UNITED STATES AIR FORCE
JOINT BASE ELMENDORF-RICHARDSON
ALASKA

ENVIRONMENTAL RESTORATION PROGRAM

SITE CHARACTERIZATION AND RISK EVALUATION REPORT
CG523 (ST703)

FINAL

JULY 2014

FINAL

SITE CHARACTERIZATION AND RISK EVALUATION REPORT CG523 (ST703)

JOINT BASE ELMENDORF-RICHARDSON, ALASKA

Prepared for
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EXECUTIVE SUMMARY

Site CG523 (ST703) is located in the northern portion of Joint Base Elmendorf-Richardson (JBER) - Elmendorf (JBER-E), Alaska, adjacent to the former location of Building 26282, the Green Lake Cabin (Figure 1-1). Site CG523 is listed in the State of Alaska Contaminated Sites Database as having Hazard Identification Number 2786 and the site status is listed as "Cleanup Complete – Institutional Controls (ICs)." The coordinates for the center of CG523 were determined to be 61.280707° N, -149.836047° W longitude (using Google Earth with aerial photography dated 14 April 2011).

Site CG523 is the former location of an unregulated 1,000-gallon steel underground storage tank (UST) used to store heating oil. The UST and associated piping were removed in July 1997. Petroleum hydrocarbon contamination of soil and groundwater is likely the result of spills and leaks from the tank and associated piping. In 2001, approximately 249 tons of contaminated soils were excavated from CG523. Six confirmation soil samples that were collected from the bottom of the excavation showed that contamination remained at the site. The UST removal and subsequent site investigations showed that fuel hydrocarbons remained in the saturated smear zone of the soil at CG523.

Soil and Groundwater Conditions – CG523 is located on the Elmendorf Moraine in an undeveloped portion of the Base. The site is relatively flat, and the ground surface in the immediate vicinity is vegetated and slopes towards Green Lake. This site's soils consist primarily of gravelly sand with trace silt from the surface to approximately 6 feet below ground surface (bgs). From 6 to 15 feet bgs the soil is typically gravelly, silty, sand. Groundwater fluctuates between 6 and 9 feet bgs and flows south to Green Lake, which is approximately 80 feet downgradient of the former UST.

Previous Investigations

Several environmental site investigations have been conducted at CG523:

- In 1997, during the UST decommissioning, five soil samples from the UST excavation were collected and analyzed. The investigation indicated that a release had occurred, and the confirmation samples showed that contaminated soils remaining in place (USAF, 1998).
- In 1998, seven soil borings were advanced, and two of the borings were completed as downgradient monitoring wells (703WL01 and 703WL02). One to three soil samples were collected from each boring and analyzed for gasoline-range organics (GRO), diesel-range organics (DRO), and benzene, toluene, ethylbenzene, and xylenes (BTEX). Select samples were also analyzed for polycyclic aromatic hydrocarbons (PAH) (USAF, 1999).

- Groundwater samples were collected from the two new monitoring wells and analyzed for GRO, DRO, BTEX, and PAH. All results were below groundwater cleanup levels.
- In 2001, approximately 249 tons of contaminated soils were excavated from CG523. Six confirmation soil samples were collected from the bottom of the excavation and analyzed for GRO, DRO, BTEX, and (USAF, 2002a). Sample results showed contaminated soils remaining in place.
- During the 2006 annual compliance monitoring, a new in-source monitoring well, 703MWIN, was installed at the former UST location. This new well and downgradient well 703WL02 were sampled for analysis of DRO and BTEX. The sample collected from the in-source well 703MWIN was also analyzed for PAH. No constituents were detected above cleanup levels (USAF, 2007). The in-source well 703MWIN was again sampled in 2007 and 2008 for DRO and BTEX. No constituents were detected above method detection limits in the samples (USAF, 2009).
- In 2008, two soil borings were advanced within the source area. Three soil samples were collected from each of two in-source soil borings. The samples were submitted for laboratory analysis for GRO, DRO, and BTEX. Two of the samples were also submitted for laboratory analysis of PAH (USAF, 2009).
- Between 1998 and 2012, groundwater monitoring was conducted at the site.

2013 Investigation - In 2013, additional site investigation work was conducted to fill data gaps and to evaluate potential risks to human health and the environment. The 2013 investigation at CG523 involved drilling 14 new soil borings and analyzing soil samples for GRO, DRO, residual-range organics (RRO), BTEX, PAH, volatile petroleum hydrocarbons (VPH), and extractable petroleum hydrocarbons (EPH). Thirteen laser-induced fluorescence (LIF) borings were drilled to help define the horizontal and vertical extent of petroleum hydrocarbon contamination. Groundwater samples collected from two existing wells and one newly installed well were analyzed for GRO, DRO, RRO, and BTEX. A groundwater sample collected from one other existing well was analyzed for DRO only. Existing wells were sampled as part of the long-term monitoring program at CG523 (groundwater data from previous sampling efforts documented that Title 18 of the Alaska Administrative Code [AAC] Chapter 75 [18 AAC 75] groundwater cleanup levels were met).

Nature and Extent of Contamination – The historical data and the 2013 data were compiled on tables, maps, and a cross-section, and the nature and extent of hydrocarbon contamination was interpreted as follows:

- Historical data at CG523 show diesel fuel releases have resulted in saturated zone contamination over an area approximately 50 feet wide and 100 feet long. Contaminated soils within the vadose zone have largely been removed by way of excavation.

- Fuel has infiltrated to the water table within the source area. The non-aqueous phase liquid (NAPL) is interpreted to have spread laterally on the water table to a width of approximately 50 feet and a length of approximately 100 feet. The NAPL has been smeared through the zone of seasonal water table fluctuation over this footprint area.
- The average and 95 percent (%) upper confidence limit (UCL) DRO concentrations within the NAPL source area are approximately 3,180 milligrams per kilogram (mg/kg) and 6,164 mg/kg, respectively.
- The groundwater sample collected from the newly installed monitoring well located in the NAPL-contaminated soil source area and screened across the water table is below Alaska Department of Environmental Conservation (ADEC) Table C cleanup levels for GRO, DRO, RRO, and BTEX.
- No visible staining of surface soils, odors, or stunted vegetation was noted at the site during the site characterization field investigation. There is no significant surface water runoff or sediment transport from the site to surface water bodies.

Risk Evaluation

Contaminant concentration data, site soil properties, and hydrogeologic conditions were used in the Hydrocarbon Risk Calculator (HRC) spreadsheet tool to evaluate the human health risk posed by the fuel. The risk evaluation was conducted following Alaska Department of Environmental Conservation (ADEC) Method Three guidelines (18 AAC 75.340 and the HRC Implementing Guidance). The risk evaluation conclusions are as follows:

- The carcinogenic cumulative risk and non-carcinogenic cumulative risk posed by the individual indicator compounds meet the ADEC risk standard, assuming a residential land use scenario.
- The risk posed by the GRO, DRO, and RRO aromatic and aliphatic surrogate fractions meets the risk standard for each exposure pathway, assuming a residential land use scenario.
- Existing site conditions meet risk-based migration-to-groundwater cleanup criteria.
- The site meets ADEC qualitative ecological/environmental risk criteria (there was no observed environmental impact from soil staining, impacted vegetation, surface water or sediment runoff). In addition, groundwater from the site meets the TAH and TAqH ambient water quality criteria. The Ecoscoping Form indicates that a more in-depth risk evaluation is not needed and that the CG523 (ST703) site conditions are protective of the environment.

Recommendations

Based on the HRC calculations and compliance with environmental criteria, it is requested that the ADEC grant JBER Site CG523 a "Cleanup Complete" determination. Institutional Controls do not appear to be applicable at this site. Following ADEC concurrence with this conclusion, groundwater monitoring of the site should be terminated and the existing monitoring wells at the site should be decommissioned.

TABLE OF CONTENTS

Section **Page**

EXECUTIVE SUMMARY ES-1

LIST OF ACRONYMS v

TITLE AND APPROVAL PAGE viii

1.0 INTRODUCTION 1-1

1.1 Purpose 1-1
1.2 Organization of Report 1-1

2.0 JBER-ELMENDORF GENERAL SITE DESCRIPTION AND REGULATORY BACKGROUND 2-1

2.1 JBER General Site Conditions 2-1
2.1.1 Location and Description 2-1
2.1.2 Physical Characteristics 2-1
2.1.3 Geology and Soils 2-1
2.1.4 Hydrogeology and Groundwater Use 2-2
2.1.5 Hydrology 2-3
2.2 Regulatory Framework 2-3
2.2.1 Risk Calculations and Cleanup Level Requirements 2-4
2.2.2 Site Characterization Requirements 2-5
2.3 General Model of a Fuel Hydrocarbon Spill 2-7
2.3.1 Spread of NAPL Following a Release 2-7
2.3.2 Identification of the NAPL-Contaminated Soil Source Area 2-9

3.0 PROGRAM FIELD ACTIVITIES, DATA PRESENTATION FORMATS, AND HRC APPROACH 3-1

3.1 Pre-Investigation Activities 3-1
3.2 Program Field Investigation Methods 3-2
3.2.1 Laser-Induced Fluorescence 3-2
3.2.2 Soil Sampling 3-2
3.2.3 Monitoring Well Installation and Development 3-3
3.2.4 Groundwater Sampling 3-4
3.2.5 Surveying 3-4
3.2.6 Waste Handling and Disposal 3-4
3.3 Program Data Presentation and Interpretation Formats 3-5
3.3.1 Screening Levels 3-5
3.3.2 Chemical Analysis and Data Tables 3-5
3.3.3 Site Map 3-10

TABLE OF CONTENTS (CONTINUED)

Section **Page**

3.3.4 Cross Section ... 3-11
3.3.5 Exposure Point Concentrations ... 3-12
3.3.6 Exposure Area ... 3-13
3.4 Human Health Hydrocarbon Risk Calculator Methodology and Approach ... 3-13
3.4.1 Forward and Backward Risk Calculations and Alternative Cleanup Levels ... 3-15
3.4.2 Hydrocarbon Risk Calculator Workbook Layout ... 3-16
3.4.3 Hydrocarbon Risk Calculator Worksheet Layout ... 3-17
3.4.4 General Information on Risk Calculation Results ... 3-18
3.4.5 Uncertainty Analysis ... 3-19
4.0 SITE CHARACTERIZATION RESULTS AND FINDINGS ... 4-1
4.1 Site Physical Characteristics ... 4-1
4.1.1 Geology and Soils ... 4-1
4.1.2 Hydrogeology and Groundwater ... 4-2
4.1.3 Hydrology ... 4-2
4.2 Summary of Previous Investigations ... 4-2
4.2.1 Investigations ... 4-2
4.2.2 Remedial Actions ... 4-3
4.2.3 Data Gaps ... 4-3
4.3 Scope of Work ... 4-4
4.4 Deviations from the Work Plan ... 4-4
4.5 Site Characterization Results ... 4-5
4.5.1 Nature and Extent of Soil Contamination ... 4-5
4.5.2 Nature and Extent of the Groundwater Contamination ... 4-6
4.5.3 Data Quality Evaluation ... 4-6
5.0 RISK EVALUATION ... 5-1
5.1 Site-Specific HRC Input Parameters ... 5-1
5.1.1 Potential Exposure Pathways and Pathways Complete at the Present Time ... 5-1
5.1.2 Soil Exposure Point Concentrations ... 5-2
5.1.3 Groundwater Exposure Point Concentrations ... 5-3
5.1.4 Non-Contaminant HRC Input Parameters ... 5-4
5.1.5 Source Area Soil Properties ... 5-4
5.1.6 Hydrogeologic Conditions ... 5-4
5.1.7 Johnson and Ettinger Vapor Intrusion Model Input Parameters ... 5-4

TABLE OF CONTENTS (CONTINUED)

Section **Page**

5.2 Site-Specific Risk Evaluation Results 5-5
5.3 Environmental / Ecological Risk Evaluation 5-6
6.0 CONCLUSIONS AND RECOMMENDATIONS 6-1
6.1 Conclusions 6-1
6.2 Recommendations 6-2
7.0 REFERENCES 7-1

LIST OF FIGURES

Figure

Figure 1-1 CG523 Location Map
Figure 2-1 CG523 Generalized Geology Map
Figure 4-1 CG523 Site Map
Figure 4-2 CG523 Cross Section A-A'
Figure 5-1a CG523 Q-Q Plot
Figure 5-1b CG523 Box Plot

LIST OF TABLES

Title

Table 2-1 Geotechnical Properties of JBER Soils
Table 2-2 Hydrogeologic Properties of JBER Soils
Table 3-1 Survey Elevation Measurements and Coordinates
Table 4-1 All BTEX, GRO, DRO & RRO Soils Results
Table 4-2 Source Area BTEX, GRO, DRO & RRO Soils Results
Table 4-3 PAH Soils Results
Table 4-4 VPH & EPH Soils Results
Table 4-5 BTEX, GRO, DRO & RRO Groundwater Results
Table 4-6 PAH Groundwater Results
Table 4-7 All VPH & EPH Groundwater Results
Table 5-1 Exposure Pathway Evaluation
Table 5-2 95% UCL Concentrations
Table 5-3 Outlier Test Results
Table 5-4a HRC Input Values and Data Sources, Exposure Point Concentrations
Table 5-4b HRC Input Values and Data Sources, Non-Contaminant Parameters
Table 5-5 Summary of Cumulative Risk Estimates
Table 5-6 Summary Bulk Fuel Hydrocarbon Risks

LIST OF APPENDICES

Appendix A – Field Logs and Data Collection Forms

A-1 Field Logbook
A-2 Soil Boring Logs
A-3 LIF Data Sheets
A-4 Photograph Log
A-5 Groundwater Sampling Data Sheets
A-6 Monitoring Well Installation Log
A-7 Chain of Custody Forms

Appendix B – Laboratory Reports and Data Quality Review (on CD)

B-1 QA/QC Summary Report and Sample Summary Table
B-2 Alaska Department of Environmental Conservation (ADEC) Checklists
B-3 Analytical Laboratory Data Packages
B-4 Geotechnical Analysis

Appendix C – Hydrocarbon Risk Calculator

C-1 Hydrocarbon Risk Calculator Results
C-2 Source Files (included with Appendix B on CD)

Appendix D – ADEC Ecoscoping Checklist

D-1 Ecoscoping Form

LIST OF ACRONYMS

%	percent
°C	degrees Celsius
°F	degrees Fahrenheit
%RE	percent reference emitter
AAC	Alaska Administrative Code
ADEC	Alaska Department of Environmental Conservation
AECOM	AECOM Technology Corporation
AFB	Air Force Base
AFCEC	Air Force Civil Engineer Center
AFID	Air Force Identification
bgs	below ground surface
BTEX	benzene, toluene, ethylbenzene, and xylenes
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
cm/sec	centimeters per second
COPC	contaminant of potential concern
C_{sat}	soil saturation concentration
CSM	conceptual site model
DAF	dilution-attenuation factor
DL	detection limits
DRO	diesel-range organics
EDB	ethylene dibromide
EPA	United States Environmental Protection Agency
EPH	extractable petroleum hydrocarbons
ESF	Environmental Staging Facility
Excel™	Microsoft Excel™
FFA	Federal Facility Agreement
ft/ft	feet per foot
GPS	global positioning system
GRO	gasoline-range organics
HI	hazard index

LIST OF ACRONYMS (CONTINUED)

HRC	Hydrocarbon Risk Calculator
ICs	institutional controls
IDW	investigative-derived waste
JBER	Joint Base Elmendorf-Richardson
JBER-E	JBER-Elmendorf
JBER-R	JBER-Richardson
K_{oc}	organic carbon partitioning coefficient
LIF	laser-induced fluorescence
LOD	level of detection
mg/kg	milligram(s) per kilogram
mg/L	milligram(s) per liter
NAPL	non-aqueous phase liquid
NOAA	National Oceanic and Atmospheric Administration
PAH	polycyclic aromatic hydrocarbon(s)
PBR	Performance-Based Remediation
PID	photoionization detector
PPE	personal protective equipment
ppm	part(s) per million
QA/QC	quality assurance/quality control
Q-Q	quartile-quartile
RRO	residual-range organics
RSL	regional screening level
RTK	real-time kinematic
SIM	selected ion monitoring
TAH	total aromatic hydrocarbon(s)
TAqH	total aqueous hydrocarbon(s)
UCL	upper confidence limit
UFP-QAPP	Uniform Federal Policy-Quality Assurance Project Plan
USAF	United States Air Force
USGS	United States Geological Survey

LIST OF ACRONYMS (CONTINUED)

UST	underground storage tank
UU/UE	unlimited use and unrestricted exposure
VOC	volatile organic compound
VPH	volatile petroleum hydrocarbon(s)
WESTON	Weston Solutions, Inc.

TITLE AND APPROVAL PAGE

Document Name:	CG523 Site Characterization and Risk Evaluation Report
Site Name/Project Name:	Performance-Based Remediation (PBR) for Alaska Group PBR – Joint Base Elmendorf-Richardson (JBER), Alaska
Site Location/Number:	CG523 (ST703)
Contract Number:	FA8903-09-D-8589
Task Order Number:	0016
Lead Organization:	Air Force Civil Engineer Center (AFCEC)
Federal Regulatory Agency:	Not applicable
State Regulatory Agency:	Alaska Department of Environmental Conservation (ADEC)
Site Manager:	Phillip Stallings, Weston Solutions, Inc. (WESTON) 425 G Street, Suite 300, Anchorage, Alaska 99501 907-343-2701 Phillip.Stallings@WestonSolutions.com
Preparation Date:	July 2014

This *CG523 (ST703) Site Characterization and Risk Evaluation Report* was prepared by qualified persons, as required by Title 18 of the Alaska Administrative Code (AAC) Chapter 75 Section 360 (18 AAC 75.360) and defined in 18 AAC 75.380(b)(9)(e). United States Air Force (USAF) and Alaska Department of Environmental Conservation (ADEC) approval of the Final *CG523 (ST703) Site Characterization and Risk Evaluation Report* will be assumed by their email concurrence with responses to comments on the Draft *CG523 (ST703) Site Characterization and Risk Evaluation Report*. No USAF or ADEC signatures will be required on this page.

Reporting Organization's Project Manager:

Signature Phillip Stallings

Phillip Stallings
Weston Solutions, Inc.

1.0 INTRODUCTION

This report presents the results of previous investigations and the 2013 site characterization activities, and evaluates potential risks to human health and the environment at CG523. Site CG523 is located within Joint Base Elmendorf-Richardson (JBER) on the former Elmendorf Air Force Base (JBER-E) adjacent to Anchorage, Alaska (Figure 1-1). Site characterization activities were conducted in 2013 under the *Basewide Uniform Federal Policy-Quality Assurance Project Plan* (UFP-QAPP) (United States Air Force [USAF], 2013a) and the *UFP-QAPP CG523 (ST703) Site Characterization Work Plan* (USAF, 2013b). The *Basewide UFP-QAPP* was approved by the United States Environmental Protection Agency (EPA) and the Alaska Department of Environmental Conservation (ADEC) on April 1, 2013 and April 16, 2013, respectively. The *UFP-QAPP CG523 (ST703) Site Characterization Work Plan* was approved by ADEC on May 20, 2013.

Work was conducted by Weston Solutions, Inc. (WESTON) under the JBER and Clear Air Force Station Performance-Based Remediation (PBR) project. This work has been authorized by the Air Force Civil Engineer Center (AFCEC) under Contract Number FA8903-09-D-8589, Task Order Number 0016. The Air Force's objective for CG523 is to achieve site closure, which is equivalent to the ADEC "Cleanup Complete" determination. To achieve site closure, the site must be suitable for unlimited use and unrestricted exposure (UU/UE), which is equivalent to the ADEC residential use scenario, with all primary exposure pathways complete.

1.1 Purpose

The purpose of this report is to present the results of the 2013 field investigation work, to combine the 2013 data with historical data to characterize the nature and extent of petroleum hydrocarbon contamination at Site CG523, and to evaluate potential risks to human health and the environment at Site CG523. The site characterization and risk evaluation were conducted within the framework of the ADEC's cleanup process (Title 18 of the Alaska Administrative Code [AAC] Chapter 75 Sections 325 to 390 [18 AAC 75.325-390] and 18 AAC 78.600). If 18 AAC 75 Method Two cleanup criteria are exceeded, the risk posed by the in situ contaminants will be evaluated under Method Three or Method Four. In this report, the Hydrocarbon Risk Calculator (HRC) is used under Method Three to assess whether site conditions meet ADEC risk criteria. If risk criteria are met, then a "Cleanup Complete" determination will be requested.

1.2 Organization of Report

This report is one of more than twenty site investigation and risk calculations reports prepared as part of a program being conducted at JBER-E under the PBR in 2013. Each of the reports included in this program need to contain the following: a description of the regulatory framework that guides the work; a conceptual model describing the movement of fuel hydrocarbons through

the soil environment; descriptions of drilling and soil sampling methods, field screening methods, groundwater sampling methods and survey methods; a description of data reduction and presentation formats; and a description of the risk evaluation approach. To facilitate the preparation and review of multiple program reports, the sections of each report that are similar and provide foundation information are presented into Sections 1, 2 and 3; while the site specific field investigation results and risk evaluation results are presented in Sections 4 and 5. If the reader is familiar with environmental regulations, concepts regarding the movement of fuel hydrocarbons through the environment, the field drilling and sampling methods, and the data presentation and risk evaluation methods, then the reader does not need to read Sections 1, 2 and 3. Instead the reader can focus on the Sections 4 and 5 which present the site specific results of the investigations and the results of the risk evaluation. Details regarding the report organization are as follows:

- **Section 1.0 – Introduction –** Presents the purpose of this report and report organization.
- **Section 2.0 – JBER-Elmendorf General Site Description and Regulatory Background** – Presents information on the local climate, general geology, hydrogeology, and hydrology; a site overview; the regulatory framework for investigating and evaluating risk at the site; and a conceptual model describing the movement of fuel hydrocarbons through the soil environment.
- **Section 3.0 – Program Field Activities, Data Presentation Formats, and HRC Approach** – Briefly describes site characterization field methods, data presentation formats and the HRC risk evaluation approach used in the JBER-E program. Note that not all of the JBER-E program investigation methods and data presentation formats were used at every site.
- **Section 4.0 – Site Characterization Results and Findings –** Presents the site-specific geology, hydrology, and hydrogeology; soil and groundwater analytical results from the 2013 field investigation; soil and groundwater results from previous investigations; and interprets results to develop an understanding of the nature of contamination at the site.
- **Section 5.0 – Risk Evaluation –** Documents exposure point concentrations, soils conditions, hydrogeologic conditions, and source area extent data used as input to the risk calculations; and presents the results of the risk calculations. If the risk calculations indicate that the site presents an unacceptable risk, then the exposure pathways and compounds contributing most significantly to risk are identified.
- **Section 6.0 – Conclusions and Recommendations –** Presents the conclusions of the report, including the nature and extent of contaminants and risk evaluation results. If the site has not been adequately characterized, or if unacceptable risk is indicated, this section identifies data gaps and risks preventing site closure and may provide recommendations for further investigation, remediation, and/or institutional controls.

- **Section 7.0 – References –** Presents references used in the preparation of this report.

Figures, tables, and appendices follow Section 7.0.

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2.0 JBER-ELMENDORF GENERAL SITE DESCRIPTION AND REGULATORY BACKGROUND

2.1 JBER General Site Conditions

2.1.1 Location and Description

JBER comprises the former JBER-E and former Fort Richardson (JBER-R), located adjacent to the city of Anchorage, Alaska. As a result of the 2005 Department of Defense Base Realignment and Closure Commission recommendation, the two installations merged to form JBER on 1 October 2010.

JBER is bounded by the Municipality of Anchorage to the south, Knik Arm to the north and west, and primarily undeveloped lands to the east. Most of the surrounding undeveloped land is part of Chugach State Park and the Chugach Mountain Range. The installation encompasses 74,000 acres of land, with elevations ranging from sea level along the Knik Arm shoreline to 3,800 feet above mean sea level in the Chugach Mountains to the south and east.

2.1.2 Physical Characteristics

JBER can be characterized as having a transitional climate between the marine climate zone along the southern coast and the continental climate zone in the interior of Alaska. Average July low and high temperatures are 52 degrees Fahrenheit (°F) and 66°F, and average January low and high temperatures are 11°F and 23°F, as recorded at Ted Stevens Anchorage International Airport for the period of record of 1981–2010 (National Oceanic and Atmospheric Administration [NOAA], 2013). Extreme temperatures during this period have ranged from -38°F to 86°F. Average annual precipitation in the Anchorage area is about 16.6 inches, with a range of 13 to 20 inches (higher precipitation may be expected in higher elevation areas). Most of the precipitation falls from July through September, when the wind is from the southwest. Snowfall averages 66 inches, which is about one-third (5.5 inches) of the total precipitation. The depth of snow on the ground does not normally exceed 24 inches.

2.1.3 Geology and Soils

JBER-E is located within the Susitna Lowlands, a broad lowland area west of the Chugach Mountains (Warhaftig, 1965). A general geologic map depicting the JBER geology excerpted from a larger United States Geological Survey map (USGS, 1972) is provided as Figure 2-1. The southern third of the installation lies on the Anchorage glacio-fluvial outwash plain. The Elmendorf Moraine (a glacial end moraine) crosses the Base from the southwest to the northeast, and ground moraine and glacio-fluvial soils (unconsolidated deposits between bedrock and the earth's surface) cover the northern portion of the Base. The runways and most of the Base facilities lie on the relatively flat outwash plain. The outwash soils consist predominantly of sandy gravels and gravelly sands deposited by streams draining glaciers advancing out of the

Knik and Matanuska valleys about 12,000 years ago. The outwash varies in thickness across JBER-E, but tends to be relatively thin just south of the Elmendorf Moraine and increases to a thickness of up to about 60 feet near Ship Creek. Ship Creek, which flows roughly along the southern margin of JBER-E, has deposited an alluvial fan that overlies the outwash where the creek flows out of the Chugach Mountains to the east; and has eroded or incised into the outwash and deposited alluvial floodplain soils on top of the Bootlegger Cove Formation in its western reaches. The Elmendorf Moraine is a low, hummocky ridge composed of a heterogeneous mixture of sand, gravel, silt, and clay, with cobbles and boulders. The moraine was deposited by the glaciers advancing out of the Knik and Matanuska Valleys. The ground moraine north of the end moraine is dominated by low, rolling hills composed of materials similar to those forming the end moraine, and may be mantled with glacio-fluvial soils. Fine-grained glacio-marine and glacio-lacustrine sediments of the Bootlegger Cove Formation underlie the outwash and the moraine.

The geotechnical properties of several of the primary JBER-E soil types have been characterized during site investigations. Some of the geotechnical data that can influence contaminant fate and transport have been compiled and grouped by soil type in Table 2-1. The data show that the outwash and glacio-fluvial soils have relatively low fines content, high bulk densities, and low moisture contents, while the moraine soils have higher silt and clay contents, and higher moisture contents, along with relatively high bulk densities.

2.1.4 Hydrogeology and Groundwater Use

JBER-E is underlain by two aquifers: a shallow water table aquifer and a deeper, confined aquifer. These aquifers are separated by the Bootlegger Cove Formation, which functions as an aquitard separating the shallow water table aquifer from a deeper, confined aquifer across most of JBER-E. The shallow aquifer is not currently used as a groundwater source on Base. Water use on Base is either supplied from the Ship Creek Dam described in 2.1.5 or from the deep aquifer. There is no communication between shallow and deep aquifers in the area of investigation. All references to groundwater in this document relate to the shallow aquifer, unless otherwise specified. Groundwater flow in the outwash plain is generally toward the south or southwest, while groundwater flow in the moraine areas is more variable, and is best characterized using localized data.

The hydraulic conductivity of JBER-E soils has been measured during many site investigations and some of the data are compiled in Table 2-2. The data show that the outwash soils, the glacio-fluvial soils north of the Elmendorf Moraine, the Ship Creek alluvium, and the Ship Creek alluvial fan have relatively high hydraulic conductivity values, while the moraine has variable but significantly lower hydraulic conductivity values. In general, the Bootlegger Cove Formation may be characterized as having a very low hydraulic conductivity (although there are some interbedded sand layers in the formation).

2.1.5 Hydrology

Surface water bodies on JBER-E include Ship Creek, Six Mile Lake, Six Mile Creek, and several other small lakes north of the Elmendorf Moraine.

Ship Creek flows from the Chugach Mountains to the east of JBER across the southern margin of JBER to Cook Inlet on the west side of the Base. Ship Creek is described as a losing stream where it flows across its alluvial fan at the foot of the mountains (because water from the stream recharges groundwater), and as a gaining stream west of Boniface Road area, where groundwater tends to flow into the stream channel. Ship Creek serves as the main source of drinking water for JBER. Water is taken from the creek at a diversion dam located approximately 10.5 miles upstream from the mouth. A water treatment plant near the dam processes the drinking water.

Six Mile Lake and Six Mile Creek drain much of JBER-E north of the Elmendorf Moraine. Flow in the creek is from east to west, and the creek discharges to the Knik Arm.

2.2 Regulatory Framework

Investigation and remediation activities at JBER are being conducted by the USAF under the Environmental Restoration Program funded by the Environmental Restoration Account.

Elmendorf Air Force Base (AFB) and Fort Richardson were placed on the National Priorities List in 1990 and 1994, respectively. As a result of this listing the USAF, EPA Region 10 and ADEC signed a Federal Facility Agreement (FFA) for Elmendorf AFB in November 1991 and the Army, EPA Region 10 and ADEC signed an FFA for Fort Richardson in December 1994. An FFA sets deadlines, objectives, responsibilities, and procedural framework for cleanup of sites regulated under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). The FFAs ensure that environmental impacts associated with past practices at JBER are investigated and appropriate actions are completed to protect human health and the environment.

Sites where petroleum compounds are the only contaminants are typically excluded from the CERCLA process and are regulated following state requirements. Sites in this category are sometimes referred to as Two-party sites in reference to legal agreements between the State and the Air Force or the State and the Army. Two-party sites are regulated by the ADEC under 18 AAC 75 and 18 AAC 78 and supporting guidance documents. As part of the formation of JBER, USAF assumed the responsibility to continue the cleanup of sites on JBER-R under previous agreements made between ADEC and the Army.

At their core, the ADEC Contaminated Sites Regulations (18 AAC 75) establish risk-based cleanup requirements and a default risk standard for the state. As listed in 18 AAC 75.325(g), the default risk standard is a *"cumulative carcinogenic risk standard of 1 in 100,000"* and a

"*cumulative noncarcinogenic risk standard at a hazard index of one across all pathways.*" As described in 18 AAC 75.325(h), if a full risk assessment is conducted, an alternate risk standard of 10^{-6} to 10^{-4} may be considered (consistent with Title 40 of the Code of Federal Regulations [CFR] Part 300 Subpart E Section 430 [40 CFR 300.430]). The ADEC Contaminated Sites Regulations, *Risk Assessment Procedures Manual* (ADEC, 2011a) and the ADEC *Cumulative Risk Guidance* (ADEC, 2008a) provide information on how to calculate and display the cumulative risk.

2.2.1 Risk Calculations and Cleanup Level Requirements

The regulations outlined in 18 AAC 75.340 allow the responsible party for each site to propose cleanup levels that meet the risk standard, and provide four different methods to assess cleanup levels that comply with the risk standard:

- **Method One** uses site characteristics and a decision matrix (Table A1 or Table A2) to arrive at risk-related cleanup levels for bulk petroleum hydrocarbon fractions (gasoline-range organics [GRO], diesel-range organics [DRO], and residual-range organics [RRO]) in soil.
- **Method Two** involves the use of generic soil cleanup levels for individual compounds (Table B1), generic petroleum hydrocarbon soil cleanup levels (Table B2) and groundwater cleanup levels (Table C), and a cumulative risk calculation. The cumulative risk calculation assesses whether the site meets the risk standard when more than one compound is present at a site and/or when multiple exposure pathways exist.
- **Methods Three and Four** calculate site-specific alternative cleanup levels. Alternative cleanup levels can be calculated using the equations presented in the ADEC's *Cleanup Levels Guidance* (ADEC 2008b), ADEC's online Method Three calculator, the HRC, or a site-specific risk assessment. The ADEC's online Method Three calculator is available at: http://dec.alaska.gov/applications/spar/webcalc/index.htm. The HRC (Version 1.1), a peer-reviewed Microsoft Excel™ (Excel™) spreadsheet model approved by the ADEC as a Method Three and Four tool, is available at: http://www.dec.alaska.gov/spar/csp/guidance/hrc/Hydrocarbon%20Risk%20Calculator.xls.

According to the Contaminated Site Regulations (18 AAC 75), if a site has been adequately characterized and meets these regulatory risk standards under a residential land use scenario (unrestricted use), then the ADEC will issue a written determination that the site has achieved a "Cleanup Complete" status. Thus, the site is considered suitable for UU/UE.

If site conditions do not meet these regulatory risk standards under the residential land use scenario, the site may require cleanup, or be considered suitable for a "Cleanup Complete – Institutional Controls (ICs)" determination from the ADEC. Under a "Cleanup Complete - ICs" determination, *institutional controls* are used to manage the potential risk posed by the

contaminants. Based on the site-specific conditions, a site with a "Cleanup Complete – ICs" designation may be suitable for use under an alternate land use scenario, such as industrial, and/or while contaminants naturally attenuate to risk-based levels.

2.2.2 Site Characterization Requirements

The contaminated site regulations also require a characterization of contaminated sites that generates the information to assess risk and plan site remediation (if remediation is required). Additional site characterization details are presented in the ADEC guidance documents. The site characterization work conducted at this JBER site meets the site characterization requirements, which include the following:

- Characterization of the site soils, geology, and groundwater conditions: including soil stratigraphy; soil textures and bedrock conditions that affect contaminant migration; depth to groundwater; groundwater flow direction and gradient; and hydraulic conductivity of the site soils.
- Delineation of the horizontal and vertical extent of soil contamination in the vadose zone, seasonally saturated zone, and saturated zone.
- Delineation of the extent of groundwater contamination (exceeding risk-based criteria and ambient water quality criteria, if the groundwater discharges to surface water near the site).
- Characterization of the contaminant concentrations in soil and groundwater (and as appropriate in sediment and surface water).

The level of site characterization detail will vary depending on site conditions, but in general the site characterization must be adequate for the purpose of the investigation, which is to characterize risk and plan remediation (if remediation is required). For example, if diesel fuel has reached the zone of seasonal water table fluctuation, then characterizing the groundwater flow regime (e.g. hydraulic conductivity, flow direction and gradient) at the site is relatively important; and in contrast, if the diesel fuel has not reached the zone of seasonal water table fluctuation, then characterizing the groundwater flow regime at the site is much less important and rough estimates of conditions will be adequate to characterize risk (because sensitivity analysis on the migration to groundwater equations, including use of the ADEC default groundwater conditions, shows that vadose zone diesel contamination cannot cause groundwater to exceed risk based criteria).

Target Analytes, Laboratory Methods and Screening Levels/Detection Limits

In the *Cumulative Risk Guidance* (ADEC, 2008a), both an indicator compound and surrogate compound approach are used to assess contamination at hydrocarbon release sites. The basic hydrocarbon analytical suite includes benzene, toluene, ethylbenzene, and xylenes (BTEX) and

16 polycyclic aromatic hydrocarbon (PAH) indicator compounds; as well as GRO, DRO, and RRO (surrogate compounds). In addition, on a case-by-case basis, analyses for fuel additives, metals, and selected volatile organic compounds (VOCs) may be required. For example, it is common to analyze for ethylene dibromide (EDB) and lead at gasoline release sites, and it is standard to analyze for VOCs at waste oil release sites, because other industrial wastes may have been mixed with the waste oil.

The laboratory test methods used were as follows: BTEX concentrations at all spill sites and VOC concentrations at waste oil spill sites were analyzed using Method SW 8260B; PAH concentrations were analyzed using Method SW 8270C selected ion monitoring (SIM); EDB concentrations were analyzed using SW 8011; and GRO, DRO, and RRO concentrations were analyzed by Methods AK101, AK102, and AK103, respectively. In addition, the WESTON team used the Washington State volatile petroleum hydrocarbon (VPH) test method and the extractable petroleum hydrocarbon (EPH) test method to characterize the GRO, DRO, and RRO ranges into smaller aromatic and aliphatic equivalent carbon groups that allow more representative phase partitioning calculations.

In 2012, the ADEC finalized and began to implement its vapor intrusion guidance document. In JBER work plans reviewed by the ADEC before March 2013, laboratory analyses included the basic hydrocarbon suite as described in the *Cumulative Risk Guidance* (ADEC, 2008a). In later work plans, the ADEC required analyses for an expanded suite of hydrocarbon compounds (e.g., hexane, cyclohexane, trimethylbenzenes, and butylbenzenes) in soil and groundwater to address the vapor intrusion route. In the summer of 2013, the ADEC informed the USAF that at sites where field work had not been initiated as of July 8, 2013, the vapor intrusion route must be addressed using soil gas samples, and stated that the expanded suite of soil and groundwater analytes would not be required, but could be used as screening values. Where required, the concentrations of the expanded suite of hydrocarbon compounds in soil and groundwater were analyzed using Method SW 8260B, and the soil gas samples were analyzed using Method TO-15 and/or Method TO-17.

Target detection limits (DLs) for soils are the most conservative (lowest) of the following:

- The migration to groundwater cleanup levels; or
- $1/10^{th}$ of the direct contact cleanup levels; or
- $1/10^{th}$ of the inhalation cleanup levels

As listed in 18 AAC 75 Method Two Table B1 and Table B2 Cleanup Levels for the under 40-inch zone.

Target DLs for groundwater are $1/10^{th}$ of the groundwater cleanup levels listed in 18 AAC 75 Table C. For compounds without ADEC cleanup criteria, the latest version of the EPA Regional

Screening Levels (RSLs) (EPA, 2013) is used. Target DLs and reporting limits are included in Tables 15-1 through 15-7 in Appendix G of the approved *JBER Basewide UFP-QAPP* (USAF, 2013a). Note that the 18 AAC 75 Method Two soil and groundwater cleanup levels are used only to assess target laboratory DLs, and that risk-based cleanup levels commonly exceed 18 AAC 75 Method Two soil and groundwater cleanup levels.

2.3 General Model of a Fuel Hydrocarbon Spill

A conceptual site model forms a framework for collecting, interpreting, and presenting site condition data, and is a required element of a site characterization report. The conceptual model used at hydrocarbon spill sites involves an understanding of how the hydrocarbon non-aqueous phase liquid (NAPL) flows through and is immobilized in the site soils; the partitioning of the hydrocarbon from the NAPL into the dissolved, vapor, and adsorbed phases; and the transport of the vapor and dissolved phases away from the NAPL.

In general, hydrocarbon-contaminated sites may be divided into three primary zones or areas: the NAPL-contaminated soil source area; the downgradient dissolved-phase plume area; and the areas that have not been contacted by NAPL or the dissolved phase plume. The site characterization and risk calculation approach described in this report is directed toward characterizing the nature, extent, and risk posed by discrete contiguous NAPL source areas.

2.3.1 Spread of NAPL Following a Release

When a hydrocarbon release occurs on the surface of unfrozen soils, the fugitive hydrocarbon tends to spread laterally across the ground surface and then infiltrate into the soils. The extent of lateral spread across the ground surface is a function of quantity and rate of hydrocarbon release, and the permeability of the surface.

Similarly, when a hydrocarbon release occurs from a below-grade tank or pipeline, the fuel initially tends to spread in response to a pressure gradient around the leak location and then infiltrates. The infiltrating fuel from the surface spill and subsurface release tends to flow primarily vertically under the influence of gravity through larger air-filled soil pores, although capillary forces may cause some lateral spreading. If a relatively small volume of hydrocarbon is spilled, the hydrocarbon will likely be immobilized in the soil above the water table. If a sufficient quantity of fuel is spilled, the infiltrating fuel reaches the saturated capillary fringe, displaces some water from the saturated soil pores, and tends to migrate laterally as a mound of free product develops near the water table. As the water table rises and falls, the mobile, free product in the vicinity of the water table encounters uncontaminated soil and tends to be smeared or trapped as immobile, residual product.

In only a few years of study, it is likely that product will be trapped or smeared both above and below the zone of water table fluctuation observed in any given year. This is because water

tables vary not only seasonally, but from year to year. At some sites, the releases from several tanks or piping leaks may coalesce into a complex contiguous source area. Gravity drainage and flow of the hydrocarbon NAPL to a point of immobility probably occurs relatively quickly at sites impacted by a discrete spill event (i.e., in a period of weeks or months), but may occur over a period of years at sites with long-term fuel leaks. However, after the long-term leak has been stopped, any mobile hydrocarbon NAPL will likely be immobilized in a period of weeks or months.

At all NAPL spill sites, a portion of the NAPL mass in the subsurface volatilizes into the air-filled soil pores, dissolves into the soil moisture and groundwater, and is adsorbed by the soil solids (primarily the organic carbon) following the phase partitioning relationships. Hydrocarbon phase partitioning describes the movement and redistribution of hydrocarbon molecules between the dissolved, vapor, adsorbed, and NAPL phases. At hydrocarbon concentrations below soil saturation concentration (C_{sat}), all hydrocarbons present in the soil are distributed between the dissolved, vapor, and sorbed phases, and the distribution of hydrocarbon may be referred to as a three-phase problem. At hydrocarbon concentrations above the saturation concentration, nonaqueous-phase hydrocarbon is present in addition to the dissolved, vapor, and sorbed phases, and the distribution of hydrocarbon may be referred to as a four-phase problem. In this report, the terms “oil phase,” “oil,” “free product,” “free phase,” and “NAPL” are used synonymously. The terms “oil,” “free product” and “NAPL” as used in this report do not indicate that the oil phase is mobile. Indeed, most of the NAPL in the soil at a contaminated site is generally held in the soil pores by capillary forces as immobile, residual saturation. Even the oil that collects on the water table surface in monitoring wells often is not mobile in the soil environment at the scale of the NAPL source area (i.e., the oil will not migrate downgradient into previously uncontaminated soils; hence, the NAPL source area will not expand).

The NAPL at hydrocarbon spill sites tends to act as a long-term source of dissolved- and vapor-phase hydrocarbons. The dissolved- and vapor-phase contaminants will tend to migrate away from the NAPL-contaminated soil source area (and the dissolved- and vapor-phase concentrations will decrease away from the source area), but the contaminant center-of-mass will not move appreciably when NAPL is present. Infiltrating precipitation encountering vadose zone hydrocarbon will tend to carry dissolved hydrocarbon toward the water table, where the precipitation containing the dissolved hydrocarbon mixes with the groundwater and is advected downgradient. Similarly, NAPL in the saturated zone will tend to partition directly into the groundwater and the dissolved hydrocarbons will be advected downgradient. Vapor-phase hydrocarbon tends to diffuse toward the ground surface and into the atmosphere and nearby buildings. At some point downgradient of the spill location, the groundwater will discharge to and mix with surface waters (e.g., a lake, a stream, or the ocean). Biodegradation of fuel hydrocarbons will likely occur throughout the contaminated zone (in the vadose zone and in the saturated zone) and limit the extent of migration.

2.3.2 Identification of the NAPL-Contaminated Soil Source Area

As described above, it is desirable to identify the "NAPL-contaminated soil source area," which is defined as the contiguous, three-dimensional volume of soil that contains NAPL. Within the NAPL-contaminated soil source zone, four phases are present. Therefore, fuel hydrocarbons will partition into soil moisture, groundwater, soil gases, and soil organic carbon to establish a local equilibrium with the NAPL, as described by the four-phase equations with Raoult's Law. The risk calculated using the hydrocarbon risk calculator is, in concept, the risk posed by the NAPL-contaminated soil source area. Hydrocarbon concentrations in all phases should be higher within the NAPL-contaminated soil source area than in the surrounding three-phase areas. In addition, the NAPL-contaminated soil source is the likely remediation target if a remedial action is required. Assessment of intrinsic remediation requires an understanding of the extent of the NAPL-contaminated source area.

The NAPL-contaminated soil source area may be identified by compiling and reviewing the existing laboratory test results, boring log callouts of contaminated soils, field screening data (such as photoionization detector [PID] headspace readings of soil samples), groundwater test results, and sampling notes. In addition, the location and depth (or elevation) of the data should be posted on maps or cross sections of the site. The laboratory results and field screening data may then be segregated based on whether the presence of NAPL is indicated.

Indicators of the presence of NAPL include the following:

- DRO soil test results above approximately 10-50 milligrams per kilogram (mg/kg) and GRO soil test results above approximately 200 mg/kg in mineral soils may generally be interpreted to indicate the presence of NAPL. Although DRO NAPL exists at concentrations above about 10-50 mg/kg, this report uses a working definition of the NAPL source area for DRO and GRO source areas as the area above the 18 AAC 75 Table B2 migration to groundwater screening levels of 250 and 300 mg/kg, respectively. For RRO source areas, the working definition of the NAPL-contaminated soil source area is the area with RRO concentrations above 250 mg/kg (although C_{sat} calculations indicate that NAPL is present at much lower concentrations and 18 AAC 75 Table B2 migration to groundwater screening levels are approximately 8,000 mg/kg). This RRO concentration is used to help define the NAPL source area, because at concentrations exceeding about 250 mg/kg, the presence of the RRO significantly affects the partitioning and risk posed by other bulk hydrocarbons and individual compounds present at the site.
- PID head space readings of thousands of parts per million (ppm) at recent gasoline spill sites, hundreds of ppm at recent diesel spill sites and old gasoline spill sites, and tens of ppm at old diesel spill sites likely indicate the presence of NAPL.
- Soil samples that have a hydrocarbon odor.
- Soil samples that are reduced when surrounding samples display oxidized conditions.

- Soil samples that show black or gray staining or an iridescent sheen when saturated.
- Soil samples that fluoresce under ultraviolet light or fluoresce during a laser-induced fluorescence (LIF) survey.
- Observations of free product on the water table in monitoring wells.
- Water sample results above solubility limits; in particular, water samples with DRO concentrations above about 2 to 4 milligrams per liter (mg/L).
- Water samples that have a sheen.

The sample locations that meet or exceed these criteria define the NAPL-contaminated source area. On both maps and cross sections, a boundary may be drawn separating the NAPL-contaminated soils from the soils that do not contain NAPL. Knowledge of the mechanics of migration of NAPL in the vadose zone and near the water table surface, including the fluctuation of the water table, will help identify the NAPL-contaminated soils. Note that soil concentrations within the NAPL-contaminated soil source zone may vary significantly in concentration and that there can be some uncontaminated samples within the NAPL-contaminated soil source zone. Because of this variability, this report does not contour concentration data and does not post hydrocarbon concentrations on site maps. Rather, the report identifies and segregates data based on whether or not it is representative of the NAPL-contaminated soil source area.

In general, most of the NAPL within the NAPL-contaminated soil source area is present as discontinuous blobs, ganglia, and pendular rings; and will not collect on the water table in monitoring wells. The presence of free product in site monitoring wells indicates that NAPL is continuously connected between adjacent soil pores over an area surrounding the monitoring well showing the product. If free product was encountered at a site, the area where free product was observed in monitoring wells should be identified on site maps. In addition, the thickness of NAPL observed was measured and compared to the "Charbeneau thickness" for the soil texture present at the water table. This helps assess whether the oil is mobile at the NAPL source area scale. The Charbeneau thickness is the thickness of oil in a monitoring well that is required to overcome the pore entry pressure of the formation soils, as described in a peer-reviewed article in *Ground Water and Remediation* (Charbeneau, et al; 2000), in American Petroleum Institute Publication 4682 (Charbeneau, et al; 1999), and as described in the Statement of Cooperation paper *Maximum Allowable Concentration, Residual Saturation, and Free Product Mobility* (Geosphere and CH2M Hill; 2006d).

In addition to assessing the extent of the NAPL contaminated soil source area, responsible parties may need to address the 'maximum allowable concentration criteria'. As described in footnote 13 to 18 AAC 75 Table B2, the 'maximum allowable concentration criteria' is the concentration of C6 - C10, C10 - C25, or C25 - C36 petroleum hydrocarbon range in surface and subsurface soil that, if exceeded, indicates an increased potential for hazardous substance

migration or for risk to human health, safety, or welfare, or to the environment; the level of a petroleum hydrocarbon may not remain at a concentration above the maximum allowable concentration unless a responsible person demonstrates that the petroleum hydrocarbon will not migrate and will not pose a significant risk to human health, safety, or welfare, or to the environment." If GRO, DRO or RRO concentrations at a site exceed the maximum allowable concentration, then the responsible party needs to document that the hydrocarbon will not migrate as a separate phase into previously uncontaminated soils, and that the risk criteria are met.

To document that the hydrocarbon will not migrate as a separate phase into previously uncontaminated soils the responsible party can assess if NAPL collects in monitoring wells installed in the contaminated soil source area during periods of sustained low water. If NAPL does not collect in the monitoring wells installed in the soil source area, then the NAPL may be described as being "discontinuous" and may be considered immobile by definition. If NAPL does collect in the monitoring wells installed in the soil source area, then the NAPL may be described as being "continuous" and the thickness may compared to the Charbeneau thickness to help assess if the NAPL is mobile. If the site with hydrocarbon concentrations exceeding the maximum allowable does not contain free product that is mobile at the site scale, then the risk posed by the residual hydrocarbon can be assessed using a risk calculation tool such as the HRC. If the site characterization documents that there is not free product that is mobile at the site scale, and that the site meets the risk standard, then the criteria identified in the regulations have been addressed and the maximum allowable concentrations may be exceeded.

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3.0 PROGRAM FIELD ACTIVITIES, DATA PRESENTATION FORMATS, AND HRC APPROACH

Site characterization field activities commonly included site reconnaissance visits, utility locates, LIF probing, soil boring and sampling, monitoring well installation, groundwater sampling, investigative-derived waste (IDW) disposal, and surveying. **Note that not all field investigation methods were applied at every site.** The general field methods are described below, followed by a description of the data presentation formats and the HRC approach used in the risk calculations. Site specific field activities are described in Section 4.3.

The primary WESTON personnel responsible for sample collection are listed below. All other personnel involved in sample collection worked under the direct supervision of the personnel listed below. All sampling was performed under the direction of qualified personnel.

Name	Project Title/Role	Qualifications/Years of Experience
Moana Leirer	Field Team/ Lead Sampler	B.S., Environmental Science (Geology Emphasis) 8 years of experience
Aaron Mroz	Field Team/ Lead Sampler	B.S., Environmental Science 8 years of experience
Jessica Young	Field Team/ Lead Sampler	B.S., Environmental Science (Microbiology) 8 years of experience
Ashley French	Field Team/ Lead Sampler	B.A., Biological Science 3 years of experience
Jeremy Miner	Site Manager/ Field Sampler	B.S., Environmental Science 10 years of experience

3.1 Pre-Investigation Activities

An initial site visit was performed by WESTON field personnel to identify and mark planned soil boring locations, based on global positioning system (GPS) coordinates and/or swing-ties from existing structures or landmarks. Locations were field-checked against proposed soil boring locations provided in the *UFP-QAPP CG523 (ST703) Site Characterization Work Plan* (USAF, 2013b). Potential hazards and access constraints were assessed and boring and LIF locations were shifted as needed.

A JBER Base Civil Engineer Work Clearance Request (dig permit) was acquired to identify potential current and abandoned underground utilities or pipelines before drilling began.

3.2 Program Field Investigation Methods

3.2.1 Laser-Induced Fluorescence

When LIF technology was implemented, it was used to help identify the horizontal and vertical extent of petroleum hydrocarbon contamination at the site. In practice, a fiber optic cable is used to transmit the laser light from a laser at the ground surface to a window in the tip of the direct push drill rods. As the probe is advanced, soil sliding past the window becomes exposed to ultraviolet light. If contaminants with fluorescent compounds exist in the exposed soil and groundwater media, the compounds will fluoresce. The fluorescence is detected by a sensor in the probe and transmitted back through a fiber optic line to an oscilloscope at the ground surface. The fluorescence is measured by an oscilloscope and quantified as a percentage of the reference emitter (%RE) energy in four different wavelengths. The relative response values may be used qualitatively to characterize the fuel type and degree of weathering. The %RE data is displayed in real time, in graphical and numerical form on a "fluorescence vs. depth" log. The LIF responds only to aromatics present in NAPL in the site soil and groundwater, and provides continuous, real-time data on petroleum contamination at a rate of about one reading per inch of downward push. LIF logs (if applicable) are included in Appendix A.

If the NAPL-contaminated soil source area was delineated by the LIF, confirmation soil sampling was typically conducted. The sampling conducted inside the source area tended to focus on contaminated soils within relatively high %RE areas. The downgradient source extent in the zone of seasonal water table fluctuation (smear zone) was documented by sampling outside the downgradient limit of the smear zone.

3.2.2 Soil Sampling

The 2013 soil borings were drilled by GeoTek Alaska, Inc. using a Geoprobe® 6620 or 8040 direct push drill rig. Soil samples were obtained by driving a stainless steel sample barrel into the soil using hydraulic down-pressure and a drive hammer. Soil cores were collected in a 5 foot-long, 2¼-inch diameter stainless steel sample barrel with a 1⅝-inch inside diameter disposable acetate liner. This method is capable of collecting a continuous soil core (in 5 foot sections) from the surface to the end depth of the boring, and at most drilling locations, continuous coring was conducted. After extruding the acetate liner from the barrel, the liner was cut open and the soils were screened along the length of the recovered soil using a PID; if a sample was collected for laboratory analysis, then the jars used for volatile analyses (GRO, BTEX, VPH, and VOCs) were filled first. A portion of the soil core (typically from near the middle of the core or from a portion of the core with a relatively high initial PID reading) was placed in a plastic bag for PID headspace screening. The PID results from the initial screening along the length of the core were recorded in a column near the center of the log form. The results of the plastic bag head space PID screening, the lab sample number, and the lab analysis methods were listed near the right margin of the log form. Soil boring logs are included in Appendix A.

Continuous logging of soil type and stratigraphy, color, grain size distribution, moisture content, occurrence of groundwater, and visual observations of staining or liquid phase petroleum were recorded in the field on a log form. The soil logs are provided in Appendix A. Soil samples may have been collected in previous investigations (prior to 2013) using soil auger and split-spoon drilling and sampling methods. Excavation samples may also have been collected during underground storage tank (UST) excavations.

In 2013, all samples were assigned a unique identification number in the field, as follows:

- The first two digits identify the sample year;
- The next five alpha-numeric places identify the USAF site name;
- The next four alpha-numeric places (offset by hyphens) identify the soil boring number;
- The next sequence of 2 to 6 numbers (offset by hyphens) identify the depth of the sample in feet; and
- The last digit identifies whether the sample was an original (0) or a duplicate (1).

Soil boring depths were dependent on requirements of the work plan or indications of contamination based on screening results (PID, visual, and olfactory). When contamination was only encountered in the vadose zone, the boring was advanced two "clean" sample intervals (10 feet) below contamination. For contamination in the smear zone, the boring was advanced one "clean" interval (5 feet) below contamination.

Soil borings and LIF probe holes were abandoned by placing 3/8-inch bentonite chips from the bottom of the boring to about one foot below grade and by placing silica sand from about one foot below grade to the ground surface.

3.2.3 Monitoring Well Installation and Development

If NAPL-contaminated soil is present in the zone of seasonal water table fluctuation or within five feet of the water table, then groundwater samples are needed to evaluate the extent of groundwater contamination and to assess groundwater ingestion risk. If groundwater sampling is required, then a minimum of one monitoring well must be representative of the NAPL-contaminated soil source area. If the source area exceeds risk criteria, then the downgradient extent of the area exceeding the risk criteria must be assessed using one or more downgradient monitoring wells (ADEC, 2011b and Geosphere, 2011). Many of the JBER-E sites investigated in 2013 have existing monitoring wells in the source area and downgradient of the source, so relatively few new wells needed to be installed in 2013. When new wells were required, 2-inch diameter polyvinyl chloride casings with 10-foot long, prepack screens spanning the water table were installed (ADEC, 2011b). Monitoring well construction details (if applicable) are presented in Appendix A.

3.2.4 Groundwater Sampling

Groundwater samples may have been collected from one or more source area wells and as needed, from one or more downgradient monitoring wells at most sites. Samples were collected using low flow techniques, which included measuring water quality parameters such as pH, conductivity, temperature, dissolved oxygen, and oxidation-reduction potential, while purging the wells. Monitoring well purging records (if applicable) are presented in Appendix A.

3.2.5 Surveying

The soil boring and LIF probe locations were surveyed by WESTON staff using a survey-grade, real-time kinematic (RTK) GPS. The surveyed boring and LIF locations have approximate sub-inch horizontal and one-inch vertical accuracies. Installed monitoring well locations and top of casing elevations were surveyed by a Licensed Surveyor from TBC, Inc. using a survey-grade RTK GPS with post-processing. Each surveyed monitoring well location has a sub-inch horizontal and 1/8-inch vertical accuracy, which satisfies ADEC location requirements for horizontal accuracy of 1.0 feet and vertical accuracy of 0.01 feet (ADEC, 2011b). The survey coordinates and elevation measurements are provided in Table 3-1.

3.2.6 Waste Handling and Disposal

Waste generated during site characterization activities included general refuse (expended personal protective equipment [PPE], paper towels, plastic bags, and plastic water containers) and IDW (i.e. soil drill cuttings, purge water from well sampling, and wastewater from decontamination activities).

Consistent with the *JBER Basewide UFP-QAPP* (USAF, 2013a), wastes were taken to the JBER Environmental Staging Facility (ESF) located at Building 955 on Warehouse Street near the intersection with Otter Lake Road. Access to the facility is coordinated through the current operations contractor, AECOM Technology Corporation (AECOM). Specific wastes were handled as described below:

- General refuse and expended PPE were disposed of in JBER refuse waste containers at the ESF or in refuse containers at the WESTON job trailer located at the Operable Unit 1 Landfill.
- Soil cuttings generated during drilling were placed into 5-gallon buckets and transported to the ESF. The soil was then transferred to 55-gallon drums that were labeled with the date, project site, borehole number(s), matrix, and contractor point of contact.
- Soil cuttings generated during monitoring well installation activities were shoveled directly into 55-gallon drums and transported to the ESF. These drums were labeled with the date, project site, boring number(s), matrix, and contractor point of contact.

- The investigative sampling results were used to characterize the soil in the drums for appropriate disposal. Grab samples were collected from drums that had no associated analytical results. The soil analytical results were provided to AECOM.
- Decontamination, development, and purge water were collected in 15-gallon containers and transported to the ESF, transferred into open-top 55-gallon drums and labeled. Decontamination water was then batch treated with other IDW water. After treatment, the water was sampled for constituents listed in the JBER water discharge permit and discharged to the storm drain after verifying constituents were below permit requirements.

3.3 Program Data Presentation and Interpretation Formats

Site characterization data are presented in maps, cross sections, tables, and text, using the formats described in this section. The characterization data for each site are presented using similar formats in order to facilitate data presentation and interpretation. The site characterization data are included in Section 4.0 and Section 5.0.

3.3.1 Screening Levels

Soil screening levels at JBER are based on 18 AAC 75 Method Two soil cleanup level tables. Specifically, soil screening levels are the most conservative (lowest) of: the migration to groundwater cleanup levels, or $1/10^{th}$ of the direct contact cleanup levels, or $1/10^{th}$ of the inhalation cleanup levels listed in 18 AAC 75 Method Two Table B1 for the under 40-inch zone, and the most conservative (lowest) of the migration to groundwater, direct contact, and inhalation cleanup levels listed in 18 AAC 75 Method Two Table B2 for the under 40-inch zone. The screening levels for groundwater are $1/10^{th}$ of the groundwater ingestion cleanup levels listed in 18 AAC 75 Table C. If an ADEC cleanup criterion does not exist for a given compound in soil or groundwater, the screening level for that compound is the latest version of the EPA RSL (EPA, 2013).

