MEMORANDUM

To: Mike Warfel

From: Margaret Kucharski

Date: October 27, 2020

Copies To: Omar Jepperson, Dave Becher, Ben Wilkinson, Ashley Selvey Farhner

Contract & Task Order: Y-11848, Task Order DA

File Code:

Subject: VCP NW 3242 – Response to Ecology Opinion Letter dated July 6, 2020, Montlake Gas Station Remedial Investigation (RI) Report dated March 2020. This response memorandum will be appended to the RI Report.

Thank you for your comments on the RI Report for the Montlake Gas Station. We appreciate your opinion and constructive comments. As discussed in our meeting attended by Washington State Department of Transportation (Margaret Kucharski, Dave Becher, Amanda Christopher), Shannon & Wilson (Meg Strong) and you on September 2, 2020, we are providing you our response on how we will address your comments.

Comment 1 – Diesel- and oil-range hydrocarbons in soil groundwater should be summed and then compared to the Model Toxics Control Act (MTCA).

Response – Comment noted. We will include an additional line in the tables for the summation when we report the cleanup activity results. As also noted during our meeting, we will compare the summed detection limits to confirm they are below the MTCA.

Comments 2 and 3 – Add additional chemicals of concern (COCs). Consider whether arsenic is an artifact of background.

Response – Diesel- or oil-range hydrocarbons and carcinogenic polycyclic aromatic hydrocarbons (cPAHs) will be included as COCs for the waste oil tank area and will be removed at the same time as the gasoline-range hydrocarbons. Confirmation samples in the area of the waste oil tank will include diesel- or oil-range hydrocarbons and cPAHs.

Response – Arsenic in groundwater will be added as a COC. However, the arsenic in groundwater above the MTCA is a function of background concentrations, except in the center of the gasoline station where elevated gasoline-range hydrocarbons are mobilizing the metal. Statistical analysis to demonstrate the background concentration of arsenic in groundwater in

the area of the Montlake Gas Station is provided as Attachment 1. The arsenic concentration in the gas station groundwater should decline after remediation.

Comment 4 – Selecting Model Remedy 2 at this point is premature.

Response – Noted. However, we needed to understand if a Model Remedy was permitted for the site to establish the path forward.

Comment 5 – Expand the selection of piezometers for inclusion on the groundwater gradient figure.

Response – The groundwater gradient figure is based on readings from one event. Many of the piezometers in the wider area have been decommissioned since then as part of the construction work and are not able to be measured. We have generated the attached Exhibit 7 (follows the same numbering as the RI Report) to demonstrate the groundwater gradient with the addition of the requested wells using data collected at a slightly earlier or later date than the data collected at the Montlake Gas Station monitoring wells. The revised gradient is reasonably similar to the gradient shown in Exhibit 7 of the RI Report and does show the preferential drainage toward the sewer line.

Comment 6 – The base of the cross sections and the excavation contour figure are different.

Response – The cross-section figures are conceptual, include offset borings, and were not intended to show more than the distribution of the contamination relative to the geology. The excavation lines were intended to roughly correlate with the excavation contours but not be precise.

Comment 7 – Please note that an interim action work plan will be prepared and sent to Ecology for review.

Response – A remedial action work plan (RAP) will be prepared and sent to Ecology with a request for an opinion letter. The RAP will include the proposed excavation work and the management and confirmation sampling approach for soil and groundwater during excavation and disposal.

Comment 8 – Add a new monitoring well closer to the property if a property "no further actions" is required.

Response – The addition of monitoring wells will depend on the effectiveness of soil and groundwater removal during remedial action. A decision on whether to add a new monitoring well will be undertaken after the completion of the remedial actions.

Currently, we are not requesting an Opinion on our response to your comments. We would welcome any feedback you may have once we submit the RAP for your review.

MJS:CL:JXS/jxs

Enc. Exhibit 7 – Groundwater Potentiometric Surface Map with Groundwater Elevation dated October 2020
Attachment 1 –Background Arsenic Evaluation for Montlake Gas Station

