption of organism only)[2]	Maximum Contaminant Levels (MCLs)[3]											
CONTAMINANT OF INTEREST																	
TPH-HCID NW-TPH Methodology							mg/kg	µg/L	µg/L	mg/kg	µg/L	µg/L	mg/kg	µg/L	µg/L	mg/kg	µg/L
Gasoline Range Hydrocarbons							26.6 U	0.238 U	0.238 U	23.6 U	>0.238	0.238 U	26.5 U	0.238 U	0.238 U	22.9 U	0.238 U
Diesel Range Hydrocarbons							66.6 U	0.600 U	0.600 U	59 U	>0.600	0.600 U	66.2 U	0.600 U	0.600 U	57.4 U	0.600 U
Heavy oil Hydrocarbons							133 U	0.600 U	0.600 U	118 U	0.600 U	0.600 U	132 U	0.600 U	0.600 U	115 U	0.600 U
Percent Dry weight (Solids)							74.2			77.1			71.1			80.2	
Total Organic Carbon							**1680**	**3.2**	**1.1**	**2620**	**1.5**	**1.6**	**3040**	**1.9**	**1.2**	**5390**	**1.1**
Polynuclear Aromatic Hydrocarbons		µg/L	µg/L		µg/L	µg/L	µg/kg	µg/L	µg/L	µg/kg	µg/L	µg/L	µg/kg	µg/L	µg/L	µg/kg	µg/L
Acenaphthene	L	520			990		18.0 U	**0.478**	**0.43**	17.3 U	**0.153**	**0.328**	18.6 U	0.100 U	**0.126**	**160.0**	**0.155**
Acenaphthylene	L						18.0 U	0.100 U	0.100 U	17.3 U	0.100 U	0.100 U	18.6 U	0.100 U	0.100 U	16.5 U	0.100 U
Anthracene	L				40,000		18.0 U	0.100 U	0.100 U	17.3 U	0.100 U	0.100 U	18.6 U	0.100 U	0.100 U	16.5 U	0.100 U
Benzo (a) anthracene	H, C				0.018		18.0 U	0.100 U	0.100 U	17.3 U	0.100 U	0.100 U	18.6 U	0.100 U	0.100 U	16.5 U	0.100 U
Benzo (a) pyrene	H, C				0.018	0.2	18.0 U	0.100 U	0.100 U	17.3 U	0.100 U	0.100 U	18.6 U	0.100 U	0.100 U	16.5 U	0.100 U
Benzo (b) fluoranthene	H, C				0.018		18.0 U	0.100 U	0.100 U	**26.5**	0.100 U	0.100 U	**18.6**	0.100 U	0.100 U	16.5 U	0.100 U
Benzo (ghi) perylene	H, C						18.0 U	0.100 U	0.100 U	17.3 U	0.100 U	0.100 U	18.6 U	0.100 U	0.100 U	16.5 U	0.100 U
Benzo (k) fluoranthene	H, C				0.018		18.0 U	0.100 U	0.100 U	**18.3**	0.100 U	0.100 U	18.6 U	0.100 U	0.100 U	16.5 U	0.100 U
Chrysene	H, C				0.018		18.0 U	0.100 U	0.100 U	**26.9**	0.100 U	0.100 U	**30.4**	0.100 U	0.100 U	16.5 U	0.100 U
Dibenzo (a,h) anthracene	H, C				0.018		18.0 U	0.200 U	0.200 U	17.3 U	0.200 U	0.200 U	18.6 U	0.200 U	0.200 U	16.5 U	0.200 U
Fluoranthene	H		54		140		18.0 U	0.100 U	0.100 U	**58.4**	0.100 U	0.100 U	**49.0**	0.100 U	0.100 U	16.5 U	0.100 U
Fluorene	L				5300		18.0 U	**0.106**	**0.135**	17.3 U	0.100 U	**0.135**	18.6 U	0.100 U	0.100 U	**33.8**	0.100 U
Indeno (1,2,3-cd) pyrene	H, C				0.018		18.0 U	0.100 U	0.100 U	17.3 U	0.100 U	0.100 U	18.6 U	0.100 U	0.100 U	16.5 U	0.100 U
Naphthalene	L	620					18.0 U	**1.010**	0.100 U	17.3 U	0.100 U	0.100 U	18.6 U	0.100 U	0.283	16.5 U	0.100 U
Phenanthrene	L						18.0 U	0.100 U	0.100 U	17.3 U	0.100 U	0.100 U	**26.5**	0.100 U	0.100 U	16.5 U	0.100 U
Pyrene	H				4,000		18.0 U	0.100 U	0.100 U	46.6	0.100 U	0.100 U	**37.0**	0.100 U	0.100 U	16.5 U	0.100 U
Total LPAHs							54.0 U	**1.7440**	**0.7650**	51.9 U	**0.4030**	**0.5955**	**73.0**	0.300 U	**0.5175**	**243.7**	**0.4050**
Total HPAHs							90.0 U	0.5500 U	0.5500 U	**220.0**	0.5500 U	0.5500 U	**190.8**	0.550 U	0.5500 U	82.5 U	0.5500 U
Total CPAHs			0.031				72.0 U	0.4500 U	0.4500 U	**115.0**	0.4500 U	0.4500 U	**104.8**	0.450 U	0.4500 U	66.0 U	0.4500 U
Total PAHs							144.0 U	**2.2940**	**1.3150**	**271.9**	**0.9530**	**1.1455**	**263.8**	0.850 U	**1.0675**	**301.1**	**0.9550**

Notes:

TPH = total petroleum hydrocarbons
U = undetected
µg/L = micrograms per liter

J = estimated value
HCID = hydrocarbon identification
µg/Kg = micrograms per kilogram
L = low molecular weight
H = high molecular weight
C = carcinogenic
mg/kg = milligrams per kilogram
PAHs = polynuclear aromatic hydrocarbons
Shaded = Indicates lowest value between Sediment Cap Performance Goals and Comparison Criteria

[1] The 1996 Record of Decision (ROD) specifies the remedial action objects 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 Willamett

[2] National Recommended Water Quality Criteria (NRWQCs) published as of August 15, 2007 are included for comparison (see http://www.epa.gov/waterscience/criteria/wqcriteria.html).
The current publication includes criteria revisions published in 2002 National Recommended Water Quality Criteria: 2002 table (EPA-822-R-02-047) and 2003 Revised human Health Water Quality Criteria (EPA-822-F-03-012).
Note that the aquatic life chronic criteria for pentachlorophenol has been adjusted to site-specific pH (7.5, representing a mid-range of the pH values measured in surface water at the site), and therefore differs from the standard table value.
Criteria for metals (Cr, Cu, Zn) have not been adjusted for site-specific hardness. Carcinogenic risk-based numbers reflect a carcinogenicity risk of 10-6.

[3] National Primary Drinking Water Regulations Maximum Contaminant Levels (MCLs) promulgated as of August 15, 2007 are included for comparison (see http://www.epa.gov/safewater/contaminants/index.html#primary).

Table G-4
Flux Chamber Summary Data: Summer 2008
McCormick and Baxter Superfund Site
Portland, Oregon

SAMPLE LOCATION		Sediment Cap Performance Goals			Willamette Cove								TFA Over Organoclay Footprint			
Sample ID		McCormick & Baxter Record of Decision, 1996, Ambient Water Quality Criteria (AWQCs)			WCFC-1G-W		WCFC-1NG-W		WCFC-3G-W		WCFC-3NG-W		TFAFC-4G-W		TFAFC-4NG-W	
Sample Date					9/8/2008 through 9/11/2008		9/8/2008 through 9/11/2008		9/8/2008 through 9/11/2008		9/8/2008 through 9/11/2008		9/8/2008 through 9/11/2008		9/8/2008 through 9/11/2008	
CONTAMINANT OF CONCERN		Human Health (fish consumption only)[1]	Human Health (consumption of organism only)[2]	Maximum Contaminant Levels (MCLs)[3]												
D 1946/E Gas Sample																
Carbon dioxide (%)					0.6	U	NM		2.6		NM		12		NM	
Carbon monoxide (%)					0.6	U	NM			U	NM		0.17	U	NM	
Methane (%)					2.6		NM		47		NM		76	E	NM	
Oxygen (%)					28		NM		3.6		NM		3.3		NM	
Total Percentage					30.6		NM		53.2		NM		91.3		NM	
VOCs (TO-15) Gas Sample [ppb(v/v)]																
1,2,4-Trichlorobenzene					10	U	NM		10	U	NM		18	U	NM	
1,2,4-Trimethylbenzene					2	U	NM		2.1		NM		3.6	U	NM	
1,3,5-Trimethylbenzene					2	U	NM		2	U	NM		3.6	U	NM	
Benzene					2	U	NM		2	U	NM		26		NM	
Ethylbenzene					2	U	NM		3.2		NM		7.6		NM	
m-Xylene & p-Xylene					2.4		NM		11		NM		18		NM	
o-Xylene					2	U	NM		4		NM		6.6		NM	
Toluene					4.9		NM		16		NM		20		NM	
Polynuclear aromatic hydrocarbons (µg/L)																
Acenaphthene	L		990		0.03500		0.05333		3.00000	E	0.81667		18	E	0.85	
Acenaphthylene	L				0.00317		0.00142	J	0.01000		0.00542		0.066		0.0079	
Anthracene	L				0.00625		0.00183		0.00258		0.00133		0.15		0.008	
Benzo (a) anthracene	H, C		0.018		0.00800		0.00083	U	0.00083	U	0.00083	U	0.0025		0.0012	U
Benzo (a) pyrene	H, C		0.018	0.2	0.00775		0.00083	U	0.00053	B J	0.00083	U	0.0011	U	0.001	U
Benzo (b) fluoranthene	H, C		0.018		0.01667		0.00083	U	0.00083	U	0.00083	U	0.0028		0.001	U
Benzo (ghi) perylene	H, C				0.00583		0.00083	U	0.00045	B J	0.00083	U	0.0011	U	0.001	U
Benzo (k) fluoranthene	H, C		0.018		0.00758		0.00076	J	0.00068	J	0.00058	J	0.0013		0.00042	J
Chrysene	H, C		0.018		0.01750		0.00083	U	0.00083	U	0.00083	U	0.0038		0.0016	
Dibenzo (a,h) anthracene	H, C		0.018		0.00133		0.00010	J	0.00018	J	0.00013	J	0.001	U	0.001	U
Fluoranthene	H	54	140		0.03500		0.00658		0.00450		0.00417	B	0.068		0.017	
Fluorene	L				0.02083		0.03250		0.19167		0.09167	B	6.000	E	0.270	
Indeno (1,2,3-cd) pyrene	H, C		0.018		0.00600		0.00083	U	0.00083	U	0.00083	U	0.001	U	0.001	U
Naphthalene	L				0.06250	U J	0.05417	U J	0.06000	U J	0.06333	U J	63.00	E J	3.000	E J
Phenanthrene	L				0.02417		0.01750		0.02917		0.01417		1.100		0.059	
Pyrene	H		4,000		0.03167		0.00708		0.00808		0.00725		0.048		0.013	
Total LPAHs					0.089	J	0.107	J	3.233	J	0.929	J	88.316	J	4.195	J
Total HPAHs					0.137		0.01453	J	0.014	J	0.0121	J	0.1264		0.0190	J
Total CPAHs		0.031			0.07067		0.00076	J	0.002	J	0.0007	J	0.01040		0.00202	J
Total PAHs					0.227	J	0.121	J	3.248	J	0.9414	J	88.442	J	4.227	J

Please refer to notes on last page of this table.

Table G-4
Flux Chamber Summary Data: Summer 2008
McCormick and Baxter Superfund Site
Portland, Oregon

SAMPLE LOCATION		Sediment Cap Performance Goals			TFA Over Organoclay Footprint								TFA Embayment			
Sample ID					TFAFC-5G-W		TFAFC-5NG-W		TFAFC-6G-W		TFAFC-6NG-W		TFAFC-7G-W		TFAFC-7NG-W	
Sample Date					9/8/2008 through 9/11/2008		9/8/2008 through 9/11/2008		9/8/2008 through 9/11/2008		9/8/2008 through 9/11/2008		9/8/2008 through 9/11/2008		9/8/2008 through 9/11/2008	
CONTAMINANT OF CONCERN		Human Health (fish consumption only)[1]	Human Health (consumption of organism only)[2]	Maximum Contaminant Levels (MCLs)[2]												
D 1946/E Gas Sample																
Carbon dioxide (%)					10		NM		11		NM		2.8		NM	
Carbon monoxide (%)					0.24	U	NM		0.66	U	NM		0.48	U	NM	
Methane (%)					86	E	NM		110		NM		61		NM	
Oxygen (%)					1.8		NM		4.3		NM		9.2		NM	
Total Percentage					97.8		NM		125.3		NM		73		NM	
VOCs (to-15) Gas Sample [ppb(v/v)]																
1,2,4-Trichlorobenzene					18	U	NM		21	J	NM		10	U	NM	
1,2,4-Trimethylbenzene					4.4		NM		4.3	U	NM		2	U	NM	
1,3,5-Trimethylbenzene					3.6	U	NM		4.3	U	NM		2	U	NM	
Benzene					7.6		NM		6.9		NM		2	U	NM	
Ethylbenzene					9		NM		8.3		NM		3		NM	
m-Xylene & p-Xylene					29		NM		26		NM		11		NM	
o-Xylene					8.9		NM		7.6		NM		3.3		NM	
Toluene					39		NM		49		NM		18		NM	
Polyaromatic Hydrocarbons (ug/L)																
Acenaphthene	L		990		0.16		0.16		0.082		0.073		0.05917		0.02833	
Acenaphthylene	L				0.0017	J	0.0021		0.0014	J	0.0012	J	0.00117	J	0.00092	J
Anthracene	L				0.0038		0.0026		0.0032		0.0021		0.00325		0.00117	
Benzo (a) anthracene	H, C		0.018		0.0028		0.001	U	0.001	U	0.001	U	0.00083	U	0.00083	U
Benzo (a) pyrene	H, C		0.018	0.2	0.001	U	0.001	U	0.001	U	0.001	U	0.00083	U	0.00083	U
Benzo (b) fluoranthene	H, C		0.018		0.0041		0.001	U	0.0011	U	0.001	U	0.00083	U	0.00083	U
Benzo (ghi) perylene	H, C				0.001	U	0.001	U	0.001	U	0.001	U	0.00083	U	0.00083	U
Benzo (k) fluoranthene	H, C		0.018		0.0018		0.00024	J	0.00055	J	0.00033	J	0.00083	J	0.00057	J
Chrysene	H, C		0.018		0.058		0.001	U	0.0014		0.001	U	0.00083	U	0.00083	U
Dibenzo (a,h) anthracene	H, C		0.018		0.00045	J	0.001	U	0.001	U	0.001	U	0.00028	J	0.00017	J
Fluoranthene	H	54	140		0.01		0.0064		0.0099		0.0069		0.01000		0.00342	
Fluorene	L				0.042		0.058		0.039		0.033		0.03750		0.01583	
Indeno (1,2,3-cd) pyrene	H, C		0.018		0.001	U	0.001	U	0.001	U	0.001	U	0.00083	U	0.00083	U
Naphthalene	L				1.7	J	0.76	J	0.6	J	0.51	J	0.19167	J	0.12500	J
Phenanthrene	L				0.016		0.021		0.027		0.022		0.02417		0.01083	
Pyrene	H		4,000		0.0094		0.0048		0.0069		0.0047		0.01000		0.00542	
Total LPAHs					1.924	J	1.004	J	0.753	J	0.6413	J	0.317	J	0.182	J
Total HPAHs					0.09	J	0.0114	J	0.0188	J	0.0119	J	0.0211	J	0.0096	J
Total CPAHs		0.031			0.06670	J	0.00024	J	0.00195	J	0.00033	J	0.00111	J	0.00073	J
Total PAHs					2.01	J	1.0151	J	0.7700	J	0.6532	J	0.3380	J	0.1917	J

Please refer to notes on last page of this table.

Table G-4
Flux Chamber Summary Data: Summer 2008
McCormick and Baxter Superfund Site
Portland, Oregon

SAMPLE LOCATION		Sediment Cap Performance Goals	Comparison Criteria		Shoreward of Organoclay Mat #2						Background Location			
Sample ID					TFAFC-8G-W		TFAFC-8NG-W		TFAFC-9G-W		TFAFC-9NG-W		BG-FC-10G-W		BG-FC-10NG-W	
Sample Date					9/8/2008 through 9/11/2008		9/8/2008 through 9/11/2008		9/8/2008 through 9/11/2008		9/8/2008 through 9/11/2008		9/8/2008 through 9/11/2008		9/8/2008 through 9/11/2008	
CONTAMINANT OF CONCERN		Human Health (fish consumption only)[1]	Human Health (consumption of organism only)[2]	Maximum Contaminant Levels (MCLs)[3]												
D 1946/E Gas Sample																
Carbon dioxide (%)					6.8		NM		0.2	U	NM		1.5		NM	
Carbon monoxide (%)					0.19	U	NM		0.2	U	NM		0.56	U	NM	
Methane (%)					36	E	NM		0.2	U	NM		45		NM	
Oxygen (%)					13		NM		25		NM		9.3		NM	
Total Percentage					55.8		NM		25		NM		55.8		NM	
VOCs (to-15) Gas Sample [ppb(v/v)]																
1,2,4-Trichlorobenzene					10	U	NM		10	J	NM		10	U	NM	
1,2,4-Trimethylbenzene					27		NM		2.5		NM		19		NM	
1,3,5-Trimethylbenzene					21		NM		2	U	NM		12		NM	
Benzene					2	U	NM		2	U	NM		2	U	NM	
Ethylbenzene					29		NM		2.6		NM		8.6		NM	
m-Xylene & p-Xylene					30		NM		10		NM		12		NM	
o-Xylene					21		NM		3.1		NM		7.7		NM	
Toluene					15		NM		9.8		NM		11		NM	
Polyaromatic Hydrocarbons (µg/L)																
Acenaphthene	L		990		20.00000	E	1.81818		0.31		4.7	E	0.83333		0.54167	
Acenaphthylene	L				0.10000		0.01182		0.0034		0.019		0.00417		0.00350	
Anthracene	L				0.02636		0.02000		0.0043		0.031		0.00275		0.00217	
Benzo (a) anthracene	H, C		0.018		0.00091	U	0.00091	U	0.001	U	0.001	U	0.00083	U	0.00083	U
Benzo (a) pyrene	H, C		0.018	0.2	0.00091	U	0.00091	U	0.001	U	0.001	U	0.00083	U	0.00083	U
Benzo (b) fluoranthene	H, C		0.018		0.00091	U	0.00091	U	0.001	U	0.001	U	0.00083	U	0.00083	U
Benzo (ghi) perylene	H, C				0.00091	U	0.00091	U	0.001	U	0.001	U	0.00083	U	0.00083	U
Benzo (k) fluoranthene	H, C		0.018		0.00017	J	0.00027	J	0.00031	J	0.00012	J	0.00035	J	0.00039	J
Chrysene	H, C		0.018		0.00091	U	0.00155		0.001	U	0.001	U	0.00083	U	0.00083	
Dibenzo (a,h) anthracene	H, C		0.018		0.00009	J	0.00091	U	0.001	U	0.000055	J	0.00023	J	0.00083	U
Fluoranthene	H	54	140		0.01909		0.05000		0.0079		0.041		0.00633		0.00583	
Fluorene	L				3.90909	E	0.73636		0.094		1.3		0.32500		0.12500	
Indeno (1,2,3-cd) pyrene	H, C		0.018		0.00091	U	0.00091	U	0.001	U	0.001	U	0.00083	U	0.00083	U
Naphthalene	L				72.72727	E J	4.27273	E J	0.12	J	0.15	J	0.11667	J	0.33333	J
Phenanthrene	L				0.26364		0.19091		0.025		0.067		0.01583		0.02000	
Pyrene	H		4,000		0.01545		0.02182		0.0057		0.029		0.00717		0.00483	
Total LPAHs					97.0	J	7.050	J	0.557	J	6.267	J	1.298	J	1.026	J
Total HPAHs					0.0348	J	0.0736	J	0.01391	J	0.070	J	0.0141	J	0.0071	J
Total CPAHs		0.031			0.00026	J	0.00182	J	0.00031	J	0.00018	J	0.0006	J	0.0012	J
Total PAHs					97.1	J	7.1236	J	0.571	J	6.337	J	1.3118	J	1.0376	J

Notes:

ppb = parts per billion
U - not detected above the method detection limit
µg/L= micrograms per liter
J = estimated value
L = low molecular weight
E = PCDE Interference
PAHs = poly nuclear aromatic hydrocarbons
NM = not measured
VOCs = volatile organic compounds
H = high molecular weight
C = carcinogenic
Shaded = Indicates lowest value between Sediment Cap Performance Goals and Comparison Criteria

[1] The 1996 Record of Decision (ROD) specifies the remedial action objects 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 federal and state Ambient Water Quality Criteria (AWQCs).

[2] National Recommended Water Quality Criteria (NRWQCs) published as of August 15, 2007 are included for comparison (see http://www.epa.gov/waterscience/criteria/wqcriteria.html). The current publication includes criteria revisions published in 2002 National Recommended Water Quality Criteria: 2002 table (EPA-822-R-02-047) and 2003 Revised human Health Water Quality Criteria (EPA-822-F-03-012). Note that the aquatic life chronic criteria for pentachlorophenol has been adjusted to site-specific pH (7.5, representing a mid-range of the pH values measured in surface water at the site), and therefore differs from the standard table value. Criteria for metals (Cr, Cu, Zn) have not been adjusted for site-specific hardness. Carcinogenic risk-based numbers reflect a carcinogenicity risk of 10-6.

[3] National Primary Drinking Water Regulations Maximum Contaminant Levels (MCLs) promulgated as of August 15, 2007 are included for comparison (see http://www.epa.gov/safewater/contaminants/index.html#primary).

Table G-5
Sediment Summary Data: Summer 2008
McCormick and Baxter Superfund Site
Portlnad, Oregon

SAMPLE LOCATION		ROD Cleanup Goals[1]	Willamette Cove								Former Tank Farm Area					
Sample Type and depth			Sand Cap		Native		Sand Cap		Native		Native	Sand Cap		Sand Cap		Sand Cap
Sample ID			MBSD0803-1.0		MBSD0803-6.1-6.5		MBSD0804-1.7-2.0		MBSD0809-6.5-6.8		MBSD0810-2.7-3.1	MBSD0817-0-0.5*		MBSD0817-2.6-2.9		MBSD0818-0.5-1.0
Sample Date			8/15/2008		8/25/2008		8/25/2008		8/25/2008		8/25/2008	8/28/2008		8/26/2008		8/26/2008
Sample Time			12:15		12:15		12:40		15:50		16:15	11:00		13:00		14:30
CONTAMINANT OF CONCERN																
Percent Solids (%)			86.8		76.6		82.9		81.5		81.3	84.9		79.6		77.2
TOC (mg/kg)			NM		NM		NM		NM		NM	688		5150		13300
Total Metals (mg/kg)			NM		NM		NM		NM		NM	NM		NM		NM
Arsenic		12	NM		NM		NM		NM		NM	2.5		2.14		6.22
Chromium (III)			NM		NM		NM		NM		NM	5.87		7.19		23.2
Copper			NM		NM		NM		NM		NM	7.97		10.8		29.2
Zinc			NM		NM		NM		NM		NM	33.8		37.8		117
Pentachlorophenol (µg/kg)		100,000	77	U	117		80.2	U	461		82.4	U	78.7	U	83.8	U	547
Polynuclear aromatic hydrocarbons (µg/kg)																
Acenaphthene	L		28.2		490		86		5.96	J	4.06	U	10.9	J	4.13	U	4890
Acenaphthylene	L		3.79	U	20.2		6.92	J	51.8		4.06	U	3.88	U	4.13	U	87.4
Anthracene	L		3.79	U	1160		11.7	J	162		4.06	U	9.52	J	4.13	U	1690
Benzo (a) anthracene	H, C		3.79	U	867		6.66	J	2310		38.6		23.5		4.13	U	2240
Benzo (a) pyrene	H, C		3.79	U	188		4.43	J	566		7.84	J	15.4	J	4.13	U	676
Benzo (b) fluoranthene	H, C		3.79	U	231		10.8	J	796		12	J	17.5		4.13	U	1370
Benzo (ghi) perylene	H, C		3.79	U	41.6		8.41	J	117		4.06	U	7.73	J	4.13	U	226
Benzo (k) fluoranthene	H, C		3.79	U	201		5.86	J	662		10.3	J	14.3	J	4.13	U	911
Chrysene	H, C		4.26	J	779		8.33	J	2050		39.8		34.8		4.13	U	2620
Dibenzo (a,h) anthracene	H, C		3.79	U	21.1		3.95	U	67.9		4.06	U	3.88	U	4.13	U	110
Fluoranthene	H		6.29	J	4640		11.1	J	7640		50.9		44.7		8.15	J	11200
Fluorene	L		6.69	J	1120		8.08	J	17.8		4.06	U	8.19	J	4.13	U	4680
Indeno (1,2,3-cd) pyrene	H, C		3.79	U	49.9		7.78	J	152		4.06	U	7.86	J	4.13	U	267
Naphthalene	L		3.79	U	29.4		5.69	J	4.04	U	4.06	U	3.88	U	4.13	U	83.4
Phenanthrene	L		3.79	U	3680		9.83	J	12.3	J	4.06	U	20.2		4.13	U	12000
Pyrene	H		4.53	J	2930		8.59	J	5190		51		38.8		6.12	J	6450
Total LPAHs			34.89	J	6499.60		128.22	J	249.86	J	12.18	U	48.81	J	27.79	U	23430.80
Total HPAHs			15.08	J	9948.60		71.96	J	19550.90		210.44	J	204.59	J	14.27	J	26070.00
Total CPAHs		2,000	4.26	J	2378.60		52.27	J	6720.90		108.54	J	121.09	J	16.52	U	8420.00
Total PAHs			41.18	J	16448.20		200.18	J	19800.76	J	210.44	J	253.40	J	14.27	J	49500.80

Please refer to notes on last page of this table.

