APPENDIX J
Remedial Investigation Data Validation

GEOENGINEERS

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MEMORANDUM

TO: Bob Elsner, Port of Anacortes
FROM: Tonya Kauhi
DATE: December 11, 2008
FILE: 5147-006-05
SUBJECT: Port of Anacortes, Dakota Creek Site - Data Quality Assessment Summary

This memorandum presents a summary of the analytical data quality review for the Port of Anacortes, Dakota Creek Site located in Anacortes, Washington. This review addresses samples collected in March and June, 2008 by GeoEngineers, Inc. (GEI). The samples were submitted to Analytical Resources, Inc. in Tukwila, Washington, CCI Analytical Laboratories in Everett, Washington and Pace Analytical in Minneapolis, Minnesota (dioxins/furans)for chemical analysis. Thirty-six (36) soil samples, eight (8) water samples and twenty-six (26) sediment samples were analyzed by one or more of the following analytical methods:

- Total Solids by EPA 160.3
- Total Organic Carbon by PSEP TOC
- Mercury by EPA 1631E
- Total metals by EPA 6020
- Polychlorinated Biphenyls by EPA 8082
- Semi-volatile Organic Compounds by EPA 8270C
- Polyaromatic hydrocarbons by SW 8270 SIM
- Dioxin/Furans by EPA 8290

PURPOSE AND OBJECTIVES

The objective of this data quality assessment is to review laboratory analytical procedures and quality control results to verify or refute the usability of data with respect to meeting project data quality objectives (DQOs). DQOs define the methods to be used in soil characterization and were developed to ensure the following:

- Samples are analyzed using well defined and acceptable methods that will provide detection limits sufficiently below established clean up criteria.
- The precision and accuracy of data are well defined and adequate to provide defensible data.
- Samples are collected using approved techniques and are representative of existing conditions.
- Quality Assurance/Quality Control (QA/QC) procedures for both field and laboratory methods meet acceptable industry practices and standards.

DATA EVALUATION CRITERIA

The following QC elements were reviewed, as applicable:

- Chain of custody documentation

- Holding times and Preservation
- Duplicates
- Method Blanks
- Laboratory matrix spike/matrix spike duplicate and/or matrix duplicate results
- Laboratory surrogate recoveries
- Laboratory check samples

DATA QUALITY ASSESSMENT SUMMARY

The data quality issues are summarized below. Data review was performed using guidance from *the USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review* (USEPA, 2002) and *USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review* (USEPA, 1999).

Holding Times and Preservation:

All samples were analyzed within appropriate holding times.

Cooler temperatures were recorded between 13.2 and 15.8C, higher then recommended levels in sample delivery group (SDG) NC92. Guidance suggest when temperature exceeds the acceptable range to reject (R flag) the non-detect samples and flag the detected samples as estimated, biased low (J- flag). However, using professional judgment the temperature exceedance does not appear to affect data usability.

Cooler temperature was recorded as 1.6 ºC in SDG K0808184. The temperature was below the recommended limits, however, would not affect data quality.

Method Blanks:

Arsenic was detected in the method blank (KWG08184-MB). Guidance states that if a blank analyte is detected, then any associated sample results for the analyte that are 5 times or less the values of the blank result are re-qualified as not detected and estimated (UJ flag). Arsenic was detected at less than 5 times the blank result in sample SMA5-3 and therefore, was qualified as not detected and estimated (UJ flag). It is possible these results are detects, however, due to the blank contamination there is less reliability in the value.

Arsenic was detected greater than 5 times the blank result in sample SMA5-2 and therefore, was qualified as estimated biased high (J+ flag).

Several dioxin/furan congeners were detected in method blank samples (BLANK-16804 and BLANK-16790). Guidance states that if a blank analyte is detected, then any associated sample results for the analyte that are 5 times or less the values of the blank result are re-qualified as not detected and estimated (UJ flag). It is possible these results are detects, however, due to the blank contamination there is less reliability in the value. See Table 1 Summary Qualification for details.

Several dioxin/furan congeners were detected in the method blank samples (BLANK-16804 and BLANK-16790). The results were greater than 5 times the blank result; therefore, the results were qualified as estimated biased high (J+ flag). See Table 1 Summary Qualification for details.

Surrogate Recoveries:

Surrogates are only evaluated on organic analyses. No surrogate recoveries exceedances were reported.

Matrix Spikes (MS)/Matrix Spike Duplicates (MSD):

Several MS/MSD spike exceedences were reported. Typically, sample results are not qualified based on matrix spike values alone but rather are evaluated in conjunction with other QC criteria. The associated Lab control spike (LCS) was within control limits and therefore no corrective action was taken.

Laboratory Control Spikes (LCS):

The recovery for 2,4-Dimethylphenol was less than the recovery limits (10% to 81%) in samples KWG08080956-3 and KWG0808956-4 (7% and 6%, respectively). 2,4-Dimethylphenol is an analyte that is known to have a poor recovery rate. Guidance suggests if the recovery is less than the lower recovery limit, the associated non-detected target compound should be rejected (“R”). Based on this criteria, we recommend rejecting the non-detected 2,4-Dimethylphenol results in samples SMA5-3 and SMA5-2.

Benzyl alcohol, 2,4-Dimethylphenol and n-Nitrodiphenylamine was detected in batch for samples within SDGs MN24 and MO05. Guidance suggests if the results from a duplicate analysis for an analyte fall outside the control limits, qualify the detected results as estimated (J) and qualify the non-detects as estimated (UJ). Based in these criteria, we recommend qualifying the detected Benzyl alcohol, 2,4-Dimethylphenol and n-Nitrodiphenylamine non-detected results in samples MN24A (G-7(s)), MN24B (G-1(s)), MN24C (G-2(s)) as estimated (UJ flag).

No additional laboratory control spike exceedences were reported.

Laboratory Replicates/Duplicates:

Several laboratory replicate exceedences were reported. Typically, sample results are not qualified based on RPD values alone but rather are evaluated in conjunction with other QC criteria. The associated Lab control spike (LCS) was within control limits and therefore no corrective action was taken.

SUMMARY AND CONCLUSIONS

Overall, the analytical data generated by GeoEngineers, Inc. during the investigation of the Port of Anacortes Dakota Creek Site is useable for intended decision making processes. This data evaluation was performed by GeoEngineers, Inc. using best professional judgment. Data users may review and re-interpret data quality for specific uses.

Attachment: Table 1. Analytical Data Result Qualifications

TABLE 1
ANALYTICAL DATA RESULT QUALIFICATIONS
PORT OF ANACORTES, DAKOTA CREEK SITE

Qualify 2,4-Dimethylphenol for samples SMA5-3 and SMA5-2 as rejected (R) due to recovery exceedance.

Qualify Arsenic for Sample SMA-3 as not detcted and estimated (UJ) and sample SMA-2 as estimated biased high (J+) due to blank contamination.

Qualify the detected Benzyl alcohol, 2,4-Dimethylphenol and n-Nitrodiphenylamine non-detected results in samples MN24A (G-7(s)), MN24B (G-1(s)), MN24C (G-2(s)) as estimated (UJ flag)

Qualify the following samples due to blank contamination or interfering substances:

	Sample Name						
GeoEngineers Sample ID.	**MW-1**	**SB-4-3.0**	**SB-4-9.0**	**SB-5-3.0**	**SB-5-9.0**	**SB-7-3.0**	**SB-7-9.0**
Laboratory Sample ID.	**806108-1L**	**806107-15**	**806107-18**	**806107-20**	**806107-23**	**806107-28**	**806107-30**
Analyte							
2,3,7,8-TCDF		UJ		J+	UJ	UJ	UJ
Total TCDF		J+		J+	UJ	UJ	UJ
1,2,3,7,8-PeCDF		UJ	J	J+	J		J
2,3,4,7,8-PeCDF		J+	J	J+		UJ	J
Total PeCDF		J+	UJ	J+	UJ	UJ	
1,2,3,7,8-PeCDD		UJ		J	UJ	UJ	J
Total PeCDD		J+		J+	UJ	UJ	
1,2,3,4,7,8-HxCDF		UJ	J	J+	J	J	UJ
1,2,3,6,7,8-HxCDF		UJ	J	J+	UJ	J	J
2,3,4,6,7,8-HxCDF		UJ	UJ	J+	UJ	UJ	J
1,2,3,7,8,9-HxCDF		J	J	J+		J	J
Total HxCDF		J+	UJ	J+	UJ	UJ	UJ
1,2,3,4,7,8-HxCDD		UJ	UJ	J+	UJ		UJ
1,2,3,6,7,8-HxCDD		UJ		J+	J		UJ
1,2,3,7,8,9-HxCDD		UJ		J+	UJ		J
Total HxCDD		J+	UJ	J+	UJ	UJ	UJ
1,2,3,4,6,7,8-HpCDF		J+	UJ	J+	UJ	J	UJ
1,2,3,4,7,8,9-HpCDF		J	J	UJ	UJ		UJ
Total HpCDF		UJ	UJ	J+	UJ	UJ	UJ
1,2,3,4,6,7,8-HpCDD	J		UJ	J+	UJ	UJ	UJ
Total HpCDD		J+	J+	J+	UJ	J+	J+
OCDF	J+	J+	J+	J+	UJ	J	UJ
OCDD	J+	J+	J+	J+	UJ	J+	J+

Notes:
See Data Verfication Worksheets for details regarding result qualifications.
Estimated = "J"
Estimated biased high = "J+"
Not Detected and estimated = "UJ"

Screener: Tonya Kauhi
Date: December 3, 2008

DATA QUALITY SCREENING & VERIFICATION WORKSHEET

Project No: 5147-006-05 **SDG: 809103**

Project Name: Port of Anacortes, Dakota Creek Industries

Laboratory: CCI Analytical Laboratories **Methods:** EPA-6010

1.0 Chain-of-Custody

	Y	N	N/A
1.1 Are all Chain-of-Custody (COC) forms included in data package?	X		
1.2 Were COC forms properly signed and dated	X		
1.3 Was sample container temperature recorded on COC form by laboratory?		X	
1.4 Is the recorded temperature within control limits (4ºC ±2ºC)	X		

Comments:

The temperature was recorded on the cooler receipt form. The temperature blank was recorded at 5.0 degrees Celsius.

2.0 Case Narrative/Sample Information

	Y	N	N/A
2.1 Is a case narrative present and does it describe analytical problems, discrepancies and corrective actions?	X		
2.2 Are the field ID and corresponding laboratory sample numbers listed in a cross-reference table?	X		
2.3 Are batch QC and associated field samples listed in a cross-reference table?	X		
2.4 Are the samples and analyses reported in the data package consistent with the information on the COC forms?	X		

Comments:

3.0 Holding Times

	Y	N	N/A
3.1 Are the holding times within the holding time criteria? (metals 180 days)	X		

Comments:

4.0 Internal Standards

	Y	N	N/A
4.1 Are all internal Standard recovery values within the control limits? (ICP-MS 30% - 120%).			X

Comments:

This information is not available in the data package.

5.0 Method Blank

	Y	N	N/A
5.1 Are there any positive results (contaminants) for any analyte in any method blank?		X	

Comments:

Screener: Tonya Kauhi
Date: November 3, 2008

6.0 Laboratory Control Sample (Certified Reference Material)

6.1 Are all %R values within the control limits or are concentrations within the manufacturers certified acceptance limits?	X		
6.2 Are all RPD values within control limits (if duplicate analyzed)?	X		

Comments:

The acceptable %R values are 40% to 135% and the acceptable RPD value is less than 20%.

7.0 Matrix Spike/Matrix Spike Duplicate

7.1 Are all %R values within the control limits?	X		
7.2 Are all RPD values within control limits?	X		

Comments:

8.0 Laboratory Duplicate

8.1 Are all RPD values within control limits?	X		

Comments:

9.0 Field Duplicate

9.1 Are all RPD values within control limits?			X

Comments:

A field duplicate was not submitted.

10.0 Field Blank

10.1 Are there any positive results (contaminants) for any analyte in any field blank			X

Comments:

A field blank was not submitted.

Project Number: ____________________

SDG/Batch: ________________________

Screener: __________ **Date:** _________

Chemist: __________ **Date:** _________

☐ See attached.

Screener: Tonya Kauhi
Date: December 3, 2008

DATA QUALITY SCREENING & VERIFICATION WORKSHEET

Project No: 5147-006-05 **SDG: 806107**

Project Name: Port of Anacortes, Dakota Creek Industries

Laboratory: Pace Analytical **Methods:** EPA 8290, EPA 6010

1.0 Chain-of-Custody

	Y	N	N/A
1.1 Are all Chain-of-Custody (COC) forms included in data package?	X		
1.2 Were COC forms properly signed and dated	X		
1.3 Was sample container temperature recorded on COC form by laboratory?		X	
1.4 Is the recorded temperature within control limits (4ºC ±2ºC)	X		

Comments:

The temperature was recorded on the cooler receipt form. The temperature blank was recorded at 5.0 degrees Celsius.

2.0 Case Narrative/Sample Information

2.1 Is a case narrative present and does it describe analytical problems, discrepancies and corrective actions?	X		
2.2 Are the field ID and corresponding laboratory sample numbers listed in a cross-reference table?	X		
2.3 Are batch QC and associated field samples listed in a cross-reference table?	X		
2.4 Are the samples and analyses reported in the data package consistent with the information on the COC forms?	X		

Comments:

3.0 Holding Times

3.1 Are the holding times within the holding time criteria? (metals 180 days)	X		

Comments:

4.0 Internal Standards

4.1 Are all internal Standard recovery values within the control limits? (ICP-MS 30% - 120%).	X		

Comments:

This information is not available in the data package.

The internal standard recovery was outside control limits of 40% to 135% for OCDD-13C in sample 806107-15MSD (37%). The data was reanalyzed and correct values were obtained according to the case narrative.

The lab flagged several PCDD and PCDF with an "I" or "E" where interfering substances prohibited the confidence in the result. We recommend qualifying these results as estimated ("J" flag). See Table 1 Summary Qualification for details.

5.0 Method Blank

5.1 Are there any positive results (contaminants) for any analyte in any method blank?	X		

Comments:

Several congeners were detected in the method blank sample (BLANK-16804). Guidance states that if a blank analyte is detected, then any associated sample results for the analyte that are 5 times or less the values of the blank result are re-qualified as not detected and estimated (UJ flag). See Table 1 Summary Qualification for details.

Screener: Tonya Kauhi
Date: November 3, 2008

Several congeners were detected in the method blank sample (BLANK-16804). The results were greater than 5 times the blank result; therefore, the results were qualified as estimated biased high (J+ flag). See Table 1 Summary Qualification for details.

6.0 Laboratory Control Sample (Certified Reference Material)

6.1 Are all %R values within the control limits or are concentrations within the manufacturers certified acceptance limits?	X		
6.2 Are all RPD values within control limits (if duplicate analyzed)?	X		

Comments:

The acceptable %R values are 40% to 135% and the acceptable RPD value is less than 20%.

7.0 Matrix Spike/Matrix Spike Duplicate

7.1 Are all %R values within the control limits?	X		
7.2 Are all RPD values within control limits?		X	

Comments:

The RPD for >C10-C12 Aliphatics, >C12-C16 Aliphatics, >C10-C12 Aromatics, >C12-C16 Aromatics, >C16-C21 Aromatics and Naphtahlene exceeded control limits. Typically, sample results are not qualified based on matrix s RPD values alone but rather are evaluated in conjunction with other QC criteria. The associated Lab control spike (LCS) was within control limits and therefore no corrective action was taken.

8.0 Laboratory Duplicate

8.1 Are all RPD values within control limits?	X		

Comments:

9.0 Field Duplicate

9.1 Are all RPD values within control limits?			X

Comments:

A field duplicate was not submitted.

10.0 Field Blank

10.1 Are there any positive results (contaminants) for any analyte in any field blank			X

Comments:

A field blank was not submitted.

Project Number: ____________________

SDG/Batch: ________________________

Screener: __________	**Date:** _________
Chemist: __________	**Date:** _________

☐ See attached.

Screener: Tonya Kauhi
Date: December 3, 2008

DATA QUALITY SCREENING & VERIFICATION WORKSHEET

Project No: 5147-006-05 **SDG: 806108**

Project Name: Port of Anacortes, Dakota Creek Industries

Laboratory: Pace Analytical, CCI Analytical Laboratories

Methods: EPA 8290, NWTPH-GX, NWTPH-DX, EPA-8260SIM, EPA-8260, EPA-8270SIM, EPA-8270, EPA-8081, EPA-8151, EPA-8321B, EPA-200.8, EPA-7470

1.0 Chain-of-Custody

	Y	N	N/A
1.1 Are all Chain-of-Custody (COC) forms included in data package?	X		
1.2 Were COC forms properly signed and dated	X		
1.3 Was sample container temperature recorded on COC form by laboratory?	X		
1.4 Is the recorded temperature within control limits (4ºC ±2ºC)	X		

Comments:

The temperature was recorded on the cooler receipt form. The temperature blank was recorded at 6.8 degrees Celsius. The samples were received by the laboratory in less than 24 hours and were on ice. Guidance suggests when temperature exceeds the acceptable range to reject (R flag) the non-detect samples and flag the detected samples as estimated, biased low (J- flag). However, using professional judgment the temperature exceedance does not appear to affect data usability.

2.0 Case Narrative/Sample Information

	Y	N	N/A
2.1 Is a case narrative present and does it describe analytical problems, discrepancies and corrective actions?	X		
2.2 Are the field ID and corresponding laboratory sample numbers listed in a cross-reference table?	X		
2.3 Are batch QC and associated field samples listed in a cross-reference table?	X		
2.4 Are the samples and analyses reported in the data package consistent with the information on the COC forms?	X		

Comments:

3.0 Holding Times

	Y	N	N/A
3.1 Are the holding times within the holding time criteria? (metals 180 days)	X		

Comments:

4.0 Internal Standards

	Y	N	N/A
4.1 Are all internal Standard recovery values within the control limits? (ICP-MS 30% - 120%).	X		

Comments:

This information is not available in the data package.

The lab flagged several PCDD and PCDF with an "I" where interfering substances prohibited the confidence in the result. We recommend qualifying the result for the isomer 1,2,3,4,6,7,8-HpCDD as estimated ("J" flag).

5.0 Method Blank

	Y	N	N/A
5.1 Are there any positive results (contaminants) for any analyte in any method blank?	X		

Comments:

Several congeners were detected in the method blank sample (BLANK-16790). Guidance states that if a blank analyte is detected, any associated sample results for the analyte that are greater than the reporting limit but less than the blank result are re-qualified as estimated. If any associated sample results for the analyte are greater than the reporting limit and greater than the blank result then use professional judgement in qualifying the results. We recommend qualifying the non-detect results for Total PeCDF, 1,2,3,4,7,8-HxCDF, Total HxCDF, 1,2,3,4,6,7,8-HpCDF, Total HpCDF, 1,2,3,4,6,7,8-HpCDD and Total HpCDD in sample 806108-1L as estimated (J-flag) and the detected results for OCDF and OCDD as estimated (J-flag).

6.0 Laboratory Control Sample (Certified Reference Material)

6.1 Are all %R values within the control limits or are concentrations within the manufacturers certified acceptance limits?	X		
6.2 Are all RPD values within control limits (if duplicate analyzed)?	X		

Comments:

The acceptable %R values are 40% to 135% and the acceptable RPD value is less than 20%.

7.0 Matrix Spike/Matrix Spike Duplicate

7.1 Are all %R values within the control limits?	X		
7.2 Are all RPD values within control limits?	X		

Comments:

8.0 Laboratory Duplicate

8.1 Are all RPD values within control limits?	X		

Comments:

9.0 Field Duplicate

9.1 Are all RPD values within control limits?			X

Comments:

A field duplicate was not submitted.

10.0 Field Blank

10.1 Are there any positive results (contaminants) for any analyte in any field blank			X

Comments:

A field blank was not submitted.

Project Number: ____________________

SDG/Batch: ________________________

Screener: __________	**Date:** _________
Chemist: __________	**Date:** _________

☐ See attached.

Screener: __________ **Date:**___________

DATA QUALITY SCREENING & VERIFICATION WORKSHEET

Project No: 5147-006-05 **SDG: K0808184**

Project Name: Dakota Creek Site

Laboratory: Columbia Analytical Services

Methods: EPA 160.3M, EPA 350.1M, PSEP Sulfide, PSEP TOC, EPA 1631E, EPA 3540, EPA 8082, EPA 8270C, EPA 8270 SIM

1.0 Chain-of-Custody

	Y	N	N/A
1.1 Are all Chain-of-Custody (COC) forms included in data package?	X		
1.2 Were COC forms properly signed and dated	X		
1.3 Was sample container temperature recorded on COC form by laboratory?	X		
1.4 Is the recorded temperature within control limits (4ºC ±2ºC)		X	

Comments: Cooler Temperature was recorded as 1.6 ºC on the cooler receipt form. The temperature was below the recommended limits, however, would not affect data quality.

2.0 Case Narrative/Sample Information

	Y	N	N/A
2.1 Is a case narrative present and does it describe analytical problems, discrepancies and corrective actions?	X		
2.2 Are the field ID and corresponding laboratory sample numbers listed in a cross-reference table?	X		
2.3 Are batch QC and associated field samples listed in a cross-reference table?		X	
2.4 Are the samples and analyses reported in the data package consistent with the information on the COC forms?	X		

Comments:

3.0 Holding Times

	Y	N	N/A
3.1 Are the holding times within the holding time criteria? (metals 180 days)	X		

Comments:

4.0 Internal Standards

	Y	N	N/A
4.1 Are all internal Standard recovery values within the control limits?	X		

Comments:

5.0 Method Blank

	Y	N	N/A
5.1 Are there any positive results (contaminants) for any analyte in any method blank?	X		

Comments:

Arsenic was detected in the method blank (KWG08184-MB). Guidance states that if a blank analyte is detected, then any associated sample results for the analyte that are 5 times or less the values of the blank result are re-qualified as not detected and estimated (UJ flag). Arsenic was detected at less than 5 times the blank result in sample SMA5-3 and therefore, was qualified as not detected and estimated (UJ flag).

Arsenic was detected greater than 5 times the blank result in sample SMA5-2 and therefore, was qualified as estimated biased high (J+ flag).

Screener: __________ **Date:**___________

6.0 Laboratory Control Sample (Certified Reference Material)

6.1 Are all %R values within the control limits or are concentrations within the manufacturers certified acceptance limits?	X		
6.2 Are all RPD values within control limits (if duplicate analyzed)?		X	

Comments:

The recovery for 2,4-Dimethylphenol was less than the recovery limits (10% to 81%) in samples KWG08080956-3 and KWG0808956-4 (7% and 6%, respectively). 2,4-Dimethylphenol is an analyte that is known to have a poor recovery rate. Guidance suggests if the recovery is less than the lower recovery limit, the associated non-detected target compound should be rejected (“R”). Based on this criteria, we recommend rejecting the non-detected 2,4-Dimethylphenol results in samples SMA5-3 and SMA5-2.

7.0 Matrix Spike/Matrix Spike Duplicate

7.1 Are all %R values within the control limits?	X		
7.2 Are all RPD values within control limits?		X	

Comments:

The RPD value for Pentachlorophenol the limit of 40 in sample SMA5-3 (RPD 44%).

Typically, sample results are not qualified based on RPD values alone but rather are evaluated in conjunction with other QC criteria. The associated Lab control spike (LCS) was within control limits and therefore no corrective action was taken.

8.0 Laboratory Duplicate

8.1 Are all RPD values within control limits?		**X**	

Comments:

9.0 Field Duplicate

9.1 Are all RPD values within control limits?			**X**

Comments: A field duplicate was not submitted.

10.0 Field Blank

10.1 Are there any positive results (contaminants) for any analyte in any field blank			**X**

Comments: A field blank was not submitted.

Project Number: ____________________

SDG/Batch: ________________________

Screener: __________ **Date:** _________

Chemist: __________ **Date:** _________

☐ See attached.

Screener: Tonya Kauhi
Date: November 3, 2008

DATA QUALITY SCREENING & VERIFICATION WORKSHEET

Project No: 5147-006-05 **SDG: K0808300**

Project Name: Port of Anacortes, Dakota Creek Industries

Laboratory: Columbia Analytical Services

Methods: EPA 160.3M, EPA 350.1M, PSEP Sulfide, PSEP TOC, EPA 1631E, EPA 3540, EPA 8082, EPA 8270C, EPA 8270 SIM

1.0 Chain-of-Custody

	Y	N	N/A
1.1 Are all Chain-of-Custody (COC) forms included in data package?	X		
1.2 Were COC forms properly signed and dated	X		
1.3 Was sample container temperature recorded on COC form by laboratory?		X	
1.4 Is the recorded temperature within control limits (4ºC ±2ºC)	X		

Comments:

The temperature was recorded on the cooler receipt form. The temperature blank was recorded at 3.0 degrees Celsius.

2.0 Case Narrative/Sample Information

	Y	N	N/A
2.1 Is a case narrative present and does it describe analytical problems, discrepancies and corrective actions?	X		
2.2 Are the field ID and corresponding laboratory sample numbers listed in a cross-reference table?	X		
2.3 Are batch QC and associated field samples listed in a cross-reference table?	X		
2.4 Are the samples and analyses reported in the data package consistent with the information on the COC forms?	X		

Comments:

3.0 Holding Times

	Y	N	N/A
3.1 Are the holding times within the holding time criteria? (metals 180 days)	X		

Comments:

4.0 Internal Standards

	Y	N	N/A
4.1 Are all internal Standard recovery values within the control limits? (ICP-MS 30% - 120%).	X		

Comments:

5.0 Method Blank

	Y	N	N/A
5.1 Are there any positive results (contaminants) for any analyte in any method blank?	X		

Comments:

Benzyl Alcohol was detected in the method blank (KWG0810601-5). Guidance states that if a blank analyte is detected, then any associated sample results for the analyte that are 5 times or less the values of the blank result are re-qualified as estimated. Benzyl alcohol was not detected in sample SMA3-2 and therefore, was no action was taken.

Screener: Tonya Kauhi
Date: November 3, 2008

6.0 Laboratory Control Sample (Certified Reference Material)

6.1 Are all %R values within the control limits or are concentrations within the manufacturers certified acceptance limits?	X		
6.2 Are all RPD values within control limits (if duplicate analyzed)?	X		

Comments:

7.0 Matrix Spike/Matrix Spike Duplicate

7.1 Are all %R values within the control limits?		X	
7.2 Are all RPD values within control limits?		X	

Comments:

The recoveries for acenaphthalene, acenaphthene, dibenzofuran, phenanthrene, anthracene and benzo(k)fluroanthene were less than established control limits in the MSD for sample K0909328-001. The QC sample is not part of this project.

The RPD values for all analytes in sample K0909328-001 exceeded the limit of 40 in QC batch KWG0810602-2. The QC sample is not part of this project.

Typically, sample results are not qualified based on matrix s RPD values alone but rather are evaluated in conjunction with other QC criteria. The associated Lab control spike (LCS) was within control limits and therefore no corrective action was taken.

8.0 Laboratory Duplicate

8.1 Are all RPD values within control limits?		X	

Comments:

The RPD for chromium (38.2%) and lead (21.0%) exceeded the control limit of 20% in sample SMA3-2. Typically, sample results are not qualified based on RPD values alone but rather are evaluated in conjunction with other QC criteria. The associated Lab control spike (LCS) was within control limits and therefore no corrective action was taken.

9.0 Field Duplicate

9.1 Are all RPD values within control limits?			X

Comments:

A field duplicate was not submitted.

10.0 Field Blank

10.1 Are there any positive results (contaminants) for any analyte in any field blank			X

Comments:

A field blank was not submitted.

Project Number: ____________________

SDG/Batch: ________________________

Screener: __________ **Date:** _________

Chemist: __________ **Date:** _________

☐ See attached.

Screener: Catalena Cabrera
Date: December 10, 2008

DATA QUALITY SCREENING & VERIFICATION WORKSHEET

Project No: 5147-006-05 **SDG: MN73, MS27, MV68, NC92, MN24, MO05**

Project Name: Port of Anacortes, Dakota Creek Industries

Laboratory: Analytical Resources Incorporated

Methods: SW8270, SIM SW8270D, SW8082, Krone/SIM SW827D, EPA 160.3, EPA 160.4, EPA 350.1M, EPA 376.5, Plumb, 1981NWTPH-HCID, 6010, 6020, 747, SW3510C

1.0 Chain-of-Custody

	Y	N	N/A
1.1 Are all Chain-of-Custody (COC) forms included in data package?	X		
1.2 Were COC forms properly signed and dated	X		
1.3 Was sample container temperature recorded on COC form by laboratory?		X	
1.4 Is the recorded temperature within control limits (4ºC ±2ºC)		X	

Comments:

The temperature was recorded on the cooler receipt form. Cooler temperatures were recorded between 13.2 and 15.8C, higher then recommended levels. Guidance suggest when temperature exceeds the acceptable range to reject (R flag) the non-detect samples and flag the detected samples as estimated, biased low (J- flag). However, using professional judgment the temperature exceedance does not appear to affect data usability.

2.0 Case Narrative/Sample Information

	Y	N	N/A
2.1 Is a case narrative present and does it describe analytical problems, discrepancies and corrective actions?	X		
2.2 Are the field ID and corresponding laboratory sample numbers listed in a cross-reference table?	X		
2.3 Are batch QC and associated field samples listed in a cross-reference table?	X		
2.4 Are the samples and analyses reported in the data package consistent with the information on the COC forms?		X	

Comments:

Case narrative reiterates the cooler temperate was outside the control limits.

Samples analyzed are not samples requested for analysis in COC.

3.0 Holding Times

	Y	N	N/A
3.1 Are the holding times within the holding time criteria? (metals 180 days)	X		

Comments:

Case narrative indicated holding times were within holding time criteria.