Screening levels were used to establish DL goals for the laboratory analysis, and the analytical data were compared with project screening levels to assess whether target analytes exceeded the screening levels. Target analytes exceeding the screening levels may be considered contaminants of potential concern (COPCs), and may be included in the risk evaluation for the site. Detections above a screening level may not be an indication of unacceptable risk. Risk evaluation (Section 5.0) identifies potential risks at a site and provides the basis for risk management decisions.

3.3.2 Chemical Analysis and Data Tables

Each site characterization report presents the laboratory analytical chemical results in multiple tables, based on the media (soil or water) and the analytes being reported (e.g., BTEX, GRO, DRO, and RRO, versus PAH, versus VOCs). The tables list the data collected in the most recent

investigation and the data collected in the previous investigations which may still be representative of site conditions and/or useful for documenting the change in concentration through time. These data tables contain information fundamental to the characterization of the nature and extent of contamination, risk evaluation, and assessment of the site status (i.e., "Cleanup Complete," or "Cleanup Complete – ICs").

Typical data tables include:

- **All BTEX, GRO, DRO, and RRO Soils Results** – The site characterization sampling typically generates as many laboratory results for BTEX, GRO, DRO, and RRO as are needed to delineate the extent of the source area and to allow statistical characterization of the source area concentrations. The first chemical data table for each site presents all of the BTEX, GRO, DRO, and RRO collected at the site, and will accordingly include samples collected inside and outside of the source area. The table includes both new data and data collected during previous investigations; the dates associated with the samples allow the reader to discern the new data from the historical data.
- **Source Area BTEX, GRO, DRO, and RRO Soils Results** – The second table contains the BTEX, GRO, DRO, and RRO results that are considered representative of the NAPL-contaminated soil source area. These data are used in the statistical characterization of the source. Note that recent and relatively old (e.g., 10 plus years old) DRO and RRO data may be used to statistically characterize the exposure point concentrations, because these fractions tend to attenuate more slowly than the BTEX and VOC fractions. In contrast, BTEX and VOC compounds intrinsically attenuate over time, and 5-10 plus year old BTEX data may no longer be representative of the source area. The older data may be overly conservative, especially when air-based remediation such as bioventing or soil vapor extraction has occurred. Hence, older BTEX and VOC data should be used with caution when calculating exposure point concentrations (i.e., rely on the more recent BTEX and VOC data rather than on older data when calculating exposure point concentrations). Older GRO data should also be used with caution when calculating exposure point concentrations, because GRO will tend to be intrinsically remediated relatively quickly compared to the DRO and RRO fractions; however, GRO rarely drives risk at diesel and jet fuel spill sites.
- **PAH Soils Results** – Analyses of PAHs are typically conducted on a limited number of samples (e.g., three or four samples) from the more heavily contaminated portions of the NAPL-contaminated soil source area. Analyses of PAHs on samples outside the source area are generally not needed. PAHs tend not to be transported outside of the source area at concentrations exceeding risk-based levels (except for naphthalene in the vapor phase). The GRO, DRO, and RRO concentrations are presented along with the PAH data to allow an assessment of whether or not the PAH is representative of the source (i.e.

whether or not it is from the more heavily contaminated portions of the source area). Maximum PAH concentrations are commonly used as input to the risk calculations, although 95 percent (%) upper confidence limits (UCLs) may be calculated if there are a sufficient number of analyses and detections from source zone samples.

- **VPH and EPH Soils Results** – VPH and EPH analyses are typically conducted on a limited number of samples (e.g., three or four samples) from the more heavily contaminated portions of the NAPL-contaminated soil source area. The data are used to subdivide the GRO, DRO, and RRO concentrations into smaller aromatic and aliphatic equivalent carbon groups in order to allow more representative phase partitioning calculations. The VPH and EPH data are presented in a table that displays the results of intermediate and final characterizations of the aromatic and aliphatic equivalent carbon groups (the spreadsheet that performs the calculations has been reviewed by ADEC). Only the VPH and EPH data from the source area are used to characterize the NAPL; therefore, if VPH and EPH samples from outside the source are analyzed, the results are presented separately from the results that are representative of the source. The central portion of the table with the multi-colored cells performs the calculations that characterize the GRO, DRO, and RRO in aromatic and aliphatic equivalent carbon groups and calculations are described in the lower right portion of the table. The bottom portion of the table provides the aromatic and aliphatic equivalent carbon data, which may be copied and pasted into the HRC.

- **BTEX, GRO, DRO, and RRO Groundwater Results** – If the NAPL-contaminated soils extend to within about five feet of the water table, groundwater samples are typically used to assess groundwater ingestion risk. At least one well should be located in the source area. If groundwater concentrations in the source area exceed risk criteria, one or more wells should be installed downgradient of the source to assess the extent of the dissolved phase plume. When multiple years of groundwater monitoring are available, all of the historical data are typically presented. The most recent data are used to assess risk, while the historical data may be used to assess plume stability and to predict when cleanup levels may be met. If more than one source area well is sampled, the maximum recent groundwater concentrations are used as input to the risk calculations.

- **PAH Groundwater Results** – At least one source area monitoring well at each site (where NAPL has migrated to within about five feet of the water table) has been tested for dissolved phase PAH.

- **VPH and EPH Groundwater Results –** Note that toxicity data are available for the GRO, DRO, and RRO aromatic and aliphatic fractions, but not for total GRO, DRO or RRO. That is, risk is only assessed for the aromatic and aliphatic fractions of the total measurement, while the total GRO, DRO and RRO measurement includes the aromatics, aliphatics and partially degraded polar organic acids and alcohols. At sites where oil has

migrated to the zone of seasonal water table fluctuation, it is common to measure total DRO concentrations above 1.5 mg/L and have DRO aromatic and DRO aliphatic concentrations well below their risk-based levels. The VPH and EPH aromatic and aliphatic equivalent carbon fractions are summed within the GRO and DRO ranges to yield GRO aromatic and GRO aliphatic and DRO aromatic and DRO aliphatic concentrations, which are used as input to the risk calculations.

- **VOC Soil Results** – If soil VOC data (beyond the BTEX compounds) has been collected at the site, that data will be presented and screened for inclusion in the risk calculations. According to the ADEC *Cumulative Risk Guidance* (ADEC, 2008a), compounds that are present at concentrations above $1/10^{th}$ of their soil direct contact or (outdoor air) inhalation cleanup levels listed in Table B1 of 18 AAC 75 are included in the risk calculations, while compounds present at lower concentrations may be screened out.
- **VOC and EDB Groundwater Results** – If groundwater VOC data (beyond the BTEX compounds) have been collected at the site, those data are presented and screened for inclusion in the risk calculations. According to the ADEC *Cumulative Risk Guidance* (ADEC, 2008a), compounds that are present at concentrations above 1/10 of their groundwater ingestion cleanup levels (listed in Table C of 18 AAC 75) are included in the risk calculations, while compounds present at lower concentrations may be screened out. At gasoline spill sites, groundwater samples were tested for EDB and if EDB was detected in groundwater, then EDB became a target analyte in soil.

The data tables use **bold font** for all analyte detections. Two types of cell shading are used: light gray shading is used to indicate BTEX, PAH, and VOC concentrations above the project screening criteria; light yellow shading is used to indicate GRO, DRO, and RRO results interpreted to be within the NAPL-contaminated soil source area. Individual compound concentration results typically are not used to assess if a sample is from the source area, because the compound's C_{sat} may be above what is measured within a source area. According to ADEC *Cumulative Risk Guidance* (ADEC, 2008a), compounds present at concentrations above $1/10^{th}$ of their soil direct contact or (outdoor air) inhalation cleanup levels listed in 18 AAC 75 Table B1, or above $1/10^{th}$ of their groundwater ingestion cleanup levels listed in 18 AAC 75 Table C, are included in the risk calculations, while compounds present at lower concentrations may be screened out. Individual compound results above the Method Two screening criteria are further evaluated using Method Three. Note that BTEX results below the Method Two screening criteria are commonly used as input to the HRC calculator, because the data is included in the phase partitioning calculations.

The 2013 site investigation work typically collected the data required to characterize risk and comply with the regulations. Therefore, not all of the older VOC and PAH data are displayed in

the data tables, and typically the pre-2010 VOC and PAH data is not used to characterize risk. In general, historical data will be used as follows:

- Pre-2010 BTEX source area soil data will be listed in Table 4-1, but not carried forward into Table 4-2 for input into the HRC due to the high natural attention of these compounds. Pre-2010 BTEX groundwater data is shown in Table 4-5, but typically only post-2011 data are carried forward into the HRC.

- In general, pre-2010 source area soil and groundwater PAH and VOC data (not including BTEX) will be listed in tables and carried forward into the HRC only if there are not more recent source area data.

For data collected in 2013, the tables list the measured concentration if the analyte is detected, and report the level of detection (LOD) and the DL if the analyte is not detected. Historical data sets commonly do not contain LOD values, so the data tables list the measured concentration if the analyte was detected, and report the DL if the analyte was not detected. The LOD is the smallest amount or concentration of a substance that must be present in a sample in order to be detected at a high level of confidence (99%). At the LOD, the false negative rate is 1% (a false negative means that the analyte is reported as not being present when it truly is present). The DL is the smallest analyte concentration that can be demonstrated to be different from zero, or a blank concentration at the 99% level of confidence. At DL, the false positive rate is 1% (a false positive means that the analyte is reported as being present when it is not truly present). In addition, data flags are included to help characterize and/or qualify the data. The most common data flags are "U" which indicates the analyte was not detected, and "J" which indicates that the analyte value is an estimated value. The "J" flag is used when compounds are detected at concentrations below the level of quantitation and/or when a quality control parameter is out of range. The "UJ" flag indicates that the analyte was not detected at or above the reported value, but that the reported value is an estimate. The "B" flag is used to indicate that the compound was also detected in a quality control blank sample at a concentration less than five times the blank concentration. If an analyte is not detected, then the result is listed as "<LOD value," followed by the data flag "U," followed by the DL in parenthesis (i.e., <0.01 U [0.005]). Rejected results are not included in the data tables, so the "R" flag is not used in the data tables.

Field duplicate samples were collected on a program basis at a rate of approximately one duplicate per 10 original samples. For each original and duplicate sample pair, only the "best result" is presented in the primary data tables, and the best result is associated with the original sample number (the original and duplicate results are presented in the laboratory data appendix). The presentation of only the best result and the best result selection logic follows the ADEC technical memorandum entitled, *Guidelines for Data Reporting, Data Averaging, and Treatment of Non-Detect Values* (ADEC, 2012a). The "best result" value is the higher of the original or duplicate result if both results are detections; the detected value if one result is a detect and one

result is a non-detect; and the lower of the original or duplicate LOD and DL if both the original and duplicate samples did not detect the analyte. If a compound was analyzed by two different laboratory methods, the best result is the result obtained from the confirmatory method (e.g., naphthalene results from the SW 8270C SIM analysis were selected over the results from the SW 8260B analysis, and EDB results from the SW8011 analysis were selected over the results from the SW 8260B analysis).

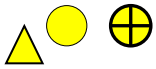
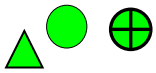
3.3.3 Site Map

The locations of soil borings and monitoring wells and the horizontal extent of the NAPL-contaminated soil source area are shown on a site map (Figure 4-1). Additional maps and/or cross-sections may be used on a site-specific basis to display site details. Information from boring logs including GRO, DRO, and RRO data, screening data, and soil descriptions have been used to identify the NAPL-contaminated soil source area using color-coded symbols on the map and cross-section. The NAPL-contaminated soil source area may be defined as the three-dimensional volume of soil that contains NAPL and has GRO, DRO, and/or RRO concentrations exceeding migration to groundwater criteria (18 AAC 75 Table B2). Additional information regarding the identification of the NAPL contaminated soil source zone is presented in Section 2.3.2.

On the site maps, LIF probe locations are shown using triangular symbols; soil borings are shown using circular symbols; and monitoring wells are shown using cross-hair symbols. Soil borings, LIF, and monitoring well locations interpreted to have NAPL contamination in the vadose zone have a yellow center. Locations interpreted as not having NAPL contamination in the vadose zone have a green center. Locations interpreted to contain NAPL contamination in the zone of seasonal water table fluctuation zone are identified with a red ring around the map symbol. Locations interpreted as not having NAPL contamination in the zone of seasonal water table fluctuation are identified with a blue ring around the map symbol. Not all of these symbols and/or colors are used in every site map.

The color coding is intended to allow visualization of the extent of vadose zone contamination (where NAPL was likely spilled and migrated toward the water table) and visualization of the extent of contamination in the zone of seasonal water table fluctuation (where NAPL spread on the water table and is smeared through the zone of seasonal water table fluctuation). The extent of vadose zone and smear zone contaminations are shown on the site map using dashed yellow and dashed red lines, respectively. In general, the dashed yellow line encompasses the sample locations showing vadose zone contamination and excludes the areas interpreted to be uncontaminated; (note that there can be uncontaminated samples collected within a NAPL-contaminated soil source area). Similarly, the dashed red line encompasses the sample locations showing smear zone contamination and excludes the areas interpreted to be uncontaminated.

Sample Map Legend

Symbols	Description
	Yellow centers for LIF probe, soil boring and monitoring well symbols where vadose zone soils are interpreted to contain NAPL
	Green centers for LIF probe, soil boring and monitoring well symbols where vadose zone soils are interpreted to not contain NAPL
	Red triangles or rings around LIF probe, soil boring and monitoring well symbols where saturated zone soils are interpreted to contain NAPL
	Blue triangles or rings around LIF probe, soil boring and monitoring well symbols where saturated zone soils are interpreted to not contain NAPL

3.3.4 Cross Section

A cross section is used at a site to help show the vertical distribution of the NAPL-contaminated soil source area in the approximate direction of groundwater flow. The cross section is a graphical data presentation tool and is not drawn to a precise scale (e.g., where several borings are close together, the distance between drawings may be exaggerated so that the data may be legibly displayed). The cross section shows soil borings and monitoring wells, and may also show excavation samples and LIF probes if they are present in the cross section line. The boring, monitoring well, and LIF probe numbers are shown immediately above the boring well or probe. Discrete soil samples from the borings and monitoring wells are shown as shaded boxes with laboratory DRO and/or GRO concentrations [in (mg/kg)] to the left of the sample location, and PID plastic bag headspace results in ppm shown to the right of the sample location. The laboratory concentrations and PID results are color-coded: yellow and green highlighting indicate vadose zone samples with and without NAPL contamination, respectively, and red and blue highlights indicate samples from the seasonally saturated zone with and without NAPL contamination, respectively. If continuous soil samples were collected and the soil core was continuously screened with a PID, then the boring or monitoring well axis will be highlighted using the same color-coding as used for individual samples.

LIF probes shown on the cross section are also color-coded using the same color coding as used for individual samples and, in general, LIF values greater than 1%RE on Channel 1 or 2%RE on Channels 2 through 4, are interpreted to indicate the presence of NAPL. The peak LIF %RE values in zones indicating the presence of NAPL may be entered on the probe axis. The color-coding is intended to allow visualization of the extent of vadose zone contamination (where NAPL was likely spilled and migrated toward the water table) and visualization of the extent of contamination in the zone of seasonal water table fluctuation (where NAPL spread on the water table and has been smeared through the zone of seasonal water table fluctuation). The extent of

vadose zone and smear zone contaminations are shown on the cross section using dashed red lines. In general, the dashed red line encompasses the sample locations showing NAPL contamination and excludes the areas interpreted to be uncontaminated (note that there can be uncontaminated samples collected within an NAPL-contaminated soil source area). The cross sections also typically display the water table and the direction of groundwater flow.

Groundwater results may also be posted in text boxes on the site map and/or cross section, and the data may be color coded to indicate if the result is indicative of the presence of NAPL based on groundwater result relative to the solubility of the compound or fraction.

3.3.5 Exposure Point Concentrations

Exposure point concentrations are the chemical concentrations that a receptor might be exposed to and are used as input to the risk calculations. Exposure point concentrations need to balance the desire to protect human health and the environment with the need to accurately represent site conditions. Consistent with the description in the EPA document *Calculating Upper Confidence Limits for Exposure Point Concentrations at Hazardous Waste Sites* (EPA, 2002), and as explicitly stated in the ADEC Technical Memorandum 01-004 (ADEC, 2003), "the arithmetic average concentration measured in a representative group of samples collected from the exposure area is generally considered the most appropriate and representative value for use as the concentration term in environmental risk assessment." The EPA and ADEC also point out that: (1) the arithmetic average concentration of a relatively small group of samples is only an estimate of the true mean, and (2) to protect human health, the 95% UCLs of the mean should be used to conservatively represent the mean concentration. Therefore, to assess human health risk, the soil concentrations used as input to human health risk calculations should typically be the 95% UCLs of a representative data set that has been collected from within the exposure area. In a representative data set, the sample locations should be randomly selected (or the results of a biased sampling plan should be appropriately stratified or grouped), and the sample population should be large enough to characterize the site. Alternatively, the highest DRO, GRO, BTEX, and PAH concentrations measured at a site may be used in place of the 95% UCL of the mean (if the highest DRO, GRO, BTEX and PAH concentrations do not indicate unacceptable risk; however, if the highest measured values suggest unacceptable risk, and there is data available to calculate a 95% UCL, then 95% UCL values should be calculated). In general, as the number of samples in a sample set increases, the 95% UCL value will tend to approach the mean or average concentration of the sample set. Note that most existing contaminated site data sets are likely biased high, because it is common to field-screen samples (visual, olfactory, and PID screening) and to analyze the most heavily contaminated samples. The use of a biased-high data set makes the risk calculations conservative.

ADEC will accept correctly calculated 95% UCLs developed using the EPA ProUCL statistics calculator. The ProUCL software is available at no cost from the EPA web site at

http://www.epa.gov/osp/hstl/tsc/software.htm#Download. The EPA ProUCL calculator assesses the data distribution and automatically selects the most appropriate method of calculating the 95% UCL. If an analyte was not detected, the median DL of the source area samples may be used as the exposure point concentration.

Maximum groundwater concentrations from recent source area monitoring well(s) data set are typically used as the groundwater exposure point concentrations, in accordance with ADEC guidance documents. For non-detect results, the DL may be used in the risk calculations. However, for the carcinogenic PAH in general, and for benzo(a)pyrene and dibenz(a,h)anthracene in particular, typical groundwater DLs can be close to or above the groundwater ingestion risk-based concentrations. In these situations, the risk calculated by using the groundwater DL as input to the risk calculations can be a significant portion of or can exceed the allowable risk level. An optional approach to assess the groundwater concentrations of the non-detect PAH is to calculate or model the groundwater concentrations using the phase partitioning equations with Raoult's Law and the soil PAH, GRO, DRO, and RRO concentrations, and to then apply the site dilution-attenuation factor (DAF). This approach is technically correct, and typically documents that dissolved PAH concentrations may be or must be orders of magnitude below the groundwater DL.

3.3.6 Exposure Area

In this document, the exposure area is interpreted to be the NAPL-contaminated soil source area. Hence, all samples from within the NAPL-contaminated soil source area that are representative of the site conditions at the time that risk is assessed should be used to calculate the source area exposure point concentrations. For BTEX, GRO, DRO, and RRO, the data in Table 4-2 are used in the exposure point concentration calculations (which are preferably the 95% UCLs). If there are too few PAH measurements to allow 95% UCL calculations, then maximum detected concentrations from within the source area may be used as the exposure point concentration. If a BTEX or PAH compound was not detected, then, with concurrence from the ADEC, the median DL of samples collected within the NAPL source area may be used as the exposure point concentration.

3.4 Human Health Hydrocarbon Risk Calculator Methodology and Approach

If soil or groundwater contaminant concentrations encountered at a site exceed ADEC Method One or Two cleanup levels, then the human health risk posed by the site contaminants are assessed under ADEC Method Three using the HRC.

The HRC is an Excel™ spreadsheet model developed to assess the human health risks associated with petroleum hydrocarbon-contaminated sites. The site characterization and risk calculation approaches described in this report are geared toward characterizing the nature, extent, and risk posed by discrete, contiguous, NAPL source areas (and not toward the statistical characterization

of a large area or industrial zone containing multiple sources). The HRC follows ADEC Method Three guidelines, including but not limited to the following: *18 AAC 75 Oil and Other Hazardous Substances Pollution Control* (ADEC, 2012b), *18 AAC 78 Underground Storage Tanks* (ADEC, 2012c) *Cleanup Levels Guidance* (ADEC, 2008b), *Cumulative Risk Guidance* (ADEC, 2008a), *Risk Assessment Procedures Manual* (ADEC, 2011a), *Guidelines For Data Reporting, Data Averaging and Treatment of Non-Detect Values* (ADEC, 2012a), *Vapor Intrusion Guidance for Contaminated Sites* (ADEC, 2012d), *Implementing Guidance for the Method 3 Hydrocarbon Risk Calculator* (ADEC, 2011c), and *Draft Field Sampling Guidance* (ADEC, 2010a).

The HRC includes the following:

- Forward calculation of carcinogenic and non-carcinogenic human health risk for the following exposure routes:

  Soil direct contact (ingestion and dermal adsorption)

  Migration to outdoor air

  Vapor intrusion or migration to indoor air

  Migration to groundwater

  Groundwater ingestion

- The calculator uses the ADEC default exposure parameters and toxicity data as listed in the ADEC *Cleanup Levels Guidance* (ADEC, 2008b).
- The calculator may be used iteratively to estimate risk-based alternative cleanup levels.
- The calculator uses both an indicator compound approach, in which the risks presented by individual compounds are calculated for each pathway, and a surrogate compound approach, in which the risks presented by GRO, DRO, and RRO aromatic and aliphatic fractions are calculated for each pathway.
- The calculator presents a "potential cumulative risk calculation," assuming that all exposure pathways are complete, and a "current cumulative risk calculation" for the pathways complete at the present time for both residential and industrial exposure scenarios. The cumulative carcinogenic and cumulative non-carcinogenic risks are calculated for the individual compounds (following ADEC guidance documents); the risk associated with GRO, DRO, and RRO aromatics and aliphatics are not included in the cumulative risk calculations.
- The calculator applies either three-phase or four-phase partitioning equations, depending on whether NAPL is present. Where NAPL is present, four-phase partitioning and Raoult's Law are used to calculate the vapor pressure and effective solubility of the hydrocarbon constituents. The vapor and dissolved phase concentrations may

subsequently be used in the calculation of risk associated with the outdoor and indoor inhalation pathways and leaching in the migration to groundwater pathway.

- The calculator uses the Johnson and Ettinger model as implemented by the EPA (EPA, 2004) to characterize risk associated with the vapor intrusion (migration-to-indoor-air) route. Risks associated with the vapor intrusion pathway may be calculated from measured soil, groundwater, or vapor concentrations.
- The calculator uses a DAF that accounts for the presence of contaminated soil in either the vadose zone or saturated zone and adjusts the migration-to-groundwater risks accordingly.
- The calculator assesses whether the subject site meets the human health risk and migration-to-groundwater closeout criteria contained in the ADEC regulations (18 AAC 75), and provides a characterization of limitations on the placement of soil excavated and transported from the subject site.
- The HRC is a peer-reviewed model approved by ADEC as an alternative to the ADEC online Method Three calculator.

3.4.1 Forward and Backward Risk Calculations and Alternative Cleanup Levels

Human health risk calculations combine phase partitioning equations, fate and transport equations, and human exposure equations to calculate risk and/or cleanup levels. Two general types of calculations are possible: forward calculations and backward calculations. Forward calculations assess the risk caused at some exposure point within or downgradient of the contaminant source area. Backward calculations assess the concentration of a contaminant in the source area that causes or creates some (acceptable) level of risk at an exposure point in or downgradient of the contaminant source area. Forward calculations are most useful for assessing risk. Backward calculations are useful for setting screening levels.

When multiple contaminants and/or multiple exposure pathways are present, backward-calculated screening levels typically do not represent true “risk-based cleanup levels,” because the backward calculation usually only accounts for one compound and one exposure route. Therefore, if there is more than one contaminant, the cumulative risk will likely exceed the allowable risk level when the screening level concentration for any one chemical is reached. In addition, when multiple contaminants and/or multiple exposure pathways are present, there is not a “unique” back-calculated soil cleanup level.

The HRC, as discussed in the manual, uses existing source area concentrations as model input and performs a forward calculation of risk for each compound and each exposure route because of the difficulty in calculating risk-based cleanup levels for sites with multiple contaminants and multiple exposure pathways. In addition, cumulative risks are calculated in the HRC model:

- If the risk meets the ADEC risk standard, the existing site concentrations become the site-specific "alternative cleanup levels" described in 18 AAC 75.340.
- If the risk exceeds acceptable levels, the HRC may be used iteratively to conduct backward calculations of alternative cleanup levels, by reducing chemical concentrations used as input into the calculator in a manner reflective of a remedial approach (e.g., soil vapor extraction would tend to remove relatively volatile compounds at a much higher rate than the relatively non-volatile compounds).

3.4.2 Hydrocarbon Risk Calculator Workbook Layout

The HRC is part of an Excel™ workbook. The basic workbook, as downloaded from the ADEC web page, contains nine worksheets. The worksheets contain the following:

- **Four-Phase, Cumulative Risk Calculations –** This worksheet contains the primary site-specific input and output from the hydrocarbon risk calculator. The input and output data displayed in this worksheet are discussed in more detail in the following section.
- **Chemical Properties –** This table lists and/or calculates the chemical property values used in the risk calculations. The compounds listed in the worksheet include the BTEX and PAH compounds and a list of about 120 sparingly soluble organic compounds that may be present as constituents of the multi-constituent NAPL. Values presented in this worksheet include the solubilities, vapor pressures, Henry's constants, and organic carbon partitioning coefficient (K_{oc}) values for the aromatic and aliphatic equivalent-carbon groups. The temperature-adjusted Henry's constant is calculated for all compounds by using the Clausius-Clapeyron equation following EPA guidance (EPA, 2001). The values in this table are locked to the general user.
- **Exposure Parameters –** This table lists the ADEC default residential and industrial exposure parameters documented in the ADEC *Cleanup Levels Guidance* (ADEC, 2008b). The values in this table are locked to the general user.
- **Slope Factors and Reference Doses –** This table lists the slope factors and reference doses/reference concentrations used in the risk calculations. The values in this table are locked to the general user.
- **Soil Data from the EPA –** This table contains basic soil property data from the EPA Johnson and Ettinger model. The values in this table are locked.
- **Dilution-Attenuation Factor –** The dilution-attenuation calculations are performed and displayed in this worksheet. Input values for the DAF worksheet are pulled from other worksheets in the calculator.
- **Site Visitor and Trench Worker –** This worksheet may be used to characterize risk to trench workers and site visitors, and is presented in addition to the default residential and

industrial scenarios. The exposure parameters may be adjusted by the Responsible Party working with ADEC. This optional worksheet is presented primarily as a risk communication and risk management tool. It may be used to characterize risks to site visitors and to identify the need for institutional and engineering controls when residential criteria are exceeded but there is no residential land use. The trench worker risk calculations are to help plan work when excavation is a potential remedial approach and to provide information for future site improvement work.

- **Conceptual Site Model Coordinates** – This worksheet presents a pictorial conceptual site model that shows the source zone, infiltration, and groundwater flow lines through the source, seasonal high and low groundwater levels, uncontaminated soil layers overlying the source, the house or other occupied structure used as input to the Johnson & Ettinger vapor intrusion calculations. In addition, this worksheet utilizes the hypothetical drinking water well used in the migration-to-groundwater calculations. The conceptual site model (CSM) may be used to graphically summarize site conditions used in the risk calculations and to check that the input values are what the user intended.
- **Input and Output Summary** – This worksheet lists the HRC input parameter values and selected output data in a single column. The worksheet may be used to build a database documenting the conditions and risk at the sites addressed by the HRC.

3.4.3 Hydrocarbon Risk Calculator Worksheet Layout

The HRC "4-phase, cumulative risk calculations" worksheet contains most of the site-specific input and output from the HRC. The HRC worksheet is divided into 12 primary sections, and the default printout of the HRC is 12 pages long, with one page printed for each section of the calculator (these sections are also referred to as Pages.). The printed output of the calculator summarizes the results of each section of the calculator; however, there are additional intermediate calculations not shown in the printout. The sections are identified with column headings with different colors. The cells requiring input data are highlighted in light yellow; all other values are fixed or calculated by the spreadsheet. Because the calculator is locked, only the light yellow cells containing input parameter values may be changed, although all of the equations in the calculator may be viewed. The purpose and type of calculations performed in each section are described below. The following discussion assumes that the reader has the spreadsheet and is familiar with ADEC regulations and guidance documents.

- Section 1 (Page 1) shows the hydrocarbon exposure point concentrations in soil and groundwater and the soil and groundwater conditions used as model input values.
- Section 2 (Page 2) shows the soil and building parameters used as input to the Johnson and Ettinger model.
- Section 3 (Page 3) summarizes the concentration and distribution of each hydrocarbon fraction in the dissolved, vapor, adsorbed, and NAPL phases. The aromatic and aliphatic

equivalent carbon character of the spilled fuel may be adjusted to match site-specific conditions by changing values in the light yellow cells.

- Sections 4 through 8 (Pages 4 through 8) list the risks associated with different exposure pathways. Residential site risks are shown on the left side of the table, and industrial site risks are shown on the right side of the table.
- Section 4 (Page 4) contains the soil-ingestion pathway risks and soil compliance levels for each compound or hydrocarbon fraction.
- Section 5 (Page 5) contains the outdoor air vapor-inhalation pathway risks for each compound or hydrocarbon fraction.
- Section 6 (Page 6) contains the indoor air vapor-inhalation pathway risks for each compound or hydrocarbon fraction.
- Section 7 (Page 7) contains the calculated migration-to-groundwater pathway risks for each compound or hydrocarbon fraction.
- Section 8 (Page 8) presents the groundwater ingestion risks for each compound or hydrocarbon fraction based on the measured concentrations in groundwater samples.
- Section 9 (Page 9) contains the results of the potential cumulative risk calculations, assuming that all pathways are complete. Residential site risks are summarized on the left side of the table, and industrial site risks are summarized on the right side of the table.
- Section 10 (Page 10) contains the results of the potential current cumulative risk calculations (the potential current cumulative risk is the risk from the exposure pathways at the site that are complete at this time.). Residential site risks are summarized on the left side of the table, and industrial site risks are summarized on the right side of the table.
- Section 11 (Page 11) assesses whether contaminated soil from the site has the potential to cause surface water to exceed ambient water quality criteria or groundwater to exceed groundwater ingestion criteria. The information could be used to assess limitations on the placement of the contaminated soil if the contaminated soil were excavated and transported offsite.
- Section 12 (Page 12) summarizes the site status based on the requirements of 18 AAC 75.

3.4.4 General Information on Risk Calculation Results

The HRC output Pages 4 through 10 present risk calculation results for the different exposure pathways or cumulative risk summaries. In each section (or page) of the output, the compounds or hydrocarbon fractions used to characterize fuels are listed in the left-most column. Compounds presenting non-carcinogenic risks are listed in regular font, and compounds with carcinogenic risks are listed in bold font. Note that benzene, ethylbenzene, and naphthalene are listed twice. The first listing is for the non-carcinogenic effect, and the second listing is for the

carcinogenic effect of these compounds (at this time, ethylbenzene and naphthalene are only considered to present carcinogenic risk through the inhalation pathways).

In output Pages 4 through 10, residential scenario risks are presented on the left side of the page and industrial scenario risks are presented on the right side of the page. Output Pages 4 through 8, for each compound or hydrocarbon fraction, list the following: the media concentration in the exposure area, the risk-based media concentration, the fraction of risk, and whether the compound or hydrocarbon fraction exceeds the risk criteria or maximum contaminant level (MCL). Note that the risk-based media concentrations do not account for cumulative risk posed by multiple compounds or exposure pathways, and therefore are not final cleanup levels. The "fraction of risk" created by the presence of each compound of interest compares the back-calculated, risk-based soil concentration to the concentration measured at the subject site:

Fraction of risk = Concentration at subject site/risk-based concentration

The fraction of risk results are displayed to three or more decimal places in the results for each pathway in the "potential cumulative risk assuming all pathways Complete" section and in the "cumulative risk for pathways complete at the present time" section of the HRC. The cumulative risk listed in the "site status summary" section of the HRC is rounded to one significant figure, as described in the *Cumulative Risk Guidance* (ADEC, 2008a).

The check for regulatory compliance with human health risk criteria is made by using Excel "if-then" statements, as follows: If the fraction of risk for a given compound is less than or equal to 1, then the site meets the compliance criteria for that compound and the spreadsheet displays "0." If the fraction of risk is greater than 1, then the site does not meet regulatory criteria and the spreadsheet displays "1" as shown for residential and industrial sites, respectively.

3.4.5 Uncertainty Analysis

The estimation of exposure requires many assumptions to describe potential exposure situations. There are uncertainties regarding the likelihood of exposure, frequency of contact with contaminated media, the concentration of contaminants at exposure points, and the period of exposure. These tend to simplify and approximate actual site conditions. In general, these assumptions are intended to be conservative and to yield an overestimate of the true risk or hazard.

Future soil exposure point concentrations were assumed to be equal to existing concentrations. This assumption does not account for volatilization, biodegradation, and dissolution and downgradient transport of contaminants over time; therefore, risk estimates are likely to be overestimated for future exposure scenarios.

In the risk characterization, the assumption was made that the total risk of developing cancer from exposure to site contaminants is the sum of the risk attributed to each individual contaminant. Likewise, the potential for the development of noncancerous adverse effects is the sum of the noncarcinogenic risks estimated for exposure to each individual contaminant. This approach is consistent with EPA guidance.

For this evaluation, the noncarcinogenic risks from all COPCs were summed to obtain the hazard index (HI). The hazard quotient for individual chemicals was not segregated based on target organs; therefore, the HI could overestimate the potential for one type of noncancerous effect, because all COPCs do not affect the same target organ.

Parameters required for implementing the Johnson and Ettinger model include soil properties (such as porosity, moisture content, and bulk density), building properties (flow rate into building), chemical properties (VOC concentrations), and exposure assumptions for the various receptor populations (i.e., workers and residents). The input values for these parameters range from default values provided in the model (e.g., physical-chemical properties) to site-specific information. These assumptions tend to simplify and approximate actual site conditions but in general, the assumptions are thought to be conservative.

4.0 SITE CHARACTERIZATION RESULTS AND FINDINGS

This section presents site-specific geology, hydrogeology, and hydrology; lists the previous investigations conducted at the site and identifies the data gaps that the 2013 investigation needed to fill; describes the scope of the 2013 investigation; presents the soil and groundwater analytical data from the previous investigations and the 2013 investigation; and identifies the extent of the NAPL-contaminated soils. All historical data from previous site investigations used in this report were cited from final reports accepted by the USAF and ADEC and are assumed to be valid. The characterization of the site presented herein uses all of the data collected at the site to present an understanding of the site that is suitable for making site closure decisions.

Site Location

CG523 is located in the northern portion of JBER, adjacent to the former location of Building 26282, the Green Lake Cabin. The former UST location is approximately 60 feet north of the Green Lake shore. Site CG523 is listed in the State of Alaska Contaminated Sites Database as having Hazard Identification Number 2786 and the site status is listed as "Cleanup Complete – ICs." The coordinates for the center of CG523 were determined to be 61.280707° N, -149.836047° W longitude (using Google Earth with aerial photography dated 14 April 2011).

Site Description

CG523 is the former location of an unregulated 1,000-gallon steel UST used to store heating oil. The UST and associated piping were removed in July of 1997. The UST decommissioning assessment and subsequent site investigations show that fuel hydrocarbons remain in the soil and groundwater at CG523. Petroleum hydrocarbon contamination, primarily DRO, is likely the result of spills and leaks from the tank and associated piping.

Summary of Previous Investigations

Site investigations were conducted in 1997, 1998, 2001, 2006, and 2008. See Section 4.2 for additional information.

4.1 Site Physical Characteristics

4.1.1 Geology and Soils

CG523 is mapped as alluvium located within the Elmendorf Moraine in an undeveloped portion of the Base (Figure 2-1). The site is relatively flat and the ground surface in the immediate vicinity is vegetated and gradually slopes to Green Lake. The 2013 soil borings show that the site soils consist primarily of gravelly sand with silt from the surface to approximately 6 feet bgs. From 6 to 15 feet bgs the soil was typically gravelly, silty sand, which is more consistent with a description of moraine than the mapped alluvium.

4.1.2 Hydrogeology and Groundwater

Groundwater levels are interpreted to vary seasonally between approximately 6 to 9 feet bgs. High water events are generally associated with spring break-up and late summer and/or autumn precipitation events. The seasonal low water level typically occurs in mid- to late winter. The groundwater flow direction at the site is toward the south-southeast, as shown in Figure 4-1. The hydraulic conductivity at CG523 is estimated to range from approximately 10^{-4} to 10^{-6} centimeters per second (cm/sec), based on the soil textures and measured hydraulic conductivities in the Elmendorf Moraine soils (Table 2-2). Based on existing piezometric surface maps produced from data collected on July 18, 2013, the gradient at the former UST location is estimated to be approximately 0.16 feet per foot (ft/ft).

Two JBER water production wells are located within one-half mile of the site. Well 24 is located hydrologically upgradient approximately 315 feet northwest of the site (61.281192° N, 149.836634° W) and was installed in 1944 to a depth of 38 feet bgs. This well is completed in the shallow aquifer. A second Base well (Well 27) is located hydrologically upgradient approximately 0.46 miles northeast of the site (61.283303° N, 149.825321° W) and was installed in 1947 to a depth of 210 feet bgs (ADNR, 2013) in the deep aquifer.

4.1.3 Hydrology

The surface water closest to CG523 is Green Lake, which is about 60 feet south of the decommissioned UST location. Surface water runoff from the site is toward Green Lake. No significant sediment transport from the site was observed.

4.2 Summary of Previous Investigations

4.2.1 Investigations

Previous environmental site investigations conducted at CG523 are described below:

- In 1997, during the UST investigation, five soil samples were collected from the UST excavation. The investigation indicated that a release had occurred, and the confirmation samples showed that soils remaining in place at the limits of excavation were contaminated with diesel fuel. There were no monitoring wells installed during tank removal (USAF, 1998).
- In 1998, seven soil borings were advanced and two of the borings were completed as downgradient monitoring wells (703WL01 and 703WL02). One to three soil samples were collected from each boring and analyzed for GRO, DRO, and BTEX. Select samples were also analyzed for PAH (USAF, 1999).
- In 2001, approximately 249 tons of contaminated soils were excavated from CG523. Six confirmation soil samples were collected from the bottom of the excavation and analyzed for DRO, BTEX compounds, and GRO (USAF, 2002a).

- During the 2006 annual compliance monitoring, a new in-source monitoring well, 703MWIN, was installed at the former UST location. The new well and downgradient well 703WL02 were then sampled for DRO and BTEX compounds. The sample collected from the in-source well 703MWIN was also sampled for PAH. No constituents were detected above cleanup levels (USAF, 2007). The in-source well 703MWIN was again sampled in 2007 and 2008 for DRO and BTEX compounds. No constituents were detected above method detection limits in the samples (USAF, 2009).
- In 2008, two soil borings were advanced within the source area. Three soil samples were collected from each of two in-source soil borings. The samples were submitted for laboratory analysis for GRO, DRO, and BTEX compounds. Two of the samples were also submitted for laboratory analysis of PAH (USAF, 2009).
- Between 1998 and 2012, groundwater monitoring was conducted.

The CG523 UST decommissioning data, soils boring data, groundwater sampling data, and chemical laboratory data collected prior to 2013 were compiled in data tables, on a site map, and in a cross section as part of the 2013 work plan preparation effort. These historical data were reinterpreted using the conceptual model of a fuel hydrocarbon spill presented in Section 2.3 of this report to identify data gaps and to develop a proposed scope of work for the 2013 investigations. The historical data include four NAPL-contaminated soil source area samples analyzed for BTEX, GRO, RRO, and DRO and three monitoring wells with groundwater data for BTEX, GRO, RRO, and DRO.

4.2.2 Remedial Actions

Remedial action at the CG523 site occurred in 2001, approximately 249 tons of contaminated soil was excavated from CG523 to the boundary shown as a black dashed line on Figure 4-1. Six confirmation soil samples were collected from the bottom of the excavation and analyzed for DRO, BTEX compounds, and GRO. Four samples had DRO above 18 AAC 75 Table B2 Method Two Soil Cleanup Levels.

4.2.3 Data Gaps

The following additional data were needed to fill existing data gaps:

- Soil samples for PAH analysis (to meet regulatory requirements and to characterize risk).
- Soil samples for VPH and EPH analysis in order to characterize the GRO, DRO, and RRO contamination in aromatic and aliphatic equivalent carbon fractions, which facilitates risk calculations.
- Additional investigation to confirm that monitoring well 703MWIN is actually located in the source area.

4.3 Scope of Work

The site characterization activities were performed between June 1 and September 30, 2013, in accordance with the *JBER Basewide UFP-QAPP* and the site-specific CG523 UFP-QAPP (USAF, 2013b). Field logbooks, soil boring logs, LIF data sheets, groundwater sampling data sheets, a photograph log, monitoring well installation details, and chain-of-custody forms are provided in Appendix A.

The following program methods were used at Site CG523:

- Laser-Induced Fluorescence
- Soil Sampling
- Monitoring Well Installation and Development
- Groundwater Sampling
- Surveying
- Waste Handling and Disposal

Thirteen LIF probes, 14 soil borings, and one monitoring well were installed at CG523 during the 2013 field investigation. LIF technology was used to help identify the horizontal and vertical extent of petroleum hydrocarbon contamination at CG523. Thirteen LIF borings (CG523L01 – CG523L13) were advanced 14 to 18 feet bgs.

Fourteen soil borings (13CG523-SB01 through 13CG523-SB14) were completed to 15 feet bgs, which is about 6 feet below the seasonal low groundwater level. The boring locations (shown in Figure 4-1) were selected to more precisely delineate the NAPL source area, to assess current soil concentrations, and to generate samples for PAH, VPH, and EPH analysis that are representative of the more heavily contaminated portions of the source area. Nine soil samples were collected from within the NAPL-contaminated soil source area and analyzed for BTEX, GRO, DRO, RRO, PAH, EPH, and VPH. One new monitoring well (703WL03) was installed to ensure there was a well inside the source area. Analytical data later showed that the two existing wells (703WL01 and 703WL02) were also located within the source area. Four groundwater samples were collected from monitoring wells and were analyzed for BTEX, GRO, RRO, DRO, PAH, VPH, and EPH.

4.4 Deviations from the Work Plan

The field work was conducted per the project standard operating procedures in the *JBER Basewide UFP-QAPP*, and the scope of work described in the site-specific work plan was accomplished with the following exceptions:

The 2013 groundwater sample from monitoring well 703MWIN was only analyzed for DRO in accordance with the long-term monitoring of compliance program sites as described in the 2008 Annual Report (USAF, 2009) recommendation for continued annual sampling of DRO and subsequent ADEC concurrence (ADEC, 2009). The 2013 field investigation indicated that this well is not located within the existing source area.

Due to steep topography along the lakeshore, a downgradient well could not be safely established at the site.

4.5 Site Characterization Results

4.5.1 Nature and Extent of Soil Contamination

Petroleum hydrocarbon contamination (primarily DRO) is likely the result of spills and leaks from the CG523 tank and associated piping. The horizontal and vertical extent of the NAPL-contaminated soil at CG523, based on all of the existing data, is shown on the Site Map (Figure 4-1) and the Cross Section (Figure 4-2) using color-coded symbols to indicate the presence or absence of NAPL at concentrations above screening levels (as described in Sections 3.3.3 and 3.3.4). Additional details regarding the locations of soil samples collected in the UST excavation are presented in Figure 4-1. Tables 4-1 through 4-7 summarize all hydrocarbon data for soil and groundwater samples collected at the CG523 site to date. The data in the tables, LIF results, and soil boring logs used to identify the extent of NAPL-contaminated soil source areas are described in Section 3.0.

Extent of the NAPL Source Area

The existing data at CG523 show that NAPL has infiltrated to approximately 6.5 feet bgs, which corresponds to the zone of seasonal groundwater fluctuation, or smear zone. Contaminated soils within the vadose zone have largely been removed by way of excavation (as indicated by the black dashed line in Figure 4-1). The NAPL contamination is confined to the soils within the zone of seasonal water table fluctuation.

The 2013 soil borings drilled to help define the extent of the NAPL encountered NAPL-contaminated soil in the zone of seasonal water table fluctuation between 6 and 9 feet bgs over an area approximately 80 feet long and 50 feet wide, as shown by the red dashed line in Figure 4-1. No sheen was visible on the surface of Green Lake downgradient of CG523, indicating that the source area does not extend to the water body.

Nature of the NAPL Source Area Soil Contamination

The data tables show 13 source area samples and 20 samples from outside the source area with GRO, DRO, RRO, and BTEX laboratory results. There is one additional source area sample with DRO results only. The soil appears to be impacted primarily by diesel fuels from the former

heating oil UST. Laboratory analyses for nine 2013 source area soil samples from the seasonally saturated zone exceed the 18 AAC 75 Table B2 DRO migration to groundwater criteria. In addition, six of these samples exceed the Table B2 GRO migration to groundwater criteria. The one source area soil sample from 2008 has GRO, DRO, and BTEX laboratory results and exceeds the 18 AAC 75 cleanup level for DRO in the seasonally saturated zone. Four excavation soil samples collected in 2001 collected within the source area from the excavation bottom (6 feet bgs) have results exceeding the 18 AAC 75 cleanup level for DRO. No samples have exceeded "maximum allowable" concentrations.

The BTEX and GRO concentrations and mass fractions in the source area soils were relatively low compared to a fresh diesel spill, which indicates that the diesel at CG523 has undergone significant natural attenuation (volatilization, dissolution, and biodegradation). BTEX results older than 2008 were not carried forward into risk calculations due to expected preferential degradation of these compounds. Laboratory results show detections of multiple PAH compounds within the source area; however, all except for naphthalene were at concentrations below the screening criteria. The EPH and VPH soils data show that the DRO is about 22% aromatics and 78% aliphatics, and that most of the DRO aliphatics are within the C12 to C16 equivalent carbon range, which is typical of weathered diesel.

No soil samples exceeded the maximum allowable concentration criteria (described in Footnote 13 to Table B2 of 18 AAC 75) and free product has not been observed on the water table in the site monitoring wells.

No visible staining of surface soils, odors, or stunted vegetation was noted at the site during the site characterization field investigation. There is no significant surface water runoff or sediment transport from the site to surface water bodies.

4.5.2 Nature and Extent of the Groundwater Contamination

The soil data and groundwater data indicate that although monitoring well 703MWIN is at the approximate UST location, it is upgradient of the NAPL-contaminated soil source area. Although monitoring wells 703WL01 and 703WL02 are downgradient of the former UST, it was unclear whether they were inside the NAPL-contaminated source area; therefore, monitoring well 703WL03 was installed in 2013 to ensure adequate representation of the source area. Review of the analytical data from 13CG523-SB12 showed the two existing wells were inside the source area. The groundwater monitoring data set includes BTEX, DRO, GRO, RRO, PAH, EPH, and VPH results from all in-source monitoring wells. The data from these wells show no exceedances of 18 AAC 75 Table C criteria.

4.5.3 Data Quality Evaluation

The soil and groundwater samples collected in 2013 were analyzed by TestAmerica Laboratories, Inc., using locations in West Sacramento, Denver, and Seattle. Upon receipt of the

laboratory results, WESTON performed a data quality review and validated the chemical data. The Quality Assurance/Quality Control (QA/QC) Summary Report form and the ADEC Laboratory Review Checklist forms are included in Appendix B. **Only validated, usable data are presented in the project data tables and used in the risk calculations.** Pre-2013 investigations cited in this report are final documents that have been reviewed and accepted by the Air Force and ADEC, and all data contained within these documents are assumed to be valid and usable.

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5.0 RISK EVALUATION

Site CG523 has fuel hydrocarbon concentrations above the 18 AAC 75 Method Two cleanup levels; therefore, a risk evaluation will be conducted following 18 AAC 75 Method Three using the HRC to assess compliance with the ADEC risk standard. Risk assessment provides the basis for making risk management decisions regarding the suitability of a site for UU/UE, for receiving a "Cleanup Complete" determination from ADEC, and for preparation of alternative cleanup levels, if needed.

Use of the HRC to evaluate human health risk involves:

- Assessing potential receptors and exposure pathways;
- Calculating exposure point concentrations for the compounds to be included in the risk calculations;
- Summarizing the site soil and groundwater conditions for use in the risk calculations, and
- Entering the data into the HRC, running the HRC and presenting the HRC results.

Table 5-1 summarizes the exposure pathways complete at the present time, and potentially complete in the future. Tables 5-2 and Table 5-3 present the 95% UCL calculation results and the outlier test results from the EPA ProUCL software. Tables 5-4a and 5-4b present input parameters used in the HRC. Input parameters for the HRC were obtained from site-specific soil contaminant concentrations and either site-specific or local measurements of soil properties. Tables 5-5 and 5-6 present a summary of the cumulative risk calculations for the individual compounds and a summary of compliance with the risk criteria for the bulk fuel hydrocarbons, respectively. The HRC standard printout tables and a compact disc containing Excel™ files of the data tables, ProUCL calculations, and the HRC are provided in Appendix C. Figures 5-1a and 5-1b present a quartile-quartile (Q-Q) and box plot for the primary bulk hydrocarbon present at the site, respectively.

The HRC is described in more detail Section 3.4 of this report and in the *HRC Risk Calculator User Manual* (Geosphere, 2011). The procedures used to evaluate risks are consistent with the following guidance: *Risk Assessment Procedures Manual* (ADEC, 2011a); *Cumulative Risk Guidance* (ADEC, 2008a); *Ecoscoping Guidance, A Tool for Developing an Ecological Conceptual Site Model* (ADEC, 2014a); *Cleanup Levels Guidance* (ADEC, 2008b); and *Implementing Guidance for the Method Three Hydrocarbon Risk Calculator* (ADEC, 2011c).

5.1 Site-Specific HRC Input Parameters

5.1.1 Potential Exposure Pathways and Pathways Complete at the Present Time

An exposure pathway evaluation identifies the means by which people, animals, and plants might come into contact with chemicals in environmental media (soil, water, and air). ADEC

makes site closure decisions based on a land use scenario that assumes the site is used for residential purposes and that the primary exposure pathways are complete. ADEC's primary exposure pathways include: soil direct contact, outdoor air inhalation, vapor intrusion, and groundwater ingestion (provided the groundwater is potable). Similarly, the USAF considers a site to be closed when the site is suitable for UU/UE, which corresponds to a residential scenario with all primary pathways complete. To meet ADEC "Cleanup Complete" criteria and USAF UU/UE criteria, the CG523 risk evaluation calculated human health risks, assuming that all primary exposure pathways were complete under a residential land use scenario. The risk derived from this calculation can be used to assess compliance with the ADEC risk standard and to assess the suitability of the site for a "Cleanup Complete" determination.

The CG523 risk evaluation also calculated risk for the pathways complete at the present time. Site CG523 is currently vacant, and the land is designated as "Community Facilities" in the JBER Land Use Plan. Soil ingestion and outdoor air exposure routes were assumed to be complete at the CG523 site at the current time, because there is fuel hydrocarbon-contaminated soil present within 15 feet of the ground surface. The indoor air exposure route was considered to be incomplete at the present time, because there are no occupied buildings within 30 feet of the CG523 source area. The groundwater ingestion exposure route was also considered to be complete at the present time, because of the drinking water well (#24) completed to a depth of approximately 38 feet bgs within the shallow groundwater aquifer located approximately 170 feet upgradient of the source area of CG523.

If the site presents an unacceptable risk, assuming that all pathways are complete under the residential scenario, then the results of the risk calculations for the pathway complete at the present time may be used to assess whether there is acceptable or unacceptable risk under the current land use scenario. If there is unacceptable risk at the current time, the site should become a priority for risk mitigation. The CG523 exposure pathways that are complete at the present time and that might reasonably exist in the future were evaluated in accordance with ADEC's *Policy Guidance on Developing Conceptual Site Models* (ADEC, 2010b). The results are summarized in Table 5-1.

5.1.2 Soil Exposure Point Concentrations

Exposure point concentrations are the chemical concentrations that a receptor might be exposed to and that are used as input to the risk calculations. The ADEC and EPA have stated that the arithmetic average concentrations measured in a representative group of samples collected from the exposure area are generally considered the most appropriate and representative value for use as the concentration term in environmental risk assessment, but that the true average concentration at a contaminated site cannot be calculated from a limited number of samples. Therefore, to assess human health risk, the soil concentrations used as input to human health risk

calculations should typically be the 95% UCLs of a representative data set collected from within the exposure area.

Soil exposure point concentrations were developed for each hydrocarbon compound and for GRO, DRO, and RRO using the NAPL-contaminated soil source area data shown in Table 4-2. Note that in Table 4-2, only the BTEX data from the 2008 and 2013 investigations is used in the calculation of the exposure point concentration; the older data was not used because the in-situ concentrations have likely decreased significantly in the 16 years since they were originally measured. The source area data set for benzene and toluene has a limited number of detections, so the maximum detected values from the source area were used as the exposure point concentration. There were adequate data to calculate 95% UCLs for ethylbenzene, xylene, GRO, DRO, and RRO, so ProUCL was used to calculate 95% UCLs. These values were used as the HRC input. ProUCL outputs are displayed in Table 5-2 (the table format is output from ProUCL).

Table 5-3 presents the ProUCL outlier test results for DRO and, as shown, the test indicated that the highest DRO concentration measured at the site (7,100 mg/kg) is not a statistical outlier and is included in the 95% UCL calculation. A Q-Q plot and box plot of the DRO source area data are presented in Figure 5-1a and Figure 5-1b, respectively.

There are insufficient PAH soil detections available to calculate 95% UCLs; so for PAH, the maximum detected concentration was used as the exposure point concentration. If there were no detections, then the maximum detection limit was used as the exposure point concentration (as shown on the right side of Table 4-3).

Three EPH and VPH source area samples were used to characterize the bulk hydrocarbon chemistry (Table 4-4). For the C9-10 aromatic and C8-C10 aliphatic ranges, the VPH data was used to calculate the source area hydrocarbon characterization, and for the C10-12 aromatic and aliphatic ranges, the EPH data was used to calculate the source area hydrocarbon characterization, unless there was a laboratory indication to use the VPH. The HRC input values calculated from the source area VPH and EPH data are shown in Table 4-4.

5.1.3 Groundwater Exposure Point Concentrations

Groundwater contaminant concentrations used as input to the risk calculations are the maximum BTEX, GRO, RRO, and DRO concentrations measured during the most recent groundwater sampling event for which there was data. For the noncarcinogenic PAH compounds, the higher of the maximum detected concentrations or maximum detection limits from 2013 were used as input to the risk calculations. For the carcinogenic PAH in general, and for benzo(a)pyrene and dibenz(a,h)anthracene in particular, typical groundwater detection limits can be close to or above the groundwater ingestion risk-based concentrations. Therefore, for the carcinogenic PAH, the

groundwater concentrations predicted or modeled by the HRC based on the soil concentration data were used as input to the risk calculations to yield more representative risk results.

5.1.4 Non-Contaminant HRC Input Parameters

A summary of non-contaminant HRC input parameters is presented in Table 5-4b. The non-contaminant input parameters include: the site-specific soil conditions; hydrogeologic conditions; climate data; source area length and vertical extent; exposure routes complete at the present time; and the building size, foundation type and foundation soil conditions used as input to the Johnson & Ettinger model.

5.1.5 Source Area Soil Properties

Average values for the soils of the Elmendorf Moraine, as presented in Table 2-1 of this report, were used for specific gravity, bulk density and moisture content. The ADEC default fraction of organic carbon value was used as input. A soil temperature value of 5 degrees Celsius (°C) was used as input to the HRC. This value is consistent with the average annual soil temperature of 3.5 °C measured at the 20-inch depth at the United States Natural Resource Conservation Service soil research site at Point McKenzie, and with the groundwater temperature of 5 °C measured using data loggers in monitoring wells located on the Elmendorf Moraine. The predominant soil texture was described as gravelly, silty sand.

5.1.6 Hydrogeologic Conditions

Based on the Figure 4-1 Site Map, the NAPL-contaminated area source length was estimated to be about 80 feet. For input into the HRC, the default ADEC aquifer thickness of 32.8 feet was used. The average hydraulic conductivity value of 0.000181 cm/sec for the soils of the Elmendorf Moraine (as presented in Table 2-2 of this report) was used as the HRC input. The average value is based on multiple tests with a Flexible Wall Permeameter, and is consistent with the range of hydraulic conductivities for glacial till (10^{-4} to 10^{-10} cm/sec) given in *Groundwater* (Freeze & Cherry, 1979).

The hydraulic gradient input value of 0.16 ft/ft is based on the water table contours presented in Figure 4-1 and on water level measurements made in the CG523 monitoring wells in 2013. Average precipitation was derived using the literature value of 16 inches of annual rainfall (NOAA, 2013). The infiltration rate of 0.081 meters per year was determined based on calculating 20% of the annual precipitation. A conservative input value of "1" was used for "potable or non-potable aquifer" to indicate that the aquifer is potable.

5.1.7 Johnson and Ettinger Vapor Intrusion Model Input Parameters

The Johnson and Ettinger model is used to assess risk associated with the vapor intrusion pathway. The model input parameters describe the building size and foundation type (slab-on-grade versus basement) and the properties and thicknesses of the uncontaminated soils between

the source area and the building foundation. Average values for the outwash soils south of the Elmendorf Moraine, as presented in Table 2-1 of this report, were used for specific gravity, bulk density, and moisture content. The ADEC default fraction of organic carbon value was used as input. There are no occupied buildings currently at the site (the pathway is not currently complete), but residences could be constructed in the future and the water table is relatively deep, so a basement foundation could readily be constructed (this is a conservative assumption). The predominant soil texture was described as sand (following the guidance provided in the EPA documentation of the model). The building size, foundation depth, perimeter crack width, and pressure differential all used the EPA default input values.

5.2 Site-Specific Risk Evaluation Results

The HRC standard printout that summarizes input parameters and output results is included in Table C-1 of Appendix C and presented in Tables 5-5 and 5-6. Table C-1 is a standard twelve-page printout summary from the HRC; the data presented in the table is described in Section 3.0 of this report. The last page of the printout presents conclusions regarding the human health risk and eligibility of the site for closeout.

Based on site-specific exposure point concentrations and non-contaminant parameters, and assuming that all exposure pathways are complete at the present time, the HRC results for the CG523 source area indicate that site conditions meet the ADEC human health risk standard established in 18 AAC 75.325. That is:

- The carcinogenic cumulative risk and non-carcinogenic cumulative risk posed by the individual indicator compound meet the risk standard, assuming a residential land use scenario and assuming that all exposure pathways are complete (soil direct contact, outdoor air vapor inhalation, indoor air vapor inhalation, and groundwater ingestion).
- The risk posed by the GRO, DRO, and RRO aromatic and aliphatic surrogate fractions meets the risk standard for each exposure pathway, assuming a residential land use scenario.
- Existing site conditions meet risk-based migration to groundwater criteria (i.e., the remaining contamination will not cause the groundwater to exceed risk-based concentrations).

Therefore, site conditions are protective of human health under an unrestricted (residential) land use scenario, and these calculations may be used to support a “Cleanup Complete” determination in accordance with 18 AAC 75.380, provided ecological criteria are also met. Note that the HRC conclusion only identifies the potential need for an institutional control when the risk standard is exceeded (or when a polar DRO fraction is present at concentrations above 1.5 mg/L). Therefore, CG523 is eligible for a “Cleanup Complete” determination.

