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Memorandum

To: Ms. Sunny Becker, Washington State Department of Ecology

Copies: Don Robbins, Port of Seattle

From: Adia Jumper, Mark Jusayan, and Megan King, Floyd|Snider

Date: August 17, 2020

Project No: Port of Seattle-Lora Lake Apartments

Re: **Evaluation of Arsenic in Groundwater at the Lora Lake Apartments Site**

This memorandum, prepared on behalf of the Port of Seattle (Port), summarizes the quarterly groundwater arsenic results and trends in groundwater at the Lora Lake Apartments Parcel (LL Apartments Parcel) of the Lora Lake Apartments Site (Site). Arsenic in groundwater, among other chemical constituents, was monitored following completion of the Site remedial action on the parcel in 2018. This memorandum also summarizes the potential sources of elevated arsenic concentrations and the Port's proposed actions to monitor groundwater.

SITE BACKGROUND

The Port and the Washington State Department of Ecology (Ecology) entered a Site Consent Decree (Decree) in September 2015 under the mutual objective of providing remedial action at the Site located at 15001 Des Moines Memorial Drive in Burien, Washington. The Decree required the Port to perform a final cleanup action at the Site as described in the Cleanup Action Plan (CAP), included as Exhibit B of the Decree (Ecology 2015). As described in the CAP, the remedial action at the LL Apartments Parcel of the Site included excavation of soils with a dioxin/furan toxic equivalent greater than 100 picograms per gram, construction of a temporary clean soil cap, and future implementation of a constructed engineered surface to contain remaining soils with elevated concentrations at the time of future site redevelopment. The excavation and temporary cap remedial actions at the LL Apartments Parcel were completed in 2018. Compliance monitoring of the remedial action is being implemented under the 2015 Compliance Monitoring Plan (Floyd|Snider 2015a).

In accordance with Washington Administrative Code 173-340-410, compliance monitoring of site groundwater is required to confirm that human health and the environment are adequately protected, the remedial action has achieved the cleanup standards, and the cleanup action remains protective after cleanup standards have been met. The Ecology-approved 2015 Compliance Monitoring Plan includes analysis of groundwater at the LL Apartments Parcel for arsenic, pentachlorophenol, and dioxins/furans and requires four consecutive events with concentrations

less than the established cleanup levels throughout the monitoring network (MW-C1, MW-C2, MW-C3, and MW-C4) prior to termination of sampling.

Sampling began in December 2019; by August 2020, cleanup goals were met and sampling of pentachlorophenol and dioxin/furans was discontinued throughout the entire monitoring network. Arsenic sampling continued due to failure to meet the requirement of four consecutive events with concentration less than the established cleanup levels throughout the monitoring network.

SUMMARY OF ARSENIC RESULTS IN GROUNDWATER

Arsenic concentrations in all samples collected from wells MW-C1, MW-C3, and MW-C4 were less than the Site cleanup level of 5 micrograms per liter (µg/L) during all six monitoring events. However, arsenic concentrations at MW-C2 exceeded arsenic cleanup levels during the spring sampling events in March 2019 and March 2020 and the June 2020 event, which appear to be associated with seasonal high groundwater table elevation. The arsenic concentration at MW-C2 was 14 µg/L in March 2019, 27 µg/L in March 2020, and 11 µg/L in June 2020. The arsenic concentrations at MW-C2 were between 1.9 and 3.7 µg/L during all other compliance monitoring events. Arsenic results from quarterly monitoring events are presented in Table 1.