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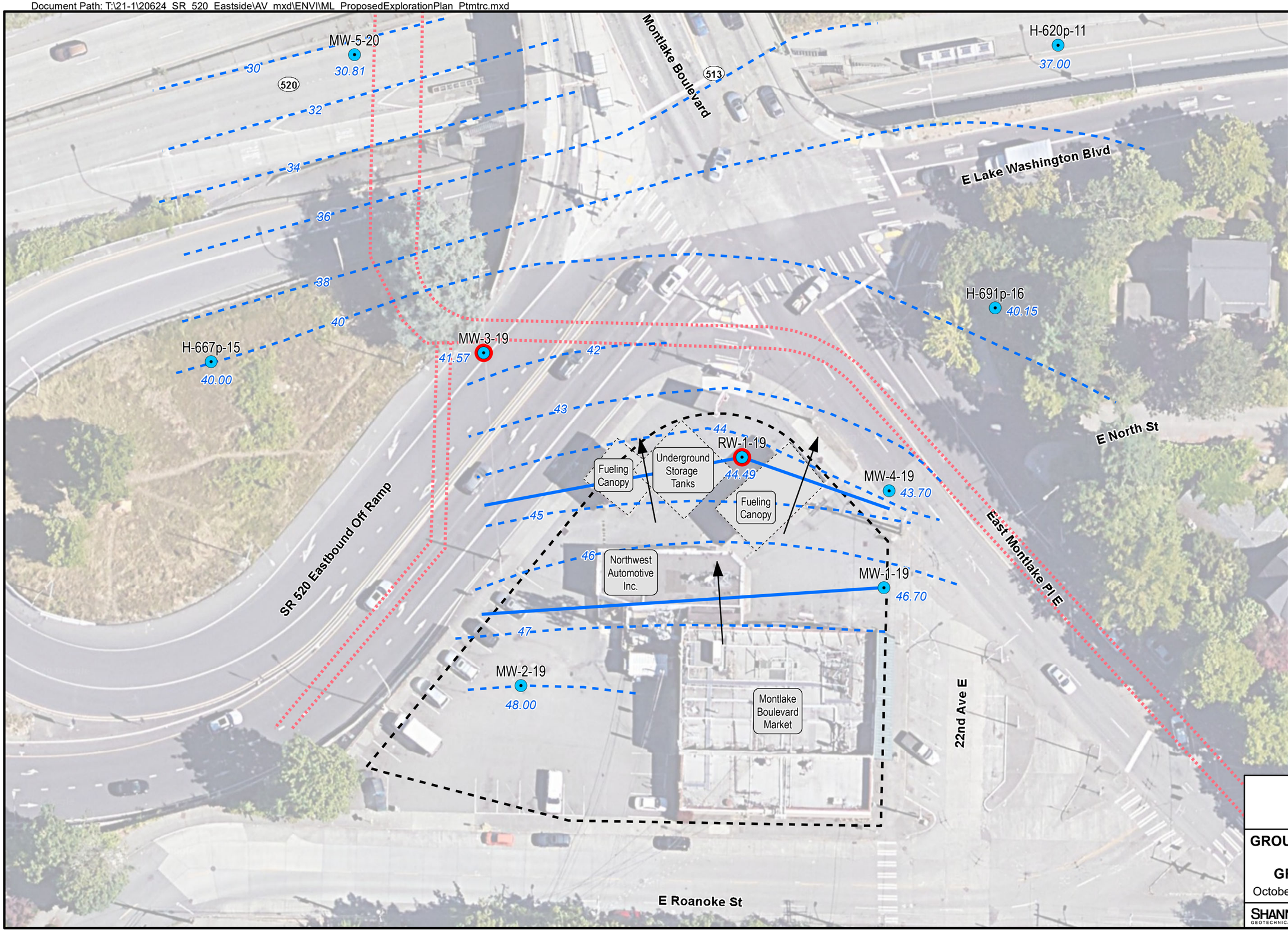

LEGEND

Groundwater Monitoring Well and Grounwater Elevation
43.7

Groundwater Monitoring Well MTCA TPH Level Exceedance

Approximate Equipotential
45

Equipotential Calculated Using Three Wells

Estimated Groundwater Flow Direction

Existing Utility - Sewer Line

King County Parcel Boundary
Public Right of Way Limit

NOTES:

1. Groundwater elevations at H-620p-11, H-667p-15, H-691p-16, and MW-5-20 recorded at variable times (not contemporaneous). All other groundwater elevations recorded October 2019.
2. Elevation in NAVD 88.

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Montlake Gas Station VCP
Remedial Investigation Report
2625 East Montlake Place East
Seattle, WA

GROUNDWATER POTENTIOMETRIC SURFACE MAP WITH GROUNDWATER ELEVATION

October 2020 21-1-22242-104

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GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

EXHIBIT 7

Washington State Department of Transportation

SR 520 Bridge Replacement and HOV Program

Background Arsenic Evaluation for Montlake Gas Station

SR 520 Bridge Replacement and HOV Program Seattle, Washington Technical Memorandum

Prepared for

Washington State Department of Transportation
SR 520 Bridge Replacement and HOV Program
999 3rd Avenue, Suite 2200
Seattle, WA 98104

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October 2020

Table of Contents

List of Exhibits

Acronyms and Abbreviations

µg/L	micrograms per liter
Ecology	Washington State Department of Ecology
EPA	Environmental Protection Agency
HOV	high-occupancy vehicle
MTCA	Model Toxics Control Act
RI	Remedial Investigation
Site	Montlake Gas Station
SR	State Route
WAC	Washington Administrative Code
WSDOT	Washington State Department of Transportation

Introduction and Purpose

Shannon & Wilson previously submitted to the Washington State Department of Ecology (Ecology) a Remedial Investigation (RI) Report for the Montlake Gas Station (Site) (Shannon & Wilson, 2020). The RI work was performed as a subtask to the Washington State Department of Transportation (WSDOT) State Route (SR) 520 Bridge Replacement and High-Occupancy Vehicle (HOV) Program. The RI concluded that:

"Arsenic and other metals detected in groundwater at the Site appear to be naturally occurring and not associated with contamination."

We also requested an opinion letter from Ecology, as part of the Voluntary Cleanup Program, following their review of the RI. Ecology provided the opinion letter (Ecology, 2020) and stated:

"Consider local and regional data for natural arsenic in groundwater, to evaluate background arsenic concentrations versus arsenic that has likely been mobilized by geochemical conditions created by degradation of petroleum constituents."

This technical memorandum evaluates local background concentrations of arsenic in groundwater using statistical methods outlined in Ecology's Model Toxics Control Act (MTCA) Washington Administrative Code (WAC) 173-340-709. Local concentrations of arsenic in shallow groundwater were evaluated using arsenic data from groundwater samples collected and analyzed from monitoring wells in the vicinity of the Site. Many of these monitoring wells were installed and sampled for geotechnical and environmental assessment as part of WSDOT's SR 520 Bridge Replacement and HOV Program. Exhibit 1 shows the location of the monitoring wells used for this evaluation in relation to the Site. Exhibit 1 also shows the location of seven monitoring wells not used in this evaluation due to known soil or groundwater contamination of either petroleum hydrocarbons or metals.