Table G-5
Sediment Summary Data: Summer 2008
McCormick and Baxter Superfund Site
Portlnad, Oregon

SAMPLE LOCATION		ROD Cleanup Goals1	Former Tank Farm Area								Background Area
Sample Type and depth			Sand Cap	Native	Sand Cap	Sand Cap	Native	Sand Cap	Native	Sand Cap	Sediment
Sample ID			MBSD0820-0-0.3	MBSD0820-1.7-2.0	MBSD0821-1.0-1.5	MBSD0825-A	MBSD0825-B	MBSD0826-A	MBSD0826-B	MBSD0830-0.3-0.8	MBSD0831-1.0-1.3
Sample Date			8/26/2008	8/26/2008	8/26/2008	8/27/2008	8/27/2008	8/27/2008	8/27/2008	8/27/2008	8/27/2008
Sample Time			15:00	15:00	15:30	9:15	9:15	9:30	9:30	10:30	11:30
CONTAMINANT OF CONCERN											
Percent Solids (%)			81.2	81.8	93.2	77.5	79.9	84.2	83.7	84.5	83.6
TOC (mg/kg)			1410	2500	943	2630	5080	511	648	553	710
Total Metals (mg/kg)			NM	NM	NM	NM	NM	NM	NM	NM	NM
Arsenic		12	**1.65**	**4.95**	**2.5**	**2.47**	**3.31**	**3.2**	**8.55**	**2.11**	**2.7**
Chromium (III)			**5.4**	**9.23**	**6.55**	**7.08**	**11.3**	**4.65**	**8.4**	**5.19**	**6.36**
Copper			**5.89**	**13.8**	**5.91**	**7.05**	**17.5**	**6.79**	**11.9**	**6.05**	**7.08**
Zinc			**28.6**	**36.8**	**37**	**42**	**50.4**	**34.3**	**48.5**	**33.7**	**43.4**
Pentachlorophenol (µg/kg)		100,000	82.5 U	**167**	71 U	85.5 U	**149**	79 U	80 U	79.1 U	80.1 U
Polynuclear aromatic hydrocarbons (µg/kg)											
Acenaphthene	L		4.06 U	**1460**	3.5 U	**359**	**405**	3.89 U	3.94 U	3.9 U	**76.8**
Acenaphthylene	L		4.06 U	**57.4**	3.5 U	**4.53** J	**23.1**	3.89 U	**5.58** J	3.9 U	3.94 U
Anthracene	L		**11.3** J	**1120**	3.5 U	**47.7**	**190**	3.89 U	**19.6**	**4.04** J	**9.22** J
Benzo (a) anthracene	H, C		**22.4**	**1020**	3.5 U	**35.5**	**350**	3.89 U	**27.3**	**5.87** J	**17.9**
Benzo (a) pyrene	H, C		**13** J	**357**	3.5 U	**16.2** J	**147**	3.89 U	**23.9**	**5.1** J	**11.9** J
Benzo (b) fluoranthene	H, C		**39.3**	**689**	**3.61** J	**31.8**	**314**	**5.9** J	**46.2**	**9.6** J	**13.1** J
Benzo (ghi) perylene	H, C		**8.27** J	**131**	3.5 U	**9.75** J	**61.6**	3.89 U	**17.2**	**4.83** J	**5.71** J
Benzo (k) fluoranthene	H, C		**23.6**	**459**	3.5 U	**20.7**	**220**	3.89 U	**33.9**	**6.62** J	**12.2** J
Chrysene	H, C		**50**	**1160**	3.5 U	**41.9**	**443**	**4.45** J	**43.4**	**9.62** J	**18.7**
Dibenzo (a,h) anthracene	H, C		4.06 U	**60.6**	3.5 U	4.21 U	**26.1**	3.89 U	**6.28** J	3.9 U	3.94 U
Fluoranthene	H		**86.9**	**6430**	3.5 U	**171**	**998**	**4.72** J	**49.1**	**22.6**	**33.9**
Fluorene	L		**5.5** J	**1530**	3.5 U	**191**	**280**	3.89 U	3.94 U	3.9 U	**31.9**
Indeno (1,2,3-cd) pyrene	H, C		**9.34** J	**153**	3.5 U	**9.57** J	**70.8**	3.89 U	**18.1**	**4.57** J	**6.29** J
Naphthalene	L		4.06 U	**48.5**	3.5 U	**15.8** J	**64.3**	3.89 U	3.94 U	3.9 U	**14.2** J
Phenanthrene	L		**34.5**	**3690**	3.5 U	**156**	**194**	3.89 U	**15.2** J	3.9 U	**7.67** J
Pyrene	H		**57.2**	**3900**	3.5 U	**98.5**	**756**	**4.39** J	**37.3**	**16.9**	**28.2**
Total LPAHs			51.30 J	7905.90	10.50 U	774.030 J	1156.40	11.67 U	40.38 J	4.04 J	139.8 J
Total HPAHs			310.01 J	14359.60	3.61 J	434.920 J	3386.50	19.46 J	302.68 J	85.71 J	147.9 J
Total CPAHs		2000	165.91 J	4029.60	3.61 J	165.420 J	1632.50	10.35 J	216.28 J	46.21 J	85.8 J
Total PAHs			361.31 J	22265.50	3.61 J	1208.95 J	4542.90	19.46 J	343.06 J	89.75 J	287.69 J

Notes:
ppb = parts per billion
U = not detected above the method detection limit
mg/kg = miligrams per kilogram
µg/kg = micrograms per kilogram
J = estimated value
L = low molecular weught
H = high molecular weight
C = carcinogenic
NM = not measured

PAHs = polyaromatic hydrocarbons
* Sample was not collected from this locationduring coring; Scott Manzano/DEQ went back to location 2 days after coring and collected sample from the surface us
[1] The 1996 Record of Decision (ROD) specifies sediment cleanup criteria.
Bold = Indicates Analyte was detected, but does not exceed the most stringent criteria.
Inverse = Indicates results that exceed the lowest (most stringent) of the sediment cap performance goals or comparison criteria.

Table G-6
Porewater Summary Data: Summer 2008
McCormick and Baxter Superfund Site
Portland, Oregon

SAMPLE LOCATION	Sediment Cap Performance Goals		Comparison Criteria			Willamette Cove									
Sample ID	McCormick & Baxter Record of Decision, 1996, Ambient Water Quality Criteria (AWQCs)		EPA Current, 2007, National Recommended Water Quality Criteria (NRWQCs)		EPA National Primary Drinking Water Regulations (NPDWRs)	MBPW0801-12	MBPW0801-12	MBPW0801-60	MBPW0802-06	MBPW0802	MBPW0802-50	MBPW0804	MBPW0805-12	MBPW0810	MBSW08WC
Sample Date						8/27/2008	9/4/2008	8/27/2008	8/28/2008	9/4/2008	8/28/2008	9/4/2008	8/27/2008	9/4/2008	8/27/2008
Sample Time						10:40	13:30	11:40	10:10	12:00	11:35	11:42	9:30	11:00	14:20
Sample Type and depth						Porewater (12 inches)	Porewater (10 inches)	Porewater (60 inches)	Porewater (6 inches)	Porewater (10 inches)	Porewater (50 inches)	Porewater (10 inches)	Porewater (12 inches)	Porewater (11 inches)	Surface Water WC
CONTAMINANT OF INTEREST	Aquatic Life (chronic)[1]	Human Health (fish consumption only)[1]	Aquatic Life (chronic)[2]	Human Health (consumption of organism only)[2]	Maximum Contaminant Levels (MCLs)[3]										
Dissolved Metals (mg/L)															
Arsenic						NA	NA	NA	NA	NA	NA	0.00976	NA	0.0112	NA
Chromium (III)						NA	NA	NA	NA	NA	NA	0.00035 U	NA	0.002	NA
Copper						NA	NA	NA	NA	NA	NA	0.00027 U	NA	0.0015 J	NA
Zinc						NA	NA	NA	NA	NA	NA	0.005	NA	0.005	NA
Total Metals (mg/L)															
Arsenic	0.19		0.15	0.00014	0.01	0.00931		0.00177	0.00528	NA	0.00072 J	[illegible]	0.00567	0.0109	0.0006 J
Chromium (III)	0.21		0.074		0.1	0.002	NA	0.002	0.002	NA	0.002	0.00035 U	0.002	0.00035 U	0.002
Copper	0.012		0.009			0.00059 J	NA	0.00027 U	0.00027 U	NA	0.00063 J	0.00027 U	0.0015 J	0.00027 U	0.00102 J
Zinc	0.11		0.12	26		0.00853	NA	0.005	0.005	NA	0.0277	0.005	0.005	0.005	0.005
Pentachlorophenol (ug/L)	13		11	3	1	0.238 U	NA	0.952 U	NA	0.238 U	0.952 U	0.238 U		0.238 U	0.952 U
Polyaromatic Hydrocarbons (ug/L)															
Acenaphthene L	520			990		NA	6.41	117	NA	163	57.7	1.81	NA	0.541	0.101
Acenaphthylene L						NA	0.0594 U	0.667 U	NA	1.19 U	0.476 U	0.0164 J	NA	0.0118 U	0.0476 U
Anthracene L				40,000		NA	0.117	8.82	NA	0.514	0.993	0.012 U	NA	0.0118 U	0.0476 U
Benzo (a) anthracene H, C				0.018		NA	0.0119 U	0.0878 J	NA	0.0119 U	0.277	0.012 U	NA	0.0118 U	0.0476 U
Benzo (a) pyrene H, C				0.018	0.2	NA	0.0119 U	0.0476 U	NA	0.0119 U	0.0476 U	0.012 U	NA	0.0118 U	0.0476 U
Benzo (b) fluoranthene H, C				0.018		NA	0.0119 U	0.0476 U	NA	0.0119 U	0.0476 U	0.012 U	NA	0.0118 U	0.0476 U
Benzo (ghi) perylene H, C						NA	0.0119 U	0.0476 U	NA	0.0119 U	0.0476 U	0.012 U	NA	0.0118 U	0.0476 U
Benzo (k) fluoranthene H, C				0.018		NA	0.0119 U	0.0476 U	NA	0.0119 U	0.0476 U	0.012 U	NA	0.0118 U	0.0476 U
Chrysene H, C				0.018		NA	0.0119 U	0.0653 J	NA	0.0119 U	0.23	0.012 U	NA	0.0118 U	0.0476 U
Dibenzo (a,h) anthracene H, C				0.018		NA	0.0238 U	0.0952 U	NA	0.0238 U	0.0952 U	0.0238 U	NA	0.0237 U	0.0952 U
Fluoranthene H		54		140		NA	0.484	5.28	NA	0.0394	26.9	0.012 U	NA	0.0118 U	0.0476 U
Fluorene L				5300		NA	2.25	109	NA	78.9	57.1	0.0268	NA	0.0742	0.0579 J
Indeno (1,2,3-cd) pyrene H, C				0.018		NA	0.0119 U	0.0476 U	NA	0.0119 U	0.0476 U	0.012 U	NA	0.0118 U	0.0476 U
Naphthalene L	620					NA	0.023	0.743	NA	265	0.382	0.464	NA	0.0184 J	0.0476 U
Phenanthrene L						NA	0.0215	43.6	NA	8.19	0.256	0.012 U	NA	0.0152 J	0.0476 U
Pyrene H				4,000		NA	0.184	2.16	NA	0.0331	13.6	0.012 U	NA	0.0118 U	0.0476 U
Total LPAHs							8.8215	279.16	NA	516	116.43	2.3172		0.6488	0.1589
Total HPAHs							0.6680	7.59	NA	0.0725	41.01	0.0660 U		0.0650 U	0.2618 U
Total CPAHs		0.031					0.0536 U	0.15	NA	0.0536 U	0.51	0.0540 U		0.0537 U	0.2142 U
Total PAHs							9.4895	286.76	NA	516	157.44	2.3172		0.6488	0.1589
Field Parameters (pre-/post-sample)															
Temperature (°C)						19.1 / 20	NA	21 / 22.2	18.7 / 19.35	NA	20.3 / NA	17.48 / 19.07		17.29 / NA	25.6
Specific Conductance (mS/cm)						0.100 / 0.100	NA	0.100/ 0.100	0.459 / 0.490	NA	0.100 / NA	0.24 / 0.234		0.36 / NA	0.100
Dissolved Oxygen (mg/L)						6.51 / 6.34	NA	6.22 / 6.19	1.03 / 1.33	NA	6.24 / NA	3.48 / 0		3.17 / NA	5.84
pH						7.74 / 7.38	NA	7.46 / 7.37	6.25 / 6.23	NA	7.37 / NA	6.48 / 6.3		6.63 / NA	7.35
Oxidation Reduction Potential (mV)						154 / 161	NA	158 / 164	55.2 / 38.4	NA	163 / NA	25 / 50		53.3 / NA	171
Turbidity (NTU)						86.2 / 88.5	NA	91.9 / 89	NM	NA	82.8 / NA	201 / 247		NM	87
General Chemistry (mg/L)															
Dissolved Iron						13.3		16.5	48.1	NA	28	5.92	32.2	13.7	0.178
Total Iron						14.3		17.5	47.2	NA	27.3	3.74	36.5	12.7	0.982
Total Suspended Solids						167	NA	74.0	62.6	NA	95.2			32.0	
Total Organic Carbon									2.4	NA	1.8	1.5		2.1	
Dissolved Organic Carbon						1.43	NA	1.57	1.69	NA	1.07	1.58	1.4	2.01	1.54

Please refer to notes on last page of this table.

Table G-6
Porewater Summary Data: Summer 2008
McCormick and Baxter Superfund Site
Portland, Oregon

SAMPLE LOCATION	Sediment Cap Performance Goals		Comparison Criteria			Former Tank Farm Area								
Sample ID	McCormick & Baxter Record of Decision, 1996, Ambient Water Quality Criteria (AWQCs)		EPA Current, 2007, National Recommended Water Quality Criteria (NRWQCs)		EPA National Primary Drinking Water Regulations (NPDWRs)	PSU5-12	PSU5-36	MBPW0812	MBPW0813-12	MBPW0813-36	MBPW0815-8	MBPW0815-40	MBPW0816A	MBPW0816B
Sample Date						9/3/2008	9/3/2008	9/3/2008	9/3/2008	9/3/2008	8/29/2008	8/29/2008	8/29/2008	8/29/2008
Sample Time						14:30	16:00	10:15	13:15	15:00	13:40	15:00	13:30	11:30
Sample Type and depth						Porewater (12 inches)	Porewater (36 inches)	Porewater (8 inches)	Porewater (12 inches)	Porewater (36 inches)	Porewater (8 inches)	Porewater (40 inches)	Porewater (2 inches over organoclay mat in sand cap)	Porewater (2 inches underneath organoclay mat)
CONTAMINANT OF INTEREST	Aquatic Life (chronic)[1]	Human Health (fish consumption only)[1]	Aquatic Life (chronic)[2]	Human Health (consumption of organism only)[2]	Maximum Contaminant Levels (MCLs)[3]									
Dissolved Metals (mg/L)														
Arsenic						0.013	0.0206	0.000482 J	0.00681	0.0256	0.0138	0.0249	0.00658	0.0177
Chromium (III)						0.00035 U	0.00035 U	0.00035 U	0.00035 U	0.00035 U	0.00035 U	0.000774 J	0.00035 U	0.000864 J
Copper						0.00027 U	0.00027 U	0.002	0.00027 U	0.00027 U	0.00027 U	0.000472 J	0.00027 U	0.00027 U
Zinc						0.005	0.005	0.005	0.0102	0.005	0.005	0.005	0.005	0.005
Total Metals (mg/L)														
Arsenic	0.19		0.15	0.00014	0.01	0.0125	0.0181	0.00097 J	0.00578	0.0197	0.0131	0.0218	0.00603	0.0174
Chromium (III)	0.21		0.074		0.1	0.002	0.002	0.00099 J	0.00035 U	0.002	0.00174 J	0.0016 J	0.00105 J	0.00517
Copper	0.012		0.009			0.00063 J	0.00083 J	0.00377	0.0007 J	0.00042 J	0.00138 J	0.00113 J	0.000405 J	0.015
Zinc	0.11		0.12	26		0.005	0.005	0.00722	0.012	0.005	0.0559	0.00699	0.00686	0.0478
Pentachlorophenol (ug/L)	13		11	3	1	0.239 U	0.238 U	0.237 U	0.544	0.238 U	0.238 U	0.952 U	0.238 U	0.238 U
Polyaromatic Hydrocarbons (ug/L)														
Acenaphthene L	520			990		0.647	2.21	0.0118 U	0.226	0.639	0.211	2.6	0.0119 U	0.249
Acenaphthylene L						0.012 U	0.0119 U	0.0118 U	0.0118 U	0.0119 U	0.0119 U	0.0952 U	0.0119 U	0.0119 U
Anthracene L				40,000		0.012 U	0.0382	0.0118 U	0.0248	0.0182 J	0.0299	0.188	0.0119 U	0.0362
Benzo (a) anthracene H, C				0.018		0.012 U	0.0119 U	0.0118 U	0.0118 U	0.0119 U	0.0119 U	0.0476 U	0.0119 U	0.0167 J
Benzo (a) pyrene H, C				0.018	0.2	0.012 U	0.0119 U	0.0118 U	0.0118 U	0.0119 U	0.0119 U	0.0476 U	0.0119 U	0.0119 U
Benzo (b) fluoranthene H, C				0.018		0.012 U	0.0119 U	0.0118 U	0.0118 U	0.0119 U	0.0119 U	0.0476 U	0.0119 U	0.0232 J
Benzo (ghi) perylene H, C						0.012 U	0.0119 U	0.0118 U	0.0118 U	0.0119 U	0.0119 U	0.0476 U	0.0119 U	0.0119 U
Benzo (k) fluoranthene H, C				0.018		0.012 U	0.0119 U	0.0118 U	0.0118 U	0.0119 U	0.0119 U	0.0476 U	0.0119 U	0.0127 J
Chrysene H, C				0.018		0.012 U	0.0209 J	0.0118 U	0.0118 U	0.0119 U	0.0149 J	0.0476 U	0.0119 U	0.0541
Dibenzo (a,h) anthracene H, C				0.018		0.0238 U	0.0238 U	0.0238 U	0.0237 U	0.0238 U	0.0238 U	0.0952 U	0.0238 U	0.0238 U
Fluoranthene H		54		140		0.0236 J	0.0837	0.0118 U	0.0849	0.0586	0.0369	0.441	0.0119 U	0.117
Fluorene L				5300		0.132	0.528	0.0118 U	0.0731	0.206	0.0699	1.37	0.0119 U	0.165
Indeno (1,2,3-cd) pyrene H, C				0.018		0.012 U	0.0119 U	0.0118 U	0.0118 U	0.0119 U	0.0119 U	0.0476 U	0.0119 U	0.0119 U
Naphthalene L	620					0.249	3.97	0.0118 U	9.6	0.0226 J	0.681	1.26	0.0274	1.58
Phenanthrene L						0.012 U	0.0302	0.0118 U	0.0397	0.0119 U	0.0165 J	1.12	0.0119 U	0.0217 J
Pyrene H				4,000		0.0244	0.075	0.0118 U	0.0657	0.0436	0.0244	0.28	0.0119 U	0.0779
Total LPAHs						1.0280	6.7764	0.0354 U	9.9636	0.8858	1.008	6.538	0.0274	2.052
Total HPAHs						0.0480	0.1796	0.0649 U	0.1506	0.1022	0.076	0.721	0.0655 U	0.302
Total CPAHs		0.031				0.0540 U	0.0209	0.0531 U	0.0532 U	0.0536 U	0.015	0.214 U	0.0536 U	0.107
Total PAHs						1.0760	6.9560	0.1003 U	10.1142	0.9880	1.085	7.259	0.0274	2.354
Field Parameters (pre-/post-sample)														
Temperature (°C)						21.72 / 22.13	20.85 / 20.76	17.95 / 18.27	22.56 / 23	21.9 / 22.2	24.02 / 25.16	23.94 / 22.45	22.54 / 22.04	21.79 / 22.43
Specific Conductance (mS/cm)						0.231 / 0.257	0.34 / 0.342	0.116 / 0.111	0.554 / 0.589	0.940 / 1.040	0.652 / 0.470	2.35 / 2.28	0.589 / 0.573	0.919 / 0.702
Dissolved Oxygen (mg/L)						0.91 / 1.61	0.64 / 1.39	8.19 / 8.93	0 / 0.25	NA	0.3 / 0.96	0.57 / 0.7	0.65 / 0.9	1.44 / 1.81
pH						6.45 / 6.45	6.26 / 6.26	6.49 / 6.57	6.34 / 6.38	6.43 / 6.44	6.62 / 6.7	6.58 / 6.48	6.64 / 6.66	6.34 / 6.73
Oxidation Reduction Potential (mV)						27.1 / 36.4	4.4 / 12.1	185 / 187	86 / 19	-43 / -32	-53 / -71	-111 / -112	-35.1 / -28.8	67.1 / 13.4
Turbidity (NTU)						NM	NM	207 / 113	78.2 / 42	160 / 122	19.8 / 19.7	184 / 119	NA	NA
General Chemistry (mg/L)														
Dissolved Iron						7.03	23.2	0.1	6.04	40.8	8.21	75.2		
Total Iron						7.13	23.6	4.09	6.2	36.9	9.89	75.7		
Total Suspended Solids						15.0	33.3		40.0	64.0	44.0	240		
Total Organic Carbon						2.3	2.7	1.8	2.2	3.5	3.4		2.3	3
Dissolved Organic Carbon						1.58	2	1.94	1.83	2.82	2.94 J	21.4	1.79	8.87

Please refer to notes on last page of this table.

Table G-6
Porewater Summary Data: Summer 2008
McCormick and Baxter Superfund Site
Portland, Oregon

SAMPLE LOCATION	Sediment Cap Performance Goals		Comparison Criteria			Former Tank Farm Area						
Sample ID	McCormick & Baxter Record of Decision, 1996, Ambient Water Quality Criteria (AWQCs)		EPA Current, 2007, National Recommended Water Quality Criteria (NRWQCs)		EPA National Primary Drinking Water Regulations (NPDWRs)	MBPW0817	MBPW0818	MBPW0820	MBPW0821	MBPW0822	MBPW0823	MBPW0824
Sample Date						8/29/2008	8/29/2008	8/29/2008	9/4/2008	9/3/2008	9/3/2008	9/2/2008
Sample Time						14:30	10:30	10:00	10:00	13:00	11:45	14:45
Sample Type and depth						Porewater (12 inches into sand/rock armoring)	Porewater (12 inches into sand/rock armoring)	(20 inches from surface through rock armoring into sand cap)	Porewater (10 inches)	Porewater (10 inches)	Porewater (11 inches)	Porewater (12 inches into sand/rock armoring)
CONTAMINANT OF INTEREST	Aquatic Life (chronic)[1]	Human Health (fish consumption only)[1]	Aquatic Life (chronic)[2]	Human Health (consumption of organism only)[2]	Maximum Contaminant Levels (MCLs)[3]							
Dissolved Metals (mg/L)												
Arsenic						0.0193	0.000905 J	0.00104	0.00062 J	0.0165	0.000487 J	0.000906 J
Chromium (III)						0.00035 U	0.00035 U	0.00035 U	0.00035 U	0.00035 U	0.00035 U	0.00035 U
Copper						0.00027 U	0.0032	0.00117 J	0.00062 J	0.00027 U	0.002	0.000744
Zinc						0.005	0.005	0.005	0.005	0.005	0.005	0.005
Total Metals (mg/L)												
Arsenic	0.19		0.15	0.00014	0.01	0.0182	0.000896 J	0.00114	0.00075 J	0.0156	0.00068 J	0.00103
Chromium (III)	0.21		0.074		0.1	0.00162 J	0.00104 J	0.0012 J	0.00262	0.002	0.002	0.002
Copper	0.012		0.009			0.000517 J	0.00195 J	0.00151 J	0.00115 J	0.00074 J	0.00145 J	0.00101 J
Zinc	0.11		0.12	26		0.00405 J	0.00466 J	0.00664	0.00905	0.005	0.005	0.00733
Pentachlorophenol (ug/L)	13		11	3	1	0.238 U	0.238 U	0.238 U	0.237 U	0.238 U	0.238 U	0.238 U
Polyaromatic Hydrocarbons (ug/L)												
Acenaphthene L	520			990		0.186	0.0119 U	0.0119 U	0.0118 U	0.0609	0.0763	0.0119 U
Acenaphthylene L						0.0119 U	0.0119 U	0.0119 U	0.0118 U	0.0119 U	0.0118 U	0.0119 U
Anthracene L				40,000		0.0332	0.0119 U	0.0119 U	0.0118 U	0.0935	0.0118 U	0.0119 U
Benzo (a) anthracene H, C				0.018		0.0119 U	0.0119 U	0.0119 U	0.0118 U	0.0176 J	0.0118 U	0.0119 U
Benzo (a) pyrene H, C				0.018	0.2	0.0119 U	0.0119 U	0.0119 U	0.0118 U	0.0119 U	0.0118 U	0.0119 U
Benzo (b) fluoranthene H, C				0.018		0.0119 U	0.0119 U	0.0119 U	0.0118 U	0.0261	0.0118 U	0.0119 U
Benzo (ghi) perylene H, C						0.0119 U	0.0119 U	0.0119 U	0.0118 U	0.0119 U	0.0118 U	0.0119 U
Benzo (k) fluoranthene H, C				0.018		0.0119 U	0.0119 U	0.0119 U	0.0118 U	0.0148 J	0.0118 U	0.0119 U
Chrysene H, C				0.018		0.0146 J	0.0119 U	0.0119 U	0.0118 U	0.0386	0.0118 U	0.0119 U
Dibenzo (a,h) anthracene H, C				0.018		0.0238 U	0.0238 U	0.0238 U	0.0237 U	0.0238 U	0.0237 U	0.0238 U
Fluoranthene H		54		140		0.182	0.0119 U	0.0119 U	0.0118 U	0.181	0.0118 U	0.0119 U
Fluorene L				5300		0.0596	0.0119 U	0.0119 U	0.0118 U	0.0558	0.0391	0.0119 U
Indeno (1,2,3-cd) pyrene H, C				0.018		0.0119 U	0.0119 U	0.0119 U	0.0118 U	0.0119 U	0.0118 U	0.0119 U
Naphthalene L	620					0.79	0.0119 U	0.0119 U	0.0118 U	0.0157 J	0.0186 J	0.0119 U
Phenanthrene L						0.0119 U	0.0119 U	0.0119 U	0.0118 U	0.0379	0.0118 U	0.0119 U
Pyrene H				4,000		0.125	0.0119 U	0.0119 U	0.0118 U	0.133	0.0118 U	0.0119 U
Total LPAHs						1.069	0.0357 U	0.0357 U	0.0354 U	0.2638	0.1340	0.0357 U
Total HPAHs						0.322	0.0655 U	0.0655 U	0.0650 U	0.4111	0.0650 U	0.0655 U
Total CPAHs		0.031				0.015	0.0536 U	0.0536 U	0.0532 U	0.0971	0.0532 U	0.0536 U
Total PAHs						1.390	0.0357 U	0.0357 U	0.1004 U	0.6749	0.1340	0.1012 U
Field Parameters (pre-/post-sample)												
Temperature (°C)						22.29 / 22.69	21.17 / 29.8	21.3 / 27.9	20.21 / 20.41	20.44 / NA	18.81 / 19.51	21.82 / 21.32
Specific Conductance (mS/cm)						0.322 / 0.352	0.093 / 0.54	0.101 / 0.101	0.123 / 0.119	0.237 / NA	0.122 / 0.125	0.124 / 0.126
Dissolved Oxygen (mg/L)						0.97 / 1.11	3.78 / 4.21	7.39 / 7.36	6.9 / 7.04	1.04 / NA	NA	1.75 / 1.69
pH						6.85 / 6.94	7.36 / 7.58	7.77 / 7.16	6.23 / 6.34	6.35 / NA	6.23 / 6.28	7 / 6.97
Oxidation Reduction Potential (mV)						-26.1 / -19.6	161.9 / 50.8	114 / 177	197 / 195	37.7 / NA	184 / 183	63 / 80
Turbidity (NTU)						NA	NA	NA	NA	NM	60.7 / 46.3	109 / 99.1
General Chemistry (mg/L)												
Dissolved Iron									0.003 U	10.1	0.1	
Total Iron									1.19	10.1	0.315	
Total Suspended Solids										20.0		
Total Organic Carbon						3.3	1.4	1.1	1.1	1.9	1.8	1.1
Dissolved Organic Carbon						6.91	3.51	1.05	1.18	1.56	1.73	8.55

Please refer to notes on last page of this table.