5.3 Environmental / Ecological Risk Evaluation

The following conditions support the determination that conditions at the CG523 site are protective of the environment:

- No visible surface soil staining or distressed vegetation was observed at the CG523 site.
- As described in the CSM, plants tend not to significantly take up or accumulate DRO hydrocarbons in their tissues; hence, animal populations feeding on the plants are not significantly exposed.
- There is not significant surface water runoff or sediment transport from the site to surface water bodies.
- Risk to the environment has been evaluated using the ecological scoping process and the Ecoscoping Form described in the ADEC Ecoscoping Guidance (ADEC, 2014a). The Ecoscoping Form indicates that a more in-depth risk evaluation is not needed and that the CG523 site conditions are protective of the environment. The completed Ecoscoping Form documenting the results is presented in Appendix D.

6.0 CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusions

The data set for CG523 supports the following conclusions:

- The existing data show that NAPL has infiltrated to approximately 6.5 feet bgs. Contaminated soils within the vadose zone have largely been removed by excavation. Saturated zone soils are interpreted in the source area to contain NAPL.
- The existing data show that diesel fuel releases have resulted in smear zone contamination source over an area approximately 80 feet long and 50 feet wide. NAPL source extends through the zone of seasonal water table fluctuation.
- The fuel is interpreted to have infiltrated to the water table within the source area. The NAPL is interpreted to have spread laterally on the water table to a width of 50 feet and migrated the length of approximately 80 feet, not extending downgradient to Green Lake. The NAPL has been smeared through the zone of seasonal water table fluctuation over this footprint area.
- The average and 95% UCL DRO concentrations within the NAPL source area are approximately 3,180 mg/kg and 6,164 mg/kg, respectively.
- Groundwater samples collected from monitoring wells located in the NAPL-contaminated soil source area and screened across the water table are below 18 AAC 75 Table C cleanup levels.
- No visible staining of surface soils, odors, or stunted vegetation was noted at the site during the site characterization field investigation. There is no significant surface water runoff or sediment transport from the site to surface water bodies.
- The carcinogenic cumulative risk and noncarcinogenic cumulative risk posed by the individual indicator compounds meet the ADEC risk standard, assuming a residential land use scenario.
- The risk posed by the GRO, DRO, and RRO aromatic and aliphatic surrogate fractions meets the risk standard for each exposure pathway, assuming a residential land use scenario.
- Existing site conditions meet risk-based migration to groundwater criteria.
- The site meets ADEC qualitative ecological/environmental risk criteria in that there were no observed environmental impacts from soil staining, impacted vegetation, surface water or sediment runoff. Additionally, groundwater from the site meets the total aromatic hydrocarbon (TAH) and total aqueous hydrocarbon (TAqH) ambient water quality

criteria. The Ecoscoping Form indicates that a more in-depth risk evaluation is not needed and that the CG523 site conditions are protective of the environment.

6.2 Recommendations

Based on the HRC calculations and compliance with environmental criteria, it is recommended that the ADEC grant Site CG523 at JBER a "Cleanup Complete" determination. Institutional Controls do not appear to be applicable at this site. Following ADEC concurrence with this conclusion, groundwater monitoring of the site should be terminated and the existing monitoring wells at the site should be decommissioned.

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FIGURES

Figure 1-1 CG523 Location Map

Figure 2-1 CG523 Generalized Geology Map

Figure 4-1 CG523 Site Map

Figure 4-2 CG523 Cross Section A-A'

Figure 5-1a CG523 Q-Q Plot

Figure 5-1b CG523 Box Plot

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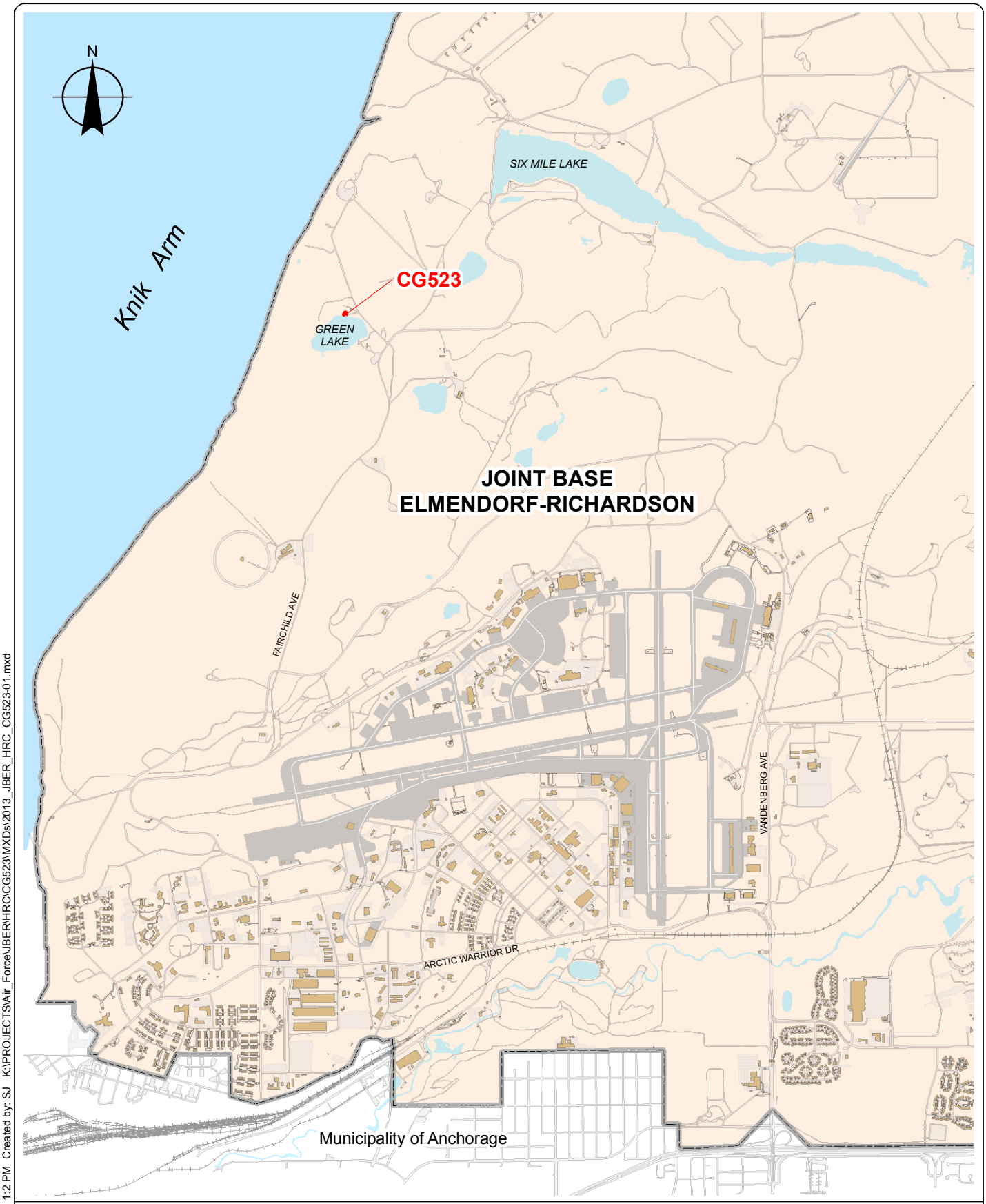

0 0.5 1 Miles

CG523 LOCATION MAP

Figure 1-1

United States Air Force
Joint Base Elmendorf-Richardson, Alaska

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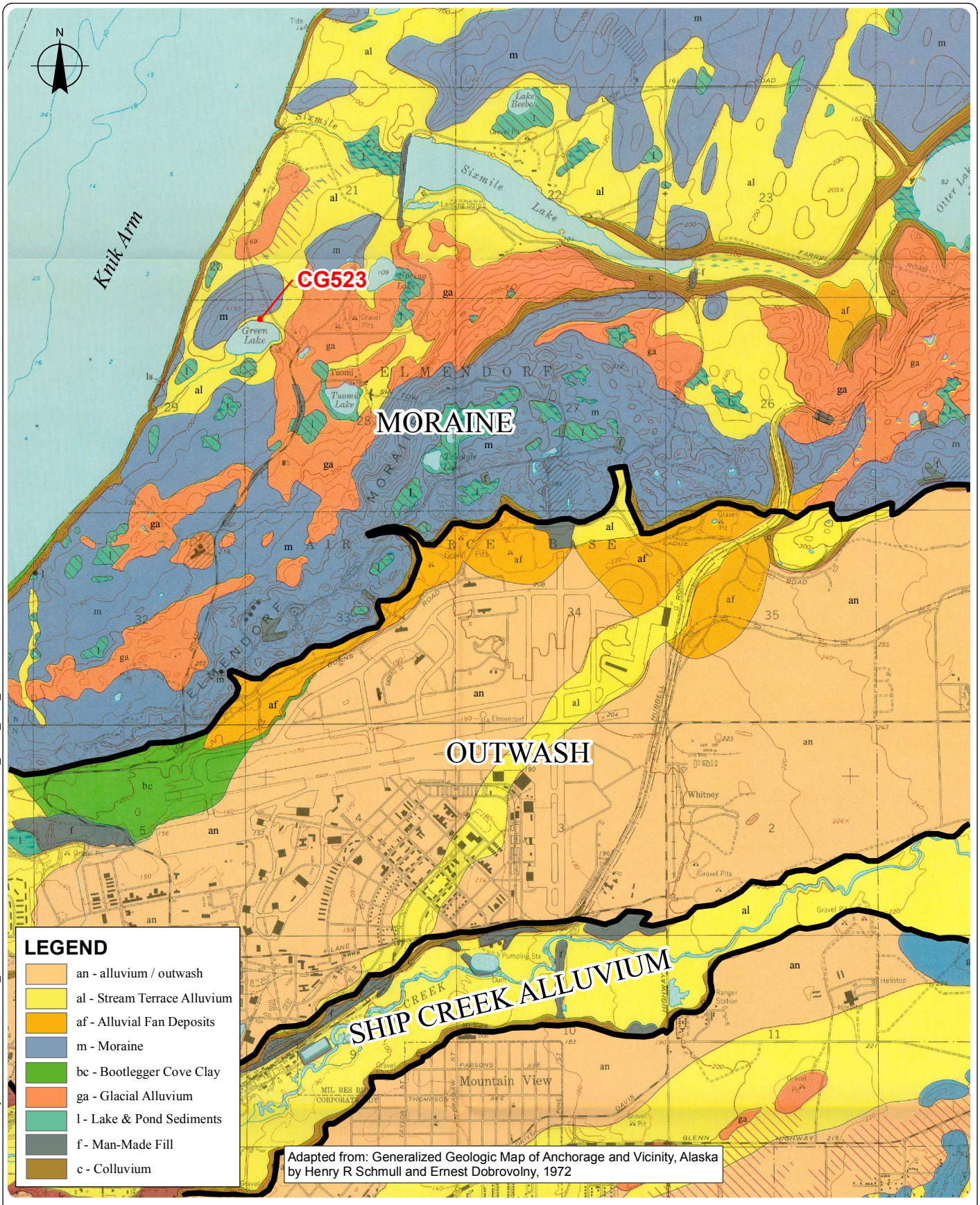

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CG523 GENERALIZED GEOLOGY MAP

United States Air Force
Joint Base Elmendorf-Richardson, Alaska

Figure **2-1**

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Plot Date: 26 Feb 2014 04:23 PM Created by: SJ K:\PROJECTS\Air_Force\JBER\PBR\HRC\CG523MXDs\2014_JBER_HRC_CG523-02.mxd

26288

Water Well 24

26278

13CG523-SB14

A

13CG523-SB09

13CG523-SB10

703WL-03 (13CG523-SB13)

CG523L09

CG523L10

EL-A200802

EL-A200801

703-08SB-01

13CG523-SB06

CG523L01

APPROXIMATE LOCATION OF FORMER 1,000-gal UST

13CG523-SB02

CG523L08

13CG523-SB08

13CG523-SB11

13CG523-SB01

13CG523-SB07

EL-A200805

CG523L03

EL-A200806

703BH04

703MWIN

CG523L07

703BH01

EL-A200803

CG523L12

CG523L11

13CG523-SB05

EL-A201201/EL-A200804

703-08SB-02

CG523L13

13CG523-SB04

CG523L06

703WL01

13CG523-SB12

CG523L05

13CG523-SB03

CG523L02

703WL02

CG523L04

APPROXIMATE LIMITS OF 2001 EXCAVATION

A'

GREEN LAKE

LEGEND

- Symbol shapes representing LIF probe, soil boring/soil sample, and monitoring well
- Yellow centers for symbols where vadose soils are interpreted to contain NAPL
- Green centers for symbols where vadose soils are interpreted to not contain NAPL
- Red triangles or rings around LIF probe, soil boring and monitoring well symbols where seasonally saturated (smear) zone soils are interpreted to contain NAPL
- Blue triangles or rings around LIF probe, soil boring and monitoring well symbols where seasonally saturated (smear) zone soils are interpreted to not contain NAPL
- Water Supply Well
- Groundwater Contour Line (feet AMSL)
- General Groundwater Flow Direction
- Estimated seasonally saturated (smear) zone source area

NOTES: 1. All soil boring names beginning with the number 13 were advanced during the 2013 field season.
2. Monitoring wells have been labeled with the monitoring well name and corresponding soil boring ID in parentheses.

Image Source: Aero-Metric, Copyright © 2009

N

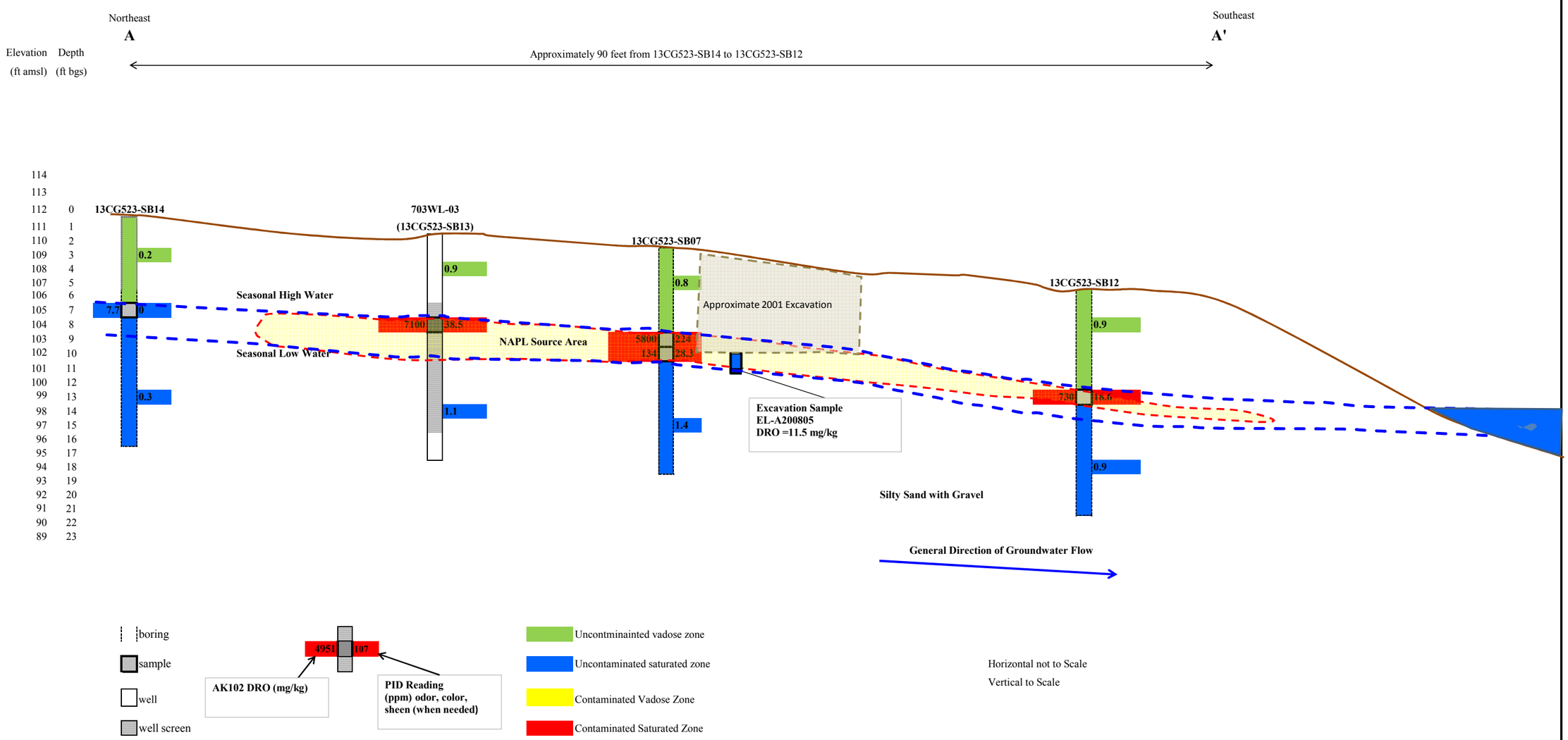
0 5 10 20 30 40 Feet

Date: 16 DEC 2013

CG523 SITE MAP

Figure 4-1

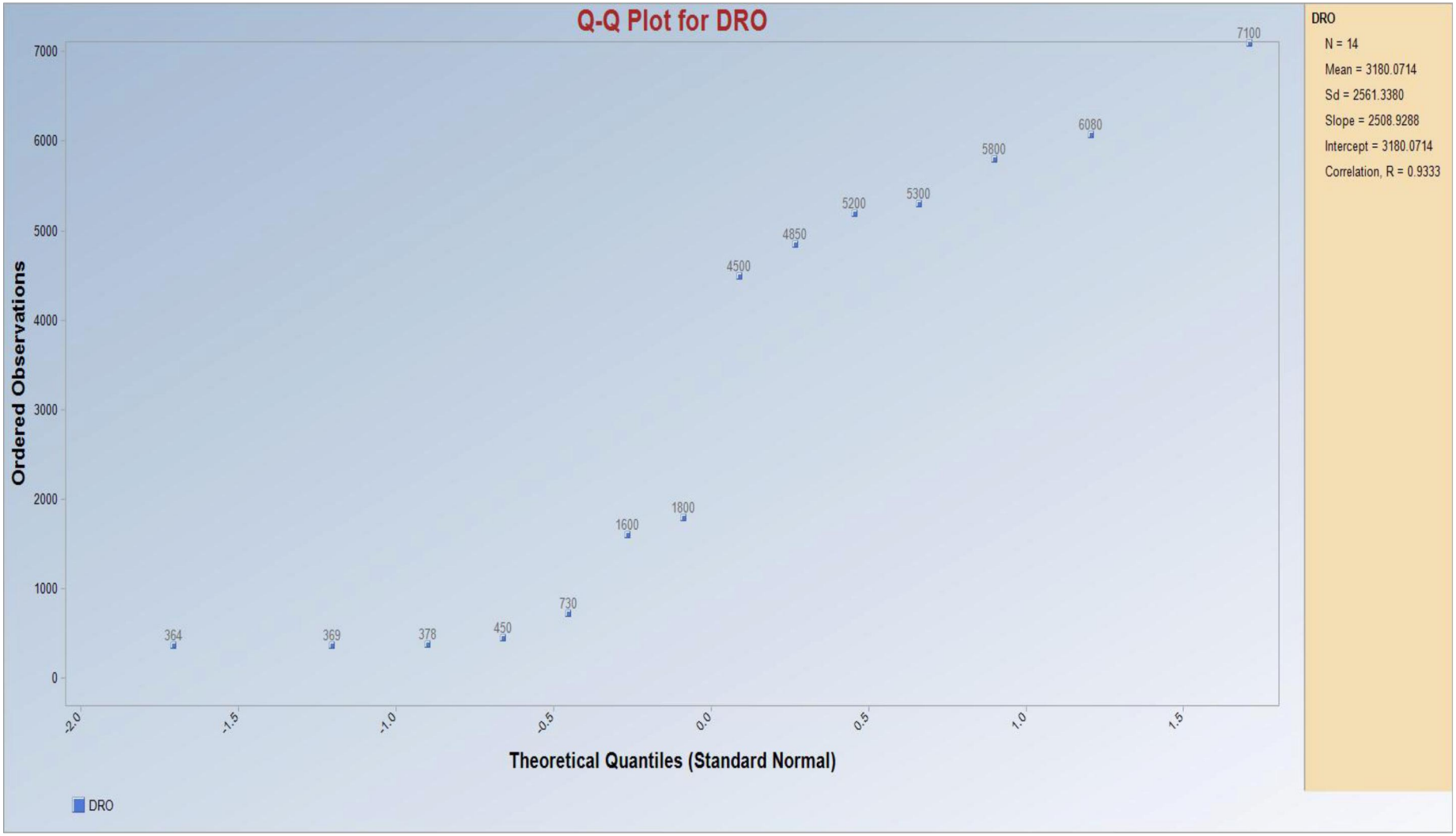
United States Air Force
Joint Base Elmendorf-Richardson, Alaska



28-Jan-14

CG523 CROSS-SECTION A-A'
United States Air Force
Joint Base Elmendorf Richardson

Figure
4-2



CG523 Q-Q PLOT

United States Air Force
Joint Base Elmendorf-Richardson, Alaska

Figure
5-1a

Date: 13 FEB 2014

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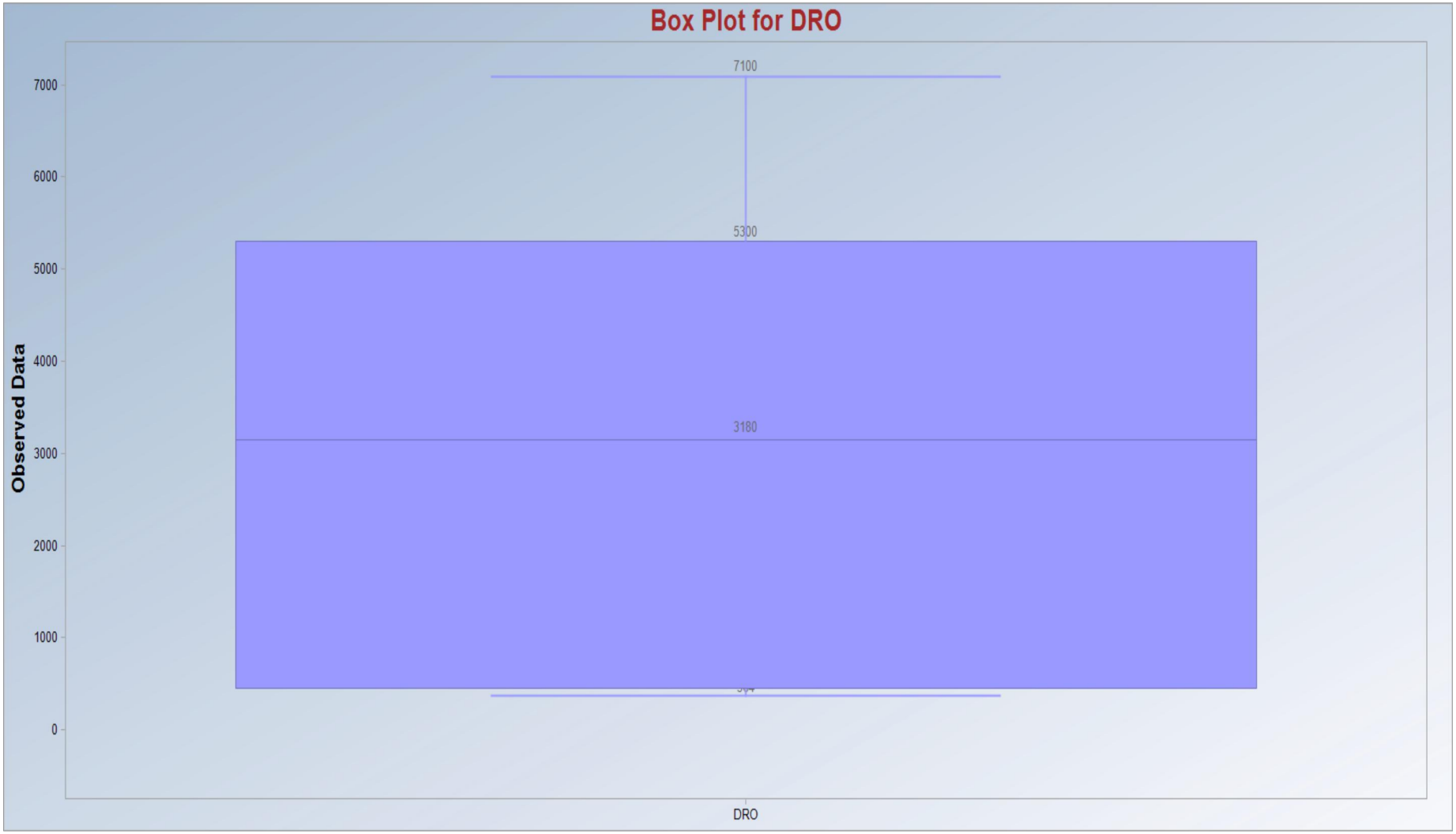

CG523 BOX PLOT

United States Air Force
Joint Base Elmendorf-Richardson, Alaska

Figure
5-1b

Date: 13 FEB 2014

TABLES

Table 2-1	Geotechnical Properties of JBER Soil Types
Table 2-2	Hydrogeologic Properties of JBER Soil Types
Table 3-1	Survey Elevation Measurements and Coordinates
Table 4-1	All BTEX, GRO, DRO & RRO Soils Results
Table 4-2	Source Area BTEX, GRO, DRO & RRO Soils Results
Table 4-3	PAH Soils Results
Table 4-4	VPH & EPH Soils Results
Table 4-5	BTEX, GRO, DRO & RRO Groundwater Results
Table 4-6	PAH Groundwater Results
Table 4-7	All VPH & EPH Groundwater Results
Table 5-1	Exposure Pathway Evaluation
Table 5-2	95% UCL Concentrations
Table 5-3	Outlier Test Results
Table 5-4a	HRC Input Values and Data Sources, Exposure Point Concentrations
Table 5-4b	HRC Input Values and Data Sources, Non-Contaminant Parameters
Table 5-5	Summary of Cumulative Risk Estimates
Table 5-6	Summary Bulk Fuel Hydrocarbon Risks

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Table 2-1 Geotech Properties of JBER Soil Types

JBER Site-Specific Data: Bulk Density, Specific Gravity & Moisture Content

Soil Type	Site	Boring Number	Sample Number	Sample Depth	Year	Bulk Density (Dry Unit Weight; lbs / ft^3)	Bulk Density (Dry Unit Weight;g/cm ^3)	Specific Gravity (ASTM D854)	Moisture Content (% of dry weight)	Reference
Glacio-Fluvial	ST036	13ST036-SB01	5	24-25	2013	141.7	2.27	2.756	1.8%	1
Glacio-Fluvial	ST036	13ST036-SB01	6	49-50	2013	118.7	1.90	2.735	2.7%	1
					average	130.2		2.7455	2.2%	
Ground Moraine	ST41	ST41-BH11-15-GT	4	15	1992	136.8	2.19		8.2%	3
Ground Moraine	ST41	ST41-BH04-5-GT	5	5	1992	103.315	1.66		15.9%	3
Ground Moraine	ST41	ST41-BH11-5-GT	6	5	1992	115.1	1.84		18.7%	3
Ground Moraine	ST41	ST41-BH12-15-GT	7	15	1992	110	1.76		8.0%	3
Ground Moraine	ST41	ST41-BH04-10-GT	8	10	1992	123.9	1.99		13.1%	3
Ground Moraine	ST41	ST41-MW37BR-65AGT	1	65	1992	111.2	1.78		16.7%	3
Ground Moraine	ST702	702WL15		7.5	2001	130.4	2.09	2.76	2.1%	2
Ground Moraine	ST702	702WL14		14.5	2001	141.6	2.27	2.705	7.6%	2
Ground Moraine	ST702	702WL17		14.5	2001	144	2.31	2.752	7.1%	2
Ground Moraine or Glacio-Fluvial	CG523	13CG523-SB05	1	4-5	2013	103.5	1.66	2.61	15.0%	1
Ground Moraine or Glacio-Fluvial	CG523	13CG523-SB05	2	9-10	2013	146.1	2.34	2.725	6.5%	1
Ground Moraine or Glacio-Fluvial	ST061	13ST061-SB05	3	4-5	2013	77.7	1.25	2.56	34.0%	1
Ground Moraine or Glacio-Fluvial	ST061	13ST061-SB05	4	9-10	2013	135.5	2.17	2.768	8.6%	1
					average	121.5		2.7	12.4%	
Outwash	ST048	13ST048-SB03	1534		2013	129.2	2.07	2.686	6.0%	1
Outwash	CG527	13CG527-SB08	1535		2013	133.1	2.13	2.729	3.0%	1
Outwash	ST048	13ST048-SB03	1536		2013	130.5	2.09	2.718	2.0%	1
Outwash	CG527	13CG527-SB08	1537		2013	138.7	2.22	2.766	3.0%	1
Outwash	SO512	13SO512-SB07	1694	14-15	2013	133.4	2.14	2.751	3.6%	1
Outwash	SO512	13SO512-SB07	1695	23-24	2013	127.4	2.04	2.756	3.0%	1
Outwash	CG516	13SO516-SB24	1696	7-10	2013	128.7	2.06	2.742	2.5%	1
Outwash	CG516	13SO516-SB24	1697	17-18	2013	135.2	2.17	2.758	4.3%	1
Outwash	ST20	ST20-BH01-84-GT	10	84	1992	112.45	1.80		18.8%	3
Outwash	ST20	ST20-BH08-20-GT	11	20	1992	110.25	1.77		14.6%	3
Outwash	ST20	ST20-BH11-15-GT	12	35	1992	128.45	2.06		6.6%	3
Outwash	OU3	E316-MW-10-09	9	4 - 6.5	1993	131.664	2.11	2.77		4
Outwash	OU3	E316-SB-14-08	8	7.5 - 14	1993	108.576	1.74	2.56		4
Outwash	OU3	E316-SB-17-08	8	7.5 - 10	1993	120.432	1.93	2.7		4
Outwash	OU3	E316-SB-19-08	8	7.5 - 9	1993	105.456	1.69	2.69		4
Outwash	OU3	E321-MW-06-09	9		1993	106.704	1.71	2.57		4
Outwash	OU3	E321-SB-08-08	8	6 - 7.5	1993	106.08	1.7	2.62		4
Outwash	OU3	E331-MW-03-08	8		1993	127.92	2.05	2.74		4
					average	123.0		2.70	6.12%	
Ship Creek Alluvial Fan	ST409	409WL01		27.5	2001	146.4	2.35	2.697	5%	2
Ship Creek Alluvial Fan	ST409	409WL02		11	2001	127.8	2.05	2.718	30%	2
Ship Creek Alluvial Fan	ST409	409WL03		3.5	2001	120.8	1.94	2.705	3%	2
					average	131.7		2.7	12.5%	

References:

1= Weston 2013 JBER PBR Site Investigation Work

2= USAF, 2002b

3= USAF, 1994a

4= USAF, 1995

Table 2-2 Hydrogeologic Properties of JBER Soil Types

Soil Type	Site	Boring Number	Screen Depth or Sample Depth	Date	Hydraulic Conductivity (cm / sec)	Notes	Method	Reference
Ground Moraine	ST702	702WL15	7.5	2001	5.4E-04		Flexible Wall Permeameter	2
Ground Moraine	ST702	702WL14	14.5	2001	5.2E-07		Flexible Wall Permeameter	2
Ground Moraine	ST702	702WL17	14.5	2001	3.1E-06		Flexible Wall Permeameter	2
					1.8E-04	average		
					9.5E-06	geometric mean		
Outwash	ST20	ST20-MW06	90-105	10/23/1992	3.0E-02	geometric mean	pneumatic test, AQTESOLVE, Bouwer& Rice	3
Outwash	ST20	ST20-MW07	53-63	10/12/1992	4.0E-02	geometric mean	slug test, AQTESOLVE, Bouwer& Rice	3
Outwash	ST20	ST20-MW07	53-63	10/12/1992	3.1E-02		pneumatic test, AQTESOLVE, Bouwer& Rice	3
Outwash	ST20	ST20-MW09	47-62	10/12/1992	1.6E-02	geometric mean	slug test, AQTESOLVE, Bouwer& Rice	3
Outwash	ST20	ST20-MW10	23-28	10/12/1992	1.8E-02	geometric mean	slug test, AQTESOLVE, Bouwer& Rice	3
Outwash	ST20	ST20-MW11	18-33	10/12/1992	1.6E-02	geometric mean	slug test, AQTESOLVE, Bouwer& Rice	3
Outwash	OU3	PT-03		1988	1.1E-01	observation well (pumping PT-01)	pump test, AQTESOLVE, Neuman	4
Outwash	OU3	GW-3A	23 - 33	1988	2.0E-01	observation well (pumping PT-01)	pump test, AQTESOLVE, Neuman	4
Outwash	OU3	PT-04		1988	2.9E-01	observation well (pumping PT-01)	pump test, AQTESOLVE, Neuman	4
Outwash	OU5	OU5MW1		~1991	1.4E-01	corrected mean	slug test, AQTESOLVE, Bouwer& Rice	5
Outwash	OU5	OU5MW5		~1991	1.0E-01	corrected mean	slug test, AQTESOLVE, Bouwer& Rice	5
Outwash	OU5	OU5MW3		~1991	8.9E-02	corrected mean	slug test, AQTESOLVE, Bouwer& Rice	5
					9.04E-02	average		
					5.8E-02	geometric mean		
Ship Creek Alluvium	OU5	OU5MW14		~1991	7.1E-01	corrected mean	slug test, AQTESOLVE, Bouwer& Rice	5
Ship Creek Alluvium	OU5	OU5MW12		~1991	2.1E-01	corrected mean	slug test, AQTESOLVE, Bouwer& Rice	5
Ship Creek Alluvium	OU5	OU5MW10		~1991	3.5E-02	mean	slug test, AQTESOLVE, Bouwer& Rice	5
Ship Creek Alluvium	OU5	OU5MW13		~1991	3.2E-02	mean	slug test, AQTESOLVE, Bouwer& Rice	5
Ship Creek Alluvium	OU5	OU5MW8		~1991	1.2E-01	corrected mean	slug test, AQTESOLVE, Bouwer& Rice	5
Ship Creek Alluvium	OU5	OU5MW15		~1991	1.2E-01	corrected mean	slug test, AQTESOLVE, Bouwer& Rice	5
Ship Creek Alluvium	OU5	OU5MW31		~1991	1.1E-02	mean	slug test, AQTESOLVE, Bouwer& Rice	5
Ship Creek Alluvium	OU5	OU5MW16		~1991	3.0E-03	corrected mean	slug test, AQTESOLVE, Bouwer& Rice	5
					1.6E-01	average		
					5.5E-02	geometric mean		

References:
2= USAF, 2002b
3= USAF, 1994a
4= USAF, 1995
5= USAF, 1994b

Table 3-1 Survey Elevation Measurements and Coordinates

Site	Location	Northing (m)	Easting (m)	Measuring Point Elevation (ft AMSL)	Depth to Water (ft) 07/18/13	Groundwater Elevation (ft AMSL) 07/18/13
CG523	CG523L01	6797352.23	347977.59	110.38	--	--
CG523	CG523L02	6797344.33	347976.02	108.73	--	--
CG523	CG523L03	6797346.53	347973.43	108.84	--	--
CG523	CG523L04	6797338.42	347979.30	106.38	--	--
CG523	CG523L05	6797340.51	347973.81	106.70	--	--
CG523	CG523L06	6797343.38	347966.36	106.92	--	--
CG523	CG523L07	6797349.41	347976.30	109.93	--	--
CG523	CG523L08	6797354.00	347966.58	110.22	--	--
CG523	CG523L09	6797359.50	347974.01	111.46	--	--
CG523	CG523L10	6797353.35	347972.03	110.71	--	--
CG523	CG523L11	6797348.95	347981.52	109.65	--	--
CG523	CG523L12	6797348.76	347979.82	109.62	--	--
CG523	CG523L13	6797345.43	347980.96	109.22	--	--
CG523	13CG523-SB01	6797353.02	347971.83	109.90	--	--
CG523	13CG523-SB02	6797354.31	347966.86	109.63	--	--
CG523	13CG523-SB03	6797344.78	347976.09	107.96	--	--
CG523	13CG523-SB04	6797343.83	347966.45	106.36	--	--
CG523	13CG523-SB05	6797348.21	347979.54	108.86	--	--
CG523	13CG523-SB06	6797350.90	347974.13	109.60	--	--
CG523	13CG523-SB07	6797350.64	347970.38	109.38	--	--
CG523	13CG523-SB08	6797353.00	347969.53	109.83	--	--
CG523	13CG523-SB09	6797355.54	347972.70	110.55	--	--
CG523	13CG523-SB14	6797363.33	347979.18	98.28	--	--
CG523	13CG523-SB14	6797363.33	347979.18	98.28	--	--
CG523	703WL-IN	6797352.48	347978.41	114.50	4.16	110.34
CG523	703WL-01	6798528.51	350081.85	122.87	5.09	117.78
CG523	703WL-02	6797342.45	347974.49	119.63	6.54	113.09
CG523	703WL-03	6797354.70	347971.05	114.62	6.50	108.12

Notes:

ft = foot / feet

m =meters

AMSL = above mean sea level

Coordinate System: UTM, Zone 6N, WGS84, meters

Vertical Datum: NAVD88

Table 4-1 All BTEX, GRO, DRO & RRO Soils Results --- CG523, JBER-E, Alaska

Site Name	Boring or Well Number	Sample Depth	Sample Date	Reference	Sample Name	Benzene (mg/kg)	Toluene (mg/kg)	Ethylbenzene (mg/kg)	Xylenes (total) (mg/kg)	GRO (mg/kg)	DRO (mg/kg)	RRO (mg/kg)
CG523	13CG523-SB01	7.0-7.5	7/2/2013	1	13CG523-SB01-7.0-7.5-0	<0.1 U (0.046)	<0.1 U (0.063)	**2.7**	**9.8**	**1100**	**5200**	**120**
CG523	13CG523-SB01	9.0-9.5	7/2/2013	1	13CG523-SB01-9.0-9.5-0	**0.021 J**	**0.034 JB**	**0.37**	**2.09**	**170**	**1600**	**170**
CG523	13CG523-SB02	6.0-6.5	7/2/2013	1	13CG523-SB02-6.0-6.5-0	<0.17 U (0.075)	<0.17 U (0.1)	**0.22 J**	**0.5 J**	**440**	**1800**	**40 J**
CG523	13CG523-SB02	8.5-9.0	7/2/2013	1	13CG523-SB02-8.5-9.0-0	<0.0082 UJ (0.0036)	**0.0088 JB**	**0.035 J**	**0.134 J**	**4.6 J**	**250**	**9.9 J**
CG523	13CG523-SB03	12.0-12.5	7/2/2013	1	13CG523-SB03-12.0-12.5-0	<0.009 U (0.0039)	<0.009 U (0.0054)	<0.009 U (0.0079)	**0.02 J**	<2.4 U (1.2)	**0.85 JB**	**6 J**
CG523	13CG523-SB04	10.0-10.5	7/2/2013	1	13CG523-SB04-10.0-10.5-0	<0.0078 U (0.0034)	<0.0078 U (0.0047)	<0.0078 U (0.0069)	<0.0178 U (0.0106)	<2.1 U (1)	**3.5**	**21**
CG523	13CG523-SB05	10.5-11.0	7/3/2013	1	13CG523-SB05-10.5-11.0-0	<0.0087 U (0.0038)	<0.0087 U (0.0052)	<0.0087 U (0.0076)	<0.0207 U (0.0118)	<2.3 U (1.2)	**1.5 B**	**6.7 J**
CG523	13CG523-SB06	6.0-6.5	7/3/2013	1	13CG523-SB06-6.0-6.5-0	<0.0097 U (0.0042)	<0.0097 U (0.0058)	<0.0097 U (0.0085)	<0.0227 U (0.0131)	**22**	**450 J**	**8.5 J**
CG523	13CG523-SB07	6.0-6.5	7/3/2013	1	13CG523-SB07-6.0-6.5-0	<0.012 U (0.0052)	<0.012 U (0.007)	**0.088**	<0.028 U (0.0159)	**390**	**5800**	**110**
CG523	13CG523-SB07	7.0-7.5	7/3/2013	1	13CG523-SB07-7.0-7.5-0	<0.055 U (0.024)	<0.055 U (0.033)	<0.055 U (0.049)	<0.129 U (0.075)	**64**	**130**	**14**
CG523	13CG523-SB08	6.0-6.5	7/3/2013	1	13CG523-SB08-6.0-6.5-0	<0.099 U (0.043)	<0.099 U (0.059)	**2.2**	**2.9 J**	**910**	**5300**	**100**
CG523	13CG523-SB09	6.0-6.5	7/3/2013	1	13CG523-SB09-6.0-6.5-0	<0.16 U (0.072)	<0.16 U (0.098)	**0.22 J**	**0.46 J**	**440 J**	**4500**	**81 J**
CG523	13CG523-SB10	6.0-6.5	7/10/2013	1	13CG523-SB10-6.0-6.5-0	<0.01 U (0.0046)	<0.01 U (0.0063)	<0.01 U (0.0092)	<0.024 U (0.0143)	<2.8 U (1.4)	**14**	**36**
CG523	13CG523-SB11	6.0-6.5	7/10/2013	1	13CG523-SB11-6.0-6.5-0	<0.012 U (0.0054)	<0.012 U (0.0074)	<0.012 U (0.011)	<0.028 U (0.0168)	<3.3 U (1.6)	**2.6**	**13**
CG523	13CG523-SB12	7.0-7.5	7/10/2013	1	13CG523-SB12-7.0-7.5-0	<0.036 U (0.016)	<0.036 U (0.022)	<0.036 U (0.032)	<0.084 U (0.049)	**12 J**	**730**	**510**
CG523	13CG523-SB13	6.0-6.5	7/10/2013	1	13CG523-SB13-6.0-6.5-0	<0.087 U (0.038)	<0.087 U (0.052)	**0.92**	**1.384 J**	**570**	**7100**	**130**
CG523	13CG523-SB14	6.0-6.5	11/13/2013	1	13CG523-SB14-6.0-6.5-0	<0.017 U (0.0066)	<0.025 U (0.017)	<0.05 U (0.017)	<0.058 U (0.034)	**6.1 JB**	**7.7 J**	**54 J**
CG523	703-08SB-01	6	7/30/2008	2	703-08SB-01	<0.006 U (0.006)	<0.0181 U (0.0181)	**0.0876**	**0.1045**	**75.1**	**364**	--
CG523	703-08SB-01	7.5	7/30/2008	2	703-08SB-01	<0.0076 U (0.0076)	<0.0228 U (0.0228)	**0.129**	**0.2209**	**22.8**	**233**	--
CG523	703-08SB-01	9	7/30/2008	2	703-08SB-01	<0.0051 U (0.0051)	<0.0152 U (0.0152)	<0.0072 U (0.0072)	<0.0302 U (0.0302)	**1.12**	**2.19**	--
CG523	703-08SB-02	6	7/30/2008	2	703-08SB-02	<0.0058 U (0.0058)	<0.0174 U (0.0174)	<0.009 U (0.009)	<0.0348 U (0.0348)	**9.97**	**42.3**	--
CG523	703-08SB-02	7.5	7/30/2008	2	703-08SB-02	<0.005 U (0.005)	<0.015 U (0.015)	<0.0078 U (0.0078)	<0.03 U (0.03)	**2.71**	**9.94**	--
CG523	703-08SB-02	9	7/30/2008	2	703-08SB-02	<0.0054 U (0.0054)	<0.0163 U (0.0163)	<0.0085 U (0.0085)	<0.0326 U (0.0326)	**1.17**	**5.88**	--
CG523	EL-A200801	6	7/13/2001	3	EL-A200801	<0.0196 U (0.0196)	**0.0279**	<0.0377 U (0.0377)	**0.026**	**41.3**	**45.7**	--
CG523	EL-A200802	5	7/13/2001	3	EL-A200802	<0.0188 U (0.0188)	**0.026**	<0.0361 U (0.0361)	**0.0238**	**36.3**	**369**	--
CG523	EL-A200803	5.5	7/13/2001	3	EL-A200803	<0.02 U (0.02)	**0.0285**	<0.0386 U (0.0386)	**0.0239**	**11.6**	**25.4**	--
CG523	EL-A200804	5.5	7/13/2001	3	EL-A200804	**0.0159**	**0.149**	**0.121**	**0.3046**	**287**	**6080**	--
CG523	EL-A200805	6.5	7/13/2001	3	EL-A200805	<0.0201 U (0.0201)	**0.0347**	<0.0386 U (0.0386)	**0.0266**	<3.86 U (3.86)	**11.5**	--
CG523	EL-A200806	6.5	7/13/2001	3	EL-A200806	<0.0145 U (0.0145)	**0.0253**	**0.0145**	**0.02**	**15.6**	**378**	--
CG523	EL-A201201	6	7/23/2001	3	EL-A201201	--	--	--	--	--	**4850**	--
CG523	703BH01	10	6/30/1998	4	703BH01	<0.346 U (0.346)	<0.0346 U (0.0346)	<0.0346 U (0.0346)	**0.2168**	<1.38 U (1.38)	**7.75**	--
CG523	703BH04	10.5	7/1/1998	4	703BH04	**0.258**	**0.674**	**0.211**	**0.968**	**6.15**	**6.55 B**	--
CG523	703WL01	6	7/1/1998	4	703WL01	<0.0613 U (0.0613)	<0.0613 U (0.0613)	<0.0613 U (0.0613)	<0.1226 U (0.1226)	<2.45 U (2.45)	**9.17 B**	--
CG523	703WL02	7.5	7/2/1998	4	703WL02	<0.0712 U (0.0712)	<0.0712 U (0.0712)	<0.0712 U (0.0712)	<0.1424 U (0.1424)	<2.85 U (2.85)	**10.9**	--
PAH maximum detected concentration or maximum detection limit if all results are non-detect (potentially used as input to the HRC)						0.258	0.674	2.7	9.8	1100	7100	510
Screening Levels & Source						0.025 F	6.5 F	6.9 F	6.3 E	300 C	250 C	10000 A

Notes:
BTEX= benzene, toluene, ethylbenzene and total xylenes
DRO = diesel-range organics
GRO = gasoline-range organics
RRO = residual-range organics
( ) = reporting limit/method detection limit
NA = not applicable
-- = not analyzed
mg/kg = milligrams per kilogram

Bold = The analyte was detected.
Shading = The result is above the screening criteria.
Yellow highlight = from the NAPL-contaminated soil source area.
ft = feet
bgs = below ground surface
U = not detected
UJ = not detected, detection limit estimated
J = estimated value
B = analyte detected in the method blank (when used as a flag in a sample result)
JB= estimated value and analyte detected in the method blank (when used as a flag in a sample result)

Screening level sources:
A = 2012 ADEC Table B2 Method Two Soil Cleanup Level (under-40-in.) – Ingestion
B = 2012 ADEC Table B2 Method Two Soil Cleanup Level (under-40-in.) – Inhalation
C = 2012 ADEC Table B2 Method Two Soil Cleanup Level (under-40-in.) – Migration to Groundwater
D = 1/10th 2012 ADEC Table B1 Method Two Soil Cleanup Level (under-40-in.) – Direct Contact
E = 1/10th 2012 ADEC Table B1 Method Two Soil Cleanup Level (under-40-in.) – Outdoor Inhalation
F = 2012 ADEC Table B1 Method Two Soil Cleanup Level (under-40-in.) – Migration to Groundwater
G = 2012 EPA Soil Regional Screening Limits – Protection of Groundwater Risk-Based

References:
1 = WESTON 2013 JBER PBR Site Investigation
2 = USAF, 2009
3 = USAF, 2002a
4 = USAF, 1999

Table 4-2 Source Area BTEX, GRO, DRO & RRO Soils Results --- CG523, JBER-E, Alaska

Site Name	Boring or Well Number	Sample Depth	Sample Date	Reference	Sample Name	Benzene (mg/kg)	Toluene (mg/kg)	Ethylbenzene (mg/kg)	Xylenes (total) (mg/kg)	GRO (mg/kg)	DRO (mg/kg)	RRO (mg/kg)
CG523	13CG523-SB01	7.0-7.5	7/2/2013	1	13CG523-SB01-7.0-7.5-0	<0.1 U (0.046)	<0.1 U (0.063)	**2.7**	**9.8**	**1100**	**5200**	**120**
CG523	13CG523-SB01	9.0-9.5	7/2/2013	1	13CG523-SB01-9.0-9.5-0	**0.021 J**	**0.034 JB**	**0.37**	**2.09**	**170**	**1600**	**170**
CG523	13CG523-SB02	6.0-6.5	7/2/2013	1	13CG523-SB02-6.0-6.5-0	<0.17 U (0.075)	<0.17 U (0.1)	**0.22 J**	**0.5 J**	**440**	**1800**	**40 J**
CG523	13CG523-SB06	6.0-6.5	7/3/2013	1	13CG523-SB06-6.0-6.5-0	<0.0097 U (0.0042)	<0.0097 U (0.0058)	<0.0097 U (0.0085)	<0.0227 U (0.0131)	**22**	**450 J**	**8.5 J**
CG523	13CG523-SB07	6.0-6.5	7/3/2013	1	13CG523-SB07-6.0-6.5-0	<0.012 U (0.0052)	<0.012 U (0.007)	**0.088**	<0.028 U (0.0159)	**390**	**5800**	**110**
CG523	13CG523-SB08	6.0-6.5	7/3/2013	1	13CG523-SB08-6.0-6.5-0	<0.099 U (0.043)	<0.099 U (0.059)	**2.2**	**2.9 J**	**910**	**5300**	**100**
CG523	13CG523-SB09	6.0-6.5	7/3/2013	1	13CG523-SB09-6.0-6.5-0	<0.16 U (0.072)	<0.16 U (0.098)	**0.22 J**	**0.46 J**	**440 J**	**4500**	**81 J**
CG523	13CG523-SB12	7.0-7.5	7/10/2013	1	13CG523-SB12-7.0-7.5-0	<0.036 U (0.016)	<0.036 U (0.022)	<0.036 U (0.032)	<0.084 U (0.049)	**12 J**	**730**	**510**
CG523	13CG523-SB13	6.0-6.5	7/10/2013	1	13CG523-SB13-6.0-6.5-0	<0.087 U (0.038)	<0.087 U (0.052)	**0.92**	**1.384 J**	**570**	**7100**	**130**
CG523	703-08SB-01	6	7/30/2008	2	703-08SB-01	<0.006 U (0.006)	<0.0181 U (0.0181)	**0.0876**	**0.1045**	**75.1**	**364**	**--**
CG523	EL-A200802	5	7/13/2001	3	EL-A200802	**--**	**--**	**--**	**--**	**36.3**	**369**	**--**
CG523	EL-A200804	5.5	7/13/2001	3	EL-A200804	**--**	**--**	**--**	**--**	**287**	**6080**	**--**
CG523	EL-A200806	6.5	7/13/2001	3	EL-A200806	**--**	**--**	**--**	**--**	**15.6**	**378**	**--**
CG523	EL-A201201	6	7/23/2001	3	EL-A201201	**--**	**--**	**--**	**--**	**--**	**4850**	**--**
PAH maximum detected concentration or maximum detection limit if all results are non-detect (potentially used as input to the HRC)						0.021	0.034	2.7	9.8	1100	7100	510
Screening Levels & Source						0.025 F	6.5 F	6.9 F	6.3 E	300 C	250 C	10000 A

Notes:
BTEX= benzene, toluene, ethylbenzene and total xylenes
DRO = diesel-range organics
GRO = gasoline-range organics
RRO = residual-range organics
( ) = reporting limit/method detection limit
NA = not applicable
-- = not analyzed
mg/kg = milligrams per kilogram

Bold = The analyte was detected.
Shading = The result is above the screening criteria.
Yellow highlight = from the NAPL-contaminated soil source area.
ft = feet
bgs = below ground surface
U = not detected
UJ = not detected, detection limit estimated
J = estimated value
B = analyte detected in the method blank (when used as a flag in a sample result)
JB= estimated value and analyte detected in the method blank (when used as a flag in a sample result)

Screening level sources:
A = 2012 ADEC Table B2 Method Two Soil Cleanup Level (under-40-in.) – Ingestion
B = 2012 ADEC Table B2 Method Two Soil Cleanup Level (under-40-in.) – Inhalation
C = 2012 ADEC Table B2 Method Two Soil Cleanup Level (under-40-in.) – Migration to Groundwater
D = 1/10th 2012 ADEC Table B1 Method Two Soil Cleanup Level (under-40-in.) – Direct Contact
E = 1/10th 2012 ADEC Table B1 Method Two Soil Cleanup Level (under-40-in.) – Outdoor Inhalation
F = 2012 ADEC Table B1 Method Two Soil Cleanup Level (under-40-in.) – Migration to Groundwater
G = 2012 EPA Soil Regional Screening Limits – Protection of Groundwater Risk-Based

References:
1 = WESTON 2013 JBER PBR Site Investigation
2 = USAF, 2009
3 = USAF, 2002a

Table 4-3 PAH Soils Results --- CG523, JBER-E, Alaska

Site Name		CG523	CG523	CG523	CG523	CG523	CG523	PAH maximum detected concentration or maximum detection limit if all results are non-detect (potentially used as input to the HRC)	Screening Levels & Source
Boring or Well Number		13CG523-SB01	13CG523-SB02	13CG523-SB02	13CG523-SB09	703-08SB-01	703-08SB-02		
Sample Depth		7.0-7.5	6.0-6.5	8.5-9.0	6.0-6.5	6	6		
Sample Date		7/2/2013	7/2/2013	7/2/2013	7/3/2013	7/30/2008	7/30/2008		
Reference		1	1	1	1	2	2		
Sample Name		13CG523-SB01-7.0-7.5-0	13CG523-SB02-6.0-6.5-0	13CG523-SB02-8.5-9.0-0	13CG523-SB09-6.0-6.5-0	703-08SB-01	703-08SB-02		
GRO	(mg/kg)	**1100**	**440**	**4.6 J**	**440 J**	**75.1**	**9.97**	1100	300 C
DRO	(mg/kg)	**5200**	**1800**	**250**	**4500**	**364**	**42.3**	5200	250 C
RRO	(mg/kg)	**120**	**40 J**	**9.9 J**	**81 J**	**--**	**--**	120	10000 A
Acenaphthene	(mg/kg)	<0.085 U (0.027)	<0.016 U (0.0051)	<0.0016 UJ (0.0005)	**0.29**	<0.0016 U (0.0016)	<0.00169 U (0.00169)	0.29	180 F
Acenaphthylene	(mg/kg)	<0.028 U (0.019)	<0.0054 U (0.0036)	<0.00053 U (0.00035)	<0.01 U (0.0068)	<0.00532 U (0.00532)	<0.00564 U (0.00564)	0.019	180F
Anthracene	(mg/kg)	**0.076 J**	**0.021 J**	**0.0031 J**	<0.031 U (0.0081)	<0.0016 U (0.0016)	**0.0029**	0.076	2060 F
Benzo[g,h,i]perylene	(mg/kg)	<0.085 U (0.057)	<0.016 U (0.011)	<0.0016 UJ (0.0011)	<0.031 U (0.021)	<0.00532 U (0.00532)	**0.00532**	0.057	140 D
Fluoranthene	(mg/kg)	**0.09 J**	**0.0095 J**	**0.0022 J**	<0.01 U (0.006)	**0.0043**	**0.00351**	0.09	190 D
Fluorene	(mg/kg)	**1.9**	**0.63**	**0.073 J**	**0.69**	**0.0741**	<0.00169 U (0.00169)	1.9	220 F
Naphthalene 8270	(mg/kg)	**6.1**	**2**	**0.093 J**	**2.1**	**0.0149**	**0.00441**	6.1	2.8 E
Phenanthrene	(mg/kg)	**1.8**	**0.62**	**0.095 J**	**0.57**	**0.0689**	**0.00274**	1.8	2060 D
Pyrene	(mg/kg)	**0.09 J**	**0.012 J**	**0.0027 J**	**0.01 J**	<0.0016 U (0.0016)	**0.00438**	0.09	140 D
Benzo[a]anthracene	(mg/kg)	**0.033 J**	<0.0054 U (0.0033)	**0.0005 J**	<0.01 U (0.0062)	<0.0016 U (0.0016)	**0.00264**	0.033	0.49 D
Benzo[b]fluoranthene	(mg/kg)	<0.085 U (0.029)	<0.016 U (0.0055)	<0.0016 UJ (0.00053)	<0.031 U (0.01)	<0.0016 U (0.0016)	**0.005**	0.029	0.49 D
Benzo[k]fluoranthene	(mg/kg)	<0.085 U (0.043)	<0.016 U (0.0082)	<0.0016 UJ (0.0008)	<0.031 U (0.016)	<0.0016 U (0.0016)	<0.00169 U (0.00169)	0.043	4.9 D
Benzo[a]pyrene	(mg/kg)	<0.088 U (0.023)	<0.016 U (0.0043)	<0.0016 UJ (0.00042)	<0.031 U (0.0082)	<0.0016 U (0.0016)	**0.0052**	0.023	0.049 D
Chrysene	(mg/kg)	**0.036 J**	**0.0062 J**	**0.0014 J**	<0.01 U (0.0071)	<0.0016 U (0.0016)	**0.0031**	0.036	49 D
Dibenz(a,h)anthracene	(mg/kg)	<0.085 U (0.068)	<0.016 U (0.013)	<0.0016 UJ (0.0013)	<0.031 U (0.025)	<0.0016 U (0.0016)	<0.0017 U (0.0017)	0.068	0.049 D
Indeno[1,2,3-cd]pyrene	(mg/kg)	<0.085 U (0.027)	<0.016 U (0.0052)	<0.0016 UJ (0.00051)	<0.031 U (0.0098)	<0.0016 U (0.0016)	**0.0041**	0.027	0.49 D
1-Methylnaphthalene	(mg/kg)	**--**	**--**	**--**	**--**	<0.0016 U (0.0016)	**0.00722**	0.00722	6.2 F
2-Methylnaphthalene	(mg/kg)	**--**	**--**	**--**	**--**	<0.0016 U (0.0016)	**0.00654**	0.00654	6.1 F

Notes:
BTEX= benzene, toluene, ethylbenzene and total xylenes
DRO = diesel-range organics
GRO = gasoline-range organics
RRO = residual-range organics
( ) = reporting limit/method detection limit
NA = not applicable
-- = not analyzed
mg/kg = milligrams per kilogram
Bold = The analyte was detected.
Shading = The result is above the screening criteria.
Yellow highlight = from the NAPL-contaminated soil source area.
ft = feet
bgs = below ground surface
U = not detected
UJ = not detected, detection limit estimated
J = estimated value
B = analyte detected in the method blank (when used as a flag in a sample result)
JB= estimated value and analyte detected in the method blank (when used as a flag in a sample result)

Screening level sources:
A = 2012 ADEC Table B2 Method Two Soil Cleanup Level (under-40-in.) – Ingestion
B = 2012 ADEC Table B2 Method Two Soil Cleanup Level (under-40-in.) – Inhalation
C = 2012 ADEC Table B2 Method Two Soil Cleanup Level (under-40-in.) – Migration to Groundwater
D = 1/10th 2012 ADEC Table B1 Method Two Soil Cleanup Level (under-40-in.) – Direct Contact
E = 1/10th 2012 ADEC Table B1 Method Two Soil Cleanup Level (under-40-in.) – Outdoor Inhalation
F = 2012 ADEC Table B1 Method Two Soil Cleanup Level (under-40-in.) – Migration to Groundwater
G = 2012 EPA Soil Regional Screening Limits – Protection of Groundwater Risk-Based