4.0 Internal Standards

	Y	N	N/A
4.1 Are all internal Standard recovery values within the control limits? (ICP-MS 30% - 120%).	X		

Comments:

This information was not available in the lab package. The case narrative did not indicate limits were not met.

5.0 Method Blank

	Y	N	N/A
5.1 Are there any positive results (contaminants) for any analyte in any method blank?		X	

Comments:

Screener:
Date: December 10, 2008

6.0 Laboratory Control Sample (Certified Reference Material)

6.1 Are all %R values within the control limits or are concentrations within the manufacturers certified acceptance limits?		X	
6.2 Are all RPD values within control limits (if duplicate analyzed)?		**X**	

Comments:

Benzyl alcohol was detected in the lab control spike (LCS-032108).

Benzyl alcohol, 2,4-Dimethylphenol and n-Nitrodiphenylamine was detected in batch for samples within MN24 & MO05.

Guidance suggests if the results from a duplicate analysis for an analyte fall outside the control limits, qualify the detected results as estimated (J) and qualify the non-detects as estimated (UJ). Based in these criteria, we recommend qualifying the detected Benzyl alcohol, 2,4-Dimethylphenol and n-Nitrodiphenylamine non-detected results in samples MN24A, MN24B, MN24C as estimated (UJ flag).

7.0 Matrix Spike/Matrix Spike Duplicate

7.1 Are all %R values within the control limits?		X	
7.2 Are all RPD values within control limits?	X		

Comments:

The percent recovery in Mercury for sample G-4-2-3 exceeded the percent recovery levels

Matrix Spike RPD % Recovery has either control limits not met or recover not applicable, sample concentrations too high for Copper, Lead, Mercury and Zinc.

The matrix duplicate for sample G-3-0-1 control limit was not met

The matrix duplicate for sample G-2 (1.5-2.5) control limit was not met

The matrix spike for duplicate G-2 (1.5-2.5) Percent recovery exceeded recovery limits

The matrix spike for G-7 (s) control limit was not met for zinc

RPD values were low for Benzyl for MN24 & MO05

High RPD values was detected for Dimethyl Phalate. A second prep batch was analyzed which detected Dibenz(a,h) Anthracene. Butylbenzylphthalate had a high RPD value. (MN24 & MO05)

MN24 & MO05 MS exceeded limits in Zinc.

Typically, sample results are not qualified based on matrix spike or RPD values alone but rather are evaluated in conjunction with other QC criteria. The associated Lab control spike (LCS) was within control limits and therefore no corrective action was taken.

8.0 Laboratory Duplicate

8.1 Are all RPD values within control limits?		X	

Comments: Sample G-7 (S) duplicate control limit was not met. For analyte arsenic, copper, lead and zinc

Samples within MN24 & MO05 had RPD outside limits for Arsenic, Copper, Lead and Zinc.

Typically, sample results are not qualified based on matrix s RPD values alone but rather are evaluated in conjunction with other QC criteria. The associated Lab control spike (LCS) was within control limits and therefore no corrective action was taken.

9.0 Field Duplicate

9.1 Are all RPD values within control limits?			X

Comments:

A field duplicate was not submitted

10.0 Field Blank

10.1 Are there any positive results (contaminants) for any analyte in any field blank			X

Comments:

A field blank was not submitted

Project Number: ____________________

SDG/Batch: ________________________

Screener: __________ **Date:** _________

Chemist: __________ **Date:** _________

☐ See attached.

GEOENGINEERS

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Data Validation Report

Project: Dakota Creek Industries Cleanup Site – Soil Data Gap Evaluation
September/October 2014 Soil Samples

GEI File No: 05147-006-10

Date: January 27, 2015

This report documents the results of a United States Environmental Protection Agency (USEPA)-defined Stage 2A data validation (USEPA Document 540-R-08-005; USEPA, 2009) of analytical data from the analyses of soil samples collected as part of the September and October 2014 sampling events, and the associated laboratory and field quality control (QC) samples. The samples were obtained from the Dakota Creek Industries Shipyard Site (Site) located in Anacortes, Washington.

OBJECTIVE AND QUALITY CONTROL ELEMENTS

GeoEngineers, Inc. (GeoEngineers) completed the data validation consistent with the USEPA Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review (USEPA, 2008) and Inorganic Superfund Data Review (USEPA 2010) (National Functional Guidelines) to determine if the laboratory analytical results meet the project objectives and are usable for their intended purpose. Data usability was assessed by determining if:

- The samples were analyzed using well-defined and acceptable methods that provide reporting limits below applicable regulatory criteria;
- The precision and accuracy of the data are well-defined and sufficient to provide defensible data; and
- The quality assurance/quality control (QA/QC) procedures utilized by the laboratory meet acceptable industry practices and standards.

In accordance with the Sampling Analysis Plan/Quality Assurance Project Plan (Appendix B of Shipyard Interim Action – Upland Soil and Groundwater, GeoEngineers, 2008), the data validation included review of the following QC elements:

- Data Package Completeness
- Chain-of-Custody Documentation
- Holding Times and Sample Preservation
- Surrogate Recoveries
- Method Blanks
- Matrix Spikes/Matrix Spike Duplicates
- Laboratory Control Samples/Laboratory Control Sample Duplicates
- Field and Laboratory Duplicates
- Reporting Limits

VALIDATED SAMPLE DELIVERY GROUPS

This data validation included review of the sample delivery groups (SDGs) listed below in Table 1.

TABLE 1: SUMMARY OF VALIDATED SAMPLE DELIVERY GROUPS

Laboratory SDG	Samples Validated
1410-019	GEI-13_2-3_093014, GEI-14_2-3_093014, GEI-15_5.5-6.5_093014, GEI-17_7-8_093014, GEI-18_8-9_093014, GEI-20_6-7_093014, GEI-21_5-6_093014, GEI-21_7.5-8.5_093014, GEI-23_7.5-8.5_093014, GEI-25_7-8_093014, GEI-26_6-7_093014
1410-019B	GEI-13_2-3_093014, GEI-13_5-6_093014, GEI-13_7-8_093014, GEI-14_2-3_093014, GEI-14_3.5-4.5_093014, GEI-14_7-8_093014, GEI-15_2-3_093014, GEI-15_5.5-6.5_093014, GEI-15_10-11_093014, GEI-16_2-3_093014, GEI-16_6-7_093014, GEI-17_1-2_093014, GEI-17_4-5_093014, GEI-17_7-8_093014, GEI-18_1-2_093014, GEI-18_4-5_093014, GEI-18_9-10_093014, GEI-23_1-2_093014, GEI-23_5-6_093014, GEI-24_2-3_093014, GEI-24_4-5_093014, GEI-25_1-2_093014, GEI-25_4-5_093014, GEI-25_9-10_093014, GEI-30_3-4_093014, GEI-30_7-8_093014
1410-019C	GEI-14_9-10_093014, GEI-15_5.5-6.5_093014, GEI-17_9-10_093014, GEI-19_2-3_093014, GEI-19_4-5_093014, GEI-19_7-8_093014, GEI-19_9-10_093014, GEI-20_2-3_093014, GEI-20_8-9_093014, GEI-21_1-2_093014, GEI-21_7.5-8.5_093014, GEI-23_7.5-8.5_093014, GEI-24_6-7_093014, GEI-24_9-10_093014, GEI-25_1-2_093014, GEI-26_2-3_093014, GEI-29_2-3_093014, GEI-30_3-4_093014, GEI-30_9-10_093014
1410-020	GEI-22_5-6_100114, GEI-28_5-6_100114, GEI-128_5-6_100114, GEI-36_5-6_100114, GEI-136_5-6_100114, GEI-37_6-7_100114, GEI-38_6-7_100114, GEI-42_6-7_100114
1410-020B	GEI-22_2-3_100114, GEI-27_1-2_100114, GEI-27_5-6_100114, GEI-28_2-3_100114, GEI-28_10-11_100114, GEI-34_2.5-3.5_100114, GEI-34_6-7_100114, GEI-35_3-4_100114, GEI-36_1-2_100114, GEI-38_1-2_100114, GEI-39_1.5-2.5_100114, GEI-39_6-7_100114, GEI-40_2-3_100114, GEI-41_1-2_100114, GEI-41_4-5_100114, GEI-41_6-7_100114, GEI-42_1-2_100114, GEI-43_1-2_100114, GEI-43_6-7_100114
1410-020C	GEI-22_7.5-8.5_100114, GEI-31_1-2_100114, GEI-31_4-5_100114, GEI-31_6-7_100114, GEI-31_9-10_100114, GEI-32_1-2_100114, GEI-33_1-2_100114, GEI-34_9-10_100114, GEI-35_8-9_100114, GEI-35_9-10_100114, GEI-37_1-2_100114, GEI-39_4-5_100114, GEI-39_6-7_100114, GEI-41_1-2_100114, GEI-41_8-9_100114, GEI-42_1-2_100114, GEI-42_4-5_100114, GEI-42_6-7_100114

Laboratory SDG	Samples Validated
1410-021	GEI-03_7-8_092914, GEI-103_7-8_092914, GEI-04_6-7_092914, GEI-05_7-8_092914, GEI-06_1.5-2.5_092914, GEI-06_7-8_092914, GEI-07_1.5-2.5_092914, GEI-07_7-8_092914, GEI-08_7-8_092914, GEI-09_0.5-1.5_092914, GEI-09_6-7_092914, GEI-10_2-3_092914, GEI-10_7-8_092914, GEI-11_7-8_092914, GEI-12_2-3_092914
1410-021B	GEI-02_1-2_092914, GEI-02_7-8_092914, GEI-03_2.5-3.5_092914, GEI-04_1-2_092914, GEI-04_3-4_092914, GEI-05_7-8_092914, GEI-06_4-5_092914, GEI-08_1.5-2.5_092914, GEI-08_4-5_092914, GEI-09_0.5-1.5_092914, GEI-09_3-4_092914, GEI-09_6-7_092914, GEI-11_2-3_092914, GEI-11_7-8_092914, GEI-12_4-5_092914
1410-021C	GEI-01_3-4_092914, GEI-02_4-5_092914, GEI-12_7-8_092914

CHEMICAL ANALYSIS PERFORMED

OnSite Environmental, Inc. (OnSite), located in Redmond, Washington, performed laboratory analyses on the soil samples using one or more of the following methods:

- Polycyclic Aromatic Hydrocarbons (PAHs) by Method SW8270D-SIM; and
- Total Arsenic and Nickel by Method EPA6010C

DATA VALIDATION SUMMARY

The results for each of the QC elements are summarized below.

Data Package Completeness

OnSite provided all required deliverables for the data validation according to the National Functional Guidelines. The laboratory followed adequate corrective action processes and all identified anomalies were discussed in the relevant laboratory case narrative.

Chain-of-Custody Documentation

Chain-of-custody (COC) forms were provided with the laboratory analytical reports. The COCs were accurate and complete when submitted to the lab. The following were noted on the sample receipt forms:

SDG 1410-019C: The laboratory noted that, for Sample GEI-29_2-3_093014, the sample collection time written on the sample label was 16:40 and 16:25 was written on the COC.

SDG 1410-020: The laboratory noted that, for Sample GEI-28_5-6_100114, the sample collection time written on the sample label was 11:25 and 12:25 was written on the COC.

SDG 1410-020B: The laboratory noted that, for Sample GEI-28_2-3_100114, the sample collection time written on the sample label was 11:20 and 12:20 was written on the COC.

Also, the laboratory noted that Samples GEI-43_1-2_100114 and GEI-43_6-7_100114 were not written on the COC. The samples were added to the COC by OnSite.

SDG 1410-020C: The laboratory noted that Sample GEI-39_4-5_100114 was written on the sample label as GEI-39_4-5_100115.

Holding Times and Sample Preservation

The sample holding time is defined as the time that elapses between sample collection and sample analysis. Maximum holding time criteria exist for each analysis to help ensure that the analyte concentrations found at the time of analysis reflect the concentration present at the time of sample collection. Established holding times were met for all analyses. The sample coolers arrived at the laboratory at the appropriate temperatures of between two and six degrees Celsius, with the exceptions noted below.

SDG 1410-019: One sample cooler temperature recorded at the laboratory was one degree Celsius. It was determined through professional judgment that since the samples were not frozen, this temperature should not affect the sample analytical results.

SDG 1410-021: The sample cooler temperature recorded at the laboratory was zero degrees Celsius. It was determined through professional judgment that since the samples were not frozen, this temperature should not affect the sample analytical results.

Surrogate Recoveries

A surrogate compound is a compound that is chemically similar to the organic analytes of interest, but unlikely to be found in any environmental sample. Surrogates are used for organic analyses and are added to all samples, standards, and blanks to serve as an accuracy and specificity check of each analysis. The surrogates are added to the samples at a known concentration and percent recoveries are calculated following analysis. All surrogate percent recoveries for field samples were within the laboratory control limits.

Method Blanks

Method blanks are analyzed to ensure that laboratory procedures and reagents do not introduce measurable concentrations of the analytes of interest. A method blank was analyzed with each batch of samples, at a frequency of 1 per 20 samples. For all sample batches, method blanks were analyzed at the required frequency. None of the analytes of interest were detected above the reporting limits in any of the method blanks.

Matrix Spikes/Matrix Spike Duplicates

Since the actual analyte concentration in an environmental sample is not known, the accuracy of a particular analysis is usually inferred by performing a matrix spike (MS) analysis on one sample from the associated batch, known as the parent sample. One aliquot of the sample is analyzed in the normal manner and then a second aliquot of the sample is spiked with a known amount of analyte concentration and analyzed. From these analyses, a percent recovery is calculated. Matrix spike duplicate (MSD) analyses are generally performed for organic analyses as a precision check and analyzed in the same sequence as a matrix spike. Using the result values from the MS and MSD, the relative percent difference (RPD) is calculated. The percent recovery control limits for MS and MSD analyses are specified in the laboratory documents, as are the RPD control limits for MS/MSD sample sets.

For inorganic methods, the matrix spike is followed by a post-digestion spike sample if any element percent recoveries were outside the control limits in the matrix spike. The percent recovery control limits for matrix spikes are 75% to 125%.

One MS/MSD analysis should be performed for every analytical batch or every 20 field samples, whichever is more frequent. The frequency requirements were met for all analyses and the percent recovery and RPD values were within the proper control limits.

Laboratory Control Samples/Laboratory Control Sample Duplicates

A laboratory control sample (LCS) is a blank sample that is spiked with a known amount of analyte and then analyzed. An LCS is similar to an MS, but without the possibility of matrix interference. Given that matrix interference is not an issue, the LCS/LCSD control limits for accuracy and precision are usually more rigorous than for MS/MSD analyses. Additionally, data qualification based on LCS/LCSD analyses would apply to all samples in the associated batch, instead of just the parent sample. The percent recovery control limits for LCS and LCSD analyses are specified in the laboratory documents, as are the RPD control limits for LCS/LCSD sample sets.

One LCS/LCSD analysis should be performed for every analytical batch or every 20 field samples, whichever is more frequent. The frequency requirements were met for all analyses and the percent recovery and RPD values were within the proper control limits.

Laboratory Duplicates

Internal laboratory duplicate analyses are performed to monitor the precision of the analyses. Two separate aliquots of a sample are analyzed as distinct samples in the laboratory and the RPD between the two results is calculated. Duplicate analyses should be performed once per analytical batch. If one or more of the samples used has a concentration less than five times the reporting limit for that sample, the absolute difference is used instead of the RPD. For organic analyses, the RPD control limits are specified in the laboratory documents. For inorganic analyses, the RPD control limit for soil samples is 35 percent. Laboratory duplicates were analyzed at the proper frequency and the specified acceptance criteria were met.

Field Duplicates

In order to assess precision, field duplicate samples are collected and analyzed along with the reviewed sample batches. The duplicate samples are analyzed for the same parameters as the associated parent samples. Precision is determined by calculating the RPD between each pair of samples. If one or more of the sample analytes has a concentration greater than five times the reporting limit for that sample, then the absolute difference is used instead of the RPD. The RPD control limit for soil samples is 50 percent.

SDG 1410-020: Two field duplicate sample pairs, GEI-28_5-6_100114/GEI-128_5-6_100114 and GEI-36_5-6_100114/GEI-136_5-6_100114, were submitted with this SDG. The precision criteria for all target analytes were met for these sample pairs.

SDG 1410-021: One field duplicate sample pair, GEI-03_7-8_092914 and GEI-103_7-8_092914, was submitted with this SDG. The precision criteria for all target analytes were met for this sample pair, with the exception of nickel. The positive results for nickel were qualified as estimated (J) in this sample pair.

Reporting Limits

The reporting limits were met by the laboratory for all target analytes throughout this sampling event, with the following exceptions:

SDG 1410-019B: The reporting limit for arsenic in Samples GEI-14_7-8_093014 and GEI-23_5-6_093014 was greater than the screening level for the Site; however, the sample concentrations were detected above the screening level.

SDG 1410-020C: The reporting limit for arsenic in Sample GEI-22_7.5-8.5_100114 was greater than the screening level for the Site; however, the sample concentration was detected above the screening level.

SDG 1410-021C: The reporting limit for arsenic in Samples GEI-01_3-4_092914, GEI-02_4-5_092914, and GEI-12_7-8_092914 was greater than the screening level for the Site.

OVERALL ASSESSMENT

As was determined by this data validation, the laboratory followed the specified analytical methods. Accuracy was acceptable, as demonstrated by the surrogate, LCS/LCSD, and MS/MSD percent recovery values. Precision was acceptable, as demonstrated by the LCS/LCSD, MS/MSD, and field/laboratory duplicate RPD values, with the exception noted above.

All data are acceptable for the intended use, with the following qualifications listed below in Table 2.

TABLE 2: SUMMARY OF QUALIFIED SAMPLES

Sample ID	Analyte	Qualifier	Reason
GEI-03_7-8_092914	Nickel	J	Field Duplicate RPD
GEI-103_7-8_092914	Nickel	J	Field Duplicate RPD

REFERENCES

U.S. Environmental Protection Agency (USEPA). “Guidance for Labeling Externally Validated Laboratory Analytical Data for Superfund Use,” EPA-540-R-08-005. January 2009.

U.S. Environmental Protection Agency (USEPA). “Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review,” EPA-540-R-08-01. June 2008.

U.S. Environmental Protection Agency (USEPA). “Contract Laboratory Program National Functional Guidelines for Inorganic Superfund Data Review,” EPA-540-R-10-011. January 2010.

GeoEngineers, Inc., “Shipyard Interim Action – Upland Soil and Groundwater,” File No. 5147-006-00. April 1, 2008.

GEOENGINEERS

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Data Validation Report

Project: Dakota Creek Industries Cleanup Site – Additional Soil Data Gap Investigation

GEI File No: 05147-006-11

Date: August 14, 2018

This report documents the results of a United States Environmental Protection Agency (USEPA)-defined Stage 2B data validation (USEPA Document 540-R-08-005; USEPA, 2009) of analytical data from the analyses of direct push soil boring samples collected as the Soil Data Gap Investigation, and the associated laboratory and field quality control (QC) samples. The samples were obtained from the Dakota Creek Industries Shipyard Site (Site) located in Anacortes, Washington.

OBJECTIVE AND QUALITY CONTROL ELEMENTS

GeoEngineers, Inc. (GeoEngineers) completed the data validation consistent with the USEPA Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review (USEPA, 2008) and Inorganic Superfund Data Review (USEPA 2010) (National Functional Guidelines) to determine if the laboratory analytical results meet the project objectives and are usable for their intended purpose. Data usability was assessed by determining if:

- The samples were analyzed using well-defined and acceptable methods that provide reporting limits below applicable regulatory criteria;
- The precision and accuracy of the data are well-defined and sufficient to provide defensible data; and
- The quality assurance/quality control (QA/QC) procedures utilized by the laboratory meet acceptable industry practices and standards.

In accordance with the Remedial Investigation/Feasibility Work Plan Addendum, Dakota Creek Industries Site (GeoEngineers, 2018), the data validation included review of the following QC elements:

- Data Package Completeness
- Chain-of-Custody Documentation
- Holding Times and Sample Preservation
- Surrogate Recoveries
- Method Blanks
- Matrix Spikes/Matrix Spike Duplicates
- Laboratory Control Samples/Laboratory Control Sample Duplicates
- Field and Laboratory Duplicates
- Instrument Tuning
- Internal Standards
- Initial Calibrations (ICALs)

- Continuing Calibrations (CCALs)
- Reporting Limits

VALIDATED SAMPLE DELIVERY GROUPS

This data validation included review of the sample delivery groups (SDGs) listed below in Table 1.

TABLE 1: SUMMARY OF VALIDATED SAMPLE DELIVERY GROUPS

Laboratory SDG	Samples Validated
1807-159	GEI-44-1.5-2, GEI-44-7.5-10, GEI-44-16-17.5, GEI-45-1-3, GEI-45-9-10, GEI-45-17-20, GEI-46-7-8.5, DUP 1-7-8.5, GEI-46-13.5-15

CHEMICAL ANALYSIS PERFORMED

Onsite Environmental (Onsite), located in Redmond, Washington, perfomed accredited laboratory analyses on all soil samples. Onsite used one or more of the following methods:

- Polycyclic Aromatic Hydrocarbons (PAHs) by Method SW8270D-SIM
- Total Arsenic by Method EPA6010D

DATA VALIDATION SUMMARY

The results for each of the QC elements are summarized below.

Data Package Completeness

Onsite provided all required deliverables for the data validation according to the National Functional Guidelines. The laboratory followed adequate corrective action processes and all identified anomalies were discussed in the relevant laboratory case narrative.

Chain-of-Custody Documentation

Chain-of-custody (COC) forms were provided with the laboratory analytical reports. The COCs were accurate and complete when submitted to the lab. Documents were properly signed and dated by field and laboratory personel, analyses were properly requested and checked by the laboratory.

Holding Times and Sample Preservation

The sample holding time is defined as the time that elapses between sample collection and sample analysis. Maximum holding time criteria exist for each analysis to help ensure that the analyte concentrations found at the time of analysis reflect the concentration present at the time of sample collection. Established holding times were met for all analyses. The sample coolers arrived at the laboratory at the appropriate temperatures of between 2 and 6 °C, with the exceptions below.

SDG 1607-159: The sample coolers were received at temperatures at 10 °C and 12°C. The analyses requested (metals and c-PAHs) were determined to relatively resilient to this amount of temperature fluctuation, even though the measured degrees exceeded the established control limits. No qualifiers were applied for these samples.

Surrogate Recoveries

A surrogate compound is a compound that is chemically similar to the organic analytes of interest, but unlikely to be found in any environmental sample. Surrogates are used for organic analyses and are added to all samples, standards, and blanks to serve as an accuracy and specificity check of each analysis. The surrogates are added to the samples at a known concentration and percent recoveries are calculated following analysis. All surrogate percent recoveries for field samples were within the laboratory control limits.

Method Blanks

Method blanks are analyzed to ensure that laboratory procedures and reagents do not introduce measurable concentrations of the analytes of interest. A method blank was analyzed with each batch of samples, at a frequency of 1 per 20 samples. For all sample batches, method blanks were analyzed at the required frequency. None of the analytes of interest were detected above the reporting limits in any of the method blanks.

Matrix Spikes/Matrix Spike Duplicates

Since the actual analyte concentration in an environmental sample is not known, the accuracy of a particular analysis is usually inferred by performing a matrix spike (MS) analysis on one sample from the associated batch, known as the parent sample. One aliquot of the sample is analyzed in the normal manner and then a second aliquot of the sample is spiked with a known amount of analyte concentration and analyzed. From these analyses, a percent recovery (%R) is calculated. Matrix spike duplicate (MSD) analyses are generally performed for organic analyses as a precision check and analyzed in the same sequence as a matrix spike. Using the result values from the MS and MSD, the relative percent difference (RPD) is calculated. The %R control limits for MS and MSD analyses are specified in the laboratory documents, as are the RPD control limits for MS/MSD sample sets.

For inorganic methods, the matrix spike is followed by a post-digestion spike sample if any element %R values were outside the control limits in the matrix spike. All metals %R control limits for matrix spikes are 75% to 125%.

One MS/MSD analysis should be performed for every analytical batch or every 20 field samples, whichever is more frequent. The frequency requirements were met for all analyses and the %R and RPD values were within the proper control limits.

SDG 1807-159: (Metals and cPAHs) A matrix spike/matrix spike duplicate was performed on Sample GEI-46-7-8.5. The %R and RPD values for all target analytes were within the established control limits in this sample set.

Laboratory Control Samples/Laboratory Control Sample Duplicates

A laboratory control sample (LCS) is a blank sample that is spiked with a known amount of analyte and then analyzed. An LCS is similar to an MS, but without the possibility of matrix interference. Given that matrix interference is not an issue, the LCS/LCSD control limits for accuracy and precision are usually more rigorous than for MS/MSD analyses. Additionally, data qualification based on LCS/LCSD analyses would apply to all samples in the associated batch, instead of just the parent sample. The percent recovery control limits for LCS and LCSD analyses are specified in the laboratory documents, as are the RPD control limits for LCS/LCSD sample sets.

One LCS/LCSD analysis should be performed for every analytical batch or every 20 field samples, whichever is more frequent. The frequency requirements were met for all analyses and the percent recovery and RPD values were within the proper control limits.

Laboratory Duplicates

Internal laboratory duplicate analyses are performed to monitor the precision of the analyses. Two separate aliquots of a sample are analyzed as distinct samples in the laboratory and the RPD between the two results is calculated. Duplicate analyses should be performed once per analytical batch. If one or more of the samples used has a concentration less than five times the reporting limit for that sample, the absolute difference is used instead of the RPD. For organic analyses, the RPD control limits are specified in the laboratory documents. For inorganic analyses, the RPD control limit for soil samples is 35 percent. Laboratory duplicates were analyzed at the proper frequency and the specified acceptance criteria were met.

Field Duplicates

In order to assess precision, field duplicate samples are collected and analyzed along with the reviewed sample batches. The duplicate samples are analyzed for the same parameters as the associated parent samples. Precision is determined by calculating the Relative Percent Difference (RPD) between each pair of samples. If one or more of the sample analytes has a concentration greater than five times the reporting limit for that sample, then the absolute difference is used instead of the RPD. The RPD control limit for soil samples is 50 percent, while the absolute difference control limit is equal to twice the reporting limit.

SDG 1607-159: One field duplicate sample pair, GEI-46-7-8.5/DUP 1-7-8.5, were submitted with this SDG. There were no positive results for any target analytes in either sample. The precision criteria for all target analytes were met for these sample pairs.

Instrument Tuning

Instrument tuning for analyses by gas chromatography/mass spectrometry (GC/MS) are completed to ensure that mass resolution, identification, and sensitivity of the analyses are acceptable. Instrument tuning should be performed at the beginning of each 12-hour period during which samples or standards are analyzed. The frequency and specified acceptance criteria were met for each applicable analysis.

Internal Standards (Low Resolution Mass Spectrometry)

Like the surrogate, an internal standard is a compound that is chemically similar to the analytes of interest, but unlikely to be found in any environmental sample. Internal standards are used only for the mass spectrometry instrumentation and are usually added to the sample aliquot after extraction has taken place. The internal standard should be analyzed at the beginning of a 12-hour sample run and the control limits for internal standard recoveries are 50 percent to 200 percent of the calibration standard. All internal standard recoveries were within the control limits, with the following exceptions:

Initial Calibrations (ICALs)

The initial calibrations were conducted according to the laboratory methods and consisted of the appropriate number of standards. For all organic analyses, the percent relative standard deviation (%RSD) and relative response factors (RRF) values were within the laboratory control limits and also the control limits stated in the National Functional Guidelines for Organic Superfund Data Review (USEPA

2017). For all inorganic analyses, the calibrations were within the laboratory control limits and also the control limits stated in the National Functional Guidelines for Inorganic Superfund Methods Data Review (USEPA 2017).

Continuing Calibrations (CCALs)

The continuing calibrations were conducted according to the laboratory methods and consisted of the appropriate number of standards. F For the NWTPH-Gx analyses, the %R values were within the control limits of ±20%. For the NWTPH-Dx analyses, the %R values were within the control limits of ±15%. For organic analyses, the percent difference (%D) and relative response factors (RRF) values were within the control limits in the National Functional Guidelines for Organic Superfund Data Review (USEPA 2017). For all inorganic analyses, the %D values were within the laboratory control limits and also the control limits stated in the National Functional Guidelines for Inorganic Superfund Methods Data Review (USEPA 2017).

Reporting Limits

The reporting limits were met by the laboratory for all target analytes throughout this sampling event.

OVERALL ASSESSMENT

As was determined by this data validation, the laboratory followed the specified analytical methods. Accuracy was acceptable, as demonstrated by the surrogate, LCS/LCSD, and MS/MSD percent recovery values. Precision was acceptable, as demonstrated by the LCS/LCSD, MS/MSD, and field/laboratory duplicate RPD values.

No data points were qualified for any reason.

REFERENCES

U.S. Environmental Protection Agency (USEPA). "Guidance for Labeling Externally Validated Laboratory Analytical Data for Superfund Use," EPA-540-R-08-005. January 2009.

U.S. Environmental Protection Agency (USEPA). "National Functional Guidelines for Organic Superfund Methods Data Review," EPA-540-R-2017-002. January 2017.

U.S. Environmental Protection Agency (USEPA). "National Functional Guidelines for Inorganic Superfund Methods Data Review," EPA-540-R-2017-001. January 2017.

GeoEngineers, Inc., "Remedial Investigation/Feasibility Work Plan Addendum, Dakota Creek Industries Site, Anacortes, Washington, Ecology Agreed Order No. DE-07TCPHQ-5080," GEI File No. 5147-006-11, August 6, 2018.