Most monitoring wells utilized in this evaluation had non-detectable concentrations of petroleum hydrocarbon constituents in groundwater. Two wells (H-667p-11 and MW-4-19) utilized in the evaluation had low concentrations (170 micrograms per liter [µg/L] and 210 µg/L, respectively) of petroleum hydrocarbons. One well (H-663p-15) had only total arsenic analytical data available. Exhibit 2 summarizes the total and dissolved concentrations of arsenic in groundwater samples collected from the monitoring wells.

Methods

For the purpose of defining background concentrations, we selected wells within the vicinity of the Site. We reviewed the geologic soil types that the utilized monitoring wells were screened in and determined whether or not they represent the shallow groundwater (first encountered groundwater with depth) typical of the Site. Typical of the Site, the geologic soil units in the monitoring wells included silts (silt, silt with sand, and sandy silt) and sands (silty sand and well-sorted sand).

We used the statistical methods outlined in MTCA WAC 173-340-709(3)(4)(5) to determine the natural background concentrations of total and dissolved arsenic in groundwater. We assumed that total and dissolved arsenic datasets were log-normally distributed per WAC 173-340-709(3)(c). In total, we analyzed total arsenic data from 25 monitoring wells and dissolved arsenic data from 24 monitoring wells. The sample collection dates for the data ranged from 2015 to 2019. The summary statistics for the total and dissolved arsenic concentrations are included as Exhibit 2. (Note: We calculate the variance and standard deviation as unbiased estimates rather than actual values for the datasets). There was a total of four non-detect (e.g., concentrations lower than method detection limit) total arsenic samples and seven non-detect dissolved arsenic samples. Per the MTCA guidance, we assigned non-detect values to be equal to one-half of the method detection limit (refer to Ecology values, Exhibit 2).

For the assumed log-normally distributed total and dissolved arsenic dataset, we computed the true upper 90th percentile as well as the true 50th percentile (to later be multiplied by four). We took this approach because the lower of the two is recommended in the MTCA guidance to be the background concentration.

TABLE 1

Chemical	True 50th Percentile	True Upper 90th Percentile
ln (Total Arsenic)	1.95	3.14
ln (Dissolved Arsenic)	1.69	2.75

The total and dissolved arsenic data have been plotted, along with the assumed log-normal distribution for each dataset using the mean and standard deviation, and are included as Exhibits 3 and 4, respectively. Percentiles were computed using the Python Programming Language SciPy Library (SciPy Community, 2020). The percentiles were also checked using the United States Environmental Protection Agency's (EPA) ProUCL statistical tool kit (EPA, 2016).

Since the total and dissolved arsenic datasets were logarithmically transformed, converting back to µg/L can be done by placing the percentiles within the exponent of the natural logarithm base, *e* (2.718281828):

$$True\ 90th\ Percentile\ =\ e^{2.75} = 15.6\ \mu g/L$$

Transforming the above values in Table 1 back into µg/L (rounded to one decimal place) using *e* as demonstrated in the above equation yields:

TABLE 2

Chemical	True 50th Percentile	True Upper 90th Percentile	True 50th Percentile X 4
Total Arsenic	7.0 µg/L	23.1 µg/L	28.0 µg/L
Dissolved Arsenic	5.4 µg/L	15.6 µg/L	21.6 µg/L

Ecology guidance (WAC 173-340-709(c)) states the natural background shall be defined as the true upper 90th percentile or four times the true 50th percentile, whichever is lower. Following that guidance, this would indicate the following natural background concentrations for total and dissolved arsenic in groundwater for the Site:

- Natural Background Total Arsenic in Groundwater = 23.1 µg/L
- Natural Background Dissolved Arsenic in Groundwater = 15.6 µg/L

Discussion and Recommendation

Maximum concentrations of total and dissolved arsenic detected during the Montlake Gas Station RI were 100 µg/L and 88 µg/L, respectively, and both were detected at remediation well RW-1-19. Because these concentrations are elevated well beyond the computed natural background for both total and dissolved arsenic in groundwater, we concur with Ecology that in the vicinity of RW-1-19, arsenic is likely being "mobilized by geochemical conditions created by degradation of petroleum constituents."

RW-1-19 was installed as a remediation well for product removal if product were to enter the well. The well is centrally located with the petroleum hydrocarbon contamination at the Site. No other monitoring wells installed had measured concentrations of total or dissolved arsenic above the computed natural background concentrations in groundwater (Exhibit 5).

As such, we recommend that arsenic be added as a site chemical of concern for groundwater. To be conservative, we recommend that the computed natural background concentrations for arsenic in groundwater be slightly lowered to set the Site cleanup standard. For total arsenic, we recommend that the computed natural background of 23.1 µg/L be lowered for the cleanup standard down to 20 µg/L. For the dissolved arsenic, we recommend that the computed natural background of 15.6 µg/L be lowered for the cleanup standard down to 10.0 µg/L.

References

Shannon & Wilson, 2020, Remedial Investigation Report for Montlake Gas Station, SR 520 Bridge Replacement and HOV Program, Seattle, Washington, March.