References:
1 = WESTON 2013 JBER PBR Site Investigation
2 = USAF, 2009

Table 4-4a Non Source Area VPH Soils Results --- CG523, JBER-E, Alaska

Site Name	Boring or Well Number	Sample Depth	Sample Date	Reference	Sample Name	Benzene	Toluene	Ethylbenzene	Xylene (total)	C8-C10 Aromatics	C9-C10 Aromatics	C10-C12 Aromatics	C12-C13 Aromatics	C5-C6 Aliphatics	C6-C8 Aliphatics	C8-C10 Aliphatics	C10-C12 Aliphatics	Total VPH
						Result (mg/kg)	Result (mg/kg)	Result (mg/kg)	Result (mg/kg)	Result (mg/kg)	Calculated Value (mg/kg)	Result (mg/kg)	Result (mg/kg)	Result (mg/kg)	Result (mg/kg)	Result (mg/kg)	Result (mg/kg)	
CG523	13CG523-SB02	8.5-9.0	7/2/2013	1	13CG523-SB02-8.5-9.0-0	<0.0082 UJ (0.0036)	0.0088 JB	0.035 J	0.134 J	0.97 JB	0.801	5.1 J	8.6	<1.8 U (0.58)	<1.8 U (0.58)	1 J	3.5 J	27

Table 4-4b Non Source Area EPH Soils Results --- CG523, JBER-E, Alaska

Site Name	Boring or Well Number	Sample Depth	Sample Date	Reference	Sample Name	C8-C10 Aromatics	C9-C10 Aromatics	C10-C12 Aromatics	C12-C16 Aromatics	C16-C21 Aromatics	C21-C34 Aromatics	C8-C10 Aliphatics	C10-C12 Aliphatics	C12-C16 Aliphatics	C16-C21 Aliphatics	C21-C34 Aliphatics	DRO Aromatics C10 to C21 (mg/kg)	DRO Aliphatics C10 to C21 (mg/kg)	DRO (Sum of C10 to C21 A&A) (mg/kg)
						Result (mg/kg)	Calculated Value (mg/kg)	Result (mg/kg)	Result (mg/kg)	Result (mg/kg)	Result (mg/kg)	Result (mg/kg)	Result (mg/kg)	Result (mg/kg)	Result (mg/kg)	Result (mg/kg)			
CG523	13CG523-SB02	8.5-9.0	7/2/2013	1	13CG523-SB02-8.5-9.0-0	--	--	1.4 J	6.5	7.3	2.9 JB	--	4.5 J	17	8	2 J	15.2	29.5	44.7

Table 4-4c Source Area BTEX and VPH Soils Results --- CG523, JBER-E, Alaska

Site Name	Boring or Well Number	Sample Depth	Sample Date	Reference	Sample Name	Benzene	Toluene	Ethylbenzene	Xylene (total)	C8-C10 Aromatics	C9-C10 Aromatics	C10-C12 Aromatics	C12-C13 Aromatics	C5-C6 Aliphatics	C6-C8 Aliphatics	C8-C10 Aliphatics	C10-C12 Aliphatics	Total VPH
						Result (mg/kg)	Result (mg/kg)	Result (mg/kg)	Result (mg/kg)	Result (mg/kg)	Calculated Value (mg/kg)	Result (mg/kg)	Result (mg/kg)	Result (mg/kg)	Result (mg/kg)	Result (mg/kg)	Result (mg/kg)	
CG523	13CG523-SB01	7.0-7.5	7/2/2013	1	13CG523-SB01-7.0-7.5-0	<0.1 U (0.046)	<0.1 U (0.063)	2.7	9.8	220	207.5	740	1400	<9.3 U (3.1)	21 J	360	930 J	3500
CG523	13CG523-SB02	6.0-6.5	7/2/2013	1	13CG523-SB02-6.0-6.5-0	<0.17 U (0.075)	<0.17 U (0.1)	0.22 J	0.5 J	60 J	59.28	320	740	<9.3 U (3.1)	5.9 J	110	400 J	1700
CG523	13CG523-SB09	6.0-6.5	7/3/2013	1	13CG523-SB09-6.0-6.5-0	<0.16 U (0.072)	<0.16 U (0.098)	0.22 J	0.46 J	36	35.32	140	270	<1.6 U (0.53)	2.8 J	64 J	180 J	630
					average with fraction:	0.064	0.087	1.047	3.587	105.333	100.700	400.000	803.333	2.243	9.900	178.000	503.333	1943.33

Table 4-4d Source Area EPH Soils Results --- CG523, JBER-E, Alaska

Site Name	Boring or Well Number	Sample Depth	Sample Date	Reference	Sample Name	C8-C10 Aromatics	C9-C10 Aromatics	C10-C12 Aromatics	C12-C16 Aromatics	C16-C21 Aromatics	C21-C34 Aromatics	C8-C10 Aliphatics	C10-C12 Aliphatics	C12-C16 Aliphatics	C16-C21 Aliphatics	C21-C34 Aliphatics	DRO Aromatics C10 to C21 (mg/kg)	DRO Aliphatics C10 to C21 (mg/kg)	DRO (Sum of C10 to C21 A&A) (mg/kg)
						Result (mg/kg)	Calculated Value (mg/kg)	Result (mg/kg)	Result (mg/kg)	Result (mg/kg)	Result (mg/kg)	Result (mg/kg)	Result (mg/kg)	Result (mg/kg)	Result (mg/kg)	Result (mg/kg)			
CG523	13CG523-SB01	7.0-7.5	7/2/2013	1	13CG523-SB01-7.0-7.5-0	--	--	260	960	1000	110	--	2600	6500	2100	270	2220	11200	13420
CG523	13CG523-SB02	6.0-6.5	7/2/2013	1	13CG523-SB02-6.0-6.5-0	--	--	99	380	490	47	--	740	2000	660	73	969	3400	4369
CG523	13CG523-SB09	6.0-6.5	7/3/2013	1	13CG523-SB09-6.0-6.5-0	--	--	53	190	260	27	--	360	900	300	33	503	1560	2063
					average with fraction:			137.333	510.000	583.333	61.333		1233.333	3133.333	1020.000	125.333			

Table 4-4e Source Area Hydrocarbon Characterization --- CG523, JBER-E, Alaska

Compounds and A&A EC Fractions	B	T	E	X	C9-C10 Aromatics	C10-C12 Aromatics	C12-C16 Aromatics	C16-C21 Aromatics	C21-C34 Aromatics	C5-C6 Aliphatics	C6-C8 Aliphatics	C8-C10 Aliphatics	C10-C12 Aliphatics	C12-C16 Aliphatics	C16-C21 Aliphatics	C21-C34 Aliphatics	TPH
Source of data used as input to the characterization were overlap exists (enter: max, VPH or EPH)					VPH							VPH					
Average concentration in A&A EC groups (mg/kg)	0.06433333	0.087	1.046666667	3.586666667	100.7	400	510	583.3333333	61.33333333	2.243333333	9.9	178	1233.333333	3133.333333	1020	125.3333333	7362.294667
Fraction of TPH mass in A&A EC groups	8.7382E-06	1.1817E-05	0.000142166	0.000487167	0.013677801	0.054330887	0.069271881	0.079232544	0.008330736	0.000304706	0.001344689	0.024177245	0.167520235	0.425591949	0.138543762	0.017023678	1.00
GRO, DRO & RRO A&A Groups	**GRO aromatics**					**DRO aromatics**			**RRO aromatics**	**GRO aliphatics**			**DRO aliphatics**			**RRO aliphatics**	
Sum of A&A EC mass fractions within GRO, DRO & RRO A&A Groups	0.01432769					0.202835312			0.008330736	0.02582664			0.731655946			0.017023678	1.00
Mass fraction of A&A EC Groups within GRO, DRO & RRO A&A Groups	0.00060988	0.000824764	0.009922453	0.034001782	0.954641117	0.267857143	0.341517857	0.390625	1.00	0.011798117	0.052065985	0.936135897	0.228960396	0.581683168	0.189356436	1.00	
Sum of A&A EC mass fractions within GRO, DRO & RRO A&A Groups	1.00					1.00			1.00	1.00			1.00			1.00	

% of TPH that is GRO=	4.02%	GRO % aromatics=	0.356815547
% of TPH that is DRO=	93.45%	GRO % aliphatics=	0.643184453
% of TPH that is RRO=	2.54%	DRO % aromatics=	0.217054264
		DRO % aliphatics=	0.782945736
		RRO % aromatics=	0.328571429
		RRO % aliphatics=	0.671428571

Table 4-4f HRC Input --- CG523, JBER-E, Alaska

input to cells C14 to C16 (4-phase, cumulative risk calcs)	
GRO: fraction aromatic	0.356815547
DRO: fraction aromatic	0.217054264
RRO: fraction aromatic	0.328571429

input to cells D75 to D77 (4-phase, cumulative risk calcs)	
Aromatic C10-C12	0.267857143
Aromatic C12-C16	0.341517857
Aromatic C16-C21	0.390625

input to cells D79 to D84 (4-phase, cumulative risk calcs)	
Aliphatic C5-C6	0.011798117
Aliphatic C6-C8	0.052065985
Aliphatic C8-C10	0.936135897
Aliphatic C10-C12	0.228960396
Aliphatic C12-C16	0.581683168
Aliphatic C16-C21	0.189356436

Notes:

VPH = volatile petroleum hydrocarbons
EPH = extractable petroleum hydrocarbons
BTEX = benzene, toluene, ethylbenzene, xylenes
TPH = total petroleum hydrocarbons
mg/kg = milligrams per kilogram
( ) = reporting limit/method detection limit
-- = not analyzed
ft = feet
bgs = below ground surface

A&A = aliphatic and aromatic
EC = equivalent carbon
HRC = Hydrocarbon Risk Calculator
GRO = gasoline-range organics
DRO = diesel-range organics
RRO = residual-range organics
NA = not applicable

U = not detected
UJ = not detected, detection limit estimated
J = estimated value
B = analyte detected in the method blank (when used as a flag in a sample result)
JB= estimated value and analyte detected in the method blank (when used as a flag in a sample result)

References:
1 = WESTON 2013 JBER PBR Site Investigation

Table 4-5 BTEX, GRO, DRO & RRO Groundwater Results --- CG523, JBER-E, Alaska

Site Name	Boring or Well Number	Sample Depth	Sample Date	Reference	Sample Name	Benzene (mg/L)	Toluene (mg/L)	Ethylbenzene (mg/L)	Xylenes (total) (mg/L)	GRO (mg/L)	DRO (mg/L)	RRO (mg/L)
CG523	703MWIN	NA	7/18/2013	1	13CG523-703MWIN-GW-0	--	--	--	--	--	**0.029 J**	--
CG523	703WL01	NA	7/19/2013	1	13CG523-703WL01-GW-0	<0.0002 U (0.00013)	**0.00025 J**	<0.0002 U (0.0001)	<0.0012 U (0.00028)	<0.025 U (0.015)	**0.031 J**	<0.1 U (0.084)
CG523	703WL02	NA	7/18/2013	1	13CG523-703WL02-GW-0	<0.0002 U (0.00013)	**0.00044 J**	<0.0002 U (0.0001)	<0.0012 U (0.00028)	<0.025 U (0.015)	**0.034 J**	<0.097 U (0.082)
CG523	703WL03	NA	7/19/2013	1	13CG523-703WL03-GW-0	**0.00023 J**	**0.0016**	**0.0012**	**0.00318 J**	**0.11**	**0.62**	<0.099 U (0.083)
CG523	703MWIN	NA	8/4/2012	2	12ST703-703MWIN-GW-0	--	--	--	--	--	**0.028 J**	--
CG523	703MWIN	NA	9/15/2011	3	703MW-IN-2011-0	--	--	--	--	--	**0.017 J**	--
CG523	703MWIN	NA	2010	4	703MW-IN	--	--	--	--	--	<0.574 U (0.574)	--
CG523	703MWIN	NA	2008	4	703MW-IN	--	--	--	--	--	<0.0667 U (0.0667)	--
CG523	703MWIN	NA	2007	4	703MW-IN	<0.0002 U (0.0002)	<0.001 U (0.001)	<0.001 U (0.001)	<0.003 U (0.003)	--	<0.05 U (0.05)	--
CG523	703MWIN	NA	2006	4	703MW-IN	**0.000136**	**0.00019**	<0.0005 U (0.0005)	**0.000389**	--	<0.417 U (0.417)	--
CG523	703WL01	NA	8/7/1998	5	703WL-01	<0.001 U (0.001)	<0.001 U (0.001)	<0.001 U (0.001)	<0.002 U (0.002)	<0.04 U (0.04)	<0.102 U (0.102)	--
CG523	703WL02	NA	2006	6	703WL-02	<0.0002 U (0.0002)	<0.0005 U (0.0005)	**0.000255**	**0.000847**	--	**0.0704**	--
CG523	703WL02	NA	2005	6	703WL-02	<0.0005 U (0.0005)	<0.0005 U (0.0005)	<0.0005 U (0.0005)	<0.002 U (0.002)	--	<0.413 U (0.413)	--
CG523	703WL02	NA	8/7/1998	5	703WL-02	<0.001 U (0.001)	<0.001 U (0.001)	<0.001 U (0.001)	<0.002 U (0.002)	<0.04 U (0.04)	<0.11 U (0.11)	--
Maximum detected concentration or maximum detection limit if all results are non-detect (potentially used as input to the HRC)						0.00023	0.0016	0.0012	0.00318	0.11	0.62	0.084
Screening Level & Source						0.0005 H	0.1 H	0.07 H	1 H	0.22 H	0.15 H	0.11 H

Notes:

BTEX = benzene, toluene, ethylbenzene, xylenes
DRO = diesel-range organics
GRO = gasoline-range organics
RRO = residual-range organics
( ) = reporting limit/method detection limit
MW = monitoring well
ft = foot / feet
bgs = below ground surface
mg/L = milligrams per liter
NA = not applicable

U = not detected
UJ = not detected, detection limit estimated
J = estimated value
B = analyte detected in the method blank (when used as a flag in a sample result)
JB= estimated value and analyte detected in the method blank (when used as a flag in a sample result)
Bold = The analyte was detected.
Shading = The result is above the screening criteria.
Screening level sources:
H= 1/10th 2012 ADEC Table C Method Two Soil Cleanup Level – Groundwater Ingestion
I= 2012 EPA Soil Regional Screening Limits – Tap Water

References:

1 = WESTON 2013 JBER PBR Site Investigation
2 = USAF, 2013c
3 = USAF, 2012
4 = USAF, 2010
5 = USAF, 1999
6 = USAF, 2007

Table 4-6 PAH Groundwater Results --- CG523, JBER-E, Alaska

		Site Name	CG523	CG523	CG523	PAH maximum detected concentration or maximum detection limit if all results are non-detect	Screening Levels & Source
		Boring or Well Number	703WL01	703WL02	703WL03		
		Sample Depth	GW	GW	GW		
		Sample Date	7/19/2013	7/18/2013	7/19/2013		
		Reference	1	1	1		
		Sample Name	13CG523-703WL01-GW-0	13CG523-703WL02-GW-0	13CG523-703WL03-GW-0		
GRO	(mg/L)		<0.025 U (0.015)	<0.025 U (0.015)	**0.11**	0.11	0.22 H
DRO	(mg/L)		**0.031 J**	**0.034 J**	**0.62**	0.62	0.15 H
RRO	(mg/L)		<0.1 U (0.084)	<0.097 U (0.082)	<0.099 U (0.083)	0.1	0.11 H
Acenaphthene	(mg/L)		<0.00001 U (0.0000032)	<0.0000098 U (0.0000031)	**0.00031**	0.00031	0.22 H
Acenaphthylene	(mg/L)		<0.00001 U (0.0000031)	<0.0000098 U (0.000003)	<0.00001 U (0.0000031)	0.0000031	0.22 H
Anthracene	(mg/L)		<0.00001 U (0.0000045)	<0.0000098 U (0.0000044)	**0.000012 J**	0.000012	1.1 H
Benzo[g,h,i]perylene	(mg/L)		<0.00001 U (0.0000056)	<0.0000098 U (0.0000054)	<0.00001 U (0.0000056)	0.0000056	0.11 H
Fluoranthene	(mg/L)		<0.00001 U (0.0000043)	<0.0000098 U (0.0000042)	<0.00001 U (0.0000043)	0.0000043	0.15 H
Fluorene	(mg/L)		<0.00001 U (0.0000041)	<0.0000098 U (0.000004)	**0.00074**	0.00074	0.15 H
Naphthalene	(mg/L)		**0.0000047 J**	**0.0000097 J**	**0.0012**	0.0012	0.073 H
Phenanthrene	(mg/L)		<0.00001 U (0.0000064)	<0.0000098 U (0.0000062)	**0.00013**	0.00013	1.1 H
Pyrene	(mg/L)		<0.00001 U (0.0000042)	<0.0000098 U (0.0000041)	<0.00001 U (0.0000042)	0.0000042	0.11 H
Benzo[a]anthracene	(mg/L)		<0.00001 U (0.0000047)	<0.0000098 U (0.0000045)	<0.00001 U (0.0000046)	0.0000047	0.00012 H
Benzo[b]fluoranthene	(mg/L)		<0.00002 U (0.000012)	<0.00002 U (0.000012)	<0.00002 U (0.000012)	0.000012	0.00012 H
Benzo[k]fluoranthene	(mg/L)		<0.00001 U (0.0000079)	<0.0000098 U (0.0000077)	<0.00001 U (0.0000079)	0.0000079	0.0012 H
Benzo[a]pyrene	(mg/L)		<0.00001 U (0.0000044)	<0.0000098 U (0.0000043)	<0.00001 U (0.0000044)	0.0000044	0.00002 H
Chrysene	(mg/L)		<0.00001 U (0.000004)	<0.0000098 U (0.0000039)	<0.00001 U (0.000004)	0.000004	0.012 H
Dibenz(a,h)anthracene	(mg/L)		<0.00002 U (0.000015)	<0.00002 U (0.000014)	<0.00002 U (0.000015)	0.000015	0.000012 H
Indeno[1,2,3-cd]pyrene	(mg/L)		<0.00002 U (0.000014)	<0.00002 U (0.000014)	<0.00002 U (0.000014)	0.000014	0.00012 H
1-Methylnaphthalene	(mg/L)		--	--	--	0	0.015 H
2-Methylnaphthalene	(mg/L)		--	--	--	0	0.015 H

Notes:
PAH = polycyclic aromatic hydrocarbons
DRO = diesel-range organics
GRO = gasoline-range organics
RRO = residual-range organics
ft = foot / feet
bgs = below ground surface
mg/L = milligrams per liter
( ) = reporting limit/method detection limit
-- = not analyzed
NA = not applicable
U = not detected
UJ = not detected, detection limit estimated
J = estimated value
B = analyte detected in the method blank (when used as a flag in a sample result)
JB= estimated value and analyte detected in the method blank (when used as a flag in a sample result)
Bold = The analyte was detected.
Shading = The result is above the screening criteria.
Screening Level Sources:
H= 1/10th 2012 ADEC Table C Method Two Soil Cleanup Level – Groundwater Ingestion
I= 2012 EPA Soil Regional Screening Limits – Tap Water
References:
1 = WESTON 2013 JBER PBR Site Investigation

Table 4-7 All VPH & EPH Groundwater Results --- CG523, JBER-E, Alaska

Site Name		CG523	CG523	CG523	
Boring or Well Number		703WL01	703WL02	703WL03	
Sample Depth		NA	NA	NA	
Sample Date		7/19/2013	7/18/2013	7/19/2013	
Reference		1	1	1	
Sample Name		13CG523-703WL01-GW-0	13CG523-703WL02-GW-0	13CG523-703WL03-GW-0	maximum value
C8-C10 Aromatics V	(mg/L)	<0.006 U (0.0052)	<0.006 U (0.0052)	**0.023 J**	
C10-C12 Aromatics V	(mg/L)	<0.006 U (0.0012)	<0.006 U (0.0012)	**0.11**	
C12-C13 Aromatics V	(mg/L)	<0.006 U (0.0028)	<0.006 U (0.0028)	**0.13**	
C5-C6 Aliphatics V	(mg/L)	<0.006 UJ (0.0029)	<0.006 UJ (0.0029)	<0.006 UJ (0.0029)	
C6-C8 Aliphatics V	(mg/L)	<0.006 U (0.0008)	**0.0038 JB**	**0.007 J**	
C8-C10 Aliphatics V	(mg/L)	**0.0018 JB**	**0.0061 JB**	**0.022 JB**	
C10-C12 Aliphatics V	(mg/L)	**0.0041 JB**	**0.0071 JB**	**0.056**	
Total VPH V	(mg/L)	<0.006 U (0.001)	**0.027 JB**	**0.37**	
C8-C10 Aromatics	(mg/L)	**--**	**--**	**--**	
C10-C12 Aromatics	(mg/L)	<0.05 U (0.0041)	<0.049 U (0.004)	**0.041 J**	
C12-C16 Aromatics	(mg/L)	<0.05 U (0.0057)	<0.049 U (0.0056)	**0.07**	
C16-C21 Aromatics	(mg/L)	<0.05 U (0.007)	<0.049 U (0.0068)	**0.04 J**	
C21-C34 Aromatics	(mg/L)	<0.05 UJ (0.015)	<0.049 UJ (0.015)	<0.05 UJ (0.015)	
C8-C10 Aliphatics	(mg/L)	**--**	**--**	**--**	
C10-C12 Aliphatics	(mg/L)	<0.05 U (0.0031)	<0.049 U (0.003)	**0.099**	
C12-C16 Aliphatics	(mg/L)	**0.0043 JB**	**0.0042 JB**	**0.12**	
C16-C21 Aliphatics	(mg/L)	**0.034 JB**	**0.017 JB**	**0.044 JB**	
C21-C34 Aliphatics	(mg/L)	**0.015 JB**	**0.015 JB**	**0.018 JB**	
GRO aromatics (C5 to C10 aro)	(mg/L)	0.0052	0.0052	0.023	0.023
GRO aliphatics (C5 to C10 ali)	(mg/L)	0.0055	0.0128	0.0319	0.0319
DRO Aromatics (C10 to C21)	(mg/L)	0.0168	0.0164	0.151	0.151
DRO Aliphatics (C10 to C21)	(mg/L)	0.0414	0.0242	0.263	0.263
RRO aromatics (C21 to C34 aro)	(mg/L)	0.015	0.015	0.015	0.015
RRO aliphatics (C21 to C34 ali)	(mg/L)	0.015	0.015	0.018	0.018
GRO (sum of C5 to C10 A&A)	(mg/L)	0.0107	0.018	0.0549	0.0549
DRO (sum of C10 to C21 A&A)	(mg/L)	0.0582	0.0406	0.414	0.414
RRO (sum of C21 to C35 A&A)	(mg/L)	0.03	0.03	0.033	0.033
GRO (AK101)	(mg/L)	<0.025 U (0.015)	<0.025 U (0.015)	**0.11**	
DRO (AK102)	(mg/L)	**0.031 J**	**0.034 J**	**0.62**	
RRO (AK103)	(mg/L)	<0.1 U (0.084)	<0.097 U (0.082)	<0.099 U (0.083)	

Notes:
VPH = volatile petroleum hydrocarbons
EPH = extractable petroleum hydrocarbons
BTEX = benzene, toluene, ethylbenzene, xylenes
TPH = total petroleum hydrocarbons
DRO = diesel-range organics
GRO = gasoline-range organics
RRO = residual-range organics
mg/L = milligrams per liter
( ) = reporting limit/method detection limit
-- = not analyzed
A&A = aliphatic and aromatic
EC = equivalent carbon
HRC = Hydrocarbon Risk Calculator
NA = not applicable
U = not detected
UJ = not detected, detection limit estimated
J = estimated value
B = analyte detected in the method blank (when used as a flag in a sample result)
JB= estimated value and analyte detected in the method blank (when used as a flag in a sample result)
References:
1 = WESTON 2013 JBER PBR Site Investigation

Table 5-1 Exposure Pathway Evaluation --- CG523, JBER-E, Alaska

Pathway	Pathway Evaluation	Explanation
Soil ingestion/direct contact	Potentially complete pathway -- present & future	Currently complete for a recreational scenario, potentially complete in the future for a residential and/or industrial scenario.
Inhalation -- outdoor air	Potentially complete pathway -- present & future	Currently complete for a recreational scenario, potentially complete in the future for a residential and/or industrial scenario.
Inhalation -- indoor air (vapor intrusion)	Potentially complete pathway -- future	Currently incomplete (no buildings present within 30 feet of the contaminated soil source area), potentially complete in the future for a residential and/or industrial scenario.
Groundwater ingestion	Potentially complete pathway -- future	Currently complete (drinking water well #24 was installed 38' bgs, located 170' upgradient of the source), potentially complete in the future for a residential scenario.
Surface water ingestion	Incomplete	Currently incomplete (surface water is not extracted near the contaminated soil source area or groundwater plume), likely incomplete in the future for a residential scenario.
Wild foods ingestion	Insignificant	The site is within a portion of the installation without wild food gathering. In addition, plants and animals feeding on the plants tend to not significantly take up or accumulate diesel range organics.
Ecological receptor exposure	Insignificant	Calculations indicate that site groundwater meets the ambient water quality criteria for benzene, total aromatic hydrocarbons, total aqueous hydrocarbons; no visible surface staining, no distressed plants, no sediment transport to surface water.

Notes:
“Insignificant” means the pathway may be complete; however, receptors are unlikely to be affected by the minimal contact, volume or concentration of remaining contamination.

“Incomplete” means contamination has no potential to contact receptors.
“Potentially complete” means contamination has the potential to contact receptors.

Table 5-2 95% UCL Concentrations --- CG523, JBER-E, Alaska

CG523 ProUCL Input File

Benzene	d_Benzene	Toluene	d_Toluene	Ethylbenzene	d_Ethylbenzene	Xylene	d_Xylene	GRO	d_GRO	DRO	d_DRO	RRO	d_RRO
0.046	0	0.063	0	2.7	1	9.8	1	1100	1	5200	1	120	1
0.021	1	0.034	1	0.37	1	2.09	1	170	1	1600	1	170	1
0.075	0	0.1	0	0.22	1	0.5	1	440	1	1800	1	40	1
0.0042	0	0.0058	0	0.0085	0	0.0131	0	22	1	450	1	8.5	1
0.0052	0	0.007	0	0.088	1	0.0159	0	390	1	5800	1	110	1
0.043	0	0.059	0	2.2	1	2.9	1	910	1	5300	1	100	1
0.072	0	0.098	0	0.22	1	0.46	1	440	1	4500	1	81	1
0.016	0	0.022	0	0.032	0	0.049	0	12	1	730	1	510	1
0.038	0	0.052	0	0.92	1	1.384	1	570	1	7100	1	130	1
0.006	0	0.0181	0	0.0876	1	0.1045	1	75.1	1	364	1		
								36.3	1	369	1		
								287	1	6080	1		
								15.6	1	378	1		
										4850	1		

CG523 ProUCL Output File

General UCL Statistics for Data Sets with Non-Detects

User Selected Options				
From File	WorkSheet.wst	Benzene	0.021	max detection
Full Precision	OFF	Toluene	0.034	max detection
Confidence Coefficient	95%	Ethylbenzene	2.046	95% UCL
Number of Bootstrap Operations	10000	Xylene	3.765	95% UCL
		GRO	689.4	95% UCL
		DRO	6164	95% UCL
		RRO	279.4	95% UCL

Ethylbenzene

General Statistics

Number of Valid Data	10	Number of Detected Data	8
Number of Distinct Detected Data	7	Number of Non-Detect Data	2
		Percent Non-Detects	20.00%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.0876	Minimum Detected	-2.435
Maximum Detected	2.7	Maximum Detected	0.993
Mean of Detected	0.851	Mean of Detected	-0.899
SD of Detected	1.031	SD of Detected	1.34
Minimum Non-Detect	0.0085	Minimum Non-Detect	-4.768
Maximum Non-Detect	0.032	Maximum Non-Detect	-3.442

Note: Data have multiple DLs - Use of KM Method is recommended
For all methods (except KM, DL/2, and ROS Methods),
Observations < Largest ND are treated as NDs

Number treated as Non-Detect	2
Number treated as Detected	8
Single DL Non-Detect Percentage	20.00%

Warning: There are only 8 Detected Values in this data
Note: It should be noted that even though bootstrap may be performed on this data set
the resulting calculations may not be reliable enough to draw conclusions

It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.762	Shapiro Wilk Test Statistic	0.905
5% Shapiro Wilk Critical Value	0.818	5% Shapiro Wilk Critical Value	0.818
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	0.683	Mean	-1.679
SD	0.976	SD	2.049
95% DL/2 (t) UCL	1.248	95% H-Stat (DL/2) UCL	65.68
Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
Mean	0.546	Mean in Log Scale	-1.548
SD	1.086	SD in Log Scale	1.808
95% MLE (t) UCL	1.176	Mean in Original Scale	0.684
95% MLE (Tiku) UCL	1.171	SD in Original Scale	0.975
		95% t UCL	1.249
		95% Percentile Bootstrap UCL	1.192
		95% BCA Bootstrap UCL	1.298
		95% H UCL	21.33

Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only	
k star (bias corrected)	0.586	Data appear Gamma Distributed at 5% Significance Level	
Theta Star	1.451		
nu star	9.38		
A-D Test Statistic	0.506	**Nonparametric Statistics**	
5% A-D Critical Value	0.743	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.743	Mean	0.698
5% K-S Critical Value	0.303	SD	0.915
Data appear Gamma Distributed at 5% Significance Level		SE of Mean	0.309
		95% KM (t) UCL	1.265
Assuming Gamma Distribution		95% KM (z) UCL	1.207
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	1.257
Minimum	0.000001	95% KM (bootstrap t) UCL	2.396
Maximum	2.7	95% KM (BCA) UCL	1.227
Mean	0.681	95% KM (Percentile Bootstrap) UCL	1.217
Median	0.22	95% KM (Chebyshev) UCL	2.046
SD	0.977	97.5% KM (Chebyshev) UCL	2.629
k star	0.229	99% KM (Chebyshev) UCL	3.775
Theta star	2.97		
Nu star	4.583	**Potential UCLs to Use**	
AppChi2	0.964	95% KM (Chebyshev) UCL	2.046
95% Gamma Approximate UCL	3.234		
95% Adjusted Gamma UCL	4.375		

Note: DL/2 is not a recommended method.

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
For additional insight, the user may want to consult a statistician.

Xylene

General Statistics

Number of Valid Data	10	Number of Detected Data	7
Number of Distinct Detected Data	7	Number of Non-Detect Data	3
		Percent Non-Detects	30.00%

Raw Statistics

Minimum Detected	0.105
Maximum Detected	9.8
Mean of Detected	2.463
SD of Detected	3.385
Minimum Non-Detect	0.0131
Maximum Non-Detect	0.049

Log-transformed Statistics

Minimum Detected	-2.259
Maximum Detected	2.282
Mean of Detected	0.0973
SD of Detected	1.478
Minimum Non-Detect	-4.335
Maximum Non-Detect	-3.016

Note: Data have multiple DLs - Use of KM Method is recommended
For all methods (except KM, DL/2, and ROS Methods),
Observations < Largest ND are treated as NDs

Number treated as Non-Detect	3
Number treated as Detected	7
Single DL Non-Detect Percentage	30.00%

Warning: There are only 7 Detected Values in this data
Note: It should be noted that even though bootstrap may be performed on this data set
the resulting calculations may not be reliable enough to draw conclusions

It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.

UCL Statistics

Normal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.714
5% Shapiro Wilk Critical Value	0.803

Data not Normal at 5% Significance Level

Assuming Normal Distribution

DL/2 Substitution Method	
Mean	1.728
SD	3.007
95% DL/2 (t) UCL	3.471
Maximum Likelihood Estimate(MLE) Method	
Mean	0.952
SD	3.67
95% MLE (t) UCL	3.079
95% MLE (Tiku) UCL	3.173

Lognormal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.982
5% Shapiro Wilk Critical Value	0.803

Data appear Lognormal at 5% Significance Level

Assuming Lognormal Distribution

DL/2 Substitution Method	
Mean	-1.289
SD	2.56
95% H-Stat (DL/2) UCL	2351
Log ROS Method	
Mean in Log Scale	-1.015
SD in Log Scale	2.16
Mean in Original Scale	1.732
SD in Original Scale	3.004
95% t UCL	3.473
95% Percentile Bootstrap UCL	3.437
95% BCA Bootstrap UCL	4.265
95% H UCL	240.6

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	0.521
Theta Star	4.726
nu star	7.295
A-D Test Statistic	0.249
5% A-D Critical Value	0.736
K-S Test Statistic	0.736
5% K-S Critical Value	0.323

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	0.000001
Maximum	9.8
Mean	1.724
Median	0.48
SD	3.009
k star	0.182
Theta star	9.495
Nu star	3.631
AppChi2	0.582
95% Gamma Approximate UCL	10.76
95% Adjusted Gamma UCL	15.27

Data Distribution Test with Detected Values Only

Data appear Gamma Distributed at 5% Significance Level

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	1.755
SD	2.836
SE of Mean	0.969
95% KM (t) UCL	3.531
95% KM (z) UCL	3.349
95% KM (jackknife) UCL	3.43
95% KM (bootstrap t) UCL	6.895
95% KM (BCA) UCL	3.765
95% KM (Percentile Bootstrap) UCL	3.525
95% KM (Chebyshev) UCL	5.978
97.5% KM (Chebyshev) UCL	7.805
99% KM (Chebyshev) UCL	11.39

Potential UCLs to Use

95% KM (BCA) UCL	3.765

Note: DL/2 is not a recommended method.

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
For additional insight, the user may want to consult a statistician.

GRO

General Statistics

Number of Valid Observations 13

Number of Distinct Observations 12

Raw Statistics

Minimum	12
Maximum	1100
Mean	343.7
Median	287
SD	351.9
Std. Error of Mean	97.59
Coefficient of Variation	1.024
Skewness	1.06

Log-transformed Statistics

Minimum of Log Data	2.485
Maximum of Log Data	7.003
Mean of log Data	5.025
SD of log Data	1.59

Relevant UCL Statistics

Normal Distribution Test

Shapiro Wilk Test Statistic	0.865
Shapiro Wilk Critical Value	0.866

Data not Normal at 5% Significance Level

Lognormal Distribution Test

Shapiro Wilk Test Statistic	0.899
Shapiro Wilk Critical Value	0.866

Data appear Lognormal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL	517.6

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL (Chen-1995)	534.9
95% Modified-t UCL (Johnson-1978)	522.4

Assuming Lognormal Distribution

95% H-UCL	3302
95% Chebyshev (MVUE) UCL	1416
97.5% Chebyshev (MVUE) UCL	1833
99% Chebyshev (MVUE) UCL	2653

Gamma Distribution Test

k star (bias corrected)	0.618
Theta Star	556
MLE of Mean	343.7
MLE of Standard Deviation	437.1
nu star	16.07
Approximate Chi Square Value (.05)	8.013
Adjusted Level of Significance	0.0301
Adjusted Chi Square Value	7.215
Anderson-Darling Test Statistic	0.394
Anderson-Darling 5% Critical Value	0.771
Kolmogorov-Smirnov Test Statistic	0.153
Kolmogorov-Smirnov 5% Critical Value	0.246

Data appear Gamma Distributed at 5% Significance Level

Data Distribution

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL	689.4
95% Adjusted Gamma UCL	765.5

Nonparametric Statistics

95% CLT UCL	504.2
95% Jackknife UCL	517.6
95% Standard Bootstrap UCL	497.3
95% Bootstrap-t UCL	575.6
95% Hall's Bootstrap UCL	605.8
95% Percentile Bootstrap UCL	504.2
95% BCA Bootstrap UCL	527.7
95% Chebyshev(Mean, Sd) UCL	769.1
97.5% Chebyshev(Mean, Sd) UCL	953.2
99% Chebyshev(Mean, Sd) UCL	1315

Potential UCL to Use

Use 95% Approximate Gamma UCL 689.4

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002) and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

DRO

General Statistics

Number of Valid Observations	14	Number of Distinct Observations	14

Raw Statistics

Minimum	364
Maximum	7100
Mean	3180
Median	3150
SD	2561
Std. Error of Mean	684.5
Coefficient of Variation	0.805
Skewness	0.102

Log-transformed Statistics

Minimum of Log Data	5.897
Maximum of Log Data	8.868
Mean of log Data	7.543
SD of log Data	1.211

Relevant UCL Statistics

Normal Distribution Test

Shapiro Wilk Test Statistic	0.846
Shapiro Wilk Critical Value	0.874

Data not Normal at 5% Significance Level

Lognormal Distribution Test

Shapiro Wilk Test Statistic	0.819
Shapiro Wilk Critical Value	0.874

Data not Lognormal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL	4392

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL (Chen-1995)	4326
95% Modified-t UCL (Johnson-1978)	4395

Assuming Lognormal Distribution

95% H-UCL	11338
95% Chebyshev (MVUE) UCL	9287
97.5% Chebyshev (MVUE) UCL	11737
99% Chebyshev (MVUE) UCL	16550

Gamma Distribution Test

k star (bias corrected)	0.907
Theta Star	3505
MLE of Mean	3180
MLE of Standard Deviation	3339
nu star	25.4
Approximate Chi Square Value (.05)	14.92
Adjusted Level of Significance	0.0312
Adjusted Chi Square Value	13.86
Anderson-Darling Test Statistic	1.018
Anderson-Darling 5% Critical Value	0.758
Kolmogorov-Smirnov Test Statistic	0.258
Kolmogorov-Smirnov 5% Critical Value	0.235

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL	5414
95% Adjusted Gamma UCL	5827

Data Distribution

Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics

95% CLT UCL	4306
95% Jackknife UCL	4392
95% Standard Bootstrap UCL	4258
95% Bootstrap-t UCL	4442
95% Hall's Bootstrap UCL	4194
95% Percentile Bootstrap UCL	4278
95% BCA Bootstrap UCL	4307
95% Chebyshev(Mean, Sd) UCL	6164
97.5% Chebyshev(Mean, Sd) UCL	7455
99% Chebyshev(Mean, Sd) UCL	9991

Potential UCL to Use

Use 95% Chebyshev (Mean, Sd) UCL 6164

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002) and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

RRO

General Statistics

Number of Valid Observations	9	Number of Distinct Observations	9

Raw Statistics

Minimum	8.5
Maximum	510
Mean	141.1
Median	110
SD	146.4
Std. Error of Mean	48.81
Coefficient of Variation	1.038
Skewness	2.383

Log-transformed Statistics

Minimum of Log Data	2.14
Maximum of Log Data	6.234
Mean of log Data	4.506
SD of log Data	1.114

Warning: There are only 9 Values in this data

Note: It should be noted that even though bootstrap methods may be performed on this data set, the resulting calculations may not be reliable enough to draw conclusions

The literature suggests to use bootstrap methods on data sets having more than 10-15 observations.

Relevant UCL Statistics

Normal Distribution Test

Shapiro Wilk Test Statistic	0.71
Shapiro Wilk Critical Value	0.829

Data not Normal at 5% Significance Level

Lognormal Distribution Test

Shapiro Wilk Test Statistic	0.902
Shapiro Wilk Critical Value	0.829

Data appear Lognormal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL	231.8

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL (Chen-1995)	262.8
95% Modified-t UCL (Johnson-1978)	238.3

Assuming Lognormal Distribution

95% H-UCL	666.8
95% Chebyshev (MVUE) UCL	409.8
97.5% Chebyshev (MVUE) UCL	520.9
99% Chebyshev (MVUE) UCL	739.2

Gamma Distribution Test

k star (bias corrected)	0.92
Theta Star	153.3
MLE of Mean	141.1
MLE of Standard Deviation	147
nu star	16.56
Approximate Chi Square Value (.05)	8.361
Adjusted Level of Significance	0.0231
Adjusted Chi Square Value	7.166
Anderson-Darling Test Statistic	0.448
Anderson-Darling 5% Critical Value	0.739
Kolmogorov-Smirnov Test Statistic	0.194
Kolmogorov-Smirnov 5% Critical Value	0.285

Data appear Gamma Distributed at 5% Significance Level

Data Distribution

Data appear Gamma Distributed at 5% Significance Level

Nonparametric Statistics

95% CLT UCL	221.3
95% Jackknife UCL	231.8
95% Standard Bootstrap UCL	216.6
95% Bootstrap-t UCL	344.5
95% Hall's Bootstrap UCL	607.5
95% Percentile Bootstrap UCL	227.6
95% BCA Bootstrap UCL	255.7
95% Chebyshev(Mean, Sd) UCL	353.8
97.5% Chebyshev(Mean, Sd) UCL	445.9
99% Chebyshev(Mean, Sd) UCL	626.8

Assuming Gamma Distribution

95% Approximate Gamma UCL	279.4
95% Adjusted Gamma UCL	326

Potential UCL to Use

Use 95% Approximate Gamma UCL 279.4

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002) and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

Table 5-3 Outlier Tests Results --- CG523, JBER-E, Alaska

Outlier Tests for Selected Variables

User Selected Options

From File	WorkSheet.wst
Full Precision	OFF
Test for Suspected Outliers with Dixon test	1
Test for Suspected Outliers with Rosner test	1

Dixon's Outlier Test for DRO

Number of data = 14
10% critical value: 0.492
5% critical value: 0.546
1% critical value: 0.641

1. Data Value 7100 is a Potential Outlier (Upper Tail)?

Test Statistic: 0.193

For 10% significance level, 7100 is not an outlier.
For 5% significance level, 7100 is not an outlier.
For 1% significance level, 7100 is not an outlier.

2. Data Value 364 is a Potential Outlier (Lower Tail)?

Test Statistic: 0.003

For 10% significance level, 364 is not an outlier.
For 5% significance level, 364 is not an outlier.
For 1% significance level, 364 is not an outlier.

Table 5-4a HRC Input Values & Data Sources, Exposure Point Concentrations --- CG523, JBER-E, Alaska

Compound	Soil Concentration Data	Groundwater Concentration Data	Dissolved Phase Half Life (days)
Benzene (c & nc)	max detected conc in 2013	max detected conc in 2013	literature value for BTEX compounds and conservative order of magnitude values for all other compounds
Toluene (nc)	max detected conc in 2013	max detected conc in 2013	
Ethylbenzene (c & nc)	95% UCL	max detected conc in 2013	
Xylenes (total) (nc)	95% UCL	max detected conc in 2013	
GRO	95% UCL	max detected conc in 2013	
DRO	95% UCL	max detected conc in 2013	
RRO	95% UCL	max detection limit in 2013	
GRO aromatics	site specific data	max detected conc in 2013	
DRO aromatics	site specific data	max detected conc in 2013	
RRO aromatics	site specific data	max detected conc in 2013	
GRO aliphatics	site specific data	max detected conc in 2013	
DRO aliphatics	site specific data	max detected conc in 2013	
RRO aliphatics	site specific data	max detected conc in 2013	
Acenaphthene (nc)	max detected conc in 2013	max detected conc in 2013	
Acenaphthylene (nc)	max detection limit in 2013	max detection limit in 2013	
Anthracene (nc)	max detected conc in 2013	max detected conc in 2013	
Benzo(g,h,i)perylene (nc)	max detection limit in 2013	max detection limit in 2013	
Fluoranthene (nc)	max detected conc in 2013	max detection limit in 2013	
Fluorene (nc)	max detected conc in 2013	max detected conc in 2013	
Naphthalene (c & nc)	max detected conc in 2013	max detected conc in 2013	
Phenanthrene (nc)	max detected conc in 2013	max detected conc in 2013	
Pyrene (nc)	max detected conc in 2013	max detection limit in 2013	
Benzo(a)anthracene (c)	max detection limit in 2013	gw modeled using soil data	
Benzo(b)fluoranthene (c)	max detection limit in 2013	gw modeled using soil data	
Benzo(k)fluoranthene (c)	max detection limit in 2013	gw modeled using soil data	
Benzo(a)pyrene (c)	max detected conc in 2013	gw modeled using soil data	
Chrysene (c)	max detected conc in 2013	gw modeled using soil data	
Dibenz(a,h)anthracene (c)	max detection limit in 2013	gw modeled using soil data	
Indeno(1,2,3-cd)pyrene (c)	max detection limit in 2013	gw modeled using soil data	

Hydrocarbon Characterization Data	
Hydrocarbon Fractions	**Distribution of DRO & GRO into Aromatic & Aliphatic Equivalent Carbon Ranges (varies by fuel type)**
GRO Aromatics Fraction	Site specific EPH & VPH data
DRO Aromatics Fraction	Site specific EPH & VPH data
RRO Aromatics Fraction	Site specific EPH & VPH data
Aromatic C_{10}-C_{12}	Site specific EPH & VPH data
Aromatic C_{12}-C_{16}	Site specific EPH & VPH data
Aromatic C_{16}-C_{21}	Site specific EPH & VPH data
Aliphatic C_5-C_6	Site specific EPH & VPH data
Aliphatic C_6-C_8	Site specific EPH & VPH data
Aliphatic C_8-C_{10}	Site specific EPH & VPH data
Aliphatic C_{10}-C_{12}	Site specific EPH & VPH data
Aliphatic C_{12}-C_{16}	Site specific EPH & VPH data
Aliphatic C_{16}-C_{21}	Site specific EPH & VPH data

Table 5-4b HRC Input Values & Data Sources,
Non-Contaminant Parameters --- CG523, JBER-E, Alaska

Source Area Soil Conditions:	Input Values			Source of Data
bulk density (lbs/ft^3)	121.5			Elmendorf ground moraine average value (Table 2-1)
specific gravity	2.7			Elmendorf ground moraine average value
moisture content (% by weight)	12.4			Elmendorf ground moraine average value (Table 2-1)
foc	0.001			ADEC default input value
Soil temp (C)	5			Elmendorf average groundwater temperature
Soil Grain Size Description (USCS or other; used to label CSM)	Gravelly Sand with Silt			Elmendorf ground moraine typical texture
Hydrogeologic Conditions:				
Source length (ft)	80			scaled from site maps
Average precipitation (in/yr)	16			NOAA Climate Data
Aquifer hydraulic conductivity (cm/sec)	1.81E-04			Elmendorf ground moraine average value (Table 2-2)
Aquifer thickness (ft; below low water at downgradient edge of source)	32.8			ADEC default input value
Infiltration rate (m/yr)	0.08128			20% of average precipitation
Hydraulic gradient	0.16			Site specific measured value
Potable or Non-potable Aquifer?	1			Potable (unless proven otherwise)
Climate Related Outdoor Air Inhalation and Soil Direct Contact Exposure Parameters				
Climate Zone of site (enter "1" for an arctic site; "2" for the <40" precip zone; and "3" for the >40" precip zone)	2			NOAA Climate Data
Groundwater Depth & Fluctuation and Soil Source Depth				
depth to groundwater at seasonal low water level at downgradient end of source (ft)	9			Estimated depth to low water based on DRO distribution at the site
seasonal water table fluctuation (ft)	3			Estimated seasonal fluctuation based on DRO distribution at the site
depth to bottom of source zone at downgradient edge of source (ft)	14			Depth of bottom of DRO source area as indicated by borings
depth to top of area wide source zone at downgradient edge of source (ft)	6			Depth of top of DRO source area as indicated by borings & LIF
Exposure Routes Complete at Present Time				
Soil Direct Contact	1			Site specific conceptual site model
Outdoor Air	1			Site specific conceptual site model
Indoor Air	0			Site specific conceptual site model
Groundwater Ingestion	0			Site specific conceptual site model
Other Input:				
ADEC Hazard ID	0			ADEC CS database
Latitude	0			ADEC CS database
Longitude	0			ADEC CS database
Width of Source (ft)	50			scaled from site maps
Area of NAPL contaminated soil source (ft^2)	4000			scaled from site maps
Ground surface slope (ft/ft, assumed to be in direction of groundwater flow)	0.16			Measured slope of water table
Johnson & Ettinger Vapor Intrusion Model Parameters				
Soil Properties:	Upper Layer	Middle Layer	Bottom Layer	
bulk density (lbs/ft^3)	121.50	121.50	121.50	Elmendorf ground moraine average value
specific gravity of solids	2.7	2.7	2.7	Elmendorf ground moraine average value
moisture content (% by weight)	12.40	12.40	12.40	Elmendorf ground moraine average value
foc	0.001	0.001	0.001	ADEC default input value
Thickness of uncontaminated soil layers above source at building location (ft; upper most layer must extend below the depth of foundation; used to define the source-building separation distance)	4	1	1	Site Specific (small foundation-source separation distance distributed among 3 layers)
Building Properties:				
Lb = length of building (cm)	1000			EPA default input value
Wb = width of building (cm)	1000			EPA default input value
Hb = height of building (cm)	244			EPA default input value
ER = air exchange rate (1/hr)	0.25			EPA default input value
Lf = depth below grade of bottom of floor slab or basement (ft)	0.49212			EPA default input value for basement - deep GW
Lcrack = enclosed space foundation thickness or slab thickness (cm)	10			EPA default input value
delta P = pressure differential between building and soil (g/cm-s^2)	40			EPA default input value
Wcrack = floor-wall seam crack width (cm)	0.1			EPA default input value

Table 5-5 Summary of Cumulative Risk Estimates --- CG523, JBER-E, Alaska

Commercial/Industrial Scenario			
Exposure Route	**Carcinogenic Risk (fraction of risk multiplied by 10^-5)**	**Carcinogenic Fraction of Risk**	**Non-Carcinogenic Fraction of Risk**
Direct Contact	8.35404E-07	0.0835	0.0006
Outdoor air inhalation	3.98104E-11	0.0000	0.0000
Indoor air inhalation (vapor intrusion)	1.1642E-09	0.0001	0.0000
Groundwater Ingestion	1.21948E-07	0.0122	0.0037
Cumulative Risk	**1E-06**	**0.1**	**0.00**
Residential Scenario			
Exposure Route	**Carcinogenic Risk (fraction of risk multiplied by 10^-5)**	**Carcinogenic Fraction of Risk**	**Non-Carcinogenic Fraction of Risk**
Direct Contact	2.05532E-06	0.2055	0.0060
Outdoor air inhalation	1.41297E-10	0.0000	0.0000
Indoor air inhalation (vapor intrusion)	4.88963E-09	0.0005	0.0001
Groundwater Ingestion	2.04873E-07	0.0205	0.0052
Cumulative Risk	**2E-06**	**0.2**	**0.0**

Notes:
Fraction of Risk values equal to or less than one meet the ADEC risk standard
Carcinogenic risk values equal to or less than 10^-5 meet the ADEC risk standard
Cumulative risk and fraction of risk values rounded to one significant digit

Table 5-6 Summary of Bulk Fuel Hydrocarbon Risks --- CG523, JBER-E, Alaska

	Soil concentration (mg/kg):[a]	Groundwater concentration (mg/L):[a]	Fraction of Risk Values				
			Direct Contact	Outdoor air inhalation	Indoor air inhalation (vapor intrusion)	Groundwater Ingestion	Migration to groundwater
Commercial / Industrial Scenario							
GRO Aromatics	240	0.023	<1	<1	<1	<1	<1
DRO Aromatics	1338	0.151	<1	<1	<1	<1	<1
RRO Aromatics	92	0.015	<1	No RfC	No RfC	<1	<1
GRO Aliphatics	443	0.032	<1	<1	<1	<1	<1
DRO Aliphatics	4826	0.263	<1	<1	<1	<1	<1
RRO Aliphatics	188	0.018	<1	No RfC	No RfC	<1	<1
Residential Scenario							
GRO Aromatics	240	0.023	<1	<1	<1	<1	<1
DRO Aromatics	1338	0.151	<1	<1	<1	<1	<1
RRO Aromatics	92	0.015	<1	No RfC	No RfC	<1	<1
GRO Aliphatics	443	0.032	<1	<1	<1	<1	<1
DRO Aliphatics	4826	0.263	<1	<1	<1	<1	<1
RRO Aliphatics	188	0.018	<1	No RfC	No RfC	<1	<1

[a] Appendix C, Table C-1 (pages 4 and 8)

Notes:

mg/kg = milligrams per kilogram

mg/L = milligram(s) per liter

Fraction of Risk values equal to or less than one meet the ADEC risk standard

No RfC = no reference concentration available; risk standard is assumed to be met due to low volatility of the fraction

Values less than one meet the ADEC risk criteria

APPENDIX A
Field Logs and Data Collection Forms

A-1 Field Logbook

A-2 Soil Boring Logs

A-3 LIF Data Sheets

A-4 Photograph Log

A-5 Groundwater Sampling Data Sheets

A-6 Monitoring Well Installation Log

A-7 Chain of Custody Forms

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A-1 Field Logbook

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JBER PBR FA8903-09-D-8589 T.O.0016 CG523-ST703 6/25/13

Field Team: Moana John (GTA) Erin (CT)
WX: Clear, Sunny ~65°F

0900 - Arrive at Job trailer; switched trucks w/ GW Team. Loaded UHaul TRUCK w/ LIF supplies & Tools. Erin recharged the LIF laser today & John picked up the neccesary O-ring for dampner.

1010 - Arrive on-site; all of the lathe placed for LIF probe locations have been knocked down. There was still some white paint on the ground in some areas, but not all LIF locations premarked are visible. Will start near MW → 703MW-1N.

1045 - Jeremy on-site to re-survey the LIF locations.

~~1045~~ 1055 - Jace - Begin LIF CG523LØ1 near (SE) of 703MW-1N.

1117 - Finished first LIF probe; minimal contamination indicated

1145 - Begin second LIF Probe CG523LØ2; NE of 703WL-02

1210 - LØ2 completed & it shows contamination at ~16.5' bgs. Not sure if 703WL-02 is downgradient. Will have to advance LIF probe south of MW. Texted Elliot about the possibilty of a LIF probe on the south side of 703WL-02; it is on a slope and John is unsure of the drill rig's capabilities or stability.

12:30 - Lunch

1300 - Move rig to next location, but Erin & I need to use bathroom. Break

1350 ~~for~~ Begin Probe ~~703WL-0~~ LØ3 ~~west~~ of LO2; probe had LIF readings above 1% @ 7.5' bgs and 12' bgs.

1415 - Completed LØ3; Elliot (GTA) & Jeremy (Weston) on-site to discuss safety & stability capabilities of ~~proposed local~~ rig for locations near the lake & on the slope. Determined the safe zone & will drill in that zone

1440 - Begin LIF probe LØ4.

1507 - Finish LØ4; bring up rods & move west to next location

1545 - Begin LIF LØ5; jeremy on-site to survey the LIF locations.

1620 - Finish borings for the day. Packing up the drill rig, & will head back to the job trailer.

1730 - END OF DAY

JBER PBR FA-8903-09-D-8589 T.O. 0006 — CG523 -ST703 — 6/25/13

~~SEE DIAGRAM~~ ~~Not to Scale~~

CG523L01 Start: 1052 Stop: 1117 — 0-4 ~ 1% RE; 4 = 1.7% RE; 4-14 = <1% RE

CG523L02 Start: 1144 Stop: 1210 — 0-6.5 ~ <1% RE; @6.5 = 5.5% RE; 6.5-14 <1% RE

CG523L03 Start: 1345 Stop: 1415 — 0-7.5 AND 12-18 = <1% RE; @12' = 1.7% RE

CG523L04 Start: 1452 Stop: 1507 — 0-12 ~ between 1-2% RE, 13-18 - <1% RE; 12-13 = 3.4% RE

CG523L05 Start: 1553 Stop: 1620 — 0-12 ~ 1-2% RE; 13-18 <1% RE; 12-13 = 2.5%

CG523L06 Start: 0949 Stop: 1010 — 0-18 ~ between 1-2% RE — 6/26/13

CG523L07 Start: 1042 Stop: 1115 — 0-5' <1% RE; 5'-8' = 1 to 2.6%; 2.6% RE @ 5' bgs; 8-14 = <1% RE

CG523L08 Start: 1409 Stop: 1430 — 0-5' <1% RE; @5' 12.6% RE; 5'-8 ~ 3.7% RE | 8-9 ~ 25.7% RE / 38.1%; 9-14 <1% RE

CG523L09 Start: 14:59 Stop: 1540 — 0-5' <1% RE; @5 = 1.5% RE; 5-14 <1% RE

CG523L10 Start: 926 Stop: ~~10~~ 945 — 0-6' bgs ~ 8-14' <1% RE; Between 6-8 ~36-1666% RE; @6' bgs = 1666% — 6/27/13

CG523L11 Start: 1018 Stop: 1042 — 0-6' <2% RE; @ 4.4' = 1.7% RE; 6-14' <1% RE

CG523L12 Start: 1101 Stop: 1128 — 0-5 <1% RE; ~5.5-14 <1% RE; @ 5' bgs = 1.4% RE

CG523L13 Start: 1131 Stop: 1155 — 0-6.5' <1% RE; 7-14' = <1% RE; @6.5 = 1.4% RE

JBER PBR FA 89~~03~~09-D-8589 TO~~0~~16 CG523-ST703 6/26/13

Field Team: ML
John (GITA)
Erin (GITA)
Wx: Clear, Sunny
~70°F

0730 - Tailgate safety meeting. Ted Deeke ~~from DA~~ Central Division Safety is on-site to observe JBER safety operations.
0815 - Load up trucks & head to the site.
0925 - Position drill rig on LØ6 location located SW of 703WL-02 & the general site. The most SW'n LIF probe
0945 - Begin LIF Ø6; Jamie Grund, Wendy, Ted Deecke & Jeremy on-site ~~1030~~ to ~~observe~~ observe the operations.
1010 - Visitors leave & LØ6 is completed; move rig to next location SE of 703MW-1N.
10:35 Begin LIF LØ7;
11:15 - Finished w/ LØ7; Shutting down LIF Laser for lunch. Secured site w/ cones to restrict access to area while away.
11:40 - Head back to ~~site~~ job trailer for BBQ WEDNESDAY
13:30 - Return to site, warm up laser on LIF & position ourselves on LØ8 location on the west side of site.
14:30 - Finish LØ8; Erin has been changing teflon tape between each probe location to preserve the spock. Moved to next location for LØ9.
14:55 - Begin LIF LØ9; Col

			Elevation - AMSL
703MW-1N	DTW = 3.81'	15:30	134.86' = 41.106 meters
703WL-02	DTW = 6.40'	15:36	131.93' = 40.213
703WL-01	DTW = 5.07'	15:38	131.41' 40.056

15:40 - DONE with LØ9, retaping spock collecting, WL measurements Cleaning up
1600 - Packing up and heading back to the job trailer.

NOTE: LIF PROBES LØ6 & LØ8 are positioned ~~on top~~ where the ground surface slopes to the west; further probing in that direction is limited to low brush & slope. Similarily probes LØ4, LØ5 & LØ6 are located along the ground that slopes to the lake on the south.

