

Technical Memorandum

TO: Andy Kallus, Washington State Department of Ecology
FROM: Dylan Frazer, LG, on behalf of the Port of Everett
DATE: July 30, 2020
RE: **5-Year Review Groundwater Monitoring Report**
North Marina West End Site
Everett, Washington

Introduction

On behalf of the Port of Everett, Landau Associates, Inc. (LAI) prepared this Technical Memorandum summarizing the results of groundwater sampling and analysis for the Washington State Department of Ecology (Ecology) 5-year review of the North Marina West End Site (Site) cleanup action located at the Port of Everett (Port) in Everett, Washington (Figure 1). A cleanup action was conducted at the Site under a Consent Decree (No. 11-2-10367-4) between the Port of Everett (Port) and Ecology. The cleanup action, as described in the Cleanup Action Plan (CAP; Ecology 2011), included long-term groundwater monitoring, which concluded in the fourth quarter of 2012 (LAI 2013). Ecology has requested that the Port conduct groundwater monitoring and prepare a report presenting the results to support Ecology's 5-year review of the performance of the Site cleanup action. Groundwater monitoring was conducted in general accordance with the 5-Year Review Groundwater Monitoring Plan (GMP), as described below.

Groundwater Monitoring

Groundwater monitoring consisted of evaluating the suitability of the monitoring network, minor rehabilitation of the wells, then collecting and analyzing groundwater samples to assess dissolved arsenic concentrations at four monitoring wells (RI-MW-4, RI-MW-11, RI-MW-11A, and RI-MW-13). This list of wells includes the well pair consisting of vertical well RI-MW-11 and angled well RI-MW-11A; data collected from these wells is used to calculate a contaminant reduction factor (CRF) and estimate contaminant concentrations at the shoreline, which is the conditional point of compliance for the Site. The well locations are shown on Figure 2. Groundwater monitoring was conducted during both the wet season (April) and dry season (September) of 2019 so that the results could capture seasonal fluctuations, if present.

Well Reconnaissance and Development

Prior to collecting samples, well reconnaissance and re-development was conducted to ensure samples would be representative of aquifer conditions. Because well re-development was necessary but not presented in the GMP, this proposed work was described to Ecology via email on April 12, 2019 (Frazer 2019).

Well reconnaissance consisted of measuring depth to water and the total well depth. All groundwater elevations and well depths approximately matched observations collected during prior groundwater monitoring events except for at RI-MW-11A, which is the angled well. At approximately 5 feet (ft) below the top of the casing at RI-MW-11A, a moderately compact plug of sand and silt with some grass or root material was observed. Because of the shallow angle of the casing and well screen of RI-MW-11A, this depth approximately matched the upper limit of the screened portion of the well. The blockage was cleared by physically breaking and removing a portion of the debris to the surface using a metal rod; debris not brought to the surface fell to the bottom of the well casing. Following removal of the blockage, a down-hole camera was used to confirm there was no damage to the integrity of the well casing or screen.

After the blockage in RI-MW-11A was cleared and the down-hole camera confirmed there were no breaks in the well screen or casing, the well was redeveloped to remove material that settled at the bottom of the well. Redevelopment was completed using a peristaltic pump with tubing that extended to the bottom of the well. Water was purged from the well repeatedly until it went dry; approximately 2 gallons of water (greater than one casing volume) was purged from the well during redevelopment.

Groundwater Sampling and Analysis

The groundwater samples were collected on April 23, 2019 and September 26, 2019. Sampling was conducted in accordance with the GMP, which referenced Appendix G of the Remedial Investigation/Feasibility Study (RI/FS) West End Site Work Plan (Work Plan; LAI 2009) and Addendum No. 1 to the Work Plan (LAI 2010). These procedures include collecting the groundwater samples within 1 hour before and 1 hour after a low tide and collecting the samples from the upper 2 ft of the water column to avoid sampling within the saltwater wedge. At the angled well (RI-MW-11A), field parameters were measured at multiple depths prior to purging to confirm the depth of the freshwater and saltwater interface; determination of the freshwater/saltwater interface using this technique was not conclusive. However, conductivity measurements recorded before sample collection at RI-MW-11A were 1,199 microsiemens per centimeter ($\mu\text{S}/\text{cm}$; April 2019) and 1,321 $\mu\text{S}/\text{cm}$ (September 2019), indicating that these samples were collected from above the freshwater/saltwater interface. Samples were field filtered, placed in laboratory-supplied sample containers, and submitted to ALS Laboratory in Everett, Washington for analysis of dissolved arsenic.