The SciPy Community, 2020, SciPy 1.5.2 (https://scipy.org), July.

United States Environmental Protection Agency (EPA), 2016, Statistical Software ProUCL 5.1.00 for Environmental Applications for Data Sets with and without Nondetect Observations, June.

Washington State Department of Ecology (Ecology), 2020, Opinion Pursuant to WAC 173-340-515(5) on Remedial Action for the following Hazardous Waste Site: Montlake Texaco, 2625 E Montlake, FID: 47724816, CSID: 14857, VCP Project No.: NW3242, July.

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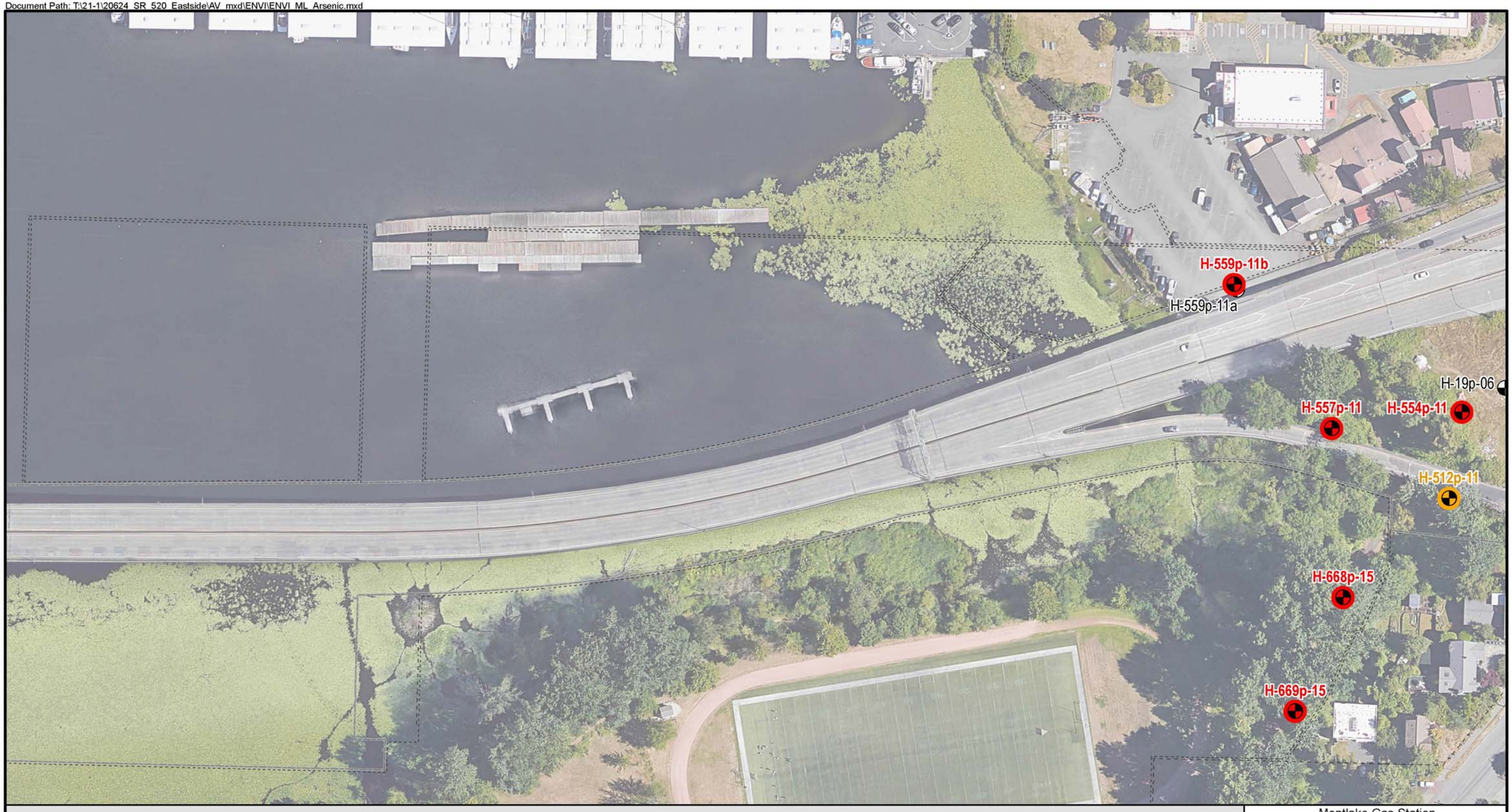

LEGEND

- Well with Total and Dissolved Arsenic Data
- Well with Total Arsenic Data Only
- Well with Total and Dissolved Arsenic Data not used for background evaluation due to known soil/groundwater contamination associated with well
- Monitoring Well
- WSDOT ROW
- Property Line

N W E S

0 100 Feet

Decommissioning performed by WSDOT or West Approach Bridge – North Contractor. Wells or VWPs indicated in this map as decommissioned have Washington State Department of Ecology decommissioning reports available online at the time of the report or have been confirmed by WSDOT.

