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May Creek Landfill
Groundwater Quality Monitoring

February 2020 – March 2022

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May Creek Landfill
Groundwater Quality Monitoring

February 2020 – March 2022

by

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Abstract

The May Creek Landfill is the site of an unpermitted solid waste landfill east of Renton, WA. In January 2003, King County notified the Department of Ecology (Ecology) of potential contamination at the site. In August 2003, Ecology placed the property on the Confirmed and Suspected Contaminated Sites List. The site was listed as confirmed for metals in surface water as well as ~~for~~ suspected for petroleum, antifreeze, metals, and gasoline in soil and groundwater. In 2016, EPA took responsibility for identifying and removing hazardous wastes and materials.

Soil samples collected in 2018 during removal activities identified soil contamination including petroleum hydrocarbons, dioxins, and metals. Surface water samples collected from transient locations around the site demonstrated that diesel and motor oil were present at concentrations above (not meeting) applicable state cleanup levels. In July 2019, EPA installed and sampled seven groundwater monitoring wells. The EPA sampling positively identified diesel range organics (DRO), metals, and semi-volatile organic compounds (SVOCs) at concentrations above cleanup levels in one or more monitoring wells.

This site is regulated under the Washington State Model Toxics Control Act (MTCA). Preliminary cleanup levels (PCULs) for potential pollutants have been established using MTCA Method B. The PCULs are set at the most stringent Method B cleanup or screening level, unless the most stringent level is below natural background; if natural background is higher than the most stringent cleanup level, the PCUL is set at the natural background value.

Ecology sampled the seven monitoring wells eight times from February 2020 through March 2022. Ecology sampled for a broad list of pollutants, including petroleum products, volatile organic compounds (VOCs), SVOCs, pesticides, polychlorinated biphenyls (PCBs), dioxins/furans, and metals. Several pollutants – including #2 diesel, lube oil, multiple metals, and PCBs – were consistently detected above the established PCULs in one or more monitoring wells.

Introduction

The May Creek Landfill is an unpermitted solid waste landfill in eastern King County (Figure 1). The site, also known as the Pillon Property, is located in a semi-rural area of unincorporated King County east of Renton. It is about 10 acres in size and surrounded by residential and agricultural land. May Valley Park is adjacent to the northwest corner of the property. Renton-Issaquah Road (Route 900) is adjacent to the northeast corner of the property.

The property has been operating as an unpermitted landfill since the early 1990s. The property owner has claimed to be operating a composting material recovery, waste reduction, and recycling business at the site (Woodke and Wing, 2019).

Unpermitted activities observed on the property during investigations conducted by county and state regulatory agencies have included:

- Receiving construction, demolition, and land clearing debris
- Scrapping metals
- Auto wrecking
- Incinerating waste
- Smelting of metals
- Storing asphalt trucks in active use
- Producing biodiesel

Due to the activities observed on the property listed above, there is a wide-ranging list of contaminants of potential concern. These contaminants include metals, volatile organic compounds (VOC), semi-volatile organic compounds (SVOC), gasoline range organics (GRO), diesel range organics (DRO), pesticides, and polychlorinated biphenyls (PCB).

Ecology listed the May Creek Landfill on its Confirmed and Suspected Contaminated Sites Lists in 2003. In 2016 EPA's Region 10 Superfund Technical Assessment and Response Team (START) was tasked with identifying and removing hazardous wastes and materials. Removal activities were completed in July 2019; this included the removal of 1,659 containers of hazardous substances, as well as the excavation and removal of 365 tons of contaminated soil. Soil samples collected during removal activities indicated that the site soils were contaminated with petroleum hydrocarbons, dioxins, and metals (Woodke and Wing, 2019). EPA also installed seven monitoring wells and conducted one round of sampling to determine if the contaminated soil has resulted in contamination of the shallow groundwater (Figure 2).

Figure 1. Location map of the May Creek Landfill.

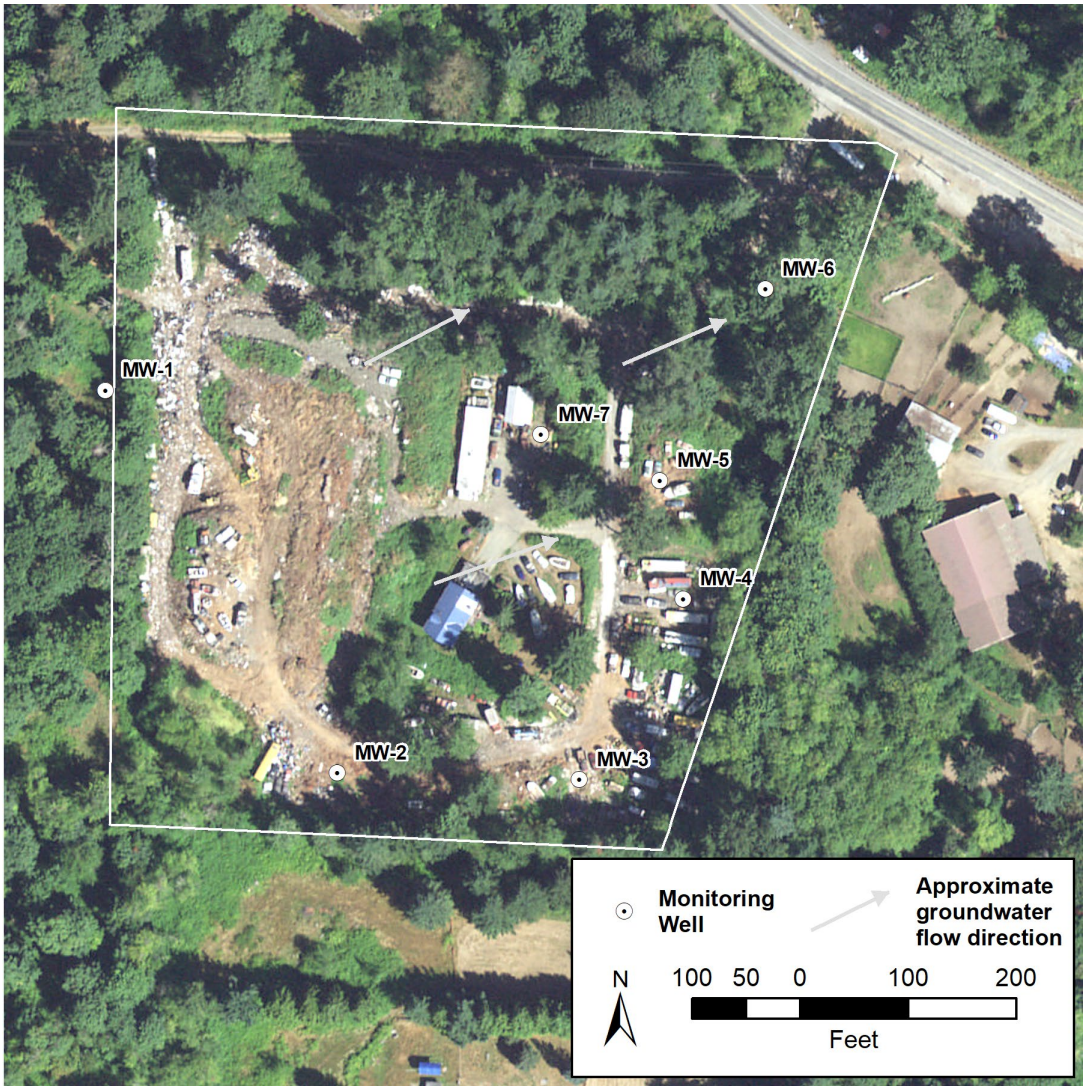

Figure 2. Location map of the seven monitoring wells and approximate groundwater flow direction.

Study Area and Surroundings

The property is located about 370-490 feet above mean sea level. It is hilly, with about 120 feet of relief. The property sits within the May Creek Watershed. May Creek flows west into Lake Washington and is part of the Cedar-Sammamish Water Resource Inventory Area (WRIA 08). The annual precipitation in the watershed ranges from 30 to 35 inches per year. Most of the precipitation falls during the winter months (Ecology, 2016).

