

Shelton Laundry and Cleaners Groundwater Monitoring Results, April and October 2023: Data Summary Report



Environmental Assessment Program

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Abstract

This report summarizes the results of groundwater testing done in April and October 2023 at the Shelton Laundry and Cleaners site (the site) in Shelton, WA. The shallow groundwater at the site is contaminated with chlorinated volatile organic compounds (cVOCs), including tetrachloroethene (PCE) and its breakdown products. The contaminant source likely came from a solvent spill outside the dry cleaner's building in 1993. The Washington State Department of Ecology (Ecology) was made aware of this spill in 1997 and took over monitoring the groundwater in 2002. In June 2005, Ecology conducted cleanup efforts by injecting a hydrogen release compound (HRC®) into the groundwater near well 4W to help treat the contamination.

Groundwater samples were collected from four shallow monitoring wells at the site in April and October 2023. PCE concentrations were found in higher amounts than the cleanup standard of 5 µg/L in samples from well 4W, with 209 µg/L in April and 6.61 µg/L in October. A breakdown product of PCE, called trichloroethene (TCE), also exceeded the cleanup standard in April 2023. The remaining samples were below cleanup levels for PCE and its breakdown products, including TCE, cis-1,2-Dichloroethene (DCE), and vinyl chloride (VC).

This report also describes the results from samples collected at monitoring well 4W using 2 different pumps — a small-diameter mechanical bladder pump and a peristaltic pump. Recent tests suggest that the bladder pump sample collection might underestimate contaminant levels, indicating that the groundwater at the Shelton Laundry Cleaners site has higher concentrations of cVOCs than previously thought.

Ecology will continue monitoring the groundwater at the site until PCE concentrations in all wells drop below the safe cleanup standard.

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Background

The Shelton Laundry and Cleaners site (the site) currently operates as a laundromat and formerly housed a dry-cleaner and is located at 117 N 1st St. in Shelton, Washington (Figure 1). Tetrachloroethene (PCE) contamination was discovered at the site in 1997 during an Environmental Site Assessment (ESA) conducted by a consulting firm working for the adjacent Wells Fargo Bank (GeoEngineers 2000). Initial investigation was conducted at the site between 1997 and 2000 and determined that PCE contamination was impacting the groundwater in the southeastern extent of the site, beneath the alley. The PCE contamination source likely originated from a solvent spill that occurred in 1993 behind the dry cleaner's commercial building (GeoEngineers 2000).

Detected concentrations of PCE from samples collected at the site's shallow groundwater monitoring wells (approximate depths of 15 feet) showed that the contamination was primarily located in well 4W, which is located closest to the reported spill. Throughout the 1997 to 2000 investigation, PCE concentrations at 4W decreased from 280 µg/L to 25 µg/L (GeoEngineers 2000; Appendix A, Tables A1 through A4).

Ecology conducted a follow-up groundwater study in 2002, consisting of the installation of four new wells (MW-5, MW-6, MW-7, MW-8) which were completed to greater depths, ranging from approximately 45 feet (ft) below ground surface (bgs) to 60 ft bgs. PCE was not detected in samples collected from the deep wells, indicating that PCE had not migrated downward. Deep wells MW-7 and MW-8, and shallow well 8W were removed from the sampling schedule in 2003 and have not since been sampled. In monitoring events between 2002 and 2005, PCE was detected in well 4W at concentrations ranging between 10 µg/L and 25 µg/L.

Remedial activities were conducted at the site in 2005, consisting of injection of a hydrogen release compound (HRC®) into groundwater to promote biodegradation of cVOC's at the site. The HRC was injected to depths ranging between 5 ft bgs and 16 ft bgs at 16 locations between wells 4W and 7W (Balaraju 2005). Results from samples collected in the year following the HRC injection indicated that enhanced degradation of cVOC's was occurring at the site.

PCE, trichloroethene (TCE), and cis-1,2-dichloroethene (DCE) concentrations fluctuated considerably in the months following HRC injection (Appendix A, Figure A1). cVOC concentrations in well 4W reached their lowest in August 2006, 15 months following injection. Beginning in 2007, PCE concentrations in 4W increased gradually to pre-injection levels. The effective period of an HRC injection is typically 12 to 18 months, which is roughly the timespan that PCE concentrations were reduced at 4W (Willett et al. 2004).

Ecology continues to monitor the site's groundwater because PCE concentrations in well 4W are still elevated above (not meeting) the Model Toxics Control Act (MTCA) Method A cleanup level of 5 µg/L.

The data and associated monitoring reports for this project are available at Ecology's Environmental Information Management (EIM) website www.ecy.wa.gov/eim/index.htm. Search Study ID, PMART001.

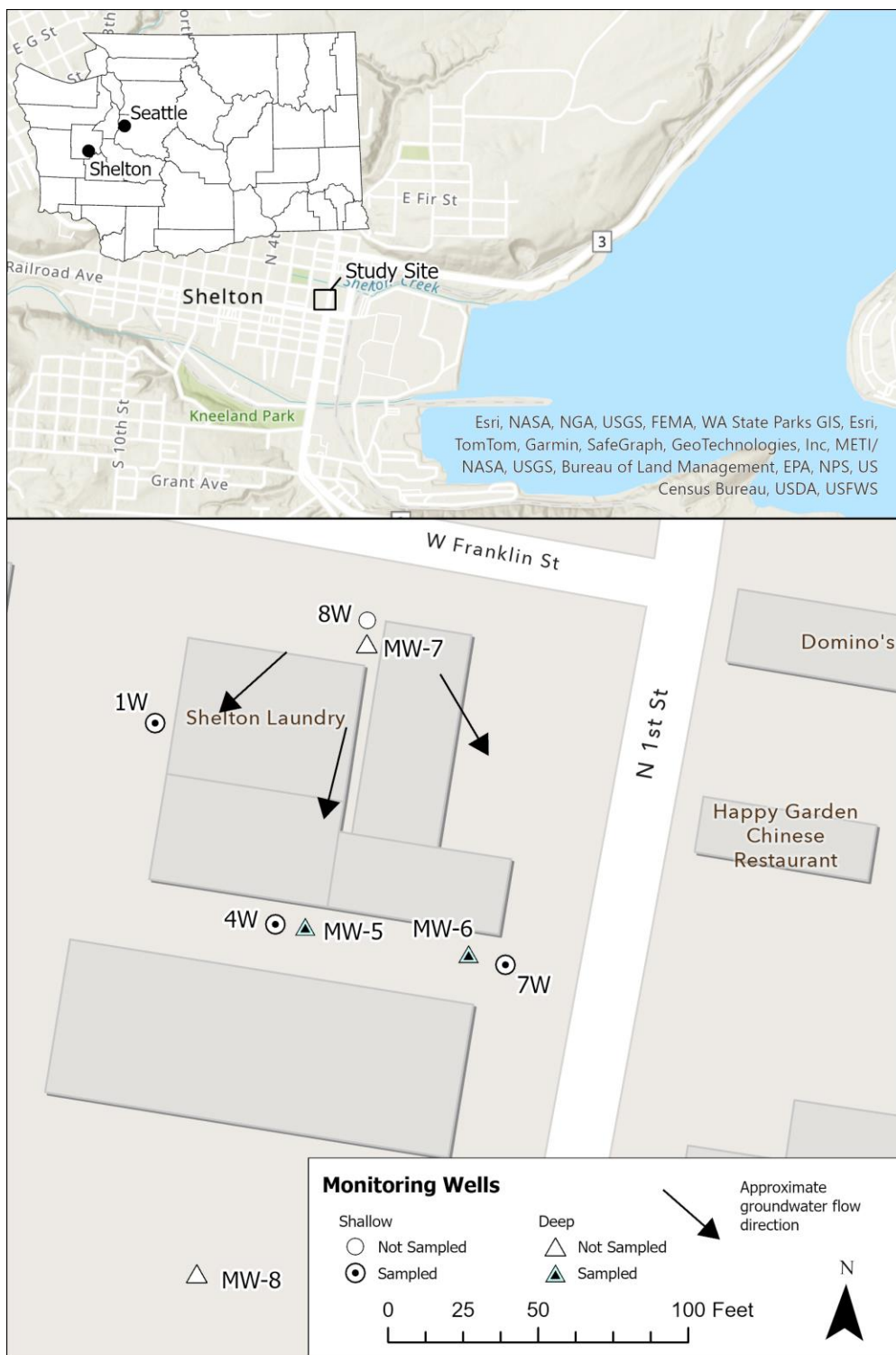


Figure 1. Shelton Laundry and Cleaners location and site details.

Physical Setting

The downtown Shelton area where the site is located is primarily underlain by recessional outwash deposits from the Vashon Stade of the Fraser glaciation. These deposits consist of stratified, moderately- to well-rounded, poorly- to moderately-sorted sand and gravels with locally minor clay and silt (Schasse et al. 2003). Well logs from the site describe silty gravel to a depth of approximately 8ft bgs, and interbedded sand and gravel from 8 ft bgs to a minimum of 60 ft bgs. Production well logs near the site describe recessional deposits continuing to depths greater than 100 ft bgs in the vicinity of Oakland Bay.

The regional groundwater flow direction is determined to be towards the south (Molenaar and Noble 1970). The measured groundwater gradient in shallow wells near the site is generally to the southeast and southwest (Figure 1). The measured groundwater gradient in the deeper wells is to the east-southeast. The vertical groundwater flow gradient, as measured from paired wells during sampling events, is small and appears to be upward.

Methods and Results

Ecology conducted two groundwater sampling events in 2023 consisting of collecting groundwater samples from three shallow monitoring wells (1W, 4W, 7W) and two deep monitoring wells (MW-5, MW-6) during April, and from three shallow monitoring wells (1W, 4W, 7W) during October. The off-schedule sampling event conducted in October 2023 occurred in response to anomalously high PCE concentrations in samples collected during April 2023. These samples were collected following protocols outlined in Ecology's Standard Operating Procedure (SOP) EAP078 (Ecology 2024). Water levels were consecutively measured from all site wells to minimize tidal influence (Table 1).

The shallow wells are constructed of 1-inch diameter PVC casing and are completed to depths of approximately 15 ft bgs, while the deep wells are constructed of 2-inch diameter PVC casing and are completed to depths of approximately 45 ft bgs. The shallow and deep wells are typically sampled on an 18-month and 36-month schedule, respectively.