Montlake Gas Station
VCP Remedial Investigation Report
2625 East Montlake Place East, Seattle, WA

BACKGROUND ARSENIC CONCENTRATION IN GROUNDWATER

October 2020 21-1-22242-104

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EXHIBIT 1
Sheet 1 of 3

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H-643p-13
H-638p-13
H-587p-11
H-640p-13
H-657p-13
H-605p-11
H-692p-16
H-655p-13
H-663p-15
H-591p-11
H-666p-15
H-665p-15
H-603p-11
H-441p-09
H-612p-11
MW-5-20
H-620p-11
H-596p-11
H-660p-13
H-691p-16
H-667p-15
MW-3-19
RW-1-19
MW-4-19
H-19p-06
H-554p-11
MW-1-19
SG-1-19
H-609p-11
MW-2-19
SG-2-19

LEGEND

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- WSDOT ROW
- Property Line

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BACKGROUND ARSENIC CONCENTRATION IN GROUNDWATER

October 2020 21-1-22242-104

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EXHIBIT 1
Sheet 2 of 3

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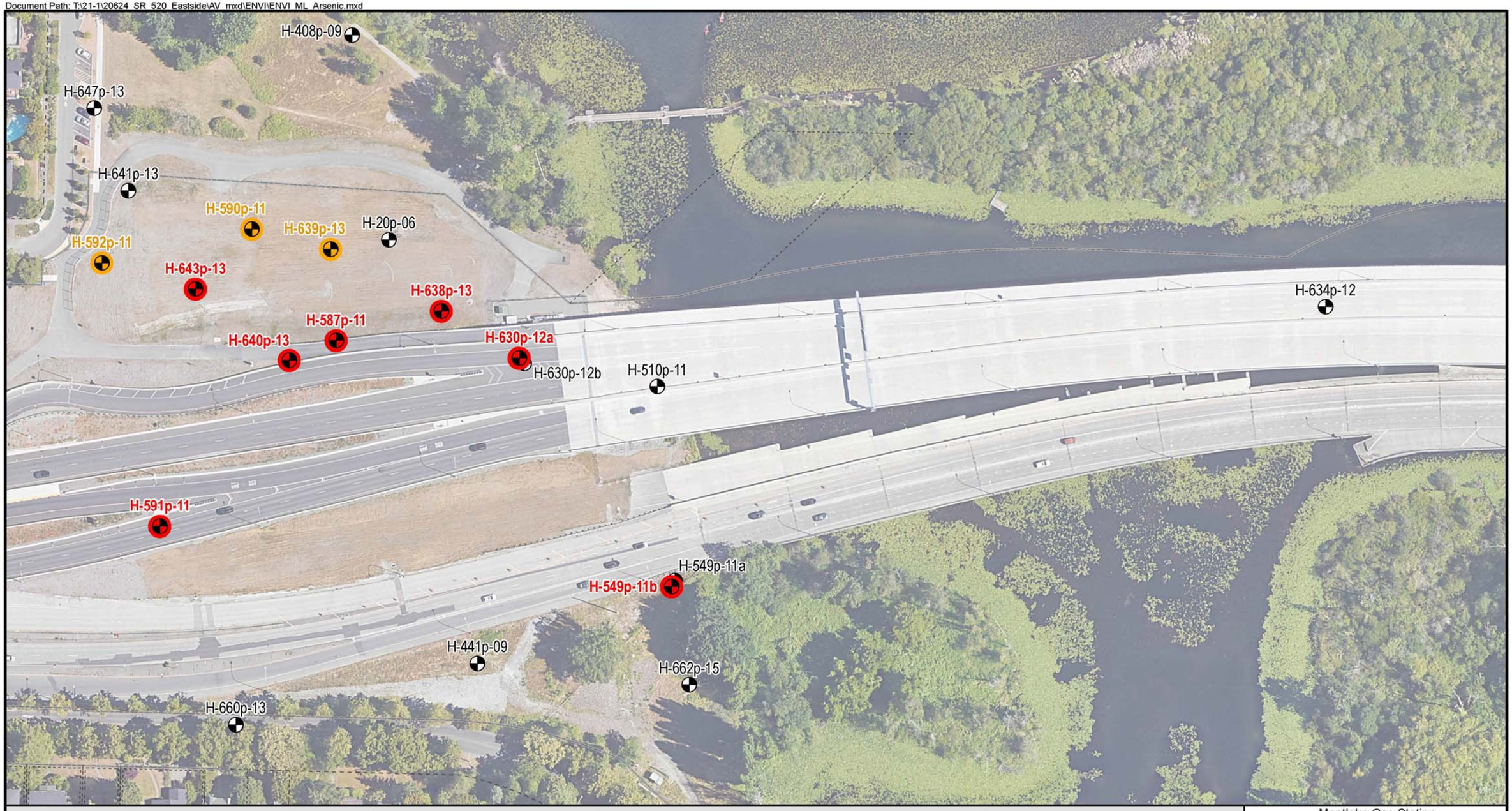

LEGEND

- Well with Total and Dissolved Arsenic Data
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BACKGROUND ARSENIC CONCENTRATION IN GROUNDWATER