Table G-6
Porewater Summary Data: Summer 2008
McCormick and Baxter Superfund Site
Portland, Oregon

SAMPLE LOCATION		Sediment Cap Performance Goals		Comparison Criteria			Former Tank Farm Area					
Sample ID		McCormick & Baxter Record of Decision, 1996, Ambient Water Quality Criteria (AWQCs)		EPA Current, 2007, National Recommended Water Quality Criteria (NRWQCs)		EPA National Primary Drinking Water Regulations (NPDWRs)	MBPW0825	MBPW0826	MBPW0827	MBPW0828	MBPW0831	MBPW0832
Sample Date							9/2/2008	9/2/2008	9/2/2008	9/2/2008	9/3/2008	8/29/2008
Sample Time							12:10	14:30	13:30	12:30	10:30	15:30
Sample Type and depth							Porewater (12 inches into sand/rock armoring)	Porewater (12 inches into sand/rock armoring)	Porewater (10 inches below filter fabric under ACB)	Porewater (10 inches below filter fabric under ACB)	Porewater (13 inches)	Porewater (8 inches)
CONTAMINANT OF INTEREST		Aquatic Life (chronic)[1]	Human Health (fish consumption only)[1]	Aquatic Life (chronic)[2]	Human Health (consumption of organism only)[2]	Maximum Contaminant Levels (MCLs)[3]						
Dissolved Metals (mg/L)												
Arsenic							0.0382	0.00282	0.0464	0.0319	0.00039 J	0.0187
Chromium (III)							0.00035 U	0.00035 U	0.00035 U	0.00035 U	0.00035 U	0.00035 U
Copper							0.000346 J	0.000326	0.00027 U	0.00027 U	0.002	0.000402 J
Zinc							0.005	0.00642	0.005	0.005	0.00843	0.00928
Total Metals (mg/L)												
Arsenic		0.19		0.15	0.00014	0.01	0.0304	0.00252	0.0384	0.0265	0.00036 J	0.0174
Chromium (III)		0.21		0.074		0.1	0.002	0.002	0.002	0.002	0.002	0.00215
Copper		0.012		0.009			0.00074 J	0.00138	0.00132	0.00171 J	0.00122 J	0.00491
Zinc		0.11		0.12	26		0.00945	0.00796	0.0157	0.00762	0.00696	0.0127
Pentachlorophenol (ug/L)		13		11	3	1	0.238 U	0.238 U	0.238 U	0.238 U	0.237 U	0.437
Polyaromatic Hydrocarbons (ug/L)												
Acenaphthene	L	520			990		0.287	0.0119 U	1.09	0.0552	12.6	45.4
Acenaphthylene	L						0.0119 U	0.0119 U	0.0122 J	0.0119 U	0.141	0.595 U
Anthracene	L				40,000		0.0679	0.0119 U	0.0172 J	0.0273	0.0247	0.936
Benzo (a) anthracene	H, C				0.018		0.0119 U	0.0119 U	0.0119 U	0.0452	0.0118 U	0.0292
Benzo (a) pyrene	H, C				0.018	0.2	0.0119 U	0.0119 U	0.0119 U	0.0210 J	0.0118 U	0.0119 U
Benzo (b) fluoranthene	H, C				0.018		0.0119 U	0.0119 U	0.0119 U	0.0442	0.0118 U	0.0248
Benzo (ghi) perylene	H, C						0.0119 U	0.0119 U	0.0119 U	0.0119 U	0.0118 U	0.0119 U
Benzo (k) fluoranthene	H, C				0.018		0.0119 U	0.0119 U	0.0119 U	0.0323	0.0118 U	0.0152 J
Chrysene	H, C				0.018		0.0119 U	0.0119 U	0.0119 U	0.0603	0.0118 U	0.0455
Dibenzo (a,h) anthracene	H, C				0.018		0.0238 U	0.0238 U	0.0238 U	0.0238 U	0.0237 U	0.0231 U
Fluoranthene	H		54		140		0.0127 J	0.0119 U	0.0119 U	0.0615	0.0123 J	0.302
Fluorene	L				5300		0.0131	0.0119 U	0.28	0.0401	2.9	19.7
Indeno (1,2,3-cd) pyrene	H, C				0.018		0.0119 U	0.0119 U	0.0119 U	0.0121 J	0.0118 U	0.0119 U
Naphthalene	L	620					0.0119 U	0.0119 U	14.8	0.0695	0.168	0.155 U
Phenanthrene	L						0.0237	0.0119 U	0.0131	0.0132	0.0492	10.3
Pyrene	H				4,000		0.0552	0.0119 U	0.0598	0.0934	0.0118 U	0.209
Total LPAHs							0.3917	0.0357 U	16.2125	0.2053	15.8829	76.491
Total HPAHs							0.0679	0.0655 U	0.0598	0.3703	0.0123	0.628
Total CPAHs			0.031				0.0536 U	0.0536 U	0.0536 U	0.2154	0.0532 U	0.115
Total PAHs							0.4596	0.1012 U	16.2723	0.5756	15.8952	77.117
Field Parameters (pre-/post-sample)												
Temperature (°C)							19.71 / 19.9	23.27 / 23.31	21.73 / 21.69	21.03 / 21.22	19.29 / 19.86	24.57 / 23.95
Specific Conductance (mS/cm)							0.209 / 0.208	0.128 / 0.145	0.186 / 0.175	0.149 / 0.141	0.208 / 0.208	0.91 / 0.817
Dissolved Oxygen (mg/L)							1.54 / 3.03	0.78 / 1.12	1.37 / 1.25	0.98 / 0.59	0.94 / 1.9	1.55 / 1.01
pH							7.71 / 7.26	6.69 / 6.88	6.66 / 6.59	8.25 / 7.13	6.07 / 6.14	6.62 / 6.67
Oxidation Reduction Potential (mV)							-44 / 4.4	25.6 / 46.3	11.6 / 10.9	-146 / -102	113.1 / 147.4	7.6 / 4.1
Turbidity (NTU)							NA	NA	NA	206 / 61.7	NM	NA
General Chemistry (mg/L)												
Dissolved Iron											0.511	
Total Iron											1.03	
Total Suspended Solids												
Total Organic Carbon							3.8	1.5	2.6	2	3	9.7
Dissolved Organic Carbon							3.1	2.76	3.31	1.56	1.59	7.91

Please refer to notes on last page of this table.

Table G-6
Porewater Summary Data: Summer 2008
McCormick and Baxter Superfund Site
Portland, Oregon

Notes:

[1] The 1996 Record of Decision (ROD) specifies the remedial action objects 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 federal and state Ambient Water Quality Criteria (AWQCs).

[2] National Recommended Water Quality Criteria (NRWQCs) published as of August 15, 2007 are included for comparison (see http://www.epa.gov/waterscience/criteria/wqcriteria.html). The current publication includes criteria revisions published in 2002 National Recommended Water Quality Criteria: 2002 table (EPA-822-R-02-047) and 2003 Revised human Health Water Quality Criteria (EPA-822-F-03-012). Note that the aquatic life chronic criteria for pentachlorophenol has been adjusted to site-specific pH (7.5, representing a mid-range of the pH values measured in surface water at the site), and therefore differs from the standard table value. Criteria for metals (Cr, Cu, Zn) have not been adjusted for site-specific hardness. Carcinogenic risk-based numbers reflect a carcinogenicity risk of 10^{-6}.

[3] National Primary Drinking Water Regulations Maximum Contaminant Levels (MCLs) promulgated as of August 15, 2007 are included for comparison (see http://www.epa.gov/safewater/contaminants/index.html#primary).

[4]The number of significant figures presented in the table do not reflect true accuracy presented by the laboratory results. Data should only retain 3 significant figures. Due to statistical evaluation using Microsoft Excel, additional significant figures may be shown.

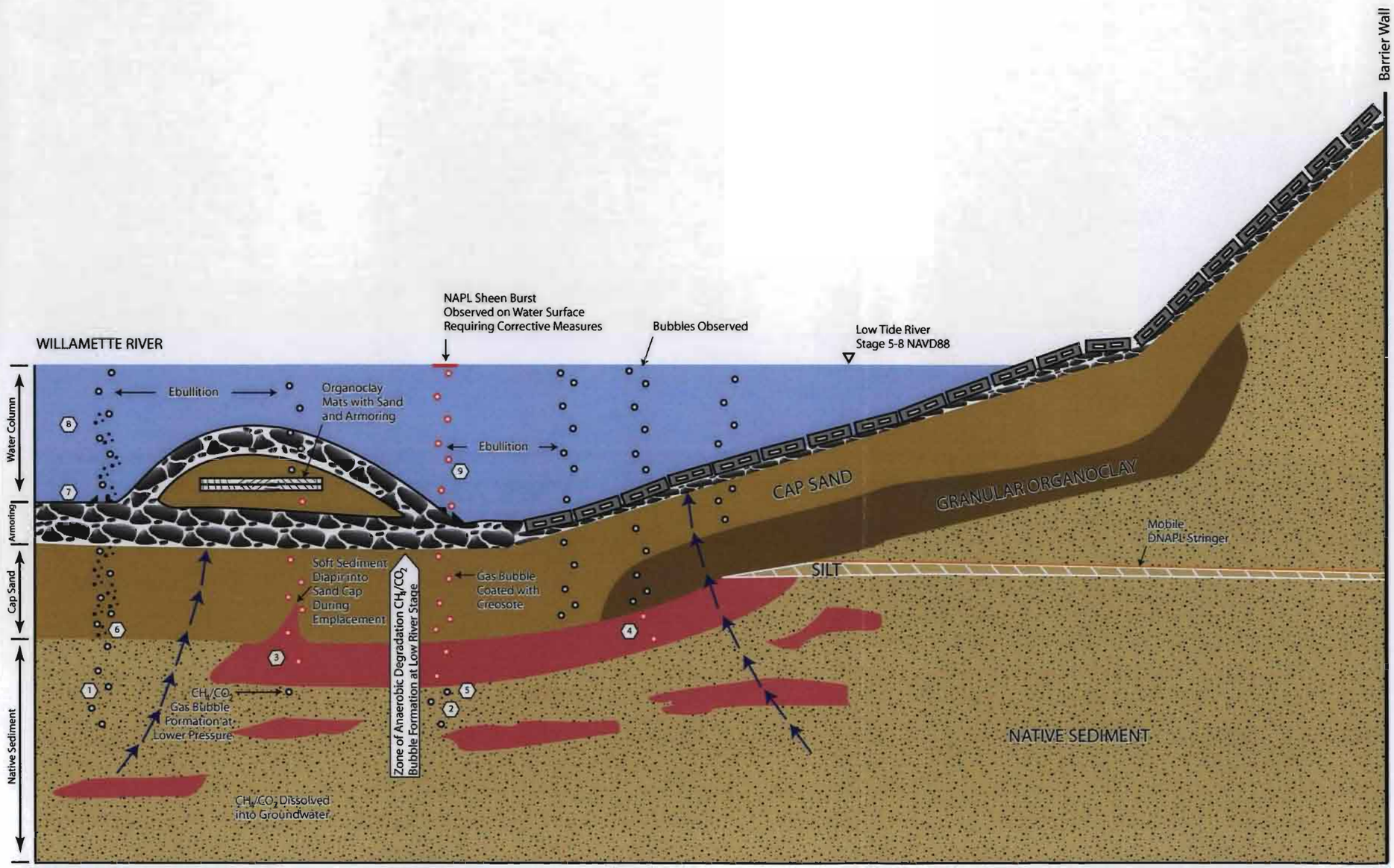
[5]Summary results for a number of inter-armoring and sub-armoring samples from the Fall 2007 sampling event were revised during data review as a result of the detection of non-carcinogenic PAHs in field rinsate samples. Original laboratory data reports are provided as an appendix to this report. Samples include inter-armoring samples IA-0907-2, 3, 4, 5, 10, 11, 12, 13, 14, 15, 16, 17, 19, 25, 26 and 64 (duplicate from location 26) and subarmoring samples SA-0907-2, 3, 4, 5, 6, 7, 8, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 25, 26, 60 (duplicate from location 12), and 62 (duplicate from location 2). Detections reported by the laboratory at less than 5 times the rinsate blank concentration were changed to 'U' values in accordance with data review guidelines. Such values were all well below the reference criteria for those PAHs, where such criteria exist.

C	Carcinogenic PAH (CPAH)
H	High Molecular Weight PAH (HPAH)
J	Estimated Value
L	Low Molecular Weight PAH (LPAH)
MCL	Drinking Water Maximum Contaminant Levels
mg/L	milligrams per liter
mS/cm	microsiemens per centimeter
mV	millivolt
NA	not analyzed
NM	Not Measured
NTU	nephelomelvic units
PAH	Polynuclear aromatic hydrocarbons
U	Value Below MDL (value represents MDL)
µg/L	micrograms per liter

Bold Indicates Analyte was detected, but does not exceed the most stringent criteria.

shaded Indicates a value less than the MDL where the MDL exceeds the stringent sediment cap performance goal or comparison criteria. Only used on the Spring and Fall 2007 data tables.

Inverse Indicates results that exceed the lowest (most stringent) of the sediment cap performance goals or comparison criteria.



LEGEND

- Articulated Concrete Block Armoring
- Rock Armoring
- Groundwater Advection
- Cap Sand
- Organoclay
- Silt
- Sand
- Residual Creosote
- (1) CH_4/CO_2 Gas Rises to Surface without Encountering Creosote
- (2) CH_4/CO_2 Gas Formation in or Below Areas of Residual Creosote Rising to Surface and Producing Sheen Burst
- (3) CH_4/CO_2 Gas Formation in or Below Areas of Residual Creosote Passing into Organoclay Mat which Sorbs the Creosote from the Gas Bubble
- (4) CH_4/CO_2 Gas Formation in or Below Areas of Residual Creosote Passing into Granular Organoclay which Sorbs the Creosote from the Gas Bubble
- (5) Partitioning of Contaminent from Porewater into Gas Bubble (Reversible)
- (6) Particulate Matter Migrating Through Ebullition Pathway Driven by Gas Bubbles
- (7) Larger Particles Settle onto Sediment Cap
- (8) Smaller Particles Suspended in Surface Water
- (9) Contaminents Partioning from Gas Bubble into Surface Water and Visa Verse Depending on Concentration in Gas Versus Surface Water

NOT TO SCALE

McCormick and Baxter Superfund Site
Portland, Oregon

Conceptual Model of Contaminant Transpart via Gas Ebullition and Ebullition-Induced Sheen

5/09

HARTCROWSER GSI Water Solutions, Inc.

Figure
G-1

P:\205 - OR DEQ\003 - 003 McCormick and Baxter\Conceptual_Model_Ebullition_07_08

LEGEND

Sample Types

- Sediment (SD)
- Porewater (PW)
- Flux Chamber (FC)
- Solid Phase Micro-Extraction (SPME)

Site Features

- Groundwater Monitoring Wells
- City of Portland Stormwater Outfall
- Cross Sections
- Subsurface Barrier Wall
- Sediment Cap Boundary
- Sediment Cap Post-Coring/ Trenching Repair
- Organoclay Granular
- Organoclay Mats (Double)
- Organoclay Mats (Single)
- Hot Spot Treatment (thickened sand layer)
- Boulder Clusters

NOTE: Aerial photo taken on September 22, 2006

0 250 500

Scale in feet

McCormick and Baxter Superfund Site
Portland, Oregon

SD, PW, FC, and SPME Samples

5/09

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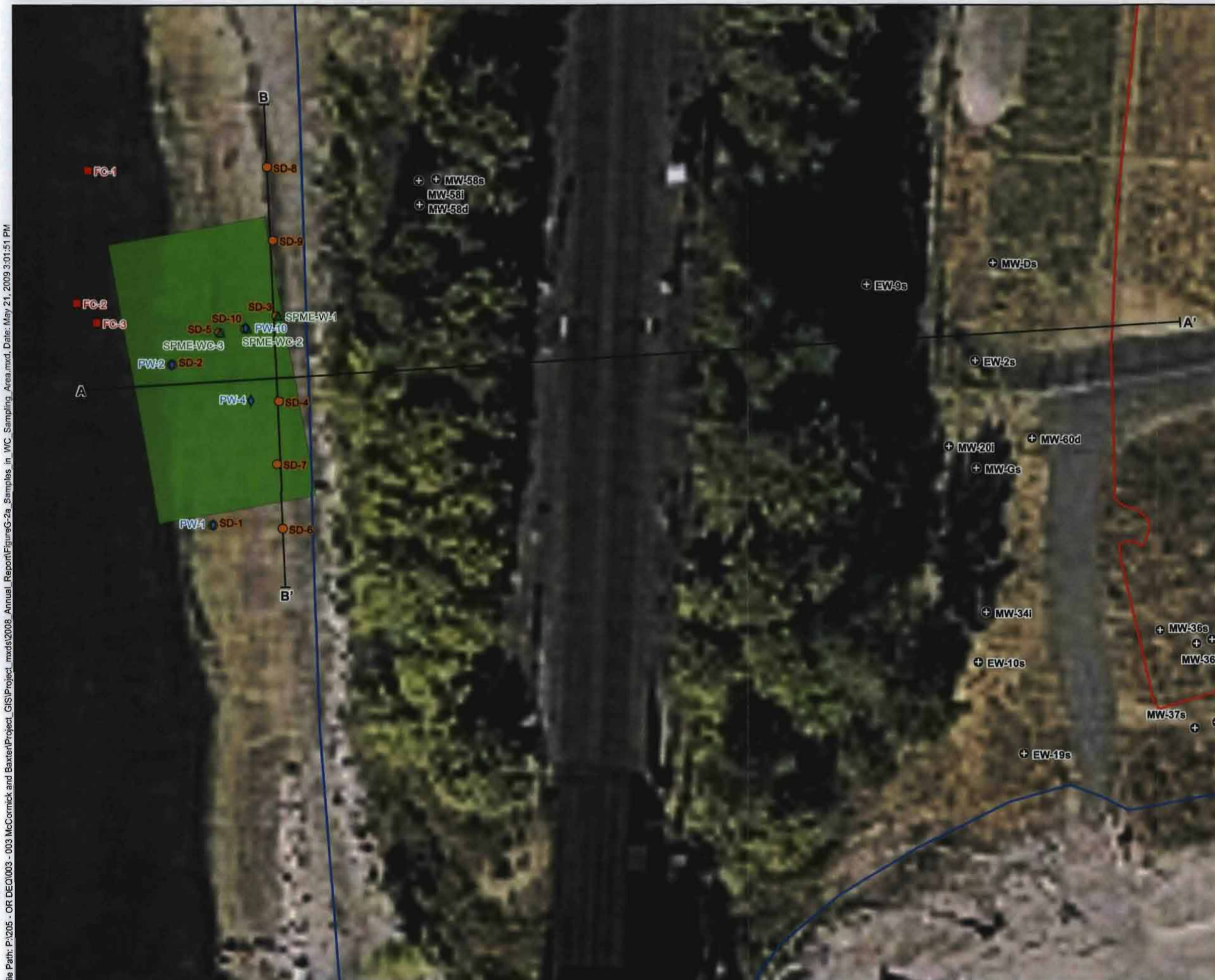
Figure
G-2

File Path: P:\205 - OR DEQ\003 - 003 McCormick and Baxter\Project_GIS\Project_mxds\2008_Annual_Report\FigureG-2_Samples_from_Summer08_EB_Studies.mxd, Date: May 21, 2009 3:00:11 PM



LEGEND

Sample Types

- Sediment (SD)
- Porewater (PW)
- Flux Chamber (FC)
- Solid Phase Micro-Extraction (SPME)

Site Features

- Groundwater Monitoring Well
- Cross Sections
- Subsurface Barrier Wall
- Sediment Cap Boundary
- Organoclay Granular

NOTE: Aerial photo taken on September 22, 2006

0 30 60

Scale in feet

McCormick and Baxter Superfund Site
Portland, Oregon

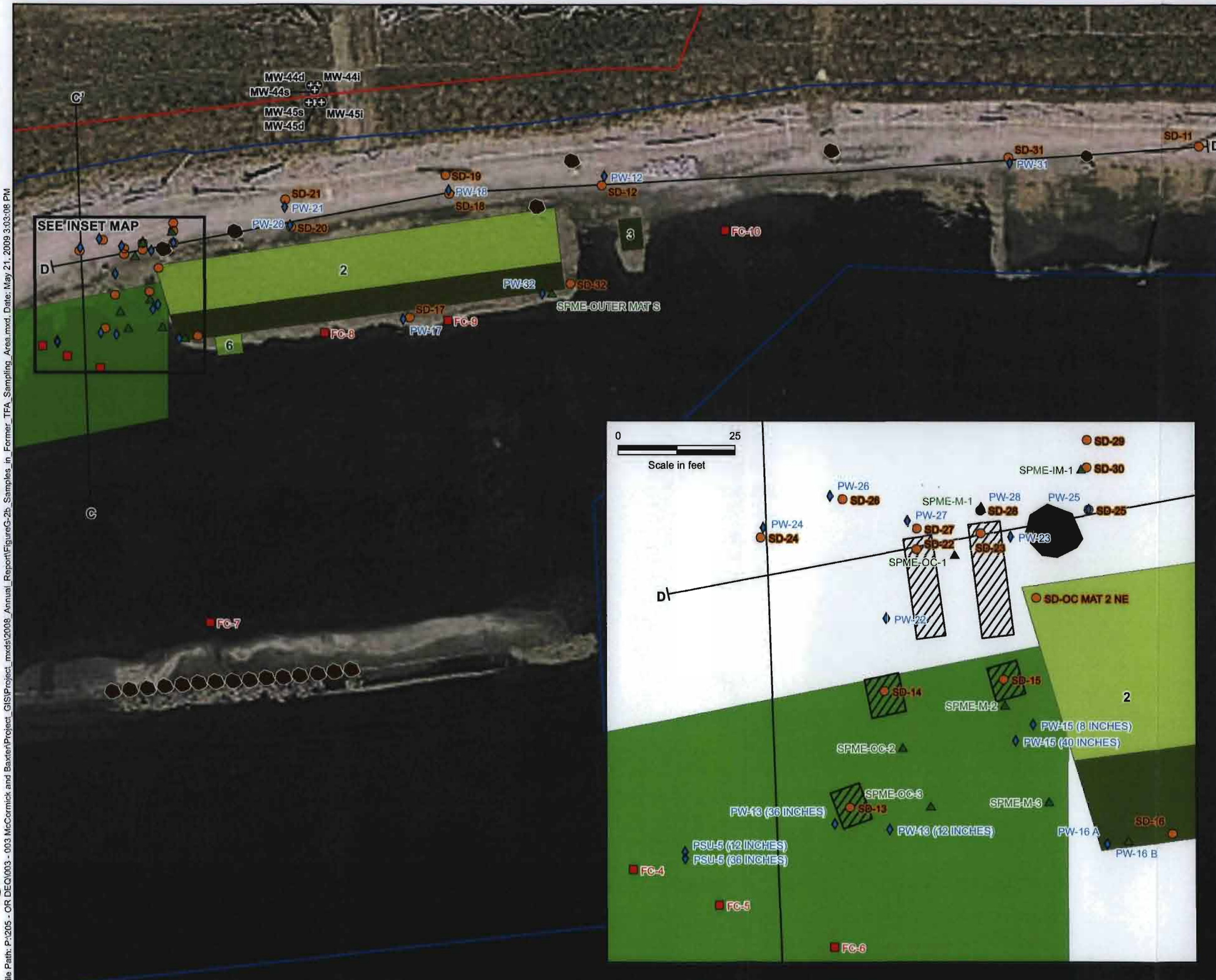
Willamette Cove Sampling Area

5/09

HARTCROWSER GSI Water Solutions, Inc.

