APPENDIX Q ANALYTICAL RESULTS OF SEDIMENT SAMPLING NEAR THE MARINE TERMINAL IN COOK INLET

Q.1 Sediment Transport Sampling and Monitoring - Phase 1 and Phase 2

Q.2 Test Pit Dredge Material Characterization Report

APPENDIX Q.1 SEDIMENT TRANSPORT SAMPLING AND MONITORING - PHASE 1 AND PHASE 2

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SEDIMENT TRANSPORT SAMPLING AND MONITORING – PHASE 1

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0	4.6	Added clarification for Figure 14- Figure 17
0	4.7	Added clarification concerning the OBS data quality
0	5.0	Revised conclusions and recommendations

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1.0 PURPOSE AND SCOPE

The Sediment Transport Sampling and Monitoring work has been designed to provide input data, validation and benchmarking of sediment infill modeling for the proposed AK LNG marine facilities. This work is being performed in phases. The field work for the first phase was completed in Apr-15 and covers the offshore area of the project in water depths deeper than -20 ft MLLW. A second phase to cover the near shore area in water depths as shallow as -5 ft MLLW will be conducted in Aug-15.

The purpose of the sediment transport sampling and monitoring is to collect current velocity, bedload and suspended load sediment transport data, which will be used to calibrate and validate an offshore sediment transport model for the Nikiski area. The sediment transport model will be utilized to design the dredging project for the Nikiski terminal and to estimate the infill rates at the site to develop long term maintenance dredging costs.

Sediment transport, both bedload transport and suspended load transport, was monitored at the two test trench locations by Nikiski over a 4-day period between 21-Apr-15 and 24-Apr-15. In addition, current velocity distribution (as a function of depth) and water level was also monitored. The water level, current velocity, and sediment transport data will be used to calibrate and validate the sediment transport model. In order to monitor the bedload transport rate, a Helley-Smith bedload sampler was deployed at 4 different sites within or proximal to the two test trench locations. In total, 21 bedload samples were collected and analyzed for bedload sediment mass and for sediment grain size distribution at the seabed. Suspended sediment concentration (SSC) data were collected by pumping water samples from selected depths and at specific times to be later analyzed for total suspended solids (TSS) in the University of Alaska Anchorage (UAA) laboratory. Also, suspended sediment concentrations were inferred from turbidity as measured by optical backscatter sensors (OBS). About 5 vertical OBS turbidity casts were taken each day. In addition to the OBS turbidity casts, a second OBS was deployed near the surface at a depth of 6.6 ft over the 4-day period. Nearby water samples were used to calibrate the OBS. Finally, selected water samples were analyzed for suspended sediment grain size distribution.

2.0 OBJECTIVES

In order to support the sedimentation modeling, the sediment transport sampling and monitoring needs to meet these objectives:

1. Collect representative sediment transport data covering the two test trench locations, sufficient to calibrate and validate a sediment transport model.
2. Collect current velocity distribution data (as a function of depth) to determine depth-averaged current velocity and to estimate near-bottom shear stress.
3. Directly measure the bedload transport rate for a range of current velocities and for different phases of the tide.
4. Determine the grain size distribution of sediment transported as bedload.
5. Estimate the vertical distribution of SSC and the variation of SSC with time, based on direct measurements of SSC from water samples collected at a range of water depths and inferred from measurements of turbidity.
6. Calibrate the OBS using direct measurements of total SSC from nearby water samples.
7. Determine the effective grain size distribution of the suspended sediment.

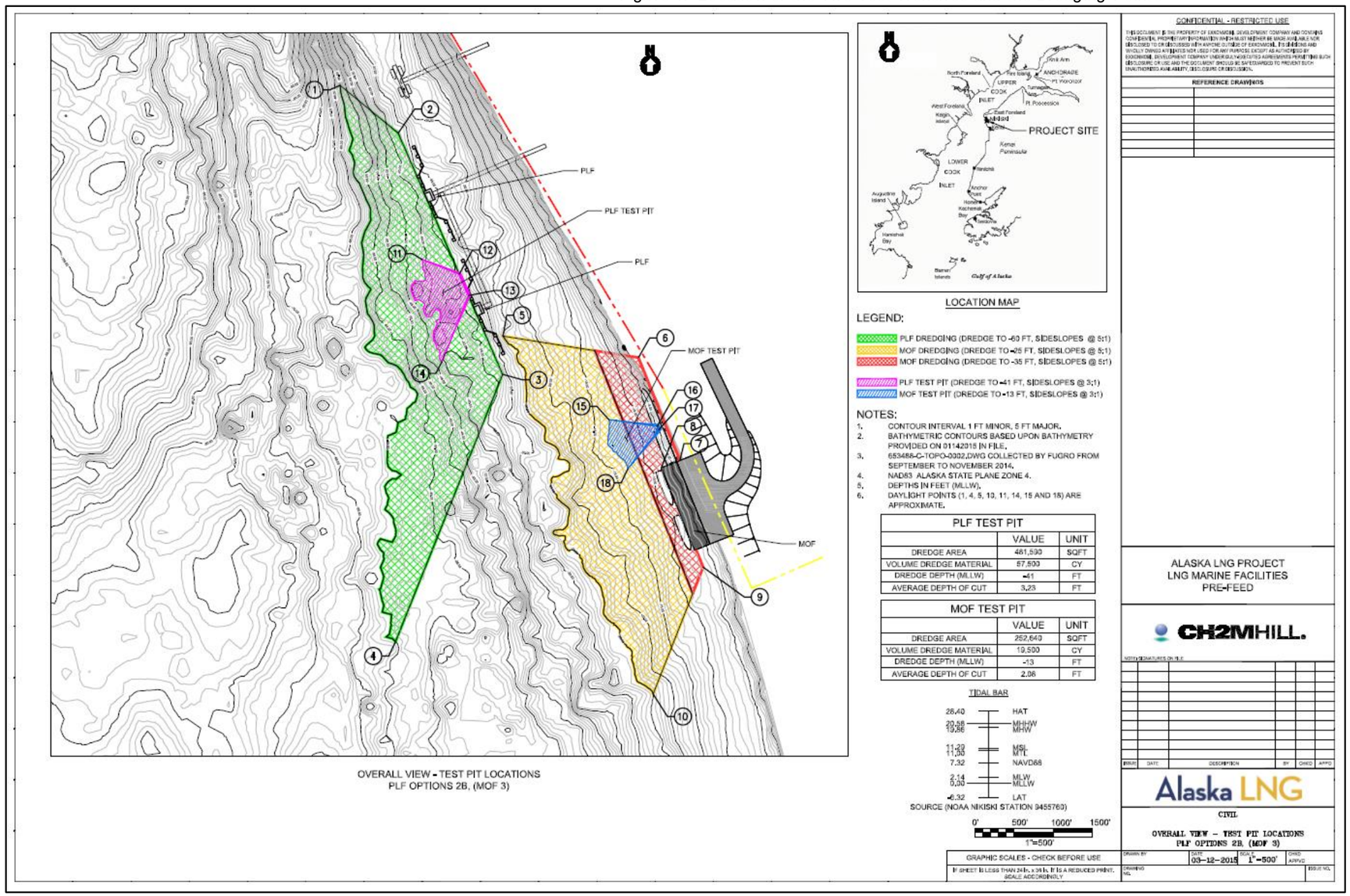
3.0 METHODOLOGY

The following methodology was used:

3.1 SAMPLING TIME PERIOD AND LOCATIONS

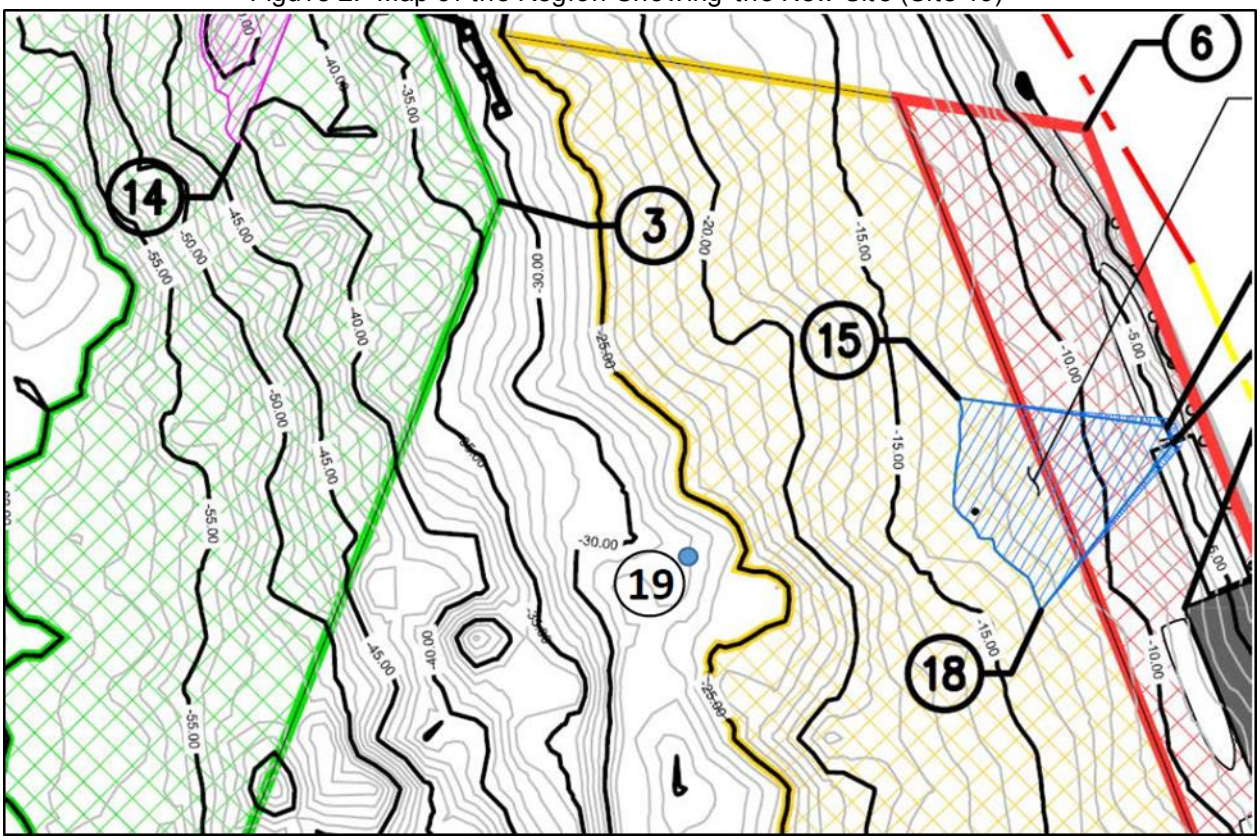
Two test trenches are being contemplated for the Nikiski area (Figure 1). One test trench is at a water depth of approximately -40 ft MLLW, and the other is at a relatively shallow water depth of approximately -13 ft MLLW. The original plan was to spend two days sampling at the deeper test trench and two days at the shallower test trench. Later, however, the Captain of the vessel, the Maritime Maid, determined that the shallow test trench was too shallow for safe access. As a result, sampling was conducted for 3 days at three locations in the footprint of the deeper test trench (sites 11, 14, and 13 as shown in Figure 1). Then, on the fourth day, sampling occurred at a new site (termed site 19, N 60°, 39 17.79'', W151° 22 29.01 as shown in Figure 2), which was offshore of the shallow test trench at a water depth of approximately -18 ft MLLW (sufficiently deep water for the Maritime Maid).

Figure 1: Location of the Two Test Trenches and the Dredging Points



DREDGING POINTS				
POINT #	NORTHING	EASTING	LATITUDE	LONGITUDE
1	2,438,636.9445	1,391,115.2482	N60° 40' 04.30"	W151° 23' 24.35"
2	2,438,017.7127	1,391,863.8385	N60° 39' 58.36"	W151° 23' 09.07"
3	2,434,894.6051	1,393,207.7877	N60° 39' 27.89"	W151° 22' 40.78"
4	2,431,433.7422	1,391,829.3805	N60° 38' 53.53"	W151° 23' 06.97"
5	2,435,369.4759	1,393,212.7438	N60° 39' 32.76"	W151° 22' 40.89"
6	2,435,110.9803	1,394,956.7171	N60° 39' 30.38"	W151° 22' 05.79"
7	2,433,779.3434	1,395,491.6550	N60° 39' 17.38"	W151° 21' 54.50"
8	2,433,690.5330	1,395,270.5767	N60° 39' 16.46"	W151° 21' 58.90"
9	2,432,397.6696	1,395,789.9308	N60° 39' 03.84"	W151° 21' 47.95"
10	2,430,755.3216	1,395,146.4556	N60° 38' 47.53"	W151° 22' 00.17"
11	2,436,361.7798	1,392,171.4428	N60° 39' 42.32"	W151° 23' 02.20"
12	2,436,191.2653	1,392,649.7960	N60° 39' 40.54"	W151° 22' 52.52"
13	2,435,915.6744	1,392,768.3878	N60° 39' 37.85"	W151° 22' 50.03"
14	2,435,059.4059	1,392,427.3662	N60° 39' 29.35"	W151° 22' 56.51"
15	2,434,308.2181	1,394,574.8789	N60° 39' 22.40"	W151° 22' 13.11"
16	2,434,221.5116	1,395,199.1962	N60° 39' 21.67"	W151° 22' 00.55"
17	2,434,174.7584	1,395,217.4505	N60° 39' 21.22"	W151° 22' 00.17"
18	2,433,674.6673	1,394,822.2055	N60° 39' 16.21"	W151° 22' 07.89"

Figure 2: Map of the Region Showing the New Site (Site 19)

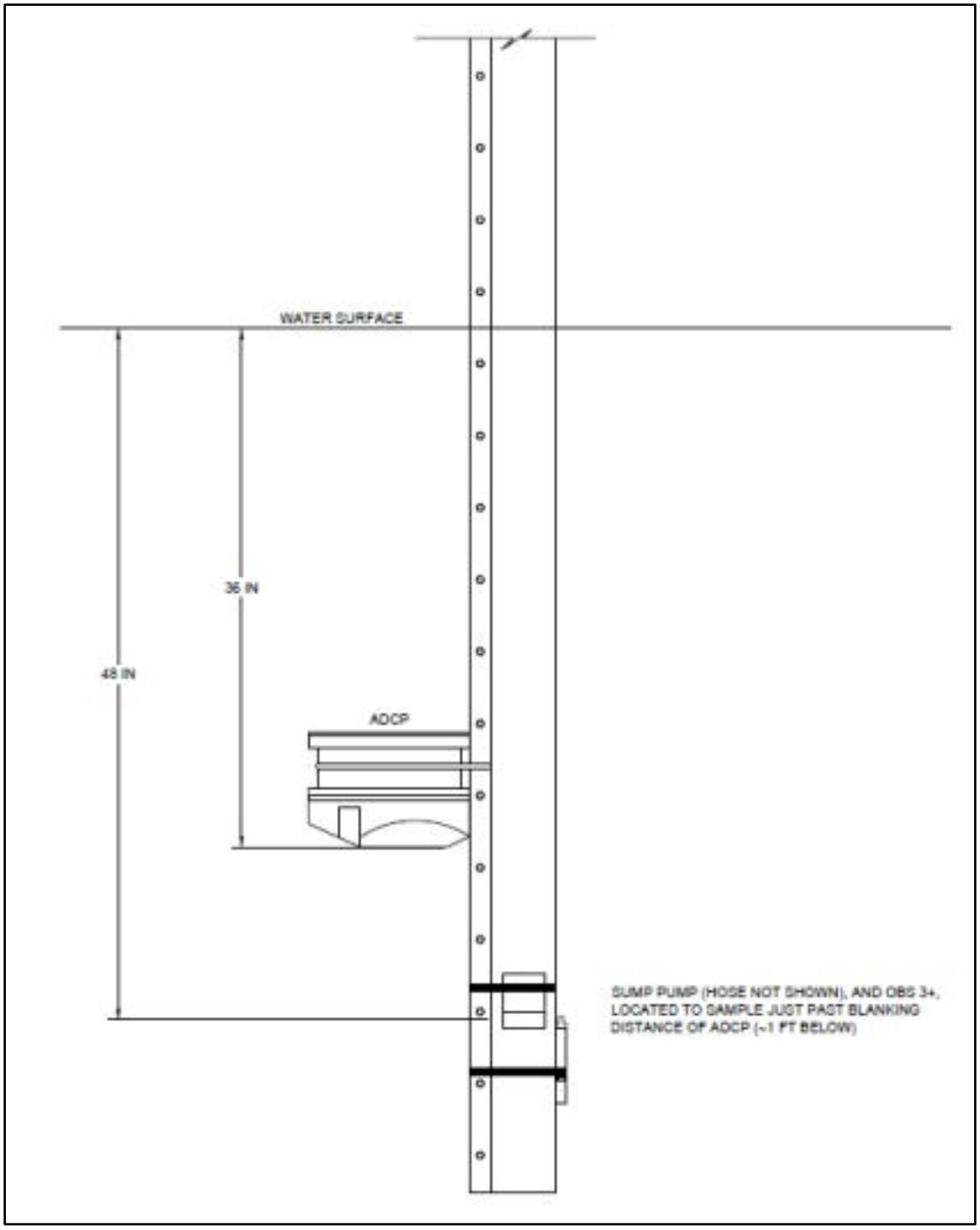


3.2 WATER VELOCITY MONITORING

A ship-mounted, downward facing Acoustic Doppler Current Profiler (ADCP) was deployed from a mast designed and built for this sampling effort as shown in Figure 3.

The ADCP collected current velocity and acoustic backscatter data as a function of depth over the water column throughout the deployment. The ADCP used was an RD Instruments WorkHorse Sentinel (600 KHz) provided by ASL. The ADCP instrument was set to collect current velocity data in vertical bins of 0.5 m (1.64 ft) at a rate of 1 Hz.

Figure 3: ADCP Mounting System, ADCP, Sump Pump, and OBS 3+



3.3 BEDLOAD TRANSPORT MONITORING

Monitoring of bedload sediment transport was carried out using a Helley-Smith bedload sampler (Model B075) as shown in Figure 4 and Figure 5. The 167-lb sampler was deployed by an onboard "line-puller" using a steel cable. In total, 21 bedload samples were collected. While a larger number of samples is suggested by the manufacturer (Appendix A), 21 samples was deemed sufficient for our purposes given the project schedule and the availability of appropriate support vessels. The Helley-Smith bedload samplers were equipped with 250-µm nets which collected larger solid bedload material while allowing water and finer material to pass through. They were also outfitted with tilt sensors, which allowed the operators to verify that the devices were nearly horizontal (within 10 degrees) during the deployment. Detailed operating instructions, derived in part from DHV CONSULTANTS et al. [1] were provided to the operators in a detailed work plan [2].

Figure 4: Helley-Smith Bedload Sampler Resting on the Sediment Bed (Schematic)

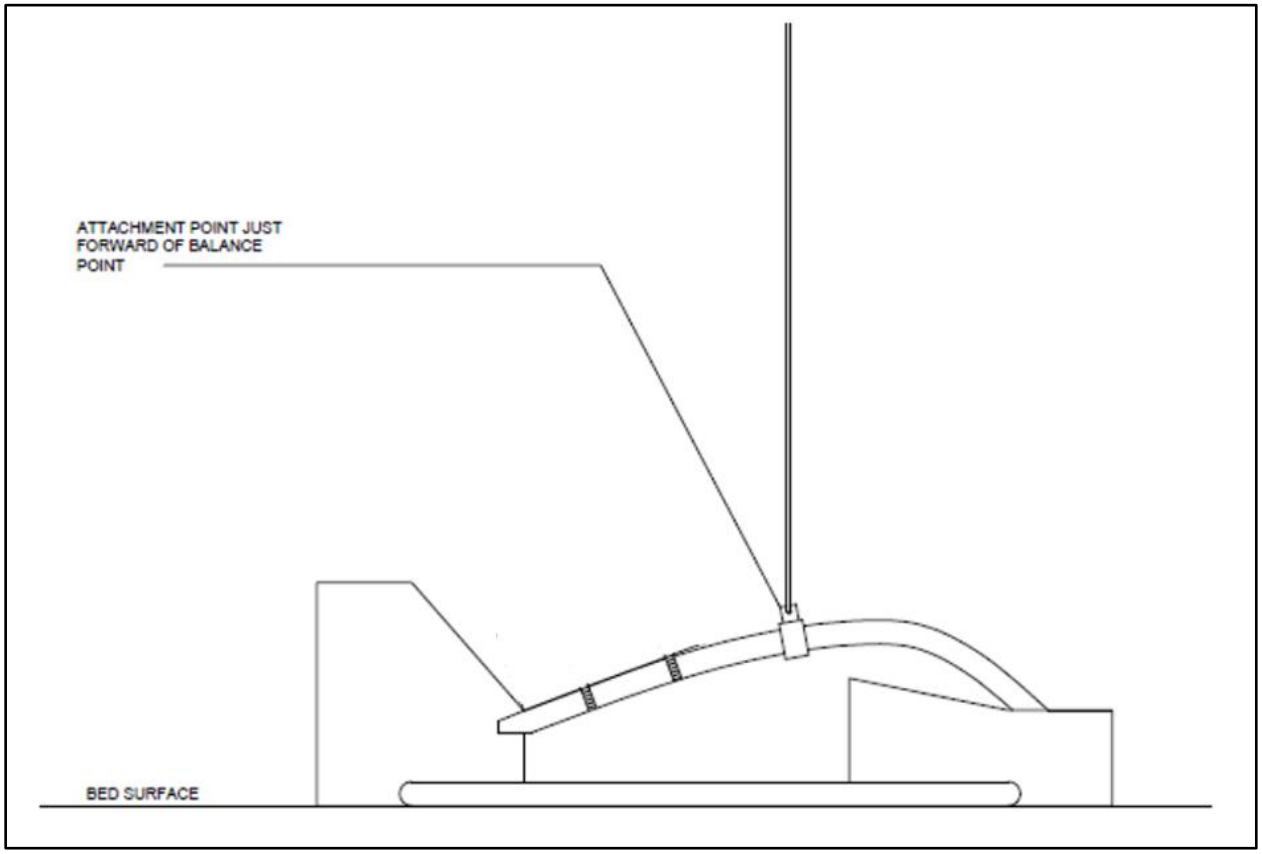
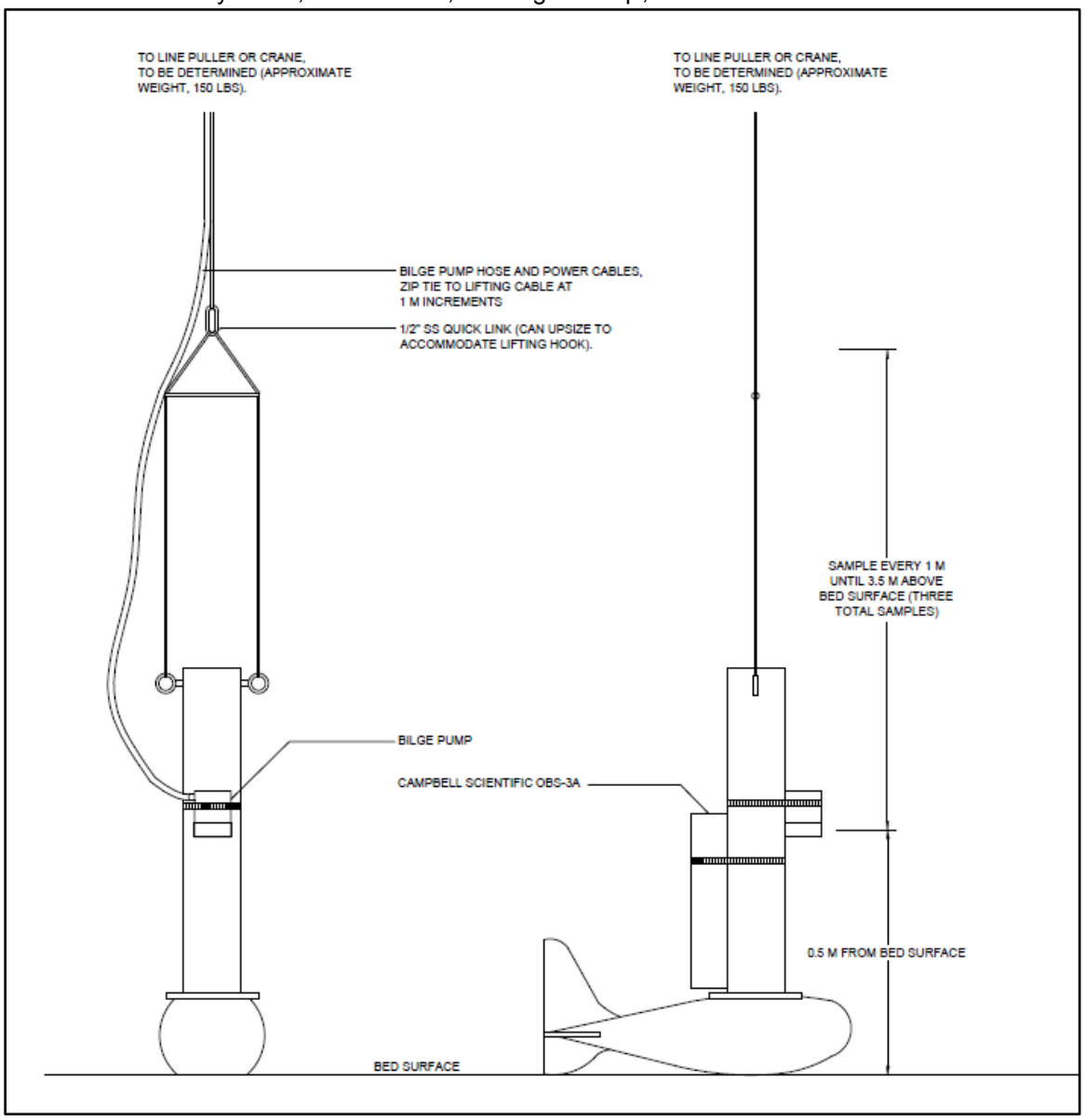


Figure 5: Helley-Smith Bedload Sampler Resting on the Sediment Bed (Photo)

3.4 SAMPLING FOR VERTICAL PROFILES OF TURBIDITY

The vertical distribution of turbidity in the water column was sampled using an OBS with an integrated depth sensor and data logger (OBS 3A, Campbell Scientific). The OBS 3A was attached to an instrumentation platform consisting of a 150-lb sounding weight and an attached, vertically orientated aluminum cylinder as shown in Figure 6. The OBS 3A (in the configuration described) was lowered through the water column to the bottom and raised back up 5 times per day. In addition, usually once per day, a bilge pump was attached to the aluminum cylinder at the same level as the OBS 3A turbidity sensor (Figure 6). The instrumentation platform (including the OBS 3A and the bilge pump) was lowered to the bottom, and as it was raised back up, it was positioned at three locations (1.6 ft, 4.9 ft, and 8.2 ft) above the seabed for 10-min each, before being returned to the surface. While the instrumentation was at these three vertical positions, the bilge pump pumped water samples to the surface. The samples were stored in 0.5-L plastic bottles and later analyzed in the UAA laboratory for TSS and for grain size distribution. Note, at each location a pair of 0.5-L (0.13 gal) samples (one after another) were taken so that there was a total of 1 L (0.26 gal) of sample collected at each location.

Figure 6: Water Sampler System including the Sounding Weight and its attached Vertical Cylinder, the OBS 3A, the Bilge Pump, the Hose and Cable



3.5 MONITORING NEAR-SURFACE TURBIDITY AND SUSPENDED SEDIMENT CONCENTRATION

A second OBS (OBS 3+, Campbell Scientific) and a second bilge pump were attached to the ADCP mast at a water depth of approximately 6.6 ft (Figure 6) in order to collect a time series of near-surface turbidity data with which to infer SSC. Unlike the OBS 3A, the OBS 3+ did not have an integrated data logger. Hence, data were stored in an onboard Campbell Scientific data logger. In total, 36 water samples of 0.5 L (0.26 gal) each were collected for TSS analysis and calibration of the OBS.

3.6 LABORATORY ANALYSES OF WATER SAMPLES – SETTLING COLUMN EXPERIMENTS

To determine TSS, a portion of the 0.5-L (0.13-gal) samples (usually about 0.026 gal) was filtered through 0.5-µm glass fiber filters. A vacuum pump was used to pull the water through the filter; filter paper was dried prior to weighing to remove any mass contribution from moisture in the filter. Settling column experiments as described in [3] were also conducted, relying on the different settling velocities of different grain size fractions to isolate and sub-sample from the original sample. To begin with, a portion of a 0.5-L (0.13 gal) sample (e.g., 0.026 gal) was analyzed to obtain TSS for the complete range of particle sizes in the sample. Next, a well-mixed portion of the sample (~0.048 gal) was poured into a 250-mL graduated cylinder which served as the settling column for these experiments. In order to sample the concentration of particles with effective grain sizes of 0.044 mm or less, the particles in the water were allowed to settle for about 96 sec and then 0.013 gal was extracted from a depth of 5.90 in. Similarly, in order to sample particles with effective grain sizes of 0.022 mm or less, particles were allowed to settle for 256 sec before extracting 0.013 gal from a depth of 5.90 in. Finally, in order to sample the concentration of particles with effective grain sizes of 0.011 mm or less, the particles in the water were allowed to settle for 25 min before extracting 0.013 gal from a depth of 5.90 in. (See Table 1) The extraction times were calculated based on Stokes Law, assuming that particles had a specific gravity of 2.65.

Table 1: Effective Grain Size and Settling Time

Effective grain size [mm]	Settling time [sec]
≤0.044	96
≤0.022	256
≤0.011	1500

3.7 LABORATORY ANALYSES OF WATER SAMPLES - LISST-100X (LASER IN-SITU SCATTERING AND TRANSMISSOMETRY)

The water samples were processed using the LISST-100X Type C instrument with 100 mL mixing chamber attachment in the UAA laboratory. Because the light transmission was otherwise <1%, it was necessary to dilute the samples. Each 100 mL (0.0264 gal) in the mixing chamber was composed of 5 mL (0.0013 gal) of sample and 95 mL (0.0251 gal) of Reverse Osmosis water. The LISST-100X records volumetric concentration (µL/L) in 32 logarithmically spaced size classes from 0.0025 mm to 0.500 mm. Samples were analyzed for 30 sec (20 records with a time interval of 1.5 sec) and results were reported as an average over the 30 sec. To develop the particle size distribution (percent passing), the upper limit of each size bin was used in the analysis. The size ranges for spherical particles can be found in Appendix B of the LISST-100X Particle Size Analyzer User's Manual v5.0 (p. 103) [4]. It was assumed that particles were spherical with a specific gravity of 2.65.

3.8 LABORATORY ANALYSES OF BEDLOAD SAMPLES

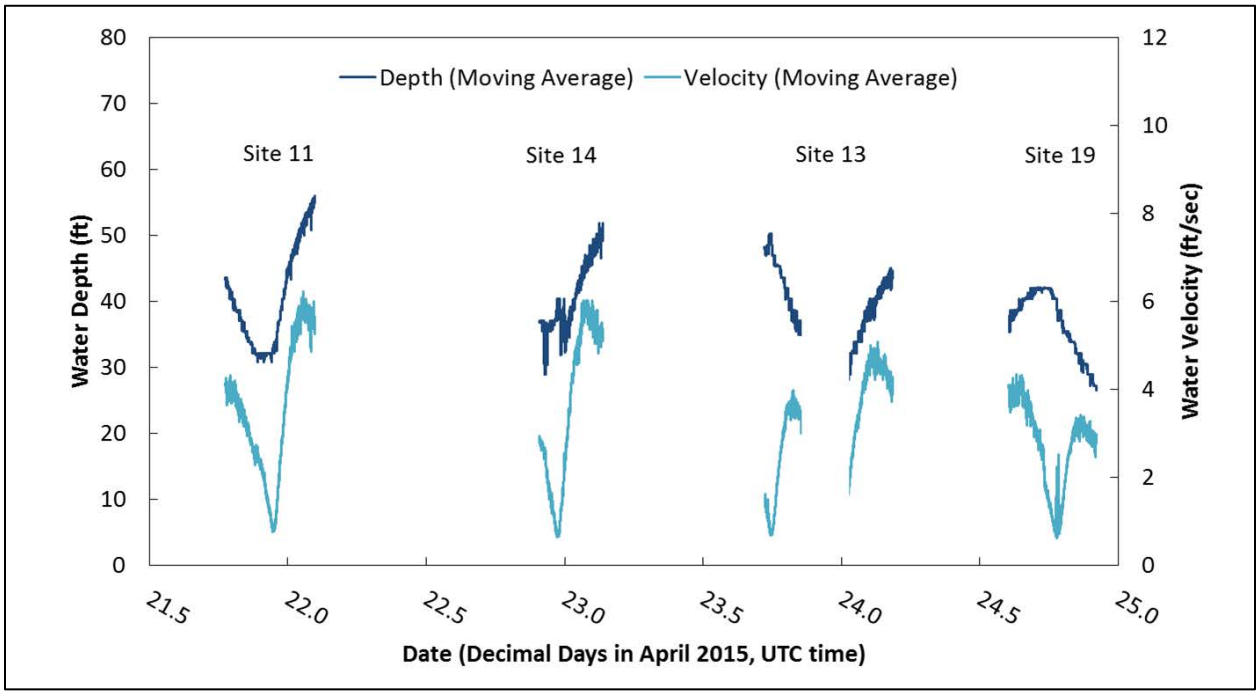
Samples collected with the bedload sampler were brought to the UAA laboratory for testing. Samples were dried in the oven for 48 h at 158°F. Then the dried samples were separated by grain size using the mechanical sieve shaker. The shaker operated for 10 min. Six sieve sizes were used in addition to the bottom pan. The sieve sizes included: 1.000, 0.850, 0.425, 0.250, 0.177, and 0.063 mm.

4.0 RESULTS

4.1 CURRENT VELOCITY AS A FUNCTION OF DEPTH

Current velocity data were collected in vertical bins of 1.64 ft at a rate of 1 Hz over the 4-day period (21 to 24-Apr-15) and at 4 locations (Figure 1). Depth-averaged velocity and water depth was computed based on the raw data as shown in Figure 7. (A moving average of 50 sec was applied to the raw data for presentation purposes.) The figure indicates the time periods of data collection during the 4 day period as well as the range of measured velocity and depth.

Figure 7: Depth-Averaged Velocity and Water Depth over 4-day Period (21 to 24-Apr-15) at Four Locations



4.2 BEDLOAD TRANSPORT – MASS TRANSPORT RATE AND GRAIN SIZE DISTRIBUTION

In total, 21 samples were collected at the 4 sites over the 4-day period. Table 2 provides a summary of data, including site number, sample number, sample collection start time, sample collection period, mass of sample collected, rate of transport into the sampler, and the adjusted rate of transport. Emmett [5] recommends a calibration factor of 0.5 for particles in the 0.250 to 0.500 mm size range. The calibration factor accounts for the fact that many particles in this size range trapped by the sampler would actually be transported as suspended load. The calibration factor has been used to adjust the raw measured transport rate in Table 2.

Selected bedload samples were analyzed for grain size distribution.

Table 2: Bedload Measurements

Site number	Sample number	Sample collection start time [dd-mon-yy hh:mm UTC]	Time period of sampling [min]	Velocity (approximate) [ft/sec]	Mass of sample collected [g]	Rate of transport (into sampler) [g/sec]	Adjusted rate of transport [g/sec]
11	1	21-Apr-15 18:07	10	3.9	5.5	0.0092	0.0046
11	2	21-Apr-15 18:53	15	3.9	10.2	0.0113	0.0057
11	3	21-Apr-15 19:30	15	3.9	2.2	0.0024	0.0012
11	4	21-Apr-15 23:37	20	3.0	1.4	0.0014	0.0007
11	5	21-Apr-15 1:12	20	5.6	10	0.0083	0.0042
11	6	Not recorded (n/r)	n/r	n/r	11.5	-	-
14	7	21-Apr-15 20:12	20	3.9	35.2	0.0293	0.0147
14	8	21-Apr-15 20:43	20	3.6	4.3	0.0036	0.0018
14	9	21-Apr-15 0:37	20	3.6	7.3	0.0061	0.0031
14	10	21-Apr-15 1:30	20	5.6	37.8	0.0315	0.0158
14	11	21-Apr-15 3:20	20	4.6	2.5	0.0021	0.0011
13	12	21-Apr-15 19:14	20	3.3	40.0	0.0157	0.0079
13	13	21-Apr-15 20:01	20	3.3	27.8	0.0232	0.0116
13	14	21-Apr-15 1:55	20	3.6	27.5	0.0229	0.0115
13	15	21-Apr-15 3:00	20	4.9	n/a	n/a	n/a
13	16	21-Apr-15 4:01	20	4.3	168.8	0.1407	0.0704
19	17	21-Apr-15 14:45	20	3.6	244.4	0.2037	0.1019
19	18	21-Apr-15 15:45	20	3.9	n/a	n/a	n/a
19	19	21-Apr-15 17:01	20	3.0	10.8	0.0090	0.0045
19	20	21-Apr-15 20:34	20	3.0	2.6	0.0022	0.0011
19	21	21-Apr-15 21:30	20	3.3	138.6	0.1155	0.0578

Table 3 provides summary data of the bedload transport samples that were analyzed for grain size distribution. Based on the grain size distribution data (described below), the median grain size, averaged over the samples, was 0.410, 0.608, 0.413, and 0.782 mm for sites 11, 14, 13, and 19, respectively. Based on visual estimates of the percent of organic material in each of the size fractions, the average organic content was calculated to be 53, 16, 14, and 10% for sites 11, 14, 13, and 19, respectively. Thus, the site nearest the shore (19) was found to have relatively course material as well as less organic content.

Table 3: Median Grain Size and Average Organic Content

Site number	Sample number	Mass of sample collected [g]	d_{50} [mm]	Organic material content of sediment [%]
11	1	5.5	0.44	53
11	2	10.2	0.44	55
11	3	2.2	0.48	53
11	4	1.7	0.32	53

Site number	Sample number	Mass of sample collected [g]	d_{50} [mm]	Organic material content of sediment [%]
11	6	10	0.36	58
14	7	35.2	1.0	5
14	8	4.3	0.67	45
14	9	7.3	0.33	32
14	10	37.8	0.49	0
14	11	2.5	0.55	0
13	12	40.0	0.38	2
13	13	28.5	0.37	55
13	14	26.7	0.42	0
13	16	168.2	0.48	0
19	17	244.3	0.38	0
19	18	1.7	0.37	47
19	19	9.3	0.36	3
19	20	1.9	2	0
19	21	138	0.8	0

Plots of grain size distribution from the bedload samples for the 4 sites are provided in Figure 8 through Figure 11 provide the grain size distributions for the samples collected at sites 11, 14, 13, and 19, respectively. Note, the nets used with the Helley-Smith bedload sampler had a mesh size of 0.250 mm. The grain size distribution measured at all sites (but sites 13 and 19 in particular) falls off with a grain size less than 0.250 mm. Given the mesh size of the nets, the presence of significant material with apparent size less than 0.250 mm at site 11 was unexpected. However, the material at site 11 had the highest organic content (~53%) and larger pieces of this material might have disaggregated through the sieving process, which aggressively shakes the material. In the future, bottom sediment grab samples will be analyzed for grain size distribution, and the bedload transport estimates will be updated based on this new data. Note, the manufacturer of the bedload samplers states that the presence of significant quantities of organic matter can reduce the trapping efficiency of the samplers (Appendix A). However, this effect is noted for sampling that results in retrieval of samples that are one half the maximum capacity of the sample bag, or greater. The samples with high organic content collected for this effort were very small and so not likely affected by the few observed pieces of organic material collected.

Measured bedload transport rates were compared with calculated transport rates based on empirical formula assuming a median sediment bed grain size of 0.400 mm (Figure 8). Measured rates (originally measured in g/s) were converted to volumetric transport rates assuming a particle specific gravity of 2.65. A trapping efficiency of 100% is assumed. The measured bedload transport rates are significantly below the rates expected based on the transport equations. This may indicate a lack of sediment supply, that the seabed is armored by coarser sediment, that the sediment is “hard pan”, or that the sediment is cohesive to a large extent. It may also indicate that there is significant amounts of bed load material in the fine sand range (i.e., smaller than 0.250 mm).

Figure 8: Grain Size Distribution from Site 11 Bedload Samples

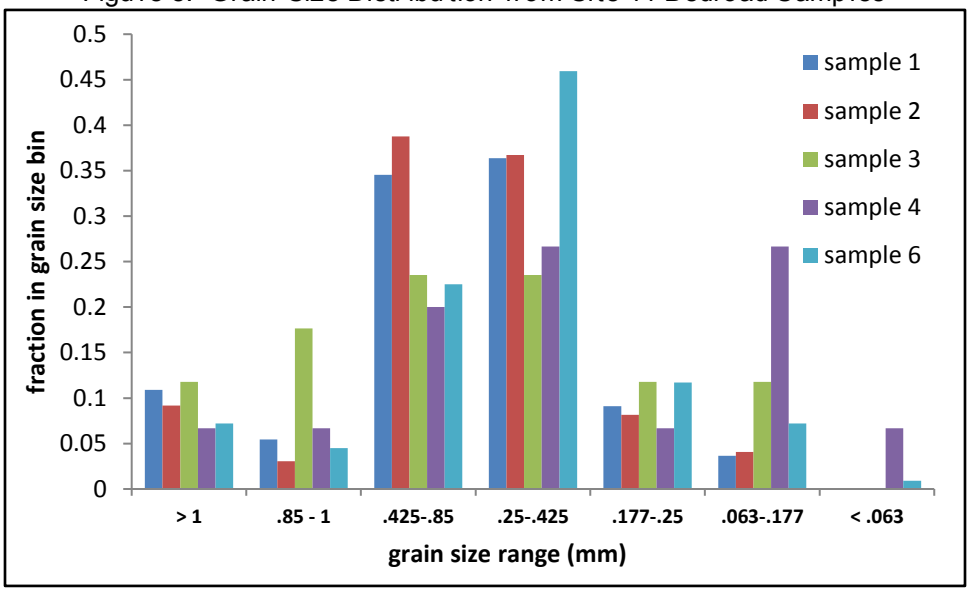


Figure 9: Grain size Distribution from Site 14 Bedload Samples

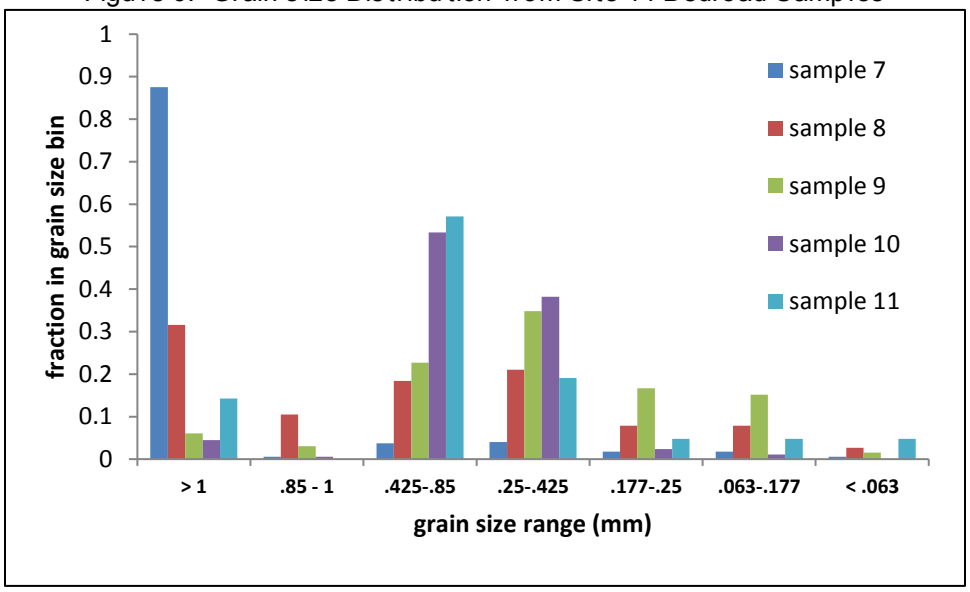


Figure 10: Grain Size Distribution from Site 13 Bedload Samples

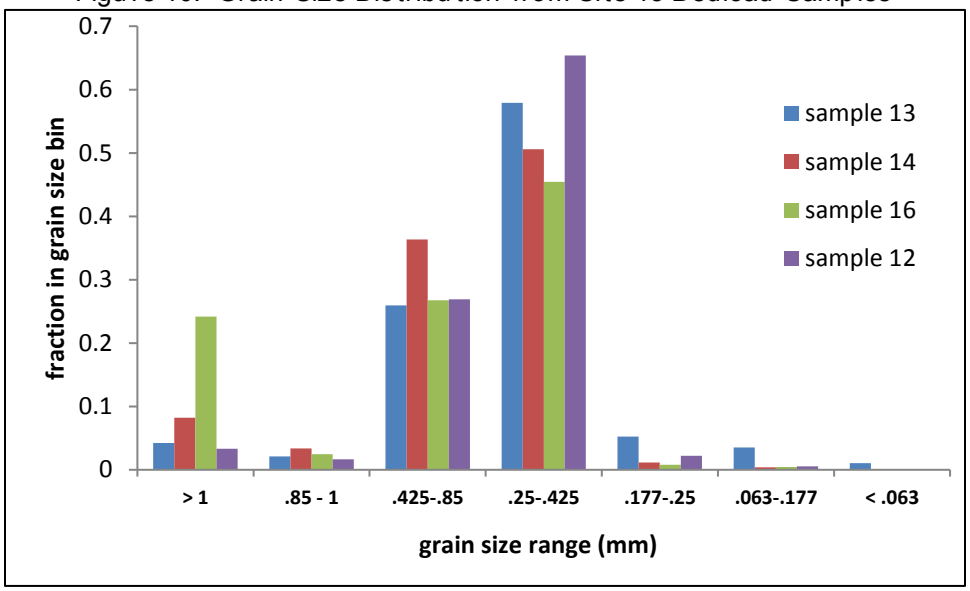


Figure 11: Grain Size Distribution from Site 19 Bedload Samples

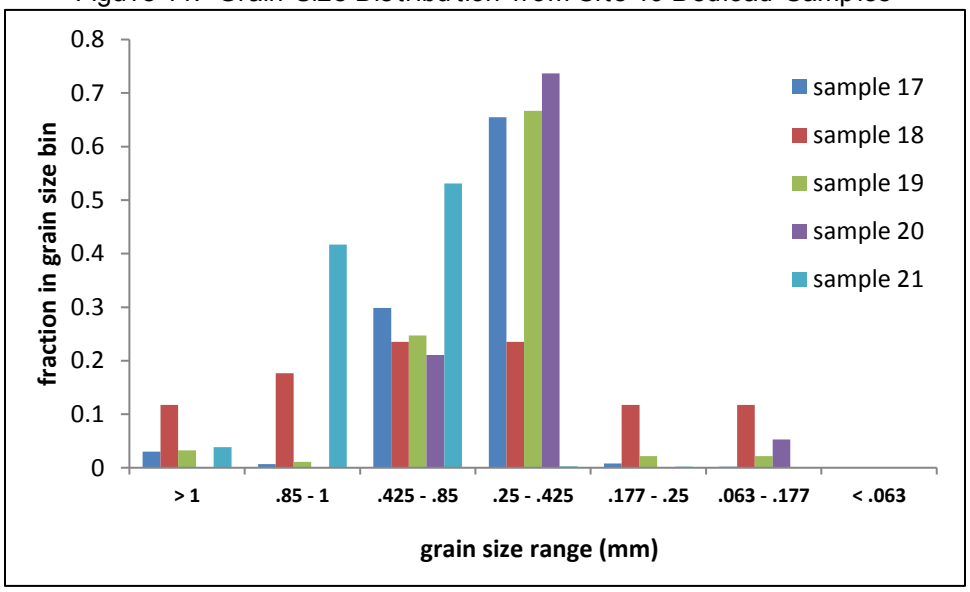
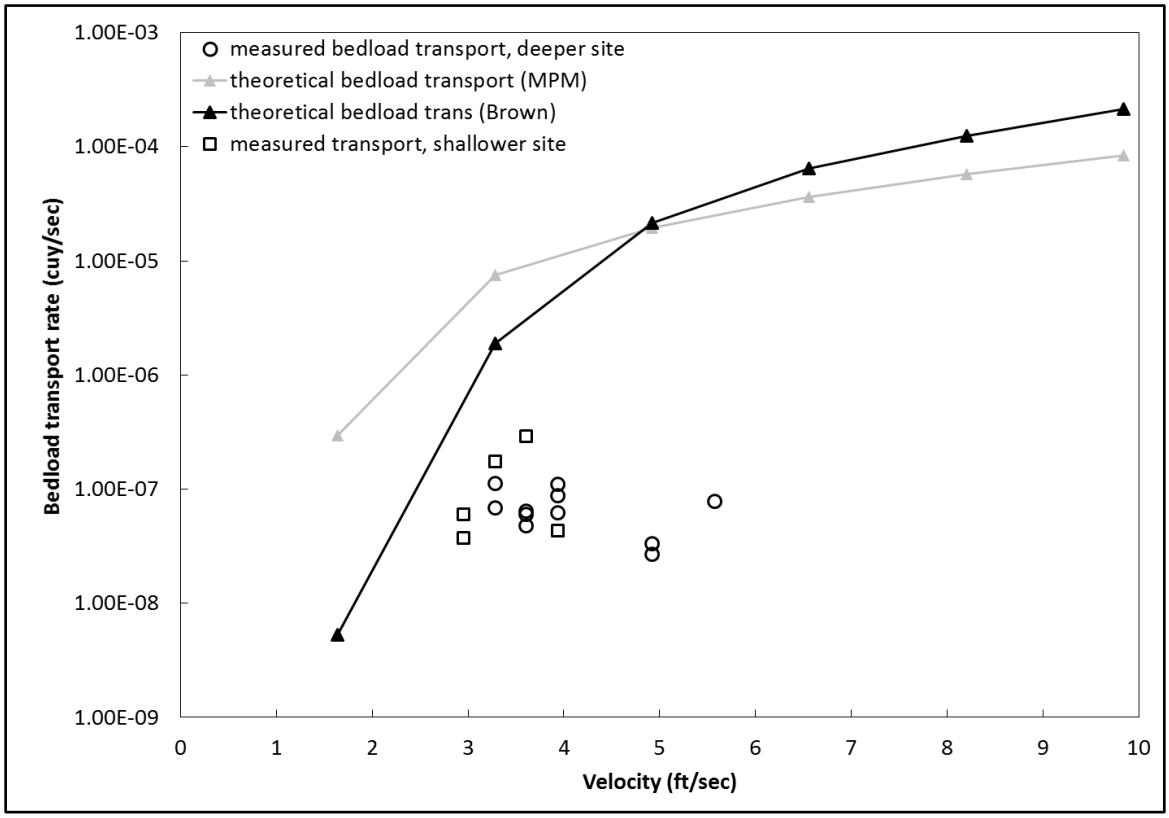


Figure 12: Comparison of Measured Bedload Transport Rates with Calculated Rates



4.3 ANALYSIS OF SUSPENDED SEDIMENT GRAIN SIZE DISTRIBUTION BY COLUMN EXPERIMENTS

Column settling experiments were performed on two samples (N7 and N82) in order to estimate the grain size distribution (Table 4). The raw data indicated that the effective d_{50} for sample N7 and N82 was 0.017 mm and 0.0187 mm, respectively. In addition, a set of column experiments was performed on industrial sediment (AGSCO Silica size 325, sample N109, Table 4) for which the median grain size (d_{50}) is reported to be about 0.014 mm (Appendix B and C). Considering the effective fall velocity from the settling experiment of the AGSCO Silica size 325, d_{50} of the sediment was 0.017 mm. This suggests that the settling experiments are reasonably accurate (uncertainty in d_{50} ~ 20%).

Table 4: Settling Column Estimate of Grain Size Distribution of Suspended Sediments

Sample number	Measurement type	site	Filter paper, dry [g]	Volume [L]	Paper and sediment, dry [g]	Concentration [g/L]	Fraction of sediment
N7	TSS	11	0.2387	0.053	0.2623	0.45	1.00
N7	≤ 0.044 mm	11	0.2405	0.053	0.2591	0.35	0.78
N7	≤ 0.022 mm	11	0.2386	0.052	0.2526	0.27	0.60
N7	≤ 0.011 mm	11	0.24	0.051	0.2486	0.17	0.38

Sample number	Measurement type	site	Filter paper, dry [g]	Volume [L]	Paper and sediment, dry [g]	Concentration [g/L]	Fraction of sediment
N82	TSS	11	0.2427	0.092	0.2827	0.43	1.00
N82	≤ 0.044 mm	11	0.2397	0.050	0.2547	0.30	0.69
N82	≤ 0.022 mm	11	0.2373	0.050	0.2501	0.26	0.59
N82	≤ 0.011 mm	11	0.2379	0.025	0.241	0.12	0.29
N105[a]	TSS	NA	0.2407	0.065	0.2751	0.53	1.00
N105[a]	≤ 0.044 mm	NA	0.2423	0.050	0.2614	0.38	0.72
N105[a]	≤ 0.022 mm	NA	0.2415	0.051	0.2577	0.32	0.60
N105[a]	≤ 0.011 mm	NA	0.2394	0.050	0.2495	0.20	0.38

Note: [a] The sediment tested was industrial sediment manufactured by AGSCO (Silica size 325)

4.4 ANALYSIS OF SUSPENDED SEDIMENT CONCENTRATION AND GRAIN SIZE DISTRIBUTION WITH THE LISST-100X

Ten samples were analyzed for total suspended solids (TSS) concentration and for median grain size distribution (Table 5) using the LISST-100X. The mass concentration measurements are discussed in detail in the next section. The median grain size measurements from the LISST-100X and from the settling tests were compared for sample N7/N102 and for N82/N115. Note, as discussed previously, 0.5-L water samples were taken in quick succession so that the pair of samples (e.g., N7 and N102) may be considered identical.

Table 5: Suspended Sediment Characteristics as Determined by the LISST-100X

Sample number	Nominal position (ft above bottom)	Time sampled (dd-mmm-yy, hr:min UTC)	Mass concentration (g/L)	Median grain size, d_{50} (**mm**)
N6	8.2	21-Apr-15, 01:51	1.44	0.033
N16	8.2	24-Apr-15, 18:08	1.02	0.025
N36	4.9	22-Apr-15, 19:50	1.01	0.024
N77	1.6	24-Apr-15, 17:46	1.18	0.034
N88	4.9	24-Apr-15, 1:41	1.43	0030
N102	4.9	22-Apr-15, 18:22	0.98	0.034
N108	1.6	22-Apr-15, 19:33	1.31	0.033
N113	4.9	24-Apr-15, 17:58	1.12	0.027
N115	1.6	22-Apr-15, 18:06	0.90	0.036
N125	1.6	24-Apr-15, 01:24	1.46	0.030

Table 6 compares the median grain size as determined from the settling column experiments and as determined by the LISST-100X tests. The median grain size based on the settling experiments was about one-half of the grain size based on the LISST-100X tests. The settling experiment data

could be biased low due to convection in the cylinders used for settling. The convection would slow the settling/deposition of particles leading to a d_{50} that is biased low.

Table 6: Comparison of Suspended Sediment Median Grain Size as Determined by the Settling Experiments and by the LISST-100X

Sample number	Median grain size from settling experiments, d_{50} (**mm**)	Median grain size from LISST-100X, d_{50} (**mm**)
N7/N102	0.017	0.034
N82/N115	0.0187	0.036

4.5 COMPARISON OF TOTAL SUSPENDED SOLIDS (TSS) – AS MEASURED BASED ON FILTRATION AND BASED ON THE LISST-100X

The suspended sediment concentration by mass in the water samples from filtration and from the LISST-100X are compared in Table 7. Surprisingly, the LISST-100X measurements of TSS were significantly higher than the measurements based on filtration. On average, the LISST-based measurements were 280% of the concentrations based on filtration. As filtration is a very precise measure of suspended sediment (with percent error on the order of 10%), it is presumed that the measurements based on filtration are more reliable. Note, it was expected that the LISST-based measurements would be more uncertain because relatively small amounts of the sample (5 mL [0.0013 gal]) were used in the analysis.

Table 7: Comparison of TSS and SSC as Determined by Filtration and Using the LISST-100X

Sample number	Mass concentration based on filtration (g/L)	Mass concentration from the LISST-100X (g/L)
N6	0.44	1.44
N16	0.47	1.02
N36	0.30	1.01
N77	0.48	1.18
N88	0.30	1.43
N102	0.45	0.98
N108	0.37	1.31
N113	0.45	1.12
N115	0.43	0.90
N125	0.50	1.46

4.6 VERTICAL DISTRIBUTION OF SUSPENDED SEDIMENT CONCENTRATION

Vertical profiles of SSC data were obtained based on the vertical casts of the OBS 3A and based on a calibration between the turbidity and suspended solids concentration (determined from TSS analysis of selected samples). Figure 13 presents the calibration of the OBS.

Figure 13: Calibration of Turbidity (NTU) Measured by the OBS 3A to SSC (g/L)

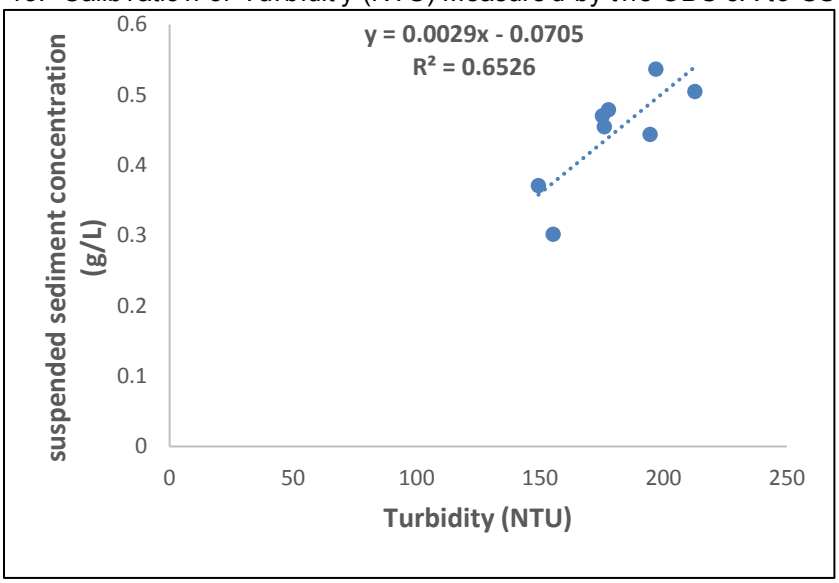


Figure 14, Figure 15, Figure 16, and Figure 17, (below) provide data on the vertical distribution of SSC at different times for sites 11, 13, 14, and 19. Clearly, there was significant variation in SSC at different times in the tidal cycle. For example, at site 11 (Figure 14), casts 1 and 2 were collected during the ebb tide when the velocity was 1.15 and 1.1 m/s, respectively. Both casts indicate a well-mixed water column which is consistent with the small grain size of the suspended sediments and the high velocities. It is noteworthy that concentration is increasing at a rapid rate. Cast 3 was taken about 3.5 hours later when the tide had shifted to the flood phase, and the velocity was about 0.8 m/s. In cast 3, the suspended sediments are no longer well mixed vertically, and the near-bottom SSCs are significantly higher than those recorded during cast 1 and 2. The lack of a well-mixed water column is consistent with the fact that the slack (low) tide had just occurred and some particle settling would have occurred particularly near the surface. The relatively high near-bottom SSCs probably reflect the high near-bottom concentrations generated on the previous ebb tide. The cast 5 concentration profile, collected later during the flood tide shows reduced near-bottom sediment concentration probably reflecting the arrival of relatively low turbidity water from the ocean.

Figure 14: Vertical Distribution of SSC from 5 Casts Taken at Site 11 on 21 to 22-Apr-15

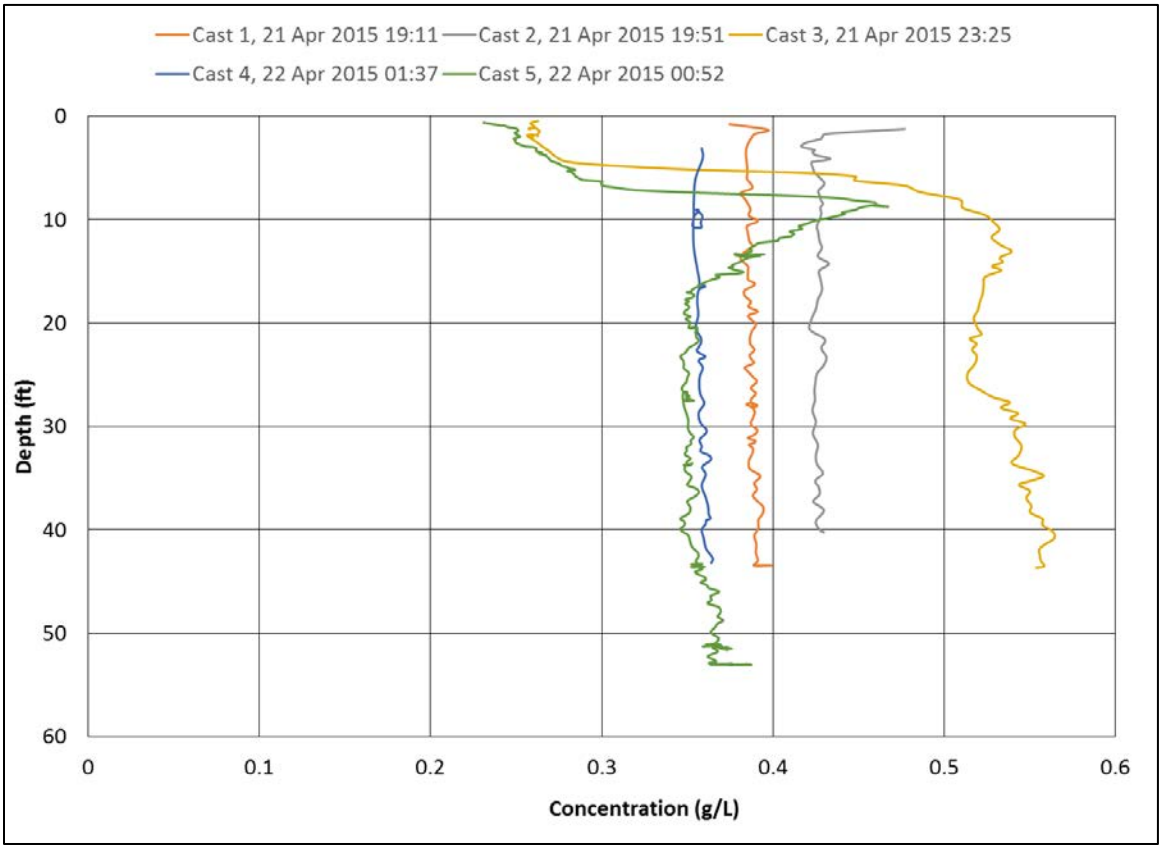


Figure 15: Vertical Distribution of SSC from 5 Casts Taken at Site 13 on 23 to 24-Apr-15

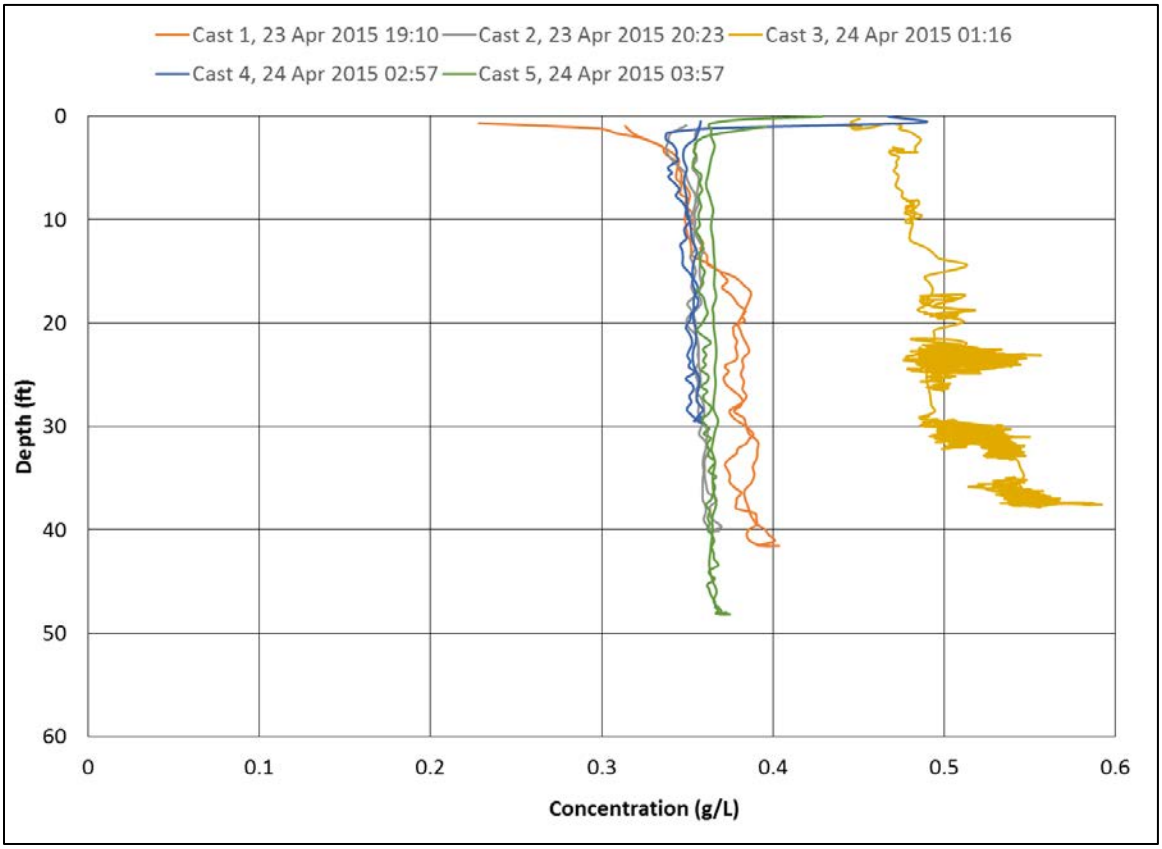


Figure 16: Vertical distribution of SSC from 5 casts Taken at Site 14 on 22-23 Apr 2015.

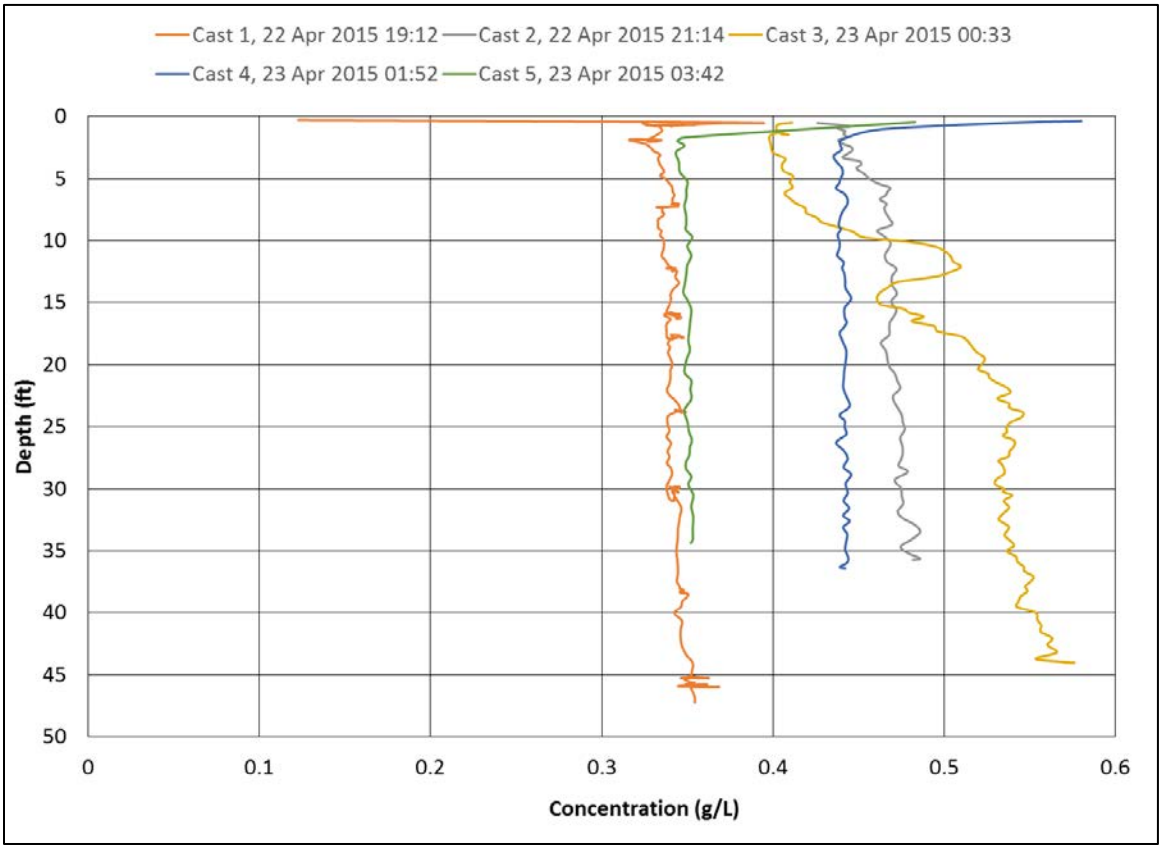
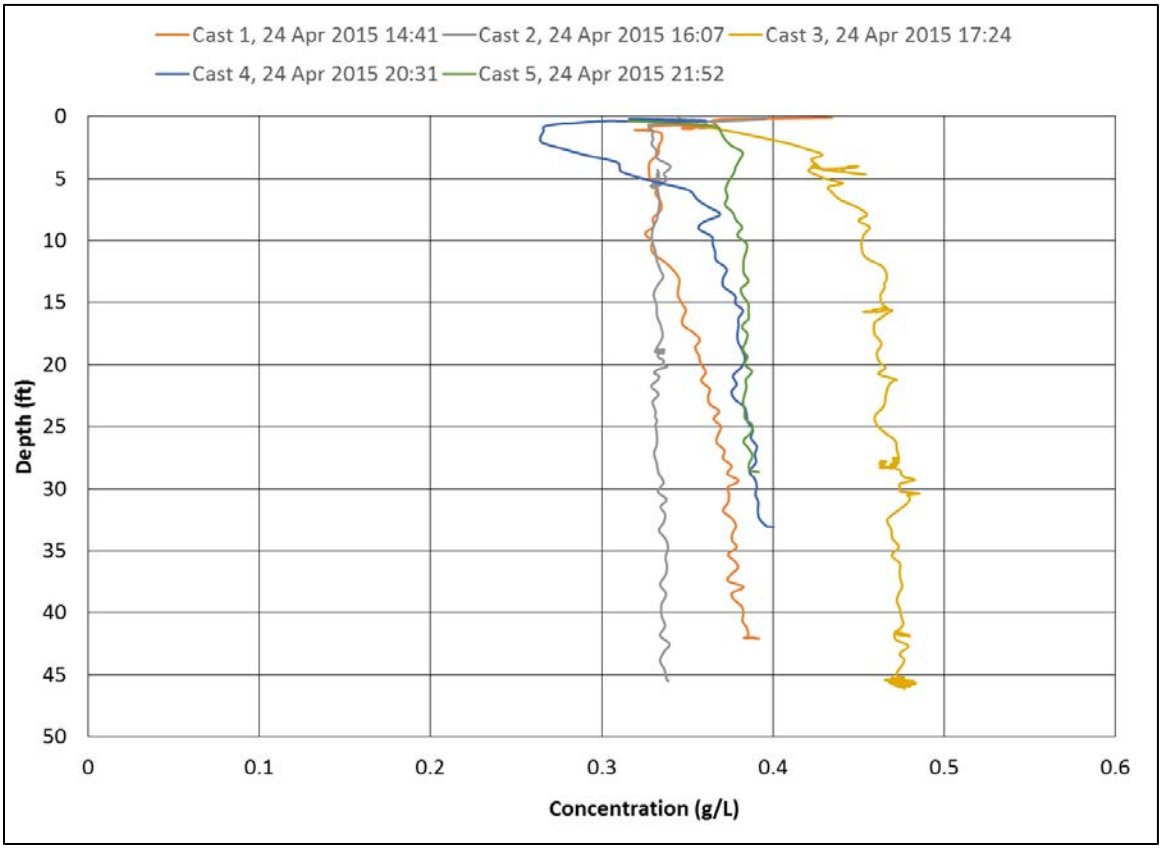


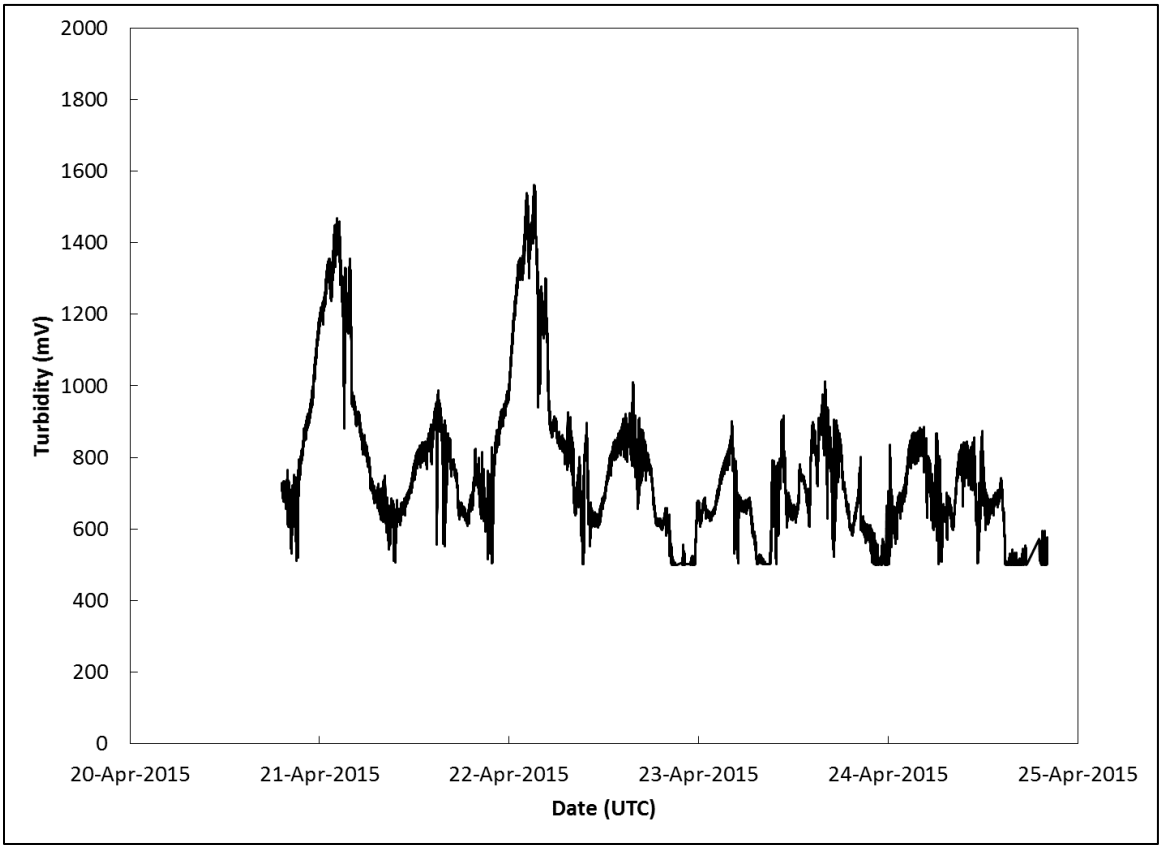
Figure 17: Vertical Distribution of SSC from 5 Casts Taken at Site 19 on 24-Apr-15



4.7 TIME SERIES OF NEAR-SURFACE TURBIDITY

Near-surface (2 m depth) turbidity was monitored using an OBS 3+ as a function of time at the different locations occupied by the Maritime Maid during the 21 to 24-Apr-15 field program (Figure 18). The raw turbidity data provided by the OBS 3+ was in millivolts (mV). Water samples near the OBS 3+ sensor were taken and analyzed in order to develop a calibration between turbidity and SSC. However, preliminary results show no correlation between the turbidity measurements with the OBS 3+ and the SSC. This may have resulted from improper retrieval of turbidity data from the Campbell Scientific datalogger.

Figure 18: Time-Series of Turbidity from 2-m Depth during the 21 to 24-Apr-15 Field Testing



5.0 CONCLUSIONS AND RECOMMENDATIONS

This report describes the Sediment Transport Sampling and Monitoring effort (Phase 1) for the Nikiski area, including its objectives, scope, methodology, and results. The principal findings include:

1. The measured bedload transport rate was more than an order of magnitude less than the expected rate considering the velocity.
2. The character of the bedload material varied from site to site. Bedload material median grain size was a minimum at site 11 (0.41 mm) and a maximum at the relatively shallow (and nearshore) site 19 (0.78 mm). Site 11 was estimated to have the highest organic matter content (53%). Site 19 was estimated to have the lowest organic matter content (10%). Thus, the nearshore (shallower) site had less organic material and coarser grains.
3. SSC by mass generally ranged from 0.3 to 0.6 g/L. Suspended sediment had an effective grain size on the order of 0.03 mm (i.e., silt sized) and the SSC (vertical) profile was generally nearly uniform. Given the velocities in the Inlet, this is an expected result, and it is consistent with sediment transport theory (e.g., the Rouse Equation [6]).
4. The data on organic matter content provided in the report is based on visual observations. The amount of organic matter in the bedload material may affect the infill of the test trenches.
5. The preliminary analysis of the near-surface turbidity data has been inconclusive.

The scope of the project did not allow for examination of seasonality of sediment transport. It is reasonable to expect that bedload transport would not vary greatly from season to season. Theoretically, bedload transport would vary a little seasonally due to seasonal variation in viscosity, but this variation is readily quantified and is expected to be small. Suspended sediment transport, on the other hand, is likely to vary significantly with season. In Cook Inlet, for example, it is well known that suspended transport rates are significantly smaller in the winter due to a reduced sediment supply. So, if there is an expectation based on the sediment transport modeling that suspended sediment transport will be a significant source of trench infilling, then accounting for seasonal variation in suspended sediment transport would be warranted.

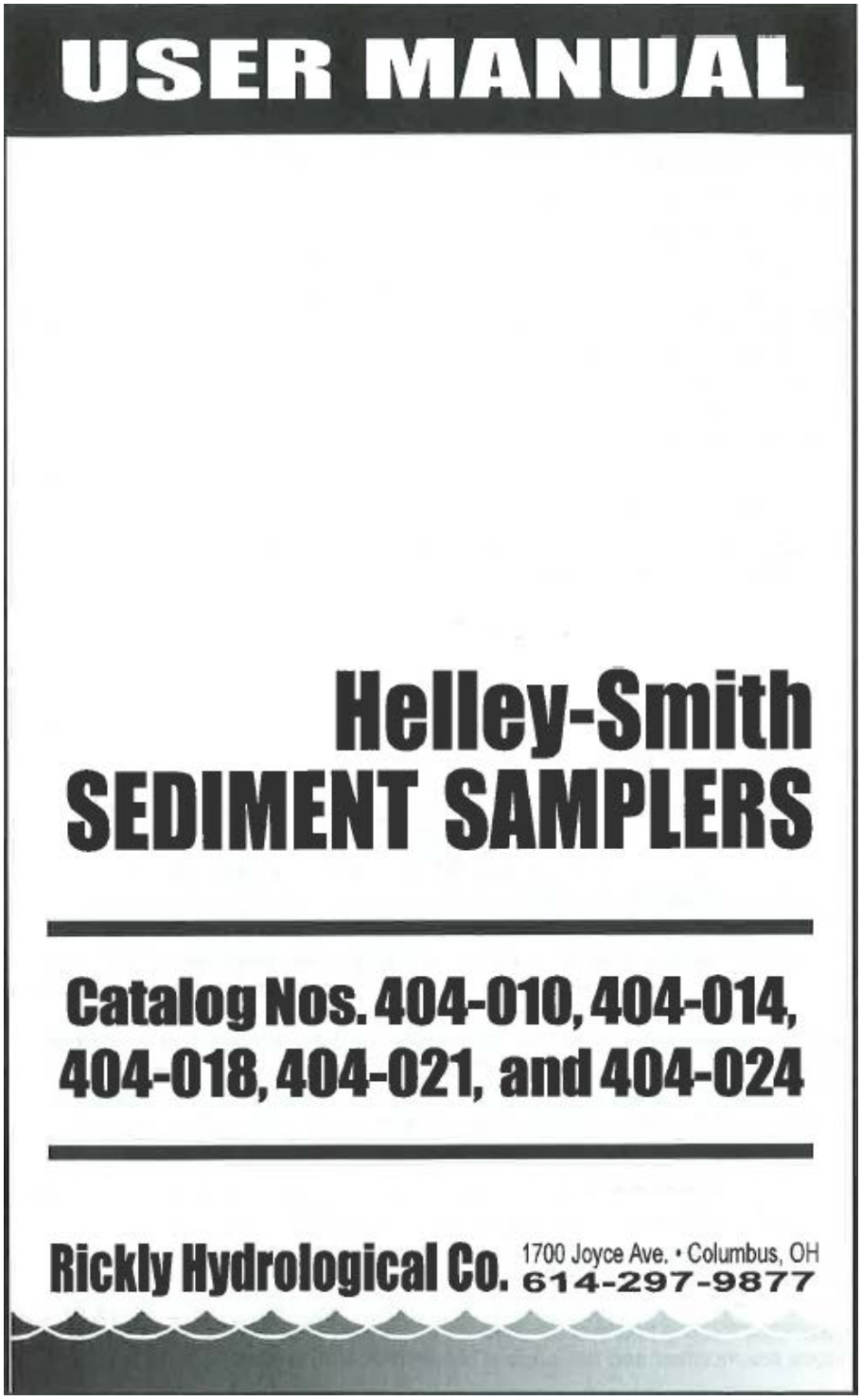
7.0 ACRONYMS AND TERMS

Term	Definition
°F	Degrees Fahrenheit
µm	Micrometers
ADCP	Acoustic Doppler Current Profiler
cu yd	Cubic Yards
d_{50}	Median Grain Size Diameter
ft	Feet
gal	Gallons
g	Grams
h	Hours
Hz	Hertz
in	Inches
KHz	Kilohertz
L	Liters
LISST	Laser In-Situ Scattering and Transmissometry
lb	Pounds
m	Meters
min	Minutes
mL	Milliliters
MLLW	Mean Lower Low Water
mm	Millimeters
mV	Millivolts
OBS	Optical Backscatter Sensor
sec	Seconds
SSC	Suspended Sediment Concetration
TSS	Total Suspended Solids
UAA	University of Alaska Anchorage

8.0 REFERENCES

ID Number	Reference Title
1	DHV CONSULTANTS & DELFT HYDRAULICS with HALCROW, TAHAL, CES, ORG & JPS 2003. Sediment Transport Measurements, Volume 5 in Hydrology Project, Government of India & Government of the Netherlands.
2	Ravens, T. and Edgerly, E. 2015. Work plan for sediment transport monitoring – Part A (Revised 18 Apr 2015).
3	Ravens, T. 1997. Sediment Resuspension in Boston Harbor. MIT PhD Dissertation.
4	LISST-100X Particle Size Analyzer User's Manual v5.0, Retrieved May, 2015 at http://www.sequoiasci.com/wp-content/uploads/2013/07/manual-5.pdf
5	Emmett, W.W., 1980. *A Field Calibration of the Sediment Trapping Characteristics of the Helley-Smith Bed Load Sampler*. Geological Survey Professional Paper 1139, Washington, USA.
6	Julien, P. 2010. Erosion and Sedimentation. Second Edition. Cambridge University Press, New York.

9.0 APPENDIX A: OWNER'S MANUAL FOR THE HELLEY-SMITH BEDLOAD SAMPLER


USER MANUAL

Helley-Smith
SEDIMENT SAMPLERS

Catalog Nos. 404-010, 404-014, 404-018, 404-021, and 404-024

Rickly Hydrological Co. 1700 Joyce Ave. • Columbus, OH 614-297-9877

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WARRANTY

Rickly Hydrological Co., Inc. warrants that its products are free from defects in material and workmanship under normal use and service for a period of one year from date of shipment from the factory.

Rickly Hydrological's obligations under this warranty are limited to, at Rickly Hydrological's option: (I) replacing or (II) repairing any products determined to be defective. In no case shall Rickly Hydrological's liability exceed the product original purchase price. This warranty does not apply to any equipment that has been repaired or altered, except by Rickly Hydrological Co., Inc., or which has been subject to misuse, negligence or accident. It is expressly agreed that this warranty will be in lieu of all warranties of fitness and in lieu of the warranty of merchantability. The warranty begins on the date of the invoice.

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MEASUREMENT OF BEDLOAD IN RIVERS

A fundamental feature of bedload movement is extreme transport rate variation even with constant flow. The theory of dune movement indicates an individual bedload sample may contain a sediment mass from zero to four times that expected from the actual average bedload of the stream. Field data shows that both spatial and temporal variability is as large or larger than predicted by this theory. Thus, an individual bedload sample may give no more than the roughest estimation of actual average bedload transport.

Significant spatial variability also occurs because bedload commonly moves within a narrow portion of channel width, which does not necessarily coincide with the zone of maximum bed shear stress. Bedload investigators should be aware of this variability and the potential inaccuracy of their data.

Guidelines

These guidelines for bedload data collection, publication, and storage supersede previous policy and guideline statements given in QWB Technical Memorandum Nos. 76.04, 77.07, 79.17, and 80.07, as well. as WRD Memorandum No. 77.60.

Acceptable Conditions

WRD policy states that samples can be collected wherever physical conditions permit it. Physical conditions permit sample collection when:

- bed is firm enough to support the sampler without it sinking into the bed;
- the streambed is smooth enough for the nozzle to lay flat on the bottom;
- stream velocity is low enough to allow the sampler to properly sit on the streambed (tetherlines allow sampler use in velocities higher than possible without them), and
- no organic or mineral deposits clog the bag to restrict flow through sampler.

SAMPLER SELECTION

The WRD invested considerable resources to study sampling characteristics of pressure difference type bedload samplers. Though many types of bedload samplers exist, in the interest of continuity and consistency, all bedload sampling by the WRD should use pressure difference type samplers recommended in this memorandum. Alternative samplers may be considered for sampling in situations outside the range of recommended type samplers or where funding is available to construct an efficient bedload trap in the streambed. Contact the Office of Surface Water regarding alternative samplers and data storage.

Figure 1 shows schematics of the Helley-Smith and FIASP samplers. Figure 2 contains a schematic of the wading sampler which may contain either a Helley-Smith or a FIASP nozzle.

SAMPLER SELECTION

US BLM-84 • Model 8010 - This 4 lb (1.8 kg) hand-held aluminum wading bedload sampler with a USGS designed 1.4 expansion ratio has a 3" x 3" (76 mm x 76 mm) entrance opening. It comes with a 5-foot adjustable handle. Use the optional 12-foot light-weight extension handle section for boat or bridge sampling in water too deep to wade. This sampler uses a style #3 nylon mesh sample bag.

US BL-84 • Model 8030 - This 65 lb. (29.5 kg) cable-suspended bedload sampler has a 3" x 3" (76 mm x 76 mm) opening and 1.4 expansion ratio. A tailfin provides flow direction orientation and a sliding collar adjusts the balance point based on stream flow conditions. The collar is set so the sampler touches the water tail first for rapid orientation with streamlines of flow. This suspension attitude also insures the sampler orifice lifts up immediately when the unit raises from the bed, eliminating sample loss. This sampler uses a style #3 sampler bag.

US BL-84C—Model 8050 - This 105 lb. (47.7 kg) cable-suspended bedload sampler is identical to Model 8030 except it is heavier for suspension in larger rivers. It also uses style #3 bag.

HELLEY-SMITH SAMPLERS

Model 8015 Hand-held - This 4 lb. (1.8 kg.) stainless steel hand-held sampler is similar to US-BLM-84 except with a 3.22 expansion ratio chamber. It uses style #1 bag.

Model 8025 Hand-held - This 10 lb (4.5 kg) stainless steel hand-held sampler has a 6" x 6" (152 mm x 152 mm) entrance opening and 3.22 expansion ratio. It uses the style #2 bag.

Model 8035 Cable-Suspended - This 65 lb. (29.5 kg.) stainless steel sampler is similar to US BL-B4 except with a 3.22 expansion ratio. It uses the style # 1 bag.

Model 8055 Cable-Suspended - This 105 lb. (47.7 kg.) sampler is identical to Model 8035 except it is heavier for suspension in larger rivers.

Model B075 Cable-Suspended - This 167 lb. (75.8 kg.) stainless steel sampler has a 6" x 6" (152 mm x 152 mm) entrance opening and 3.22 expansion ratio. It uses style #2 bag.

BEDLOAD SAMPLER SEDIMENT BAGS

- **Style #1** - Fits 3.22 expansion ratio 3" orifice
- **Style #2** - Fits 3.22 expansion ratio 6" orifice
- **Style #3** - Fits 1.4 expansion ratio 3" orifice

Bag Mesh Size

Standard bag mesh sizes include 0.25, 0.5, 1.0, and 2.0 mm; 0.25 mm is the most common. Large quantities of fine material (about equal in size to the mesh opening) and large organic material (such as leaves) can clog the bag and invalidate the sample. Increasing mesh size may decrease clogging Choose a mesh size to minimize both clogging and fine bedload loss.

NOZZLE EXPANSION RATIO

The WRD endorses the 1.40 expansion ratio nozzle tentatively recommended by the Technical Committee of the Federal Interagency Sedimentation Subcommittee. Though not completely quantified, differences between the 1.40 and 3.22 expansion ratio are likely small relative to potential errors from sub-optimal sampling procedures. Therefore, samplers with either the 3.22 or 1.40 expansion ratio are acceptable.

NOZZLE SIZE

At present (1990), no established criteria exists for nozzle size selection. The nozzle, however, should be at least two times the size of the largest particles in motion. Some hydrologists recommend a nozzle size at least 5 times the size of the largest particle in motion.

SAMPLING PROCEDURE

Particle Size Analysis

Particle size analyses of the bedload and suspended load are mandatory. Though not necessary to perform such analyses on every set of samples, perform enough analyses to define particle size distribution when bedload samples are collected at the site. Particle sizes may vary with flow conditions or season of the year.

If possible, collect representative bed material samples and conduct particle size analyses. Collect a volume sufficient to accurately define sizes present in the bed.

Tetherlines

A tetherline, attached as shown in Figure 1, provides more sampler control and prevents downstream drift while lowered through the sampling vertical. Tetherlines also help eliminate cross-stream "swimming" of the sampler. Tetherlines used with cable suspension may reduce the potential for scooping during sampler placement and retrieval.

Cross-sectional Procedures

The USGS Open-File Report 86-531 lists three cross-sectional procedures: the Single Equal Width Increment (SEWI) method, the Multiple Equal Width Increment (MEWI) method, and the Unequal Width Increment (UWI) method. The SEWI method is the most common and involves collecting 2 samples at each of 20 verticals. Sampling procedures should consider spatial (cross-sectional) variations and temporal (at-a-point) variations. Knowledge of past bedload locations does not necessarily imply future bedload locations, and it is unlikely such pre-judgment allows substitution of spatial concerns for temporal, or vice versa.

Ordinarily, field personnel must collect excess samples at a site to gain enough knowledge to select the appropriate measurement procedure. At some sites, it may be possible to define temporal and spatial variation with 40 samples while others may require 100 or more. A plot of individual bedload transport rates as a function of distance from the bank is often useful in selecting the appropriate sampling procedure. Ultrasonic depth soundings can be very useful to evaluate bedload variations. Optimal sampling procedure varies with season and flow conditions.

Sampling Time

The sampling time is the length of time the sampler rests on the bed and accumulates material for each individual sample. Long sampling times tend to average out short-term rate fluctuations and produce rates that vary about the mean rate in accordance with normal distribution. Short times, however, tend to reflect instantaneous rate variations and often correspond to asymmetrical distributions. The relatively small sampler capacity limits the range of acceptable sampling times, often to 30 to 60 seconds. Avoid sampling times of less than 10 seconds, and never fill the sample bag more than about half full. Limit sampling time to prevent significant clogging.

Sample Compositing

A bedload sample is the material collected during one sampling time. The width increment is the width of channel represented by the sample vertical. Analyze individual bedload samples either individually or combined into one or more composite samples. Composite only samples collected with equal sampling times and width increments.

Until site sampling variability is understood, analyze all samples individually. The more samples composited, the less learned about variability in space and time.

Analyses

Computation of Bedload Discharge

During sampling, investigators usually define the mean transport rate at a series of lateral locations, often equally spaced. For this strategy, composite no samples from different verticals. Rather, plot sample rates on a graph of

RATE versus WIDTH. Express RATE in units of weight per unit time per unit width. For conditions of reasonably constant discharge, average the rates at each measurement vertical and plot a curve representing lateral distribution of the bedload transport rate across the channel (or channels). This curve provides insight into the true shape of the lateral distribution curve. The area under the curve represents the total cross-section bedload transport rate in weight per unit time.

Sampler Efficiency

There are two general ways to measure bedload sampler efficiency:

1. Measure the ratio of water flow passing through the nozzle relative to the amount that would pass through the nozzle opening space if the sampler were not there. This is called the hydraulic efficiency. A value of 1.54, for example, indicates that 1.54 times more flow passes through the sampler as would pass through the nozzle opening space if the sampler were not in place.
2. The more relevant efficiency is the sediment-trapping efficiency, which is the amount of material the sampler traps relative to the amount of material that would have passed through the space occupied by the sampler nozzle if the sampler were not in place. Sediment-trapping efficiency is much more difficult to determine.

STEP #1

Place open end of bag over three of the sampler corners. Put the seams on top of the orifice.

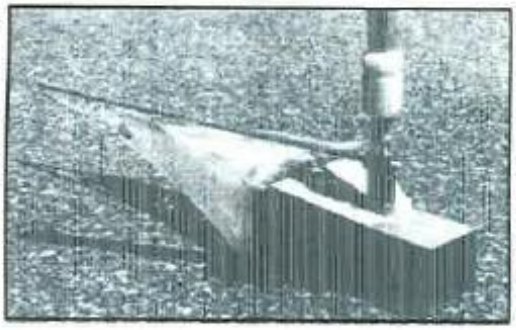
STEP #2

Slide bag down on the orifice past the groove. Pull bag over fourth corner. The rubber ring seats in the groove.

STEP #3

Slide bag over the other corners.

This method allows fast assembly. Reverse the procedure to remove the bag quickly and eliminate possible bag damage.



10.0 APPENDIX B: PRODUCT INFORMATION FOR AGSCO INDUSTRIAL SEDIMENT (AGSCO GROUND QUARTZ #325) WHICH WAS USED FOR CALIBRATING THE SETTLING COLUMN TESTING

AGSCO CORPORATION

TECHNICAL DATA

AGSCO GROUND QUARTZ #325

PHYSICAL PROPERTIES

SPECIFIC GRAVITY	2.65 g/cm^3
LOOSE PACK BULK DENSITY	1.28 - 1.36 g/cm^3 (80-85 lbs/ft^3)
pH in distilled water	7
MELTING POINT	3040 ^{o}F to 3400 ^{o}F
HARDNESS	Knoop - 820; Mohs – 7

TYPICAL CHEMICAL ANALYSIS

SILICON DIOXIDE	(SiO_2)	99.700%
IRON OXIDE	(Fe_2O_3)	0.022
ALUMINUM OXIDE	(Al_2O_3)	0.123
TITANIUM DIOXIDE	(TiO_2)	0.010
CALCIUM OXIDE	(CaO)	0.010
MAGNESIUM OXIDE	(MgO)	<0.010
SODIUM OXIDE	(Na_2O)	<0.010
POTASSIUM OXIDE	(K_2O)	<0.010
LOSS ON IGNITION		0.100

TYPICAL PARTICLE SIZE ANALYSIS

(Percent finer than mesh size)

Mesh	Novaculite 325 Discontinued	AGSCO Quartz #325
200	100	99.8
270	99.5	99.0
325	98	98.5
400	93.1	93.5
475	82.2	82.7
625	67.1	80
Avg. Particle Size, µ	27	28

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11.0 APPENDIX C: PRODUCT INFORMATION FOR AGSCO INDUSTRIAL SEDIMENT (AGSCO SILICA FLOUR 325) WHICH IS SIMILAR TO THE SEDIMENT USED TO CALIBRATE THE SETTLING COLUMN TESTING

AGSCO CORPORATION

TECHNICAL DATA

SILICA FLOUR 325

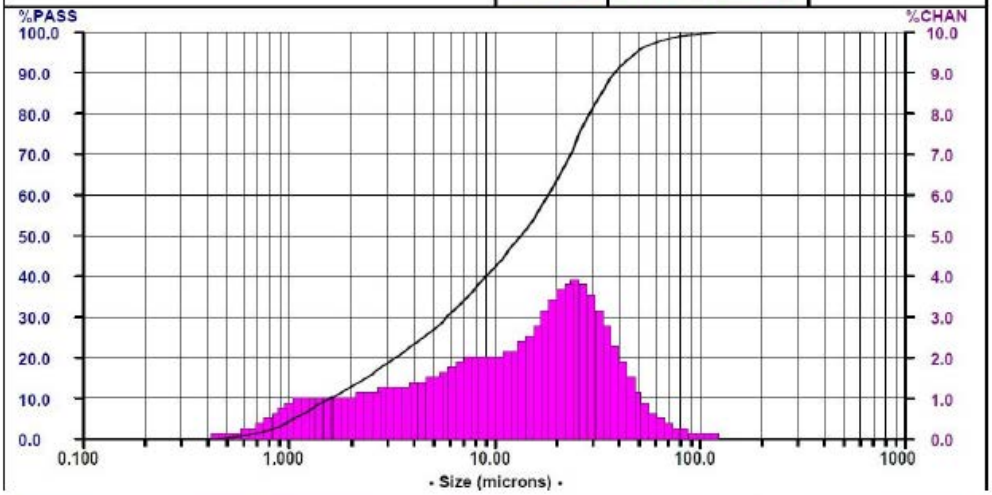
AGSCO silica flours are produced by grinding rounded Midwest sands to a finer particle size. These flours are useful in grouting compounds, the fines content of concrete, and refractory mixes to name just a few. Each product is valued for its particular size distribution and AGSCO stocks sizes as small as 1.6 micron mean. (Also see the Ultra Fine Silica Flours data sheet)

The particle size measurement of these flours is usually determined by sieve analysis. (These are shown on other data sheets as reported by the use of customary sieves) However, because the flours are so finely ground most of the particle size distribution is smaller than 325 mesh, the usual smallest sieve. Thus it is necessary to use laser light scattering techniques to give a full picture of the particle size distribution. Shown below is the distribution for Silica Flour 325. The mean volume size is 17.8 microns (50th percentile is 13.55) with a top size of about 49 microns. As with each of these flours there is a fine tail which stretches down to a less than one micron.

Lot# 50022813

Silica Flour 325

Summary	Percentiles		Dia	Vol%	Width
mv = 17.80	10% = 1.594	60% = 18.41	13.55	100%	29.68
mn = 0.846	20% = 3.292	70% = 23.29			
ma = 4.654	30% = 5.881	80% = 29.15			
cs = 1.289	40% = 9.089	90% = 38.59			
sd = 14.84	50% = 13.55	95% = 48.82			



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12.0 APPENDIX D: DATA LOG OF THE WATER SAMPLES

This data log included all of the pertinent data from the water sampling effort.

AK LNG Dredge Pit Study- Water Sampling Data Sheet								
Name:Elan Edgerly							Contact Info:	
No	Water Sampling						Notes[c]	Conditions
	Date	Sample Water Depth[a,b]	Water Sample Number	Pump Start Time (UTC)	Collection Time	Duration		
	dd-mmm-yy	m	WS0nn	hh:mm	hh:mm	seconds		
1	18-Apr-15	6	WS018	14:23	14:28	10.00	example data entry for w. sample	E.g. Seas calm, 5 knot variable
2	21-Apr-15	16	N122	18:08	18:08:30	3.00	OBS3A Site11_1.log	-
3	21-Apr-15	16	N87	18:08		3.00	-	-
4	21-Apr-15	13.5	N61	19:34:30	19:35	3.00	OBS3A Site11_2.log	-
5	21-Apr-15	13.5	N114	-	-	3.00	-	-
6	21-Apr-15	14	N120	23:38	23:38:30	2.00	OBS3A_Site11_3.log	-
7	21-Apr-15	14	N104	-	-	2.00	-	-
-	-	-	-	-	Site 11 - Flood	-	-	-
8	22-Apr-15	17.5	N110	1:13	1:13:30	2.50	OBS3A_Site11_4.log	-
9	-	-	N67	-	-	2.50	-	-
10	-	-	-	-	-	-	-	-
11	22-Apr-15	0.5	N115	18:00	18:06	10.00	18.3 water depth, 18:03 first see water at deck, 0.6 m/s and increasing	-
12	-	0.5	N82	18:08	18:15	8.00		-
13	-	1.5	N7	18:16	18:22	10.00	Site11_5_PlusWaterSample	1.2 m/s. Fish drifted up 0.75m during the wait
14	-	1.5	N102	-	-	8.00	-	-

AK LNG Dredge Pit Study- Water Sampling Data Sheet								
Name:Elan Edgerly							Contact Info:	
No	Water Sampling						Notes[c]	Conditions
	Date	Sample Water Depth[a,b]	Water Sample Number	Pump Start Time (UTC)	Collection Time	Duration		
	dd-mmm-yy	m	WS0nn	hh:mm	hh:mm	seconds		
15	-	2.5	N54	18:23	18:30	10.00	Ooops. Pump wasn't co-located with OBS. Re-located after cast	-
16	-	2.5	N83	-	-	10.00	Photos in photo library	-
17	-	Transit to Site 14	-	-	-	-	-	-
18	22-Apr-15	0.5	N108	19:17	19:33	10.00	-	-
19	22-Apr-15	0.5	N116	-	-	10.00	-	-
20	22-Apr-15	1.5	N36	19:35	19:50	12.00	-	-
21	22-Apr-15	1.5	N78	-	-	12.00	-	-
22	22-Apr-15	2.5	N45	19:51	20:06	15.00	-	-
23	22-Apr-15	2.5	N50	-	-	16.00	-	-
24	22-Apr-15	12	N79	20:14	20:16	2.00	Site14_1_PlusWaterSample (pumped sample)	ADCP Mast samples
25	22-Apr-15	12	N118	-	-	2.00	-	-
26	22-Apr-15	12	N22	20:54	20:56	2.00	Site14_2.log	ADCP Mast samples
27	22-Apr-15	12	N74	-	-	2.00	-	-
28	-	-	-	-	-		Site 14 - Flood	-
29	23-Apr-15	14	N52	0:37	0:39	2.00	Site14_3.log (OBS cast)	-
30	23-Apr-15	-	N71	-	-	2.00	-	-
31	23-Apr-15	15.5	N81	1:28:30	1:30:30	2.00	Site14_4.log (OBS cast)	cable not long enough to reach bottom with the wire angle achieved.
32	23-Apr-15	-	N55	-	-	2.00	-	-

AK LNG Dredge Pit Study- Water Sampling Data Sheet

Name:Elan Edgerly | Contact Info:

No	Water Sampling						Notes[c]	Conditions
	Date	Sample Water Depth[a,b]	Water Sample Number	Pump Start Time (UTC)	Collection Time	Duration		
	dd-mmm-yy	m	WS0nn	hh:mm	hh:mm	seconds		
33	23-Apr-15	18	N32	3:42	3:44	2.00	Site14_5.log (OBS cast)	-
34	-	-	N123	-		2.00	-	-
35	-	-	-	-	Site 13 - End of Flood, turning into an ebb	-	-	-
36	23-Apr-15	16.5	N21	17:34	17:43	15.00	0.5 m/s flood and decreasing	-
37	-	-	N64	-	-	13.00	17:30 Sounding weight on bed, pause while we take care of snarl with hose and pump cables on deck.	-
38	-	-	N31	17:44	17:53	14.00	Water first on deck after 2.5 min. Wait about 9 min.	-
39	-	-	N101	-	-	13.00	Ship's crew saw 4' sand waves on ship's sounder as approaching and anchoring.	-
40	-	-	N57	17:55	18:04	14.00	Tide has turned to an ebb. ~ 0.5 knt	-
41	-	-	N91	-	-	13.00	Start at 60 N 39.667', 151W 22.5744	End at 60 N 39.6163, 151W 22.8674'
42	-	-	-	-	-	-	Site13_WaterSample .log	-
43	23-Apr-15	14.5	N47	19:24	19:26	2.00	Ebbng ~ 1 m/s	OBS3A_Site13_1.log
44	-	-	N51	-	-	2.00	-	-
45	23-Apr-15	13	N4	20:06	20:09	2.50	See ~ 1m difference across the 4 beams. 1 m/s ebb	OBS3A_Site13_2.log
46	-	-	N43	-	-	2.50	-	-
47	24-Apr-15	12	-	-	-	-	Site 13 - Flood	-

AK LNG Dredge Pit Study- Water Sampling Data Sheet								
Name:Elan Edgerly							Contact Info:	
No	Water Sampling						Notes[c]	Conditions
	Date	Sample Water Depth[a,b]	Water Sample Number	Pump Start Time (UTC)	Collection Time	Duration		
	dd-mmm-yy	m	WS0nn	hh:mm	hh:mm	seconds		
48	-	0.5	N13	1:09	1:24	10.00	OBS3A_Site13_3_pluswatersample	-
49	-	0.5	N125	-	-	8.00	Seems battery was low. Put onto charger. Will run for 15 min as it took 6 min before water was first on deck.	-
50	-	1.5	N88	1:26	1:41	9.00	Fish is drifting up in water column as current speeds increase. Will do next sample at 9 min as per AM. The time to fill seems to indicate we are gathering a valid sample, and we will hopefully have less time for the fish to lift even higher into the water column.	-
51	-	1.5	N1	-	-	8.00	-	-
52	-	2.5	N25	1:42	1:51	9.00	-	-
53	-	2.5	N6	-	-	-	-	-
54	24-Apr-15	14.5	N19	2:58	3:00	2.00	OBS3A_Site13_4.log	-
55	-	-	N84	-	-	2.00	-	-
56	24-Apr-15	15.5	N44	3:59	4:01	2.00	OBS3A_Site13_5.log	-
57	-	-	N69	-	-	2.00	-	-
58	-	-	-	-	-	-	Site 19 Flood - 24 April, 2015	-
59	24-Apr-15	13.5	N3	14:42	14:44	2.00	~ 1.1 m/s flood currents	OBS3A_Site19_1.log
60	-	-	N70	-	-	2.00	-	-
61	24-Apr-15	14	N41	15:12	15:14	2.00	1.2 m/s currents	OBS3A_Site19_2.log
62	-	-	N99	-	-	2.00	-	-

AK LNG Dredge Pit Study- Water Sampling Data Sheet								
Name:Elan Edgerly							Contact Info:	
No	Water Sampling						Notes[c]	Conditions
	Date	Sample Water Depth[a,b]	Water Sample Number	Pump Start Time (UTC)	Collection Time	Duration		
	dd-mmm-yy	m	WS0nn	hh:mm	hh:mm	seconds		
63	24-Apr-15	14.7	N77	17:33	17:46	8.00	~0.6 m/s flood	At 5 minutes run time, still no water pumped to the deck.
64	-	-	N56	-	-	9.00	[Ship] charger indicated full charge last night, so pulled off charger. It now measures 12.2V. Put charger on and wait 10 minutes beyond when external power is applied.	-
65	-	-	N5	17:48	17:58	8.00	Currents have fallen to about 0.4 m/s	-
66	-	-	N113	-	-	8.00	-	-
67	-	-	N16	17:59	18:08	8.00	-	-
68	-	-	N121	-	-	8.00	-	-
69	24-Apr-15	14.5	N27	18:13	18:15	2.00	Mast sample at end of flood.	-
70	-	-	N117	-	-	2.00	-	-
71	24-Apr-15	11.6	N17	20:34	20:26	2.00	To document proceedure: Write times to the minute, but a stop watch is used to determine latent time threshold is met.	
72	-	-	N38	-	-	2.00	OBS3A_Site19_4	Ths sample for 0.9 m/s on the ebb.
73	24-Apr-15	10	N94	20:52	20:55	2.00	OBS3A_Site19_5	Ebbing ~0.8 m/s
74	-	-	N107	-	-	2.00	-	-
75	-	-	-	-	-	-	-	-
76	-	-	-	-	-	-	-	-
77	-	-	-	-	-	-	-	-
78	-	-	-	-	-	-	-	-

AK LNG Dredge Pit Study- Water Sampling Data Sheet								
Name:Elan Edgerly							Contact Info:	
No	Water Sampling						Notes[c]	Conditions
	Date	Sample Water Depth[a,b]	Water Sample Number	Pump Start Time (UTC)	Collection Time	Duration		
	dd-mmm-yy	m	WS0nn	hh:mm	hh:mm	seconds		
79	-	-	-	-	-	-	-	-
80	-	-	-	-	-	-	-	-
81	-	-	-	-	-	-	-	-

13.0 APPENDIX E: DATA LOG OF THE BEDLOAD SAMPLES

AK LNG Dredge Pit Study- Sediment Data Sheet

Name:
Contact Info:

No	Bed-load Sampling: Bed-load Sample-Water Depth (ADCP Sounding - ADCP at 1.94	Time bed-load sample on bottom (UTC)	Time bed-load sample lifted	Sediment Sample (bag) Number	Weight of Bucket and Sediment, Wet (lb oz)		WEIGHT LB	WEIGHT OZ	Mass of particles (14 oz bag and bucket assumed) kg	period of sampling (min) min	cubic m per second	vel. (m/s) [m/s]			Notes[a]	Conditions
														note: back in the lab, the bag and bucket seem to weigh 16.7 oz.		
	m	hh:mm	hh:mm	SS0m	Wt											
1	23	14:23	14:23	SS023	2 2.5										example data entry for s. sample	E.g. Seas calm, 5 knot variable
2	16	4/21/2015 17:55	NA	NA	NA										Start ADCP Site 11 ebb. Small swell. File Site11_0.	
3	16	4/21/2015 18:07	18:17	1	14.5			14.5	0.014204545	10.00	1.57828E-08				Includes some dead leaves; OBS3A Site11_1	
4	15	4/21/2015 18:30	18:45	NA	NA										Still a small sample. Do not collect. Try adjusting a few more things.	
5	15	4/21/2015 18:34	NA	NA	NA										ADCP not recording. It is now recording.	
6	14.5	4/21/2015 18:53	19:08	2	01:04.7		1.00	4.70	0.113636364	15.00	8.41751E-08	1.2			net 4, 1.2 m/s	
7	13.5	4/21/2015 19:30	19:45	3	01:03.9		1.00	3.90	0.090909091	15.00	6.73401E-08	1.2			net 6, 1.2 m/s	
8				FLOOD, Site 11												
9	14	4/21/2015 23:37	23:57	4	01:02.5		1.00	2.50	0.051136364	20.00	2.84091E-08				Bag entire sample, See video 107-1315 for scale behaviour under calm conditions.	
10	17.5	4/22/2015 1:12	1:32	5								1.70			Add broom stick to counter drag of tilt ping	1.7 m/s, movie 107-1320 shows deplo
11				net 6	01:03.0		1.00	3.00	0.065340909						Includes red bungee	Movie 1321 shows recovery, photo 13
12																Photos 107-1325-1333 shows grain siz
13	19	4/22/2015 2:20	NA	NA	NA										Swell of 4-5 feet on the beam makes further operations risky to equipment and pe	
14															Transiting north of the Forelands, transecting to file Transect_to_Forelands_21-22	
15				Operations for 22 April, ADT												
16	NA	NA	NA	NA	NA										Start transect to Site 11 Transit_to_Site11	Leave at the end of the Ebb, and find f
17	NA	NA	NA	NA	NA										Start ADCP at Site 11: Site11_22April_0	
18	16	18:36	18:56	#6	01:03.5		1.00	3.50	0.079545455	20.00	4.41919E-08				Did the depth shoal during the sample due to ship swinging on anchor, or was it th	
19	NA	NA	NA	NA	NA										Transit to Site 14	
20	12	20:12	20:32	7	01:03.7		1.00	3.70	0.085227273	20.00	4.73485E-08	1.2			1.2 m/s ebb. Note variability in 4 ADCP beams is 1m range. Occassional double pi	
21															Discover that ADCP was gathering data, but not logging to computer. Start loggin	
22	14.3	20:43	21:03	8	01:03.0		1.00	3.00	0.065340909	20.00	3.63005E-08	1.1			13.3 m depth, 1.1 m/s ebb, net #6.	
23	21:40														Restart ADCP log to file Site14_22April	
24	NA	NA	NA	NA	NA										Tide turns to a flood at Site 14, April 23, UTC.	
25	14	0:37	0:57	9	01:03.6		1.00	3.60	0.082386364	20.00	4.57702E-08	1.1			Flooding. Starts at 1.1 m/s and ramps up to 1.1 m/s during sample	
26	15.5	1:30	1:50	10	01:04.5		1.00	4.50	0.107954545	20.00	5.99747E-08	1.7			Flooding. 1.7 m/s and increasing. 1-2' swell and 10-15 knot winds from N. net #6	
27	18	3:20	3:40	11	01:02.0		1.00	2.00	0.036931818	20.00	2.05177E-08	1.5			1.5 m/s flood falling to 1.3 m/s, net 5. Retain this net for analysis.	
				Operations for 23 April, 2015 ADT												
28	NA	NA	NA	NA	NA										23 April, 2015 ADT. Starting at Site 13	ADCP file Site13_23-24April
29	14.5	19:14	19:34	12 (net 6)	01:04.0		1.00	4.00	0.09375	20.00	5.20833E-08	1			Ebbing 1 m/s and increasing	
30															Less biological material than at other sites. More sand-like. Also, evidence of sand	
31															Weight of rinsed net and bucket is 1:1.9 (took advantage of unusually calm condit	
32															Values measured with Elan (unrinsed) were 16.5 oz. Is the difference due to wett	
33	13.5	20:01	20:21	13 (net 2)	01:06.1		1.00	6.10	0.153409091	20.00	8.52273E-08	1			1 m/s. Biology is back in the sample.	
34				Site 13 Flood 23 April 2015 PM (ADT)												
35	13.5	01:55:00 (24 Apr UTC)	2:15	14 (net 6)	01:03.8		1.00	3.80	0.088068182	20.00	4.89268E-08	1.1			1.1 m/s	
36	14.5	3:00	3:20	15 (net 2)	01:02.3		1.00	2.30	0.045454545	20.00	2.52525E-08	1.5			1.5 m/s	calm seas and winds, almost nothing v
37	15.5	4:01	4:21	16 (net 6)								1.30			1.3 m/s flood	
38	16.5				Site 19 24 April 2015 (flood)											
39	17.5	13.5	14:45 (24 Apr, 2015 UTC)	15:05	# 17 (net 2)	01:14.7	1	14.7	0.397727273	20.00	2.2096E-07	1.1			1.1 m/s. Sample includes dead twig.	
40	18.5	14	15:45	16:05	#18 (net 3)	01:02.8	1.00	2.80	0.059659091	20.00	3.31439E-08	1.2			1.2 m/s flood	Hmm... very different from last cast. N
41	19.5	14.7	17:01	17:21	#19 (net 2)	01:03.6	1.00	3.60	0.082386364	20.00	4.57702E-08	0.9			~0.9 m/s and falling.	What happened with the elevation? ((
42	20.5	11.6	20:34	20:54	#20 (net 3)	01:02.5	1.00	2.50	0.051136364	20.00	2.84091E-08	0.9			0.9 m/s on the ebb	Crew notes sticky globs of clay on ans
43	21.5															Ask crane operator about 1st cast this
44	22.5	10.5	21:30	21:50	#21 (net 2)	01:09.1	1.00	9.10	0.238636364	20.00	1.32576E-07	1			~ 1m/s on the ebb	Also sample the swept net.

APPENDIX Q ANALYTICAL RESULTS OF SEDIMNENT SAMPLING NEAR THE MARINE TERMINAL IN COOK INLET

SEDIMENT TRANSPORT SAMPLING AND MONITORING – PHASE 2

Confidential

SEDIMENT TRANSPORT SAMPLING AND MONITORING – PHASE 2 REPORT

USAL-CH-JRZZZ-90-000028-001

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1.0 PURPOSE AND SCOPE

BP, ConocoPhillips, ExxonMobil, TransCanada and the State of Alaska signed a Heads of Agreement (HOA) establishing the guiding principles and basic framework under which the participants will advance the Alaska LNG Project. Refer to the project website at www.ak-lng.com for further details.

In order to accommodate the Pre-FEED objectives for the Alaska LNG Project (AKLNG), CH2M HILL Engineers Inc. (CH2M) has been contracted to provide the Pre-FEED for the Marine Facilities at the LNG export site in Nikiski. As part of the Dredging Studies and Execution Planning, CH2M has examined the feasibility of dredging to support the construction of the Marine Facilities. Part of the studies to support the dredging feasibility assessment include the development of a numerical sediment transport model. The Sediment Transport Sampling and Monitoring is designed to collect field measurements of the flow and sediment regimes, and has been carried out in two phases.

The goal of Sediment Transport Sampling and Monitoring – Phase 1 was to collect field measurements to characterize offshore flow and sediment transport. The Phase 1 data were collected in open water from vessel-mounted instruments for four days from 21-Apr-15 through 24-Apr-15. The results of that effort are documented in the report *Sediment Transport Sampling and Monitoring – Phase 1* (USAL-CH-JRZZZ-90-000028-000). The goal of Phase 2 was to collect data to characterize nearshore and longshore flow and sediment transport. The Phase 2 work was shore-based and carried out on four days between 31-Aug-15 and 28-Sep-15. The purpose of this report is to document the Phase 2 field campaign.

To measure longshore sediment transport as a function of wave conditions in the surf zone, hydrodynamic and sediment transport data collection episodes over four tidal cycles at the Salamatof Road access point were attempted. The field campaigns were shore-based, i.e., instruments were placed on the beach face at low tide, submerged as the tide came in, and exposed again for retrieval as the tide receded. Furthermore, the field measurements, laboratory analyses, and computations from measured variables were designed to meet the following objectives:

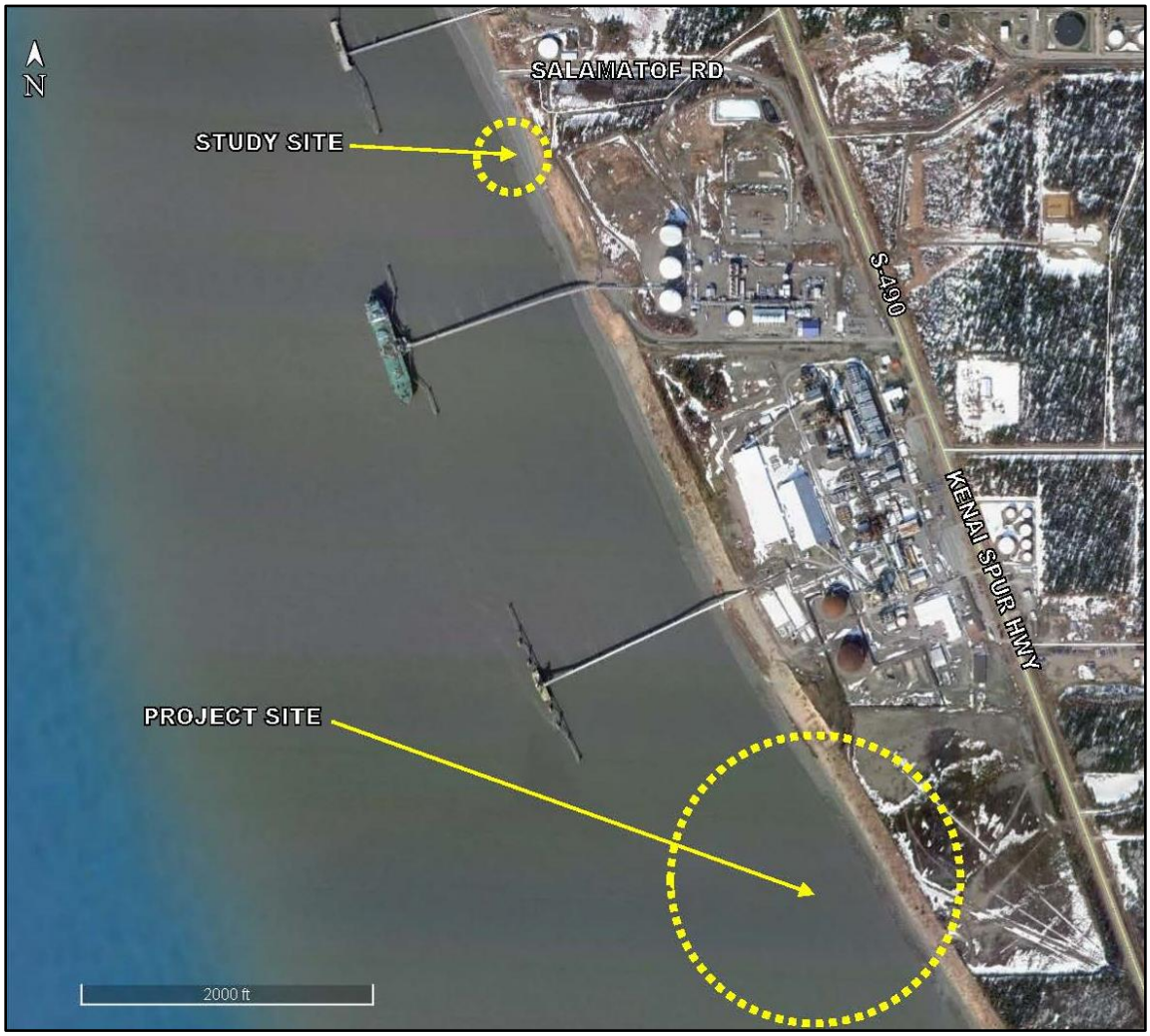
- Compute depth-averaged velocity and develop the logarithmic velocity profile.
- Analyze water samples for suspended sediment concentration (SSC) and particle size frequency distribution; determine representative grain size of the suspended sediment.
- Calibrate the Optical Backscatter (OBS) sensors with in situ SSC from water samples.
- Infer SSC from the signal of four OBS sensors and develop the SSC profile from the Rouse Equation.
- Compute the suspended sediment transport rate.
- Compute wave parameters.
- Analyze bedload samples for total mass and particle size frequency distribution; determine representative grain size of the bedload.
- Compute bedload transport rates from field data; the widely-used US Army Corps of Engineers (USACE)-supported Coastal Engineering Research Center (CERC) formula; and van Rijn's simple general equation for longshore transport (van Rijn, 2014).

2.0 STUDY SITE

The Alaska LNG Project is evaluating alternatives for the location of the Marine Facility nearby Nikiski on the Kenai Peninsula. As part of the dredging investigation for the Marine Facility, the excavation of test pits has been proposed. The test pits would be excavated at the Project Site and sediment infill would be regularly monitored over a period of two years. This will allow comparison of measured sediment infill rates with simulated sediment infill rates from a sediment transport model.

The closest public access point to the Project Site is at Salamatof Road. Salamatof Road is about 2 mi north of the project site near the ConocoPhillips Kenai LNG facility (Figure 1). Between Salamatof Road and the Project Site, locations along the beach may be inundated to the toe of the bluff at high tide. This restricts beach access, and presents safety concerns for access and hauling field equipment along the beach at the Project Site. However, locating the instruments close to Salamatof Rd offers direct access and provides safe exit at high tide without risk of inundation.

Figure 1: Sampling Location



The Salamatof Road access point and the Project Site were generally similar in nature, as confirmed by a visit to this area at low tide on 21-Sep-15. The beach sediment was gravel atop sand everywhere. The bluffs in this area were sand and gravel with elevation of approximately +120 ft MLLW. Furthermore, the LIDAR surveys taken on 3-Feb-15 show similar beach profiles in this area. In this coastal setting, little overall variation in the beach response to wave conditions was expected over a distance of 2 miles. Therefore, field data and observations collected at the Salamatof Road access point were assumed to reasonably reflect similar conditions at the Project Site.

The shoreline tidal zone is characterized by well-graded gravels and sands and immediately bounded by 120 to 160 ft tall sand bluffs to the east.

3.0 METHODS

A combination of field measurements, laboratory analyses, and computations from measured variables was implemented in order to achieve the stated objectives.

3.1 FIELD MEASUREMENTS

Shore-based field measurements were attempted over three tidal cycles on three days: 21-Sep-15, 25-Sep-15, and 28-Sep-15. Conditions varied over the sampling days. The conditions necessary for data collection are windy enough to produce moderate waves but not so windy as to compromise the safety of personnel or equipment. Understanding that it is inherently difficult to predict the weather and that the weather may change with little warning, a significant wave height of 2-4 ft was sought for the data collection periods. A significant wave height greater than 5-6 ft presents safety challenges for personnel and equipment; particularly the instruments packages QUAD-1 and QUAD-2 (see Figure 2 and Figure 3).

By contrast, the Bedload Samplers and Barnacle 53 (Figure 4 and Figure 5) are generally better capable of withstanding very rough weather. On 25-Sep-15, rough weather precluded collection of suspended sediment transport data (QUAD-1 and QUAD-2 were removed from the surf zone); however, the bad weather did not disrupt collection of bedload data (the Bedload Samplers and Barnacle 53 remained for the duration of the tidal cycle). A fourth campaign was attempted on 31-Aug-15, however, malfunction of the data logger severely limited data collection on this day; both suspended sediment transport data and bedload transport data were incomplete.

Because this work concerned longshore sediment transport in the surf zone, instrument packages were placed on the beach face at low tide, submerged as the tide came in, and exposed again for retrieval as the tide receded. This allowed for data collection in the shallow surf zone for the duration of time that each stationary instrument package remained submerged. The mobilization of field equipment took about 2 hr with instrument packages placed within that 2 hr period; demobilization was similarly about 2 hr with instrument packages removed as they become available with the receding tide. Fieldwork was limited to daylight hours and the timing of field measurements on the sampling days is shown in Table 1. All times are noted in Local Daylight Saving Time (LDT).

Table 1: Guidance for the Timing of Field Measurements

Date	Time (LDT)			Height of High Water[b, c] (ft)
	Sunrise[a]	High Water[b]	Sunset[a]	
31-Aug-15	6:56 a.m.	6:38 p.m.	9:14 p.m.	24.6
21-Sep-15	7:47 a.m.	11:49 a.m.	8:09 p.m.	16.1
25-Sep-15	7:57 a.m.	3:33 p.m.	7:56 p.m.	21.3
28-Sep-15	8:04 a.m.	5:27 p.m.	7:47 p.m.	25.2

Note: [a] From NOAA Solar Caculator for Nikiski, Alaska.
[b] From NOAA Tide Predictions for Nikiski, Alaska (Station 9455760).
[c] Referenced to MLLW.

Instrument package QUAD-1 was used to obtain measurements of: pressure for the computation of water depth and near-bottom velocity at two vertical positions with two Nortek Vectors; OBS intensity to infer SSC at four vertical positions with four Campbell Scientific OBS-3+ sensors; and SSC and particle size frequency distribution from water samples collected with a bilge pump.

The instrument package QUAD-2 was used to obtain measurements of: pressure for the computation of water depth and high-frequency velocity for the computation of wave height, direction, and period using a Nortek Vector. Two Helley-Smith Bedload Samplers (Model 8075) were used to collect bedload samples with the purpose of characterizing bedload material and deriving bedload transport rates. The SonTek ADP was mounted to a Barnacle 53, a trawl-resistant bottom mount frame from Teledyne Oceanscience, and used to obtain measurements of pressure for the computation of water depth and vertical profiles of high-frequency velocity for the computation of wave height, direction, and period.

The instrument packages are described in Table 2, including the instrument package name, the instrument(s), the measurement(s), and the designation, as applicable. In addition, QUAD-1 is shown in Figure 1; QUAD-2 is shown in Figure 2; the Helley-Smith Bedload Sampler is shown in Figure 3; and the Barnacle 53 is shown in Figure 4.

Table 2: Instrument Packages

Instrument Package	Instrument(s)	Parameter(s) Measured	Designation
QUAD-1	Nortek Vector (2)	Velocity and pressure	Bottom Current-ADV
			Top Current-ADV
	Campbell Scientific OBS-3+ (4)	Optical Backscatter intensity to infer SSC	OBS-1
			OBS-2
			OBS-3
			OBS-4
	Bilge Pump	Water samples to measure SSC and particle size frequency distribution	-
QUAD-2	Nortek Vector	Velocity and pressure to compute wave height, direction, and period	Wave-ADV
Bedload Sampler	Helley-Smith Bedload Sampler (Model 8075)	Bedload samples to estimate bedload transport rate and particle size frequency distribution	-
Barnacle 53	SonTek ADP	Velocity and pressure to compute wave height, direction, and period	-

Figure 2: QUAD-1 Sampling Package

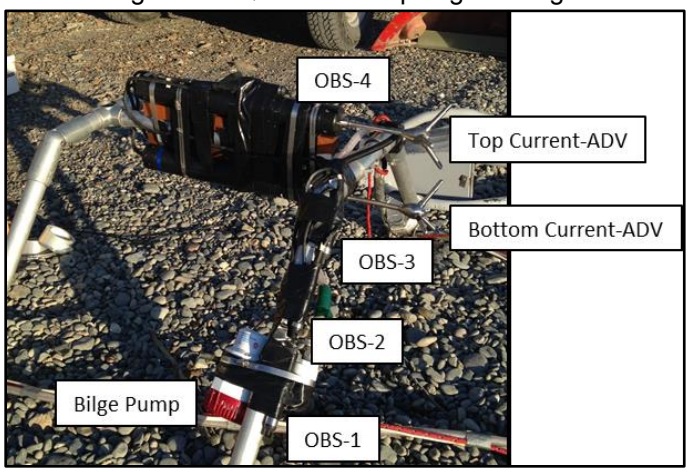


Figure 3: QUAD-2 Sampling Package

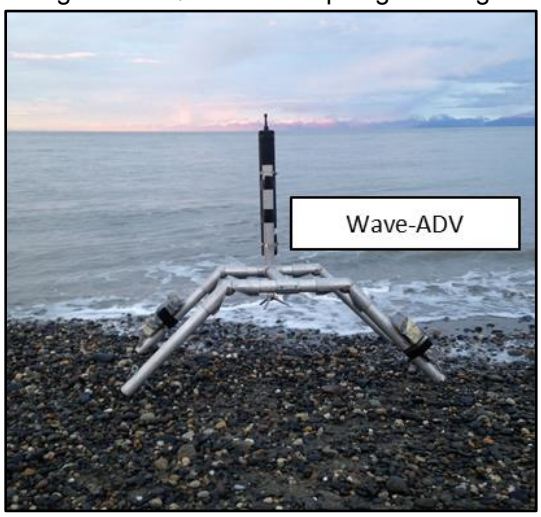


Figure 4: Bedload Sampler

Figure 5: Barnacle 53

Details regarding the field measurements by date are listed in Table 3 and include the deployed instrument package(s), the instrument(s), the designation, the sensor height or orientation, and the sampling rate/interval, as applicable.

On 21-Sep-15 and 28-Sep-15, QUAD-2 was placed first, offering the greatest submergence at the time of high water. Next, a Bedload Sampler was placed nearby QUAD-2 (within a few meters). Then QUAD-1 was placed on the beach with a second Bedload Sampler nearby (also within a few meters).

On 25-Sep-15, the Barnacle 53 was placed first at the approximate time of low water (12:00 p.m.). QUAD-1 and QUAD-2 were deployed as described on 21-Sep-15 and 28-Sep-15. However, the weather conditions grew increasingly adverse (significant wave height at breaking reached about 6 ft); to protect the instruments from being damaged, they were pulled from the surf zone within about 30 min of deployment instead of remaining for several hours as planned. Two Bedload Samples were collected in addition to the SonTek ADP data.

Table 3: Field Measurements

Date	Instrument Package(s) Deployed	Instrument(s)	Designation	Sensor Height or Orientation	Sampling Rate/Interval
21-Sep-15	QUAD-1	Nortek Vector (2)	Bottom Current-ADV	0.29 m above bottom	4 Hz
			Top Current-ADV	0.49 m above bottom	4 Hz
		Campbell Scientific OBS-3+ (4)	OBS-1	0.13 m above bottom	4 Hz
			OBS-2	0.23 m above bottom	4 Hz
			OBS-3	0.39 m above bottom	4 Hz
			OBS-4	0.50 m above bottom	4 Hz
		Bilge Pump	-	0.13 m above bottom	Every 10-20 min
	QUAD-2	Nortek Vector	Wave-ADV	0.43 m above bottom	4 Hz
	Bedload Sampler	Helley-Smith Bedload Sampler (Model 8075)	-	-	1 time
25-Sep-15	Barnacle 53	SonTek ADP	-	Bottom mounted with 0.25-m vertical bins	0.67 Hz
	Bedload Sampler	Helley-Smith Bedload Sampler (Model 8075)	-	-	2 times
28-Sep-15	QUAD-1	Nortek Vector (2)	Bottom Current-ADV	0.25 m above bottom	4 Hz
			Top Current-ADV	0.47 m above bottom	4 Hz

Date	Instrument Package(s) Deployed	Instrument(s)	Designation	Sensor Height or Orientation	Sampling Rate/Interval
		Campbell Scientific OBS-3+ (3)	OBS-2	0.23 m above bottom	4 Hz
			OBS-3	0.39 m above bottom	4 Hz
			OBS-4	0.50 m above bottom	4 Hz
		Bilge Pump	-	0.13 m above bottom	Every 10-20 min
	QUAD-2	Nortek Vector	Wave-ADV	0.43 m above bottom	4 Hz
	Bedload Sampler	Helley-Smith Bedload Sampler (Model 8075)	-	-	2 times

3.2 LABORATORY ANALYSES

3.2.1 Suspended Sediment

Water samples were analyzed for Suspended Sediment Concentration (SSC) and particle size frequency distribution in the University of Alaska Anchorage (UAA) Fluid Mechanics Laboratory. To determine SSC, water samples were processed with a vacuum pump apparatus using 0.3-µm glass fiber filters from PALL Life Sciences (Type A/E). The filters were dried in a 70ºC oven for 24 hr to remove any moisture and the pre-weight was recorded. Then ~100 mL of water sample was pulled through the filter using the vacuum pump. The exact volume of water was recorded. The filter and sediment were dried in a 70ºC oven for 24 hr and the dry weight was recorded.

To determine particle size frequency distribution, water samples were processed in the laboratory using the LISST-100X Type C instrument (LISST-100X) from Sequoia Scientific, Inc., with the 100-mL mixing chamber attachment. The LISST-100X uses laser diffraction to obtain suspended size distribution in 32 logarithmically spaced size classes of median diameter from 2.5 to 500 µm and reports concentration by size class in volumetric units.

Typically, water samples coming from Cook Inlet have had high concentrations of suspended sediment (>0.8 g/L), and therefore the light transmission of the standard 50 mm optical path of the LISST-100X has been <1%. This has necessitated the dilution of Cook Inlet water samples in the past; a preliminary review of the water samples indicated this was also necessary here. In this case, 5 mL of water sample was diluted with 95 mL of Reverse Osmosis water for analysis in the 100-mL mixing chamber. Samples were analyzed for 30 sec (20 records with a time interval of 1.5 sec) and results were reported as an average over the 30 sec. To develop the particle size distribution (percent passing), the upper limit of each size class was used in the analysis.

The logarithmically spaced size classes are shown in Table 4. In keeping with standard practice, it was assumed that the particles were spherical. The median size refers to the diameter of a sphere representative of each size bin.

Table 4: LISST-100X Size Classes

Size Bins 1-16				Size Bins 17-32			
Size Bin	Lower Limit (µm)	Upper Limit (µm)	Median Size (µm)	Size Bin	Lower Limit (µm)	Upper Limit (µm)	Median Size (µm)
1	2.50	2.95	2.72	17	35.4	41.7	38.4
2	2.95	3.48	3.20	18	41.7	49.2	45.3
3	3.48	4.11	3.78	19	49.2	58.1	53.5
4	4.11	4.85	4.46	20	58.1	68.6	63.1
5	4.85	5.72	5.27	21	68.6	80.9	74.5
6	5.72	6.75	6.21	22	80.9	95.5	87.9
7	6.75	7.97	7.33	23	95.5	113	104
8	7.97	9.40	8.65	24	113	133	122
9	9.40	11.1	10.2	25	133	157	144
10	11.1	13.1	12.1	26	157	185	170
11	13.1	15.4	14.2	27	185	218	201
12	15.4	18.2	16.8	28	218	258	237
13	18.2	21.5	19.8	29	258	304	280
14	21.5	25.4	23.4	30	304	359	331
15	25.4	30.0	27.6	31	359	424	390
16	30.0	35.4	32.5	32	424	500	460

Note: From LISST-100X User's Manual Version 5.1.

3.2.2 Bedload

Bedload samples were analyzed for total mass and particle size frequency distribution in the UAA Geotechnical Engineering and Soil Mechanics Laboratory. The samples were dried in a 70ºC oven for 48 hr and the total weight was recorded. To determine particle size frequency distribution, bedload samples were processed using the Sieve Tester Model SS-15 from Gilson Company, Inc. The pre-weight of each sieve was recorded. Each sample was shaker tested for 10 min. Then the dry weight retained on each sieve was recorded. The sieve series shown in Table 5 were selected based on engineering judgement considering the material collected, and thus other sieve sizes were not used.

Table 5: Sieve Series for Shaker Testing

Sieve Size (mm)	Opening (in)	Standard Mesh (US)
25.00	0.985	-
19.00	0.749	-
9.50	0.374	-
4.75	0.187	4
2.00	0.079	10
0.850	0.033	20
0.600	0.024	30

Sieve Size (mm)	Opening (in)	Standard Mesh (US)
0.425	0.017	40
0.250	0.010	60
Pan	-	-

4.0 DATA ANALYSIS AND RESULTS

4.1 SUSPENDED SEDIMENT TRANSPORT

Suspended sediment transport refers to the movement of sediment entrained in the water column. This is in contrast to bedload transport, which refers to movement of sediment along the bed layer. The bed layer thickness was taken as $2d_{b,50}$, where $d_{b,50}$ was the median grain size of the bed sediment. The vertical extent of suspended sediment transport was, therefore, $2d_{b,50}$ to the height of the water column, H.

To estimate suspended sediment transport rates, vertical profiles of velocity and SSC were required. Time-averaged logarithmic velocity profiles were computed using available field data. The Rouse Equation was used to develop SSC profiles, also time-averaged and using available field data (Rouse, 1937). The necessary data were available for 21-Sep-15 and 28-Sep-15 (see Table 3). The total suspended sediment transport is reported here as the rate of suspended sediment transport per unit length in the cross-shore direction and was computed according to:

Equation 1: Suspended Sediment Transport Rate

$$Suspended\ Sediment\ Transport\ Rate\ = \sum_{z=2d_{b,50}}^{H} C(z)U(z)\Delta z$$

where z was the height above bottom, $C(z)$ was the suspended sediment concentration as a function of height above bottom, $U(z)$ was the velocity as a function of height above bottom, and Δz was the thickness of the vertical layer taken as $\Delta x = 5\ mm$. From the laboratory analyses of the bedload samples, $d_{b,50} = 15\ mm$ (see Section 4.2). Considering the experimental set-up, the height of the water column, H, at the location of QUAD-1 varied throughout the tidal cycle; H was determined from the pressure signal of the Bottom Current-ADV, correcting for atmospheric pressure and adjusting for the height of the sensor.

4.1.1 Velocity Profiles

The logarithmic velocity profile is computed from:

Equation 2: Log Law of the Wall

$$U(z) = u_* \frac{1}{\kappa} ln \frac{z}{z_0}$$

where u_* was the shear velocity, κ was the von Kármán constant ($\kappa \cong 0.41$), and z_0 was the elevation of zero velocity and has been empirically-determined (*Julien*, 2010, p. 117, Eq. 6.12b).

The shear velocity is computed using:

Equation 3: Shear Velocity

$$u_* \cong \frac{V}{\left[5.75 log\left(\frac{2H}{d_{b,50}}\right)\right]}$$

where V was the depth-averaged velocity measured with the Current-ADV at a height b from the bed (*Julien*, 2010, p. 121, Eq. 6.19c); V was determined by averaging each of the three directional components of velocity and resolving the magnitude. The depth-averaged flow velocity has been found analytically to be at a height of $0.37H$ (*Julien*, 2010, p. 121). In these analyses $\frac{b}{H}$ varied with

varying H through the tidal cycle; the Current-ADV that was mostly closely aligned to a height of $0.37H$ was selected for the depth-averaged velocity for each time period (see Table 3 and Table 6).

Considering a rough boundary, z_0 was given including the Nikuradse roughness height as:

Equation 4: Nikuradse Roughness Height

$$z_0 = \frac{k_s'}{30}$$

where k_s' was the Nikuradse roughness height ($k_s' \cong 6.8d_{b,50}$; *Julien*, 2010, p. 120). For $d_{b,50} = 15\ mm$, $z_0 = 0.0034$. Note that this is the roughness of the seabed due to grains packed unevenly along the surface, and not the roughness of each individual grain. The variables for the computation of the logarithm velocity profile (Equation 2) for each period are listed in Table 6.

Table 6: Variables for the Computation of the Velocity Profile (Equation 2)

Date	Time (LDT)	$\boldsymbol{H}$ (m)	$\boldsymbol{b}$ (m)	$\frac{\boldsymbol{b}}{\boldsymbol{H}}$	$\boldsymbol{V}$ (m/sec)	$\boldsymbol{u_*}$ (m/sec)
21-Sep-15	10:00 a.m.	0.9	0.294	0.33	0.0917	0.0077
21-Sep-15	10:30 a.m.	1.2	0.486	0.41	0.1335	0.0105
21-Sep-15	11:00 a.m.	1.4	0.486	0.35	0.1805	0.0138
21-Sep-15	11:30 a.m.	1.5	0.486	0.32	0.1693	0.0128
21-Sep-15	12:00 p.m.	1.5	0.486	0.32	0.0424	0.0032
21-Sep-15	12:30 p.m.	1.3	0.486	0.37	0.1384	0.0108
21-Sep-15	1:00 p.m.	1.1	0.486	0.44	0.2354	0.0189
28-Sep-15	5:00 p.m.	0.5	0.254	0.51	0.0481	0.0046
28-Sep-15	5:30 p.m.	0.5	0.254	0.51	0.0790	0.0075
28-Sep-15	6:00 p.m.	0.4	0.254	0.64	0.1365	0.0137

Note: $\kappa \cong 0.41$ and $z_0 \cong 0.0034\ m$.

Considering both Bottom and Top Current-ADVs and evaluating Equation 2 at the vertical position of each sensor, the velocity computed according to the logarithmic velocity profile was compared with the direct measurement of velocity from the corresponding Current-ADV and found to be in good agreement (see Table 7; Figure 6).

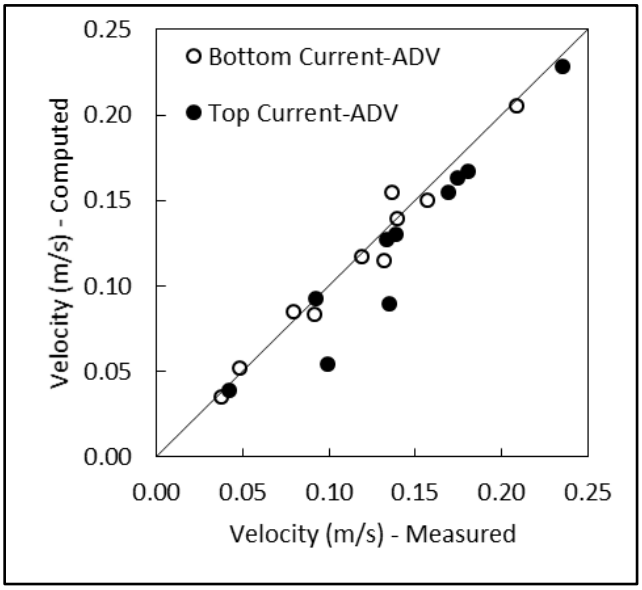
Table 7: Comparison of Measured and Computed Velocity

Date	Time (LDT)	Velocity at the elev. of the Bottom Current-ADV (m/sec)		Velocity at the elev. of the Top Current-ADV (m/sec)	
		Measured	Computed	Measured	Computed
21-Sep-15	10:00 a.m.	0.0917	0.0834	0.0919	0.0928
21-Sep-15	10:30 a.m.	0.1321	0.1146	0.1335	0.1275
21-Sep-15	11:00 a.m.	0.1568	0.1504	0.1805	0.1673
21-Sep-15	11:30 a.m.	0.1393	0.1392	0.1693	0.1549
21-Sep-15	12:00 p.m.	0.0376	0.0349	0.0424	0.0388
21-Sep-15	12:30 p.m.	0.1186	0.1169	0.1384	0.1301
21-Sep-15	1:00 p.m.	0.2086	0.2056	0.2354	0.2287

Date	Time (LDT)	Velocity at the elev. of the Bottom Current-ADV (m/sec)		Velocity at the elev. of the Top Current-ADV (m/sec)	
		Measured	Computed	Measured	Computed
28-Sep-15	5:00 p.m.	0.0481	0.0516	0.0992	0.0545
28-Sep-15	5:30 p.m.	0.0790	0.0848	0.1352	0.0895
28-Sep-15	6:00 p.m.	0.1365	0.1547	0.1743	0.1634

Note: For the Bottom Current-ADV, n=10 and R^2=0.97; for the Top Current-ADV, n=10 and R^2=0.92.

Figure 6: Comparison of Measured and Computed Velocity



4.1.2 Suspended Sediment Characteristics

Suspended sediment characteristics determined from water samples are listed in Table 8. The determination of mass concentration by vacuum filtration is included in Section 9.0, Appendix B, as are figures showing the particle size frequency distribution and percent passing for each water sample. The median grain size was taken at 50% passing; the modal diameter was taken as the median size of the most prevalent particle size class of the particle size frequency distribution.

Table 8: Suspended Sediment Characteristics

Date	Time (LDT)	Water Sample	Mass Concentration[a] (g/L)	Median Grain Size[b], $d_{s,50}$ (μm)	Modal Diameter[b], (μm)
21-Sep-15	9:49 a.m.	N125	0.28	20	14.2
21-Sep-15	10:05 a.m.	N21	0.18	20	23.4
21-Sep-15	10:25 a.m.	N55	0.45	15	14.2
21-Sep-15	10:44 a.m.	N79	0.57	24	23.4
21-Sep-15	11:11 a.m.	N77	0.55	24	23.4
21-Sep-15	11:33 a.m.	N72	0.60	22	23.4
21-Sep-15	1:25 p.m.	N36	0.46	30	23.4

Date	Time (LDT)	Water Sample	Mass Concentration[a] (g/L)	Median Grain Size[b], $d_{s,50}$ (µm)	Modal Diameter[b], (µm)
21-Sep-15	1:39 p.m.	N60	0.85	24	23.4
28-Sep-15	4:52 p.m.	N83	0.53	20	19.8
28-Sep-15	5:02 p.m.	N87	-	20	19.8
28-Sep-15	5:26 p.m.	N7	0.94	23	14.2
28-Sep-15	5:45 p.m.	N113	1.19	16	14.2
28-Sep-15	6:04 p.m.	N90	1.13	17	14.2

Note: [a] Determined by vacuum filtration.
[b] Determined by LISST-100X.

4.1.3 Optical Backscatter Calibration

The signal strength of OBS sensors was used to infer *in-situ* SSC after calibration of the OBS signal with measured SSC coming from water samples. To calibrate the OBS sensors, the signal strength of the bottom-most OBS sensor was averaged over a period of 1 min at the time corresponding to 1 min before the collection of each water sample. (This lag accounted for the travel time in the hose from the bilge pump at QUAD-1 to the point of collection.) The mass concentration as determined by vacuum filtration and the signal strength of the bottom-most OBS sensor at the time corresponding to the collection of the water samples are listed in Table 9.

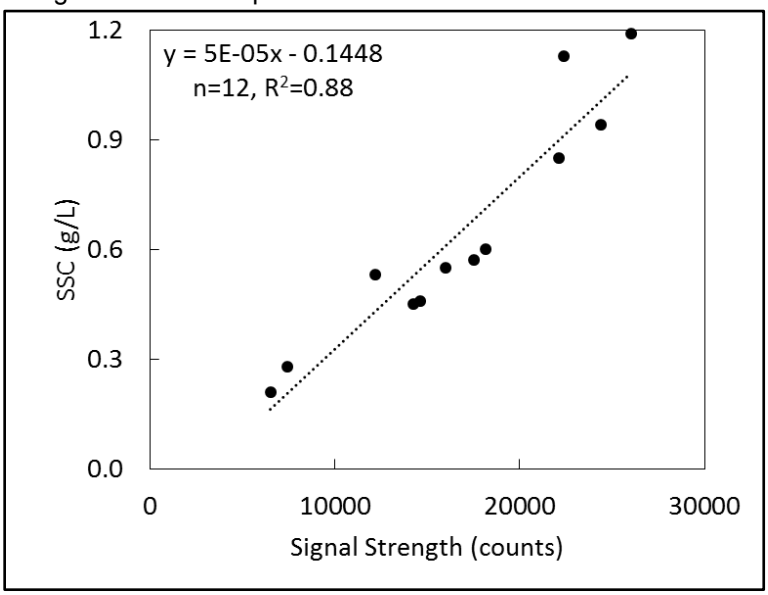
Table 9: Optical Backscatter Calibration

Date	Time (LDT)	Mass Concentration[a] (g/L)	Signal Strength[b] (counts)
21-Sep-15	9:49 a.m.	0.28	7408
21-Sep-15	10:05 a.m.	0.18	6510
21-Sep-15	10:25 a.m.	0.45	14262
21-Sep-15	10:44 a.m.	0.57	17517
21-Sep-15	11:11 a.m.	0.55	16012
21-Sep-15	11:33 a.m.	0.60	18171
21-Sep-15	1:25 p.m.	0.46	14593
21-Sep-15	1:39 p.m.	0.85	22122
28-Sep-15	4:52 p.m.	0.53	12163
28-Sep-15	5:26 p.m.	0.94	24413
28-Sep-15	5:45 p.m.	1.19	26008
28-Sep-15	6:04 p.m.	1.13	22378

Note: [a] Determined by vacuum filtration.
[b] From the bottom-most OBS sensor.

The calibration of SSC and the signal strength of the bottom-most OBS sensor was then determined by linear regression. The relation is shown in Figure 7.

Figure 7: Linear Regression of Suspended Sediment Concentration versus Signal Strength



Next, the values of SSC were determined according to the linear regression and are listed by OBS sensor for each time period in Table 10.

Table 10: Suspended Sediment Concentration by Optical Backscatter Sensor

Date	Time (LDT)	OBS-1		OBS-2		OBS-3		OBS-4	
		Signal (counts)	SSC (g/L)	Signal (counts)	SSC (g/L)	Signal (counts)	SSC (g/L)	Signal (counts)	SSC (g/L)
21-Sep-15	10:00 a.m.	7275	0.22	7129	0.21	6117	0.16	-	-
21-Sep-15	10:30 a.m.	15681	0.64	14919	0.60	12620	0.49	11412	0.43
21-Sep-15	11:00 a.m.	19422	0.83	18501	0.78	15465	0.63	14522	0.58
21-Sep-15	11:30 a.m.	18027	0.76	16814	0.70	12853	0.50	12006	0.46
21-Sep-15	12:00 p.m.	12190	0.46	10074	0.36	8325	0.27	8012	0.26
21-Sep-15	12:30 p.m.	9394	0.32	7529	0.23	5186	0.11	5004	0.11
21-Sep-15	1:00 p.m.	8540	0.28	8026	0.26	6101	0.16	4787	0.09
28-Sep-15	5:00 p.m.	-	-	16177	0.66	15003	0.61	7190	0.21
28-Sep-15	5:30 p.m.	-	-	25492	1.13	21605	0.94	12970	0.50
28-Sep-15	6:00 p.m.	-	-	25052	1.11	23811	1.05	-	-

Note: Data at OBS-1 on 28-Sep-15 were lacking because the sensor malfunctioned.

Data at OBS-4 were missing for those periods when the sensor was only intermittently submerged due to breaking waves.

4.1.4 Profiles of Suspended Sediment Concentration

The time-averaged SSC profiles were developed with knowledge of the depth-averaged velocity, the suspended sediment characteristics, and the inference of SSC from OBS data. The time-averaged SSC profile was given by the Rouse Equation:

Equation 5: Rouse Equation

$$C(z) = C_a \left[\frac{(H-z)/z}{(H-a)/a} \right]^{Z_R}$$

where C_a was the reference concentration at a reference elevation, a, above the bed and Z_R was the Rouse number (Julien, 2010, p. 231, Eq. 10.20a). The reference concentration was inferred from the OBS signal of the bottom-most OBS sensor; the reference elevation was the vertical position of the bottom-most OBS sensor (see Table 3). The Rouse number reflects the ratio of the sediment properties to the hydraulic flow characteristics and was given by

Equation 6: Rouse Number

$$Z_R = \frac{w_s}{\alpha \kappa u_*}$$

where w_s was the sediment fall velocity and α was a fitting parameter introduced for this data set ($\alpha = 0.5$). The fitting parameter was selected on the basis of best fit. The sediment fall velocity for natural particles is:

Equation 7: Sediment Settling Velocity

$$w_s = \exp\left(-b_1 + b_2 \ln(Re_p) - b_3(\ln(Re_p))^2 - b_4(\ln(Re_p))^3 + b_5(\ln(Re_p))^4\right)\sqrt{gRd_{s,50}}$$

where $b_1 = 2.891394$, $b_2 = 0.95296$, $b_3 = 0.056835$, $b_4 = 0.002892$, $b_5 = 0.000245$, Re_p was the explicit particle Reynolds number, g was the acceleration due to gravity ($g = 9.81\ m/sec^2$), and R was the submerged specific gravity (Dietrich, 1982; see Bombardelli and Moreno, 2012, p. 233). The median grain size of the suspended sediment for each time period was taken from Table 8, considering the laboratory analyses of the water samples. The explicit particle Reynolds number:

Equation 8: Particle Reynolds Number

$$Re_p = \frac{\sqrt{gRd_{s,50}^3}}{\nu}$$

where ν was the kinematic viscosity of water taken as $\nu = 10^{-6}\ m^2/sec$. The submerged specific gravity was defined as:

Equation 9: Submerged Specific Gravity

$$R = \frac{(\rho_s - \rho)}{\rho}$$

where ρ_s was the sediment density taken as $\rho_s = 2{,}650\ kg/m^3$ and ρ was the water density taken as $\rho = 1{,}028\ kg/m^3$.

The Rouse Equation was originally developed to describe the vertical distribution of SSC in open-channel flows. However, it has also been demonstrated that it is an appropriate model for the wave-averaged distribution of SSC in coastal environments such as the study site (see *Raudkivi,* 1998, p. 361). The variables for the computation of the SSC profile (Equation 3) for each period are listed in Table 11.

Table 11: Variables for the Computation of the Suspended Sediment Concentration Profile (see Equation 3

Date	Time (LDT)	C_a (g/L)	a (m)	H (m)	$d_{s,50}$ (μm)	w_s (mm/sec)	u_* (m/sec)	Z_R
21-Sep-15	10:00 a.m.	0.22	0.1270	0.9	20	0.340	0.0077	0.2165
21-Sep-15	10:30 a.m.	0.64	0.1270	1.2	24	0.497	0.0105	0.2300
21-Sep-15	11:00 a.m.	0.83	0.1270	1.4	24	0.497	0.0138	0.1753
21-Sep-15	11:30 a.m.	0.76	0.1270	1.5	24	0.497	0.0128	0.1894
21-Sep-15	12:00 p.m.	0.46	0.1270	1.5	24	0.497	0.0032	0.7561
21-Sep-15	12:30 p.m.	0.32	0.1270	1.3	24	0.497	0.0108	0.2254
21-Sep-15	1:00 p.m.	0.28	0.1270	1.1	24	0.497	0.0189	0.1282
28-Sep-15	5:00 p.m.	0.66	0.2032	0.5	20	0.340	0.0046	0.3621
28-Sep-15	5:30 p.m.	1.13	0.2032	0.5	23	0.455	0.0075	0.2947
28-Sep-15	6:00 p.m.	1.11	0.2032	0.4	16	0.212	0.0137	0.0754

Considering the OBS data and evaluating Equation 3 at the vertical position of each sensor, the SSC computed according to the Rouse Equation was compared with the inferred value of SSC from the corresponding OBS sensor and found to be in good agreement (see Table 12 and Figure 8).

Table 12: Comparison of Inferred and Computed Suspended Sediment Concentration

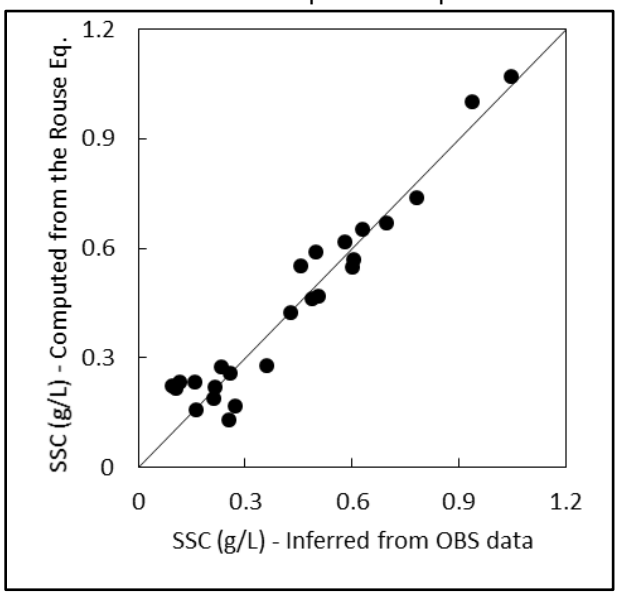
Date	Time (LDT)	SSC at the Height of the OBS Sensors (g/L)					
		OBS-2		OBS-3		OBS-4	
		Inferred	Computed	Inferred	Computed	Inferred	Computed
21-Sep-15	10:00 a.m.	0.21	0.19	0.16	0.16	-	-
21-Sep-15	10:30 a.m.	0.55	0.60	0.49	0.46	0.43	0.42
21-Sep-15	11:00 a.m.	0.78	0.74	0.63	0.65	0.58	0.62
21-Sep-15	11:30 a.m.	0.70	0.67	0.50	0.59	0.46	0.55
21-Sep-15	12:00 p.m.	0.36	0.28	0.27	0.17	0.26	0.13
21-Sep-15	12:30 p.m.	0.23	0.27	0.11	0.23	0.11	0.22
21-Sep-15	1:00 p.m.	0.26	0.26	0.16	0.23	0.09	0.22
28-Sep-15	5:00 p.m.	-	-	0.61	0.57	0.21	0.22
28-Sep-15	5:30 p.m.	-	-	0.94	1.00	0.50	0.47
28-Sep-15	6:00 p.m.	-	-	1.05	1.07	-	-

Notes: For all pairwise data, n=25 and R^2=0.93.

Data at OBS-2 on 28-Sep-15 were used to determine reference concentration (OBS-1 malfunctioned).

Data at OBS-4 were missing for those time periods when the sensor was only intermittently submerged due to breaking waves.

Figure 8: Comparison of Inferred and Computed Suspended Sediment Concentration



4.1.5 Suspended Sediment Transport Rates

Lastly, the suspended sediment transport rates were computed according to Equation 1 for each time period and are listed in Table 13.

Table 13: Computed Suspended Sediment Transport Rates

Date	Time (LDT)	Suspended Sediment Transport Rates		
		By Mass (kg/m·sec)	By Volume[a] (m^3/m·sec)	By Volume (cu yd/ft·sec)
21-Sep-15	10:00 a.m.	0.0111	6.98×10^{-6}	2.78×10^{-6}
21-Sep-15	10:30 a.m.	0.0575	3.62×10^{-5}	1.44×10^{-5}
21-Sep-15	11:00 a.m.	0.1279	8.04×10^{-5}	3.21×10^{-5}
21-Sep-15	11:30 a.m.	0.1127	7.09×10^{-5}	2.83×10^{-5}
21-Sep-15	12:00 p.m.	0.0068	4.28×10^{-6}	1.71×10^{-6}
21-Sep-15	12:30 p.m.	0.0320	2.01×10^{-5}	8.02×10^{-6}
21-Sep-15	1:00 p.m.	0.0505	3.18×10^{-5}	1.27×10^{-5}
28-Sep-15	5:00 p.m.	0.0123	7.74×10^{-6}	3.08×10^{-6}
28-Sep-15	5:30 p.m.	0.0350	2.20×10^{-5}	8.78×10^{-6}
28-Sep-15	6:00 p.m.	0.0531	3.34×10^{-5}	1.33×10^{-5}

Note: [a] $Rate\ by\ Volume\ (m^3/m\cdot sec) = \frac{Rate\ by\ Mass}{\rho_s(1-p)}$, where p was the porosity taken as $p = 0.4$.

4.2 BEDLOAD TRANSPORT

As stated previously, bedload transport refers to the movement of sediment along the bed layer. Bedload transport rates were estimated from field data and computed according to the CERC Formula and the 2014 van Rijn Equation, expressions covering transport in the longshore direction. These expressions are predicated on the principle that the longshore transport rate is proportional to the longshore energy flux. In addition, these equations are empirically-based and expressed in SI units. The bedload transport is reported here as the total rate of bedload transport over the length of the surf zone measured in the cross-shore direction.

4.2.1 From Field Data

The total longshore transport rate from field data by mass ($kg/sec \cdot m$):

Equation 10: Measured Longshore Transport Rate

$$Q_{Field} = \frac{\alpha G_s}{wt}$$

where α was a calibration factor for the Helley-Smith bedload sampler taken as $\alpha_{H-S} = 1.0$ for particles of 0.50 to 16 mm, G_s was the dry mass of sediment catch, w was the width of the intake opening ($w = 0.152\ m$), and t was the sampling period in the surf zone.

4.2.2 CERC Formula

The CERC Formula was developed by the US Army Corps of Engineers and is arguably the most widely used model for estimating the total longshore transport rate. The bedload transport rate by volume (m^3/sec), according to the CERC Formula:

Equation 11: CERC Formula for Longshore Transport Rate

$$Q_{CERC} = \frac{K_1}{16\left(\frac{\rho_s}{\rho} - 1\right)(1-p)} H_{br,rms}^2 C_{gbr} \sin(2\Theta_{br})$$

where K_1 was an empirical coefficient taken as $K_1 = 0.05$, $H_{br,rms}$ was the root mean square of the significant wave height at breaking, C_{gbr} was the group wave celerity at breaking, and Θ_{br} was the incident wave angle at breaking relative to shore-normal (Coastal Engineering Manual, 2002, Eq. 2.7). The empirical coefficient was selected on the basis of best fit. The wave parameters at breaking were determined by transforming the wave conditions measured at the Wave-ADV and SonTek ADP to the point of breaking, considering both shoaling and refraction.

The root mean square of the significant wave height at breaking:

Equation 12: Root Mean Square Wave Height at Breaking

$$H_{br,rms} = H_{br}/\sqrt{2}$$

where H_{br} was the significant wave height at breaking.

4.2.3 2014 van Rijn Equation

The simple general equation for longshore transport rate by mass (kg/sec), according to the 2014 van Rijn Equation:

Equation 13: van Rijn Equation for Longshore Transport Rate

$$Q_{van\ Rijn} = 0.00018\rho_s g^{0.5}(tan\beta)^{0.4}(d_{b,50})^{-0.6}(H_{br})^{3.1}\sin(2\Theta_{br})$$

where $tan\beta$ was the slope of the beach/surf zone (van Rijn, 2014, p. 33, Eq. 6). This expression is valid for grain sizes in the range of 0.1 to 100 mm and slopes in the range of 0.01 to 0.1 (van Rijn, 2014, p. 33). Recall that the representative grain size for this study was 15 mm and the slope was 0.08.

4.2.4 Bedload Characteristics

Bedload characteristics were determined from the bedload samples (see Table 14). The figures showing the particle size frequency distribution and percent passing for each bedload sample are included in Appendix B. The median grain size was taken at 50% passing; the modal diameter was taken as the median size of the most prevalent grain size class of the particle size frequency distribution. According to the Wentworth scale for sediment classification, the bedload material was predominately pebble (*Wentworth*, 1922; see *Sorensen*, 2006, p. 250). By observation, the bedload samples were consistently clean, of mineral origin, and contained no appreciable amount of organic material. Furthermore, the material was granular and very coarse.

Table 14: Bedload Characteristics

Date	Bedload Sample	Total Mass (g)	Median Grain Size, d_{50} (mm)	Modal diameter (mm)	Wentworth Classification	
					Predominant Class[a]	Percent by Mass
21-Sep-15	BL1	12,600	15	15	Pebble	85
21-Sep-15	BL2	3,500	12	15	Pebble	82
25-Sep-15	BL2	28,000	10	15	Pebble	62
25-Sep-15	BL3	47,000	14	15	Pebble	98
28-Sep-15	BL1	12,700	15	15	Pebble	98
28-Sep-15	BL2	28,000	12	15	Pebble	82

Note: [a]The Wentworth scale for sediment classification defines pebbles as 4-64 mm.

4.2.5 Wave Conditions

In order to compute bedload transport rates, it was necessary to characterize the wave environment. On 21-Sep-15 and 28-Sep-15, wave conditions were determined from Wave-ADV data at QUAD-2. On 25-Sep-15, wave conditions were determined from SonTek ADP data. Unfortunately, Fugro wave data from the nearby Kenai LNG Mooring Dolphin 4 was available for comparison for the dates of the nearshore deployment.

Similar to the procedure described in Section 4.1, the height of the water column, H, was determined from the pressure signal of the Wave-ADV (21-Sep-15 and 28-Sep-15) and the SonTek ADP (25-Sep-15), correcting for atmospheric pressure and adjusting for the height of the sensor.

For 21-Sep-15 and 28-Sep-15, the significant wave height at the water surface was calculated from:

Equation 14: Significant Wave Height

$$H_s = 4\sigma\left(\frac{\cosh(kH)}{\cosh(kd)}\right)$$

where σ was the standard deviation of the linearly detrended pressure signal over each 10-min time period expressed in units of length; the term $\left(\frac{\cosh(kH)}{\cosh(kd)}\right)$ comes from linear wave theory and extrapolated the significant wave height from the vertical position of the pressure sensor to the water surface; k was the wave number; and d was the distance from bottom to the point of measurement.

The wave number is:

Equation 15: Wave Number

$$k = \frac{2\pi}{L}$$

where L was the wavelength.

The wavelength is:

Equation 16: Wavelength

$$L = L_0 \left[\tanh \left[2\pi \sqrt{H/g} \right]^{3/2} \right]^{2/3}$$

where L_0 was the deep water wavelength (*Dean and Dalrymple*, 2002, p. 90, Eq. 5.4).

The deep-water wavelength is:

Equation 17: Deepwater Wavelength

$$L_0 = \frac{gT^2}{2\pi}$$

where T was the average wave period (see *Sorensen*, 2006, p. 15, Eq. 2.17).

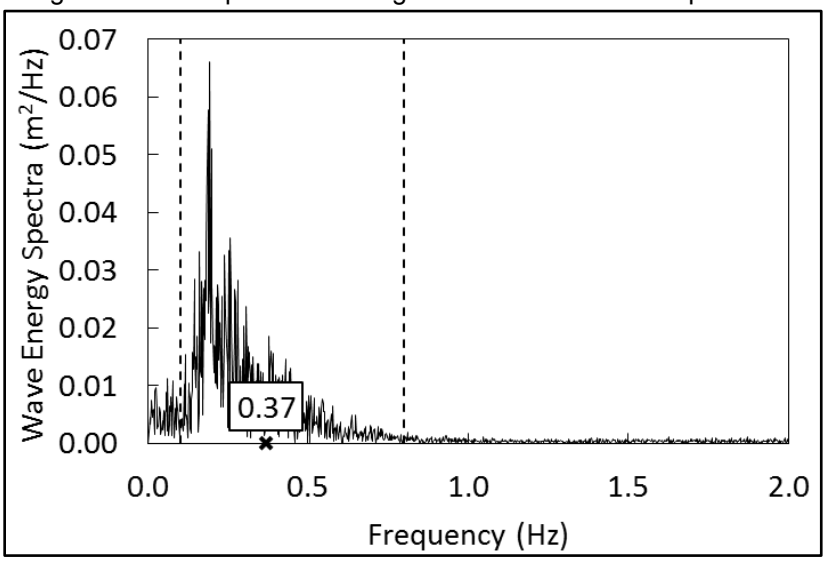
The wave period was determined from the wave spectrum for each 10-min time period. A Fast Fourier Transform (FFT) was performed on the linearly detrended pressure signal pressure and from the resulting spectral density plot, peaks were identified (see Figure 9). For 25-Sep-2015, there was a distinct peak attributed to the Pacific swell at ~0.05 Hz (corresponding to a wave period of ~20 sec). To determine the average period of the wind-waves, a fortieth-order Butterworth high-pass filter was applied that passed all frequencies above 0.133 Hz. This corresponded to wave periods shorter than 7.5 sec, which were attributed to wind-waves. For 21-Sep-15 and 28-Sep-15, the Pacific swell was not manifest in the spectral density plots and so no filter was warranted for those days. Considering only the wind-waves, the average period was determined according to:

Equation 18: Average Wave Period (Spectral)

$$T = \frac{\sum S_i}{\sum S_i f_i}$$

where S_i was the spectral magnitude at frequency i, and f_i was the frequency (Madsen et al., 1993, p. 1309, Eq. 2). The average period was determined as a weighted average of the frequency spectrum from 0.1 Hz to 0.8 Hz (noted by vertical dashed lines in Figure 8). The example in Figure 8 shows an average frequency of 0.37 Hz, corresponding to an average wave period of 2.7 sec.

Figure 9: Example Illustrating the Wave Period Computation



For 25-Sep-15, root mean square significant wave height at the water surface was computed according to

Equation 19: Root Mean Square Significant Wave Height

$$H_{s,rms} = \frac{u_{rms}T}{\pi}\left[\frac{\sinh(kd)}{\cosh(kH)}\right]$$

where u_{rms} is the root mean square bottom velocity amplitude of the directional sea (adapted from Sorenson, 2006, p.18, Eq. 2.21). Velocity data were extracted from the bottom-most bin of the SonTek ADP.

The group wave celerity is:

Equation 20: Wave Group Celerity

$$C_g = nC$$

where n represented the fraction of the mechanical energy in a wave that was transmitted forward with each wave period and C was the wave celerity (Sorenson, 2006, p. 30, Eq. 2.45). The term n was given by:

Equation 21: Wave Group Celerity n-Number

$$n = \frac{1}{2}\left(1 + \frac{2kH}{\sinh(2kH)}\right)$$

(*Sorensen*, 2006, p. 24, Eq. 2.38). The wave celerity is:

Equation 22: Wave Phase Celerity

$$C = \frac{L}{T}$$

(*Sorensen,* 2006, p. 12, Eq. 2.2).

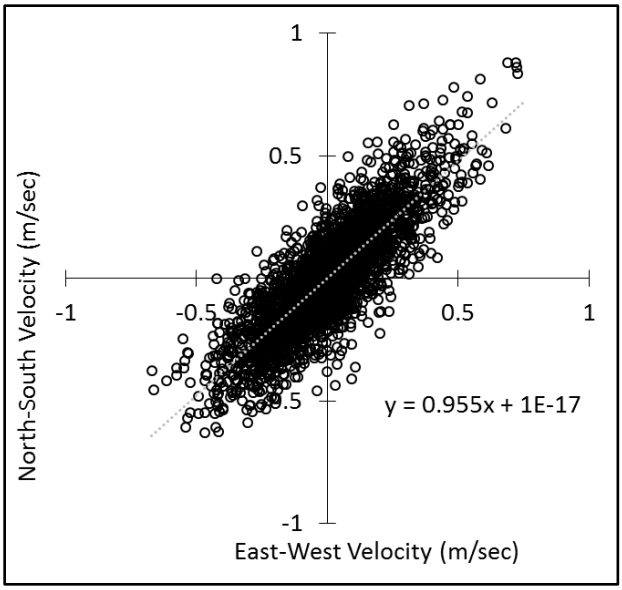
For 25-Sep-15 and 28-Sep-15, the wave angle relative to shore-normal, Θ, was computed from the linearly detrended directional components of velocity in the east-west and north-south directions.

The pairwise components of the velocity were plotted for each 10-min time period and the slope of the line of best fit was used to compute the wave angle relative to the axes of the instrument compass (see For 21-Sep-15, the wave direction was determined from field observation. This was necessary because the measured wave angle data were unrealistic and likely resulted from a problem with the Wave-ADV's internal compass. (Different instruments were used on 21-Sep-15 and 28-Sep-15 deployments; this was verified by instrument serial number.)