1715 - END OF DAY

1220 1345

JBER PBR FA-8903-09-D-8589 T.O. 0016 8993 3525

CG523-ST703

TU100

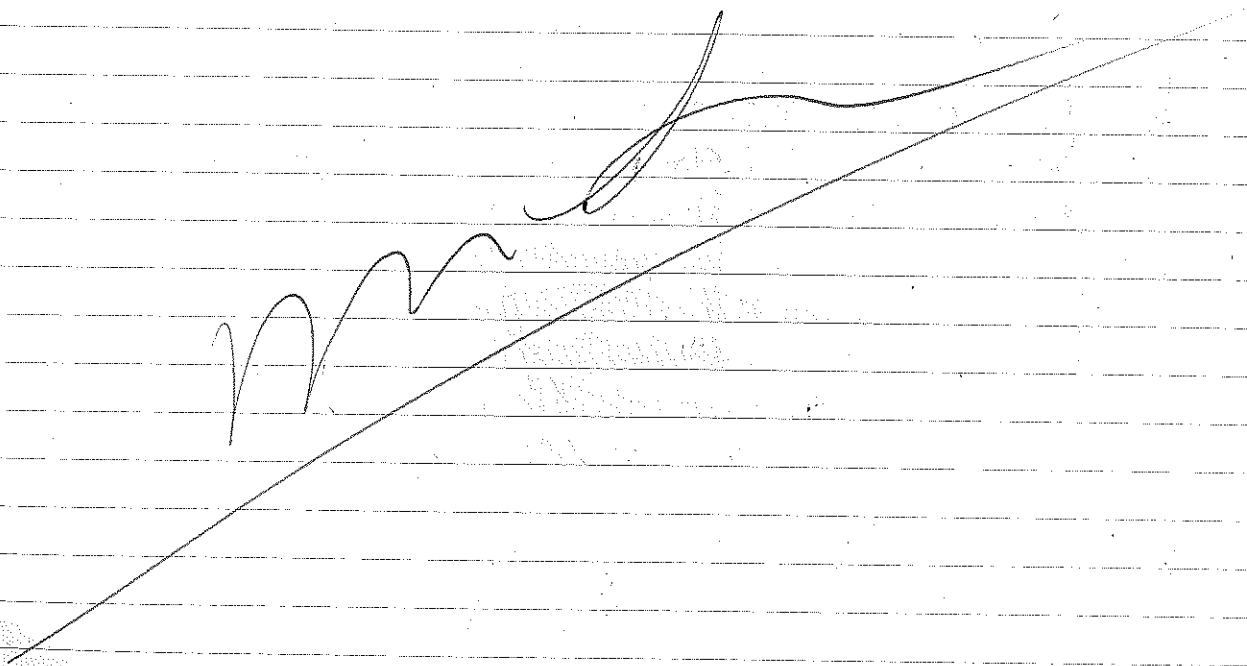
6/27/13

Field Team: Moana
John (GTA)
Erin (CT)
WX: Clear, windy ~65°F

0730 - Tailgate meeting (safety); discuss sites for LIF
0830 - Head to site CG523; begin warm up & rig offload.
920 - Begin ~~LØ~~ L10; From 6-8' bgs there was very high readings 359% - 1166%.
1010 - Begin L11 on the east side of site; LIF reading was clean.
1054 - Begin L12 potentially located within the source area.
1125 - Begin L13; this will be our last probe for the site. Jeremy on-site to survey LIF probe locations. He also gathered the elevations of all of the 3 MW's on-site, to determine GW Flow
Packed up rig/gear.
1200 - Back to job trailer. Erin will upload LIF Logs there where she has cell service
1300 - Lunch
1345 - Back at job trailer to get WP for TU100

TU100 ↓

1420 - Onsite at TU100, Erin is warming laser; Jeremy relocated LIF locations. John unloading Rig.
1525 - Begin with first LIF probe for TU100. First probe TU100L01
1600 - Completed TU100L01 to ~34' bgs. Bringing up the rods, packing up, securing site and shutting down LIF.
1655 - Heading back to job trailer
1715 - END OF DAY



7/2/13 CG543 & CG523

PID = 0.0 ppm. Headspace PID = 0.0 ppm. This is the saturated zone sample at this boring. ——— AM

9:05 Late Entry: ~~The~~ labeling the trip blank as 13CG543-TB01-SO1-0 at 8:00 for BTEX, ~~DRO~~ GRO & VPH. AM

9:15 Complete 13CG543-SB01 to 20 ft. All PID 0.0 ppm. ——— AM

9:20 Moving to 13CG543-SB02 which is near monitoring well 785WL-01. AM

9:30 Start drilling at 13CG543-SB02. AM

9:55 Collecting soil sample labeled 13CG543-SB02-2.0-2.5-0 at 2-2.5 ft for DRO, RRO & BTEX & GRO. PID=0.0 ppm. Headspace PID = 0.0 ppm. Collected as vadose zone sample. ——— AM

10:10 Complete 13CG543-SB02 to 15 ft. All PID 0.0 ppm. ——— AM

10:15 Moving to location 13CG543-SB03 which is in the vicinity of ~~13~~ AM 785WL-01. ——— AM

10:20 Start drilling at 13CG543-SB03. AM

~~10:25 Collecteding so~~ AM

10:25 Collecting soil sample labeled

7/2/13

CG543 & CG523 7/2/13

13CG543-SB03-2.0-2.5-0 at 2-2.5 ft for BTEX, DRO, RRO & GRO. PID=28.3 ppm Headspace PID = 6.8 ppm. This is ~~an~~ an elevated PID sample. ——— AM

10:35 Collecting soil sample labeled 13CG543-SB03-7.0-7.5-0 at 7-7.5 ft for BTEX, DRO, RRO, GRO, EPH, VPH & PAHs. MS/MSD for DRO, RRO, EPH, VPH & PAHs. PID = 95.9 ppm Headspace PID = 70.9 ppm. ——— AM

This is a source area sample collected for AM because of PID & odor. ——— AM

10:40 Collecting soil sample labeled 13CG543-SB03-9.0-9.5-0 at 9-9.5 ft for DRO, GRO, RRO & BTEX. Collected as elevated PID although PID may have been affected by drydown so this may give us vertical delineation. ——— AM

11:05 Complete 13CG543-SB03 to 20 ft. We had 10 ft of clean PID at the bottom of the boring. ——— AM

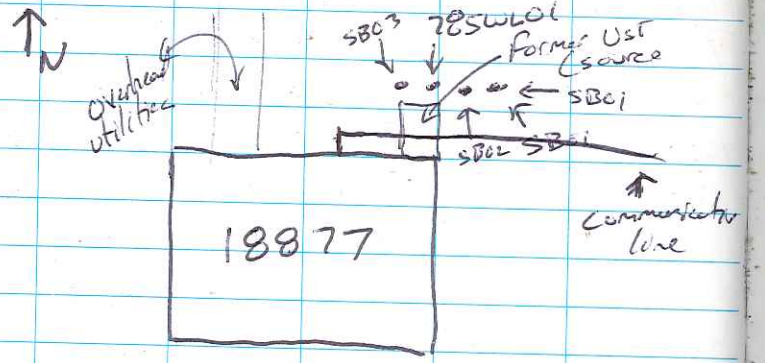
11:15 Wendy Armento onsite. ——— AM

7/2/13

7/2/13 CG543 & CG523

11:20 Walking possible additional locations with Wendy. There is a communication line running over the source area. —MA

11:25 Wendy offsite. There are no other source area locations we can drill at this location because of the communication utility. Sit Diagram



11:30 S.t cleanup. —MA

12:10 Depart CG543. —MA

12:20 Arrive at field trailer. —MA

12:50 Got all CG523 LIF results, map & workplan. —MA

13:10 Arrive at CG523. —MA

7/2/13

CG543 & CG523 7/2/13

13:15 Setting up at 13CG523-SB01 which is at LIF location CG523L10. —MA

13:20 Wendy onsite. —MA

13:30 Start drilling at 13CG523-SB01. Wendy offsite. —MA

13:45 Collecting soil samples labeled 13CG523-SB01-7.0-7.5-0 ~~at 7-7.5 ft~~ for and duplicate 13CG523-SB01-7.0-7.5-1 at 7-7.5 ft for BTEX, DRO, GRO, RRO, EPH, VPH & PAHs. PID = 374 ppm. Headspace PID = 280 ppm. This is an elevated PID / petroleum odor sample. —MA

13:50 Collecting soil sample labeled 13CG523-SB01-9.0-9.5-0 at 9-9.5 ft for BTEX, DRO, GRO & RRO. PID = 117 ppm Headspace PID = 72.7 ppm. This is an elevated PID / petroleum odor sample. —MA

14:10 Complete 13CG523-SB01 to 15 ft.

14:15 Moving to 13CG523-SB02 which is at LIF location CG523L08. —MA

14:20 Start drilling 13CG523-SB02. —MA

14:30 Collecting soil sample labeled 13CG523-SB02-6.0-6.5-0 at 6-6.5 ft

7/2/13

7/2/13 CG543 & CG523

for BTEX, DRO, RRO, GRO, EPH, VPH & PAHs. PID = 90.9 ppm. Headspace PID = 71.6 ppm. This is a high PID sample. —AM

14:35 Collecting soil sample labeled 13CG523-SB02-8.5-9.0-0 at 8.5-9 ft for BTEX, DRO, RRO, GRO, EPH, VPH & PAHs. PID = 16.0 ppm. Headspace PID = ~~51.3 ppm~~ ~~21.8 ppm~~. Collected because of LIF response. —AM

14:45 Complete 13CG523-SB02 to 15 ft —AM

15:00 Moving to 13CG523-SB03 which is at LIF location ~~13~~CG523LO2. —AM

15:10 Start drilling at 13CG523-SB03. —AM

15:35 Collecting soil sample labeled 13CG523-SB03-12.0-12.5-0 at 12-12.5 ft for BTEX, DRO, GRO, RRO. PID = 0.0 ppm. Headspace PID = 0.0 ppm. This is a clean down-gradient smear zone sample. —AM

15:40 Jeremy Miner onsite. —AM

15:45 13CG523-SB03 was completed to 15 ft. —AM

15:50 Setting up at 13CG523-SB04

AM 7/2/13

CG543 & CG523 7/2/13

which is a LIF location ~~13~~CG523LO6

15:55 Start drilling at 13CG523-SB04. Jeremy offsite. —AM

16:15 Collecting soil sample labeled 13CG523-SB04-10.0-10.5-0 at 10-10.5 ft for BTEX, DRO, RRO & GRO. PID = 0.0 ppm. Headspace PID = 0.0 ppm. This is a clean downgradient smear zone sample. —AM

16:25 Complete 13CG523-SB04 to 15 ft. This is a clean down gradient location. —AM

16:30 Site cleanup. —AM

16:40 Depart CG523. —AM

17:00 Back at field trailer. —AM

17:05 Geotek offsite. —AM

17:30 Weston offsite. —AM

AM 7/2/13

7/3/13

CG523 & TU100

Personnel: Aaron Marr & Hunter Littlefield (Weston)
Weston: 80's & cloudy, possible rain. — AM
Objective: Soil sampling at CG523. — AM
7:00 Weston onsite. — AM
7:10 Calibrate PID. — AM
7:15 Loading site vehicles — AM
7:30 H&S Meeting — AM
7:55 Depart field trailer — AM
8:10 Arrive at CG523. — AM
8:25 Setting up at 13CG523-SB05 which is at ~~a~~ AM LIF location CG523L02. — AM
8:30 Start drilling at 13CG523-SB05.
8:45 Collecting soil sample labeled 13CG523-SB05-10.5-11.0-0 at 10.5-11 ft for BTEX DRO, GRO & RRO. PID = 0.4 ppm. Headspace = 0.0 ppm. This is a horizontal delineation sample in the smear zone. — AM
8:50 Complete 13CG523-SB05 to 15ft. This is a clean horizontal delineation location. — AM
9:00 labeling trip blanks with an ID of 13CG523-TB01-SO1-0 for

AM 7/3/13

7/3/13

CG523 & TU100

BTEX, GRO & VPH with a time of 8:00. — AM
9:05 Setting up at 13CG523-SB06 which is ~~at~~ in the middle of LIF locations ~~13C~~ AM ~~CG523-1~~ AM CG523L07 & CG523L10. The goal of this location is additional source area samples for the HRC. — AM
9:10 start drilling at 13CG523-SB06.
9:15 Collecting soil samples labeled 13CG523-SB06-6.0-6.5-0 and duplicate 13CG523-SB06-6.0-6.5-1 at 6-6.5 ft for BTEX DRO, GRO & RRO. PID = 35.5 ppm Headspace PID = 209 ppm. This is a source area sample with elevated PID. — AM
9:20 Jeremy Miner onsite. — AM
9:30 Complete 13CG523-SB06 to 15ft. — AM
9:45 Setting up at 13CG523-SB07 which is 10 feet from LIF location CG523L10 ~~to~~ toward 13CG523-SB04.
Jeremy Miner offsite. — AM

AM 7/3/13

7/10/13 CG529 & CG523

VOC fraction is an MS/MSD. PID=0.0ppm Headspace PID=0.1ppm. Collected as a clean horizontal delineation sample in the smear zone. —— AH

11:10 Complete 13CG529-SB10 to 35 ft. This is a clean delineation boring. Torey Miner onsite. —— AH

11:15 Moving to 13CG529-SB11 which is west of 13CG529-SB10 and southwest of 13CG529-SB07 and south of 13CG529-SB09. 13CG529-SB11 will be a down gradient horizontal delineation location. —— AH

11:20 Start drilling at 13CG529-SB11. Torey Miner offsite. —— AH

13:05 Collecting soil sample labeled 13CG529-SB11-27.0-27.5-0 at 27-27.5 ft for VOC, DRO, GRO & RRO. PID=0.1ppm Headspace PID=0.2ppm. This sample is a clean horizontal delineation sample collected in the smear zone. AH

13:15 Glen is again having trouble getting the 30-35 ft core. —— AH

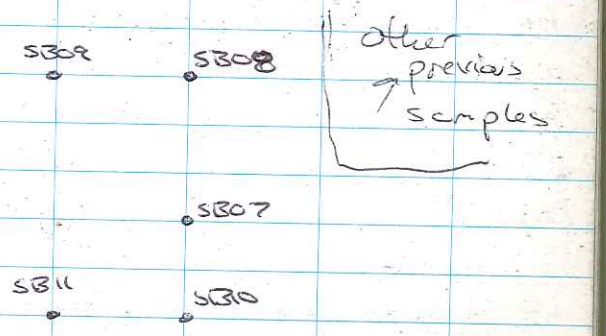
13:30 Complete 13CG529-SB11 to

AH 7/10/13

CG529 & CG523 7/10/13

35 ft. This was a clean horizontal delineation location. —— AH

13:35 Sample location Map (NTS)



13:40 Cleaning up at ~~13CG529~~ CG529. —— AH

13:50 Back to field office to get figure of proposed borings for CG523. AH

14:10 Off to CG523. —— AH

14:30 Arrive at CG523. —— AH

14:40 Setting up 13CG523-SB10 which 20 feet northwest of location 13CG523-SB02. —— AH

14:45 Start drilling at 13CG523-SB10. AH

14:55 Collecting soil sample labeled 13CG523-SB10-6.0-6.5-0 at 6-6.5 ft

AH 7/10/13

7/10/13 CG529 & CG523

for BTEX, DRO, GRO & RRO. PID = 0.0ppm Headspace PID = 0.4ppm. This is a horizontal delineation sample of 13CG523-SB02 (collected at same interval as highest PID). ——— AM

15:05 Complete 13CG523-SB10 to 15 ft. Boring was all clean. ——— AM

15:10 Moving to 13CG523-SB11 which is approximately 25 ft southwest of 13CG523-SB02. ~~+3C~~ AM 13CG523-SB11 is a boring for horizontal delineation. AM

15:20 Start drilling at 13CG523-SB11. AM

15:30 Collecting soil sample labeled 13CG523-SB11-6.0-6.5-0 at 6-6.5 ft for BTEX, DRO, GRO & RRO. PID = 0.0ppm Headspace PID = 0.0ppm. This is a horizontal delineation sample of 13CG523-SB02 (collected at same interval as highest PID. ——— AM

15:40 Complete 13CG523-SB11 to 15 ft. Boring was all clean. ——— AM

15:45 Moving to 13CG523-SB12 which is at ~~+3~~ AM LIF location CG523LOC5. ——— AM

7/10/13

CG523 & CG529 7/10/13

15:55 ~~Moving to~~ AM Start drilling at 13CG523-SB12. ——— AM

16:05 Collecting soil sample 13CG523-SB12-7.0-7.5-0 at 7-7.5 ft for BTEX, DRO, RRO & GRO. PID = 2.7 ppm. Headspace PID = 18.6ppm. Collected as highest PID in the 5-10 ft core. ——— AM

16:15 Complete 13CG523-SB12 to 15 ft. AM

16:20 Moving to 13CG523-SB13 which is in between 13CG523-SB01, 13CG523-SB08 & 13CG523-SB09. AM

16:25 Start drilling at 13CG523-SB13. AM

16:35 Collecting soil sample labeled 13CG523-SB13-6.0-6.5-0 at 6-6.5 ft for BTEX, DRO, GRO, RRO. PID = 258ppm Headspace PID = 385ppm. Collected as highest PID in the borehole. AM

16:50 Complete 13CG523-SB13 to 15 ft. ——— AM

16:45 S.t, cleanup. ——— AM

16:55 Depart CG523 & field trailer. ——— AM

17:30 GeoTek offsite. ——— AM

18:45 Weston offsite. ——— AM

7/10/13

7/11/13

CG523 & STO61

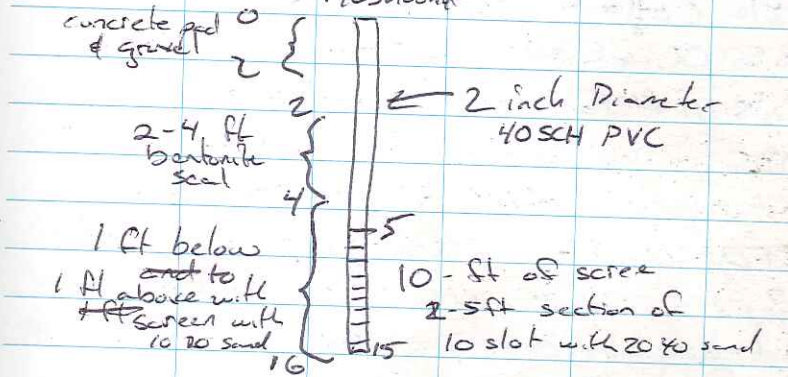
Personnel: Aaron Mroz & Hunter Littlefield (Weston)
Glen Rawson & Mike Kelly (GeoTek)
Weather: Up to 70. ——— AM
Objective: Well install at CG523 the STO61. ——— AM
7:00 Weston onsite. ——— AM
7:05 Calibrated PID. ——— AM
7:15 Loading s.t. vehicles ——— AM
7:30 H&S Meeting. ——— AM
8:00 Depart for CG523. ——— AM
8:20 Arrive at CG523. ——— AM
8:30 Setting up to install a monitoring well at yesterdays boring 13CG523-SB13. The monitoring well will be 703WL-03. ——— AM
8:40 Start augering with a 4¼ inner diameter hollow stem auger with the Geoprobe 6620 DT. ——— AM
9:10 Augered down to 17 ft, added approximately 7 gallons of water to control heaving conditions.
9:15 Popping the plug ~~to ven~~ then will start constructing the well. ——— AM

AM 7/11/13

7/11/13

CG523 & STO61

10:00 GeoTek did not bring enough sand for the well construction Hunter & Mike offsite to get more sand. ——— AM
10:20 Jeremy Miner onsite. ——— AM
10:35 Hunter & Mike back with sand. ——— AM
10:45 Jeremy offsite. ——— AM
11:00 Well construction 703WL-03



11:05 703WL-03 DTW: 10.25'
DTB = 15.12'. Both measurements from top of inner casing and measure with an interface probe. ——— AM
11:10 Created ~~so~~ two soil cutting drums which we will

AM 7/11/13

7/11/13

CGS23 & STOG1

come back for later site cleanup.
11:25 Depart CGS23. ——— Hs
12:30 Arrive at STOG1. Prepping SSA. STOG1 is by building 2130. —Hs
11:40 Setting up at 13STOG1-SB01 which is at LIF location STOG1L10. This will be our clean downgradient boring. —Hs
11:55 Start drilling at 13STOG1-SB02.
12:10 Collecting soil sample labeled 13STOG1-SB01-10.5-11.0-0 at 10.5-11 ft for petroleum-related VOC, DRO, GRO & RRO. DRO, GRO & RRO are MS/MSD Fraction. PID = 0.0 ppm. Headspace PID = 0.0 ppm. This is our clean down-gradient soil sample in the smear zone to confirm LIF results. ——— As
12:40 Complete 13STOG1-SB01 to 25 ft (through zone of groundwater Seasonal fluctuation. ——— As
12:45 Moving to 13STOG1-SB02 which is in the vicinity of STOG1L09 LIF location. —Hs

7/11/13

7/11/13

CGS23 & STOG1

12:50 Start drilling at 13STOG1-SB02 which is a location with LIF responses and soil samples from this boring will be used for the HRE. —Hs
13:15 Collecting soil sample labeled 13STOG1-SB02-18.0-18.5-0 at 18-18.5 ft for petroleum-related VOC, DRO, RRO & GRO. PID = 0.0 ppm. Headspace PID = 0.0 ppm. Collected because of LIF response. —Hs
13:20 The 20-25 ft core had a rock stuck in the barrel so we did not get full recovery as such we will have to drill back down for this interval. We will also drill back down to get another 15-20 ft interval to confirm or deny the LIF hit at 19 ft. ——— Hs
13:25 Jeremy Miner onsite. —Hs
13:45 We have drilled down to 30 ft at 13STOG1-SB02 and are now going to drill back down to collect the 15-25 ft

7/11/13

1335 CHECK FLOW RATE
1336 STOP ± 5 gpm
1342 T: 226.6 NTU. DRUM
FULL. PUMPED ± 25 gal.
1400 PS DEPARTS SITE
1500 PUMP H_2O AT CONTRACTOR YARD.
1545 HEADING BACK TO JOB TRAILER
1630 END OF DAY

7/11

7/12 CG523 1ST 03
0730 TAILGATE
PERSONNEL: VT/HL
WEATHER: 70-80F SUNNY
OBJECTIVE: DEVELOP WELL.
0815 CAL. W/S: 10E1418499
CONDUCTIVITY @ 15C = 1147
READING - 1147
pH 4.01 @ 20C = 4.00
READING - 3.99
pH 7.00 @ 20C = 7.01
READING - 6.98
ORP -240
-240.4
% DO @ 752.0 mmHg
99.9%
0930 BREAK/PACK TWO COOLERS
1100 ARRIVE @ CG523
STW: 7.17'
TO THE DEPTH: 15.08'
1143 START PUMPING. 175HZ
1146 STOP PUMP. CHECK H_2O
DTW 10.60'

1148 START PUMPING @ 130 H_2O

1152 STOP PUMPING. WELL DRY

1155 RECOVERY. DTW 11.00'

1202 2 gal of water added to well

1204 DTW 8.75, begin surge for 5 min.

1210 DTW Not getting ~~begin purge~~ reading. Not purging, add 3 gal water for 10 gal total.

1218 DTW 4.91 surge 5 min

1220 SURGING ~~DRY~~. DTW 8.10'

ADD 2 ~~GAL~~ AND PUMP

1221 BEGIN ~~PURGING~~. SURGING.

WHILE PUMPING @ ~~130~~ 150 Hz

1224. PUMP DRY. WILL ADD 10 MORE GAL. SURGE, THEN SURGE/BURGE DRY.

1235 WENDY ARMENTO ARRIVES ONSITE WITH MORE H_2O

1235 SURGE 1 MIN

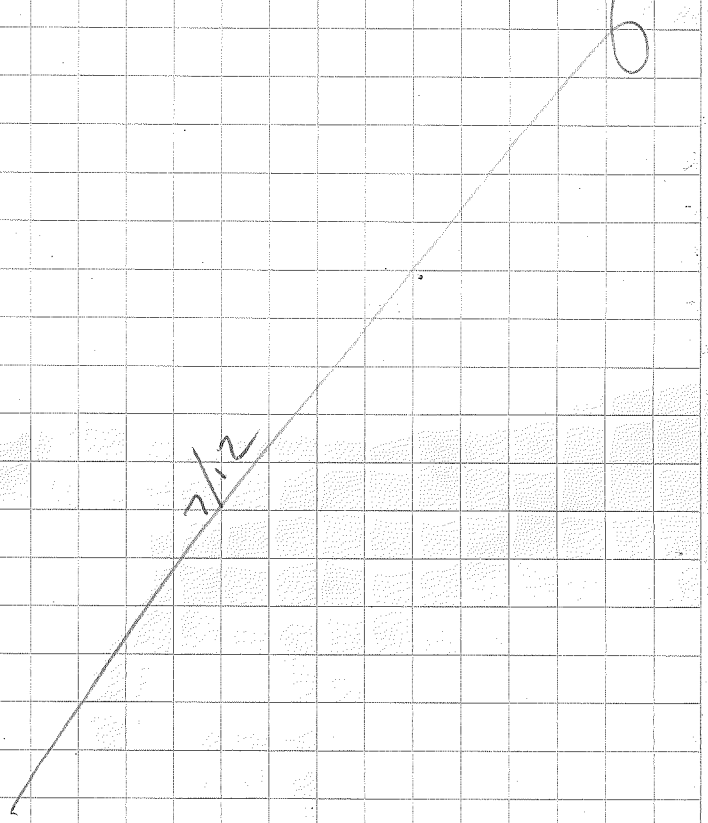
1236 SURGE/BURGE @ 135 Hz. H_2O BEGINS TO CLEAR. SURGE. 5 MIN. BURGE. H_2O BEGINS TO CLEAR.

1240 WELL PUMPS DRY. CONSIDERED DEVELOPED.

1300 LUNCH

1330 SAMPLE MANAGEMENT AND COOLER DROP W TTT.

1630 END OF DAY



1200 ~~LUNCH~~

1300 DROP SPL 4/11-03 TO BE PICKED UP 7/31

1330 135TO37 - OUSMW10 - GW-0 MS/D (8)

1345 135TO37 - OUSMW12 - GW-0

1355 135TO37 - OUSMW13 - GW-0

1410 ARRIVE @ MILL AND FEED TO P/U NON-TOX, NON-HAZ WASTE KILLER "ECO-SMART"

1430 ARRIVE @ OFFICE TO TALK TO KIM BUSSE ABOUT CAT REJECTED

1500 SPRAY @ ST 576

1530 SPRAY @ OLL OF MW-16

1730 END OF DAY

1045 135TO37 - OUSMW11 - GW-0 m

1400 135TO37 - OUSMW~~15~~16 - GW-0 m

7/17

7/18

CL-523 / LL-535

0730: TAILGATE

0800 LOAD TRUCK & CALIBRATE YSI (SEE HN NOTES)

~~0830~~ HEAD TO GREEN LAKE

0945

0915 SET UP ON 703MW-03 AND 703MW-IN. SEE GROUNDWATER DATA SHEETS.

1000 JY/SJ DEPART JBER TO RETURN UHAUL TRUCK AND TAKE NATIVE SEED TO WAREHOUSE FOR KIM BUSSE

1130 ARRIVE BACK @ JOB TRAILER. LUNCH

1150 CALIBRATE YSI 10108994

CONFIDENCE SOLUTION 16-20C	
COND. 7630-7970	COND @ 23C 1359
READING 7788	READING 1359
pH 6.8-7.2	%DO @ 763.1 mmHg
READING 7.07	READING 100.5%
ORP 222-252	
READING 218.6	

RECALIBRATE COND.

H Nelson
A French

JBER - G-Water

7-18-2013

0730 tailgate meeting @ field trailer
0750 calibrate YSI's

1H100451	16.99°C, 10. F102074
17°C	
Spec Cond 1.199	Spec Cond 1.199
pH - 4.01, 7.00	pH 4.01,
%DO 763.0	%DO 762.8

0900 A French and H Nelson arrived @ Green Lake CG523/ST703 to Sample a new well 703mw03 and bladder pump well 703mwIN
1300 finished at 703mwIN and purged 703mw03 dry to grab sample tomorrow.
1330 Set up at well 703mw02 to Sample for full set.
1600 left CG523 to Return to trailer
1630 Left for the de-watering to purge 55 gal drum from the day.
1700 finished for the day & signed out at the trailer.

Heidi J Nelson
7-18-13

H Nelson
M Dickson
A French

JBER G-Water

7-19-2013

0730 Safety tailgate
0745 calibrate YSI

10. F102074	21512D
temp 18.03	temp 17.97
Spec Cond 1225	pH 4.01, 7.00
pH 4.01, 7.00	ORP 240
%DO 763.4 tw	Spec Cond 1.225
	%DO 761.9

0830 M. Dickson & H Nelson left field trailer to head to Green Lake CG523 / ST703.
0900 arrived at CG523 / ST703
0950 finished taking grab sample at new well 703mw03.
1000 Set up at well 703mw01 to Sample full set.
1200 finished @ CG523 & returned to the trailer.
1230 Sample management w/ A. French M. Dickenson returned to the office for the day.
1530 A. French and H. Nelson left for TA and TTT.
1630 H. Nelson off site

Heidi J Nelson
7-19-2013

(2)
10/21/13

ST036, CG523, ST061

10:15 Jerry Moser onsite.
10:40 Cut the 20-25 ft core which had ~~36~~ f 36 inches of recovery. We have capped and taped the 24-25 ft section with an ID of 13ST36-SB01-24-25 for specific gravity and ~~specific~~ bulk density.
10:50 Cut the 45-50 ft core which had 35 inches of recovery. We have capped and taped the 49-50 ft section with an ID of 13ST36-SB01-49-50 for specific gravity and ~~specific~~ bulk density.
11:00 Site cleanup.
11:10 Jerry offsite. Depart ST36.
11:15 Arrive at ~~ST~~ CG523.
11:20 Setting up at 13CG523-SB05.
11:25 Start drilling at 13CG523-SB05.
11:40 Cut the 0-5 ft core which had 30 inches of recovery. We have capped and taped the 4-5 ft section with an ID of 13CG523-SB05-4-5 for specific gravity and ~~specific~~ bulk density
11:55 Cut the 5-10 ft core which

10/21/13

(3)
10/21/13

ST036, CG523, ST061

had 35 inches of recovery. We have capped and taped the 9-10 ft section with an ID of 13CG523-SB05-9-10 for specific gravity and bulk density.
12:00 Move to ST061.
12:05 Setting up at 13ST061-SB01.
12:10 Drilling at 13ST061-SB01.
12:15 Cut the 0-5 ft core which had 35 inches of recovery. We have capped and taped the 4-5 ft section with an ID of 13ST061-SB05-4-5 for specific gravity & bulk density.
12:20 Cut the 5-10 ft core which had 36 inches of recovery. We have capped and taped the 9-10 ft section with an ID of 13ST061-SB05-9-10 for specific gravity and bulk density.
12:35 Back to field trailer.
12:55 Weston complete field work for the day and work on demob.

10/21/13

10/25/13

CG509

Personel: Haven Moe & Elliot Bruce (western)
Weather: 30's & clear.
Objective: Gauge monitoring wells with interface probe we rented of TII.
9:20 Arrive at field trailer and loading up site vehicle.
9:30 All measurements will be collected from top of inner casing.
9:35 Depart for CG-509
9:40 Measurement to ~~Gauge~~

ID	DTW
401WL-02	30.60 ft
401WL-03	32.92 ft
401WL-04	30.95 ft
401P2-05	dyed 28.52 ft ~~dry~~
401P2-01	dyed 28.31 ft ~~dry~~
401P2-03	31.58 ft
401WL-01	30.49 ft
SP216-04	36.41 ft
SP216-05	30.69 ft

10:20 Complete well gauging, back to field trailer.
10:45 Western offsite.

10/25/13

11/13/13

CG-SG & SD025

Personel: Haven Moe & Elliot Bruce (western)
Travis Drewry & Logan Hermens (GeoTek)
Weather: 30's & possible freezing rain
Objective: soil boring at CG-523 & well install at SD512 & SD025.
7:30 Western onsite.
7:50 Calibrate PID.
8:00 Health & Safety.
8:15 Travis head extended H&S.
8:30 GeoTek loading up. Today we have the 8040 Geoprobe.
9:00 Depart for CG-523 after having to tow the truck hauling the rig out of the snow/ice.
~~10:20~~ 10:00 Arrive at CG-523 and locate CG-523-LOG.
~~9:35~~ 10:35 Setting up at 13CG-523-SB14 which is in the vicinity of CG-523-LOG and its purpose is a clean up/grave location.
9:50 start drilling at 13CG523-SB14.
9:55 labeling trip blank as 13CG523-TB[illegible]-SO-0 for BTEX & GRO
10:00 Collecting soil sample labeled

11/13/13

11/13/13

CG523 & SD025

13CG523-SB14-6.0-6.5-0 at 6-6.5 ft for BTEX, DRO, RRO, GRO, MS/MSD. PID = 0.0 ppm. Headspace PID = 0.0 ppm. Collected as clean upgradient sample.

10:20 Completed 13CG523-SB14 to 15 ft. Finish up logging cores.

10:30 Silt cleanup.

10:45 GeoTek to drop rig off at SD025 then set water and fuel and food. Weston to stay at CG520 to wait for survey team.

11:20 Weston depart SOSTZ for SD025.

11:25 Weston at SOSTZ/SD025

11:55 GeoTek onsite. Walk out to 13SD025-SB02.

12:00 GeoTek setting up to install a well at 13SD025-SB02.

13:05 Start augering at 13SD025. Using 4¼ inner diameter ~~auger~~ augers

13:10 Jeremy Miner onsite.

13:50 At 35 ft with the augers

14:20 Constructing the well.

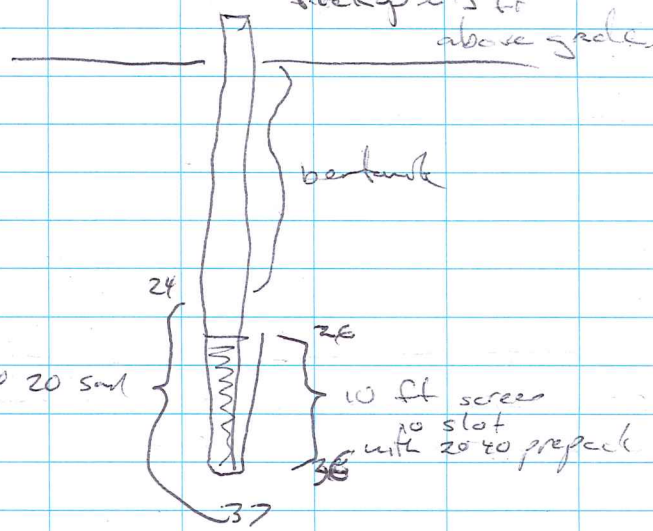
15:00 Jeremy offsite.

11/13/13

11/13/13

CG523 & SD025

16:00 Well Construction SD025MW01



16:25 From TIC DTW = 31.47 ft TD = 39.45'.

16:40 The concrete is frozen so we can not set the ~~ft~~ stickup today. Everything else is done.

16:50 Weston back to field trailer.

17:15 GeoTek at field trailer.

17:30 Offsite.

11/13/13

A-2 Soil Boring Logs

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WESTON SOLUTIONS

Client: AFCEC

Boring ID: 13CG523-SB01

Page 1 of 1

Project & Site Name: SBER-E CG523

Date: 7/2/13

Logged by: Aron Mraz

Borehole Soil Core Sample Log

TD=15 ft

Depth (ft)	Driven Depth and Recovery (ft)	Color	Moisture	PID (ppm)	Description	Sample ID, Time and Analyses
0–5	43"	Very Dark Brown 10YR 2/2	Dry	0.0 0.0 0.0 0.0 0.0	Gravel 30%, c sand 15%, m sand 40%, f sand 10%, silt 5% SW (largest gravel 1"D)	
5–7	38"	Very Dark Greenish Gray GLEY1 3/1 10GY	Moist	0.7 4.5		
7–8		Black 10YR 2/1		374	Gravel 30%, c sand 5%, f sand 30%, silt 35% petroleum odor SM	Headspace = 280ppm 13CG-523-SB01-7.0-7.5-0 13CG523-SB01-7.0-7.5-1 at 7-7.5ft for BTEX, DRO, RRO, GRO, PAH, VPH, EPH 13:45
8–9				281		
9–10				117		13:52 13CG-523-SB01-9.0-9.5-0 at 9-9.5 for BTEX, DRO, RRO & GRO Headspace PID=72.7ppm
10–12	32"	Dark Greenish Gray GLEY1 4/1 5GY		1.6 2.8		
12–13				1.9		Headspace at 12-12.5ft PID=0.1ppm
13–14				1.6		
14–15				1.0		
15					End of borehole	
16–20						

WESTON SOLUTIONS

Client: AFCEC

Boring ID: 13CG523-SB02 Page 1 of 1

Project & Site Name: JBER-E CG523

Date: 7/2/13

Logged by: Aaron Mroz

Borehole Soil Core Sample Log

TD = 15ft

Depth (ft)	Driven Depth and Recovery (ft)	Color	Moisture	PID (ppm)	Description	Sample ID, Time and Analyses
1	46"	Brown 10YR 4/3	Dry	0.0	Gravel 20%, c sand 10% m sand 20%, f sand 30% silt 20% (SM) (largest gravel >1½"D)	
2		Dark Yellowish Brown 10YR 3/4		0.0		Headspace at 2-2.5ft PID = 0.4 ppm
3		Dark Brown 10YR 3/3		0.0		
4				0.0		
5		Black 10YR 2/1		36.2		
6	43"	Greenish Gray GLEY1 5/1 5GY	moist	34.9	Gravel 30%, c sand 5% f sand 30%, silt 35% (SM) (largest gravel >1½"D)	Headspace PID = 71.6ppm 13CG523-SB02-6.0-6.5-0 BTEX, DRO, RRO, GRO EPH, VPH, PAHs
7				90.9		
8				26.0		
9		Black 10YR 2/1		16.0		Headspace PID = 51.3 ppm 13CG523-SB02-8.5-9.0-0 BTEX, DRO, RRO, GRO VPH, EPH, PAHs
10		Dark Greenish Gray GLEY1 4/1 5GY		6.6		
11	39"	Black 10YR 2/1		5.7		
12		Dark Greenish Gray GLEY1 4/1 5GY		0.8		
13				0.1		Headspace at 12-12.5ft PID = 0.5 ppm
14				0.2		
15				0.2		
16						
17						
18						
19						
20						

WESTON SOLUTIONS

Client: AFCEC

Boring ID: 13CG523-SB03

Page 1 of 1

Borehole Soil Core Sample Log

Project & Site Name: JBER-E CG523

Date: 7/2/13

TD = 15 ft

Logged by: Aaron Mroz

Depth (ft)	Driven Depth and Recovery (ft)	Color	Moisture	PID (ppm)	Description	Sample ID, Time and Analyses
1	24"	Dark Brown 10YR 3/3	Dry	0.0	Gravel 20%, c sand 10% m sand 20%, f sand 30% silt 20% [SM] (largest gravel 1"D)	
2				0.0		Headspace at 2-2.5 ft PID = 0.7 ppm
3				0.0		
4		Greenish Gray GLEY 1 6/1 10GY		0.3	Gravel 60%, c sand 30%, m sand 10% (largest gravel >1½"D) [GW]	
5		Dark Brown 10YR 3/3		0.6	Gravel 20%, c sand 10%, [SM] m sand 20%, f sand 30% silt 20% (largest gravel 1"D)	
6		Black 10YR 2/1	Moist	0.1	Gravel 20%, c sand 5% m sand 5%, f sand 30% silt 20%, organics 20% (largest gravel 1"D) [SM]	
7	33"					
8		Dark Greenish Gray GLEY 1 4/1 5G		0.2	Gravel 30%, c sand 5% f sand 30%, silt 35% (largest gravel >1½"D) [SM]	Headspace at 7-7.5 ft PID = 0.9 ppm
9				0.1		
10				0.3		
11				0.0		
12	42"		Wet	0.0	Gravel 30%, c sand 10% m sand 40%, f sand 10% silt 10% [SW]	Headspace PID = 0.0 ppm 13CG523-SB03-12.0-12.5-CO DRO, RRO, GRO, BTEX
13			Moist	0.0	Gravel 30%, c sand 5% f sand 30%, silt 35% largest gravel >1½"D [SM]	
14				0.0		
15				0.0		
16						
17						
18						
19						
20						

WESTON SOLUTIONS

Client: AFCEC

Boring ID: 13CG523-SB04

Page 1 of 1

Borehole Soil Core Sample Log

Project & Site Name: JBER-E CG-523

Date: 8/2/13

Logged by: Haven Mooz

TD = 15 ft

Depth (ft)	Driven Depth and Recovery (ft)	Color	Moisture	PID (ppm)	Description	Sample ID, Time and Analyses
1	37"	Olive Brown 2.5Y 4/3	Dry	0.1	Gravel 20% c sand 10% m sand 10% f sand 40% silt 20% (largest gravel >1½" D) SM	
2		Dark Brown 10YR 3/3	moist	0.0		Headspace at 2-2.5ft PID = 0.5 ppm
3				0.0		
4			Dry	0.0		
5				0.0		
6	41"	Black 10YR 2/1	wet	0.0	Gravel 20%, c sand 5% m sand 5%, f sand 30% silt 20%, organics 20% SM	
7				0.0		
8		Dark Greenish Gray GLEY 1 4/1 10Y	moist	0.0	Gravel 30%, f sand 40% silt 30% (largest gravel 1" D) SM	Headspace at 7-7.5ft PID = 0.6ppm
9				0.0		
10				0.0		
11	43"	Very Dark Gray 10YR 3/1	wet	0.0	Gravel 30%, m sand 20% f sand 40%, silt 10% SW	Headspace PID = 0.0 ppm 13CG523-SB04-10.0-10.5-0 at 10-10.5ft for BTEX DRO, RRO, GRO 16:15
12		Very Dark Greenish Gray GLEY 3/1 5G 3/1	moist	0.0	Gravel 30%, f sand 40% silt 30% SM (largest gravel 1" D) dense	
13				0.0		
14				0.0		
15				0.0		
16					End of borehole	
17						
18						
19						
20						

WESTON SOLUTIONS

Client: AFCEC

Boring ID: 13CG-523-SB05

Page 1 of 1

Project & Site Name: JBER-E CG-523

Date: 7/3/13

Logged by: Aaron Moe

Borehole Soil Core Sample Log

TD=15 ft

Depth (ft)	Driven Depth and Recovery (ft)	Color	Moisture	PID (ppm)	Description	Sample ID, Time and Analyses
1	30"	Olive Brown 2.5Y 4/3	Dry	0.5	Gravel 30%, c sand 10%, m sand 10%, f sand 30%, silt 20% SM (largest gravel >1½"D)	
2		Dark Olive Brown 2.5Y 3/3	moist	0.7		
3				0.4		Headspace at 2-2.5 ft PID = 1.2 ppm
4				0.3		
5		Black 10YR 2/1		0.3	Gravel 20%, m sand 10% f sand 40% silt 20% organics 10% SM	
		Very Dark Grayish Brown 2.5Y 3/2			Gravel 30%, c sand 10%, m sand 20%, f sand 30%, silt 10% SW	
6				0.2	Gravel 30%, f sand 30% silt 30%, clay 10% SM (largest gravel ½"D)	
7		Dark Greenish Gray GLEY1 4/1 5GY		0.3		Headspace at 7-7.5 ft PID = 1.3 ppm
8	30" 31"	Black 10YR 2/1		0.2	Gravel 20%, m sand 10% f sand 40% silt 20% organics 10% SM	
9		Dark Greenish Gray GLEY1 4/1 5GY		0.3	Gravel 30%, f sand 40% silt 30% SM (largest gravel ½"D)	
10				0.1		
11			wet	0.4		8:45 13CG-523-SB05-10.5-11.0-0 at 10.5-11 ft for BTEX DRO, GRO, & RRO Headspace = 0.0 ppm
12	39"		moist	0.2		
13				0.4		
14				0.0		
15				0.0	End of borehole	
16						
17						
18						
19						
20						

WESTON SOLUTIONS

Borehole Soil Core Sample Log

Client: AFCEC

Boring ID: 13CG523-SB06

Page 1 of 1

Project & Site Name: SBER-E CG523

Date: 7/3/13

Logged by: Aaron Mroz

TD = 15ft

Depth (ft)	Driven Depth and Recovery (ft)	Color	Moisture	PID (ppm)	Description	Sample ID, Time and Analyses
1	46"	Very Dark Brown 10YR 2/2	Dry	0.0	Gravel 30%, c sand 10%, m sand 40%, f sand 20% (largest gravel >1½"D) SW	
2				0.0		
3				0.5		Headspace at 2-2.5ft PID = 0.9 ppm
4			moist	0.4		
5				0.7		
6				0.3		
7	41"	Dark Greenish Gray ~~GLEY 4/1~~ GLEY 1 4/1 SGY		35.5	Gravel 30%, c sand 5%, m sand 5%, f sand 30%, silt 30% SM (largest gravel >1½"D)	9:15 13CG523-SB06-6.0-6.5-0 13CG523-SB06-6.0-6.5-1 at 6-6.5ft for BTEX DRO, GRO, RRO Headspace = 209 ppm
8				6.0		
9				1.0	dense	
10				1.3		
11				~~NA~~ 1.3		
12	26"			0.3		Headspace at 12-12.5ft PID = 1.5 ppm
13				0.4		
14				0.2		
15				0.1		
16					End of borehole	
17						
18						
19						
20						

WESTON SOLUTIONS

Client: AFCEC

Boring ID: 13CG523-SB07

Page 1 of 1

Project & Site Name: JBER-E CG523

Date: 7/3/13

Logged by: Aaron Mroz

Borehole Soil Core Sample Log

TD = 15 ft

Depth (ft)	Driven Depth and Recovery (ft)	Color	Moisture	PID (ppm)	Description	Sample ID, Time and Analyses
0	42"	Very Dark Brown 10YR 2/2	DM	0.5	Gravel 30% c sand 10% m sand 40% f sand 20% (largest gravel >1½"D) SW	
1				0.6		
2				0.4		Headspace at 2-2.5 ft PID = 0.8 ppm
3		NO ODOR				
4			Moist	0.3		
5				0.1		
6	31"			8.8		10:05 Headspace PID = 224 ppm 13CG523-SB07-6.0-6.5-G at 6-6.5 ft for BTEX, DRO GRO, RRO
7		Dark Greenish Grey GLEY1 4/1 SGY		11.6	Gravel 30%, c sand 5% SM m sand 5%, f sand 30% silt 30% petroleum odor (largest gravel ½" D)	10:10 13CG523-SB07-7.0-7.5-G at 7-7.5 ft for BTEX, DRO, RRO, GRO
8		Black 10YR 2/1		74.0	Gravel 20%, m sand 10% f sand 40%, silt 20%, obsidies 10% SM	
9		Dark Greenish Grey GLEY1 4/1 SGY		14.0	Gravel 30%, c sand 5% m sand 5% f sand 30% silt 30% SM (largest gravel >(½"D) dense	Headspace PID = ~~285~~ 28.3 ppm
10				2.9		
11	27"			~~100~~ M		
12				10.8		Headspace at 12-12.5 ft PID = 1.4 ppm
13				7.2		
14				6.2		
15				2.4		
16					End of borehole	
17						
18						
19						
20						

WESTON SOLUTIONS

Client: AFCEC

Boring ID: 13CG523-SB08 Page 1 of 1

Borehole Soil Core Sample Log

Project & Site Name: JBER-E CG523

Date: 7/3/13

Logged by: Aaron Mroz

TD = 15ft

Depth (ft)	Driven Depth and Recovery (ft)	Color	Moisture	PID (ppm)	Description	Sample ID, Time and Analyses
1	22"	Dark Brown 10YR 3/3	Dry	0.7	Gravel 30%, c sand 10%, m sand 10%, f sand 30%, silt 10%, organics 10% SW	
2		Very Dark Brown 10YR 3/2		1.2	Gravel 30%, c sand 10%, m sand 40%, f sand 20% (largest gravel >(½"D) SW	Headspace at 2-2.5 ft PID = 1.4 ppm
3				0.5		
4				1.5		
5			moist	17.9		
6	35"	Dark Greenish Gray GLEY 1 4/1 5GY		206		10:50 Headspace PID = 17 ppm 13CG523-SB08-6.0-6.5-0 at 6-6.5ft for BTEX, DRO, RRO & GRO
7				38.5	Gravel 30%, c sand 5%, m sand 5%, f sand 30%, silt 30%, petroleum odor (largest gravel 1"D) SM	
8		Black 10YR 2/1		15.0	Gravel 20%, m sand 10% f sand 40% silt 20%, organics 10% SM	
9		Dark Greenish Gray GLEY 1 4/1 5GY		16.8	Gravel 30%, c sand 5%, m sand 5%, f sand 30% silt 30% SM	
10				9.6		
11	39"			20.1	(largest gravel 1"D) dense	Headspace at 12-12.5 ft PID = 1.1 ppm
12				3.0		
13				1.3		
14				1.8		
15					End of borehole	
16						
17						
18						
19						
20						

WESTON SOLUTIONS

Client: AFCEC

Boring ID: 13CG523-SB09

Page 1 of 1

Project & Site Name: JBER-E CG523

Date: 7/3/13

Logged by: Karen Mraz

Borehole Soil Core Sample Log

TD = 15 ft

Depth (ft)	Driven Depth and Recovery (ft)	Color	Moisture	PID (ppm)	Description	Sample ID, Time and Analyses
1	43"	Very Dark Brown 10YR 2/2	Dry	1.0	Gravel 30%, c sand 10%, m sand 40%, f sand 20% (largest gravel > 1½"D) SW	
2				0.6		
3				1.1		Headspace at 2-2.5 ft PID = 0.8 ppm
4				0.7		
5				0.7		
6	50"	Dark Greenish Gray GLEY1 4/1 5GY	moist	19.0		Headspace = 235 ppm 13CG523-SB09-6.0-6.5-0 at 6-6.5 ft for BTEX, DRO, RRO, GRO, EPH, VPH & PAH's. 11:15
7				329	Gravel 30%, c sand 5%, m sand 5%, f sand 30%, silt 30% (largest petroleum odor gravel ½"D) SM	
8		Black 10YR 2/1		237	Gravel 20%, m sand 10%, f sand 40%, silt 20%, organics 10% SM	
9		Dark Greenish Gray GLEY1 4/1 5GY		21.7	Gravel 30%, c sand 5%, m sand 5%, f sand 30%, silt 30% (largest gravel > 1½"D) SM	
10				13.8		
11	24"			2.2		
12				0.6	dense	Headspace 12-12.5 ft PID = 1.0 ppm
13				1.7		
14				0.5		
15					End of Borehole	
16						
17						
18						
19						
20						

WESTON SOLUTIONS

Client: AFCEC

Boring ID: 13CG523-SB10

Page 1 of 1

Project & Site Name: SBER-E 7/10/13

Date: 7/10/13

Borehole Soil Core Sample Log

TD = 15 ft

Logged by: Aaron Mroz

Depth (ft)	Driven Depth and Recovery (ft)	Color	Moisture	PID (ppm)	Description	Sample ID, Time and Analyses
1	46"	Brown 10YR 4/3	Dry	0.0	Gravel 15%, c sand 5%, m sand 10%, f sand 50%, silt 10%, organics 10% (SW)	
2		Dark Brown 10YR 2/2		0.0	Gravel 30%, c sand 5%, m sand 10%, f sand 35%, silt 20% (SM) (largest gravel 1"D)	Headspace at 2-2.5 ft PID = 0.2 ppm
3				0.0		
4				0.0		
5		Black 10YR 2/1	moist	0.0	Gravel 20%, c sand 5%, f sand 30%, silt 20%, clay 10%, organics 15% (largest gravel ½"D) (SM)	
6	36"			0.0		14:55 Headspace PID = 0.4 ppm 13CG523-SB10-6.0-6.5-0 at 6-6.5 ft for BTEX, DRO, GRO, RRO
7				0.0		
8		Dark Grey GLEY 4/N		0.0	Gravel 30%, f sand 40%, silt 30% (SM) dense (largest gravel 1"D)	
9				0.0		
10				0.0		
11	34"			0.0		
12				0.0		Headspace at 12-12.5 ft PID = 0.7 ppm
13				0.0		
14				0.0		
15				0.0		
					End of borehole	

Client: AFCEC

Boring ID: 13CG523-SB11

Page 1 of 1

Project & Site Name: JBER-E ~~7/10/13 CG523~~

Date: 7/10/13

Logged by: Aaron Metz

Borehole Soil Core Sample Log

PID = 15 ft

Depth (ft)	Driven Depth and Recovery (ft)	Color	Moisture	PID (ppm)	Description	Sample ID, Time and Analyses
0	39"	Brown 10YR 4/3	Dry	0.0	Gravel 15%, c sand 5%, m sand 10%, f sand 50%, silt 10%, organics 10% SW	
1		Dark Brown 10YR 2/2		0.0	Gravel 30%, c sand 5%, m sand 10%, f sand 35%, silt 20% SM (largest gravel >1½"D)	
2				0.0		Headspace at 2-2.5ft PID = 0.5 ppm
3				0.0		
4				0.0		
5			moist			
6	40"	Olive Brown 2.5Y 4/3	wet	0.0	Gravel 60%, c sand 20%, m sand 20%, largest gravel 1"D GW	15:30
7		Black 10YR 2/1	moist	0.0	Gravel 20%, c sand 5%, f sand 30%, silt 20%, clay 10%, organics 15%, largest gravel 1"D SM	13CG523-SB11-6.0-6.5-0 at 6-6.5 for BTEX, DRO, GRO, RRO Headspace PID = 0.0 ppm
8		Dark Grey GLEY1 4/N		0.0	Gravel 30%, f sand 40%, silt 30% SM dense (largest gravel 1"D	
9				0.0		
10				0.0		
11	49"	Olive Brown 2.5Y 4/3	wet		Gravel 50%, c sand 30%, m sand 20% ~~SM~~ SW (largest gravel 1"D)	
12						Headspace at 12-12.5ft PID = 0.3 ppm
13		Dark Grey GLEY1 4/N	Moist		Gravel 30%, f sand 40%, silt 30% SM dense (largest gravel 1"D)	
14						
15					End of borehole	
16						
17						
18						
19						
20						

Client: AFCEC

Boring ID: 13CG523-SB12

Page 1 of 1

Project & Site Name: JBER-E ~~7/10/13 CG523~~

Date: 7/10/13

Logged by: Aaron Mac

Borehole Soil Core Sample Log

TD = 15 ft

Depth (ft)	Driven Depth and Recovery (ft)	Color	Moisture	PID (ppm)	Description	Sample ID, Time and Analyses
1	43"	Brown 10YR 4/3	Dry	0.0	Gravel 15%, c sand 5%, m sand 10%, f sand 50%, silt 10%, organics 10% (largest gravel ½" D) SW	
2				0.0		
3		Dark Brown 10YR 2/2		0.0	Gravel 30%, c sand 10%, m sand 10%, f sand 30% (largest gravel >1½" D) SW	Headspace at 2-2.5 ft PID = 0.9 ppm
4				0.0		
5				0.0		
6	39"	Black 10YR 2/1	moist	0.0	Gravel 10%, f sand 30%, silt 20%, organics 50% SM	
7				2.7		16:05 Headspace PID = 18.9 ppm 13CG523-SB12-7.0-7.5-C at 7-7.5 ft for BTEX, DRO, GRO & PRO
8		Dark Grey GLEY 1 4/N		0.9	Gravel 30%, f sand 40%, silt 30% dense (largest gravel 1" D) SM	
9				1.1		
10	50"		wet	2.7	Gravel 40%, c sand 20%, m sand 20%, f sand 20% SW	
11				0.2	Gravel 30%, f sand 40%, silt 30% SM dense (largest gravel 1" D)	
12				0.1		Headspace at 12-12.5 ft PID = 0.0 ppm
13				0.3		
14				0.0		
15					End of borehole	
16						
17						
18						
19						
20						

WESTON SOLUTIONS

Client: AFCEC

Boring ID: 13CG523-SB13

Page 1 of 1

Project & Site Name: JBER-E CG523

Date: 7/10/13

Logged by: Aaron Mroz

Borehole Soil Core Sample Log

TD = 15 ft

Depth (ft)	Driven Depth and Recovery (ft)	Color	Moisture	PID (ppm)	Description	Sample ID, Time and Analyses
0	50"	Dark Brown 10YR 3/3	Dry	0.0	Gravel 15%, m sand 10%, f sand 30%, silt 30%, cobbles 15% [SM]	
1		Very Dark Brown 10YR 2/2		0.0	Gravel 30%, c sand 15%, m sand 40%, f sand 10%, silt 5% [SW]	
2					(largest gravel >1½"D)	
3				0.0		Headspace at 2-2.5ft PID = 0.9 ppm
4				0.0		
5				0.0		
6	50"	Dark Grey GLEY 1 4/N	moist	0.2	Gravel 30%, f sand 40% silt 30% [SM]	16:35 Headspace PID = 385 ppm 13CG523-SB13-6.0-6.5-0 at 6-6.5ft BTEX, DRO, GRO, RRO
7				258	(largest gravel 1"D)	
8				233		
9				81.5	petroleum odor 6-9 ft	
10				7.5		
11	15"			1.7		
12						Headspace at 12-12.5ft PID = 1.1 ppm
13				1.3		
14						
15					End of borehole	
16						
17						
18						
19						
20						

WESTON SOLUTIONS

Client: AFCEC

Boring ID: 13CG523-SB14

Page 1 of 1

Borehole Soil Core Sample Log

TD: 15 ft
GW: NA

Project & Site Name: JBER-E CG523

Date: 11/13/13

Logged by: Aaron Mroz

Depth (ft)	Driven Depth and Recovery (ft)	Color	Moisture	PID (ppm)	Description	Sample ID, Time and Analyses
1	48"	2.5Y 3/2 Very Dark Grayish Brown	Moist	0.0	Gravel 40%, C-SAND 10%, M-SAND 20% F-SAND 20%, SILT 10% [SW]	headspace @ 2-2½ ft PID = 0.2 ppm
2				0.0		
3				0.0	Largest gravel = 1" D	
4		Very Dark Gray 2.5Y 3/1	WET	0.0	~~Gravel 60%, C-SAND 10%, M-SAND 10%, F-SAND 15%, SILT 5%~~ [GW]	
5		10YR 2/2	Moist	0.0	Gravel 10%, M-SAND 10%, F-SAND 20%, SILT 30%, organics 30%, [PL]	
6	45"	2.5Y 3/1 Very Dark Gray	WET	0.0	Gravel 70%, C-SAND 15%, M-SAND 10%, organics 30% [GW]	Headspace PID = 0.0 ppm 13CG523-SB14-6.0-6.5-0 BTEX, GRO, DRO, RRO
7		Dark Greenish Gray GLEY1 4/1 5g/1	Moist	0.0	Gravel 20%, M-SAND 10%, f-Sand 30% Silt 40% [SM]	
8				0.0		
9				0.0	some organics @ 8 ft	
10				0.0		
11	47"		Wet	0.0	Gravel 60%, C-SAND 15%, M-SAND 15% F-SAND 10% [GW]	headspace @ 12-12½ ft PID = 0.3 ppm.
12				0.0		
13			Moist	0.0	Gravel 20%, M-SAND 10%, F-SAND 30%, Silt 40% [SM]	
14		Dark Greenish Gray GLEY1 4/1 10Y		0.0		
15						
	End of Borehole	Borehole			End of Borehole	