October 2020 21-1-22242-104

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EXHIBIT 1
Sheet 3 of 3

Monitoring Well	Total As (µg/L)	Flag (U or J)	Ecology Values (ND = 1/2*MDL) (µg/L)	Log Transformed Value E22	Dissolved As (µg/L)	Flag (U or J)	Ecology Values (ND = 1/2*MDL) (µg/L)	Log Transformed Value [ln(µg/L)]	Petroleum?	Date Sampled (YY-Mon.)
H-549p-11b	17		17	2.83	17		17	2.83	N	11-Apr
H-554p-11	3.3	U	1.7	0.53	3	U	1.5	0.41	N	11-Apr
H-557p-11	8.3		8.3	2.12	6.6		6.6	1.89	N	11-Jun
H-559p-11b	12		12	2.48	3.3		3.3	1.19	N	11-Jun
H-587p-11	3.3	U	1.7	0.53	3	U	1.5	0.41	N	11-Jun
H-591p-11	3.5		3.5	1.25	3	U	1.5	0.41	N	11-May
H-596p-11	17		17	2.83	7.3		7.3	1.99	N	11-Jun
H-603p-11	9.9		9.9	2.29	9.3		9.3	2.23	N	11-May
H-605p-11	7		7	1.95	3	U	1.5	0.41	N	11-May
H-609p-11	24		24	3.18	23		23	3.14	N	11-Apr
H-620p-11	38		38	3.64	26		26	3.26	N	11-Jun
H-630p-12a	6.4		6.4	1.86	8		8	2.08	N	12-Mar
H-638p-13	9.4		9.4	2.24	5.4		5.4	1.69	N	13-Apr
H-640p-13	6.3		6.3	1.84	5.4		5.4	1.69	N	13-Apr
H-643p-13	38		38	3.64	13		13	2.56	N	13-Apr
H-655p-13	4.6		4.6	1.53	3	U	1.5	0.41	N	13-Sep
H-663p-15*	22		22	3.09	--	--	--	--	--	15-Feb
H-665p-15	13		13	2.56	11		11	2.40	N	15-Apr
H-666p-15	6.4		6.4	1.86	3.5		3.5	1.25	N	15-Apr
H-667p-15	5.8		5.8	1.76	3.4		3.4	1.22	GRO = 0.17	15-Feb
H-668p-15	6.6		6.6	1.89	6.8		6.8	1.92	N	15-Mar
H-669p-15	13		13	2.56	12		12	2.48	N	15-Mar
MW-1-19	3.3	U	1.7	0.53	3	U	1.5	0.41	N	19-Oct
MW-2-19	3.3	U	1.7	0.53	3	U	1.5	0.41	N	19-Oct
MW-4-19	5.9		5.9	1.77	5.1		5.1	1.63	GRO = 0.21	19-Oct

SUMMARY STATISTICS FOR NORMAL AND LOG TRANSFORMED DATA

	Mean	Logarithmic Mean	Standard Deviation	Logarithmic Standard Deviation	Variables	Logarithmic Variables
Dissolved	7.36	1.60	6.78	0.94	45.95	0.89
Total	11.24	2.05	10.07	0.91	101.44	0.83

Notes:

*indicates that only total arsenic data was sampled from the well

µg/L = micrograms per liter; Ecology = Washington State Department of Ecology; MDL = method detection limit; Mon. = Month; ND = Non-Detect; N = No; U = not detected above the laboratory method detection limit; J = an estimated value associated with laboratory quality assurance assessment; Y = Yes; YY = Year

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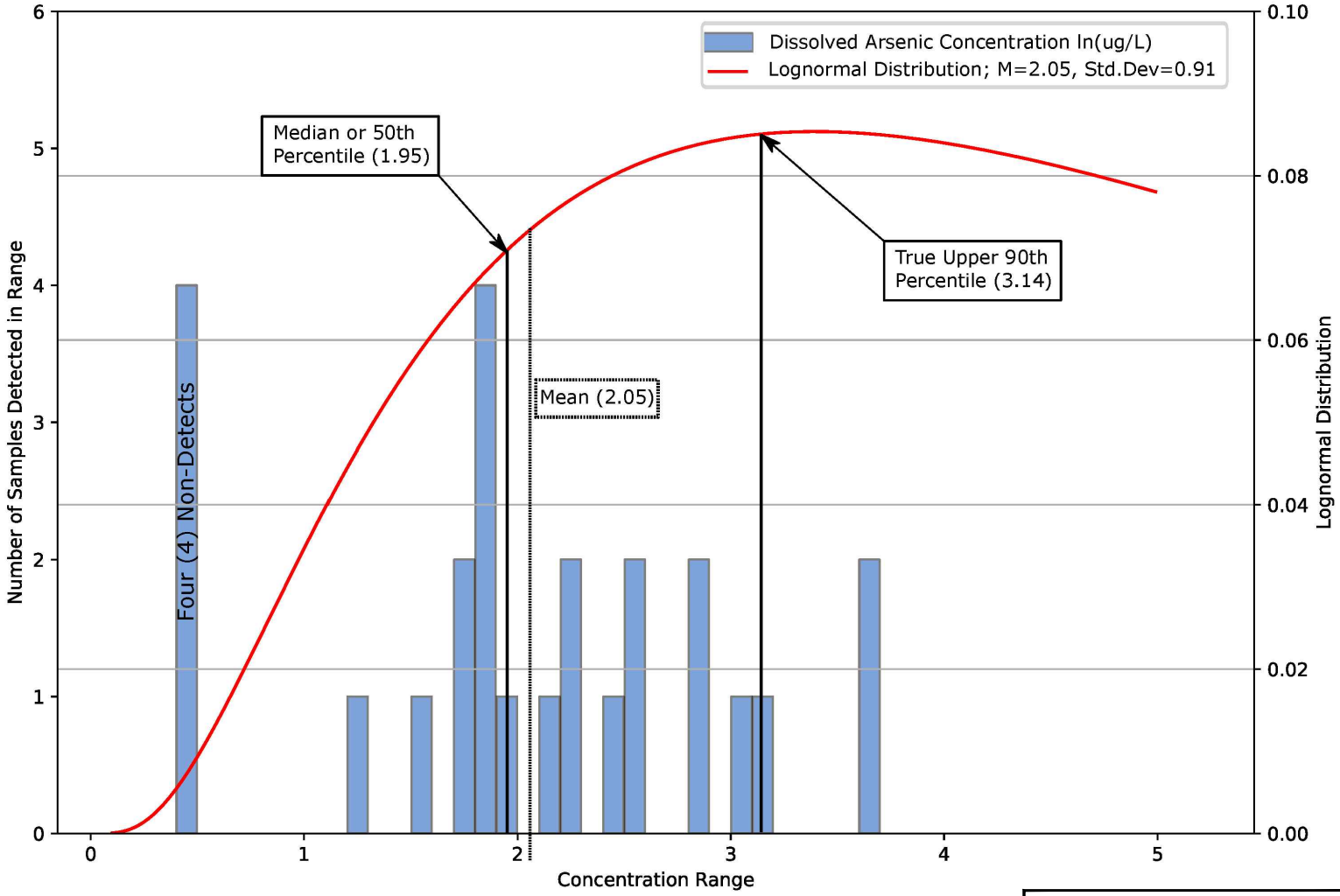