POTENTIAL SOURCES OF ELEVATED ARSENIC

Arsenic is a naturally occurring metal in the earth's crust that can be found in soil and groundwater but can also come from human activities such as mining or smelting ores that contain arsenic. The natural background levels for arsenic in soil in Washington is 7 parts per million (Ecology 1994). Groundwater in Washington does not have an established natural background concentration for arsenic; however, concentrations greater than 10 mg/L have been found in many wells throughout the state (WSDOH 2007). In 2006, S.S. Papadopulos & Associates, Inc., conducted an arsenic study in the vicinity of the Seattle-Tacoma International Airport (STIA) to supplement evidence that indicates that local levels of arsenic in groundwater are not caused by the fill materials used to construct the STIA's Third Runway embankment (SSPA 2006). The study found that elevated arsenic is naturally occurring within the vicinity of STIA and fluctuates seasonally. This seasonal cycling of arsenic concentration was found locally, occurring in proximity to peat, and that strong reducing conditions can occur temporarily that allow for the release of arsenic from native soils into groundwater.

Prior to completion of the remedial action at the Site, extensive soil and groundwater sampling was conducted to delineate the nature and extent of contamination at the Site. Arsenic was not identified as a contaminant of concern (COC) in soil at the Site, because there were no detections of arsenic at concentrations greater than the Model Toxics Control Act Method A cleanup level (20 milligrams per kilogram) during remedial investigations (Floyd|Snider 2015b). Remedial investigations also included groundwater monitoring, and former monitoring well MW-01 was located in the vicinity of compliance well MW-C2. Historical groundwater monitoring at well MW-01 detected concentrations of arsenic ranging from 5.6 µg/L to 14.2 µg/L, with the highest concentration occurring during a spring monitoring event (Floyd|Snider 2015b). These data

indicate seasonal fluctuation of arsenic in groundwater may have been occurring prior to completion of the remedial action.

During the remedial action at the LL Apartments Parcel (adjacent to the STIA), the apartment buildings were demolished and contaminated soil throughout the Site exceeding cleanup levels for Site COCs (pentachlorophenol, carcinogenic polycyclic aromatic hydrocarbons, total petroleum hydrocarbons, and lead) and the remediation level for dioxins/furans was excavated. A total of 41,829 tons of contaminated soil was removed from the parcel. After the excavation was completed, imported fill and crushed concrete from the demolition of building foundations were used for backfilling. A minimum of 3 feet of crushed concrete was placed within the excavation a minimum of 3 feet above the highest historical groundwater table elevation reading, and no less than 2 feet below the final surface grade within Excavation Area 3 (Figure 1).

The dissolution of the cement contained in crushed concrete can affect the pH value of groundwater because of the alkaline components of cement. The pH value of groundwater is one of the most important factors in controlling arsenic mobility. Exceedances of arsenic at MW-C2 during the March 2019 and March 2020 occurred during the local seasonal high elevations for groundwater. Although the measured groundwater at MW-C2 during these sampling events is below the elevation of the crushed concrete backfill, the elevations are within approximately 3 feet. Furthermore, the capillary fringe between the vadose and the saturated zones during these seasonal high groundwater elevations is within approximately 2 feet of the crushed concrete. Alkalis from the crushed concrete have the potential to leach into groundwater and mobilize the arsenic within the native soils below. The relatively high frequency of precipitation in the spring months and higher than average rainfall totals in June 2020 likely led to infiltration of stormwater through the crushed concrete fill, providing another mechanism for leaching of the alkaline components into the native soils that may mobilize arsenic into groundwater. Field parameters, groundwater elevation, and arsenic concentration for MW-C2 are summarized in Table 2 and show the relationship between groundwater elevation and arsenic concentrations.

CONCLUSION AND NEXT STEPS

Seasonal exceedances of arsenic concentrations correlated with high pH and high groundwater is a pattern observed at MW-C2 that is unique to the location and not observed within the rest of the monitoring network. MW-C2 is the only monitoring well located within an area where crushed concrete was placed. MW-C3 located within the LL Apartments Parcel and downgradient of MW-C2 and MW-C4 located further downgradient in the eastern Des Moines Memorial Drive right-of-way did not contain elevated concentrations of arsenic during the spring seasonal events, confirming the elevated arsenic concentrations are isolated to MW-C2 and are not migrating off site.