A-3 LIF Data Sheets

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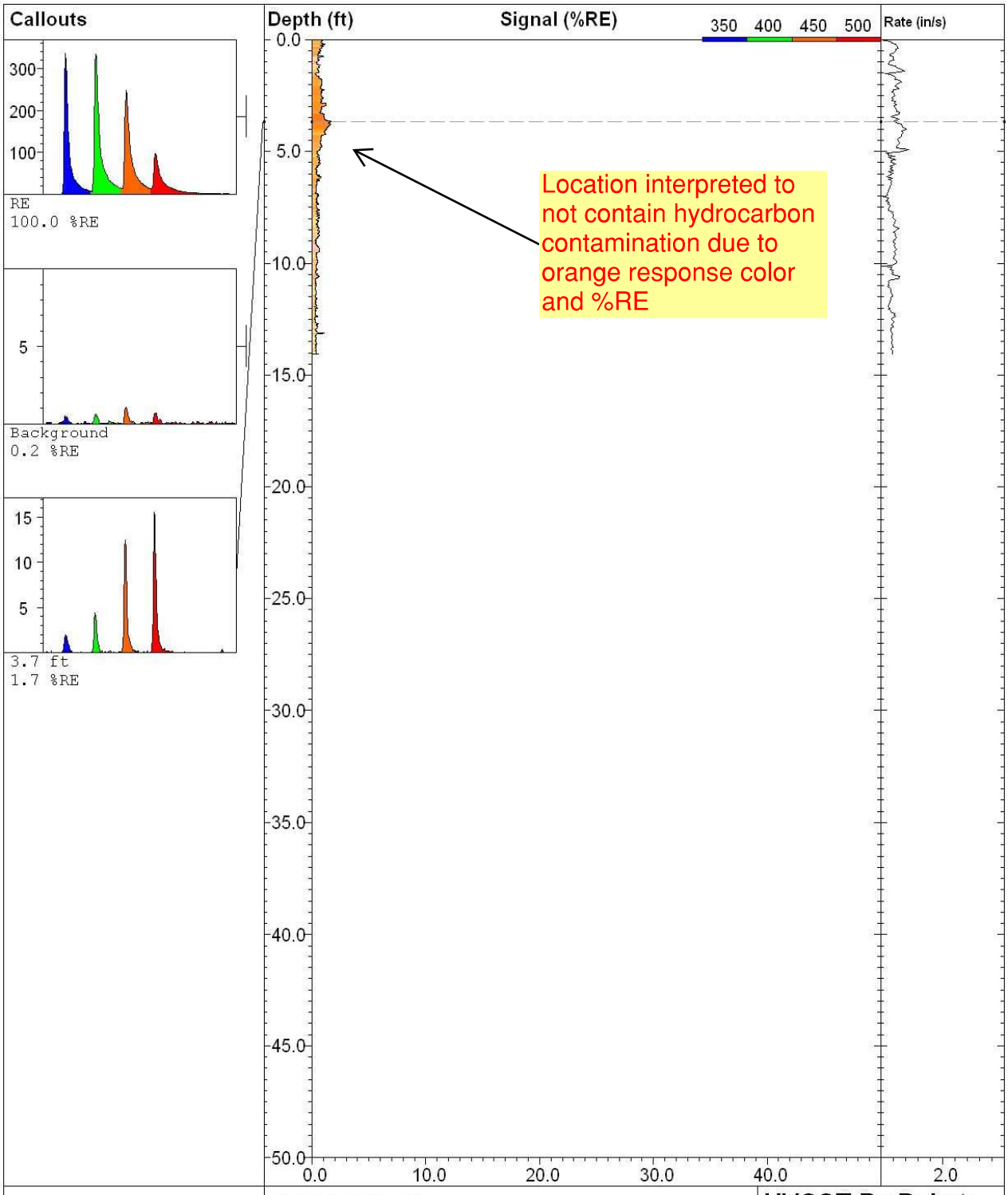

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CG523L01

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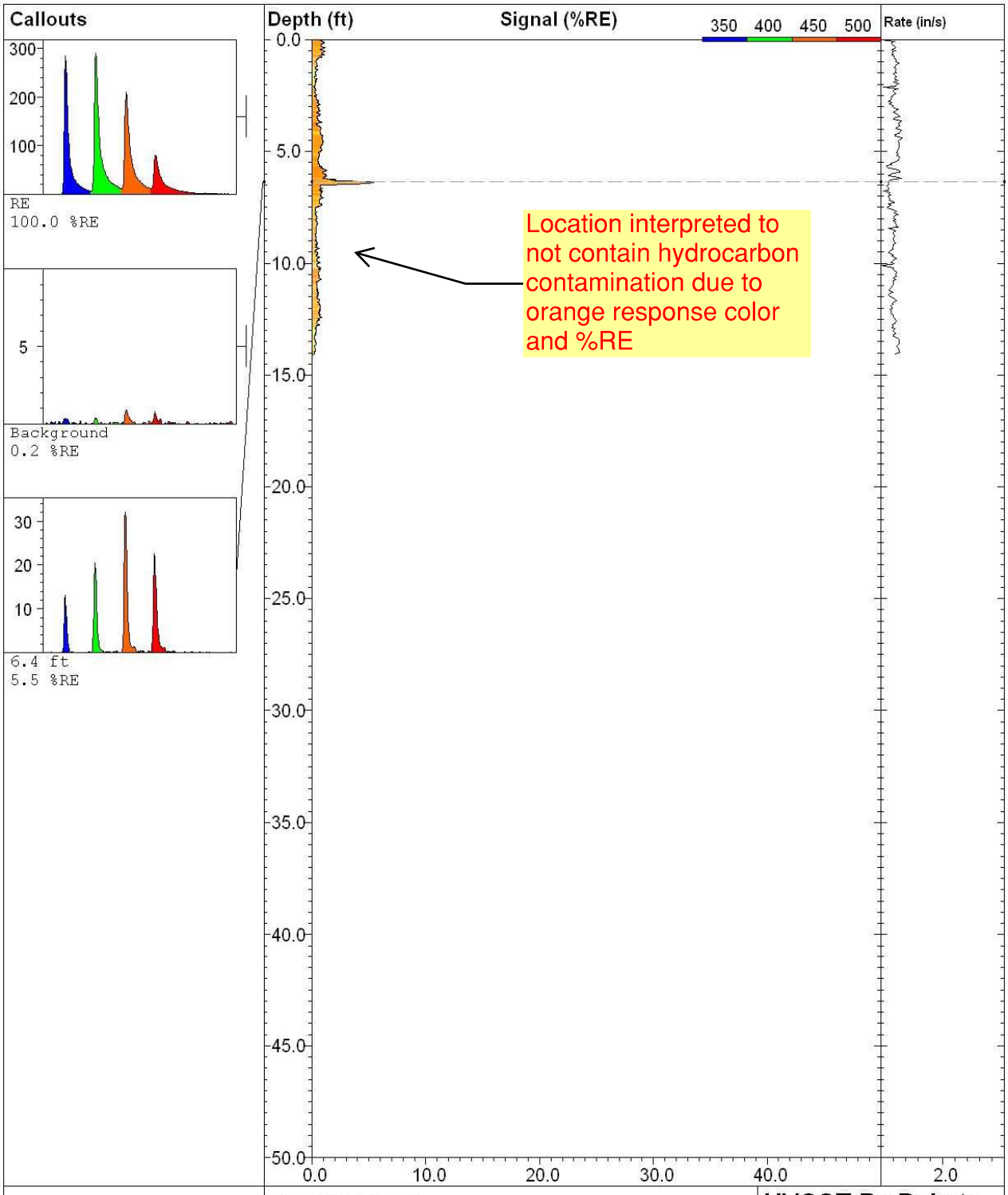
Site: **Weston JBER 2013**	*Latitude / Datum:* **Unavailable / NA**	*Final depth:* **14.07 ft**
Client: **Weston**	*Longitude / Fix:* **Unavailable / NA**	*Max signal:* **1.7 % @ 3.67 ft**
Job:	*Operator/Unit:* **EEM/UVOST1008**	*Date & Time:* **2013-06-25 10:52 ADT**



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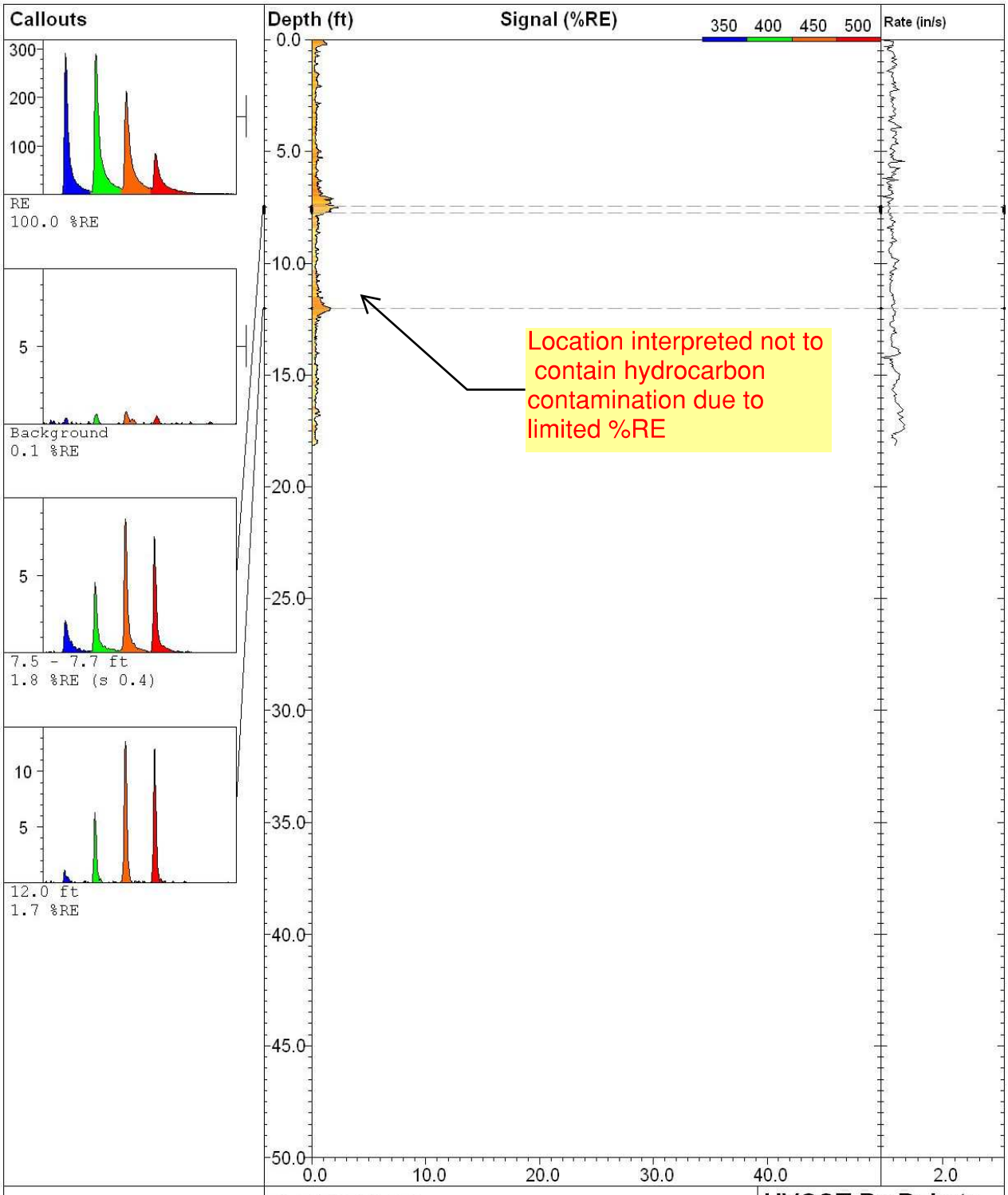
Site: **Weston JBER 2013**	*Latitude / Datum:* **Unavailable / NA**	*Final depth:* **14.07 ft**
Client: **Weston**	*Longitude / Fix:* **Unavailable / NA**	*Max signal:* **5.5 % @ 6.37 ft**
Job:	*Operator/Unit:* **EEM/UVOST1008**	*Date & Time:* **2013-06-25 11:44 ADT**



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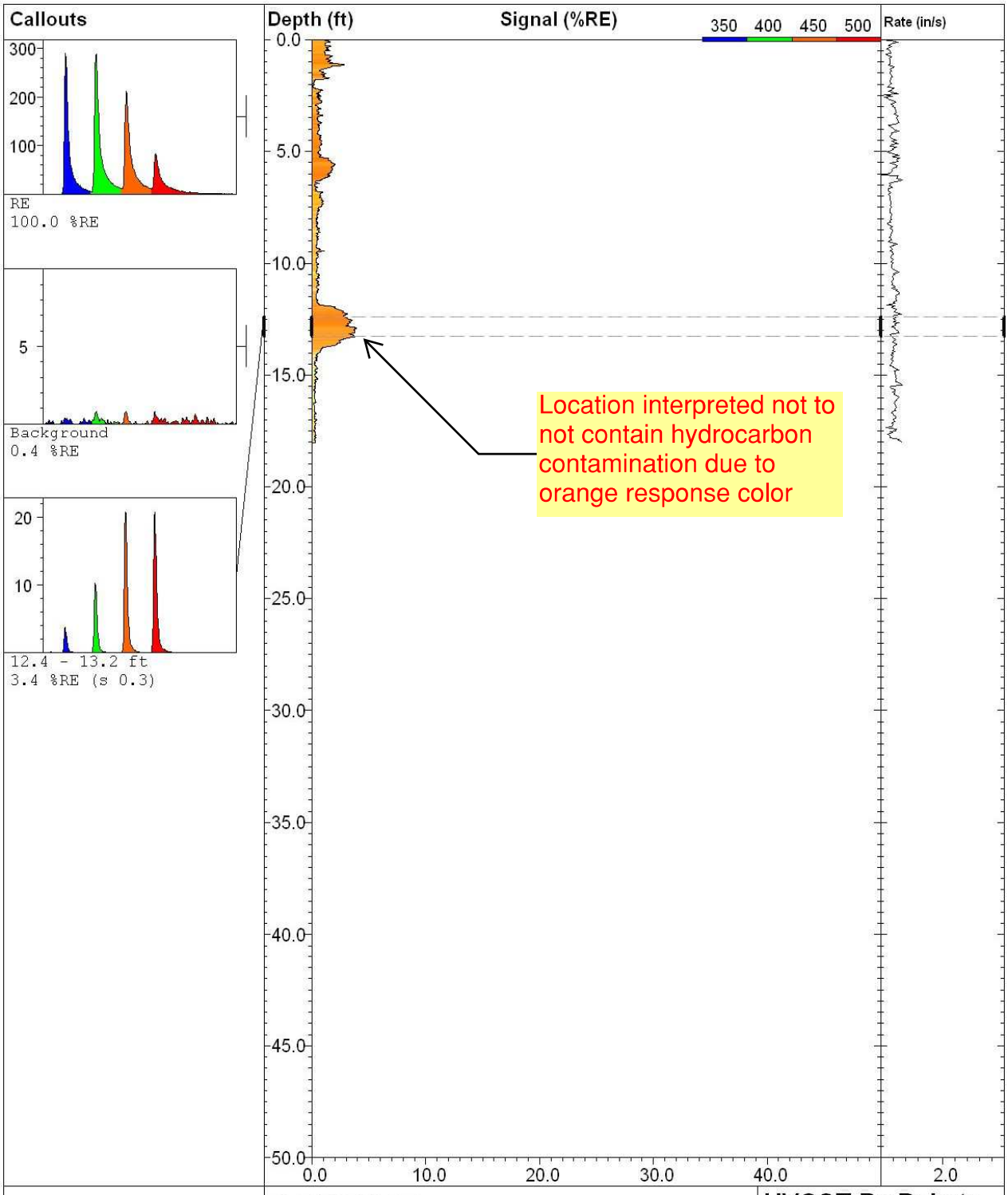
Site: **Weston JBER 2013**	*Latitude / Datum:* **Unavailable / NA**	*Final depth:* **18.16 ft**
Client: **Weston**	*Longitude / Fix:* **Unavailable / NA**	*Max signal:* **2.3 % @ 7.52 ft**
Job:	*Operator/Unit:* **EEM/UVOST1008**	*Date & Time:* **2013-06-25 13:45 ADT**



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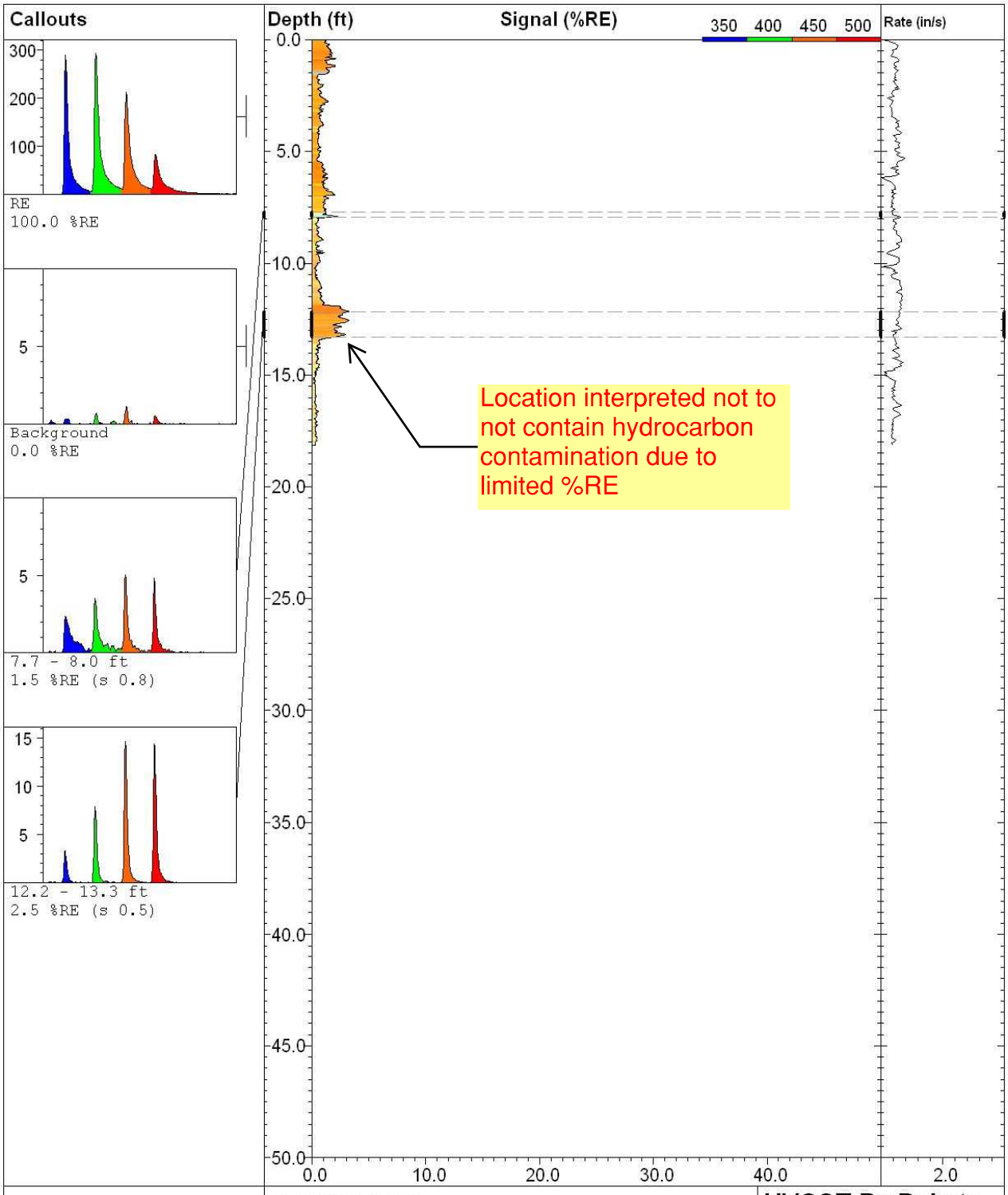
Site: **Weston JBER 2013**	*Latitude / Datum:* **Unavailable / NA**	*Final depth:* **18.05 ft**
Client: **Weston**	*Longitude / Fix:* **Unavailable / NA**	*Max signal:* **3.9 % @ 12.90 ft**
Job:	*Operator/Unit:* **EEM/UVOST1008**	*Date & Time:* **2013-06-25 14:52 ADT**



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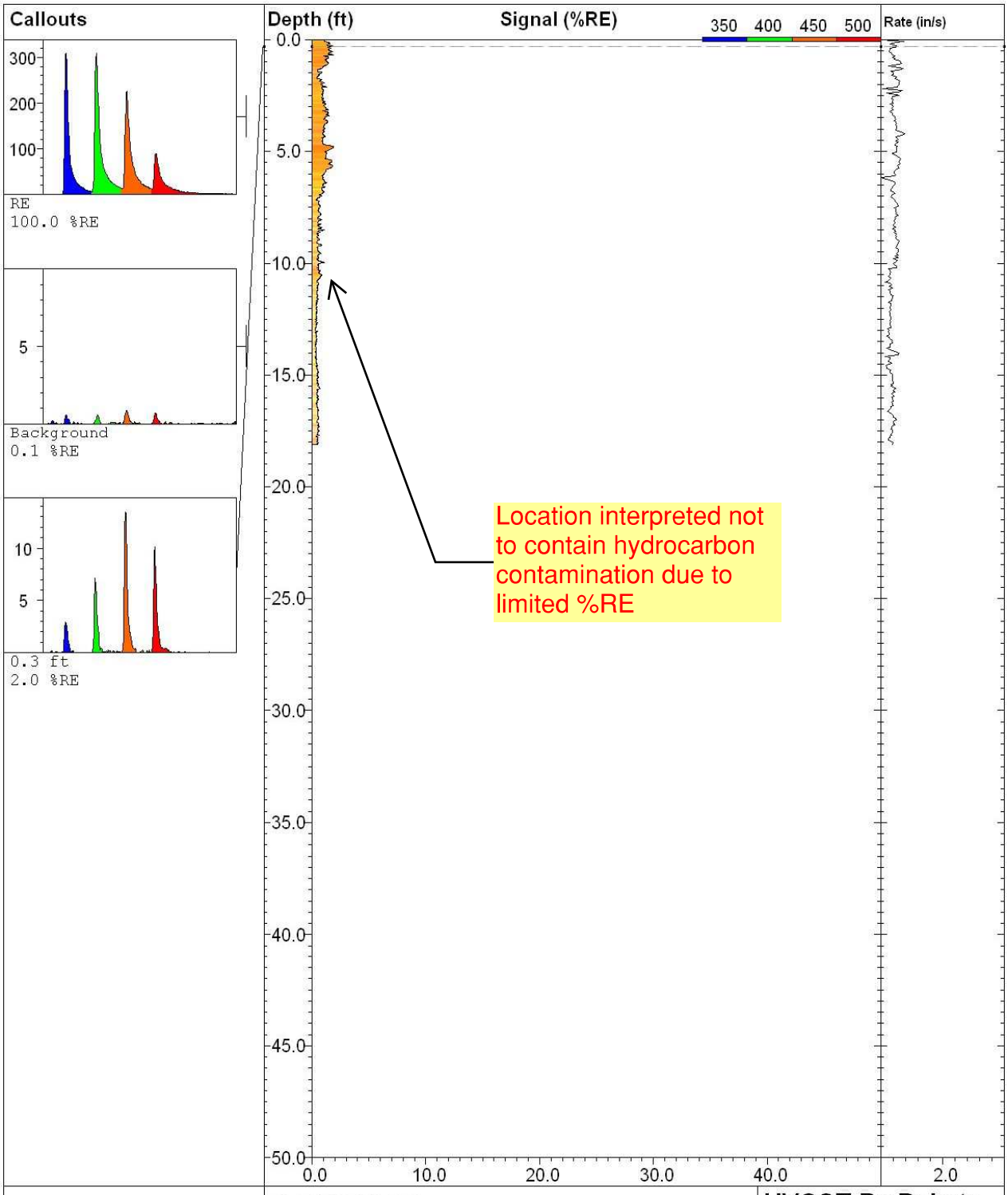
Site: **Weston JBER 2013**	*Latitude / Datum:* **Unavailable / NA**	*Final depth:* **18.16 ft**
Client: **Weston**	*Longitude / Fix:* **Unavailable / NA**	*Max signal:* **3.2 % @ 12.15 ft**
Job:	*Operator/Unit:* **EEM/UVOST1008**	*Date & Time:* **2013-06-25 15:53 ADT**



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CG523L06

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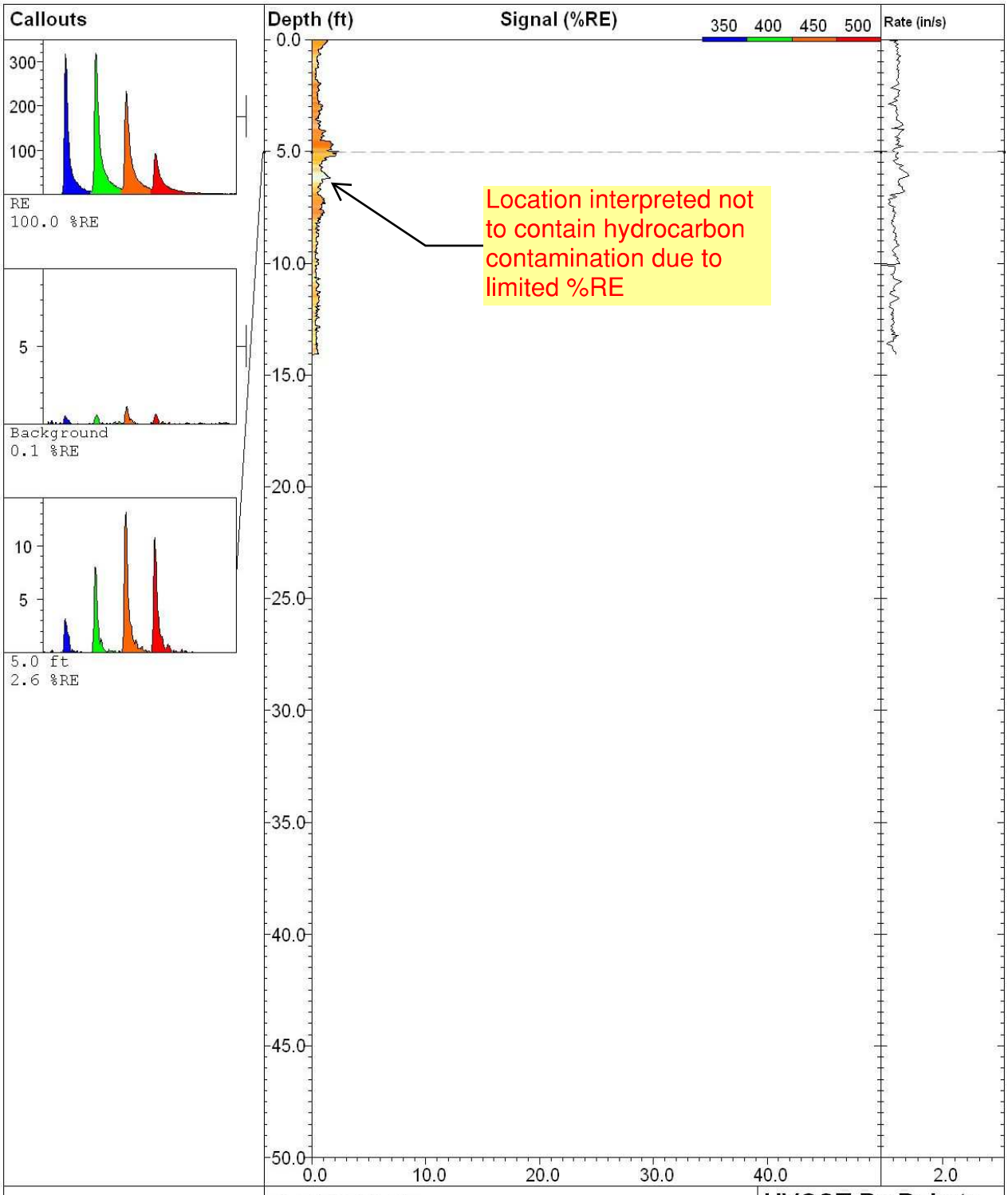
Site: **Weston JBER 2013**	*Latitude / Datum:* **Unavailable / NA**	*Final depth:* **18.14 ft**
Client: **Weston**	*Longitude / Fix:* **Unavailable / NA**	*Max signal:* **2.0 % @ 0.31 ft**
Job:	*Operator/Unit:* **EEM/UVOST1008**	*Date & Time:* **2013-06-26 09:49 ADT**



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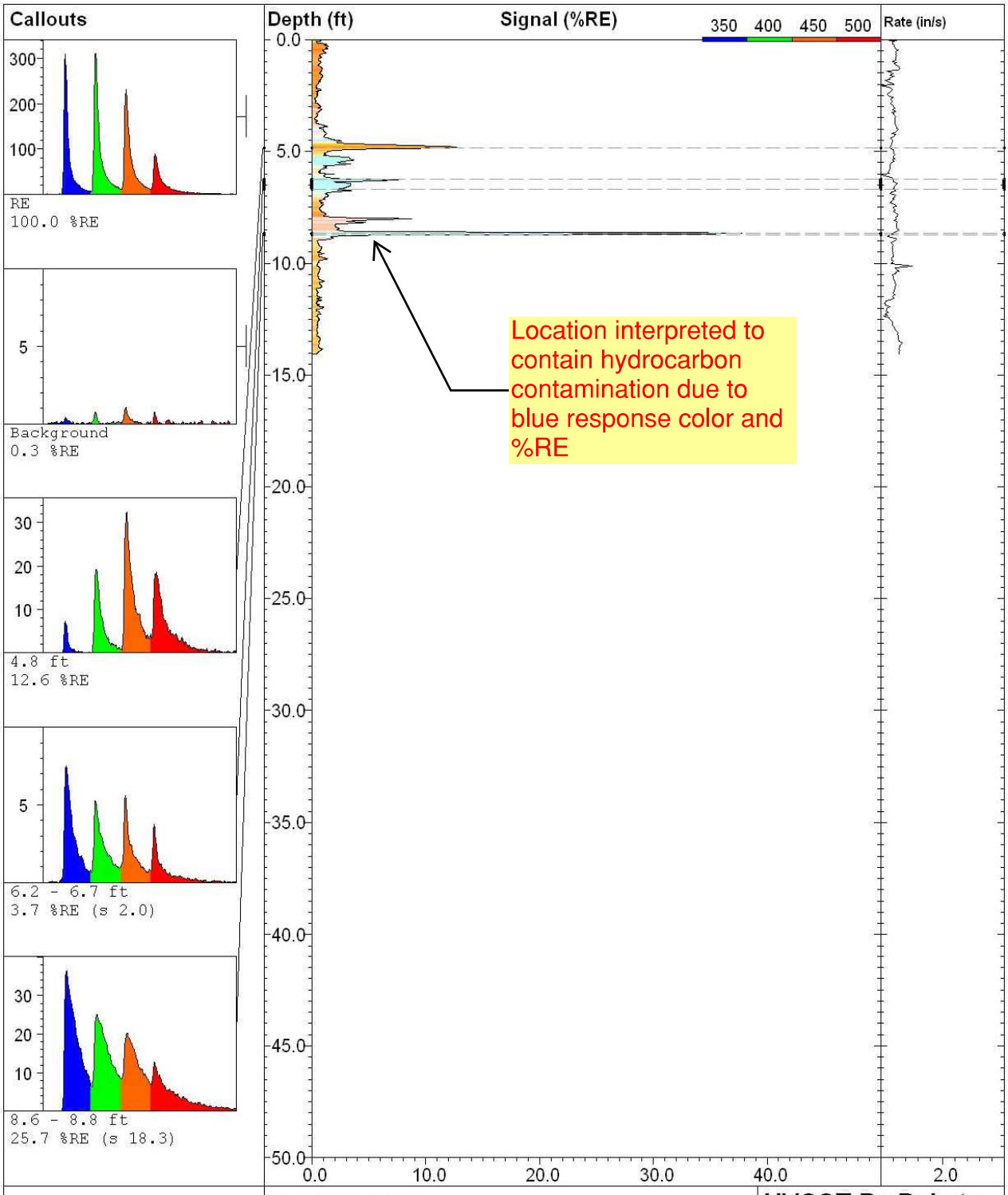
Site: **Weston JBER 2013**	*Latitude / Datum:* **Unavailable / NA**	*Final depth:* **14.07 ft**
Client: **Weston**	*Longitude / Fix:* **Unavailable / NA**	*Max signal:* **2.6 % @ 5.03 ft**
Job:	*Operator/Unit:* **EEM/UVOST1008**	*Date & Time:* **2013-06-26 10:42 ADT**



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CG523L08

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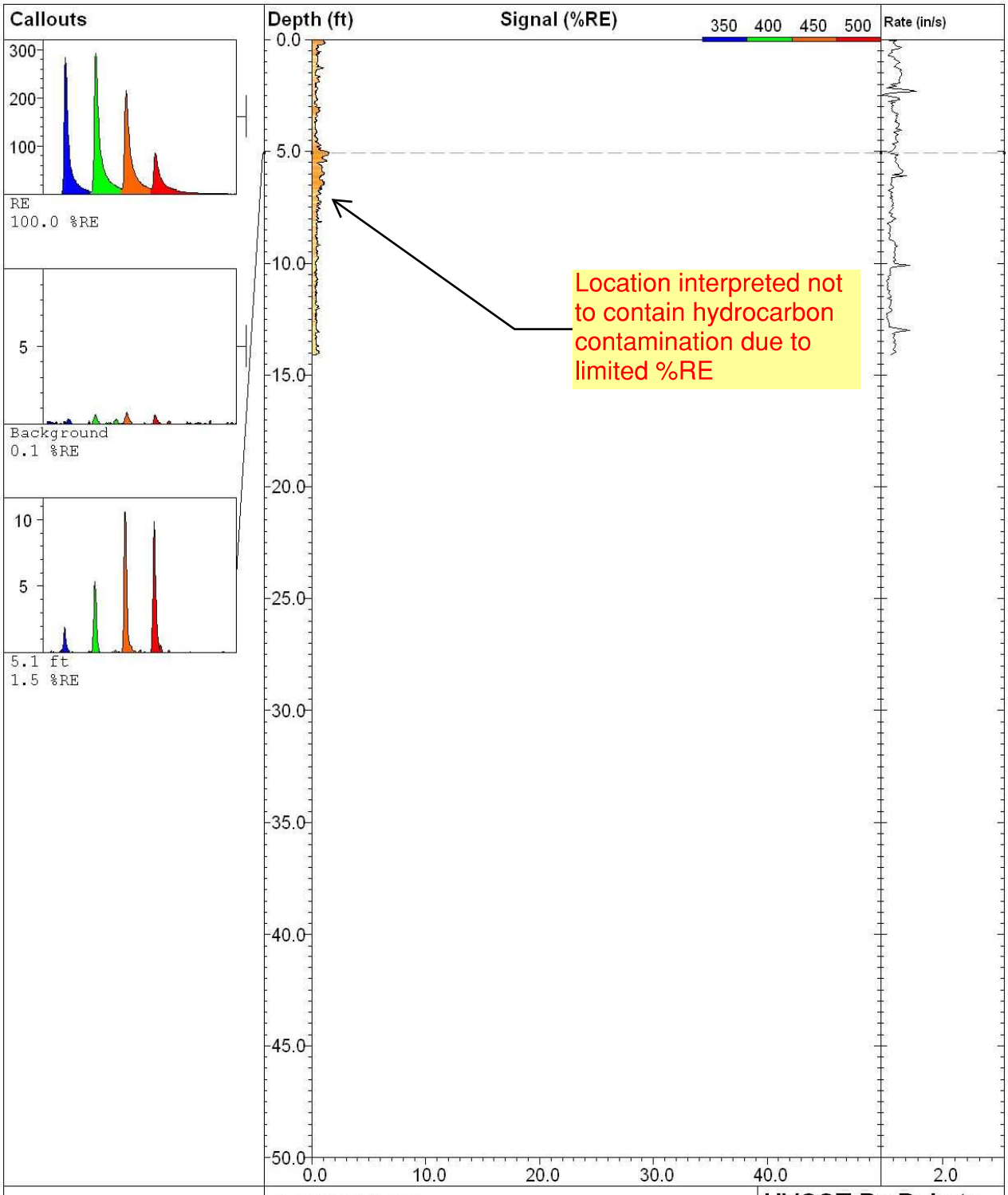
Site: **Weston JBER 2013**	*Latitude / Datum:* **Unavailable / NA**	*Final depth:* **14.05 ft**
Client: **Weston**	*Longitude / Fix:* **Unavailable / NA**	*Max signal:* **38.1 % @ 8.64 ft**
Job:	*Operator/Unit:* **EEM/UVOST1008**	*Date & Time:* **2013-06-26 14:09 ADT**



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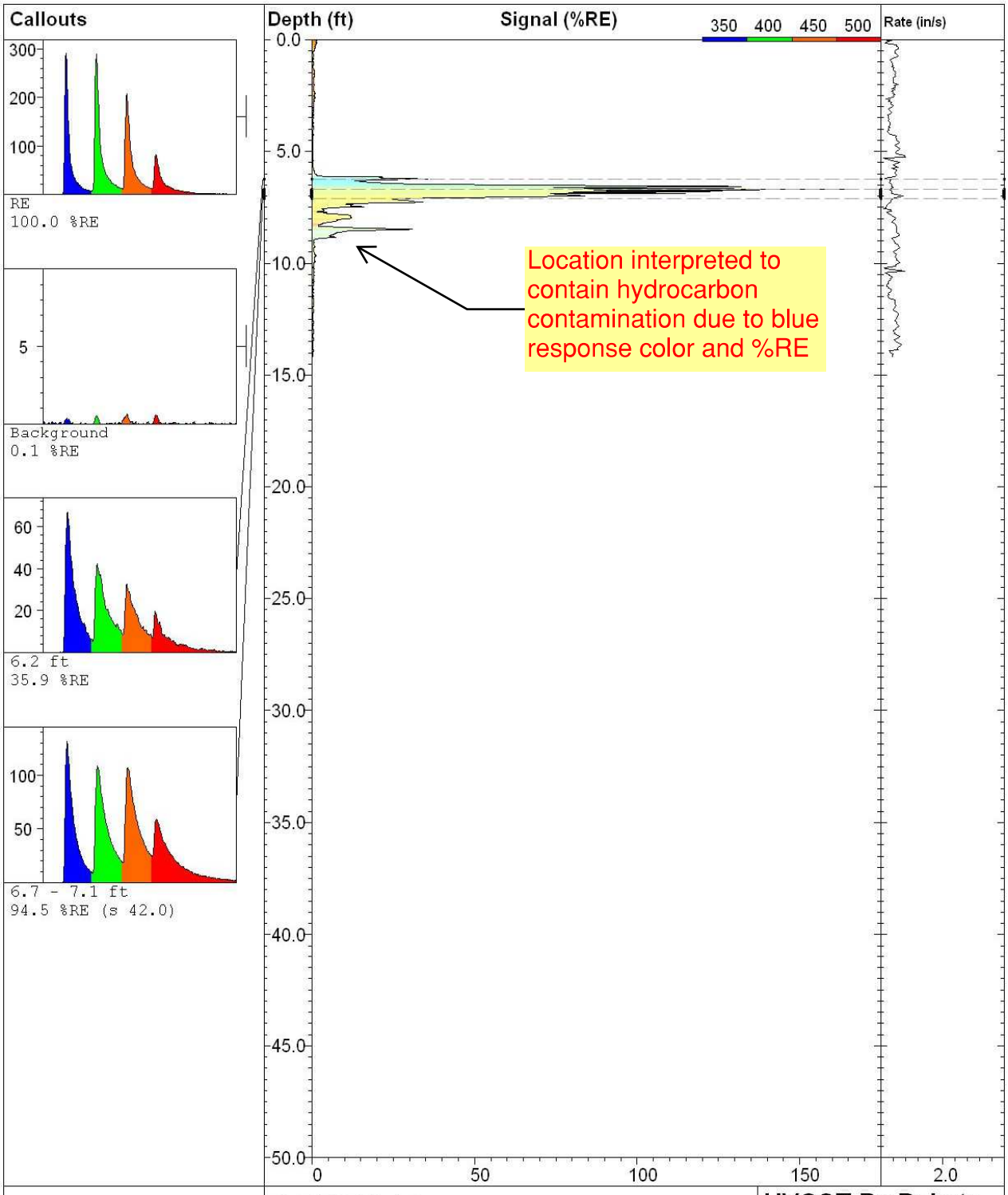
Site: **Weston JBER 2013**	*Latitude / Datum:* **Unavailable / NA**	*Final depth:* **14.08 ft**
Client: **Weston**	*Longitude / Fix:* **Unavailable / NA**	*Max signal:* **1.5 % @ 5.06 ft**
Job:	*Operator/Unit:* **EEM/UVOST1008**	*Date & Time:* **2013-06-26 14:59 ADT**



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Site: **Weston JBER 2013**	*Latitude / Datum:* **Unavailable / NA**	*Final depth:* **14.18 ft**
Client: **Weston**	*Longitude / Fix:* **Unavailable / NA**	*Max signal:* **166.0 % @ 6.70 ft**
Job:	*Operator/Unit:* **EEM/UVOST1008**	*Date & Time:* **2013-06-27 09:26 ADT**

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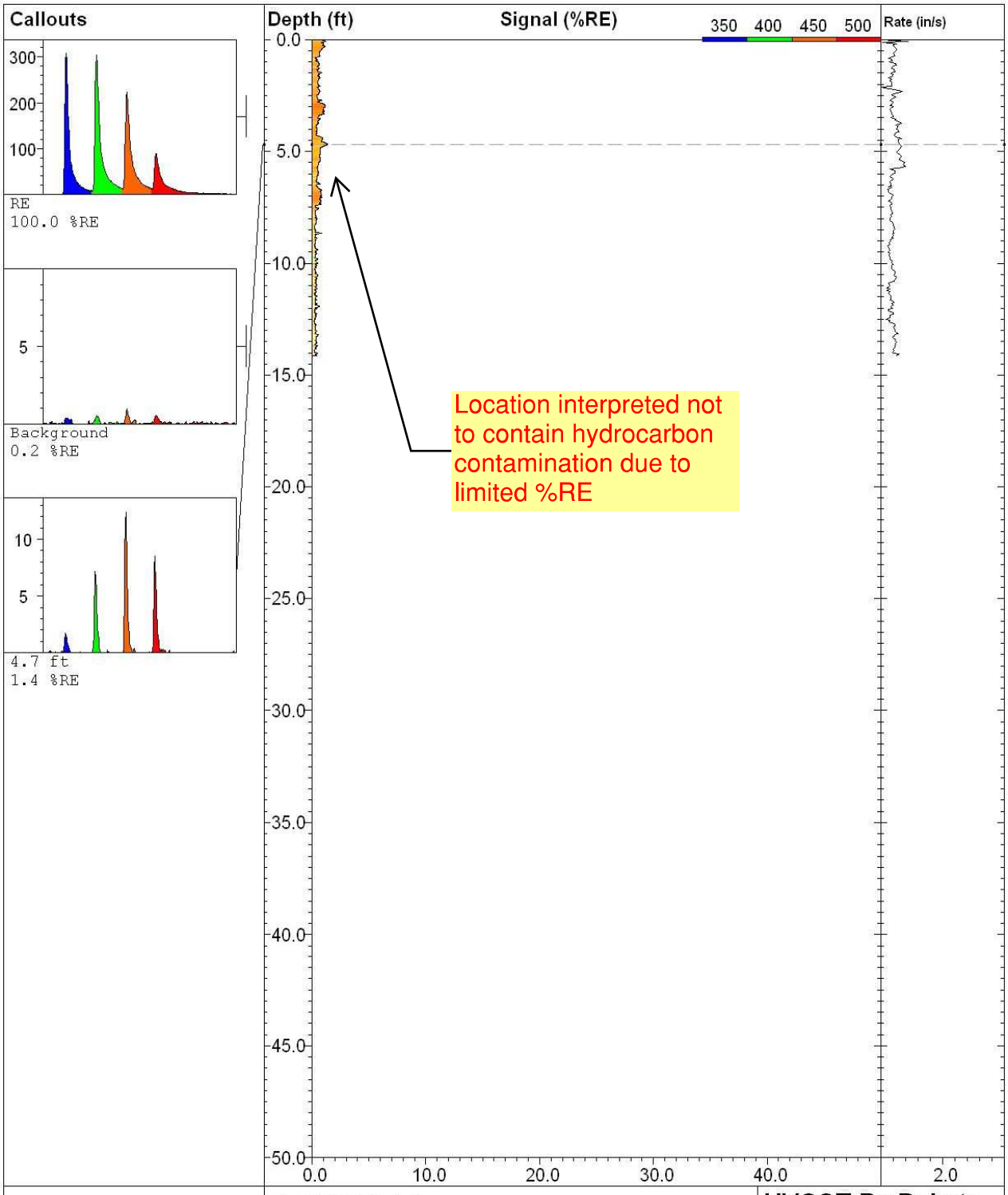
Site: **Weston JBER 2013**	*Latitude / Datum:* **Unavailable / NA**	*Final depth:* **14.15 ft**
Client: **Weston**	*Longitude / Fix:* **Unavailable / NA**	*Max signal:* **1.7 % @ 4.39 ft**
Job:	*Operator/Unit:* **EEM/UVOST1008**	*Date & Time:* **2013-06-27 10:18 ADT**



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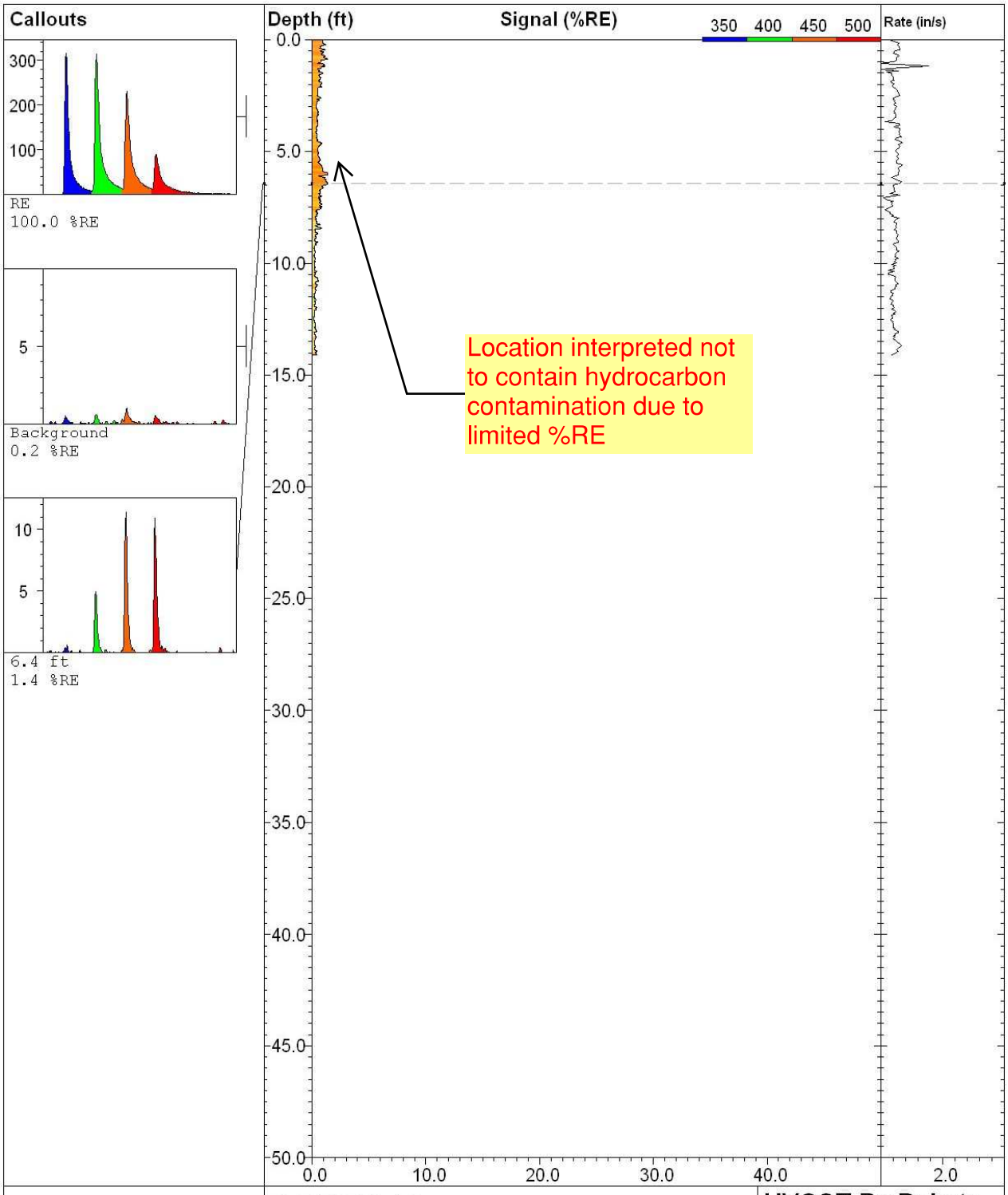
Site: **Weston JBER 2013**	*Latitude / Datum:* **Unavailable / NA**	*Final depth:* **14.14 ft**
Client: **Weston**	*Longitude / Fix:* **Unavailable / NA**	*Max signal:* **1.4 % @ 4.69 ft**
Job:	*Operator/Unit:* **EEM/UVOST1008**	*Date & Time:* **2013-06-27 11:01 ADT**



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CG523L13

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Site: **Weston JBER 2013**	*Latitude / Datum:* **Unavailable / NA**	*Final depth:* **14.10 ft**
Client: **Weston**	*Longitude / Fix:* **Unavailable / NA**	*Max signal:* **1.4 % @ 6.42 ft**
Job:	*Operator/Unit:* **EEM/UVOST1008**	*Date & Time:* **2013-06-27 11:31 ADT**

A-4 Photograph Log

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Photograph 1

Location: **CG523** **Date: 06/25/13**
Description: **A southwest-facing view of CG523**

Photograph 2

Location: **SO541** **Date: 06/27/13**
Description: **A west-facing view of CG523 with lath marking the LIF locations**

Photograph 3

Location: **CG523** **Date: 06/27/13**
Description: **An east-facing view of LIF drilling at CG523 L13**

Photograph 4

Location: **CG523** **Date: 7/19/13**
Description: **Preparing to sample groundwater at CG523**

A-5 Groundwater Sampling Data Sheets

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Groundwater Sampling Record

Project Name: JBER HRC
Well ID: 703 MW-1N
Project Location: Green Lake ST703 (GS-23)
Sample No.: 136523-703MW1N-GW-0
Project Number: 20077.049.0116.3020.03
Sampler(s): A. French, H Nelson
Date/Time: 7-18-2013 0950
Weather: 60-70 Sunny

Water Level Measurements and Purge Data

Time	Depth of Well (TOC)	Depth to Water (TOC)	Feet of Water in Well	Gallons per Well Volume (3/4" = 0.024; 2" dia. = 0.163 gal/ft, 4" dia.=0.653 gal/ft)
0950	14.37 ☐ Meas. ☐ Hist.	~~14.37~~ 4.16 Initial	~~4.16~~ 10.21	0.25 (3) 0.735

Water Level Measurement Method: ☒ Electric Tape ☐ Other:
Well Evacuation Method: ☐ Peristaltic Pump ☐ Submersible Pump ☐ Bailer ☒ Other: Bladder
Purge Rate: 0.015
Begin Purge: Time: 0947
End Purge: Time: 1050
Total Volume Purged: 0.9
Well Volumes Purged: 3
Purge Water Disposed: ☒ 55-gal Drum ☐ Storage Tank ☐ Ground ☐ Liquabin ☐ Other:

Sample Collection Method & Analysis

Sample Type: ☒ Groundwater ☐ Surface Water ☐ Other:
Sample Time: 1100
Sample Collection Method: ☒ Pump Type: Bladder Dedicated ☐ Y ☐ N ☐ Bailer ☐ Other:
Decon Procedure: ☐ N/A ☒ Alconox Wash ☐ Tap Rinse ☐ DI Water ☐ Other:
Sample Description (color, turbidity, odor, sheen, etc.): cloudy/silty odorless

Sample Containers

Quantity	Size	Bottle Type	Laboratory Analysis
~~x 2~~ 1	1L	☒ Glass ☐ Plastic	AK102
		☐ Glass ☐ Plastic	
		☐ Glass ☐ Plastic	
		☐ Glass ☐ Plastic	
		☐ Glass ☐ Plastic	
		☐ Glass ☐ Plastic	

Notes:

Sampler Signature: Ashley French Heidi Nelson

Date: 7-18-2013 Well ID: 703 MW-1N

Well Evacuation / Field Parameters

Time	Depth to Water (TOC)	Volume (gallons)	± 0.2 Temp (°C)	± 3% Cond (µS/cm)	± 10% DO (mg/L)	± 0.1 pH	± 10mV ORP (mV)	± 10% or 1 NTU Color/ Turbidity
1005	14.16	0.1	13.57	0.296	0.87	7.85	-112.1	197.2
1010		0.2	13.51	0.296	0.65	7.90	-116.6	174.0
1015		0.3	13.60	0.295	0.57	7.91	-110.9	145.6
1020		0.4	12.22	0.285	1.00	7.63	-116.0	320.1
1025		0.5	13.21	0.291	0.99	7.59	-122.5	150.7
1030		0.6	12.84	0.299	0.71	7.98	-155.1 ~~-160.~~	130.2
1035		0.7	13.39	0.297	0.666	7.97	-156.1	117.3
1040		0.8	13.58	0.296	0.57	7.97	-157.8	98.66
1045		0.9	13.80	0.298	0.59	8.00	-148.3	119.9

Notes :

Groundwater Sampling Record

Project Name: JBER HRC
Project Location: CG523 (ST703)
Project Number: 20077.049.016.3010.01
Date/Time: 07/19/13 09:53
Well ID: 703WL01
Sample No.: 13CG523-703WL01-GW-0
Sampler(s): M. Dickinsen, H. Nelson
Weather: Sunny w/ breeze, 60's

Water Level Measurements and Purge Data

Time	Depth of Well (TOC)	Depth to Water (TOC)	Feet of Water in Well	Gallons per Well Volume (2" dia. = 0.163 gal/ft, 4" dia.=0.653 gal/ft) (3/4" = 0.024)
09:53	16.13 ☒ Meas. ☐ Hist.	5.09 Initial	11.04	1.799 x 3 = 5.399

Water Level Measurement Method: ☒ Electric Tape ☐ Other:

Well Evacuation Method: ☐ Peristaltic Pump ☐ Submersible Pump ☐ Bailer ☒ Other: Hurricane Pump

Purge Rate: 0.068 gpm

Begin Purge: Time: 10:06

End Purge: Time: 11:27

Total Volume Purged: 5.5

Well Volumes Purged: 1.04

Purge Water Disposed: ☐ 55-gal Drum ☐ Storage Tank ☐ Ground ☐ Liquabin ☐ Other:

Sample Collection Method & Analysis

Sample Type: ☒ Groundwater ☐ Surface Water ☐ Other:

Sample Time: 11:30

Sample Collection Method: ☐ Pump Type: Dedicated ☐ Y ☐ N ☐ Bailer ☐ Other:

Decon Procedure: ☐ N/A ☒ Alconox Wash ☐ Tap Rinse ☐ DI Water ☐ Other:

Sample Description (color, turbidity, odor, sheen, etc.):

Sample Containers

Quantity	Size	Bottle Type	Laboratory Analysis
3	40 ml	☒ Glass ☐ Plastic	SW8260B-BTEX
3	40 ml	☒ Glass ☐ Plastic	AK101
3	40 ml	☒ Glass ☐ Plastic	NWVPH
2	1L UP	☒ Glass ☐ Plastic	SW8270C-SIM
2	1L HCl	☒ Glass ☐ Plastic	AK102/103
2	1L HCl	☒ Glass ☐ Plastic	NWEPH

Notes:

Sampler Signature:

Date: 07/19/13 Well ID: 703WL01

Well Evacuation / Field Parameters

Time	Depth to Water (TOC)	Volume (gallons)	± 0.2 Temp (°C)	± 3% Cond (µS/cm)	± 10% DO (mg/L)	± 0.1 pH	± 10mV ORP (mV)	± 10% or 1 NTU Color/ Turbidity
10:15	5.89	0.5	9.36	~~0.298~~ 0.283 MD	2.6	8.25	48.7	174.8
10:20	6.22	1.0	8.64	0.280	2.6	8.24	48.1	297.9
10:25	6.33	1.25	8.77	0.279	2.6	8.21	45.3	266.9
10:30	6.49	1.5	9.38	0.280	3.1	8.22	39.4	234.8
10:35	6.63	2	10.27	0.280	3.0	8.21	34.5	175.9
10:40	6.71	2.25	10.75	0.279	2.6	8.18	32.1	145.3
10:45	~~6.~~85	2.3	11.03	0.286	2.7	8.19	26.4	131.4
10:50	7.20	2.5	9.17	0.284	3.2	8.20	22.4	71.61
10:55	7.62	2.75	8.66	0.284	2.7	8.16	19.7	44.04
11:00	7.78	3.0	8.38	0.282	4.3	8.10	20.1	38.58
11:05	8.28	3.5	8.00	0.282	1.5	8.07	14.9	19.6
11:10	8.5	4.0	8.05	0.281	1.5	8.03	11.7	12.94
11:15	8.85	4.5	8.04	0.280	1.2	8.05	7.6	13.61
11:20	9.02	5.0	7.95	0.280	0.9	8.07	4.0	23.03
11:25	9.21	5.5	7.88	0.281	1.2	8.13	0.0	53.6

Notes :

Sample time: 11:30

Groundwater Sampling Record

Project Name: JBER ~~LTM~~ HRC
Well ID: 703WL02
Project Location: CG523/Green Lake
Sample No.: 13CG523-703WL02-GW-0
Project Number: 20077.049.016.3020.03
Sampler(s): Heidi Nelson, Ashley French
Date/Time: 7/18/13 1310
Weather: Partly cloudy, 70's

Water Level Measurements and Purge Data

Time	Depth of Well (TOC)	Depth to Water (TOC)	Feet of Water in Well	Gallons per Well Volume (3/4" = 0.024; 2" dia. = 0.163 gal/ft, 4" dia.=0.653 gal/ft)
1310	16.15 ☒ Meas. ☐ Hist.	6.54 Initial	9.61	1.566 x 3 = 4.70

Water Level Measurement Method: ☒ Electric Tape ☐ Other:
Well Evacuation Method: ☐ Peristaltic Pump ☐ Submersible Pump ☐ Bailer ☒ Other: Hurricane
Purge Rate:
Begin Purge: Time: 1326
End Purge: Time: 1425
Total Volume Purged: 5.5
Well Volumes Purged: 1
Purge Water Disposed: ☒ 55-gal Drum ☐ Storage Tank ☐ Ground ☐ Liquabin ☐ Other:

Sample Collection Method & Analysis

Sample Type: ☒ Groundwater ☐ Surface Water ☐ Other:
Sample Time: 1430
Sample Collection Method: ☒ Pump Type: Dedicated ☐ Y ☐ N ☐ Bailer ☒ Other: Hurricane
Decon Procedure: ☐ N/A ☒ Alconox Wash ☐ Tap Rinse ☐ DI Water ☐ Other:
Sample Description (color, turbidity, odor, sheen, etc.): —

Sample Containers

Quantity	Size	Bottle Type	Laboratory Analysis
~~8~~ 6	40mL VOA	☒ Glass ☐ Plastic	AK101
~~8~~ 6	40mL VOA	☒ Glass ☐ Plastic	SW8260-BTEX
~~8~~ 6	40mL VOA	☒ Glass ☐ Plastic	NWVPH
~~8~~ 4	1L Amber	☒ Glass ☐ Plastic	AK102/103
~~8~~ 4	1L Amber	☒ Glass ☐ Plastic	NWEPH
~~8~~ 4	1L Amber	☒ Glass ☐ Plastic	~~SW8270SIM~~ (AF) SW8270C SIM

Notes: (dup) DUP

Sampler Signature: Ashley French Heidi Nelson

Date: 7/18/13 Well ID: 703WL02

Well Evacuation / Field Parameters

Time	Depth to Water (TOC)	Volume (gallons)	± 0.2 Temp (°C)	± 3% Cond (µS/cm)	± 10% DO (mg/L)	± 0.1 pH	± 10mV ORP (mV)	± 10% or 1 NTU Color/ Turbidity
1335	7.35	0.5	9.95	0.326	1.09	7.04	87.2	26.4
1340	7.48	1.0	10.20	0.320	0.99	6.98	77.7	8.71
1345	7.68	1.5	10.39	0.318	0.97	6.96	76.1	7.27
1350	7.98	2.0	9.16	0.318	0.59	6.93	75.5	2.39
1355	8.15	2.5	9.77	0.315	0.50	6.92	69.6	1.52
1400	8.35	3.0	9.40	0.316	0.47	6.92	65.2	0.37
1405	8.64	3.5	9.05	0.316	0.44	6.91	60.0	0.45
1410	8.85	4.0	9.02	0.313	0.39	6.88	53.8	2.03
1415	8.99	4.5	9:27	0.310	0.33	6.87	42.5	2.28
* 1420	9.13	5.0	9.49	0.304	0.55	7.15	22.5	3.50
1425	9.23	5.5	9.74	0.304	0.30	7.19	15.3	2.79

Notes : * varied readings because new ysi display was plugged in at 1419

Groundwater Sampling Record

Project Name: JBER HRC
Well ID: MW03WLQ3
Project Location: CG-523 (SS703)
Sample No.: 13CG523-703WL03-GW-0
Project Number: 20177.049.016.3010.01
Sampler(s): H. Nelson, S. Young
Date/Time: 7/18/13 0915
Weather: Sunny w/slight breeze 70°

Water Level Measurements and Purge Data

Time	Depth of Well (TOC)	Depth to Water (TOC)	Feet of Water in Well	Gallons per Well Volume (3/4" = 0.024; 2" dia. = 0.163 gal/ft, 4" dia.=0.653 gal/ft)
0915	15.08 ☐ Meas. ☐ Hist.	~~4.34~~ 6.50 Initial	~~5.69~~ 8.58 SF	~~0.93 (3) = 2.78~~ SF 1.40 (3) = 4.2

Water Level Measurement Method: ☒ Electric Tape ☐ Other:
Well Evacuation Method: ☐ Peristaltic Pump ☐ Submersible Pump ☐ Bailer ☒ Other:
Purge Rate:
Begin Purge: Time: 0935 Total Volume Purged:
End Purge: Time: Well Volumes Purged:
Purge Water Disposed: ☒ 55-gal Drum ☐ Storage Tank ☐ Ground ☐ Liquabin ☐ Other:

Sample Collection Method & Analysis

Sample Type: ☒ Groundwater ☐ Surface Water ☐ Other:
Sample Time:
Sample Collection Method: ☐ Pump Type: Dedicated ☐ Y ☐ N ☐ Bailer ☐ Other:
Decon Procedure: ☐ N/A ☒ Alconox Wash ☐ Tap Rinse ☐ DI Water ☐ Other:
Sample Description (color, turbidity, odor, sheen, etc.):

Sample Containers

Quantity	Size	Bottle Type	Laboratory Analysis
3	40 ml	☒ Glass ☐ Plastic	SW8260B-BTEX
3	40 ml	☒ Glass ☐ Plastic	AK101
3	40 ml	☒ Glass ☐ Plastic	NWNPH
2	1L UNP	☒ Glass ☐ Plastic	SW8270C-SIM
2	1L HCL	☒ Glass ☐ Plastic	AK102/103
2	1L HCL	☒ Glass ☐ Plastic	NWEPH

Notes: 7-19-2013 - Grab sample. Water @ 7.00 ft. Sample time: 9:10

Sampler Signature:

Date: 7/18/13 Well ID: 703WL03

Well Evacuation / Field Parameters

Time	Depth to Water (TOC)	Volume (gallons)	± 0.2 Temp (°C)	± 3% Cond (µS/cm)	± 10% DO (mg/L) (9%)	± 0.1 pH	± 10mV ORP (mV)	± 10% or 1 NTU Color/ Turbidity
0945	7.58	0.25	9.06	0.305	1.73	7.43	-38.4	347
0950	8.00	0.50	9.64	0.306	1.62	7.59	-52.5	188
0955	8.36	1.00	9.95	0.308	1.79	7.60	-22.9	77.7
1000	8.82	1.50	9.02	0.313	1.84	7.62	-28.0	27.8
1005	9.10	2.00	9.48	0312	1.60	7.65	-22.5	28.2
*1010	9.76	3.50	8.72	0.318	2.58	7.69	-5.0	42.0
1015	10.09	4.00	9.39	0.316	2.88	7.72	-5.9	28.6
1020	10.53	4.50	9.55	0.313	2.73	7.75	0.5	126
1025	10.79	5.00	8.47	0.309	2.1	7.92	-185.3	232
1030	11.42	5.50	8.66	0.311	1.9	8.00	-189.8	732
1035		6.00	10.28	0.310	1.9	8.04	-189.7	1034

Notes : * flow through cell was leaking so it was switched out

Purged well dry. Surged for five minutes and purged remaining half gallon from well. water was silty and dark with sheen.