Geology of the May Creek Watershed is described as high-relief sedimentary and volcanic bedrock on the northeastern side of the valley. Vashon glacial sediments infilled a surface trough of bedrock through the remainder of the valley. Most of the glacial sediments observed at the surface are from the Vashon Stade. Till material deposited by the ice and compacted during

glacial occupation underlies the valley bottom and is present at the surface throughout much of the basin. The valley bottom is filled with recessional outwash deposits (Anchor QEA, 2010).

Groundwater flow in May Creek Valley is likely to the northwest, following the direction of the valley. Groundwater beneath the site flows northeast, following topography toward May Creek (Figure 2; Figures E1 – E8 in Appendix E).

Previous Work

Holt Services installed the seven monitoring wells (Figure 2) in July 2019. Completion depths range from 17 to 29 feet. Well logs indicate near-surface deposits are composed primarily of silt, commonly with sand or sand and gravel. Sand is also a major constituent, commonly with silt or gravel. Relatively minor amounts of gravel are present compared to silt and sand deposits. Various types of debris and waste material were at all well locations except MW-1. Depth of fill ranges from 1.5 to 9.5 feet below ground surface (bgs). At the time of well installation, groundwater was encountered from about 9 to 21 feet bgs. Well construction information is included in Appendix A.

The EPA sampling identified at least one screening level exceedance in each of the seven monitoring wells (Ecology and Environment, 2020).

- Motor oil exceeded the EPA's screening levels in MW-2, MW-6, and MW-7.
- Diesel exceeded screening levels in MW-7.
- Cobalt, iron, and manganese exceeded screening levels in two or more wells.
- Arsenic exceeded screening levels in all wells.
- SVOC compounds exceeded screening levels in five wells.
- 2,6-dinitrotoluene exceeded screening levels in MW-3, MW-4, and MW-7.
- Bis(2-ethylhexyl) phthalate exceeded screening levels in MW-5 and MW-6.
- Hexachlorobenzene, hexachlorobutadiene, and hexachloroethane exceeded screening levels in MW- 3

The screening level exceedances found in the EPA sampling are summarized in Appendix B.

Regulatory Criteria

This site is regulated under Washington's Model Toxics Control Act (MTCA) (WAC 173-340). Results presented in this report are compared to preliminary cleanup levels (PCULs), listed in Appendix C. The PCULs are set at the most stringent method B cleanup or screening level that applies, unless the most stringent level is below natural background; if natural background is higher than the most stringent cleanup level, the PCUL is set at the natural background value.

Methods

From February 2020 through March 2022, Ecology completed eight quarterly rounds of groundwater sampling from the seven monitoring wells at May Creek Landfill (Table 1). The spring 2020 sampling was cancelled due to the emergency response to the COVID-19 pandemic. That round of sampling was completed in early 2022.

Table 1. Sampling dates for May Creek Landfill groundwater monitoring.

Quarter	Start Date	End Date
Winter 2020	2/10/20	2/12/20
Spring 2020	*Cancelled*	*Cancelled*
Summer 2020	8/3/2020	8/5/2020
Fall 2020	10/12/2020	10/14/2020
Winter 2021	1/25/2021	1/27/2021
Spring 2021	4/5/2021	4/6/2021
Summer 2021	7/12/2021	7/13/2021
Fall 2021	10/26/2021	10/27/2021
Makeup Round	2/28/2022	3/1/2022

For simplicity, throughout the remainder of this report, March 2022 will be used in table headings and text to refer to the samples collected during the final round of sampling.

The wells were sampled in accordance with the site-specific Quality Assurance Project Plan (QAPP) (Carnes, 2020a), QAPP Addendum (Carnes, 2020b), and Ecology's standard operating procedures (SOPs) noted in this report.

Ecology employed industry-standard sampling procedures. Prior to purging the wells, depth to water was measured according to SOP EAP052 (Marti, 2018). Low-flow sampling techniques were used to purge and sample the wells. Because the wells are low yielding and slow to recover, a peristaltic pump with dedicated tubing was used. All the wells typically experienced draw-down while purging, therefore the pump tubing intake was placed near the bottom of the screen interval, and the wells purged at a rate from 200 to 500 mL/minute.

Before sampling, wells were purged through a continuous flow cell until field parameters stabilized (pH, temperature, specific conductance, dissolved oxygen, oxidation reduction potential, and turbidity) as specified in SOP EAP078 (Marti, 2020).

Samples were collected in clean laboratory-supplied bottles for a range of analytes, including volatile organic compounds (VOCs), semi-volatile organic compounds (SVOC), total petroleum hydrocarbons as gasoline and diesel (TPH-G and TPH-D), metals, pesticides, PCB aroclors, PCB congeners and dibenzo-*p*-dioxins and dibenzo-furans (dioxins/furans). Analytical laboratory, analytical methods, and the number of sampling events for each method are summarized in Table 2.

Table 2. Summary of laboratory methods used in this study.

Analyte Group	Analytical (Instrumental) Method	Laboratory	Number of sampling events
Metals	EPA 200.7 (Martin et al, 1994), EPA 200.8 (Creed et al., 1994), EPA 245.1 (O'Dell et al., 1994)[1] EPA 7470A (USEPA, 1994a) [1]	MEL	8
VOC	EPA 8260D (USEPA, 2018a)	MEL, OnSite	5
SVOC	EPA 8270E (USEPA, 2018b)	MEL	8
TPH-G	NWTPH-Gx (Ecology, 1997)	MEL	5
TPH-D	NWTPH-Dx (Ecology, 1997)	MEL	8
Pesticides	EPA 8081B (USEPA, 2007a)	MEL	5
PCB Aroclors	EPA 8082A (USEPA, 2007b)	MEL	5
PCB Congeners	EPA 1668C (USEPA, 2010)	SGS AXYS	4
Dioxins/Furans	EPA 1613B (USEPA, 1994b)	SGS AXYS	4

[1] Mercury was analyzed using EPA Method 241.1 for all sampling events except for October 2021, when EPA Method 7470 was used due to lab scheduling constraints.

MEL: Manchester Environmental Laboratory.

OnSite: OnSite Environmental, Inc. in Redmond, WA.

In August 2020, PCB congeners and dioxins/furans analyses were added. In July 2021, the suite of analyte groups sampled for was reduced to TPH-D, SVOCs, and metals after reviewing the available results.

Samples collected for analysis of volatile organic compounds (VOC) were submitted to MEL for four of the five sampling events that included VOC analysis. Due to an instrument failure at MEL, OnSite Environmental, Inc. analyzed the January 2021 VOC samples.

For seven sampling events, mercury was analyzed using EPA method 245.1 (O'Dell et al., 1994). For the samples collected in October 2021, due to schedule constraints, MEL analyzed for mercury using EPA method 7470A (USEPA, 1994a). Changing the method allowed MEL to batch the mercury analyses with samples from a separate project.

Field duplicate samples were collected during each sampling event. Field replicates were collected from well MW-7 for all analytes except during October 2020. Duplicate samples for TPH-D, TPH-G, and VOCs were collected at MW-7 during October 2020, duplicate samples for

all other analyte groups were collected at MW-5. The relative percent difference (RPD[1]) was calculated for analytes that were detected above the reporting limit in the duplicate samples. The October 2020 duplicate results for lube oil had a RPD of 92.5%, far exceeding acceptance criteria of 40% for TPH-D. The October 2021, duplicate results for calcium had a RPD of 163%, far exceeding the acceptance criteria of 20% for metals analyses. During The calculated RPD values are within the acceptable ranges described in the QAPP (Carnes, 2020).

The laboratory data quality control and quality assurance results indicate that the analytical performance was good. All results are usable as qualified. Appendix D provides a summary of the project quality assurance data.

[1] RPD is the difference between replicate sample results, divided by the replicate mean, expressed as a percentage. This calculation provides a measure of the overall sampling and analytical precision. Precision estimates are influenced by the random error introduced by collection and measurement procedures, and by the natural variability of the concentrations in the media being sampled.

Results

Field Parameters

Water level measurements taken prior to purging indicate that groundwater flow direction is in to the northeast, towards May Creek (Figure 2, Table 3). Groundwater contour maps from each sampling event are presented in Figures E1 – E8 in Appendix E. Table 4 presents the range of field parameters in each well. Complete results are included in Appendix E. Box plots comparing the range of each field parameter at each well are presented in Figures 3 through 6.

Table 3. Water level elevations in each well, February 2020 to March 2022.
Vertical datum NAVD88

Well	Feb. 2020	Aug. 2020	Oct. 2020	Jan. 2021	April 2021	July 2021	Oct. 2021	March 2022
MW-1	465.75	460.87	459.57	465.29	465.13	460.2	459.77	466.27
MW-2	461.31	456.93	457.23	461.01	459.62	456.78	458.43	462.47
MW-3	441.00	436.68	434.64	439.84	437.85	436.52	433.27	438.09
MW-4	427.76	422.29	420.5	426.22	425.61	422.09	421.08	425.33
MW-5	422.25	417.18	416.53	420.11	419.99	418.11	418.59	422.02
MW-6	389.41	382.13	380.42	389.22	388.27	382.70	377.76	392.70
MW-7	435.16	431.25	433.26	435.47	434.75	431.15	434.17	435.62

Table 4. Range of values of stabilized field parameters in each well, February 2020 to March 2022.

Well	Ground Water Elevation (ft.)[1]	pH (Standard Units)	Conductivity (µS/cm)	Dissolved Oxygen (mg/L)	Oxidation Reduction Potential (mV)	Turbidity (NTU)
MW-1 Min.	459.57	5.4	100	6.1	43	0.2
Max.	466.27	5.9	139	11.9	183	8.7
MW-2 Min.	456.78	6.1	505	0	-125	0.4
Max.	462.47	6.8	1069	0	20	2.2
MW-3 Min.	433.27	5.9	503	0	-1	1.1
Max.	441.00	6.6	594	5.7	114	5.0
MW-4 Min.	420.5	5.1	337	0	32	1.2
Max.	427.76	5.9	392	0.9	137	7.7
MW-5 Min.	416.53	6.0	490	0	-87	0.7
Max.	422.25	6.4	594	0	-23	2.1
MW-6 Min.	377.76	6.1	561	0	-25	1.06
Max.	392.70	6.7	746	0.7	89	44.5
MW-7 Min.	431.15	6.2	1025	0	-105	0.8
Max.	435.62	6.4	1380	0.7	26	22.2

[1] NAVD88

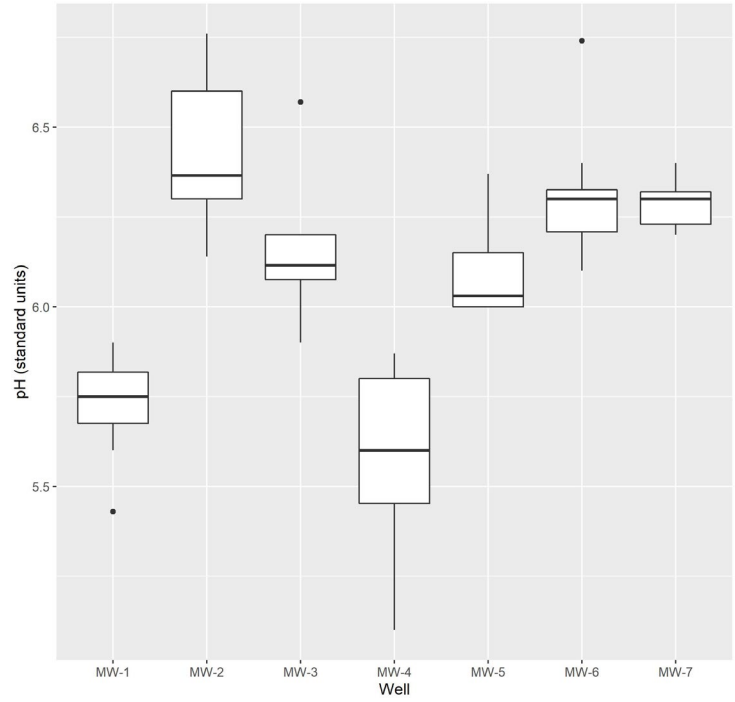

Figure 3. Box plot of groundwater pH.

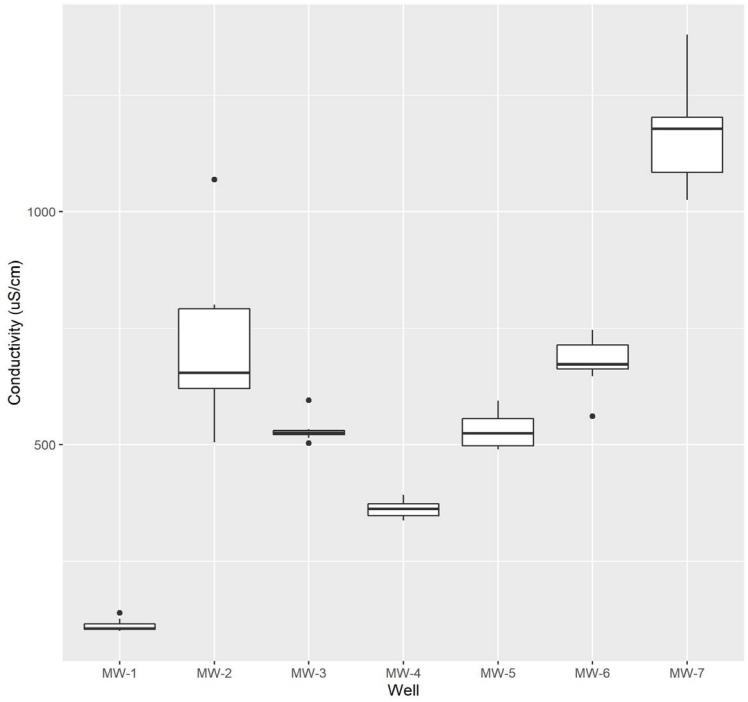

Figure 4. Box plot of groundwater conductivity.

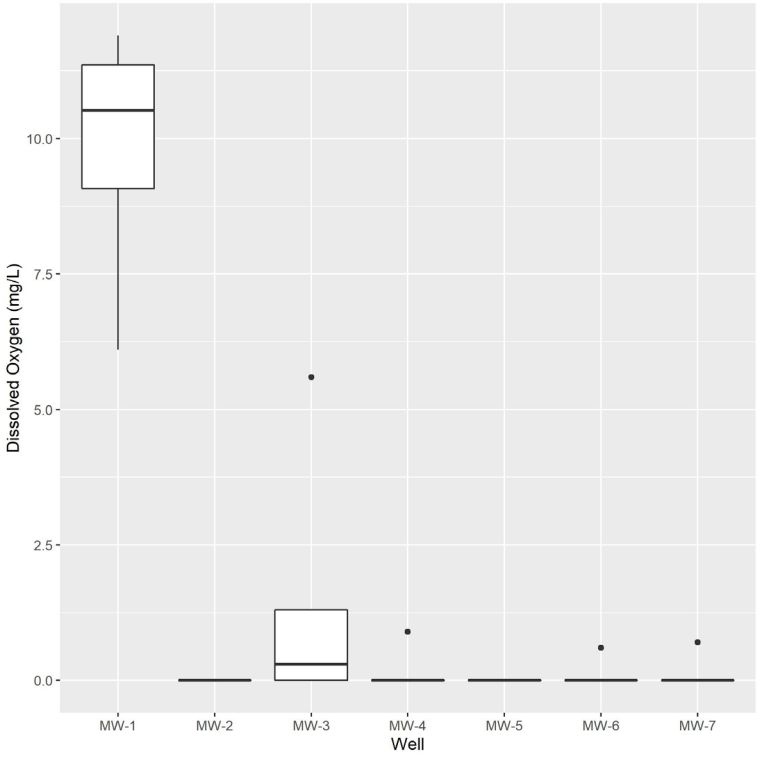

Figure 5. Box plot of dissolved oxygen in groundwater.

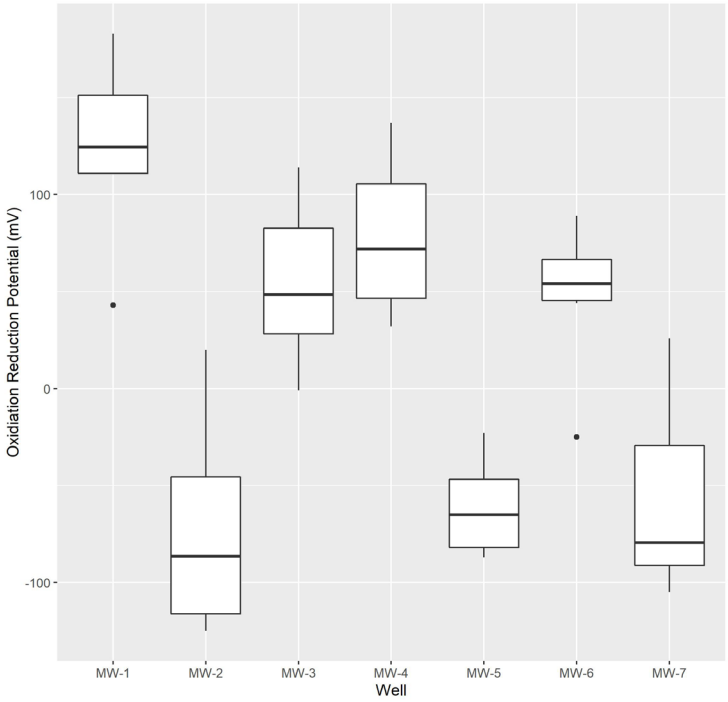

Figure 6. Box plot of groundwater oxidation-reduction potential.

Groundwater pH ranged from 5.1 to 6.8. Conductivity ranged from 100 µS/cm to 1380 µS/cm, with the lowest values in well MW-1 and the highest values in MW-2 and MW-7. Dissolved oxygen was highest in MW-1, ranging from 6.1 to 11.9 mg/L. In MW-2 through MW-7, dissolved oxygen concentrations were predominately less than 1 mg/L, or 0 mg/L, indicating anaerobic conditions. In MW-1, MW-3, MW-4, and MW-6, oxidation-reduction potential (ORP) was predominately positive over the 2020-2022 monitoring period. In MW-2, MW-5, and MW-7, ORP values were predominately negative.

Turbidity generally fell below 10 NTU prior to sampling. However, during the February 2020 sampling, turbidity in MW-6 was 44.5 NTU and in MW-7 was 22.2 NTU. These wells were found to have elevated turbidity levels due to falling water levels.

Petroleum Products

Diesel range organics were consistently detected above the PCULs in well MW-7. The concentration of #2 diesel ranged from 0.99 to 1.91 mg/L, exceeding the PCUL of 0.5 mg/L. Lube oil concentrations also exceeded the 0.5 mg/L PCUL with a concentration range of 1.01 to 3.20 mg/L.

During April 2021, #2 diesel was detected below the 0.5 mg/L PCUL in MW-5 and MW-6 (Table 5).

Low concentrations of lube oil were detected occasionally in MW-2, MW-5, and MW-6. Concentrations slightly exceeded the PCUL twice in MW-6 (Table 6).

Table 5. Concentration of #2 diesel (mg/L) in each well, February 2020 – March 2022.

Well	Feb 20	Aug 20	Oct 20	Jan 21	April 21	July 21	Oct 21	Feb/Mar 22
MW-1	0.15U	REJ	0.26U	0.15U	0.15U	0.18U	0.23U	0.17U
MW-2	0.15U	REJ	0.22U	REJ	0.18U	0.23U	0.47U	0.25U
MW-3	0.15U	REJ	0.25U	REJ	0.18U	0.23U	0.28U	0.33U
MW-4	0.15U	REJ	0.24U	REJ	0.15U	0.21U	0.28U	0.23U
MW-5	0.15U	REJ	0.22U	REJ	***0.31***	0.34U	0.55U	0.42U
MW-6	0.15U	REJ	0.36U	REJ	***0.38***	0.36U	0.67U	0.45U
MW-7	**0.99**	**1.49B**	**1.3J**	**1.54B**	**1.39**	**1.30**	**1.91**	**1.12**

U: Analyte was not detected at or above the reported result.
B: Analyte detected in sample and field blank. Reported result is sample concentration without blank correction or associated quantitation limit.
REJ: Sample results 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.
Bold: Analyte positively identified in sample.
Underlined: Analyte positively identified in sample at a concentration above PCUL.

Table 6. Concentration of lube oil (mg/L) in each well, February 2020 – March 2022.

Well	Feb 20	Aug 20	Oct 20	Jan 21	April 21	July 21	Oct 21	Feb/Mar 22
MW-1	0.37U	0.38U	0.38U	0.38U	0.37U	0.40U	0.37U	0.37U
MW-2	0.38U	0.37U	0.38U	0.38U	0.38U	0.38U	***0.39***	0.38U
MW-3	0.38U	0.39U	0.39U	0.4U	0.40U	0.37U	0.37U	0.38U
MW-4	0.38U	0.37U	0.38U	0.38U	0.38U	0.38U	0.38U	0.37U
MW-5	0.37U	0.38U	0.38U	0.37U	0.38U	0.38U	***0.49***	0.48U
MW-6	0.38U	0.38U	0.39U	**0.44**	**0.49**	0.51U	**0.64**	**0.79**
MW-7	**1.01**	**1.68**	REJ	**2.44**	**2.43**	**2.12**	**3.20**	**2.05**

U: Analyte was not detected at or above the reported result.
REJ: Sample results 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.
Bold: Analyte positively identified in sample.
Underlined: Analyte positively identified in sample at a concentration above PCUL

During the August 2020 and January 2021 sampling, #2 diesel was detected in the field equipment blanks at concentrations of 0.39 mg/L and 0.18 mg/L, respectively. Groundwater sample results within three times the blank concentrations have been deemed unusable and have been rejected.

For all diesel range organics detections, the laboratory analyst noted that the chromatograms did not match the standard chromatograms for diesel or lube oil. This mismatch between the sample and standard chromatograms may be due to (1) weathering of diesel and lube oil hydrocarbons, (2) the presence of unknown hydrocarbons, or (3) non-hydrocarbon interference.

Gasoline range organics were not detected during any sampling events.

All Total Petroleum Hydrocarbon data are presented in Appendix F.

Metals

Ecology analyzed groundwater samples for the 22 metals on the EPA target analyte list, plus mercury. Nineteen of the metals have been assigned PCULs. Five metals, including aluminum, arsenic, cobalt, iron, and manganese were consistently detected above the applicable PCUL (Figures 7–11, Tables 7–11). Detected metals from MW-6 and MW-7 in the February 2020 samples may be biased high due to high turbidity values associated with those samples. Those results have been assigned an "L" qualifier; the actual concentrations may be lower than reported. Results for all metals are included in Appendix G.

Aluminum was consistently detected in wells MW-2, MW-5, MW-6, and MW-7. Typical concentrations ranged from 0.026 to 0.406 mg/L; MW-6 had an anomalously high detection of 3.35 mg/L during February 2020. Aluminum concentrations exceeded the 0.05 mg/L PCUL in at least one well during each sampling round except for the July 2021 sampling (Figure 7, Table 7).

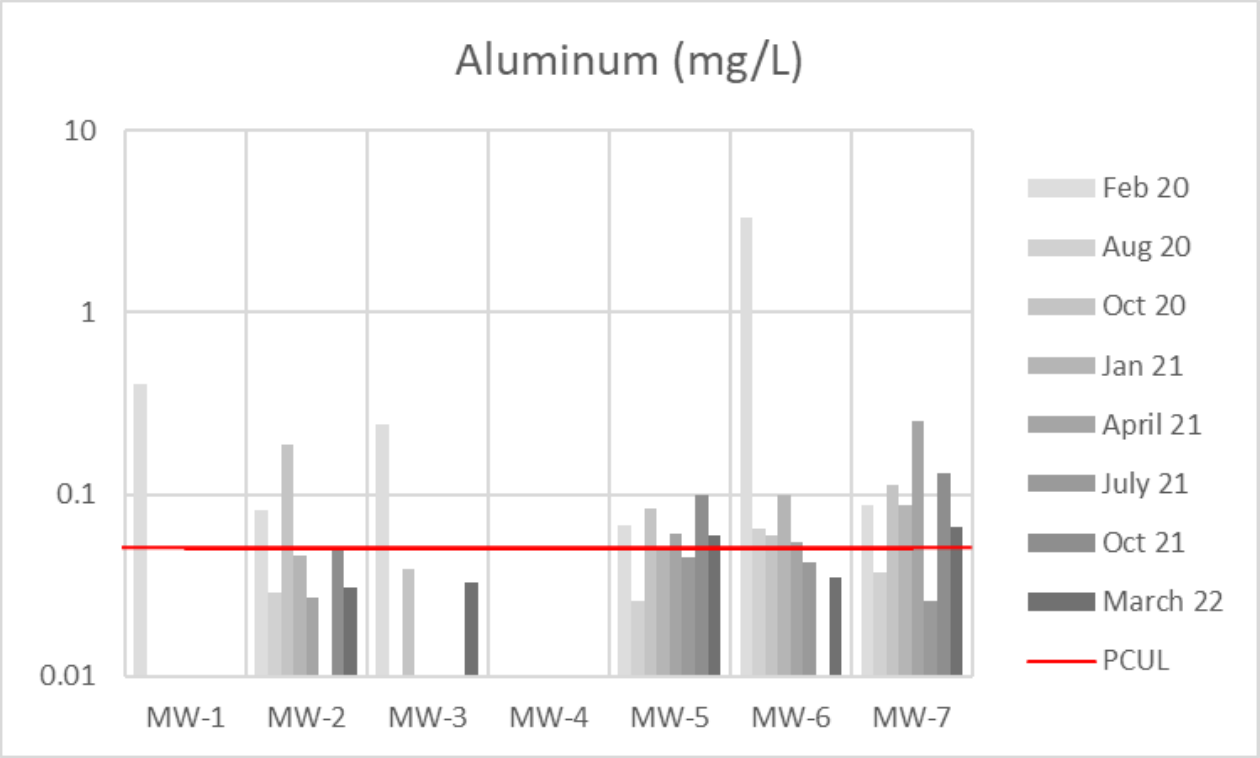

Figure 7. Bar chart showing aluminum concentrations in mg/L (log scale) in each monitoring well, February 2020 – March 2022.
The 0.05 mg/L PCUL is shown in red.

Table 7. Aluminum concentrations (mg/L) in each well, February 2020 – March 2022.

Well	Feb 20	Aug 20	Oct 20	Jan 21	April 21	July 21	Oct 21	Feb/Mar 22
MW-1	**0.406**	0.025U	0.025U	0.025U	0.025U	0.025U	0.025U	0.025U
MW-2	**0.081**	**0.029**	**0.187**	**0.046**	**0.027**	0.025U	**0.049**	**0.031**
MW-3	**0.241**	0.025U	**0.039**	0.025U	0.025U	0.025U	0.025U	**0.033**
MW-4	0.025U	0.025U	0.025U	0.025U	0.025U	0.025U	0.025U	0.025U
MW-5	**0.067**	**0.026**	**0.083**	**0.049**	**0.061**	**0.045**	**0.098**	**0.059**
MW-6	**3.35L**	**0.064**	**0.059**	**0.099**	**0.055**	**0.042**	0.025U	**0.035**
MW-7	**0.087L**	**0.037**	**0.112**	**0.088**	**0.251**	**0.026**	**0.131**	**0.066**

U: Analyte was not detected at or above the reported result.
L: Value is likely less than the reported result. Reported result may be biased high.
Bold: Analyte positively identified in sample.
Underlined: Analyte positively identified in sample at a concentration above PCUL.

Arsenic was detected in all the wells, but only exceeded the PCUL in 2 of the wells (Figure 8, Table 8). Arsenic concentrations consistently exceeded the PCUL in wells MW-2 and MW-7. Arsenic concentrations in MW-2 ranged from 1.97 to 13.6 µg/L. In MW-7, arsenic concentrations ranged from 2.99 to 12.8 µg/L.

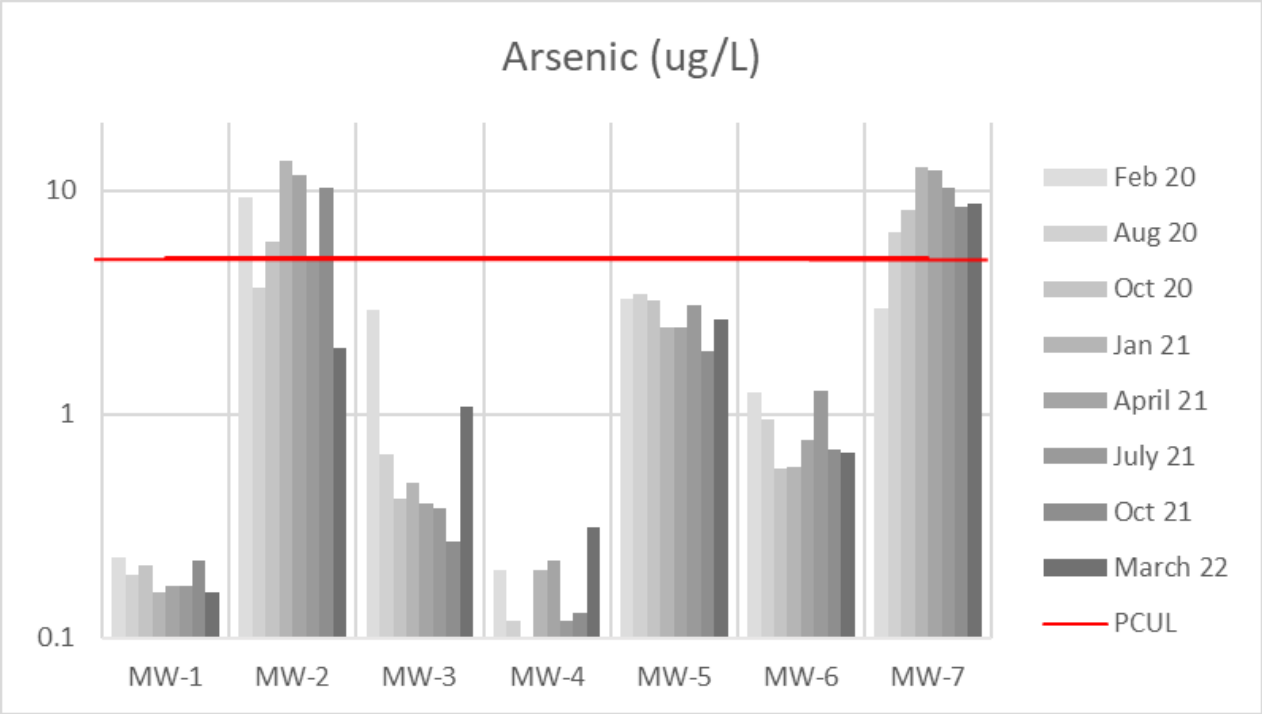

Figure 8. Bar chart showing arsenic concentrations in µg/L (log scale) in each monitoring well, February 2020 – March 2022.
The 5 µg/L PCUL is shown in red.

Table 8. Arsenic concentrations (µg/L) in each well, February 2020 – March 2022.

Well	Feb 20	Aug 20	Oct 20	Jan 21	April 21	July 21	Oct 21	Feb/Mar 22
MW-1	**0.23**	**0.19**	**0.21**	**0.16**	**0.17**	**0.17**	**0.22**	**0.16**
MW-2	**9.36**	**3.7**	**5.87**	**13.6**	**11.7**	**5**	**10.2**	**1.97**
MW-3	**2.94**	**0.66**	**0.42**	**0.49**	**0.4**	**0.38**	**0.27**	**1.08**
MW-4	**0.2**	**0.12**	0.1U	**0.2**	**0.22**	**0.12**	**0.13**	**0.31**
MW-5	**3.28**	**3.44**	**3.24**	**2.44**	**2.46**	**3.08**	**1.92**	**2.64**
MW-6	**1.26L**	**0.95**	**0.57**	**0.58**	**0.77**	**1.27**	**0.7**	**0.67**
MW-7	**2.99L**	**6.53**	**8.16**	**12.8**	**12.4**	**10.2**	**8.42**	**8.68**

U: Analyte was not detected at or above the reported result.
L: Value is likely less than the reported result. Reported result may be biased high.
Bold: Analyte positively identified in sample.
Underlined: Analyte positively identified in sample at a concentration above PCUL

Cobalt was consistently detected in all wells except MW-1. Concentrations in well MW-7 exceeded the PCUL during every sample round. Additionally, concentrations in MW-5 exceeded the PCUL during two rounds of sampling, and the concentration in MW-3 exceeded the PCUL during one round (Figure 9, Table 9).

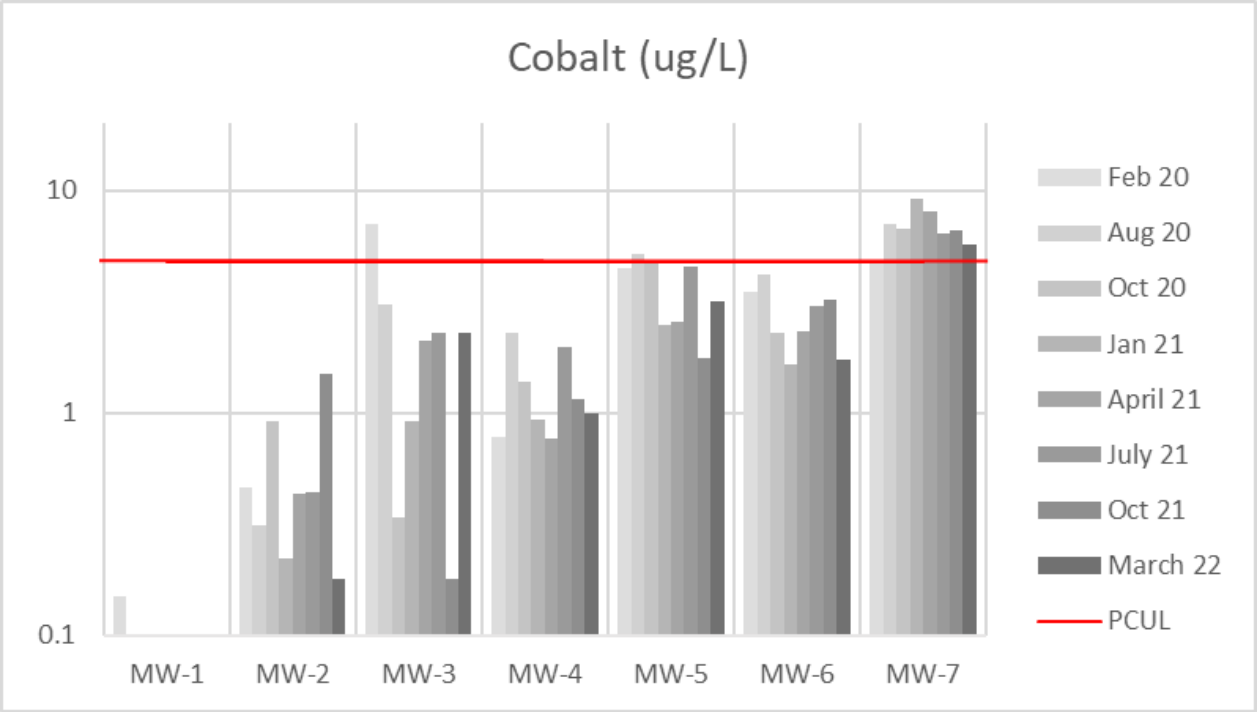

Figure 9. Bar chart showing cobalt concentrations in µg/L (log scale) in each monitoring well, February 2020 – March 2022.
The 4.8 µg/L PCUL is shown in red.

Table 9. Cobalt concentrations (µg/L) in each well, February 2020 – March 2022.

Well	Feb 20	Aug 20	Oct 20	Jan 21	April 21	July 21	Oct 21	Feb/Mar 22
MW-1	**0.15**	0.1U	0.1U	0.1U	0.1U	0.1U	0.1U	0.1U
MW-2	**0.46**	**0.31**	**0.91**	**0.22**	**0.43**	**0.44**	**1.5**	**0.18**
MW-3	**7.06**	**3.06**	**0.34**	**0.92**	**2.11**	**2.27**	**0.18**	**2.28**
MW-4	**0.78**	**2.29**	**1.37**	**0.93**	**0.76**	**1.99**	**1.16**	**0.99**
MW-5	**4.44**	**5.17**	**4.88**	**2.49**	**2.57**	**4.56**	**1.76**	**3.16**
MW-6	**3.51L**	**4.17**	**2.29**	**1.66**	**2.33**	**3.04**	**3.24**	**1.73**
MW-7	**4.81L**	**7.08**	**6.68**	**9.11**	**7.99**	**6.42**	**6.62**	**5.71**

U: Analyte was not detected at or above the reported result.
L: Value is likely less than the reported result. Reported result may be biased high.
Bold: Analyte positively identified in sample.
Underlined: Analyte positively identified in sample at a concentration above PCUL

Iron was consistently detected in wells MW-2 through MW-7. In MW-2, MW-5, and MW-7, iron concentrations were commonly higher than 10 mg/L, far exceeding the 0.3 mg/L PCUL. Additionally, iron exceeded the PCUL in at least one sampling event in MW-3, MW-4, and MW-6 (Figure 10, Table 10).

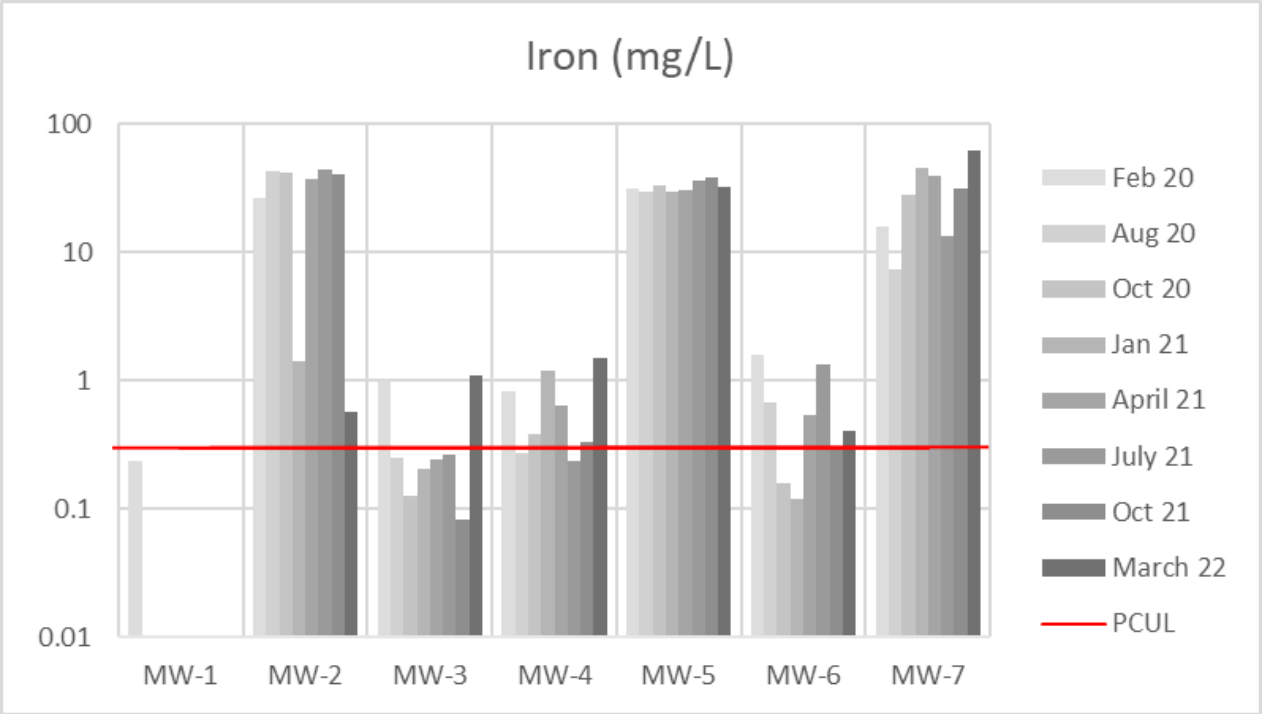

Figure 10. Bar chart showing iron concentrations in mg/L (log scale) in each monitoring well, February 2020 – March 2022.
The 0.3 mg/L PCUL is shown in red.

Table 10. Iron concentrations (mg/L) in each well, February 2020 – March 2022.

