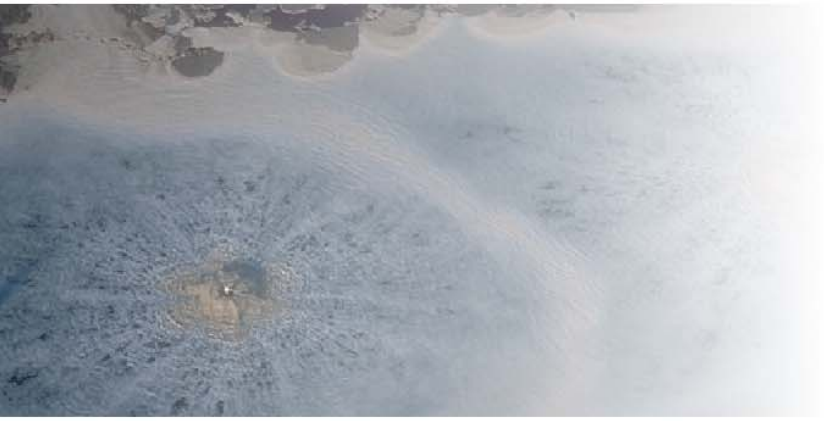

Remedial Investigation/
Feasibility Study
Port of Tacoma Parcel 88
1621 Marine View Drive
Tacoma, Washington

Prepared for
Port of Tacoma

February 20, 2013
17652-00

HARTCROWSER

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REMEDIAL INVESTIGATION/FEASIBILITY STUDY
PORT OF TACOMA PARCEL 88
1621 MARINE VIEW DRIVE
TACOMA, WASHINGTON

1.0 INTRODUCTION

We prepared this Remedial Investigation/Feasibility Study (RI/FS) Report on behalf of the Port of Tacoma (Port) for submittal to the Washington State Department of Ecology (Ecology) pursuant to Section VII(C) of Agreed Order DE8400. This report was prepared in accordance with WAC 173-340-350 and documents the nature and extent of contamination at Parcel 88 (the Site) and recommended cleanup actions.

Information on the Site, including physical characteristics, past ownership and land uses, and previous environmental investigations and cleanups is presented in the Environmental Assessment Report (Hart Crowser 2010) and the Previous Cleanup Activities Report (Hart Crowser 2011); these documents are incorporated by reference into this RI/FS and pertinent information is summarized within this document.

2.0 LOCATION AND SETTING

The Site is referred to as Parcel 88 (Facility Site # 34114562) and is generally located at Pierce County Tax Parcel 0421313048, at the street address of 1621 Marine View Drive, Port of Tacoma, Tacoma, WA 98422, but also includes portions of Pierce County Tax Parcels 0421313049 and 0420062130 where contaminants were found to have been spread (Figure 1).

A large portion of the Site now lies within the Port's recently completed Parcel 88 Combined Habitat Mitigation Area. The mitigation area includes constructed tidal channels connected to Hylebos Creek, adjacent intertidal marsh and vegetated shorelands in the southwestern portion of the Site, and upland habitat in the south central and southeastern portions of the Site. This area is bounded to the south by Hylebos Creek (a tributary to Commencement Bay via the Hylebos Waterway), to the west by Morningside Drain and Marine View Drive, and to the north and east by steep slopes (Figure 2).

Native soil at the Site consists of alluvium at the lowest elevations (lower area) and glacial outwash deposits on the slopes. The alluvium was deposited by rivers and streams and typically consists of granular and fine-grained soils ranging

from silty sand to sandy silt with occasional gravel and wood. Zones of coarser sand and gravel also occur locally in the alluvium. The glacial outwash soils are typically granular and include poorly- to well-graded sand and gravel to silty sand and gravel.

Groundwater elevations indicate that groundwater flows southerly to southwesterly from the uplands north and east of the property (recharge areas) toward Hylebos Creek and Morningside Drain (discharge areas).

3.0 SITE HISTORY

3.1 Ownership

The Port has owned the Site since 2006. From 1996 until it was sold to the Port, the Site was owned by Michael Parsons and/or Marine View, Inc., a business in which Mr. Parsons held an interest. From the 1960s to 1996, the Site was owned by William Fjetland, Camille Fjetland, and/or business interests in which one or both of these individuals held an interest. Before that, the ownership of the Site is unknown. Available records indicate that a number of entities operated at the Site before the Port's ownership. These entities are listed in the IRAR (Hart Crowser 2011).

3.2 Land Use

Before the 1950s, the Site was undeveloped land. Approximately 9 acres in the southwest corner of tax parcel 0421313048 were lowlands abutting Hylebos Creek, and the rest of the Site consisted of steep slopes and upland ridgelines and bluffs. From the 1950s through 2006, the Site was used as a sand and gravel mine and an inert solid waste recycling facility. During that time, a significant volume of material (soil, concrete, asphalt, wood waste, and metal debris) was imported and used as fill at the Site, primarily in the 9-acre lowlands. This fill raised the grade substantially over much of the lowlands; in places, the post-fill surface elevation was 20 feet or more above the original surface elevation.

Historical aerial photos indicate that aggregate mining began at the top of the bluffs on adjacent property to the north, and progressed southward along the bluffs. Sometime between 1965 and 1970, the use of lower (western) portion of the Site began. Soil/fill stockpiles appeared in the lower portion of the Site in a 1970 photo, and by 1973 some mining into the hillside in the northeast corner of the lower portion of the Site was evident. Also, a network of roads was evident on the eastern portion of the Site and there was evidence of mining

activities extending onto the Site from neighboring property in the 1970 aerial photo.

By 1978 the lower portion of the Site was well established; the Maintenance Building had been constructed and there were clear working road systems within the area, including a road along Hylebos Creek leading from the active western portion of the Site to a ravine in the south-central portion of the Site (Figure 3).

Aerial photographs from 1978 through 2006 show material management activities on the lower portion of the Site and progressively more-extensive mining activities on the moderate hillsides in the east/southeast/south-central portions of the Site. The log cabin (office) appears in the lower portion of the Site in photos from 1978 and 2002, but is gone in a 2006 photo; a second support building appears between the Maintenance Building and the log cabin in 1985 and 1989 photos but is gone by 1998; and a residence in the south-central ravine is evident in the 1992 photo but is gone by 1998. These photos also show that materials management activities in the lower portion of the Site during this time were not static, and there were changes in material stockpile locations, equipment staging areas, and active access roads.

In the eastern portion of the Site, active mining across the hilltops is depicted in aerial photos from 1978 through 2004. Aerial photos from 2002 suggest that activities on the hillside in the east-central portion of the Site included, at that time, construction debris recycling (stockpiling and crushing). Photos from 1998 through 2004 indicate that some fill material (appearing to be concrete rubble) was placed on hillsides on the east side of the Site. By 2006, nearly all of this area shows re-establishing vegetation, and active mining was limited to what later became the steep east-west ravine in the center of the Site.

The Port purchased the Site in May 2006. Thereafter, site activities were limited to removal of recycled material stockpiles and equipment the previous owner had left on the lower portion of the Site; temporary use of the lower portion of the Site by the neighboring tenant for truck turnaround and scales; and occasional use of the lower portion of the property by Port maintenance for temporary staging.

3.3 Environmental Investigations

Several Environmental Site Assessments (ESAs) and other investigations were performed between 1993 and 2000, before the Port purchased the property. These assessments were documented in the following reports: ATEC Associates

(1993 and 1996), Parametrix (1993), Optimum Environment (1996, 2000a, and 2000b), and Neuston Consulting (1997).

In 2005, Phase I and Phase II ESAs were conducted on behalf of the Port pursuant to the Port's possible purchase of the property from Parsons (GeoEngineers 2005). These assessments summarized the reports listed above and included the results of a limited field investigation that involved analysis of soil and groundwater samples.

In 2009 additional environmental investigations were undertaken on behalf of the Port to better characterize the nature and extent of contamination in the lower portion of the Site before cleanup and redevelopment (Hart Crowser 2010).

3.4 Site Listing and Hazard Ranking

In 2007 Ecology issued an Early Notice Letter to the Port indicating that an Initial Investigation of the Site by the Tacoma-Pierce County Health Department had resulted in listing the Site on Ecology's Confirmed or Suspected Contaminated Site List with a Facility Site Identification Number of 34114562. In July 2008, the Tacoma-Pierce County Health Department completed a Site Hazard Assessment; the resulting Site ranking was 3. On May 10, 2011, the Port and Ecology entered into Agreed Order DE8400 under the MTCA to complete remedial action at the Site.

4.0 PRE-CLEANUP ENVIRONMENTAL CONDITIONS

As described below, several environmental cleanups have been conducted at the Site. Conditions before these cleanups are documented in detail in reports by Hart Crowser (2011) and GeoEngineers (2005).

The primary areas of environmental contamination before Site cleanup were the Main Fill Area (MFA) and the Metals Contamination Area (MCA). Both areas are located in the lower area of the Site. In addition, an area in the north central upland portion of the Site was also used to store concrete and asphalt debris/rubble for reprocessing and sale. Historical environmental site conditions are shown on Figures 3 through 6 and are summarized below.

4.1 Main Fill Area

Before the 2010 Port cleanup, much of the MFA was underlain by a thick prism of fill. The fill composition was variable, consisting primarily of soil and

manmade debris (mostly concrete, asphalt and wood waste, but also including creosote-treated pilings, brick, glass, plastic, and metal). Some areas of the Site were underlain by fill consisting mostly or entirely of wood chips. Historically, several USTs and ASTs were located within the MFA and activities including equipment maintenance, vehicle fueling, and debris/rubble stockpiling took place here.

Fill and soil in the MFA were impacted by petroleum hydrocarbons, as evidenced by analytical results and by the observations of sheen and odor documented in the 2005 ESA report and the 2009 investigation report. Petroleum impacts were generally confined to the fill prism, but did extend into the underlying soil in a few areas. Diesel detections ranged from 6.4 to 5,900 milligrams per kilogram (mg/kg), and motor oil detections ranged from 62 to 5,000 mg/kg.

Fill and soil in some parts of the MFA were also impacted by metals. Arsenic concentrations ranged to 153 mg/kg. In a few locations, copper and lead were also elevated, ranging up 154 mg/kg and 303 mg/kg, respectively.

Groundwater impacts within the MFA were limited. Petroleum hydrocarbons were detected in groundwater from only one of the 13 sampling locations (MW-2). The maximum concentrations detected for DRO and ORO were 1,900 ug/L and 750 ug/L, respectively. Copper and mercury concentrations were also elevated (4 ug/L and 0.05 ug/L in samples from MW-109 and P-1, respectively).

4.2 Metals Contamination Area

Before the 2010 cleanup activities, the MCA was underlain by several feet of slag-bearing sand and gravel fill. The fill was placed over native materials to form a flat building lot for the residence that was once on the Site and to form the base for the unpaved roadway between the MCA and the MFA. In some locations in the MCA, the fill contained pebble-size and larger pieces of slag that were used to fill former drainage pathways, providing a more solid base for roads while allowing natural flows to continue to Hylebos Creek.

Arsenic and lead were detected at elevated concentrations (maximum of 523 and 314 mg/kg, respectively) in every sample of the fill material in the MCA. Other metals, including copper and zinc, were detected in a number of soil samples at elevated concentrations within the fill in this area. Only low levels of metals were detected in groundwater samples from the MCA.

4.3 Upland Portion of the Site

An area in the north central upland portion of the Site was previously used to store concrete and asphalt debris/rubble for reprocessing and sale. GeoEngineers (2005) estimated there was about 26,000 cubic yards of material.

GeoEngineers (2005) collected two samples of the concrete and asphalt debris/rubble to analyze for petroleum hydrocarbons and metals. Neither diesel-range organics (DRO) nor gasoline-range organics were detected in either sample. Oil-range organics (ORO) was detected in one sample at 470 mg/kg. The detection of ORO without DRO is consistent with the documented presence of asphalt. No elevated metals were detected in either sample. The rubble was later removed.

Because a relatively low concentration of ORO was detected in the debris/rubble, and because heavy-range petroleum fractions like asphalt are relatively immobile, groundwater impacts in the uplands were judged to be very unlikely. Therefore, groundwater monitoring wells were not installed in the upland portion of the Site. Subsequent groundwater monitoring in lowland wells (MW-107 and MW-108) downgradient from the former location of the debris/rubble did not detect petroleum hydrocarbons. These results support the conclusion that that there were no groundwater impacts associated with the concrete and asphalt debris/rubble.

5.0 PREVIOUS CLEANUP ACTIVITIES

Previous cleanup activities at the Site consisted of several tank closures in the 1990s, a number of pre-sale cleanup actions conducted by Parsons in 2006, and the Port's major cleanup in 2010. These activities are described in detail in Hart Crowser (2011), shown on Figure 7, and summarized below.

5.1 UST Removals (1990s)

In 1991 four USTs were removed from the lower area of the Site by employees of Portside Recycling, which was the operator at the time (ATEC Associates 1993). Little additional information is available regarding these USTs or this removal action, but the ATEC report indicates that no soil assessment was completed at the time of the removals.

In 1997 West Pac Environmental, Inc. of Seattle removed three additional USTs and an associated pump island from the MFA. These tanks were located northwest of the Maintenance Building. The associated UST Site Assessment

was completed by Neuston Consulting of Burien, Washington (Neuston Consulting 1997). The last known use of the USTs reported was for diesel truck and heavy equipment fueling, and at the time of removal they were estimated to be over 25 years old. Approximately 100 tons of contaminated soil were excavated and disposed of off site, and post-excavation samples documented that remaining soil did not exceed the MTCA Method A level for diesel.

5.2 Rubble Removal and Other Cleanup Activities (2006)

Before the Port purchased the property in 2006, the previous owner removed about 30,000 thousand cubic yards of debris from the Site. This material included unprocessed concrete and asphalt rubble from the upland portion of the property; about 4,000 tons of glass, window frames, and wood debris from the near the Maintenance Building; and about 5,000 cubic yards of scattered debris including wood, plastic, metal, rubber, and building remains from within the MCA and MFA. The previous owner also contracted Environmental Chemical Solutions of Gig Harbor, Washington, to remove approximately 25 cubic yards of petroleum-contaminated surficial soil from two 15-square-foot areas between the Maintenance Building and the former log cabin office building in the MFA.

5.3 Port of Tacoma Cleanup (2010)

As described above, the remaining areas of environmental contamination at the time of the Port's 2010 cleanup actions and redevelopment were the MFA and the MCA, which occupied the lower portion of the Site.

The cleanup approach for the MFA involved mass excavation of the entire fill prism down to native material except along the eastern hillside where some untreated wood waste was left in place. During the MFA excavation, a UST was discovered and removed along with two extensive areas of petroleum-impacted native soil. All soil exhibiting field indications of petroleum impacts (sheen, odor, etc.) was removed. Figure 8 shows the relationship between the extent of the pre-cleanup petroleum impacts and the extent of the remedial excavation. This figure demonstrates that the lateral and vertical extent of the excavation encompassed the impacted soil. Post-excavation soil samples further confirmed that contaminated material was successfully removed from the MFA (Figure 10).

The cleanup approach for the MCA involved excavation of slag-bearing fill. The fill was removed down to native material or to the elevation where the pre-cleanup sampling indicated there was no longer impacted material. Figure 9 shows the relationship between the extent of the pre-cleanup metal impacts and the extent of the fill removal. This figure demonstrates that the lateral and

vertical extent of the removal encompassed the impacted fill. Post-excavation samples further confirmed that contaminated material was successfully removed from the MCA (Figure 10).

Uncontaminated concrete rubble from the MFA was crushed and hauled offsite for beneficial reuse and all contaminated fill and soil from the Site was disposed of at LRI Landfill (LRI) in Graham, Washington.

6.0 CONCEPTUAL SITE MODEL

A conceptual site model identifies the potential sources of contamination at a Site and describes that pathways through which receptors may be exposed to them.

As discussed in Section 4.0, the sources of the petroleum contamination at the Site appear to have been leaks and spills of petroleum and/or imported fill material that was contaminated with petroleum products. The distribution of petroleum impacts was highly variable and generally localized, which is consistent with these suspected sources. The source of the metals contamination in the MCA was clearly imported fill. The likely source of the elevated levels of metals in the MFA was imported soil or other debris.

Before the Port's 2010 cleanup actions, impacted media at the Site consisted primarily of the contaminated fill itself along with underlying native soil in some locations (e.g., the southeast and southwest overexcavation areas). Groundwater impacts were highly localized and found only in the MFA.

The MFA and MCA are not currently a source of drinking water, and are now largely located below the high tide level, precluding future groundwater development. Development of groundwater along the shoreline of the MFA and MCA is similarly not practicable for several reasons:

1. A large portion of the Site, including the MFA and MCA and surrounding land, is now a mitigation area providing restored native habitat for terrestrial plants and animals and aquatic organisms. The Port developed the Site to mitigate for habitat lost during construction of other Port-related projects; as such, the Port is required to maintain these areas as habitat in perpetuity (a restrictive covenant filed with Pierce County—record number 201005260144—restricts use to only natural resources restoration and access for incidental maintenance of overhead electrical transmission lines). Accordingly, the Site is fenced and gated and is only accessible to maintenance workers.

2. Topography, stratigraphy, and water table elevation data from the pre-cleanup monitoring well network indicate that groundwater in this vicinity is hydraulically connected to the adjacent surface water (the tidal waters of the Hylebos Waterway), such that pumping in these areas would induce intrusion of tidally influenced surface water. As presented in Table 2, post-cleanup sampling of two new wells installed along the shoreline documented exceedances of the state drinking water criteria for specific conductivity (SC) and total dissolved solids (TDS) of 700 uS/cm and 500 mg/L, respectively. In well MW-201, SC and TDS exceeded criteria in two out of two sampling rounds, ranging to 1,300 uS/cm and 871 mg/L, respectively. In well MW-202, SC and TDS exceeded criteria in one out of three sampling rounds, ranging to 1,490 uS/cm and 978 mg/L, respectively.

3. In addition, shoreline wells MW-201 and -202 also exceed drinking water criteria adopted by the Tacoma-Pierce County Health Department (Environmental Health Code, Chapter 3) for SC and TDS. These criteria are based on the state's standards and the exceedances mentioned above also apply to the local standards.

Based on the site characteristics outlined above, current and potential future exposure pathways at the Site are:

- Exposure of maintenance workers to remaining contaminants in soil/sediments;

- Exposure of terrestrial organisms (plants, soil invertebrates, and wildlife) to remaining contaminants in soil;

- Exposure of benthic marine organisms to remaining contaminants in soil/sediments that now lie below the high tide level; and

- Exposure of aquatic organisms to surface water, if the surface water contacts contaminated groundwater discharging to surface water (e.g., via seeps).

7.0 CONTAMINANTS OF CONCERN

Pre-cleanup investigations included the analysis of soil and groundwater samples for petroleum hydrocarbons, carcinogenic polynuclear aromatic hydrocarbons (cPAHs), polychlorinated biphenyls (PCBs), and metals (GeoEngineers 2005; Hart Crowser 2010 and 2011). Based on the analytical results, DRO, and ORO, and metals (arsenic, lead, copper, mercury, and zinc) were identified as contaminants of concern (COCs) in soil and groundwater at the MFA. At the

MCA, the contaminants of concern were metals (arsenic, lead, copper, and zinc) in soil.

8.0 SITE CLEANUP STANDARDS

As defined in WAC 173-340-700, cleanup standards consist of cleanup levels for hazardous substances present at the Site along with the location where these cleanup levels must be met (point of compliance). A cleanup level is the concentration of a hazardous substance in soil, water, air, or sediment that is determined to be protective of human health and the environment under specified exposure conditions.

8.1 Soil Cleanup Standards

The following cleanup levels for soil—including for portions of the Site that were excavated to below the high tide level and are now periodically inundated—are based on the conceptual site model described in Section 6.0:[1]

- Method A soil cleanup levels apply to DRO, ORO, arsenic, mercury, and lead. These standards address the exposure pathway from soil/sediment to humans.

- Method B cleanup levels apply to copper and zinc (which do not have Method A levels). These standards address the exposure pathway from soil/sediment to humans.

- Sediment quality standards listed in WAC 173-204-320 apply to metals and the relevant toxic components of DRO and ORO (polynuclear aromatic hydrocarbons [PAHs]) in the portions of the Site that now lie below high tide. These standards apply to address exposure to benthic organisms.

Cleanup levels for soil/sediment are presented in Table 1.

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[1] The Site does not pose a threat of significant adverse effects to terrestrial ecological receptors; therefore, soil cleanup levels based on this pathway were not developed. Under the terrestrial ecological evaluation procedures outlined in WAC 173-340-7491(1)(a) and -7492(2)(c)(i), the Site may be removed from further ecological consideration if no hazardous substances listed in Table 749-2 are or will be present in the soil above the point of compliance established under WAC 173-340-7490(4). Post-cleanup monitoring documented in the IRAR (Hart Crowser 2011) and in this RI/FS demonstrates that these conditions have been met.

In accordance with WAC 173-340-7490(4)(b), the standard point of compliance for soil is 15 feet below the ground surface. This represents a reasonable estimate of the depth of soil that could be excavated and distributed at the soil surface as a result of site development activities. For sites with institutional controls to prevent excavation of deeper soil, a conditional point of compliance may be set at the biologically active soil zone, assumed to extend to a depth of 6 feet, to prevent exposure of terrestrial organisms (WAC 173-340-7490(4)(a)).

For pathways involving exposure of benthic organisms, compliance is assessed within the biologically active zone (WAC 173-204-200(26)), commonly considered to be the upper 10 centimeters (approximately 4 inches).

8.2 Groundwater Cleanup Standards

Cleanup levels for groundwater are presented in Table 2. These cleanup levels were identified based on the conceptual site model presented above in Section 6.0:

- Method A surface water cleanup levels for groundwater address the exposure pathway of metals to aquatic organisms from discharge of groundwater into surface water. As stipulated in WAC 173-340-730[2], Method A surface water cleanup levels are based on state surface water standards (WAC 173-201A), federal water quality criteria under section 304 of the Clean Water Act, and federal surface water criteria under the National Toxics rule (40 CFR Part 131).

- Method A groundwater cleanup levels also address the exposure pathway of petroleum hydrocarbons to aquatic organisms. No numeric standards for total petroleum hydrocarbons exist for surface water; however, Method A refers to a narrative standard of concentrations that will not cause a sheen on surface water.

- As described in Section 6.0, groundwater at the Site is not a current or future source of drinking water. Therefore, the drinking-water based Method A groundwater cleanup levels are not appropriate cleanup levels for this site.

In general, the standard point of compliance for groundwater under MTCA is throughout the site from the top of the saturated zone extending vertically to the lowest point which could potentially be affected by the site. However, where the groundwater cleanup level is based on protection of surface water and the property containing the source of contamination abuts the surface water, a conditional point of compliance may be defined that is located within the surface water as close as technically possible to the point or points where

groundwater flows into the surface water (WAC 720(8)(d)(i)). Because the Site meets these criteria, the appropriate point of compliance for groundwater is defined as the point(s) where groundwater flows into surface water.

9.0 CURRENT NATURE AND EXTENT OF CONTAMINATION

As documented in Hart Crowser (2011), contaminated fill and soil that was present in the lower portion of the Site (the MFA and MCA) was removed by the Port in 2010. Post-cleanup soil samples from that effort (along with three additional samples collected subsequently from the unpaved roadway, RD-CS-1, -2, and -3) reflect current site conditions. These samples are shown on Figure 10. Comparing the soil monitoring results to the Site Cleanup Standards, it is clear that the current concentrations of constituents of concern meet the standards (Table 1).[2] In addition, unprocessed concrete and asphalt rubble stored on the upper portion of the Site was removed in 2006 as a condition of the Port's purchase of the property.

Groundwater impacts at the Site were minor even before the Port's 2010 cleanup and were limited to three wells in the MFA. These three wells were screened within the contaminated fill/soil prism. The Port's 2010 cleanup addressed groundwater impacts through source removal by excavating impacted fill and soil at the Site. With the completion of the habitat mitigation project, groundwater now discharges to the constructed intertidal channels via surface water seeps.

No sheens have been observed in these seeps. In addition, results from groundwater samples collected from post-cleanup wells MW-201 and -202 were below groundwater cleanup levels (Table 2).

So, based on this data, COCs are no longer present at the Site above cleanup levels protective of current and future human health and terrestrial and ecological exposure pathways.

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[2] Arsenic exceeded the soil cleanup level in one sample, RD-CS-2, located on the unpaved roadway. However, because a) the magnitude of this exceedance was low (<2 times the cleanup level); b) the upper 95% confidence limit for arsenic in post-cleanup samples at the Site was less than the cleanup level (4.1 mg/kg versus 20 mg/kg); and c) only one out of 68 samples (1.5%) exceeded the cleanup level, the Site-wide arsenic concentration complies with the cleanup level in accordance with WAC 173-340-740(7)(d)(i), -740(7)(e)(i), and -740(7)(e)(ii), which specify how compliance is to be assessed in cases where one or more confirmation samples exceeds cleanup levels.

10.0 FEASIBILITY STUDY

The purpose of a feasibility study is to develop and evaluate alternatives to enable a cleanup action to be selected for the site. However, if concentrations of hazardous substances do not exceed the cleanup level at a standard point of compliance, no further action is necessary per WAC 173-340-350(8)(a), and a feasibility study would not be required. As summarized above, due to the Port's 2010 cleanup actions, concentrations of hazardous substances at the Site no longer exceed cleanup levels.

In selecting its 2010 cleanup action, the Port considered alternatives ranging in protectiveness from partial removal of impacted soil to complete removal of impacted soil. The Port chose to remove all impacted soil to achieve maximum protectiveness for the subsequent habitat mitigation project and to minimize the need for institutional controls and long-term performance monitoring.

The only remaining cleanup action involves implementing a groundwater performance monitoring program to meet the requirements of WAC 173-340-410(1)(b).

MTCA describes the minimum requirements and procedures for selecting cleanup actions. As detailed in the following paragraphs, the proposed cleanup action for the Site, groundwater monitoring, complies with the provisions of this section.

10.1 Threshold Requirements

WAC 173-340-360[2][a] requires that cleanup actions protect human health and the environment; comply with MTCA cleanup standards, including applicable state and federal laws; and provide for compliance monitoring.

As described in the RI/FS report (Hart Crowser 2012) and summarized above, the Port's cleanup action removed fill and impacted soil that exceeded cleanup levels and provided a potential source to groundwater and surface water. Post cleanup monitoring confirmed that the remaining soil/sediment meets cleanup levels and does not pose a risk to human health or the environment. Initial results indicate that source removal has reduced contaminants in groundwater to below state and federal levels for protection of surface water. The remaining proposed cleanup action is compliance monitoring to confirm that groundwater cleanup levels have been met.

10.2 Other Requirements

WAC 173-340-360[2][b] requires that when selecting from cleanup action alternatives that fulfill the threshold requirements, the selected action shall: a) Use permanent solutions to the maximum extent practicable; b) Provide for a reasonable restoration time frame; and c) Consider public concerns. As described in the following subsections, the Port's cleanup action at the Site fulfills these requirements.

10.2.1 Permanence

Under WAC 173-340-360[3][f][ii], permanence refers to the degree to which the alternative permanently reduces the toxicity, mobility or volume of hazardous substances, including the adequacy of the alternative in destroying the hazardous substances, the reduction or elimination of hazardous substance releases and sources of releases, the degree of irreversibility of waste treatment process, and the characteristics and quantity of treatment residuals generated.

The Port's cleanup action removed fill and impacted soil that exceeded cleanup levels and provided a potential source to groundwater and surface water. The complete removal of contaminated fill and soil from the Site and its disposal in a permitted landfill is considered highly permanent.

10.2.2 Restoration Time Frame

The Port's cleanup action removed fill and impacted soil that exceeded cleanup levels and provided a potential source to groundwater and surface water. Post cleanup monitoring confirmed that the remaining soil/sediment meets cleanup levels and does not pose a risk to human health or the environment. Initial results indicate that source removal has reduced contaminants in groundwater to below state and federal levels for protection of surface water. Because cleanup levels have been met at the site, the MTCA requirement that the selected cleanup action achieve a reasonable restoration time frame has been met. The remaining proposed cleanup action is compliance monitoring in accordance with WAC 173-340-410..

10.2.3 Consideration of Public Concern

Ecology will solicit public comments on the CAP and will modify the cleanup approach as appropriate to take into account public concerns.