Figure
G-2a

File Path: P:\205 - OR DEQ\003 - 003 McCormick and Baxter\Project_GIS\Project_mxds\2008_Annual_Report\FigureG-2a_Samples_in_WC_Sampling_Area.mxd, Date: May 21, 2009 3:01:51 PM



LEGEND

Sample Types

- Sediment (SD)
- Porewater (PW)
- Flux Chamber (FC)
- Solid Phase Micro-Extraction (SPME)

Site Features

- Groundwater Monitoring Well
- Cross Sections
- Subsurface Barrier Wall
- Sediment Cap Boundary
- Sediment Cap Post-Coring/ Trenching Repair
- Organoclay Granular
- Organoclay Mats (Double)
- Organoclay Mats (Single)
- Hot Spot Treatment (thickened sand layer)
- Boulder Clusters

NOTE: Aerial photo taken on September 22, 2006

0 70 140
Scale in feet

McCormick and Baxter Superfund Site
Portland, Oregon

Former Tank Farm Area Sampling Area

5/09

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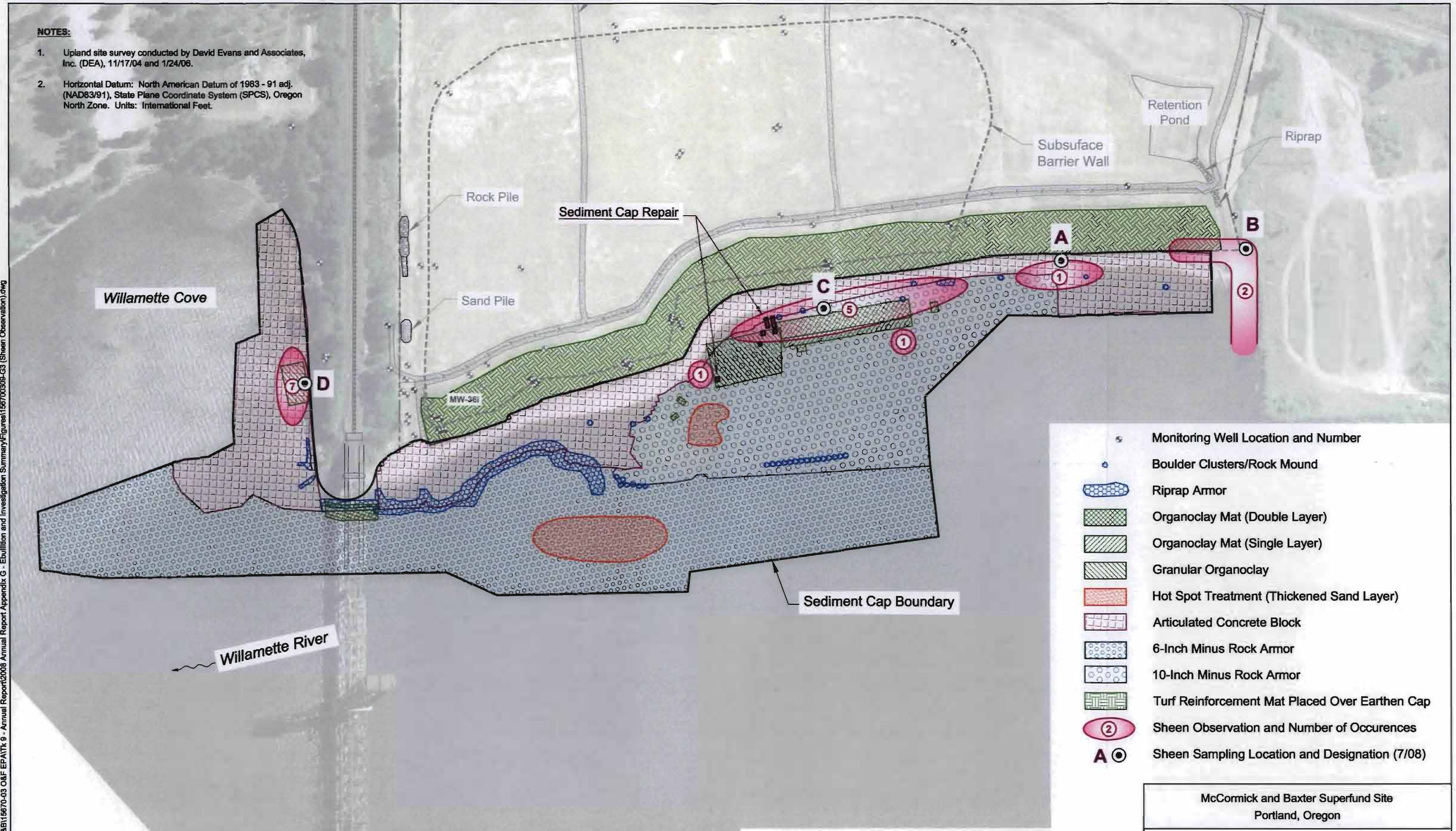
Figure
G-2b

File Path: P:\205 - OR DEQ\003 - 003 McCormick and Baxter\Project_GIS\Project_mxds\2008_Annual_Report\FigureG-2b_Samples_in_Former_TFA_Sampling_Area.mxd, Date: May 21, 2009 3:03:08 PM

NOTES:

1. Upland site survey conducted by David Evans and Associates, Inc. (DEA), 11/17/04 and 1/24/06.
2. Horizontal Datum: North American Datum of 1983 - 91 adj. (NAD83/91), State Plane Coordinate System (SPCS), Oregon North Zone. Units: International Feet.



McCormick and Baxter Superfund Site
Portland, Oregon

Sheen Observation Summary

5/09

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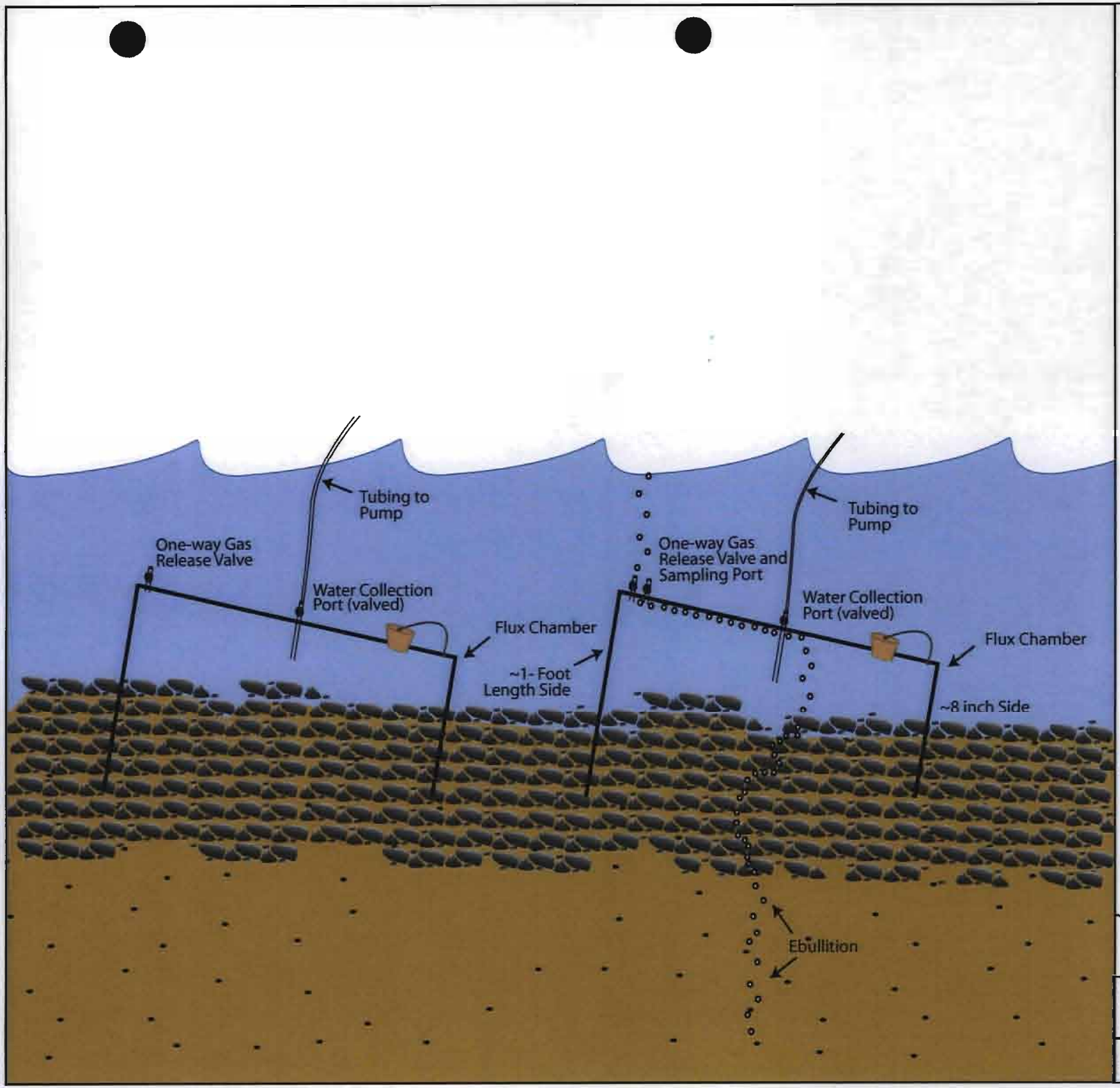
GSI Water Solutions, Inc.

Figure
G-3

F:\Data\Jobs\DEQ\15670-xx M&B\15670-03 O&F EPA\Tx 9 - Annual Report\2008 Annual Report Appendix G - Ebullition and Investigation Summary\Figures\15670309-G3 (Sheen Observation).dwg



LEGEND

- Cap Sand
- Rock Armoring
- Gas Bubbles

NOT TO SCALE

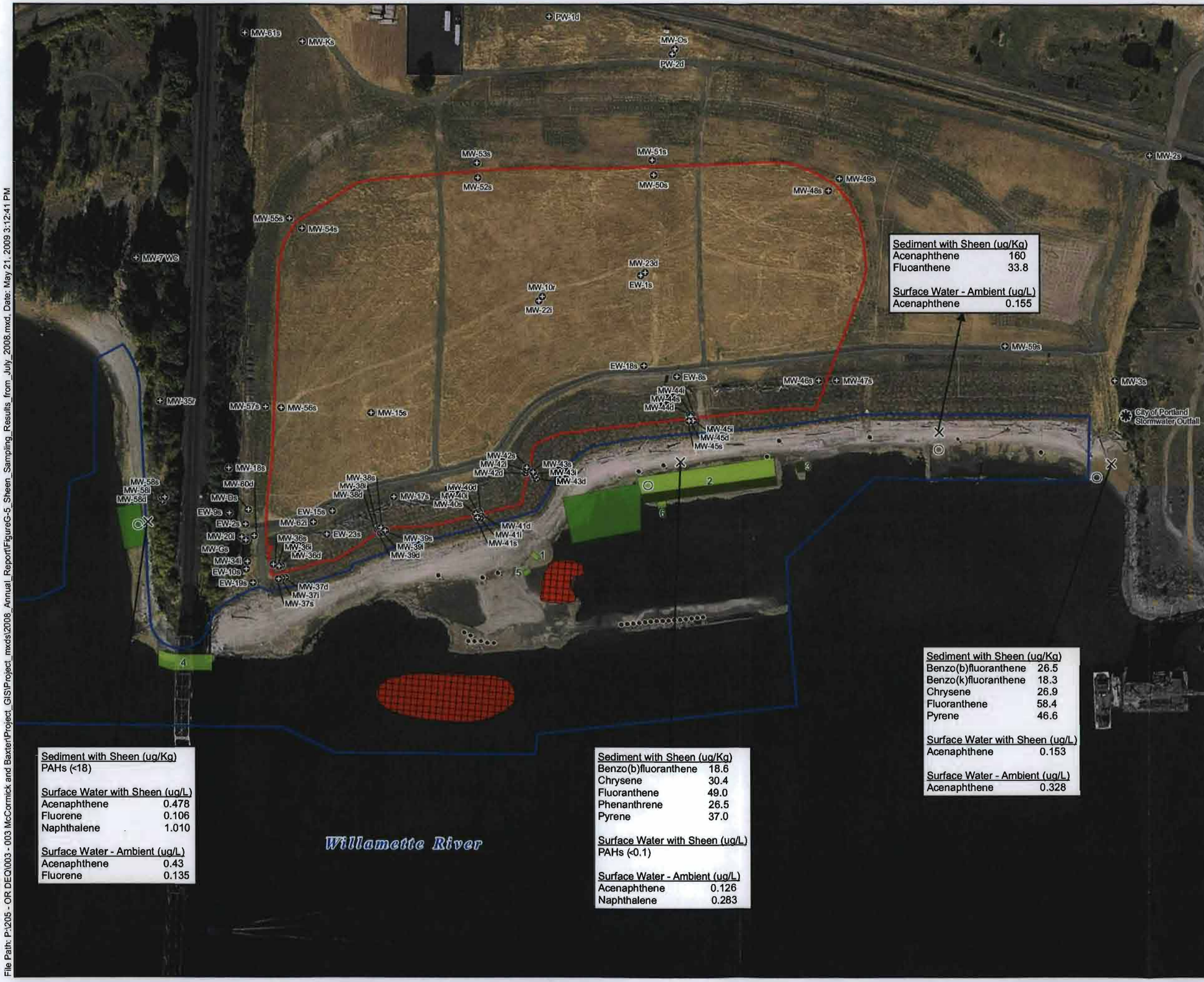
McCormick and Baxter Superfund Site
Portland, Oregon

Flux Chamber Schematic for Ebullition Sampling

5/09

HARTCROWSER GSI

Figure
G-4



LEGEND

Sample Types

- × Co-located Sediment and Surface Water Sample with Sheen
- ○ Ambient Surface Water Sample Adjacent to Area with Sheen

Site Features

- Groundwater Monitoring Wells
- City of Portland Stormwater Outfall
- Subsurface Barrier Wall
- Sediment Cap Boundary
- Organoclay Granular
- Organoclay Mats (Double)
- Organoclay Mats (Single)
- Hot Spot Treatment (thickened sand layer)
- Boulder Clusters

ABBREVIATIONS:
ug/kg = micrograms per kilogram
ug/L = micrograms per liter
PAH = polynuclear aromatic hydrocarbons

NOTE: Aerial photo taken on September 22, 2006

0 200 400
Scale in feet

McCormick and Baxter Superfund Site
Portland, Oregon

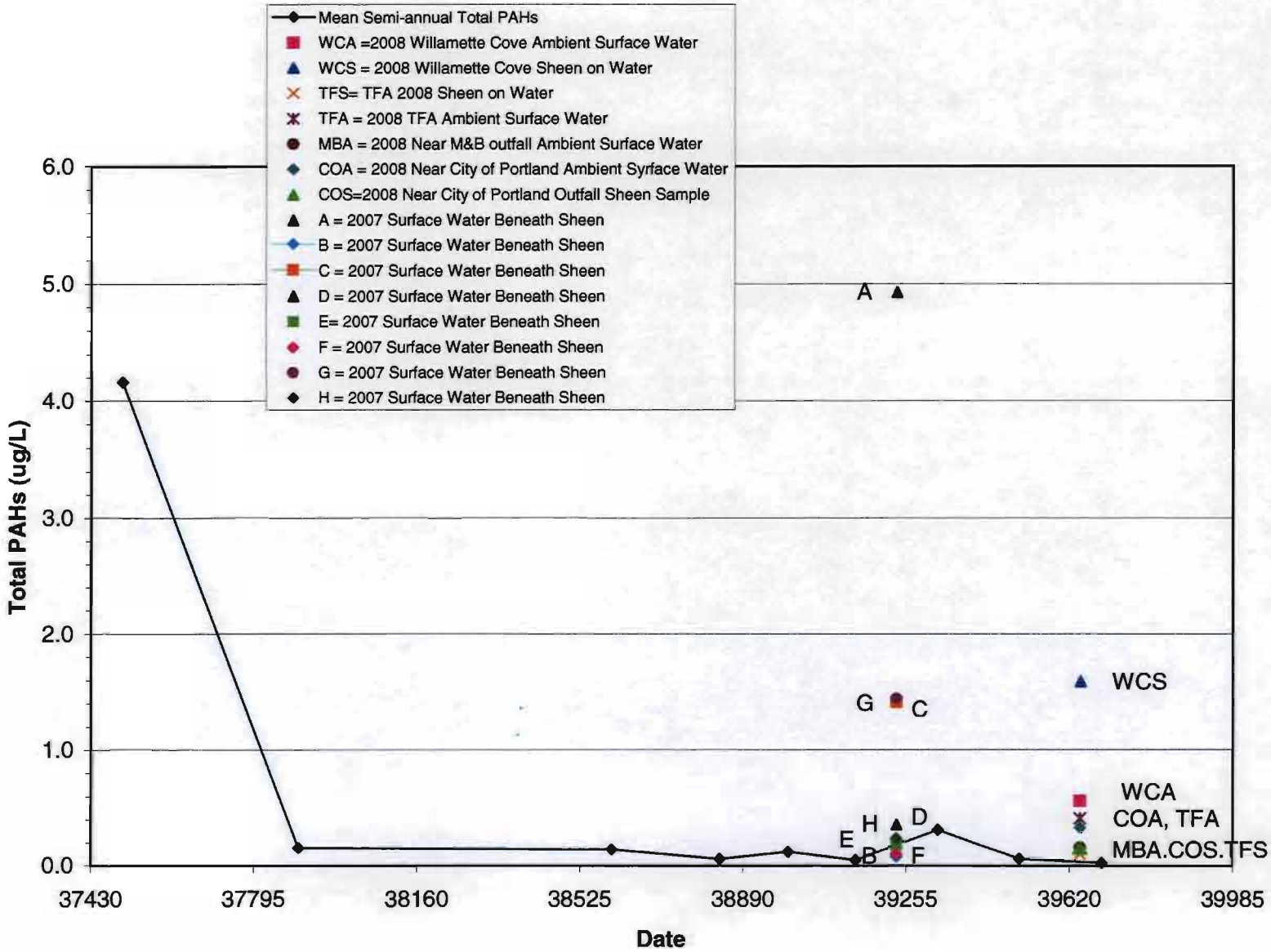
Sheen Sampling Results from July 2008

5/09

HARTCROWSER GSI Water Solutions, Inc.

Figure
G-5

File Path: P:\205 - OR DEQ\003 - 003 McCormick and Baxter\Project_GIS\Project_mxds\2008_Annual_Report\FigureG-5_Sheen_Sampling_Results_from_July_2008.mxd, Date: May 21, 2009 3:12:41 PM



McCormick and Baxter Superfund Site
Portland, Oregon

Total PAHs in Sheen versus Surface Water

5/09

Figure
G-6

HARTCROWSER

GSI Water Solutions, Inc.

File Path: P:\205 - OR DEQ\003 - 003 McCormick and Baxter\Project_GIS\Project_mxds\2008_Annual_Report\FigureG-7_Ebullition_Locations_from_July31_2008.mxd, Date: May 21, 2009 3:21:32 PM

LEGEND

- Ebullition Locations
- Extent of Survey

Site Features

- Groundwater Monitoring Wells
- City of Portland Stormwater Outfall
- Willamette River Level During Sampling Event (8.19 feet)
- Subsurface Barrier Wall
- Sediment Cap Boundary
- Organoclay Granular
- Organoclay Mats (Double)
- Organoclay Mats (Single)
- Hot Spot Treatment (thickened sand layer)
- Boulder Clusters

NOTES:

1) Aerial photo taken on September 22, 2006
2) Willamette River low tide at 15:00 at 8.19 feet NAVD88

0 200 400

Scale in feet

McCormick and Baxter Superfund Site
Portland, Oregon

Ebullition Locations from July 31, 2008

5/09

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Figure
G-7

LEGEND

- Ebullition Locations
- Extent of Survey

Site Features

- Groundwater Monitoring Wells
- City of Portland Stormwater Outfall
- Willamette River Level During Sampling Event (8.19 feet)
- Subsurface Barrier Wall
- Sediment Cap Boundary
- Organoclay Granular
- Organoclay Mats (Double)
- Organoclay Mats (Single)
- Hot Spot Treatment (thickened sand layer)
- Boulder Clusters

NOTES:

1) Aerial photo taken on September 22, 2006
2) Willamette River low tide at 13:00 at 5.25 feet NAVD88

0 200 400

Scale in feet

McCormick and Baxter Superfund Site
Portland, Oregon

Ebullition Locations from September 12, 2008

5/09

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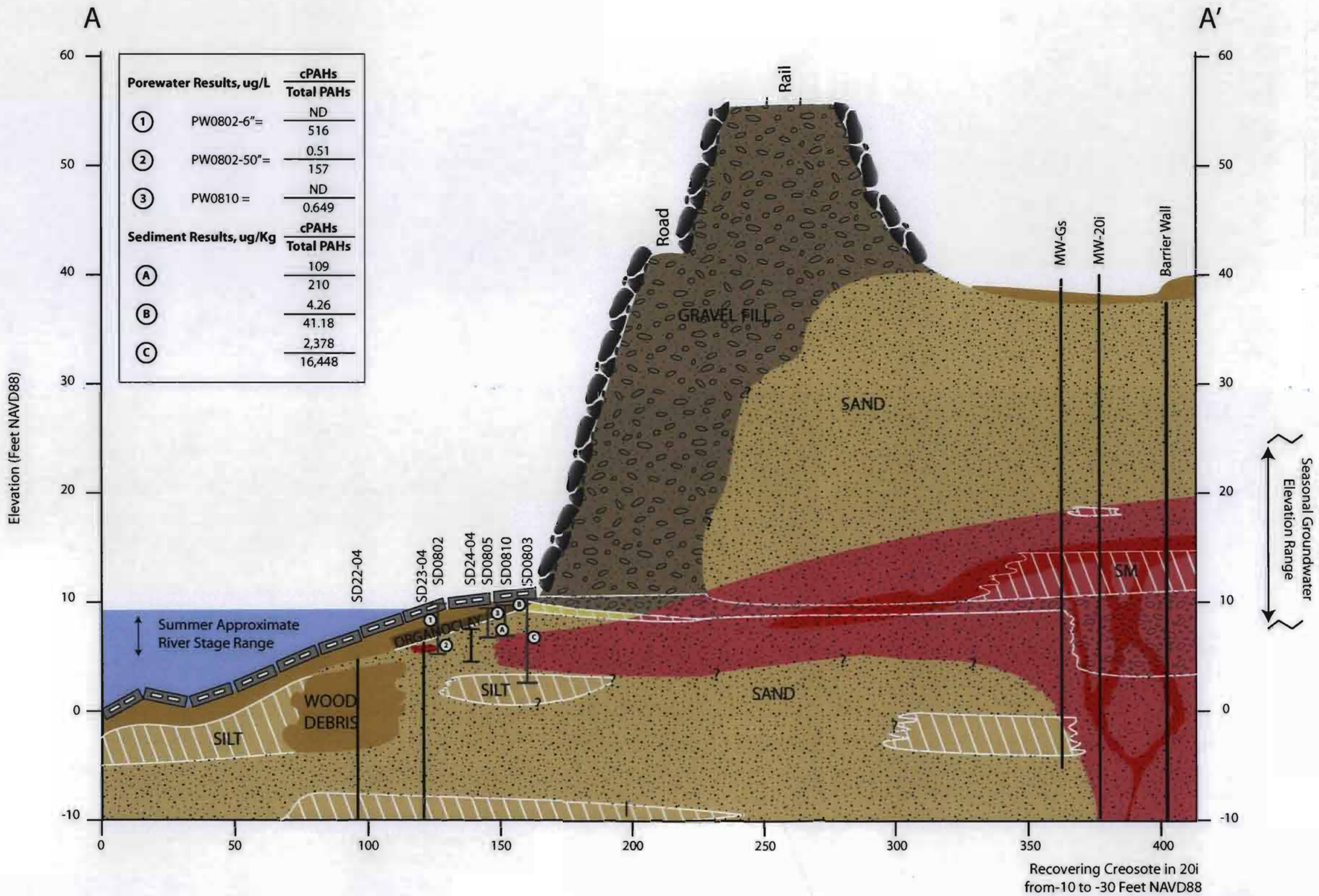
Figure
G-8

File Path: P:\205 - OR DEQ\003 - 003 McCormick and Baxter\Project_GIS\Project_mxds\2008_Annual_Report\FigureG-8_Ebullition_Locations_from_Sept12_2008.mxd, Date: May 21, 2009 3:23:48 PM



LEGEND

- Articulated Concrete Block Armoring
- Rock Armoring
- Cap Sand
- Organoclay
- Silty Sand
- Silt
- Sand
- Gravel Fill
- Gravel
- Residual Creosote
- Potential Mobile Creosote
- 2008 Boring
- 2004 Boring

NOTES

cPAH	Carcinogenic PAHs
PAH	Polynuclear Aromatic Hydrocarbons
ug/kg	Micrograms per kilogram
ug/L	Micrograms per liter
ND	Not Detected

SCALE

10 feet

4x Vertical Exaggeration

40 feet

McCormick and Baxter Superfund Site
Portland, Oregon

Willamette Cove Cross Section A-A'
Geology and Contaminant Distribution

5/09

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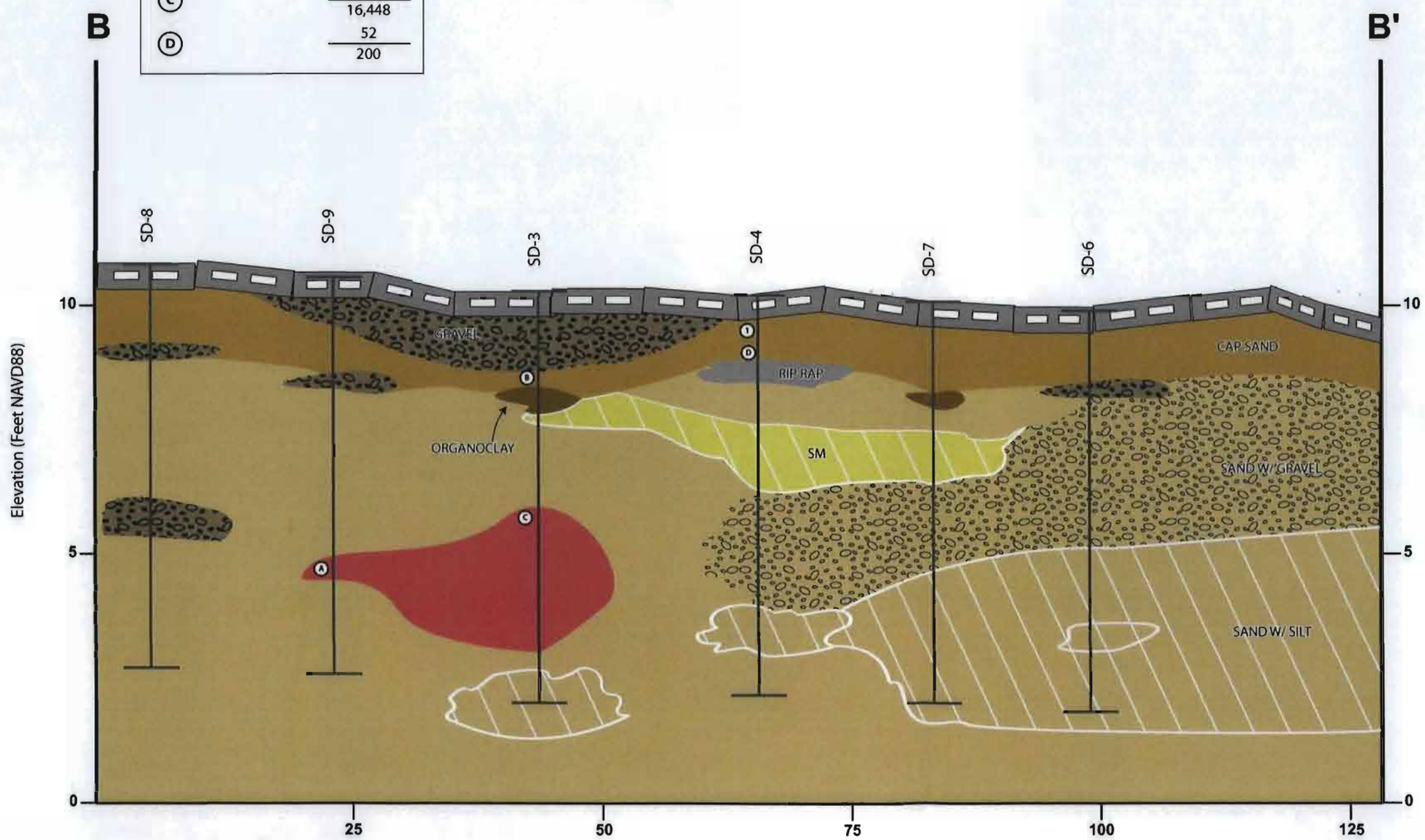
Figure
G-9

P:\205 - OR DEQ\003 - 003 McCormick and Baxter\Conceptual_Model_Ebullition_07_08

Porewater Results, ug/L	cPAHs / Total PAHs
(1) PW0804 =	ND / 2.32

Sediment Results, ug/Kg	cPAHs / Total PAHs
(A)	6,720 / 19,800
(B)	4.26 / 41.18
(C)	2,378 / 16,448
(D)	52 / 200



LEGEND

- Articulated Concrete Block Armoring
- Cap Sand
- Organoclay
- SM
- Silt
- Sand
- Gravel
- Rip Rap
- Residual Creosote
- Potential Mobile Creosote
- 2008 Boring

NOTES

cPAH	Carcinogenic PAHs
PAH	Polynuclear Aromatic Hydrocarbons
ug/kg	Micrograms per kilogram
ug/L	Micrograms per liter
ND	Not Detected

SCALE

5x Vertical Exaggeration

2.5 feet

12.5 feet

McCormick and Baxter Superfund Site
Portland, Oregon

Willamette Cove Cross Section B-B'
Geology and Contaminant Distribution

5/09

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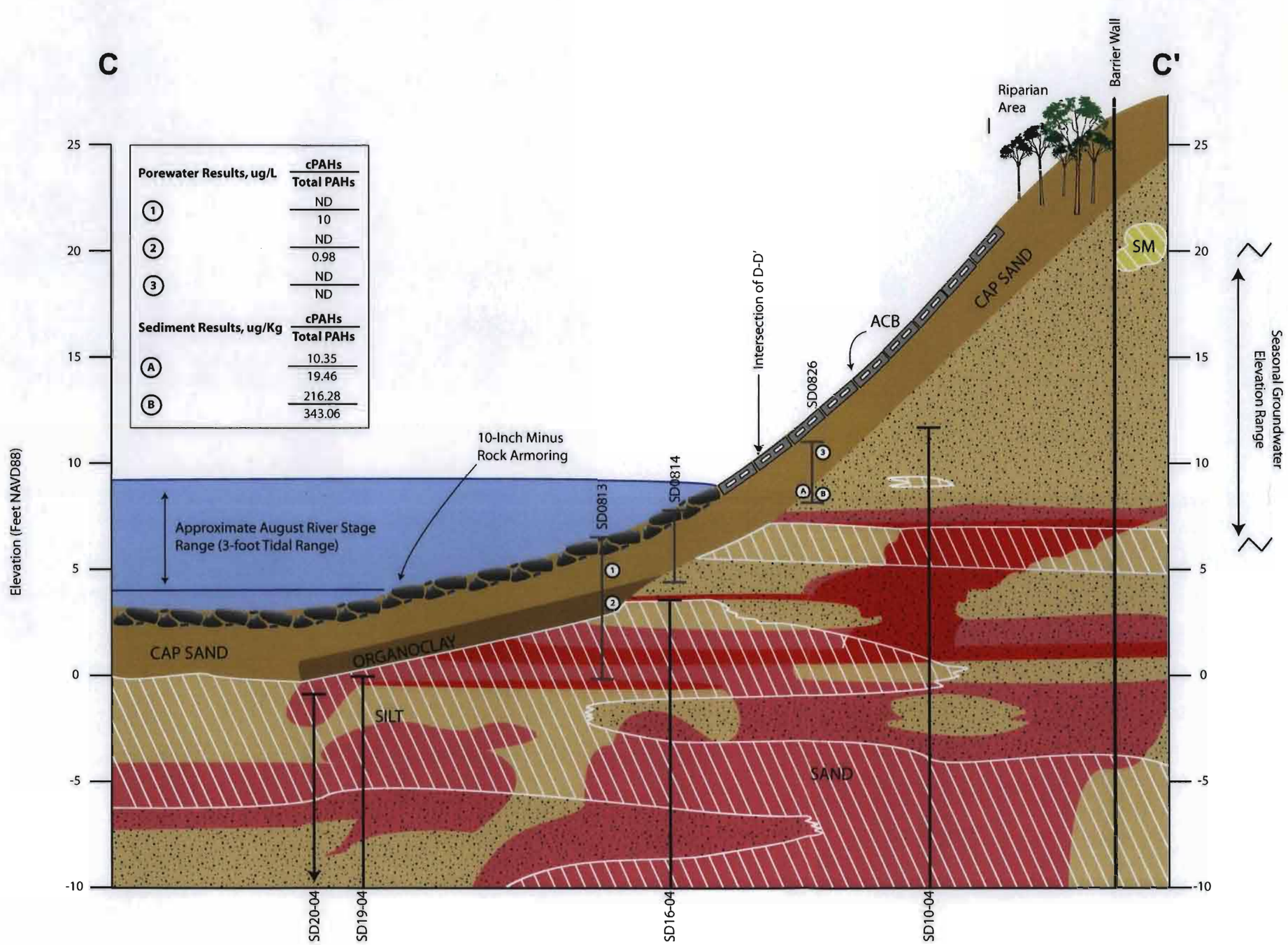
Figure
G-10

File Path: \\gsi-sbs-001\Projects\205 - OR DEQ\003 - 003 McCormick and Baxter\Project_GIS\Project_mxds\2008_Annual_Report\Cross_Section_D-D'.mxd



LEGEND

- Articulated Concrete Block Armoring
- Rock Armoring
- Cap Sand
- Organoclay
- Silty Sand
- Silt
- Sand
- Residual Creosote
- Potential Mobile Creosote
- 2008 Boring
- 2004 Boring

NOTES

cPAH	Carcinogenic PAHs
PAH	Polynuclear Aromatic Hydrocarbons
ug/kg	Micrograms per kilogram
ug/L	Micrograms per liter
ND	Not Detected

SCALE

5 feet × 30 feet
6x Vertical Exaggeration

McCormick and Baxter Superfund Site
Portland, Oregon

Former TFA Cross Section C-C'
Geology and Contaminant Distribution

5/09

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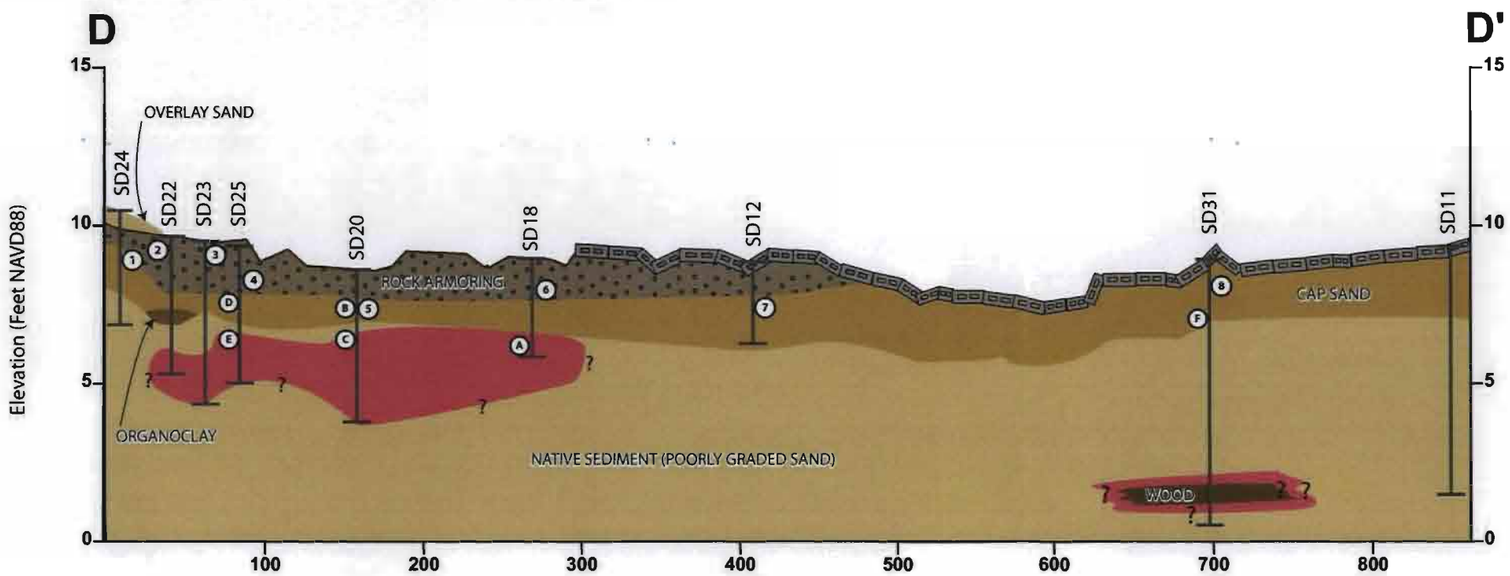
Figure
G-11

P:\205 - OR DEQ\003 - 003 McCormick and Baxter\Conceptual_Model_Ebullition_07_08

Porewater Results, ug/L	cPAHs / Total PAHs
1	ND / ND
2	0.0971 / 0.6749
3	ND / 0.134
4	ND / 0.4596
5	ND / ND
6	ND / ND
7	ND / ND
8	ND / 15

Sediment Results, ug/Kg	cPAHs / Total PAHs
A	8,420 / 49,500
B	165.91 / 361.31
C	4,029.6 / 22,265.5
D	165.42 / 1,208.95
E	1,632.5 / 4,542.9
F	85.8 / 287.69



LEGEND

- Surface Elevation
- Articulated Concrete Block Armoring
- Cap Sand
- Organoclay
- Overlay Sand
- Native Sediment
- Rock Armoring
- Residual Creosote
- Potential Mobile Creosote
- 2008 Boring

NOTES

cPAH	Carcinogenic PAHs
PAH	Polynuclear Aromatic Hydrocarbons
ug/kg	Micrograms per kilogram
ug/L	Micrograms per liter
ND	Not Detected

SCALE

5 feet

20x Vertical Exaggeration

100 feet

McCormick and Baxter Superfund Site
Portland, Oregon

TFA Cross Section D-D'
Geology and Contaminant Distribution

5/09

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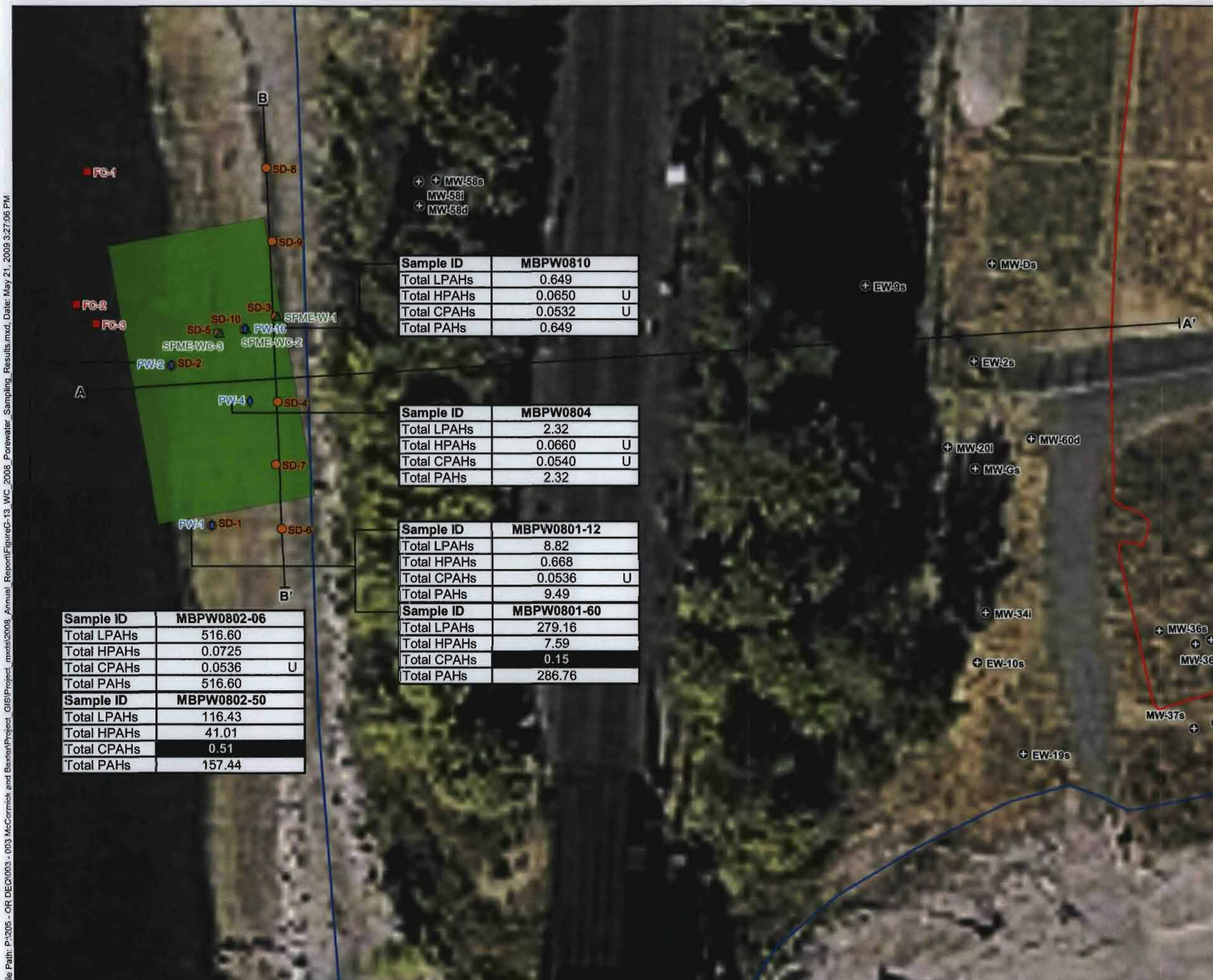
Figure
G-12

File Path: \\gsi-sbs-00\projects\205 - OR DEQ\003 - 003 McCormick and Baxter\Project_GIS\Project_mxds\2008_Annual_Rpt_Cross_Section_C-C'.mxd



Sample ID	MBPW0810	
Total LPAHs	0.649	
Total HPAHs	0.0650	U
Total CPAHs	0.0532	U
Total PAHs	0.649	

Sample ID	MBPW0804	
Total LPAHs	2.32	
Total HPAHs	0.0660	U
Total CPAHs	0.0540	U
Total PAHs	2.32	

Sample ID	MBPW0801-12	
Total LPAHs	8.82	
Total HPAHs	0.668	
Total CPAHs	0.0536	U
Total PAHs	9.49	
Sample ID	**MBPW0801-60**	
Total LPAHs	279.16	
Total HPAHs	7.59	
Total CPAHs	0.15	
Total PAHs	286.76	

Sample ID	MBPW0802-06	
Total LPAHs	516.60	
Total HPAHs	0.0725	
Total CPAHs	0.0536	U
Total PAHs	516.60	
Sample ID	**MBPW0802-50**	
Total LPAHs	116.43	
Total HPAHs	41.01	
Total CPAHs	0.51	
Total PAHs	157.44	

LEGEND

Sample Types

- Sediment (SD)
- Porewater (PW)
- Flux Chamber (FC)
- Solid Phase Micro-Extraction (SPME)

Site Features

- Groundwater Monitoring Well
- Cross Sections
- Subsurface Barrier Wall
- Sediment Cap Boundary
- Organoclay Granular

ABBREVIATIONS:

PAHs = polynuclear aromatic hydrocarbons
CPAHs = carcinogenic PAHs
LPAHs = low molecular weight PAHs
HPAH = High molecular weight PAHs
U = not detected
ug/L = micrograms per liter

NOTES:

1) PAHs presented in ug/L
2) Black shading indicates sediment cap performance goal exceeded
3) Aerial photo taken on September 22, 2006

0 30 60
Scale in feet

McCormick and Baxter Superfund Site
Portland, Oregon

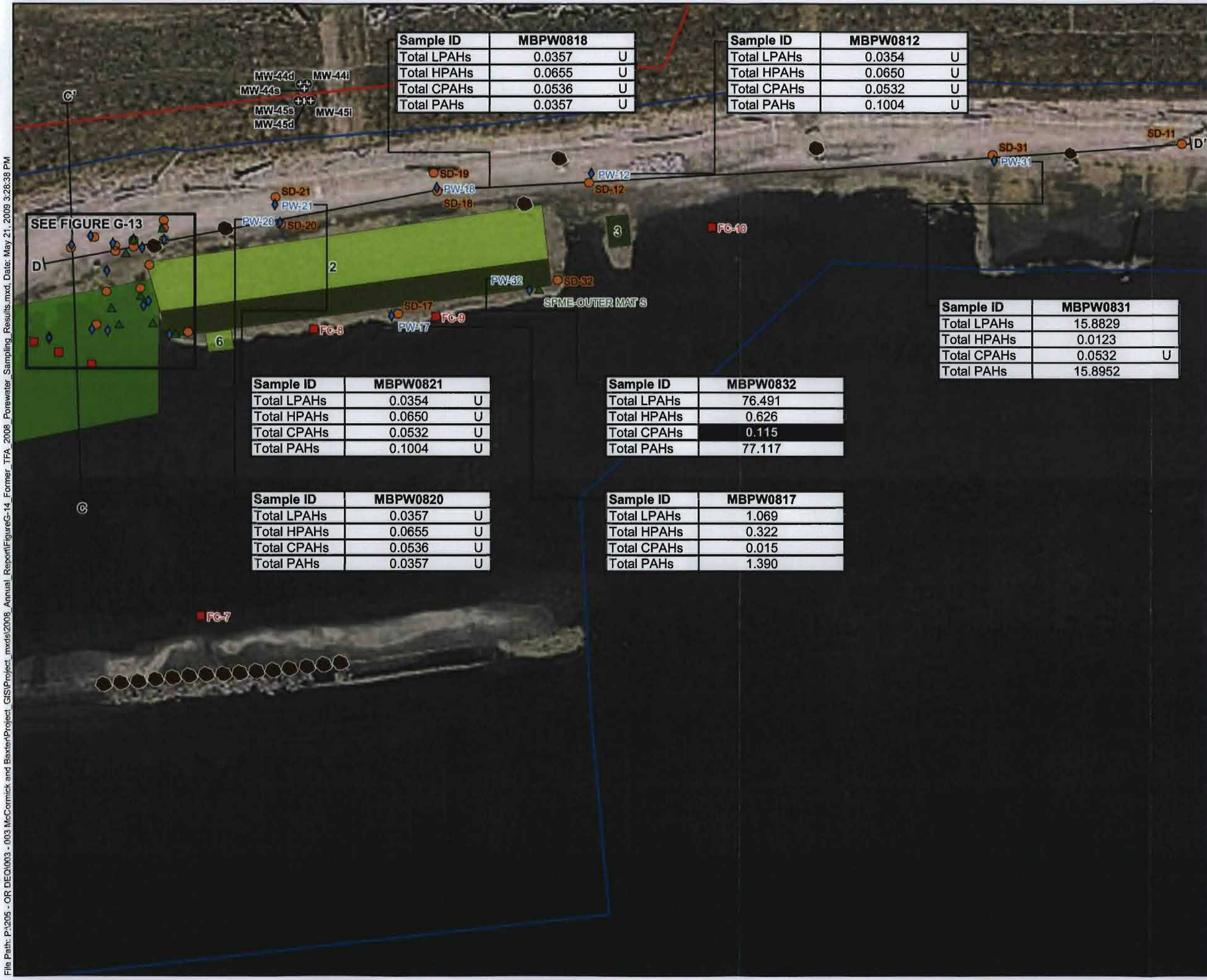
Willamette Cove 2008 Porewater Sampling Results

5/09

HARTCROWSER GSI Water Solutions, Inc.

Figure
G-13

File Path: P:\205 - OR DEQ\003 - 003 McCormick and Baxter\Project_GIS\Project_mxds\2008_Annual_Report\FigureG-13_WC_2008_Porewater_Sampling_Results.mxd, Date: May 21, 2009 3:27:06 PM



Sample ID	MBPW0818	
Total LPAHs	0.0357	U
Total HPAHs	0.0655	U
Total CPAHs	0.0536	U
Total PAHs	0.0357	U

Sample ID	MBPW0812	
Total LPAHs	0.0354	U
Total HPAHs	0.0650	U
Total CPAHs	0.0532	U
Total PAHs	0.1004	U

Sample ID	MBPW0831	
Total LPAHs	15.8829	
Total HPAHs	0.0123	
Total CPAHs	0.0532	U
Total PAHs	15.8952	

Sample ID	MBPW0821	
Total LPAHs	0.0354	U
Total HPAHs	0.0650	U
Total CPAHs	0.0532	U
Total PAHs	0.1004	U

Sample ID	MBPW0832
Total LPAHs	76.491
Total HPAHs	0.626
Total CPAHs	0.115
Total PAHs	77.117

Sample ID	MBPW0820	
Total LPAHs	0.0357	U
Total HPAHs	0.0655	U
Total CPAHs	0.0536	U
Total PAHs	0.0357	U

Sample ID	MBPW0817
Total LPAHs	1.069
Total HPAHs	0.322
Total CPAHs	0.015
Total PAHs	1.390

LEGEND

Sample Types

- Sediment (SD)
- Porewater (PW)
- Flux Chamber (FC)
- Solid Phase Micro-Extraction (SPME)

Site Features

- Groundwater Monitoring Well
- Cross Sections
- Subsurface Barrier Wall
- Sediment Cap Boundary
- Organoclay Granular
- Organoclay Mats (Double)
- Organoclay Mats (Single)
- Hot Spot Treatment (thickened sand layer)
- Boulder Clusters

ABBREVIATIONS:

PAHs = polynuclear aromatic hydrocarbons
CPAHs = carcinogenic PAHs
LPAHs = low molecular weight PAHs
HPAH = High molecular weight PAHs
U = not detected
ug/L = micrograms per liter

NOTES:

1) PAHs presented in ug/L
2) Black shading indicates sediment cap performance goal exceeded
3) Aerial photo taken on September 22, 2006

0 70 140
Scale in feet

McCormick and Baxter Superfund Site
Portland, Oregon

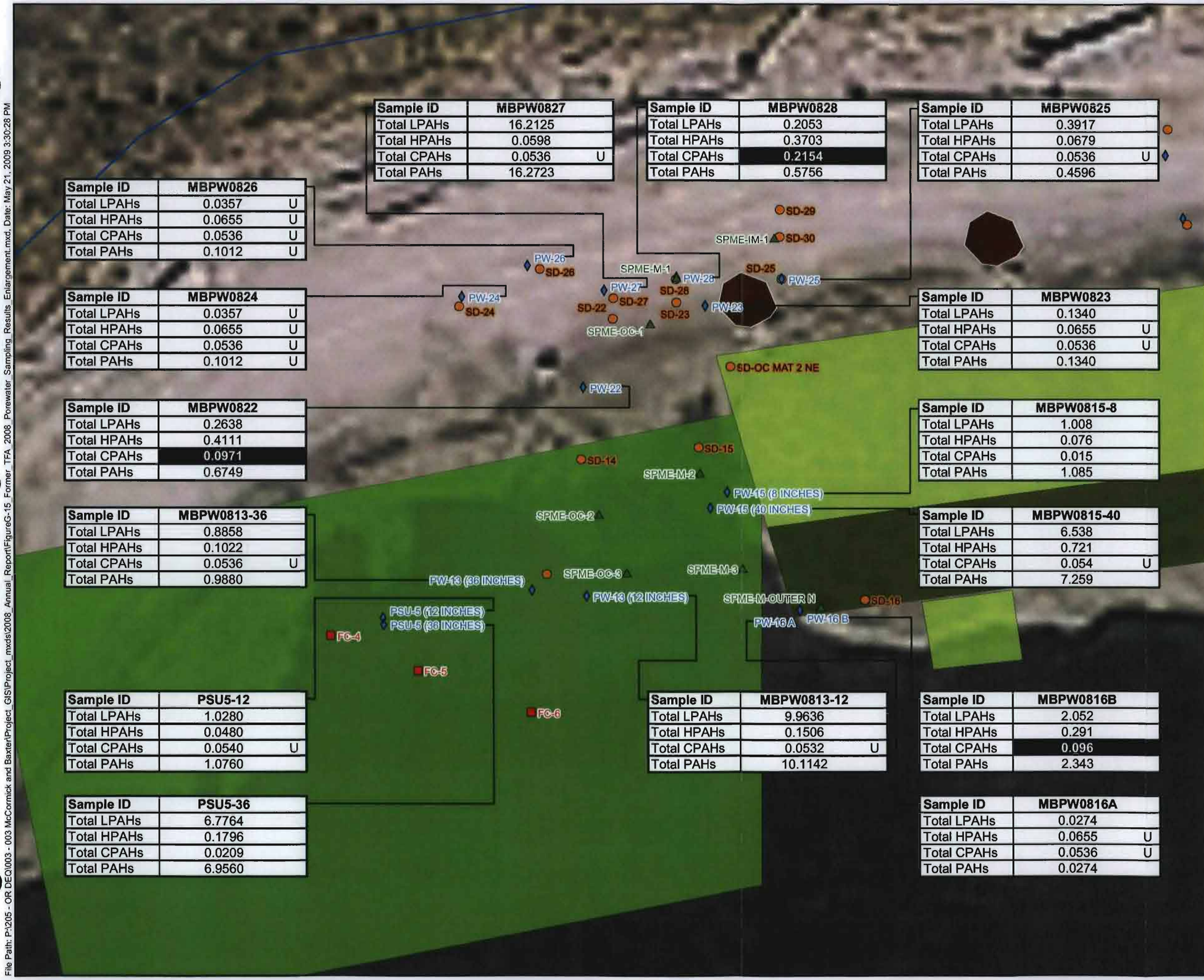
Former Tank Farm Area 2008 Porewater Sampling Results

5/09

HARTCROWSER GSI Water Solutions, Inc.