GEOENGINEERS

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Data Validation Report

Project:	Dakota Creek Industires – Remedial Investigation Supplemental Groundwater Sampling and Analysis
File:	5147-006-08
Date:	June 22, 2012
Lab Report:	1205-244

GENERAL

This report presents the results of a United States Environmental Protection Agency (USEPA)-defined Stage 2A validation (USEPA Document 540-R-08-005; USEPA, 2009) of analytical data from the analyses of water samples obtained from Dakota Creeek Industries Site located in Anacortes, Washington.

Objective and Quality Control (QC) Elements

The objective of the data quality assessment was to review laboratory analytical procedures and QC results to evaluate whether the samples were analyzed using well-defined and acceptable methods that provide quantitation limits below applicable regulatory criteria, the precision and accuracy of the data are well defined and sufficient to provide defensible data, and the quality assurance/quality control (QA/QC) procedures utilized by the laboratory meet acceptable industry practices and standards. The laboratory data was reviewed for following QC elements:

- Chain of Custody
- Holding Times
- Surrogates
- Method and Trip Blanks
- Laboratory Control Samples
- Matrix Spikes/Matrix Spike Duplicates
- Laboratory and Field Duplicates
- Dual column confirmations (PCBs only)
- Reporting Limits

Chemical Analysis Performed:

Samples obtained during the cleanup action were submitted to a Department of Ecology (Ecology)-certified laboratory - OnSite Environmental, Inc. (OnSite) of Redmond, Washington for one or more of the following analyses:

- Gasoline-range petroleum hydrocarbons by Ecology Method NWTPH-Gx;
- Diesel- and heavy oil-range petroleum hydrocarbons by Ecology Method NWTPH-Dx with silica gel/sulfuric acid cleanup;
- Volatile organic compounds (VOCs) by EPA Method 8260B;
- Semivolatile organic compounds (VOCs) by EPA Method 8270D/SIM;
- Metals by EPA Method 200.8/7470A;
- Organochlorinated Pesticides and Organochlorinated Herbicides by EPA Method 8081A; and

- Dioxin and Furans by EPA Method 8290.

OnSite Sample Data Groups (SDGs):

Following laboratory SDGs were delivered by OnSite and were reviewed by GeoEngineers for QC elements listed above:

- 1205-244

DATA QUALITY ASSESSMENT SUMMARY

The results for each of the QC elements are summarized below. The data assessment was performed using guidance in two USEPA documents: USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review (USEPA, 2004) and USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review (USEPA, 2008).

Chain-of-Custody Documentation

Chain-of-custody forms were provided with the laboratory analytical reports. No transcription errors were found, and the appropriate signatures were applied. There were no anomalies mentioned in the sample receipt forms, as the samples were transported to the laboratory at the appropriate temperatures of between 2 and 6 degrees Celsius.

Holding Times

The holding time is defined as the time that elapses between sample collection and sample analysis. Maximum holding time criteria exist for each analysis to help ensure that the analyte concentrations found at the time of analysis reflect the concentration present at the time of sample collection. Established holding times were met for all analyses.

Surrogate Recoveries

A surrogate compound is a compound that is chemically similar to the analytes of interest, but unlikely to be found in any environmental sample. Surrogates are used for organic analyses and are added to all samples, standards, and blanks to serve as an accuracy and specificity check of each analysis. The surrogates are added at a known concentration and percent recoveries are calculated following analysis. All surrogate recoveries for field samples were within the laboratory control limits.

Method Blanks

Method blanks are analyzed to ensure that laboratory procedures and reagents do not introduce measurable concentrations of the analytes of interest. Method blanks were analyzed with each batch of samples, at a frequency of one per twenty samples. For all sample batches, method blanks for all applicable methods were analyzed at the required frequency. None of the analytes of interest were detected above the reporting limits in any of the method blanks, with the exceptions below:

- **Dioxins/Furans:** The target analyte OCDD was detected in the method blank extracted on 6/11/2012. The concentrations for this analyte were qualified (U) as not-detected in Samples MW-3A, DUP, MW-6, and MW-7.

Matrix Spikes/Matrix Spike Duplicates (MS/MSD)

Because the actual analyte concentration in an environmental sample is not known, the accuracy of a particular analysis is usually inferred by performing a matrix spike (MS) analysis. One aliquot of sample is analyzed in the normal manner, and then a second aliquot of the sample is spiked with a known amount of analyte concentration and analyzed. From these analyses, a percent recovery (%R) is calculated. Matrix spike duplicates (MSD) analyses are generally performed for organic analyses as a precision check. For some organic analytical methods, such as NWTPH-Dx, a laboratory control sample/ laboratory control sample duplicate (LCS/LCSD) sample set is performed in lieu of a MS/MSD analysis.

For inorganics methods, the matrix spike (referred to as a “spiked sample”) is typically followed by a post spike sample if any element recoveries were outside the control limits in the “spike sample”.

Matrix spike analyses should be performed once per analytical batch or every twenty field samples, whichever is more frequent. The recovery criteria for matrix spikes and laboratory control samples are specified in the laboratory documents as are the relative percent difference values. The frequency requirements were met for all analyses and the %R/RPD values were within the proper control limits.

Laboratory Control Samples/ Laboratory Control Sample Duplicates (LCS/LCSD)

A laboratory control sample is essentially a blank sample that is spiked with a known amount of analyte concentration and analyzed. It is to be treated much like a matrix spike, without the possibility for matrix interference. As there is no actual sample matrix in the analysis, the analytical expectations for accuracy and precision are usually more rigorous and qualification would apply to all samples in the batch, instead of the parent sample only.

Laboratory control sample analyses should be performed once per analytical batch or every twenty field samples, whichever is more frequent. The recovery criteria for laboratory control samples are specified in the laboratory documents as are the relative percent difference values. The frequency requirements were met for all analyses, and the %R/RPD values were within the proper control limits.

Laboratory Duplicates (Metals and Fuels only)

Internal laboratory duplicate analyses are performed to monitor the precision of the analyses. Two separate aliquots of a sample are analyzed as distinct samples in the laboratory, and the RPD between the two results is calculated. Duplicate analyses should be performed once per analytical batch. If one or more of the samples used has a concentration greater than five times the reporting limit for that sample, the absolute difference is used instead of the RPD.

Laboratory duplicates were analyzed at the proper frequency and the specified acceptance criteria were met in all cases.

Field Replicates/Duplicates

Field duplicate samples were collected and analyzed along with the reviewed sample batches. The duplicate samples were analyzed for the same parameters as the associated parent samples. As mentioned above for the laboratory duplicates the RPD is used as the criteria for assessing precision, unless one or more of the samples used has a concentration greater than five times the reporting limit for that sample, the absolute difference is used instead of the RPD.

The following field duplicate sample set was analyzed:

- MW-3A/DUP

The RPD/absolute difference value for the field duplicate sample sets were within their respective control limits.

Additional Data Quality Issues

The laboratory flagged several results with an "I" (interference present) or "P" (polychlorinated diphenyl ether [PCDE] interference) where interfering substances reduced confidence in the sample result. Consequently, the results listed below were qualified as not detected in the associated samples.

Sample ID	Analytes
MW-3A	1,2,3,4,6,7,8-HpCDD
MW-6	1,2,3,4,6,7,8-HpCDD
MW-7	1,2,3,4,6,7,8-HpCDD

Reporting Limits

Total and Dissolved Metals: The arsenic reporting limits were elevated by the laboratory because of matrix interference in the sample. This reporting limit modification resulted in several samples having arsenic reporting limits greater than preliminary cleanup levels for the Site.

OVERALL ASSESSMENT

As was determined by this data validation, the laboratory followed the specified analytical methods. Accuracy was acceptable, as demonstrated by the surrogate, LCS/LCSD, and MS/MSD %R values. Precision was acceptable, as demonstrated by the laboratory duplicate, LCS/LCSD and MS/MSD RPD and absolute difference values. Based on the data quality review, it is our opinion that the analytical data are of acceptable quality for their intended use.

REFERENCES

U.S. Environmental Protection Agency (USEPA). "Contract Laboratory Program National Functional Guidelines for Inorganic Data Review," OSWER 9240.1-45, EPA 540-R-04-004. October 2004.

U.S. Environmental Protection Agency (USEPA). "Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review," EPA-540-R-08-01. June 2008.

U.S. Environmental Protection Agency (USEPA). "Guidance for Labeling Externally Validated Laboratory Analytical Data for Superfund Use," EPA-540-R-08-005. January 2009.

GeoEngineers

Data Validation Report

Plaza 600 Building, 600 Stewart Street, Suite 1700, Seattle, WA 98101, Telephone: 206.728.2674, Fax: 206.728.2732 www.geoengineers.com

Project:	Dakota Creek Industires – Remedial Investigation Supplemental 2nd Quarter Groundwater Sampling and Analysis
File:	5147-006-08
Date:	January 12, 2018
Lab Report:	1208-139

GENERAL

This report presents the results of a United States Environmental Protection Agency (USEPA)-defined Stage 2A validation (USEPA Document 540-R-08-005; USEPA, 2009) of analytical data from the analyses of water samples obtained from Dakota Creeek Industries Site located in Anacortes, Washington.

Objective and Quality Control (QC) Elements

The objective of the data quality assessment was to review laboratory analytical procedures and QC results to evaluate whether the samples were analyzed using well-defined and acceptable methods that provide quantitation limits below applicable regulatory criteria, the precision and accuracy of the data are well defined and sufficient to provide defensible data, and the quality assurance/quality control (QA/QC) procedures utilized by the laboratory meet acceptable industry practices and standards. The laboratory data was reviewed for following QC elements:

- Chain of Custody
- Holding Times
- Surrogates
- Method and Trip Blanks
- Laboratory Control Samples
- Matrix Spikes/Matrix Spike Duplicates
- Laboratory and Field Duplicates
- Dual column confirmations (PCBs only)
- Reporting Limits

Chemical Analysis Performed:

Samples obtained during the cleanup action were submitted to a Department of Ecology (Ecology)-certified laboratory - OnSite Environmental, Inc. (OnSite) of Redmond, Washington for one or more of the following analyses:

- Gasoline-range petroleum hydrocarbons by Ecology Method NWTPH-Gx;
- Diesel- and heavy oil-range petroleum hydrocarbons by Ecology Method NWTPH-Dx with silica gel/sulfuric acid cleanup;
- Volatile organic compounds (VOCs) by EPA Method 8260B;
- Semivolatile organic compounds (VOCs) by EPA Method 8270D/SIM;
- Metals by EPA Method 200.8/7470A;
- Organochlorinated Pesticides and Organochlorinated Herbicides by EPA Method 8081A; and

- Dioxin and Furans by EPA Method 8290.

OnSite Sample Data Groups (SDGs):

Following laboratory SDGs were delivered by OnSite and were reviewed by GeoEngineers for QC elements listed above:

- 1208-139

DATA QUALITY ASSESSMENT SUMMARY

The results for each of the QC elements are summarized below. The data assessment was performed using guidance in two USEPA documents: USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review (USEPA, 2004) and USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review (USEPA, 2008).

Chain-of-Custody Documentation

Chain-of-custody (COC) forms were provided with the laboratory analytical reports. No transcription errors were found, and the appropriate signatures were applied. There were no anomalies mentioned in the sample receipt forms, as the samples were transported to the laboratory at the appropriate temperatures of between 2 and 6 degrees Celsius.

Sample MW-6_120816 was missing one amber container from what was written on the COC. Also, the Sample TRIP BLANK_120816 was originally not written on the COC. No action was taken other than to note these discrepencies here.

Holding Times

The holding time is defined as the time that elapses between sample collection and sample analysis. Maximum holding time criteria exist for each analysis to help ensure that the analyte concentrations found at the time of analysis reflect the concentration present at the time of sample collection. Established holding times were met for all analyses.

Surrogate Recoveries

A surrogate compound is a compound that is chemically similar to the analytes of interest, but unlikely to be found in any environmental sample. Surrogates are used for organic analyses and are added to all samples, standards, and blanks to serve as an accuracy and specificity check of each analysis. The surrogates are added at a known concentration and percent recoveries are calculated following analysis. All surrogate recoveries for field samples were within the laboratory control limits.

Method Blanks

Method blanks are analyzed to ensure that laboratory procedures and reagents do not introduce measurable concentrations of the analytes of interest. Method blanks were analyzed with each batch of samples, at a frequency of one per twenty samples. For all sample batches, method blanks for all applicable methods were analyzed at the required frequency. None of the analytes of interest were detected above the reporting limits in any of the method blanks, with the exceptions below:

- **Dioxins/Furans:** The target analyte 1,2,3,4,6,7,8-HpCDD was detected in the method blank extracted on 9/6/2012. There were no concentrations for this analyte in any of the associated samples, no qualifiers were required. There was also a positive result for OCDD in the same method blank that was flagged by the laboratory to resemble instrument interference. This interference detection was regarded as non-detected for the purposes of validation.

Matrix Spikes/Matrix Spike Duplicates (MS/MSD)

Because the actual analyte concentration in an environmental sample is not known, the accuracy of a particular analysis is usually inferred by performing a matrix spike (MS) analysis. One aliquot of sample is analyzed in the normal manner, and then a second aliquot of the sample is spiked with a known amount of analyte concentration and analyzed. From these analyses, a percent recovery (%R) is calculated. Matrix spike duplicates (MSD) analyses are generally performed for organic analyses as a precision check. For some organic analytical methods, such as NWTPH-Dx, a laboratory control sample/ laboratory control sample duplicate (LCS/LCSD) sample set is performed in lieu of a MS/MSD analysis.

For inorganics methods, the matrix spike (referred to as a “spiked sample”) is typically followed by a post spike sample if any element recoveries were outside the control limits in the “spike sample”.

Matrix spike analyses should be performed once per analytical batch or every twenty field samples, whichever is more frequent. The recovery criteria for matrix spikes and laboratory control samples are specified in the laboratory documents as are the relative percent difference values. The frequency requirements were met for all analyses and the %R/RPD values were within the proper control limits.

Laboratory Control Samples/ Laboratory Control Sample Duplicates (LCS/LCSD)

A laboratory control sample is essentially a blank sample that is spiked with a known amount of analyte concentration and analyzed. It is to be treated much like a matrix spike, without the possibility for matrix interference. As there is no actual sample matrix in the analysis, the analytical expectations for accuracy and precision are usually more rigorous and qualification would apply to all samples in the batch, instead of the parent sample only.

Laboratory control sample analyses should be performed once per analytical batch or every twenty field samples, whichever is more frequent. The recovery criteria for laboratory control samples are specified in the laboratory documents as are the relative percent difference values. The frequency requirements were met for all analyses, and the %R/RPD values were within the proper control limits.

Laboratory Duplicates (Metals and Fuels only)

Internal laboratory duplicate analyses are performed to monitor the precision of the analyses. Two separate aliquots of a sample are analyzed as distinct samples in the laboratory, and the RPD between the two results is calculated. Duplicate analyses should be performed once per analytical batch. If one or more of the samples used has a concentration greater than five times the reporting limit for that sample, the absolute difference is used instead of the RPD.

Laboratory duplicates were analyzed at the proper frequency and the specified acceptance criteria were met in all cases.

Field Replicates/Duplicates

Field duplicate samples were collected and analyzed along with the reviewed sample batches. The duplicate samples were analyzed for the same parameters as the associated parent samples. As mentioned above for the laboratory duplicates the RPD is used as the criteria for assessing precision, unless one or more of the samples used has a concentration greater than five times the reporting limit for that sample, the absolute difference is used instead of the RPD.

The following field duplicate sample set was analyzed:

- MW-3A/DUP

The RPD/absolute difference value for the field duplicate sample sets were within their respective control limits.

Additional Data Quality Issues

The laboratory flagged several results with an “I” (interference present) or “P” (polychlorinated diphenyl ether [PCDE] interference) where interfering substances reduced confidence in the sample result. Consequently, the results listed below were qualified as not detected in the associated samples.

Sample ID	Analytes
MW-6_120816	OCDD
DUP_120816	OCDD

Reporting Limits

Total and Dissolved Metals: The arsenic reporting limits were elevated by the laboratory because of matrix interference in the sample. This reporting limit modification resulted in several samples having arsenic reporting limits greater than preliminary cleanup levels for the Site.

OVERALL ASSESSMENT

As was determined by this data validation, the laboratory followed the specified analytical methods. Accuracy was acceptable, as demonstrated by the surrogate, LCS/LCSD, and MS/MSD %R values. Precision was acceptable, as demonstrated by the laboratory duplicate, LCS/LCSD and MS/MSD RPD and absolute difference values. Based on the data quality review, it is our opinion that the analytical data are of acceptable quality for their intended use.

REFERENCES

U.S. Environmental Protection Agency (USEPA). “Contract Laboratory Program National Functional Guidelines for Inorganic Data Review,” OSWER 9240.1-45, EPA 540-R-04-004. October 2004.

U.S. Environmental Protection Agency (USEPA). "Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review," EPA-540-R-08-01. June 2008.

U.S. Environmental Protection Agency (USEPA). "Guidance for Labeling Externally Validated Laboratory Analytical Data for Superfund Use," EPA-540-R-08-005. January 2009.

GeoEngineers

Data Validation Report

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Project: Dakota Creek Industries Cleanup Project

File: 5147-006-08

Date: January 2, 2013

This report presents the results of a United States Environmental Protection Agency (USEPA)-defined Stage 2A validation (USEPA Document 540-R-08-005; USEPA, 2009) of analytical data from the analyses of groundwater samples obtained at the Dakota Creek Industries Site on November 13, 2012. Samples obtained were submitted to OnSite Environmental, Inc. (OnSite) of Redmond, Washington for chemical analysis of diesel- and heavy oil-range petroleum hydrocarbons, semi-volatile organic compounds, volatile organic compounds, polycyclic aromatic hydrocarbons (PAHs) by SIM analysis, pesticides, herbicides, total and dissolved metals (arsenic, copper, mercury, nickel, silver and zinc). Selected samples were subsequently sent to Pace Analytical Services of Minneapolis, Minnesota for the analysis of dioxins/furans. The objective of the data quality assessment was to review laboratory analytical procedures and QC results to evaluate whether the samples were analyzed using well-defined and acceptable methods that provide quantitation limits below applicable regulatory criteria, the precision and accuracy of the data are well defined and sufficient to provide defensible data, and the quality assurance/quality control (QA/QC) procedures utilized by the laboratory meet acceptable industry practices and standards.

OnSite sample data group (SDG) number 1211-109 was reviewed for the following quality control (QC) elements:

- Chain of Custody
- Holding Times
- Surrogates
- Method and Trip Blanks
- Laboratory Control Samples
- Matrix Spikes/Matrix Spike Duplicates
- Laboratory and Field Duplicates
- Internal Standards
- Dual column confirmations (Pesticides and Herbicides only)
- Reporting Limits and Miscellaneous

DATA QUALITY ASSESSMENT SUMMARY

The results for each of the QC elements are summarized below. The data assessment was performed using guidance in two USEPA documents: USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review (USEPA, 2010) and USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review (USEPA, 2008), and USEPA Contract Laboratory Program National Functional Guidelines for Chorinated Dibenzo-p-dioxins and Chlorinated Dibenzofurans (USEPA, 2011).

CHAIN-OF-CUSTODY DOCUMENTATION

Chain-of-custody forms were provided with the laboratory analytical reports. No transcription errors were found, and the appropriate signatures were applied. There were no anomalies mentioned in the sample receipt forms, as the samples were transported to the laboratory at the appropriate temperatures of between 2 and 6 degrees Celsius.

HOLDING TIMES AND SAMPLE PRESERVATION

The holding time is defined as the time that elapses between sample collection and sample analysis. Recommended maximum holding time criteria exist for each analysis to help ensure that the analyte concentrations found at the time of analysis reflect the concentrations present at the time of sample collection. Recommended holding times were met for all analyses.

METHOD BLANKS

Method blanks are analyzed to assess whether laboratory procedures or reagents may have introduced measurable concentrations of the analytes of interest into project samples. Method blanks were analyzed with each batch of project samples, at a frequency of one per twenty samples. No method blank detections were reported by the testing laboratory, with the exceptions below:

- (Dioxins/Furans): The method blank extracted on 11/26/12 reported a positive detection for OCDF below 3 times the standard reporting limit. The associated samples reported no positive results for OCDF at concentrations greater than 3 times the standard reporting limit. No action was required.

SURROGATE RECOVERIES

A surrogate compound is a compound that is chemically similar to one or more analytes of interest, but unlikely to be found in any project sample. Surrogates are used for organic analyses and are added to all project samples, laboratory standards and blank samples to verify the accuracy and specificity of each analysis. The surrogates are added at a known concentration, and percent recoveries (%R) are calculated after analysis. All surrogate recoveries were within laboratory control limits.

MATRIX SPIKES/MATRIX SPIKE DUPLICATES

Because actual analyte concentrations in environmental samples are not known and may differ from concentrations determined through laboratory analysis, the accuracy of a particular analysis is usually inferred by performing a matrix spike (MS) analysis. One aliquot of a sample is analyzed in the normal manner, and then a second aliquot of the sample (the MS sample) is spiked with a known amount of analyte and analyzed. From the MS analysis, a %R value is calculated. Matrix spike duplicate (MSD) analyses are generally performed for organic analyses as a precision check.

Due to the field sampling limitations of this sampling event, often times a laboratory control sample/laboratory control sample duplicate (LCS/LCSD) sample set was analyzed in lieu of an MS/MSD analysis. LCS/LCSD analyses are discussed in the next section.

LABORATORY CONTROL SAMPLES/LABORATORY CONTROL SAMPLE DUPLICATES

A laboratory control sample (LCS) is a blank sample that is spiked with a known amount of analyte and then analyzed. An LCS is similar to an MS, but without the possibility of matrix interference. Because matrix interference is not an issue, the LCS/LCSD control limits for accuracy and precision are usually more rigorous than for MS/MSD analyses. Additionally, data qualification based on LCS/LCSD analysis would apply to all samples in the analytical batch instead of just the parent sample.

One LCS/LCSD analysis should be performed for every analytical batch or every 20 project samples, whichever is more frequent. The recovery criteria (%R) for LCS and LCSD analyses are specified in the laboratory documents, as are the relative percent difference (RPD) criteria for LCS/LCSD sample pairs. The frequency criteria were met for all analyses. The %R and RPD values for all target analytes in the LCS/LCSD analyses were within the laboratory control limits.

FIELD DUPLICATES

One field duplicate sample was obtained and analyzed along with the primary project samples. The duplicate sample was analyzed for the same parameters as the associated primary samples. The RPD between the primary and duplicate samples is used to assess sample heterogeneity and laboratory precision, unless one or more of the samples used has a concentration greater than five times the method reporting limit for that sample. In such cases, the absolute difference is used instead of the RPD. The RPD control limit for water samples is 35 percent.

One field duplicate sample pair (MW-3A_121113/DUP_121113) was analyzed. The precision criteria above were met for all target analytes.

Internal Standards

Like the surrogate, an internal standard is a compound that is chemically similar to the analytes of interest, but unlikely to be found in any environmental sample. Internal standards are used only for the mass spectrometry (MS) instrumentation and are usually added to the sample aliquot after extraction has taken place. The internal standard should be analyzed at the beginning of a 12 hour sample run and the control limits for internal standard recoveries are -50% to +100% of the calibration standard. All internal standard recoveries were within the control limits.

Dual Column Confirmations

The pesticide and herbicide compounds are analyzed by two columns, a primary and a secondary column. The percent difference (%D) values for any positive results between the primary and secondary columns are assessed against a control limit of 40%. All positive results for Aroclors were properly confirmed by a secondary column with %D values less than 40%.

Reporting Limits and Miscellaneous

The laboratory indicated that several samples were screened before extraction because of the probable affects of natural matrix interference. In cases where arsenic could not be distinguished because of interference, the laboratory raised the reporting limits, and indicated this with a “U1” qualifier. These data points were appropriately taken through the validation process, and these reporting limits were qualified (U1) in GeoEngineer’s database.

- (Dioxins/Furans): Because the results for 1,2,3,4,6,7,8-HpCDD, OCDF, and OCDD in Sample DUP_121113 were flagged by the testing laboratory with an “I” (Interference present); the results of these compounds in this sample should be qualified as not detected (U).

  Because the results for 1,2,3,4,6,7,8-HpCDD and OCDF in Sample MW-3A_121113 were flagged by the testing laboratory with an “I” (Interference present); the results of these compounds in this sample should be qualified as not detected (U).

  Because the results for 1,2,3,4,6,7,8-HpCDD and OCDD in Sample MW-6_121113 were flagged by the testing laboratory with an “I” (Interference present); the results of these compounds in this sample should be qualified as not detected (U).

  Because the results for OCDD in Sample MW-7_121113 were flagged by the testing laboratory with an “I” (Interference present); the results of these compounds in this sample should be qualified as not detected (U).

OVERALL ASSESSMENT

The results of this Stage 2A data validation indicate that the laboratory followed the specified analytical methods. The accuracy of the data is acceptable, as demonstrated by the surrogate, LCS/LCSD, and MS/MSD %R values. The precision of the data also is acceptable, as demonstrated by the LCS/LCSD, MS/MSD, laboratory and field duplicate RPD values. Based on the data quality review, it is our opinion that the analytical data are of acceptable quality for their intended use.

REFERENCES

U.S. Environmental Protection Agency (USEPA). “Contract Laboratory Program National Functional Guidelines for Inorganic Data Review,” OSWER 9240.1-45, EPA 540-R-04-004. October 2004.

U.S. Environmental Protection Agency (USEPA). “Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review,” EPA-540-R-08-01. June 2008.

U.S. Environmental Protection Agency (USEPA). “Guidance for Labeling Externally Validated Laboratory Analytical Data for Superfund Use,” EPA-540-R-08-005. January 2009.

GEOENGINEERS

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Data Validation Report

Project:	Dakota Creek Industires – Remedial Investigation Supplemental 4TH Quarter Groundwater Sampling and Analysis
File:	5147-006-08
Date:	March 17, 2013
Lab Report:	1302-095

GENERAL

This report presents the results of a United States Environmental Protection Agency (USEPA)-defined Stage 2A validation (USEPA Document 540-R-08-005; USEPA, 2009) of analytical data from the analyses of water samples obtained from Dakota Creeek Industries Site located in Anacortes, Washington.

Objective and Quality Control (QC) Elements

The objective of the data quality assessment was to review laboratory analytical procedures and QC results to evaluate whether the samples were analyzed using well-defined and acceptable methods that provide quantitation limits below applicable regulatory criteria, the precision and accuracy of the data are well defined and sufficient to provide defensible data, and the quality assurance/quality control (QA/QC) procedures utilized by the laboratory meet acceptable industry practices and standards. The laboratory data was reviewed for following QC elements:

- Chain of Custody
- Holding Times
- Surrogates
- Method and Trip Blanks
- Laboratory Control Samples
- Matrix Spikes/Matrix Spike Duplicates
- Laboratory and Field Duplicates
- Dual column confirmations (PCBs only)
- Reporting Limits

Chemical Analysis Performed:

Samples obtained during the cleanup action were submitted to a Department of Ecology (Ecology)-certified laboratory - OnSite Environmental, Inc. (OnSite) of Redmond, Washington for one or more of the following analyses:

- Gasoline-range petroleum hydrocarbons by Ecology Method NWTPH-Gx;
- Diesel- and heavy oil-range petroleum hydrocarbons by Ecology Method NWTPH-Dx with silica gel/sulfuric acid cleanup;
- Volatile organic compounds (VOCs) by EPA Method 8260B;
- Semivolatile organic compounds (VOCs) by EPA Method 8270D/SIM;
- Metals by EPA Method 200.8/7470A;
- Organochlorinated Pesticides and Organochlorinated Herbicides by EPA Method 8081A; and

- Dioxin and Furans by EPA Method 8290.

OnSite Sample Data Groups (SDGs):

Following laboratory SDGs were delivered by OnSite and were reviewed by GeoEngineers for QC elements listed above:

- 1302-095

DATA QUALITY ASSESSMENT SUMMARY

The results for each of the QC elements are summarized below. The data assessment was performed using guidance in two USEPA documents: USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review (USEPA, 2004) and USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review (USEPA, 2008).

Chain-of-Custody Documentation

Chain-of-custody forms were provided with the laboratory analytical reports. No transcription errors were found, and the appropriate signatures were applied. There were no anomalies mentioned in the sample receipt forms, as the samples were transported to the laboratory at the appropriate temperatures of between 2 and 6 degrees Celsius.

Holding Times

The holding time is defined as the time that elapses between sample collection and sample analysis. Maximum holding time criteria exist for each analysis to help ensure that the analyte concentrations found at the time of analysis reflect the concentration present at the time of sample collection. Established holding times were met for all analyses.

Surrogate Recoveries

A surrogate compound is a compound that is chemically similar to the analytes of interest, but unlikely to be found in any environmental sample. Surrogates are used for organic analyses and are added to all samples, standards, and blanks to serve as an accuracy and specificity check of each analysis. The surrogates are added at a known concentration and percent recoveries are calculated following analysis. All surrogate recoveries for field samples were within the laboratory control limits.

Method Blanks

Method blanks are analyzed to ensure that laboratory procedures and reagents do not introduce measurable concentrations of the analytes of interest. Method blanks were analyzed with each batch of samples, at a frequency of one per twenty samples. For all sample batches, method blanks for all applicable methods were analyzed at the required frequency. None of the analytes of interest were detected above the reporting limits in any of the method blanks.

Trip blanks are analyzed to provide an indication as to whether volatile compounds have cross-contaminated other like samples within the transportation process to the laboratory. Typically, samples are stored in a cooler for as much as 24 hours before arriving at the laboratory. One trip blank was collected on 2/13/13. None of the volatiles analytes were detected above the reporting limits in any analyses.

In all cases, the blank contamination qualified results should be recognized as a reporting limit, instead of a positive result for data users.