11.0 CONCLUSIONS

The Port's 2010 cleanup activities at Parcel 88, along with earlier cleanups at the Site, achieved the following objectives:

- Upland soil at the Site does not pose a risk to human health or terrestrial organisms.
- Soil/sediment in areas that are now below the high tide level do not pose a risk to benthic organisms.
- Groundwater that discharges to surface water does not pose a risk to aquatic organisms.
- Except for groundwater performance monitoring, no further action is required.

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Table 1 - Post-Cleanup Soil Monitoring Results

Analyte/Sample (mg/kg)	Method A Cleanup Level (Unrestricted)	Method B Cleanup Level	Terrestrial Ecological Screening Level (a)	SMS Sediment Quality Standards	Main Fill Area							
					OEX-B-1	OEX-B-2	OEX-B-3	OEX-B-4	OEX-B-5	OEX-B-6	OSD-CS13	OSD-CS14
Petroleum Hydrocarbons												
DRO	2,000	-	200	-	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
ORO	2,000	-	200	-	100 U	100 U	100 U	100 U	100 U	100 U	100 U	100 U
Metals												
Arsenic	20	-	20	57	-	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Copper	-	3,200	100	390	-	17	19	23	14	24	8.2	10
Lead	250	-	220	450	-	4 U	4 U	4 U	4 U	4 U	4 U	4 U
Mercury	2	-	9	0.41	-	0.05 U	0.085	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
Zinc	-	24,000	270	410	-	23	23	33	21	29	14	16
cPAHs												
Benzo[a]anthracene	-	1.4	-	0.55 (e)	-	0.033 U	0.033 U	0.033 U	0.033 U	0.033 U	0.033 U	0.033 U
Benzo[a]pyrene	0.1	0.14	12	0.50 (e)	-	0.033 U	0.033 U	0.033 U	0.033 U	0.033 U	0.033 U	0.033 U
Chrysene	-	140	-	0.55 (e)	-	0.033 U	0.033 U	0.033 U	0.033 U	0.033 U	0.033 U	0.033 U
Dibenz(a,h)anthracene	-	0.14	-	0.06 (e)	-	0.033 U	0.033 U	0.033 U	0.033 U	0.033 U	0.033 U	0.033 U
Indeno(1,2,3-cd)pyrene	-	1.4	-	-	-	0.033 U	0.033 U	0.033 U	0.033 U	0.033 U	0.033 U	0.033 U
Benzofluoranthenes, total	-	1.40	-	1.15 (e)	-	0.033 U	0.033 U	0.033 U	0.033 U	0.033 U	0.033 U	0.033 U
Total cPAHs (c)	0.1	-	-	-	-	0.033 U	0.033 U	0.033 U	0.033 U	0.033 U	0.033 U	0.033 U
Total HPAHs (f)	-	-	-	4.8 (e)	-	0.033 U	0.033 U	0.033 U	0.033 U	0.033 U	0.033 U	0.033 U

Notes:
Values exceeding cleanup levels are shaded.
- = not available or not applicable.
(a) Terrestrial ecological screening levels are based on MTCA Table 749-2.
(b) Cleanup level based on chromium (III).
(c) Total cPAH values calculated using Toxicity Equivalency Factors
in accordance with WAC 173-340-708(e).
(e) Sediment Quality Standard shown is expressed on a dry weight basis
assuming a total organic carbon carbon content of 0.5 percent.
(f) Total HPAH values presented represent the sum of the high molecular weight polynuclear aromatic hydrocarbons benz(a)anthracene, chrysene, total benzofluoranthenes, benzo(a)pyrene, indeno(1,2,3,-c,d)pyrene, dibenzo(a,h)anthracene, and benzo(g,h,i)perylene. Fluoranthene and pyrene, which are included in the calculation of total HPAHs under SMS (WAC 173-204-320), are not identified as cPAHs under MTCA (WAC 173-340-708([e]) and, therefore, were not routinely analyzed. They are not included in the values for total HPAHs presented in this table.
(g) Results shown are mean values of four replicate analyses.

Table 1 - Post-Cleanup Soil Monitoring Results

Analyte/Sample (mg/kg)	Method A Cleanup Level (Unrestricted)	Method B Cleanup Level	Terrestrial Ecological Screening Level (a)	SMS Sediment Quality Standards	Main Fill Area							
					OSD-CS15	OSD-CS16	OSD-CS17	OSD-CS18	OSD-CS19	OSD-CS20	OSD-CS21	OSD-CS-22
Petroleum Hydrocarbons												
DRO	2,000	-	200	-	24.1	10 U	10 U	10 U	10 U	10 U	10 U	10 U
ORO	2,000	-	200	-	100 U	100 U	100 U	100 U	100 U	100 U	100 U	100 U
Metals												
Arsenic	20	-	20	57	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Copper	-	3,200	100	390	11	11	9.6	10	7.6	11	13	13
Lead	250	-	220	450	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
Mercury	2	-	9	0.41	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
Zinc	-	24,000	270	410	20	18	15	28	18	18	99	24
cPAHs												
Benzo[a]anthracene	-	1.4	-	0.55 (e)	0.033 U	0.033 U	0.033 U	0.033 U	0.033 U	0.033 U	0.033 U	0.033 U
Benzo[a]pyrene	0.1	0.14	12	0.50 (e)	0.033 U	0.033 U	0.033 U	0.033 U	0.033 U	0.033 U	0.033 U	0.033 U
Chrysene	-	140	-	0.55 (e)	0.033 U	0.033 U	0.033 U	0.033 U	0.033 U	0.033 U	0.033 U	0.033 U
Dibenz(a,h)anthracene	-	0.14	-	0.06 (e)	0.033 U	0.033 U	0.033 U	0.033 U	0.033 U	0.033 U	0.033 U	0.033 U
Indeno(1,2,3-cd)pyrene	-	1.4	-	-	0.033 U	0.033 U	0.033 U	0.033 U	0.033 U	0.033 U	0.033 U	0.033 U
Benzofluoranthenes, total	-	1.40	-	1.15 (e)	0.033 U	0.033 U	0.033 U	0.033 U	0.033 U	0.033 U	0.033 U	0.033 U
Total cPAHs (c)	0.1	-	-	-	0.033 U	0.033 U	0.033 U	0.033 U	0.033 U	0.033 U	0.033 U	0.033 U
Total HPAHs (f)	-	-	-	4.8 (e)	0.033 U	0.033 U	0.033 U	0.033 U	0.033 U	0.033 U	0.033 U	0.033 U

Notes:
Values exceeding cleanup levels are shaded.
- = not available or not applicable.
(a) Terrestrial ecological screening levels are based on MTCA Table 749-2.
(b) Cleanup level based on chromium (III).
(c) Total cPAH values calculated using Toxicity Equivalency Factors in accordance with WAC 173-340-708(e).
(e) Sediment Quality Standard shown is expressed on a dry weight basis assuming a total organic carbon carbon content of 0.5 percent.
(f) Total HPAH values presented represent the sum of the high molecular weight polynuclear arom benz(a)anthracene, chrysene, total benzofluoranthenes, benzo(a)pyrene, indeno(1,2,3,-c,d)pyrene dibenzo(a,h)anthracene, and benzo(g,h,i)perylene. Fluoranthene and pyrene, which are included total HPAHs under SMS (WAC 173-204-320), are not identified as cPAHs under MTCA (WAC 173-340-708([e]) and, therefore, were not routinely analyzed. They are not included in the values presented in this table.
(g) Results shown are mean values of four replicate analyses.

Table 1 - Post-Cleanup Soil Monitoring Results

Analyte/Sample (mg/kg)	Method A Cleanup Level (Unrestricted)	Method B Cleanup Level	Terrestrial Ecological Screening Level (a)	SMS Sediment Quality Standards	Main Fill Area				Main Fill Area (SW Overexcavation)		
					OSD-CS-23	OSD-CS-24	OSD-CS-25	OSD-CS-26	OSD-CS-1	OSD-CS-2	OSD-CS-4
Petroleum Hydrocarbons											
DRO	2,000	-	200	-	10 U	10 U	10 U	10 U	6.2 U	6.2 U	7.1 U
ORO	2,000	-	200	-	100 U	100 U	100 U	100 U	12 U	12 U	20
Metals											
Arsenic	20	-	20	57	5 U	5 U	5 U	5 U	5.7 U	5.9 U	6.1 U
Copper	-	3,200	100	390	12	13	12	7.1	16.6	19.9	15.3
Lead	250	-	220	450	4 U	4 U	4 U	4 U	3	7	13
Mercury	2	-	9	0.41	0.05 U	0.05 U	0.05 U	0.05 U	0.03 U	0.04	0.04
Zinc	-	24,000	270	410	35	20	18	16	26	36	34
cPAHs											
Benzo[a]anthracene	-	1.4	-	0.55 (e)	0.033 U	0.033 U	0.033 U	0.033 U	0.005 U	0.011	0.011
Benzo[a]pyrene	0.1	0.14	12	0.50 (e)	0.033 U	0.033 U	0.033 U	0.033 U	0.005 U	0.013	0.014
Chrysene	-	140	-	0.55 (e)	0.033 U	0.033 U	0.033 U	0.033 U	0.008	0.019	0.054
Dibenz(a,h)anthracene	-	0.14	-	0.06 (e)	0.033 U	0.033 U	0.033 U	0.033 U	0.005 U	0.005 U	0.005 U
Indeno(1,2,3-cd)pyrene	-	1.4	-	-	0.033 U	0.033 U	0.033 U	0.033 U	0.005 U	0.009	0.016
Benzofluoranthenes, total	-	1.40	-	1.15 (e)	0.033 U	0.033 U	0.033 U	0.033 U	0.008	0.025	0.050
Total cPAHs (c)	0.1	-	-	-	0.033 U	0.033 U	0.033 U	0.033 U	0.001	0.018	0.022
Total HPAHs (f)	-	-	-	4.8 (e)	0.033 U	0.033 U	0.033 U	0.033 U	0.017	0.077	0.145

Notes:
Values exceeding cleanup levels are shaded.
- = not available or not applicable.
(a) Terrestrial ecological screening levels are based on MTCA Table 749-2.
(b) Cleanup level based on chromium (III).
(c) Total cPAH values calculated using Toxicity Equivalency Factors in accordance with WAC 173-340-708(e).
(e) Sediment Quality Standard shown is expressed on a dry weight basis assuming a total organic carbon carbon content of 0.5 percent.
(f) Total HPAH values presented represent the sum of the high molecular weight polynuclear arom benz(a)anthracene, chrysene, total benzofluoranthenes, benzo(a)pyrene, indeno(1,2,3,-c,d)pyrene dibenzo(a,h)anthracene, and benzo(g,h,i)perylene. Fluoranthene and pyrene, which are included total HPAHs under SMS (WAC 173-204-320), are not identified as cPAHs under MTCA (WAC 173-340-708([e]) and, therefore, were not routinely analyzed. They are not included in the values presented in this table.
(g) Results shown are mean values of four replicate analyses.

Table 1 - Post-Cleanup Soil Monitoring Results

Analyte/Sample (mg/kg)	Method A Cleanup Level (Unrestricted)	Method B Cleanup Level	Terrestrial Ecological Screening Level (a)	SMS Sediment Quality Standards	Main Fill Area (SW Overexcavation)							
					OSD-CS-5	OSD-CS-7	OSD-CS-8	OSD-CS-9	OEX-SW-1	OEX-SW-2	OEX-SW-3	OEX-SW-4
Petroleum Hydrocarbons												
DRO	2,000	-	200	-	6.5 U	6.5 U	6.2 U	6.3 U	10 U	10 U	10 U	10 U
ORO	2,000	-	200	-	13 U	13 U	12 U	13 U	100 U	100 U	100 U	100 U
Metals												
Arsenic	20	-	20	57	6.3 U	6.6 U	5.8 U	5.9 U	5 U	5 U	5 U	5 U
Copper	-	3,200	100	390	21.5	14.5	17.1	17	12	10	9.9	9.2
Lead	250	-	220	450	5	3 U	6	13	4 U	4 U	4 U	4 U
Mercury	2	-	9	0.41	0.03	0.03 U	0.03 U	0.06	0.05 U	0.05 U	0.05 U	0.05 U
Zinc	-	24,000	270	410	78	24	32	34	18	18	20	15
cPAHs												
Benzo[a]anthracene	-	1.4	-	0.55 (e)	0.005 U	0.005 U	0.005 U	0.006	0.033 U	0.033 U	0.033 U	0.033 U
Benzo[a]pyrene	0.1	0.14	12	0.50 (e)	0.005 U	0.005 U	0.005 U	0.007	0.033 U	0.033 U	0.033 U	0.033 U
Chrysene	-	140	-	0.55 (e)	0.005 U	0.005 U	0.005 U	0.011	0.033 U	0.033 U	0.033 U	0.033 U
Dibenz(a,h)anthracene	-	0.14	-	0.06 (e)	0.005 U	0.005 U	0.005 U	0.005 U	0.033 U	0.033 U	0.033 U	0.033 U
Indeno(1,2,3-cd)pyrene	-	1.4	-	-	0.005 U	0.005 U	0.005 U	0.005	0.033 U	0.033 U	0.033 U	0.033 U
Benzofluoranthenes, total	-	1.40	-	1.15 (e)	0.005 U	0.005 U	0.005 U	0.015	0.033 U	0.033 U	0.033 U	0.033 U
Total cPAHs (c)	0.1	-	-	-	0.005 U	0.005 U	0.005 U	0.010	0.033 U	0.033 U	0.033 U	0.033 U
Total HPAHs (f)	-	-	-	4.8 (e)	0.005 U	0.005 U	0.005 U	0.044	0.033 U	0.033 U	0.033 U	0.033 U

Notes:
Values exceeding cleanup levels are shaded.
- = not available or not applicable.
(a) Terrestrial ecological screening levels are based on MTCA Table 749-2.
(b) Cleanup level based on chromium (III).
(c) Total cPAH values calculated using Toxicity Equivalency Factors in accordance with WAC 173-340-708(e).
(e) Sediment Quality Standard shown is expressed on a dry weight basis assuming a total organic carbon carbon content of 0.5 percent.
(f) Total HPAH values presented represent the sum of the high molecular weight polynuclear arom benz(a)anthracene, chrysene, total benzofluoranthenes, benzo(a)pyrene, indeno(1,2,3,-c,d)pyrene dibenzo(a,h)anthracene, and benzo(g,h,i)perylene. Fluoranthene and pyrene, which are included total HPAHs under SMS (WAC 173-204-320), are not identified as cPAHs under MTCA (WAC 173-340-708([e]) and, therefore, were not routinely analyzed. They are not included in the values presented in this table.
(g) Results shown are mean values of four replicate analyses.

Table 1 - Post-Cleanup Soil Monitoring Results

Analyte/Sample (mg/kg)	Method A Cleanup Level (Unrestricted)	Method B Cleanup Level	Terrestrial Ecological Screening Level (a)	SMS Sediment Quality Standards	Main Fill Area (SW Overexcavation)			Main Fill Area (SE Overexcavation Area)					
					OEX-SW-5	OEX-SW-6	OEX-SW-7	OEX2-B1	OEX2-B2	OEX2-B3	OEX2-B4	OEX2-B6	OSD-CS3
Petroleum Hydrocarbons													
DRO	2,000	-	200	-	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
ORO	2,000	-	200	-	100 U	100 U	100 U	100 U	100 U	100 U	100 U	100 U	100 U
Metals													
Arsenic	20	-	20	57	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Copper	-	3,200	100	390	10	9.9	11	9.9	6.4	8.8	7.8	7	9.6
Lead	250	-	220	450	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
Mercury	2	-	9	0.41	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
Zinc	-	24,000	270	410	23	20	20	16	16	17	18	15	17
cPAHs													
Benzo[a]anthracene	-	1.4	-	0.55 (e)	0.033 U	0.033 U	0.033 U	0.033 U	0.033 U	0.033 U	0.033 U	0.033 U	0.033 U
Benzo[a]pyrene	0.1	0.14	12	0.50 (e)	0.033 U	0.033 U	0.033 U	0.033 U	0.033 U	0.033 U	0.033 U	0.033 U	0.033 U
Chrysene	-	140	-	0.55 (e)	0.033 U	0.033 U	0.033 U	0.033 U	0.033 U	0.033 U	0.033 U	0.033 U	0.033 U
Dibenz(a,h)anthracene	-	0.14	-	0.06 (e)	0.033 U	0.033 U	0.033 U	0.033 U	0.033 U	0.033 U	0.033 U	0.033 U	0.033 U
Indeno(1,2,3-cd)pyrene	-	1.4	-	-	0.033 U	0.033 U	0.033 U	0.033 U	0.033 U	0.033 U	0.033 U	0.033 U	0.033 U
Benzofluoranthenes, total	-	1.40	-	1.15 (e)	0.033 U	0.033 U	0.033 U	0.033 U	0.033 U	0.033 U	0.033 U	0.033 U	0.033 U
Total cPAHs (c)	0.1	-	-	-	0.033 U	0.033 U	0.033 U	0.033 U	0.033 U	0.033 U	0.033 U	0.033 U	0.033 U
Total HPAHs (f)	-	-	-	4.8 (e)	0.033 U	0.033 U	0.033 U	0.033 U	0.033 U	0.033 U	0.033 U	0.033 U	0.033 U

Notes:
Values exceeding cleanup levels are shaded.
- = not available or not applicable.
(a) Terrestrial ecological screening levels are based on MTCA Table 749-2.
(b) Cleanup level based on chromium (III).
(c) Total cPAH values calculated using Toxicity Equivalency Factors in accordance with WAC 173-340-708(e).
(e) Sediment Quality Standard shown is expressed on a dry weight basis assuming a total organic carbon carbon content of 0.5 percent.
(f) Total HPAH values presented represent the sum of the high molecular weight polynuclear arom benz(a)anthracene, chrysene, total benzofluoranthenes, benzo(a)pyrene, indeno(1,2,3,-c,d)pyrene dibenzo(a,h)anthracene, and benzo(g,h,i)perylene. Fluoranthene and pyrene, which are included total HPAHs under SMS (WAC 173-204-320), are not identified as cPAHs under MTCA (WAC 173-340-708([e]) and, therefore, were not routinely analyzed. They are not included in the values presented in this table.
(g) Results shown are mean values of four replicate analyses.

Table 1 - Post-Cleanup Soil Monitoring Results

Analyte/Sample (mg/kg)	Method A Cleanup Level (Unrestricted)	Method B Cleanup Level	Terrestrial Ecological Screening Level (a)	SMS Sediment Quality Standards	Main Fill Area (SE Overexcavation Area)							
					OSD-CS6	OEX2-SW1	OEX2-SW2	OEX2-SW3	OEX2-SW4	OEX2-SW5	OEX2-SW6	TPH2-SW1
Petroleum Hydrocarbons												
DRO	2,000	-	200	-	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
ORO	2,000	-	200	-	100 U	100 U	100 U	100 U	100 U	100 U	100 U	100 U
Metals												
Arsenic	20	-	20	57	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Copper	-	3,200	100	390	11	8.2	14	11	8.9	17	8.8	19
Lead	250	-	220	450	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
Mercury	2	-	9	0.41	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
Zinc	-	24,000	270	410	20	15	21	16	16	22	17	27
cPAHs												
Benzo[a]anthracene	-	1.4	-	0.55 (e)	0.033 U	0.033 U	0.033 U	0.033 U	0.033 U	0.033 U	0.033 U	0.033 U
Benzo[a]pyrene	0.1	0.14	12	0.50 (e)	0.033 U	0.033 U	0.033 U	0.033 U	0.033 U	0.033 U	0.033 U	0.033 U
Chrysene	-	140	-	0.55 (e)	0.033 U	0.033 U	0.033 U	0.033 U	0.033 U	0.033 U	0.033 U	0.033 U
Dibenz(a,h)anthracene	-	0.14	-	0.06 (e)	0.033 U	0.033 U	0.033 U	0.033 U	0.033 U	0.033 U	0.033 U	0.033 U
Indeno(1,2,3-cd)pyrene	-	1.4	-	-	0.033 U	0.033 U	0.033 U	0.033 U	0.033 U	0.033 U	0.033 U	0.033 U
Benzofluoranthenes, total	-	1.40	-	1.15 (e)	0.033 U	0.033 U	0.033 U	0.033 U	0.033 U	0.033 U	0.033 U	0.033 U
Total cPAHs (c)	0.1	-	-	-	0.033 U	0.033 U	0.033 U	0.033 U	0.033 U	0.033 U	0.033 U	0.033 U
Total HPAHs (f)	-	-	-	4.8 (e)	0.033 U	0.033 U	0.033 U	0.033 U	0.033 U	0.033 U	0.033 U	0.033 U

Notes:
Values exceeding cleanup levels are shaded.
- = not available or not applicable.
(a) Terrestrial ecological screening levels are based on MTCA Table 749-2.
(b) Cleanup level based on chromium (III).
(c) Total cPAH values calculated using Toxicity Equivalency Factors in accordance with WAC 173-340-708(e).
(e) Sediment Quality Standard shown is expressed on a dry weight basis assuming a total organic carbon carbon content of 0.5 percent.
(f) Total HPAH values presented represent the sum of the high molecular weight polynuclear arom benz(a)anthracene, chrysene, total benzofluoranthenes, benzo(a)pyrene, indeno(1,2,3,-c,d)pyrene dibenzo(a,h)anthracene, and benzo(g,h,i)perylene. Fluoranthene and pyrene, which are included total HPAHs under SMS (WAC 173-204-320), are not identified as cPAHs under MTCA (WAC 173-340-708([e]) and, therefore, were not routinely analyzed. They are not included in the values presented in this table.
(g) Results shown are mean values of four replicate analyses.

Table 1 - Post-Cleanup Soil Monitoring Results

Analyte/Sample (mg/kg)	Method A Cleanup Level (Unrestricted)	Method B Cleanup Level	Terrestrial Ecological Screening Level (a)	SMS Sediment Quality Standards	Metals Contamination Area							
					NRDA9-13b	NRDA9-14b	NRDA9-15b	NRDA9-16b	NRDA9-17b	NRDA9-18b	NRDA9-19b	TP-314-S-2
Petroleum Hydrocarbons												
DRO	2,000	-	200	-	-	-	-	-	-	-	-	-
ORO	2,000	-	200	-	-	-	-	-	-	-	-	-
Metals												
Arsenic	20	-	20	57	9.5	6 U	5.7 U	5.7 U	17.4	14.4	6.6 U	5.9 U
Copper	-	3,200	100	390	-	-	-	-	-	-	-	23.4
Lead	250	-	220	450	2	2	9	25	18	12	5 U	3
Mercury	2	-	9	0.41	0.03	0.02 U	0.03	0.04	0.04	0.05	0.03	0.03 U
Zinc	-	24,000	270	410	-	-	-	-	-	-	-	36
cPAHs												
Benzo[a]anthracene	-	1.4	-	0.55 (e)	-	-	-	-	-	-	-	-
Benzo[a]pyrene	0.1	0.14	12	0.50 (e)	-	-	-	-	-	-	-	-
Chrysene	-	140	-	0.55 (e)	-	-	-	-	-	-	-	-
Dibenz(a,h)anthracene	-	0.14	-	0.06 (e)	-	-	-	-	-	-	-	-
Indeno(1,2,3-cd)pyrene	-	1.4	-	-	-	-	-	-	-	-	-	-
Benzofluoranthenes, total	-	1.40	-	1.15 (e)	-	-	-	-	-	-	-	-
Total cPAHs (c)	0.1	-	-	-	-	-	-	-	-	-	-	-
Total HPAHs (f)	-	-	-	4.8 (e)	-	-	-	-	-	-	-	-

Notes:
Values exceeding cleanup levels are shaded.
- = not available or not applicable.
(a) Terrestrial ecological screening levels are based on MTCA Table 749-2.
(b) Cleanup level based on chromium (III).
(c) Total cPAH values calculated using Toxicity Equivalency Factors in accordance with WAC 173-340-708(e).
(e) Sediment Quality Standard shown is expressed on a dry weight basis assuming a total organic carbon carbon content of 0.5 percent.
(f) Total HPAH values presented represent the sum of the high molecular weight polynuclear arom benz(a)anthracene, chrysene, total benzofluoranthenes, benzo(a)pyrene, indeno(1,2,3,-c,d)pyrene dibenzo(a,h)anthracene, and benzo(g,h,i)perylene. Fluoranthene and pyrene, which are included total HPAHs under SMS (WAC 173-204-320), are not identified as cPAHs under MTCA (WAC 173-340-708([e]) and, therefore, were not routinely analyzed. They are not included in the values presented in this table.
(g) Results shown are mean values of four replicate analyses.

Table 1 - Post-Cleanup Soil Monitoring Results

Analyte/Sample (mg/kg)	Method A Cleanup Level (Unrestricted)	Method B Cleanup Level	Terrestrial Ecological Screening Level (a)	SMS Sediment Quality Standards	Metals Contamination Area							
					TP-315-S-2	TP-317-S-2	TP-318-S-2	TP-319-S-2	TP-320-S-2	TP-321-S-2	TP-322-S-2	TP-323-S-2
Petroleum Hydrocarbons												
DRO	2,000	-	200	-	-	-	-	-	-	-	-	-
ORO	2,000	-	200	-	-	-	-	-	-	-	-	-
Metals												
Arsenic	20	-	20	57	13	6.3 U	9.2 U	6.1 U	7.1	7.1 U	10.6	5.6 U
Copper	-	3,200	100	390	18.8	15.8	18.9	10.8	21.8	16.3	21.8	29.4
Lead	250	-	220	450	7	3	4	2 U	5	3 U	14	4
Mercury	2	-	9	0.41	0.06	0.02 U	0.04 U	0.03 U	0.03 U	0.03 U	0.09	0.02 U
Zinc	-	24,000	270	410	35	20	35	19	30	20	61	42
cPAHs												
Benzo[a]anthracene	-	1.4	-	0.55 (e)	-	-	-	-	-	-	-	-
Benzo[a]pyrene	0.1	0.14	12	0.50 (e)	-	-	-	-	-	-	-	-
Chrysene	-	140	-	0.55 (e)	-	-	-	-	-	-	-	-
Dibenz(a,h)anthracene	-	0.14	-	0.06 (e)	-	-	-	-	-	-	-	-
Indeno(1,2,3-cd)pyrene	-	1.4	-	-	-	-	-	-	-	-	-	-
Benzofluoranthenes, total	-	1.40	-	1.15 (e)	-	-	-	-	-	-	-	-
Total cPAHs (c)	0.1	-	-	-	-	-	-	-	-	-	-	-
Total HPAHs (f)	-	-	-	4.8 (e)	-	-	-	-	-	-	-	-

Notes:
Values exceeding cleanup levels are shaded.
- = not available or not applicable.
(a) Terrestrial ecological screening levels are based on MTCA Table 749-2.
(b) Cleanup level based on chromium (III).
(c) Total cPAH values calculated using Toxicity Equivalency Factors in accordance with WAC 173-340-708(e).
(e) Sediment Quality Standard shown is expressed on a dry weight basis assuming a total organic carbon carbon content of 0.5 percent.
(f) Total HPAH values presented represent the sum of the high molecular weight polynuclear arom benz(a)anthracene, chrysene, total benzofluoranthenes, benzo(a)pyrene, indeno(1,2,3,-c,d)pyrene dibenzo(a,h)anthracene, and benzo(g,h,i)perylene. Fluoranthene and pyrene, which are included total HPAHs under SMS (WAC 173-204-320), are not identified as cPAHs under MTCA (WAC 173-340-708([e]) and, therefore, were not routinely analyzed. They are not included in the values presented in this table.
(g) Results shown are mean values of four replicate analyses.