Along with the implementation of the environmental covenants currently being drafted, which identify arsenic contamination in groundwater and include restrictions for groundwater extraction and use, ongoing monitoring of MW-C2 and the downgradient monitoring well MW-C3 for arsenic annually during the spring season is proposed to continue to document arsenic

conditions and confirm that the extent of groundwater impact is not migrating. Because compliance monitoring of the Lora Lake Parcel (LL Parcel) will be conducted annually in the spring, ongoing monitoring of MW-C2 and MW-C3 can be conducted in concert with compliance monitoring for the LL Parcel. Compliance monitoring for the Site will be evaluated after 5 years of monitoring (in 2025), in accordance with the Compliance Monitoring Plan (Floyd|Snider 2015a), and at that time, an evaluation can be conducted to determine if ongoing monitoring for arsenic in groundwater at the LL Apartments Parcel is warranted. Results of ongoing monitoring will be reported to Ecology in Annual Compliance Monitoring Reports submitted in the first quarter of each year, for the previous year.

The Port requests your concurrence that quarterly groundwater monitoring at the LL Apartments Parcel for arsenic can transition to arsenic in monitoring wells MW-C2 and MW-C3 only during the spring quarter, coordinated with annual monitoring for the LL Parcel, and reported to Ecology in annual Compliance Monitoring Reports for the Site. During the periodic (5-year) review of the Site, the necessity for ongoing monitoring at the LL Apartments Parcel will be evaluated by the Port and Ecology, based on results of this annual monitoring.

REFERENCES

Floyd|Snider. 2015a. *Port of Seattle Lora Lake Apartments Site Compliance Monitoring Plan.* September.

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Shen, R., K. G. Pennell, and E. M. Suuberg. 2013. "Influence of Soil Moisture on Soil Gas Vapor Concentration for Vapor Intrusion." *Environmental Engineering Science 30*(10): 628–637.

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Washington State Department of Ecology (Ecology). 1994. *Natural Background Soil Metals Concentrations in Washington State.* Toxics Cleanup Program. Publication No. 94-115. October.

_____. 2015. *Consent Decree RE: Lora Lake Apartments Site, Burien, Washington.* 9 September.

Washington State Department of Health (WSDOH). 2007. Arsenic Detections in Washington Public Water Supplies. 27 September.