Results

The results of groundwater monitoring, consisting of dissolved arsenic results and field parameter measurements, for this 5-year review and historical data from 2009, 2010, and 2012 are presented in Table 1. The data are compared to the dissolved arsenic Site cleanup level of 5 micrograms per liter ($\mu\text{g}/\text{L}$). Laboratory data reports were validated using quality assurance procedures presented in the

GMP. No data qualifiers were necessary for the data collected in 2019, indicating the data are appropriate for evaluating compliance. Sample collection forms generated in the field are stored electronically at LAI and are available for review upon request.

Contaminant Reduction Factor

A CRF is calculated using data collected at the Site for each monitoring event, and is subsequently used to estimate contaminant concentrations in groundwater at the conditional point of compliance, which is the groundwater/surface water interface. Table 1 includes presentation of a calculated CRF for each groundwater monitoring event and an estimated arsenic concentration at the conditional point of compliance after applying the CRF. The CRF was calculated using procedures used during long-term groundwater monitoring, which was most recently presented in the December 2013 Compliance Monitoring Report (LAI 2013). These procedures consist of calculating an initial reduction factor ($[\text{concentration at RI-MW-11}]/[\text{concentration at RI-MW-11A}]$), then squaring this initial reduction factor to calculate a total concentration reduction factor between vertical wells and the groundwater/surface water interface. This total concentration reduction factor applied at all wells, with the exception of angled well RI-MW-11A. Because the location of angled well RI-MW-11A is already half the distance to the shoreline, the initial concentration factor ($[\text{concentration at RI-MW-11}]/[\text{concentration at RI-MW-11A}]$) was used to calculate adjusted concentrations seaward of RI-MW-11A.

Dissolved Arsenic

Dissolved arsenic was detected at all wells during both sampling events, and nearly all concentrations were greater than the cleanup level of 5 µg/L. Dissolved arsenic concentrations at vertical wells ranged from 84 µg/L to 120 µg/L (RI-MW-4), 32 µg/L to 40 µg/L (RI-MW-11), and 4.3 µg/L to 11 µg/L (RI-MW-13). At the angled well seaward of RI-MW-11, dissolved arsenic concentrations ranged between 8.8 µg/L and 7.3 µg/L.

Estimated dissolved arsenic concentrations at the conditional point of compliance, which was calculated by applying the CRF at each well, indicated dissolved arsenic concentrations ranging between 0.3 µg/L and 6.7 µg/L. These concentrations are all below the cleanup level except for a slight exceedances at RI-MW-4 during the April 2019 monitoring event (6.4 µg/L; field duplicate result was 6.7 µg/L).

Conclusions

Based on the monitoring data and using the CRF as discussed above, dissolved arsenic is estimated to be below the cleanup level (in compliance) at the conditional point of compliance in the vicinity of monitoring wells RI-MW-11, and RI-MW-11A, and RI-MW-13 during both monitoring events, and at RI-MW-4 during the second monitoring event. Dissolved arsenic is estimated to be present at

concentrations slightly greater than the cleanup levels at the conditional point of compliance in the vicinity of monitoring well RI-MW-4 only during the April 2019 monitoring event.

In addition to most estimated dissolved arsenic concentrations at the conditional point of compliance meeting the cleanup standards, detected concentrations of arsenic at each vertical monitoring well were generally lower during this 5-year review sampling than during historical monitoring events. Although these vertical wells are not the regulated point of compliance, the data provides an indication that groundwater quality is improving.

One exception to this trend of improving conditions is observed at RI-MW-4, where dissolved arsenic concentrations were greater during both events than some past data. However, the estimated concentrations seaward of this monitoring well were within the historical range and below the cleanup level during one sampling event.

The CRF provides a conservative estimate of the groundwater concentration at the point of discharge to surface water, and previous surface water quality monitoring has documented that surface water concentrations of arsenic at the point of groundwater discharge to surface water are well below the Site groundwater cleanup level. Based on these considerations and data presented in this report, we recommend that future monitoring continue to be conducted on a 5-year schedule per the periodic review of the final cleanup action conducted by Ecology as outlined in the Consent Decree.

Use of This Report

This Technical Memorandum has been prepared for the exclusive use of the Port of Everett for specific application to the North Marina West End Site. No other party is entitled to rely on the information, conclusions, and recommendations included in this document without the express written consent of LAI. Further, the reuse of information, conclusions, and recommendations provided herein for extensions of the project or for any other project, without review and authorization by LAI, shall be at the user's sole risk. LAI warrants that within the limitations of scope, schedule, and budget, our services have been provided in a manner consistent with that level of care and skill ordinarily exercised by members of the profession currently practicing in the same locality under similar conditions as this project. We make no other warranty, either express or implied.