Table 1 - Post-Cleanup Soil Monitoring Results

Analyte/Sample (mg/kg)	Method A Cleanup Level (Unrestricted)	Method B Cleanup Level	Terrestrial Ecological Screening Level (a)	SMS Sediment Quality Standards	Metals Contamination Area				
					TP-324-S-2	TP-325-S-2	RD-CS-1	RD-CS-2(g)	RD-CS-3
Petroleum Hydrocarbons									
DRO	2,000	-	200	-	-	-	-	-	-
ORO	2,000	-	200	-	-	-	-	-	-
Metals									
Arsenic	20	-	20	57	17.8	18.6	7.7	34.4	6.4 U
Copper	-	3,200	100	390	36.5	31.3	12.3	26.7	25
Lead	250	-	220	450	10	14	8	2.5	3 U
Mercury	2	-	9	0.41	0.03 U	0.05	0.04	0.03 U	0.03
Zinc	-	24,000	270	410	54	68	22	69.25	29
cPAHs									
Benzo[a]anthracene	-	1.4	-	0.55 (e)	-	-	-	-	-
Benzo[a]pyrene	0.1	0.14	12	0.50 (e)	-	-	-	-	-
Chrysene	-	140	-	0.55 (e)	-	-	-	-	-
Dibenz(a,h)anthracene	-	0.14	-	0.06 (e)	-	-	-	-	-
Indeno(1,2,3-cd)pyrene	-	1.4	-	-	-	-	-	-	-
Benzofluoranthenes, total	-	1.40	-	1.15 (e)	-	-	-	-	-
Total cPAHs (c)	0.1	-	-	-	-	-	-	-	-
Total HPAHs (f)	-	-	-	4.8 (e)	-	-	-	-	-

Notes:
Values exceeding cleanup levels are shaded.
- = not available or not applicable.
(a) Terrestrial ecological screening levels are based on MTCA Table 749-2.
(b) Cleanup level based on chromium (III).
(c) Total cPAH values calculated using Toxicity Equivalency Factors in accordance with WAC 173-340-708(e).
(e) Sediment Quality Standard shown is expressed on a dry weight basis assuming a total organic carbon carbon content of 0.5 percent.
(f) Total HPAH values presented represent the sum of the high molecular weight polynuclear arom benz(a)anthracene, chrysene, total benzofluoranthenes, benzo(a)pyrene, indeno(1,2,3,-c,d)pyrene dibenzo(a,h)anthracene, and benzo(g,h,i)perylene. Fluoranthene and pyrene, which are included total HPAHs under SMS (WAC 173-204-320), are not identified as cPAHs under MTCA (WAC 173-340-708([e]) and, therefore, were not routinely analyzed. They are not included in the values presented in this table.
(g) Results shown are mean values of four replicate analyses.

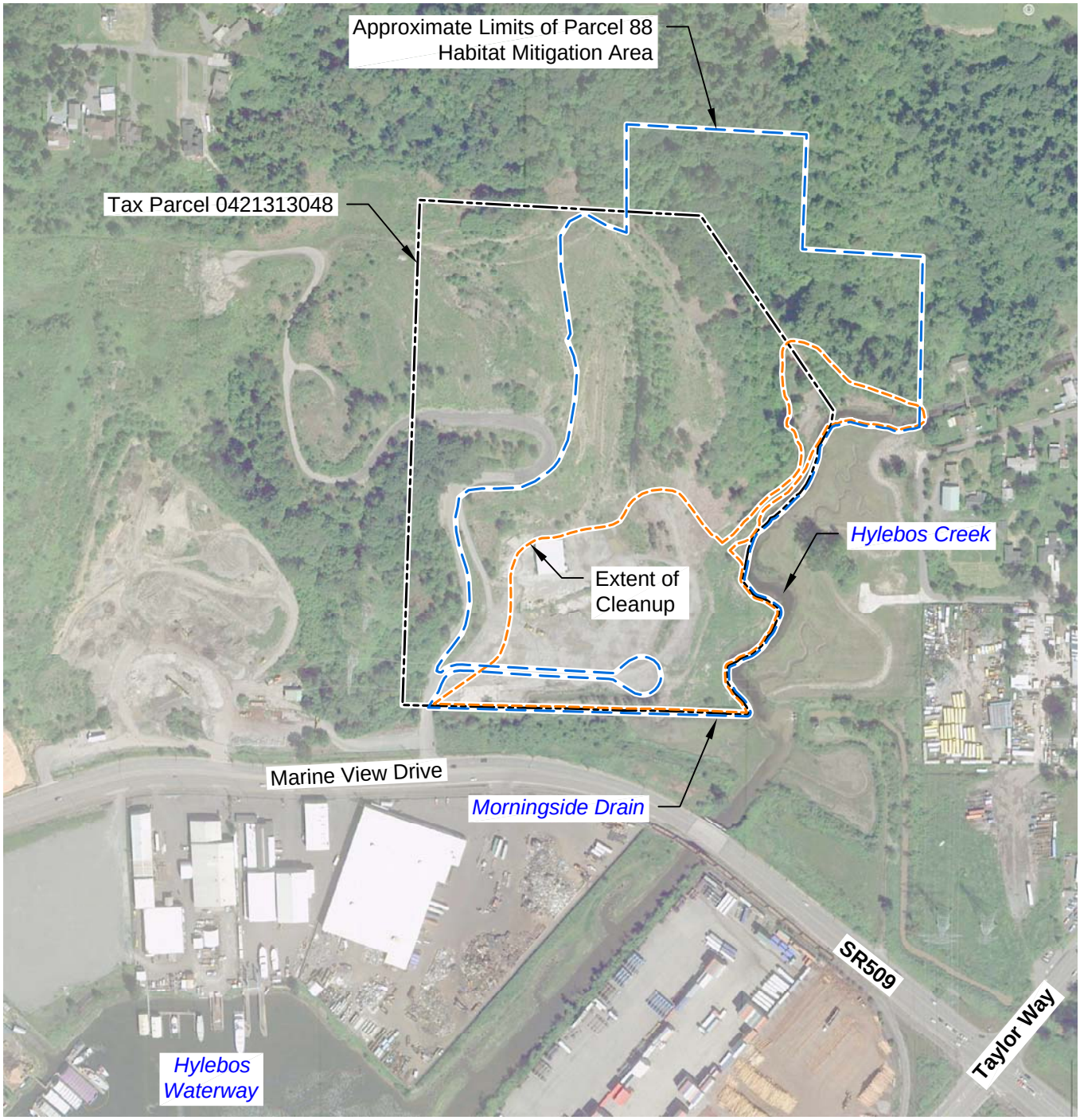
Table 2 - Post-Cleanup Groundwater Monitoring Results

Analyte/Sample (ug/L unless otherwise noted)	Lowest Surface Water Criterion for Aquatic Life (a)	Secondary MCL (WAC 246-290-310)	MW-201		MW-202	
Petroleum Hydrocarbons						
DRO	Narrative criterion; no sheen	--	100	U	100	U
ORO		--	200	U	200	U
Metals						
Arsenic, dissolved	36	--	0.9		17.6	
Copper, dissolved	2.4	--	0.5		0.5	U
Lead, dissolved	8.1	--	0.1	U	0.1	U
Mercury, total	0.025	--	0.01	U	0.01	U
Zinc, dissolved	81	--	4	U	4	U
Conventionals		--				
pH (standard units)	--	--	6.62		6.56	
Temperature (deg. C)	--	--	14.66		15.19	
Specific conductivity (uS/cm)	--	700	**1,300** (9/7/12) **979** (10/10/12)		642 (9/7/12) 525 (10/10/12) **1,490** (12/18/12) **1,110** (12/18/12; lab)	
Total dissolved solids (mg/L)	--	500	**871** (9/7/12) **656** (10/10/12)		430 (9/7/12) 354 (10/10/12) **978** (12/18/12) **826** (12/18/12; lab)	
Dissolved oxygen (mg/L)	--	--	0.04		0.04	
ORP (mV)	--	--	-99		-38	

Notes:
Values exceeding criteria are bolded.
- = not available or not applicable.
(a) Chapter 173-201A WAC; Clean Water Act §304; and National Toxics Rule, 40 CFR 131

Results shown are for petroleum hydrocarbons and total mercury samples collected on 9/7/12 and for dissolved metals samples collected on 10/12/12. (Dissolved metals samples collected on 9/7/12 were inadvertently filtered twice and not preserved; therefore, they were recollected on 10/10/12.)

Conventionals were measured in the field except where noted. Field TDS was estimated using the relationship TDS=0.67 x specific conductivity.



Source: **Base map prepared from Google Earth Pro, 2010.**

N

0 400 800

Scale in Feet

Port of Tacoma Parcel 88, RI/FS
Tacoma, Washington

Vicinity Map

17652-00 2/13

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Figure
1

EAL 02/19/13 1765200-RIFS-001.dwg

Former Metals Contamination Area

Approximate Limits of Parcel 88
Combined Habitat Mitigation Area

Former Main Fill Area

Tidal Channel

Unpaved Roadway

Creek

Hylebos

Tidal Channel

Tidal Channel

BPA Access Road

Morningside Drain

N

0 100 200

Scale in Feet

Notes:
1. Post-cleanup topography shown.
2. Vertical datum is MLLW.

Port of Tacoma Parcel 88, RI/FS
Tacoma, Washington

Current Site Plan

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Figure
2

EAL 02/19/13 1765200-RIFS-002.dwg

Exploration Location and Number

Hart Crowser
(Results presented in Hart Crowser [2010])

- TP-113 ■ Test Pit
- HC-200 ● Boring
- MW-101S ◔ Monitoring Well
- MW-101D ⊕ Monitoring Well - Deep
- P-1 ⊙ Push Probe
- TP-323 ◆ **Hart Crowser** **(Results presented in Hart Crowser [2011])** Test Pit
- MW-1 ○ **GeoEngineers** **(Results presented in GeoEngineers [2005])** Boring and Monitoring Well
- TP-1 ⊞ Test Pit

- Extent of Soil Cleanup
- Analytical results below MTCA Method A (unrestricted) or terrestrial ecological levels of 2,000 mg/kg or 460 mg/kg respectively or, if no analytical results were available, there were no field indications of petroleum impacts (sheen or odor).
- There were field indications of petroleum impacts (sheen and/or odor); no analytical results.
- Analytical results exceeded MTCA Method A (unrestricted) or terrestrial ecological levels.

94/170
- Maximum Motor Oil-Range Petroleum Hydrocarbon Concentration in mg/kg
- Maximum Diesel-Range Petroleum Hydrocarbon Concentration in mg/kg

NS/NO
- Maximum Odor Field Observation
- Maximum Sheen Field Observation

NS = No Sheen
SS = Slight Sheen
MS = Moderate Sheen
HS = Heavy Sheen

NO = No Odor
SO = Slight Petroleum-Like Odor
PO = Some Petroleum-Like Odor to Moderate Petroleum-Like Odor
HO = Heavy/Strong Petroleum-Like Odor

U = Not detected at the reporting limit shown

Former Metals Contamination Area

Former Main Fill Area

Former Maintenance Building

Unpaved Roadway

Creek

Hylebos

Morningside Drain

TP-322 NS/NO; NRDA9-16 NS/NO; TP-323 NS/NO; NRDA9-17 NS/NO; NRDA9-SW-2 NS/NO; NRDA9-SW-1 NS/NO; TP-1 NS/NO; NRDA9-CS-E NS/NO; TP-324 NS/NO; TP-314 NS/NO; NRDA9-18 NS/NO; NRDA9-14 NS/NO; TP-320; TP-318 NS/NO; NRDA9-13 NS/NO; P-10 NS/NO; TP-319 NS/NO; TP-317 NS/NO; TP-316 NS/NO; TP-315 NS/NO; NRDA9-CS-W NS/NO; TP-112 NS/NO; TP-111 NS/NO; TP-321 NS/NO; NRDA9-15 NS/NO; NRDA9-SW-3 NS/NO; NRDA9-SW-4 NS/NO; P-8 NS/NO; NRDA9-19 NS/NO; TP-325 NS/NO; TP-110 NS/NO

TP-201 6.4/62 NS/NO; TP-2 NS; TP-109 NS/NO; TP-200 SS/PO; HC-200 45/220 SS/SO; TP-108 NS/NO; MW-1 10 U/100 U MS; HC-201 160/980 SS/SO; TP-202 130/570 NS/NO; TP-3 10 U/640 NS; P-7 11/57 NS/SO; HC-4 5900/760U HS/HO; TP-125 NS/NO; TP-107 NS/NO; MW-109 MS/PO; TP-206 NS/NO; MW-108 NS/NO; TP-15 10 U/2300 NS; TP-16 10 U/100 U NS; TP-10 100 U/100 U HS; TP-19 10 U/640 MS; TP-133 NS/NO; TP-14 10 U/1200 HS; TP-204 NS/NO; MW-107 NS/NO; TP-11 MS; HC-2A NS/NO; HC-2 NS/NO; TP-13 10 U/350 MS; MW-3 MS; TP-104 NS/NO; TP-121 MS/SO; TP-12 10 U/100 U MS; TP-9 10 U/100 U NS; TP-120 HS/PO; TP-122 NS/NO; MW-105 SS/SO; TP-119 NS/SO; TP-103 NS/NO; TP-17 10 U/100 U SS; P-4 600/5000 SS/SO; MW-104 SS/SO; TP-128 NS/SO; P-2 150/520 SS/NO; TP-118 MS/NO; TP-126 NS/NO; MW-101S SS/SO; MW-101D NS/NO; TP-124 NS/NO; MW-101DA NS/NO; HC-5 NS/NO; TP-207 NS/NO; MW-103 NS/NO; TP-117 MS/SO; TP-18 10 U/890 SS; TP-8 SS; HC-3 NS/NO; TP-7 360/394 NS; TP-4 45/103 NS; MW-106 NS/NO; TP-127 NS/NO; TP-116 NS/NO; TP-132 NS/HO; P-9 930/1800 MS/PO; P-3 1200/1800 SS/SO; MW-2 10 U/100 U HS; P-5 160/1400 SS/SO; TP-105 NS/NO; TP-115 HS/PO; MW-102 MS/PO; TP-131 NS/NO; TP-102 NS/SO; TP-101 NS/SO; P-1 280/2700 SS/SO; TP-123 SS/PO; TP-129 HS/NO; TP-114 SS/NO; HC-1 94/710 NS/MO; TP-113 HS/NO; TP-106 NS/NO; P-6 NS/NO; TP-205 NS/NO; TP-203 NS/NO

0 100 200
Scale in Feet

Notes:
1. Pre-cleanup topography shown.
2. Vertical datum is MLLW.

Port of Tacoma Parcel 88, RI/FS
Tacoma, Washington

Pre-Cleanup Soil Petroleum Hydrocarbon Results

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Figure **3**

EAL 11/3/12 1765200-RIFS-003.dwg

Exploration Location and Number

Hart Crowser
(Results presented in Hart Crowser [2010])

- TP-113 ■ Test Pit
- HC-200 ● Boring
- MW-101S ◔ Monitoring Well
- MW-101D ⊕ Monitoring Well - Deep
- P-1 ⊙ Push Probe

Hart Crowser
(Additional characterization samples collected during construction; results presented in this report)

- TP-323 ◆ Test Pit

GeoEngineers
(Results presented in GeoEngineers [2005])

- MW-1 ○ Boring and Monitoring Well
- TP-1 ⊞ Test Pit

[1] Pre-cleanup exceedance of cleanup level occurs at depth >15 feet below post-cleanup ground surface (i.e., below standard point of compliance per WAC 173-340(6)(d)).

Slag Particles Observed in Surficial Fill

Extent of Soil Cleanup

Metals were not detected in soil above MTCA Method A (unrestricted) or terrestrial ecological levels, except as noted.

One or more metals were detected above MTCA Method A (unrestricted) or terrestrial ecological levels (See table below.) Only those Metal(s) exceeding criteria are shown. Results in mg/kg.

Unshaded sample locations were not analyzed for metals.

Metal	Method A Cleanup Level (unrestricted) (mg/kg)	Terrestrial Ecological Cleanup Level (mg/kg)
Arsenic	20	20
Cadmium	2	25
Chromium (Total)	2,000	42
Copper	-	100
Lead	250	220
Mercury	2	9
Nickel	-	100
Selenium	-	0.8
Zinc	-	270

Former Metals Contamination Area

Former Main Fill Area

Unpaved Roadway

Creek

Hylebos

Morningside Drain

TP-322 As 22; NRDA9-16; TP-323; NRDA9-SW-1 As 54; TP-324 As 18; TP-1; NRDA9-18 As 45; NRDA9-14; TP-316 As 48 Cu 115; TP-318 As 55; NRDA9-13; TP-315; NRDA9-CS-E; TP-314; P-10 As 438 Cu 416 Pb 301 Zn 1000; TP-320; TP-112; TP-111; TP-321 As 122 Cu 130 Zn 197; TP-317 As 88; NRDA9-15; NRDA9-SW-4; NRDA9-19; NRDA9-CS-W As 230 Cu 279 Zn 473; TP-325; NRDA9-SW-3 As 92 Cu 104; TP-319 As 26; TP-110; P-8 As 153 Cu 222 Zn 324; TP-2; TP-109; TP-201; HC-200 As 153 Cu 154 Zn 488; TP-200; TP-108; MW-1; HC-201 As 30 Pb 303 Zn 288; TP-202 Cu 253; TP-3 As 34; P-7 As 116; HC-4 As 39; TP-206; MW-108; TP-15; TP-16; TP-10; TP-19; TP-133; TP-14; TP-204; MW-107; TP-11; HC-2A; HC-2; MW-3; TP-12; TP-13; TP-9; TP-104; TP-121; TP-120; TP-122; MW-109; TP-125; TP-107; HC-5; TP-119; MW-105; P-4 As 30 Cu 125 Pb 290; TP-103; TP-17; MW-104; MW-101S; MW-101D; MW-101DA; TP-118; TP-128; P-2; TP-126; TP-124; TP-207; MW-103; TP-117; TP-18; TP-8; HC-3; TP-7; TP-4; TP-127; TP-116; P-9 As 22; TP-132; P-3; MW-2; TP-105; P-5 As 23; TP-115; MW-102; TP-131; TP-102; TP-123; P-1 As 37; TP-101; TP-129; TP-114; HC-1; TP-113; TP-106; P-6 As 36; TP-205; TP-203

N

0 100 200
Scale in Feet

Notes:
1. Pre-cleanup topography shown.
2. Vertical datum is MLLW.

Port of Tacoma Parcel 88, RI/FS
Tacoma, Washington

Pre-Cleanup Soil Metals Results

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Figure 4

EAL 11/3/12 1765200-RIFS-004.dwg

Exploration Location and Number

Hart Crowser
(Results presented in Hart Crowser [2010])

MW-101S Monitoring Well - Shallow

MW-101D Monitoring Well - Deep

P-8 Push Probe (grab groundwater sample)

Analytical results showed that either DRO or ORO were below MTCA Method A level (500 µg/L)

Analytical results showed that both DRO and ORO exceeded MTCA Method A level (500 µg/L)

DRO — Diesel-Range Petroleum Hydrocarbon Concentration in µg/L

ORO — Heavy Oil-Range Petroleum Hydrocarbon Concentration in µg/L

Overall Groundwater Flow Direction

Former Metals Contamination Area

Former Main Fill Area

P-10

P-8

MW-108

MW-1

MW-107

MW-105

MW-109

MW-104

MW-101D

MW-101S

MW-103

MW-106

MW-2

DRO	1,900
ORO	750

MW-102

Unpaved Roadway

Creek

Hylebos

Morningside Drain

N

0 100 200

Scale in Feet

Notes:

1. Results shown are maximum values from 7/09 and 11/09 sampling events.
2. Pre-cleanup topography shown.
3. Vertical datum is MLLW.

Port of Tacoma Parcel 88, RI/FS
Tacoma, Washington

Pre-Cleanup Groundwater Petroleum Hydrocarbons Results

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Figure 5

EAL 11/3/12 1765200-RIFS-005.dwg

Exploration Location and Number

Hart Crowser
(Results presented in Hart Crowser [2010])

MW-101S Monitoring Well - Shallow

MW-101D Monitoring Well - Deep

P-1 Push Probe (grab groundwater sample)

9.3 Dissolved metals concentrations in µg/L

Overall Groundwater Flow Direction

Concentrations of metals were below marine chronic surface water quality standards for Washington (WAC 173-201A-240), as shown below.

Concentration of one or more metals exceeded surface water quality standards. Concentrations of exceeding metals are shown.

Metal	Surface Water Quality Standards (ug/L)
Arsenic	36
Cadmium	9.3
Chromium	50
Copper	3.1
Lead	8.1
Mercury	0.025
Zinc	81

Former Metals Contamination Area

Former Main Fill Area

P-10
P-8
MW-1
MW-108
MW-107
MW-109 (Cu 4)
P-7
MW-105
MW-104
P-4
P-2
MW-101S
MW-101D
MW-103
MW-106
P-9
P-3
MW-2
P-5
MW-102
P-1 (Hg 0.054)
P-6

Unpaved Roadway
Creek
Hylebos
Morningside Drain

150 100 50

N

0 100 200
Scale in Feet

Notes:
1. Results shown are maximum values from 7/09 and 11/09 sampling events.
2. Pre-cleanup topography shown.
3. Vertical datum is MLLW.

Port of Tacoma Parcel 88, RI/FS
Tacoma, Washington

Pre-Cleanup Groundwater Metals Results

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Figure **6**

EAL 11/3/12 1765200-RIFS-006.dwg

1997 USTs and Pump Island Removal

2006 Petroleum-Impacted Soil Removal

2006 Debris/Rubble Removal

Unprocessed Concrete and Asphalt Rubble

Unprocessed Concrete and Asphalt Rubble

Tax Parcel 0421313048

Window Debris

Misc. Rubble and Debris

Rubble and Debris from Former Log Cabin

Rubble and Debris from Former Residence

Petroleum-Impacted Soil Hot Spots

General Location of USTs and Pump Island

Maintenance Building

Misc. Rubble and Debris

Unprocessed Concrete and Asphalt Rubble

Misc. Rubble and Debris

Truck Scale

Hylebos Creek

Morningside Drain

Marine View Drive

N

0 150 300

Scale in Feet

Notes:

1. Pre-cleanup topography shown.
2. Vertical datum is MLLW.

Port of Tacoma Parcel 88, RI/FS
Tacoma, Washington

1997 and 2006 Cleanup Activities

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Figure **7**

EAL 11/3/12 1765200-RIFS-007.dwg

Exploration Location and Number

Hart Crowser
(Results presented in Hart Crowser [2010])

- TP-113 ■ Test Pit
- HC-200 ● Boring
- MW-101S ◔ Monitoring Well
- MW-101D ⊕ Monitoring Well - Deep
- P-1 ⊙ Push Probe

Hart Crowser
(Additional characterization samples collected during construction; results presented in Hart Crowser [2011])

- TP-323 ◆ Test Pit

GeoEngineers
(Results presented in GeoEngineers [2005])

- MW-1 ○ Boring and Monitoring Well
- TP-1 ⊞ Test Pit

- Extent of Soil Cleanup
- Pre-cleanup results exceeded soil cleanup levels.
- Pre-cleanup field indications of petroleum impacts (sheen and/or odor).
- 24/12 — Approximate elevation of bottom of remedial excavation (feet MLLW).
- Approximate elevation of pre-cleanup soil impacts (feet MLLW).

Former Metals Contamination Area

Former Main Fill Area

Southeast Overexcavation Area

Southwest Overexcavation Area

Unpaved Roadway

Tidal Channel

Creek

Hylebos

Morningside Drain

BPA Access Road

TP-322 ◆ NRDA9-16 TP-323 ◆ NRDA9-17 NRDA9-SW-1 ◆ NRDA9-SW-2 TP-1 ⊞ NRDA9-CS-E TP-324 NRDA9-14 ◆ TP-318 NRDA9-13 TP-314 NRDA9-18 TP-320 P-10 ⊙ TP-112 ■ TP-111 TP-321 TP-319 TP-317 TP-316 NRDA9-CS-W NRDA9-15 ◆ NRDA9-SW-3 NRDA9-SW-4 ◆ P-8 ⊙ NRDA9-19 TP-325 TP-315 TP-110 ■ TP-201 ■ TP-2 ⊞ TP-109 ■ TP-108 ■ MW-1 ○ TP-200 68/68 ■ HC-200 ● HC-201 94/47 ● TP-206 ■ MW-108 ◔ TP-15 32/28 ⊞ TP-16 TP-10 ⊞ TP-19 33/30 ⊞ TP-133 ■ TP-14 21/14 ⊞ TP-204 ■ MW-107 ◔ TP-11 29/12 ⊞ HC-2A HC-2 TP-202 32/20 ■ TP-3 20/12 ⊞ OEX2-12 7/≤4 HC-4 13/≤4 MW-3 23/11 ◔ TP-13 ⊞ TP-12 ⊞ TP-9 ⊞ TP-104 ■ TP-121 24/12 ■ TP-122 ■ P-7 ⊙ TP-120 18/11 ■ MW-105 14/12 ◔ MW-109 10/≤4 ◔ TP-125 ■ TP-107 ■ TP-17 ⊞ TP-119 23/10 ■ TP-103 ■ MW-104 9/9 ◔ P-4 ⊙ TP-128 26/20 ■ P-2 13/10 ⊙ TP-118 23/10 ■ TP-124 ■ MW-101S 11/8 ◔ MW-101D 11/8 ◔ HC-5 TP-207 ■ TP-126 ■ MW-101DA 11/8 MW-103 ◔ TP-117 ■ TP-18 25/12 ⊞ HC-3 TP-8 ⊞ TP-7 ⊞ TP-4 ⊞ MW-106 ◔ TP-127 ■ TP-116 ■ P-9 3/≤3 ⊙ TP-132 18/10 ■ P-3 18/11 ⊙ MW-2 ○ P-5 15/8 ⊙ TP-105 ■ TP-115 19/12 ■ MW-102 12/≤7 ◔ TP-102 17/13 ■ TP-131 ■ TP-101 19/14 ■ P-1 9/≤7 ⊙ TP-123 15/≤7 ■ TP-129 17/17 ■ TP-114 19/16 ■ OEX-S-2-10 10/≤7 HC-1 19/19 ● TP-113 20/20 ■ TP-106 ■ P-6 ⊙ TP-205 ■ TP-203 ■

N

0 100 200
Scale in Feet

Notes:
1. Post-cleanup topography shown.
2. Vertical datum is MLLW (feet).

Port of Tacoma Parcel 88, RI/FS
Tacoma, Washington

Relationship Between Pre-Cleanup Petroleum Impacts and Remedial Excavation Elevations

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Figure **8**

EAL 11/11/12 1765200-RIFS-009.dwg

Exploration Location and Number

Hart Crowser
(Results presented in Hart Crowser [2010])

- TP-113 ■ Test Pit
- HC-200 ● Boring
- MW-101S ◒ Monitoring Well
- MW-101D ⊕ Monitoring Well - Deep
- P-1 ⊙ Push Probe
- TP-323 ✥ **Hart Crowser** **(Results presented in Hart Crowser [2011])** Test Pit
- MW-1 ○ **GeoEngineers** **(Results presented in GeoEngineers [2005])** Boring and Monitoring Well
- TP-1 ⊞ Test Pit

- Extent of Soil Cleanup
- Pre-cleanup metal(s) exceeded soil cleanup levels.
- 1 Pre-cleanup exceedance of cleanup level occurs at depth >15 feet below post-cleanup ground surface (i.e., below standard point of compliance 173-340(6)(d)).
- 24/12 — Approximate elevation of bottom of remedial excavation (feet MLLW).
- Approximate elevation of pre-cleanup soil impacts (feet MLLW).
- Slag Particles Observed in Surface Soil

Former Metals Contamination Area

Former Main Fill Area

Southeast Overexcavation Area

Southwest Overexcavation Area

Unpaved Roadway

BPA Access Road

Creek

Hylebos

Tidal Channel

Tidal Channel

Morningside Drain

TP-322 NRDA9-16 TP-323 NRDA9-17 17/17 NRDA9-SW-1 14/14 NRDA9-SW-2 14/<10 TP-1 TP-324 NRDA9-CS-E TP-314 P-10 10/<10 TP-112 NRDA9-18 16/12 TP-320 NRDA9-14 TP-318 13/12 TP-316 12/10 NRDA9-13 TP-315 TP-111 TP-321 13/12 TP-319 12/12 TP-317 12/12 NRDA9-15 NRDA9-SW-3 14/<10 P-8 15/<10 NRDA9-SW-4 NRDA9-19 NRDA9-CS-W 14/<10 TP-325 TP-110 TP-201 TP-2 TP-109 HC-200 50/75 1 TP-200 TP-206 MW-108 HC-201 31/48 1 TP-15 TP-16 TP-10 TP-19 TP-133 TP-14 TP-204 MW-107 TP-11 HC-2A HC-2 MW-3 TP-202 29/20 TP-3 20/12 TP-104 TP-121 HC-4 13/≤4 TP-12 TP-13 TP-9 TP-120 TP-122 P-7 14/11 MW-109 TP-125 TP-107 HC-5 TP-119 MW-105 P-4 16/11 TP-103 TP-17 TP-128 P-2 TP-207 MW-104 MW-101S MW-101D MW-101DA TP-118 TP-126 TP-124 MW-103 TP-117 TP-18 TP-8 HC-3 TP-7 TP-4 MW-106 TP-127 TP-116 P-9 11/≤3 P-5 15/8 TP-105 TP-132 P-3 MW-2 TP-115 MW-102 TP-123 TP-131 TP-102 TP-101 P-1 13/≤7 TP-129 TP-114 HC-1 TP-113 TP-106 P-6 12/12 TP-205 TP-203 TP-108 MW-1

0 100 200
Scale in Feet

Notes:
1. Post-cleanup topography shown.
2. Vertical datum is MLLW (feet).

Port of Tacoma Parcel 88, RI/FS
Tacoma, Washington

Relationship Between Pre-Cleanup Metals Impacts and Remedial Excavation Elevations

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Figure **9**

EAL 11/11/12 1765200-RIFS-010.dwg

2010 Excavation Areas

2010 Deep Impacted Soil Excavation Areas

OSD-CS-23 Post-Cleanup Soil Sample Location and Number

MW-201 Post-Cleanup Monitoring Well Location and Number

All post-cleanup samples were less than soil and groundwater cleanup levels except for arsenic in soil sample RD-CS-2.

Analytical reports for these samples are presented in Hart Crowser (2010 and 2011) except results for, RD-CS-1, RD-CS-2, RD-CS-3, MW-201, and MW-202 which are presented in this report.

Former Metals Contamination Area

Former Main Fill Area

Southeast Overexcavation Area

Southwest Overexcavation Area

Unpaved Roadway

Hylebos Creek

Tidal Channel

Tidal Channel

Morningside Drain

BPA Access Road

TP-322-S-2
NRDA9-16b
TP-323-S-2
NRDA9-17b
TP-324-S-2
NRDA9-18b
TP-320-S-2
NRDA9-14b
NRDA9-13b
TP-318-S-2
TP-314-S-2
TP-321-S-2
NRDA9-15b
TP-317-S-2
TP-319-S-2
TP-315-S-2
NRDA9-19b
TP-325-S-2
RD-CS-3
RD-CS-2
As 34.4 mg/kg
RD-CS-1
MW-202
OEX2-SW5
OEX2-SW6
OEX2-SW4
OEX2-SW3
OEX2-B6
OEX2-B3
OEX2-B2
OEX2-SW1
OEX2-B4
OEX2-B1
OEX2-SW2
TPH2-SW1
OEX2-B5
OSD-CS-2
OSD-CS-17
OSD-CS-18
OSD-CS-23
OSD-CS-20
OSD-CS-16
UST-CS
OSD-CS-21
OSD-CS-24
OSD-CS-3
OSD-CS-9
OSD-CS-19
OSD-CS-5
OSD-CS-26
OSD-CS-25
OSD-CS-15
OEX-SW-1
OEX-B-5
OSD-CS-13
OSD-CS-1
OSD-CS-6
OEX-SW-7
OSD-CS-4
OEX-B-6
OEX-B-4
OSD-CS-22
OSD-CS-14
MW-201
OSD-CS-8
OEX-SW-6
OEX-SW-2
OEX-B-1
OEX-B-2
OSD-CS-7
OEX-B-3
OEX-SW-3
OEX-SW-5
OEX-SW-4

N

0 100 200
Scale in Feet

Notes:
1. Post-cleanup topography shown.
2. Vertical datum is MLLW.

Port of Tacoma Parcel 88, RI/FS
Tacoma, Washington

Post Cleanup Sample Locations

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Figure
10

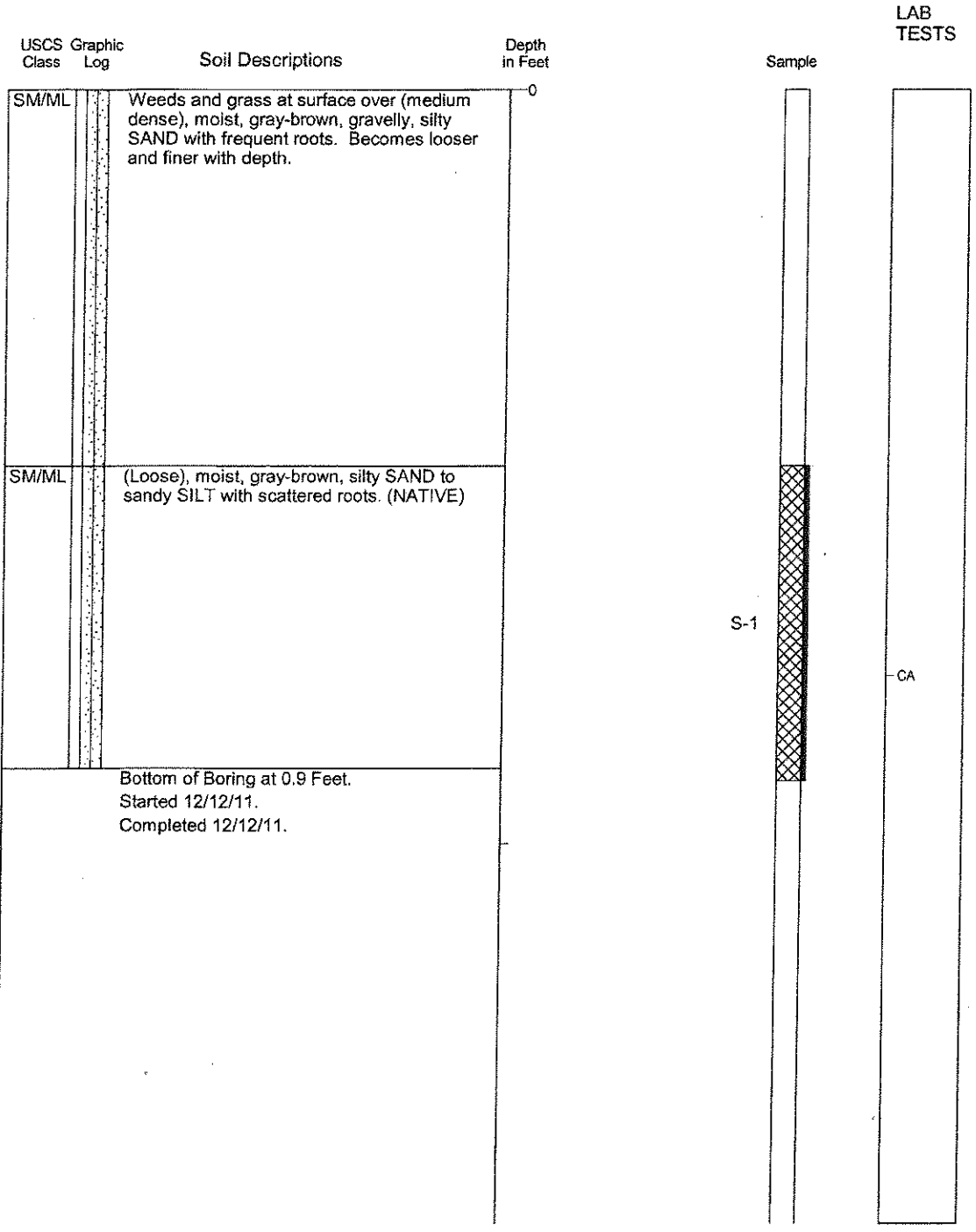
EAL 11/11/12 1765200-RIFS-008.dwg

APPENDIX A
BORING LOGS (RD-CS-1, -2, AND -3; AND MW-201 AND -202)

Hand-Auger Log RD-CS-1

Location: N 47.258832 E -122.354005
Approximate Ground Surface Elevation: Feet
Horizontal Datum: WGS 1984
Vertical Datum: NA

Drill Equipment: Hand Auger
Hammer Type:
Hole Diameter: inches
Logged By: P. Cordell Reviewed By: M. Dagel



STRATAPROBE LOG 1765200-HA.GPJ HC_CORP.GDT 1/26/12

1. Refer to Figure A-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 conditions, if indicated, are at time of excavation. Conditions may vary with time.

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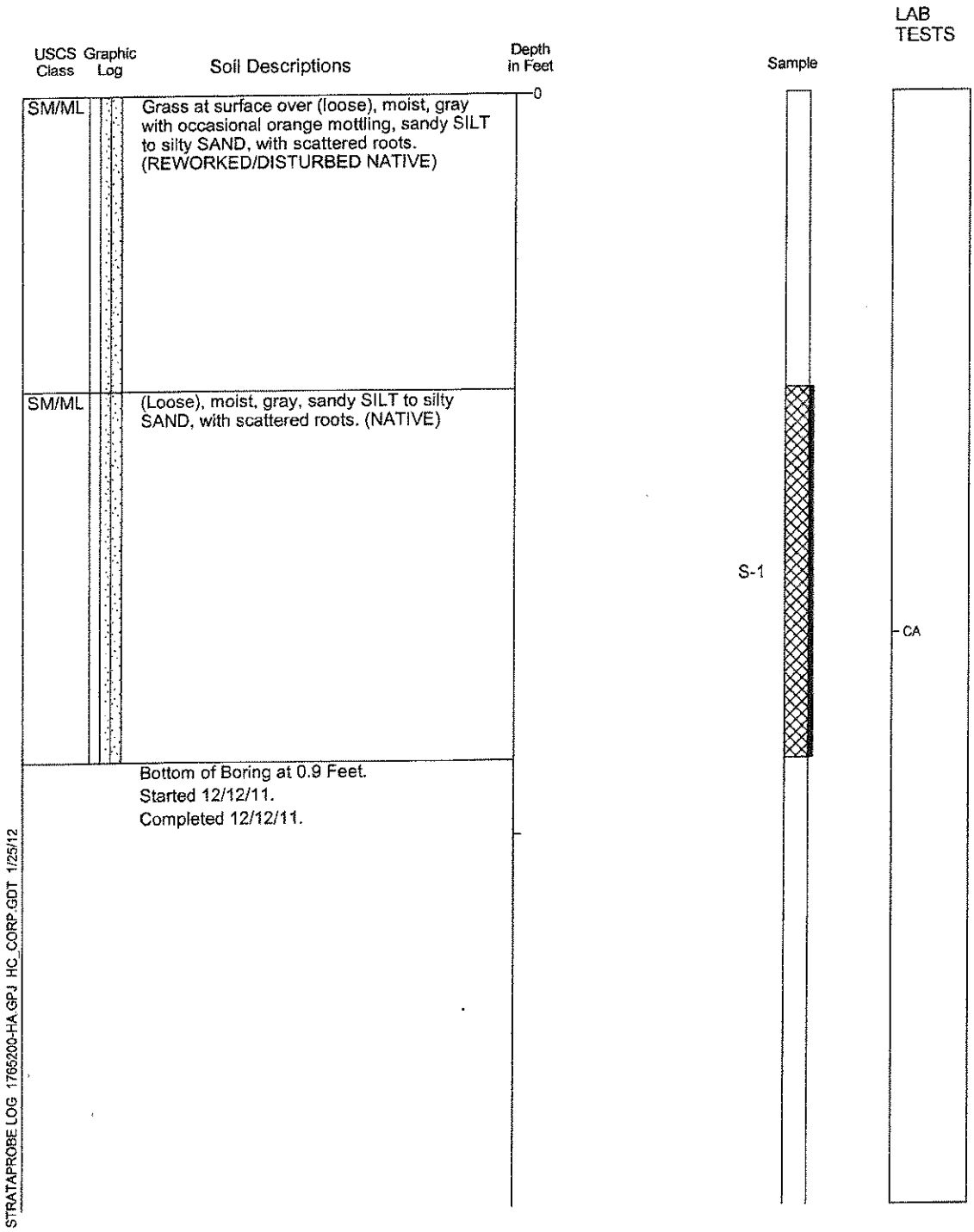
Figure A-2

Hand-Auger Log RD-CS-2

Location: N 47.258603 E -122.353717
Approximate Ground Surface Elevation: Feet
Horizontal Datum: WGS 1984
Vertical Datum: NA

Drill Equipment: Hand Auger
Hammer Type:
Hole Diameter: inches
Logged By: P. Cordell Reviewed By: M. Dagel



STRATAPROBE LOG 1765200-HA.GPJ HC_CORP.GDT 1/25/12

HARTCROWSER

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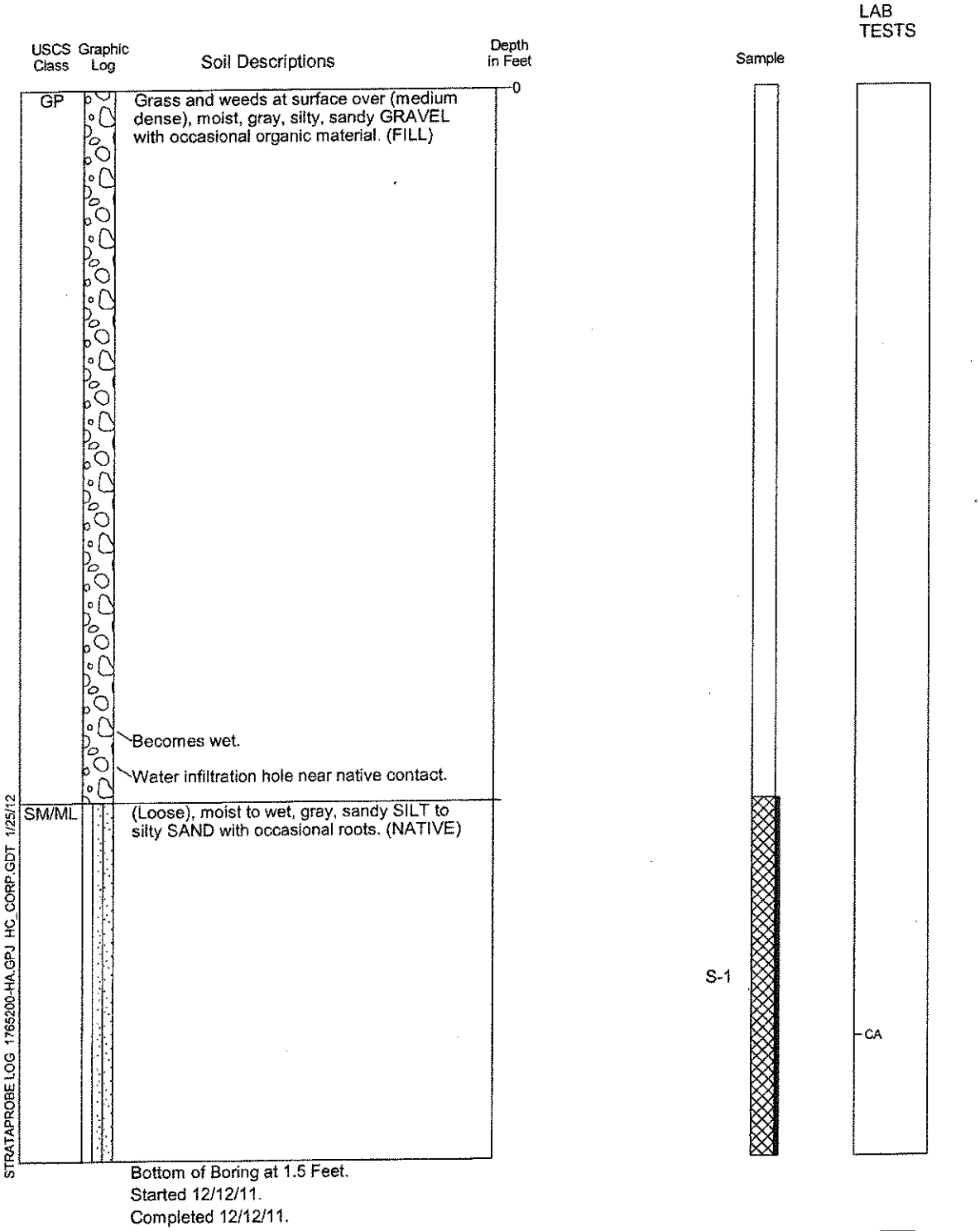
Figure A-3

1. Refer to Figure A-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 conditions, if indicated, are at time of excavation. Conditions may vary with time.

Hand-Auger Log RD-CS-3

Location: N 47.258404 E -122.353446
Approximate Ground Surface Elevation: Feet
Horizontal Datum: WGS 1984
Vertical Datum: NA

Drill Equipment: Hand Auger
Hammer Type:
Hole Diameter: inches
Logged By: P. Cordell Reviewed By: M. Dagel



1. Refer to Figure A-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 conditions, if indicated, are at time of excavation. Conditions may vary with time.

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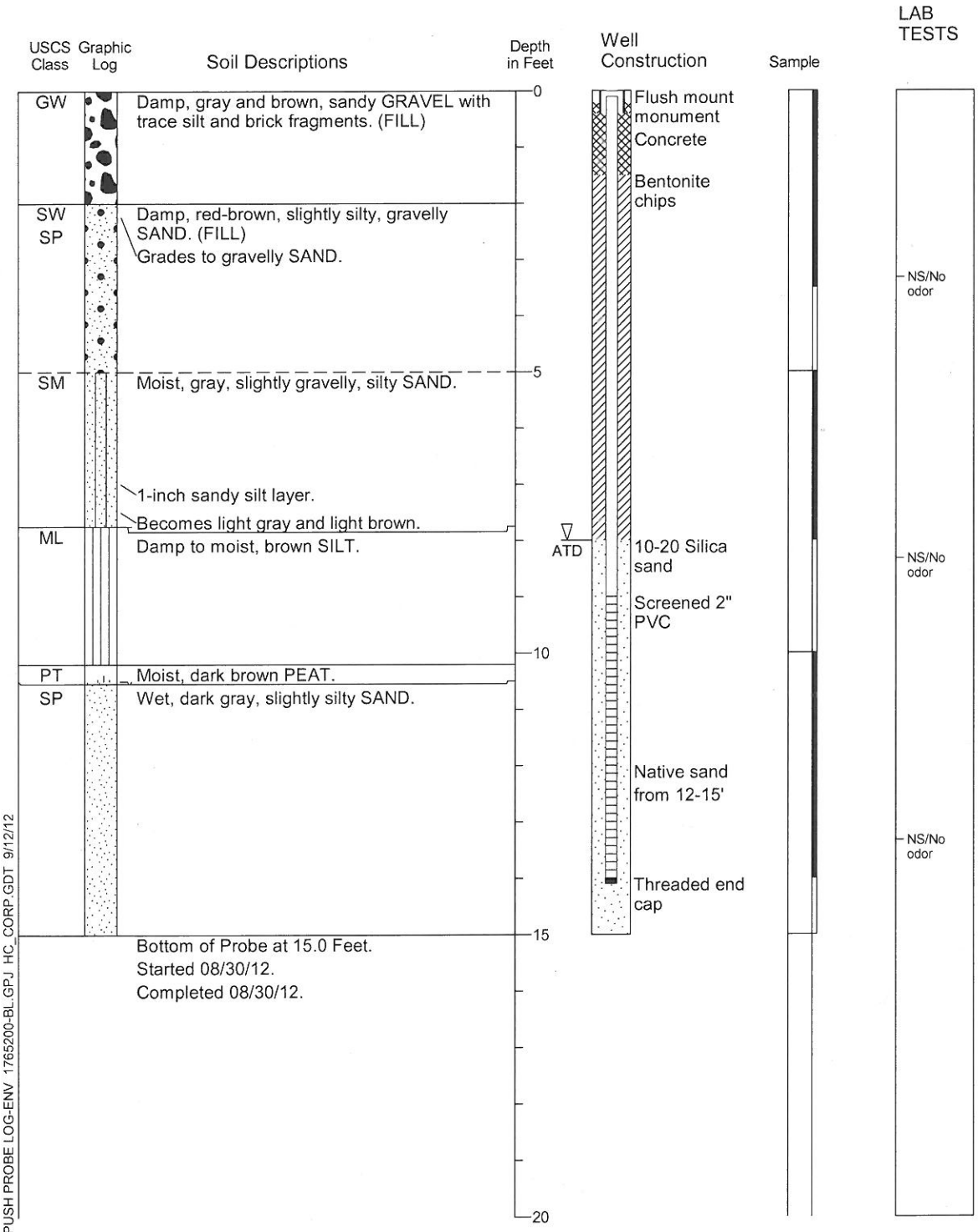
Figure A-4

Push Probe Log MW-201

Location: Latitude: 47.259457 Longitude: -122.355385
Approximate Ground Surface Elevation: NA Feet
Horizontal Datum: NA
Vertical Datum: WGS 84

Drill Equipment: Push Probe
Sample Type: Acetate Liner
Hole Diameter: 4 inches
Logged By: P. Cordell Reviewed By: M. Dagel



PUSH PROBE LOG-ENV 1765200-BL.GPJ HC_CORP.GDT 9/12/12

1. Refer to Figure A-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.

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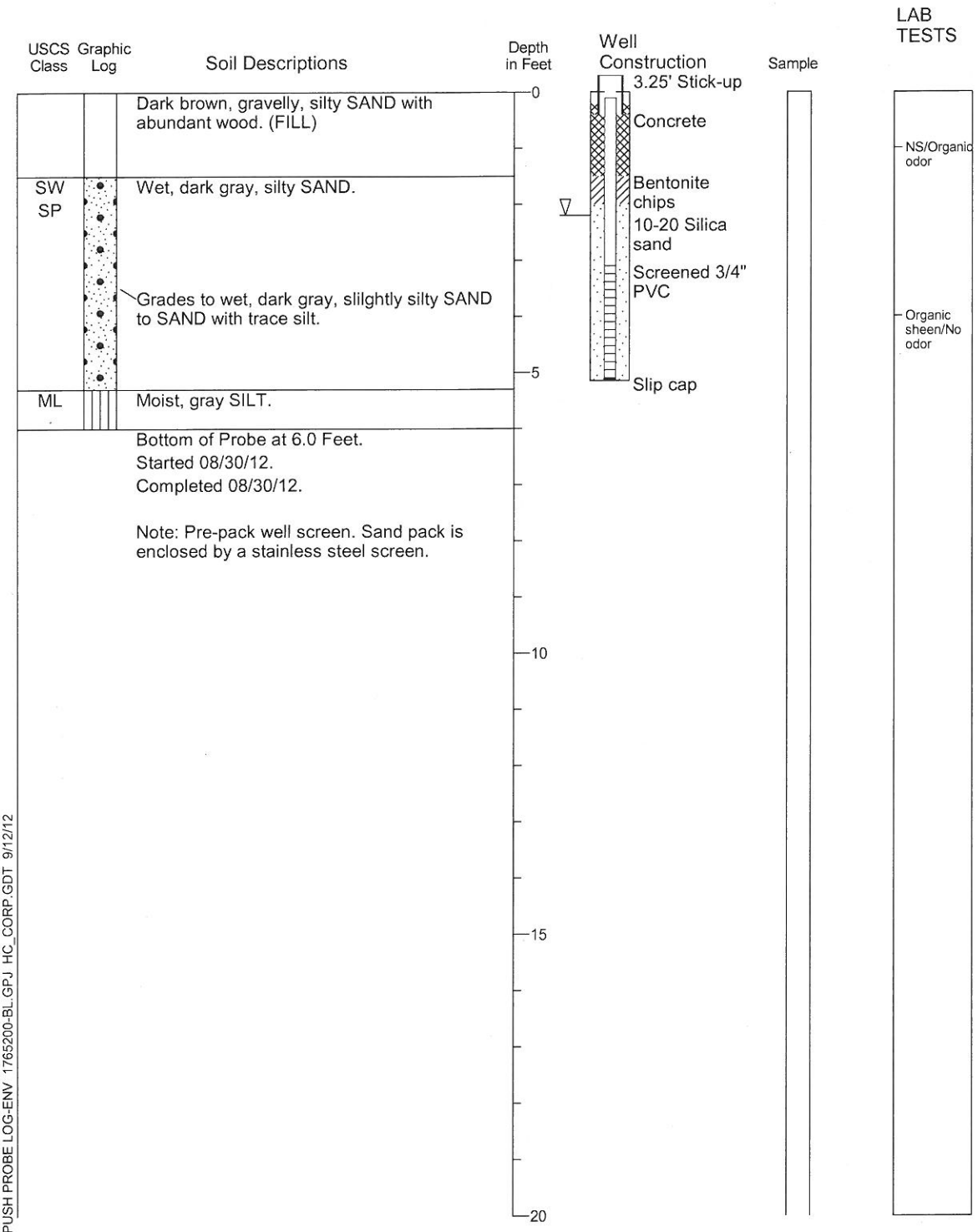
Figure A-2

Hand-Auger Log MW-202

Location: Latitude: 47.259136 Longitude: -122.354281
Approximate Ground Surface Elevation: NA Feet
Horizontal Datum: NA
Vertical Datum: WGS 84

Drill Equipment: Hand Auger
Sample Type: Grab
Hole Diameter: 3 inches
Logged By: P. Cordell Reviewed By: M. Dagel



PUSH PROBE LOG-ENV 1765200-BL.GPJ HC_CORP.GDT 9/12/12

1. Refer to Figure A-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 conditions, if indicated, are at time of excavation. Conditions may vary with time.

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Figure A-3

APPENDIX B
LABORATORY REPORTS
(RD-CS-1, -2, AND -3; AND MW-201 AND -202)

Analytical Resources, Incorporated
Analytical Chemists and Consultants

HARTCROWSER
Seattle, Edmonds, Vancouver, Portland

3 soils

December 20, 2011

Mark Dagel
Hart Crowser, Inc.
1700 Westlake Avenue N. Suite 200
Seattle, WA 98109-3256

RE: Client Project: Parcel 88
ARI Job No.: UA85

geotechnical • environmental • natural resources

Dear Mark;

Please find enclosed the original Chain-of-Custody (COC) records, sample receipt documentation, and the final data for samples from the project referenced above. Analytical Resources, Inc. (ARI) received three soil samples on December 12, 2011. The samples were received in good condition with a cooler temperature of 4.1 °C.

The samples were analyzed for Total Metals, as requested on the COC.

The matrix spike is out of control low for zinc with RPDs for copper and zinc outside of the +/- 20% control limits. All other QC is in control and no further corrective action was taken.

There were no other anomalies associated with the analyses of these samples.

Sincerely,

ANALYTICAL RESOURCES, INC.

Kelly Bottem
Client Services Manager
kellyb@arilabs.com
206/695-6211
Enclosures

cc: eFile UA85

KFB/kb

Chain of Custody Record & Laboratory Analysis Request

ARI Assigned Number: UA85	Turn-around Requested: Standard
ARI Client Company: Hart Crowser	Phone: 206 324 9530
Client Contact: Mark Dagel	
Client Project Name: Parcel 88	
Client Project #: 17652-00	Samplers: PRC

Page: 1	of 1
Date: 12/12/11	Ice Present? Y
No. of Coolers: 1	Cooler Temps: 4.1

Analytical Resources, Incorporated
Analytical Chemists and Consultants
4611 South 134th Place, Suite 100
Tukwila, WA 98168
206-695-6200 206-695-6201 (fax)

Sample ID	Date	Time	Matrix	No Containers	*Metals 3050B	Mercury 7471A	Analysis Requested						Notes/Comments
RD-CS-1	12/12/11	1120	Soil	1	X	X							
RD-CS-2	"	1100	"	2	X	X							*MS/MSD*
RD-CS-3	"	1040	"	1	X	X							

Comments/Special Instructions
* Arsenic
Cadmium
Chromium
Copper
Lead
Nickel
Selenium
Zinc

Relinquished by: (Signature)		Received by (Signature)	
Printed Name:	Phil Cordell	Printed Name:	A. Volgaardsen
Company:	Hart Crowser	Company:	ARI
Date & Time	12/12/11 1305	Date & Time	12/12/11 1305

Relinquished by: (Signature)		Received by: (Signature)	
Printed Name.		Printed Name:	
Company.		Company	
Date & Time:		Date & Time.	

Analytical Resources, Incorporated
Analytical Chemists and Consultants

Cooler Receipt Form

ARI Client: Hart Crowser

Project Name: Parcel 88

COC No(s): _____ (NA)

Delivered by: Fed-Ex UPS Courier (Hand Delivered) Other: _____

Assigned ARI Job No: LIAE5

Tracking No: _____ (NA)

Preliminary Examination Phase:

Were intact, properly signed and dated custody seals attached to the outside of to cooler?	YES	(NO)
Were custody papers included with the cooler?	(YES)	NO
Were custody papers properly filled out (ink, signed, etc)	(YES)	NO
Temperature of Cooler(s) (°C) (recommended 2 0-6 0 °C for chemistry): 4.1		
If cooler temperature is out of compliance fill out form 00070F	Temp Gun ID#: 90941619	

Cooler Accepted by: AV Date: 12/12/11 Time: 1305

Complete custody forms and attach all shipping documents

Log-In Phase:

Was a temperature blank included in the cooler?		YES	(NO)
What kind of packing material was used?	Bubble Wrap (Wet Ice) Gel Packs (Baggies) Foam Block Paper Other: _____		
Was sufficient ice used (if appropriate)?	NA	(YES)	NO
Were all bottles sealed in individual plastic bags?		YES	(NO)
Did all bottles arrive in good condition (unbroken)?		(YES)	NO
Were all bottle labels complete and legible?		(YES)	NO
Did the number of containers listed on COC match with the number of containers received?		(YES)	NO
Did all bottle labels and tags agree with custody papers?		(YES) AV	(NO)
Were all bottles used correct for the requested analyses?		(YES)	NO
Do any of the analyses (bottles) require preservation? (attach preservation sheet, excluding VOCs)	(NA)	YES	NO
Were all VOC vials free of air bubbles?	(NA)	YES	NO
Was sufficient amount of sample sent in each bottle?		(YES)	NO
Date VOC Trip Blank was made at ARI	(NA)		

Was Sample Split by ARI: (NA) YES Date/Time _____ Equipment: _____ Split by: _____

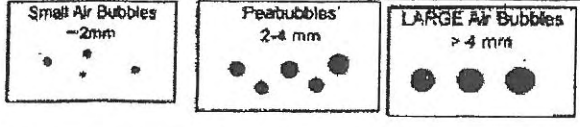
Samples Logged by: AV Date: 12/12/11 Time: 1445

***** Notify Project Manager of discrepancies or concerns *****

Sample ID on Bottle	Sample ID on COC	Sample ID on Bottle	Sample ID on COC
RC-CS-1	RD-CS-1		
RC-CS-2	RD-CS-2		
RC-CS-3	RD-CS-3		

Additional Notes, Discrepancies, & Resolutions:

By AV Date 12/12/11



Small → "sm"
Peabubbles → "pb"
Large → "lg"
Headspace → "hs"

Sample ID Cross Reference Report

ANALYTICAL RESOURCES INCORPORATED

ARI Job No: UA85
Client: Hart Crowser, Inc
Project Event: 17652-00
Project Name: Parcel 88

	Sample ID	ARI Lab ID	ARI LIMS ID	Matrix	Sample Date/Time	VTSR
1.	RD-CS-1	UA85A	11-28414	Soil	12/12/11 11:20	12/12/11 13:05
2.	RD-CS-2	UA85B	11-28415	Soil	12/12/11 11:00	12/12/11 13:05
3.	RD-CS-3	UA85C	11-28416	Soil	12/12/11 10:40	12/12/11 13:05

Printed 12/12/11

ANALYTICAL RESOURCES INCORPORATED

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS
Page 1 of 1

Sample ID: RD-CS-1
SAMPLE

Lab Sample ID: UA85A
LIMS ID: 11-28414
Matrix: Soil
Data Release Authorized:
Reported: 12/16/11

QC Report No: UA85-Hart Crowser, Inc
Project: Parcel 88
17652-00
Date Sampled: 12/12/11
Date Received: 12/12/11

Percent Total Solids: 74.1%

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	mg/kg-dry	Q
3050B	12/14/11	6010B	12/15/11	**7440-38-2**	**Arsenic**	6.3	**7.7**	
3050B	12/14/11	6010B	12/15/11	7440-43-9	Cadmium	0.3	0.3	U
3050B	12/14/11	6010B	12/15/11	**7440-47-3**	**Chromium**	0.6	**15.1**	
3050B	12/14/11	6010B	12/15/11	**7440-50-8**	**Copper**	0.3	**12.3**	
3050B	12/14/11	6010B	12/15/11	**7439-92-1**	**Lead**	3	**8**	
CLP	12/14/11	7471A	12/15/11	**7439-97-6**	**Mercury**	0.02	**0.04**	
3050B	12/14/11	6010B	12/15/11	**7440-02-0**	**Nickel**	1	**8**	
3050B	12/14/11	6010B	12/15/11	7782-49-2	Selenium	6	6	U
3050B	12/14/11	6010B	12/15/11	**7440-66-6**	**Zinc**	1	**22**	

U-Analyte undetected at given RL
RL-Reporting Limit

ANALYTICAL RESOURCES INCORPORATED

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS
Page 1 of 1

Sample ID: RD-CS-2
SAMPLE

Lab Sample ID: UA85B
LIMS ID: 11-28415
Matrix: Soil
Data Release Authorized:
Reported: 12/16/11

QC Report No: UA85-Hart Crowser, Inc
Project: Parcel 88
17652-00
Date Sampled: 12/12/11
Date Received: 12/12/11

Percent Total Solids: 76.8%

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	mg/kg-dry	Q
3050B	12/14/11	6010B	12/15/11	**7440-38-2**	**Arsenic**	6.2	**44.4**	
3050B	12/14/11	6010B	12/15/11	**7440-43-9**	**Cadmium**	0.2	**0.3**	
3050B	12/14/11	6010B	12/15/11	**7440-47-3**	**Chromium**	0.6	**15.8**	
3050B	12/14/11	6010B	12/15/11	**7440-50-8**	**Copper**	0.2	**37.5**	
3050B	12/14/11	6010B	12/15/11	**7439-92-1**	**Lead**	2	**3**	
CLP	12/14/11	7471A	12/15/11	7439-97-6	Mercury	0.03	0.03	U
3050B	12/14/11	6010B	12/15/11	**7440-02-0**	**Nickel**	1	**12**	
3050B	12/14/11	6010B	12/15/11	7782-49-2	Selenium	6	6	U
3050B	12/14/11	6010B	12/15/11	**7440-66-6**	**Zinc**	1	**127**	

U-Analyte undetected at given RL
RL-Reporting Limit

ANALYTICAL RESOURCES INCORPORATED

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS
Page 1 of 1

Sample ID: RD-CS-2
DUPLICATE

Lab Sample ID: UA85B
LIMS ID: 11-28415
Matrix: Soil
Data Release Authorized:
Reported: 12/16/11

QC Report No: UA85-Hart Crowser, Inc
Project: Parcel 88
17652-00
Date Sampled: 12/12/11
Date Received: 12/12/11

MATRIX DUPLICATE QUALITY CONTROL REPORT

Analyte	Analysis Method	Sample	Duplicate	RPD	Control Limit	Q
Arsenic	6010B	44.4	39.4	11.9%	+/- 20%	
Cadmium	6010B	0.3	0.2 U	40.0%	+/- 0.2	L
Chromium	6010B	15.8	15.8	0.0%	+/- 20%	
Copper	6010B	37.5	30.6	20.3%	+/- 20%	*
Lead	6010B	3	2 U	40.0%	+/- 2	L
Mercury	7471A	0.03 U	0.03 U	0.0%	+/- 0.03	L
Nickel	6010B	12	11	8.7%	+/- 20%	
Selenium	6010B	6 U	6 U	0.0%	+/- 6	L
Zinc	6010B	127	68	60.5%	+/- 20%	*

Reported in mg/kg-dry

*-Control Limit Not Met
L-RPD Invalid, Limit = Detection Limit

ANALYTICAL RESOURCES INCORPORATED

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS
Page 1 of 1

Sample ID: RD-CS-2
MATRIX SPIKE

Lab Sample ID: UA85B
LIMS ID: 11-28415
Matrix: Soil
Data Release Authorized:
Reported: 12/16/11

QC Report No: UA85-Hart Crowser, Inc
Project: Parcel 88
17652-00
Date Sampled: 12/12/11
Date Received: 12/12/11

MATRIX SPIKE QUALITY CONTROL REPORT

Analyte	Analysis Method	Sample	Spike	Spike Added	% Recovery	Q
Arsenic	6010B	44.4	285	249	96.6%	
Cadmium	6010B	0.3	64.5	62.3	103%	
Chromium	6010B	15.8	76.7	62.3	97.8%	
Copper	6010B	37.5	96.4	62.3	94.5%	
Lead	6010B	3	245	249	97.2%	
Mercury	7471A	0.03 U	0.34	0.299	114%	
Nickel	6010B	12	68	62.3	89.9%	
Selenium	6010B	6 U	235	249	94.4%	
Zinc	6010B	127	126	62.3	-1.6%	N

Reported in mg/kg-dry

N-Control Limit Not Met
H-% Recovery Not Applicable, Sample Concentration Too High
NA-Not Applicable, Analyte Not Spiked

Percent Recovery Limits: 75-125%

ANALYTICAL RESOURCES INCORPORATED

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS
Page 1 of 1

Sample ID: RD-CS-3
SAMPLE

Lab Sample ID: UA85C
LIMS ID: 11-28416
Matrix: Soil
Data Release Authorized:
Reported: 12/16/11

QC Report No: UA85-Hart Crowser, Inc
Project: Parcel 88
17652-00
Date Sampled: 12/12/11
Date Received: 12/12/11

Percent Total Solids: 75.5%

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	mg/kg-dry	Q
3050B	12/14/11	6010B	12/15/11	7440-38-2	Arsenic	6.4	6.4	U
3050B	12/14/11	6010B	12/15/11	7440-43-9	Cadmium	0.3	0.3	U
3050B	12/14/11	6010B	12/15/11	**7440-47-3**	**Chromium**	0.6	**18.1**	
3050B	12/14/11	6010B	12/15/11	**7440-50-8**	**Copper**	0.3	**25.0**	
3050B	12/14/11	6010B	12/15/11	7439-92-1	Lead	3	3	U
CLP	12/14/11	7471A	12/15/11	7439-97-6	Mercury	0.03	0.03	U
3050B	12/14/11	6010B	12/15/11	**7440-02-0**	**Nickel**	1	**12**	
3050B	12/14/11	6010B	12/15/11	7782-49-2	Selenium	6	6	U
3050B	12/14/11	6010B	12/15/11	**7440-66-6**	**Zinc**	1	**29**	

U-Analyte undetected at given RL
RL-Reporting Limit

ANALYTICAL RESOURCES INCORPORATED

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS
Page 1 of 1

Sample ID: LAB CONTROL

Lab Sample ID: UA85LCS
LIMS ID: 11-28414
Matrix: Soil
Data Release Authorized:
Reported: 12/16/11

QC Report No: UA85-Hart Crowser, Inc
Project: Parcel 88
17652-00
Date Sampled: NA
Date Received: NA

BLANK SPIKE QUALITY CONTROL REPORT

Analyte	Analysis Method	Spike Found	Spike Added	% Recovery	Q
Arsenic	6010B	192	200	96.0%	
Cadmium	6010B	50.5	50.0	101%	
Chromium	6010B	49.0	50.0	98.0%	
Copper	6010B	50.8	50.0	102%	
Lead	6010B	194	200	97.0%	
Mercury	7471A	0.52	0.50	104%	
Nickel	6010B	46	50	92.0%	
Selenium	6010B	189	200	94.5%	
Zinc	6010B	47	50	94.0%	

Reported in mg/kg-dry

N-Control limit not met
NA-Not Applicable, Analyte Not Spiked
Control Limits: 80-120%

ANALYTICAL RESOURCES INCORPORATED

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS
Page 1 of 1

Sample ID: METHOD BLANK

Lab Sample ID: UA85MB
LIMS ID: 11-28414
Matrix: Soil
Data Release Authorized:
Reported: 12/16/11

QC Report No: UA85-Hart Crowser, Inc
Project: Parcel 88
17652-00
Date Sampled: NA
Date Received: NA

Percent Total Solids: NA

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	mg/kg-dry	Q
3050B	12/14/11	6010B	12/15/11	7440-38-2	Arsenic	5	5	U
3050B	12/14/11	6010B	12/15/11	7440-43-9	Cadmium	0.2	0.2	U
3050B	12/14/11	6010B	12/15/11	7440-47-3	Chromium	0.5	0.5	U
3050B	12/14/11	6010B	12/15/11	7440-50-8	Copper	0.2	0.2	U
3050B	12/14/11	6010B	12/15/11	7439-92-1	Lead	2	2	U
CLP	12/14/11	7471A	12/15/11	7439-97-6	Mercury	0.02	0.02	U
3050B	12/14/11	6010B	12/15/11	7440-02-0	Nickel	1	1	U
3050B	12/14/11	6010B	12/15/11	7782-49-2	Selenium	5	5	U
3050B	12/14/11	6010B	12/15/11	7440-66-6	Zinc	1	1	U

U-Analyte undetected at given RL
RL-Reporting Limit

Analytical Resources, Incorporated
Analytical Chemists and Consultants

HARTCROWSER
Seattle, Edmonds, Vancouver, Portland

3 soil aliquots from RD-CS-2

March 19, 2012

Mark Dagel
Hart Crowser, Inc.
1700 Westlake Avenue N. Suite 200
Seattle, WA 98109-3256

RE: Client Project: Parcel 88
ARI Job No.: UM07

geotechnical • environmental • natural resources

Dear Mark;

Please find enclosed the original Chain-of-Custody (COC) records, sample receipt documentation, and the final data for samples from the project referenced above. Analytical Resources, Inc. (ARI) received three soil samples on December 12, 2011. The samples were received in good condition with a cooler temperature of 4.1 °C.

The samples were originally analyzed for Total Metals, as requested on the COC and reported under UA85.

At the request of Hart Crowser, Inc, sample RD-CS-2 was homogenized and analyzed for total metals three times. Mercury was analyzed outside of the method recommended holding time.

There were no other anomalies associated with the analyses of these samples.

Sincerely,

ANALYTICAL RESOURCES, INC.

Kelly Bottem
Client Services Manager
kellyb@arilabs.com
206/695-6211
Enclosures

cc: eFile UM07

KFB/kb

Chain of Custody Record & Laboratory Analysis Request

ARI Assigned Number: UA85	Turn-around Requested: Standard	Page: 1 of 1	
ARI Client Company: Hart Crowser	Phone: 206 324 9530	Date: 12/12/11	Ice Present? Y
Client Contact: Mark Dagel		No. of Coolers: 1	Cooler Temps: 4.1
Client Project Name: Parcel 88			
Client Project #: 17652-00	Samplers: PRC		

Analytical Resources, Incorporated
Analytical Chemists and Consultants
4611 South 134th Place, Suite 100
Tukwila, WA 98168
206-695-6200 206-695-6201 (fax)

Sample ID	Date	Time	Matrix	No. Containers	Analysis Requested: * Metals 3050B	Mercury 7471A							Notes/Comments
RD-CS-1	12/12/11	1120	Soil	1	X	X							
RD-CS-2	"	1100	"	2	X	X							*MS/MSD
RD-CS-3	"	1040	"	1	X	X							

Comments/Special Instructions
* Arsenic ✓
Cadmium ✓
Chromium ✓
Copper ✓
Lead ✓
Nickel ✓
Selenium ✓
Zinc ✓

Relinquished by: (Signature)		Received by: (Signature)		Relinquished by: (Signature)	Received by (Signature)
Printed Name: Phil Cordell		Printed Name: A. Volgardsen		Printed Name	Printed Name
Company: Hart Crowser		Company: ARI		Company	Company:
Date & Time: 12/12/11 1305		Date & Time: 12/12/11 1305		Date & Time	Date & Time

UA85:00002

Analytical Resources, Incorporated
Analytical Chemists and Consultants

Cooler Receipt Form

ARI Client Hart Crowser — Project Name: Parcel 86

COC No(s) _____ (NA) — Delivered by Fed-Ex UPS Courier (Hand Delivered) Other: _____

Assigned ARI Job No UA85 — Tracking No _____ (NA)

Preliminary Examination Phase:

Were intact, properly signed and dated custody seals attached to the outside of to cooler?	YES	(NO)
Were custody papers included with the cooler?	(YES)	NO
Were custody papers properly filled out (ink, signed, etc)	(YES)	NO
Temperature of Cooler(s) (°C) (recommended 2.0-6 0 °C for chemistry) 4.1		

If cooler temperature is out of compliance fill out form 00070F — Temp Gun ID#: 90941619

Cooler Accepted by AV — Date: 12/12/11 — Time: 1305

Complete custody forms and attach all shipping documents

Log-In Phase:

Was a temperature blank included in the cooler?		YES	(NO)
What kind of packing material was used? Bubble Wrap (Wet Ice) Gel Packs (Baggies) Foam Block Paper Other: _____			
Was sufficient ice used (if appropriate)?	NA	(YES)	NO
Were all bottles sealed in individual plastic bags?		YES	(NO)
Did all bottles arrive in good condition (unbroken)?		(YES)	NO
Were all bottle labels complete and legible?		(YES)	NO
Did the number of containers listed on COC match with the number of containers received?		(YES)	NO
Did all bottle labels and tags agree with custody papers?		(YES) AV	(NO)
Were all bottles used correct for the requested analyses?		(YES)	NO
Do any of the analyses (bottles) require preservation? (attach preservation sheet, excluding VOCs)	(NA)	YES	NO
Were all VOC vials free of air bubbles?	(NA)	YES	NO
Was sufficient amount of sample sent in each bottle?		(YES)	NO
Date VOC Trip Blank was made at ARI	(NA)		

Was Sample Split by ARI: (NA) YES Date/Time: _____ Equipment: _____ Split by: _____

Samples Logged by AV — Date: 12/12/11 — Time: 1445

*** Notify Project Manager of discrepancies or concerns ***

Sample ID on Bottle	Sample ID on COC	Sample ID on Bottle	Sample ID on COC
RC-CS-1	RD-CS-1		
RC-CS-2	RD-CS-2		
RC-CS-3	RD-CS-3		

Additional Notes, Discrepancies, & Resolutions:

By AV — Date 12/12/11

Small Air Bubbles ~2mm	Peabubbles 2-4 mm	LARGE Air Bubbles > 4 mm
• • •	• • •	• • •

Small → "sm"
Peabubbles → "pb"
Large → "lg"
Headspace → "hs"

Sample ID Cross Reference Report

ANALYTICAL RESOURCES INCORPORATED

ARI Job No: UM07
Client: Hart Crowser, Inc
Project Event: 17652-00
Project Name: Parcel 88

	Sample ID	ARI Lab ID	ARI LIMS ID	Matrix	Sample Date/Time	VTSR
1.	RD-CS-2	UM07A	12-4333	Soil	12/12/11 11:00	12/12/11 13:05
2.	RD-CS-2	UM07B	12-4334	Soil	12/12/11 11:00	12/12/11 13:05
3.	RD-CS-2	UM07C	12-4335	Soil	12/12/11 11:00	12/12/11 13:05

Subject: Re: Additional analyses requested from archived sample
From: Kelly Bottem <kellyb@arilabs.com>
Date: 3/13/2012 9:13 AM
To: Mark Dagel <Mark.Dagel@hartcrowser.com>, 'Login' <login@arilabs.com>

Login please pull this sample and let me know if we have it.
K

On 3/12/2012 2:36 PM, Mark Dagel wrote:

> Hi Kelly--We're interested in having three additional soil aliquots from an archived soil sample jar re-run for metals (same analytes/methods as original analysis). Our goal is to evaluate heterogeneity of results within this sample container. We'd like the contents of the container homogenized and then three aliquots taken and analyzed.
> The sample is UA85B (our sample RD-CS-2), collected on 12/12/11.
> Please let me know if you see any problems with this approach and an approximate schedule for completion. Thanks --Mark
>
> Mark Dagel
>
> Hart Crowser
>
> 1700 Westlake Avenue North, Suite 200
>
> Seattle, Washington 98109
>
> 206.826.4534 (direct)
>
> 206.473.2514 (cell)
>
> 206.324.9530 (receptionist)
>
> 206.826.4480 (conference call-in number)
>
> 206.328.5581 (fax)

--

Kelly Frances Bottem, Client Services Manager
Analytical Resources, Inc.
4611 S. 134th Place, Suite 100
Tukwila, WA 98168-3240
Website: http://www.arilabs.com
Direct Phone: 206-695-6211
E-Mail: kellyb@arilabs.com
Fax: 206-695-6201
Cell: 206-228-1385

"Never interrupt someone doing something you said couldn't be done" - Amelia Earhart

***Before printing, think about ENVIRONMENTAL responsibility

ANALYTICAL RESOURCES INCORPORATED

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS
Page 1 of 1

Sample ID: RD-CS-2
SAMPLE

Lab Sample ID: UM07A
LIMS ID: 12-4333
Matrix: Soil
Data Release Authorized:
Reported: 03/19/12

QC Report No: UM07-Hart Crowser, Inc
Project: Parcel 88
17652-00
Date Sampled: 12/12/11
Date Received: 12/12/11

Percent Total Solids: 77.5%

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	mg/kg-dry	Q
3050B	03/13/12	6010B	03/15/12	**7440-38-2**	**Arsenic**	6.2	**32.3**	
3050B	03/13/12	6010B	03/15/12	7440-43-9	Cadmium	0.2	0.2	U
3050B	03/13/12	6010B	03/15/12	**7440-47-3**	**Chromium**	0.6	**16.9**	
3050B	03/13/12	6010B	03/15/12	**7440-50-8**	**Copper**	0.2	**23.1**	
3050B	03/13/12	6010B	03/15/12	7439-92-1	Lead	2	2	U
CLP	03/13/12	7471A	03/16/12	7439-97-6	Mercury	0.03	0.03	U
3050B	03/13/12	6010B	03/15/12	**7440-02-0**	**Nickel**	1	**12**	
3050B	03/13/12	6010B	03/15/12	7782-49-2	Selenium	6	6	U
3050B	03/13/12	6010B	03/15/12	**7440-66-6**	**Zinc**	1	**54**	

U-Analyte undetected at given RL
RL-Reporting Limit

ANALYTICAL RESOURCES INCORPORATED

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS
Page 1 of 1

Sample ID: RD-CS-2
SAMPLE

Lab Sample ID: UM07B
LIMS ID: 12-4334
Matrix: Soil
Data Release Authorized:
Reported: 03/19/12

QC Report No: UM07-Hart Crowser, Inc
Project: Parcel 88
17652-00
Date Sampled: 12/12/11
Date Received: 12/12/11

Percent Total Solids: 77.8%

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	mg/kg-dry	Q
3050B	03/13/12	6010B	03/15/12	**7440-38-2**	**Arsenic**	6.0	**31.8**	
3050B	03/13/12	6010B	03/15/12	7440-43-9	Cadmium	0.2	0.2	U
3050B	03/13/12	6010B	03/15/12	**7440-47-3**	**Chromium**	0.6	**17.4**	
3050B	03/13/12	6010B	03/15/12	**7440-50-8**	**Copper**	0.2	**22.3**	
3050B	03/13/12	6010B	03/15/12	**7439-92-1**	**Lead**	2	**2**	
CLP	03/13/12	7471A	03/16/12	7439-97-6	Mercury	0.02	0.02	U
3050B	03/13/12	6010B	03/15/12	**7440-02-0**	**Nickel**	1	**12**	
3050B	03/13/12	6010B	03/15/12	7782-49-2	Selenium	6	6	U
3050B	03/13/12	6010B	03/15/12	**7440-66-6**	**Zinc**	1	**45**	

U-Analyte undetected at given RL
RL-Reporting Limit

ANALYTICAL RESOURCES INCORPORATED

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS
Page 1 of 1

Sample ID: RD-CS-2
SAMPLE

Lab Sample ID: UM07C
LIMS ID: 12-4335
Matrix: Soil
Data Release Authorized:
Reported: 03/19/12

QC Report No: UM07-Hart Crowser, Inc
Project: Parcel 88
17652-00
Date Sampled: 12/12/11
Date Received: 12/12/11

Percent Total Solids: 77.8%

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	mg/kg-dry	Q
3050B	03/13/12	6010B	03/15/12	**7440-38-2**	**Arsenic**	6.1	**29.1**	
3050B	03/13/12	6010B	03/15/12	7440-43-9	Cadmium	0.2	0.2	U
3050B	03/13/12	6010B	03/15/12	**7440-47-3**	**Chromium**	0.6	**17.6**	
3050B	03/13/12	6010B	03/15/12	**7440-50-8**	**Copper**	0.2	**23.7**	
3050B	03/13/12	6010B	03/15/12	7439-92-1	Lead	2	2	U
CLP	03/13/12	7471A	03/16/12	7439-97-6	Mercury	0.03	0.03	U
3050B	03/13/12	6010B	03/15/12	**7440-02-0**	**Nickel**	1	**12**	
3050B	03/13/12	6010B	03/15/12	7782-49-2	Selenium	6	6	U
3050B	03/13/12	6010B	03/15/12	**7440-66-6**	**Zinc**	1	**51**	

U-Analyte undetected at given RL
RL-Reporting Limit

ANALYTICAL RESOURCES INCORPORATED

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS
Page 1 of 1

Sample ID: METHOD BLANK

Lab Sample ID: UM07MB
LIMS ID: 12-4333
Matrix: Soil
Data Release Authorized:
Reported: 03/19/12

QC Report No: UM07-Hart Crowser, Inc
Project: Parcel 88
17652-00
Date Sampled: NA
Date Received: NA

Percent Total Solids: NA

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	mg/kg-dry	Q
3050B	03/13/12	6010B	03/15/12	7440-38-2	Arsenic	5	5	U
3050B	03/13/12	6010B	03/15/12	7440-43-9	Cadmium	0.2	0.2	U
3050B	03/13/12	6010B	03/15/12	7440-47-3	Chromium	0.5	0.5	U
3050B	03/13/12	6010B	03/15/12	7440-50-8	Copper	0.2	0.2	U
3050B	03/13/12	6010B	03/15/12	7439-92-1	Lead	2	2	U
CLP	03/13/12	7471A	03/16/12	7439-97-6	Mercury	0.02	0.02	U
3050B	03/13/12	6010B	03/15/12	7440-02-0	Nickel	1	1	U
3050B	03/13/12	6010B	03/15/12	7782-49-2	Selenium	5	5	U
3050B	03/13/12	6010B	03/15/12	7440-66-6	Zinc	1	1	U

U-Analyte undetected at given RL
RL-Reporting Limit

ANALYTICAL RESOURCES INCORPORATED

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS
Page 1 of 1

Sample ID: LAB CONTROL

Lab Sample ID: UM07LCS
LIMS ID: 12-4333
Matrix: Soil
Data Release Authorized:
Reported: 03/19/12

QC Report No: UM07-Hart Crowser, Inc
Project: Parcel 88
17652-00
Date Sampled: NA
Date Received: NA

BLANK SPIKE QUALITY CONTROL REPORT

Analyte	Analysis Method	Spike Found	Spike Added	% Recovery	Q
Arsenic	6010B	200	200	100%	
Cadmium	6010B	47.5	50.0	95.0%	
Chromium	6010B	52.3	50.0	105%	
Copper	6010B	51.1	50.0	102%	
Lead	6010B	196	200	98.0%	
Mercury	7471A	0.52	0.50	104%	
Nickel	6010B	49	50	98.0%	
Selenium	6010B	200	200	100%	
Zinc	6010B	50	50	100%	

Reported in mg/kg-dry

N-Control limit not met
NA-Not Applicable, Analyte Not Spiked
Control Limits: 80-120%

Analytical Resources, Incorporated
Analytical Chemists and Consultants

2 waters

HARTCROWSER
Seattle Edmonds Vancouver Portland

upload TPH results + Hg results only

September 24, 2012

Mark Dagel
Hart Crowser, Inc.
1700 Westlake Avenue N. Suite 200
Seattle, WA 98109-3256

RE: Client Project: Parcel 88
ARI Job No.: VI65 and VK17

geotechnical • environmental • natural resources

Dear Mark;

Please find enclosed the original Chain-of-Custody (COC) records, sample receipt documentation, and the final data for samples from the project referenced above. Analytical Resources, Inc. (ARI) received two water samples on September 7, 2012. The samples were received in good condition with a cooler temperature of 5.9 °C.

The samples were analyzed for NWTPH-Dx, dissolved metals and total mercury as requested on the COC.

There were no anomalies associated with the analyses of these samples.

A copy of this report and all associated raw data will be kept on file at ARI. Should you have any questions regarding these results, please feel free to contact me at your convenience.

Sincerely,

ANALYTICAL RESOURCES, INC.

Kelly Bottem
Client Services Manager
kellyb@arilabs.com
206/695-6211
Enclosures

cc: eFile VI65, VK17

KFB/kb

4611 South 134th Place, Suite 100 • Tukwila WA 98168 • **206-695-6200** • **206-695-6201** fax

Sample Custody Record

V165

Samples Shipped to: ARI

HARTCROWSER
Hart Crowser, Inc.
1700 Westlake Avenue North, Suite 200
Seattle, Washington 98109-6212
Office: 206.324.9530 • Fax 206.328.5581

JOB 17652-00 LAB NUMBER

PROJECT NAME PARCEL 88

HART CROWSER CONTACT MARK DAGEL

SAMPLED BY: PRC and SMF

LAB NO.	SAMPLE ID	DESCRIPTION	DATE	TIME	MATRIX	*DISSOLVED METALS	TOTAL Hg	TPH**	NO. OF CONTAINERS	OBSERVATIONS/COMMENTS/ COMPOSITING INSTRUCTIONS
	MW201		9/7/12	11:45A	H_2O	✓	✓	✓	4	
	MW202		9/7/12	12:45P	H_2O	✓	✓	✓	4	

REQUESTED ANALYSIS

RELINQUISHED BY	DATE	RECEIVED BY	DATE
SIGNATURE [signature]	9/7/12	SIGNATURE	
PRINT NAME Phil Cordell	TIME 1555	PRINT NAME	TIME
COMPANY HC		COMPANY	

RELINQUISHED BY	DATE	RECEIVED BY	DATE
SIGNATURE [signature]	9/7/12	SIGNATURE	
PRINT NAME Jennifer Millsap	TIME 1555	PRINT NAME	TIME
COMPANY AKI		COMPANY	

SPECIAL SHIPMENT HANDLING OR STORAGE REQUIREMENTS:

*As, Cd, Cr, Cu, Pb and Zn

** Diesel and heavy oil.

COOLER NO.: STORAGE LOCATION:

See Lab Work Order No. ______ for Other Contract Requirements

TOTAL NUMBER OF CONTAINERS

SAMPLE RECEIPT INFORMATION
CUSTODY SEALS: ☐YES ☐NO ☐N/A
GOOD CONDITION ☐YES ☐NO
TEMPERATURE ______
SHIPMENT METHOD: ☐HAND ☐COURIER ☐OVERNIGHT

TURNAROUND TIME:
☐ 24 HOURS ☐ 1 WEEK
☐ 48 HOURS ☒ STANDARD
☐ 72 HOURS OTHER ______

White and Yellow Copies to Lab   Pink to Project Manager   Lab to Return White Copy to Hart Crowser   Gold to Sample Custodian

AJ 9/24/12

Analytical Resources, Incorporated
Analytical Chemists and Consultants

Cooler Receipt Form

ARI Client: Hart Crowser

Project Name: Parcel 88

COC No(s): _____ (NA)

Delivered by: Fed-Ex UPS Courier Hand-Delivered Other: _____

Assigned ARI Job No: V165

Tracking No: _____ NA

Preliminary Examination Phase:

Were intact, properly signed and dated custody seals attached to the outside of to cooler?	YES	(NO)
Were custody papers included with the cooler?	(YES)	NO
Were custody papers properly filled out (ink, signed, etc.)	(YES)	NO
Temperature of Cooler(s) (°C) (recommended 2.0-6.0 °C for chemistry)	5.9	
If cooler temperature is out of compliance fill out form 00070F	Temp Gun ID#:	90877957

Cooler Accepted by: JM Date: 9/7/12 Time: 1555

Complete custody forms and attach all shipping documents

Log-In Phase:

Was a temperature blank included in the cooler?		YES	(NO)
What kind of packing material was used? ...	Bubble Wrap (Wet Ice) Gel Packs (Baggies) Foam Block Paper Other:		
Was sufficient ice used (if appropriate)?	NA	(YES)	NO
Were all bottles sealed in individual plastic bags?		(YES)	NO
Did all bottles arrive in good condition (unbroken)?		(YES)	NO
Were all bottle labels complete and legible?		(YES)	NO
Did the number of containers listed on COC match with the number of containers received?		(YES)	NO
Did all bottle labels and tags agree with custody papers?		(YES)	NO
Were all bottles used correct for the requested analyses?		(YES)	NO
Do any of the analyses (bottles) require preservation? (attach preservation sheet, excluding VOCs)...	NA	(YES)	NO
Were all VOC vials free of air bubbles?	(NA)	YES	NO
Was sufficient amount of sample sent in each bottle?		(YES)	NO
Date VOC Trip Blank was made at ARI	(NA)		

Was Sample Split by ARI : (NA) YES Date/Time: _____ Equipment: _____ Split by: _____

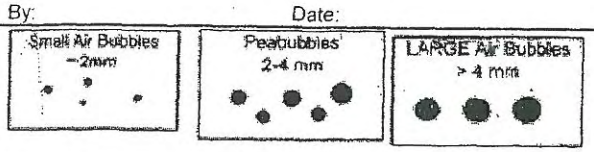
Samples Logged by: JM Date: 9/7/12 Time: 1608

***** Notify Project Manager of discrepancies or concerns *****

Sample ID on Bottle	Sample ID on COC	Sample ID on Bottle	Sample ID on COC

Additional Notes, Discrepancies, & Resolutions:

By: Date:



Small → "sm"
Peabubbles → "pb"
Large → "lg"
Headspace → "hs"

V165 : 66663 AV 9/24/12

V165 : 66663

PRESERVATION VERIFICATION 09/07/12
Page 1 of 1

ANALYTICAL RESOURCES INCORPORATED

ARI Job No: **VI65**

Inquiry Number: NONE
Analysis Requested: 09/10/12
Contact: Dagel, Mark
Client: Hart Crowser, Inc
Logged by: JM
Sample Set Used: Yes-481
Validatable Package: No
Deliverables:

PC: Kelly
VTSR: 09/07/12

Project #: 17652-00
Project: PARCEL 88
Sample Site:
SDG No:
Analytical Protocol: In-house

LOGNUM ARI ID	CLIENT ID	CN >12	WAD >12	NH3 <2	COD <2	FOG <2	MET <2	PHEN <2	PHOS <2	TKN <2	NO23 <2	TOC <2	S2 >9	AK102 <2	Fe2+ <2	DMET FLT	DOC FLT	PARAMETER	ADJUSTED TO	LOT NUMBER	AMOUNT ADDED	DATE/BY
12-17097 **VI65A**	MW201						TOT pass											NB 09-7-12 pH				
12-17098 **VI65B**	MW202						TOT pass															
12-17099 **VI65C**	MW201						DIS Sai									N		pH	<2	MP2342	2.0mL	NB 09-07-12
12-17100 **VI65D**	MW202						DIS Sai									N		pH	<2	MP2342	2.0mL	NB 09-07-12

Samples C & D filtered & preserved in lab.
-NB 09-07-12

Checked By JM Date 9/7/12

Sample ID Cross Reference Report

ANALYTICAL RESOURCES INCORPORATED

ARI Job No: VI65
Client: Hart Crowser, Inc
Project Event: 17652-00
Project Name: PARCEL 88

	Sample ID	ARI Lab ID	ARI LIMS ID	Matrix	Sample Date/Time	VTSR
1.	MW201	VI65A	12-17097	Water	09/07/12 11:45	09/07/12 15:55
2.	MW202	VI65B	12-17098	Water	09/07/12 12:45	09/07/12 15:55
3.	MW201	VI65C	12-17099	Water	09/07/12 11:45	09/07/12 15:55
4.	MW202	VI65D	12-17100	Water	09/07/12 12:45	09/07/12 15:55

VI65:00005

~~VI65:00005~~ AV
9/24/12

Analytical Resources, Incorporated
Analytical Chemists and Consultants

Data Reporting Qualifiers

Effective 2/14/2011

Inorganic Data

U	Indicates that the target analyte was not detected at the reported concentration
*	Duplicate RPD is not within established control limits
B	Reported value is less than the CRDL but ≥ the Reporting Limit
N	Matrix Spike recovery not within established control limits
NA	Not Applicable, analyte not spiked
H	The natural concentration of the spiked element is so much greater than the concentration spiked that an accurate determination of spike recovery is not possible
L	Analyte concentration is ≤5 times the Reporting Limit and the replicate control limit defaults to ±1 RL instead of the normal 20% RPD

Organic Data

U	Indicates that the target analyte was not detected at the reported concentration
*	Flagged value is not within established control limits
B	Analyte detected in an associated Method Blank at a concentration greater than one-half of ARI's Reporting Limit or 5% of the regulatory limit or 5% of the analyte concentration in the sample.
J	Estimated concentration when the value is less than ARI's established reporting limits
D	The spiked compound was not detected due to sample extract dilution
E	Estimated concentration calculated for an analyte response above the valid instrument calibration range. A dilution is required to obtain an accurate quantification of the analyte.
Q	Indicates a detected analyte with an initial or continuing calibration that does not meet established acceptance criteria (<20%RSD, <20%Drift or minimum RRF).

S — Indicates an analyte response that has saturated the detector. The calculated concentration is not valid; a dilution is required to obtain valid quantification of the analyte

NA — The flagged analyte was not analyzed for

NR — Spiked compound recovery is not reported due to chromatographic interference

NS — The flagged analyte was not spiked into the sample

M — Estimated value for an analyte detected and confirmed by an analyst but with low spectral match parameters. This flag is used only for GC-MS analyses

M2 — The sample contains PCB congeners that do not match any standard Aroclor pattern. The PCBs are identified and quantified as the Aroclor whose pattern most closely matches that of the sample. The reported value is an estimate.

N — The analysis indicates the presence of an analyte for which there is presumptive evidence to make a "tentative identification"

Y — The analyte is not detected at or above the reported concentration. The reporting limit is raised due to chromatographic interference. The Y flag is equivalent to the U flag with a raised reporting limit.

EMPC — Estimated Maximum Possible Concentration (EMPC) defined in EPA Statement of Work DLM02.2 as a value "calculated for 2,3,7,8-substituted isomers for which the quantitation and /or confirmation ion(s) has signal to noise in excess of 2.5, but does not meet identification criteria" **(Dioxin/Furan analysis only)**

C — The analyte was positively identified on only one of two chromatographic columns. Chromatographic interference prevented a positive identification on the second column

P — The analyte was detected on both chromatographic columns but the quantified values differ by ≥40% RPD with no obvious chromatographic interference

X — Analyte signal includes interference from polychlorinated diphenyl ethers. **(Dioxin/Furan analysis only)**

Z — Analyte signal includes interference from the sample matrix or perfluorokerosene ions. **(Dioxin/Furan analysis only)**

Geotechnical Data

A	The total of all fines fractions. This flag is used to report total fines when only sieve analysis is requested and balances total grain size with sample weight.
F	Samples were frozen prior to particle size determination
SM	Sample matrix was not appropriate for the requested analysis. This normally refers to samples contaminated with an organic product that interferes with the sieving process and/or moisture content, porosity and saturation calculations
SS	Sample did not contain the proportion of "fines" required to perform the pipette portion of the grain size analysis
W	Weight of sample in some pipette aliquots was below the level required for accurate weighting

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
TOTAL DIESEL RANGE HYDROCARBONS
NWTPHD by GC/FID-Silica and Acid Cleaned
Extraction Method:
Page 1 of 1

QC Report No: VK17-Hart Crowser, Inc
Project: PARCEL 88
17652-00

Matrix: Water
Data Release Authorized: MW
Reported: 09/24/12

ARI ID	Sample ID	Extraction Date	Analysis Date	EFV DL	Range/Surrogate	RL	Result
MB-091112	Method Blank	09/11/12	09/21/12	1.00	Diesel Range	0.10	< 0.10 U
12-17955	HC ID: ---		FID3B	1.0	Motor Oil Range	0.20	< 0.20 U
					o-Terphenyl		83.7%
VK17A	MW201	09/11/12	09/21/12	1.00	Diesel Range	0.10	< 0.10 U
12-17955	HC ID: ---		FID3B	1.0	Motor Oil Range	0.20	< 0.20 U
					o-Terphenyl		82.5%
VK17B	MW202	09/11/12	09/21/12	1.00	Diesel Range	0.10	< 0.10 U
12-17956	HC ID: ---		FID3B	1.0	Motor Oil Range	0.20	< 0.20 U
					o-Terphenyl		80.3%

Reported in mg/L (ppm)

EFV-Effective Final Volume in mL.
DL-Dilution of extract prior to analysis.
RL-Reporting limit.

Diesel range quantitation on total peaks in the range from C12 to C24.
Motor Oil range quantitation on total peaks in the range from C24 to C38.
HC ID: DRO/RRO indicate results of organics or additional hydrocarbons in ranges are not identifiable.

ANALYTICAL RESOURCES INCORPORATED

CLEANED TPHD SURROGATE RECOVERY SUMMARY

Matrix: Water

QC Report No: VK17-Hart Crowser, Inc
Project: PARCEL 88
17652-00

Client ID	OTER	TOT OUT
MB-091112	83.7%	0
LCS-091112	89.3%	0
MW201	82.5%	0
MW202	80.3%	0

	LCS/MB LIMITS	QC LIMITS
(OTER) = o-Terphenyl	(50-150)	(50-150)

Prep Method: SW3510C
Log Number Range: 12-17955 to 12-17956

FORM-II TPHD

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
NWTPHD by GC/FID-Silica and Acid Cleaned **Sample ID: LCS-091112**
Page 1 of 1 **LAB CONTROL**

Lab Sample ID: LCS-091112
LIMS ID: 12-17955
Matrix: Water
Data Release Authorized: MW
Reported: 09/24/12

QC Report No: VK17-Hart Crowser, Inc
Project: PARCEL 88
17652-00
Date Sampled: 09/07/12
Date Received: 09/07/12

Date Extracted: 09/11/12
Date Analyzed: 09/21/12 12:13
Instrument/Analyst: FID/VTS

Sample Amount: 500 mL
Final Extract Volume: 1.0 mL
Dilution Factor: 1.00

Range	Lab Control	Spike Added	Recovery
Diesel	2.25	3.00	75.0%

TPHD Surrogate Recovery

o-Terphenyl	89.3%

Results reported in mg/L

FORM III

ANALYTICAL RESOURCES INCORPORATED

TOTAL DIESEL RANGE HYDROCARBONS-EXTRACTION REPORT

ARI Job: VK17
Matrix: Water — Project: PARCEL 88
Date Received: 09/07/12 — 17652-00

ARI ID	Client ID	Samp Amt	Final Vol	Prep Date
12-17955-091112MB1	Method Blank	500 mL	1.00 mL	09/11/12
12-17955-091112LCS1	Lab Control	500 mL	1.00 mL	09/11/12
12-17955-VK17A	MW201	500 mL	1.00 mL	09/11/12
12-17956-VK17B	MW202	500 mL	1.00 mL	09/11/12

Analytical Resources Inc.
TPH Quantitation Report

Data file: /chem3/fid3b.i/20120921.b/0921b006.d
Method: /chem3/fid3b.i/20120921.b/ftphfid3b.m
Instrument: fid3b.i
Operator: AR
Report Date: 09/21/2012
Macro: FID:3B091712

ARI ID: VK17MBW1
Client ID:
Injection: 21-SEP-2012 11:54
Dilution Factor: 1

FID:3B RESULTS

Compound	RT	Shift	Height	Area	Method	Range	Total Area	Conc
Toluene	1.013	-0.010	22365	20826	WATPHG	(Tol-C12)	508909	25.28
C8	1.233	-0.005	9209	18182	WATPHD	(C12-C24)	166764	13.00
C10	2.886	-0.003	1622	421	WATPHM	(C24-C38)	156087	18.46
C12	3.731	-0.002	1537	728	AK102	(C10-C25)	263337	16.84
C14	4.330	-0.002	721	445	AK103	(C25-C36)	139011	16.55
C16	4.850	0.002	1002	138	OR.DIES	(C10-C28)	273373	15.29
C18	5.299	-0.002	958	531				
C20	5.699	0.004	1346	861				
C22	6.048	-0.002	639	471				
C24	6.375	0.002	367	260				
C25	6.532	0.006	1394	2240				
C26	6.665	-0.006	104	55				
C28	6.949	0.000	1145	344	FUEL OIL	(C10-C24)	262109	17.98
C32	7.457	0.004	2165	2551				
C34	7.685	0.001	771	450				
Filter Peak	7.944	0.003	1342	609				
C36	7.919	0.017	1986	1452	BUNKERC	(C10-C38)	418196	85.26
o-terph	5.391	0.001	985741	630631	JET-A	(C10-C18)	213064	14.80
Triacon Surr	7.216	0.001	1029563	651049				

Range Times: NW Diesel(3.783 - 6.423) NW Gas(0.973 - 3.783) NW M.Oil(6.423 - 8.165)
AK102(2.840 - 6.476) AK103(6.476 - 7.952) Jet A(2.840 - 5.351)

Surrogate	Area	Amount	%Rec
o-Terphenyl	630631	37.7	83.7
Triacontane	651049	44.7	99.4

Analyte	RF	Curve Date
o-Terph Surr	16747.9	13-SEP-2012
Triacon Surr	14552.1	13-SEP-2012
Gas	20131.4	14-SEP-2012
Diesel	12832.6	13-SEP-2012
Motor Oil	8456.6	13-SEP-2012
AK102	15633.9	13-SEP-2012
AK103	8399.4	11-AUG-2012
JetA	14399.0	16-FEB-2012
OR Diesel	17876.0	
Bunker C	4904.8	14-SEP-2012
Fuel Oil	14574.0	16-JUN-2012

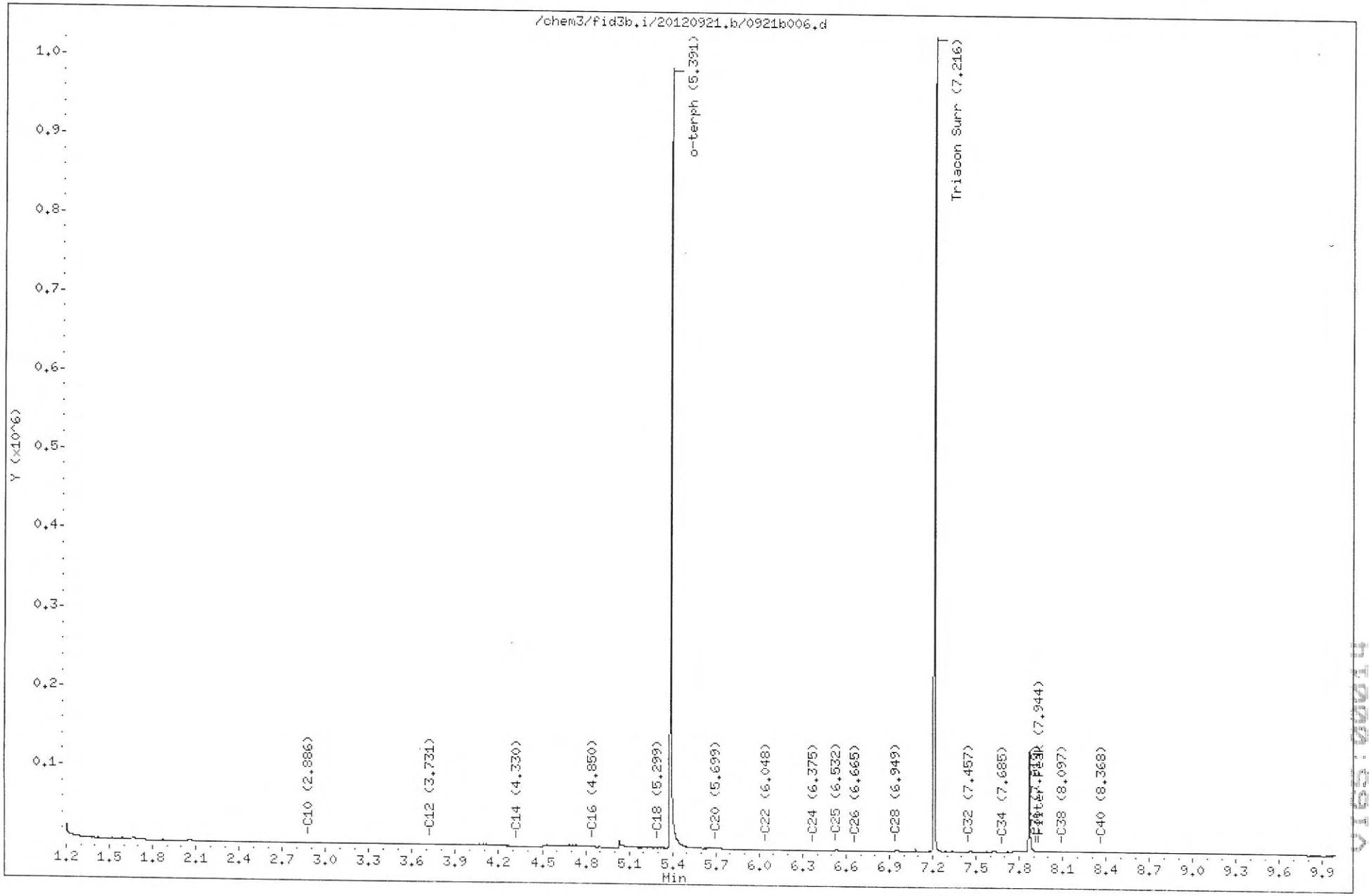
VIB
9-21-12

Data File: /chem3/fid3b.i/20120921.b/0921b006.d
Date : 21-SEP-2012 11:54
Client ID:
Sample Info: VK17MBW1

Instrument: fid3b.i

Operator: AR
Column diameter: 0.25

Column phase: RTX-1



Analytical Resources Inc.
TPH Quantitation Report

Data file: /chem3/fid3b.i/20120921.b/0921b007.d
Method: /chem3/fid3b.i/20120921.b/ftphfid3b.m
Instrument: fid3b.i
Operator: AR
Report Date: 09/21/2012
Macro: FID:3B091712

ARI ID: VK17LCSW1
Client ID:
Injection: 21-SEP-2012 12:13
Dilution Factor: 1

FID:3B RESULTS

Compound	RT	Shift	Height	Area	Method	Range	Total Area	Conc
Toluene	1.013	-0.010	22057	20454	WATPHG	(Tol-C12)	3796126	188.57
C8	1.231	-0.007	9299	7617	WATPHD	(C12-C24)	14418930	1123.62
C10	2.895	0.006	81010	71403	WATPHM	(C24-C38)	253348	29.96
C12	3.734	0.002	167908	140053	AK102	(C10-C25)	16921219	1082.34 M
C14	4.334	0.001	311501	304472	AK103	(C25-C36)	214307	25.51
C16	4.851	0.004	488316	390028	OR.DIES	(C10-C28)	17017459	951.97 M
C18	5.305	0.004	446903	352496				
C20	5.698	0.003	312514	274800				
C22	6.050	0.001	161437	131740				
C24	6.373	0.000	41793	45294				
C25	6.526	0.000	18317	20393				
C26	6.674	0.003	6763	7638				
C28	6.952	0.003	1993	1435	FUEL OIL	(C10-C24)	16894213	1159.20
C32	7.456	0.003	1661	530				
C34	7.677	-0.007	515	282				
Filter Peak	7.946	0.005	820	227				
C36	7.918	0.016	1400	1840	BUNKERC	(C10-C38)	17147562	3496.08
o-terph	5.394	0.004	1078922	672946	JET-A	(C10-C18)	12841296	891.82
Triacon Surr	7.215	0.000	1060439	673710				

Range Times: NW Diesel(3.783 - 6.423) NW Gas(0.973 - 3.783) NW M.Oil(6.423 - 8.165)
AK102(2.840 - 6.476) AK103(6.476 - 7.952) Jet A(2.840 - 5.351)

Surrogate	Area	Amount	%Rec
o-Terphenyl	672946	40.2	89.3
Triacontane	673710	46.3	102.9

Analyte	RF	Curve Date
o-Terph Surr	16747.9	13-SEP-2012
Triacon Surr	14552.1	13-SEP-2012
Gas	20131.4	14-SEP-2012
Diesel	12832.6	13-SEP-2012
Motor Oil	8456.6	13-SEP-2012
AK102	15633.9	13-SEP-2012
AK103	8399.4	11-AUG-2012
JetA	14399.0	16-FEB-2012
OR Diesel	17876.0	
Bunker C	4904.8	14-SEP-2012
Fuel Oil	14574.0	16-JUN-2012

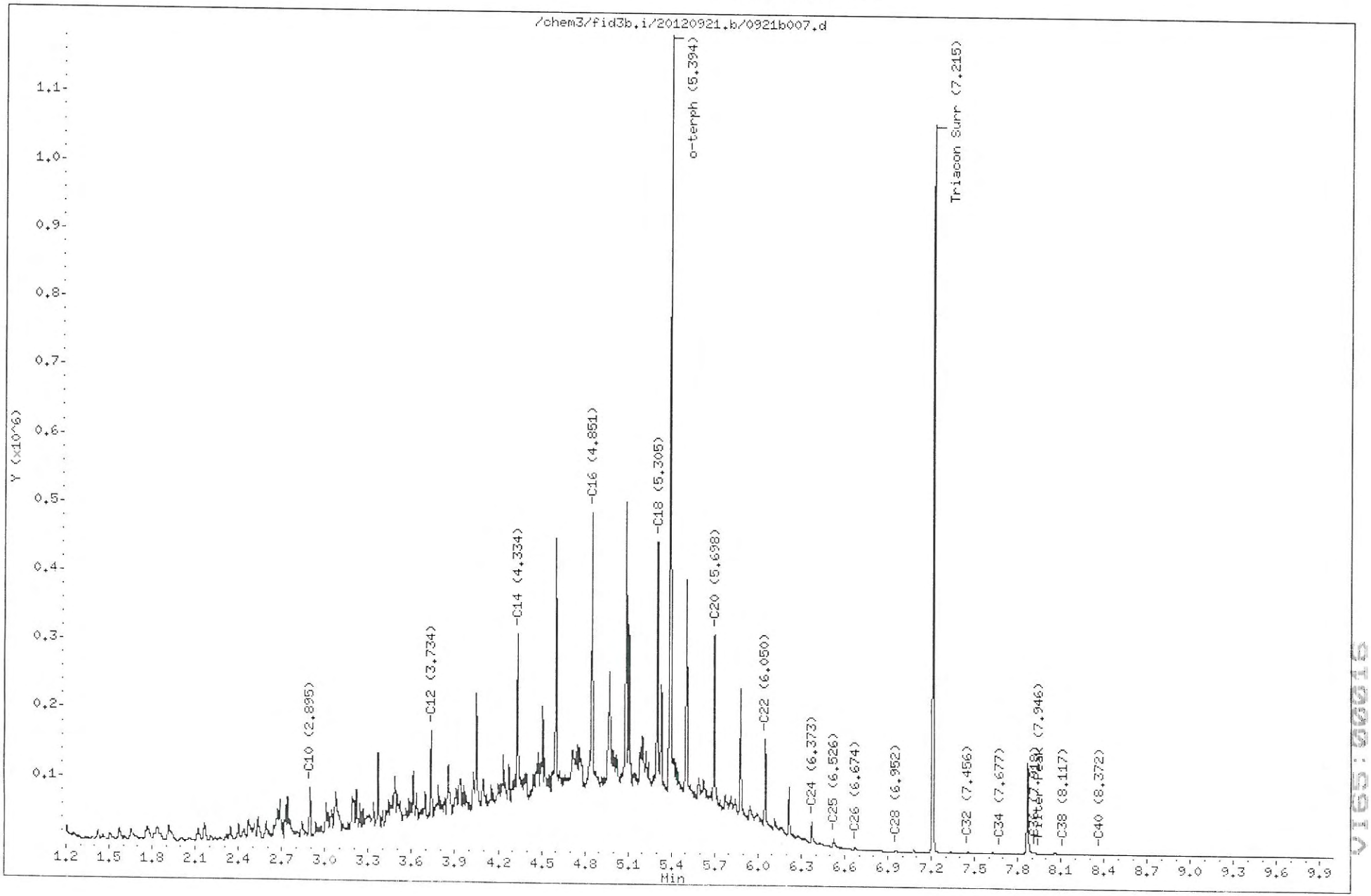
Data File: /chem3/fid3b.i/20120921.b/0921b007.d
Date : 21-SEP-2012 12:13
Client ID:
Sample Info: VK17LCSW1

Column phase: RTX-1

VB 9.21.12

Instrument: fid3b.i

Operator: AR
Column diameter: 0.25



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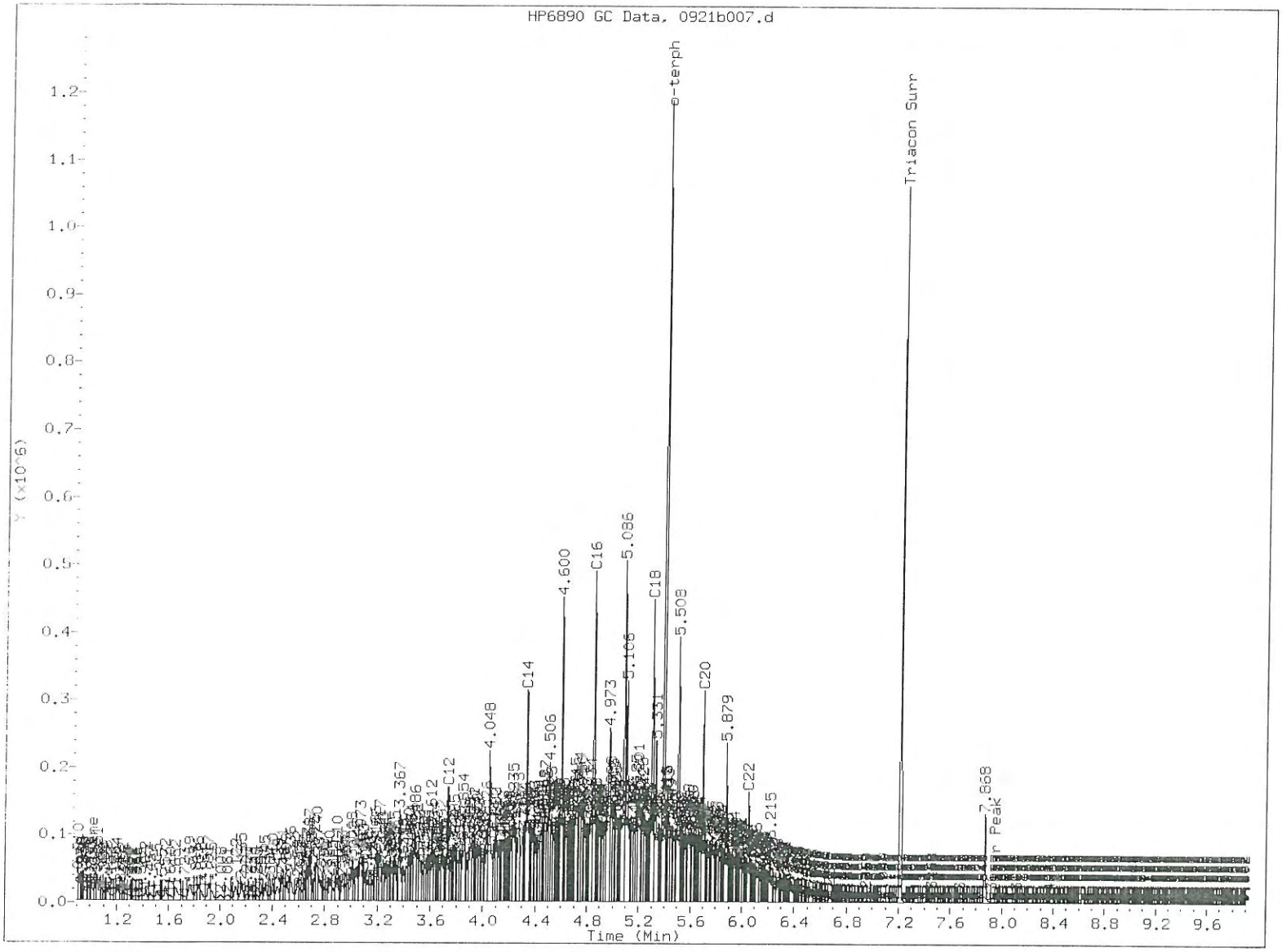


MANUAL INTEGRATION

1. Baseline correction
3. Peak not found
5. Skimmed surrogate

Analyst: VD Date: 9-21-12

Analytical Resources Inc.
TPH Quantitation Report

Data file: /chem3/fid3b.i/20120921.b/0921b009.d
Method: /chem3/fid3b.i/20120921.b/ftphfid3b.m
Instrument: fid3b.i
Operator: AR
Report Date: 09/21/2012
Macro: FID:3B091712

ARI ID: VK17A
Client ID:
Injection: 21-SEP-2012 12:51
Dilution Factor: 1

FID:3B RESULTS

Compound	RT	Shift	Height	Area	Method	Range	Total Area	Conc
Toluene	1.027	0.004	11709	10684	WATPHG	(Tol-C12)	261502	12.99
C8	1.236	-0.002	5262	9238	WATPHD	(C12-C24)	178473	13.91
C10	2.881	-0.009	687	161	WATPHM	(C24-C38)	194073	22.95
C12	3.723	-0.010	1716	2565	AK102	(C10-C25)	262149	16.77
C14	4.336	0.003	422	263	AK103	(C25-C36)	178512	21.25
C16	4.851	0.003	1335	210	OR.DIES	(C10-C28)	280928	15.72
C18	5.302	0.001	1234	482				
C20	5.689	-0.006	2193	1684				
C22	6.047	-0.003	1282	1186				
C24	6.376	0.003	595	448				
C25	6.530	0.004	1724	1449				
C26	6.672	0.001	199	29				
C28	6.942	-0.007	5623	6357	FUEL OIL	(C10-C24)	260107	17.85
C32	7.456	0.003	1896	2091				
C34	7.678	-0.006	1632	1702				
Filter Peak	7.949	0.007	1011	294				
C36	7.918	0.015	1622	1241	BUNKERC	(C10-C38)	454180	92.60
o-terph	5.391	0.001	1011330	622024	JET-A	(C10-C18)	213293	14.81
Triacon Surr	7.215	0.000	924160	639506				

Range Times: NW Diesel(3.783 - 6.423) NW Gas(0.973 - 3.783) NW M.Oil(6.423 - 8.165)
AK102(2.840 - 6.476) AK103(6.476 - 7.952) Jet A(2.840 - 5.351)

Surrogate	Area	Amount	%Rec
o-Terphenyl	622024	37.1	82.5
Triacontane	639506	43.9	97.7

Analyte	RF	Curve Date
o-Terph Surr	16747.9	13-SEP-2012
Triacon Surr	14552.1	13-SEP-2012
Gas	20131.4	14-SEP-2012
Diesel	12832.6	13-SEP-2012
Motor Oil	8456.6	13-SEP-2012
AK102	15633.9	13-SEP-2012
AK103	8399.4	11-AUG-2012
JetA	14399.0	16-FEB-2012
OR Diesel	17876.0	
Bunker C	4904.8	14-SEP-2012
Fuel Oil	14574.0	16-JUN-2012

9-21-12

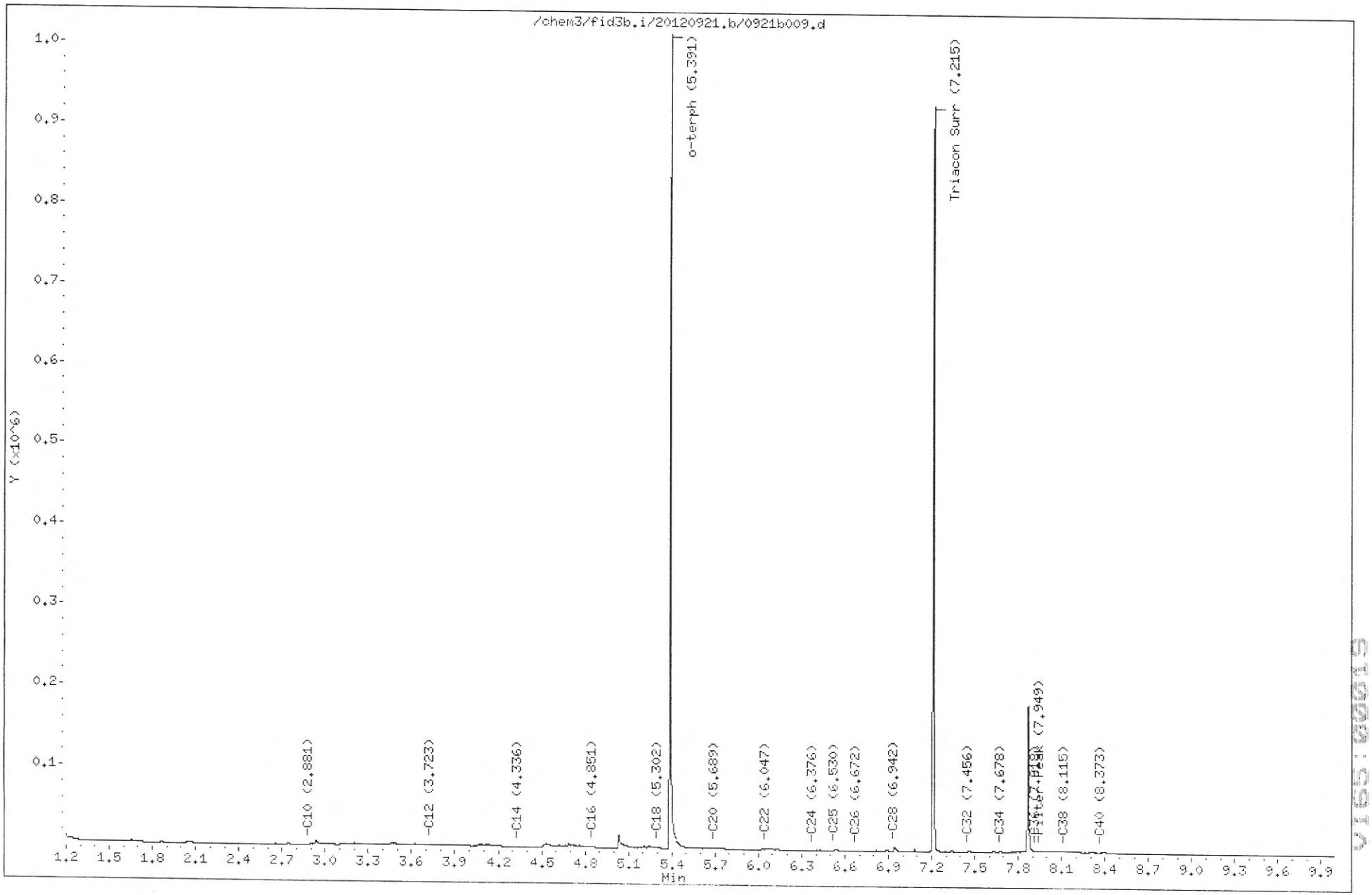
VI65:00018

Data File: /chem3/fid3b.i/20120921.b/0921b009.d
Date : 21-SEP-2012 12:51
Client ID:
Sample Info: VK17A

Instrument: fid3b.i

Operator: AR
Column diameter: 0.25

Column phase: RTX-1



Analytical Resources Inc.
TPH Quantitation Report

Data file: /chem3/fid3b.i/20120921.b/0921b010.d
Method: /chem3/fid3b.i/20120921.b/ftphfid3b.m
Instrument: fid3b.i
Operator: AR
Report Date: 09/21/2012
Macro: FID:3B091712

ARI ID: VK17B
Client ID:
Injection: 21-SEP-2012 13:10
Dilution Factor: 1

FID:3B RESULTS

Compound	RT	Shift	Height	Area	Method	Range	Total Area	Conc
Toluene	1.014	-0.010	22048	19921	WATPHG	(Tol-C12)	499161	24.80
C8	1.233	-0.005	9107	16890	WATPHD	(C12-C24)	178168	13.88
C10	2.892	0.002	1713	863	WATPHM	(C24-C38)	156758	18.54
C12	3.731	-0.002	1663	1074	AK102	(C10-C25)	281475	18.00
C14	4.332	-0.001	832	243	AK103	(C25-C36)	145238	17.29
C16	4.852	0.004	1161	207	OR.DIES	(C10-C28)	290215	16.23
C18	5.301	0.001	1035	585				
C20	5.693	-0.002	1595	1575				
C22	6.047	-0.003	879	564				
C24	6.376	0.003	462	250				
C25	6.535	0.008	1178	1025				
C26	6.669	-0.002	67	7				
C28	6.954	0.005	853	709	FUEL OIL	(C10-C24)	279869	19.20
C32	7.458	0.005	1694	1317				
C34	7.683	-0.001	419	354				
Filter Peak	7.946	0.004	861	170				
C36	7.915	0.012	1504	267	BUNKERC	(C10-C38)	436627	89.02
o-terph	5.391	0.001	973027	605048	JET-A	(C10-C18)	241190	16.75
Triacon Surr	7.215	0.000	940154	623902				

Range Times: NW Diesel(3.783 - 6.423) NW Gas(0.973 - 3.783) NW M.Oil(6.423 - 8.165)
AK102(2.840 - 6.476) AK103(6.476 - 7.952) Jet A(2.840 - 5.351)

Surrogate	Area	Amount	%Rec
o-Terphenyl	605048	36.1	80.3
Triacontane	623902	42.9	95.3

Analyte	RF	Curve Date
o-Terph Surr	16747.9	13-SEP-2012
Triacon Surr	14552.1	13-SEP-2012
Gas	20131.4	14-SEP-2012
Diesel	12832.6	13-SEP-2012
Motor Oil	8456.6	13-SEP-2012
AK102	15633.9	13-SEP-2012
AK103	8399.4	11-AUG-2012
JetA	14399.0	16-FEB-2012
OR Diesel	17876.0	
Bunker C	4904.8	14-SEP-2012
Fuel Oil	14574.0	16-JUN-2012

VTB
9.21.12

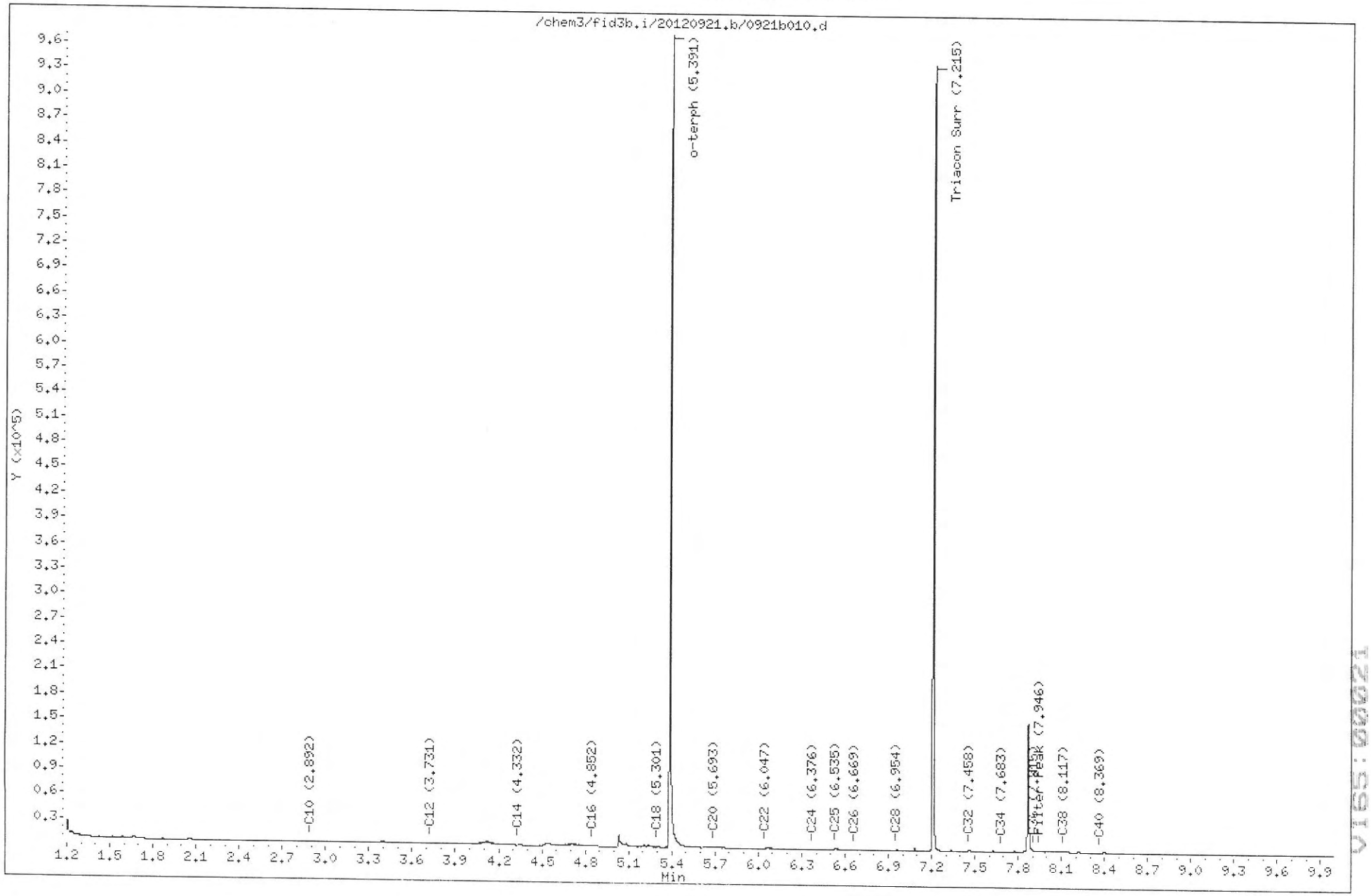
VI65:00020

Data File: /chem3/fid3b.i/20120921.b/0921b010.d
Date : 21-SEP-2012 13:10
Client ID:
Sample Info: VK17B

Instrument: fid3b.i

Operator: AR
Column diameter: 0.25

Column phase: RTX-1



ANALYTICAL RESOURCES INCORPORATED

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS

Sample ID: MW201
SAMPLE

Lab Sample ID: VI65A
LIMS ID: 12-17097
Matrix: Water
Data Release Authorized:
Reported: 09/17/12

QC Report No: VI65-Hart Crowser, Inc
Project: PARCEL 88
17652-00
Date Sampled: 09/07/12
Date Received: 09/07/12

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	µg/L	Q
7470A	09/11/12	7470A	09/17/12	7439-97-6	Mercury	0.1	0.1	U

U-Analyte undetected at given RL
RL-Reporting Limit

~~VI65:00019~~ 9/24/12

ANALYTICAL RESOURCES INCORPORATED

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS
Page 1 of 1

Sample ID: MW201
MATRIX SPIKE

Lab Sample ID: VI65A
LIMS ID: 12-17097
Matrix: Water
Data Release Authorized:
Reported: 09/17/12

QC Report No: VI65-Hart Crowser, Inc
Project: PARCEL 88
17652-00
Date Sampled: 09/07/12
Date Received: 09/07/12

MATRIX SPIKE QUALITY CONTROL REPORT

Analyte	Analysis Method	Sample	Spike	Spike Added	% Recovery	Q
Mercury	7470A	0.1 U	1.1	1.0	110%	

Reported in µg/L

N-Control Limit Not Met
H-% Recovery Not Applicable, Sample Concentration Too High
NA-Not Applicable, Analyte Not Spiked
NR-Not Recovered

Percent Recovery Limits: 75-125%

VI65:00023

VI65:00020 AV 9/24/12

ANALYTICAL RESOURCES INCORPORATED

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS
Page 1 of 1

Sample ID: MW201
DUPLICATE

Lab Sample ID: VI65A
LIMS ID: 12-17097
Matrix: Water
Data Release Authorized:
Reported: 09/17/12

QC Report No: VI65-Hart Crowser, Inc
Project: PARCEL 88
17652-00
Date Sampled: 09/07/12
Date Received: 09/07/12

MATRIX DUPLICATE QUALITY CONTROL REPORT

Analyte	Analysis Method	Sample	Duplicate	RPD	Control Limit	Q
Mercury	7470A	0.1 U	0.1 U	0.0%	+/- 0.1	L

Reported in µg/L

*-Control Limit Not Met
L-RPD Invalid, Limit = Detection Limit

VI65:00624 AV 9/24/12

VI65:00624

ANALYTICAL RESOURCES INCORPORATED

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS
Page 1 of 1

Sample ID: MW202
SAMPLE

Lab Sample ID: VI65B
LIMS ID: 12-17098
Matrix: Water
Data Release Authorized:
Reported: 09/17/12

QC Report No: VI65-Hart Crowser, Inc
Project: PARCEL 88
17652-00
Date Sampled: 09/07/12
Date Received: 09/07/12

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	µg/L	Q
7470A	09/11/12	7470A	09/17/12	7439-97-6	Mercury	0.1	0.1	U

U-Analyte undetected at given RL
RL-Reporting Limit

FORM-I

~~VI65:00022~~ AN 9/24/12

VI65:00025

ANALYTICAL RESOURCES INCORPORATED

INORGANICS ANALYSIS DATA SHEET
DISSOLVED METALS
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Sample ID: MW201
SAMPLE

Lab Sample ID: VI65C
LIMS ID: 12-17099
Matrix: Water
Data Release Authorized:
Reported: 09/17/12

QC Report No: VI65-Hart Crowser, Inc
Project: PARCEL 88
17652-00
Date Sampled: 09/07/12
Date Received: 09/07/12

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	µg/L	Q
200.8	09/11/12	200.8	09/13/12	**7440-38-2**	**Arsenic**	0.5	**0.5**	J
200.8	09/11/12	200.8	09/13/12	7440-43-9	Cadmium	0.1	0.1	U J
200.8	09/11/12	200.8	09/13/12	**7440-47-3**	**Chromium**	1	**2**	J
200.8	09/11/12	200.8	09/13/12	7440-50-8	Copper	0.5	0.5	U J
200.8	09/11/12	200.8	09/13/12	7439-92-1	Lead	0.1	0.1	U J
200.8	09/11/12	200.8	09/13/12	7440-66-6	Zinc	4	4	U J

U-Analyte undetected at given RL
RL-Reporting Limit

A
10/8/12

FORM-I

VI65:00023 AW 9/24/12

VI65:00025

ANALYTICAL RESOURCES INCORPORATED

INORGANICS ANALYSIS DATA SHEET
DISSOLVED METALS
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Sample ID: MW201
DUPLICATE

Lab Sample ID: VI65C
LIMS ID: 12-17099
Matrix: Water
Data Release Authorized:
Reported: 09/17/12

QC Report No: VI65-Hart Crowser, Inc
Project: PARCEL 88
17652-00
Date Sampled: 09/07/12
Date Received: 09/07/12

MATRIX DUPLICATE QUALITY CONTROL REPORT

Analyte	Analysis Method	Sample	Duplicate	RPD	Control Limit	Q
Arsenic	200.8	0.5	0.6	18.2%	+/- 0.5	L
Cadmium	200.8	0.1 U	0.1 U	0.0%	+/- 0.1	L
Chromium	200.8	2	2	0.0%	+/- 1	L
Copper	200.8	0.5 U	0.5 U	0.0%	+/- 0.5	L
Lead	200.8	0.1 U	0.1 U	0.0%	+/- 0.1	L
Zinc	200.8	4 U	4 U	0.0%	+/- 4	L

Reported in µg/L

*-Control Limit Not Met
L-RPD Invalid, Limit = Detection Limit

VI65:00024 AV 9/24/12

VI65:00027

ANALYTICAL RESOURCES INCORPORATED

INORGANICS ANALYSIS DATA SHEET
DISSOLVED METALS
Page 1 of 1

Sample ID: MW201
MATRIX SPIKE

Lab Sample ID: VI65C
LIMS ID: 12-17099
Matrix: Water
Data Release Authorized:
Reported: 09/17/12

QC Report No: VI65-Hart Crowser, Inc
Project: PARCEL 88
17652-00
Date Sampled: 09/07/12
Date Received: 09/07/12

MATRIX SPIKE QUALITY CONTROL REPORT

Analyte	Analysis Method	Sample	Spike	Spike Added	% Recovery	Q
Arsenic	200.8	0.5	24.4	25.0	95.6%	
Cadmium	200.8	0.1 U	23.6	25.0	94.4%	
Chromium	200.8	2	23	25	84.0%	
Copper	200.8	0.5 U	24.3	25.0	97.2%	
Lead	200.8	0.1 U	25.0	25.0	100%	
Zinc	200.8	4 U	73	80	91.2%	

Reported in µg/L

N-Control Limit Not Met
H-% Recovery Not Applicable, Sample Concentration Too High
NA-Not Applicable, Analyte Not Spiked

Percent Recovery Limits: 75-125%

FORM-V

VI65:00025 AW 9/24/12

ANALYTICAL RESOURCES INCORPORATED

INORGANICS ANALYSIS DATA SHEET
DISSOLVED METALS
Page 1 of 1

Sample ID: MW202
SAMPLE

Lab Sample ID: VI65D
LIMS ID: 12-17100
Matrix: Water
Data Release Authorized:
Reported: 09/17/12

QC Report No: VI65-Hart Crowser, Inc
Project: PARCEL 88
17652-00
Date Sampled: 09/07/12
Date Received: 09/07/12

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	µg/L	Q
200.8	09/11/12	200.8	09/13/12	**7440-38-2**	**Arsenic**	0.5	**19.1**	J
200.8	09/11/12	200.8	09/13/12	7440-43-9	Cadmium	0.1	0.1	U J
200.8	09/11/12	200.8	09/13/12	7440-47-3	Chromium	1	1	U J
200.8	09/11/12	200.8	09/13/12	7440-50-8	Copper	0.5	0.5	U J
200.8	09/11/12	200.8	09/13/12	7439-92-1	Lead	0.1	0.1	U J
200.8	09/11/12	200.8	09/13/12	7440-66-6	Zinc	4	4	U J

U-Analyte undetected at given RL
RL-Reporting Limit

A
10/8/12

FORM-I

~~VI65:00026~~ 9/24/12

VI65:00029

ANALYTICAL RESOURCES INCORPORATED

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS
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Sample ID: LAB CONTROL

Lab Sample ID: VI65LCS
LIMS ID: 12-17098
Matrix: Water
Data Release Authorized:
Reported: 09/17/12

QC Report No: VI65-Hart Crowser, Inc
Project: PARCEL 88
17652-00
Date Sampled: NA
Date Received: NA

BLANK SPIKE QUALITY CONTROL REPORT

Analyte	Analysis Method	Spike Found	Spike Added	% Recovery	Q
Mercury	7470A	2.2	2.0	110%	

Reported in µg/L

N-Control limit not met
Control Limits: 80-120%

VI65:00627 AV 9/24/12

VI65:00656

ANALYTICAL RESOURCES INCORPORATED

INORGANICS ANALYSIS DATA SHEET
DISSOLVED METALS

Sample ID: LAB CONTROL

Lab Sample ID: VI65LCS
LIMS ID: 12-17100
Matrix: Water
Data Release Authorized:
Reported: 09/17/12

QC Report No: VI65-Hart Crowser, Inc
Project: PARCEL 88
17652-00
Date Sampled: NA
Date Received: NA

BLANK SPIKE QUALITY CONTROL REPORT

Analyte	Analysis Method	Spike Found	Spike Added	% Recovery	Q
Arsenic	200.8	24.6	25.0	98.4%	
Cadmium	200.8	24.0	25.0	96.0%	
Chromium	200.8	24.3	25.0	97.2%	
Copper	200.8	24.9	25.0	99.6%	
Lead	200.8	24.4	25.0	97.6%	
Zinc	200.8	76	80	95.0%	

Reported in µg/L

N-Control limit not met
Control Limits: 80-120%

~~VI65:00028~~ AV 9/24/12

ANALYTICAL RESOURCES INCORPORATED

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS
Page 1 of 1

Sample ID: METHOD BLANK

Lab Sample ID: VI65MB
LIMS ID: 12-17098
Matrix: Water
Data Release Authorized:
Reported: 09/17/12

QC Report No: VI65-Hart Crowser, Inc
Project: PARCEL 88
17652-00
Date Sampled: NA
Date Received: NA

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	µg/L	Q
7470A	09/11/12	7470A	09/17/12	7439-97-6	Mercury	0.1	0.1	U

U-Analyte undetected at given RL
RL-Reporting Limit

~~VI65:00029~~ AV 9/24/12

VI65:00032

ANALYTICAL RESOURCES INCORPORATED

INORGANICS ANALYSIS DATA SHEET
DISSOLVED METALS

Sample ID: METHOD BLANK

Lab Sample ID: VI65MB
LIMS ID: 12-17100
Matrix: Water
Data Release Authorized:
Reported: 09/17/12

QC Report No: VI65-Hart Crowser, Inc
Project: PARCEL 88
17652-00
Date Sampled: NA
Date Received: NA

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	µg/L	Q
200.8	09/11/12	200.8	09/13/12	7440-38-2	Arsenic	0.2	0.2	U
200.8	09/11/12	200.8	09/13/12	7440-43-9	Cadmium	0.1	0.1	U
200.8	09/11/12	200.8	09/13/12	7440-47-3	Chromium	0.5	0.5	U
200.8	09/11/12	200.8	09/13/12	7440-50-8	Copper	0.5	0.5	U
200.8	09/11/12	200.8	09/13/12	7439-92-1	Lead	0.1	0.1	U
200.8	09/11/12	200.8	09/13/12	7440-66-6	Zinc	4	4	U

U-Analyte undetected at given RL
RL-Reporting Limit

VI65:00030 AV 9/24/12

VI65:00033

Analytical Resources, Incorporated
Analytical Chemists and Consultants

2 waters

HARTCROWSER
Seattle, Edmonds, Vancouver, Portland

October 17, 2012

Mark Dagel
Hart Crowser, Inc.
1700 Westlake Avenue N. Suite 200
Seattle, WA 98109-3256

RE: Client Project: Parcel 88
ARI Job No.: VN00

geotechnical • environmental • natural resources

Dear Mark;

Please find enclosed the original Chain-of-Custody (COC) record, sample receipt documentation, and the final data for samples from the project referenced above. Analytical Resources, Inc. (ARI) received two water samples on October 12, 2012. The samples were received in good condition with a cooler temperature of 2.8 °C.

The samples were analyzed for dissolved metals as requested on the COC.

The percent differences (%Ds) for chromium were slightly high for the CCALs that bracketed the analyses of these samples. Due to the expedited TAT for these samples, no corrective actions were taken.

There were no further anomalies associated with the analyses of these samples.

A copy of this report and all associated raw data will be kept on file at ARI. Should you have any questions regarding these results, please feel free to contact me at your convenience.

Sincerely,

ANALYTICAL RESOURCES, INC.

FOR

Kelly Bottem
Client Services Manager
kellyb@arilabs.com
206/695-6211
Enclosures

cc: eFile VN00

KFB/kb

4611 South 134th Place, Suite 100 • Tukwila WA 98168 • **206-695-6200** • **206-695-6201** fax

Sample Custody Record

Samples Shipped to: AAT

HARTCROWSER

Hart Crowser, Inc.
1700 Westlake Avenue North, Suite 200
Seattle, Washington 98109-6212
Office: 206.324.9530 • **Fax** 206.328.5581

JOB 17652-00 LAB NUMBER

PROJECT NAME Parcel 88

HART CROWSER CONTACT M. Dagel

SAMPLED BY: PRC

LAB NO.	SAMPLE ID	DESCRIPTION	DATE	TIME	MATRIX	Dissolved Metals*	NO. OF CONTAINERS	OBSERVATIONS/COMMENTS/ COMPOSITING INSTRUCTIONS
								VNOO
	MW-201		10/12/12	0835	H_2O	X	1	Field filtered
	MW-202		10/12/12	0905	H_2O	X	1	Field filtered

RELINQUISHED BY	DATE	RECEIVED BY	DATE
SIGNATURE	10/12/12	SIGNATURE A. Volgaardsen	10/12/12
PRINT NAME Phil Crandell	TIME 1030	PRINT NAME	TIME 1030
COMPANY HC		COMPANY ARI	
RELINQUISHED BY	DATE	RECEIVED BY	DATE
SIGNATURE		SIGNATURE	
PRINT NAME	TIME	PRINT NAME	TIME
COMPANY		COMPANY	

SPECIAL SHIPMENT HANDLING OR STORAGE REQUIREMENTS:
*As, Cd, Cr, Cu, Pb and Zn by EPA 200.8

TOTAL NUMBER OF CONTAINERS

SAMPLE RECEIPT INFORMATION
CUSTODY SEALS: ☐YES ☐NO ☐N/A
GOOD CONDITION ☐YES ☐NO
TEMPERATURE
SHIPMENT METHOD: ☐HAND ☐COURIER ☐OVERNIGHT

COOLER NO.: STORAGE LOCATION:

See Lab Work Order No. for Other Contract Requirements

TURNAROUND TIME:
☐ 24 HOURS ☐ 1 WEEK
☒ 48 HOURS ☐STANDARD
☐72 HOURS OTHER

White and Yellow Copies to Lab Pink to Project Manager Lab to Return White Copy to Hart Crowser Gold to Sample Custodian

Analytical Resources, Incorporated
Analytical Chemists and Consultants

Cooler Receipt Form

ARI Client: Hart Crowser | Project Name: Parcel 88

COC No(s): (NA) | Delivered by: Fed-Ex UPS Courier Hand Delivered Other: ____

Assigned ARI Job No: VN00 | Tracking No: (NA)

Preliminary Examination Phase:

Were intact, properly signed and dated custody seals attached to the outside of to cooler?	YES	(NO)
Were custody papers included with the cooler?	(YES)	NO
Were custody papers properly filled out (ink, signed, etc.)	(YES)	NO
Temperature of Cooler(s) (°C) (recommended 2.0-6.0 °C for chemistry) 2.8		

If cooler temperature is out of compliance fill out form 00070F | Temp Gun ID#: 90877952

Cooler Accepted by: AV | Date: 10/12/12 | Time: 1630

Complete custody forms and attach all shipping documents

Log-In Phase:

Was a temperature blank included in the cooler?		YES	(NO)
What kind of packing material was used? ... Bubble Wrap (Wet Ice) Gel Packs Baggies Foam Block Paper Other: ____			
Was sufficient ice used (if appropriate)?	NA	(YES)	NO
Were all bottles sealed in individual plastic bags?		YES	(NO)
Did all bottles arrive in good condition (unbroken)?		(YES)	NO
Were all bottle labels complete and legible?		(YES)	NO
Did the number of containers listed on COC match with the number of containers received?		(YES)	NO
Did all bottle labels and tags agree with custody papers?		(YES)	NO
Were all bottles used correct for the requested analyses?		(YES)	NO
Do any of the analyses (bottles) require preservation? (attach preservation sheet, excluding VOCs)...	NA	(YES)	NO
Were all VOC vials free of air bubbles?	(NA)	YES	NO
Was sufficient amount of sample sent in each bottle?		(YES)	NO
Date VOC Trip Blank was made at ARI	(NA)		

Was Sample Split by ARI : (NA) YES Date/Time: ____ Equipment: ____ Split by: ____

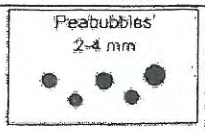
Samples Logged by: TS | Date: 10-12-12 | Time: 1134

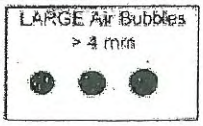
*** Notify Project Manager of discrepancies or concerns ***

Sample ID on Bottle	Sample ID on COC	Sample ID on Bottle	Sample ID on COC

Additional Notes, Discrepancies, & Resolutions:

By: Date:





Small → "sm"
Peabubbles → "pb"
Large → "lg"
Headspace → "hs"

VN00 : 00003

Sample ID Cross Reference Report

ANALYTICAL RESOURCES INCORPORATED

ARI Job No: VN00
Client: Hart Crowser, Inc
Project Event: 17652-00
Project Name: Parcel 88

	Sample ID	ARI Lab ID	ARI LIMS ID	Matrix	Sample Date/Time	VTSR
1.	MW-201	VN00A	12-19804	Water	10/12/12 08:35	10/12/12 10:30
2.	MW-202	VN00B	12-19805	Water	10/12/12 09:05	10/12/12 10:30

Analytical Resources, Incorporated
Analytical Chemists and Consultants

Data Reporting Qualifiers

Effective 2/14/2011

Inorganic Data

U	Indicates that the target analyte was not detected at the reported concentration
*	Duplicate RPD is not within established control limits
B	Reported value is less than the CRDL but ≥ the Reporting Limit
N	Matrix Spike recovery not within established control limits
NA	Not Applicable, analyte not spiked
H	The natural concentration of the spiked element is so much greater than the concentration spiked that an accurate determination of spike recovery is not possible
L	Analyte concentration is ≤5 times the Reporting Limit and the replicate control limit defaults to ±1 RL instead of the normal 20% RPD

Organic Data

U	Indicates that the target analyte was not detected at the reported concentration
*	Flagged value is not within established control limits
B	Analyte detected in an associated Method Blank at a concentration greater than one-half of ARI's Reporting Limit or 5% of the regulatory limit or 5% of the analyte concentration in the sample.
J	Estimated concentration when the value is less than ARI's established reporting limits
D	The spiked compound was not detected due to sample extract dilution
E	Estimated concentration calculated for an analyte response above the valid instrument calibration range. A dilution is required to obtain an accurate quantification of the analyte.
Q	Indicates a detected analyte with an initial or continuing calibration that does not meet established acceptance criteria (<20%RSD, <20%Drift or minimum RRF).

S	Indicates an analyte response that has saturated the detector. The calculated concentration is not valid; a dilution is required to obtain valid quantification of the analyte
NA	The flagged analyte was not analyzed for
NR	Spiked compound recovery is not reported due to chromatographic interference
NS	The flagged analyte was not spiked into the sample
M	Estimated value for an analyte detected and confirmed by an analyst but with low spectral match parameters. This flag is used only for GC-MS analyses
M2	The sample contains PCB congeners that do not match any standard Aroclor pattern. The PCBs are identified and quantified as the Aroclor whose pattern most closely matches that of the sample. The reported value is an estimate.
N	The analysis indicates the presence of an analyte for which there is presumptive evidence to make a "tentative identification"
Y	The analyte is not detected at or above the reported concentration. The reporting limit is raised due to chromatographic interference. The Y flag is equivalent to the U flag with a raised reporting limit.
EMPC	Estimated Maximum Possible Concentration (EMPC) defined in EPA Statement of Work DLM02.2 as a value "calculated for 2,3,7,8-substituted isomers for which the quantitation and /or confirmation ion(s) has signal to noise in excess of 2.5, but does not meet identification criteria" **(Dioxin/Furan analysis only)**
C	The analyte was positively identified on only one of two chromatographic columns. Chromatographic interference prevented a positive identification on the second column
P	The analyte was detected on both chromatographic columns but the quantified values differ by ≥40% RPD with no obvious chromatographic interference
X	Analyte signal includes interference from polychlorinated diphenyl ethers. **(Dioxin/Furan analysis only)**
Z	Analyte signal includes interference from the sample matrix or perfluorokerosene ions. **(Dioxin/Furan analysis only)**

Geotechnical Data

A	The total of all fines fractions. This flag is used to report total fines when only sieve analysis is requested and balances total grain size with sample weight.
F	Samples were frozen prior to particle size determination
SM	Sample matrix was not appropriate for the requested analysis. This normally refers to samples contaminated with an organic product that interferes with the sieving process and/or moisture content, porosity and saturation calculations
SS	Sample did not contain the proportion of "fines" required to perform the pipette portion of the grain size analysis
W	Weight of sample in some pipette aliquots was below the level required for accurate weighting

ANALYTICAL RESOURCES INCORPORATED

INORGANICS ANALYSIS DATA SHEET
DISSOLVED METALS
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Sample ID: MW-201
SAMPLE

Lab Sample ID: VN00A
LIMS ID: 12-19804
Matrix: Water
Data Release Authorized:
Reported: 10/17/12

QC Report No: VN00-Hart Crowser, Inc
Project: Parcel 88
17652-00
Date Sampled: 10/12/12
Date Received: 10/12/12

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	µg/L	Q
200.8	10/15/12	200.8	10/16/12	**7440-38-2**	**Arsenic**	0.5	**0.9**	
200.8	10/15/12	200.8	10/15/12	7440-43-9	Cadmium	0.1	0.1	U
200.8	10/15/12	200.8	10/16/12	**7440-47-3**	**Chromium**	1	**5**	J
200.8	10/15/12	200.8	10/15/12	**7440-50-8**	**Copper**	0.5	**0.5**	
200.8	10/15/12	200.8	10/15/12	7439-92-1	Lead	0.1	0.1	U
200.8	10/15/12	200.8	10/15/12	7440-66-6	Zinc	4	4	U

U-Analyte undetected at given RL
RL-Reporting Limit

ANALYTICAL RESOURCES INCORPORATED

INORGANICS ANALYSIS DATA SHEET
DISSOLVED METALS
Page 1 of 1

Sample ID: MW-201
DUPLICATE

Lab Sample ID: VN00A
LIMS ID: 12-19804
Matrix: Water
Data Release Authorized:
Reported: 10/17/12

QC Report No: VN00-Hart Crowser, Inc
Project: Parcel 88
17652-00
Date Sampled: 10/12/12
Date Received: 10/12/12

MATRIX DUPLICATE QUALITY CONTROL REPORT

Analyte	Analysis Method	Sample	Duplicate	RPD	Control Limit	Q
Arsenic	200.8	0.9	1.0	10.5%	+/- 0.5	L
Cadmium	200.8	0.1 U	0.1 U	0.0%	+/- 0.1	L
Chromium	200.8	5	5	0.0%	+/- 1	L
Copper	200.8	0.5	0.5 U	0.0%	+/- 0.5	L
Lead	200.8	0.1 U	0.1 U	0.0%	+/- 0.1	L
Zinc	200.8	4 U	4 U	0.0%	+/- 4	L

Reported in µg/L

*-Control Limit Not Met
L-RPD Invalid, Limit = Detection Limit

ANALYTICAL RESOURCES INCORPORATED

INORGANICS ANALYSIS DATA SHEET
DISSOLVED METALS
Page 1 of 1

Sample ID: MW-201
MATRIX SPIKE

Lab Sample ID: VN00A
LIMS ID: 12-19804
Matrix: Water
Data Release Authorized:
Reported: 10/17/12

QC Report No: VN00-Hart Crowser, Inc
Project: Parcel 88
17652-00
Date Sampled: 10/12/12
Date Received: 10/12/12

MATRIX SPIKE QUALITY CONTROL REPORT

Analyte	Analysis Method	Sample	Spike	Spike Added	% Recovery	Q
Arsenic	200.8	0.9	28.0	25.0	108%	
Cadmium	200.8	0.1 U	23.6	25.0	94.4%	
Chromium	200.8	5	29	25	96.0%	
Copper	200.8	0.5	24.0	25.0	94.0%	
Lead	200.8	0.1 U	26.2	25.0	105%	
Zinc	200.8	4 U	73	80	91.2%	

Reported in µg/L

N-Control Limit Not Met
H-% Recovery Not Applicable, Sample Concentration Too High
NA-Not Applicable, Analyte Not Spiked

Percent Recovery Limits: 75-125%

ANALYTICAL RESOURCES INCORPORATED

INORGANICS ANALYSIS DATA SHEET
DISSOLVED METALS
Page 1 of 1

Sample ID: MW-202
SAMPLE

Lab Sample ID: VN00B
LIMS ID: 12-19805
Matrix: Water
Data Release Authorized:
Reported: 10/17/12

QC Report No: VN00-Hart Crowser, Inc
Project: Parcel 88
17652-00
Date Sampled: 10/12/12
Date Received: 10/12/12

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	µg/L	Q
200.8	10/15/12	200.8	10/15/12	**7440-38-2**	**Arsenic**	0.2	**17.6**	
200.8	10/15/12	200.8	10/15/12	7440-43-9	Cadmium	0.1	0.1	U
200.8	10/15/12	200.8	10/16/12	7440-47-3	Chromium	1	1	U
200.8	10/15/12	200.8	10/15/12	7440-50-8	Copper	0.5	0.5	U
200.8	10/15/12	200.8	10/15/12	7439-92-1	Lead	0.1	0.1	U
200.8	10/15/12	200.8	10/15/12	7440-66-6	Zinc	4	4	U

U-Analyte undetected at given RL
RL-Reporting Limit

ANALYTICAL RESOURCES INCORPORATED

INORGANICS ANALYSIS DATA SHEET
DISSOLVED METALS
Page 1 of 1

Sample ID: METHOD BLANK

Lab Sample ID: VN00MB
LIMS ID: 12-19805
Matrix: Water
Data Release Authorized:
Reported: 10/17/12

QC Report No: VN00-Hart Crowser, Inc
Project: Parcel 88
17652-00
Date Sampled: NA
Date Received: NA

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	µg/L	Q
200.8	10/15/12	200.8	10/15/12	7440-38-2	Arsenic	0.2	0.2	U
200.8	10/15/12	200.8	10/15/12	7440-43-9	Cadmium	0.1	0.1	U
200.8	10/15/12	200.8	10/15/12	7440-47-3	Chromium	0.5	0.5	U
200.8	10/15/12	200.8	10/15/12	7440-50-8	Copper	0.5	0.5	U
200.8	10/15/12	200.8	10/15/12	7439-92-1	Lead	0.1	0.1	U
200.8	10/15/12	200.8	10/15/12	7440-66-6	Zinc	4	4	U

U-Analyte undetected at given RL
RL-Reporting Limit

ANALYTICAL RESOURCES INCORPORATED

INORGANICS ANALYSIS DATA SHEET
DISSOLVED METALS

Sample ID: LAB CONTROL

Lab Sample ID: VN00LCS
LIMS ID: 12-19805
Matrix: Water
Data Release Authorized:
Reported: 10/17/12

QC Report No: VN00-Hart Crowser, Inc
Project: Parcel 88
17652-00
Date Sampled: NA
Date Received: NA

BLANK SPIKE QUALITY CONTROL REPORT

Analyte	Analysis Method	Spike Found	Spike Added	% Recovery	Q
Arsenic	200.8	25.8	25.0	103%	
Cadmium	200.8	24.1	25.0	96.4%	
Chromium	200.8	24.2	25.0	96.8%	
Copper	200.8	26.8	25.0	107%	
Lead	200.8	26.7	25.0	107%	
Zinc	200.8	83	80	104%	

Reported in µg/L

N-Control limit not met
Control Limits: 80-120%

Analytical Resources, Incorporated
Analytical Chemists and Consultants

December 26, 2012

Mark Dagel
Hart Crowser, Inc.
1700 Westlake Avenue N. Suite 200
Seattle, WA 98109-3256

RE: Client Project: Parcel 88
ARI Job No.: VW93

Dear Mark;

Please find enclosed the original Chain-of-Custody (COC) record, sample receipt documentation, and the final data for samples from the project referenced above. Analytical Resources, Inc. (ARI) received one water sample on December 18, 2012. The samples were received in good condition with a cooler temperature of 5.9 ºC.

The samples were analyzed for TDS, Conductivity and Chloride, as requested on the COC.

There were no anomalies associated with the analyses of these samples.

A copy of this report and all associated raw data will be kept on file at ARI. Should you have any questions regarding these results, please feel free to contact me at your convenience.

Sincerely,

ANALYTICAL RESOURCES, INC.

Kelly Bottem
Client Services Manager
kellyb@arilabs.com
206/695-6211
Enclosures

cc: eFile VW93

KFB/kb

4611 South 134th Place, Suite 100 • Tukwila WA 98168 • **206-695-6200** • **206-695-6201** fax

Chain of Custody Record & Laboratory Analysis Request

ARI Assigned Number: VW93	Turn-around Requested: 48hr	Page: 1 of 1	
ARI Client Company: Hart Crowser	Phone: 206-324-9530	Date: 12/18/12	Ice Present? Y
Client Contact: Mark Dagel		No. of Coolers: 1	Cooler Temps: 5.4
Client Project Name: 17652-00 Parcel 88			
Client Project #: 17652-00	Samplers: PRC		

Analytical Resources, Incorporated
Analytical Chemists and Consultants
4611 South 134th Place, Suite 100
Tukwila, WA 98168
206-695-6200 206-695-6201 (fax)

Sample ID	Date	Time	Matrix	No. Containers	Analysis Requested: Chloride	TDS	Electrical Conductivity						Notes/Comments
MW-202	12/18/12	1020	H_2O	1	X	X	X						

Comments/Special Instructions	Relinquished by: (Signature)	Received by: (Signature)	Relinquished by: (Signature)	Received by: (Signature)
	Printed Name: Phil Cordell	Printed Name: Taylor Streeter	Printed Name:	Printed Name:
	Company: HC	Company: ARI	Company:	Company:
	Date & Time: 12/18/12 1200	Date & Time: 12-18-12 1200	Date & Time:	Date & Time:

Limits of Liability: *ARI will perform all requested services in accordance with appropriate methodology following ARI Standard Operating Procedures and the ARI Quality Assurance Program. This program meets standards for the industry. The total liability of ARI, its officers, agents, employees, or successors, arising out of or in connection with the requested services, shall not exceed the Invoiced amount for said services. The acceptance by the client of a proposal for services by ARI release ARI from any liability in excess thereof, not withstanding any provision to the contrary in any contract, purchase order or co-signed agreement between ARI and the Client.*

Sample Retention Policy: All samples submitted to ARI will be appropriately discarded no sooner than 90 days after receipt or 60 days after submission of hardcopy data, whichever is longer, unless alternate retention schedules have been established by work-order or contract.

Analytical Resources, Incorporated
Analytical Chemists and Consultants

Cooler Receipt Form

ARI Client: Hart crowser

Project Name: _____

COC No(s): _____ NA

Delivered by: Fed-Ex UPS Courier Hand Delivered Other: _____

Assigned ARI Job No: _____

Tracking No: _____ NA

Preliminary Examination Phase:

Were intact, properly signed and dated custody seals attached to the outside of to cooler?	YES	NO
Were custody papers included with the cooler?	YES	NO
Were custody papers properly filled out (ink, signed, etc.)	YES	NO

Temperature of Cooler(s) (°C) (recommended 2.0-6.0 °C for chemistry): 5.4

If cooler temperature is out of compliance fill out form 00070F

Temp Gun ID#: 90877945

Cooler Accepted by: TS Date: 12-18-12 Time: _____

Complete custody forms and attach all shipping documents

Log-In Phase:

Was a temperature blank included in the cooler?		YES	NO
What kind of packing material was used? ... Bubble Wrap Wet Ice Gel Packs Baggies Foam Block Paper Other: _____			
Was sufficient ice used (if appropriate)?	NA	YES	NO
Were all bottles sealed in individual plastic bags?		YES	NO
Did all bottles arrive in good condition (unbroken)?		YES	NO
Were all bottle labels complete and legible?		YES	NO
Did the number of containers listed on COC match with the number of containers received?		YES	NO
Did all bottle labels and tags agree with custody papers?		YES	NO
Were all bottles used correct for the requested analyses?		YES	NO
Do any of the analyses (bottles) require preservation? (attach preservation sheet, excluding VOCs)...	NA	YES	NO
Were all VOC vials free of air bubbles?	NA	YES	NO
Was sufficient amount of sample sent in each bottle?		YES	NO
Date VOC Trip Blank was made at ARI...	NA		

Was Sample Split by ARI : NA YES Date/Time: _____ Equipment: _____ Split by: _____

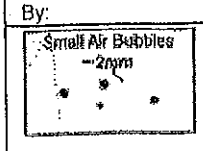
Samples Logged by: TS Date: 12/18/12 Time: 1248

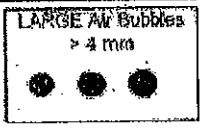
***** Notify Project Manager of discrepancies or concerns *****

Sample ID on Bottle	Sample ID on COC	Sample ID on Bottle	Sample ID on COC

Additional Notes, Discrepancies, & Resolutions:

By: Date:





Small → "sm"
Peabubbles → "pb"
Large → "lg"
Headspace → "hs"

Sample ID Cross Reference Report

ANALYTICAL RESOURCES INCORPORATED

ARI Job No: VW93
Client: Hart Crowser, Inc
Project Event: 17652-00
Project Name: 17652-00 Parcel 88

	Sample ID	ARI Lab ID	ARI LIMS ID	Matrix	Sample Date/Time	VTSR
1.	MW-202	VW93A	12-25085	Water	12/18/12 10:20	12/18/12 12:00

SAMPLE RESULTS-CONVENTIONALS
VW93-Hart Crowser, Inc

ANALYTICAL RESOURCES INCORPORATED

Matrix: Water
Data Release Authorized:
Reported: 12/26/12

Project: 17652-00 Parcel 88
Event: 17652-00
Date Sampled: 12/18/12
Date Received: 12/18/12

Client ID: MW-202
ARI ID: 12-25085 VW93A

Analyte	Date Batch	Method	Units	RL	Sample
Conductivity	12/18/12 121812#1	EPA 120.1	umhos/cm	1.00	1,110
Total Dissolved Solids	12/18/12 121812#1	EPA 160.1	mg/L	10.0	826
Chloride	12/18/12 121812#1	EPA 325.2	mg/L	10.0	63.1

RL Analytical reporting limit
U Undetected at reported detection limit

METHOD BLANK RESULTS-CONVENTIONALS
VW93-Hart Crowser, Inc

ANALYTICAL RESOURCES INCORPORATED

Matrix: Water
Data Release Authorized:
Reported: 12/26/12

Project: 17652-00 Parcel 88
Event: 17652-00
Date Sampled: NA
Date Received: NA

Analyte	Method	Date	Units	Blank	ID
Conductivity	EPA 120.1	12/18/12	umhos/cm	< 1.00 U	
Total Dissolved Solids	EPA 160.1	12/18/12	mg/L	< 5.0 U	
Chloride	EPA 325.2	12/18/12	mg/L	< 1.0 U	FB

FB Filtration Blank

LAB CONTROL RESULTS-CONVENTIONALS
VW93-Hart Crowser, Inc

ANALYTICAL RESOURCES INCORPORATED

Matrix: Water
Data Release Authorized:
Reported: 12/26/12

Project: 17652-00 Parcel 88
Event: 17652-00
Date Sampled: NA
Date Received: NA

Analyte/Method	QC ID	Date	Units	LCS	Spike Added	Recovery
Total Dissolved Solids EPA 160.1	ICVL	12/18/12	mg/L	568	500	113.6%

STANDARD REFERENCE RESULTS-CONVENTIONALS
VW93-Hart Crowser, Inc

ANALYTICAL RESOURCES INCORPORATED

Matrix: Water
Data Release Authorized:
Reported: 12/26/12

Project: 17652-00 Parcel 88
Event: 17652-00
Date Sampled: NA
Date Received: NA

Analyte/SRM ID	Method	Date	Units	SRM	True Value	Recovery
Conductivity Ricca #4110724	EPA 120.1	12/18/12	umhos/cm	993	1,000	99.3%
Chloride ERA #411010	EPA 325.2	12/18/12	mg/L	5.1	5.0	102.0%

REPLICATE RESULTS-CONVENTIONALS
VW93-Hart Crowser, Inc

ANALYTICAL RESOURCES INCORPORATED

Matrix: Water
Data Release Authorized:
Reported: 12/26/12

Project: 17652-00 Parcel 88
Event: 17652-00
Date Sampled: 12/18/12
Date Received: 12/18/12

Analyte	Method	Date	Units	Sample	Replicate(s)	RPD/RSD
ARI ID: VW93A Client ID: MW-202						
Conductivity	EPA 120.1	12/18/12	umhos/cm	1,110	1,120	0.9%
Total Dissolved Solids	EPA 160.1	12/18/12	mg/L	826	829	0.4%
Chloride	EPA 325.2	12/18/12	mg/L	63.1	62.2	1.4%

MS/MSD RESULTS-CONVENTIONALS
VW93-Hart Crowser, Inc

ANALYTICAL RESOURCES INCORPORATED

Matrix: Water
Data Release Authorized:
Reported: 12/26/12

Project: 17652-00 Parcel 88
Event: 17652-00
Date Sampled: 12/18/12
Date Received: 12/18/12

Analyte	Method	Date	Units	Sample	Spike	Spike Added	Recovery
ARI ID: VW93A Client ID: MW-202							
Chloride	EPA 325.2	12/18/12	mg/L	63.1	173	100	109.9%