Black Lake Grocery Groundwater Monitoring Results, October 2024: Data Summary Report

Environmental Assessment Program

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Abstract

Black Lake Grocery is an active convenience store and gas station situated on the northwestern corner of Black Lake in Thurston County, Washington. Petroleum hydrocarbon contamination was first discovered in the soil and groundwater at the Black Lake Grocery site in 1989, originating from leaking underground storage tanks. In 1995, these tanks were removed, and the surrounding contaminated soil was excavated. A permeable reactive barrier consisting of a sphagnum moss-filled pit was installed along Black Lake's shoreline in 2004. This treatment wall passively remediates contaminated groundwater as it flows from the site towards Black Lake.

Summit Envirosolutions sampled on-site monitoring wells to assess groundwater petroleum contamination between November 1993 and June 2009. In 2011, the Washington State Department of Ecology assumed responsibility for sampling at the site to monitor the efficacy of remedial actions.

This report describes water quality results from samples collected at 4 monitoring wells during the 2024 groundwater monitoring event. These samples were analyzed for benzene, toluene, ethylbenzene, xylenes (BTEX), and gasoline range total petroleum hydrocarbons (TPH-G).

Analytical results from groundwater samples collected in 2024 indicate continued contamination of the near-surface aquifer at the site. While contaminant concentrations have decreased since initial remedial activities took place in 1995, groundwater sample contaminant concentrations continue to exceed (not meet) established cleanup levels in 4 of the site's wells. Sample concentrations downgradient of the treatment wall indicate reduced BTEX and TPH-G concentrations; these concentrations also suggest that petroleum contamination is migrating from the site into Black Lake.

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Background

Black Lake Grocery, located at 4409 Black Lake Blvd Southwest in Olympia, WA, is an active convenience store and gas station. The site is situated on the northwestern shore of Black Lake (Figure 1). The store occupies a portion of a 5.2-acre parcel of land located approximately 100 ft upslope from the lakeshore. Subsurface investigations conducted in 1989 as part of a geotechnical study for the expansion of Black Lake Boulevard revealed gasoline-range petroleum hydrocarbon contamination of soil and groundwater at the site (Dames and Moore 1990).

Summit Envirosolutions (Summit) conducted initial cleanup activities at the site in 1995 in concurrence with the expansion project of Black Lake Boulevard. These activities took place between June and July 1995. They consisted of the removal of 7 underground storage tanks (USTs) and the excavation and off-site disposal of approximately 1,200 cubic yards of petroleum-contaminated soil. The footprint of the excavated soil included the area between the property boundaries at Goldsby Street and Black Lake Boulevard, and the store building itself (Figure 1). The excavation of impacted soil is a partial excavation because site soils extended under county roads and could not be fully removed (Summit 2000). Soil excavations were completed to depths ranging from approximately 10 feet to 13 feet below ground surface (bgs) (Ecology 2002).

Analytical results from soil samples collected along the perimeter of the excavated area continued to exceed (not meet) the Model Toxics Control Act (MTCA) Method A cleanup levels in soils (WAC 173-340-740) for benzene, toluene, ethylbenzene, and xylenes (BTEX), and gasoline-range total petroleum hydrocarbons (TPH-G).

Additional site characterization was conducted in 2000 by Summit through completion of a Remedial Investigation/Feasibility Study (RI/FS). At that time, a contaminant plume was delineated near the former USTs and extended downgradient to Black Lake. A stormwater culvert located under Black Lake Boulevard was found to pass through the northeastern extent of the plume. In 1995, Summit collected a groundwater sample north of this culvert, and the groundwater analytical results indicated no impact from petroleum contamination at the site (Summit 2000). This northeastern portion of the plume has not been sampled since 1995.

To reduce the remaining groundwater contamination from petroleum hydrocarbons, a remediation strategy utilizing both natural attenuation and an engineered passive treatment wall was selected in the Cleanup Action Plan (CAP) (Ecology 2002). This treatment wall was installed along the shore of Black Lake in November 2004. Treatment wall dimensions are approximately 120 ft long, 5 ft wide, and 12 ft deep. The treatment wall acts as a permeable reactive barrier, in which engineered sphagnum peat moss absorbs petroleum hydrocarbons and provides a catalytic surface that promotes the growth of microbes that degrade these contaminants. Natural attenuation mechanisms upgradient of the treatment wall are additionally intended to reduce groundwater contaminant concentrations.

Site cleanup objectives will be met when contamination concentrations do not exceed both MTCA Method A groundwater cleanup levels (WAC 173-340-720) and CAP cleanup levels (Ecology 2002). Cleanup levels established in the CAP for toluene, ethylbenzene, and xylenes are lower than the MTCA Method A groundwater cleanup levels; however, the CAP cleanup levels have been erroneously cited as MTCA Method A cleanup levels (Ecology 2002).

Groundwater monitoring activities conducted by Summit Envirosolutions between November 1993 and June 2009 indicated that concentrations of BTEX and TPH-G had decreased following both the excavation of contaminated soils and the subsequent installation of the treatment wall. While contaminant concentrations decreased throughout this monitoring period, they continued to exceed (not meet) the MTCA Method A cleanup levels for groundwater in 5 of the 11 on-site monitoring wells (Appendix A, Figures A1 – A5, Tables A1 – A11). Ecology assumed responsibility for groundwater monitoring activities in 2010 and began regularly scheduled sampling activities at the site in August 2011 to assess the efficacy of the selected remedial strategy.

In the Engineering Design Report submitted to Ecology in 2005, Summit estimated that the combination of source material excavation and biodegradation would reduce contaminant concentrations at the site to below cleanup levels by 2020 (Summit 2005). Sampling of conventional geochemical parameters (dissolved organic carbon, total and dissolved iron, sulfate, nitrate, nitrite, and turbidity) in 2011 and 2012 indicated favorable conditions for the biodegradation of hydrocarbon contamination (Marti 2013).

This data report summarizes groundwater results from four on-site wells for October 2024. The data and historical monitoring reports for this site are available at Ecology's Environmental Information Management (EIM) website www.ecy.wa.gov/eim/index.htm. Search Study ID, PMART007.