Figure 10). The angle was then corrected for the magnetic declination (16.6° counter-clockwise shift) and adjusted relative to shore normal (24° counter-clockwise shift). The convention adopted for the wave angles was positive for clockwise from shore-normal and negative for counter-clockwise from shore-normal. For 25-Sep-15, the pairwise components of the velocity were extracted from the top-most bin that was completed submerged. For 28-Sep-15, the pairwise components of velocity were measured at the height of the Wave-ADV sensor.

For 21-Sep-15, the wave direction was determined from field observation. This was necessary because the measured wave angle data were unrealistic and likely resulted from a problem with the Wave-ADV's internal compass. (Different instruments were used on 21-Sep-15 and 28-Sep-15 deployments; this was verified by instrument serial number.)

Figure 10: Example Illustrating Wave Angle Computation



A summary of wave conditions for each relevant 10-min time period at the location of the Wave-ADV (21-Sep-15 and 28-Sep-15) and SonTek ADP (25-Sep-15) are listed in Table 15.

Table 15: Summary of Wave Conditions at Instrument Location

Date	Time (LDT)	H (m)	H_s (m)	T (sec)	C_g (m/sec)	Θ[a]
21-Sep-15	9:30 a.m.	1.1	0.15	2.1	1.97	2
21-Sep-15	9:40 a.m.	1.2	0.15	2.2	2.06	2
21-Sep-15	1:30 p.m.	1.3	0.17	2.6	2.42	2
21-Sep-15	1:40 p.m.	1.2	0.13	2.7	2.48	2
21-Sep-15	1:50 p.m.	1.0	0.15	2.8	2.45	2
25-Sep-15	2:00 p.m.	2.3	1.03	4.3	3.72	-1

Date	Time (LDT)	H (m)	H_s (m)	T (sec)	C_g (m/sec)	Θ[a]
25-Sep-15	2:10 p.m.	2.5	1.01	4.4	3.84	3
25-Sep-15	2:20 p.m.	2.6	1.02	4.3	3.85	0.3
25-Sep-15	3:20 p.m.	3.2	1.01	4.6	3.19	-4
25-Sep-15	3:30 p.m.	3.2	1.18	4.7	3.32	-4
25-Sep-15	3:40 p.m.	3.2	1.14	4.6	3.25	-5
28-Sep-15	4:20 p.m.	0.7	0.35	2.7	2.19	1
28-Sep-15	4:30 p.m.	0.8	0.41	2.8	2.32	4
28-Sep-15	4:40 p.m.	1.0	0.41	2.9	2.50	5
28-Sep-15	4:50 p.m.	1.1	0.40	2.9	2.55	8
28-Sep-15	6:00 p.m.	1.1	0.40	3.1	1.37	-2
28-Sep-15	6:10 p.m.	1.0	0.40	3.1	1.33	-2
28-Sep-15	6:20 p.m.	0.9	0.41	3.1	1.29	-3
28-Sep-15	6:30 p.m.	0.7	0.42	3.1	1.19	-1

Note: [a] Degrees clockwise from shore-normal.

4.2.6 Wave Transformation

In order to compute the longshore transport rates in the surf zone, the wave conditions were transformed from the instrument locations to the point of breaking. This transformation was required for the computation of the bedload transport rate from field data (Equation 4), because it was assumed that the sediment collection time corresponded only to time that the Bedload Sampler remained in the surf zone. Furthermore, the CERC Formula (Equation 5) and the 2014 van Rijn Equation (Equation 6) required wave conditions at breaking, variables that cannot be measured directly.

The wave transformation considered two processes: shoaling and refraction. Shoaling was expressed through the shoaling coefficient:

Equation 23: Shoaling Coefficient

$$K_s = \frac{H_1}{H_2} = \sqrt{\frac{n_2 L_2}{n_1 L_1}}$$

where H_1 and H_2 were the wave heights before and after shoaling, respectively. Refraction was expressed through the refraction coefficient:

Equation 24: Refraction Coefficient

$$K_r = \frac{H_1}{H_2} = \sqrt{\frac{B_2}{B_1}} = \sqrt{\frac{cos\theta_2}{cos\theta_1}}$$

where B_1 and B_2 were the distances between wave rays before and after refraction and θ was the wave crest angle, relative to shore-normal. With these two terms, wave transformation was defined from one point to another as:

Equation 25: Wave Point Transformation Ratio

$$\frac{H_1}{H_2} = K_s K_r$$

and solved for H_2 (*Sorenson*, 2006, p. 25, Eq. 2.41). This process is repeated to the point of breaking, specified when the ratio of wave height to water depth (or Breaker Index) reaches 0.8. This ratio was determined by the surf similarity parameter, given by:

Equation 26: Surf Similarity Parameter

$$\xi = tan\beta \sqrt{H/_{L_0}}$$

(*Dean and Dalrymple*, 2002, p. 97, Eq. 5.17).

To compute the bedload transport rate using the field data, it was necessary to know the duration of time the Bedload Samplers were in the surf zone. To accomplish this, the Breaker Index at each Bedload Sampler location was computed for each 10-min time period. Next the total time in the surf zone was determined from the time the Bedload Sampler entered the surf zone (from field notes) and the time that the Breaker Index dropped below 0.8. For example, for 21-Sep-15 BL2, the Bedload Sampler entered the surf zone at 9:30 a.m. and the Breaker Index dropped below 0.8 at 9:40 a.m. so the time in the surf zone on the flood tide was 10 min.

For 21-Sep-15 and 28-Sep-15, the Bedload Samplers remained underwater throughout the tidal cycle. Thus, they were once again in the surf zone during the ebb tide. This time contributed to the total time in the surf zone and was determined from the time the Breaker Index exceeded 0.8 and when the sampler was removed from the surf zone (from field notes). For example, for 21-Sep-15 BL2, the Breaker Index exceeded 0.8 at 1:30 p.m. and the Bedload Sampler was removed from the surf zone at 1:50 p.m., then the time in the surf zone was 20 min. The total time that the Bedload Sampler remained in the surf zone during both the flood and ebb tide was a total of 30 min. Based on this methodology, it was determined that the Bedload Samplers were in the surf zone for the time periods shown in Table 16.

Table 16: Bedload Sampler Time in Surf Zone

Sample	Time in the Surf Zone (LDT)		Total Duration in the Surf Zone (min)
	During Flood Tide	During Ebb Tide	
21-Sep-15 BL2	9:30 a.m. to 9:40 a.m.	1:30 p.m. to 1:50 p.m.	30
25-Sep-15 BL2	2:00 p.m. to 2:20 p.m.[a]	-	20
25-Sep-15 BL3	-	3:15 p.m. to 3:40 p.m.[b]	25
28-Sep-15 BL1	4:30 p.m. to 4:45 p.m.	6:05 p.m. to 6:30 p.m.	40
28-Sep-15 BL2	4:05 p.m. to 4:20 p.m.	6:30 p.m. to 6:55 p.m.	40

Note: [a] Based on field observation.
[b] Based on field observation. Bedload sampler was deployed at time of high water.

The variables for the computation of bedload transport rates (Equation 4) are shown in Table 17.

Table 17: Variables for the Computation of Bedload Transport Rates (Equation 4)

Sample	G_s (kg)	t (min)	Length of the Surf Zone in the Cross-shore Direction (m)
21-Sep-15 BL2	12.6	30	1
25-Sep-15 BL2	3.50	20	5
25-Sep-15 BL3	28.0	25	5
28-Sep-15 BL1	47.0	40	3
28-Sep-15 BL2	12.7	40	3

The variables for the computation of bedload transport rates according to the CERC Formula (Equation 5) and the 2014 van Rijn Equation (Equation 6) for the relevant 10-min time periods are shown in Table 18.

Table 18: Variables for the Computation of Bedload Transport Rates (Equation 5 and Equation 6)

Date	Time (LDT)	H_{br} (m)	$H_{br,rms}$ (m)	C_{gbr} (m/sec)	Θ_{br}
21-Sep-15	9:30 a.m.	0.18	0.13	1.41	1
21-Sep-15	9:40 a.m.	0.18	0.13	1.47	1
21-Sep-15	1:30 p.m.	0.21	0.15	1.56	1
21-Sep-15	1:40 p.m.	0.17	0.12	1.42	1
21-Sep-15	1:50 p.m.	0.20	0.14	1.42	1
25-Sep-15	2:00 p.m.	1.11	0.78	3.21	-0.6
25-Sep-15	2:10 p.m.	1.11	0.78	3.24	2
25-Sep-15	2:20 p.m.	1.15	0.79	2.23	0.2
25-Sep-15	3:20 p.m.	1.13	0.80	2.54	-3
25-Sep-15	3:30 p.m.	1.29	0.91	2.75	-3
25-Sep-15	3:40 p.m.	1.25	0.88	2.66	-4
28-Sep-15	4:20 p.m.	0.37	0.26	1.94	1
28-Sep-15	4:30 p.m.	0.44	0.31	1.99	3
28-Sep-15	4:40 p.m.	0.45	0.32	2.06	4
28-Sep-15	4:50 p.m.	0.45	0.32	1.97	6
28-Sep-15	6:00 p.m.	0.45	0.32	1.07	1
28-Sep-15	6:10 p.m.	0.44	0.31	1.08	2
28-Sep-15	6:20 p.m.	0.45	0.32	1.07	2
28-Sep-15	6:30 p.m.	0.44	0.31	1.10	1

4.2.7 Bedload Transport Rates

The bedload transport rates computed according to Equation 4 are listed in Table 19.

Table 19: Bedload Transport Rates from Field Data

Sample	Bedload Transport Rates by Volume (m^3/sec)
21-Sep-15 BL2	7.95×10^{-6}
25-Sep-15 BL2	4.83×10^{-4}
25-Sep-15 BL3	6.48×10^{-4}
28-Sep-15 BL1	1.45×10^{-4}
28-Sep-15 BL2	6.57×10^{-5}

The bedload transport rates computed according to Equation 5 and Equation 6 for each relevant 10-min time period are listed in Table 20.

Table 20: Bedload Transport Rates from the CERC Formula and 2014 van Rijn Equation

Date	Time (LDT)	Bedload Transport Rates by Volume (m^3/sec)	
		CERC Formula (K_1=0.04)	2014 van Rijn Equation
21-Sep-15	9:30 a.m.	2.11×10^{-6}	7.29×10^{-7}
21-Sep-15	9:40 a.m.	2.19×10^{-6}	7.29×10^{-7}
21-Sep-15	1:30 p.m.	3.17×10^{-6}	1.18×10^{-6}
21-Sep-15	1:40 p.m.	1.89×10^{-6}	6.11×10^{-7}
21-Sep-15	1:50 p.m.	2.62×10^{-6}	1.01×10^{-6}
25-Sep-15	2:00 p.m.	1.08×10^{-4}	1.21×10^{-4}
25-Sep-15	2:10 p.m.	4.35×10^{-4}	4.85×10^{-4}
25-Sep-15	2:20 p.m.	2.55×10^{-5}	4.16×10^{-5}
25-Sep-15	3:20 p.m.	3.75×10^{-4}	5.47×10^{-4}
25-Sep-15	3:30 p.m.	6.74×10^{-4}	1.10×10^{-3}
25-Sep-15	3:40 p.m.	7.08×10^{-4}	1.10×10^{-3}
28-Sep-15	4:20 p.m.	4.41×10^{-6}	6.80×10^{-6}
28-Sep-15	4:30 p.m.	1.91×10^{-5}	3.49×10^{-5}
28-Sep-15	4:40 p.m.	2.76×10^{-5}	4.98×10^{-5}
28-Sep-15	4:50 p.m.	3.94×10^{-5}	7.44×10^{-5}
28-Sep-15	6:00 p.m.	3.59×10^{-6}	1.25×10^{-5}
28-Sep-15	6:10 p.m.	6.93×10^{-6}	2.33×10^{-5}
28-Sep-15	6:20 p.m.	7.18×10^{-6}	2.50×10^{-5}

The bedload transport rates computed according to the CERC Formula and the 2014 van Rijn Equation were then compared with the value determined from field data and found to be generally in good agreement (see Table 21 and

Table 22; Figure 11).

The 2014 van Rijn Equation under-predicted gravel/shingle longshore transport for very low waves (<0.5 m) as noted by van Rijn (2014, p. 33; see Figure 12). The value of the empirical coefficient of the CERC Formula in this study was taken as $K_1 = 0.04$, which was generally consistent with a previous study considering gravel/shingle longshore transport at Narwhal Island, North Arctic Alaska ($K_1 = 0.035$).

Like the 2014 van Rijn Formula, the CERC Formula under-predicted gravel/shingle longshore transport for very low waves (<0.5 m; see Figure 12). At higher waves (>1.0 m), the measured and computed values were in very good agreement (Figure 11).

Table 21: Comparison of Bedload Transport Rates (SI Units)

Sample	Bedload Transport Rates by Volume (m^3/sec)		
	Measured	CERC Formula (K_1=0.04)	2014 van Rijn Equation
21-Sep-15 BL2	7.95×10^{-6}	2.40×10^{-6}	8.52×10^{-7}
25-Sep-15 BL2	4.83×10^{-4}	1.90×10^{-4}	2.16×10^{-4}
25-Sep-15 BL3	6.48×10^{-4}	5.86×10^{-4}	9.16×10^{-4}
28-Sep-15 BL1	1.45×10^{-4}	1.53×10^{-5}	2.62×10^{-5}
28-Sep-15 BL2	6.57×10^{-5}	3.97×10^{-6}	9.20×10^{-6}

Table 22: Comparison Bedload Transport Rates (US Customary Units)

Sample	Bedload Transport Rates by Volume (cu yd / sec)		
	Measured	CERC Formula (K_1=0.04)	2014 van Rijn Equation
21-Sep-15 BL2	1.04×10^{-5}	3.14×10^{-6}	1.11×10^{-6}
25-Sep-15 BL2	6.32×10^{-4}	2.49×10^{-4}	2.83×10^{-4}
25-Sep-15 BL3	8.48×10^{-4}	7.66×10^{-4}	1.20×10^{-3}
28-Sep-15 BL1	1.90×10^{-4}	2.00×10^{-5}	3.43×10^{-5}
28-Sep-15 BL2	8.59×10^{-5}	5.19×10^{-6}	1.20×10^{-5}

Figure 11: Comparison of Bedload Transport Rates

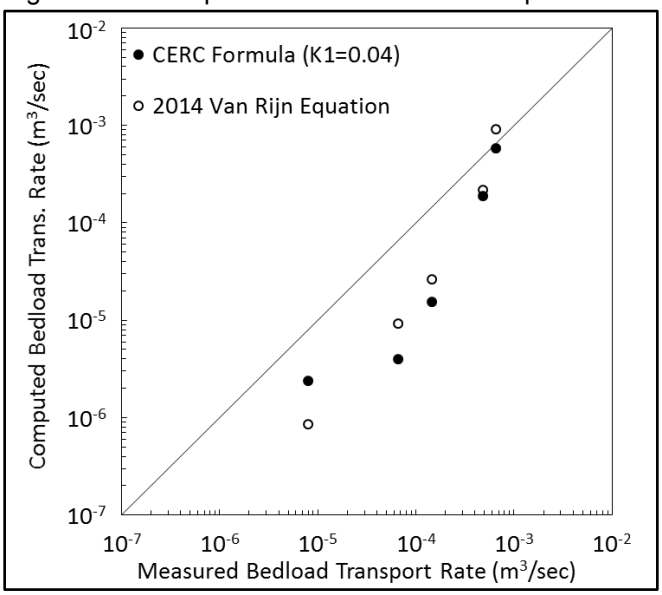
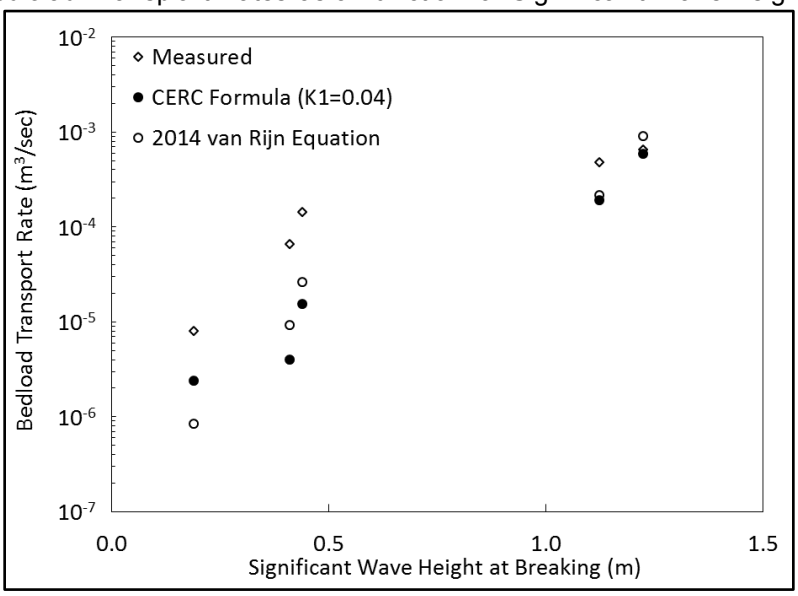


Figure 12: Bedload Transport Rates as a Function of Significant Wave Height at Breaking



5.0 SUMMARY

This report documents the Sediment Transport Sampling and Monitoring – Phase 2 effort to characterize longshore sediment transport from field measurements, laboratory analyses, and computations from measured variables. Note that the *Sediment Transport Sampling and Monitoring – Phase 1* (USAL-CH-JRZZZ-90-000028-000) effort examined the SSC and Bedload transport rates in relatively deep water (i.e., without breaking waves), and thus there is not direct comparison between the two campaigns.

The key findings of the Sediment Transport Sampling and Monitoring – Phase 2 campaign include:

- The logarithmic velocity profile was in good agreement with direct measurements of velocity.
- Considering the suspended sediment characteristics, the representative grain size, $d_{s,50}$, was taken as 16-24 µm.
- On 21-Sep-15, the reference concentration of suspended sediment began at a value of 0.22 g/L, increased to a value of 0.83 g/L with the flood tide, and subsided to a value of 0.28 g/L with the ebb tide.
- On 28-Sep-15, the reference concentration of suspended sediment ranged from 0.66 g/L to 1.13 g/L.
- The Rouse Equation was in good agreement with inferred values of SSC coming from the OBS sensors.
- Considering a range of flow conditions, the suspended sediment transport rates ranged from 4.28×10^{-6} $m^3/m\cdot sec$ to 8.04×10^{-5} $m^3/m\cdot sec$.
- Considering the bedload characteristics, the representative grain size, $d_{b,50}$, was taken as 15 mm.
- The value of the empirical coefficient of the CERC Formula for this study was 0.04, which was selected on the basis of best fit. This was generally consistent with the findings of a previous study considering gravel/shingle longshore transport at Narwhal Island, North Arctic Alaska.
- Considering a range of wave conditions, the bedload transport rates ranged from 10^{-3} m^3/sec to 10^{-5} m^3/sec.
- Furthermore, considering a range of wave conditions, the bedload transport rates predicted by the CERC Formula and the 2014 van Rijn Equation were within 100% of those derived from bedload measurements. For waves >1.0 m, agreement was within 60%.

Note that success of measuring sediment transport, whether bedload or suspended load, in the nearshore depends on an extremely robust suite of instruments to withstand the surf zone conditions with breaking waves. Future data collection campaigns should take the experiences gained and documented in this study in planning around both conditions as well as instruments and methodologies.

6.0 ACRONYMS AND TERMS

Term	Definition
ºC	Degrees Celsius
α	Fitting parameter for the Rouse Equation, $\alpha = 0.5$
α_{H-S}	Calibration factor for the Helley-Smith Bedload Sampler taken as $\alpha_{H-S} = 1.0$
Δz	Thickness of the Vertical Layer
ξ	Surf Similarity Parameter
Θ	Incident Wave Angle relative to Shore-normal
Θ_{br}	Incident Wave Angle at Breaking relative to Shore-normal
κ	Von Kármán Constant, $\kappa \cong 0.41$
ρ	Water density taken as $\rho = 1{,}028\ kg/m^3$
ρ_s	Sediment density taken as $\rho_s = 2{,}650\ kg/m^3$
µm	Micrometers
ν	Kinematic Viscosity of Water taken as $\nu = 10^{-6}\ m^2/sec$
σ	Standard Deviation of the Linearly Detrended Pressure Signal
a	Reference Elevation
ADP	Acoustic Doppler Profiler
b	Height from Bottom Corresponding to the Depth-averaged Velocity
B	Distance between Wave Rays
$b_{i,i=1-5}$	Constants in the Dietrich Formula
C_a	Reference Concentration
CERC	Coastal Engineering Research Center
CH2M	CH2M HILL Engineers Inc.
C	Wave Celerity
C_g	Group Wave Celerity
C_{gbr}	Group Wave Celerity at Breaking
$C(z)$	Suspended Sediment Concentration as a Function of Height above Bottom
d	Distance from Bottom to the Point of Measurement
$d_{b,50}$	Median Grain Size of the Bed Sediment
$d_{s,50}$	Median Grain Size of the Suspended Sediment
f	Frequency
FERC	Federal Energy Regulatory Commission
FFT	Fast Fourier Transform
ft	Feet
g	Grams
g	Acceleration due to gravity, $g = 9.81\ m/sec^2$
G_s	Dry mass of sediment catch of the Helley-Smith Bedload Sampler

Term	Definition
hr	Hours
H	Height of the Water Column
H_{br}	Significant Wave Height at Breaking
$H_{br,rms}$	Root Mean Square of the Significant Wave Height at Breaking
H_s	Significant Wave Height at the Water Surface
$H_{s,rms}$	Root Mean Square of the Significant Wave Height at the Water Surface
IMS	Ice Mitigation Structures
in	Inches
k	Wave Number
K_1	Empirical Coefficient of the CERC Formula taken as $K_1 = 0.05$
K_r	Refraction Coefficient
k_s'	Nikuradse Grain Roughness Height
K_s	Shoaling Coefficient
L	Wavelength
L_0	Deep Water Wavelength
L	Liters
LDT	Local Daylight Saving Time
LISST-100X	Laser In Situ Scattering and Transmissometry 100X Type C Instrument
LNG	Liquefied Natural Gas
m	Meters
min	Minutes
mL	Milliliters
MLLW	Mean Lower Low Water
mm	Millimeters
Mode	Peak of the Particle Size Frequency Distribution
MOF	Materials Offloading Facility
n	Sample Size
n	Fraction of the Wave Mechanical Energy Transmitted Forward
NOAA	National Oceanic and Atmospheric Administration
OBS	Optical Backscatter
p	Porosity taken as $p = 0.4$
PLF	Product Loading Facility
Q_{CERC}	Longshore Transport Rate according to the CERC Formula
Q_{Field}	Longshore Transport Rate from Field Data
$Q_{van\ Rijn}$	Longshore Transport Rate according to the 2014 van Rijn Equation
R	Correlation Coefficient

Term	Definition
R	Submerged Specific Gravity
Re_p	Explicit Particle Reynolds Number
RMSE	Root Mean Square Error
S	Spectral Magnitude
sec	Seconds
SSC	Suspended Sediment Concentration
SVF	Support Vessel Facility
t	Sampling Period of the Helley-Smith Bedload Sampler in the Surf Zone
T	Wave Period
$tan\beta$	Slope of the Beach/Surf Zone
u_{rms}	Root Mean Square Bottom Velocity Amplitude of the Directional Sea
u_*	Shear Velocity
UAA	University of Alaska Anchorage
USACE	US Army Corps of Engineers
$U(z)$	Velocity as a Function of Height above Bottom
V	Depth-averaged Velocity
w	Width of the Intake Opening of the Helley-Smith Bedload Sampler, $w = 0.152\ m$
w_s	Sediment Fall Velocity
z_0	Elevation of Zero Velocity
z	Height above Bottom
Z_R	Rouse Number

7.0 REFERENCES

ID Number	Reference Title
-	Bombardelli, F. A. and P. A. Moreno (2012), Exchange at the bed sediments-water column interface, in *Fluid Mechanics of Environmental Interfaces*, 2nd ed., edited by C. Gualtieri and D. T. Mihailovic, Taylor & Francis, London, U.K.
-	Chadwick, A. J. (1989), Field measurements and numerical model verification of coastal shingle transport, *Advances in Water Modelling and Measurement*, BHRA, The Fluid Engineering Centre, Chapter 27, pp. 381-402.
-	Coastal Engineering Manual (30-Apr-2002), US Army Corps of Engineers, Coastal Engineering Research Center, US Government Printing Office, Washington, DC.
-	Dean, R. G. and R. A. Dalrymple (2002), *Coastal Processes with Engineering Applications*, Cambridge University Press, Cambridge, U.K.
-	Dietrich, W. E. (1982), Settling velocity of natural particles, *Water Resour. Res.*, 18(6): 1615-1626.
-	Julien, P. Y. (2010), *Erosion and Sedimentation*, 2nd ed., Cambridge University Press, Cambridge, U.K.
-	Madsen, O. S., L. D. Wright, and T. A. Chisholm (1993), Wind stress, bed roughness and sediment suspension on the inner shelf during an extreme storm event, *Cont. Shelf Res.*, 13(11): 1303-1324.
-	Raudkivi, A. J. (1998), *Loose Boundary Hydraulics*, 3rd ed., Pergamon Press, Oxford, U.K.
-	Ravens, T. M. and Lee, W. (2007) Evolution of a North Slope barrier island (Narwhal Island, North Arctic Alaska) 1955-2007. AGU Fall Meeting, Dec. 10-14. San Francisco.
-	Rouse, H. (1937), Modern conceptions of the mechanics of fluid turbulence. *Trans. Am. Soc. Civ. Eng.* 102: 463-541.
USAL-CH-JRZZZ-90-000028-000	Sediment Transport Sampling and Monitoring – Phase 1
-	Shore Protection Manual (1984), US Army Corps of Engineers, Coastal Engineering Research Center, US Government Printing Office, Washington, DC.
-	Sorensen, R. M. (2006), *Basic Coastal Engineering*, 3rd ed., Springer, New York, NY.
-	Van Rijn, L. C. (2014), A simple general expression for longshore transport of sand, gravel and shingle, *Coastal Eng.*, 90: 23-39.
-	Wentworth, C. K. (1922), A scale of grade and class terms for clastic sediments, *J. Geol.*, 30(5): 377-392.

8.0 APPENDIX A – FIELD SUMMARY

9.0 APPENDIX B – SUSPENDED SEDIMENT

Table 23: Determination of Mass Concentration by Vacuum Filtration

Filter Number	Water Sample	Pre-weight (g)	Dry Weight (g)	Water Volume (mL)	Mass Concentration[a] (g/L)
1	N113	0.118	0.232	96	1.19
2	N90	0.118	0.317	176	1.13
3	N83	0.118	0.170	98	0.53
4	N7	0.117	0.234	124	0.94
5	N60	0.117	0.214	114	0.85
6	N125	0.117	0.155	138	0.28
7	N21	0.118	0.142	134	0.18
8	N72	0.118	0.193	124	0.60
9	N36	0.117	0.176	127	0.46
10	N55	0.118	0.167	108	0.45
11	N79	0.117	0.175	102	0.57
12	N77	0.118	0.170	95	0.55

Note: [a] $Mass\ Concentration\ (g/L) = \frac{(Dry\ Weight - Pre\text{-}weight)}{Water\ Volume} \times 1000$

Figure 13: Particle Size Frequency Distribution for Water Sample N125

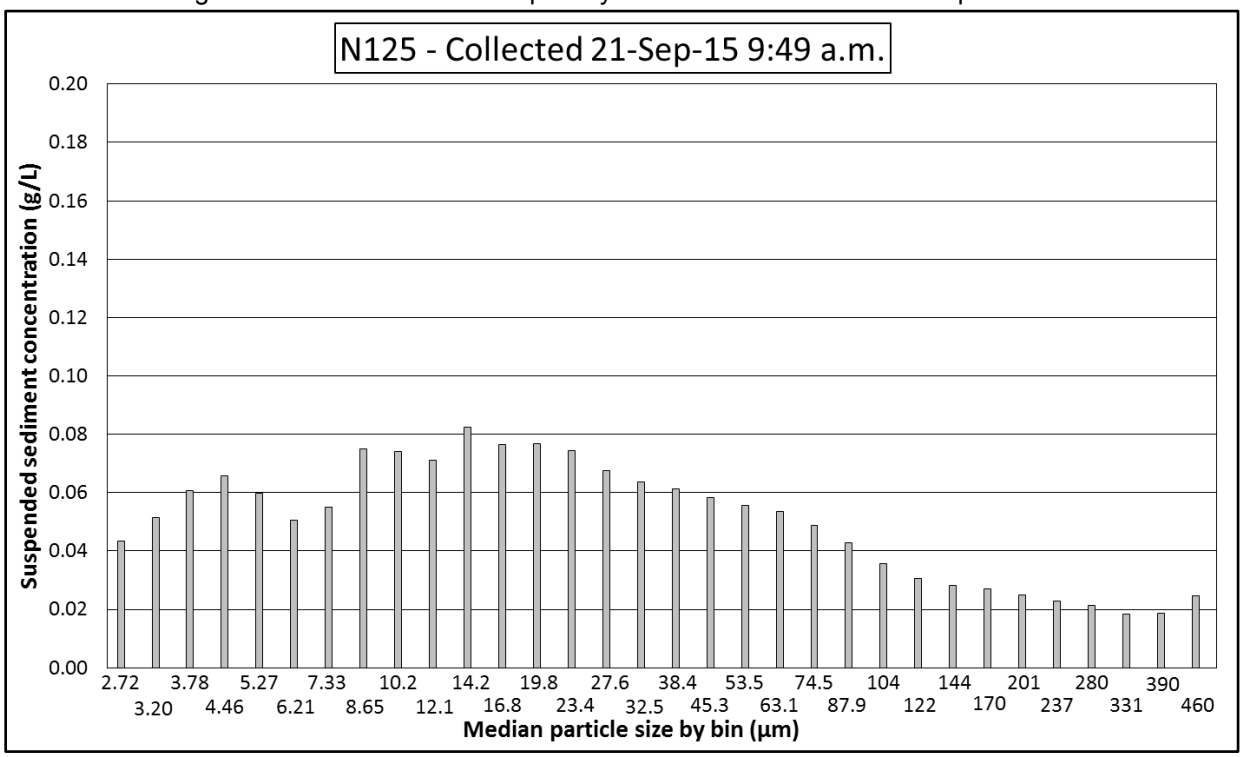


Figure 14: Percent Passing for Water Sample N125

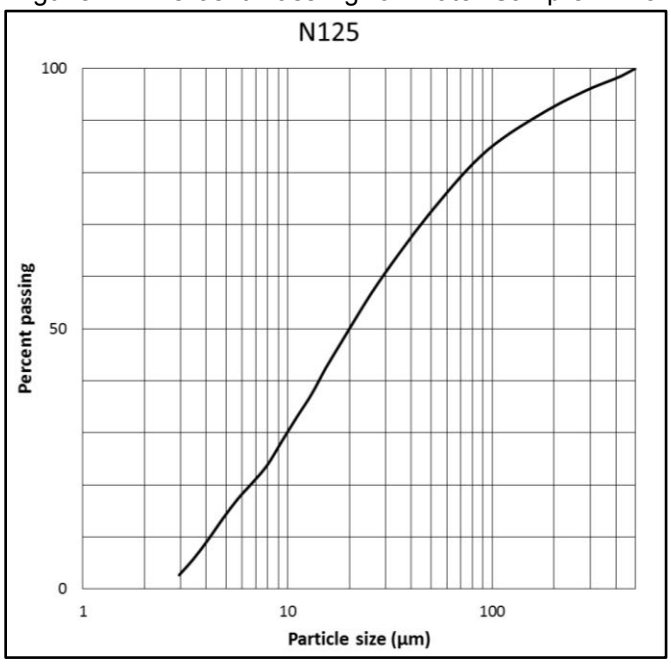


Figure 15: Particle Size Frequency Distribution for Water Sample N21

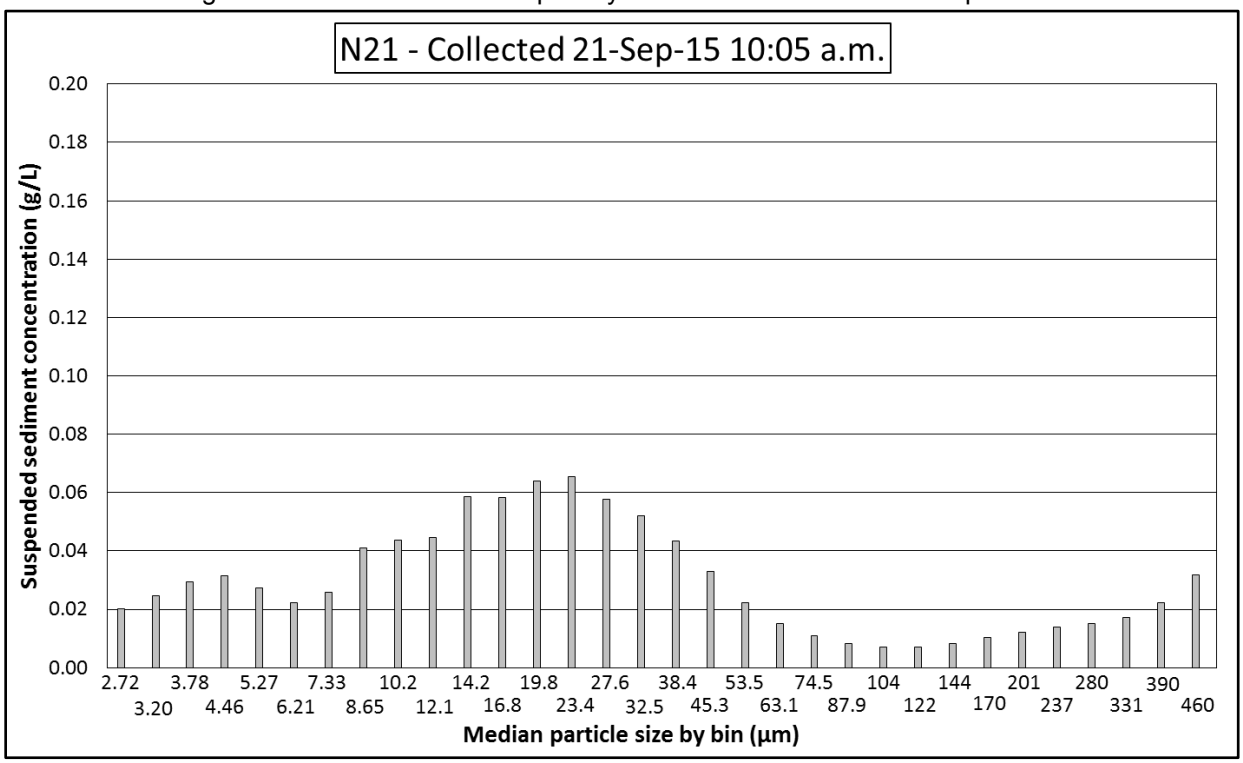


Figure 16: Percent Passing for Water Sample N21

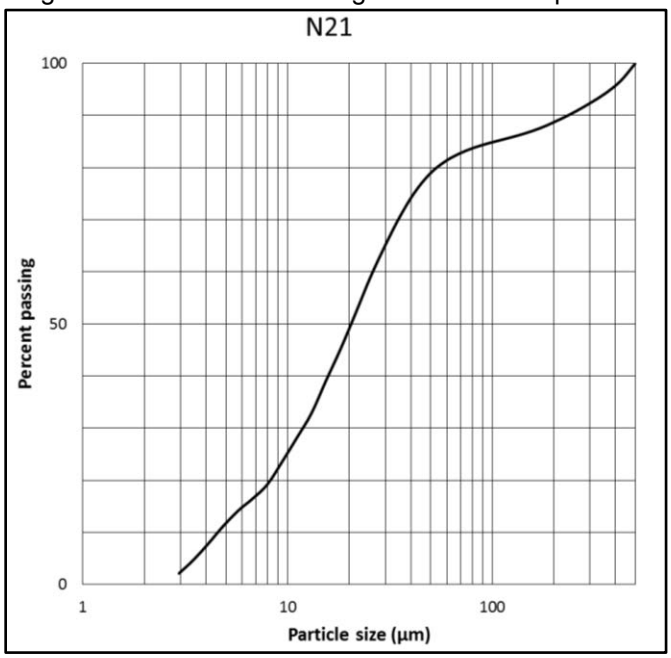


Figure 17: Particle Size Frequency Distribution for Water Sample N55

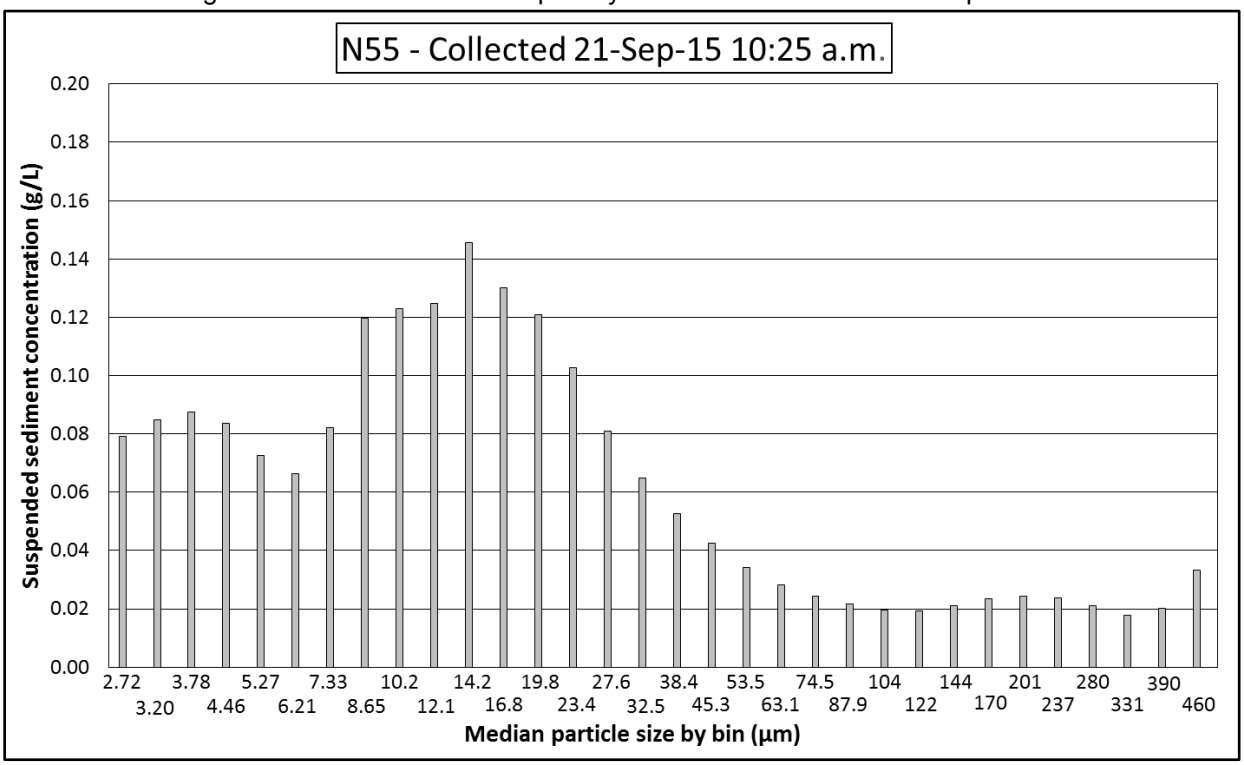


Figure 18: Percent Passing for Water Sample N55

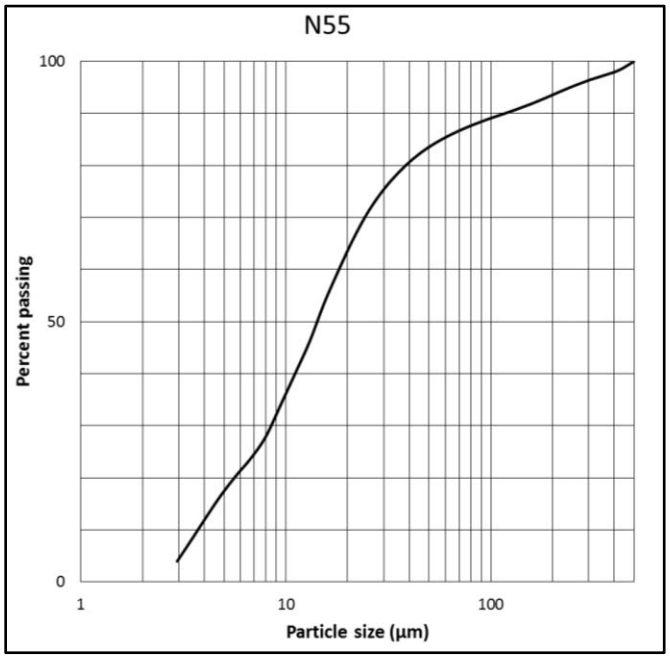
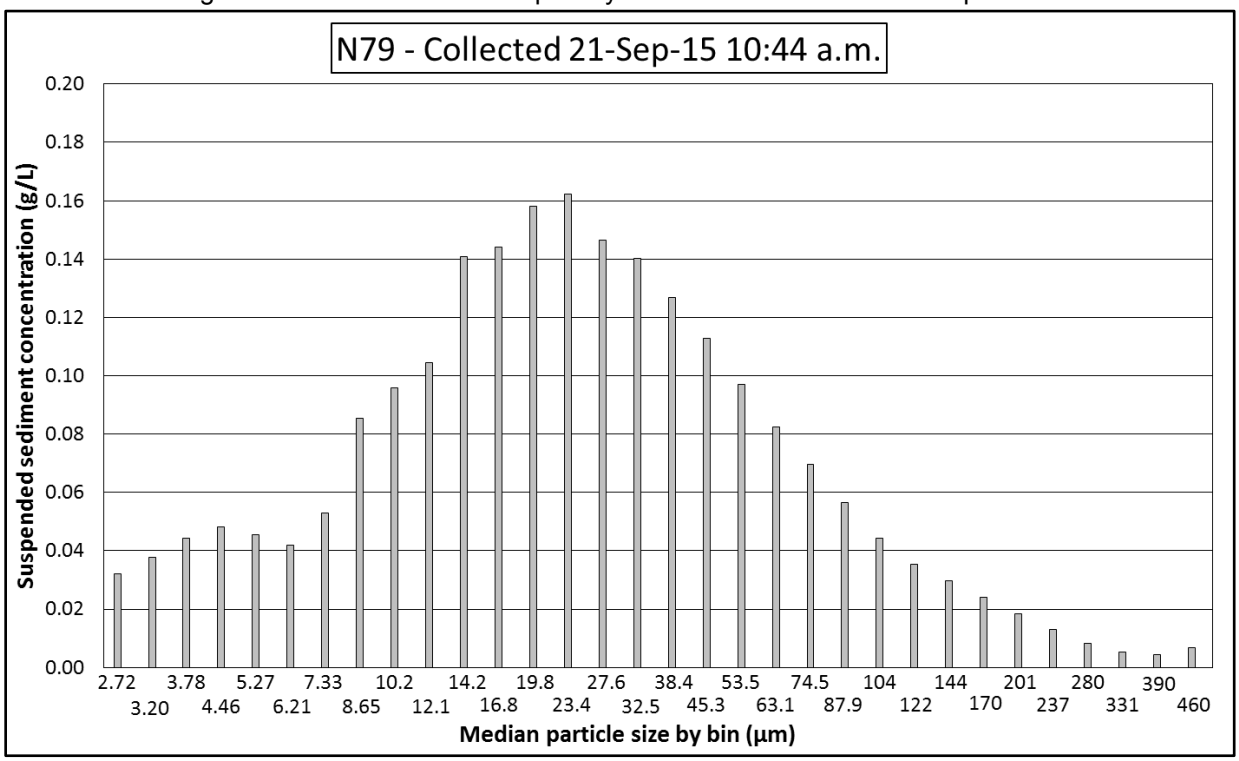


Figure 19: Particle Size Frequency Distribution for Water Sample N79



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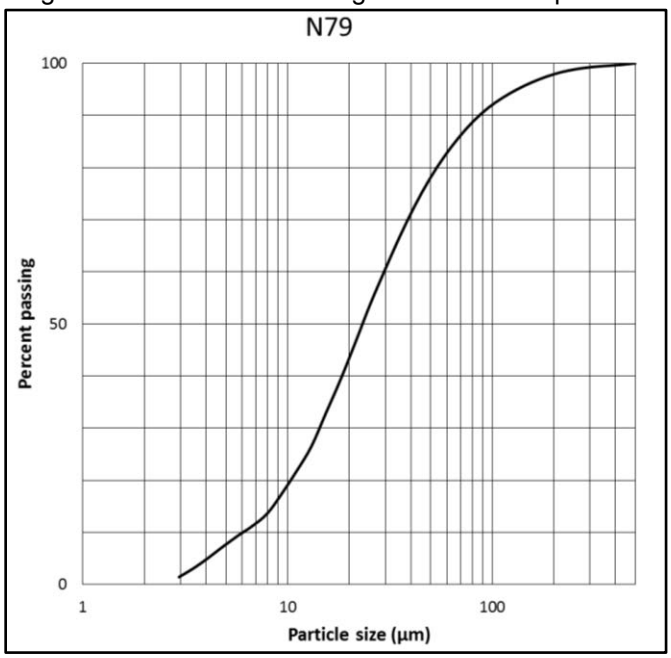
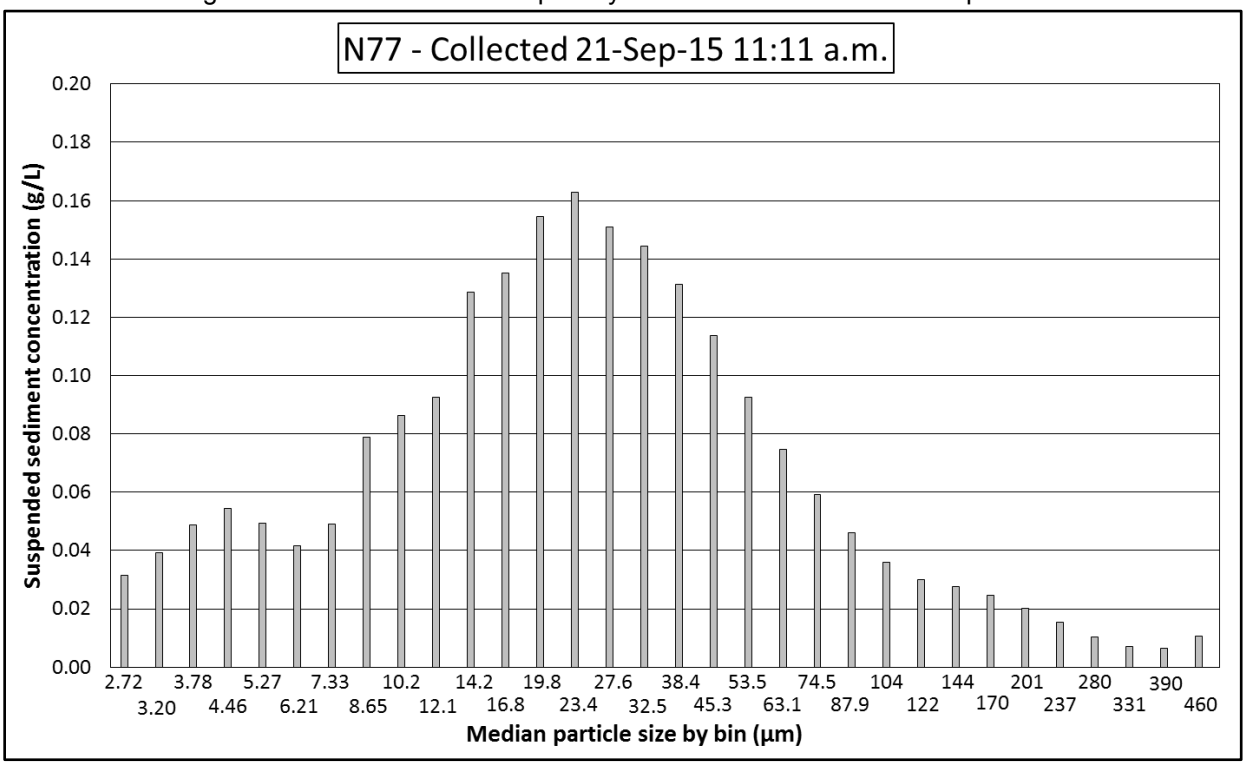


Figure 21: Particle Size Frequency Distribution for Water Sample N77



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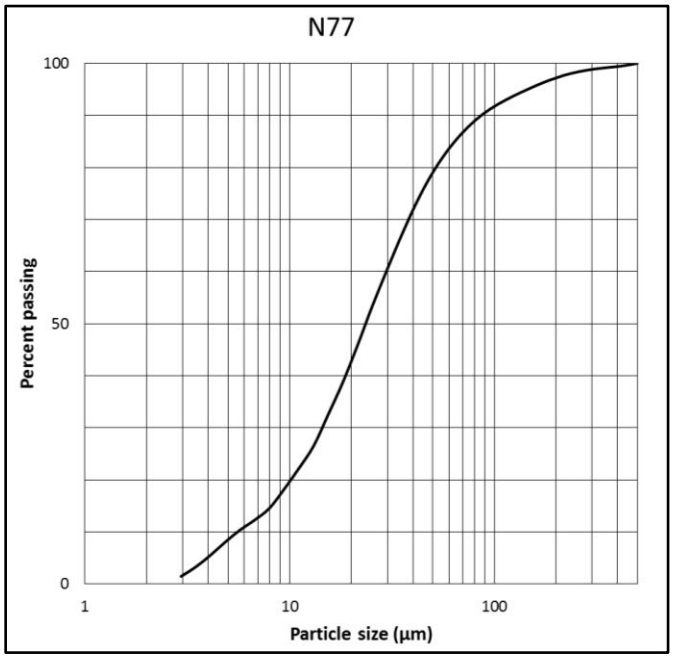
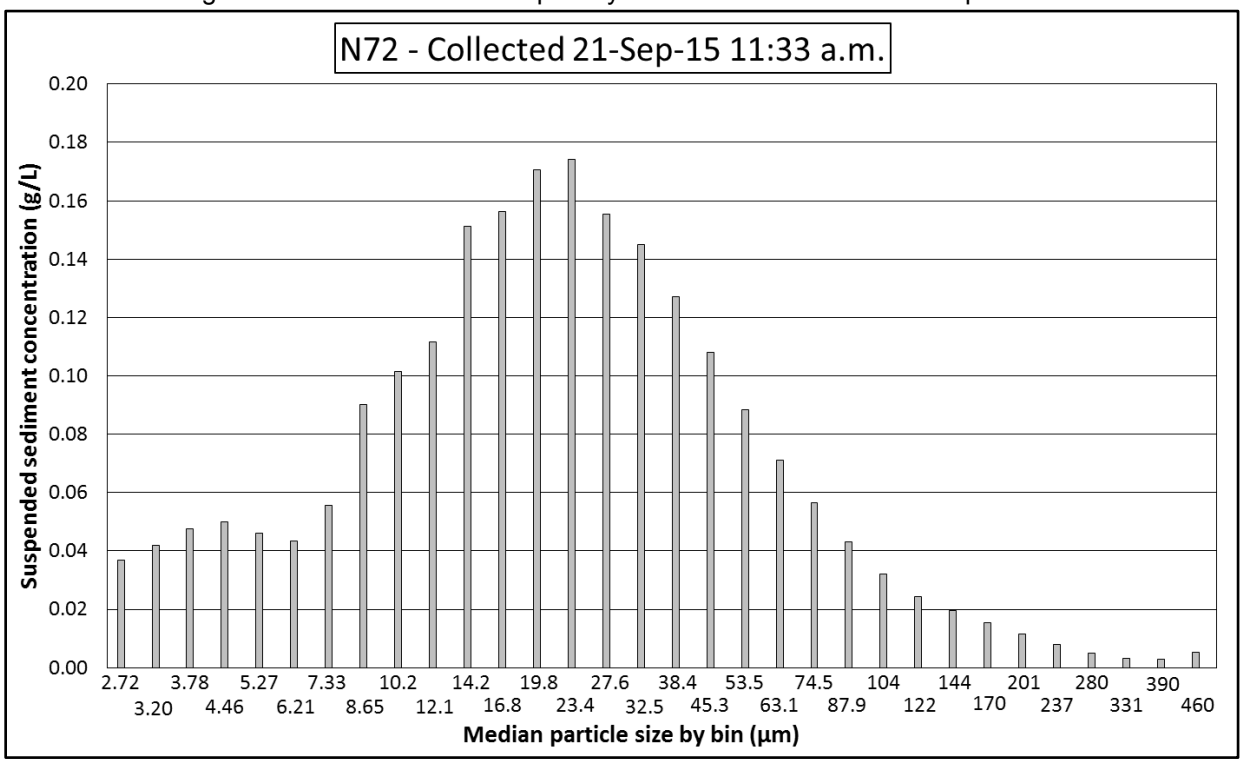


Figure 23: Particle Size Frequency Distribution for Water Sample N72



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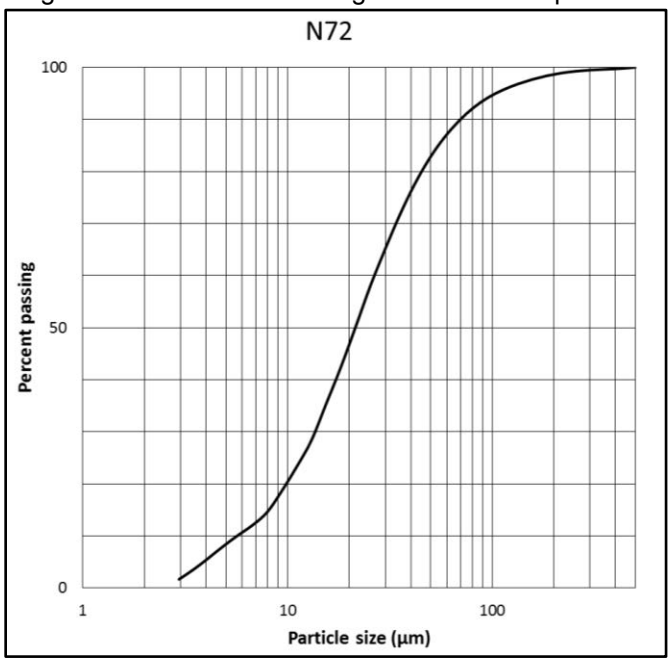
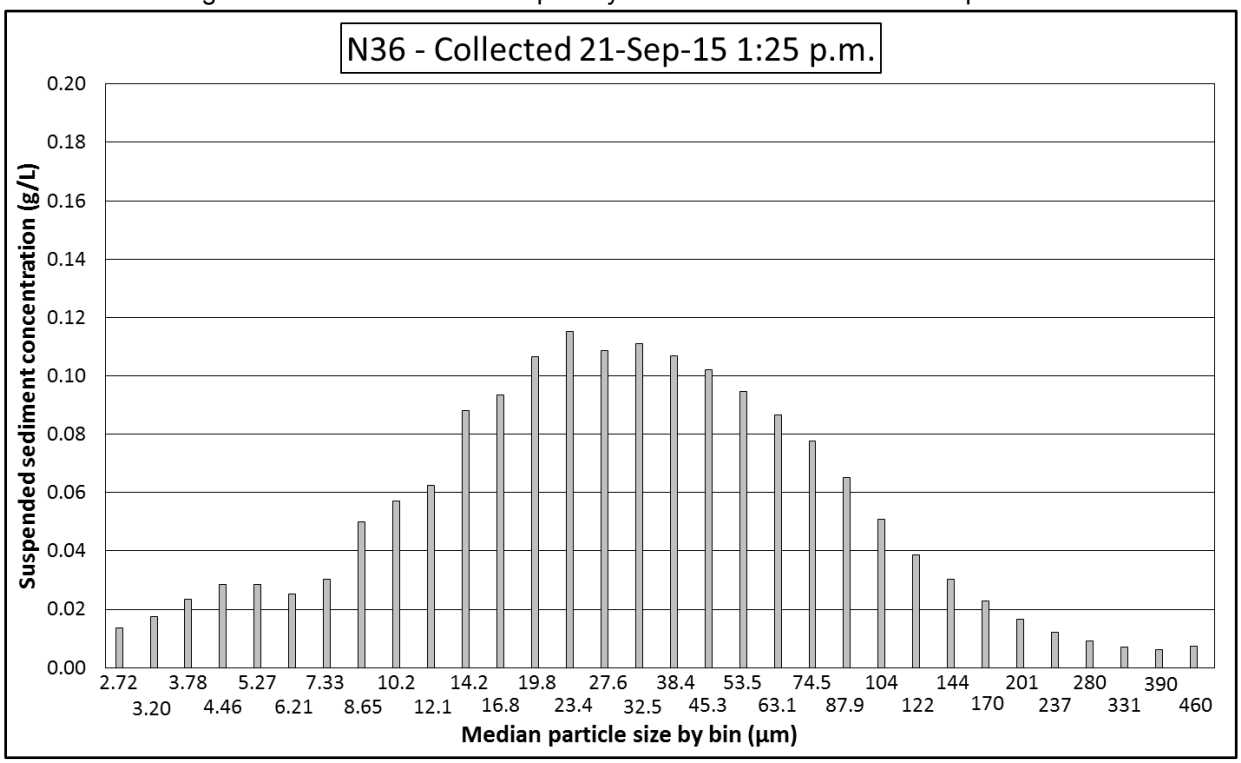


Figure 25: Particle Size Frequency Distribution for Water Sample N36



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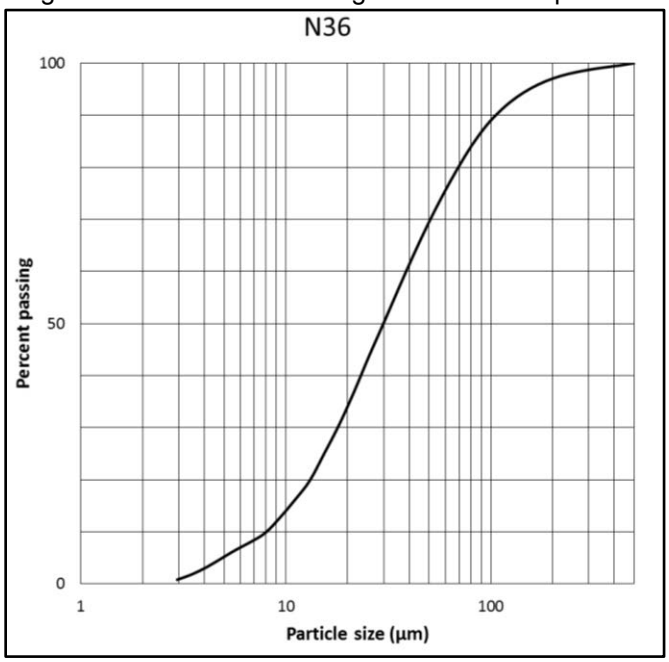


Figure 27: Particle Size Frequency Distribution for Water Sample N60

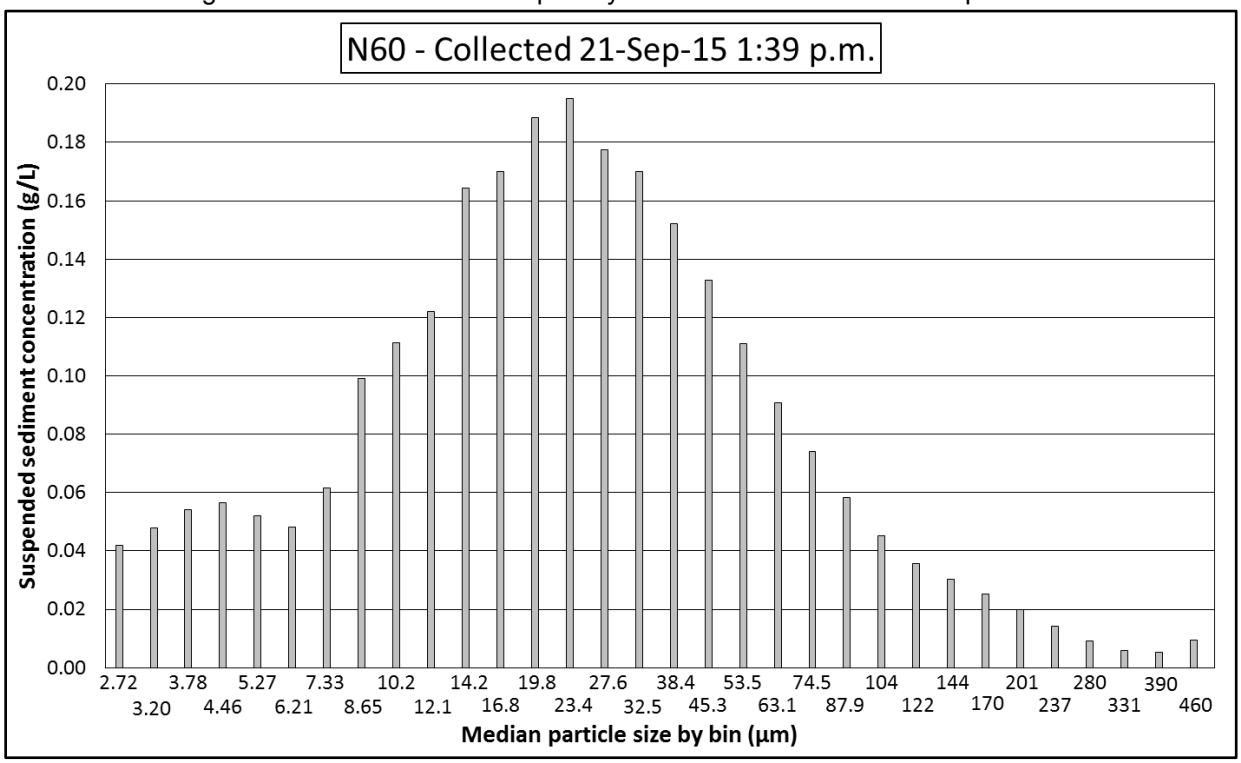


Figure 28: Percent Passing for Water Sample N60

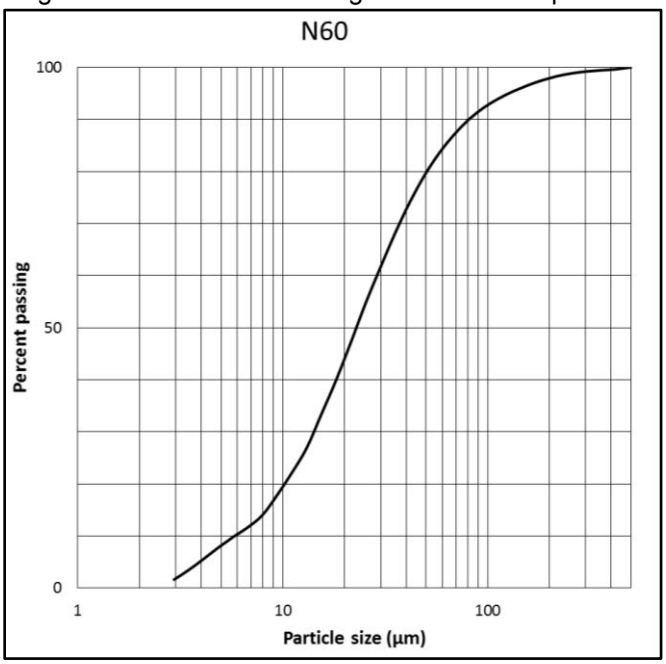


Figure 29: Particle Size Frequency Distribution for Water Sample N83

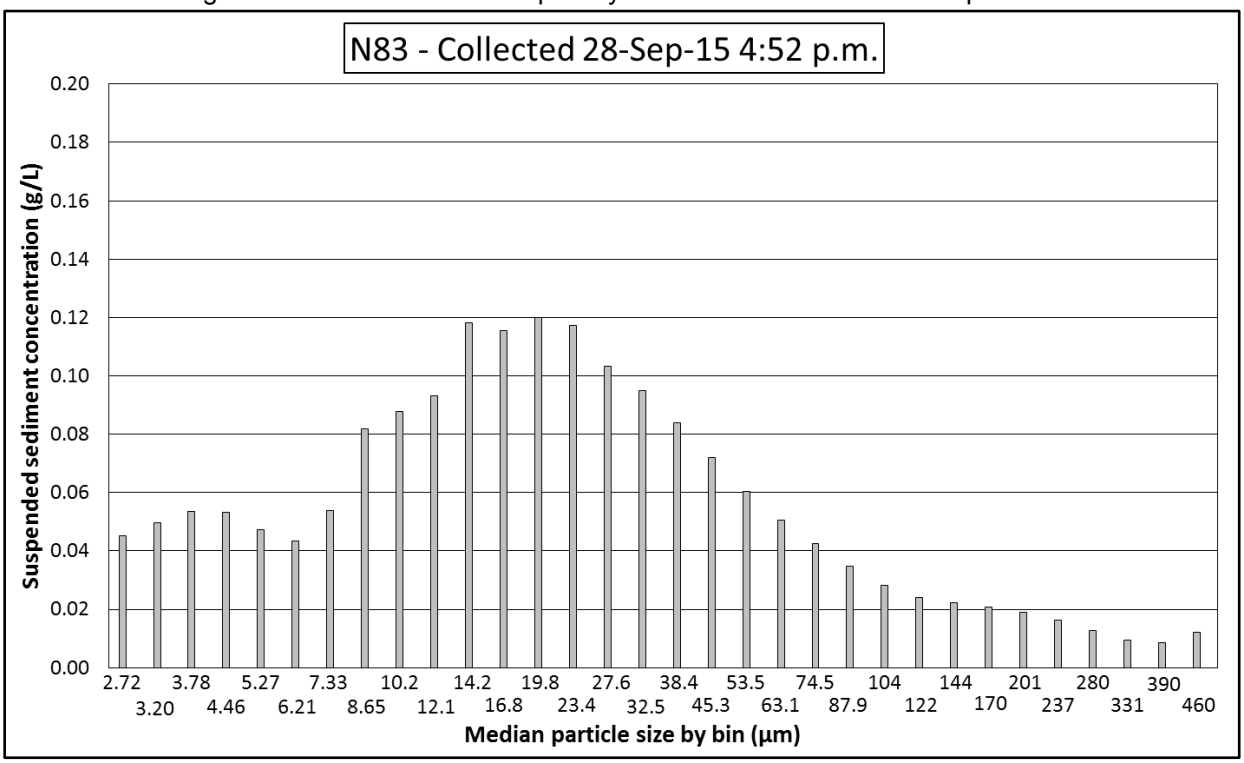


Figure 30: Percent Passing for Water Sample N83

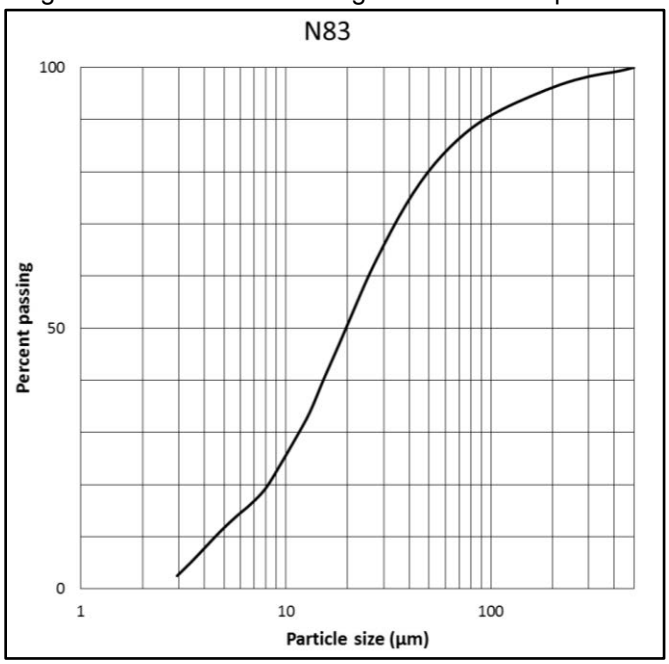
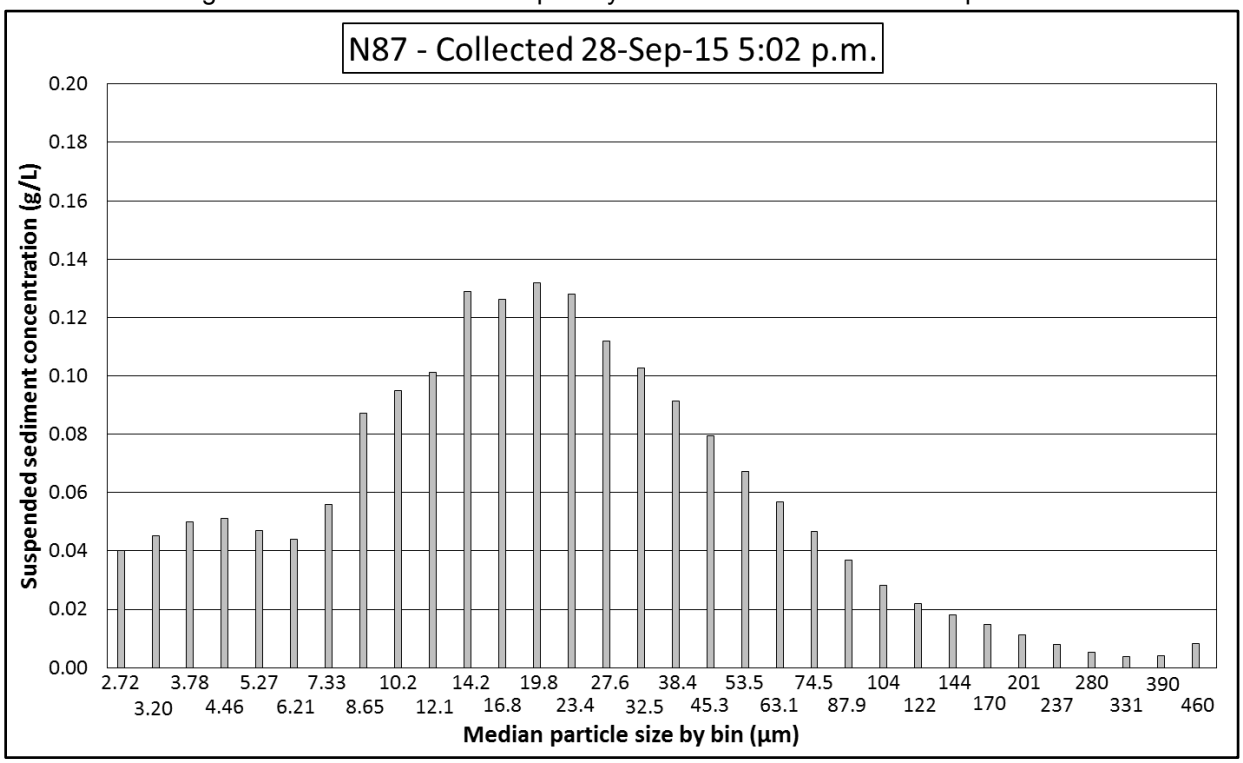


Figure 31: Particle Size Frequency Distribution for Water Sample N87



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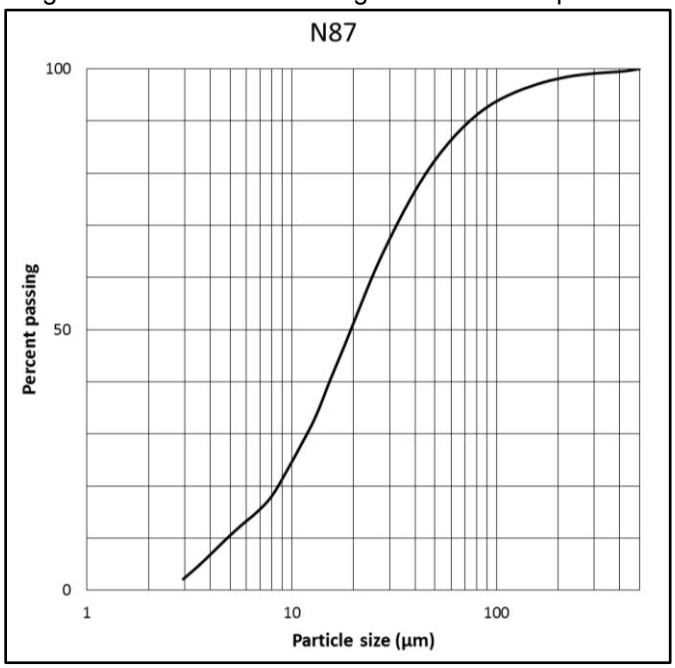


Figure 33: Particle Size Frequency Distribution for Water Sample N7

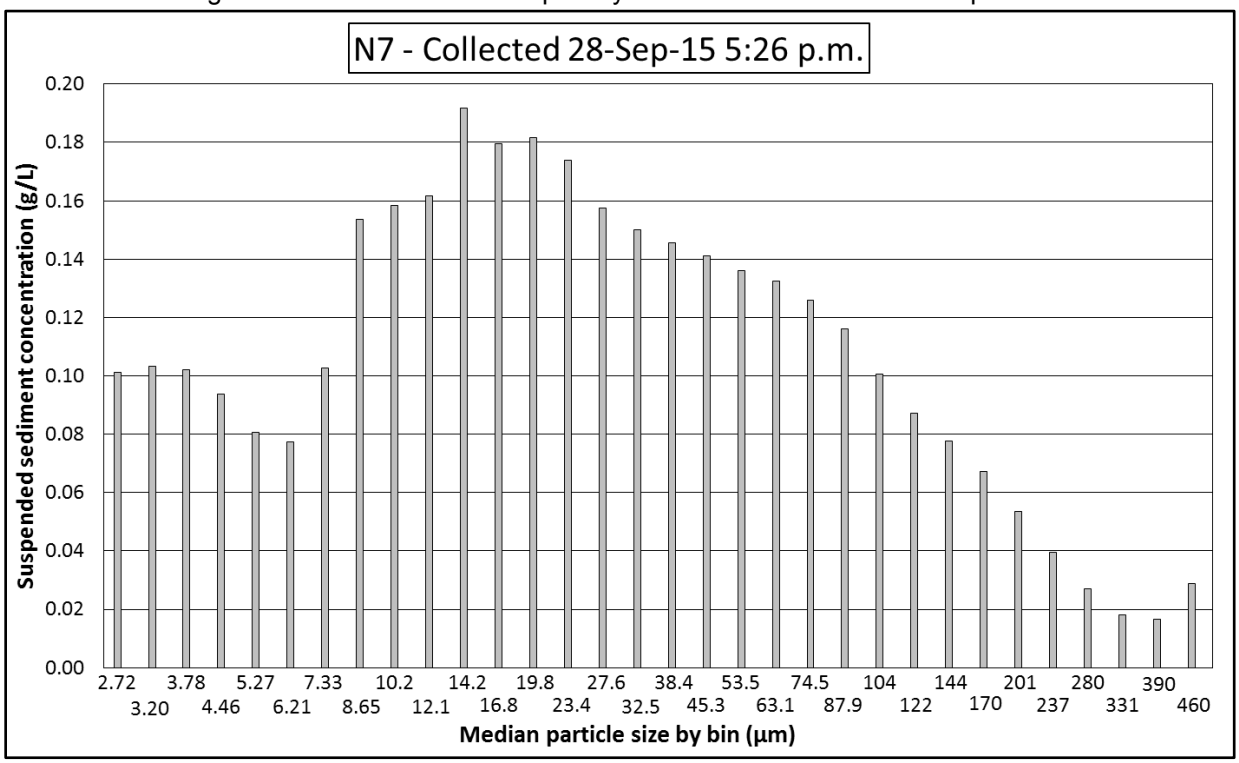


Figure 34: Percent Passing for Water Sample N7

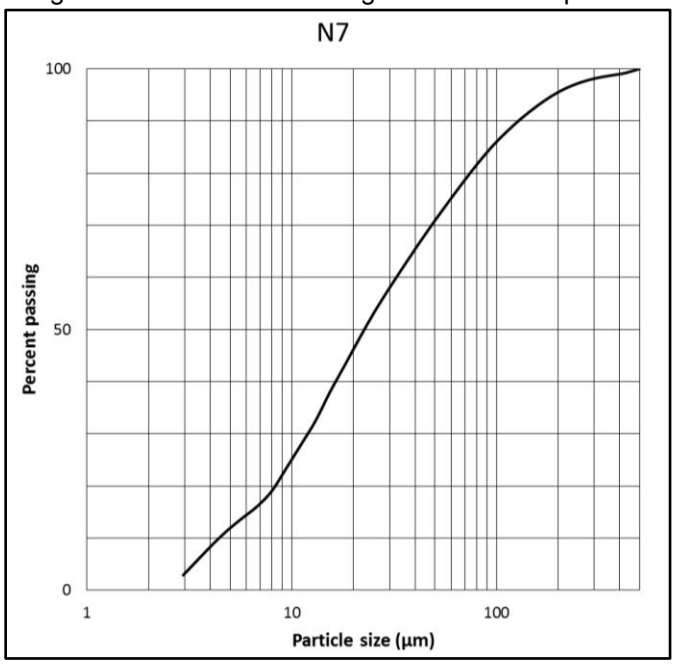


Figure 35: Particle Size Frequency Distribution for Water Sample N113

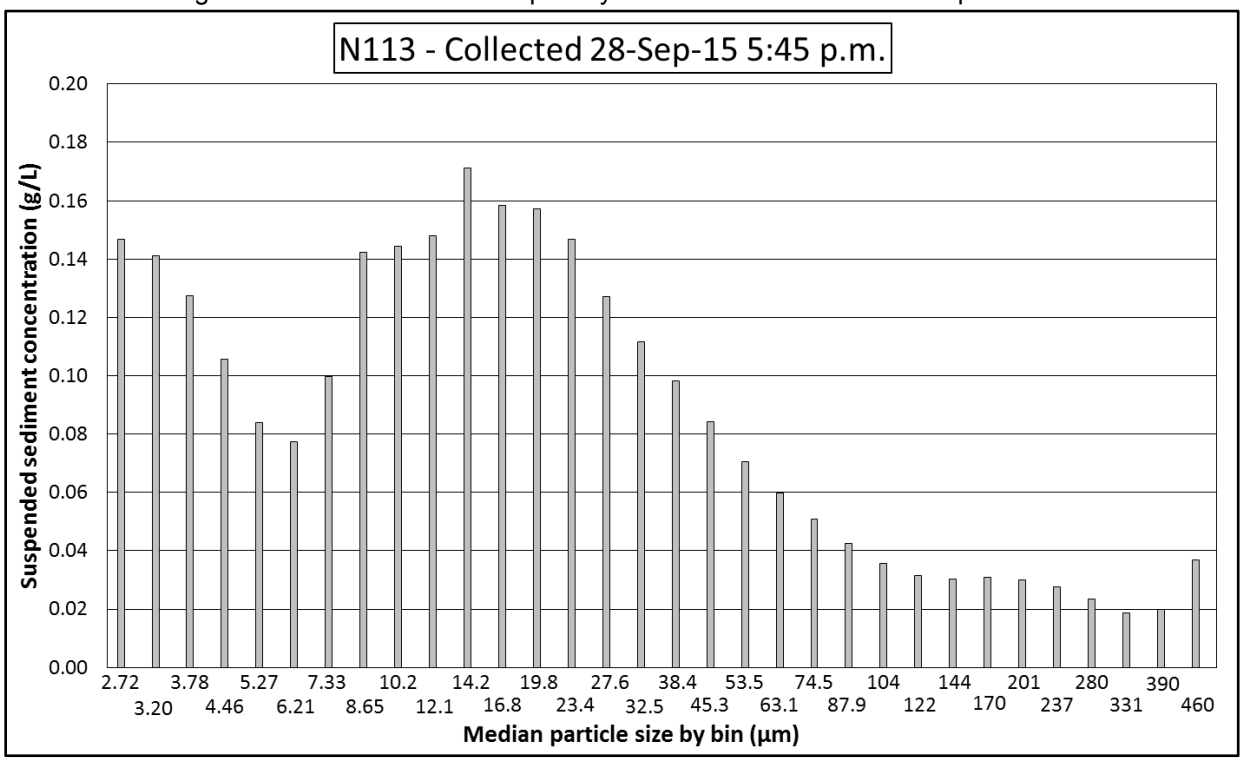


Figure 36: Percent Passing for Water Sample N113

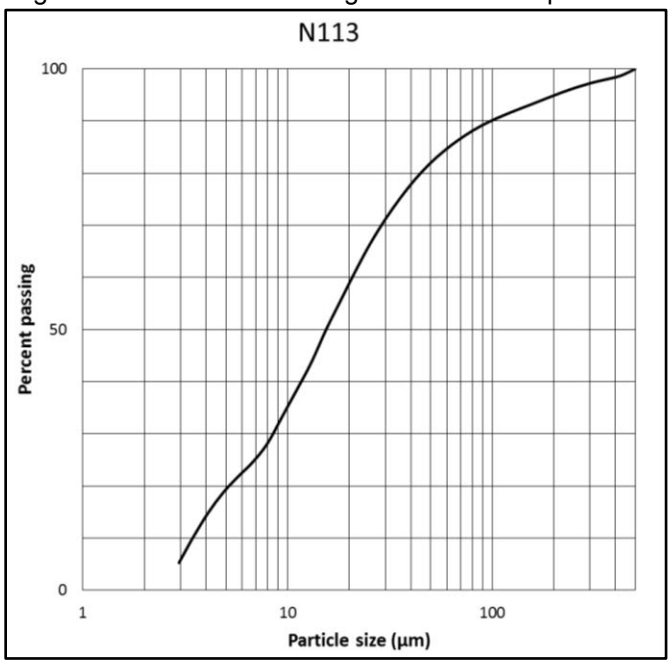


Figure 37: Particle Size Frequency Distribution for Water Sample N90

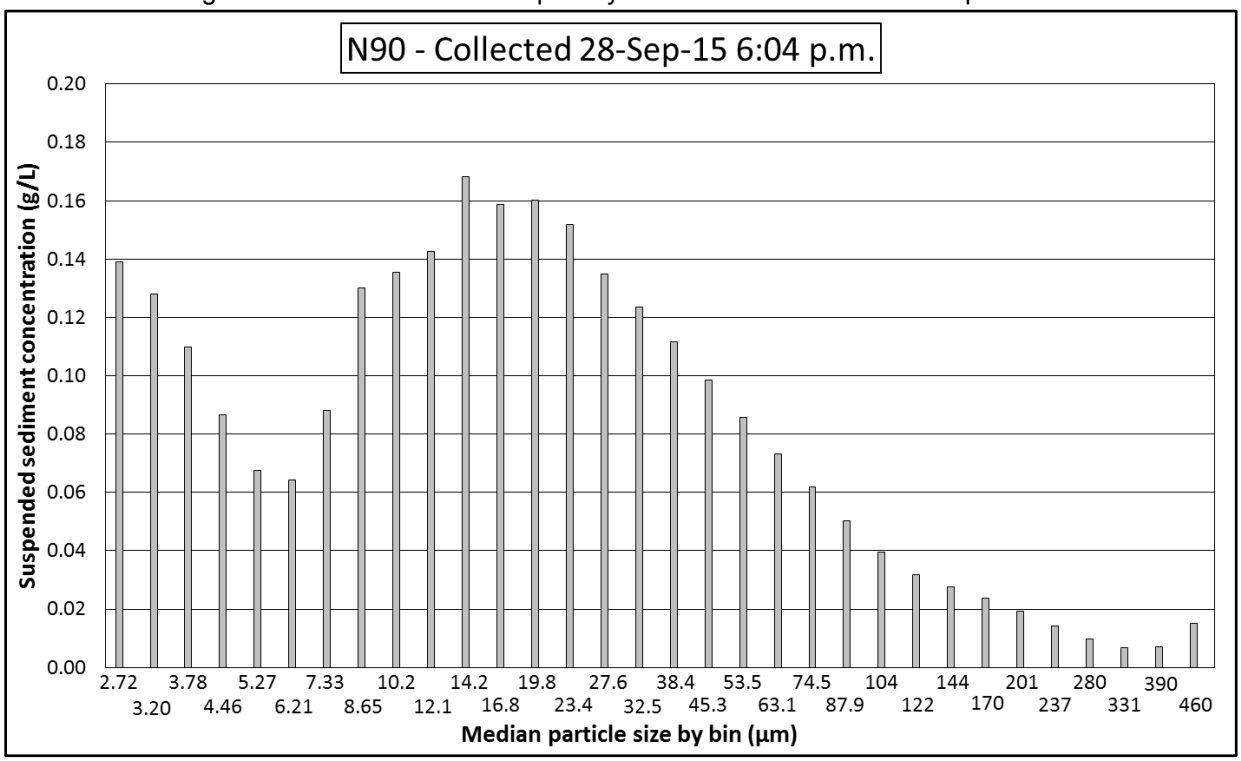
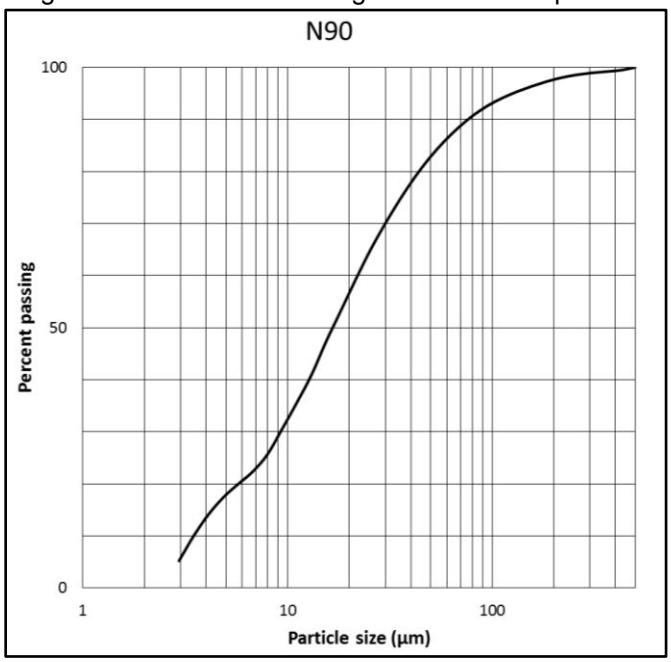


Figure 38: Percent Passing for Water Sample N90



10.0 APPENDIX C – BEDLOAD

Figure 39: Particle Size Frequency Distribution for Bedload Sample 21-Sep-15 BL1

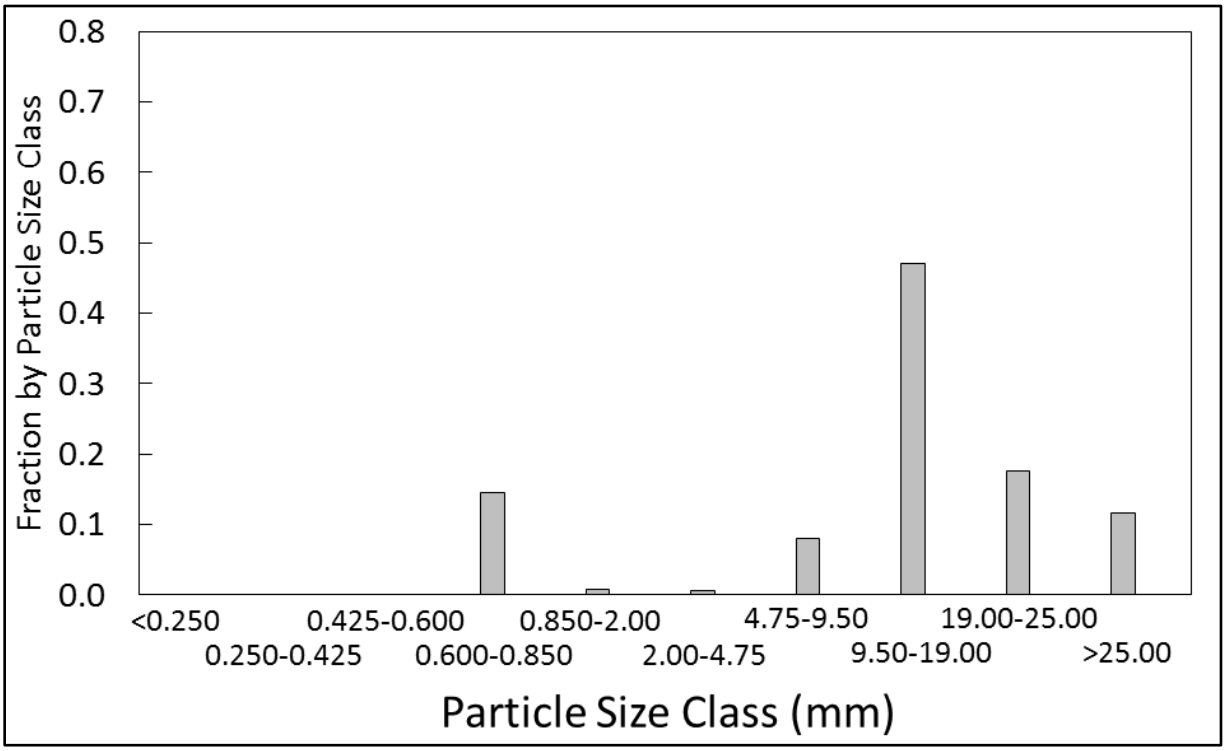


Figure 40: Percent Passing for Bedload Sample 21-Sep-15 BL1

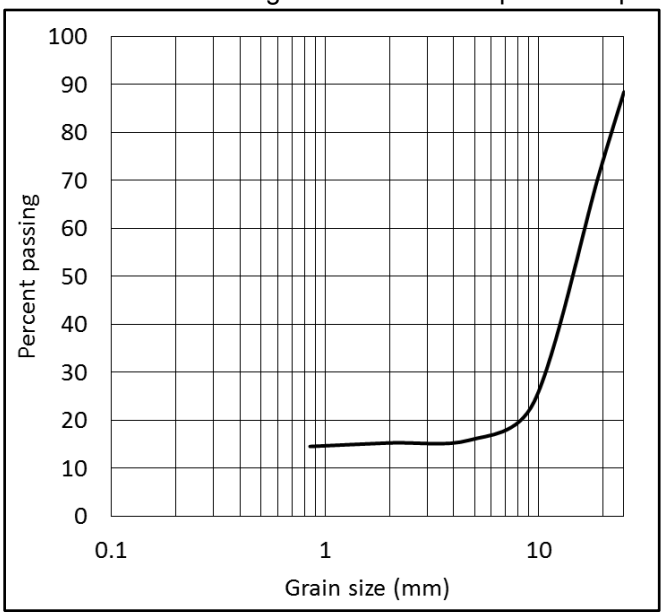


Figure 41: Particle Size Frequency Distribution for Bedload Sample 25-Sep-15 BL2

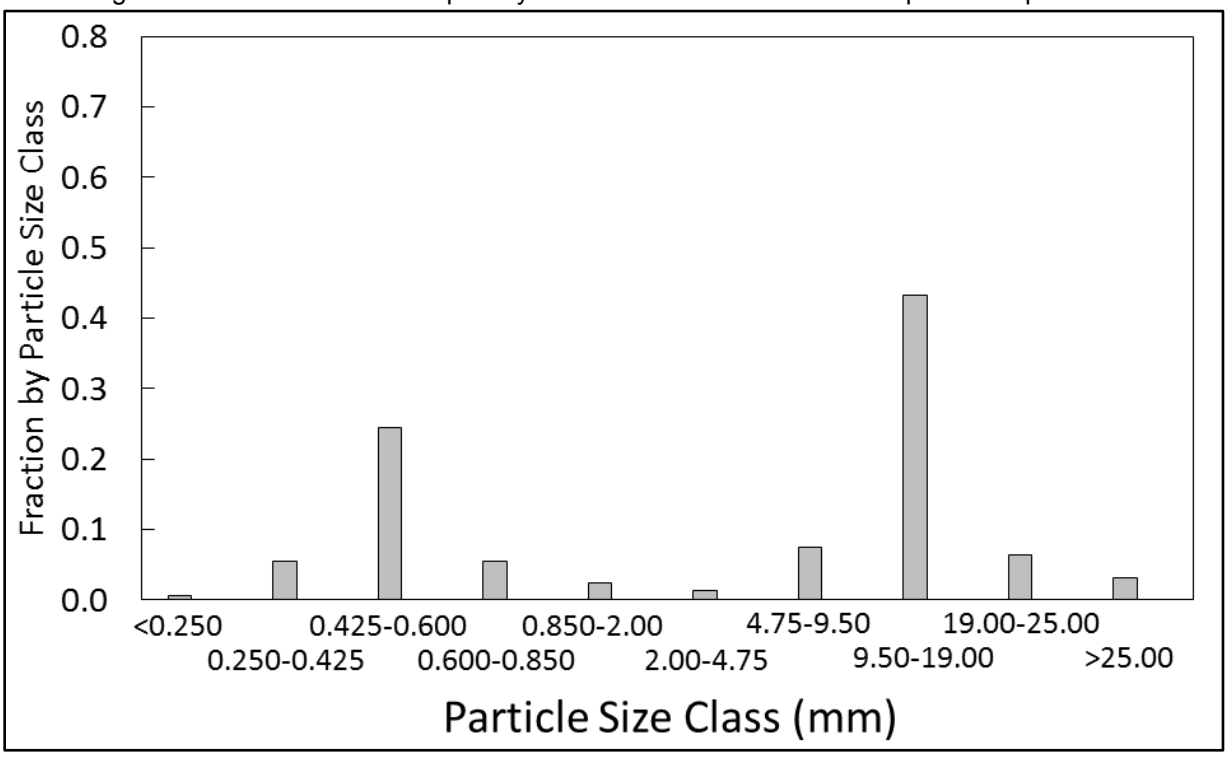


Figure 42: Percent Passing for Bedload Sample 25-Sep-15 BL2

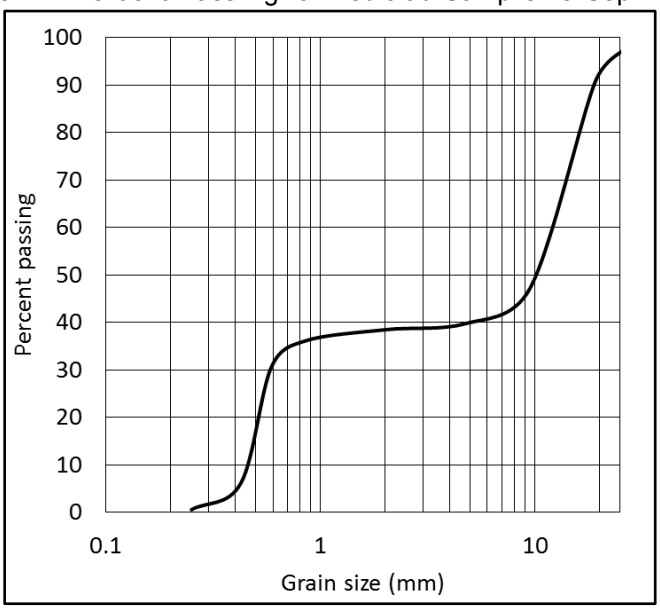


Figure 43: Particle Size Frequency Distribution for Bedload Sample 25-Sep-15 BL3

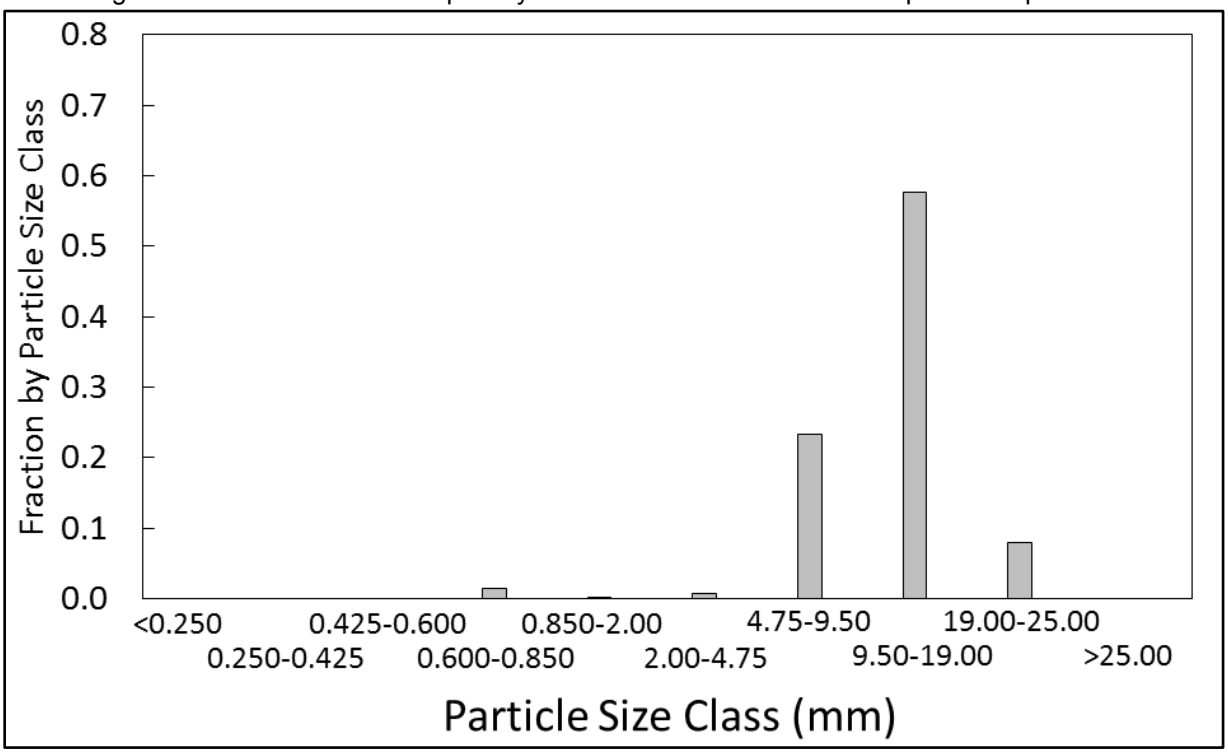


Figure 44: Percent Passing for Bedload Sample 25-Sep-15 BL3

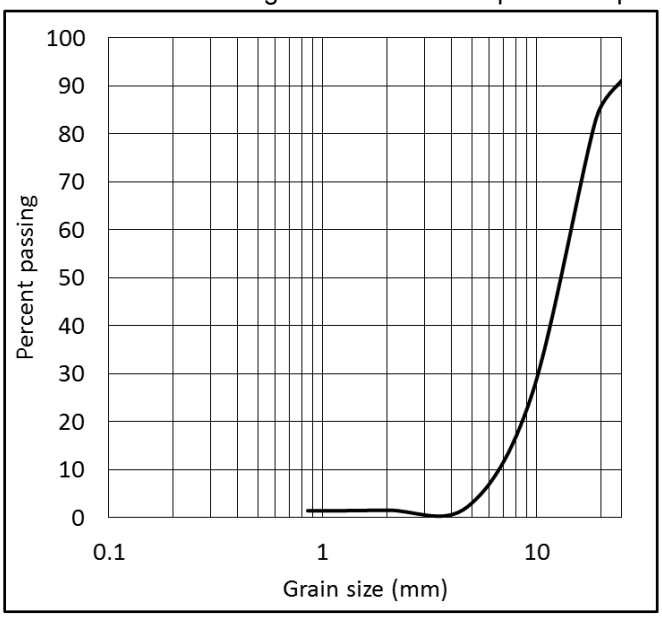


Figure 45: Particle Size Frequency Distribution for Bedload Sample 28-Sep-15 BL1

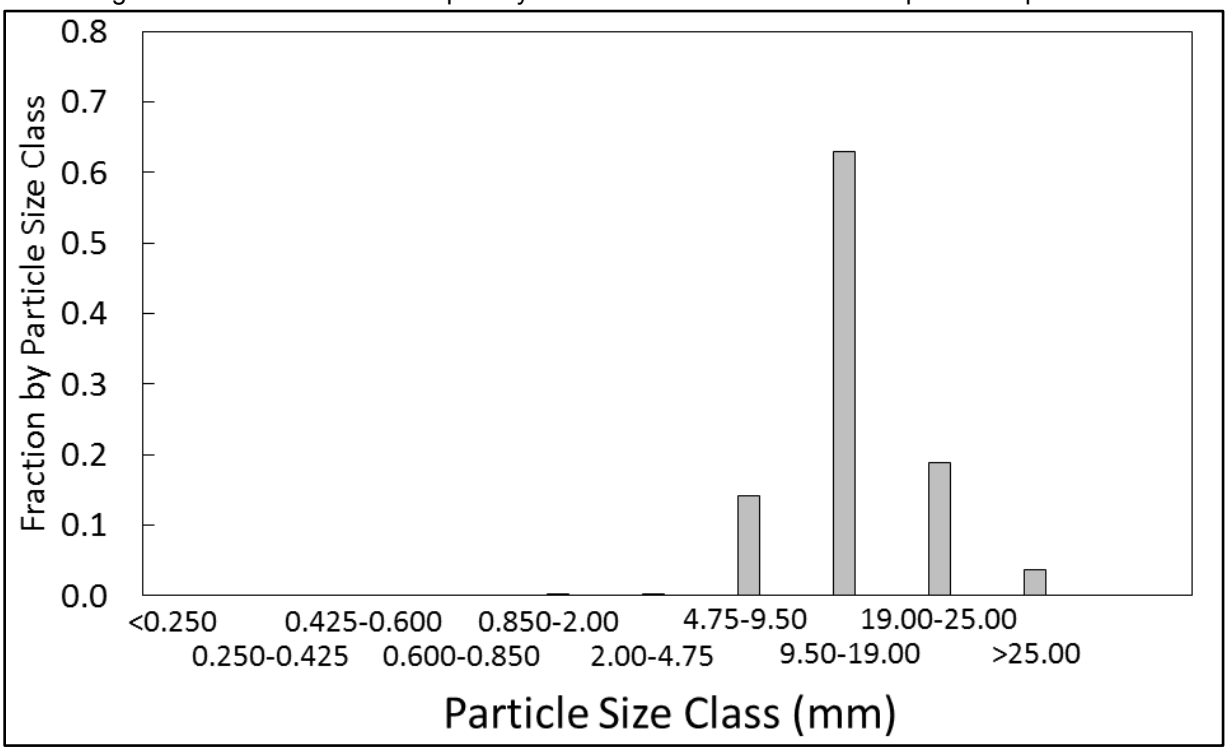


Figure 46: Percent Passing for Bedload Sample 28-Sep-15 BL1

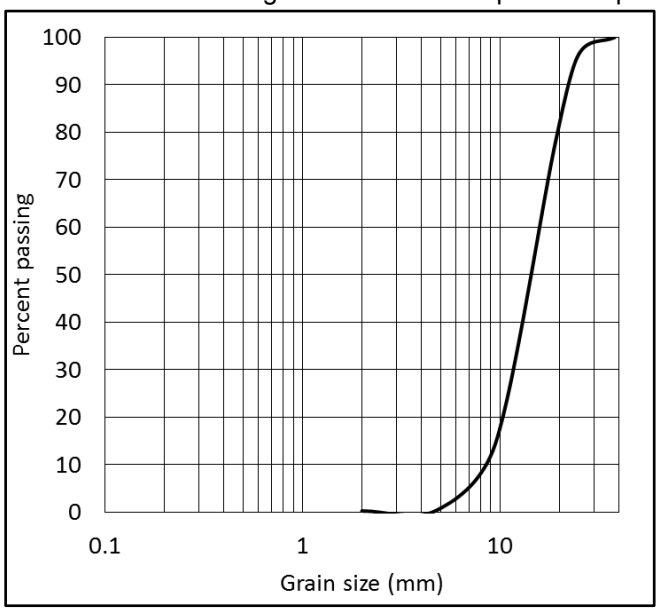


Figure 47: Particle Size Frequency Distribution for Bedload Sample 28-Sep-15 BL2

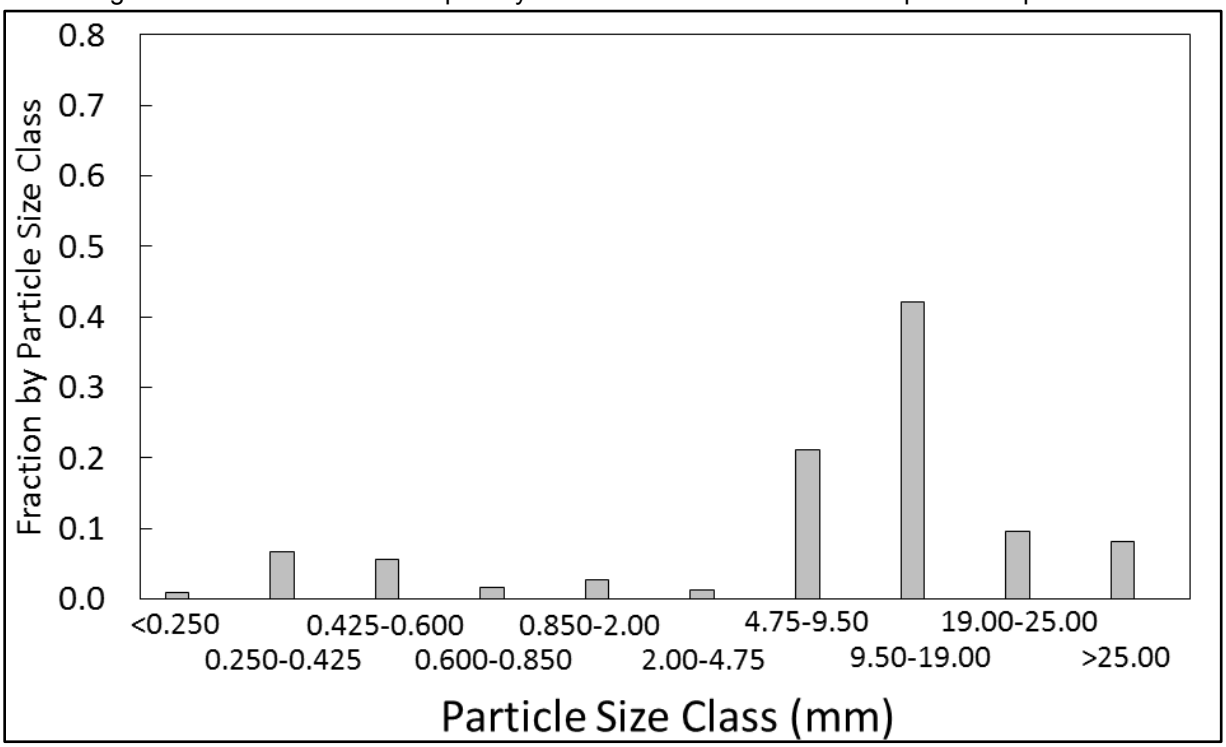
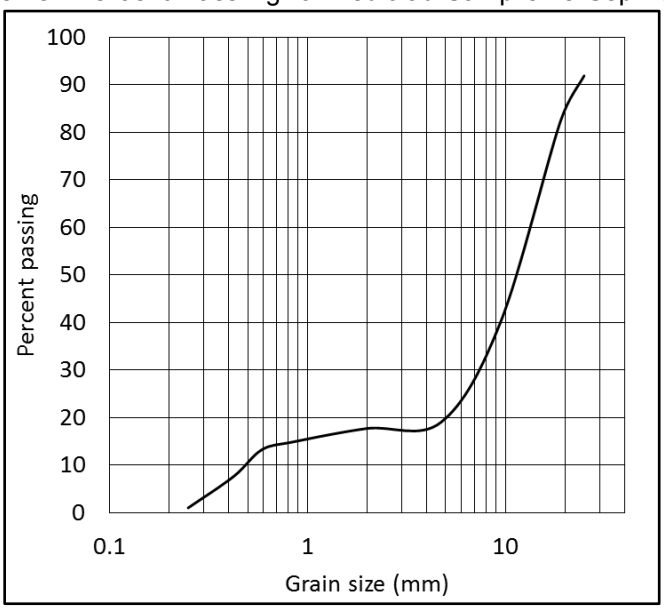


Figure 48: Percent Passing for Bedload Sample 28-Sep-15 BL2



APPENDIX Q.2 TEST PIT DREDGE MATERIAL CHARACTERIZATION REPORT

Confidential

TEST PIT DREDGE MATERIAL CHARACTERIZATION REPORT

USAL-CH-JRZZZ-90-000032-000

Rev	Date	Revision Description	Originator	Reviewer / Endorser	Response Code	Approver
A	22-Jan-16	Issued for Review	C. Andrews			R. Andrews
0	07-Apr-16	Issued for Use	C. Andrews			S. O'Neil

Document Control No.	Country	Facility	Originator	Discipline	Type	Sub-Type	Location	Sequence	Identifier
	US	AL	CH	J	R	ZZZ	90	000032	000

REVISION MODIFICATION LOG

Revision	Section	Description
0	Various	2.1 corrected reference to Figure 1, remove SAP last paragraph
		2.2 inserted “proposed” in front of reuse site
		Figure 2 revised Elevation text
		2.5.1 revised text in last paragraph
		3.1 Partial deletion of data objectives
		Global: update SQuirT to SQuiRT
		Table 1 Added method to bioassay and bioaccumulation
		4.1.1 revised text to reference SAP rather than User’s Manual and reference to one test pit
		4.1.2 Updated to Fugro Consultants Inc. and address
		4.1.3 text edit in last paragraph
		4.1.4 text edit to Table 3 footnote
		4.1.5 Deleted Figure 6, update text in last paragraph
		Table 4 Adjusted columns to fit text
		Table 5 Deleted Bioassay and Bioaccumulation
		Figure 7 removed background text box
		8.1 update text and order of ft and meters
		8.2 updated second to last bullet text
		11 Removed highlighted references

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1.0 PURPOSE AND SCOPE

1.1 PURPOSE

BP, ConocoPhillips, ExxonMobil, TransCanada and the Alaska Gas Development Corporation signed a Heads of Agreement (HOA) establishing the guiding principles and basic framework under which the participants will advance the Alaska LNG Project (AKLNG). Refer to the project website at www.ak-lng.com for further details.

In order to accommodate the Pre- Front End Engineering Design (FEED) objectives for AKLNG, CH2M HILL Engineers Inc. (CH2M) has been contracted to provide the Pre-FEED for the Marine Facilities at the LNG export site in Nikiski. As part of the Dredging Studies activities, CH2M is examining the feasibility of dredging to support the design and construction of the proposed Marine Facilities comprising Product Loading Facilities (PLF), Material Offload Facilities (MOF) and potential pioneering facilities needed to execute enabling works.

Dredging will be needed to implement the development of the marine facilities for the project, but the constructability of the capital dredging and the rate of sedimentation following construction of the project that will dictate long-term maintenance dredging needs are uncertain.

An investigative program to develop a better understanding of the properties of the dredge material and the behavior of sedimentation at the site has been created. This program includes acquisition of geotechnical data, sediment transport monitoring, and sedimentation modeling. A component of this program includes construction and monitoring of a dredge test pit at the MOF site. The purpose of the test pit is to observe constructability of dredging at the site, measure infill rates for the dredge footprint, and quantify potential impacts of dredging and dredge material reuse.

1.2 SCOPE

In order to permit construction of the proposed test pit physical and chemical characterization of the sediment to be dredged must be performed and compared to the material and placement criteria at the potential disposal and reuse sites. The results of the characterization will be used to determine suitability of the dredged material for placement at the reuse or disposal sites. This report presents to findings of this sediment characterization effort.

The field work was conducted in accordance with the *Test Pit Dredge Material Characterization Sampling and Analysis Plan (USAL-CH-JPZZZ-90-000002-000)* (herein referred to as the SAP), and *Test Pit Dredge Material Characterization Field Execution Plan* (USAL-CH-BREXE-90-000004-000) (herein referred to as the FXP).

1.3 OVERVIEW OF REPORT

This report is organized into the following sections:

- **Section 1: Purpose and Scope** summarizes the project background and scope, describes the reported study, and provides the general organization of this document.
- **Section 2: Site Background and Conceptual Site Model.**
- **Section 3: Characterization Approach** describes the sampling design for sediment and benthic samples collected at the proposed Marine Terminal in the fall of 2015.
- **Section 4**: **Field Sampling Methods** describes the procedures used for benthic and sediment sample collection.
- **Section 5: Sample Handling and Custody** discusses sample handling and custody protocol.
- **Section 6: Quality Assurance/Quality Control** discusses chemical analyses, quality assurance/quality control (QA/QC) requirements, and laboratory corrective actions.

- **Section 7: Data Management, Review, and Evaluation** discusses usability of data as a result of the QA/QC protocols.
- **Section 8: Results and Conclusions** presents the sediment analysis results and the conclusions of the dredge material characterization.
- **Section 9: Benthic Bioassessment Sampling** presents the benthic sampling methods and analysis results.
- **Section 10: Acronyms and Terms.**
- **Section 11: References** contains complete references for documents cited in this report.
- **Appendix A:** Presents the sediment boring logs and chain-of-custody documentation.
- **Appendix B:** Presents photographs taken in the field.
- **Appendix C:** Presents the QA/QC summary and data validation report.
- **Appendix D:** Presents the laboratory reports for the analytical data collected during the project.
- **Appendix E:** Presents the Laboratory Reports.
- **Appendix F:** Presents the Benthic Testing Report.

2.0 SITE BACKGROUND AND CONCEPTUAL SITE MODEL

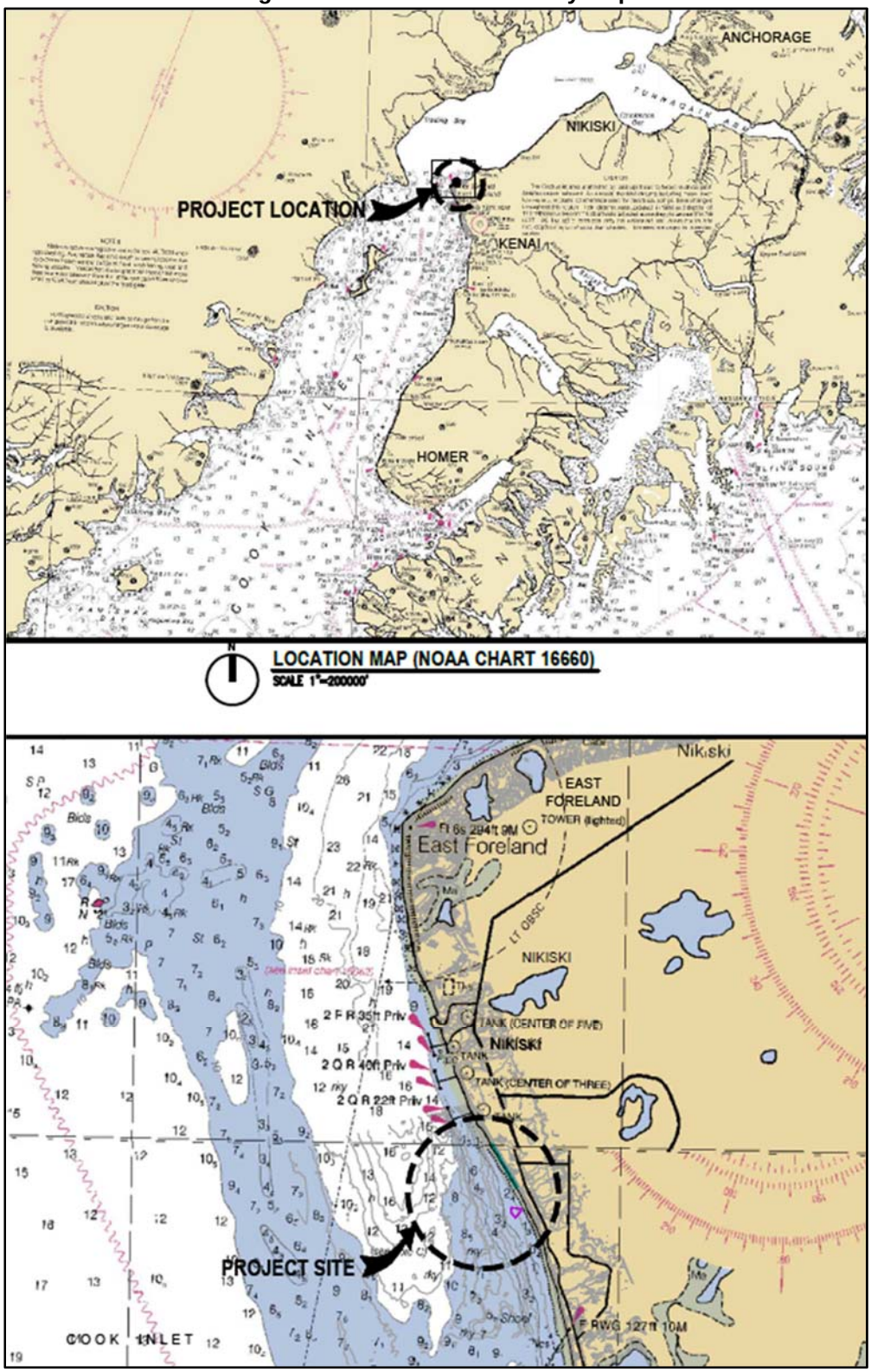
2.1 SITE LOCATION, DESCRIPTION, AND HISTORY

The field study area is located near Nikiski, Alaska, approximately 60 miles directly southwest of Anchorage and 9 miles northwest of Kenai. Road access to Nikiski is via the Seward, Sterling, and Kenai Spur Highway. (See Figure 1). Several on-shore oil and gas production facilities and offshore drilling platforms are located in and around Nikiski. Oil was discovered in the area in 1957, and since then the community has grown from a small homesteading community to one with 4,493 residents that mostly work in or associated with this industry (ADCCED, 2015).

Four existing marine facilities, including the existing Rig Tenders Dock, Tesoro Refinery terminal, Kenai LNG terminal, and Agrium Bulk terminal (listed from north to south) are located immediately north of the field study area. The field study area is currently undeveloped with no marine facilities in place. The shoreline tidal zone is characterized by well-graded gravels and sands and immediately bounded by 120 to 160 ft tall sand bluffs to the east.

To measure actual rates of sedimentation at the proposed site of the future marine facilities, two test pits were planned. One test pit was intended to represent the dredging needed for a PLF option that would require dredging in an area where existing water depths range from -30 ft to -60 ft MLLW. A second test pit was planned to represent the dredging needed for a near shore MOF option that requires dredging in existing water depths between -5 ft and -35 ft MLLW. The test pit locations are described as Test Pit 1 and Test Pit 2, respectively, as shown in Figure 2 *Test Pit Dredge Material Characterization Sampling and Analysis Plan* (USAL-CH-JPZZZ-90-000002-000)) was prepared accordingly and presented to the permitting agencies in Anchorage for their concurrence. Subsequently the project options that would require dredging for the PLF were eliminated from further consideration and the test pit program reduced to a single test pit for the MOF dredging options.

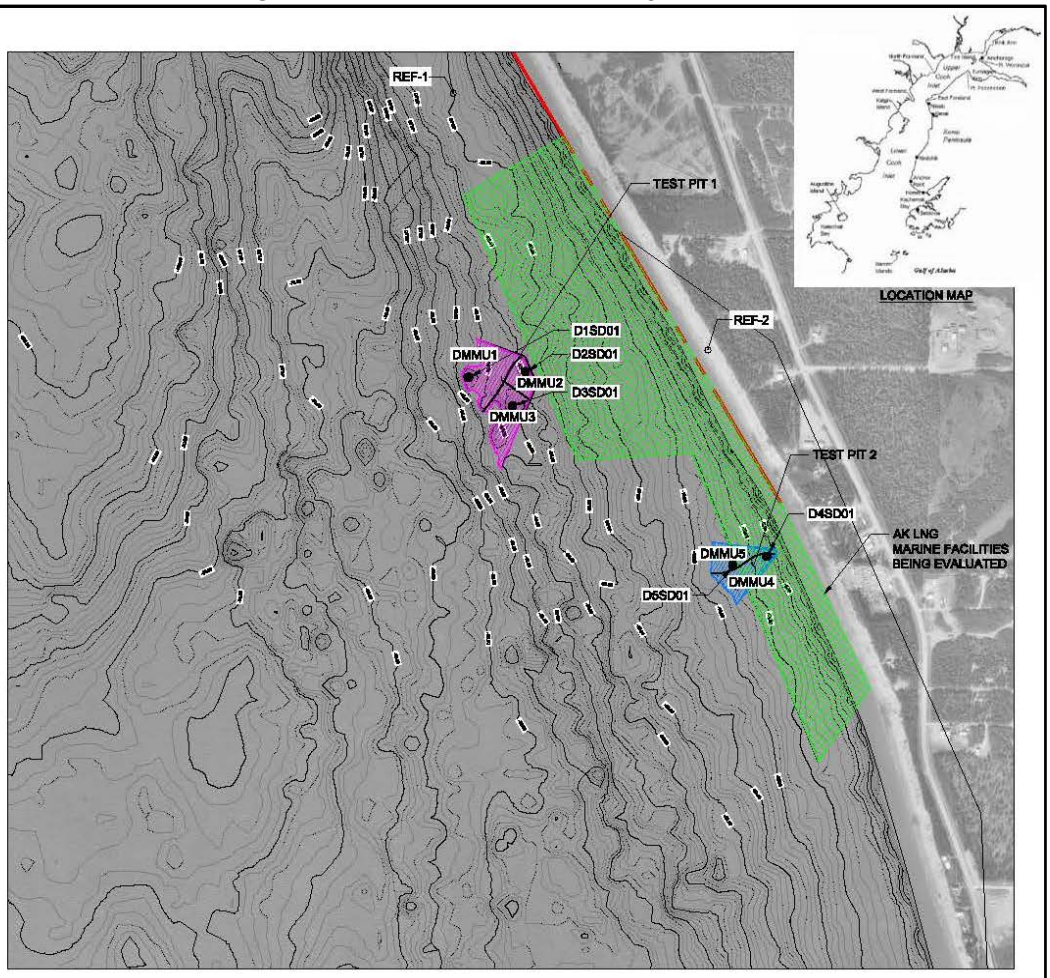
Figure 1: Location and Vicinity Map



2.2 TEST PIT DESIGN

Test Pit 2 is proposed to be dredged to a depth of -13 ft MLLW, requiring removal of approximately 20,000 cu yd of material over a 5.79-acre area. Figure 2 shows the plan view of the Test Pit 2 and Figure 3 shows the planned cross-sectional design of Test Pit 2. In addition, sediment samples were collected at a proposed beach nourishment site to provide a comparison of the dredged sediment to the beach material at the proposed reuse site.

Figure 2: Site Location and Study Features



LEGEND:

PHASE I

- TEST PIT 1 (DREDGING -41 FT MLLW @ SLOPE 3:1)
- TEST PIT 2 (DREDGING -13 FT MLLW @ SLOPE 3:1)
- MARINE FACILITIES
- VBc VIBRACORE LOCATION

TEST PIT 1		
	VALUE	UNIT
DREDGE AREA	481,590	SQFT
VOLUME DREDGE MATERIAL	57,500	CY
DREDGE ELEVATION (MLLW)	-41	FT
AVERAGE DEPTH OF CUT	3.23	FT

TEST PIT 2		
	VALUE	UNIT
DREDGE AREA	252,640	SQFT
VOLUME DREDGE MATERIAL	19,500	CY
DREDGE ELEVATION (MLLW)	-13	FT
AVERAGE DEPTH OF CUT	2.08	FT

NOTES:

1. CONTOUR INTERVAL 1 FT MINOR, 5 FT MAJOR.
2. BATHYMETRIC CONTOURS BASED UPON BATHYMETRY PROVIDED ON 01142015 IN FILE.
3. 653488-C-TOPO-0002.DWG COLLECTED BY FUGRO FROM SEPTEMBER TO NOVEMBER 2014.
4. NAD83 ALASKA STATE PLANE ZONE 4.
5. DEPTHS IN FEET (MLLW).

N

0 1500 3000 FT.

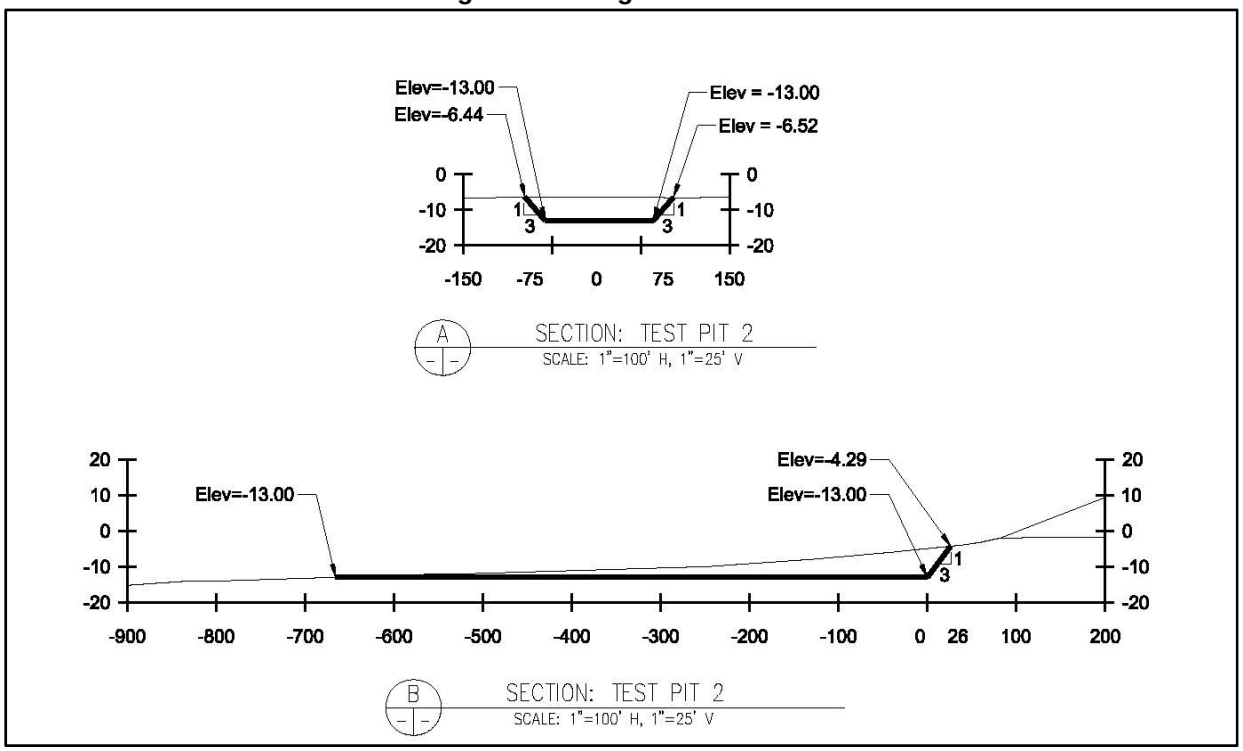
1"=1500'

FIGURE 1-2

Alaska LNG:
Proposed Test Pit And Capital Dredging

ch2m Nikiski, Alaska

Figure 3: Design of Test Pit 2

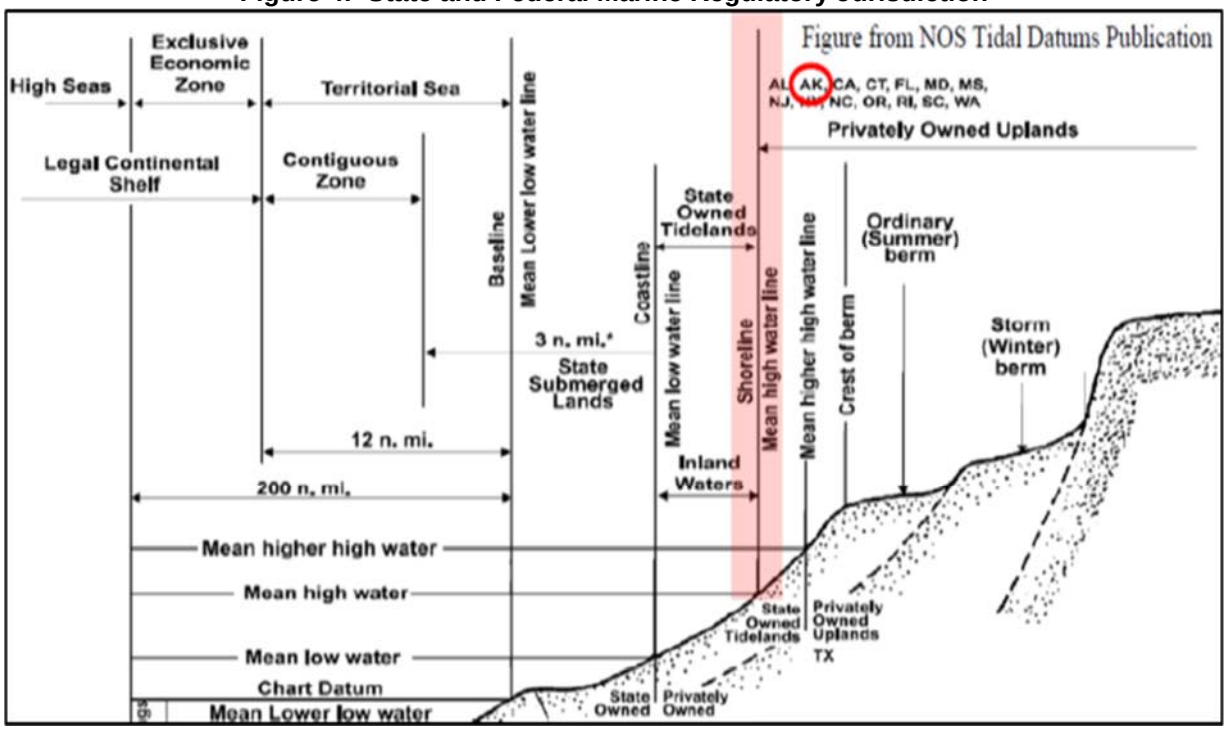


2.3 REGULATORY JURISDICTION AND OVERSIGHT

The State of Alaska owns most of the tidal and submerged lands along Alaska's coastline. Tidelands include the land between mean (average) high and mean low tide. Submerged lands are seaward of mean low tide to 3 miles offshore. The tide and submerged lands include all land between the mean high tide line and 3 miles offshore of the mean low tideline as shown in Figure 4. The Alaska Department of Environmental Conservation (ADEC) oversees environmental management on both state-owned and private lands in Alaska.

In addition to ADEC regulatory oversight, review by the United States Army Corps of Engineers (USACE) may be required depending on potential dredge material placement. If potential dredge material is to be discharged into Alaskan waters as fill, then evaluation by USACE under Section 404 of the Clean Water Act (CWA) and Section 10 of the Rivers and Harbors Act would be required.

Figure 4: State and Federal Marine Regulatory Jurisdiction



2.4 SUMMARY OF PREVIOUS INVESTIGATIONS

There is no known documented chemical or biological information available for sediment at the area of investigation.

2.5 PRELIMINARY CONCEPTUAL SITE MODEL

Limited historical information specific to the study area is readily available. No documentation of known chemical or biological environmental impacts were readily found in the document record.

2.5.1 Dredge Management Area Ranking

The USACE's *Dredge Material Evaluation and Disposal Procedures (DMMP) User's Manual* provides a classification scheme for ranking dredge material management units (DMMUs) as high, moderate, low-moderate, and low priority (USACE, 2014). These rankings represent a best professional judgment of the potential risk that sediments may pose to humans or aquatic organisms during dredging or placement.

Ranking of the proposed sediment DMMUs dredging area was based on two major factors:

- Available information on chemical and biological-response characteristics of the sediments.
- The number, kinds, and proximity of chemical sources (existing and historical).

Based on a lack of historical information and unknown potential sources of pollution, a *moderate* ranking was assigned to the study area that contains the test pits, indicating that moderate concentrations of chemicals of concern (COCs) could be present in the area to be dredged.

Therefore, each of the proposed test pit dredging areas was divided into multiple DMMUs. As shown in Figure 2, the location of Test Pit 2 is divided into a surface DMMU (DMMU 4) and subsurface DMMU (DMMU 5) of approximately 10,000 cu yd each.

3.0 CHARACTERIZATION APPROACH

3.1 DATA OBJECTIVES

Data from this study will be used to determine the quality of the sediment for evaluating dredged materials management options (beneficial reuse or disposal), the potential environmental quality impacts associated with dredging operations, and the quality of underlying sediments that would compose the post-dredge (leave layer) surface. Depending on the results of the sediment characterization, dredged material beneficial use or placement options could include:

- In-water disposal (at a designated and permitted in-water site).
- Beneficial reuse (e.g., beach nourishment, nearshore placement, or construction fill).
- Upland disposal at an approved facility or site (confined placement facility or landfill).
- Possibly a combination of the three types of placement.

The purpose of this report is to summarize the sediment characterization data and observations collected from within the proposed test pit and below the dredged prism during the field effort from September to November 2015. In addition, beach material collected at a proposed beach nourishment site is characterized to provide background information for future considerations of placement options.

3.2 TARGET ANALYTES

Due to limited site history and sediment chemistry data, a standard target analyte list was used during the study as summarized in Table 1. The list of target analytes includes chemicals of concern (COCs), which are both regulated and have been known to be widespread in the environment. Table 1 is based on sediment COCs from the *DMMP User's Manual*, NOAA's Screening Quick Reference Table (SQuiRT), and ADEC Method 2 Soil Cleanup levels (USACE, 2014; Buchman, 2008; ADEC, 2015).

Table 1: List of Target Analyses, Methods, and Applicable Samples

Analyses	Analytical Method	Applicable Samples	
		Sediment Samples	Beach Nourishment Samples
Physical and Sediment Conventional Analyses			
Grain Size	ASTM D422	X	X
Total Organic Carbon (TOC)	SW5310B modified	X	X
Total Solids	SW2450-G	X	X
Total Volatile Solids (TVS)	E160.4	X	
Total Sulfides	E353.2	X	
Ammonia	E350.1	X	
Chemical Analyses			
VOCs	SW8260B	X	
BTEX	SW8260B		X
SVOCs	SW8270C	X	
Phytosterols	SW8270C	X	
PAH	SW8270-SIM	X	
Pesticides	SW8081A	X	
Herbicides	SW8151A	X	
PCBs	SW8082	X	
Trace metals (including mercury)	SW6010B/ SW7470A/SW7471A	X	X
TPH – GRO	AK101	X	X
TPH – DRO/RRO	AK 102/AK103	X	X
Biological Analyses (if needed)			
Bioassay	PSEP 1995	X	
Bioaccumulation	Lee *et al*. 1989	X	

Notes:

AVS = acid volatile sulfides
BTEX = Benzene, Toluene, Ethylbenzene, and Xylenes
DRO = diesel range organics
GRO = gasoline range organics
PAH = polyaromatic hydrocarbon
PCB = polychlorinated biphenyl
RRO = residual range organics
SEM = simultaneously extractable metals
SVOC = semivolatile organic compound
TOC = total organic carbon
TPH = total petroleum hydrocarbons
TVS = total volatile solids
VOC = volatile organic compound

3.3 EVALUATION SCREENING LEVELS

Screening levels (SLs) are conservative, predominately risk-based values used to determine and evaluate the nature and extent of contamination in sediment. The SLs are intended for screening purposes only; exceedance of an SL is not an indication of unacceptable risk. SLs consider cumulative exposure of human and ecological receptors to contaminants in sediment through direct contact and upland protection of groundwater. Marine material dredged as part of test pit dredging may be placed at either a designated and permitted in-water site, at a nearshore location as beach

nourishment or construction fill, at an approved upland facility (confined placement facility or landfill), or a combination of the aforementioned placement options. Analytical data from the test pit location was evaluated against screening levels (SLs) based on the following sources:

- DMMP User's Manual - Table 8-2, DMMP COCs and Regulatory Guidelines.
- NOAA Screening Quick Reference Table (SQuiRT) values.
- ADEC Method 2 Soil Cleanup Levels - Table B1, Migration to Groundwater values.

Table 2 presents the list of potential target analytes and their respective SLs, where available. The sediment material was compared to the User's Manual and NOAA SQuiRT values when considering in-water placement. Dredged material proposed for in-water placement was compared to the User's Manual and NOAA SQuiRTs values, whichever is more conservative. The ADEC Method 2 Soil Cleanup levels for migration to groundwater were considered when considering nearshore and upland placement. If the results of the sediment sampling analysis exceed screening levels, then additional chemical, physical, and biological analysis of the dredge test pit sediments for in-water placement were considered. SL exceedances could require further bioassay testing to determine if the dredged material is suitable for unconfined, aquatic placement.

The "Z-sample" ("Z" layer) represents the material that will be exposed by dredging. Z-samples were collected from each sediment core from the first 2 feet below the dredging over-depth and archived. The Z-layer samples were analyzed if dredge sediment results exceeded SLs. Analytical results from the Z-samples were compared with the analytical results within the dredge sediment when the Z-samples results exceeded the SLs. If the Z-sample results are equivalent to or less than the analytical results of samples taken within the dredge sediment prism, the newly exposed surface will be considered acceptable and no further analysis is necessary.

Table 2: Summary of Target Analytes and Representative Screening Levels

CHEMICAL	CAS [(a)]	SEDIMENT					
		DMMP User's Manual/ITM (µg/kg unless specified otherwise)*			NOAA SQuiRTs (ppb dry weight unless specified otherwise)		ADEC Method 2 Cleanup Levels for Migration to Groundwater (mg/kg)
		SL	BT	ML	TEL	PEL	Migration to Groundwater
METALS (mg/kg)			*(mg/kg)				
Antimony	7440-36-0	150	---	200			3.6
Arsenic	7440-38-2	57	507.1	700	7,240	41,600	3.9
Cadmium	7440-43-9	5.1	11.3	14	680	4,210	5.00
Chromium	7440-47-3	260	260	---	52,300	160,000	25
Copper	7440-50-8	390	1,027	1,300	18,700	108,000	460
Lead	7439-92-1	450	975	1,200	30,240	112,000	--
Mercury	7439-97-6	0.41	1.5	2.3	130	700	1.4
Nickel	7440-02-0	---	---	---	15,900	42,800	8.6
Selenium [(b)]	7782-49-2	---	3	---			3.4
Silver	7440-22-4	6.1	6.1	8.4	730	1,770	11.2
Zinc	7440-66-6	410	2,783	3,800	124,000	271,000	4100

CHEMICAL	CAS [a]	SEDIMENT					
		DMMP User's Manual/ITM (µg/kg unless specified otherwise)*			NOAA SQuiRTs (ppb dry weight unless specified otherwise)		ADEC Method 2 Cleanup Levels for Migration to Groundwater (mg/kg)
		SL	BT	ML	TEL	PEL	Migration to Groundwater
ORGANICS (µg/kg)							
Tributyltin ion (intersitial water µg/L)	36643-28-4	---	0.15	---			
Tributyltin ion (bulk; µg/kg)[c]	36643-28-4	---	73	---			5500
PAHs							
Total PAH	---				1,684	16,770	--
Total LPAH	---	5,200	---	29,000	312	1,442	--
Naphthalene	91-20-3	2,100	---	2,400	34.6	391	20
Acenaphthylene	208-96-8	560	---	1,300	5.87	128	180
Acenaphthene	83-32-9	500	---	2,000	6.71	88.9	180
Fluorene	86-73-7	540	---	3,600	21.2	144	220
Phenanthrene	85-01-8	1,500	---	21,000	86.7	544	3000
Anthracene	120-12-7	960	---	13,000	46.9	245	3000
2-Methylnaphthalene[d]	91-57-6	670	---	1,900	20.2	201	6.1
Total HPAH	---	12,000	---	69,000	655	6,676	--
Fluoranthene	206-44-0	1,700	4,600	30,000	113	1,494	1400
Pyrene	129-00-0	2,600	11,980	16,000	153	1398	1000
Benz(a)anthracene	56-55-3	1,300	---	5,100	74.8	693	3.6
Chrysene	218-01-9	1,400	---	21,000	108	846	360
benzo(b)-fluoranthene	205-99-2						12
Benzofluoranthenes(b,j,k)[e]	205-99-,2 205-82-3, 207–08-9	3,200	---	9,900			12
Benzo(a)pyrene	50-32-8	1,600	---	3,600	88.8	763	2.1
Indeno(1,2,3-c,d)pyrene	193-39-5	600	---	4,400			41
Dibenz(a,h)anthracene	53-70-3	230	---	1,900	6.22	135	4.00
Benzo(g,h,i)perylene	191-24-2	670	---	3,200			38700
CHLORINATED HYDROCARBONS							
1,3-Dichlorobenzene	541-73-1						28
1,4-Dichlorobenzene	106-46-7	110	---	120			0.64
1,2-Dichlorobenzene	95-50-1	35	---	110			5.1
1,2,4-Trichlorobenzene	120-82-1	31	---	64			0.85

CHEMICAL	CAS [a]	SEDIMENT					
		DMMP User's Manual/ITM (µg/kg unless specified otherwise)*			NOAA SQuiRTs (ppb dry weight unless specified otherwise)		ADEC Method 2 Cleanup Levels for Migration to Groundwater (mg/kg)
		SL	BT	ML	TEL	PEL	Migration to Groundwater
Hexachlorobenzene (HCB)	118-74-1	22	168	230			0.047
PHTHALATES							
Dimethyl phthalate	131-11-3	71	---	1,400			1100
Diethyl phthalate	84-66-22	200	---	1,200			130
Di-n-butyl phthalate	84-74-2	1,400	---	5,100			80
Butyl benzyl phthalate	85-68-7	63	---	970			920
Bis (2-ethylhexyl) phthalate	117-81-7	1,300	---	8,300			13
Di-n-octyl phthalate	117-84-0	6,200	---	6,200			3800
PHENOLS							
Phenol	108-95-2	420	---	1,200			68
2-Methylphenol	95-48-7	63	---	77			15
4-Methylphenol	106-44-5	670	---	3,600			1.5
2,4-Dimethylphenol	105-67-9	29	---	210			8.8
Pentachlorophenol	87-86-5	400	504	690			0.047
Nonylphenol	25154-52-3				1,000	---	--
MISCELLANEOUS EXTRACTABLES							
Benzyl alcohol	100-51-6	57	---	870			--
Benzoic acid	65-85-0	650	---	760			410
Dibenzofuran	132-64-9	540	---	1,700			11
Hexachlorobutadiene	87-68-3	29	---	270			0.12
N-Nitrosodiphenylamine	86-30-6	28	---	130			15
VOLATILE ORGANICS							
Trichloroethene	79-01-6	160	---	1,600			0.020
Tetrachloroethene	127-18-4	57	---	210			0.024
Ethylbenzene	100-41-4	10	---	50			6.9
Total Xylene (sum of o-, m-, p-)	95-47-6, 108-38-3, 106-42-3	40	---	160			63
PESTICIDES & PCBs							
DDD, 4,4-(p,p-DDD, TDE)	72-54-8	16	---	---	1.22	7.81	7.2

CHEMICAL	CAS [a]	SEDIMENT					
		DMMP User's Manual/ITM (µg/kg unless specified otherwise)*			NOAA SQuiRTs (ppb dry weight unless specified otherwise)		ADEC Method 2 Cleanup Levels for Migration to Groundwater (mg/kg)
		SL	BT	ML	TEL	PEL	Migration to Groundwater
DDE, 4,4-(p,p-DDE)	72-55-9	9	---	---	2.07	374	5.1
DDT, 4,4-(p,p-DDT)	50-29-3	12	---	---	1.19	4.77	7.3
Total DDT (sum of 4,4'-DDD, 4,4'-DDE and 4,4'-DDT)	72-54-8, 72-55-9, 50-29-3	---	50	69	3.89	51.7	19.6
Aldrin	309-00-2	9.5	---	---			0.070
Chlordane	57749				2.26	4.79	2.3
Total Chlordane (sum of cis-chlordane, trans-chlordane, cis-nonachlor, trans-nonachlor, oxychlordane)	5103-71-9, 5103-74-2, 5103-73-1, 39765-80-5, 27304-13-8	2.8	37	---			--
Dieldrin	60-57-1	1.9	---	---	0.72	4.3	0.0076
Heptachlor	76-44-8	1.5	---	---			0.28
Heptachlor epoxide	1024-57-3				--	2.74	0.014
Gamma-BHC (Lindane)	58-89-9				0.32	0.99	0.0095
Toxaphene					0.1	--	3.9
PCB Aroclor 1254	---				63.3	709	
Total PCBs (Aroclors)	---	130	38 [5]	3,100			--
Linar alkylbenzene sulfonates (LAS)	---				<12,800	>62,000	

Notes:
[a] Chemical Abstract Service Registry Number
[b] This Nickel SL1 value is based on the 90th percentile of soil background data from WA state (Ecology, 1994), and was adopted by the DMMP agencies at the 2014 SMARM (DMMP/RSET, 2014b)
[c] Bulk sediment measurement of TBT is used for z-sample evaluations or when porewater extraction cannot be accomplished
[d] 2-Methylnaphthalene is not included in the summation for total LPAH.
[e] This value is normalized to total organic carbon, and is expressed in mg/kg carbon

µg/kg = microgram per kilogram
µg/L = microgram per liter
ADEC = Alaska Department of Environmental Conservation
BT = Bioaccumulation Trigger
CAS = Chemical Abstract Service
DMMP = Dredged Material Management Plan
ITM = Inland Testing Manual
mg/kg = milligram per kilogram
ML = Maximum Levels
NOAA SQuiRT = National Oceanic and Atmospheric Administration Screening Quick Reference Table
PCB = polychlorinated biphenyl
PEL = Probable Effects Level
RSET = Regional Sediment Evaluation Team
SL = Screening Levels
TEL = Threshold Effects Level

4.0 FIELD SAMPLING METHODS

4.1 MARINE SEDIMENT SAMPLING METHODOLOGY

4.1.1 Sample Location, Types, and Quantity

The sampling approach, following SAP, required collecting sufficient volumes of sediment for physical, chemical, and biological testing (USACE, 2014). Because biological testing would only be "triggered" if chemical contamination were to be identified, adequate volumes of sediment were archived for biological testing pending the results of chemical analyses.

Due to deteriorating marine weather, including increasing safety concerns due icy conditions and schedule constraints, it was only possible to collect samples at Test Pit 2. Two DMMUs were identified within Test Pit 2: DMMU4 and DMMU5.

To fully characterize the test pit DMMU, a vertical compositing sampling scheme was performed at two sediment core locations, D4SD01 and D5SD01, within DMMU4 and DMMU5, respectively. Two co-located cores were collected at location D4SD01 (DS4A and DS4B) and two co-located cores were collected at D5SD01 (DS5A and DS5B) as shown in Figure 5. Core locations were determined using the SAP for heterogeneous sample volumes (4,000 cubic yards, maximum sediment volume represented by a single sample) and sampling vessel accessibility and maneuverability at each location.

Further detail on the core collection is presented in Sections 4.1.2 through 4.1.5.

4.1.2 Sampling Barge

Core collection was completed from the jackup barge Skate A. The sampling vessel, drilling equipment, and drilling personnel were supplied by:

Fugro Consultants Inc.
6100 Hillcroft Ave
Houston, Texas 77081

4.1.3 Station Positioning Methods

The proposed sample station coordinates were determined during project planning using computer-aided design/geographic information system (CAD/GIS) software, and the coordinates were uploaded to the barge GPS units for navigation. Once in the field, station positioning was accomplished by navigating the jackup barge to each proposed core location.

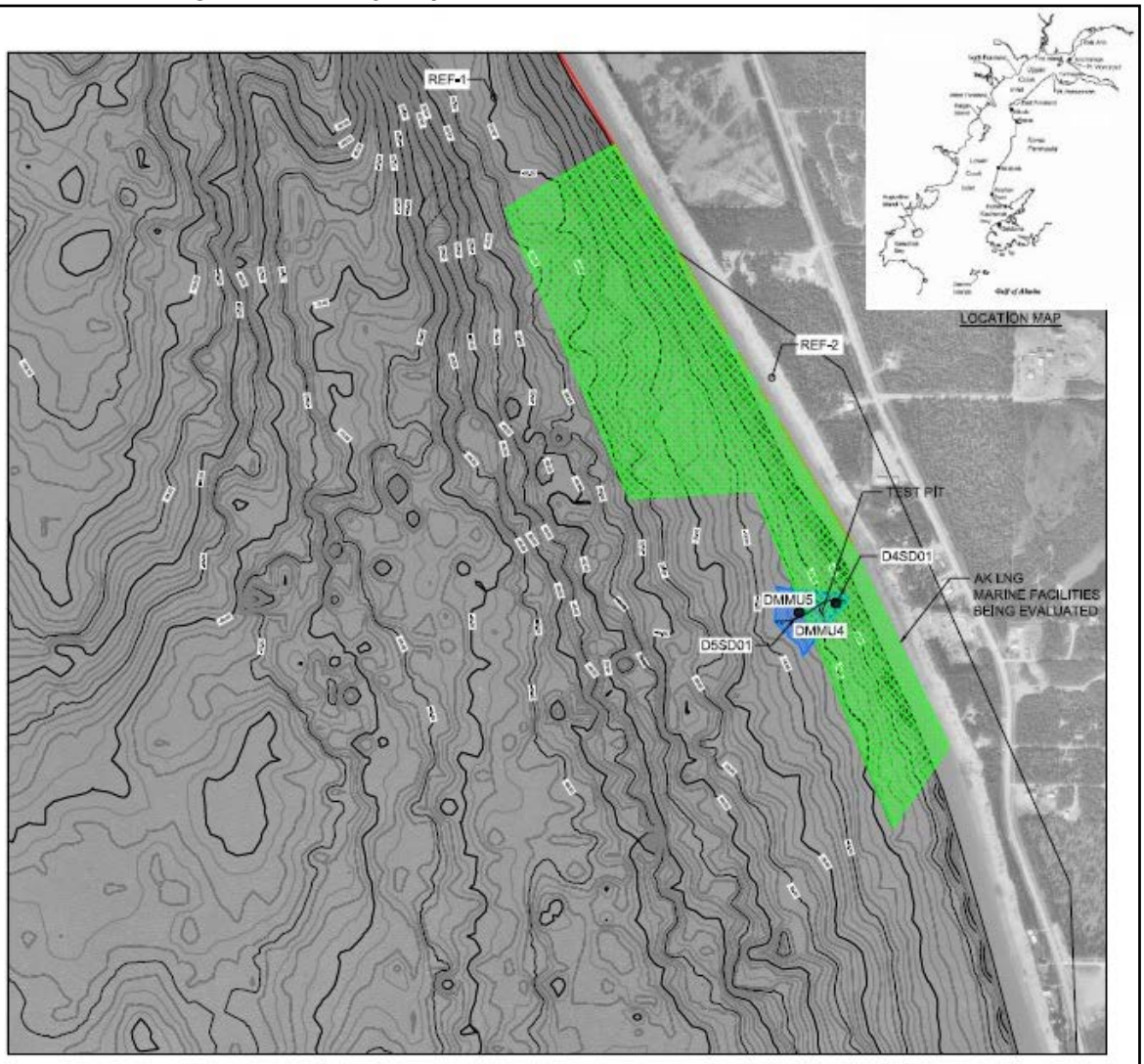
Once the jackup was positioned at the core location, depth soundings were taken to obtain the current depth of water at the core locations. Soundings were taken by lowering a weighted tape line into Cook Inlet. Once the weights on the end of the tape measure had landed on the bottom, the tape was pulled vertical and the depth of water was recorded. The water total depth was then converted to MLLW using NOAA tidal data to normalize the depth of water measurement to MLLW. The depth-of-water measurement was normalized by subtracting the tide stage elevation 4.1.5rom the measured depth-of-water measurement. The tide stage at each given time was read from the daily tidal prediction graphs obtained from the NOAA Web site. At the end of each day, the tidal prediction graphs were compared with the daily actual tidal data to verify the tidal stage corrections. Any corrections to the actual MLLW elevation were then made.

4.1.4 Sediment Core Collection Methods

Sediment core collection was performed during slack tides from 2-Nov-15 to 4-Nov-15. Sediment borings were initially advanced using a drive sampler with a U-100 hammer provided by Fugro. A

4-inch-outside diameter, 18-inch long drive sampler with a PVC liner was advanced into the sediment. After each 18-inch long sample run, the sampler was retracted and the sediment core liner was removed from the sampler. A 6-inch long “cleanup” run was performed prior to advancing the next sample interval. Consequently, the portion of the core sampled with the drive sampler was not a continuous core. This process was repeated until the borehole reached the desired depth or refusal. If refusal was reached within a boring, Fugro switched drilling methods to a continuous core GEOBOR-S drilling system. The GEOBOR-S drilling system was advancing using a 4-inch-outside diameter, 18-inch long sampler with a PVC liner. The depths of each sampling method at each core location are summarized in Table 3.

Figure 5: Vicinity Map, DMMUs and Sediment Core Locations



LEGEND:

PHASE I

TEST PIT (DREDGING -13 FT MLLW @ SLOPE 3:1)

MARINE FACILITIES

VIBRACORE LOCATION (20')

TEST PIT		
	VALUE	UNIT
DREDGE AREA	252,640	SQFT
VOLUME DREDGE MATERIAL	19,500	CY
DREDGE DEPTH (MLLW)	-13	FT
AVERAGE DEPTH OF CUT	2.08	FT

NOTES:

1. CONTOUR INTERVAL 1 FT MINOR, 5 FT MAJOR.
2. BATHYMETRIC CONTOURS BASED UPON BATHYMETRY PROVIDED ON 01142015 IN FILE.
3. 653488-C-TOPO-0002.DWG COLLECTED BY FUGRO FROM SEPTEMBER TO NOVEMBER 2014.
4. NAD83 ALASKA STATE PLANE ZONE 4.
5. DEPTHS IN FEET (MLLW).

The percent recovery was determined for each core segment, and Fugro logged this recovery information as well as the lithology of the core segment on their boring log. They also logged the station information, depth to mudline, and total depth of core advancement on the boring log. CH2M

reviewed the preliminary boring logs during sediment sample collection and amended the boring logs with sediment core PID readings and additional observations.

Per the SAP, sediment cores were planned to be advanced down to an elevation from -21.39 to -30.27 ft MLLW. The actual total depths of the core advancement for D4SD01-A and D4SD01-B were 20.51 and 18.54 ft below mud line (bml). The actual total depths of the core advancement for D5SD01-A and D5SD01-B were 19.19 and 18.37 ft bml.

Core segments were labeled with a unique sample identifier using Fugro's nomenclature system, and were capped with slip caps that were taped in place. The cores were stored on ice in coolers aboard the sampling vessel until they were transported to onshore facilities for processing and sample collection.

Table 3: Sediment Boring Method

Core Location	Mudline Elevation (MLLW)	Depth Interval using the Drive Sampler (bml)	Depth Interval using the Geobore-S Sampler (bml)	Total Depth Elevation (MLLW)
D4SD01-A	-7.87 ft (-2.4 m)	0 - 4.92 ft (0 - 1.5 m)	4.92 - 20.51 ft (1.5 - 6.25 m)	-28.21 ft (-8.6 m)
D4SD01-B	-7.55 ft (-2.3 m)	0 - 1.64 ft (0 - 0.5 m)	1.64 - 18.54 ft (0 - 5.65 m)	-26.04 ft (-7.9 m)
D5SD01-A[1]	-12.14 ft (-3.7 m)	1.64 - 19.19 ft (0.5 - 5.85 m)	0 - 1.64 ft (0 - 0.5 m)	-21.39 ft (-6.5 m)
D5SD01-B[2]	-11.80 ft (3.6 m)	0 - 18.37 ft (0 - 5.6 m)	N/A	-30.27 ft (-9.2 m)

Notes: [1] The drive sampler was initially used at this location down to a depth of 1.64 ft (0.5 m) with no recovery. A second attempt was then made using the Geobore-S sampler from 0 to 1.64 ft (0 - 0.5 m) with 50% recovery. The sampling method was then switched back to the drive sampler which was advancing from 1.64 ft (0.5 m) to total depth at 19.19 ft (5.85 m).

[2] The Geobore-S sampler was not used for boring D5SD01-B.

4.1.5 Sediment Core Processing Methods

Upon receipt at the upland processing facility, the cores were opened with a specially-designed saw or Dremel tool. The entire core length was screened with a PID, which had been calibrated at the beginning of each sample processing day, according to the manufacturer's instructions. Calibration information was recorded in the field notebook. The PID readings were noted on a copy of the boring logs for that specific core.

With the exception of the samples collected at the beach site (described in more detail in Section 4.2), the entire core length was then photographed, and observed for vertical heterogeneity. The sample intervals were determined from the heterogeneity. These sample intervals are summarized in Table 3.

The sediment cores were to be divided into various intervals based on visual heterogeneity, with a discrete "Z" sample collected at the bottom of the sediment core at the appropriate elevation that would correspond with the top 2 feet of the newly exposed sediment surface after dredging (see Table 5).

Each upper, lower, and "Z" layer sediment sample consisted of multiple subsamples collected from the entire sample interval. The sample intervals were composited and analyzed for the physical properties and laboratory analyses as listed in Table 4 and Table 5. "Z" samples were also collected and analyzed as specified in Table 4 and Table 5.

Once analyzed, the sediment results were screened against the screening values detailed in the User's Manual, NOAA SQuiRTs, and ADEC Method 2 cleanup levels for migration to groundwater as presented in Section 12.0.

Table 4: Sediment Sample Information

DMMU	Sediment Core	Sample ID	Mudline Elevation m MLLW (ft MLLW)	Sample Interval (ft below mudline)	Sample Interval Elevation (ft MLLW)	Sample Type
4	D4SD01-A	D4ADS01-001.48-01 [a]	-2.4 m (-7.87 ft)	0.0 – 1.48	-7.87 to -9.35 ft	Normal
4	D4SD01-B	D4BGC07-14.4416.57-01 [a]	-2.3 m (-7.55 ft)	14.44 – 16.57	-21.99 to -24.12 ft	Normal
4	D4SD01-B	D4BGC06-11.8113.54-01[a]	-2.3 m (-7.55 ft)	11.81 – 13.54	-19.36 to -21.09 ft	Normal
4	D4SD01-A and D4SD01-B	D4SD04-0.503-01[b]	-2.4 m / -2.3 m (-7.87 ft / -7.55 ft)	1.64 – 9.84	-9.19 to -17.39 ft	Normal
4	D4SD01-A and D4SD01-B	D4SD04-0.503-101 [b]	-2.4 m / -2.3 m (-7.87 ft / -7.55 ft)	1.64 - 9.84	-9.19 to -17.39 ft	Field Duplicate
4	D4SD01-A and D4SD01-B	D4SD04-0304.25-02 [b]	-2.4 m / -2.3 m (-7.87 ft / -7.55 ft)	9.84 - 13.94	-17.39 to -21.49 ft	Normal
4	D4SD01-A and D4SD01-B	D4SD04-4.2518.86-03[c]	-2.4 m / -2.3 m (-7.87 ft / -7.55 ft)	13.94 - 18.86	-21.49 ft to -26.51 ft	Z-Layer
5	D5SD01-A and D5SD01-B	D5SD01-0002-01 [b]	-3.6 m / - 3.7 m (-11.8 ft / -12.14 ft)	0.0 – 6.56	-11.8 to -18.36 ft	Normal
5	D5SD01-A and D5SD01-B	D5SD01-0204-02 [b]	-3.6 m / - 3.7 m (-11.8 ft / -12.14 ft)	6.56 – 13.12	-18.36 ft to -24.92	Normal
5	D5SD01-A and D5SD01-B	D5SD01-0404.9-03[b]	-3.6 m / - 3.7 m (-11.8 ft / -12.14 ft)	13.12 - 16.08	-24.92 to -27.88	Z-layer

Notes: a. Depths given in sample ID are in feet bml.
b. Depths given in sample ID are in meters.
c. Depths given in sample ID area in meters (top elevation) and feet (bottom elevation).

Sediment samples from the selected sample intervals for all sediment cores were evaluated for the full suite of COCs (Table 5). Sediment material from the interval anticipated to remain in situ after future dredging (Z-layer or "leave layer") was collected and analyzed. Within each sediment sample interval, the volatile analyte samples were initially collected from the undisturbed core. These included VOC, GRO (AK101), and sulfide samples. VOC samples were immediately preserved in accordance with the SAP and transferred to the freezer. The remaining sediment material from the entire sample interval was then spooned into a decontaminated stainless steel mixing bowl with a decontaminated stainless steel spoon and mixed until visually homogeneous. The homogenous composite sample material was then spooned into clean, laboratory-supplied sample containers. Any remaining composite sample material was collected in a 1-gallon Ziploc bag for geotechnical analysis. Geotechnical testing parameters are summarized in Table 6. The sampling equipment was then decontaminated before reuse.

Table 5: Marine Sediment Sample Analytes, Methods, and Applicable Samples

Analyses	Analytical Method	Applicable Samples
Conventionals		
Total Solids	SW2450-G	All sediment samples
TVS	E160.4	All sediment samples
Grain Size	ASTM D422	All sediment samples
TOC	SW5310B modified	All sediment samples
Total Sulfides	E353.2	All sediment samples
Ammonia	E350.1	All sediment samples
Chemicals of Concern		
VOCs	SW8260B	All sediment samples
SVOCs	SW8270C	All sediment samples
PAH	SW8270-SIM	All sediment samples
Pesticides	SW8081A	All sediment samples
PCBs	SW8082	All sediment samples
Trace metals (including mercury)	SW6010B/ SW7470A/SW7471A	All sediment samples
AVS with SEM	EPA-121-R91-100	Beach Nourishment samples only
TPH – GRO	AK101	All sediment samples
TPH – DRO and RRO	AK 102/AK103	All sediment samples

Notes: AVS = acid volatile sulfides.
DRO = diesel range organics.
GRO = gasoline range organics.
PAH = polyaromatic hydrocarbon.
PCB = polychlorinated biphenyl.
RRO = residual range organics.
SEM = simultaneously extractable metals.
SVOC = semivolatile organic compound.
TOC = total organic carbon.
TPH = total petroleum hydrocarbons.
TVS = total volatile solids.
VOC = volatile organic compound.

In addition to chemical analysis, corresponding samples were collected and archived for bioassay and/or bioaccumulation testing pending the results of the chemical analysis and/or regulatory agency review needs. Ammonia and sulfide samples were collected to assess potential interference with bioassay test results.

All samples were labeled with sample ID, sample collection date and time, sampler initials, and analyses requested before being stored in coolers on ice until being prepared for shipment to the laboratory, as described in Section 4.2.

Table 6: Geotechnical Testing Parameters and Methods

Parameter	Method
Percent Moisture	ASTM D2216
Sediment pH	E150.1
Grain size with hydrometer	ASTM D422
Sediment Specific Gravity	ASTM D854B
Atterberg Limits	ASTM D4318
USCS Classification	ASTM 2487
Grain Density	API RP 40
Bulk Density	ASTM D7263

4.2 SURFACE SAMPLE COLLECTION METHODS

4.2.1 Beach Nourishment Reference Sample

One beach nourishment site reference grab sample was collected on 28-Oct-15 from the location shown in Figure 5. The reference sediment samples were collected using a stainless steel spoon in the upper 6 inches of beach sediment. A small depression in the reference sample area was dug with a decontaminated stainless steel spoon to a depth of approximately one inch to remove the surface material. The volatile analytes (sulfide, VOCs, AK101) were then collected and preserved as specified in the SAP. The stainless steel spoon was then used to transfer material from approximately 2 inches to 6 inches below ground surface (bgs) to a decontaminated stainless steel bowl. The spoon was then used to homogenize the sediment to a visually homogenous state. The homogenized sediment was then transferred to the rest of the sample containers as specified in Table 7. All sample containers were labeled with the sample ID, date and time of collection, analytes, and sampler initials. The coolers were then stored on ice in a cooler until they were returned to the warehouse. Upon arrival at the warehouse, the VOC samples were frozen in a chest freezer where they were kept frozen until they were prepared for shipment to the laboratory. All other samples were stored on ice in a cooler at 4 degrees Celsius until prepared for shipment to the laboratory.

Table 7: Beach nourishment Site Sample Analytes, Methods, and Applicable Samples

Analyses	Analytical Method	Applicable Samples
Grain Size	ASTM D422	All beach nourishment site samples
TPH - GRO	AK101	All beach nourishment site samples
TPH - DRO and - RRO	AK 102/AK103	All beach nourishment site samples
BTEX	SW8260B	All beach nourishment site samples
Trace metals (including mercury)	SW6010B/ SW7470A/SW7471A	All beach nourishment site samples
AVS with SEM	EPA-121-R91-100	All beach nourishment site samples
TOC	SW5310B modified	All beach nourishment site samples
Total Solids	SW2450-G	All beach nourishment site samples

4.3 EQUIPMENT DECONTAMINATION

Decontamination of sampling equipment was conducted consistently to ensure the quality of the samples collected. All equipment that came into contact with potentially contaminated samples was decontaminated. Disposable equipment intended for one-time use that is factory wrapped generally does not need to be decontaminated before use, unless evidence of contamination is present. All one-time use, disposable sampling equipment, and accessories was discarded once used and a new set of equipment was used for each subsequent sample. Disposable sampling equipment was used as much as practical including soil core bags, nitrile gloves. All non-disposable sampling equipment, including split-barrel samplers, spoons, trowels, bowls, and pumps used to collect samples for chemical analyses, were decontaminated before each use. The decontamination procedure will consisted of the following basic steps:

- Non-ionic detergent wash.
- Potable water rinse.
- Distilled/deionized water rinse.
- Air drying.
- Wrapping sampler in new aluminum foil.

The wastewater from the decontamination activities was disposed of according to the methods described in Section 4.6.

An equipment blank was collected by collecting DI water run through a decontaminated stainless steel bowl used for sediment interval homogenization. The equipment blank sample was submitted to ASL under chain of custody procedures for analysis.

4.4 DEVIATIONS FROM THE SAP

Due to schedule and weather constraints, sediment cores were not advanced at DMMUs 1 through 3 in Test Pit 1.

As described in Section 4.1.1, there were issues with delivery of all core segments from locations D4SD01-A and D4SD01-B, so initial samples were collected based on available core segments, rather than on vertical heterogeneity as specified in the SAP.

The SAP specified that a boring log would be created for each core by CH2M staff during sediment core processing. However, the CH2M field staff determined during processing that the lithology descriptions on the Fugro boring logs matched what field staff were seeing in the opened sediment cores, so new boring logs were not created during processing. Notes on sample collection and PID readings during sample processing were added to a copy of the Fugro boring logs.

The SAP specified that the sediment cores would be advanced to a total depth equal to an elevation of -13 ft MLLW. However, Fugro advanced the cores significantly deeper than the target bottom elevation. This error was not caught until after core processing had been completed, so the cores were split into multiple sample intervals based on visual heterogeneity, and these collected sample intervals extended below the target bottom dredge depth. Additionally, field staff mistakenly believed the “z-layer” sample should be collected from 13 to 15 feet below mudline, rather than an elevation of -13 to -15 MLLW. Therefore, these z-layer samples were collected from depths greater than the specified 2 feet below the target dredge prism.

Total sulfide was not specified as a required analyte for the beach nourishment reference sample. This analyte was inadvertently requested on the Chain of Custody and was analyzed in addition to the required analytes.

VOCs and GRO (AK101) were required analytes for the sediment core characterization. However, these analytes were not collected for samples D4BGC06-11.8113.54-01 or D4BDS01-001.31-01.

Total sulfide was a required analyte for the sediment core characterization, but this analyte was not collected for sample D4BGC06-11.8113.54-01.

The SAP specified that Z-layer samples were specified to be collected but archived unless chemical testing on the dredge prism samples indicated the z-layer samples should be tested. This direction was overlooked, and all collected samples were analyzed upon sample collection.

4.5 FIELD DOCUMENTATION

A field boring log was produced by Fugro for each core advanced at DMMU #4 and DMMU #5. An additional project notebook log were maintained throughout the sample processing effort to record information pertaining to each core and sample interval. The field boring log includes the station ID, core number, time of sampling, location coordinates, depth to the mudline, and adjustments for the water stage at the time of sampling. Observations of the material in each core were recorded on the lithology log at the time of core processing, including layer depths, color, sediment type, type and amount of possible debris observed in the sample, and other distinctive characteristics (e.g., odors, staining, etc.). For reference, digital photographs were selectively taken of the sediment cores (see Appendix A for field notebook and boring logs, and Appendix B for photographs).

4.6 INVESTIGATION-DERIVED WASTE

Waste generated during fieldwork included personal protective equipment, disposable sampling items (such as core liners), sediment cuttings, decontamination wash water, and other wastes generated during general sampling activities, drilling, and decontamination. In general, environmental media (sediment) that is suspected or known to be contaminated was left onsite where it was found. All wastes required to be containerized and treated offsite were secured in labeled containers (i.e., 55-gallon drums), held onsite at the Rig Tenders Facility pending analysis, and properly disposed of offsite at an approved, licensed facility. Table 8 summarizes the waste streams and placement paths.

Table 8: Anticipated Waste Streams and Placement Paths

Waste Stream	Disposal
Refuse	All general refuse such as personal protective equipment, gloves, paper towels, plastic sheeting, etc., that does not have the potential to contain hazardous material were disposed of at the Central Peninsula Landfill.
Sediment Sampling Wastewater	Wastewater from sediment sampling operations was discharged overboard during sediment sampling activities.
Sediment	Sediment encountered during coring, sampling, or other sediment operations were drummed and labeled pending analysis.

5.0 SAMPLE HANDLING AND CUSTODY

5.1 LABORATORY METHODS, SAMPLE CONTAINERS, PRESERVATION REQUIREMENTS, AND HOLDING TIMES

Details of sample processing and analysis procedures were presented in the project SAP (CH2M, 2015). Table 2 of the SAP lists the analytical methods and holding time requirements, and Table 3 provides reporting limits for each chemical constituent.

5.2 SAMPLE CUSTODY

Sample custody was documented according to the chain-of-custody procedures outlined below.

5.2.1 Chain-of-Custody Records

Sample containers were shipped in custody-sealed coolers on ice to the laboratory via commercial airlines and commercial courier. Samples were stored appropriately and held in the custody of CH2M personnel from the time of collection until the samples were transferred to the courier.

5.2.2 Transfer of Custody and Shipment

Each sample shipment to the laboratory contained a chain-of-custody form that was sealed in a Ziploc®-type bag and taped to the inside of at least one of the shipment coolers. Each shipped cooler was sealed with a signed and dated custody seal by the relinquishing party, and placed on the cooler so that the cooler could not be opened without the custody seal being broken or removed.

Any requested changes to the laboratory analyses or handling were noted, initialed, and dated on the chain-of-custody form. Upon completion of the laboratory analyses, the analytical laboratory sent copies of the appropriate chain-of-custody forms to CH2M.

Samples were sent for physical and chemistry analysis to:

CH2M HILL Applied Sciences Laboratory
1100 NE Circle Blvd, Suite 300
Corvallis, OR 97330

Analysis of hexavalent chromium, sulfides, ammonia, and pesticides were subcontracted to:

ALS Environmental
1317 S 13th Ave
Kelso, WA 98626

6.0 QUALITY ASSURANCE/QUALITY CONTROL

6.1 CHEMICAL ANALYSES

The analytical data collected during the project were evaluated to ensure that the data quality objectives for the project were achieved. First, the analytical data were verified and reviewed at the laboratory (Applied Sciences Laboratory [ASL] in Corvallis, Oregon) by the analyst producing the data and by an experienced data reviewer before the data were released to CH2M.

The analyst reviewed the laboratory data to ensure that the following criteria were satisfied:

- Sample preparation and documentation were correct and complete.
- Sample analysis information was correct and complete.
- The appropriate analytical procedures were followed.
- Analytical results were correct and complete.
- QC samples were within established control limits.
- Analytical and QC documentation was complete.

In addition, the entire data package was reviewed to ensure that:

- Calibration data were scientifically sound and appropriate.
- Qualitative and quantitative results appeared plausible and correct.
- The data package was complete and ready for document archiving.

QC procedures for chemical analyses included analytical instrument calibration, verification of sample holding times, blank analyses to identify potential sample contamination in the laboratory, duplicate analyses to test analytical precision, evaluation of spike recovery, and internal calibration standards to test analytical accuracy.

QC samples collected during the field effort included one field duplicate sample collected from the beach nourishment sample location named Ref-1. A second field duplicate, along with an MS/MSD sample was collected from parent marine sediment sample D4SD04-0.503-01 (DMMU 4, from 1.64 to 9.84 ft bml).

7.0 DATA MANAGEMENT, REVIEW, AND EVALUATION

Laboratory QC procedures were conducted by ASL and ALS.

7.1 DATA REVIEW AND VALIDATION

In addition to the laboratory QC procedures conducted by ASL, CH2M's project chemist reviewed and validated the collected data as described below. The data quality evaluation (DQE) report is contained in Appendix D.

7.1.1 Data Review

This review followed guidance provided by the USEPA Contract Laboratory Program (CLP) National Functional Guidelines. Data qualifiers or corrections were applied where necessary. Data review for each analysis included evaluation of the following (where appropriate):

- The chain-of-custody documentation.
- Holding-time compliance.
- The required quality control (QC) samples at the specified frequencies.
- Method blanks.
- Laboratory control sample/laboratory control sample duplicates (LCS/LCSD).
- Surrogate spike recoveries for organic analyses.
- Matrix spike/matrix spike duplicate (MS/MSD) samples.
- Initial and continuing calibration information and other method-specific criteria.