Matrix Spikes/Matrix Spike Duplicates (MS/MSD)

Because the actual analyte concentration in an environmental sample is not known, the accuracy of a particular analysis is usually inferred by performing a matrix spike (MS) analysis. One aliquot of sample is analyzed in the normal manner, and then a second aliquot of the sample is spiked with a known amount of analyte concentration and analyzed. From these analyses, a percent recovery (%R) is calculated. Matrix spike duplicates (MSD) analyses are generally performed for organic analyses as a precision check. For some organic analytical methods, such as NWTPH-Dx, a laboratory control sample/ laboratory control sample duplicate (LCS/LCSD) sample set is performed in lieu of a MS/MSD analysis.

For inorganics methods, the matrix spike (referred to as a “spiked sample”) is typically followed by a post spike sample if any element recoveries were outside the control limits in the “spike sample”.

Matrix spike analyses should be performed once per analytical batch or every twenty field samples, whichever is more frequent. The recovery criteria for matrix spikes and laboratory control samples are specified in the laboratory documents as are the relative percent difference values. The frequency requirements were met for all analyses and the %R/RPD values were within the proper control limits.

Laboratory Control Samples/ Laboratory Control Sample Duplicates (LCS/LCSD)

A laboratory control sample is essentially a blank sample that is spiked with a known amount of analyte concentration and analyzed. It is to be treated much like a matrix spike, without the possibility for matrix interference. As there is no actual sample matrix in the analysis, the analytical expectations for accuracy and precision are usually more rigorous and qualification would apply to all samples in the batch, instead of the parent sample only.

Laboratory control sample analyses should be performed once per analytical batch or every twenty field samples, whichever is more frequent. The recovery criteria for laboratory control samples are specified in the laboratory documents as are the relative percent difference values. The frequency requirements were met for all analyses, and the %R/RPD values were within the proper control limits.

Laboratory Duplicates (Metals and Fuels only)

Internal laboratory duplicate analyses are performed to monitor the precision of the analyses. Two separate aliquots of a sample are analyzed as distinct samples in the laboratory, and the RPD between the two results is calculated. Duplicate analyses should be performed once per analytical batch. If one or more of the samples used has a concentration greater than five times the reporting limit for that sample, the absolute difference is used instead of the RPD.

Laboratory duplicates were analyzed at the proper frequency and the specified acceptance criteria were met in all cases.

Field Replicates/Duplicates

Field duplicate samples were collected and analyzed along with the reviewed sample batches. The duplicate samples were analyzed for the same parameters as the associated parent samples. As mentioned above for the laboratory duplicates the RPD is used as the criteria for assessing precision, unless one or more of the samples used has a concentration greater than five times the reporting limit for that sample, the absolute difference is used instead of the RPD.

The following field duplicate sample set was analyzed:

- MW-3A/DUP

The absolute difference value for 2,4-D was greater than the criteria mentioned above. The positive results for this compound were qualified as estimated (J) in both samples.

Additional Data Quality Issues

The laboratory flagged several results with an “I” (interference present) or “P” (polychlorinated diphenyl ether [PCDE] interference) where interfering substances reduced confidence in the sample result. Consequently, the results listed below were qualified as not detected in the associated samples.

Sample ID	Analytes
DUP	OCDD
MW-7	OCDD

The laboratory analyzed all pesticides and herbicides by SW8081B and SW8151A. These methods require the sample results to be reported from a dual-column electron capture detector (ECD) system. Since this system requires the use of two columns, it produces two results simultaneously. The laboratory is required to report the precision of these results in the form of a relative percent difference (RPD) value, one column being considered primary and the other column being considered as a secondary check.

If the RPD value is greater than 40 %, the analytical result is qualified as tentatively identified (NJ). Below is a list of compounds that were qualified NJ because of column confirmation outliers.

Sample ID	Analytes
DUP	2,4-D
MW-6	2,4-D

Reporting Limits

Total and Dissolved Metals: The arsenic reporting limits were elevated by the laboratory because of matrix interference in MW-1, MW-2, and MW-7. These reporting limit modifications resulted in several samples having arsenic reporting limits greater than preliminary cleanup levels for the Site.

OVERALL ASSESSMENT

As was determined by this data validation, the laboratory followed the specified analytical methods. Accuracy was acceptable, as demonstrated by the surrogate, LCS/LCSD, and MS/MSD %R values. Precision was acceptable, as demonstrated by the laboratory duplicate, LCS/LCSD and MS/MSD RPD and absolute difference values. Based on the data quality review, it is our opinion that the analytical data are of acceptable quality for their intended use.

REFERENCES

U.S. Environmental Protection Agency (USEPA). "Contract Laboratory Program National Functional Guidelines for Inorganic Data Review," OSWER 9240.1-45, EPA 540-R-04-004. October 2004.

U.S. Environmental Protection Agency (USEPA). "Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review," EPA-540-R-08-01. June 2008.

U.S. Environmental Protection Agency (USEPA). "Guidance for Labeling Externally Validated Laboratory Analytical Data for Superfund Use," EPA-540-R-08-005. January 2009.

Data Validation Report

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Project: Dakota Creek Industries Cleanup Site – Semi-Annual Groundwater Monitoring

GEI File No: 05147-006-11

Date: August 27, 2019

This report documents the results of a United States Environmental Protection Agency (USEPA)-defined Stage 2B data validation (USEPA Document 540-R-08-005; USEPA, 2009) of analytical data from the analyses of four rounds of groundwater samples collected as the semi-anual groundwater monitoring phase, and the associated laboratory and field quality control (QC) samples. The samples were obtained from the Dakota Creek Industries Shipyard Site (Site) located in Anacortes, Washington.

OBJECTIVE AND QUALITY CONTROL ELEMENTS

GeoEngineers, Inc. (GeoEngineers) completed the data validation consistent with the USEPA Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review (USEPA, 2008) and Inorganic Superfund Data Review (USEPA 2010) (National Functional Guidelines) to determine if the laboratory analytical results meet the project objectives and are usable for their intended purpose. Data usability was assessed by determining if:

- The samples were analyzed using well-defined and acceptable methods that provide reporting limits below applicable regulatory criteria;
- The precision and accuracy of the data are well-defined and sufficient to provide defensible data; and
- The quality assurance/quality control (QA/QC) procedures utilized by the laboratory meet acceptable industry practices and standards.

In accordance with the Remedial Investigation/Feasibility Work Plan and Sampling and Analysis Plan Addendum (GeoEngineers, 2015), the data validation included review of the following QC elements:

- Data Package Completeness
- Chain-of-Custody Documentation
- Holding Times and Sample Preservation
- Surrogate Recoveries
- Method Blanks
- Matrix Spikes/Matrix Spike Duplicates
- Laboratory Control Samples/Laboratory Control Sample Duplicates
- Field and Laboratory Duplicates
- Initial Calibrations (ICALs)
- Continuing Calibrations (CCALs)
- Internal Standards

- Reporting Limits

VALIDATED SAMPLE DELIVERY GROUPS

This data validation included review of the sample delivery groups (SDGs) listed below in Table 1.

TABLE 1: SUMMARY OF VALIDATED SAMPLE DELIVERY GROUPS

Laboratory SDG	Samples Validated
AVX9	MW-1_021016, MW-3A_021116, DUP_021016, MW-4_021116, MW-6_021116, MW-7_021016, MW-8_021016
1608-259	MW-1_081816, MW-2B_081916, MW-3A_081916, MW-DUP_081816, MW-4_081816, MW-6_081916, MW-7_081916, MW-8_081816
1702-162	MW-1_021517, MW-2B_021517, MW-3A_021617, MW-DUP_021517, MW-4_021517, MW-6_021617, MW-7_021617, MW-8_021517
1708-302	MW-1_08232017, MW-2B_08232017, MW-3A_08242017, DUP_08232017, MW-4_08242017, MW-6_08242017, MW-7_08232017, MW-8_08232017

CHEMICAL ANALYSIS PERFORMED

Analytical Resources, Incorporated (ARI), located in Tukwila, Washington, performed laboratory analyses on the first round of groundwater analyses. Onsite Environmental (Onsite), located in Redmond, Washington, perfomed laboratory analyses on the second, third, and fourth rounds of groundwater analyses. Both laboratories used one or more of the following methods:

- Polycyclic Aromatic Hydrocarbons (PAHs) by Method SW8270D-SIM
- Total Arsenic and Nickel by Method EPA6010C or EPA200.8
- Total Dissolved Solids by Method SM2540C

DATA VALIDATION SUMMARY

The results for each of the QC elements are summarized below.

Data Package Completeness

ARI provided all required deliverables for the data validation according to the National Functional Guidelines. The laboratory followed adequate corrective action processes and all identified anomalies were discussed in the relevant laboratory case narrative.

Chain-of-Custody Documentation

Chain-of-custody (COC) forms were provided with the laboratory analytical reports. The COCs were accurate and complete when submitted to the lab. Documents were properly signed and dated by field and laboratory personel, analyses were properly requested and checked by the laboratory.

Holding Times and Sample Preservation

The sample holding time is defined as the time that elapses between sample collection and sample analysis. Maximum holding time criteria exist for each analysis to help ensure that the analyte concentrations found at the time of analysis reflect the concentration present at the time of sample collection. Established holding times were met for all analyses. The sample coolers arrived at the laboratory at the appropriate temperatures of between two and six degrees Celsius.

SDG 1608-259: The sample containers for the dissolved metals analyses contained a noticeable amount of solid bottom material for Samples MW-1_081816, MW-8_081816, and MW-DUP_081816. The samples were field filtered, and this solid material could have been the result of precipitation due to the sample preservative. No qualifiers were applied for these samples.

SDG 1702-162: The sample containers for the dissolved metals analyses contained a noticeable amount of solid bottom material for Samples MW-1_021517 and MW-8_021517. The samples were field filtered, and this solid material could have been the result of precipitation due to the sample preservative. No qualifiers were applied for these samples.

SDG 1708-302: The sample containers for the dissolved metals analyses contained a noticeable amount of solid bottom material for Samples MW-1_08232017, MW-8_08232017, and DUP_08232017. The samples were field filtered, and this solid material could have been the result of precipitation due to the sample preservative. No qualifiers were applied for these samples.

Surrogate Recoveries

A surrogate compound is a compound that is chemically similar to the organic analytes of interest, but unlikely to be found in any environmental sample. Surrogates are used for organic analyses and are added to all samples, standards, and blanks to serve as an accuracy and specificity check of each analysis. The surrogates are added to the samples at a known concentration and percent recoveries are calculated following analysis. All surrogate percent recoveries for field samples were within the laboratory control limits, with the following exceptions:

SDG 1608-259: (PAHs) The surrogate 2-fluorobiphenyl was greater than the control limit in Sample MW-4_081816. The sample reported two other base-neutral surrogates that were within their respective reporting limits. No qualifiers were applied for this outlier.

SDG 1708-302: (PAHs) The surrogate pyrene-d10 was less than the control limit in Sample MW-4_08242017. The sample reported two other base-neutral surrogates that were within their respective reporting limits. No qualifiers were applied for this outlier.

Method Blanks

Method blanks are analyzed to ensure that laboratory procedures and reagents do not introduce measurable concentrations of the analytes of interest. A method blank was analyzed with each batch of samples, at a frequency of 1 per 20 samples. For all sample batches, method blanks were analyzed at the required frequency. None of the analytes of interest were detected above the reporting limits in any of the method blanks.

Matrix Spikes/Matrix Spike Duplicates

Since the actual analyte concentration in an environmental sample is not known, the accuracy of a particular analysis is usually inferred by performing a matrix spike (MS) analysis on one sample from the associated batch, known as the parent sample. One aliquot of the sample is analyzed in the normal manner and then a second aliquot of the sample is spiked with a known amount of analyte concentration and analyzed. From these analyses, a percent recovery (%R) is calculated. Matrix spike duplicate (MSD) analyses are generally performed for organic analyses as a precision check and analyzed in the same sequence as a matrix spike. Using the result values from the MS and MSD, the relative percent difference (RPD) is calculated. The %R control limits for MS and MSD analyses are specified in the laboratory documents, as are the RPD control limits for MS/MSD sample sets.

For inorganic methods, the matrix spike is followed by a post-digestion spike sample if any element %R values were outside the control limits in the matrix spike. All metals %R control limits for matrix spikes are 75% to 125%.

One MS/MSD analysis should be performed for every analytical batch or every 20 field samples, whichever is more frequent. The frequency requirements were met for all analyses and the %R and RPD values were within the proper control limits.

SDG 1708-302: A matrix spike/matrix spike duplicate was performed on Sample MW-8_08232017. The %R values for benzo(a)anthracene, chrysene, benzo(b)fluoranthene, benzo(k)fluoranthene, indeno(1,2,3-c,d)pyrene and dibenz(a,h)anthracene were less than the control limits in both the MS and MSD in this sample set. The positive results for these analytes were qualified as estimated (J) in the parent sample.

Laboratory Control Samples/Laboratory Control Sample Duplicates

A laboratory control sample (LCS) is a blank sample that is spiked with a known amount of analyte and then analyzed. An LCS is similar to an MS, but without the possibility of matrix interference. Given that matrix interference is not an issue, the LCS/LCSD control limits for accuracy and precision are usually more rigorous than for MS/MSD analyses. Additionally, data qualification based on LCS/LCSD analyses would apply to all samples in the associated batch, instead of just the parent sample. The percent recovery control limits for LCS and LCSD analyses are specified in the laboratory documents, as are the RPD control limits for LCS/LCSD sample sets.

One LCS/LCSD analysis should be performed for every analytical batch or every 20 field samples, whichever is more frequent. The frequency requirements were met for all analyses and the percent recovery and RPD values were within the proper control limits.

Laboratory Duplicates

Internal laboratory duplicate analyses are performed to monitor the precision of the analyses. Two separate aliquots of a sample are analyzed as distinct samples in the laboratory and the RPD between the two results is calculated. Duplicate analyses should be performed once per analytical batch. If one or more of the samples used has a concentration less than five times the reporting limit for that sample, the absolute difference is used instead of the RPD. For organic analyses, the RPD control limits are specified in the laboratory documents. For inorganic analyses, the RPD control limit for soil samples is 35 percent. Laboratory duplicates were analyzed at the proper frequency and the specified acceptance criteria were met.

Field Duplicates

In order to assess precision, field duplicate samples are collected and analyzed along with the reviewed sample batches. The duplicate samples are analyzed for the same parameters as the associated parent samples. Precision is determined by calculating the RPD between each pair of samples. If one or more of the sample analytes has a concentration greater than five times the reporting limit for that sample, then the absolute difference is used instead of the RPD. The RPD control limit for soil samples is 50 percent.

SDG AVX9: One field duplicate sample pair, MW-3A_021116/DUP_021016, were submitted with this SDG. The precision criteria for all target analytes were met for these sample pairs.

SDG 1608-259: One field duplicate sample pair, MW-8_081816/MW-DUP_081816, were submitted with this SDG. The precision criteria for all target analytes were met for these sample pairs.

SDG 1702-162: One field duplicate sample pair, MW-8_021517/DUP_021517, were submitted with this SDG. The absolute difference for total arsenic, dissolved arsenic, and total dissolved solids exceeded the control limits in this sample pair. The positive results for total and dissolved arsenic were qualified as estimated (J) in both samples.

SDG 1708-302: One field duplicate sample pair, MW-8_02232017/DUP_08232017, were submitted with this SDG. The absolute difference values for benzo(a)anthracene, chrysene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, indeno(1,2,3-c,d)pyrene exceeded the control limits in this sample pair. The positive results for these analytes were qualified as estimated (J) in both samples.

Initial Calibrations (ICALs)

All initial calibrations were conducted according to the laboratory methods and consisted of the appropriate number of standards. For inorganic analyses, all percent recoveries were within the control limits of 90% and 110%. For organic analyses, all percent relative standard deviation (%RSD) and relative response factors (RRF) values were within the control limits stated in the USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review (USEPA, 2017).

Initial Calibration Verifications (ICVs)

All continuing calibrations were conducted according to the laboratory methods and consisted of the appropriate number of standards. For inorganic analyses, all percent recoveries were within the control limits of 90% and 110%. For organic analyses, all percent difference (%D) and relative response factors (RRF) values were within the control limits in the USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review (USEPA, 2017).

Internal Standards (Low Resolution Mass Spectrometry)

Like the surrogate, an internal standard is a compound that is chemically similar to the analytes of interest, but unlikely to be found in any environmental sample. Internal standards are used only for the mass spectrometry instrumentation and are usually added to the sample aliquot after extraction has taken place. The internal standard should be analyzed at the beginning of a 12 hour sample run. For organic analyses, the control limits for internal standard recoveries are 50 percent to 200 percent of the calibration standard. For inorganic analyses, the control limits for internal standard recoveries are 60 percent to 125 percent of the calibration standard. All internal standard recoveries were within the control limits.

Reporting Limits

The reporting limits were met by the laboratory for all target analytes throughout this sampling event.

SDG 1708-302 (CPAHs): The laboratory reported two sets of data for Samples MW-4_08242017, MW-8_08242017, and DUP_0823207. The samples were initially extracted on 8/28/17 and re-extracted on 8/30/17 because of a possible mix up in sample labeling. The re-extracted results for Samples MW-8_08242017 and DUP_0823207 were opposite the initial results. As a precaution, Geoengineers used the highest of the sets of data for these two samples. In conclusion, the initial results for Sample MW-8_08242017 and the re-extracted results for Samples MW-4_08242017 and DUP_0823207 were labeled (DNR) as Do-Not-Report.

OVERALL ASSESSMENT

As was determined by this data validation, the laboratory followed the specified analytical methods. Accuracy was acceptable, as demonstrated by the surrogate, LCS/LCSD, and MS/MSD percent recovery values. Precision was acceptable, as demonstrated by the LCS/LCSD, MS/MSD, and field/laboratory duplicate RPD values, with the exceptions noted above.

Data points were qualified because of field duplicate precision outliers and because of MS/MSD %R outliers. Data were also labeled as (DNR) Do-Not-Report in order to avoid presenting more than one data point per analyte in a sample.

REFERENCES

U.S. Environmental Protection Agency (USEPA). “Guidance for Labeling Externally Validated Laboratory Analytical Data for Superfund Use,” EPA-540-R-08-005. January 2009.

U.S. Environmental Protection Agency (USEPA). “Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review,” EPA-540-R-08-01. June 2008.

U.S. Environmental Protection Agency (USEPA). “Contract Laboratory Program National Functional Guidelines for Inorganic Superfund Data Review,” EPA-540-R-10-011. January 2010.

GeoEngineers, Inc., “Remedial Investigation/Feasibility Work Plan and Sampling and Analysis Plan Addendum, Dakota Creek Industries Site, Anacortes, Washington, Ecology Consent Decree No. DE-07TCPHQ-5080,” GEI File No. 5147-006-11, October 26, 2015.

APPENDIX K
Interim Action Report

Interim Action Report

Dakota Creek Industries
Ecology Agreed Order No. DE-07TCPHQ-5080
Anacortes, Washington

for
Port of Anacortes

October 6, 2010

GeoEngineers
Earth Science + Technology

Interim Action Report

Dakota Creek Industries
Ecology Agreed Order No. DE-07TCPHQ-5080
Anacortes, Washington

for
Port of Anacortes

October 6, 2010

GeoEngineers

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Interim Action Report

Dakota Creek Industries
Ecology Agreed Order No. DE-07TCPHQ-5080

File No. 5147-006-06

October 6, 2010

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INTRODUCTION

This report documents the interim action completed at the Dakota Creek Industries (DCI) shipyard facility (Site) located at 115 Q Avenue in Anacortes, Washington (Figure 1). The interim action was conducted in compliance with the Washington State Department of Ecology (Ecology) Agreed Order Number DE-07TCPHQ-5080 (Agreed Order) for the site dated December 2007. Interim action activities were completed in general accordance with the Ecology-approved "Dakota Creek Industries Remedial Investigation/Feasibility Study and Interim Action Work Plan" dated January 2, 2008 (Work Plan) and the Ecology-approved "Interim Action Work Plan Addendum, Dakota Creek Industries Shipyard" (Work Plan Addendum) dated June 17, 2008 (GeoEngineers). Site features and general layout are shown on Figure 2.

The interim action removed contaminated marine sediments exceeding the Washington Sediment Quality Standards (SQS) from the marine area of the Site. Interim action activities were completed between August and October 2008 as a component of Site redevelopment activities. The planned interim action consisted of removing contaminated sediment identified in portions of the marine area basin during historical investigations and during the 2008 Remedial Investigation. The results of Remedial Investigation sediment sampling are shown on Figure 3.

Contaminated soil was identified on the upland portion of the site during historic site investigations and the 2008 Remedial Investigation (Figure 4) but was not originally planned as part of the interim action. However, a portion of the impacted soil located on the east side of the site was removed during utility installation as part of upland Site redevelopment activities. The results of this soil removal are documented in this report.

The interim action activities, including marine area basin habitat restoration, were completed in December 2008.

BACKGROUND

The Site has been used for shipbuilding, bulk fuel storage, shipping, and other maritime-related industrial purposes since approximately 1879. A ferry dock, which was located near existing Pier 1, was also used at the site in the early 1900s. The Port and Dakota Creek Industries are redeveloping the upland and marine areas of the site to increase the capacity and efficiency of operations, improve stormwater facilities, and implement public access improvements.

The marine area of the Site includes the sediments located within the off channel basin and extends from the shoreline to the outer harbor line. The piers and docks previously located in the marine area basin were demolished in July 2008 prior to the interim action dredging to facilitate access to the marine area sediments. The two marine railways that were located within the marine area basin between the "L" Dock and the "East" Dock, and between the "East" Dock and Pier 2 were removed in the early 1990's and in 2008, respectively.

Contaminated soil, groundwater and sediment were identified at the site during previous investigations. Areas of impacted soil at the site were removed as part of previous remedial actions, including an interim cleanup action performed in 2002 under Ecology's Voluntary Cleanup Program

(VCP). Approximately 3,900 cubic yards of metals and petroleum hydrocarbon contaminated soil was excavated from the east and central portions of the site during the 2002 VCP excavation activities and disposed of at a permitted off-site landfill. The limits of the 2002 remedial excavations are shown on Figure 4. Confirmation soil samples were collected from the sidewalls of each of the completed investigations verifying that the remaining soil contained contaminants of concern at concentrations less than Ecology's Model Toxics Cleanup Act (MTCA) cleanup levels. The results of the independent cleanup action were summarized by Landau in the 2002 report "Completion Report, Independent Cleanup Action Dakota Creek Industries Shipyard Facility" (Landau 2002). An opinion letter was not issued by Ecology at the time of this voluntary cleanup action.

Detailed information describing the Site including its history, current uses, existing property features and a summary of environmental investigations completed at the site between 1985 and 2007 is presented in the Work Plan. The soil, groundwater and sediment remedial investigation (RI) was completed at the site in March 2008. The Port completed an additional upland soil investigation in October 2008 to evaluate the extent of arsenic impacted soil identified on the east side of the site during previous investigations. The results of the RI are summarized in the "Investigation Data Report, Dakota Creek Industries Shipyard Facility" (Data Report) by GeoEngineers dated December 2008.

NATURE AND EXTENT OF CONTAMINATION

General

Sediment and soil contamination was identified in parts of the marine area basin during previous investigations completed at the site conducted between 1985 and 2007 and during the 2008 RI sampling and analysis activities. Historical Site use including bulk material and fuel oil storage facilities, shipyard activities on the upland and marine area and historic discharges from the former Scott Paper Mill and City of Anacortes municipal sewer outfalls are all potential sources to the contamination detected at the Site.

Sediment

Investigations completed at the site identified that marine area basin sediments are contaminated with several contaminants of concern (COCs) at concentrations exceeding the respective Sediment Management Standards (SMS). The COCs exceeding SMS include metals (arsenic, lead, copper, mercury and zinc), polychlorinated biphenyls (PCBs) and polycyclic aromatic hydrocarbons (PAHs). Figure 3 presents the location of sediment samples collected from within the marine area basin with COCs detected above respective SMS screening levels. The impacted sediment was shown to extend to approximately 1.0 foot below the sediment surface at the eastern edge of the basin (sample location G-2), approximately 4 feet below the sediment surface in the southwest corner of the marine area basin (sample locations G-5 and G-6) and to the native till contact in the southeast corner of the marine area basin (G-3 and G-4). SMS exceedances identified in the sediment samples collected from the site are presented in Table 1 and on Figure 3.

The marine area basin sediments were characterized for the purposes of dredged material disposal in addition to the RI sediment characterization. The marine area basin was divided into two dredge material management units (DMMUs) for the Dredge Material Management Program (DMMP) characterization study as shown on Figure 3. DMMU-1 encompasses the near surface sediments in the outer (north) half of the marine area basin and DMMU-2 encompasses the near surface sediments located in the nearshore (south) half of the marine area basin. The near surface sediments consist of sandy silt extending vertically from the sediment surface approximately 0.5 feet to 5 feet down to the native glacial till contact.

The DMMP issued an open water disposal Suitability Determination (SD) on April 12, 2001 (updated March 23, 2007). The SD identifies the proposed dredge material within DMMU-1, and the native till material underlying both DMMU-1 and DMMU-2 as suitable for disposal at the Rosario Strait dispersive open water disposal site. The dredge material within DMMU-2 was determined to be unsuitable for open water disposal due to exceedances of PAH compounds.

Upland Soil

Upland investigations (including the RI) completed at the site identified exceedances of preliminary cleanup levels (CULs) for metals (arsenic, copper and zinc), and dioxins/furans in site soil and/or groundwater in various areas at the site. The upland component of the interim action was limited to the area of arsenic impacted soil on the east side of the site as shown on Figure 4. Arsenic concentrations in soil samples collected from this area exceeded human health criteria and the contaminated soil in this area was identified as likely to require remedial action.

Soil arsenic concentration data collected during the October 2008 RI were used to evaluate the limits of the interim action excavations. Arsenic was selected as the indicator chemical for planning the interim action excavations due to the availability of arsenic data at the time. Based on the analytical results of the October 2008 investigation, the native glacial till unit is clean and was used as the lower limit boundary of the soil removal activities completed during the interim action.

Investigation sample locations and preliminary CUL exceedances in this portion of the site are shown on Figure 4. Preliminary CUL exceedances are discussed in detail in the Data Report (December 2008).

INTERIM ACTION SCOPE

The primary purpose of the proposed interim action at the DCI shipyard facility was to remove contaminated sediments exceeding SMS cleanup levels. The interim action was completed as described in the Work Plan (GeoEngineers 2008a) and Work Plan Addendum (GeoEngineers 2008b) and consisted of the removal of contaminated sediment identified in the marine are of the basin (see Figure 3). The primary component of the proposed interim action, contaminated sediment dredging, was designed to achieve an immediate elimination of contaminated sediment from the marine area basin and eliminate the potential environmental impacts posed from leaving the contaminated sediment in-place.

Soil remediation in the upland portion of the site was not part of the original interim action scope described in the Work Plan or Work Plan Addendum. However, during completion of the interim action construction, the scope of the interim action was adjusted to include removal of arsenic contaminated soil in the eastern portion of the site, as approved by Ecology in a September 5, 2008 email from Panjini Balaraju (Ecology 2008). The purpose of the additional interim action scope was to remove arsenic contaminated soil from utility trenches being constructed as part of the Site redevelopment infrastructure improvements. The trench excavations for new utility installations at the site were modified such that the trenches were over-excavated to the clean native till surface in order to completely remove the overlying contaminated soil. Additionally, the excavated trenches were widened to facilitate the feasibility of future excavations, if required. The added soil-removal component of the interim action achieved an immediate reduction in the volume of metals contaminated upland soil on the site and decreased the potential environmental impacts posed from leaving the contaminated soil in-place.

INTERIM ACTION DREDGING AND EXCAVATION ACTIVITIES

General

Interim action construction at the site was completed between July and November 2008. The interim actions at the site were conducted in general accordance with the MTCA Cleanup regulation and applicable state and federal laws described in WAC 173-340-430.

The Port's general contractor for interim action construction was Pacific Pile and Marine of Seattle, Washington. Pacific Pile and Marine completed the contaminated sediment dredging and soil excavation for the interim action. The Port's environmental consultant was GeoEngineers, Inc. of Seattle, Washington. GeoEngineers assisted Pacific Pile and Marine with segregating clean and contaminated soil/sediment during construction, collected confirmatory sediment samples from the limits of the remedial dredge and excavation areas and documented the remedial activities.

The extent of contaminated sediment and soil removed during the interim action was evaluated during removal activities using field observations and chemical analyses of samples collected from the dredged surface and excavation sidewalls. A GeoEngineers field representative was onsite during dredging and excavation activities to field screen dredged and excavated materials for evidence of contamination and to assist the contractor in identifying the limits of removal activities. Confirmation sediment samples were collected from the post-dredge surface to confirm the completeness of the dredging action. The native till layer underlying the Site was used as the lower "clean" limit to the upland excavations. The native layer had been shown to not contain chemical contamination in the environmental investigation studies of the Site. Field observations were used to identify the native till within the dredge prism and in the utility trench excavations to confirm that the contaminated sediment and soil had been removed.

The sections below present the specific activities performed during the interim action.

Contaminated Sediment Dredging

Interim action dredging at the site was completed between July and September 2008 to remove sediment containing metals, PAHs, SVOCs and/or PCBs contamination at concentrations exceeding SMS CSL criteria. The areas and limits of the environmental dredging are shown on Figure 5. The L Dock, East Dock and marine railway remnant located in the site marine area basin were demolished and removed as a component of Project Pier 1 prior to the interim action. The environmental dredging was completed in general accordance with the scope described in the Work Plan Addendum (GeoEngineers 2008b).

Sediment remediation activities completed as part of the interim action included the following:

- Mobilizing dredging equipment (barge-mounted long-reach excavator with hydraulic bucket, haul trucks, and sediment transport barges to the site.
- Construction of a sediment containment and handling facility at the Port's Pier 2 property.
- Implementing environmental protection best management practices (BMPs) for dredging as required by the project permits. The BMPs addressed sediment loss, drainage, and erosion control; spill prevention and pollution control; and all other controls needed to protect environmental quality at both the dredging location and the Pier 2 sediment containment and handling facility. The BMPs are described in the US Army Corps of Engineers Permit, the Interim Action Work Plan and the Pollution Prevention Plan section of the project Construction Quality Control Plan. Typical BMPs that were utilized include: using a clamshell-type bucket and ensuring complete closure of the dredge bucket before raising it from the sediment surface; using silt and debris control booms at all times dredging was occurring; performing monitoring of water column turbidity; minimizing barge grounding and propeller wash to avoid disturbing the sediment surface; and control of decant and water at the Pier 2 facility.
- Implementing site access and vessel control measures to comply with U.S. Coast Guard and other federal, state, and local vessel moorage, Site security, and navigation requirements.
- Dredging of contaminated sediment from the site. Dredging was completed as outlined in the Work Plan Addendum. During dredging of contaminated sediment requiring upland disposal, the dredged material was initially placed on transport barges and the full barges were delivered to the Port's adjacent Pier 2 facility where the material was offloaded and placed in stockpiles. Dredged material loaded to haul trucks was delivered directly to Pier 2. The dredged material was temporarily stored in stockpiles on Pier 2 to allow dewatering and sample collection in preparation for transport to an off-site disposal facility. The completed dredge areas and final post-dredge surface elevations are shown on Figure 5.
- Sediment dewatering and processing in preparation for offsite transport. Sediments delivered to Pier 2 were dewatered and processed for shipment to an Ecology-approved landfill. Sediment processing included screening of aggregate materials greater than 2 inches from the sediment matrix. The screened material were washed of fine particulates and returned to the Site for use as backfill material. Sediment handling also included amendment with diatomataceous earth to facilitate control of free water for shipment.
- Transport of contaminated dredged material to an Ecology-approved landfill. Contaminated dredged material was loaded into trucks and delivered to Waste Management's Subtitle D landfill facility in Wenatchee, Washington for disposal.
- Collection of confirmation sediment samples from the post-dredge sediment surface in five of the six (SMA-1 through SMA-5) Sediment Management Areas (SMAs) in the nearshore portion of the marine area basin (Figure 5).
- Backfill Sediment Management Area SMA-1 with habitat mix backfill material to restore the sediment surface to grade (Figure 5).

Approximately 26,000 cubic yards (estimated 38,000 tons) of contaminated sediment was dredged from the marine area basin to complete the interim action. The extent of dredging and the bathymetry of the post interim action dredged surface are shown on Figure 5. The final dredged surface was surveyed by Pacific Pile & Marine.

The basin was divided into six SMAs as shown on Figures 3 and 5. Each SMA required specific consideration during dredging activities. Dredging was sequenced so that the more-contaminated sediments located in the inner basin SMAs were dredged before the less contaminated outer-basin SMAs. The purpose of the sequencing was to allow any residuals that may be generated by the inner basin dredging to be removed during outer-basin dredging. Dredging of contaminated sediment was completed across the entire basin prior to dredging the areas of clean sediment for the basin redevelopment project.

Dredging extended south of the SMA boundaries in the area between the former location of the joiner shop and monitoring well MW-3 to facilitate removal of the bulkhead structure and the tieback system. Petroleum sheen and odor was observed along the alignment of bulkhead structure . The impacted soil and sediment was observed to contain a heavy oil material extending vertically from near top elevation of the bulkhead to the underlying native contact. The observed contaminated soil and sediment was completely removed to the underlying native contact and disposed along with the other contaminated dredged material. As part of the excavation activities, the components of monitoring well MW-3, and the soil located in the vicinity of the well within the screened interval were completely removed during the additional removal activities. The area of upland soil removal performed during dredging is shown on Figure 5.

On completion of the interim action dredging, the confirmation sampling results were review by the Dredged Material Management Program to confirm that no contamination was present at the dredged surface. On receipt of confirmation of the contaminated sediment dredging completeness, further dredging of the basin was allowed. The dredged native material was disposed at the Rosario Straight open water disposal site in accordance with the project permits. The open water dredging and disposal is not part of the interim action at the Site.

Basin sediments with concentrations of contaminants exceeding the CSLs were removed from the basin during the interim action dredging. The intent of the Ecology-approved plan was to have the interim action be as complete as possible; however, the interim action may not constitute the final cleanup action for the entire site. The interim action was completed in a manner that does not foreclose reasonable alternatives for a future site cleanup action (if necessary), which is consistent with WAC 173-340-430. The final cleanup action for the Site will be determined on completion of the Remedial Investigation, Feasibility Study and Cleanup Action Plan.

Sediment Dredging Performance Monitoring

Confirmation samples were collected from the five nearshore SMAs (SMA-1 through SMA-5). No confirmation sample was collected from SMA-6 as the sediment in this SMA does not have any SMS exceedances of COCs. SMA-6 was included in the contaminated sediment dredging due to the detections of dioxins/furans in samples collected at this location that prevented open-water disposal. There are no SMS criteria for dioxins/furans.

The sediment confirmation samples were collected from the post-dredge surface. Field observation of the dredged material and dredged surfaces, where exposed during low tides and in the dredge cuttings was conducted to confirm that dredging to the native till contact was achieved prior to collecting the confirmation sediment samples. Confirmation sediment samples were submitted to Columbia Analytical Services laboratory of Kelso, Washington for analysis of SMS COCs including SVOCs, PAHs, PCBs, metals and total organic carbon. Table 2 presents the results of analysis of confirmation samples and the sample locations are presented on Figure 5. None of the confirmation samples had detection of COCs above the respective SMS criteria.

Dredged Material Dewatering, Handling and Disposal

A dredged material handling area was constructed on the east side of the DCI facility using concrete blocks and silt fencing to confine the dredged sediment within the paved stockpile area. The dewatering effluent was collected in tanks and solids were allowed to settle out of the water prior to discharge. The clarified decant water was discharged back into the basin at the point of dredging and within the area monitored for water quality criteria as allowed by the project permits.

Aggregate greater than 2-inches were screened from the sediment matrix using a mechanical sorter. The screened aggregate was washed of fine particulates and returned to the Site for use as backfill material. Sediment screening and washing was completed within the Pier 2 material handling facility to control loss of contaminants. Wash water was treated with the decant water described above.

The screened and de-watered, contaminated sediment was trucked to the Waste Management Subtitle D landfill facility in Wenatchee, Washington for disposal.

Soil Excavation

Upland soil removal was completed on the east side of the Site between October and November 2008 as part of the interim action. Soil within utility corridors being constructed as part of the upland redevelopment was excavated to the extent practicable to remove soil containing elevated arsenic detections. The utility trenches were over-excavated to the underlying native soil layer, beyond the depth necessary for utility installation in order to remove contamination from within the utility corridor. The extent of contaminated soil removal performed during utility trench excavation is presented on Figure 6.

Upland soil remediation activities completed as part of the interim action included the following:

- Implemented environmental protection measures for soil excavation, transport and disposal that addressed drainage, erosion control, spill prevention, pollution control, and other controls needed to protect environmental quality. Specific environmental protection measures included use of silt fencing, silt dikes, catch basin silt barriers, and containment and coverage of lined stockpiles.
- Implemented site access and traffic control measures including fencing and vehicle control flaggers were implemented to maintain safe working conditions and protect the public during the interim action.
- Demolished asphalt and concrete pavement as needed to access existing utilities requiring removal and the proposed utility corridors.
- Removed contaminated soil from within utility trench excavations on the east portion of the site. The extent of the completed trench excavations are shown on Figure 6. Excavation of the utility

trenches was completed to the native till soil underlying the contaminated upper soil to confirm that all of the contaminated soil was removed during excavation activities.

- Transported contaminated soil for offsite disposal at Waste Management's Subtitle D landfill in Wenatchee, Washington.
- Backfilled the utilities excavations to the planned utility grade with imported, clean fill soil. The remainder of the utility trenches were backfilled to site grade with select fill after the subsurface utilities were installed.
- Covered upland site surfaces with a combination of clean granular fill, crushed rock, or structures.

The utility trenches in this area were over-excavated down to the fill/native contact, at depths ranging from approximately 3 feet to 9.5 feet bgs. Approximately 572 cubic yards of arsenic contaminated soil were removed from this portion of the site. The impacted soil was placed directly into dump trucks and brought to the Pier 2 materials handling facility. Contaminated soil was transported from Pier 2 by truck and disposal at the Waste Management Subtitle D landfill facility in Wenatchee, Washington. The utility trenches were backfilled to the designed utility grade with clean imported fill in accordance to the redevelopment project requirements prior placing the utilities.

Metals contaminated soil remains on the east side of the site in the areas that were not excavated for utility installation (Figure 6). Based on the depth to native glacial till observed in the test pits completed in October 2008, approximately 728 cy of metals impacted soil remains on the east side of the site.

BACKFILL AND SITE RESTORATION FOLLOWING THE INTERIM ACTION

Backfill

Project Pier 1 involved expanding the upland grade northward after the interim action dredging. To facilitate the filling, a permanent sheet pile wall installed at approximately the northern edge of SMA-3 and SMA-4. The area of SMA-3 and SMA-4 behind the sheet pile wall was backfilled to match the surrounding upland grade with fill designed for the redevelopment. In areas of the marine area basin where the post-dredge surface was at a lower elevation than design grade, habitat backfill material was placed to restore the subtidal slopes to grade or to the slopes designed for the redevelopment dredging. The entire area of SMA-1 was backfilled to original grade with habitat mix backfill material following completion of all contaminated sediment dredging.

Soil excavations completed on the east side of the site were backfilled with clean imported select fill to the planned utility grade. Following installation of the underground utilities, the excavations were then backfilled using select fill to the site surface grade of approximately +13 feet MLLW. A building has also been constructed on the east portion of the site over part of the remedial excavation area.

Utility Demolition, Relocation and Restoration

Utilities (electric power, water, sewer, etc.) located within the upland interim action area that served historical and existing facilities at the site were decommissioned (if operational) prior to the remedial excavations. Previously decommissioned utilities from historic site activities were removed from the utilities excavation/remedial action excavation prior to backfilling, placing new utilities and backfilling the utilities excavations to the upland site grade with select import fill. Utilities that were to resume operation after the completion of the remedial excavation were restored.

LIMITATIONS

This report has been prepared for the exclusive use of the Port of Anacortes.

Within the limitations of scope, schedule and budget, our services have been executed in accordance with generally accepted environmental science practices in this area at the time this report was prepared. The conclusions and opinions presented in this report are based on our professional knowledge, judgment and experience. No warranty or other conditions, express or implied, should be understood.

Any electronic form, facsimile or hard copy of the original document (email, text, table and/or figure), if provided, and any attachments should be considered a copy of the original document. The original document is stored by GeoEngineers, Inc. and will serve as the official document of record.

REFERENCES

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TABLES

GeoEngineers

TABLE 1
REMEDIAL INVESTIGATION SEDIMENT SAMPLE RESULTS
DAKOTA CREEK INDUSTRIES - INTERIM ACTION COMPLETION
PORT OF ANACORTES

Sample Identification	Sediment Quality Standards (SQS) WAC 173-204-320)	Sediment Cleanup Screening Level (CSL) WAC 173-204-520	G-1 (s')		Exceedance Ratio	G-1 (1-2')		Exceedance Ratio	G-2 (s')		Exceedance Ratio	G-2 (1.5-2.5')		Exceedance Ratio	G-3 (0-1')		Exceedance Ratio	G-3 (4-5')		Exceedance Ratio	G-4 (2-3')		Exceedance Ratio	G-4 (4-5')		Exceedance Ratio	G-5 (0-1')		Exceedance Ratio	G-5 (4-5')		Exceedance Ratio	G-6 (2-3')		Exceedance Ratio	G-6 (4-5')		Exceedance Ratio	G-7 (s')		Exceedance Ratio
Conventionals																																									
Total Solids (%)	–	–	46.50			47.40			52.90			39.50			83.10			74.50			81.90			82.40			81.80			84.40			73.00			83.90			79.3		
Total Volatile Solids (%)	–	–	14.54			12.25			9.94			28.59			2.32			7.08			2.55			1.52			0.88			3.17			4.19			1.34			1.78		
Ammonia (mg/kg)	–	–	6.17			20.6			14.1			24.2			0.62			1.77			3.61			9.29			0.22			2.61			3.75			2.93			1.62		
Total Sulfides (mg/kg)	–	–	303			485			231			400			333			370			435			1.19	U		69.7			10.9			1,320			12.4			245		
Total Organic Carbon (%)	–	–	1.96			2.78			2.17			8.53			1.03			4.54			1.39			1.01			0.451			1.73			1.60			1.03			0.602		
Metals	**mg/kg Dry Weight**																																								
Arsenic	57	93	10	U		10	U		9			10	U		30			30			**70**		1.23	6	U		**300**		3.23	6	U		33			6	U		37		
Cadmium	5.1	6.7	0.8			0.8			0.8			0.9			0.6	U		0.8			0.8			0.3			1.2			0.2	U		0.8			0.2	U		0.3		
Chromium	260	270	30			25			31.4			29			47			50			50			17.3			55			25.9			20.6			29.8			30.2		
Copper	390	390	49.3			44.0			36.4			47.6			**648**		1.66	**1,730**		4.44	**1,040**		2.67	52.3			**1,720**		4.41	28.2			**3,870**		9.92	12.0			77.2		
Lead	450	530	15			26			17			34			**609**		1.15	**801**		1.51	**939**		1.77	22			338			12			188			5			25		
Mercury	0.41	0.59	0.1			0.3			**0.51**		1.24	0.4			**4.39**		7.44	**8.8**		14.92	**17.8**		30.2	0.11			**1.43**		2.42	0.22			**4.43**		7.51	0.05	U		0.07		
Silver	6.1	6.1	0.7	U		0.8	U		0.5	U		0.7	U		0.9	U		1	U		0.9	U		0.3	U		0.9	U		0.3	U		0.5			0.3	U		0.4	U	
Zinc	410	960	84			76			59			76			320			**1,150**		1.20	**456**		1.11	37			**974**		1.01	39			307			28			90		
Organotins (porewater tributyltin) ug/L	--	--	0.019	U		NA			0.019	U		NA			1.4			NA			1.3			NA			0.68			NA			0.16			NA			0.026	U	
Polycyclic Aromatic Hydrocarbons	**mg/kg Organic Carbon (c)**																																								
LPAH (d)	370	780	51.07			9			31.6			8.03			91.7			118.7			172.7			42.4			238.4			23.0			232.6			19.1			11.8		
Naphthalene	99	170	7			0.72	U		1.7			0.6			5.6	U		2.64			10.8			2.5			13.1	U		1.5			5.7			1.9	U		3.3	U	
Acenaphthylene	66	66	4.7			0.72	U		1.8			0.5			5.2	J		2.86			7.2			2.0	U		13.1	U		1.2	U		15.6			1.9	U		3.3	U	
Acenaphthene	16	57	1.4			0.72	U		0.9	J		0.2	U		5.3	J		7.49			**16.5**		1.03	3.1			12.0	J		9.25			9.38			4.5			3.3	U	
Fluorene	23	79	4.8			0.72	U		2.7			0.8			4.5	J		7.93			19.4			4.6			11.5	J		1.2			14.4			1.9	U		3.3	U	
Phenanthrene	100	480	28.6			5.76			20.3			5.63			54.4			77.09			86.33			23.8			**166**		1.66	7.51			68.75			9.7			2.8	J	
Anthracene	220	1,200	4.9			1.5			4.2			0.5			19.4			20.7			32.4			7.5			35.5			2.9			118.8			2.0			2.3	J	
2-Methylnaphthalene	38	64	1.9			0.72	U		0.8	J		0.4			5.6	U		1.7			7.91			2.0	U		13.1	U		1.2	U		3.9			1.9	U		3.3	U	
HPAH (e)	960	5,300	241.3			52.09			108.8			23			**1,240**		1.29	950.88			**1,448.9**		1.51	287.0			**1,355**		1.41	104.2			**1,890.0**		1.97	46.9			51.00		
Fluoranthene	160	1,200	43.9			11.5			26.3			5.98			**214**		1.33	**211.5**		1.32	**417.3**	D	2.61	73.3			**332.6**		2.08	26.6			**687.50**	D	4.30	13.6			8.0		
Pyrene	1,000	1,400	36.7			11.2			23.0			5.04			223.3			215.9			244.6	D		65.3			243.9			30.6			468.8	D		13.6			15		
Benzo(a)anthracene	110	270	18.4			4.7			9.22			1.88			94.2			81.50			107.9			22.8			**122**		1.11	9.25			**162.5**		1.48	3.7			4.0		
Chrysene	110	460	28.6			7.6			10.6			2.58			**117**		1.06	83.70			**151.1**		1.37	29.7			**160**		1.45	10.4			**193.8**		1.76	3.9			5.5		
Total Benzofluoranthenes (f)	230	450	46.4			9.4			17.1			3.40			**282**		1.22	193.8			**259.0**		1.13	45.5			**243.9**		1.06	13.3			206.3			5.6			9.5		
Benzo(a)pyrene	99	210	29.1			4.3			10.1			1.88			**136**		1.37	85.90			**115.1**		1.16	24.8			**115**		1.16	8.09			93.75			3.6			3.7		
Indeno(l,2,3-c,d)pyrene	34	88	18.4			1.7			5.99			1.0			**70.9**		2.08	33.04			**61.9**		1.82	9.90			**59.9**		1.76	2.8			**34.4**		1.01	1.9	U		2.8	J	
Dibenz(a,h)anthracene	12	33	5.1			1.3			1.4			1.2			**33.0**		1.00	**16.96**		1.41	**28.8**		2.40	6.4			**20.2**		1.68	1.0			9.38			0.66			1.0	U	
Benzo(g,h,i)perylene	31	78	14.8			1.5			5.07			1.0			**70.9**		2.29	28.63			**63.3**		2.04	9.3			**57.6**		1.86	2.6			**33.8**		1.09	1.9	U		2.5	J	
1,2-Dichlorobenzene	2.3	2.3	0.32			0.33	U		0.3	U		0.07	U		0.60	U		0.1	U		1.3			0.60	U		1.4	U		0.4	U		1.0			0.6	U		1.0	U	
1,4-Dichlorobenzene	3.1	9	0.66			0.35			0.3	U		0.07	U		0.60	U		0.1	U		1.0			0.60	U		1.4	U		0.4	U		0.4	U		0.6	U		1.0	U	
1,2,4-Trichlorobenzene	0.81	1.8	0.32	U		0.22	U		0.29	U		0.07	U		0.60	U		0.1	U		0.4	U		0.60	U		*1.4*	*U*	1.70	0.4	U		0.4	U		0.6	U		*1.0*	*U*	1.25
Hexachlorobenzene	0.38	2.3	0.32	U		0.22	U		0.29	U		0.07	U		*0.60*	*U*	1.58	0.1	U		*0.4*	*U*	1.17	0.60	U		*1.4*	*U*	3.62	0.4	U		*0.4*	*U*	1.00	*0.6*	*U*	1.56	*1.0*	*U*	2.67
Dimethylphthalate	53	53	0.82	U		0.54	U		0.7	U		0.18	U		5.6	U		0.3	U		4.2	U		1.49	U		13	U		0.9	U		3.6	U		1.5	U		2.5	U	
Diethylphlhalate	61	110	1.02	U		0.72	U		0.9	U		0.23	U		5.6	U		1.3	U		4.2	U		2.0	U		13	U		1.2	U		3.6	U		1.9	U		3.3	U	
Di-n-Butylphthalate	220	1,700	1.02	U		0.72	U		0.9	U		0.23	U		5.6	U		1.3	U		4.2	U		2.0	U		13	U		1.2	U		3.6	U		1.9	U		3.3	U	
Butylbenzylphthalate	4.9	64	0.82	U		0.65			0.7	U		0.18	U		1.5	U		0.3	U		1.4			3.2			3.3	U		0.9	U		0.9	U		1.5	U		2.5	U	
bis(2-Ethylhexyl)phthalate	47	78	3.21			2.4			2.2			0.23	U		15.5			24.23			36.7			98.0		1.26	88.7		1.14	1.5			11.3			1.9	U		6.8		
Di-n-octyl phthalate	58	4,500	1.02	U		0.72	U		0.9	U		0.23	U		5.6	U		1.3	U		4.2	U		2.0	U		13	U		1.2	U		3.6	U		1.9	U		3.3	U	
Dibenzofuran	15	58	2.86			0.72	U		1.0			0.38			5.6	U		3.52			9.35			2.1			13	U		1.2	U		5.9			1.9	U		3.3	U	
Hexachlorobutadiene	3.9	6.2	0.32	U		0.22	U		0.3	U		0.07	U		0.60	U		0.1	U		0.4	U		0.6	U		1.4	U		0.4	U		0.4	U		0.6	U		1.0	U	
N-Nitrosodiphenylamine	11	11	0.32	UJ		0.24	U		0.9	UJ		0.10			0.60	U		1.2	U		0.4	U		11.9		1.08	1.4	U		0.4	U		0.4	U		0.6	U		2.5	UJ	
Total PCBs mg/kg OC(g)	12	65	1	U		0.72	U		5.44			1.66			**14.1**		1.17	**16.8**		1.40	**26.0**		2.17	2.0	U		**37.3**		3.10	1.1	U		8.38			1.8	U		3	U	
	ug/kg dry weight																																								
Phenol	420	1,200	34			20	U		20	U		20	U		43	J		59	U		76			20	U		59	U		20	U		58	U		20	U		20	U	
2-Methylphenol	63	63	6.2	U		7.3			6.2	U		6.1	U		6.2	U		17			6.2	U		6.1	U		6.2	U		6.2	U		6.1	U		6.1	U		6.2	U	
4-Methylphenol	670	670	59			20	U		19	J		20	U		58	U		59	U		45	J		20	U		59	U		20	U		58	U		20	U		20	U	
2, 4-Dimethylphenol	29	29	6.2	UJ		6.1	U		6.2	UJ		6.1	U		6.2	U		16			40		1.38	6.1	U		6.2	U		6.2	U		6.1	U		6.1	U		6.2	UJ	
Pentachlorophenol	360	690	31	U		30	U		31	U		31	U		290	U		42			70			30	U		40			31	U		31	U		31	U		31	U	
Benzyl Alcohol	57	73	31	UJ		**70**	J1	1.23	31	UJ		31	U		31	U		30	U		31	U		30	U		31	U		31	U		31	U		31	U		31	UJ	
Benzoic Acid	650	650	200	U		200	U		200	U		200	U		580	U		590	U		580	U		200	U		590	U		200	U		580	U		200	U		200	U	

Notes:

[a] Sediment samples were collected March 14, 2008.

[b] This table summarizes sediment sample analytical results with reference to the Sediment Management Standards (SMS) Sediment Quality Standards (SQS) and/or Cleanup Screening Levels (CSL).

[c] The listed chemical parameter criteria represent concentrations in parts per million, "normalized," or expressed, on a total organic carbon basis. To normalize to total organic carbon, the dry weight concentration for each parameter is divided by the decimal fraction representing the percent total organic carbon content of the sediment.

[d] The LPAH criterion represents the sum of the following "low molecular weight polynuclear aromatic hydrocarbon" compounds: Naphthalene, Acenaphthylene, Acenaphthene, Fluorene, Phenanthrene, and Anthracene. The LPAH criterion is not the sum of the criteria values for the individual LPAH compounds as listed.

[e] The HPAH criterion represents the sum of the following "high molecular weight polynuclear aromatic hydrocarbon" compounds: Fluoranthene, Pyrene, Benzo(a)anthracene, Chrysene, Total Benzofluoranthenes, Benzo(a)pyrene, Indeno(1,2,3,-c,d)pyrene, Dibenz(a,h) anthracene, and Benzo(g,h,i)perylene. The HPAH criterion is not the sum of the criteria values for the individual HPAH compounds as listed.

[f] The benzofluoranthenes criterion represents the sum of the concentrations of the "b," "j" and "k" isomers.

[g] PCBs = Polychlorinated biphenyls.

D = Concentration from sample diluted to obtain an accurate quantification of the analyte.

J = Estimated concentration as indicated by the laboratory

J1 = Benzyl alcohol is known to be a poor performer. Laboratory QA/QC was outside of limits. This concentration should be considered an estimate. Benzyl alcohol was not detected in the full scan.

U = analyte not detected at this concentration

X = Method detection limit exceeds the SQS or CSL criteria

NA = not analyzed

mg/kg = milligram per kilogram ug/kg = microgram per kilogram OC = organic carbon ppm = parts per million (s) = surface sample, 0-20 cm

Bold indicates concentrations greater than the SMS SQS Grey shading indicates concentrations greater than the CSL *Italics* indicates elevated method detection limit greater than SQS criteria. All associated dry weight concentrations are less than the associated apparent effects thresholds (AET).

SEAT:\5\5147006\06\Finals\514700606 Table 1-2.xls

TABLE 2
SUMMARY OF CONFIRMATION SAMPLE RESULTS[1] RELATIVE TO SMS CRITERIA[2] - SEDIMENT
DAKOTA CREEK INDUSTRIES - INTERIM ACTION COMPLETION
PORT OF ANACORTES, WASHINGTON

Chemical	SMA 1-1		SMA 2-1		SMA 3-2		DCI 4-1		DCI 4-1a		SMA5-2		SMA5-3		SMS Criteria	
															SQS	CSL
Conventionals																
Total Solids (%)	78.1		73.2		73.2		86.7		85.7		83.6		85		--	--
Total Organic Carbon (%)	0.12		0.09		0.09		0.1		0.09		0.32		0.44		--	--
Metals (mg/kg dry weight)																
Arsenic	4.4		1.71		2.11		3.89		2.98		4.2		1.9		57	93
Cadmium	0.054		0.091		0.078		0.077		0.071		0.3	B	0.3	B	5.1	6.7
Chromium	26.2		12.7		51.1		244		96.9		35.3		33.3		260	270
Copper	27.4		16.1		23.6		27.8		25.7		29.1		25.9		390	390
Lead	4.08		3.73		4.21		2.45		3.00		3.00	B	2.90	U	450	530
Mercury	0.033		0.0453		0.0221		0.032		0.036		0.041		0.036		0.41	0.59
Silver	0.07		0.05		0.07		0.07		0.06		0.8	U	0.8	U	6.1	6.1
Zinc	43.9		25.4		42.0		43.7		44.2		53.0		41.7		410	960
LPAHs (mg/kg OC)																
Acenaphthylene	0.20	U	0.50	J	0.49	J	0.24	U	0.27	U	0.12	J	0.55	U	66	66
Acenaphthene	0.76	J	7.56		0.87	J	0.23	U	0.26	U	1.59	J	0.21	J	16	57
Anthracene	0.42	J	9.22		2.78		0.47	U	0.52	U	0.88	J	0.19	J	220	1,200
Fluorene	0.92	J	9.56		1.44	J	0.5	U	0.56	U	1.41	J	0.27	J	23	79
Naphthalene	2.08		11.11		1.44	J	0.91	J	0.91	J	1.56	J	0.18	J	99	170
Phenanthrene	2.42		36.67		7.00		0.81	J	1.00	J	4.69	J	0.86		100	480
2-Methylnaphthalene	0.71	J	7.56		0.68	J	0.5	J	0.47	J	0.25	J	0.12	J	38	64
Total LPAH3	7.26		74.61		14.02		2.22	J	2.38	J	10.49		1.86		370	780
HPAHs (mg/kg OC)																
Benzo(a)anthracene	1.08	J	16.67		5.56		0.48	U	0.53	U	1.00		0.22	J	110	270
Benzo(a)pyrene	0.72	J	14.44		5.89		0.14	U	0.16	U	0.91		0.14	J	99	210
Total Benzofluoranthenes4	1.56	J	22.89		10.11		0.25	U	0.28	U	2.09		0.39	J	230	450
Benzo(g,h,i)perylene	0.78	J	11.00		3.89		0.64	U	0.71	U	0.72		0.64	U	31	78
Chrysene	0.92	J	17.78		7.89		0.47	J	0.28	U	1.69		0.41		110	460
Dibenzo(a,h)anthracene	0.28	U	3.89		1.09	J	0.28	U	0.31	U	0.16	J	0.28	U	12	33
Fluoranthene	2.50		40.00		11.11		0.63	J	0.68	J	4.38		1.00		160	1,200
Indeno(1,2,3-cd)pyrene	0.69	J	9.89		4.44		0.16	U	0.18	U	0.72		0.12	J	34	88
Pyrene	3.33		44.44		12.22		0.72	J	0.72	J	4.38		0.84		1,000	1,400
Total HPAHs5	8.23		126.67		45.53		1.82	J	1.40	J	18.13		3.86		960	5,300
Chlorinated Hydrocarbons (mg/kg OC)																
Hexachlorobenzene	1.00	U6	1.33	U6	1.33	U6	1.2	U6	1.33	U6	0.38	U	0.27	U	0.38	2.3
Hexachlorobutadiene	2.08	U	2.78	U	2.78	U	2.5	U	2.78	U	0.78	U	0.57	U	3.9	6.2
1,2-Dichlorobenzene	2.42	U6	3.22	U6	6.56	U6	2.9	U6	3.22	U6	1.84	U	1.34	U	2.3	2.3
1,4-Dichlorobenzene	2.42	U	3.22	U6	2.89	U	2.9	U	3.22	U6	0.91	U	0.59	U	3.1	9
1,2,4-Trichlorobenzene	2.17	U6	2.89	U6	2.89	U6	2.6	U6	2.89	U6	0.81	U	0.59	U	0.81	1.8

Chemical	SMA 1-1		SMA 2-1		SMA 3-2		DCI 4-1		DCI 4-1a		SMA5-2		SMA5-3		SMS Criteria	
															SQS	CSL
Phthalates (mg/kg OC)																
Diethyl phthalate	1.08	U	1.44	U	1.44	U	1.5		1.56		0.44	J	0.32	J	61	110
Dimethyl phthalate	0.83	U	1.11	U	1.11	U	1	U	1.11	U	0.31	U	0.23	U	53	53
Di-n-butyl phthalate	6.58	U	8.78	U	8.87	U	7.9	U	8.78	U	2.63	J	2.02	J	220	1700
Di-n-octyl phthalate	1.42	U	1.89	U	1.89	U	1.7	U	1.89	U	0.53	U	0.29	U	58	4500
Bis (2-ethylhexyl) phthalate	5.83	U	10.44	J	7.78	U	7	U	20		2.19	U	1.59	U	47	78
Butyl benzyl phthalate	2.67	U	3.56	U	3.56	U	3.2	U	3.56	U	1.00	U	0.73	U	4.9	64
Phenols and Miscellaneous (µg/kg dry weight)																
Pentachlorophenol	20	U	20	U	20	U	20	U	20	U	20	U	20	U	360	690
Phenol	2	U	2	U	2	U	2	U	2	U	2	U	2	U	420	1,200
2 Methylphenol	1.5	U	1.5	U	1.5	U	1.5	U	1.5	U	1.5	U	1.5	U	63	63
4 Methylphenol	3.4	J	1.5	U	1.5	U	1.5	U	1.5	U	1.5	U	1.5	U	670	670
2,4-Dimethylphenol	5.5	U	5.5	U	5.5	U	5.5	U	5.5	U	5.5	U	5.5	U	29	29
Miscellaneous Compounds																
Benzoic acid (µg/kg dry weight)	96	U	96	U	96	U	96	U	96	U	96	U	96	U	650	650
Benzyl alcohol (µg/kg dry weight)	2.1	U	2.1	U	2.1	U	2.1	U	2.1	U	2.1	U	2.1	U	57	73
Dibenzofuran (mg/kg OC)	0.73	J	7.00		0.94	J	0.59	U	0.66	U	0.9	J	0.27	U	15	58
N-Nitrosodiohenylamine (mg/kg OC)	1.33	U	1.78	U	1.78	U	1.6	U	1.78	U	0.5	U	0.36	U	11	11
PCBs (mg/kg OC)																
Total PCBs	1.08	U	3.40		1.44	U	1.3	U	1.44	U	0.41	U	0.29	U	12	65

Notes: s

1 Chemical analysis performed by Columbia Analytical Services of Kelso, Washington

2 SMS = Sediment Management Standards Criteria; SQS = Sediment Quality Standards; CSL = Cleanup Screening Level.

3 Total LPAHs = The sum of Acenaphthalene, Acenaphthene, Anthracene, Fluorene, Napthalene and Phenanthrene.

4 Total benzofluoranthenes = The sum of the "b" and "k" isomers.

5 Total HPAHs = The sum of Benzo(a)anthracene, Benzo(a) pyrene, Total Benzofluoranthenes, Benzo(g,h,i)perylene, Chrysene, Dibenzo(a,h)anthracene, Fluoranthene, Indeno(1,2,3-c,d)pyrene and pyrene.

6 Elevated non-detection due to organic carbon normalization with a total organic carbon percentage less than 0.1%. The dry weight detection limit is less than the applicable lowest Apparent Effects Threshold.

U = Laboratory data qualifier indicating analyte undetected at given reporting limit

J = estimated value

B= indicates analyte was detected in laboratory blank

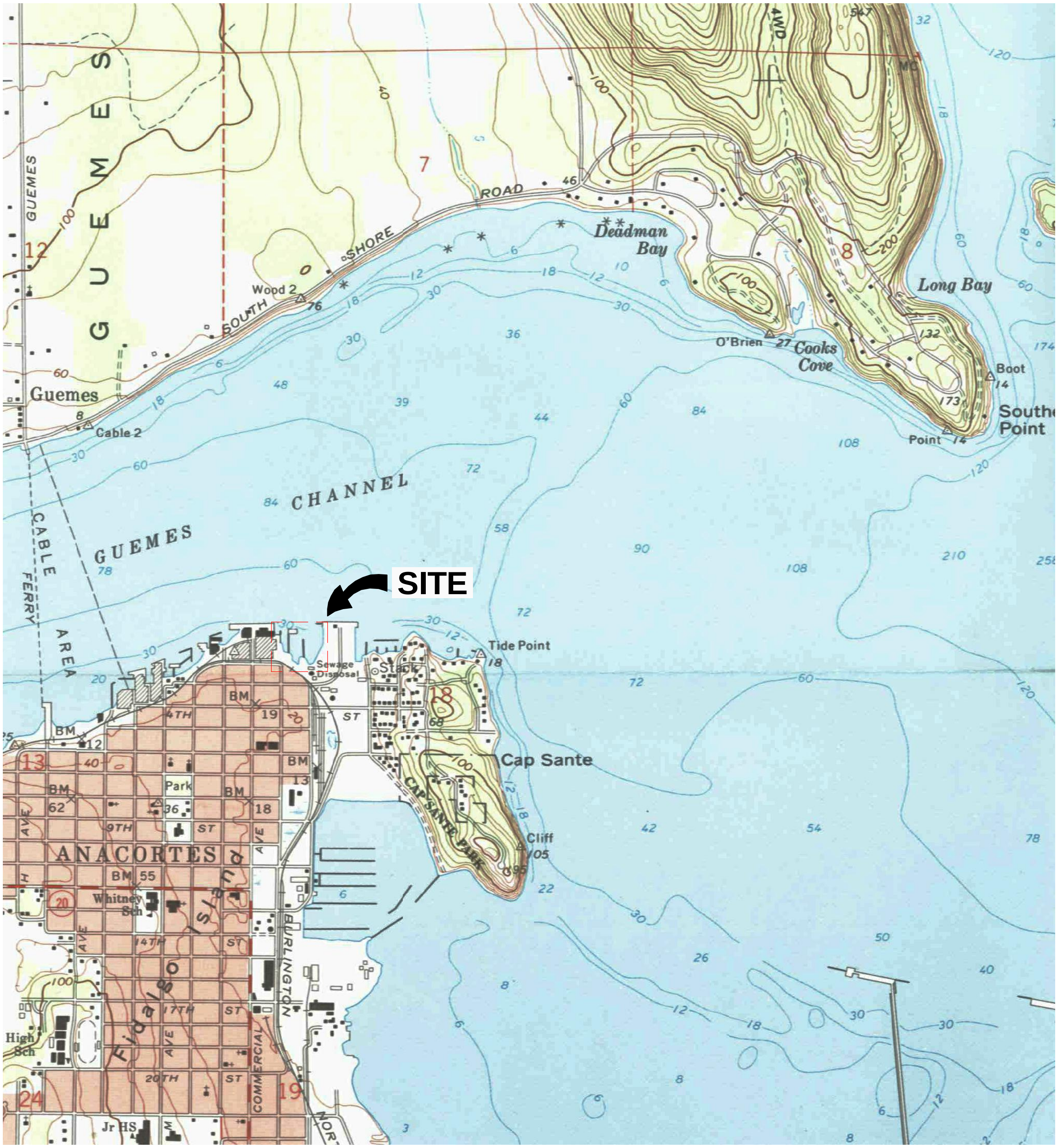
Bold indicates that the detected concentration exceeds the SMS SQS.

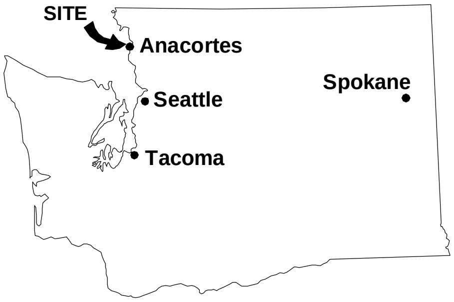
-- = Not available or not applicable.

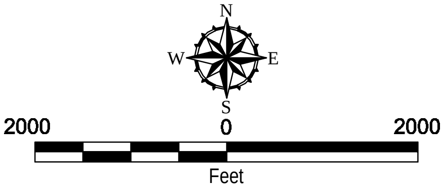
SEAT:\5\5147006\06\Finals\514700606 Table 1-2.xls

FIGURES

GeoEngineers







Reference: USGS 7.5' topographic quadrangle map "(Anacortes North, Wash.," photoinspected 1978).

Vicinity Map

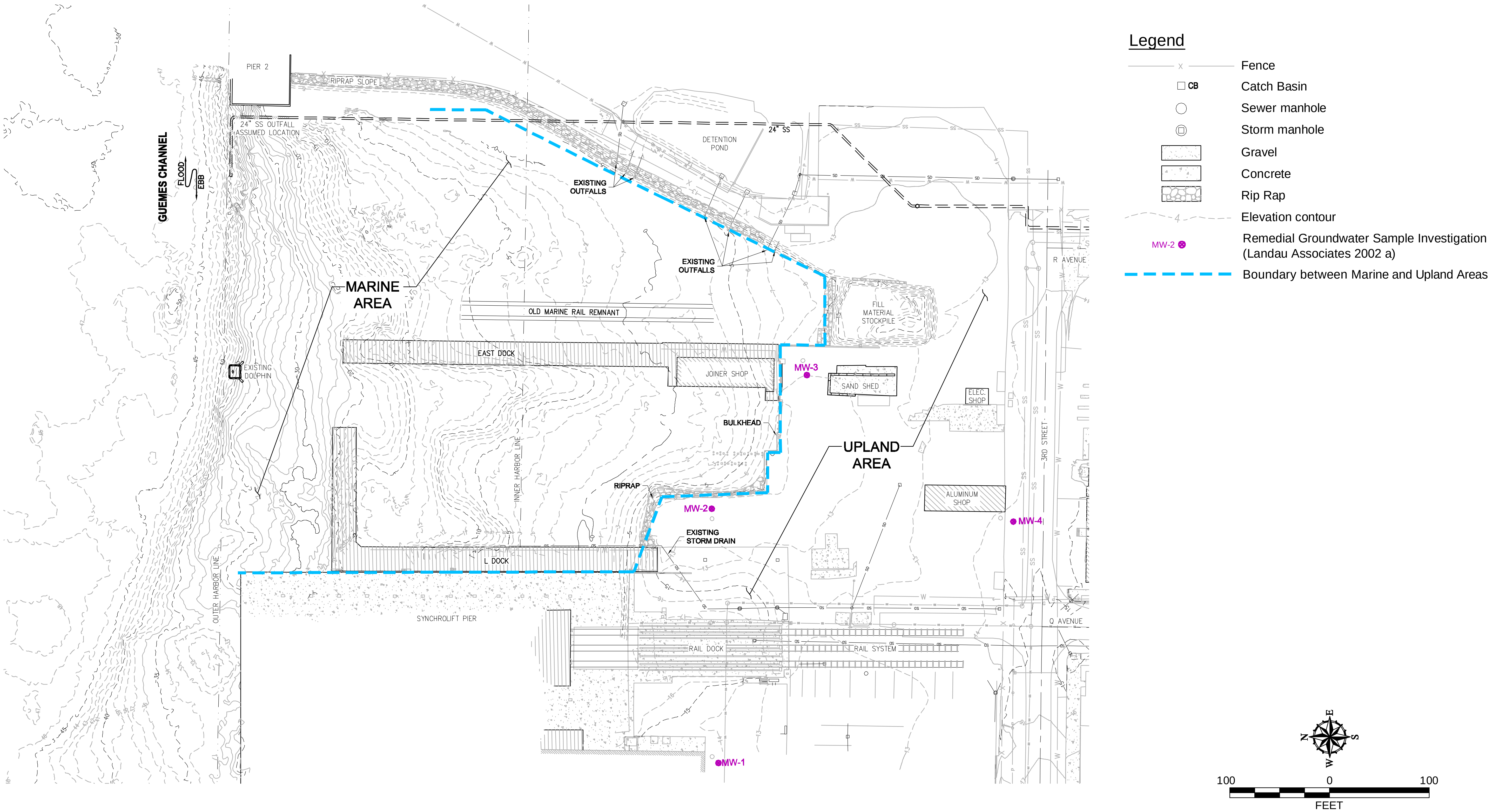
Port of Anacortes - Dakota Creek Industries
Anacortes, Washington

GeoEngineers

Figure 1

P:\5\5147006\06\CAD\Construction Completion Figures\514700605 FIG 1.DWG\TAB:F1 MODIFIED BY TMICHAUD ON JUN 08, 2010 - 14:58

P:\5\5147006\06\CAD\Construction Completion Figures\514700605 FIG 2.dwg\TAB:F2 modified by tmichaud on Jul 29, 2010 - 10:01



NOTES:

1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. can not guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

Reference: AutoCAD drawing entitled "Existing Conditions and Project Control", file name 064065.01-1.14.dwg, by PND Engineers, Inc., dated September 2007.

SURVEY NOTES

1) THIS DRAWING BASED ON SURVEY BY LEONARD, BOUDINOT, SKODJE INC. NOV. 2006

2) HORIZONTAL DATUM = BETWEEN THE MONUMENT AT THE INTERSECTION OF "R" AVENUE AND 4TH STREET AND THE MONUMENT AT THE INTERSECTION OF "T" AVENUE AND 4TH STREET. BEARS S 88°06'27" E, AS CALCULATED FROM COORDINATES SHOWN ON RECORD OF SURVEY, "A SURVEY OF ANACORTES HARBOR LINES IN T.35 N., R.1 E., AND T.34 N., & 35 N., R.2 E., W.M.", AS RECORDED UNDER AUDITOR'S FILE NUMBER 200110030106, RECORDS OF SKAGIT COUNTY, WASHINGTON.

3) VERTICAL DATUM = STANDARD DISK, STAMPED "5 1922", SET VERTICALLY IN THE EAST END OF NORTH FACE OF CONCRETE FOUNDATION OF GREAT NORTHERN RAILWAY STATION ON EAST SIDE OF R" AVENUE AT SEVENTH STREET. IT IS 3 1/2 FEET WEST OF THE NORTHEAST CORNER OF BUILDING, 3/4 FOOT ABOVE BRICK SIDEWALK, AND 26 FEET WEST OF THE WEST RAIL OF RAILROAD TRACK. ELEVATION = 16.98 FEET ABOVE MEAN LOWER LOW WATER (MLLW).

6) THIS DRAWING REPRESENTS THE EXISTING CONDITIONS AS FOUND ON THE DATE OF SURVEY; NOV. 2006. F.B.#651, PGS. 68-70.

7) THE UTILITIES SHOWN HEREON REPRESENT WHAT WAS FOUND BY FIELD INVESTIGATION ON THE DATE OF THE SURVEY. THE 1-800 UTILITY LOCATE SERVICE WAS USED. OTHER UNDERGROUND UTILITIES DO EXIST IN THIS AREA. THIS MAP IS REPRESENTING SOME UTILITIES THAT WERE NOT APPARENT ON THE GROUND.

8) CONTOURS AND SURFACE FEATURES AS REPRESENTED HEREON ARE IN CONFORMANCE WITH ACCEPTED INDUSTRY PRACTICE. CONTOUR INTERVAL: 1 FOOT.

Site Plan - Pre-Interim Action Site Features

Port of Anacortes - Dakota Creek Industries
Anacortes, Washington

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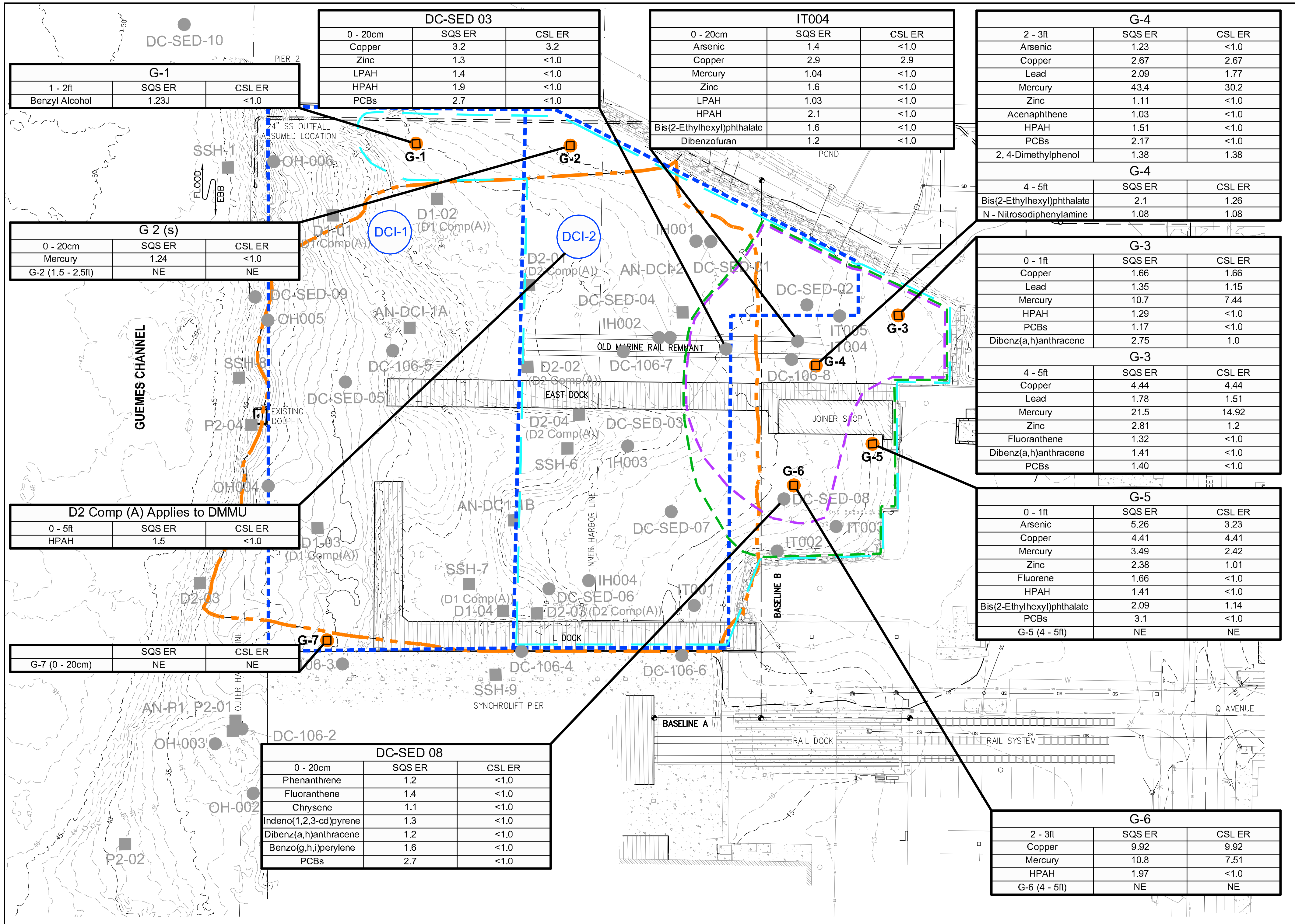
Figure 2



G-1		
1 - 2ft	SQS ER	CSL ER
Benzyl Alcohol	1.23J	<1.0

DC-SED 03		
0 - 20cm	SQS ER	CSL ER
Copper	3.2	3.2
Zinc	1.3	<1.0
LPAH	1.4	<1.0
HPAH	1.9	<1.0
PCBs	2.7	<1.0

IT004		
0 - 20cm	SQS ER	CSL ER
Arsenic	1.4	<1.0
Copper	2.9	2.9
Mercury	1.04	<1.0
Zinc	1.6	<1.0
LPAH	1.03	<1.0
HPAH	2.1	<1.0
Bis(2-Ethylhexyl)phthalate	1.6	<1.0
Dibenzofuran	1.2	<1.0

G-4		
2 - 3ft	SQS ER	CSL ER
Arsenic	1.23	<1.0
Copper	2.67	2.67
Lead	2.09	1.77
Mercury	43.4	30.2
Zinc	1.11	<1.0
Acenaphthene	1.03	<1.0
HPAH	1.51	<1.0
PCBs	2.17	<1.0
2, 4-Dimethylphenol	1.38	1.38
G-4		
4 - 5ft	SQS ER	CSL ER
Bis(2-Ethylhexyl)phthalate	2.1	1.26
N - Nitrosodiphenylamine	1.08	1.08

G 2 (s)		
0 - 20cm	SQS ER	CSL ER
Mercury	1.24	<1.0
G-2 (1.5 - 2.5ft)	NE	NE

G-3		
0 - 1ft	SQS ER	CSL ER
Copper	1.66	1.66
Lead	1.35	1.15
Mercury	10.7	7.44
HPAH	1.29	<1.0
PCBs	1.17	<1.0
Dibenz(a,h)anthracene	2.75	1.0
G-3		
4 - 5ft	SQS ER	CSL ER
Copper	4.44	4.44
Lead	1.78	1.51
Mercury	21.5	14.92
Zinc	2.81	1.2
Fluoranthene	1.32	<1.0
Dibenz(a,h)anthracene	1.41	<1.0
PCBs	1.40	<1.0

D2 Comp (A) Applies to DMMU		
0 - 5ft	SQS ER	CSL ER
HPAH	1.5	<1.0

G-5		
0 - 1ft	SQS ER	CSL ER
Arsenic	5.26	3.23
Copper	4.41	4.41
Mercury	3.49	2.42
Zinc	2.38	1.01
Fluorene	1.66	<1.0
HPAH	1.41	<1.0
Bis(2-Ethylhexyl)phthalate	2.09	1.14
PCBs	3.1	<1.0
G-5 (4 - 5ft)	NE	NE

	SQS ER	CSL ER
G-7 (0 - 20cm)	NE	NE

DC-SED 08		
0 - 20cm	SQS ER	CSL ER
Phenanthrene	1.2	<1.0
Fluoranthene	1.4	<1.0
Chrysene	1.1	<1.0
Indeno(1,2,3-cd)pyrene	1.3	<1.0
Dibenz(a,h)anthracene	1.2	<1.0
Benzo(g,h,i)perylene	1.6	<1.0
PCBs	2.7	<1.0

G-6		
2 - 3ft	SQS ER	CSL ER
Copper	9.92	9.92
Mercury	10.8	7.51
HPAH	1.97	<1.0
G-6 (4 - 5ft)	NE	NE

Legend

Existing and Historical Site Features

4 Elevation contour

DCI-2 Dredge Material Management Unit (DMMU) Designation

DMMU boundaries

Estimated Extent of Surface and Subsurface Sediments Exceeding SQS

Estimated Extent of Surface Sediments Exceeding CSL (0 to 1 foot)

Estimated Extent of Subsurface Sediments Exceeding CSL (1 to 4 feet)

NE = Concentration of chemicals of concern did not exceed the SQS or CSL criteria.

SQS ER = Ratio of analytical result to sediment quality standard criteria.

CSL ER = Ratio of analytical result to cleanup screening level.

Historical Sediment Sample Location and Type

■ Subsurface sediment core

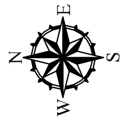
● Surface sediment grab

Future Redevelopment Feature

Planned project Pier 1 dredge boundary

2008 RI/FS Sample Locations and Type

G-7 ▣ Sediment core sample and surface sample location (March 2008)



100 0 100
FEET

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Reference: AutoCAD drawing entitled "Existing Conditions and Project Control", file name 064065.01-1.14.dwg, by PND Engineers, Inc., dated September 2007; and PDF of Figure 1.1 "Sediment Sampling Locations" from the Sediment Sampling Data Report by Floyd Snider, dated 1/3/2007.

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8) CONTOURS AND SURFACE FEATURES AS REPRESENTED HEREON ARE IN CONFORMANCE WITH ACCEPTED INDUSTRY PRACTICE. CONTOUR INTERVAL: 1 FOOT.

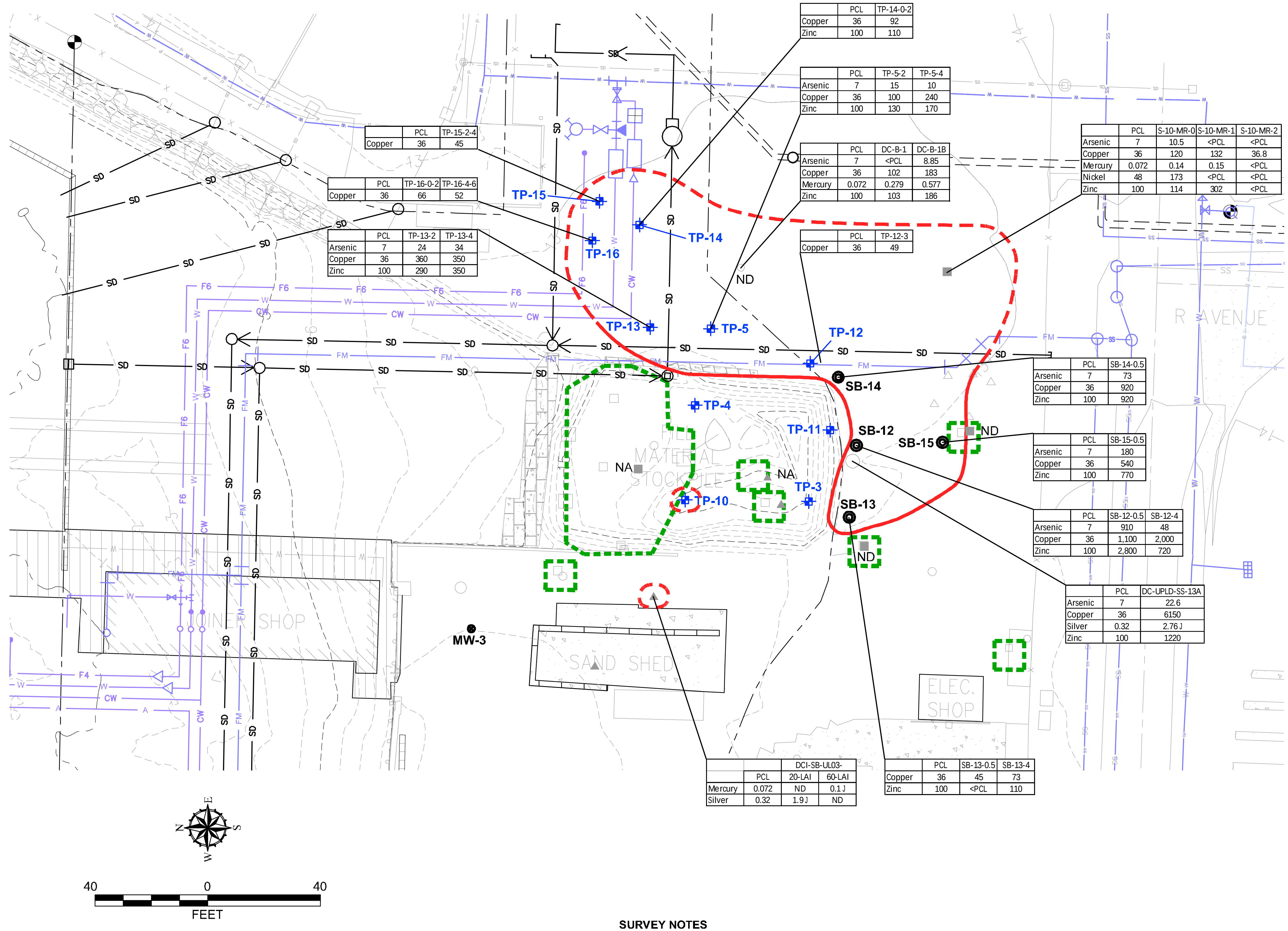
Summary of SQS and CSL Exceedances

Port of Anacortes - Dakota Creek Industries
Anacortes, Washington

GEOENGINEERS

Figure 3

P:\5\5147006\06\CAD\CONSTRUCTION COMPLETION FIGURES\514700605 FIG 3.DWG\TAB:F3 MODIFIED BY TMICHAUD ON SEP 07, 2010 - 15:11



	PCL	TP-14-0-2
Copper	36	92
Zinc	100	110

	PCL	TP-5-2	TP-5-4
Arsenic	7	15	10
Copper	36	100	240
Zinc	100	130	170

	PCL	TP-15-2-4
Copper	36	45

	PCL	TP-16-0-2	TP-16-4-6
Copper	36	66	52

	PCL	TP-13-2	TP-13-4
Arsenic	7	24	34
Copper	36	360	350
Zinc	100	290	350

	PCL	DC-B-1	DC-B-1B
Arsenic	7	<PCL	8.85
Copper	36	102	183
Mercury	0.072	0.279	0.577
Zinc	100	103	186

	PCL	TP-12-3
Copper	36	49

	PCL	S-10-MR-0	S-10-MR-1	S-10-MR-2
Arsenic	7	10.5	<PCL	<PCL
Copper	36	120	132	36.8
Mercury	0.072	0.14	0.15	<PCL
Nickel	48	173	<PCL	<PCL
Zinc	100	114	302	<PCL

	PCL	SB-14-0.5
Arsenic	7	73
Copper	36	920
Zinc	100	920

	PCL	SB-15-0.5
Arsenic	7	180
Copper	36	540
Zinc	100	770

	PCL	SB-12-0.5	SB-12-4
Arsenic	7	910	48
Copper	36	1,100	2,000
Zinc	100	2,800	720

	PCL	DC-UPLD-SS-13A
Arsenic	7	22.6
Copper	36	6150
Silver	0.32	2.76 J
Zinc	100	1220

		DCI-SB-UL03-	
	PCL	20-LAI	60-LAI
Mercury	0.072	ND	0.1 J
Silver	0.32	1.9 J	ND

	PCL	SB-13-0.5	SB-13-4
Copper	36	45	73
Zinc	100	<PCL	110

Legend

Existing and Historical Site Features

—x—	Existing fence
▨	Gravel
▨	Concrete
▨	Rip Rap
- - 4 - -	Elevation contour
◌	Limits of the 2002 Remedial Excavation (Landau Associates, 2002 c)

Historical Soil/Groundwater Sample Location and Type

□	Confirmation soil sample (Landau Associates 2002 a)
○	Environmental Site Assessment (Otten Engineering 1997)
△	Hydraulic winch soil excavation (Landau Associates 2001)
▲	EPA site inspection (Weston 2001)
■	Remedial investigation soil sample (Landau Associates 2002 a)
MW-3 ●	Remedial investigation groundwater sample (Landau Associates 2002 a)
ND =	Arsenic not detected in historic soil sample near potential remediation excavation
NA =	Arsenic not analyzed in historic soil sample near potential remediation excavation

2008 Soil/Groundwater Sample Location and Type

SB-14 ◉	Soil borings
TP-3 ✛	GeoEngineers test pit locations
◌	Estimated limits of potential remediation excavation of arsenic in soil exceedances greater than MTCA Method C protection of human health CUL (for direct contact)

Proposed Project Pier 1 Utility Locations

—SD—	Storm drain line
—SS—	Sanitary sewer
—FM—	Force main
—W—	Water main
—F6—	Fire line
—CW—	Coldwater
—A—	Compressed Air
⊟	Trench drain, in-line catch basin w/ trash bucket
◎	Type 2 catch basin w/ grate per WSDOT Std Plan B10.20-00
○	Type 2 catch basin w/ solid lid per WSDOT Std Plan B10.20-00
○▯	Storm water pump station

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3. See Tables 1 and 2 for tabulated data screened against cleanup criteria.
4. Soil CUL exceedences are presented in black text and groundwater CUL exceedences are presented in blue text.