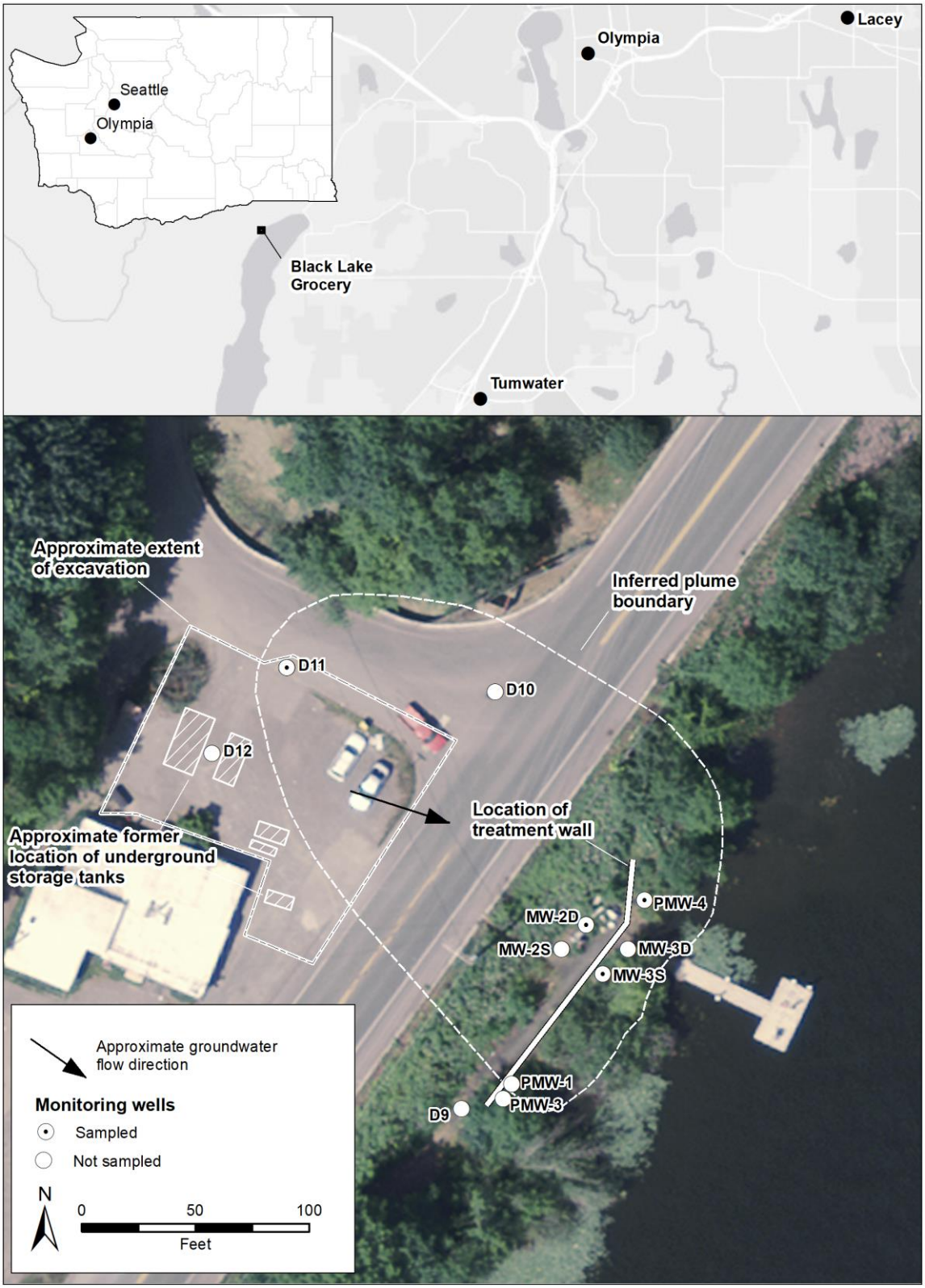

Figure 1. Black Lake Grocery Location and Site Details.
Groundwater flow direction and former UST placement based on Summit's figure and are not to scale (Summit 2004).

Methods and Results

Ecology collected groundwater samples from four monitoring wells (D11, MW-2D, MW-3S, PMW-4) at the site in October 2024 (Figure 1). Previous monitoring events indicate that contaminant concentrations continue to exceed site cleanup levels in three of these wells. Groundwater monitoring wells MW-2S and D-10 were not sampled during this event. Although contaminant concentrations at D-10 have historically been high, the well is low-yielding, and water level recovery is slow. This well is also difficult to access due to traffic along Black Lake Boulevard. Well MW-2S is a shallow well that is also low-yielding and slow to recover. During this monitoring event, the well did not recover enough water to sample following initial purging activities.

Ecology conducted this monitoring event utilizing industry-standard, low-flow sampling techniques. Low yields and slow water level recovery at the site wells necessitated the use of a peristaltic pump with dedicated tubing for purging and sampling procedures. Well purging was conducted through continuously pumping water into a flow-through cell at a rate of 0.5 liter/minute or below. Well purging was considered complete upon field parameter (pH, temperature, specific conductance, dissolved oxygen, and oxidization-reduction potential) stabilization as outlined by SOP EAP078 (Ecology 2024). Well construction information and measured water levels are provided below in Table 1. Stabilized field parameters are provided in Table 2.

Table 1. Well construction details and water levels for October 2024.

Well ID	Land Surface Elevation (feet, NAVD88)	Well Depth (feet bgs)	Screened Interval (feet bgs)	2024 Groundwater Elevation (feet, NAVD88)
D11	136.08	15	5 – 15	130.13
MW-2D	132.77	15	12 – 15	128.85
MW-2S	131.97	5	2 – 5	129.77
MW-3S	131.11	5	2 – 5	127.94
PMW-4	132.14	11	1 – 11	129.82

bgs: Below ground surface.
NAVD88: North American Vertical Datum of 1988.

Water levels measured during the October 2024 monitoring event decreased compared to the April 2023 monitoring event (Figures A2 – A5). Groundwater elevations decreased between 0.8 ft and 2.73 ft at wells MW-2S and MW-2D, respectively. This decrease in groundwater elevation reflects the observed trend of seasonal groundwater level variation.

Table 2. Field measurements from October 2024 sampling.

Well ID	pH (std. units)	Specific Conductivity (µS/cm)	Dissolved Oxygen (mg/L)	Oxidation-Reduction Potential (mV)	Turbidity (NTU)
D11	6.2	579	0.2	-24	1.9
MW-2D	6.7	283	2.4	27	7.5
MW-3S	6.1	475	0.3	-56	5.8
PMW-4	6.3	389	0.2	-65	2.5

std. units: Standard units
µS/cm: Microsiemens per centimeter
mg/L: Milligrams per liter
mV: Millivolts
NTU: Nephelometric turbidity units

Groundwater samples collected during the October 2024 monitoring event were submitted to the Manchester Environmental Laboratory under standard chain-of-custody procedures for analysis of BTEX and TPH-G. Sampling locations are chosen to assess contaminant concentrations upgradient and downgradient from the treatment wall. Analytical results for BTEX and TPH-G are summarized in Table 3 and are displayed by analyte in Figure A5. These results are compared to both the CAP cleanup levels for the site (Ecology 2002) and the MTCA Method A groundwater cleanup levels (WAC 173-340-720).

For quality control purposes, a field duplicate sample was collected from well PMW-4 and submitted as a blind duplicate to the laboratory. Relative percent differences (RPDs) were calculated utilizing analytical results from both the parent and duplicate samples as specified in the Quality Assurance Project Plan (Marti 2011). RPDs for all analytes ranged from 4.3% to 16.9% (Table 4).

Table 3. Analytical results from the October 2024 sampling and associated cleanup levels.

Well ID	Benzene	Toluene	Ethylbenzene	Total Xylenes[a]	TPH-G
D11	**615**	**66.3**	**630**	**170.4**	**8180**
MW-2D	1U	1U	1U	3U	70U
MW-3S	**13.1**	**3.15**	1U	**150**	**447**
PMW-4	**6.92**	**1.97**	**56.3**	**49.3**	**1060**
CAP cleanup levels	**5**	**40**	**30**	**20**	**1000**
MTCA cleanup levels	**5**	**1000**	**700**	**1000**	**800 – 1000** [b]

Note. All concentrations are in µg/L.
Bold: Analyte was detected.
Underline: Values are greater than the CAP or MTCA Method A cleanup levels; the most protective level is used.
U: Analyte was not detected at or above the reported value.
CAP: Cleanup Action Plan (Ecology 2002).
MTCA: MTCA Method A Groundwater Cleanup Level (WAC 173-340-720).
[a] The reported total xylenes concentration is the sum of isomers m,p-xylene and o-xylene.
[b] The MTCA Method A cleanup limit for TPH-G is 800 µg/L when benzene is present, and 1000 µg/L when benzene is not present.

Table 4. Relative percent differences of duplicate results from well PMW-4.

Analyte	PMW-4 (µg/L)	PMW-4 Duplicate (µg/L)	RPD (%)
Benzene	5.84	6.92	16.9
Toluene	1.70	1.97	14.7
Ethylbenzene	51.2	56.3	9.5
m, p-Xylene	45.4	47.4	4.3
o-Xylene	1.70	1.94	13.2
TPH-G	1060	998	6.0

µg/L: Micrograms per liter
RPD: Relative percent difference

All calculated RPDs were within the data quality objective (DQO) of 30% as established in the QAPP (Marti 2011). Analytical results presented in this report represent the highest detected concentrations of each analyte between the parent and duplicate samples. The results of the laboratory data quality control and quality assurance indicate that the analytical performance was good. All results are considered usable as reported.

Historical data collected at the site from 1993 through 2024 are presented in Figures A2 – A5 and Tables A1 – A11.

Upper Portion of the Project Area — Well D11

Well D11 is located along Goldsby Street near the north-central extent of the excavated area. Analytical results indicate that BTEX and TPH-G concentrations in well D11 continue to exceed (not meet) the most stringent cleanup levels (Table 3). Concentrations of contaminants in well D11 have generally decreased since sampling began in the mid- to late-1990s; however, benzene, ethylbenzene, total xylenes, and TPH-G concentrations remain significantly elevated above cleanup levels (Figure A2). BTEX and TPH-G concentrations in well D11 remain among the highest in the Black Lake Grocery project area.

In October 2024, BTEX and TPH-G concentrations decreased from April 2023 concentrations (Figure A2, Table A3).

Groundwater Upgradient of the Treatment Wall — Wells MW-2S, MW-2D

Wells MW-2S and MW-2D are housed in a well cluster located along the base of a bluff, approximately 100 feet downgradient from the former USTs, along the upgradient side of the treatment wall. Wells MW-2S and MW-2D are both relatively shallow wells, with completion depths of 5 ft bgs and 15 ft bgs, respectively. Well MW-2S typically reports the highest concentrations of the regularly sampled wells but could not be sampled during this event due to low recovery of water following purging (Figure A3, Table A8).

Analytical results from the deeper well MW-2D indicate concentrations below the reporting limits for all contaminants. Samples collected at this well have had concentrations below reporting limits since 2013, having decreased substantially following interim remedial action (Table A9).

Groundwater Downgradient of the Treatment Wall — Wells MW-3S, PMW-4

Well MW-3S is located approximately 20 feet southeast of well MW-2S along the downgradient side of the treatment wall. Well MW-3S is a shallow well, with a completion depth of about 5 ft bgs.

Benzene concentrations in MW-3S continue to exceed (not meet) both the CAP cleanup level and the MTCA Method A cleanup level, while concentrations of total xylenes exceeded only the CAP cleanup level. Concentrations of TPH-G and toluene were below the most stringent cleanup levels, and ethylbenzene was not detected above the laboratory reporting limit. (Table 3)

BTEX concentrations in well MW-3S were initially similar to those found in samples collected at well MW-2S and had decreased up to 99% within 6 months of treatment wall installation in 2005 (Figure A4). Following a rapid decline, concentrations began to steadily increase and then started to level off in 2011. Contaminant concentrations have gradually decreased at MW-3S since 2014 (Figure A4, Table A10). In October 2024, benzene, total xylenes, and TPH-G decreased compared to April 2023 concentrations. These decreases reflect an apparent seasonal trend in concentrations of these analytes. This trend shows an increase in

concentration during spring sampling events and a decrease in the fall, with an overall downward trend since 2015.

Well PMW-4 is located on the northern extent of the downgradient side of the treatment wall and is completed to approximately 10 ft bgs. Analytical results indicate that concentrations of benzene and TPH-G at PMW-4 continue to exceed (not meet) both the CAP cleanup levels and MTCA Method A cleanup levels (Table 3). Detected concentrations of ethylbenzene and total xylenes were above the CAP cleanup levels, but below the MTCA cleanup levels, and toluene was below both cleanup levels. All analytes increased at PMW-4 compared to the sample collected during the April 2023 monitoring event (Table A7). While TPH-G concentrations at PMW-4 were higher than the most stringent cleanup levels in October 2024, this analyte has fluctuated considerably throughout monitoring events, with concentrations that typically exceed (do not meet) established cleanup levels. BTEX concentrations have generally decreased since monitoring began in 2005 (Figure A5, Table A7).

Conclusions

Analytical results from the October 2024 groundwater monitoring event confirm that the near-surface aquifer at Black Lake Grocery continues to be impacted by petroleum hydrocarbon contamination. Samples collected on both the upgradient and downgradient sides of the treatment wall continue to exceed (not meet) applicable cleanup limits for at least one analyte in 3 of the 4 wells sampled (D11, MW-3S, PMW-4) (Table 3).

Following partial soil excavation and removal in 1995 and the installation of a treatment wall in 2004, contaminant concentrations have decreased at the Black Lake Grocery site. Since 2015, analytical results from wells MW-2S and MW-3S have shown pronounced seasonal variations in contaminant concentrations that correlate with seasonal changes in groundwater levels. BTEX and TPH-G concentrations are relatively low in the fall when groundwater levels are lowest and increase in the spring as groundwater levels rise. This apparent trend continued as indicated by analytical results from samples collected at well MW-3S during the 2024 groundwater monitoring event (Figure A3). Well MW-2S would be expected to show the same trend, as there was a similar seasonal water level drop; however, there is no data for this sampling event. This seasonal trend generally appears weaker in wells D11 and PMW-4 (Figures A2 and A5).

Comparison of historical analytical results from upgradient well MW-2S to downgradient wells MW-3S and PMW-4 demonstrates a decrease in contaminant concentrations by an order of magnitude or greater on the downgradient side of the treatment wall. This decrease suggests that the treatment wall removes contaminants from groundwater. The engineered material within the treatment wall is known to have limited capacity to adsorb and react with contaminants and has been used in on-site application for over twenty years.

While previous samples collected from near-shore sediment and the water of Black Lake did not contain reportable concentrations of BTEX and TPH-G (Coots 2005), the continued detection of petroleum contamination in wells MW-3S and PMW-4 suggests that the contaminant plume likely extends into Black Lake. Wells MW-3S and PMW-4 are located less

than 10 feet from the lakeshore, and no further remedial measures extend beyond the treatment wall.