A-6 Monitoring Well Installation Log

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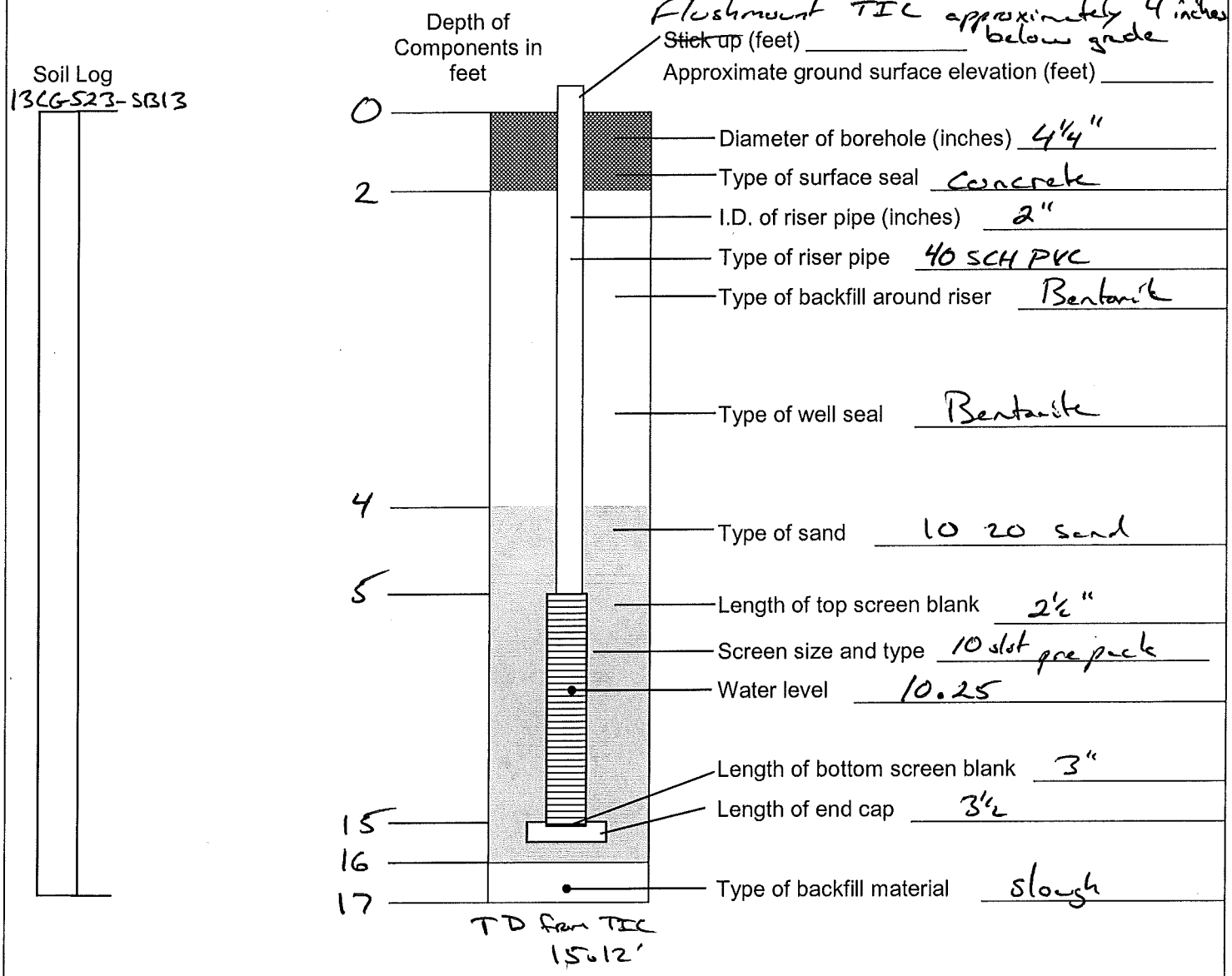
MONITORING WELL INSTALLATION REPORT

Project Name: JBER-F | Well No.: 703WL-03

Project No.: CG523 | Observer: Aaron Mroz

Date/Time: 7/11/13 / 1105 | Drilling Method: Geoprobe HSA



Remarks: Using 10 ft of screen which is two sections of 5 ft pre pack (10 slot with 20 40 sand)

Approximately 7 gallons of water added to control heaving conditions

Amount of Materials:

Sand	~~2½ bc~~ 8 bags	Monument	flushmount
Cement	2 bags	Riser	5 FT
Bentonite pellets	1 bag	Screen	10ft (2 5ft prepacks)
Bentonite/Volclay	—	Other	—

A-7 Chain of Custody Forms

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TestAmerica Laboratories, Inc.
880 Riverside Parkway
West Sacramento, CA 95605
phone: (916) 373-5600 fax: (916) 372-1059

Chain of Custody Record

WESTON SOLUTIONS

320-3424 Chain of Custody

Client:	WESTON 425 G Street, Suite 300 Anchorage, AK 99501 (907) 276-6610	**Project Name:** JBER HRC **Project Number: 20077.049.016.3010.01** **Client contact:**	**CoC Number:** 13HRC039 **Cooler ID:** Troop Beverly Hills
Report to:	WESTON	**Invoice to:** WESTON	**PO number: 0082882**

Sample ID	Collection Date	Time	Sampler	Number	Container Type	Preservative	Matrix	Analyses Requested Group	QC	TAT	Notes
13CG523-TB01-GW-0	7/18/2013	800	JY/HN	3	40 mL VOA	4C, HCL	GW	AK101		15 DAY	
13CG523-TB01-GW-0	7/18/2013	800	JY/HN	3	40 mL VOA	4C, HCL	GW	SW8260B-BTEX		15 DAY	SEE NOTES BELOW
13CG523-TB01-GW-0	7/18/2013	800	JY/HN	3	40 mL VOA	4C, HCL	GW	NWVPH		15 DAY	
13CG535-516MW04-GW-0	7/18/2013	1317	JY/HN	9	40 mL VOA	4C, HCL	GW	AK101	MS/D	15 DAY	
13CG535-516MW04-GW-0	7/18/2013	1317	JY/HN	9	40 mL VOA	4C, HCL	GW	SW8260B-BTEX	MS/D	15 DAY	
13CG535-516MW04-GW-0	7/18/2013	1317	JY/HN	9	40 mL VOA	4C, HCL	GW	NWVPH	MS/D	15 DAY	
13CG523-703WL02-GW-0	7/18/2013	1430	JY/HN	3	40 mL VOA	4C, HCL	GW	AK101		15 DAY	
13CG523-703WL02-GW-0	7/18/2013	1430	JY/HN	3	40 mL VOA	4C, HCL	GW	SW8260B-BTEX		15 DAY	
13CG523-703WL02-GW-0	7/18/2013	1430	JY/HN	3	40 mL VOA	4C, HCL	GW	NWVPH		15 DAY	
13CG523-703WL02-GW-1	7/18/2013	1430	JY/HN	3	40 mL VOA	4C, HCL	GW	AK101		15 DAY	
13CG523-703WL02-GW-1	7/18/2013	1430	JY/HN	3	40 mL VOA	4C, HCL	GW	SW8260B-BTEX		15 DAY	
13CG523-703WL02-GW-1	7/18/2013	1430	JY/HN	3	40 mL VOA	4C, HCL	GW	NWVPH		15 DAY	
13CG523-703WL01-GW-0	7/19/2013	1130	JY/HN	3	40 mL VOA	4C, HCL	GW	AK101		15 DAY	
13CG523-703WL01-GW-0	7/19/2013	1130	JY/HN	3	40 mL VOA	4C, HCL	GW	SW8260B-BTEX		15 DAY	
13CG523-703WL01-GW-0	7/19/2013	1130	JY/HN	3	40 mL VOA	4C, HCL	GW	NWVPH		15 DAY	
13CG523-703WL03-GW-0	7/19/2013	910	JY/HN	3	40 mL VOA	4C, HCL	GW	AK101		15 DAY	
13CG523-703WL03-GW-0	7/19/2013	910	JY/HN	3	40 mL VOA	4C, HCL	GW	SW8260B-BTEX		15 DAY	
13CG523-703WL03-GW-0	7/19/2013	910	JY/HN	3	40 mL VOA	4C, HCL	GW	NWVPH		15 DAY	

NOTE: Report TB for both JBER HRC CoC# 13HRC039 and JBER LTM CoC #13LTM008

Relinquish By:	Heidi Nelson	7/19/13	15:03	**Relinquish By:**	Madihu Ahmed	07/19/13	16:20
	Signature/Printed Name	Date/Time			Signature/Printed Name		Date/Time
Received By:	Andrew Pilcl	7/19/13	15:03	**Received By:**		7-20-13	0005
	Signature/Printed Name	Date/Time			Signature/Printed Name		Date/Time

T: 5.8°C 1.3°C

TestAmerica Laboratories, Inc
880 Riverside Parkway
West Sacramento, CA 95605
phone: (916) 373-5600 fax. (916) 372-1059

Chain of Custody Record

SDG 320-3424

WESTON SOLUTIONS

Client: WESTON 425 G Street, Suite 300 Anchorage, AK 99501 (907) 276-6610	**Project Name:** JBER HRC **Project Number:** 20077.049.016.3010.01 **Client contact:**	**CoC Number:** 13HRC036	1 of 1 CoCs
		Cooler ID: Revenge of the Nerds	
Report to: WESTON	**Invoice to:** WESTON	**PO number:** 0082882	

Sample ID	Collection Date	Time	Sampler	Number	Container Type	Preservative	Matrix	Analyses Requested Group	QC	TAT	Notes
13CG523-703WL02-GW-1	7/18/2013	1430	JY/HN	2	1L Amber	4C, HCL	GW	AK102/103		15 DAY	
13CG535-516MW04-GW-0	7/18/2013	1317	JY/HN	6	1L Amber	4C, HCL	GW	AK102/103	MS/D	15 DAY	

Relinquish By: Heidi J Nelson	Heidi J Nelson	7/19/13 1500	**Relinquish By:** Madiha Ahmed	Madiha Ahmed	7/19/13 15:30
Received By: Madiha Ahmed	Madiha Ahmed	7/19/13 1500	**Received By:**		7-20-13 1005 0.6 °C
Signature/Printed Name		Date/Time	Signature/Printed Name		Date/Time

Temp: 3.7°C

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West Sacramento, CA 95605
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Chain of Custody Record

SDG 320-3424

Client:	WESTON 425 G Street, Suite 300 Anchorage, AK 99501 (907) 276-6610	Project Name: JBER HRC Project Number: 20077.049.016.3010.01 Client contact:	CoC Number: 13HRC037	1 of 1 CoCs
Report to:	WESTON	Invoice to: WESTON	Cooler ID: Return of the Jedi	PO number: 0082882

Sample ID	Collection Date	Time	Sampler	Number	Container Type	Preservative	Matrix	Analyses Requested Group	QC	TAT	Notes
13CG523-703WL02-GW-1	7/18/2013	1430	JY/HN	2	1L Amber	4C	GW	SW8270C SIM		15 DAY	
13CG535-516MW04-GW-0	7/18/2013	1317	JY/HN	6	1L Amber	4C, HCL	GW	NWEPH	MS/D	15 DAY	
13CG523-703WL03-GW-0	7/19/2012	910	JY/HN	2	1L Amber	4C, HCL	GW	AK102/103		15 DAY	

	Signature/Printed Name	Date/Time		Signature/Printed Name	Date/Time
Relinquish By:	Heidi Nelson	7/19/13 1500	Relinquish By:	Andrew Pilch	7/19/13 1522
Received By:	Andrew Pilch	7/19/13 15:01	Received By:		9-20-13 1005 4.2°C T:5.6°C

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880 Riverside Parkway
West Sacramento, CA 95605
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Chain of Custody Record

SDG 320-3424

WESTON SOLUTIONS

Client: WESTON 425 G Street, Suite 300 Anchorage, AK 99501 (907) 276-6610	**Project Name:** JBER HRC **Project Number: 20077.049.016.3010.01** **Client contact:**	**CoC Number:** 13HRC041	1 of 1 CoCs
Report to: WESTON	**Invoice to:** WESTON	**Cooler ID:** Teen Wolf	**PO number: 0082882**

Sample ID	Collection Date	Time	Sampler	Number	Container Type	Preservative	Matrix	Analyses Requested Group	QC	TAT	Notes
13CG523-703WL03-GW-0	7/19/2013	910	JY/HN	2	1L Amber	4C	GW	SW8270C SIM		15 DAY	
13CG523-703WL03-GW-0	7/19/2013	910	JY/HN	2	1L Amber	4C, HCL	GW	NWEPH		15 DAY	
13CG523-703WL01-GW-0	7/19/2013	1130	JY/HN	2	1L Amber	4C	GW	SW8270C SIM		15 DAY	
13CG523-703WL01-GW-0	7/19/2013	1130	JY/HN	2	1L Amber	4C, HCL	GW	NWEPH		15 DAY	
13CG523-703WL01-GW-0	7/19/2013	1130	JY/HN	2	1L Amber	4C, HCL	GW	AK102/103		15 DAY	

Relinquish By:	Heidi J Nelson / Heidi Nelson	7/19/13 1500	**Relinquish By:**	Madiha Ahmed	07/19/13 15:20
	Signature/Printed Name	Date/Time		Signature/Printed Name	Date/Time
Received By:	Madiha Ahmed	7/19/13 1500	**Received By:**	7-20-13	1005 2.2°C
	Signature/Printed Name	Date/Time		Signature/Printed Name	Date/Time

Temp: 4.8°C

TestAmerica Laboratories, Inc.
880 Riverside Parkway
West Sacramento, CA 95605
phone: (916) 373-5600 fax: (916) 372-1059

Chain of Custody Reco

320-3255 Chain of

Client:	WESTON 425 G Street, Suite 300 Anchorage, AK 99501 (907) 276-6610	**Project Name:** JBER HRC **Project Number:** **Client contact:**	**CoC Number: 13HRC027** 1 of 3 CoCs **Cooler ID:** The Naked Gun
Report to:	WESTON	**Invoice to:** WESTON	**PO number: 0082882**

Sample ID	Collection Date	Time	Sampler	Number	Container Type	Preservative	Matrix	Analyses Requested Group	QC	TAT	Notes
13CG543-SB03-7.0-7.5-0	7/2/2013	1035	AM/HL/JY	2	8 oz Amber	4C	SO	AK102/103; SW8270C SIM	MS/D	3 DAY	
13CG543-SB03-7.0-7.5-0	7/2/2013	1035	AM/HL/JY	2	4 oz Amber	4C	SO	NWEPH	MS/D	3 DAY	
13CG543-SB03-9.0-9.5-0	7/2/2013	1040	AM/HL/JY	1	4 oz Amber	4C, MeOH	SO	SW8260B-BTEX		3 DAY	
13CG543-SB03-9.0-9.5-0	7/2/2013	1040	AM/HL/JY	1	4 oz Amber	4C, MeOH	SO	AK101		3 DAY	
13CG543-SB03-9.0-9.5-0	7/2/2013	1040	AM/HL/JY	1	4 oz Amber	4C	SO	AK102/103		3 DAY	
13CG523-SB01-7.0-7.5-0	7/2/2013	1345	AM/HL/JY	1	4 oz Amber	4C, MeOH	SO	SW8260B-BTEX		3 DAY	
13CG523-SB01-7.0-7.5-0	7/2/2013	1345	AM/HL/JY	1	4 oz Amber	4C, MeOH	SO	AK101		3 DAY	
13CG523-SB01-7.0-7.5-0	7/2/2013	1345	AM/HL/JY	1	8 oz Amber	4C	SO	AK102/103; SW8270C SIM		3 DAY	
13CG523-SB01-7.0-7.5-0	7/2/2013	1345	AM/HL/JY	1	4 oz Amber	4C	SO	NWEPH		3 DAY	
13CG523-SB01-7.0-7.5-0	7/2/2013	1345	AM/HL/JY	1	4 oz Amber	4C, MeOH	SO	NWVPH		3 DAY	
13CG523-SB01-7.0-7.5-1	7/2/2013	1345	AM/HL/JY	1	4 oz Amber	4C, MeOH	SO	SW8260B-BTEX		3 DAY	
13CG523-SB01-7.0-7.5-1	7/2/2013	1345	AM/HL/JY	1	4 oz Amber	4C, MeOH	SO	AK101		3 DAY	
13CG523-SB01-7.0-7.5-1	7/2/2013	1345	AM/HL/JY	1	8 oz Amber	4C	SO	AK102/103; SW8270C SIM		3 DAY	
13CG523-SB01-7.0-7.5-1	7/2/2013	1345	AM/HL/JY	1	4 oz Amber	4C	SO	NWEPH		3 DAY	
13CG523-SB01-7.0-7.5-1	7/2/2013	1345	AM/HL/JY	1	4 oz Amber	4C, MeOH	SO	NWVPH		3 DAY	
13CG523-SB01-9.0-9.5-0	7/2/2013	1350	AM/HL/JY	1	4 oz Amber	4C, MeOH	SO	AK101		3 DAY	
13CG523-SB01-9.0-9.5-0	7/2/2013	1350	AM/HL/JY	1	4 oz Amber	4C	SO	AK102/103		3 DAY	
13CG523-SB01-9.0-9.5-0	7/2/2013	1350	AM/HL/JY	1	4 oz Amber	4C, MeOH	SO	SW8260B-BTEX		3 DAY	
13CG523-SB02-6.0-6.5-0	7/2/2013	1430	AM/HL/JY	1	4 oz Amber	4C, MeOH	SO	SW8260B-BTEX		3 DAY	
13CG523-SB02-6.0-6.5-0	7/2/2013	1430	AM/HL/JY	1	4 oz Amber	4C, MeOH	SO	AK101		3 DAY	
13CG523-SB02-6.0-6.5-0	7/2/2013	1430	AM/HL/JY	1	8 oz Amber	4C	SO	AK102/103; SW8270C SIM		3 DAY	
13CG523-SB02-6.0-6.5-0	7/2/2013	1430	AM/HL/JY	1	4 oz Amber	4C	SO	NWEPH		3 DAY	
13CG523-SB02-6.0-6.5-0	7/2/2013	1430	AM/HL/JY	1	4 oz Amber	4C, MeOH	SO	NWVPH		3 DAY	
13CG523-SB02-8.5-9.0-0	7/2/2013	1435	AM/HL/JY	1	4 oz Amber	4C, MeOH	SO	SW8260B-BTEX		3 DAY	
13CG523-SB02-8.5-9.0-0	7/2/2013	1435	AM/HL/JY	1	4 oz Amber	4C, MeOH	SO	AK101		3 DAY	
13CG523-SB02-8.5-9.0-0	7/2/2013	1435	AM/HL/JY	1	8 oz Amber	4C	SO	AK102/103; SW8270C SIM		3 DAY	
13CG523-SB02-8.5-9.0-0	7/2/2013	1435	AM/HL/JY	1	4 oz Amber	4C	SO	NWEPH		3 DAY	

Relinquish By:	JESS Young	7/3/13 1435	**Relinquish By:** Heidi Nelson Heidi Nelson	7/3/13 1522
	Signature/Printed Name	Date/Time	Signature/Printed Name	Date/Time
Received By: Heidi Nelson Heidi Nelson	7/3/13 1435	**Received By:** Madiha Ahmed	Madiha Ahmed	7/3/13 15:25
Signature/Printed Name	Date/Time	Signature/Printed Name		Date/Time

*rec'd broken & transferred to another jar cw 7-8-13

Temp: 5.6°C

Relinquish By: Madiha Ahmed 07/05/13 1911 recd by: 7-6-13 1040 1.0, 0.2

TestAmerica Laboratories, Inc.
880 Riverside Parkway
West Sacramento, CA 95605
phone: (916) 373-5600 fax: (916) 372-1059

Chain of Custody Record

WESTON SOLUTIONS

Client: WESTON 425 G Street, Suite 300 Anchorage, AK 99501 (907) 276-6610	**Project Name:** JBER HRC **Project Number:** **Client contact:**	**CoC Number: 13HRC027**	2 of 3 CoCs
		Cooler ID: The Naked Gun	
Report to: WESTON	**Invoice to:** WESTON	**PO number: 0082882**	

Sample ID	Collection Date	Time	Sampler	Number	Container Type	Preservative	Matrix	Analyses Requested Group	QC	TAT	Notes
13CG523-SB02-8.5-9.0-0	7/2/2013	1435	AM/HL/JY	1	4 oz Amber	4C, MeOH	SO	NWVPH		3 DAY	
13CG523-SB03-12.0-12.5-0	7/2/2013	1535	AM/HL/JY	1	4 oz Amber	4C, MeOH	SO	SW8260B-BTEX		3 DAY	
13CG523-SB03-12.0-12.5-0	7/2/2013	1535	AM/HL/JY	1	4 oz Amber	4C, MeOH	SO	AK101		3 DAY	
13CG523-SB03-12.0-12.5-0	7/2/2013	1535	AM/HL/JY	1	4 oz Amber	4C	SO	AK102/103		3 DAY	
13CG523-SB04-10.0-10.5-0	7/2/2013	1615	AM/HL/JY	1	4 oz Amber	4C, MeOH	SO	SW8260B-BTEX		3 DAY	
13CG523-SB04-10.0-10.5-0	7/2/2013	1615	AM/HL/JY	1	4 oz Amber	4C, MeOH	SO	AK101		3 DAY	
13CG523-SB04-10.0-10.5-0	7/2/2013	1615	AM/HL/JY	1	4 oz Amber	4C	SO	AK102/103		3 DAY	
13CG523-SB05-10.5-11.0-0	7/3/2013	845	AM/HL/JY	1	4 oz Amber	4C, MeOH	SO	SW8260B-BTEX		3 DAY	
13CG523-SB05-10.5-11.0-0	7/3/2013	845	AM/HL/JY	1	4 oz Amber	4C, MeOH	SO	AK101		3 DAY	
13CG523-SB05-10.5-11.0-0	7/3/2013	845	AM/HL/JY	1	4 oz Amber	4C	SO	AK102/103		3 DAY	
* 13CG523-TB01-SO-0	7/3/2013	850	AM/HL/JY	1	4 oz Amber	4C, MeOH	SO	SW8260B-BTEX	TB	3 DAY	
* 13CG523-TB01-SO-0	7/3/2013	850	AM/HL/JY	1	4 oz Amber	4C, MeOH	SO	AK101	TB	3 DAY	
* 13CG523-TB01-SO-0	7/3/2013	850	AM/HL/JY	1	4 oz Amber	4C, MeOH	SO	NWVPH	TB	3 DAY	
13CG523-SB06-6.0-6.5-0	7/3/2013	915	AM/HL/JY	1	4 oz Amber	4C, MeOH	SO	SW8260B-BTEX		3 DAY	
13CG523-SB06-6.0-6.5-0	7/3/2013	915	AM/HL/JY	1	4 oz Amber	4C, MeOH	SO	AK101		3 DAY	
13CG523-SB06-6.0-6.5-0	7/3/2013	915	AM/HL/JY	1	4 oz Amber	4C	SO	AK102/103		3 DAY	
13CG523-SB06-6.0-6.5-1	7/3/2013	915	AM/HL/JY	1	4 oz Amber	4C, MeOH	SO	SW8260B-BTEX		3 DAY	
13CG523-SB06-6.0-6.5-1	7/3/2013	915	AM/HL/JY	1	4 oz Amber	4C, MeOH	SO	AK101		3 DAY	
13CG523-SB06-6.0-6.5-1	7/3/2013	915	AM/HL/JY	1	4 oz Amber	4C	SO	AK102/103		3 DAY	
13CG523-SB07-6.0-6.5-0	7/3/2013	1005	AM/HL/JY	1	4 oz Amber	4C, MeOH	SO	SW8260B-BTEX		3 DAY	
13CG523-SB07-6.0-6.5-0	7/3/2013	1005	AM/HL/JY	1	4 oz Amber	4C, MeOH	SO	AK101		3 DAY	
13CG523-SB07-6.0-6.5-0	7/3/2013	1005	AM/HL/JY	1	4 oz Amber	4C	SO	AK102/103		3 DAY	
13CG523-SB07-7.0-7.5-0	7/3/2013	1010	AM/HL/JY	1	4 oz Amber	4C, MeOH	SO	SW8260B-BTEX		3 DAY	
13CG523-SB07-7.0-7.5-0	7/3/2013	1010	AM/HL/JY	1	4 oz Amber	4C, MeOH	SO	AK101		3 DAY	
13CG523-SB07-7.0-7.5-0	7/3/2013	1010	AM/HL/JY	1	4 oz Amber	4C	SO	AK102/103		3 DAY	

Relinquish By:	Jess Young	7/3/13 1435	**Relinquish By:**	Heidi Nelson	7-3-13 1522
	Signature/Printed Name	Date/Time		Signature/Printed Name	Date/Time
Received By:	Heidi Nelson	7/3/13 1435	**Received By:**	Madiha Ahmed	7-3-13 15:25
	Signature/Printed Name	Date/Time		Signature/Printed Name	Date/Time

Temp: 5.6°C

Relinquish By: Madiha Ahmed 07/05/13 11:11 rec'd by: Cyl Lee 7-6-13 1040 ~0.0.2

* labeled 13CG523-TB01-SO-0 7-2-13 @ 800 AH 7-6-13

TestAmerica Laboratories, Inc.
880 Riverside Parkway
West Sacramento, CA 95605
phone: (916) 373-5600 fax: (916) 372-1059

Chain of Custody Record

WESTON SOLUTIONS

Client: WESTON 425 G Street, Suite 300 Anchorage, AK 99501 (907) 276-6610	**Project Name:** JBER HRC **Project Number:** **Client contact:**	**CoC Number: 13HRC027**	3 of 3 CoCs
Report to: WESTON	**Invoice to:** WESTON	**Cooler ID:** The Naked Gun	
		PO number: 0082882	

Sample ID	Collection Date	Time	Sampler	Number	Container Type	Preservative	Matrix	Analyses Requested Group	QC	TAT	Notes
13CG523-SB08-6.0-6.5-0	7/3/2013	1050	AM/HL/JY	1	4 oz Amber	4C, MeOH	SO	SW8260B-BTEX		3 DAY	
13CG523-SB08-6.0-6.5-0	7/3/2013	1050	AM/HL/JY	1	4 oz Amber	4C, MeOH	SO	AK101		3 DAY	
13CG523-SB08-6.0-6.5-0	7/3/2013	1050	AM/HL/JY	1	4 oz Amber	4C	SO	AK102/103		3 DAY	

Relinquish By: Jess Young	7/3/13 1435	**Relinquish By:** Heidi Nelson	7/3/13 1522
Signature/Printed Name	Date/Time	Signature/Printed Name	Date/Time
Received By: Heidi Nelson Heidi Nelson	7/3/13 1435	**Received By:** Madina Ahmed	7/3/13 15:28
Signature/Printed Name	Date/Time	Signature/Printed Name	Temp: 5.6°C Date/Time

Relinquish By: Madina Ahmed 07/05/13 11:11 recd by: [illegible] 7-6-13 1040 1.0, 0.7

TestAmerica Laboratories, Inc.
880 Riverside Parkway
West Sacramento, CA 95605
phone: (916) 373-5600 fax: (916) 372-1059

Chain of Custody Record

SDG 320-3255-1

Client:	WESTON 425 G Street, Suite 300 Anchorage, AK 99501 (907) 276-6610	Project Name: JBER HRC Project Number: Client contact:	CoC Number: 13HRC026	2 of 2 CoCs
Report to:	WESTON	Invoice to: WESTON	Cooler ID: Airplane! PO number: 0082882	

Sample ID	Collection Date	Time	Sampler	Number	Container Type	Preservative	Matrix	Analyses Requested Group	QC	TAT	Notes
13CG543-SB02-2.0-2.5-0	7/2/2013	0955	AM/HL/JY	1	4 oz Amber	4C, MeOH	SO	SW8260B-BTEX		3 DAY	
13CG543-SB02-2.0-2.5-0	7/2/2013	955	AM/HL/JY	1	4 oz Amber	4C, MeOH	SO	AK101		3 DAY	
13CG543-SB02-2.0-2.5-0	7/2/2013	955	AM/HL/JY	1	4 oz Amber	4C	SO	AK102/103		3 DAY	
13CG543-SB03-2.0-2.5-0	7/2/2013	1025	AM/HL/JY	1	4 oz Amber	4C, MeOH	SO	SW8260B-BTEX		3 DAY	
13CG543-SB03-2.0-2.5-0	7/2/2013	1025	AM/HL/JY	1	4 oz Amber	4C, MeOH	SO	AK101		3 DAY	
13CG543-SB03-2.0-2.5-0	7/2/2013	1025	AM/HL/JY	1	4 oz Amber	4C	SO	AK102/103		3 DAY	
13CG543-SB03-7.0-7.5-0	7/2/2013	1035	AM/HL/JY	1	4 oz Amber	4C, MeOH	SO	SW8260B-BTEX		3 DAY	
13CG543-SB03-7.0-7.5-0	7/2/2013	1035	AM/HL/JY	1	4 oz Amber	4C, MeOH	SO	AK101		3 DAY	
13CG543-SB03-7.0-7.5-0	7/2/2013	1035	AM/HL/JY	3	4 oz Amber	4C, MeOH	SO	NWVPH	MS/D	3 DAY	
13CG523-SB09-6.0-6.5-0	7/3/2013	1115	AM/HL/JY	1	4 oz Amber	4C, MeOH	SO	SW8260B-BTEX		3 DAY	
13CG523-SB09-6.0-6.5-0	7/3/2013	1115	AM/HL/JY	1	4 oz Amber	4C, MeOH	SO	AK101		3 DAY	
13CG523-SB09-6.0-6.5-0	7/3/2013	1115	AM/HL/JY	1	8 oz Amber	4C	SO	AK102/103; SW8270C SIM		3 DAY	
13CG523-SB09-6.0-6.5-0	7/3/2013	1115	AM/HL/JY	1	4 oz Amber	4C	SO	NWEPH		3 DAY	
13CG523-SB09-6.0-6.5-0	7/3/2013	1115	AM/HL/JY	1	4 oz Amber	4C, MeOH	SO	NWVPH		3 DAY	

	Signature/Printed Name	Date/Time		Signature/Printed Name	Date/Time
Relinquish By:	Jess Young	7/3/13 1435	Relinquish By:	Heidi Nelson	7-3-13 1527
Received By:	Heidi Nelson	7/3/13 1435	Received By:	Madiha Ahmed	7-3-13 15:25

Temp: 5.1°C

Relinquish By: Madiha Ahmed 07/05/13 11:11 rec'd by: 7-6-13 1040 3.2, 1.2

TestAmerica Laboratories, Inc.
880 Riverside Parkway
West Sacramento, CA 95605
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Chain of Custody Record

SDG 320-3255-1

WESTON SOLUTIONS

Client: WESTON 425 G Street, Suite 300 Anchorage, AK 99501 (907) 276-6610	**Project Name:** JBER HRC **Project Number:** **Client contact:**	**CoC Number:** 13HRC027	1 of 3 CoCs
Report to: WESTON	**Invoice to:** WESTON	**Cooler ID:** The Naked Gun **PO number:** 0082882	

Sample ID	Collection Date	Time	Sampler	Number	Container Type	Preservative	Matrix	Analyses Requested Group	QC	TAT	Notes
13CG543-SB03-7.0-7.5-0	7/2/2013	1035	AM/HL/JY	2	8 oz Amber	4C	SO	AK102/103; SW8270C SIM	MS/D	3 DAY	
13CG543-SB03-7.0-7.5-0	7/2/2013	1035	AM/HL/JY	2	4 oz Amber	4C	SO	NWEPH	MS/D	3 DAY	
13CG543-SB03-9.0-9.5-0	7/2/2013	1040	AM/HL/JY	1	4 oz Amber	4C, MeOH	SO	SW8260B-BTEX		3 DAY	
13CG543-SB03-9.0-9.5-0	7/2/2013	1040	AM/HL/JY	1	4 oz Amber	4C, MeOH	SO	AK101		3 DAY	
13CG543-SB03-9.0-9.5-0	7/2/2013	1040	AM/HL/JY	1	4 oz Amber	4C	SO	AK102/103		3 DAY	
13CG523-SB01-7.0-7.5-0	7/2/2013	1345	AM/HL/JY	1	4 oz Amber	4C, MeOH	SO	SW8260B-BTEX		3 DAY	
13CG523-SB01-7.0-7.5-0	7/2/2013	1345	AM/HL/JY	1	4 oz Amber	4C, MeOH	SO	AK101		3 DAY	
13CG523-SB01-7.0-7.5-0	7/2/2013	1345	AM/HL/JY	1	8 oz Amber	4C	SO	AK102/103; SW8270C SIM		3 DAY	
13CG523-SB01-7.0-7.5-0	7/2/2013	1345	AM/HL/JY	1	4 oz Amber	4C	SO	NWEPH		3 DAY	
13CG523-SB01-7.0-7.5-0	7/2/2013	1345	AM/HL/JY	1	4 oz Amber	4C, MeOH	SO	NWVPH		3 DAY	
13CG523-SB01-7.0-7.5-1	7/2/2013	1345	AM/HL/JY	1	4 oz Amber	4C, MeOH	SO	SW8260B-BTEX		3 DAY	
13CG523-SB01-7.0-7.5-1	7/2/2013	1345	AM/HL/JY	1	4 oz Amber	4C, MeOH	SO	AK101		3 DAY	
13CG523-SB01-7.0-7.5-1	7/2/2013	1345	AM/HL/JY	1	8 oz Amber	4C	SO	AK102/103; SW8270C SIM		3 DAY	
13CG523-SB01-7.0-7.5-1	7/2/2013	1345	AM/HL/JY	1	4 oz Amber	4C	SO	NWEPH		3 DAY	
13CG523-SB01-7.0-7.5-1	7/2/2013	1345	AM/HL/JY	1	4 oz Amber	4C, MeOH	SO	NWVPH		3 DAY	
13CG523-SB01-9.0-9.5-0	7/2/2013	1350	AM/HL/JY	1	4 oz Amber	4C, MeOH	SO	AK101		3 DAY	
13CG523-SB01-9.0-9.5-0	7/2/2013	1350	AM/HL/JY	1	4 oz Amber	4C	SO	AK102/103		3 DAY	
13CG523-SB01-9.0-9.5-0	7/2/2013	1350	AM/HL/JY	1	4 oz Amber	4C, MeOH	SO	SW8260B-BTEX		3 DAY	
13CG523-SB02-6.0-6.5-0	7/2/2013	1430	AM/HL/JY	1	4 oz Amber	4C, MeOH	SO	SW8260B-BTEX		3 DAY	
13CG523-SB02-6.0-6.5-0	7/2/2013	1430	AM/HL/JY	1	4 oz Amber	4C, MeOH	SO	AK101		3 DAY	
13CG523-SB02-6.0-6.5-0	7/2/2013	1430	AM/HL/JY	1	8 oz Amber	4C	SO	AK102/103; SW8270C SIM		3 DAY	
13CG523-SB02-6.0-6.5-0	7/2/2013	1430	AM/HL/JY	1	4 oz Amber	4C	SO	NWEPH		3 DAY	
13CG523-SB02-6.0-6.5-0	7/2/2013	1430	AM/HL/JY	1	4 oz Amber	4C, MeOH	SO	NWVPH		3 DAY	
13CG523-SB02-8.5-9.0-0	7/2/2013	1435	AM/HL/JY	1	4 oz Amber	4C, MeOH	SO	SW8260B-BTEX		3 DAY	
13CG523-SB02-8.5-9.0-0	7/2/2013	1435	AM/HL/JY	1	4 oz Amber	4C, MeOH	SO	AK101		3 DAY	
13CG523-SB02-8.5-9.0-0	7/2/2013	1435	AM/HL/JY	1	8 oz Amber	4C	SO	AK102/103; SW8270C SIM		3 DAY	
13CG523-SB02-8.5-9.0-0	7/2/2013	1435	AM/HL/JY	1	4 oz Amber	4C	SO	NWEPH		3 DAY	

Relinquish By: JESS Young 7/3/13 1435 Relinquish By: Heidi Nelson Heidi Nelson 7/3/13 1522
Signature/Printed Name Date/Time Signature/Printed Name Date/Time

Received By: Heidi Nelson Heidi Nelson 7/3/13 1435 Received By: Madina Ahmed Madina Ahmed 7/3/13 15:25
Signature/Printed Name Date/Time Signature/Printed Name Date/Time

Rec'd broken & transferred to another jar cw 7-8-13

Temp: 5.6°C

Relinquish By: Madina Madina Ahmed 07/05/13 1111 Rec'd by: [illegible] 7-8-13 1040

TestAmerica Laboratories, Inc.
880 Riverside Parkway
West Sacramento, CA 95605
phone: (916) 373-5600 fax: (916) 372-1059

Chain of Custody Record

WESTON

320-8345 Chain of Custody

Client: WESTON 425 G Street, Suite 300 Anchorage, AK 99501 (907) 276-6610	**Project Name:** JBER HRC **Project Number: 20077.049.016.3010.01** **Client contact:**	**CoC Number:** 13HRC031 **Cooler ID:** Say Anything	
Report to: WESTON	**Invoice to:** WESTON	**PO number: 0082882**	

Sample ID	Collection Date	Time	Sampler	Number	Container Type	Preservative	Matrix	Analyses Requested Group	QC	TAT	Notes
13CG535-SB05-38.0-38.5-0	7/9/2013	1300	AM/JY	1	4 oz Amber	4C, MeOH	SO	SW8260B-BTEX		15 DAY	
13CG535-SB05-38.0-38.5-0	7/9/2013	1300	AM/JY	1	8 oz Amber	4C	SO	AK102/103		15 DAY	
13CG535-SB05-38.0-38 5-0	7/9/2013	1300	AM/JY	1	4 oz Amber	4C, MeOH	SO	AK101		15 DAY	
13CG529-TB02-SO-0	7/10/2013	~~840~~ 0800	AM/JY	1	4 oz Amber	4C, MeOH	SO	NWVPH	TB	15 DAY	
13CG529-TB02-SO-0	7/10/2013	~~840~~ 0800	AM/JY	1	4 oz Amber	4C, MeOH	SO	SW8260B	TB	15 DAY	
13CG529-TB02-SO-0	7/10/2013	~~840~~ 0800	AM/JY	1	4 oz Amber	4C, MeOH	SO	AK101	TB	15 DAY	
13CG529-SB09-26.5-27.0-0	7/10/2013	915	AM/JY	1	8 oz Amber	4C	SO	AK102/103		15 DAY	
13CG529-SB09-26.5-27.0-0	7/10/2013	915	AM/JY	1	4 oz Amber	4C, MeOH	SO	AK101		15 DAY	
13CG529-SB09-26.5-27.0-0	7/10/2013	915	AM/JY	1	4 oz Amber	4C, MeOH	SO	SW8260B		15 DAY	
13CG529-SB09-26.5-27.0-0	7/10/2013	915	AM/JY	1	8 oz Amber	4C	SO	AK102/103		15 DAY	
13CG529-SB10-27.0-27.5-0	7/10/2013	1055	AM/JY	1	4 oz Amber	4C, MeOH	SO	AK101		15 DAY	
13CG529-SB10-27.0-27.5-0	7/10/2013	1055	AM/JY	3	4 oz Amber	4C, MeOH	SO	SW8260B	MS/D	15 DAY	
13CG529-SB10-27.0-27.5-0	7/10/2013	1055	AM/JY	1	8 oz Amber	4C	SO	AK102/103		15 DAY	
13CG529-SB11-27.0-27.5-0	7/10/2013	1305	AM/JY	1	4 oz Amber	4C, MeOH	SO	AK101		15 DAY	
13CG529-SB11-27 0-27.5-0	7/10/2013	1305	AM/JY	1	4 oz Amber	4C, MeOH	SO	SW8260B		15 DAY	
13CG529-SB11-27.0-27.5-0	7/10/2013	1305	AM/JY	1	8 oz Amber	4C	SO	AK102/103		15 DAY	
13CG523-SB10-6.0-6.5-0	7/10/2013	1455	AM/JY	1	4 oz Amber	4C, MEOH	SO	SW8260B-BTEX		15 DAY	
13CG523-SB10-6 0-6.5-0	7/10/2013	1455	AM/JY	1	8 oz Amber	4C	SO	AK102/103		15 DAY	
13CG523-SB10-6 0-6.5-0	7/10/2013	1455	AM/JY	1	4 oz Amber	4C, MEOH	SO	AK101		15 DAY	
13CG523-SB11-6.0-6.5-0	7/10/2013	1530	AM/JY	1	4 oz Amber	4C, MEOH	SO	SW8260B-BTEX		15 DAY	
13CG523-SB11-6.0-6 5-0	7/10/2013	1530	AM/JY	1	8 oz Amber	4C	SO	AK102/103		15 DAY	
13CG523-SB11-6.0-6 5-0	7/10/2013	1530	AM/JY	1	4 oz Amber	4C, MEOH	SO	AK101		15 DAY	

Relinquish By:	Jess Young	7/12/13 1500	**Relinquish By:**	Madiha Ahmed	7/12/13 1505
	Signature/Printed Name	Date/Time		Signature/Printed Name	Date/Time
Received By:	Madiha Ahmed	7/12/13 15:05	**Received By:**	C.Hyfield	7-13-13 1150 55
	Signature/Printed Name	Date/Time		Signature/Printed Name	Date/Time

MA 7/12/13

Temp 5.0°C 3.4, 2.7

TestAmerica Laboratories, Inc.
880 Riverside Parkway
West Sacramento, CA 95605
phone: (916) 373-5600 fax: (916) 372-1059

Chain of Custody Record

SDG 320-3345

Client:	WESTON 425 G Street, Suite 300 Anchorage, AK 99501 (907) 276-6610	Project Name: JBER HRC Project Number: 20077.049.016.3010.01 Client contact:	CoC Number: 13HRC031 Cooler ID: Say Anything	2 of 2 page(s)
Report to:	WESTON	Invoice to: WESTON	PO number: 0082882	

Sample ID	Collection Date	Time	Sampler	Number	Container Type	Preservative	Matrix	Analyses Requested Group	QC	TAT	Notes
13CG523-SB12-7.0-7.5-0	7/10/2013	1605	AM/JY	1	4 oz Amber	4C, MEOH	SO	SW8260B-BTEX		15 DAY	
13CG523-SB12-7.0-7.5-0	7/10/2013	1605	AM/JY	1	8 oz Amber	4C	SO	AK102/103		15 DAY	
13CG523-SB12-7.0-7.5-0	7/10/2013	1605	AM/JY	1	4 oz Amber	4C, MEOH	SO	AK101		15 DAY	
13CG523-SB13-6.0-6.5-0	7/10/2013	1635	AM/JY	1	4 oz Amber	4C, MEOH	SO	SW8260B-BTEX		15 DAY	
13CG523-SB13-6.0-6 5-0	7/10/2013	1635	AM/JY	1	8 oz Amber	4C	SO	AK102/103		15 DAY	
13CG523-SB13-6.0-6 5-0	7/10/2013	1635	AM/JY	1	4 oz Amber	4C, MEOH	SO	AK101		15 DAY	
13ST061-SB01-10.5-11.0-0	7/11/2013	1210	AM/JY	1	4 oz Amber	4C, MeOH	SO	SW8260B-Modified		15 DAY	
13ST061-SB01-10.5-11.0-0	7/11/2013	1210	AM/JY	2	8 oz Amber	4C	SO	AK102/103	MS/D	15 DAY	
13ST061-SB01-10 5-11.0-0	7/11/2013	1210	AM/JY	3	4 oz Amber	4C, MEOH	SO	AK101	MS/D	15 DAY	
13ST061-SB02-19 0-19.5-0	7/11/2013	1315	AM/JY	1	4 oz Amber	4C, MeOH	SO	SW8260B-Modified		15 DAY	
13ST061-SB02-19.0-19 5-0	7/11/2013	1315	AM/JY	1	8 oz Amber	4C	SO	AK102/103		15 DAY	
13ST061-SB02-19.0-19.5-0	7/11/2013	1315	AM/JY	1	4 oz Amber	4C, MEOH	SO	AK101		15 DAY	

Relinquish By:	Jess Young	7/12/13	1500	Relinquish By: Madhira Ahmed	7/12/13 15:05
	Signature/Printed Name		Date/Time	Signature/Printed Name	Date/Time
Received By:	Madhira Ahmed	7/12/13	15:05	Received By: Citytrack	7-13-13 1150 MA 7/12/13
	Signature/Printed Name		Date/Time	Signature/Printed Name	Date/Time

Temp 5.0°C 3.4, 2.3

TestAmerica Laboratories, Inc.
880 Riverside Parkway
West Sacramento, CA 95605
phone. (916) 373-5600 fax: (916) 372-1059

Chain of Custody Record

320-4997 Chain of Custody

Client: WESTON 425 G Street, Suite 300 Anchorage, AK 99501 (907) 276-6610	**Project Name: JBER LTM** **Project Number: 20077.049.016.3040.03** **Client contact:**	**CoC Number:** 13LTM028 **Cooler ID:** Heavy Metal	
Report to: WESTON	**Invoice to:** WESTON	**PO number: 0082882**	

Sample ID	Collection Date	Time	Sampler	Number	Container Type	Preservative	Matrix	Analyses Requested Group	QC	TAT	Notes
13CG523-TB02-SO-0	11/13/2013	955	AM/EB/JY	1	4 oz Amber	4C, MeOH	SO	SW8260B-BTEX		15 DAY	
13CG523-TB02-SO-0	11/13/2013	955	AM/EB/JY	1	4 oz Amber	4C, MeOH	SO	AK101		15 DAY	
13CG523-SB14-6 0-6.5-0	11/13/2013	1000	AM/EB/JY	3	4 oz Amber	4C, MeOH	SO	SW8260B-BTEX	MS/D	15 DAY	
13CG523-SB14-6.0-6.5-0	11/13/2013	1000	AM/EB/JY	3	4 oz Amber	4C, MeOH	SO	AK101	MS/D	15 DAY	
13CG523-SB14-6 0-6.5-0	11/13/2013	1000	AM/EB/JY	2	8 oz Amber	4C	SO	AK102/103	MS/D	15 DAY	

Relinquish By:	Jess Yount	11/14/13 1540	**Relinquish By:**	Laura Šercar	11/14/13 16:20
	Signature/Printed Name	Date/Time		Signature/Printed Name	Date/Time
Received By:	Laura Šercar	11/14/13 15:40	**Received By:**	Cathy Trela	11-15-13 1050
	Signature/Printed Name T = 1.1 °C	Date/Time		Signature/Printed Name	Date/Time

2.6°C

APPENDIX B
Laboratory Reports and Data Quality Review (on CD)

B-1 QA/QC Summary Report and Sample Summary Table

B-2 Alaska Department of Environmental Conservation (ADEC) Checklists

B-3 Analytical Laboratory Data Packages

B-4 Geotechnical Analysis

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APPENDIX C
Hydrocarbon Risk Calculator

C-1 Hydrocarbon Risk Calculator Results

C-2 Source Files (included with Appendix B on CD)

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C-1 Hydrocarbon Risk Calculator Results

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Table C-1	Hydrocarbon Risk Calculator	Facility Location: CG523	Facility Name: JBER-E, Alaska
Page 1	Model Input Parameters:	Version 1.1, Lawrence Acomb, Geosphere, Inc., March 4, 2011	Solver solution based on work of Hun Seak Park, 1999; VBA macro by Ted Cahalane, 2010

Site Specific and/or Field Data in Yellow Highlighted Cells

Concentrations in Site Soils (mg/kg):		
Benzene (c & nc)		0.021
Toluene (nc)		0.034
Ethylbenzene (c & nc)		2.046
Xylenes (total) (nc)		3.765
GRO (mg/kg)		689.
DRO (mg/kg)		6,164.
RRO (mg/kg)		279.
Total Petroleum Hydrocarbons (mg/kg)		7,132.800
GRO Aromatics Fraction (ADEC default=0.50)		0.36
DRO Aromatics Fraction (ADEC default=0.40)		0.22
RRO Aromatics Fraction (ADEC default=0.40)		0.33
See Note #1 regarding use of ND values		
Acenaphthene (nc)		0.29
Acenaphthylene (nc)		0.019
Anthracene (nc)		0.076
Benzo(g,h,i)perylene (nc)		0.057
Fluoranthene (nc)		0.09
Fluorene (nc)		1.9
Naphthalene (c & nc)		6.1
Phenanthrene (nc)		1.8
Pyrene (nc)		0.09
Benzo(a)anthracene (c)		0.033
Benzo(b)fluoranthene (c)		0.029
Benzo(k)fluoranthene (c)		0.043
Benzo(a)pyrene (c)		0.023
Chrysene (c)		0.036
Dibenz(a,h)anthracene (c)		0.068
Indeno(1,2,3-cd)pyrene (c)		0.027
	nc	
	nc	
	nc	
	nc	
	nc	
	nc	
	nc	
	c	

Chemical Concentrations in Site Groundwater (mg/L):	Calculate	Dissolved Phase Half Life (days; used in DAF calculations):
Benzene (mg/L)	2.30E-04	400
Toluene (mg/L)	0.0016	100
Ethylbenzene (mg/L)	0.0012	100
Xylene (mg/L)	0.0032	100
GRO (mg/L)	0.11	100
DRO (mg/L)	0.62	100
RRO (mg/L)	0.084	100
GRO aromatics (mg/L)	0.023	100
DRO aromatics (mg/L)	0.151	100
RRO aromatics (mg/L)	0.015	100
GRO aliphatics (mg/L)	0.0319	100
DRO aliphatics (mg/L)	0.263	100
RRO aliphatics (mg/L)	0.018	100
Acenaphthene (nc)	3.10E-04	10,000
Acenaphthylene (nc)	3.10E-06	10,000
Anthracene (nc)	1.20E-05	10,000
Benzo(g,h,i)perylene (nc)	5.60E-06	10,000
Fluoranthene (nc)	4.30E-06	10,000
Fluorene (nc)	7.40E-04	10,000
Naphthalene (c & nc)	0.0012	10,000
Phenanthrene (nc)	1.30E-04	10,000
Pyrene (nc)	4.20E-06	10,000
Benzo(a)anthracene (c)	2.59E-07	10,000
Benzo(b)fluoranthene (c)	4.13E-08	10,000
Benzo(k)fluoranthene (c)	9.96E-08	10,000
Benzo(a)pyrene (c)	4.34E-08	10,000
Chrysene (c)	5.85E-07	10,000
Dibenz(a,h)anthracene (c)	5.82E-07	10,000
Indeno(1,2,3-cd)pyrene (c)	4.06E-09	10,000

Soil Conditions:	Site Specific and/or Field Data in Yellow Highlighted Cells	ADEC Default Value (all climate zones)
bulk density (lbs/ft^3)	121.5	93.6
bulk density (g/cm^3)	1.95	1.5
specific gravity	2.7	2.65
porosity	0.279	0.43
moisture content (% by weight)	12.4	10
foc	0.0010	0.001
water filled porosity	0.241	0.15
air filled porosity	0.020	0.28
NAPL filled porosity	0.017	
water saturation	86.59%	
NAPL saturation	6.10%	
Soil temp (C)	5	25
Soil Grain Size Description (USCS or other; used to label CSM)	Gravelly Sand with Silt	
Hydrogeologic Conditions:		ADEC Default Values <40" precip/yr
Source length (ft)	80	105
Average precipitation (in/yr)	16	25.59
Default Estimated Infiltration Rate (20% of precip, m/yr)	0.081	0.13
Aquifer hydraulic conductivity (cm/sec)	1.81E-04	2.78E-03
Aquifer thickness (ft; below low water at downgradient edge of source)	32.8	32.8
Source length (m)	24	32
Infiltration rate (m/yr)	0.081	0.13
Hydraulic gradient	0.160	0.002
Aquifer hydraulic conductivity (m/yr)	5.71E+01	8.76E+02
Aquifer thickness (ft; below low water)	10.0	10.0
Mixing Zone Depth minimum of (m)	5.5	5.5 maximum
Dilution Factor (lower seasonal value)	2.4	minimum DAF (for all compounds)
Vadose Zone or Smear Zone Source?	1	4 indicates vadose zone source, 1 indicates a saturated zone source
Potable or Non-potable Aquifer?	1	Enter 1 for potable aquifer, 10 for non-potable aquifer (to be considered non-potable the groundwater must have been evaluated and determined to be non-potable by the ADEC as per 18 AAC 75.350
ADEC Reckey No.:		
ADEC Hazard ID		
Latitude		
Longitude		
Width of Source (ft)	50	
Area of NAPL contaminated soil source (ft^2)	4,000	
Ground surface slope (ft/ft, assumed to be in direction of groundwater flow)	0.16	

	ADEC Default Values >40" precip/yr
	105
	118.11
	0.6
	2.78E-03
	32.8
	32
	0.6
	0.002
	8.76E+02
	10.0
	5.5 maximum
	2.4

FYI Unit Conversions	
bulk density conversion input (g/cm^3)	bulk density output (lbs/ft^3)
1.66	103.584
K (ft/day)	K (cm/sec)
400	0.141111111
Exposure Routes Complete at Present Time	
Exposure Routes	enter 1 for complete pathways; 0 for incomplete pathways
Soil Direct Contact	1
Outdoor Air	1
Indoor Air	0
Groundwater Ingestion	0

Solver Instructions & Information:

"Solver" is an Excel add-in tool, installed from the program discs. In addition, the "macro" which performs the calculations must be "enabled" while the spreadsheet is opening.

1. Enter site specific hydrocarbon concentration data, and soil and groundwater conditions data.

2. Click on the "Calculate" button in cell D4. The phase partitioning equations are solved and the results are saved in the spreadsheet.

3. Any time data entry values are changed the spreadsheet should be re-calculated (click on the "Calculate" button again).

Molar density (mol/L)*NAPL filled porosity initial value=.0001	0.080174992
Initial air filled porosity (used to start iterations)	0.037
Conservation of volume equation (should be zero or close to zero, i.e. a very small number)	1.26E-10

Climate Related Outdoor Air Inhalation and Soil Direct Contact Exposure Parameters

Climate Zone of site (enter "1" for an arctic site; "2" for the <40" precip zone; and "3" for the >40" precip zone)	2

Soil Ingestion & Inhalation Exposure Frequency (days/yr)		ADEC Default Values
Residential	Industrial	arctic zone; precip <40"; precip >40"
270	250	Res 200; 270; 330 / Indus 200; 250; 250
Q/C for volatilization to Outdoor Air calcs.		
Residential	Industrial	
90.82	90.82	100.13; 90.82; 82.72

depth to groundwater at seasonal low water level at downgradient end of source (ft)	9
seasonal water table fluctuation (ft)	3
depth to bottom of source zone at downgradient edge of source (ft)	14
depth to top of area wide source zone at downgradient edge of source (ft)	6
saturated source thickness at low water level (ft; depth of NAPL source below low water table)	5
saturated source thickness at high water level (ft; thickness of saturated source zone below high water table)	8.00
total thickness of the source zone (ft)	8
seasonal water table fluctuation (m)	0.914
saturated source thickness at low water level (m; depth of source below low water table)	1.524
saturated source thickness at high water level (m; thickness of source zone below high water table)	2.438

Smear Zone Source--- NAPL source extends through zone of seasonal water table fluctuation

Table C-1	Migration to Indoor Air-- Data Entry	CG523	JBER-E, Alaska
Page 2	NAPL source area soil gas concentrations or measured soil gas concentrations used as input. Attenuation factor "alpha" calculated by the Johnson & Ettinger model following the EPA advanced soil gas solution to the J & E model. Incremental risk posed by NAPL source area soil gas concentrations via the migration to indoor air pathway shown in section 6 below and entered into the cumulative risk calculations.		