Figure
G-14

File Path: P:\205 - OR DEQ\003 - 003 McCormick and Baxter\Project_GIS\Project_mxds\2008_Annual_Report\FigureG-14_Former_TFA_2008_Porewater_Sampling_Results.mxd, Date: May 21, 2009 3:28:38 PM



Sample ID	MBPW0827	
Total LPAHs	16.2125	
Total HPAHs	0.0598	
Total CPAHs	0.0536	U
Total PAHs	16.2723	

Sample ID	MBPW0828	
Total LPAHs	0.2053	
Total HPAHs	0.3703	
Total CPAHs	0.2154	
Total PAHs	0.5756	

Sample ID	MBPW0825	
Total LPAHs	0.3917	
Total HPAHs	0.0679	
Total CPAHs	0.0536	U
Total PAHs	0.4596	

Sample ID	MBPW0826	
Total LPAHs	0.0357	U
Total HPAHs	0.0655	U
Total CPAHs	0.0536	U
Total PAHs	0.1012	U

Sample ID	MBPW0824	
Total LPAHs	0.0357	U
Total HPAHs	0.0655	U
Total CPAHs	0.0536	U
Total PAHs	0.1012	U

Sample ID	MBPW0823	
Total LPAHs	0.1340	
Total HPAHs	0.0655	U
Total CPAHs	0.0536	U
Total PAHs	0.1340	

Sample ID	MBPW0822	
Total LPAHs	0.2638	
Total HPAHs	0.4111	
Total CPAHs	0.0971	
Total PAHs	0.6749	

Sample ID	MBPW0815-8	
Total LPAHs	1.008	
Total HPAHs	0.076	
Total CPAHs	0.015	
Total PAHs	1.085	

Sample ID	MBPW0813-36	
Total LPAHs	0.8858	
Total HPAHs	0.1022	
Total CPAHs	0.0536	U
Total PAHs	0.9880	

Sample ID	MBPW0815-40	
Total LPAHs	6.538	
Total HPAHs	0.721	
Total CPAHs	0.054	U
Total PAHs	7.259	

Sample ID	PSU5-12	
Total LPAHs	1.0280	
Total HPAHs	0.0480	
Total CPAHs	0.0540	U
Total PAHs	1.0760	

Sample ID	MBPW0813-12	
Total LPAHs	9.9636	
Total HPAHs	0.1506	
Total CPAHs	0.0532	U
Total PAHs	10.1142	

Sample ID	MBPW0816B	
Total LPAHs	2.052	
Total HPAHs	0.291	
Total CPAHs	0.096	
Total PAHs	2.343	

Sample ID	PSU5-36	
Total LPAHs	6.7764	
Total HPAHs	0.1796	
Total CPAHs	0.0209	
Total PAHs	6.9560	

Sample ID	MBPW0816A	
Total LPAHs	0.0274	
Total HPAHs	0.0655	U
Total CPAHs	0.0536	U
Total PAHs	0.0274	

LEGEND

Sample Types

- Sediment (SD)
- Porewater (PW)
- Flux Chamber (FC)
- Solid Phase Micro-Extraction (SPME)

Site Features

- Sediment Cap Boundary
- Organoclay Granular
- Organoclay Mats (Double)
- Organoclay Mats (Single)
- Boulder Clusters

ABBREVIATIONS:

PAHs = polynuclear aromatic hydrocarbons
CPAHs = carcinogenic PAHs
LPAHs = low molecular weight PAHs
HPAH = High molecular weight PAHs
U = not detected
ug/L = micrograms per liter

NOTES:

1) PAHs presented in ug/L
2) Black shading indicates sediment cap performance goal exceeded
3) Aerial photo taken on September 22, 2006

0 20 40
Scale in feet

McCormick and Baxter Superfund Site
Portland, Oregon

Former Tank Farm Area 2008
Porewater Sampling Results (Enlargement)

5/09

HARTCROWSER GSI Water Solutions, Inc.

Figure
G-15

File Path: P:\205 - OR DEQ\003 - 003 McCormick and Baxter\Project_GIS\Project_mxds\2008_Annual_Report\FigureG-15_Former_TFA_2008_Porewater_Sampling_Results_Enlargement.mxd, Date: May 21, 2009 3:30:28 PM

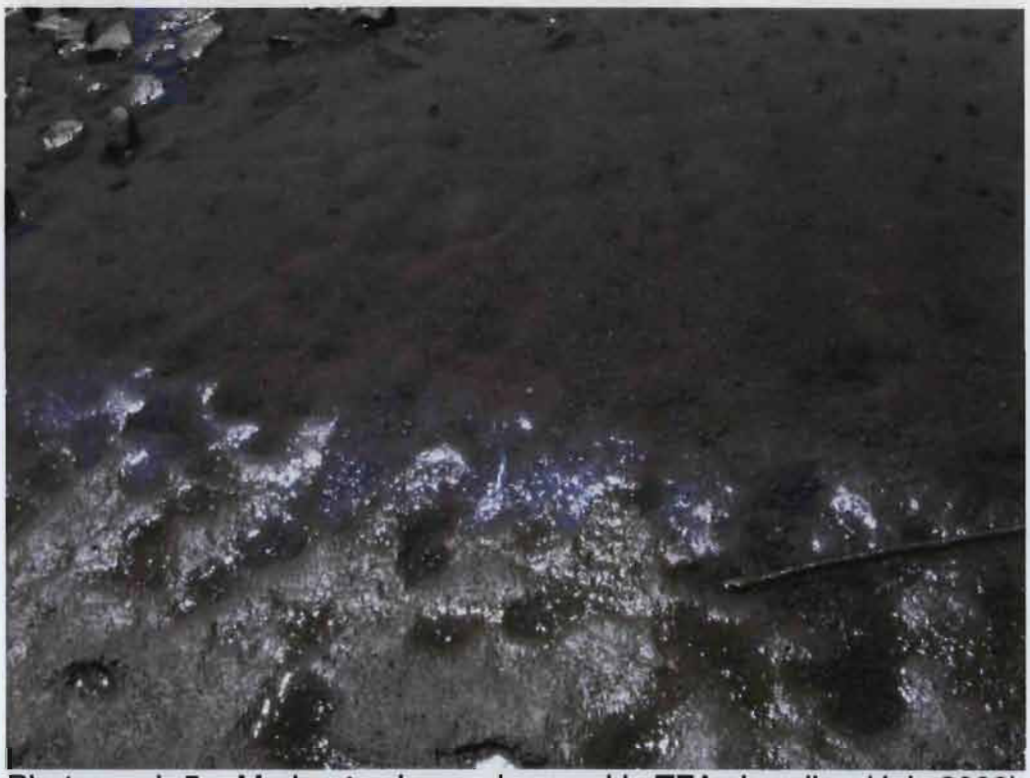
ATTACHMENT A
PHOTOGRAPHIC DOCUMENTATION

Photograph 1 – Moderate sheen observed between ACB in Willamette Cove (July 2008).

Photograph 2 – Moderate sheen observed between ACB in Willamette Cove (July 2008).

Photograph 3 – Moderate sheen observed in ACB in Willamette Cove area (July 2008).

Photograph 4 – Sheen observed in Willamette Cove. Appears to be flowing with groundwater discharge (July 2008).



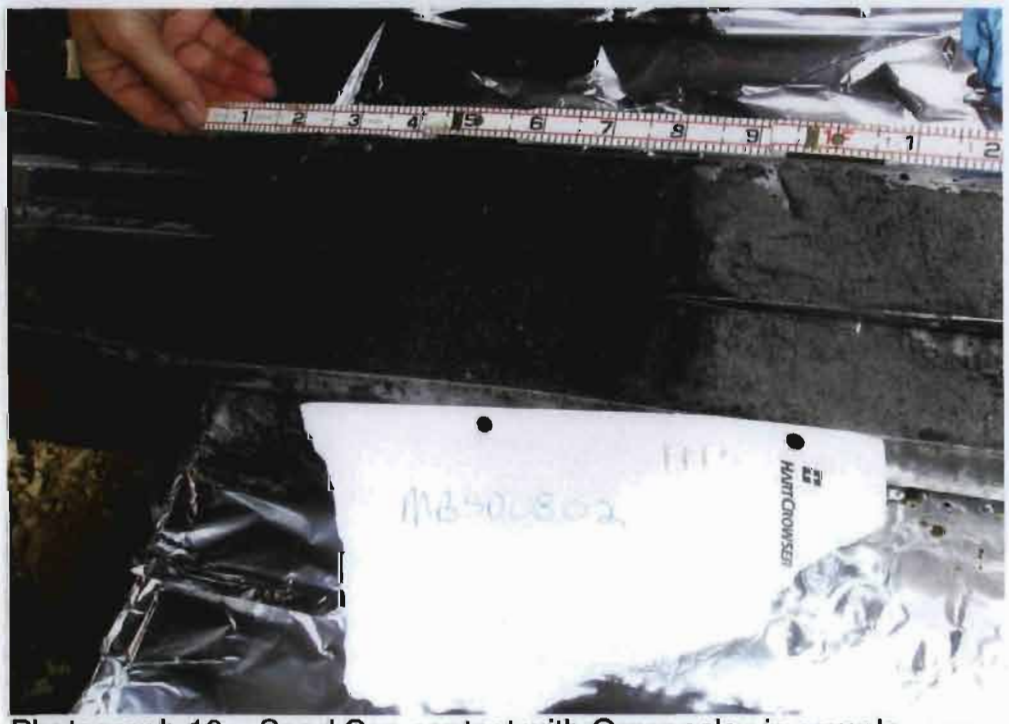
Photograph 5 – Moderate sheen observed in TFA shoreline (July 2008).

Photograph 6 – Moderate sheen observed in TFA. Appears only at low-tide shoreline river level.

Photograph 7 – Moderate sheen City of Portland outfall. Photograph taken looking south.

Photograph 8 – Sediment sample collection using a push probe in Willamette Cove. Photograph taken looking north.

Photograph 9 – Sediment sampling using four-foot-long three-inch cores. Photograph taken looking east.



Photograph 10 – Sand Cap contact with Organoclay in sample MBSD0802.

Photograph 11 – Sand Cap with oxidized layer at 2.5 to 3.0 feet below ground surface in sample MBSD0803.

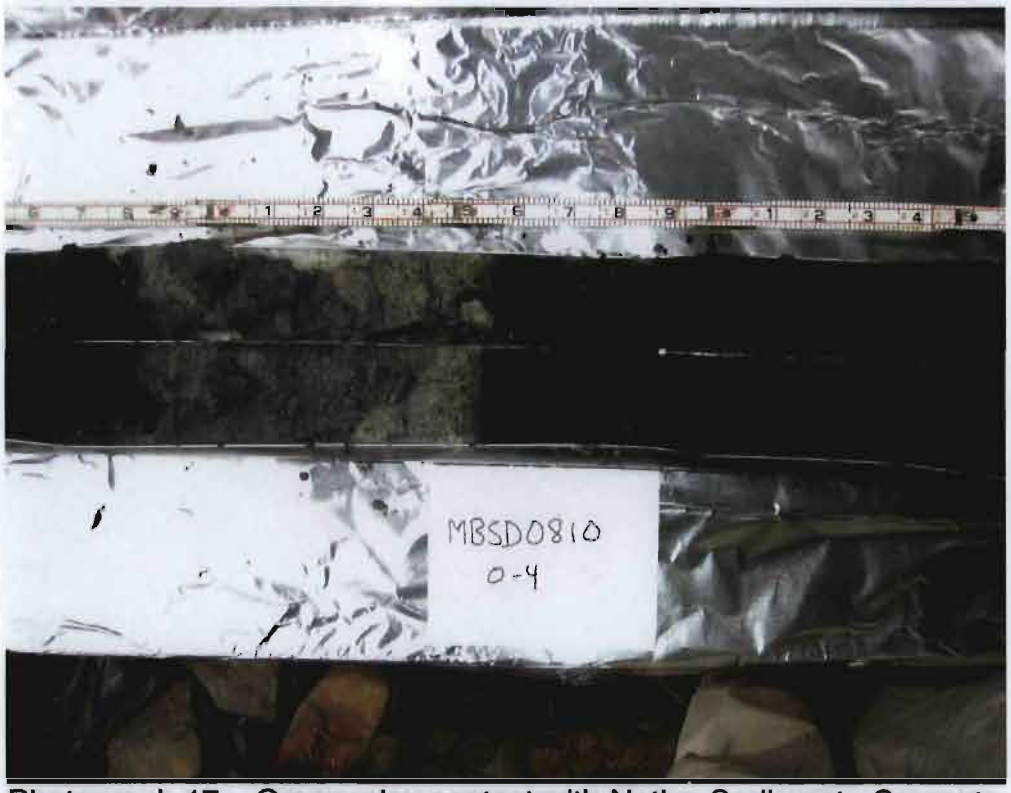
Photograph 12 – Black Native Sediment with creosote odor at 6.0 to 7.0 feet below ground surface in sample MBSD0803.

Photograph 13 – Organoclay contact with Native Sediment in sample MBSD0805. No odor.

Photograph 14 – Black Native Sediment with creosote odor at 7.0 to 8.0 feet below ground surface in sample MBSD0806.

Photograph 15 – Organoclay contact with Native Sediment. No odor. Sample MBSD0807.

Photograph 16 – Sediment collection using push probe during high tide. Photograph taken looking south.

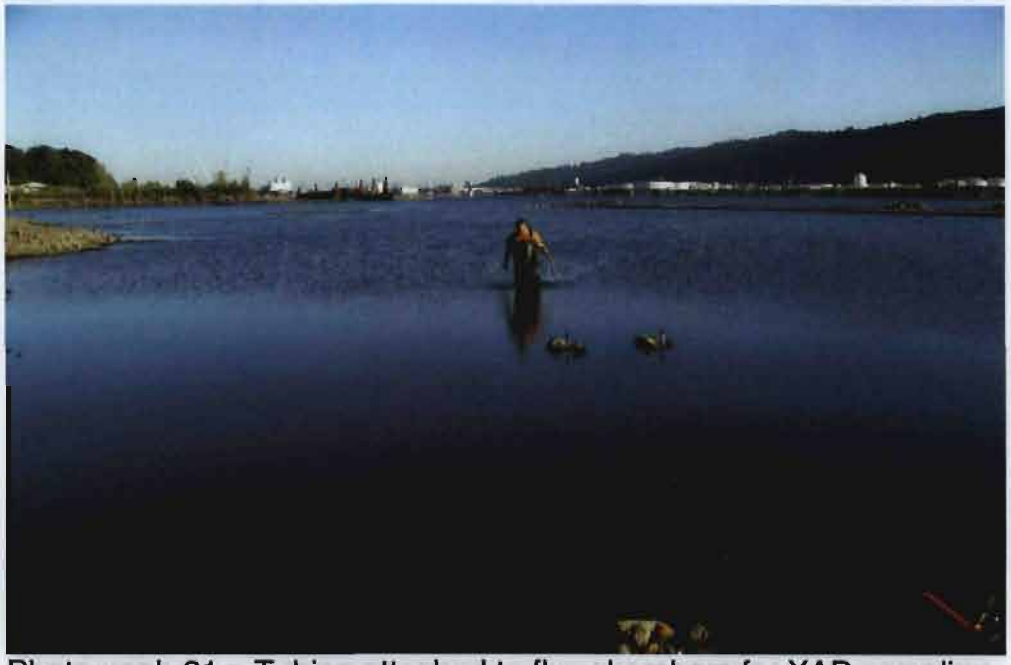


Photograph 17 – Organoclay contact with Native Sediment. Creosote odor in Native Sediment. Sample MBSD0810.

Photograph 18 – Moderate sheen observed in push probe trenches in TFA. Note: Trenches backfilled with organoclay.

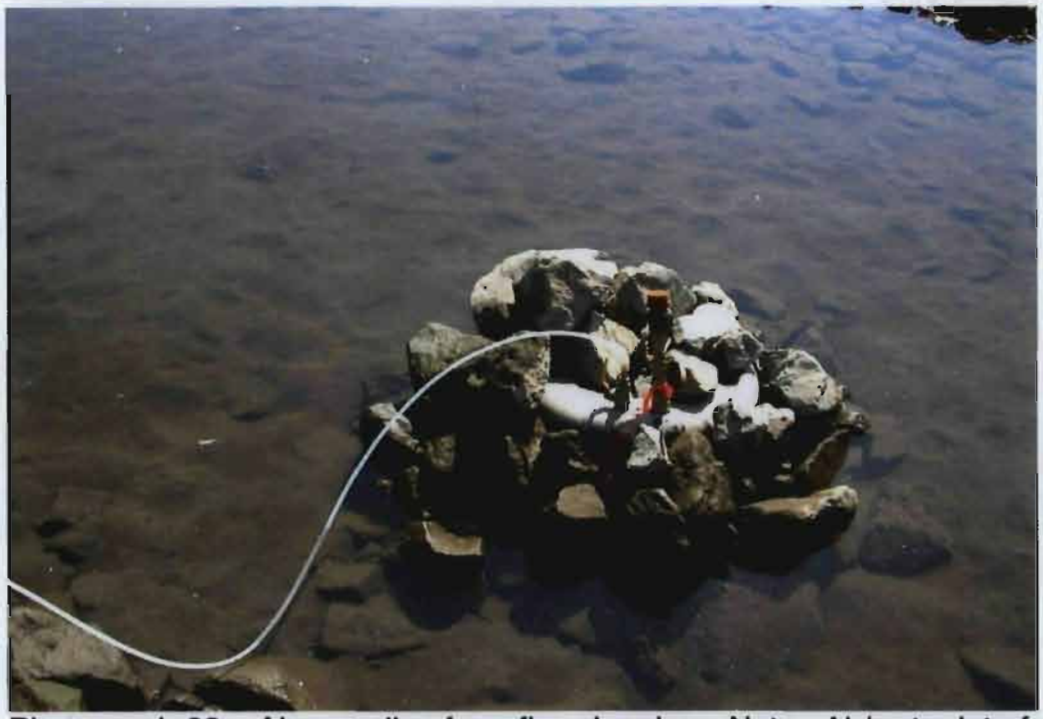
Photograph 19 – Sheen observed following push probe activities.
Note: Sheen was removed from pooled surface water and trenches backfilled with organoclay.

Photograph 20 – Flux chambers covered in rock in the TFA granular organoclay area. Photograph taken looking south.



Photograph 21 – Tubing attached to flux chambers for XAD sampling.
Photograph taken looking south.

Photograph 22 – Low-flow flux chamber sampling using a peristaltic pump.
Photograph taken looking northwest.



Photograph 23 – Air sampling from flux chamber. Note: Air/water interface can be seen in tubing during sampling.

Photograph 24 – Air sampling using peristaltic pump and tevlar bag.

Photograph 25 – Trench repair with organoclay mats following Ebullition and Sheen Investigation activities.

Photograph 26 – Organoclay mat installation. Photograph taken looking east.

Photograph 27 – Rock armoring placement on organoclay mats.
Photograph taken looking northwest.

ATTACHMENT B
LABORATORY DATA AND DATA QUALITY ASSURANCE MEMORANDUM

Included only on the O&M Report DVD

ATTACHMENT C
BORING LOGS

Key to Exploration Logs

Sample Description

Classification of soils in this report is based on visual field and laboratory observations which include density/consistency, moisture condition, grain size, and plasticity estimates and should not be construed to imply field nor laboratory testing unless presented herein. Visual-manual classification methods of ASTM D 2488 were used as an identification guide.

Density/Consistency

Soil density/consistency in borings is related primarily to the Standard Penetration Resistance. Soil density/consistency in test pits and probes is estimated based on visual observation and is presented parenthetically on the logs.