This document has been prepared under the supervision and direction of the following key staff.

LANDAU ASSOCIATES, INC.



Dylan Frazer, LG
Associate



Jeremy Davis
Senior Associate

JMD/DHF/ljl

[P:\147\029\610\R\5-YR REVIEW REPORT\PORT OF EVERETT N MARINA WEST END SITE 5 YR REVIEW_FINAL 073020.DOCX]

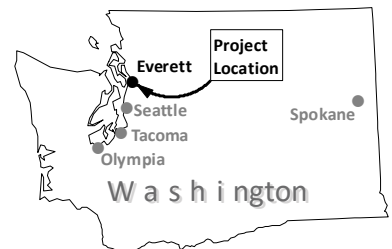
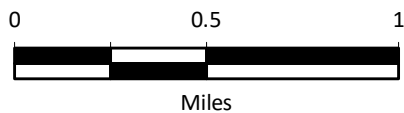
Attachments:

- Figure 1 Vicinity Map
- Figure 2 Groundwater Monitoring Locations
- Table 1 West End Analytical Table

References

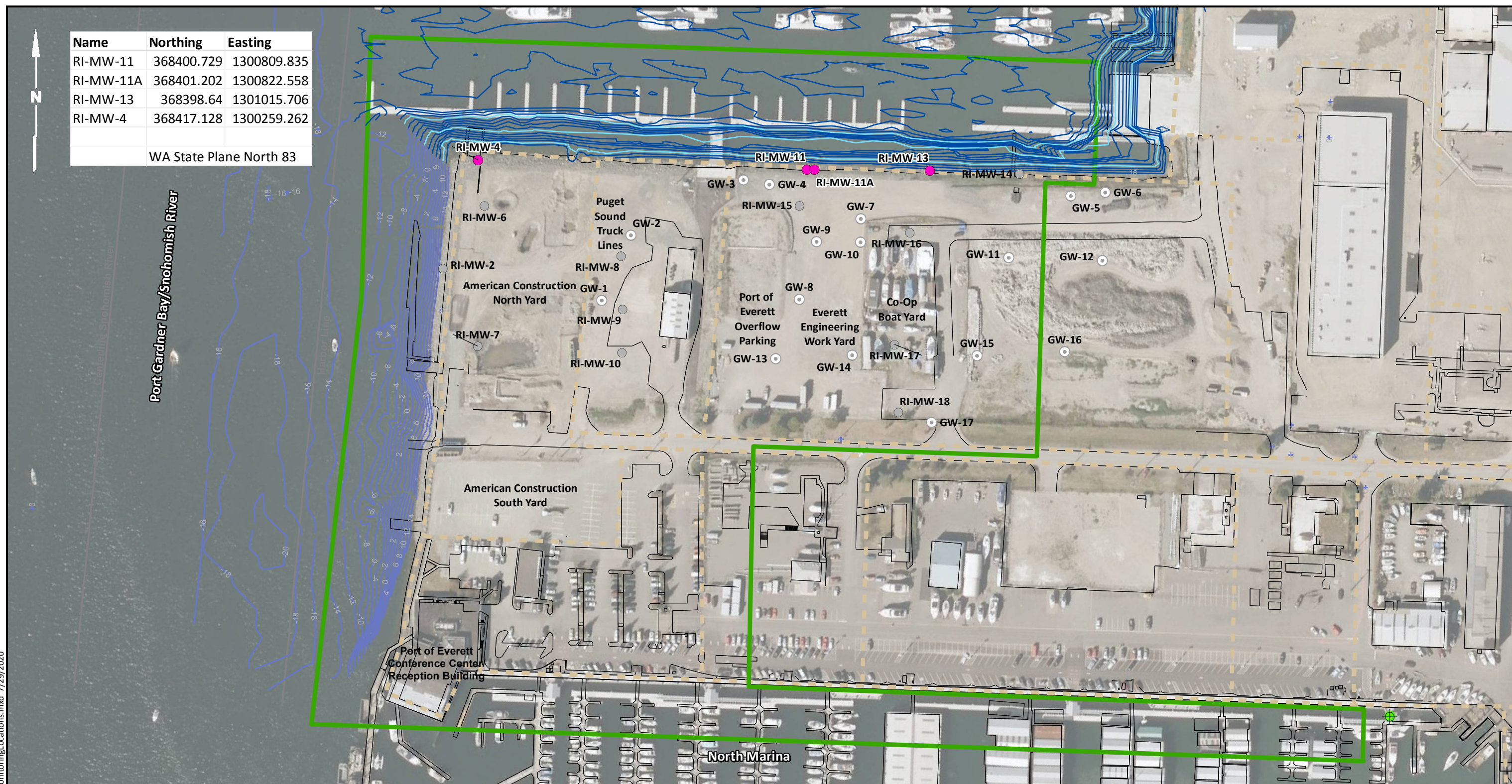
- Ecology. 2011. Cleanup Action Plan, North Marina West End Site, Everett, Washington. Washington State Department of Ecology, Toxics Cleanup Program, Olympia, Washington. August 16.
- Frazer, D. 2019. "Re: Port of Everett North Marina West End-Final 5-Year Review GMP." From Dylan Frazer, Landau Associates, Inc., to Andrew Kallus, Washington State Department of Ecology. April 12.
- LAI. 2009. Final RI/FS Work Plan, West End Site, Everett, Washington. Landau Associates, Inc. March 20.
- LAI. 2010. Technical Memorandum: RI/FS Work Plan West End Site Addendum No. 1, Groundwater Quality Monitoring at Conditional Point of Compliance, Port of Everett, Washington. Landau Associates, Inc. March 8.
- LAI. 2013. Report, 4Q12 Compliance Monitoring, North Marina West End Site, Everett, Washington. Landau Associates, Inc. December 6.
- LAI. 2019. Technical Memorandum: 5-Year Review Groundwater Monitoring Plan, North Marina West End Site, Everett, Washington. Landau Associates, Inc. February 12.