LIST OF ATTACHMENTS

Table 1 Lora Lake Apartments Parcel Groundwater Monitoring Data

Table 2 Groundwater Results and Field Parameters for MW-C2

Figure 1 Monitoring Wells and Excavation Area 3

Tables

Table 1
Lora Lake Apartments Parcel Groundwater Monitoring Data

Location			Site	MW-C1									
Sample ID			Cleanup	MW-C1-121218	MW-C1-121218-D	MW-C1-031519	MW-C1-031519-D	MW-C1-062119	MW-C1-062119-D	MW-C1-092019	MW-C1-092019-D	MW-C1-121819	MW-C1-121819-D
Sample Date				12/12/2018	12/12/2018	03/15/2019	03/15/2019	06/21/2019	06/21/2019	09/20/2019	09/20/2019	12/18/2019	12/18/2019
Analyte	CAS No.	Units	Level										
Dissolved Metals by USEPA 200.8													
Arsenic	7440-38-2	µg/L	5	0.11 JQ	0.11 JQ	0.11 JQ	0.096 JQ	0.15	0.12	0.16 JQ	0.15 JQ	0.10 JQ	0.091 JQ
Phenols by USEPA 8041A													
Pentachlorophenol	87-86-5	µg/L	1	0.025 U	0.025 U	0.025 U	0.025 U	0.025	0.025	0.025 U	0.025 U		
Dioxins/Furans by USEPA 1613B													
2,3,7,8-TCDD (Dioxin)	1746-01-6	pg/L	--	0.520 U	0.290 U	2.68 U	1.65 U	1.01 U	0.860 U	2.11 U	1.53 U		
1,2,3,7,8-PeCDD	40321-76-4	pg/L	--	0.490 U	0.350 U	3.25 U	1.64 U	1.02 U	0.990 U	1.17 U	1.48 U		
1,2,3,4,7,8-HxCDD	39227-28-6	pg/L	--	0.470 U	0.330 U	3.02 U	1.71 U	0.850 U	0.920 U	1.28 U	1.83 U		
1,2,3,6,7,8-HxCDD	57653-85-7	pg/L	--	0.430 U	0.320 U	2.95 U	1.72 U	0.790 U	0.860 U	1.11 U	1.68 U		
1,2,3,7,8,9-HxCDD	19408-74-3	pg/L	--	0.470 U	0.340 U	3.11 U	1.79 U	0.850 U	0.920 U	1.22 U	1.80 U		
1,2,3,4,6,7,8-HpCDD	35822-46-9	pg/L	--	1.48 U	0.980 U	11.0 U	2.11 UJ	1.54 UJ	1.24 UJ	2.04 U	1.60 U		
OCDD	3268-87-9	pg/L	--	3.37 J	5.71 J	148 J	9.90 J	4.65 UJ	5.59 UJ	7.48 UJ	15.5 U		
2,3,7,8-TCDF	51207-31-9	pg/L	--	0.380 U	0.340 U	2.64 U	1.67 U	1.32 U	1.10 U	1.95 U	1.45 U		
1,2,3,7,8-PeCDF	57117-41-6	pg/L	--	0.450 U	0.310 U	3.47 U	1.71 U	1.89 UJ	1.50 U	1.16 U	1.42 U		
2,3,4,7,8-PeCDF	57117-31-4	pg/L	--	0.410 U	0.280 U	3.14 U	1.53 U	1.43 U	1.24 U	0.930 U	1.15 U		
1,2,3,4,7,8-HxCDF	70648-26-9	pg/L	--	0.260 U	0.240 U	1.80 U	1.01 U	0.470 UJ	0.430 U	0.980 U	1.34 U		
1,2,3,6,7,8-HxCDF	57117-44-9	pg/L	--	0.260 U	0.250 U	1.86 U	1.01 U	0.500 UJ	0.450 UJ	0.960 U	1.42 U		
1,2,3,7,8,9-HxCDF	72918-21-9	pg/L	--	0.280 U	0.650 U	2.10 U	1.11 U	0.530 UJ	0.460 U	1.04 U	1.45 U		
2,3,4,6,7,8-HxCDF	60851-34-5	pg/L	--	0.260 U	0.240 U	1.66 U	0.960 U	0.450 UJ	0.410 UJ	0.980 U	1.34 U		
1,2,3,4,6,7,8-HpCDF	67562-39-4	pg/L	--	0.270 U	0.290 U	1.74 U	1.20 U	0.420 UJ	0.580 UJ	1.02 U	0.720 U		
1,2,3,4,7,8,9-HpCDF	55673-89-7	pg/L	--	0.370 U	0.250 U	2.36 U	1.70 UJ	0.600 UJ	0.860 UJ	1.69 U	1.06 U		
OCDF	39001-02-0	pg/L	--	1.22 UJ	0.860 UJ	11.2 UJ	4.23 UJ	1.53 UJ	1.99 UJ	2.65 UJ	2.15 U		
Dioxin/furan TEQ	--	pg/L	6.7	0.726 J	0.512 J	4.57 J	2.48 J	1.56 UJ	1.43 UJ	2.30 UJ	2.30 U		

Notes:

Blank cells are intentional.

Results are rounded to 2 significant figures, except dioxin/furan results, which are rounded to 3 significant figures.

-- Not available.

BOLD/RED Analyte detected at a concentration greater than the site cleanup level.