SAND or GRAVEL Density	Standard Penetration Resistance (N) in Blows/Foot	SILT or CLAY Consistency	Standard Penetration Resistance (N) in Blows/Foot	Approximate Shear Strength in TSF
Very loose	0 to 4	Very soft	0 to 2	<0.125
Loose	4 to 10	Soft	2 to 4	0.125 to 0.25
Medium dense	10 to 30	Medium stiff	4 to 8	0.25 to 0.5
Dense	30 to 50	Stiff	8 to 15	0.5 to 1.0
Very dense	>50	Very stiff	15 to 30	1.0 to 2.0
		Hard	>30	>2.0

Moisture

Dry	Little perceptible moisture
Damp	Some perceptible moisture, likely below optimum
Moist	Likely near optimum moisture content
Wet	Much perceptible moisture, likely above optimum

Minor Constituents	Estimated Percentage
Trace	<5
Slightly (clayey, silty, etc.)	5 - 12
Clayey, silty, sandy, gravelly	12 - 30
Very (clayey, silty, etc.)	30 - 50

Sampling Test Symbols

- 1.5" I.D. Split Spoon
- Grab (Jar)
- 3.0" I.D. Split Spoon
- Shelby Tube (Pushed)
- Push Probe
- Cuttings
- Core Run

Test Symbols

NA	Not Available
NS	No Sheen
SS	Slight Sheen
MS	Moderate Sheen
HS	Heavy Sheen
PAHs	Polynuclear Aromatic Hydrocarbons
PCP	Pentachlorophenol
TOC	Total Organic Carbon
Metals	Total Copper, Zinc, Chromium, and Arsenic
PID	Photoionization Detector Reading
ppm	Parts per Million

SOIL CLASSIFICATION CHART

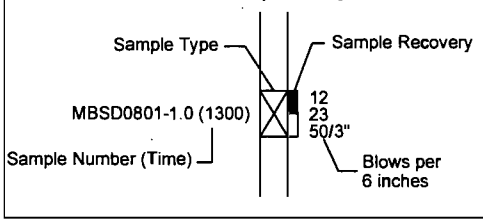
MAJOR DIVISIONS			SYMBOLS GRAPH	SYMBOLS LETTER	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	CLEAN GRAVELS (LITTLE OR NO FINES)		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
				GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
	MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
				GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	SAND AND SANDY SOILS	CLEAN SANDS (LITTLE OR NO FINES)		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
				SP	POORLY-GRADED SANDS, GRAVELLY SAND, LITTLE OR NO FINES
	MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)		SM	SILTY SANDS, SAND - SILT MIXTURES
				SC	CLAYEY SANDS, SAND - CLAY MIXTURES
FINE GRAINED SOILS	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
				OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS	LIQUID LIMIT GREATER THAN 50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY
				OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS

Groundwater Indicators

- Groundwater Level on Date or (ATD) At Time of Drilling
- Groundwater Seepage (Test Pits)

Sample Key



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15670-03/Task 9 1/09

Figure GG-1

Push Probe Exploration MBSD0801 - Willamette Cove

Location: McCormick and Baxter Superfund Site
Logged By: Tim Skrotzki
Reviewed By: Heidi Blischke

Drill Equipment: 4-Foot Core
Hammer Type: Geoprobe
Hole Diameter: 3 inches

USCS Class	Graphic Log	Soil Descriptions	Depth in Feet		Core Length & Recovery	TESTS & (PID)
		ACB.	0			
SP		SAND CAP. No odor.				
SP-SM		NATIVE SEDIMENT: Poorly graded SAND with SILT, black, wet, loose, slight creosote odor.		MBSD0801-0-4 (1045)		NS (NA)
			5	MBSD0801-4-8 (1100)		NS (NA)
		Bottom of Boring at 8.0 Feet. Started 08/25/08. Completed 08/25/08. Backfilled with organoclay.	10			

STRATAPROBE LOG 156700309 (PUSH PROBES).GPJ HC_CORP.GDT 3/16/09

1. Refer to Figure GG-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. USCS designations are based on visual manual classification (ASTM D 2488) unless otherwise supported by laboratory testing (ASTM D 2487).
4. Groundwater level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.
5. Drilled By: Cascade Drilling

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15670-03/Task 9 1/09

Figure GG-2

Push Probe Exploration MBSD0802 - Willamette Cove

Location: McCormick and Baxter Superfund Site
Logged By: Tim Skrotzki
Reviewed By: Heidi Blischke

Drill Equipment: 4-Foot Core
Hammer Type: Geoprobe
Hole Diameter: 3 inches

USCS Class	Graphic Log	Soil Descriptions	Depth in Feet	Core Length & Recovery	TESTS & (PID)
		ACB.	0		
SP		SAND CAP: Slight creosote odor.			NS (NA)
CL		ORGANOCLAY: No creosote odor. Bottom 2.5 inches layerted tan and gray.			NS (NA)
SP-SM		NATIVE SEDIMENT: Poorly graded SAND with SILT, black, wet, slight creosote odor at bottom.			SS (NA)
					NS
		Bottom of Boring at 4.0 Feet. Started 08/25/08. Completed 08/25/08. Backfilled with organoclay. Samples collected for the University of Texas.	5 10		

STRATAPROBE LOG 156700309 (PUSH PROBES).GPJ HC_CORP.GDT 3/16/09

1. Refer to Figure GG-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. USCS designations are based on visual manual classification (ASTM D 2488) unless otherwise supported by laboratory testing (ASTM D 2487).
4. Groundwater level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.
5. Drilled By: Cascade Drilling

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15670-03/Task 9 1/09

Figure GG-3

Push Probe Exploration MBSD0803 - Willamette Cove

Location: McCormick and Baxter Superfund Site
Logged By: Tim Skrotzki
Reviewed By: Heidi Blischke

Drill Equipment: 4-Foot Core
Hammer Type: Geoprobe
Hole Diameter: 3 inches

USCS Class	Graphic Log	Soil Descriptions	Depth in Feet	Core Length & Recovery	TESTS & (PID)
		ACB.	0		
GP		ROCK ARMORING, no odor.			
SP		SAND CAP, no odor.		MSD0803-1.0 (1200)	NS, PAHs, PCP (NA)
CL		ORGANOCLAY, no odor.		MSD0803-1.5 (1205)	NS (NA)
SP-SM		NATIVE SEDIMENT: Poorly graded SAND with SILT, gray, moist, no odor.			
SP		Poorly graded SAND, reddish-brown, wet, oxidized.		MSD0803-2.5 (1210)	NS (NA)
		Becomes black, no oxidation.			
		Becomes reddish-brown, oxidized, no creosote odor.	5		
		Becomes black, strong creosote odor.			
				MSD0803-6.1-6.5 (1245)	MS, PAHs, PCP (NA)
		No sheen, strong creosote odor.			
ML		SILT with SAND, dark gray, wet, moderate plasticity, creosote odor.			NS
		Bottom of Boring at 8.0 Feet.			
		Started 08/25/08.			
		Completed 08/25/08.			
		Backfilled with organoclay. Samples collected for the University of Texas.			
			10		

STRATAPROBE LOG 156700309 (PUSH PROBES).GPJ HC_CORP.GDT 3/16/09

1. Refer to Figure GG-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. USCS designations are based on visual manual classification (ASTM D 2488) unless otherwise supported by laboratory testing (ASTM D 2487).
4. Groundwater level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.
5. Drilled By: Cascade Drilling

HARTCROWSER

15670-03/Task 9 1/09

Figure GG-4

Push Probe Exploration MBSD0804 - Willamette Cove

Location: McCormick and Baxter Superfund Site
Logged By: Tim Skrotzki
Reviewed By: Heidi Blischke

Drill Equipment: 4-Foot Core
Hammer Type: Geoprobe
Hole Diameter: 3 inches

USCS Class	Graphic Log	Soil Descriptions	Depth in Feet		Core Length & Recovery	TESTS & (PID)
		ACB.	0			
SP		SAND CAP.				
GP		ROCK ARMORING, no odor.				NS (NA)
						NS (NA)
SP		NATIVE SEDIMENT: Poorly graded SAND, gray, moist, no odor.		MBSD0804-1.7-2.0 (1240)		NS (NA)
		Becomes silty, reddish-brown, oxidized.		MBSD0804-2.5-2.8 (1300)		NS (NA)
		Becomes gravelly and gray; gravel angular 1-2".				
		Becomes reddish-brown and wet.	5			
ML		SILT with SAND, gray, moist, no odor.				
SP		Poorly graded SAND, black, moist, no odor.		MBSD0804-6.5-8.0 (1308)		NS (NA)
		Bottom of Boring at 8.0 Feet. Started 08/25/08. Completed 08/25/08. Backfilled with bentonite chips.	10			

STRATAPROBE LOG 15670309 (PUSH PROBES).GPJ HC_CORP.GDT 3/16/09

1. Refer to Figure GG-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. USCS designations are based on visual manual classification (ASTM D 2488) unless otherwise supported by laboratory testing (ASTM D 2487).
4. Groundwater level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.
5. Drilled By: Cascade Drilling

HARTCROWSER

15670-03/Task 9 1/09

Figure GG-5

Push Probe Exploration MBSD0805 - Willamette Cove

Location: McCormick and Baxter Superfund Site
Logged By: Tim Skrotzki
Reviewed By: Heidi Blischke

Drill Equipment: 4-Foot Core
Hammer Type: Geoprobe
Hole Diameter: 3 inches

USCS Class	Graphic Log	Soil Descriptions	Depth in Feet	Core Length & Recovery	TESTS & (PID)
		ACB.	0		
SP		SAND CAP: No odor.			
CL		ORGANOCLAY: Gray latyer at upper boundary with sand cap, reduced, hydrogen sulfide odor, no creosote odor.			
SP		NATIVE SEDIMENT: Poorly graded SAND, black, moist, no odor.			NS (NA)
		Bottom of Boring at 4.0 Feet. Started 08/25/08. Completed 08/25/08. Backfilled with organoclay. Samples collected for the University of Texas.	5 10		

STRATAPROBE LOG 156700309 (PUSH PROBES).GPJ HC_CORP.GDT 3/18/09

1. Refer to Figure GG-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. USCS designations are based on visual manual classification (ASTM D 2488) unless otherwise supported by laboratory testing (ASTM D 2487).
4. Groundwater level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.
5. Drilled By: Cascade Drilling

HARTCROWSER

15670-03/Task 9 1/09

Figure GG-6

Push Probe Exploration MBSD0806 - Willamette Cove

Location: McCormick and Baxter Superfund Site
Logged By: Tim Skrotzki
Reviewed By: Heidi Blischke

Drill Equipment: 4-Foot Core
Hammer Type: Geoprobe
Hole Diameter: 3 inches

USCS Class	Graphic Log	Soil Descriptions	Depth in Feet	Core Length & Recovery	TESTS & (PID)
		ACB.	0		
SP		SAND CAP, no creosote odor.			
GP		Large angular rock (BNRR slope rock).			
SP		NATIVE SEDIMENT: Poorly graded SAND, reddish brown, moist, rounded gravel, 2" minus, no odor.		MBSD0806-2.2-2.8 (1430)	NS (NA)
		Becomes silty, gray, and wet.	5		
		Wood debris.			
ML		SILT with SAND, gray, moist, moderate creosote odor.		MBSD0806-6.9-7.1 (1440)	NS (NA)
SP		Poorly graded SAND, gray, wet, moderate creosote odor.			
		Bottom of Boring at 8.0 Feet. Started 08/25/08. Completed 08/25/08. Backfilled with bentonite chips.	10		

STRATAPROBE LOG 156700309 (PUSH PROBES).GPJ HC_CORP.GDT 3/16/09

1. Refer to Figure GG-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. USCS designations are based on visual manual classification (ASTM D 2488) unless otherwise supported by laboratory testing (ASTM D 2487).
4. Groundwater level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.
5. Drilled By: Cascade Drilling

HARTCROWSER

15670-03/Task 9 1/09

Figure GG-7

Push Probe Exploration MBSD0807 - Willamette Cove

Location: McCormick and Baxter Superfund Site
Logged By: Tim Skrotzki
Reviewed By: Heidi Blischke

Drill Equipment: 4-Foot Core
Hammer Type: Geoprobe
Hole Diameter: 3 inches

USCS Class	Graphic Log	Soil Descriptions	Depth in Feet		Core Length & Recovery	TESTS & (PID)
		ACB.	0			
SP		SAND CAP, no odor.				
CL		ORGANOCLAY, no odor.				
SP		NATIVE SEDIMENT: Poorly graded SAND with basalt chips, black, moist, no odor.		MBSD0807-1.7-2.3 (1504)		NS (NA)
SM		Silty SAND, gray, moist, no odor.				
SP		SAND with gravel, reddish brown, moist, rounded gravel 1-2", no odor.				
		Becomes silty, dark gray, slight creosote odor.	5	MBSD0807-5.0-5.4 (1510)		NS (NA)
		Wood Debris.		MBSD0807-7.0-7.4 (1515)		NS (NA)
		Bottom of Boring at 8.0 Feet. Started 08/25/08. Completed 08/25/08. Backfilled with organoclay.	10			

STRATAPROBE LOG 156700309 (PUSH PROBES).GPJ HC_CORP.GDT 3/16/09

1. Refer to Figure GG-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. USCS designations are based on visual manual classification (ASTM D 2488) unless otherwise supported by laboratory testing (ASTM D 2487).
4. Groundwater level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.
5. Drilled By: Cascade Drilling

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Figure GG-8

Push Probe Exploration MBSD0808 - Willamette Cove

Location: McCormick and Baxter Superfund Site
Logged By: Tim Skrotzki
Reviewed By: Heidi Blischke

Drill Equipment: 4-Foot Core
Hammer Type: Geoprobe
Hole Diameter: 3 inches

USCS Class	Graphic Log	Soil Descriptions	Depth in Feet	Core Length & Recovery	TESTS & (PID)
		ACB.	0		
SP		SAND CAP, mixed with basalt rock from railroad bank, no odor.			
GP		Large angular rock (BNRR slope rock).			
SP		NATIVE SEDIMENT: Poorly graded SAND, coarse grained, moist, no odor.			NS (NA)
		Becomes gray.			
			5		
		Becomes reddish-brown and oxidized, no odor.			NS (NA)
		Becomes black, no odor.			NS (NA)
		Bottom of Boring at 8.0 Feet. Started 08/25/08. Completed 08/25/08. Backfilled with bentonite chips.			
			10		

STRATAPROBE LOG 156700309 (PUSH PROBES).GPJ HC_CORP.GDT 3/16/09

1. Refer to Figure GG-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. USCS designations are based on visual manual classification (ASTM D 2488) unless otherwise supported by laboratory testing (ASTM D 2487).
4. Groundwater level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.
5. Drilled By: Cascade Drilling

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Figure GG-9

Push Probe Exploration MBSD0809 - Willamette Cove

Location: McCormick and Baxter Superfund Site
Logged By: Tim Skrotzki
Reviewed By: Heidi Blischke

Drill Equipment: 4-Foot Core
Hammer Type: Geoprobe
Hole Diameter: 3 inches

USCS Class	Graphic Log	Soil Descriptions	Depth in Feet	Core Length & Recovery	TESTS & (PID)
		ACB.	0		
GP		ROCK ARMORING.			
SP		SAND CAP, no odor.			NS (NA)
GP		NATIVE SEDIMENT: GRAVEL, reddish-brown, moist, oxidized, no odor.			
SP		Poorly graded SAND, gray, moist, no creosote odor.			NS (NA)
			5		
		Stained SILT layer, slight creosote odor.		MBSD0809-6.5-6.8 (1550)	MS, PAHs, PCP (NA)
		Becomes reddish-brown, no creosote odor.			NS (NA)
		Bottom of Boring at 8.0 Feet. Started 08/25/08. Completed 08/25/08. Backfilled with bentonite chips.			
			10		

STRATAPROBE LOG 156700309 (PUSH PROBES).GPJ HC_CORP.GDT 3/16/09

1. Refer to Figure GG-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. USCS designations are based on visual manual classification (ASTM D 2488) unless otherwise supported by laboratory testing (ASTM D 2487).
4. Groundwater level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.
5. Drilled By: Cascade Drilling

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Figure GG-10

Push Probe Exploration MBSD0810 - Willamette Cove

Location: McCormick and Baxter Superfund Site
Logged By: Tim Skrotzki
Reviewed By: Heidi Blischke

Drill Equipment: 4-Foot Core
Hammer Type: Geoprobe
Hole Diameter: 3 inches

USCS Class	Graphic Log	Soil Descriptions	Depth in Feet	Core Length & Recovery	TESTS & (PID)
		ACB.	0		
SP		SAND CAP, no odor.			
CL		ORGANOCLAY: No creosote odor.			
SP		NATIVE SEDIMENT: Poorly graded SAND, black, moist, slight creosote odor.			NS (NA)
GP		GRAVEL, gray, wet, gravel angular, slight creosote odor.		MBSD0810-2.7-3.1 (1615)	HS, PAHs, PCP (NA)
SP		Poorly graded SAND, reddish-brown, wet, oxidized, strong creosote odor.			
		Bottom of Boring at 4.0 Feet. Started 08/25/08. Completed 08/25/08. Backfilled with organoclay. Samples collected for the University of Texas.	5 10		

STRATAPROBE LOG 156700309 (PUSH PROBES).GPJ HC_CORP.GDT 3/16/09

1. Refer to Figure GG-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. USCS designations are based on visual manual classification (ASTM D 2488) unless otherwise supported by laboratory testing (ASTM D 2487).
4. Groundwater level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.
5. Drilled By: Cascade Drilling

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Figure GG-11

Push Probe Exploration MBSD0811 - TFA

Location: McCormick and Baxter Superfund Site
Logged By: Tim Skrotzki
Reviewed By: Heidi Blischke

Drill Equipment: 4-Foot Core
Hammer Type: Geoprobe
Hole Diameter: 3 inches

USCS Class	Graphic Log	Soil Descriptions	Depth in Feet	Core Length & Recovery	TESTS & (PID)
		ACB.	0		
SP		SAND CAP mixed with gravel, no odor.			NS (NA)
		Becomes gray and wet.			
		Not available, capped for PSU research.	5		
		Bottom of Boring at 8.0 Feet. Started 08/26/08. Completed 08/26/08. Backfilled with bentonite chips.	10		

STRATAPROBE LOG 156700309 (PUSH PROBES).GPJ HC_CORP.GDT 3/16/09

1. Refer to Figure GG-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. USCS designations are based on visual manual classification (ASTM D 2488) unless otherwise supported by laboratory testing (ASTM D 2487).
4. Groundwater level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.
5. Drilled By: Cascade Drilling

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Figure GG-12

Push Probe Exploration MBSD0812 - TFA

Location: McCormick and Baxter Superfund Site
Logged By: Tim Skrotzki
Reviewed By: Heidi Blischke

Drill Equipment: 4-Foot Core
Hammer Type: Geoprobe
Hole Diameter: 3 inches

USCS Class	Graphic Log	Soil Descriptions	Depth in Feet	Core Length & Recovery	TESTS & (PID)
		ACB.	0		
GP		ROCK ARMORING.			
SP		SAND CAP: No odor.			NS (NA)
		Bottom of Boring at 4.0 Feet. Started 08/26/08. Completed 08/26/08. Backfilled with bentonite chips.	5 10		

STRATAPROBE LOG 156700309 (PUSH PROBES).GPJ HC_CORP.GDT 3/16/09

1. Refer to Figure GG-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. USCS designations are based on visual manual classification (ASTM D 2488) unless otherwise supported by laboratory testing (ASTM D 2487).
4. Groundwater level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.
5. Drilled By: Cascade Drilling

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Figure GG-13

Push Probe Exploration MBSD0813 - TFA

Location: McCormick and Baxter Superfund Site
Logged By: Tim Skrotzki
Reviewed By: Heidi Blischke

Drill Equipment: 4-Foot Core
Hammer Type: Geoprobe
Hole Diameter: 3 inches

USCS Class	Graphic Log	Soil Descriptions	Depth in Feet	Core Length & Recovery	TESTS & (PID)
SP		Poorly graded SAND, gray, wet, no odor (deposited sand in sediment cap).	0		
GP		ROCK ARMORING, no odor.			
SP		SAND CAP, no creosote odor.			NS (<5 ppm)
CL		ORGANOCLAY: Slight creosote odor.			NS (NA)
ML		SILT, dark gray, wet, strong creosote odor, pin sized globules of NAPL.	5		HS (14.1 ppm)
		Bottom of Boring at 8.0 Feet. Started 08/26/08. Completed 08/26/08. Backfilled with organoclay. Samples collected for the University of Texas and Portland State University.	10		

STRATAPROBE LOG 156700309 (PUSH PROBES).GPJ HC_CORP.GDT 3/16/09

1. Refer to Figure GG-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. USCS designations are based on visual manual classification (ASTM D 2488) unless otherwise supported by laboratory testing (ASTM D 2487).
4. Groundwater level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.
5. Drilled By: Cascade Drilling

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Figure GG-14

Push Probe Exploration MBSD0814 - TFA

Location: McCormick and Baxter Superfund Site
Logged By: Tim Skrotzki
Reviewed By: Heidi Blischke

Drill Equipment: 4-Foot Core
Hammer Type: Geoprobe
Hole Diameter: 3 inches

USCS Class	Graphic Log	Soil Descriptions	Depth in Feet	Core Length & Recovery	TESTS & (PID)
GP		ROCK ARMORING.	0		
SP		SAND CAP: No odor.			NS (NA)
		Bottom of Boring at 4.0 Feet. Started 08/26/08. Completed 08/26/08. Backfilled with organoclay.	5 10		

STRATAPROBE LOG 156700309 (PUSH PROBES).GPJ HC_CORP.GDT 3/16/09

1. Refer to Figure GG-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. USCS designations are based on visual manual classification (ASTM D 2488) unless otherwise supported by laboratory testing (ASTM D 2487).
4. Groundwater level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.
5. Drilled By: Cascade Drilling

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Figure GG-15

Push Probe Exploration MBSD0815 - TFA

Location: McCormick and Baxter Superfund Site
Logged By: Tim Skrotzki
Reviewed By: Heidi Blischke

Drill Equipment: 4-Foot Core
Hammer Type: Geoprobe
Hole Diameter: 3 inches

USCS Class	Graphic Log	Soil Descriptions	Depth in Feet	Core Length & Recovery	TESTS & (PID)
GP		ROCK ARMORING.	0		
SP		SAND CAP: No odor.			NS (NA)
SP		NATIVE SEDIMENT: Poorly graded SAND, gray, wet, no creosote odor.			NS (<5 ppm)
		Becomes dark gray, strong creosote odor.			MS (6.9 ppm)
			5		
ML		SILT lense.			
		Bottom of Boring at 8.0 Feet. Started 08/26/08. Completed 08/26/08. Backfilled with organoclay. Samples collected for the University of Texas and Portland State University.			
			10		

STRATAPROBE LOG 156700309 (PUSH PROBES).GPJ HC_CORP.GDT 3/16/09

1. Refer to Figure GG-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. USCS designations are based on visual manual classification (ASTM D 2488) unless otherwise supported by laboratory testing (ASTM D 2487).
4. Groundwater level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.
5. Drilled By: Cascade Drilling

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Figure GG-16

Push Probe Exploration MBSD0816 - TFA

Location: McCormick and Baxter Superfund Site
Logged By: Tim Skrotzki
Reviewed By: Heidi Blischke

Drill Equipment: 4-Foot Core
Hammer Type: Geoprobe
Hole Diameter: 3 inches

USCS Class	Graphic Log	Soil Descriptions	Depth in Feet	Core Length & Recovery	TESTS & (PID)
GP		ROCK ARMORING.	0		
SP		SAND CAP.			
SP		NATIVE SEDIMENT: Poorly graded SAND, gray, wet, creosote odor.	5		SS (NA)
		Bottom of Boring at 8.0 Feet. Started 08/26/08. Completed 08/26/08. Backfilled with organoclay. Depth are uncertain, sloughed material are in core.	10		

STRATAPROBE LOG 156700309 (PUSH PROBES).GPJ HC_CORP.GDT 3/16/09

1. Refer to Figure GG-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. USCS designations are based on visual manual classification (ASTM D 2488) unless otherwise supported by laboratory testing (ASTM D 2487).
4. Groundwater level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.
5. Drilled By: Cascade Drilling

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Figure GG-17

Push Probe Exploration MBSD0817 - TFA

Location: McCormick and Baxter Superfund Site
Logged By: Tim Skrotzki
Reviewed By: Heidi Blischke

Drill Equipment: 4-Foot Core
Hammer Type: Geoprobe
Hole Diameter: 3 inches

USCS Class	Graphic Log	Soil Descriptions	Depth in Feet	Core Length & Recovery	TESTS & (PID)
GP		ROCK ARMORING.	0		
SP		SAND CAP: No odor.			NS (NA)
				MBSD0817-2.6-2.9 (1300)	MS, PAHs, PCP, TOC METALS (NA)
ML		NATIVE SEDIMENT: SILT, gray, wet, wood debris, creosote odor.			
		Bottom of Boring at 4.0 Feet. Started 08/26/08. Completed 08/26/08.	5		
			10		

STRATAPROBE LOG 156700309 (PUSH PROBES).GPJ HC_CORP.GDT 3/16/09

1. Refer to Figure GG-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. USCS designations are based on visual manual classification (ASTM D 2488) unless otherwise supported by laboratory testing (ASTM D 2487).
4. Groundwater level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.
5. Drilled By: Cascade Drilling

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Figure GG-18

Push Probe Exploration MBSD0818 - TFA

Location: McCormick and Baxter Superfund Site
Logged By: Tim Skrotzki
Reviewed By: Heidi Blischke

Drill Equipment: 4-Foot Core
Hammer Type: Geoprobe
Hole Diameter: 3 inches

USCS Class	Graphic Log	Soil Descriptions	Depth in Feet		Core Length & Recovery	TESTS & (PID)
GP		ROCK ARMORING.	0			
SP		SAND CAP: No creosote odor.		MBSD0818-0.5-1.0 (1430)		NS, PAHs, PCP, TOC METALS (<5 ppm)
ML		NATIVE SEDIMENT: SILT, gray, wet, wood debris, moderate creosote odor.		MBSD0818-1.0-1.5 (1435)		SS (5.8 ppm)
		Bottom of Boring at 4.0 Feet. Started 08/26/08. Completed 08/26/08.	5			
			10			

STRATAPROBE LOG 156700309 (PUSH PROBES).GPJ HC_CORP.GDT 3/16/09

1. Refer to Figure GG-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. USCS designations are based on visual manual classification (ASTM D 2488) unless otherwise supported by laboratory testing (ASTM D 2487).
4. Groundwater level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.
5. Drilled By: Cascade Drilling

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Figure GG-19

Push Probe Exploration MBSD0819 - TFA

Location: McCormick and Baxter Superfund Site
Logged By: Tim Skrotzki
Reviewed By: Heidi Blischke

Drill Equipment: 4-Foot Core
Hammer Type: Geoprobe
Hole Diameter: 3 inches

USCS Class	Graphic Log	Soil Descriptions	Depth in Feet		Core Length & Recovery	TESTS & (PID)
GP		ROCK ARMORING.	0			
SP		SAND CAP, no odor.				
				MBSD0819-1.0-1.3 (1440)		NS (<5 ppm)
SP		NATIVE SEDIMENT: Poorly graded SAND with gravel, reddish-brown, wet, rounded gravel 0.5-1", oxidized, no creosote odor.				
				MBSD0819-2.3-2.6 (1444)		NS (<5 ppm)
		Becomes coarse grained, black, creosote odor.				
			5			
		Becomes gravelly.				
		Becomes less gravelly.				
		Creosote odor.	10			
				MBSD0819-10.3-10.6 (1455)		MS (<5 ppm)
		Bottom of Boring at 12.0 Feet. Started 08/26/08. Completed 08/26/08.				
		Backfilled with bentonite chips.				