The shallow wells have historically been sampled using a small-diameter mechanical bladder pump due to the 1-inch diameter PVC construction. In October 2021, Ecology collected samples from well 4W using a peristaltic pump after sampling the well with the small-diameter bladder pump. This was done to assess whether results from the two pumping methods are comparable. Samples were collected using a peristaltic pump at the five wells sampled during April 2023, with an additional comparative sample collected from well 4W using a small-diameter bladder pump.

Ecology utilized industry-standard low-flow sampling techniques for both pumping devices. Prior to sample collection, the wells were purged through a continuous flow-cell water quality meter at rates of 0.5 liters/minute (L/min) or below. Field parameters (pH, temperature, specific conductance, dissolved oxygen, oxidation-reduction potential, and turbidity) were measured at regular intervals and continued until parameter stabilization was achieved (Table 2). Comparison samples were collected at well 4W by removing the peristaltic pump tubing

and inserting the small-diameter bladder pump, and purging the well until parameters stabilized again. Samples were collected using a peristaltic pump at the three wells sampled in October 2023.

Table 1. Well construction details and water levels collected at Shelton Laundry and Cleaners, April and October 2023.

Well ID	Land Surface Elevation ^a (feet)	Well Depth (feet bgs)	Screened Interval (feet bgs)	April Groundwater Elevation ^a (feet)	October Groundwater Elevation ^a (feet)
1W	15.10	14.56	4 – 14	10.05	9.48
4W	14.67	13.77	3.5 – 13.5	10.12	9.60
7W	14.10	14.83	4.5 – 14.5	10.02	9.51
8W	14.04	14.8	4.5 – 14.5	10.19	9.72
MW-5	14.66	45.5	35 – 45	10.11	9.60
MW-6	14.25	45.3	35 – 45	10.06	9.54
MW-7	14.17	45.4	35 – 45	10.27	9.73
MW-8	15.32	60.5	50 – 60	10.11	--

bgs: Below ground surface.

^a Vertical datum is NAVD29

'--': Not measured

Table 2. Field data for Shelton Laundry and Cleaners, April and October 2023.

Well ID ¹	Date	pH (std. units)	Specific Conductance (µS/cm)	Dissolved Oxygen (mg/L)	Oxidation-Reduction Potential (mV)	Turbidity (NTU)
1W	4/2023	6.9	184	5.2	147	0.3
1W	10/2023	7.0	192	5.1	114	2.0
4W	4/2023	7.0	184	4.8	147	0.9
4W (bladder)	4/2023	7.0	184	4.8	147	0.9
4W	10/2023	6.8	191	4.7	119	1.8
MW-5	4/2023	6.9	187	4.9	148	0.3
MW-6	4/2023	7.0	191	5.0	150	0.5
7W	4/2023	7.0	187	5.1	149	0.4
7W	10/2023	6.8	191	5.2	128	1.9

mg/L: Milligrams per liter

mV: Millivolts

NTU: Nephelometric turbidity units

std. units: Standard pH units

µg/L: Micrograms per liter

Following completion of purging activities, Ecology personnel collected groundwater samples, which were submitted to the Manchester Environmental Laboratory (MEL) in Port Orchard, WA for analysis of volatile organic compounds (VOCs) by a modified Environmental Protection Agency (EPA) SW846 Method 8260D. Analytical results for the chemicals of concern (COCs) at the site (PCE, TCE, and cis-1,2-DCE) are summarized in Table 3.

Quality control samples were collected as directed by the Quality Assurance Project Plan (QAPP) and included blind field duplicate and matrix spike/matrix spike duplicate samples (Marti 2002). These samples were collected from well 4W during both the April and October 2023 sampling events.

Relative percent differences (RPDs) were calculated from the parent and duplicate samples and compared to the data quality objective of 30% for RPDs. The RPDs for PCE concentrations in quality control samples collected during April 2023 were 92% and 2.9% for the bladder and peristaltic pumping methods, respectively. The bladder pumping method RPD exceeded the DQO of 30%, and the associated results are qualified as an estimated value. The PCE concentration RPD in October 2023 was 0.2%. The results from laboratory data quality control and quality assurance samples indicated that analytical performance was good and that the results are usable as qualified. The RPD calculations for April and October 2023 are provided in Table 4 and Table 5, respectively.

Table 3. Summary of analytical sample data for Shelton Laundry and Cleaners, April and October 2023.

Well ID	Date	PCE (µg/L)	TCE (µg/L)	Cis-1,2-DCE (µg/L)
1W	4/2023	1 U	1 U	1 U
1W	10/2023	1 U	1 U	1 U
4W	4/2023	<u>209</u>	<u>9.31</u>	<u>2.18</u>
4W (Bladder)	4/2023	<u>124 J</u>	<u>5.87</u>	<u>1.4</u>
4W	10/2023	<u>6.61</u>	<u>2.32</u>	<u>0.93 J</u>
MW-5	4/2023	1 U	1 U	1 U
MW-6	4/2023	1 U	1 U	1 U
7W	4/2023	<u>0.64 J</u>	1 U	1 U
7W	10/2023	1 UJ	1 U	1 U
Cleanup Levels	--	5 ^a	5 ^a	70 ^b

Bold: Analyte was detected in the sample.

Underlined: Values are greater than (did not meet) MTCA cleanup levels.

U: Analyte was not detected at or above the reported value.

UJ: Analyte was not detected at or above the reported estimate.

J: Analyte was positively identified. The associated numerical result is an estimate.

^a Cleanup levels for PCE and TCE are based on MTCA Method A cleanup levels (WAC 173-340-720)

^b The cleanup level for Cis-1,2-DCE is based on the Federal Maximum Contaminant Level (40 CFR Part 141.61)

'--': Not applicable.

Table 4. Duplicate results from well 4W, April 2023.

Well	4W (Bladder)	4W (Bladder Duplicate)	4W (Peristaltic)	4W (Peristaltic duplicate)	RPD (Bladder)	RPD (Peristaltic)
PCE	46 J	124 J	203	209	92%	2.9%
TCE	4.86	5.87	9.31	9.09	19%	2.4%
Cis-1,2-DCE	1.23	1.4	2.18	2.06	13%	5.7%

Bold: Analyte was detected in the sample.

Underlined: Values are greater than (did not meet) MTCA cleanup levels.

J: Analyte was positively identified. The associated numerical result is an estimate.

RPD: Relative percentage difference

Table 5. Duplicate results from well 4W, October 2023.

Well	4W (Peristaltic)	4W (Peristaltic duplicate)	RPD (Peristaltic)
PCE	6.6	6.61	0.2%
TCE	2.32	2.27	2.2%
Cis-1,2-DCE	0.93 J	0.9 J	3.3%

Bold: Analyte was detected in the sample.

Underlined: Values are greater than (did not meet) MTCA cleanup levels.

J: Analyte was positively identified. The associated numerical result is an estimate.

RPD: Relative percentage difference

PCE concentrations in April 2023 parent and duplicate samples collected from well 4W with the peristaltic pumping method were 203 µg/L and 209 µg/L, respectively. These concentrations were greater than the PCE concentrations reported from samples collected with the bladder pumping method, which were 46 J µg/L and 124 J µg/L for the parent and duplicate, respectively. During October 2023, PCE concentrations were 6.6 µg/L and 6.61 µg/L for the parent and duplicate samples, respectively. All PCE concentrations during the April and October 2023 sampling event exceeded the MTCA cleanup level of 5 µg/L. PCE concentrations in 7W were reported as an estimated 0.64 J µg/L during April 2023, below the MTCA cleanup level of 5 µg/L.

TCE concentrations from 4W during April 2023 were 9.31 µg/L and 5.87 µg/L for the peristaltic and bladder pumping methods, respectively, exceeding the MTCA cleanup level of 5 µg/L. During October 2023, the TCE concentration at 4W was 2.32 µg/L, below the MTCA cleanup level.

Cis-1,2-DCE was detected at concentrations of 2.18 µg/L and 1.4 µg/L during April 2023 for the peristaltic and bladder pumping methods, respectively, below the MTCA cleanup level of 70 µg/L. October 2023 cis-1,2-DCE concentration was an estimated 0.93 J µg/L, below the 1 µg/L reporting limit.

Concentrations of site COCs were not detected above the reporting limit in samples collected at the remaining wells during both April and October 2023. Data summaries for historical monitoring results from 1998 to the present are provided in Appendix A.

Discussion and Conclusions

Analytical results from the 2023 monitoring events indicate continued contamination of the shallow groundwater at the Shelton Laundry and Cleaners site. This contamination is found primarily in the area of monitoring well 4W. PCE concentrations at 4W ranged from 209 µg/L to 6.61 µg/L during April and October 2023, respectively, exceeding the MTCA cleanup level of 5 µg/L. The April 2023 results represent a significant increase in reported PCE concentrations. In response to these anomalously high results, another sampling event was conducted in October 2023, which reported contaminant concentrations within the historical concentration range.

The metabolic breakdown product TCE was detected in 4W at concentrations of 9.31 µg/L and 2.32 µg/L during April and October 2023, respectively, exceeding the MTCA cleanup level of 5 µg/L in April 2023. Cis-1,2-DCE was detected in 4W at concentrations ranging from 2.18 µg/L to an estimated 0.93 J µg/L during April and October 2023, respectively, below the 70 µg/L cleanup level.

PCE was detected in 7W at an estimated concentration of 0.64 J µg/L during the April 2023 sampling event. Prior to this detection, PCE had not been detected in 7W since February 2006. PCE was not detected above reporting limits in the sample collected during October 2023. The detection in April 2023 is consistent with the anomalously high result at 4W. The metabolic breakdown products TCE and cis-1,2-DCE were not detected above reporting limits in 7W during April and October 2023.

The remaining wells sampled (1W, MW-5, MW-6) continue to have no detectable levels of contamination.

In April 2023, Ecology sampled well 4W using both a mechanical bladder pump and a peristaltic pump to compare contaminant concentrations between the two pumping methods. Contaminant concentrations were significantly elevated in samples collected using the peristaltic pump compared to those collected with the mechanical bladder pump. The samples collected using the mechanical bladder pump were taken after the peristaltic pump primary and duplicate samples, following a secondary purging cycle. PCE concentrations in the sample collected with the peristaltic pump were reported as 209 µg/L, nearly twice the concentration of those collected using the mechanical bladder pump, which reported an estimated PCE concentration of 124 J µg/L. PCE degradation products TCE and cis-1,2-DCE were both higher in the samples collected using the peristaltic pump. These results indicate that the mechanical bladder pump yields concentrations that are biased low, and that the actual concentrations in site groundwater are higher than previous results suggest. These results are consistent with results from previous comparative samples collected during the June 2020 and October 2021 sampling events (Carnes 2023).

Recommendations

Based on results from sampling in 2023, we recommend continued monitoring of groundwater under the current sampling schedule until PCE concentrations in well 4W stay

below the cleanup standard of 5 µg/L. Testing every 18-months in shallow wells 1W, 4W, and 7W will help track seasonal changes in PCE concentrations and water levels at the site. PCE has not been detected above reporting limits at wells MW-5 and MW-6, so testing every 36-months at these wells is enough. Because higher concentrations of PCE and its breakdown products (TCE, DCE) were found when using the peristaltic pumping method, we recommend using this method in future sampling.

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Appendix A.

Figure A1 shows variations of PCE, TCE, and cis-1,2-DCE concentrations, and water levels in monitoring well 4W from 2002 through 2023.

Tables A1 through A12 list historical results from groundwater sampling at the Shelton Laundry and Cleaners site.

- Tables A1 – A4 show results from four shallow monitoring wells (1W, 4W, 7W, 8W) collected by GeoEngineers from July 1998 to September 2000.
- Tables A5 – A7 show results from three shallow monitoring wells (1W, 4W, 7W) collected by Ecology from July 2002 through October 2023.
- Tables A8 – A9 show results from two deep monitoring wells (MW-5, MW-6) collected by Ecology from July 2002 through April 2023.
- Tables A10 – A12 show results from one shallow monitoring well (8W) and two deep monitoring wells (MW-7, MW-8) collected by Ecology from July 2002 through April 2003.

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

bgs: Below ground surface

DCE: Dichloroethene

ft: Feet

HRC: Hydrogen release compound

NA: Not applicable

NAVD29: North American Vertical Datum of 1929

PCE: Tetrachloroethene

TCE: Trichloroethene

µg/L: Micrograms per liter

Underlined: Values are greater than (did not meet) cleanup levels.

Bold: Analyte was detected in the sample.

U: Analyte was not detected at or above the reported value.

J: Analyte was positively identified, and the associated numerical result is an estimate.

UJ: Analyte was not detected at or above the reported estimated result.

--: Not sampled/measured

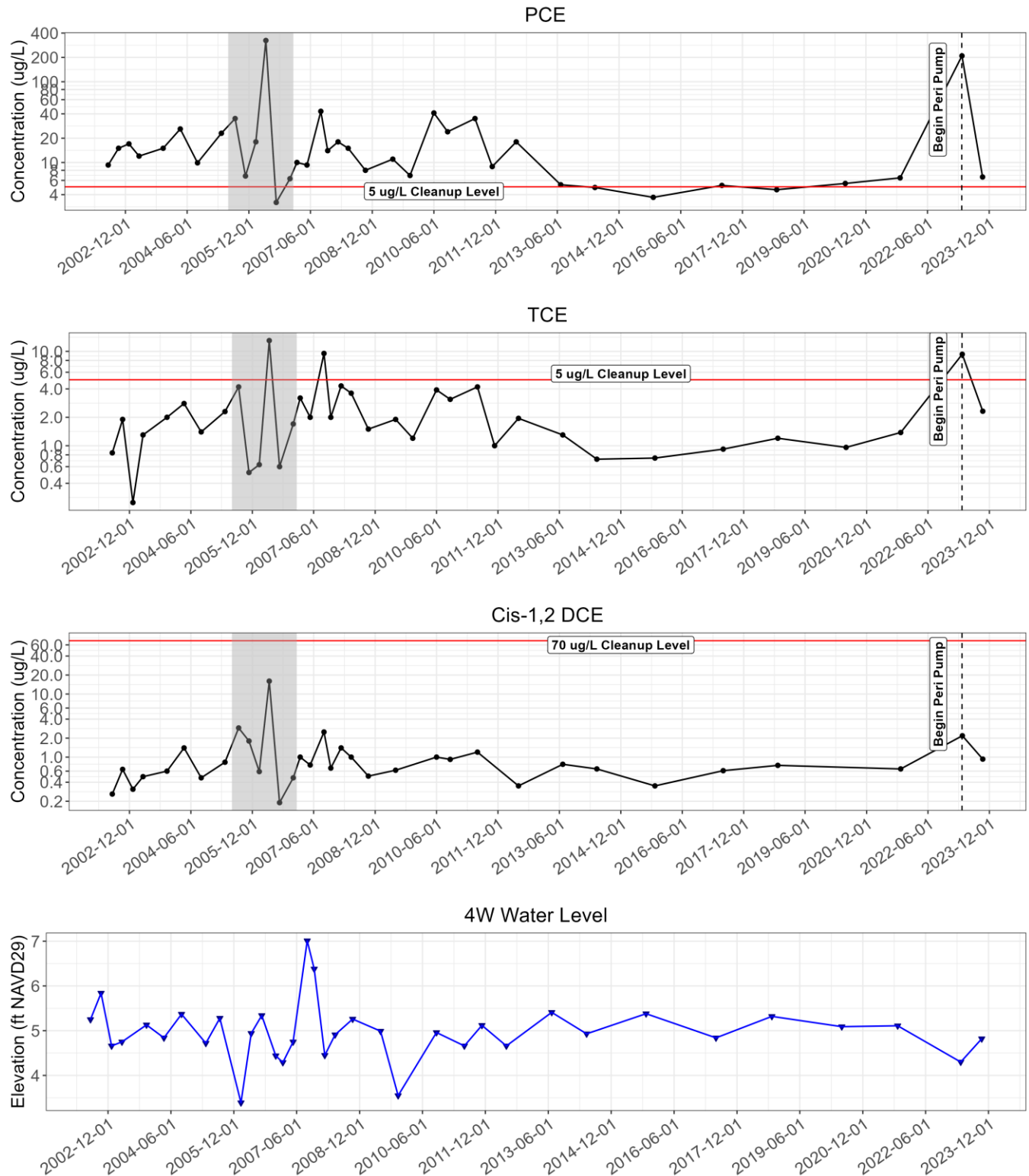


Figure A1. cVOC concentrations ($\mu\text{g/L}$, log scale) and water levels (ft NAVD29) in well 4W, 2002 – 2023.

The gray area represents the effective period of the HRC injection.

Table A1. Historical sample results collected by GeoEngineers from shallow monitoring well 1W, July 1998 to July 1999.

Date	PCE (µg/L)	TCE (µg/L)	Cis-1,2-DCE (µg/L)
7/1998	<1.0	<1.0	--
11/1998	<1.0	<1.0	--
7/1999	<1.0	<1.0	--

Table A2. Historical sample results collected by GeoEngineers from shallow monitoring well 4W, July 1998 to September 2000.

Date	PCE (µg/L)	TCE (µg/L)	Cis-1,2-DCE (µg/L)
7/1998	280	4.7	33
11/1998	130	<1.0	<1.0
7/1999	39	<1.0	<1.0
9/2000	25	<1.0	<1.0

Table A3. Historical sample results collected by GeoEngineers from shallow monitoring well 7W, July 1998 to September 2000.

Date	PCE (µg/L)	TCE (µg/L)	Cis-1,2-DCE (µg/L)
7/1998	4.3	<1.0	6.4
11/1998	3	<1.0	<1.0
7/1999	<1.0	<1.0	<1.0
9/2000	1.2	<1.0	<1.0

Table A4. Historical sample results collected by GeoEngineers from shallow monitoring well 8W, July 1998 to September 2000.

Date	PCE (µg/L)	TCE (µg/L)	Cis-1,2-DCE (µg/L)
7/1998	<1.0	<1.0	--
11/1998	<1.0	<1.0	--
7/1999	<1.0	<1.0	--
9/2000	--	--	--

Table A5. Historical sample results and water levels collected by Ecology from shallow monitoring well 1W, July 2002 to October 2023.

Date	Water Level (feet bgs)	PCE (µg/L)	TCE (µg/L)	Cis-1,2-DCE (µg/L)
7/2002	5.78	1 U	1 U	1 U
10/2002	6.08	1 U	2 U	1 U
1/2003	5.19	1 U	1 U	1 U
4/2003	5.25	1 U	1 U	1 U
11/2003	5.64	--	--	--
4/2004	5.36	--	--	--
9/2004	5.89	--	--	--
4/2005	5.23	--	--	--
8/2005	5.86	1 U	1 U	1 U
11/2005	5.23	1 U	1 U	1 U
2/2006	4.00	1 U	1 U	1 U
5/2006	5.46	1 U	1 U	1 U
8/2006	5.89	1 U	1 U	1 U
12/2006	5.15	1 U	1 U	1 U
2/2007	4.79	1 U	1 U	1 U
5/2007	5.25	1 U	1 U	1 U
9/2007	7.45	2 U	2 U	1 U
11/2007	6.89	2 U	1 U	1 U
2/2008	4.95	1 U	1 U	2 U
5/2008	5.44	2 U	1 U	1 U
10/2008	5.81	1 U	1 U	1 U
6/2009	5.5	1 U	1 U	1 U
11/2009	4.05	1 U	1 U	1 U
6/2010	--	1 U	1 U	1 U
10/2010	5.49	1 U	1 U	1 U
6/2011	5.18	2 U	1 U	1 U
11/2011	5.66	1 U	1 U	1 U
6/2012	5.18	1 U	1 U	1 U
7/2013	5.93	1 U	1 U	1 U
5/2014	5.42	1 U	1 U	1 U
10/2015	5.41	1 U	1 U	1 U
6/2017	5.38	1 U	1 U	1 U
10/2018	5.86	1 U	1 U	1 U
6/2020	5.62	1 UJ	1 UJ	1 UJ
10/2021	5.69	1 U	1 U	1 U
4/2023	4.32	1 U	1 U	1 U
10/2023	4.89	1 U	1 U	1 U
<i>Project Cleanup Level</i>	NA	5	5	70

Table A6. Historical sample results and water levels collected by Ecology from shallow monitoring well 4W, July 2002 to October 2023.

Date	Water Level (feet bgs)	PCE (µg/L)	TCE (µg/L)	Cis-1,2-DCE (µg/L)
7/2002	5.25	<u>9.3</u>	0.84 J	0.26 J
10/2002	5.84	<u>15</u>	1.9 J	0.64 J
1/2003	4.66	<u>17</u>	0.25 J	0.31 J
4/2003	4.75	<u>12</u>	1.3	0.49 J
11/2003	5.13	<u>15</u>	2	0.6 J
4/2004	4.84	<u>26 J^a</u>	2.8 J ^a	1.4
9/2004	5.37	<u>9.9</u>	1.4	0.47 J
4/2005	4.72	<u>23</u>	2.3	0.83 J
8/2005	5.28	<u>35 J^a</u>	4.2 J ^a	2.9 J ^a
11/2005	--	<u>6.8</u>	0.52 J	1.8
2/2006	3.39	<u>18 J^a</u>	0.63 J	0.59 J
5/2006	4.94	<u>324</u>	<u>13</u>	16
8/2006	5.34	3.2 J	0.6 J	0.19 J
12/2006	4.44	<u>6.3</u>	1.7	0.47 J
2/2007	4.29	<u>10</u>	3.2	1
5/2007	4.75	<u>9.3</u>	2	0.75 J
9/2007	7.01	<u>43</u>	<u>9.5</u>	2.5
11/2007	6.38	<u>14</u>	2	0.67 J
2/2008	4.45	<u>18</u>	4.3 J ^a	1.4 J
5/2008	4.91	<u>15 J</u>	3.6	1
10/2008	5.26	<u>8</u>	1.5	0.5 J
6/2009	4.99	<u>11</u>	1.9	0.62 J
11/2009	3.55	<u>6.9 J</u>	1.2	1 U
6/2010	--	<u>41 J^a</u>	3.9 J ^a	1
10/2010	4.96	<u>24</u>	3.1	0.92 J
6/2011	4.66	<u>35 J</u>	4.2 J	1.2
11/2011	5.12	<u>8.9 J</u>	1 J	1 U
6/2012	4.66	<u>18 J^a</u>	1.95 J ^a	0.35 J
7/2013	5.41	<u>5.3</u>	1.3	0.77 J
5/2014	4.93	4.9	0.72 J	0.65 J
10/2015	5.38	3.7 J	0.74 J	0.35 J
6/2017	4.84	<u>5.2</u>	0.92 J	0.61 J
10/2018	5.32	4.6	1.2	0.74 J
6/2020	5.09	<u>5.5 J^a</u>	0.96 J ^a	1 UJ
10/2021	5.11	<u>6.45</u>	1.38	0.65
4/2023	4.3	<u>209</u>	<u>9.31</u>	2.18
10/2023	4.82	<u>6.61</u>	2.32	0.93 J
Project Cleanup Level	NA	5	5	70

^a Average concentration of duplicate samples when RPD > 30%.

Table A7. Historical sample results and water levels collected by Ecology from shallow monitoring well 7W, July 2002 to October 2023.

Date	Water Level (feet bgs)	PCE (µg/L)	TCE (µg/L)	Cis-1,2-DCE (µg/L)
7/2002	5.21	1 U	1 U	1 U
10/2002	5.08	0.19 J	2 U	1 U
1/2003	4.25	1 U	1 U	1 U
4/2003	4.32	1 U	1 U	1 U
11/2003	4.69	1 U	1 U	1 U
4/2004	4.39	1.7	1 U	1 U
9/2004	4.92	0.47 J	0.26 J	1 U
4/2005	4.28	0.15 J	1 U	1 U
8/2005	4.80	0.38 J	1 U	1 U
11/2005	--	1 U	1 U	1 U
2/2006	2.96	0.53 J	1 U	1 U
5/2006	4.51	1 U	1 U	1 U
8/2006	4.9	1 UJ	1 U	1 U
12/2006	4.01	1 U	1 U	1 U
2/2007	3.84	1 U	1 U	1 U
5/2007	4.30	1 U	1 U	1 U
9/2007	6.65	2 U	2 U	1 U
11/2007	6.01	2 U	1 U	1 U
2/2008	4.00	1 U	1 U	2 U
5/2008	4.45	2 U	1 U	1 U
10/2008	4.8	1 U	1 U	1 U
6/2009	4.53	1 U	1 U	1 U
11/2009	3.13	1 U	1 U	1 U
6/2010	4.30	1 U	1 U	1 U
10/2010	4.51	1 U	1 U	1 U
6/2011	4.24	2 U	1 U	1 U
11/2011	4.21	1 U	1 U	1 U
6/2012	4.67	1 U	1 U	1 U
7/2013	4.21	1 U	1 U	1 U
5/2014	4.96	1 U	1 U	1 U
10/2015	4.49	1 U	1 U	1 U
6/2017	5.00	1 U	1 U	1 U
10/2018	4.38	1 U	1 U	1 U
6/2020	4.84	1 UJ	1 UJ	1 UJ
10/2021	4.65	1 U	1 U	1 U
4/2023	3.91	0.64 J	1 U	1 U
10/2023	4.23	1 UJ	1 U	1 U
<i>Project Cleanup Level</i>	<i>NA</i>	<i>5</i>	<i>5</i>	<i>70</i>

Table A8. Historical sample results and water levels collected by Ecology from deep monitoring well MW-5, July 2002 to October 2023.