Abbreviations:

CAS Chemical Abstracts Service
HpCDD Heptachlorodibenzo-p-dioxin
HpCDF Heptachlorodibenzofuran
HxCDD Hexachlorodibenzo-p-dioxin
HxCDF Hexachlorodibenzofuran
µg/L Micrograms per liter
OCDD Octachlorodibenzodioxin
OCDF Octachlorodibenzofuran
PeCDD Pentachlorodibenzo-p-dioxin
PeCDF Pentachlorodibenzofuran
pg/L Picograms per liter
TCDD Tetrachlorodibenzo-p-dioxin
TCDF Tetrachlorodibenzofuran
TEQ Toxic equivalent

Qualifiers:

J Analyte was detected; concentration is considered to be an estimate.
JQ Analyte was detected between the method detection limit and reporting limit; concentration is considered to be an estimate.
U Analyte was not detected at the given reporting limit.
UJ Analyte was not detected; concentration given is the reporting limit, which is considered to be an estimate.

Table 1
Lora Lake Apartments Parcel Groundwater Monitoring Data

			Location	MW-C1 (cont.)				MW-C2						
			Sample ID	MW-C1-033020	MW-C1-033020-D	MW-C1-061720	MW-C1-061720-D	MW-C2-121218	MW-C2-031519	MW-C2-062119	MW-C2-092019	MW-C2-121819	MW-C2-033020	MW-C2-061720
			Sample Date	03/30/2020	03/30/2020	06/17/2020	06/17/2020	12/12/2018	03/15/2019	06/21/2019	09/20/2019	12/18/2019	03/30/2020	06/17/2020
Analyte	CAS No.	Units	Site Cleanup Level											
Dissolved Metals by USEPA 200.8														
Arsenic	7440-38-2	µg/L	5	0.12 JQ	0.13 JQ	0.14 JQ	0.14 JQ	2.6	**14**	3.7	2.1	1.9	**27**	**11**
Phenols by USEPA 8041A														
Pentachlorophenol	87-86-5	µg/L	1					0.062	0.69	0.051	0.031			
Dioxin/Furans by USEPA 1613B														
2,3,7,8-TCDD (Dioxin)	1746-01-6	pg/L	--					0.370 U	2.41 U	1.94 U	1.94 U			
1,2,3,7,8-PeCDD	40321-76-4	pg/L	--					0.440 U	3.25 U	1.82 U	1.17 U			
1,2,3,4,7,8-HxCDD	39227-28-6	pg/L	--					0.530 U	3.69 U	1.20 U	1.50 U			
1,2,3,6,7,8-HxCDD	57653-85-7	pg/L	--					0.900 U	4.96 J	1.11 U	1.29 U			
1,2,3,7,8,9-HxCDD	19408-74-3	pg/L	--					0.550 U	3.65 U	1.19 U	1.42 U			
1,2,3,4,6,7,8-HpCDD	35822-46-9	pg/L	--					22.5	86.5	47.8	14.8			
OCDD	3268-87-9	pg/L	--					232 J	553	515 J	126 J			
2,3,7,8-TCDF	51207-31-9	pg/L	--					0.450 U	3.49 U	1.87 U	1.69 U			
1,2,3,7,8-PeCDF	57117-41-6	pg/L	--					0.670 U	2.62 U	1.67 U	1.42 U			
2,3,4,7,8-PeCDF	57117-31-4	pg/L	--					0.400 U	2.35 U	1.42 U	1.10 U			
1,2,3,4,7,8-HxCDF	70648-26-9	pg/L	--					0.550 J	1.87 U	1.26 U	1.11 U			
1,2,3,6,7,8-HxCDF	57117-44-9	pg/L	--					0.450 U	1.89 U	1.27 U	1.12 U			
1,2,3,7,8,9-HxCDF	72918-21-9	pg/L	--					0.330 U	2.08 U	1.31 U	1.25 U			
2,3,4,6,7,8-HxCDF	60851-34-5	pg/L	--					0.530 J	1.70 U	1.15 U	1.10 U			
1,2,3,4,6,7,8-HpCDF	67562-39-4	pg/L	--					4.71 J	13.8	12.0 U	3.60 U			
1,2,3,4,7,8,9-HpCDF	55673-89-7	pg/L	--					0.580 U	2.03 U	1.84 U	0.740 U			
OCDF	39001-02-0	pg/L	--					21.2 J	40.5	45.2 J	13.8 J			
Dioxin/furan TEQ	--	pg/L	6.7					1.09 J	5.83 J	3.35 J	2.48 J			

Notes:

Blank cells are intentional.