G:\Projects\147\029\600\601\F01 VicMap.mxd 10/18/2018



Data Source: Esri 2012

G:\Projects\147\029\610\F02 GWMonitoringLocations.mxd 7/29/2020



Name	Northing	Easting
RI-MW-11	368400.729	1300809.835
RI-MW-11A	368401.202	1300822.558
RI-MW-13	368398.64	1301015.706
RI-MW-4	368417.128	1300259.262
WA State Plane North 83		

Legend

● Groundwater Compliance Monitoring Sample Location

● Previous Groundwater Compliance Monitoring Location

○ Previous Direct-Push Groundwater Grab Sample Location

⊕ Everett Shipyard RI Sediment Location

— Post Dredge Minor Contour (2' Interval, MLLW)

— Post Dredge Major Contour (10' Interval, MLLW)

— West End Site Boundary

— Approximate Boundary of Leasehold

— Bathymetry (MLLW) Based on Data Collected in 2003 & 2004

— Harbor Line and River Center Line

Note

1. At locations where lube oil was analyzed, diesel and gasoline range petroleum hydrocarbons were also analyzed but were not detected.

Data Source: Google Earth (2008 Image); Elevation Contours, Harbor Line, and Centerline of Snohomish River: Port of Everett Hydrographic Survey of Tall Ship Moorage; Post Dredge Elevation Contours (2005, PND Engineers)