7.1.2 Overall Assessment

The final activity in the data quality evaluation is an assessment of whether the data meet the data quality objectives. The goal of this assessment is to demonstrate that a sufficient number of representative samples were collected and the resulting analytical data can be used to support the decision-making process. The following summary highlights the data evaluation findings for the events described in the DQE report:

- No data were rejected. Completeness for all method/matrix/analyte combinations was 100 percent.
- Approximately 67 percent of the PSEP data were qualified due to low-level detections in the method blanks. The degree to which blank contamination was observed suggests a contamination issue at the laboratory.
- Approximately 27 percent of the E350.1 data were qualified due to low-level detections in the method blanks. The degree to which blank contamination was observed suggests a contamination issue at the laboratory.
- Approximately three percent of the SW6010B data were qualified due to low-level detections in the method blanks. The degree to which blank contamination was observed is within reasonable method expectations.
- FD RPD exceedances were observed for Methods E350.1, SW6010B, SW8081B, SW8260B and Lloyd Kahn; 22 results were qualified as estimated.
- MS/MSD recovery exceedances were observed for Methods SW6010B, SW7196A, SW8260B, SW8270C and Lloyd Kahn; 18 results were qualified as estimated.

Although data were qualified as estimated due to QC exceedances as noted, overall precision and accuracy of the data, as measured by field and laboratory QC indicators suggest that data are usable for projects objectives.

7.2 DATA EVALUATION

Dredge Material Management Program (DMMP) guidance has been developed for most of the elements identified in the SAP. For example, screening level (SL) values have been developed for all chemical constituents of potential concern except for wood derivatives. Bioassay performance criteria were also defined in the SAP.

Sediment analyses were also screened against the National Oceanic and Atmospheric Administration's (NOAA) Screening Quick Reference Tables (SQuiRTs) Threshold and Probable Effects Levels (TEL and PEL) in an effort to assess ecological risk associated with the proposed dredge material. SQuiRTs were developed for preliminary screening and to identify potential impacts to coastal resources and habitats. Compositing core material is further discussed in Section 4.1.5.

7.2.1 Sulfide Sampling

Sulfide subsamples were collected immediately upon determining the sample intervals, and prior to compositing of the sample interval material. Sediments that were directly in contact with core liners or the sides of the grab sampler were not be used.

For sulfide sampling, 30 grams of sediment were placed in a 4-ounce sampling jar and covered with 5 milliliters of 2-Normal zinc acetate. The sulfide sample was then shaken vigorously to completely expose the sediment to the zinc acetate.

The sulfide sampling jars was clearly labeled with the project name, sample/composite identification (ID), type of analysis to be performed, date and time, initials of person(s) preparing the sample, and referenced by entry into the logbook. The sulfide sampling jars were labeled to indicate that zinc acetate had been added as a preservative.

7.2.2 Physical and Chemical Analysis Guidelines

Physical analysis included particle size distribution, total solids, TVS, water content, and TOC. Analysis of total solids, TVS, and total sulfides followed the *Recommended Protocols for Measuring Conventional Sediment Variables in Puget Sound* (PSEP, 1986). Ammonia analysis was conducted according to standard EPA/USACE procedures (Plumb, 1981). Appendix D of *The Recommended Guidelines for Measuring Organic Compounds in Puget Sound Water, Sediment and Tissue Samples* (PSEP, 1997b) was consulted for analysis of TOC.

Particle size was determined using ASTM Method D-422, which subdivides the silt-clay fraction by pipette and hydrometer, respectively. Modified ASTM sieve numbers 4, 10, 20, 40, 60, 140, and 230 were used to evaluate particle size distribution. The fine-grained fraction was classified by phi size (+5, +6, +7, +8, >8).

7.2.3 Water Column Analysis Methodology

A hydrographic profile of the water column overlying the dredge areas was created by measuring water quality parameters with depth from the sampling vessel to the mudline at each sediment coring location. This profile was created by measuring temperature, conductivity, dissolved oxygen, pH, and oxidation-reduction potential (ORP) with depth using a YSI 556 multiparameter device. The water quality profiles (including temperature, pH, conductivity and Dissolved Oxygen) are shown in Figure 6 through Figure 9, and the field sheets are included as Appendix C.

Figure 6: Temperature Profile with Depth

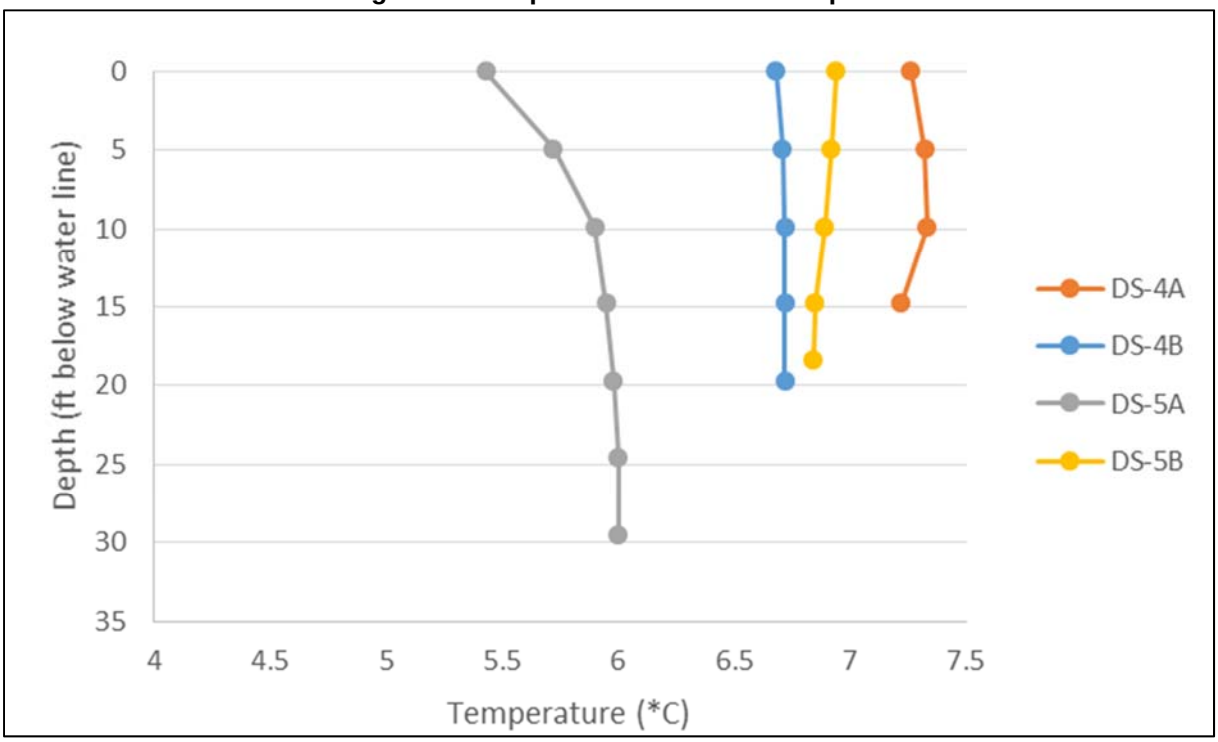


Figure 7: pH Profile with Depth

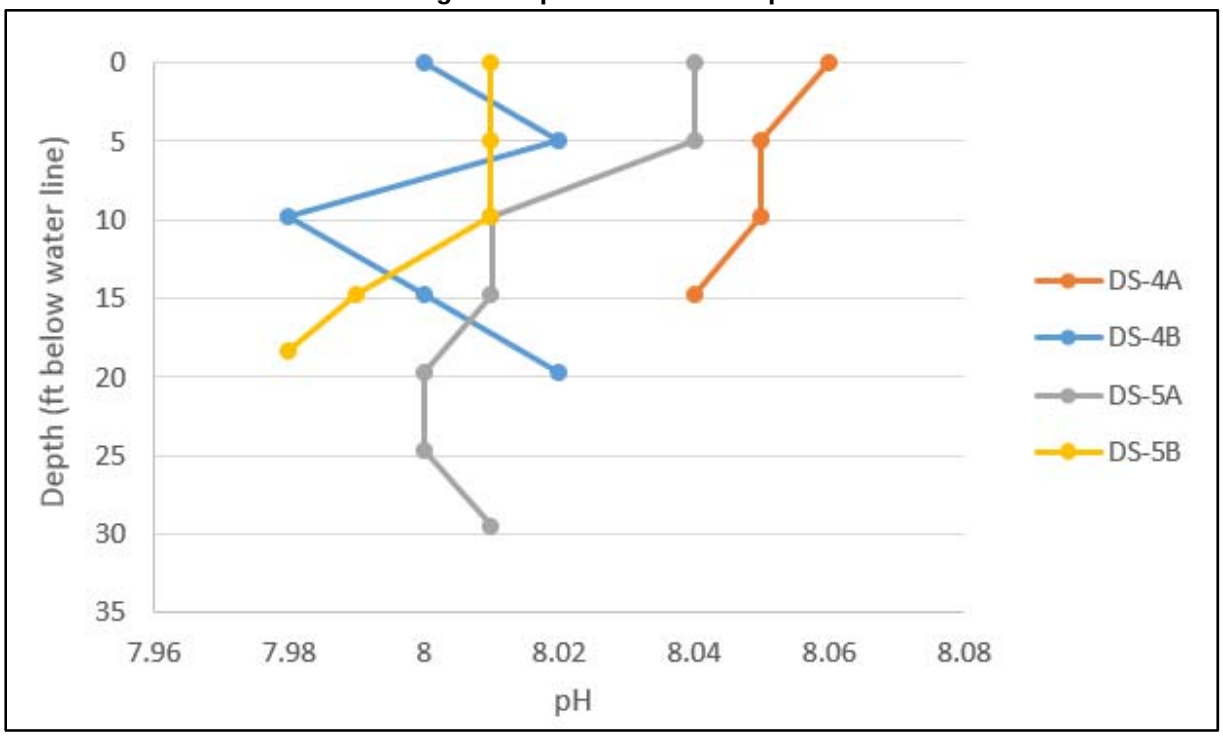


Figure 8: Conductivity Profile with Depth

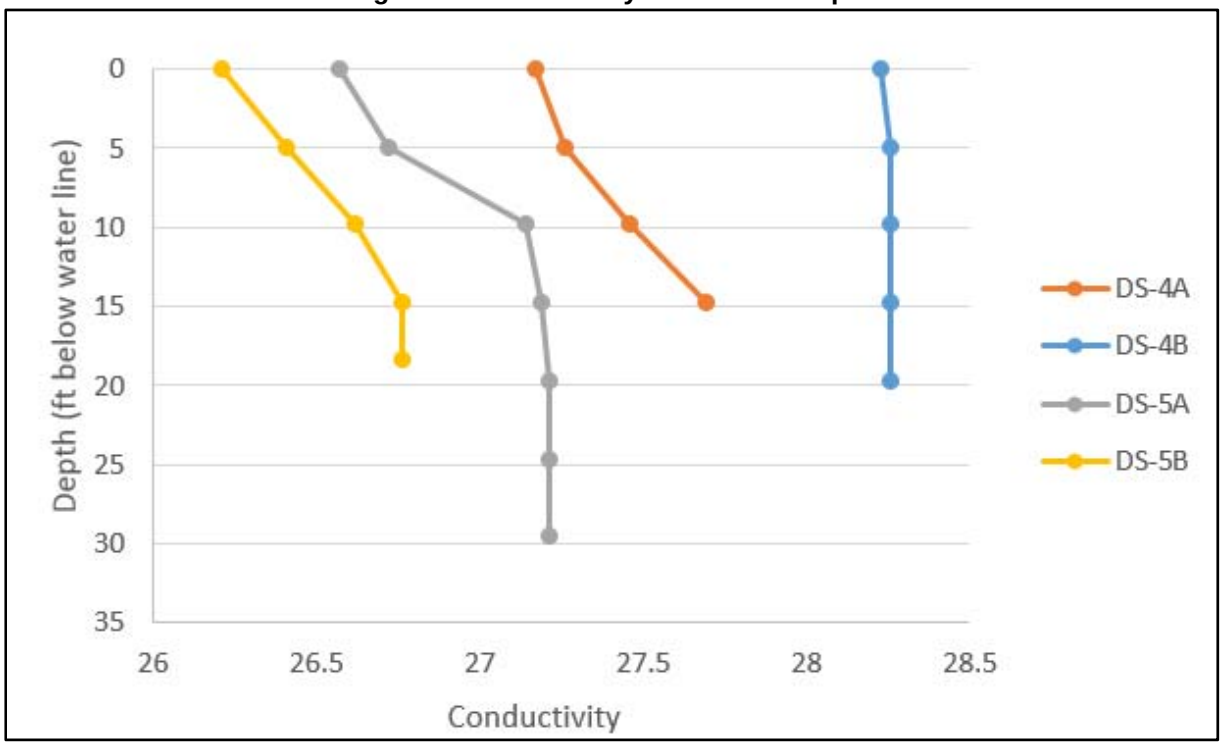
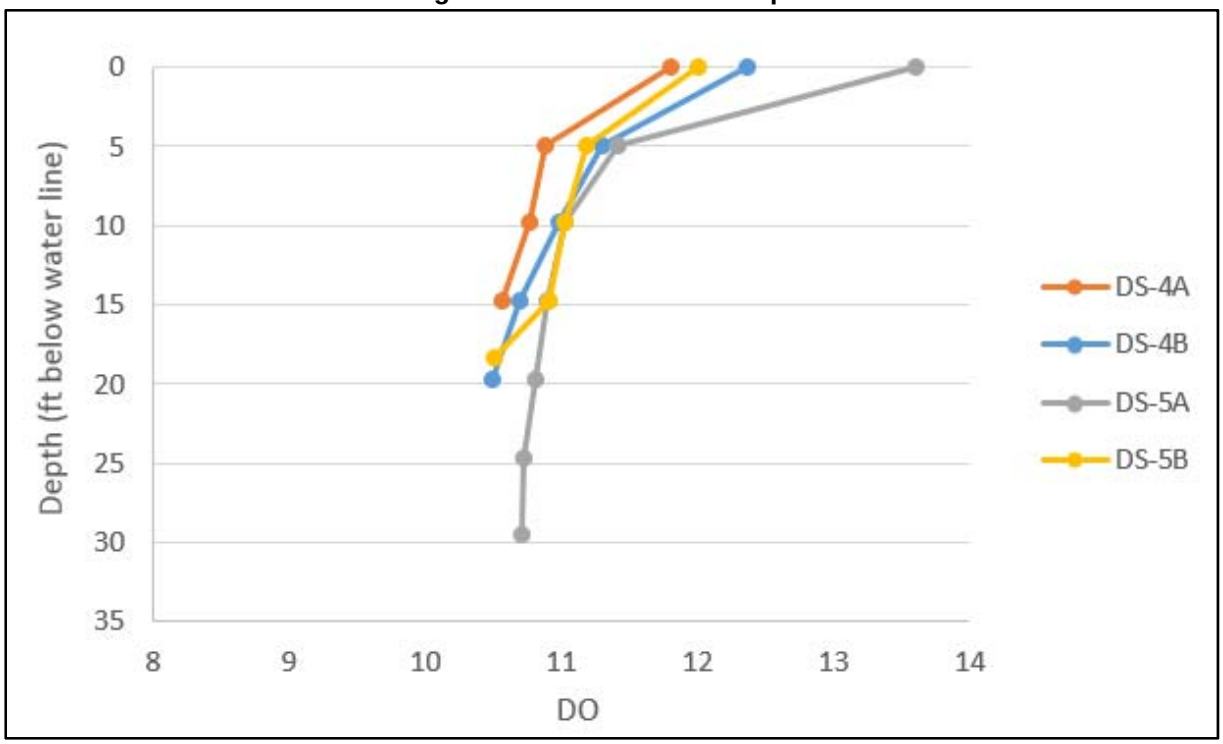


Figure 9: DO Profile with Depth



7.2.4 Beach Nourishment Sampling Methodology

To determine if the dredged sediment is suitable for reuse as beach nourishment, detected COCs in the sediment must be below ADEC Method 2 levels. This sample location was named Ref-2. The purpose for sampling at the toe of the bluff site was to determine baseline conditions and stability for the bluff to support the placement of the dredged material.

8.0 RESULTS AND CONCLUSIONS

Section 8.1 summarizes the results of the particle size analysis and physical characterization, and Section 8.2 summarizes the results of the chemical characterization. The complete laboratory analytical reports are included as Appendix E.

8.1 PHYSICAL AND GEOTECHNICAL PROPERTIES

Field observations of sediment cores indicate that the sediment has limited heterogeneity, consisting of dark gray sand with occasional silty material toward the top of the borings, and transitioning to lean clay around 9.8-13.1 ft bml (3 to 4 m bml). Sediment boring logs and sample photographs are contained in Appendixes A and B, respectively. As shown in Table 9, the amount of fines in the core homogenate samples in the test pit area varied widely, ranging from less than 5 percent to 88 percent fines (silt and clay). Leave layer samples in D4SD01 and D5SD02 were generally lean clays, consisting of more than 82.9 percent fines. In brief, particle size data indicate that the material to be dredged from DMMU#4 and DMMU#5 is sand dominated to approximately 9.8-13.1 ft bml (3 to 4 m bml) (ranging from 3.5 to 30.7 percent fines), and transitioning to lean clay below that depth (ranging from 82.9 to 87.7 percent fines). The reference beach nourishment sample was a coarse-grained soil with predominately sand and gravel, and only 2.44 percent fines. The USCS classification of the reference sample was not determined.

8.1.1 Chemical Characterization Data

Table 10 summarizes the chemical characterization data, including appropriate data qualifiers, from the sediment core samples. Chemical concentrations were compared with the User's Manual chemical guideline values. For management of dredge material, the in-water screening level (SL), maximum level (ML), and bioaccumulation triggers (BTs) are the standards to be met. If these standards are not met, then no in-water placement will occur and the dredge material will be beneficially reused or placed in an approved upland disposal site. Therefore, sediment samples were also compared with the ADEC Method 2 cleanup levels for migration to groundwater for approval of upland disposal.

Table 10 shows the analytical data collected for the standard suite of chemical analytes, including VOCs, trace metals, SVOCs (including PAHs), pesticides (including PCBs). Data qualifiers attached to individual chemical results are discussed in more detail in Section 7.1. Method detection limits (MDLs) are reported for undetected analytes, with the "U" qualifier indicating that the chemical was not detected.

Data from samples (including field duplicates) collected from the DMMUs and the reference sites were evaluated by comparing each data point with the associated SLs, expressed on a dry-weight basis. Following is a summary of the findings by category of chemical analyte.

8.1.2 Volatile Organic Compounds

The sediment samples were analyzed for the full suite of VOC compounds (Table 10). Only four of the VOC compounds have DMMP User's Manual screening levels. None of those four compounds were detected, and all MDLs were below the User's Manual SLs. Therefore, no ecological risk is believed to be associated with this class of compounds. No VOC compounds were detected at concentrations exceeding the ADEC Method 2 Cleanup Levels for Migration to Groundwater, while the MDL for 1,2-Dibromoethane (EDB) exceeded the ADEC Cleanup level.

8.1.3 Semivolatile Organic Compounds (Including Polynuclear Aromatic Hydrocarbons)

The sediment samples were analyzed for selected SVOCs, including PAHs, chlorinated hydrocarbons, phthalates, phenols, and other miscellaneous extractables (Table 10). For PAHs, the NOAA SQuirTs values are more conservative than User's Manual values. However, no PAH compounds were detected at values exceeding the NOAA SQuirTs values, the User's Manual values, or the ADEC Method 2 Cleanup Levels, indicating PAHs do not present an ecological risk.

For non-PAH SVOC compounds, no compounds were detected at concentrations exceeding any of the SLs or the ADEC Method 2 Cleanup Level for Migration to Groundwater. However, the MDLs of many of the non-PAH SVOC compounds were greater than either the ADEC Level 2 Cleanup Levels, User's Manual values, and/or NOAA SQuirTs values. It is unlikely this class of compounds will pose ecological risk.

8.1.4 Total Petroleum Hydrocarbons (TPH)

Diesel, gasoline, and oil-range TPH were analyzed. While these compounds were detected in several of the sediment samples, none were detected above the ADEC Method 2 Migration to Groundwater values and are therefore not considered an issue for dredge sediment disposal purposes. There are no NOAA SQuirTs or User's Manual SLs for this class of compounds.

8.1.5 Pesticides (Including Polychlorinated Biphenyls)

Sediment samples were analyzed for target chlorinated pesticides, including DDT isomers, aldrin, BHC and chlordane isomers, dieldrin, endosulfan, endrin, heptachlor, methoxychlor, toxaphene, lindane, and PCBs. None of the individual PCB compounds were detected, but the MDL of the total PCBs did exceed the NOAA SQuirTs TEL value. None of these pesticide compounds were detected above MDLs in any of the sediment samples, but the MDL for gamma-BHC (Lindane) was greater than the NOAA SQUIRTS TEL values. It is not expected that the pesticides or PCBs are likely to result in adverse ecological effects.

8.1.6 Tributyltin

Tributylin (TBT) was not detected in any of the analyzed samples; therefore, no ecological risk is likely to be associated with this class of compounds.

8.1.7 Trace Metals

The beach nourishment reference sample was analyzed for cadmium, copper, lead, nickel, and zinc via Acid Volatile Sulfide (AVS) with Simultaneously Extracted Metals (SEM) (Table 10). No metals were detected at concentrations exceeding the ADEC Method 2 Cleanup Values for Migration to Groundwater. There are no NOAA SQuirTs or User's Manual SLs for these compounds.

The marine sediment samples were analyzed for antimony, arsenic, barium, beryllium, cadmium, chromium, copper, lead, mercury, nickel, selenium, silver, thallium, vanadium, zinc, and hexavalent chromium (Table 10). The NOAA SQuirTs values are more conservative than the User's Manual values for metals. User's Manual values have been developed for most metals, with the exceptions of barium, beryllium, nickel, thallium, and vanadium. No metals were detected at concentrations exceeding the User's Manual values. Copper, nickel, and silver were detected at concentrations exceeding the NOAA SQuirTs TEL values. Arsenic, chromium, nickel, and selenium were detected at concentrations exceeding the ADEC Method 2 Cleanup Levels for migration to groundwater.

8.2 CONCLUSIONS

The results of the dredge material characterization, and the conclusions drawn from these results, are summarized as follows:

- Post-dredge placement options, based on physical characterization alone, should be consistent with coarser or sand-dominated material. Material planned for dredging (up to -13 ft MLLW elevation) is sand dominated.
- Proposed dredge material from the DMMUs appears to be suitable for aquatic disposal and beneficial reuse, and further indicates that no bioassay testing of sediments will be necessary. This assessment was made before the archived sediment sample holding times were exceeded.
- No potential contaminants were detected at concentrations above the associated screening levels identified in the User's Manual.
- Several metal compounds were detected at concentrations above the associated screening levels identified in NOAA SQuiRTs.
- Several metal compounds were detected at concentrations above the associated ADEC Method 2 Cleanup Level for Migration to Groundwater, indicating that upland disposal / beneficial reuse may not be an appropriate disposal method for these dredged sediment materials.
- Leave layer samples were generally sandy clay, consisting of more than 80 percent fines.
- The data review and validation process indicated no significant laboratory deviation from specified protocols. Most reported data were considered to be valid and representative, and the data were acceptable endpoints as set forth in the project SAP (CH2M HILL, 2015). In cases where deviations were observed, the conclusions presented in this report are not expected to be affected.

Table 9: Draft Test Pit Dredge Sediment Geotechnical Results

Analyte	Client Sample ID		D4ADS01-001.48-01	D4BGC07-14.4416.57-01	D4BGC06-11.8113.54-01	REF-2	D4SD04-0.503-01	D4SD04-0304.25-02	D4SD04-4.2518.86-03	D5SD01-0002-01	D5SD01-0204-02	D4BDS01-001.31-01	D5SD01-0404.9-03	D4SD04-5.756.25-04
	ASL Lab Report ID		P3549	P3549	P3549	P3522	P3586	P3586	P3586	P3586	P3586	P3586	P3586	P3586
	ASL Lab Sample ID		P354901	P354902	P354903	P352201	P358601	P358605	P358606	P358607	P358608	P358609	P358610	P358612
	ALS Lab Report ID		K1512542	K1512542	K1512542	K1512414	K1512773	K1512773	K1512773	K1512773	K1512773	K1512773	K1512773	-
	ALS Lab Sample ID		K1512542-001	K1512542-002	K1512542-003	K1512414-001	K1512773-001	K1512773-003	K1512773-004	K1512773-005	K1512773-006	K1512773-007	K1512773-008	-
	Sample Date and Time		11/2/2015 21:00	11/3/15 10:00	11/3/15 11:00	10/29/2015 15:18	11/5/15 13:30	11/5/15 16:30	11/5/15 14:50	11/6/15 11:15	11/6/15 13:00	11/3/15 11:00	11/6/15 14:45	11/5/15 17:20
	Matrix		Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil
	Type		Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab
		Analysis Method	Result											
Atterberg Limits														
Liquid Limit	-	ASTM D4318	-	32	-	-	-	-	33	-	-	-	35	37
Plastic Limit	-	ASTM D4318	-	19	-	-	-	-	18	-	-	-	18	18
Plasticity Index	-	ASTM D4318	NP	13.7	NP	-	NP	NP	14.9	NP	NP	NP	17.2	18.8
Density														
Specific Gravity	-	ASTM D854	2.33	2.41	2.34	-		-	-	-	-	-	-	-
Grain Density	g/cm^3	API RP40	2.76	2.64	2.71	-	2.68	2.72	2.77	2.74	2.73	2.68	2.8	2.76
Bulk Density	g/cm^3	ASTM D7263	1.75	2.17	1.72	-	1.92	1.91	2.02	1.83	1.86	1.72	1.99	2.05
Particle Size														
USCS Description	-	ASTM D2487	Poorly Graded Sand with Gravel	Lean Clay	Silty Sand	-	Silty Sand	Silty Sand	Lean Clay with Sand	Silty Sand	Silty Sand	Poorly Graded Sand with Silty Clay	Lean Clay	Lean Clay
Gravel	Wt %	ASTM D422	27.8	0.0	0.0	22.25	0.70	0.0	0.90	1.50	0.60	1.40	0.90	0.40
Sand	Wt %	ASTM D422	68.7	12.3	84.5	75.31	79.1	74.6	16.2	84	68.7	90.4	12.1	12.1
Fines	Wt %	ASTM D422	3.50	87.7	15.5	2.44	20.2	25.4	82.9	14.5	30.7	8.2	87.0	87.5

Table 10: Draft Test Pit Dredge Sediment Concentration Data

Analyte	CAS#	Client Sample ID		D4ADS01-001.48-01	D4BGC07-14.4416.57-01	D4BGC06-11.8113.54-01	REF-2	REF-102	D4SD04-0.503-01	D4SD04-0.503-101	D4SD04-0304.25-02	D4SD04-4.2518.86-03	D5SD01-0002-01	D5SD01-0204-02	D4BDS01-001.31-01	D5SD01-0404.9-03	DMMP User's Manual/ Inland Testing Manual			NOAA SQuiRTs		2008 ADEC Method 2 Cleanup Levels for Migration to Groundwater
		ASL Lab Report ID		P3549	P3549	P3549	P3522	P3522	P3586	P3586	P3586	P3586	P3586	P3586	P3586	P3586						
		ASL Lab Sample ID		P354901	P354902	P354903	P352201	P352204	P358601	P358602	P358605	P358606	P358607	P358608	P358609	P358610						
		ALS Lab Report ID		K1512542	K1512542	K1512542	K1512414	K1512414	K1512773	K1512773	K1512773	K1512773	K1512773	K1512773	K1512773	K1512773						
		ALS Lab Sample ID		K1512542-001	K1512542-002	K1512542-003	K1512414-001	K1512414-002	K1512773-001	K1512773-002	K1512773-003	K1512773-004	K1512773-005	K1512773-006	K1512773-007	K1512773-008						
		Within 3 days of occurence of exceedance		11/2/2015 21:00	11/3/15 10:00	11/3/15 11:00	10/29/2015 15:18	10/29/2015 15:28	11/5/15 13:30	11/5/15 13:40	11/5/15 16:30	11/5/15 14:50	11/6/15 11:15	11/6/15 13:00	11/3/15 11:00	11/6/15 14:45						
		Matrix		Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil						
		Type		Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab						
			Analysis Method	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	SL	BT	ML	TEL	PEL	
VOC/BTEX																	(ug/kg)			(ug/kg)		(ug/kg)
Dichlorodifluoromethane	75-71-8	µg/Kg	SW8260B	0.27 U	0.32 U	-	-	-	0.28 U	0.25 U	0.28 U	0.29 U	0.24 U	0.27 U	-	0.28 U	-	-	-	-	-	140000
Chloromethane	74-87-3	µg/Kg	SW8260B	0.27 U	0.32 U	-	-	-	1.9	10.4	0.44 J	10.5	0.24 U	0.27 U	-	0.34 J	-	-	-	-	-	210
Vinyl Chloride	75-01-4	µg/Kg	SW8260B	0.27 U	0.32 U	-	-	-	0.28 U	0.25 U	0.28 U	0.29 U	0.24 U	0.27 U	-	0.28 U	-	-	-	-	-	8.5
Bromomethane	74-83-9	µg/Kg	SW8260B	0.27 U	0.32 U	-	-	-	0.28 U	0.25 U	0.28 U	0.29 U	0.24 U	0.27 U	-	0.28 U	-	-	-	-	-	160
Chloroethane	75-00-3	µg/Kg	SW8260B	0.27 U	0.32 U	-	-	-	0.28 U	0.25 U	0.28 U	0.29 U	0.24 U	0.27 U	-	0.28 U	-	-	-	-	-	580000
Trichlorofluoromethane	75-69-4	µg/Kg	SW8260B	0.27 U	0.32 U	-	-	-	0.28 U	0.25 U	0.28 U	0.29 U	0.24 U	0.27 U	-	0.28 U	-	-	-	-	-	86000
Acetone	67-64-1	µg/Kg	SW8260B	1.08 U	4.72 J	-	-	-	149 D	163 D	10.9	7.88	3.60 J	4.81 J	-	10.2	-	-	-	-	-	88000000
1,1-Dichloroethene	75-35-4	µg/Kg	SW8260B	0.27 U	0.32 U	-	-	-	0.28 U	0.25 U	0.28 U	0.29 U	0.24 U	0.27 U	-	0.28 U	-	-	-	-	-	30
Methylene chloride	75-09-2	µg/Kg	SW8260B	0.27 U	0.32 U	-	-	-	0.28 U	0.25 U	0.28 U	0.29 U	0.24 U	0.27 U	-	0.28 U	-	-	-	-	-	16
trans-1,2-Dichloroethene	156-60-5	µg/Kg	SW8260B	0.27 U	0.32 U	-	-	-	0.28 U	0.25 U	0.28 U	0.29 U	0.24 U	0.27 U	-	0.28 U	-	-	-	-	-	370
Methyl tert-butyl ether (MTBE)	1634-04-4	µg/Kg	SW8260B	0.27 U	0.32 U	-	-	-	0.28 U	0.25 U	0.28 U	0.29 U	0.24 U	0.27 U	-	0.28 U	-	-	-	-	-	1300
1,1-Dichloroethane	75-34-3	µg/Kg	SW8260B	0.27 U	0.32 U	-	-	-	0.28 U	0.25 U	0.28 U	0.29 U	0.24 U	0.27 U	-	0.28 U	-	-	-	-	-	25000
2-Butanone (MEK)	78-93-3	µg/Kg	SW8260B	2.15 U	2.58 U	-	-	-	22.9	29.5	2.22 U	2.32 U	1.92 U	2.14 U	-	2.25 U	-	-	-	-	-	59000
cis-1,2-Dichloroethene	156-59-2	µg/Kg	SW8260B	0.27 U	0.32 U	-	-	-	0.28 U	0.25 U	0.28 U	0.29 U	0.24 U	0.27 U	-	0.28 U	-	-	-	-	-	240
Bromochloromethane	74-97-5	µg/Kg	SW8260B	0.27 U	0.32 U	-	-	-	0.28 U	0.25 U	0.28 U	0.29 U	0.24 U	0.27 U	-	0.28 U	-	-	-	-	-	-
Chloroform	67-66-3	µg/Kg	SW8260B	0.27 U	0.32 U	-	-	-	0.28 U	0.25 U	0.28 U	0.29 U	0.24 U	0.27 U	-	0.28 U	-	-	-	-	-	460
2,2-Dichloropropane	594-20-7	µg/Kg	SW8260B	0.27 U	0.32 U	-	-	-	0.28 U	0.25 U	0.28 U	0.29 U	0.24 U	0.27 U	-	0.28 U	-	-	-	-	-	-
1,2-Dichloroethane	107-06-2	µg/Kg	SW8260B	0.27 U	0.32 U	-	-	-	0.28 U	0.25 U	0.28 U	0.29 U	0.24 U	0.27 U	-	0.28 U	-	-	-	-	-	16
1,1,1-Trichloroethane	71-55-6	µg/Kg	SW8260B	0.27 U	0.32 U	-	-	-	0.28 U	0.25 U	0.28 U	0.29 U	0.24 U	0.27 U	-	0.28 U	-	-	-	-	-	820
1,1-Dichloropropene	563-58-6	µg/Kg	SW8260B	0.27 U	0.32 U	-	-	-	0.28 U	0.25 U	0.28 U	0.29 U	0.24 U	0.27 U	-	0.28 U	-	-	-	-	-	-
Carbon tetrachloride	56-23-5	µg/Kg	SW8260B	0.27 U	0.32 U	-	-	-	0.28 U	0.25 U	0.28 U	0.29 U	0.24 U	0.27 U	-	0.28 U	-	-	-	-	-	23
Benzene	71-43-2	µg/Kg	SW8260B	0.27 U	0.32 U	-	0.21 U	0.23 U	5.23	19.7	0.32 J	0.29 U	0.24 U	0.27 U	-	0.28 U	-	-	-	-	-	25
Dibromomethane	74-95-3	µg/Kg	SW8260B	0.27 U	0.32 U	-	-	-	0.28 U	0.25 U	0.28 U	0.29 U	0.24 U	0.27 U	-	0.28 U	-	-	-	-	-	1100

Analyte	CAS#	Client Sample ID		D4ADS01-001.48-01	D4BGC07-14.4416.57-01	D4BGC06-11.8113.54-01	REF-2	REF-102	D4SD04-0.503-01	D4SD04-0.503-101	D4SD04-0304.25-02	D4SD04-4.2518.86-03	D5SD01-0002-01	D5SD01-0204-02	D4BDS01-001.31-01	D5SD01-0404.9-03	DMMP User's Manual/ Inland Testing Manual			NOAA SQuiRTs		2008 ADEC Method 2 Cleanup Levels for Migration to Groundwater
		ASL Lab Report ID		P3549	P3549	P3549	P3522	P3522	P3586	P3586	P3586	P3586	P3586	P3586	P3586	P3586						
		ASL Lab Sample ID		P354901	P354902	P354903	P352201	P352204	P358601	P358602	P358605	P358606	P358607	P358608	P358609	P358610						
		ALS Lab Report ID		K1512542	K1512542	K1512542	K1512414	K1512414	K1512773	K1512773	K1512773	K1512773	K1512773	K1512773	K1512773	K1512773						
		ALS Lab Sample ID		K1512542-001	K1512542-002	K1512542-003	K1512414-001	K1512414-002	K1512773-001	K1512773-002	K1512773-003	K1512773-004	K1512773-005	K1512773-006	K1512773-007	K1512773-008						
		Within 3 days of occurence of exceedance		11/2/2015 21:00	11/3/15 10:00	11/3/15 11:00	10/29/2015 15:18	10/29/2015 15:28	11/5/15 13:30	11/5/15 13:40	11/5/15 16:30	11/5/15 14:50	11/6/15 11:15	11/6/15 13:00	11/3/15 11:00	11/6/15 14:45						
		Matrix		Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil						
		Type		Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab						
			Analysis Method	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	SL	BT	ML	TEL	PEL	
VOC/BTEX																	(ug/kg)			(ug/kg)		(ug/kg)
1,2-Dichloropropane	78-87-5	µg/Kg	SW8260B	0.27 U	0.32 U	-	-	-	0.28 U	0.25 U	0.28 U	0.29 U	0.24 U	0.27 U	-	0.28 U	-	-	-	-	-	18
Trichloroethene (TCE)	79-01-6	µg/Kg	SW8260B	0.27 U	0.32 U	-	-	-	0.28 U	0.25 U	0.28 U	0.29 U	0.24 U	0.27 U	-	0.28 U	-	-	-	-	-	20
Bromodichloromethane	75-27-4	µg/Kg	SW8260B	0.27 U	0.32 U	-	-	-	0.28 U	0.25 U	0.28 U	0.29 U	0.24 U	0.27 U	-	0.28 U	-	-	-	-	-	44
cis-1,3-Dichloropropene	10061-01-5	µg/Kg	SW8260B	0.27 U	0.32 U	-	-	-	0.28 U	0.25 U	0.28 U	0.29 U	0.24 U	0.27 U	-	0.28 U	-	-	-	-	-	33
4-Methyl-2-pentanone (MIBK)	108-10-1	µg/Kg	SW8260B	1.08 U	1.29 U	-	-	-	1.13 U	1.0 U	1.11 U	1.16 U	0.96 U	1.07 U	-	1.13 U	-	-	-	-	-	8100
trans-1,3-Dichloropropene	10061-02-6	µg/Kg	SW8260B	0.27 U	0.32 U	-	-	-	0.28 U	0.25 U	0.28 U	0.29 U	0.24 U	0.27 U	-	0.28 U	-	-	-	-	-	33
1,1,2-Trichloroethane	79-00-5	µg/Kg	SW8260B	0.27 U	0.32 U	-	-	-	0.28 U	0.25 U	0.28 U	0.29 U	0.24 U	0.27 U	-	0.28 U	-	-	-	-	-	18
Toluene	108-88-3	µg/Kg	SW8260B	0.27 U	0.32 U	-	0.21 U	0.23 U	5.20	13.5	0.91 J	0.29 U	0.24 U	0.27 U	-	0.28 U	-	-	-	-	-	6500
1,3-Dichloropropane	142-28-9	µg/Kg	SW8260B	0.27 U	0.32 U	-	-	-	0.28 U	0.25 U	0.28 U	0.29 U	0.24 U	0.27 U	-	0.28 U	-	-	-	-	-	-
Dibromochloromethane	124-48-1	µg/Kg	SW8260B	0.27 U	0.32 U	-	-	-	0.28 U	0.25 U	0.28 U	0.29 U	0.24 U	0.27 U	-	0.28 U	-	-	-	-	-	32
1,2-Dibromoethane (EDB)	106-93-4	µg/Kg	SW8260B	0.27 U	0.32 U	-	-	-	0.28 U	0.25 U	0.28 U	0.29 U	0.24 U	0.27 U	-	0.28 U	-	-	-	-	-	0.16
Tetrachloroethene (PCE)	127-18-4	µg/Kg	SW8260B	0.27 U	0.32 U	-	-	-	0.28 U	0.25 U	0.28 U	0.29 U	0.24 U	0.27 U	-	0.28 U	-	-	-	-	-	24
1-Chlorohexane	544-10-5	µg/Kg	SW8260B	0.27 U	0.32 U	-	-	-	0.28 U	0.25 U	0.28 U	0.29 U	0.24 U	0.27 U	-	0.28 U	-	-	-	-	-	-
1,1,1,2-Tetrachloroethane	630-20-6	µg/Kg	SW8260B	0.27 U	0.32 U	-	-	-	0.28 U	0.25 U	0.28 U	0.29 U	0.24 U	0.27 U	-	0.28 U	-	-	-	-	-	-
Chlorobenzene	108-90-7	µg/Kg	SW8260B	0.27 U	0.32 U	-	-	-	0.28 U	0.25 U	0.28 U	0.29 U	0.24 U	0.27 U	-	0.28 U	-	-	-	-	-	630
Ethylbenzene	100-41-4	µg/Kg	SW8260B	0.27 U	0.32 U	-	0.21 U	0.23 U	**0.83 J**	**1.30**	0.28 U	0.29 U	0.24 U	0.27 U	-	0.28 U	-	-	-	-	-	6900
m,p-Xylene	108-38-3/1	µg/Kg	SW8260B	0.54 U	0.64 U	-	0.42 U	0.47 U	**2.14 J**	**4.21**	0.56 U	0.58 U	**0.73 J**	0.53 U	-	0.56 U	-	-	-	-	-	63000
Bromoform	75-25-2	µg/Kg	SW8260B	0.27 U	0.32 U	-	-	-	0.28 U	0.25 U	0.28 U	0.29 U	0.24 U	0.27 U	-	0.28 U	-	-	-	-	-	340
Styrene	100-42-5	µg/Kg	SW8260B	0.27 U	0.32 U	-	-	-	0.28 U	**0.81 J**	0.28 U	0.29 U	0.24 U	0.27 U	-	0.28 U	-	-	-	-	-	960
1,1,2,2-Tetrachloroethane	79-34-5	µg/Kg	SW8260B	0.27 U	0.32 U	-	-	-	0.28 U	0.25 U	0.28 U	0.29 U	0.24 U	0.27 U	-	0.28 U	-	-	-	-	-	17
o-Xylene	95-47-6	µg/Kg	SW8260B	0.27 U	0.32 U	-	0.21 U	0.23 U	**1.51**	**3.35**	0.28 U	0.29 U	**0.47 J**	0.27 U	-	0.28 U	-	-	-	-	-	63000
1,2,3-Trichloropropane	96-18-4	µg/Kg	SW8260B	0.27 U	0.32 U	-	-	-	0.28 U	0.25 U	0.28 U	0.29 U	0.24 U	0.27 U	-	0.28 U	-	-	-	-	-	0.53
Isopropylbenzene	98-82-8	µg/Kg	SW8260B	0.27 U	0.32 U	-	-	-	0.28 U	0.25 U	0.28 U	0.29 U	0.24 U	0.27 U	-	0.28 U	-	-	-	-	-	51000
Bromobenzene	108-86-1	µg/Kg	SW8260B	0.27 U	0.32 U	-	-	-	0.28 U	0.25 U	0.28 U	0.29 U	0.24 U	0.27 U	-	0.28 U	-	-	-	-	-	-

Analyte	CAS#	Client Sample ID		D4ADS01-001.48-01	D4BGC07-14.4416.57-01	D4BGC06-11.8113.54-01	REF-2	REF-102	D4SD04-0.503-01	D4SD04-0.503-101	D4SD04-0304.25-02	D4SD04-4.2518.86-03	D5SD01-0002-01	D5SD01-0204-02	D4BDS01-001.31-01	D5SD01-0404.9-03	DMMP User's Manual/ Inland Testing Manual			NOAA SQuiRTs		2008 ADEC Method 2 Cleanup Levels for Migration to Groundwater
		ASL Lab Report ID		P3549	P3549	P3549	P3522	P3522	P3586	P3586	P3586	P3586	P3586	P3586	P3586	P3586						
		ASL Lab Sample ID		P354901	P354902	P354903	P352201	P352204	P358601	P358602	P358605	P358606	P358607	P358608	P358609	P358610						
		ALS Lab Report ID		K1512542	K1512542	K1512542	K1512414	K1512414	K1512773	K1512773	K1512773	K1512773	K1512773	K1512773	K1512773	K1512773						
		ALS Lab Sample ID		K1512542-001	K1512542-002	K1512542-003	K1512414-001	K1512414-002	K1512773-001	K1512773-002	K1512773-003	K1512773-004	K1512773-005	K1512773-006	K1512773-007	K1512773-008						
		Within 3 days of occurence of exceedance		11/2/2015 21:00	11/3/15 10:00	11/3/15 11:00	10/29/2015 15:18	10/29/2015 15:28	11/5/15 13:30	11/5/15 13:40	11/5/15 16:30	11/5/15 14:50	11/6/15 11:15	11/6/15 13:00	11/3/15 11:00	11/6/15 14:45						
		Matrix		Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil						
		Type		Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab						
			Analysis Method	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	SL	BT	ML	TEL	PEL	
VOC/BTEX																	(ug/kg)			(ug/kg)		(ug/kg)
n-Propylbenzene	103-65-1	µg/Kg	SW8260B	0.27 U	0.32 U	-	-	-	0.28 U	0.25 U	0.28 U	0.29 U	0.24 U	0.27 U	-	0.28 U	-	-	-	-	-	15000
2-Chlorotoluene	95-49-8	µg/Kg	SW8260B	0.27 U	0.32 U	-	-	-	0.28 U	0.25 U	0.28 U	0.29 U	0.24 U	0.27 U	-	0.28 U	-	-	-	-	-	-
4-Chlorotoluene	106-43-4	µg/Kg	SW8260B	0.27 U	0.32 U	-	-	-	0.28 U	0.25 U	0.28 U	0.29 U	0.24 U	0.27 U	-	0.28 U	-	-	-	-	-	-
1,3,5-Trimethylbenzene	108-67-8	µg/Kg	SW8260B	0.27 U	0.32 U	-	-	-	0.28 U	**0.36 J**	0.28 U	0.29 U	0.24 U	0.27 U	-	0.28 U	-	-	-	-	-	23000
tert-Butylbenzene	98-06-6	µg/Kg	SW8260B	0.27 U	0.32 U	-	-	-	0.28 U	0.25 U	0.28 U	0.29 U	0.24 U	0.27 U	-	0.28 U	-	-	-	-	-	12000
1,2,4-Trimethylbenzene	95-63-6	µg/Kg	SW8260B	**0.43 J**	0.32 U	-	-	-	**0.63 J**	**1.62**	0.28 U	0.29 U	**0.63 J**	0.27 U	-	0.28 U	-	-	-	-	-	23000
sec-Butylbenzene	135-98-8	µg/Kg	SW8260B	0.27 U	0.32 U	-	-	-	0.28 U	0.25 U	0.28 U	0.29 U	0.24 U	0.27 U	-	0.28 U	-	-	-	-	-	12000
1,3-Dichlorobenzene	541-73-1	µg/Kg	SW8260B	0.27 U	0.32 U	-	-	-	0.28 U	0.25 U	0.28 U	0.29 U	0.24 U	0.27 U	-	0.28 U	-	-	-	-	-	28000
1,4-Dichlorobenzene	106-46-7	µg/Kg	SW8260B	0.27 U	0.32 U	-	-	-	0.28 U	0.25 U	0.28 U	0.29 U	0.24 U	0.27 U	-	0.28 U	110	-	120	-	-	640
p-Isopropyltoluene	99-87-6	µg/Kg	SW8260B	0.27 U	0.32 U	-	-	-	**0.41 J**	**0.88 J**	0.28 U	0.29 U	0.24 U	0.27 U	-	0.28 U	-	-	-	-	-	-
1,2-Dichlorobenzene	95-50-1	µg/Kg	SW8260B	0.27 U	0.32 U	-	-	-	0.28 U	0.25 U	0.28 U	0.29 U	0.24 U	0.27 U	-	0.28 U	35	-	110			5100
n-Butylbenzene	104-51-8	µg/Kg	SW8260B	0.27 U	0.32 U	-	-	-	0.28 U	0.25 U	0.28 U	0.29 U	0.24 U	0.27 U	-	0.28 U	-	-	-	-	-	15000
1,2-Dibromo-3-chloropropane	96-12-8	µg/Kg	SW8260B	0.27 U	0.32 U	-	-	-	0.28 U	0.25 U	0.28 U	0.29 U	0.24 U	0.27 U	-	0.28 U	-	-	-	-	-	-
1,2,4-Trichlorobenzene	120-82-1	µg/Kg	SW8260B	0.27 U	0.32 U	-	-	-	0.28 U	0.25 U	0.28 U	0.29 U	0.24 U	0.27 U	-	0.28 U	31	-	64	-	-	850
Naphthalene	91-20-3	µg/Kg	SW8260B	0.27 U	0.32 U	-	-	-	**0.86 J**	**1.88**	0.28 U	0.29 U	0.24 U	0.27 U	-	0.28 U	2,100	-	2,400	34.6	391	20000
Hexachlorobutadiene	87-68-3	µg/Kg	SW8260B	0.27 U	0.32 U	-	-	-	0.28 U	0.25 U	0.28 U	0.29 U	0.24 U	0.27 U	-	0.28 U	-	-	-	-	-	120
1,2,3-Trichlorobenzene	87-61-6	µg/Kg	SW8260B	0.27 U	0.32 U	-	-	-	0.28 U	0.25 U	0.28 U	0.29 U	0.24 U	0.27 U	-	0.28 U	-	-	-	-	-	-
Xylenes, Total	1330-20-7	µg/Kg	SW8260B	0.81 U	0.96 U	-	0.63 U	0.70 U	**3.65 J**	**7.56**	0.84 U	0.84 U	**1.20 J**	0.80 U	-	0.84 U	-	-	-	-	-	63000
PAHs																	**(ug/kg)**			**(ug/kg)**		**(ug/kg)**
Naphthalene	91-20-3	µg/Kg	SW8270C-SIM	**0.27 J**	**1.55**	**0.37 J**	-	-	**4.88**	**5.53**	**1.20**	**1.32**	**0.73 J**	**0.41 J**	**0.27 J**	**1.87**	2,100	-	2,400	34.6	391	20000
2-Methylnaphthalene	91-57-6	µg/Kg	SW8270C-SIM	0.22 U	**6.04**	**0.50 J**	-	-	**4.15**	**3.65**	**1.94**	**5.34**	**1.68**	**0.95 J**	0.24 U	**7.35**	670	-	1,900	20.2	201	6100

Analyte	CAS#	Client Sample ID		D4ADS01-001.48-01	D4BGC07-14.4416.57-01	D4BGC06-11.8113.54-01	REF-2	REF-102	D4SD04-0.503-01	D4SD04-0.503-101	D4SD04-0304.25-02	D4SD04-4.2518.86-03	D5SD01-0002-01	D5SD01-0204-02	D4BDS01-001.31-01	D5SD01-0404.9-03	DMMP User's Manual/ Inland Testing Manual			NOAA SQuiRTs		2008 ADEC Method 2 Cleanup Levels for Migration to Groundwater
		ASL Lab Report ID		P3549	P3549	P3549	P3522	P3522	P3586	P3586	P3586	P3586	P3586	P3586	P3586	P3586						
		ASL Lab Sample ID		P354901	P354902	P354903	P352201	P352204	P358601	P358602	P358605	P358606	P358607	P358608	P358609	P358610						
		ALS Lab Report ID		K1512542	K1512542	K1512542	K1512414	K1512414	K1512773	K1512773	K1512773	K1512773	K1512773	K1512773	K1512773	K1512773						
		ALS Lab Sample ID		K1512542-001	K1512542-002	K1512542-003	K1512414-001	K1512414-002	K1512773-001	K1512773-002	K1512773-003	K1512773-004	K1512773-005	K1512773-006	K1512773-007	K1512773-008						
		Within 3 days of occurence of exceedance		11/2/2015 21:00	11/3/15 10:00	11/3/15 11:00	10/29/2015 15:18	10/29/2015 15:28	11/5/15 13:30	11/5/15 13:40	11/5/15 16:30	11/5/15 14:50	11/6/15 11:15	11/6/15 13:00	11/3/15 11:00	11/6/15 14:45						
		Matrix		Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil						
		Type		Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab						
			Analysis Method	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	SL	BT	ML	TEL	PEL	
VOC/BTEX																	(ug/kg)			(ug/kg)		(ug/kg)
1-Methylnaphthalene	90-12-0	µg/Kg	SW8270C-SIM	0.21 U	**3.67**	**0.35 J**	-	-	**2.97**	**2.87**	**1.00 J**	**3.20**	**1.13 J**	**0.50 J**	0.22 U	**4.67**	-	-	-	-	-	6200
Acenaphthylene	208-96-8	µg/Kg	SW8270C-SIM	0.21 U	0.22 U	0.22 U	-	-	**0.26 J**	**0.54 J**	0.21 U	0.22 U	0.21 U	0.23 U	0.23 U	**0.36 J**	560	-	1,300	5.87	128	180000
Acenaphthene	83-32-9	µg/Kg	SW8270C-SIM	0.19 U	0.19 U	0.19 U	-	-	**0.39 J**	**0.33 J**	0.18 U	0.19 U	0.18 U	0.20 U	0.20 U	0.20 U	500	-	2,000	-	-	180000
Fluorene	86-73-7	µg/Kg	SW8270C-SIM	0.21 U	0.21 U	0.21 U	-	-	**2.05**	**2.19**	**0.41 J**	0.21 U	**0.49 J**	0.23 U	0.23 U	**2.17**	540	-	3,600	21.2	144	220000
Phenanthrene	85-01-8	µg/Kg	SW8270C-SIM	**0.30 J**	**5.73**	**0.49 J**	-	-	**3.33**	**2.83**	**1.15 J**	**5.32**	**1.48**	**1.23 J**	**0.51 J**	**7.41**	1,500	-	21,000	86.7	544	3000000
Anthracene	120-12-7	µg/Kg	SW8270C-SIM	0.31 U	0.31 U	0.31 U	-	-	**1.15 J**	**1.14 J**	0.31 U	0.31 U	0.31 U	0.33 U	0.33 U	0.33 U	960	-	13,000	46.9	245	3000000
Fluoranthene	206-44-0	µg/Kg	SW8270C-SIM	0.22 U	**1.40**	**0.25 J**	-	-	**1.35**	**1.39**	**0.49 J**	**1.36**	**0.52 J**	**0.55 J**	**0.31 J**	**1.72**	1,700	4,600	30,000	113	1494	1400000
Pyrene	129-00-0	µg/Kg	SW8270C-SIM	**0.20 J**	**2.39**	**0.37 J**	-	-	**1.67**	**1.47**	**0.68 J**	**2.53**	**0.85 J**	**0.91 J**	**0.37 J**	**3.05**	2,600	11,980	16,000	153	1,398	1000000
Benzo(a)anthracene	56-55-3	µg/Kg	SW8270C-SIM	0.18 U	0.18 U	0.18 U	-	-	**0.41 J**	0.18 U	0.18 U	0.18 U	0.18 U	0.20 U	0.20 U	**0.43 J**	1,300	-	5,100	74.8	693	3600
Chrysene	218-01-9	µg/Kg	SW8270C-SIM	0.36 U	**1.43**	0.36 U	-	-	**0.65 J**	**0.42 J**	0.36 U	**1.04 J**	0.36 U	0.39 U	0.39 U	**1.41**	1,400	-	21,000	108	846	360000
Benzo(b)fluoranthene	205-99-2	µg/Kg	SW8270C-SIM	0.41 U	0.41 U	0.42 U	-	-	0.41 U	0.40 U	0.41 U	0.41 U	0.41 U	0.44 U	0.44 U	0.43 U	3,200	-	9,900	-	-	12000
Benzo(k)fluoranthene	207-08-9	µg/Kg	SW8270C-SIM	0.57 U	0.57 U	0.57 U	-	-	0.57 U	0.55 U	0.56 U	0.57 U	0.56 U	0.61 U	0.61 U	0.60 U	3,200	-	9,900	-	-	120000
Benzo(a)pyrene	50-32-8	µg/Kg	SW8270C-SIM	0.28 U	0.28 U	0.28 U	-	-	0.28 U	0.27 U	0.28 U	0.28 U	0.28 U	0.30 U	0.30 U	0.29 U	1,600	-	3,600	88.8	763	2100
Indeno(1,2,3-c,d)pyrene	193-39-5	µg/Kg	SW8270C-SIM	0.44 U	0.45 U	0.45 U	-	-	0.45 U	0.43 U	0.44 U	0.45 U	0.44 U	0.48 U	0.48 U	0.47 U	600	-	4,400	-	-	41000
Dibenzo(a,h)anthracene	53-70-3	µg/Kg	SW8270C-SIM	0.41 U	0.41 U	0.41 U	-	-	0.41 U	0.40 U	0.40 U	0.41 U	0.40 U	0.44 U	0.44 U	0.43 U	230	-	1,900	6.22	135	4000

Analyte	CAS#	Client Sample ID		D4ADS01-001.48-01	D4BGC07-14.4416.57-01	D4BGC06-11.8113.54-01	REF-2	REF-102	D4SD04-0.503-01	D4SD04-0.503-101	D4SD04-0304.25-02	D4SD04-4.2518.86-03	D5SD01-0002-01	D5SD01-0204-02	D4BDS01-001.31-01	D5SD01-0404.9-03	DMMP User's Manual/ Inland Testing Manual			NOAA SQuiRTs		2008 ADEC Method 2 Cleanup Levels for Migration to Groundwater
		ASL Lab Report ID		P3549	P3549	P3549	P3522	P3522	P3586	P3586	P3586	P3586	P3586	P3586	P3586	P3586						
		ASL Lab Sample ID		P354901	P354902	P354903	P352201	P352204	P358601	P358602	P358605	P358606	P358607	P358608	P358609	P358610						
		ALS Lab Report ID		K1512542	K1512542	K1512542	K1512414	K1512414	K1512773	K1512773	K1512773	K1512773	K1512773	K1512773	K1512773	K1512773						
		ALS Lab Sample ID		K1512542-001	K1512542-002	K1512542-003	K1512414-001	K1512414-002	K1512773-001	K1512773-002	K1512773-003	K1512773-004	K1512773-005	K1512773-006	K1512773-007	K1512773-008						
		Within 3 days of occurence of exceedance		11/2/2015 21:00	11/3/15 10:00	11/3/15 11:00	10/29/2015 15:18	10/29/2015 15:28	11/5/15 13:30	11/5/15 13:40	11/5/15 16:30	11/5/15 14:50	11/6/15 11:15	11/6/15 13:00	11/3/15 11:00	11/6/15 14:45						
		Matrix		Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil						
		Type		Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab						
			Analysis Method	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	SL	BT	ML	TEL	PEL	
VOC/BTEX																	(ug/kg)			(ug/kg)		(ug/kg)
Benzo(g,h,i)perylene	191-24-2	µg/Kg	SW8270C-SIM	0.44 U	0.45 U	0.45 U	-	-	0.45 U	0.43 U	0.44 U	0.45 U	0.44 U	0.48 U	0.48 U	0.47 U	670	-	3,200	-	-	38700000
Total Low MW PAHs NaphthaleneAcenaphthyleneAcenaphtheneFluorenePhenanthreneAnthracene2-Methylnaphthalene	91-20-3208-96-883-32-986-73-785-01-8120-12-791-57-6	µg/Kg	SW8270C-SIM	1.71	14.3	2.29	-	-	16.2	16.2	5.40	12.9	5.08	3.58	2.01	19.7	5,200	-	29,000	312	1,442	-
Total High MW PAHs Fluoranthene Pyrene Benz(a)anthracene Chrysene Benzofluoranthenes (b, j ,k) Benzo(a)pyrene Indeno(1,2,3-c,d)pyrene Dibenz(a,h)anthracene Benzo(g,h,i)perylene	206-44-0 129-00-0 56-55-3 218-01-9 205-99-2 205-82-3 207-08-9 50-32-8 193-39-5 53-70-3 191-24-2	µg/Kg	SW8270C-SIM	3.51	7.97	3.74	-	-	6.93	6.21	4.52	7.96	4.72	5.10	4.32	9.59	12,000	-	69,000	655	6,676	-
Total PAHs	-	µg/Kg		5.43	25.9	6.38		-	25.8	25.0	10.6	23.8	10.7	8.88	6.25	33.7	-	-	-	1,684	16,770	-
SVOCs																	**(ug/kg)**			**(ug/kg)**		**(ug/kg)**
N-Nitrosodimethylamine	62-75-9	µg/Kg	SW8270C	81.0 U	81.2 U	81.0 U	-	-	78.3 U	77.3 U	79.5 U	79.9 U	78.9 U	81.9 U	81.9 U	80.7 U	-	-	-	-	-	0.053
Pyridine	110-86-1	µg/Kg	SW8270C	81.0 U	81.2 U	81.0 U	-	-	78.3 U	77.3 U	79.5 U	79.9 U	78.9 U	81.9 U	81.9 U	80.7 U	-	-	-	-	-	-
Aniline	62-53-3	µg/Kg	SW8270C	81.0 U	81.2 U	81.0 U	-	-	78.3 U	77.3 U	79.5 U	79.9 U	78.9 U	81.9 U	81.9 U	80.7 U	-	-	-	-	-	-
Phenol	108-95-2	µg/Kg	SW8270C	81.0 U	81.2 U	81.0 U	-	-	78.3 U	**152 J**	79.5 U	79.9 U	78.9 U	81.9 U	81.9 U	80.7 U	420	---	1,200			68000
bis(2-Chloroethyl)ether	111-44-4	µg/Kg	SW8270C	81.0 U	81.2 U	81.0 U	-	-	78.3 U	77.3 U	79.5 U	79.9 U	78.9 U	81.9 U	81.9 U	80.7 U	-	-	-	-	-	2.2

Analyte	CAS#	Client Sample ID		D4ADS01-001.48-01	D4BGC07-14.4416.57-01	D4BGC06-11.8113.54-01	REF-2	REF-102	D4SD04-0.503-01	D4SD04-0.503-101	D4SD04-0304.25-02	D4SD04-4.2518.86-03	D5SD01-0002-01	D5SD01-0204-02	D4BDS01-001.31-01	D5SD01-0404.9-03	DMMP User's Manual/ Inland Testing Manual			NOAA SQuiRTs		2008 ADEC Method 2 Cleanup Levels for Migration to Groundwater
		ASL Lab Report ID		P3549	P3549	P3549	P3522	P3522	P3586	P3586	P3586	P3586	P3586	P3586	P3586	P3586						
		ASL Lab Sample ID		P354901	P354902	P354903	P352201	P352204	P358601	P358602	P358605	P358606	P358607	P358608	P358609	P358610						
		ALS Lab Report ID		K1512542	K1512542	K1512542	K1512414	K1512414	K1512773	K1512773	K1512773	K1512773	K1512773	K1512773	K1512773	K1512773						
		ALS Lab Sample ID		K1512542-001	K1512542-002	K1512542-003	K1512414-001	K1512414-002	K1512773-001	K1512773-002	K1512773-003	K1512773-004	K1512773-005	K1512773-006	K1512773-007	K1512773-008						
		Within 3 days of occurence of exceedance		11/2/2015 21:00	11/3/15 10:00	11/3/15 11:00	10/29/2015 15:18	10/29/2015 15:28	11/5/15 13:30	11/5/15 13:40	11/5/15 16:30	11/5/15 14:50	11/6/15 11:15	11/6/15 13:00	11/3/15 11:00	11/6/15 14:45						
		Matrix		Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil						
		Type		Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab						
			Analysis Method	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	SL	BT	ML	TEL	PEL	
VOC/BTEX																	(ug/kg)			(ug/kg)		(ug/kg)
2-Chlorophenol	95-57-8	µg/Kg	SW8270C	81.0 U	81.2 U	81.0 U	-	-	78.3 U	77.3 U	79.5 U	79.9 U	78.9 U	81.9 U	81.9 U	80.7 U	-	-	-	-	-	1500
1,3-Dichlorobenzene	541-73-1	µg/Kg	SW8270C	81.0 U	81.2 U	81.0 U	-	-	78.3 U	77.3 U	79.5 U	79.9 U	78.9 U	81.9 U	81.9 U	80.7 U	-	-	-	-	-	28000
1,4-Dichlorobenzene	106-46-7	µg/Kg	SW8270C	81.0 U	81.2 U	81.0 U	-	-	78.3 U	77.3 U	79.5 U	79.9 U	78.9 U	81.9 U	81.9 U	80.7 U	110	-	120	-	-	640
Benzyl alcohol	100-51-6	µg/Kg	SW8270C	81.0 U	81.2 U	81.0 U	-	-	78.3 U	77.3 U	79.5 U	79.9 U	78.9 U	81.9 U	81.9 U	80.7 U	57	-	870	-	-	-
1,2-Dichlorobenzene	95-50-1	µg/Kg	SW8270C	81.0 U	81.2 U	81.0 U	-	-	78.3 U	77.3 U	79.5 U	79.9 U	78.9 U	81.9 U	81.9 U	80.7 U	35	-	110	-	-	5100
2-Methylphenol	95-48-7	µg/Kg	SW8270C	81.0 U	81.2 U	81.0 U	-	-	78.3 U	77.3 U	79.5 U	79.9 U	78.9 U	81.9 U	81.9 U	80.7 U	63	-	77	-	-	15000
bis(2-Chloroisopropyl)ether	108-60-1	µg/Kg	SW8270C	81.0 U	81.2 U	81.0 U	-	-	78.3 U	77.3 U	79.5 U	79.9 U	78.9 U	81.9 U	81.9 U	80.7 U		-		-	-	-
3-,4-Methylphenol	108-39-4 106-44-5	µg/Kg	SW8270C	81.0 U	81.2 U	81.0 U	-	-	78.3 U	**124 J**	79.5 U	79.9 U	78.9 U	81.9 U	81.9 U	80.7 U	670	-	3,600	-	-	1500
N-Nitroso-di-n-propylamine	621-64-7	µg/Kg	SW8270C	81.0 U	81.2 U	81.0 U	-	-	78.3 U	77.3 U	79.5 U	79.9 U	78.9 U	81.9 U	81.9 U	80.7 U	-	-	-	-	-	1.1
Hexachloroethane	67-72-1	µg/Kg	SW8270C	81.0 U	81.2 U	81.0 U	-	-	78.3 U	77.3 U	79.5 U	79.9 U	78.9 U	81.9 U	81.9 U	80.7 U	-	-	-	-	-	210
Benzoic Acid	65-85-0	µg/Kg	SW8270C	122 U	122 U	121 U	-	-	117 U	116 U	119 U	120 U	118 U	123 U	123 U	**229 J**	650	-	760	-	-	410000
Nitrobenzene	98-95-3	µg/Kg	SW8270C	81.0 U	81.2 U	81.0 U	-	-	78.3 U	77.3 U	79.5 U	79.9 U	78.9 U	81.9 U	81.9 U	80.7 U	-	-	-	-	-	94
Isophorone	78-59-1	µg/Kg	SW8270C	81.0 U	81.2 U	81.0 U	-	-	78.3 U	77.3 U	79.5 U	79.9 U	78.9 U	81.9 U	81.9 U	80.7 U	-	-	-	-	-	3100
2-Nitrophenol	88-75-5	µg/Kg	SW8270C	81.0 U	81.2 U	81.0 U	-	-	78.3 U	77.3 U	79.5 U	79.9 U	78.9 U	81.9 U	81.9 U	80.7 U	-	-	-	-	-	-
2,4-Dimethylphenol	105-67-9	µg/Kg	SW8270C	81.0 U	81.2 U	81.0 U	-	-	78.3 U	77.3 U	79.5 U	79.9 U	78.9 U	81.9 U	81.9 U	80.7 U	29	-	210	-	-	8800
bis(2-Chloroethoxy)methane	111-91-1	µg/Kg	SW8270C	81.0 U	81.2 U	81.0 U	-	-	78.3 U	77.3 U	79.5 U	79.9 U	78.9 U	81.9 U	81.9 U	80.7 U	-	-	-	-	-	-
2,4-Dichlorophenol	120-83-2	µg/Kg	SW8270C	81.0 U	81.2 U	81.0 U	-	-	78.3 U	77.3 U	79.5 U	79.9 U	78.9 U	81.9 U	81.9 U	80.7 U	-	-	-	-	-	1300
1,2,4-Trichlorobenzene	120-82-1	µg/Kg	SW8270C	81.0 U	81.2 U	81.0 U	-	-	78.3 U	77.3 U	79.5 U	79.9 U	78.9 U	81.9 U	81.9 U	80.7 U	31	-	64	-	-	850
Naphthalene	91-20-3	µg/Kg	SW8270C	81.0 U	81.2 U	81.0 U	-	-	78.3 U	77.3 U	79.5 U	79.9 U	78.9 U	81.9 U	81.9 U	80.7 U	2,100	-	2,400	34.6	391	20000
4-Chloroaniline	106-47-8	µg/Kg	SW8270C	81.0 U	81.2 U	81.0 U	-	-	78.3 U	77.3 U	79.5 U	79.9 U	78.9 U	81.9 U	81.9 U	80.7 U	-	-	-	-	-	57
Hexachlorobutadiene	87-68-3	µg/Kg	SW8270C	81.0 U	81.2 U	81.0 U	-	-	78.3 U	77.3 U	79.5 U	79.9 U	78.9 U	81.9 U	81.9 U	80.7 U	11	-	270	-	-	120
4-Chloro-3-methyl phenol	59-50-7	µg/Kg	SW8270C	81.0 U	81.2 U	81.0 U	-	-	78.3 U	77.3 U	79.5 U	79.9 U	78.9 U	81.9 U	81.9 U	80.7 U	-	-	-	-	-	-

Analyte	CAS#	Client Sample ID		D4ADS01-001.48-01	D4BGC07-14.4416.57-01	D4BGC06-11.8113.54-01	REF-2	REF-102	D4SD04-0.503-01	D4SD04-0.503-101	D4SD04-0304.25-02	D4SD04-4.2518.86-03	D5SD01-0002-01	D5SD01-0204-02	D4BDS01-001.31-01	D5SD01-0404.9-03	DMMP User's Manual/ Inland Testing Manual			NOAA SQuiRTs		2008 ADEC Method 2 Cleanup Levels for Migration to Groundwater
		ASL Lab Report ID		P3549	P3549	P3549	P3522	P3522	P3586	P3586	P3586	P3586	P3586	P3586	P3586	P3586						
		ASL Lab Sample ID		P354901	P354902	P354903	P352201	P352204	P358601	P358602	P358605	P358606	P358607	P358608	P358609	P358610						
		ALS Lab Report ID		K1512542	K1512542	K1512542	K1512414	K1512414	K1512773	K1512773	K1512773	K1512773	K1512773	K1512773	K1512773	K1512773						
		ALS Lab Sample ID		K1512542-001	K1512542-002	K1512542-003	K1512414-001	K1512414-002	K1512773-001	K1512773-002	K1512773-003	K1512773-004	K1512773-005	K1512773-006	K1512773-007	K1512773-008						
		Within 3 days of occurence of exceedance		11/2/2015 21:00	11/3/15 10:00	11/3/15 11:00	10/29/2015 15:18	10/29/2015 15:28	11/5/15 13:30	11/5/15 13:40	11/5/15 16:30	11/5/15 14:50	11/6/15 11:15	11/6/15 13:00	11/3/15 11:00	11/6/15 14:45						
		Matrix		Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil						
		Type		Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab						
			Analysis Method	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	SL	BT	ML	TEL	PEL	
VOC/BTEX																	(ug/kg)			(ug/kg)		(ug/kg)
2-Methylnaphthalene	91-57-6	µg/Kg	SW8270C	81.0 U	81.2 U	81.0 U	-	-	78.3 U	77.3 U	79.5 U	79.9 U	78.9 U	81.9 U	81.9 U	80.7 U	670	-	1,900	20.2	201	6100
Hexachlorocyclopentadiene	77-47-4	µg/Kg	SW8270C	81.0 U	81.2 U	81.0 U	-	-	78.3 U	77.3 U	79.5 U	79.9 U	78.9 U	81.9 U	81.9 U	80.7 U	-	-	-	-	-	1300
2,4,6-Trichlorophenol	88-06-2	µg/Kg	SW8270C	81.0 U	81.2 U	81.0 U	-	-	78.3 U	77.3 U	79.5 U	79.9 U	78.9 U	81.9 U	81.9 U	80.7 U	-	-	-	-	-	1400
2,4,5-Trichlorophenol	95-95-4	µg/Kg	SW8270C	81.0 U	81.2 U	81.0 U	-	-	78.3 U	77.3 U	79.5 U	79.9 U	78.9 U	81.9 U	81.9 U	80.7 U	-	-	-	-	-	67000
2-Chloronaphthalene	91-58-7	µg/Kg	SW8270C	81.0 U	81.2 U	81.0 U	-	-	78.3 U	77.3 U	79.5 U	79.9 U	78.9 U	81.9 U	81.9 U	80.7 U	-	-	-	-	-	120000
2-Nitroaniline	88-74-4	µg/Kg	SW8270C	81.0 U	81.2 U	81.0 U	-	-	78.3 U	77.3 U	79.5 U	79.9 U	78.9 U	81.9 U	81.9 U	80.7 U	-	-	-	-	-	-
Dimethylphthalate	131-11-3	µg/Kg	SW8270C	81.0 U	81.2 U	81.0 U	-	-	78.3 U	77.3 U	79.5 U	79.9 U	78.9 U	81.9 U	81.9 U	80.7 U	71	-	1,400	-	-	1100000
Acenaphthylene	208-96-8	µg/Kg	SW8270C	81.0 U	81.2 U	81.0 U	-	-	78.3 U	77.3 U	79.5 U	79.9 U	78.9 U	81.9 U	81.9 U	80.7 U	560	-	1,300	5.87	128	180000
2,6-Dinitrotoluene	606-20-2	µg/Kg	SW8270C	81.0 U	81.2 U	81.0 U	-	-	78.3 U	77.3 U	79.5 U	79.9 U	78.9 U	81.9 U	81.9 U	80.7 U	-	-	-	-	-	9.4
Acenaphthene	83-32-9	µg/Kg	SW8270C	81.0 U	81.2 U	81.0 U	-	-	78.3 U	77.3 U	79.5 U	79.9 U	78.9 U	81.9 U	81.9 U	80.7 U	500	-	2,000	-	-	180000
2,4-Dinitrophenol	51-28-5	µg/Kg	SW8270C	81.0 U	81.2 U	81.0 U	-	-	78.3 U	77.3 U	79.5 U	79.9 U	78.9 U	81.9 U	81.9 U	80.7 U	-	-	-	-	-	540
4-Nitrophenol	100-02-7	µg/Kg	SW8270C	81.0 U	81.2 U	81.0 U	-	-	78.3 U	77.3 U	79.5 U	79.9 U	78.9 U	81.9 U	81.9 U	80.7 U	-	-	-	-	-	-
2,4-Dinitrotoluene	121-14-2	µg/Kg	SW8270C	81.0 U	81.2 U	81.0 U	-	-	78.3 U	77.3 U	79.5 U	79.9 U	78.9 U	81.9 U	81.9 U	80.7 U	-	-	-	-	-	9.3
Dibenzofuran	132-64-9	µg/Kg	SW8270C	81.0 U	81.2 U	81.0 U	-	-	78.3 U	77.3 U	79.5 U	79.9 U	78.9 U	81.9 U	81.9 U	80.7 U	540	-	1,700	-	-	11000
Diethylphthalate	84-66-2	µg/Kg	SW8270C	81.0 U	81.2 U	81.0 U	-	-	78.3 U	77.3 U	79.5 U	79.9 U	78.9 U	81.9 U	81.9 U	80.7 U	200	-	1,200	-	-	130000
3-Nitroaniline	99-09-2	µg/Kg	SW8270C	81.0 U	81.2 U	81.0 U	-	-	78.3 U	77.3 U	79.5 U	79.9 U	78.9 U	81.9 U	81.9 U	80.7 U	-	-	-	-	-	-
Fluorene	86-73-7	µg/Kg	SW8270C	81.0 U	81.2 U	81.0 U	-	-	78.3 U	77.3 U	79.5 U	79.9 U	78.9 U	81.9 U	81.9 U	80.7 U	540	-	3,600	21.2	144	220000
4-Chlorophenyl phenyl ether	7005-72-3	µg/Kg	SW8270C	81.0 U	81.2 U	81.0 U	-	-	78.3 U	77.3 U	79.5 U	79.9 U	78.9 U	81.9 U	81.9 U	80.7 U	-	-	-	-	-	-
4-Nitroaniline	100-01-6	µg/Kg	SW8270C	81.0 U	81.2 U	81.0 U	-	-	78.3 U	77.3 U	79.5 U	79.9 U	78.9 U	81.9 U	81.9 U	80.7 U	-	-	-	-	-	-
4,6-Dinitro-2-methyl phenol	534-52-1	µg/Kg	SW8270C	81.0 U	81.2 U	81.0 U	-	-	78.3 U	77.3 U	79.5 U	79.9 U	78.9 U	81.9 U	81.9 U	80.7 U	-	-	-	-	-	-

Analyte	CAS#	Client Sample ID		D4ADS01-001.48-01	D4BGC07-14.4416.57-01	D4BGC06-11.8113.54-01	REF-2	REF-102	D4SD04-0.503-01	D4SD04-0.503-101	D4SD04-0304.25-02	D4SD04-4.2518.86-03	D5SD01-0002-01	D5SD01-0204-02	D4BDS01-001.31-01	D5SD01-0404.9-03	DMMP User's Manual/ Inland Testing Manual			NOAA SQuiRTs		2008 ADEC Method 2 Cleanup Levels for Migration to Groundwater
		ASL Lab Report ID		P3549	P3549	P3549	P3522	P3522	P3586	P3586	P3586	P3586	P3586	P3586	P3586	P3586						
		ASL Lab Sample ID		P354901	P354902	P354903	P352201	P352204	P358601	P358602	P358605	P358606	P358607	P358608	P358609	P358610						
		ALS Lab Report ID		K1512542	K1512542	K1512542	K1512414	K1512414	K1512773	K1512773	K1512773	K1512773	K1512773	K1512773	K1512773	K1512773						
		ALS Lab Sample ID		K1512542-001	K1512542-002	K1512542-003	K1512414-001	K1512414-002	K1512773-001	K1512773-002	K1512773-003	K1512773-004	K1512773-005	K1512773-006	K1512773-007	K1512773-008						
		Within 3 days of occurence of exceedance		11/2/2015 21:00	11/3/15 10:00	11/3/15 11:00	10/29/2015 15:18	10/29/2015 15:28	11/5/15 13:30	11/5/15 13:40	11/5/15 16:30	11/5/15 14:50	11/6/15 11:15	11/6/15 13:00	11/3/15 11:00	11/6/15 14:45						
		Matrix		Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil						
		Type		Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab						
			Analysis Method	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	SL	BT	ML	TEL	PEL	
VOC/BTEX																	(ug/kg)			(ug/kg)		(ug/kg)
N-Nitrosodiphenylamine	86-30-6	µg/Kg	SW8270C	81.0 U	81.2 U	81.0 U	-	-	78.3 U	77.3 U	79.5 U	79.9 U	78.9 U	81.9 U	81.9 U	80.7 U	28	-	130	-	-	15000
1,2-Diphenylhydrazine	122-66-7	µg/Kg	SW8270C	81.0 U	81.2 U	81.0 U	-	-	78.3 U	77.3 U	79.5 U	79.9 U	78.9 U	81.9 U	81.9 U	80.7 U	-	-	-	-	-	-
4-Bromophenyl phenyl ether	101-55-3	µg/Kg	SW8270C	81.0 U	81.2 U	81.0 U	-	-	78.3 U	77.3 U	79.5 U	79.9 U	78.9 U	81.9 U	81.9 U	80.7 U	-	-	-	-	-	-
Hexachlorobenzene	118-74-1	µg/Kg	SW8270C	81.0 U	81.2 U	81.0 U	-	-	78.3 U	77.3 U	79.5 U	79.9 U	78.9 U	81.9 U	81.9 U	80.7 U	22	168	230	-	-	47
Pentachlorophenol	87-86-5	µg/Kg	SW8270C	81.0 U	81.2 U	81.0 U	-	-	78.3 U	77.3 U	79.5 U	79.9 U	78.9 U	81.9 U	81.9 U	80.7 U	400	504	690	-	-	47
Phenanthrene	85-01-8	µg/Kg	SW8270C	81.0 U	81.2 U	81.0 U	-	-	78.3 U	77.3 U	79.5 U	79.9 U	78.9 U	81.9 U	81.9 U	80.7 U	1,500	-	21,000	86.7	544	3000000
Anthracene	120-12-7	µg/Kg	SW8270C	81.0 U	81.2 U	81.0 U	-	-	78.3 U	77.3 U	79.5 U	79.9 U	78.9 U	81.9 U	81.9 U	80.7 U	960	-	13,000	46.9	245	3000000
Carbazole	86-74-8	µg/Kg	SW8270C	81.0 U	81.2 U	81.0 U	-	-	78.3 U	77.3 U	79.5 U	79.9 U	78.9 U	81.9 U	81.9 U	80.7 U	-	-	-	-	-	6500
Di-n-butylphthalate	84-74-2	µg/Kg	SW8270C	81.0 U	81.2 U	81.0 U	-	-	78.3 U	77.3 U	79.5 U	79.9 U	78.9 U	81.9 U	81.9 U	80.7 U	1,400	-	5,100	-	-	80000
Fluoranthene	206-44-0	µg/Kg	SW8270C	81.0 U	81.2 U	81.0 U	-	-	78.3 U	77.3 U	79.5 U	79.9 U	78.9 U	81.9 U	81.9 U	80.7 U	1,700	4,600	30,000	113	1494	1400000
Pyrene	129-00-0	µg/Kg	SW8270C	81.0 U	81.2 U	81.0 U	-	-	78.3 U	77.3 U	79.5 U	79.9 U	78.9 U	81.9 U	81.9 U	80.7 U	2,600	11,980	16,000	153	1,398	1000000
Butylbenzylphthalate	85-68-7	µg/Kg	SW8270C	81.0 U	81.2 U	81.0 U	-	-	78.3 U	77.3 U	79.5 U	79.9 U	78.9 U	81.9 U	81.9 U	80.7 U	63	-	970	-	-	920000
Benzo(a)anthracene	56-55-3	µg/Kg	SW8270C	81.0 U	81.2 U	81.0 U	-	-	78.3 U	77.3 U	79.5 U	79.9 U	78.9 U	81.9 U	81.9 U	80.7 U	1,300	-	5,100	74.8	693	3600
3,3'-Dichlorobenzidine	91-94-1	µg/Kg	SW8270C	81.0 U	81.2 U	81.0 U	-	-	78.3 U	77.3 U	79.5 U	79.9 U	78.9 U	81.9 U	81.9 U	80.7 U	-	-	-	-	-	190
Chrysene	218-01-9	µg/Kg	SW8270C	81.0 U	81.2 U	81.0 U	-	-	78.3 U	77.3 U	79.5 U	79.9 U	78.9 U	81.9 U	81.9 U	80.7 U	1,400	-	21,000	108	846	360000
bis(2-Ethylhexyl)phthalate	117-81-7	µg/Kg	SW8270C	81.0 U	81.2 U	81.0 U	-	-	78.3 U	77.3 U	79.5 U	79.9 U	78.9 U	81.9 U	81.9 U	80.7 U	1,300	-	8,300	182	2,647	13000
Di-n-octylphthalate	117-84-0	µg/Kg	SW8270C	81.0 U	81.2 U	81.0 U	-	-	78.3 U	77.3 U	79.5 U	79.9 U	78.9 U	81.9 U	81.9 U	80.7 U	6,200	-	6,200	-	-	3800000
Benzo(b)fluoroanthene	205-99-2	µg/Kg	SW8270C	81.0 U	81.2 U	81.0 U	-	-	78.3 U	77.3 U	79.5 U	79.9 U	78.9 U	81.9 U	81.9 U	80.7 U	-	-	-	-	-	12000

Analyte	CAS#	Client Sample ID		D4ADS01-001.48-01	D4BGC07-14.4416.57-01	D4BGC06-11.8113.54-01	REF-2	REF-102	D4SD04-0.503-01	D4SD04-0.503-101	D4SD04-0304.25-02	D4SD04-4.2518.86-03	D5SD01-0002-01	D5SD01-0204-02	D4BDS01-001.31-01	D5SD01-0404.9-03	DMMP User's Manual/ Inland Testing Manual			NOAA SQuiRTs		2008 ADEC Method 2 Cleanup Levels for Migration to Groundwater
		ASL Lab Report ID		P3549	P3549	P3549	P3522	P3522	P3586	P3586	P3586	P3586	P3586	P3586	P3586	P3586						
		ASL Lab Sample ID		P354901	P354902	P354903	P352201	P352204	P358601	P358602	P358605	P358606	P358607	P358608	P358609	P358610						
		ALS Lab Report ID		K1512542	K1512542	K1512542	K1512414	K1512414	K1512773	K1512773	K1512773	K1512773	K1512773	K1512773	K1512773	K1512773						
		ALS Lab Sample ID		K1512542-001	K1512542-002	K1512542-003	K1512414-001	K1512414-002	K1512773-001	K1512773-002	K1512773-003	K1512773-004	K1512773-005	K1512773-006	K1512773-007	K1512773-008						
		Within 3 days of occurence of exceedance		11/2/2015 21:00	11/3/15 10:00	11/3/15 11:00	10/29/2015 15:18	10/29/2015 15:28	11/5/15 13:30	11/5/15 13:40	11/5/15 16:30	11/5/15 14:50	11/6/15 11:15	11/6/15 13:00	11/3/15 11:00	11/6/15 14:45						
		Matrix		Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil						
		Type		Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab						
			Analysis Method	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	SL	BT	ML	TEL	PEL	
VOC/BTEX																	(ug/kg)			(ug/kg)		(ug/kg)
Benzo(k)fluoranthene	207-08-9	µg/Kg	SW8270C	81.0 U	81.2 U	81.0 U	-	-	78.3 U	77.3 U	79.5 U	79.9 U	78.9 U	81.9 U	81.9 U	80.7 U	-	-	-	-	-	120000
Benzo(a)pyrene	50-32-8	µg/Kg	SW8270C	81.0 U	81.2 U	81.0 U	-	-	78.3 U	77.3 U	79.5 U	79.9 U	78.9 U	81.9 U	81.9 U	80.7 U	1,600	-	3,600	88.8	763	2100
Indeno(1,2,3-c,d)pyrene	193-39-5	µg/Kg	SW8270C	81.0 U	81.2 U	81.0 U	-	-	78.3 U	77.3 U	79.5 U	79.9 U	78.9 U	81.9 U	81.9 U	80.7 U	-	-	-	-	-	41000
Dibenzo(a,h)anthracene	53-70-3	µg/Kg	SW8270C	81.0 U	81.2 U	81.0 U	-	-	78.3 U	77.3 U	79.5 U	79.9 U	78.9 U	81.9 U	81.9 U	80.7 U	230	-	1,900	6.22	135	4000
Benzo(g,h,i)perylene	191-24-2	µg/Kg	SW8270C	81.0 U	81.2 U	81.0 U	-	-	78.3 U	77.3 U	79.5 U	79.9 U	78.9 U	81.9 U	81.9 U	80.7 U	-	-	-	-	-	38700000
Petroleum Hydrocarbons (mg/Kg)																	**(mg/kg)**			**(mg/kg)**		**(mg/kg)**
TPH-Gasoline	TPH-Gasoline	mg/Kg	AK101	0.69 U	0.74 U	-	0.48 U	0.53 U	**2.66**	**1.70 J**	0.74 U	0.62 U	0.64 U	0.69 U	0.90 U	0.81 U	-	-	-	-	-	300
TPH-Diesel	TPH-Diesel	mg/Kg	AK102/103	**5.68 J**	**6.63 J**	**6.33 J**	4.62 U	4.76 U	**7.86 J**	**7.44 J**	**5.88 J**	**12.8**	**6.81 J**	**7.05 J**	**8.53 J**	**14.2**	-	-	-	-	-	250
TPH-Oil	TPH-Oil	mg/Kg	AK102/103	**21.2**	**26.1**	**14.7**	**7.68 J**	**10.5 J**	**29.8**	**32.3**	**28.2**	**61.2**	**33.4**	**34.9**	**37.1**	**68.9**	-	-	-	-	-	11000
PCBs																	**(ug/kg)**			**(ug/kg)**		**(ug/kg)**
Aroclor-1016	12674-11-2	µg/Kg	SW8082	6.06 U	6.10 U	6.09 U	-	-	6.08 U	5.90 U	5.92 U	6.15 U	5.74 U	6.47 U	6.31 U	6.26 U	-	-	-	-	-	1000
Aroclor-1260	11096-82-5	µg/Kg	SW8082	6.06 U	6.10 U	6.09 U	-	-	6.08 U	5.90 U	5.92 U	6.15 U	5.74 U	6.47 U	6.31 U	6.26 U	-	-	-	-	-	1000
Aroclor-1221	11104-28-2	µg/Kg	SW8082	12.1 U	12.2 U	12.2 U	-	-	12.2 U	11.8 U	11.8 U	12.3 U	11.5 U	12.9 U	12.6 U	12.5 U	-	-	-	-	-	1000
Aroclor-1232	11141-16-5	µg/Kg	SW8082	6.06 U	6.10 U	6.09 U	-	-	6.08 U	5.90 U	5.92 U	6.15 U	5.74 U	6.47 U	6.31 U	6.26 U	-	-	-	-	-	1000
Aroclor-1242	53469-21-9	µg/Kg	SW8082	6.06 U	6.10 U	6.09 U	-	-	6.08 U	5.90 U	5.92 U	6.15 U	5.74 U	6.47 U	6.31 U	6.26 U	-	-	-	-	-	1000
Aroclor-1248	12672-29-6	µg/Kg	SW8082	6.06 U	6.10 U	6.09 U	-	-	6.08 U	5.90 U	5.92 U	6.15 U	5.74 U	6.47 U	6.31 U	6.26 U	-	-	-	-	-	1000
Aroclor-1254	11097-69-1	µg/Kg	SW8082	6.06 U	6.10 U	6.09 U	-	-	6.08 U	5.90 U	5.92 U	6.15 U	5.74 U	6.47 U	6.31 U	6.26 U	-	-	-	63.3	709	1000
Total PCBs (Aroclors)		µg/Kg	SW8083	48.4 U	48.8 U	48.7 U	-	-	48.6 U	47.2 U	47.3 U	49.2 U	45.9 U	51.7 U	50.5 U	50.0 U	130	38	3,100	21.6	189	1000
Organochlorine Pesticides																	**(ug/kg)**			**(ug/kg)**		**(ug/kg)**
alpha-BHC	319-84-6	µg/Kg	8081B	0.35 U	0.35 U	0.35 U	-	-	0.35 U	0.35 U	0.35 U	0.35 U	0.35 U	0.35 U	0.35 U	0.35 U	-	-	-	-	-	6.4

Analyte	CAS#	Client Sample ID		D4ADS01-001.48-01	D4BGC07-14.4416.57-01	D4BGC06-11.8113.54-01	REF-2	REF-102	D4SD04-0.503-01	D4SD04-0.503-101	D4SD04-0304.25-02	D4SD04-4.2518.86-03	D5SD01-0002-01	D5SD01-0204-02	D4BDS01-001.31-01	D5SD01-0404.9-03	DMMP User's Manual/ Inland Testing Manual			NOAA SQuiRTs		2008 ADEC Method 2 Cleanup Levels for Migration to Groundwater
		ASL Lab Report ID		P3549	P3549	P3549	P3522	P3522	P3586	P3586	P3586	P3586	P3586	P3586	P3586	P3586						
		ASL Lab Sample ID		P354901	P354902	P354903	P352201	P352204	P358601	P358602	P358605	P358606	P358607	P358608	P358609	P358610						
		ALS Lab Report ID		K1512542	K1512542	K1512542	K1512414	K1512414	K1512773	K1512773	K1512773	K1512773	K1512773	K1512773	K1512773	K1512773						
		ALS Lab Sample ID		K1512542-001	K1512542-002	K1512542-003	K1512414-001	K1512414-002	K1512773-001	K1512773-002	K1512773-003	K1512773-004	K1512773-005	K1512773-006	K1512773-007	K1512773-008						
		Within 3 days of occurence of exceedance		11/2/2015 21:00	11/3/15 10:00	11/3/15 11:00	10/29/2015 15:18	10/29/2015 15:28	11/5/15 13:30	11/5/15 13:40	11/5/15 16:30	11/5/15 14:50	11/6/15 11:15	11/6/15 13:00	11/3/15 11:00	11/6/15 14:45						
		Matrix		Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil						
		Type		Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab						
			Analysis Method	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	SL	BT	ML	TEL	PEL	
VOC/BTEX																	(ug/kg)			(ug/kg)		(ug/kg)
beta-BHC	319-85-7	µg/Kg	8081B	0.50 U	0.50 U	0.50 U	-	-	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	-	-	-	-	-	22
gamma-BHC (Lindane)	58-89-9	µg/Kg	8081B	0.45 U	0.45 U	0.45 U	-	-	0.45 U	0.45 U	0.45 U	0.45 U	0.45 U	0.45 U	0.45 U	0.45 U	-	-	-	0.32	0.99	9.5
delta-BHC	319-86-8	µg/Kg	8081B	0.37 U	0.37 U	0.37 U	-	-	0.37 U	0.37 U	0.37 U	0.37 U	0.37 U	0.37 U	0.37 U	0.37 U	-	-	-	-	-	-
Heptachlor	76-44-8	µg/Kg	8081B	0.83 U	0.83 U	0.83 U	-	-	0.83 U	0.83 U	0.83 U	0.83 U	0.83 U	0.83 U	0.83 U	0.83 U	1.5	-	270	-	-	280
Aldrin	309-00-2	µg/Kg	8081B	0.34 U	0.34 U	0.34 U	-	-	0.34 U	0.34 U	0.34 U	0.34 U	0.34 U	0.34 U	0.34 U	0.34 U	9.5	-	-	-	-	70
Heptachlor Epoxide	1024-57-3	µg/Kg	8081B	0.39 U	0.39 U	0.39 U	-	-	0.39 U	0.39 U	0.39 U	0.39 U	0.39 U	0.39 U	0.39 U	0.39 U	-	-	-	-	2.74	14
gamma-Chlordane	5103-74-2	µg/Kg	8081B	0.60 U	0.60 U	0.60 U	-	-	0.60 U	0.60 U	0.60 U	0.60 U	0.60 U	0.60 U	0.60 U	0.60 U	-	-	-	-	-	2300
Endosulfan	115-29-7	µg/Kg	8081B	1.7 U	1.7 U	1.7 U	-	-	1.7 U	1.7 U	1.7 U	1.7 U	1.7 U	1.7 U	1.7 U	1.7 U	-	-	-	-	-	64000
alpha-Chlordane	5103-71-9	µg/Kg	8081B	1.2 U	1.2 U	1.2 U	-	-	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	-	-	-	-	-	2300
Dieldrin	60-57-1	µg/Kg	8081B	0.48 U	0.48 U	0.48 U	-	-	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	1.9	-	1,700	0.72	4.3	7.6
4,4'-DDE	72-55-9	µg/Kg	8081B	1.6 U	1.6 U	1.6 U	-	-	1.6 U	1.6 U	1.6 U	1.6 U	1.6 U	1.6 U	1.6 U	1.6 U	9	-	-	2.07	374	5100
Endrin	72-20-8	µg/Kg	8081B	0.45 U	0.45 U	0.45 U		-	0.45 U	0.45 U	0.45 U	0.45 U	0.45 U	0.45 U	0.45 U	0.45 U	-	-	-	-	-	290
Endosulfan II	33213-65-9	µg/Kg	8081B	0.86 U	0.86 U	0.86 U	-	-	0.86 U	0.86 U	0.86 U	0.86 U	0.86 U	0.86 U	0.86 U	0.86 U	-	-	-	-	-	-
4,4'-DDD	72-54-8	µg/Kg	8081B	1.0 U	1.0 U	1.0 U	-	-	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	16	-	-	1.22	7.81	7200
Endrin Aldehyde	7421-93-4	µg/Kg	8081B	1.4 U	1.4 U	1.4 U	-	-	1.4 U	1.4 U	1.4 U	1.4 U	1.4 U	1.4 U	1.4 U	1.4 U	-	-	-	-	-	-
Endosulfan Sulfate	1031-07-8	µg/Kg	8081B	0.57 U	0.57 U	0.57 U	-	-	0.57 U	0.57 U	0.57 U	0.57 U	0.57 U	0.57 U	0.57 U	0.57 U	-	-	-	-	-	-
4,4'-DDT	50-29-3	µg/Kg	8081B	0.85 U	0.85 U	0.85 U	-	-	0.85 U	0.85 U	0.85 U	0.85 U	0.85 U	0.85 U	0.85 U	0.85 U	12	-	-	1.19	4.77	7300
Endrin Ketone	53494-70-5	µg/Kg	8081B	0.55 U	0.55 U	0.55 U	-	-	0.55 U	0.55 U	0.55 U	0.55 U	0.55 U	0.55 U	0.55 U	0.55 U	-	-	-	-	-	-
Methoxychlor	72-43-5	µg/Kg	8081B	0.61 U	0.61 U	0.61 U	-	-	0.61 U	0.61 U	0.61 U	0.61 U	0.61 U	0.61 U	0.61 U	0.61 U	-	-	-	-	-	23000
Toxaphene	8001-35-2	µg/Kg	8081B	37 U	37 U	37 U	-	-	37 U	37 U	37 U	37 U	37 U	37 U	37 U	37 U	-	-	-	-	-	3900
Total DDD/DDE/DDT	72-55-9 72-54-8 50-29-3	µg/Kg	8081B	3.45 U	3.45 U	3.45 U	-	-	3.45 U	3.45 U	3.45 U	3.45 U	3.45 U	3.45 U	3.45 U	3.45 U	-	50	69	3.89	51.7	-

Analyte	CAS#	Client Sample ID		D4ADS01-001.48-01	D4BGC07-14.4416.57-01	D4BGC06-11.8113.54-01	REF-2	REF-102	D4SD04-0.503-01	D4SD04-0.503-101	D4SD04-0304.25-02	D4SD04-4.2518.86-03	D5SD01-0002-01	D5SD01-0204-02	D4BDS01-001.31-01	D5SD01-0404.9-03	DMMP User's Manual/ Inland Testing Manual			NOAA SQuiRTs		2008 ADEC Method 2 Cleanup Levels for Migration to Groundwater
		ASL Lab Report ID		P3549	P3549	P3549	P3522	P3522	P3586	P3586	P3586	P3586	P3586	P3586	P3586	P3586						
		ASL Lab Sample ID		P354901	P354902	P354903	P352201	P352204	P358601	P358602	P358605	P358606	P358607	P358608	P358609	P358610						
		ALS Lab Report ID		K1512542	K1512542	K1512542	K1512414	K1512414	K1512773	K1512773	K1512773	K1512773	K1512773	K1512773	K1512773	K1512773						
		ALS Lab Sample ID		K1512542-001	K1512542-002	K1512542-003	K1512414-001	K1512414-002	K1512773-001	K1512773-002	K1512773-003	K1512773-004	K1512773-005	K1512773-006	K1512773-007	K1512773-008						
		Within 3 days of occurence of exceedance		11/2/2015 21:00	11/3/15 10:00	11/3/15 11:00	10/29/2015 15:18	10/29/2015 15:28	11/5/15 13:30	11/5/15 13:40	11/5/15 16:30	11/5/15 14:50	11/6/15 11:15	11/6/15 13:00	11/3/15 11:00	11/6/15 14:45						
		Matrix		Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil						
		Type		Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab						
			Analysis Method	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	SL	BT	ML	TEL	PEL	
VOC/BTEX																	(ug/kg)			(ug/kg)		(ug/kg)
Total Chlordane	5103-71-95103-74-25103-73-139765-80-527304-13-8	µg/Kg	8081B	1.80 U	1.80 U	1.80 U	-	-	1.80 U	1.80 U	1.80 U	1.80 U	1.80 U	1.80 U	1.80 U	1.80 U	2.8	37	-	2.26	4.79	-
Butyltins (mg/Kg)																	**(ug/kg)**			**(ug/kg)**		**(ug/kg)**
Tri-n-butyltin Cation	36643-28-4	mg/Kg		-	-	-	-	-	0.51 U	0.50 U	0.52 U	0.52 U	0.51 U	0.53 U	0.53 U	0.53 U	-	73	-	-	-	5500000
Metals (mg/Kg)																	**(mg/kg)**			**(mg/kg)**		**(mg/kg)**
Antimony	7440-36-0	mg/Kg	SW6010B	0.41 U	0.46 U	**0.78 J**	**1.40 J**	**1.19 J**	**1.43 J**	**1.02 J**	**1.08 J**	**2.91**	**2.00 J**	**4.01**	**0.75 J**	**4.26**	150	-	200	-	-	3.6
Arsenic	7440-38-2	mg/Kg	SW6010B	**4.15**	**21.5**	**8.12**	**3.84**	**5.37**	**5.52**	**6.76**	**6.78**	**17.8**	**8.41**	**14.9**	**9.64**	**27.1**	57	507.1	700	-	42	3.9
Barium	7440-39-3	mg/Kg	SW6010B	**38.0**	**127**	**43.3**	**37.7**	**32.9**	**40.1**	**44.6**	**50.4**	**87.4**	**40.2**	**43.6**	**32.2**	**118**	-	-	-	130	-	1100
Beryllium	7440-41-7	mg/Kg	SW6010B	**1.41**	**3.63**	**1.42**	**1.42**	**1.33**	**1.28**	**1.26**	**1.36**	**2.79**	**1.56**	**2.37**	**1.58**	**3.70**	-	-	-	-	-	42
Cadmium	7440-43-9	mg/Kg	SW6010B	0.081 U	0.093 U	0.069 U	0.075 U	0.089 U	0.099 U	0.063 U	0.080 U	**0.84**	0.082 U	0.083 U	0.11 U	**0.31 J**	5.1	11.3	14	0.68	4.21	5
Chromium	7440-47-3	mg/Kg	SW6010B	**13.3**	**41.0**	**14.7**	**12.8**	**11.6**	**14.0**	**14.4**	**15.1**	**31.6**	**14.9**	**17.0**	**13.9**	**39.2**	260	260	-	52	160	25
Copper	7440-50-8	mg/Kg	SW6010B	**7.89**	**42.0**	**10.0**	**8.75**	**7.38**	**11.6**	**13.8**	**12.4**	**30.1**	**9.16**	**12.4**	**7.42**	**37.0**	390	1,027	1,300	18.7	108	460
Lead	7439-92-1	mg/Kg	SW6010B	**1.81**	**9.67**	**3.30**	**3.28**	**1.82**	**2.57**	**1.80**	**1.95**	**9.14**	**3.02**	**4.09**	**2.47**	**11.7**	450	975	1,200	30	112	400
Mercury	7439-97-6	mg/Kg	SW7471A	**0.012 J**	**0.07**	**0.013 J**	0.010 U	0.0098 U	**0.023**	**0.016 J**	**0.020 J**	**0.042**	**0.026**	**0.023**	**0.013 J**	**0.072**	0.41	1.5	2.3	0.13	0.70	1.4
Nickel	7440-02-0	mg/Kg	SW6010B	**14.0**	**41.4**	**15.5**	**13.2**	**12.4**	**15.1**	**16.0**	**16.6**	**32.5**	**14.9**	**17.1**	**13.9**	**36.7**	-	-	-	15.9	43	86
Selenium	7782-49-2	mg/Kg	SW6010B	1.63 U	1.86 U	1.38 U	1.50 U	1.78 U	**2.57 J**	**3.97**	**4.40**	**3.69**	**1.72 J**	**3.56 J**	2.20 U	**3.62 J**	-	3	-	-	-	3.4
Silver	7440-22-4	mg/Kg	SW6010B	0.20 U	**0.84 J**	0.17 U	0.19 U	0.22 U	0.25 U	0.16 U	0.20 U	**2.09**	**1.43**	**2.39**	**1.47**	**3.24**	6.1	6.1	8.4	0.73	1.77	11.2
Thallium	7440-28-0	mg/Kg	SW6010B	0.41 U	0.46 U	0.34 U	0.37 U	0.45 U	0.50 U	0.31 U	0.40 U	0.29 U	0.41 U	0.41 U	0.55 U	0.46 U	-	-	-	-	-	1.9
Vanadium	7440-62-2	mg/Kg	SW6010B	**26.3**	**56.3**	**25.0**	**29.2**	**28.2**	**27.3**	**28.1**	**28.6**	**47.6**	**29.5**	**35.1**	**28.8**	**58.5**	-	-	-	-	-	3400

Analyte	CAS#	Client Sample ID		D4ADS01-001.48-01	D4BGC07-14.4416.57-01	D4BGC06-11.8113.54-01	REF-2	REF-102	D4SD04-0.503-01	D4SD04-0.503-101	D4SD04-0304.25-02	D4SD04-4.2518.86-03	D5SD01-0002-01	D5SD01-0204-02	D4BDS01-001.31-01	D5SD01-0404.9-03	DMMP User's Manual/ Inland Testing Manual			NOAA SQuiRTs		2008 ADEC Method 2 Cleanup Levels for Migration to Groundwater
		ASL Lab Report ID		P3549	P3549	P3549	P3522	P3522	P3586	P3586	P3586	P3586	P3586	P3586	P3586	P3586						
		ASL Lab Sample ID		P354901	P354902	P354903	P352201	P352204	P358601	P358602	P358605	P358606	P358607	P358608	P358609	P358610						
		ALS Lab Report ID		K1512542	K1512542	K1512542	K1512414	K1512414	K1512773	K1512773	K1512773	K1512773	K1512773	K1512773	K1512773	K1512773						
		ALS Lab Sample ID		K1512542-001	K1512542-002	K1512542-003	K1512414-001	K1512414-002	K1512773-001	K1512773-002	K1512773-003	K1512773-004	K1512773-005	K1512773-006	K1512773-007	K1512773-008						
		Within 3 days of occurence of exceedance		11/2/2015 21:00	11/3/15 10:00	11/3/15 11:00	10/29/2015 15:18	10/29/2015 15:28	11/5/15 13:30	11/5/15 13:40	11/5/15 16:30	11/5/15 14:50	11/6/15 11:15	11/6/15 13:00	11/3/15 11:00	11/6/15 14:45						
		Matrix		Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil						
		Type		Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab						
			Analysis Method	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	SL	BT	ML	TEL	PEL	
VOC/BTEX																	(ug/kg)			(ug/kg)		(ug/kg)
Zinc	7440-66-6	mg/Kg	SW6010B	**31.5**	**98.6**	**33.3**	**30.1**	**27.4**	**31.2**	**33.4**	**35.6**	**75.2**	**32.2**	**36.4**	**30.3**	**88.1**	410	2,783	3,800	124	271	4100
Chromium, Hexavalent	18540-29-9	mg/Kg	7196A	0.10 U	0.10 U	0.10 U	-	-	0.10 U	0.10 U	0.10 U	**0.18 J**	0.10 U	0.10 U	0.10 U	0.10 U	-	-	-	-	-	25
Acid Volatile Sulfide (AVS) with Simultaneously Extracted Metals (SEM)																	**(mg/kg)**			**(mg/kg)**		**(mg/Kg)**
Acid Volatile Sulfide (AVS)	18496-25-8AV	mg/Kg	AVS	-	-	-	0.64 U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cadmium	7440-43-9	mg/Kg	SW6010B: AVS	-	-	-	0.12 U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5
Copper	7440-50-8	mg/Kg	SW6010B: AVS	-	-	-	**3.40**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	460
Lead	7439-92-1	mg/Kg	SW6010B: AVS	-	-	-	**0.72 J**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	400
Nickel	7440-02-0	mg/Kg	SW6010B: AVS	-	-	-	**2.98**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	86
Zinc	7440-66-6	mg/Kg	SW6010B: AVS	-	-	-	**5.73**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4100
General Chemistry																						
Total Organic Carbon (TOC)	TOC	mg/Kg	LYDKHN	**175**	**7290**	**871**	**178**	**240**	**2120**	**5200**	**3400**	**5020**	**3380**	**4390**	**3260**	**6430**	-	-	-	-	-	-
Moisture	Moisture	%	ASTM D2216	**23.6**	**21.1**	**22.2**	-	-	**17.5**	**18.3**	**20.3**	**19.9**	**19.6**	**22.8**	**23.8**	**22.4**	-	-	-	-	-	-
Total Solids (TS)	TSS	%	SM2540G	**80.9**	**82.6**	**81.8**	**86.5**	**83.7**	**85.1**	**84.5**	**83.1**	**83.4**	**83.6**	**81.5**	**80.8**	**81.7**	-	-	-	-	-	-
Total Solids (TS)	TSS	%	E160.3 Modified	**81.5**	**82.3**	**82.8**	-	-	**83.8**	**85.3**	**83.9**	**82.5**	**84.0**	**81.4**	**81.2**	**81.1**	-	-	-	-	-	-
Total Volatile Solids (TVS)	TVS	%	E160.4	**1.20**	**3.0**	**1.1**	-	-	**2.1**	**1.2**	**1.3**	**2.6**	**1.4**	**2.0**	**1.5**	**3.1**	-	-	-	-	-	-
pH	PH	pH Units	E150.1	**8.35**	**8.99**	**8.59**	-	-	**8.39**	-	**8.37**	**8.91**	**8.33**	**8.35**	**8.23**	**9.01**	-	-	-	-	-	-
Total Sulfide	Sulfide	mg/Kg	PSEP Sulfide	0.8 U	**0.9 BJ**	-	0.6 U	0.6 U	**2.5 B**	**0.8 BJ**	0.80 U	**0.9 BJ**	**0.7 BJ**	0.7 U	**1.4 BJ**	0.8 U	-	-	-	-	-	-

Analyte	CAS#	Client Sample ID		D4ADS01-001.48-01	D4BGC07-14.4416.57-01	D4BGC06-11.8113.54-01	REF-2	REF-102	D4SD04-0.503-01	D4SD04-0.503-101	D4SD04-0304.25-02	D4SD04-4.2518.86-03	D5SD01-0002-01	D5SD01-0204-02	D4BDS01-001.31-01	D5SD01-0404.9-03	DMMP User's Manual/ Inland Testing Manual			NOAA SQuiRTs		2008 ADEC Method 2 Cleanup Levels for Migration to Groundwater
		ASL Lab Report ID		P3549	P3549	P3549	P3522	P3522	P3586	P3586	P3586	P3586	P3586	P3586	P3586	P3586						
		ASL Lab Sample ID		P354901	P354902	P354903	P352201	P352204	P358601	P358602	P358605	P358606	P358607	P358608	P358609	P358610						
		ALS Lab Report ID		K1512542	K1512542	K1512542	K1512414	K1512414	K1512773	K1512773	K1512773	K1512773	K1512773	K1512773	K1512773	K1512773						
		ALS Lab Sample ID		K1512542-001	K1512542-002	K1512542-003	K1512414-001	K1512414-002	K1512773-001	K1512773-002	K1512773-003	K1512773-004	K1512773-005	K1512773-006	K1512773-007	K1512773-008						
		Within 3 days of occurence of exceedance		11/2/2015 21:00	11/3/15 10:00	11/3/15 11:00	10/29/2015 15:18	10/29/2015 15:28	11/5/15 13:30	11/5/15 13:40	11/5/15 16:30	11/5/15 14:50	11/6/15 11:15	11/6/15 13:00	11/3/15 11:00	11/6/15 14:45						
		Matrix		Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil						
		Type		Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab						
			Analysis Method	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	SL	BT	ML	TEL	PEL	
VOC/BTEX																	(ug/kg)			(ug/kg)		(ug/kg)
Ammonia	Ammonia	mg/Kg	350.1M	0.05 U	**1.47**	0.05 U	**-**	**-**	**1.01**	**1.94**	**0.75**	**2.30**	**0.56 J**	**0.47 J**	**0.07 J**	**1.53**	-	-	-	-	-	-

Notes: B = The analyte was detected in the associated method blank at a level that is significant relative to the sample result as defined by the DOD or NELAC standards.
D = Dilution Run.
U =Not detected at specified detection limit.
J = Estimated value below reporting limit.

9.0 BENTHIC BIOASSESSMENT SAMPLING

9.1 OVERVIEW AND OBJECTIVE OF SURVEY

This section provides a description of the sampling design for the benthic bioassessment that was performed at the project site on 29-Sep-15 (MTS, 2015). The objective of the benthic bioassessment survey was to develop baseline information concerning benthic macroinvertebrate species composition, which is important for evaluating benthic habitat quality. No site-specific benthic macroinvertebrate data were previously known to exist for the project site.

9.2 SAMPLING DESIGN

One grab sample was collected at each of five stations within the two test pit sites. As mentioned earlier, a scope reduction limited the Test Pit Dredge Material Characterization effort to Test Pit 2. Nevertheless, the benthic bioassessment surveys were carried at Test Pit 1 and Test Pit 2.

Benthic samples were collected from five areas, as follows:

- Test Pit 1 (DMMU #1 through DMMU #3).
- Test Pit 2 (DMMU #4 and DMMU #5).

The GPS coordinates of the stations were recorded during sampling by the on-board GPS.

9.3 SAMPLE COLLECTION

The samples were collected by lowering a 0.1 square meter (m^2) (1.08 ft^2) KC Day sediment sampler to collect biological sediment cores. Once the vessel was on station and stopped, the sampler was lowered to the seafloor using the hydraulic winch via a cable that ran through a block suspended from the A-frame. Once on the bottom, the winch was used to raise the sampler.

9.3.1 Sample Processing in the Field

Benthic infauna samples were sieved through a 0.5 mm (0.020 in) mesh screen and the retained material was placed in a container and fixed with a 10% solution of buffered formalin and seawater for a minimum of 3 days (maximum 14 days).

9.4 SAMPLE PROCESSING AT THE LABORATORY

In the MTS laboratory, the samples were then washed through a 0.25 mm (0.010) mesh screen to remove the formalin solution and transferred to appropriately sized containers. These containers were filled with a mixture of 70% isopropyl alcohol and rose bengal stain. Rose bengal is a protein stain added to facilitate sorting the animals from any retained detritus.

The transferred and stained samples were sorted under a dissecting microscope. All animals were removed and placed in respective major phylogenetic groups (Polychaeta, Mollusca, Crustacea, Echinodermata and miscellaneous). Twenty percent of the remaining detritus in each sample was then resorted by a separate sorter as part of a quality control step. This quality control step follows the protocols set forth for benthic studies in EPA Region 10 (Tetra Tech 1987).

9.5 TAXONOMIC IDENTIFICATION

Following the sorting of animals by major phylogenetic group, specialist taxonomists then identified all organisms to the lowest practical taxonomic level within each sorted group. The number of each identified taxon was recorded and entered into a Microsoft Excel spreadsheet. Following

identification and data entry, the benthic indices and statistics were calculated for each sampled station. The complete benthic report indicating the taxonomic identifications are included as Appendix F.

9.6 TAXONOMIC RESULTS AND DISCUSSION

The results show a benthic infaunal community that is generally low in species abundance and diversity. A recent study of the infauna of Cook Inlet found an average abundance of 505 animals per 0.1 square meter grab sample (Fukuyama et al. 2012). However, one sample in lower Cook Inlet accounted for 60% of the total organisms. That observation means that the remaining stations had approximately 207 animals per sample. Additionally, the study concluded that there was a strong north-south gradient of increasing diversity. Upper Cook Inlet and industrial areas were found to have much lower numbers of individuals and fewer taxa.

The observations within this study are similar to Fukuyama et al. (2012). The sampling locations in this study are in the northern portion of Cook Inlet. Fukuyama et al. (2012) hypothesized that tidal currents, low salinity, and high turbidity results in a local environment with low total organic carbon and a high proportion of fine sediment. These factors result place a high level of environmental stress on infaunal communities thereby potentially limiting abundance and diversity.

The results of the ANOSIM analysis support the idea that local conditions lead to disturbed benthic communities. Moreover, those communities can change dramatically over short distances. This is evident by the fact that there was no statistical grouping of stations between the two test pit monitoring areas. Additionally, the dissimilarity observed in the Bray-Curtis ordination matrix shows that all of the stations were generally dissimilar from one another. This tends to support the idea that benthic communities may be continually stressed such that taxa are constantly in flux. The alternative is that the bottom is spatially complex such that changes in substrate over relatively short distances result in very different benthic infaunal communities.

Given the results of the ANOSIM it seems reasonable that those stations sampled at Test Pit 1 can be used as a reasonable surrogate for a reference station if one is necessary for future analysis of effects at Test Pit 2. While the communities are not the same, it appears that local heterogeneity across even small distances means that it is unlikely that a similar reference could exist. Thus, comparison of stations over time can be used to determine coarse effects of dredging at Test Pit 1. Any future comparisons should take into consideration that infaunal communities in this area are not likely to be stable and therefore general characteristics such as taxa richness and organism abundance may be the most suitable metric for determining if project activities place an even greater stress on infaunal communities than already seems to be present.

Given the relatively low number of individuals and taxa present at Test Pit 1, it is difficult to argue that dredging the test pit will have any lasting impact to benthic infaunal communities within the region. However, the small numbers of samples collected make it difficult to know actual variation in the diversity and abundance of taxa in the region. Given the variation present within the infaunal community any future sampling should consider increasing the sample size to get a better estimate of variation and increase statistical power.

10.0 ACRONYMS AND TERMS

Term	Definition
°C	degrees Celsius
ADEC	Alaska Department of Environmental Conservation
AKLNG Marine Terminal	Alaska Liquefied Natural Gas Marine Terminal
AKLNG Project	Alaska Liquefied Natural Gas Project
ANOSIM	Analysis of Similarity
ASTM	American Society of Testing and Materials
AVS	acid volatile sulfide
CFR	*Code of Federal Regulations*
COC	chemical of concern
cu yd	Cubic Yard
CWA	Clean Water Act
DMMP	Dredged Material Management Plan
DMMU	dredge material management unit
DOT	U.S. Department of Transportation
DRO	diesel-range organics
EFH	Essential Fish Habitat
EPA	U.S. Environmental Protection Agency
ft	Feet
g	Gram
GPS	global positioning system
GRO	gasoline-range organics
HSP	Health, Safety, and Environment Plan
ID	identification
ITM	Inland Testing Manual
LNG	liquefied natural gas
Magnuson-Stevens Act	Magnuson-Stevens Fishery Conservation and Management Act
MDL	Method Detection Limit
MHHW	Mean Higher High Water
MHW	Mean High Water
mL	Milliliter
MLLW	Mean Lower Low Water
MPRSA	Marine Protection, Research, and Sanctuaries Act
MS	matrix spike
MSD	matrix spike duplicate
MSL	mean sea level
NEPA	National Environmental Policy Act

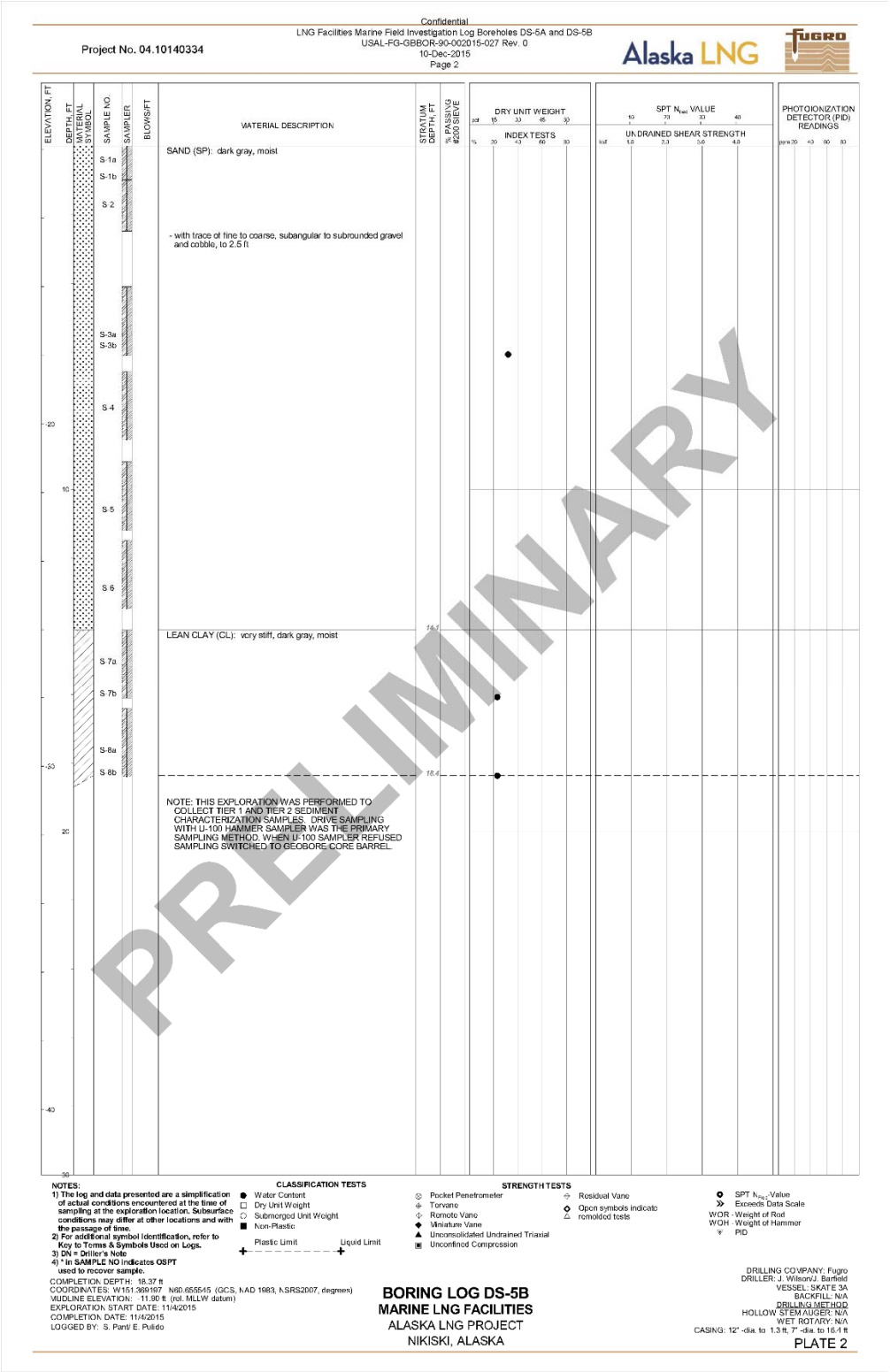
Term	Definition
NOAA	National Oceanic and Atmospheric Administration
OTM	Ocean Testing Manual
oz	Ounce
PAH	polyaromatic hydrocarbon
PCB	polychlorinated biphenyl
PEL	permissible exposure limit
PID	photoionization detector
PSEP	Puget Sound Estuary Program
QA	quality assurance
QC	quality control
RRO	residual-range organics
SAP	Sampling and Analysis Plan
SEM	simultaneously extractable metals
SL	screening level
SQuirT	Screening Quick Reference Table
SVOC	semivolatile organic compound
TBP	theoretical bioaccumulation potential
TEL	toxic exposure limit
TOC	total organic compound
TPH	total petroleum hydrocarbons
TVS	total volatile solids
USACE	U.S. Army Corps of Engineers
U.S.C.	*U.S. Code*
VOC	volatile organic compound

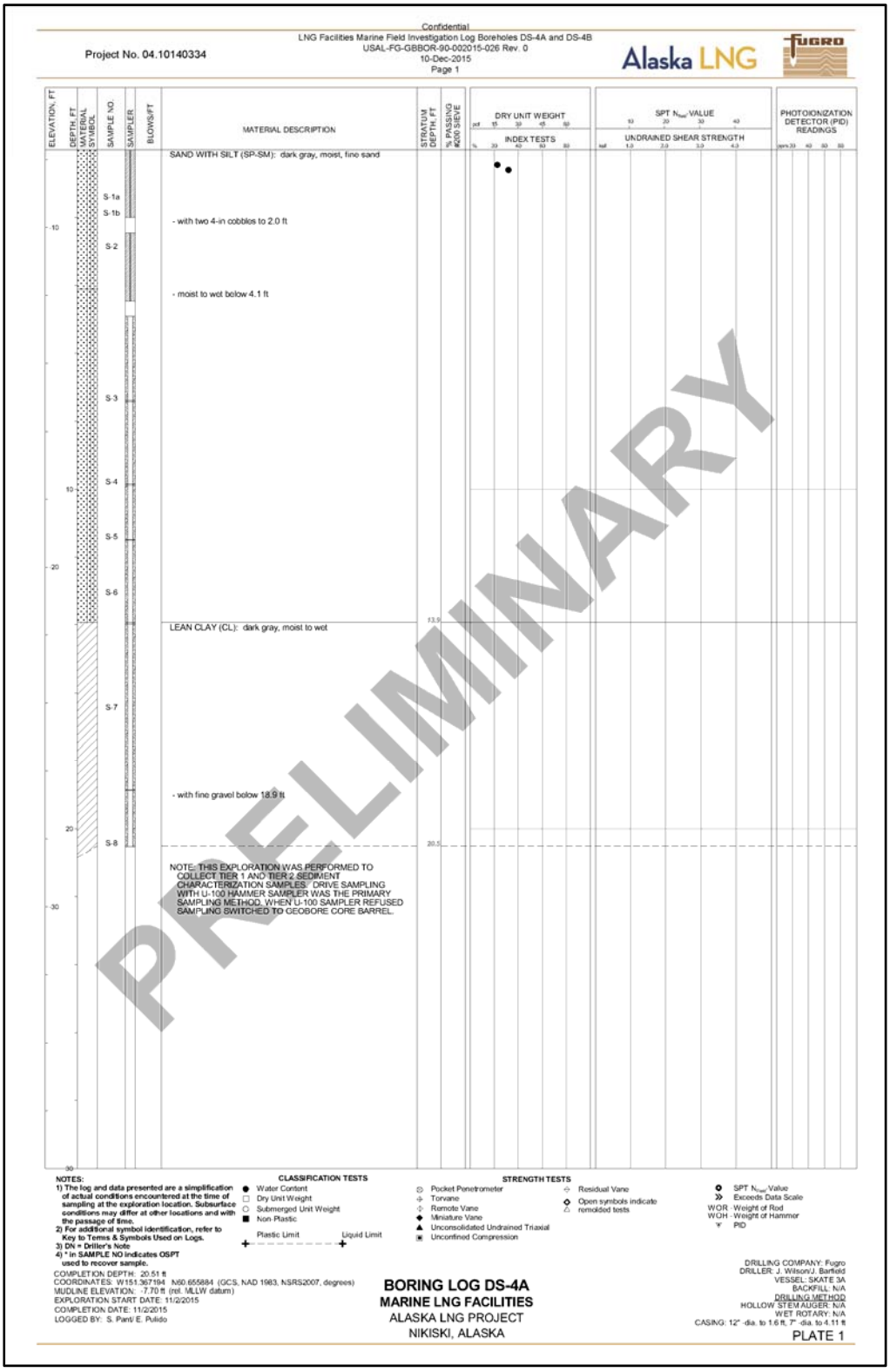
11.0 REFERENCES

ID Number	Reference Title
USAL-CH-JPZZZ-90-000002-000	Test Pit Dredge Material Characterization Sampling and Analysis Plan
USAL-CH-BREXE-90-000004-000	Test Pit Dredge Material Characterization Field Execution Plan
	Alaska Department of Commerce, Community, and Economic Development (ADCCED). 2015. Community and Regional Affairs, Community: Nikiski. State of Alaska. November. https://www.commerce.alaska.gov/dcra/DCRAExternal/community/Details/763156a2-5a06-4344-8413-dbf6b225e730
	Alaska Department of Environmental Conservation (ADEC). 2008. Cleanup Levels Guidance. June 9. http://dec.alaska.gov/spar/csp/guidance_forms/docs/cleanuplevels.pdf
	Alaska Department of Environmental Conservation (ADEC). 2013. Dredge Material Guidance. June. http://dec.alaska.gov/spar/csp/guidance_forms/docs/Final_Dredge_Material_Guidance_June_2013.pdf
	Alaska Department of Environmental Conservation (ADEC). 2010. Draft Field Sampling Guidance. May. http://dec.alaska.gov/spar/csp/guidance_forms/docs/Draft_Field_Sampling_Guidance.pdf
	Alaska Department of Environmental Conservation (ADEC). 2015. Oil and Other Hazardous Substances Pollution Control. 18 Alaska Administrative Code (AAC) 75. Revised June 17, 2015.
	American Society for Testing and Materials (ASTM). 1993. "Practice for Description and Identification of Soils (Visual-Manual Procedure)." ASTM D-2488-93
	Buchman, M. F., 2008. NOAA Screening Quick Reference Tables, NOAA OR&R Report 08-1, Seattle WA, Office of Response and Restoration Division, National Oceanic and Atmospheric Administrations. http://response.restoration.noaa.gov/environmental-restoration/environmental-assessment-tools/squirt-cards.html
	Fukuyama, A.K., G. Gillingham and S.I. Hartwell. 2012. Integrated Cook Inlet Environmental Monitoring and Assessment Program (ICIEMAP): Benthic Infaunal Communities. Alaska Marine Science Symposium, Anchorage, Alaska, January.
	Lee, H., II, B.L. Boese, J. Pelletier, M. Winsor, D.T. Specht and R.C. Randall. 1989. *Guidance Manual: Bedded Sediment Tests. U.S.* Environmental Protection Agency, Pacific Ecosystems Branch, Bioaccumulation Team, Newport, OR. EPA-600/x-89-302.
	Plumb, Russell H. 1981. *Procedures for Handling and Chemical Analysis of Sediment and Water Samples*, US EPA
	Puget Sound Estuary Program (PSEP). 1986. *Recommended Protocols for Measuring Conventional Sediment Variables in Puget Sound*.
	Puget Sound Estuary Program (PSEP). 1995. *Recommended Guidelines for Conducting Laboratory Bioassays on Puget Sound Sediments* (July 1995 Revisions). Prepared for U.S. Environmental Protection Agency, Region 10, Office of Puget Sound, Seattle, WA, and the Puget Sound Water Quality Authority, Olympia, WA.
	Puget Sound Estuary Program (PSEP). 1997. *The Recommended Guidelines for Measuring Organic Compounds in Puget Sound Water, Sediment and Tissue Samples*.
	U.S. Army Corps of Engineers (USACE). 2014. *Dredge Material Evaluation and Disposal Procedures User's Manual*. Prepared by Dredge Material Management Office U.S. Army Corps of Engineers – Seattle District. July. http://www.nws.usace.army.mil/Missions/CivilWorks/Dredging/UsersManual.aspx
	U.S. Environmental Protection Agency (EPA). 2004. Contract Laboratory Program, National Functional Guidelines.

ID Number	Reference Title
	U.S. Environmental Protection Agency/ Puget Sound Estuary Program (EPA/PSEP). 1987. *Protocols for Sampling and Analyzing Subtidal Benthic Macroinvertebrate Assemblages in Puget Sound*.
	U.S. Environmental Protection Agency/U.S. Army Corps of Engineers (EPA/USACE). 1991. *Evaluation of Dredged Material Proposed for Ocean Disposal - Testing Manual.* EPA-503/8-91/001, Washington, DC.
	U.S. Environmental Protection Agency/U.S. Army Corps of Engineers (EPA/USACE). 1998. *Evaluation of Dredged Material Proposed for Discharge in Waters of the U.S. - Testing Manual: Inland Testing Manual*. EPA-823-B-98-004, Washington D.C. February. http://www2.epa.gov/sites/production/files/2015-08/documents/inland_testing_manual_0.pdf
	MTS. 2015. Benthic Infaunal Sampling and Analysis of Samples Collected for the AKLNG Benthic Sampling in Nikiski, AK. November.

12.0 APPENDIX A – FIELD DOCUMENTATION




Confidential
LNG Facilities Marine Field Investigation Log Boreholes DS-4A and DS-4B
USAL-FG-GBBOR-90-002015-026 Rev. 0
10-Dec-2015
Page 1
Project No. 04.10140334
Alaska LNG
FUGRO
ELEVATION, FT
DEPTH, FT
MATERIAL SYMBOL
SAMPLE NO.
SAMPLER
BLOWS/FT
MATERIAL DESCRIPTION
STRATUM DEPTH, FT
% PASSING #200 SIEVE
DRY UNIT WEIGHT
INDEX TESTS
SPT N60 VALUE
UNDRAINED SHEAR STRENGTH
PHOTOIONIZATION DETECTOR (PID) READINGS
SAND WITH SILT (SP-SM): dark gray, moist, fine sand
S-1a
S-1b
- with two 4-in cobbles to 2.0 ft
S-2
- moist to wet below 4.1 ft
S-3
S-4
S-5
S-6
LEAN CLAY (CL): dark gray, moist to wet
13.9
S-7
- with fine gravel below 18.9 ft
S-8
20.5
NOTE: THIS EXPLORATION WAS PERFORMED TO COLLECT TIER 1 AND TIER 2 SEDIMENT CHARACTERIZATION SAMPLES. DRIVE SAMPLING WITH U-100 HAMMER SAMPLER WAS THE PRIMARY SAMPLING METHOD. WHEN U-100 SAMPLER REFUSED SAMPLING SWITCHED TO GEOBORE CORE BARREL.
PRELIMINARY
NOTES:
1) The log and data presented are a simplification of actual conditions encountered at the time of sampling at the exploration location. Subsurface conditions may differ at other locations and with the passage of time.
2) For additional symbol identification, refer to Key to Terms & Symbols Used on Logs.
3) DN = Driller's Note
4) * in SAMPLE NO indicates OSPT used to recover sample.
COMPLETION DEPTH: 20.51 ft
COORDINATES: W151.367194 N60.655884 (GCS, NAD 1983, NSRS2007, degrees)
MUDLINE ELEVATION: -7.70 ft (rel. MLLW datum)
EXPLORATION START DATE: 11/2/2015
COMPLETION DATE: 11/2/2015
LOGGED BY: S. Pant/ E. Pulido
CLASSIFICATION TESTS
Water Content
Dry Unit Weight
Submerged Unit Weight
Non Plastic
Plastic Limit
Liquid Limit
STRENGTH TESTS
Pocket Penetrometer
Torvane
Remote Vane
Miniature Vane
Unconsolidated Undrained Triaxial
Unconfined Compression
Residual Vane
Open symbols indicate remolded tests
SPT N60 Value
Exceeds Data Scale
WOR - Weight of Rod
WOH - Weight of Hammer
PID
BORING LOG DS-4A
MARINE LNG FACILITIES
ALASKA LNG PROJECT
NIKISKI, ALASKA
DRILLING COMPANY: Fugro
DRILLER: J. Wilson/J. Barfield
VESSEL: SKATE 3A
BACKFILL: N/A
DRILLING METHOD
HOLLOW STEM AUGER: N/A
WET ROTARY: N/A
CASING: 12" -dia. to 1.6 ft, 7" -dia. to 4.11 ft
PLATE 1

Confidential
LNG Facilities Marine Field Investigation Log Boreholes DS-4A and DS-4B
USAL-FG-GBBOR-90-002015-026 Rev. 0
10-Dec-2015
Page 2

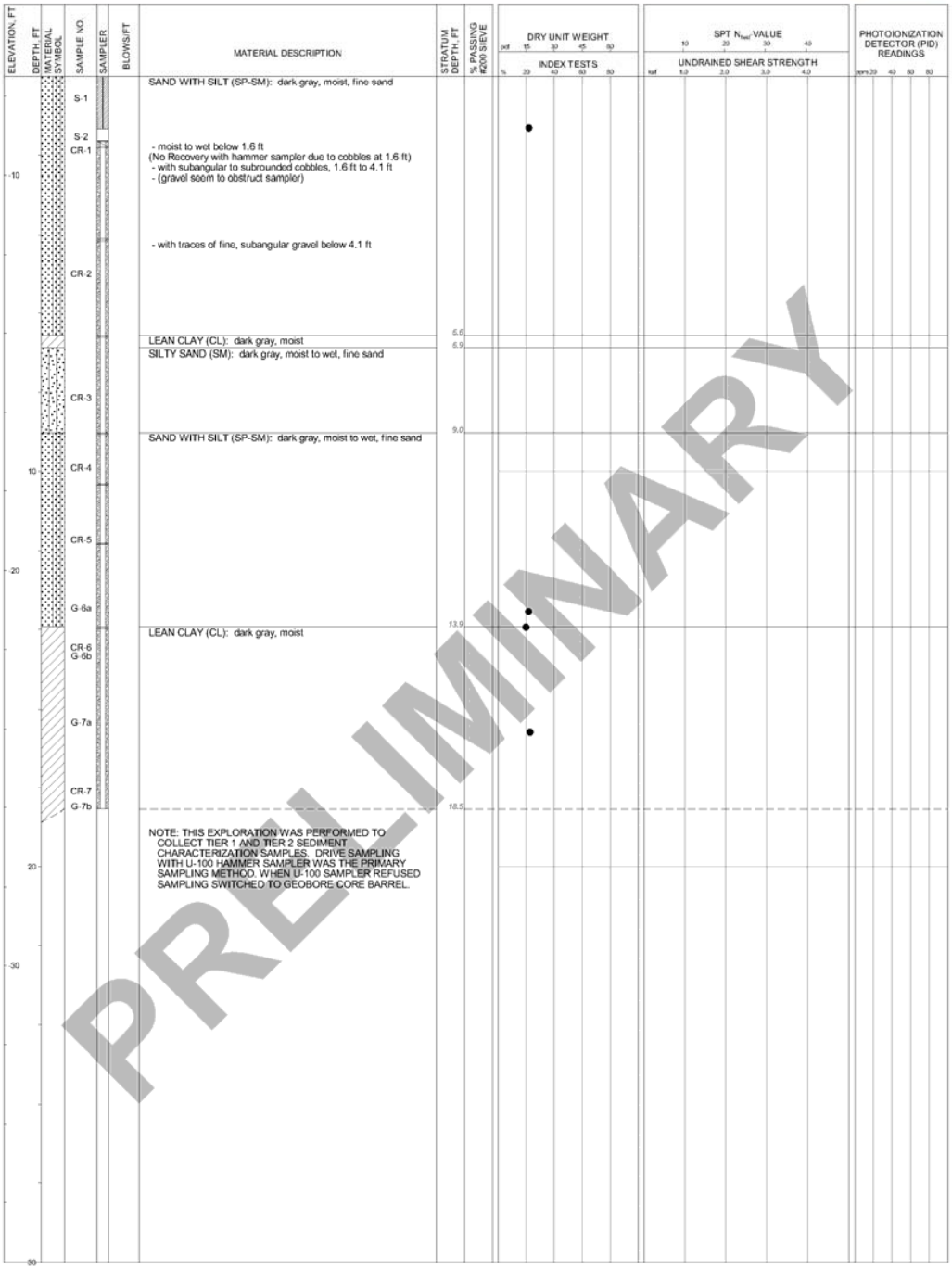
Project No. 04.10140334

Alaska LNG

FUGRO

ELEVATION, FT	DEPTH, FT	MATERIAL SYMBOL	SAMPLE NO.	SAMPLER	BLOWS/FT	MATERIAL DESCRIPTION	STRATUM DEPTH, FT	% PASSING #200 SIEVE	DRY UNIT WEIGHT (pcf 15 30 45 60) / INDEX TESTS (% 20 40 60 80)	SPT N_{field} VALUE (10 20 30 40) / UNDRAINED SHEAR STRENGTH (ksf 1.0 2.0 3.0 4.0)	PHOTOIONIZATION DETECTOR (PID) READINGS (ppm 20 40 60 80)
			S-1			SAND WITH SILT (SP-SM): dark gray, moist, fine sand					
			S-2								
			CR-1			- moist to wet below 1.6 ft (No Recovery with hammer sampler due to cobbles at 1.6 ft) - with subangular to subrounded cobbles, 1.6 ft to 4.1 ft - (gravel seem to obstruct sampler)					
-10											
			CR-2			- with traces of fine, subangular gravel below 4.1 ft					
						LEAN CLAY (CL): dark gray, moist	5.6				
						SILTY SAND (SM): dark gray, moist to wet, fine sand	6.9				
			CR-3								
						SAND WITH SILT (SP-SM): dark gray, moist to wet, fine sand	9.0				
	10		CR-4								
			CR-5								
-20			G-6a								
						LEAN CLAY (CL): dark gray, moist	13.9				
			CR-6 G-6b								
			G-7a								
			CR-7 G-7b				18.5				
						NOTE: THIS EXPLORATION WAS PERFORMED TO COLLECT TIER 1 AND TIER 2 SEDIMENT CHARACTERIZATION SAMPLES. DRIVE SAMPLING WITH U-100 HAMMER SAMPLER WAS THE PRIMARY SAMPLING METHOD. WHEN U-100 SAMPLER REFUSED SAMPLING SWITCHED TO GEOBORE CORE BARREL.					
	20										
-30											
	30										

PRELIMINARY



NOTES:
1) The log and data presented are a simplification of actual conditions encountered at the time of sampling at the exploration location. Subsurface conditions may differ at other locations and with the passage of time.
2) For additional symbol identification, refer to Key to Terms & Symbols Used on Logs.
3) DN = Driller's Note
4) * in SAMPLE NO indicates OSPT used to recover sample.

CLASSIFICATION TESTS
- ● Water Content
- □ Dry Unit Weight
- ○ Submerged Unit Weight
- ■ Non-Plastic
- Plastic Limit — Liquid Limit

STRENGTH TESTS
- Pocket Penetrometer
- Torvane
- Remote Vane
- Miniature Vane
- Unconsolidated Undrained Triaxial
- Unconfined Compression
- Residual Vane
- Open symbols indicate remolded tests
- SPT N_{field} Value
- » Exceeds Data Scale
- WOR - Weight of Rod
- WOH - Weight of Hammer
- PID

COMPLETION DEPTH: 18.54 ft
COORDINATES: W151.367120 N60.655808 (GCS, NAD 1983, NSRS2007, degrees)
MUDLINE ELEVATION: -7.50 ft (rel. MLLW datum)
EXPLORATION START DATE: 11/3/2015
COMPLETION DATE: 11/3/2015
LOGGED BY: S. Pant/ E. Pulido

BORING LOG DS-4B
MARINE LNG FACILITIES
ALASKA LNG PROJECT
NIKISKI, ALASKA

DRILLING COMPANY: Fugro
DRILLER: J. Wilson/J. Barfield
VESSEL: SKATE 3A
BACKFILL: N/A
DRILLING METHOD
HOLLOW STEM AUGER: N/A
WET ROTARY: N/A
CASING: 12" -dia. to 1.3 ft, 7" -dia. to 1.6 ft

PLATE 2

Confidential
LNG Facilities Marine Field Investigation Log Boreholes DS-5A and DS-5B
USAL-FG-GBBOR-90-002015-027 Rev. 0
10-Dec-2015
Page 1

Project No. 04.10140334

Alaska LNG

NOTES:
1) The log and data presented are a simplification of actual conditions encountered at the time of sampling at the exploration location. Subsurface conditions may differ at other locations and with the passage of time.
2) For additional symbol identification, refer to Key to Terms & Symbols Used on Logs.
3) DN = Driller's Note
4) * In SAMPLE NO Indicates OSPT used to recover sample.

CLASSIFICATION TESTS
- Water Content
- Dry Unit Weight
- Submerged Unit Weight
- Non-Plastic
- Plastic Limit — Liquid Limit

STRENGTH TESTS
- Pocket Penetrometer
- Torvane
- Remote Vane
- Miniature Vane
- Unconsolidated Undrained Triaxial
- Unconfined Compression
- Residual Vane
- Open symbols indicate remolded tests
- SPT N_{60} Value
- Exceeds Data Scale
- WOR - Weight of Rod
- WOH - Weight of Hammer
- PID

COMPLETION DEPTH: 19.19 ft
COORDINATES: W151.369148 N60.655579 (GCS, NAD 1983, NSRS2007, degrees)
MUDLINE ELEVATION: -12.20 ft (rel. MLLW datum)
EXPLORATION START DATE: 11/4/2015
COMPLETION DATE: 11/4/2015
LOGGED BY: S. Pant/ E. Pulido

BORING LOG DS-5A
MARINE LNG FACILITIES
ALASKA LNG PROJECT
NIKISKI, ALASKA

DRILLING COMPANY: Fugro
DRILLER: J. Wilson/J. Barfield
VESSEL: SKATE 3A
BACKFILL: N/A
DRILLING METHOD
HOLLOW STEM AUGER: N/A
WET ROTARY: N/A
CASING: 12" -dia. to 1.3 ft, 7" -dia. to 19.19 ft

PLATE 1

CONTENTS

PAGE	REFERENCE	DATE

10/29/15

1

PROJECT - AKLNG DREDGE TEST PIT SAMPLING
STAFF: J. KNUTH + M. BRUNO
WEATHER: PARTLY CLOUDY, ~40°F
HSSE: DRIVING AT LOWLIGHT TOPIC

9:40 ARRIVE @ RIGTENDER WAREHOUSE. BEGIN TO ADDRESS SAMPLE METHOD + ANALYTE LIST QUESTIONS W/ CARRIE ANDREWS, BILLY OLIVER (AKLNG), + ~~[illegible]~~ FUGRO. ~~[illegible]~~ INVENTORY ~~[illegible]~~/JARS ONSITE + ORDER ADDITIONAL JARS. 25 SAMPLES. plus Dups, MS/MSD, + EB in total. Calibrate YSI + PID.

NEXT PAGE

Rite in the Rain

6

11/6/15

PURPOSE: SAMPLE CORE 5A + 5B
STAFF: J. KNUTH + S. Re'
HSE: HAND TOOLS / Review New Powertool AHA.
WEATHER: ~34°F + CLOUDY

800 J.K. PICKUP COOLER w/ 5A + 5B @ RAVN CARGO. GO TO Home Depot + purchase Dremel tool to SAW open CORE liners. Go to office + Review boring logs for 5A + 5B.

9:30 S. Re' @ office. CONTINUE to Setup + prep. for Sampling.

Begin to open cores 5-1, 5-3, + 5-3 from 5A + 5B both 0-2.0 meters. Sample ID: DS5D01-0002-01

11:15 Sample time

13:00 DS5D01-0204-02 Collect sample @ 2-4.0 meters

14:45 DS5D01-0404.9-03-Z-sample 4 to 4.9 meters depth.

11/6/15

7

1545 Collect EB using DI WATER FROM DEIONIZED SAMPLE BOWL. EB110615-01. SEND TO ASL CORVALLIS, Metals, PAH/SVOC, PCB/TPH D (AK102, AK103), TPHG (AK101), TOC, + VOCs.

1600 PACK-UP SAMPLE COOLERS + RETURN UHAUL TRUCK

1910 J. KNUTH FINISH PACKING COOLER w/ VOC FROZEN SAMPLES + LOAD COOLERS INTO TRUCK.

1930 S. KNUTH LEAVES OFFICE TO DELIVER SAMPLES TO GOLDSTREAK. WAYBILLS 027-1606-7564 + 027-1606-7586

2045 END OF DAY.

Rite in the Rain

4

11/5/15

9:30 PICKUP CORES + FIELD EQUIPMENT @ RAVN CARGO.
10:00 ORGANIZE + INVENTORY CORES + EQUIPMENT
11:30 DECIDE TO SAMPLE CORES 4A
12:15 ~~PREPARE TO OPEN CORE 4A-S3 + 4A-S4 (1.5-3.0 m)~~

~~PREVIOUS COLLECTED INTERVALS DS-4B (0-0.4 m, 3.6-4.25 m) 4.25 m - 5.65 m)~~

~~Need 2 sample @ 3-6.25 m~~ 5.65

PREPARE TO COLLECT COMPOSITE SAMPLE: meters depth

13:30 D4SD04-0.503-01
13:40 D4SD04-0.503-101
13:30 D4SD04-0.503-01MS
13:30 D4SD04-0.503-01SD

PID-4.2 opened core (see log for others)

11/5/15 5

14:30 SR 1115 ~~16:30~~ Collect Sample
~~D4SD03 04.25-02~~
D4SD04-0304.25-02
BIOASSAY ARCHIVE INCLUDES ARCHIVE FOR D4BG06-11.8113.54-01

14:50 SR 1115 ~~16:50~~ Collect Sample
D4SD04-4.2518.86-03
SAMPLE INTERVAL ACTUALLY 4.25-5.65 meters
5.65 m = 18.86 ft

17:20 Collect Sample
D4SD04-5.756.25-04
Z Sample

1830 PACK UP SAMPLES + EQUIPMENT FOR DAY. STORE SAMPLES IN UHAUL OUTSIDE IN 30-36°F temps. VOCs freezing in freezer.
1840 END OF DAY

Rite in the Rain

34.25 31
27.5 25.5

Kristin Reardon
Elan Edgerly
11-3-15
10 am

Borehole VB 4B

CR-6 11.81 - 13.54 ft
CR-7 14.4 - 16.57 ft
} Fugro designation

D4BGC07 - 14.4416.57 - 01

10 AM

D4B = DMMU #4B
GC = Geo-core
14.4416.57 = Depth range: 14.44' - 16.57'
} CR-7

D4BGC06 - 11.8113.54 - 01

11 AM

D4B = DMMU #4B
GC = Geo-core
11.8113.54 = Depth Range: 11.81 - 13.54
} CR-6

Kristin Reardon
Elan Edgerly
11-4-15
12:30 pm

D4BDS01-001.31 ft-01

FUGRO

STANDARD FIELD LOGGING FORM

DRILL HOLE NO: IDS-4A

PROJECT NO: 04.10140334

PROJECT NAME: ALASKA LNG PROJECT

LOCATION: COOK INLET, ALASKA

PROJECT MGR: ABHISHEK SHETHJI, P.E.

CLIENT: ALASKA LNG LLC (AKLNG)

LOGGER: S. Pana / E. Pulido

DRILLER: Jwilson / J Pur

Drill Method: HAR / CCC

Drill Size: See additional info

Drill Rig: SKATE 3A

START Date: NOV 2, 2015 Time: 17:00

COMPLETION Date: NOV 2 2015 Time: 2230

COMPLETION DEPTH (m/ft): 6.25m / 20.51ft

LOCATION DESCRIPTION: Marine terminal Area

Pg. 1 of 2

SURFACE ELEVATION (m/ft): -2.4m / -7.7 REFERENCE DATUM: NAD83

COORDINATES (LAT/LON): 60-6'-58.84"N / 151.367194°W REFERENCE DATUM: MLLW

Additional Information:
DTM: 10.0m DTW: 5.4m @16:15, Nov 2, 2015
WD: 4.6m Tide: 2.25m MLLW @16:15
Mudline: -2.4m MLLW
12" casing to

GROUNDWATER DEPTH (ft) ▽ INITIAL: - ▼STATIC:

WELL COMPL. DEPTH: - WELL TYPE

BACKFILLED with: -

DATE Requested for Review | ENGINEER to Review

DEPTH, meters	SAMPLE Type or Symbol	SAMPLE Top & Bottom Depth, m	SAMPLE Number	HAMMER INFO: Weight, lbs: Drop, in: Downhole/Uphole Cathead/Autotrip BLOWS/15 cm	SAMPLE LENGTH, cm Driven	Recovered	Total/Intact	MATERIAL DESCRIPTION, including... SOIL TYPE/USCS SYMBOL SAND (SP) Lean CLAY (CL)	SOIL DENSITY very dense / SOIL CONSISTENCY very soft	COLOR olive gray	MOISTURE moist	ODORS/STAINING oxidation staining	INCLUSIONS micaceous	MODIFIERS with trace of silt	PP TV MV Reading, ksf	PID OVA FID MODEL
0.0m															PID	
17.15		S1: 0.0-0.6m		30 for table + 15 for shoe total blows, 65	60	60	60	S-1: SILTY SAND (SP-SM); fine		dark gray	moist					
0.6m								S-1a: 0.0-0.45m (mer)								
0.75m		S-2: 0.7m			60	15	15	S-1b: 0.45-0.6m (shoe) (bag)								
0.9m																
1.0m		1.35m														
1.35								S-2: SAND (SP-SM);			moist					
1.5		S-3 1.5		2 min	75	75	75	most fine — S-2 NOT DELIVERED TO CH								
2040		2.25						[LN: only 1 cm recovery, shoe can't keep in hole]								
2.0m								S-3: SILTY SAND (SP-SM); DARK GRAY, MOIST FINE SAND Organic odor							4.2	
2.25		S-4 2.25 3m		4 min	75	75	75	S-4: SILTY SAND (SP-SM); DARK GRAY MOIST-WET, FINE							0.3	
3.0m																
2125		S-5 3.0 3.5m		4 min	50	50	50	S-5: SILTY SAND (SP-SM); DARK GRAY MOIST-WET, FINE							0.9	
3.5																
2200		S-6 3.5 4.25		5 min	75	50	50	S-6: SILTY SAND (SP-SM); DARK GRAY MOIST-WET, FINE							0.0	
4.0m								[DN- LOST PARTIAL RECOVERY WHILE RETRIEVING BARREL]								
4.25		S-7 4.25 5.75		8 min	150	80	80	S-7: LEAN CLAY; DARK GRAY MOIST-WET							0.0	
2215																
5.0m																
5.75																
230		S-8		5 min	50	50	50	S-8: LEAN CLAY; DARK GRAY, MOIST WITH FINE GRAVEL, SUBANGULAR - SUBROUNDED							0.0	
6.0m																

FUGRO

STANDARD FIELD LOGGING FORM

DRILL HOLE NO: DS-4A

Pg. 2 of 2

PROJECT NO: 04.10140334
PROJECT NAME: ALASKA LNG PROJECT
LOCATION: COOK INLET, ALASKA
PROJECT MGR: ABHISHEK SHETHJI, P.E.
CLIENT: ALASKA LNG LLC (AKLNG)

Additional Information:

LOGGER:
DRILLER:
Drill Method:
Drill Size:
Drill Rig:
START
Date
Time
COMPLETION
Date
Time
COMPLETION DEPTH (m/ft):

LOCATION DESCRIPTION:
SURFACE ELEVATION (m/ft): REFERENCE DATUM:
COORDINATES (LAT/LON): REFERENCE DATUM:

GROUNDWATER
DEPTH (ft) ▽ INITIAL: ▼STATIC:
WELL COMPL. DEPTH: WELL TYPE:
BACKFILLED with:

DATE Requested for Review | ENGINEER to Review

DEPTH, meters	SAMPLE Type or Symbol	Top & Bottom Depth, m	Sample Number	HAMMER INFO: Weight, lbs: Drop, in: Downhole/Uphole Cathead/Autotrip BLOWS/15 cm	SAMPLE LENGTH, cm Driven	Recovered	Total /Intact	MATERIAL DESCRIPTION, including... SOIL TYPE/USCS SYMBOL SAND (SP) Lean CLAY (CL)	SOIL DENSITY very dense SOIL CONSISTENCY very soft	COLOR olive gray	MOISTURE moist	ODORS/STAINING oxidation staining	INCLUSIONS micaceous	MODIFIERS with trace of silt	PP / TV / MV Reading, ksf	PID / OVA / FID MODEL:
		S-8						S-8 PREVIOUS PAGE								
6.25		5.75														
		6.25						EOB - 6.25m (20.51') NOV 2 2230 hr.								

FUGRO

STANDARD FIELD LOGGING FORM

DRILL HOLE NO: DS-4B

PROJECT NO: 04.10140334
PROJECT NAME: ALASKA LNG PROJECT
LOCATION: COOK INLET, ALASKA
PROJECT MGR: ABHISHEK SHETHJI, P.E.
CLIENT: ALASKA LNG LLC (AKLNG)

LOGGER: S. PANT / E. PULLOO
DRILLER: J. WILSON / J. SANDY
Drill Method: MR / CORE
Drill Size: SEE ADD. INFO
Drill Rig: SKATE 3A
START Date NOV 3 2015 Time
COMPLETION Date Time
COMPLETION DEPTH (m/ft):

LOCATION DESCRIPTION: MARINE TERMINAL
Pg. 1 of
SURFACE ELEVATION (m/ft): -1.9m / 6.23ft
REFERENCE DATUM: NAD 83
COORDINATES (LAT/LON):
REFERENCE DATUM: MLLW

GROUNDWATER DEPTH (ft) ▽ INITIAL: — ▼ STATIC: —
WELL COMPL. DEPTH: — WELL TYPE: —
BACKFILLED with: —
DATE Requested for Review | ENGINEER to Review

Additional Information:
DTM: 10.1m DTW 4.6m @0010 Nov 3
WD: 5.5 TIDE = 3.5m MLLW @0010
MUDLINE: -2.0m MLLW
12" RAIN TO 0.4m BML

DEPTH, meters	SAMPLE Type or Symbol	Top & Bottom Depth, m	Sample Number	HAMMER INFO: Weight, lbs: Drop, in: Downhole/Uphole Cathead/Autotrip BLOWS/15 cm	SAMPLE LENGTH, cm Driven	Recovered	Total /Intact	MATERIAL DESCRIPTION, including... SOIL TYPE/USCS SYMBOL SAND (SP) Lean CLAY (CL)	SOIL DENSITY very dense SOIL CONSISTENCY very soft	COLOR olive gray	MOISTURE moist	ODORS/STAINING oxidation staining	INCLUSIONS micaceous	MODIFIERS with trace of silt	PP / TV / MV Reading, ksf PID	PID / OVA / FID MODEL
0140			S-1 0.0 0.4	100 BLOWS	40	20/10		S-1: SILTY SAND (SP-SM); DARK GRAY MOIST FINE -S1-KR+EE								
0.4																
0.5			S-2 0.5 0.75	60 BLOWS	5	0/0		[LN - NO RECOVERY ON SUDE] S-2: NO RECOVERY - GRAVEL SEEM TO OBSTRUCT SAMPLING								
0.55																
0245			CR-1 0.5 1.25m	2 MIN	75	9/9		CR-1: SILTY SAND (SP-SM); DARK GRAY MOIST - WET COBBLES SUBANGULAR TO SUBROUNDED 3" cobble (x1)							0.2	
1																
1.25			CR-2 1.25 2.0m	2 MIN	75	30/30		CR-2: SILTY SAND (SP-SM); DARK GRAY MOIST-WET [illegible] FINE GRAVEL [illegible]							0.8	
0255																
2			CR-3 2.0 2.75m	2 MIN	75	50/50		CR-3: TUBE TOP 10cm LEAN CLAY (CL); DARK GRAY MOIST REST TUBE SILTY SAND (SP-SM); DARK GRAY MOIST-WET, FINE							0.0	
0330																
0.75			CR-4 2.75 3.15m	2 MIN	40	30/30		CR-4: SILTY SAND (SP-SM); DARK GRAY MOIST-WET, FINE							1.6	
0350																
3																
3.15			CR-5 3.15 3.6	3 MIN	45	45/45		CR-5 SILTY SAND (SP-SM); DARK GRAY MOIST-WET, FINE							0.0	
0405																
3.6			CR-6 3.6 4.25m	2 MIN	65	85/65		11-3 opened @ 10AM CR-6: SILTY SAND (SP-SM); DARK GRAY MOIST-WET FINE -CR-6-KR.+EE								
0510																
4																
4.25			G-6a 3.6-4.13 G-6b 4.13-4.25m					11-3 opened @ 10 AM CR-7: LEAN CLAY (CL); DARK GRAY MOIST -CR-7-KR.E.E.								
0630																
5			CR-7 4.25-5.65m													
			G-7a 4.4 5.05m G-7b 5.05 5.65	4 MIN	140	130/120										
5.65								EOB = 5.65 m (18.54 ft) NOV 3 2015 0630 hrs								

FUGRO

STANDARD FIELD LOGGING FORM

DRILL HOLE NO: DS-5A

Pg. 1 of

PROJECT NO: 04.10140334

PROJECT NAME: ALASKA LNG PROJECT

LOCATION: COOK INLET, ALASKA

PROJECT MGR: ABHISHEK SHETHJI, P.E.

CLIENT: ALASKA LNG LLC (AKLNG)

LOGGER: DS: [illegible] / [illegible]

DRILLER: [illegible] / J.B. [illegible]

Drill Method: MR/CCR

Drill Size: [illegible]

Drill Rig: SKATE 3A

START Date: Nov 4, 2015 Time: 12:30

COMPLETION Date: Nov 4, 2015 Time: 16:30

COMPLETION DEPTH (m/ft): 5.85m (19.19ft)

LOCATION DESCRIPTION: Marine Terminal Area

SURFACE ELEVATION (m/ft):

REFERENCE DATUM: MLLW

COORDINATES (LAT/LON):

REFERENCE DATUM: NAD 83

GROUNDWATER DEPTH (ft) ▽ INITIAL: – ▼ STATIC: –

WELL COMPL. DEPTH: – WELL TYPE: –

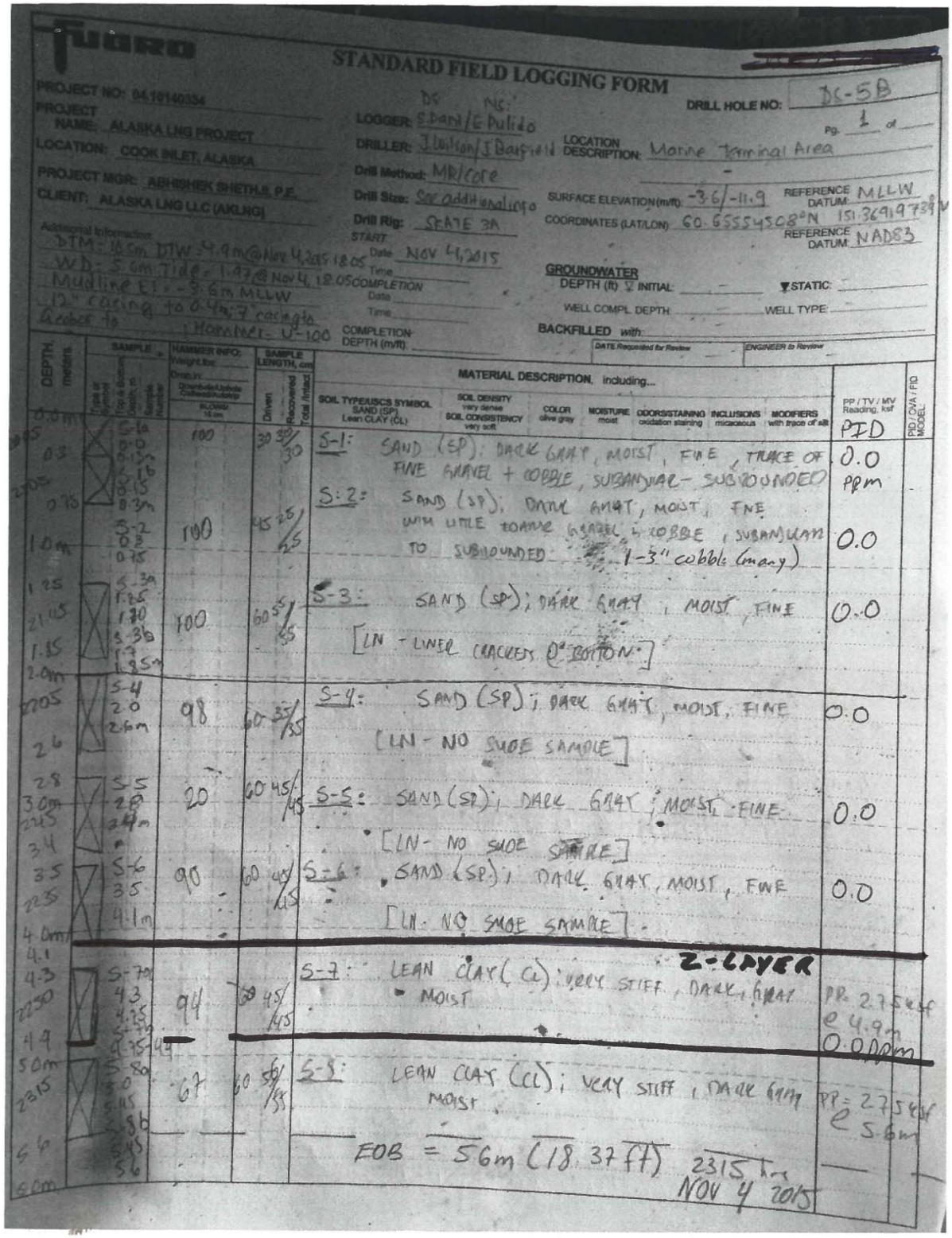
BACKFILLED with: –

DATE Requested for Review: ENGINEER to Review:

Additional Information:
DTM = 10.4m DTW = 1.4m @
WD: Tide:
Mudline El =
12" casing to 0.4m; 7" casing to 0.0m
Geobar to 5.25m Hammer = 0-100

DEPTH, meters	SAMPLE: Type or Symbol	SAMPLE: Top & Bottom Depth, m	SAMPLE: Sample Number	HAMMER INFO: Weight, lbs: / Drop, in: / Downhole/Uphole Cathead/Autotrip / BLOWS/15 cm	SAMPLE LENGTH, cm: Driven	SAMPLE LENGTH, cm: Recovered	SAMPLE LENGTH, cm: Total /intact	MATERIAL DESCRIPTION, including... SOIL TYPE/USCS SYMBOL SAND (SP) Lean CLAY (CL) / SOIL DENSITY very dense / SOIL CONSISTENCY very soft / COLOR olive gray / MOISTURE moist / ODORS/STAINING oxidation staining / INCLUSIONS micaceous / MODIFIERS with trace of silt	PP / TV / MV Reading, ksf PID	PID / OVA / FID MODEL
0.0m 12:35			S1 0-0m	100	0	0/0		S1: No recovery	0.3	
13:30 0.5m			CR-1 0-0.5m	7min	50	25/25		DN: set 7" casing to mudline and start coring CR-1: SAND (SP); dark gray, moist; fine [LN: difficult to extract sample: only half full] Tube sample		
0.75m 14:45 1.0m			S-2 0.75-1.35m	100	60	60/60		S-2: SAND (SP); dark gray, moist; fine [LN: S-2a - 45cm - liner; S-2b - 15cm - bag]	3.6	
1.35m 1.5m 15:15 2.0m 2.1m			S-3 1.5-2.1m	100	60	34/34		S-3: SAND (SP), dark gray, moist, fine (LN: NO shoe sample)	4.1	
2.25 15:30 2.85			S-4 2.25-2.85m	100	60	55/55		S-4: SAND (SP), dark gray; moist, fine; with little clay pockets [LN: S-4a: 40cm (liner); S-4b: 15cm (bag)]	0.0	
3.0m 16:00 3.6m			S-5 3.0-3.6m	100	60	50/50		S-5: Lean CLAY (CL); very stiff, moist, dark gray; sand at the bottom; dark gray [LN: S-5a: 40cm (liner), S-5b: 10cm (bag)] [LN- wrong depth on picture 3.6-3.75m: incorrect]	PP: 2.75 ksf @ 3.75m 0.0ppm	
3.75 16:15 4.0m			S-6 3.75-4.35	80	60	60/60		S-6: Lean CLAY (CL), very stiff, moist; dark gray [LN: S-6a: 45cm (liner); S-6b: 15cm (bag)]	PP: 2.75 ksf @ 4.35m 0.0ppm	
4.35 4.5 16:20 5.0m 5.1m			S-7 4.5-5.1m	78	60	60/60		S-7: lean CLAY (CL); very stiff; moist; dark gray [LN: S-7a: 45cm (liner); S-7b: 15cm (bag)]	PP: 2.75 ksf @ 5.1m 0.0ppm	
5.25m 16:30 6.0m			S-8 5.25-5.85m	99	60	60/60		S-8: TOP: Lean CLAY (CL), very stiff, dark gray, moist; BOTTOM: SAND (SP); dark gray, moist, fine with sand parting [LN: S-8a: 45cm liner; S-8b: 7.5cm bag from top (CLAY); S-8c: 7.5cm bag from bottom (SAND)] EOH 5.85m (19.19ft) @ 16:30, NOV 4, 2015	PP: 2.75 ksf @ 5.25m	

Z-SAMPLE



TUBRO

STANDARD FIELD LOGGING FORM

PROJECT NO: 04.10140334
PROJECT NAME: ALASKA LNG PROJECT
LOCATION: COOK INLET, ALASKA
PROJECT MGR: ABHISHEK SHETHJI, P.E.
CLIENT: ALASKA LNG LLC (AKLNG)

DRILL HOLE NO: DS-5B
Pg. 1 of

LOGGER: DS: S.Dant / NS: E.Pulido
DRILLER: J.Wilson / J.Barfield
Drill Method: MR/core
Drill Size: See additional info
Drill Rig: SKATE 3A
START Date: NOV 4, 2015 Time:
COMPLETION Date: Time:
COMPLETION DEPTH (m/ft):

LOCATION DESCRIPTION: Marine Terminal Area
SURFACE ELEVATION (m/ft): -3.6/-11.9
REFERENCE DATUM: MLLW
COORDINATES (LAT/LON): 60.65554508°N 151.36919739°W
REFERENCE DATUM: NAD83

GROUNDWATER DEPTH (ft) ▽ INITIAL: — ▼ STATIC: —
WELL COMPL. DEPTH: — WELL TYPE: —
BACKFILLED with:
DATE Requested for Review: — ENGINEER to Review: —

Additional Information:
DTM: 10.5m DTW: 4.9m @ Nov 4, 2015 18:05
WD: 5.6m Tide: 1.97 @ Nov 4, 18:05
Mudline El: -3.6m MLLW
12" casing to 0.4m; 7" casing to
Geobor to ; Hammer: U-100

DEPTH, meters	SAMPLE: Type or Symbol / Top & Bottom Depth, m / Sample Number	HAMMER INFO: Weight, lbs / Drop, in / Downhole/Uphole Calibrated/Autotrip / BLOWS/15 cm	SAMPLE LENGTH, cm: Driven / Recovered / Total Intact	MATERIAL DESCRIPTION, including... SOIL TYPE/USCS SYMBOL SAND (SP) Lean CLAY (CL) / SOIL DENSITY very dense / SOIL CONSISTENCY very soft / COLOR olive gray / MOISTURE moist / ODORS/STAINING oxidation staining / INCLUSIONS micaceous / MODIFIERS with trace of silt	PP / TV / MV Reading, ksf / PID	PID / OVA / FID MODEL
0.0m / 0.05 / 0.3	S-1a 0.0 0.13m	100	30 30/30	S-1: SAND (SP); DARK GRAY, MOIST, FINE, TRACE OF FINE GRAVEL + COBBLE, SUBANGULAR - SUBROUNDED	0.0 ppm	
2205 / 0.75	S-1b 0.15 0.3m			S-2: SAND (SP); DARK GRAY, MOIST, FINE WITH LITTLE COARSE GRAVEL + COBBLE, SUBANGULAR TO SUBROUNDED 1-3" cobble (many)		
1.0m	S-2 0.3 0.75	100	45 25/25		0.0	
1.25 / 2145 / 1.85 / 2.0m	S-3a 1.25 1.70 S-3b 1.7 1.85m	100	60 55/55	S-3: SAND (SP); DARK GRAY, MOIST, FINE [LN - LINER CRACKED @ BOTTOM]	0.0	
2205 / 2.6	S-4 2.0 2.6m	98	60 35/35	S-4: SAND (SP); DARK GRAY, MOIST, FINE [LN - NO SHOE SAMPLE]	0.0	
2.8 / 3.0m / 2245 / 3.4	S-5 2.8 3.4m	20	60 45/45	S-5: SAND (SP); DARK GRAY; MOIST, FINE [LN - NO SHOE SAMPLE]	0.0	
3.5 / 2235 / 4.0m	S-6 3.5 4.1m	90	60 45/45	S-6: SAND (SP); DARK GRAY, MOIST, FINE [LN - NO SHOE SAMPLE]	0.0	
4.1 / 4.3 / 2250 / 4.9	S-7a 4.3 4.75 S-7b 4.75-4.9	94	60 45/45	S-7: LEAN CLAY (CL); VERY STIFF, DARK GRAY MOIST — Z-LAYER	PP = 2.75 ksf @ 4.9m 0.0 ppm	
5.0m / 2315 / 5.6 / 5.0m	S-8a 5.0 5.45 S-8b 5.45 5.6	67	60 56/55	S-8: LEAN CLAY (CL); VERY STIFF, DARK GRAY MOIST	PP = 2.75 ksf @ 5.6m	
				EOB = 5.6m (18.37 ft) 2315 hrs NOV 4 2015		

4B

EMB/KER
11-3-15 LOA

ch2m

PROJECT NUMBER: AKLNG
CORE ID NUMBER:
SHEET OF

SEDIMENT CORE LOG

PROJECT:
LOCATION:
Tide Correction:
ELEVATION:
DRILLING CONTRACTOR:
Depth to Mudline:
DRILLING METHOD AND EQUIPMENT USED: ~~Vibro-Core Method~~ Geo-core (GC)
WATER LEVELS:
START:
END:
LOGGER:

DEPTH BELOW MUDLINE (FT)	INTERVAL (FT)	RECOVERY (FT)	#/TYPE	% COMPACTION MIN = 75%	CORE DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY.	COMMENTS: DEPTH OF CASING, SAMPLE LOCATION, SAMPLE ID, REFUSAL
0					MUDLINE	
	1.3'	8"			Silty Sand (SM); dark gray	homogeneous; mineral origin; method of collection: Drive Sample
5						
10						
11.81'					(SM) silty sand, olive Grey, moist	Fugro sample: CR-06 homogenous, inorganic name: D4BGC06-11.81-13.54-01
13.54'	2.58	2.13				
14.44'					(CL) Lean clay, olive grey, moist	Fugro sample: CR-07 homogenous, inorganic name: D4BGC07-14.44-16.57-01
15						
16.57'	2.85	2.29				
20						

geo-core

4A

11-2-15 9PM

ch2m

PROJECT NUMBER: AK LNG

CORE ID NUMBER: ~~D4A~~ DS01-001-98-01

SHEET OF

SEDIMENT CORE LOG

PROJECT:
LOCATION:
Tide Correction:
ELEVATION:
DRILLING CONTRACTOR:
Depth to Mudline:
DRILLING METHOD AND EQUIPMENT USED: ~~VibraCore~~ Methods Drive Sample
WATER LEVELS:
START:
END:
LOGGER:

DEPTH BELOW MUDLINE (FT)	INTERVAL (FT)	RECOVERY (FT)	#/TYPE	% COMPACTION MIN = 75%	CORE DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY.	COMMENTS: DEPTH OF CASING, SAMPLE LOCATION, SAMPLE ID, REFUSAL
0					MUDLINE	
	1.96'	1.96'	- total		(SM) silty sand; dark gray; moist	homogeneous; ~~[illegible]~~ ~~[illegible]~~ mineral origin; no organic material
	1.48'	-	sample length			Method of collection: Drive sample VB-4A → AKA. DS4A ← Fugro designatio
5						
10						
15						
20						

13.0 APPENDIX B – PHOTOGRAPHS

ch2m

PHOTOGRAPH LOG

Project: AKLNG Sediment Test Pit Dredge
Project Number: 653488.16.06

Logger: J. Knuth
Date: 11/7/15

Page #	File Name:	Boring ID:	Sample ID:	Description:
1	IMG-1567	DS-4A	S-3	Core Label
2	IMG-1568	DS-4A	S-3	Core Lithology
NA	IMG-1569	DELETED	DELETED	DELETED
3	IMG-1570	DS-4A	S-4	Core Label
4	IMG-1571	DS-4A	S-4	Core Lithology
NA	IMG-1572	DELETED	DELETED	DELETED
5	IMG-1573	DS-4B	CR-1	Core Label
6	IMG-1574	DS-4B	CR-1	Core Lithology
7	IMG-1575	DS-4B	CR-2	Core Label
8	IMG-1576	DS-4B	CR-2	Core Lithology
NA	IMG-1577	DELETED	DELETED	DELETED
9	IMG-1578	DS-4B	CR-3	Core Label
10	IMG-1579	DS-4B	CR-3	Core Lithology
NA	IMG-1580	DELETED	DELETED	DELETED
11	IMG-1581	DS-4B	CR-4	Core Label
12	IMG-1582	DS-4B	CR-4	Core Lithology
NA	IMG-1583	DELETED	DELETED	DELETED
13	IMG-1584	DS-4A	S-5	Core Label
14	IMG-1585	DS-4A	S-5	Core Lithology
NA	IMG-1586	DELETED	DELETED	DELETED
15	IMG-1587	DS-4B	CR-5	Core Label
16	IMG-1588	DS-4B	CR-5	Core Lithology
17	IMG-1589	DS-4A	S-7	Core Label
18	IMG-1590	DS-4A	S-7	Core Lithology
19	IMG-1591	DS-4B	G-7b	Core Label
20	IMG-1592	DS-4B	G-7b	Core Lithology
21	IMG-1593	DS-4A	S-8	Core Label
22	IMG-1594	DS-4A	S-8	Core Lithology
NA	IMG-1595	DELETED	DELETED	DELETED
23	IMG-1596	DS-5A	S-2a	Core Label
NA	IMG-1597	DELETED	DELETED	DELETED
24	IMG-1598	DS-5A	S-2a	Core Lithology
25	IMG-1599	DS-5A	CR-1	Core Label
26	IMG-1600	DS-5A	CR-1	Core Lithology
27	IMG-1601	DS-5A	S-3a	Core Label
28	IMG-1602	DS-5A	S-3a	Core Lithology
29	IMG-1603	DS-5B	S-1b	Core Label
NA	IMG-1604	DELETED	DELETED	DELETED
30	IMG-1605	DS-5B	S-1b	Core Lithology
31	IMG-1606	DS-5B	S-2	Core Lithology

Page 1 of 2

ch2m

PHOTOGRAPH LOG

Project: AKLNG Sediment Test Pit Dredge
Project Number: 653488.16.06

Logger: J. Knuth
Date: 11/7/15

Page #	File Name:	Boring ID:	Sample ID:	Description:
32	IMG-1607	DS-5B	S-3a	Core Label
NA	IMG-1608	DELETED	DELETED	DELETED
33	IMG-1609	DS-5B	S-3a	Core Lithology
34	IMG-1610	DS-5B	S-5	Core Label
NA	IMG-1611	DELETED	DELETED	DELETED
35	IMG-1612	DS-5B	S-5	Core Lithology
36	IMG-1613	DS-5B	S-4	Core Label
37	IMG-1614	DS-5B	S-4	Core Lithology
38	IMG-1615	DS-5B	S-6	Core Label
39	IMG-1616	DS-5B	S-6	Core Lithology
40	IMG-1617	DS-5A	S-4b	Core Label
NA	IMG-1618	DELETED	DELETED	DELETED
41	IMG-1619	DS-5A	S-4b	Core Lithology
42	IMG-1620	DS-5A	S-5	Core Lithology
43	IMG-1621	DS-5B	S-7a	Core Label
44	IMG-1622	DS-5B	S-7a	Core Lithology
45	IMG-1623	DS-5A	S-6a	Core Label
46	IMG-1624	DS-5A	S-6a	Core Lithology
47	IMG-1625	DS-5A	S-7a	Core Label
48	IMG-1626	DS-5A	S-7a	Core Lithology
49	IMG-1627	DS-5B	S-8a	Core Label
NA	IMG-1628	DELETED	DELETED	DELETED
50	IMG-1629	DS-5B	S-8a	Core Lithology
51	IMG-1630	DS-5A	S-8a	Core Label
52	IMG-1631	DS-5A	S-8a	Core Lithology
53	NA			Photo Log
54	NA			Photo Log

Fugro Consultants Inc.
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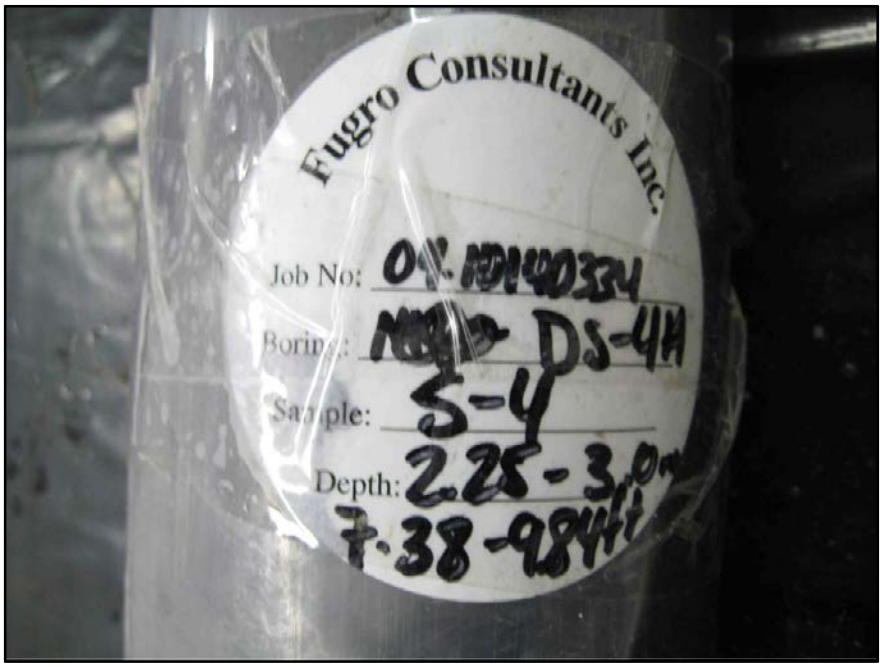
Boring: [redacted] DS-4A
Sample: S-3
Depth: 1.5-2.25m
4.92-7.38ft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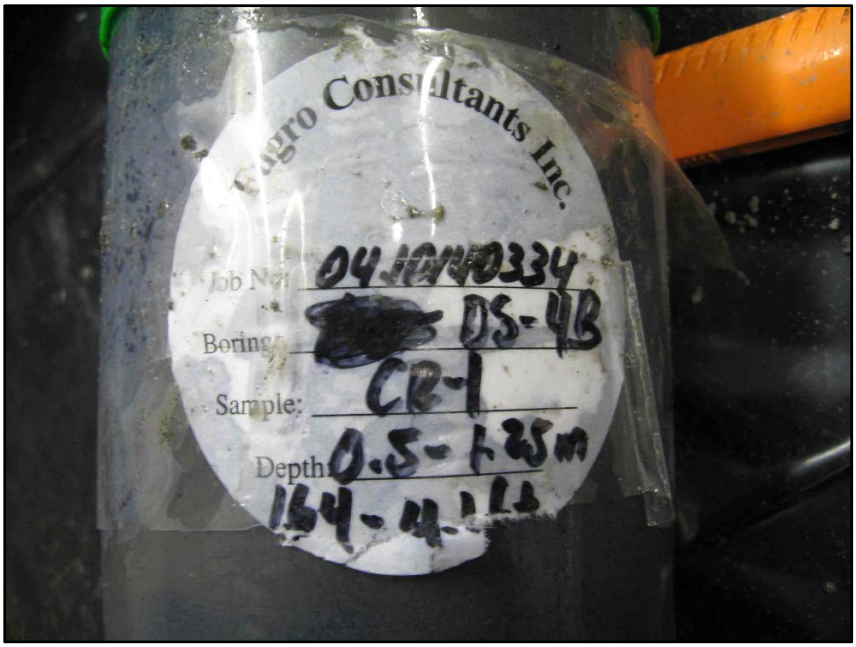
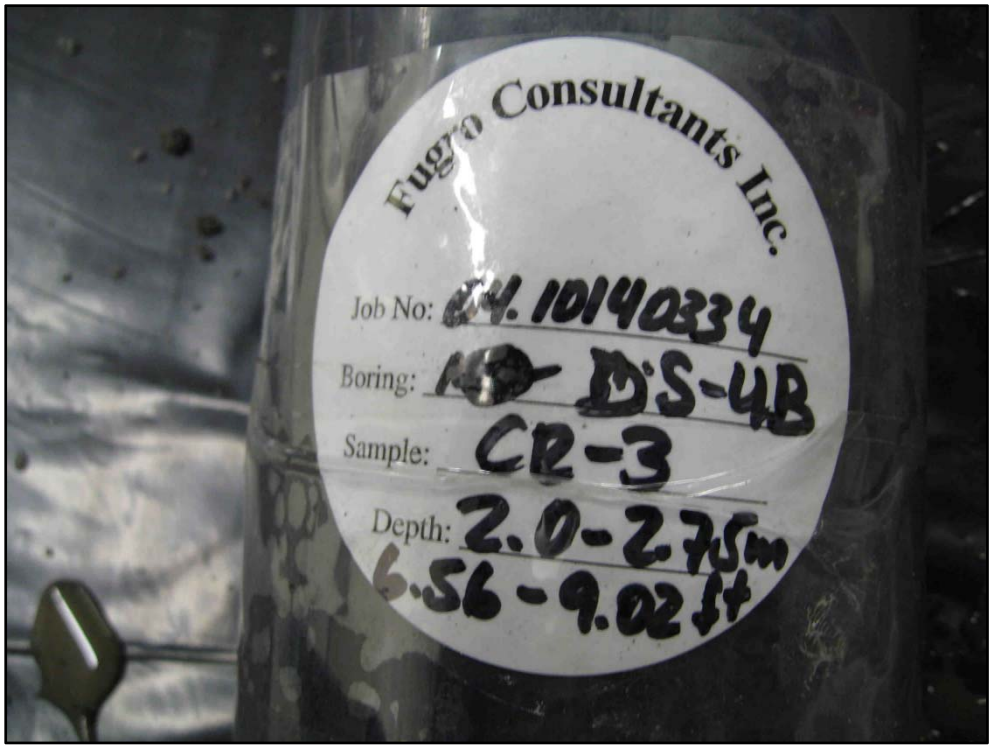
Job No:
Boring:
DS-4A
Sample:
S-4
Depth:
2.25-3.0m



Fugro Consultants Inc.
Job No: 04J0140334
Boring: [redacted] DS-4B
Sample: CR-1
Depth: 0.5-1.25m

Fugro Consultants Inc.
Job No: 04.[illegible]40334
Boring: DS-4B
Sample: CR-2
Depth: 1.25-2.0m
4.1-6.56ft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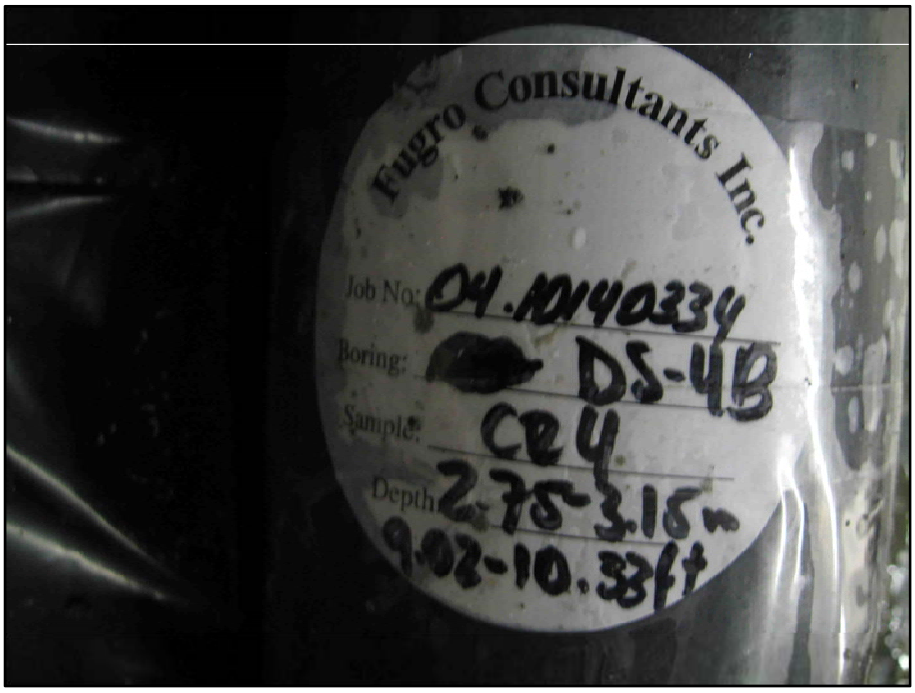
Job No: 04.10140334
Boring: DS-4B
Sample: CR-3
Depth: 2.0-2.75m
6.56-9.02 ft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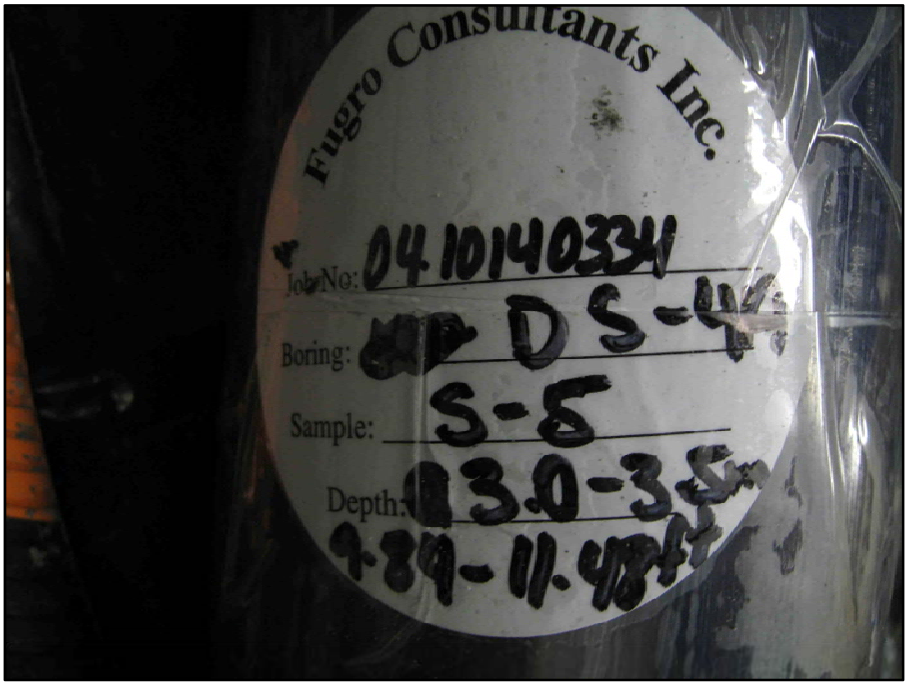
Job No: P4.10140334
Boring: DS-4B
Sample: CR4
Depth 2.75-3.15m
9.02-10.33ft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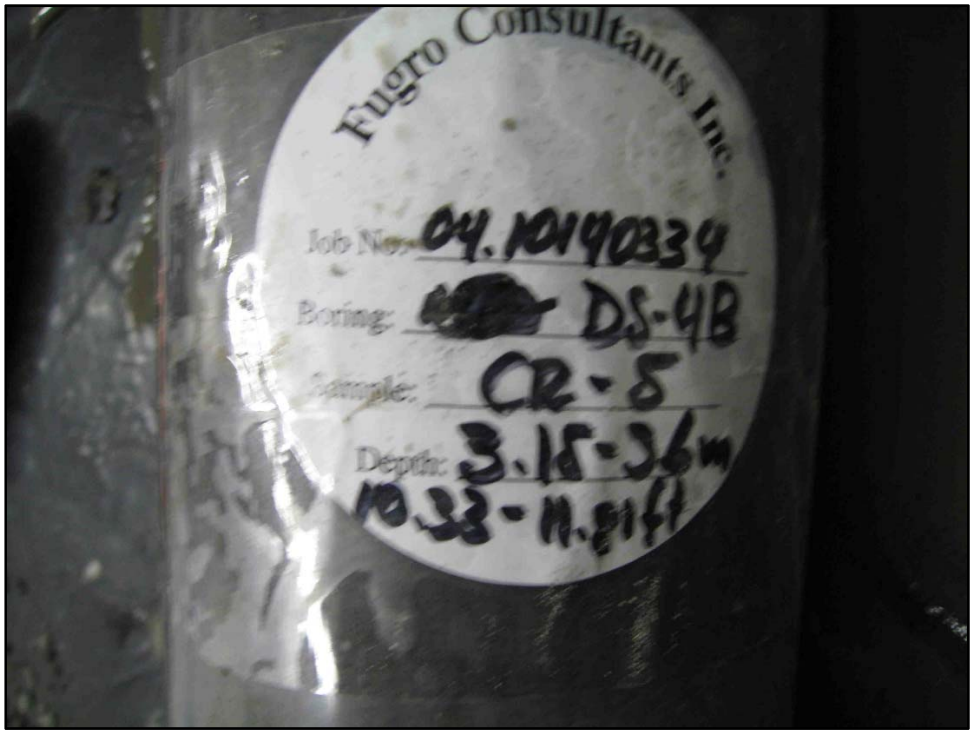
Job No: 0410140334
Boring: DS-4
Sample: S-5
Depth: 3.0-3.5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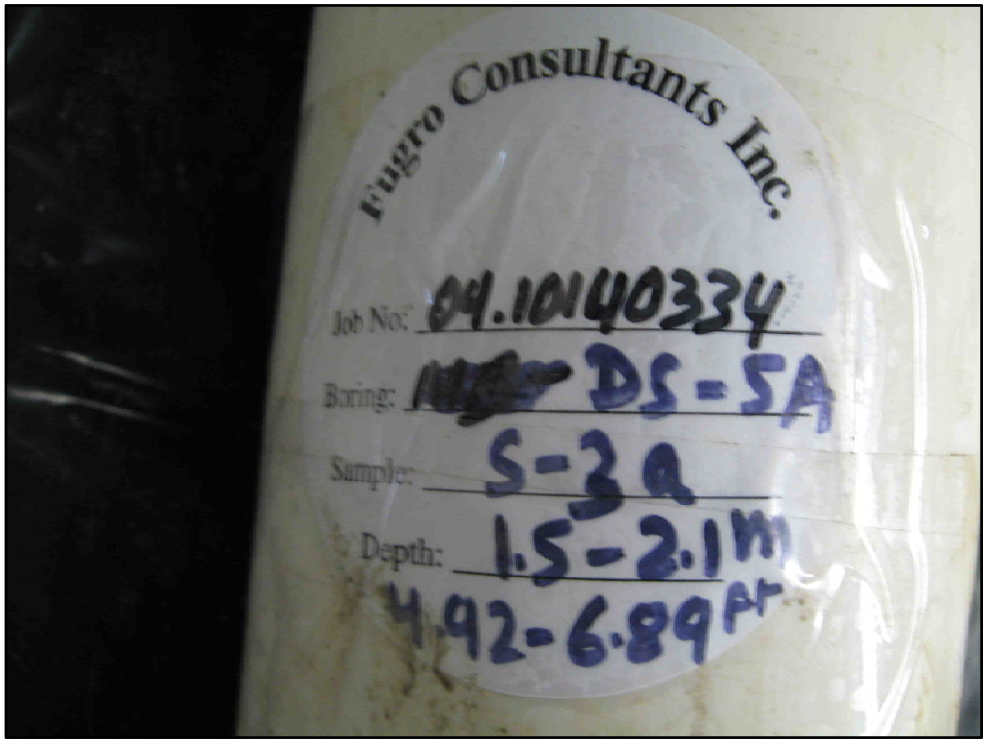
Job No: 04.10140334
Boring: [redacted] DS-4B
Sample: CR-8
Depth: 3.15-3.6m
10.33-11.81ft

Fugro Consultants Inc.
Job No: 04.10140334
Boring: DS-44
Sample: S-7
Depth: 4.25-5.75m
13.94-18.86ft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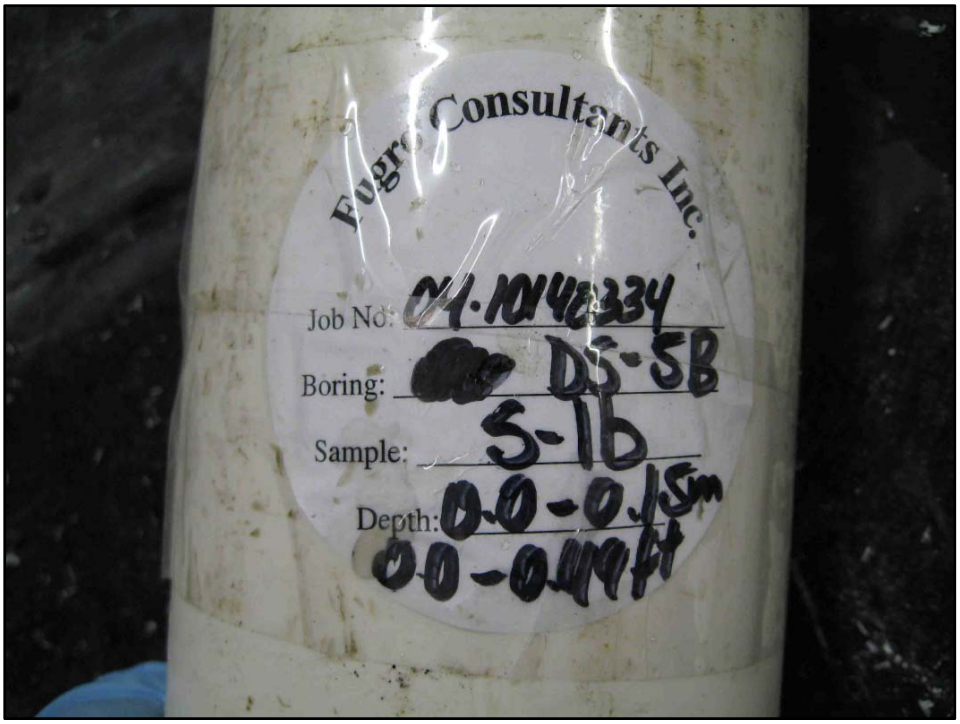
Job No: 04.10140334
Boring: DS-5A
Sample: S-3a
Depth: 1.5-2.1m
4.92-6.89ft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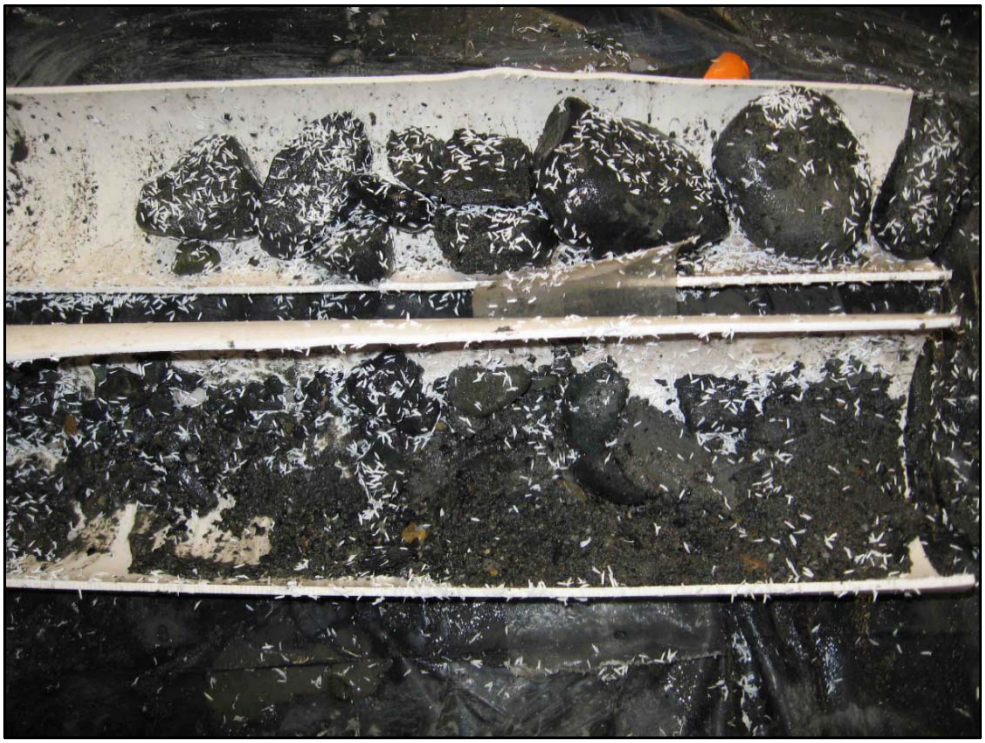
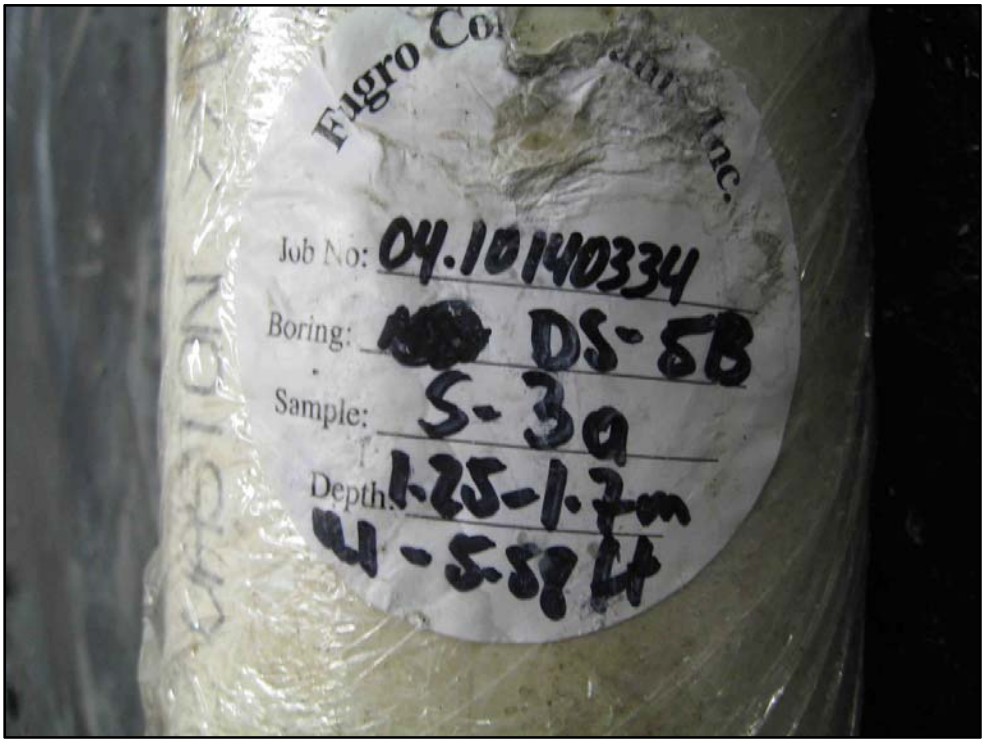
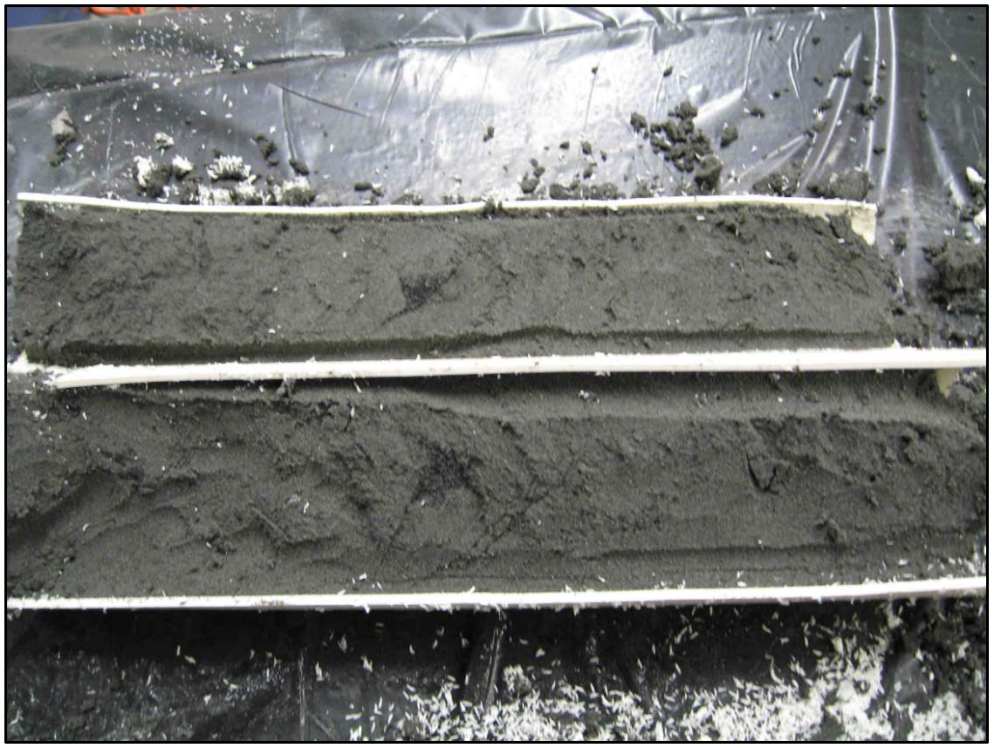
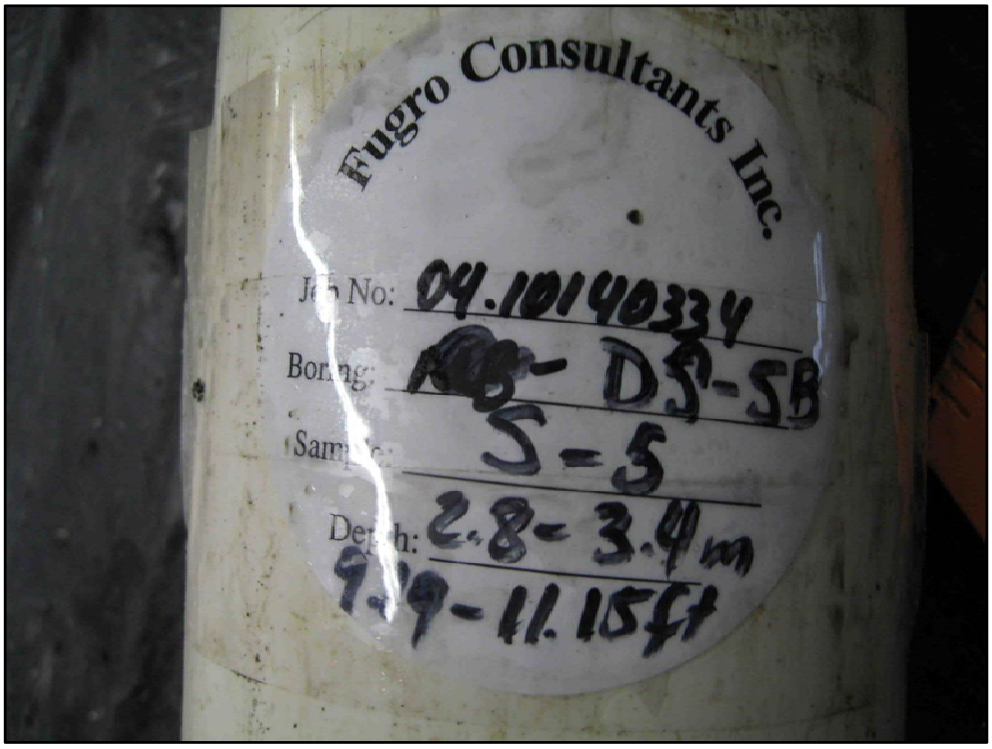
Job No:
Boring: DS-5B
Sample: S-1b
Depth: 0.0-0.15m
0.0-0.49ft




Fugro Co
Inc.
Job No: 04.10140334
Boring: DS-8B
Sample: S-3a
Depth: 1.25-1.7m
4-5.5ft

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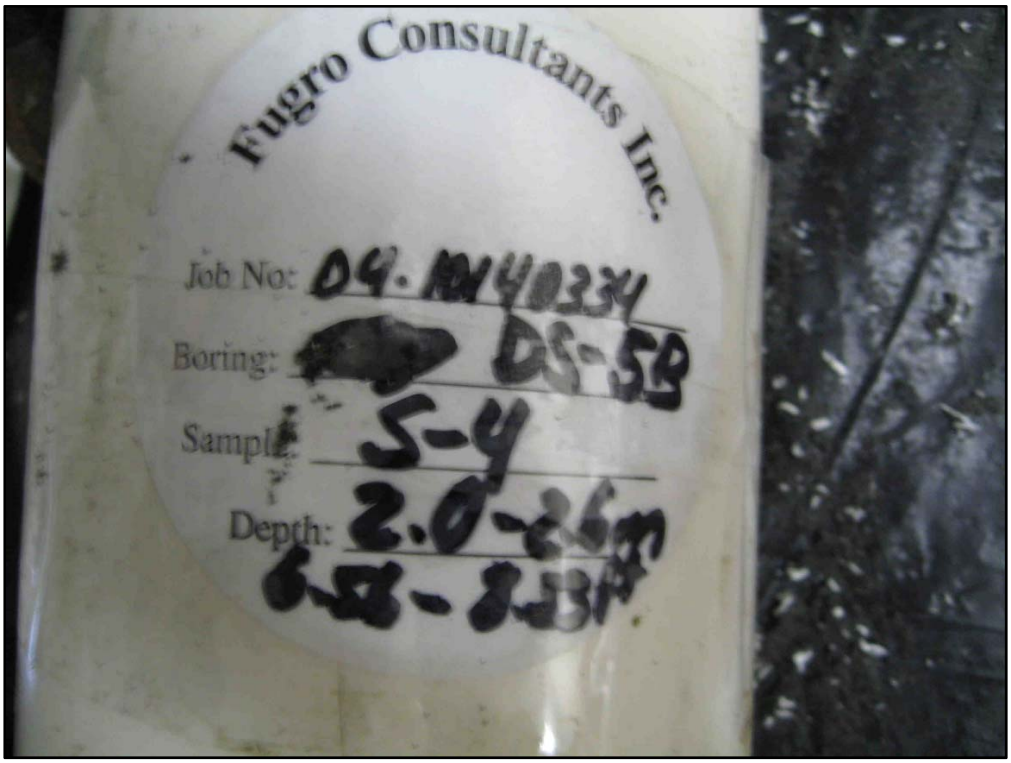
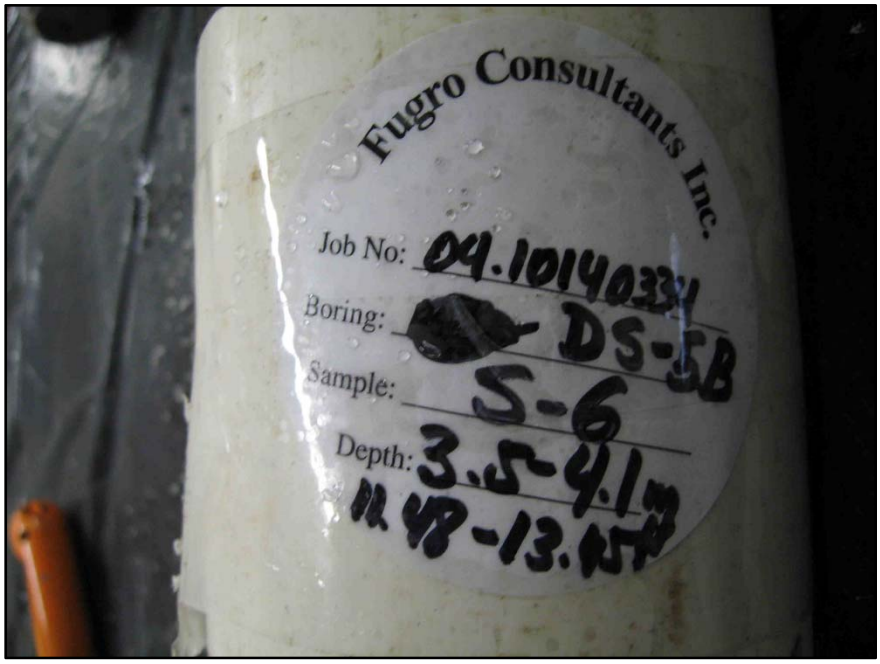
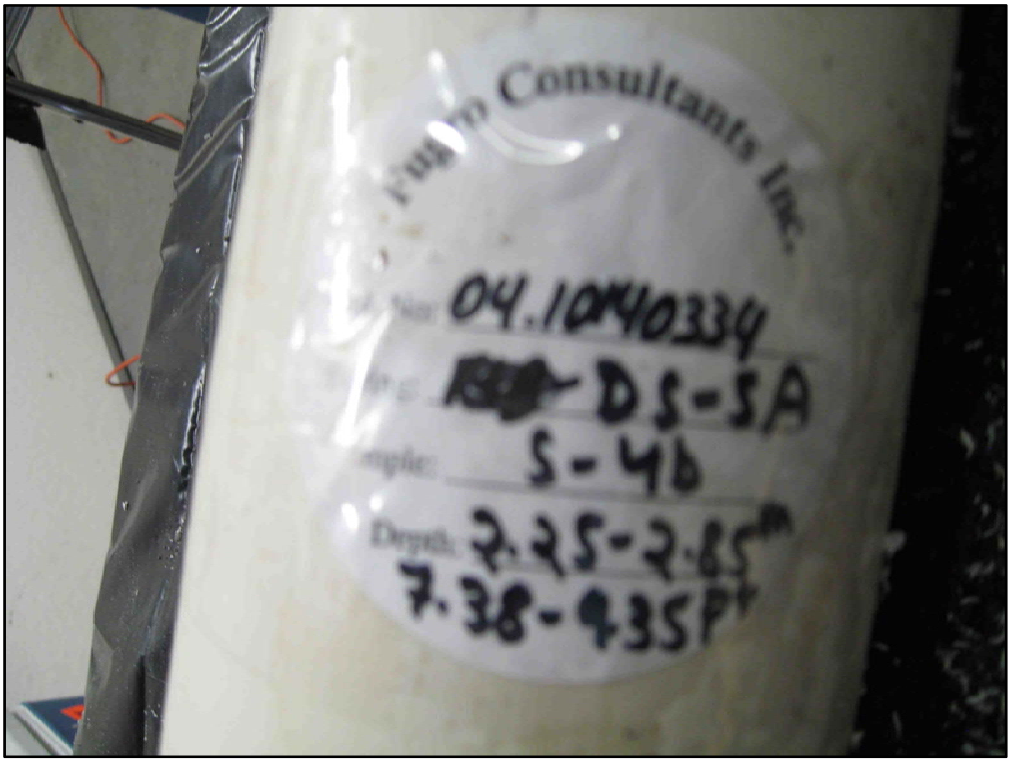
Boring: DS-5B
Sample: S-5
Depth: 2.8-3.4m
9.19-11.15ft

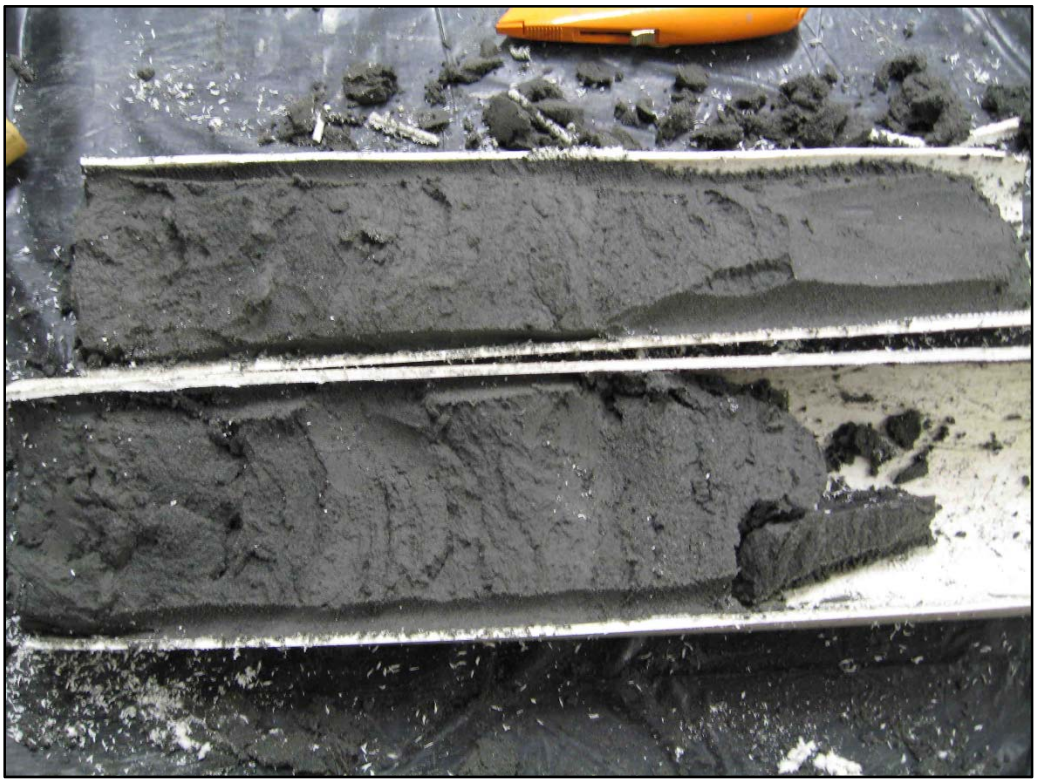


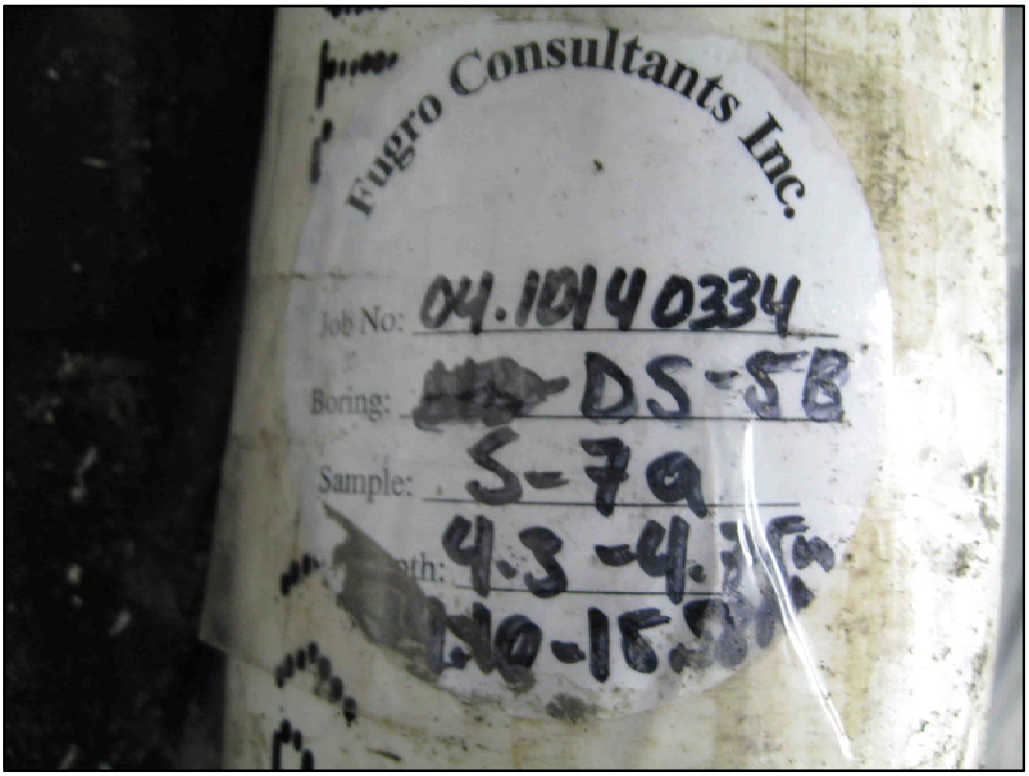
Fugro Consultants Inc.
Job No: 04-10140334
Boring: DS-5B
Sample: S-4
Depth: 2.0-2.6m

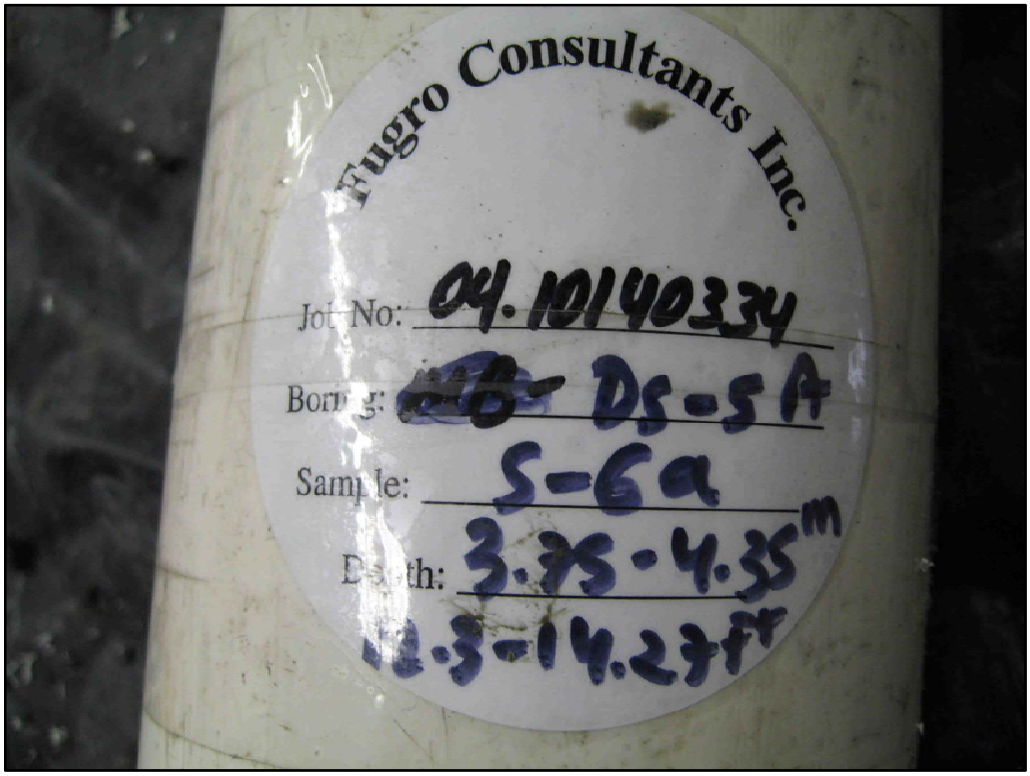

Fugro Consultants Inc.
Job No: 04.10140331
Boring: DS-5B
Sample: S-6
Depth: 3.5-4.1m

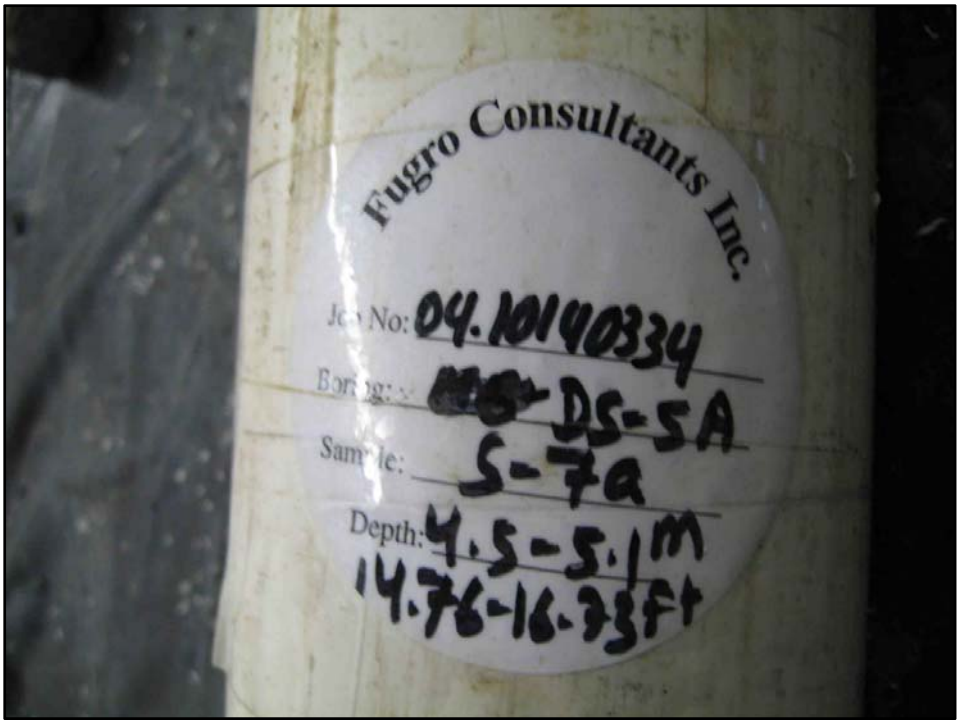
Jackson

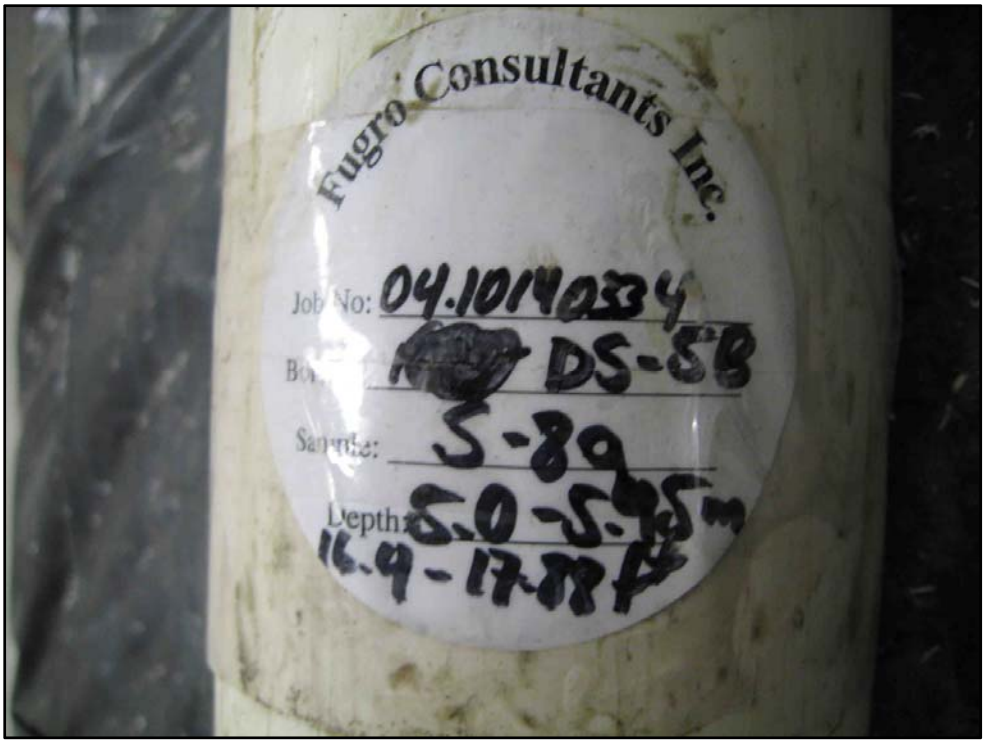

Consultants Inc.
04.1040334
DS-5A
S-4b
2.25-2.85
7.38-9.35



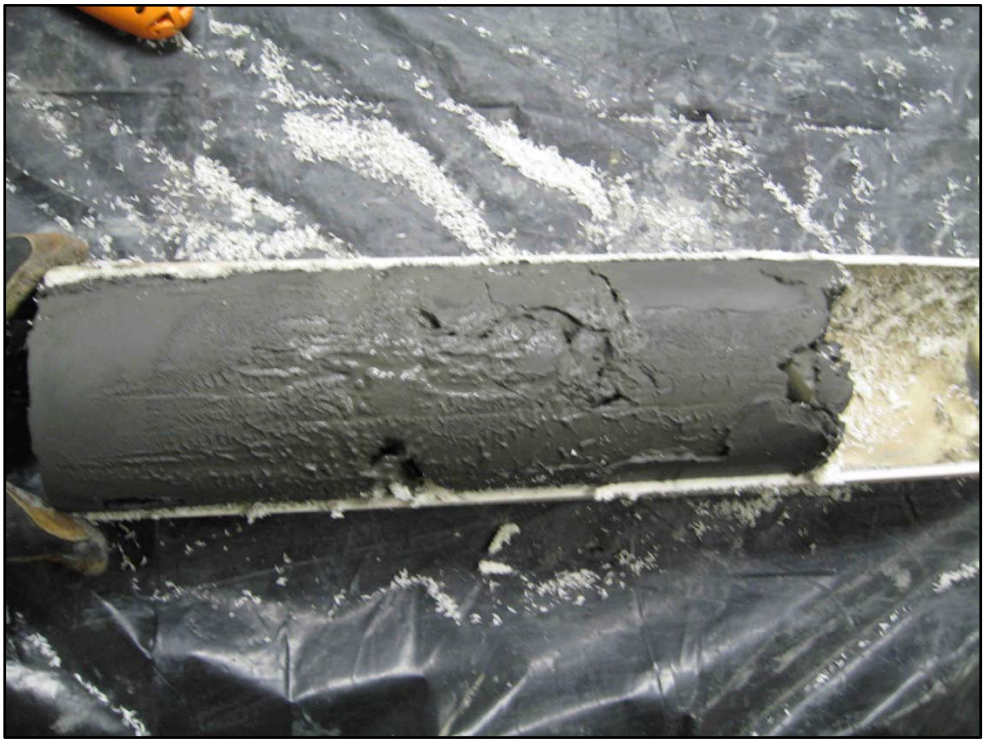

Fugro Consultants Inc.
Job No: 04.10140334
Boring: DS-5B
Sample: S-7a
4.3-4.

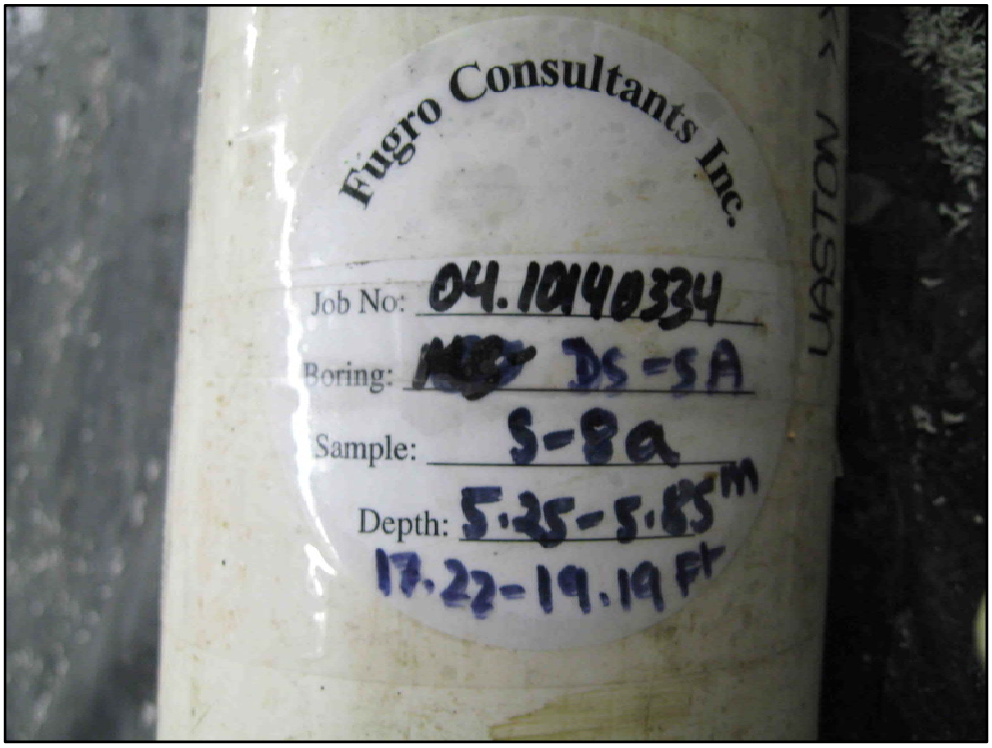

Fugro Consultants Inc.
Job No: 04.10140334
Boring: DS-5A
Sample: S-6a
Depth: 3.75-4.35m
12.3-14.27ft


Fugro Consultants Inc.
Job No: 04.10140334
Boring: DS-5A
Sample: S-7a
Depth: 4.5-5.1m
14.76-16.73ft



Fugro Consultants Inc.
Job No: 04.10140334
DS-5B
S-8a
Depth: 5.0-5.95m
16.4-17.88ft




Fugro Consultants Inc.
Job No: 04.10140334
Boring: DS-5A
Sample: S-8a
Depth: 5.35-5.85m
17.22-19.19 ft
WESTON

14.0 APPENDIX C – WATER QUALITY PROFILE FIELD DATA

ch2m

AKLNG TEST PIT DREDGE
WATER QUALITY MEASUREMENT DATASHEET

Sample Location: DS-4R
Date: NOV 3 2015
Project # 353488.15.02
Start Time: 0010
Logger Name: E. PULIDO
End Time: 0020
Field & Weather Conditions: CLOUDY / SNOW 20°F

Depth to Mudline (FT Below Surface): SEE COMMENTS
Tide Correction (FT): SEE COMMENTS
Location GPS Coordinates: 60.655805440N 151.367120220W (NAD83)

Instrument Measurements:

DEPTH BELOW DECK (m)	Depth of Probe/Sonde (meters)	Temp (C)	Cond (mS/cm)	DO (mg/L)	pH	ORP (mV)
5.6	Surface (<0.5)	6.68	28.23 / 27.60	12.36	8.0	274.1
7.1	1.5	6.71	28.26 / 27.60	11.30	8.02	274.3
8.6	3	6.72	28.26 / 27.60	10.98	7.98	275.3
9.1	4.5	6.72	28.26 / 27.60	10.90	8.0	274.1
10.1	6	6.72	28.26 / 27.60	10.80	8.02	274.1
	7.5					
	9					
	10.5					
	12					
	13.5					
	15					
	16.5					
	18					
	19.5					
	21					
	22.5					
	24					
	25.5					
	27					
	28.5					
	30					
	31.5					
	33					
	34.5					
	36					

Notes/Comments/Observations:
DTM = 10.1m DTW = 4.6m @ 0015 NOV 3, 2015 TIDE = 3.2m @ 0015 NOV 3
WD = 5.5m @ 0015
MUDLINE : ELEV -2.3m MLLW

ch2m

AKLNG TEST PIT DREDGE
WATER QUALITY MEASUREMENT DATASHEET

Sample Location: D5-5A
Date: Nov 4, 2015
Project #: 853438.16.02
Start Time: 12:40
Logger Name: Stant
End Time: 12:50
Field & Weather Conditions: Overcast, 29°F

Depth to Mudline (FT Below Surface): See comments below
Tide Correction (FT): See comments below
Location GPS Coordinates: 60.65557886°N 151.36914764°W CNAD83

Instrument Measurements:

Below deck (m)	Depth of Probe/Sonde (meters)	Temp (C)	Cond (mS/cm) mS/cm / Sal	DO (mg/L)	pH	ORP (mV)
1.4	Surface (<0.5)	5.43	26.57/26.77	13.61	8.04	207.3
2.9	1.5	5.72	26.72/26.77	11.41	8.04	204.7
4.4	3	5.90	27.14/27.02	11.03	8.01	204.9
5.9	4.5	5.95	27.19/27.05	10.89	8.01	204.9
7.4	6	5.98	27.21/27.05	10.81	8.00	205.0
8.9	7.5	6.00	27.21/27.04	10.72	8.00	205.5
10.4	9	6.00	27.21/27.03	10.71	8.01	204.8
	10.5					
	12					
	13.5					
	15					
	16.5					
	18					
	19.5					
	21					
	22.5					
	24					
	25.5					
	27					
	28.5					
	30					
	31.5					
	33					
	34.5					
	36					

Notes/Comments/Observations:
DTM = 10.4m DTW = 1.4m @ Nov 4, 2015, 12:40 Water depth = 9.0m
Tide @ Nov 4, 2015, 12:40 = 5.27m
Mudline El. = -3.7m MLLW (-12.2 ft MLLW)

ch2m

AKLNG TEST PIT DREDGE
WATER QUALITY MEASUREMENT DATASHEET

Sample Location: DS-4A (DH5201)
Date: Nov 2, 2015
Project Number: 19-05
Start Time: 16:15
Logger Name: S. Pant
End Time: 16:24
Field & Weather Conditions: Overcast 33°F
Depth to Mudline (Ft. below Surface): see comments
Tide Correction (Ft.): see comments
Location GPS Coordinates: 60.635884114°N 151.367194311°W
Instrument Measurements:

Depth below deck m	Depth of Measurements (Meters)	Temp (C)	Cond (mS/cm) ms/cm/Sal	DO (mg/L)	pH	ORP (mV)
5.4	Surface (0.5)	7.26	27.17/26.02	11.81	8.06	240.4
6.9	1.5	7.32	27.26/26.07	10.88	8.05	240.2
8.4	3	7.33	27.46/26.33	10.77	8.05	238.6
9.9	4.5	7.22	27.69/26.62	10.57	8.04	238.7
	6					
	7.5					
	9					
	10.5					
	12					
	13.5					
	15					
	16.5					
	18					
	19.5					
	21					
	22.5					
	24					
	25.5					
	27					
	28.5					
	30					
	31.5					
	33					
	34.5					
	36					

Notes/Comments/Observations: Low tide = 2.01m @15:12; Slack water @16:42
DTM: 10.0m; DTW = 5.4m @ 16:15 Nov 2; Tide = 2.25m @ 16:15 Nov 2
∴ WD = 4.6m @ 16:15
Mudline El = -2.4m MLLW

ch2m

AKLNG TEST PIT DREDGE
WATER QUALITY MEASUREMENT DATASHEET

Sample Location: DS-5B
Date: Nov 4, 2015
Project #: 652/82.13.02
Start Time: 18:05
Logger Name: S. Pant
End Time: 18:13
Field & Weather Conditions: Overcast

Depth to Mudline (FT Below Surface): See comments below
Tide Correction (FT): See comments below
Location GPS Coordinates: 60.655545°N 151.269197°W NAD83

Instrument Measurements:

Depth of Probe/Sonde (meters)	Temp (°C)	Cond (mS/cm) mS/cm / ppt	DO (mg/L)	pH	ORP (mV)
Surface (~0.5)	6.94	26.21 / 25.21	12.0	8.01	282.6
1.5	6.92	26.41 / 25.5	11.18	8.01	282.7
3	6.89	26.62 / 25.78	11.03	8.01	283.0
4.5	6.85	26.76 / 25.90	10.41	7.99	284.3
5.6	6.84	26.76 / 25.91	10.51	7.98	284.8
7.5					
9					
10.5					
12					
13.5					
15					
16.5					
18					
19.5					
21					
22.5					
24					
25.5					
27					
28.5					
30					
31.5					
33					
34.5					
36					

below deck (m)
4.9
6.4
7.9
9.4
10.5

Notes/Comments/Observations:
DTM = 10.5m DTW = 4.9m @ Nov 4, 2015, 18:05 Water depth = 5.6m
Tide @ Nov 4, 2015, 18:05 = 1.97m
Mudline El = -3.6m MLLW (-11.97 ft MLLW)

15.0 APPENDIX D – DATA QA/QC SUMMARY – WPI

Attachment 1: Data QA/QC Summary - WPI

Attachment 1 - Data QAQC Summary - WP

1.0 INTRODUCTION

The objective of this data quality evaluation (DQE) report is to assess the data quality of analytical results for soil samples collected as part of the Test Pit Dredge Material Characterization at the Alaska LNG facility near Nikiski on the Kenai Peninsula of Alaska. The data may also be used to support future activities such as feasibility studies, risk assessments, fate and transport modeling and remedial actions. Individual method requirements and guidelines from the USEPA Contract Laboratory National Functional Guidelines (NFG) for Superfund Organic Methods Data Review (August 2014) and the USEPA Contract Laboratory NFG for Inorganic Superfund Data Review (August 2014) were used as the basis for this assessment.

This report is intended as a general data quality assessment designed to summarize data issues.

2.0 ANALYTICAL DATA

This DQE report covers 14 primary samples, 2 field duplicates (FD), one equipment blank (EB) and 3 trip blanks (TB). All samples were collected between October 29, 2015 and November 6, 2015. A list of samples associated with this DQE is included in Attachment 1.

The sample results were reported as three sample delivery groups (SDG) presented in Table 1. The analyses were performed by Applied Sciences Laboratory in Corvallis, Oregon (CHMC) and ALS Environmental in Kelso, Washington (ALS). Samples were shipped to CHMC; CHMC was responsible for shipment of samples to ALS.

Table 1: Sample Delivery Groups

P3522
P3549
P3586

Twenty-three methods were used to analyze the environmental samples. Selected samples were analyzed for one or more of the following analytes/methods in Table 2. Samples were also analyzed for geotechnical parameters; however, geotechnical data are not validated and are not presented in this assessment.

Table 2: Analytical Parameters by Laboratory

Parameter	Method	Laboratory
Gasoline Range Organics (GRO)	AK101	CHMC
Diesel and Residual Range Organics (DRO/RRO)	AK102/103	CHMC
Percent moisture	ASTM D2216	CHMC
Acid volatile sulfide	AVS	CHMC
pH	E150.1	CHMC
Total volatile solids	E160.4	CHMC
Metals	E200.7/SW6010B	CHMC
Mercury	E245.1/SW7471A	CHMC
Ammonia	E350.1	ALS
Tributyltin	Krone	ALS
Total sulfide	PSEP	ALS
Total solids	SM2540B/SM2540G	CHMC
Hexavalent chromium	SW7196A	ALS
Total Organic Carbon (TOC)	Lloyd Kahn/SM5310B	CHMC
Pesticides	SW8081B	ALS
Polychlorinated biphenyls	SW8082	CHMC
Volatile Organic Compounds	SW8260B	CHMC
Semi-volatile organic compounds	SW8270C	CHMC
Polynuclear Aromatic Hydrocarbons	SW8270C-SIM	CHMC

The assessment of data includes a review of: (1) the chain-of-custody (COC) documentation; (2) holding-time compliance; (3) the required quality control (QC) samples at the specified frequencies; (4) method blanks; (5) laboratory control sample/laboratory control sample duplicates (LCS/LCSD); (6) surrogate spike recoveries; (7) matrix spike/matrix spike duplicate (MS/MSD) samples; and (8) initial and continuing calibration information and other method-specific criteria.

Field samples were also reviewed to ascertain field compliance and data quality issues. This included a review of FDs, TBs and an EB.

Data flags were assigned using the NFG as guidance. Multiple flags are routinely applied to specific sample method/matrix/analyte combinations, but there will be only one final flag. A final flag is applied to the data and is the most conservative of the applied validation flags. The final flag also includes matrix and blank sample impacts.

The data flags are defined below:

- J = The analyte was positively identified, and the quantitation is an estimation because of discrepancies in meeting certain analyte-specific quality control criteria. Or the analyte was positively identified, but the associated concentration is estimated above the method detection limit and below the reporting limit (RL).
- R = The data are rejected because of deficiencies in meeting QC criteria and may not be used for decision making.
- U = The analyte was analyzed for, but the analyte was not detected or the analyte was detected in the sample at a concentration less than or equal to five times (10 times for common laboratory contaminants) an associated blank concentration.
- UJ = The analyte was not detected; however, the result is estimated because of discrepancies in meeting certain analyte-specific QC criteria.

3.0 FINDINGS

The overall summaries of the data validation findings are contained in the following sections and Table 3. Only findings that resulted in data qualifiers being applied to the data are discussed.

Also included as documentation of data validation findings is the Alaska Department of Environmental Conservation Laboratory Data Review Checklist (Version 2.7, January 2010). A checklist is provided for each laboratory SDG and can be found in Attachment 2 to this DQE.

3.1 HOLDING TIMES

All holding-time criteria were met.

3.2 CALIBRATION

All initial and continuing calibration criteria were met.

3.3 METHOD AND CALIBRATION BLANKS

Method blanks were analyzed at the required frequency and were free of contamination with the following exceptions:

Ammonia was detected below the RL in a continuing calibration blank (CCB) for Method E350.1. Three associated results detected less than five times the blank concentration were qualified as not detected and flagged “U”.

Antimony was detected below the RL in a method blank for Method SW6010B. Six associated results detected less than five times the blank concentration were qualified as not detected and flagged “U”.

Total sulfide was detected above the RL in the method blanks for Method PSEP. Eight associated results detected less than five times the blank concentration were qualified as not detected and flagged “U”.

3.4 TRIP BLANKS

Three TBs were collected and were free of contamination.

3.5 EQUIPMENT BLANKS

One EB was collected and was free of contamination that would affect the data.

3.6 FIELD DUPLICATES

Two FD sets were collected. Precision was acceptable with the following exceptions:

The relative percent difference (RPD) of lead was greater than criteria in FD set REF-2/REF-102 for Method SW6010B. Two associated detected results were qualified as estimated and flagged “J”.

The RPD of ammonia was greater than criteria in FD set D4SD04-0.503-01/D4SD04-0.503-101 for Method E350.1. Two associated detected results were qualified as estimated and flagged “J”.

The RPD of TOC was greater than criteria in FD set D4SD04-0.503-01/D4SD04-0.503-101 for Method Lloyd Kahn. Two associated detected results were qualified as estimated and flagged “J”.

The RPD of 4,4'-DDT was greater than criteria in FD set D4SD04-0.503-01/D4SD04-0.503-101 for Method SW8081B. One associated nondetected result was qualified as estimated and flagged "UJ"; one associated detected result was qualified as estimated and flagged "J".

The RPDs of 1,2,4-trimethylbenzene, benzene, chloromethane, m,p-xylene, naphthalene, o-xylene and toluene were greater than criteria FD set D4SD04-0.503-01/D4SD04-0.503-101 for Method SW8260B. Fourteen associated detected results were qualified as estimated and flagged "J".

3.7 MATRIX SPIKE SAMPLES

The results of MS/MSD analyses provide information about the possible influence of the matrix on either accuracy or precision of the measurements. All acceptance criteria were met with the following exceptions:

The recovery of hexavalent chromium was less than criteria in the MS and MSD of sample D4SD04-0.503-01 for Method SW7196A. The associated nondetected result was qualified as estimated and flagged "UJ".

The recovery of TOC was greater than criteria in the MS of sample REF-2 and in the MSD of sample D4SD04-0.503-01 for Method Lloyd Kahn. Two associated detected results were qualified as estimated and flagged "J".

The recoveries of antimony was less than criteria in the MS and MSD of sample D4SD04-0.503-01, and the recovery of barium was greater than criteria in the MS and MSD of this same sample, for Method SW6010B. Two associated detected results were qualified as estimated and flagged "J".

The recoveries of antimony, barium, selenium and vanadium were less than criteria in the MS and/or MSD of sample REF-2 for Method SW6010B. One associated nondetected result was qualified as estimated and flagged "UJ"; three associated detected results were qualified as estimated and flagged "J".

The recovery of benzoic acid was less than criteria in the MS and MSD of sample D4SD04-0.503-01 for Method SW8270C. The associated nondetected result was qualified as estimated and flagged "UJ".

The recoveries of 1,2,3-trichlorobenzene, 1,2,4-trichlorobenzene, 2-butanone, benzene, chloromethane, naphthalene and toluene were less than criteria in the MS and/or MSD of sample D4SD04-0.503-01 for Method SW8260B. Two associated nondetected results were qualified as estimated and flagged "UJ"; five associated detected results were qualified as estimated and flagged "J".

The recovery of acetone was less than criteria in the MS of sample D4SD04-0.503-01, and greater than criteria in the MSD of this same sample, for Method SW8260B. The associated detected result was qualified as estimated and flagged "J".

3.8 SURROGATES

Surrogates were added to all samples for the methods requiring their use. Surrogate recoveries met criteria.

3.9 LABORATORY CONTROL SAMPLES

LCS/LCSDs were analyzed and all accuracy and precision criteria were met.

3.10 INTERNAL STANDARDS

All internal standard acceptance criteria were met.

3.11 CHAIN OF CUSTODY AND SAMPLE RECEIPT DISCREPANCIES

3.11.1 SDG P3522

No discrepancies were noted.

3.11.2 SDG P3549

Samples for pH analysis were received past holding time. Soil samples for pH require leaching within 30 days, no data were qualified.

Samples were received at 0.3 degrees Celsius. There was no evidence of freezing so no data were qualified.

Sample TRVL BLK did not specify if it was for VOC or GRO, sample was logged in for VOC only because only one vial was received.

3.11.3 SDG P3586

Samples for pH analysis were received past holding time. Soil samples for pH require leaching within 30 days, no data were qualified.

A MS/MSD was requested for total solids and volatile solids; however, MS/MSD is not applicable for these methods.

Sample D4SD04-4.2518.86-03 (P358606) label requests ammonia, hexavalent chromium, pesticide, and tributyltin analysis; however, the chain of custody does not list requested analysis. Sample was logged in per the labels.

Sample TRIP BLANK (P358614) was not received.

3.12 OVERALL ASSESSMENT

The final activity in the data quality evaluation is an assessment of whether the data meet the data quality objectives. The goal of this assessment is to demonstrate that a sufficient number of representative samples were collected and the resulting analytical data can be used to support the decision making process. The following summary highlights the data evaluation findings for the above defined events:

1. No data were rejected. Completeness for all method/matrix/analyte combinations was 100 percent.
2. Approximately 67 percent of the PSEP data were qualified due to low-level detections in the method blanks. The degree to which blank contamination was observed suggests a contamination issue at the laboratory.
3. Approximately 27 percent of the E350.1 data were qualified due to low-level detections in the method blanks. The degree to which blank contamination was observed suggests a contamination issue at the laboratory.
4. Approximately three percent of the SW6010B data were qualified due to low-level detections in the method blanks. The degree to which blank contamination was observed is within reasonable method expectations.

5. FD RPD exceedances were observed for Methods E350.1, SW6010B, SW8081B, SW8260B and Lloyd Kahn; 22 results were qualified as estimated.
6. MS/MSD recovery exceedances were observed for Methods SW6010B, SW7196A, SW8260B, SW8270C and Lloyd Kahn; 18 results were qualified as estimated.
7. Although data were qualified as estimated due to QC exceedances as noted, overall precision and accuracy of the data, as measured by field and laboratory QC indicators suggest that data are usable for projects objectives.

Table 3: Validation Flags

Sample ID	Method	Analyte	Final Result	Units	Final Flag	Reason
D4BDS01-001.31-01	E350.1	Ammonia	0.07	mg/Kg	U	CCB<RL
D4BDS01-001.31-01	PSEP	Total sulfide	1.4	mg/Kg	U	LB>RL
D4BDS01-001.31-01	SW6010B	Antimony	0.75	mg/Kg	U	LB<RL
D4BGC07-14.4416.57-01	PSEP	Total sulfide	0.9	mg/Kg	U	LB>RL
D4SD04-0.503-01	E350.1	Ammonia	1.01	mg/Kg	J	FD>RPD
D4SD04-0.503-01	PSEP	Total sulfide	2.5	mg/Kg	U	LB>RL
D4SD04-0.503-01	PSEP	Total sulfide	1.5	mg/Kg	U	LB>RL
D4SD04-0.503-01	PSEP	Total sulfide	2	mg/Kg	U	LB>RL
D4SD04-0.503-01	SW6010B	Antimony	1.43	mg/Kg	U	LB<RL
D4SD04-0.503-01	SW6010B	Antimony	1.43	mg/Kg	J	SD<LCL
D4SD04-0.503-01	SW6010B	Antimony	1.43	mg/Kg	J	MS<LCL
D4SD04-0.503-01	SW6010B	Barium	40.1	mg/Kg	J	MS>UCL
D4SD04-0.503-01	SW6010B	Barium	40.1	mg/Kg	J	SD>UCL
D4SD04-0.503-01	SW7196A	Hexavalent Chromium	0.1	mg/Kg	UJ	MS<LCL
D4SD04-0.503-01	SW7196A	Hexavalent Chromium	0.1	mg/Kg	UJ	SD<LCL
D4SD04-0.503-01	SW8081B	4,4'-DDT	0.00085	mg/Kg	UJ	FD>RPD
D4SD04-0.503-01	SW8260B	1,2,3-Trichlorobenzene	0.00028	mg/Kg	UJ	MS<LCL
D4SD04-0.503-01	SW8260B	1,2,3-Trichlorobenzene	0.00028	mg/Kg	UJ	SD<LCL
D4SD04-0.503-01	SW8260B	1,2,4-Trichlorobenzene	0.00028	mg/Kg	UJ	SD<LCL
D4SD04-0.503-01	SW8260B	1,2,4-Trichlorobenzene	0.00028	mg/Kg	UJ	MS<LCL
D4SD04-0.503-01	SW8260B	1,2,4-Trimethylbenzene	0.00063	mg/Kg	J	FD>RPD
D4SD04-0.503-01	SW8260B	2-Butanone	0.0229	mg/Kg	J	MS<LCL
D4SD04-0.503-01	SW8260B	Acetone	0.149	mg/Kg	J	MS<LCL
D4SD04-0.503-01	SW8260B	Acetone	0.149	mg/Kg	J	SD>UCL
D4SD04-0.503-01	SW8260B	Benzene	0.00523	mg/Kg	J	FD>RPD
D4SD04-0.503-01	SW8260B	Benzene	0.00523	mg/Kg	J	MS<LCL
D4SD04-0.503-01	SW8260B	Benzene	0.00523	mg/Kg	J	SD<LCL
D4SD04-0.503-01	SW8260B	Chloromethane	0.00194	mg/Kg	J	FD>RPD
D4SD04-0.503-01	SW8260B	Chloromethane	0.00194	mg/Kg	J	MS<LCL
D4SD04-0.503-01	SW8260B	Chloromethane	0.00194	mg/Kg	J	SD<LCL

Sample ID	Method	Analyte	Final Result	Units	Final Flag	Reason
D4SD04-0.503-01	SW8260B	m,p-Xylene	0.00214	mg/Kg	J	FD>RPD
D4SD04-0.503-01	SW8260B	Naphthalene	0.00086	mg/Kg	J	FD>RPD
D4SD04-0.503-01	SW8260B	Naphthalene	0.00086	mg/Kg	J	MS<LCL
D4SD04-0.503-01	SW8260B	o-Xylene	0.00151	mg/Kg	J	FD>RPD
D4SD04-0.503-01	SW8260B	Toluene	0.0052	mg/Kg	J	SD<LCL
D4SD04-0.503-01	SW8260B	Toluene	0.0052	mg/Kg	J	FD>RPD
D4SD04-0.503-01	SW8260B	Toluene	0.0052	mg/Kg	J	MS<LCL
D4SD04-0.503-01	SW8270C	Benzoic Acid	0.117	mg/Kg	UJ	MS<LCL
D4SD04-0.503-01	SW8270C	Benzoic Acid	0.117	mg/Kg	UJ	SD<LCL
D4SD04-0.503-01	Lloyd Kahn	Total organic carbon	2120	mg/Kg	J	FD>RPD
D4SD04-0.503-01	Lloyd Kahn	Total organic carbon	2120	mg/Kg	J	SD>UCL
D4SD04-0.503-101	E350.1	Ammonia	1.94	mg/Kg	J	FD>RPD
D4SD04-0.503-101	PSEP	Total sulfide	0.8	mg/Kg	U	LB>RL
D4SD04-0.503-101	SW6010B	Antimony	1.02	mg/Kg	U	LB<RL
D4SD04-0.503-101	SW8081B	4,4'-DDT	0.0088	mg/Kg	J	FD>RPD
D4SD04-0.503-101	SW8260B	1,2,4-Trimethylbenzene	0.00162	mg/Kg	J	FD>RPD
D4SD04-0.503-101	SW8260B	Benzene	0.0197	mg/Kg	J	FD>RPD
D4SD04-0.503-101	SW8260B	Chloromethane	0.0104	mg/Kg	J	FD>RPD
D4SD04-0.503-101	SW8260B	m,p-Xylene	0.00421	mg/Kg	J	FD>RPD
D4SD04-0.503-101	SW8260B	Naphthalene	0.00188	mg/Kg	J	FD>RPD
D4SD04-0.503-101	SW8260B	o-Xylene	0.00335	mg/Kg	J	FD>RPD
D4SD04-0.503-101	SW8260B	Toluene	0.0135	mg/Kg	J	FD>RPD
D4SD04-0.503-101	Lloyd Kahn	Total organic carbon	5200	mg/Kg	J	FD>RPD
D4SD04-0304.25-02	SW6010B	Antimony	1.08	mg/Kg	U	LB<RL
D4SD04-4.2518.86-03	PSEP	Total sulfide	0.9	mg/Kg	U	LB>RL
D4SD04-4.2518.86-03	SW6010B	Antimony	2.91	mg/Kg	U	LB<RL
D5SD01-0002-01	E350.1	Ammonia	0.56	mg/Kg	U	CCB<RL
D5SD01-0002-01	PSEP	Total sulfide	0.7	mg/Kg	U	LB>RL
D5SD01-0002-01	SW6010B	Antimony	2	mg/Kg	U	LB<RL
D5SD01-0204-02	E350.1	Ammonia	0.47	mg/Kg	U	CCB<RL
REF-102	SW6010B	Lead	1.82	mg/Kg	J	FD>RPD
REF-2	SW6010B	Antimony	1.4	mg/Kg	J	MS<LCL
REF-2	SW6010B	Antimony	1.4	mg/Kg	J	SD<LCL
REF-2	SW6010B	Barium	37.7	mg/Kg	J	MS<LCL
REF-2	SW6010B	Lead	3.28	mg/Kg	J	FD>RPD
REF-2	SW6010B	Selenium	1.5	mg/Kg	UJ	SD<LCL
REF-2	SW6010B	Vanadium	29.2	mg/Kg	J	MS<LCL

Sample ID	Method	Analyte	Final Result	Units	Final Flag	Reason
REF-2	Lloyd Kahn	Total organic carbon	178	mg/Kg	J	MS>UCL

Notes:

CCB<RL = Continuing calibration blank concentration less than the reporting limit
mg/Kg = milligrams per kilogram
FD>RPD = Field duplicate relative percent difference criterion exceeded
LB<RL = Laboratory blank concentration less than the reporting limit
LB>RL = Laboratory blank concentration greater than the reporting limit
MS<LCL = Matrix spike recovery less than the lower control limit
MS>UCL = Matrix spike recovery greater than the upper control limit
SD<LCL = Matrix spike duplicate recovery less than the lower control limit
SD>UCL = Matrix spike duplicate recovery greater than the upper control limit

4.0 ACRONYMS AND TERMS

Term	Definition

5.0 REFERENCES

ID Number	Reference Title

6.0 ATTACHMENT 1: SAMPLES ASSOCIATED WITH DQE

Sample ID	Collection Date	Sample Type
D4ADS01-001.48-01	02-Nov-15	N
D4BDS01-001.31-01	03-Nov-15	N
D4BGC06-11.8113.54.01	03-Nov-15	N
D4BGC06-11.8113.54-0	03-Nov-15	N
D4BGC07-14.4416.57-0	03-Nov-15	N
D4BGC07-14.4416.57-01	03-Nov-15	N
D4SD04-0.503-01	05-Nov-15	N
D4SD04-0.503-101	05-Nov-15	FD
D4SD04-0304.25-02	05-Nov-15	N
D4SD04-4.2518.86-03	05-Nov-15	N
D4SD04-5.756.25-04	05-Nov-15	N
D5SD01-0002-01	06-Nov-15	N
D5SD01-0204-02	06-Nov-15	N
D5SD01-0404.9-03	06-Nov-15	N
EB110615-01	06-Nov-15	EB
REF-102	29-Oct-15	FD
REF-2	29-Oct-15	N
TB102915-01	29-Oct-15	TB
TB110315-01	03-Nov-15	TB
TRVL BLK	03-Nov-15	TB

Notes:

EB = equipment blank
FD= field duplicate
N = primary sample
TB = trip blank

7.0 ATTACHMENT 2: ADEC CHECKLISTS

Appendix B_ADEC Checklists.pdf

Laboratory Data Review Checklist

CompletedBy	Berney Kidd		
Title	Project Chemist	Date	12/29/2015
CS Report Name		ReportDate	12/23/2015
Consultant Firm	CH2M Hill		
Laboratory Name	Applied Science Laboratory	Laboratory Report Number	P3522
ADEC File Number		ADECRecKeyNumber	

1. Laboratory

a. Did an ADEC CS approved laboratory receive and perform all of the submitted sample analyses?

◉ Yes ○ No ○ NA (Please explain.) Comments:

b. If the samples were transferred to another "network" laboratory or sub-contracted to an alternate laboratory, was the laboratory performing the analyses ADEC CS approved?

◉ Yes ○ No ○ NA (Please explain.) Comments:

Samples transferred to ALS in Kelso, Washington for methods E350.1, Krone, PSEP and SW8081B.

2. Chain of Custody (COC)

a. COC information completed, signed, and dated (including released/received by)?

◉ Yes ○ No ○ NA (Please explain.) Comments:

b. Correct analyses requested?

◉ Yes ○ No ○ NA (Please explain.) Comments:

3. Laboratory Sample Receipt Documentation

a. Sample/cooler temperature documented and within range at receipt (4° ± 2° C)?

◉ Yes ○ No ○ NA (Please explain.) Comments:

2.1C

b. Sample preservation acceptable - acidified waters, Methanol preserved VOC soil (GRO, BTEX, Volatile Chlorinated Solvents, etc.)?

◉ Yes ○ No ○ NA (Please explain.) Comments:

c. Sample condition documented - broken, leaking (Methanol), zero headspace (VOC vials)?

◉ Yes ○ No ○ NA (Please explain.) Comments:

d. If there were any discrepancies, were they documented? - For example, incorrect sample containers/ preservation, sample temperature outside of acceptance range, insufficient or missing samples, etc.?

○ Yes ○ No ◉ NA (Please explain.) Comments:

No discrepancies.

e. Data quality or usability affected? (Please explain)

Comments:

All data are usable as reported.

4. Case Narrative

a.Present and understandable?

◉ Yes ○ No ○ NA (Please explain.) Comments:

b. Discrepancies, errors or QC failures identified by the lab?

◉ Yes ○ No ○ NA (Please explain.) Comments:

MS/MSD exceedances.

c. Were all corrective actions documented?

◉ Yes ○ No ○ NA (Please explain.) Comments:

d. What is the effect on data quality/usability according to the case narrative?

Comments:

All data are usable.

5. Samples Results

a. Correct analyses performed/reported as requested on COC?

◉ Yes ○ No ○ NA (Please explain.) Comments:

b. All applicable holding times met?

◉ Yes ○ No ○ NA (Please explain.) Comments:

c. All soils reported on a dry weight basis?

◉ Yes ○ No ○ NA (Please explain.) Comments:

d. Are the reported PQLs less than the Cleanup Level or the minimum required detection level for the project?

○ Yes ○ No ◉ NA (Please explain.) Comments:

See site-specific report for details.

e. Data quality or usability affected? (Please explain)

Comments:

All data are usable as reported.

6. QC Samples

a. Method Blank

i. One method blank reported per matrix, analysis and 20 samples?

◉ Yes ○ No ○ NA (Please explain.) Comments:

ii. All method blank results less than PQL?

◉ Yes ○ No ○ NA (Please explain.) Comments:

iii. If above PQL, what samples are affected?

Comments:

iv. Do the affected sample(s) have data flags? If so, are the data flags clearly defined?

○ Yes ○ No ◉ NA (Please explain.) Comments:

v. Data quality or usability affected? (Please explain)

Comments:

All data are usable as reported.

b. Laboratory Control Sample/Duplicate (LCS/LCSD)

i. Organics - One LCS/LCSD reported per matrix, analysis and 20 samples? (LCS/LCSD required per AK methods, LCS required per SW846)

◉ Yes ○ No ○ NA (Please explain.) Comments:

ii. Metals/Inorganics - One LCS and one sample duplicate reported per matrix, analysis and 20 samples?

◉ Yes ○ No ○ NA (Please explain.) Comments:

iii. Accuracy - All percent recoveries (%R) reported and within method or laboratory limits? And project specified DQOs, if applicable. (AK Petroleum methods: AK101 60%-120%, AK102 75%-125%, AK103 60%-120%; all other analyses see the laboratory QC pages)

◉ Yes ○ No ○ NA (Please explain.) Comments:

iv. Precision - All relative percent differences (RPD) reported and less than method or laboratory limits? And project specified DQOs, if applicable. RPD reported from LCS/LCSD, MS/DMSD, and or sample/sample duplicate. (AK Petroleum methods 20%; all other analyses see the laboratory QC pages)

◉ Yes ○ No ○ NA (Please explain.) Comments:

v. If %R or RPD is outside of acceptable limits, what samples are affected?

Comments:

vi. Do the affected samples(s) have data flags? If so, are the data flags clearly defined?

○ Yes ○ No ◉ NA (Please explain.) Comments:

vii. Data quality or usability affected? (Please explain)

Comments:

All data are usable as reported.

c. Surrogates - Organics Only

i. Are surrogate recoveries reported for organic analyses - field, QC and laboratory samples?

◉ Yes ○ No ○ NA (Please explain.) Comments:

ii. Accuracy - All percent recoveries (%R) reported and within method or laboratory limits? And project specified DQOs, if applicable. (AK Petroleum methods 50-150 %R; all other analyses see the laboratory report pages)

◉ Yes ○ No ○ NA (Please explain.) Comments:

iii. Do the sample results with failed surrogate recoveries have data flags? If so, are the data flags clearly defined?

○ Yes ○ No ◉ NA (Please explain.) Comments:

No surrogate exceedances.

iv. Data quality or usability affected? (Use the comment box to explain.).

Comments:

d. Trip Blank - Volatile analyses only (GRO, BTEX, Volatile Chlorinated Solvents, etc.): Water and Soil

i. One trip blank reported per matrix, analysis and for each cooler containing volatile samples? (If not, enter explanation below.)

◉ Yes ○ No ○ NA (Please explain.) Comments:

ii. Is the cooler used to transport the trip blank and VOA samples clearly indicated on the COC? (If not, a comment explaining why must be entered below)

◉ Yes ○ No ○ NA (Please explain.) Comments:

iii. All results less than PQL?

◉ Yes ○ No ○ NA (Please explain.) Comments:

iv. If above PQL, what samples are affected?

Comments:

v. Data quality or usability affected? (Please explain.)

Comments:

No data affected.

e. Field Duplicate

i. One field duplicate submitted per matrix, analysis and 10 project samples?

◉ Yes ○ No ○ NA (Please explain.) Comments:

ii. Submitted blind to lab?

◉ Yes ○ No ○ NA (Please explain.) Comments:

iii. Precision - All relative percent differences (RPD) less than specified DQOs? (Recommended: 30% water, 50% soil)

$$RPD\ (\%) = \text{Absolute Value of: } \frac{(R1 - R2) \times 100}{((R1 + R2)/2)}$$

Where R1 = Sample Concentration
R2 = Field Duplicate Concentration

○ Yes ◉ No ○ NA (Please explain.) Comments:

These samples were out of control for SW6010B: Lead (REF-102, %RPD 57.25 vs 50), Lead (REF-2, %RPD 57.25 vs 50), associated sample results were flagged J.

iv. Data quality or usability affected? (Use the comment box to explain why or why not.)

◉ Yes ○ No ○ NA (Please explain.) Comments:

Data qualified as estimated.

f. Decontamination or Equipment Blank (if applicable)

◉ Yes ○ No ○ NA (Please explain.) Comments:

Equipment blank is reported in SDG P3586.

i. All results less than PQL?

◉ Yes ○ No ○ NA (Please explain.) Comments:

There were no detections that would affect the data.

ii. If above PQL, what samples are affected?

iii. Data quality or usability affected? (Please explain.)

7. Other Data Flags/Qualifiers (ACOE, AFCEE, Lab Specific, etc.)
   a. Defined and appropriate?

◉ Yes ○ No ○ NA (Please explain.) Comments:

Matrix:

These samples were flagged for Matrix spike duplicate recovery criteria less than the lower control limit: Antimony (REF-2, %R = 49 LCL=80 UCL=120), Selenium (REF-2, %R = 78 LCL=80 UCL=120) for SW6010B. Associated detected result was qualified as estimated and flagged "J"; associated nondetected result qualified as estimated and flagged "UJ".

These samples were flagged for Matrix spike recovery greater than the upper control limit: Total Organic Carbon (REF-2, %R = 139 LCL=75 UCL=125) for Lloyd Kahn. Associated detected result was qualified as estimated and flagged "J".

These samples were flagged for Matrix spike recovery less than the lower control limit: Antimony (REF-2, %R = 57 LCL=80 UCL=120), Barium (REF-2, %R = 59 LCL=80 UCL=120), Vanadium (REF-2, %R = 74 LCL=80 UCL=120) for SW6010B. Associated detected result was qualified as estimated and flagged "J".

Laboratory Data Review Checklist

CompletedBy	Berney Kidd		
Title	Project Chemist	Date	12/29/2013
CS Report Name		ReportDate	12/23/2015
Consultant Firm	CH2M Hill		
Laboratory Name	Applied Sciences Laboratory	Laboratory Report Number	P3549
ADEC File Number		ADECRecKeyNumber	

1. Laboratory

a. Did an ADEC CS approved laboratory receive and perform all of the submitted sample analyses?

◉ Yes ○ No ○ NA (Please explain.) Comments:

b. If the samples were transferred to another "network" laboratory or sub-contracted to an alternate laboratory, was the laboratory performing the analyses ADEC CS approved?

◉ Yes ○ No ○ NA (Please explain.) Comments:

Samples transferred to ALS in Kelso, Washington for methods E350.1, Krone, PSEP and SW8081B.

2. Chain of Custody (COC)

a. COC information completed, signed, and dated (including released/received by)?

◉ Yes ○ No ○ NA (Please explain.) Comments:

b. Correct analyses requested?

◉ Yes ○ No ○ NA (Please explain.) Comments:

3. Laboratory Sample Receipt Documentation

a. Sample/cooler temperature documented and within range at receipt (4° ± 2° C)?

◉ Yes ○ No ○ NA (Please explain.) Comments:

Samples received at 0.3C. There was no evidence of freezing so no data were qualified.

b. Sample preservation acceptable - acidified waters, Methanol preserved VOC soil (GRO, BTEX, Volatile Chlorinated Solvents, etc.)?

◉ Yes ○ No ○ NA (Please explain.) Comments:

c. Sample condition documented - broken, leaking (Methanol), zero headspace (VOC vials)?

◉ Yes ○ No ○ NA (Please explain.) Comments:

d. If there were any discrepancies, were they documented? - For example, incorrect sample containers/ preservation, sample temperature outside of acceptance range, insufficient or missing samples, etc.?

◉ Yes ○ No ○ NA (Please explain.) Comments:

Samples for pH analysis were received past holding time. Soil samples for pH require leaching within 30 days, no data were qualified.

Sample TRVL BLK did not specify if it was for VOC or GRO, sample was logged in for VOC only because only one vial was received.

e. Data quality or usability affected? (Please explain)

Comments:

All data are usable as reported.

4. Case Narrative

a.Present and understandable?

◉ Yes ○ No ○ NA (Please explain.) Comments:

b. Discrepancies, errors or QC failures identified by the lab?

○ Yes ○ No ◉ NA (Please explain.) Comments:

No discrepancies.

c. Were all corrective actions documented?

◉ Yes ○ No ○ NA (Please explain.) Comments:

d. What is the effect on data quality/usability according to the case narrative?

Comments:

All data are usable as reported.

5. Samples Results

a. Correct analyses performed/reported as requested on COC?

◉ Yes ○ No ○ NA (Please explain.) Comments:

b. All applicable holding times met?

◉ Yes ○ No ○ NA (Please explain.) Comments:

c. All soils reported on a dry weight basis?

◉ Yes ○ No ○ NA (Please explain.) Comments:

d. Are the reported PQLs less than the Cleanup Level or the minimum required detection level for the project?

○ Yes ○ No ◉ NA (Please explain.) Comments:

See site specific report for details.

e. Data quality or usability affected? (Please explain)

Comments:

All data are usable as reported.

6. QC Samples

a. Method Blank

i. One method blank reported per matrix, analysis and 20 samples?

◉ Yes ○ No ○ NA (Please explain.) Comments:

ii. All method blank results less than PQL?

○ Yes ◉ No ○ NA (Please explain.) Comments:

Total sulfide was detected in a method blank for Method PSEP.

iii. If above PQL, what samples are affected?

Comments:

D4BGC07-14.4416.57-01

iv. Do the affected sample(s) have data flags? If so, are the data flags clearly defined?

◉ Yes ○ No ○ NA (Please explain.) Comments:

Associated sample result less than five times the blank concentration was qualified as not detected and flagged "U".

v. Data quality or usability affected? (Please explain)

Comments:

Result qualified as not detected.

b. Laboratory Control Sample/Duplicate (LCS/LCSD)

i. Organics - One LCS/LCSD reported per matrix, analysis and 20 samples? (LCS/LCSD required per AK methods, LCS required per SW846)

◉ Yes ○ No ○ NA (Please explain.) Comments:

ii. Metals/Inorganics - One LCS and one sample duplicate reported per matrix, analysis and 20 samples?

◉ Yes ○ No ○ NA (Please explain.) Comments:

iii. Accuracy - All percent recoveries (%R) reported and within method or laboratory limits? And project specified DQOs, if applicable. (AK Petroleum methods: AK101 60%-120%, AK102 75%-125%, AK103 60%-120%; all other analyses see the laboratory QC pages)

◉ Yes ○ No ○ NA (Please explain.) Comments:

iv. Precision - All relative percent differences (RPD) reported and less than method or laboratory limits? And project specified DQOs, if applicable. RPD reported from LCS/LCSD, MS/DMSD, and or sample/sample duplicate. (AK Petroleum methods 20%; all other analyses see the laboratory QC pages)

◉ Yes ○ No ○ NA (Please explain.) Comments:

v. If %R or RPD is outside of acceptable limits, what samples are affected?

Comments:

vi. Do the affected samples(s) have data flags? If so, are the data flags clearly defined?

○ Yes ○ No ◉ NA (Please explain.) Comments:

vii. Data quality or usability affected? (Please explain)

Comments:

All data are usable as reported.

c. Surrogates - Organics Only

i. Are surrogate recoveries reported for organic analyses - field, QC and laboratory samples?

◉ Yes ○ No ○ NA (Please explain.) Comments:

ii. Accuracy - All percent recoveries (%R) reported and within method or laboratory limits? And project specified DQOs, if applicable. (AK Petroleum methods 50-150 %R; all other analyses see the laboratory report pages)

◉ Yes ○ No ○ NA (Please explain.) Comments:

iii. Do the sample results with failed surrogate recoveries have data flags? If so, are the data flags clearly defined?

○ Yes ○ No ◉ NA (Please explain.) Comments:

No surrogate exceedances.

iv. Data quality or usability affected? (Use the comment box to explain.).

Comments:

d. Trip Blank - Volatile analyses only (GRO, BTEX, Volatile Chlorinated Solvents, etc.): Water and Soil

i. One trip blank reported per matrix, analysis and for each cooler containing volatile samples? (If not, enter explanation below.)

◉ Yes ○ No ○ NA (Please explain.) Comments:

ii. Is the cooler used to transport the trip blank and VOA samples clearly indicated on the COC? (If not, a comment explaining why must be entered below)

◉ Yes ○ No ○ NA (Please explain.) Comments:

iii. All results less than PQL?

◉ Yes ○ No ○ NA (Please explain.) Comments:

iv. If above PQL, what samples are affected?

Comments:

v. Data quality or usability affected? (Please explain.)

Comments:

e. Field Duplicate

i. One field duplicate submitted per matrix, analysis and 10 project samples?

○ Yes ○ No ◉ NA (Please explain.) Comments:

A FD was not reported in this SDG.

ii. Submitted blind to lab?

○ Yes ○ No ◉ NA (Please explain.) Comments:

A FD was not reported in this SDG.

iii. Precision - All relative percent differences (RPD) less than specified DQOs? (Recommended: 30% water, 50% soil)

$$RPD\ (\%) = \text{Absolute Value of: } \frac{(R1 - R2) \times 100}{((R1 + R2)/2)}$$

Where R1 = Sample Concentration
R2 = Field Duplicate Concentration

○ Yes ○ No ◉ NA (Please explain.) Comments:

A FD was not reported in this SDG.

iv. Data quality or usability affected? (Use the comment box to explain why or why not.)

○ Yes ○ No ◉ NA (Please explain.) Comments:

A FD was not reported in this SDG.

f. Decontamination or Equipment Blank (if applicable)

◉ Yes ○ No ○ NA (Please explain.) Comments:

Equipment blank is reported in SDG P3586.

i. All results less than PQL?

◉ Yes ○ No ○ NA (Please explain.) Comments:

There were no detections that would affect the data.

ii. If above PQL, what samples are affected?

iii. Data quality or usability affected? (Please explain.)

7. Other Data Flags/Qualifiers (ACOE, AFCEE, Lab Specific, etc.)

a. Defined and appropriate?

○ Yes ○ No ◉ NA (Please explain.) Comments:

No other flags applied.

Laboratory Data Review Checklist

CompletedBy	Berney Kidd		
Title	Project Chemist	Date	12/29/2013
CS Report Name		ReportDate	12/23/2015
Consultant Firm	CH2M Hill		
Laboratory Name	Applied Sciences Laboratory	Laboratory Report Number	P3586
ADEC File Number		ADECRecKeyNumber	

1. Laboratory

a. Did an ADEC CS approved laboratory receive and perform all of the submitted sample analyses?

◉ Yes ○ No ○ NA (Please explain.) Comments:

b. If the samples were transferred to another "network" laboratory or sub-contracted to an alternate laboratory, was the laboratory performing the analyses ADEC CS approved?

◉ Yes ○ No ○ NA (Please explain.) Comments:

Samples transferred to ALS in Kelso, Washington for methods E350.1, Krone, PSEP and SW8081B.

2. Chain of Custody (COC)

a. COC information completed, signed, and dated (including released/received by)?

◉ Yes ○ No ○ NA (Please explain.) Comments:

b. Correct analyses requested?

◉ Yes ○ No ○ NA (Please explain.) Comments:

3. Laboratory Sample Receipt Documentation

a. Sample/cooler temperature documented and within range at receipt (4° ± 2° C)?

◉ Yes ○ No ○ NA (Please explain.) Comments:

3.3C

b. Sample preservation acceptable - acidified waters, Methanol preserved VOC soil (GRO, BTEX, Volatile Chlorinated Solvents, etc.)?

◉ Yes ○ No ○ NA (Please explain.) Comments:

c. Sample condition documented - broken, leaking (Methanol), zero headspace (VOC vials)?

◉ Yes ○ No ○ NA (Please explain.) Comments:

d. If there were any discrepancies, were they documented? - For example, incorrect sample containers/ preservation, sample temperature outside of acceptance range, insufficient or missing samples, etc.?

◉ Yes ○ No ○ NA (Please explain.) Comments:

Samples for pH analysis were received past holding time. Soil samples for pH require leaching within 30 days, no data were qualified.
A MS/MSD was requested for total solids and volatile solids; however, MS/MSD is not applicable for these methods.
Sample D4SD04-4.2518.86-03 (P358606) label requests ammonia, hexavalent chromium, pesticide, and tributyltin analysis; however, the chain of custody does not list requested analysis. Sample was logged in per the labels.
Sample TRIP BLANK (P358614) was not received.

e. Data quality or usability affected? (Please explain)

Comments:

All data are usable as reported.

4. Case Narrative

a.Present and understandable?

◉ Yes ○ No ○ NA (Please explain.) Comments:

b. Discrepancies, errors or QC failures identified by the lab?

◉ Yes ○ No ○ NA (Please explain.) Comments:

MS/MSD recovery exceedances.
LCS recovery exceedances (not associated to project samples)

c. Were all corrective actions documented?

◉ Yes ○ No ○ NA (Please explain.) Comments:

d. What is the effect on data quality/usability according to the case narrative?

Comments:

All data are usable as reported.

5. Samples Results

a. Correct analyses performed/reported as requested on COC?

◉ Yes ○ No ○ NA (Please explain.) Comments:

b. All applicable holding times met?

◉ Yes ○ No ○ NA (Please explain.) Comments:

c. All soils reported on a dry weight basis?

◉ Yes ○ No ○ NA (Please explain.) Comments:

d. Are the reported PQLs less than the Cleanup Level or the minimum required detection level for the project?

○ Yes ○ No ◉ NA (Please explain.) Comments:

See site-specific report for details.

e. Data quality or usability affected? (Please explain)

Comments:

All data are usable as reported.

6. QC Samples

a. Method Blank

i. One method blank reported per matrix, analysis and 20 samples?

◉ Yes ○ No ○ NA (Please explain.) Comments:

ii. All method blank results less than PQL?

○ Yes ◉ No ○ NA (Please explain.) Comments:

Antimony was detected in a method blank for SW6010B.

Total sulfide was detected in a method blank for Method PSEP.

iii. If above PQL, what samples are affected?

Comments:

D4BDS01-001.31-01, D5SD01-0002-01, D4SD04-0.503-01, D4SD04-0.503-101, D4SD04-4.2518.86-03, D4SD04-0304.25-02

iv. Do the affected sample(s) have data flags? If so, are the data flags clearly defined?

◉ Yes ○ No ○ NA (Please explain.) Comments:

Associated sample results less than five times the blank concentration were qualified as not detected and flagged "U".

v. Data quality or usability affected? (Please explain)

Comments:

Some data qualifed as not detected.

b. Laboratory Control Sample/Duplicate (LCS/LCSD)

i. Organics - One LCS/LCSD reported per matrix, analysis and 20 samples? (LCS/LCSD required per AK methods, LCS required per SW846)

◉ Yes ○ No ○ NA (Please explain.) Comments:

ii. Metals/Inorganics - One LCS and one sample duplicate reported per matrix, analysis and 20 samples?

◉ Yes ○ No ○ NA (Please explain.) Comments:

iii. Accuracy - All percent recoveries (%R) reported and within method or laboratory limits? And project specified DQOs, if applicable. (AK Petroleum methods: AK101 60%-120%, AK102 75%-125%, AK103 60%-120%; all other analyses see the laboratory QC pages)

◉ Yes ○ No ○ NA (Please explain.) Comments:

iv. Precision - All relative percent differences (RPD) reported and less than method or laboratory limits? And project specified DQOs, if applicable. RPD reported from LCS/LCSD, MS/DMSD, and or sample/sample duplicate. (AK Petroleum methods 20%; all other analyses see the laboratory QC pages)

◉ Yes ○ No ○ NA (Please explain.) Comments:

v. If %R or RPD is outside of acceptable limits, what samples are affected?
Comments:

vi. Do the affected samples(s) have data flags? If so, are the data flags clearly defined?

○ Yes ○ No ◉ NA (Please explain.) Comments:

vii. Data quality or usability affected? (Please explain)
Comments:

All data are usable as reported.

c. Surrogates - Organics Only

i. Are surrogate recoveries reported for organic analyses - field, QC and laboratory samples?

◉ Yes ○ No ○ NA (Please explain.) Comments:

ii. Accuracy - All percent recoveries (%R) reported and within method or laboratory limits? And project specified DQOs, if applicable. (AK Petroleum methods 50-150 %R; all other analyses see the laboratory report pages)

◉ Yes ○ No ○ NA (Please explain.) Comments:

iii. Do the sample results with failed surrogate recoveries have data flags? If so, are the data flags clearly defined?

○ Yes ○ No ◉ NA (Please explain.) Comments:

No surrogate exceedances.

iv. Data quality or usability affected? (Use the comment box to explain.).

Comments:

d. Trip Blank - Volatile analyses only (GRO, BTEX, Volatile Chlorinated Solvents, etc.): Water and Soil

i. One trip blank reported per matrix, analysis and for each cooler containing volatile samples? (If not, enter explanation below.)

◉ Yes ○ No ○ NA (Please explain.) Comments:

ii. Is the cooler used to transport the trip blank and VOA samples clearly indicated on the COC? (If not, a comment explaining why must be entered below)

◉ Yes ○ No ○ NA (Please explain.) Comments:

iii. All results less than PQL?

◉ Yes ○ No ○ NA (Please explain.) Comments:

iv. If above PQL, what samples are affected?

Comments:

v. Data quality or usability affected? (Please explain.)

Comments:

e. Field Duplicate

i. One field duplicate submitted per matrix, analysis and 10 project samples?

◉ Yes ○ No ○ NA (Please explain.) Comments:

ii. Submitted blind to lab?

◉ Yes ○ No ○ NA (Please explain.) Comments:

iii. Precision - All relative percent differences (RPD) less than specified DQOs? (Recommended: 30% water, 50% soil)

$$RPD\ (\%) = \text{Absolute Value of: } \frac{(R1 - R2) \times 100}{((R1 + R2)/2)}$$

Where R1 = Sample Concentration

R2 = Field Duplicate Concentration

○ Yes ◉ No ○ NA (Please explain.) Comments:

These samples were out of control for SW8260B in FD set D4SD04-0.503-01/D4SD04-0.503-101: 1,2,4-

Trimethylbenzene (%RPD 88 vs 50), Benzene (%RPD 116.09 vs 50), Chloromethane (%RPD 137.12 vs 50), m,p-Xylene (%RPD 65.2 vs 50), Naphthalene (%RPD 74.45 vs 50), o-Xylene (%RPD 75.72 vs 50), Toluene (%RPD 88.77 vs 50), associated sample results were flagged J.

These samples were out of control for Lloyd Kahn: Total Organic Carbon (D4SD04-0.503-01/D4SD04-0.503-101, %RPD = 84.15 vs 50), associated sample results were flagged J.

These analytes were out of control in FD set D4SD04-0.503-01/D4SD04-0.503-101 for Method E350.1: Ammonia (%RPD = 63.05 vs 50). Associated detected results were flagged J.

These analytes were out of control in FD set D4SD04-0.503-01/D4SD04-0.503-101 for Method SW8081B: 4,4'-DDT (%RPD = 98 vs 50). Associated detected result flagged J and nondetected result flagged UJ.

iv. Data quality or usability affected? (Use the comment box to explain why or why not.)

◉ Yes ○ No ○ NA (Please explain.) Comments:

Data qualified as estimated.

f. Decontamination or Equipment Blank (if applicable)

◉ Yes ○ No ○ NA (Please explain.) Comments:

i. All results less than PQL?

◉ Yes ○ No ○ NA (Please explain.) Comments:

There were no detected that would affect the data.

ii. If above PQL, what samples are affected?

iii. Data quality or usability affected? (Please explain.)

Data are usable as reported.

7. Other Data Flags/Qualifiers (ACOE, AFCEE, Lab Specific, etc.)

a. Defined and appropriate?

◉ Yes ○ No ○ NA (Please explain.) Comments:

Calibration:

Ammonia was detected in a continuing calibration blank for Metho E350.1. Associated samples D4BDS01-001.31-01, D5SD01-0002-01, D5SD01-0204-02 were detected less than five times the blank concentration. The results were qualified as not detected and flagged "U".

Matrix:

These samples were flagged for Matrix spike duplicate recovery criteria greater than the upper control limit:
Barium (D4SD04-0.503-01, %R = 127 LCL=80 UCL=120) for SW6010B. The associated detected result was qualified as estimated and flagged "J".

Acetone (D4SD04-0.503-01, %R = 135 LCL=70 UCL=130) for SW8260B. The associated detected

result was qualified as estimated and flagged "J".

Total Organic Carbon (D4SD04-0.503-01, %R = 158 LCL=75 UCL=125) for SW9060. The associated detected result was qualified as estimated and flagged "J".

These samples were flagged for Matrix spike duplicate recovery criteria less than the lower control limit:
Antimony (D4SD04-0.503-01, %R = 40 LCL=80 UCL=120) for SW6010B. The associated detected result was qualified as estimated and flagged "J".

Hexavelent chromium (D4SD04-0.503-01, %R = 18 LCL=72 UCL=125) for SW7196A. The associated detected result was qualified as estimated and flagged "J".

1,2,3-Trichlorobenzene (D4SD04-0.503-01, %R = 63 LCL=70 UCL=130), 1,2,4-Trichlorobenzene (D4SD04-0.503-01, %R = 63 LCL=70 UCL=130), Benzene (D4SD04-0.503-01, %R = 11 LCL=70 UCL=130), Chloromethane (D4SD04-0.503-01, %R = 52 LCL=70 UCL=130), Toluene (D4SD04-0.503-01, %R = 45 LCL=70 UCL=130) for SW8260B. The associated detected results were qualified as estimated and flagged "J".

Benzoic Acid (D4SD04-0.503-01, %R = 17 LCL=30 UCL=110) for SW8270C. The associated detected result was qualified as estimated and flagged "J".

These samples were flagged for Matrix spike recovery greater than the upper control limit:
Barium (D4SD04-0.503-01, %R = 130 LCL=80 UCL=120) for SW6010B. The associated detected result was qualified as estimated and flagged "J".

These samples were flagged for Matrix spike recovery less than the lower control limit:
Antimony (D4SD04-0.503-01, %R = 36 LCL=80 UCL=120) for SW6010B. The associated detected result was qualified as estimated and flagged "J".

Hexavelent chromium (D4SD04-0.503-01, %R = 23 LCL=72 UCL=125) for SW7196A. The associated detected result was qualified as estimated and flagged "J".

1,2,3-Trichlorobenzene (D4SD04-0.503-01, %R = 66 LCL=70 UCL=130), 1,2,4-Trichlorobenzene (D4SD04-0.503-01, %R = 68 LCL=70 UCL=130), 2-Butanone (MEK) (D4SD04-0.503-01, %R = 58 LCL=70 UCL=130), Acetone (D4SD04-0.503-01, %R = 35 LCL=70 UCL=130), Benzene (D4SD04-0.503-01, %R = 8 LCL=70 UCL=130), Chloromethane (D4SD04-0.503-01, %R = 44 LCL=70 UCL=130), Naphthalene (D4SD04-0.503-01, %R = 65 LCL=70 UCL=130), Toluene (D4SD04-0.503-01, %R = 44 LCL=70 UCL=130) for SW8260B. The associated detected results were qualified as estimated and flagged "J".

Benzoic Acid (D4SD04-0.503-01, %R = 21 LCL=30 UCL=110) for SW8270C. The associated detected result was qualified as estimated and flagged "J".

16.0 APPENDIX E – LABORATORY REPORTS

Attachment 2: P3522 Report

Attachment 2 - P3522 Report.pdf

Attachment 3: Revised P3522 Report

Attachment 4 - P3549 Report.pdf

Attachment 4: P3549 Report

Attachment 4 - P3549 Report.pdf

Attachment 5: P3586 Report

Attachment 5 - P3586 Report.pdf

Analytical Report for

Alaska LNG

ASL Report #: P3522
Project ID: 653488.16.06

Attn: Carrie Andrews/PDX

Authorized and Released By:

Kathy McKinley

Laboratory Project Manager
Kathy McKinley
(541) 758-0235 ext.23144
November 24, 2015

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

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

Accredited in accordance with NELAP:
Oregon (100022)
Louisiana (05031)

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

ASL Report #: P3522

Sample Receipt Comments

We certify that the test results meet all NELAP requirements except those listed below:

- CH2M HILL Applied Sciences Laboratory is not accredited by NELAP for the following tests: ASTM D422, EPA-821-R-91-100, E Draft Method, 1991, Lloyd Kahn/EPA9060M.

Some analyses were subcontracted to an outside laboratory and their report is attached.

Sample Cross-Reference

ASL Sample ID	Client Sample ID	Date/Time Collected	Date Received
P352201	REF-2	10/29/15 15:18	10/31/15
P352202MS	REF-2MS	10/29/15 15:18	10/31/15
P352203MSD	REF-2MSD	10/29/15 15:18	10/31/15
P352204	REF-102	10/29/15 15:28	10/31/15
P352205	TB102915-01	10/29/15 09:00	10/31/15

CH2MHILL
Applied Sciences Laboratory (ASL)

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

CASE NARRATIVE
GC/MS VOLATILES ANALYSIS

Lab Name: CH2M HILL ASL **ASL SDG#:** P3522

Project: Alaska LNG **Project #:** 653488.16.06

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

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

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

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

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

Method(s):
SW8260B: SW5030, SW5035

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Client Sample ID: **TB102915-01**

Project Name: Alaska LNG
Sample Date: 10/29/15
Sample Time: 09:00
Type: Grab
Matrix: Water

Lab Information

Lab Sample ID: **P352205**

Date Received: 10/31/15
Dilution Factor: 1
Report Revision No.: 0

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Volatiles								
Benzene	71-43-2	0.15	0.50	0.15	U	ug/L	SW8260B	11/02/15
Toluene	108-88-3	0.15	0.50	0.15	U	ug/L	SW8260B	11/02/15
Ethylbenzene	100-41-4	0.15	0.50	0.15	U	ug/L	SW8260B	11/02/15
m,p-Xylene	108-38-3/1	0.30	1.00	0.30	U	ug/L	SW8260B	11/02/15
o-Xylene	95-47-6	0.15	0.50	0.15	U	ug/L	SW8260B	11/02/15
Xylenes, Total	1330-20-7	0.30	1.50	0.30	U	ug/L	SW8260B	11/02/15

Surrogate	% Recovery	Control Limits	Qualifier
Dibromofluoromethane	99	70-130	
1,2-Dichloroethane-d4	102	70-130	
Toluene-d8	96	70-130	
4-Bromofluorobenzene	94	70-130	

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information		Lab Information	
Client Sample ID:	**WB1-1102**	**Lab Sample ID:**	**WB1-1102**
Project Name:	Alaska LNG	Date Received:	N/A
Sample Date:	N/A	Dilution Factor:	1
Sample Time:	N/A	Report Revision No.:	0
Type:	QC		
Matrix:	Water		

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Volatiles								
Benzene	71-43-2	0.15	0.50	0.15	U	ug/L	SW8260B	11/02/15
Toluene	108-88-3	0.15	0.50	0.15	U	ug/L	SW8260B	11/02/15
Ethylbenzene	100-41-4	0.15	0.50	0.15	U	ug/L	SW8260B	11/02/15
m,p-Xylene	108-38-3/1	0.30	1.00	0.30	U	ug/L	SW8260B	11/02/15
o-Xylene	95-47-6	0.15	0.50	0.15	U	ug/L	SW8260B	11/02/15
Xylenes, Total	1330-20-7	0.30	1.50	0.30	U	ug/L	SW8260B	11/02/15

Surrogate	% Recovery	Control Limits	Qualifier
Dibromofluoromethane	101	70-130	
1,2-Dichloroethane-d4	102	70-130	
Toluene-d8	98	70-130	
4-Bromofluorobenzene	97	70-130	

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Project Name: Alaska LNG
Type: QC
Matrix: Water

Lab Information

LCS ID: BS1W1102

Report Revision No.: 0
Dilution Factor: 1

Analyte	CAS#	Spike Amount	Sample Result	Units	%Recovery	Analysis Method	Date Analyzed
GC/MS Volatiles							
Benzene	71-43-2	20.0	19.5	ug/L	98	SW8260B	11/02/15
Toluene	108-88-3	20.0	20.3	ug/L	101	SW8260B	11/02/15
Ethylbenzene	100-41-4	20.0	19.8	ug/L	99	SW8260B	11/02/15
m,p-Xylene	108-38-3/1	40.0	39.0	ug/L	98	SW8260B	11/02/15
o-Xylene	95-47-6	20.0	19.0	ug/L	95	SW8260B	11/02/15

Surrogate	% Recovery	Control Limits	Qualifier
Dibromofluoromethane	98	70-130	
1,2-Dichloroethane-d4	96	70-130	
Toluene-d8	98	70-130	
4-Bromofluorobenzene	99	70-130	

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information		Lab Information	
Client Sample ID:	**REF-2**	**Lab Sample ID:**	**P352201**
Project Name:	Alaska LNG	Date Received:	10/31/15
Sample Date:	10/29/15	Dilution Factor:	1
Sample Time:	15:18	Report Revision No.:	0
Type:	Grab		
Matrix:	Soil		
Basis:	Dry Weight		

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Volatiles								
Benzene	71-43-2	0.21	0.84	0.21	U	ug/Kg	SW8260B	11/03/15
Toluene	108-88-3	0.21	0.84	0.21	U	ug/Kg	SW8260B	11/03/15
Ethylbenzene	100-41-4	0.21	0.84	0.21	U	ug/Kg	SW8260B	11/03/15
m,p-Xylene	108-38-3/1	0.42	1.68	0.42	U	ug/Kg	SW8260B	11/03/15
o-Xylene	95-47-6	0.21	0.84	0.21	U	ug/Kg	SW8260B	11/03/15
Xylenes, Total	1330-20-7	0.21	2.52	0.21	U	ug/Kg	SW8260B	11/03/15

Surrogate	% Recovery	Control Limits	Qualifier
Dibromofluoromethane	106	70-130	
1,2-Dichloroethane-d4	113	70-130	
Toluene-d8	96	70-130	
4-Bromofluorobenzene	89	70-130	

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information		Lab Information	
Client Sample ID:	**REF-2MS**	**Lab Sample ID:**	**P352202MS**
Project Name:	Alaska LNG	Date Received:	10/31/15
Sample Date:	10/29/15	Dilution Factor:	1
Sample Time:	15:18	Report Revision No.:	0
Type:	Grab		
Matrix:	Soil		
Basis:	Dry Weight		

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Volatiles								
Benzene	71-43-2	0.21	0.84	16.1		ug/Kg	SW8260B	11/03/15
Toluene	108-88-3	0.21	0.84	16.1		ug/Kg	SW8260B	11/03/15
Ethylbenzene	100-41-4	0.21	0.84	15.5		ug/Kg	SW8260B	11/03/15
m,p-Xylene	108-38-3/1	0.42	1.68	31.9		ug/Kg	SW8260B	11/03/15
o-Xylene	95-47-6	0.21	0.84	16.3		ug/Kg	SW8260B	11/03/15
Xylenes, Total	1330-20-7	0.21	2.52	48.1		ug/Kg	SW8260B	11/03/15

Surrogate	% Recovery	Control Limits	Qualifier
Dibromofluoromethane	103	70-130	
1,2-Dichloroethane-d4	109	70-130	
Toluene-d8	95	70-130	
4-Bromofluorobenzene	96	70-130	

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information		Lab Information	
Client Sample ID:	**REF-2MSD**	**Lab Sample ID:**	**P352203MSD**
Project Name:	Alaska LNG	Date Received:	10/31/15
Sample Date:	10/29/15	Dilution Factor:	1
Sample Time:	15:18	Report Revision No.:	0
Type:	Grab		
Matrix:	Soil		
Basis:	Dry Weight		

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Volatiles								
Benzene	71-43-2	0.21	0.84	16.2		ug/Kg	SW8260B	11/03/15
Toluene	108-88-3	0.21	0.84	16.3		ug/Kg	SW8260B	11/03/15
Ethylbenzene	100-41-4	0.21	0.84	15.8		ug/Kg	SW8260B	11/03/15
m,p-Xylene	108-38-3/1	0.42	1.68	32.0		ug/Kg	SW8260B	11/03/15
o-Xylene	95-47-6	0.21	0.84	16.6		ug/Kg	SW8260B	11/03/15
Xylenes, Total	1330-20-7	0.21	2.52	48.6		ug/Kg	SW8260B	11/03/15

Surrogate	% Recovery	Control Limits	Qualifier
Dibromofluoromethane	103	70-130	
1,2-Dichloroethane-d4	109	70-130	
Toluene-d8	95	70-130	
4-Bromofluorobenzene	96	70-130	

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information		Lab Information	
Client Sample ID:	**REF-102**	**Lab Sample ID:**	**P352204**
Project Name:	Alaska LNG	Date Received:	10/31/15
Sample Date:	10/29/15	Dilution Factor:	1
Sample Time:	15:28	Report Revision No.:	0
Type:	Grab		
Matrix:	Soil		
Basis:	Dry Weight		

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Volatiles								
Benzene	71-43-2	0.23	0.94	0.23	U	ug/Kg	SW8260B	11/03/15
Toluene	108-88-3	0.23	0.94	0.23	U	ug/Kg	SW8260B	11/03/15
Ethylbenzene	100-41-4	0.23	0.94	0.23	U	ug/Kg	SW8260B	11/03/15
m,p-Xylene	108-38-3/1	0.47	1.87	0.47	U	ug/Kg	SW8260B	11/03/15
o-Xylene	95-47-6	0.23	0.94	0.23	U	ug/Kg	SW8260B	11/03/15
Xylenes, Total	1330-20-7	0.23	2.81	0.23	U	ug/Kg	SW8260B	11/03/15

Surrogate	% Recovery	Control Limits	Qualifier
Dibromofluoromethane	106	70-130	
1,2-Dichloroethane-d4	111	70-130	
Toluene-d8	95	70-130	
4-Bromofluorobenzene	86	70-130	

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information		Lab Information	
Client Sample ID:	**SB1-1103**	**Lab Sample ID:**	**SB1-1103**
Project Name:	Alaska LNG	Date Received:	N/A
Sample Date:	N/A	Dilution Factor:	1
Sample Time:	N/A	Report Revision No.:	0
Type:	QC		
Matrix:	Soil		
Basis:	Dry Weight		

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Volatiles								
Benzene	71-43-2	0.25	1.00	0.25	U	ug/Kg	SW8260B	11/03/15
Toluene	108-88-3	0.25	1.00	0.25	U	ug/Kg	SW8260B	11/03/15
Ethylbenzene	100-41-4	0.25	1.00	0.25	U	ug/Kg	SW8260B	11/03/15
m,p-Xylene	108-38-3/1	0.50	2.00	0.50	U	ug/Kg	SW8260B	11/03/15
o-Xylene	95-47-6	0.25	1.00	0.25	U	ug/Kg	SW8260B	11/03/15
Xylenes, Total	1330-20-7	0.25	3.00	0.25	U	ug/Kg	SW8260B	11/03/15

Surrogate	% Recovery	Control Limits	Qualifier
Dibromofluoromethane	103	70-130	
1,2-Dichloroethane-d4	111	70-130	
Toluene-d8	93	70-130	
4-Bromofluorobenzene	86	70-130	

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Project Name: Alaska LNG
Type: QC
Matrix: Soil

Lab Information

LCS ID: BS1S1103

Report Revision No.: 0
Dilution Factor: 1

Analyte	CAS#	Spike Amount	Sample Result	Units	%Recovery	Analysis Method	Date Analyzed
GC/MS Volatiles							
Benzene	71-43-2	20.0	18.8	ug/Kg	94	SW8260B	11/03/15
Toluene	108-88-3	20.0	18.7	ug/Kg	93	SW8260B	11/03/15
Ethylbenzene	100-41-4	20.0	18.8	ug/Kg	94	SW8260B	11/03/15
m,p-Xylene	108-38-3/1	40.0	36.9	ug/Kg	92	SW8260B	11/03/15
o-Xylene	95-47-6	20.0	18.1	ug/Kg	91	SW8260B	11/03/15

Surrogate	% Recovery	Control Limits	Qualifier
Dibromofluoromethane	100	70-130	
1,2-Dichloroethane-d4	103	70-130	
Toluene-d8	94	70-130	
4-Bromofluorobenzene	94	70-130	

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

CH2MHILL
Applied Sciences Laboratory (ASL)

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Tel 541-768-3120 Fax 541-752-0276

CASE NARRATIVE
GC VOLATILES ANALYSIS

Lab Name: CH2M HILL ASL **ASL SDG#:** P3522

Project: Alaska LNG **Project #:** 653488.16.06

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

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

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

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

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

Method(s):
AK101: SW5030

Analytical Exception(s):
All surrogates were manually integrated per method requirements.

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information		Lab Information	
Client Sample ID:	**REF-2**	**Lab Sample ID:**	**P352201**
Project Name:	Alaska LNG	Date Received:	10/31/15
Sample Date:	10/29/15	Dilution Factor:	1
Sample Time:	15:18	Report Revision No.:	0
Type:	Grab		
Matrix:	Soil		
Basis:	Dry Weight		

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC Volatiles								
TPH-Gasoline	TPH-Gasoline	0.48	1.35	0.48	U	mg/Kg	AK101	11/09/15

Surrogate	% Recovery	Control Limits	Qualifier
a,a,a-Trifluorotoluene	75	50-150	
4-Bromofluorobenzene	98	50-150	

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information		Lab Information	
Client Sample ID:	**REF-2MS**	**Lab Sample ID:**	**P352202MS**
Project Name:	Alaska LNG	Date Received:	10/31/15
Sample Date:	10/29/15	Dilution Factor:	1
Sample Time:	15:18	Report Revision No.:	0
Type:	Grab		
Matrix:	Soil		
Basis:	Dry Weight		

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC Volatiles								
TPH-Gasoline	TPH-Gasoline	0.48	1.35	13.2		mg/Kg	AK101	11/09/15

Surrogate	% Recovery	Control Limits	Qualifier
a,a,a-Trifluorotoluene	80	50-150	
4-Bromofluorobenzene	99	50-150	

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information		Lab Information	
Client Sample ID:	**REF-2MSD**	**Lab Sample ID:**	**P352203MSD**
Project Name:	Alaska LNG	Date Received:	10/31/15
Sample Date:	10/29/15	Dilution Factor:	1
Sample Time:	15:18	Report Revision No.:	0
Type:	Grab		
Matrix:	Soil		
Basis:	Dry Weight		

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC Volatiles								
TPH-Gasoline	TPH-Gasoline	0.48	1.35	14.0		mg/Kg	AK101	11/09/15

Surrogate	% Recovery	Control Limits	Qualifier
a,a,a-Trifluorotoluene	78	50-150	
4-Bromofluorobenzene	107	50-150	

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information		Lab Information	
Client Sample ID:	**REF-102**	**Lab Sample ID:**	**P352204**
Project Name:	Alaska LNG	Date Received:	10/31/15
Sample Date:	10/29/15	Dilution Factor:	1
Sample Time:	15:28	Report Revision No.:	0
Type:	Grab		
Matrix:	Soil		
Basis:	Dry Weight		

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC Volatiles								
TPH-Gasoline	TPH-Gasoline	0.53	1.49	0.53	U	mg/Kg	AK101	11/09/15

Surrogate	% Recovery	Control Limits	Qualifier
a,a,a-Trifluorotoluene	68	50-150	
4-Bromofluorobenzene	102	50-150	

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information		Lab Information	
Client Sample ID:	**SB1-1109**	**Lab Sample ID:**	**SB1-1109**
Project Name:	Alaska LNG	Date Received:	N/A
Sample Date:	N/A	Dilution Factor:	1
Sample Time:	N/A	Report Revision No.:	0
Type:	QC		
Matrix:	Soil		
Basis:	Dry Weight		

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC Volatiles								
TPH-Gasoline	TPH-Gasoline	0.71	2.00	0.71	U	mg/Kg	AK101	11/09/15

Surrogate	% Recovery	Control Limits	Qualifier
a,a,a-Trifluorotoluene	96	60-120	
4-Bromofluorobenzene	107	60-120	

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Project Name: Alaska LNG
Type: QC
Matrix: Soil

Lab Information

LCS ID: BS1S1109

Report Revision No.: 0
Dilution Factor: 1

Analyte	CAS#	Spike Amount	Sample Result	Units	%Recovery	Analysis Method	Date Analyzed
GC Semi-Volatiles							
TPH-Gasoline	TPH-Gasoline	20.0	19.8	mg/Kg	99	AK101	11/09/15

Surrogate	% Recovery	Control Limits	Qualifier
a,a,a-Trifluorotoluene	93	60-120	
4-Bromofluorobenzene	97	60-120	

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

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CASE NARRATIVE
GC SEMI-VOLATILES ANALYSIS

Lab Name: CH2M HILL ASL **ASL SDG#:** P3522

Project: Alaska LNG **Project #:** 653488.16.06

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

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

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

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

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

Method(s):
AK102/103: SW3550

Surrogate Standard(s):
All surrogates were manually integrated per method requirements.

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information		Lab Information	
Client Sample ID:	**REF-2**	**Lab Sample ID:**	**P352201**
Project Name:	Alaska LNG	Date Received:	10/31/15
Sample Date:	10/29/15	Dilution Factor:	1
Sample Time:	15:18	Report Revision No.:	0
Type:	Grab		
Matrix:	Soil		
Basis:	Dry Weight		

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC Semi-Volatiles								
TPH-Diesel	TPH-Diesel	4.62	11.6	4.62	U	mg/Kg	AK102/103	11/10/15
TPH-Oil	TPH-Oil	4.62	11.6	7.68	J	mg/Kg	AK102/103	11/10/15

Surrogate	% Recovery	Control Limits	Qualifier
o-Terphenyl	88	50-150	
Octacosane	91	50-150	

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information		Lab Information	
Client Sample ID:	**REF-2MS**	**Lab Sample ID:**	**P352202MS**
Project Name:	Alaska LNG	Date Received:	10/31/15
Sample Date:	10/29/15	Dilution Factor:	1
Sample Time:	15:18	Report Revision No.:	0
Type:	Grab		
Matrix:	Soil		
Basis:	Dry Weight		

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC Semi-Volatiles								
TPH-Diesel	TPH-Diesel	4.66	11.6	112		mg/Kg	AK102/103	11/10/15
TPH-Oil	TPH-Oil	4.66	11.6	114		mg/Kg	AK102/103	11/10/15

Surrogate	% Recovery	Control Limits	Qualifier
o-Terphenyl	95	50-150	
Octacosane	96	50-150	

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information		Lab Information	
Client Sample ID:	**REF-2MSD**	**Lab Sample ID:**	**P352203MSD**
Project Name:	Alaska LNG	Date Received:	10/31/15
Sample Date:	10/29/15	Dilution Factor:	1
Sample Time:	15:18	Report Revision No.:	0
Type:	Grab		
Matrix:	Soil		
Basis:	Dry Weight		

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC Semi-Volatiles								
TPH-Diesel	TPH-Diesel	4.62	11.5	109		mg/Kg	AK102/103	11/10/15
TPH-Oil	TPH-Oil	4.62	11.5	108		mg/Kg	AK102/103	11/10/15

Surrogate	% Recovery	Control Limits	Qualifier
o-Terphenyl	93	50-150	
Octacosane	94	50-150	

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information		Lab Information	
Client Sample ID:	**REF-102**	**Lab Sample ID:**	**P352204**
Project Name:	Alaska LNG	Date Received:	10/31/15
Sample Date:	10/29/15	Dilution Factor:	1
Sample Time:	15:28	Report Revision No.:	0
Type:	Grab		
Matrix:	Soil		
Basis:	Dry Weight		

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC Semi-Volatiles								
TPH-Diesel	TPH-Diesel	4.76	11.9	4.76	U	mg/Kg	AK102/103	11/10/15
TPH-Oil	TPH-Oil	4.76	11.9	10.5	J	mg/Kg	AK102/103	11/10/15

Surrogate	% Recovery	Control Limits	Qualifier
o-Terphenyl	94	50-150	
Octacosane	97	50-150	

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information		Lab Information	
Client Sample ID:	**SB2-1106**	**Lab Sample ID:**	**SB2-1106**
Project Name:	Alaska LNG	Date Received:	N/A
Sample Date:	N/A	Dilution Factor:	1
Sample Time:	N/A	Report Revision No.:	0
Type:	QC		
Matrix:	Soil		
Basis:	Dry Weight		

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC Semi-Volatiles								
TPH-Diesel	TPH-Diesel	4.00	10.0	4.00	U	mg/Kg	AK102/103	11/09/15
TPH-Oil	TPH-Oil	4.00	10.0	4.00	U	mg/Kg	AK102/103	11/09/15

Surrogate	% Recovery	Control Limits	Qualifier
o-Terphenyl	94	60-120	
Octacosane	96	60-120	

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information		Lab Information	
		LCS ID:	BS2S1106
Project Name:	Alaska LNG	Report Revision No.:	0
Type:	QC	Dilution Factor:	1
Matrix:	Soil		

Analyte	CAS#	Spike Amount	Sample Result	Units	%Recovery	Analysis Method	Date Analyzed
GC Semi-Volatiles							
TPH-Diesel	TPH-Diesel	100	94.7	mg/Kg	95	AK102/103	11/09/15
TPH-Oil	TPH-Oil	100	93.8	mg/Kg	94	AK102/103	11/09/15

Surrogate	% Recovery	Control Limits	Qualifier
o-Terphenyl	94	60-120	
Octacosane	94	60-120	

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

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CASE NARRATIVE
METALS ANALYSIS

Lab Name: CH2M HILL ASL **ASL SDG#:** P3522

Project: Alaska LNG **Project #:** 653488.16.06

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

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

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

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

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

Method(s):
SW6010B: SW3050
SW7471A

Matrix Spike/Matrix Spike Duplicate(s):
SW6010B: MS recovery of Barium(59%) in REF-2MS did not meet acceptance criteria of 75-125%. MS recovery of Antimony(57%) in REF-2MS did not meet acceptance criteria of 75-125%. MS recovery of Vanadium(74%) in REF-2MS did not meet acceptance criteria of 75-125%. MSD recovery of Antimony(49%) in REF-2MSD did not meet acceptance criteria of 75-125%.

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Client Sample ID: REF-2

Project Name: Alaska LNG
Sample Date: 10/29/15
Sample Time: 15:18
Type: Grab
Matrix: Soil
Basis: Dry Weight

Lab Information

Lab Sample ID: P352201

Date Received: 10/31/15
Report Revision No: 0

Analyte	Dilution Factor	DL	RL	Result	Qual	Units	Analysis Method	Prep Method	Date Analyzed
Metals									
Antimony	1	0.37	1.87	1.40	J	mg/Kg	SW6010B	SW3050	11/18/15
Arsenic	1	0.89	2.24	3.84		mg/Kg	SW6010B	SW3050	11/18/15
Barium	1	0.037	0.75	37.7		mg/Kg	SW6010B	SW3050	11/18/15
Beryllium	1	0.037	0.30	1.42		mg/Kg	SW6010B	SW3050	11/18/15
Cadmium	1	0.075	0.37	0.075	U	mg/Kg	SW6010B	SW3050	11/18/15
Chromium	1	0.037	0.75	12.8		mg/Kg	SW6010B	SW3050	11/18/15
Copper	1	0.37	1.50	8.75		mg/Kg	SW6010B	SW3050	11/18/15
Lead	1	0.26	1.50	3.28		mg/Kg	SW6010B	SW3050	11/18/15
Mercury	1	0.010	0.023	0.010	U	mg/Kg	SW7471A	METHOD	11/03/15
Nickel	1	0.19	1.50	13.2		mg/Kg	SW6010B	SW3050	11/18/15
Selenium	1	1.50	3.74	1.50	U	mg/Kg	SW6010B	SW3050	11/18/15
Silver	1	0.19	0.75	0.19	U	mg/Kg	SW6010B	SW3050	11/18/15
Thallium	1	0.37	2.99	0.37	U	mg/Kg	SW6010B	SW3050	11/18/15
Vanadium	1	0.19	1.87	29.2		mg/Kg	SW6010B	SW3050	11/18/15
Zinc	1	0.37	1.50	30.1		mg/Kg	SW6010B	SW3050	11/18/15

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Client Sample ID: REF-2MS

Project Name: Alaska LNG
Sample Date: 10/29/15
Sample Time: 15:18
Type: Grab
Matrix: Soil
Basis: Dry Weight

Lab Information

Lab Sample ID: P352202MS

Date Received: 10/31/15
Report Revision No: 0

Analyte	Dilution Factor	DL	RL	Result	Qual	Units	Analysis Method	Prep Method	Date Analyzed
Metals									
Antimony	1	0.33	1.66	20.4		mg/Kg	SW6010B	SW3050	11/18/15
Arsenic	1	0.79	1.99	37.5		mg/Kg	SW6010B	SW3050	11/18/15
Barium	1	0.033	0.66	57.4		mg/Kg	SW6010B	SW3050	11/18/15
Beryllium	1	0.033	0.27	33.8		mg/Kg	SW6010B	SW3050	11/18/15
Cadmium	1	0.066	0.33	32.9		mg/Kg	SW6010B	SW3050	11/18/15
Chromium	1	0.033	0.66	42.1		mg/Kg	SW6010B	SW3050	11/18/15
Copper	1	0.33	1.33	39.1		mg/Kg	SW6010B	SW3050	11/18/15
Lead	1	0.23	1.33	34.0		mg/Kg	SW6010B	SW3050	11/18/15
Mercury	1	0.0085	0.019	0.20		mg/Kg	SW7471A	METHOD	11/03/15
Nickel	1	0.17	1.33	42.7		mg/Kg	SW6010B	SW3050	11/18/15
Selenium	1	1.33	3.32	31.1		mg/Kg	SW6010B	SW3050	11/18/15
Silver	1	0.17	0.66	16.1		mg/Kg	SW6010B	SW3050	11/18/15
Thallium	1	0.33	2.66	29.1		mg/Kg	SW6010B	SW3050	11/18/15
Vanadium	1	0.17	1.66	53.8		mg/Kg	SW6010B	SW3050	11/18/15
Zinc	1	0.33	1.33	57.7		mg/Kg	SW6010B	SW3050	11/18/15

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Client Sample ID: REF-2MSD

Project Name: Alaska LNG
Sample Date: 10/29/15
Sample Time: 15:18
Type: Grab
Matrix: Soil
Basis: Dry Weight

Lab Information

Lab Sample ID: P352203MSD

Date Received: 10/31/15
Report Revision No: 0

Analyte	Dilution Factor	DL	RL	Result	Qual	Units	Analysis Method	Prep Method	Date Analyzed
Metals									
Antimony	1	0.46	2.31	24.2		mg/Kg	SW6010B	SW3050	11/18/15
Arsenic	1	1.10	2.77	48.2		mg/Kg	SW6010B	SW3050	11/18/15
Barium	1	0.046	0.92	80.1		mg/Kg	SW6010B	SW3050	11/18/15
Beryllium	1	0.046	0.37	43.5		mg/Kg	SW6010B	SW3050	11/18/15
Cadmium	1	0.092	0.46	42.2		mg/Kg	SW6010B	SW3050	11/18/15
Chromium	1	0.046	0.92	55.5		mg/Kg	SW6010B	SW3050	11/18/15
Copper	1	0.46	1.85	50.0		mg/Kg	SW6010B	SW3050	11/18/15
Lead	1	0.32	1.85	43.1		mg/Kg	SW6010B	SW3050	11/18/15
Mercury	1	0.0091	0.020	0.21		mg/Kg	SW7471A	METHOD	11/03/15
Nickel	1	0.23	1.85	56.1		mg/Kg	SW6010B	SW3050	11/18/15
Selenium	1	1.85	4.62	36.0		mg/Kg	SW6010B	SW3050	11/18/15
Silver	1	0.23	0.92	20.7		mg/Kg	SW6010B	SW3050	11/18/15
Thallium	1	0.46	3.70	37.2		mg/Kg	SW6010B	SW3050	11/18/15
Vanadium	1	0.23	2.31	68.5		mg/Kg	SW6010B	SW3050	11/18/15
Zinc	1	0.46	1.85	69.5		mg/Kg	SW6010B	SW3050	11/18/15

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Client Sample ID: REF-102

Project Name: Alaska LNG
Sample Date: 10/29/15
Sample Time: 15:28
Type: Grab
Matrix: Soil
Basis: Dry Weight

Lab Information

Lab Sample ID: P352204

Date Received: 10/31/15
Report Revision No: 0

Analyte	Dilution Factor	DL	RL	Result	Qual	Units	Analysis Method	Prep Method	Date Analyzed
Metals									
Antimony	1	0.45	2.23	1.19	J	mg/Kg	SW6010B	SW3050	11/18/15
Arsenic	1	1.06	2.67	5.37		mg/Kg	SW6010B	SW3050	11/18/15
Barium	1	0.045	0.89	32.9		mg/Kg	SW6010B	SW3050	11/18/15
Beryllium	1	0.045	0.36	1.33		mg/Kg	SW6010B	SW3050	11/18/15
Cadmium	1	0.089	0.45	0.089	U	mg/Kg	SW6010B	SW3050	11/18/15
Chromium	1	0.045	0.89	11.6		mg/Kg	SW6010B	SW3050	11/18/15
Copper	1	0.45	1.78	7.38		mg/Kg	SW6010B	SW3050	11/18/15
Lead	1	0.30	1.78	1.82		mg/Kg	SW6010B	SW3050	11/18/15
Mercury	1	0.0098	0.022	0.0098	U	mg/Kg	SW7471A	METHOD	11/03/15
Nickel	1	0.22	1.78	12.4		mg/Kg	SW6010B	SW3050	11/18/15
Selenium	1	1.78	4.45	1.78	U	mg/Kg	SW6010B	SW3050	11/18/15
Silver	1	0.22	0.89	0.22	U	mg/Kg	SW6010B	SW3050	11/18/15
Thallium	1	0.45	3.56	0.45	U	mg/Kg	SW6010B	SW3050	11/18/15
Vanadium	1	0.22	2.23	28.2		mg/Kg	SW6010B	SW3050	11/18/15
Zinc	1	0.45	1.78	27.4		mg/Kg	SW6010B	SW3050	11/18/15

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Project Name: Alaska LNG
Sample Date: N/A
Sample Time: N/A
Type: QC
Matrix: Soil
Basis: Dry Weight

Lab Information

Method Blank ID: SB1-1102

Date Received: N/A
Report Revision No: 0

Analyte	Dilution Factor	DL	RL	Result	Qual	Units	Analysis Method	Prep Method	Date Analyzed
Metals									
Mercury	1	0.0090	0.020	0.0090	U	mg/Kg	SW7471A	METHOD	11/03/15

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Project Name: Alaska LNG
Sample Date: N/A
Sample Time: N/A
Type: QC
Matrix: Soil
Basis: Dry Weight

Lab Information

Method Blank ID: SB1-1110

Date Received: N/A
Report Revision No: 0

Analyte	Dilution Factor	DL	RL	Result	Qual	Units	Analysis Method	Prep Method	Date Analyzed
Metals									
Antimony	1	0.50	2.50	0.50	U	mg/Kg	SW6010B	SW3050	11/18/15
Arsenic	1	1.19	3.00	1.19	U	mg/Kg	SW6010B	SW3050	11/18/15
Barium	1	0.050	1.00	0.050	U	mg/Kg	SW6010B	SW3050	11/18/15
Beryllium	1	0.050	0.40	0.050	U	mg/Kg	SW6010B	SW3050	11/18/15
Cadmium	1	0.10	0.50	0.10	U	mg/Kg	SW6010B	SW3050	11/18/15
Chromium	1	0.050	1.00	0.050	U	mg/Kg	SW6010B	SW3050	11/18/15
Copper	1	0.50	2.00	0.50	U	mg/Kg	SW6010B	SW3050	11/18/15
Lead	1	0.34	2.00	0.34	U	mg/Kg	SW6010B	SW3050	11/18/15
Nickel	1	0.25	2.00	0.25	U	mg/Kg	SW6010B	SW3050	11/18/15
Selenium	1	2.00	5.00	2.41	J	mg/Kg	SW6010B	SW3050	11/18/15
Silver	1	0.25	1.00	0.25	U	mg/Kg	SW6010B	SW3050	11/18/15
Thallium	1	0.50	4.00	0.50	U	mg/Kg	SW6010B	SW3050	11/18/15
Vanadium	1	0.25	2.50	0.25	U	mg/Kg	SW6010B	SW3050	11/18/15
Zinc	1	0.50	2.00	0.50	U	mg/Kg	SW6010B	SW3050	11/18/15

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Project Name: Alaska LNG
Type: QC
Matrix: Soil

Lab Information

Blank Spike ID: BS1S1102

Report Revision No: 0
Dilution Factor: 1

Analyte	Spike Amount	Result	Units	%Recovery	Analysis Method	Prep Method	Date Analyzed
Metals							
Mercury	0.20	0.20	mg/Kg	102	SW7471A	METHOD	11/03/15

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Project Name: Alaska LNG
Type: QC
Matrix: Soil

Lab Information

Blank Spike ID: BS1S1110

Report Revision No: 0
Dilution Factor: 1

Analyte	Spike Amount	Result	Units	%Recovery	Analysis Method	Prep Method	Date Analyzed
Metals							
Antimony	50.0	51.9	mg/Kg	104	SW6010B	SW3050	11/18/15
Arsenic	50.0	50.9	mg/Kg	102	SW6010B	SW3050	11/18/15
Barium	50.0	50.3	mg/Kg	101	SW6010B	SW3050	11/18/15
Beryllium	50.0	48.9	mg/Kg	98	SW6010B	SW3050	11/18/15
Cadmium	50.0	50.2	mg/Kg	100	SW6010B	SW3050	11/18/15
Chromium	50.0	50.5	mg/Kg	101	SW6010B	SW3050	11/18/15
Copper	50.0	49.7	mg/Kg	99	SW6010B	SW3050	11/18/15
Lead	50.0	50.5	mg/Kg	101	SW6010B	SW3050	11/18/15
Nickel	50.0	54.5	mg/Kg	109	SW6010B	SW3050	11/18/15
Selenium	50.0	48.9	mg/Kg	98	SW6010B	SW3050	11/18/15
Silver	25.0	24.2	mg/Kg	97	SW6010B	SW3050	11/18/15
Thallium	50.0	49.5	mg/Kg	99	SW6010B	SW3050	11/18/15
Vanadium	50.0	48.5	mg/Kg	97	SW6010B	SW3050	11/18/15
Zinc	50.0	51.5	mg/Kg	103	SW6010B	SW3050	11/18/15

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

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CASE NARRATIVE
METALS ANALYSIS

Lab Name: CH2M HILL ASL **ASL SDG#:** P3522

Project: Alaska LNG **Project #:** 653488.16.06

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

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

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

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

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

Method(s):
SW6010B: AVS

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Client Sample ID: REF-2

Project Name: Alaska LNG
Sample Date: 10/29/15
Sample Time: 15:18
Type: Grab
Matrix: Soil
Basis: Dry Weight

Lab Information

Lab Sample ID: P352201

Date Received: 10/31/15
Report Revision No: 0

Analyte	Dilution Factor	DL	RL	Result	Qual	Units	Analysis Method	Prep Method	Date Analyzed
Metals									
Cadmium	1	0.12	0.58	0.12	U	mg/Kg	SW6010B	AVS	11/16/15
Copper	1	0.58	2.31	3.40		mg/Kg	SW6010B	AVS	11/16/15
Lead	1	0.39	2.31	0.72	J	mg/Kg	SW6010B	AVS	11/16/15
Nickel	1	0.29	2.31	2.98		mg/Kg	SW6010B	AVS	11/16/15
Zinc	1	0.58	2.31	5.73		mg/Kg	SW6010B	AVS	11/16/15

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Project Name: Alaska LNG
Sample Date: N/A
Sample Time: N/A
Type: QC
Matrix: Soil
Basis: Dry Weight

Lab Information

Method Blank ID: SB1-1111

Date Received: N/A
Report Revision No: 0

Analyte	Dilution Factor	DL	RL	Result	Qual	Units	Analysis Method	Prep Method	Date Analyzed
Metals									
Cadmium	1	0.10	0.50	0.10	U	mg/Kg	SW6010B	AVS	11/16/15
Copper	1	0.50	2.00	0.50	U	mg/Kg	SW6010B	AVS	11/16/15
Lead	1	0.34	2.00	0.34	U	mg/Kg	SW6010B	AVS	11/16/15
Nickel	1	0.25	2.00	0.25	U	mg/Kg	SW6010B	AVS	11/16/15
Zinc	1	0.50	2.00	0.50	U	mg/Kg	SW6010B	AVS	11/16/15

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Project Name: Alaska LNG
Type: QC
Matrix: Soil

Lab Information

Blank Spike ID: BS1S1111

Report Revision No: 0
Dilution Factor: 1

Analyte	Spike Amount	Result	Units	%Recovery	Analysis Method	Prep Method	Date Analyzed
Metals							
Cadmium	20.6	21.6	mg/Kg	105	SW6010B	AVS	11/16/15
Copper	20.6	21.8	mg/Kg	106	SW6010B	AVS	11/16/15
Lead	20.6	20.2	mg/Kg	98	SW6010B	AVS	11/16/15
Nickel	20.6	20.4	mg/Kg	99	SW6010B	AVS	11/16/15
Zinc	20.6	21.0	mg/Kg	102	SW6010B	AVS	11/16/15

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

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

CASE NARRATIVE
GENERAL CHEMISTRY ANALYSIS

Lab Name: CH2M HILL ASL **ASL SDG#:** P3522

Project: Alaska LNG **Project #:** 653488.16.06

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

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

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

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

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

Method(s):
LYDKHN

Calibration Verification(s):
LYDKHN: CV recovery of Total Organic Carbon(123%) in CV2-1117 did not meet acceptance criteria of 80-120%.

Matrix Spike/Matrix Spike Duplicate(s):
LYDKHN: MS recovery of Total Organic Carbon(139%) in REF-2MS did not meet acceptance criteria of 70-130%.

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information		Lab Information	
Project Name:	**Alaska LNG**	**Lab Batch ID:**	**P3522**
Date Received:	10/31/15	Analysis Method:	LYDKHN
Type:	See C.O.C.	Units:	mg/Kg
Matrix:	Soil	Report Revision No.:	0
Basis:	Dry Weight		

Client Sample ID	Lab Sample ID	Dilution Factor	DL	RL	Total Organic Carbon Result	Qualifier	Date Analyzed
General Chemistry							
REF-2	P352201	1	30.3	101	178		11/17/15
REF-2MS	P352202MS	1	54.4	180	2680		11/17/15
REF-2MSD	P352203MSD	1	56.3	187	2410		11/17/15
REF-102	P352204	1	30.3	100	240		11/17/15
SB1-1117	SB1-1117	1	30.1	100	30.1	U	11/17/15

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Project Name: Alaska LNG
Type: QC
Matrix: Soil
Basis: Dry Weight

Lab Information

Lab Batch ID: P3522

Report Revision No.: 0

LCS ID	Analyte	Spike Amount	Sample Result	Units	% Recovery	Analysis Method	Date Analyzed
General Chemistry							
BS1S1117	Total Organic Carbon	1180	1250	mg/Kg	106	LYDKHN	11/17/15

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information		Lab Information	
Client Sample ID:	**REF-2**		
Project Name:	Alaska LNG	Report Revision No.:	0
Type:	QC		
Matrix:	Soil		

Analyte	CAS#	MS %Recovery	MSD %Recovery	RPD	QC Limits	RPD Limits	Analysis Method
General Chemistry							
Total Organic Carbon	TOC	139 *	120	10.5	70-130	20	LYDKHN

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

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

CASE NARRATIVE
GENERAL CHEMISTRY ANALYSIS

Lab Name: CH2M HILL ASL **ASL SDG#:** P3522

Project: Alaska LNG **Project #:** 653488.16.06

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

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

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

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

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

Method(s):
AVS
SM2540G

Matrix Spike/Matrix Spike Duplicate(s):
AVS: MS/MSd reocvery of AVS (61%, 66%) failed to meet the acceptance criteria of 85-115%.

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Project Name: **Alaska LNG**

Date Received: 10/31/15
Type: See C.O.C.
Matrix: Soil
Basis: Dry Weight

Lab Information

Lab Batch ID: **P3522**

Analysis Method: AVS
Units: mg/Kg
Report Revision No.: 0

Client Sample ID	Lab Sample ID	Dilution Factor	DL	Acid Volatile Sulfide RL	Result	Qualifier	Date Analyzed
General Chemistry							
REF-2	P352201	1	0.64	9.60	0.64	U	11/11/15
SB1-1111	SB1-1111	1	0.11	1.60	0.11	U	11/11/15

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Project Name: **Alaska LNG**

Date Received: 10/31/15
Type: See C.O.C.
Matrix: Soil
Basis: Dry Weight

Lab Information

Lab Batch ID: **P3522**

Analysis Method: SM2540G
Units: Percent
Report Revision No.: 0

Client Sample ID	Lab Sample ID	Dilution Factor	DL	RL	Total Solids (TS) Result	Qualifier	Date Analyzed
General Chemistry							
REF-2	P352201	1	N/A	N/A	86.5		11/12/15
REF-102	P352204	1	N/A	N/A	83.7		11/12/15

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Project Name: Alaska LNG
Type: QC
Matrix: Soil
Basis: Dry Weight

Lab Information

Lab Batch ID: P3522

Report Revision No.: 0

LCS ID	Analyte	Spike Amount	Sample Result	Units	% Recovery	Analysis Method	Date Analyzed
General Chemistry							
BS1S1111	Acid Volatile Sulfide	5.50	5.62	mg/Kg	102	AVS	11/11/15

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

Summary of SEM/AVS Ratio **SDG:** P3522

Client ID	Lab ID	AVS[1] umol/g dry sed	SEM[2] umol/g dry sed	SEM/AVS[3]	
REF-2	P352201	0.020	0.20	9.84	*

*AVS is non-detect

[1]AVS = Acid Volatile Sulfide
[2]SEM = Simultaneously Extracted Metals
[3]SEM/AVS = Ratio of umol/g values

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

Chain of Custody Record

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

Client Contact

Project Name: AK LNG
Project # or PO #: 653488.16.06
Company Name: CH2M
Address: 2020 SW 4th Ave Ste 300
City/State/Zip: Portland OR 97201
Project Manager: Carrie Andrews
Phone #: 503-736-4270
Report to email: carrie.andrews@ch2m.com

Analysis Turnaround Time

TAT is Calander days
TAT if different from below
☒ 21 days (STD)
☐ 14 days * ☐ 3 day *
☐ 7 days * ☐ 2 days *
☐ 5 days * ☐ 1 day *
* (Surcharges will apply)

Preservation Used

For Lab Use Only:

SDG: P3522
Custody Seals intact? ☒ Yes ☐ No
Hand delivered? ☐ Yes ☒ No
Cooler Temp 5.4 °C
Therm ID No.: 173 Therm Exp. 1/27/16
Packing Material: Circle Below
(Ice) Blue Ice Box Bubble Wrap
Radiological Screen? ☐ Yes ☒ No

Sample Identification (Limit of 20 characters)	Sample Date	Sample Time	Sample Type (C=Comp, G=Grab)	Matrix (Water, Soil, Air)	Total # of Cont.	AK101 (6)	AK103/103 (1)	SW8260B - BTEX only (7)	Trace Metals (1)	Hg (1)	TOC (1)	Total solids (1)	Grain Size (1)		Sample Specific Notes:	Lab ID:
REF-2	10/29/15	1518	C/G	SED	5	X	X	X	X	X	X	X	X			1
REF-2MS	10/29/15	1518	C/G	SED	5	X	X	X	X	X	X	X				2
REF-2MSD	10/29/15	1519	C/G	SED	5	X	X	X	X	X	X	X				3
REF-102	10/29/15	1528	C/G	SED	5	X	X	X	X	X	X	X				4
TB102915-01	10/29/15	0900	G	W	2	X		X								5

Preservation Used: 1= Ice, 2= HCl; 3= H2SO4; 4=HNO3; 5=NaOH; 6= Other MeOH 7: Freeze

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

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

Sampled By: Morgan Bruno Date/Time: 10/29/15 1518
Received by: Kathy McCenk Date/Time: 10/31/15 1030
Received in Laboratory by: Clemente Castro Date/Time: 10/31/15 11:45

Relinquished by: Morgan Bruno Date/Time: 10/30/15 1030
Relinquished by: Date/Time:
Shipped Via: ☐ UPS ☐ Fed-Ex ☐ USPS ☒ Other Tracking #:

Special Instructions/QC Requirements Trace Metals / Hg by SW6010B / SW7470A / SW7471A
AK101 & BTEX are grabs - all other analytes are composites

CH2MHILL
Applied Sciences Laboratory (ASL)

Sample Receipt Record

SDG ID: P3522 | Date Received: 10/31/15

Client/Project: Alaska LNG | Received By: PC

Were custody seals intact and on the outside of the cooler?	☑ Yes	☐ No	☐ N/A
Shipping Record:	☐ Hand Delivered	☐ On File	☐ COC
Radiological Screening for DoD	☐ Yes	☐ No	☑ N/A
Packing Material:	☐ Hand Delivered	☑ Ice	☐ Blue Ice ☐ Box
Temp OK? (<6C) Therm ID: TH173 Exp. 1/16 5.4 °C	☑ Yes	☐ No	☐ N/A
Was a Chain of Custody (CoC) Provided?	☑ Yes	☐ No	☐ N/A
Was the CoC correctly filled out (If No, document below)	☑ Yes	☐ No	☐ N/A
Did sample labels agree with COC? (If No, document below)	☑ Yes	☐ No	☐ N/A
Did the CoC list a correct bottle count and the preservative types (No=Correct on CoC)	☑ Yes	☐ No	☐ N/A
Were the sample containers in good condition (broken or leaking)?	☑ Yes	☑ No	☐ N/A
Was enough sample volume provided for analysis? (If No, document below)	☑ Yes	☐ No	☐ N/A
Containers supplied by ASL?	☑ Yes	☐ No	☐ N/A
Any sample with < 1/2 holding time remaining? If so contact LPM	☐ Yes	☑ No	☐ N/A
Samples have multi-phase? If yes, document on SRER	☐ Yes	☑ No	☐ N/A
All water VOCs free of air bubbles? No, document on SRER	☑ Yes	☐ No	☐ N/A
pH of all samples met criteria on receipt? If "No", preserve and document below.	☐ Yes	☐ No	☑ N/A
Dissolved/Soluble metals filtered in the field?	☐ Yes	☐ No	☑ N/A
Dissolved/Soluble metals have sediment in bottom of container? If so document below.	☐ Yes	☐ No	☑ N/A

Preservation Adjustment

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

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

Sample Exception Report (The following exceptions were noted)

1. P352202 AK102/103 (Client ID: REF-2MS) arrived with cracked lid - taped to prevent further damage.
2. AVS-SEM was added to sample P3522-1 (REF-2) per Carrie Andrews/PDX on 10/31/15

Client was notified on: Client contact:

Resolution to Exception:

ALS Environmental
ALS Group USA, Corp
1317 South 13th Avenue
Kelso, WA 98626
T : +1 360 577 7222
F : +1 360 636 1068
www.alsglobal.com

November 23, 2015

Analytical Report for Service Request No: K1512414

Ms. Kathy McKinley
CH2M Hill Inc. Applied Sciences Laboratory
1100 NE Circle Blvd., Suite 300
Corvallis, OR 97330

RE: AK LNG / 653488.16.06

Dear Ms.McKinley,

Enclosed are the results of the sample(s) submitted to our laboratory October 31, 2015
For your reference, these analyses have been assigned our service request number **K1512414.**

Analyses were performed according to our laboratory's NELAP-approved quality assurance program. The test results meet requirements of the current NELAP standards, where applicable, and except as noted in the laboratory case narrative provided. For a specific list of NELAP-accredited analytes, refer to the certifications section at www.alsglobal.com. All results are intended to be considered in their entirety, and ALS Group USA Corp. dba ALS Environmental (ALS) is not responsible for use of less than the complete report. Results apply only to the items submitted to the laboratory for analysis and individual items (samples) analyzed, as listed in the report.

Please contact me if you have any questions. My extension is 3275. You may also contact me via email at Chris.Leaf@ALSGlobal.com.

Respectfully submitted,

ALS Group USA, Corp. dba ALS Environmental

for

Chris Leaf
Project Manager

RIGHTSLINK

ALS Environmental
ALS Group USA, Corp
1317 South 13th Avenue
Kelso, WA 98626
T : +1 360 577 7222
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www.alsglobal.com

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Acronyms

ASTM	American Society for Testing and Materials
A2LA	American Association for Laboratory Accreditation
CARB	California Air Resources Board
CAS Number	Chemical Abstract Service registry Number
CFC	Chlorofluorocarbon
CFU	Colony-Forming Unit
DEC	Department of Environmental Conservation
DEQ	Department of Environmental Quality
DHS	Department of Health Services
DOE	Department of Ecology
DOH	Department of Health
EPA	U. S. Environmental Protection Agency
ELAP	Environmental Laboratory Accreditation Program
GC	Gas Chromatography
GC/MS	Gas Chromatography/Mass Spectrometry
LOD	Limit of Detection
LOQ	Limit of Quantitation
LUFT	Leaking Underground Fuel Tank
M	Modified
MCL	Maximum Contaminant Level is the highest permissible concentration of a substance allowed in drinking water as established by the USEPA.
MDL	Method Detection Limit
MPN	Most Probable Number
MRL	Method Reporting Limit
NA	Not Applicable
NC	Not Calculated
NCASI	National Council of the Paper Industry for Air and Stream Improvement
ND	Not Detected
NIOSH	National Institute for Occupational Safety and Health
PQL	Practical Quantitation Limit
RCRA	Resource Conservation and Recovery Act
SIM	Selected Ion Monitoring
TPH	Total Petroleum Hydrocarbons
tr	Trace level is the concentration of an analyte that is less than the PQL but greater than or equal to the MDL.

Inorganic Data Qualifiers

*	The result is an outlier. See case narrative.
#	The control limit criteria is not applicable. See case narrative.
B	The analyte was found in the associated method blank at a level that is significant relative to the sample result as defined by the DOD or NELAC standards.
E	The result is an estimate amount because the value exceeded the instrument calibration range.
J	The result is an estimated value.
U	The analyte was analyzed for, but was not detected ("Non-detect") at or above the MRL/MDL. *DOD-QSM 4.2 definition* : Analyte was not detected and is reported as less than the LOD or as defined by the project. The detection limit is adjusted for dilution.
i	The MRL/MDL or LOQ/LOD is elevated due to a matrix interference.
X	See case narrative.
Q	See case narrative. One or more quality control criteria was outside the limits.
H	The holding time for this test is immediately following sample collection. The samples were analyzed as soon as possible after receipt by the laboratory.

Metals Data Qualifiers

#	The control limit criteria is not applicable. See case narrative.
J	The result is an estimated value.
E	The percent difference for the serial dilution was greater than 10%, indicating a possible matrix interference in the sample.
M	The duplicate injection precision was not met.
N	The Matrix Spike sample recovery is not within control limits. See case narrative.
S	The reported value was determined by the Method of Standard Additions (MSA).
U	The analyte was analyzed for, but was not detected ("Non-detect") at or above the MRL/MDL. *DOD-QSM 4.2 definition* : Analyte was not detected and is reported as less than the LOD or as defined by the project. The detection limit is adjusted for dilution.
W	The post-digestion spike for furnace AA analysis is out of control limits, while sample absorbance is less than 50% of spike absorbance.
i	The MRL/MDL or LOQ/LOD is elevated due to a matrix interference.
X	See case narrative.
+	The correlation coefficient for the MSA is less than 0.995.
Q	See case narrative. One or more quality control criteria was outside the limits.

Organic Data Qualifiers

*	The result is an outlier. See case narrative.
#	The control limit criteria is not applicable. See case narrative.
A	A tentatively identified compound, a suspected aldol-condensation product.
B	The analyte was found in the associated method blank at a level that is significant relative to the sample result as defined by the DOD or NELAC standards.
C	The analyte was qualitatively confirmed using GC/MS techniques, pattern recognition, or by comparing to historical data.
D	The reported result is from a dilution.
E	The result is an estimated value.
J	The result is an estimated value.
N	The result is presumptive. The analyte was tentatively identified, but a confirmation analysis was not performed.
P	The GC or HPLC confirmation criteria was exceeded. The relative percent difference is greater than 40% between the two analytical results.
U	The analyte was analyzed for, but was not detected ("Non-detect") at or above the MRL/MDL. *DOD-QSM 4.2 definition* : Analyte was not detected and is reported as less than the LOD or as defined by the project. The detection limit is adjusted for dilution.
i	The MRL/MDL or LOQ/LOD is elevated due to a chromatographic interference.
X	See case narrative.
Q	See case narrative. One or more quality control criteria was outside the limits.

Additional Petroleum Hydrocarbon Specific Qualifiers

F	The chromatographic fingerprint of the sample matches the elution pattern of the calibration standard.
L	The chromatographic fingerprint of the sample resembles a petroleum product, but the elution pattern indicates the presence of a greater amount of lighter molecular weight constituents than the calibration standard.
H	The chromatographic fingerprint of the sample resembles a petroleum product, but the elution pattern indicates the presence of a greater amount of heavier molecular weight constituents than the calibration standard.
O	The chromatographic fingerprint of the sample resembles an oil, but does not match the calibration standard.
Y	The chromatographic fingerprint of the sample resembles a petroleum product eluting in approximately the correct carbon range, but the elution pattern does not match the calibration standard.
Z	The chromatographic fingerprint does not resemble a petroleum product.

ALS Group USA Corp. dba ALS Environmental (ALS) - Kelso
State Certifications, Accreditations, and Licenses

Agency	Web Site	Number
Alaska DEC UST	http://dec.alaska.gov/applications/eh/ehllabreports/USTLabs.aspx	UST-040
Arizona DHS	http://www.azdhs.gov/lab/license/env.htm	AZ0339
Arkansas - DEQ	http://www.adeq.state.ar.us/techsvs/labcert.htm	88-0637
California DHS (ELAP)	http://www.cdph.ca.gov/certlic/labs/Pages/ELAP.aspx	2795
DOD ELAP	http://www.denix.osd.mil/edqw/Accreditation/AccreditedLabs.cfm	L14-51
Florida DOH	http://www.doh.state.fl.us/lab/EnvLabCert/WaterCert.htm	E87412
Hawaii DOH	Not available	-
Idaho DHW	http://www.healthandwelfare.idaho.gov/Health/Labs/CertificationDrinkingWaterLabs/tabid/1833/Default.aspx	-
ISO 17025	http://www.pjlabs.com/	L14-50
Louisiana DEQ	http://www.deq.louisiana.gov/portal/DIVISIONS/PublicParticipationandPermitSupport/LouisianaLaboratoryAccreditationProgram.aspx	03016
Maine DHS	Not available	WA01276
Michigan DEQ	http://www.michigan.gov/deq/0,1607,7-135-3307_4131_4156---,00.html	9949
Minnesota DOH	http://www.health.state.mn.us/accreditation	053-999-457
Montana DPHHS	http://www.dphhs.mt.gov/publichealth/	CERT0047
Nevada DEP	http://ndep.nv.gov/bsdw/labservice.htm	WA01276
New Jersey DEP	http://www.nj.gov/dep/oqa/	WA005
North Carolina DWQ	http://www.dwqlab.org/	605
Oklahoma DEQ	http://www.deq.state.ok.us/CSDnew/labcert.htm	9801
Oregon – DEQ (NELAP)	http://public.health.oregon.gov/LaboratoryServices/EnvironmentalLaboratoryAccreditation/Pages/index.aspx	WA100010
South Carolina DHEC	http://www.scdhec.gov/environment/envserv/	61002
Texas CEQ	http://www.tceq.texas.gov/field/qa/env_lab_accreditation.html	T104704427
Washington DOE	http://www.ecy.wa.gov/programs/eap/labs/lab-accreditation.html	C544
Wisconsin DNR	http://dnr.wi.gov/	998386840
Wyoming (EPA Region 8)	http://www.epa.gov/region8/water/dwhome/wyomingdi.html	-
Kelso Laboratory Website	www.alsglobal.com	NA

Analyses were performed according to our laboratory's NELAP-approved quality assurance program. A complete listing of specific NELAP-certified analytes, can be found in the certification section at www.ALSGlobal.com or at the accreditation bodies web site.

Please refer to the certification and/or accreditation body's web site if samples are submitted for compliance purposes. The states highlighted above, require the analysis be listed on the state certification if used for compliance purposes and if the method/anlayte is offered by that state.

Case Narrative

ALS Environmental—Kelso Laboratory
1317 South 13th Avenue, Kelso, WA 98626
Phone (360)577-7222 Fax (360)636-1068
www.alsglobal.com

ALS ENVIRONMENTAL

Client:	CH2M Hill	**Service Request No.:**	K1512414
Project:	AK LNG/ 653488.16.06	**Date Received:**	10/31/15
Sample Matrix:	Sediment		

Case Narrative

All analyses were performed consistent with the quality assurance program of ALS Environmental. This report contains analytical results for samples designated for Tier III deliverables including summary forms for each of the analyses. When appropriate to the method, method blank results have been reported with each analytical test.

Sample Receipt

Two sediment samples were received for analysis at ALS Environmental on 10/31/15. The samples were received in good condition and consistent with the accompanying chain of custody form. The samples were stored in a refrigerator at 4ºC upon receipt at the laboratory.

General Chemistry Parameters

No anomalies associated with the analysis of these samples were observed.

Approved by_____

Chain of Custody

ALS Environmental—Kelso Laboratory
1317 South 13th Avenue, Kelso, WA 98626
Phone (360)577-7222 Fax (360)636-1068
www.alsglobal.com

K1512414*

SR# ~~K1512412~~

COC Set 1 of 1

COC# _____

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ALS Environmental

CHAIN OF CUSTODY

64029

003

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www.alsglobal.com

Project Name: AKLNG

Project Number: 653488.16.06

Project Manager: Carrie Andrews

Company: CH2M

Address: 2020 SW 4th Ave Ste 300 Portland OR 97201

Phone #: 503-736-4270

email: carrie.andrews@chamicom

Sampler Signature: [signature]

Sampler Printed Name: Morgan Bruno

CLIENT SAMPLE ID	LABID	SAMPLING Date	SAMPLING Time	Matrix	NUMBER OF CONTAINERS	7D 350.1M / NH3 Plumb	7D PSEP Sulfide / PSEP Sulfide	14D 8081A / PEST_OC	30D 7196A / Cr6	999D 1160.3 Modified / TS	1	2	3	4	5	Remarks
1. REF-2		10/29/15	1518	SD			X									
2. REF-2MS		10/29/15	1518	SD			X									
3. REF-2MSD		10/29/15	1518	SD			X									
4. REF-102		10/29/15	1528	SD			X									
5.																
6.																
7.																
8.																
9.																
10.																

Report Requirements

___ I. Routine Report: Method Blank, Surrogate, as required

___ II. Report Dup., MS, MSD as required

___ III. CLP Like Summary (no raw data)

___ IV. Data Validation Report

___ V. EDD

Invoice Information

P.O.# _____

Bill To: _____

Turnaround Requirements

___ 24 hr. ___ 48 hr.

___ 5 Day

X Standard

Requested Report Date

Circle which metals are to be analyzed

Total Metals: Al As Sb Ba Be B Ca Cd Co Cr Cu Fe Pb Mg Mn Mo Ni K Ag Na Se Sr Tl Sn V Zn Hg

Dissolved Metals: Al As Sb Ba Be B Ca Cd Co Cr Cu Fe Pb Mg Mn Mo Ni K Ag Na Se Sr Tl Sn V Zn Hg

Special Instructions/Comments:

*Indicate State Hydrocarbon Procedure: AK CA WI Northwest Other_____(Circle One)

Relinquished By:	Received By:	Relinquished By:	Received By:	Relinquished By:	Received By:
Signature: [signature]	Signature: [signature]	Signature	Signature	Signature	Signature
Printed Name: Morgan Bruno	Printed Name: MS	Printed Name	Printed Name	Printed Name	Printed Name
Firm: CH2M	Firm: 10/31/15 1000	Firm	Firm	Firm	Firm
Date/Time: 10/30/15 1030	Date/Time	Date/Time	Date/Time	Date/Time	Date/Time

*CL - 11/2/2015

ALS

K1512414* PC CL

Cooler Receipt and Preservation Form

Client / Project: CIZM Service Request *K15* ~~12412~~

Received: 10/31/15 Opened: 10/31/15 By: L Unloaded: 10/31/15 By: L

1. Samples were received via? *Mail* *Fed Ex* *UPS* *DHL* *PDX* *Courier* *Hand Delivered*
2. Samples were received in: (circle) *Cooler* *Box* *Envelope* *Other* _____ *NA*
3. Were custody seals on coolers? NA Y N If yes, how many and where? 1F1B

   If present, were custody seals intact? Y N If present, were they signed and dated? Y N

Raw Cooler Temp	Corrected Cooler Temp	Raw Temp Blank	Corrected Temp Blank	Corr. Factor	Thermometer ID	Cooler/COC ID NA	Tracking Number NA	Filed
0.1	0.3	3.9	4.1	0.2	363			✓

4. Packing material: *Inserts* *Baggies* *Bubble Wrap* *Gel Packs* *Wet Ice* *Dry Ice* *Sleeves* _____
5. Were custody papers properly filled out (ink, signed, etc.)? NA Y N
6. Did all bottles arrive in good condition (unbroken)? *Indicate in the table below.* NA Y N
7. Were all sample labels complete (i.e analysis, preservation, etc.)? NA Y N
8. Did all sample labels and tags agree with custody papers? *Indicate major discrepancies in the table on page 2.* NA Y N
9. Were appropriate bottles/containers and volumes received for the tests indicated? NA Y N
10. Were the pH-preserved bottles (*see SMO GEN SOP*) received at the appropriate pH? *Indicate in the table below* NA Y N
11. Were VOA vials received without headspace? *Indicate in the table below.* NA Y N
12. Was C12/Res negative? NA Y N

Sample ID on Bottle	Sample ID on COC	Identified by:

Sample ID	Bottle Count Bottle Type	Out of Temp	Head-space	Broke	pH	Reagent	Volume added	Reagent Lot Number	Initials	Time

Notes, Discrepancies, & Resolutions: _____

*CL - 11/2/15

General Chemistry

ALS Environmental—Kelso Laboratory
1317 South 13th Avenue, Kelso, WA 98626
Phone (360)577-7222 Fax (360)636-1068
www.alsglobal.com

ALS Group USA, Corp.
dba ALS Environmental

Analytical Report

Client:	CH2M Hill	**Service Request:**	K1512414
Project:	AK LNG/653488.16.06	**Date Collected:**	10/29/15
Sample Matrix:	Sediment	**Date Received:**	10/31/15
Analysis Method:	PSEP Sulfide	**Units:**	mg/Kg
Prep Method:	Method	**Basis:**	As Received

Sulfide, Total

Sample Name	Lab Code	Result	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
REF-2	K1512414-001	ND U	1.9	0.6	1	11/05/15 21:52	11/5/15	
REF-102	K1512414-002	ND U	1.9	0.6	1	11/05/15 21:52	11/5/15	
Method Blank	K1512414-MB	**2.8**	1.0	0.3	1	11/05/15 21:52	11/5/15	

ALS Group USA, Corp.
dba ALS Environmental

QA/QC Report

Client:	CH2M Hill	**Service Request:**	K1512414
Project	AK LNG/653488.16.06	**Date Collected:**	10/29/15
Sample Matrix:	Sediment	**Date Received:**	10/31/15
		Date Analyzed:	11/05/15

Triplicate Sample Summary
General Chemistry Parameters

Sample Name:	REF-2	**Units:**	mg/Kg
Lab Code:	K1512414-001	**Basis:**	As Received
Analysis Method:	PSEP Sulfide		
Prep Method:	Method		

Analyte Name	MRL	MDL	Sample Result	Duplicate K1512414-001DUP Result	Triplicate K1512414-001TRP Result	Average	RSD	RSD Limit
Sulfide, Total	2.0	0.6	ND	ND	ND	NC	NC	20

Results flagged with an asterisk (*) indicate values outside control criteria.

Results flagged with a pound (#) indicate the control criteria is not applicable.

Percent recoveries and relative percent differences (RPD) are determined by the software using values in the calculation which have not been rounded.

Printed 11/16/2015 2:05:01 PM

ALS Group USA, Corp.
dba ALS Environmental

QA/QC Report

Client:	CH2M Hill	**Service Request:**	K1512414
Project:	AK LNG/653488.16.06	**Date Collected:**	10/29/15
Sample Matrix:	Sediment	**Date Received:**	10/31/15
		Date Analyzed:	11/5/15
		Date Extracted:	11/5/15

Duplicate Matrix Spike Summary
Sulfide, Total

Sample Name:	REF-2	**Units:**	mg/Kg
Lab Code:	K1512414-001	**Basis:**	As Received
Analysis Method:	PSEP Sulfide		
Prep Method:	Method		

		Matrix Spike K1512414-001MS			**Duplicate Matrix Spike** K1512414-001DMS					
Analyte Name	**Sample Result**	**Result**	**Spike Amount**	**% Rec**	**Result**	**Spike Amount**	**% Rec**	**% Rec Limits**	**RPD**	**RPD Limit**
Sulfide, Total	ND U	590	730	80	600	720	83	28-175	2	20

Results flagged with an asterisk (*) indicate values outside control criteria.

Results flagged with a pound (#) indicate the control criteria is not applicable.

Percent recoveries and relative percent differences (RPD) are determined by the software using values in the calculation which have not been rounded.

ALS Group USA, Corp.
dba ALS Environmental

QA/QC Report

Client:	CH2M Hill	**Service Request:**	K1512414
Project:	AK LNG/653488.16.06	**Date Analyzed:**	11/05/15
Sample Matrix:	Sediment	**Date Extracted:**	11/05/15

Lab Control Sample Summary
Sulfide, Total

Analysis Method:	PSEP Sulfide	**Units:**	mg/Kg
Prep Method:	Method	**Basis:**	As Received
		Analysis Lot:	470785

Sample Name	Lab Code	Result	Spike Amount	% Rec	% Rec Limits
Lab Control Sample	K1512414-LCS	286	370	78	39-166

Client: CH2M Hill **Service Request:** K1512414
Project: AK LNG/653488.16.06

Continuing Calibration Verification (CCV) Summary

Sulfide, Total

Analysis Method: PSEP Sulfide **Units:** mg/L

	Analysis Lot	Lab Code	Date Analyzed	True Value	Measured Value	Percent Recovery	Acceptance Limits
CCV1	470785	KQ1513002-01	11/05/15 21:52	0.548	0.556	101	90-110
CCV2	470785	KQ1513002-02	11/05/15 21:52	0.548	0.543	99	90-110

ALS Group USA, Corp.
dba ALS Environmental

QA/QC Report

Client: CH2M Hill **Service Request:**K1512414
Project: AK LNG/653488.16.06

Continuing Calibration Blank (CCB) Summary
Sulfide, Total

Analysis Method: PSEP Sulfide **Units:**mg/Kg

	Analysis Lot	Lab Code	Date Analyzed	MRL	MDL	Result	Q
CCB1	470785	KQ1513002-03	11/05/15 21:52	1.0	0.3	ND	U
CCB2	470785	KQ1513002-04	11/05/15 21:52	1.0	0.3	ND	U

CH2MHILL
Applied Sciences Laboratory (ASL)

CH2M HILL
Applied Sciences Laboratory (ASL)
1100 NE Circle Blvd, Suite 300
Corvallis, OR 97330
Tel 541.768.3120
Email: asl@ch2m.com

Amended Report

Date:	12/11/2015	Client:	AK LNG
SDG No.:	P3522	Project/Task:	
Revision No.:	1	Completed by:	MQ
Affected Method(s):	Particle Size	Approved by:	KM

Amendment(s) Completed and Reason(s):

Particle Size fraction missing from formal report.

Amendment(s) Justification:

	Reporting error
	Calculation error
X	Missing information/data
	Wrong information/data
	Analytical problem/correction
	Client change/request
	Subcontracted laboratory error
	Other (define)

Edata Required:

	Yes
	No

ch2m

Analytical Report for

Alaska LNG

ASL Report #: P3522
Project ID: 653488.16.06

Attn: Carrie Andrews/PDX

Authorized and Released By:

Kathy McKinley

Laboratory Project Manager
Kathy McKinley
(541) 758-0235 ext.23144
December 11, 2015

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

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

Accredited in accordance with NELAP:
Oregon (100022)
Louisiana (05031)

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

ASL Report #: P3522

Sample Receipt Comments

We certify that the test results meet all NELAP requirements except those listed below:

- CH2M HILL Applied Sciences Laboratory is not accredited by NELAP for the following tests: ASTM D422.

This is a supplemental report for Particle Size by ASTM D422.

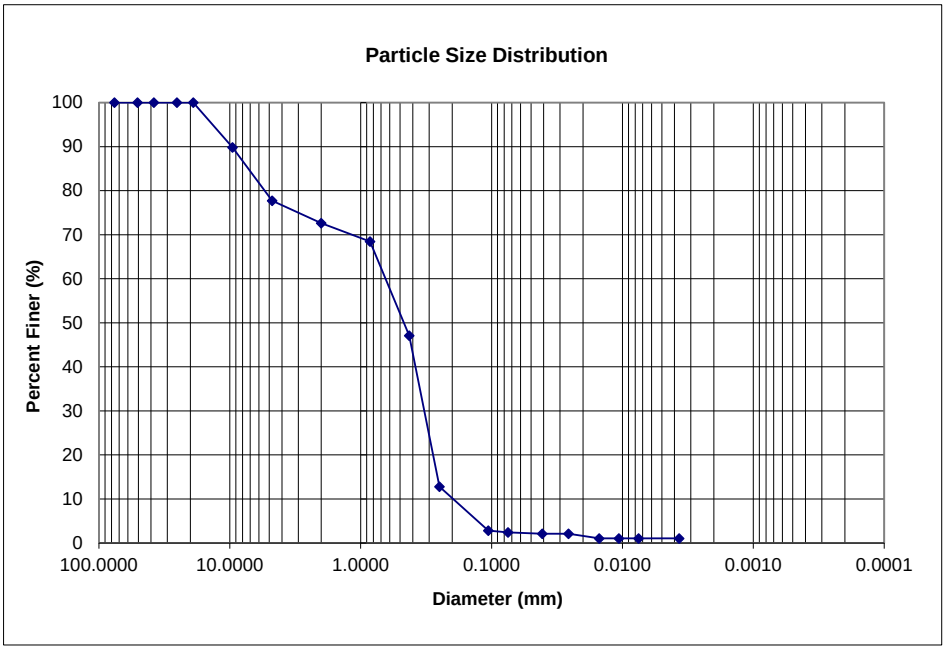
Sample Cross-Reference

ASL Sample ID	Client Sample ID	Date/Time Collected	Date Received
P352201	REF-2	10/29/15 15:18	10/31/15
P352202MS	REF-2MS	10/29/15 15:18	10/31/15
P352203MSD	REF-2MSD	10/29/15 15:18	10/31/15
P352204	REF-102	10/29/15 15:28	10/31/15
P352205	TB102915-01	10/29/15 09:00	10/31/15

PARTICLE SIZE DISTRIBUTION (ASTM D422)

Analyst	SB/JVP
Date	11/5/2015
SDG	P352201
Client ID	REF-2
Sample Mass (g)	479.63

	Sieve	Sieve Size	Weight Retained	Weight Retained	Cumulative Coarser	Cumulative Finer
Sieve Analysis	#	mm	g	%	%	%
	3"	76.20	0.0	0.00	0.00	100.00
	2"	50.80	0.0	0.00	0.00	100.00
	1.5"	38.10	0.0	0.00	0.00	100.00
	1"	25.40	0.0	0.00	0.00	100.00
	3/4"	19.05	0.0	0.00	0.00	100.00
	3/8"	9.525	48.8	10.17	10.17	89.83
	4	4.750	58.0	12.08	22.25	77.75
	10	2.000	24.6	5.13	27.38	72.62
	20	0.850	19.8	4.13	31.52	68.48
	40	0.425	102.6	21.40	52.91	47.09
	60	0.250	164.5	34.30	87.21	12.79
	140	0.106	47.7	9.95	97.16	2.84
	200	0.075	2.0	0.41	97.56	2.44
		Effective Diameter				Cumulative Finer
Hydrometer Analysis		mm				%
		0.041				2.13
		0.026				2.13
		0.015				1.06
		0.011				1.06
		0.008				1.06
		0.004				1.06



Test Pit Dredge Material
Characterization Report
Confidential

USAL-CH-JRZZZ-90-000032-000
Attachment 3
07-Apr-16; Rev 0

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

Chain of Custody Record

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

Alaska LNG

Client Contact

Project Name: AK LNG
Project # or PO #: 653488.16.06
Company Name: CH2M
Address: 2020 SW 4th Ave Ste 300
City/State/Zip: Portland OR 97201
Project Manager: Carrie Andrews
Phone #: 503-736-4270
Report to email: carrie.andrews@ch2m.com

Analysis Turnaround Time

TAT is Calander days
TAT if different from below _____
☒ 21 days (STD)
☐ 14 days * ☐ 3 day *
☐ 7 days * ☐ 2 days *
☐ 5 days * ☐ 1 day *
* (Surcharges will apply)

Preservation Used

6	1	7	1	1	1	1	1	

Analysis Requested

Sample Identification (Limit of 20 characters)	Sample Date	Sample Time	Sample Type (C=Comp, G=Grab)	Matrix (Water, Soil, Air)	Total # of Cont.	AK101	AK102/103	SW8260B - BTEX only	Trace Metals	Hg	TOC	Total Solids	Grain Size		Sample Specific Notes:	Lab ID:
REF-2	10/29/15	1518	C/G	SED	5	X	X	X	X	X	X	X	X			1
REF-2MS	10/29/15	1518	C/G	SED	5	X	X	X	X	X	X	X				2
REF-2MSD	10/29/15	1518	C/G	SED	5	X	X	X	X	X	X	X				3
REF-102	10/29/15	1528	C/G	SED	5	X	X	X	X	X	X	X				4
TB102915-01	10/29/15	0900	G	W	2	X		X								5

For Lab Use Only:

SDG: D3522
Custody Seals intact? ☒ Yes ☐ No
Hand delivered? ☐ Yes ☒ No
Cooler Temp: 5.4 °C
Therm ID No.: 173 Therm Exp. 1/27/16
Packing Material: Circle Below
Ice Blue Ice Box Bubble Wrap
Radiological Screen? ☐ Yes ☒ No

Preservation Used: 1= Ice, 2= HCl; 3= H2SO4; 4=HNO3; 5=NaOH; 6= Other MeOH 7: Freeze

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

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

Sampled By: [signature] Morgan Bruno Date/Time: 10/29/15 1518
Relinquished by: [signature] Morgan Bruno Date/Time: 10/30/15 1030
Received by: [signature] Kathy McKenly Date/Time: 10/31/15 1030
Relinquished by: Date/Time:
Received in Laboratory by: [signature] Castro Date/Time: 10/31/15 11:45
Shipped Via: ☐ UPS ☐ Fed-Ex ☐ USPS ☒ Other Tracking #:

Special Instructions/QC Requirements: Trace Metals / Hg by SW6010B / SW7470A / SW7471A
AK101 & BTEX are grabs - all other analytes are composites

Alaska LNG

CH2MHILL
Applied Sciences Laboratory (ASL)

Sample Receipt Record

SDG ID: P3522 | Date Received: 10/31/15

Client/Project: Alaska LNG | Received By: PC

Were custody seals intact and on the outside of the cooler?		☑ Yes	☐ No	☐ N/A
Shipping Record:	☐ Hand Delivered	☐ On File	☐ COC	
Radiological Screening for DoD		☐ Yes	☐ No	☑ N/A
Packing Material:	☐ Hand Delivered	☑ Ice	☐ Blue Ice	☐ Box
Temp OK? (<6C) Therm ID: TH173 Exp. 1/16	5.4 °C	☑ Yes	☐ No	☐ N/A
Was a Chain of Custody (CoC) Provided?		☑ Yes	☐ No	☐ N/A
Was the CoC correctly filled out (If No, document below)		☑ Yes	☐ No	☐ N/A
Did sample labels agree with COC? (If No, document below)		☑ Yes	☐ No	☐ N/A
Did the CoC list a correct bottle count and the preservative types (No=Correct on CoC)		☑ Yes	☐ No	☐ N/A
Were the sample containers in good condition (broken or leaking)?		☑ Yes	☑ No	☐ N/A
Was enough sample volume provided for analysis? (If No, document below)		☑ Yes	☐ No	☐ N/A
Containers supplied by ASL?		☑ Yes	☐ No	☐ N/A
Any sample with < 1/2 holding time remaining? If so contact LPM		☐ Yes	☑ No	☐ N/A
Samples have multi-phase? If yes, document on SRER		☐ Yes	☑ No	☐ N/A
All water VOCs free of air bubbles? No, document on SRER		☑ Yes	☐ No	☐ N/A
pH of all samples met criteria on receipt? If "No", preserve and document below.		☐ Yes	☐ No	☑ N/A
Dissolved/Soluble metals filtered in the field?		☐ Yes	☐ No	☑ N/A
Dissolved/Soluble metals have sediment in bottom of container? If so document below.		☐ Yes	☐ No	☑ N/A

Preservation Adjustment

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

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

Sample Exception Report (The following exceptions were noted)

1. P352202 AK102/103 (Client ID: REF-2MS) arrived with cracked lid - taped to prevent further damage.
2. AVS-SEM was added to sample P3522-1 (REF-2) per Carrie Andrews/PDX on 10/31/15

Client was notified on: Client contact:

Resolution to Exception:

Analytical Report for

Alaska LNG

ASL Report #: P3549
Project ID: 653488.16.06

Attn: Carrie Andrews/PDX

Authorized and Released By:

Kathy McKinley

Laboratory Project Manager
Kathy McKinley
(541) 758-0235 ext.23144
November 20, 2015

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

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

Accredited in accordance with NELAP:
Oregon (100022)
Louisiana (05031)

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

ASL Report #: P3549

Sample Receipt Comments

We certify that the test results meet all NELAP requirements except those listed below:

- CH2M HILL Applied Sciences Laboratory is not accredited by NELAP for the following tests: ASTM D2216, ASTM D422, ASTM D854B, ASTM D4318, ASTM 2487, API RP40, ASTM D7263, Lloyd Kahn/EPA9060M.

Sample Cross-Reference

ASL Sample ID	Client Sample ID	Date/Time Collected	Date Received
P354901	D4ADS01-001.48-01	11/02/15 21:00	11/04/15
P354902	D4BGC07-14.4416.57-01	11/03/15 10:00	11/04/15
P354903	D4BGC06-11.8113.54-01	11/03/15 11:00	11/04/15
P354904	TRVL BLK	11/03/15 08:00	11/04/15

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

CASE NARRATIVE
GC/MS VOLATILES ANALYSIS

Lab Name: CH2M HILL ASL **ASL SDG#:** P3549

Project: Alaska LNG **Project #:** 653488.16.06

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

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

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

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

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

Method(s):
SW8260B: SW5030, SW5035

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Client Sample ID: **D4ADS01-001.48-01**

Project Name: Alaska LNG
Sample Date: 11/02/15
Sample Time: 21:00
Type: Grab
Matrix: Soil
Basis: Dry Weight

Lab Information

Lab Sample ID: **P354901**

Date Received: 11/04/15
Dilution Factor: 1
Report Revision No.: 0

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Volatiles								
Dichlorodifluoromethane	75-71-8	0.27	1.08	0.27	U	ug/Kg	SW8260B	11/09/15
Chloromethane	74-87-3	0.27	1.08	0.27	U	ug/Kg	SW8260B	11/09/15
Vinyl Chloride	75-01-4	0.27	1.08	0.27	U	ug/Kg	SW8260B	11/09/15
Bromomethane	74-83-9	0.27	1.08	0.27	U	ug/Kg	SW8260B	11/09/15
Chloroethane	75-00-3	0.27	1.08	0.27	U	ug/Kg	SW8260B	11/09/15
Trichlorofluoromethane	75-69-4	0.27	1.08	0.27	U	ug/Kg	SW8260B	11/09/15
Acetone	67-64-1	1.08	5.38	1.08	U	ug/Kg	SW8260B	11/09/15
1,1-Dichloroethene	75-35-4	0.27	1.08	0.27	U	ug/Kg	SW8260B	11/09/15
Methylene chloride	75-09-2	0.27	1.08	0.27	U	ug/Kg	SW8260B	11/09/15
trans-1,2-Dichloroethene	156-60-5	0.27	1.08	0.27	U	ug/Kg	SW8260B	11/09/15
Methyl tert-butyl ether (MTBE)	1634-04-4	0.27	1.08	0.27	U	ug/Kg	SW8260B	11/09/15
1,1-Dichloroethane	75-34-3	0.27	1.08	0.27	U	ug/Kg	SW8260B	11/09/15
2-Butanone (MEK)	78-93-3	2.15	5.38	2.15	U	ug/Kg	SW8260B	11/09/15
cis-1,2-Dichloroethene	156-59-2	0.27	1.08	0.27	U	ug/Kg	SW8260B	11/09/15
Bromochloromethane	74-97-5	0.27	1.08	0.27	U	ug/Kg	SW8260B	11/09/15
Chloroform	67-66-3	0.27	1.08	0.27	U	ug/Kg	SW8260B	11/09/15
2,2-Dichloropropane	594-20-7	0.27	1.08	0.27	U	ug/Kg	SW8260B	11/09/15
1,2-Dichloroethane	107-06-2	0.27	1.08	0.27	U	ug/Kg	SW8260B	11/09/15
1,1,1-Trichloroethane	71-55-6	0.27	1.08	0.27	U	ug/Kg	SW8260B	11/09/15
1,1-Dichloropropene	563-58-6	0.27	1.08	0.27	U	ug/Kg	SW8260B	11/09/15
Carbon tetrachloride	56-23-5	0.27	1.08	0.27	U	ug/Kg	SW8260B	11/09/15
Benzene	71-43-2	0.27	1.08	0.27	U	ug/Kg	SW8260B	11/09/15
Dibromomethane	74-95-3	0.27	1.08	0.27	U	ug/Kg	SW8260B	11/09/15
1,2-Dichloropropane	78-87-5	0.27	1.08	0.27	U	ug/Kg	SW8260B	11/09/15
Trichloroethene (TCE)	79-01-6	0.27	1.08	0.27	U	ug/Kg	SW8260B	11/09/15
Bromodichloromethane	75-27-4	0.27	1.08	0.27	U	ug/Kg	SW8260B	11/09/15
cis-1,3-Dichloropropene	10061-01-5	0.27	1.08	0.27	U	ug/Kg	SW8260B	11/09/15
4-Methyl-2-pentanone (MIBK)	108-10-1	1.08	5.38	1.08	U	ug/Kg	SW8260B	11/09/15
trans-1,3-Dichloropropene	10061-02-6	0.27	1.08	0.27	U	ug/Kg	SW8260B	11/09/15
1,1,2-Trichloroethane	79-00-5	0.27	1.08	0.27	U	ug/Kg	SW8260B	11/09/15
Toluene	108-88-3	0.27	1.08	0.27	U	ug/Kg	SW8260B	11/09/15
1,3-Dichloropropane	142-28-9	0.27	1.08	0.27	U	ug/Kg	SW8260B	11/09/15
Dibromochloromethane	124-48-1	0.27	1.08	0.27	U	ug/Kg	SW8260B	11/09/15
1,2-Dibromoethane (EDB)	106-93-4	0.27	1.08	0.27	U	ug/Kg	SW8260B	11/09/15
Tetrachloroethene (PCE)	127-18-4	0.27	1.08	0.27	U	ug/Kg	SW8260B	11/09/15
1-Chlorohexane	544-10-5	0.27	1.08	0.27	U	ug/Kg	SW8260B	11/09/15
1,1,1,2-Tetrachloroethane	630-20-6	0.27	1.08	0.27	U	ug/Kg	SW8260B	11/09/15
Chlorobenzene	108-90-7	0.27	1.08	0.27	U	ug/Kg	SW8260B	11/09/15
Ethylbenzene	100-41-4	0.27	1.08	0.27	U	ug/Kg	SW8260B	11/09/15
m,p-Xylene	108-38-3/1	0.54	2.15	0.54	U	ug/Kg	SW8260B	11/09/15
Bromoform	75-25-2	0.27	1.08	0.27	U	ug/Kg	SW8260B	11/09/15
Styrene	100-42-5	0.27	1.08	0.27	U	ug/Kg	SW8260B	11/09/15

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Client Sample ID: **D4ADS01-001.48-01**

Project Name: Alaska LNG
Sample Date: 11/02/15
Sample Time: 21:00
Type: Grab
Matrix: Soil
Basis: Dry Weight

Lab Information

Lab Sample ID: **P354901**

Date Received: 11/04/15
Dilution Factor: 1
Report Revision No.: 0

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Volatiles								
1,1,2,2-Tetrachloroethane	79-34-5	0.27	1.08	0.27	U	ug/Kg	SW8260B	11/09/15
o-Xylene	95-47-6	0.27	1.08	0.27	U	ug/Kg	SW8260B	11/09/15
1,2,3-Trichloropropane	96-18-4	0.27	1.08	0.27	U	ug/Kg	SW8260B	11/09/15
Isopropylbenzene	98-82-8	0.27	1.08	0.27	U	ug/Kg	SW8260B	11/09/15
Bromobenzene	108-86-1	0.27	1.08	0.27	U	ug/Kg	SW8260B	11/09/15
n-Propylbenzene	103-65-1	0.27	1.08	0.27	U	ug/Kg	SW8260B	11/09/15
2-Chlorotoluene	95-49-8	0.27	1.08	0.27	U	ug/Kg	SW8260B	11/09/15
4-Chlorotoluene	106-43-4	0.27	1.08	0.27	U	ug/Kg	SW8260B	11/09/15
1,3,5-Trimethylbenzene	108-67-8	0.27	1.08	0.27	U	ug/Kg	SW8260B	11/09/15
tert-Butylbenzene	98-06-6	0.27	1.08	0.27	U	ug/Kg	SW8260B	11/09/15
1,2,4-Trimethylbenzene	95-63-6	0.27	1.08	0.43	J	ug/Kg	SW8260B	11/09/15
sec-Butylbenzene	135-98-8	0.27	1.08	0.27	U	ug/Kg	SW8260B	11/09/15
1,3-Dichlorobenzene	541-73-1	0.27	1.08	0.27	U	ug/Kg	SW8260B	11/09/15
1,4-Dichlorobenzene	106-46-7	0.27	1.08	0.27	U	ug/Kg	SW8260B	11/09/15
p-Isopropyltoluene	99-87-6	0.27	1.08	0.27	U	ug/Kg	SW8260B	11/09/15
1,2-Dichlorobenzene	95-50-1	0.27	1.08	0.27	U	ug/Kg	SW8260B	11/09/15
n-Butylbenzene	104-51-8	0.27	1.08	0.27	U	ug/Kg	SW8260B	11/09/15
1,2-Dibromo-3-chloropropane	96-12-8	0.27	1.08	0.27	U	ug/Kg	SW8260B	11/09/15
1,2,4-Trichlorobenzene	120-82-1	0.27	1.08	0.27	U	ug/Kg	SW8260B	11/09/15
Naphthalene	91-20-3	0.27	1.08	0.27	U	ug/Kg	SW8260B	11/09/15
Hexachlorobutadiene	87-68-3	0.27	1.08	0.27	U	ug/Kg	SW8260B	11/09/15
1,2,3-Trichlorobenzene	87-61-6	0.27	1.08	0.27	U	ug/Kg	SW8260B	11/09/15

Surrogate	% Recovery	Control Limits	Qualifier
Dibromofluoromethane	98	70-130	
1,2-Dichloroethane-d4	100	70-130	
Toluene-d8	95	70-130	
4-Bromofluorobenzene	88	70-130	

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Client Sample ID: **D4BGC07-14.4416.57-01**

Project Name: Alaska LNG
Sample Date: 11/03/15
Sample Time: 10:00
Type: Grab
Matrix: Soil
Basis: Dry Weight

Lab Information

Lab Sample ID: **P354902**

Date Received: 11/04/15
Dilution Factor: 1
Report Revision No.: 0

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Volatiles								
Dichlorodifluoromethane	75-71-8	0.32	1.29	0.32	U	ug/Kg	SW8260B	11/09/15
Chloromethane	74-87-3	0.32	1.29	0.32	U	ug/Kg	SW8260B	11/09/15
Vinyl Chloride	75-01-4	0.32	1.29	0.32	U	ug/Kg	SW8260B	11/09/15
Bromomethane	74-83-9	0.32	1.29	0.32	U	ug/Kg	SW8260B	11/09/15
Chloroethane	75-00-3	0.32	1.29	0.32	U	ug/Kg	SW8260B	11/09/15
Trichlorofluoromethane	75-69-4	0.32	1.29	0.32	U	ug/Kg	SW8260B	11/09/15
Acetone	67-64-1	1.29	6.45	4.72	J	ug/Kg	SW8260B	11/09/15
1,1-Dichloroethene	75-35-4	0.32	1.29	0.32	U	ug/Kg	SW8260B	11/09/15
Methylene chloride	75-09-2	0.32	1.29	0.32	U	ug/Kg	SW8260B	11/09/15
trans-1,2-Dichloroethene	156-60-5	0.32	1.29	0.32	U	ug/Kg	SW8260B	11/09/15
Methyl tert-butyl ether (MTBE)	1634-04-4	0.32	1.29	0.32	U	ug/Kg	SW8260B	11/09/15
1,1-Dichloroethane	75-34-3	0.32	1.29	0.32	U	ug/Kg	SW8260B	11/09/15
2-Butanone (MEK)	78-93-3	2.58	6.45	2.58	U	ug/Kg	SW8260B	11/09/15
cis-1,2-Dichloroethene	156-59-2	0.32	1.29	0.32	U	ug/Kg	SW8260B	11/09/15
Bromochloromethane	74-97-5	0.32	1.29	0.32	U	ug/Kg	SW8260B	11/09/15
Chloroform	67-66-3	0.32	1.29	0.32	U	ug/Kg	SW8260B	11/09/15
2,2-Dichloropropane	594-20-7	0.32	1.29	0.32	U	ug/Kg	SW8260B	11/09/15
1,2-Dichloroethane	107-06-2	0.32	1.29	0.32	U	ug/Kg	SW8260B	11/09/15
1,1,1-Trichloroethane	71-55-6	0.32	1.29	0.32	U	ug/Kg	SW8260B	11/09/15
1,1-Dichloropropene	563-58-6	0.32	1.29	0.32	U	ug/Kg	SW8260B	11/09/15
Carbon tetrachloride	56-23-5	0.32	1.29	0.32	U	ug/Kg	SW8260B	11/09/15
Benzene	71-43-2	0.32	1.29	0.32	U	ug/Kg	SW8260B	11/09/15
Dibromomethane	74-95-3	0.32	1.29	0.32	U	ug/Kg	SW8260B	11/09/15
1,2-Dichloropropane	78-87-5	0.32	1.29	0.32	U	ug/Kg	SW8260B	11/09/15
Trichloroethene (TCE)	79-01-6	0.32	1.29	0.32	U	ug/Kg	SW8260B	11/09/15
Bromodichloromethane	75-27-4	0.32	1.29	0.32	U	ug/Kg	SW8260B	11/09/15
cis-1,3-Dichloropropene	10061-01-5	0.32	1.29	0.32	U	ug/Kg	SW8260B	11/09/15
4-Methyl-2-pentanone (MIBK)	108-10-1	1.29	6.45	1.29	U	ug/Kg	SW8260B	11/09/15
trans-1,3-Dichloropropene	10061-02-6	0.32	1.29	0.32	U	ug/Kg	SW8260B	11/09/15
1,1,2-Trichloroethane	79-00-5	0.32	1.29	0.32	U	ug/Kg	SW8260B	11/09/15
Toluene	108-88-3	0.32	1.29	0.32	U	ug/Kg	SW8260B	11/09/15
1,3-Dichloropropane	142-28-9	0.32	1.29	0.32	U	ug/Kg	SW8260B	11/09/15
Dibromochloromethane	124-48-1	0.32	1.29	0.32	U	ug/Kg	SW8260B	11/09/15
1,2-Dibromoethane (EDB)	106-93-4	0.32	1.29	0.32	U	ug/Kg	SW8260B	11/09/15
Tetrachloroethene (PCE)	127-18-4	0.32	1.29	0.32	U	ug/Kg	SW8260B	11/09/15
1-Chlorohexane	544-10-5	0.32	1.29	0.32	U	ug/Kg	SW8260B	11/09/15
1,1,1,2-Tetrachloroethane	630-20-6	0.32	1.29	0.32	U	ug/Kg	SW8260B	11/09/15
Chlorobenzene	108-90-7	0.32	1.29	0.32	U	ug/Kg	SW8260B	11/09/15
Ethylbenzene	100-41-4	0.32	1.29	0.32	U	ug/Kg	SW8260B	11/09/15
m,p-Xylene	108-38-3/1	0.64	2.58	0.64	U	ug/Kg	SW8260B	11/09/15
Bromoform	75-25-2	0.32	1.29	0.32	U	ug/Kg	SW8260B	11/09/15
Styrene	100-42-5	0.32	1.29	0.32	U	ug/Kg	SW8260B	11/09/15

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Client Sample ID: **D4BGC07-14.4416.57-01**

Project Name: Alaska LNG
Sample Date: 11/03/15
Sample Time: 10:00
Type: Grab
Matrix: Soil
Basis: Dry Weight

Lab Information

Lab Sample ID: **P354902**

Date Received: 11/04/15
Dilution Factor: 1
Report Revision No.: 0

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Volatiles								
1,1,2,2-Tetrachloroethane	79-34-5	0.32	1.29	0.32	U	ug/Kg	SW8260B	11/09/15
o-Xylene	95-47-6	0.32	1.29	0.32	U	ug/Kg	SW8260B	11/09/15
1,2,3-Trichloropropane	96-18-4	0.32	1.29	0.32	U	ug/Kg	SW8260B	11/09/15
Isopropylbenzene	98-82-8	0.32	1.29	0.32	U	ug/Kg	SW8260B	11/09/15
Bromobenzene	108-86-1	0.32	1.29	0.32	U	ug/Kg	SW8260B	11/09/15
n-Propylbenzene	103-65-1	0.32	1.29	0.32	U	ug/Kg	SW8260B	11/09/15
2-Chlorotoluene	95-49-8	0.32	1.29	0.32	U	ug/Kg	SW8260B	11/09/15
4-Chlorotoluene	106-43-4	0.32	1.29	0.32	U	ug/Kg	SW8260B	11/09/15
1,3,5-Trimethylbenzene	108-67-8	0.32	1.29	0.32	U	ug/Kg	SW8260B	11/09/15
tert-Butylbenzene	98-06-6	0.32	1.29	0.32	U	ug/Kg	SW8260B	11/09/15
1,2,4-Trimethylbenzene	95-63-6	0.32	1.29	0.32	U	ug/Kg	SW8260B	11/09/15
sec-Butylbenzene	135-98-8	0.32	1.29	0.32	U	ug/Kg	SW8260B	11/09/15
1,3-Dichlorobenzene	541-73-1	0.32	1.29	0.32	U	ug/Kg	SW8260B	11/09/15
1,4-Dichlorobenzene	106-46-7	0.32	1.29	0.32	U	ug/Kg	SW8260B	11/09/15
p-Isopropyltoluene	99-87-6	0.32	1.29	0.32	U	ug/Kg	SW8260B	11/09/15
1,2-Dichlorobenzene	95-50-1	0.32	1.29	0.32	U	ug/Kg	SW8260B	11/09/15
n-Butylbenzene	104-51-8	0.32	1.29	0.32	U	ug/Kg	SW8260B	11/09/15
1,2-Dibromo-3-chloropropane	96-12-8	0.32	1.29	0.32	U	ug/Kg	SW8260B	11/09/15
1,2,4-Trichlorobenzene	120-82-1	0.32	1.29	0.32	U	ug/Kg	SW8260B	11/09/15
Naphthalene	91-20-3	0.32	1.29	0.32	U	ug/Kg	SW8260B	11/09/15
Hexachlorobutadiene	87-68-3	0.32	1.29	0.32	U	ug/Kg	SW8260B	11/09/15
1,2,3-Trichlorobenzene	87-61-6	0.32	1.29	0.32	U	ug/Kg	SW8260B	11/09/15

Surrogate	% Recovery	Control Limits	Qualifier
Dibromofluoromethane	102	70-130	
1,2-Dichloroethane-d4	106	70-130	
Toluene-d8	95	70-130	
4-Bromofluorobenzene	82	70-130	

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Client Sample ID: **TRVL BLK**

Project Name: Alaska LNG
Sample Date: 11/03/15
Sample Time: 08:00
Type: Grab
Matrix: Water

Lab Information

Lab Sample ID: **P354904**

Date Received: 11/04/15
Dilution Factor: 1
Report Revision No.: 0

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Volatiles								
Dichlorodifluoromethane	75-71-8	0.15	0.50	0.15	U	ug/L	SW8260B	11/06/15
Chloromethane	74-87-3	0.15	0.50	0.15	U	ug/L	SW8260B	11/06/15
Vinyl Chloride	75-01-4	0.15	0.50	0.15	U	ug/L	SW8260B	11/06/15
Bromomethane	74-83-9	0.20	0.50	0.20	U	ug/L	SW8260B	11/06/15
Chloroethane	75-00-3	0.15	0.50	0.15	U	ug/L	SW8260B	11/06/15
Trichlorofluoromethane	75-69-4	0.15	0.50	0.15	U	ug/L	SW8260B	11/06/15
Acetone	67-64-1	1.00	5.00	1.00	U	ug/L	SW8260B	11/06/15
1,1-Dichloroethene	75-35-4	0.15	0.50	0.15	U	ug/L	SW8260B	11/06/15
Methylene chloride	75-09-2	0.15	0.50	0.15	U	ug/L	SW8260B	11/06/15
trans-1,2-Dichloroethene	156-60-5	0.15	0.50	0.15	U	ug/L	SW8260B	11/06/15
Methyl tert-butyl ether (MTBE)	1634-04-4	0.15	0.50	0.15	U	ug/L	SW8260B	11/06/15
1,1-Dichloroethane	75-34-3	0.15	0.50	0.15	U	ug/L	SW8260B	11/06/15
2-Butanone (MEK)	78-93-3	2.00	5.00	2.00	U	ug/L	SW8260B	11/06/15
cis-1,2-Dichloroethene	156-59-2	0.15	0.50	0.15	U	ug/L	SW8260B	11/06/15
Bromochloromethane	74-97-5	0.15	0.50	0.15	U	ug/L	SW8260B	11/06/15
Chloroform	67-66-3	0.15	0.50	0.15	U	ug/L	SW8260B	11/06/15
2,2-Dichloropropane	594-20-7	0.15	0.50	0.15	U	ug/L	SW8260B	11/06/15
1,2-Dichloroethane	107-06-2	0.15	0.50	0.15	U	ug/L	SW8260B	11/06/15
1,1,1-Trichloroethane	71-55-6	0.15	0.50	0.15	U	ug/L	SW8260B	11/06/15
1,1-Dichloropropene	563-58-6	0.15	0.50	0.15	U	ug/L	SW8260B	11/06/15
Carbon tetrachloride	56-23-5	0.15	0.50	0.15	U	ug/L	SW8260B	11/06/15
Benzene	71-43-2	0.15	0.50	0.15	U	ug/L	SW8260B	11/06/15
Dibromomethane	74-95-3	0.15	0.50	0.15	U	ug/L	SW8260B	11/06/15
1,2-Dichloropropane	78-87-5	0.15	0.50	0.15	U	ug/L	SW8260B	11/06/15
Trichloroethene (TCE)	79-01-6	0.15	0.50	0.15	U	ug/L	SW8260B	11/06/15
Bromodichloromethane	75-27-4	0.15	0.50	0.15	U	ug/L	SW8260B	11/06/15
cis-1,3-Dichloropropene	10061-01-5	0.15	0.50	0.15	U	ug/L	SW8260B	11/06/15
4-Methyl-2-pentanone (MIBK)	108-10-1	0.50	2.00	0.50	U	ug/L	SW8260B	11/06/15
trans-1,3-Dichloropropene	10061-02-6	0.15	0.50	0.15	U	ug/L	SW8260B	11/06/15
1,1,2-Trichloroethane	79-00-5	0.15	0.50	0.15	U	ug/L	SW8260B	11/06/15
Toluene	108-88-3	0.15	0.50	0.15	U	ug/L	SW8260B	11/06/15
1,3-Dichloropropane	142-28-9	0.15	0.50	0.15	U	ug/L	SW8260B	11/06/15
Dibromochloromethane	124-48-1	0.15	0.50	0.15	U	ug/L	SW8260B	11/06/15
1,2-Dibromoethane (EDB)	106-93-4	0.15	0.50	0.15	U	ug/L	SW8260B	11/06/15
Tetrachloroethene (PCE)	127-18-4	0.15	0.50	0.15	U	ug/L	SW8260B	11/06/15
1-Chlorohexane	544-10-5	0.15	0.50	0.15	U	ug/L	SW8260B	11/06/15
1,1,1,2-Tetrachloroethane	630-20-6	0.15	0.50	0.15	U	ug/L	SW8260B	11/06/15
Chlorobenzene	108-90-7	0.15	0.50	0.15	U	ug/L	SW8260B	11/06/15
Ethylbenzene	100-41-4	0.15	0.50	0.15	U	ug/L	SW8260B	11/06/15
m,p-Xylene	108-38-3/1	0.30	1.00	0.30	U	ug/L	SW8260B	11/06/15
Bromoform	75-25-2	0.15	0.50	0.15	U	ug/L	SW8260B	11/06/15
Styrene	100-42-5	0.15	0.50	0.15	U	ug/L	SW8260B	11/06/15

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information		Lab Information	
Client Sample ID:	**TRVL BLK**	**Lab Sample ID:**	**P354904**
Project Name:	Alaska LNG	Date Received:	11/04/15
Sample Date:	11/03/15	Dilution Factor:	1
Sample Time:	08:00	Report Revision No.:	0
Type:	Grab		
Matrix:	Water		

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Volatiles								
1,1,2,2-Tetrachloroethane	79-34-5	0.15	0.50	0.15	U	ug/L	SW8260B	11/06/15
o-Xylene	95-47-6	0.15	0.50	0.15	U	ug/L	SW8260B	11/06/15
1,2,3-Trichloropropane	96-18-4	0.15	0.50	0.15	U	ug/L	SW8260B	11/06/15
Isopropylbenzene	98-82-8	0.15	0.50	0.15	U	ug/L	SW8260B	11/06/15
Bromobenzene	108-86-1	0.15	0.50	0.15	U	ug/L	SW8260B	11/06/15
n-Propylbenzene	103-65-1	0.15	0.50	0.15	U	ug/L	SW8260B	11/06/15
2-Chlorotoluene	95-49-8	0.15	0.50	0.15	U	ug/L	SW8260B	11/06/15
4-Chlorotoluene	106-43-4	0.15	0.50	0.15	U	ug/L	SW8260B	11/06/15
1,3,5-Trimethylbenzene	108-67-8	0.15	0.50	0.15	U	ug/L	SW8260B	11/06/15
tert-Butylbenzene	98-06-6	0.15	0.50	0.15	U	ug/L	SW8260B	11/06/15
1,2,4-Trimethylbenzene	95-63-6	0.15	0.50	0.15	U	ug/L	SW8260B	11/06/15
sec-Butylbenzene	135-98-8	0.15	0.50	0.15	U	ug/L	SW8260B	11/06/15
1,3-Dichlorobenzene	541-73-1	0.15	0.50	0.15	U	ug/L	SW8260B	11/06/15
1,4-Dichlorobenzene	106-46-7	0.15	0.50	0.15	U	ug/L	SW8260B	11/06/15
p-Isopropyltoluene	99-87-6	0.15	0.50	0.15	U	ug/L	SW8260B	11/06/15
1,2-Dichlorobenzene	95-50-1	0.15	0.50	0.15	U	ug/L	SW8260B	11/06/15
n-Butylbenzene	104-51-8	0.15	0.50	0.15	U	ug/L	SW8260B	11/06/15
1,2-Dibromo-3-chloropropane	96-12-8	0.15	0.50	0.15	U	ug/L	SW8260B	11/06/15
1,2,4-Trichlorobenzene	120-82-1	0.15	0.50	0.15	U	ug/L	SW8260B	11/06/15
Naphthalene	91-20-3	0.15	0.50	0.15	U	ug/L	SW8260B	11/06/15
Hexachlorobutadiene	87-68-3	0.15	0.50	0.15	U	ug/L	SW8260B	11/06/15
1,2,3-Trichlorobenzene	87-61-6	0.15	0.50	0.15	U	ug/L	SW8260B	11/06/15

Surrogate	% Recovery	Control Limits	Qualifier
Dibromofluoromethane	102	70-130	
1,2-Dichloroethane-d4	106	70-130	
Toluene-d8	94	70-130	
4-Bromofluorobenzene	90	70-130	

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Client Sample ID: **SB1-1109**

Project Name: Alaska LNG
Sample Date: N/A
Sample Time: N/A
Type: QC
Matrix: Soil
Basis: Dry Weight

Lab Information

Lab Sample ID: **SB1-1109**

Date Received: N/A
Dilution Factor: 1
Report Revision No.: 0

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Volatiles								
Dichlorodifluoromethane	75-71-8	0.25	1.00	0.25	U	ug/Kg	SW8260B	11/09/15
Chloromethane	74-87-3	0.25	1.00	0.25	U	ug/Kg	SW8260B	11/09/15
Vinyl Chloride	75-01-4	0.25	1.00	0.25	U	ug/Kg	SW8260B	11/09/15
Bromomethane	74-83-9	0.25	1.00	0.25	U	ug/Kg	SW8260B	11/09/15
Chloroethane	75-00-3	0.25	1.00	0.25	U	ug/Kg	SW8260B	11/09/15
Trichlorofluoromethane	75-69-4	0.25	1.00	0.25	U	ug/Kg	SW8260B	11/09/15
Acetone	67-64-1	1.00	5.00	1.00	U	ug/Kg	SW8260B	11/09/15
1,1-Dichloroethene	75-35-4	0.25	1.00	0.25	U	ug/Kg	SW8260B	11/09/15
Methylene chloride	75-09-2	0.25	1.00	0.25	U	ug/Kg	SW8260B	11/09/15
trans-1,2-Dichloroethene	156-60-5	0.25	1.00	0.25	U	ug/Kg	SW8260B	11/09/15
Methyl tert-butyl ether (MTBE)	1634-04-4	0.25	1.00	0.25	U	ug/Kg	SW8260B	11/09/15
1,1-Dichloroethane	75-34-3	0.25	1.00	0.25	U	ug/Kg	SW8260B	11/09/15
2-Butanone (MEK)	78-93-3	2.00	5.00	2.00	U	ug/Kg	SW8260B	11/09/15
cis-1,2-Dichloroethene	156-59-2	0.25	1.00	0.25	U	ug/Kg	SW8260B	11/09/15
Bromochloromethane	74-97-5	0.25	1.00	0.25	U	ug/Kg	SW8260B	11/09/15
Chloroform	67-66-3	0.25	1.00	0.25	U	ug/Kg	SW8260B	11/09/15
2,2-Dichloropropane	594-20-7	0.25	1.00	0.25	U	ug/Kg	SW8260B	11/09/15
1,2-Dichloroethane	107-06-2	0.25	1.00	0.25	U	ug/Kg	SW8260B	11/09/15
1,1,1-Trichloroethane	71-55-6	0.25	1.00	0.25	U	ug/Kg	SW8260B	11/09/15
1,1-Dichloropropene	563-58-6	0.25	1.00	0.25	U	ug/Kg	SW8260B	11/09/15
Carbon tetrachloride	56-23-5	0.25	1.00	0.25	U	ug/Kg	SW8260B	11/09/15
Benzene	71-43-2	0.25	1.00	0.25	U	ug/Kg	SW8260B	11/09/15
Dibromomethane	74-95-3	0.25	1.00	0.25	U	ug/Kg	SW8260B	11/09/15
1,2-Dichloropropane	78-87-5	0.25	1.00	0.25	U	ug/Kg	SW8260B	11/09/15
Trichloroethene (TCE)	79-01-6	0.25	1.00	0.25	U	ug/Kg	SW8260B	11/09/15
Bromodichloromethane	75-27-4	0.25	1.00	0.25	U	ug/Kg	SW8260B	11/09/15
cis-1,3-Dichloropropene	10061-01-5	0.25	1.00	0.25	U	ug/Kg	SW8260B	11/09/15
4-Methyl-2-pentanone (MIBK)	108-10-1	1.00	5.00	1.00	U	ug/Kg	SW8260B	11/09/15
trans-1,3-Dichloropropene	10061-02-6	0.25	1.00	0.25	U	ug/Kg	SW8260B	11/09/15
1,1,2-Trichloroethane	79-00-5	0.25	1.00	0.25	U	ug/Kg	SW8260B	11/09/15
Toluene	108-88-3	0.25	1.00	0.25	U	ug/Kg	SW8260B	11/09/15
1,3-Dichloropropane	142-28-9	0.25	1.00	0.25	U	ug/Kg	SW8260B	11/09/15
Dibromochloromethane	124-48-1	0.25	1.00	0.25	U	ug/Kg	SW8260B	11/09/15
1,2-Dibromoethane (EDB)	106-93-4	0.25	1.00	0.25	U	ug/Kg	SW8260B	11/09/15
Tetrachloroethene (PCE)	127-18-4	0.25	1.00	0.25	U	ug/Kg	SW8260B	11/09/15
1-Chlorohexane	544-10-5	0.25	1.00	0.25	U	ug/Kg	SW8260B	11/09/15
1,1,1,2-Tetrachloroethane	630-20-6	0.25	1.00	0.25	U	ug/Kg	SW8260B	11/09/15
Chlorobenzene	108-90-7	0.25	1.00	0.25	U	ug/Kg	SW8260B	11/09/15
Ethylbenzene	100-41-4	0.25	1.00	0.25	U	ug/Kg	SW8260B	11/09/15
m,p-Xylene	108-38-3/1	0.50	2.00	0.50	U	ug/Kg	SW8260B	11/09/15
Bromoform	75-25-2	0.25	1.00	0.25	U	ug/Kg	SW8260B	11/09/15
Styrene	100-42-5	0.25	1.00	0.25	U	ug/Kg	SW8260B	11/09/15

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information		Lab Information	
Client Sample ID:	**SB1-1109**	**Lab Sample ID:**	**SB1-1109**
Project Name:	Alaska LNG	Date Received:	N/A
Sample Date:	N/A	Dilution Factor:	1
Sample Time:	N/A	Report Revision No.:	0
Type:	QC		
Matrix:	Soil		
Basis:	Dry Weight		

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Volatiles								
1,1,2,2-Tetrachloroethane	79-34-5	0.25	1.00	0.25	U	ug/Kg	SW8260B	11/09/15
o-Xylene	95-47-6	0.25	1.00	0.25	U	ug/Kg	SW8260B	11/09/15
1,2,3-Trichloropropane	96-18-4	0.25	1.00	0.25	U	ug/Kg	SW8260B	11/09/15
Isopropylbenzene	98-82-8	0.25	1.00	0.25	U	ug/Kg	SW8260B	11/09/15
Bromobenzene	108-86-1	0.25	1.00	0.25	U	ug/Kg	SW8260B	11/09/15
n-Propylbenzene	103-65-1	0.25	1.00	0.25	U	ug/Kg	SW8260B	11/09/15
2-Chlorotoluene	95-49-8	0.25	1.00	0.25	U	ug/Kg	SW8260B	11/09/15
4-Chlorotoluene	106-43-4	0.25	1.00	0.25	U	ug/Kg	SW8260B	11/09/15
1,3,5-Trimethylbenzene	108-67-8	0.25	1.00	0.25	U	ug/Kg	SW8260B	11/09/15
tert-Butylbenzene	98-06-6	0.25	1.00	0.25	U	ug/Kg	SW8260B	11/09/15
1,2,4-Trimethylbenzene	95-63-6	0.25	1.00	0.25	U	ug/Kg	SW8260B	11/09/15
sec-Butylbenzene	135-98-8	0.25	1.00	0.25	U	ug/Kg	SW8260B	11/09/15
1,3-Dichlorobenzene	541-73-1	0.25	1.00	0.25	U	ug/Kg	SW8260B	11/09/15
1,4-Dichlorobenzene	106-46-7	0.25	1.00	0.25	U	ug/Kg	SW8260B	11/09/15
p-Isopropyltoluene	99-87-6	0.25	1.00	0.25	U	ug/Kg	SW8260B	11/09/15
1,2-Dichlorobenzene	95-50-1	0.25	1.00	0.25	U	ug/Kg	SW8260B	11/09/15
n-Butylbenzene	104-51-8	0.25	1.00	0.25	U	ug/Kg	SW8260B	11/09/15
1,2-Dibromo-3-chloropropane	96-12-8	0.25	1.00	0.25	U	ug/Kg	SW8260B	11/09/15
1,2,4-Trichlorobenzene	120-82-1	0.25	1.00	0.25	U	ug/Kg	SW8260B	11/09/15
Naphthalene	91-20-3	0.25	1.00	0.25	U	ug/Kg	SW8260B	11/09/15
Hexachlorobutadiene	87-68-3	0.25	1.00	0.25	U	ug/Kg	SW8260B	11/09/15
1,2,3-Trichlorobenzene	87-61-6	0.25	1.00	0.25	U	ug/Kg	SW8260B	11/09/15

Surrogate	% Recovery	Control Limits	Qualifier
Dibromofluoromethane	105	70-130	
1,2-Dichloroethane-d4	116	70-130	
Toluene-d8	94	70-130	
4-Bromofluorobenzene	85	70-130	

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Client Sample ID: **WB1-1106**

Project Name: Alaska LNG
Sample Date: N/A
Sample Time: N/A
Type: QC
Matrix: Water

Lab Information

Lab Sample ID: **WB1-1106**

Date Received: N/A
Dilution Factor: 1
Report Revision No.: 0

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Volatiles								
Dichlorodifluoromethane	75-71-8	0.15	0.50	0.15	U	ug/L	SW8260B	11/06/15
Chloromethane	74-87-3	0.15	0.50	0.15	U	ug/L	SW8260B	11/06/15
Vinyl Chloride	75-01-4	0.15	0.50	0.15	U	ug/L	SW8260B	11/06/15
Bromomethane	74-83-9	0.20	0.50	0.20	U	ug/L	SW8260B	11/06/15
Chloroethane	75-00-3	0.15	0.50	0.15	U	ug/L	SW8260B	11/06/15
Trichlorofluoromethane	75-69-4	0.15	0.50	0.15	U	ug/L	SW8260B	11/06/15
Acetone	67-64-1	1.00	5.00	1.00	U	ug/L	SW8260B	11/06/15
1,1-Dichloroethene	75-35-4	0.15	0.50	0.15	U	ug/L	SW8260B	11/06/15
Methylene chloride	75-09-2	0.15	0.50	0.15	U	ug/L	SW8260B	11/06/15
trans-1,2-Dichloroethene	156-60-5	0.15	0.50	0.15	U	ug/L	SW8260B	11/06/15
Methyl tert-butyl ether (MTBE)	1634-04-4	0.15	0.50	0.15	U	ug/L	SW8260B	11/06/15
1,1-Dichloroethane	75-34-3	0.15	0.50	0.15	U	ug/L	SW8260B	11/06/15
2-Butanone (MEK)	78-93-3	2.00	5.00	2.00	U	ug/L	SW8260B	11/06/15
cis-1,2-Dichloroethene	156-59-2	0.15	0.50	0.15	U	ug/L	SW8260B	11/06/15
Bromochloromethane	74-97-5	0.15	0.50	0.15	U	ug/L	SW8260B	11/06/15
Chloroform	67-66-3	0.15	0.50	0.15	U	ug/L	SW8260B	11/06/15
2,2-Dichloropropane	594-20-7	0.15	0.50	0.15	U	ug/L	SW8260B	11/06/15
1,2-Dichloroethane	107-06-2	0.15	0.50	0.15	U	ug/L	SW8260B	11/06/15
1,1,1-Trichloroethane	71-55-6	0.15	0.50	0.15	U	ug/L	SW8260B	11/06/15
1,1-Dichloropropene	563-58-6	0.15	0.50	0.15	U	ug/L	SW8260B	11/06/15
Carbon tetrachloride	56-23-5	0.15	0.50	0.15	U	ug/L	SW8260B	11/06/15
Benzene	71-43-2	0.15	0.50	0.15	U	ug/L	SW8260B	11/06/15
Dibromomethane	74-95-3	0.15	0.50	0.15	U	ug/L	SW8260B	11/06/15
1,2-Dichloropropane	78-87-5	0.15	0.50	0.15	U	ug/L	SW8260B	11/06/15
Trichloroethene (TCE)	79-01-6	0.15	0.50	0.15	U	ug/L	SW8260B	11/06/15
Bromodichloromethane	75-27-4	0.15	0.50	0.15	U	ug/L	SW8260B	11/06/15
cis-1,3-Dichloropropene	10061-01-5	0.15	0.50	0.15	U	ug/L	SW8260B	11/06/15
4-Methyl-2-pentanone (MIBK)	108-10-1	0.50	2.00	0.50	U	ug/L	SW8260B	11/06/15
trans-1,3-Dichloropropene	10061-02-6	0.15	0.50	0.15	U	ug/L	SW8260B	11/06/15
1,1,2-Trichloroethane	79-00-5	0.15	0.50	0.15	U	ug/L	SW8260B	11/06/15
Toluene	108-88-3	0.15	0.50	0.15	U	ug/L	SW8260B	11/06/15
1,3-Dichloropropane	142-28-9	0.15	0.50	0.15	U	ug/L	SW8260B	11/06/15
Dibromochloromethane	124-48-1	0.15	0.50	0.15	U	ug/L	SW8260B	11/06/15
1,2-Dibromoethane (EDB)	106-93-4	0.15	0.50	0.15	U	ug/L	SW8260B	11/06/15
Tetrachloroethene (PCE)	127-18-4	0.15	0.50	0.15	U	ug/L	SW8260B	11/06/15
1-Chlorohexane	544-10-5	0.15	0.50	0.15	U	ug/L	SW8260B	11/06/15
1,1,1,2-Tetrachloroethane	630-20-6	0.15	0.50	0.15	U	ug/L	SW8260B	11/06/15
Chlorobenzene	108-90-7	0.15	0.50	0.15	U	ug/L	SW8260B	11/06/15
Ethylbenzene	100-41-4	0.15	0.50	0.15	U	ug/L	SW8260B	11/06/15
m,p-Xylene	108-38-3/1	0.30	1.00	0.30	U	ug/L	SW8260B	11/06/15
Bromoform	75-25-2	0.15	0.50	0.15	U	ug/L	SW8260B	11/06/15
Styrene	100-42-5	0.15	0.50	0.15	U	ug/L	SW8260B	11/06/15

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information		Lab Information	
Client Sample ID:	**WB1-1106**	**Lab Sample ID:**	**WB1-1106**
Project Name:	Alaska LNG	Date Received:	N/A
Sample Date:	N/A	Dilution Factor:	1
Sample Time:	N/A	Report Revision No.:	0
Type:	QC		
Matrix:	Water		

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Volatiles								
1,1,2,2-Tetrachloroethane	79-34-5	0.15	0.50	0.15	U	ug/L	SW8260B	11/06/15
o-Xylene	95-47-6	0.15	0.50	0.15	U	ug/L	SW8260B	11/06/15
1,2,3-Trichloropropane	96-18-4	0.15	0.50	0.15	U	ug/L	SW8260B	11/06/15
Isopropylbenzene	98-82-8	0.15	0.50	0.15	U	ug/L	SW8260B	11/06/15
Bromobenzene	108-86-1	0.15	0.50	0.15	U	ug/L	SW8260B	11/06/15
n-Propylbenzene	103-65-1	0.15	0.50	0.15	U	ug/L	SW8260B	11/06/15
2-Chlorotoluene	95-49-8	0.15	0.50	0.15	U	ug/L	SW8260B	11/06/15
4-Chlorotoluene	106-43-4	0.15	0.50	0.15	U	ug/L	SW8260B	11/06/15
1,3,5-Trimethylbenzene	108-67-8	0.15	0.50	0.15	U	ug/L	SW8260B	11/06/15
tert-Butylbenzene	98-06-6	0.15	0.50	0.15	U	ug/L	SW8260B	11/06/15
1,2,4-Trimethylbenzene	95-63-6	0.15	0.50	0.15	U	ug/L	SW8260B	11/06/15
sec-Butylbenzene	135-98-8	0.15	0.50	0.15	U	ug/L	SW8260B	11/06/15
1,3-Dichlorobenzene	541-73-1	0.15	0.50	0.15	U	ug/L	SW8260B	11/06/15
1,4-Dichlorobenzene	106-46-7	0.15	0.50	0.15	U	ug/L	SW8260B	11/06/15
p-Isopropyltoluene	99-87-6	0.15	0.50	0.15	U	ug/L	SW8260B	11/06/15
1,2-Dichlorobenzene	95-50-1	0.15	0.50	0.15	U	ug/L	SW8260B	11/06/15
n-Butylbenzene	104-51-8	0.15	0.50	0.15	U	ug/L	SW8260B	11/06/15
1,2-Dibromo-3-chloropropane	96-12-8	0.15	0.50	0.15	U	ug/L	SW8260B	11/06/15
1,2,4-Trichlorobenzene	120-82-1	0.15	0.50	0.15	U	ug/L	SW8260B	11/06/15
Naphthalene	91-20-3	0.15	0.50	0.15	U	ug/L	SW8260B	11/06/15
Hexachlorobutadiene	87-68-3	0.15	0.50	0.15	U	ug/L	SW8260B	11/06/15
1,2,3-Trichlorobenzene	87-61-6	0.15	0.50	0.15	U	ug/L	SW8260B	11/06/15

Surrogate	% Recovery	Control Limits	Qualifier
Dibromofluoromethane	107	70-130	
1,2-Dichloroethane-d4	114	70-130	
Toluene-d8	105	70-130	
4-Bromofluorobenzene	99	70-130	

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Project Name: Alaska LNG
Type: QC
Matrix: Soil

Lab Information

LCS ID: BS1S1109

Report Revision No.: 0
Dilution Factor: 1

Analyte	CAS#	Spike Amount	Sample Result	Units	%Recovery	Analysis Method	Date Analyzed
GC/MS Volatiles							
Dichlorodifluoromethane	75-71-8	20.0	20.1	ug/Kg	101	SW8260B	11/09/15
Chloromethane	74-87-3	20.0	21.0	ug/Kg	105	SW8260B	11/09/15
Vinyl Chloride	75-01-4	20.0	19.3	ug/Kg	96	SW8260B	11/09/15
Bromomethane	74-83-9	20.0	19.3	ug/Kg	96	SW8260B	11/09/15
Chloroethane	75-00-3	20.0	19.6	ug/Kg	98	SW8260B	11/09/15
Trichlorofluoromethane	75-69-4	20.0	21.7	ug/Kg	109	SW8260B	11/09/15
Acetone	67-64-1	20.0	22.8	ug/Kg	114	SW8260B	11/09/15
1,1-Dichloroethene	75-35-4	20.0	19.9	ug/Kg	99	SW8260B	11/09/15
Methylene chloride	75-09-2	20.0	22.8	ug/Kg	114	SW8260B	11/09/15
trans-1,2-Dichloroethene	156-60-5	20.0	20.3	ug/Kg	102	SW8260B	11/09/15
Methyl tert-butyl ether (MTBE)	1634-04-4	20.0	19.5	ug/Kg	97	SW8260B	11/09/15
1,1-Dichloroethane	75-34-3	20.0	20.1	ug/Kg	100	SW8260B	11/09/15
2-Butanone (MEK)	78-93-3	20.0	21.0	ug/Kg	105	SW8260B	11/09/15
cis-1,2-Dichloroethene	156-59-2	20.0	20.5	ug/Kg	102	SW8260B	11/09/15
Bromochloromethane	74-97-5	20.0	20.2	ug/Kg	101	SW8260B	11/09/15
Chloroform	67-66-3	20.0	20.2	ug/Kg	101	SW8260B	11/09/15
2,2-Dichloropropane	594-20-7	20.0	20.4	ug/Kg	102	SW8260B	11/09/15
1,2-Dichloroethane	107-06-2	20.0	21.7	ug/Kg	108	SW8260B	11/09/15
1,1,1-Trichloroethane	71-55-6	20.0	20.5	ug/Kg	103	SW8260B	11/09/15
1,1-Dichloropropene	563-58-6	20.0	18.8	ug/Kg	94	SW8260B	11/09/15
Carbon tetrachloride	56-23-5	20.0	20.5	ug/Kg	103	SW8260B	11/09/15
Benzene	71-43-2	20.0	19.6	ug/Kg	98	SW8260B	11/09/15
Dibromomethane	74-95-3	20.0	20.6	ug/Kg	103	SW8260B	11/09/15
1,2-Dichloropropane	78-87-5	20.0	20.3	ug/Kg	101	SW8260B	11/09/15
Trichloroethene (TCE)	79-01-6	20.0	19.6	ug/Kg	98	SW8260B	11/09/15
Bromodichloromethane	75-27-4	20.0	20.5	ug/Kg	103	SW8260B	11/09/15
cis-1,3-Dichloropropene	10061-01-5	20.0	21.2	ug/Kg	106	SW8260B	11/09/15
4-Methyl-2-pentanone (MIBK)	108-10-1	20.0	22.5	ug/Kg	112	SW8260B	11/09/15
trans-1,3-Dichloropropene	10061-02-6	20.0	19.9	ug/Kg	99	SW8260B	11/09/15
1,1,2-Trichloroethane	79-00-5	20.0	20.3	ug/Kg	102	SW8260B	11/09/15
Toluene	108-88-3	20.0	19.3	ug/Kg	97	SW8260B	11/09/15
1,3-Dichloropropane	142-28-9	20.0	20.7	ug/Kg	104	SW8260B	11/09/15
Dibromochloromethane	124-48-1	20.0	20.5	ug/Kg	103	SW8260B	11/09/15
1,2-Dibromoethane (EDB)	106-93-4	20.0	20.4	ug/Kg	102	SW8260B	11/09/15
Tetrachloroethene (PCE)	127-18-4	20.0	18.8	ug/Kg	94	SW8260B	11/09/15
1-Chlorohexane	544-10-5	20.0	17.9	ug/Kg	90	SW8260B	11/09/15
1,1,1,2-Tetrachloroethane	630-20-6	20.0	19.9	ug/Kg	100	SW8260B	11/09/15
Chlorobenzene	108-90-7	20.0	18.1	ug/Kg	90	SW8260B	11/09/15
Ethylbenzene	100-41-4	20.0	19.2	ug/Kg	96	SW8260B	11/09/15
m,p-Xylene	108-38-3/1	40.0	37.7	ug/Kg	94	SW8260B	11/09/15
Bromoform	75-25-2	20.0	21.0	ug/Kg	105	SW8260B	11/09/15
Styrene	100-42-5	20.0	19.5	ug/Kg	98	SW8260B	11/09/15

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Project Name: Alaska LNG
Type: QC
Matrix: Soil

Lab Information

LCS ID: BS1S1109

Report Revision No.: 0
Dilution Factor: 1

Analyte	CAS#	Spike Amount	Sample Result	Units	%Recovery	Analysis Method	Date Analyzed
GC/MS Volatiles							
1,1,2,2-Tetrachloroethane	79-34-5	20.0	20.7	ug/Kg	103	SW8260B	11/09/15
o-Xylene	95-47-6	20.0	18.2	ug/Kg	91	SW8260B	11/09/15
1,2,3-Trichloropropane	96-18-4	20.0	20.7	ug/Kg	104	SW8260B	11/09/15
Isopropylbenzene	98-82-8	20.0	18.0	ug/Kg	90	SW8260B	11/09/15
Bromobenzene	108-86-1	20.0	19.4	ug/Kg	97	SW8260B	11/09/15
n-Propylbenzene	103-65-1	20.0	17.8	ug/Kg	89	SW8260B	11/09/15
2-Chlorotoluene	95-49-8	20.0	17.7	ug/Kg	89	SW8260B	11/09/15
4-Chlorotoluene	106-43-4	20.0	17.4	ug/Kg	87	SW8260B	11/09/15
1,3,5-Trimethylbenzene	108-67-8	20.0	19.4	ug/Kg	97	SW8260B	11/09/15
tert-Butylbenzene	98-06-6	20.0	17.9	ug/Kg	89	SW8260B	11/09/15
1,2,4-Trimethylbenzene	95-63-6	20.0	19.2	ug/Kg	96	SW8260B	11/09/15
sec-Butylbenzene	135-98-8	20.0	17.8	ug/Kg	89	SW8260B	11/09/15
1,3-Dichlorobenzene	541-73-1	20.0	17.2	ug/Kg	86	SW8260B	11/09/15
1,4-Dichlorobenzene	106-46-7	20.0	19.2	ug/Kg	96	SW8260B	11/09/15
p-Isopropyltoluene	99-87-6	20.0	18.0	ug/Kg	90	SW8260B	11/09/15
1,2-Dichlorobenzene	95-50-1	20.0	18.4	ug/Kg	92	SW8260B	11/09/15
n-Butylbenzene	104-51-8	20.0	19.7	ug/Kg	98	SW8260B	11/09/15
1,2-Dibromo-3-chloropropane	96-12-8	20.0	22.1	ug/Kg	111	SW8260B	11/09/15
1,2,4-Trichlorobenzene	120-82-1	20.0	19.8	ug/Kg	99	SW8260B	11/09/15
Naphthalene	91-20-3	20.0	22.6	ug/Kg	113	SW8260B	11/09/15
Hexachlorobutadiene	87-68-3	20.0	18.4	ug/Kg	92	SW8260B	11/09/15
1,2,3-Trichlorobenzene	87-61-6	20.0	20.6	ug/Kg	103	SW8260B	11/09/15

Surrogate	% Recovery	Control Limits	Qualifier
Dibromofluoromethane	101	70-130	
1,2-Dichloroethane-d4	105	70-130	
Toluene-d8	95	70-130	
4-Bromofluorobenzene	94	70-130	

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Project Name: Alaska LNG
Type: QC
Matrix: Water

Lab Information

LCS ID: BS1W1106

Report Revision No.: 0
Dilution Factor: 1

Analyte	CAS#	Spike Amount	Sample Result	Units	%Recovery	Analysis Method	Date Analyzed
GC/MS Volatiles							
Dichlorodifluoromethane	75-71-8	20.0	18.5	ug/L	93	SW8260B	11/06/15
Chloromethane	74-87-3	20.0	16.6	ug/L	83	SW8260B	11/06/15
Vinyl Chloride	75-01-4	20.0	17.0	ug/L	85	SW8260B	11/06/15
Bromomethane	74-83-9	20.0	19.7	ug/L	99	SW8260B	11/06/15
Chloroethane	75-00-3	20.0	19.6	ug/L	98	SW8260B	11/06/15
Trichlorofluoromethane	75-69-4	20.0	20.3	ug/L	101	SW8260B	11/06/15
Acetone	67-64-1	20.0	18.8	ug/L	94	SW8260B	11/06/15
1,1-Dichloroethene	75-35-4	20.0	19.5	ug/L	98	SW8260B	11/06/15
Methylene chloride	75-09-2	20.0	20.7	ug/L	104	SW8260B	11/06/15
trans-1,2-Dichloroethene	156-60-5	20.0	19.2	ug/L	96	SW8260B	11/06/15
Methyl tert-butyl ether (MTBE)	1634-04-4	20.0	19.4	ug/L	97	SW8260B	11/06/15
1,1-Dichloroethane	75-34-3	20.0	18.5	ug/L	93	SW8260B	11/06/15
2-Butanone (MEK)	78-93-3	20.0	19.8	ug/L	99	SW8260B	11/06/15
cis-1,2-Dichloroethene	156-59-2	20.0	19.3	ug/L	97	SW8260B	11/06/15
Bromochloromethane	74-97-5	20.0	19.5	ug/L	98	SW8260B	11/06/15
Chloroform	67-66-3	20.0	19.8	ug/L	99	SW8260B	11/06/15
2,2-Dichloropropane	594-20-7	20.0	20.3	ug/L	102	SW8260B	11/06/15
1,2-Dichloroethane	107-06-2	20.0	20.6	ug/L	103	SW8260B	11/06/15
1,1,1-Trichloroethane	71-55-6	20.0	21.3	ug/L	106	SW8260B	11/06/15
1,1-Dichloropropene	563-58-6	20.0	19.9	ug/L	99	SW8260B	11/06/15
Carbon tetrachloride	56-23-5	20.0	22.4	ug/L	112	SW8260B	11/06/15
Benzene	71-43-2	20.0	19.3	ug/L	97	SW8260B	11/06/15
Dibromomethane	74-95-3	20.0	19.5	ug/L	98	SW8260B	11/06/15
1,2-Dichloropropane	78-87-5	20.0	18.5	ug/L	93	SW8260B	11/06/15
Trichloroethene (TCE)	79-01-6	20.0	20.7	ug/L	103	SW8260B	11/06/15
Bromodichloromethane	75-27-4	20.0	20.6	ug/L	103	SW8260B	11/06/15
cis-1,3-Dichloropropene	10061-01-5	20.0	21.9	ug/L	109	SW8260B	11/06/15
4-Methyl-2-pentanone (MIBK)	108-10-1	20.0	20.2	ug/L	101	SW8260B	11/06/15
trans-1,3-Dichloropropene	10061-02-6	20.0	20.4	ug/L	102	SW8260B	11/06/15
1,1,2-Trichloroethane	79-00-5	20.0	19.4	ug/L	97	SW8260B	11/06/15
Toluene	108-88-3	20.0	21.0	ug/L	105	SW8260B	11/06/15
1,3-Dichloropropane	142-28-9	20.0	18.4	ug/L	92	SW8260B	11/06/15
Dibromochloromethane	124-48-1	20.0	20.1	ug/L	101	SW8260B	11/06/15
1,2-Dibromoethane (EDB)	106-93-4	20.0	19.1	ug/L	95	SW8260B	11/06/15
Tetrachloroethene (PCE)	127-18-4	20.0	19.1	ug/L	95	SW8260B	11/06/15
1-Chlorohexane	544-10-5	20.0	19.9	ug/L	100	SW8260B	11/06/15
1,1,1,2-Tetrachloroethane	630-20-6	20.0	19.7	ug/L	99	SW8260B	11/06/15
Chlorobenzene	108-90-7	20.0	17.7	ug/L	89	SW8260B	11/06/15
Ethylbenzene	100-41-4	20.0	20.1	ug/L	101	SW8260B	11/06/15
m,p-Xylene	108-38-3/1	40.0	40.2	ug/L	100	SW8260B	11/06/15
Bromoform	75-25-2	20.0	21.5	ug/L	108	SW8260B	11/06/15
Styrene	100-42-5	20.0	20.9	ug/L	105	SW8260B	11/06/15

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Project Name: Alaska LNG
Type: QC
Matrix: Water

Lab Information

LCS ID: BS1W1106

Report Revision No.: 0
Dilution Factor: 1

Analyte	CAS#	Spike Amount	Sample Result	Units	%Recovery	Analysis Method	Date Analyzed
GC/MS Volatiles							
1,1,2,2-Tetrachloroethane	79-34-5	20.0	17.9	ug/L	90	SW8260B	11/06/15
o-Xylene	95-47-6	20.0	19.9	ug/L	100	SW8260B	11/06/15
1,2,3-Trichloropropane	96-18-4	20.0	17.8	ug/L	89	SW8260B	11/06/15
Isopropylbenzene	98-82-8	20.0	19.2	ug/L	96	SW8260B	11/06/15
Bromobenzene	108-86-1	20.0	18.7	ug/L	93	SW8260B	11/06/15
n-Propylbenzene	103-65-1	20.0	19.0	ug/L	95	SW8260B	11/06/15
2-Chlorotoluene	95-49-8	20.0	19.0	ug/L	95	SW8260B	11/06/15
4-Chlorotoluene	106-43-4	20.0	18.8	ug/L	94	SW8260B	11/06/15
1,3,5-Trimethylbenzene	108-67-8	20.0	21.8	ug/L	109	SW8260B	11/06/15
tert-Butylbenzene	98-06-6	20.0	19.9	ug/L	99	SW8260B	11/06/15
1,2,4-Trimethylbenzene	95-63-6	20.0	21.5	ug/L	108	SW8260B	11/06/15
sec-Butylbenzene	135-98-8	20.0	19.5	ug/L	98	SW8260B	11/06/15
1,3-Dichlorobenzene	541-73-1	20.0	17.9	ug/L	89	SW8260B	11/06/15
1,4-Dichlorobenzene	106-46-7	20.0	18.7	ug/L	93	SW8260B	11/06/15
p-Isopropyltoluene	99-87-6	20.0	18.6	ug/L	93	SW8260B	11/06/15
1,2-Dichlorobenzene	95-50-1	20.0	18.4	ug/L	92	SW8260B	11/06/15
n-Butylbenzene	104-51-8	20.0	20.6	ug/L	103	SW8260B	11/06/15
1,2-Dibromo-3-chloropropane	96-12-8	20.0	20.2	ug/L	101	SW8260B	11/06/15
1,2,4-Trichlorobenzene	120-82-1	20.0	22.7	ug/L	114	SW8260B	11/06/15
Naphthalene	91-20-3	20.0	22.8	ug/L	114	SW8260B	11/06/15
Hexachlorobutadiene	87-68-3	20.0	20.6	ug/L	103	SW8260B	11/06/15
1,2,3-Trichlorobenzene	87-61-6	20.0	22.9	ug/L	115	SW8260B	11/06/15

Surrogate	% Recovery	Control Limits	Qualifier
Dibromofluoromethane	101	70-130	
1,2-Dichloroethane-d4	103	70-130	
Toluene-d8	104	70-130	
4-Bromofluorobenzene	100	70-130	

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

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

CASE NARRATIVE
GC/MS SEMI-VOLATILES ANALYSIS

Lab Name: CH2M HILL ASL **ASL SDG#:** P3549

Project: Alaska LNG **Project #:** 653488.16.06

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

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

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

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

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

Method(s):
SW8270C-SIM: SW3550

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information		Lab Information	
Client Sample ID:	**D4ADS01-001.48-01**	**Lab Sample ID:**	**P354901**
Project Name:	Alaska LNG	Date Received:	11/04/15
Sample Date:	11/02/15	Dilution Factor:	1
Sample Time:	21:00	Report Revision No.:	0
Type:	Grab		
Matrix:	Soil		
Basis:	Dry Weight		

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Semi-Volatiles								
Naphthalene	91-20-3	0.21	1.21	0.27	J	ug/Kg	SW8270C-SI	11/16/15
2-Methylnaphthalene	91-57-6	0.22	1.21	0.22	U	ug/Kg	SW8270C-SI	11/16/15
1-Methylnaphthalene	90-12-0	0.21	1.21	0.21	U	ug/Kg	SW8270C-SI	11/16/15
Acenaphthylene	208-96-8	0.21	1.21	0.21	U	ug/Kg	SW8270C-SI	11/16/15
Acenaphthene	83-32-9	0.19	1.21	0.19	U	ug/Kg	SW8270C-SI	11/16/15
Fluorene	86-73-7	0.21	1.21	0.21	U	ug/Kg	SW8270C-SI	11/16/15
Phenanthrene	85-01-8	0.23	1.21	0.30	J	ug/Kg	SW8270C-SI	11/16/15
Anthracene	120-12-7	0.31	1.21	0.31	U	ug/Kg	SW8270C-SI	11/16/15
Fluoranthene	206-44-0	0.22	1.21	0.22	U	ug/Kg	SW8270C-SI	11/16/15
Pyrene	129-00-0	0.18	1.21	0.20	J	ug/Kg	SW8270C-SI	11/16/15
Benzo(a)anthracene	56-55-3	0.18	1.21	0.18	U	ug/Kg	SW8270C-SI	11/16/15
Chrysene	218-01-9	0.36	1.21	0.36	U	ug/Kg	SW8270C-SI	11/16/15
Benzo(b)fluoroanthene	205-99-2	0.41	1.21	0.41	U	ug/Kg	SW8270C-SI	11/16/15
Benzo(k)fluoranthene	207-08-9	0.57	1.21	0.57	U	ug/Kg	SW8270C-SI	11/16/15
Benzo(a)pyrene	50-32-8	0.28	1.21	0.28	U	ug/Kg	SW8270C-SI	11/16/15
Indeno(1,2,3-c,d)pyrene	193-39-5	0.44	1.21	0.44	U	ug/Kg	SW8270C-SI	11/16/15
Dibenzo(a,h)anthracene	53-70-3	0.41	1.21	0.41	U	ug/Kg	SW8270C-SI	11/16/15
Benzo(g,h,i)perylene	191-24-2	0.44	1.21	0.44	U	ug/Kg	SW8270C-SI	11/16/15

Surrogate	% Recovery	Control Limits	Qualifier
Terphenyl-d14	90	18-137	

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information		Lab Information	
Client Sample ID:	**D4BGC07-14.4416.57-01**	**Lab Sample ID:**	**P354902**
Project Name:	Alaska LNG	Date Received:	11/04/15
Sample Date:	11/03/15	Dilution Factor:	1
Sample Time:	10:00	Report Revision No.:	0
Type:	Grab		
Matrix:	Soil		
Basis:	Dry Weight		

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Semi-Volatiles								
Naphthalene	91-20-3	0.21	1.21	1.55		ug/Kg	SW8270C-SI	11/16/15
2-Methylnaphthalene	91-57-6	0.22	1.21	6.04		ug/Kg	SW8270C-SI	11/16/15
1-Methylnaphthalene	90-12-0	0.21	1.21	3.67		ug/Kg	SW8270C-SI	11/16/15
Acenaphthylene	208-96-8	0.22	1.21	0.22	U	ug/Kg	SW8270C-SI	11/16/15
Acenaphthene	83-32-9	0.19	1.21	0.19	U	ug/Kg	SW8270C-SI	11/16/15
Fluorene	86-73-7	0.21	1.21	0.21	U	ug/Kg	SW8270C-SI	11/16/15
Phenanthrene	85-01-8	0.23	1.21	5.73		ug/Kg	SW8270C-SI	11/16/15
Anthracene	120-12-7	0.31	1.21	0.31	U	ug/Kg	SW8270C-SI	11/16/15
Fluoranthene	206-44-0	0.22	1.21	1.40		ug/Kg	SW8270C-SI	11/16/15
Pyrene	129-00-0	0.18	1.21	2.39		ug/Kg	SW8270C-SI	11/16/15
Benzo(a)anthracene	56-55-3	0.18	1.21	0.18	U	ug/Kg	SW8270C-SI	11/16/15
Chrysene	218-01-9	0.36	1.21	1.43		ug/Kg	SW8270C-SI	11/16/15
Benzo(b)fluoroanthene	205-99-2	0.41	1.21	0.41	U	ug/Kg	SW8270C-SI	11/16/15
Benzo(k)fluoranthene	207-08-9	0.57	1.21	0.57	U	ug/Kg	SW8270C-SI	11/16/15
Benzo(a)pyrene	50-32-8	0.28	1.21	0.28	U	ug/Kg	SW8270C-SI	11/16/15
Indeno(1,2,3-c,d)pyrene	193-39-5	0.45	1.21	0.45	U	ug/Kg	SW8270C-SI	11/16/15
Dibenzo(a,h)anthracene	53-70-3	0.41	1.21	0.41	U	ug/Kg	SW8270C-SI	11/16/15
Benzo(g,h,i)perylene	191-24-2	0.45	1.21	0.45	U	ug/Kg	SW8270C-SI	11/16/15

Surrogate	% Recovery	Control Limits	Qualifier
Terphenyl-d14	89	18-137	

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information		Lab Information	
Client Sample ID:	**D4BGC06-11.8113.54-01**	**Lab Sample ID:**	**P354903**
Project Name:	Alaska LNG	Date Received:	11/04/15
Sample Date:	11/03/15	Dilution Factor:	1
Sample Time:	11:00	Report Revision No.:	0
Type:	Grab		
Matrix:	Soil		
Basis:	Dry Weight		

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Semi-Volatiles								
Naphthalene	91-20-3	0.21	1.22	0.37	J	ug/Kg	SW8270C-SI	11/16/15
2-Methylnaphthalene	91-57-6	0.22	1.22	0.50	J	ug/Kg	SW8270C-SI	11/16/15
1-Methylnaphthalene	90-12-0	0.21	1.22	0.35	J	ug/Kg	SW8270C-SI	11/16/15
Acenaphthylene	208-96-8	0.22	1.22	0.22	U	ug/Kg	SW8270C-SI	11/16/15
Acenaphthene	83-32-9	0.19	1.22	0.19	U	ug/Kg	SW8270C-SI	11/16/15
Fluorene	86-73-7	0.21	1.22	0.21	U	ug/Kg	SW8270C-SI	11/16/15
Phenanthrene	85-01-8	0.23	1.22	0.49	J	ug/Kg	SW8270C-SI	11/16/15
Anthracene	120-12-7	0.31	1.22	0.31	U	ug/Kg	SW8270C-SI	11/16/15
Fluoranthene	206-44-0	0.22	1.22	0.25	J	ug/Kg	SW8270C-SI	11/16/15
Pyrene	129-00-0	0.18	1.22	0.37	J	ug/Kg	SW8270C-SI	11/16/15
Benzo(a)anthracene	56-55-3	0.18	1.22	0.18	U	ug/Kg	SW8270C-SI	11/16/15
Chrysene	218-01-9	0.36	1.22	0.36	U	ug/Kg	SW8270C-SI	11/16/15
Benzo(b)fluoroanthene	205-99-2	0.42	1.22	0.42	U	ug/Kg	SW8270C-SI	11/16/15
Benzo(k)fluoranthene	207-08-9	0.57	1.22	0.57	U	ug/Kg	SW8270C-SI	11/16/15
Benzo(a)pyrene	50-32-8	0.28	1.22	0.28	U	ug/Kg	SW8270C-SI	11/16/15
Indeno(1,2,3-c,d)pyrene	193-39-5	0.45	1.22	0.45	U	ug/Kg	SW8270C-SI	11/16/15
Dibenzo(a,h)anthracene	53-70-3	0.41	1.22	0.41	U	ug/Kg	SW8270C-SI	11/16/15
Benzo(g,h,i)perylene	191-24-2	0.45	1.22	0.45	U	ug/Kg	SW8270C-SI	11/16/15

Surrogate	% Recovery	Control Limits	Qualifier
Terphenyl-d14	81	18-137	

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information		Lab Information	
Client Sample ID:	**SB1-1107**	**Lab Sample ID:**	**SB1-1107**
Project Name:	Alaska LNG	Date Received:	N/A
Sample Date:	N/A	Dilution Factor:	1
Sample Time:	N/A	Report Revision No.:	0
Type:	QC		
Matrix:	Soil		
Basis:	Dry Weight		

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Semi-Volatiles								
Naphthalene	91-20-3	0.17	1.00	0.17	U	ug/Kg	SW8270C-SI	11/16/15
2-Methylnaphthalene	91-57-6	0.18	1.00	0.18	U	ug/Kg	SW8270C-SI	11/16/15
1-Methylnaphthalene	90-12-0	0.17	1.00	0.17	U	ug/Kg	SW8270C-SI	11/16/15
Acenaphthylene	208-96-8	0.18	1.00	0.18	U	ug/Kg	SW8270C-SI	11/16/15
Acenaphthene	83-32-9	0.15	1.00	0.15	U	ug/Kg	SW8270C-SI	11/16/15
Fluorene	86-73-7	0.18	1.00	0.18	U	ug/Kg	SW8270C-SI	11/16/15
Phenanthrene	85-01-8	0.19	1.00	0.19	U	ug/Kg	SW8270C-SI	11/16/15
Anthracene	120-12-7	0.26	1.00	0.26	U	ug/Kg	SW8270C-SI	11/16/15
Fluoranthene	206-44-0	0.18	1.00	0.18	U	ug/Kg	SW8270C-SI	11/16/15
Pyrene	129-00-0	0.15	1.00	0.15	U	ug/Kg	SW8270C-SI	11/16/15
Benzo(a)anthracene	56-55-3	0.15	1.00	0.15	U	ug/Kg	SW8270C-SI	11/16/15
Chrysene	218-01-9	0.30	1.00	0.30	U	ug/Kg	SW8270C-SI	11/16/15
Benzo(b)fluoroanthene	205-99-2	0.34	1.00	0.34	U	ug/Kg	SW8270C-SI	11/16/15
Benzo(k)fluoranthene	207-08-9	0.47	1.00	0.47	U	ug/Kg	SW8270C-SI	11/16/15
Benzo(a)pyrene	50-32-8	0.23	1.00	0.23	U	ug/Kg	SW8270C-SI	11/16/15
Indeno(1,2,3-c,d)pyrene	193-39-5	0.37	1.00	0.37	U	ug/Kg	SW8270C-SI	11/16/15
Dibenzo(a,h)anthracene	53-70-3	0.34	1.00	0.34	U	ug/Kg	SW8270C-SI	11/16/15
Benzo(g,h,i)perylene	191-24-2	0.37	1.00	0.37	U	ug/Kg	SW8270C-SI	11/16/15

Surrogate	% Recovery	Control Limits	Qualifier
Terphenyl-d14	88	18-137	

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Project Name: Alaska LNG
Type: QC
Matrix: Soil

Lab Information

LCS ID: BS1S1107

Report Revision No.: 0
Dilution Factor: 1

Analyte	CAS#	Spike Amount	Sample Result	Units	%Recovery	Analysis Method	Date Analyzed
GC/MS Semi-Volatiles							
Naphthalene	91-20-3	50.0	33.3	ug/Kg	67	SW8270C-SIM	11/16/15
2-Methylnaphthalene	91-57-6	50.0	35.5	ug/Kg	71	SW8270C-SIM	11/16/15
1-Methylnaphthalene	90-12-0	50.0	34.5	ug/Kg	69	SW8270C-SIM	11/16/15
Acenaphthylene	208-96-8	50.0	40.4	ug/Kg	81	SW8270C-SIM	11/16/15
Acenaphthene	83-32-9	50.0	37.9	ug/Kg	76	SW8270C-SIM	11/16/15
Fluorene	86-73-7	50.0	37.8	ug/Kg	76	SW8270C-SIM	11/16/15
Phenanthrene	85-01-8	50.0	38.5	ug/Kg	77	SW8270C-SIM	11/16/15
Anthracene	120-12-7	50.0	38.0	ug/Kg	76	SW8270C-SIM	11/16/15
Fluoranthene	206-44-0	50.0	38.3	ug/Kg	77	SW8270C-SIM	11/16/15
Pyrene	129-00-0	50.0	37.4	ug/Kg	75	SW8270C-SIM	11/16/15
Benzo(a)anthracene	56-55-3	50.0	39.9	ug/Kg	80	SW8270C-SIM	11/16/15
Chrysene	218-01-9	50.0	41.5	ug/Kg	83	SW8270C-SIM	11/16/15
Benzo(b)fluoroanthene	205-99-2	50.0	41.9	ug/Kg	84	SW8270C-SIM	11/16/15
Benzo(k)fluoranthene	207-08-9	50.0	40.5	ug/Kg	81	SW8270C-SIM	11/16/15
Benzo(a)pyrene	50-32-8	50.0	37.4	ug/Kg	75	SW8270C-SIM	11/16/15
Indeno(1,2,3-c,d)pyrene	193-39-5	50.0	40.7	ug/Kg	81	SW8270C-SIM	11/16/15
Dibenzo(a,h)anthracene	53-70-3	50.0	43.2	ug/Kg	86	SW8270C-SIM	11/16/15
Benzo(g,h,i)perylene	191-24-2	50.0	42.9	ug/Kg	86	SW8270C-SIM	11/16/15

Surrogate	% Recovery	Control Limits	Qualifier
Terphenyl-d14	91	18-137	

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

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

CASE NARRATIVE
GC/MS SEMI-VOLATILES ANALYSIS

Lab Name: CH2M HILL ASL **ASL SDG#:** P3549

Project: Alaska LNG **Project #:** 653488.16.06

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

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

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

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

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

Method(s):
SW8270C: SW3550

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Client Sample ID: **D4ADS01-001.48-01**

Project Name: Alaska LNG
Sample Date: 11/02/15
Sample Time: 21:00
Type: Grab
Matrix: Soil
Basis: Dry Weight

Lab Information

Lab Sample ID: **P354901**

Date Received: 11/04/15
Dilution Factor: 1
Report Revision No.: 0

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Semi-Volatiles								
N-Nitrosodimethylamine	62-75-9	81.0	207	81.0	U	ug/Kg	SW8270C	11/19/15
Pyridine	110-86-1	81.0	207	81.0	U	ug/Kg	SW8270C	11/19/15
Aniline	62-53-3	81.0	207	81.0	U	ug/Kg	SW8270C	11/19/15
Phenol	108-95-2	81.0	207	81.0	U	ug/Kg	SW8270C	11/19/15
bis(2-Chloroethyl)ether	111-44-4	81.0	207	81.0	U	ug/Kg	SW8270C	11/19/15
2-Chlorophenol	95-57-8	81.0	207	81.0	U	ug/Kg	SW8270C	11/19/15
1,3-Dichlorobenzene	541-73-1	81.0	207	81.0	U	ug/Kg	SW8270C	11/19/15
1,4-Dichlorobenzene	106-46-7	81.0	207	81.0	U	ug/Kg	SW8270C	11/19/15
Benzyl alcohol	100-51-6	81.0	207	81.0	U	ug/Kg	SW8270C	11/19/15
1,2-Dichlorobenzene	95-50-1	81.0	207	81.0	U	ug/Kg	SW8270C	11/19/15
2-Methylphenol	95-48-7	81.0	207	81.0	U	ug/Kg	SW8270C	11/19/15
bis(2-Chloroisopropyl)ether	108-60-1	81.0	207	81.0	U	ug/Kg	SW8270C	11/19/15
3-,4-Methylphenol	108-39-4/106	81.0	207	81.0	U	ug/Kg	SW8270C	11/19/15
N-Nitroso-di-n-propylamine	621-64-7	81.0	207	81.0	U	ug/Kg	SW8270C	11/19/15
Hexachloroethane	67-72-1	81.0	207	81.0	U	ug/Kg	SW8270C	11/19/15
Benzoic Acid	65-85-0	122	486	122	U	ug/Kg	SW8270C	11/19/15
Nitrobenzene	98-95-3	81.0	207	81.0	U	ug/Kg	SW8270C	11/19/15
Isophorone	78-59-1	81.0	207	81.0	U	ug/Kg	SW8270C	11/19/15
2-Nitrophenol	88-75-5	81.0	207	81.0	U	ug/Kg	SW8270C	11/19/15
2,4-Dimethylphenol	105-67-9	81.0	207	81.0	U	ug/Kg	SW8270C	11/19/15
bis(2-Chloroethoxy)methane	111-91-1	81.0	207	81.0	U	ug/Kg	SW8270C	11/19/15
2,4-Dichlorophenol	120-83-2	81.0	207	81.0	U	ug/Kg	SW8270C	11/19/15
1,2,4-Trichlorobenzene	120-82-1	81.0	207	81.0	U	ug/Kg	SW8270C	11/19/15
Naphthalene	91-20-3	81.0	207	81.0	U	ug/Kg	SW8270C	11/19/15
4-Chloroaniline	106-47-8	81.0	207	81.0	U	ug/Kg	SW8270C	11/19/15
Hexachlorobutadiene	87-68-3	81.0	207	81.0	U	ug/Kg	SW8270C	11/19/15
4-Chloro-3-methyl phenol	59-50-7	81.0	207	81.0	U	ug/Kg	SW8270C	11/19/15
2-Methylnaphthalene	91-57-6	81.0	207	81.0	U	ug/Kg	SW8270C	11/19/15
Hexachlorocyclopentadiene	77-47-4	81.0	207	81.0	U	ug/Kg	SW8270C	11/19/15
2,4,6-Trichlorophenol	88-06-2	81.0	207	81.0	U	ug/Kg	SW8270C	11/19/15
2,4,5-Trichlorophenol	95-95-4	81.0	207	81.0	U	ug/Kg	SW8270C	11/19/15
2-Chloronaphthalene	91-58-7	81.0	207	81.0	U	ug/Kg	SW8270C	11/19/15
2-Nitroaniline	88-74-4	81.0	207	81.0	U	ug/Kg	SW8270C	11/19/15
Dimethylphthalate	131-11-3	81.0	207	81.0	U	ug/Kg	SW8270C	11/19/15
Acenaphthylene	208-96-8	81.0	207	81.0	U	ug/Kg	SW8270C	11/19/15
2,6-Dinitrotoluene	606-20-2	81.0	207	81.0	U	ug/Kg	SW8270C	11/19/15
Acenaphthene	83-32-9	81.0	207	81.0	U	ug/Kg	SW8270C	11/19/15
2,4-Dinitrophenol	51-28-5	81.0	405	81.0	U	ug/Kg	SW8270C	11/19/15
4-Nitrophenol	100-02-7	81.0	207	81.0	U	ug/Kg	SW8270C	11/19/15
2,4-Dinitrotoluene	121-14-2	81.0	207	81.0	U	ug/Kg	SW8270C	11/19/15
Dibenzofuran	132-64-9	81.0	207	81.0	U	ug/Kg	SW8270C	11/19/15
Diethylphthalate	84-66-2	81.0	207	81.0	U	ug/Kg	SW8270C	11/19/15

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Client Sample ID: **D4ADS01-001.48-01**

Project Name: Alaska LNG
Sample Date: 11/02/15
Sample Time: 21:00
Type: Grab
Matrix: Soil
Basis: Dry Weight

Lab Information

Lab Sample ID: **P354901**

Date Received: 11/04/15
Dilution Factor: 1
Report Revision No.: 0

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Semi-Volatiles								
3-Nitroaniline	99-09-2	81.0	207	81.0	U	ug/Kg	SW8270C	11/19/15
Fluorene	86-73-7	81.0	207	81.0	U	ug/Kg	SW8270C	11/19/15
4-Chlorophenyl phenyl ether	7005-72-3	81.0	207	81.0	U	ug/Kg	SW8270C	11/19/15
4-Nitroaniline	100-01-6	81.0	207	81.0	U	ug/Kg	SW8270C	11/19/15
4,6-Dinitro-2-methyl phenol	534-52-1	81.0	207	81.0	U	ug/Kg	SW8270C	11/19/15
N-Nitrosodiphenylamine	86-30-6	81.0	207	81.0	U	ug/Kg	SW8270C	11/19/15
1,2-Diphenylhydrazine	122-66-7	81.0	207	81.0	U	ug/Kg	SW8270C	11/19/15
4-Bromophenyl phenyl ether	101-55-3	81.0	207	81.0	U	ug/Kg	SW8270C	11/19/15
Hexachlorobenzene	118-74-1	81.0	207	81.0	U	ug/Kg	SW8270C	11/19/15
Pentachlorophenol	87-86-5	81.0	207	81.0	U	ug/Kg	SW8270C	11/19/15
Phenanthrene	85-01-8	81.0	207	81.0	U	ug/Kg	SW8270C	11/19/15
Anthracene	120-12-7	81.0	207	81.0	U	ug/Kg	SW8270C	11/19/15
Carbazole	86-74-8	81.0	207	81.0	U	ug/Kg	SW8270C	11/19/15
Di-n-butylphthalate	84-74-2	81.0	207	81.0	U	ug/Kg	SW8270C	11/19/15
Fluoranthene	206-44-0	81.0	207	81.0	U	ug/Kg	SW8270C	11/19/15
Pyrene	129-00-0	81.0	207	81.0	U	ug/Kg	SW8270C	11/19/15
Butylbenzylphthalate	85-68-7	81.0	207	81.0	U	ug/Kg	SW8270C	11/19/15
Benzo(a)anthracene	56-55-3	81.0	207	81.0	U	ug/Kg	SW8270C	11/19/15
3,3'-Dichlorobenzidine	91-94-1	81.0	207	81.0	U	ug/Kg	SW8270C	11/19/15
Chrysene	218-01-9	81.0	207	81.0	U	ug/Kg	SW8270C	11/19/15
bis(2-Ethylhexyl)phthalate	117-81-7	81.0	207	81.0	U	ug/Kg	SW8270C	11/19/15
Di-n-octylphthalate	117-84-0	81.0	207	81.0	U	ug/Kg	SW8270C	11/19/15
Benzo(b)fluoroanthene	205-99-2	81.0	207	81.0	U	ug/Kg	SW8270C	11/19/15
Benzo(k)fluoranthene	207-08-9	81.0	207	81.0	U	ug/Kg	SW8270C	11/19/15
Benzo(a)pyrene	50-32-8	81.0	207	81.0	U	ug/Kg	SW8270C	11/19/15
Indeno(1,2,3-c,d)pyrene	193-39-5	81.0	207	81.0	U	ug/Kg	SW8270C	11/19/15
Dibenzo(a,h)anthracene	53-70-3	81.0	207	81.0	U	ug/Kg	SW8270C	11/19/15
Benzo(g,h,i)perylene	191-24-2	81.0	207	81.0	U	ug/Kg	SW8270C	11/19/15

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information		Lab Information	
Client Sample ID:	**D4ADS01-001.48-01**	**Lab Sample ID:**	**P354901**
Project Name:	Alaska LNG	Date Received:	11/04/15
Sample Date:	11/02/15	Dilution Factor:	1
Sample Time:	21:00	Report Revision No.:	0
Type:	Grab		
Matrix:	Soil		
Basis:	Dry Weight		

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Semi-Volatiles								

Surrogate	% Recovery	Control Limits	Qualifier
2-Fluorophenol	38	25-121	
Phenol-d5	51	24-113	
Nitrobenzene-d5	48	23-120	
2-Fluorobiphenyl	58	30-115	
2,4,6-Tribromophenol	53	19-122	
Terphenyl-d14	78	18-137	

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Client Sample ID: **D4BGC07-14.4416.57-01**

Project Name: Alaska LNG
Sample Date: 11/03/15
Sample Time: 10:00
Type: Grab
Matrix: Soil
Basis: Dry Weight

Lab Information

Lab Sample ID: **P354902**

Date Received: 11/04/15
Dilution Factor: 1
Report Revision No.: 0

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Semi-Volatiles								
N-Nitrosodimethylamine	62-75-9	81.2	207	81.2	U	ug/Kg	SW8270C	11/19/15
Pyridine	110-86-1	81.2	207	81.2	U	ug/Kg	SW8270C	11/19/15
Aniline	62-53-3	81.2	207	81.2	U	ug/Kg	SW8270C	11/19/15
Phenol	108-95-2	81.2	207	81.2	U	ug/Kg	SW8270C	11/19/15
bis(2-Chloroethyl)ether	111-44-4	81.2	207	81.2	U	ug/Kg	SW8270C	11/19/15
2-Chlorophenol	95-57-8	81.2	207	81.2	U	ug/Kg	SW8270C	11/19/15
1,3-Dichlorobenzene	541-73-1	81.2	207	81.2	U	ug/Kg	SW8270C	11/19/15
1,4-Dichlorobenzene	106-46-7	81.2	207	81.2	U	ug/Kg	SW8270C	11/19/15
Benzyl alcohol	100-51-6	81.2	207	81.2	U	ug/Kg	SW8270C	11/19/15
1,2-Dichlorobenzene	95-50-1	81.2	207	81.2	U	ug/Kg	SW8270C	11/19/15
2-Methylphenol	95-48-7	81.2	207	81.2	U	ug/Kg	SW8270C	11/19/15
bis(2-Chloroisopropyl)ether	108-60-1	81.2	207	81.2	U	ug/Kg	SW8270C	11/19/15
3-,4-Methylphenol	108-39-4/106	81.2	207	81.2	U	ug/Kg	SW8270C	11/19/15
N-Nitroso-di-n-propylamine	621-64-7	81.2	207	81.2	U	ug/Kg	SW8270C	11/19/15
Hexachloroethane	67-72-1	81.2	207	81.2	U	ug/Kg	SW8270C	11/19/15
Benzoic Acid	65-85-0	122	487	122	U	ug/Kg	SW8270C	11/19/15
Nitrobenzene	98-95-3	81.2	207	81.2	U	ug/Kg	SW8270C	11/19/15
Isophorone	78-59-1	81.2	207	81.2	U	ug/Kg	SW8270C	11/19/15
2-Nitrophenol	88-75-5	81.2	207	81.2	U	ug/Kg	SW8270C	11/19/15
2,4-Dimethylphenol	105-67-9	81.2	207	81.2	U	ug/Kg	SW8270C	11/19/15
bis(2-Chloroethoxy)methane	111-91-1	81.2	207	81.2	U	ug/Kg	SW8270C	11/19/15
2,4-Dichlorophenol	120-83-2	81.2	207	81.2	U	ug/Kg	SW8270C	11/19/15
1,2,4-Trichlorobenzene	120-82-1	81.2	207	81.2	U	ug/Kg	SW8270C	11/19/15
Naphthalene	91-20-3	81.2	207	81.2	U	ug/Kg	SW8270C	11/19/15
4-Chloroaniline	106-47-8	81.2	207	81.2	U	ug/Kg	SW8270C	11/19/15
Hexachlorobutadiene	87-68-3	81.2	207	81.2	U	ug/Kg	SW8270C	11/19/15
4-Chloro-3-methyl phenol	59-50-7	81.2	207	81.2	U	ug/Kg	SW8270C	11/19/15
2-Methylnaphthalene	91-57-6	81.2	207	81.2	U	ug/Kg	SW8270C	11/19/15
Hexachlorocyclopentadiene	77-47-4	81.2	207	81.2	U	ug/Kg	SW8270C	11/19/15
2,4,6-Trichlorophenol	88-06-2	81.2	207	81.2	U	ug/Kg	SW8270C	11/19/15
2,4,5-Trichlorophenol	95-95-4	81.2	207	81.2	U	ug/Kg	SW8270C	11/19/15
2-Chloronaphthalene	91-58-7	81.2	207	81.2	U	ug/Kg	SW8270C	11/19/15
2-Nitroaniline	88-74-4	81.2	207	81.2	U	ug/Kg	SW8270C	11/19/15
Dimethylphthalate	131-11-3	81.2	207	81.2	U	ug/Kg	SW8270C	11/19/15
Acenaphthylene	208-96-8	81.2	207	81.2	U	ug/Kg	SW8270C	11/19/15
2,6-Dinitrotoluene	606-20-2	81.2	207	81.2	U	ug/Kg	SW8270C	11/19/15
Acenaphthene	83-32-9	81.2	207	81.2	U	ug/Kg	SW8270C	11/19/15
2,4-Dinitrophenol	51-28-5	81.2	405	81.2	U	ug/Kg	SW8270C	11/19/15
4-Nitrophenol	100-02-7	81.2	207	81.2	U	ug/Kg	SW8270C	11/19/15
2,4-Dinitrotoluene	121-14-2	81.2	207	81.2	U	ug/Kg	SW8270C	11/19/15
Dibenzofuran	132-64-9	81.2	207	81.2	U	ug/Kg	SW8270C	11/19/15
Diethylphthalate	84-66-2	81.2	207	81.2	U	ug/Kg	SW8270C	11/19/15

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Client Sample ID: **D4BGC07-14.4416.57-01**

Project Name: Alaska LNG
Sample Date: 11/03/15
Sample Time: 10:00
Type: Grab
Matrix: Soil
Basis: Dry Weight

Lab Information

Lab Sample ID: **P354902**

Date Received: 11/04/15
Dilution Factor: 1
Report Revision No.: 0

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Semi-Volatiles								
3-Nitroaniline	99-09-2	81.2	207	81.2	U	ug/Kg	SW8270C	11/19/15
Fluorene	86-73-7	81.2	207	81.2	U	ug/Kg	SW8270C	11/19/15
4-Chlorophenyl phenyl ether	7005-72-3	81.2	207	81.2	U	ug/Kg	SW8270C	11/19/15
4-Nitroaniline	100-01-6	81.2	207	81.2	U	ug/Kg	SW8270C	11/19/15
4,6-Dinitro-2-methyl phenol	534-52-1	81.2	207	81.2	U	ug/Kg	SW8270C	11/19/15
N-Nitrosodiphenylamine	86-30-6	81.2	207	81.2	U	ug/Kg	SW8270C	11/19/15
1,2-Diphenylhydrazine	122-66-7	81.2	207	81.2	U	ug/Kg	SW8270C	11/19/15
4-Bromophenyl phenyl ether	101-55-3	81.2	207	81.2	U	ug/Kg	SW8270C	11/19/15
Hexachlorobenzene	118-74-1	81.2	207	81.2	U	ug/Kg	SW8270C	11/19/15
Pentachlorophenol	87-86-5	81.2	207	81.2	U	ug/Kg	SW8270C	11/19/15
Phenanthrene	85-01-8	81.2	207	81.2	U	ug/Kg	SW8270C	11/19/15
Anthracene	120-12-7	81.2	207	81.2	U	ug/Kg	SW8270C	11/19/15
Carbazole	86-74-8	81.2	207	81.2	U	ug/Kg	SW8270C	11/19/15
Di-n-butylphthalate	84-74-2	81.2	207	81.2	U	ug/Kg	SW8270C	11/19/15
Fluoranthene	206-44-0	81.2	207	81.2	U	ug/Kg	SW8270C	11/19/15
Pyrene	129-00-0	81.2	207	81.2	U	ug/Kg	SW8270C	11/19/15
Butylbenzylphthalate	85-68-7	81.2	207	81.2	U	ug/Kg	SW8270C	11/19/15
Benzo(a)anthracene	56-55-3	81.2	207	81.2	U	ug/Kg	SW8270C	11/19/15
3,3'-Dichlorobenzidine	91-94-1	81.2	207	81.2	U	ug/Kg	SW8270C	11/19/15
Chrysene	218-01-9	81.2	207	81.2	U	ug/Kg	SW8270C	11/19/15
bis(2-Ethylhexyl)phthalate	117-81-7	81.2	207	81.2	U	ug/Kg	SW8270C	11/19/15
Di-n-octylphthalate	117-84-0	81.2	207	81.2	U	ug/Kg	SW8270C	11/19/15
Benzo(b)fluoroanthene	205-99-2	81.2	207	81.2	U	ug/Kg	SW8270C	11/19/15
Benzo(k)fluoranthene	207-08-9	81.2	207	81.2	U	ug/Kg	SW8270C	11/19/15
Benzo(a)pyrene	50-32-8	81.2	207	81.2	U	ug/Kg	SW8270C	11/19/15
Indeno(1,2,3-c,d)pyrene	193-39-5	81.2	207	81.2	U	ug/Kg	SW8270C	11/19/15
Dibenzo(a,h)anthracene	53-70-3	81.2	207	81.2	U	ug/Kg	SW8270C	11/19/15
Benzo(g,h,i)perylene	191-24-2	81.2	207	81.2	U	ug/Kg	SW8270C	11/19/15

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information		Lab Information	
Client Sample ID:	**D4BGC07-14.4416.57-01**	**Lab Sample ID:**	**P354902**
Project Name:	Alaska LNG	Date Received:	11/04/15
Sample Date:	11/03/15	Dilution Factor:	1
Sample Time:	10:00	Report Revision No.:	0
Type:	Grab		
Matrix:	Soil		
Basis:	Dry Weight		

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Semi-Volatiles								

Surrogate	% Recovery	Control Limits	Qualifier
2-Fluorophenol	48	25-121	
Phenol-d5	54	24-113	
Nitrobenzene-d5	56	23-120	
2-Fluorobiphenyl	66	30-115	
2,4,6-Tribromophenol	58	19-122	
Terphenyl-d14	88	18-137	

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Client Sample ID: **D4BGC06-11.8113.54-01**

Project Name: Alaska LNG
Sample Date: 11/03/15
Sample Time: 11:00
Type: Grab
Matrix: Soil
Basis: Dry Weight

Lab Information

Lab Sample ID: **P354903**

Date Received: 11/04/15
Dilution Factor: 1
Report Revision No.: 0

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Semi-Volatiles								
N-Nitrosodimethylamine	62-75-9	81.0	206	81.0	U	ug/Kg	SW8270C	11/19/15
Pyridine	110-86-1	81.0	206	81.0	U	ug/Kg	SW8270C	11/19/15
Aniline	62-53-3	81.0	206	81.0	U	ug/Kg	SW8270C	11/19/15
Phenol	108-95-2	81.0	206	81.0	U	ug/Kg	SW8270C	11/19/15
bis(2-Chloroethyl)ether	111-44-4	81.0	206	81.0	U	ug/Kg	SW8270C	11/19/15
2-Chlorophenol	95-57-8	81.0	206	81.0	U	ug/Kg	SW8270C	11/19/15
1,3-Dichlorobenzene	541-73-1	81.0	206	81.0	U	ug/Kg	SW8270C	11/19/15
1,4-Dichlorobenzene	106-46-7	81.0	206	81.0	U	ug/Kg	SW8270C	11/19/15
Benzyl alcohol	100-51-6	81.0	206	81.0	U	ug/Kg	SW8270C	11/19/15
1,2-Dichlorobenzene	95-50-1	81.0	206	81.0	U	ug/Kg	SW8270C	11/19/15
2-Methylphenol	95-48-7	81.0	206	81.0	U	ug/Kg	SW8270C	11/19/15
bis(2-Chloroisopropyl)ether	108-60-1	81.0	206	81.0	U	ug/Kg	SW8270C	11/19/15
3-,4-Methylphenol	108-39-4/106	81.0	206	81.0	U	ug/Kg	SW8270C	11/19/15
N-Nitroso-di-n-propylamine	621-64-7	81.0	206	81.0	U	ug/Kg	SW8270C	11/19/15
Hexachloroethane	67-72-1	81.0	206	81.0	U	ug/Kg	SW8270C	11/19/15
Benzoic Acid	65-85-0	121	486	121	U	ug/Kg	SW8270C	11/19/15
Nitrobenzene	98-95-3	81.0	206	81.0	U	ug/Kg	SW8270C	11/19/15
Isophorone	78-59-1	81.0	206	81.0	U	ug/Kg	SW8270C	11/19/15
2-Nitrophenol	88-75-5	81.0	206	81.0	U	ug/Kg	SW8270C	11/19/15
2,4-Dimethylphenol	105-67-9	81.0	206	81.0	U	ug/Kg	SW8270C	11/19/15
bis(2-Chloroethoxy)methane	111-91-1	81.0	206	81.0	U	ug/Kg	SW8270C	11/19/15
2,4-Dichlorophenol	120-83-2	81.0	206	81.0	U	ug/Kg	SW8270C	11/19/15
1,2,4-Trichlorobenzene	120-82-1	81.0	206	81.0	U	ug/Kg	SW8270C	11/19/15
Naphthalene	91-20-3	81.0	206	81.0	U	ug/Kg	SW8270C	11/19/15
4-Chloroaniline	106-47-8	81.0	206	81.0	U	ug/Kg	SW8270C	11/19/15
Hexachlorobutadiene	87-68-3	81.0	206	81.0	U	ug/Kg	SW8270C	11/19/15
4-Chloro-3-methyl phenol	59-50-7	81.0	206	81.0	U	ug/Kg	SW8270C	11/19/15
2-Methylnaphthalene	91-57-6	81.0	206	81.0	U	ug/Kg	SW8270C	11/19/15
Hexachlorocyclopentadiene	77-47-4	81.0	206	81.0	U	ug/Kg	SW8270C	11/19/15
2,4,6-Trichlorophenol	88-06-2	81.0	206	81.0	U	ug/Kg	SW8270C	11/19/15
2,4,5-Trichlorophenol	95-95-4	81.0	206	81.0	U	ug/Kg	SW8270C	11/19/15
2-Chloronaphthalene	91-58-7	81.0	206	81.0	U	ug/Kg	SW8270C	11/19/15
2-Nitroaniline	88-74-4	81.0	206	81.0	U	ug/Kg	SW8270C	11/19/15
Dimethylphthalate	131-11-3	81.0	206	81.0	U	ug/Kg	SW8270C	11/19/15
Acenaphthylene	208-96-8	81.0	206	81.0	U	ug/Kg	SW8270C	11/19/15
2,6-Dinitrotoluene	606-20-2	81.0	206	81.0	U	ug/Kg	SW8270C	11/19/15
Acenaphthene	83-32-9	81.0	206	81.0	U	ug/Kg	SW8270C	11/19/15
2,4-Dinitrophenol	51-28-5	81.0	404	81.0	U	ug/Kg	SW8270C	11/19/15
4-Nitrophenol	100-02-7	81.0	206	81.0	U	ug/Kg	SW8270C	11/19/15
2,4-Dinitrotoluene	121-14-2	81.0	206	81.0	U	ug/Kg	SW8270C	11/19/15
Dibenzofuran	132-64-9	81.0	206	81.0	U	ug/Kg	SW8270C	11/19/15
Diethylphthalate	84-66-2	81.0	206	81.0	U	ug/Kg	SW8270C	11/19/15

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Client Sample ID: **D4BGC06-11.8113.54-01**

Project Name: Alaska LNG
Sample Date: 11/03/15
Sample Time: 11:00
Type: Grab
Matrix: Soil
Basis: Dry Weight

Lab Information

Lab Sample ID: **P354903**

Date Received: 11/04/15
Dilution Factor: 1
Report Revision No.: 0

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Semi-Volatiles								
3-Nitroaniline	99-09-2	81.0	206	81.0	U	ug/Kg	SW8270C	11/19/15
Fluorene	86-73-7	81.0	206	81.0	U	ug/Kg	SW8270C	11/19/15
4-Chlorophenyl phenyl ether	7005-72-3	81.0	206	81.0	U	ug/Kg	SW8270C	11/19/15
4-Nitroaniline	100-01-6	81.0	206	81.0	U	ug/Kg	SW8270C	11/19/15
4,6-Dinitro-2-methyl phenol	534-52-1	81.0	206	81.0	U	ug/Kg	SW8270C	11/19/15
N-Nitrosodiphenylamine	86-30-6	81.0	206	81.0	U	ug/Kg	SW8270C	11/19/15
1,2-Diphenylhydrazine	122-66-7	81.0	206	81.0	U	ug/Kg	SW8270C	11/19/15
4-Bromophenyl phenyl ether	101-55-3	81.0	206	81.0	U	ug/Kg	SW8270C	11/19/15
Hexachlorobenzene	118-74-1	81.0	206	81.0	U	ug/Kg	SW8270C	11/19/15
Pentachlorophenol	87-86-5	81.0	206	81.0	U	ug/Kg	SW8270C	11/19/15
Phenanthrene	85-01-8	81.0	206	81.0	U	ug/Kg	SW8270C	11/19/15
Anthracene	120-12-7	81.0	206	81.0	U	ug/Kg	SW8270C	11/19/15
Carbazole	86-74-8	81.0	206	81.0	U	ug/Kg	SW8270C	11/19/15
Di-n-butylphthalate	84-74-2	81.0	206	81.0	U	ug/Kg	SW8270C	11/19/15
Fluoranthene	206-44-0	81.0	206	81.0	U	ug/Kg	SW8270C	11/19/15
Pyrene	129-00-0	81.0	206	81.0	U	ug/Kg	SW8270C	11/19/15
Butylbenzylphthalate	85-68-7	81.0	206	81.0	U	ug/Kg	SW8270C	11/19/15
Benzo(a)anthracene	56-55-3	81.0	206	81.0	U	ug/Kg	SW8270C	11/19/15
3,3'-Dichlorobenzidine	91-94-1	81.0	206	81.0	U	ug/Kg	SW8270C	11/19/15
Chrysene	218-01-9	81.0	206	81.0	U	ug/Kg	SW8270C	11/19/15
bis(2-Ethylhexyl)phthalate	117-81-7	81.0	206	81.0	U	ug/Kg	SW8270C	11/19/15
Di-n-octylphthalate	117-84-0	81.0	206	81.0	U	ug/Kg	SW8270C	11/19/15
Benzo(b)fluoroanthene	205-99-2	81.0	206	81.0	U	ug/Kg	SW8270C	11/19/15
Benzo(k)fluoranthene	207-08-9	81.0	206	81.0	U	ug/Kg	SW8270C	11/19/15
Benzo(a)pyrene	50-32-8	81.0	206	81.0	U	ug/Kg	SW8270C	11/19/15
Indeno(1,2,3-c,d)pyrene	193-39-5	81.0	206	81.0	U	ug/Kg	SW8270C	11/19/15
Dibenzo(a,h)anthracene	53-70-3	81.0	206	81.0	U	ug/Kg	SW8270C	11/19/15
Benzo(g,h,i)perylene	191-24-2	81.0	206	81.0	U	ug/Kg	SW8270C	11/19/15

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information		Lab Information	
Client Sample ID:	**D4BGC06-11.8113.54-01**	**Lab Sample ID:**	**P354903**
Project Name:	Alaska LNG	Date Received:	11/04/15
Sample Date:	11/03/15	Dilution Factor:	1
Sample Time:	11:00	Report Revision No.:	0
Type:	Grab		
Matrix:	Soil		
Basis:	Dry Weight		

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Semi-Volatiles								

Surrogate	% Recovery	Control Limits	Qualifier
2-Fluorophenol	39	25-121	
Phenol-d5	46	24-113	
Nitrobenzene-d5	47	23-120	
2-Fluorobiphenyl	54	30-115	
2,4,6-Tribromophenol	51	19-122	
Terphenyl-d14	73	18-137	

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information		Lab Information	
Client Sample ID:	**SB3-1107**	**Lab Sample ID:**	**SB3-1107**
Project Name:	Alaska LNG	Date Received:	N/A
Sample Date:	N/A	Dilution Factor:	1
Sample Time:	N/A	Report Revision No.:	0
Type:	QC		
Matrix:	Soil		
Basis:	Dry Weight		

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Semi-Volatiles								
N-Nitrosodimethylamine	62-75-9	66.7	170	66.7	U	ug/Kg	SW8270C	11/19/15
Pyridine	110-86-1	66.7	170	66.7	U	ug/Kg	SW8270C	11/19/15
Aniline	62-53-3	66.7	170	66.7	U	ug/Kg	SW8270C	11/19/15
Phenol	108-95-2	66.7	170	66.7	U	ug/Kg	SW8270C	11/19/15
bis(2-Chloroethyl)ether	111-44-4	66.7	170	66.7	U	ug/Kg	SW8270C	11/19/15
2-Chlorophenol	95-57-8	66.7	170	66.7	U	ug/Kg	SW8270C	11/19/15
1,3-Dichlorobenzene	541-73-1	66.7	170	66.7	U	ug/Kg	SW8270C	11/19/15
1,4-Dichlorobenzene	106-46-7	66.7	170	66.7	U	ug/Kg	SW8270C	11/19/15
Benzyl alcohol	100-51-6	66.7	170	66.7	U	ug/Kg	SW8270C	11/19/15
1,2-Dichlorobenzene	95-50-1	66.7	170	66.7	U	ug/Kg	SW8270C	11/19/15
2-Methylphenol	95-48-7	66.7	170	66.7	U	ug/Kg	SW8270C	11/19/15
bis(2-Chloroisopropyl)ether	108-60-1	66.7	170	66.7	U	ug/Kg	SW8270C	11/19/15
3-,4-Methylphenol	108-39-4/106	66.7	170	66.7	U	ug/Kg	SW8270C	11/19/15
N-Nitroso-di-n-propylamine	621-64-7	66.7	170	66.7	U	ug/Kg	SW8270C	11/19/15
Hexachloroethane	67-72-1	66.7	170	66.7	U	ug/Kg	SW8270C	11/19/15
Benzoic Acid	65-85-0	100	400	100	U	ug/Kg	SW8270C	11/19/15
Nitrobenzene	98-95-3	66.7	170	66.7	U	ug/Kg	SW8270C	11/19/15
Isophorone	78-59-1	66.7	170	66.7	U	ug/Kg	SW8270C	11/19/15
2-Nitrophenol	88-75-5	66.7	170	66.7	U	ug/Kg	SW8270C	11/19/15
2,4-Dimethylphenol	105-67-9	66.7	170	66.7	U	ug/Kg	SW8270C	11/19/15
bis(2-Chloroethoxy)methane	111-91-1	66.7	170	66.7	U	ug/Kg	SW8270C	11/19/15
2,4-Dichlorophenol	120-83-2	66.7	170	66.7	U	ug/Kg	SW8270C	11/19/15
1,2,4-Trichlorobenzene	120-82-1	66.7	170	66.7	U	ug/Kg	SW8270C	11/19/15
Naphthalene	91-20-3	66.7	170	66.7	U	ug/Kg	SW8270C	11/19/15
4-Chloroaniline	106-47-8	66.7	170	66.7	U	ug/Kg	SW8270C	11/19/15
Hexachlorobutadiene	87-68-3	66.7	170	66.7	U	ug/Kg	SW8270C	11/19/15
4-Chloro-3-methyl phenol	59-50-7	66.7	170	66.7	U	ug/Kg	SW8270C	11/19/15
2-Methylnaphthalene	91-57-6	66.7	170	66.7	U	ug/Kg	SW8270C	11/19/15
Hexachlorocyclopentadiene	77-47-4	66.7	170	66.7	U	ug/Kg	SW8270C	11/19/15
2,4,6-Trichlorophenol	88-06-2	66.7	170	66.7	U	ug/Kg	SW8270C	11/19/15
2,4,5-Trichlorophenol	95-95-4	66.7	170	66.7	U	ug/Kg	SW8270C	11/19/15
2-Chloronaphthalene	91-58-7	66.7	170	66.7	U	ug/Kg	SW8270C	11/19/15
2-Nitroaniline	88-74-4	66.7	170	66.7	U	ug/Kg	SW8270C	11/19/15
Dimethylphthalate	131-11-3	66.7	170	66.7	U	ug/Kg	SW8270C	11/19/15
Acenaphthylene	208-96-8	66.7	170	66.7	U	ug/Kg	SW8270C	11/19/15
2,6-Dinitrotoluene	606-20-2	66.7	170	66.7	U	ug/Kg	SW8270C	11/19/15
Acenaphthene	83-32-9	66.7	170	66.7	U	ug/Kg	SW8270C	11/19/15
2,4-Dinitrophenol	51-28-5	66.7	333	66.7	U	ug/Kg	SW8270C	11/19/15
4-Nitrophenol	100-02-7	66.7	170	66.7	U	ug/Kg	SW8270C	11/19/15
2,4-Dinitrotoluene	121-14-2	66.7	170	66.7	U	ug/Kg	SW8270C	11/19/15
Dibenzofuran	132-64-9	66.7	170	66.7	U	ug/Kg	SW8270C	11/19/15
Diethylphthalate	84-66-2	66.7	170	66.7	U	ug/Kg	SW8270C	11/19/15

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information		Lab Information	
Client Sample ID:	**SB3-1107**	**Lab Sample ID:**	**SB3-1107**
Project Name:	Alaska LNG	Date Received:	N/A
Sample Date:	N/A	Dilution Factor:	1
Sample Time:	N/A	Report Revision No.:	0
Type:	QC		
Matrix:	Soil		
Basis:	Dry Weight		

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Semi-Volatiles								
3-Nitroaniline	99-09-2	66.7	170	66.7	U	ug/Kg	SW8270C	11/19/15
Fluorene	86-73-7	66.7	170	66.7	U	ug/Kg	SW8270C	11/19/15
4-Chlorophenyl phenyl ether	7005-72-3	66.7	170	66.7	U	ug/Kg	SW8270C	11/19/15
4-Nitroaniline	100-01-6	66.7	170	66.7	U	ug/Kg	SW8270C	11/19/15
4,6-Dinitro-2-methyl phenol	534-52-1	66.7	170	66.7	U	ug/Kg	SW8270C	11/19/15
N-Nitrosodiphenylamine	86-30-6	66.7	170	66.7	U	ug/Kg	SW8270C	11/19/15
1,2-Diphenylhydrazine	122-66-7	66.7	170	66.7	U	ug/Kg	SW8270C	11/19/15
4-Bromophenyl phenyl ether	101-55-3	66.7	170	66.7	U	ug/Kg	SW8270C	11/19/15
Hexachlorobenzene	118-74-1	66.7	170	66.7	U	ug/Kg	SW8270C	11/19/15
Pentachlorophenol	87-86-5	66.7	170	66.7	U	ug/Kg	SW8270C	11/19/15
Phenanthrene	85-01-8	66.7	170	66.7	U	ug/Kg	SW8270C	11/19/15
Anthracene	120-12-7	66.7	170	66.7	U	ug/Kg	SW8270C	11/19/15
Carbazole	86-74-8	66.7	170	66.7	U	ug/Kg	SW8270C	11/19/15
Di-n-butylphthalate	84-74-2	66.7	170	66.7	U	ug/Kg	SW8270C	11/19/15
Fluoranthene	206-44-0	66.7	170	66.7	U	ug/Kg	SW8270C	11/19/15
Pyrene	129-00-0	66.7	170	66.7	U	ug/Kg	SW8270C	11/19/15
Butylbenzylphthalate	85-68-7	66.7	170	66.7	U	ug/Kg	SW8270C	11/19/15
Benzo(a)anthracene	56-55-3	66.7	170	66.7	U	ug/Kg	SW8270C	11/19/15
3,3'-Dichlorobenzidine	91-94-1	66.7	170	66.7	U	ug/Kg	SW8270C	11/19/15
Chrysene	218-01-9	66.7	170	66.7	U	ug/Kg	SW8270C	11/19/15
bis(2-Ethylhexyl)phthalate	117-81-7	66.7	170	66.7	U	ug/Kg	SW8270C	11/19/15
Di-n-octylphthalate	117-84-0	66.7	170	66.7	U	ug/Kg	SW8270C	11/19/15
Benzo(b)fluoroanthene	205-99-2	66.7	170	66.7	U	ug/Kg	SW8270C	11/19/15
Benzo(k)fluoranthene	207-08-9	66.7	170	66.7	U	ug/Kg	SW8270C	11/19/15
Benzo(a)pyrene	50-32-8	66.7	170	66.7	U	ug/Kg	SW8270C	11/19/15
Indeno(1,2,3-c,d)pyrene	193-39-5	66.7	170	66.7	U	ug/Kg	SW8270C	11/19/15
Dibenzo(a,h)anthracene	53-70-3	66.7	170	66.7	U	ug/Kg	SW8270C	11/19/15
Benzo(g,h,i)perylene	191-24-2	66.7	170	66.7	U	ug/Kg	SW8270C	11/19/15

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information		Lab Information	
Client Sample ID:	**SB3-1107**	**Lab Sample ID:**	**SB3-1107**
Project Name:	Alaska LNG	Date Received:	N/A
Sample Date:	N/A	Dilution Factor:	1
Sample Time:	N/A	Report Revision No.:	0
Type:	QC		
Matrix:	Soil		
Basis:	Dry Weight		

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Semi-Volatiles								

Surrogate	% Recovery	Control Limits	Qualifier
2-Fluorophenol	54	25-121	
Phenol-d5	61	24-113	
Nitrobenzene-d5	52	23-120	
2-Fluorobiphenyl	61	30-115	
2,4,6-Tribromophenol	64	19-122	
Terphenyl-d14	84	18-137	

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Project Name: Alaska LNG
Type: QC
Matrix: Soil

Lab Information

LCS ID: BS4S1107

Report Revision No.: 0
Dilution Factor: 1

Analyte	CAS#	Spike Amount	Sample Result	Units	%Recovery	Analysis Method	Date Analyzed
GC/MS Semi-Volatiles							
N-Nitrosodimethylamine	62-75-9	8000	5620	ug/Kg	70	SW8270C	11/19/15
Pyridine	110-86-1	8000	4690	ug/Kg	59	SW8270C	11/19/15
Aniline	62-53-3	8000	5330	ug/Kg	67	SW8270C	11/19/15
Phenol	108-95-2	8000	5770	ug/Kg	72	SW8270C	11/19/15
bis(2-Chloroethyl)ether	111-44-4	8000	5900	ug/Kg	74	SW8270C	11/19/15
2-Chlorophenol	95-57-8	8000	5690	ug/Kg	71	SW8270C	11/19/15
1,3-Dichlorobenzene	541-73-1	8000	5540	ug/Kg	69	SW8270C	11/19/15
1,4-Dichlorobenzene	106-46-7	8000	5580	ug/Kg	70	SW8270C	11/19/15
Benzyl alcohol	100-51-6	8000	6070	ug/Kg	76	SW8270C	11/19/15
1,2-Dichlorobenzene	95-50-1	8000	5700	ug/Kg	71	SW8270C	11/19/15
2-Methylphenol	95-48-7	8000	5950	ug/Kg	74	SW8270C	11/19/15
bis(2-Chloroisopropyl)ether	108-60-1	8000	6060	ug/Kg	76	SW8270C	11/19/15
3-,4-Methylphenol	108-39-4/106	8000	5990	ug/Kg	75	SW8270C	11/19/15
N-Nitroso-di-n-propylamine	621-64-7	8000	6140	ug/Kg	77	SW8270C	11/19/15
Hexachloroethane	67-72-1	8000	5570	ug/Kg	70	SW8270C	11/19/15
Benzoic Acid	65-85-0	8000	6850	ug/Kg	86	SW8270C	11/19/15
Nitrobenzene	98-95-3	8000	5980	ug/Kg	75	SW8270C	11/19/15
Isophorone	78-59-1	8000	6000	ug/Kg	75	SW8270C	11/19/15
2-Nitrophenol	88-75-5	8000	6040	ug/Kg	76	SW8270C	11/19/15
2,4-Dimethylphenol	105-67-9	8000	5410	ug/Kg	68	SW8270C	11/19/15
bis(2-Chloroethoxy)methane	111-91-1	8000	5980	ug/Kg	75	SW8270C	11/19/15
2,4-Dichlorophenol	120-83-2	8000	5940	ug/Kg	74	SW8270C	11/19/15
1,2,4-Trichlorobenzene	120-82-1	8000	5830	ug/Kg	73	SW8270C	11/19/15
Naphthalene	91-20-3	8000	6000	ug/Kg	75	SW8270C	11/19/15
4-Chloroaniline	106-47-8	8000	6050	ug/Kg	76	SW8270C	11/19/15
Hexachlorobutadiene	87-68-3	8000	5860	ug/Kg	73	SW8270C	11/19/15
4-Chloro-3-methyl phenol	59-50-7	8000	6220	ug/Kg	78	SW8270C	11/19/15
2-Methylnaphthalene	91-57-6	8000	6070	ug/Kg	76	SW8270C	11/19/15
Hexachlorocyclopentadiene	77-47-4	8000	4900	ug/Kg	61	SW8270C	11/19/15
2,4,6-Trichlorophenol	88-06-2	8000	6270	ug/Kg	78	SW8270C	11/19/15
2,4,5-Trichlorophenol	95-95-4	8000	6280	ug/Kg	79	SW8270C	11/19/15
2-Chloronaphthalene	91-58-7	8000	6220	ug/Kg	78	SW8270C	11/19/15
2-Nitroaniline	88-74-4	8000	6440	ug/Kg	80	SW8270C	11/19/15
Dimethylphthalate	131-11-3	8000	6330	ug/Kg	79	SW8270C	11/19/15
Acenaphthylene	208-96-8	8000	6160	ug/Kg	77	SW8270C	11/19/15
2,6-Dinitrotoluene	606-20-2	8000	6420	ug/Kg	80	SW8270C	11/19/15
Acenaphthene	83-32-9	8000	6270	ug/Kg	78	SW8270C	11/19/15
2,4-Dinitrophenol	51-28-5	8000	6310	ug/Kg	79	SW8270C	11/19/15
4-Nitrophenol	100-02-7	8000	6500	ug/Kg	81	SW8270C	11/19/15
2,4-Dinitrotoluene	121-14-2	8000	6470	ug/Kg	81	SW8270C	11/19/15
Dibenzofuran	132-64-9	8000	6200	ug/Kg	78	SW8270C	11/19/15
Diethylphthalate	84-66-2	8000	6290	ug/Kg	79	SW8270C	11/19/15

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Project Name: Alaska LNG
Type: QC
Matrix: Soil

Lab Information

LCS ID: BS4S1107

Report Revision No.: 0
Dilution Factor: 1

Analyte	CAS#	Spike Amount	Sample Result	Units	%Recovery	Analysis Method	Date Analyzed
GC/MS Semi-Volatiles							
3-Nitroaniline	99-09-2	8000	6280	ug/Kg	79	SW8270C	11/19/15
Fluorene	86-73-7	8000	6490	ug/Kg	81	SW8270C	11/19/15
4-Chlorophenyl phenyl ether	7005-72-3	8000	6500	ug/Kg	81	SW8270C	11/19/15
4-Nitroaniline	100-01-6	8000	6670	ug/Kg	83	SW8270C	11/19/15
4,6-Dinitro-2-methyl phenol	534-52-1	8000	5940	ug/Kg	74	SW8270C	11/19/15
N-Nitrosodiphenylamine	86-30-6	8000	6230	ug/Kg	78	SW8270C	11/19/15
1,2-Diphenylhydrazine	122-66-7	8000	6240	ug/Kg	78	SW8270C	11/19/15
4-Bromophenyl phenyl ether	101-55-3	8000	6340	ug/Kg	79	SW8270C	11/19/15
Hexachlorobenzene	118-74-1	8000	6400	ug/Kg	80	SW8270C	11/19/15
Pentachlorophenol	87-86-5	8000	6340	ug/Kg	79	SW8270C	11/19/15
Phenanthrene	85-01-8	8000	6350	ug/Kg	79	SW8270C	11/19/15
Anthracene	120-12-7	8000	6360	ug/Kg	79	SW8270C	11/19/15
Carbazole	86-74-8	8000	6410	ug/Kg	80	SW8270C	11/19/15
Di-n-butylphthalate	84-74-2	8000	6920	ug/Kg	86	SW8270C	11/19/15
Fluoranthene	206-44-0	8000	7090	ug/Kg	89	SW8270C	11/19/15
Pyrene	129-00-0	8000	6590	ug/Kg	82	SW8270C	11/19/15
Butylbenzylphthalate	85-68-7	8000	6450	ug/Kg	81	SW8270C	11/19/15
Benzo(a)anthracene	56-55-3	8000	6610	ug/Kg	83	SW8270C	11/19/15
3,3'-Dichlorobenzidine	91-94-1	8000	6600	ug/Kg	82	SW8270C	11/19/15
Chrysene	218-01-9	8000	6190	ug/Kg	77	SW8270C	11/19/15
bis(2-Ethylhexyl)phthalate	117-81-7	8000	6160	ug/Kg	77	SW8270C	11/19/15
Di-n-octylphthalate	117-84-0	8000	6270	ug/Kg	78	SW8270C	11/19/15
Benzo(b)fluoroanthene	205-99-2	8000	6410	ug/Kg	80	SW8270C	11/19/15
Benzo(k)fluoranthene	207-08-9	8000	6270	ug/Kg	78	SW8270C	11/19/15
Benzo(a)pyrene	50-32-8	8000	6560	ug/Kg	82	SW8270C	11/19/15
Indeno(1,2,3-c,d)pyrene	193-39-5	8000	6680	ug/Kg	83	SW8270C	11/19/15
Dibenzo(a,h)anthracene	53-70-3	8000	6660	ug/Kg	83	SW8270C	11/19/15
Benzo(g,h,i)perylene	191-24-2	8000	6350	ug/Kg	79	SW8270C	11/19/15

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information		Lab Information	
		LCS ID:	BS4S1107
Project Name:	Alaska LNG	Report Revision No.:	0
Type:	QC	Dilution Factor:	1
Matrix:	Soil		

Analyte	CAS#	Spike Amount	Sample Result	Units	%Recovery	Analysis Method	Date Analyzed
GC/MS Semi-Volatiles							

Surrogate	% Recovery	Control Limits	Qualifier
2-Fluorophenol	61	25-121	
Phenol-d5	70	24-113	
Nitrobenzene-d5	68	23-120	
2-Fluorobiphenyl	75	30-115	
2,4,6-Tribromophenol	78	19-122	
Terphenyl-d14	92	18-137	

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

CH2MHILL
Applied Sciences Laboratory (ASL)

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

CASE NARRATIVE
GC VOLATILES ANALYSIS

Lab Name: CH2M HILL ASL **ASL SDG#:** P3549

Project: Alaska LNG **Project #:** 653488.16.06

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

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

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

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

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

Method(s):
AK101: SW5030

Analytical Exception(s):
All surrogates were manually integrated per method requirements.

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information		Lab Information	
Client Sample ID:	**D4ADS01-001.48-01**	**Lab Sample ID:**	**P354901**
Project Name:	Alaska LNG	Date Received:	11/04/15
Sample Date:	11/02/15	Dilution Factor:	1
Sample Time:	21:00	Report Revision No.:	0
Type:	Grab		
Matrix:	Soil		
Basis:	Dry Weight		

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC Volatiles								
TPH-Gasoline	TPH-Gasoline	0.69	1.95	0.69	U	mg/Kg	AK101	11/09/15

Surrogate	% Recovery	Control Limits	Qualifier
a,a,a-Trifluorotoluene	79	50-150	
4-Bromofluorobenzene	105	50-150	

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information		Lab Information	
Client Sample ID:	**D4BGC07-14.4416.57-01**	**Lab Sample ID:**	**P354902**
Project Name:	Alaska LNG	Date Received:	11/04/15
Sample Date:	11/03/15	Dilution Factor:	1
Sample Time:	10:00	Report Revision No.:	0
Type:	Grab		
Matrix:	Soil		
Basis:	Dry Weight		

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC Volatiles								
TPH-Gasoline	TPH-Gasoline	0.74	2.09	0.74	U	mg/Kg	AK101	11/09/15

Surrogate	% Recovery	Control Limits	Qualifier
a,a,a-Trifluorotoluene	78	50-150	
4-Bromofluorobenzene	107	50-150	

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information		Lab Information	
Client Sample ID:	**SB1-1109**	**Lab Sample ID:**	**SB1-1109**
Project Name:	Alaska LNG	Date Received:	N/A
Sample Date:	N/A	Dilution Factor:	1
Sample Time:	N/A	Report Revision No.:	0
Type:	QC		
Matrix:	Soil		
Basis:	Dry Weight		

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC Volatiles								
TPH-Gasoline	TPH-Gasoline	0.71	2.00	0.71	U	mg/Kg	AK101	11/09/15

Surrogate	% Recovery	Control Limits	Qualifier
a,a,a-Trifluorotoluene	96	60-120	
4-Bromofluorobenzene	107	60-120	

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Project Name: Alaska LNG
Type: QC
Matrix: Soil

Lab Information

LCS ID: BS1S1109

Report Revision No.: 0
Dilution Factor: 1

Analyte	CAS#	Spike Amount	Sample Result	Units	%Recovery	Analysis Method	Date Analyzed
GC Semi-Volatiles							
TPH-Gasoline	TPH-Gasoline	20.0	19.8	mg/Kg	99	AK101	11/09/15

Surrogate	% Recovery	Control Limits	Qualifier
a,a,a-Trifluorotoluene	93	60-120	
4-Bromofluorobenzene	97	60-120	

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

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

CASE NARRATIVE
PCB AROCLORS ANALYSIS

Lab Name: CH2M HILL ASL **ASL SDG#:** P3549

Project: Alaska LNG **Project #:** 653488.16.06

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

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

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

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

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

Method(s):
SW8082: SW3550

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Client Sample ID: **D4ADS01-001.48-01**

Project Name: Alaska LNG
Sample Date: 11/02/15
Sample Time: 21:00
Type: Grab
Matrix: Soil
Basis: Dry Weight

Lab Information

Lab Sample ID: **P354901**

Date Received: 11/04/15
Dilution Factor: 1
Report Revision No.: 0

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC Semi-Volatiles								
Aroclor-1016	12674-11-2	6.06	30.3	6.06	U	ug/Kg	SW8082	11/10/15
Aroclor-1260	11096-82-5	6.06	30.3	6.06	U	ug/Kg	SW8082	11/10/15
Aroclor-1221	11104-28-2	12.1	30.3	12.1	U	ug/Kg	SW8082	11/10/15
Aroclor-1232	11141-16-5	6.06	30.3	6.06	U	ug/Kg	SW8082	11/10/15
Aroclor-1242	53469-21-9	6.06	30.3	6.06	U	ug/Kg	SW8082	11/10/15
Aroclor-1248	12672-29-6	6.06	30.3	6.06	U	ug/Kg	SW8082	11/10/15
Aroclor-1254	11097-69-1	6.06	30.3	6.06	U	ug/Kg	SW8082	11/10/15

Surrogate	% Recovery	Control Limits	Qualifier
DCBP	88	25-143	

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Client Sample ID: **D4BGC07-14.4416.57-01**

Project Name: Alaska LNG
Sample Date: 11/03/15
Sample Time: 10:00
Type: Grab
Matrix: Soil
Basis: Dry Weight

Lab Information

Lab Sample ID: **P354902**

Date Received: 11/04/15
Dilution Factor: 1
Report Revision No.: 0

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC Semi-Volatiles								
Aroclor-1016	12674-11-2	6.10	30.5	6.10	U	ug/Kg	SW8082	11/10/15
Aroclor-1260	11096-82-5	6.10	30.5	6.10	U	ug/Kg	SW8082	11/10/15
Aroclor-1221	11104-28-2	12.2	30.5	12.2	U	ug/Kg	SW8082	11/10/15
Aroclor-1232	11141-16-5	6.10	30.5	6.10	U	ug/Kg	SW8082	11/10/15
Aroclor-1242	53469-21-9	6.10	30.5	6.10	U	ug/Kg	SW8082	11/10/15
Aroclor-1248	12672-29-6	6.10	30.5	6.10	U	ug/Kg	SW8082	11/10/15
Aroclor-1254	11097-69-1	6.10	30.5	6.10	U	ug/Kg	SW8082	11/10/15

Surrogate	% Recovery	Control Limits	Qualifier
DCBP	89	25-143	

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Client Sample ID: **D4BGC06-11.8113.54-01**

Project Name: Alaska LNG
Sample Date: 11/03/15
Sample Time: 11:00
Type: Grab
Matrix: Soil
Basis: Dry Weight

Lab Information

Lab Sample ID: **P354903**

Date Received: 11/04/15
Dilution Factor: 1
Report Revision No.: 0

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC Semi-Volatiles								
Aroclor-1016	12674-11-2	6.09	30.5	6.09	U	ug/Kg	SW8082	11/10/15
Aroclor-1260	11096-82-5	6.09	30.5	6.09	U	ug/Kg	SW8082	11/10/15
Aroclor-1221	11104-28-2	12.2	30.5	12.2	U	ug/Kg	SW8082	11/10/15
Aroclor-1232	11141-16-5	6.09	30.5	6.09	U	ug/Kg	SW8082	11/10/15
Aroclor-1242	53469-21-9	6.09	30.5	6.09	U	ug/Kg	SW8082	11/10/15
Aroclor-1248	12672-29-6	6.09	30.5	6.09	U	ug/Kg	SW8082	11/10/15
Aroclor-1254	11097-69-1	6.09	30.5	6.09	U	ug/Kg	SW8082	11/10/15

Surrogate	% Recovery	Control Limits	Qualifier
DCBP	85	25-143	

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information		Lab Information	
Client Sample ID:	**SB2-1107**	**Lab Sample ID:**	**SB2-1107**
Project Name:	Alaska LNG	Date Received:	N/A
Sample Date:	N/A	Dilution Factor:	1
Sample Time:	N/A	Report Revision No.:	0
Type:	QC		
Matrix:	Soil		
Basis:	Dry Weight		

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC Semi-Volatiles								
Aroclor-1016	12674-11-2	5.00	25.0	5.00	U	ug/Kg	SW8082	11/10/15
Aroclor-1260	11096-82-5	5.00	25.0	5.00	U	ug/Kg	SW8082	11/10/15
Aroclor-1221	11104-28-2	10.0	25.0	10.0	U	ug/Kg	SW8082	11/10/15
Aroclor-1232	11141-16-5	5.00	25.0	5.00	U	ug/Kg	SW8082	11/10/15
Aroclor-1242	53469-21-9	5.00	25.0	5.00	U	ug/Kg	SW8082	11/10/15
Aroclor-1248	12672-29-6	5.00	25.0	5.00	U	ug/Kg	SW8082	11/10/15
Aroclor-1254	11097-69-1	5.00	25.0	5.00	U	ug/Kg	SW8082	11/10/15

Surrogate	% Recovery	Control Limits	Qualifier
DCBP	90	25-143	

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Project Name: Alaska LNG
Type: QC
Matrix: Soil

Lab Information

LCS ID: BS2S1107

Report Revision No.: 0
Dilution Factor: 1

Analyte	CAS#	Spike Amount	Sample Result	Units	%Recovery	Analysis Method	Date Analyzed
GC Semi-Volatiles							
Aroclor-1016	12674-11-2	125	115	ug/Kg	92	SW8082	11/10/15
Aroclor-1260	11096-82-5	125	122	ug/Kg	98	SW8082	11/10/15

Surrogate	% Recovery	Control Limits	Qualifier
DCBP	92	25-143	

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

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CASE NARRATIVE
GC SEMI-VOLATILES ANALYSIS

Lab Name: CH2M HILL ASL **ASL SDG#:** P3549

Project: Alaska LNG **Project #:** 653488.16.06

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

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

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

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

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

Method(s):
AK102/103: SW3550

Surrogate Standard(s):
All surrogates were manually integrated per method requirements.

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information		Lab Information	
Client Sample ID:	**D4ADS01-001.48-01**	**Lab Sample ID:**	**P354901**
Project Name:	Alaska LNG	Date Received:	11/04/15
Sample Date:	11/02/15	Dilution Factor:	1
Sample Time:	21:00	Report Revision No.:	0
Type:	Grab		
Matrix:	Soil		
Basis:	Dry Weight		

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC Semi-Volatiles								
TPH-Diesel	TPH-Diesel	4.83	12.1	5.68	J	mg/Kg	AK102/103	11/10/15
TPH-Oil	TPH-Oil	4.83	12.1	21.2		mg/Kg	AK102/103	11/10/15

Surrogate	% Recovery	Control Limits	Qualifier
o-Terphenyl	91	50-150	
Octacosane	96	50-150	

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information		Lab Information	
Client Sample ID:	**D4BGC07-14.4416.57-01**	**Lab Sample ID:**	**P354902**
Project Name:	Alaska LNG	Date Received:	11/04/15
Sample Date:	11/03/15	Dilution Factor:	1
Sample Time:	10:00	Report Revision No.:	0
Type:	Grab		
Matrix:	Soil		
Basis:	Dry Weight		

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC Semi-Volatiles								
TPH-Diesel	TPH-Diesel	4.87	12.2	6.63	J	mg/Kg	AK102/103	11/10/15
TPH-Oil	TPH-Oil	4.87	12.2	26.1		mg/Kg	AK102/103	11/10/15

Surrogate	% Recovery	Control Limits	Qualifier
o-Terphenyl	76	50-150	
Octacosane	79	50-150	

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information		Lab Information	
Client Sample ID:	**D4BGC06-11.8113.54-01**	**Lab Sample ID:**	**P354903**
Project Name:	Alaska LNG	Date Received:	11/04/15
Sample Date:	11/03/15	Dilution Factor:	1
Sample Time:	11:00	Report Revision No.:	0
Type:	Grab		
Matrix:	Soil		
Basis:	Dry Weight		

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC Semi-Volatiles								
TPH-Diesel	TPH-Diesel	4.84	12.1	6.33	J	mg/Kg	AK102/103	11/10/15
TPH-Oil	TPH-Oil	4.84	12.1	14.7		mg/Kg	AK102/103	11/10/15

Surrogate	% Recovery	Control Limits	Qualifier
o-Terphenyl	79	50-150	
Octacosane	82	50-150	

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information		Lab Information	
Client Sample ID:	**SB2-1106**	**Lab Sample ID:**	**SB2-1106**
Project Name:	Alaska LNG	Date Received:	N/A
Sample Date:	N/A	Dilution Factor:	1
Sample Time:	N/A	Report Revision No.:	0
Type:	QC		
Matrix:	Soil		
Basis:	Dry Weight		

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC Semi-Volatiles								
TPH-Diesel	TPH-Diesel	4.00	10.0	4.00	U	mg/Kg	AK102/103	11/09/15
TPH-Oil	TPH-Oil	4.00	10.0	4.00	U	mg/Kg	AK102/103	11/09/15

Surrogate	% Recovery	Control Limits	Qualifier
o-Terphenyl	94	60-120	
Octacosane	96	60-120	

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Project Name: Alaska LNG
Type: QC
Matrix: Soil

Lab Information

LCS ID: BS2S1106

Report Revision No.: 0
Dilution Factor: 1

Analyte	CAS#	Spike Amount	Sample Result	Units	%Recovery	Analysis Method	Date Analyzed
GC Semi-Volatiles							
TPH-Diesel	TPH-Diesel	100	94.7	mg/Kg	95	AK102/103	11/09/15
TPH-Oil	TPH-Oil	100	93.8	mg/Kg	94	AK102/103	11/09/15

Surrogate	% Recovery	Control Limits	Qualifier
o-Terphenyl	94	60-120	
Octacosane	94	60-120	

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

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CASE NARRATIVE
METALS ANALYSIS

Lab Name: CH2M HILL ASL **ASL SDG#:** P3549

Project: Alaska LNG **Project #:** 653488.16.06

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

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

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

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

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

Method(s):
SW6010B: SW3050
SW7471A

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Client Sample ID: D4ADS01-001.48-01

Project Name: Alaska LNG
Sample Date: 11/02/15
Sample Time: 21:00
Type: Grab
Matrix: Soil
Basis: Dry Weight

Lab Information

Lab Sample ID: P354901

Date Received: 11/04/15
Report Revision No: 0

Analyte	Dilution Factor	DL	RL	Result	Qual	Units	Analysis Method	Prep Method	Date Analyzed
Metals									
Antimony	1	0.41	2.03	0.41	U	mg/Kg	SW6010B	SW3050	11/18/15
Arsenic	1	0.97	2.44	4.15		mg/Kg	SW6010B	SW3050	11/18/15
Barium	1	0.041	0.81	38.0		mg/Kg	SW6010B	SW3050	11/18/15
Beryllium	1	0.041	0.33	1.41		mg/Kg	SW6010B	SW3050	11/18/15
Cadmium	1	0.081	0.41	0.081	U	mg/Kg	SW6010B	SW3050	11/18/15
Chromium	1	0.041	0.81	13.3		mg/Kg	SW6010B	SW3050	11/18/15
Copper	1	0.41	1.63	7.89		mg/Kg	SW6010B	SW3050	11/18/15
Lead	1	0.28	1.63	1.81		mg/Kg	SW6010B	SW3050	11/18/15
Mercury	1	0.010	0.023	0.012	J	mg/Kg	SW7471A	METHOD	11/11/15
Nickel	1	0.20	1.63	14.0		mg/Kg	SW6010B	SW3050	11/18/15
Selenium	1	1.63	4.07	1.63	U	mg/Kg	SW6010B	SW3050	11/18/15
Silver	1	0.20	0.81	0.20	U	mg/Kg	SW6010B	SW3050	11/18/15
Thallium	1	0.41	3.25	0.41	U	mg/Kg	SW6010B	SW3050	11/18/15
Vanadium	1	0.20	2.03	26.3		mg/Kg	SW6010B	SW3050	11/18/15
Zinc	1	0.41	1.63	31.5		mg/Kg	SW6010B	SW3050	11/18/15

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Client Sample ID: D4BGC07-14.4416.57-01

Project Name: Alaska LNG
Sample Date: 11/03/15
Sample Time: 10:00
Type: Grab
Matrix: Soil
Basis: Dry Weight

Lab Information

Lab Sample ID: P354902

Date Received: 11/04/15
Report Revision No: 0

Analyte	Dilution Factor	DL	RL	Result	Qual	Units	Analysis Method	Prep Method	Date Analyzed
Metals									
Antimony	1	0.46	2.32	0.46	U	mg/Kg	SW6010B	SW3050	11/18/15
Arsenic	1	1.11	2.79	21.5		mg/Kg	SW6010B	SW3050	11/18/15
Barium	1	0.046	0.93	127		mg/Kg	SW6010B	SW3050	11/18/15
Beryllium	1	0.046	0.37	3.63		mg/Kg	SW6010B	SW3050	11/18/15
Cadmium	1	0.093	0.46	0.093	U	mg/Kg	SW6010B	SW3050	11/18/15
Chromium	1	0.046	0.93	41.0		mg/Kg	SW6010B	SW3050	11/18/15
Copper	1	0.46	1.86	42.0		mg/Kg	SW6010B	SW3050	11/18/15
Lead	1	0.32	1.86	9.67		mg/Kg	SW6010B	SW3050	11/18/15
Mercury	1	0.0099	0.022	0.070		mg/Kg	SW7471A	METHOD	11/11/15
Nickel	1	0.23	1.86	41.4		mg/Kg	SW6010B	SW3050	11/18/15
Selenium	1	1.86	4.65	1.86	U	mg/Kg	SW6010B	SW3050	11/18/15
Silver	1	0.23	0.93	0.84	J	mg/Kg	SW6010B	SW3050	11/18/15
Thallium	1	0.46	3.72	0.46	U	mg/Kg	SW6010B	SW3050	11/18/15
Vanadium	1	0.23	2.32	56.3		mg/Kg	SW6010B	SW3050	11/18/15
Zinc	1	0.46	1.86	98.6		mg/Kg	SW6010B	SW3050	11/18/15

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Client Sample ID: D4BGC06-11.8113.54-01

Project Name: Alaska LNG
Sample Date: 11/03/15
Sample Time: 11:00
Type: Grab
Matrix: Soil
Basis: Dry Weight

Lab Information

Lab Sample ID: P354903

Date Received: 11/04/15
Report Revision No: 0

Analyte	Dilution Factor	DL	RL	Result	Qual	Units	Analysis Method	Prep Method	Date Analyzed
Metals									
Antimony	1	0.34	1.72	0.78	J	mg/Kg	SW6010B	SW3050	11/18/15
Arsenic	1	0.82	2.06	8.12		mg/Kg	SW6010B	SW3050	11/18/15
Barium	1	0.034	0.69	43.3		mg/Kg	SW6010B	SW3050	11/18/15
Beryllium	1	0.034	0.28	1.42		mg/Kg	SW6010B	SW3050	11/18/15
Cadmium	1	0.069	0.34	0.069	U	mg/Kg	SW6010B	SW3050	11/18/15
Chromium	1	0.034	0.69	14.7		mg/Kg	SW6010B	SW3050	11/18/15
Copper	1	0.34	1.38	10.0		mg/Kg	SW6010B	SW3050	11/18/15
Lead	1	0.23	1.38	3.30		mg/Kg	SW6010B	SW3050	11/18/15
Mercury	1	0.010	0.022	0.013	J	mg/Kg	SW7471A	METHOD	11/11/15
Nickel	1	0.17	1.38	15.5		mg/Kg	SW6010B	SW3050	11/18/15
Selenium	1	1.38	3.44	1.38	U	mg/Kg	SW6010B	SW3050	11/18/15
Silver	1	0.17	0.69	0.17	U	mg/Kg	SW6010B	SW3050	11/18/15
Thallium	1	0.34	2.75	0.34	U	mg/Kg	SW6010B	SW3050	11/18/15
Vanadium	1	0.17	1.72	25.0		mg/Kg	SW6010B	SW3050	11/18/15
Zinc	1	0.34	1.38	33.3		mg/Kg	SW6010B	SW3050	11/18/15

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Project Name: Alaska LNG
Sample Date: N/A
Sample Time: N/A
Type: QC
Matrix: Soil
Basis: Dry Weight

Lab Information

Method Blank ID: SB1-1110

Date Received: N/A
Report Revision No: 0

Analyte	Dilution Factor	DL	RL	Result	Qual	Units	Analysis Method	Prep Method	Date Analyzed
Metals									
Antimony	1	0.50	2.50	0.50	U	mg/Kg	SW6010B	SW3050	11/18/15
Arsenic	1	1.19	3.00	1.19	U	mg/Kg	SW6010B	SW3050	11/18/15
Barium	1	0.050	1.00	0.050	U	mg/Kg	SW6010B	SW3050	11/18/15
Beryllium	1	0.050	0.40	0.050	U	mg/Kg	SW6010B	SW3050	11/18/15
Cadmium	1	0.10	0.50	0.10	U	mg/Kg	SW6010B	SW3050	11/18/15
Chromium	1	0.050	1.00	0.050	U	mg/Kg	SW6010B	SW3050	11/18/15
Copper	1	0.50	2.00	0.50	U	mg/Kg	SW6010B	SW3050	11/18/15
Lead	1	0.34	2.00	0.34	U	mg/Kg	SW6010B	SW3050	11/18/15
Mercury	1	0.0090	0.020	0.0090	U	mg/Kg	SW7471A	METHOD	11/11/15
Nickel	1	0.25	2.00	0.25	U	mg/Kg	SW6010B	SW3050	11/18/15
Selenium	1	2.00	5.00	2.41	J	mg/Kg	SW6010B	SW3050	11/18/15
Silver	1	0.25	1.00	0.25	U	mg/Kg	SW6010B	SW3050	11/18/15
Thallium	1	0.50	4.00	0.50	U	mg/Kg	SW6010B	SW3050	11/18/15
Vanadium	1	0.25	2.50	0.25	U	mg/Kg	SW6010B	SW3050	11/18/15
Zinc	1	0.50	2.00	0.50	U	mg/Kg	SW6010B	SW3050	11/18/15

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Project Name: Alaska LNG
Type: QC
Matrix: Soil

Lab Information

Blank Spike ID: BS1S1110

Report Revision No: 0
Dilution Factor: 1

Analyte	Spike Amount	Result	Units	%Recovery	Analysis Method	Prep Method	Date Analyzed
Metals							
Antimony	50.0	51.9	mg/Kg	104	SW6010B	SW3050	11/18/15
Arsenic	50.0	50.9	mg/Kg	102	SW6010B	SW3050	11/18/15
Barium	50.0	50.3	mg/Kg	101	SW6010B	SW3050	11/18/15
Beryllium	50.0	48.9	mg/Kg	98	SW6010B	SW3050	11/18/15
Cadmium	50.0	50.2	mg/Kg	100	SW6010B	SW3050	11/18/15
Chromium	50.0	50.5	mg/Kg	101	SW6010B	SW3050	11/18/15
Copper	50.0	49.7	mg/Kg	99	SW6010B	SW3050	11/18/15
Lead	50.0	50.5	mg/Kg	101	SW6010B	SW3050	11/18/15
Mercury	0.20	0.21	mg/Kg	103	SW7471A	METHOD	11/11/15
Nickel	50.0	54.5	mg/Kg	109	SW6010B	SW3050	11/18/15
Selenium	50.0	48.9	mg/Kg	98	SW6010B	SW3050	11/18/15
Silver	25.0	24.2	mg/Kg	97	SW6010B	SW3050	11/18/15
Thallium	50.0	49.5	mg/Kg	99	SW6010B	SW3050	11/18/15
Vanadium	50.0	48.5	mg/Kg	97	SW6010B	SW3050	11/18/15
Zinc	50.0	51.5	mg/Kg	103	SW6010B	SW3050	11/18/15

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

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CASE NARRATIVE
GENERAL CHEMISTRY ANALYSIS

Lab Name: CH2M HILL ASL **ASL SDG#:** P3549

Project: Alaska LNG **Project #:** 653488.16.06

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

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

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

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

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

Method(s):
LYDKHN

Calibration Verification(s):
LYDKHN: CV recovery of Total Organic Carbon(123%) in CV2-1117 did not meet acceptance criteria of 80-120%.

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information		Lab Information	
Project Name:	**Alaska LNG**	**Lab Batch ID:**	**P3549**
Date Received:	11/04/15	Analysis Method:	LYDKHN
Type:	See C.O.C.	Units:	mg/Kg
Matrix:	Soil	Report Revision No.:	0
Basis:	Dry Weight		

Client Sample ID	Lab Sample ID	Dilution Factor	DL	RL	Total Organic Carbon Result	Qualifier	Date Analyzed
General Chemistry							
D4ADS01-001.48-01	P354901	1	30.6	101	175		11/17/15
D4BGC07-14.4416.57-01	P354902	1	31.0	103	7290		11/17/15
D4BGC06-11.8113.54-01	P354903	1	30.4	101	871		11/17/15
SB1-1117	SB1-1117	1	30.1	100	30.1	U	11/17/15

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Project Name: Alaska LNG
Type: QC
Matrix: Soil
Basis: Dry Weight

Lab Information

Lab Batch ID: P3549

Report Revision No.: 0

LCS ID	Analyte	Spike Amount	Sample Result	Units	% Recovery	Analysis Method	Date Analyzed
General Chemistry							
BS1S1117	Total Organic Carbon	1180	1250	mg/Kg	106	LYDKHN	11/17/15

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

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CASE NARRATIVE
GENERAL CHEMISTRY ANALYSIS

Lab Name: CH2M HILL ASL **ASL SDG#:** P3549

Project: Alaska LNG **Project #:** 653488.16.06

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

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

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

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

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

Method(s):
ASTM D2216
E150.1
E160.4
SM2540G

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Project Name: **Alaska LNG**

Date Received: 11/04/15
Type: See C.O.C.
Matrix: Soil
Basis: Dry Weight

Lab Information

Lab Batch ID: **P3549**

Analysis Method: ASTM D2216
Units: Percent
Report Revision No.: 0

Client Sample ID	Lab Sample ID	Dilution Factor	DL	RL	Moisture Result	Qualifier	Date Analyzed
General Chemistry							
D4ADS01-001.48-01	P354901	1	N/A	N/A	23.6		11/06/15
D4BGC07-14.4416.57-01	P354902	1	N/A	N/A	21.1		11/06/15
D4BGC06-11.8113.54-01	P354903	1	N/A	N/A	22.2		11/06/15

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information		Lab Information	
Project Name:	**Alaska LNG**	**Lab Batch ID:**	**P3549**
Date Received:	11/04/15	Analysis Method:	SM2540G
Type:	See C.O.C.	Units:	Percent
Matrix:	Soil	Report Revision No.:	0
Basis:	Dry Weight		

Client Sample ID	Lab Sample ID	Dilution Factor	DL	RL	Total Solids (TS) Result	Qualifier	Date Analyzed
General Chemistry							
D4ADS01-001.48-01	P354901	1	N/A	N/A	80.9		11/06/15
D4BGC07-14.4416.57-01	P354902	1	N/A	N/A	82.6		11/06/15
D4BGC06-11.8113.54-01	P354903	1	N/A	N/A	81.8		11/06/15

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information		Lab Information	
Project Name:	**Alaska LNG**	**Lab Batch ID:**	**P3549**
Date Received:	11/04/15	Analysis Method:	E160.4
Type:	See C.O.C.	Units:	Percent
Matrix:	Soil	Report Revision No.:	0
Basis:	Dry Weight		

Client Sample ID	Lab Sample ID	Dilution Factor	DL	RL	Total Volatile Solids (TVS) Result	Qualifier	Date Analyzed
General Chemistry							
D4ADS01-001.48-01	P354901	1	N/A	N/A	1.2		11/06/15
D4BGC07-14.4416.57-01	P354902	1	N/A	N/A	3.0		11/06/15
D4BGC06-11.8113.54-01	P354903	1	N/A	N/A	1.1		11/06/15

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information		Lab Information	
Project Name:	**Alaska LNG**	**Lab Batch ID:**	**P3549**
Date Received:	11/04/15	Analysis Method:	E150.1
Type:	See C.O.C.	Units:	pH Units
Matrix:	Soil	Report Revision No.:	0
Basis:	Dry Weight		

Client Sample ID	Lab Sample ID	Dilution Factor	DL	RL	pH Result	Qualifier	Date Analyzed
General Chemistry							
D4ADS01-001.48-01	P354901	1	N/A	N/A	8.35	*	11/04/15 16:44
D4BGC07-14.4416.57-01	P354902	1	N/A	N/A	8.99	*	11/04/15 16:45
D4BGC06-11.8113.54-01	P354903	1	N/A	N/A	8.59	*	11/04/15 16:46

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information	Lab Information
	Lab Batch ID: P3549
Project Name: Alaska LNG	Report Revision No.: 0
Type: QC	
Matrix: Soil	
Basis: As Received	

LCS ID	Analyte	Spike Amount	Sample Result	Units	% Recovery	Analysis Method	Date Analyzed
General Chemistry							
BS1S1104	pH	7.00	7.04	pH Units	101	E150.1	11/04/15

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

CASE NARRATIVE
GENERAL CHEMISTRY ANALYSIS

Lab Name: CH2M HILL/LAB/CVO ASL SDG #: P3549

Project: Alaska LNG Project #: 653488.16.06

I. Methods:

Analysis: Grain size with Hydrometer (ASTM D422), Specific Gravity- soil (ASTM D854B), Atterberg Limits (ASTM D4318), USCS Classification (ASTM 2487), Grain Density by API RP (API RP40), and Bulk Density (ASTM D7263).

II. Receipt/Holding Times:
All acceptance criteria were met.

III. Analysis:

A. Initial Calibration(s):
Not applicable.

B. Calibration Verification(s):
Not applicable.

C. Blanks:
Not applicable.

D. Laboratory Control Sample(s):
Not applicable.

E. Matrix Spike/Matrix Spike Duplicate Sample(s):
Not applicable.

F. Analytical Exception(s):
None.

G. Other:
None.

IV. Documentation Exception(s):
None.

V. I certify that this data package is in compliance with the terms and conditions agreed to by the client and CH2M HILL, both technically and for completeness, except for the conditions detailed above. Release of the data contained in this hardcopy data package has been authorized by the Laboratory Manager or designee, as verified by the following signature.

Prepared by: [signature] Date: 11/16/15

Reviewed by: Kathy McKinley Date: 11/18/15

CH2MHILL

Particle Size Distribution, ASTM D422

Client ID D4ADS01-001.48-01 **Lab ID** **P354901**

Project Name Alaska LNG

Analysis By: SB/JVP

Reviewed By:

Sample Weight, g	421.81

Sieve Analysis

#	Particle Diameter mm	Weight Retained g	Weight Retained %	Cumulative Weight Retained %	Sieve Finer %
4	4.750	117.18	27.78	27.78	72.22
10	2.000	5.03	1.19	28.97	71.03
20	0.850	2.92	0.69	29.67	70.33
40	0.425	6.94	1.64	31.31	68.69
60	0.250	54.37	12.89	44.20	55.80
140	0.106	210.09	49.81	94.00	6.00
200	0.075	10.56	2.50	96.51	3.49
Pan	< 0.075	14.73	3.49	100.00	0.00

Soil Description	Retained on Sieve Sieve No.	Weight Percent %
Gravel	4	27.8
Coarse Sand	10	1.2
Medium Sand	40	2.3
Fine Sand	200	65.2
Silt/Clay	< 200	3.5

USCS Description by ASTM D2487
Poorly Graded Sand with Gravel

Hydrometer Analysis - 151H

Time mins	Particle Diameter mm	Calculated Weight g	Calculated Weight %	Cumulative Weight Retained %	Hydrometer Finer %
2	0.041	14.08	3.34	99.85	4.41
5	0.026	0.00	0.00	99.85	4.41
15	0.015	0.22	0.05	99.90	2.94
30	0.011	0.00	0.00	99.90	2.94
60	0.007	0.00	0.00	99.90	2.94
120	0.005	0.00	0.00	99.90	2.94
250	0.004	0.22	0.05	99.95	1.47
		0.22	0.05	100.00	

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Particle Size Distribution, ASTM D422

Client ID D4BGC07-14.4416.57-01 **Lab ID** **P354902**

Project Name Alaska LNG

Analysis By: SB/JVP

Reviewed By:

Sample Weight, g	325.30

Sieve Analysis

#	Particle Diameter mm	Weight Retained g	Weight Retained %	Cumulative Weight Retained %	Sieve Finer %
4	4.750	0.00	0.00	0.00	100.00
10	2.000	0.00	0.00	0.00	100.00
20	0.850	0.15	0.05	0.05	99.95
40	0.425	0.64	0.20	0.24	99.76
60	0.250	0.98	0.30	0.54	99.46
140	0.106	17.98	5.53	6.07	93.93
200	0.075	20.20	6.21	12.28	87.72
Pan	< 0.075	285.35	87.72	100.00	0.00

Soil Description	Retained on Sieve Sieve No.	Weight Percent %
Gravel	4	0.0
Coarse Sand	10	0.0
Medium Sand	40	0.2
Fine Sand	200	12.0
Silt/Clay	< 200	87.7

USCS Description by ASTM D2487
Lean Clay

Hydrometer Analysis - 151H

Time mins	Particle Diameter mm	Calculated Weight g	Calculated Weight %	Cumulative Weight Retained %	Hydrometer Finer %
2	0.029	52.29	16.07	28.36	81.68
5	0.019	21.85	6.72	35.07	74.02
15	0.012	21.85	6.72	41.79	66.36
30	0.008	14.57	4.48	46.27	61.26
60	0.006	7.28	2.24	48.51	58.70
120	0.004	7.28	2.24	50.74	56.15
250	0.003	14.57	4.48	55.22	51.05
		145.66	44.78	100.00	

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Particle Size Distribution, ASTM D422

Client ID D4BGC06-11.8113.54-01 **Lab ID** **P354903**

Project Name Alaska LNG

Analysis By: SB/JVP

Reviewed By:

Sample Weight, g	404.00

Sieve Analysis

#	Particle Diameter mm	Weight Retained g	Weight Retained %	Cumulative Weight Retained %	Sieve Finer %
4	4.750	0.00	0.00	0.00	100.00
10	2.000	0.00	0.00	0.00	100.00
20	0.850	0.00	0.00	0.00	100.00
40	0.425	0.60	0.15	0.15	99.85
60	0.250	19.22	4.76	4.90	95.10
140	0.106	266.57	65.98	70.89	29.11
200	0.075	54.87	13.58	84.47	15.53
Pan	< 0.075	62.74	15.53	100.00	0.00

Soil Description	Retained on Sieve Sieve No.	Weight Percent %
Gravel	4	0.0
Coarse Sand	10	0.0
Medium Sand	40	0.1
Fine Sand	200	84.3
Silt/Clay	< 200	15.5

USCS Description by ASTM D2487
Silty Sand

Hydrometer Analysis - 151H

Time mins	Particle Diameter mm	Calculated Weight g	Calculated Weight %	Cumulative Weight Retained %	Hydrometer Finer %
2	0.040	58.13	14.39	98.86	7.35
5	0.025	0.00	0.00	98.86	7.35
15	0.015	1.84	0.46	99.32	4.41
30	0.010	0.00	0.00	99.32	4.41
60	0.007	0.00	0.00	99.32	4.41
120	0.005	0.92	0.23	99.54	2.94
250	0.004	0.00	0.00	99.54	2.94
		1.84	0.46	100.00	

Specific Gravity by ASTM D854

Lab Sample ID	P354901
Client ID	D4ADS01.48-01
Date	11/12/2015
Analyst	EMT

Dry Pycnometer Mass, g	235.84
Water Filled Pycnometer Mass, g	484.58
Water Temperature, °C	21.2
Density of Water, g/cm^3	0.99816
Flask Volume, cm^3	249.20
Oven Dry Sample Mass, g	15.03
Sample in Pycnometer Mass, g	493.17

Specific Gravity	2.33

Specific Gravity by ASTM D854

Lab Sample ID	P354902
Client ID	D4BGC07-14.4416.57-01
Date	11/12/2015
Analyst	EMT

Dry Pycnometer Mass, g	235.84
Water Filled Pycnometer Mass, g	484.58
Water Temperature, °C	21.2
Density of Water, g/cm^3	0.99816
Flask Volume, cm^3	249.20
Oven Dry Sample Mass, g	15.01
Sample in Pycnometer Mass, g	493.35

Specific Gravity	2.41

Specific Gravity by ASTM D854

Lab Sample ID	P354903
Client ID	D4BGC06-11.8113.54-01
Date	11/12/2015
Analyst	EMT

Dry Pycnometer Mass, g	235.84
Water Filled Pycnometer Mass, g	484.58
Water Temperature, °C	21.2
Density of Water, g/cm^3	0.99816
Flask Volume, cm^3	249.20
Oven Dry Sample Mass, g	15.04
Sample in Pycnometer Mass, g	493.20

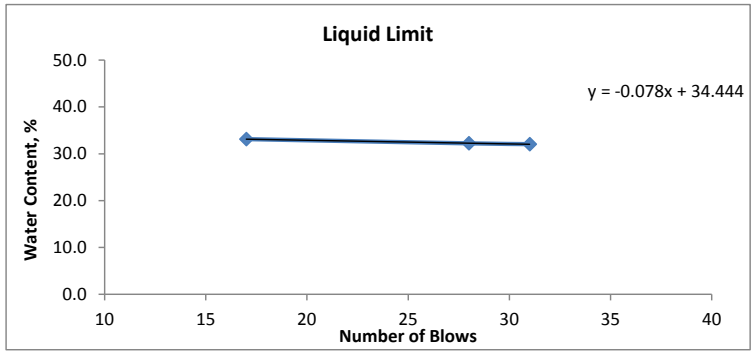
Specific Gravity	2.34

Atterberg Limits

Analyst:	SB/EMT
Date:	11/10/2015
Sample ID:	P354902
Sample Description:	D4BGC07-14.4416.57-01

Liquid Limit

Container ID	Container Tare g	Wet Sample + Tare g	Dry Sample + Tare g	Water Content %	Blows Number
02-A	28.04	35.62	33.78	32.06	31
02-B	28.25	38.55	36.04	32.22	28
02-C	28.88	39.57	36.91	33.13	17
Liquid Limit =	32				



Plastic Limit

Container ID	Container Tare g	Wet Sample + Tare g	Dry Sample + Tare g	Water Content %
02-D	28.9	36.33	35.18	18.31
02-E	28.63	36.85	35.52	19.30
Plastic Limit =	19			

Plasticity Index =	13.7

Liquid Limit, LL

Plot the water content and the corresponding number of blows on the semilogarithmic chart, above. Draw the best straight line.
The liquid limit, LL, is the water content corresponding to 25 blows, rounded to the nearest whole number.

Plastic Limit, PL

The average of the two water contents, rounded to the nearest whole number is the plastic limit, PL.

Plasticity Index, PI

PI=LL-PL
If the LL or PL could not be determined, or if the PL is equal to or greater than LL, report the soil as nonplastic, NP.

Water Content

(Wet sample+Tare - Dry Sample+Tare)/(Dry sample+Tare - Container Tare)x100

CH2M HILL Applied Sciences Laboratory

Client Information		Lab Information	
Project Name:	**Alaska LNG**	**Lab Batch ID:**	**P3549**
Sampling Date:	See CoC	Analysis Method:	ASTM D4318
Sampling Time:	See CoC	Units:	N/A
Type:	Grab	Date Received:	11/4/2015
Matrix:	Soil	Report Revision No.:	0
Basis:	Dry Weight	Analyzed By:	EMT
		Revewed By:	Km

Atterberg Limits

Client Sample ID	Lab Sample ID	Liquid Limit	Plastic Limit	Plasticity Index	Date Analyzed
D4ADS01-001.48-01	P354901	_	_	NP	11/10/2015
D4BGC07-14.4416.57-01	P354902	32	19	13.7	11/10/2015
D4BGC06-11.8113.54-01	P354903	_	_	NP	11/10/2015

NP=Non-Plastic

_ = Can not be determined

Sample Summary			
Sample ID	Sample Mass (g)	Grain Density (g/cm^3)	Notes
P354901	159.93	2.76	
P354902	95.49	2.64	
P354903	140.72	2.71	

Bulk Density by ASTM D7263

Lab Sample ID	P354901
Client ID	D4ADS01-001.48-01
Date	11/13/2015
Analyst	SB/EMT

Loose Soil	
Dry Cylinder Mass, g	66.25
Water Filled Cylinder Mass, g	91.08
Water Temperature, °C	20.6
Density of Water, g/cm ^{3}	0.99828
Temperature Coefficient, K	1.00008
Cylinder Volume, cm ^{3}	24.83
Sample Filled Cylinder Mass, g	109.73

Bulk Density, g/cm^3	1.75

Bulk Density by ASTM D7263

Lab Sample ID	P354901DUP
Client ID	D4ADS01-001.48-01
Date	11/13/2015
Analyst	SB/EMT

Loose Soil	
Dry Cylinder Mass, g	66.25
Water Filled Cylinder Mass, g	91.08
Water Temperature, °C	20.6
Density of Water, g/cm ^{3}	0.99828
Temperature Coefficient, K	1.00008
Cylinder Volume, cm ^{3}	24.83
Sample Filled Cylinder Mass, g	109.90

Bulk Density, g/cm^3	1.76

Bulk Density by ASTM D7263

Lab Sample ID	P354902
Client ID	D4BGC07-14.4416.57-01
Date	11/13/2015
Analyst	SB/EMT

Loose Soil	
Dry Cylinder Mass, g	66.25
Water Filled Cylinder Mass, g	91.08
Water Temperature, °C	20.6
Density of Water, g/cm^3	0.99828
Temperature Coefficient, K	1.00008
Cylinder Volume, cm^3	24.83
Sample Filled Cylinder Mass, g	120.07

Bulk Density, g/cm^3	2.17

Bulk Density by ASTM D7263

Lab Sample ID	P354903
Client ID	D4BGC06-11.8113.54-01
Date	11/13/2015
Analyst	SB/EMT

Loose Soil	
Dry Cylinder Mass, g	66.25
Water Filled Cylinder Mass, g	91.08
Water Temperature, °C	20.6
Density of Water, g/cm^3	0.99828
Temperature Coefficient, K	1.00008
Cylinder Volume, cm^3	24.83
Sample Filled Cylinder Mass, g	108.84

Bulk Density, g/cm^3	1.72

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

Chain of Custody Record

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

Client Contact

Project Name: AK LNG
Project # or PO #: 653488.16.06
Company Name: CH2M
Address: 2020 SW 4th Ave Ste 300
City/State/Zip: Portland OR 97201
Project Manager: Carrie Andrews
Phone #: 503-736-4270
Report to email: carrie.andrews@ch2m.com

Analysis Turnaround Time

TAT is Calander days

TAT if different from below _____

☒ 21 days (STD)
☐ 14 days * ☐ 3 day *
☐ 7 days * ☐ 2 days *
☐ 5 days * ☐ 1 day *

* (Surcharges will apply)

For Lab Use Only:

SDG: P3549
Custody Seals intact? ☒ Yes ☐ No
Hand delivered? ☐ Yes ☒ No
Cooler Temp 0.3°C
Therm ID No. 173 Therm Exp. 01/16
Packing Material: Circle Below
(Ice) Blue Ice Box Bubble Wrap
Radiological Screen? ☐ Yes ☒ No

Sample Identification (Limit of 20 characters)	Sample Date	Sample Time	Sample Type (C=Comp, G=Grab)	Matrix (Water, (Soil), Air)	Total # of Cont.	VOCs	AK101	AK102/103	Trace Metals (Hg)	PCBs	Total Volatile Solids	TOC	PAHs/SVOC	Geotechnical	Sample Specific Notes:	Lab ID:
						7	6	1	1	1	1	1	1	1		
D4ADS01-001.48-01	11-2	9pm	G	Y	2	X	X								time is process time; refer to bore log for collection time	1 Y
D4ADS01-001.48-01	11-2	9pm	C	Y	5			X	X	X	X	X	X	X		2
D4BGC07-14.4416.57-01	11-3	10AM	G	Y	2	X	X									2
D4BGC07-14.4416.57-01	11-3	10AM	C	Y	5			X	X	X	X	X	X	X		
D4BGC06-11.8113.54-01	11-3	11AM	C	Y	5			X	X	X	X	X	X	X		3
RVL BLK					1											4

Preservation Used: 1= Ice, 2= HCl; 3= H2SO4; 4=HNO3; 5=NaOH; 6= Other MeOH 7=FREEZE

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

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

Sampled By: Kristin Reardon Date/Time: 11-3-15 12pm
Received by: Date/Time:
Received in Laboratory by: Date/Time: 11/4/15 1245
Relinquished by: Date/Time:
Relinquished by: Date/Time:
Shipped Via: ☐ UPS ☐ Fed-Ex ☐ USPS ☒ Other Tracking #:

Special Instructions/QC Requirements
Geotechnical includes: Grain size w/ hydrometer; Atterberg limits; USCS classification, % moisture, pH, specific gravity, grain density, & bulk density

Alaska LNG
Test Pit Dredge Material Characterization Report
Confidential
BLCC-UZZ-00-000003-000
Attachment 2
07-Apr-16; Rev 0

CH2MHILL
Applied Sciences Laboratory (ASL)

Sample Receipt Record

SDG ID: P3549 Date Received:11/4/15

Client/Project: AK LNG Received By:JVP

Were custody seals intact and on the outside of the cooler?	☑ Yes	☐ No	☐ N/A
Shipping Record:	☐ Hand Delivered	☑ On File	☐ COC
Radiological Screening for DoD	☐ Yes	☐ No	☑ N/A
Packing Material:	☐ Hand Delivered	☑ Ice	☐ Blue Ice ☐ Box
Temp OK? (<6C) Therm ID: TH173 Exp. 01/16	0.3 °C ☑ Yes	☐ No	☐ N/A
Was a Chain of Custody (CoC) Provided?	☑ Yes	☐ No	☐ N/A
Was the CoC correctly filled out (If No, document below)	☑ Yes	☐ No	☐ N/A
Did sample labels agree with COC? (If No, document below)	☑ Yes	☐ No	☐ N/A
Did the CoC list a correct bottle count and the preservative types (No=Correct on CoC)	☑ Yes	☐ No	☐ N/A
Were the sample containers in good condition (broken or leaking)?	☑ Yes	☐ No	☐ N/A
Was enough sample volume provided for analysis? (If No, document below)	☑ Yes	☐ No	☐ N/A
Containers supplied by ASL?	☑ Yes	☐ No	☐ N/A
Any sample with < 1/2 holding time remaining? If so contact LPM	☑ Yes	☐ No	☐ N/A
Samples have multi-phase? If yes, document on SRER	☐ Yes	☑ No	☐ N/A
All water VOCs free of air bubbles? No, document on SRER	☐ Yes	☐ No	☑ N/A
pH of all samples met criteria on receipt? If "No", preserve and document below.	☐ Yes	☐ No	☑ N/A
Dissolved/Soluble metals filtered in the field?	☐ Yes	☐ No	☑ N/A
Dissolved/Soluble metals have sediment in bottom of container? If so document below.	☐ Yes	☐ No	☑ N/A

Preservation Adjustment

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

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

Sample Exception Report (The following exceptions were noted)

1) pH samples are past holding time.
2) TRVL BLK did not specify whether for VOC or TPH. Logged in for VOC.
3) Only one vial provided for TRVL BLK (P354904), logged in for VOC only.

Client was notified on: 10/4/15 Client contact:

Resolution to Exception:

2) log in for both per Carrie Andrews

Analytical Report for

Alaska LNG

ASL Report #: P3586
Project ID: 653488.16.06

Attn: Carrie Andrews/PDX

Authorized and Released By:

Kathy McKinley

Laboratory Project Manager
Kathy McKinley
(541) 758-0235 ext.23144
December 01, 2015

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

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

Accredited in accordance with NELAP:
Oregon (100022)
Louisiana (05031)

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

ASL Report #: P3586

Sample Receipt Comments

We certify that the test results meet all NELAP requirements except those listed below:

- CH2M HILL Applied Sciences Laboratory is not accredited by NELAP for the following tests: ASTM D2216, ASTM D422, ASTM D854B, ASTM D4318, ASTM 2487, API RP40, ASTM D7263, LYDKHN.

Some analyses were subcontracted to an outside laboratory and their results will follow.

Sample Cross-Reference

ASL Sample ID	Client Sample ID	Date/Time Collected	Date Received
P358601	D4SD04-0.503-01	11/05/15 13:30	11/07/15
P358602	D4SD04-0.503-101	11/05/15 13:40	11/07/15
P358603MS	D4SD04-0.503-01MS	11/05/15 13:30	11/07/15
P358604MSD	D4SD04-0.503-01SD	11/05/15 13:30	11/07/15
P358605	D4SD04-0304.25-02	11/05/15 16:30	11/07/15
P358606	D4SD04-4.2518.86-03	11/05/15 14:50	11/07/15
P358607	D5SD01-0002-01	11/06/15 11:15	11/07/15
P358608	D5SD01-0204-02	11/06/15 13:00	11/07/15
P358609	D4BDS01-001.31-01	11/03/15 11:00	11/07/15
P358610	D5SD01-0404.9-03	11/06/15 14:45	11/07/15
P358611	TB110315-01	11/03/15 08:00	11/07/15
P358612	D4SD04-5.756.25-04	11/05/15 17:20	11/07/15
P358613	EB110615-01	11/06/15 15:45	11/07/15
P358614	TRIP BLANK	11/06/15 15:45	11/07/15
P358615	D4ADS01-001.48-01	11/02/15 21:00	11/07/15
P358616	D4BGC07-14.4416.57-01	11/03/15 10:00	11/07/15

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

CASE NARRATIVE
GC/MS VOLATILES ANALYSIS

Lab Name: CH2M HILL ASL **ASL SDG#:** P3586

Project: Alaska LNG **Project #:** 653488.16.06

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

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

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

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

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

Method(s):
SW8260B: SW5030, SW5035

Matrix Spike/Matrix Spike Duplicate(s):
Recovery of Chloromethane in D4SD04-0.503-01MS and D4SD04-0.503-01SD did not meet acceptance criteria of 70-130%. Recovery of Acetone in D4SD04-0.503-01MS and D4SD04-0.503-01SD did not meet acceptance criteria of 70-130%. Recovery of 2-Butanone (MEK) in D4SD04-0.503-01MS and D4SD04-0.503-01SD did not meet acceptance criteria of 70-130%. Recovery of Benzene in D4SD04-0.503-01MS and D4SD04-0.503-01SD did not meet acceptance criteria of 70-130%. Recovery of Toluene in D4SD04-0.503-01MS and D4SD04-0.503-01SD did not meet acceptance criteria of 70-130%. Recovery of 1,2,4-Trichlorobenzene in D4SD04-0.503-01MS and D4SD04-0.503-01SD did not meet acceptance criteria of 70-130%. Recovery of Naphthalene in D4SD04-0.503-01MS and D4SD04-0.503-01SD did not meet acceptance criteria of 70-130%. Recovery of 1,2,3-Trichlorobenzene in D4SD04-0.503-01MS and D4SD04-0.503-01SD did not meet acceptance criteria of 70-130%.

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Client Sample ID: **D4SD04-0.503-01**

Project Name: Alaska LNG
Sample Date: 11/05/15
Sample Time: 13:30
Type: Grab
Matrix: Soil
Basis: Dry Weight

Lab Information

Lab Sample ID: **P358601**

Date Received: 11/07/15
Dilution Factor: 1
Report Revision No.: 0

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Volatiles								
Dichlorodifluoromethane	75-71-8	0.28	1.13	0.28	U	ug/Kg	SW8260B	11/09/15
Chloromethane	74-87-3	0.28	1.13	1.94		ug/Kg	SW8260B	11/09/15
Vinyl Chloride	75-01-4	0.28	1.13	0.28	U	ug/Kg	SW8260B	11/09/15
Bromomethane	74-83-9	0.28	1.13	0.28	U	ug/Kg	SW8260B	11/09/15
Chloroethane	75-00-3	0.28	1.13	0.28	U	ug/Kg	SW8260B	11/09/15
Trichlorofluoromethane	75-69-4	0.28	1.13	0.28	U	ug/Kg	SW8260B	11/09/15
Acetone	67-64-1	1.13	5.65	154	E	ug/Kg	SW8260B	11/09/15
1,1-Dichloroethene	75-35-4	0.28	1.13	0.28	U	ug/Kg	SW8260B	11/09/15
Methylene chloride	75-09-2	0.28	1.13	0.28	U	ug/Kg	SW8260B	11/09/15
trans-1,2-Dichloroethene	156-60-5	0.28	1.13	0.28	U	ug/Kg	SW8260B	11/09/15
Methyl tert-butyl ether (MTBE)	1634-04-4	0.28	1.13	0.28	U	ug/Kg	SW8260B	11/09/15
1,1-Dichloroethane	75-34-3	0.28	1.13	0.28	U	ug/Kg	SW8260B	11/09/15
2-Butanone (MEK)	78-93-3	2.26	5.65	22.9		ug/Kg	SW8260B	11/09/15
cis-1,2-Dichloroethene	156-59-2	0.28	1.13	0.28	U	ug/Kg	SW8260B	11/09/15
Bromochloromethane	74-97-5	0.28	1.13	0.28	U	ug/Kg	SW8260B	11/09/15
Chloroform	67-66-3	0.28	1.13	0.28	U	ug/Kg	SW8260B	11/09/15
2,2-Dichloropropane	594-20-7	0.28	1.13	0.28	U	ug/Kg	SW8260B	11/09/15
1,2-Dichloroethane	107-06-2	0.28	1.13	0.28	U	ug/Kg	SW8260B	11/09/15
1,1,1-Trichloroethane	71-55-6	0.28	1.13	0.28	U	ug/Kg	SW8260B	11/09/15
1,1-Dichloropropene	563-58-6	0.28	1.13	0.28	U	ug/Kg	SW8260B	11/09/15
Carbon tetrachloride	56-23-5	0.28	1.13	0.28	U	ug/Kg	SW8260B	11/09/15
Benzene	71-43-2	0.28	1.13	5.23		ug/Kg	SW8260B	11/09/15
Dibromomethane	74-95-3	0.28	1.13	0.28	U	ug/Kg	SW8260B	11/09/15
1,2-Dichloropropane	78-87-5	0.28	1.13	0.28	U	ug/Kg	SW8260B	11/09/15
Trichloroethene (TCE)	79-01-6	0.28	1.13	0.28	U	ug/Kg	SW8260B	11/09/15
Bromodichloromethane	75-27-4	0.28	1.13	0.28	U	ug/Kg	SW8260B	11/09/15
cis-1,3-Dichloropropene	10061-01-5	0.28	1.13	0.28	U	ug/Kg	SW8260B	11/09/15
4-Methyl-2-pentanone (MIBK)	108-10-1	1.13	5.65	1.13	U	ug/Kg	SW8260B	11/09/15
trans-1,3-Dichloropropene	10061-02-6	0.28	1.13	0.28	U	ug/Kg	SW8260B	11/09/15
1,1,2-Trichloroethane	79-00-5	0.28	1.13	0.28	U	ug/Kg	SW8260B	11/09/15
Toluene	108-88-3	0.28	1.13	5.20		ug/Kg	SW8260B	11/09/15
1,3-Dichloropropane	142-28-9	0.28	1.13	0.28	U	ug/Kg	SW8260B	11/09/15
Dibromochloromethane	124-48-1	0.28	1.13	0.28	U	ug/Kg	SW8260B	11/09/15
1,2-Dibromoethane (EDB)	106-93-4	0.28	1.13	0.28	U	ug/Kg	SW8260B	11/09/15
Tetrachloroethene (PCE)	127-18-4	0.28	1.13	0.28	U	ug/Kg	SW8260B	11/09/15
1-Chlorohexane	544-10-5	0.28	1.13	0.28	U	ug/Kg	SW8260B	11/09/15
1,1,1,2-Tetrachloroethane	630-20-6	0.28	1.13	0.28	U	ug/Kg	SW8260B	11/09/15
Chlorobenzene	108-90-7	0.28	1.13	0.28	U	ug/Kg	SW8260B	11/09/15
Ethylbenzene	100-41-4	0.28	1.13	0.83	J	ug/Kg	SW8260B	11/09/15
m,p-Xylene	108-38-3/1	0.56	2.26	2.14	J	ug/Kg	SW8260B	11/09/15
Bromoform	75-25-2	0.28	1.13	0.28	U	ug/Kg	SW8260B	11/09/15
Styrene	100-42-5	0.28	1.13	0.28	U	ug/Kg	SW8260B	11/09/15

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Client Sample ID: **D4SD04-0.503-01**

Project Name: Alaska LNG
Sample Date: 11/05/15
Sample Time: 13:30
Type: Grab
Matrix: Soil
Basis: Dry Weight

Lab Information

Lab Sample ID: **P358601**

Date Received: 11/07/15
Dilution Factor: 1
Report Revision No.: 0

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Volatiles								
1,1,2,2-Tetrachloroethane	79-34-5	0.28	1.13	0.28	U	ug/Kg	SW8260B	11/09/15
o-Xylene	95-47-6	0.28	1.13	1.51		ug/Kg	SW8260B	11/09/15
1,2,3-Trichloropropane	96-18-4	0.28	1.13	0.28	U	ug/Kg	SW8260B	11/09/15
Isopropylbenzene	98-82-8	0.28	1.13	0.28	U	ug/Kg	SW8260B	11/09/15
Bromobenzene	108-86-1	0.28	1.13	0.28	U	ug/Kg	SW8260B	11/09/15
n-Propylbenzene	103-65-1	0.28	1.13	0.28	U	ug/Kg	SW8260B	11/09/15
2-Chlorotoluene	95-49-8	0.28	1.13	0.28	U	ug/Kg	SW8260B	11/09/15
4-Chlorotoluene	106-43-4	0.28	1.13	0.28	U	ug/Kg	SW8260B	11/09/15
1,3,5-Trimethylbenzene	108-67-8	0.28	1.13	0.28	U	ug/Kg	SW8260B	11/09/15
tert-Butylbenzene	98-06-6	0.28	1.13	0.28	U	ug/Kg	SW8260B	11/09/15
1,2,4-Trimethylbenzene	95-63-6	0.28	1.13	0.63	J	ug/Kg	SW8260B	11/09/15
sec-Butylbenzene	135-98-8	0.28	1.13	0.28	U	ug/Kg	SW8260B	11/09/15
1,3-Dichlorobenzene	541-73-1	0.28	1.13	0.28	U	ug/Kg	SW8260B	11/09/15
1,4-Dichlorobenzene	106-46-7	0.28	1.13	0.28	U	ug/Kg	SW8260B	11/09/15
p-Isopropyltoluene	99-87-6	0.28	1.13	0.41	J	ug/Kg	SW8260B	11/09/15
1,2-Dichlorobenzene	95-50-1	0.28	1.13	0.28	U	ug/Kg	SW8260B	11/09/15
n-Butylbenzene	104-51-8	0.28	1.13	0.28	U	ug/Kg	SW8260B	11/09/15
1,2-Dibromo-3-chloropropane	96-12-8	0.28	1.13	0.28	U	ug/Kg	SW8260B	11/09/15
1,2,4-Trichlorobenzene	120-82-1	0.28	1.13	0.28	U	ug/Kg	SW8260B	11/09/15
Naphthalene	91-20-3	0.28	1.13	0.86	J	ug/Kg	SW8260B	11/09/15
Hexachlorobutadiene	87-68-3	0.28	1.13	0.28	U	ug/Kg	SW8260B	11/09/15
1,2,3-Trichlorobenzene	87-61-6	0.28	1.13	0.28	U	ug/Kg	SW8260B	11/09/15

Surrogate	% Recovery	Control Limits	Qualifier
Dibromofluoromethane	100	70-130	
1,2-Dichloroethane-d4	103	70-130	
Toluene-d8	94	70-130	
4-Bromofluorobenzene	77	70-130	

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Client Sample ID: **D4SD04-0.503-01DL**

Project Name: Alaska LNG
Sample Date: 11/05/15
Sample Time: 13:30
Type: Grab
Matrix: Soil
Basis: Dry Weight

Lab Information

Lab Sample ID: **P358601DL**

Date Received: 11/07/15
Dilution Factor: 1
Report Revision No.: 0

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Volatiles								
Dichlorodifluoromethane	75-71-8	1.26	5.03	1.26	U	ug/Kg	SW8260B	11/09/15
Chloromethane	74-87-3	1.26	5.03	1.91	J	ug/Kg	SW8260B	11/09/15
Vinyl Chloride	75-01-4	1.26	5.03	1.26	U	ug/Kg	SW8260B	11/09/15
Bromomethane	74-83-9	1.26	5.03	1.26	U	ug/Kg	SW8260B	11/09/15
Chloroethane	75-00-3	1.26	5.03	1.26	U	ug/Kg	SW8260B	11/09/15
Trichlorofluoromethane	75-69-4	1.26	5.03	1.26	U	ug/Kg	SW8260B	11/09/15
Acetone	67-64-1	5.03	25.1	149		ug/Kg	SW8260B	11/09/15
1,1-Dichloroethene	75-35-4	1.26	5.03	1.26	U	ug/Kg	SW8260B	11/09/15
Methylene chloride	75-09-2	1.26	5.03	1.26	U	ug/Kg	SW8260B	11/09/15
trans-1,2-Dichloroethene	156-60-5	1.26	5.03	1.26	U	ug/Kg	SW8260B	11/09/15
Methyl tert-butyl ether (MTBE)	1634-04-4	1.26	5.03	1.26	U	ug/Kg	SW8260B	11/09/15
1,1-Dichloroethane	75-34-3	1.26	5.03	1.26	U	ug/Kg	SW8260B	11/09/15
2-Butanone (MEK)	78-93-3	10.1	25.1	10.1	U	ug/Kg	SW8260B	11/09/15
cis-1,2-Dichloroethene	156-59-2	1.26	5.03	1.26	U	ug/Kg	SW8260B	11/09/15
Bromochloromethane	74-97-5	1.26	5.03	1.26	U	ug/Kg	SW8260B	11/09/15
Chloroform	67-66-3	1.26	5.03	1.26	U	ug/Kg	SW8260B	11/09/15
2,2-Dichloropropane	594-20-7	1.26	5.03	1.26	U	ug/Kg	SW8260B	11/09/15
1,2-Dichloroethane	107-06-2	1.26	5.03	1.26	U	ug/Kg	SW8260B	11/09/15
1,1,1-Trichloroethane	71-55-6	1.26	5.03	1.26	U	ug/Kg	SW8260B	11/09/15
1,1-Dichloropropene	563-58-6	1.26	5.03	1.26	U	ug/Kg	SW8260B	11/09/15
Carbon tetrachloride	56-23-5	1.26	5.03	1.26	U	ug/Kg	SW8260B	11/09/15
Benzene	71-43-2	1.26	5.03	4.22	J	ug/Kg	SW8260B	11/09/15
Dibromomethane	74-95-3	1.26	5.03	1.26	U	ug/Kg	SW8260B	11/09/15
1,2-Dichloropropane	78-87-5	1.26	5.03	1.26	U	ug/Kg	SW8260B	11/09/15
Trichloroethene (TCE)	79-01-6	1.26	5.03	1.26	U	ug/Kg	SW8260B	11/09/15
Bromodichloromethane	75-27-4	1.26	5.03	1.26	U	ug/Kg	SW8260B	11/09/15
cis-1,3-Dichloropropene	10061-01-5	1.26	5.03	1.26	U	ug/Kg	SW8260B	11/09/15
4-Methyl-2-pentanone (MIBK)	108-10-1	5.03	25.1	5.03	U	ug/Kg	SW8260B	11/09/15
trans-1,3-Dichloropropene	10061-02-6	1.26	5.03	1.26	U	ug/Kg	SW8260B	11/09/15
1,1,2-Trichloroethane	79-00-5	1.26	5.03	1.26	U	ug/Kg	SW8260B	11/09/15
Toluene	108-88-3	1.26	5.03	5.32		ug/Kg	SW8260B	11/09/15
1,3-Dichloropropane	142-28-9	1.26	5.03	1.26	U	ug/Kg	SW8260B	11/09/15
Dibromochloromethane	124-48-1	1.26	5.03	1.26	U	ug/Kg	SW8260B	11/09/15
1,2-Dibromoethane (EDB)	106-93-4	1.26	5.03	1.26	U	ug/Kg	SW8260B	11/09/15
Tetrachloroethene (PCE)	127-18-4	1.26	5.03	1.26	U	ug/Kg	SW8260B	11/09/15
1-Chlorohexane	544-10-5	1.26	5.03	1.26	U	ug/Kg	SW8260B	11/09/15
1,1,1,2-Tetrachloroethane	630-20-6	1.26	5.03	1.26	U	ug/Kg	SW8260B	11/09/15
Chlorobenzene	108-90-7	1.26	5.03	1.26	U	ug/Kg	SW8260B	11/09/15
Ethylbenzene	100-41-4	1.26	5.03	1.26	U	ug/Kg	SW8260B	11/09/15
m,p-Xylene	108-38-3/1	2.51	10.1	2.51	U	ug/Kg	SW8260B	11/09/15
Bromoform	75-25-2	1.26	5.03	1.26	U	ug/Kg	SW8260B	11/09/15
Styrene	100-42-5	1.26	5.03	1.26	U	ug/Kg	SW8260B	11/09/15

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Client Sample ID: **D4SD04-0.503-01DL**

Project Name: Alaska LNG
Sample Date: 11/05/15
Sample Time: 13:30
Type: Grab
Matrix: Soil
Basis: Dry Weight

Lab Information

Lab Sample ID: **P358601DL**

Date Received: 11/07/15
Dilution Factor: 1
Report Revision No.: 0

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Volatiles								
1,1,2,2-Tetrachloroethane	79-34-5	1.26	5.03	1.26	U	ug/Kg	SW8260B	11/09/15
o-Xylene	95-47-6	1.26	5.03	1.41	J	ug/Kg	SW8260B	11/09/15
1,2,3-Trichloropropane	96-18-4	1.26	5.03	1.26	U	ug/Kg	SW8260B	11/09/15
Isopropylbenzene	98-82-8	1.26	5.03	1.26	U	ug/Kg	SW8260B	11/09/15
Bromobenzene	108-86-1	1.26	5.03	1.26	U	ug/Kg	SW8260B	11/09/15
n-Propylbenzene	103-65-1	1.26	5.03	1.26	U	ug/Kg	SW8260B	11/09/15
2-Chlorotoluene	95-49-8	1.26	5.03	1.26	U	ug/Kg	SW8260B	11/09/15
4-Chlorotoluene	106-43-4	1.26	5.03	1.26	U	ug/Kg	SW8260B	11/09/15
1,3,5-Trimethylbenzene	108-67-8	1.26	5.03	1.26	U	ug/Kg	SW8260B	11/09/15
tert-Butylbenzene	98-06-6	1.26	5.03	1.26	U	ug/Kg	SW8260B	11/09/15
1,2,4-Trimethylbenzene	95-63-6	1.26	5.03	1.26	U	ug/Kg	SW8260B	11/09/15
sec-Butylbenzene	135-98-8	1.26	5.03	1.26	U	ug/Kg	SW8260B	11/09/15
1,3-Dichlorobenzene	541-73-1	1.26	5.03	1.26	U	ug/Kg	SW8260B	11/09/15
1,4-Dichlorobenzene	106-46-7	1.26	5.03	1.26	U	ug/Kg	SW8260B	11/09/15
p-Isopropyltoluene	99-87-6	1.26	5.03	1.26	U	ug/Kg	SW8260B	11/09/15
1,2-Dichlorobenzene	95-50-1	1.26	5.03	1.26	U	ug/Kg	SW8260B	11/09/15
n-Butylbenzene	104-51-8	1.26	5.03	1.26	U	ug/Kg	SW8260B	11/09/15
1,2-Dibromo-3-chloropropane	96-12-8	1.26	5.03	1.26	U	ug/Kg	SW8260B	11/09/15
1,2,4-Trichlorobenzene	120-82-1	1.26	5.03	1.26	U	ug/Kg	SW8260B	11/09/15
Naphthalene	91-20-3	1.26	5.03	1.31	J	ug/Kg	SW8260B	11/09/15
Hexachlorobutadiene	87-68-3	1.26	5.03	1.26	U	ug/Kg	SW8260B	11/09/15
1,2,3-Trichlorobenzene	87-61-6	1.26	5.03	1.26	U	ug/Kg	SW8260B	11/09/15

Surrogate	% Recovery	Control Limits	Qualifier
Dibromofluoromethane	103	70-130	
1,2-Dichloroethane-d4	109	70-130	
Toluene-d8	96	70-130	
4-Bromofluorobenzene	85	70-130	

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Client Sample ID: **D4SD04-0.503-101**

Project Name: Alaska LNG
Sample Date: 11/05/15
Sample Time: 13:40
Type: Grab
Matrix: Soil
Basis: Dry Weight

Lab Information

Lab Sample ID: **P358602**

Date Received: 11/07/15
Dilution Factor: 1
Report Revision No.: 0

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Volatiles								
Dichlorodifluoromethane	75-71-8	0.25	1.0	0.25	U	ug/Kg	SW8260B	11/09/15
Chloromethane	74-87-3	0.25	1.0	10.4		ug/Kg	SW8260B	11/09/15
Vinyl Chloride	75-01-4	0.25	1.0	0.25	U	ug/Kg	SW8260B	11/09/15
Bromomethane	74-83-9	0.25	1.0	0.25	U	ug/Kg	SW8260B	11/09/15
Chloroethane	75-00-3	0.25	1.0	0.25	U	ug/Kg	SW8260B	11/09/15
Trichlorofluoromethane	75-69-4	0.25	1.0	0.25	U	ug/Kg	SW8260B	11/09/15
Acetone	67-64-1	1.0	4.99	141	E	ug/Kg	SW8260B	11/09/15
1,1-Dichloroethene	75-35-4	0.25	1.0	0.25	U	ug/Kg	SW8260B	11/09/15
Methylene chloride	75-09-2	0.25	1.0	0.25	U	ug/Kg	SW8260B	11/09/15
trans-1,2-Dichloroethene	156-60-5	0.25	1.0	0.25	U	ug/Kg	SW8260B	11/09/15
Methyl tert-butyl ether (MTBE)	1634-04-4	0.25	1.0	0.25	U	ug/Kg	SW8260B	11/09/15
1,1-Dichloroethane	75-34-3	0.25	1.0	0.25	U	ug/Kg	SW8260B	11/09/15
2-Butanone (MEK)	78-93-3	2.00	4.99	29.5		ug/Kg	SW8260B	11/09/15
cis-1,2-Dichloroethene	156-59-2	0.25	1.0	0.25	U	ug/Kg	SW8260B	11/09/15
Bromochloromethane	74-97-5	0.25	1.0	0.25	U	ug/Kg	SW8260B	11/09/15
Chloroform	67-66-3	0.25	1.0	0.25	U	ug/Kg	SW8260B	11/09/15
2,2-Dichloropropane	594-20-7	0.25	1.0	0.25	U	ug/Kg	SW8260B	11/09/15
1,2-Dichloroethane	107-06-2	0.25	1.0	0.25	U	ug/Kg	SW8260B	11/09/15
1,1,1-Trichloroethane	71-55-6	0.25	1.0	0.25	U	ug/Kg	SW8260B	11/09/15
1,1-Dichloropropene	563-58-6	0.25	1.0	0.25	U	ug/Kg	SW8260B	11/09/15
Carbon tetrachloride	56-23-5	0.25	1.0	0.25	U	ug/Kg	SW8260B	11/09/15
Benzene	71-43-2	0.25	1.0	19.7		ug/Kg	SW8260B	11/09/15
Dibromomethane	74-95-3	0.25	1.0	0.25	U	ug/Kg	SW8260B	11/09/15
1,2-Dichloropropane	78-87-5	0.25	1.0	0.25	U	ug/Kg	SW8260B	11/09/15
Trichloroethene (TCE)	79-01-6	0.25	1.0	0.25	U	ug/Kg	SW8260B	11/09/15
Bromodichloromethane	75-27-4	0.25	1.0	0.25	U	ug/Kg	SW8260B	11/09/15
cis-1,3-Dichloropropene	10061-01-5	0.25	1.0	0.25	U	ug/Kg	SW8260B	11/09/15
4-Methyl-2-pentanone (MIBK)	108-10-1	1.0	4.99	1.0	U	ug/Kg	SW8260B	11/09/15
trans-1,3-Dichloropropene	10061-02-6	0.25	1.0	0.25	U	ug/Kg	SW8260B	11/09/15
1,1,2-Trichloroethane	79-00-5	0.25	1.0	0.25	U	ug/Kg	SW8260B	11/09/15
Toluene	108-88-3	0.25	1.0	13.5		ug/Kg	SW8260B	11/09/15
1,3-Dichloropropane	142-28-9	0.25	1.0	0.25	U	ug/Kg	SW8260B	11/09/15
Dibromochloromethane	124-48-1	0.25	1.0	0.25	U	ug/Kg	SW8260B	11/09/15
1,2-Dibromoethane (EDB)	106-93-4	0.25	1.0	0.25	U	ug/Kg	SW8260B	11/09/15
Tetrachloroethene (PCE)	127-18-4	0.25	1.0	0.25	U	ug/Kg	SW8260B	11/09/15
1-Chlorohexane	544-10-5	0.25	1.0	0.25	U	ug/Kg	SW8260B	11/09/15
1,1,1,2-Tetrachloroethane	630-20-6	0.25	1.0	0.25	U	ug/Kg	SW8260B	11/09/15
Chlorobenzene	108-90-7	0.25	1.0	0.25	U	ug/Kg	SW8260B	11/09/15
Ethylbenzene	100-41-4	0.25	1.0	1.30		ug/Kg	SW8260B	11/09/15
m,p-Xylene	108-38-3/1	0.50	2.00	4.21		ug/Kg	SW8260B	11/09/15
Bromoform	75-25-2	0.25	1.0	0.25	U	ug/Kg	SW8260B	11/09/15
Styrene	100-42-5	0.25	1.0	0.81	J	ug/Kg	SW8260B	11/09/15

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Client Sample ID: **D4SD04-0.503-101**

Project Name: Alaska LNG
Sample Date: 11/05/15
Sample Time: 13:40
Type: Grab
Matrix: Soil
Basis: Dry Weight

Lab Information

Lab Sample ID: **P358602**

Date Received: 11/07/15
Dilution Factor: 1
Report Revision No.: 0

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Volatiles								
1,1,2,2-Tetrachloroethane	79-34-5	0.25	1.0	0.25	U	ug/Kg	SW8260B	11/09/15
o-Xylene	95-47-6	0.25	1.0	3.35		ug/Kg	SW8260B	11/09/15
1,2,3-Trichloropropane	96-18-4	0.25	1.0	0.25	U	ug/Kg	SW8260B	11/09/15
Isopropylbenzene	98-82-8	0.25	1.0	0.25	U	ug/Kg	SW8260B	11/09/15
Bromobenzene	108-86-1	0.25	1.0	0.25	U	ug/Kg	SW8260B	11/09/15
n-Propylbenzene	103-65-1	0.25	1.0	0.25	U	ug/Kg	SW8260B	11/09/15
2-Chlorotoluene	95-49-8	0.25	1.0	0.25	U	ug/Kg	SW8260B	11/09/15
4-Chlorotoluene	106-43-4	0.25	1.0	0.25	U	ug/Kg	SW8260B	11/09/15
1,3,5-Trimethylbenzene	108-67-8	0.25	1.0	0.36	J	ug/Kg	SW8260B	11/09/15
tert-Butylbenzene	98-06-6	0.25	1.0	0.25	U	ug/Kg	SW8260B	11/09/15
1,2,4-Trimethylbenzene	95-63-6	0.25	1.0	1.62		ug/Kg	SW8260B	11/09/15
sec-Butylbenzene	135-98-8	0.25	1.0	0.25	U	ug/Kg	SW8260B	11/09/15
1,3-Dichlorobenzene	541-73-1	0.25	1.0	0.25	U	ug/Kg	SW8260B	11/09/15
1,4-Dichlorobenzene	106-46-7	0.25	1.0	0.25	U	ug/Kg	SW8260B	11/09/15
p-Isopropyltoluene	99-87-6	0.25	1.0	0.88	J	ug/Kg	SW8260B	11/09/15
1,2-Dichlorobenzene	95-50-1	0.25	1.0	0.25	U	ug/Kg	SW8260B	11/09/15
n-Butylbenzene	104-51-8	0.25	1.0	0.25	U	ug/Kg	SW8260B	11/09/15
1,2-Dibromo-3-chloropropane	96-12-8	0.25	1.0	0.25	U	ug/Kg	SW8260B	11/09/15
1,2,4-Trichlorobenzene	120-82-1	0.25	1.0	0.25	U	ug/Kg	SW8260B	11/09/15
Naphthalene	91-20-3	0.25	1.0	1.88		ug/Kg	SW8260B	11/09/15
Hexachlorobutadiene	87-68-3	0.25	1.0	0.25	U	ug/Kg	SW8260B	11/09/15
1,2,3-Trichlorobenzene	87-61-6	0.25	1.0	0.25	U	ug/Kg	SW8260B	11/09/15

Surrogate	% Recovery	Control Limits	Qualifier
Dibromofluoromethane	94	70-130	
1,2-Dichloroethane-d4	107	70-130	
Toluene-d8	93	70-130	
4-Bromofluorobenzene	77	70-130	

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Client Sample ID: **D4SD04-0.503-101DL**

Project Name: Alaska LNG
Sample Date: 11/05/15
Sample Time: 13:40
Type: Grab
Matrix: Soil
Basis: Dry Weight

Lab Information

Lab Sample ID: **P358602DL**

Date Received: 11/07/15
Dilution Factor: 1
Report Revision No.: 0

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Volatiles								
Dichlorodifluoromethane	75-71-8	1.11	4.42	1.11	U	ug/Kg	SW8260B	11/09/15
Chloromethane	74-87-3	1.11	4.42	5.25		ug/Kg	SW8260B	11/09/15
Vinyl Chloride	75-01-4	1.11	4.42	1.11	U	ug/Kg	SW8260B	11/09/15
Bromomethane	74-83-9	1.11	4.42	1.11	U	ug/Kg	SW8260B	11/09/15
Chloroethane	75-00-3	1.11	4.42	1.11	U	ug/Kg	SW8260B	11/09/15
Trichlorofluoromethane	75-69-4	1.11	4.42	1.11	U	ug/Kg	SW8260B	11/09/15
Acetone	67-64-1	4.42	22.1	163		ug/Kg	SW8260B	11/09/15
1,1-Dichloroethene	75-35-4	1.11	4.42	1.11	U	ug/Kg	SW8260B	11/09/15
Methylene chloride	75-09-2	1.11	4.42	1.11	U	ug/Kg	SW8260B	11/09/15
trans-1,2-Dichloroethene	156-60-5	1.11	4.42	1.11	U	ug/Kg	SW8260B	11/09/15
Methyl tert-butyl ether (MTBE)	1634-04-4	1.11	4.42	1.11	U	ug/Kg	SW8260B	11/09/15
1,1-Dichloroethane	75-34-3	1.11	4.42	1.11	U	ug/Kg	SW8260B	11/09/15
2-Butanone (MEK)	78-93-3	8.85	22.1	29.5		ug/Kg	SW8260B	11/09/15
cis-1,2-Dichloroethene	156-59-2	1.11	4.42	1.11	U	ug/Kg	SW8260B	11/09/15
Bromochloromethane	74-97-5	1.11	4.42	1.11	U	ug/Kg	SW8260B	11/09/15
Chloroform	67-66-3	1.11	4.42	1.11	U	ug/Kg	SW8260B	11/09/15
2,2-Dichloropropane	594-20-7	1.11	4.42	1.11	U	ug/Kg	SW8260B	11/09/15
1,2-Dichloroethane	107-06-2	1.11	4.42	1.11	U	ug/Kg	SW8260B	11/09/15
1,1,1-Trichloroethane	71-55-6	1.11	4.42	1.11	U	ug/Kg	SW8260B	11/09/15
1,1-Dichloropropene	563-58-6	1.11	4.42	1.11	U	ug/Kg	SW8260B	11/09/15
Carbon tetrachloride	56-23-5	1.11	4.42	1.11	U	ug/Kg	SW8260B	11/09/15
Benzene	71-43-2	1.11	4.42	23.6		ug/Kg	SW8260B	11/09/15
Dibromomethane	74-95-3	1.11	4.42	1.11	U	ug/Kg	SW8260B	11/09/15
1,2-Dichloropropane	78-87-5	1.11	4.42	1.11	U	ug/Kg	SW8260B	11/09/15
Trichloroethene (TCE)	79-01-6	1.11	4.42	1.11	U	ug/Kg	SW8260B	11/09/15
Bromodichloromethane	75-27-4	1.11	4.42	1.11	U	ug/Kg	SW8260B	11/09/15
cis-1,3-Dichloropropene	10061-01-5	1.11	4.42	1.11	U	ug/Kg	SW8260B	11/09/15
4-Methyl-2-pentanone (MIBK)	108-10-1	4.42	22.1	4.42	U	ug/Kg	SW8260B	11/09/15
trans-1,3-Dichloropropene	10061-02-6	1.11	4.42	1.11	U	ug/Kg	SW8260B	11/09/15
1,1,2-Trichloroethane	79-00-5	1.11	4.42	1.11	U	ug/Kg	SW8260B	11/09/15
Toluene	108-88-3	1.11	4.42	15.5		ug/Kg	SW8260B	11/09/15
1,3-Dichloropropane	142-28-9	1.11	4.42	1.11	U	ug/Kg	SW8260B	11/09/15
Dibromochloromethane	124-48-1	1.11	4.42	1.11	U	ug/Kg	SW8260B	11/09/15
1,2-Dibromoethane (EDB)	106-93-4	1.11	4.42	1.11	U	ug/Kg	SW8260B	11/09/15
Tetrachloroethene (PCE)	127-18-4	1.11	4.42	1.11	U	ug/Kg	SW8260B	11/09/15
1-Chlorohexane	544-10-5	1.11	4.42	1.11	U	ug/Kg	SW8260B	11/09/15
1,1,1,2-Tetrachloroethane	630-20-6	1.11	4.42	1.11	U	ug/Kg	SW8260B	11/09/15
Chlorobenzene	108-90-7	1.11	4.42	1.11	U	ug/Kg	SW8260B	11/09/15
Ethylbenzene	100-41-4	1.11	4.42	1.25	J	ug/Kg	SW8260B	11/09/15
m,p-Xylene	108-38-3/1	2.21	8.85	3.47	J	ug/Kg	SW8260B	11/09/15
Bromoform	75-25-2	1.11	4.42	1.11	U	ug/Kg	SW8260B	11/09/15
Styrene	100-42-5	1.11	4.42	1.11	U	ug/Kg	SW8260B	11/09/15

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Client Sample ID: **D4SD04-0.503-101DL**

Project Name: Alaska LNG
Sample Date: 11/05/15
Sample Time: 13:40
Type: Grab
Matrix: Soil
Basis: Dry Weight

Lab Information

Lab Sample ID: **P358602DL**

Date Received: 11/07/15
Dilution Factor: 1
Report Revision No.: 0

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Volatiles								
1,1,2,2-Tetrachloroethane	79-34-5	1.11	4.42	1.11	U	ug/Kg	SW8260B	11/09/15
o-Xylene	95-47-6	1.11	4.42	2.62	J	ug/Kg	SW8260B	11/09/15
1,2,3-Trichloropropane	96-18-4	1.11	4.42	1.11	U	ug/Kg	SW8260B	11/09/15
Isopropylbenzene	98-82-8	1.11	4.42	1.11	U	ug/Kg	SW8260B	11/09/15
Bromobenzene	108-86-1	1.11	4.42	1.11	U	ug/Kg	SW8260B	11/09/15
n-Propylbenzene	103-65-1	1.11	4.42	1.11	U	ug/Kg	SW8260B	11/09/15
2-Chlorotoluene	95-49-8	1.11	4.42	1.11	U	ug/Kg	SW8260B	11/09/15
4-Chlorotoluene	106-43-4	1.11	4.42	1.11	U	ug/Kg	SW8260B	11/09/15
1,3,5-Trimethylbenzene	108-67-8	1.11	4.42	1.11	U	ug/Kg	SW8260B	11/09/15
tert-Butylbenzene	98-06-6	1.11	4.42	1.11	U	ug/Kg	SW8260B	11/09/15
1,2,4-Trimethylbenzene	95-63-6	1.11	4.42	1.11	U	ug/Kg	SW8260B	11/09/15
sec-Butylbenzene	135-98-8	1.11	4.42	1.11	U	ug/Kg	SW8260B	11/09/15
1,3-Dichlorobenzene	541-73-1	1.11	4.42	1.11	U	ug/Kg	SW8260B	11/09/15
1,4-Dichlorobenzene	106-46-7	1.11	4.42	1.11	U	ug/Kg	SW8260B	11/09/15
p-Isopropyltoluene	99-87-6	1.11	4.42	1.11	U	ug/Kg	SW8260B	11/09/15
1,2-Dichlorobenzene	95-50-1	1.11	4.42	1.11	U	ug/Kg	SW8260B	11/09/15
n-Butylbenzene	104-51-8	1.11	4.42	1.11	U	ug/Kg	SW8260B	11/09/15
1,2-Dibromo-3-chloropropane	96-12-8	1.11	4.42	1.11	U	ug/Kg	SW8260B	11/09/15
1,2,4-Trichlorobenzene	120-82-1	1.11	4.42	1.11	U	ug/Kg	SW8260B	11/09/15
Naphthalene	91-20-3	1.11	4.42	1.16	J	ug/Kg	SW8260B	11/09/15
Hexachlorobutadiene	87-68-3	1.11	4.42	1.11	U	ug/Kg	SW8260B	11/09/15
1,2,3-Trichlorobenzene	87-61-6	1.11	4.42	1.11	U	ug/Kg	SW8260B	11/09/15

Surrogate	% Recovery	Control Limits	Qualifier
Dibromofluoromethane	103	70-130	
1,2-Dichloroethane-d4	110	70-130	
Toluene-d8	96	70-130	
4-Bromofluorobenzene	84	70-130	

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Client Sample ID: **D4SD04-0.503-01MS**

Project Name: Alaska LNG
Sample Date: 11/05/15
Sample Time: 13:30
Type: Grab
Matrix: Soil
Basis: Dry Weight

Lab Information

Lab Sample ID: **P358603MS**

Date Received: 11/07/15
Dilution Factor: 1
Report Revision No.: 0

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Volatiles								
Dichlorodifluoromethane	75-71-8	0.25	1.0	16.9		ug/Kg	SW8260B	11/09/15
Chloromethane	74-87-3	0.25	1.0	19.2		ug/Kg	SW8260B	11/09/15
Vinyl Chloride	75-01-4	0.25	1.0	17.0		ug/Kg	SW8260B	11/09/15
Bromomethane	74-83-9	0.25	1.0	16.3		ug/Kg	SW8260B	11/09/15
Chloroethane	75-00-3	0.25	1.0	16.4		ug/Kg	SW8260B	11/09/15
Trichlorofluoromethane	75-69-4	0.25	1.0	20.1		ug/Kg	SW8260B	11/09/15
Acetone	67-64-1	1.0	4.99	148	E	ug/Kg	SW8260B	11/09/15
1,1-Dichloroethene	75-35-4	0.25	1.0	18.3		ug/Kg	SW8260B	11/09/15
Methylene chloride	75-09-2	0.25	1.0	20.0		ug/Kg	SW8260B	11/09/15
trans-1,2-Dichloroethene	156-60-5	0.25	1.0	18.5		ug/Kg	SW8260B	11/09/15
Methyl tert-butyl ether (MTBE)	1634-04-4	0.25	1.0	17.8		ug/Kg	SW8260B	11/09/15
1,1-Dichloroethane	75-34-3	0.25	1.0	18.5		ug/Kg	SW8260B	11/09/15
2-Butanone (MEK)	78-93-3	2.00	4.99	41.2		ug/Kg	SW8260B	11/09/15
cis-1,2-Dichloroethene	156-59-2	0.25	1.0	18.6		ug/Kg	SW8260B	11/09/15
Bromochloromethane	74-97-5	0.25	1.0	18.1		ug/Kg	SW8260B	11/09/15
Chloroform	67-66-3	0.25	1.0	19.1		ug/Kg	SW8260B	11/09/15
2,2-Dichloropropane	594-20-7	0.25	1.0	20.1		ug/Kg	SW8260B	11/09/15
1,2-Dichloroethane	107-06-2	0.25	1.0	19.5		ug/Kg	SW8260B	11/09/15
1,1,1-Trichloroethane	71-55-6	0.25	1.0	20.0		ug/Kg	SW8260B	11/09/15
1,1-Dichloropropene	563-58-6	0.25	1.0	18.4		ug/Kg	SW8260B	11/09/15
Carbon tetrachloride	56-23-5	0.25	1.0	20.4		ug/Kg	SW8260B	11/09/15
Benzene	71-43-2	0.25	1.0	21.3		ug/Kg	SW8260B	11/09/15
Dibromomethane	74-95-3	0.25	1.0	18.1		ug/Kg	SW8260B	11/09/15
1,2-Dichloropropane	78-87-5	0.25	1.0	18.3		ug/Kg	SW8260B	11/09/15
Trichloroethene (TCE)	79-01-6	0.25	1.0	18.4		ug/Kg	SW8260B	11/09/15
Bromodichloromethane	75-27-4	0.25	1.0	18.9		ug/Kg	SW8260B	11/09/15
cis-1,3-Dichloropropene	10061-01-5	0.25	1.0	17.0		ug/Kg	SW8260B	11/09/15
4-Methyl-2-pentanone (MIBK)	108-10-1	1.0	4.99	18.1		ug/Kg	SW8260B	11/09/15
trans-1,3-Dichloropropene	10061-02-6	0.25	1.0	17.1		ug/Kg	SW8260B	11/09/15
1,1,2-Trichloroethane	79-00-5	0.25	1.0	18.0		ug/Kg	SW8260B	11/09/15
Toluene	108-88-3	0.25	1.0	22.3		ug/Kg	SW8260B	11/09/15
1,3-Dichloropropane	142-28-9	0.25	1.0	17.8		ug/Kg	SW8260B	11/09/15
Dibromochloromethane	124-48-1	0.25	1.0	17.7		ug/Kg	SW8260B	11/09/15
1,2-Dibromoethane (EDB)	106-93-4	0.25	1.0	17.4		ug/Kg	SW8260B	11/09/15
Tetrachloroethene (PCE)	127-18-4	0.25	1.0	18.4		ug/Kg	SW8260B	11/09/15
1-Chlorohexane	544-10-5	0.25	1.0	17.0		ug/Kg	SW8260B	11/09/15
1,1,1,2-Tetrachloroethane	630-20-6	0.25	1.0	19.3		ug/Kg	SW8260B	11/09/15
Chlorobenzene	108-90-7	0.25	1.0	18.6		ug/Kg	SW8260B	11/09/15
Ethylbenzene	100-41-4	0.25	1.0	20.0		ug/Kg	SW8260B	11/09/15
m,p-Xylene	108-38-3/1	0.50	2.00	40.8		ug/Kg	SW8260B	11/09/15
Bromoform	75-25-2	0.25	1.0	16.0		ug/Kg	SW8260B	11/09/15
Styrene	100-42-5	0.25	1.0	18.7		ug/Kg	SW8260B	11/09/15

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Client Sample ID: **D4SD04-0.503-01MS**

Project Name: Alaska LNG
Sample Date: 11/05/15
Sample Time: 13:30
Type: Grab
Matrix: Soil
Basis: Dry Weight

Lab Information

Lab Sample ID: **P358603MS**

Date Received: 11/07/15
Dilution Factor: 1
Report Revision No.: 0

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Volatiles								
1,1,2,2-Tetrachloroethane	79-34-5	0.25	1.0	17.9		ug/Kg	SW8260B	11/09/15
o-Xylene	95-47-6	0.25	1.0	20.7		ug/Kg	SW8260B	11/09/15
1,2,3-Trichloropropane	96-18-4	0.25	1.0	18.1		ug/Kg	SW8260B	11/09/15
Isopropylbenzene	98-82-8	0.25	1.0	19.6		ug/Kg	SW8260B	11/09/15
Bromobenzene	108-86-1	0.25	1.0	17.5		ug/Kg	SW8260B	11/09/15
n-Propylbenzene	103-65-1	0.25	1.0	19.0		ug/Kg	SW8260B	11/09/15
2-Chlorotoluene	95-49-8	0.25	1.0	18.5		ug/Kg	SW8260B	11/09/15
4-Chlorotoluene	106-43-4	0.25	1.0	17.6		ug/Kg	SW8260B	11/09/15
1,3,5-Trimethylbenzene	108-67-8	0.25	1.0	19.0		ug/Kg	SW8260B	11/09/15
tert-Butylbenzene	98-06-6	0.25	1.0	19.5		ug/Kg	SW8260B	11/09/15
1,2,4-Trimethylbenzene	95-63-6	0.25	1.0	19.3		ug/Kg	SW8260B	11/09/15
sec-Butylbenzene	135-98-8	0.25	1.0	18.6		ug/Kg	SW8260B	11/09/15
1,3-Dichlorobenzene	541-73-1	0.25	1.0	15.7		ug/Kg	SW8260B	11/09/15
1,4-Dichlorobenzene	106-46-7	0.25	1.0	19.3		ug/Kg	SW8260B	11/09/15
p-Isopropyltoluene	99-87-6	0.25	1.0	22.7		ug/Kg	SW8260B	11/09/15
1,2-Dichlorobenzene	95-50-1	0.25	1.0	19.1		ug/Kg	SW8260B	11/09/15
n-Butylbenzene	104-51-8	0.25	1.0	20.8		ug/Kg	SW8260B	11/09/15
1,2-Dibromo-3-chloropropane	96-12-8	0.25	1.0	19.3		ug/Kg	SW8260B	11/09/15
1,2,4-Trichlorobenzene	120-82-1	0.25	1.0	13.7		ug/Kg	SW8260B	11/09/15
Naphthalene	91-20-3	0.25	1.0	15.0		ug/Kg	SW8260B	11/09/15
Hexachlorobutadiene	87-68-3	0.25	1.0	18.5		ug/Kg	SW8260B	11/09/15
1,2,3-Trichlorobenzene	87-61-6	0.25	1.0	13.3		ug/Kg	SW8260B	11/09/15

Surrogate	% Recovery	Control Limits	Qualifier
Dibromofluoromethane	98	70-130	
1,2-Dichloroethane-d4	103	70-130	
Toluene-d8	96	70-130	
4-Bromofluorobenzene	89	70-130	

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Client Sample ID: **D4SD04-0.503-01SD**

Project Name: Alaska LNG
Sample Date: 11/05/15
Sample Time: 13:30
Type: Grab
Matrix: Soil
Basis: Dry Weight

Lab Information

Lab Sample ID: **P358604MSD**

Date Received: 11/07/15
Dilution Factor: 1
Report Revision No.: 0

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Volatiles								
Dichlorodifluoromethane	75-71-8	0.25	1.0	17.1		ug/Kg	SW8260B	11/09/15
Chloromethane	74-87-3	0.25	1.0	20.9		ug/Kg	SW8260B	11/09/15
Vinyl Chloride	75-01-4	0.25	1.0	17.6		ug/Kg	SW8260B	11/09/15
Bromomethane	74-83-9	0.25	1.0	17.1		ug/Kg	SW8260B	11/09/15
Chloroethane	75-00-3	0.25	1.0	17.1		ug/Kg	SW8260B	11/09/15
Trichlorofluoromethane	75-69-4	0.25	1.0	20.2		ug/Kg	SW8260B	11/09/15
Acetone	67-64-1	1.0	4.99	168	E	ug/Kg	SW8260B	11/09/15
1,1-Dichloroethene	75-35-4	0.25	1.0	18.6		ug/Kg	SW8260B	11/09/15
Methylene chloride	75-09-2	0.25	1.0	20.4		ug/Kg	SW8260B	11/09/15
trans-1,2-Dichloroethene	156-60-5	0.25	1.0	18.4		ug/Kg	SW8260B	11/09/15
Methyl tert-butyl ether (MTBE)	1634-04-4	0.25	1.0	18.5		ug/Kg	SW8260B	11/09/15
1,1-Dichloroethane	75-34-3	0.25	1.0	18.8		ug/Kg	SW8260B	11/09/15
2-Butanone (MEK)	78-93-3	2.00	4.99	47.5		ug/Kg	SW8260B	11/09/15
cis-1,2-Dichloroethene	156-59-2	0.25	1.0	19.0		ug/Kg	SW8260B	11/09/15
Bromochloromethane	74-97-5	0.25	1.0	18.7		ug/Kg	SW8260B	11/09/15
Chloroform	67-66-3	0.25	1.0	19.5		ug/Kg	SW8260B	11/09/15
2,2-Dichloropropane	594-20-7	0.25	1.0	20.2		ug/Kg	SW8260B	11/09/15
1,2-Dichloroethane	107-06-2	0.25	1.0	20.0		ug/Kg	SW8260B	11/09/15
1,1,1-Trichloroethane	71-55-6	0.25	1.0	20.1		ug/Kg	SW8260B	11/09/15
1,1-Dichloropropene	563-58-6	0.25	1.0	18.7		ug/Kg	SW8260B	11/09/15
Carbon tetrachloride	56-23-5	0.25	1.0	20.4		ug/Kg	SW8260B	11/09/15
Benzene	71-43-2	0.25	1.0	21.9		ug/Kg	SW8260B	11/09/15
Dibromomethane	74-95-3	0.25	1.0	18.4		ug/Kg	SW8260B	11/09/15
1,2-Dichloropropane	78-87-5	0.25	1.0	18.7		ug/Kg	SW8260B	11/09/15
Trichloroethene (TCE)	79-01-6	0.25	1.0	18.9		ug/Kg	SW8260B	11/09/15
Bromodichloromethane	75-27-4	0.25	1.0	19.8		ug/Kg	SW8260B	11/09/15
cis-1,3-Dichloropropene	10061-01-5	0.25	1.0	18.9		ug/Kg	SW8260B	11/09/15
4-Methyl-2-pentanone (MIBK)	108-10-1	1.0	4.99	19.2		ug/Kg	SW8260B	11/09/15
trans-1,3-Dichloropropene	10061-02-6	0.25	1.0	18.8		ug/Kg	SW8260B	11/09/15
1,1,2-Trichloroethane	79-00-5	0.25	1.0	18.8		ug/Kg	SW8260B	11/09/15
Toluene	108-88-3	0.25	1.0	22.5		ug/Kg	SW8260B	11/09/15
1,3-Dichloropropane	142-28-9	0.25	1.0	18.7		ug/Kg	SW8260B	11/09/15
Dibromochloromethane	124-48-1	0.25	1.0	19.6		ug/Kg	SW8260B	11/09/15
1,2-Dibromoethane (EDB)	106-93-4	0.25	1.0	18.3		ug/Kg	SW8260B	11/09/15
Tetrachloroethene (PCE)	127-18-4	0.25	1.0	18.2		ug/Kg	SW8260B	11/09/15
1-Chlorohexane	544-10-5	0.25	1.0	16.7		ug/Kg	SW8260B	11/09/15
1,1,1,2-Tetrachloroethane	630-20-6	0.25	1.0	19.6		ug/Kg	SW8260B	11/09/15
Chlorobenzene	108-90-7	0.25	1.0	18.7		ug/Kg	SW8260B	11/09/15
Ethylbenzene	100-41-4	0.25	1.0	20.1		ug/Kg	SW8260B	11/09/15
m,p-Xylene	108-38-3/1	0.50	2.00	41.1		ug/Kg	SW8260B	11/09/15
Bromoform	75-25-2	0.25	1.0	18.4		ug/Kg	SW8260B	11/09/15
Styrene	100-42-5	0.25	1.0	18.9		ug/Kg	SW8260B	11/09/15

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Client Sample ID: **D4SD04-0.503-01SD**

Project Name: Alaska LNG
Sample Date: 11/05/15
Sample Time: 13:30
Type: Grab
Matrix: Soil
Basis: Dry Weight

Lab Information

Lab Sample ID: **P358604MSD**

Date Received: 11/07/15
Dilution Factor: 1
Report Revision No.: 0

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Volatiles								
1,1,2,2-Tetrachloroethane	79-34-5	0.25	1.0	18.3		ug/Kg	SW8260B	11/09/15
o-Xylene	95-47-6	0.25	1.0	20.8		ug/Kg	SW8260B	11/09/15
1,2,3-Trichloropropane	96-18-4	0.25	1.0	18.7		ug/Kg	SW8260B	11/09/15
Isopropylbenzene	98-82-8	0.25	1.0	19.6		ug/Kg	SW8260B	11/09/15
Bromobenzene	108-86-1	0.25	1.0	17.9		ug/Kg	SW8260B	11/09/15
n-Propylbenzene	103-65-1	0.25	1.0	18.7		ug/Kg	SW8260B	11/09/15
2-Chlorotoluene	95-49-8	0.25	1.0	18.2		ug/Kg	SW8260B	11/09/15
4-Chlorotoluene	106-43-4	0.25	1.0	17.5		ug/Kg	SW8260B	11/09/15
1,3,5-Trimethylbenzene	108-67-8	0.25	1.0	18.7		ug/Kg	SW8260B	11/09/15
tert-Butylbenzene	98-06-6	0.25	1.0	19.2		ug/Kg	SW8260B	11/09/15
1,2,4-Trimethylbenzene	95-63-6	0.25	1.0	19.0		ug/Kg	SW8260B	11/09/15
sec-Butylbenzene	135-98-8	0.25	1.0	18.0		ug/Kg	SW8260B	11/09/15
1,3-Dichlorobenzene	541-73-1	0.25	1.0	15.9		ug/Kg	SW8260B	11/09/15
1,4-Dichlorobenzene	106-46-7	0.25	1.0	19.5		ug/Kg	SW8260B	11/09/15
p-Isopropyltoluene	99-87-6	0.25	1.0	22.1		ug/Kg	SW8260B	11/09/15
1,2-Dichlorobenzene	95-50-1	0.25	1.0	19.4		ug/Kg	SW8260B	11/09/15
n-Butylbenzene	104-51-8	0.25	1.0	19.1		ug/Kg	SW8260B	11/09/15
1,2-Dibromo-3-chloropropane	96-12-8	0.25	1.0	20.8		ug/Kg	SW8260B	11/09/15
1,2,4-Trichlorobenzene	120-82-1	0.25	1.0	12.7		ug/Kg	SW8260B	11/09/15
Naphthalene	91-20-3	0.25	1.0	16.0		ug/Kg	SW8260B	11/09/15
Hexachlorobutadiene	87-68-3	0.25	1.0	15.9		ug/Kg	SW8260B	11/09/15
1,2,3-Trichlorobenzene	87-61-6	0.25	1.0	12.7		ug/Kg	SW8260B	11/09/15

Surrogate	% Recovery	Control Limits	Qualifier
Dibromofluoromethane	98	70-130	
1,2-Dichloroethane-d4	103	70-130	
Toluene-d8	96	70-130	
4-Bromofluorobenzene	89	70-130	

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Client Sample ID: **D4SD04-0304.25-02**

Project Name: Alaska LNG
Sample Date: 11/05/15
Sample Time: 16:30
Type: Grab
Matrix: Soil
Basis: Dry Weight

Lab Information

Lab Sample ID: **P358605**

Date Received: 11/07/15
Dilution Factor: 1
Report Revision No.: 0

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Volatiles								
Dichlorodifluoromethane	75-71-8	0.28	1.11	0.28	U	ug/Kg	SW8260B	11/09/15
Chloromethane	74-87-3	0.28	1.11	0.44	J	ug/Kg	SW8260B	11/09/15
Vinyl Chloride	75-01-4	0.28	1.11	0.28	U	ug/Kg	SW8260B	11/09/15
Bromomethane	74-83-9	0.28	1.11	0.28	U	ug/Kg	SW8260B	11/09/15
Chloroethane	75-00-3	0.28	1.11	0.28	U	ug/Kg	SW8260B	11/09/15
Trichlorofluoromethane	75-69-4	0.28	1.11	0.28	U	ug/Kg	SW8260B	11/09/15
Acetone	67-64-1	1.11	5.56	10.9		ug/Kg	SW8260B	11/09/15
1,1-Dichloroethene	75-35-4	0.28	1.11	0.28	U	ug/Kg	SW8260B	11/09/15
Methylene chloride	75-09-2	0.28	1.11	0.28	U	ug/Kg	SW8260B	11/09/15
trans-1,2-Dichloroethene	156-60-5	0.28	1.11	0.28	U	ug/Kg	SW8260B	11/09/15
Methyl tert-butyl ether (MTBE)	1634-04-4	0.28	1.11	0.28	U	ug/Kg	SW8260B	11/09/15
1,1-Dichloroethane	75-34-3	0.28	1.11	0.28	U	ug/Kg	SW8260B	11/09/15
2-Butanone (MEK)	78-93-3	2.22	5.56	2.22	U	ug/Kg	SW8260B	11/09/15
cis-1,2-Dichloroethene	156-59-2	0.28	1.11	0.28	U	ug/Kg	SW8260B	11/09/15
Bromochloromethane	74-97-5	0.28	1.11	0.28	U	ug/Kg	SW8260B	11/09/15
Chloroform	67-66-3	0.28	1.11	0.28	U	ug/Kg	SW8260B	11/09/15
2,2-Dichloropropane	594-20-7	0.28	1.11	0.28	U	ug/Kg	SW8260B	11/09/15
1,2-Dichloroethane	107-06-2	0.28	1.11	0.28	U	ug/Kg	SW8260B	11/09/15
1,1,1-Trichloroethane	71-55-6	0.28	1.11	0.28	U	ug/Kg	SW8260B	11/09/15
1,1-Dichloropropene	563-58-6	0.28	1.11	0.28	U	ug/Kg	SW8260B	11/09/15
Carbon tetrachloride	56-23-5	0.28	1.11	0.28	U	ug/Kg	SW8260B	11/09/15
Benzene	71-43-2	0.28	1.11	0.32	J	ug/Kg	SW8260B	11/09/15
Dibromomethane	74-95-3	0.28	1.11	0.28	U	ug/Kg	SW8260B	11/09/15
1,2-Dichloropropane	78-87-5	0.28	1.11	0.28	U	ug/Kg	SW8260B	11/09/15
Trichloroethene (TCE)	79-01-6	0.28	1.11	0.28	U	ug/Kg	SW8260B	11/09/15
Bromodichloromethane	75-27-4	0.28	1.11	0.28	U	ug/Kg	SW8260B	11/09/15
cis-1,3-Dichloropropene	10061-01-5	0.28	1.11	0.28	U	ug/Kg	SW8260B	11/09/15
4-Methyl-2-pentanone (MIBK)	108-10-1	1.11	5.56	1.11	U	ug/Kg	SW8260B	11/09/15
trans-1,3-Dichloropropene	10061-02-6	0.28	1.11	0.28	U	ug/Kg	SW8260B	11/09/15
1,1,2-Trichloroethane	79-00-5	0.28	1.11	0.28	U	ug/Kg	SW8260B	11/09/15
Toluene	108-88-3	0.28	1.11	0.91	J	ug/Kg	SW8260B	11/09/15
1,3-Dichloropropane	142-28-9	0.28	1.11	0.28	U	ug/Kg	SW8260B	11/09/15
Dibromochloromethane	124-48-1	0.28	1.11	0.28	U	ug/Kg	SW8260B	11/09/15
1,2-Dibromoethane (EDB)	106-93-4	0.28	1.11	0.28	U	ug/Kg	SW8260B	11/09/15
Tetrachloroethene (PCE)	127-18-4	0.28	1.11	0.28	U	ug/Kg	SW8260B	11/09/15
1-Chlorohexane	544-10-5	0.28	1.11	0.28	U	ug/Kg	SW8260B	11/09/15
1,1,1,2-Tetrachloroethane	630-20-6	0.28	1.11	0.28	U	ug/Kg	SW8260B	11/09/15
Chlorobenzene	108-90-7	0.28	1.11	0.28	U	ug/Kg	SW8260B	11/09/15
Ethylbenzene	100-41-4	0.28	1.11	0.28	U	ug/Kg	SW8260B	11/09/15
m,p-Xylene	108-38-3/1	0.56	2.22	0.56	U	ug/Kg	SW8260B	11/09/15
Bromoform	75-25-2	0.28	1.11	0.28	U	ug/Kg	SW8260B	11/09/15
Styrene	100-42-5	0.28	1.11	0.28	U	ug/Kg	SW8260B	11/09/15

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information		Lab Information	
Client Sample ID:	**D4SD04-0304.25-02**	**Lab Sample ID:**	**P358605**
Project Name:	Alaska LNG	Date Received:	11/07/15
Sample Date:	11/05/15	Dilution Factor:	1
Sample Time:	16:30	Report Revision No.:	0
Type:	Grab		
Matrix:	Soil		
Basis:	Dry Weight		

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Volatiles								
1,1,2,2-Tetrachloroethane	79-34-5	0.28	1.11	0.28	U	ug/Kg	SW8260B	11/09/15
o-Xylene	95-47-6	0.28	1.11	0.28	U	ug/Kg	SW8260B	11/09/15
1,2,3-Trichloropropane	96-18-4	0.28	1.11	0.28	U	ug/Kg	SW8260B	11/09/15
Isopropylbenzene	98-82-8	0.28	1.11	0.28	U	ug/Kg	SW8260B	11/09/15
Bromobenzene	108-86-1	0.28	1.11	0.28	U	ug/Kg	SW8260B	11/09/15
n-Propylbenzene	103-65-1	0.28	1.11	0.28	U	ug/Kg	SW8260B	11/09/15
2-Chlorotoluene	95-49-8	0.28	1.11	0.28	U	ug/Kg	SW8260B	11/09/15
4-Chlorotoluene	106-43-4	0.28	1.11	0.28	U	ug/Kg	SW8260B	11/09/15
1,3,5-Trimethylbenzene	108-67-8	0.28	1.11	0.28	U	ug/Kg	SW8260B	11/09/15
tert-Butylbenzene	98-06-6	0.28	1.11	0.28	U	ug/Kg	SW8260B	11/09/15
1,2,4-Trimethylbenzene	95-63-6	0.28	1.11	0.28	U	ug/Kg	SW8260B	11/09/15
sec-Butylbenzene	135-98-8	0.28	1.11	0.28	U	ug/Kg	SW8260B	11/09/15
1,3-Dichlorobenzene	541-73-1	0.28	1.11	0.28	U	ug/Kg	SW8260B	11/09/15
1,4-Dichlorobenzene	106-46-7	0.28	1.11	0.28	U	ug/Kg	SW8260B	11/09/15
p-Isopropyltoluene	99-87-6	0.28	1.11	0.28	U	ug/Kg	SW8260B	11/09/15
1,2-Dichlorobenzene	95-50-1	0.28	1.11	0.28	U	ug/Kg	SW8260B	11/09/15
n-Butylbenzene	104-51-8	0.28	1.11	0.28	U	ug/Kg	SW8260B	11/09/15
1,2-Dibromo-3-chloropropane	96-12-8	0.28	1.11	0.28	U	ug/Kg	SW8260B	11/09/15
1,2,4-Trichlorobenzene	120-82-1	0.28	1.11	0.28	U	ug/Kg	SW8260B	11/09/15
Naphthalene	91-20-3	0.28	1.11	0.28	U	ug/Kg	SW8260B	11/09/15
Hexachlorobutadiene	87-68-3	0.28	1.11	0.28	U	ug/Kg	SW8260B	11/09/15
1,2,3-Trichlorobenzene	87-61-6	0.28	1.11	0.28	U	ug/Kg	SW8260B	11/09/15

Surrogate	% Recovery	Control Limits	Qualifier
Dibromofluoromethane	103	70-130	
1,2-Dichloroethane-d4	106	70-130	
Toluene-d8	96	70-130	
4-Bromofluorobenzene	83	70-130	

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Client Sample ID: **D4SD04-4.2518.86-03**

Project Name: Alaska LNG
Sample Date: 11/05/15
Sample Time: 14:50
Type: Grab
Matrix: Soil
Basis: Dry Weight

Lab Information

Lab Sample ID: **P358606**

Date Received: 11/07/15
Dilution Factor: 1
Report Revision No.: 0

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Volatiles								
Dichlorodifluoromethane	75-71-8	0.29	1.16	0.29	U	ug/Kg	SW8260B	11/09/15
Chloromethane	74-87-3	0.29	1.16	10.5		ug/Kg	SW8260B	11/09/15
Vinyl Chloride	75-01-4	0.29	1.16	0.29	U	ug/Kg	SW8260B	11/09/15
Bromomethane	74-83-9	0.29	1.16	0.29	U	ug/Kg	SW8260B	11/09/15
Chloroethane	75-00-3	0.29	1.16	0.29	U	ug/Kg	SW8260B	11/09/15
Trichlorofluoromethane	75-69-4	0.29	1.16	0.29	U	ug/Kg	SW8260B	11/09/15
Acetone	67-64-1	1.16	5.80	7.88		ug/Kg	SW8260B	11/09/15
1,1-Dichloroethene	75-35-4	0.29	1.16	0.29	U	ug/Kg	SW8260B	11/09/15
Methylene chloride	75-09-2	0.29	1.16	0.29	U	ug/Kg	SW8260B	11/09/15
trans-1,2-Dichloroethene	156-60-5	0.29	1.16	0.29	U	ug/Kg	SW8260B	11/09/15
Methyl tert-butyl ether (MTBE)	1634-04-4	0.29	1.16	0.29	U	ug/Kg	SW8260B	11/09/15
1,1-Dichloroethane	75-34-3	0.29	1.16	0.29	U	ug/Kg	SW8260B	11/09/15
2-Butanone (MEK)	78-93-3	2.32	5.80	2.32	U	ug/Kg	SW8260B	11/09/15
cis-1,2-Dichloroethene	156-59-2	0.29	1.16	0.29	U	ug/Kg	SW8260B	11/09/15
Bromochloromethane	74-97-5	0.29	1.16	0.29	U	ug/Kg	SW8260B	11/09/15
Chloroform	67-66-3	0.29	1.16	0.29	U	ug/Kg	SW8260B	11/09/15
2,2-Dichloropropane	594-20-7	0.29	1.16	0.29	U	ug/Kg	SW8260B	11/09/15
1,2-Dichloroethane	107-06-2	0.29	1.16	0.29	U	ug/Kg	SW8260B	11/09/15
1,1,1-Trichloroethane	71-55-6	0.29	1.16	0.29	U	ug/Kg	SW8260B	11/09/15
1,1-Dichloropropene	563-58-6	0.29	1.16	0.29	U	ug/Kg	SW8260B	11/09/15
Carbon tetrachloride	56-23-5	0.29	1.16	0.29	U	ug/Kg	SW8260B	11/09/15
Benzene	71-43-2	0.29	1.16	0.29	U	ug/Kg	SW8260B	11/09/15
Dibromomethane	74-95-3	0.29	1.16	0.29	U	ug/Kg	SW8260B	11/09/15
1,2-Dichloropropane	78-87-5	0.29	1.16	0.29	U	ug/Kg	SW8260B	11/09/15
Trichloroethene (TCE)	79-01-6	0.29	1.16	0.29	U	ug/Kg	SW8260B	11/09/15
Bromodichloromethane	75-27-4	0.29	1.16	0.29	U	ug/Kg	SW8260B	11/09/15
cis-1,3-Dichloropropene	10061-01-5	0.29	1.16	0.29	U	ug/Kg	SW8260B	11/09/15
4-Methyl-2-pentanone (MIBK)	108-10-1	1.16	5.80	1.16	U	ug/Kg	SW8260B	11/09/15
trans-1,3-Dichloropropene	10061-02-6	0.29	1.16	0.29	U	ug/Kg	SW8260B	11/09/15
1,1,2-Trichloroethane	79-00-5	0.29	1.16	0.29	U	ug/Kg	SW8260B	11/09/15
Toluene	108-88-3	0.29	1.16	0.29	U	ug/Kg	SW8260B	11/09/15
1,3-Dichloropropane	142-28-9	0.29	1.16	0.29	U	ug/Kg	SW8260B	11/09/15
Dibromochloromethane	124-48-1	0.29	1.16	0.29	U	ug/Kg	SW8260B	11/09/15
1,2-Dibromoethane (EDB)	106-93-4	0.29	1.16	0.29	U	ug/Kg	SW8260B	11/09/15
Tetrachloroethene (PCE)	127-18-4	0.29	1.16	0.29	U	ug/Kg	SW8260B	11/09/15
1-Chlorohexane	544-10-5	0.29	1.16	0.29	U	ug/Kg	SW8260B	11/09/15
1,1,1,2-Tetrachloroethane	630-20-6	0.29	1.16	0.29	U	ug/Kg	SW8260B	11/09/15
Chlorobenzene	108-90-7	0.29	1.16	0.29	U	ug/Kg	SW8260B	11/09/15
Ethylbenzene	100-41-4	0.29	1.16	0.29	U	ug/Kg	SW8260B	11/09/15
m,p-Xylene	108-38-3/1	0.58	2.32	0.58	U	ug/Kg	SW8260B	11/09/15
Bromoform	75-25-2	0.29	1.16	0.29	U	ug/Kg	SW8260B	11/09/15
Styrene	100-42-5	0.29	1.16	0.29	U	ug/Kg	SW8260B	11/09/15

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Client Sample ID: **D4SD04-4.2518.86-03**

Project Name: Alaska LNG
Sample Date: 11/05/15
Sample Time: 14:50
Type: Grab
Matrix: Soil
Basis: Dry Weight

Lab Information

Lab Sample ID: **P358606**

Date Received: 11/07/15
Dilution Factor: 1
Report Revision No.: 0

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Volatiles								
1,1,2,2-Tetrachloroethane	79-34-5	0.29	1.16	0.29	U	ug/Kg	SW8260B	11/09/15
o-Xylene	95-47-6	0.29	1.16	0.29	U	ug/Kg	SW8260B	11/09/15
1,2,3-Trichloropropane	96-18-4	0.29	1.16	0.29	U	ug/Kg	SW8260B	11/09/15
Isopropylbenzene	98-82-8	0.29	1.16	0.29	U	ug/Kg	SW8260B	11/09/15
Bromobenzene	108-86-1	0.29	1.16	0.29	U	ug/Kg	SW8260B	11/09/15
n-Propylbenzene	103-65-1	0.29	1.16	0.29	U	ug/Kg	SW8260B	11/09/15
2-Chlorotoluene	95-49-8	0.29	1.16	0.29	U	ug/Kg	SW8260B	11/09/15
4-Chlorotoluene	106-43-4	0.29	1.16	0.29	U	ug/Kg	SW8260B	11/09/15
1,3,5-Trimethylbenzene	108-67-8	0.29	1.16	0.29	U	ug/Kg	SW8260B	11/09/15
tert-Butylbenzene	98-06-6	0.29	1.16	0.29	U	ug/Kg	SW8260B	11/09/15
1,2,4-Trimethylbenzene	95-63-6	0.29	1.16	0.29	U	ug/Kg	SW8260B	11/09/15
sec-Butylbenzene	135-98-8	0.29	1.16	0.29	U	ug/Kg	SW8260B	11/09/15
1,3-Dichlorobenzene	541-73-1	0.29	1.16	0.29	U	ug/Kg	SW8260B	11/09/15
1,4-Dichlorobenzene	106-46-7	0.29	1.16	0.29	U	ug/Kg	SW8260B	11/09/15
p-Isopropyltoluene	99-87-6	0.29	1.16	0.29	U	ug/Kg	SW8260B	11/09/15
1,2-Dichlorobenzene	95-50-1	0.29	1.16	0.29	U	ug/Kg	SW8260B	11/09/15
n-Butylbenzene	104-51-8	0.29	1.16	0.29	U	ug/Kg	SW8260B	11/09/15
1,2-Dibromo-3-chloropropane	96-12-8	0.29	1.16	0.29	U	ug/Kg	SW8260B	11/09/15
1,2,4-Trichlorobenzene	120-82-1	0.29	1.16	0.29	U	ug/Kg	SW8260B	11/09/15
Naphthalene	91-20-3	0.29	1.16	0.29	U	ug/Kg	SW8260B	11/09/15
Hexachlorobutadiene	87-68-3	0.29	1.16	0.29	U	ug/Kg	SW8260B	11/09/15
1,2,3-Trichlorobenzene	87-61-6	0.29	1.16	0.29	U	ug/Kg	SW8260B	11/09/15

Surrogate	% Recovery	Control Limits	Qualifier
Dibromofluoromethane	105	70-130	
1,2-Dichloroethane-d4	109	70-130	
Toluene-d8	94	70-130	
4-Bromofluorobenzene	77	70-130	

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Client Sample ID: **D5SD01-0002-01**

Project Name: Alaska LNG
Sample Date: 11/06/15
Sample Time: 11:15
Type: Grab
Matrix: Soil
Basis: Dry Weight

Lab Information

Lab Sample ID: **P358607**

Date Received: 11/07/15
Dilution Factor: 1
Report Revision No.: 0

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Volatiles								
Dichlorodifluoromethane	75-71-8	0.24	0.96	0.24	U	ug/Kg	SW8260B	11/09/15
Chloromethane	74-87-3	0.24	0.96	0.24	U	ug/Kg	SW8260B	11/09/15
Vinyl Chloride	75-01-4	0.24	0.96	0.24	U	ug/Kg	SW8260B	11/09/15
Bromomethane	74-83-9	0.24	0.96	0.24	U	ug/Kg	SW8260B	11/09/15
Chloroethane	75-00-3	0.24	0.96	0.24	U	ug/Kg	SW8260B	11/09/15
Trichlorofluoromethane	75-69-4	0.24	0.96	0.24	U	ug/Kg	SW8260B	11/09/15
Acetone	67-64-1	0.96	4.79	3.60	J	ug/Kg	SW8260B	11/09/15
1,1-Dichloroethene	75-35-4	0.24	0.96	0.24	U	ug/Kg	SW8260B	11/09/15
Methylene chloride	75-09-2	0.24	0.96	0.24	U	ug/Kg	SW8260B	11/09/15
trans-1,2-Dichloroethene	156-60-5	0.24	0.96	0.24	U	ug/Kg	SW8260B	11/09/15
Methyl tert-butyl ether (MTBE)	1634-04-4	0.24	0.96	0.24	U	ug/Kg	SW8260B	11/09/15
1,1-Dichloroethane	75-34-3	0.24	0.96	0.24	U	ug/Kg	SW8260B	11/09/15
2-Butanone (MEK)	78-93-3	1.92	4.79	1.92	U	ug/Kg	SW8260B	11/09/15
cis-1,2-Dichloroethene	156-59-2	0.24	0.96	0.24	U	ug/Kg	SW8260B	11/09/15
Bromochloromethane	74-97-5	0.24	0.96	0.24	U	ug/Kg	SW8260B	11/09/15
Chloroform	67-66-3	0.24	0.96	0.24	U	ug/Kg	SW8260B	11/09/15
2,2-Dichloropropane	594-20-7	0.24	0.96	0.24	U	ug/Kg	SW8260B	11/09/15
1,2-Dichloroethane	107-06-2	0.24	0.96	0.24	U	ug/Kg	SW8260B	11/09/15
1,1,1-Trichloroethane	71-55-6	0.24	0.96	0.24	U	ug/Kg	SW8260B	11/09/15
1,1-Dichloropropene	563-58-6	0.24	0.96	0.24	U	ug/Kg	SW8260B	11/09/15
Carbon tetrachloride	56-23-5	0.24	0.96	0.24	U	ug/Kg	SW8260B	11/09/15
Benzene	71-43-2	0.24	0.96	0.24	U	ug/Kg	SW8260B	11/09/15
Dibromomethane	74-95-3	0.24	0.96	0.24	U	ug/Kg	SW8260B	11/09/15
1,2-Dichloropropane	78-87-5	0.24	0.96	0.24	U	ug/Kg	SW8260B	11/09/15
Trichloroethene (TCE)	79-01-6	0.24	0.96	0.24	U	ug/Kg	SW8260B	11/09/15
Bromodichloromethane	75-27-4	0.24	0.96	0.24	U	ug/Kg	SW8260B	11/09/15
cis-1,3-Dichloropropene	10061-01-5	0.24	0.96	0.24	U	ug/Kg	SW8260B	11/09/15
4-Methyl-2-pentanone (MIBK)	108-10-1	0.96	4.79	0.96	U	ug/Kg	SW8260B	11/09/15
trans-1,3-Dichloropropene	10061-02-6	0.24	0.96	0.24	U	ug/Kg	SW8260B	11/09/15
1,1,2-Trichloroethane	79-00-5	0.24	0.96	0.24	U	ug/Kg	SW8260B	11/09/15
Toluene	108-88-3	0.24	0.96	0.24	U	ug/Kg	SW8260B	11/09/15
1,3-Dichloropropane	142-28-9	0.24	0.96	0.24	U	ug/Kg	SW8260B	11/09/15
Dibromochloromethane	124-48-1	0.24	0.96	0.24	U	ug/Kg	SW8260B	11/09/15
1,2-Dibromoethane (EDB)	106-93-4	0.24	0.96	0.24	U	ug/Kg	SW8260B	11/09/15
Tetrachloroethene (PCE)	127-18-4	0.24	0.96	0.24	U	ug/Kg	SW8260B	11/09/15
1-Chlorohexane	544-10-5	0.24	0.96	0.24	U	ug/Kg	SW8260B	11/09/15
1,1,1,2-Tetrachloroethane	630-20-6	0.24	0.96	0.24	U	ug/Kg	SW8260B	11/09/15
Chlorobenzene	108-90-7	0.24	0.96	0.24	U	ug/Kg	SW8260B	11/09/15
Ethylbenzene	100-41-4	0.24	0.96	0.24	U	ug/Kg	SW8260B	11/09/15
m,p-Xylene	108-38-3/1	0.48	1.92	0.73	J	ug/Kg	SW8260B	11/09/15
Bromoform	75-25-2	0.24	0.96	0.24	U	ug/Kg	SW8260B	11/09/15
Styrene	100-42-5	0.24	0.96	0.24	U	ug/Kg	SW8260B	11/09/15

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Client Sample ID: **D5SD01-0002-01**

Project Name: Alaska LNG
Sample Date: 11/06/15
Sample Time: 11:15
Type: Grab
Matrix: Soil
Basis: Dry Weight

Lab Information

Lab Sample ID: **P358607**

Date Received: 11/07/15
Dilution Factor: 1
Report Revision No.: 0

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Volatiles								
1,1,2,2-Tetrachloroethane	79-34-5	0.24	0.96	0.24	U	ug/Kg	SW8260B	11/09/15
o-Xylene	95-47-6	0.24	0.96	0.47	J	ug/Kg	SW8260B	11/09/15
1,2,3-Trichloropropane	96-18-4	0.24	0.96	0.24	U	ug/Kg	SW8260B	11/09/15
Isopropylbenzene	98-82-8	0.24	0.96	0.24	U	ug/Kg	SW8260B	11/09/15
Bromobenzene	108-86-1	0.24	0.96	0.24	U	ug/Kg	SW8260B	11/09/15
n-Propylbenzene	103-65-1	0.24	0.96	0.24	U	ug/Kg	SW8260B	11/09/15
2-Chlorotoluene	95-49-8	0.24	0.96	0.24	U	ug/Kg	SW8260B	11/09/15
4-Chlorotoluene	106-43-4	0.24	0.96	0.24	U	ug/Kg	SW8260B	11/09/15
1,3,5-Trimethylbenzene	108-67-8	0.24	0.96	0.24	U	ug/Kg	SW8260B	11/09/15
tert-Butylbenzene	98-06-6	0.24	0.96	0.24	U	ug/Kg	SW8260B	11/09/15
1,2,4-Trimethylbenzene	95-63-6	0.24	0.96	0.63	J	ug/Kg	SW8260B	11/09/15
sec-Butylbenzene	135-98-8	0.24	0.96	0.24	U	ug/Kg	SW8260B	11/09/15
1,3-Dichlorobenzene	541-73-1	0.24	0.96	0.24	U	ug/Kg	SW8260B	11/09/15
1,4-Dichlorobenzene	106-46-7	0.24	0.96	0.24	U	ug/Kg	SW8260B	11/09/15
p-Isopropyltoluene	99-87-6	0.24	0.96	0.24	U	ug/Kg	SW8260B	11/09/15
1,2-Dichlorobenzene	95-50-1	0.24	0.96	0.24	U	ug/Kg	SW8260B	11/09/15
n-Butylbenzene	104-51-8	0.24	0.96	0.24	U	ug/Kg	SW8260B	11/09/15
1,2-Dibromo-3-chloropropane	96-12-8	0.24	0.96	0.24	U	ug/Kg	SW8260B	11/09/15
1,2,4-Trichlorobenzene	120-82-1	0.24	0.96	0.24	U	ug/Kg	SW8260B	11/09/15
Naphthalene	91-20-3	0.24	0.96	0.24	U	ug/Kg	SW8260B	11/09/15
Hexachlorobutadiene	87-68-3	0.24	0.96	0.24	U	ug/Kg	SW8260B	11/09/15
1,2,3-Trichlorobenzene	87-61-6	0.24	0.96	0.24	U	ug/Kg	SW8260B	11/09/15

Surrogate	% Recovery	Control Limits	Qualifier
Dibromofluoromethane	103	70-130	
1,2-Dichloroethane-d4	110	70-130	
Toluene-d8	96	70-130	
4-Bromofluorobenzene	87	70-130	

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Client Sample ID: **D5SD01-0204-02**

Project Name: Alaska LNG
Sample Date: 11/06/15
Sample Time: 13:00
Type: Grab
Matrix: Soil
Basis: Dry Weight

Lab Information

Lab Sample ID: **P358608**

Date Received: 11/07/15
Dilution Factor: 1
Report Revision No.: 0

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Volatiles								
Dichlorodifluoromethane	75-71-8	0.27	1.07	0.27	U	ug/Kg	SW8260B	11/09/15
Chloromethane	74-87-3	0.27	1.07	0.27	U	ug/Kg	SW8260B	11/09/15
Vinyl Chloride	75-01-4	0.27	1.07	0.27	U	ug/Kg	SW8260B	11/09/15
Bromomethane	74-83-9	0.27	1.07	0.27	U	ug/Kg	SW8260B	11/09/15
Chloroethane	75-00-3	0.27	1.07	0.27	U	ug/Kg	SW8260B	11/09/15
Trichlorofluoromethane	75-69-4	0.27	1.07	0.27	U	ug/Kg	SW8260B	11/09/15
Acetone	67-64-1	1.07	5.35	4.81	J	ug/Kg	SW8260B	11/09/15
1,1-Dichloroethene	75-35-4	0.27	1.07	0.27	U	ug/Kg	SW8260B	11/09/15
Methylene chloride	75-09-2	0.27	1.07	0.27	U	ug/Kg	SW8260B	11/09/15
trans-1,2-Dichloroethene	156-60-5	0.27	1.07	0.27	U	ug/Kg	SW8260B	11/09/15
Methyl tert-butyl ether (MTBE)	1634-04-4	0.27	1.07	0.27	U	ug/Kg	SW8260B	11/09/15
1,1-Dichloroethane	75-34-3	0.27	1.07	0.27	U	ug/Kg	SW8260B	11/09/15
2-Butanone (MEK)	78-93-3	2.14	5.35	2.14	U	ug/Kg	SW8260B	11/09/15
cis-1,2-Dichloroethene	156-59-2	0.27	1.07	0.27	U	ug/Kg	SW8260B	11/09/15
Bromochloromethane	74-97-5	0.27	1.07	0.27	U	ug/Kg	SW8260B	11/09/15
Chloroform	67-66-3	0.27	1.07	0.27	U	ug/Kg	SW8260B	11/09/15
2,2-Dichloropropane	594-20-7	0.27	1.07	0.27	U	ug/Kg	SW8260B	11/09/15
1,2-Dichloroethane	107-06-2	0.27	1.07	0.27	U	ug/Kg	SW8260B	11/09/15
1,1,1-Trichloroethane	71-55-6	0.27	1.07	0.27	U	ug/Kg	SW8260B	11/09/15
1,1-Dichloropropene	563-58-6	0.27	1.07	0.27	U	ug/Kg	SW8260B	11/09/15
Carbon tetrachloride	56-23-5	0.27	1.07	0.27	U	ug/Kg	SW8260B	11/09/15
Benzene	71-43-2	0.27	1.07	0.27	U	ug/Kg	SW8260B	11/09/15
Dibromomethane	74-95-3	0.27	1.07	0.27	U	ug/Kg	SW8260B	11/09/15
1,2-Dichloropropane	78-87-5	0.27	1.07	0.27	U	ug/Kg	SW8260B	11/09/15
Trichloroethene (TCE)	79-01-6	0.27	1.07	0.27	U	ug/Kg	SW8260B	11/09/15
Bromodichloromethane	75-27-4	0.27	1.07	0.27	U	ug/Kg	SW8260B	11/09/15
cis-1,3-Dichloropropene	10061-01-5	0.27	1.07	0.27	U	ug/Kg	SW8260B	11/09/15
4-Methyl-2-pentanone (MIBK)	108-10-1	1.07	5.35	1.07	U	ug/Kg	SW8260B	11/09/15
trans-1,3-Dichloropropene	10061-02-6	0.27	1.07	0.27	U	ug/Kg	SW8260B	11/09/15
1,1,2-Trichloroethane	79-00-5	0.27	1.07	0.27	U	ug/Kg	SW8260B	11/09/15
Toluene	108-88-3	0.27	1.07	0.27	U	ug/Kg	SW8260B	11/09/15
1,3-Dichloropropane	142-28-9	0.27	1.07	0.27	U	ug/Kg	SW8260B	11/09/15
Dibromochloromethane	124-48-1	0.27	1.07	0.27	U	ug/Kg	SW8260B	11/09/15
1,2-Dibromoethane (EDB)	106-93-4	0.27	1.07	0.27	U	ug/Kg	SW8260B	11/09/15
Tetrachloroethene (PCE)	127-18-4	0.27	1.07	0.27	U	ug/Kg	SW8260B	11/09/15
1-Chlorohexane	544-10-5	0.27	1.07	0.27	U	ug/Kg	SW8260B	11/09/15
1,1,1,2-Tetrachloroethane	630-20-6	0.27	1.07	0.27	U	ug/Kg	SW8260B	11/09/15
Chlorobenzene	108-90-7	0.27	1.07	0.27	U	ug/Kg	SW8260B	11/09/15
Ethylbenzene	100-41-4	0.27	1.07	0.27	U	ug/Kg	SW8260B	11/09/15
m,p-Xylene	108-38-3/1	0.53	2.14	0.53	U	ug/Kg	SW8260B	11/09/15
Bromoform	75-25-2	0.27	1.07	0.27	U	ug/Kg	SW8260B	11/09/15
Styrene	100-42-5	0.27	1.07	0.27	U	ug/Kg	SW8260B	11/09/15

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information		Lab Information	
Client Sample ID:	**D5SD01-0204-02**	**Lab Sample ID:**	**P358608**
Project Name:	Alaska LNG	Date Received:	11/07/15
Sample Date:	11/06/15	Dilution Factor:	1
Sample Time:	13:00	Report Revision No.:	0
Type:	Grab		
Matrix:	Soil		
Basis:	Dry Weight		

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Volatiles								
1,1,2,2-Tetrachloroethane	79-34-5	0.27	1.07	0.27	U	ug/Kg	SW8260B	11/09/15
o-Xylene	95-47-6	0.27	1.07	0.27	U	ug/Kg	SW8260B	11/09/15
1,2,3-Trichloropropane	96-18-4	0.27	1.07	0.27	U	ug/Kg	SW8260B	11/09/15
Isopropylbenzene	98-82-8	0.27	1.07	0.27	U	ug/Kg	SW8260B	11/09/15
Bromobenzene	108-86-1	0.27	1.07	0.27	U	ug/Kg	SW8260B	11/09/15
n-Propylbenzene	103-65-1	0.27	1.07	0.27	U	ug/Kg	SW8260B	11/09/15
2-Chlorotoluene	95-49-8	0.27	1.07	0.27	U	ug/Kg	SW8260B	11/09/15
4-Chlorotoluene	106-43-4	0.27	1.07	0.27	U	ug/Kg	SW8260B	11/09/15
1,3,5-Trimethylbenzene	108-67-8	0.27	1.07	0.27	U	ug/Kg	SW8260B	11/09/15
tert-Butylbenzene	98-06-6	0.27	1.07	0.27	U	ug/Kg	SW8260B	11/09/15
1,2,4-Trimethylbenzene	95-63-6	0.27	1.07	0.27	U	ug/Kg	SW8260B	11/09/15
sec-Butylbenzene	135-98-8	0.27	1.07	0.27	U	ug/Kg	SW8260B	11/09/15
1,3-Dichlorobenzene	541-73-1	0.27	1.07	0.27	U	ug/Kg	SW8260B	11/09/15
1,4-Dichlorobenzene	106-46-7	0.27	1.07	0.27	U	ug/Kg	SW8260B	11/09/15
p-Isopropyltoluene	99-87-6	0.27	1.07	0.27	U	ug/Kg	SW8260B	11/09/15
1,2-Dichlorobenzene	95-50-1	0.27	1.07	0.27	U	ug/Kg	SW8260B	11/09/15
n-Butylbenzene	104-51-8	0.27	1.07	0.27	U	ug/Kg	SW8260B	11/09/15
1,2-Dibromo-3-chloropropane	96-12-8	0.27	1.07	0.27	U	ug/Kg	SW8260B	11/09/15
1,2,4-Trichlorobenzene	120-82-1	0.27	1.07	0.27	U	ug/Kg	SW8260B	11/09/15
Naphthalene	91-20-3	0.27	1.07	0.27	U	ug/Kg	SW8260B	11/09/15
Hexachlorobutadiene	87-68-3	0.27	1.07	0.27	U	ug/Kg	SW8260B	11/09/15
1,2,3-Trichlorobenzene	87-61-6	0.27	1.07	0.27	U	ug/Kg	SW8260B	11/09/15

Surrogate	% Recovery	Control Limits	Qualifier
Dibromofluoromethane	105	70-130	
1,2-Dichloroethane-d4	110	70-130	
Toluene-d8	97	70-130	
4-Bromofluorobenzene	88	70-130	

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Client Sample ID: **D5SD01-0404.9-03**

Project Name: Alaska LNG
Sample Date: 11/06/15
Sample Time: 14:45
Type: Grab
Matrix: Soil
Basis: Dry Weight

Lab Information

Lab Sample ID: **P358610**

Date Received: 11/07/15
Dilution Factor: 1
Report Revision No.: 0

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Volatiles								
Dichlorodifluoromethane	75-71-8	0.28	1.13	0.28	U	ug/Kg	SW8260B	11/09/15
Chloromethane	74-87-3	0.28	1.13	0.34	J	ug/Kg	SW8260B	11/09/15
Vinyl Chloride	75-01-4	0.28	1.13	0.28	U	ug/Kg	SW8260B	11/09/15
Bromomethane	74-83-9	0.28	1.13	0.28	U	ug/Kg	SW8260B	11/09/15
Chloroethane	75-00-3	0.28	1.13	0.28	U	ug/Kg	SW8260B	11/09/15
Trichlorofluoromethane	75-69-4	0.28	1.13	0.28	U	ug/Kg	SW8260B	11/09/15
Acetone	67-64-1	1.13	5.64	10.2		ug/Kg	SW8260B	11/09/15
1,1-Dichloroethene	75-35-4	0.28	1.13	0.28	U	ug/Kg	SW8260B	11/09/15
Methylene chloride	75-09-2	0.28	1.13	0.28	U	ug/Kg	SW8260B	11/09/15
trans-1,2-Dichloroethene	156-60-5	0.28	1.13	0.28	U	ug/Kg	SW8260B	11/09/15
Methyl tert-butyl ether (MTBE)	1634-04-4	0.28	1.13	0.28	U	ug/Kg	SW8260B	11/09/15
1,1-Dichloroethane	75-34-3	0.28	1.13	0.28	U	ug/Kg	SW8260B	11/09/15
2-Butanone (MEK)	78-93-3	2.25	5.64	2.25	U	ug/Kg	SW8260B	11/09/15
cis-1,2-Dichloroethene	156-59-2	0.28	1.13	0.28	U	ug/Kg	SW8260B	11/09/15
Bromochloromethane	74-97-5	0.28	1.13	0.28	U	ug/Kg	SW8260B	11/09/15
Chloroform	67-66-3	0.28	1.13	0.28	U	ug/Kg	SW8260B	11/09/15
2,2-Dichloropropane	594-20-7	0.28	1.13	0.28	U	ug/Kg	SW8260B	11/09/15
1,2-Dichloroethane	107-06-2	0.28	1.13	0.28	U	ug/Kg	SW8260B	11/09/15
1,1,1-Trichloroethane	71-55-6	0.28	1.13	0.28	U	ug/Kg	SW8260B	11/09/15
1,1-Dichloropropene	563-58-6	0.28	1.13	0.28	U	ug/Kg	SW8260B	11/09/15
Carbon tetrachloride	56-23-5	0.28	1.13	0.28	U	ug/Kg	SW8260B	11/09/15
Benzene	71-43-2	0.28	1.13	0.28	U	ug/Kg	SW8260B	11/09/15
Dibromomethane	74-95-3	0.28	1.13	0.28	U	ug/Kg	SW8260B	11/09/15
1,2-Dichloropropane	78-87-5	0.28	1.13	0.28	U	ug/Kg	SW8260B	11/09/15
Trichloroethene (TCE)	79-01-6	0.28	1.13	0.28	U	ug/Kg	SW8260B	11/09/15
Bromodichloromethane	75-27-4	0.28	1.13	0.28	U	ug/Kg	SW8260B	11/09/15
cis-1,3-Dichloropropene	10061-01-5	0.28	1.13	0.28	U	ug/Kg	SW8260B	11/09/15
4-Methyl-2-pentanone (MIBK)	108-10-1	1.13	5.64	1.13	U	ug/Kg	SW8260B	11/09/15
trans-1,3-Dichloropropene	10061-02-6	0.28	1.13	0.28	U	ug/Kg	SW8260B	11/09/15
1,1,2-Trichloroethane	79-00-5	0.28	1.13	0.28	U	ug/Kg	SW8260B	11/09/15
Toluene	108-88-3	0.28	1.13	0.28	U	ug/Kg	SW8260B	11/09/15
1,3-Dichloropropane	142-28-9	0.28	1.13	0.28	U	ug/Kg	SW8260B	11/09/15
Dibromochloromethane	124-48-1	0.28	1.13	0.28	U	ug/Kg	SW8260B	11/09/15
1,2-Dibromoethane (EDB)	106-93-4	0.28	1.13	0.28	U	ug/Kg	SW8260B	11/09/15
Tetrachloroethene (PCE)	127-18-4	0.28	1.13	0.28	U	ug/Kg	SW8260B	11/09/15
1-Chlorohexane	544-10-5	0.28	1.13	0.28	U	ug/Kg	SW8260B	11/09/15
1,1,1,2-Tetrachloroethane	630-20-6	0.28	1.13	0.28	U	ug/Kg	SW8260B	11/09/15
Chlorobenzene	108-90-7	0.28	1.13	0.28	U	ug/Kg	SW8260B	11/09/15
Ethylbenzene	100-41-4	0.28	1.13	0.28	U	ug/Kg	SW8260B	11/09/15
m,p-Xylene	108-38-3/1	0.56	2.25	0.56	U	ug/Kg	SW8260B	11/09/15
Bromoform	75-25-2	0.28	1.13	0.28	U	ug/Kg	SW8260B	11/09/15
Styrene	100-42-5	0.28	1.13	0.28	U	ug/Kg	SW8260B	11/09/15

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information		Lab Information	
Client Sample ID:	**D5SD01-0404.9-03**	**Lab Sample ID:**	**P358610**
Project Name:	Alaska LNG	Date Received:	11/07/15
Sample Date:	11/06/15	Dilution Factor:	1
Sample Time:	14:45	Report Revision No.:	0
Type:	Grab		
Matrix:	Soil		
Basis:	Dry Weight		

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Volatiles								
1,1,2,2-Tetrachloroethane	79-34-5	0.28	1.13	0.28	U	ug/Kg	SW8260B	11/09/15
o-Xylene	95-47-6	0.28	1.13	0.28	U	ug/Kg	SW8260B	11/09/15
1,2,3-Trichloropropane	96-18-4	0.28	1.13	0.28	U	ug/Kg	SW8260B	11/09/15
Isopropylbenzene	98-82-8	0.28	1.13	0.28	U	ug/Kg	SW8260B	11/09/15
Bromobenzene	108-86-1	0.28	1.13	0.28	U	ug/Kg	SW8260B	11/09/15
n-Propylbenzene	103-65-1	0.28	1.13	0.28	U	ug/Kg	SW8260B	11/09/15
2-Chlorotoluene	95-49-8	0.28	1.13	0.28	U	ug/Kg	SW8260B	11/09/15
4-Chlorotoluene	106-43-4	0.28	1.13	0.28	U	ug/Kg	SW8260B	11/09/15
1,3,5-Trimethylbenzene	108-67-8	0.28	1.13	0.28	U	ug/Kg	SW8260B	11/09/15
tert-Butylbenzene	98-06-6	0.28	1.13	0.28	U	ug/Kg	SW8260B	11/09/15
1,2,4-Trimethylbenzene	95-63-6	0.28	1.13	0.28	U	ug/Kg	SW8260B	11/09/15
sec-Butylbenzene	135-98-8	0.28	1.13	0.28	U	ug/Kg	SW8260B	11/09/15
1,3-Dichlorobenzene	541-73-1	0.28	1.13	0.28	U	ug/Kg	SW8260B	11/09/15
1,4-Dichlorobenzene	106-46-7	0.28	1.13	0.28	U	ug/Kg	SW8260B	11/09/15
p-Isopropyltoluene	99-87-6	0.28	1.13	0.28	U	ug/Kg	SW8260B	11/09/15
1,2-Dichlorobenzene	95-50-1	0.28	1.13	0.28	U	ug/Kg	SW8260B	11/09/15
n-Butylbenzene	104-51-8	0.28	1.13	0.28	U	ug/Kg	SW8260B	11/09/15
1,2-Dibromo-3-chloropropane	96-12-8	0.28	1.13	0.28	U	ug/Kg	SW8260B	11/09/15
1,2,4-Trichlorobenzene	120-82-1	0.28	1.13	0.28	U	ug/Kg	SW8260B	11/09/15
Naphthalene	91-20-3	0.28	1.13	0.28	U	ug/Kg	SW8260B	11/09/15
Hexachlorobutadiene	87-68-3	0.28	1.13	0.28	U	ug/Kg	SW8260B	11/09/15
1,2,3-Trichlorobenzene	87-61-6	0.28	1.13	0.28	U	ug/Kg	SW8260B	11/09/15

Surrogate	% Recovery	Control Limits	Qualifier
Dibromofluoromethane	105	70-130	
1,2-Dichloroethane-d4	117	70-130	
Toluene-d8	94	70-130	
4-Bromofluorobenzene	81	70-130	

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Client Sample ID: **TB110315-01**

Project Name: Alaska LNG
Sample Date: 11/03/15
Sample Time: 08:00
Type: Grab
Matrix: Water

Lab Information

Lab Sample ID: **P358611**

Date Received: 11/07/15
Dilution Factor: 1
Report Revision No.: 0

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Volatiles								
Dichlorodifluoromethane	75-71-8	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
Chloromethane	74-87-3	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
Vinyl Chloride	75-01-4	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
Bromomethane	74-83-9	0.20	0.50	0.20	U	ug/L	SW8260B	11/09/15
Chloroethane	75-00-3	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
Trichlorofluoromethane	75-69-4	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
Acetone	67-64-1	1.00	5.00	1.00	U	ug/L	SW8260B	11/09/15
1,1-Dichloroethene	75-35-4	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
Methylene chloride	75-09-2	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
trans-1,2-Dichloroethene	156-60-5	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
Methyl tert-butyl ether (MTBE)	1634-04-4	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
1,1-Dichloroethane	75-34-3	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
2-Butanone (MEK)	78-93-3	2.00	5.00	2.00	U	ug/L	SW8260B	11/09/15
cis-1,2-Dichloroethene	156-59-2	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
Bromochloromethane	74-97-5	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
Chloroform	67-66-3	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
2,2-Dichloropropane	594-20-7	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
1,2-Dichloroethane	107-06-2	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
1,1,1-Trichloroethane	71-55-6	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
1,1-Dichloropropene	563-58-6	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
Carbon tetrachloride	56-23-5	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
Benzene	71-43-2	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
Dibromomethane	74-95-3	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
1,2-Dichloropropane	78-87-5	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
Trichloroethene (TCE)	79-01-6	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
Bromodichloromethane	75-27-4	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
cis-1,3-Dichloropropene	10061-01-5	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
4-Methyl-2-pentanone (MIBK)	108-10-1	0.50	2.00	0.50	U	ug/L	SW8260B	11/09/15
trans-1,3-Dichloropropene	10061-02-6	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
1,1,2-Trichloroethane	79-00-5	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
Toluene	108-88-3	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
1,3-Dichloropropane	142-28-9	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
Dibromochloromethane	124-48-1	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
1,2-Dibromoethane (EDB)	106-93-4	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
Tetrachloroethene (PCE)	127-18-4	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
1-Chlorohexane	544-10-5	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
1,1,1,2-Tetrachloroethane	630-20-6	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
Chlorobenzene	108-90-7	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
Ethylbenzene	100-41-4	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
m,p-Xylene	108-38-3/1	0.30	1.00	0.30	U	ug/L	SW8260B	11/09/15
Bromoform	75-25-2	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
Styrene	100-42-5	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Client Sample ID: **TB110315-01**

Project Name: Alaska LNG
Sample Date: 11/03/15
Sample Time: 08:00
Type: Grab
Matrix: Water

Lab Information

Lab Sample ID: **P358611**

Date Received: 11/07/15
Dilution Factor: 1
Report Revision No.: 0

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Volatiles								
1,1,2,2-Tetrachloroethane	79-34-5	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
o-Xylene	95-47-6	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
1,2,3-Trichloropropane	96-18-4	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
Isopropylbenzene	98-82-8	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
Bromobenzene	108-86-1	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
n-Propylbenzene	103-65-1	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
2-Chlorotoluene	95-49-8	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
4-Chlorotoluene	106-43-4	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
1,3,5-Trimethylbenzene	108-67-8	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
tert-Butylbenzene	98-06-6	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
1,2,4-Trimethylbenzene	95-63-6	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
sec-Butylbenzene	135-98-8	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
1,3-Dichlorobenzene	541-73-1	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
1,4-Dichlorobenzene	106-46-7	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
p-Isopropyltoluene	99-87-6	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
1,2-Dichlorobenzene	95-50-1	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
n-Butylbenzene	104-51-8	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
1,2-Dibromo-3-chloropropane	96-12-8	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
1,2,4-Trichlorobenzene	120-82-1	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
Naphthalene	91-20-3	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
Hexachlorobutadiene	87-68-3	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
1,2,3-Trichlorobenzene	87-61-6	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15

Surrogate	% Recovery	Control Limits	Qualifier
Dibromofluoromethane	101	70-130	
1,2-Dichloroethane-d4	114	70-130	
Toluene-d8	98	70-130	
4-Bromofluorobenzene	93	70-130	

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Client Sample ID: **EB110615-01**

Project Name: Alaska LNG
Sample Date: 11/06/15
Sample Time: 15:45
Type: Grab
Matrix: Water

Lab Information

Lab Sample ID: **P358613**

Date Received: 11/07/15
Dilution Factor: 1
Report Revision No.: 0

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Volatiles								
Dichlorodifluoromethane	75-71-8	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
Chloromethane	74-87-3	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
Vinyl Chloride	75-01-4	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
Bromomethane	74-83-9	0.20	0.50	0.20	U	ug/L	SW8260B	11/09/15
Chloroethane	75-00-3	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
Trichlorofluoromethane	75-69-4	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
Acetone	67-64-1	1.00	5.00	1.00	U	ug/L	SW8260B	11/09/15
1,1-Dichloroethene	75-35-4	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
Methylene chloride	75-09-2	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
trans-1,2-Dichloroethene	156-60-5	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
Methyl tert-butyl ether (MTBE)	1634-04-4	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
1,1-Dichloroethane	75-34-3	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
2-Butanone (MEK)	78-93-3	2.00	5.00	2.00	U	ug/L	SW8260B	11/09/15
cis-1,2-Dichloroethene	156-59-2	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
Bromochloromethane	74-97-5	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
Chloroform	67-66-3	0.15	0.50	0.62		ug/L	SW8260B	11/09/15
2,2-Dichloropropane	594-20-7	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
1,2-Dichloroethane	107-06-2	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
1,1,1-Trichloroethane	71-55-6	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
1,1-Dichloropropene	563-58-6	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
Carbon tetrachloride	56-23-5	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
Benzene	71-43-2	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
Dibromomethane	74-95-3	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
1,2-Dichloropropane	78-87-5	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
Trichloroethene (TCE)	79-01-6	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
Bromodichloromethane	75-27-4	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
cis-1,3-Dichloropropene	10061-01-5	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
4-Methyl-2-pentanone (MIBK)	108-10-1	0.50	2.00	0.50	U	ug/L	SW8260B	11/09/15
trans-1,3-Dichloropropene	10061-02-6	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
1,1,2-Trichloroethane	79-00-5	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
Toluene	108-88-3	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
1,3-Dichloropropane	142-28-9	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
Dibromochloromethane	124-48-1	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
1,2-Dibromoethane (EDB)	106-93-4	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
Tetrachloroethene (PCE)	127-18-4	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
1-Chlorohexane	544-10-5	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
1,1,1,2-Tetrachloroethane	630-20-6	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
Chlorobenzene	108-90-7	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
Ethylbenzene	100-41-4	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
m,p-Xylene	108-38-3/1	0.30	1.00	0.30	U	ug/L	SW8260B	11/09/15
Bromoform	75-25-2	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
Styrene	100-42-5	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Client Sample ID: **EB110615-01**

Project Name: Alaska LNG
Sample Date: 11/06/15
Sample Time: 15:45
Type: Grab
Matrix: Water

Lab Information

Lab Sample ID: **P358613**

Date Received: 11/07/15
Dilution Factor: 1
Report Revision No.: 0

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Volatiles								
1,1,2,2-Tetrachloroethane	79-34-5	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
o-Xylene	95-47-6	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
1,2,3-Trichloropropane	96-18-4	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
Isopropylbenzene	98-82-8	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
Bromobenzene	108-86-1	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
n-Propylbenzene	103-65-1	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
2-Chlorotoluene	95-49-8	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
4-Chlorotoluene	106-43-4	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
1,3,5-Trimethylbenzene	108-67-8	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
tert-Butylbenzene	98-06-6	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
1,2,4-Trimethylbenzene	95-63-6	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
sec-Butylbenzene	135-98-8	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
1,3-Dichlorobenzene	541-73-1	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
1,4-Dichlorobenzene	106-46-7	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
p-Isopropyltoluene	99-87-6	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
1,2-Dichlorobenzene	95-50-1	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
n-Butylbenzene	104-51-8	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
1,2-Dibromo-3-chloropropane	96-12-8	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
1,2,4-Trichlorobenzene	120-82-1	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
Naphthalene	91-20-3	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
Hexachlorobutadiene	87-68-3	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
1,2,3-Trichlorobenzene	87-61-6	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15

Surrogate	% Recovery	Control Limits	Qualifier
Dibromofluoromethane	105	70-130	
1,2-Dichloroethane-d4	116	70-130	
Toluene-d8	100	70-130	
4-Bromofluorobenzene	93	70-130	

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information		Lab Information	
Client Sample ID:	**SB1-1109**	**Lab Sample ID:**	**SB1-1109**
Project Name:	Alaska LNG	Date Received:	N/A
Sample Date:	N/A	Dilution Factor:	1
Sample Time:	N/A	Report Revision No.:	0
Type:	QC		
Matrix:	Soil		
Basis:	Dry Weight		

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Volatiles								
Dichlorodifluoromethane	75-71-8	0.25	1.00	0.25	U	ug/Kg	SW8260B	11/09/15
Chloromethane	74-87-3	0.25	1.00	0.25	U	ug/Kg	SW8260B	11/09/15
Vinyl Chloride	75-01-4	0.25	1.00	0.25	U	ug/Kg	SW8260B	11/09/15
Bromomethane	74-83-9	0.25	1.00	0.25	U	ug/Kg	SW8260B	11/09/15
Chloroethane	75-00-3	0.25	1.00	0.25	U	ug/Kg	SW8260B	11/09/15
Trichlorofluoromethane	75-69-4	0.25	1.00	0.25	U	ug/Kg	SW8260B	11/09/15
Acetone	67-64-1	1.00	5.00	1.00	U	ug/Kg	SW8260B	11/09/15
1,1-Dichloroethene	75-35-4	0.25	1.00	0.25	U	ug/Kg	SW8260B	11/09/15
Methylene chloride	75-09-2	0.25	1.00	0.25	U	ug/Kg	SW8260B	11/09/15
trans-1,2-Dichloroethene	156-60-5	0.25	1.00	0.25	U	ug/Kg	SW8260B	11/09/15
Methyl tert-butyl ether (MTBE)	1634-04-4	0.25	1.00	0.25	U	ug/Kg	SW8260B	11/09/15
1,1-Dichloroethane	75-34-3	0.25	1.00	0.25	U	ug/Kg	SW8260B	11/09/15
2-Butanone (MEK)	78-93-3	2.00	5.00	2.00	U	ug/Kg	SW8260B	11/09/15
cis-1,2-Dichloroethene	156-59-2	0.25	1.00	0.25	U	ug/Kg	SW8260B	11/09/15
Bromochloromethane	74-97-5	0.25	1.00	0.25	U	ug/Kg	SW8260B	11/09/15
Chloroform	67-66-3	0.25	1.00	0.25	U	ug/Kg	SW8260B	11/09/15
2,2-Dichloropropane	594-20-7	0.25	1.00	0.25	U	ug/Kg	SW8260B	11/09/15
1,2-Dichloroethane	107-06-2	0.25	1.00	0.25	U	ug/Kg	SW8260B	11/09/15
1,1,1-Trichloroethane	71-55-6	0.25	1.00	0.25	U	ug/Kg	SW8260B	11/09/15
1,1-Dichloropropene	563-58-6	0.25	1.00	0.25	U	ug/Kg	SW8260B	11/09/15
Carbon tetrachloride	56-23-5	0.25	1.00	0.25	U	ug/Kg	SW8260B	11/09/15
Benzene	71-43-2	0.25	1.00	0.25	U	ug/Kg	SW8260B	11/09/15
Dibromomethane	74-95-3	0.25	1.00	0.25	U	ug/Kg	SW8260B	11/09/15
1,2-Dichloropropane	78-87-5	0.25	1.00	0.25	U	ug/Kg	SW8260B	11/09/15
Trichloroethene (TCE)	79-01-6	0.25	1.00	0.25	U	ug/Kg	SW8260B	11/09/15
Bromodichloromethane	75-27-4	0.25	1.00	0.25	U	ug/Kg	SW8260B	11/09/15
cis-1,3-Dichloropropene	10061-01-5	0.25	1.00	0.25	U	ug/Kg	SW8260B	11/09/15
4-Methyl-2-pentanone (MIBK)	108-10-1	1.00	5.00	1.00	U	ug/Kg	SW8260B	11/09/15
trans-1,3-Dichloropropene	10061-02-6	0.25	1.00	0.25	U	ug/Kg	SW8260B	11/09/15
1,1,2-Trichloroethane	79-00-5	0.25	1.00	0.25	U	ug/Kg	SW8260B	11/09/15
Toluene	108-88-3	0.25	1.00	0.25	U	ug/Kg	SW8260B	11/09/15
1,3-Dichloropropane	142-28-9	0.25	1.00	0.25	U	ug/Kg	SW8260B	11/09/15
Dibromochloromethane	124-48-1	0.25	1.00	0.25	U	ug/Kg	SW8260B	11/09/15
1,2-Dibromoethane (EDB)	106-93-4	0.25	1.00	0.25	U	ug/Kg	SW8260B	11/09/15
Tetrachloroethene (PCE)	127-18-4	0.25	1.00	0.25	U	ug/Kg	SW8260B	11/09/15
1-Chlorohexane	544-10-5	0.25	1.00	0.25	U	ug/Kg	SW8260B	11/09/15
1,1,1,2-Tetrachloroethane	630-20-6	0.25	1.00	0.25	U	ug/Kg	SW8260B	11/09/15
Chlorobenzene	108-90-7	0.25	1.00	0.25	U	ug/Kg	SW8260B	11/09/15
Ethylbenzene	100-41-4	0.25	1.00	0.25	U	ug/Kg	SW8260B	11/09/15
m,p-Xylene	108-38-3/1	0.50	2.00	0.50	U	ug/Kg	SW8260B	11/09/15
Bromoform	75-25-2	0.25	1.00	0.25	U	ug/Kg	SW8260B	11/09/15
Styrene	100-42-5	0.25	1.00	0.25	U	ug/Kg	SW8260B	11/09/15

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information		Lab Information	
Client Sample ID:	**SB1-1109**	**Lab Sample ID:**	**SB1-1109**
Project Name:	Alaska LNG	Date Received:	N/A
Sample Date:	N/A	Dilution Factor:	1
Sample Time:	N/A	Report Revision No.:	0
Type:	QC		
Matrix:	Soil		
Basis:	Dry Weight		

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Volatiles								
1,1,2,2-Tetrachloroethane	79-34-5	0.25	1.00	0.25	U	ug/Kg	SW8260B	11/09/15
o-Xylene	95-47-6	0.25	1.00	0.25	U	ug/Kg	SW8260B	11/09/15
1,2,3-Trichloropropane	96-18-4	0.25	1.00	0.25	U	ug/Kg	SW8260B	11/09/15
Isopropylbenzene	98-82-8	0.25	1.00	0.25	U	ug/Kg	SW8260B	11/09/15
Bromobenzene	108-86-1	0.25	1.00	0.25	U	ug/Kg	SW8260B	11/09/15
n-Propylbenzene	103-65-1	0.25	1.00	0.25	U	ug/Kg	SW8260B	11/09/15
2-Chlorotoluene	95-49-8	0.25	1.00	0.25	U	ug/Kg	SW8260B	11/09/15
4-Chlorotoluene	106-43-4	0.25	1.00	0.25	U	ug/Kg	SW8260B	11/09/15
1,3,5-Trimethylbenzene	108-67-8	0.25	1.00	0.25	U	ug/Kg	SW8260B	11/09/15
tert-Butylbenzene	98-06-6	0.25	1.00	0.25	U	ug/Kg	SW8260B	11/09/15
1,2,4-Trimethylbenzene	95-63-6	0.25	1.00	0.25	U	ug/Kg	SW8260B	11/09/15
sec-Butylbenzene	135-98-8	0.25	1.00	0.25	U	ug/Kg	SW8260B	11/09/15
1,3-Dichlorobenzene	541-73-1	0.25	1.00	0.25	U	ug/Kg	SW8260B	11/09/15
1,4-Dichlorobenzene	106-46-7	0.25	1.00	0.25	U	ug/Kg	SW8260B	11/09/15
p-Isopropyltoluene	99-87-6	0.25	1.00	0.25	U	ug/Kg	SW8260B	11/09/15
1,2-Dichlorobenzene	95-50-1	0.25	1.00	0.25	U	ug/Kg	SW8260B	11/09/15
n-Butylbenzene	104-51-8	0.25	1.00	0.25	U	ug/Kg	SW8260B	11/09/15
1,2-Dibromo-3-chloropropane	96-12-8	0.25	1.00	0.25	U	ug/Kg	SW8260B	11/09/15
1,2,4-Trichlorobenzene	120-82-1	0.25	1.00	0.25	U	ug/Kg	SW8260B	11/09/15
Naphthalene	91-20-3	0.25	1.00	0.25	U	ug/Kg	SW8260B	11/09/15
Hexachlorobutadiene	87-68-3	0.25	1.00	0.25	U	ug/Kg	SW8260B	11/09/15
1,2,3-Trichlorobenzene	87-61-6	0.25	1.00	0.25	U	ug/Kg	SW8260B	11/09/15

Surrogate	% Recovery	Control Limits	Qualifier
Dibromofluoromethane	105	70-130	
1,2-Dichloroethane-d4	116	70-130	
Toluene-d8	94	70-130	
4-Bromofluorobenzene	85	70-130	

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Client Sample ID: **WB1-1109**

Project Name: Alaska LNG
Sample Date: N/A
Sample Time: N/A
Type: QC
Matrix: Water

Lab Information

Lab Sample ID: **WB1-1109**

Date Received: N/A
Dilution Factor: 1
Report Revision No.: 0

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Volatiles								
Dichlorodifluoromethane	75-71-8	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
Chloromethane	74-87-3	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
Vinyl Chloride	75-01-4	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
Bromomethane	74-83-9	0.20	0.50	0.20	U	ug/L	SW8260B	11/09/15
Chloroethane	75-00-3	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
Trichlorofluoromethane	75-69-4	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
Acetone	67-64-1	1.00	5.00	1.00	U	ug/L	SW8260B	11/09/15
1,1-Dichloroethene	75-35-4	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
Methylene chloride	75-09-2	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
trans-1,2-Dichloroethene	156-60-5	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
Methyl tert-butyl ether (MTBE)	1634-04-4	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
1,1-Dichloroethane	75-34-3	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
2-Butanone (MEK)	78-93-3	2.00	5.00	2.00	U	ug/L	SW8260B	11/09/15
cis-1,2-Dichloroethene	156-59-2	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
Bromochloromethane	74-97-5	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
Chloroform	67-66-3	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
2,2-Dichloropropane	594-20-7	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
1,2-Dichloroethane	107-06-2	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
1,1,1-Trichloroethane	71-55-6	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
1,1-Dichloropropene	563-58-6	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
Carbon tetrachloride	56-23-5	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
Benzene	71-43-2	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
Dibromomethane	74-95-3	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
1,2-Dichloropropane	78-87-5	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
Trichloroethene (TCE)	79-01-6	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
Bromodichloromethane	75-27-4	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
cis-1,3-Dichloropropene	10061-01-5	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
4-Methyl-2-pentanone (MIBK)	108-10-1	0.50	2.00	0.50	U	ug/L	SW8260B	11/09/15
trans-1,3-Dichloropropene	10061-02-6	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
1,1,2-Trichloroethane	79-00-5	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
Toluene	108-88-3	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
1,3-Dichloropropane	142-28-9	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
Dibromochloromethane	124-48-1	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
1,2-Dibromoethane (EDB)	106-93-4	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
Tetrachloroethene (PCE)	127-18-4	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
1-Chlorohexane	544-10-5	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
1,1,1,2-Tetrachloroethane	630-20-6	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
Chlorobenzene	108-90-7	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
Ethylbenzene	100-41-4	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
m,p-Xylene	108-38-3/1	0.30	1.00	0.30	U	ug/L	SW8260B	11/09/15
Bromoform	75-25-2	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
Styrene	100-42-5	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Client Sample ID: **WB1-1109**

Project Name: Alaska LNG
Sample Date: N/A
Sample Time: N/A
Type: QC
Matrix: Water

Lab Information

Lab Sample ID: **WB1-1109**

Date Received: N/A
Dilution Factor: 1
Report Revision No.: 0

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Volatiles								
1,1,2,2-Tetrachloroethane	79-34-5	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
o-Xylene	95-47-6	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
1,2,3-Trichloropropane	96-18-4	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
Isopropylbenzene	98-82-8	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
Bromobenzene	108-86-1	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
n-Propylbenzene	103-65-1	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
2-Chlorotoluene	95-49-8	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
4-Chlorotoluene	106-43-4	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
1,3,5-Trimethylbenzene	108-67-8	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
tert-Butylbenzene	98-06-6	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
1,2,4-Trimethylbenzene	95-63-6	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
sec-Butylbenzene	135-98-8	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
1,3-Dichlorobenzene	541-73-1	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
1,4-Dichlorobenzene	106-46-7	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
p-Isopropyltoluene	99-87-6	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
1,2-Dichlorobenzene	95-50-1	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
n-Butylbenzene	104-51-8	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
1,2-Dibromo-3-chloropropane	96-12-8	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
1,2,4-Trichlorobenzene	120-82-1	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
Naphthalene	91-20-3	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
Hexachlorobutadiene	87-68-3	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15
1,2,3-Trichlorobenzene	87-61-6	0.15	0.50	0.15	U	ug/L	SW8260B	11/09/15

Surrogate	% Recovery	Control Limits	Qualifier
Dibromofluoromethane	100	70-130	
1,2-Dichloroethane-d4	109	70-130	
Toluene-d8	101	70-130	
4-Bromofluorobenzene	100	70-130	

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Project Name: Alaska LNG
Type: QC
Matrix: Soil

Lab Information

LCS ID: BS1S1109

Report Revision No.: 0
Dilution Factor: 1

Analyte	CAS#	Spike Amount	Sample Result	Units	%Recovery	Analysis Method	Date Analyzed
GC/MS Volatiles							
Dichlorodifluoromethane	75-71-8	20.0	20.1	ug/Kg	101	SW8260B	11/09/15
Chloromethane	74-87-3	20.0	21.0	ug/Kg	105	SW8260B	11/09/15
Vinyl Chloride	75-01-4	20.0	19.3	ug/Kg	96	SW8260B	11/09/15
Bromomethane	74-83-9	20.0	19.3	ug/Kg	96	SW8260B	11/09/15
Chloroethane	75-00-3	20.0	19.6	ug/Kg	98	SW8260B	11/09/15
Trichlorofluoromethane	75-69-4	20.0	21.7	ug/Kg	109	SW8260B	11/09/15
Acetone	67-64-1	20.0	22.8	ug/Kg	114	SW8260B	11/09/15
1,1-Dichloroethene	75-35-4	20.0	19.9	ug/Kg	99	SW8260B	11/09/15
Methylene chloride	75-09-2	20.0	22.8	ug/Kg	114	SW8260B	11/09/15
trans-1,2-Dichloroethene	156-60-5	20.0	20.3	ug/Kg	102	SW8260B	11/09/15
Methyl tert-butyl ether (MTBE)	1634-04-4	20.0	19.5	ug/Kg	97	SW8260B	11/09/15
1,1-Dichloroethane	75-34-3	20.0	20.1	ug/Kg	100	SW8260B	11/09/15
2-Butanone (MEK)	78-93-3	20.0	21.0	ug/Kg	105	SW8260B	11/09/15
cis-1,2-Dichloroethene	156-59-2	20.0	20.5	ug/Kg	102	SW8260B	11/09/15
Bromochloromethane	74-97-5	20.0	20.2	ug/Kg	101	SW8260B	11/09/15
Chloroform	67-66-3	20.0	20.2	ug/Kg	101	SW8260B	11/09/15
2,2-Dichloropropane	594-20-7	20.0	20.4	ug/Kg	102	SW8260B	11/09/15
1,2-Dichloroethane	107-06-2	20.0	21.7	ug/Kg	108	SW8260B	11/09/15
1,1,1-Trichloroethane	71-55-6	20.0	20.5	ug/Kg	103	SW8260B	11/09/15
1,1-Dichloropropene	563-58-6	20.0	18.8	ug/Kg	94	SW8260B	11/09/15
Carbon tetrachloride	56-23-5	20.0	20.5	ug/Kg	103	SW8260B	11/09/15
Benzene	71-43-2	20.0	19.6	ug/Kg	98	SW8260B	11/09/15
Dibromomethane	74-95-3	20.0	20.6	ug/Kg	103	SW8260B	11/09/15
1,2-Dichloropropane	78-87-5	20.0	20.3	ug/Kg	101	SW8260B	11/09/15
Trichloroethene (TCE)	79-01-6	20.0	19.6	ug/Kg	98	SW8260B	11/09/15
Bromodichloromethane	75-27-4	20.0	20.5	ug/Kg	103	SW8260B	11/09/15
cis-1,3-Dichloropropene	10061-01-5	20.0	21.2	ug/Kg	106	SW8260B	11/09/15
4-Methyl-2-pentanone (MIBK)	108-10-1	20.0	22.5	ug/Kg	112	SW8260B	11/09/15
trans-1,3-Dichloropropene	10061-02-6	20.0	19.9	ug/Kg	99	SW8260B	11/09/15
1,1,2-Trichloroethane	79-00-5	20.0	20.3	ug/Kg	102	SW8260B	11/09/15
Toluene	108-88-3	20.0	19.3	ug/Kg	97	SW8260B	11/09/15
1,3-Dichloropropane	142-28-9	20.0	20.7	ug/Kg	104	SW8260B	11/09/15
Dibromochloromethane	124-48-1	20.0	20.5	ug/Kg	103	SW8260B	11/09/15
1,2-Dibromoethane (EDB)	106-93-4	20.0	20.4	ug/Kg	102	SW8260B	11/09/15
Tetrachloroethene (PCE)	127-18-4	20.0	18.8	ug/Kg	94	SW8260B	11/09/15
1-Chlorohexane	544-10-5	20.0	17.9	ug/Kg	90	SW8260B	11/09/15
1,1,1,2-Tetrachloroethane	630-20-6	20.0	19.9	ug/Kg	100	SW8260B	11/09/15
Chlorobenzene	108-90-7	20.0	18.1	ug/Kg	90	SW8260B	11/09/15
Ethylbenzene	100-41-4	20.0	19.2	ug/Kg	96	SW8260B	11/09/15
m,p-Xylene	108-38-3/1	40.0	37.7	ug/Kg	94	SW8260B	11/09/15
Bromoform	75-25-2	20.0	21.0	ug/Kg	105	SW8260B	11/09/15
Styrene	100-42-5	20.0	19.5	ug/Kg	98	SW8260B	11/09/15

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Project Name: Alaska LNG
Type: QC
Matrix: Soil

Lab Information

LCS ID: BS1S1109

Report Revision No.: 0
Dilution Factor: 1

Analyte	CAS#	Spike Amount	Sample Result	Units	%Recovery	Analysis Method	Date Analyzed
GC/MS Volatiles							
1,1,2,2-Tetrachloroethane	79-34-5	20.0	20.7	ug/Kg	103	SW8260B	11/09/15
o-Xylene	95-47-6	20.0	18.2	ug/Kg	91	SW8260B	11/09/15
1,2,3-Trichloropropane	96-18-4	20.0	20.7	ug/Kg	104	SW8260B	11/09/15
Isopropylbenzene	98-82-8	20.0	18.0	ug/Kg	90	SW8260B	11/09/15
Bromobenzene	108-86-1	20.0	19.4	ug/Kg	97	SW8260B	11/09/15
n-Propylbenzene	103-65-1	20.0	17.8	ug/Kg	89	SW8260B	11/09/15
2-Chlorotoluene	95-49-8	20.0	17.7	ug/Kg	89	SW8260B	11/09/15
4-Chlorotoluene	106-43-4	20.0	17.4	ug/Kg	87	SW8260B	11/09/15
1,3,5-Trimethylbenzene	108-67-8	20.0	19.4	ug/Kg	97	SW8260B	11/09/15
tert-Butylbenzene	98-06-6	20.0	17.9	ug/Kg	89	SW8260B	11/09/15
1,2,4-Trimethylbenzene	95-63-6	20.0	19.2	ug/Kg	96	SW8260B	11/09/15
sec-Butylbenzene	135-98-8	20.0	17.8	ug/Kg	89	SW8260B	11/09/15
1,3-Dichlorobenzene	541-73-1	20.0	17.2	ug/Kg	86	SW8260B	11/09/15
1,4-Dichlorobenzene	106-46-7	20.0	19.2	ug/Kg	96	SW8260B	11/09/15
p-Isopropyltoluene	99-87-6	20.0	18.0	ug/Kg	90	SW8260B	11/09/15
1,2-Dichlorobenzene	95-50-1	20.0	18.4	ug/Kg	92	SW8260B	11/09/15
n-Butylbenzene	104-51-8	20.0	19.7	ug/Kg	98	SW8260B	11/09/15
1,2-Dibromo-3-chloropropane	96-12-8	20.0	22.1	ug/Kg	111	SW8260B	11/09/15
1,2,4-Trichlorobenzene	120-82-1	20.0	19.8	ug/Kg	99	SW8260B	11/09/15
Naphthalene	91-20-3	20.0	22.6	ug/Kg	113	SW8260B	11/09/15
Hexachlorobutadiene	87-68-3	20.0	18.4	ug/Kg	92	SW8260B	11/09/15
1,2,3-Trichlorobenzene	87-61-6	20.0	20.6	ug/Kg	103	SW8260B	11/09/15

Surrogate	% Recovery	Control Limits	Qualifier
Dibromofluoromethane	101	70-130	
1,2-Dichloroethane-d4	105	70-130	
Toluene-d8	95	70-130	
4-Bromofluorobenzene	94	70-130	

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Project Name: Alaska LNG
Type: QC
Matrix: Water

Lab Information

LCS ID: BS1W1109

Report Revision No.: 0
Dilution Factor: 1

Analyte	CAS#	Spike Amount	Sample Result	Units	%Recovery	Analysis Method	Date Analyzed
GC/MS Volatiles							
Dichlorodifluoromethane	75-71-8	20.0	17.9	ug/L	89	SW8260B	11/09/15
Chloromethane	74-87-3	20.0	17.3	ug/L	87	SW8260B	11/09/15
Vinyl Chloride	75-01-4	20.0	18.5	ug/L	92	SW8260B	11/09/15
Bromomethane	74-83-9	20.0	18.1	ug/L	91	SW8260B	11/09/15
Chloroethane	75-00-3	20.0	18.2	ug/L	91	SW8260B	11/09/15
Trichlorofluoromethane	75-69-4	20.0	24.3	ug/L	121	SW8260B	11/09/15
Acetone	67-64-1	20.0	20.4	ug/L	102	SW8260B	11/09/15
1,1-Dichloroethene	75-35-4	20.0	19.3	ug/L	96	SW8260B	11/09/15
Methylene chloride	75-09-2	20.0	19.1	ug/L	95	SW8260B	11/09/15
trans-1,2-Dichloroethene	156-60-5	20.0	19.2	ug/L	96	SW8260B	11/09/15
Methyl tert-butyl ether (MTBE)	1634-04-4	20.0	21.4	ug/L	107	SW8260B	11/09/15
1,1-Dichloroethane	75-34-3	20.0	17.8	ug/L	89	SW8260B	11/09/15
2-Butanone (MEK)	78-93-3	20.0	19.5	ug/L	97	SW8260B	11/09/15
cis-1,2-Dichloroethene	156-59-2	20.0	19.2	ug/L	96	SW8260B	11/09/15
Bromochloromethane	74-97-5	20.0	19.2	ug/L	96	SW8260B	11/09/15
Chloroform	67-66-3	20.0	19.9	ug/L	99	SW8260B	11/09/15
2,2-Dichloropropane	594-20-7	20.0	21.2	ug/L	106	SW8260B	11/09/15
1,2-Dichloroethane	107-06-2	20.0	22.0	ug/L	110	SW8260B	11/09/15
1,1,1-Trichloroethane	71-55-6	20.0	23.1	ug/L	116	SW8260B	11/09/15
1,1-Dichloropropene	563-58-6	20.0	20.6	ug/L	103	SW8260B	11/09/15
Carbon tetrachloride	56-23-5	20.0	23.8	ug/L	119	SW8260B	11/09/15
Benzene	71-43-2	20.0	18.6	ug/L	93	SW8260B	11/09/15
Dibromomethane	74-95-3	20.0	19.3	ug/L	96	SW8260B	11/09/15
1,2-Dichloropropane	78-87-5	20.0	17.8	ug/L	89	SW8260B	11/09/15
Trichloroethene (TCE)	79-01-6	20.0	20.8	ug/L	104	SW8260B	11/09/15
Bromodichloromethane	75-27-4	20.0	20.9	ug/L	104	SW8260B	11/09/15
cis-1,3-Dichloropropene	10061-01-5	20.0	21.5	ug/L	108	SW8260B	11/09/15
4-Methyl-2-pentanone (MIBK)	108-10-1	20.0	22.1	ug/L	110	SW8260B	11/09/15
trans-1,3-Dichloropropene	10061-02-6	20.0	21.1	ug/L	105	SW8260B	11/09/15
1,1,2-Trichloroethane	79-00-5	20.0	19.0	ug/L	95	SW8260B	11/09/15
Toluene	108-88-3	20.0	20.8	ug/L	104	SW8260B	11/09/15
1,3-Dichloropropane	142-28-9	20.0	16.8	ug/L	84	SW8260B	11/09/15
Dibromochloromethane	124-48-1	20.0	19.0	ug/L	95	SW8260B	11/09/15
1,2-Dibromoethane (EDB)	106-93-4	20.0	18.5	ug/L	92	SW8260B	11/09/15
Tetrachloroethene (PCE)	127-18-4	20.0	18.9	ug/L	95	SW8260B	11/09/15
1-Chlorohexane	544-10-5	20.0	20.9	ug/L	104	SW8260B	11/09/15
1,1,1,2-Tetrachloroethane	630-20-6	20.0	19.0	ug/L	95	SW8260B	11/09/15
Chlorobenzene	108-90-7	20.0	16.8	ug/L	84	SW8260B	11/09/15
Ethylbenzene	100-41-4	20.0	19.6	ug/L	98	SW8260B	11/09/15
m,p-Xylene	108-38-3/1	40.0	39.0	ug/L	97	SW8260B	11/09/15
Bromoform	75-25-2	20.0	20.8	ug/L	104	SW8260B	11/09/15
Styrene	100-42-5	20.0	21.0	ug/L	105	SW8260B	11/09/15

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

CH2M HILL ASL

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Tel 541-768-3120 Fax 541-752-0276

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Project Name: Alaska LNG
Type: QC
Matrix: Water

Lab Information

LCS ID: BS1W1109

Report Revision No.: 0
Dilution Factor: 1

Analyte	CAS#	Spike Amount	Sample Result	Units	%Recovery	Analysis Method	Date Analyzed
GC/MS Volatiles							
1,1,2,2-Tetrachloroethane	79-34-5	20.0	15.9	ug/L	80	SW8260B	11/09/15
o-Xylene	95-47-6	20.0	19.1	ug/L	96	SW8260B	11/09/15
1,2,3-Trichloropropane	96-18-4	20.0	18.2	ug/L	91	SW8260B	11/09/15
Isopropylbenzene	98-82-8	20.0	19.8	ug/L	99	SW8260B	11/09/15
Bromobenzene	108-86-1	20.0	18.3	ug/L	92	SW8260B	11/09/15
n-Propylbenzene	103-65-1	20.0	18.4	ug/L	92	SW8260B	11/09/15
2-Chlorotoluene	95-49-8	20.0	18.7	ug/L	94	SW8260B	11/09/15
4-Chlorotoluene	106-43-4	20.0	18.3	ug/L	92	SW8260B	11/09/15
1,3,5-Trimethylbenzene	108-67-8	20.0	22.3	ug/L	111	SW8260B	11/09/15
tert-Butylbenzene	98-06-6	20.0	20.5	ug/L	103	SW8260B	11/09/15
1,2,4-Trimethylbenzene	95-63-6	20.0	21.6	ug/L	108	SW8260B	11/09/15
sec-Butylbenzene	135-98-8	20.0	19.3	ug/L	96	SW8260B	11/09/15
1,3-Dichlorobenzene	541-73-1	20.0	17.6	ug/L	88	SW8260B	11/09/15
1,4-Dichlorobenzene	106-46-7	20.0	17.8	ug/L	89	SW8260B	11/09/15
p-Isopropyltoluene	99-87-6	20.0	18.8	ug/L	94	SW8260B	11/09/15
1,2-Dichlorobenzene	95-50-1	20.0	18.0	ug/L	90	SW8260B	11/09/15
n-Butylbenzene	104-51-8	20.0	19.2	ug/L	96	SW8260B	11/09/15
1,2-Dibromo-3-chloropropane	96-12-8	20.0	20.8	ug/L	104	SW8260B	11/09/15
1,2,4-Trichlorobenzene	120-82-1	20.0	22.4	ug/L	112	SW8260B	11/09/15
Naphthalene	91-20-3	20.0	23.4	ug/L	117	SW8260B	11/09/15
Hexachlorobutadiene	87-68-3	20.0	20.4	ug/L	102	SW8260B	11/09/15
1,2,3-Trichlorobenzene	87-61-6	20.0	22.5	ug/L	112	SW8260B	11/09/15

Surrogate	% Recovery	Control Limits	Qualifier
Dibromofluoromethane	100	70-130	
1,2-Dichloroethane-d4	110	70-130	
Toluene-d8	104	70-130	
4-Bromofluorobenzene	102	70-130	

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

1100 NE Circle Blvd., Suite 300
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CASE NARRATIVE
GC/MS SEMI-VOLATILES ANALYSIS

Lab Name: CH2M HILL ASL **ASL SDG#:** P3586

Project: Alaska LNG **Project #:** 653488.16.06

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

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

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

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

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

Method(s):
SW8270C-SIM: SW3510, SW3550

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information		Lab Information	
Client Sample ID:	**EB110615-01**	**Lab Sample ID:**	**P358613**
Project Name:	Alaska LNG	Date Received:	11/07/15
Sample Date:	11/06/15	Dilution Factor:	1
Sample Time:	15:45	Report Revision No.:	0
Type:	Grab		
Matrix:	Water		

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Semi-Volatiles								
Naphthalene	91-20-3	0.0040	0.0096	0.012		ug/L	SW8270C-SI	11/16/15
2-Methylnaphthalene	91-57-6	0.0024	0.0096	0.0033	J	ug/L	SW8270C-SI	11/16/15
1-Methylnaphthalene	90-12-0	0.0029	0.0096	0.0029	U	ug/L	SW8270C-SI	11/16/15
Acenaphthylene	208-96-8	0.0013	0.0096	0.0013	U	ug/L	SW8270C-SI	11/16/15
Acenaphthene	83-32-9	0.0017	0.0096	0.0017	U	ug/L	SW8270C-SI	11/16/15
Fluorene	86-73-7	0.0013	0.0096	0.0013	U	ug/L	SW8270C-SI	11/16/15
Phenanthrene	85-01-8	0.0015	0.0096	0.0024	J	ug/L	SW8270C-SI	11/16/15
Anthracene	120-12-7	0.0019	0.0096	0.0019	U	ug/L	SW8270C-SI	11/16/15
Fluoranthene	206-44-0	0.0031	0.0096	0.0031	U	ug/L	SW8270C-SI	11/16/15
Pyrene	129-00-0	0.0036	0.0096	0.0036	U	ug/L	SW8270C-SI	11/16/15
Benzo(a)anthracene	56-55-3	0.0019	0.0096	0.0019	U	ug/L	SW8270C-SI	11/16/15
Chrysene	218-01-9	0.0023	0.0096	0.0023	U	ug/L	SW8270C-SI	11/16/15
Benzo(b)fluoroanthene	205-99-2	0.0029	0.0096	0.0029	U	ug/L	SW8270C-SI	11/16/15
Benzo(k)fluoranthene	207-08-9	0.0033	0.0096	0.0033	U	ug/L	SW8270C-SI	11/16/15
Benzo(a)pyrene	50-32-8	0.0025	0.0096	0.0025	U	ug/L	SW8270C-SI	11/16/15
Indeno(1,2,3-c,d)pyrene	193-39-5	0.0019	0.0096	0.0019	U	ug/L	SW8270C-SI	11/16/15
Dibenzo(a,h)anthracene	53-70-3	0.0033	0.0096	0.0033	U	ug/L	SW8270C-SI	11/16/15
Benzo(g,h,i)perylene	191-24-2	0.0023	0.0096	0.0023	U	ug/L	SW8270C-SI	11/16/15

Surrogate	% Recovery	Control Limits	Qualifier
Terphenyl-d14	101	33-141	

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information		Lab Information	
Client Sample ID:	**WB1-1113**	**Lab Sample ID:**	**WB1-1113**
Project Name:	Alaska LNG	Date Received:	N/A
Sample Date:	N/A	Dilution Factor:	1
Sample Time:	N/A	Report Revision No.:	0
Type:	QC		
Matrix:	Water		

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Semi-Volatiles								
Naphthalene	91-20-3	0.0041	0.010	0.0041	U	ug/L	SW8270C-SI	11/16/15
2-Methylnaphthalene	91-57-6	0.0025	0.010	0.0025	U	ug/L	SW8270C-SI	11/16/15
1-Methylnaphthalene	90-12-0	0.0030	0.010	0.0030	U	ug/L	SW8270C-SI	11/16/15
Acenaphthylene	208-96-8	0.0014	0.010	0.0014	U	ug/L	SW8270C-SI	11/16/15
Acenaphthene	83-32-9	0.0018	0.010	0.0018	U	ug/L	SW8270C-SI	11/16/15
Fluorene	86-73-7	0.0014	0.010	0.0014	U	ug/L	SW8270C-SI	11/16/15
Phenanthrene	85-01-8	0.0015	0.010	0.0015	U	ug/L	SW8270C-SI	11/16/15
Anthracene	120-12-7	0.0020	0.010	0.0020	U	ug/L	SW8270C-SI	11/16/15
Fluoranthene	206-44-0	0.0033	0.010	0.0033	U	ug/L	SW8270C-SI	11/16/15
Pyrene	129-00-0	0.0038	0.010	0.0038	U	ug/L	SW8270C-SI	11/16/15
Benzo(a)anthracene	56-55-3	0.0019	0.010	0.0019	U	ug/L	SW8270C-SI	11/16/15
Chrysene	218-01-9	0.0024	0.010	0.0024	U	ug/L	SW8270C-SI	11/16/15
Benzo(b)fluoroanthene	205-99-2	0.0031	0.010	0.0031	U	ug/L	SW8270C-SI	11/16/15
Benzo(k)fluoranthene	207-08-9	0.0035	0.010	0.0035	U	ug/L	SW8270C-SI	11/16/15
Benzo(a)pyrene	50-32-8	0.0026	0.010	0.0026	U	ug/L	SW8270C-SI	11/16/15
Indeno(1,2,3-c,d)pyrene	193-39-5	0.0019	0.010	0.0019	U	ug/L	SW8270C-SI	11/16/15
Dibenzo(a,h)anthracene	53-70-3	0.0034	0.010	0.0034	U	ug/L	SW8270C-SI	11/16/15
Benzo(g,h,i)perylene	191-24-2	0.0024	0.010	0.0024	U	ug/L	SW8270C-SI	11/16/15

Surrogate	% Recovery	Control Limits	Qualifier
Terphenyl-d14	95	33-141	

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information		Lab Information	
Client Sample ID:	**D4SD04-0.503-01**	**Lab Sample ID:**	**P358601**
Project Name:	Alaska LNG	Date Received:	11/07/15
Sample Date:	11/05/15	Dilution Factor:	1
Sample Time:	13:30	Report Revision No.:	0
Type:	Grab		
Matrix:	Soil		
Basis:	Dry Weight		

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Semi-Volatiles								
Naphthalene	91-20-3	0.21	1.21	4.88		ug/Kg	SW8270C-SI	11/16/15
2-Methylnaphthalene	91-57-6	0.22	1.21	4.15		ug/Kg	SW8270C-SI	11/16/15
1-Methylnaphthalene	90-12-0	0.21	1.21	2.97		ug/Kg	SW8270C-SI	11/16/15
Acenaphthylene	208-96-8	0.22	1.21	0.26	J	ug/Kg	SW8270C-SI	11/16/15
Acenaphthene	83-32-9	0.19	1.21	0.39	J	ug/Kg	SW8270C-SI	11/16/15
Fluorene	86-73-7	0.21	1.21	2.05		ug/Kg	SW8270C-SI	11/16/15
Phenanthrene	85-01-8	0.23	1.21	3.33		ug/Kg	SW8270C-SI	11/16/15
Anthracene	120-12-7	0.31	1.21	1.15	J	ug/Kg	SW8270C-SI	11/16/15
Fluoranthene	206-44-0	0.22	1.21	1.35		ug/Kg	SW8270C-SI	11/16/15
Pyrene	129-00-0	0.18	1.21	1.67		ug/Kg	SW8270C-SI	11/16/15
Benzo(a)anthracene	56-55-3	0.18	1.21	0.41	J	ug/Kg	SW8270C-SI	11/16/15
Chrysene	218-01-9	0.36	1.21	0.65	J	ug/Kg	SW8270C-SI	11/16/15
Benzo(b)fluoroanthene	205-99-2	0.41	1.21	0.41	U	ug/Kg	SW8270C-SI	11/16/15
Benzo(k)fluoranthene	207-08-9	0.57	1.21	0.57	U	ug/Kg	SW8270C-SI	11/16/15
Benzo(a)pyrene	50-32-8	0.28	1.21	0.28	U	ug/Kg	SW8270C-SI	11/16/15
Indeno(1,2,3-c,d)pyrene	193-39-5	0.45	1.21	0.45	U	ug/Kg	SW8270C-SI	11/16/15
Dibenzo(a,h)anthracene	53-70-3	0.41	1.21	0.41	U	ug/Kg	SW8270C-SI	11/16/15
Benzo(g,h,i)perylene	191-24-2	0.45	1.21	0.45	U	ug/Kg	SW8270C-SI	11/16/15

Surrogate	% Recovery	Control Limits	Qualifier
Terphenyl-d14	90	18-137	

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information		Lab Information	
Client Sample ID:	**D4SD04-0.503-101**	**Lab Sample ID:**	**P358602**
Project Name:	Alaska LNG	Date Received:	11/07/15
Sample Date:	11/05/15	Dilution Factor:	1
Sample Time:	13:40	Report Revision No.:	0
Type:	Grab		
Matrix:	Soil		
Basis:	Dry Weight		

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Semi-Volatiles								
Naphthalene	91-20-3	0.20	1.17	5.53		ug/Kg	SW8270C-SI	11/17/15
2-Methylnaphthalene	91-57-6	0.21	1.17	3.65		ug/Kg	SW8270C-SI	11/17/15
1-Methylnaphthalene	90-12-0	0.20	1.17	2.87		ug/Kg	SW8270C-SI	11/17/15
Acenaphthylene	208-96-8	0.21	1.17	0.54	J	ug/Kg	SW8270C-SI	11/17/15
Acenaphthene	83-32-9	0.18	1.17	0.33	J	ug/Kg	SW8270C-SI	11/17/15
Fluorene	86-73-7	0.21	1.17	2.19		ug/Kg	SW8270C-SI	11/17/15
Phenanthrene	85-01-8	0.22	1.17	2.83		ug/Kg	SW8270C-SI	11/17/15
Anthracene	120-12-7	0.30	1.17	1.14	J	ug/Kg	SW8270C-SI	11/17/15
Fluoranthene	206-44-0	0.21	1.17	1.39		ug/Kg	SW8270C-SI	11/17/15
Pyrene	129-00-0	0.17	1.17	1.47		ug/Kg	SW8270C-SI	11/17/15
Benzo(a)anthracene	56-55-3	0.18	1.17	0.18	U	ug/Kg	SW8270C-SI	11/17/15
Chrysene	218-01-9	0.35	1.17	0.42	J	ug/Kg	SW8270C-SI	11/17/15
Benzo(b)fluoroanthene	205-99-2	0.40	1.17	0.40	U	ug/Kg	SW8270C-SI	11/17/15
Benzo(k)fluoranthene	207-08-9	0.55	1.17	0.55	U	ug/Kg	SW8270C-SI	11/17/15
Benzo(a)pyrene	50-32-8	0.27	1.17	0.27	U	ug/Kg	SW8270C-SI	11/17/15
Indeno(1,2,3-c,d)pyrene	193-39-5	0.43	1.17	0.43	U	ug/Kg	SW8270C-SI	11/17/15
Dibenzo(a,h)anthracene	53-70-3	0.40	1.17	0.40	U	ug/Kg	SW8270C-SI	11/17/15
Benzo(g,h,i)perylene	191-24-2	0.43	1.17	0.43	U	ug/Kg	SW8270C-SI	11/17/15

Surrogate	% Recovery	Control Limits	Qualifier
Terphenyl-d14	102	18-137	

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information		Lab Information	
Client Sample ID:	**D4SD04-0.503-01MS**	**Lab Sample ID:**	**P358603MS**
Project Name:	Alaska LNG	Date Received:	11/07/15
Sample Date:	11/05/15	Dilution Factor:	1
Sample Time:	13:30	Report Revision No.:	0
Type:	Grab		
Matrix:	Soil		
Basis:	Dry Weight		

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Semi-Volatiles								
Naphthalene	91-20-3	0.21	1.21	46.4		ug/Kg	SW8270C-SI	11/17/15
2-Methylnaphthalene	91-57-6	0.22	1.21	48.2		ug/Kg	SW8270C-SI	11/17/15
1-Methylnaphthalene	90-12-0	0.21	1.21	45.5		ug/Kg	SW8270C-SI	11/17/15
Acenaphthylene	208-96-8	0.21	1.21	49.9		ug/Kg	SW8270C-SI	11/17/15
Acenaphthene	83-32-9	0.19	1.21	47.2		ug/Kg	SW8270C-SI	11/17/15
Fluorene	86-73-7	0.21	1.21	52.2		ug/Kg	SW8270C-SI	11/17/15
Phenanthrene	85-01-8	0.22	1.21	51.3		ug/Kg	SW8270C-SI	11/17/15
Anthracene	120-12-7	0.31	1.21	51.0		ug/Kg	SW8270C-SI	11/17/15
Fluoranthene	206-44-0	0.21	1.21	50.6		ug/Kg	SW8270C-SI	11/17/15
Pyrene	129-00-0	0.18	1.21	50.0		ug/Kg	SW8270C-SI	11/17/15
Benzo(a)anthracene	56-55-3	0.18	1.21	50.3		ug/Kg	SW8270C-SI	11/17/15
Chrysene	218-01-9	0.36	1.21	51.7		ug/Kg	SW8270C-SI	11/17/15
Benzo(b)fluoroanthene	205-99-2	0.41	1.21	46.9		ug/Kg	SW8270C-SI	11/17/15
Benzo(k)fluoranthene	207-08-9	0.57	1.21	44.0		ug/Kg	SW8270C-SI	11/17/15
Benzo(a)pyrene	50-32-8	0.28	1.21	42.4		ug/Kg	SW8270C-SI	11/17/15
Indeno(1,2,3-c,d)pyrene	193-39-5	0.44	1.21	42.6		ug/Kg	SW8270C-SI	11/17/15
Dibenzo(a,h)anthracene	53-70-3	0.41	1.21	48.1		ug/Kg	SW8270C-SI	11/17/15
Benzo(g,h,i)perylene	191-24-2	0.44	1.21	46.0		ug/Kg	SW8270C-SI	11/17/15

Surrogate	% Recovery	Control Limits	Qualifier
Terphenyl-d14	104	18-137	

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information		Lab Information	
Client Sample ID:	**D4SD04-0.503-01SD**	**Lab Sample ID:**	**P358604MSD**
Project Name:	Alaska LNG	Date Received:	11/07/15
Sample Date:	11/05/15	Dilution Factor:	1
Sample Time:	13:30	Report Revision No.:	0
Type:	Grab		
Matrix:	Soil		
Basis:	Dry Weight		

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Semi-Volatiles								
Naphthalene	91-20-3	0.21	1.21	43.0		ug/Kg	SW8270C-SI	11/17/15
2-Methylnaphthalene	91-57-6	0.22	1.21	45.5		ug/Kg	SW8270C-SI	11/17/15
1-Methylnaphthalene	90-12-0	0.21	1.21	42.1		ug/Kg	SW8270C-SI	11/17/15
Acenaphthylene	208-96-8	0.21	1.21	49.0		ug/Kg	SW8270C-SI	11/17/15
Acenaphthene	83-32-9	0.19	1.21	46.5		ug/Kg	SW8270C-SI	11/17/15
Fluorene	86-73-7	0.21	1.21	52.8		ug/Kg	SW8270C-SI	11/17/15
Phenanthrene	85-01-8	0.22	1.21	50.9		ug/Kg	SW8270C-SI	11/17/15
Anthracene	120-12-7	0.31	1.21	50.6		ug/Kg	SW8270C-SI	11/17/15
Fluoranthene	206-44-0	0.21	1.21	51.2		ug/Kg	SW8270C-SI	11/17/15
Pyrene	129-00-0	0.18	1.21	51.1		ug/Kg	SW8270C-SI	11/17/15
Benzo(a)anthracene	56-55-3	0.18	1.21	49.7		ug/Kg	SW8270C-SI	11/17/15
Chrysene	218-01-9	0.36	1.21	51.1		ug/Kg	SW8270C-SI	11/17/15
Benzo(b)fluoroanthene	205-99-2	0.41	1.21	46.3		ug/Kg	SW8270C-SI	11/17/15
Benzo(k)fluoranthene	207-08-9	0.57	1.21	44.5		ug/Kg	SW8270C-SI	11/17/15
Benzo(a)pyrene	50-32-8	0.28	1.21	41.9		ug/Kg	SW8270C-SI	11/17/15
Indeno(1,2,3-c,d)pyrene	193-39-5	0.44	1.21	39.3		ug/Kg	SW8270C-SI	11/17/15
Dibenzo(a,h)anthracene	53-70-3	0.41	1.21	43.7		ug/Kg	SW8270C-SI	11/17/15
Benzo(g,h,i)perylene	191-24-2	0.44	1.21	42.0		ug/Kg	SW8270C-SI	11/17/15

Surrogate	% Recovery	Control Limits	Qualifier
Terphenyl-d14	104	18-137	

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information		Lab Information	
Client Sample ID:	**D4SD04-0304.25-02**	**Lab Sample ID:**	**P358605**
Project Name:	Alaska LNG	Date Received:	11/07/15
Sample Date:	11/05/15	Dilution Factor:	1
Sample Time:	16:30	Report Revision No.:	0
Type:	Grab		
Matrix:	Soil		
Basis:	Dry Weight		

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Semi-Volatiles								
Naphthalene	91-20-3	0.21	1.20	1.20		ug/Kg	SW8270C-SI	11/17/15
2-Methylnaphthalene	91-57-6	0.22	1.20	1.94		ug/Kg	SW8270C-SI	11/17/15
1-Methylnaphthalene	90-12-0	0.20	1.20	1.00	J	ug/Kg	SW8270C-SI	11/17/15
Acenaphthylene	208-96-8	0.21	1.20	0.21	U	ug/Kg	SW8270C-SI	11/17/15
Acenaphthene	83-32-9	0.18	1.20	0.18	U	ug/Kg	SW8270C-SI	11/17/15
Fluorene	86-73-7	0.21	1.20	0.41	J	ug/Kg	SW8270C-SI	11/17/15
Phenanthrene	85-01-8	0.22	1.20	1.15	J	ug/Kg	SW8270C-SI	11/17/15
Anthracene	120-12-7	0.31	1.20	0.31	U	ug/Kg	SW8270C-SI	11/17/15
Fluoranthene	206-44-0	0.21	1.20	0.49	J	ug/Kg	SW8270C-SI	11/17/15
Pyrene	129-00-0	0.18	1.20	0.68	J	ug/Kg	SW8270C-SI	11/17/15
Benzo(a)anthracene	56-55-3	0.18	1.20	0.18	U	ug/Kg	SW8270C-SI	11/17/15
Chrysene	218-01-9	0.36	1.20	0.36	U	ug/Kg	SW8270C-SI	11/17/15
Benzo(b)fluoroanthene	205-99-2	0.41	1.20	0.41	U	ug/Kg	SW8270C-SI	11/17/15
Benzo(k)fluoranthene	207-08-9	0.56	1.20	0.56	U	ug/Kg	SW8270C-SI	11/17/15
Benzo(a)pyrene	50-32-8	0.28	1.20	0.28	U	ug/Kg	SW8270C-SI	11/17/15
Indeno(1,2,3-c,d)pyrene	193-39-5	0.44	1.20	0.44	U	ug/Kg	SW8270C-SI	11/17/15
Dibenzo(a,h)anthracene	53-70-3	0.40	1.20	0.40	U	ug/Kg	SW8270C-SI	11/17/15
Benzo(g,h,i)perylene	191-24-2	0.44	1.20	0.44	U	ug/Kg	SW8270C-SI	11/17/15

Surrogate	% Recovery	Control Limits	Qualifier
Terphenyl-d14	95	18-137	

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information		Lab Information	
Client Sample ID:	**D4SD04-4.2518.86-03**	**Lab Sample ID:**	**P358606**
Project Name:	Alaska LNG	Date Received:	11/07/15
Sample Date:	11/05/15	Dilution Factor:	1
Sample Time:	14:50	Report Revision No.:	0
Type:	Grab		
Matrix:	Soil		
Basis:	Dry Weight		

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Semi-Volatiles								
Naphthalene	91-20-3	0.21	1.21	1.32		ug/Kg	SW8270C-SI	11/17/15
2-Methylnaphthalene	91-57-6	0.22	1.21	5.34		ug/Kg	SW8270C-SI	11/17/15
1-Methylnaphthalene	90-12-0	0.21	1.21	3.20		ug/Kg	SW8270C-SI	11/17/15
Acenaphthylene	208-96-8	0.22	1.21	0.22	U	ug/Kg	SW8270C-SI	11/17/15
Acenaphthene	83-32-9	0.19	1.21	0.19	U	ug/Kg	SW8270C-SI	11/17/15
Fluorene	86-73-7	0.21	1.21	0.21	U	ug/Kg	SW8270C-SI	11/17/15
Phenanthrene	85-01-8	0.23	1.21	5.32		ug/Kg	SW8270C-SI	11/17/15
Anthracene	120-12-7	0.31	1.21	0.31	U	ug/Kg	SW8270C-SI	11/17/15
Fluoranthene	206-44-0	0.22	1.21	1.36		ug/Kg	SW8270C-SI	11/17/15
Pyrene	129-00-0	0.18	1.21	2.53		ug/Kg	SW8270C-SI	11/17/15
Benzo(a)anthracene	56-55-3	0.18	1.21	0.18	U	ug/Kg	SW8270C-SI	11/17/15
Chrysene	218-01-9	0.36	1.21	1.04	J	ug/Kg	SW8270C-SI	11/17/15
Benzo(b)fluoroanthene	205-99-2	0.41	1.21	0.41	U	ug/Kg	SW8270C-SI	11/17/15
Benzo(k)fluoranthene	207-08-9	0.57	1.21	0.57	U	ug/Kg	SW8270C-SI	11/17/15
Benzo(a)pyrene	50-32-8	0.28	1.21	0.28	U	ug/Kg	SW8270C-SI	11/17/15
Indeno(1,2,3-c,d)pyrene	193-39-5	0.45	1.21	0.45	U	ug/Kg	SW8270C-SI	11/17/15
Dibenzo(a,h)anthracene	53-70-3	0.41	1.21	0.41	U	ug/Kg	SW8270C-SI	11/17/15
Benzo(g,h,i)perylene	191-24-2	0.45	1.21	0.45	U	ug/Kg	SW8270C-SI	11/17/15

Surrogate	% Recovery	Control Limits	Qualifier
Terphenyl-d14	92	18-137	

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information		Lab Information	
Client Sample ID:	**D5SD01-0002-01**	**Lab Sample ID:**	**P358607**
Project Name:	Alaska LNG	Date Received:	11/07/15
Sample Date:	11/06/15	Dilution Factor:	1
Sample Time:	11:15	Report Revision No.:	0
Type:	Grab		
Matrix:	Soil		
Basis:	Dry Weight		

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Semi-Volatiles								
Naphthalene	91-20-3	0.21	1.20	0.73	J	ug/Kg	SW8270C-SI	11/17/15
2-Methylnaphthalene	91-57-6	0.22	1.20	1.68		ug/Kg	SW8270C-SI	11/17/15
1-Methylnaphthalene	90-12-0	0.20	1.20	1.13	J	ug/Kg	SW8270C-SI	11/17/15
Acenaphthylene	208-96-8	0.21	1.20	0.21	U	ug/Kg	SW8270C-SI	11/17/15
Acenaphthene	83-32-9	0.18	1.20	0.18	U	ug/Kg	SW8270C-SI	11/17/15
Fluorene	86-73-7	0.21	1.20	0.49	J	ug/Kg	SW8270C-SI	11/17/15
Phenanthrene	85-01-8	0.22	1.20	1.48		ug/Kg	SW8270C-SI	11/17/15
Anthracene	120-12-7	0.31	1.20	0.31	U	ug/Kg	SW8270C-SI	11/17/15
Fluoranthene	206-44-0	0.21	1.20	0.52	J	ug/Kg	SW8270C-SI	11/17/15
Pyrene	129-00-0	0.18	1.20	0.85	J	ug/Kg	SW8270C-SI	11/17/15
Benzo(a)anthracene	56-55-3	0.18	1.20	0.18	U	ug/Kg	SW8270C-SI	11/17/15
Chrysene	218-01-9	0.36	1.20	0.36	U	ug/Kg	SW8270C-SI	11/17/15
Benzo(b)fluoroanthene	205-99-2	0.41	1.20	0.41	U	ug/Kg	SW8270C-SI	11/17/15
Benzo(k)fluoranthene	207-08-9	0.56	1.20	0.56	U	ug/Kg	SW8270C-SI	11/17/15
Benzo(a)pyrene	50-32-8	0.28	1.20	0.28	U	ug/Kg	SW8270C-SI	11/17/15
Indeno(1,2,3-c,d)pyrene	193-39-5	0.44	1.20	0.44	U	ug/Kg	SW8270C-SI	11/17/15
Dibenzo(a,h)anthracene	53-70-3	0.40	1.20	0.40	U	ug/Kg	SW8270C-SI	11/17/15
Benzo(g,h,i)perylene	191-24-2	0.44	1.20	0.44	U	ug/Kg	SW8270C-SI	11/17/15

Surrogate	% Recovery	Control Limits	Qualifier
Terphenyl-d14	111	18-137	

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information		Lab Information	
Client Sample ID:	**D5SD01-0204-02**	**Lab Sample ID:**	**P358608**
Project Name:	Alaska LNG	Date Received:	11/07/15
Sample Date:	11/06/15	Dilution Factor:	1
Sample Time:	13:00	Report Revision No.:	0
Type:	Grab		
Matrix:	Soil		
Basis:	Dry Weight		

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Semi-Volatiles								
Naphthalene	91-20-3	0.23	1.30	0.41	J	ug/Kg	SW8270C-SI	11/17/15
2-Methylnaphthalene	91-57-6	0.24	1.30	0.95	J	ug/Kg	SW8270C-SI	11/17/15
1-Methylnaphthalene	90-12-0	0.22	1.30	0.50	J	ug/Kg	SW8270C-SI	11/17/15
Acenaphthylene	208-96-8	0.23	1.30	0.23	U	ug/Kg	SW8270C-SI	11/17/15
Acenaphthene	83-32-9	0.20	1.30	0.20	U	ug/Kg	SW8270C-SI	11/17/15
Fluorene	86-73-7	0.23	1.30	0.23	U	ug/Kg	SW8270C-SI	11/17/15
Phenanthrene	85-01-8	0.24	1.30	1.23	J	ug/Kg	SW8270C-SI	11/17/15
Anthracene	120-12-7	0.33	1.30	0.33	U	ug/Kg	SW8270C-SI	11/17/15
Fluoranthene	206-44-0	0.23	1.30	0.55	J	ug/Kg	SW8270C-SI	11/17/15
Pyrene	129-00-0	0.19	1.30	0.91	J	ug/Kg	SW8270C-SI	11/17/15
Benzo(a)anthracene	56-55-3	0.20	1.30	0.20	U	ug/Kg	SW8270C-SI	11/17/15
Chrysene	218-01-9	0.39	1.30	0.39	U	ug/Kg	SW8270C-SI	11/17/15
Benzo(b)fluoroanthene	205-99-2	0.44	1.30	0.44	U	ug/Kg	SW8270C-SI	11/17/15
Benzo(k)fluoranthene	207-08-9	0.61	1.30	0.61	U	ug/Kg	SW8270C-SI	11/17/15
Benzo(a)pyrene	50-32-8	0.30	1.30	0.30	U	ug/Kg	SW8270C-SI	11/17/15
Indeno(1,2,3-c,d)pyrene	193-39-5	0.48	1.30	0.48	U	ug/Kg	SW8270C-SI	11/17/15
Dibenzo(a,h)anthracene	53-70-3	0.44	1.30	0.44	U	ug/Kg	SW8270C-SI	11/17/15
Benzo(g,h,i)perylene	191-24-2	0.48	1.30	0.48	U	ug/Kg	SW8270C-SI	11/17/15

Surrogate	% Recovery	Control Limits	Qualifier
Terphenyl-d14	106	18-137	

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information		Lab Information	
Client Sample ID:	**D4BDS01-001.31-01**	**Lab Sample ID:**	**P358609**
Project Name:	Alaska LNG	Date Received:	11/07/15
Sample Date:	11/03/15	Dilution Factor:	1
Sample Time:	11:00	Report Revision No.:	0
Type:	Grab		
Matrix:	Soil		
Basis:	Dry Weight		

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Semi-Volatiles								
Naphthalene	91-20-3	0.23	1.30	0.27	J	ug/Kg	SW8270C-SI	11/17/15
2-Methylnaphthalene	91-57-6	0.24	1.30	0.24	U	ug/Kg	SW8270C-SI	11/17/15
1-Methylnaphthalene	90-12-0	0.22	1.30	0.22	U	ug/Kg	SW8270C-SI	11/17/15
Acenaphthylene	208-96-8	0.23	1.30	0.23	U	ug/Kg	SW8270C-SI	11/17/15
Acenaphthene	83-32-9	0.20	1.30	0.20	U	ug/Kg	SW8270C-SI	11/17/15
Fluorene	86-73-7	0.23	1.30	0.23	U	ug/Kg	SW8270C-SI	11/17/15
Phenanthrene	85-01-8	0.24	1.30	0.51	J	ug/Kg	SW8270C-SI	11/17/15
Anthracene	120-12-7	0.33	1.30	0.33	U	ug/Kg	SW8270C-SI	11/17/15
Fluoranthene	206-44-0	0.23	1.30	0.31	J	ug/Kg	SW8270C-SI	11/17/15
Pyrene	129-00-0	0.19	1.30	0.37	J	ug/Kg	SW8270C-SI	11/17/15
Benzo(a)anthracene	56-55-3	0.20	1.30	0.20	U	ug/Kg	SW8270C-SI	11/17/15
Chrysene	218-01-9	0.39	1.30	0.39	U	ug/Kg	SW8270C-SI	11/17/15
Benzo(b)fluoroanthene	205-99-2	0.44	1.30	0.44	U	ug/Kg	SW8270C-SI	11/17/15
Benzo(k)fluoranthene	207-08-9	0.61	1.30	0.61	U	ug/Kg	SW8270C-SI	11/17/15
Benzo(a)pyrene	50-32-8	0.30	1.30	0.30	U	ug/Kg	SW8270C-SI	11/17/15
Indeno(1,2,3-c,d)pyrene	193-39-5	0.48	1.30	0.48	U	ug/Kg	SW8270C-SI	11/17/15
Dibenzo(a,h)anthracene	53-70-3	0.44	1.30	0.44	U	ug/Kg	SW8270C-SI	11/17/15
Benzo(g,h,i)perylene	191-24-2	0.48	1.30	0.48	U	ug/Kg	SW8270C-SI	11/17/15

Surrogate	% Recovery	Control Limits	Qualifier
Terphenyl-d14	94	18-137	

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information		Lab Information	
Client Sample ID:	**D5SD01-0404.9-03**	**Lab Sample ID:**	**P358610**
Project Name:	Alaska LNG	Date Received:	11/07/15
Sample Date:	11/06/15	Dilution Factor:	1
Sample Time:	14:45	Report Revision No.:	0
Type:	Grab		
Matrix:	Soil		
Basis:	Dry Weight		

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Semi-Volatiles								
Naphthalene	91-20-3	0.22	1.27	1.87		ug/Kg	SW8270C-SI	11/17/15
2-Methylnaphthalene	91-57-6	0.23	1.27	7.35		ug/Kg	SW8270C-SI	11/17/15
1-Methylnaphthalene	90-12-0	0.22	1.27	4.67		ug/Kg	SW8270C-SI	11/17/15
Acenaphthylene	208-96-8	0.23	1.27	0.36	J	ug/Kg	SW8270C-SI	11/17/15
Acenaphthene	83-32-9	0.20	1.27	0.20	U	ug/Kg	SW8270C-SI	11/17/15
Fluorene	86-73-7	0.22	1.27	2.17		ug/Kg	SW8270C-SI	11/17/15
Phenanthrene	85-01-8	0.24	1.27	7.41		ug/Kg	SW8270C-SI	11/17/15
Anthracene	120-12-7	0.33	1.27	0.33	U	ug/Kg	SW8270C-SI	11/17/15
Fluoranthene	206-44-0	0.23	1.27	1.72		ug/Kg	SW8270C-SI	11/17/15
Pyrene	129-00-0	0.19	1.27	3.05		ug/Kg	SW8270C-SI	11/17/15
Benzo(a)anthracene	56-55-3	0.19	1.27	0.43	J	ug/Kg	SW8270C-SI	11/17/15
Chrysene	218-01-9	0.38	1.27	1.41		ug/Kg	SW8270C-SI	11/17/15
Benzo(b)fluoroanthene	205-99-2	0.43	1.27	0.43	U	ug/Kg	SW8270C-SI	11/17/15
Benzo(k)fluoranthene	207-08-9	0.60	1.27	0.60	U	ug/Kg	SW8270C-SI	11/17/15
Benzo(a)pyrene	50-32-8	0.29	1.27	0.29	U	ug/Kg	SW8270C-SI	11/17/15
Indeno(1,2,3-c,d)pyrene	193-39-5	0.47	1.27	0.47	U	ug/Kg	SW8270C-SI	11/17/15
Dibenzo(a,h)anthracene	53-70-3	0.43	1.27	0.43	U	ug/Kg	SW8270C-SI	11/17/15
Benzo(g,h,i)perylene	191-24-2	0.47	1.27	0.47	U	ug/Kg	SW8270C-SI	11/17/15

Surrogate	% Recovery	Control Limits	Qualifier
Terphenyl-d14	89	18-137	

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information		Lab Information	
Client Sample ID:	**SB1-1112**	**Lab Sample ID:**	**SB1-1112**
Project Name:	Alaska LNG	Date Received:	N/A
Sample Date:	N/A	Dilution Factor:	1
Sample Time:	N/A	Report Revision No.:	0
Type:	QC		
Matrix:	Soil		
Basis:	Dry Weight		

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Semi-Volatiles								
Naphthalene	91-20-3	0.17	1.00	0.17	U	ug/Kg	SW8270C-SI	11/16/15
2-Methylnaphthalene	91-57-6	0.18	1.00	0.18	U	ug/Kg	SW8270C-SI	11/16/15
1-Methylnaphthalene	90-12-0	0.17	1.00	0.17	U	ug/Kg	SW8270C-SI	11/16/15
Acenaphthylene	208-96-8	0.18	1.00	0.18	U	ug/Kg	SW8270C-SI	11/16/15
Acenaphthene	83-32-9	0.15	1.00	0.15	U	ug/Kg	SW8270C-SI	11/16/15
Fluorene	86-73-7	0.18	1.00	0.18	U	ug/Kg	SW8270C-SI	11/16/15
Phenanthrene	85-01-8	0.19	1.00	0.19	U	ug/Kg	SW8270C-SI	11/16/15
Anthracene	120-12-7	0.26	1.00	0.26	U	ug/Kg	SW8270C-SI	11/16/15
Fluoranthene	206-44-0	0.18	1.00	0.18	U	ug/Kg	SW8270C-SI	11/16/15
Pyrene	129-00-0	0.15	1.00	0.15	U	ug/Kg	SW8270C-SI	11/16/15
Benzo(a)anthracene	56-55-3	0.15	1.00	0.15	U	ug/Kg	SW8270C-SI	11/16/15
Chrysene	218-01-9	0.30	1.00	0.30	U	ug/Kg	SW8270C-SI	11/16/15
Benzo(b)fluoroanthene	205-99-2	0.34	1.00	0.34	U	ug/Kg	SW8270C-SI	11/16/15
Benzo(k)fluoranthene	207-08-9	0.47	1.00	0.47	U	ug/Kg	SW8270C-SI	11/16/15
Benzo(a)pyrene	50-32-8	0.23	1.00	0.23	U	ug/Kg	SW8270C-SI	11/16/15
Indeno(1,2,3-c,d)pyrene	193-39-5	0.37	1.00	0.37	U	ug/Kg	SW8270C-SI	11/16/15
Dibenzo(a,h)anthracene	53-70-3	0.34	1.00	0.34	U	ug/Kg	SW8270C-SI	11/16/15
Benzo(g,h,i)perylene	191-24-2	0.37	1.00	0.37	U	ug/Kg	SW8270C-SI	11/16/15

Surrogate	% Recovery	Control Limits	Qualifier
Terphenyl-d14	98	18-137	

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Project Name: Alaska LNG
Type: QC
Matrix: Soil

Lab Information

LCS ID: BS1S1112

Report Revision No.: 0
Dilution Factor: 1

Analyte	CAS#	Spike Amount	Sample Result	Units	%Recovery	Analysis Method	Date Analyzed
GC/MS Semi-Volatiles							
Naphthalene	91-20-3	50.0	19.7	ug/Kg	39	SW8270C-SIM	11/16/15
2-Methylnaphthalene	91-57-6	50.0	28.9	ug/Kg	58	SW8270C-SIM	11/16/15
1-Methylnaphthalene	90-12-0	50.0	28.6	ug/Kg	57	SW8270C-SIM	11/16/15
Acenaphthylene	208-96-8	50.0	38.2	ug/Kg	76	SW8270C-SIM	11/16/15
Acenaphthene	83-32-9	50.0	37.2	ug/Kg	74	SW8270C-SIM	11/16/15
Fluorene	86-73-7	50.0	38.8	ug/Kg	78	SW8270C-SIM	11/16/15
Phenanthrene	85-01-8	50.0	41.6	ug/Kg	83	SW8270C-SIM	11/16/15
Anthracene	120-12-7	50.0	38.8	ug/Kg	78	SW8270C-SIM	11/16/15
Fluoranthene	206-44-0	50.0	42.6	ug/Kg	85	SW8270C-SIM	11/16/15
Pyrene	129-00-0	50.0	42.1	ug/Kg	84	SW8270C-SIM	11/16/15
Benzo(a)anthracene	56-55-3	50.0	41.3	ug/Kg	83	SW8270C-SIM	11/16/15
Chrysene	218-01-9	50.0	44.7	ug/Kg	89	SW8270C-SIM	11/16/15
Benzo(b)fluoroanthene	205-99-2	50.0	44.4	ug/Kg	89	SW8270C-SIM	11/16/15
Benzo(k)fluoranthene	207-08-9	50.0	45.7	ug/Kg	91	SW8270C-SIM	11/16/15
Benzo(a)pyrene	50-32-8	50.0	39.0	ug/Kg	78	SW8270C-SIM	11/16/15
Indeno(1,2,3-c,d)pyrene	193-39-5	50.0	48.9	ug/Kg	98	SW8270C-SIM	11/16/15
Dibenzo(a,h)anthracene	53-70-3	50.0	53.0	ug/Kg	106	SW8270C-SIM	11/16/15
Benzo(g,h,i)perylene	191-24-2	50.0	51.7	ug/Kg	103	SW8270C-SIM	11/16/15

Surrogate	% Recovery	Control Limits	Qualifier
Terphenyl-d14	97	18-137	

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Project Name: Alaska LNG
Type: QC
Matrix: Water

Lab Information

LCS ID: BS1W1113

Report Revision No.: 0
Dilution Factor: 1

Analyte	CAS#	Spike Amount	Sample Result	Units	%Recovery	Analysis Method	Date Analyzed
GC/MS Semi-Volatiles							
Naphthalene	91-20-3	0.50	0.41	ug/L	83	SW8270C-SIM	11/16/15
2-Methylnaphthalene	91-57-6	0.50	0.40	ug/L	79	SW8270C-SIM	11/16/15
1-Methylnaphthalene	90-12-0	0.50	0.39	ug/L	78	SW8270C-SIM	11/16/15
Acenaphthylene	208-96-8	0.50	0.47	ug/L	95	SW8270C-SIM	11/16/15
Acenaphthene	83-32-9	0.50	0.43	ug/L	87	SW8270C-SIM	11/16/15
Fluorene	86-73-7	0.50	0.44	ug/L	87	SW8270C-SIM	11/16/15
Phenanthrene	85-01-8	0.50	0.45	ug/L	90	SW8270C-SIM	11/16/15
Anthracene	120-12-7	0.50	0.44	ug/L	88	SW8270C-SIM	11/16/15
Fluoranthene	206-44-0	0.50	0.46	ug/L	91	SW8270C-SIM	11/16/15
Pyrene	129-00-0	0.50	0.45	ug/L	90	SW8270C-SIM	11/16/15
Benzo(a)anthracene	56-55-3	0.50	0.46	ug/L	93	SW8270C-SIM	11/16/15
Chrysene	218-01-9	0.50	0.48	ug/L	95	SW8270C-SIM	11/16/15
Benzo(b)fluoroanthene	205-99-2	0.50	0.46	ug/L	93	SW8270C-SIM	11/16/15
Benzo(k)fluoranthene	207-08-9	0.50	0.45	ug/L	90	SW8270C-SIM	11/16/15
Benzo(a)pyrene	50-32-8	0.50	0.45	ug/L	90	SW8270C-SIM	11/16/15
Indeno(1,2,3-c,d)pyrene	193-39-5	0.50	0.50	ug/L	100	SW8270C-SIM	11/16/15
Dibenzo(a,h)anthracene	53-70-3	0.50	0.53	ug/L	105	SW8270C-SIM	11/16/15
Benzo(g,h,i)perylene	191-24-2	0.50	0.51	ug/L	102	SW8270C-SIM	11/16/15

Surrogate	% Recovery	Control Limits	Qualifier
Terphenyl-d14	135	33-141	

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Client Sample ID: **D4SD04-0.503-01**

Project Name: Alaska LNG
Type: QC
Matrix: Soil

Lab Information

Report Revision No.: 0

Analyte	CAS#	MS %Recovery	MSD %Recovery	RPD	QC Limits	RPD Limits	Analysis Method
GC/MS							
Naphthalene	91-20-3	69	64	7.47	35-125	35	SW8270C-SI
2-Methylnaphthalene	91-57-6	74	69	5.87	35-125	35	SW8270C-SI
1-Methylnaphthalene	90-12-0	71	65	7.80	35-125	35	SW8270C-SI
Acenaphthylene	208-96-8	83	81	1.75	35-125	35	SW8270C-SI
Acenaphthene	83-32-9	78	77	1.57	35-125	35	SW8270C-SI
Fluorene	86-73-7	84	85	1.06	35-125	35	SW8270C-SI
Phenanthrene	85-01-8	80	79	0.62	35-125	35	SW8270C-SI
Anthracene	120-12-7	83	83	0.69	35-125	35	SW8270C-SI
Fluoranthene	206-44-0	82	83	1.33	35-125	35	SW8270C-SI
Pyrene	129-00-0	81	82	2.07	35-125	35	SW8270C-SI
Benzo(a)anthracene	56-55-3	83	82	1.28	35-125	35	SW8270C-SI
Chrysene	218-01-9	85	84	1.19	35-125	35	SW8270C-SI
Benzo(b)fluoroanthene	205-99-2	78	77	1.16	35-125	35	SW8270C-SI
Benzo(k)fluoranthene	207-08-9	74	74	0.96	35-125	35	SW8270C-SI
Benzo(a)pyrene	50-32-8	71	70	1.21	35-125	35	SW8270C-SI
Indeno(1,2,3-c,d)pyrene	193-39-5	71	66	8.12	35-125	35	SW8270C-SI
Dibenzo(a,h)anthracene	53-70-3	80	73	9.53	35-125	35	SW8270C-SI
Benzo(g,h,i)perylene	191-24-2	77	70	9.18	35-125	35	SW8270C-SI

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

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

CASE NARRATIVE
GC/MS SEMI-VOLATILES ANALYSIS

Lab Name: CH2M HILL ASL **ASL SDG#:** P3586

Project: Alaska LNG **Project #:** 653488.16.06

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

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

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

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

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

Method(s):
SW8270C: SW3510, SW3550

Laboratory Control Sample(s):
BS recovery of Hexachlorobutadiene(29%) and Benzo(a)pyrene(28%) in BS1W1109 did not meet acceptance criteria of 30-110%.
BS recovery of Hexachlorocyclopentadiene(18%) in BS1W1109 did not meet acceptance criteria of 20-120%.

Matrix Spike/Matrix Spike Duplicate(s):
MS(21%) and MSD(17%) recovery of Benzoic Acid in D4SD04-0.503-01MS and D4SD04-0.503-01SD did not meet acceptance criteria of 30-110%.

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Client Sample ID: **EB110615-01**

Project Name: Alaska LNG
Sample Date: 11/06/15
Sample Time: 15:45
Type: Grab
Matrix: Water

Lab Information

Lab Sample ID: **P358613**

Date Received: 11/07/15
Dilution Factor: 1
Report Revision No.: 0

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Semi-Volatiles								
N-Nitrosodimethylamine	62-75-9	1.97	4.92	1.97	U	ug/L	SW8270C	11/20/15
Pyridine	110-86-1	1.97	4.92	1.97	U	ug/L	SW8270C	11/20/15
Aniline	62-53-3	1.97	4.92	1.97	U	ug/L	SW8270C	11/20/15
Phenol	108-95-2	1.97	4.92	1.97	U	ug/L	SW8270C	11/20/15
bis(2-Chloroethyl)ether	111-44-4	1.97	4.92	1.97	U	ug/L	SW8270C	11/20/15
2-Chlorophenol	95-57-8	1.97	4.92	1.97	U	ug/L	SW8270C	11/20/15
1,3-Dichlorobenzene	541-73-1	1.97	4.92	1.97	U	ug/L	SW8270C	11/20/15
1,4-Dichlorobenzene	106-46-7	1.97	4.92	1.97	U	ug/L	SW8270C	11/20/15
Benzyl alcohol	100-51-6	1.97	4.92	1.97	U	ug/L	SW8270C	11/20/15
1,2-Dichlorobenzene	95-50-1	1.97	4.92	1.97	U	ug/L	SW8270C	11/20/15
2-Methylphenol	95-48-7	1.97	4.92	1.97	U	ug/L	SW8270C	11/20/15
bis(2-Chloroisopropyl)ether	108-60-1	1.97	4.92	1.97	U	ug/L	SW8270C	11/20/15
3-,4-Methylphenol	108-39-4/106	1.97	4.92	1.97	U	ug/L	SW8270C	11/20/15
N-Nitroso-di-n-propylamine	621-64-7	1.97	4.92	1.97	U	ug/L	SW8270C	11/20/15
Hexachloroethane	67-72-1	1.97	4.92	1.97	U	ug/L	SW8270C	11/20/15
Benzoic Acid	65-85-0	1.97	9.84	1.97	U	ug/L	SW8270C	11/20/15
Nitrobenzene	98-95-3	1.97	4.92	1.97	U	ug/L	SW8270C	11/20/15
Isophorone	78-59-1	1.97	4.92	1.97	U	ug/L	SW8270C	11/20/15
2-Nitrophenol	88-75-5	1.97	4.92	1.97	U	ug/L	SW8270C	11/20/15
2,4-Dimethylphenol	105-67-9	1.97	4.92	1.97	U	ug/L	SW8270C	11/20/15
bis(2-Chloroethoxy)methane	111-91-1	1.97	4.92	1.97	U	ug/L	SW8270C	11/20/15
2,4-Dichlorophenol	120-83-2	1.97	4.92	1.97	U	ug/L	SW8270C	11/20/15
1,2,4-Trichlorobenzene	120-82-1	1.97	4.92	1.97	U	ug/L	SW8270C	11/20/15
Naphthalene	91-20-3	1.97	4.92	1.97	U	ug/L	SW8270C	11/20/15
4-Chloroaniline	106-47-8	1.97	4.92	1.97	U	ug/L	SW8270C	11/20/15
Hexachlorobutadiene	87-68-3	1.97	4.92	1.97	U	ug/L	SW8270C	11/20/15
4-Chloro-3-methyl phenol	59-50-7	1.97	4.92	1.97	U	ug/L	SW8270C	11/20/15
2-Methylnaphthalene	91-57-6	1.97	4.92	1.97	U	ug/L	SW8270C	11/20/15
Hexachlorocyclopentadiene	77-47-4	1.97	4.92	1.97	U	ug/L	SW8270C	11/20/15
2,4,6-Trichlorophenol	88-06-2	1.97	4.92	1.97	U	ug/L	SW8270C	11/20/15
2,4,5-Trichlorophenol	95-95-4	1.97	4.92	1.97	U	ug/L	SW8270C	11/20/15
2-Chloronaphthalene	91-58-7	1.97	4.92	1.97	U	ug/L	SW8270C	11/20/15
2-Nitroaniline	88-74-4	1.97	4.92	1.97	U	ug/L	SW8270C	11/20/15
Dimethylphthalate	131-11-3	1.97	4.92	1.97	U	ug/L	SW8270C	11/20/15
Acenaphthylene	208-96-8	1.97	4.92	1.97	U	ug/L	SW8270C	11/20/15
2,6-Dinitrotoluene	606-20-2	1.97	4.92	1.97	U	ug/L	SW8270C	11/20/15
Acenaphthene	83-32-9	1.97	4.92	1.97	U	ug/L	SW8270C	11/20/15
2,4-Dinitrophenol	51-28-5	1.97	9.84	1.97	U	ug/L	SW8270C	11/20/15
4-Nitrophenol	100-02-7	1.97	4.92	1.97	U	ug/L	SW8270C	11/20/15
2,4-Dinitrotoluene	121-14-2	1.97	4.92	1.97	U	ug/L	SW8270C	11/20/15
Dibenzofuran	132-64-9	1.97	4.92	1.97	U	ug/L	SW8270C	11/20/15
Diethylphthalate	84-66-2	1.97	4.92	1.97	U	ug/L	SW8270C	11/20/15

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Client Sample ID: **EB110615-01**

Project Name: Alaska LNG
Sample Date: 11/06/15
Sample Time: 15:45
Type: Grab
Matrix: Water

Lab Information

Lab Sample ID: **P358613**

Date Received: 11/07/15
Dilution Factor: 1
Report Revision No.: 0

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Semi-Volatiles								
3-Nitroaniline	99-09-2	1.97	4.92	1.97	U	ug/L	SW8270C	11/20/15
Fluorene	86-73-7	1.97	4.92	1.97	U	ug/L	SW8270C	11/20/15
4-Chlorophenyl phenyl ether	7005-72-3	1.97	4.92	1.97	U	ug/L	SW8270C	11/20/15
4-Nitroaniline	100-01-6	1.97	4.92	1.97	U	ug/L	SW8270C	11/20/15
4,6-Dinitro-2-methyl phenol	534-52-1	1.97	4.92	1.97	U	ug/L	SW8270C	11/20/15
N-Nitrosodiphenylamine	86-30-6	1.97	4.92	1.97	U	ug/L	SW8270C	11/20/15
1,2-Diphenylhydrazine	122-66-7	1.97	4.92	1.97	U	ug/L	SW8270C	11/20/15
4-Bromophenyl phenyl ether	101-55-3	1.97	4.92	1.97	U	ug/L	SW8270C	11/20/15
Hexachlorobenzene	118-74-1	1.97	4.92	1.97	U	ug/L	SW8270C	11/20/15
Pentachlorophenol	87-86-5	1.97	4.92	1.97	U	ug/L	SW8270C	11/20/15
Phenanthrene	85-01-8	1.97	4.92	1.97	U	ug/L	SW8270C	11/20/15
Anthracene	120-12-7	1.97	4.92	1.97	U	ug/L	SW8270C	11/20/15
Carbazole	86-74-8	1.97	4.92	1.97	U	ug/L	SW8270C	11/20/15
Di-n-butylphthalate	84-74-2	1.97	4.92	1.97	U	ug/L	SW8270C	11/20/15
Fluoranthene	206-44-0	1.97	4.92	1.97	U	ug/L	SW8270C	11/20/15
Pyrene	129-00-0	1.97	4.92	1.97	U	ug/L	SW8270C	11/20/15
Butylbenzylphthalate	85-68-7	1.97	4.92	1.97	U	ug/L	SW8270C	11/20/15
Benzo(a)anthracene	56-55-3	1.97	4.92	1.97	U	ug/L	SW8270C	11/20/15
3,3'-Dichlorobenzidine	91-94-1	1.97	4.92	1.97	U	ug/L	SW8270C	11/20/15
Chrysene	218-01-9	1.97	4.92	1.97	U	ug/L	SW8270C	11/20/15
bis(2-Ethylhexyl)phthalate	117-81-7	1.97	4.92	1.97	U	ug/L	SW8270C	11/20/15
Di-n-octylphthalate	117-84-0	1.97	4.92	1.97	U	ug/L	SW8270C	11/20/15
Benzo(b)fluoroanthene	205-99-2	1.97	4.92	1.97	U	ug/L	SW8270C	11/20/15
Benzo(k)fluoranthene	207-08-9	1.97	4.92	1.97	U	ug/L	SW8270C	11/20/15
Benzo(a)pyrene	50-32-8	1.97	4.92	1.97	U	ug/L	SW8270C	11/20/15
Indeno(1,2,3-c,d)pyrene	193-39-5	1.97	4.92	1.97	U	ug/L	SW8270C	11/20/15
Dibenzo(a,h)anthracene	53-70-3	1.97	4.92	1.97	U	ug/L	SW8270C	11/20/15
Benzo(g,h,i)perylene	191-24-2	1.97	4.92	1.97	U	ug/L	SW8270C	11/20/15

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information		Lab Information	
Client Sample ID:	**EB110615-01**	**Lab Sample ID:**	**P358613**
Project Name:	Alaska LNG	Date Received:	11/07/15
Sample Date:	11/06/15	Dilution Factor:	1
Sample Time:	15:45	Report Revision No.:	0
Type:	Grab		
Matrix:	Water		

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Semi-Volatiles								

Surrogate	% Recovery	Control Limits	Qualifier
2-Fluorophenol	39	21-115	
Phenol-d5	27	5-115	
Nitrobenzene-d5	59	35-114	
2-Fluorobiphenyl	63	43-116	
2,4,6-Tribromophenol	66	5-123	
Terphenyl-d14	90	33-141	

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Client Sample ID: **WB1-1109**

Project Name: Alaska LNG
Sample Date: N/A
Sample Time: N/A
Type: QC
Matrix: Water

Lab Information

Lab Sample ID: **WB1-1109**

Date Received: N/A
Dilution Factor: 1
Report Revision No.: 0

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Semi-Volatiles								
N-Nitrosodimethylamine	62-75-9	2.00	5.00	2.00	U	ug/L	SW8270C	11/19/15
Pyridine	110-86-1	2.00	5.00	2.00	U	ug/L	SW8270C	11/19/15
Aniline	62-53-3	2.00	5.00	2.00	U	ug/L	SW8270C	11/19/15
Phenol	108-95-2	2.00	5.00	2.00	U	ug/L	SW8270C	11/19/15
bis(2-Chloroethyl)ether	111-44-4	2.00	5.00	2.00	U	ug/L	SW8270C	11/19/15
2-Chlorophenol	95-57-8	2.00	5.00	2.00	U	ug/L	SW8270C	11/19/15
1,3-Dichlorobenzene	541-73-1	2.00	5.00	2.00	U	ug/L	SW8270C	11/19/15
1,4-Dichlorobenzene	106-46-7	2.00	5.00	2.00	U	ug/L	SW8270C	11/19/15
Benzyl alcohol	100-51-6	2.00	5.00	2.00	U	ug/L	SW8270C	11/19/15
1,2-Dichlorobenzene	95-50-1	2.00	5.00	2.00	U	ug/L	SW8270C	11/19/15
2-Methylphenol	95-48-7	2.00	5.00	2.00	U	ug/L	SW8270C	11/19/15
bis(2-Chloroisopropyl)ether	108-60-1	2.00	5.00	2.00	U	ug/L	SW8270C	11/19/15
3-,4-Methylphenol	108-39-4/106	2.00	5.00	2.00	U	ug/L	SW8270C	11/19/15
N-Nitroso-di-n-propylamine	621-64-7	2.00	5.00	2.00	U	ug/L	SW8270C	11/19/15
Hexachloroethane	67-72-1	2.00	5.00	2.00	U	ug/L	SW8270C	11/19/15
Benzoic Acid	65-85-0	2.00	10.0	2.00	U	ug/L	SW8270C	11/19/15
Nitrobenzene	98-95-3	2.00	5.00	2.00	U	ug/L	SW8270C	11/19/15
Isophorone	78-59-1	2.00	5.00	2.00	U	ug/L	SW8270C	11/19/15
2-Nitrophenol	88-75-5	2.00	5.00	2.00	U	ug/L	SW8270C	11/19/15
2,4-Dimethylphenol	105-67-9	2.00	5.00	2.00	U	ug/L	SW8270C	11/19/15
bis(2-Chloroethoxy)methane	111-91-1	2.00	5.00	2.00	U	ug/L	SW8270C	11/19/15
2,4-Dichlorophenol	120-83-2	2.00	5.00	2.00	U	ug/L	SW8270C	11/19/15
1,2,4-Trichlorobenzene	120-82-1	2.00	5.00	2.00	U	ug/L	SW8270C	11/19/15
Naphthalene	91-20-3	2.00	5.00	2.00	U	ug/L	SW8270C	11/19/15
4-Chloroaniline	106-47-8	2.00	5.00	2.00	U	ug/L	SW8270C	11/19/15
Hexachlorobutadiene	87-68-3	2.00	5.00	2.00	U	ug/L	SW8270C	11/19/15
4-Chloro-3-methyl phenol	59-50-7	2.00	5.00	2.00	U	ug/L	SW8270C	11/19/15
2-Methylnaphthalene	91-57-6	2.00	5.00	2.00	U	ug/L	SW8270C	11/19/15
Hexachlorocyclopentadiene	77-47-4	2.00	5.00	2.00	U	ug/L	SW8270C	11/19/15
2,4,6-Trichlorophenol	88-06-2	2.00	5.00	2.00	U	ug/L	SW8270C	11/19/15
2,4,5-Trichlorophenol	95-95-4	2.00	5.00	2.00	U	ug/L	SW8270C	11/19/15
2-Chloronaphthalene	91-58-7	2.00	5.00	2.00	U	ug/L	SW8270C	11/19/15
2-Nitroaniline	88-74-4	2.00	5.00	2.00	U	ug/L	SW8270C	11/19/15
Dimethylphthalate	131-11-3	2.00	5.00	2.00	U	ug/L	SW8270C	11/19/15
Acenaphthylene	208-96-8	2.00	5.00	2.00	U	ug/L	SW8270C	11/19/15
2,6-Dinitrotoluene	606-20-2	2.00	5.00	2.00	U	ug/L	SW8270C	11/19/15
Acenaphthene	83-32-9	2.00	5.00	2.00	U	ug/L	SW8270C	11/19/15
2,4-Dinitrophenol	51-28-5	2.00	10.0	2.00	U	ug/L	SW8270C	11/19/15
4-Nitrophenol	100-02-7	2.00	5.00	2.00	U	ug/L	SW8270C	11/19/15
2,4-Dinitrotoluene	121-14-2	2.00	5.00	2.00	U	ug/L	SW8270C	11/19/15
Dibenzofuran	132-64-9	2.00	5.00	2.00	U	ug/L	SW8270C	11/19/15
Diethylphthalate	84-66-2	2.00	5.00	2.00	U	ug/L	SW8270C	11/19/15

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Client Sample ID: **WB1-1109**

Project Name: Alaska LNG
Sample Date: N/A
Sample Time: N/A
Type: QC
Matrix: Water

Lab Information

Lab Sample ID: **WB1-1109**

Date Received: N/A
Dilution Factor: 1
Report Revision No.: 0

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Semi-Volatiles								
3-Nitroaniline	99-09-2	2.00	5.00	2.00	U	ug/L	SW8270C	11/19/15
Fluorene	86-73-7	2.00	5.00	2.00	U	ug/L	SW8270C	11/19/15
4-Chlorophenyl phenyl ether	7005-72-3	2.00	5.00	2.00	U	ug/L	SW8270C	11/19/15
4-Nitroaniline	100-01-6	2.00	5.00	2.00	U	ug/L	SW8270C	11/19/15
4,6-Dinitro-2-methyl phenol	534-52-1	2.00	5.00	2.00	U	ug/L	SW8270C	11/19/15
N-Nitrosodiphenylamine	86-30-6	2.00	5.00	2.00	U	ug/L	SW8270C	11/19/15
1,2-Diphenylhydrazine	122-66-7	2.00	5.00	2.00	U	ug/L	SW8270C	11/19/15
4-Bromophenyl phenyl ether	101-55-3	2.00	5.00	2.00	U	ug/L	SW8270C	11/19/15
Hexachlorobenzene	118-74-1	2.00	5.00	2.00	U	ug/L	SW8270C	11/19/15
Pentachlorophenol	87-86-5	2.00	5.00	2.00	U	ug/L	SW8270C	11/19/15
Phenanthrene	85-01-8	2.00	5.00	2.00	U	ug/L	SW8270C	11/19/15
Anthracene	120-12-7	2.00	5.00	2.00	U	ug/L	SW8270C	11/19/15
Carbazole	86-74-8	2.00	5.00	2.00	U	ug/L	SW8270C	11/19/15
Di-n-butylphthalate	84-74-2	2.00	5.00	2.00	U	ug/L	SW8270C	11/19/15
Fluoranthene	206-44-0	2.00	5.00	2.00	U	ug/L	SW8270C	11/19/15
Pyrene	129-00-0	2.00	5.00	2.00	U	ug/L	SW8270C	11/19/15
Butylbenzylphthalate	85-68-7	2.00	5.00	2.00	U	ug/L	SW8270C	11/19/15
Benzo(a)anthracene	56-55-3	2.00	5.00	2.00	U	ug/L	SW8270C	11/19/15
3,3'-Dichlorobenzidine	91-94-1	2.00	5.00	2.00	U	ug/L	SW8270C	11/19/15
Chrysene	218-01-9	2.00	5.00	2.00	U	ug/L	SW8270C	11/19/15
bis(2-Ethylhexyl)phthalate	117-81-7	2.00	5.00	2.00	U	ug/L	SW8270C	11/19/15
Di-n-octylphthalate	117-84-0	2.00	5.00	2.00	U	ug/L	SW8270C	11/19/15
Benzo(b)fluoroanthene	205-99-2	2.00	5.00	2.00	U	ug/L	SW8270C	11/19/15
Benzo(k)fluoranthene	207-08-9	2.00	5.00	2.00	U	ug/L	SW8270C	11/19/15
Benzo(a)pyrene	50-32-8	2.00	5.00	2.00	U	ug/L	SW8270C	11/19/15
Indeno(1,2,3-c,d)pyrene	193-39-5	2.00	5.00	2.00	U	ug/L	SW8270C	11/19/15
Dibenzo(a,h)anthracene	53-70-3	2.00	5.00	2.00	U	ug/L	SW8270C	11/19/15
Benzo(g,h,i)perylene	191-24-2	2.00	5.00	2.00	U	ug/L	SW8270C	11/19/15

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information		Lab Information	
Client Sample ID:	**WB1-1109**	**Lab Sample ID:**	**WB1-1109**
Project Name:	Alaska LNG	Date Received:	N/A
Sample Date:	N/A	Dilution Factor:	1
Sample Time:	N/A	Report Revision No.:	0
Type:	QC		
Matrix:	Water		
Basis:	As Received		

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Semi-Volatiles								

Surrogate	% Recovery	Control Limits	Qualifier
2-Fluorophenol	47	21-115	
Phenol-d5	32	5-115	
Nitrobenzene-d5	63	35-114	
2-Fluorobiphenyl	62	43-116	
2,4,6-Tribromophenol	76	5-123	
Terphenyl-d14	102	33-141	

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Client Sample ID: **D4SD04-0.503-01**

Project Name: Alaska LNG
Sample Date: 11/05/15
Sample Time: 13:30
Type: Grab
Matrix: Soil
Basis: Dry Weight

Lab Information

Lab Sample ID: **P358601**

Date Received: 11/07/15
Dilution Factor: 1
Report Revision No.: 0

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Semi-Volatiles								
N-Nitrosodimethylamine	62-75-9	78.3	200	78.3	U	ug/Kg	SW8270C	11/22/15
Pyridine	110-86-1	78.3	200	78.3	U	ug/Kg	SW8270C	11/22/15
Aniline	62-53-3	78.3	200	78.3	U	ug/Kg	SW8270C	11/22/15
Phenol	108-95-2	78.3	200	78.3	U	ug/Kg	SW8270C	11/22/15
bis(2-Chloroethyl)ether	111-44-4	78.3	200	78.3	U	ug/Kg	SW8270C	11/22/15
2-Chlorophenol	95-57-8	78.3	200	78.3	U	ug/Kg	SW8270C	11/22/15
1,3-Dichlorobenzene	541-73-1	78.3	200	78.3	U	ug/Kg	SW8270C	11/22/15
1,4-Dichlorobenzene	106-46-7	78.3	200	78.3	U	ug/Kg	SW8270C	11/22/15
Benzyl alcohol	100-51-6	78.3	200	78.3	U	ug/Kg	SW8270C	11/22/15
1,2-Dichlorobenzene	95-50-1	78.3	200	78.3	U	ug/Kg	SW8270C	11/22/15
2-Methylphenol	95-48-7	78.3	200	78.3	U	ug/Kg	SW8270C	11/22/15
bis(2-Chloroisopropyl)ether	108-60-1	78.3	200	78.3	U	ug/Kg	SW8270C	11/22/15
3-,4-Methylphenol	108-39-4/106	78.3	200	78.3	U	ug/Kg	SW8270C	11/22/15
N-Nitroso-di-n-propylamine	621-64-7	78.3	200	78.3	U	ug/Kg	SW8270C	11/22/15
Hexachloroethane	67-72-1	78.3	200	78.3	U	ug/Kg	SW8270C	11/22/15
Benzoic Acid	65-85-0	117	469	117	U	ug/Kg	SW8270C	11/22/15
Nitrobenzene	98-95-3	78.3	200	78.3	U	ug/Kg	SW8270C	11/22/15
Isophorone	78-59-1	78.3	200	78.3	U	ug/Kg	SW8270C	11/22/15
2-Nitrophenol	88-75-5	78.3	200	78.3	U	ug/Kg	SW8270C	11/22/15
2,4-Dimethylphenol	105-67-9	78.3	200	78.3	U	ug/Kg	SW8270C	11/22/15
bis(2-Chloroethoxy)methane	111-91-1	78.3	200	78.3	U	ug/Kg	SW8270C	11/22/15
2,4-Dichlorophenol	120-83-2	78.3	200	78.3	U	ug/Kg	SW8270C	11/22/15
1,2,4-Trichlorobenzene	120-82-1	78.3	200	78.3	U	ug/Kg	SW8270C	11/22/15
Naphthalene	91-20-3	78.3	200	78.3	U	ug/Kg	SW8270C	11/22/15
4-Chloroaniline	106-47-8	78.3	200	78.3	U	ug/Kg	SW8270C	11/22/15
Hexachlorobutadiene	87-68-3	78.3	200	78.3	U	ug/Kg	SW8270C	11/22/15
4-Chloro-3-methyl phenol	59-50-7	78.3	200	78.3	U	ug/Kg	SW8270C	11/22/15
2-Methylnaphthalene	91-57-6	78.3	200	78.3	U	ug/Kg	SW8270C	11/22/15
Hexachlorocyclopentadiene	77-47-4	78.3	200	78.3	U	ug/Kg	SW8270C	11/22/15
2,4,6-Trichlorophenol	88-06-2	78.3	200	78.3	U	ug/Kg	SW8270C	11/22/15
2,4,5-Trichlorophenol	95-95-4	78.3	200	78.3	U	ug/Kg	SW8270C	11/22/15
2-Chloronaphthalene	91-58-7	78.3	200	78.3	U	ug/Kg	SW8270C	11/22/15
2-Nitroaniline	88-74-4	78.3	200	78.3	U	ug/Kg	SW8270C	11/22/15
Dimethylphthalate	131-11-3	78.3	200	78.3	U	ug/Kg	SW8270C	11/22/15
Acenaphthylene	208-96-8	78.3	200	78.3	U	ug/Kg	SW8270C	11/22/15
2,6-Dinitrotoluene	606-20-2	78.3	200	78.3	U	ug/Kg	SW8270C	11/22/15
Acenaphthene	83-32-9	78.3	200	78.3	U	ug/Kg	SW8270C	11/22/15
2,4-Dinitrophenol	51-28-5	78.3	391	78.3	U	ug/Kg	SW8270C	11/22/15
4-Nitrophenol	100-02-7	78.3	200	78.3	U	ug/Kg	SW8270C	11/22/15
2,4-Dinitrotoluene	121-14-2	78.3	200	78.3	U	ug/Kg	SW8270C	11/22/15
Dibenzofuran	132-64-9	78.3	200	78.3	U	ug/Kg	SW8270C	11/22/15
Diethylphthalate	84-66-2	78.3	200	78.3	U	ug/Kg	SW8270C	11/22/15

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Client Sample ID: **D4SD04-0.503-01**

Project Name: Alaska LNG
Sample Date: 11/05/15
Sample Time: 13:30
Type: Grab
Matrix: Soil
Basis: Dry Weight

Lab Information

Lab Sample ID: **P358601**

Date Received: 11/07/15
Dilution Factor: 1
Report Revision No.: 0

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Semi-Volatiles								
3-Nitroaniline	99-09-2	78.3	200	78.3	U	ug/Kg	SW8270C	11/22/15
Fluorene	86-73-7	78.3	200	78.3	U	ug/Kg	SW8270C	11/22/15
4-Chlorophenyl phenyl ether	7005-72-3	78.3	200	78.3	U	ug/Kg	SW8270C	11/22/15
4-Nitroaniline	100-01-6	78.3	200	78.3	U	ug/Kg	SW8270C	11/22/15
4,6-Dinitro-2-methyl phenol	534-52-1	78.3	200	78.3	U	ug/Kg	SW8270C	11/22/15
N-Nitrosodiphenylamine	86-30-6	78.3	200	78.3	U	ug/Kg	SW8270C	11/22/15
1,2-Diphenylhydrazine	122-66-7	78.3	200	78.3	U	ug/Kg	SW8270C	11/22/15
4-Bromophenyl phenyl ether	101-55-3	78.3	200	78.3	U	ug/Kg	SW8270C	11/22/15
Hexachlorobenzene	118-74-1	78.3	200	78.3	U	ug/Kg	SW8270C	11/22/15
Pentachlorophenol	87-86-5	78.3	200	78.3	U	ug/Kg	SW8270C	11/22/15
Phenanthrene	85-01-8	78.3	200	78.3	U	ug/Kg	SW8270C	11/22/15
Anthracene	120-12-7	78.3	200	78.3	U	ug/Kg	SW8270C	11/22/15
Carbazole	86-74-8	78.3	200	78.3	U	ug/Kg	SW8270C	11/22/15
Di-n-butylphthalate	84-74-2	78.3	200	78.3	U	ug/Kg	SW8270C	11/22/15
Fluoranthene	206-44-0	78.3	200	78.3	U	ug/Kg	SW8270C	11/22/15
Pyrene	129-00-0	78.3	200	78.3	U	ug/Kg	SW8270C	11/22/15
Butylbenzylphthalate	85-68-7	78.3	200	78.3	U	ug/Kg	SW8270C	11/22/15
Benzo(a)anthracene	56-55-3	78.3	200	78.3	U	ug/Kg	SW8270C	11/22/15
3,3'-Dichlorobenzidine	91-94-1	78.3	200	78.3	U	ug/Kg	SW8270C	11/22/15
Chrysene	218-01-9	78.3	200	78.3	U	ug/Kg	SW8270C	11/22/15
bis(2-Ethylhexyl)phthalate	117-81-7	78.3	200	78.3	U	ug/Kg	SW8270C	11/22/15
Di-n-octylphthalate	117-84-0	78.3	200	78.3	U	ug/Kg	SW8270C	11/22/15
Benzo(b)fluoroanthene	205-99-2	78.3	200	78.3	U	ug/Kg	SW8270C	11/22/15
Benzo(k)fluoranthene	207-08-9	78.3	200	78.3	U	ug/Kg	SW8270C	11/22/15
Benzo(a)pyrene	50-32-8	78.3	200	78.3	U	ug/Kg	SW8270C	11/22/15
Indeno(1,2,3-c,d)pyrene	193-39-5	78.3	200	78.3	U	ug/Kg	SW8270C	11/22/15
Dibenzo(a,h)anthracene	53-70-3	78.3	200	78.3	U	ug/Kg	SW8270C	11/22/15
Benzo(g,h,i)perylene	191-24-2	78.3	200	78.3	U	ug/Kg	SW8270C	11/22/15

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information		Lab Information	
Client Sample ID:	**D4SD04-0.503-01**	**Lab Sample ID:**	**P358601**
Project Name:	Alaska LNG	Date Received:	11/07/15
Sample Date:	11/05/15	Dilution Factor:	1
Sample Time:	13:30	Report Revision No.:	0
Type:	Grab		
Matrix:	Soil		
Basis:	Dry Weight		

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Semi-Volatiles								

Surrogate	% Recovery	Control Limits	Qualifier
2-Fluorophenol	46	25-121	
Phenol-d5	51	24-113	
Nitrobenzene-d5	51	23-120	
2-Fluorobiphenyl	58	30-115	
2,4,6-Tribromophenol	51	19-122	
Terphenyl-d14	74	18-137	

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Client Sample ID: **D4SD04-0.503-101**

Project Name: Alaska LNG
Sample Date: 11/05/15
Sample Time: 13:40
Type: Grab
Matrix: Soil
Basis: Dry Weight

Lab Information

Lab Sample ID: **P358602**

Date Received: 11/07/15
Dilution Factor: 1
Report Revision No.: 0

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Semi-Volatiles								
N-Nitrosodimethylamine	62-75-9	77.3	197	77.3	U	ug/Kg	SW8270C	11/22/15
Pyridine	110-86-1	77.3	197	77.3	U	ug/Kg	SW8270C	11/22/15
Aniline	62-53-3	77.3	197	77.3	U	ug/Kg	SW8270C	11/22/15
Phenol	108-95-2	77.3	197	152	J	ug/Kg	SW8270C	11/22/15
bis(2-Chloroethyl)ether	111-44-4	77.3	197	77.3	U	ug/Kg	SW8270C	11/22/15
2-Chlorophenol	95-57-8	77.3	197	77.3	U	ug/Kg	SW8270C	11/22/15
1,3-Dichlorobenzene	541-73-1	77.3	197	77.3	U	ug/Kg	SW8270C	11/22/15
1,4-Dichlorobenzene	106-46-7	77.3	197	77.3	U	ug/Kg	SW8270C	11/22/15
Benzyl alcohol	100-51-6	77.3	197	77.3	U	ug/Kg	SW8270C	11/22/15
1,2-Dichlorobenzene	95-50-1	77.3	197	77.3	U	ug/Kg	SW8270C	11/22/15
2-Methylphenol	95-48-7	77.3	197	77.3	U	ug/Kg	SW8270C	11/22/15
bis(2-Chloroisopropyl)ether	108-60-1	77.3	197	77.3	U	ug/Kg	SW8270C	11/22/15
3-,4-Methylphenol	108-39-4/106	77.3	197	124	J	ug/Kg	SW8270C	11/22/15
N-Nitroso-di-n-propylamine	621-64-7	77.3	197	77.3	U	ug/Kg	SW8270C	11/22/15
Hexachloroethane	67-72-1	77.3	197	77.3	U	ug/Kg	SW8270C	11/22/15
Benzoic Acid	65-85-0	116	464	116	U	ug/Kg	SW8270C	11/22/15
Nitrobenzene	98-95-3	77.3	197	77.3	U	ug/Kg	SW8270C	11/22/15
Isophorone	78-59-1	77.3	197	77.3	U	ug/Kg	SW8270C	11/22/15
2-Nitrophenol	88-75-5	77.3	197	77.3	U	ug/Kg	SW8270C	11/22/15
2,4-Dimethylphenol	105-67-9	77.3	197	77.3	U	ug/Kg	SW8270C	11/22/15
bis(2-Chloroethoxy)methane	111-91-1	77.3	197	77.3	U	ug/Kg	SW8270C	11/22/15
2,4-Dichlorophenol	120-83-2	77.3	197	77.3	U	ug/Kg	SW8270C	11/22/15
1,2,4-Trichlorobenzene	120-82-1	77.3	197	77.3	U	ug/Kg	SW8270C	11/22/15
Naphthalene	91-20-3	77.3	197	77.3	U	ug/Kg	SW8270C	11/22/15
4-Chloroaniline	106-47-8	77.3	197	77.3	U	ug/Kg	SW8270C	11/22/15
Hexachlorobutadiene	87-68-3	77.3	197	77.3	U	ug/Kg	SW8270C	11/22/15
4-Chloro-3-methyl phenol	59-50-7	77.3	197	77.3	U	ug/Kg	SW8270C	11/22/15
2-Methylnaphthalene	91-57-6	77.3	197	77.3	U	ug/Kg	SW8270C	11/22/15
Hexachlorocyclopentadiene	77-47-4	77.3	197	77.3	U	ug/Kg	SW8270C	11/22/15
2,4,6-Trichlorophenol	88-06-2	77.3	197	77.3	U	ug/Kg	SW8270C	11/22/15
2,4,5-Trichlorophenol	95-95-4	77.3	197	77.3	U	ug/Kg	SW8270C	11/22/15
2-Chloronaphthalene	91-58-7	77.3	197	77.3	U	ug/Kg	SW8270C	11/22/15
2-Nitroaniline	88-74-4	77.3	197	77.3	U	ug/Kg	SW8270C	11/22/15
Dimethylphthalate	131-11-3	77.3	197	77.3	U	ug/Kg	SW8270C	11/22/15
Acenaphthylene	208-96-8	77.3	197	77.3	U	ug/Kg	SW8270C	11/22/15
2,6-Dinitrotoluene	606-20-2	77.3	197	77.3	U	ug/Kg	SW8270C	11/22/15
Acenaphthene	83-32-9	77.3	197	77.3	U	ug/Kg	SW8270C	11/22/15
2,4-Dinitrophenol	51-28-5	77.3	386	77.3	U	ug/Kg	SW8270C	11/22/15
4-Nitrophenol	100-02-7	77.3	197	77.3	U	ug/Kg	SW8270C	11/22/15
2,4-Dinitrotoluene	121-14-2	77.3	197	77.3	U	ug/Kg	SW8270C	11/22/15
Dibenzofuran	132-64-9	77.3	197	77.3	U	ug/Kg	SW8270C	11/22/15
Diethylphthalate	84-66-2	77.3	197	77.3	U	ug/Kg	SW8270C	11/22/15

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Client Sample ID: **D4SD04-0.503-101**

Project Name: Alaska LNG
Sample Date: 11/05/15
Sample Time: 13:40
Type: Grab
Matrix: Soil
Basis: Dry Weight

Lab Information

Lab Sample ID: **P358602**

Date Received: 11/07/15
Dilution Factor: 1
Report Revision No.: 0

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Semi-Volatiles								
3-Nitroaniline	99-09-2	77.3	197	77.3	U	ug/Kg	SW8270C	11/22/15
Fluorene	86-73-7	77.3	197	77.3	U	ug/Kg	SW8270C	11/22/15
4-Chlorophenyl phenyl ether	7005-72-3	77.3	197	77.3	U	ug/Kg	SW8270C	11/22/15
4-Nitroaniline	100-01-6	77.3	197	77.3	U	ug/Kg	SW8270C	11/22/15
4,6-Dinitro-2-methyl phenol	534-52-1	77.3	197	77.3	U	ug/Kg	SW8270C	11/22/15
N-Nitrosodiphenylamine	86-30-6	77.3	197	77.3	U	ug/Kg	SW8270C	11/22/15
1,2-Diphenylhydrazine	122-66-7	77.3	197	77.3	U	ug/Kg	SW8270C	11/22/15
4-Bromophenyl phenyl ether	101-55-3	77.3	197	77.3	U	ug/Kg	SW8270C	11/22/15
Hexachlorobenzene	118-74-1	77.3	197	77.3	U	ug/Kg	SW8270C	11/22/15
Pentachlorophenol	87-86-5	77.3	197	77.3	U	ug/Kg	SW8270C	11/22/15
Phenanthrene	85-01-8	77.3	197	77.3	U	ug/Kg	SW8270C	11/22/15
Anthracene	120-12-7	77.3	197	77.3	U	ug/Kg	SW8270C	11/22/15
Carbazole	86-74-8	77.3	197	77.3	U	ug/Kg	SW8270C	11/22/15
Di-n-butylphthalate	84-74-2	77.3	197	77.3	U	ug/Kg	SW8270C	11/22/15
Fluoranthene	206-44-0	77.3	197	77.3	U	ug/Kg	SW8270C	11/22/15
Pyrene	129-00-0	77.3	197	77.3	U	ug/Kg	SW8270C	11/22/15
Butylbenzylphthalate	85-68-7	77.3	197	77.3	U	ug/Kg	SW8270C	11/22/15
Benzo(a)anthracene	56-55-3	77.3	197	77.3	U	ug/Kg	SW8270C	11/22/15
3,3'-Dichlorobenzidine	91-94-1	77.3	197	77.3	U	ug/Kg	SW8270C	11/22/15
Chrysene	218-01-9	77.3	197	77.3	U	ug/Kg	SW8270C	11/22/15
bis(2-Ethylhexyl)phthalate	117-81-7	77.3	197	77.3	U	ug/Kg	SW8270C	11/22/15
Di-n-octylphthalate	117-84-0	77.3	197	77.3	U	ug/Kg	SW8270C	11/22/15
Benzo(b)fluoroanthene	205-99-2	77.3	197	77.3	U	ug/Kg	SW8270C	11/22/15
Benzo(k)fluoranthene	207-08-9	77.3	197	77.3	U	ug/Kg	SW8270C	11/22/15
Benzo(a)pyrene	50-32-8	77.3	197	77.3	U	ug/Kg	SW8270C	11/22/15
Indeno(1,2,3-c,d)pyrene	193-39-5	77.3	197	77.3	U	ug/Kg	SW8270C	11/22/15
Dibenzo(a,h)anthracene	53-70-3	77.3	197	77.3	U	ug/Kg	SW8270C	11/22/15
Benzo(g,h,i)perylene	191-24-2	77.3	197	77.3	U	ug/Kg	SW8270C	11/22/15

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information		Lab Information	
Client Sample ID:	**D4SD04-0.503-101**	**Lab Sample ID:**	**P358602**
Project Name:	Alaska LNG	Date Received:	11/07/15
Sample Date:	11/05/15	Dilution Factor:	1
Sample Time:	13:40	Report Revision No.:	0
Type:	Grab		
Matrix:	Soil		
Basis:	Dry Weight		

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Semi-Volatiles								

Surrogate	% Recovery	Control Limits	Qualifier
2-Fluorophenol	49	25-121	
Phenol-d5	55	24-113	
Nitrobenzene-d5	54	23-120	
2-Fluorobiphenyl	60	30-115	
2,4,6-Tribromophenol	58	19-122	
Terphenyl-d14	80	18-137	

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Client Sample ID: **D4SD04-0.503-01MS**

Project Name: Alaska LNG
Sample Date: 11/05/15
Sample Time: 13:30
Type: Grab
Matrix: Soil
Basis: Dry Weight

Lab Information

Lab Sample ID: **P358603MS**

Date Received: 11/07/15
Dilution Factor: 1
Report Revision No.: 0

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Semi-Volatiles								
N-Nitrosodimethylamine	62-75-9	78.4	200	1540		ug/Kg	SW8270C	11/22/15
Pyridine	110-86-1	78.4	200	1340		ug/Kg	SW8270C	11/22/15
Aniline	62-53-3	78.4	200	1390		ug/Kg	SW8270C	11/22/15
Phenol	108-95-2	78.4	200	1630		ug/Kg	SW8270C	11/22/15
bis(2-Chloroethyl)ether	111-44-4	78.4	200	1670		ug/Kg	SW8270C	11/22/15
2-Chlorophenol	95-57-8	78.4	200	1530		ug/Kg	SW8270C	11/22/15
1,3-Dichlorobenzene	541-73-1	78.4	200	1420		ug/Kg	SW8270C	11/22/15
1,4-Dichlorobenzene	106-46-7	78.4	200	1440		ug/Kg	SW8270C	11/22/15
Benzyl alcohol	100-51-6	78.4	200	1700		ug/Kg	SW8270C	11/22/15
1,2-Dichlorobenzene	95-50-1	78.4	200	1480		ug/Kg	SW8270C	11/22/15
2-Methylphenol	95-48-7	78.4	200	1680		ug/Kg	SW8270C	11/22/15
bis(2-Chloroisopropyl)ether	108-60-1	78.4	200	1730		ug/Kg	SW8270C	11/22/15
3-,4-Methylphenol	108-39-4/106	78.4	200	1750		ug/Kg	SW8270C	11/22/15
N-Nitroso-di-n-propylamine	621-64-7	78.4	200	1860		ug/Kg	SW8270C	11/22/15
Hexachloroethane	67-72-1	78.4	200	1460		ug/Kg	SW8270C	11/22/15
Benzoic Acid	65-85-0	118	470	642		ug/Kg	SW8270C	11/22/15
Nitrobenzene	98-95-3	78.4	200	1730		ug/Kg	SW8270C	11/22/15
Isophorone	78-59-1	78.4	200	1850		ug/Kg	SW8270C	11/22/15
2-Nitrophenol	88-75-5	78.4	200	1680		ug/Kg	SW8270C	11/22/15
2,4-Dimethylphenol	105-67-9	78.4	200	1710		ug/Kg	SW8270C	11/22/15
bis(2-Chloroethoxy)methane	111-91-1	78.4	200	1770		ug/Kg	SW8270C	11/22/15
2,4-Dichlorophenol	120-83-2	78.4	200	1640		ug/Kg	SW8270C	11/22/15
1,2,4-Trichlorobenzene	120-82-1	78.4	200	1550		ug/Kg	SW8270C	11/22/15
Naphthalene	91-20-3	78.4	200	1680		ug/Kg	SW8270C	11/22/15
4-Chloroaniline	106-47-8	78.4	200	1690		ug/Kg	SW8270C	11/22/15
Hexachlorobutadiene	87-68-3	78.4	200	1530		ug/Kg	SW8270C	11/22/15
4-Chloro-3-methyl phenol	59-50-7	78.4	200	1900		ug/Kg	SW8270C	11/22/15
2-Methylnaphthalene	91-57-6	78.4	200	1740		ug/Kg	SW8270C	11/22/15
Hexachlorocyclopentadiene	77-47-4	78.4	200	1090		ug/Kg	SW8270C	11/22/15
2,4,6-Trichlorophenol	88-06-2	78.4	200	1860		ug/Kg	SW8270C	11/22/15
2,4,5-Trichlorophenol	95-95-4	78.4	200	1840		ug/Kg	SW8270C	11/22/15
2-Chloronaphthalene	91-58-7	78.4	200	1850		ug/Kg	SW8270C	11/22/15
2-Nitroaniline	88-74-4	78.4	200	2010		ug/Kg	SW8270C	11/22/15
Dimethylphthalate	131-11-3	78.4	200	1950		ug/Kg	SW8270C	11/22/15
Acenaphthylene	208-96-8	78.4	200	1820		ug/Kg	SW8270C	11/22/15
2,6-Dinitrotoluene	606-20-2	78.4	200	1980		ug/Kg	SW8270C	11/22/15
Acenaphthene	83-32-9	78.4	200	1910		ug/Kg	SW8270C	11/22/15
2,4-Dinitrophenol	51-28-5	78.4	391	993		ug/Kg	SW8270C	11/22/15
4-Nitrophenol	100-02-7	78.4	200	1920		ug/Kg	SW8270C	11/22/15
2,4-Dinitrotoluene	121-14-2	78.4	200	2000		ug/Kg	SW8270C	11/22/15
Dibenzofuran	132-64-9	78.4	200	1880		ug/Kg	SW8270C	11/22/15
Diethylphthalate	84-66-2	78.4	200	2000		ug/Kg	SW8270C	11/22/15

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Client Sample ID: **D4SD04-0.503-01MS**

Project Name: Alaska LNG
Sample Date: 11/05/15
Sample Time: 13:30
Type: Grab
Matrix: Soil
Basis: Dry Weight

Lab Information

Lab Sample ID: **P358603MS**

Date Received: 11/07/15
Dilution Factor: 1
Report Revision No.: 0

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Semi-Volatiles								
3-Nitroaniline	99-09-2	78.4	200	1940		ug/Kg	SW8270C	11/22/15
Fluorene	86-73-7	78.4	200	1970		ug/Kg	SW8270C	11/22/15
4-Chlorophenyl phenyl ether	7005-72-3	78.4	200	1950		ug/Kg	SW8270C	11/22/15
4-Nitroaniline	100-01-6	78.4	200	2090		ug/Kg	SW8270C	11/22/15
4,6-Dinitro-2-methyl phenol	534-52-1	78.4	200	1600		ug/Kg	SW8270C	11/22/15
N-Nitrosodiphenylamine	86-30-6	78.4	200	1960		ug/Kg	SW8270C	11/22/15
1,2-Diphenylhydrazine	122-66-7	78.4	200	2120		ug/Kg	SW8270C	11/22/15
4-Bromophenyl phenyl ether	101-55-3	78.4	200	1900		ug/Kg	SW8270C	11/22/15
Hexachlorobenzene	118-74-1	78.4	200	1910		ug/Kg	SW8270C	11/22/15
Pentachlorophenol	87-86-5	78.4	200	1610		ug/Kg	SW8270C	11/22/15
Phenanthrene	85-01-8	78.4	200	1970		ug/Kg	SW8270C	11/22/15
Anthracene	120-12-7	78.4	200	1940		ug/Kg	SW8270C	11/22/15
Carbazole	86-74-8	78.4	200	1990		ug/Kg	SW8270C	11/22/15
Di-n-butylphthalate	84-74-2	78.4	200	2090		ug/Kg	SW8270C	11/22/15
Fluoranthene	206-44-0	78.4	200	1940		ug/Kg	SW8270C	11/22/15
Pyrene	129-00-0	78.4	200	2030		ug/Kg	SW8270C	11/22/15
Butylbenzylphthalate	85-68-7	78.4	200	2140		ug/Kg	SW8270C	11/22/15
Benzo(a)anthracene	56-55-3	78.4	200	1980		ug/Kg	SW8270C	11/22/15
3,3'-Dichlorobenzidine	91-94-1	78.4	200	2020		ug/Kg	SW8270C	11/22/15
Chrysene	218-01-9	78.4	200	2040		ug/Kg	SW8270C	11/22/15
bis(2-Ethylhexyl)phthalate	117-81-7	78.4	200	2170		ug/Kg	SW8270C	11/22/15
Di-n-octylphthalate	117-84-0	78.4	200	2520		ug/Kg	SW8270C	11/22/15
Benzo(b)fluoroanthene	205-99-2	78.4	200	2270		ug/Kg	SW8270C	11/22/15
Benzo(k)fluoranthene	207-08-9	78.4	200	2310		ug/Kg	SW8270C	11/22/15
Benzo(a)pyrene	50-32-8	78.4	200	2240		ug/Kg	SW8270C	11/22/15
Indeno(1,2,3-c,d)pyrene	193-39-5	78.4	200	2300		ug/Kg	SW8270C	11/22/15
Dibenzo(a,h)anthracene	53-70-3	78.4	200	2340		ug/Kg	SW8270C	11/22/15
Benzo(g,h,i)perylene	191-24-2	78.4	200	2250		ug/Kg	SW8270C	11/22/15

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information		Lab Information	
Client Sample ID:	**D4SD04-0.503-01MS**	**Lab Sample ID:**	**P358603MS**
Project Name:	Alaska LNG	Date Received:	11/07/15
Sample Date:	11/05/15	Dilution Factor:	1
Sample Time:	13:30	Report Revision No.:	0
Type:	Grab		
Matrix:	Soil		
Basis:	Dry Weight		

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Semi-Volatiles								

Surrogate	% Recovery	Control Limits	Qualifier
2-Fluorophenol	45	25-121	
Phenol-d5	53	24-113	
Nitrobenzene-d5	58	23-120	
2-Fluorobiphenyl	60	30-115	
2,4,6-Tribromophenol	63	19-122	
Terphenyl-d14	74	18-137	

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Client Sample ID: **D4SD04-0.503-01SD**

Project Name: Alaska LNG
Sample Date: 11/05/15
Sample Time: 13:30
Type: Grab
Matrix: Soil
Basis: Dry Weight

Lab Information

Lab Sample ID: **P358604MSD**

Date Received: 11/07/15
Dilution Factor: 1
Report Revision No.: 0

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Semi-Volatiles								
N-Nitrosodimethylamine	62-75-9	77.4	197	1740		ug/Kg	SW8270C	11/22/15
Pyridine	110-86-1	77.4	197	1530		ug/Kg	SW8270C	11/22/15
Aniline	62-53-3	77.4	197	1550		ug/Kg	SW8270C	11/22/15
Phenol	108-95-2	77.4	197	1900		ug/Kg	SW8270C	11/22/15
bis(2-Chloroethyl)ether	111-44-4	77.4	197	1910		ug/Kg	SW8270C	11/22/15
2-Chlorophenol	95-57-8	77.4	197	1760		ug/Kg	SW8270C	11/22/15
1,3-Dichlorobenzene	541-73-1	77.4	197	1620		ug/Kg	SW8270C	11/22/15
1,4-Dichlorobenzene	106-46-7	77.4	197	1650		ug/Kg	SW8270C	11/22/15
Benzyl alcohol	100-51-6	77.4	197	1950		ug/Kg	SW8270C	11/22/15
1,2-Dichlorobenzene	95-50-1	77.4	197	1710		ug/Kg	SW8270C	11/22/15
2-Methylphenol	95-48-7	77.4	197	1930		ug/Kg	SW8270C	11/22/15
bis(2-Chloroisopropyl)ether	108-60-1	77.4	197	1990		ug/Kg	SW8270C	11/22/15
3-,4-Methylphenol	108-39-4/106	77.4	197	2050		ug/Kg	SW8270C	11/22/15
N-Nitroso-di-n-propylamine	621-64-7	77.4	197	2110		ug/Kg	SW8270C	11/22/15
Hexachloroethane	67-72-1	77.4	197	1680		ug/Kg	SW8270C	11/22/15
Benzoic Acid	65-85-0	116	464	533		ug/Kg	SW8270C	11/22/15
Nitrobenzene	98-95-3	77.4	197	1960		ug/Kg	SW8270C	11/22/15
Isophorone	78-59-1	77.4	197	2130		ug/Kg	SW8270C	11/22/15
2-Nitrophenol	88-75-5	77.4	197	1970		ug/Kg	SW8270C	11/22/15
2,4-Dimethylphenol	105-67-9	77.4	197	1960		ug/Kg	SW8270C	11/22/15
bis(2-Chloroethoxy)methane	111-91-1	77.4	197	2020		ug/Kg	SW8270C	11/22/15
2,4-Dichlorophenol	120-83-2	77.4	197	1900		ug/Kg	SW8270C	11/22/15
1,2,4-Trichlorobenzene	120-82-1	77.4	197	1790		ug/Kg	SW8270C	11/22/15
Naphthalene	91-20-3	77.4	197	1930		ug/Kg	SW8270C	11/22/15
4-Chloroaniline	106-47-8	77.4	197	1840		ug/Kg	SW8270C	11/22/15
Hexachlorobutadiene	87-68-3	77.4	197	1770		ug/Kg	SW8270C	11/22/15
4-Chloro-3-methyl phenol	59-50-7	77.4	197	2140		ug/Kg	SW8270C	11/22/15
2-Methylnaphthalene	91-57-6	77.4	197	1970		ug/Kg	SW8270C	11/22/15
Hexachlorocyclopentadiene	77-47-4	77.4	197	1440		ug/Kg	SW8270C	11/22/15
2,4,6-Trichlorophenol	88-06-2	77.4	197	2100		ug/Kg	SW8270C	11/22/15
2,4,5-Trichlorophenol	95-95-4	77.4	197	2050		ug/Kg	SW8270C	11/22/15
2-Chloronaphthalene	91-58-7	77.4	197	2090		ug/Kg	SW8270C	11/22/15
2-Nitroaniline	88-74-4	77.4	197	2260		ug/Kg	SW8270C	11/22/15
Dimethylphthalate	131-11-3	77.4	197	2220		ug/Kg	SW8270C	11/22/15
Acenaphthylene	208-96-8	77.4	197	2090		ug/Kg	SW8270C	11/22/15
2,6-Dinitrotoluene	606-20-2	77.4	197	2230		ug/Kg	SW8270C	11/22/15
Acenaphthene	83-32-9	77.4	197	2160		ug/Kg	SW8270C	11/22/15
2,4-Dinitrophenol	51-28-5	77.4	386	986		ug/Kg	SW8270C	11/22/15
4-Nitrophenol	100-02-7	77.4	197	2140		ug/Kg	SW8270C	11/22/15
2,4-Dinitrotoluene	121-14-2	77.4	197	2260		ug/Kg	SW8270C	11/22/15
Dibenzofuran	132-64-9	77.4	197	2110		ug/Kg	SW8270C	11/22/15
Diethylphthalate	84-66-2	77.4	197	2230		ug/Kg	SW8270C	11/22/15

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Client Sample ID: **D4SD04-0.503-01SD**

Project Name: Alaska LNG
Sample Date: 11/05/15
Sample Time: 13:30
Type: Grab
Matrix: Soil
Basis: Dry Weight

Lab Information

Lab Sample ID: **P358604MSD**

Date Received: 11/07/15
Dilution Factor: 1
Report Revision No.: 0

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Semi-Volatiles								
3-Nitroaniline	99-09-2	77.4	197	2150		ug/Kg	SW8270C	11/22/15
Fluorene	86-73-7	77.4	197	2250		ug/Kg	SW8270C	11/22/15
4-Chlorophenyl phenyl ether	7005-72-3	77.4	197	2190		ug/Kg	SW8270C	11/22/15
4-Nitroaniline	100-01-6	77.4	197	2320		ug/Kg	SW8270C	11/22/15
4,6-Dinitro-2-methyl phenol	534-52-1	77.4	197	1760		ug/Kg	SW8270C	11/22/15
N-Nitrosodiphenylamine	86-30-6	77.4	197	2230		ug/Kg	SW8270C	11/22/15
1,2-Diphenylhydrazine	122-66-7	77.4	197	2370		ug/Kg	SW8270C	11/22/15
4-Bromophenyl phenyl ether	101-55-3	77.4	197	2180		ug/Kg	SW8270C	11/22/15
Hexachlorobenzene	118-74-1	77.4	197	2200		ug/Kg	SW8270C	11/22/15
Pentachlorophenol	87-86-5	77.4	197	1730		ug/Kg	SW8270C	11/22/15
Phenanthrene	85-01-8	77.4	197	2230		ug/Kg	SW8270C	11/22/15
Anthracene	120-12-7	77.4	197	2210		ug/Kg	SW8270C	11/22/15
Carbazole	86-74-8	77.4	197	2250		ug/Kg	SW8270C	11/22/15
Di-n-butylphthalate	84-74-2	77.4	197	2350		ug/Kg	SW8270C	11/22/15
Fluoranthene	206-44-0	77.4	197	2200		ug/Kg	SW8270C	11/22/15
Pyrene	129-00-0	77.4	197	2290		ug/Kg	SW8270C	11/22/15
Butylbenzylphthalate	85-68-7	77.4	197	2410		ug/Kg	SW8270C	11/22/15
Benzo(a)anthracene	56-55-3	77.4	197	2220		ug/Kg	SW8270C	11/22/15
3,3'-Dichlorobenzidine	91-94-1	77.4	197	2130		ug/Kg	SW8270C	11/22/15
Chrysene	218-01-9	77.4	197	2320		ug/Kg	SW8270C	11/22/15
bis(2-Ethylhexyl)phthalate	117-81-7	77.4	197	2460		ug/Kg	SW8270C	11/22/15
Di-n-octylphthalate	117-84-0	77.4	197	2840		ug/Kg	SW8270C	11/22/15
Benzo(b)fluoroanthene	205-99-2	77.4	197	2550		ug/Kg	SW8270C	11/22/15
Benzo(k)fluoranthene	207-08-9	77.4	197	2670		ug/Kg	SW8270C	11/22/15
Benzo(a)pyrene	50-32-8	77.4	197	2570		ug/Kg	SW8270C	11/22/15
Indeno(1,2,3-c,d)pyrene	193-39-5	77.4	197	2640		ug/Kg	SW8270C	11/22/15
Dibenzo(a,h)anthracene	53-70-3	77.4	197	2660		ug/Kg	SW8270C	11/22/15
Benzo(g,h,i)perylene	191-24-2	77.4	197	2550		ug/Kg	SW8270C	11/22/15

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information		Lab Information	
Client Sample ID:	**D4SD04-0.503-01SD**	**Lab Sample ID:**	**P358604MSD**
Project Name:	Alaska LNG	Date Received:	11/07/15
Sample Date:	11/05/15	Dilution Factor:	1
Sample Time:	13:30	Report Revision No.:	0
Type:	Grab		
Matrix:	Soil		
Basis:	Dry Weight		

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Semi-Volatiles								

Surrogate	% Recovery	Control Limits	Qualifier
2-Fluorophenol	47	25-121	
Phenol-d5	56	24-113	
Nitrobenzene-d5	63	23-120	
2-Fluorobiphenyl	63	30-115	
2,4,6-Tribromophenol	66	19-122	
Terphenyl-d14	78	18-137	

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Client Sample ID: **D4SD04-0304.25-02**

Project Name: Alaska LNG
Sample Date: 11/05/15
Sample Time: 16:30
Type: Grab
Matrix: Soil
Basis: Dry Weight

Lab Information

Lab Sample ID: **P358605**

Date Received: 11/07/15
Dilution Factor: 1
Report Revision No.: 0

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Semi-Volatiles								
N-Nitrosodimethylamine	62-75-9	79.5	203	79.5	U	ug/Kg	SW8270C	11/22/15
Pyridine	110-86-1	79.5	203	79.5	U	ug/Kg	SW8270C	11/22/15
Aniline	62-53-3	79.5	203	79.5	U	ug/Kg	SW8270C	11/22/15
Phenol	108-95-2	79.5	203	79.5	U	ug/Kg	SW8270C	11/22/15
bis(2-Chloroethyl)ether	111-44-4	79.5	203	79.5	U	ug/Kg	SW8270C	11/22/15
2-Chlorophenol	95-57-8	79.5	203	79.5	U	ug/Kg	SW8270C	11/22/15
1,3-Dichlorobenzene	541-73-1	79.5	203	79.5	U	ug/Kg	SW8270C	11/22/15
1,4-Dichlorobenzene	106-46-7	79.5	203	79.5	U	ug/Kg	SW8270C	11/22/15
Benzyl alcohol	100-51-6	79.5	203	79.5	U	ug/Kg	SW8270C	11/22/15
1,2-Dichlorobenzene	95-50-1	79.5	203	79.5	U	ug/Kg	SW8270C	11/22/15
2-Methylphenol	95-48-7	79.5	203	79.5	U	ug/Kg	SW8270C	11/22/15
bis(2-Chloroisopropyl)ether	108-60-1	79.5	203	79.5	U	ug/Kg	SW8270C	11/22/15
3-,4-Methylphenol	108-39-4/106	79.5	203	79.5	U	ug/Kg	SW8270C	11/22/15
N-Nitroso-di-n-propylamine	621-64-7	79.5	203	79.5	U	ug/Kg	SW8270C	11/22/15
Hexachloroethane	67-72-1	79.5	203	79.5	U	ug/Kg	SW8270C	11/22/15
Benzoic Acid	65-85-0	119	477	119	U	ug/Kg	SW8270C	11/22/15
Nitrobenzene	98-95-3	79.5	203	79.5	U	ug/Kg	SW8270C	11/22/15
Isophorone	78-59-1	79.5	203	79.5	U	ug/Kg	SW8270C	11/22/15
2-Nitrophenol	88-75-5	79.5	203	79.5	U	ug/Kg	SW8270C	11/22/15
2,4-Dimethylphenol	105-67-9	79.5	203	79.5	U	ug/Kg	SW8270C	11/22/15
bis(2-Chloroethoxy)methane	111-91-1	79.5	203	79.5	U	ug/Kg	SW8270C	11/22/15
2,4-Dichlorophenol	120-83-2	79.5	203	79.5	U	ug/Kg	SW8270C	11/22/15
1,2,4-Trichlorobenzene	120-82-1	79.5	203	79.5	U	ug/Kg	SW8270C	11/22/15
Naphthalene	91-20-3	79.5	203	79.5	U	ug/Kg	SW8270C	11/22/15
4-Chloroaniline	106-47-8	79.5	203	79.5	U	ug/Kg	SW8270C	11/22/15
Hexachlorobutadiene	87-68-3	79.5	203	79.5	U	ug/Kg	SW8270C	11/22/15
4-Chloro-3-methyl phenol	59-50-7	79.5	203	79.5	U	ug/Kg	SW8270C	11/22/15
2-Methylnaphthalene	91-57-6	79.5	203	79.5	U	ug/Kg	SW8270C	11/22/15
Hexachlorocyclopentadiene	77-47-4	79.5	203	79.5	U	ug/Kg	SW8270C	11/22/15
2,4,6-Trichlorophenol	88-06-2	79.5	203	79.5	U	ug/Kg	SW8270C	11/22/15
2,4,5-Trichlorophenol	95-95-4	79.5	203	79.5	U	ug/Kg	SW8270C	11/22/15
2-Chloronaphthalene	91-58-7	79.5	203	79.5	U	ug/Kg	SW8270C	11/22/15
2-Nitroaniline	88-74-4	79.5	203	79.5	U	ug/Kg	SW8270C	11/22/15
Dimethylphthalate	131-11-3	79.5	203	79.5	U	ug/Kg	SW8270C	11/22/15
Acenaphthylene	208-96-8	79.5	203	79.5	U	ug/Kg	SW8270C	11/22/15
2,6-Dinitrotoluene	606-20-2	79.5	203	79.5	U	ug/Kg	SW8270C	11/22/15
Acenaphthene	83-32-9	79.5	203	79.5	U	ug/Kg	SW8270C	11/22/15
2,4-Dinitrophenol	51-28-5	79.5	397	79.5	U	ug/Kg	SW8270C	11/22/15
4-Nitrophenol	100-02-7	79.5	203	79.5	U	ug/Kg	SW8270C	11/22/15
2,4-Dinitrotoluene	121-14-2	79.5	203	79.5	U	ug/Kg	SW8270C	11/22/15
Dibenzofuran	132-64-9	79.5	203	79.5	U	ug/Kg	SW8270C	11/22/15
Diethylphthalate	84-66-2	79.5	203	79.5	U	ug/Kg	SW8270C	11/22/15

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Client Sample ID: **D4SD04-0304.25-02**

Project Name: Alaska LNG
Sample Date: 11/05/15
Sample Time: 16:30
Type: Grab
Matrix: Soil
Basis: Dry Weight

Lab Information

Lab Sample ID: **P358605**

Date Received: 11/07/15
Dilution Factor: 1
Report Revision No.: 0

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Semi-Volatiles								
3-Nitroaniline	99-09-2	79.5	203	79.5	U	ug/Kg	SW8270C	11/22/15
Fluorene	86-73-7	79.5	203	79.5	U	ug/Kg	SW8270C	11/22/15
4-Chlorophenyl phenyl ether	7005-72-3	79.5	203	79.5	U	ug/Kg	SW8270C	11/22/15
4-Nitroaniline	100-01-6	79.5	203	79.5	U	ug/Kg	SW8270C	11/22/15
4,6-Dinitro-2-methyl phenol	534-52-1	79.5	203	79.5	U	ug/Kg	SW8270C	11/22/15
N-Nitrosodiphenylamine	86-30-6	79.5	203	79.5	U	ug/Kg	SW8270C	11/22/15
1,2-Diphenylhydrazine	122-66-7	79.5	203	79.5	U	ug/Kg	SW8270C	11/22/15
4-Bromophenyl phenyl ether	101-55-3	79.5	203	79.5	U	ug/Kg	SW8270C	11/22/15
Hexachlorobenzene	118-74-1	79.5	203	79.5	U	ug/Kg	SW8270C	11/22/15
Pentachlorophenol	87-86-5	79.5	203	79.5	U	ug/Kg	SW8270C	11/22/15
Phenanthrene	85-01-8	79.5	203	79.5	U	ug/Kg	SW8270C	11/22/15
Anthracene	120-12-7	79.5	203	79.5	U	ug/Kg	SW8270C	11/22/15
Carbazole	86-74-8	79.5	203	79.5	U	ug/Kg	SW8270C	11/22/15
Di-n-butylphthalate	84-74-2	79.5	203	79.5	U	ug/Kg	SW8270C	11/22/15
Fluoranthene	206-44-0	79.5	203	79.5	U	ug/Kg	SW8270C	11/22/15
Pyrene	129-00-0	79.5	203	79.5	U	ug/Kg	SW8270C	11/22/15
Butylbenzylphthalate	85-68-7	79.5	203	79.5	U	ug/Kg	SW8270C	11/22/15
Benzo(a)anthracene	56-55-3	79.5	203	79.5	U	ug/Kg	SW8270C	11/22/15
3,3'-Dichlorobenzidine	91-94-1	79.5	203	79.5	U	ug/Kg	SW8270C	11/22/15
Chrysene	218-01-9	79.5	203	79.5	U	ug/Kg	SW8270C	11/22/15
bis(2-Ethylhexyl)phthalate	117-81-7	79.5	203	79.5	U	ug/Kg	SW8270C	11/22/15
Di-n-octylphthalate	117-84-0	79.5	203	79.5	U	ug/Kg	SW8270C	11/22/15
Benzo(b)fluoroanthene	205-99-2	79.5	203	79.5	U	ug/Kg	SW8270C	11/22/15
Benzo(k)fluoranthene	207-08-9	79.5	203	79.5	U	ug/Kg	SW8270C	11/22/15
Benzo(a)pyrene	50-32-8	79.5	203	79.5	U	ug/Kg	SW8270C	11/22/15
Indeno(1,2,3-c,d)pyrene	193-39-5	79.5	203	79.5	U	ug/Kg	SW8270C	11/22/15
Dibenzo(a,h)anthracene	53-70-3	79.5	203	79.5	U	ug/Kg	SW8270C	11/22/15
Benzo(g,h,i)perylene	191-24-2	79.5	203	79.5	U	ug/Kg	SW8270C	11/22/15

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information		Lab Information	
Client Sample ID:	**D4SD04-0304.25-02**	**Lab Sample ID:**	**P358605**
Project Name:	Alaska LNG	Date Received:	11/07/15
Sample Date:	11/05/15	Dilution Factor:	1
Sample Time:	16:30	Report Revision No.:	0
Type:	Grab		
Matrix:	Soil		
Basis:	Dry Weight		

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Semi-Volatiles								

Surrogate	% Recovery	Control Limits	Qualifier
2-Fluorophenol	45	25-121	
Phenol-d5	50	24-113	
Nitrobenzene-d5	49	23-120	
2-Fluorobiphenyl	57	30-115	
2,4,6-Tribromophenol	60	19-122	
Terphenyl-d14	81	18-137	

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Client Sample ID: **D4SD04-4.2518.86-03**

Project Name: Alaska LNG
Sample Date: 11/05/15
Sample Time: 14:50
Type: Grab
Matrix: Soil
Basis: Dry Weight

Lab Information

Lab Sample ID: **P358606**

Date Received: 11/07/15
Dilution Factor: 1
Report Revision No.: 0

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Semi-Volatiles								
N-Nitrosodimethylamine	62-75-9	79.9	204	79.9	U	ug/Kg	SW8270C	11/22/15
Pyridine	110-86-1	79.9	204	79.9	U	ug/Kg	SW8270C	11/22/15
Aniline	62-53-3	79.9	204	79.9	U	ug/Kg	SW8270C	11/22/15
Phenol	108-95-2	79.9	204	79.9	U	ug/Kg	SW8270C	11/22/15
bis(2-Chloroethyl)ether	111-44-4	79.9	204	79.9	U	ug/Kg	SW8270C	11/22/15
2-Chlorophenol	95-57-8	79.9	204	79.9	U	ug/Kg	SW8270C	11/22/15
1,3-Dichlorobenzene	541-73-1	79.9	204	79.9	U	ug/Kg	SW8270C	11/22/15
1,4-Dichlorobenzene	106-46-7	79.9	204	79.9	U	ug/Kg	SW8270C	11/22/15
Benzyl alcohol	100-51-6	79.9	204	79.9	U	ug/Kg	SW8270C	11/22/15
1,2-Dichlorobenzene	95-50-1	79.9	204	79.9	U	ug/Kg	SW8270C	11/22/15
2-Methylphenol	95-48-7	79.9	204	79.9	U	ug/Kg	SW8270C	11/22/15
bis(2-Chloroisopropyl)ether	108-60-1	79.9	204	79.9	U	ug/Kg	SW8270C	11/22/15
3-,4-Methylphenol	108-39-4/106	79.9	204	79.9	U	ug/Kg	SW8270C	11/22/15
N-Nitroso-di-n-propylamine	621-64-7	79.9	204	79.9	U	ug/Kg	SW8270C	11/22/15
Hexachloroethane	67-72-1	79.9	204	79.9	U	ug/Kg	SW8270C	11/22/15
Benzoic Acid	65-85-0	120	479	120	U	ug/Kg	SW8270C	11/22/15
Nitrobenzene	98-95-3	79.9	204	79.9	U	ug/Kg	SW8270C	11/22/15
Isophorone	78-59-1	79.9	204	79.9	U	ug/Kg	SW8270C	11/22/15
2-Nitrophenol	88-75-5	79.9	204	79.9	U	ug/Kg	SW8270C	11/22/15
2,4-Dimethylphenol	105-67-9	79.9	204	79.9	U	ug/Kg	SW8270C	11/22/15
bis(2-Chloroethoxy)methane	111-91-1	79.9	204	79.9	U	ug/Kg	SW8270C	11/22/15
2,4-Dichlorophenol	120-83-2	79.9	204	79.9	U	ug/Kg	SW8270C	11/22/15
1,2,4-Trichlorobenzene	120-82-1	79.9	204	79.9	U	ug/Kg	SW8270C	11/22/15
Naphthalene	91-20-3	79.9	204	79.9	U	ug/Kg	SW8270C	11/22/15
4-Chloroaniline	106-47-8	79.9	204	79.9	U	ug/Kg	SW8270C	11/22/15
Hexachlorobutadiene	87-68-3	79.9	204	79.9	U	ug/Kg	SW8270C	11/22/15
4-Chloro-3-methyl phenol	59-50-7	79.9	204	79.9	U	ug/Kg	SW8270C	11/22/15
2-Methylnaphthalene	91-57-6	79.9	204	79.9	U	ug/Kg	SW8270C	11/22/15
Hexachlorocyclopentadiene	77-47-4	79.9	204	79.9	U	ug/Kg	SW8270C	11/22/15
2,4,6-Trichlorophenol	88-06-2	79.9	204	79.9	U	ug/Kg	SW8270C	11/22/15
2,4,5-Trichlorophenol	95-95-4	79.9	204	79.9	U	ug/Kg	SW8270C	11/22/15
2-Chloronaphthalene	91-58-7	79.9	204	79.9	U	ug/Kg	SW8270C	11/22/15
2-Nitroaniline	88-74-4	79.9	204	79.9	U	ug/Kg	SW8270C	11/22/15
Dimethylphthalate	131-11-3	79.9	204	79.9	U	ug/Kg	SW8270C	11/22/15
Acenaphthylene	208-96-8	79.9	204	79.9	U	ug/Kg	SW8270C	11/22/15
2,6-Dinitrotoluene	606-20-2	79.9	204	79.9	U	ug/Kg	SW8270C	11/22/15
Acenaphthene	83-32-9	79.9	204	79.9	U	ug/Kg	SW8270C	11/22/15
2,4-Dinitrophenol	51-28-5	79.9	399	79.9	U	ug/Kg	SW8270C	11/22/15
4-Nitrophenol	100-02-7	79.9	204	79.9	U	ug/Kg	SW8270C	11/22/15
2,4-Dinitrotoluene	121-14-2	79.9	204	79.9	U	ug/Kg	SW8270C	11/22/15
Dibenzofuran	132-64-9	79.9	204	79.9	U	ug/Kg	SW8270C	11/22/15
Diethylphthalate	84-66-2	79.9	204	79.9	U	ug/Kg	SW8270C	11/22/15

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Client Sample ID: **D4SD04-4.2518.86-03**

Project Name: Alaska LNG
Sample Date: 11/05/15
Sample Time: 14:50
Type: Grab
Matrix: Soil
Basis: Dry Weight

Lab Information

Lab Sample ID: **P358606**

Date Received: 11/07/15
Dilution Factor: 1
Report Revision No.: 0

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Semi-Volatiles								
3-Nitroaniline	99-09-2	79.9	204	79.9	U	ug/Kg	SW8270C	11/22/15
Fluorene	86-73-7	79.9	204	79.9	U	ug/Kg	SW8270C	11/22/15
4-Chlorophenyl phenyl ether	7005-72-3	79.9	204	79.9	U	ug/Kg	SW8270C	11/22/15
4-Nitroaniline	100-01-6	79.9	204	79.9	U	ug/Kg	SW8270C	11/22/15
4,6-Dinitro-2-methyl phenol	534-52-1	79.9	204	79.9	U	ug/Kg	SW8270C	11/22/15
N-Nitrosodiphenylamine	86-30-6	79.9	204	79.9	U	ug/Kg	SW8270C	11/22/15
1,2-Diphenylhydrazine	122-66-7	79.9	204	79.9	U	ug/Kg	SW8270C	11/22/15
4-Bromophenyl phenyl ether	101-55-3	79.9	204	79.9	U	ug/Kg	SW8270C	11/22/15
Hexachlorobenzene	118-74-1	79.9	204	79.9	U	ug/Kg	SW8270C	11/22/15
Pentachlorophenol	87-86-5	79.9	204	79.9	U	ug/Kg	SW8270C	11/22/15
Phenanthrene	85-01-8	79.9	204	79.9	U	ug/Kg	SW8270C	11/22/15
Anthracene	120-12-7	79.9	204	79.9	U	ug/Kg	SW8270C	11/22/15
Carbazole	86-74-8	79.9	204	79.9	U	ug/Kg	SW8270C	11/22/15
Di-n-butylphthalate	84-74-2	79.9	204	79.9	U	ug/Kg	SW8270C	11/22/15
Fluoranthene	206-44-0	79.9	204	79.9	U	ug/Kg	SW8270C	11/22/15
Pyrene	129-00-0	79.9	204	79.9	U	ug/Kg	SW8270C	11/22/15
Butylbenzylphthalate	85-68-7	79.9	204	79.9	U	ug/Kg	SW8270C	11/22/15
Benzo(a)anthracene	56-55-3	79.9	204	79.9	U	ug/Kg	SW8270C	11/22/15
3,3'-Dichlorobenzidine	91-94-1	79.9	204	79.9	U	ug/Kg	SW8270C	11/22/15
Chrysene	218-01-9	79.9	204	79.9	U	ug/Kg	SW8270C	11/22/15
bis(2-Ethylhexyl)phthalate	117-81-7	79.9	204	79.9	U	ug/Kg	SW8270C	11/22/15
Di-n-octylphthalate	117-84-0	79.9	204	79.9	U	ug/Kg	SW8270C	11/22/15
Benzo(b)fluoroanthene	205-99-2	79.9	204	79.9	U	ug/Kg	SW8270C	11/22/15
Benzo(k)fluoranthene	207-08-9	79.9	204	79.9	U	ug/Kg	SW8270C	11/22/15
Benzo(a)pyrene	50-32-8	79.9	204	79.9	U	ug/Kg	SW8270C	11/22/15
Indeno(1,2,3-c,d)pyrene	193-39-5	79.9	204	79.9	U	ug/Kg	SW8270C	11/22/15
Dibenzo(a,h)anthracene	53-70-3	79.9	204	79.9	U	ug/Kg	SW8270C	11/22/15
Benzo(g,h,i)perylene	191-24-2	79.9	204	79.9	U	ug/Kg	SW8270C	11/22/15

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information		Lab Information	
Client Sample ID:	**D4SD04-4.2518.86-03**	**Lab Sample ID:**	**P358606**
Project Name:	Alaska LNG	Date Received:	11/07/15
Sample Date:	11/05/15	Dilution Factor:	1
Sample Time:	14:50	Report Revision No.:	0
Type:	Grab		
Matrix:	Soil		
Basis:	Dry Weight		

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Semi-Volatiles								

Surrogate	% Recovery	Control Limits	Qualifier
2-Fluorophenol	49	25-121	
Phenol-d5	55	24-113	
Nitrobenzene-d5	56	23-120	
2-Fluorobiphenyl	63	30-115	
2,4,6-Tribromophenol	55	19-122	
Terphenyl-d14	81	18-137	

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Client Sample ID: **D5SD01-0002-01**

Project Name: Alaska LNG
Sample Date: 11/06/15
Sample Time: 11:15
Type: Grab
Matrix: Soil
Basis: Dry Weight

Lab Information

Lab Sample ID: **P358607**

Date Received: 11/07/15
Dilution Factor: 1
Report Revision No.: 0

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Semi-Volatiles								
N-Nitrosodimethylamine	62-75-9	78.9	201	78.9	U	ug/Kg	SW8270C	11/22/15
Pyridine	110-86-1	78.9	201	78.9	U	ug/Kg	SW8270C	11/22/15
Aniline	62-53-3	78.9	201	78.9	U	ug/Kg	SW8270C	11/22/15
Phenol	108-95-2	78.9	201	78.9	U	ug/Kg	SW8270C	11/22/15
bis(2-Chloroethyl)ether	111-44-4	78.9	201	78.9	U	ug/Kg	SW8270C	11/22/15
2-Chlorophenol	95-57-8	78.9	201	78.9	U	ug/Kg	SW8270C	11/22/15
1,3-Dichlorobenzene	541-73-1	78.9	201	78.9	U	ug/Kg	SW8270C	11/22/15
1,4-Dichlorobenzene	106-46-7	78.9	201	78.9	U	ug/Kg	SW8270C	11/22/15
Benzyl alcohol	100-51-6	78.9	201	78.9	U	ug/Kg	SW8270C	11/22/15
1,2-Dichlorobenzene	95-50-1	78.9	201	78.9	U	ug/Kg	SW8270C	11/22/15
2-Methylphenol	95-48-7	78.9	201	78.9	U	ug/Kg	SW8270C	11/22/15
bis(2-Chloroisopropyl)ether	108-60-1	78.9	201	78.9	U	ug/Kg	SW8270C	11/22/15
3-,4-Methylphenol	108-39-4/106	78.9	201	78.9	U	ug/Kg	SW8270C	11/22/15
N-Nitroso-di-n-propylamine	621-64-7	78.9	201	78.9	U	ug/Kg	SW8270C	11/22/15
Hexachloroethane	67-72-1	78.9	201	78.9	U	ug/Kg	SW8270C	11/22/15
Benzoic Acid	65-85-0	118	473	118	U	ug/Kg	SW8270C	11/22/15
Nitrobenzene	98-95-3	78.9	201	78.9	U	ug/Kg	SW8270C	11/22/15
Isophorone	78-59-1	78.9	201	78.9	U	ug/Kg	SW8270C	11/22/15
2-Nitrophenol	88-75-5	78.9	201	78.9	U	ug/Kg	SW8270C	11/22/15
2,4-Dimethylphenol	105-67-9	78.9	201	78.9	U	ug/Kg	SW8270C	11/22/15
bis(2-Chloroethoxy)methane	111-91-1	78.9	201	78.9	U	ug/Kg	SW8270C	11/22/15
2,4-Dichlorophenol	120-83-2	78.9	201	78.9	U	ug/Kg	SW8270C	11/22/15
1,2,4-Trichlorobenzene	120-82-1	78.9	201	78.9	U	ug/Kg	SW8270C	11/22/15
Naphthalene	91-20-3	78.9	201	78.9	U	ug/Kg	SW8270C	11/22/15
4-Chloroaniline	106-47-8	78.9	201	78.9	U	ug/Kg	SW8270C	11/22/15
Hexachlorobutadiene	87-68-3	78.9	201	78.9	U	ug/Kg	SW8270C	11/22/15
4-Chloro-3-methyl phenol	59-50-7	78.9	201	78.9	U	ug/Kg	SW8270C	11/22/15
2-Methylnaphthalene	91-57-6	78.9	201	78.9	U	ug/Kg	SW8270C	11/22/15
Hexachlorocyclopentadiene	77-47-4	78.9	201	78.9	U	ug/Kg	SW8270C	11/22/15
2,4,6-Trichlorophenol	88-06-2	78.9	201	78.9	U	ug/Kg	SW8270C	11/22/15
2,4,5-Trichlorophenol	95-95-4	78.9	201	78.9	U	ug/Kg	SW8270C	11/22/15
2-Chloronaphthalene	91-58-7	78.9	201	78.9	U	ug/Kg	SW8270C	11/22/15
2-Nitroaniline	88-74-4	78.9	201	78.9	U	ug/Kg	SW8270C	11/22/15
Dimethylphthalate	131-11-3	78.9	201	78.9	U	ug/Kg	SW8270C	11/22/15
Acenaphthylene	208-96-8	78.9	201	78.9	U	ug/Kg	SW8270C	11/22/15
2,6-Dinitrotoluene	606-20-2	78.9	201	78.9	U	ug/Kg	SW8270C	11/22/15
Acenaphthene	83-32-9	78.9	201	78.9	U	ug/Kg	SW8270C	11/22/15
2,4-Dinitrophenol	51-28-5	78.9	394	78.9	U	ug/Kg	SW8270C	11/22/15
4-Nitrophenol	100-02-7	78.9	201	78.9	U	ug/Kg	SW8270C	11/22/15
2,4-Dinitrotoluene	121-14-2	78.9	201	78.9	U	ug/Kg	SW8270C	11/22/15
Dibenzofuran	132-64-9	78.9	201	78.9	U	ug/Kg	SW8270C	11/22/15
Diethylphthalate	84-66-2	78.9	201	78.9	U	ug/Kg	SW8270C	11/22/15

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information		Lab Information	
Client Sample ID:	**D5SD01-0002-01**	**Lab Sample ID:**	**P358607**
Project Name:	Alaska LNG	Date Received:	11/07/15
Sample Date:	11/06/15	Dilution Factor:	1
Sample Time:	11:15	Report Revision No.:	0
Type:	Grab		
Matrix:	Soil		
Basis:	Dry Weight		

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Semi-Volatiles								
3-Nitroaniline	99-09-2	78.9	201	78.9	U	ug/Kg	SW8270C	11/22/15
Fluorene	86-73-7	78.9	201	78.9	U	ug/Kg	SW8270C	11/22/15
4-Chlorophenyl phenyl ether	7005-72-3	78.9	201	78.9	U	ug/Kg	SW8270C	11/22/15
4-Nitroaniline	100-01-6	78.9	201	78.9	U	ug/Kg	SW8270C	11/22/15
4,6-Dinitro-2-methyl phenol	534-52-1	78.9	201	78.9	U	ug/Kg	SW8270C	11/22/15
N-Nitrosodiphenylamine	86-30-6	78.9	201	78.9	U	ug/Kg	SW8270C	11/22/15
1,2-Diphenylhydrazine	122-66-7	78.9	201	78.9	U	ug/Kg	SW8270C	11/22/15
4-Bromophenyl phenyl ether	101-55-3	78.9	201	78.9	U	ug/Kg	SW8270C	11/22/15
Hexachlorobenzene	118-74-1	78.9	201	78.9	U	ug/Kg	SW8270C	11/22/15
Pentachlorophenol	87-86-5	78.9	201	78.9	U	ug/Kg	SW8270C	11/22/15
Phenanthrene	85-01-8	78.9	201	78.9	U	ug/Kg	SW8270C	11/22/15
Anthracene	120-12-7	78.9	201	78.9	U	ug/Kg	SW8270C	11/22/15
Carbazole	86-74-8	78.9	201	78.9	U	ug/Kg	SW8270C	11/22/15
Di-n-butylphthalate	84-74-2	78.9	201	78.9	U	ug/Kg	SW8270C	11/22/15
Fluoranthene	206-44-0	78.9	201	78.9	U	ug/Kg	SW8270C	11/22/15
Pyrene	129-00-0	78.9	201	78.9	U	ug/Kg	SW8270C	11/22/15
Butylbenzylphthalate	85-68-7	78.9	201	78.9	U	ug/Kg	SW8270C	11/22/15
Benzo(a)anthracene	56-55-3	78.9	201	78.9	U	ug/Kg	SW8270C	11/22/15
3,3'-Dichlorobenzidine	91-94-1	78.9	201	78.9	U	ug/Kg	SW8270C	11/22/15
Chrysene	218-01-9	78.9	201	78.9	U	ug/Kg	SW8270C	11/22/15
bis(2-Ethylhexyl)phthalate	117-81-7	78.9	201	78.9	U	ug/Kg	SW8270C	11/22/15
Di-n-octylphthalate	117-84-0	78.9	201	78.9	U	ug/Kg	SW8270C	11/22/15
Benzo(b)fluoroanthene	205-99-2	78.9	201	78.9	U	ug/Kg	SW8270C	11/22/15
Benzo(k)fluoranthene	207-08-9	78.9	201	78.9	U	ug/Kg	SW8270C	11/22/15
Benzo(a)pyrene	50-32-8	78.9	201	78.9	U	ug/Kg	SW8270C	11/22/15
Indeno(1,2,3-c,d)pyrene	193-39-5	78.9	201	78.9	U	ug/Kg	SW8270C	11/22/15
Dibenzo(a,h)anthracene	53-70-3	78.9	201	78.9	U	ug/Kg	SW8270C	11/22/15
Benzo(g,h,i)perylene	191-24-2	78.9	201	78.9	U	ug/Kg	SW8270C	11/22/15

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information		Lab Information	
Client Sample ID:	**D5SD01-0002-01**	**Lab Sample ID:**	**P358607**
Project Name:	Alaska LNG	Date Received:	11/07/15
Sample Date:	11/06/15	Dilution Factor:	1
Sample Time:	11:15	Report Revision No.:	0
Type:	Grab		
Matrix:	Soil		
Basis:	Dry Weight		

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Semi-Volatiles								

Surrogate	% Recovery	Control Limits	Qualifier
2-Fluorophenol	42	25-121	
Phenol-d5	46	24-113	
Nitrobenzene-d5	46	23-120	
2-Fluorobiphenyl	49	30-115	
2,4,6-Tribromophenol	47	19-122	
Terphenyl-d14	66	18-137	

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information		Lab Information	
Client Sample ID:	**D5SD01-0204-02**	**Lab Sample ID:**	**P358608**
Project Name:	Alaska LNG	Date Received:	11/07/15
Sample Date:	11/06/15	Dilution Factor:	1
Sample Time:	13:00	Report Revision No.:	0
Type:	Grab		
Matrix:	Soil		
Basis:	Dry Weight		

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Semi-Volatiles								
N-Nitrosodimethylamine	62-75-9	81.9	209	81.9	U	ug/Kg	SW8270C	11/22/15
Pyridine	110-86-1	81.9	209	81.9	U	ug/Kg	SW8270C	11/22/15
Aniline	62-53-3	81.9	209	81.9	U	ug/Kg	SW8270C	11/22/15
Phenol	108-95-2	81.9	209	81.9	U	ug/Kg	SW8270C	11/22/15
bis(2-Chloroethyl)ether	111-44-4	81.9	209	81.9	U	ug/Kg	SW8270C	11/22/15
2-Chlorophenol	95-57-8	81.9	209	81.9	U	ug/Kg	SW8270C	11/22/15
1,3-Dichlorobenzene	541-73-1	81.9	209	81.9	U	ug/Kg	SW8270C	11/22/15
1,4-Dichlorobenzene	106-46-7	81.9	209	81.9	U	ug/Kg	SW8270C	11/22/15
Benzyl alcohol	100-51-6	81.9	209	81.9	U	ug/Kg	SW8270C	11/22/15
1,2-Dichlorobenzene	95-50-1	81.9	209	81.9	U	ug/Kg	SW8270C	11/22/15
2-Methylphenol	95-48-7	81.9	209	81.9	U	ug/Kg	SW8270C	11/22/15
bis(2-Chloroisopropyl)ether	108-60-1	81.9	209	81.9	U	ug/Kg	SW8270C	11/22/15
3-,4-Methylphenol	108-39-4/106	81.9	209	81.9	U	ug/Kg	SW8270C	11/22/15
N-Nitroso-di-n-propylamine	621-64-7	81.9	209	81.9	U	ug/Kg	SW8270C	11/22/15
Hexachloroethane	67-72-1	81.9	209	81.9	U	ug/Kg	SW8270C	11/22/15
Benzoic Acid	65-85-0	123	491	123	U	ug/Kg	SW8270C	11/22/15
Nitrobenzene	98-95-3	81.9	209	81.9	U	ug/Kg	SW8270C	11/22/15
Isophorone	78-59-1	81.9	209	81.9	U	ug/Kg	SW8270C	11/22/15
2-Nitrophenol	88-75-5	81.9	209	81.9	U	ug/Kg	SW8270C	11/22/15
2,4-Dimethylphenol	105-67-9	81.9	209	81.9	U	ug/Kg	SW8270C	11/22/15
bis(2-Chloroethoxy)methane	111-91-1	81.9	209	81.9	U	ug/Kg	SW8270C	11/22/15
2,4-Dichlorophenol	120-83-2	81.9	209	81.9	U	ug/Kg	SW8270C	11/22/15
1,2,4-Trichlorobenzene	120-82-1	81.9	209	81.9	U	ug/Kg	SW8270C	11/22/15
Naphthalene	91-20-3	81.9	209	81.9	U	ug/Kg	SW8270C	11/22/15
4-Chloroaniline	106-47-8	81.9	209	81.9	U	ug/Kg	SW8270C	11/22/15
Hexachlorobutadiene	87-68-3	81.9	209	81.9	U	ug/Kg	SW8270C	11/22/15
4-Chloro-3-methyl phenol	59-50-7	81.9	209	81.9	U	ug/Kg	SW8270C	11/22/15
2-Methylnaphthalene	91-57-6	81.9	209	81.9	U	ug/Kg	SW8270C	11/22/15
Hexachlorocyclopentadiene	77-47-4	81.9	209	81.9	U	ug/Kg	SW8270C	11/22/15
2,4,6-Trichlorophenol	88-06-2	81.9	209	81.9	U	ug/Kg	SW8270C	11/22/15
2,4,5-Trichlorophenol	95-95-4	81.9	209	81.9	U	ug/Kg	SW8270C	11/22/15
2-Chloronaphthalene	91-58-7	81.9	209	81.9	U	ug/Kg	SW8270C	11/22/15
2-Nitroaniline	88-74-4	81.9	209	81.9	U	ug/Kg	SW8270C	11/22/15
Dimethylphthalate	131-11-3	81.9	209	81.9	U	ug/Kg	SW8270C	11/22/15
Acenaphthylene	208-96-8	81.9	209	81.9	U	ug/Kg	SW8270C	11/22/15
2,6-Dinitrotoluene	606-20-2	81.9	209	81.9	U	ug/Kg	SW8270C	11/22/15
Acenaphthene	83-32-9	81.9	209	81.9	U	ug/Kg	SW8270C	11/22/15
2,4-Dinitrophenol	51-28-5	81.9	409	81.9	U	ug/Kg	SW8270C	11/22/15
4-Nitrophenol	100-02-7	81.9	209	81.9	U	ug/Kg	SW8270C	11/22/15
2,4-Dinitrotoluene	121-14-2	81.9	209	81.9	U	ug/Kg	SW8270C	11/22/15
Dibenzofuran	132-64-9	81.9	209	81.9	U	ug/Kg	SW8270C	11/22/15
Diethylphthalate	84-66-2	81.9	209	81.9	U	ug/Kg	SW8270C	11/22/15

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information		Lab Information	
Client Sample ID:	**D5SD01-0204-02**	**Lab Sample ID:**	**P358608**
Project Name:	Alaska LNG	Date Received:	11/07/15
Sample Date:	11/06/15	Dilution Factor:	1
Sample Time:	13:00	Report Revision No.:	0
Type:	Grab		
Matrix:	Soil		
Basis:	Dry Weight		

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Semi-Volatiles								
3-Nitroaniline	99-09-2	81.9	209	81.9	U	ug/Kg	SW8270C	11/22/15
Fluorene	86-73-7	81.9	209	81.9	U	ug/Kg	SW8270C	11/22/15
4-Chlorophenyl phenyl ether	7005-72-3	81.9	209	81.9	U	ug/Kg	SW8270C	11/22/15
4-Nitroaniline	100-01-6	81.9	209	81.9	U	ug/Kg	SW8270C	11/22/15
4,6-Dinitro-2-methyl phenol	534-52-1	81.9	209	81.9	U	ug/Kg	SW8270C	11/22/15
N-Nitrosodiphenylamine	86-30-6	81.9	209	81.9	U	ug/Kg	SW8270C	11/22/15
1,2-Diphenylhydrazine	122-66-7	81.9	209	81.9	U	ug/Kg	SW8270C	11/22/15
4-Bromophenyl phenyl ether	101-55-3	81.9	209	81.9	U	ug/Kg	SW8270C	11/22/15
Hexachlorobenzene	118-74-1	81.9	209	81.9	U	ug/Kg	SW8270C	11/22/15
Pentachlorophenol	87-86-5	81.9	209	81.9	U	ug/Kg	SW8270C	11/22/15
Phenanthrene	85-01-8	81.9	209	81.9	U	ug/Kg	SW8270C	11/22/15
Anthracene	120-12-7	81.9	209	81.9	U	ug/Kg	SW8270C	11/22/15
Carbazole	86-74-8	81.9	209	81.9	U	ug/Kg	SW8270C	11/22/15
Di-n-butylphthalate	84-74-2	81.9	209	81.9	U	ug/Kg	SW8270C	11/22/15
Fluoranthene	206-44-0	81.9	209	81.9	U	ug/Kg	SW8270C	11/22/15
Pyrene	129-00-0	81.9	209	81.9	U	ug/Kg	SW8270C	11/22/15
Butylbenzylphthalate	85-68-7	81.9	209	81.9	U	ug/Kg	SW8270C	11/22/15
Benzo(a)anthracene	56-55-3	81.9	209	81.9	U	ug/Kg	SW8270C	11/22/15
3,3'-Dichlorobenzidine	91-94-1	81.9	209	81.9	U	ug/Kg	SW8270C	11/22/15
Chrysene	218-01-9	81.9	209	81.9	U	ug/Kg	SW8270C	11/22/15
bis(2-Ethylhexyl)phthalate	117-81-7	81.9	209	81.9	U	ug/Kg	SW8270C	11/22/15
Di-n-octylphthalate	117-84-0	81.9	209	81.9	U	ug/Kg	SW8270C	11/22/15
Benzo(b)fluoroanthene	205-99-2	81.9	209	81.9	U	ug/Kg	SW8270C	11/22/15
Benzo(k)fluoranthene	207-08-9	81.9	209	81.9	U	ug/Kg	SW8270C	11/22/15
Benzo(a)pyrene	50-32-8	81.9	209	81.9	U	ug/Kg	SW8270C	11/22/15
Indeno(1,2,3-c,d)pyrene	193-39-5	81.9	209	81.9	U	ug/Kg	SW8270C	11/22/15
Dibenzo(a,h)anthracene	53-70-3	81.9	209	81.9	U	ug/Kg	SW8270C	11/22/15
Benzo(g,h,i)perylene	191-24-2	81.9	209	81.9	U	ug/Kg	SW8270C	11/22/15

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information		Lab Information	
Client Sample ID:	**D5SD01-0204-02**	**Lab Sample ID:**	**P358608**
Project Name:	Alaska LNG	Date Received:	11/07/15
Sample Date:	11/06/15	Dilution Factor:	1
Sample Time:	13:00	Report Revision No.:	0
Type:	Grab		
Matrix:	Soil		
Basis:	Dry Weight		

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Semi-Volatiles								

Surrogate	% Recovery	Control Limits	Qualifier
2-Fluorophenol	49	25-121	
Phenol-d5	55	24-113	
Nitrobenzene-d5	56	23-120	
2-Fluorobiphenyl	61	30-115	
2,4,6-Tribromophenol	59	19-122	
Terphenyl-d14	80	18-137	

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Client Sample ID: **D4BDS01-001.31-01**

Project Name: Alaska LNG
Sample Date: 11/03/15
Sample Time: 11:00
Type: Grab
Matrix: Soil
Basis: Dry Weight

Lab Information

Lab Sample ID: **P358609**

Date Received: 11/07/15
Dilution Factor: 1
Report Revision No.: 0

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Semi-Volatiles								
N-Nitrosodimethylamine	62-75-9	81.9	209	81.9	U	ug/Kg	SW8270C	11/22/15
Pyridine	110-86-1	81.9	209	81.9	U	ug/Kg	SW8270C	11/22/15
Aniline	62-53-3	81.9	209	81.9	U	ug/Kg	SW8270C	11/22/15
Phenol	108-95-2	81.9	209	81.9	U	ug/Kg	SW8270C	11/22/15
bis(2-Chloroethyl)ether	111-44-4	81.9	209	81.9	U	ug/Kg	SW8270C	11/22/15
2-Chlorophenol	95-57-8	81.9	209	81.9	U	ug/Kg	SW8270C	11/22/15
1,3-Dichlorobenzene	541-73-1	81.9	209	81.9	U	ug/Kg	SW8270C	11/22/15
1,4-Dichlorobenzene	106-46-7	81.9	209	81.9	U	ug/Kg	SW8270C	11/22/15
Benzyl alcohol	100-51-6	81.9	209	81.9	U	ug/Kg	SW8270C	11/22/15
1,2-Dichlorobenzene	95-50-1	81.9	209	81.9	U	ug/Kg	SW8270C	11/22/15
2-Methylphenol	95-48-7	81.9	209	81.9	U	ug/Kg	SW8270C	11/22/15
bis(2-Chloroisopropyl)ether	108-60-1	81.9	209	81.9	U	ug/Kg	SW8270C	11/22/15
3-,4-Methylphenol	108-39-4/106	81.9	209	81.9	U	ug/Kg	SW8270C	11/22/15
N-Nitroso-di-n-propylamine	621-64-7	81.9	209	81.9	U	ug/Kg	SW8270C	11/22/15
Hexachloroethane	67-72-1	81.9	209	81.9	U	ug/Kg	SW8270C	11/22/15
Benzoic Acid	65-85-0	123	491	123	U	ug/Kg	SW8270C	11/22/15
Nitrobenzene	98-95-3	81.9	209	81.9	U	ug/Kg	SW8270C	11/22/15
Isophorone	78-59-1	81.9	209	81.9	U	ug/Kg	SW8270C	11/22/15
2-Nitrophenol	88-75-5	81.9	209	81.9	U	ug/Kg	SW8270C	11/22/15
2,4-Dimethylphenol	105-67-9	81.9	209	81.9	U	ug/Kg	SW8270C	11/22/15
bis(2-Chloroethoxy)methane	111-91-1	81.9	209	81.9	U	ug/Kg	SW8270C	11/22/15
2,4-Dichlorophenol	120-83-2	81.9	209	81.9	U	ug/Kg	SW8270C	11/22/15
1,2,4-Trichlorobenzene	120-82-1	81.9	209	81.9	U	ug/Kg	SW8270C	11/22/15
Naphthalene	91-20-3	81.9	209	81.9	U	ug/Kg	SW8270C	11/22/15
4-Chloroaniline	106-47-8	81.9	209	81.9	U	ug/Kg	SW8270C	11/22/15
Hexachlorobutadiene	87-68-3	81.9	209	81.9	U	ug/Kg	SW8270C	11/22/15
4-Chloro-3-methyl phenol	59-50-7	81.9	209	81.9	U	ug/Kg	SW8270C	11/22/15
2-Methylnaphthalene	91-57-6	81.9	209	81.9	U	ug/Kg	SW8270C	11/22/15
Hexachlorocyclopentadiene	77-47-4	81.9	209	81.9	U	ug/Kg	SW8270C	11/22/15
2,4,6-Trichlorophenol	88-06-2	81.9	209	81.9	U	ug/Kg	SW8270C	11/22/15
2,4,5-Trichlorophenol	95-95-4	81.9	209	81.9	U	ug/Kg	SW8270C	11/22/15
2-Chloronaphthalene	91-58-7	81.9	209	81.9	U	ug/Kg	SW8270C	11/22/15
2-Nitroaniline	88-74-4	81.9	209	81.9	U	ug/Kg	SW8270C	11/22/15
Dimethylphthalate	131-11-3	81.9	209	81.9	U	ug/Kg	SW8270C	11/22/15
Acenaphthylene	208-96-8	81.9	209	81.9	U	ug/Kg	SW8270C	11/22/15
2,6-Dinitrotoluene	606-20-2	81.9	209	81.9	U	ug/Kg	SW8270C	11/22/15
Acenaphthene	83-32-9	81.9	209	81.9	U	ug/Kg	SW8270C	11/22/15
2,4-Dinitrophenol	51-28-5	81.9	409	81.9	U	ug/Kg	SW8270C	11/22/15
4-Nitrophenol	100-02-7	81.9	209	81.9	U	ug/Kg	SW8270C	11/22/15
2,4-Dinitrotoluene	121-14-2	81.9	209	81.9	U	ug/Kg	SW8270C	11/22/15
Dibenzofuran	132-64-9	81.9	209	81.9	U	ug/Kg	SW8270C	11/22/15
Diethylphthalate	84-66-2	81.9	209	81.9	U	ug/Kg	SW8270C	11/22/15

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Client Sample ID: **D4BDS01-001.31-01**

Project Name: Alaska LNG
Sample Date: 11/03/15
Sample Time: 11:00
Type: Grab
Matrix: Soil
Basis: Dry Weight

Lab Information

Lab Sample ID: **P358609**

Date Received: 11/07/15
Dilution Factor: 1
Report Revision No.: 0

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Semi-Volatiles								
3-Nitroaniline	99-09-2	81.9	209	81.9	U	ug/Kg	SW8270C	11/22/15
Fluorene	86-73-7	81.9	209	81.9	U	ug/Kg	SW8270C	11/22/15
4-Chlorophenyl phenyl ether	7005-72-3	81.9	209	81.9	U	ug/Kg	SW8270C	11/22/15
4-Nitroaniline	100-01-6	81.9	209	81.9	U	ug/Kg	SW8270C	11/22/15
4,6-Dinitro-2-methyl phenol	534-52-1	81.9	209	81.9	U	ug/Kg	SW8270C	11/22/15
N-Nitrosodiphenylamine	86-30-6	81.9	209	81.9	U	ug/Kg	SW8270C	11/22/15
1,2-Diphenylhydrazine	122-66-7	81.9	209	81.9	U	ug/Kg	SW8270C	11/22/15
4-Bromophenyl phenyl ether	101-55-3	81.9	209	81.9	U	ug/Kg	SW8270C	11/22/15
Hexachlorobenzene	118-74-1	81.9	209	81.9	U	ug/Kg	SW8270C	11/22/15
Pentachlorophenol	87-86-5	81.9	209	81.9	U	ug/Kg	SW8270C	11/22/15
Phenanthrene	85-01-8	81.9	209	81.9	U	ug/Kg	SW8270C	11/22/15
Anthracene	120-12-7	81.9	209	81.9	U	ug/Kg	SW8270C	11/22/15
Carbazole	86-74-8	81.9	209	81.9	U	ug/Kg	SW8270C	11/22/15
Di-n-butylphthalate	84-74-2	81.9	209	81.9	U	ug/Kg	SW8270C	11/22/15
Fluoranthene	206-44-0	81.9	209	81.9	U	ug/Kg	SW8270C	11/22/15
Pyrene	129-00-0	81.9	209	81.9	U	ug/Kg	SW8270C	11/22/15
Butylbenzylphthalate	85-68-7	81.9	209	81.9	U	ug/Kg	SW8270C	11/22/15
Benzo(a)anthracene	56-55-3	81.9	209	81.9	U	ug/Kg	SW8270C	11/22/15
3,3'-Dichlorobenzidine	91-94-1	81.9	209	81.9	U	ug/Kg	SW8270C	11/22/15
Chrysene	218-01-9	81.9	209	81.9	U	ug/Kg	SW8270C	11/22/15
bis(2-Ethylhexyl)phthalate	117-81-7	81.9	209	81.9	U	ug/Kg	SW8270C	11/22/15
Di-n-octylphthalate	117-84-0	81.9	209	81.9	U	ug/Kg	SW8270C	11/22/15
Benzo(b)fluoroanthene	205-99-2	81.9	209	81.9	U	ug/Kg	SW8270C	11/22/15
Benzo(k)fluoranthene	207-08-9	81.9	209	81.9	U	ug/Kg	SW8270C	11/22/15
Benzo(a)pyrene	50-32-8	81.9	209	81.9	U	ug/Kg	SW8270C	11/22/15
Indeno(1,2,3-c,d)pyrene	193-39-5	81.9	209	81.9	U	ug/Kg	SW8270C	11/22/15
Dibenzo(a,h)anthracene	53-70-3	81.9	209	81.9	U	ug/Kg	SW8270C	11/22/15
Benzo(g,h,i)perylene	191-24-2	81.9	209	81.9	U	ug/Kg	SW8270C	11/22/15

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information		Lab Information	
Client Sample ID:	**D4BDS01-001.31-01**	**Lab Sample ID:**	**P358609**
Project Name:	Alaska LNG	Date Received:	11/07/15
Sample Date:	11/03/15	Dilution Factor:	1
Sample Time:	11:00	Report Revision No.:	0
Type:	Grab		
Matrix:	Soil		
Basis:	Dry Weight		

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Semi-Volatiles								

Surrogate	% Recovery	Control Limits	Qualifier
2-Fluorophenol	48	25-121	
Phenol-d5	54	24-113	
Nitrobenzene-d5	52	23-120	
2-Fluorobiphenyl	57	30-115	
2,4,6-Tribromophenol	58	19-122	
Terphenyl-d14	76	18-137	

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Client Sample ID: **D5SD01-0404.9-03**

Project Name: Alaska LNG
Sample Date: 11/06/15
Sample Time: 14:45
Type: Grab
Matrix: Soil
Basis: Dry Weight

Lab Information

Lab Sample ID: **P358610**

Date Received: 11/07/15
Dilution Factor: 1
Report Revision No.: 0

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Semi-Volatiles								
N-Nitrosodimethylamine	62-75-9	80.7	206	80.7	U	ug/Kg	SW8270C	11/22/15
Pyridine	110-86-1	80.7	206	80.7	U	ug/Kg	SW8270C	11/22/15
Aniline	62-53-3	80.7	206	80.7	U	ug/Kg	SW8270C	11/22/15
Phenol	108-95-2	80.7	206	80.7	U	ug/Kg	SW8270C	11/22/15
bis(2-Chloroethyl)ether	111-44-4	80.7	206	80.7	U	ug/Kg	SW8270C	11/22/15
2-Chlorophenol	95-57-8	80.7	206	80.7	U	ug/Kg	SW8270C	11/22/15
1,3-Dichlorobenzene	541-73-1	80.7	206	80.7	U	ug/Kg	SW8270C	11/22/15
1,4-Dichlorobenzene	106-46-7	80.7	206	80.7	U	ug/Kg	SW8270C	11/22/15
Benzyl alcohol	100-51-6	80.7	206	80.7	U	ug/Kg	SW8270C	11/22/15
1,2-Dichlorobenzene	95-50-1	80.7	206	80.7	U	ug/Kg	SW8270C	11/22/15
2-Methylphenol	95-48-7	80.7	206	80.7	U	ug/Kg	SW8270C	11/22/15
bis(2-Chloroisopropyl)ether	108-60-1	80.7	206	80.7	U	ug/Kg	SW8270C	11/22/15
3-,4-Methylphenol	108-39-4/106	80.7	206	80.7	U	ug/Kg	SW8270C	11/22/15
N-Nitroso-di-n-propylamine	621-64-7	80.7	206	80.7	U	ug/Kg	SW8270C	11/22/15
Hexachloroethane	67-72-1	80.7	206	80.7	U	ug/Kg	SW8270C	11/22/15
Benzoic Acid	65-85-0	121	484	229	J	ug/Kg	SW8270C	11/22/15
Nitrobenzene	98-95-3	80.7	206	80.7	U	ug/Kg	SW8270C	11/22/15
Isophorone	78-59-1	80.7	206	80.7	U	ug/Kg	SW8270C	11/22/15
2-Nitrophenol	88-75-5	80.7	206	80.7	U	ug/Kg	SW8270C	11/22/15
2,4-Dimethylphenol	105-67-9	80.7	206	80.7	U	ug/Kg	SW8270C	11/22/15
bis(2-Chloroethoxy)methane	111-91-1	80.7	206	80.7	U	ug/Kg	SW8270C	11/22/15
2,4-Dichlorophenol	120-83-2	80.7	206	80.7	U	ug/Kg	SW8270C	11/22/15
1,2,4-Trichlorobenzene	120-82-1	80.7	206	80.7	U	ug/Kg	SW8270C	11/22/15
Naphthalene	91-20-3	80.7	206	80.7	U	ug/Kg	SW8270C	11/22/15
4-Chloroaniline	106-47-8	80.7	206	80.7	U	ug/Kg	SW8270C	11/22/15
Hexachlorobutadiene	87-68-3	80.7	206	80.7	U	ug/Kg	SW8270C	11/22/15
4-Chloro-3-methyl phenol	59-50-7	80.7	206	80.7	U	ug/Kg	SW8270C	11/22/15
2-Methylnaphthalene	91-57-6	80.7	206	80.7	U	ug/Kg	SW8270C	11/22/15
Hexachlorocyclopentadiene	77-47-4	80.7	206	80.7	U	ug/Kg	SW8270C	11/22/15
2,4,6-Trichlorophenol	88-06-2	80.7	206	80.7	U	ug/Kg	SW8270C	11/22/15
2,4,5-Trichlorophenol	95-95-4	80.7	206	80.7	U	ug/Kg	SW8270C	11/22/15
2-Chloronaphthalene	91-58-7	80.7	206	80.7	U	ug/Kg	SW8270C	11/22/15
2-Nitroaniline	88-74-4	80.7	206	80.7	U	ug/Kg	SW8270C	11/22/15
Dimethylphthalate	131-11-3	80.7	206	80.7	U	ug/Kg	SW8270C	11/22/15
Acenaphthylene	208-96-8	80.7	206	80.7	U	ug/Kg	SW8270C	11/22/15
2,6-Dinitrotoluene	606-20-2	80.7	206	80.7	U	ug/Kg	SW8270C	11/22/15
Acenaphthene	83-32-9	80.7	206	80.7	U	ug/Kg	SW8270C	11/22/15
2,4-Dinitrophenol	51-28-5	80.7	403	80.7	U	ug/Kg	SW8270C	11/22/15
4-Nitrophenol	100-02-7	80.7	206	80.7	U	ug/Kg	SW8270C	11/22/15
2,4-Dinitrotoluene	121-14-2	80.7	206	80.7	U	ug/Kg	SW8270C	11/22/15
Dibenzofuran	132-64-9	80.7	206	80.7	U	ug/Kg	SW8270C	11/22/15
Diethylphthalate	84-66-2	80.7	206	80.7	U	ug/Kg	SW8270C	11/22/15

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Client Sample ID: **D5SD01-0404.9-03**

Project Name: Alaska LNG
Sample Date: 11/06/15
Sample Time: 14:45
Type: Grab
Matrix: Soil
Basis: Dry Weight

Lab Information

Lab Sample ID: **P358610**

Date Received: 11/07/15
Dilution Factor: 1
Report Revision No.: 0

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Semi-Volatiles								
3-Nitroaniline	99-09-2	80.7	206	80.7	U	ug/Kg	SW8270C	11/22/15
Fluorene	86-73-7	80.7	206	80.7	U	ug/Kg	SW8270C	11/22/15
4-Chlorophenyl phenyl ether	7005-72-3	80.7	206	80.7	U	ug/Kg	SW8270C	11/22/15
4-Nitroaniline	100-01-6	80.7	206	80.7	U	ug/Kg	SW8270C	11/22/15
4,6-Dinitro-2-methyl phenol	534-52-1	80.7	206	80.7	U	ug/Kg	SW8270C	11/22/15
N-Nitrosodiphenylamine	86-30-6	80.7	206	80.7	U	ug/Kg	SW8270C	11/22/15
1,2-Diphenylhydrazine	122-66-7	80.7	206	80.7	U	ug/Kg	SW8270C	11/22/15
4-Bromophenyl phenyl ether	101-55-3	80.7	206	80.7	U	ug/Kg	SW8270C	11/22/15
Hexachlorobenzene	118-74-1	80.7	206	80.7	U	ug/Kg	SW8270C	11/22/15
Pentachlorophenol	87-86-5	80.7	206	80.7	U	ug/Kg	SW8270C	11/22/15
Phenanthrene	85-01-8	80.7	206	80.7	U	ug/Kg	SW8270C	11/22/15
Anthracene	120-12-7	80.7	206	80.7	U	ug/Kg	SW8270C	11/22/15
Carbazole	86-74-8	80.7	206	80.7	U	ug/Kg	SW8270C	11/22/15
Di-n-butylphthalate	84-74-2	80.7	206	80.7	U	ug/Kg	SW8270C	11/22/15
Fluoranthene	206-44-0	80.7	206	80.7	U	ug/Kg	SW8270C	11/22/15
Pyrene	129-00-0	80.7	206	80.7	U	ug/Kg	SW8270C	11/22/15
Butylbenzylphthalate	85-68-7	80.7	206	80.7	U	ug/Kg	SW8270C	11/22/15
Benzo(a)anthracene	56-55-3	80.7	206	80.7	U	ug/Kg	SW8270C	11/22/15
3,3'-Dichlorobenzidine	91-94-1	80.7	206	80.7	U	ug/Kg	SW8270C	11/22/15
Chrysene	218-01-9	80.7	206	80.7	U	ug/Kg	SW8270C	11/22/15
bis(2-Ethylhexyl)phthalate	117-81-7	80.7	206	80.7	U	ug/Kg	SW8270C	11/22/15
Di-n-octylphthalate	117-84-0	80.7	206	80.7	U	ug/Kg	SW8270C	11/22/15
Benzo(b)fluoroanthene	205-99-2	80.7	206	80.7	U	ug/Kg	SW8270C	11/22/15
Benzo(k)fluoranthene	207-08-9	80.7	206	80.7	U	ug/Kg	SW8270C	11/22/15
Benzo(a)pyrene	50-32-8	80.7	206	80.7	U	ug/Kg	SW8270C	11/22/15
Indeno(1,2,3-c,d)pyrene	193-39-5	80.7	206	80.7	U	ug/Kg	SW8270C	11/22/15
Dibenzo(a,h)anthracene	53-70-3	80.7	206	80.7	U	ug/Kg	SW8270C	11/22/15
Benzo(g,h,i)perylene	191-24-2	80.7	206	80.7	U	ug/Kg	SW8270C	11/22/15

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information		Lab Information	
Client Sample ID:	**D5SD01-0404.9-03**	**Lab Sample ID:**	**P358610**
Project Name:	Alaska LNG	Date Received:	11/07/15
Sample Date:	11/06/15	Dilution Factor:	1
Sample Time:	14:45	Report Revision No.:	0
Type:	Grab		
Matrix:	Soil		
Basis:	Dry Weight		

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Semi-Volatiles								

Surrogate	% Recovery	Control Limits	Qualifier
2-Fluorophenol	43	25-121	
Phenol-d5	49	24-113	
Nitrobenzene-d5	51	23-120	
2-Fluorobiphenyl	55	30-115	
2,4,6-Tribromophenol	48	19-122	
Terphenyl-d14	70	18-137	

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information		Lab Information	
Client Sample ID:	**SB2-1112**	**Lab Sample ID:**	**SB2-1112**
Project Name:	Alaska LNG	Date Received:	N/A
Sample Date:	N/A	Dilution Factor:	1
Sample Time:	N/A	Report Revision No.:	0
Type:	QC		
Matrix:	Soil		
Basis:	Dry Weight		

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Semi-Volatiles								
N-Nitrosodimethylamine	62-75-9	66.7	170	66.7	U	ug/Kg	SW8270C	11/19/15
Pyridine	110-86-1	66.7	170	66.7	U	ug/Kg	SW8270C	11/19/15
Aniline	62-53-3	66.7	170	66.7	U	ug/Kg	SW8270C	11/19/15
Phenol	108-95-2	66.7	170	66.7	U	ug/Kg	SW8270C	11/19/15
bis(2-Chloroethyl)ether	111-44-4	66.7	170	66.7	U	ug/Kg	SW8270C	11/19/15
2-Chlorophenol	95-57-8	66.7	170	66.7	U	ug/Kg	SW8270C	11/19/15
1,3-Dichlorobenzene	541-73-1	66.7	170	66.7	U	ug/Kg	SW8270C	11/19/15
1,4-Dichlorobenzene	106-46-7	66.7	170	66.7	U	ug/Kg	SW8270C	11/19/15
Benzyl alcohol	100-51-6	66.7	170	66.7	U	ug/Kg	SW8270C	11/19/15
1,2-Dichlorobenzene	95-50-1	66.7	170	66.7	U	ug/Kg	SW8270C	11/19/15
2-Methylphenol	95-48-7	66.7	170	66.7	U	ug/Kg	SW8270C	11/19/15
bis(2-Chloroisopropyl)ether	108-60-1	66.7	170	66.7	U	ug/Kg	SW8270C	11/19/15
3-,4-Methylphenol	108-39-4/106	66.7	170	66.7	U	ug/Kg	SW8270C	11/19/15
N-Nitroso-di-n-propylamine	621-64-7	66.7	170	66.7	U	ug/Kg	SW8270C	11/19/15
Hexachloroethane	67-72-1	66.7	170	66.7	U	ug/Kg	SW8270C	11/19/15
Benzoic Acid	65-85-0	100	400	100	U	ug/Kg	SW8270C	11/19/15
Nitrobenzene	98-95-3	66.7	170	66.7	U	ug/Kg	SW8270C	11/19/15
Isophorone	78-59-1	66.7	170	66.7	U	ug/Kg	SW8270C	11/19/15
2-Nitrophenol	88-75-5	66.7	170	66.7	U	ug/Kg	SW8270C	11/19/15
2,4-Dimethylphenol	105-67-9	66.7	170	66.7	U	ug/Kg	SW8270C	11/19/15
bis(2-Chloroethoxy)methane	111-91-1	66.7	170	66.7	U	ug/Kg	SW8270C	11/19/15
2,4-Dichlorophenol	120-83-2	66.7	170	66.7	U	ug/Kg	SW8270C	11/19/15
1,2,4-Trichlorobenzene	120-82-1	66.7	170	66.7	U	ug/Kg	SW8270C	11/19/15
Naphthalene	91-20-3	66.7	170	66.7	U	ug/Kg	SW8270C	11/19/15
4-Chloroaniline	106-47-8	66.7	170	66.7	U	ug/Kg	SW8270C	11/19/15
Hexachlorobutadiene	87-68-3	66.7	170	66.7	U	ug/Kg	SW8270C	11/19/15
4-Chloro-3-methyl phenol	59-50-7	66.7	170	66.7	U	ug/Kg	SW8270C	11/19/15
2-Methylnaphthalene	91-57-6	66.7	170	66.7	U	ug/Kg	SW8270C	11/19/15
Hexachlorocyclopentadiene	77-47-4	66.7	170	66.7	U	ug/Kg	SW8270C	11/19/15
2,4,6-Trichlorophenol	88-06-2	66.7	170	66.7	U	ug/Kg	SW8270C	11/19/15
2,4,5-Trichlorophenol	95-95-4	66.7	170	66.7	U	ug/Kg	SW8270C	11/19/15
2-Chloronaphthalene	91-58-7	66.7	170	66.7	U	ug/Kg	SW8270C	11/19/15
2-Nitroaniline	88-74-4	66.7	170	66.7	U	ug/Kg	SW8270C	11/19/15
Dimethylphthalate	131-11-3	66.7	170	66.7	U	ug/Kg	SW8270C	11/19/15
Acenaphthylene	208-96-8	66.7	170	66.7	U	ug/Kg	SW8270C	11/19/15
2,6-Dinitrotoluene	606-20-2	66.7	170	66.7	U	ug/Kg	SW8270C	11/19/15
Acenaphthene	83-32-9	66.7	170	66.7	U	ug/Kg	SW8270C	11/19/15
2,4-Dinitrophenol	51-28-5	66.7	333	66.7	U	ug/Kg	SW8270C	11/19/15
4-Nitrophenol	100-02-7	66.7	170	66.7	U	ug/Kg	SW8270C	11/19/15
2,4-Dinitrotoluene	121-14-2	66.7	170	66.7	U	ug/Kg	SW8270C	11/19/15
Dibenzofuran	132-64-9	66.7	170	66.7	U	ug/Kg	SW8270C	11/19/15
Diethylphthalate	84-66-2	66.7	170	66.7	U	ug/Kg	SW8270C	11/19/15

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information		Lab Information	
Client Sample ID:	**SB2-1112**	**Lab Sample ID:**	**SB2-1112**
Project Name:	Alaska LNG	Date Received:	N/A
Sample Date:	N/A	Dilution Factor:	1
Sample Time:	N/A	Report Revision No.:	0
Type:	QC		
Matrix:	Soil		
Basis:	Dry Weight		

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Semi-Volatiles								
3-Nitroaniline	99-09-2	66.7	170	66.7	U	ug/Kg	SW8270C	11/19/15
Fluorene	86-73-7	66.7	170	66.7	U	ug/Kg	SW8270C	11/19/15
4-Chlorophenyl phenyl ether	7005-72-3	66.7	170	66.7	U	ug/Kg	SW8270C	11/19/15
4-Nitroaniline	100-01-6	66.7	170	66.7	U	ug/Kg	SW8270C	11/19/15
4,6-Dinitro-2-methyl phenol	534-52-1	66.7	170	66.7	U	ug/Kg	SW8270C	11/19/15
N-Nitrosodiphenylamine	86-30-6	66.7	170	66.7	U	ug/Kg	SW8270C	11/19/15
1,2-Diphenylhydrazine	122-66-7	66.7	170	66.7	U	ug/Kg	SW8270C	11/19/15
4-Bromophenyl phenyl ether	101-55-3	66.7	170	66.7	U	ug/Kg	SW8270C	11/19/15
Hexachlorobenzene	118-74-1	66.7	170	66.7	U	ug/Kg	SW8270C	11/19/15
Pentachlorophenol	87-86-5	66.7	170	66.7	U	ug/Kg	SW8270C	11/19/15
Phenanthrene	85-01-8	66.7	170	66.7	U	ug/Kg	SW8270C	11/19/15
Anthracene	120-12-7	66.7	170	66.7	U	ug/Kg	SW8270C	11/19/15
Carbazole	86-74-8	66.7	170	66.7	U	ug/Kg	SW8270C	11/19/15
Di-n-butylphthalate	84-74-2	66.7	170	66.7	U	ug/Kg	SW8270C	11/19/15
Fluoranthene	206-44-0	66.7	170	66.7	U	ug/Kg	SW8270C	11/19/15
Pyrene	129-00-0	66.7	170	66.7	U	ug/Kg	SW8270C	11/19/15
Butylbenzylphthalate	85-68-7	66.7	170	66.7	U	ug/Kg	SW8270C	11/19/15
Benzo(a)anthracene	56-55-3	66.7	170	66.7	U	ug/Kg	SW8270C	11/19/15
3,3'-Dichlorobenzidine	91-94-1	66.7	170	66.7	U	ug/Kg	SW8270C	11/19/15
Chrysene	218-01-9	66.7	170	66.7	U	ug/Kg	SW8270C	11/19/15
bis(2-Ethylhexyl)phthalate	117-81-7	66.7	170	66.7	U	ug/Kg	SW8270C	11/19/15
Di-n-octylphthalate	117-84-0	66.7	170	66.7	U	ug/Kg	SW8270C	11/19/15
Benzo(b)fluoroanthene	205-99-2	66.7	170	66.7	U	ug/Kg	SW8270C	11/19/15
Benzo(k)fluoranthene	207-08-9	66.7	170	66.7	U	ug/Kg	SW8270C	11/19/15
Benzo(a)pyrene	50-32-8	66.7	170	66.7	U	ug/Kg	SW8270C	11/19/15
Indeno(1,2,3-c,d)pyrene	193-39-5	66.7	170	66.7	U	ug/Kg	SW8270C	11/19/15
Dibenzo(a,h)anthracene	53-70-3	66.7	170	66.7	U	ug/Kg	SW8270C	11/19/15
Benzo(g,h,i)perylene	191-24-2	66.7	170	66.7	U	ug/Kg	SW8270C	11/19/15

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information		Lab Information	
Client Sample ID:	**SB2-1112**	**Lab Sample ID:**	**SB2-1112**
Project Name:	Alaska LNG	Date Received:	N/A
Sample Date:	N/A	Dilution Factor:	1
Sample Time:	N/A	Report Revision No.:	0
Type:	QC		
Matrix:	Soil		
Basis:	Dry Weight		

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC/MS Semi-Volatiles								

Surrogate	% Recovery	Control Limits	Qualifier
2-Fluorophenol	51	25-121	
Phenol-d5	56	24-113	
Nitrobenzene-d5	56	23-120	
2-Fluorobiphenyl	65	30-115	
2,4,6-Tribromophenol	57	19-122	
Terphenyl-d14	81	18-137	

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Project Name: Alaska LNG
Type: QC
Matrix: Soil

Lab Information

LCS ID: BS2S1112

Report Revision No.: 0
Dilution Factor: 1

Analyte	CAS#	Spike Amount	Sample Result	Units	%Recovery	Analysis Method	Date Analyzed
GC/MS Semi-Volatiles							
N-Nitrosodimethylamine	62-75-9	2670	1330	ug/Kg	50	SW8270C	11/19/15
Pyridine	110-86-1	2670	1160	ug/Kg	44	SW8270C	11/19/15
Aniline	62-53-3	2670	1380	ug/Kg	52	SW8270C	11/19/15
Phenol	108-95-2	2670	1430	ug/Kg	54	SW8270C	11/19/15
bis(2-Chloroethyl)ether	111-44-4	2670	1470	ug/Kg	55	SW8270C	11/19/15
2-Chlorophenol	95-57-8	2670	1380	ug/Kg	52	SW8270C	11/19/15
1,3-Dichlorobenzene	541-73-1	2670	1300	ug/Kg	49	SW8270C	11/19/15
1,4-Dichlorobenzene	106-46-7	2670	1320	ug/Kg	50	SW8270C	11/19/15
Benzyl alcohol	100-51-6	2670	1560	ug/Kg	58	SW8270C	11/19/15
1,2-Dichlorobenzene	95-50-1	2670	1360	ug/Kg	51	SW8270C	11/19/15
2-Methylphenol	95-48-7	2670	1500	ug/Kg	56	SW8270C	11/19/15
bis(2-Chloroisopropyl)ether	108-60-1	2670	1460	ug/Kg	55	SW8270C	11/19/15
3-,4-Methylphenol	108-39-4/106	2670	1540	ug/Kg	58	SW8270C	11/19/15
N-Nitroso-di-n-propylamine	621-64-7	2670	1610	ug/Kg	60	SW8270C	11/19/15
Hexachloroethane	67-72-1	2670	1310	ug/Kg	49	SW8270C	11/19/15
Benzoic Acid	65-85-0	2670	1650	ug/Kg	62	SW8270C	11/19/15
Nitrobenzene	98-95-3	2670	1550	ug/Kg	58	SW8270C	11/19/15
Isophorone	78-59-1	2670	1620	ug/Kg	61	SW8270C	11/19/15
2-Nitrophenol	88-75-5	2670	1570	ug/Kg	59	SW8270C	11/19/15
2,4-Dimethylphenol	105-67-9	2670	1510	ug/Kg	57	SW8270C	11/19/15
bis(2-Chloroethoxy)methane	111-91-1	2670	1590	ug/Kg	60	SW8270C	11/19/15
2,4-Dichlorophenol	120-83-2	2670	1550	ug/Kg	58	SW8270C	11/19/15
1,2,4-Trichlorobenzene	120-82-1	2670	1500	ug/Kg	56	SW8270C	11/19/15
Naphthalene	91-20-3	2670	1550	ug/Kg	58	SW8270C	11/19/15
4-Chloroaniline	106-47-8	2670	1610	ug/Kg	60	SW8270C	11/19/15
Hexachlorobutadiene	87-68-3	2670	1480	ug/Kg	55	SW8270C	11/19/15
4-Chloro-3-methyl phenol	59-50-7	2670	1660	ug/Kg	62	SW8270C	11/19/15
2-Methylnaphthalene	91-57-6	2670	1600	ug/Kg	60	SW8270C	11/19/15
Hexachlorocyclopentadiene	77-47-4	2670	1270	ug/Kg	48	SW8270C	11/19/15
2,4,6-Trichlorophenol	88-06-2	2670	1680	ug/Kg	63	SW8270C	11/19/15
2,4,5-Trichlorophenol	95-95-4	2670	1680	ug/Kg	63	SW8270C	11/19/15
2-Chloronaphthalene	91-58-7	2670	1670	ug/Kg	63	SW8270C	11/19/15
2-Nitroaniline	88-74-4	2670	1730	ug/Kg	65	SW8270C	11/19/15
Dimethylphthalate	131-11-3	2670	1720	ug/Kg	65	SW8270C	11/19/15
Acenaphthylene	208-96-8	2670	1630	ug/Kg	61	SW8270C	11/19/15
2,6-Dinitrotoluene	606-20-2	2670	1750	ug/Kg	66	SW8270C	11/19/15
Acenaphthene	83-32-9	2670	1710	ug/Kg	64	SW8270C	11/19/15
2,4-Dinitrophenol	51-28-5	2670	1680	ug/Kg	63	SW8270C	11/19/15
4-Nitrophenol	100-02-7	2670	1770	ug/Kg	67	SW8270C	11/19/15
2,4-Dinitrotoluene	121-14-2	2670	1790	ug/Kg	67	SW8270C	11/19/15
Dibenzofuran	132-64-9	2670	1690	ug/Kg	63	SW8270C	11/19/15
Diethylphthalate	84-66-2	2670	1720	ug/Kg	65	SW8270C	11/19/15

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Project Name: Alaska LNG
Type: QC
Matrix: Soil

Lab Information

LCS ID: BS2S1112

Report Revision No.: 0
Dilution Factor: 1

Analyte	CAS#	Spike Amount	Sample Result	Units	%Recovery	Analysis Method	Date Analyzed
GC/MS Semi-Volatiles							
3-Nitroaniline	99-09-2	2670	1710	ug/Kg	64	SW8270C	11/19/15
Fluorene	86-73-7	2670	1760	ug/Kg	66	SW8270C	11/19/15
4-Chlorophenyl phenyl ether	7005-72-3	2670	1760	ug/Kg	66	SW8270C	11/19/15
4-Nitroaniline	100-01-6	2670	1820	ug/Kg	68	SW8270C	11/19/15
4,6-Dinitro-2-methyl phenol	534-52-1	2670	1610	ug/Kg	60	SW8270C	11/19/15
N-Nitrosodiphenylamine	86-30-6	2670	1710	ug/Kg	64	SW8270C	11/19/15
1,2-Diphenylhydrazine	122-66-7	2670	1720	ug/Kg	65	SW8270C	11/19/15
4-Bromophenyl phenyl ether	101-55-3	2670	1720	ug/Kg	64	SW8270C	11/19/15
Hexachlorobenzene	118-74-1	2670	1740	ug/Kg	65	SW8270C	11/19/15
Pentachlorophenol	87-86-5	2670	1710	ug/Kg	64	SW8270C	11/19/15
Phenanthrene	85-01-8	2670	1730	ug/Kg	65	SW8270C	11/19/15
Anthracene	120-12-7	2670	1720	ug/Kg	64	SW8270C	11/19/15
Carbazole	86-74-8	2670	1750	ug/Kg	66	SW8270C	11/19/15
Di-n-butylphthalate	84-74-2	2670	1750	ug/Kg	66	SW8270C	11/19/15
Fluoranthene	206-44-0	2670	1780	ug/Kg	67	SW8270C	11/19/15
Pyrene	129-00-0	2670	1750	ug/Kg	66	SW8270C	11/19/15
Butylbenzylphthalate	85-68-7	2670	1720	ug/Kg	65	SW8270C	11/19/15
Benzo(a)anthracene	56-55-3	2670	1740	ug/Kg	65	SW8270C	11/19/15
3,3'-Dichlorobenzidine	91-94-1	2670	1800	ug/Kg	68	SW8270C	11/19/15
Chrysene	218-01-9	2670	1770	ug/Kg	66	SW8270C	11/19/15
bis(2-Ethylhexyl)phthalate	117-81-7	2670	1750	ug/Kg	66	SW8270C	11/19/15
Di-n-octylphthalate	117-84-0	2670	1710	ug/Kg	64	SW8270C	11/19/15
Benzo(b)fluoroanthene	205-99-2	2670	1710	ug/Kg	64	SW8270C	11/19/15
Benzo(k)fluoranthene	207-08-9	2670	1760	ug/Kg	66	SW8270C	11/19/15
Benzo(a)pyrene	50-32-8	2670	1710	ug/Kg	64	SW8270C	11/19/15
Indeno(1,2,3-c,d)pyrene	193-39-5	2670	1760	ug/Kg	66	SW8270C	11/19/15
Dibenzo(a,h)anthracene	53-70-3	2670	1790	ug/Kg	67	SW8270C	11/19/15
Benzo(g,h,i)perylene	191-24-2	2670	1740	ug/Kg	65	SW8270C	11/19/15

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information		Lab Information	
		LCS ID:	BS2S1112
Project Name:	Alaska LNG	Report Revision No.:	0
Type:	QC	Dilution Factor:	1
Matrix:	Soil		

Analyte	CAS#	Spike Amount	Sample Result	Units	%Recovery	Analysis Method	Date Analyzed
GC/MS Semi-Volatiles							

Surrogate	% Recovery	Control Limits	Qualifier
2-Fluorophenol	43	25-121	
Phenol-d5	53	24-113	
Nitrobenzene-d5	55	23-120	
2-Fluorobiphenyl	64	30-115	
2,4,6-Tribromophenol	64	19-122	
Terphenyl-d14	75	18-137	

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Project Name: Alaska LNG
Type: QC
Matrix: Water

Lab Information

LCS ID: BS1W1109

Report Revision No.: 0
Dilution Factor: 1

Analyte	CAS#	Spike Amount	Sample Result	Units	%Recovery	Analysis Method	Date Analyzed
GC/MS Semi-Volatiles							
N-Nitrosodimethylamine	62-75-9	80.0	31.7	ug/L	40	SW8270C	11/19/15
Pyridine	110-86-1	80.0	29.1	ug/L	36	SW8270C	11/19/15
Aniline	62-53-3	80.0	44.9	ug/L	56	SW8270C	11/19/15
Phenol	108-95-2	80.0	23.8	ug/L	30	SW8270C	11/19/15
bis(2-Chloroethyl)ether	111-44-4	80.0	48.9	ug/L	61	SW8270C	11/19/15
2-Chlorophenol	95-57-8	80.0	45.7	ug/L	57	SW8270C	11/19/15
1,3-Dichlorobenzene	541-73-1	80.0	32.3	ug/L	40	SW8270C	11/19/15
1,4-Dichlorobenzene	106-46-7	80.0	33.9	ug/L	42	SW8270C	11/19/15
Benzyl alcohol	100-51-6	80.0	48.2	ug/L	60	SW8270C	11/19/15
1,2-Dichlorobenzene	95-50-1	80.0	37.0	ug/L	46	SW8270C	11/19/15
2-Methylphenol	95-48-7	80.0	46.6	ug/L	58	SW8270C	11/19/15
bis(2-Chloroisopropyl)ether	108-60-1	80.0	49.0	ug/L	61	SW8270C	11/19/15
3-,4-Methylphenol	108-39-4/106	80.0	45.2	ug/L	56	SW8270C	11/19/15
N-Nitroso-di-n-propylamine	621-64-7	80.0	54.5	ug/L	68	SW8270C	11/19/15
Hexachloroethane	67-72-1	80.0	24.6	ug/L	31	SW8270C	11/19/15
Benzoic Acid	65-85-0	80.0	36.1	ug/L	45	SW8270C	11/19/15
Nitrobenzene	98-95-3	80.0	50.8	ug/L	63	SW8270C	11/19/15
Isophorone	78-59-1	80.0	54.4	ug/L	68	SW8270C	11/19/15
2-Nitrophenol	88-75-5	80.0	50.8	ug/L	63	SW8270C	11/19/15
2,4-Dimethylphenol	105-67-9	80.0	41.5	ug/L	52	SW8270C	11/19/15
bis(2-Chloroethoxy)methane	111-91-1	80.0	52.1	ug/L	65	SW8270C	11/19/15
2,4-Dichlorophenol	120-83-2	80.0	50.4	ug/L	63	SW8270C	11/19/15
1,2,4-Trichlorobenzene	120-82-1	80.0	39.2	ug/L	49	SW8270C	11/19/15
Naphthalene	91-20-3	80.0	47.3	ug/L	59	SW8270C	11/19/15
4-Chloroaniline	106-47-8	80.0	49.9	ug/L	62	SW8270C	11/19/15
Hexachlorobutadiene	87-68-3	80.0	23.3	ug/L	29 *	SW8270C	11/19/15
4-Chloro-3-methyl phenol	59-50-7	80.0	55.9	ug/L	70	SW8270C	11/19/15
2-Methylnaphthalene	91-57-6	80.0	48.6	ug/L	61	SW8270C	11/19/15
Hexachlorocyclopentadiene	77-47-4	80.0	14.5	ug/L	18 *	SW8270C	11/19/15
2,4,6-Trichlorophenol	88-06-2	80.0	55.1	ug/L	69	SW8270C	11/19/15
2,4,5-Trichlorophenol	95-95-4	80.0	55.3	ug/L	69	SW8270C	11/19/15
2-Chloronaphthalene	91-58-7	80.0	51.2	ug/L	64	SW8270C	11/19/15
2-Nitroaniline	88-74-4	80.0	58.1	ug/L	73	SW8270C	11/19/15
Dimethylphthalate	131-11-3	80.0	58.3	ug/L	73	SW8270C	11/19/15
Acenaphthylene	208-96-8	80.0	51.7	ug/L	65	SW8270C	11/19/15
2,6-Dinitrotoluene	606-20-2	80.0	58.4	ug/L	73	SW8270C	11/19/15
Acenaphthene	83-32-9	80.0	54.5	ug/L	68	SW8270C	11/19/15
2,4-Dinitrophenol	51-28-5	80.0	57.7	ug/L	72	SW8270C	11/19/15
4-Nitrophenol	100-02-7	80.0	27.4	ug/L	34	SW8270C	11/19/15
2,4-Dinitrotoluene	121-14-2	80.0	59.8	ug/L	75	SW8270C	11/19/15
Dibenzofuran	132-64-9	80.0	54.7	ug/L	68	SW8270C	11/19/15
Diethylphthalate	84-66-2	80.0	58.7	ug/L	73	SW8270C	11/19/15

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Project Name: Alaska LNG
Type: QC
Matrix: Water

Lab Information

LCS ID: BS1W1109

Report Revision No.: 0
Dilution Factor: 1

Analyte	CAS#	Spike Amount	Sample Result	Units	%Recovery	Analysis Method	Date Analyzed
GC/MS Semi-Volatiles							
3-Nitroaniline	99-09-2	80.0	56.8	ug/L	71	SW8270C	11/19/15
Fluorene	86-73-7	80.0	57.6	ug/L	72	SW8270C	11/19/15
4-Chlorophenyl phenyl ether	7005-72-3	80.0	56.6	ug/L	71	SW8270C	11/19/15
4-Nitroaniline	100-01-6	80.0	61.0	ug/L	76	SW8270C	11/19/15
4,6-Dinitro-2-methyl phenol	534-52-1	80.0	54.3	ug/L	68	SW8270C	11/19/15
N-Nitrosodiphenylamine	86-30-6	80.0	55.2	ug/L	69	SW8270C	11/19/15
1,2-Diphenylhydrazine	122-66-7	80.0	58.0	ug/L	73	SW8270C	11/19/15
4-Bromophenyl phenyl ether	101-55-3	80.0	56.3	ug/L	70	SW8270C	11/19/15
Hexachlorobenzene	118-74-1	80.0	57.2	ug/L	72	SW8270C	11/19/15
Pentachlorophenol	87-86-5	80.0	57.5	ug/L	72	SW8270C	11/19/15
Phenanthrene	85-01-8	80.0	57.5	ug/L	72	SW8270C	11/19/15
Anthracene	120-12-7	80.0	56.0	ug/L	70	SW8270C	11/19/15
Carbazole	86-74-8	80.0	58.5	ug/L	73	SW8270C	11/19/15
Di-n-butylphthalate	84-74-2	80.0	59.4	ug/L	74	SW8270C	11/19/15
Fluoranthene	206-44-0	80.0	58.4	ug/L	73	SW8270C	11/19/15
Pyrene	129-00-0	80.0	58.1	ug/L	73	SW8270C	11/19/15
Butylbenzylphthalate	85-68-7	80.0	59.2	ug/L	74	SW8270C	11/19/15
Benzo(a)anthracene	56-55-3	80.0	58.3	ug/L	73	SW8270C	11/19/15
3,3'-Dichlorobenzidine	91-94-1	80.0	57.3	ug/L	72	SW8270C	11/19/15
Chrysene	218-01-9	80.0	60.0	ug/L	75	SW8270C	11/19/15
bis(2-Ethylhexyl)phthalate	117-81-7	80.0	60.3	ug/L	75	SW8270C	11/19/15
Di-n-octylphthalate	117-84-0	80.0	24.2	ug/L	30	SW8270C	11/19/15
Benzo(b)fluoroanthene	205-99-2	80.0	24.4	ug/L	31	SW8270C	11/19/15
Benzo(k)fluoranthene	207-08-9	80.0	23.9	ug/L	30	SW8270C	11/19/15
Benzo(a)pyrene	50-32-8	80.0	22.2	ug/L	28 *	SW8270C	11/19/15
Indeno(1,2,3-c,d)pyrene	193-39-5	80.0	24.1	ug/L	30	SW8270C	11/19/15
Dibenzo(a,h)anthracene	53-70-3	80.0	24.5	ug/L	31	SW8270C	11/19/15
Benzo(g,h,i)perylene	191-24-2	80.0	23.8	ug/L	30	SW8270C	11/19/15

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information		Lab Information	
		LCS ID:	BS1W1109
Project Name:	Alaska LNG	Report Revision No.:	0
Type:	QC	Dilution Factor:	1
Matrix:	Water		

Analyte	CAS#	Spike Amount	Sample Result	Units	%Recovery	Analysis Method	Date Analyzed
GC/MS Semi-Volatiles							

Surrogate	% Recovery	Control Limits	Qualifier
2-Fluorophenol	39	21-115	
Phenol-d5	31	5-115	
Nitrobenzene-d5	64	35-114	
2-Fluorobiphenyl	57	43-116	
2,4,6-Tribromophenol	77	5-123	
Terphenyl-d14	85	33-141	

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Client Sample ID: **D4SD04-0.503-01**

Project Name: Alaska LNG
Type: QC
Matrix: Soil

Lab Information

Report Revision No.: 0

Analyte	CAS#	MS %Recovery	MSD %Recovery	RPD	QC Limits	RPD Limits	Analysis Method
GC/MS							
N-Nitrosodimethylamine	62-75-9	49	56	12.6	30-110	50	SW8270C
Pyridine	110-86-1	43	49	12.9	30-110	50	SW8270C
Aniline	62-53-3	45	50	10.8	30-110	50	SW8270C
Phenol	108-95-2	52	61	15.3	20-120	50	SW8270C
bis(2-Chloroethyl)ether	111-44-4	53	62	13.6	30-110	50	SW8270C
2-Chlorophenol	95-57-8	49	57	13.7	20-120	50	SW8270C
1,3-Dichlorobenzene	541-73-1	45	52	13.3	30-110	50	SW8270C
1,4-Dichlorobenzene	106-46-7	46	53	13.9	30-110	50	SW8270C
Benzyl alcohol	100-51-6	54	63	14.0	30-110	50	SW8270C
1,2-Dichlorobenzene	95-50-1	47	55	14.5	30-110	50	SW8270C
2-Methylphenol	95-48-7	54	63	14.3	30-110	50	SW8270C
bis(2-Chloroisopropyl)ether	108-60-1	55	64	14.1	30-110	50	SW8270C
3-,4-Methylphenol	108-39-4/106	56	66	16.0	20-120	50	SW8270C
N-Nitroso-di-n-propylamine	621-64-7	59	68	12.5	30-110	50	SW8270C
Hexachloroethane	67-72-1	47	54	14.3	30-110	50	SW8270C
Benzoic Acid	65-85-0	21 *	17 *	18.5	30-110	50	SW8270C
Nitrobenzene	98-95-3	55	63	12.7	30-110	50	SW8270C
Isophorone	78-59-1	59	69	14.2	30-110	50	SW8270C
2-Nitrophenol	88-75-5	54	64	15.4	20-120	50	SW8270C
2,4-Dimethylphenol	105-67-9	55	63	13.7	20-120	50	SW8270C
bis(2-Chloroethoxy)methane	111-91-1	56	65	13.3	30-110	50	SW8270C
2,4-Dichlorophenol	120-83-2	52	61	14.8	20-120	50	SW8270C
1,2,4-Trichlorobenzene	120-82-1	50	58	14.4	30-110	50	SW8270C
Naphthalene	91-20-3	54	63	13.8	30-110	50	SW8270C
4-Chloroaniline	106-47-8	54	60	8.50	30-110	50	SW8270C
Hexachlorobutadiene	87-68-3	49	57	14.7	30-110	50	SW8270C
4-Chloro-3-methyl phenol	59-50-7	61	69	12.2	20-120	50	SW8270C
2-Methylnaphthalene	91-57-6	55	64	12.4	30-110	50	SW8270C
Hexachlorocyclopentadiene	77-47-4	35	47	27.8	20-120	50	SW8270C
2,4,6-Trichlorophenol	88-06-2	59	68	12.2	20-120	50	SW8270C
2,4,5-Trichlorophenol	95-95-4	59	66	11.0	20-120	50	SW8270C
2-Chloronaphthalene	91-58-7	59	68	11.8	30-110	50	SW8270C
2-Nitroaniline	88-74-4	64	73	11.7	30-110	50	SW8270C
Dimethylphthalate	131-11-3	62	72	12.7	30-110	50	SW8270C
Acenaphthylene	208-96-8	58	68	13.5	30-110	50	SW8270C
2,6-Dinitrotoluene	606-20-2	63	72	12.1	30-110	50	SW8270C
Acenaphthene	83-32-9	61	70	12.2	30-110	50	SW8270C
2,4-Dinitrophenol	51-28-5	32	32	0.70	20-120	50	SW8270C
4-Nitrophenol	100-02-7	61	69	10.5	20-120	50	SW8270C
2,4-Dinitrotoluene	121-14-2	64	73	12.1	30-110	50	SW8270C
Dibenzofuran	132-64-9	60	68	11.3	30-110	50	SW8270C
Diethylphthalate	84-66-2	64	72	10.8	30-110	50	SW8270C
3-Nitroaniline	99-09-2	62	70	10.0	30-110	50	SW8270C

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Client Sample ID: **D4SD04-0.503-01**

Project Name: Alaska LNG
Type: QC
Matrix: Soil

Lab Information

Report Revision No.: 0

Analyte	CAS#	MS %Recovery	MSD %Recovery	RPD	QC Limits	RPD Limits	Analysis Method
GC/MS							
Fluorene	86-73-7	63	73	13.0	30-110	50	SW8270C
4-Chlorophenyl phenyl ether	7005-72-3	62	71	11.9	30-110	50	SW8270C
4-Nitroaniline	100-01-6	67	75	10.5	30-110	50	SW8270C
4,6-Dinitro-2-methyl phenol	534-52-1	51	57	9.63	20-120	50	SW8270C
N-Nitrosodiphenylamine	86-30-6	63	72	12.8	30-110	50	SW8270C
1,2-Diphenylhydrazine	122-66-7	68	77	11.4	30-110	50	SW8270C
4-Bromophenyl phenyl ether	101-55-3	61	71	13.9	30-110	50	SW8270C
Hexachlorobenzene	118-74-1	61	71	14.2	30-110	50	SW8270C
Pentachlorophenol	87-86-5	52	56	7.22	20-120	50	SW8270C
Phenanthrene	85-01-8	63	72	12.4	30-110	50	SW8270C
Anthracene	120-12-7	62	71	13.0	30-110	50	SW8270C
Carbazole	86-74-8	63	73	12.4	30-110	50	SW8270C
Di-n-butylphthalate	84-74-2	67	76	11.6	30-110	50	SW8270C
Fluoranthene	206-44-0	62	71	12.5	30-110	50	SW8270C
Pyrene	129-00-0	65	74	11.9	30-110	50	SW8270C
Butylbenzylphthalate	85-68-7	68	78	11.6	30-110	50	SW8270C
Benzo(a)anthracene	56-55-3	63	72	11.1	30-110	50	SW8270C
3,3'-Dichlorobenzidine	91-94-1	65	69	5.38	30-110	50	SW8270C
Chrysene	218-01-9	65	75	12.7	30-110	50	SW8270C
bis(2-Ethylhexyl)phthalate	117-81-7	69	80	12.3	30-110	50	SW8270C
Di-n-octylphthalate	117-84-0	80	92	12.1	30-110	50	SW8270C
Benzo(b)fluoroanthene	205-99-2	73	83	11.6	30-110	50	SW8270C
Benzo(k)fluoranthene	207-08-9	74	86	14.3	30-110	50	SW8270C
Benzo(a)pyrene	50-32-8	72	83	13.5	30-110	50	SW8270C
Indeno(1,2,3-c,d)pyrene	193-39-5	73	85	13.9	30-110	50	SW8270C
Dibenzo(a,h)anthracene	53-70-3	75	86	12.6	30-110	50	SW8270C
Benzo(g,h,i)perylene	191-24-2	72	83	12.8	30-110	50	SW8270C

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

1100 NE Circle Blvd., Suite 300
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CASE NARRATIVE
PCB AROCLORS ANALYSIS

Lab Name: CH2M HILL ASL **ASL SDG#:** P3586

Project: Alaska LNG **Project #:** 653488.16.06

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

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

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

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

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

Method(s):
SW8082: SW3550, SW3510

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Client Sample ID: **EB110615-01**

Project Name: Alaska LNG
Sample Date: 11/06/15
Sample Time: 15:45
Type: Grab
Matrix: Water

Lab Information

Lab Sample ID: **P358613**

Date Received: 11/07/15
Dilution Factor: 1
Report Revision No.: 0

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC Semi-Volatiles								
Aroclor-1016	12674-11-2	0.020	0.049	0.020	U	ug/L	SW8082	11/16/15
Aroclor-1260	11096-82-5	0.020	0.049	0.020	U	ug/L	SW8082	11/16/15
Aroclor-1221	11104-28-2	0.020	0.049	0.020	U	ug/L	SW8082	11/16/15
Aroclor-1232	11141-16-5	0.020	0.049	0.020	U	ug/L	SW8082	11/16/15
Aroclor-1242	53469-21-9	0.020	0.049	0.020	U	ug/L	SW8082	11/16/15
Aroclor-1248	12672-29-6	0.020	0.049	0.020	U	ug/L	SW8082	11/16/15
Aroclor-1254	11097-69-1	0.020	0.049	0.020	U	ug/L	SW8082	11/16/15

Surrogate	% Recovery	Control Limits	Qualifier
DCBP	96	34-133	

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Client Sample ID: **WB2-1113**

Project Name: Alaska LNG
Sample Date: N/A
Sample Time: N/A
Type: QC
Matrix: Water

Lab Information

Lab Sample ID: **WB2-1113**

Date Received: N/A
Dilution Factor: 1
Report Revision No.: 0

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC Semi-Volatiles								
Aroclor-1016	12674-11-2	0.020	0.050	0.020	U	ug/L	SW8082	11/16/15
Aroclor-1260	11096-82-5	0.020	0.050	0.020	U	ug/L	SW8082	11/16/15
Aroclor-1221	11104-28-2	0.020	0.050	0.020	U	ug/L	SW8082	11/16/15
Aroclor-1232	11141-16-5	0.020	0.050	0.020	U	ug/L	SW8082	11/16/15
Aroclor-1242	53469-21-9	0.020	0.050	0.020	U	ug/L	SW8082	11/16/15
Aroclor-1248	12672-29-6	0.020	0.050	0.020	U	ug/L	SW8082	11/16/15
Aroclor-1254	11097-69-1	0.020	0.050	0.020	U	ug/L	SW8082	11/16/15

Surrogate	% Recovery	Control Limits	Qualifier
DCBP	91	34-133	

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Client Sample ID: **D4SD04-0.503-01**

Project Name: Alaska LNG
Sample Date: 11/05/15
Sample Time: 13:30
Type: Grab
Matrix: Soil
Basis: Dry Weight

Lab Information

Lab Sample ID: **P358601**

Date Received: 11/07/15
Dilution Factor: 1
Report Revision No.: 0

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC Semi-Volatiles								
Aroclor-1016	12674-11-2	6.08	30.4	6.08	U	ug/Kg	SW8082	11/13/15
Aroclor-1260	11096-82-5	6.08	30.4	6.08	U	ug/Kg	SW8082	11/13/15
Aroclor-1221	11104-28-2	12.2	30.4	12.2	U	ug/Kg	SW8082	11/13/15
Aroclor-1232	11141-16-5	6.08	30.4	6.08	U	ug/Kg	SW8082	11/13/15
Aroclor-1242	53469-21-9	6.08	30.4	6.08	U	ug/Kg	SW8082	11/13/15
Aroclor-1248	12672-29-6	6.08	30.4	6.08	U	ug/Kg	SW8082	11/13/15
Aroclor-1254	11097-69-1	6.08	30.4	6.08	U	ug/Kg	SW8082	11/13/15

Surrogate	% Recovery	Control Limits	Qualifier
DCBP	77	25-143	

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information		Lab Information	
Client Sample ID:	**D4SD04-0.503-101**	**Lab Sample ID:**	**P358602**
Project Name:	Alaska LNG	Date Received:	11/07/15
Sample Date:	11/05/15	Dilution Factor:	1
Sample Time:	13:40	Report Revision No.:	0
Type:	Grab		
Matrix:	Soil		
Basis:	Dry Weight		

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC Semi-Volatiles								
Aroclor-1016	12674-11-2	5.90	29.5	5.90	U	ug/Kg	SW8082	11/13/15
Aroclor-1260	11096-82-5	5.90	29.5	5.90	U	ug/Kg	SW8082	11/13/15
Aroclor-1221	11104-28-2	11.8	29.5	11.8	U	ug/Kg	SW8082	11/13/15
Aroclor-1232	11141-16-5	5.90	29.5	5.90	U	ug/Kg	SW8082	11/13/15
Aroclor-1242	53469-21-9	5.90	29.5	5.90	U	ug/Kg	SW8082	11/13/15
Aroclor-1248	12672-29-6	5.90	29.5	5.90	U	ug/Kg	SW8082	11/13/15
Aroclor-1254	11097-69-1	5.90	29.5	5.90	U	ug/Kg	SW8082	11/13/15

Surrogate	% Recovery	Control Limits	Qualifier
DCBP	82	25-143	

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Client Sample ID: **D4SD04-0.503-01MS**

Project Name: Alaska LNG
Sample Date: 11/05/15
Sample Time: 13:30
Type: Grab
Matrix: Soil
Basis: Dry Weight

Lab Information

Lab Sample ID: **P358603MS**

Date Received: 11/07/15
Dilution Factor: 1
Report Revision No.: 0

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC Semi-Volatiles								
Aroclor-1016	12674-11-2	6.07	30.3	138		ug/Kg	SW8082	11/13/15
Aroclor-1260	11096-82-5	6.07	30.3	151		ug/Kg	SW8082	11/13/15
Aroclor-1221	11104-28-2	12.1	30.3	12.1	U	ug/Kg	SW8082	11/13/15
Aroclor-1232	11141-16-5	6.07	30.3	6.07	U	ug/Kg	SW8082	11/13/15
Aroclor-1242	53469-21-9	6.07	30.3	6.07	U	ug/Kg	SW8082	11/13/15
Aroclor-1248	12672-29-6	6.07	30.3	6.07	U	ug/Kg	SW8082	11/13/15
Aroclor-1254	11097-69-1	6.07	30.3	6.07	U	ug/Kg	SW8082	11/13/15

Surrogate	% Recovery	Control Limits	Qualifier
DCBP	92	25-143	

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Client Sample ID: **D4SD04-0.503-01SD**

Project Name: Alaska LNG
Sample Date: 11/05/15
Sample Time: 13:30
Type: Grab
Matrix: Soil
Basis: Dry Weight

Lab Information

Lab Sample ID: **P358604MSD**

Date Received: 11/07/15
Dilution Factor: 1
Report Revision No.: 0

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC Semi-Volatiles								
Aroclor-1016	12674-11-2	6.01	30.0	140		ug/Kg	SW8082	11/13/15
Aroclor-1260	11096-82-5	6.01	30.0	148		ug/Kg	SW8082	11/13/15
Aroclor-1221	11104-28-2	12.0	30.0	12.0	U	ug/Kg	SW8082	11/13/15
Aroclor-1232	11141-16-5	6.01	30.0	6.01	U	ug/Kg	SW8082	11/13/15
Aroclor-1242	53469-21-9	6.01	30.0	6.01	U	ug/Kg	SW8082	11/13/15
Aroclor-1248	12672-29-6	6.01	30.0	6.01	U	ug/Kg	SW8082	11/13/15
Aroclor-1254	11097-69-1	6.01	30.0	6.01	U	ug/Kg	SW8082	11/13/15

Surrogate	% Recovery	Control Limits	Qualifier
DCBP	97	25-143	

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Client Sample ID: **D4SD04-0304.25-02**

Project Name: Alaska LNG
Sample Date: 11/05/15
Sample Time: 16:30
Type: Grab
Matrix: Soil
Basis: Dry Weight

Lab Information

Lab Sample ID: **P358605**

Date Received: 11/07/15
Dilution Factor: 1
Report Revision No.: 0

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC Semi-Volatiles								
Aroclor-1016	12674-11-2	5.92	29.6	5.92	U	ug/Kg	SW8082	11/13/15
Aroclor-1260	11096-82-5	5.92	29.6	5.92	U	ug/Kg	SW8082	11/13/15
Aroclor-1221	11104-28-2	11.8	29.6	11.8	U	ug/Kg	SW8082	11/13/15
Aroclor-1232	11141-16-5	5.92	29.6	5.92	U	ug/Kg	SW8082	11/13/15
Aroclor-1242	53469-21-9	5.92	29.6	5.92	U	ug/Kg	SW8082	11/13/15
Aroclor-1248	12672-29-6	5.92	29.6	5.92	U	ug/Kg	SW8082	11/13/15
Aroclor-1254	11097-69-1	5.92	29.6	5.92	U	ug/Kg	SW8082	11/13/15

Surrogate	% Recovery	Control Limits	Qualifier
DCBP	84	25-143	

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Client Sample ID: **D4SD04-4.2518.86-03**

Project Name: Alaska LNG
Sample Date: 11/05/15
Sample Time: 14:50
Type: Grab
Matrix: Soil
Basis: Dry Weight

Lab Information

Lab Sample ID: **P358606**

Date Received: 11/07/15
Dilution Factor: 1
Report Revision No.: 0

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC Semi-Volatiles								
Aroclor-1016	12674-11-2	6.15	30.7	6.15	U	ug/Kg	SW8082	11/13/15
Aroclor-1260	11096-82-5	6.15	30.7	6.15	U	ug/Kg	SW8082	11/13/15
Aroclor-1221	11104-28-2	12.3	30.7	12.3	U	ug/Kg	SW8082	11/13/15
Aroclor-1232	11141-16-5	6.15	30.7	6.15	U	ug/Kg	SW8082	11/13/15
Aroclor-1242	53469-21-9	6.15	30.7	6.15	U	ug/Kg	SW8082	11/13/15
Aroclor-1248	12672-29-6	6.15	30.7	6.15	U	ug/Kg	SW8082	11/13/15
Aroclor-1254	11097-69-1	6.15	30.7	6.15	U	ug/Kg	SW8082	11/13/15

Surrogate	% Recovery	Control Limits	Qualifier
DCBP	79	25-143	

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information		Lab Information	
Client Sample ID:	**D5SD01-0002-01**	**Lab Sample ID:**	**P358607**
Project Name:	Alaska LNG	Date Received:	11/07/15
Sample Date:	11/06/15	Dilution Factor:	1
Sample Time:	11:15	Report Revision No.:	0
Type:	Grab		
Matrix:	Soil		
Basis:	Dry Weight		

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC Semi-Volatiles								
Aroclor-1016	12674-11-2	5.74	28.7	5.74	U	ug/Kg	SW8082	11/13/15
Aroclor-1260	11096-82-5	5.74	28.7	5.74	U	ug/Kg	SW8082	11/13/15
Aroclor-1221	11104-28-2	11.5	28.7	11.5	U	ug/Kg	SW8082	11/13/15
Aroclor-1232	11141-16-5	5.74	28.7	5.74	U	ug/Kg	SW8082	11/13/15
Aroclor-1242	53469-21-9	5.74	28.7	5.74	U	ug/Kg	SW8082	11/13/15
Aroclor-1248	12672-29-6	5.74	28.7	5.74	U	ug/Kg	SW8082	11/13/15
Aroclor-1254	11097-69-1	5.74	28.7	5.74	U	ug/Kg	SW8082	11/13/15

Surrogate	% Recovery	Control Limits	Qualifier
DCBP	89	25-143	

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information		Lab Information	
Client Sample ID:	**D5SD01-0204-02**	**Lab Sample ID:**	**P358608**
Project Name:	Alaska LNG	Date Received:	11/07/15
Sample Date:	11/06/15	Dilution Factor:	1
Sample Time:	13:00	Report Revision No.:	0
Type:	Grab		
Matrix:	Soil		
Basis:	Dry Weight		

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC Semi-Volatiles								
Aroclor-1016	12674-11-2	6.47	32.3	6.47	U	ug/Kg	SW8082	11/13/15
Aroclor-1260	11096-82-5	6.47	32.3	6.47	U	ug/Kg	SW8082	11/13/15
Aroclor-1221	11104-28-2	12.9	32.3	12.9	U	ug/Kg	SW8082	11/13/15
Aroclor-1232	11141-16-5	6.47	32.3	6.47	U	ug/Kg	SW8082	11/13/15
Aroclor-1242	53469-21-9	6.47	32.3	6.47	U	ug/Kg	SW8082	11/13/15
Aroclor-1248	12672-29-6	6.47	32.3	6.47	U	ug/Kg	SW8082	11/13/15
Aroclor-1254	11097-69-1	6.47	32.3	6.47	U	ug/Kg	SW8082	11/13/15

Surrogate	% Recovery	Control Limits	Qualifier
DCBP	90	25-143	

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information		Lab Information	
Client Sample ID:	**D4BDS01-001.31-01**	**Lab Sample ID:**	**P358609**
Project Name:	Alaska LNG	Date Received:	11/07/15
Sample Date:	11/03/15	Dilution Factor:	1
Sample Time:	11:00	Report Revision No.:	0
Type:	Grab		
Matrix:	Soil		
Basis:	Dry Weight		

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC Semi-Volatiles								
Aroclor-1016	12674-11-2	6.31	31.5	6.31	U	ug/Kg	SW8082	11/13/15
Aroclor-1260	11096-82-5	6.31	31.5	6.31	U	ug/Kg	SW8082	11/13/15
Aroclor-1221	11104-28-2	12.6	31.5	12.6	U	ug/Kg	SW8082	11/13/15
Aroclor-1232	11141-16-5	6.31	31.5	6.31	U	ug/Kg	SW8082	11/13/15
Aroclor-1242	53469-21-9	6.31	31.5	6.31	U	ug/Kg	SW8082	11/13/15
Aroclor-1248	12672-29-6	6.31	31.5	6.31	U	ug/Kg	SW8082	11/13/15
Aroclor-1254	11097-69-1	6.31	31.5	6.31	U	ug/Kg	SW8082	11/13/15

Surrogate	% Recovery	Control Limits	Qualifier
DCBP	88	25-143	

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Client Sample ID: **D5SD01-0404.9-03**

Project Name: Alaska LNG
Sample Date: 11/06/15
Sample Time: 14:45
Type: Grab
Matrix: Soil
Basis: Dry Weight

Lab Information

Lab Sample ID: **P358610**

Date Received: 11/07/15
Dilution Factor: 1
Report Revision No.: 0

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC Semi-Volatiles								
Aroclor-1016	12674-11-2	6.26	31.3	6.26	U	ug/Kg	SW8082	11/13/15
Aroclor-1260	11096-82-5	6.26	31.3	6.26	U	ug/Kg	SW8082	11/13/15
Aroclor-1221	11104-28-2	12.5	31.3	12.5	U	ug/Kg	SW8082	11/13/15
Aroclor-1232	11141-16-5	6.26	31.3	6.26	U	ug/Kg	SW8082	11/13/15
Aroclor-1242	53469-21-9	6.26	31.3	6.26	U	ug/Kg	SW8082	11/13/15
Aroclor-1248	12672-29-6	6.26	31.3	6.26	U	ug/Kg	SW8082	11/13/15
Aroclor-1254	11097-69-1	6.26	31.3	6.26	U	ug/Kg	SW8082	11/13/15

Surrogate	% Recovery	Control Limits	Qualifier
DCBP	88	25-143	

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information		Lab Information	
Client Sample ID:	**SB1-1111**	**Lab Sample ID:**	**SB1-1111**
Project Name:	Alaska LNG	Date Received:	N/A
Sample Date:	N/A	Dilution Factor:	1
Sample Time:	N/A	Report Revision No.:	0
Type:	QC		
Matrix:	Soil		
Basis:	Dry Weight		

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC Semi-Volatiles								
Aroclor-1016	12674-11-2	5.00	25.0	5.00	U	ug/Kg	SW8082	11/13/15
Aroclor-1260	11096-82-5	5.00	25.0	5.00	U	ug/Kg	SW8082	11/13/15
Aroclor-1221	11104-28-2	10.0	25.0	10.0	U	ug/Kg	SW8082	11/13/15
Aroclor-1232	11141-16-5	5.00	25.0	5.00	U	ug/Kg	SW8082	11/13/15
Aroclor-1242	53469-21-9	5.00	25.0	5.00	U	ug/Kg	SW8082	11/13/15
Aroclor-1248	12672-29-6	5.00	25.0	5.00	U	ug/Kg	SW8082	11/13/15
Aroclor-1254	11097-69-1	5.00	25.0	5.00	U	ug/Kg	SW8082	11/13/15

Surrogate	% Recovery	Control Limits	Qualifier
DCBP	95	25-143	

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Project Name: Alaska LNG
Type: QC
Matrix: Soil

Lab Information

LCS ID: BS1S1111

Report Revision No.: 0
Dilution Factor: 1

Analyte	CAS#	Spike Amount	Sample Result	Units	%Recovery	Analysis Method	Date Analyzed
GC Semi-Volatiles							
Aroclor-1016	12674-11-2	125	120	ug/Kg	96	SW8082	11/13/15
Aroclor-1260	11096-82-5	125	128	ug/Kg	102	SW8082	11/13/15

Surrogate	% Recovery	Control Limits	Qualifier
DCBP	97	25-143	

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

CH2M HILL ASL

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CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Project Name: Alaska LNG
Type: QC
Matrix: Water

Lab Information

LCS ID: BS2W1113

Report Revision No.: 0
Dilution Factor: 1

Analyte	CAS#	Spike Amount	Sample Result	Units	%Recovery	Analysis Method	Date Analyzed
GC Semi-Volatiles							
Aroclor-1016	12674-11-2	0.25	0.23	ug/L	92	SW8082	11/16/15
Aroclor-1260	11096-82-5	0.25	0.23	ug/L	92	SW8082	11/16/15

Surrogate	% Recovery	Control Limits	Qualifier
DCBP	91	34-133	

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

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CASE NARRATIVE
GC VOLATILES ANALYSIS

Lab Name: CH2M HILL ASL **ASL SDG#:** P3586

Project: Alaska LNG **Project #:** 653488.16.06

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

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

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

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

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

Method(s):
AK101: SW5030

Analytical Exception(s):
All surrogates were manually integrated per method requirements.

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information		Lab Information	
Client Sample ID:	**D4SD04-0.503-01**	**Lab Sample ID:**	**P358601**
Project Name:	Alaska LNG	Date Received:	11/07/15
Sample Date:	11/05/15	Dilution Factor:	1
Sample Time:	13:30	Report Revision No.:	0
Type:	Grab		
Matrix:	Soil		
Basis:	Dry Weight		

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC Volatiles								
TPH-Gasoline	TPH-Gasoline	0.74	2.08	2.66		mg/Kg	AK101	11/09/15

Surrogate	% Recovery	Control Limits	Qualifier
a,a,a-Trifluorotoluene	81	50-150	
4-Bromofluorobenzene	106	50-150	

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information		Lab Information	
Client Sample ID:	**D4SD04-0.503-101**	**Lab Sample ID:**	**P358602**
Project Name:	Alaska LNG	Date Received:	11/07/15
Sample Date:	11/05/15	Dilution Factor:	1
Sample Time:	13:40	Report Revision No.:	0
Type:	Grab		
Matrix:	Soil		
Basis:	Dry Weight		

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC Volatiles								
TPH-Gasoline	TPH-Gasoline	0.61	1.71	1.70	J	mg/Kg	AK101	11/09/15

Surrogate	% Recovery	Control Limits	Qualifier
a,a,a-Trifluorotoluene	76	50-150	
4-Bromofluorobenzene	101	50-150	

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information		Lab Information	
Client Sample ID:	**D4SD04-0.503-01MS**	**Lab Sample ID:**	**P358603MS**
Project Name:	Alaska LNG	Date Received:	11/07/15
Sample Date:	11/05/15	Dilution Factor:	1
Sample Time:	13:30	Report Revision No.:	0
Type:	Grab		
Matrix:	Soil		
Basis:	Dry Weight		

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC Volatiles								
TPH-Gasoline	TPH-Gasoline	0.74	2.08	22.5		mg/Kg	AK101	11/09/15

Surrogate	% Recovery	Control Limits	Qualifier
a,a,a-Trifluorotoluene	84	50-150	
4-Bromofluorobenzene	103	50-150	

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information		Lab Information	
Client Sample ID:	**D4SD04-0.503-01SD**	**Lab Sample ID:**	**P358604MSD**
Project Name:	Alaska LNG	Date Received:	11/07/15
Sample Date:	11/05/15	Dilution Factor:	1
Sample Time:	13:30	Report Revision No.:	0
Type:	Grab		
Matrix:	Soil		
Basis:	Dry Weight		

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC Volatiles								
TPH-Gasoline	TPH-Gasoline	0.74	2.08	22.4		mg/Kg	AK101	11/09/15

Surrogate	% Recovery	Control Limits	Qualifier
a,a,a-Trifluorotoluene	83	50-150	
4-Bromofluorobenzene	101	50-150	

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Client Sample ID: **D4SD04-0304.25-02**

Project Name: Alaska LNG
Sample Date: 11/05/15
Sample Time: 16:30
Type: Grab
Matrix: Soil
Basis: Dry Weight

Lab Information

Lab Sample ID: **P358605**

Date Received: 11/07/15
Dilution Factor: 1
Report Revision No.: 0

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC Volatiles								
TPH-Gasoline	TPH-Gasoline	0.74	2.09	0.74	U	mg/Kg	AK101	11/09/15

Surrogate	% Recovery	Control Limits	Qualifier
a,a,a-Trifluorotoluene	83	50-150	
4-Bromofluorobenzene	94	50-150	

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information		Lab Information	
Client Sample ID:	**D4SD04-4.2518.86-03**	**Lab Sample ID:**	**P358606**
Project Name:	Alaska LNG	Date Received:	11/07/15
Sample Date:	11/05/15	Dilution Factor:	1
Sample Time:	14:50	Report Revision No.:	0
Type:	Grab		
Matrix:	Soil		
Basis:	Dry Weight		

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC Volatiles								
TPH-Gasoline	TPH-Gasoline	0.62	1.75	0.62	U	mg/Kg	AK101	11/09/15

Surrogate	% Recovery	Control Limits	Qualifier
a,a,a-Trifluorotoluene	78	50-150	
4-Bromofluorobenzene	103	50-150	

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information		Lab Information	
Client Sample ID:	**D5SD01-0002-01**	**Lab Sample ID:**	**P358607**
Project Name:	Alaska LNG	Date Received:	11/07/15
Sample Date:	11/06/15	Dilution Factor:	1
Sample Time:	11:15	Report Revision No.:	0
Type:	Grab		
Matrix:	Soil		
Basis:	Dry Weight		

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC Volatiles								
TPH-Gasoline	TPH-Gasoline	0.64	1.80	0.64	U	mg/Kg	AK101	11/09/15

Surrogate	% Recovery	Control Limits	Qualifier
a,a,a-Trifluorotoluene	78	50-150	
4-Bromofluorobenzene	106	50-150	

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information		Lab Information	
Client Sample ID:	**D5SD01-0204-02**	**Lab Sample ID:**	**P358608**
Project Name:	Alaska LNG	Date Received:	11/07/15
Sample Date:	11/06/15	Dilution Factor:	1
Sample Time:	13:00	Report Revision No.:	0
Type:	Grab		
Matrix:	Soil		
Basis:	Dry Weight		

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC Volatiles								
TPH-Gasoline	TPH-Gasoline	0.69	1.95	0.69	U	mg/Kg	AK101	11/09/15

Surrogate	% Recovery	Control Limits	Qualifier
a,a,a-Trifluorotoluene	79	50-150	
4-Bromofluorobenzene	105	50-150	

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information		Lab Information	
Client Sample ID:	**D4BDS01-001.31-01**	**Lab Sample ID:**	**P358609**
Project Name:	Alaska LNG	Date Received:	11/07/15
Sample Date:	11/03/15	Dilution Factor:	1
Sample Time:	11:00	Report Revision No.:	0
Type:	Grab		
Matrix:	Soil		
Basis:	Dry Weight		

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC Volatiles								
TPH-Gasoline	TPH-Gasoline	0.90	2.53	0.90	U	mg/Kg	AK101	11/09/15

Surrogate	% Recovery	Control Limits	Qualifier
a,a,a-Trifluorotoluene	79	50-150	
4-Bromofluorobenzene	103	50-150	

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information		Lab Information	
Client Sample ID:	**D5SD01-0404.9-03**	**Lab Sample ID:**	**P358610**
Project Name:	Alaska LNG	Date Received:	11/07/15
Sample Date:	11/06/15	Dilution Factor:	1
Sample Time:	14:45	Report Revision No.:	0
Type:	Grab		
Matrix:	Soil		
Basis:	Dry Weight		

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC Volatiles								
TPH-Gasoline	TPH-Gasoline	0.81	2.30	0.81	U	mg/Kg	AK101	11/09/15

Surrogate	% Recovery	Control Limits	Qualifier
a,a,a-Trifluorotoluene	80	50-150	
4-Bromofluorobenzene	101	50-150	

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Client Sample ID: **TB110315-01**

Project Name: Alaska LNG
Sample Date: 11/03/15
Sample Time: 08:00
Type: Grab
Matrix: Water

Lab Information

Lab Sample ID: **P358611**

Date Received: 11/07/15
Dilution Factor: 1
Report Revision No.: 0

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC Volatiles								
TPH-Gasoline	TPH-Gasoline	35.5	100	35.5	U	ug/L	AK101	11/12/15

Surrogate	% Recovery	Control Limits	Qualifier
a,a,a-Trifluorotoluene	89	50-150	
4-Bromofluorobenzene	91	50-150	

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information		Lab Information	
Client Sample ID:	**EB110615-01**	**Lab Sample ID:**	**P358613**
Project Name:	Alaska LNG	Date Received:	11/07/15
Sample Date:	11/06/15	Dilution Factor:	1
Sample Time:	15:45	Report Revision No.:	0
Type:	Grab		
Matrix:	Water		

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC Volatiles								
TPH-Gasoline	TPH-Gasoline	35.5	100	35.5	U	ug/L	AK101	11/09/15

Surrogate	% Recovery	Control Limits	Qualifier
a,a,a-Trifluorotoluene	92	50-150	
4-Bromofluorobenzene	102	50-150	

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information		Lab Information	
Client Sample ID:	**SB1-1109**	**Lab Sample ID:**	**SB1-1109**
Project Name:	Alaska LNG	Date Received:	N/A
Sample Date:	N/A	Dilution Factor:	1
Sample Time:	N/A	Report Revision No.:	0
Type:	QC		
Matrix:	Soil		
Basis:	Dry Weight		

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC Volatiles								
TPH-Gasoline	TPH-Gasoline	0.71	2.00	0.71	U	mg/Kg	AK101	11/09/15

Surrogate	% Recovery	Control Limits	Qualifier
a,a,a-Trifluorotoluene	96	60-120	
4-Bromofluorobenzene	107	60-120	

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Client Sample ID: **WB1-1109**
Project Name: Alaska LNG
Sample Date: N/A
Sample Time: N/A
Type: QC
Matrix: Water

Lab Information

Lab Sample ID: **WB1-1109**
Date Received: N/A
Dilution Factor: 1
Report Revision No.: 0

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC Volatiles								
TPH-Gasoline	TPH-Gasoline	35.5	100	35.5	U	ug/L	AK101	11/09/15

Surrogate	% Recovery	Control Limits	Qualifier
a,a,a-Trifluorotoluene	96	60-120	
4-Bromofluorobenzene	107	60-120	

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Client Sample ID: **WB2-1112**
Project Name: Alaska LNG
Sample Date: N/A
Sample Time: N/A
Type: QC
Matrix: Water

Lab Information

Lab Sample ID: **WB2-1112**
Date Received: N/A
Dilution Factor: 1
Report Revision No.: 0

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC Volatiles								
TPH-Gasoline	TPH-Gasoline	35.5	100	35.5	U	ug/L	AK101	11/12/15

Surrogate	% Recovery	Control Limits	Qualifier
a,a,a-Trifluorotoluene	85	60-120	
4-Bromofluorobenzene	95	60-120	

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information		Lab Information	
		LCS ID:	BS1S1109
Project Name:	Alaska LNG	Report Revision No.:	0
Type:	QC	Dilution Factor:	1
Matrix:	Soil		

Analyte	CAS#	Spike Amount	Sample Result	Units	%Recovery	Analysis Method	Date Analyzed
GC Semi-Volatiles							
TPH-Gasoline	TPH-Gasoline	20.0	19.8	mg/Kg	99	AK101	11/09/15

Surrogate	% Recovery	Control Limits	Qualifier
a,a,a-Trifluorotoluene	93	60-120	
4-Bromofluorobenzene	97	60-120	

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information		Lab Information	
		LCS ID:	BS1W1109
Project Name:	Alaska LNG	Report Revision No.:	0
Type:	QC	Dilution Factor:	1
Matrix:	Water		

Analyte	CAS#	Spike Amount	Sample Result	Units	%Recovery	Analysis Method	Date Analyzed
GC Semi-Volatiles							
TPH-Gasoline	TPH-Gasoline	1000	990	ug/L	99	AK101	11/09/15

Surrogate	% Recovery	Control Limits	Qualifier
a,a,a-Trifluorotoluene	93	60-120	
4-Bromofluorobenzene	97	60-120	

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information		Lab Information	
		LCS ID:	BS1W1112
Project Name:	Alaska LNG	Report Revision No.:	0
Type:	QC	Dilution Factor:	1
Matrix:	Water		

Analyte	CAS#	Spike Amount	Sample Result	Units	%Recovery	Analysis Method	Date Analyzed
GC Semi-Volatiles							
TPH-Gasoline	TPH-Gasoline	1000	982	ug/L	98	AK101	11/12/15

Surrogate	% Recovery	Control Limits	Qualifier
a,a,a-Trifluorotoluene	91	60-120	
4-Bromofluorobenzene	98	60-120	

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

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CASE NARRATIVE
GC SEMI-VOLATILES ANALYSIS

Lab Name: CH2M HILL ASL **ASL SDG#:** P3586

Project: Alaska LNG **Project #:** 653488.16.06

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

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

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

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

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

Method(s):
AK102/103: SW3510, SW3550

Surrogate Standard(s):
All surrogates were manually integrated per method requirements.

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Client Sample ID: **EB110615-01**

Project Name: Alaska LNG
Sample Date: 11/06/15
Sample Time: 15:45
Type: Grab
Matrix: Water

Lab Information

Lab Sample ID: **P358613**

Date Received: 11/07/15
Dilution Factor: 1
Report Revision No.: 0

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC Semi-Volatiles								
TPH-Diesel	TPH-Diesel	17.5	158	17.5	U	ug/L	AK102/103	11/18/15
TPH-Oil	TPH-Oil	18.6	158	26.5	J	ug/L	AK102/103	11/18/15

Surrogate	% Recovery	Control Limits	Qualifier
o-Terphenyl	89	50-150	
Octacosane	89	50-150	

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information		Lab Information	
Client Sample ID:	**WB3-1113**	**Lab Sample ID:**	**WB3-1113**
Project Name:	Alaska LNG	Date Received:	N/A
Sample Date:	N/A	Dilution Factor:	1
Sample Time:	N/A	Report Revision No.:	0
Type:	QC		
Matrix:	Water		

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC Semi-Volatiles								
TPH-Diesel	TPH-Diesel	17.6	160	17.6	U	ug/L	AK102/103	11/18/15
TPH-Oil	TPH-Oil	18.8	160	27.5	J	ug/L	AK102/103	11/18/15

Surrogate	% Recovery	Control Limits	Qualifier
o-Terphenyl	86	60-120	
Octacosane	82	60-120	

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information		Lab Information	
Client Sample ID:	**D4SD04-0.503-01**	**Lab Sample ID:**	**P358601**
Project Name:	Alaska LNG	Date Received:	11/07/15
Sample Date:	11/05/15	Dilution Factor:	1
Sample Time:	13:30	Report Revision No.:	0
Type:	Grab		
Matrix:	Soil		
Basis:	Dry Weight		

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC Semi-Volatiles								
TPH-Diesel	TPH-Diesel	4.51	11.3	7.86	J	mg/Kg	AK102/103	11/18/15
TPH-Oil	TPH-Oil	4.51	11.3	29.8		mg/Kg	AK102/103	11/18/15

Surrogate	% Recovery	Control Limits	Qualifier
o-Terphenyl	88	50-150	
Octacosane	89	50-150	

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information		Lab Information	
Client Sample ID:	**D4SD04-0.503-101**	**Lab Sample ID:**	**P358602**
Project Name:	Alaska LNG	Date Received:	11/07/15
Sample Date:	11/05/15	Dilution Factor:	1
Sample Time:	13:40	Report Revision No.:	0
Type:	Grab		
Matrix:	Soil		
Basis:	Dry Weight		

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC Semi-Volatiles								
TPH-Diesel	TPH-Diesel	4.72	11.8	7.44	J	mg/Kg	AK102/103	11/18/15
TPH-Oil	TPH-Oil	4.72	11.8	32.3		mg/Kg	AK102/103	11/18/15

Surrogate	% Recovery	Control Limits	Qualifier
o-Terphenyl	92	50-150	
Octacosane	94	50-150	

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information		Lab Information	
Client Sample ID:	**D4SD04-0.503-01MS**	**Lab Sample ID:**	**P358603MS**
Project Name:	Alaska LNG	Date Received:	11/07/15
Sample Date:	11/05/15	Dilution Factor:	1
Sample Time:	13:30	Report Revision No.:	0
Type:	Grab		
Matrix:	Soil		
Basis:	Dry Weight		

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC Semi-Volatiles								
TPH-Diesel	TPH-Diesel	4.59	11.5	99.7		mg/Kg	AK102/103	11/18/15
TPH-Oil	TPH-Oil	4.59	11.5	120		mg/Kg	AK102/103	11/18/15

Surrogate	% Recovery	Control Limits	Qualifier
o-Terphenyl	89	50-150	
Octacosane	90	50-150	

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information		Lab Information	
Client Sample ID:	**D4SD04-0.503-01SD**	**Lab Sample ID:**	**P358604MSD**
Project Name:	Alaska LNG	Date Received:	11/07/15
Sample Date:	11/05/15	Dilution Factor:	1
Sample Time:	13:30	Report Revision No.:	0
Type:	Grab		
Matrix:	Soil		
Basis:	Dry Weight		

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC Semi-Volatiles								
TPH-Diesel	TPH-Diesel	4.48	11.2	104		mg/Kg	AK102/103	11/18/15
TPH-Oil	TPH-Oil	4.48	11.2	122		mg/Kg	AK102/103	11/18/15

Surrogate	% Recovery	Control Limits	Qualifier
o-Terphenyl	93	50-150	
Octacosane	94	50-150	

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information		Lab Information	
Client Sample ID:	**D4SD04-0304.25-02**	**Lab Sample ID:**	**P358605**
Project Name:	Alaska LNG	Date Received:	11/07/15
Sample Date:	11/05/15	Dilution Factor:	1
Sample Time:	16:30	Report Revision No.:	0
Type:	Grab		
Matrix:	Soil		
Basis:	Dry Weight		

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC Semi-Volatiles								
TPH-Diesel	TPH-Diesel	4.91	12.3	5.88	J	mg/Kg	AK102/103	11/18/15
TPH-Oil	TPH-Oil	4.91	12.3	28.2		mg/Kg	AK102/103	11/18/15

Surrogate	% Recovery	Control Limits	Qualifier
o-Terphenyl	92	50-150	
Octacosane	94	50-150	

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information		Lab Information	
Client Sample ID:	**D4SD04-4.2518.86-03**	**Lab Sample ID:**	**P358606**
Project Name:	Alaska LNG	Date Received:	11/07/15
Sample Date:	11/05/15	Dilution Factor:	1
Sample Time:	14:50	Report Revision No.:	0
Type:	Grab		
Matrix:	Soil		
Basis:	Dry Weight		

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC Semi-Volatiles								
TPH-Diesel	TPH-Diesel	4.84	12.1	12.8		mg/Kg	AK102/103	11/18/15
TPH-Oil	TPH-Oil	4.84	12.1	61.2		mg/Kg	AK102/103	11/18/15

Surrogate	% Recovery	Control Limits	Qualifier
o-Terphenyl	96	50-150	
Octacosane	101	50-150	

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information		Lab Information	
Client Sample ID:	**D5SD01-0002-01**	**Lab Sample ID:**	**P358607**
Project Name:	Alaska LNG	Date Received:	11/07/15
Sample Date:	11/06/15	Dilution Factor:	1
Sample Time:	11:15	Report Revision No.:	0
Type:	Grab		
Matrix:	Soil		
Basis:	Dry Weight		

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC Semi-Volatiles								
TPH-Diesel	TPH-Diesel	4.80	12.0	6.81	J	mg/Kg	AK102/103	11/18/15
TPH-Oil	TPH-Oil	4.80	12.0	33.4		mg/Kg	AK102/103	11/18/15

Surrogate	% Recovery	Control Limits	Qualifier
o-Terphenyl	96	50-150	
Octacosane	98	50-150	

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information		Lab Information	
Client Sample ID:	**D5SD01-0204-02**	**Lab Sample ID:**	**P358608**
Project Name:	Alaska LNG	Date Received:	11/07/15
Sample Date:	11/06/15	Dilution Factor:	1
Sample Time:	13:00	Report Revision No.:	0
Type:	Grab		
Matrix:	Soil		
Basis:	Dry Weight		

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC Semi-Volatiles								
TPH-Diesel	TPH-Diesel	5.01	12.5	7.05	J	mg/Kg	AK102/103	11/18/15
TPH-Oil	TPH-Oil	5.01	12.5	34.9		mg/Kg	AK102/103	11/18/15

Surrogate	% Recovery	Control Limits	Qualifier
o-Terphenyl	92	50-150	
Octacosane	95	50-150	

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information		Lab Information	
Client Sample ID:	**D4BDS01-001.31-01**	**Lab Sample ID:**	**P358609**
Project Name:	Alaska LNG	Date Received:	11/07/15
Sample Date:	11/03/15	Dilution Factor:	1
Sample Time:	11:00	Report Revision No.:	0
Type:	Grab		
Matrix:	Soil		
Basis:	Dry Weight		

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC Semi-Volatiles								
TPH-Diesel	TPH-Diesel	5.13	12.8	8.53	J	mg/Kg	AK102/103	11/18/15
TPH-Oil	TPH-Oil	5.13	12.8	37.1		mg/Kg	AK102/103	11/18/15

Surrogate	% Recovery	Control Limits	Qualifier
o-Terphenyl	91	50-150	
Octacosane	94	50-150	

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information		Lab Information	
Client Sample ID:	**D5SD01-0404.9-03**	**Lab Sample ID:**	**P358610**
Project Name:	Alaska LNG	Date Received:	11/07/15
Sample Date:	11/06/15	Dilution Factor:	1
Sample Time:	14:45	Report Revision No.:	0
Type:	Grab		
Matrix:	Soil		
Basis:	Dry Weight		

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC Semi-Volatiles								
TPH-Diesel	TPH-Diesel	4.89	12.2	14.2		mg/Kg	AK102/103	11/18/15
TPH-Oil	TPH-Oil	4.89	12.2	68.9		mg/Kg	AK102/103	11/18/15

Surrogate	% Recovery	Control Limits	Qualifier
o-Terphenyl	96	50-150	
Octacosane	100	50-150	

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information		Lab Information	
Client Sample ID:	**SB1-1116**	**Lab Sample ID:**	**SB1-1116**
Project Name:	Alaska LNG	Date Received:	N/A
Sample Date:	N/A	Dilution Factor:	1
Sample Time:	N/A	Report Revision No.:	0
Type:	QC		
Matrix:	Soil		
Basis:	Dry Weight		

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC Semi-Volatiles								
TPH-Diesel	TPH-Diesel	4.00	10.0	4.00	U	mg/Kg	AK102/103	11/18/15
TPH-Oil	TPH-Oil	4.00	10.0	4.17	J	mg/Kg	AK102/103	11/18/15

Surrogate	% Recovery	Control Limits	Qualifier
o-Terphenyl	93	60-120	
Octacosane	92	60-120	

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Project Name: Alaska LNG
Type: QC
Matrix: Soil

Lab Information

LCS ID: BS1S1116

Report Revision No.: 0
Dilution Factor: 1

Analyte	CAS#	Spike Amount	Sample Result	Units	%Recovery	Analysis Method	Date Analyzed
GC Semi-Volatiles							
TPH-Diesel	TPH-Diesel	100	90.5	mg/Kg	91	AK102/103	11/18/15
TPH-Oil	TPH-Oil	100	88.8	mg/Kg	89	AK102/103	11/18/15

Surrogate	% Recovery	Control Limits	Qualifier
o-Terphenyl	96	60-120	
Octacosane	96	60-120	

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Project Name: Alaska LNG
Type: QC
Matrix: Water

Lab Information

LCS ID: BS3W1113

Report Revision No.: 0
Dilution Factor: 1

Analyte	CAS#	Spike Amount	Sample Result	Units	%Recovery	Analysis Method	Date Analyzed
GC Semi-Volatiles							
TPH-Diesel	TPH-Diesel	1000	770	ug/L	77	AK102/103	11/18/15
TPH-Oil	TPH-Oil	1000	791	ug/L	79	AK102/103	11/18/15

Surrogate	% Recovery	Control Limits	Qualifier
o-Terphenyl	93	60-120	
Octacosane	94	60-120	

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

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CASE NARRATIVE
METALS ANALYSIS

Lab Name: CH2M HILL ASL **ASL SDG#:** P3586

Project: Alaska LNG **Project #:** 653488.16.06

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

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

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

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

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

Method(s):
E200.7: E200.2
E245.1

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Client Sample ID: EB110615-01

Project Name: Alaska LNG
Sample Date: 11/06/15
Sample Time: 15:45
Type: Grab
Matrix: Water

Lab Information

Lab Sample ID: P358613

Date Received: 11/07/15
Report Revision No: 0

Analyte	Dilution Factor	DL	RL	Result	Qual	Units	Analysis Method	Prep Method	Date Analyzed
Metals									
Antimony	1	5.00	25.0	5.00	U	ug/L	E200.7	E200.2	11/20/15
Arsenic	1	10.0	25.0	10.0	U	ug/L	E200.7	E200.2	11/20/15
Barium	1	0.50	10.0	0.65	J	ug/L	E200.7	E200.2	11/20/15
Beryllium	1	0.50	4.00	0.50	U	ug/L	E200.7	E200.2	11/20/15
Cadmium	1	0.50	5.00	0.50	U	ug/L	E200.7	E200.2	11/20/15
Chromium	1	0.50	10.0	0.50	U	ug/L	E200.7	E200.2	11/20/15
Copper	1	2.50	10.0	2.50	U	ug/L	E200.7	E200.2	11/20/15
Lead	1	2.50	25.0	2.50	U	ug/L	E200.7	E200.2	11/20/15
Mercury	1	0.045	0.10	0.045	U	ug/L	E245.1	METHOD	11/13/15
Nickel	1	2.50	20.0	2.50	U	ug/L	E200.7	E200.2	11/20/15
Selenium	1	20.0	50.0	20.0	U	ug/L	E200.7	E200.2	11/20/15
Silver	1	1.25	10.0	1.25	U	ug/L	E200.7	E200.2	11/24/15
Thallium	1	6.62	40.0	6.62	U	ug/L	E200.7	E200.2	11/20/15
Vanadium	1	2.50	10.0	2.50	U	ug/L	E200.7	E200.2	11/20/15
Zinc	1	2.50	20.0	2.50	U	ug/L	E200.7	E200.2	11/20/15

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Project Name: Alaska LNG
Sample Date: N/A
Sample Time: N/A
Type: QC
Matrix: Water

Lab Information

Method Blank ID: WB1-1110

Date Received: N/A
Report Revision No: 0

Analyte	Dilution Factor	DL	RL	Result	Qual	Units	Analysis Method	Prep Method	Date Analyzed
Metals									
Antimony	1	5.00	25.0	5.00	U	ug/L	E200.7	E200.2	11/20/15
Arsenic	1	10.0	25.0	10.0	U	ug/L	E200.7	E200.2	11/20/15
Barium	1	0.50	10.0	0.50	U	ug/L	E200.7	E200.2	11/20/15
Beryllium	1	0.50	4.00	0.50	U	ug/L	E200.7	E200.2	11/20/15
Cadmium	1	0.50	5.00	0.50	U	ug/L	E200.7	E200.2	11/20/15
Chromium	1	0.50	10.0	0.50	U	ug/L	E200.7	E200.2	11/20/15
Copper	1	2.50	10.0	2.50	U	ug/L	E200.7	E200.2	11/20/15
Lead	1	2.50	25.0	5.66	J	ug/L	E200.7	E200.2	11/20/15
Nickel	1	2.50	20.0	2.50	U	ug/L	E200.7	E200.2	11/20/15
Selenium	1	20.0	50.0	20.0	U	ug/L	E200.7	E200.2	11/20/15
Thallium	1	6.62	40.0	6.62	U	ug/L	E200.7	E200.2	11/20/15
Vanadium	1	2.50	10.0	2.50	U	ug/L	E200.7	E200.2	11/20/15
Zinc	1	2.50	20.0	2.50	U	ug/L	E200.7	E200.2	11/20/15

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Project Name: Alaska LNG
Sample Date: N/A
Sample Time: N/A
Type: QC
Matrix: Water

Lab Information

Method Blank ID: WB1-1113

Date Received: N/A
Report Revision No: 0

Analyte	Dilution Factor	DL	RL	Result	Qual	Units	Analysis Method	Prep Method	Date Analyzed
Metals									
Mercury	1	0.045	0.10	0.045	U	ug/L	E245.1	METHOD	11/13/15

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Project Name: Alaska LNG
Sample Date: N/A
Sample Time: N/A
Type: QC
Matrix: Water

Lab Information

Method Blank ID: WB1-1123

Date Received: N/A
Report Revision No: 0

Analyte	Dilution Factor	DL	RL	Result	Qual	Units	Analysis Method	Prep Method	Date Analyzed
Metals									
Silver	1	1.25	10.0	1.25	U	ug/L	E200.7	E200.2	11/24/15

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Project Name: Alaska LNG
Type: QC
Matrix: Water

Lab Information

Blank Spike ID: BS1W1110

Report Revision No: 0
Dilution Factor: 1

Analyte	Spike Amount	Result	Units	%Recovery	Analysis Method	Prep Method	Date Analyzed
Metals							
Antimony	500	485	ug/L	97	E200.7	E200.2	11/20/15
Arsenic	500	484	ug/L	97	E200.7	E200.2	11/20/15
Barium	500	493	ug/L	99	E200.7	E200.2	11/20/15
Beryllium	500	503	ug/L	101	E200.7	E200.2	11/20/15
Cadmium	500	494	ug/L	99	E200.7	E200.2	11/20/15
Chromium	500	495	ug/L	99	E200.7	E200.2	11/20/15
Copper	500	477	ug/L	95	E200.7	E200.2	11/20/15
Lead	500	494	ug/L	99	E200.7	E200.2	11/20/15
Nickel	500	520	ug/L	104	E200.7	E200.2	11/20/15
Selenium	500	526	ug/L	105	E200.7	E200.2	11/20/15
Thallium	500	497	ug/L	99	E200.7	E200.2	11/20/15
Vanadium	500	485	ug/L	97	E200.7	E200.2	11/20/15
Zinc	500	496	ug/L	99	E200.7	E200.2	11/20/15

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Project Name: Alaska LNG
Type: QC
Matrix: Water

Lab Information

Blank Spike ID: BS1W1113

Report Revision No: 0
Dilution Factor: 1

Analyte	Spike Amount	Result	Units	%Recovery	Analysis Method	Prep Method	Date Analyzed
Metals							
Mercury	1.00	0.98	ug/L	98	E245.1	METHOD	11/13/15

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Project Name: Alaska LNG
Type: QC
Matrix: Water

Lab Information

Blank Spike ID: BS1W1123

Report Revision No: 0
Dilution Factor: 1

Analyte	Spike Amount	Result	Units	%Recovery	Analysis Method	Prep Method	Date Analyzed
Metals							
Silver	250	236	ug/L	94	E200.7	E200.2	11/24/15

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

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CASE NARRATIVE
METALS ANALYSIS

Lab Name: CH2M HILL ASL **ASL SDG#:** P3586

Project: Alaska LNG **Project #:** 653488.16.06

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

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

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

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

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

Method(s):
SW6010B: SW3050
SW7471A

Matrix Spike/Matrix Spike Duplicate(s):
SW6010B: MS recovery of Barium(129%) in D4SD04-0.503-01MS did not meet acceptance criteria of 75-125%. MS recovery of Antimony(36%) in D4SD04-0.503-01MS did not meet acceptance criteria of 75-125%. MSD recovery of Barium(126%) in D4SD04-0.503-01SD did not meet acceptance criteria of 75-125%. MSD recovery of Antimony(40%) in D4SD04-0.503-01SD did not meet acceptance criteria of 75-125%.

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Client Sample ID: D4SD04-0.503-01

Project Name: Alaska LNG
Sample Date: 11/05/15
Sample Time: 13:30
Type: Grab
Matrix: Soil
Basis: Dry Weight

Lab Information

Lab Sample ID: P358601

Date Received: 11/07/15
Report Revision No: 0

Analyte	Dilution Factor	DL	RL	Result	Qual	Units	Analysis Method	Prep Method	Date Analyzed
Metals									
Antimony	1	0.50	2.48	1.43	J	mg/Kg	SW6010B	SW3050	11/18/15
Arsenic	1	1.18	2.97	5.52		mg/Kg	SW6010B	SW3050	11/18/15
Barium	1	0.050	0.99	40.1		mg/Kg	SW6010B	SW3050	11/18/15
Beryllium	1	0.050	0.40	1.28		mg/Kg	SW6010B	SW3050	11/18/15
Cadmium	1	0.099	0.50	0.099	U	mg/Kg	SW6010B	SW3050	11/18/15
Chromium	1	0.050	0.99	14.0		mg/Kg	SW6010B	SW3050	11/18/15
Copper	1	0.50	1.98	11.6		mg/Kg	SW6010B	SW3050	11/18/15
Lead	1	0.34	1.98	2.57		mg/Kg	SW6010B	SW3050	11/18/15
Mercury	1	0.0098	0.022	0.023		mg/Kg	SW7471A	METHOD	11/11/15
Nickel	1	0.25	1.98	15.1		mg/Kg	SW6010B	SW3050	11/18/15
Selenium	1	1.98	4.95	2.57	J	mg/Kg	SW6010B	SW3050	11/18/15
Silver	1	0.25	0.99	0.25	U	mg/Kg	SW6010B	SW3050	11/18/15
Thallium	1	0.50	3.96	0.50	U	mg/Kg	SW6010B	SW3050	11/18/15
Vanadium	1	0.25	2.48	27.3		mg/Kg	SW6010B	SW3050	11/18/15
Zinc	1	0.50	1.98	31.2		mg/Kg	SW6010B	SW3050	11/18/15

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Client Sample ID: D4SD04-0.503-101

Project Name: Alaska LNG
Sample Date: 11/05/15
Sample Time: 13:40
Type: Grab
Matrix: Soil
Basis: Dry Weight

Lab Information

Lab Sample ID: P358602

Date Received: 11/07/15
Report Revision No: 0

Analyte	Dilution Factor	DL	RL	Result	Qual	Units	Analysis Method	Prep Method	Date Analyzed
Metals									
Antimony	1	0.31	1.57	1.02	J	mg/Kg	SW6010B	SW3050	11/18/15
Arsenic	1	0.75	1.88	6.76		mg/Kg	SW6010B	SW3050	11/18/15
Barium	1	0.031	0.63	44.6		mg/Kg	SW6010B	SW3050	11/18/15
Beryllium	1	0.031	0.25	1.26		mg/Kg	SW6010B	SW3050	11/18/15
Cadmium	1	0.063	0.31	0.063	U	mg/Kg	SW6010B	SW3050	11/18/15
Chromium	1	0.031	0.63	14.4		mg/Kg	SW6010B	SW3050	11/18/15
Copper	1	0.31	1.25	13.8		mg/Kg	SW6010B	SW3050	11/18/15
Lead	1	0.21	1.25	1.80		mg/Kg	SW6010B	SW3050	11/18/15
Mercury	1	0.0087	0.019	0.016	J	mg/Kg	SW7471A	METHOD	11/11/15
Nickel	1	0.16	1.25	16.0		mg/Kg	SW6010B	SW3050	11/18/15
Selenium	1	1.25	3.13	3.97		mg/Kg	SW6010B	SW3050	11/18/15
Silver	1	0.16	0.63	0.16	U	mg/Kg	SW6010B	SW3050	11/18/15
Thallium	1	0.31	2.50	0.31	U	mg/Kg	SW6010B	SW3050	11/18/15
Vanadium	1	0.16	1.57	28.1		mg/Kg	SW6010B	SW3050	11/18/15
Zinc	1	0.31	1.25	33.4		mg/Kg	SW6010B	SW3050	11/18/15

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Client Sample ID: D4SD04-0.503-01MS

Project Name: Alaska LNG
Sample Date: 11/05/15
Sample Time: 13:30
Type: Grab
Matrix: Soil
Basis: Dry Weight

Lab Information

Lab Sample ID: P358603MS

Date Received: 11/07/15
Report Revision No: 0

Analyte	Dilution Factor	DL	RL	Result	Qual	Units	Analysis Method	Prep Method	Date Analyzed
Metals									
Antimony	1	0.39	1.97	15.7		mg/Kg	SW6010B	SW3050	11/18/15
Arsenic	1	0.94	2.36	42.7		mg/Kg	SW6010B	SW3050	11/18/15
Barium	1	0.039	0.79	91.3		mg/Kg	SW6010B	SW3050	11/18/15
Beryllium	1	0.039	0.31	41.8		mg/Kg	SW6010B	SW3050	11/18/15
Cadmium	1	0.079	0.39	39.0		mg/Kg	SW6010B	SW3050	11/18/15
Chromium	1	0.039	0.79	55.6		mg/Kg	SW6010B	SW3050	11/18/15
Copper	1	0.39	1.57	54.2		mg/Kg	SW6010B	SW3050	11/18/15
Lead	1	0.27	1.57	39.9		mg/Kg	SW6010B	SW3050	11/18/15
Mercury	1	0.0097	0.021	0.25		mg/Kg	SW7471A	METHOD	11/11/15
Nickel	1	0.20	1.57	56.6		mg/Kg	SW6010B	SW3050	11/18/15
Selenium	1	1.57	3.93	45.1		mg/Kg	SW6010B	SW3050	11/18/15
Silver	1	0.20	0.79	15.9		mg/Kg	SW6010B	SW3050	11/18/15
Thallium	1	0.39	3.15	32.3		mg/Kg	SW6010B	SW3050	11/18/15
Vanadium	1	0.20	1.97	71.1		mg/Kg	SW6010B	SW3050	11/18/15
Zinc	1	0.39	1.57	71.3		mg/Kg	SW6010B	SW3050	11/18/15

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Client Sample ID: D4SD04-0.503-01SD

Project Name: Alaska LNG
Sample Date: 11/05/15
Sample Time: 13:30
Type: Grab
Matrix: Soil
Basis: Dry Weight

Lab Information

Lab Sample ID: P358604MSD

Date Received: 11/07/15
Report Revision No: 0

Analyte	Dilution Factor	DL	RL	Result	Qual	Units	Analysis Method	Prep Method	Date Analyzed
Metals									
Antimony	1	0.44	2.19	18.9		mg/Kg	SW6010B	SW3050	11/18/15
Arsenic	1	1.05	2.63	52.7		mg/Kg	SW6010B	SW3050	11/18/15
Barium	1	0.044	0.88	95.6		mg/Kg	SW6010B	SW3050	11/18/15
Beryllium	1	0.044	0.35	46.5		mg/Kg	SW6010B	SW3050	11/18/15
Cadmium	1	0.088	0.44	42.9		mg/Kg	SW6010B	SW3050	11/18/15
Chromium	1	0.044	0.88	58.9		mg/Kg	SW6010B	SW3050	11/18/15
Copper	1	0.44	1.75	59.1		mg/Kg	SW6010B	SW3050	11/18/15
Lead	1	0.30	1.75	45.8		mg/Kg	SW6010B	SW3050	11/18/15
Mercury	1	0.0095	0.021	0.24		mg/Kg	SW7471A	METHOD	11/11/15
Nickel	1	0.22	1.75	60.3		mg/Kg	SW6010B	SW3050	11/18/15
Selenium	1	1.75	4.39	51.6		mg/Kg	SW6010B	SW3050	11/18/15
Silver	1	0.22	0.88	19.4		mg/Kg	SW6010B	SW3050	11/18/15
Thallium	1	0.44	3.51	35.9		mg/Kg	SW6010B	SW3050	11/18/15
Vanadium	1	0.22	2.19	74.6		mg/Kg	SW6010B	SW3050	11/18/15
Zinc	1	0.44	1.75	77.8		mg/Kg	SW6010B	SW3050	11/18/15

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Client Sample ID: D4SD04-0304.25-02

Project Name: Alaska LNG
Sample Date: 11/05/15
Sample Time: 16:30
Type: Grab
Matrix: Soil
Basis: Dry Weight

Lab Information

Lab Sample ID: P358605

Date Received: 11/07/15
Report Revision No: 0

Analyte	Dilution Factor	DL	RL	Result	Qual	Units	Analysis Method	Prep Method	Date Analyzed
Metals									
Antimony	1	0.40	2.01	1.08	J	mg/Kg	SW6010B	SW3050	11/18/15
Arsenic	1	0.96	2.41	6.78		mg/Kg	SW6010B	SW3050	11/18/15
Barium	1	0.040	0.80	50.4		mg/Kg	SW6010B	SW3050	11/18/15
Beryllium	1	0.040	0.32	1.36		mg/Kg	SW6010B	SW3050	11/18/15
Cadmium	1	0.080	0.40	0.080	U	mg/Kg	SW6010B	SW3050	11/18/15
Chromium	1	0.040	0.80	15.1		mg/Kg	SW6010B	SW3050	11/18/15
Copper	1	0.40	1.60	12.4		mg/Kg	SW6010B	SW3050	11/18/15
Lead	1	0.27	1.60	1.95		mg/Kg	SW6010B	SW3050	11/18/15
Mercury	1	0.0094	0.021	0.020	J	mg/Kg	SW7471A	METHOD	11/11/15
Nickel	1	0.20	1.60	16.6		mg/Kg	SW6010B	SW3050	11/18/15
Selenium	1	1.60	4.01	4.40		mg/Kg	SW6010B	SW3050	11/18/15
Silver	1	0.20	0.80	0.20	U	mg/Kg	SW6010B	SW3050	11/18/15
Thallium	1	0.40	3.21	0.40	U	mg/Kg	SW6010B	SW3050	11/18/15
Vanadium	1	0.20	2.01	28.6		mg/Kg	SW6010B	SW3050	11/18/15
Zinc	1	0.40	1.60	35.6		mg/Kg	SW6010B	SW3050	11/18/15

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Client Sample ID: D4SD04-4.2518.86-03

Project Name: Alaska LNG
Sample Date: 11/05/15
Sample Time: 14:50
Type: Grab
Matrix: Soil
Basis: Dry Weight

Lab Information

Lab Sample ID: P358606

Date Received: 11/07/15
Report Revision No: 0

Analyte	Dilution Factor	DL	RL	Result	Qual	Units	Analysis Method	Prep Method	Date Analyzed
Metals									
Antimony	1	0.29	1.45	2.91		mg/Kg	SW6010B	SW3050	11/20/15
Arsenic	1	0.69	1.74	17.8		mg/Kg	SW6010B	SW3050	11/20/15
Barium	1	0.029	0.58	87.4		mg/Kg	SW6010B	SW3050	11/20/15
Beryllium	1	0.029	0.23	2.79		mg/Kg	SW6010B	SW3050	11/20/15
Cadmium	1	0.058	0.29	0.84		mg/Kg	SW6010B	SW3050	11/20/15
Chromium	1	0.029	0.58	31.6		mg/Kg	SW6010B	SW3050	11/20/15
Copper	1	0.29	1.16	30.1		mg/Kg	SW6010B	SW3050	11/20/15
Lead	1	0.20	1.16	9.14		mg/Kg	SW6010B	SW3050	11/20/15
Mercury	1	0.010	0.023	0.042		mg/Kg	SW7471A	METHOD	11/11/15
Nickel	1	0.14	1.16	32.5		mg/Kg	SW6010B	SW3050	11/20/15
Selenium	1	1.16	2.89	3.69		mg/Kg	SW6010B	SW3050	11/20/15
Silver	1	0.14	0.58	2.09		mg/Kg	SW6010B	SW3050	11/20/15
Thallium	1	0.29	2.31	0.29	U	mg/Kg	SW6010B	SW3050	11/20/15
Vanadium	1	0.14	1.45	47.6		mg/Kg	SW6010B	SW3050	11/20/15
Zinc	1	0.29	1.16	75.2		mg/Kg	SW6010B	SW3050	11/20/15

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Client Sample ID: D5SD01-0002-01

Project Name: Alaska LNG
Sample Date: 11/06/15
Sample Time: 11:15
Type: Grab
Matrix: Soil
Basis: Dry Weight

Lab Information

Lab Sample ID: P358607

Date Received: 11/07/15
Report Revision No: 0

Analyte	Dilution Factor	DL	RL	Result	Qual	Units	Analysis Method	Prep Method	Date Analyzed
Metals									
Antimony	1	0.41	2.06	2.00	J	mg/Kg	SW6010B	SW3050	11/20/15
Arsenic	1	0.98	2.47	8.41		mg/Kg	SW6010B	SW3050	11/20/15
Barium	1	0.041	0.82	40.2		mg/Kg	SW6010B	SW3050	11/20/15
Beryllium	1	0.041	0.33	1.56		mg/Kg	SW6010B	SW3050	11/20/15
Cadmium	1	0.082	0.41	0.082	U	mg/Kg	SW6010B	SW3050	11/20/15
Chromium	1	0.041	0.82	14.9		mg/Kg	SW6010B	SW3050	11/20/15
Copper	1	0.41	1.65	9.16		mg/Kg	SW6010B	SW3050	11/20/15
Lead	1	0.28	1.65	3.02		mg/Kg	SW6010B	SW3050	11/20/15
Mercury	1	0.0096	0.021	0.026		mg/Kg	SW7471A	METHOD	11/11/15
Nickel	1	0.21	1.65	14.9		mg/Kg	SW6010B	SW3050	11/20/15
Selenium	1	1.65	4.12	1.72	J	mg/Kg	SW6010B	SW3050	11/20/15
Silver	1	0.21	0.82	1.43		mg/Kg	SW6010B	SW3050	11/20/15
Thallium	1	0.41	3.30	0.41	U	mg/Kg	SW6010B	SW3050	11/20/15
Vanadium	1	0.21	2.06	29.5		mg/Kg	SW6010B	SW3050	11/20/15
Zinc	1	0.41	1.65	32.2		mg/Kg	SW6010B	SW3050	11/20/15

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Client Sample ID: D5SD01-0204-02

Project Name: Alaska LNG
Sample Date: 11/06/15
Sample Time: 13:00
Type: Grab
Matrix: Soil
Basis: Dry Weight

Lab Information

Lab Sample ID: P358608

Date Received: 11/07/15
Report Revision No: 0

Analyte	Dilution Factor	DL	RL	Result	Qual	Units	Analysis Method	Prep Method	Date Analyzed
Metals									
Antimony	1	0.41	2.07	4.01		mg/Kg	SW6010B	SW3050	11/20/15
Arsenic	1	0.99	2.48	14.9		mg/Kg	SW6010B	SW3050	11/20/15
Barium	1	0.041	0.83	43.6		mg/Kg	SW6010B	SW3050	11/20/15
Beryllium	1	0.041	0.33	2.37		mg/Kg	SW6010B	SW3050	11/20/15
Cadmium	1	0.083	0.41	0.083	U	mg/Kg	SW6010B	SW3050	11/20/15
Chromium	1	0.041	0.83	17.0		mg/Kg	SW6010B	SW3050	11/20/15
Copper	1	0.41	1.66	12.4		mg/Kg	SW6010B	SW3050	11/20/15
Lead	1	0.28	1.66	4.09		mg/Kg	SW6010B	SW3050	11/20/15
Mercury	1	0.0091	0.020	0.023		mg/Kg	SW7471A	METHOD	11/11/15
Nickel	1	0.21	1.66	17.1		mg/Kg	SW6010B	SW3050	11/20/15
Selenium	1	1.66	4.14	3.56	J	mg/Kg	SW6010B	SW3050	11/20/15
Silver	1	0.21	0.83	2.39		mg/Kg	SW6010B	SW3050	11/20/15
Thallium	1	0.41	3.31	0.41	U	mg/Kg	SW6010B	SW3050	11/20/15
Vanadium	1	0.21	2.07	35.1		mg/Kg	SW6010B	SW3050	11/20/15
Zinc	1	0.41	1.66	36.4		mg/Kg	SW6010B	SW3050	11/20/15

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Client Sample ID: D4BDS01-001.31-01

Project Name: Alaska LNG
Sample Date: 11/03/15
Sample Time: 11:00
Type: Grab
Matrix: Soil
Basis: Dry Weight

Lab Information

Lab Sample ID: P358609

Date Received: 11/07/15
Report Revision No: 0

Analyte	Dilution Factor	DL	RL	Result	Qual	Units	Analysis Method	Prep Method	Date Analyzed
Metals									
Antimony	1	0.55	2.75	0.75	J	mg/Kg	SW6010B	SW3050	11/20/15
Arsenic	1	1.31	3.31	9.64		mg/Kg	SW6010B	SW3050	11/20/15
Barium	1	0.055	1.10	32.2		mg/Kg	SW6010B	SW3050	11/20/15
Beryllium	1	0.055	0.44	1.58		mg/Kg	SW6010B	SW3050	11/20/15
Cadmium	1	0.11	0.55	0.11	U	mg/Kg	SW6010B	SW3050	11/20/15
Chromium	1	0.055	1.10	13.9		mg/Kg	SW6010B	SW3050	11/20/15
Copper	1	0.55	2.20	7.42		mg/Kg	SW6010B	SW3050	11/20/15
Lead	1	0.38	2.20	2.47		mg/Kg	SW6010B	SW3050	11/20/15
Mercury	1	0.011	0.023	0.013	J	mg/Kg	SW7471A	METHOD	11/11/15
Nickel	1	0.28	2.20	13.9		mg/Kg	SW6010B	SW3050	11/20/15
Selenium	1	2.20	5.51	2.20	U	mg/Kg	SW6010B	SW3050	11/20/15
Silver	1	0.28	1.10	1.47		mg/Kg	SW6010B	SW3050	11/20/15
Thallium	1	0.55	4.41	0.55	U	mg/Kg	SW6010B	SW3050	11/20/15
Vanadium	1	0.28	2.75	28.8		mg/Kg	SW6010B	SW3050	11/20/15
Zinc	1	0.55	2.20	30.3		mg/Kg	SW6010B	SW3050	11/20/15

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Client Sample ID: D5SD01-0404.9-03

Project Name: Alaska LNG
Sample Date: 11/06/15
Sample Time: 14:45
Type: Grab
Matrix: Soil
Basis: Dry Weight

Lab Information

Lab Sample ID: P358610

Date Received: 11/07/15
Report Revision No: 0

Analyte	Dilution Factor	DL	RL	Result	Qual	Units	Analysis Method	Prep Method	Date Analyzed
Metals									
Antimony	1	0.46	2.32	4.26		mg/Kg	SW6010B	SW3050	11/20/15
Arsenic	1	1.11	2.78	27.1		mg/Kg	SW6010B	SW3050	11/20/15
Barium	1	0.046	0.93	118		mg/Kg	SW6010B	SW3050	11/20/15
Beryllium	1	0.046	0.37	3.70		mg/Kg	SW6010B	SW3050	11/20/15
Cadmium	1	0.093	0.46	0.31	J	mg/Kg	SW6010B	SW3050	11/20/15
Chromium	1	0.046	0.93	39.2		mg/Kg	SW6010B	SW3050	11/20/15
Copper	1	0.46	1.86	37.0		mg/Kg	SW6010B	SW3050	11/20/15
Lead	1	0.32	1.86	11.7		mg/Kg	SW6010B	SW3050	11/20/15
Mercury	1	0.0092	0.020	0.072		mg/Kg	SW7471A	METHOD	11/11/15
Nickel	1	0.23	1.86	36.7		mg/Kg	SW6010B	SW3050	11/20/15
Selenium	1	1.86	4.64	3.62	J	mg/Kg	SW6010B	SW3050	11/20/15
Silver	1	0.23	0.93	3.24		mg/Kg	SW6010B	SW3050	11/20/15
Thallium	1	0.46	3.71	0.46	U	mg/Kg	SW6010B	SW3050	11/20/15
Vanadium	1	0.23	2.32	58.5		mg/Kg	SW6010B	SW3050	11/20/15
Zinc	1	0.46	1.86	88.1		mg/Kg	SW6010B	SW3050	11/20/15

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Project Name: Alaska LNG
Sample Date: N/A
Sample Time: N/A
Type: QC
Matrix: Soil
Basis: Dry Weight

Lab Information

Method Blank ID: SB1-1110

Date Received: N/A
Report Revision No: 0

Analyte	Dilution Factor	DL	RL	Result	Qual	Units	Analysis Method	Prep Method	Date Analyzed
Metals									
Antimony	1	0.50	2.50	0.78	J	mg/Kg	SW6010B	SW3050	11/18/15
Arsenic	1	1.19	3.00	1.19	U	mg/Kg	SW6010B	SW3050	11/18/15
Barium	1	0.050	1.00	0.050	U	mg/Kg	SW6010B	SW3050	11/18/15
Beryllium	1	0.050	0.40	0.050	U	mg/Kg	SW6010B	SW3050	11/18/15
Cadmium	1	0.10	0.50	0.10	U	mg/Kg	SW6010B	SW3050	11/18/15
Chromium	1	0.050	1.00	0.050	U	mg/Kg	SW6010B	SW3050	11/18/15
Copper	1	0.50	2.00	0.50	U	mg/Kg	SW6010B	SW3050	11/18/15
Lead	1	0.34	2.00	0.34	U	mg/Kg	SW6010B	SW3050	11/18/15
Mercury	1	0.0090	0.020	0.0090	U	mg/Kg	SW7471A	METHOD	11/11/15
Nickel	1	0.25	2.00	0.25	U	mg/Kg	SW6010B	SW3050	11/18/15
Selenium	1	2.00	5.00	2.00	U	mg/Kg	SW6010B	SW3050	11/18/15
Silver	1	0.25	1.00	0.25	U	mg/Kg	SW6010B	SW3050	11/18/15
Thallium	1	0.50	4.00	0.50	U	mg/Kg	SW6010B	SW3050	11/18/15
Vanadium	1	0.25	2.50	0.25	U	mg/Kg	SW6010B	SW3050	11/18/15
Zinc	1	0.50	2.00	0.50	U	mg/Kg	SW6010B	SW3050	11/18/15

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Project Name: Alaska LNG
Type: QC
Matrix: Soil

Lab Information

Blank Spike ID: BS1S1110

Report Revision No: 0
Dilution Factor: 1

Analyte	Spike Amount	Result	Units	%Recovery	Analysis Method	Prep Method	Date Analyzed
Metals							
Antimony	50.0	49.9	mg/Kg	100	SW6010B	SW3050	11/18/15
Arsenic	50.0	49.9	mg/Kg	100	SW6010B	SW3050	11/18/15
Barium	50.0	49.8	mg/Kg	100	SW6010B	SW3050	11/18/15
Beryllium	50.0	49.6	mg/Kg	99	SW6010B	SW3050	11/18/15
Cadmium	50.0	47.9	mg/Kg	96	SW6010B	SW3050	11/18/15
Chromium	50.0	49.2	mg/Kg	98	SW6010B	SW3050	11/18/15
Copper	50.0	48.5	mg/Kg	97	SW6010B	SW3050	11/18/15
Lead	50.0	48.8	mg/Kg	98	SW6010B	SW3050	11/18/15
Mercury	0.20	0.21	mg/Kg	103	SW7471A	METHOD	11/11/15
Nickel	50.0	52.0	mg/Kg	104	SW6010B	SW3050	11/18/15
Selenium	50.0	52.2	mg/Kg	104	SW6010B	SW3050	11/18/15
Silver	25.0	24.2	mg/Kg	97	SW6010B	SW3050	11/18/15
Thallium	50.0	48.8	mg/Kg	98	SW6010B	SW3050	11/18/15
Vanadium	50.0	49.1	mg/Kg	98	SW6010B	SW3050	11/18/15
Zinc	50.0	48.2	mg/Kg	96	SW6010B	SW3050	11/18/15

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Client Sample ID: **D4SD04-0.503-01**

Project Name: Alaska LNG
Type: QC
Matrix: Soil

Lab Information

Report Revision No.: 0

Analyte	CAS#	MS %Recovery	MSD %Recovery	RPD	QC Limits	RPD Limits	Analysis Method
Metals							
Lead	7439-92-1	95	99	13.8	75-125	20	SW6010B
Nickel	7440-02-0	105	103	6.2	75-125	20	SW6010B
Silver	7440-22-4	81	88	19.8	75-125	20	SW6010B
Thallium	7440-28-0	82	82	10.6	75-125	20	SW6010B
Antimony	7440-36-0	36 *	40 *	18.5	75-125	20	SW6010B
Arsenic	7440-38-2	95	108	21.0 *	75-125	20	SW6010B
Barium	7440-39-3	130 *	127 *	4.7	75-125	20	SW6010B
Beryllium	7440-41-7	103	103	10.7	75-125	20	SW6010B
Cadmium	7440-43-9	99	98	9.5	75-125	20	SW6010B
Chromium	7440-47-3	106	103	5.8	75-125	20	SW6010B
Copper	7440-50-8	108	108	8.7	75-125	20	SW6010B
Vanadium	7440-62-2	111	108	4.9	75-125	20	SW6010B
Zinc	7440-66-6	102	106	8.7	75-125	20	SW6010B
Selenium	7782-49-2	108	112	13.5	75-125	20	SW6010B
Mercury	7439-97-6	104	104	0.8	75-125	20	SW7471A

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

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CASE NARRATIVE
GENERAL CHEMISTRY ANALYSIS

Lab Name: CH2M HILL ASL **ASL SDG#:** P3586

Project: Alaska LNG **Project #:** 653488.16.06

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

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

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

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

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

Method(s):
SM5310B

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information		Lab Information	
Project Name:	**Alaska LNG**	**Lab Batch ID:**	**P3586**
Date Received:	11/07/15	Analysis Method:	SM5310B
Type:	See C.O.C.	Units:	mg/L
Matrix:	Water	Report Revision No.:	0

Client Sample ID	Lab Sample ID	Dilution Factor	DL	RL	Total Organic Carbon Result	Qualifier	Date Analyzed
General Chemistry							
EB110615-01	P358613	1	0.20	0.50	0.83		11/29/15
WB1-1129	WB1-1129	1	0.20	0.50	0.20	U	11/29/15

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Project Name: Alaska LNG
Type: QC
Matrix: Water

Lab Information

Lab Batch ID: P3586

Report Revision No.: 0

LCS ID	Analyte	Spike Amount	Sample Result	Units	% Recovery	Analysis Method	Date Analyzed
General Chemistry							
BS1W1129	Total Organic Carbon	5.00	4.77	mg/L	95	SM5310B	11/29/15

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

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CASE NARRATIVE
GENERAL CHEMISTRY ANALYSIS

Lab Name: CH2M HILL ASL **ASL SDG#:** P3586

Project: Alaska LNG **Project #:** 653488.16.06

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

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

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

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

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

Method(s):
LYDKHN

Matrix Spike/Matrix Spike Duplicate(s):
LYDKHN: MSD recovery of Total Organic Carbon(158%) in D4SD04-0.503-01SD did not meet acceptance criteria of 70-130%.

Analytical Exception(s):
LYDKHN: The %RSD in sample P358607 (28%) exceeded the acceptance criteria (25% RSD).

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Project Name: **Alaska LNG**

Date Received: 11/07/15
Type: See C.O.C.
Matrix: Soil
Basis: Dry Weight

Lab Information

Lab Batch ID: **P3586**

Analysis Method: LYDKHN
Units: mg/Kg
Report Revision No.: 0

Client Sample ID	Lab Sample ID	Dilution Factor	DL	RL	Total Organic Carbon Result	Qualifier	Date Analyzed
General Chemistry							
D4SD04-0.503-01	P358601	1	84.7	281	2120		11/24/15
D4SD04-0.503-101	P358602	1	72.6	241	5200		11/24/15
D4SD04-0.503-01MS	P358603MS	1	63.4	210	4720		11/24/15
D4SD04-0.503-01SD	P358604MSD	1	61.3	203	5320		11/24/15
D4SD04-0304.25-02	P358605	1	82.9	275	3400		11/24/15
D4SD04-4.2518.86-03	P358606	1	75.1	249	5020		11/24/15
D5SD01-0002-01	P358607	1	90.0	299	3380		11/25/15
D5SD01-0204-02	P358608	1	58.8	195	4390		11/25/15
D4BDS01-001.31-01	P358609	1	63.7	211	3260		11/25/15
D5SD01-0404.9-03	P358610	1	76.3	253	6430		11/25/15
SB1-1124	SB1-1124	1	30.1	100	30.1	U	11/24/15
SB1-1125	SB1-1125	1	30.1	100	30.1	U	11/25/15

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Project Name: Alaska LNG
Type: QC
Matrix: Soil
Basis: Dry Weight

Lab Information

Lab Batch ID: P3586

Report Revision No.: 0

LCS ID	Analyte	Spike Amount	Sample Result	Units	% Recovery	Analysis Method	Date Analyzed
General Chemistry							
BS1S1124	Total Organic Carbon	1180	1260	mg/Kg	107	LYDKHN	11/24/15
BS1S1125	Total Organic Carbon	1180	1020	mg/Kg	87	LYDKHN	11/25/15

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information		Lab Information	
Client Sample ID:	**D4SD04-0.503-01**		
Project Name:	Alaska LNG	Report Revision No.:	0
Type:	QC		
Matrix:	Soil		

Analyte	CAS#	MS %Recovery	MSD %Recovery	RPD	QC Limits	RPD Limits	Analysis Method
General Chemistry							
Total Organic Carbon	TOC	124	158 *	12.1	70-130	20	LYDKHN

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

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CASE NARRATIVE
GENERAL CHEMISTRY ANALYSIS

Lab Name: CH2M HILL ASL **ASL SDG#:** P3586

Project: Alaska LNG **Project #:** 653488.16.06

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

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

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

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

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

Method(s):
ASTM 2216
E150.1
E160.4
SM2540B
SM2540G
ASTM D2216

Holding Time(s):
E150.1: All samples for pH were analyzed outside of holding time due to samples being received with limited holding time remaining.

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Project Name: **Alaska LNG**

Date Received: 11/07/15
Type: See C.O.C.
Matrix: Soil
Basis: Dry Weight

Lab Information

Lab Batch ID: **P3586**

Analysis Method: ASTM D2216
Units: Percent
Report Revision No.: 0

Client Sample ID	Lab Sample ID	Dilution Factor	DL	RL	Moisture Result	Qualifier	Date Analyzed
General Chemistry							
D4SD04-0.503-01	P358601	1	N/A	N/A	17.5		11/09/15
D4SD04-0.503-101	P358602	1	N/A	N/A	18.3		11/09/15
D4SD04-0304.25-02	P358605	1	N/A	N/A	20.3		11/09/15
D4SD04-4.2518.86-03	P358606	1	N/A	N/A	19.9		11/09/15
D5SD01-0002-01	P358607	1	N/A	N/A	19.6		11/09/15
D5SD01-0204-02	P358608	1	N/A	N/A	22.8		11/09/15
D4BDS01-001.31-01	P358609	1	N/A	N/A	23.8		11/09/15
D5SD01-0404.9-03	P358610	1	N/A	N/A	22.4		11/09/15
D4SD04-5.756.25-04	P358612	1	N/A	N/A	20.4		11/09/15

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information		Lab Information	
Project Name:	**Alaska LNG**	**Lab Batch ID:**	**P3586**
Date Received:	11/07/15	Analysis Method:	SM2540G
Type:	See C.O.C.	Units:	Percent
Matrix:	Soil	Report Revision No.:	0
Basis:	Dry Weight		

Client Sample ID	Lab Sample ID	Dilution Factor	DL	RL	Total Solids (TS) Result	Qualifier	Date Analyzed
General Chemistry							
D4SD04-0.503-01	P358601	1	N/A	N/A	85.1		11/09/15
D4SD04-0.503-101	P358602	1	N/A	N/A	84.5		11/09/15
D4SD04-0304.25-02	P358605	1	N/A	N/A	83.1		11/09/15
D4SD04-4.2518.86-03	P358606	1	N/A	N/A	83.4		11/09/15
D5SD01-0002-01	P358607	1	N/A	N/A	83.6		11/09/15
D5SD01-0204-02	P358608	1	N/A	N/A	81.5		11/09/15
D4BDS01-001.31-01	P358609	1	N/A	N/A	80.8		11/09/15
D5SD01-0404.9-03	P358610	1	N/A	N/A	81.7		11/09/15
D4SD04-5.756.25-04	P358612	1	N/A	N/A	83.1		11/09/15

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information		Lab Information	
Project Name:	**Alaska LNG**	**Lab Batch ID:**	**P3586**
Date Received:	11/07/15	Analysis Method:	SM2540B
Type:	See C.O.C.	Units:	mg/L
Matrix:	Water	Report Revision No.:	0

Client Sample ID	Lab Sample ID	Dilution Factor	DL	RL	Total Solids (TS) Result	Qualifier	Date Analyzed
General Chemistry							
EB110615-01	P358613	1	N/A	N/A	N/A	U	11/09/15
WB1-1109	WB1-1109	1	N/A	N/A	N/A	U	11/09/15

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Project Name: **Alaska LNG**

Date Received: 11/07/15
Type: See C.O.C.
Matrix: Soil
Basis: Dry Weight

Lab Information

Lab Batch ID: **P3586**

Analysis Method: E160.4
Units: Percent
Report Revision No.: 0

Client Sample ID	Lab Sample ID	Dilution Factor	DL	RL	Total Volatile Solids (TVS) Result	Qualifier	Date Analyzed
General Chemistry							
D4SD04-0.503-01	P358601	1	N/A	N/A	2.1		11/09/15
D4SD04-0.503-101	P358602	1	N/A	N/A	1.2		11/09/15
D4SD04-0304.25-02	P358605	1	N/A	N/A	1.3		11/09/15
D4SD04-4.2518.86-03	P358606	1	N/A	N/A	2.6		11/09/15
D5SD01-0002-01	P358607	1	N/A	N/A	1.4		11/09/15
D5SD01-0204-02	P358608	1	N/A	N/A	2.0		11/09/15
D4BDS01-001.31-01	P358609	1	N/A	N/A	1.5		11/09/15
D5SD01-0404.9-03	P358610	1	N/A	N/A	3.1		11/09/15
D4SD04-5.756.25-04	P358612	1	N/A	N/A	3.1		11/09/15

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information		Lab Information	
Project Name:	**Alaska LNG**	**Lab Batch ID:**	**P3586**
Date Received:	11/07/15	Analysis Method:	E160.4
Type:	See C.O.C.	Units:	mg/L
Matrix:	Water	Report Revision No.:	0

Client Sample ID	Lab Sample ID	Dilution Factor	DL	RL	Total Volatile Solids (TVS) Result	Qualifier	Date Analyzed
General Chemistry							
EB110615-01	P358613	1	N/A	N/A	26.0		11/09/15
WB1-1109	WB1-1109	1	N/A	N/A	22.0		11/09/15

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information		Lab Information	
Project Name:	**Alaska LNG**	**Lab Batch ID:**	**P3586**
Date Received:	11/07/15	Analysis Method:	E150.1
Type:	See C.O.C.	Units:	pH Units
Matrix:	Soil	Report Revision No.:	0
Basis:	Dry Weight		

Client Sample ID	Lab Sample ID	Dilution Factor	DL	RL	pH Result	Qualifier	Date Analyzed
General Chemistry							
D4SD04-0.503-01	P358601	1	N/A	N/A	8.39	*	11/07/15 16:01
D4SD04-0304.25-02	P358605	1	N/A	N/A	8.37	*	11/07/15 16:02
D4SD04-4.2518.86-03	P358606	1	N/A	N/A	8.91	*	11/07/15 16:04
D5SD01-0002-01	P358607	1	N/A	N/A	8.33	*	11/07/15 16:05
D5SD01-0204-02	P358608	1	N/A	N/A	8.35	*	11/07/15 16:06
D4BDS01-001.31-01	P358609	1	N/A	N/A	8.23	*	11/07/15 16:07
D5SD01-0404.9-03	P358610	1	N/A	N/A	9.01	*	11/07/15 16:08
D4SD04-5.756.25-04	P358612	1	N/A	N/A	8.74	*	11/07/15 16:10

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Project Name: Alaska LNG
Type: QC
Matrix: Soil
Basis: As Received

Lab Information

Lab Batch ID: P3586

Report Revision No.: 0

LCS ID	Analyte	Spike Amount	Sample Result	Units	% Recovery	Analysis Method	Date Analyzed
General Chemistry							
BS1S1107	pH	7.00	7.04	pH Units	101	E150.1	11/07/15

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

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Project Name: Alaska LNG
Type: QC
Matrix: Water

Lab Information

Lab Batch ID: P3586

Report Revision No.: 0

LCS ID	Analyte	Spike Amount	Sample Result	Units	% Recovery	Analysis Method	Date Analyzed
General Chemistry							
BS1W1109	Total Solids (TS)	1100	1080	mg/L	98	SM2540B	11/09/15

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

CH2M Applied Sciences Laboratory (ASL)
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CASE NARRATIVE
GEOTECHNICAL ANALYSIS

Lab Name: CH2M ASL ASL SDG #: P3586

Project: Alaska LNG Project #: 653488.16.06

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

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

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

Method(s):
Grain size with Hydrometer (ASTM D422), Specific Gravity- soil (ASTM D854B), Atterberg Limits (ASTM D4318), USCS Classification (ASTM 2487), Grain Density by API RP (API RP40), and Bulk Density (ASTM D7263).

Analytical Exception(s):
None.

Other:
None.

Documentation Exception(s):
None.

CH2MHILL

Particle Size Distribution, ASTM D422

Client ID D4SD04-0.503-01 **Lab ID** **P358601**

Project Name Alaska LNG

Analysis By: SB/JVP

Reviewed By:

Sample Weight, g	466.70

Sieve Analysis

#	Particle Diameter mm	Weight Retained g	Weight Retained %	Cumulative Weight Retained %	Sieve Finer %
4	4.750	3.43	0.73	0.73	99.27
10	2.000	5.68	1.22	1.95	98.05
20	0.850	1.78	0.38	2.33	97.67
40	0.425	2.97	0.64	2.97	97.03
60	0.250	32.16	6.89	9.86	90.14
140	0.106	273.40	58.58	68.44	31.56
200	0.075	53.17	11.39	79.84	20.16
Pan	< 0.075	94.10	20.16	100.00	0.00

Soil Description	Retained on Sieve Sieve No.	Weight Percent %
Gravel	4	0.7
Coarse Sand	10	1.2
Medium Sand	40	1.0
Fine Sand	200	76.9
Silt/Clay	< 200	20.2

USCS Description by ASTM D2487
Silty Sand

Hydrometer Analysis - 151H

Time mins	Particle Diameter mm	Calculated Weight g	Calculated Weight %	Cumulative Weight Retained %	Hydrometer Finer %
2	0.038	80.32	17.21	97.05	14.64
5	0.025	2.76	0.59	97.64	11.71
15	0.014	1.38	0.30	97.93	10.25
30	0.010	1.38	0.30	98.23	8.79
60	0.007	1.38	0.30	98.52	7.32
120	0.005	1.38	0.30	98.82	5.86
250	0.004	0.00	0.00	98.82	5.86
		5.51	1.18	100.00	

CH2MHILL

Particle Size Distribution, ASTM D422

Client ID D4SD04-0304.25-02 **Lab ID** **P358605**

Project Name Alaska LNG

Analysis By: SB/JVP

Reviewed By:

Sample Weight, g	458.30

Sieve Analysis

#	Particle Diameter mm	Weight Retained g	Weight Retained %	Cumulative Weight Retained %	Sieve Finer %
4	4.750	0.19	0.04	0.04	99.96
10	2.000	0.40	0.09	0.13	99.87
20	0.850	0.39	0.09	0.21	99.79
40	0.425	0.83	0.18	0.40	99.60
60	0.250	13.64	2.98	3.37	96.63
140	0.106	250.38	54.63	58.00	42.00
200	0.075	76.21	16.63	74.63	25.37
Pan	< 0.075	116.26	25.37	100.00	0.00

Soil Description	Retained on Sieve Sieve No.	Weight Percent %
Gravel	4	0.0
Coarse Sand	10	0.1
Medium Sand	40	0.3
Fine Sand	200	74.2
Silt/Clay	< 200	25.4

USCS Description by ASTM D2487
Silty Sand

Hydrometer Analysis - 151H

Time mins	Particle Diameter mm	Calculated Weight g	Calculated Weight %	Cumulative Weight Retained %	Hydrometer Finer %
2	0.038	99.34	21.68	96.31	14.55
5	0.025	3.38	0.74	97.05	11.64
15	0.014	1.69	0.37	97.42	10.19
30	0.010	1.69	0.37	97.78	8.73
60	0.007	1.69	0.37	98.15	7.28
120	0.005	0.00	0.00	98.15	7.28
250	0.004	1.69	0.37	98.52	5.82
		6.77	1.48	100.00	

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Particle Size Distribution, ASTM D422

Client ID D4SD04-4.2518.86-03 **Lab ID** **P358606**

Project Name Alaska LNG

Analysis By: SB/JVP

Reviewed By:

Sample Weight, g	455.73

Sieve Analysis

#	Particle Diameter mm	Weight Retained g	Weight Retained %	Cumulative Weight Retained %	Sieve Finer %
4	4.750	4.10	0.90	0.90	99.10
10	2.000	0.47	0.10	1.00	99.00
20	0.850	1.99	0.44	1.44	98.56
40	0.425	2.67	0.59	2.03	97.97
60	0.250	3.98	0.87	2.90	97.10
140	0.106	36.96	8.11	11.01	88.99
200	0.075	27.84	6.11	17.12	82.88
Pan	< 0.075	377.73	82.88	100.00	0.00

Soil Description	Retained on Sieve Sieve No.	Weight Percent %
Gravel	4	0.9
Coarse Sand	10	0.1
Medium Sand	40	1.0
Fine Sand	200	15.1
Silt/Clay	< 200	82.9

USCS Description by ASTM D2487
Lean Clay with Sand

Hydrometer Analysis - 151H

Time mins	Particle Diameter mm	Calculated Weight g	Calculated Weight %	Cumulative Weight Retained %	Hydrometer Finer %
2	0.031	106.14	23.29	40.41	71.90
5	0.020	9.70	2.13	42.53	69.33
15	0.012	38.80	8.51	51.05	59.06
30	0.009	9.70	2.13	53.18	56.49
60	0.006	29.10	6.39	59.56	48.79
120	0.004	0.00	0.00	59.56	48.79
250	0.003	29.10	6.39	65.95	41.09
		155.19	34.05	100.00	

CH2MHILL

Particle Size Distribution, ASTM D422

Client ID D5SD01-0002-01 **Lab ID P358607**

Project Name Alaska LNG

Analysis By: SB/JVP

Reviewed By:

Sample Weight, g	446.61

Sieve Analysis

#	Particle Diameter mm	Weight Retained g	Weight Retained %	Cumulative Weight Retained %	Sieve Finer %
4	4.750	6.72	1.50	1.50	98.50
10	2.000	7.70	1.72	3.23	96.77
20	0.850	5.22	1.17	4.40	95.60
40	0.425	7.38	1.65	6.05	93.95
60	0.250	30.73	6.88	12.93	87.07
140	0.106	271.96	60.89	73.82	26.18
200	0.075	52.24	11.70	85.52	14.48
Pan	< 0.075	64.66	14.48	100.00	0.00

Soil Description	Retained on Sieve Sieve No.	Weight Percent %
Gravel	4	1.5
Coarse Sand	10	1.7
Medium Sand	40	2.8
Fine Sand	200	79.5
Silt/Clay	< 200	14.5

USCS Description by ASTM D2487
Silty Sand

Hydrometer Analysis - 151H

Time mins	Particle Diameter mm	Calculated Weight g	Calculated Weight %	Cumulative Weight Retained %	Hydrometer Finer %
2	0.039	57.12	12.79	98.31	11.66
5	0.025	1.89	0.42	98.73	8.75
15	0.015	0.94	0.21	98.94	7.29
30	0.010	0.94	0.21	99.16	5.83
60	0.007	0.00	0.00	99.16	5.83
120	0.005	0.94	0.21	99.37	4.37
250	0.004	0.00	0.00	99.37	4.37
		2.83	0.63	100.00	

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Particle Size Distribution, ASTM D422

Client ID D5SD01-0204-02 **Lab ID P358608**

Project Name Alaska LNG

Analysis By: SB/JVP

Reviewed By:

Sample Weight, g	459.80

Sieve Analysis

#	Particle Diameter mm	Weight Retained g	Weight Retained %	Cumulative Weight Retained %	Sieve Finer %
4	4.750	2.54	0.55	0.55	99.45
10	2.000	2.65	0.58	1.13	98.87
20	0.850	0.86	0.19	1.32	98.68
40	0.425	1.64	0.36	1.67	98.33
60	0.250	18.85	4.10	5.77	94.23
140	0.106	219.94	47.83	53.61	46.39
200	0.075	72.18	15.70	69.31	30.69
Pan	< 0.075	141.14	30.69	100.00	0.00

Soil Description	Retained on Sieve Sieve No.	Weight Percent %
Gravel	4	0.6
Coarse Sand	10	0.6
Medium Sand	40	0.5
Fine Sand	200	67.6
Silt/Clay	< 200	30.7

USCS Description by ASTM D2487
Silty Sand

Hydrometer Analysis - 151H

Time mins	Particle Diameter mm	Calculated Weight g	Calculated Weight %	Cumulative Weight Retained %	Hydrometer Finer %
2	0.037	116.61	25.36	94.67	17.37
5	0.024	4.09	0.89	95.56	14.48
15	0.014	4.09	0.89	96.44	11.58
30	0.010	2.04	0.44	96.89	10.14
60	0.007	2.04	0.44	97.33	8.69
120	0.005	0.00	0.00	97.33	8.69
250	0.004	2.04	0.44	97.78	7.24
		10.22	2.22	100.00	

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Particle Size Distribution, ASTM D422

Client ID D4BDS01-001.31-01 **Lab ID** **P358609**

Project Name Alaska LNG

Analysis By: SB/JVP

Reviewed By:

Sample Weight, g	443.60

Sieve Analysis

#	Particle Diameter mm	Weight Retained g	Weight Retained %	Cumulative Weight Retained %	Sieve Finer %
4	4.750	6.10	1.38	1.38	98.62
10	2.000	2.58	0.58	1.96	98.04
20	0.850	1.47	0.33	2.29	97.71
40	0.425	2.72	0.61	2.90	97.10
60	0.250	41.98	9.46	12.36	87.64
140	0.106	315.38	71.10	83.46	16.54
200	0.075	36.97	8.33	91.79	8.21
Pan	< 0.075	36.40	8.21	100.00	0.00

Soil Description	Retained on Sieve Sieve No.	Weight Percent %
Gravel	4	1.4
Coarse Sand	10	0.6
Medium Sand	40	0.9
Fine Sand	200	88.9
Silt/Clay	< 200	8.2

USCS Description by ASTM D2487
Poorly Graded Sand with Silty Clay

Hydrometer Analysis - 151H

Time mins	Particle Diameter mm	Calculated Weight g	Calculated Weight %	Cumulative Weight Retained %	Hydrometer Finer %
2	0.041	34.80	7.84	99.64	4.40
5	0.026	0.00	0.00	99.64	4.40
15	0.015	0.53	0.12	99.76	2.93
30	0.011	0.00	0.00	99.76	2.93
60	0.007	0.00	0.00	99.76	2.93
120	0.005	0.53	0.12	99.88	1.47
250	0.004	0.00	0.00	99.88	1.47
		0.53	0.12	100.00	

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Particle Size Distribution, ASTM D422

Client ID D5SD01-0404.9-03 **Lab ID** **P358610**

Project Name Alaska LNG

Analysis By: SB/JVP

Reviewed By:

Sample Weight, g	618.63

Sieve Analysis

#	Particle Diameter mm	Weight Retained g	Weight Retained %	Cumulative Weight Retained %	Sieve Finer %
4	4.750	5.38	0.87	0.87	99.13
10	2.000	0.25	0.04	0.91	99.09
20	0.850	5.16	0.83	1.74	98.26
40	0.425	5.82	0.94	2.69	97.31
60	0.250	8.82	1.43	4.11	95.89
140	0.106	33.61	5.43	9.54	90.46
200	0.075	21.22	3.43	12.97	87.03
Pan	< 0.075	538.37	87.03	100.00	0.00

Soil Description	Retained on Sieve Sieve No.	Weight Percent %
Gravel	4	0.9
Coarse Sand	10	0.0
Medium Sand	40	1.8
Fine Sand	200	10.3
Silt/Clay	< 200	87.0

USCS Description by ASTM D2487
Lean Clay

Hydrometer Analysis - 151H

Time mins	Particle Diameter mm	Calculated Weight g	Calculated Weight %	Cumulative Weight Retained %	Hydrometer Finer %
2	0.029	106.53	17.22	30.19	80.21
5	0.019	41.79	6.76	36.95	72.45
15	0.012	55.72	9.01	45.96	62.10
30	0.008	13.93	2.25	48.21	59.51
60	0.006	27.86	4.50	52.71	54.34
120	0.004	27.86	4.50	57.22	49.16
250	0.003	27.86	4.50	61.72	43.99
		236.82	38.28	100.00	

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Particle Size Distribution, ASTM D422

Client ID D4SD04-5.756.25-04 **Lab ID** **P358612**

Project Name Alaska LNG

Analysis By: SB/JVP

Reviewed By:

Sample Weight, g	387.81

Sieve Analysis

#	Particle Diameter mm	Weight Retained g	Weight Retained %	Cumulative Weight Retained %	Sieve Finer %
4	4.750	1.54	0.40	0.40	99.60
10	2.000	0.31	0.08	0.48	99.52
20	0.850	4.18	1.08	1.55	98.45
40	0.425	4.29	1.11	2.66	97.34
60	0.250	6.04	1.56	4.22	95.78
140	0.106	19.73	5.09	9.31	90.69
200	0.075	12.42	3.20	12.51	87.49
Pan	< 0.075	339.30	87.49	100.00	0.00

Soil Description	Retained on Sieve Sieve No.	Weight Percent %
Gravel	4	0.4
Coarse Sand	10	0.1
Medium Sand	40	2.2
Fine Sand	200	9.8
Silt/Clay	< 200	87.5

USCS Description by ASTM D2487
Lean Clay

Hydrometer Analysis - 151H

Time mins	Particle Diameter mm	Calculated Weight g	Calculated Weight %	Cumulative Weight Retained %	Hydrometer Finer %
2	0.029	63.43	16.35	28.86	81.31
5	0.019	25.86	6.67	35.53	73.68
15	0.012	25.86	6.67	42.20	66.06
30	0.008	17.24	4.45	46.65	60.98
60	0.006	25.86	6.67	53.32	53.36
120	0.004	17.24	4.45	57.76	48.28
250	0.003	17.24	4.45	62.21	43.19
		146.56	37.79	100.00	

Specific Gravity by ASTM D854

Lab Sample ID	P358601
Client ID	D4SD04-0.503-01
Date	11/12/2015
Analyst	EMT

Dry Pycnometer Mass, g	235.84
Water Filled Pycnometer Mass, g	484.58
Water Temperature, °C	21.2
Density of Water, g/cm^3	0.99816
Flask Volume, cm^3	249.20
Oven Dry Sample Mass, g	10.25
Sample in Pycnometer Mass, g	490.15

Specific Gravity	2.19

Specific Gravity by ASTM D854

Lab Sample ID	P358601D
Client ID	D4SD04-0.503-01
Date	11/12/2015
Analyst	EMT

Dry Pycnometer Mass, g	235.84
Water Filled Pycnometer Mass, g	484.58
Water Temperature, °C	21.2
Density of Water, g/cm^3	0.99816
Flask Volume, cm^3	249.20
Oven Dry Sample Mass, g	10.26
Sample in Pycnometer Mass, g	490.39

Specific Gravity	2.31

Specific Gravity by ASTM D854

Lab Sample ID	P358605
Client ID	D4SD04-0304.25-02
Date	11/12/2015
Analyst	EMT

Dry Pycnometer Mass, g	235.84
Water Filled Pycnometer Mass, g	484.58
Water Temperature, °C	21.2
Density of Water, g/cm^3	0.99816
Flask Volume, cm^3	249.20
Oven Dry Sample Mass, g	15.03
Sample in Pycnometer Mass, g	493.20

Specific Gravity	2.34

Specific Gravity by ASTM D854

Lab Sample ID	P358606
Client ID	D4SD04-4.2518.86-03
Date	11/12/2015
Analyst	EMT

Dry Pycnometer Mass, g	235.84
Water Filled Pycnometer Mass, g	484.58
Water Temperature, °C	21.2
Density of Water, g/cm^3	0.99816
Flask Volume, cm^3	249.20
Oven Dry Sample Mass, g	15.00
Sample in Pycnometer Mass, g	493.15

Specific Gravity	2.33

Specific Gravity by ASTM D854

Lab Sample ID	P358607
Client ID	D5SD01-0002-01
Date	11/12/2015
Analyst	EMT

Dry Pycnometer Mass, g	235.84
Water Filled Pycnometer Mass, g	484.58
Water Temperature, °C	21.2
Density of Water, g/cm^3	0.99816
Flask Volume, cm^3	249.20
Oven Dry Sample Mass, g	15.06
Sample in Pycnometer Mass, g	494.14

Specific Gravity	2.74

Specific Gravity by ASTM D854

Lab Sample ID	P358608
Client ID	D5SD01-0204-02
Date	11/12/2015
Analyst	EMT

Dry Pycnometer Mass, g	235.84
Water Filled Pycnometer Mass, g	484.58
Water Temperature, °C	21.2
Density of Water, g/cm^3	0.99816
Flask Volume, cm^3	249.20
Oven Dry Sample Mass, g	15.01
Sample in Pycnometer Mass, g	493.52

Specific Gravity	2.47

Specific Gravity by ASTM D854

Lab Sample ID	P358609
Client ID	D4BDS01-001.31-01
Date	11/12/2015
Analyst	EMT

Dry Pycnometer Mass, g	235.84
Water Filled Pycnometer Mass, g	484.58
Water Temperature, °C	21.2
Density of Water, g/cm^3	0.99816
Flask Volume, cm^3	249.20
Oven Dry Sample Mass, g	15.02
Sample in Pycnometer Mass, g	494.36

Specific Gravity	2.87

Specific Gravity by ASTM D854

Lab Sample ID	P358610
Client ID	D5SD01-0404.9-03
Date	11/12/2015
Analyst	EMT

Dry Pycnometer Mass, g	235.84
Water Filled Pycnometer Mass, g	484.58
Water Temperature, °C	21.2
Density of Water, g/cm^3	0.99816
Flask Volume, cm^3	249.20
Oven Dry Sample Mass, g	10.10
Sample in Pycnometer Mass, g	489.93

Specific Gravity	2.13

Specific Gravity by ASTM D854

Lab Sample ID	P358612
Client ID	D4SD04-5.756.25-04
Date	11/12/2015
Analyst	EMT

Dry Pycnometer Mass, g	235.84
Water Filled Pycnometer Mass, g	484.58
Water Temperature, °C	21.2
Density of Water, g/cm^3	0.99816
Flask Volume, cm^3	249.20
Oven Dry Sample Mass, g	15.09
Sample in Pycnometer Mass, g	493.10

Specific Gravity	2.30

CH2M HILL Applied Sciences Laboratory

Client Information		Lab Information	
Project Name:	**Alaska LNG**	**Lab Batch ID:**	**P3586**
Sampling Date:	See CoC	Analysis Method:	ASTM D4318
Sampling Time:	See CoC	Units:	N/A
Type:	Grab	Date Received:	11/7/2015
Matrix:	Soil	Report Revision No.:	0
Basis:	Dry Weight	Analyzed By:	EMT
		Revewed By:	

Atterberg Limits

Client Sample ID	Lab Sample ID	Liquid Limit	Plastic Limit	Plasticity Index	Date Analyzed
D4SD04-0.503-01	P358601	_	_	NP	11/11/2015
D4SD04-0304.25-02	P358605	_	_	NP	11/11/2015
D4SD04-4.2518.86-03	P358606	33	18	14.9	11/11/2015
D5SD01-0002-01	P358607	_	_	NP	11/11/2015
D5SD01-0204-02	P358608	_	_	NP	11/11/2015
D4BDS01-001.31-01	P358609	_	_	NP	11/11/2015
D5SD01-0404.9-03	P358610	35	18	17.2	11/11/2015
D4SD04-5.756.25-04	P358612	37	18	18.8	11/11/2015

NP=Non-Plastic

_ = Can not be determined

Sample Summary			
Sample ID	Sample Mass (g)	Grain Density (g/cm^3)	Notes
P358601	157.44	2.68	
P358605	164.96	2.72	
P358606	101.40	2.77	
P358607	158.18	2.74	
P358608	139.34	2.73	
P358609	118.07	2.68	
P358610	94.16	2.80	
P358612	103.13	2.76	

Porosity Bench Sheet

Sample Information

Sample ID:	QA/QC	**Analyst:**	SB
Client ID:	QA/QC	**Date/Time:**	11/16/15 1:25 PM

Calibration Information

Ref. Chamber Volume, cm^3	Sample Chamber Vol, cm^3
304.48	680.78

Blank Measurements, TV = $0cm^3$

Replicate	Ambient Pressure psig	Initial Pressure psig	Final Pressure psig	Adj. Init. Pressure psig	Adj. Final Pressure psig	Grain Volume cm^3
1	0.00	97.55	30.14	97.55	30.14	-0.22
2	0.00	97.53	30.14	97.53	30.14	-0.02
3	0.01	97.53	30.14	97.52	30.13	-0.24
4	-0.03	97.58	30.15	97.61	30.18	0.48
					Average:	0.00
					Standard Deviation:	0.34

Jar Measurements, TV ~ $55.00cm^3$

Replicate	Ambient Pressure psig	Initial Pressure psig	Final Pressure psig	Adj. Init. Pressure psig	Adj. Final Pressure psig	Grain Volume cm^3
1	0.00	97.52	31.93	97.52	31.93	55.31
2	0.00	97.52	31.92	97.52	31.92	55.02
3	-0.01	97.54	31.91	97.55	31.92	54.74
4	0.01	97.57	31.94	97.56	31.93	54.93
					Average:	55.00
					Standard Deviation:	0.24

Grain Density Bench Sheet

Sample Information

Sample ID:	P358601	**Analyst:**	SB
Client ID:	D4SD04-0.503-01	**Analysis Date:**	11/16/2015
		Sample Mass (g):	157.44

Calibration Information

Container Volume, cm^3	Ref. Chamber Volume, cm^3	Sample Chamber Vol, cm^3
55.00	304.48	680.78

Sample Measurements

Replicate Number	Ambient Pressure psig	Initial Pressure psig	Final Pressure psig	Adj. Init. Pressure psig	Adj. Final Pressure psig	Grain Volume cm^3
1	0.00	97.54	34.09	97.54	34.09	59.06
2	0.01	97.55	34.11	97.54	34.10	59.31
3	0.02	97.49	34.07	97.47	34.05	58.66
4	0.02	97.52	34.06	97.50	34.04	58.14
					Average:	58.79
					Standard Deviation:	0.51

Grain Density Results

Ave. Grain Volume cm^3	Grain Density g/cm^3
58.79	2.68

Grain Density Bench Sheet

Sample Information

Sample ID:	P358605	**Analyst:**	SB
Client ID:	D4SD04-0304.25-02	**Analysis Date:**	11/16/2015
		Sample Mass (g):	164.96

Calibration Information

Container Volume, cm^3	Ref. Chamber Volume, cm^3	Sample Chamber Vol, cm^3
55.00	304.48	680.78

Sample Measurements

Replicate Number	Ambient Pressure psig	Initial Pressure psig	Final Pressure psig	Adj. Init. Pressure psig	Adj. Final Pressure psig	Grain Volume cm^3
1	0.00	97.49	34.13	97.49	34.13	60.52
2	0.00	97.50	34.13	97.50	34.13	60.43
3	0.00	97.53	34.16	97.53	34.16	60.93
4	-0.01	97.51	34.15	97.52	34.16	61.02
					Average:	60.73
					Standard Deviation:	0.29

Grain Density Results

Ave. Grain Volume cm^3	Grain Density g/cm^3
60.73	2.72

Grain Density Bench Sheet

Sample Information

Sample ID:	P358606	**Analyst:**	SB
Client ID:	D4SD04-4.2518.86-03	**Analysis Date:**	11/16/2015
		Sample Mass (g):	101.40

Calibration Information

Container Volume, cm^3	Ref. Chamber Volume, cm^3	Sample Chamber Vol, cm^3
55.00	304.48	680.78

Sample Measurements

Replicate Number	Ambient Pressure psig	Initial Pressure psig	Final Pressure psig	Adj. Init. Pressure psig	Adj. Final Pressure psig	Grain Volume cm^3
1	0.00	97.68	33.29	97.68	33.29	36.84
2	0.00	97.50	33.20	97.50	33.20	36.07
3	0.00	97.61	33.25	97.61	33.25	36.41
4	0.00	97.65	33.29	97.65	33.29	37.11
					Average:	36.61
					Standard Deviation:	0.46

Grain Density Results

Ave. Grain Volume cm^3	Grain Density g/cm^3
36.61	2.77

Grain Density Bench Sheet

Sample Information

Sample ID:	P358607	**Analyst:**	SB
Client ID:	D5SD01-0002-01	**Analysis Date:**	11/16/2015
		Sample Mass (g):	158.18

Calibration Information

Container Volume, cm^3	Ref. Chamber Volume, cm^3	Sample Chamber Vol, cm^3
55.00	304.48	680.78

Sample Measurements

Replicate Number	Ambient Pressure psig	Initial Pressure psig	Final Pressure psig	Adj. Init. Pressure psig	Adj. Final Pressure psig	Grain Volume cm^3
1	0.00	97.71	34.09	97.71	34.09	57.54
2	-0.02	97.71	34.08	97.73	34.10	57.62
3	-0.03	97.75	34.10	97.78	34.13	57.94
4	-0.01	97.72	34.09	97.73	34.10	57.62
					Average:	57.68
					Standard Deviation:	0.18

Grain Density Results

Ave. Grain Volume cm^3	Grain Density g/cm^3
57.68	2.74

Grain Density Bench Sheet

Sample Information

Sample ID:	P358608	**Analyst:**	SB
Client ID:	D5SD01-0204-02	**Analysis Date:**	11/16/2015
		Sample Mass (g):	139.34

Calibration Information

Container Volume, cm^3	Ref. Chamber Volume, cm^3	Sample Chamber Vol, cm^3
55.00	304.48	680.78

Sample Measurements

Replicate Number	Ambient Pressure psig	Initial Pressure psig	Final Pressure psig	Adj. Init. Pressure psig	Adj. Final Pressure psig	Grain Volume cm^3
1	0.00	97.75	33.86	97.75	33.86	51.25
2	0.00	97.72	33.84	97.72	33.84	51.00
3	-0.01	97.75	33.84	97.76	33.85	50.90
4	0.00	97.80	33.86	97.80	33.86	50.80
					Average:	50.99
					Standard Deviation:	0.19

Grain Density Results

Ave. Grain Volume cm^3	Grain Density g/cm^3
50.99	2.73

Grain Density Bench Sheet

Sample Information

Sample ID:	P358609	**Analyst:**	SB
Client ID:	D4BDS01-001.31-01	**Analysis Date:**	11/16/2015
		Sample Mass (g):	118.07

Calibration Information

Container Volume, cm^3	Ref. Chamber Volume, cm^3	Sample Chamber Vol, cm^3
55.00	304.48	680.78

Sample Measurements

Replicate Number	Ambient Pressure psig	Initial Pressure psig	Final Pressure psig	Adj. Init. Pressure psig	Adj. Final Pressure psig	Grain Volume cm^3
1	0.00	97.73	33.59	97.73	33.59	44.37
2	0.00	97.71	33.56	97.71	33.56	43.76
3	-0.03	97.71	33.55	97.74	33.58	44.01
4	-0.03	97.77	33.58	97.80	33.61	44.26
					Average:	44.10
					Standard Deviation:	0.27

Grain Density Results

Ave. Grain Volume cm^3	Grain Density g/cm^3
44.10	2.68

Grain Density Bench Sheet

Sample Information

Sample ID:	P358610	**Analyst:**	SB
Client ID:	D5SD01-0404.9-03	**Analysis Date:**	11/16/2015
		Sample Mass (g):	94.16

Calibration Information

Container Volume, cm^3	Ref. Chamber Volume, cm^3	Sample Chamber Vol, cm^3
55.00	304.48	680.78

Sample Measurements

Replicate Number	Ambient Pressure psig	Initial Pressure psig	Final Pressure psig	Adj. Init. Pressure psig	Adj. Final Pressure psig	Grain Volume cm^3
1	0.00	97.73	33.18	97.73	33.18	33.42
2	0.01	97.72	33.19	97.71	33.18	33.60
3	-0.02	97.77	33.20	97.79	33.22	33.95
4	-0.02	97.71	33.17	97.73	33.19	33.69
					Average:	33.67
					Standard Deviation:	0.22

Grain Density Results

Ave. Grain Volume cm^3	Grain Density g/cm^3
33.67	2.80

Grain Density Bench Sheet

Sample Information

Sample ID:	P358612	**Analyst:**	SB
Client ID:	D4SD04-5.756.25-04	**Analysis Date:**	11/16/2015
		Sample Mass (g):	103.13

Calibration Information

Container Volume, cm^3	Ref. Chamber Volume, cm^3	Sample Chamber Vol, cm^3
55.00	304.48	680.78

Sample Measurements

Replicate Number	Ambient Pressure psig	Initial Pressure psig	Final Pressure psig	Adj. Init. Pressure psig	Adj. Final Pressure psig	Grain Volume cm^3
1	0.00	97.73	33.35	97.73	33.35	37.99
2	0.00	97.74	33.34	97.74	33.34	37.63
3	0.00	97.73	33.31	97.73	33.31	36.92
4	0.00	97.72	33.30	97.72	33.30	36.74
					Average:	37.32
					Standard Deviation:	0.59

Grain Density Results

Ave. Grain Volume cm^3	Grain Density g/cm^3
37.32	2.76

Porosity Bench Sheet

Sample Information

Sample ID:	QA/QC Zero Check	**Analyst:**	SB
Client ID:	QA/QC Zero Check	**Date/Time:**	11/16/15 3:09 PM

Calibration Information

Ref. Chamber Volume, cm^3	Sample Chamber Vol, cm^3
304.48	680.78

Blank Measurements, TV = $0cm^3$

Replicate	Ambient Pressure psig	Initial Pressure psig	Final Pressure psig	Adj. Init. Pressure psig	Adj. Final Pressure psig	Grain Volume cm^3
1	0.00	97.75	30.21	97.75	30.21	0.05
2	0.00	97.68	30.18	97.68	30.18	-0.23
3	0.00	97.75	30.21	97.75	30.21	0.05
4	0.00	97.70	30.19	97.70	30.19	-0.10
					Average:	-0.06
					Standard Deviation:	0.13

Jar Measurements, TV ~ $55.00cm^3$

Replicate	Ambient Pressure psig	Initial Pressure psig	Final Pressure psig	Adj. Init. Pressure psig	Adj. Final Pressure psig	Grain Volume cm^3
1						
2						
3						
4						
					Average:	
					Standard Deviation:	

Bulk Density by ASTM D7263

Lab Sample ID	P358601
Client ID	D4SD04-0.503-01
Date	11/13/2015
Analyst	SB/EMT

Loose Soil	
Dry Cylinder Mass, g	66.25
Water Filled Cylinder Mass, g	91.08
Water Temperature, °C	20.6
Density of Water, g/cm^3	0.99828
Temperature Coefficient, K	1.00008
Cylinder Volume, cm^3	24.83
Sample Filled Cylinder Mass, g	113.86

Bulk Density, g/cm^3	1.92

Bulk Density by ASTM D7263

Lab Sample ID	P358605
Client ID	D4SD04-0304.25-02
Date	11/13/2015
Analyst	SB/EMT

Loose Soil	
Dry Cylinder Mass, g	66.25
Water Filled Cylinder Mass, g	91.08
Water Temperature, °C	20.6
Density of Water, g/cm ^{3}	0.99828
Temperature Coefficient, K	1.00008
Cylinder Volume, cm ^{3}	24.83
Sample Filled Cylinder Mass, g	113.79

Bulk Density, g/cm^3	1.91

Bulk Density by ASTM D7263

Lab Sample ID	P358606
Client ID	D4SD04-4.2518.86-03
Date	11/13/2015
Analyst	SB/EMT

Loose Soil	
Dry Cylinder Mass, g	66.25
Water Filled Cylinder Mass, g	91.08
Water Temperature, °C	20.6
Density of Water, g/cm^3	0.99828
Temperature Coefficient, K	1.00008
Cylinder Volume, cm^3	24.83
Sample Filled Cylinder Mass, g	116.28

Bulk Density, g/cm^3	2.02

Bulk Density by ASTM D7263

Lab Sample ID	P358607
Client ID	D5SD01-0002-01
Date	11/13/2015
Analyst	SB/EMT

Loose Soil	
Dry Cylinder Mass, g	66.25
Water Filled Cylinder Mass, g	91.08
Water Temperature, °C	20.6
Density of Water, g/cm ^{3}	0.99828
Temperature Coefficient, K	1.00008
Cylinder Volume, cm ^{3}	24.83
Sample Filled Cylinder Mass, g	111.65

Bulk Density, g/cm^3	1.83

Bulk Density by ASTM D7263

Lab Sample ID	P358608
Client ID	D5SD01-0204-02
Date	11/13/2015
Analyst	SB/EMT

Loose Soil	
Dry Cylinder Mass, g	66.25
Water Filled Cylinder Mass, g	91.08
Water Temperature, °C	20.6
Density of Water, g/cm ^{3}	0.99828
Temperature Coefficient, K	1.00008
Cylinder Volume, cm ^{3}	24.83
Sample Filled Cylinder Mass, g	112.55

Bulk Density, g/cm^3	1.86

Bulk Density by ASTM D7263

Lab Sample ID	P358609
Client ID	D4BDS01-001.31-01
Date	11/13/2015
Analyst	SB/EMT

Loose Soil	
Dry Cylinder Mass, g	66.25
Water Filled Cylinder Mass, g	91.08
Water Temperature, °C	20.6
Density of Water, g/cm ^{3}	0.99828
Temperature Coefficient, K	1.00008
Cylinder Volume, cm ^{3}	24.83
Sample Filled Cylinder Mass, g	109.01

Bulk Density, g/cm^3	1.72

Bulk Density by ASTM D7263

Lab Sample ID	P358610
Client ID	D5SD01-0404.9-03
Date	11/13/2015
Analyst	SB/EMT

Loose Soil	
Dry Cylinder Mass, g	66.25
Water Filled Cylinder Mass, g	91.08
Water Temperature, °C	20.6
Density of Water, g/cm ^{3}	0.99828
Temperature Coefficient, K	1.00008
Cylinder Volume, cm ^{3}	24.83
Sample Filled Cylinder Mass, g	115.68

Bulk Density, g/cm^3	1.99

Bulk Density by ASTM D7263

Lab Sample ID	P358612
Client ID	D4SD04-5.756.25-04
Date	11/13/2015
Analyst	SB/EMT

Loose Soil	
Dry Cylinder Mass, g	66.25
Water Filled Cylinder Mass, g	91.08
Water Temperature, °C	20.6
Density of Water, g/cm ^{3}	0.99828
Temperature Coefficient, K	1.00008
Cylinder Volume, cm ^{3}	24.83
Sample Filled Cylinder Mass, g	117.23

Bulk Density, g/cm^3	2.05

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

Chain of Custody Record

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

Client Contact

Project Name: AKLNG
Project # or PO #: 653488.16.06
Company Name: CH2M
Address: 949 E. 36th Ave.
City/State/Zip: Anchorage/AK/99508
Project Manager: Carrie Andrews
Phone #: 503-208-3413
Report to email: carrie.andrews@ch2m.com

Analysis Turnaround Time

TAT is Calander days

TAT if different from below _____

☒ 21 days (STD)
☐ 14 days * ☐ 3 day *
☐ 7 days * ☐ 2 days *
☐ 5 days * ☐ 1 day *

* (Surcharges will apply)

Preservation Used

	VOCs (Grab)	Trace Metals/Hg (Comp)	PCBs, AK102/103, Total Volatile Solids (Comp)	AK101 (Grab)	PAHs/SVOCs (Comp)	TOC (Comp)	Geotechnical (Comp)	Bioassay (5gal Bucket) ARCHIVE		Sample Specific Notes:	Lab ID:
Frozen		4°	4°	Meoh	4°	4°					
Sample Identification (Limit of 20 characters) / Sample Date / Sample Time / Sample Type (C=Comp, G=Grab) / Matrix (Water, Soil, Air) / Total # of Cont.											
D4SD04-0.503-01 / 11/5/15 / 13:30 / C/G / S / 6	1	1	1	1	1	1		1			1
D4SD04-0.503-101 / 11/5/15 / 13:40 / C/G / S / 6	1	1	1	1	1	1					2
D4SD04-0.503-01MS / 11/5/15 / 13:30 / C/G / S / 6	1	1	1	1	1	1				MS	3ms
D4SD04-0.503-01SD / 11/5/15 / 13:30 / C/G / S / 6	1	1	1	1	1	1				MSD	4msD
D4SD04-0304.25-02 / 11/5/15 / 16:30 / C/G / S / 6	1	1	1	1	1	1		1			5
D4SD04-4.25 18.86-03 / 11/5/15 / 14:50 / C/G / S / 6	1	1	1	1	1	1		1			6
~~D4SD04-5.75 6.25-04~~ / ~~11/5/15~~ / ~~17:20~~ / ~~C/G~~ / ~~S~~ / ~~6~~	~~1~~	~~1~~	~~1~~	~~1~~	~~1~~	~~1~~	~~1~~				~~SR~~
D5SD01-0002-01 / 11/6/15 / 11:15 / C/G / S / 6	1	1	1	1	1	1		1			11/6/15 1700 7
D5SD01-0204-02 /	1	13:00 / C/G / S / 6	1	1	1	1	1	1			8
D4BDS01-001.31-01 / 11/3/15 / 11:00 / C/G / S / 5	NO	1	1	1	1	1					9
D5SD01-0404.9-03 / 11/6/15 / 14:45 / C/G / S / 6	1	1	1	1	1	1		1			10
TB110315-01 / 11/3/15 / 08:00 / — / W / 4	2			2						Trip Blank	11
~~EB110615-01~~ / ~~11-6-15~~ / ~~15:45~~ / ~~—~~ / ~~W~~ / ~~14~~	~~3~~	~~1~~	~~3~~	~~3~~	~~3~~	~~1~~				~~Equipment Blank~~	~~11/6/15 1700~~

SR 11/6

For Lab Use Only:

SDG: P3586
Custody Seals intact? ☒ Yes ☐ No
Hand delivered? ☐ Yes ☒ No
Cooler Temp: 3.3°C
Therm ID No.: A3 Therm Exp. 01/16
Packing Material: Circle Below
(Ice) Blue Ice Box Bubble Wrap
Radiological Screen? ☐ Yes ☒ No

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

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

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

Sampled By: [signature] Date/Time: 11/6/15 1900
Received by: [signature] Date/Time:
Received in Laboratory by: [signature] Date/Time: 11/7/15 1115

Relinquished by: Date/Time:
Relinquished by: Date/Time:
Shipped Via: ☐ UPS ☐ Fed-Ex ☐ USPS ☐ Other Tracking #:

Special Instructions/QC Requirements: ~~Geotechnical analysis: % Moisture/ASTM D2216; pH/E150.1; grain size with hydrometer/ASTM D422; specific gravity/ASTM D854B; Atterberg Limits by ASTM D4318; USCS class/ASTM 2487; grain density/API RP40; bulk density D7263~~ SR 11/6

Alaska LNG
Test Pit Dredge Material Characterization Report
Confidential
USACE-CELRZ-R-TR-2015-00032-0000
07-Apr-16; Rev 0
Attachment 5

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

Chain of Custody Record

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

Client Contact

Project Name: AKLNG
Project # or PO #: 653488.16.06
Company Name: CH2M
Address: 2020 SW 4th Ave Ste 300
City/State/Zip: Portland/OR/97201
Project Manager: Carrie Andrews
Phone #: 503-736-4270
Report to email: Carrie.andrews@ch2m.com

Analysis Turnaround Time

TAT is Calander days

TAT if different from below _____

☒ 21 days (STD)
☐ 14 days * ☐ 3 day *
☐ 7 days * ☐ 2 days *
☐ 5 days * ☐ 1 day *

* (Surcharges will apply)

Preservation Used

For Lab Use Only:

SDG: P3586
Custody Seals intact? ☒ Yes ☐ No
Hand delivered? ☐ Yes ☒ No
Cooler Temp: 3.3 °C
Therm ID No.: 73 Therm Exp. 01/16
Packing Material: Circle Below
(Ice) Blue Ice Box Bubble Wrap
Radiological Screen? ☐ Yes ☒ No

Analysis Requested

Sample Identification (Limit of 20 characters)	Sample Date	Sample Time	Sample Type (C=Comp, G=Grab)	Matrix (Water, Soil, Air)	Total # of Cont.	% Moisture/ASTM D2216	pH E150.1	Grain Size w/hydrometer ASTM D422	Specific Gravity ASTM D854/B	Atterburg Limits ASTM D4318	USCS Class ASTM 2487	Grain density API RP 40	Bulk density ASTM D7263		Sample Specific Notes:	Lab ID:
D4SD04-0.503-01	11/5/15	13:30	C	S	1	X	X	X	X	X	X	X	X			1
D4SD04-03.04.25-02	|	14:30	C	S	1	X	|	|	|	|	|	|	|			5 2
D4SD04-4.2518.86-03	|	14:50	C	S	1	X	|	|	|	|	|	|	|			6 3
D4SD04-5.756.25-04	|	17:20	C	S	1	X	|	|	|	|	|	|	|			12 4
D5SD01-0002-01	11/6/15	11:15	C	S	1	|	|	|	|	|	|	|	|			7 5
D5SD01-0204-02	|	13:00	C	S	1	|	|	|	|	|	|	|	|			8 6
D4BDS01-001.31-01	11/3/15	11:00	C	S	1	X	X	X	X	X	X	X	X			9 7
D5SD01-0404.9-03	11/6/15	14:45	C	S	1	X	X	X	X	X	X	X	X			10 8

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

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

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

Sampled By: JEREMIAH KNUTA Date/Time: 11/6/15 1700
Relinquished by: Date/Time:
Received by: Date/Time:
Relinquished by: Date/Time:
Received in Laboratory by: Date/Time: 11/9/15 1115
Shipped Via: ☐ UPS ☐ Fed-Ex ☐ USPS ☐ Other Tracking #:
Special Instructions/QC Requirements

R06 JLR 11/7/15

DOC CONTROL ID: ASL1081-0814

Alaska LNG
Confidential
Test Pit Dredge Material Characterization Report
USA-CH2MHILL-R2772020-000003-000
Attachment 5
07-Apr-16; Rev 0

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

Chain of Custody Record

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

Client Contact

Project Name: AKLNG
Project # or PO #: 653488.16.06
Company Name: CH2M
Address: 949 E 36TH AVE
City/State/Zip: Anchorage AK 99517
Project Manager: Carrie Andrews
Phone #: 503-208-3413
Report to email: carrie.andrews@ch2m.com

Analysis Turnaround Time

TAT is Calander days

TAT if different from below _____

☒ 21 days (STD)
☐ 14 days * ☐ 3 day *
☐ 7 days * ☐ 2 days *
☐ 5 days * ☐ 1 day *

* (Surcharges will apply)

Preservation Used: HCL, HNO3, 4°C, HCL, 4°C, H2SO4

For Lab Use Only:

SDG: P3586
Custody Seals intact? ☒ Yes ☐ No
Hand delivered? ☐ Yes ☒ No
Cooler Temp: 3 °C
Therm ID No. 173 Therm Exp. 01/16
Packing Material: Circle Below
(Ice) Blue Ice Box Bubble Wrap
Radiological Screen? ☐ Yes ☒ No

Sample Identification (Limit of 20 characters)	Sample Date	Sample Time	Sample Type (C=Comp, G=Grab)	Matrix (Water, Soil, Air)	Total # of Cont.	VOCs	Trace metals/Hg	PCBs/AK102/103 Total Vol. Solids	AK101	PAHs/SVOCs	TOC				Sample Specific Notes:	Lab ID:
EB110615-01	11-6-15	15:45	—	W	14	3	1	3	3	3	1				Equip Blank	13
TRIP BLANK	11-6-15	1545		W	1	1			1							14

Analysis Requested

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

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

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

Sampled By: [signature] Date/Time: 11/6/15 1700
Received by: Date/Time:
Received in Laboratory by: [signature] Date/Time: 11/7/15 1115
Special Instructions/QC Requirements

Relinquished by: Date/Time:
Relinquished by: Date/Time:
Shipped Via: ☐ UPS ☐ Fed-Ex ☐ USPS ☐ Other Tracking #:

DOC CONTROL ID: ASL1081-0814

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

Chain of Custody Record

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

Client Contact

Project Name: AKLNG
Project # or PO #: 653488.16.06
Company Name: CH2M
Address: 949 E 36th Ave
City/State/Zip: Anchorage AK 99517
Project Manager: Carrie Andrews
Phone #: 503-208-3413
Report to email: carrie.andrews@ch2m.com

Analysis Turnaround Time

TAT is Calander days
TAT if different from below _____
☒ 21 days (STD)
☐ 14 days * ☐ 3 day *
☐ 7 days * ☐ 2 days *
☐ 5 days * ☐ 1 day *
* (Surcharges will apply)

Preservation Used

Analysis Requested

For Lab Use Only:
SDG: P3586
Custody Seals intact? ☒ Yes ☐ No
Hand delivered? ☐ Yes ☒ No
Cooler Temp 3.3 °C
Therm ID No. 73 Therm Exp. 01/16
Packing Material: Circle Below
Ice Blue Ice Box Bubble Wrap
Radiological Screen? ☐ Yes ☒ No

Sample Identification (Limit of 20 characters)	Sample Date	Sample Time	Sample Type (C=Comp, G=Grab)	Matrix (Water, Soil, Air)	Total # of Cont.	Bioassay archive									Sample Specific Notes:	Lab ID:
D4ADS01-001.48-01	11-2	21:00	C	S	1	1										15
D4BGC07-14.4416.57-01	11-3	10:00	C	S	1	1										16
~~D4BGC06-11.8113.54-01~~	~~11-3~~	~~11:00~~	~~C~~	~~S~~	~~1~~	~~1~~	KMR 11/6/15 17:00									
D4BDS01-001.31-01	11-4	12:00	C	S	1	1										17

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

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

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

Sampled By: Kristin Reardon Date/Time: 11-6-15 17:00
Received by: Date/Time:
Received in Laboratory by: [signature] Date/Time: 11/7/15 1115
Special Instructions/QC Requirements

Relinquished by: Date/Time:
Relinquished by: Date/Time:
Shipped Via: ☐ UPS ☐ Fed-Ex ☐ USPS ☐ Other Tracking #:

DOC CONTROL ID: ASL1081-0814

Attachment 5
07-Apr-16; Rev 0

Alaska LNG
Test Pit Dredge Material Characterization Report
Confidential
USAF-CH-JR22200-000030-000

CH2MHILL
Applied Sciences Laboratory (ASL)

Sample Receipt Record

SDG ID: P3586 Date Received:11/7/15

Client/Project: Alaska LNG Received By:JVP

Were custody seals intact and on the outside of the cooler?	☑ Yes	☐ No	☐ N/A
Shipping Record:	☐ Hand Delivered	☑ On File	☐ COC
Radiological Screening for DoD	☐ Yes	☐ No	☑ N/A
Packing Material:	☐ Hand Delivered	☑ Ice	☐ Blue Ice ☐ Box
Temp OK? (<6C) Therm ID: TH173 Exp. 01/16	3.3 °C ☑ Yes	☐ No	☐ N/A
Was a Chain of Custody (CoC) Provided?	☑ Yes	☐ No	☐ N/A
Was the CoC correctly filled out (If No, document below)	☑ Yes	☐ No	☐ N/A
Did sample labels agree with COC? (If No, document below)	☑ Yes	☐ No	☐ N/A
Did the CoC list a correct bottle count and the preservative types (No=Correct on CoC)	☑ Yes	☐ No	☐ N/A
Were the sample containers in good condition (broken or leaking)?	☑ Yes	☐ No	☐ N/A
Was enough sample volume provided for analysis? (If No, document below)	☑ Yes	☐ No	☐ N/A
Containers supplied by ASL?	☑ Yes	☐ No	☐ N/A
Any sample with < 1/2 holding time remaining? If so contact LPM	☑ Yes	☐ No	☐ N/A
Samples have multi-phase? If yes, document on SRER	☐ Yes	☑ No	☐ N/A
All water VOCs free of air bubbles? No, document on SRER	☑ Yes	☐ No	☐ N/A
pH of all samples met criteria on receipt? If "No", preserve and document below.	☑ Yes	☐ No	☐ N/A
Dissolved/Soluble metals filtered in the field?	☐ Yes	☐ No	☑ N/A
Dissolved/Soluble metals have sediment in bottom of container? If so document below.	☐ Yes	☐ No	☑ N/A

Preservation Adjustment

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

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

Sample Exception Report (The following exceptions were noted)

1) pH samples are past holidng time.
2) MS/MSD requested for TS/VS analysis. Not applicable for TS/VS analysis.
3) Sample D4SD04-4.2518.86-03 (P358606) label requests NH3, Cr(VI), Pest, and TBT analysis; however COC does not list requested analysis.
4) Sample TRIP BLANK (P358614) is missing. Sample TB110315-01 (P358611) includes two VOAs for TPH and two VOAs for VOC analysis.

Client was notified on: Client contact:

Resolution to Exception:

3) ALS has plenty of sample and did not require it to be shipped.
4) No analysis for TRIP BLANK (P358614)

17.0 APPENDIX F – BENTHIC TESTING REPORT

Attachment 6: Benthic Report

Attachment 6 - Benthic Report.pdf

Carrie Andrews
Project Manager
CH2M
2020 SW 4th Avenue, Suite 300
Portland, OR 97201

January 10, 2016

Re: Benthic Infaunal Sampling and Analysis of Samples Collected for the AKLNG Benthic Sampling in Nikiski, AK

Dear Carrie:

Thank you for contracting Marine Taxonomic Services (MTS) to provide support for the AKLNG Benthic Sampling Project (Project) in Cook Inlet, Nikiski, AK. This letter provides the methods and results relating to the collection, processing, and identification of the collected infauna. We have discussed the results relative to potential impacts associated with dredging to create test pits for analysis of sediment transport models.

Sample Collection

MTS staff Seth Jones worked with CH2M to conduct infaunal sampling while adhering to methods in accordance with CH2M Project plans. The team worked aboard the Research Vessel Westerly and was assisted by its crew. The vessel is outfitted with an articulating A-frame with a hydraulic winch.

The samples were collected on September 29, 2015. The samples were collected by lowering a 0.1 m2 (1.08 ft2) KC Day sediment sampler to collect biological sediment cores. Once the vessel was on station and stopped, the sampler was lowered to the seafloor using the hydraulic winch via a cable that ran through a block suspended from the A-frame. Once on the bottom, the winch was used to raise the sampler.

Samples were collected from two target zones. The first was the site of Test Pit 1. The second was at the site of Test Pit 2. At Test Pit 1, three benthic infaunal samples were collected at stations D1SD01, D2SD02, and D3SD03. At Test Pit 2, two benthic infaunal samples were collected at stations D4SD01, and D5SD01. All samples were collected in accordance with the project's sampling and analysis plan (CH2M 2015).

Benthic Sample Processing and Analysis

Benthic infauna samples were sieved through a 0.5 mm (0.020 in) mesh screen and the retained material was placed in a container and fixed with a 10% solution of buffered formalin and seawater for a minimum of 3 days (maximum 14 days). In the MTS laboratory, the samples were then washed through a 0.25 mm (0.010) mesh screen to remove the formalin solution and transferred to appropriately sized containers. These containers were filled with a mixture of 70%

isopropyl alcohol and rose bengal stain. Rose bengal is a protein stain added to facilitate sorting the animals from any retained detritus.

The transferred and stained samples were sorted under a dissecting microscope. All animals were removed and placed in respective major phylogenetic groups (Polychaeta, Mollusca, Crustacea, Echinodermata and miscellaneous). Twenty percent of the remaining detritus in each sample was then resorted by a separate sorter as part of a quality control step. This quality control step follows the protocols set forth for benthic studies in EPA Region 10 (Tetra Tech 1987).

Following the sorting of animals by major phylogenetic group, specialist taxonomists then identified all organisms to the lowest practical taxonomic level within each sorted group. The number of each identified taxon was recorded and entered into a Microsoft Excel spreadsheet.

Following identification and data entry, the benthic indices and statistics were calculated for each sampled station. Where appropriate, the individual station data were retained and used to calculate means for the indices and statistics calculated for the entire Project. The calculated statistics and indices included abundance of individuals captured, species richness, Margalef's richness index (MR [Margalef 1958]), Shannon-Wiener species diversity (H' [refer to Krebs 1989]), Pielou's species evenness (J' [Pielou 1966]), and Simpson's diversity index (SDV [Simpson, 1949]).

Specifically, the provided measures were calculated as follows:

Abundance was calculated as the sum of all captured individuals across all taxonomic classifications.

Species richness was simply the number of unique taxonomic classifications made by the taxonomists within each provided sample. The term taxon richness is more appropriate because not all identifications were made to the level of species. It is notable that the taxonomic specialists utilize standardized procedures and identifications for identifying regional species. Thus, the data are externally consistent with other regional studies.

Margalef's Species Richness Index was calculated as,

$$MR = (S - 1)/\ln(n)$$

where *MR* is Margalef's species richness index, *S* equals the number of species captured, and *n* equals the number of individuals captured within the same sample.

The Shannon Function was calculated as,

$$H' = \sum (p_i)(log_2 p_i)$$

where H' is the index of species diversity and p_i equals the proportion of total sample belonging to i^{th} species.

The Pielou species evenness index was calculated as,

$$J' = \frac{H'}{log_2 S}$$

where J' is the species evenness index based on H', H' is the Shannon diversity and S is the number of species sampled.

Simpson's Diversity Index was calculated as,

$$SDV = 1 - \sum {p_i}^2$$

Where SDV is Simpson's Diversity Index and p_i equals the proportion of the total sample belonging to the ith species.

An analysis of similarity (ANOSIM) was used to test for statistical significance among the sampled areas (refer to Clarke 1993). The ANOSIM requires the *a priori* assignment of samples to groups. For the test, the invertebrate station data were assigned to two groups based on whether the stations were within Test Pit 1 or Test Pit 2.

The ANOSIM relies on the Bray-Curtis dissimilarity measure. The Bray Curtis Measure was calculated as,

$$B = \frac{\sum |X_{ij} - X_{jk}|}{\sum (X_{ij} + X_{jk})}$$

Where X_{ij}, X_{jk} is the number of individuals in species i in each sample. The measure ignores cases in which a species is absent from both samples.

The null hypothesis is that there are no differences between the groups.

The ANOSIM test statistic "R" is calculated by comparing the means of the ranked dissimilarities between groups and within groups (Henderson and Seaby 2014). R ranges from +1 to -1. A value of +1 means that all the most similar samples are within the same groups. A value of -1 means that all of the most similar samples are outside of the groups. A value of zero means that the high and low similarities are perfectly mixed with no relationship to the group assignment (null hypothesis).

The ANOSIM test for significance compares the ranked similarity within and between groups to the similarity that would happen by random chance. In the analysis the samples are randomly assigned to groups repeatedly to calculate a value of R based on the random distribution of

samples across groups. The observed value of R can then be compared to the random distribution to determine if it is significantly different from random (Henderson and Seaby 2014). A significant value means that the null hypothesis should be rejected and therefor that samples within groups are more similar than samples between groups.

Benthic Community Results

A total of 5 stations in the Project survey area were sampled in October 2015 for benthic community analysis (Table 1). All of the samples were collected within 80 m (263 ft) of the intended target. The field sampling logs are included as Attachment A.

Table 1. The below table provides the sampling station target coordinates, the actual sample distance from the target coordinates, and the depth at the time of sampling.

	Target Coordinates		Distance to Target		Depth	
Station ID	Latitude	Longitude	Meters	Feet	Meters	Feet
D1SD01	N 60° 39' 38.46"	W 151° 23' 3.61"	75	246.1	12.8	42.0
D2SD01	N 60° 39' 39.14"	W 151° 22' 52.08"	80	262.5	9.8	32.2
D3SD01	N 60° 39' 35.69"	W 151° 22' 54.52"	10	32.8	10.3	33.8
D4SD01	N 60° 39' 21.07"	W 151° 22' 1.90"	14	45.9	3.6	11.8
D5SD01	N 60° 39' 20.13"	W 151° 22' 8.76"	25	82.0	8.7	28.5

In the analysis of the 5 benthic samples, there were a total of 37 benthic invertebrate taxonomic identifications and 186 individuals captured by the sampling program (

Table 2). The abundance of individuals captured within a station ranged from a low of 8 animals at station 3 to a high of 110 animals at station 1. The raw invertebrate abundance data are attached as an appendix to this report (Attachment B).

The number of unique identifications ranged from a low of 5 at stations 3 and 5 to a high of 29 at station 1. A tabular summary of abundance, richness, diversity (H' and SDV), evenness (J') and Margalef's species richness index (MR) at the sampled stations is provided in

Table 2. Also included are summary statistics (means) among sample stations as well as overall calculations for the Project survey area as a whole. For some calculations, the difference between the mean and the calculation of an index for the entirety of the Project area is meaningful. For instance,

Table 2. The below table provides the summary statistics and indices for the sampled stations and the Project sample area as a whole ("All").

	Station ID					
Parameter	**1**	**2**	**3**	**4**	**5**	**All**
Abundance	110	21	8	40	7	186
Mean Abundance						37
Species (Taxa) Richness	29	8	5	8	5	37
Mean Richness						11
Margalef's Index (SR)	5.96	2.30	1.92	1.90	2.06	6.89
Mean SR						2.83
Diversity H'	3.73	2.58	2.16	2.27	2.24	4.27
Mean H'						2.60
Evenness (J')	0.77	0.86	0.93	0.76	0.96	0.82
Mean J'						0.86
Simpson's Index (SDV)	0.86	0.79	0.75	0.72	0.78	0.92
Mean SDV						0.78

species diversity (H') is provided as a mean of the sampled stations to understand the average diversity among stations. However, the calculation of H' for the entire Project area uses the total richness and evenness of organisms across the entire zone (pooled samples).

Figures are provided for easy inspection of trends among some of the calculated parameters and compare the parameters across sampling stations. Each of the figures includes a mean for the presented index or statistic for the entire Project area. Figure 1 shows the abundance individuals per sample; Figure 2 shows the total species (taxa) richness; Figure 3 displays Margalef's species richness; Figure 4 shows species diversity (H') and Figure 5 shows the Simpson's diversity index (SDV).

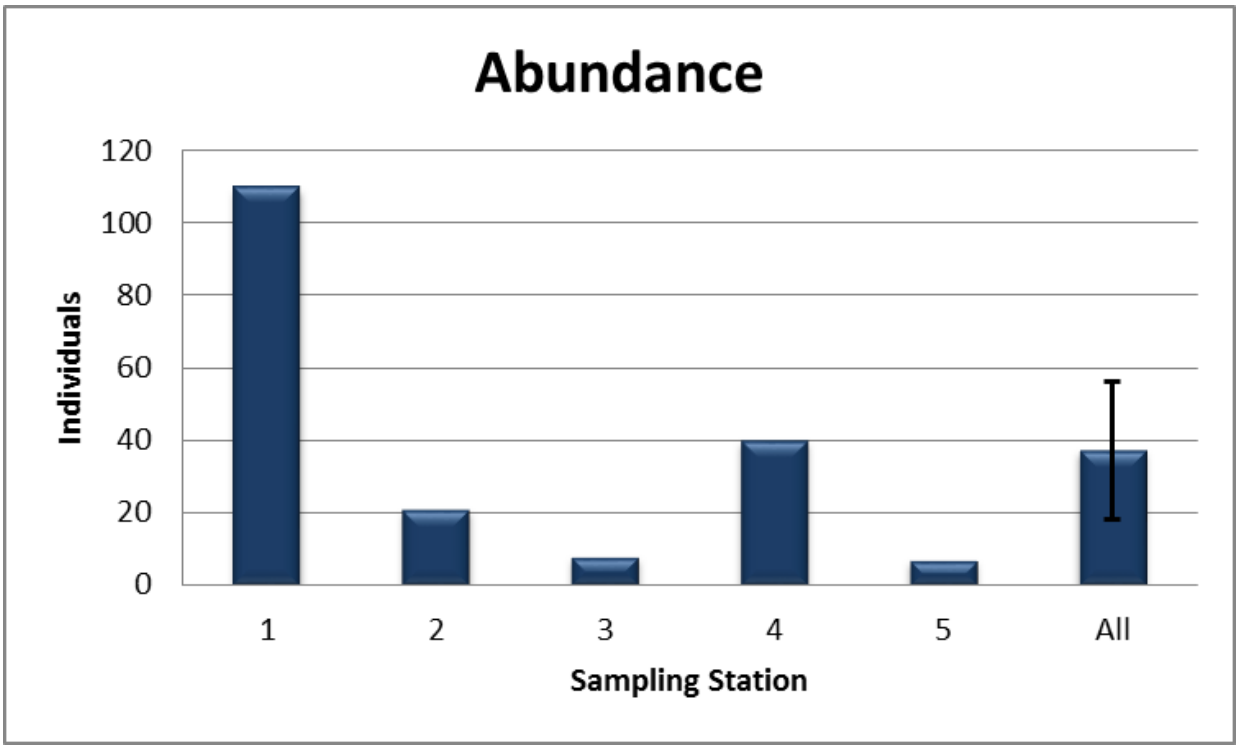

Figure 1 - The above figure shows the abundance of animals captured at each station and provides the average for the entire Project survey area. Error bars for the Project area are ±1 standard error of the mean.

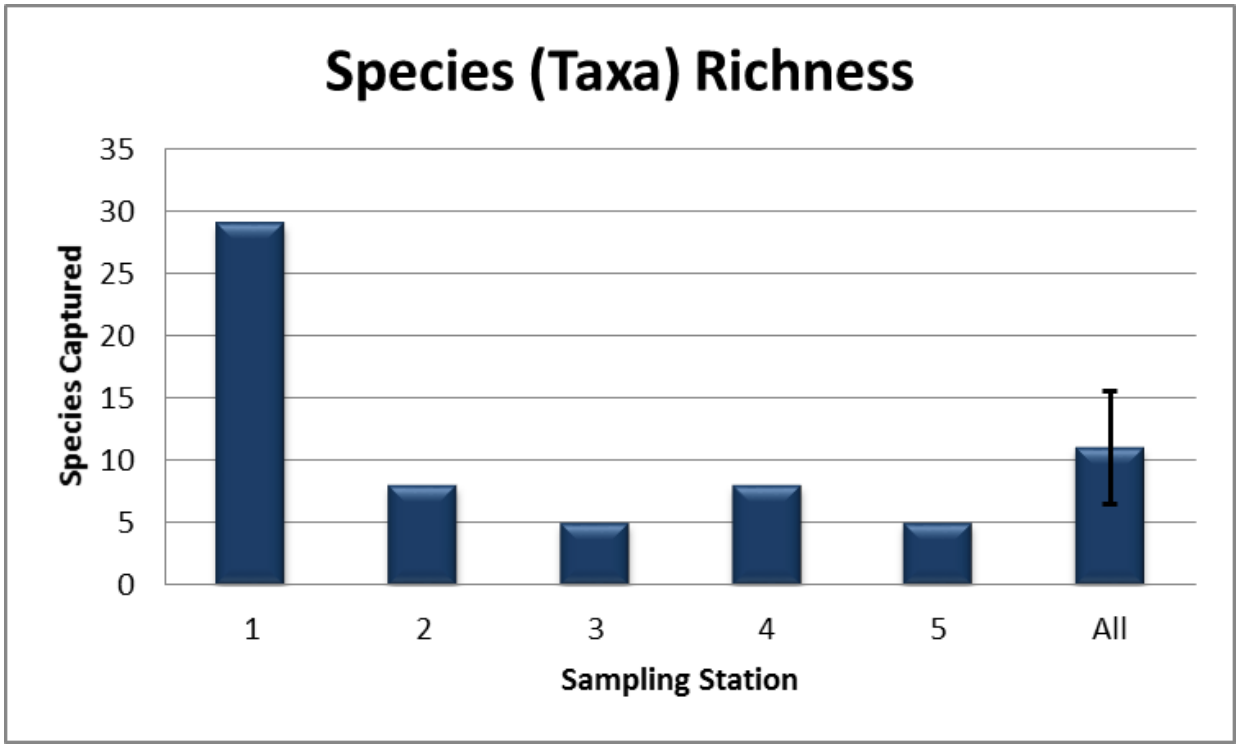

Figure 2 - The above figure shows the taxa richness at each station and provides the average for the entire Project survey area. Error bars for the Project area are ±1 standard error of the mean.

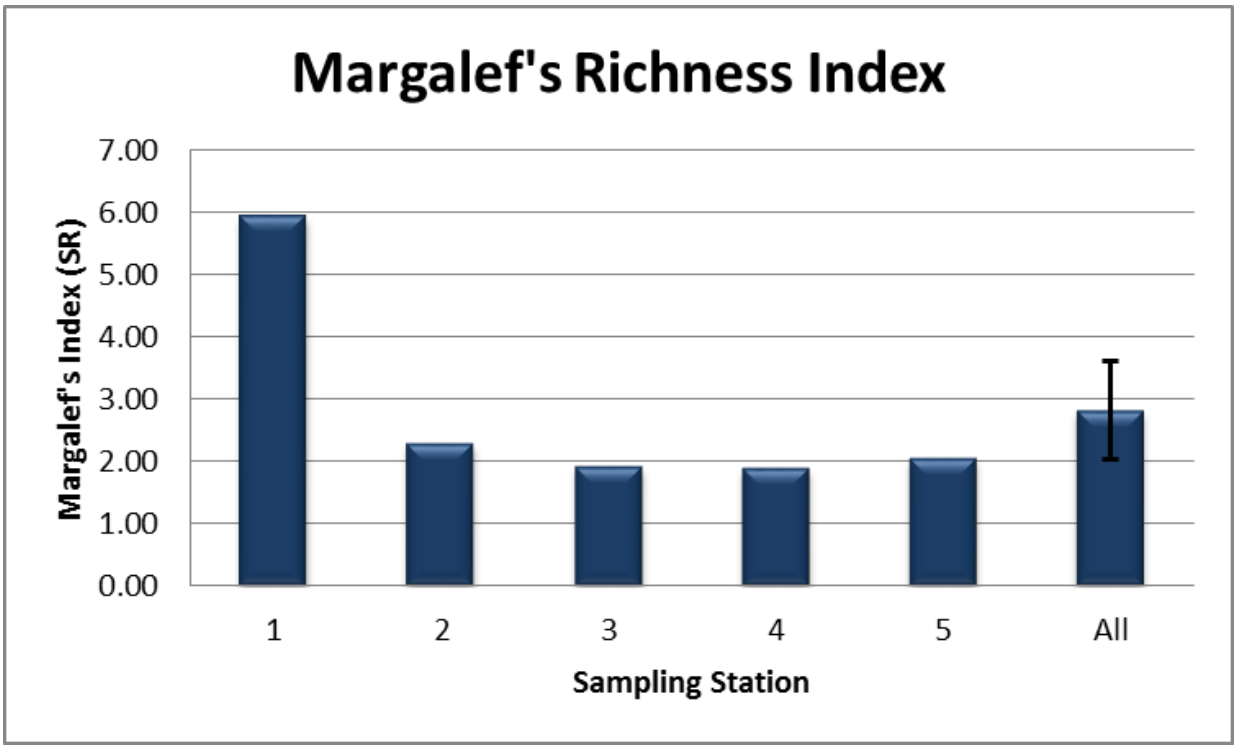

Figure 3 - The above figure shows Margelef's richness index at each station and provides the average for the entire Project survey area. Error bars for the Project area are ±1 standard error of the mean.

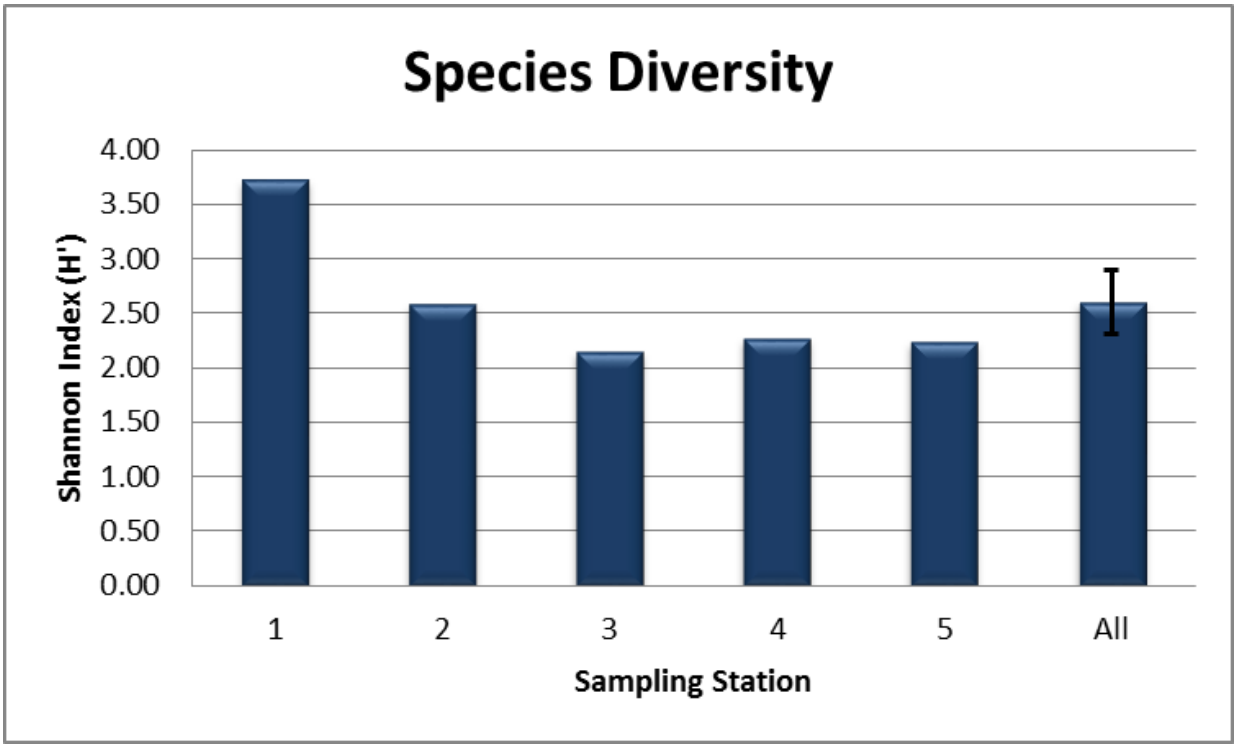

Figure 4 - The above figure shows the Shannon index (H') at each station and provides the average H' for the entire Project survey area. Error bars for the Project area are ±1 standard error of the mean.

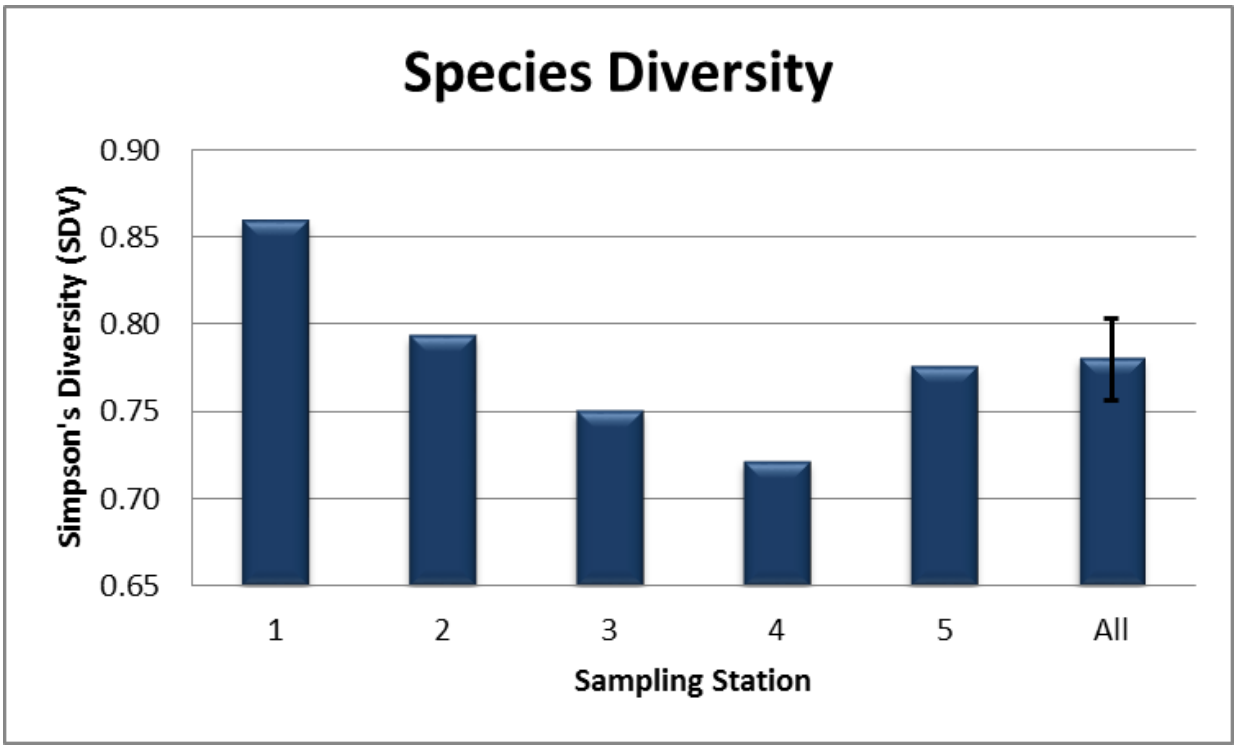

Figure 5 - The above figure shows the Simpson's index (SDV) at each station and provides the average SDV for the entire Project survey area. Error bars for the Project area are ±1 standard error of the mean.

Results from the calculation of the Bray-Curtis Measure are shown in Table 6. This analysis was used to quantify the compositional dissimilarity between stations/samples based on counts. Each value in the Bray-Curtis ordination matrix represents a dissimilarity of a pairwise comparison of two stations. Samples with values close to 1.0 indicate a greater difference with regards to species composition.

The one notable trend with regards to the dissimilarity values is that station 2 and station 3 were completely dissimilar. Simple inspection of the data shows that there was no species overlap between station 2 and station 3. Overall, there was very little similarity among the 5 sampled stations. The results of the ANOSIM show that there is no difference between the two test pit groups (r=-0.333, p=0.887).

Table 3. The below table provides the Bray-Curtis ordination matrix of all pairwise comparisons between sampled stations.

Station	1	2	3	4	5
1					
2	0.938931				
3	0.881356	1			
4	0.906667	0.672131	0.958333		
5	0.948718	0.785714	0.866667	0.87234	

Discussion

The results show a benthic infaunal community that is generally low in species abundance and diversity. A recent study of the infauna of Cook Inlet found an average abundance of 505 animals per 0.1 square meter grab sample (Fukuyama et al. 2012). However, one sample in lower Cook Inlet accounted for 60% of the total organisms. That observation means that the remaining stations had approximately 207 animals per sample. Additionally, the study concluded that there was a strong north-south gradient of increasing diversity. Upper Cook Inlet and industrial areas were found to have much lower numbers of individuals and fewer taxa.

The observations within this study are similar to Fukuyama et al. (2012). The sampling locations in this study are in the northern portion of Cook Inlet. Fukuyama et al. (2012) hypothesized that tidal currents, low salinity, and high turbidity results in a local environment with low total organic carbon and a high proportion of fine sediment. These factors result place a high level of environmental stress on infaunal communities thereby potentially limiting abundance and diversity.

The results of the ANOSIM analysis support the idea that local conditions lead to disturbed benthic communities. Moreover, those communities can change dramatically over short distances. This is evident by the fact that there was no statistical grouping of stations between the two test pit monitoring areas. Additionally, the dissimilarity observed in the Bray-Curtis

ordination matrix shows that all of the stations were generally dissimilar from one another. This tends to support the idea that benthic communities may be continually stressed such that taxa are constantly in flux. The alternative is that the bottom is spatially complex such that changes in substrate over relatively short distances result in very different benthic infaunal communities.

As of the writing of this letter, it is understood that Test Pit 1 will not be dredged. Giventhe results of the ANOSIM it seems reasonable that those stations sampled at Test Pit 1 can be used as a reasonable surrogate for a reference station if one is necessary for future analysis of effects at Test Pit 2. While the communities are not the same, it appears that local herogeneaty across even small distances means that it is unlikely that a similar reference could exist. Thus, comparison of stations over time can be used to determine coarse effects of dredging at Test Pit 1. Any future comparisons should take into consideration that infaunal communities in this area are not likely to be stable and therefore general characteristics such as taxa richness and organism abundance may be the most suitable metric for determining if project activities place an even greater stress on infaunal communities than already seems to be present.

Given the relatively low number of individuals and taxa present at Test Pit 1, it is difficult to argue that dredging the test pit will have any lasting impact to benthic infaunal communities within the region. However, the small numbers of samples collected make it difficult to know actual variation in the diversity and abundance of taxa in the region. Given the variation present within the infaunal community any future sampling should consider increasing the sample size to get a better estimate of variation and increase statistical power.

It was a pleasure working with you and your team on this Project. If you have any questions regarding this letter or need additional information, please do not hesitate to contact me at seth@consultmts.com or 858.232.1958.

Sincerely,

Seth Jones
President and Project Manager

References

Bray, J. R. and J. T. Curtis. (1957). An ordination of upland forest communities of southern Wisconsin. *Ecological Monographs* 27:325-349.

Clarke, K. R. (1993). Nonparametric multivariate analyses of changes in community structure. Australian Journal of Ecology 18:117–143.

Fukuyama, A.K., Gillingham, G., and Hartwell, S.I. (2012). Integrated Cook Inlet Environmental Monitoring and Assessment Program (ICIEMAP): Benthic Infaunal Communities. Alaska Marine Science Symposium, Anchorage Alaska. January 2012.

Henderson, P.A., and Seaby , R.M.H. (2014). Community Analysis Package Version 5. Pisces Conservation Ltd, Lymington, UK.

Krebs, C.J. (1989). Ecological Methodology. Harper & Row, NY. 654pp.

Margalef, R. (1958). Information theory in ecology. Gen. Syst. 3: 36-71.

Pielou, E.C. (1966). The measurement of diversity in different types of biological collections. Journal of Theoretical Biology 13:131-144.

Simpson, E. H. (1949). Measurement of diversity. Nature 163:688

Tetra Tech, Inc. (1987). Recommended Protocols for Sampling and Analyzing Subtidal Benthic Macroinvertebrate Assemblages in Puget Sound. Report to: US EPA Region 10. Seattle, WA.

Attachment A

Benthic Infaunal Data

Cook Inlet
Species Data
For CH2M Hill
By Marine Taxonomic Services, Inc
Collected on September 29, 2015

Station	1	2	3	4	5	Tally
ANNELIDA						
Ampharetidae			1			**1**
Cirratulidae		3			2	**5**
Dorvillidae		1				**1**
Flabelligeridae	4					**4**
Lumbrineridae	1					**1**
Melinna elisabethae	33		2			**35**
Nereidae	1					**1**
Nicomache lumbricalis	4					**4**
Polycirrus sp	1					**1**
Saballaridae	2					**2**
Sphareosyllis sp	5					**5**
Spionidae	21	1				**22**
Syllis armillaris	3	2		3		**8**
Terebellidae	7		1	2		**10**
CRUSTACEA						
Aoridae sp	1	1				**2**
Cirripedia - Balanomorpjha	1			18		**19**
Jassa sp	1		1		1	**3**
Leptochelia savignyi		7		9		**16**
Maera danae	2					**2**
Munnogonium sp	2					**2**
Photis sp	2					**2**
Stenothoidae sp	1					**1**
MOLLUSCA						
Bivalvia sp		1				**1**
Hiatella arctica	1					**1**
Musculus sp	1					**1**
MISCELLANEOUS						
Arhynchite pugettensis	3		3			**6**
Clavipora occidentalis	1			5	2	**8**
Ectopleura marina	4					**4**
Electra crustulenta	1					**1**
Enteropneusta	1					**1**
Lineus sp	1					**1**
Maricola				1		**1**
Nematoda	2				1	**3**
Neorhabdocoela				1		**1**
Stolidobranchia	1					**1**
Terebratulida, juv	2					**2**
Tubulanus sp A		5		1	1	**7**

Attachment B

Infaunal Field Sampling Logs

MTS
Marine Taxonomic Services, Ltd.

STATION OCCUPATION

BIGHT'13

Agency Code: CH2M/AKLNG

Vessel Name: RV/WESTERLY

Arrival Time (hh:mm):

Clear: ☐ Partly cloudy: ☒ Rain: ☐ Thunderstorm: ☐ Fog: ☒

Sea State: Calm ☐ Choppy ☒ Rough ☐

Salinity (ppt): ____ At estuary Sites only

Station ID: D2SD01

Date: 26 Sept 2015

Abandon? Y or N (If Y explain in comments):

Station Fail Code:

Wind
Speed (kts): 10
Direction (4): Variable

Swell
Period (s): 10
Height (ft): 1
GPS Direction (4): Variable

Nav Type
DGPS: ☒

Equipment Type
Van Veen: ☐
Tandem Van Veen: ☐
KC Dig: X

Station Comments

GRAB EVENTS

Sample types (Chk all that apply)

#	Time (hh:mm) UTC	Latitude (DD°MM.mmmm) Northing	Longitude (DD°MM.mmmm) Easting	Depth (m)	Distance to target (m)	Grab Fail Code (6)	Penetration (cm)	Composition (1)	Odor (2)	Color (3)	Shell Hash (Y/N)	Infauna	Sed Chem	Grain Size	Sed Tox	Debris (Y/N)
1	1721	6726184.78	58849.45	9.77	80		10	Sand, gravel	NO	Brown	No	X	—	—	—	No
Grab Event Comments:																
Grab Event Comments:																
Grab Event Comments:																
Grab Event Comments:																
Grab Event Comments:																
Grab Event Comments:																

1 Sediment Composition: Coarse sand, Fine sand, Silt/clay, Gravel, Cobble, Mixed
2 Sediment Odor: None (N), Petroleum (P), Hydrogen sulfide (HS), Humic (HU), Other (O, describe in comments)
3 Sediment Color: Brown, Gray, Black, Olive green, Red
4 Directions: N, NE, E, SE, S, SW, W, NW, or XX for calm

MTS
Marine Taxonomic Services, Ltd.

BIGHT'13

STATION OCCUPATION

Agency Code: CH2M/AKLNG
Vessel Name: RV/WESTERLY
Arrival Time (hh:mm):

Clear [ ]
Partly cloudy [X]
Rain [ ]
Thunderstorm [ ]
Fog [ ]

Sea State
Calm [ ]
Choppy [X]
Rough [ ]

Salinity (ppt): [ ] At estuary Sites only

Station ID: D4 SD01
Date: 26 Sept 2015

Abandon? Y or N (If Y explain in comments):

Station Fail Code:

Wind
Speed (kts): 10
Direction (4): Variable

Swell
Period (s): 10
Height (ft): 1
GPS Direction (4): Variable

Nav Type
DGPS [X]

Equipment Type
Van Veen [ ]
Tandem Van Veen [ ]
KC Dang X

Station Comments:

GRAB EVENTS

Sample types (Chk all that apply)

#	UTC Time (~~hh:mm~~)	Northing Latitude (~~DD°MM.mmmmm~~)	Easting Longitude (~~DD°MM.mmmmm~~)	Depth (m)	Distance to target (m)	Grab Fail Code (6)	Penetration (cm)	Composition (1)	Odor (2)	Color (3)	Shell Hash (Y/N)	Infauna	Sed Chem	Grain Size	Sed Tox	Debris (Y/N)
1937	6725564.01	584264.10		3.6	14		10	Sand, gravel, mud	N	Brown/gray	N	X	—	—	—	N
Grab Event Comments:																
Grab Event Comments:																
Grab Event Comments:																
Grab Event Comments:																
Grab Event Comments:																
Grab Event Comments:																

1 Sediment Composition: Coarse sand, Fine sand, Silt/clay, Gravel, Cobble, Mixed
2 Sediment Odor: None (N), Petroleum (P), Hydrogen sulfide (HS), Humic (HU), Other (O, describe in comments)
3 Sediment Color: Brown, Gray, Black, Olive green, Red
4 Directions: N, NE, E, SE, S, SW, W, NW, or XX for calm

MTS
Marine Taxonomic Services, Ltd.

STATION OCCUPATION

BIGHT'13

Agency Code CH2M/AKLNG
Vessel Name RV/WESTERLY
Arrival Time (hh:mm)

Clear [ ] Rain [ ]
Partly cloudy [X] Thunderstorm [ ]
Fog [ ]

Sea State
Calm [ ]
Choppy [X]
Rough [ ]

Salinity (ppt) [ ] At estuary Sites only

Station ID DS SD01
Date 26 Sept 2015

Abandon? Y or N (If Y explain in comments)

Station Fail Code [ ]

Wind
Speed (kts) 10
Direction (4) Variable

Swell
Period (s) 10
Height (ft) 1
GPS Direction (4) Variable

Nav Type
DGPS [X]

Equipment Type
Van Veen [ ]
Tandem Van Veen [ ]
KC Day X

Station Comments

GRAB EVENTS

Sample types (Chk all that apply)

	#	Time (hh:mm) UTC	Latitude (DD°MM.mmmm) North	Longitude (DD°MM.mmmm) Easting	Depth (m)	Distance to target (m)	Grab Fail Code (6)	Penetration (cm)	Composition (1)	Odor (2)	Color (3)	Shell Hash (Y/N)	Infauna	Sed Chem	Grain Size	Sed Tox	Debris (Y/N)
A	4	1757	6726920.05	5882537.0	8.9		No Sample	—	—			—	X	—	—	—	—
	Grab Event Comments:																
B		1800	6726897.94	5882648.8	8.74	25m		10	Sand/gravel	N	Brown	N	X	—	—	—	N
	Grab Event Comments: winch line-stuck halfway up — Sample Came up Good!																
	Grab Event Comments:																
	Grab Event Comments:																
	Grab Event Comments:																
	Grab Event Comments:																

1 Sediment Composition: Coarse sand, Fine sand, Silt/clay, Gravel, Cobble, Mixed
2 Sediment Odor: None (N), Petroleum (P), Hydrogen sulfide (HS), Humic (HU), Other (O, describe in comments)
3 Sediment Color: Brown, Gray, Black, Olive green, Red
4 Directions: N, NE, E, SE, S, SW, W, NW, or XX for calm