Results are rounded to 2 significant figures, except dioxin/furan results, which are rounded to 3 significant figures.

-- Not available.

BOLD/RED Analyte detected at a concentration greater than the site cleanup level.

Abbreviations:

CAS Chemical Abstracts Service
HpCDD Heptachlorodibenzo-p-dioxin
HpCDF Heptachlorodibenzofuran
HxCDD Hexachlorodibenzo-p-dioxin
HxCDF Hexachlorodibenzofuran
µg/L Micrograms per liter
OCDD Octachlorodibenzodioxin
OCDF Octachlorodibenzofuran
PeCDD Pentachlorodibenzo-p-dioxin
PeCDF Pentachlorodibenzofuran
pg/L Picograms per liter
TCDD Tetrachlorodibenzo-p-dioxin
TCDF Tetrachlorodibenzofuran
TEQ Toxic equivalent

Qualifiers:

J Analyte was detected; concentration is considered to be an estimate.
JQ Analyte was detected between the method detection limit and reporting limit; concentration is considered to be an estimate.
U Analyte was not detected at the given reporting limit.
UJ Analyte was not detected; concentration given is the reporting limit, which is considered to be an estimate.

Table 1
Lora Lake Apartments Parcel Groundwater Monitoring Data

			Location		MW-C3							MW-C4			
			Sample ID	Site	MW-C3-121218	MW-C3-031519	MW-C3-062119	MW-C3-092019	MW-C3-121819	MW-C3-033020	MW-C3-061720	MW-10-092019	MW-10-121819	MW-C4-033020	MW-C4-061720
			Sample Date	Cleanup	12/12/2018	03/15/2019	06/21/2019	09/20/2019	12/18/2019	03/30/2020	06/17/2020	09/20/2019	12/18/2019	03/30/2020	06/17/2020
Analyte	**CAS No.**	**Units**		**Level**											
Dissolved Metals by USEPA 200.8															
Arsenic	7440-38-2	µg/L		5	0.24	0.26	0.20	0.22	0.22	0.25	0.22	0.47	0.42	0.37	0.49
Phenols by USEPA 8041A															
Pentachlorophenol	87-86-5	µg/L		1	0.025 U	0.025 U	0.025	0.025 U				0.025 U			
Dioxin/Furans by USEPA 1613B															
2,3,7,8-TCDD (Dioxin)	1746-01-6	pg/L		--	0.350 U	0.650 U	2.01 U	1.71 U				1.73 U			
1,2,3,7,8-PeCDD	40321-76-4	pg/L		--	0.330 U	0.670 U	1.14 U	1.34 U				0.980 U			
1,2,3,4,7,8-HxCDD	39227-28-6	pg/L		--	0.390 U	0.770 U	1.02 U	1.55 UJ				0.960 U			
1,2,3,6,7,8-HxCDD	57653-85-7	pg/L		--	0.380 U	0.730 U	0.940 U	1.39 U				0.870 U			
1,2,3,7,8,9-HxCDD	19408-74-3	pg/L		--	0.400 U	0.780 U	1.01 U	1.50 U				0.930 U			
1,2,3,4,6,7,8-HpCDD	35822-46-9	pg/L		--	0.520 U	1.03 U	1.45 U	1.60 U				1.45 U			
OCDD	3268-87-9	pg/L		--	3.23 J	9.11 J	4.34 J	4.98 UJ				10.7 U			
2,3,7,8-TCDF	51207-31-9	pg/L		--	0.310 U	0.710 U	1.49 U	1.92 U				1.82 U			
1,2,3,7,8-PeCDF	57117-41-6	pg/L		--	0.310 U	0.820 U	1.23 U	1.19 U				1.03 U			
2,3,4,7,8-PeCDF	57117-31-4	pg/L		--	0.290 U	0.750 U	1.00 U	0.960 U				0.850 U			
1,2,3,4,7,8-HxCDF	70648-26-9	pg/L		--	0.180 U	0.540 U	0.800 U	0.750 U				0.720 U			
1,2,3,6,7,8-HxCDF	57117-44-9	pg/L		--	0.180 U	0.510 U	0.830 U	0.720 U				0.700 U			
1,2,3,7,8,9-HxCDF	72918-21-9	pg/L		--	0.520 U	0.540 U	0.870 U	0.830 U				0.750 U			
2,3,4,6,7,8-HxCDF	60851-34-5	pg/L		--	0.180 U	0.500 U	0.760 U	0.740 U				0.700 U			
1,2,3,4,6,7,8-HpCDF	67562-39-4	pg/L		--	0.140 U	0.330 U	0.580 U	0.550 U				0.590 U			
1,2,3,4,7,8,9-HpCDF	55673-89-7	pg/L		--	0.180 U	0.440 U	0.750 UJ	0.810 U				0.860 U			
OCDF	39001-02-0	pg/L		--	0.690 UJ	1.02 U	2.82 UJ	2.76 UJ				2.80 U			
Dioxin/furan TEQ	--	pg/L		6.7	0.520 J	1.05 J	2.15 J	2.17 UJ				1.89 U			