0 160 320

Scale in Feet

North Marina West End Site
Everett, Washington

Groundwater Monitoring Locations

Figure
2

Table 1
West End Analytical Table
Port of Everett
Everett, Washington

Sample Location	Task	Sample Type	Lab Sample ID	Date	Dissolved Metals (µg/L; EPA 200.8)		Field Parameters						
					Arsenic	Arsenic (reduction factor applied)	pH	Cond (µS/cm)	Turbidity (NTU)	DO mg/L	Temp (°C)	ORP (mv)	Fe2+ (mg/L)
Cleanup Levels				N/A	5	5	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Calculated Reduction Factor (d,e)	Remedial Investigation			4/1/2010	N/A	25.0	N/A	N/A	N/A	N/A	N/A	N/A	N/A
				5/14/2010	N/A	25.0	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Long-Term Compliance Monitoring			1/9/2012	N/A	3.8	N/A	N/A	N/A	N/A	N/A	N/A	N/A
				4/23/2012	N/A	3.5	N/A	N/A	N/A	N/A	N/A	N/A	N/A
				7/31/2012	N/A	4.4	N/A	N/A	N/A	N/A	N/A	N/A	N/A
				10/19/2012	N/A	2.6	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	5-Yr GWM			4/25/2019	N/A	13.2	N/A	N/A	N/A	N/A	N/A	N/A	N/A
				9/26/2019	N/A	30.0	N/A	N/A	N/A	N/A	N/A	N/A	N/A
MW-1	RI Groundwater Samples	N	PC60E	6/12/2009	6	--	7.14	1,229	1.21	2.59	13.97	36.9	2.2
		FD	PC60G	6/12/2009	6	--	7.14	1,229	1.21	2.59	13.97	36.9	2.2
		N	PP11A	9/17/2009	6	--	6.64	11,142	3.52	6.50	16.67	-49.2	1.3
		FD	PP11S	9/17/2009	6	--	6.64	11,142	3.52	6.50	16.67	-49.2	1.3
		N	QR08D	4/1/2010	5	0.20 (a)	7.37	12,605	7.16	0.7	9.75	-33.8	--
	LTCM Groundwater Samples	N	UD98E	01/09/2012	5.3	1.4	6.81	5,548	29.59	0.88	8.56	-228.8	--
		FD	UD98K	01/09/2012	5.9	1.5	--	--	--	--	--	--	--
		N	UR56A	4/23/2012	3.9	1.1	6.29	1,308	10.3	0.37	11.89	-93.9	--
		FD	UR56I	4/23/2012	3.9	1.1	--	--	--	--	--	--	--
		N	PC60F	6/12/2009	1	--	8.51	1,465	2.11	2.2	12.0	-284.7	0.8
		N	PP11B	9/17/2009	0.5 U	--	7.16	2,609	4.46	0.78	15.59	-300.4	0.0
		N	VE42A	7/31/2012	14	3.2	6.98	4,348	low (b)	0.48	17.3	--	--
		FD	VE42I	7/31/2012	--	--	6.98	4,348	low (b)	0.48	17.3	--	--
		N	VO41A	10/19/2012	13	5.0	6.92	6,149	low (b)	1.03	15.7	-134.2	--

Table 1
West End Analytical Table
Port of Everett
Everett, Washington

Sample Location	Task	Sample Type	Lab Sample ID	Date	Dissolved Metals (µg/L; EPA 200.8)		Field Parameters						
					Arsenic	Arsenic (reduction factor applied)	pH	Cond (µS/cm)	Turbidity (NTU)	DO mg/L	Temp (°C)	ORP (mv)	Fe2+ (mg/L)
Cleanup Levels				N/A	5	5	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Calculated Reduction Factor (d,e)	Remedial Investigation			4/1/2010	N/A	25.0	N/A	N/A	N/A	N/A	N/A	N/A	N/A
				5/14/2010	N/A	25.0	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Long-Term Compliance Monitoring			1/9/2012	N/A	3.8	N/A	N/A	N/A	N/A	N/A	N/A	N/A
				4/23/2012	N/A	3.5	N/A	N/A	N/A	N/A	N/A	N/A	N/A
				7/31/2012	N/A	4.4	N/A	N/A	N/A	N/A	N/A	N/A	N/A
				10/19/2012	N/A	2.6	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	5-Yr GWM			4/25/2019	N/A	13.2	N/A	N/A	N/A	N/A	N/A	N/A	N/A
				9/26/2019	N/A	30.0	N/A	N/A	N/A	N/A	N/A	N/A	N/A
MW-3	RI Groundwater Samples	N	PD51A	6/16/2009	0.9	--	9.55	2,113	5.58	2.43	11.48	-288.3	1.0
		N	PP11C	9/18/2009	2	--	7.10	-300	4.12	8.24	15.45	-300.2	0.8
		N	QR08E	4/1/2010	--	--	8.32	14,254	--	0.39	10.27	-223.2	--
	LTCM Groundwater Samples	N	UD98F	01/09/2012	6	1.6	7.22	14,173	6.60	6.42	9.74	-208.0	--
		N	UR56B	4/23/2012	5 U	--	6.99	11,386	8.75	0.61	11.60	-285.7	--
		N	VE42B	7/31/2012	5 U	--	6.96	13,625	low (b)	0.37	14.4	--	--
		N	VO41B	10/19/2012	5	1.9	6.84	19,204	low (b)	0.56	15.2	-155.9	--
		FD	VO41I	10/19/2012	--	--	--	--	--	--	--	--	--
MW-4	RI Groundwater Samples	N	PD51B	6/17/2009	7.3	--	7.80	225	12.75	2.82	12.32	-45.2	2.0
		N	PP11D	9/17/2009	22.4	--	6.30	1,082	66.92	1.31	15.69	-151.4	3.0
		N	QR08F	4/1/2010	8.6	0.34 (a)	7.80	1,540	417.2	0.32	9.81	-154.8	--
	LTCM Groundwater Samples	N	UD98G	01/09/2012	37.8	9.9	7.36	673	613	1.56	9.79	-191.0	--
		N	UR56C	4/23/2012	37.9	11.0	5.99	1,288	27.3	0.44	9.93	-181.2	--
		N	VE42C	7/31/2012	40.6	9.3	6.89	795	low (b)	0.11	14.7	--	--
		N	VO41C	10/19/2012	38.4	14.8	7.03	653	low (b)	0.64	15.4	-110.6	--
	5-Yr GWM	N	EV19040170-01	4/23/2019	84	6.4	6.83	2,667	low (b)	2.65	10.7	-45.8	--
		FD	EV19040170-02	4/23/2019	88	6.7	6.83	2,675	low (b)	2.63	10.7	-46.5	--
		N	EV19090205-05	9/26/2019	120	4.0	7.32	934	N/A	0.13	17.3	-59.7	--