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SR 520 TOTAL ARSENIC BACKGROUND CONCENTRATIONS LOGNORMAL DISTRIBUTION

October 2020 21-1-22242-104

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EXHIBIT 3

EXHIBIT 3

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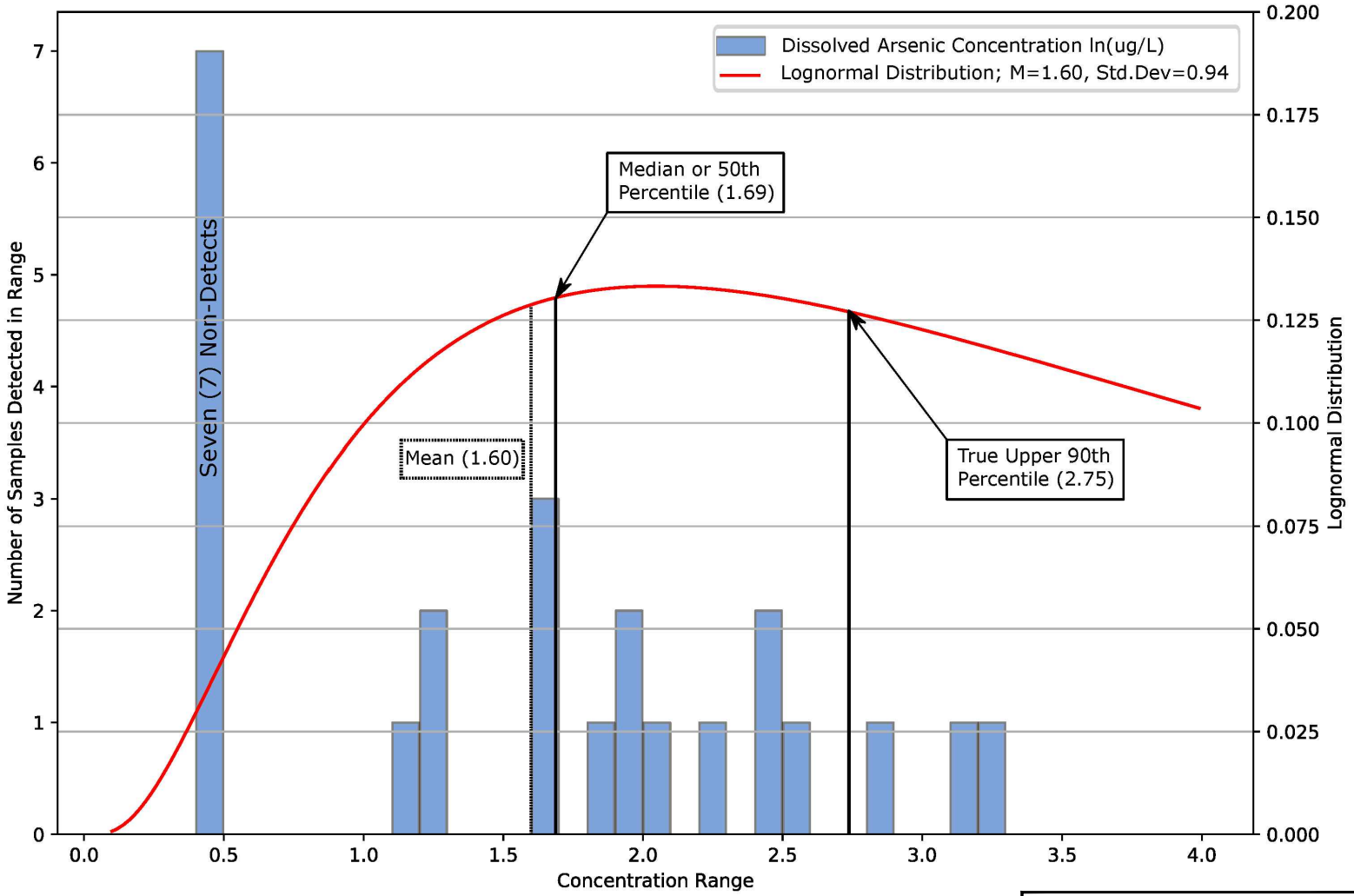

Montlake Gas Station
VCP Remedial Investigation Report
2625 East Montlake Place East, Seattle, WA