Notes:

Blank cells are intentional.

Results are rounded to 2 significant figures, except dioxin/furan results, which are rounded to 3 significant figures.

-- Not available.

BOLD/RED Analyte detected at a concentration greater than the site cleanup level.

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HpCDD Heptachlorodibenzo-p-dioxin
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PeCDD Pentachlorodibenzo-p-dioxin
PeCDF Pentachlorodibenzofuran
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TEQ Toxic equivalent

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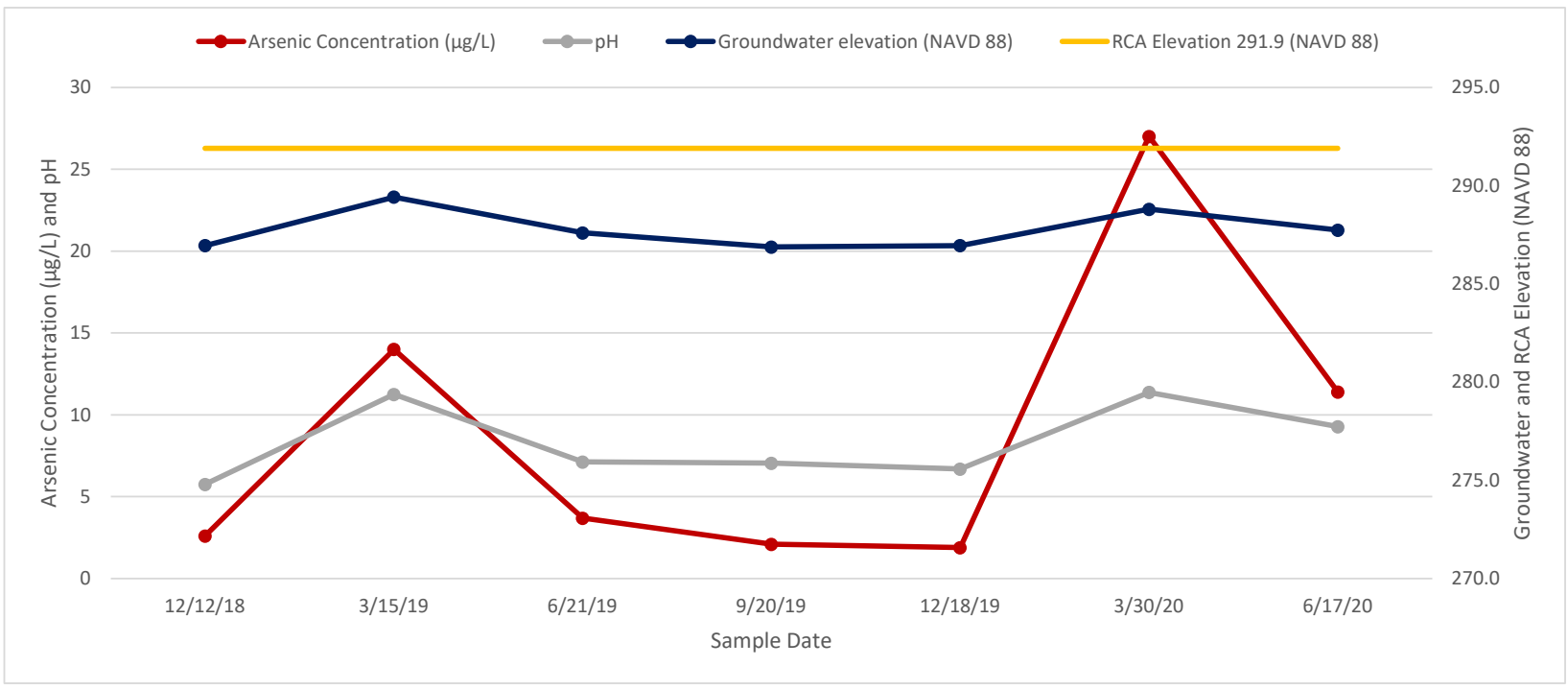
U Analyte was not detected at the given reporting limit.
UJ Analyte was not detected; concentration given is the reporting limit, which is considered to be an estimate.