Date	Water Level (feet bgs)	PCE (µg/L)	TCE (µg/L)	Cis-1,2-DCE (µg/L)
7/2002	5.21	1 U	1 U	1 U
10/2002	5.52	1 U	2 U	1 U
1/2003	4.66	1 U	1 U	1 U
4/2003	4.75	1 U	1 U	1 U
11/2003	5.13	1 U	1 U	1 U
4/2004	4.83	1 UJ	1 U	1 U
9/2004	5.38	1 U	1 U	1 U
4/2005	4.71	1 U	1 U	1 U
8/2005	5.27	1 U	1 U	1 U
11/2005	4.70	1 U	1 U	1 U
2/2006	3.24	1 U	1 U	1 U
5/2006	4.94	1 U	1 U	1 U
8/2006	5.34	1 UJ	1 U	1 U
12/2006	4.44	1 U	1 U	1 U
2/2007	4.27	1 U	1 U	1 U
5/2007	4.76	1 U	1 U	1 U
9/2007	7.00	2 U	2 U	1 U
11/2007	6.34	2 U	1 U	1 U
2/2008	4.45	1 U	1 U	2 U
5/2008	4.89	2 U	1 U	1 U
10/2008	5.28	1 U	1 U	1 U
6/2009	4.98	1 U	1 U	1 U
11/2009	3.55	1 U	1 U	1 U
6/2010	4.64	1 U	1 U	1 U
10/2010	4.94	1 U	1 U	1 U
6/2011	4.65	2 U	1 U	1 U
11/2011	5.11	1 U	1 U	1 U
6/2012	4.65	--	--	--
7/2013	5.38	1 U	1 U	1 U
5/2014	4.91	--	--	--
10/2015	5.35	1 U	1 U	1 U
6/2017	4.84	1 U	1 U	1 U
10/2018	5.30	--	--	--
6/2020	5.08	1 U	1 U	1 U
10/2021	5.11	--	--	--
4/2023	4.29	1 U	1 U	1 U
10/2023	4.8	--	--	--
<i>Project Cleanup Level</i>	NA	5	5	70

Table A9. Historical sample results and water levels collected by Ecology from deep monitoring well MW-6, July 2002 to October 2023.

Date	Water Level (feet bgs)	PCE (µg/L)	TCE (µg/L)	Cis-1,2-DCE (µg/L)
7/2002	4.90	1 U	1 U	1 U
10/2002	5.15	1 U	2 U	1 U
1/2003	4.34	1 U	1 U	1 U
4/2003	4.39	1 U	1 U	1 U
11/2003	4.77	1 U	1 U	1 U
4/2004	4.49	1 UJ	1 U	1 UJ
9/2004	5.02	1 U	1 U	1 U
4/2005	4.37	1 U	1 U	1 U
8/2005	4.88	1 U	1 U	1 U
11/2005	4.32	1 U	1 U	1 U
2/2006	3.04	1 U	1 U	1 U
5/2006	4.59	1 U	1 U	1 U
8/2006	4.99	1 UJ	1 U	1 U
12/2006	4.12	1 U	1 U	1 U
2/2007	3.93	1 U	1 U	1 U
5/2007	4.38	1 U	1 U	1 U
9/2007	6.71	2 U	2 U	1 U
11/2007	6.15	2 U	1 U	1 U
2/2008	4.08	1 U	1 U	2 U
5/2008	4.55	2 U	1 U	1 U
10/2008	4.90	1 U	1 U	1 U
6/2009	4.64	1 U	1 U	1 U
11/2009	3.20	1 U	1 U	1 U
6/2010	4.30	1 U	1 U	1 U
10/2010	4.59	1 U	1 U	1 U
6/2011	4.30	2 U	1 U	1 U
11/2011	4.75	1 U	1 U	1 U
6/2012	4.30	--	--	--
7/2013	5.04	1 U	1 U	1 U
5/2014	4.59	--	--	--
10/2015	5.00	1 U	1 U	1 U
6/2017	4.49	1 U	1 U	1 U
10/2018	4.94	--	--	--
6/2020	4.74	1 U	1 U	1 U
10/2021	5.76	--	--	--
4/2023	3.92	1 U	1 U	1 U
10/2023	4.42	--	--	--
<i>Project Cleanup Level</i>	NA	5	5	70

Table A10. Historical sample results and water levels collected by Ecology from shallow monitoring well 8W, July 2002 to April 2003.

Date	Water Level (feet bgs)	PCE (µg/L)	TCE (µg/L)	Cis-1,2-DCE (µg/L)
7/2002	4.51	1 U	1 U	1 U
10/2002	4.81	1 U	2 U	1 U
1/2003	3.93	1 U	1 U	1 U
4/2003	4.97	1 U	1 U	1 U
<i>Project Cleanup Level</i>	NA	5	5	70

Table A11. Historical sample results and water levels collected by Ecology from deep monitoring well MW-7, July 2002 to April 2003.

Date	Water Level (feet bgs)	PCE (µg/L)	TCE (µg/L)	Cis-1,2-DCE (µg/L)
7/2002	4.61	1 U	1 U	1 U
10/2002	4.87	1 U	2 U	1 U
1/2003	4.06	1 U	1 U	1 U
4/2003	4.15	1 U	1 U	1 U
<i>Project Cleanup Level</i>	NA	5	5	70

Table A12. Historical sample results and water levels collected by Ecology from deep monitoring well MW-8, July 2002 to April 2003.

Date	Water Level (feet bgs)	PCE (µg/L)	TCE (µg/L)	Cis-1,2-DCE (µg/L)
7/2002	5.90	1 U	1 U	1 U
10/2002	6.51	1 U	2 U	1 U
1/2003	5.30	1 U	1 U	1 U
4/2003	5.41	1 U	1 U	1 U
<i>Project Cleanup Level</i>	NA	5	5	70