Recommendations

Analysis of the October 2024 monitoring results yields the following recommendations:

- Due to continued contaminant concentrations in excess (not meeting) of established cleanup levels, groundwater monitoring at the Black Lake Grocery site should continue. This monitoring will provide information regarding the efficacy of the treatment wall as it may be approaching the end of its treatment capacity. Potential increases in contaminant concentrations downgradient of the treatment wall may occur as the sorptive or reactive capacity of the engineered material is exhausted.
- Further characterization may provide better insight into site conditions, including the extent of the contaminant plume near the northern edge of the site and into Black Lake. Additional sampling would help determine whether the treatment wall effectiveness is adequate or if alternative remedial strategies should be considered. Further sampling and characterization of the site using conventional parameters may help assess the effectiveness of the treatment wall, as in a previous Ecology study (Marti 2013). Collection of samples within the lake using temporary piezometers or a push-point sampler will additionally facilitate better plume delineation.

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WAC 173-340-740. Unrestricted Land Use Soil Cleanup Standards. Washington State Department of Ecology, Olympia, WA.

Appendix A. Sampling Results, 1993 – 2024

This appendix presents sampling data from Black Lake Grocery monitoring wells from 1993 through 2024.

The following qualifiers, symbols, and abbreviations are used in the tables below:

- **Bold**: Analyte was detected.
- **Underline**: Values are greater than the CAP cleanup levels.
- U: Analyte was not detected at or above the reported value.
- J: Analyte was detected, and the reported numerical value is an estimate.
- REJ: Sample results rejected, the presence or absence of the analyte cannot be verified.
- —: Not Sampled
- CAP CL: Cleanup Action Plan Cleanup Limit.

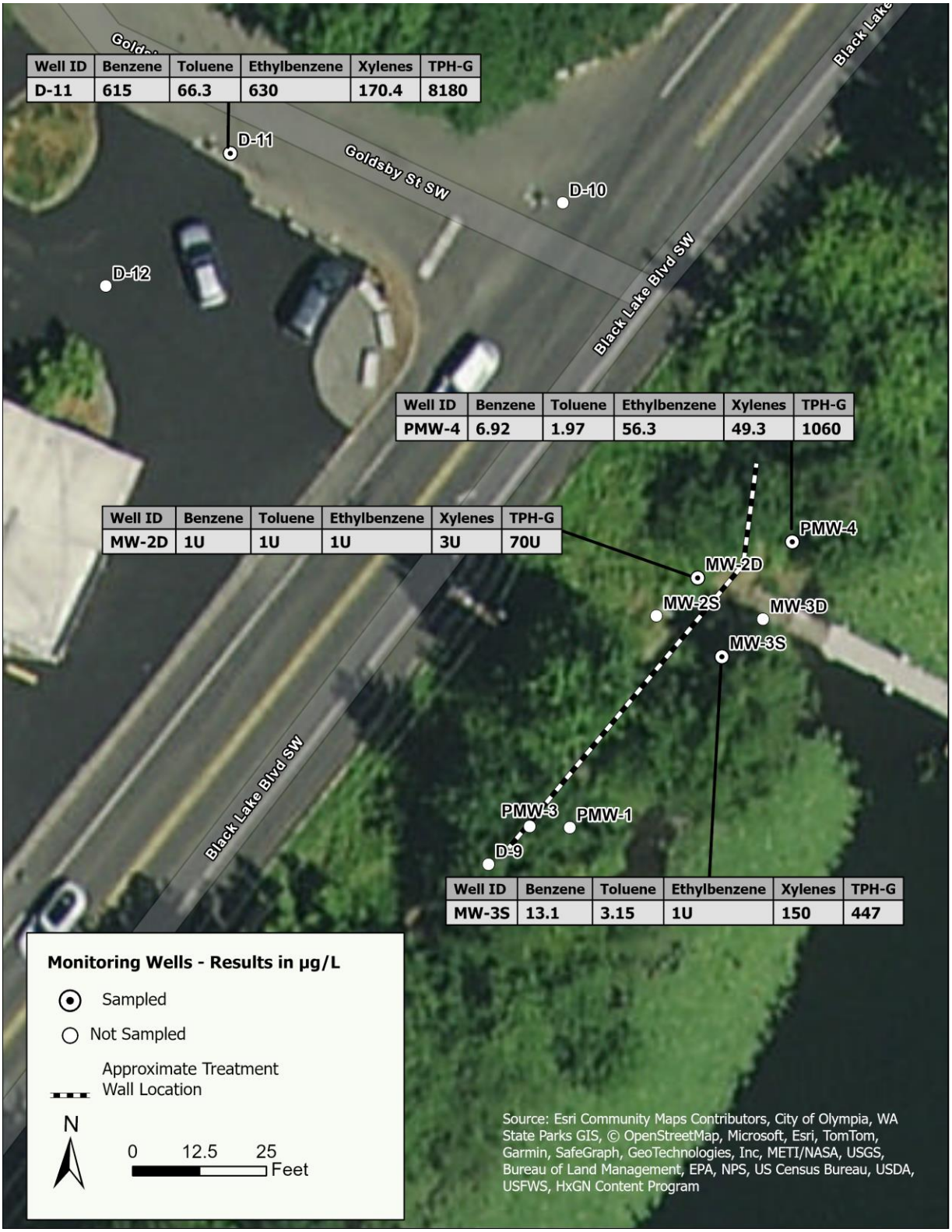

Figure A1. BTEX and TPH-G concentrations for all wells sampled during October 2024.

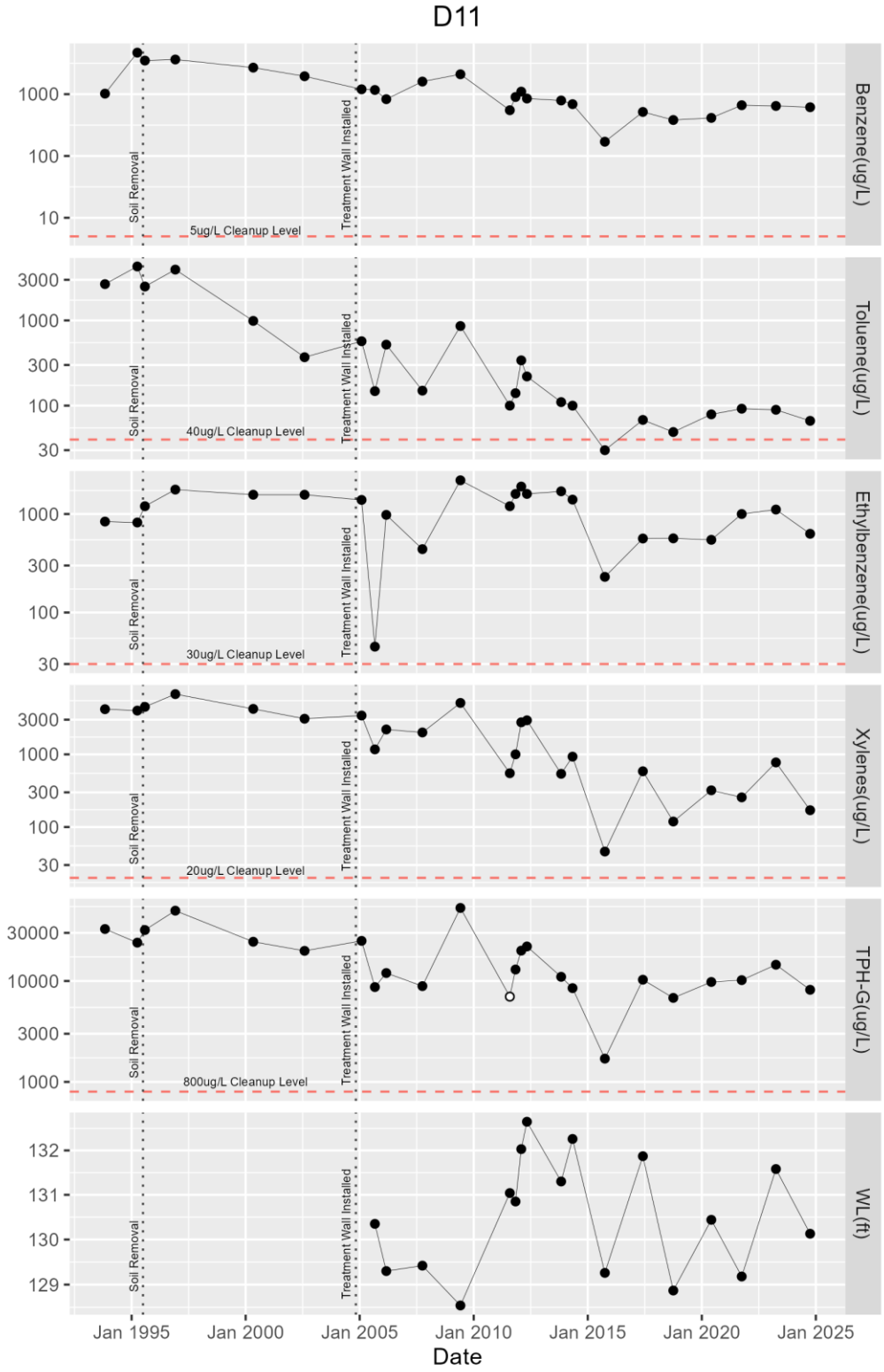

Figure A2. Contaminant concentrations (µg/L, log scale) and groundwater elevations (ft) for well D11, November 1993 to October 2024.

Open circles indicate the analyte was not detected and are plotted at one-half the reporting limit.

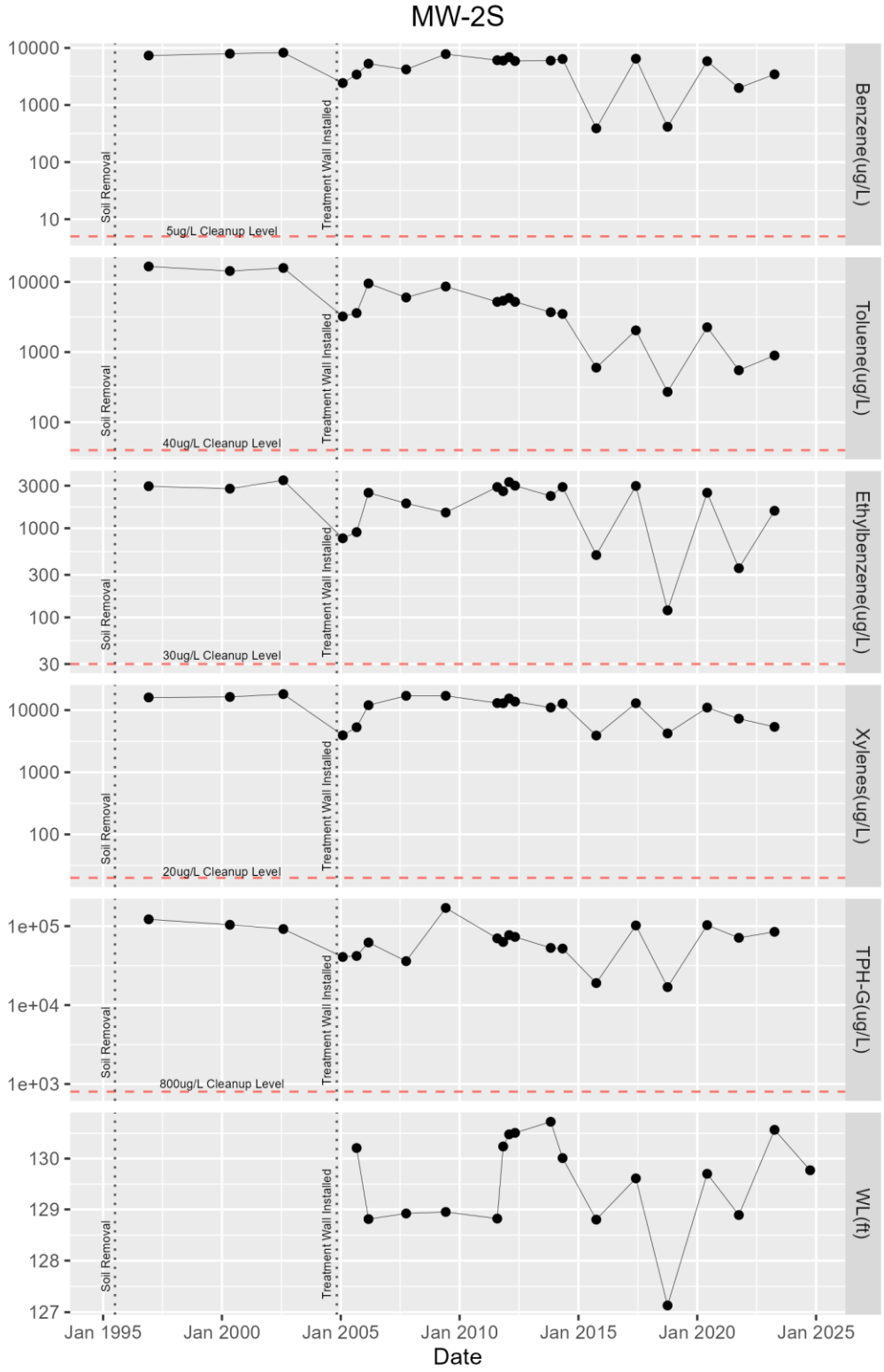

Figure A3. Contaminant concentrations (µg/L, log scale) and groundwater elevations (ft) for well MW-2S, November 1993 to October 2024.

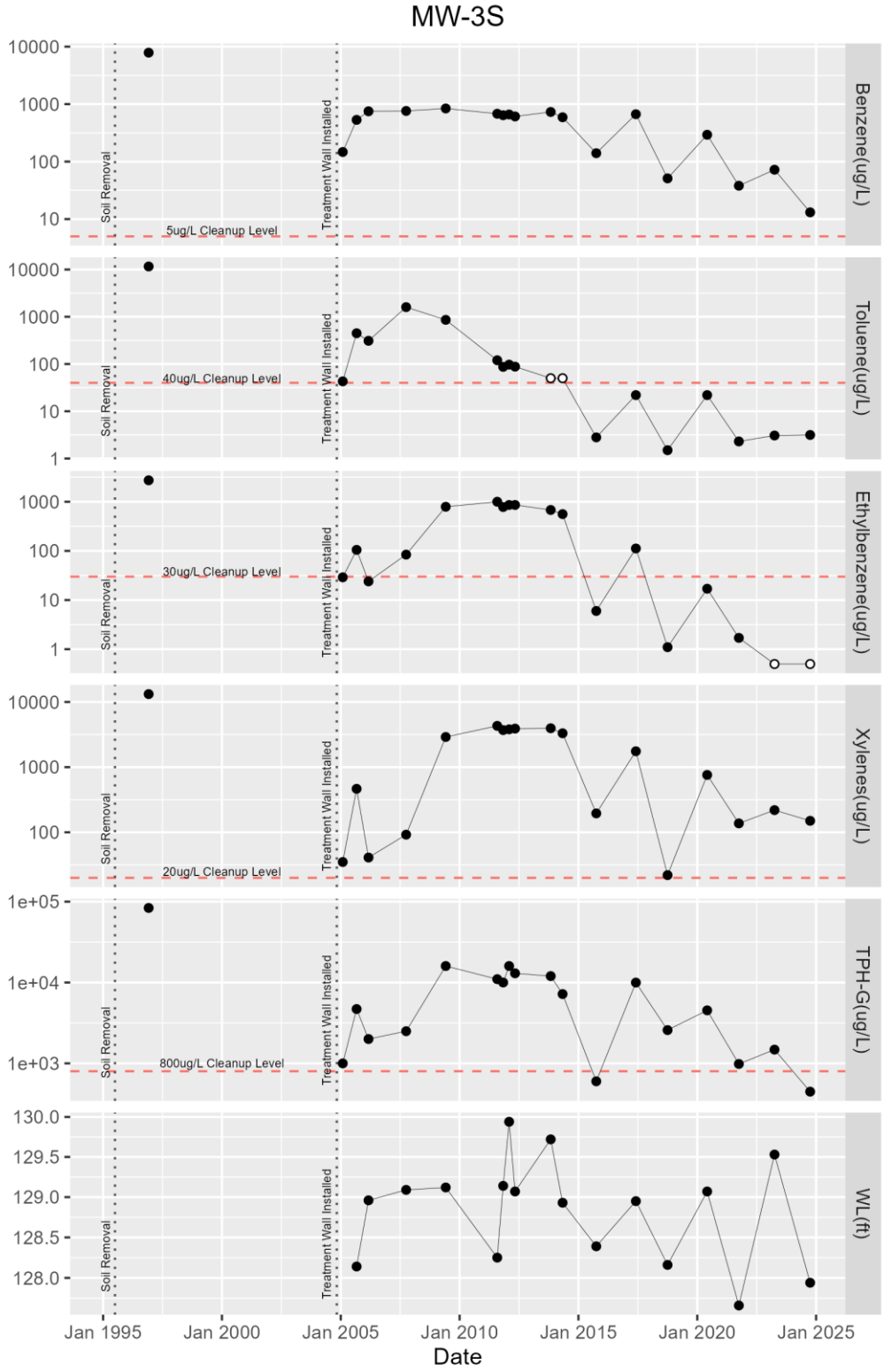

Figure A4. Contaminant concentrations (µg/L, log scale) and groundwater elevations (ft) for well MW-3S, November 1993 to October 2024.

Open circles indicate the analyte was not detected and are plotted at one-half the reporting limit.

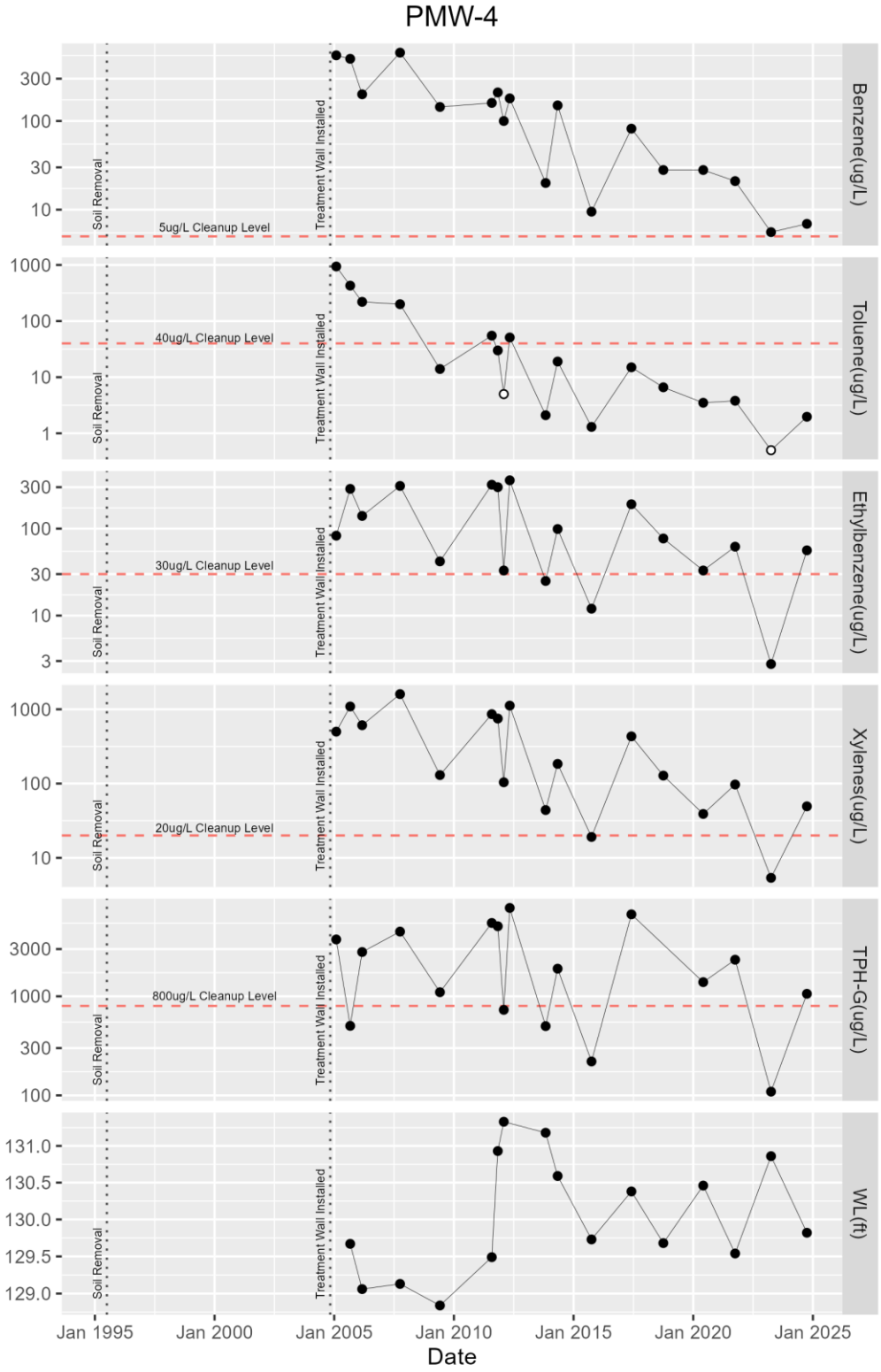

Figure A5. Contaminant concentrations (µg/L, log scale) and groundwater elevations (ft) for well PMW-4, November 1993 to October 2024.

Open circles indicate the analyte was not detected and are plotted at one-half the reporting limit.

Table A1. Analytical results in µg/L from 1993 to 2014 for monitoring well D9.

Date	Benzene	Toluene	Ethylbenzene	Total Xylenes	TPH-G
Nov-93	**909**	**3520**	**1720**	**6050**	**57,570**
Apr-95	**830**	**1500**	**1300**	**2600**	**28,000**
Aug-95	**570**	**680**	**510**	**1100**	**13,000**
Dec-96	**164**	**190**	**170**	**418**	**3300**
Feb-05	1 U	**8.4**	**4.9**	**33**	**1510**
Sep-05	1 U	**17**	**3.7**	**18**	**160**
Mar-06	1 U	1 U	1 U	1 U	100 U
Oct-07	1 U	1 U	1 U	1 U	100 U
Sep-09	1 U	1 U	1 U	1 U	100 U
Aug-11	1 U	1 U	1 U	3 U	140 U
Nov-11	1 U	1 U	1 U	3 U	40 U
Feb-12	1 U	1 U	1 U	3 U	70 U
May-12	1 U	1 U	1 U	3 U	70 U
Nov-13	1 U	1 U	1 U	3 U	70 U
May-14	1 U	1 U	1 U	3 U	70 U
CAP CL	**5**	**40**	**30**	**20**	**800**

Table A2. Analytical results in µg/L from 1993 to 2013 for monitoring well D10.

Date	Benzene	Toluene	Ethylbenzene	Total Xylenes	TPH-G
Nov-93	**8450**	**8670**	**1450**	**5260**	**30,680**
Dec-96	**8150**	**4830**	**2190**	**9680**	**45,500**
May-00	**5580**	**931**	**1070**	**3660**	**40,700**
Aug-02	**8270**	**674**	**1680**	**3290**	**32,100**
Feb-05	**706**	**79**	**237**	**295**	**5420**
Sep-05	**3440**	**368**	**525**	**1050**	**15,700**
Mar-06	**4000**	**150**	**570**	**290**	**9000**
Oct-07	**510**	**22**	**38**	**190**	**1300**
Sep-09	**3700**	**130**	**540**	**290**	**6800**
Aug-11	**4400**	**120**	**700**	**400**	**3300**
Nov-11	**2700**	100 U	**360**	300 U	**2300**
Feb-12	**5800**	100 U	**910**	**750**	**4700**
May-12	**2000**	**58**	**410**	**450**	**2500**
Nov-13	REJ	REJ	REJ	REJ	REJ
CAP CL	**5**	**40**	**30**	**20**	**800**

Table A3. Analytical results in µg/L from 1993 to 2024 for monitoring well D11.

Date	Benzene	Toluene	Ethylbenzene	Total Xylenes	TPH-G
Nov-93	1020	2670	838	4180	32750
Apr-95	4700	4300	820	4000	24000
Aug-95	3500	2500	1200	4500	32000
Dec-96	3640	3950	1770	6740	49800
May-00	2690	988	1570	4220	24500
Aug-02	1950	370	1570	3090	19900
Feb-05	1200	570	1390	3420	25000
Sep-05	1170	148	45	1170	8710
Mar-06	830	520	980	2200	12000
Oct-07	1600	150	440	2000	8900
Sep-09	2100	860	2200	5100	53000
Aug-11	550	100	1200	550	140 U
Nov-11	900	140	1600	1000	13000
Feb-12	1100	340	1900	2760	20000
May-12	850	220	1600	2940	22000
Nov-13	790	110	1700	540	11000
May-14	690	100	1400	930	8500
Oct-15	170	30	230	46	1700
Jun-17	516	68	564	585	10300
Oct-18	382	49	566	119	6800
Jun-20	413	79	547	320J	9780
Oct-21	663	92	1000	256	10200
Apr-23	645	89	1110	774	14500
Oct-24	615	66	630	170	8180
CAP CL	5	40	30	20	800

Table A4. Analytical results in µg/L from 1995 to 2014 for monitoring well D12.

Date	Benzene	Toluene	Ethylbenzene	Total Xylenes	TPH-G
Aug-95	**0.5**	0.5 U	**0.7**	1 U	50 U
Dec-96	0.5 U	0.5 U	0.5 U	1 U	50 U
May-00	0.5 U	0.5 U	0.5 U	1 U	50 U
Aug-02	0.5 U	2 U	1 U	1.5 U	100 U
Feb-05	**17**	**34**	**5.8**	**31**	**360**
Sep-05	**2.2**	**1.4**	1 U	**2**	100 U
Mar-06	**1.6**	1 U	1 U	**15**	100 U
Oct-07	**9.6**	1 U	1 U	**24**	**140**
Sep-09	1 U	1 U	1 U	3 U	100 U
Aug-11	1 U	1 U	1 U	3 U	140 U
Nov-11	1 U	1 U	1 U	3 U	40 U
Feb-12	1 U	1 U	1 U	3 U	70 U
May-12	1 U	1 U	1 U	3 U	70 U
Nov-13	1 U	1 U	1 U	3 U	70 U
May-14	1 U	1 U	1 U	3 U	70 U
CAP CL	**5**	**40**	**30**	**20**	**800**

Table A5. Analytical results in µg/L from 2005 to 2014 for monitoring well PMW-1.

Date	Benzene	Toluene	Ethylbenzene	Total Xylenes	TPH-G
Feb-05	1 U	1 U	1 U	1 U	100 U
Sep-05	**272**	**7.2**	**2.3**	**11**	100 U
Mar-06	1 U	**6.7**	1 U	1 U	100 U
Oct-07	1 U	1 U	1 U	1 U	100 U
Sep-09	1 U	**2.4**	1 U	3 U	100 U
Aug-11	1 U	1 U	1 U	3 U	140 U
Nov-11	**2.5**	**6.6**	**4.2**	**9.4**	**110**
Feb-12	**1.9**	**18**	**2.3**	**5.3**	**92**
May-12	**1.3**	**9.5**	**4**	**7.2**	**83**
Nov-13	**1.6**	**1.1**	**1.1**	**8.9**	70 U
May-14	**3.6**	**1.1**	**1.8**	**16**	70 U
CAP CL	**5**	**40**	**30**	**20**	**800**

Table A6. Analytical results in µg/L from 2005 to 2014 for monitoring well PMW-3.

Date	Benzene	Toluene	Ethylbenzene	Total Xylenes	TPH-G
Feb-05	**1.1**	**8.7**	1 U	1 U	**125**
Sep-05	**14**	**296**	**9.7**	**33**	**523**
Mar-06	**2.7**	**320**	1 U	**16**	**480**
Oct-07	**6.1**	**340**	**27**	**34**	**480**
Sep-09	1 U	1 U	1 U	3 U	**150**
Aug-11	1 U	1 U	1 U	3 U	140 U
Nov-11	1 U	**5.4**	1 U	3 U	40 U
Feb-12	1 U	1 U	1 U	3 U	70 U
May-12	1 U	**1.5**	1 U	3 U	70 U
Nov-13	1 U	1 U	1 U	3 U	70 U
May-14	1 U	1 U	1 U	3 U	70 U
CAP CL	**5**	**40**	**30**	**20**	**800**

Table A7. Analytical results in µg/L from 2005 to 2024 for monitoring well PMW-4.