STRATAPROBE LOG 156700309 (PUSH PROBES).GPJ HC_CORP.GDT 3/16/09

1. Refer to Figure GG-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. USCS designations are based on visual manual classification (ASTM D 2488) unless otherwise supported by laboratory testing (ASTM D 2487).
4. Groundwater level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.
5. Drilled By: Cascade Drilling

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Figure GG-20

Push Probe Exploration MBSD0820 - TFA

Location: McCormick and Baxter Superfund Site
Logged By: Tim Skrotzki
Reviewed By: Heidi Blischke

Drill Equipment: 4-Foot Core
Hammer Type: Geoprobe
Hole Diameter: 3 inches

USCS Class	Graphic Log	Soil Descriptions	Depth in Feet	Core Length & Recovery	TESTS & (PID)
GP		ROCK ARMORING.	0	MBSD0820-0-0.3 (1500)	NS, PAHs, PCP, TOC METALS (NA)
				MBSD0820-1.7-2.0 (1500)	HS, PAHs, PCP, TOC METALS (NA)
				MBSD0820-2.7-3.0 (1510)	SS (NA)
SP		SAND CAP, no odor.			
GP		NATIVE SEDIMENT: Poorly graded GRAVEL, gray, wet, no creosote odor.			
SP		Poorly graded SAND, black, wet, wood debris, creosote odor.			
ML		SILT, moist, gray, creosote odor.	5		
		Bottom of Boring at 4.0 Feet. Started 08/26/08. Completed 08/26/08. Backfilled with bentonite chips.	10		

STRATAPROBE LOG 156700309 (PUSH PROBES).GPJ HC_CORP.GDT 3/16/09

1. Refer to Figure GG-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. USCS designations are based on visual manual classification (ASTM D 2488) unless otherwise supported by laboratory testing (ASTM D 2487).
4. Groundwater level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.
5. Drilled By: Cascade Drilling

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Figure GG-21

Push Probe Exploration MBSD0821 - TFA

Location: McCormick and Baxter Superfund Site
Logged By: Tim Skrotzki
Reviewed By: Heidi Blischke

Drill Equipment: 4-Foot Core
Hammer Type: Geoprobe
Hole Diameter: 3 inches

USCS Class	Graphic Log	Soil Descriptions	Depth in Feet		Core Length & Recovery	TESTS & (PID)
		ACB.	0			
SP		SAND CAP, no odor.				
				MBSD0821-1.0-1.5 (1530)		NS, PAHs, PCP, TOC METALS (<5 ppm)
SP		NATIVE SEDIMENT: Poorly graded SAND, reddish-brown, wet, coarse-grained, rounded, no odor.		MBSD0821-1.9-2.3 (1535)		NS (<5 ppm)
			5			
ML		SILT lense, no odor. Becomes black, no odor.		MBSD0821-6.2-6.5 (1540)		NS (<5 ppm)
				MBSD0821-7.1-7.4 (1545)		NS (<5 ppm)
ML		SILT lense, no odor.				
		Bottom of Boring at 8.0 Feet. Started 08/26/08. Completed 08/26/08.				
			10			

STRATAPROBE LOG 156700309 (PUSH PROBES).GPJ HC_CORP.GDT 3/16/09

1. Refer to Figure GG-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. USCS designations are based on visual manual classification (ASTM D 2488) unless otherwise supported by laboratory testing (ASTM D 2487).
4. Groundwater level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.
5. Drilled By: Cascade Drilling

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Figure GG-22

Push Probe Exploration MBSD0822 - TFA

Location: McCormick and Baxter Superfund Site
Logged By: Tim Skrotzki
Reviewed By: Heidi Blischke

Drill Equipment: 4-Foot Core
Hammer Type: Geoprobe
Hole Diameter: 3 inches

USCS Class	Graphic Log	Soil Descriptions	Depth in Feet	Core Length & Recovery	TESTS & (PID)
SP		SAND CAP: Strong creosote odor.	0		
CL		ORGANOCLAY.			
SP		NATIVE SEDIMENT: Poorly graded SAND, black, moist, strong creosote odor, globules of creosote.			HS (50.1 pm)
		Bottom of Boring at 4.0 Feet. Started 08/26/08. Completed 08/26/08. Samples collected for the University of Texas.	5 10		

STRATAPROBE LOG 156700309 (PUSH PROBES).GPJ HC_CORP.GDT 3/16/09

1. Refer to Figure GG-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. USCS designations are based on visual manual classification (ASTM D 2488) unless otherwise supported by laboratory testing (ASTM D 2487).
4. Groundwater level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.
5. Drilled By: Cascade Drilling

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Figure GG-23

Push Probe Exploration MBSD0823 - TFA

Location: McCormick and Baxter Superfund Site
Logged By: Tim Skrotzki
Reviewed By: Heidi Blischke

Drill Equipment: 4-Foot Core
Hammer Type: Geoprobe
Hole Diameter: 3 inches

USCS Class	Graphic Log	Soil Descriptions	Depth in Feet	Core Length & Recovery	TESTS & (PID)
GP		ROCK ARMORING intermixed with SAND CAP.	0		
SP		NATIVE SEDIMENT: Poorly graded SAND, gray, wet, slight creosote odor.			
		Becomes coarse grained, black, strong creosote odor, pin sized globules of creosote.			HS (48.7 ppm)
		Bottom of Boring at 4.0 Feet. Started 08/26/08. Completed 08/26/08.			
		Samples collected for the University of Texas.	5		
			10		

STRATAPROBE LOG 156700309 (PUSH PROBES).GPJ HC_CORP.GDT 3/16/09

1. Refer to Figure GG-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. USCS designations are based on visual manual classification (ASTM D 2488) unless otherwise supported by laboratory testing (ASTM D 2487).
4. Groundwater level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.
5. Drilled By: Cascade Drilling

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Figure GG-24

Push Probe Exploration MBSD0824 - TFA

Location: McCormick and Baxter Superfund Site
Logged By: Tim Skrotzki
Reviewed By: Heidi Blischke

Drill Equipment: 4-Foot Core
Hammer Type: Geoprobe
Hole Diameter: 3 inches

USCS Class	Graphic Log	Soil Descriptions	Depth in Feet	Core Length & Recovery	TESTS & (PID)
		ACB.	0		
SP		POST-CAP SEDIMENT: SAND, gray, moist.			
GP		ROCK ARMORING.			
SP		SAND CAP, no odor.			
SP		NATIVE SEDIMENT: Poorly graded SAND, reddish-brown, wet, oxidized, no odor.			NS (NA)
		Bottom of Boring at 4.0 Feet. Started 08/26/08. Completed 08/26/08. Samples collected for the University of Texas.	5 10		

STRATAPROBE LOG 156700309 (PUSH PROBES).GPJ HC_CORP.GDT 3/16/09

1. Refer to Figure GG-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. USCS designations are based on visual manual classification (ASTM D 2488) unless otherwise supported by laboratory testing (ASTM D 2487).
4. Groundwater level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.
5. Drilled By: Cascade Drilling

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Figure GG-25

Push Probe Exploration MBSD0825 - TFA

Location: McCormick and Baxter Superfund Site
Logged By: Tim Skrotzki
Reviewed By: Heidi Blischke

Drill Equipment: 4-Foot Core
Hammer Type: Geoprobe
Hole Diameter: 3 inches

USCS Class	Graphic Log	Soil Descriptions	Depth in Feet	Core Length & Recovery	TESTS & (PID)
GP		ROCK ARMORING.	0	MBSD0825-A (0915) MBSD0825-B (0915)	NS, PAHs, PCP, TOC METALS (<5 ppm) HS, PAHs, PCP, TOC METALS (77.9 ppm)
SP		SAND CAP: No creosote odor.			
SP		NATIVE SEDIMENT: Poorly graded SAND, black, wet, creosote odor, globules of creosote.	5		
		Bottom of Boring at 4.0 Feet. Started 08/27/08. Completed 08/27/08. Backfilled with organoclay.	10		

STRATAPROBE LOG 156700309 (PUSH PROBES).GPJ HC_CORP.GDT 3/16/09

1. Refer to Figure GG-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. USCS designations are based on visual manual classification (ASTM D 2488) unless otherwise supported by laboratory testing (ASTM D 2487).
4. Groundwater level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.
5. Drilled By: Cascade Drilling

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Figure GG-26

Push Probe Exploration MBSD0826 - TFA

Location: McCormick and Baxter Superfund Site
Logged By: Tim Skrotzki
Reviewed By: Heidi Blischke

Drill Equipment: 4-Foot Core
Hammer Type: Geoprobe
Hole Diameter: 3 inches

USCS Class	Graphic Log	Soil Descriptions	Depth in Feet	Core Length & Recovery	TESTS & (PID)
		ACB.	0		
SP		SAND CAP, no odor.		MBSD0826-A (0925)	NS (<5 ppm)
SP		NATIVE SEDIMENT: Poorly graded SAND, reddish-brown, wet, rounded gravel, oxidized, no odor.		MBSD0826-B (0930)	NS, PAHs, PCP, TOC METALS (<5 ppm)
		Bottom of Boring at 4.0 Feet. Started 08/27/08. Completed 08/27/08.	5 10		

STRATAPROBE LOG 156700309 (PUSH PROBES).GPJ HC_CORP.GDT 3/16/09

1. Refer to Figure GG-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. USCS designations are based on visual manual classification (ASTM D 2488) unless otherwise supported by laboratory testing (ASTM D 2487).
4. Groundwater level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.
5. Drilled By: Cascade Drilling

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Figure GG-27

Push Probe Exploration MBSD0827 - TFA

Location: McCormick and Baxter Superfund Site
Logged By: Tim Skrotzki
Reviewed By: Heidi Blischke

Drill Equipment: 4-Foot Core
Hammer Type: Geoprobe
Hole Diameter: 3 inches

USCS Class	Graphic Log	Soil Descriptions	Depth in Feet	Core Length & Recovery	TESTS & (PID)
		ACB.	0		
SP		SAND CAP: No creosote odor.			
SP		NATIVE SEDIMENT: Poorly graded SAND, black, wet, creosote odor.			MS (NA)
ML		SILT, gray, moist, wood debris, creosote odor.			HS (NA)
		Bottom of Boring at 4.0 Feet. Started 08/27/08. Completed 08/27/08. Backfilled with organoclay. Samples collected for the University of Texas.	5 10		

STRATAPROBE LOG 156700309 (PUSH PROBES).GPJ HC_CORP.GDT 3/16/09

1. Refer to Figure GG-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. USCS designations are based on visual manual classification (ASTM D 2488) unless otherwise supported by laboratory testing (ASTM D 2487).
4. Groundwater level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.
5. Drilled By: Cascade Drilling

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Figure GG-28

Push Probe Exploration MBSD0828 - TFA

Location: McCormick and Baxter Superfund Site
Logged By: Tim Skrotzki
Reviewed By: Heidi Blischke

Drill Equipment: 4-Foot Core
Hammer Type: Geoprobe
Hole Diameter: 3 inches

USCS Class	Graphic Log	Soil Descriptions	Depth in Feet	Core Length & Recovery	TESTS & (PID)
		ACB.	0		
SP		SAND CAP, no odor.			NS (NA)
SP		NATIVE SEDIMENT: Poorly grarded SAND with rounded gravel, gray, wet, no creosote odor.			
		Becomes dark gray, no gravel, creosote odor.			HS (NA)
		Wood debris.			
		Becomes saturated with creosote.			
		Bottom of Boring at 4.0 Feet.			
		Started 08/27/08.			
		Completed 08/27/08.			
		Backfilled with organoclay.	5		
		Samples collected for the University of Texas.			
			10		

STRATAPROBE LOG 15670030 9 (PUSH PROBES).GPJ HC_CORP.GDT 3/16/09

1. Refer to Figure GG-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. USCS designations are based on visual manual classification (ASTM D 2488) unless otherwise supported by laboratory testing (ASTM D 2487).
4. Groundwater level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.
5. Drilled By: Cascade Drilling

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Figure GG-29

Push Probe Exploration MBSD0829 - TFA

Location: McCormick and Baxter Superfund Site
Logged By: Tim Skrotzki
Reviewed By: Heidi Blischke

Drill Equipment: 4-Foot Core
Hammer Type: Geoprobe
Hole Diameter: 3 inches

USCS Class	Graphic Log	Soil Descriptions	Depth in Feet	Core Length & Recovery	TESTS & (PID)
		ACB.	0		
SP		SAND CAP, no odor.		MBSD0829-A	NS (NA)
SP		NATIVE SEDIMENT: Poorly graded, gravelly SAND, reddish-brown, wet, rounded gravel 0.5-1", oxidized, no odor.		MBSD0829-B	NS (NA)
		Becomes gray with glass debris, no odor, no odor.			
		Bottom of Boring at 4.0 Feet. Started 08/27/08. Completed 08/27/08. Backfilled with bentonite chips.	5 10		

STRATAPROBE LOG 156700309 (PUSH PROBES).GPJ HC_CORP.GDT 3/16/09

1. Refer to Figure GG-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. USCS designations are based on visual manual classification (ASTM D 2488) unless otherwise supported by laboratory testing (ASTM D 2487).
4. Groundwater level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.
5. Drilled By: Cascade Drilling

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Figure GG-30

Push Probe Exploration MBSD0830 - TFA

Location: McCormick and Baxter Superfund Site
Logged By: Tim Skrotzki
Reviewed By: Heidi Blischke

Drill Equipment: 4-Foot Core
Hammer Type: Geoprobe
Hole Diameter: 3 inches

USCS Class	Graphic Log	Soil Descriptions	Depth in Feet		Core Length & Recovery	TESTS & (PID)
		ACB.	0			
SP		SAND CAP.		MBSD0830-0.3-0.8 (1030) MBSD0830-0.8 (1035)		NS, PAHs, PCP, TOC, METALS (NA) NS (NA)
SP		NATIVE SEDIMENT: Poorly graded SAND with GRAVEL, reddish-brown, wet, oxidized, no odor.		MBSD0830-2.3-2.5 (1040)		NS (NA)
		Bottom of Boring at 4.0 Feet. Started 08/27/08. Completed 08/27/08.	5			
			10			

STRATAPROBE LOG 156700309 (PUSH PROBES).GPJ HC_CORP.GDT 3/16/09

1. Refer to Figure GG-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. USCS designations are based on visual manual classification (ASTM D 2488) unless otherwise supported by laboratory testing (ASTM D 2487).
4. Groundwater level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.
5. Drilled By: Cascade Drilling

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Figure GG-31

Push Probe Exploration MBSD0831 - TFA

Location: McCormick and Baxter Superfund Site
Logged By: Tim Skrotzki
Reviewed By: Heidi Blischke

Drill Equipment: 4-Foot Core
Hammer Type: Geoprobe
Hole Diameter: 3 inches

USCS Class	Graphic Log	Soil Descriptions	Depth in Feet		Core Length & Recovery	TESTS & (PID)
		ACB.	0			
SP		SAND CAP intermixed with ROCK ARMORING, no odor.				
SP		NATIVE SEDIMENT: Poorly graded SAND with rounded gravel, gray, wet, no creosote odor.		MBSD0831-1.0-1.3 (1100)		NS (NA)
				MBSD0831-2.8-3.1 (1105)		HS (NA)
			5			
		Wood debris, creosote odor.				NS (NA)
ML		SILT lense.				
		Creosote odor.				HS (NA)
		Bottom of Boring at 8.0 Feet. Started 08/27/08. Completed 08/27/08. Backfilled with bentonite chips.				
			10			

STRATAPROBE LOG 156700309 (PUSH PROBES).GPJ HC_CORP.GDT 3/16/09

1. Refer to Figure GG-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. USCS designations are based on visual manual classification (ASTM D 2488) unless otherwise supported by laboratory testing (ASTM D 2487).
4. Groundwater level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.
5. Drilled By: Cascade Drilling

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Figure GG-32

Push Probe Exploration MBSD0832 - TFA

Location: McCormick and Baxter Superfund Site
Logged By: Tim Skrotzki
Reviewed By: Heidi Blischke

Drill Equipment: 4-Foot Core
Hammer Type: Geoprobe
Hole Diameter: 3 inches

USCS Class	Graphic Log	Soil Descriptions	Depth in Feet		Core Length & Recovery	TESTS & (PID)
SP		SAND CAP intermixed with ROCK ARMORING.	0	MBSD0832-0.7-1.0 (1250)		NS (NA)
GP-GM		ROCK ARMORING intermixed with SILT.				
SP		NATIVE SEDIMENT: Poorly graded SAND with rounded gravel, gray, wet, no creosote odor.		MBSD0832-1.5-1.7 (1255)		NS (NA)
ML		SILT, gray, wet, slight creosote odor.				SS (NA)
		Bottom of Boring at 4.0 Feet. Started 08/27/08. Completed 08/27/08.	5			
			10			

STRATAPROBE LOG 156700309 (PUSH PROBES).GPJ HC_CORP.GDT 3/16/09

1. Refer to Figure GG-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. USCS designations are based on visual manual classification (ASTM D 2488) unless otherwise supported by laboratory testing (ASTM D 2487).
4. Groundwater level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.
5. Drilled By: Cascade Drilling

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Figure GG-33

ATTACHMENT D
SHEEN PHOTOMICROGRAPHS

Included only on the O&M Report DVD

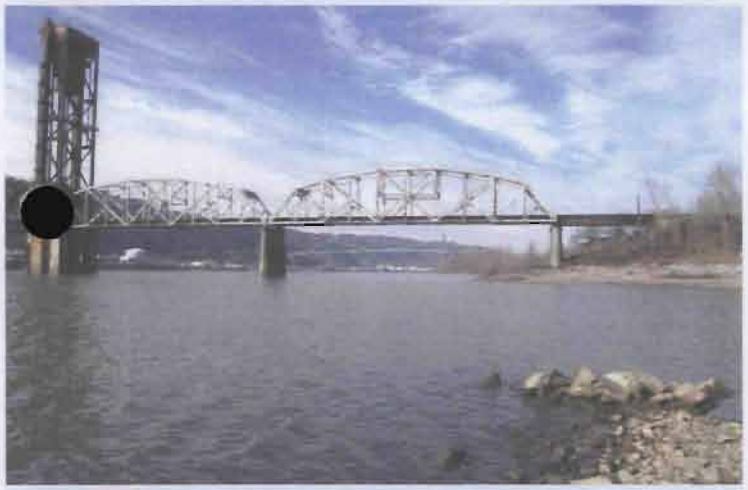
ATTACHMENT E
CETCO RESULTS FOR ABSORPTIVE CAPACITY AND PERMITTIVITY

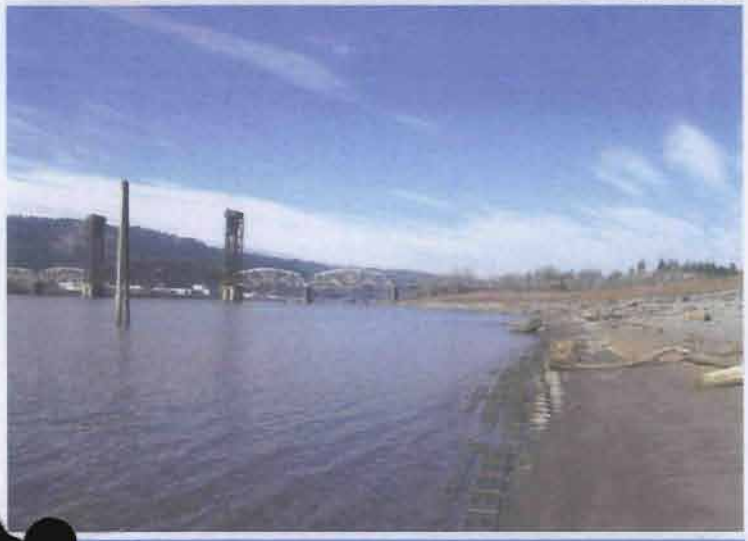
Included only on the O&M Report DVD

ATTACHMENT F
TECHNICAL MEMORANDUM: NAPL FLUX ASSESSMENT OF BEACH SEEPS IN WILLAMETTE COVE

Included only on the O&M Report DVD

Appendix H

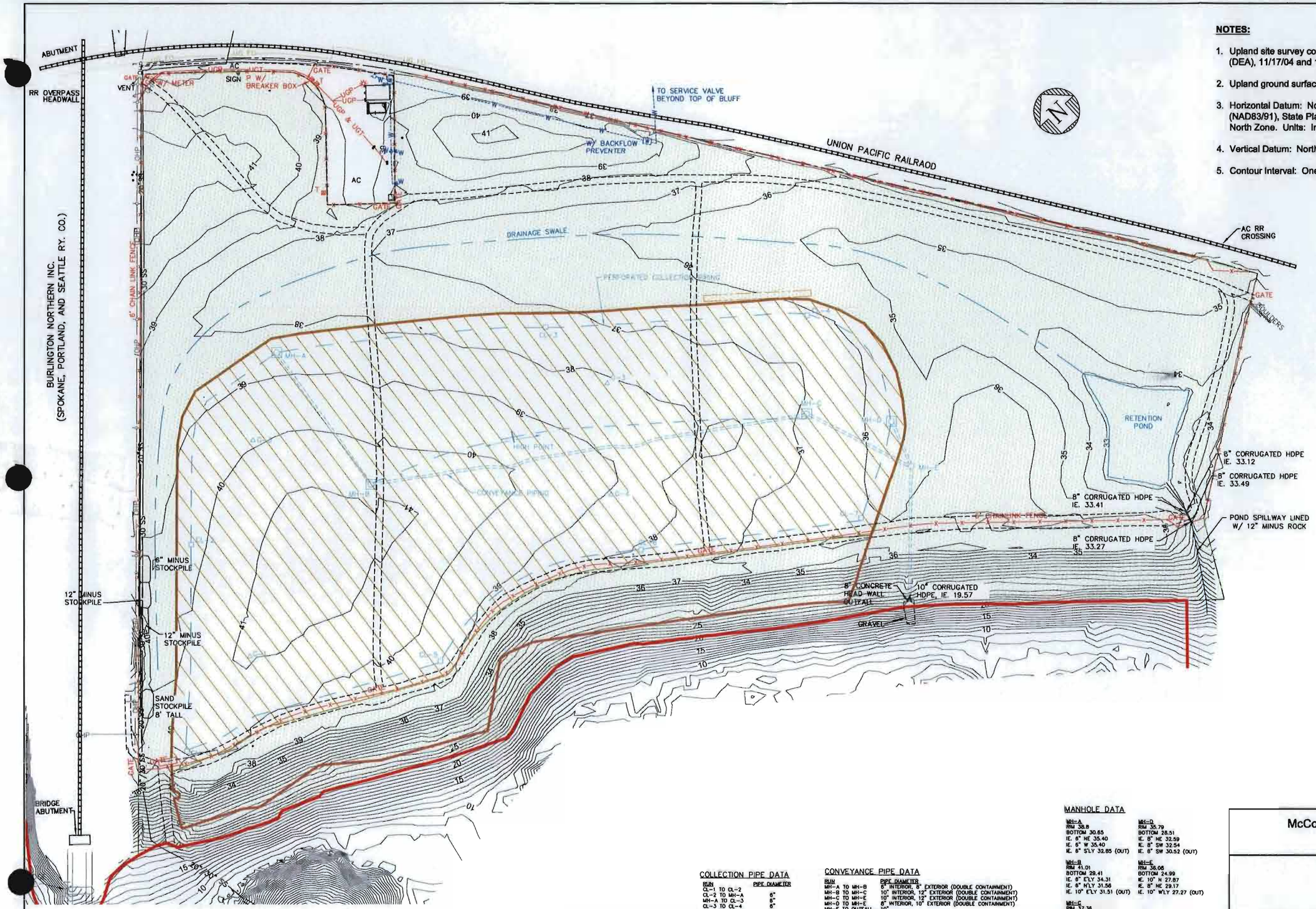




APPENDIX H
UPDATED SITE-WIDE RECORD DRAWINGS

OPERATION AND MAINTENANCE REPORT
JANUARY 2008 THROUGH DECEMBER 2008

Hart Crowser/GSI
15670-03/Task 9 May 22, 2009



NOTES:

1. Upland site survey conducted by David Evans and Associates, Inc. (DEA), 11/17/04 and 1/24/06.
2. Upland ground surface resurveyed by OTAK, Inc., 9/16/08.
3. Horizontal Datum: North American Datum of 1983 - 91 adj. (NAD83/91), State Plane Coordinate System (SPCS), Oregon North Zone. Units: International Feet.
4. Vertical Datum: North American Vertical Datum of 1988 (NAVD88)
5. Contour Interval: One-Foot.

LEGEND:

- PROPERTY LINE
- 5 GROUND SURFACE ELEVATION CONTOUR (FT. NAVD 88)
- SS HIGH PRESSURE SEWER
- STM STORM SEWER
- W WATER
- WATER VAULT
- VALVE (AS NOTED)
- FIRE HYDRANT
- UGP UNDERGROUND POWER
- OPH OVERHEAD POWER
- UGT UNDERGROUND TELEPHONE
- UG FO UNDERGROUND FIBER OPTIC
- FENCE
- GAS VENT
- CLEAN OUT
- MANHOLE
- RISER
- UTILITY RISER
- UTILITY POLE
- GRAVEL ACCESS ROAD
- SUBSURFACE BARRIER WALL
- SEDIMENT CAP BOUNDARY
- IMPERMEABLE CAP
- EARTHEN CAP

COLLECTION PIPE DATA

RUN	PIPE DIAMETER
CL-1 TO CL-2	6"
CL-2 TO MH-A	6"
MH-A TO CL-3	6"
CL-3 TO CL-4	6"
CL-4 TO MH-D	6"
MH-B TO MH-C	6"
CL-1 TO CL-5	6"
CL-5 TO CL-6	6"
CL-6 TO CL-7	6"
CL-7 TO MH-D	6"

CONVEYANCE PIPE DATA

RUN	PIPE DIAMETER
MH-A TO MH-B	6" INTERIOR, 8" EXTERIOR (DOUBLE CONTAINMENT)
MH-B TO MH-C	10" INTERIOR, 12" EXTERIOR (DOUBLE CONTAINMENT)
MH-C TO MH-E	10" INTERIOR, 12" EXTERIOR (DOUBLE CONTAINMENT)
MH-D TO MH-E	8" INTERIOR, 10" EXTERIOR (DOUBLE CONTAINMENT)
MH-E TO OUTFALL	10"

NOTE: CONVEYANCE PIPE LOCATIONS BASED ON DESIGN PLAN AND FIELD OBSERVATIONS

MANHOLE DATA

MH-A
RIM 38.8
BOTTOM 30.65
IE. 6" NE 35.40
IE. 6" W 35.40
IE. 6" S'LY 32.85 (OUT)

MH-B
RIM 41.01
BOTTOM 29.41
IE. 6" E'LY 34.31
IE. 6" N'LY 31.56
IE. 10" E'LY 31.51 (OUT)

MH-C
RIM 37.36
BOTTOM 27.50
IE. 10" NW 29.61
IE. 6" SW 33.81
IE. 10" SW 29.46 (OUT)

MH-D
RIM 35.79
BOTTOM 28.51
IE. 8" NE 32.59
IE. 8" SW 32.54
IE. 6" SW 30.52 (OUT)

MH-E
RIM 36.06
BOTTOM 24.99
IE. 10" N 27.87
IE. 8" NE 29.17
IE. 10" W'LY 27.27 (OUT)

NOTE: ELEVATIONS IN FT. NAVD 88

McCormick and Baxter Superfund Site
Portland, Oregon

Upland Cap Features

5/09

HARTCROWSER

GSI Water Solutions, Inc.

Figure
H-1