SR 520 DISSOLVED ARSENIC BACKGROUND CONCENTRATIONS LOGNORMAL DISTRIBUTION

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EXHIBIT 4

EXHIBIT 4

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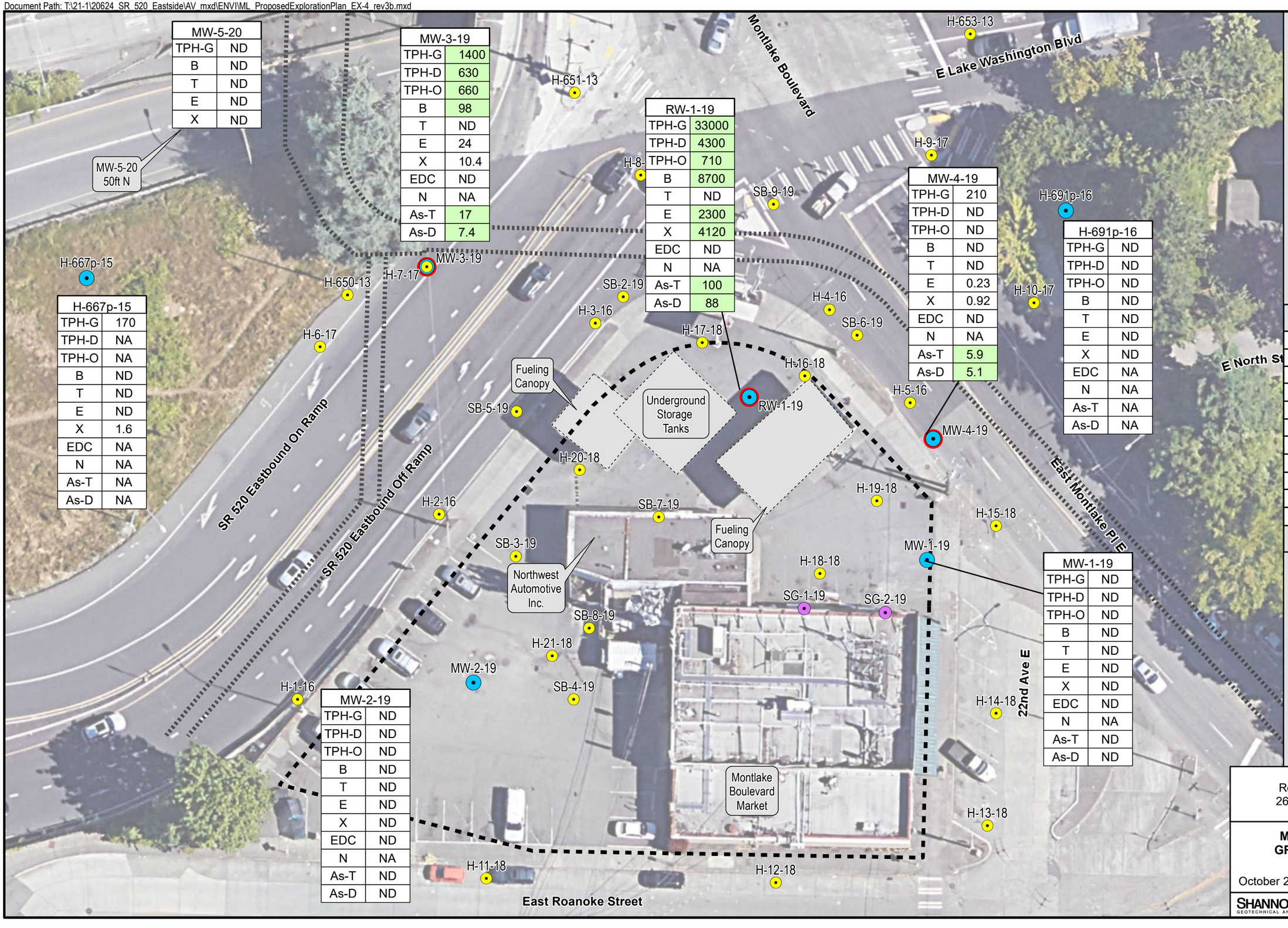

LEGEND

MTCA Level Exceedance

EXPLORATIONS

Soil Borings

Groundwater Monitoring Well

Soil Gas Probes

Existing Utility - Sewer Line

King County Parcel Boundary
Public Right of Way Limit

Constituent	MTCA Cleanup Level (mg/kg)
TPH-Gasoline (TPH-G)	800
TPH-Diesel (TPH-D)	500
TPH-Heavy Oil (TPH-O)	500
Benzene (B)	5
Toluene (T)	1000
Ethylbenzene (E)	700
Xylenes (X)	1000
1,2-Dichloroethane (EOC)	5
Total Naphthalenes (N)	160
Total Arsenic (As-T)	5
Dissolved Arsenic (As-D)	5
MTCA Exceedance	Exceedance If Shaded Green

NOTE
1. Cells are filled with compound-specific color when detected above the MTCA Cleanup Level. Compounds which are not detected are filled with white.
2. Xylenes are reported as the summation of m,p-xylene and o-xylene.
3. MTCA = Model Toxics Control Act
4. ND = Not Detected
5. NA = Not Applicable

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Feet

Montlake Gas Station VCP
Remedial Investigation Report
2625 East Montlake Place East
Seattle, WA

MONTLAKE GAS STATION GROUNDWATER CHEMICAL CONCENTRATIONS

October 2020 21- 22242-104

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EXHIBIT 5