Date	Benzene	Toluene	Ethylbenzene	Total Xylenes	TPH-G
Feb-05	**550**	**940**	**83**	**500**	**3750**
Sep-05	**503**	**428**	**287**	**1090**	**503**
Mar-06	**200**	**220**	**140**	**610**	**2800**
Oct-07	**590**	**200**	**310**	**1600**	**4500**
Sep-09	**144**	**14**	**42**	**130**	**1100**
Aug-11	**160**	**55**	**320**	**860**	**5500**
Nov-11	**210**	**30**	**300**	**750**	**5100**
Feb-12	**100**	10U	**33**	**104**	**730**
May-12	**180**	**51**	**360**	**1120**	**7800**
Nov-13	**20**	**2.1**	**25**	**44**	**500**
May-14	**150**	**19**	**99**	**184**	**1900**
Oct-15	**9.5J**	**1.3**	**16J**	**19.1J**	**220**
Jun-17	**82**	**15**	**191**	**432**	**6720**
Oct-18	**28**	**6.6**	**77**	**128**	**REJ**
Jun-20	**28**	**3.5J**	**33**	**39**	**1390**
Oct-21	**21J**	**3.8J**	**62J**	**97J**	**2340J**
Apr-23	**5.6**	1U	**2.8**	**5.4**	**109**
Oct-24	**6.9**	**2.0**	**56**	**49**	**1060**
CAP CL	**5**	**40**	**30**	**20**	**800**

Table A8. Analytical results in µg/L from 1996 to 2023 for monitoring well MW-2S.

Date	Benzene	Toluene	Ethylbenzene	Total Xylenes	TPH-G
Dec-96	7360	16600	2960	16000	122000
May-00	7930	14300	2780	16300	104000
Aug-02	8270	15800	3450	18100	91800
Feb-05	2430	3220	771	3930	40700
Sep-05	3420	3600	904	5300	41900
Mar-06	5300	9500	2500	12000	62000
Oct-07	4200	6000	1900	17000	36000
Sep-09	7800	8600	1500	17000	170000
Aug-11	6100	5200	2900	13000	70000
Nov-11	6000	5400	2600	12900	63000
Feb-12	6900	5900	3300	15400	77000
May-12	5900	5200	3000	13700	73000
Nov-13	6000	3700	2300	11000	53000
May-14	6400	3500	2900	12700	52000
Oct-15	390	600	500	3900	19000
Jun-17	6480	2040	2980	12930	102000
Oct-18	416J	271J	120J	4220J	16900J
Jun-20	5860	2260	2500	10980	103000
Oct-21	1990J	551J	356J	7280J	71100J
Apr-23	3450	894	1570J	5380	84700
CAP CL	5	40	30	20	800

Table A9. Analytical results in µg/L from 1996 to 2024 for monitoring well MW-2D.

Date	Benzene	Toluene	Ethylbenzene	Total Xylenes	TPH-G
Dec-96	**3040**	**7300**	**1830**	**10,700**	**64,000**
May-00	**787**	**29**	**42**	**13**	**425**
Aug-02	**4.2**	2 U	1 U	1.5 U	**219**
Feb-05	**47**	**105**	**23**	**139**	**1200**
Sep-05	**63**	**21**	**3.7**	**31**	**395**
Sep-09	**3.5**	1 U	1 U	3 U	100 U
Aug-11	1 U	1 U	1 U	3 U	140 U
Nov-11	**19**	1 U	1 U	3 U	40 U
Feb-12	**50**	1 U	1 U	3 U	70 U
May-12	**30**	1 U	1 U	3 U	70 U
Nov-13	**36**	1 U	1 U	3 U	70 U
May-14	1 U	1 U	1 U	3 U	70 U
Oct-15	1 U	1 U	1 U	3 U	70 U
Jun-17	1 U	1 U	1 U	3 U	70 U
Oct-18	1 U	1 U	1 U	3 U	70 U
Jun-20	1 U	1 U	1 U	3 U	70 U
Oct-21	1 U	1 U	1 U	3 U	70 U
Apr-23	1 U	1 U	1 U	3 U	70 U
Oct-24	1 U	1 U	1 U	3 U	70 U
CAP CL	**5**	**40**	**30**	**20**	**800**

Table A10. Analytical results from 1996 to 2024 for monitoring well MW-3S.

Date	Benzene	Toluene	Ethylbenzene	Total Xylenes	TPH-G
Dec-96	**7860**	**11600**	**2730**	**13200**	**83600**
Feb-05	**147**	**43**	**29**	**35**	**1000**
Sep-05	**532**	**448**	**105**	**465**	**4700**
Mar-06	**750**	**310**	**24**	**41**	**2000**
Oct-07	**760**	**1600**	**84**	**92**	**2500**
Sep-09	**840**	**860**	**790**	**2900**	**16000**
Aug-11	**680**	**120**	**1000**	**4300**	**11000**
Nov-11	**640**	**87**	**780**	**3700**	**10000**
Feb-12	**660**	**97**	**860**	**3800**	**16000**
May-12	**610**	**88**	**860**	**3900**	**13000**
Nov-13	**730**	100U	**680**	**3950**	**12000**
May-14	**590**	100U	**560**	**3310**	**7200**
Oct-15	**140**	**2.8**	**6**	**195**	**600**
Jun-17	**667**	**22**	**112**	**1753**	**9980**
Oct-18	**51**	**1.5**	**1.1**	**22**	**2580**
Jun-20	**293**	**22**	**17**	**759J**	**4530**
Oct-21	**38**	**2.3**	**1.7**	**137**	**984**
Apr-23	**72**	**3.1**	1 U	**219**	**1480**
Oct-24	**13**	**3.2**	1 U	**150**	**447**
CAP CL	**5**	**40**	**30**	**20**	**800**

Table A11. Analytical results from 1996 to 2014 for monitoring well MW-3D.

Date	Benzene	Toluene	Ethylbenzene	Total Xylenes	TPH-G
Dec-96	**132**	**138**	**21**	**1440**	**11,600**
Aug-02	0.5 U	2 U	1 U	1.5 U	100 U
Feb-05	1 U	1 U	1 U	1 U	100 U
Sep-05	**78**	**89**	**16**	**100**	**800**
Mar-06	**1.6**	1 U	1 U	1 U	100 U
Oct-07	**51**	**70**	**44**	**190**	**490**
Sep-09	1 U	**1.4**	1 U	**5**	100 U
Aug-11	1 U	1 U	1 U	3 U	140 U
Nov-11	1 U	1 U	1 U	3 U	40 U
Feb-12	1 U	1 U	1 U	3 U	70 U
May-12	1 U	1 U	1 U	3 U	70 U
Nov-13	1 U	1 U	1 U	3 U	70 U
May-14	1 U	1 U	1 U	3 U	70 U
CAP CL	**5**	**40**	**30**	**20**	**800**