Table 1
West End Analytical Table
Port of Everett
Everett, Washington

Sample Location	Task	Sample Type	Lab Sample ID	Date	Dissolved Metals (µg/L; EPA 200.8)		Field Parameters						
					Arsenic	Arsenic (reduction factor applied)	pH	Cond (µS/cm)	Turbidity (NTU)	DO mg/L	Temp (°C)	ORP (mv)	Fe2+ (mg/L)
Cleanup Levels				N/A	5	5	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Calculated Reduction Factor (d,e)	Remedial Investigation			4/1/2010	N/A	25.0	N/A	N/A	N/A	N/A	N/A	N/A	N/A
				5/14/2010	N/A	25.0	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Long-Term Compliance Monitoring			1/9/2012	N/A	3.8	N/A	N/A	N/A	N/A	N/A	N/A	N/A
				4/23/2012	N/A	3.5	N/A	N/A	N/A	N/A	N/A	N/A	N/A
				7/31/2012	N/A	4.4	N/A	N/A	N/A	N/A	N/A	N/A	N/A
				10/19/2012	N/A	2.6	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	5-Yr GWM			4/25/2019	N/A	13.2	N/A	N/A	N/A	N/A	N/A	N/A	N/A
				9/26/2019	N/A	30.0	N/A	N/A	N/A	N/A	N/A	N/A	N/A
MW-5	RI Groundwater Samples	N	PD51C	6/17/2009	5.2	--	8.13	142	6.35	2.26	13.21	-68.2	1.5
		N	PP11E	9/17/2009	2.8	--	7.60	844	1.61	6.44	16.32	-163.1	1.1
	LTCM Groundwater Samples	N	UD98H	01/09/2012	3.3	0.87	8.79	553	3.44	0.59	9.50	-112.0	--
		N	UR56D	4/23/2012	1.4	0.41	5.74	310	14.6	0.76	10.07	-91.1	--
		N	VE42D	7/31/2012	1.8	0.41	6.84	944	low (b)	0.12	17.2	--	--
		N	VO41D	10/19/2012	1.2	0.46	7.03	909	low (b)	0.54	15.1	-121.0	--
MW-11	RI Groundwater Samples	N	PD51I	6/18/2009	61.8	--	8.19	346	18.06	2.95	13.65	-90.8	2.2
		FD	PD51J	6/18/2009	58.7	--	8.19	346	18.06	2.95	13.65	-90.8	2.2
		N	PP11K	9/18/2009	51.2	--	6.68	1,980	70.77	3.55	17.73	-123.3	5.0
		FD	PP11U	9/18/2009	--	--	6.68	1,980	70.77	3.55	17.73	-123.3	5.0
		N	QR08I	4/1/2010	50.3	2.0 (a)	7.5	1,612	4.41	0.33	10.32	-123.3	--
		FD	QR08A	4/1/2010	49.8	2.0 (a)	--	--	--	--	--	--	--
		N	QW56C	5/14/2010	48	1.9 (a)	8.25	3,220	--	0.02	12.31	-142.8	--
		FD	QW56B	5/14/2010	51	2.0 (a)	--	--	--	--	--	--	--
	LTCM Groundwater Samples	N	UD98A	01/09/2012	33.2	8.7	7.82	1,554	9.19	0.45	10.72	-139.3	--
		N	UR56E	4/23/2012	31.6	9.1	6.57	1,632	50.3	0.31	11.37	-101.5	--
		N	VE42E	7/31/2012	45.5	10.4	6.89	1,338	low (b)	0.25	14.8	--	--
		N	VO41E	10/19/2012	37	14.3	6.61	1,078	low (b)	0.63	15.61	-122.1	--
	5-Yr GWM	N	EV19040170-03	4/25/2019	32	2.4	6.53	2,286	low (b)	1.74	11.1	-87.9	--
		N	EV19090205-02	9/26/2019	40	1.3	6.63	1,679	low (b)	4.14	16.9	-44.9	--

Table 1
West End Analytical Table
Port of Everett
Everett, Washington

Sample Location	Task	Sample Type	Lab Sample ID	Date	Dissolved Metals (µg/L; EPA 200.8)		Field Parameters						
					Arsenic	Arsenic (reduction factor applied)	pH	Cond (µS/cm)	Turbidity (NTU)	DO mg/L	Temp (°C)	ORP (mv)	Fe2+ (mg/L)
Cleanup Levels				N/A	5	5	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Calculated Reduction Factor (d,e)	Remedial Investigation			4/1/2010	N/A	25.0	N/A	N/A	N/A	N/A	N/A	N/A	N/A
				5/14/2010	N/A	25.0	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Long-Term Compliance Monitoring			1/9/2012	N/A	3.8	N/A	N/A	N/A	N/A	N/A	N/A	N/A
				4/23/2012	N/A	3.5	N/A	N/A	N/A	N/A	N/A	N/A	N/A
				7/31/2012	N/A	4.4	N/A	N/A	N/A	N/A	N/A	N/A	N/A
				10/19/2012	N/A	2.6	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	5-Yr GWM			4/25/2019	N/A	13.2	N/A	N/A	N/A	N/A	N/A	N/A	N/A
				9/26/2019	N/A	30.0	N/A	N/A	N/A	N/A	N/A	N/A	N/A
MW-11A	RI Groundwater Samples	N	QR07A	4/1/2010	6.1	1.2 (a)	7.13	3,614	--	0.97	11.34	-49.4	--
		N	QW56D	5/14/2010	9	1.8 (a)	7.39	2,593	--	0.25	12.25	-64	--
		N	QR07B	4/1/2010	5.5	1.1 (a)	7.06	3,155	--	7.06	10.46	-61.8	--
	LTCM Groundwater Samples	N	UD98B	01/09/2012	17.0	8.7	6.32	2,791	80.7	2.18	9.17	-139.4	--
		FD	UD98C	01/09/2012	--	--	--	--	--	--	--	--	--
		N	UR56F	4/23/2012	16.8	9.0	6.72	1,236	61.5	0.51	12.98	-96.8	--
		FD	UR56J	4/23/2012	17.0	9.1	--	--	--	--	--	--	--
		N	VE42F	7/31/2012	21.8	10.4	6.96	1,313	low (b)	0.25	16.9	--	--
		FD	VE42J	7/31/2012	21.2	10.2	6.96	1,313	low (b)	0.25	16.9	--	--
		N	VO41F	10/19/2012	18 J	11.2	6.38	13,576	low (b)	0.51	13.6	-47.0	--
		FD	VO41J	10/19/2012	23 J	14.3	--	--	--	--	--	--	--
		5-Yr GWM	N	EV19040170-04	4/25/2019	8.8	2.4	6.68	1,199	low (b)	4.07	10.8	0.3
	N		EV19090205-01	9/26/2019	7.3	1.3	6.57	1,321	high (b)	4.77	16.0	73.0	--
MW-12	RI Groundwater Samples	N	PD51K	6/18/2009	6	--	8.32	258	2.69	2.21	13.01	-78.1	1.8
		N	PP11L	9/18/2009	3.2	--	6.93	3,078	14.25	1.98	15.72	-113.4	7.0
		N	QR08H	4/1/2010	9.8	0.39 (a)	7.62	363	--	0.31	10.12	-107.8	--
	LTCM Groundwater Samples	N	UD98I	01/09/2012	6.1	1.6	8.35	1,316	8.89	0.50	9.95	-172.8	--
		N	UR56G	4/23/2012	8.2	2.4	6.64	357	5.51	0.48	10.94	-62.0	--
		N	VE42G	7/31/2012	7.7	1.8	7.07	559	low (b)	0.14	15.1	--	--
		N	VO41G	10/19/2012	2.7	1.04	7.00	662	low (b)	0.42	15.0	-93.2	--

Table 1
West End Analytical Table
Port of Everett
Everett, Washington

Sample Location	Task	Sample Type	Lab Sample ID	Date	Dissolved Metals (µg/L; EPA 200.8)		Field Parameters						
					Arsenic	Arsenic (reduction factor applied)	pH	Cond (µS/cm)	Turbidity (NTU)	DO mg/L	Temp (°C)	ORP (mv)	Fe2+ (mg/L)
Cleanup Levels				N/A	5	5	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Calculated Reduction Factor (d,e)	Remedial Investigation			4/1/2010	N/A	25.0	N/A	N/A	N/A	N/A	N/A	N/A	N/A
				5/14/2010	N/A	25.0	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Long-Term Compliance Monitoring			1/9/2012	N/A	3.8	N/A	N/A	N/A	N/A	N/A	N/A	N/A
				4/23/2012	N/A	3.5	N/A	N/A	N/A	N/A	N/A	N/A	N/A
				7/31/2012	N/A	4.4	N/A	N/A	N/A	N/A	N/A	N/A	N/A
				10/19/2012	N/A	2.6	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	5-Yr GWM			4/25/2019	N/A	13.2	N/A	N/A	N/A	N/A	N/A	N/A	N/A
				9/26/2019	N/A	30.0	N/A	N/A	N/A	N/A	N/A	N/A	N/A
MW-13	RI Groundwater Samples	N	PD51L	6/17/2009	41.9	--	7.86	331	4.67	3.09	13.40	-99.7	1.4
		N	PP11M	9/18/2009	36.7	--	6.45	2,520	16.86	1.26	17.69	-90.2	2.0
		N	QR08G	4/1/2010	23.2	0.93 (a)	7.56	786	--	0.55	10.3	-120.2	--
	LTCM Groundwater Samples	N	UD98J	01/09/2012	17.3	4.5	8.55	1,217	9.26	0.38	9.91	-208.8	--
		N	UR56H	4/23/2012	12.6	3.6	5.66	524	12.9	0.82	10.67	-7.64	--
		N	VE42H	7/31/2012	17.8	4.1	6.88	705	low (b)	0.56	15.0	--	--
		N	VO41H	10/19/2012	17	6.6	6.41	967	low (b)	0.31	15.6	-107.2	--
	5-Yr GWM	N	EV19040170-05	4/23/2019	4.3	0.3	6.74	629	low (b)	0.49	10.8	-50.5	--
		N	EV19090205-04	9/26/2019	9.9	0.33	6.53	6,853	low (b)	2.21	17.3	-33.5	--
		FD	EV19090205-03	9/26/2019	11	0.37	6.53	6,797	low (b)	2.21	17.3	-37.7	--

Notes:
Bold text indicates detected analyte.
Green shading indicates concentration exceeds cleanup level.
U = The analyte was analyzed for, but was not detected above the level of the reported sample quantitation limit.
J = Indicates the analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.
(a) A reduction factor of 25 was applied to the arsenic concentrations for MW-1, MW-4, MW-12, and MW-13 groundwater samples collected during the RI. A reduction factor of 5 was applied to the arsenic concentration for MW-11A groundwater samples collected during the RI.
(b) Based on visual observation.
(c) A reduction factor of 25 was applied to the vinyl chloride concentration for MW-11 groundwater samples collected during the RI. A reduction factor of 5 was applied to the vinyl chloride concentration for MW-11A groundwater samples collected during the RI.
(d) The calculated reduction factor was determined based on the methods presented in Section 2.3 of the main text. Note that for arsenic and vinyl chloride groundwater data collected in April and May 2010 as part of the RI a reduction factor of 25 was used [see notes (a) and (b) above].
(e) The calculated reduction factor listed is applied to all sample locations except for MW-11A. For this location, the calculated reduction factor is determined by dividing the reported concentration for MW-11 by the reported concentration for MW-11A.

Acronyms/Abbreviations:
°C = degrees Celsius
µg/L = micrograms per liter
µS/cm = micro Siemens per centimeter
-- = not analyzed
DO = dissolved oxygen
EPA = US Environmental Protection Agency
Fe2+ = ferrous iron

FD = field duplicate
ID = Identification
Lab = laboratory
LTCM = Long-Term Compliance Monitoring
mg/L = milligrams per liter
mv = millivolt
N = primary sample

N/A = Not Applicable
NTU = nephelometric turbidity unit
ORP = Oxidation Reduction Potential
RI = Remedial Investigation
SIM = Select Ion Monitoring
Temp = temperature
5-Yr GWM = Five Year Review Groundwater Monitoring