Site Specific and/or Field Data in Yellow Highlighted Cells

Soil Properties:		Upper most uncontaminated soil layer immediately below slab	Middle Layer (not contaminated)	Bottom Layer (not contaminated)	**Building Properties:**	input value	default input values: **basement**	default input values: **slab on grade**			**Human Health Exposure Criteria**		
bulk density (lbs/ft^3)		121.50	121.50	121.50	**Lb** = length of building (cm)	1000	1000	1000	**L_T** = total source-building separation distance (cm)	168		Residential	Industrial
bulk density (g/cm^3)		1.95	1.95	1.95	**Wb** = width of building (cm)	1000	1000	1000	**Acrack= area of total cracks (cm^2)** = Xcrack* Wcrack = Ab/n	400	Target Carcinogenic Risk (TRC; default = 10^-5)	1.00E-05	1.00E-05
specific gravity of solids		2.7	2.7	2.7	**Hb** = height of building (cm)	244	366	244	**Xcrack** = floor -wall seam perimeter (cm)	4000	THQ= target hazard quotient (default = 1.0)	1	1
porosity		0.28	0.28	0.28	**ER** = air exchange rate (1/hr)	0.25	0.25		**u** = viscosity of air (g/cm-sec)	1.74E-04	ATc= averaging time carcinogen (days), (=70 years)	25,550	25,550
moisture content (% by weight)		12.40	12.40	12.40	**Lf** = depth below grade of bottom of floor slab or basement (cm)	15	200	15	**Zcrack** = crack depth below grade (cm)	15	ATnc= averaging time non-carcinogen	30	30
foc		0.001	0.001	0.001	**Lf** = depth below grade of bottom of floor slab or basement (ft)	0.49212	6.5616	0.49212	**equation 16 r crack**= n /(Ab /Xcrack)	1.00E-01	ED= exposure duration (30 years)	30	25
water filled porosity		0.241	0.241	0.241	**Lcrack** = enclosed space foundation thickness or **slab thickness** (cm)	10	10	10	**n** = Acrack/Ab (0<=n<=1)	3.77E-04	EF= effective exposure frequency (350 days/year)	350	100
air filled porosity		0.037	0.037	0.037	**delta P** = pressure differential between building and soil (g/cm-s^2)	40	40 g/cm-s^2 = 4 pascals (Pa)	typical conservative values = 4 or 5 Pa; max range = 0 to 20 Pa	**equation 14 Q building**=building ventilation rate (cm^3/sec) = (Lb*Wb*Hb*ER)/3,600s/h	1.69E+04	Industrial Scenario Exposure Frequency input values	days per week	6
Thickness of uncontaminated soil layers above source at building location (ft; upper most layer must extend below the depth of foundation; used to define the source-building separation distance)		4	1	1	**kv** = soil vapor permeability= top soil layer (cm^2)	2.58E-09	1.00E-08		**equation 14 Q building**=building ventilation rate (cm^3/sec; if a value is input it will be used in the alpha calculation--optional)			hours per day	8
layer thickness (cm)		121.92	30.48	30.48	**A_B**= surface area of enclosed space below grade (cm^2)	1.06E+06	=area of basement walls+ basement floor... or area of slab on grade		**equation 15 Q soil** = (2* pi * delta P* kv* Xcrack)/u ln (2 Zcrack/ r crack)	2.62E+00		weeks per year	50
Ls (ft) = Total depth to contaminant or to soil gas sample if soil gas data used as input to model		6	**Ls** (cm)	182.88	**Q building** =building ventilation rate (cm^3/sec)	1.69E+04			Rc (gas constant, cal/mol-degree K	1.9872	C cancer =	[(TCR*ATc)/(EF*ED*URF)]	
kv = soil vapor permeability (cm^2; est. values in cells Q65 to S65)		2.58E-09	2.58E-09	2.58E-09	**Wcrack** = floor-wall seam crack width (cm)	0.1			R (gas constant, atm-m^3/mol-degree K	8.2057E-05	C non-cancer =	(TQH*Rfc*1000ug/mg)	

Table C-1 — Phase Partitioning Results — CG523 — JBER-E, Alaska

Page 3 column 1	2	3	4	5	6	7	8	9	10	11	12	13	14
Hydrocarbon Fractions		**Median Equivalent Carbon**	**Distribution of DRO & GRO into Aromatic & Aliphatic Equivalent Carbon Ranges (varies by fuel type)**	**Bulk Soil Concentration (mg/kg)**	**Fraction of TPH Mass**	**Xi (Mole Fraction in NAPL using 4-phase model; unique solution)**	**Concentration in Soil Water (mg of chemical/L of pore water)**	**Concentration in Soil Gas (mg/L pore air)**	**% of Hydrocarbon Mass in Dissolved Phase**	**% of Hydrocarbon Mass in Vapor Phase**	**% of Hydrocarbon Mass Adsorbed to Soils**	**% of Hydrocarbon Mass in NAPL**	**Sum of Dissolved, Vapor, Adsorbed and NAPL Phases**
Benzene C_5-C_7		6.50	from analysis	0.021	0.000003	5.62E-06	1.01E-02	9.08E-04	5.941%	0.045%	7.930%	86.08%	100.00%
Toluene C_7-C_8		7.58	from analysis	0.034	0.000005	8.49E-06	4.47E-03	4.24E-04	1.629%	0.013%	3.521%	94.84%	100.00%
Ethylbenzene C_8-C_9		8.50	from analysis	2.046	0.000287	4.57E-04	7.72E-02	7.71E-03	0.468%	0.004%	1.953%	97.58%	100.00%
Xylene C_8-C_9		8.63	from analysis	3.765	0.000528	8.49E-04	9.00E-02	7.44E-03	0.296%	0.002%	1.059%	98.64%	100.00%
Aromatic C_9-C_{10}		9.00	from analysis	240.123	0.033665	4.99E-02	3.22E+00	4.35E-01	0.166%	0.002%	2.126%	97.71%	100.00%
Aromatic C_{10}-C_{12}		11.00	0.26786	358.372	0.050243	6.61E-02	1.62E+00	5.24E-02	0.056%	0.000%	1.137%	98.81%	100.00%
Aromatic C_{12}-C_{16}		13.00	0.34152	456.924	0.064060	7.60E-02	7.09E-01	1.07E-02	0.019%	0.000%	0.618%	99.36%	100.00%
Aromatic C_{16}-C_{21}		17.00	0.39063	522.626	0.073271	7.34E-02	9.89E-02	3.82E-04	0.002%	0.000%	0.189%	99.81%	100.00%
Aromatic C_{21}-C_{35}		25.00	1.0000	91.803	0.012871	1.00E-02	2.83E-04	5.27E-08	0.000%	0.000%	0.019%	99.98%	100.00%
Aliphatic C_5-C_6		5.50	0.01180	5.231	0.000733	1.55E-03	5.57E-02	1.07E+00	0.132%	0.214%	0.855%	98.80%	100.00%
Aliphatic C_6-C_8		7.00	0.05207	23.087	0.003237	5.45E-03	2.93E-02	5.76E-01	0.016%	0.026%	0.482%	99.48%	100.00%
Aliphatic C_8-C_{10}		9.00	0.93614	415.093	0.058195	7.71E-02	3.29E-02	7.68E-01	0.001%	0.002%	0.239%	99.76%	100.00%
Aliphatic C_{10}-C_{12}		11.00	0.22896	1104.981	0.154915	1.69E-01	5.73E-03	1.63E-01	0.000%	0.000%	0.124%	99.88%	100.00%
Aliphatic C_{12}-C_{16}		13.00	0.58168	2807.248	0.393569	3.65E-01	9.84E-04	6.64E-02	0.000%	0.000%	0.067%	99.93%	100.00%
Aliphatic C_{16}-C_{21}		17.00	0.18936	913.849	0.128119	9.18E-02	1.56E-06	6.69E-04	0.000%	0.000%	0.021%	99.98%	100.00%
Aliphatic C_{21}-C_{35}		25.00	1.0000	187.597	0.026301	1.30E-02	8.76E-12	1.08E-07	0.000%	0.000%	0.002%	100.00%	100.00%
				7132.800	**100.0000%**	**1.00000**	**5.96E+00**	**3.16E+00**					

sum of GRO aromatic mass fractions must equal 1	1.000000E+00	689.400	sum of GRO concentrations should equal input GRO concentration
sum of GRO aliphatic mass fractions must equal 1	1.000000E+00	6164.000	sum of DRO concentrations must equal input DRO concentration
sum of DRO aromatic mass fractions must equal 1	1.000000E+00	279.400	sum of RRO concentrations must equal input RRO concentration
sum of DRO aliphatic mass fractions must equal 1	1.000000E+00		

Table C-1 Soil Direct Contact Risks

Page 4 CG523 JBER-E, Alaska

1	2	3	4	5	6	7	8	9
Compounds		Sample Concentrations (mg/kg)	Soil Direct Contact Risk Based Level Residential Land Use	Residential Land Use Fraction of Risk Based Concentration (values greater than 1 exceed the risk based target)	Check for compliance with risk levels (0= in compliance; 1= not in compliance)	Soil Direct Contact Risk Based Level Industrial Land Use	Industrial Land Use Fraction of Risk Based Concentration (values greater than 1 exceed the risk based target)	Check for compliance with risk levels (0= in compliance; 1= not in compliance)
Benzene (c & nc)	nc	0.021	406.	5.18E-05	0	8,176.	2.57E-06	0
Toluene (nc)	nc	0.034	8,111.	4.19E-06	0	163,520.	2.08E-07	0
Ethylbenzene (c & nc)	nc	2.046	10,139.	2.02E-04	0	204,400.	1.00E-05	0
Xylenes (total) (nc)	nc	3.765	20,278.	1.86E-04	0	408,800.	9.21E-06	0
GRO Aromatics (nc)	nc	240.	20,278.	0.0118	0	408,800.	5.87E-04	0
DRO Aromatics (nc)	nc	1,338.	4,056.	**0.3299**	0	81,760.	0.0164	0
RRO Aromatics (nc)	nc	91.8029	3,042.	0.0302	0	61,320.	0.0015	0
GRO Aliphatics (nc)	nc	443.	506,944.	8.75E-04	0	10,220,000.	4.34E-05	0
DRO Aliphatics (nc)	nc	4,826.	10,139.	**0.476**	0	204,400.	0.0236	0
RRO Aliphatics (nc)	nc	188.	202,778.	9.25E-04	0	4,088,000.	4.59E-05	0
Acenaphthene (nc)	nc	0.29	2,798.	1.04E-04	0	18,765.	1.55E-05	0
Acenaphthylene (nc)	nc	0.019	2,798.	6.79E-06	0	18,765.	1.01E-06	0
Anthracene (nc)	nc	0.076	20,566.	3.70E-06	0	188,220.	4.04E-07	0
Benzo(g,h,i)perylene (nc)	nc	0.057	1,399.	4.07E-05	0	9,383.	6.08E-06	0
Fluoranthene (nc)	nc	0.09	1,865.	4.82E-05	0	12,510.	7.19E-06	0
Fluorene (nc)	nc	1.9	2,347.	8.10E-04	0	18,448.	1.03E-04	0
Naphthalene (c & nc)	nc	6.1	1,394.	0.0044	0	12,998.	4.69E-04	0
Phenanthrene (nc)	nc	1.8	20,566.	8.75E-05	0	188,220.	9.56E-06	0
Pyrene (nc)	nc	0.09	1,399.	6.43E-05	0	9,383.	9.59E-06	0
Benzene (c & nc)	**c**	0.021	151.	1.39E-04	0	1,041.	2.02E-05	0
Ethylbenzene (c & nc)	**c**	0.034	No Sfo	0.00E+00	0	No Sfo	0.00E+00	0
Benzo(a)anthracene (c)	**c**	0.033	4.8866	0.0068	0	12.017	0.0027	0
Benzo(b)fluoranthene (c)	**c**	0.029	4.8866	0.0059	0	12.017	0.0024	0
Benzo(k)fluoranthene (c)	**c**	0.043	48.8656	8.80E-04	0	120.	3.58E-04	0
Benzo(a)pyrene (c)	**c**	0.023	0.4887	0.0471	0	1.2017	0.0191	0
Chrysene (c)	**c**	0.036	489.	7.37E-05	0	1,202.	3.00E-05	0
Dibenz(a,h)anthracene (c)	**c**	0.068	0.4887	**0.1392**	0	1.2017	0.0566	0
Indeno(1,2,3-cd)pyrene (c)	**c**	0.027	4.8866	0.0055	0	12.017	0.0022	0
Naphthalene (c & nc)	**c**	6.1	No Sfo	0.00E+00	0	No Sfo	0.00E+00	0
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Carcinogenic Cumulative Risk				0.2055	0		0.0835	0
Non-carcinogenic Cumulative Risk				0.006	0		6.44E-04	0

Values shown in the fourth and seventh columns are the normalized fraction of the risk based level, and not the carcinogenic risk level. The fraction of risk multiplied by 10^ -5 equals the carcinogenic risk level for the carcinogenic compounds. Carcinogenic compounds shown in bold.

Table C-1 Migration to Outdoor Air Vapor Inhalation Risks

Page 5 CG523 JBER-E, Alaska

1	2	3	4	5	6	7	8	9
Compounds		Vapor Concentration in Sample (based on 3 or 4- phase partitioning, whichever is accurate, mg/L)	Residential Site Hypothetical Soil Vapor Concentration when HQ=1 or Target Risk =10^-5 (mg/L; from 3-phase equation)	Fraction of Risk Based Concentration (values greater than 1 exceed the risk based target)	Check for compliance with risk levels (0= in compliance; 1= not in compliance)	Industrial Site Hypothetical Soil Vapor Concentration when HQ=1 or Target Risk =10^-5 (mg/L; from 3-phase equation)	Fraction of Risk Based Concentration (values greater than 1 exceed the risk based target)	Check for compliance with risk levels (0= in compliance; 1= not in compliance)
Benzene (c & nc)	nc	2.08E-05	708.	2.93E-08	0	2,093.	9.92E-09	0
Toluene (nc)	nc	1.52E-04	107,943.	1.41E-09	0	319,263.	4.76E-10	0
Ethylbenzene (c & nc)	nc	1.20E-04	18,652.	6.43E-09	0	55,168.	2.17E-09	0
Xylenes (total) (nc)	nc	2.63E-04	1,703.	1.54E-07	0	5,038.	5.22E-08	0
GRO Aromatics (nc)	nc	0.0031	4,853.	6.40E-07	0	14,355.	2.16E-07	0
DRO Aromatics (nc)	nc	0.0049	701.	6.96E-06	0	2,073.	2.35E-06	0
RRO Aromatics (nc)	nc	2.79E-06	No RfC	0.00E+00	0	No RfC	0.00E+00	0
GRO Aliphatics (nc)	nc	0.7452	809,686.	9.20E-07	0	2,394,811.	3.11E-07	0
DRO Aliphatics (nc)	nc	0.9659	17,389.	5.55E-05	0	51,431.	1.88E-05	0
RRO Aliphatics (nc)	nc	8.32E-06	No RfC	0.00E+00	0	No RfC	0.00E+00	0
Acenaphthene (nc)	nc	3.47E-07	No RfC	0.00E+00	0	No RfC	0.00E+00	0
Acenaphthylene (nc)	nc	2.84E-09	No RfC	0.00E+00	0	No RfC	0.00E+00	0
Anthracene (nc)	nc	3.12E-09	No RfC	0.00E+00	0	No RfC	0.00E+00	0
Benzo(g,h,i)perylene (nc)	nc	2.77E-12	No RfC	0.00E+00	0	No RfC	0.00E+00	0
Fluoranthene (nc)	nc	1.44E-10	No RfC	0.00E+00	0	No RfC	0.00E+00	0
Fluorene (nc)	nc	4.32E-07	No RfC	0.00E+00	0	No RfC	0.00E+00	0
Naphthalene (c & nc)	nc	4.80E-06	2.1689	2.21E-06	0	6.415	7.48E-07	0
Phenanthrene (nc)	nc	2.84E-08	No RfC	0.00E+00	0	No RfC	0.00E+00	0
Pyrene (nc)	nc	1.76E-10	No RfC	0.00E+00	0	No RfC	0.00E+00	0
Benzene (c & nc)	**c**	2.08E-05	70.5601	2.94E-07	0	250.	8.29E-08	0
Ethylbenzene (c & nc)	**c**	1.20E-04	396.	3.03E-07	0	1,404.	8.54E-08	0
Benzo(a)anthracene (c)	**c**	8.35E-12	1.34E-04	6.24E-08	0	4.75E-04	1.76E-08	0
Benzo(b)fluoranthene (c)	**c**	5.29E-14	3.63E-06	1.46E-08	0	1.29E-05	4.10E-09	0
Benzo(k)fluoranthene (c)	**c**	9.20E-14	2.64E-05	3.48E-09	0	9.38E-05	9.80E-10	0
Benzo(a)pyrene (c)	**c**	2.68E-14	1.39E-07	1.93E-07	0	4.94E-07	5.43E-08	0
Chrysene (c)	**c**	6.84E-12	0.0058	1.18E-09	0	0.0205	3.33E-10	0
Dibenz(a,h)anthracene (c)	**c**	1.14E-14	3.18E-09	3.58E-06	0	1.13E-08	1.01E-06	0
Indeno(1,2,3-cd)pyrene (c)	**c**	1.68E-15	6.37E-07	2.64E-09	0	2.26E-06	7.44E-10	0
Naphthalene (c & nc)	**c**	4.80E-06	0.4962	9.68E-06	0	1.761	2.73E-06	0
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Carcinogenic Cumulative Risk				1.41E-05	0		3.98E-06	0
Non-carcinogenic Cumulative Risk				2.41E-06	0		8.13E-07	0

Values shown in the fourth and seventh columns are the normalized fraction of the risk based level, and not the carcinogenic risk level. The fraction of risk multiplied by 10^ -5 equals the carcinogenic risk level for the carcinogenic compounds. Carcinogenic compounds shown in bold.

Table C-1 Migration to Indoor Air Vapor Inhalation Risks

Page 6 CG523 JBER-E, Alaska

1	2	3	4	5	6	7	8	9	10
Compounds		Vapor Concentration in Sample (ug/m^3)	Building Vapor Concentration given site conditions (ug/m^3)	Residential Land Use Building Vapor Concentration when HQ=1 or Target Risk =10^-5 (ug/m^3; Value listed depends on whether C or NC risks are being evaluated)	Residential Land Use Fraction of Risk Based Concentration (values greater than 1 exceed the risk based target)	Residential Land Use check for compliance with risk levels (0= in compliance; 1= not in compliance)	Industrial Land Use Building Vapor Concentration when HQ=1 or Target Risk =10^-5 (ug/m^3; Value listed depends on whether C or NC risks are being evaluated)	Industrial Land Use Fraction of Risk Based Concentration (values greater than 1 exceed the risk based target)	Industrial Land Use check for compliance with risk levels (0= in compliance; 1= not in compliance)
Benzene (c & nc)	nc	20.7574	2.32E-04	31.2857	7.413E-06	0	131.4.	1.765E-06	0
Toluene (nc)	nc	152.	0.0016	5,214.	3.044E-07	0	21,900.0.	7.247E-08	0
Ethylbenzene (c & nc)	nc	120.	0.0011	1,043.	1.045E-06	0	4,380.0.	2.488E-07	0
Xylenes (total) (nc)	nc	263.	0.0027	104.	2.549E-05	0	438.0.	6.068E-06	0
GRO Aromatics (nc)	nc	3,107.	0.0335	417.	8.039E-05	0	1,752.0.	1.914E-05	0
DRO Aromatics (nc)	nc	4,878.	0.0922	209.	4.421E-04	0	876.0.	1.053E-04	0
RRO Aromatics (nc)	nc	2.7941	4.04E-04	No RfC	0.000E+00	0	No RfC	0.000E+00	0
GRO Aliphatics (nc)	nc	745,210.	6.0021	19,189.	3.128E-04	0	80,592.0.	7.448E-05	0
DRO Aliphatics (nc)	nc	965,886.	7.7766	1,043.	0.00746	0	4,380.0.	0.00178	0
RRO Aliphatics (nc)	nc	8.3165	6.68E-05	No RfC	0.000E+00	0	No RfC	0.000E+00	0
Acenaphthene (nc)	nc	0.3469	3.51E-05	No RfC	0.000E+00	0	No RfC	0.000E+00	0
Acenaphthylene (nc)	nc	0.0028	3.04E-07	No RfC	0.000E+00	0	No RfC	0.000E+00	0
Anthracene (nc)	nc	0.0031	4.30E-07	No RfC	0.000E+00	0	No RfC	0.000E+00	0
Benzo(g,h,i)perylene (nc)	nc	2.77E-06	1.09E-08	No RfC	0.000E+00	0	No RfC	0.000E+00	0
Fluoranthene (nc)	nc	1.44E-04	2.29E-08	No RfC	0.000E+00	0	No RfC	0.000E+00	0
Fluorene (nc)	nc	0.4319	5.25E-05	No RfC	0.000E+00	0	No RfC	0.000E+00	0
Naphthalene (c & nc)	nc	4.8011	2.61E-04	3.1286	8.357E-05	0	13.14	1.990E-05	0
Phenanthrene (nc)	nc	0.0284	3.98E-06	No RfC	0.000E+00	0	No RfC	0.000E+00	0
Pyrene (nc)	nc	1.76E-04	2.76E-08	No RfC	0.000E+00	0	No RfC	0.000E+00	0
Benzene (c & nc)	**c**	20.7574	2.32E-04	3.1197	7.434E-05	0	13.10256	1.770E-05	0
Ethylbenzene (c & nc)	**c**	120.	0.0011	22.1212	4.926E-05	0	92.90909	1.173E-05	0
Benzo(a)anthracene (c)	**c**	8.35E-06	1.45E-09	0.2765	5.260E-09	0	1.16136	1.252E-09	0
Benzo(b)fluoranthene (c)	**c**	5.29E-08	6.50E-11	0.2765	2.351E-10	0	1.16136	5.597E-11	0
Benzo(k)fluoranthene (c)	**c**	9.20E-08	1.54E-10	2.7652	5.569E-11	0	11.61364	1.326E-11	0
Benzo(a)pyrene (c)	**c**	2.68E-08	1.05E-10	0.0277	3.809E-09	0	0.11614	9.069E-10	0
Chrysene (c)	**c**	6.84E-06	1.58E-09	27.6515	5.703E-11	0	116.1.	1.358E-11	0
Dibenz(a,h)anthracene (c)	**c**	1.14E-08	7.49E-10	0.0277	2.709E-08	0	0.11614	6.450E-09	0
Indeno(1,2,3-cd)pyrene (c)	**c**	1.68E-09	6.22E-12	0.2765	2.249E-11	0	1.16136	5.354E-12	0
Naphthalene (c & nc)	**c**	4.8011	2.61E-04	0.7157	3.653E-04	0	3.00588	8.698E-05	0
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Carcinogenic Cumulative Risk					4.89E-04	0		1.16E-04	0
Non-carcinogenic Cumulative Risk					1.18E-04	0		2.81E-05	0

Values shown in the fifth and eighth columns are the normalized fraction of the risk based level, and not the carcinogenic risk level. The fraction of risk multiplied by 10^ -5 equals the carcinogenic risk level for the carcinogenic compounds. Carcinogenic compounds shown in bold.

Table C-1 Calculated Migration to Groundwater Levels

Page 7 CG523 JBER-E, Alaska

1	2	3	4	5	6	7	8	9	10	11	12
Compounds		Dissolved Concentration in Soil Sample (based on 3 or 4 phase partitioning, whichever is accurate, mg/l)	Maximum Contaminant Level (mg/L)	Residential Land Human Health Risk Based Drinking Water Concentration (mg/l)	Residential Land Soil Moisture Target Concentration (MCL or Risk Based Concentration Multiplied by the DAF…..MCLs values used for compounds with MCLs)	Hypothetical Fraction of Risk Based Concentration (values greater than 1 exceed the risk based target; MCLs not used; if water is non-potable then hypothetical risk is 0)	Check for compliance with regulatory levels (MCLs used for compounds with MCLs: 0= in compliance; 1= not in compliance; potability of groundwater not considered)	Industrial Land Human Health Risk Based Drinking Water Concentration (mg/l)	Industrial Land Soil Moisture Target Concentration (MCL or Risk Based Concentration Multiplied by the DAF…..MCLs values used for compounds with MCLs)	Hypothetical Fraction of Risk Based Concentration (values greater than 1 exceed the risk based target; MCLs not used)	Check for compliance with regulatory levels (MCLs used for compounds with MCLs & Residential RBCs used for compounds without MCLs: 0= in compliance; 1= not in compliance)
Benzene (c & nc)	nc	0.0101	0.005	0.146	1.246E-02	0.0277	0	0.2044	1.246E-02	0.0198	0
Toluene (nc)	nc	0.0045	1.	2.92	2.589E+00	5.91E-04	0	4.088	2.589E+00	4.22E-04	0
Ethylbenzene (c & nc)	nc	0.0772	0.7	3.65	1.823E+00	0.0081	0	5.11	1.823E+00	0.0058	0
Xylenes (total) (nc)	nc	0.09	10.	7.3	1.899E+01	0.0047	0	10.22	2.601E+01	0.0034	0
GRO Aromatics (nc)	nc	3.2206		7.3	1.914E+01	0.1682	0	10.22	2.680E+01	0.1202	0
DRO Aromatics (nc)	nc	2.4303		1.46	3.834E+00	0.6338	0	2.044	5.368E+00	0.4527	0
RRO Aromatics (nc)	nc	2.83E-04		1.095	2.880E+00	9.83E-05	0	1.533	4.033E+00	7.02E-05	0
GRO Aliphatics (nc)	nc	0.1178		183.	4.801E+02	2.45E-04	0	256.	6.721E+02	1.75E-04	0
DRO Aliphatics (nc)	nc	0.0067		3.65	9.602E+00	6.99E-04	0	5.11	1.344E+01	4.99E-04	0
RRO Aliphatics (nc)	nc	8.76E-12		73.	1.920E+02	4.56E-14	0	102.	2.688E+02	3.26E-14	0
Acenaphthene (nc)	nc	8.297E-04		2.19	5.432E+00	1.53E-04	0	3.066	7.605E+00	1.09E-04	0
Acenaphthylene (nc)	nc	2.111E-04		2.19	5.432E+00	3.89E-05	0	3.066	7.605E+00	2.78E-05	0
Anthracene (nc)	nc	3.380E-05		10.95	2.795E+01	1.21E-06	0	15.33	3.913E+01	8.64E-07	0
Benzo(g,h,i)perylene (nc)	nc	4.082E-07		1.095	2.880E+00	1.42E-07	0	1.533	4.033E+00	1.01E-07	0
Fluoranthene (nc)	nc	1.832E-05		1.46	3.806E+00	4.81E-06	0	2.044	5.328E+00	3.44E-06	0
Fluorene (nc)	nc	0.00398		1.46	3.672E+00	0.0011	0	2.044	5.141E+00	7.73E-04	0
Naphthalene (c & nc)	nc	0.12086		0.73	1.781E+00	0.0679	0	1.022	2.493E+00	0.0485	0
Phenanthrene (nc)	nc	0.0015		10.95	2.796E+01	5.37E-05	0	15.33	3.915E+01	3.83E-05	0
Pyrene (nc)	nc	2.523E-05		1.095	2.854E+00	8.84E-06	0	1.533	3.995E+00	6.32E-06	0
Benzene (c & nc)	**c**	0.0101	0.005	0.0155	1.246E-02	0.2608	0	0.026	1.246E-02	0.1552	0
Ethylbenzene (c & nc)	**c**	0.0772	0.7	No Sfo	1.823E+00	0.00E+00	0	No Sfo	1.823E+00	0.00E+00	0
Benzo(a)anthracene (c)	**c**	6.797E-07	0.001	0.0012	2.625E-03	2.22E-04	0	0.002	2.625E-03	1.32E-04	0
Benzo(b)fluoranthene (c)	**c**	1.085E-07	0.001	0.0012	2.630E-03	3.54E-05	0	0.002	2.630E-03	2.11E-05	0
Benzo(k)fluoranthene (c)	**c**	2.619E-07	0.001	0.0117	2.630E-03	8.54E-06	0	0.0196	2.630E-03	5.08E-06	0
Benzo(a)pyrene (c)	**c**	1.141E-07	2.00E-04	1.17E-04	3.069E-04	3.72E-04	0	1.96E-04	5.156E-04	2.21E-04	0
Chrysene (c)	**c**	1.536E-06	0.1	0.1167	2.625E-01	5.01E-06	0	0.196	2.625E-01	2.98E-06	0
Dibenz(a,h)anthracene (c)	**c**	1.531E-06	1.00E-04	1.17E-04	2.631E-04	0.005	0	1.96E-04	2.631E-04	0.003	0
Indeno(1,2,3-cd)pyrene (c)	**c**	1.069E-08	0.001	0.0012	2.631E-03	3.48E-06	0	0.002	2.631E-03	2.07E-06	0
Naphthalene (c & nc)	**c**	0.12086		No Sfo	No Sfo	0.00E+00	0	No Sfo	No Sfo	0.00E+00	0
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Carcinogenic Cumulative Risk						0.2665	0			0.1586	0
Non-carcinogenic Cumulative Risk						0.1103	0			0.0788	0

Values shown in the sixth and tenth columns are the normalized fraction of the risk based level, and not the carcinogenic risk level. The fraction of risk multiplied by 10^ -5 equals the carcinogenic risk level for the carcinogenic compounds. Carcinogenic compounds shown in bold.

">1E+308" indicates that the DAF value is greater can be calculated in excel (i.e. compounds are essentially immobile) and "1/>1E+308" indicates that the risk and or equilibrium concentration is very low (inconsequential).

Table C-1 — Groundwater Ingestion Risk (Measured Concentrations)

Page 8 — **CG523** — **JBER-E, Alaska**

1	2	3	4	5	6	7	8	9	10	11	12
Compounds		Dissolved Concentration Measured in Water Sample (mg/l)	Maximum Contaminant Level (mg/L)	Residential Land Use Human Health Risk Based Water Concentration (mg/l)	Groundwater Compliance Concentration (MCL or Residential Land Use Health Based Water Concentration at down gradient edge of source area; mg/l)	Fraction of Risk Based Concentration (values greater than 1 exceed the risk based target; MCLs not used)	Check for compliance with regulatory levels (MCLs used for compounds with MCLs: 0= in compliance; 1= not in compliance)	Industrial Land Use Human Health Based Water Concentration (mg/l)	Groundwater Compliance Concentration (MCL or Industrial Land Use Health Based Water Concentration at down gradient edge of source area; mg/l)	Fraction of Risk Based Concentration (values greater than 1 exceed the risk based target; MCLs not used)	Check for compliance with regulatory levels (MCLs used for compounds with MCLs: 0= in compliance; 1= not in compliance)
Benzene (c & nc)	nc	2.30E-04	0.005	0.146	0.005	0.0016	0	0.2044	0.005	0.0011	0
Toluene (nc)	nc	0.0016	1.	2.92	1.	5.48E-04	0	4.088	1.	3.91E-04	0
Ethylbenzene (c & nc)	nc	0.0012	0.7	3.65	0.7	3.29E-04	0	5.11	0.7	2.35E-04	0
Xylenes (total) (nc)	nc	0.0032	10.	7.3	7.3	4.36E-04	0	10.22	10.	3.11E-04	0
GRO Aromatics (nc)	nc	0.023		7.3	7.3	0.0032	0	10.22	10.22	0.0023	0
DRO Aromatics (nc)	nc	0.151		1.46	1.46	**0.1034**	0	2.044	2.044	0.0739	0
RRO Aromatics (nc)	nc	0.015		1.095	1.095	0.0137	0	1.533	1.533	0.0098	0
GRO Aliphatics (nc)	nc	0.0319		183.	183.	1.75E-04	0	256.	256.	1.25E-04	0
DRO Aliphatics (nc)	nc	0.263		3.65	3.65	0.0721	0	5.11	5.11	0.0515	0
RRO Aliphatics (nc)	nc	0.018		73.	73.	2.47E-04	0	102.	102.	1.76E-04	0
Acenaphthene (nc)	nc	3.10E-04		2.19	2.19	1.42E-04	0	3.066	3.066	1.01E-04	0
Acenaphthylene (nc)	nc	3.10E-06		2.19	2.19	1.42E-06	0	3.066	3.066	1.01E-06	0
Anthracene (nc)	nc	1.20E-05		10.95	10.95	1.10E-06	0	15.33	15.33	7.83E-07	0
Benzo(g,h,i)perylene (nc)	nc	5.60E-06		1.095	1.095	5.11E-06	0	1.533	1.533	3.65E-06	0
Fluoranthene (nc)	nc	4.30E-06		1.46	1.46	2.95E-06	0	2.044	2.044	2.10E-06	0
Fluorene (nc)	nc	7.40E-04		1.46	1.46	5.07E-04	0	2.044	2.044	3.62E-04	0
Naphthalene (c & nc)	nc	0.0012		0.73	0.73	0.0016	0	1.022	1.022	0.0012	0
Phenanthrene (nc)	nc	1.30E-04		10.95	10.95	1.19E-05	0	15.33	15.33	8.48E-06	0
Pyrene (nc)	nc	4.20E-06		1.095	1.095	3.84E-06	0	1.533	1.533	2.74E-06	0
Benzene (c & nc)	**c**	2.30E-04	0.005	0.0155	0.005	0.0149	0	0.026	0.005	0.0088	0
Ethylbenzene (c & nc)	**c**	0.0012	0.7	No Sfo	0.7	0.00E+00	0	No Sfo	0.7	0.00E+00	0
Benzo(a)anthracene (c)	**c**	2.59E-07	0.001	0.0012	0.001	2.22E-04	0	0.002	0.001	1.32E-04	0
Benzo(b)fluoranthene (c)	**c**	4.13E-08	0.001	0.0012	0.001	3.54E-05	0	0.002	0.001	2.11E-05	0
Benzo(k)fluoranthene (c)	**c**	9.96E-08	0.001	0.0117	0.001	8.54E-06	0	0.0196	0.001	5.08E-06	0
Benzo(a)pyrene (c)	**c**	4.34E-08	2.00E-04	1.17E-04	1.17E-04	3.72E-04	0	1.96E-04	1.96E-04	2.21E-04	0
Chrysene (c)	**c**	5.85E-07	0.1	0.1167	0.1	5.01E-06	0	0.196	0.1	2.98E-06	0
Dibenz(a,h)anthracene (c)	**c**	5.82E-07	1.00E-04	1.17E-04	1.00E-04	0.005	0	1.96E-04	1.00E-04	0.003	0
Indeno(1,2,3-cd)pyrene (c)	**c**	4.06E-09	0.001	0.0012	0.001	3.48E-06	0	0.002	0.001	2.07E-06	0
Naphthalene (c & nc)	**c**	0.0012		No Sfo	No Sfo	0.00E+00	0	No Sfo	No Sfo	0.00E+00	0
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Carcinogenic Cumulative Risk						0.0205	0			0.0122	0
Non-carcinogenic Cumulative Risk						0.0052	0			0.0037	0

Values shown in the seventh and eleventh columns are the normalized fraction of the risk based level, and not the carcinogenic risk level. The fraction of risk multiplied by 10^ -5 equals the carcinogenic risk level for the carcinogenic compounds. Carcinogenic compounds shown in bold.

If the groundwater is non-potable then groundwater ingestion risk is zero.

Table C-1 — Potential Cumulative Risk Assuming All Pathways Complete

DRO, GRO and RRO not included in cumulative risk calculations

Page 9 — CG523 — JBER-E, Alaska

1	2	3	4	5	6	7	8	9	10	11	12	13	14
Compounds		Fraction of Soil Direct Contact Risk, Residential Site	Fraction of Outdoor Air Inhalation Risk, Residential Site	Fraction of Indoor Air Inhalation Risk, Residential Site	Fraction of Groundwater Ingestion Risk, Residential Site	Sum of Fraction of Risk Values for Residential Site	Residential Site Check for compliance with risk levels (0= in compliance; 1= not in compliance)	Fraction of Soil Direct Contact Risk, Industrial Site	Fraction of Outdoor Air Inhalation Risk, Industrial Site	Fraction of Indoor Air Inhalation Risk, Industrial Site	Fraction of Groundwater Ingestion Risk, Industrial Site	Sum of Fraction of Risk Values for Industrial Site	Industrial Site Check for compliance with risk levels (0= in compliance; 1= not in compliance)
Benzene (c & nc)	nc	5.18E-05	2.93E-08	7.41E-06	0.0016	0.0016	0	2.57E-06	9.92E-09	1.77E-06	0.0011	0.0011	0
Toluene (nc)	nc	4.19E-06	1.41E-09	3.04E-07	5.48E-04	5.52E-04	0	2.08E-07	4.76E-10	7.25E-08	3.91E-04	3.92E-04	0
Ethylbenzene (c & nc)	nc	2.02E-04	6.43E-09	1.04E-06	3.29E-04	5.32E-04	0	1.00E-05	2.17E-09	2.49E-07	2.35E-04	2.45E-04	0
Xylenes (total) (nc)	nc	1.86E-04	1.54E-07	2.55E-05	4.36E-04	6.47E-04	0	9.21E-06	5.22E-08	6.07E-06	3.11E-04	3.26E-04	0
GRO Aromatics (nc)	nc												
DRO Aromatics (nc)	nc												
RRO Aromatics (nc)	nc												
GRO Aliphatics (nc)	nc												
DRO Aliphatics (nc)	nc												
RRO Aliphatics (nc)	nc												
Acenaphthene (nc)	nc	1.04E-04	0.00E+00	0.00E+00	1.42E-04	2.45E-04	0	1.55E-05	0.00E+00	0.00E+00	1.01E-04	1.17E-04	0
Acenaphthylene (nc)	nc	6.79E-06	0.00E+00	0.00E+00	1.42E-06	8.21E-06	0	1.01E-06	0.00E+00	0.00E+00	1.01E-06	2.02E-06	0
Anthracene (nc)	nc	3.70E-06	0.00E+00	0.00E+00	1.10E-06	4.79E-06	0	4.04E-07	0.00E+00	0.00E+00	7.83E-07	1.19E-06	0
Benzo(g,h,i)perylene (nc)	nc	4.07E-05	0.00E+00	0.00E+00	5.11E-06	4.59E-05	0	6.08E-06	0.00E+00	0.00E+00	3.65E-06	9.73E-06	0
Fluoranthene (nc)	nc	4.82E-05	0.00E+00	0.00E+00	2.95E-06	5.12E-05	0	7.19E-06	0.00E+00	0.00E+00	2.10E-06	9.30E-06	0
Fluorene (nc)	nc	8.10E-04	0.00E+00	0.00E+00	5.07E-04	0.0013	0	1.03E-04	0.00E+00	0.00E+00	3.62E-04	4.65E-04	0
Naphthalene (c & nc)	nc	0.0044	2.21E-06	8.36E-05	0.0016	0.0061	0	4.69E-04	7.48E-07	1.99E-05	0.0012	0.0017	0
Phenanthrene (nc)	nc	8.75E-05	0.00E+00	0.00E+00	1.19E-05	9.94E-05	0	9.56E-06	0.00E+00	0.00E+00	8.48E-06	1.80E-05	0
Pyrene (nc)	nc	6.43E-05	0.00E+00	0.00E+00	3.84E-06	6.82E-05	0	9.59E-06	0.00E+00	0.00E+00	2.74E-06	1.23E-05	0
Benzene (c & nc)	**c**	1.39E-04	2.94E-07	7.43E-05	0.0149	0.0151	0	2.02E-05	8.29E-08	1.77E-05	0.0088	0.0089	0
Ethylbenzene (c & nc)	**c**	0.00E+00	3.03E-07	4.93E-05	0.00E+00	4.96E-05	0	0.00E+00	8.54E-08	1.17E-05	0.00E+00	1.18E-05	0
Benzo(a)anthracene (c)	**c**	0.0068	6.24E-08	5.26E-09	2.22E-04	0.007	0	0.0027	1.76E-08	1.25E-09	1.32E-04	0.0029	0
Benzo(b)fluoranthene (c)	**c**	0.0059	1.46E-08	2.35E-10	3.54E-05	0.006	0	0.0024	4.10E-09	5.60E-11	2.11E-05	0.0024	0
Benzo(k)fluoranthene (c)	**c**	8.80E-04	3.48E-09	5.57E-11	8.54E-06	8.89E-04	0	3.58E-04	9.80E-10	1.33E-11	5.08E-06	3.63E-04	0
Benzo(a)pyrene (c)	**c**	0.0471	1.93E-07	3.81E-09	3.72E-04	0.0474	0	0.0191	5.43E-08	9.07E-10	2.21E-04	0.0194	0
Chrysene (c)	**c**	7.37E-05	1.18E-09	5.70E-11	5.01E-06	7.87E-05	0	3.00E-05	3.33E-10	1.36E-11	2.98E-06	3.29E-05	0
Dibenz(a,h)anthracene (c)	**c**	**0.1392**	3.58E-06	2.71E-08	0.005	**0.1441**	0	0.0566	1.01E-06	6.45E-09	0.003	0.0596	0
Indeno(1,2,3-cd)pyrene (c)	**c**	0.0055	2.64E-09	2.25E-11	3.48E-06	0.0055	0	0.0022	7.44E-10	5.35E-12	2.07E-06	0.0022	0
Naphthalene (c & nc)	**c**	0.00E+00	9.68E-06	3.65E-04	0.00E+00	3.75E-04	0	0.00E+00	2.73E-06	8.70E-05	0.00E+00	8.97E-05	0
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Carcinogenic Cumulative Risk						0.2265						0.0959	0
Non-carcinogenic Cumulative Risk						0.0113						0.0044	0

Values shown in the second through sixth and eighth through twelfth columns are the normalized fraction of the risk based level, and not the carcinogenic risk level. The fraction of risk multiplied by 10^ -5 equals the carcinogenic risk level for the carcinogenic compounds. Carcinogenic compounds shown in bold.

Table C-1	Cumulative Risk for Pathways Complete at Present Time								DRO, GRO and RRO not included in cumulative risk calculations			
Page 10	CG523				JBER-E, Alaska							
1	2	3	4	5	6	7	8	9	10	11	12	13	14
Compounds		Fraction of Soil Direct Contact Risk, Residential Site	Fraction of Outdoor Air Inhalation Risk, Residential Site	Fraction of Indoor Air Inhalation Risk, Residential Site	Fraction of Groundwater Ingestion Risk, Residential Site	Sum of Fraction of Risk Values for Residential Site	Residential Site Check for compliance with risk levels (0= in compliance; 1= not in compliance)	Fraction of Soil Direct Contact Risk, Industrial Site	Fraction of Outdoor Air Inhalation Risk, Industrial Site	Fraction of Indoor Air Inhalation Risk, Industrial Site	Fraction of Groundwater Ingestion Risk, Industrial Site	Sum of Fraction of Risk Values for Industrial Site	Industrial Site Check for compliance with risk levels (0= in compliance; 1= not in compliance)
Benzene (c & nc)	nc	5.18E-05	2.93E-08	0.00E+00	0.00E+00	5.18E-05	0	2.57E-06	9.92E-09	0.00E+00	0.00E+00	2.58E-06	0
Toluene (nc)	nc	4.19E-06	1.41E-09	0.00E+00	0.00E+00	4.19E-06	0	2.08E-07	4.76E-10	0.00E+00	0.00E+00	2.08E-07	0
Ethylbenzene (c & nc)	nc	2.02E-04	6.43E-09	0.00E+00	0.00E+00	2.02E-04	0	1.00E-05	2.17E-09	0.00E+00	0.00E+00	1.00E-05	0
Xylenes (total) (nc)	nc	1.86E-04	1.54E-07	0.00E+00	0.00E+00	1.86E-04	0	9.21E-06	5.22E-08	0.00E+00	0.00E+00	9.26E-06	0
GRO Aromatics (nc)	nc												
DRO Aromatics (nc)	nc												
RRO Aromatics (nc)	nc												
GRO Aliphatics (nc)	nc												
DRO Aliphatics (nc)	nc												
RRO Aliphatics (nc)	nc												
Acenaphthene (nc)	nc	1.04E-04	0.00E+00	0.00E+00	0.00E+00	1.04E-04	0	1.55E-05	0.00E+00	0.00E+00	0.00E+00	1.55E-05	0
Acenaphthylene (nc)	nc	6.79E-06	0.00E+00	0.00E+00	0.00E+00	6.79E-06	0	1.01E-06	0.00E+00	0.00E+00	0.00E+00	1.01E-06	0
Anthracene (nc)	nc	3.70E-06	0.00E+00	0.00E+00	0.00E+00	3.70E-06	0	4.04E-07	0.00E+00	0.00E+00	0.00E+00	4.04E-07	0
Benzo(g,h,i)perylene (nc)	nc	4.07E-05	0.00E+00	0.00E+00	0.00E+00	4.07E-05	0	6.08E-06	0.00E+00	0.00E+00	0.00E+00	6.08E-06	0
Fluoranthene (nc)	nc	4.82E-05	0.00E+00	0.00E+00	0.00E+00	4.82E-05	0	7.19E-06	0.00E+00	0.00E+00	0.00E+00	7.19E-06	0
Fluorene (nc)	nc	8.10E-04	0.00E+00	0.00E+00	0.00E+00	8.10E-04	0	1.03E-04	0.00E+00	0.00E+00	0.00E+00	1.03E-04	0
Naphthalene (c & nc)	nc	0.0044	2.21E-06	0.00E+00	0.00E+00	0.0044	0	4.69E-04	7.48E-07	0.00E+00	0.00E+00	4.70E-04	0
Phenanthrene (nc)	nc	8.75E-05	0.00E+00	0.00E+00	0.00E+00	8.75E-05	0	9.56E-06	0.00E+00	0.00E+00	0.00E+00	9.56E-06	0
Pyrene (nc)	nc	6.43E-05	0.00E+00	0.00E+00	0.00E+00	6.43E-05	0	9.59E-06	0.00E+00	0.00E+00	0.00E+00	9.59E-06	0
Benzene (c & nc)	**c**	1.39E-04	2.94E-07	0.00E+00	0.00E+00	1.40E-04	0	2.02E-05	8.29E-08	0.00E+00	0.00E+00	2.03E-05	0
Ethylbenzene (c & nc)	**c**	0.00E+00	3.03E-07	0.00E+00	0.00E+00	3.03E-07	0	0.00E+00	8.54E-08	0.00E+00	0.00E+00	8.54E-08	0
Benzo(a)anthracene (c)	**c**	0.0068	6.24E-08	0.00E+00	0.00E+00	0.0068	0	0.0027	1.76E-08	0.00E+00	0.00E+00	0.0027	0
Benzo(b)fluoranthene (c)	**c**	0.0059	1.46E-08	0.00E+00	0.00E+00	0.0059	0	0.0024	4.10E-09	0.00E+00	0.00E+00	0.0024	0
Benzo(k)fluoranthene (c)	**c**	8.80E-04	3.48E-09	0.00E+00	0.00E+00	8.80E-04	0	3.58E-04	9.80E-10	0.00E+00	0.00E+00	3.58E-04	0
Benzo(a)pyrene (c)	**c**	0.0471	1.93E-07	0.00E+00	0.00E+00	0.0471	0	0.0191	5.43E-08	0.00E+00	0.00E+00	0.0191	0
Chrysene (c)	**c**	7.37E-05	1.18E-09	0.00E+00	0.00E+00	7.37E-05	0	3.00E-05	3.33E-10	0.00E+00	0.00E+00	3.00E-05	0
Dibenz(a,h)anthracene (c)	**c**	**0.1392**	3.58E-06	0.00E+00	0.00E+00	**0.1392**	0	0.0566	1.01E-06	0.00E+00	0.00E+00	0.0566	0
Indeno(1,2,3-cd)pyrene (c)	**c**	0.0055	2.64E-09	0.00E+00	0.00E+00	0.0055	0	0.0022	7.44E-10	0.00E+00	0.00E+00	0.0022	0
Naphthalene (c & nc)	**c**	0.00E+00	9.68E-06	0.00E+00	0.00E+00	9.68E-06	0	0.00E+00	2.73E-06	0.00E+00	0.00E+00	2.73E-06	0
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Carcinogenic Cumulative Risk						0.2055						0.0835	0
Non-carcinogenic Cumulative Risk						0.006						6.44E-04	0

Values shown in the second through sixth and eighth through twelfth columns are the normalized fraction of the risk based level, and not the carcinogenic risk level. The fraction of risk multiplied by 10^ -5 equals the carcinogenic risk level for the carcinogenic compounds. Carcinogenic compounds shown in bold.

Table C-1 Partitioning into Groundwater & Surface Water

Page 11 CG523 JBER-E, Alaska

1	2	3	4	5	6	7	8	9
Compounds		Calculated Equilibrium Conc. (from soil data & solver or goal seek) (mg/L)	Measured Dissolved Phase Conc. (mg/L)	Groundwater Compliance Concentration (MCL or Residential Land Use Health Based Water Concentration at down gradient edge of source area; mg/l)	Check for vadose zone fill potential (DAF of 3.3; 0 =suitable for vadose zone fill; 1 =not suitable for vadose zone fill; "ND" input concentrations not assessed)	Check for saturated zone fill potential (DAF of 1; 0 =suitable for saturated zone fill; 1 =not suitable for saturated zone fill; "ND" input concentrations not assessed)	Ambient Water Quality Criteria (mg/L)	Check for surface water body fill potential (DAF of 1; 0 =suitable for fill in surface water; 1 =not suitable for fill in surface water; "ND" input concentrations not assessed)
Benzene		0.0101	2.30E-04	0.005	0	0	0.005	0
Toluene		0.0045	0.0016	1.	0	0		
Ethylbenzene		0.0772	0.0012	0.7	0	0		
Xylene		0.09	0.0032	7.3	0	0		
GRO Aromatics		3.2206	0.023	7.3	0	0		
DRO Aromatics		2.4303	0.151	1.46	0	0		
RRO Aromatics		2.83E-04	0.015	1.095	0	0		
GRO Aliphatics		0.1178	0.0319	183.	0	0		
DRO Aliphatics		0.0067	0.263	3.65	0	0		
RRO Aliphatics		8.76E-12	0.018	73.	0	0		
Acenaphthene		8.30E-04	3.10E-04	2.19	0	0		
Acenaphthylene		2.11E-04	3.10E-06	2.19	0	0		
Anthracene		3.38E-05	1.20E-05	10.95	0	0		
Benzo(g,h,i)perylene		4.08E-07	5.60E-06	1.095	0	0		
Fluoranthene		1.83E-05	4.30E-06	1.46	0	0		
Fluorene		0.004	7.40E-04	1.46	0	0		
Naphthalene		0.1209	0.0012	0.73	0	0		
Phenanthrene		0.0015	1.30E-04	10.95	0	0		
Pyrene		2.52E-05	4.20E-06	1.095	0	0		
Benzo (a) Anthracene		6.80E-07	2.59E-07	0.001	0	0		
Benzo (b) fluoranthene		1.09E-07	4.13E-08	0.001	0	0		
Benzo (k) fluoranthene		2.62E-07	9.96E-08	0.001	0	0		
Benzo (a) pyrene		1.14E-07	4.34E-08	1.17E-04	0	0		
Chrysene		1.54E-06	5.85E-07	0.1	0	0		
Dibenz (a,h) anthracene		1.53E-06	5.82E-07	1.00E-04	0	0		
Indeno (1,2,3-cd) pyrene		1.07E-08	4.06E-09	0.001	0	0		
TAH		0.1817	0.0062				0.01	0
TAqH		0.3092	0.0086				0.015	0
DRO sheen (mg/kg)							230	1
				sum	0	0	sum	1

These calculations may be used to assess the potential limitations on the off-site transport and placement of hydrocarbon impacted soil.

Table C-1 Site Status Summary

Page 12 CG523 JBER-E, Alaska

1	2	3	4	5	6	7	8
		Cumulative Risks for Residential Site (rounded to 1 significant digit)	soil ingestion check for compliance with risk criteria (0= in compliance; 1 or >1 = not in compliance; number is the number of carcinogenic and non-carcinogenic direct contact criteria exceeded)	migration to outdoor air check for compliance with risk criteria (0= in compliance; 1= not in compliance)	migration to indoor air check for compliance with risk criteria (0= in compliance; 1= not in compliance)	groundwater ingestion check for compliance with risk criteria (0= in compliance; 1 or >1 = not in compliance; number is the number of carcinogenic and non-carcinogenic direct contact criteria exceeded)	migration to groundwater check for compliance (0= in compliance; 1 = not in compliance)
Potential Carcinogenic Cumulative Fraction of Risk		**0.2**	0			0	
Potential Non-carcinogenic Cumulative Risk		**0.01**	0			0	
Existing Carcinogenic Cumulative Fraction of Risk		0.2055					
Existing non-carcinogenic Cumulative Risk		0.006					
GRO Aromatics			0	0	0	0	0
DRO Aromatics			0	0	0	0	0
RRO Aromatics			0	0	0	0	0
GRO Aliphatics			0	0	0	0	0
DRO Aliphatics			0	0	0	0	0
RRO Aliphatics			0	0	0	0	0
check for ultimate GRO, DRO, RRO compliance			**0**				

Site conditions meet the ADEC human health risk standard established in 18 AAC 75.325. Site conditions are protective of human health under an unrestricted (residential) landuse scenario.	**0**
Migration to groundwater criteria are attained in surface and subsurface soils as per 18 AAC 75.340. These calculations may be used to support a Cleanup Complete determination.	**0**
Site meets the risk standard and migration to groundwater criteria established in the contaminanted site regulations and may be closed as per 18 AAC 75.380 (provided ecological criteria also met). Eligible for a 'cleanup complete' determination	
Site soils appear suitable for use as vadose zone fill	
Site soils appear suitable for use as saturated zone fill	
Site soils should not be used as wetlands or surface water fill	
A DRO polar fraction may be present, the risk posed by the polar fraction is not known.	

C-2 Source Files (included with Appendix B on CD)

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APPENDIX D
ADEC Ecoscoping Checklist

D-1 Ecoscoping Form

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D-1 Ecoscoping Form

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ECOSCOPING FORM

Site Name: CG523 (ST703)
Completed by: Phillip Stallings
Date: May 15, 2014

Instructions: Follow the italicized instructions in each section below. "Off-ramps," where the evaluation ends before completing all of the sections, can be taken when indicated by the instructions. Comment boxes should be used to help support your answers.

1. Direct Visual Impacts and Acute Toxicity

Are direct impacts that may result from the site contaminants evident, or is acute toxicity from high contaminant concentrations suspected? C*heck the appropriate box.*

☐ Yes – D*escribe observations below and evaluate all of the remaining sections <u>without taking any off-ramps</u>.*
☒ No – *Go to next section.*

Comments:

2. Terrestrial and Aquatic Exposure Routes

Check each terrestrial and aquatic route that could occur at the site.

<u>Terrestrial Exposure Routes</u>

☐ Exposure to water-borne contaminants as a result of wading or swimming in contaminated waters or ingesting contaminated water.
☐ Contaminant uptake in terrestrial plants whose roots are in contact with contaminated surface water.
☐ Contaminant migration via saturated or unsaturated groundwater zones and discharge at upland "seep" locations (not associated with a wetland or waterbody).
☐ Contaminant uptake by terrestrial plants whose roots are in contact with soil moisture or groundwater present within the root zone (generally no more than 4 feet below ground surface.
☐ Particulates deposited on plants directly or from rain splash.
☐ Incidental ingestion and/or exposure while animals grub for food, burrow (up to 2 feet for small animals or 6 feet for large animals), or groom.

☐ Inhalation of fugitive dust or vapors disturbed by foraging or burrowing activities.

☐ Bioaccumulatives (other than PAHs, which bioaccumulate more readily in aquatic environments) taken up by soil invertebrates, which are in turn eaten by higher food chain organisms (see the *Policy Guidance on Developing Conceptual Site Models*).

☐ Other site-specific exposure pathways.

Aquatic Exposure Routes

☐ Contaminated surface runoff migration to water bodies through swales, drainage ditches, or overland flow.

☐ Aquatic receptors exposed through osmotic exchange, respiration, or ventilation of surface waters.

☐ Contaminant migration via saturated or unsaturated groundwater zones and discharge at "seep" locations along banks or directly to surface water.

☐ Deposition into sediments from upwelling of contaminated groundwater.

☐ Aquatic receptors may be exposed directly to contaminated sediments through foraging or burrowing, or indirectly exposed due to osmotic exchange, respiration, or ventilation of sediment pore water.

☐ Aquatic plants rooted in contaminated sediments.

☐ Bioaccumulatives (see the *Policy Guidance on Developing Conceptual Site Models*) taken up by sediment invertebrates, which are in turn eaten by higher food chain organisms.

☐ Other site-specific exposure pathways.

If any of the above boxes are checked, go on to the next section. If none are checked, end the evaluation and check the box below.

☒ OFF-RAMP: NO FURTHER ECOLOGICAL EVALUATION NECESSARY

Comments:

3. Habitat

Check all that may apply. See Ecoscoping Guidance for additional help.

☐ Habitat that could be affected by the contamination supports valued species (i.e., species that are regulated, used for subsistence, have ceremonial importance, have commercial value, or provide recreational opportunity).

☐ Critical habitat or anadromous stream in an area that could be affected by the contamination.

☐ Habitat that is important to the region that could be affected by the contamination.

☐ Contamination is in a park, preserve, or wildlife refuge.

If any of the above boxes are checked, go on to the next scoping factor. If none are checked, end the evaluation and check the box below.

☐ OFF-RAMP: NO FURTHER ECOLOGICAL EVALUATION NECESSARY

Comments:

4. Contaminant Quantity

Check all that may apply. See Ecoscoping Guidance for additional help.

☐ Endangered or threatened species are present.

☐ The aquatic environment is or could be affected.

☐ Non-petroleum contaminants may be present, or the total area of petroleum-contaminated surface soil exceeds one-half acre.

If any of the above boxes are checked, go on to the next scoping factor. If none are checked, end the evaluation and check the box below.

☐ OFF-RAMP: NO FURTHER ECOLOGICAL EVALUATION NECESSARY

Comments:

5. Toxicity Determination

Check all that apply.

☐ Bioaccumulative chemicals are present (see *Policy Guidance on Developing Conceptual Site Models*).

☐ Contaminants exceed benchmark levels (see the Ecological Benchmark Tool in RAIS, available at: http://rais.ornl.gov/tools/eco_search.php).

If either box is checked, complete a detailed Ecological Conceptual Site Model (see DEC's Policy Guidance on Developing Conceptual Site Models*) and submit it with the form to your DEC project manager.*

If neither box is checked, check the box below and submit this form to your DEC project manager.

☐ OFF-RAMP: NO FURTHER ECOLOGICAL EVALUATION NECESSARY

Comments: