Harper Estuary Restoration Project Phase II

Data Report

Prepared for

Toxics Cleanup Program
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List of Acronyms

bgs	below ground surface
cPAH	carcinogenic polycyclic aromatic hydrocarbon
DW	dry weight
Ecology	Washington State Department of Ecology
EMPC	estimated maximum possible concentration
EPA	Environmental Protection Agency
GPS	global positioning system
LCS/LCSC	laboratory control sample/laboratory control sample duplicate
mg/kg	milligrams per kilogram
mm	millimeter
MS/MSD	matrix spike/matrix spike duplicate
MTCA	Model Toxics Control Act
ng/kg	nanograms per kilogram
PAH	polycyclic aromatic hydrocarbon
PSEP	Puget Sound Estuary Program
PSNERP	Puget Sound Nearshore Ecosystem Restoration Program
QAPP	Quality Assurance Project Plan
QA/QC	quality assurance/quality control
SAP	Sampling and Analysis Plan
SVOC	semivolatile organic compound
TEF	toxic equivalent factor
TEQ	toxic equivalency
TPH	total petroleum hydrocarbons
TPH-G	gasoline-range hydrocarbons
TPH-Dx	diesel- and oil-range hydrocarbons
USEPA	U.S. Environmental Protection Agency
VOC	volatile organic compound
WHO	World Health Organization
µg/kg	micrograms per kilogram

1.0 Introduction

This data report describes activities conducted by Leidos to assist the Washington State Department of Ecology (Ecology) with the evaluation of the potential presence of environmental contaminants in the Harper Estuary restoration project area.

The Harper Estuary restoration project will restore unimpeded tidal influence and habitat processes to a pocket estuary currently impacted by an undersized culvert and historical fill. The project will build on past nearshore habitat restoration feasibility studies and conceptual design work developed by the Puget Sound Nearshore Ecosystem Restoration Program (PSNERP) in 2011. The project is intended to restore tidal inundation to the estuary by either removing the SE Olympiad Road completely or constructing a new bridge to span the estuary; removing bulkheads, debris, and fill associated with the boat ramp and former brick factory (Harper Brick and Tile Company); and planting native vegetation to re-establish estuarine salt marsh.

In 2012 a Level I Survey was conducted at the site. This survey included a records search, on-site interviews, and an assessment of the project site. The Level I findings indicated the presence of fill and other debris including brick and industrial waste from the old brick-making factory that existed near the project area. The records search did not reveal any contamination or potential contaminant sources on or in the vicinity of the project area. However, the survey recommended that a Level II Survey be completed.

The project area is located approximately 0.5 mile east of Port Orchard on the Kitsap Peninsula near the community of Southworth. Harper estuary is located in Section 02 of Township 23N, Range 02E in southern Kitsap County. The current estuary is bounded to the west by SE Southworth Drive (State Route 160) and is divided by SE Olympiad Drive.

1.1 Project Scope and Study Objectives

The Harper Estuary Restoration Project Phase II scope included the following:

- Conduct soil sampling and analysis of the discrete soil samples from the southwestern shoreline near the former brick factory and the northeastern old roadway embankment area.
- Present sample results and compare to relevant screening criteria.

2.0 Field Sampling

This section describes the collection of soil samples and presents analytical results for Harper Estuary. Sample locations are shown in Figure 1 and chemical analysis results are presented in Tables 1 and 2. Field documents and laboratory data reports are provided in Appendix A and B, respectively.

On January 24, 2014, Ecology and Leidos performed a site visit at Harper Estuary to identify preliminary sample locations to characterize the southwestern shoreline near the former brick factory and the northeastern old roadway embankment area. Ecology and Leidos agreed that six soil sample stations would be advanced at the site, with three sample stations along the southwestern shoreline and three sample stations along the northeastern old roadway embankment area.

On February 20, 2014, Leidos collected soil samples at Harper Estuary. Sample stations HE-1 through HE-6 were selected in consultation with the Ecology Project Manager (Figure 1). At all sample stations, soil consisted of silty fine to coarse sand. Red brick debris was encountered at all sample stations. Yellow brick debris was encountered at station HE-5.

Station ID	Depth (inches)	Soil Description
HE-1	6 – 12	Reddish light brown to gray silty fine to coarse sand, moist, loose, roots, little to some gravel to occasional cobble size brick debris throughout, fill.
HE-1	12 – 24	Reddish light brown to gray silty fine to coarse sand, moist to wet, loose, roots, brick debris, little to some gravel to occasional cobble, fill. Water at 18 inches bgs.
HE-2	6 – 12	Reddish light brown to gray silty fine to coarse sand, moist, loose, roots, large brick debris, little to some gravel to occasional cobble, fill.
HE-2	12 – 24	Reddish light brown to gray silty fine to coarse sand, moist to wet, loose, roots, large brick debris, little to some gravel and cobble, fill.
HE-3	6 – 12	Reddish light brown to gray silty fine to coarse sand, moist, loose, roots, brick debris, little to some gravel and cobble, fill.
HE-3	12 – 24	Reddish light brown to gray, silty to coarse sand, wet, loose, roots, brick debris, some gravel to cobble, charcoal, fill.
HE-4	6 – 12	Reddish light brown to gray, silty fine to coarse sand, moist, loose, roots, wood debris, gravel to cobble, fill.
HE-4	12 – 20	Reddish light brown to gray, silty fine to coarse sand, moist loose, roots, gravel to cobble, fill.
HE-5	6 – 12	Brown to gray, silty fine to coarse sand, moist, loose, roots, brick gravel to cobble, fill.
HE-5	12 – 24	Mottled brown to gray, silty fine to coarse sand, moist, loose, roots, gravel-sized brick debris, fill. Yellow brick observed.
HE-6	6 – 12	Brown to dark brown, silty fine to coarse sand, moist, loose, roots, gravel- to cobble-sized brick debris, fill.
HE-6	18 – 23	Brown to dark brown, silty fine to coarse sand, moist, loose, roots, gravel- to cobble-sized brick debris, fill.

Leidos collected 12 discrete soil samples (two from each sample station) and two composite soil samples. Additional soil was collected at station HE-2 between 12 and 24 inches below ground

surface (bgs) to prepare a laboratory duplicate sample. Two composite soil samples were collected from the combined 6- to 12-inch bgs samples from stations HE-1 through HE-3 and HE-4 through HE-6. Additional soil was collected from HE-1 through HE-3 to prepare a laboratory duplicate. Sample information and analyses conducted for each sample are presented in the table below.

Sample ID	Depth (inches)	Analysis
HE-1-20140220-S-6-12	6 – 12	TPH-G, TPH-Dx, VOCs, SVOCs/PAHs, Metals
HE-1-20140220-S-12-24	12 – 24	TPH-G, TPH-Dx, VOCs, SVOCs/PAHs, Metals
HE-2-20140220-S-6-12	6 – 12	TPH-G, TPH-Dx, VOCs, SVOCs/PAHs, Metals
HE-2-20140220-S-12-24	12 – 24	TPH-G, TPH-Dx, VOCs, SVOCs/PAHs, Metals
HE-2-20140220-S-12-24-DUP	12 – 24	TPH-G, TPH-Dx, VOCs, SVOCs/PAHs, Metals
HE-3-20140220-S-6-12	6 – 12	TPH-G, TPH-Dx, VOCs, SVOCs/PAHs, Metals
HE-3-20140220-S-18-24	18 – 24	TPH-G, TPH-Dx, VOCs, SVOCs/PAHs, Metals
HE-4-20140220-S-6-12	6 – 12	TPH-G, TPH-Dx, VOCs, SVOCs/PAHs, Metals
HE-4-20140220-S-18-20	18 – 20	TPH-G, TPH-Dx, VOCs, SVOCs/PAHs, Metals
HE-5-20140220-S-6-12	6 – 12	TPH-G, TPH-Dx, VOCs, SVOCs/PAHs, Metals
HE-5-20140220-S-18-24	18 – 24	TPH-G, TPH-Dx, VOCs, SVOCs/PAHs, Metals
HE-6-20140220-S-6-12	6 – 12	TPH-G, TPH-Dx, VOCs, SVOCs/PAHs, Metals
HE-6-20140220-S-18-23	18 – 23	TPH-G, TPH-Dx, VOCs, SVOCs/PAHs, Metals
HE-COMP1-20140220-S-6-12	6 – 12	Dioxins/Furans
HE-COMP1-20140220-S-6-12-DUP	6 – 12	Dioxins/Furans
HE-COMP2-20140220-S-6-12	6 – 12	Dioxins/Furans

From each station, one soil sample was collected between 6 and 12 inches bgs. A second sample was collected near the bottom of each station. Deeper samples were collected from moist, but not wet, soil. Samples were collected using a stainless steel hand auger from station HE-1 and the shallow horizon from station HE-2. Due to the pervasive brick fill, continued use of the hand auger was impractical to collect the deep horizon sample from station HE-2 and all samples from stations HE-3 through HE-6. Samples from these horizons were collected using a decontaminated post hole digger and shovel. The depth of each subsurface sample was measured from the ground surface with a tape measure.

Soil samples to be analyzed for volatile organic compounds (VOCs) and gasoline-range hydrocarbons (TPH-G) were collected using a terra core syringe to collect undisturbed, non-homogenized soil directly from the hand auger (Station HE-1 and the shallow horizon sample at station HE-2) or from the sidewalls of the station (deep horizon sample at station HE-2 and stations HE-3 through HE-6) to ensure that sample was composed of undisturbed, non-homogenized soil.

Soil samples to be analyzed for diesel- and oil-range hydrocarbons (TPH-Dx), semivolatile organic compounds (SVOCs)/polycyclic aromatic hydrocarbons (PAHs), and metals were transferred from the hand auger or shovel to a stainless steel bowl using a stainless steel spoon. Samples collected from the shovel were collected from the soil at the top of the shovel to obtain

soil that was not in contact with the shovel surface. Any material greater than approximately 2 millimeter (mm) diameter (e.g., rocks, brick fragments, twigs, or foreign objects) was removed from the sample with a decontaminated stainless steel spoon or freshly gloved hand. Each sample was gently homogenized in a stainless steel bowl and then transferred to pre-labeled sample jars.

Two composite samples for analysis of dioxins/furans were prepared in the field. Three discrete samples from the shallow horizon were combined to make one composite sample from the south side of the site (HE-1 through HE-3) and one from the north side of the site (HE-4 through HE-6). Approximately equal volumes of the component samples were placed into a decontaminated stainless steel bowl and gently mixed with a decontaminated stainless steel spoon. Any material greater than approximately 2 mm diameter (e.g., rocks, brick fragments, twigs, or foreign objects) was removed from the sample with a decontaminated stainless steel spoon or freshly gloved hand. The homogenous composite samples were then transferred into a pre-labeled sampling container.

Decontaminated stainless steel sampling spoons and bowls were used to collect each sample. The post hole digger and shovel were decontaminated in accordance with the Puget Sound Estuary Program (PSEP 1997) using a laboratory-grade detergent and water solution, rinsed with tap water, and rinsed with distilled water. The sample information was recorded on a chain-of-custody form and the samples were placed on ice in a cooler. The samples were delivered to TestAmerica by courier.

Soil not intended for analysis was temporarily placed on plastic sheeting and deposited back in the hole at each station after sampling activities were completed. Photographs were taken at each sample station (Appendix A). Coordinates for each sample station were recorded using a Global Positioning System (GPS) unit.

The field team did not deviate from the Sampling Analysis Plan/Quality Assurance Project Plan (SAP/QAPP, Leidos 2014) during sampling activities.

3.0 Chemical Analysis

Discrete soil samples were submitted to TestAmerica for the following analyses:

- TPH-gasoline by NWTPH-Gx
- TPH-diesel/oil by NWTPH-Dx with sulfuric acid/silica gel cleanup
- VOCs by EPA 8260B
- SVOCs by EPA 8270C
- Priority pollutant metals (antimony, arsenic, beryllium, cadmium, chromium, copper, lead, mercury, nickel, selenium, silver, thallium, and zinc) by EPA 6020/6010B/7471A

The composite soil samples were submitted to TestAmerica for analysis of dioxins/furans by EPA 1613B. Analytical results are summarized in Tables 1 and 2. Laboratory reports are provided as Appendix B.

3.1 Analytical Results

The analytical results were compared to Washington State Model Toxics Control Act (MTCA) Method A soil cleanup level for unrestricted land use, or to MTCA Method B soil cleanup levels, if MTCA Method A soil cleanup levels have not been promulgated for a chemical. If carcinogenic and non-carcinogenic MTCA Method B soil cleanup levels have been promulgated for a chemical, the lower cleanup level was used for comparison (WAC 173-340-900; Ecology 2007). Soil cleanup levels have not been promulgated under MTCA for all chemicals. Analytical results are compared to MTCA soil cleanup levels in Table 1.

Metals concentrations were detected in all samples. Arsenic concentrations exceeding the MTCA Method A soil cleanup level were detected in both samples collected at station HE-3. Chromium concentrations in all samples exceeded the MTCA Method A cleanup level for hexavalent chromium (19 milligrams per kilogram [mg/kg]), but did not exceed the MTCA Method A cleanup level for trivalent chromium (2,000 mg/kg). In most soil, chromium is predominantly present as trivalent chromium. The presence of hexavalent chromium in soil is typically associated with industrial manufacturing and wastes from the metallurgical, refractory, and chemical industries (U.S. Department of Health and Human Services 2012). Hexavalent chromium is not associated with manufacturing clay bricks like those produced by the former Harper Brick and Tile Company. All other metals concentrations were below MTCA Method A and B soil cleanup levels.

Concentrations of multiple PAHs were detected in all samples, with the exception of the 18- to 20-inch bgs sample from station HE-4. Individual concentrations of PAHs did not exceed MTCA Method A or B soil cleanup levels. The toxic equivalency (TEQ) total concentration for carcinogenic PAHs (cPAHs) for each sample was below the MTCA Method A soil cleanup level, 100 μg/kg, with the exception of the sample collected at 12- to 24 inches bgs from station HE-2. The total cPAH TEQ concentration for this single exceedance is 110 μg/kg.

Low concentrations of diethyl phthalate were detected in all samples, with the exception of the 18- to 23-inch bgs sample from station HE-6. Concentrations of diethyl phthalate did not exceed

the MTCA Method B soil cleanup level. Dimethyl phthalate was detected in one sample, the 6- to 12-inch bgs sample from station HE-6, at a concentration of 73 J µg/kg. MTCA soil cleanup levels for dimethyl phthalate have not been promulgated. Bis(2-chloro-1-methylethyl) ether was detected in one sample, HE-4 between 6 and 12 inches bgs, at a concentration of 44 J µg/kg. N-nitrosodiphenylamine was detected in one sample, HE-5 between 18 and 24 inches bgs, at a concentration of 20 J µg/kg. Concentrations of bis(2-chloro-1-methylethyl) and n-nitrosodiphenylamine did not exceed MTCA Method B soil cleanup levels.

VOCs were detected in two samples. In the 18- to 24-inch bgs sample from station HE-3, 1,1-dichloroethene was detected at a concentration of 0.69 J µg/kg, below the MTCA Method B soil cleanup level. P-isopropyltoluene was detected at a concentration of 1.4 J µg/kg in the 6- to 12- inch bgs sample from station HE-6. MTCA Method soil cleanup levels for p-isopropyltoluene have not been promulgated. No other VOCs were detected. Methylene chloride was not detected in any sample; however, the laboratory reporting limit exceeded the MTCA Method A soil cleanup level of 20 µg/kg in all samples except the 6- to 12-inch bgs sample from station HE-5 and those samples collected from station HE-6.

Petroleum hydrocarbon concentrations were detected below MTCA Method A cleanup levels in 10 samples. Petroleum hydrocarbons were not detected in the samples from station HE-4 and the 6- to 12-inch bgs sample from station HE-5.

Dioxins and furans were detected in the three composite samples (Table 2). MTCA Method B cleanup levels have been promulgated for 2,3,7,8-TCDD (11 nanograms per kilogram [ng/kg]) and total HXCDD (161 ng/kg). Concentrations in soil at Harper Estuary were below these cleanup levels (Table 2).

The dioxin and furan TEQs are toxicity-weighted calculated totals. Both TEQ concentrations of dioxin and furan compounds were normalized to the toxicity of 2,3,7,8-TCDD using toxic equivalent factors (TEFs) updated by the World Health Organization (WHO) in 2005 (Van den Berg et al. 2006) and incorporated into MTCA (WAC 173-340-900, Table 708-1; Ecology 2007).

The total dioxins TEQ is equivalent to the sum of the concentrations of the seven individual dioxin congeners multiplied by their TEF (potency relative to 2,3,7,8-TCDD). The total furans TEQ is equivalent to the sum of the concentrations of the ten individual furan congeners multiplied by their TEF (potency relative to 2,3,7,8-TCDD). The total dioxins/furans TEQ is the sum of the total dioxins and total furans TEQs. Any result qualified as an estimated maximum possible concentration (EMPC) by the laboratory was treated as non-detect at the reported value when calculating TEQs. Results qualified as an EMPC are flagged with a "q" qualifier in Table 2.

Non-detected values were assessed using zero or half the detection limit (or reported EMPC value) depending on whether the specific dioxin/furan congener was detected in any sample at the site. For congeners that are detected at the site, but were not detected in the sample of concern, a value of one-half the detection limit (or reported EMPC value) was used for calculating TEQs. For congeners that are not detected in any samples at the site, a value of zero was used for calculating TEQs (Ecology 2013). Dioxin and furan TEFs are listed below.

Analyte	TEF
Dioxins	
1,2,3,4,6,7,8-HPCDD	0.01
1,2,3,4,7,8-HXCDD	0.1
1,2,3,6,7,8-HXCDD	0.1
1,2,3,7,8,9-HXCDD	0.1
1,2,3,7,8-PECDD	1
2,3,7,8-TCDD	1
OCDD	0.0003

Analyte	TEF
Furans	
1,2,3,4,6,7,8-HPCDF	0.01
1,2,3,4,7,8,9-HPCDF	0.01
1,2,3,4,7,8-HXCDF	0.1
1,2,3,6,7,8-HXCDF	0.1
1,2,3,7,8,9-HXCDF	0.1
1,2,3,7,8-PECDF	0.03
2,3,4,6,7,8-HXCDF	0.1
2,3,4,7,8-PECDF	0.3
2,3,7,8-TCDF	0.1
OCDF	0.0003

Ecological Indicator Soil Concentrations

The analytical results were compared the concentrations of contaminants listed in Table 749-2 of MTCA (Priority Contaminants of Ecological Concern for Sites that Qualify for the Simplified Terrestrial Ecological Evaluation Procedure) to identify chemicals of potential ecological concern. The total dioxins TEQ was compared to the screening value in Table 749-2 for chlorinated dibenzo-p-dioxins (total) (Ecology 2007). The total furans TEQ was compared to the screening value in Table 749-2 for chlorinated dibenzofurans (total) (Ecology 2007). Based on this comparison, arsenic, selenium, zinc, and dioxins and furans may be chemicals of potential ecological concern (Table 3).

3.2 QA/QC Summary

All sample collection and analytical procedures were conducted following the quality assurance/quality control (QA/QC) requirements specified in the project SAP/QAPP (Leidos 2014). The QA/QC procedures ensure that the results of the investigation are defensible and usable for their intended purpose.

3.2.1 Laboratory Duplicate Samples

Laboratory duplicate samples were prepared by TestAmerica and analyzed for all chemicals specified in the SAP/QAPP (Leidos 2014). Duplicate sample results are used to assess the precision of the analytical process and to evaluate the representativeness of the data collected. The laboratory duplicate analyses were performed using sample HE-COMP1-20140220-S-6-12 for the dioxins/furans analysis and with sample HE-2-20140220-S-12-24 for all other analyses. All results were within acceptance limits for precision with the following exceptions: arsenic, total TCDD, total PeCDD, and total HxCDD. Consequently, all arsenic results were J-qualified as estimated. The results for these dioxin homolog groups were J-qualified as estimated in the original and duplicate samples only.

3.2.2 Trip Blank Sample

A trip blank sample was provided by TestAmerica consisting of laboratory-supplied organic-free water, methanol, and/or sand and was carried through all phases of sample transport to ensure that no contamination occurred during shipping. The trip blank sample was included in the cooler containing VOC and TPH-G sub-samples and was analyzed for VOCs and TPH-G. No chemicals were detected in the trip blank sample.

3.3 Data Validation

All chemical results gathered during this investigation were independently validated by EcoChem, Inc. of Seattle, WA. A full-level EPA Stage 4 data validation was performed on all soil sample results, and a compliance-level screening was performed on the trip blank sample results. Data validation was performed following EPA guidance (EPA 1994, 2008, 2009, 2010, 2011). No results were rejected during data validation, and all results are considered acceptable for use, as qualified. Issues resulting in data qualification are summarized below. Additional details, including a list of all qualified results, are presented in Appendix C.

Eighteen results for two chemicals were re-qualified as nondetect during data validation because of method blank contamination, including 11 results for bis(2-ethylhexyl) phthalate with detected concentrations ranging from 74 to 100 µg/kg dry weight (DW), and 7 results for motor oil with detected concentrations ranging from 35 to 77 mg/kg DW. For those results that were detected above associated method detection limits but below reporting limits, the final reported values were elevated to the associated reporting limits, ranging from 690 to 1,100 µg/kg DW for bis(2-ethylhexyl) phthalate and 51 to 77 mg/kg DW for motor oil.

Twenty-one dioxin/furan results were q-qualified by TestAmerica as being estimated maximum possible concentrations because not all method required compound identification parameters were met. Eight q-qualified dioxin/furan congener results were requalified as nondetect (Uq-qualified) at the reported concentrations, and thirteen q-qualified results for dioxin/furan total homolog groups were requalified as “Jq” to indicate a detected result with an estimated value.

Results for 27 various chemicals were J- or UJ-qualified as estimated because calibration verification, matrix spike/matrix spike duplicate (MS/MSD), laboratory control sample/ laboratory control sample duplicate (LCS/LCSD), internal standard, and/or duplicate sample relative percent differences were outside of control limits. A full list of qualified results

including the reason for data qualification is presented in the data validation report (Appendix C).

The chromatograms for five samples resembled weathered/degraded diesel fuel and/or motor oil. The associated results were flagged "Y" by the laboratory to indicate they are estimated concentrations that do not fully resemble the pattern of the calibration standard. These results are reported with a final qualifier of J in Tables 1 through 3.

4.0 Conclusion

Leidos collected discrete and composite soil samples at Harper Estuary. Discrete soil samples were submitted to TestAmerica for analysis of TPH- gasoline, TPH- diesel/oil, VOCs, SVOCs, priority pollutant metals, and dioxins/furans.

Concentrations of metals, PAHs, phthalates, VOCs, petroleum hydrocarbons, and dioxins/furans were detected in soil. MTCA soil cleanup levels have not been promulgated for all chemicals that were detected in soil at Harper Estuary. The following chemicals exceeded MTCA Method A cleanup levels:

- Arsenic in two soil samples collected from station HE-3, to the south of SE Olympiad Drive.
- The total cPAHs TEQ of 110 μg/kg for the 12- to 24-inch bgs sample from station HE-2 exceeded the MTCA Method A cleanup level (100 μg/kg).

The analytical results were compared the concentrations of contaminants listed in Table 749-2 of MTCA (Priority Contaminants of Ecological Concern for Sites that Qualify for the Simplified Terrestrial Ecological Evaluation Procedure) to identify chemicals of potential ecological concern. Based on this comparison, arsenic, selenium, zinc, and dioxins and furans may be chemicals of potential ecological concern at Harper Estuary.

5.0 References

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Figure

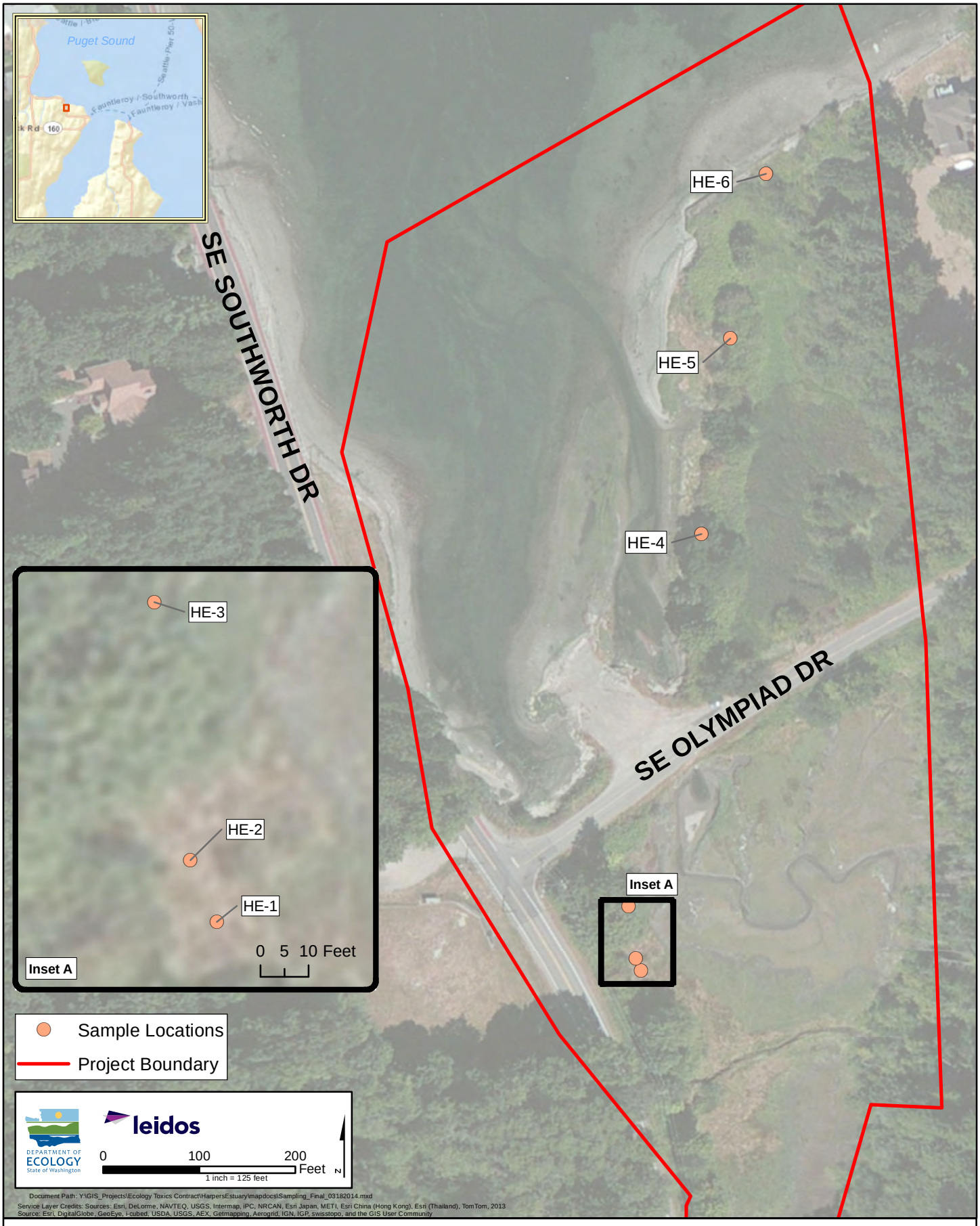


Figure 1. Harper Estuary Restoration Area Phase II Investigation Map

Tables

Table 1. Harper Estuary Restoration Project Phase II
Analytical Results - Metals, SVOCs, VOCs, and Petroleum Hydrocarbons

Chemical	MTCA Method A CUL	MTCA Method B Carc CUL	MTCA Method B NC CUL	HE-1-20140220-S-6-12		HE-1-20140220-S-12-24		HE-2-20140220-S-6-12		HE-2-20140220-S-12-24		HE-2-20140220-S-12-24-DUP		HE-3-20140220-S-6-12		HE-3-20140220-S-18-24		HE-4-20140220-S-6-12		HE-4-20140220-S-18-20		HE-5-20140220-S-6-12		HE-5-20140220-S-18-24		HE-6-20140220-S-6-12		HE-6-20140220-S-18-23	
Metals (mg/kg)																													
Antimony	--	--	32	1.0		0.90		0.89		1.1		0.909		0.73		0.70		0.37		0.47		0.23		1.5		0.65		0.26	
Arsenic	20	--	--	14	J	11	J	12	J	16	J	13.2	J	21	J	33	J	6.6	J	6.5	J	4.8	J	15	J	5.2	J	3.6	J
Beryllium	--	--	--	0.75		0.84		0.60		0.63		0.531		0.92		1.1		0.29		0.28		0.20		0.96		0.62		0.25	
Cadmium	2	--	--	0.28		0.22	J	0.27		0.48		0.332		0.16	J	0.19	J	0.092	J	0.060	J	0.14		0.25		0.26		0.11	J
Chromium[a]	19 / 2000	--	--	33		28		25		25		21.1		37		33		23		22		22		27		24		21	
Copper	--	--	--	58	J	78	J	43	J	66	J	55.4		69	J	58	J	25	J	30	J	14	J	55	J	42	J	21	J
Lead	250	--	--	32		22		94		71		59.7		6.5		4.0		26		28		9.1		26		120		26	
Mercury	2	--	--	0.052		0.025		0.040		0.045		0.0412		0.018	J	0.0087	J	0.052		0.062		0.029		0.018	J	0.024		0.012	J
Nickel	--	--	--	39		33		31		30		24.9		50		43		29		26		27		30		30		23	
Selenium	--	--	400	0.98		0.86	J	0.76	J	1.0	J	0.744	J	0.94	J	0.89	J	0.39	J	0.36	J	0.29	J	1.1		0.55	J	0.38	J
Silver	--	--	400	0.078	J	0.079	J	0.059	J	0.057	J	0.0472	J	0.054	J	0.055	J	0.045	J	0.045	J	0.026	J	0.072	J	0.036	J	0.022	J
Thallium	--	--	--	0.63	U	0.77	U	0.66	U	0.77	U	0.63	U	0.70	U	0.76	U	0.58	U	0.64	U	0.35	U	0.57	U	0.56	U	0.36	U
Zinc	--	--	4,000	140		71		260		530		440		38		26		52		48		33		56		67		33	
PAHs (µg/kg)																													
Acenaphthene	--	--	4,800,000	28	U	32	U	27	U	36	U	30	U	30	U	33	U	27	U	31	U	21	U	28	U	23	U	21	U
Acenaphthylene	--	--	--	28	U	32	U	7.7	J	16	J	8.63	J	30	U	33	U	27	U	31	U	21	U	28	U	23	U	21	U
Anthracene	--	--	24,000,000	8.8	J	32	U	7.5	J	25	J	15.5	J	30	U	33	U	27	U	31	U	21	U	9.7	J	23	U	21	U
Benz[a]anthracene	--	1,400	--	25	J	8.8	J	16	J	34	J	27.3	J	30	U	33	U	6.8	J	31	U	5.5	J	21	J	33		7.3	J
Benzo(b)fluoranthene	--	1,400	--	31		32	U	25	J	100		65.2		30	U	33	U	13	J	31	U	21	U	23	J	47		13	J
Benzo(k)fluoranthene	--	14,000	--	35	U	40	U	12	J	35	J	29.8	J	37	U	41	U	34	U	39	U	26	U	35	U	18	J	27	U
Benzofluoranthene	--	--	--	31		40	U	37	J	140	J	95.0	J	37	U	41	U	13	J	39	U	26	U	23	J	65	J	13	J
Benzo(ghi)perylene	--	--	--	35	U	40	U	34	U	67		46.3		37	U	41	U	34	U	39	U	26	U	35	U	20	J	27	U
Benzo(a)pyrene	100	--	--	28	J	48	U	24	J	71		55.7		45	U	49	U	40	U	47	U	31	U	23	J	44		15	J
Chrysene	--	--	--	32	J	40	U	19	J	64		54.0		37	U	41	U	34	U	39	U	26	U	19	J	40		5.7	J
Dibenzo(a,h)anthracene	--	--	--	57	U	64	U	55	U	28	J	60	U	60	U	66	U	54	U	62	U	41	U	56	U	46	U	43	U
Dibenzofuran	--	--	80,000	28	J	160	U	41	J	69	J	55.2	J	150	U	160	U	130	U	160	U	100	U	46	J	120	U	110	U
Fluoranthene	--	--	3,200,000	40		32	U	20	J	45		37.5		30	U	33	U	27	U	31	U	5.2	J	22	J	50		8.7	J
Fluorene	--	--	3,200,000	28	U	32	U	27	U	36	U	30	U	30	U	33	U	27	U	31	U	21	U	28	U	23	U	21	U
Indeno(1,2,3-cd)pyrene	--	1,400	--	27	J	64	U	55	U	71	J	52.4	J	60	U	66	U	54	U	62	U	41	U	19	J	28	J	43	U
1-Methylnaphthalene	--	35,000	--	110		21	J	130		240		191		21	J	12	J	40	U	47	U	31	U	110		7.2	J	32	U
2-Methylnaphthalene	--	--	--	150		30	J	160		300		243		24	J	17	J	27	U	31	U	21	U	130		7.7	J	21	U
Naphthalene	5,000	--	--	68		13	J	87		150		130		9.7	U	9.7	J	8.0	UJ	9.2	UJ	5.1	U	76		6.0	UJ	4.3	U
Phenanthrene	--	--	--	78		15	J	61		130		96.0		9.1	J	9.4	J	27	U	31	U	5.9	J	64		17	J	21	U
Pyrene	--	--	--	54		32	U	21	J	50		43.1		30	U	33	U	27	U	31	U	5.6	J	25	J	61		9.5	J
Total HPAHs	--	--	--	240	J	8.8	J	140	J	500	J	365	J	60	U	66	U	20	J	62	U	16	J	150	J	320	J	59	J
Total LPAHs	--	--	--	150	J	28	J	160	J	320	J	250	J	9.1	J	19	J	27	U	31	U	5.9	J	150	J	17	J	21	U
cPAHs, nd RL*0	100	--	--	37	J	0.88	J	29	J	110	J	73.7	J	0	U	0	U	2.0	J	0	U	0.55	J	29	J	57	J	17	J
cPAHs, nd RL*0.5	100	--	--	50	J	45	J	43	J	110	J	85.7	J	43	U	47	U	37	J	44	U	29	J	42	J	66	J	29	J
cPAHs, nd RL*1	100	--	--	63	J	88	J	57	J	110	J	97.7	J	85	U	93	U	73	J	88	U	57	J	55	J	75	J	41	J
Phthalates (µg/kg)																													
Butyl benzyl phthalate	--	530,000	--	280	U	320	U	270	U	360	U	300	U	300	U	330	U	270	U	310	U	210	U	280	U	230	U	210	U
Dibutyl phthalate	--	--	8,000,000	710	U	810	U	680	U	900	U	740	U	740	U	820	U	670	U	780	U	520	U	700	U	580	U	530	U
Di-n-octyl phthalate	--	--	--	710	U	810	U	680	U	900	U	740	U	740	U	820	U	670	U	780	U	520	U	700	U	580	U	530	U
Diethyl phthalate	--	--	64,000,000	34	J	35	J	24	J	39	J	29.1	J	30	J	27	J	26	J	36	J	17	J	24	J	18	J	210	U
Dimethyl phthalate	--	--	--	140	U	160	U	140	U	180	U	150	U	150	U	160	U	130	U	160	U	100	U	140	U	73	J	110	U
Bis(2-ethylhexyl) phthalate	--	71,000	1,600,000	850	U	970	U	820	U	1,100	U	890	U	890	U	980	U	810	U	930	U	620	U	840	U	690	U	640	U

Table 1. Harper Estuary Restoration Project Phase II
Analytical Results - Metals, SVOCs, VOCs, and Petroleum Hydrocarbons

Chemical	MTCA Method A CUL	MTCA Method B Carc CUL	MTCA Method B NC CUL	HE-1-20140220-S-6-12		HE-1-20140220-S-12-24		HE-2-20140220-S-6-12		HE-2-20140220-S-12-24		HE-2-20140220-S-12-24-DUP		HE-3-20140220-S-6-12		HE-3-20140220-S-18-24		HE-4-20140220-S-6-12		HE-4-20140220-S-18-20		HE-5-20140220-S-6-12		HE-5-20140220-S-18-24		HE-6-20140220-S-6-12		HE-6-20140220-S-18-23	
Phenols (µg/kg)																													
2,4,5-Trichlorophenol	--	--	--	140	U	160	U	140	U	180	U	150	U	150	U	160	U	130	U	160	U	100	U	140	U	120	U	110	U
2,4,6-Trichlorophenol	--	--	--	210	U	240	U	200	U	270	U	220	U	220	U	250	U	200	U	230	U	160	U	210	U	170	U	160	U
2,4-Dichlorophenol	--	--	--	140	U	160	U	140	U	180	U	150	U	150	U	160	U	130	U	160	U	100	U	140	U	120	U	110	U
2,4-Dimethylphenol	--	--	--	140	U	160	U	140	U	180	U	150	U	150	U	160	U	130	U	160	U	100	U	140	U	120	U	110	U
2,4-Dinitrophenol	--	--	--	1400	UJ	1600	UJ	1400	UJ	1800	UJ	1500	UJ	1500	UJ	1600	UJ	1300	UJ	1600	UJ	1000	UJ	1400	UJ	1200	UJ	1100	UJ
2-Chlorophenol	--	--	--	140	U	160	U	140	U	180	U	150	U	150	U	160	U	130	U	160	U	100	U	140	U	120	U	110	U
2-Nitrophenol	--	--	--	140	U	160	U	140	U	180	U	150	U	150	U	160	U	130	U	160	U	100	U	140	U	120	U	110	U
m,p-Cresol	--	--	400,000	280	U	320	U	270	U	360	U	300	U	300	U	330	U	270	U	310	U	210	U	280	U	230	U	210	U
4,6-Dinitro-2-methylphenol	--	--	--	1400	U	1600	U	1400	U	1800	U	1500	U	1500	U	1600	U	1300	U	1600	U	1000	U	1400	U	1200	U	1100	U
4-Chloro-3-methylphenol	--	--	--	140	U	160	U	140	U	180	U	150	U	150	U	160	U	130	U	160	U	100	U	140	U	120	U	110	U
4-Nitrophenol	--	--	--	1400	UJ	1600	UJ	1400	UJ	1800	UJ	1500	UJ	1500	UJ	1600	UJ	1300	UJ	1600	UJ	1000	UJ	1400	UJ	1200	UJ	1100	UJ
o-Cresol	--	--	4,000,000	140	U	160	U	140	U	180	U	150	U	150	U	160	U	130	U	160	U	100	U	140	U	120	U	110	U
Pentachlorophenol	--	2,500	--	280	U	320	U	270	U	360	U	300	U	300	U	330	U	270	U	310	U	210	U	280	U	230	U	210	U
Phenol	--	--	24,000,000	140	U	160	U	140	U	180	U	150	U	150	U	160	U	130	U	160	U	100	U	140	U	120	U	110	U
Other SVOCs (µg/kg)																													
Benzoic acid	--	--	320,000,000	3500	U	4000	U	3400	U	4500	U	3700	U	3700	U	4100	U	3400	U	3900	U	2600	U	3500	U	2900	U	2700	U
Benzyl alcohol	--	--	8,000,000	140	U	160	U	140	U	180	U	150	U	150	U	160	U	130	U	160	U	100	U	140	U	120	U	110	U
4-bromophenyl phenyl ether	--	--	--	140	U	160	U	140	U	180	U	150	U	150	U	160	U	130	U	160	U	100	U	140	U	120	U	110	U
Carbazole	--	--	--	140	U	160	U	140	U	13	J	150	U	150	U	160	U	130	U	160	U	100	U	140	U	120	U	110	U
Bis(2-chloro-1-methylethyl) ether	--	14,000	--	350	U	400	U	340	U	450	U	370	U	370	U	410	U	44	J	390	U	260	U	350	U	290	U	270	U
4-Chloroaniline	--	--	--	140	U	160	U	140	U	180	U	150	U	150	U	160	U	130	U	160	U	100	U	140	U	120	U	110	U
2-Chloronaphthalene	--	--	--	28	U	32	U	27	U	36	U	30	U	30	U	33	U	27	U	31	U	21	U	28	U	23	U	21	U
Bis(2-chloroethoxy)methane	--	--	--	140	U	160	U	140	U	180	U	150	U	150	U	160	U	130	U	160	U	100	U	140	U	120	U	110	U
Bis(2-chloroethyl)ether	--	909	--	140	U	160	U	140	U	180	U	150	U	150	U	160	U	130	U	160	U	100	U	140	U	120	U	110	U
4-Chlorophenyl-phenylether	--	--	--	140	U	160	U	140	U	180	U	150	U	150	U	160	U	130	U	160	U	100	U	140	U	120	U	110	U
1,2-Dichlorobenzene	--	--	--	2.0	UJ	1.9	U	1.8	UJ	2.4	UJ	1.8	U	1.9	U	2.2	U	1.6	UJ	1.8	UJ	1.0	U	1.5	UJ	1.2	UJ	0.86	U
1,3-Dichlorobenzene	--	--	--	2.0	UJ	1.9	U	1.8	UJ	2.4	UJ	1.8	U	1.9	U	2.2	U	1.6	UJ	1.8	UJ	1.0	U	1.5	UJ	1.2	UJ	0.86	U
1,4-Dichlorobenzene	--	--	--	2.0	UJ	1.9	U	1.8	UJ	2.4	UJ	1.8	U	1.9	U	2.2	U	1.6	UJ	1.8	UJ	1.0	U	1.5	UJ	1.2	UJ	0.86	U
3,3'-Dichlorobenzidine	--	--	--	280	U	320	U	270	U	360	U	300	U	300	U	330	U	270	U	310	U	210	U	280	U	230	U	210	U
2,4-Dinitrotoluene	--	--	--	140	U	160	U	140	U	180	U	150	U	150	U	160	U	130	U	160	U	100	U	140	U	120	U	110	U
2,6-Dinitrotoluene	--	--	--	140	U	160	U	140	U	180	U	150	U	150	U	160	U	130	U	160	U	100	U	140	U	120	U	110	U
Hexachlorobenzene	--	625	--	71	U	81	U	68	U	90	U	74	U	74	U	82	U	67	U	78	U	52	U	70	U	58	U	53	U
Hexachlorobutadiene	--	13,000	--	2.0	UJ	1.9	U	1.8	UJ	2.4	UJ	1.8	U	1.9	U	2.2	U	1.6	UJ	1.8	UJ	1.0	U	1.5	UJ	1.2	UJ	0.86	U
Hexachlorocyclopentadiene	--	--	400,000	140	U	160	U	140	U	180	U	150	U	150	U	160	U	130	U	160	U	100	U	140	U	120	U	110	U
Hexachloroethane	--	71,000	--	140	U	160	U	140	U	180	U	150	U	150	U	160	U	130	U	160	U	100	U	140	U	120	U	110	U
Isophorone	--	1,050,000	--	140	U	160	U	140	U	180	U	150	U	150	U	160	U	130	U	160	U	100	U	140	U	120	U	110	U
2-Nitroaniline	--	--	--	140	U	160	U	140	U	180	U	150	U	150	U	160	U	130	U	160	U	100	U	140	U	120	U	110	U
4-Nitroaniline	--	--	--	140	U	160	U	140	U	180	U	150	U	150	U	160	U	130	U	160	U	100	U	140	U	120	U	110	U
m-Nitroaniline	--	--	--	140	UJ	160	UJ	140	UJ	180	UJ	150	UJ	150	UJ	160	UJ	130	UJ	160	UJ	100	UJ	140	UJ	120	UJ	110	UJ
Nitrobenzene	--	--	160,000	140	U	160	U	140	U	180	U	150	U	150	U	160	U	130	U	160	U	100	U	140	U	120	U	110	U
n-Nitrosodiphenylamine	--	200,000	--	71	U	81	U	68	U	90	U	74	U	74	U	82	U	67	U	78	U	52	U	20	J	58	U	53	U
n-Nitrosodi-n-propylamine	--	143	--	140	U	160	U	140	U	180	U	150	U	150	U	160	U	130	U	160	U	100	U	140	U	120	U	110	U
1,2,4-Trichlorobenzene	--	--	--	4.0	UJ	3.8	U	3.6	UJ	4.7	UJ	3.6	U	3.9	U	4.5	U	3.2	UJ	3.7	UJ	2.0	U	3.0	UJ	2.4	UJ	1.7	U
VOCs (µg/kg)																													
1,1,1,2-Tetrachloroethane	--	--	--	2.0	U	1.9	U	1.8	U	2.4	U	1.8	U	1.9	U	2.2	U	1.6	U	1.8	U	1.0	U	1.5	U	1.2	U	0.86	U
1,1,1-Trichloroethane	2,000	--	--	2.0	U	1.9	U	1.8	U	2.4	U	1.8	U	1.9	U	2.2	U	1.6	U	1.8	U	1.0	U	1.5	U	1.2	U	0.86	U
1,1,2,2-Tetrachloroethane	--	--	--	4.0	UJ	3.8	U	3.6	UJ	4.7	UJ	3.6	U	3.9	U	4.5	U	3.2	UJ	3.7	UJ	2.0	U	3.0	UJ	2.4	UJ	1.7	U

Table 1. Harper Estuary Restoration Project Phase II
Analytical Results - Metals, SVOCs, VOCs, and Petroleum Hydrocarbons

Chemical	MTCA Method A CUL	MTCA Method B Carc CUL	MTCA Method B NC CUL	HE-1-20140220-S-6-12	HE-1-20140220-S-12-24	HE-2-20140220-S-6-12	HE-2-20140220-S-12-24	HE-2-20140220-S-12-24-DUP	HE-3-20140220-S-6-12	HE-3-20140220-S-18-24	HE-4-20140220-S-6-12	HE-4-20140220-S-18-20	HE-5-20140220-S-6-12	HE-5-20140220-S-18-24	HE-6-20140220-S-6-12	HE-6-20140220-S-18-23
1,1,2-Trichloroethane	--	--	--	2.0 U	1.9 U	1.8 U	2.4 U	1.8 U	1.9 U	2.2 U	1.6 U	1.8 U	1.0 U	1.5 U	1.2 U	0.86 U
1,1-Dichloroethane	--	--	--	2.0 U	1.9 U	1.8 U	2.4 U	1.8 U	1.9 U	2.2 U	1.6 U	1.8 U	1.0 U	1.5 U	1.2 U	0.86 U
1,1-Dichloroethene	--	--	16,000	10 U	9.5 U	9.1 U	12 U	9.1 U	9.7 U	0.69 J	8.0 U	9.2 U	5.1 U	7.5 U	6.0 U	4.3 U
1,1-Dichloropropene	--	--	--	2.0 U	1.9 U	1.8 U	2.4 U	1.8 U	1.9 U	2.2 U	1.6 U	1.8 U	1.0 U	1.5 U	1.2 U	0.86 U
1,2,3-Trichlorobenzene	--	--	--	4.0 UJ	3.8 U	3.6 UJ	4.7 UJ	3.6 U	3.9 U	4.5 U	3.2 UJ	3.7 UJ	2.0 U	3.0 UJ	2.4 UJ	1.7 U
1,2,3-Trichloropropane	--	--	--	2.0 UJ	1.9 U	1.8 UJ	2.4 UJ	1.8 U	1.9 U	2.2 U	1.6 UJ	1.8 UJ	1.0 U	1.5 UJ	1.2 UJ	0.86 U
1,2,4-Trimethylbenzene	--	--	--	4.0 UJ	3.8 U	3.6 UJ	4.7 UJ	3.6 U	3.9 U	4.5 U	3.2 UJ	3.7 UJ	2.0 U	3.0 UJ	2.4 UJ	1.7 U
1,2-Dibromo-3-chloropropane	--	--	--	4.0 UJ	3.8 U	3.6 UJ	4.7 UJ	3.6 U	3.9 U	4.5 U	3.2 UJ	3.7 UJ	2.0 U	3.0 UJ	2.4 UJ	1.7 U
1,2-Dichloroethane	--	--	--	2.0 U	1.9 U	1.8 U	2.4 U	1.8 U	1.9 U	2.2 U	1.6 U	1.8 U	1.0 U	1.5 U	1.2 U	0.86 U
1,2-Dichloropropane	--	--	--	2.0 U	1.9 U	1.8 U	2.4 U	1.8 U	1.9 U	2.2 U	1.6 U	1.8 U	1.0 U	1.5 U	1.2 U	0.86 U
1,3,5-Trimethylbenzene	--	--	--	10 UJ	9.5 U	9.1 UJ	12 UJ	9.1 U	9.7 U	11 U	8.0 UJ	9.2 UJ	5.1 U	7.5 UJ	6.0 UJ	4.3 U
1,3-Dichloropropane	--	--	--	2.0 U	1.9 U	1.8 U	2.4 U	1.8 U	1.9 U	2.2 U	1.6 U	1.8 U	1.0 U	1.5 U	1.2 U	0.86 U
2,2-Dichloropropane	--	--	--	2.0 U	1.9 U	1.8 U	2.4 U	1.8 U	1.9 U	2.2 U	1.6 U	1.8 U	1.0 U	1.5 U	1.2 U	0.86 U
2-Chlorotoluene	--	--	--	4.0 UJ	3.8 U	3.6 UJ	4.7 UJ	3.6 U	3.9 U	4.5 U	3.2 UJ	3.7 UJ	2.0 U	3.0 UJ	2.4 UJ	1.7 U
4-Chlorotoluene	--	--	--	4.0 UJ	3.8 U	3.6 UJ	4.7 UJ	3.6 U	3.9 U	4.5 U	3.2 UJ	3.7 UJ	2.0 U	3.0 UJ	2.4 UJ	1.7 U
Benzene	30	--	--	2.0 U	1.9 U	1.8 U	2.4 U	1.8 U	1.9 U	2.2 U	1.6 U	1.8 U	1.0 U	1.5 U	1.2 U	0.86 U
Bromobenzene	--	--	--	4.0 UJ	3.8 U	3.6 UJ	4.7 UJ	3.6 U	3.9 U	4.5 U	3.2 UJ	3.7 UJ	2.0 U	3.0 UJ	2.4 UJ	1.7 U
Bromochloromethane	--	--	--	2.0 U	1.9 U	1.8 U	2.4 U	1.8 U	1.9 U	2.2 U	1.6 U	1.8 U	1.0 U	1.5 U	1.2 U	0.86 U
Bromoform	--	127,000	--	2.0 U	1.9 U	1.8 U	2.4 U	1.8 U	1.9 U	2.2 U	1.6 U	1.8 U	1.0 U	1.5 U	1.2 U	0.86 U
Bromomethane	--	--	112,000	2.0 UJ	1.9 UJ	1.8 UJ	2.4 UJ	1.8 U	1.9 UJ	2.2 UJ	1.6 UJ	1.8 UJ	1.0 UJ	1.5 UJ	1.2 UJ	0.86 UJ
Carbon tetrachloride	--	14,300	--	2.0 U	1.9 U	1.8 U	2.4 U	1.8 U	1.9 U	2.2 U	1.6 U	1.8 U	1.0 U	1.5 U	1.2 U	0.86 U
CFC-11	--	--	--	2.0 U	1.9 U	1.8 U	2.4 U	1.8 U	1.9 U	2.2 U	1.6 U	1.8 U	1.0 U	1.5 U	1.2 U	0.86 U
CFC-12	--	--	--	2.0 UJ	1.9 UJ	1.8 UJ	2.4 UJ	1.8 U	1.9 UJ	2.2 UJ	1.6 UJ	1.8 UJ	1.0 UJ	1.5 UJ	1.2 UJ	0.86 UJ
Chlorobenzene	--	--	1,600,000	2.0 U	1.9 U	1.8 U	2.4 U	1.8 U	1.9 U	2.2 U	1.6 U	1.8 U	1.0 U	1.5 U	1.2 U	0.86 U
Chlorodibromomethane	--	--	--	2.0 U	1.9 U	1.8 U	2.4 U	1.8 U	1.9 U	2.2 U	1.6 U	1.8 U	1.0 U	1.5 U	1.2 U	0.86 U
Chloroethane	--	--	--	2.0 U	1.9 U	1.8 U	2.4 U	1.8 U	1.9 U	2.2 U	1.6 U	1.8 U	1.0 U	1.5 U	1.2 U	0.86 U
Chloroform	--	--	800,000	2.0 U	1.9 U	1.8 U	2.4 U	1.8 U	1.9 U	2.2 U	1.6 U	1.8 U	1.0 U	1.5 U	1.2 U	0.86 U
Chloromethane	--	--	--	2.0 U	1.9 U	1.8 U	2.4 U	1.8 U	1.9 U	2.2 U	1.6 U	1.8 U	1.0 U	1.5 U	1.2 U	0.86 U
cis-1,2-Dichloroethene	--	--	160,000	2.0 U	1.9 U	1.8 U	2.4 U	1.8 U	1.9 U	2.2 U	1.6 U	1.8 U	1.0 U	1.5 U	1.2 U	0.86 U
cis-1,3-Dichloropropene	--	--	--	2.0 U	1.9 U	1.8 U	2.4 U	1.8 U	1.9 U	2.2 U	1.6 U	1.8 U	1.0 U	1.5 U	1.2 U	0.86 U
Cumene	--	--	--	4.0 U	3.8 U	3.6 U	4.7 U	3.6 U	3.9 U	4.5 U	3.2 U	3.7 U	2.0 U	3.0 U	2.4 U	1.7 U
Dibromomethane	--	--	--	2.0 U	1.9 U	1.8 U	2.4 U	1.8 U	1.9 U	2.2 U	1.6 U	1.8 U	1.0 U	1.5 U	1.2 U	0.86 U
Dichlorobromomethane	--	12,000	--	2.0 U	1.9 U	1.8 U	2.4 U	1.8 U	1.9 U	2.2 U	1.6 U	1.8 U	1.0 U	1.5 U	1.2 U	0.86 U
Ethylbenzene	6,000	--	--	2.0 U	1.9 U	1.8 U	2.4 U	1.8 U	1.9 U	2.2 U	1.6 U	1.8 U	1.0 U	1.5 U	1.2 U	0.86 U
Ethylene dibromide	5	--	--	2.0 U	1.9 U	1.8 U	2.4 U	1.8 U	1.9 U	2.2 U	1.6 U	1.8 U	1.0 U	1.5 U	1.2 U	0.86 U
m,p-Xylene	--	--	16,000,000	4.0 U	3.8 U	3.6 U	4.7 U	3.6 U	3.9 U	4.5 U	3.2 U	3.7 U	2.0 U	3.0 U	2.4 U	1.7 U
Methyl t-butyl ether	100	--	--	2.0 U	1.9 U	1.8 U	2.4 U	1.8 U	1.9 U	2.2 U	1.6 U	1.8 U	1.0 U	1.5 U	1.2 U	0.86 U
Methylene chloride	20	--	--	30 U	29 U	27 U	35 U	27 U	29 U	33 U	24 U	28 U	15 U	22 U	18 U	13 U
N-butylbenzene	--	--	--	4.0 UJ	3.8 U	3.6 UJ	4.7 UJ	3.6 U	3.9 U	4.5 U	3.2 UJ	3.7 UJ	2.0 U	3.0 UJ	2.4 UJ	1.7 U
N-propylbenzene	--	--	8,000,000	2.0 UJ	1.9 U	1.8 UJ	2.4 UJ	1.8 U	1.9 U	2.2 U	1.6 UJ	1.8 UJ	1.0 U	1.5 UJ	1.2 UJ	0.86 U
o-Xylene	--	--	16,000,000	2.0 U	1.9 U	1.8 U	2.4 U	1.8 U	1.9 U	2.2 U	1.6 U	1.8 U	1.0 U	1.5 U	1.2 U	0.86 U
p-Isopropyltoluene	--	--	--	4.0 UJ	3.8 U	3.6 UJ	4.7 UJ	3.6 U	3.9 U	4.5 U	3.2 UJ	3.7 UJ	2.0 U	3.0 UJ	1.4 J	1.7 U
Sec-butylbenzene	--	--	--	4.0 UJ	3.8 U	3.6 UJ	4.7 UJ	3.6 U	3.9 U	4.5 U	3.2 UJ	3.7 UJ	2.0 U	3.0 UJ	2.4 UJ	1.7 U
Styrene	--	--	16,000,000	4.0 U	3.8 U	3.6 U	4.7 U	3.6 U	3.9 U	4.5 U	3.2 U	3.7 U	2.0 U	3.0 U	2.4 U	1.7 U
Tert-butylbenzene	--	--	--	4.0 UJ	3.8 U	3.6 UJ	4.7 UJ	3.6 U	3.9 U	4.5 U	3.2 UJ	3.7 UJ	2.0 U	3.0 UJ	2.4 UJ	1.7 U
Tetrachloroethene	50	--	--	2.0 U	1.9 U	1.8 U	2.4 U	1.8 U	1.9 U	2.2 U	1.6 U	1.8 U	1.0 U	1.5 U	1.2 U	0.86 U
Toluene	7,000	--	--	4.0 U	3.8 U	3.6 U	4.7 U	3.6 U	3.9 U	4.5 U	3.2 U	3.7 U	2.0 U	3.0 U	2.4 U	1.7 U
Total xylenes	9,000	--	--	4.0 U	3.8 U	3.6 U	4.7 U	3.60 U	3.9 U	4.5 U	3.2 U	3.7 U	2.0 U	3.0 U	2.4 U	1.7 U

Table 1. Harper Estuary Restoration Project Phase II
Analytical Results - Metals, SVOCs, VOCs, and Petroleum Hydrocarbons

Chemical	MTCA Method A CUL	MTCA Method B Carc CUL	MTCA Method B NC CUL	HE-1-20140220-S-6-12		HE-1-20140220-S-12-24		HE-2-20140220-S-6-12		HE-2-20140220-S-12-24		HE-2-20140220-S-12-24-DUP		HE-3-20140220-S-6-12		HE-3-20140220-S-18-24		HE-4-20140220-S-6-12		HE-4-20140220-S-18-20		HE-5-20140220-S-6-12		HE-5-20140220-S-18-24		HE-6-20140220-S-6-12		HE-6-20140220-S-18-23	
Trans-1,2-dichloroethene	--	--	720,000	2.0	U	1.9	U	1.8	U	2.4	U	1.8	U	1.9	U	2.2	U	1.6	U	1.8	U	1.0	U	1.5	U	1.2	U	0.86	U
Trans-1,3-dichloropropene	--	--	--	2.0	U	1.9	U	1.8	U	2.4	U	1.8	U	1.9	U	2.2	U	1.6	U	1.8	U	1.0	U	1.5	U	1.2	U	0.86	U
Trichloroethene	30	--	--	2.0	U	1.9	U	1.8	U	2.4	U	1.8	U	1.9	U	2.2	U	1.6	U	1.8	U	1.0	U	1.5	U	1.2	U	0.86	U
Vinyl chloride	--	--	240,000	2.0	U	1.9	U	1.8	U	2.4	U	1.8	U	1.9	U	2.2	U	1.6	U	1.8	U	1.0	U	1.5	U	1.2	U	0.86	U
Petroleum Hydrocarbons (mg/kg)																													
Gasoline-range hydrocarbons	100	--	--	2.2	J	7.7	U	7.3	U	1.6	J	4.12	J	9.2	U	9.5	U	7.1	U	8.3	U	4.2	U	7.1	U	0.98	J	3.9	U
Diesel-range hydrocarbons	2,000	--	--	79	J	53	J	67	J	120	J	165		9.3	J	11	J	34	U	38	U	26	U	49	J	12	J	6.6	J
Motor oil-range hydrocarbons	2,000	--	--	200	J	130	J	140	J	290	J	389		76	U	77	U	68	U	77	U	51	U	160	J	77	U	52	U

Notes:

MTCA Method B Cleanup Levels are presented for chemicals for which MTCA Method A Cleanup Levels have not been promulgated. If carcinogenic and non-carcinogenic MTCA Method B Cleanup Levels have been promulgated, the lower of the two cleanup levels is shown. Cleanup Levels have not been promulgated under MTCA for all chemicals.

[a] Chromium concentrations are compared to the MTCA Method A Cleanup Levels for Chromium (VI) of 19 mg/kg and Chromium (III) of 2,000 mg/kg.

Nondetect results in ***italics*** exceed MTCA Method A Cleanup Levels.

Detected results that are **shaded gray** exceed the MTCA Method A Cleanup Levels for unrestricted land use.

All samples were collected on 2/20/2014.

PAHs = polycyclic aromatic hydrocarbons

cPAHs = carcinogenic polycyclic aromatic hydrocarbons

HPAHs = high molecular weight polycyclic aromatic hydrocarbons

LPAHs = low molecular weight polycyclic aromatic hydrocarbons

MTCA = Model Toxics Control Act

MTCA Method A CUL = MTCA Method A Cleanup Level for unrestricted land use

MTCA Method B Carc CUL = MTCA Method B Cleanup Level for Carcingen, Direct contact (ingestion only), unrestricted land use

MTCA Method B NC CUL = MTCA Method B Cleanup Level for Non-carcingen, Direct contact (ingestion only), unrestricted land use

CUL = cleanup level

nd = nondetect

RL = reporting limit

SVOCs = semivolatile organic compounds

VOCs = volatile organic compounds

mg/kg = milligrams per kilogram

µg/kg = micrograms per kilogram

Data Qualifiers:

J = estimated concentration

U = nondetect

UJ = nondetect as estimated reporting limit

Table 2. Harper Estuary Restoration Project Phase II
Analytical Results - Dioxins and Furans

Chemical	MTCA Method B CUL, Carcinogen	HE-COMP1-20140220-S-6-12		HE-COMP1-20140220-S-6-12-DUP		HE-COMP2-20140220-S-6-12	
Dioxins and Furans (ng/kg)							
1,2,3,4,6,7,8-HPCDD	--	20.9		25.66		14.1	
1,2,3,4,6,7,8-HPCDF	--	14.7		22.94		4.07	Uq
1,2,3,4,7,8,9-HPCDF	--	0.511	U	1.695	J	0.609	U
1,2,3,4,7,8-HXCDD	--	1.61	J	1.939	Uq	0.287	U
1,2,3,4,7,8-HXCDF	--	5.58	J	8.816		0.945	Uq
1,2,3,6,7,8-HXCDD	--	2.04	Uq	4.054	J	0.947	Uq
1,2,3,6,7,8-HXCDF	--	3.34	J	6.041	J	0.861	U
1,2,3,7,8,9-HXCDD	--	2.12	Uq	5.280	J	0.771	J
1,2,3,7,8,9-HXCDF	--	0.386	U	0.561	U	1.06	U
1,2,3,7,8-PECDD	--	1.66	J	2.335	J	0.393	U
1,2,3,7,8-PECDF	--	4.06	J	5.928	J	0.519	U
2,3,4,6,7,8-HXCDF	--	1.91	J	3.600	J	0.819	U
2,3,4,7,8-PECDF	--	4.31	J	5.819	J	0.532	U
2,3,7,8-TCDD	11	0.830	J	0.8933	J	0.319	Uq
2,3,7,8-TCDF	--	2.75		3.139	Uq	0.805	J
OCDD	--	111		113.6		155	
OCDF	--	6.72	J	13.10	J	4.86	J
Total HPCDD	--	44.9		52.65		33.0	
Total HPCDF	--	22.2		34.09		10.1	Jq
Total HXCDD	161	41.1	Jq	74.39	Jq	9.76	Jq
Total HXCDF	--	62.0	Jq	47.68		8.26	Jq
Total PECDD	--	38.1	Jq	87.02	J	2.63	J
Total PECDF	--	53.1		73.25	Jq	6.74	
Total TCDD	--	31.0	Jq	83.05	Jq	2.38	Jq
Total TCDF	--	61.5		90.79	Jq	4.37	Jq
Total Dioxins/Furans TEQ	11	6.03	J	8.73	J	1.01	J
Total Dioxins TEQ	--	3.10	J	4.55	J	0.682	J
Total Furans TEQ	--	2.92	J	4.18	J	0.324	J

Notes:

TEQs were calculated using the approach described in Section 3.1.

All samples were collected on 2/20/2014.

MTCA Method B CUL, Carcinogen = MTCA Method B Cleanup Level for soil, direct contact, carcinogen

TEQ = toxic equivalency

ng/kg = nanograms per kilogram

Data Qualifiers:

J = estimated concentration

Jq = estimated concentration; the reported result is the estimated maximum possible concentration quantitated using a theoretical ion ratio, the measured ion ratio does not meet qualitative identification criteria and indicates possible interference.

U = nondetect

UJ = nondetect as estimated reporting limit

Uq = nondetect; the reported value is the estimated maximum possible concentration quantitated using a theoretical ion ratio, the measured ion ratio does not meet qualitative identification criteria and indicates possible interference.

Table 3. Harper Estuary Restoration Project Phase II
Comparison of Analytical Results to Priority Contaminants of Ecological Concern (MTCA Table 749-2)

Chemical	Unrestricted Land Use Soil Concentration	HE-1-20140220-S-6-12	HE-1-20140220-S-12-24	HE-2-20140220-S-6-12	HE-2-20140220-S-12-24	HE-2-20140220-S-12-24-	HE-3-20140220-S-6-12	HE-3-20140220-S-18-24	HE-4-20140220-S-6-12	HE-4-20140220-S-18-20	HE-5-20140220-S-6-12	HE-5-20140220-S-18-24	HE-6-20140220-S-6-12	HE-6-20140220-S-18-23
Metals (mg/kg)														
Antimony	--	1.0	0.90	0.89	1.1	0.909	0.73	0.70	0.37	0.47	0.23	1.5	0.65	0.26
Arsenic[a]	20 / 95	14 J	11 J	12 J	16 J	13.2 J	21 J	33 J	6.6 J	6.5 J	4.8 J	15 J	5.2 J	3.6 J
Beryllium	25	0.75	0.84	0.60	0.63	0.531	0.92	1.1	0.29	0.28	0.20	0.96	0.62	0.25
Cadmium	25	0.28	0.22 J	0.27	0.48	0.332	0.16 J	0.19 J	0.092 J	0.060 J	0.14	0.25	0.26	0.11 J
Chromium	42	33	28	25	25	21.1	37	33	23	22	22	27	24	21
Copper	100	58 J	78 J	43 J	66 J	55.4	69 J	58 J	25 J	30 J	14 J	55 J	42 J	21 J
Lead	220	32	22	94	71	59.7	6.5	4.0	26	28	9.1	26	120	26
Mercury[b]	9 / 0.7	0.052	0.025	0.040	0.045	0.0412	0.018 J	0.0087 J	0.052	0.062	0.029	0.018 J	0.024	0.012 J
Nickel	100	39	33	31	30	24.9	50	43	29	26	27	30	30	23
Selenium	0.8	0.98	0.86 J	0.76 J	1.0 J	0.744 J	0.94 J	0.89 J	0.39 J	0.36 J	0.29 J	1.1	0.55 J	0.38 J
Zinc	270	140	71	260	530	440	38	26	52	48	33	56	67	33
PAHs (µg/kg)														
Benzo(a)pyrene	30,000	28 J	48 U	24 J	71	55.7	45 U	49 U	40 U	47 U	31 U	23 J	44	15 J
Phthalates (µg/kg)														
Dibutyl phthalate	200	710 U	810 U	680 U	900 U	740 U	740 U	820 U	670 U	780 U	520 U	700 U	580 U	530 U
Phenols (µg/kg)														
Pentachlorophenol	11,000	280 U	320 U	270 U	360 U	300 U	300 U	330 U	270 U	310 U	210 U	280 U	230 U	210 U
Other SVOCs (µg/Kg)														
Hexachlorobenzene	31,000	71 U	81 U	68 U	90 U	74 U	74 U	82 U	67 U	78 U	52 U	70 U	58 U	53 U
Petroleum Hydrocarbons (mg/kg)														
Gasoline-range hydrocarbons	200	2.2 J	7.7 U	7.3 U	1.6 J	4.12 J	9.2 U	9.5 U	7.1 U	8.3 U	4.2 U	7.1 U	0.98 J	3.9 U
Diesel-range hydrocarbons	460	79 J	53 J	67 J	120 J	165	9.3 J	11 J	34 U	38 U	26 U	49 J	12 J	6.6 J
Motor oil-range hydrocarbons	460	200 J	130 J	140 J	290 J	389	76 U	77 U	68 U	77 U	51 U	160 J	77 U	52 U
Dioxins and Furans (ng/kg)														
Total Dioxins TEQ	5	--	--	--	--	--	--	--	--	--	--	--	--	--
Total Furans TEQ	3	--	--	--	--	--	--	--	--	--	--	--	--	--

Notes:

Detected results that are **shaded gray** exceed Priority Contaminants of Ecological Concern Concentrations (Table 749-2).

[a] Arsenic concentrations are compared to Table 749-2 concentrations for Arsenic III of 20 mg/kg and Arsenic V of 95 mg/kg.

[b] Mercury concentrations are compared to Table 749-2 concentrations for inorganic mercury of 9 mg/kg and organic mercury of 0.7 mg/kg.

All samples were collected on 2/20/2014.

MTCA = Model Toxics Control Act

PAHs = polycyclic aromatic hydrocarbons

SVOCs = semivolatile organic compounds

TEQ = toxic equivalency

mg/kg = milligrams per Kilogram

µg/kg = micrograms per Kilogram

ng/kg = nanograms per Kilogram

-- = not analyzed

Data Qualifiers:

J = estimated concentration

U = nondetect

UJ = nondetect as estimated reporting limit

Table 3. Harper Estuary Restoration Project Phase II
Comparison of Analytical Results to Priority Contaminants of Ecological Concern (MTCA Table 749-2)

Chemical	Unrestricted Land Use	HE-COMP1-20140220-S-6-12	HE-COMP1-20140220-S-6-12-DUP	HE-COMP2-20140220-S-6-12
Metals (mg/kg)				
Antimony	--	--	--	--
Arsenic	20 / 95	--	--	--
Beryllium	25	--	--	--
Cadmium	25	--	--	--
Chromium	42	--	--	--
Copper	100	--	--	--
Lead	220	--	--	--
Mercury	9 / 0.7	--	--	--
Nickel	100	--	--	--
Selenium	0.8	--	--	--
Zinc	270	--	--	--
PAHs (µg/kg)				
Benzo(a)pyrene	30,000	--	--	--
Phthalates (µg/kg)				
Dibutyl phthalate	200	--	--	--
Phenols (µg/kg)				
Pentachlorophenol	11,000	--	--	--
Other SVOCs (µg/kg)				
Hexachlorobenzene	31,000	--	--	--
Petroleum Hydrocarbons (mg/kg)				--
Gasoline-range hydrocarbons	200	--	--	--
Diesel-range hydrocarbons	460	--	--	--
Motor oil-range hydrocarbons	460	--	--	--
Dioxins and Furans (ng/kg)				
Total Dioxins TEQ	5	3.10 J	4.55 J	0.682 J
Total Furans TEQ	3	2.92 J	4.18 J	0.324 J

Appendix A

Field Documentation

Appendix A-1

Field Log

01/24/14

1110 Aaron Wisher and Megan Gay arrive at Harper Estuary boat launch. Discuss route to hospital.

1115 Jim Heytvelt, Kitsap County Cultural Resources, arrives at site. (volunteer)

1143 Sue Donohue (Kitsap County) and Celina Abercrombie (Ecology) arrive at the site. Sue Donohue, community liasion for Harper Estuary project.

1230 Charlotte Garrido, Kitsap County Commissioner arrives at site.

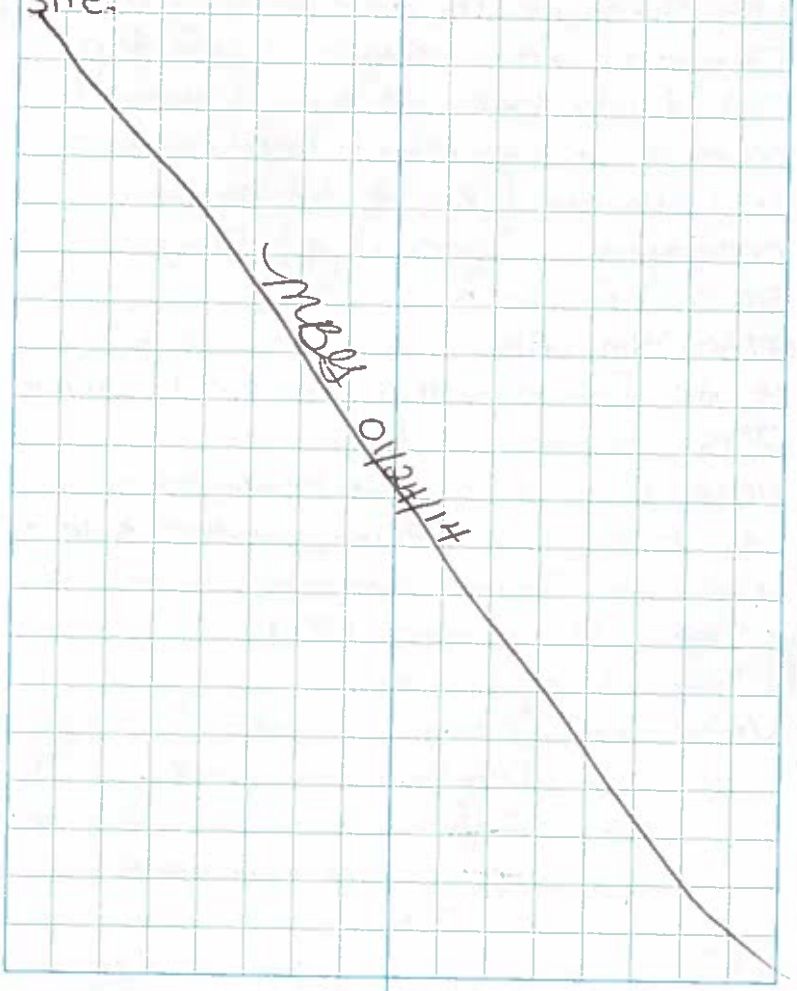
Celina Abercrombie requested information for sampling and characterizing the brick fill.

M. Gay and Abercrombie discussed boring locations and sampling techniques. Three borings will be advanced in the berm fill area north of Olympiad Drive. Three borings will be advanced in the brick-filled area south of Olympiad Drive and east of Southworth Drive. Samples will be collected in the fill, avoiding the organic surficial materials.

01/24/14

1333 J. Heytvelt, S. Donohue, and C. Garrido leave site.

1345 A. Wisher and M. Gay leave site.



Harper Estuary Soil Sampling 08/20/2014

0645 Megan Gay, Aaron Wisher, and Michael Page (Leidos) arrive at site. Tide coming in, windy.

0700 Site Health and Safety Meeting. Discussed site hazards, slips trips and falls, back strain, aquatic life, muscle strain from hand augering and shoveling, route to hospital, emergency procedures, Discussed scope of work.

0730 Celina Abercrombie (Ecology) arrives at site. Begin setting up field equipment

0745 - Calibrated PID, started

0812 Begin digging at HE-1, south side of SE Olympiad Drive, western side of Estuary. Grass covered

0828 GPS recorded HE-1

0827 Photo recorded

0830 SUE Donahue (Kitsap Co.) onsite

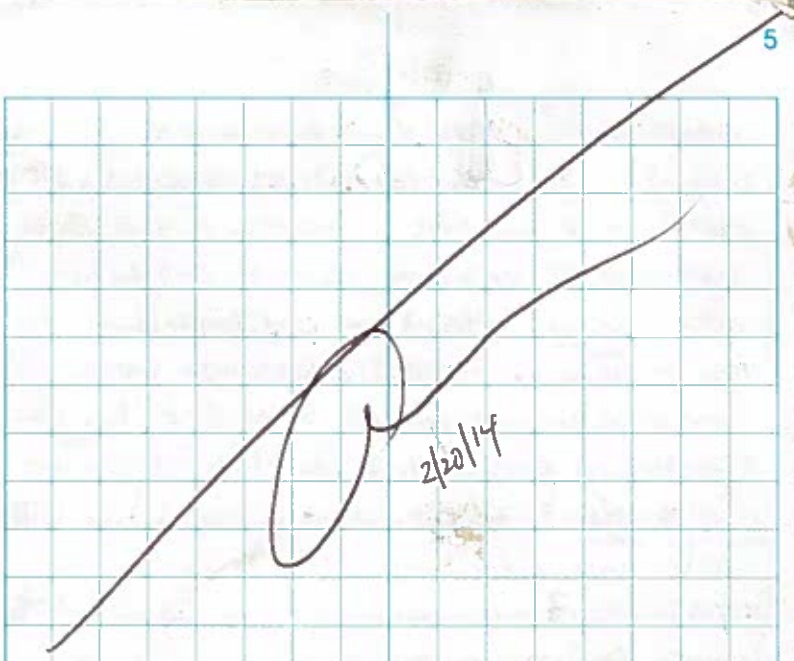
0840 VOC/TPH Samples 6-12 ①

HE-1 6-12 silt/sand, brick debris, roots [A]

12-24 silt/sand, brick debris, roots, grey [B]

▽ 18"

0920 VOC/TPH SAMPLES 12-24 ②



① 0840 HE-1-20140220-S-6-12 6 containers

② 0920 HE-1-20140220-S-12-24 6 containers

[A] HE-1, 6-12" Reddish-light Brown to gray silty fine to Coarse SAND, moist, loose, roots (1"max), little to Some gravel to occ. cobble size Brick debris throughout. (SM) fill

[B] HE-1, 12-24" Reddish-light Brown to gray silty fine to Coarse SAND, moist to wet, loose, roots, brick debris, little to some gravel to occ cobble. (SM) fill

▽ 18"

E-mailed 04/24/14 1000

0940 HE-2 SM, large brick debris, [A]
extensive roots, black to brown
0941 GPS recorded [B]
0941 Photo recorded
0950 Sample HE-2 at 6-12 inches ①
1015 Sample HE-2 at 12-24 inches ②
VOCs collected at 18 inches Extra
material submitted for lab duplicate
1035 HE-3 -6-12-SM, reddish brn, brick, roots [E] ③
1040 Sample HE-3 TPH 6-12
1059 HE-3 12-24 SM, red/brn, bricks, roots, charcoal [D] ④
1105 SAMPLE 12-24
1107 GPS/Photos Recorded
1108 Backfill HE-2
1112 Backfill HE-1
1114 HE-COMP1 collected ⑨
1150 Doris SMALL ONSITE visit
1230 HE-4 · SM, dbrn, roots, wood 6-12 [E]
1240 ~~1235~~ HE-4 SAMPLE 6-12 ⑤
1250 HE-4 SAMPLE 12-24 ⑥
HE-4, SM, dbrn, rocks, 12-24 [F]
1252 GPS, Photo
1315 HE-5 ~~MISSED~~ SM, Bricks, debris, roots, wood 6-12 [G]
HE-5 SAMPLE 6-12 ⑦
1354 HE-5 SAMPLE 12-24 ⑧
HE-5 12-24, mottled brn/gray SM, Bricks, wood, roots [H]

① 0950 HE-2-20140220-S-6-12 6 containers
② 1015 HE-2-20140220-S-12-24 6 containers
③ 1038 HE-3-20140220-S-6-12 6 containers field duplicate
④ 1059 HE-3-20140220-S-18-24 6 containers
⑤ 1240 HE-4-20140220-S-6-12 5 containers
⑥ 1250 HE-4-20140220-S-18-20 6 containers emailed 04/24/14
⑦ 1315 1350 HE-5-20140220-S-6-12 6 containers
⑧ 1354 HE-5-20140220-S-18-24 6 containers
⑨ 1114 HE-COMP1-20140220-S-6-2 2 containers field duplicate

[A] HE-2 6-12, reddish-light Brown to gray, silty fine to coarse SAND, moist, loose, roots, large Brick debris, little to some gravel to occ. cobble (SM) fill

[B] HE-2 12-24, reddish-light Brn to gray, silty fine to coarse SAND, moist to wet loose, roots, Brick debris, little to some gravel and cobble (SM) fill

[C] HE-3 6-12 - reddish-lt. brn to gray, silty fine to coarse SAND, moist loose, roots, Brick debris, little to some gravel and cobble (SM) fill

[D] HE-3 12-24, reddish-lt. brn. to gray, silty fine to coarse SAND, WET, loose, roots brick debris, some gravel to cobble, charcoal (SM) fill

[E] HE-4 6-12, reddish-lt.brn. to gray, silty fine to coarse SAND, moist, loose roots, wood debris, gravel to cobble (SM)

[F] HE-4 12-24, reddish-lt.brn to gray, silty fine to coarse SAND, moist loose, roots, gravel to cobble (SM)

[G] HE-5 6-12, Brn to gray, silty fine to coarse SAND, moist, loose, roots, brick, gravel to cobble (SM) fill

[H] HE-5 12-24", mottled Brn to gray, silty fine to coarse SAND, moist, loose, roots, brick debris, gravel size, (SM) fill

02/20/2014

1420 HE-6 6-12 Sm brn gravel, roots, roots, brick chips [A]
1427 HE-6 6-12 Sample ①
1430 HE-6 18-23 sm brn gravel, wood, roots, brick, [B]
1441 HE-6 18-23 SAmple ②
1437 HE-COMP2 SAmple ③
1440 GPS, Photo
1445 HE-6 backfill
1515 Megan Gay, Aaron Wisher, and Michael Pagel depart site.

Megan Gay 02/20/2014

① 1427 HE-6-20140220-S-6-12 6 containers
② 1441 HE-6-20140220-S-18-23 6 containers
③ 1437. HE-COMP2-20140220-S-6-12 1 container

[A] HE-6 6'-12' Brn to dk Brn., silty fine to coarse SAND, moist, loose, roots, brick debris, gravel to cobble size (SM) fill

[B] HE-6 18'-23', Brn. to dk brn, silty fine to coarse SAND, moist, loose, roots, brick debris, gravel to cobble size, (SM) fill

Aaron Wisher 2/20/2014

Appendix A-2

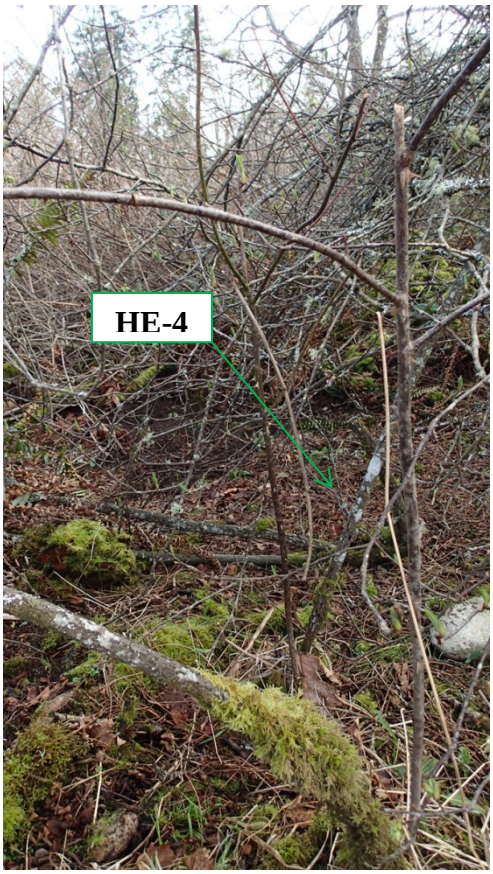
Field Photographs

Harper Estuary, view to the north from SE Olympiad Drive

Sample Station HE-1, view to the northeast

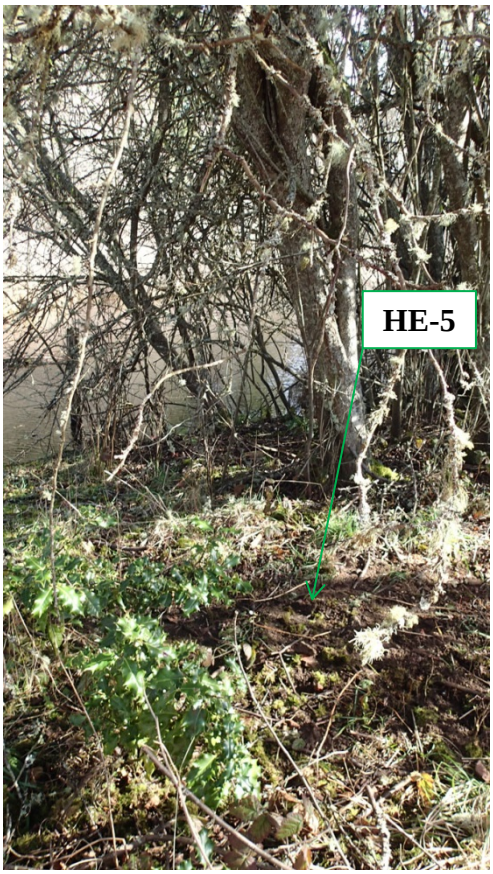
Sample Station HE-2, view to the south

Sample Station HE-3, view to the east



Sample Station HE-4, view to the southeast

Sample Station HE-5, view to the west



Sample Station HE-5, view to the southeast

Sample Station HE-6, view to the southwest

View to the north from Sample Station HE-6

View to the west near Sample Station HE-6

Appendix B

Laboratory Reports

(provided on CD)

Appendix C

Data Validation Report

EcoChem, INC.
Environmental Data Quality

DATA VALIDATION REPORT

HARPER ESTUARY RESTORATION PROJECT
PHASE II

Prepared for:

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EcoChem Project: C4155-2

April 2, 2014

Approved for Release

Christine Ransom
Project Manager
EcoChem, Inc.

PROJECT NARRATIVE

Basis for Data Validation

This report summarizes the results of the data validation performed on soil samples and quality control (QC) sample data for the Harper Estuary Restoration Project - Phase II. All fractions received full (EPA Stage 4) level validation; with trip blanks receiving a compliance level review (EPA Stage 2A). A complete list of samples is provided in the **Sample Index**.

All analyses, except dioxins, were performed by TestAmerica Laboratories, Inc., Seattle, Washington. The dioxin analysis was performed by TestAmerica, West Sacramento, California. The analytical methods and EcoChem project chemists are listed below.

Analysis	Method of Analysis	Primary Review	Secondary Review
Dioxin/Furans	EPA 1613B	M. Swanson	C. Ransom
Volatile Organic Compounds (VOC)	SW8260	M. Failor	
Semivolatile Organic Compounds (SVOC)	SW8270C		
Total Petroleum Hydrocarbons – Diesel Range	NWTPH-Dx		
Total Petroleum Hydrocarbons – Gasoline Range	NWTPH-Gx		
Metals and Mercury	SW6020, 7471A	J. Holder	

The data were reviewed using guidance and quality control criteria documented in the analytical methods; The *Harper Estuary Restoration Project Phase II, Sampling and Analysis Plan/Quality Assurance Project Plan* (Leidos, February 2014); *USEPA National Functional Guidelines for Organic Data Review* (EPA, 2008); *USEPA National Functional Guidelines for Chlorinated Dioxin/Furan Data Review* (EPA, 2011); and *USEPA National Functional Guidelines for Inorganic Data Review* (EPA, 1994, 2010).

EcoChem's goal in assigning data validation qualifiers is to assist in proper data interpretation. If values are estimated (assigned a J), data may be used for site evaluation purposes but reasons for data qualification should be taken into consideration when interpreting sample concentrations. Data that have been rejected (R) should not be used for any purpose. Values with no data qualifier meet all data quality goals as outlined in the EPA Functional Guidelines.

Data qualifier definitions, reason codes, and validation criteria are included as **Appendix A**. **Appendix B** contains the Qualified Data Summary Table. Data validation worksheets are kept on file at EcoChem. A qualified laboratory electronic data deliverable (EDD) is also submitted with this report.

Sample Index
Harper Estuary Restoration Project - Phase II

SDG	Sample ID	Lab ID	VOC	SVOC	TPH-Dx	TPH-Gx	Dioxins	Metals
580-42463-1	HE-1-20140220-S-6-12	42463-1	✓	✓	✓	✓		✓
580-42463-1	HE-1-20140220-S-12-24	42463-2	✓	✓	✓	✓		✓
580-42463-1	HE-2-20140220-S-6-12	42463-3	✓	✓	✓	✓		✓
580-42463-1	HE-2-20140220-S-12-24	42463-4	✓	✓	✓	✓		✓
580-42463-1	HE-3-20140220-S-6-12	42463-5	✓	✓	✓	✓		✓
580-42463-1	HE-3-20140220-S-18-24	42463-6	✓	✓	✓	✓		✓
580-42463-1	HE-4-20140220-S-6-12	42463-7	✓	✓	✓	✓		✓
580-42463-1	HE-4-20140220-S-18-20	42463-8	✓	✓	✓	✓		✓
580-42463-1	HE-5-20140220-S-6-12	42463-9	✓	✓	✓	✓		✓
580-42463-1	HE-5-20140220-S-18-24	42463-10	✓	✓	✓	✓		✓
580-42463-1	HE-6-20140220-S-6-12	42463-11	✓	✓	✓	✓		✓
580-42463-1	HE-6-20140220-S-18-23	42463-12	✓	✓	✓	✓		✓
580-42463-1	Trip Blank	42463-15	✓			✓		
580-42463-2	HE-COMP1-20140220-S-6-12	42463-13					✓	
580-42463-2	HE-COMP2-20140220-S-6-12	42463-14					✓	

DATA VALIDATION REPORT
Harper Estuary Restoration Project – Phase II
Dioxin & Furan Compounds by EPA Method 1613B

This report documents the review of analytical data from the analysis of soil samples and the associated laboratory quality control (QC) samples. Samples were analyzed by TestAmerica Laboratories, Inc., West Sacramento, California. Refer to the **Sample Index** for a complete list of samples.

SDG	Number of Samples	Validation Level
J42463-2	2 Soil Composite	EPA Stage 4

I. DATA PACKAGE COMPLETENESS

The laboratory submitted all required deliverables for a full validation. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative.

The samples were initially received at Test America, Seattle, WA and then transferred to Test America, West Sacramento, CA. The transfer documentation between the laboratories was not included in the original data package. The laboratory was contacted and the transfer documentation was submitted.

II. TECHNICAL DATA VALIDATION

The QC requirements that were reviewed are listed below.

✓	Sample Receipt, Preservation, and Holding Times	✓	Laboratory Control Samples (LCS)
✓	System Performance and Resolution Checks	1	Matrix Spikes/Matrix Spike Duplicate (MS/MSD)
✓	Initial Calibration (ICAL)	2	Laboratory Duplicate Samples
✓	Calibration Verification	✓	Target Analyte List
✓	Method Blanks	✓	Reported Results
1	Field Blanks	2	Compound Identification
✓	Labeled Compound Recovery	✓	Calculation Verification

✓Method quality objectives (MQO) and QC criteria have been met. No outliers are noted or discussed.
[1] Quality control results are discussed below, but no data were qualified.
[2] Quality control outliers that impact the reported data were noted. Data qualifiers were issued as discussed below.

Field Blanks

No field blanks were submitted.

Matrix Spike/Matrix Spike Duplicate

Matrix spike/matrix spike duplicate (MS/MSD) analyses were not performed. The laboratory control sample (LCS) was used to evaluate laboratory accuracy and the laboratory duplicate analysis was used to evaluate laboratory precision.

Laboratory Duplicates

The laboratory relative percent difference (RPD) control limit is 50%. For results less than 5x the reporting limit (RL), the absolute difference between the sample and duplicate must be less than 2x RL.

The laboratory duplicate analysis was performed using Sample HE-COMP1-20140220-S-6-12. The RPD values for total TCDD, PeCDD and HxCDD were greater than the control limit. The results for these homolog groups were estimated (J-9) in the parent sample.

Field Duplicates

No field duplicates were submitted.

Compound Identification

The method requires the confirmation of 2,3,7,8-TCDF using a second GC column as the DB-5 column cannot fully separate 2,3,7,8-TCDF from closely eluting non-target TCDF isomers. The laboratory performed a second column confirmation when the positive result for 2,3,7,8-TCDF was greater than the reporting limit.

The laboratory assigned a "q" flag to one or more analytes to indicate that the ion ratio criterion for positive identification was not met. Because the ion abundance ratio is the primary identification criterion for high resolution mass spectroscopy, an outlier indicates that the reported result may be a false positive. The "q" flagged results for single analytes were qualified as not detected (U-25) at the reported concentration. The "q" flagged results for total homolog groups were estimated (J-25).

Calculation Verification

Several results were verified by recalculation from the raw data. No calculation or transcription errors were found.

III. OVERALL ASSESSMENT

As was determined by this evaluation, the laboratory followed the specified analytical method. Accuracy was acceptable as demonstrated by the labeled compound and LCS recoveries. With the exceptions noted above, precision was acceptable as demonstrated by the laboratory duplicate RPD values.

Data were qualified as not detected based on ion ratio outliers. Data were estimated due to homolog group ion ratio outliers and laboratory precision outliers.

All data, as qualified, are acceptable for use.

DATA VALIDATION REPORT
Harper Estuary Restoration Project - Phase II
Volatile Organic Compounds by SW846 Method 8260B

This report documents the review of analytical data from the analysis of soil samples and the associated field and laboratory quality control (QC) samples. Samples were analyzed by TestAmerica Laboratories, Inc., Seattle, Washington. Refer to the **Sample Index** for a complete list of samples.

SDG	Number of Samples	Validation Level
J42463-1	12 Soil	EPA Stage 4
	1 Trip Blank	EPA Stage 2A

I. DATA PACKAGE COMPLETENESS

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative.

II. VERIFICATION OF EDD TO LABORATORY REPORT

Sample results and related quality control data were received as an electronic data deliverable (EDD) and laboratory report. The EDD was verified against the laboratory report; no errors were found. At the request of Leidos, the laboratory used the Washington Department of Ecology Environmental Information Management (EIM) specified analyte names in the EDD. The differences between the data package and the EDD are noted below:

Analyte in PDF	Analyte in EDD
dichlorodifluoromethane	CFC-12
trichlorofluoromethane	CFC-11
chlorobromomethane	bromochloromethane
isopropylbenzene	cumene
4-isopropyltoluene	p-isopropyltoluene

III. TECHNICAL DATA VALIDATION

The QC elements that were reviewed are listed below.

✓	Sample Receipt, Preservation, and Holding Times	✓	Laboratory Control Samples (LCS/LCSD)
2	Initial Calibration (ICAL)	✓	Laboratory Duplicates
✓	GC/MS Instrument Performance Check	1	Field Duplicates
✓	Continuing Calibration (CCAL)	✓	Target Analyte List
✓	Blanks (Method)	✓	Reporting Limits (MDL and MRL)
1	Field Blanks	1	Compound Identification
✓	Surrogate Compounds	✓	Reported Results
1	Matrix Spike/Matrix Spike Duplicates (MS/MSD)	✓	Reporting Limits
2	Internal Standards	1	Calculation Verification

✓ Stated method quality objectives (MQO) and QC criteria have been met. No outliers are noted or discussed.
[1] Quality control results are discussed below, but no data were qualified.
[2] Quality control outliers that impact the reported data were noted. Data qualifiers were issued as discussed below.

Initial Calibration

The initial calibration verification (ICV) percent difference (%D) values for dichlorodifluoromethane (CFC-12) and bromomethane were outside the control limits of +/- 30% and indicated a potential low bias. These analytes were not detected in the field samples; results were estimated (UJ-5BL).

Field Blanks

One trip blank was submitted. No target analytes were detected in the trip blank.

Matrix Spike/Matrix Spike Duplicates

Matrix spike/matrix spike duplicate (MS/MSD) samples were not analyzed. Accuracy and precision were evaluated using the laboratory control sample/laboratory control sample duplicate (LCS/LCSD) and laboratory duplicate analyses.

Internal Standards

The responses for the internal standard 1,4-dichlorobenzene-d4 in the samples listed below were less than 50% of the response in the initial calibration midpoint standard. The analytes associated with this internal standard were estimated (J/UJ-19).

HE-1-20140220-S-6-12
HE-2-20140220-S-6-12
HE-2-20140220-S-12-24
HE-4-20140220-S-6-12
HE-4-20140220-S-18-20
HE-5-20140220-S-18-24
HE-6-20140220-S-6-12

Field Duplicates

No field duplicates were submitted.

Calculation Verification

Several results were verified by recalculation from the raw data. No calculation or transcription errors were noted.

IV. OVERALL ASSESSMENT

As was determined by this evaluation, the laboratory followed the specified analytical method. Accuracy was acceptable as demonstrated by the surrogate and LCS/LCSD percent recovery values. Precision was also acceptable as demonstrated by the LCS/LCSD and laboratory duplicate relative percent difference values.

Results were estimated due to ICV %D outliers and internal standard response outliers.

All data, as qualified, are acceptable for use.

DATA VALIDATION REPORT
Harper Estuary Restoration Project - Phase II
Semivolatile Organic Compounds by SW846 Method 8270C

This report documents the review of analytical data from the analysis of soil samples and the associated laboratory quality control (QC) samples. Samples were analyzed by TestAmerica Laboratories, Inc., Fife, Washington. Refer to the **Sample Index** for a complete list of samples.

SDG	Number of Samples	Validation Level
J42463-1	12 Soil	EPA Stage 4

I. DATA PACKAGE COMPLETENESS

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative.

II. VERIFICATION OF EDD TO LABORATORY REPORT

Sample results and related quality control data were received as an electronic data deliverable (EDD) and laboratory report. The EDD was verified against the laboratory report; no errors were found. At the request of Leidos, the laboratory used the Washington Department of Ecology Environmental Information Management (EIM) specified analyte names in the EDD. The differences between the data package and the EDD are noted below:

Analyte in PDF	Analyte in EDD
2-methylphenol	o-cresol
3 & 4 methylphenol	m,p-cresol
3-nitroaniline	m-nitroaniline
di-n-butylphthalate	dibutylphthalate
2,2'oxybis [1-chloropropane]	Bis(2-chloro-1-methylethyl) ether

II. TECHNICAL DATA VALIDATION

The QC elements that were reviewed are listed below.

✓	Sample Receipt, Preservation, and Holding Times	✓	Laboratory Duplicates
✓	Initial Calibration (ICAL)	✓	Internal Standards
✓	GC/MS Instrument Performance Check	1	Field Duplicates
1	Continuing Calibration (CCAL)	✓	Target Analyte List
2	Blanks (Method)	✓	Reporting Limits (MDL and MRL)
1	Field Blanks	✓	Compound Identification
✓	Surrogate Compounds	✓	Reported Results
2	Laboratory Control Samples (LCS/LCSD)	✓	Reporting Limits
1	Matrix Spike/Matrix Spike Duplicates (MS/MSD)	1	Calculation Verification

✓ ***Stated method quality objectives (MQO) and QC criteria have been met. No outliers are noted or discussed.***
[1] ***Quality control results are discussed below, but no data were qualified.***
[2] ***Quality control outliers that impact the reported data were noted. Data qualifiers were issued as discussed below.***

Continuing Calibration

The continuing calibration (CCAL) percent difference values for 4-nitrophenol were outside of the control limits of +/- 25% and were indicative of an increase in the instrument response. This analyte was not detected in the associated samples; no action was necessary based on the potential high bias.

Method Blanks

Bis (2-ethylhexyl) phthalate was detected in the method blank. In order to evaluate the effect of method blank contamination on the field samples, an action level was established at 10x the blank concentration (common laboratory contaminant). Positive results in the associated samples that were less than the action level were qualified as not-detected (U-7). Qualified results less than the reporting limit (RL), should be considered to be not detected at the RL. The "result" and "result_num" fields in the database were changed to the RL for cases where the qualified result was less than the RL. This change was also annotated in the "val_notes" field. No action was taken for results that were greater than the action levels or for non-detects.

Field Blanks

No field blanks were submitted.

Laboratory Control Samples

The laboratory control sample/laboratory control sample duplicate (LCS/LCSD) %R values for 3-nitroaniline and 2,4-dinitrophenol were less than the lower control limit. These analytes were not detected in the field samples; the results were estimated (UJ-10L) to indicate a potential low bias.

The LCS/LCSD %R values for 4-nitrophenol were greater than the upper control limit, indicating a potential high bias. This analyte was not detected in the associated samples; no action was necessary.

Matrix Spike/Matrix Spike Duplicates

Matrix spike/matrix spike duplicates (MS/MSD) were using sample HE-6-20140220-18-23. The %R values for 4-nitrophenol were greater than the upper control limit of 125%, indicating a potential high bias. This analyte was not detected in the parent sample; therefore; no action was necessary.

Field Duplicates

No field duplicates were submitted.

Calculation Verification

Several results were verified by recalculation from the raw data. No calculation or transcription errors were noted.

IV. OVERALL ASSESSMENT

As was determined by this evaluation, the laboratory followed the specified analytical method. With the exceptions noted above, accuracy was acceptable as demonstrated by the surrogate, LCS/LCSD, and MS/MSD percent recovery values and precision was acceptable as demonstrated by the LCS/LCSD, MS/MSD, and laboratory duplicate RPD values.

Detection limits were elevated due to method blank contamination. Data were estimated based on LCS/LCSD %R outliers.

All data, as qualified, are acceptable for use.

DATA VALIDATION REPORT
Harper Estuary Restoration Project - Phase II
Diesel Range Hydrocarbons and Motor Oil by Method NWTPH-Dx

This report documents the review of analytical data from the analysis of soil samples and the associated laboratory quality control (QC) samples. Samples were analyzed by TestAmerica Laboratories, Inc., Seattle, Washington. Refer to the **Sample Index** for a complete list of samples.

SDG	Number of Samples	Validation Level
J42463-1	12 Soil	EPA Stage 4

I. DATA PACKAGE COMPLETENESS

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative.

II. VERIFICATION OF EDD TO LABORATORY REPORT

Sample results and related quality control data were received as an EDD and laboratory report. The EDD was verified against the laboratory report; no errors were found.

III. TECHNICAL DATA VALIDATION

The QC requirements that were reviewed are listed below.

✓	Sample Receipt, Preservation, and Holding Times	✓	Laboratory Control Samples (LCS/LCSD)
✓	Initial Calibration (ICAL)	1	Laboratory Duplicates
✓	Continuing Calibration (CCAL)	1	Field Duplicates
2	Blanks (Method)	✓	Target Analyte List
1	Field Blanks	✓	Reporting Limits (MDL and MRL)
✓	Surrogate Compounds	2	Reported Results
1	Matrix Spike/Matrix Spike Duplicates (MS/MSD)	1	Calculation Verification

✓Method quality objectives (MQO) and QC criteria have been met. No outliers are noted or discussed.
[1] Quality control results are discussed below, but no data were qualified.
[2] Quality control outliers that impact the reported data were noted. Data qualifiers were issued as discussed below.

Method Blanks

Motor oil was detected in the method blank. In order to evaluate the effect of method blank contamination on the field samples, an action level was established at 5x the blank concentration. Positive results in the associated samples that were less than the action level were qualified as not-detected (U-7). Qualified results less than the reporting limit (RL), should be considered to be not detected at the RL. The "result" and "result_num" fields in the database were changed to the RL for cases where the qualified result was less than the RL. This change was also annotated in the "val_notes" field. No action was taken for results that were greater than the action levels or for non-detects.

Field Blanks

No field blanks were submitted.

Matrix Spike/ Matrix Spike Duplicates

Matrix spike/matrix spike duplicate (MS/MSD) samples were not analyzed. Precision and accuracy were evaluated using the laboratory control sample/laboratory control sample duplicate (LCS/LCSD) and laboratory duplicate analyses.

Field Duplicates

No field duplicates were submitted.

Reported Results

The chromatograms for several samples resembled weathered/degraded diesel fuel and/or motor oil. The results for these fuel ranges were flagged "Y" by the laboratory. These "Y" flagged results were flagged (J-2) to indicate they did not fully resemble the pattern of the calibration standard.

Calculation Verification

Several results associated with the sample were verified by recalculation from the raw data. No calculation or transcription errors were found.

IV. OVERALL ASSESSMENT

As was determined by this evaluation, the laboratory followed the specified analytical method. Accuracy was acceptable, as demonstrated by the surrogate and LCS/LCSD %R values. Precision was also acceptable as demonstrated by the laboratory duplicate and LCS/LCSD RPD values.

Detection limits were elevated due to method blank contamination. Results were estimated based on chromatograms that did not match the calibration standard.

All data, as qualified, are acceptable for use.

DATA VALIDATION REPORT
Harper Estuary Restoration Project - Phase II
Gasoline Range Organics by Method NWTPH-Gx

This report documents the review of analytical data from the analysis of soil samples and the associated laboratory and field quality control (QC) samples. Samples were analyzed by TestAmerica Laboratories, Inc., Seattle, Washington. Refer to the **Sample Index** for a complete list of samples.

SDG	Number of Samples	Validation Level
J42463-1	12 Soil	EPA Stage 4
	1 Trip Blank	EPA Stage 2A

I. DATA PACKAGE COMPLETENESS

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative.

II. VERIFICATION OF EDD TO LABORATORY REPORT

Sample results and related quality control data were received as an EDD and laboratory report. The EDD was verified against the laboratory report; the following error was found:

There was a typo in the "ANLMETHOD" field. During validation, the analytical method was changed from NWTHP-Gx to NWTPH-Gx and annotated in the "val_notes" field. No further action was taken.

III. TECHNICAL DATA VALIDATION

The QC requirements that were reviewed are listed below.

✓	Sample Receipt, Preservation, and Holding Times	✓	Laboratory Control Samples (LCS/LCSD)
✓	Initial Calibration (ICAL)	✓	Laboratory Duplicates
✓	Continuing Calibration (CCAL)	1	Field Duplicates
✓	Blanks (Method)	✓	Target Analyte List
1	Field Blanks	✓	Reporting Limits (MDL and MRL)
✓	Surrogate Compounds	✓	Reported Results
1	Matrix Spike/Matrix Spike Duplicates (MS/MSD)	1	Calculation Verification

✓Method quality objectives (MQO) and QC criteria have been met. No outliers are noted or discussed.
[1] Quality control results are discussed below, but no data were qualified.
[2] Quality control outliers that impact the reported data were noted. Data qualifiers were issued as discussed below.

Field Blanks

One trip blank was submitted. Gasoline range organics were not detected in the trip blank.

Matrix Spike/ Matrix Spike Duplicates

Matrix spike/matrix spike duplicate (MS/MSD) samples were not analyzed. Precision and accuracy were evaluated using the laboratory control sample (LCS) and laboratory duplicate analyses.

Field Duplicates

No field duplicates were submitted.

Calculation Verification

Several results associated with the sample were verified by recalculation from the raw data. No calculation or transcription errors were found.

IV. OVERALL ASSESSMENT

As was determined by this evaluation, the laboratory followed the specified analytical method. Accuracy was acceptable, as demonstrated by the surrogate and LCS recoveries. Precision was also acceptable as demonstrated by the laboratory duplicate results.

No data were qualified for any reason.

All data, as reported, are acceptable for use.

DATA VALIDATION REPORT
Harper Estuary Restoration Project - Phase II
Metals by Method 6020 and
Mercury by Method 7471A

This report documents the review of analytical data from the analysis of soil samples and the associated laboratory quality control (QC) samples. Samples were analyzed by TestAmerica Laboratories Inc., Seattle, Washington. Refer to the **Sample Index** for a complete list of samples.

SDG	Number of Samples	Validation Level
J42463-1	12 Soil	EPA Stage 4

I. DATA PACKAGE COMPLETENESS

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative.

II. EDD TO HARDCOPY VERIFICATION

A complete (100%) verification of the electronic data deliverable (EDD) results was performed by comparison to the hardcopy laboratory data package. No errors were noted.

III. TECHNICAL DATA VALIDATION

The QC requirements that were reviewed are listed below.

✓	Sample Receipt, Preservation, and Holding Times	2	Laboratory Duplicates
✓	Initial Calibration	1	Field Duplicates
✓	Calibration Verification	✓	Interference Check Samples
✓	Reporting Limit Standards	✓	Serial Dilutions
✓	Laboratory Blanks	✓	ICP-MS Internal Standards
1	Field (Equipment Rinsate) Blanks	✓	Reporting Limits
✓	Laboratory Control Samples (LCS/LCSD)	✓	Reported Results
2	Matrix Spike/Matrix Spike Duplicates (MS/MSD)	1	Calculation Verification
✓	Reference Material (SRM)		

✓Method quality objectives (MQO) and QC criteria have been met. No outliers are noted or discussed.
[1] Quality control results are discussed below, but no data were qualified.
[2] Quality control outliers that impact the reported data were noted. Data qualifiers were issued as discussed below.

Field Blanks

Field blank samples were not submitted.

Matrix Spike/Matrix Spike Duplicates

Sample HE-2-20140220-S-12-24 was used for the matrix spike/matrix spike duplicate (MS/MSD) analyses. The MS/MSD percent recovery (%R) values for copper were greater than the upper control limit. All results for this analyte were estimated (J-8H) to indicate a potential high bias. The chromium MSD %R value was greater than the upper control limit. The corresponding MS %R value was acceptable. No action was taken for this single outlier.

Laboratory Duplicates

Sample HE-2-20140220-S-12-24 was analyzed in duplicate. The laboratory duplicate relative percent difference (RPD) control limit is 20% for results greater than five times (5x) the reporting limit (RL). For results less than 5x RL, the difference between the sample and duplicate must be less than the 2x the RL.

The arsenic RPD value was greater than the control limit. All results for this analyte were estimated (J-9).

Field Duplicates

Field duplicate samples were not submitted.

Calculation Verification

Several results were verified by recalculation from the raw data. No calculation or transcription errors were noted.

IV. OVERALL ASSESSMENT

As was determined by this evaluation, the laboratory followed the specified analytical methods. With the exceptions noted above, accuracy was acceptable as demonstrated by the laboratory control sample/laboratory control sample duplicate (LCS/LCSD), reference material, and MS/MSD %R values and precision was acceptable as demonstrated by the LCS/LCSD, MS/MSD and laboratory duplicate RPD values.

Data were estimated based on MS/MSD recovery and laboratory duplicate precision outliers.

All data, as qualified, are acceptable for use.

EcoChem, INC.
Environmental Data Quality

APPENDIX A

DATA QUALIFIER DEFINITIONS, REASON CODES, AND CRITERIA TABLES

DATA VALIDATION QUALIFIER CODES
Based on National Functional Guidelines

The following definitions provide brief explanations of the qualifiers assigned to results in the data review process.

U	The analyte was analyzed for, but was not detected above the reported sample quantitation limit.
J	The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.
NJ	The analysis indicates the presence of an analyte that has been "tentatively identified" and the associated numerical value represents the approximate concentration.
UJ	The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.
R	The sample results are rejected due to serious deficiencies in the ability to analyze the sample and meet quality control criteria. The presence or absence of the analyte cannot be verified.

The following is an EcoChem qualifier that may also be assigned during the data review process:

DNR	Do not report; a more appropriate result is reported from another analysis or dilution.

DATA QUALIFIER REASON CODES

Group	Code	Reason for Qualification
Sample Handling	1	Improper Sample Handling or Sample Preservation (i.e., headspace, cooler temperature, pH, summa canister pressure); Exceeded Holding Times
Instrument Performance	24	Instrument Performance (i.e., tune, resolution, retention time window, endrin breakdown, lock-mass)
	5A	Initial Calibration (RF, %RSD, r^2)
	5B	Calibration Verification (ICV, CCV, CCAL; RF, %D, %R) Use bias flags (H,L)[1] where appropriate
Blank Contamination	6	Field Blank Contamination (Equipment Rinsate, Trip Blank, etc.)
	7	Lab Blank Contamination (i.e., method blank, instrument blank, etc.) Use low bias flag (L)[1] for negative instrument blanks
Precision and Accuracy	8	Matrix Spike (MS &/or MSD) Recoveries Use bias flags (H,L)[1] where appropriate
	9	Precision (all replicates: LCS/LCSD, MS/MSD, Lab Replicate, Field Replicate)
	10	Laboratory Control Sample Recoveries (a.k.a. Blank Spikes) Use bias flags (H,L)[1] where appropriate
	12	Reference Material Use bias flags (H,L)[1] where appropriate
	13	Surrogate Spike Recoveries (a.k.a. labeled compounds, recovery standards) Use bias flags (H,L)[1] where appropriate
Interferences	16	ICP/ICP-MS Serial Dilution Percent Difference
	17	ICP/ICP-MS Interference Check Standard Recovery Use bias flags (H,L)[1] where appropriate
	19	Internal Standard Performance (i.e., area, retention time, recovery)
	22	Elevated Detection Limit due to Interference (i.e., chemical and/or matrix)
	23	Bias from Matrix Interference (i.e. diphenyl ether, PCB/pesticides)
Identification and Quantitation	2	Chromatographic pattern in sample does not match pattern of calibration standard
	3	2nd column confirmation (RPD or %D)
	4	Tentatively Identified Compound (TIC) (associated with NJ only)
	20	Calibration Range or Linear Range Exceeded
	25	Compound Identification (i.e., ion ratio, retention time, relative abundance, etc.)
Miscellaneous	11	A more appropriate result is reported (multiple reported analyses i.e., dilutions, re-extractions, etc. Associated with "R" and "DNR" only)
	14	Other (See DV report for details)
	26	Method QC information not provided

[1] H = high bias indicated
L = low bias indicated

Dioxin/Furan Analysis by HRMS, EPA SW-846, Methods 1613b and 8290

QC Element	Acceptance Criteria	Source of Criteria	Action for Non-Conformance	Reason Code	Discussion and Comments
Sample Handling					
Cooler/Storage Temperature Preservation	Waters/Solids ≤ 6°C & in the dark Tissues <-10°C & in the dark **Preservation Aqueous:** Cl_2 present but Thiosulfate not added pH not adjusted when required	NFG (1) Method(2)	J(pos)/R(ND) if thiosulfate not added if Cl_2 present; J(pos)/UJ(ND) if pH not adjusted J(pos)/UJ(ND) if temp > °C	1	**EcoChem PJ, see TM-05, Rev. 2** If there is evidence the samples have not been stored properly i.e. not chilled for several days
Holding Time	**If properly stored, 1 year or:** **Extraction (all matrices):** 30 days from collection **Analysis (all matrices)**: 45 days from extraction	NFG (1) Method(2)	If not properly stored: J(pos)/UJ(ND) if HT exceedance	1	**EcoChem PJ, see TM-05, Rev. 2** Gross exceedance = > 1 year 2011 NFG Note: Under CWA, SDWA, and RCRA the HT for H2O is 7 days.
Instrument Performance					
Mass Resolution (Tuning)	PFK (Perfluorokerosene) >=10,000 resolving power at m/z 304.9824. Exact mass of m/z 380.9760 w/in 5 ppm of theoretical value (380.97410 to 380.97790) . Analyzed prior to ICAL and at the start and end of each 12 hr. shift.	NFG (1) Method (2)	R(pos/ND) all analytes in all samples associated with the tune	24	
Window Defining Mix and Column Performance Mix	Both mixes must be analyzed before ICAL and CCAL Valley < 25% (valley = (x/y)*100%) where x = ht. of TCDD & y = baseline to bottom of valley For all isomers eluting near the 2378-TCDD peak (TCDD only for 8290)	NFG (1) Method (2)	J(pos) if valley > 25%	24	**EcoChem PJ, see TM-05, Rev. 2**;
Initial Calibration **Sensitivity**	S/N ratio > 10 for all native and labeled compounds in CS1 std.	NFG (1) Method (2)	If <10, elevate Det. Limit or R(ND)	5A	
Initial Calibration **Retention Time**	Ion Abundance ratios within QC limits (Table 8 of method 8290) (Table 9 of method 1613B)	NFG (1) Method (2)	If 2 or more ion ratios are out for one compound in ICAL, J(pos)	5A	**EcoChem PJ, see TM-05, Rev. 2**
Initial Calibration (Minimum 5 stds.) **Stability**	%RSD < 20% for native compounds %RSD <30% for labeled compounds (%RSD < 35% for labeled compounds under 1613b)	NFG (1) Method (2)	J(pos) natives if %RSD > 20%	5A	
	Absolute RT of $^{13}C_{12}$-1234-TCDD >25 min on DB5 & >15 min on DB-225	NFG (1) Method (2)	Narrate, no action		**EcoChem PJ, see TM-05, Rev. 2**

Dioxin/Furan Analysis by HRMS, EPA SW-846, Methods 1613b and 8290

QC Element	Acceptance Criteria	Source of Criteria	Action for Non-Conformance	Reason Code	Discussion and Comments
Continuing Calibration (Prior to each 12 hr. shift) **Sensitivity**	S/N ratio for CS3 standard > 10	NFG [1] Method [2]	If <10, elevate Det. Limit or R(ND)	5B	
Continuing Calibration (Prior to each 12 hr. shift) **Retention Time**	Ion Abundance ratios within QC limits (Table 8 of method 8290) (Table 9 of method 1613B)	NFG [1] Method [2]	No action if %D acceptable, review sample ion ratios, U(pos) if ion ratio outside limits	25	**EcoChem PJ, see TM-05, Rev. 2**
Continuing Calibration (Prior to each 12 hr. shift) **Stability**	%D+/-20% for native compounds %D +/-30% for labeled compounds **(Must meet limits in Table 6, Method 1613B)** If %D in the closing CCAL are within 25%/35%, the mean RF from the two CCAL may be used to calculate samples **(Section 8.3.2.4 of 8290)**.	NFG [1] Method [2]	**Labeled compounds:** Narrate, no action. **Native compounds:** 1613: J(pos)/UJ(ND)if %D is outside Table 6 limits J(pos)/R(ND) if %D is +/-75% of Table 6 limts 8290: J(pos)/UJ(ND) if %D = 20% - 75% J(pos)/R(ND) if %D > 75%	5B (H,L)[3]	
	Absolute RT of $^{13}C_{12}$-1234-TCDD and $^{13}C_{12}$-123789-HxCDD should be +/- 15 seconds of ICAL RRT for all other compounds must meet criteria listed in Table 2 Method 1316.	NFG (1) Method (2)	Narrate, no action	5B	**EcoChem PJ, see TM-05, Rev. 2**
Blank Contamination					
Method Blank (MB)	MB: One per matrix per batch of (of ≤ 20 samples) No detected compounds > RL	NFG (1) Method (2)	U(pos) if result is < 5X action level.	7	**Heirarchy of blank review:** **#1 - Review MB, quaify as needed** **#2 - Review FB , qualify as needed**
Field Blank (FB)	FB: frequency as per QAPP No detected compounds > RL		U(pos) if result is < 5X action level.	6	
Precision and Accuracy					
MS/MSD (recovery)	**MS/MSD not typically required for HRMS analyses.** If lab analyzes MS/MSD then one set per matrix per batch (of ≤ 20 samples) Use most current laboratory control limits	EcoChem standard policy	Qualify parent only unless other QC indicates systematic problems: J(pos) if both %R > UCL - high bias J(pos)/UJ(ND) if both %R < LCL - low bias J(pos)/R(ND) if both %R < 10% - very low bias J(pos)/UJ(ND) if one > UCL & one < LCL, with no bias **PJ if only one %R outlier**	8 (H,L)[3]	No action if only one spike %R is outside criteria. No action if parent concentration is >4x the amount spiked. Qualify parent sample only.

Dioxin/Furan Analysis by HRMS, EPA SW-846, Methods 1613b and 8290

QC Element	Acceptance Criteria	Source of Criteria	Action for Non-Conformance	Reason Code	Discussion and Comments
MS/MSD (RPD)	**MS/MSD not typically required for HRMS analyses.** If lab analyzes MS/MSD then one set per matrix per batch (of ≤ 20 samples) Use most current laboratory control limits	EcoChem standard policy	J(pos) in parent sample if RPD > CL	9	Qualify parent sample only.
LCS (or OPR)	One per lab batch (of ≤ 20 samples) Use most current laboratory control limits	NFG (1) Method (2)	Qualify all associated samples J(pos) if %R > UCL - high bias J(pos)/UJ(ND) if both %R < LCL - low bias J(pos)/R(ND) if both %R < 10% - very low bias J(pos)/UJ(ND) if one > UCL & one < LCL, with no bias **PJ if only one %R outlier**	10 (H,L)[3]	No action if only one spike %R is outside criteria, when LCSD is analyzed. Qualify all associated samples.
LCS/LCSD (RPD)	One set per matrix and batch of 20 samples RPD < 35%	Method (2) Ecochem Standard Policy	J(pos) assoc. compound in all samples	9	Qualify all associated samples.
Lab Duplicate (RPD)	One per lab batch (of ≤ 20 samples) Use most current laboratory control limits	EcoChem standard policy	J(pos)/UJ(ND) if RPD > CL	9	
Labeled Compounds (Internal Standards)	Added to all samples %R = 40% - 135% in all samples 8290 %R must meet limits in Table 7 Method 1613B	NFG (1) Method (2)	J(pos) if %R > UCL - high bias J(pos)/UJ(ND) if %R < LCL - low bias J(pos)/R(ND) if %R < 10% - very low bias	13 (H,L)[3]	
Field Duplicates	Solids: RPD <50% OR difference < 2X RL (for results < 5X RL) Aqueous: RPD <35% OR difference < 1X RL (for results < 5X RL)	EcoChem standard policy	Narrate and qualify if required by project **(EcoChem PJ)**	9	
Compound ID and Calculation					
Quantitation/ Identification	All ions for each isomer must maximize within +/- 2 seconds. S/N ratio >2.5 Ion ratios must meet criteria listed in Table 8 Method 8290, or Table 9 of 1613B; RRTs w/in limits in Table 2 of 1613B	NFG (1) Method (2)	Narrate in report; qualify if necessary NJ(pos) for retention time outliers. U(pos) for ion ratio outliers.	25	**EcoChem PJ, see TM-05, Rev. 2**
EMPC (estimated maximum possible concentration)	If quantitation identification criteria are not met, laboratory should report an EMPC value.	NFG (1) Method (2)	If laboratory correctly reported an EMPC value, qualify the native compound U(pos) to indicate that the value is a detection limit and qualify total homolog groups J(pos)	25	**Use professional judgment See TM-05, Rev. 2.**
Interferences	Interferences from chlorodiphenyl ether compounds	EPA (1) Method (2)	J(pos)/UJ(ND) if present	23	
	Lock masses must not deviate +/- 20% from values in Table 8 of 1613B	Method (2)	J(pos)/UJ(ND) if present	24	

Dioxin/Furan Analysis by HRMS, EPA SW-846, Methods 1613b and 8290

QC Element	Acceptance Criteria	Source of Criteria	Action for Non-Conformance	Reason Code	Discussion and Comments
Second Column Confirmation	All 2,3,7,8-TCDF hits must be confirmed on a DB-225 (or equiv) column. All QC criteria must also be met for the confirmation analysis.	NFG [1] Method [2]	Report the DB-225 value. If not performed use PJ.	3	DNR-11 DB5 result if both results from both columns are reported
Calculation Check	Check 10% of field & QC sample results	EcoChem standard policy	Contact laboratory for resolution and/or corrective action	na	Full data validation only.
Electronic Data Deliverable (EDD)					
Verification of EDD to hardcopy data	EcoChem verify @ 10% unless problems noted; then increase level up to 100% for next several packages.		Depending on scope of problem, correct at EcoChem (minor issues) to resubmittal by laboratory (major issues).	na	EcoChem Project Manager and/or Database Administrator will work with lab to provide long-term corrective action.
Dilutions, Re-extractions and/or Reanalyses	Report only one result per analyte	Standard reporting policy	Use "DNR" to flag results that will not be reported.	11	

(pos): Positive Result(s)

(ND): Non-detects

[1] National Functional Guidelines for Chlorinated Dibenzo-p-Dioxins (CDDs) & Chlorinated Dibenzofurans (CDFs) Data Review, September 2011

[2] Polychlorinated Dibenzodioxins (PCDDs) and Polychlorinated Dibenzofurans (PCDFs) by High-Resolution Gas Chromatography/High-Resolution Mass Spectrometry (HRGC/HRMS), USEPA SW-846, Method 8290

[2] EPA Method 1613, Rev.B, Tetra-through Octa-Chlorinated Dioxins and Furans by Isotope Dilution HRGS/HRMS, October 1994

[3] "H" = high bias indicate; "L" = low bias indicated

EcoChem Validation Guidelines for Volatile Organic Analysis by Gas Chromatography-Mass Spectroscopy (GC-MS) by EPA Method SW-846 8260
Based on EPA National Gunctional Guidelines for Organic Data Review (2008)

QC Element	Acceptance Criteria	Source of Criteria	Action for Non-Conformance	Reason Code	Discussion and Comments
Sample Handling					
Cooler/Storage Temperature Preservation	4°C±2°C Aqueous: HCl to pH < 2	NFG [1] Method [2,3]	J(pos)/UJ(ND) if > 6 °C J(pos)/R(ND) if > 12 °C	1	For aqueous samples only: pH ≤ 2, 2-chloroethyl vinyl ether (R-1)
Holding Time	**Aqueous:** 14 days preserved 7 Days: unpreserved (aromatics only) **Solid:** 14 Days	NFG [1] Method [2,3]	J(pos)/UJ(ND) if HT exceeded J(pos)/R(ND) if gross exceedance(> 2X HT)	1	Gross exceedance = > 2X HT, as per 1999 NFG
Instrument Performance					
Tuning	BFB Beginning of each 12 hour period Use method acceptance criteria	NFG [1] Method [2,3]	R(pos/ND) all analytes in all samples associated with the tune	24	12 hour clock begins with a new BFB tune or if the closing CCV within criteria.
Initial Calibration **Sensivity**	Minimum 5 standards RRF ≥ 0.05 RRF ≥ 0.01 poor responders * RRF ≥ 0.005 1,4-dioxane *	NFG [1] Method [2,3]	**If MDL= reporting limit:** J(pos)/R(ND) if RRF < limit **If reporting limit > MDL:** note in worksheet if RRF < limit	5A	**TM-06** EcoChem Policy for the Evaluation and Qualification of GCMS Instrument Performance ICV±30%
Initial Calibration **Stability**	%RSD ≤ 20.0% %RSD ≤ 40.0% poor responders * %RSD ≤ 50.0% 1,4-dioxane *		J(pos) if %RSD > limit	5A	
Continuing Calibration **Stability**	RRF ≥ 0.05 RRF ≥ 0.01 poor responders * RRF ≥ 0.005 1,4-dioxane *	NFG [1] Method [2,3]	**If MDL= reporting limit:** J(pos)/R(ND) if RRF < limit **If reporting limit > MDL:** note in worksheet if RRF < limit	5B (H,L)[4]	
Continuing Calibration **Sensitivity**	%D ≤ 25.0% %D ≤ 40.0% poor responders * %D ≤ 50.0% 1,4-dioxane *		If > +/-90%: J(pos)/R(ND) J(pos) - high bias J(pos)/UJ(ND) - low bias	5B	
Blank Contamination					
Method Blank (MB)	MB: One per matrix per batch of (of ≤ 20 samples) No detected compounds > MDL No TICs present	NFG [1] Method [2,3]	U(pos) if result is < 5X or 10X action level, as per analyte. R(pos) TICs using 10X rule	7	10X action level for methylene chloride, acetone, & 2-butanone. 5X for all other volatile target analytes **Hierarchy of blank review:** **#1 - Review MB, quaify as needed** **#2 - Review TB/FB , qualify as needed**
Trip Blank (TB)	TB & FB: frequency as per QAPP No detected compounds > MDL	NFG [1] Method [2,3]	U(pos) if result is < 5X or 10X action level, as per analyte.	6	
Field Blank (FB)	TB & FB: frequency as per QAPP No detected compounds > MDL	NFG [1] Method [2,3]	U(pos) if result is < 5X or 10X action level, as per analyte.	6	
Precision and Accuracy					
MS/MSD (recovery)	One per matrix per batch (of ≤ 20 samples) Use method acceptance criteria/laboratory limits	NFG [1] Method [2,3]	Qualify parent only unless other QC indicates systematic problems: J(pos) if both %R > UCL - high bias J(pos)/UJ(ND) if both %R < LCL - low bias J(pos)/R(ND) if both %R < 10% - very low bias J(pos)/UJ(ND) if one > UCL & one < LCL, with no bias **PJ if only one %R outlier**	8 (H,L)[4]	No action if only one spike %R is outside criteria. No action if parent concentration is >4x the amount spiked. Qualify parent sample only. NFG specifies J(pos)/**PJ**(ND) results <20%, EcoChem **PJ** is J(pos)/R(ND) <10%.
MS/MSD (RPD)	One per matrix per batch (of ≤ 20 samples) Use method acceptance criteria/laboratory limits	NFG [1] Method [2,3]	J(pos) in parent sample if RPD > CL	9	Qualify parent sample only
LCS/LCSD (recovery)	One per matrix per batch (of ≤ 20 samples) Use method acceptance criteria/laboratory limits	NFG [1] Method [2,3]	Qualify all associated samples J(pos) if %R > UCL - high bias J(pos)/UJ(ND) if both %R < LCL - low bias J(pos)/R(ND) if both %R < 10% - very low bias J(pos)/UJ(ND) if one > UCL & one < LCL, with no bias **PJ if only one %R outlier**	10 (H,L)[4]	No action if only one spike %R is outside criteria, when LCSD is analyzed. Qualify all associated samples.
LCS/LCSD RPD	One set per matrix and batch of 20 samples RPD < 35%	NFG [1] Method [2,3]	J(pos) assoc. compound in all samples	9	Qualify all associated samples.

EcoChem Validation Guidelines for Volatile Organic Analysis by Gas Chromatography-Mass Spectroscopy (GC-MS) by EPA Method SW-846 8260
Based on EPA National Gunctional Guidelines for Organic Data Review (2008)

QC Element	Acceptance Criteria	Source of Criteria	Action for Non-Conformance	Reason Code	Discussion and Comments
LCS *low conc. H2O VOA*	One per lab batch (of ≤ 20 samples) Within method control limits	NFG [1] Method [2,3]	J(pos) assoc. compound if > UCL - high bias J(pos)/R(ND) assoc. compound if < LCL - low bias J(pos)/R(ND) all compound if half are < LCL - very low bias	10 (H,L)[4]	
LCS *regular VOA (H2O & solid)*	One per lab batch (of ≤ 20 samples) Lab or method control limits	NFG [1] Method [2,3]	J(pos) if %R > UCL J(pos)/UJ(ND) if %R <LCL J(pos)/R(ND) if %R < 10% **(EcoChem PJ)**	10	
Surrogates	Added to all samples Within method control limits	NFG [1] Method [2,3]	Note: No action if there are 4+ surrogates and only 1 outlier. J(pos) if %R >UCL - high bias J(pos)/UJ(ND) if %R <LCL - low bias J(pos)/R(ND) if <10% - very low bias	13 (H,L)[4]	NFG specifies surrogates and CL, and to J(pos)/R(ND) results <20%, EcoChem **PJ** is J(pos)/R(ND) <10%.
Internal Standards	Added to all samples Acceptable Range: IS area 50% to 200% of CCAL area RT within 30 seconds of CC RT	NFG [1] Method [2,3]	J(pos) if > 200% J(pos)/UJ(ND) if < 50% J(pos)/R(ND) if < 25% RT>30 seconds, narrate and notify PM	19	
Field Duplicates	Solids: RPD <50% OR difference < 2X RL (for results < 5X RL) Aqueous: RPD <35% OR difference < 1X RL (for results < 5X RL)	Ecochem Standard Policy	Narrate and qualify if required by project **(EcoChem PJ)** Qualify only field duplicate samples J(pos)/UJ(ND)	9	
Compound Identification and Quantitation					
Quantitation/ Identification	RRT within 0.06 of standard RRT Ion relative intensity within 20% of standard All ions in std. at > 10% intensity must be present in sample	NFG [1] Method [2,3]	**See Technical Director if outliers are found**	14 25 (false pos)	
TICs	Major ions (>10%) in reference must be present in sample; intensities agree within 20%; check identification	NFG [1] Method [2,3]	NJ the TIC unless: R(pos) common laboratory contaminants **See Technical Director for ID issues**	4	Common laboratory contaminants: aldol condensation products, solvent preservatives, and reagent contaminants
Calibration Range	Results exceed the upper calibration range	EcoChem standard policy	Qualify J(pos)	20	If result from dilution analysis is not reported.
Calculation Check	Check 10% of field & QC sample results	EcoChem standard policy	Contact laboratory for resolution and/or corrective action	na	Full data validation only.
Electronic Data Deliverable (EDD)					
Verification of EDD to hardcopy data	EcoChem verify @ 10% unless problems noted; then increase level up to 100% for next several packages.	EcoChem standard policy	Depending on scope of problem, correct at EcoChem (minor issues) to resubmittal by laboratory (major issues).	na	EcoChem Project Manager and/or Database Administrator will work with lab to provide long-term corrective action.
Dilutions, Re-extractions and/or Reanalyses	Report only one result per analyte	EcoChem standard policy	Use "DNR" to flag results that will not be reported.	11	**TM-04 Rev. 1** EcoChem Policy for Rejection/Selection Process for Multiple Results

[1] National Functional Guidelines for Organic Data Review, June, 2008

[2] Method SW846 8260B Volatile Organic Compounds by Gas Chromatography/Mass Spectrometry (GC/MS)

[3] Method SW846 8260C Volatile Organic Compounds by Gas Chromatography/Mass Spectrometry (GC/MS)

[4] "H" = high bias indicated; "L" = low bias indicated

(pos): Positive Result(s)

(ND): Non-detects

* "Poor responder" compounds: acetone, 2-butanone, carbon disulfide, chloroethane, chloromethane, cyclohexane, 1,2-dibromoethane, dichlorodifluoromethane, cis-1,2-dichloroethene, 1,2-dichloropropane, 1,2-dibromo-3-chloropropane, 2-hexanone, isopropylbenzene, methyl acetate, methylene chloride, methylcyclohexane, 4-methyl-2-pentanone, methyl tert-butyl ether, trans-1,2-dichloroethene, trichlorofluoromethane, 1,1,2-trichloro-1,2,2-trifluoroethane use a 0.010 RRF criterion. And 1,4-dioxane uses a 0.005 RRF criterion.

Semivolatile Organic Analysis by GCMS, SW846 Method 8270D

QC Element	Acceptance Criteria	Source of Criteria	Action for Non-Conformance	Reason Code	Discussion and Comments
Sample Handling					
Cooler/Storage Temperature Preservation	4°C±2°C	NFG [1] Method [2]	J(pos)/UJ(ND) if > 6 deg. C (EcoChem PJ)	1	
Holding Time	**Extraction Aqueous:** 7 days from collection **Extraction Solid:** 14 days from collection **Analysis (all matrices)**: 40 days from extraction	NFG [1] Method [2]	J(pos)/UJ(ND) if HT exceeded J(pos)/R(ND) if gross exceedance(> 2X HT)	1	Gross exceedance = > 2X HT, as per 1999 NFG
Instrument Performance					
Tuning	DFTPP Beginning of each 12 hour period Use method acceptance criteria	NFG [1] Method [2]	R(pos/ND) all analytes in all samples associated with the tune	24	12 hour clock begins with a new DFTPP tune or if the closing CCV within criteria.
Initial Calibration **Stability**	Minimum 5 standards %RSD ≤ 20.0% %RSD ≤ 40.0% poor responders * **or** co-efficient of determination (r^2) > 0.99	NFG (1) Method (2)	J(pos) if %RSD > limit **or** r^2 value <0.99	5A	**TM-06** EcoChem Policy for the Evaluation and Qualification of GCMS Instrument Performance
Initial Calibration **Sensivity**	RRF ≥ 0.05 RRF ≥ 0.01 poor responders *	NFG [1] Method [2]	**If MDL= reporting limit:** J(pos)/R(ND) if RRF < limit **If reporting limit > MDL:** note in worksheet if RRF < limit	5A	
Initial Calibration Verification Check **Stability**	Prepared from second source; analyze after each ICAL Percent recovery limits = 70-130%	NFG [1] Method [2]	If < 10%: J(pos)/R(ND) If > 130 % J(pos) - high bias If < 70%: J(pos)/UJ(ND) - low bias	5A (H,L)[3]	
Continuing Calibration **Stability**	Prior to sample analysis and every 12 hours %D ≤ 25% %D ≤ 40.0% poor responders *	NFG [1] Method [2]	If > +/-90%: J(pos)/R(ND) If -90% to -26%: J(pos) - high bias If 26% to 90%: J(pos)/UJ(ND) - low bias	5B (H,L)[3]	
Continuing Calibration **Sensitivity**	RRF ≥ 0.05 RRF ≥ 0.01 poor responders *	NFG [1] Method [2]	**If MDL= reporting limit:** J(pos)/R(ND) if RRF < 0.05 **If reporting limit > MDL:** note in worksheet if RRF <0.05	5B	
Blank Contamination					
Method Blank (MB)	MB: One per matrix per batch of (of ≤ 20 samples) No detected compounds > RL	NFG [1] Method [2]	U(pos) if result is < 5X or 10X action level, as per analyte.	7	10X action level applies to bis(2-ethylhexyl) phthalate only. 5X for all other target analytes **Hierarchy of blank review:** **#1 - Review MB, quaify as needed** **#2 - Review FB , qualify as needed**
	No TICs present		R(pos) TICs using 10X rule	7	
Field Blank (FB)	FB: frequency as per QAPP No detected compounds > RL		U(pos) if result is < 5X or 10X action level, as per analyte.	6	
Precision and Accuracy					
MS/MSD (recovery)	One per matrix per batch (of ≤ 20 samples) Use method acceptance criteria/laboratory limits	NFG [1] Method [2]	Qualify parent only unless other QC indicates systematic problems: J(pos) if both %R > UCL - high bias J(pos)/UJ(ND) if both %R < LCL - low bias J(pos)/R(ND) if both %R < 10% - very low bias J(pos)/UJ(ND) if one > UCL & one < LCL, with no bias **PJ if only one %R outlier**	8 (H,L)[3]	No action if only one spike %R is outside criteria. No action if parent concentration is >4x the amount spiked. Qualify parent sample only. NFG specifies J(pos)/**PJ**(ND) results <20%, EcoChem **PJ** is J(pos)/R(ND) <10%.
MS/MSD (RPD)	One per matrix per batch (of ≤ 20 samples) Use method acceptance criteria/laboratory limits	NFG [1] Method [2]	J(pos) in parent sample if RPD > CL	9	Qualify parent sample only

Semivolatile Organic Analysis by GCMS, SW846 Method 8270D

QC Element	Acceptance Criteria	Source of Criteria	Action for Non-Conformance	Reason Code	Discussion and Comments
LCS/LCSD (recovery)	One per matrix per batch (of ≤ 20 samples) Use method acceptance criteria/laboratory limits	Method [2] Ecochem Standard Policy	Qualify all associated samples J(pos) if %R > UCL - high bias J(pos)/UJ(ND) if both %R < LCL - low bias J(pos)/R(ND) if both %R < 10% - very low bias J(pos)/UJ(ND) if one > UCL & one < LCL, with no bias **PJ if only one %R outlier**	10 (H,L)[3]	No action if only one spike %R is outside criteria, when LCSD is analyzed. Qualify all associated samples.
LCS/LCSD (RPD)	One set per matrix and batch of 20 samples RPD < 35%	Method (2) Ecochem Standard Policy	J(pos) assoc. compound in all samples	9	
Surrogates	Minimum of 3 acid & 3 base/neutral (B/N) compounds added to all samples Within method control limits	NFG [1] Method [2]	Note: Do not qualify if only 1 acid and/or 1 B/N surrogate is out, unless <10%. *** J(pos) if %R > UCL - high bias J(pos)/UJ(ND) if %R < LCL - low bias J(pos)/R(ND) if %R < 10% - very low bias	13 (H,L)[3]	*** If 1 surrogate outlier < 10% then J(pos)/R(ND) NFG specifies surrogates and CL, and to J(pos)/R(ND) results <20%, EcoChem **PJ** is J(pos)/R(ND) <10%.
Internal Standards	Added to all samples Acceptable Range: IS area 50% to 200% of CCAL area RT within 30 seconds of CC RT	NFG [1] Method [2]	J(pos) if > 200% J(pos)/UJ(ND) if < 50% J(pos)/R(ND) if < 25% RT>30 seconds, narrate and notify PM	19	
Field Duplicates	Solids: RPD <50% OR difference < 2X RL (for results < 5X RL) Aqueous: RPD <35% OR difference < 1X RL (for results < 5X RL)	Ecochem Standard Policy	Narrate and qualify if required by project **(EcoChem PJ)** Qualify only field duplicate samples J(pos)/UJ(ND)	9	
Compound Identification and Quantitation and Calculation					
Quantitation/ Identification	RRT within 0.06 of standard RRT Ion relative intensity within 20% of standard All ions in std. at > 10% intensity must be present in sample	NFG [1] Method [2]	**See Technical Director if outliers are found**	14 25 (false pos)	
TICs	Major ions (>10%) in reference must be present in sample; intensities agree within 20%; check identification	NFG [1] Method [2]	NJ the TIC unless: R(pos) common laboratory contaminants **See Technical Director for ID issues**	4	
Calibration Range	Results exceed the upper calibration range	EcoChem standard policy	Qualify J(pos)	20	If result from dilution analysis is not reported.
Calculation Check	Check 10% of field & QC sample results	EcoChem standard policy	Contact laboratory for resolution and/or corrective action	na	Full data validation only.
Electronic Data Deliverable (EDD)					
Verification of EDD to hardcopy data	EcoChem verify @ 10% unless problems noted; then increase level up to 100% for next several packages.	EcoChem standard policy	Depending on scope of problem, correct at EcoChem (minor issues) to resubmittal by laboratory (major issues).	na	EcoChem Project Manager and/or Database Administrator will work with lab to provide long-term corrective action.
Dilutions, Re-extractions and/or Reanalyses	Report only one result per analyte	EcoChem standard policy	Use "DNR" to flag results that will not be reported.	11	**TM-04 Rev. 1** EcoChem Policy for Rejection/Selection Process for Multiple Results

[1] National Functional Guidelines for Organic Data Review, October, 2008

[2] Method SW846 8270D Semivolatile Organic Compounds by Gas Chromatography/Mass Spectrometry (GC/MS), Revision 4, February 2007.

[3] "H" = high bias indicated; "L" = low bias indicated

(pos): Positive Result(s)

(ND): Non-detects

* "Poor responder" compounds: acetophenone, atrazine, benzaldehyde, 1,1'-biphenyl, bis(2-ethylhexyl)phthalate, butylbenzylphthalate, caprolactam, carbazole, 4-chloroaniline, diethylphthalate, di-n-butylphthalate, 3-3'-dichlorobenzidine, dimethylphthalate, 2,4-dinitrophenol, 4,6-dinitro-2-methylphenol, di-n-octylphthalate, hexachlorobutadiene, hexachlorocyclopentadiene, 2-nitroaniline, 3-nitroaniline, 4-nitroaniline, 4-nitrophenol, N-nitrosodiphenylamine, 2,2'-oxybis-(1-chloropropane), 1,2,4,5-tetrachlorobenzene use a 0.010 RRF criterion.

EcoChem Validation Guidelines for Total Petroleum Hydrocarbons-Diesel & Residual Range

(Based on EPA National Functional Guidelines as applied to criteria in NWTPH-Dx, June 1997, Wa DOE & Oregon DEQ)

VALIDATION QC ELEMENT	ACCEPTANCE CRITERIA	ACTION	REASON CODE
Cooler Temperature & Preservation	4°C±2°C Water: HCl to pH < 2	J(+)/UJ(-) if greater than 6 deg. C	1
Holding Time	Ext. Waters: 14 days preserved 7 days unpreserved Ext. Solids: 14 Days Analysis: 40 days from extraction	J(+)/UJ(-) if hold times exceeded J(+)/R(-) if exceeded > 3X (EcoChem PJ)	1
Initial Calibration	5 calibration points (All within 15% of true value) Linear Regression: $R^2 \geq 0.990$ If used, RSD of response factors ≤20%	Narrate if fewer than 5 calibration levels or if %R >15% J(+)/UJ(-) if R^2 <0.990 J(+)/UJ(-) if %RSD > 20%	5A
Mid-range Calibration Check Std.	Analyzed before and after each analysis shift & every 20 samples. Recovery range 85% to 115%	Narrate if frequency not met. J(+)/UJ(-) if %R < 85% J(+) if %R >115%	5B
Method Blank	At least one per batch (≤20 samples) No results >RL	U (at the RL) if sample result is < RL & < 5X blank result.	7
		U (at reported sample value) if sample result is ≥ RL and < 5X blank result	7
Field Blanks (if required by project)	No results > RL	Action is same as method blank for positive results remaining in the field blank after method blank qualifiers are assigned.	6
MS samples (accuracy) (if required by project)	%R within lab control limits	Qualify parent only, unless other QC indicates systematic problems. J(+) if both %R > upper control limit (UCL) J(+)/UJ(-) if both %R < lower control limit (LCL) No action if parent conc. >5X the amount spiked. Use PJ if only one %R outlier	8
Precision: MS/MSD or LCS/LCSD or sample/dup	At least one set per batch (≤10 samples) RPD ≤ lab control limit	J(+) if RPD > lab control limits	9
LCS (not required by method)	%R within lab control limits	J(+)/UJ(-) if %R < LCL J(+) if %R > UCL J(+)/R(-) if any %R <10% (EcoChem PJ)	10

EcoChem Validation Guidelines for Total Petroleum Hydrocarbons-Diesel & Residual Range

(Based on EPA National Functional Guidelines as applied to criteria in NWTPH-Dx, June 1997, Wa DOE & Oregon DEQ)

VALIDATION QC ELEMENT	ACCEPTANCE CRITERIA	ACTION	REASON CODE
Surrogates	2-fluorobiphenyl, p-terphenyl, o-terphenyl, and/or pentacosane added to all samples (inc. QC samples). %R = 50-150%	J(+)/UJ(-) if %R < LCL J(+) if %R > UCL J(+)/R(-) if any %R <10% No action if 2 or more surrogates are used, and only one is outside control limits. (EcoChem PJ)	13
Pattern Identification	Compare sample chromatogram to standard chromatogram to ensure range and pattern are reasonable match. Laboratory may flag results which have poor match.	J(+)	2
Field Duplicates	Use project control limits, if stated in QAPP EcoChem default: water: RPD < 35% solids: RPD < 50%	Narrate (Use Professional Judgement to qualify)	9
Two analyses for one sample (dilution)	Report only one result per analyte	"DNR" (or client requested qualifier) all results that should not be reported. (See TM-04)	11

EcoChem Validation Guidelines for Total Petroleum Hydrocarbons-Gasoline Range

(Based on EPA National Functional Guidelines as applied to criteria in NWTPH-Gx, June 1997, Wa DOE & Oregon DEQ)

VALIDATION QC ELEMENT	ACCEPTANCE CRITERIA	ACTION	REASON CODE
Cooler Temperature & Preservation	4°C±2°C Water: HCl to pH < 2	J(+)/UJ(-) if greater than 6 deg. C	1
Holding Time	Waters: 14 days preserved 7 days unpreserved Solids: 14 Days	J(+)/UJ(-) if hold times exceeded J(+)/R(-) if exceeded > 3X (EcoChem PJ)	1
Initial Calibration	5 calibration points (All within 15% of true value) Linear Regression: $R^2 \geq 0.990$ If used, RSD of response factors ≤20%	Narrate if fewer than 5 calibration levels or if %R >15% J(+)/UJ(-) if R^2 <0.990 J(+)/UJ(-) if %RSD > 20%	5A
Mid-range Calibration Check Std.	Analyzed before and after each analysis shift & every 20 samples. Recovery range 80% to 120%	Narrate if frequency not met. J(+)/UJ(-) if %R < 80% J(+) if %R >120%	5B
Method Blank	At least one per batch (≤10 samples) No results >RL	U (at the RL) if sample result is < RL & < 5X blank result.	7
		U (at reported sample value) if sample result is ≥ RL and < 5X blank result	7
Trip Blank (if required by project)	No results >RL	Action is same as method blank for positive results remaining in trip blank after method blank qualifiers are assigned.	18
Field Blanks (if required by project)	No results > RL	Action is same as method blank for positive results remaining in field blank after method and trip blank qualifiers are assigned.	6
MS samples (accuracy) (if required by project)	%R within lab control limits	Qualify parent only, unless other QC indicates systematic problems. J(+) if both %R > upper control limit (UCL) J(+)/UJ(-) if both %R < lower control limit (LCL) No action if parent conc. >5X the amount spiked. Use PJ if only one %R outlier	8
Precision: MS/MSD or LCS/LCSD or sample/dup	At least one set per batch (≤10 samples) RPD ≤ lab control limit	J(+) if RPD > lab control limits	9

EcoChem Validation Guidelines for Total Petroleum Hydrocarbons-Gasoline Range

(Based on EPA National Functional Guidelines as applied to criteria in NWTPH-Gx, June 1997, Wa DOE & Oregon DEQ)

VALIDATION QC ELEMENT	ACCEPTANCE CRITERIA	ACTION	REASON CODE
LCS (not required by method)	%R within lab control limits	J(+)/UJ(-) if %R < LCL J(+) if %R > UCL J(+)/R(-) if any %R <10% (EcoChem PJ)	10
Surrogates	Bromofluorobenzene and/or 1,4-difluorobenzene added to all samples (inc. QC samples). %R = 50-150%	J(+)/UJ(-) if %R < LCL J(+) if %R >UCL J(+)/R(-) if any %R <10% No action if 2 or more surrogates are used, and only one is outside control limits. (EcoChem PJ)	13
Pattern Identification	Compare sample chromatogram to standard chromatogram to ensure range and pattern are reasonable match. Laboratory may flag results which have poor match.	J(+)	2
Field Duplicates	Use project control limits, if stated in QAPP EcoChem default: water: RPD < 35% solids: RPD < 50%	Narrate outliers If required by project, qualify with J(+)/UJ(-)	9
Two analyses for one sample (e.g., dilution)	Report only one result per analyte	"DNR" (or client requested qualifier) all results that should not be reported. (See TM-04)	11

EcoChem Validation Guidelines for Metals Analysis by ICP-MS (Based on Inorganic NFG 1994 & 2004)

VALIDATION QC ELEMENT	ACCEPTANCE CRITERIA	ACTION	REASON CODE
Cooler Temperature and Preservation	Cooler temperature: 4°C ±2° Waters: Nitric Acid to pH < 2 For Dissolved Metals: 0.45um filter & preserve after filtration	EcoChem Professional Judgment - no qualification based on cooler temperature outliers J(+)/UJ(-) if pH preservation requirements are not met	1
Holding Time	180 days from date sampled Frozen tissues - HT extended to 2 years	J(+)/UJ(-) if holding time exceeded	1
Tune	Prior to ICAL monitoring compounds analyzed 5 times wih Std Dev. ≤ 5% mass calibration <0.1 amu from True Value Resolution < 0.9 AMU @ 10% peak height or <0.75 amu @ 5% peak height	Use Professional Judgment to evaluate tune J(+)/UJ(-) if tune criteria not met	5A
Initial Calibration	Blank + minimum 1 standard If more than 1 standard, r>0.995	J(+)/UJ(-) if r<0.995 (for multi point cal)	5A
Initial Calibration Verification (ICV)	Independent source analyzed immediately after calibration %R within ±10% of true value	J(+)/UJ(-) if %R 75-89% J(+) if %R = 111-125% R(+) if %R > 125% R(+/-) if %R < 75%	5A
Continuing Calibration Verification (CCV)	Every ten samples, immediately following ICV/ICB and at end of run ±10% of true value	J(+)/UJ(-) if %R = 75-89% J(+) if %R 111-125% R(+) if %R > 125% R(+/-) if %R < 75%	5B

Initial and Continuing Calibration Blanks (ICB/CCB)	After each ICV and CCV
	every ten samples and end of run
	| blank | < IDL (MDL)
		Action level is 5x absolute value of blank conc.
		For (+) blanks, U(+) results < action level
		For (-) blanks, J(+)/UJ(-) results < action level
		refer to **TM-02** for additional details
			7

Reporting Limit Standard (CRI)	2x RL analyzed beginning of run Not required for Al, Ba, Ca, Fe, Mg, Na, K %R = 70%-130% (50%-150% Co,Mn, Zn)	R(-),(+) < 2x RL if %R < 50% (< 30% Co,Mn, Zn) J(+) < 2x RL, UJ(-) if %R 50-69% (30%-49% Co,Mn, Zn) J(+) < 2x RL if %R 130%-180% (150%-200% Co,Mn, Zn) R(+) < 2x RL if %R > 180% (200% Co, Mn, Zn)	14
Interference Check Samples (ICSA/ICSAB)	Required by SW 6020, but not 200.8 ICSAB %R 80% - 120% for all spiked elements | ICSA | < IDL (MDL) for all unspiked elements	For samples with Al, Ca, Fe, or Mg > ICS levels R(+/-) if %R < 50% J(+) if %R >120% J(+)/UJ(-) if %R = 50% to 79% Use Professional Judgment for ICSA to determine if bias is present see **TM-09** for additional details	17
Method Blank	One per matrix per batch (batch not to exceed 20 samples) blank < MDL	Action level is 5x blank concentration U(+) results < action level	7

EcoChem Validation Guidelines for Metals Analysis by ICP-MS (Based on Inorganic NFG 1994 & 2004)

VALIDATION QC ELEMENT	ACCEPTANCE CRITERIA	ACTION	REASON CODE
Laboratory Control Sample (LCS)	One per matrix per batch Blank Spike: %R within 80%-120%	R(+/-) if %R < 50% J(+)/UJ(-) if %R = 50-79% J(+) if %R >120%	10
	CRM: Result within manufacturer's certified acceptance range or project guidelines	J(+)/UJ(-) if < LCL, J(+) if > UCL	
Matrix Spike/ Matrix Spike Duplicate (MS/MSD)	One per matrix per batch 75-125% for samples where results do not exceed 4x spike level	J(+) if %R>125% J(+)/UJ(-) if %R <75% J(+)/R(-) if %R<30% **or** J(+)/UJ(-) if Post Spike %R 75%-125% Qualify all samples in batch	8
Post-digestion Spike	If Matrix Spike is outside 75-125%, Spike parent sample at 2x the sample conc.	No qualifiers assigned based on this element	
Laboratory Duplicate (or MS/MSD)	One per matrix per batch RPD < 20% for samples > 5x RL Diff ≤ RL for samples >RL and < 5x RL (Diff ≤ 2x RL for solids)	J(+)/UJ(-) if RPD > 20% or diff > RL all samples in batch	9
Serial Dilution	5x dilution one per matrix %D < 10% for original sample values > 50x MDL	J(+)/UJ(-) if %D >10% All samples in batch	16
Internal Standards	Every sample SW6020: 60%-125% of cal blank IS 200.8: 30%-120% of cal blank IS	J (+)/UJ (-) all analytes associated with IS outlier	19
Field Blank	Blank < MDL	Action level is 5x blank conc. U(+) sample values < AL in associated field samples only	6
Field Duplicate	For results > 5x RL: Water: RPD < 35% Solid: RPD < 50% For results < 5 x RL: Water: Diff < RL Solid: Diff < 2x RL	J(+)/UJ(-) in parent samples only	9
Linear Range	Sample concentrations must fall within range	J values over range	20

EcoChem Validation Guidelines for Mercury Analysis by CVAA (Based on Inorganic NFG 1994 & 2004)

VALIDATION QC ELEMENT	ACCEPTANCE CRITERIA	ACTION	REASON CODE
Cooler Temperature and Preservation	Cooler temperature: 4°C ±2° Waters: Nitric Acid to pH < 2 For Dissolved Metals: 0.45um filter & preserve after filtration	EcoChem Professional Judgment - no qualification based on cooler temperature outliers J(+)/UJ(-) if pH preservation requirements are not met	1
Holding Time	28 days from date sampled Frozen tissues: HT extended to 6 months	J(+)/UJ(-) if holding time exceeded	1
Initial Calibration	Blank + 4 standards, one at RL r > 0.995	J(+)/UJ(-) if r<0.995	5A
Initial Calibration Verification (ICV)	Independent source analyzed immediately after calibration %R within ±20% of true value	J(+)/UJ(-) if %R = 65%-79% J(+) if %R = 121-135% R(+/-) if %R < 65% R(+) if %R > 135%	5A
Continuing Calibration Verification (CCV)	Every ten samples, immediately following ICV/ICB and at end of run %R within ±20% of true value	J(+)/UJ(-) if %R = 65%-79% J(+) if %R = 121-135% R(+/-) if %R < 65% R(+) if %R > 135%	5B

Initial and Continuing Calibration Blanks (ICB/CCB)	after each ICV and CCV
	every ten samples and end of run
	| blank | < IDL (MDL)
		Action level is 5x absolute value of blank conc.
		For (+) blanks, U(+) results < action level
		For (-) blanks, J(+)/UJ(-) results < action level
		refer to **TM-02** for additional details
			7

Reporting Limit Standard (CRA)	conc at RL - analyzed beginning of run %R = 70-130%	R(-),(+)<2xRL if %R <50% J(+)<2x RL, UJ(-) if %R 50-69% J(+) <2x RL if %R 130-180% R(+)<2x RL if %R>180%	14
Method Blank	One per matrix per batch (batch not to exceed 20 samples) blank < MDL	Action level is 5x blank concentration U(+) results < action level	7
Laboratory Control Sample (LCS)	One per matrix per batch		10
	Blank Spike: %R within 80-120%	R(+/-) if %R < 50% J(+)/UJ(-) if %R = 50-79% J(+) if %R >120%	
	CRM: Result within manufacturer's certified acceptance range or project guidelines	J(+)/UJ(-) if < LCL, J(+) if > UCL	
Matrix Spike/Matrix Spike Duplicate (MS/MSD)	One per matrix per batch 5% frequency 75-125% for samples less than 4x spike level	J(+) if %R>125% J(+)/UJ(-) if %R <75% J(+)/R(-) if %R<30% all samples in batch	8
Laboratory Duplicate (or MS/MSD)	One per matrix per batch RPD < 20% for samples > 5x RL Diff ≤ RL for samples >RL and < 5x RL (Diff ≤ 2x RL for solids)	J(+)/UJ(-) if RPD > 20% or diff > RL all samples in batch	9

EcoChem Validation Guidelines for Mercury Analysis by CVAA (Based on Inorganic NFG 1994 & 2004)

VALIDATION QC ELEMENT	ACCEPTANCE CRITERIA	ACTION	REASON CODE
Field Blank	Blank < MDL	Action level is 5x blank conc. U(+) sample values < action level in associated field samples only	6
Field Duplicate	For results > 5x RL: Water: RPD < 35% Solid: RPD < 50% For results < 5x RL: Water: Diff<RL Solid: Diff < 2x RL	J(+)/UJ(-) in parent samples only	9
Linear Range	Sample concentrations must be less than 110% of high standard	J values over range	20

EcoChem, INC.
Environmental Data Quality

APPENDIX B
QUALIFIED DATA SUMMARY TABLE

Qualified Data Summary Table
Harper Estuary Restoration Project - Phase II

Sample ID	Lab ID	Method	Analyte	Result	Units	Lab Flag	DV Qual	Reason Code
HE-1-20140220-S-6-12	580-42463-1	SW6020	ARSENIC	14	mg/Kg		J	9
HE-1-20140220-S-6-12	580-42463-1	SW6020	COPPER	58	mg/Kg		J	8H
HE-5-20140220-S-18-24	580-42463-10	SW6020	ARSENIC	15	mg/Kg		J	9
HE-5-20140220-S-18-24	580-42463-10	SW6020	COPPER	55	mg/Kg		J	8H
HE-6-20140220-S-6-12	580-42463-11	SW6020	ARSENIC	5.2	mg/Kg		J	9
HE-6-20140220-S-6-12	580-42463-11	SW6020	COPPER	42	mg/Kg		J	8H
HE-6-20140220-S-18-23	580-42463-12	SW6020	ARSENIC	3.6	mg/Kg		J	9
HE-6-20140220-S-18-23	580-42463-12	SW6020	COPPER	21	mg/Kg		J	8H
HE-1-20140220-S-12-24	580-42463-2	SW6020	ARSENIC	11	mg/Kg		J	9
HE-1-20140220-S-12-24	580-42463-2	SW6020	COPPER	78	mg/Kg		J	8H
HE-2-20140220-S-6-12	580-42463-3	SW6020	ARSENIC	12	mg/Kg		J	9
HE-2-20140220-S-6-12	580-42463-3	SW6020	COPPER	43	mg/Kg		J	8H
HE-2-20140220-S-12-24	580-42463-4	SW6020	ARSENIC	16	mg/Kg		J	9
HE-2-20140220-S-12-24	580-42463-4	SW6020	COPPER	66	mg/Kg		J	8H
HE-2-20140220-S-12-24	580-42463-4DU	SW6020	ARSENIC	13.2	mg/Kg	F3	J	9
HE-2-20140220-S-12-24	580-42463-4DU	SW6020	COPPER	55.4	mg/Kg		J	8H
HE-3-20140220-S-6-12	580-42463-5	SW6020	ARSENIC	21	mg/Kg		J	9
HE-3-20140220-S-6-12	580-42463-5	SW6020	COPPER	69	mg/Kg		J	8H
HE-3-20140220-S-18-24	580-42463-6	SW6020	ARSENIC	33	mg/Kg		J	9
HE-3-20140220-S-18-24	580-42463-6	SW6020	COPPER	58	mg/Kg		J	8H
HE-4-20140220-S-6-12	580-42463-7	SW6020	ARSENIC	6.6	mg/Kg		J	9
HE-4-20140220-S-6-12	580-42463-7	SW6020	COPPER	25	mg/Kg		J	8H
HE-4-20140220-S-18-20	580-42463-8	SW6020	ARSENIC	6.5	mg/Kg		J	9
HE-4-20140220-S-18-20	580-42463-8	SW6020	COPPER	30	mg/Kg		J	8H
HE-5-20140220-S-6-12	580-42463-9	SW6020	ARSENIC	4.8	mg/Kg		J	9
HE-5-20140220-S-6-12	580-42463-9	SW6020	COPPER	14	mg/Kg		J	8H
HE-1-20140220-S-6-12	580-42463-1	SW8260	1,1,2,2-TETRACHLOROETHANE	4	ug/Kg	U*	UJ	19
HE-1-20140220-S-6-12	580-42463-1	SW8260	1,2,3-TRICHLOROBENZENE	4	ug/Kg	U*	UJ	19
HE-1-20140220-S-6-12	580-42463-1	SW8260	1,2,3-TRICHLOROPROPANE	2	ug/Kg	U*	UJ	19
HE-1-20140220-S-6-12	580-42463-1	SW8260	1,2,4-TRICHLOROBENZENE	4	ug/Kg	U*	UJ	19
HE-1-20140220-S-6-12	580-42463-1	SW8260	1,2,4-TRIMETHYLBENZENE	4	ug/Kg	U*	UJ	19
HE-1-20140220-S-6-12	580-42463-1	SW8260	1,2-DIBROMO-3-CHLOROPROPANE	4	ug/Kg	U*	UJ	19
HE-1-20140220-S-6-12	580-42463-1	SW8260	1,2-DICHLOROBENZENE	2	ug/Kg	U*	UJ	19
HE-1-20140220-S-6-12	580-42463-1	SW8260	1,3,5-TRIMETHYLBENZENE	10	ug/Kg	U*	UJ	19
HE-1-20140220-S-6-12	580-42463-1	SW8260	1,3-DICHLOROBENZENE	2	ug/Kg	U*	UJ	19
HE-1-20140220-S-6-12	580-42463-1	SW8260	1,4-DICHLOROBENZENE	2	ug/Kg	U*	UJ	19
HE-1-20140220-S-6-12	580-42463-1	SW8260	2-CHLOROTOLUENE	4	ug/Kg	U*	UJ	19
HE-1-20140220-S-6-12	580-42463-1	SW8260	4-CHLOROTOLUENE	4	ug/Kg	U*	UJ	19
HE-1-20140220-S-6-12	580-42463-1	SW8260	BROMOBENZENE	4	ug/Kg	U*	UJ	19
HE-1-20140220-S-6-12	580-42463-1	SW8260	BROMOMETHANE	2	ug/Kg	U	UJ	5BL
HE-1-20140220-S-6-12	580-42463-1	SW8260	CFC-12	2	ug/Kg	U	UJ	5BL
HE-1-20140220-S-6-12	580-42463-1	SW8260	HEXACHLOROBUTADIENE	2	ug/Kg	U*	UJ	19

Qualified Data Summary Table
Harper Estuary Restoration Project - Phase II

Sample ID	Lab ID	Method	Analyte	Result	Units	Lab Flag	DV Qual	Reason Code
HE-1-20140220-S-6-12	580-42463-1	SW8260	NAPHTHALENE	10	ug/Kg	U*	UJ	19
HE-1-20140220-S-6-12	580-42463-1	SW8260	N-BUTYLBENZENE	4	ug/Kg	U*	UJ	19
HE-1-20140220-S-6-12	580-42463-1	SW8260	N-PROPYLBENZENE	2	ug/Kg	U*	UJ	19
HE-1-20140220-S-6-12	580-42463-1	SW8260	P-ISOPROPYLTOLUENE	4	ug/Kg	U*	UJ	19
HE-1-20140220-S-6-12	580-42463-1	SW8260	SEC-BUTYLBENZENE	4	ug/Kg	U*	UJ	19
HE-1-20140220-S-6-12	580-42463-1	SW8260	TERT-BUTYLBENZENE	4	ug/Kg	U*	UJ	19
HE-5-20140220-S-18-24	580-42463-10	SW8260	1,1,2,2-TETRACHLOROETHANE	3	ug/Kg	U*	UJ	19
HE-5-20140220-S-18-24	580-42463-10	SW8260	1,2,3-TRICHLOROBENZENE	3	ug/Kg	U*	UJ	19
HE-5-20140220-S-18-24	580-42463-10	SW8260	1,2,3-TRICHLOROPROPANE	1.5	ug/Kg	U*	UJ	19
HE-5-20140220-S-18-24	580-42463-10	SW8260	1,2,4-TRICHLOROBENZENE	3	ug/Kg	U*	UJ	19
HE-5-20140220-S-18-24	580-42463-10	SW8260	1,2,4-TRIMETHYLBENZENE	3	ug/Kg	U*	UJ	19
HE-5-20140220-S-18-24	580-42463-10	SW8260	1,2-DIBROMO-3-CHLOROPROPANE	3	ug/Kg	U*	UJ	19
HE-5-20140220-S-18-24	580-42463-10	SW8260	1,2-DICHLOROBENZENE	1.5	ug/Kg	U*	UJ	19
HE-5-20140220-S-18-24	580-42463-10	SW8260	1,3,5-TRIMETHYLBENZENE	7.5	ug/Kg	U*	UJ	19
HE-5-20140220-S-18-24	580-42463-10	SW8260	1,3-DICHLOROBENZENE	1.5	ug/Kg	U*	UJ	19
HE-5-20140220-S-18-24	580-42463-10	SW8260	1,4-DICHLOROBENZENE	1.5	ug/Kg	U*	UJ	19
HE-5-20140220-S-18-24	580-42463-10	SW8260	2-CHLOROTOLUENE	3	ug/Kg	U*	UJ	19
HE-5-20140220-S-18-24	580-42463-10	SW8260	4-CHLOROTOLUENE	3	ug/Kg	U*	UJ	19
HE-5-20140220-S-18-24	580-42463-10	SW8260	BROMOBENZENE	3	ug/Kg	U*	UJ	19
HE-5-20140220-S-18-24	580-42463-10	SW8260	BROMOMETHANE	1.5	ug/Kg	U	UJ	5BL
HE-5-20140220-S-18-24	580-42463-10	SW8260	CFC-12	1.5	ug/Kg	U	UJ	5BL
HE-5-20140220-S-18-24	580-42463-10	SW8260	HEXACHLOROBUTADIENE	1.5	ug/Kg	U*	UJ	19
HE-5-20140220-S-18-24	580-42463-10	SW8260	NAPHTHALENE	7.5	ug/Kg	U*	UJ	19
HE-5-20140220-S-18-24	580-42463-10	SW8260	N-BUTYLBENZENE	3	ug/Kg	U*	UJ	19
HE-5-20140220-S-18-24	580-42463-10	SW8260	N-PROPYLBENZENE	1.5	ug/Kg	U*	UJ	19
HE-5-20140220-S-18-24	580-42463-10	SW8260	P-ISOPROPYLTOLUENE	3	ug/Kg	U*	UJ	19
HE-5-20140220-S-18-24	580-42463-10	SW8260	SEC-BUTYLBENZENE	3	ug/Kg	U*	UJ	19
HE-5-20140220-S-18-24	580-42463-10	SW8260	TERT-BUTYLBENZENE	3	ug/Kg	U*	UJ	19
HE-6-20140220-S-6-12	580-42463-11	SW8260	1,1,2,2-TETRACHLOROETHANE	2.4	ug/Kg	U*	UJ	19
HE-6-20140220-S-6-12	580-42463-11	SW8260	1,2,3-TRICHLOROBENZENE	2.4	ug/Kg	U*	UJ	19
HE-6-20140220-S-6-12	580-42463-11	SW8260	1,2,3-TRICHLOROPROPANE	1.2	ug/Kg	U*	UJ	19
HE-6-20140220-S-6-12	580-42463-11	SW8260	1,2,4-TRICHLOROBENZENE	2.4	ug/Kg	U*	UJ	19
HE-6-20140220-S-6-12	580-42463-11	SW8260	1,2,4-TRIMETHYLBENZENE	2.4	ug/Kg	U*	UJ	19
HE-6-20140220-S-6-12	580-42463-11	SW8260	1,2-DIBROMO-3-CHLOROPROPANE	2.4	ug/Kg	U*	UJ	19
HE-6-20140220-S-6-12	580-42463-11	SW8260	1,2-DICHLOROBENZENE	1.2	ug/Kg	U*	UJ	19
HE-6-20140220-S-6-12	580-42463-11	SW8260	1,3,5-TRIMETHYLBENZENE	6	ug/Kg	U*	UJ	19
HE-6-20140220-S-6-12	580-42463-11	SW8260	1,3-DICHLOROBENZENE	1.2	ug/Kg	U*	UJ	19
HE-6-20140220-S-6-12	580-42463-11	SW8260	1,4-DICHLOROBENZENE	1.2	ug/Kg	U*	UJ	19
HE-6-20140220-S-6-12	580-42463-11	SW8260	2-CHLOROTOLUENE	2.4	ug/Kg	U*	UJ	19
HE-6-20140220-S-6-12	580-42463-11	SW8260	4-CHLOROTOLUENE	2.4	ug/Kg	U*	UJ	19
HE-6-20140220-S-6-12	580-42463-11	SW8260	BROMOBENZENE	2.4	ug/Kg	U*	UJ	19
HE-6-20140220-S-6-12	580-42463-11	SW8260	BROMOMETHANE	1.2	ug/Kg	U	UJ	5BL

Qualified Data Summary Table
Harper Estuary Restoration Project - Phase II

Sample ID	Lab ID	Method	Analyte	Result	Units	Lab Flag	DV Qual	Reason Code
HE-6-20140220-S-6-12	580-42463-11	SW8260	CFC-12	1.2	ug/Kg	U	UJ	5BL
HE-6-20140220-S-6-12	580-42463-11	SW8260	HEXACHLOROBUTADIENE	1.2	ug/Kg	U*	UJ	19
HE-6-20140220-S-6-12	580-42463-11	SW8260	NAPHTHALENE	6	ug/Kg	U*	UJ	19
HE-6-20140220-S-6-12	580-42463-11	SW8260	N-BUTYLBENZENE	2.4	ug/Kg	U*	UJ	19
HE-6-20140220-S-6-12	580-42463-11	SW8260	N-PROPYLBENZENE	1.2	ug/Kg	U*	UJ	19
HE-6-20140220-S-6-12	580-42463-11	SW8260	P-ISOPROPYLTOLUENE	1.4	ug/Kg	J*	J	19
HE-6-20140220-S-6-12	580-42463-11	SW8260	SEC-BUTYLBENZENE	2.4	ug/Kg	U*	UJ	19
HE-6-20140220-S-6-12	580-42463-11	SW8260	TERT-BUTYLBENZENE	2.4	ug/Kg	U*	UJ	19
HE-6-20140220-S-18-23	580-42463-12	SW8260	BROMOMETHANE	0.86	ug/Kg	U	UJ	5BL
HE-6-20140220-S-18-23	580-42463-12	SW8260	CFC-12	0.86	ug/Kg	U	UJ	5BL
Trip Blank	580-42463-15	SW8260	BROMOMETHANE	1	ug/Kg	U	UJ	5BL
Trip Blank	580-42463-15	SW8260	CFC-12	1	ug/Kg	U	UJ	5BL
HE-1-20140220-S-12-24	580-42463-2	SW8260	BROMOMETHANE	1.9	ug/Kg	U	UJ	5BL
HE-1-20140220-S-12-24	580-42463-2	SW8260	CFC-12	1.9	ug/Kg	U	UJ	5BL
HE-2-20140220-S-6-12	580-42463-3	SW8260	1,1,2,2-TETRACHLOROETHANE	3.6	ug/Kg	U*	UJ	19
HE-2-20140220-S-6-12	580-42463-3	SW8260	1,2,3-TRICHLOROBENZENE	3.6	ug/Kg	U*	UJ	19
HE-2-20140220-S-6-12	580-42463-3	SW8260	1,2,3-TRICHLOROPROPANE	1.8	ug/Kg	U*	UJ	19
HE-2-20140220-S-6-12	580-42463-3	SW8260	1,2,4-TRICHLOROBENZENE	3.6	ug/Kg	U*	UJ	19
HE-2-20140220-S-6-12	580-42463-3	SW8260	1,2,4-TRIMETHYLBENZENE	3.6	ug/Kg	U*	UJ	19
HE-2-20140220-S-6-12	580-42463-3	SW8260	1,2-DIBROMO-3-CHLOROPROPANE	3.6	ug/Kg	U*	UJ	19
HE-2-20140220-S-6-12	580-42463-3	SW8260	1,2-DICHLOROBENZENE	1.8	ug/Kg	U*	UJ	19
HE-2-20140220-S-6-12	580-42463-3	SW8260	1,3,5-TRIMETHYLBENZENE	9.1	ug/Kg	U*	UJ	19
HE-2-20140220-S-6-12	580-42463-3	SW8260	1,3-DICHLOROBENZENE	1.8	ug/Kg	U*	UJ	19
HE-2-20140220-S-6-12	580-42463-3	SW8260	1,4-DICHLOROBENZENE	1.8	ug/Kg	U*	UJ	19
HE-2-20140220-S-6-12	580-42463-3	SW8260	2-CHLOROTOLUENE	3.6	ug/Kg	U*	UJ	19
HE-2-20140220-S-6-12	580-42463-3	SW8260	4-CHLOROTOLUENE	3.6	ug/Kg	U*	UJ	19
HE-2-20140220-S-6-12	580-42463-3	SW8260	BROMOBENZENE	3.6	ug/Kg	U*	UJ	19
HE-2-20140220-S-6-12	580-42463-3	SW8260	BROMOMETHANE	1.8	ug/Kg	U	UJ	5BL
HE-2-20140220-S-6-12	580-42463-3	SW8260	CFC-12	1.8	ug/Kg	U	UJ	5BL
HE-2-20140220-S-6-12	580-42463-3	SW8260	HEXACHLOROBUTADIENE	1.8	ug/Kg	U*	UJ	19
HE-2-20140220-S-6-12	580-42463-3	SW8260	NAPHTHALENE	9.1	ug/Kg	U*	UJ	19
HE-2-20140220-S-6-12	580-42463-3	SW8260	N-BUTYLBENZENE	3.6	ug/Kg	U*	UJ	19
HE-2-20140220-S-6-12	580-42463-3	SW8260	N-PROPYLBENZENE	1.8	ug/Kg	U*	UJ	19
HE-2-20140220-S-6-12	580-42463-3	SW8260	P-ISOPROPYLTOLUENE	3.6	ug/Kg	U*	UJ	19
HE-2-20140220-S-6-12	580-42463-3	SW8260	SEC-BUTYLBENZENE	3.6	ug/Kg	U*	UJ	19
HE-2-20140220-S-6-12	580-42463-3	SW8260	TERT-BUTYLBENZENE	3.6	ug/Kg	U*	UJ	19
HE-2-20140220-S-12-24	580-42463-4	SW8260	1,1,2,2-TETRACHLOROETHANE	4.7	ug/Kg	U*	UJ	19
HE-2-20140220-S-12-24	580-42463-4	SW8260	1,2,3-TRICHLOROBENZENE	4.7	ug/Kg	U*	UJ	19
HE-2-20140220-S-12-24	580-42463-4	SW8260	1,2,3-TRICHLOROPROPANE	2.4	ug/Kg	U*	UJ	19
HE-2-20140220-S-12-24	580-42463-4	SW8260	1,2,4-TRICHLOROBENZENE	4.7	ug/Kg	U*	UJ	19
HE-2-20140220-S-12-24	580-42463-4	SW8260	1,2,4-TRIMETHYLBENZENE	4.7	ug/Kg	U*	UJ	19
HE-2-20140220-S-12-24	580-42463-4	SW8260	1,2-DIBROMO-3-CHLOROPROPANE	4.7	ug/Kg	U*	UJ	19

Qualified Data Summary Table
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Sample ID	Lab ID	Method	Analyte	Result	Units	Lab Flag	DV Qual	Reason Code
HE-2-20140220-S-12-24	580-42463-4	SW8260	1,2-DICHLOROBENZENE	2.4	ug/Kg	U*	UJ	19
HE-2-20140220-S-12-24	580-42463-4	SW8260	1,3,5-TRIMETHYLBENZENE	12	ug/Kg	U*	UJ	19
HE-2-20140220-S-12-24	580-42463-4	SW8260	1,3-DICHLOROBENZENE	2.4	ug/Kg	U*	UJ	19
HE-2-20140220-S-12-24	580-42463-4	SW8260	1,4-DICHLOROBENZENE	2.4	ug/Kg	U*	UJ	19
HE-2-20140220-S-12-24	580-42463-4	SW8260	2-CHLOROTOLUENE	4.7	ug/Kg	U*	UJ	19
HE-2-20140220-S-12-24	580-42463-4	SW8260	4-CHLOROTOLUENE	4.7	ug/Kg	U*	UJ	19
HE-2-20140220-S-12-24	580-42463-4	SW8260	BROMOBENZENE	4.7	ug/Kg	U*	UJ	19
HE-2-20140220-S-12-24	580-42463-4	SW8260	BROMOMETHANE	2.4	ug/Kg	U	UJ	5BL
HE-2-20140220-S-12-24	580-42463-4	SW8260	CFC-12	2.4	ug/Kg	U	UJ	5BL
HE-2-20140220-S-12-24	580-42463-4	SW8260	HEXACHLOROBUTADIENE	2.4	ug/Kg	U*	UJ	19
HE-2-20140220-S-12-24	580-42463-4	SW8260	NAPHTHALENE	12	ug/Kg	U*	UJ	19
HE-2-20140220-S-12-24	580-42463-4	SW8260	N-BUTYLBENZENE	4.7	ug/Kg	U*	UJ	19
HE-2-20140220-S-12-24	580-42463-4	SW8260	N-PROPYLBENZENE	2.4	ug/Kg	U*	UJ	19
HE-2-20140220-S-12-24	580-42463-4	SW8260	P-ISOPROPYLTOLUENE	4.7	ug/Kg	U*	UJ	19
HE-2-20140220-S-12-24	580-42463-4	SW8260	SEC-BUTYLBENZENE	4.7	ug/Kg	U*	UJ	19
HE-2-20140220-S-12-24	580-42463-4	SW8260	TERT-BUTYLBENZENE	4.7	ug/Kg	U*	UJ	19
HE-2-20140220-S-12-24	580-42463-4DU	SW8260	BROMOMETHANE	1.8	ug/Kg	U	UJ	5BL
HE-2-20140220-S-12-24	580-42463-4DU	SW8260	CFC-12	1.8	ug/Kg	U	UJ	5BL
HE-3-20140220-S-6-12	580-42463-5	SW8260	BROMOMETHANE	1.9	ug/Kg	U	UJ	5BL
HE-3-20140220-S-6-12	580-42463-5	SW8260	CFC-12	1.9	ug/Kg	U	UJ	5BL
HE-3-20140220-S-18-24	580-42463-6	SW8260	BROMOMETHANE	2.2	ug/Kg	U	UJ	5BL
HE-3-20140220-S-18-24	580-42463-6	SW8260	CFC-12	2.2	ug/Kg	U	UJ	5BL
HE-4-20140220-S-6-12	580-42463-7	SW8260	1,1,2,2-TETRACHLOROETHANE	3.2	ug/Kg	U*	UJ	19
HE-4-20140220-S-6-12	580-42463-7	SW8260	1,2,3-TRICHLOROBENZENE	3.2	ug/Kg	U*	UJ	19
HE-4-20140220-S-6-12	580-42463-7	SW8260	1,2,3-TRICHLOROPROPANE	1.6	ug/Kg	U*	UJ	19
HE-4-20140220-S-6-12	580-42463-7	SW8260	1,2,4-TRICHLOROBENZENE	3.2	ug/Kg	U*	UJ	19
HE-4-20140220-S-6-12	580-42463-7	SW8260	1,2,4-TRIMETHYLBENZENE	3.2	ug/Kg	U*	UJ	19
HE-4-20140220-S-6-12	580-42463-7	SW8260	1,2-DIBROMO-3-CHLOROPROPANE	3.2	ug/Kg	U*	UJ	19
HE-4-20140220-S-6-12	580-42463-7	SW8260	1,2-DICHLOROBENZENE	1.6	ug/Kg	U*	UJ	19
HE-4-20140220-S-6-12	580-42463-7	SW8260	1,3,5-TRIMETHYLBENZENE	8	ug/Kg	U*	UJ	19
HE-4-20140220-S-6-12	580-42463-7	SW8260	1,3-DICHLOROBENZENE	1.6	ug/Kg	U*	UJ	19
HE-4-20140220-S-6-12	580-42463-7	SW8260	1,4-DICHLOROBENZENE	1.6	ug/Kg	U*	UJ	19
HE-4-20140220-S-6-12	580-42463-7	SW8260	2-CHLOROTOLUENE	3.2	ug/Kg	U*	UJ	19
HE-4-20140220-S-6-12	580-42463-7	SW8260	4-CHLOROTOLUENE	3.2	ug/Kg	U*	UJ	19
HE-4-20140220-S-6-12	580-42463-7	SW8260	BROMOBENZENE	3.2	ug/Kg	U*	UJ	19
HE-4-20140220-S-6-12	580-42463-7	SW8260	BROMOMETHANE	1.6	ug/Kg	U	UJ	5BL
HE-4-20140220-S-6-12	580-42463-7	SW8260	CFC-12	1.6	ug/Kg	U	UJ	5BL
HE-4-20140220-S-6-12	580-42463-7	SW8260	HEXACHLOROBUTADIENE	1.6	ug/Kg	U*	UJ	19
HE-4-20140220-S-6-12	580-42463-7	SW8260	NAPHTHALENE	8	ug/Kg	U*	UJ	19
HE-4-20140220-S-6-12	580-42463-7	SW8260	N-BUTYLBENZENE	3.2	ug/Kg	U*	UJ	19
HE-4-20140220-S-6-12	580-42463-7	SW8260	N-PROPYLBENZENE	1.6	ug/Kg	U*	UJ	19
HE-4-20140220-S-6-12	580-42463-7	SW8260	P-ISOPROPYLTOLUENE	3.2	ug/Kg	U*	UJ	19

Qualified Data Summary Table
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Sample ID	Lab ID	Method	Analyte	Result	Units	Lab Flag	DV Qual	Reason Code
HE-4-20140220-S-6-12	580-42463-7	SW8260	SEC-BUTYLBENZENE	3.2	ug/Kg	U*	UJ	19
HE-4-20140220-S-6-12	580-42463-7	SW8260	TERT-BUTYLBENZENE	3.2	ug/Kg	U*	UJ	19
HE-4-20140220-S-18-20	580-42463-8	SW8260	1,1,2,2-TETRACHLOROETHANE	3.7	ug/Kg	U*	UJ	19
HE-4-20140220-S-18-20	580-42463-8	SW8260	1,2,3-TRICHLOROBENZENE	3.7	ug/Kg	U*	UJ	19
HE-4-20140220-S-18-20	580-42463-8	SW8260	1,2,3-TRICHLOROPROPANE	1.8	ug/Kg	U*	UJ	19
HE-4-20140220-S-18-20	580-42463-8	SW8260	1,2,4-TRICHLOROBENZENE	3.7	ug/Kg	U*	UJ	19
HE-4-20140220-S-18-20	580-42463-8	SW8260	1,2,4-TRIMETHYLBENZENE	3.7	ug/Kg	U*	UJ	19
HE-4-20140220-S-18-20	580-42463-8	SW8260	1,2-DIBROMO-3-CHLOROPROPANE	3.7	ug/Kg	U*	UJ	19
HE-4-20140220-S-18-20	580-42463-8	SW8260	1,2-DICHLOROBENZENE	1.8	ug/Kg	U*	UJ	19
HE-4-20140220-S-18-20	580-42463-8	SW8260	1,3,5-TRIMETHYLBENZENE	9.2	ug/Kg	U*	UJ	19
HE-4-20140220-S-18-20	580-42463-8	SW8260	1,3-DICHLOROBENZENE	1.8	ug/Kg	U*	UJ	19
HE-4-20140220-S-18-20	580-42463-8	SW8260	1,4-DICHLOROBENZENE	1.8	ug/Kg	U*	UJ	19
HE-4-20140220-S-18-20	580-42463-8	SW8260	2-CHLOROTOLUENE	3.7	ug/Kg	U*	UJ	19
HE-4-20140220-S-18-20	580-42463-8	SW8260	4-CHLOROTOLUENE	3.7	ug/Kg	U*	UJ	19
HE-4-20140220-S-18-20	580-42463-8	SW8260	BROMOBENZENE	3.7	ug/Kg	U*	UJ	19
HE-4-20140220-S-18-20	580-42463-8	SW8260	BROMOMETHANE	1.8	ug/Kg	U	UJ	5BL
HE-4-20140220-S-18-20	580-42463-8	SW8260	CFC-12	1.8	ug/Kg	U	UJ	5BL
HE-4-20140220-S-18-20	580-42463-8	SW8260	HEXACHLOROBUTADIENE	1.8	ug/Kg	U*	UJ	19
HE-4-20140220-S-18-20	580-42463-8	SW8260	NAPHTHALENE	9.2	ug/Kg	U*	UJ	19
HE-4-20140220-S-18-20	580-42463-8	SW8260	N-BUTYLBENZENE	3.7	ug/Kg	U*	UJ	19
HE-4-20140220-S-18-20	580-42463-8	SW8260	N-PROPYLBENZENE	1.8	ug/Kg	U*	UJ	19
HE-4-20140220-S-18-20	580-42463-8	SW8260	P-ISOPROPYLTOLUENE	3.7	ug/Kg	U*	UJ	19
HE-4-20140220-S-18-20	580-42463-8	SW8260	SEC-BUTYLBENZENE	3.7	ug/Kg	U*	UJ	19
HE-4-20140220-S-18-20	580-42463-8	SW8260	TERT-BUTYLBENZENE	3.7	ug/Kg	U*	UJ	19
HE-5-20140220-S-6-12	580-42463-9	SW8260	BROMOMETHANE	1	ug/Kg	U	UJ	5BL
HE-5-20140220-S-6-12	580-42463-9	SW8260	CFC-12	1	ug/Kg	U	UJ	5BL
HE-1-20140220-S-6-12	580-42463-1	SW8270C	2,4-DINITROPHENOL	1400	ug/Kg	U*	UJ	10L
HE-1-20140220-S-6-12	580-42463-1	SW8270C	BIS(2-ETHYLHEXYL) PHTHALATE	850	ug/Kg	JB	U	7
HE-1-20140220-S-6-12	580-42463-1	SW8270C	M-NITROANILINE	140	ug/Kg	U*	UJ	10L
HE-5-20140220-S-18-24	580-42463-10	SW8270C	2,4-DINITROPHENOL	1400	ug/Kg	U*	UJ	10L
HE-5-20140220-S-18-24	580-42463-10	SW8270C	BIS(2-ETHYLHEXYL) PHTHALATE	840	ug/Kg	JB	U	7
HE-5-20140220-S-18-24	580-42463-10	SW8270C	M-NITROANILINE	140	ug/Kg	U*	UJ	10L
HE-6-20140220-S-6-12	580-42463-11	SW8270C	2,4-DINITROPHENOL	1200	ug/Kg	U*	UJ	10L
HE-6-20140220-S-6-12	580-42463-11	SW8270C	BIS(2-ETHYLHEXYL) PHTHALATE	690	ug/Kg	JB	U	7
HE-6-20140220-S-6-12	580-42463-11	SW8270C	M-NITROANILINE	120	ug/Kg	U*	UJ	10L
HE-6-20140220-S-18-23	580-42463-12	SW8270C	2,4-DINITROPHENOL	1100	ug/Kg	U*	UJ	10L
HE-6-20140220-S-18-23	580-42463-12	SW8270C	M-NITROANILINE	110	ug/Kg	U*	UJ	10L
HE-1-20140220-S-12-24	580-42463-2	SW8270C	2,4-DINITROPHENOL	1600	ug/Kg	U*	UJ	10L
HE-1-20140220-S-12-24	580-42463-2	SW8270C	BIS(2-ETHYLHEXYL) PHTHALATE	970	ug/Kg	JB	U	7
HE-1-20140220-S-12-24	580-42463-2	SW8270C	M-NITROANILINE	160	ug/Kg	U*	UJ	10L
HE-2-20140220-S-6-12	580-42463-3	SW8270C	2,4-DINITROPHENOL	1400	ug/Kg	U*	UJ	10L
HE-2-20140220-S-6-12	580-42463-3	SW8270C	BIS(2-ETHYLHEXYL) PHTHALATE	820	ug/Kg	JB	U	7

Qualified Data Summary Table
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Sample ID	Lab ID	Method	Analyte	Result	Units	Lab Flag	DV Qual	Reason Code
HE-2-20140220-S-6-12	580-42463-3	SW8270C	M-NITROANILINE	140	ug/Kg	U*	UJ	10L
HE-2-20140220-S-12-24	580-42463-4	SW8270C	2,4-DINITROPHENOL	1800	ug/Kg	U*	UJ	10L
HE-2-20140220-S-12-24	580-42463-4	SW8270C	BIS(2-ETHYLHEXYL) PHTHALATE	1100	ug/Kg	JB	U	7
HE-2-20140220-S-12-24	580-42463-4	SW8270C	M-NITROANILINE	180	ug/Kg	U*	UJ	10L
HE-2-20140220-S-12-24	580-42463-4DU	SW8270C	2,4-DINITROPHENOL	1500	ug/Kg	U*	UJ	10L
HE-2-20140220-S-12-24	580-42463-4DU	SW8270C	BIS(2-ETHYLHEXYL) PHTHALATE	890	ug/Kg	J	U	7
HE-2-20140220-S-12-24	580-42463-4DU	SW8270C	M-NITROANILINE	150	ug/Kg	U*	UJ	10L
HE-3-20140220-S-6-12	580-42463-5	SW8270C	2,4-DINITROPHENOL	1500	ug/Kg	U*	UJ	10L
HE-3-20140220-S-6-12	580-42463-5	SW8270C	BIS(2-ETHYLHEXYL) PHTHALATE	890	ug/Kg	JB	U	7
HE-3-20140220-S-6-12	580-42463-5	SW8270C	M-NITROANILINE	150	ug/Kg	U*	UJ	10L
HE-3-20140220-S-18-24	580-42463-6	SW8270C	2,4-DINITROPHENOL	1600	ug/Kg	U*	UJ	10L
HE-3-20140220-S-18-24	580-42463-6	SW8270C	BIS(2-ETHYLHEXYL) PHTHALATE	980	ug/Kg	JB	U	7
HE-3-20140220-S-18-24	580-42463-6	SW8270C	M-NITROANILINE	160	ug/Kg	U*	UJ	10L
HE-4-20140220-S-6-12	580-42463-7	SW8270C	2,4-DINITROPHENOL	1300	ug/Kg	U*	UJ	10L
HE-4-20140220-S-6-12	580-42463-7	SW8270C	BIS(2-ETHYLHEXYL) PHTHALATE	810	ug/Kg	JB	U	7
HE-4-20140220-S-6-12	580-42463-7	SW8270C	M-NITROANILINE	130	ug/Kg	U*	UJ	10L
HE-4-20140220-S-18-20	580-42463-8	SW8270C	2,4-DINITROPHENOL	1600	ug/Kg	U*	UJ	10L
HE-4-20140220-S-18-20	580-42463-8	SW8270C	BIS(2-ETHYLHEXYL) PHTHALATE	930	ug/Kg	JB	U	7
HE-4-20140220-S-18-20	580-42463-8	SW8270C	M-NITROANILINE	160	ug/Kg	U*	UJ	10L
HE-5-20140220-S-6-12	580-42463-9	SW8270C	2,4-DINITROPHENOL	1000	ug/Kg	U*	UJ	10L
HE-5-20140220-S-6-12	580-42463-9	SW8270C	M-NITROANILINE	100	ug/Kg	U*	UJ	10L
HE-1-20140220-S-6-12	580-42463-1	NWTPH-DX	#2 DIESEL	79	mg/Kg	Y	J	2
HE-1-20140220-S-6-12	580-42463-1	NWTPH-DX	MOTOR OIL	200	mg/Kg	BY	J	2
HE-5-20140220-S-18-24	580-42463-10	NWTPH-DX	#2 DIESEL	49	mg/Kg	Y	J	2
HE-5-20140220-S-18-24	580-42463-10	NWTPH-DX	MOTOR OIL	160	mg/Kg	BY	J	2
HE-6-20140220-S-6-12	580-42463-11	NWTPH-DX	MOTOR OIL	77	mg/Kg	B	U	7
HE-6-20140220-S-18-23	580-42463-12	NWTPH-DX	MOTOR OIL	52	mg/Kg	JB	U	7
HE-1-20140220-S-12-24	580-42463-2	NWTPH-DX	#2 DIESEL	53	mg/Kg	Y	J	2
HE-1-20140220-S-12-24	580-42463-2	NWTPH-DX	MOTOR OIL	130	mg/Kg	BY	J	2
HE-2-20140220-S-6-12	580-42463-3	NWTPH-DX	#2 DIESEL	67	mg/Kg	Y	J	2
HE-2-20140220-S-6-12	580-42463-3	NWTPH-DX	MOTOR OIL	140	mg/Kg	BY	J	2
HE-2-20140220-S-12-24	580-42463-4	NWTPH-DX	#2 DIESEL	120	mg/Kg	Y	J	2
HE-2-20140220-S-12-24	580-42463-4	NWTPH-DX	MOTOR OIL	290	mg/Kg	BY	J	2
HE-3-20140220-S-6-12	580-42463-5	NWTPH-DX	MOTOR OIL	76	mg/Kg	JB	U	7
HE-3-20140220-S-18-24	580-42463-6	NWTPH-DX	MOTOR OIL	77	mg/Kg	JB	U	7
HE-4-20140220-S-6-12	580-42463-7	NWTPH-DX	MOTOR OIL	68	mg/Kg	JB	U	7
HE-4-20140220-S-18-20	580-42463-8	NWTPH-DX	MOTOR OIL	77	mg/Kg	JB	U	7
HE-5-20140220-S-6-12	580-42463-9	NWTPH-DX	MOTOR OIL	51	mg/Kg	JB	U	7
HE-COMP1-20140220-S-6-12	580-42463-13	EPA1613B	1,2,3,6,7,8-HXCDD	2	pg/g	Jq	U	25
HE-COMP1-20140220-S-6-12	580-42463-13	EPA1613B	1,2,3,7,8,9-HXCDD	2.1	pg/g	Jq	U	25
HE-COMP1-20140220-S-6-12	580-42463-13	EPA1613B	TOTAL HXCDD	41	pg/g	q	J	9,25
HE-COMP1-20140220-S-6-12	580-42463-13	EPA1613B	TOTAL HXCDF	62	pg/g	q	J	25

Qualified Data Summary Table
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Sample ID	Lab ID	Method	Analyte	Result	Units	Lab Flag	DV Qual	Reason Code
HE-COMP1-20140220-S-6-12	580-42463-13	EPA1613B	TOTAL PECDD	38	pg/g	q	J	9,25
HE-COMP1-20140220-S-6-12	580-42463-13	EPA1613B	TOTAL TCDD	31	pg/g	q	J	9,25
HE-COMP1-20140220-S-6-12	580-42463-13 DU	EPA1613B	1,2,3,4,7,8-HXCDD	1.939	pg/g	Jq	U	25
HE-COMP1-20140220-S-6-12	580-42463-13 DU	EPA1613B	TOTAL HXCDD	74.39	pg/g	q	J	9,25
HE-COMP1-20140220-S-6-12	580-42463-13 DU	EPA1613B	TOTAL PECDD	87.02	pg/g		J	9
HE-COMP1-20140220-S-6-12	580-42463-13 DU	EPA1613B	TOTAL PECDF	73.25	pg/g	q	J	25
HE-COMP1-20140220-S-6-12	580-42463-13 DU	EPA1613B	TOTAL TCDD	83.05	pg/g	q	J	9,25
HE-COMP1-20140220-S-6-12	580-42463-13 DU	EPA1613B	TOTAL TCDF	90.79	pg/g	q	J	25
HE-COMP1-20140220-S-6-12	580-42463-13 DU	EPA1613B	2,3,7,8-TCDF	3.139	pg/g	q	U	25
HE-COMP2-20140220-S-6-12	580-42463-14	EPA1613B	1,2,3,4,6,7,8-HPCDF	4.1	pg/g	Jq	U	25
HE-COMP2-20140220-S-6-12	580-42463-14	EPA1613B	1,2,3,4,7,8-HXCDF	5.7	pg/g	Uq	U	25
HE-COMP2-20140220-S-6-12	580-42463-14	EPA1613B	1,2,3,6,7,8-HXCDD	0.95	pg/g	Jq	U	25
HE-COMP2-20140220-S-6-12	580-42463-14	EPA1613B	2,3,7,8-TCDD	0.32	pg/g	Jq	U	25
HE-COMP2-20140220-S-6-12	580-42463-14	EPA1613B	TOTAL HPCDF	10	pg/g	q	J	25
HE-COMP2-20140220-S-6-12	580-42463-14	EPA1613B	TOTAL HXCDD	9.8	pg/g	q	J	25
HE-COMP2-20140220-S-6-12	580-42463-14	EPA1613B	TOTAL HXCDF	8.3	pg/g	q	J	25
HE-COMP2-20140220-S-6-12	580-42463-14	EPA1613B	TOTAL TCDD	2.4	pg/g	q	J	25
HE-COMP2-20140220-S-6-12	580-42463-14	EPA1613B	TOTAL TCDF	4.4	pg/g	q	J	25