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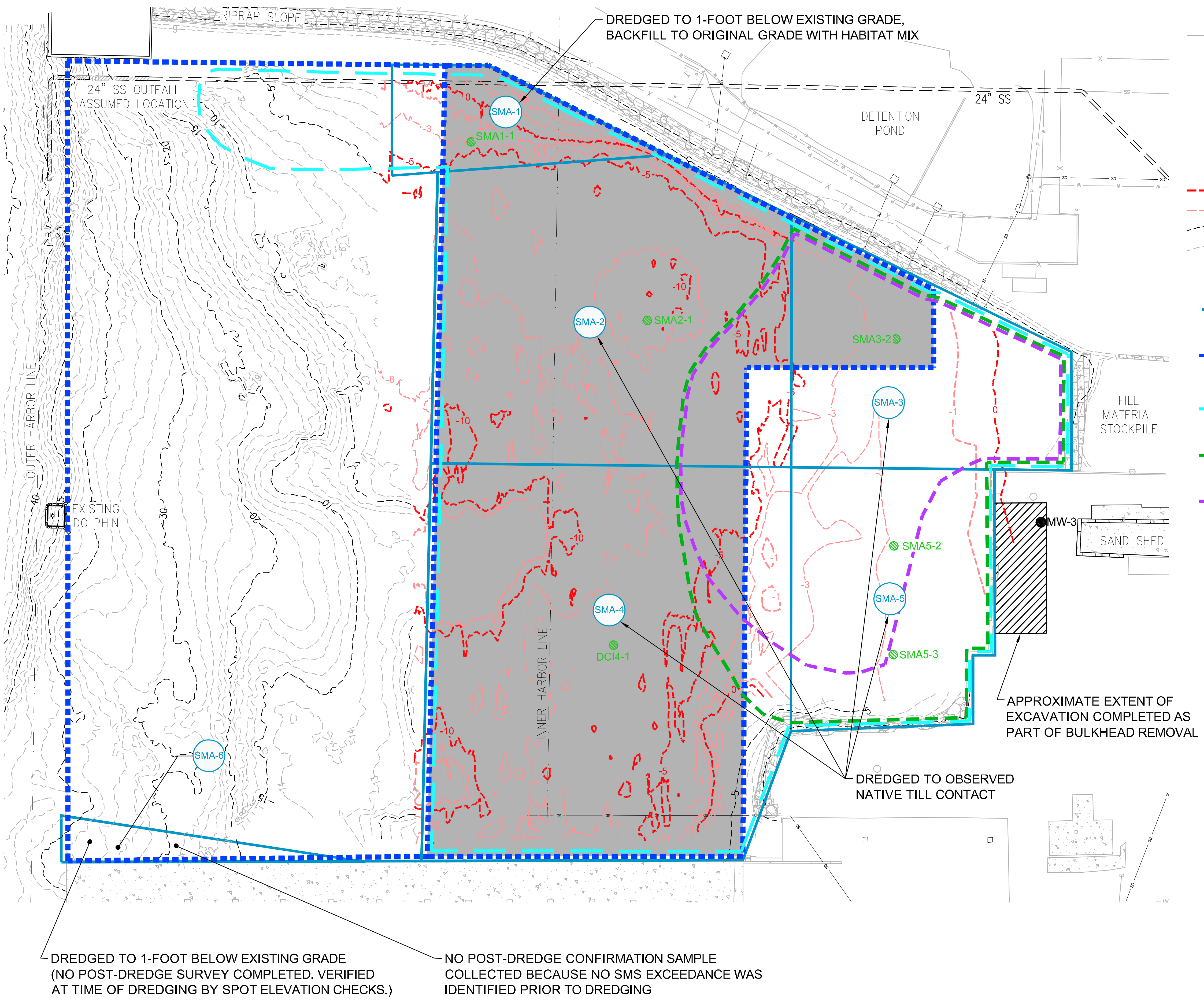
Summary of Preliminary Cleanup Level Exceedances and Upland Sample Locations - Soil

Port of Anacortes - Dakota Creek Industries
Anacortes, Washington

GEOENGINEERS

Figure 4

P:\5\5147006\06\CAD\Construction Completion Figures\514700605 Fig 4.dwg\TAB:Fig 4 Modified by tmichaud on Jul 30, 2010 - 10:16



Legend

—x—	Fence
☐ CB	Catch Basin
○	Sewer manhole
◎	Storm manhole
▨	Gravel
▨	Concrete
▨	Rip Rap
- - -10- - -	Post-dredge surface major contour
- - -1- - -	Post-dredge surface minor contour
- - -5- - -	Pre-dredge surface major contour
- - -4- - -	Pre-dredge surface minor contour
SMA-6	Interim Action Sediment Management Area (SMA) Designation
—	SMA Boundary
SMA1-1 ●	Post-Dredge Confirmation Sample Location
······	DMMU boundaries
▨	DMMU exceeds SQS criteria for PAHs
— —	Estimated Extent of Surface and Subsurface Sediments Exceeding SQS
- - -	Estimated Extent of Surface Sediments Exceeding CSL (0 to 1 foot)
- - -	Estimated Extent of Subsurface Sediments Exceeding CSL (1 to 4 feet)

60 0 60

FEET

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Reference: Base survey: AutoCAD drawing entitled "Existing Conditions and Project Control", file name 064065.01-1.14.dwg, by PND Engineers, Inc., dated September 2007. Dredge surface: Excel file entitled Post Dredge As-Built.xyz provided by DredgeTech LLC on 10-24-2008.

Post-Dredge Surface and Confirmation Sample Locations

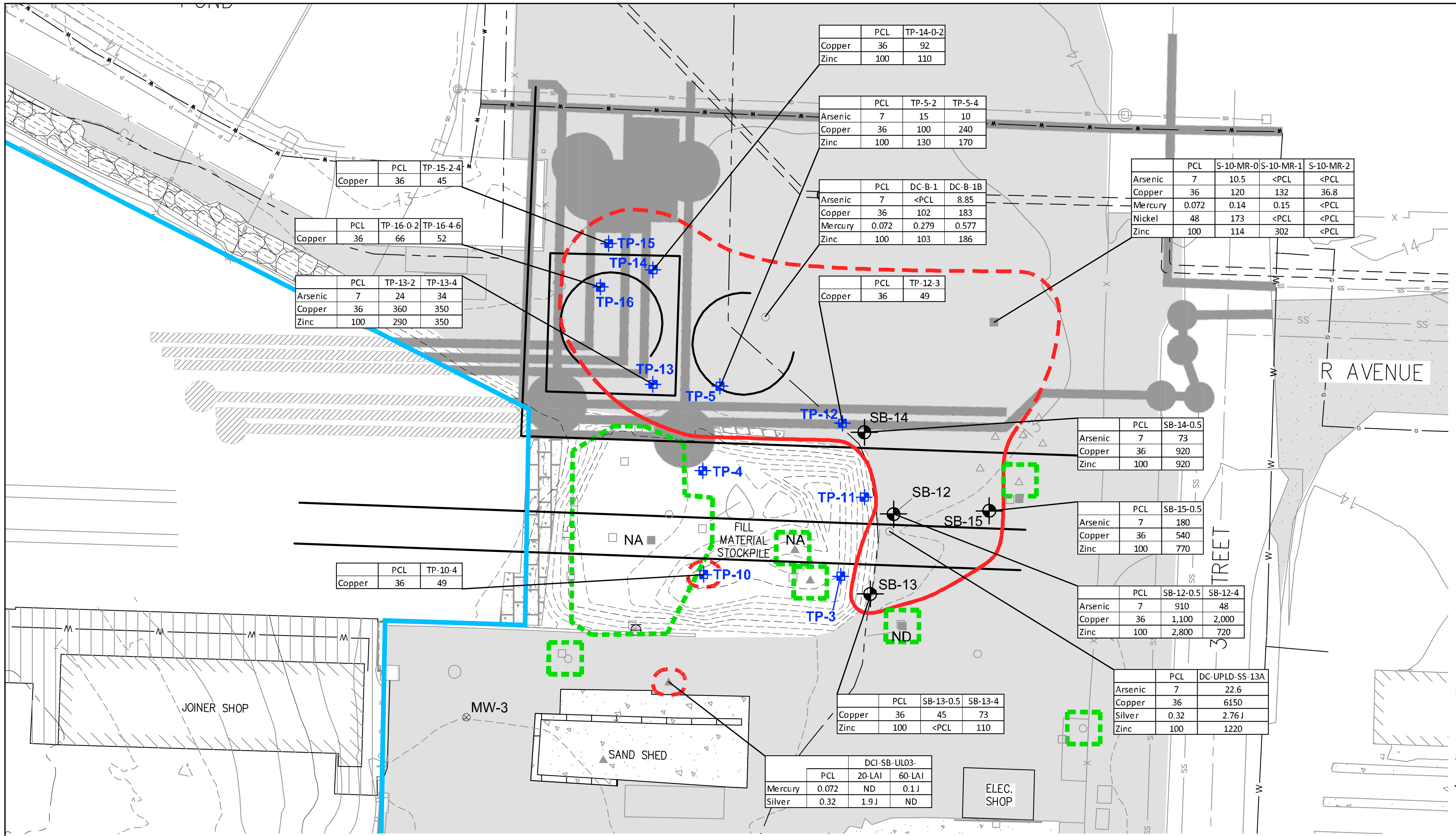
Port of Anacortes - Dakota Creek Industries
Anacortes, Washington

GEOENGINEERS

Figure 5

P:\5\5147006\06\CAD\CONSTRUCTION COMPLETION FIGURES\514700605 FIG 5.DWG\TAB:F5 MODIFIED BY TMICHAUD ON SEP 07, 2010 - 15:12

P:\5\5147006\06\CAD\Construction Completion Figures\514700605 FIG 6.dwg\TAB:Fig 6 modified by tmichaud on Aug 09, 2010 - 11:35



	PCL	TP-14-0-2
Copper	36	92
Zinc	100	110

	PCL	TP-5-2	TP-5-4
Arsenic	7	15	10
Copper	36	100	240
Zinc	100	130	170

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Copper	36	102	183
Mercury	0.072	0.279	0.577
Zinc	100	103	186

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Copper	36	45

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Zinc	100	1220

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Zinc	100	<PCL	110

		DCI-SB-UL03-	
	PCL	20-LAI	60-LAI
Mercury	0.072	ND	0.1 J
Silver	0.32	1.9 J	ND

Legend

Existing and Historical Site Features

—x— Existing fence
▨ Gravel
▨ Concrete
▨ Rip Rap
- - 4 - - Elevation contour
◌ Limits of the 2002 Remedial Excavation (Landau Associates, 2002 c)
◌ Estimated extent of soil exceeding metals preliminary cleanup levels
▬ Area of soil removal performed for utility installation during Interim Action Construction
▨ Area of utility installation performed within new backfill
— Boundary between Marine and Upland Areas

Historical Soil/Groundwater Sample Location and Type

□ Confirmation soil sample (Landau Associates 2002 a)
● TPH soil excavation (A-1 Pump Service 1991)
○ Environmental Site Assessment (Otten Engineering 1997)
△ Hydraulic winch soil excavation (Landau Associates 2001)
▲ EPA site inspection (Weston 2001)
■ Remedial investigation soil sample (Landau Associates 2002 a)
⊗ Remedial investigation groundwater monitoring well (Landau Associates 2002 a)

Remedial Investigation Field Study Sample Location and Type

SB-2 ⊕ Soil borings (GeoEngineers 2008)
MW-5 ⊕ Monitoring well (GeoEngineers 2008)
SS-1 ⊞ Surface soil samples (GeoEngineers 2008)
SB-11 ▲ Hand auger soil boring (GeoEngineers 2008)
TP-15 ⊞ Test pit (GeoEngineers 2008)
ER Ratio of analytical result to preliminary cleanup level

NOTE: Remediated historical exceedences not shown.

N
E
S
W

40 0 40
FEET

NOTES:

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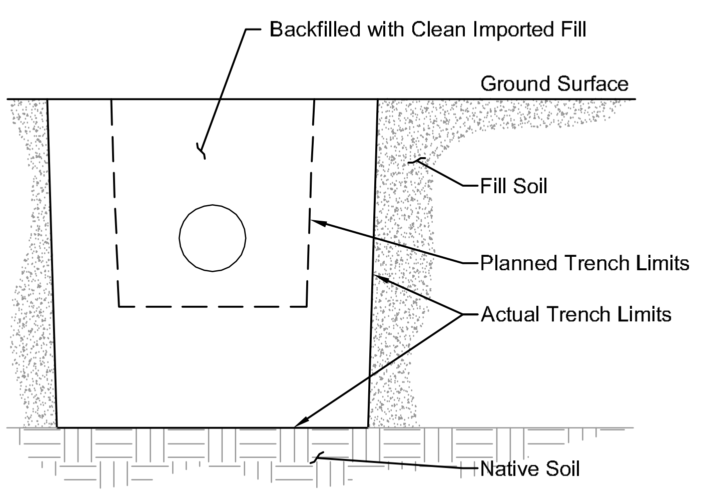

Typical Upland Utility Trench Cross-Section
for Installation in Contaminated Fill

Utility Trench /
Remedial Excavation Locations

Port of Anacortes - Dakota Creek Industries
Anacortes, Washington

GeoEngineers

Figure 6

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APPENDIX L

Worksheet for Calculating Soil Cleanup Levels for Protection of Human Health: Soil Direct Contact Pathway

A2. 1C Worksheet for Calculating Soil Cleanup Levels for Protection of Human Health: (Soil Direct Contact Pathway) Method C: Industrial Land Use (WAC 173-340-745)

Date: 9/5/2019
Site Name: Dakota Creek Industries
Sample Name: DCI

Chemical of Concern or EC Group	Current Condition				Adjusted Condition			
	Measured Soil Conc @dry basis	HQ	RISK	Pass or Fail?	Soil Conc being tested	HQ	RISK	Pass or Fail?
	mg/kg	unitless	unitless		mg/kg	unitless	unitless	
Petroleum EC Fraction								
AL_EC >5-6	0				0.00E+00			
AL_EC >6-8	0				0.00E+00			
AL_EC >8-10	0				0.00E+00			
AL_EC >10-12	250	5.73E-03			2.14E+03	4.91E-02		
AL_EC >12-16	2220	1.11E-01			1.90E+04	9.51E-01		
AL_EC >16-21	0				0.00E+00			
AL_EC >21-34	0				0.00E+00			
AR_EC >8-10	0				0.00E+00			
AR_EC >10-12	0				0.00E+00			
AR_EC >12-16	0				0.00E+00			
AR_EC >16-21	0				0.00E+00			
AR_EC >21-34	0				0.00E+00			
Benzene	0		0.00E+00		0.00E+00		0.00E+00	
Toluene	0				0.00E+00			
Ethylbenzene	0				0.00E+00			
Total Xylenes	0				0.00E+00			
Naphthalene	0				0.00E+00	0.00E+00		
1-Methyl Naphthalene	0				0.00E+00	0.00E+00		
2-Methyl Naphthalene	0				0.00E+00	0.00E+00		
n-Hexane	0				0.00E+00	0.00E+00		
MTBE	0				0.00E+00			
Ethylene Dibromide (EDB)	0		0.00E+00		0.00E+00	0.00E+00	0.00E+00	
1,2 Dichloroethane (EDC)	0		0.00E+00		0.00E+00	0.00E+00	0.00E+00	
Benzo(a)anthracene	0		0.00E+00		0.00E+00		0.00E+00	
Benzo(b)fluoranthene	0		0.00E+00		0.00E+00		0.00E+00	
Benzo(k)fluoranthene	0		0.00E+00		0.00E+00		0.00E+00	
Benzo(a)pyrene	0		0.00E+00		0.00E+00		0.00E+00	
Chrysene	0		0.00E+00		0.00E+00		0.00E+00	
Dibenz(a,h)anthracene	0		0.00E+00		0.00E+00		0.00E+00	
Indeno(1,2,3-cd)pyrene	0		0.00E+00		0.00E+00		0.00E+00	
Sum	**2470**	1.17E-01	0.00E+00		2.12E+04	1.00E+00	0.00E+00	

TEST CURRENT CONDITION

Measured TPH Soil Conc, mg/kg= 2470.000
HI= 1.167E-01
RISK= 0.000E+00
Pass or Fail? Pass

Check Residual Saturation (WAC340-747(10))

CALCULATE PROTECTIVE CONDITION

This tool allows the user to calculate protective TPH soil concentration based on various soil quality criteria. The Workbook uses the same composition ratio as for the measured data.

Calculate Protective TPH soil Conc

Selected Criterion: @HI=1
Most Stringent? YES

Protctive TPH Soil Conc, mg/kg = 21160.093
HI = 1.000E+00
RISK = 0.000E+00

Check Residual Saturation (WAC340-747(10))

TEST ADJUSTED CONDITION

This tool allows the user to test whether a particular TPH soil concentration is protective of human health. The Workbook uses the same composition ratio as for the measured data.

Test Adjusted TPH Soil Conc

Tested TPH Soil Conc, mg/kg= 21160.093
HI= 1.000E+00
RISK= 0.000E+00
Pass or Fail? Pass

Check Residual Saturation (WAC340-747(10))

APPENDIX M

Cleanup Action Alternative Cost Estimates

Table M-1

Cleanup Action Alternative 1 (Containment and Compliance Monitoring) Cost Estimate

Dakota Creek Industries
Anacortes, Washington

Item No.	Item Description	Estimated Quantity[1]	Unit Cost[2] (2021$)	Unit	Estimated Cost	Notes/ Assumptions
Construction						
1	Mobilization/Demobilization	1	10	%	$39,732	Includes mobilization to the site, installation of temporary site controls including temporary traffic, and erosion and sediment controls (as applicable), and demob from the site. Estimated as 10% of construction costs.
2	Excavation of Existing Surface to Support New Asphalt Pavement Cap	1,375	$10	CY	$13,750	Assumes excavation of top 9 inches of existing gravel working surface to create space for placement of asphalt pavement cap. Cost includes on-site management/stockpiling of the material.
3	Transport and Disposal of Material Generated from Excavation for New Asphalt Pavement Cap	2,475	$75	TON	$185,625	Assume 1.8 ton/cy (in-place). Assumes that the material generated will be transported to a landfill for permitted disposal.
4	Waste Disposal Characterization Sample Analysis	7	$65	EA	$447	Assumes 1 multi-point composite sample per 200 cubic yards of material generated for off-site disposal. Additional soil characterization may be required by the receiving facility to support waste disposal acceptance.
5	Placement of New Asphalt Pavement Cap	5,500	$35	SY	$192,500	Assumes placement of 5 inches of base course and 4 inches of asphalt; no new stormwater system installation; and stormwater runoff flows to existing drainage structures or match existing drainage pattern.
6	Installation of Warning Signs	1	$5,000	LS	$5,000	Includes installation of warning signs at Site to protect employees and the general public.
				Total Construction Cost	**$437,054**	
Compliance Monitoring						
7	Compliance Groundwater Sampling and Reporting	10	$8,500	EVNT	$85,000	Perform compliance monitoring on a semi-annual basis for up to five years utilizing the existing network. Assumes up to seven wells will be sampled per monitoring event and preparation of annual monitoring reports summarizing results for Ecology submittal.
8	Compliance Groundwater Sample Analysis	12	$2,800	EVNT	$28,000	Compliance monitoring includes chemical analysis of cPAHs and/or total and dissolved metals at each of the selected monitoring well locations including duplicate sample per sampling event.
9	Long-Term Groundwater Sampling and Reporting	5	$8,500	EVNT	$42,500	Perform long-term groundwater monitoring utilizing the existing network of wells. It is assumed that groundwater monitoring would be competed once per Ecology Five Year Periodic Review period for up to 25 years following completion of the compliance monitoring period. Assumes up to seven wells will be sampled per monitoring event and preparation of an annual monitoring reports summarizing results for Ecology submittal.
10	Long-Term Groundwater Sample Analysis	5	$2,800	EVNT	$14,000	Compliance monitoring includes chemical analysis of cPAHs and/or total and dissolved metals at each of the selected monitoring well locations including duplicate sample per sampling event.
11	Purge Water Testing and Disposal	15	$275	EA	$4,125	Disposal fee for purge water generated during each monitoring event. Assumes one 55-gallon drum per monitoring event will be generated for disposal.
12	Annual Cap Inspection and Reporting	30	$6,500	EVNT	$195,000	Perform visual inspection on an annual basis for to observe the conditions of the pavement cap surfaces and document the result of each inspection in an annual cap inspection report for Ecology submittal. Cap inspection and report will be in perpetuity as long as the cap exists and contamination remains onsite. For cost estimating purposes, a minimum of 30 years is assumed.
				Total Compliance Monitoring Cost	**$368,625**	
Professional/Administrative Support						
13	Compliance Monitoring Plan	1	$45,000	LS	$45,000	The Compliance Monitoring Plan will detail the groundwater confirmational and long-term monitoring to verify the effectiveness of the cleanup action.
14	Institutional Controls Monitoring and Maintenance Plan	1	$65,000	LS	$65,000	Institutional Controls Monitoring and Maintenance Plan to identify the controls that are being utilized at the Site, to provide guidelines for the monitoring and maintenance, and handling and disposal of soil and groundwater encountered during future Site maintenance and/or development activities.

Item No.	Item Description	Estimated Quantity[1]	Unit Cost[2] (2019$)	Unit	Estimated Cost	Notes/ Assumptions
15	Project Planning, Design and Construction Management Support	1	$65,000	LS	$65,000	Percentage of total construction and compliance monitoring cost. Consists of permitting, remedial design, bid drawings and specifications, and regulatory support that are necessary to implement the remedial alternative.
				Total Professional/Administrative Services	**$175,000**	
				Cleanup Alternative Subtotal	**$980,679**	Subtotal of construction, compliance monitoring and professional/administrative costs.
				Sales Tax (8.7%)	**$38,024**	Sales tax applied to construction costs.
				Contingency (20%)	**$203,741**	Assumes 20 percent contingency for construction, compliance monitoring and professional/administrative costs to cover unknowns, unforeseen circumstances, or unanticipated conditions.
				Cleanup Alternative Total[3]	**$1,180,000**	Accuracy of the total remedial alternative cost is considered -30 to +50 % based on EPA's Guide to Developing and Documenting Cost Estimates During the Feasibility Study.

Notes:

[1] Concept design level.

[2] Unit costs based on a combination of published engineering reference manuals (i.e., 2019 RS Means Heavy Construction Cost Data Manual); construction cost estimates solicited from applicable vendors and contractors; review of actual costs incurred during similar, applicable projects; and professional judgment. Unit costs are based on 2019 dollars.

[3] Total Remedial Action Alternative Costs are rounded up to the nearest $10,000.

LS = lump sum
CY = cubic yard
SY = square yard
EA = each
EVNT = event
RCRA = Resource Conservation and Recovery Act

Table M-2

Cleanup Action Alternative 2 (Partial Source Area Removal) Cost Estimate

Dakota Creek Industries
Anacortes, Washington

Item No.	Item Description	Estimated Quantity[1]	Unit Cost[2] (2021$)	Unit	Estimated Cost	Notes/ Assumptions
Construction						
1	Mobilization/Demobilization	1	10	%	$86,472	Includes mobilization to the site, installation of temporary site controls including temporary traffic, and erosion and sediment controls (as applicable), and demob from the site. Estimated as 10% of construction costs.
2	Asphalt Demolition	1,500	$20	SY	$30,000	Includes removal of existing asphalt surface and portion of top course surfacing material in source areas. Assumes removal depth to 6" below ground surface.
3	Demolition Debris Recycling/Disposal	450	$25	TON	$11,250	Includes loading and transportation of demolished asphalt debris to permitted recycling facility.
4	Monitoring Well Decommissioning by Licensed Driller	1	$1,500	LS	$1,500	Decommission MW-7 prior to construction.
5	Excavation Dewatering, Treatment and Disposal	1	$35,000	LS	$35,000	Unit cost based on similar projects.
6	Soil Removal, Handling and Loading	3,600	$10	CY	$36,000	Assume in-place volume. Cost includes excavation, handling, stockpile and loading.
7	Contaminated Soil Transport and Disposal	6,480	$75	TON	$486,000	Assume 1.8 ton/cy (in-place). Assumes that the material generated will be transported and disposed at a RCRA Subtitle D landfill.
8	Waste Disposal Characterization Sample Analysis	7	$65	EA	$468	Assumes 1 multi-point composite sample per 500 cubic yards of material generated for off-site disposal. Additional soil characterization may be required by the receiving facility to support waste disposal acceptance.
9	Utility Protection and/or Temporary Relocation and Restoration	1	$35,000	LS	$35,000	Protect utilities and/or temporarily reroute and restore to facilitate remedial excavation activities.
10	Purchase, Place and Compact Backfill Material	6,480	$25	TON	$162,000	Cost includes purchase, filling and compaction.
11	Surveying	1	$10,000	LS	$10,000	Unit cost based on similar projects.
12	Placement of Asphalt Pavement to Restore Source Area Excavation	1,500	$35	SY	$52,500	Assumes placement of 5 inches of base course and 4 inches of asphalt; no new stormwater system installation; and stormwater runoff flows to existing drainage structures or match existing drainage pattern.
13	Installation of Warning Signs	1	$5,000	LS	$5,000	Includes installation of warning signs at Site to protect employees and the general public.
				Total Construction Cost	**$951,190**	
Compliance Monitoring						
14	Confirmation Soil Sample Analysis	30	$65	EA	$1,950	Verification sidewall and base samples to confirm the limits the soil removal activities. Assumes one sample per 40 linear feet of sidewall and one sample per 625 square feet of base and 10 % duplicate samples.
15	Monitoring Well Installation by Licensed Driller	1	$3,500	LS	$3,500	Install one replacement monitoring well following soil removal and backfilling.
16	Compliance Groundwater Sampling and Reporting	12	$6,500	EVNT	$78,000	Perform compliance monitoring on a semi-annual basis for up to five years utilizing the existing network. Assumes up to five wells will be sampled per monitoring event and preparation of annual monitoring reports summarizing results for Ecology submittal.
17	Compliance Groundwater Sample Analysis	10	$2,100	EVNT	$21,000	Compliance monitoring includes chemical analysis of cPAHs and/or total and dissolved metals at each of the selected monitoring well locations including duplicate sample per sampling event.
18	Long-Term Groundwater Sampling and Reporting	5	$8,500	EVNT	$42,500	Perform long-term groundwater monitoring utilizing the existing network of wells. It is assumed that groundwater monitoring would be competed once per Ecology Five Year Periodic Review period for up to 25 years following completion of the compliance monitoring period. Assumes up to seven wells will be sampled per monitoring event and preparation of an annual monitoring reports summarizing results for Ecology submittal.

Item No.	Item Description	Estimated Quantity[1]	Unit Cost[2] (2019$)	Unit	Estimated Cost	Notes/ Assumptions
19	Long-Term Groundwater Sample Analysis	5	$2,800	EVNT	$14,000	Compliance monitoring includes chemical analysis of cPAHs and/or total and dissolved metals at each of the selected monitoring well locations including duplicate sample per sampling event.
20	Purge Water Testing and Disposal	15	$275	EA	$4,125	Disposal fee for purge water generated during each monitoring event. Assumes one 55-gallon drum per monitoring event will be generated for disposal.
21	Annual Cap Inspection and Reporting	30	$6,500	EVNT	$195,000	Perform visual inspection on an annual basis for to observe the conditions of the pavement cap surfaces and document the result of each inspection in an annual cap inspection report for Ecology submittal. Cap inspection and report will be in perpetuity as long as the cap exists and contamination remains onsite. For cost estimating purposes, a minimum of 30 years is assumed.
				Total Compliance Monitoring Cost	**$360,075**	
Professional/Administrative Support						
22	Engineering Design Report and Compliance Monitoring Plan	1	$65,000	LS	$65,000	Engineering Design Report will detail the plans and procedures that will be used for cleanup of the Site. The Compliance Monitoring Plan will detail the groundwater performance, confirmational and long-term monitoring to verify the effectiveness of the cleanup action.
24	Cleanup Action Report	1	$65,000	LS	$65,000	Cleanup Action Report will detail the soil removal, verification sampling and restoration activities completed during construction.
25	Institutional Controls Monitoring and Maintenance Plan	1	$65,000	LS	$65,000	Institutional Controls Monitoring and Maintenance Plan to identify the controls that are being utilized at the Site, to provide guidelines for the monitoring and maintenance, and handling and disposal of soil and groundwater encountered during future Site maintenance and/or development activities.
23	Project Planning, Design and Construction Management Support	1	$180,000	LS	$180,000	Percentage of total construction and compliance monitoring cost. Consists of permitting, remedial design, bid drawings and specifications, and regulatory support that are necessary to implement the remedial alternative.
				Total Professional/Administrative Services	**$375,000**	
				Cleanup Alternative Subtotal	**$1,686,265**	Subtotal of construction, compliance monitoring and professional/administrative costs.
				Sales Tax (8.7%)	**$82,754**	Sales tax applied to construction costs.
				Contingency (20%)	**$353,804**	Assumes 20 percent contingency for construction, compliance monitoring and professional/administrative costs to cover unknowns, unforeseen circumstances, or unanticipated conditions.
				Cleanup Alternative Total[3]	**$2,120,000**	Accuracy of the total remedial alternative cost is considered -30 to +50 % based on EPA's Guide to Developing and Documenting Cost Estimates During the Feasibility Study.

Notes:

[1] Concept design level.

[2] Unit costs based on a combination of published engineering reference manuals (i.e., 2019 RS Means Heavy Construction Cost Data Manual); construction cost estimates solicited from applicable vendors and contractors; review of actual costs incurred during similar, applicable projects; and professional judgment. Unit costs are based on 2019 dollars.

[3] Total Remedial Action Alternative Costs are rounded up to the nearest $10,000.

LS = lump sum
CY = cubic yard
SY = square yard
EA = each
EVNT = event
TON = tons
SF = square feet
RCRA = Resource Conservation and Recovery Act

Table M-3

Cleanup Action Alternative 3 (Source Area In Situ Treatment) Cost Estimate

Dakota Creek Industries
Anacortes, Washington

Item No.	Item Description	Estimated Quantity[1]	Unit Cost[2] (2021$)	Unit	Estimated Cost	Notes/ Assumptions
Construction						
1	Mobilization/Demobilization	1	10	%	$124,705	Includes mobilization to the site, installation of temporary site controls including temporary traffic, and erosion and sediment controls (as applicable), and demob from the site. Estimated as 10% of construction costs.
2	Installation of Temporary Injection Wells and Vaults	7,800	$45	CY	$351,000	Includes installation of injection wells, piping and injection system vaults.
3	Installation of Temporary Monitoring Wells to Evaluate In Situ Treatment Performance	6	$3,500	EA	$21,000	Includes installation of additional groundwater monitoring wells to monitor in situ treatment performance.
4	In Situ Treatment	7,800	$60	CY	$468,000	Includes purchase of chemical reagents and in situ injection of reagents within contaminant source areas. Assumes two rounds of injection events.
5	Excavation of Existing Surface to Support New Asphalt Pavement Cap	1,375	$10	CY	$13,750	Assumes excavation of top 9 inches of existing gravel working surface to create space for placement of asphalt pavement cap. Cost includes on-site management/stockpiling of the material.
6	Transport and Disposal of Material Generated from Excavation for New Asphalt Pavement Cap	2,475	$75	TON	$185,625	Assume 1.8 ton/cy (in-place). Assumes that the material generated will be transported to a landfill for permitted disposal.
7	Waste Disposal Characterization Sample Analysis	3	$65	EA	$179	Assumes 1 multi-point composite sample per 500 cubic yards of material generated for off-site disposal. Additional soil characterization may be required by the receiving facility to support waste disposal acceptance.
8	Placement of New Asphalt Pavement Cap	5,500	$35	SY	$192,500	Assumes placement of 5 inches of base course and 4 inches of asphalt; no new stormwater system installation; and stormwater runoff flows to existing drainage structures or match existing drainage pattern.
9	Surveying	1	$10,000	LS	$10,000	Includes surveying of injection locations and survey records documentation.
10	Installation of Warning Signs	1	$5,000	LS	$5,000	Includes installation of warning signs at Site to protect employees and the general public.
				Total Construction Cost	**$1,371,759**	
Compliance Monitoring						
11	Performance Groundwater Sampling and Reporting	8	$7,250	EVNT	$58,000	Perform performance monitoring on a quarterly basis for up to two years at new temporary monitoring well locations to evaluate in situ treatment performance. Assumes up to six wells will be monitored per sampling event.
12	Performance Groundwater Sample Analysis	8	$2,450	EVNT	$19,600	Compliance monitoring includes chemical analysis of cPAHs and/or total and dissolved metals at each of the selected monitoring well locations including duplicate sample per sampling event.
13	Compliance Groundwater Sampling and Reporting	10	$8,500	EVNT	$85,000	Perform compliance monitoring on a semi-annual basis for up to five years utilizing the existing network. Assumes up to seven wells will be sampled per monitoring event and preparation of annual monitoring reports summarizing results for Ecology submittal.
14	Compliance Groundwater Sample Analysis	10	$2,800	EVNT	$28,000	Compliance monitoring includes chemical analysis of cPAHs and/or total and dissolved metals at each of the selected monitoring well locations including duplicate sample per sampling event.
15	Long-Term Groundwater Sampling and Reporting	5	$8,500	EVNT	$42,500	The Compliance Monitoring Plan will detail the groundwater confirmational and long-term monitoring to verify the effectiveness of the cleanup action.
16	Long-Term Groundwater Sample Analysis	5	$2,800	EVNT	$14,000	Prepare Institutional Controls Monitoring and Maintenance Plan to identify the controls that are being utilized at the Site, to provide guidelines for the monitoring and maintenance, and handling and disposal of soil and groundwater encountered during future Site maintenance and/or development activities.

Item No.	Item Description	Estimated Quantity[1]	Unit Cost[2] (2019$)	Unit	Estimated Cost	Notes/ Assumptions
17	Purge Water Testing and Disposal	18	$275	EA	$4,950	Disposal fee for purge water generated during each monitoring event. Assumes one 55-gallon drum per monitoring event will be generated for disposal.
18	Annual Cap Inspection and Reporting	30	$6,500	EVNT	$195,000	Perform visual inspection on an annual basis for to observe the conditions of the pavement cap surfaces and document the result of each inspection in an annual cap inspection report for Ecology submittal. Cap inspection and report will be in perpetuity as long as the cap exists and contamination remains onsite. For cost estimating purposes, a minimum of 30 years is assumed.
				Total Compliance Monitoring Cost	**$447,050**	
Professional/Administrative Support						
19	Engineering Design Report and Compliance Monitoring Plan	1	$85,000	LS	$85,000	Engineering Design Report will detail the plans and procedures that will be used for cleanup of the Site. The Compliance Monitoring Plan will detail the groundwater performance, confirmational and long-term monitoring to verify the effectiveness of the cleanup action.
20	Treatability Study	1	$100,000	LS	$100,000	Perform laboratory-scale treatability study to develop full-scale design including determination of engineering parameters (pressure, flow, temperature, mixing energy, etc.), required chemical reagent dosage, and chemical compatibility in order to design, optimize or troubleshoot full-scale processes.
21	Cleanup Action Report	1	$80,000	LS	$80,000	Cleanup Action Report will detail the in situ treatment activities, compliance monitoring and restoration activities completed during construction.
22	Institutional Controls Monitoring and Maintenance Plan	1	$65,000	LS	$65,000	Institutional Controls Monitoring and Maintenance Plan to identify the controls that are being utilized at the Site, to provide guidelines for the monitoring and maintenance, and handling and disposal of soil and groundwater encountered during future Site maintenance and/or development activities.
23	Project Planning, Design and Construction Management Support	1	$230,000	LS	$230,000	Percentage of total construction and compliance monitoring cost. Consists of permitting, remedial design, bid drawings and specifications, and regulatory support that are necessary to implement the remedial alternative.
				Total Professional/Administrative Services	**$330,000**	
				Cleanup Alternative Subtotal	**$2,148,809**	Subtotal of construction, compliance monitoring and professional/administrative costs.
				Sales Tax (8.7%)	**$119,343**	Sales tax applied to construction costs.
				Contingency (20%)	**$453,630**	Assumes 20 percent contingency for construction, compliance monitoring and professional/administrative costs to cover unknowns, unforeseen circumstances, or unanticipated conditions.
				Cleanup Alternative Total[3]	**$2,610,000**	Accuracy of the total remedial alternative cost is considered -30 to +50 % based on EPA's Guide to Developing and Documenting Cost Estimates During the Feasibility Study.

Notes:

[1] Concept design level.

[2] Unit costs based on a combination of published engineering reference manuals (i.e., 2019 RS Means Heavy Construction Cost Data Manual); construction cost estimates solicited from applicable vendors and contractors; review of actual costs incurred during similar, applicable projects; and professional judgment. Unit costs are based on 2019 dollars.

[3] Total Remedial Action Alternative Costs are rounded up to the nearest $10,000.

LS = lump sum
CY = cubic yard
SY = square yard
EA = each
EVNT = event
RCRA = Resource Conservation and Recovery Act

Table M-4

Cleanup Action Alternative 4 (Source Area Removal) Cost Estimate

Dakota Creek Industries
Anacortes, Washington

Item No.	Item Description	Estimated Quantity[1]	Unit Cost[2] (2021$)	Unit	Estimated Cost	Notes/ Assumptions
Construction						
1	Mobilization/Demobilization	1	10	%	$218,267	Includes mobilization to the site, installation of temporary site controls including temporary traffic, and erosion and sediment controls (as applicable), and demob from the site. Estimated as 10% of construction costs.
2	Asphalt Demolition	2,400	$20	SY	$48,000	Includes removal of existing asphalt surface and portion of top course surfacing material in source areas. Assumes removal depth to 6" below ground surface.
3	Demolition Debris Recycling/Disposal	720	$25	TON	$18,000	Includes loading and transportation of demolished asphalt debris to permitted recycling facility.
4	Monitoring Well Decommissioning by Licensed Driller	1	$1,500	LS	$1,500	Decommission MW-7 prior to construction.
5	Excavation Dewatering, Treatment and Disposal	1	$65,000	LS	$65,000	Unit cost based on similar projects.
6	Temporary Excavation Shoring	6,000	$30	SF	$180,000	Assumes installation and removal of temporary excavation shoring, 200 ft (L) x 30 ft (D), 6,000 SF.
7	Soil Removal, Handling and Loading	9,000	$10	CY	$90,000	Assume in-place volume. Cost includes excavation, handling, stockpile and loading.
8	Contaminated Soil Transport and Disposal	16,200	$75	TON	$1,215,000	Assume 1.8 ton/cy (in-place). Assumes that the material generated will be transported and disposed at Cadman in Everett under their Class II material designation.
9	Waste Disposal Characterization Sample Analysis	18	$65	EA	$1,170	Assumes 1 multi-point composite sample per 500 cubic yards of material generated for off-site disposal. Additional soil characterization may be required by the receiving facility to support waste disposal acceptance.
10	Utility Protection and/or Temporary Relocation and Restoration	1	$50,000	LS	$50,000	Protect utilities and/or temporarily reroute and restore to facilitate remedial excavation activities.
11	Purchase, Place and Compact Backfill Material	16,200	$25	TON	$405,000	Cost includes purchase, filling and compaction.
12	Surveying	1	$20,000	LS	$20,000	Unit cost based on similar projects.
13	Placement of Asphalt Pavement to Restore Source Area Excavation	2,400	$35	SY	$84,000	Assumes placement of 5 inches of base course and 4 inches of asphalt; no new stormwater system installation; and stormwater runoff flows to existing drainage structures or match existing drainage pattern.
14	Installation of Warning Signs	1	$5,000	LS	$5,000	Includes installation of warning signs at Site to protect employees and the general public.
				Total Construction Cost	**$2,400,937**	
Compliance Monitoring						
15	Confirmation Soil Sample Analysis	65	$65	EA	$4,225	Verification sidewall and base samples to confirm the limits the soil removal activities. Assumes one sample per 40 linear feet of sidewall and one sample per 625 square feet of base and 10 % duplicate samples.
16	Monitoring Well Installation by Licensed Driller	1	$3,500	LS	$3,500	Install one replacement monitoring well following soil removal and backfilling.
17	Compliance Groundwater Sampling and Reporting	12	$8,500	EVNT	$85,000	Perform compliance monitoring on a semi-annual basis for up to five years utilizing the existing network. Assumes up to seven wells will be sampled per monitoring event and preparation of annual monitoring reports summarizing results for Ecology submittal.
18	Compliance Groundwater Sample Analysis	10	$2,800	EVNT	$28,000	Compliance monitoring includes chemical analysis of cPAHs and/or total and dissolved metals at each of the selected monitoring well locations including duplicate sample per sampling event.

Item No.	Item Description	Estimated Quantity[1]	Unit Cost[2] (2019$)	Unit	Estimated Cost	Notes/ Assumptions
19	Long-Term Groundwater Sampling and Reporting	5	$8,500	EVNT	$42,500	Perform long-term groundwater monitoring utilizing the existing network of wells. It is assumed that groundwater monitoring would be competed once per Ecology Five Year Periodic Review period for up to 25 years following completion of the compliance monitoring period. Assumes up to seven wells will be sampled per monitoring event and preparation of an annual monitoring reports summarizing results for Ecology submittal.
20	Long-Term Groundwater Sample Analysis	5	$2,800	EVNT	$14,000	Compliance monitoring includes chemical analysis of cPAHs and/or total and dissolved metals at each of the selected monitoring well locations including duplicate sample per sampling event.
21	Purge Water Testing and Disposal	15	$275	EA	$4,125	Disposal fee for purge water generated during each monitoring event. Assumes one 55-gallon drum per monitoring event will be generated for disposal.
22	Annual Cap Inspection and Reporting	30	6500	EVNT	$195,000	Perform visual inspection on an annual basis for to observe the conditions of the pavement cap surfaces and document the result of each inspection in an annual cap inspection report for Ecology submittal. Cap inspection and report will be in perpetuity as long as the cap exists and contamination remains onsite. For cost estimating purposes, a minimum of 30 years is assumed.
Total Compliance Monitoring Cost					**$376,350**	
Professional/Administrative Support						
23	Engineering Design Report and Compliance Monitoring Plan	1	$135,000	LS	$135,000	Engineering Design Report will detail the plans and procedures that will be used for cleanup of the Site. The Compliance Monitoring Plan will detail the groundwater performance, confirmational and long-term monitoring to verify the effectiveness of the cleanup action.
24	Cleanup Action Report	1	$150,000	LS	$150,000	Cleanup Action Report will detail the soil removal, verification sampling and restoration activities completed during construction.
25	Institutional Controls Monitoring and Maintenance Plan	1	$65,000	LS	$65,000	Institutional Controls Monitoring and Maintenance Plan to identify the controls that are being utilized at the Site, to provide guidelines for the monitoring and maintenance, and handling and disposal of soil and groundwater encountered during future Site maintenance and/or development activities.
26	Project Planning, Design and Construction Management Support	1	$325,000	LS	$325,000	Percentage of total construction and compliance monitoring cost. Consists of permitting, remedial design, bid drawings and specifications, and regulatory support that are necessary to implement the remedial alternative.
Total Professional/Administrative Services					**$675,000**	
Cleanup Alternative Subtotal					**$3,452,287**	Subtotal of construction, compliance monitoring and professional/administrative costs.
Sales Tax (8.7%)					**$208,882**	Sales tax applied to construction costs.
Contingency (20%)					**$732,234**	Assumes 20 percent contingency for construction, compliance monitoring and professional/administrative costs to cover unknowns, unforeseen circumstances, or unanticipated conditions.
Cleanup Alternative Total[3]					**$4,390,000**	Accuracy of the total remedial alternative cost is considered -30 to +50 % based on EPA's Guide to Developing and Documenting Cost Estimates During the Feasibility Study.

Notes:

[1] Concept design level.

[2] Unit costs based on a combination of published engineering reference manuals (i.e., 2019 RS Means Heavy Construction Cost Data Manual); construction cost estimates solicited from applicable vendors and contractors; review of actual costs incurred during similar, applicable projects; and professional judgment. Unit costs are based on 2019 dollars.

[3] Total Remedial Action Alternative Costs are rounded up to the nearest $10,000.

LS = lump sum
CY = cubic yard
SY = square yard
EA = each
EVNT = event
TON = tons
SF = square feet
RCRA = Resource Conservation and Recovery Act

Table M-5

Cleanup Action Alternative 5 (Site-Wide In Situ Treatment) Cost Estimate

Dakota Creek Industries
Anacortes, Washington

Item No.	Item Description	Estimated Quantity[1]	Unit Cost[2] (2021$)	Unit	Estimated Cost	Notes/ Assumptions
Construction						
1	Mobilization/Demobilization	1	10	%	$412,905	Includes mobilization to the site, installation of temporary site controls including temporary traffic, and erosion and sediment controls (as applicable), and demob from the site. Estimated as 10% of construction costs.
2	Installation of Temporary Injection Wells and Vaults	35,000	$45	CY	$1,575,000	Includes installation of injection wells, piping and injection system vaults.
3	Installation of Temporary Monitoring Wells to Evaluate In Situ Treatment Performance	12	$3,500	EA	$42,000	Includes installation of additional groundwater monitoring wells to monitor in situ treatment performance.
4	In Situ Treatment	35,000	$60	CY	$2,100,000	Includes purchase of chemical reagents and in situ injection of reagents within contaminant source areas. Assumes two rounds of injection events.
5	Excavation of Existing Surface to Support New Asphalt Pavement Cap	1,375	$10	CY	$13,750	Assumes excavation of top 9 inches of existing gravel working surface to create space for placement of asphalt pavement cap. Cost includes on-site management/stockpiling of the material.
6	Transport and Disposal of Material Generated from Excavation for New Asphalt Pavement Cap	2,475	$75	TON	$185,625	Assume 1.8 ton/cy (in-place). Assumes that the material generated will be transported to a landfill for permitted disposal.
7	Waste Disposal Characterization Sample Analysis	3	$65	EA	$179	Assumes 1 multi-point composite sample per 500 cubic yards of material generated for off-site disposal. Additional soil characterization may be required by the receiving facility to support waste disposal acceptance.
7	Placement of New Asphalt Pavement Cap	5,500	$35	SY	$192,500	Assumes placement of 5 inches of base course and 4 inches of asphalt; no new stormwater system installation; and stormwater runoff flows to existing drainage structures or match existing drainage pattern.
8	Surveying	1	$15,000	LS	$15,000	Includes surveying of injection locations and survey records documentation.
9	Installation of Warning Signs	1	$5,000	LS	$5,000	Includes installation of warning signs at Site to protect employees and the general public.
				Total Construction Cost	**$4,541,959**	
Compliance Monitoring						
13	Performance Groundwater Sampling and Reporting	8	$14,500	EVNT	$58,000	Perform performance monitoring on a quarterly basis for up to two years at selected monitoring well locations to evaluate in situ treatment performance. Assumes up to fourteen wells will be monitored per sampling event.
14	Performance Groundwater Sample Analysis	8	$4,900	EVNT	$19,600	Chemical analysis of cPAHs and/or total and dissolved metals at selected monitoring well locations (assumes up to fourteen wells) during quarterly performance monitoring. Includes duplicate sample per sampling event.
15	Compliance Groundwater Sampling and Reporting	10	$8,500	EVNT	$85,000	Perform compliance monitoring on a semi-annual basis for up to five years utilizing the existing network. Assumes up to seven wells will be sampled per monitoring event and preparation of annual monitoring reports summarizing results for Ecology submittal.
16	Compliance Groundwater Sample Analysis	10	$2,800	EVNT	$28,000	Compliance monitoring includes chemical analysis of cPAHs and/or total and dissolved metals at each of the selected monitoring well locations including duplicate sample per sampling event.
17	Long-Term Groundwater Sampling and Reporting	5	$8,500	EVNT	$42,500	Perform long-term groundwater monitoring utilizing the existing network of wells. It is assumed that groundwater monitoring would be competed once per Ecology Five Year Periodic Review period for up to 25 years following completion of the compliance monitoring period. Assumes up to seven wells will be sampled per monitoring event and preparation of an annual monitoring reports summarizing results for Ecology submittal.
18	Long-Term Groundwater Sample Analysis	5	$2,800	EVNT	$14,000	Compliance monitoring includes chemical analysis of cPAHs and/or total and dissolved metals at each of the selected monitoring well locations including duplicate sample per sampling event.

Item No.	Item Description	Estimated Quantity[1]	Unit Cost[2] (2019$)	Unit	Estimated Cost	Notes/ Assumptions
19	Purge Water Testing and Disposal	16	$275	EA	$4,950	Disposal fee for purge water generated during each monitoring event. Assumes one 55-gallon drum per monitoring event will be generated for disposal.
20	Annual Cap Inspection and Reporting	30	$6,500	EVNT	$195,000	Perform visual inspection on an annual basis for to observe the conditions of the pavement cap surfaces and document the result of each inspection in an annual cap inspection report for Ecology submittal. Cap inspection and report will be in perpetuity as long as the cap exists and contamination remains onsite. For cost estimating purposes, a minimum of 30 years is assumed.
				Total Compliance Monitoring Cost	**$447,050**	
Professional/Administrative Support						
21	Engineering Design Report and Compliance Monitoring Plan	1	$175,000	LS	$175,000	Engineering Design Report will detail the plans and procedures that will be used for cleanup of the Site. The Compliance Monitoring Plan will detail the groundwater performance, confirmational and long-term monitoring to verify the effectiveness of the cleanup action.
22	Institutional Controls Monitoring and Maintenance Plan	1	$65,000	LS	$65,000	Institutional Controls Monitoring and Maintenance Plan to identify the controls that are being utilized at the Site, to provide guidelines for the monitoring and maintenance, and handling and disposal of soil and groundwater encountered during future Site maintenance and/or development activities.
23	Treatability Study	1	$100,000	LS	$100,000	Perform laboratory-scale treatability study to develop full-scale design including determination of engineering parameters (pressure, flow, temperature, mixing energy, etc.), required chemical reagent dosage, and chemical compatibility in order to design, optimize or troubleshoot full-scale processes.
24	Cleanup Action Report	1	$150,000	LS	$150,000	Cleanup Action Report will detail the soil removal, verification sampling and restoration activities completed during construction.
25	Project Planning, Design and Construction Management Support	1	$325,000	LS	$325,000	Percentage of total construction and compliance monitoring cost. Consists of permitting, remedial design, bid drawings and specifications, and regulatory support that are necessary to implement the remedial alternative.
				Total Professional/Administrative Services	**$815,000**	
				Cleanup Alternative Subtotal	**$5,804,009**	Subtotal of construction, compliance monitoring and professional/administrative costs.
				Sales Tax (8.7%)	**$395,150**	Sales tax applied to construction costs.
				Contingency (20%)	**$1,239,832**	Assumes 20 percent contingency for construction, compliance monitoring and professional/administrative costs to cover unknowns, unforeseen circumstances, or unanticipated conditions.
				Cleanup Alternative Total[3]	**$7,050,000**	Accuracy of the total remedial alternative cost is considered -30 to +50 % based on EPA's Guide to Developing and Documenting Cost Estimates During the Feasibility Study.

Notes:

[1] Concept design level.

[2] Unit costs based on a combination of published engineering reference manuals (i.e., 2019 RS Means Heavy Construction Cost Data Manual); construction cost estimates solicited from applicable vendors and contractors; review of actual costs incurred during similar, applicable projects; and professional judgment. Unit costs are based on 2019 dollars.

[3] Total Remedial Action Alternative Costs are rounded up to the nearest $10,000.

LS = lump sum
CY = cubic yard
SY = square yard
EA = each
EVNT = event
RCRA = Resource Conservation and Recovery Act

Table M-6

Cleanup Action Alternative 6 (Site-Wide Removal) Cost Estimate

Dakota Creek Industries
Anacortes, Washington

Item No.	Item Description	Estimated Quantity[1]	Unit Cost[2] (2021$)	Unit	Estimated Cost	Notes/ Assumptions
Construction						
1	Mobilization/Demobilization	1	10	%	$680,504	Includes mobilization to the site, installation of temporary site controls including temporary traffic, and erosion and sediment controls (as applicable), and demob from the site. Estimated as 10% of construction costs.
2	Asphalt Demolition	10,500	$20	SY	$210,000	Includes removal of existing asphalt surface and portion of top course surfacing material in source areas. Assumes removal depth to 6" below ground surface.
3	Demolition Debris Recycling/Disposal	3,150	$30	TON	$94,500	Includes loading and transportation of demolished asphalt debris to permitted recycling facility.
4	Monitoring Well Decommissioning by Licensed Driller	2	$1,500	LS	$3,000	Decommission MW-2B, MW-4 and MW-7 prior to construction.
5	Excavation Dewatering, Treatment and Disposal	1	$200,000	LS	$200,000	Unit cost based on similar projects.
6	Temporary Excavation Shoring	18,000	$30	SF	$540,000	Assumes installation and removal of temporary excavation shoring, 600 ft (L) x 30 ft (D), 18,000 SF.
7	Soil Removal, Handling and Loading	39,000	$10	CY	$390,000	Assume in-place volume. Cost includes excavation, handling, stockpile and loading.
8	Contaminated Soil Transport and Disposal	70,200	$75	TON	$5,265,000	Assume 1.8 ton/cy (in-place). Assumes that the material generated will be transported and disposed at a RCRA Subtitle D landfill.
9	Waste Disposal Characterization Sample Analysis	39	$65	EA	$2,535	Assumes 1 multi-point composite sample per 1,000 cubic yards of material generated for off-site disposal. Additional soil characterization may be required by the receiving facility to support waste disposal acceptance.
10	Utility protection and/or temporary relocation and restoration	1	$100,000	LS	$100,000	Protect utilities and/or temporarily reroute and restore to facilitate remedial excavation activities.
11	Purchase, Place and Compact Backfill Material	70,200	$25	TON	$1,755,000	Cost includes purchase, filling and compaction.
12	Surveying	1	$60,000	LS	$60,000	Unit cost based on similar projects.
13	Placement of Asphalt Pavement to Restore Excavation Areas	14,000	$35	SY	$490,000	Assumes placement of 5 inches of base course and 4 inches of asphalt; no new stormwater system installation; and stormwater runoff flows to existing drainage structures or match existing drainage pattern.
				Total Construction Cost	**$9,790,539**	
Compliance Monitoring						
14	Confirmation Soil Sample Analysis	300	$325	EA	$97,500	Verification sidewall and base samples to confirm the limits the soil removal activities. Assumes one sample per 40 linear feet of sidewall and one sample per 625 square feet of base and 10 % duplicate samples.
15	Monitoring well Installation by Licensed Driller	3	$3,500	LS	$10,500	Install one replacement monitoring well following soil removal and backfilling.
16	Compliance Groundwater Sampling and Reporting	8	$8,500	EVNT	$68,000	Perform compliance monitoring on a quarterly basis for up to two years at selected monitoring well locations. Assumes that up to seven well will be monitored per event. Prepare annual monitoring reports summarizing results for Ecology submittal.
17	Compliance Groundwater Sample Analysis	8	$2,800	EVNT	$22,400	Compliance monitoring includes chemical analysis of cPAHs and/or total and dissolved metals at selected monitoring well locations (assumes up to seven wells) including duplicate sample per sampling event.

Item No.	Item Description	Estimated Quantity[1]	Unit Cost[2] (2019$)	Unit	Estimated Cost	Notes/ Assumptions
18	Long-Term Groundwater Sampling and Reporting	20	$3,500	EVNT	$70,000	Perform long-term groundwater monitoring at MW-8. It is assumed that groundwater monitoring would be competed on a semi-annual basis for up to ten years that annual monitoring reports summarizing the results will be prepared for Ecology submittal.
19	Long-Term Groundwater Sample Analysis	20	$560	EVNT	$11,200	Compliance monitoring includes chemical analysis of cPAHs and/or total and dissolved metals at each of the selected monitoring well locations including duplicate sample per sampling event.
20	Purge Water Testing and Disposal	8	$275	EA	$2,200	Disposal fee for purge water generated during each monitoring event. Assumes one 55-gallon drum per monitoring event will be generated for disposal.
				Total Compliance Monitoring Cost	**$281,800**	
Professional/Administrative Support						
21	Engineering Design Report and Compliance Monitoring Plan	1	$175,000	LS	$175,000	Engineering Design Report will detail the plans and procedures that will be used for cleanup of the Site. The Compliance Monitoring Plan will detail the groundwater performance, confirmational and long-term monitoring to verify the effectiveness of the cleanup action.
22	Cleanup Action Report	1	$150,000	LS	$150,000	Cleanup Action Report will detail the soil removal, verification sampling and restoration activities completed during construction.
23	Project Planning, Design and Construction Management Support	1	$450,000	LS	$450,000	Percentage of total construction and compliance monitoring cost. Consists of permitting, remedial design, bid drawings and specifications, and regulatory support that are necessary to implement the remedial alternative.
				Total Professional/Administrative Services	**$775,000**	
				Cleanup Alternative Subtotal	**$10,847,339**	Subtotal of construction, compliance monitoring and professional/administrative costs.
				Sales Tax (8.7%)	**$851,777**	Sales tax applied to construction costs.
				Contingency (20%)	**$2,339,823**	Assumes 20 percent contingency for construction, compliance monitoring and professional/administrative costs to cover unknowns, unforeseen circumstances, or unanticipated conditions.
				Cleanup Alternative Total[3]	**$13,190,000**	Accuracy of the total remedial alternative cost is considered -30 to +50 % based on EPA's Guide to Developing and Documenting Cost Estimates During the Feasibility Study.

Notes:

[1] Concept design level.

[2] Unit costs based on a combination of published engineering reference manuals (i.e., 2019 RS Means Heavy Construction Cost Data Manual); construction cost estimates solicited from applicable vendors and contractors; review of actual costs incurred during similar, applicable projects; and professional judgment. Unit costs are based on 2019 dollars.

[3] Total Remedial Action Alternative Costs are rounded up to the nearest $10,000.

LS = lump sum
CY = cubic yard
EA = each
EVNT = event
-- = not applicable
IHS = indicator hazardous substance
cm = centimeter
SF = square feet

GeoEngineers