Well	Feb 20	Aug 20	Oct 20	Jan 21	April 21	July 21	Oct 21	Feb/Mar 22
MW-1	**0.236**	0.025U	0.025U	0.025U	0.025U	0.025U	0.025U	0.025U
MW-2	**26.7**	**42.2**	**41.2**	**1.41**	**37.1**	**43.6**	**40.6**	**0.565**
MW-3	**1.01**	**0.247**	**0.127**	**0.206**	**0.246**	**0.263**	**0.083**	**1.09**
MW-4	**0.816**	**0.27**	**0.379**	**1.2**	**0.641**	**0.236**	**0.332**	**1.49**
MW-5	**31.6**	**29.9**	**33.1**	**29.9**	**30.1**	**36.2**	**38.6**	**32.1**
MW-6	**1.58L**	**0.684**	**0.16**	**0.119**	**0.534**	**1.32**	**0.307**	**0.402**
MW-7	**16L**	**7.43**	**27.5**	**45.2**	**39.3**	**13.4**	**31.5**	**61**

U: Analyte was not detected at or above the reported result.
L: Value is likely less than the reported result. Reported result may be biased high.
Bold: Analyte positively identified in sample.
Underlined: Analyte positively identified in sample at a concentration above PCUL

Manganese concentrations far exceeded the 50 µg/L PCUL in each monitoring well during each sampling event, except for in well MW-1 (Figure 11, Table 11). In MW-2 through MW-7, manganese concentrations ranged from 80.3 to 6990 µg/L. Concentrations were consistently above 1000 µg/L in MW-2, MW-5, MW-6, and MW-7. Manganese concentrations in MW-1 did not exceed the PCUL during any sampling event.

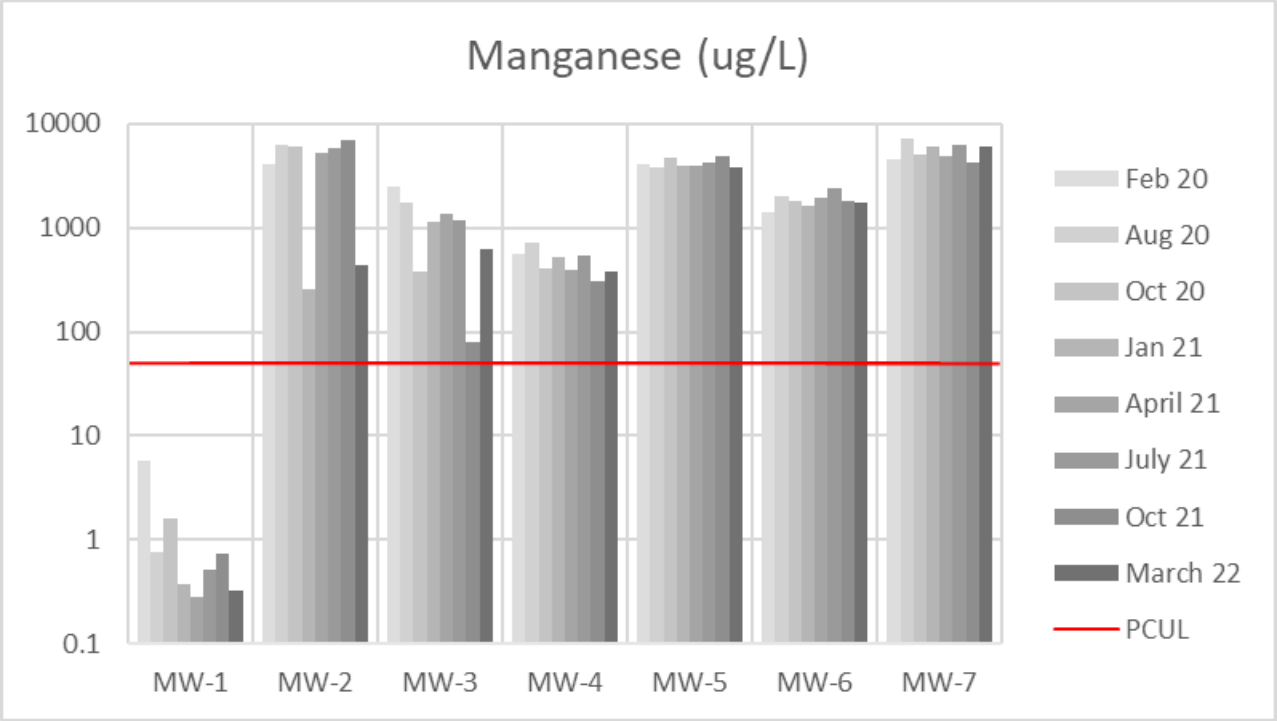

Figure 11. Bar chart showing manganese concentrations in µg/L (log scale) in each monitoring well, February 2020 – March 2022.
The 50 µg/L PCUL is shown in red.

Table 11. Manganese concentrations (µg/L) in each well, February 2020 – March 2022.

Well	Feb 20	Aug 20	Oct 20	Jan 21	Apr 21	July 21	Oct 21	Feb/Mar 22
MW-1	**5.78**	**0.766**	**1.59**	**0.374**	**0.285**	**0.508**	**0.725**	**0.323**
MW-2	**4140**	**6300**	**6100**	**260**	**5320**	**5900**	**6990**	**439**
MW-3	**2490**	**1730**	**377**	**1140**	**1350**	**1200**	**80.3**	**616**
MW-4	**562**	**710**	**409**	**527**	**399**	**538**	**305**	**379**
MW-5	**4050**	**3810**	**4630**	**3920**	**3960**	**4250**	**4850**	**3830**
MW-6	**1410L**	**2000**	**1790**	**1610**	**1970**	**2400**	**1830**	**1750**
MW-7	**4560L**	**7230**	**4970**	**6080**	**4920**	**6180**	**4180**	**6000**

U: Analyte was not detected at or above the reported result.
L: Value is likely less than the reported result. Reported result may be biased high.
Bold: Analyte positively identified in sample.
Underlined: Analyte positively identified in sample at a concentration above PCUL.

Volatile Organic Compounds

Ecology submitted groundwater samples for analysis of VOCs from five sampling events, February 2020 – April 2021. No VOCs were detected above the PCUL in any well. In February 2020, acetone was detected at approximately 6 µg/L in MW-7, and m,p-xylene was detected at an estimated concentration below the reporting limit of 2 µg/L. The concentrations of acetone and m,p-xylene in the February MW-7 sample were far below their respective cleanup levels. Analytical results for VOCs are included in Appendix H.

Semivolatile Organic Compounds

Ecology submitted samples for analysis of SVOCs for each of the eight rounds of sampling. Eight SVOC analytes were detected in one or more samples during the monitoring period. Pentachlorophenol was detected at concentrations of 0.205 and 0.106 µg/L in August 2020 and July 2021, respectively, above the 0.002 µg/L PCUL. All SVOC detections are summarized in Table 12. Full analytical results are shown in Appendix I.

Table 12. Summary of SVOC detections in wells, February 2020 – March 2022.

Analyte	PCUL (µg/L)	Range of Concentrations (µg/L)	Summary of Detections
2,4-Dichlorophenol	10	**0.379J**	Detected below reporting limit only in MW-2 in February 2020.
2,3,5,6-Tetrachlorophenol	na	**0.0978J**	Detected below reporting limit only in MW-7 in August 2020.
Anthracene	na	**0.0979J**	Detected below reporting limit only in MW-7 in August 2020.
Caffeine	na	**0.0623J**	Detected below reporting limit only in MW-3 in February 2022.
Cholesterol	na	**1.5J**	Detected below the reporting limit in MW-2 in July 2021
Diethyl Phthalate	200	**0.0988J**	Detected only in MW-1 in February 2020.
Pentachlorophenol	0.002	**0.106 - 0.205**	Detected above PCUL in MW-7 in August 2020 and July 2021.
Tris(2-chloroethyl) Phosphate	na	**0.0467J – 0.156**	Detected near or below the reporting limit in multiple wells during every sampling event except Jan 2021. MW-1 was the only well without a positive detection.

Bold: Analyte positively identified in sample.
Underlined: Analyte positively identified in sample at a concentration above PCUL.

Pesticides

No pesticides were detected in any sample over the monitoring period. Analytical results for pesticides are presented in Appendix J.

PCBs

Ecology submitted samples for analysis of PCB aroclors for the first five rounds of sampling. There were no positive detections in the samples submitted for analysis of PCB aroclors due to the relatively high detection limits of that analysis. PCB aroclors results are presented in Appendix K.

Ecology also submitted samples for high-resolution analysis of PCB congeners for four rounds of sampling, beginning with the August 2020 sampling event. In the samples submitted for high-resolution analysis of PCB congeners, one or more PCB congeners were positively detected in each monitoring during all four sampling events, except for MW-3 and MW-5 in January 2021, and MW-1 in April 2021. All positive detection for PCB congeners were at concentrations below the reporting limit and have been qualified as estimates. Estimated total concentrations above the 7 pg/L PCUL were found in each well except for MW-3 (Table 13). Full PCB congener results are included in Appendix L.

Table 13. Summary of estimated total PCB concentrations (pg/L) in each well, August 2020 – April 2021.

Monitoring Well	Aug 2020	Oct 2020	Jan 2021	Apr 2021
MW-1	**1.65**	**19.945**	**14.977**	--
MW-2	**34.84**	**3.979**	**160.15**	**23.67**
MW-3	**0.638**	**5.971**	--	**2**
MW-4	**18.716**	**0.966**	**156.08**	**3.713**
MW-5	**1.233**	**24.144**	--	**0.991**
MW-6	**0.56**	**2.041**	**135.27**	**75.175**
MW-7	**2.664**	**183.24**	**150.905**	5.279

Bold: Analyte positively identified in sample.
Underlined: Analyte positively identified in sample at a concentration above PCUL.

Dioxins/Furans

Samples analyzed for dioxins/furans from three monitoring wells (MW-1, MW-5, MW-7) were submitted in four rounds of sampling, beginning in August 2020. One dioxin compound (1,2,3,7,8-PeCDD) and one furan compound (1,2,3,4,6,7,8-HpCDF) was detected in MW-5 in August 2020. In MW-7, two dioxin compounds were detected; 1,2,3,4,6,7,8-HpCDD was detected in October 2020, and OCDD was detected in October 2020, January 2021, and April 2021. No dioxins or

furans were detected in MW-1. Positive results are summarized in Table 14. Full results are listed in Appendix M. None of the detected compounds have been assigned PCULs.

Table 14. Summary of positive detections of dioxins/furans (pg/L).

Month	Well MW-5	Well MW-7
August 2020	1,2,3,4,6,7,8-HpCDF – **0.736J** 1,2,3,7,8-PeCDD – **0.713J**	--
October 2020	--	1,2,3,4,6,7,8-HpCDD – **1.4J** OCDD – **6.89J**
January 2021	--	OCDD – **6.36J**
April 2021	--	OCDD – **12.5J**

Bold: Analyte positively identified in sample.
Underlined: Analyte positively identified in sample at a concentration above PCUL.

Summary and Conclusions

From February 2020 through March 2022, Ecology sampled seven monitoring wells at the May Creek Landfill site eight times. Ecology sampled for a broad list of pollutants, including petroleum products, VOCs, SVOCs, pesticides, PCBs, dioxins/furans, and metals. Several pollutants, including #2 diesel, lube oil, multiple metals, and PCBs, were consistently detected above the established preliminary cleanup levels (PCULs) in one or more wells.

Diesel range petroleum products were primarily detected in well MW-7, where concentrations of #2 diesel and lube oil exceeded (did not meet) the PCUL in each sampling event. Lube oil was found in excess of the PCUL in MW-6 in October 2021 and February 2022. For all positive detection of diesel and lube oil from August 2020 through the end of the monitoring period, the MEL analyst noted that the chromatograms did not match the relevant standard chromatogram.

Five metals – aluminum, arsenic, cobalt, manganese, and iron – were found above applicable PCULs across the site during each sampling event. Well MW-7 exhibited the most exceedances, with those five metals detected above the PCUL during at least six of the eight sampling rounds. Wells MW-2, MW-5, and MW-6 consistently exceeded the PCUL for multiple metals.

Manganese was the metal that exceeded the PCUL most often. Manganese exceeded the 50 µg/L PCUL in wells MW-2 through MW-7 during each round of sampling. Manganese concentrations were above 1000 µg/L in every sample from MW-5, MW-6, and MW-7, and were typically above 1000 µg/L in MW-2.

Iron consistently exceeded the 0.3 µg/L PCUL in MW-2, MW-5 and MW-7. Iron concentrations in those three wells ranged from 0.57 to 61 µg/L, and typically greater than 10 µg/L. In MW-3, MW-4, and MW-6 iron concentrations exceeded the 0.3 µg/L PCUL during at least two sampling rounds.

Arsenic commonly exceeded the 5 µg/L PCUL in MW-2 and MW-7. Arsenic concentrations did not exceed the PCUL in any other wells.

The upgradient well, MW-1, had one PCUL exceedance for aluminum during the first round of sampling. There were no other exceedances in MW-1, and the concentration of most metals in MW-1 was generally lower than wells MW-2 through MW-7.

Total concentrations of PCB congeners exceeded the 7 pg/L in each well except for MW-3. Total PCB concentrations in MW-2 exceeded the PCUL in three of the four sampling events that included analysis for PCB congeners. Wells MW-1, MW-5, MW-6, and MW-7 each had two rounds of sampling with PCB concentrations above the 7 pg/L PCUL, and MW-5 exceeded the PCUL during only one round of sampling.

Two dioxin compounds and one furan compound were detected in MW-5 and MW-7. None of the detected dioxins/furans compounds have associated PCULs.

One SVOC, pentachlorophenol, was detected above the 0.002 µg/L PCUL in MW-7 during the August and July 2021 sampling. Another SVOC, tris(2-chloroethyl) phosphate, was detected in each sampling event except January 2021. There is no PCUL set for tris(2-chloroethyl) phosphate.

No VOCs were detected above relevant PCULs, and no pesticides were positively identified in any sample.

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Glossary, Acronyms, and Abbreviations

Glossary

Conductivity: A measure of water's ability to conduct an electrical current. Conductivity is related to the concentration and charge of dissolved ions in water.

Dissolved oxygen (DO): A measure of the amount of oxygen dissolved in water.

Parameter: Water quality constituent being measured (analyte). A physical, chemical, or biological property whose values determine environmental characteristics or behavior.

pH: A measure of the acidity or alkalinity of water. A low pH value (0 to 7) indicates that an acidic condition is present, while a high pH (7 to 14) indicates a basic or alkaline condition. A pH of 7 is considered neutral. Since the pH scale is logarithmic, a water sample with a pH of 8 is ten times more basic than one with a pH of 7.

Pollution: Contamination or other alteration of the physical, chemical, or biological properties of any waters of the state. This includes change in temperature, taste, color, turbidity, or odor of the waters. It also includes discharge of any liquid, gaseous, solid, radioactive, or other substance into any waters of the state. This definition assumes that these changes will, or are likely to, create a nuisance or render such waters harmful, detrimental, or injurious to (1) public health, safety, or welfare; (2) domestic, commercial, industrial, agricultural, recreational, or other legitimate beneficial uses; or (3) livestock, wild animals, birds, fish, or other aquatic life.

Watershed: A drainage area or basin in which all land and water areas drain or flow toward a central collector, such as a stream, river, or lake at a lower elevation.

Acronyms and Abbreviations

Dup	duplicate
Ecology	Washington State Department of Ecology
EIM	Environmental Information Management database
EPA	U.S. Environmental Protection Agency
MEL	Manchester Environmental Laboratory
MTCA	Model Toxics Control Act
MW	monitoring well
ORP	oxidation/reduction potential
PCB	polychlorinated biphenyls
PCUL	preliminary cleanup level
RPD	relative percent difference
SOP	standard operating procedures
TAL	total analytes list
WAC	Washington Administrative Code
WRIA	Water Resource Inventory Area

Units of Measurement

°C	degrees centigrade
ft	feet
mg/L	milligrams per liter (parts per million)
NTU	nephelometric turbidity units
pg/L	picograms per liter (parts per quadrillion)
µg/L	micrograms per liter (parts per billion)
µS/cm	microsiemens per centimeter, a unit of conductivity

Appendices

The following appendices are linked to this report online at:
https://apps.ecology.wa.gov/publications/SummaryPages/2203019.html.

Appendix A. Monitoring Well Information

Appendix B. 2019 EPA Sampling Results Summary

Appendix C. Preliminary Cleanup Levels

Appendix D. Quality Assurance Review

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Appendix G. Metals

Appendix H. Volatile Organic Compounds

Appendix I. Semivolatile Organic Compounds

Appendix J. Pesticides

Appendix K. PCB Aroclors

Appendix L. PCB Congeners

Appendix M. Dioxins/Furans