Table 2
Groundwater Results and Field Parameters for MW-C2

Date	12/12/2018	03/15/2019	06/21/2019	09/20/2019	12/18/2019	03/30/2020	06/17/2020
Parameter							
Arsenic (µg/L)	2.6	**14**	3.7	2.1	1.9	**27**	**11**
Depth to water (feet BTOC)	17.4	14.9	16.7	17.4	17.4	15.5	16.6
Groundwater elevation (NAVD 88)	287.0	289.4	287.6	286.9	287.0	288.8	287.7
Distance from groundwater to RCA (feet)	4.9	2.5	4.3	5.0	4.9	3.1	4.2
Distance from max capillary fringe to RCA (feet) (1)	3.9	1.4	3.2	4.0	3.9	2.0	3.1
pH	5.8	11.3	7.1	7.1	6.7	11.4	9.3
Dissolved oxygen (mg/L)	0.00	0.57	0.24	0.32	1.76	0.37	0.35
Conductivity (mS/cm)	0.63	0.60	0.39	0.39	0.41	0.69	0.47
Turbidity (NTU)	0.0	14.2	3.0	5.3	1.8	2.3	3.1
ORP (mV)	41	26	-74	-96	21	-243	-105



Notes:

Arsenic results are rounded to 2 significant figures; field parameter results are rounded to 3 significant figures.

1 The capillary fringe is the zone directly above the water table where groundwater seeps up into pore spaces through capillary action. Capillary fringe range for sand (feet): 0.56–1.05 (Shen, Pennell, and Suuberg 2013).

RED/BOLD Indicates exceedance of the site cleanup level of 5 µg/L.

Abbreviations:

BTOC Below top of casing
µg/L Micrograms per liter
mg/L Milligrams per liter
mS/cm Microsiemens per centimeter
mV Millivolts
NAVD 88 North American Vertical Datum of 1988
NTU Nephelometric turbidity units
ORP Oxidation-reduction potential
RCA Recycled concrete aggregate

Figure

Legend

- Monitoring Well
- City Boundary
- Excavation Area 3
- Tax Parcel Boundary

Notes:
· Aerial imagery obtained from Nearmap, 2020.
· Inset basemap tiles by Stamen Design, under CC BY 3.0. Data by OpenStreetMap, under ODbL.

0 150 300 600
Scale in Feet

N

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Lora Lake Apartments Site
Port of Seattle

Figure 1
Monitoring Wells and
Excavation Area 3

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7/8/2020