



City of Bothell™

Public Works Department

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Bothell, WA 98011

LETTER OF TRANSMITTAL

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Date: April 17, 2016

Company: Department of Ecology
Attn: Sunny Becker NWRO Toxics
Address: Cleanup Program 3190 - 160th SE
Bellevue, WA 98008

From: Nduta Mbutia, Capital Projects Division

Attached please find: Electronic copy of:-

- 1) Letter Report (4/14/2017) - QTR 4, Post-Round 2 Supplemental Injections
Sampling Event Groundwater Monitoring Report for Ultra Custom Care Cleaners

- | | |
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| <input type="checkbox"/> For your information/files | <input type="checkbox"/> For your action |
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Comments:



April 14, 2017
HWA Project No. 2007-098

Washington State Department of Ecology
3190 160th Ave SE
Bellevue, WA 98008

Attention: Sunny Becker

Subject: **Ultra Custom Care Cleaners Site
Ground Water Monitoring Report
Fourth Quarter After Bioremediation Round 2**

Dear Ms. Becker:

This letter describes HWA Geosciences fourth quarter ground water monitoring results for the Ultra Custom Care Cleaners site (the Site), which was performed after the second round of in-situ bioremediation that was initiated in March 2016.

Introduction and Background

On January 26, 2016 a technical memorandum detailing the purpose and rationale for a second round of supplemental bioremediation injections was submitted to Ecology, and subsequently approved in February (see attached excerpt for the second round plan). The injections were implemented with minimal deviations from the approved plan.

This technical report documents the fourth quarter of monitoring completed in March 2017 following the second round of in-situ bioremediation completed in April 2016. In accordance with the approved interim action work plan, this is the last round of monitoring required. Interim action cleanup and monitoring of the Site is being performed in accordance with Agreed Order DE9704 between the City of Bothell and the Washington Department of Ecology (Ecology). As part of the approved scope of work for Interim Action No. 2 (Ultra Custom Cleaners, Interim Action Work Plan No. 2, November 7, 2014), enhanced in-situ bioremediation materials were injected into subsurface soil and ground water in four areas to stimulate biological activity and accelerate degradation of tetrachlorethene (PCE) and its degradation products trichloroethene (TCE), (cis) 1,2-dichlorethene (DCE), and vinyl chloride (VC), at the source area and down-gradient plume. Prior and recent injection locations are shown on Figure 1.

Based on past ground water investigations and monitoring data, concentrations of PCE and its degradation products are present in ground water beneath the Site extending from the source area at Bothell Way NE just north 183rd Street, along the east side of Bothell Way NE, to just south of Main Street. Some of

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these concentrations exceed Model Toxics Control Act (MTCA) Method A cleanup levels. Ground water monitoring well locations and analytical results are illustrated on Figure 2.

Post remediation ground water monitoring was performed to evaluate the effectiveness of remediation efforts for two years (eight quarters), per the Interim Action Work Plan. Based on the approved interim action work plan, we recommend meeting with Ecology to discuss transitioning the site from Interim Action to finalizing the remedial investigation, and preparing a feasibility study and draft cleanup action plan.

The following paragraphs describe ground water monitoring activities, laboratory results for ground water samples, and the results of our data evaluation activities. Laboratory results are summarized in Table 1.

Ground Water Monitoring Results

Figure 2 shows ground water PCE concentrations measured during the March 2017 and previous sampling rounds. Data for monitoring wells that have not exhibited compounds of concern above cleanup levels are not shown on Figure 2.

Following is a list of analytes monitored and their significance with respect to the bioremediation efforts:

- Halogenated Volatile Organic Compounds (HVOCs) – PCE should be decreasing in treated areas. TCE, DCE, and VC typically increase (in that order) then decrease during biological treatment, as successive reductive dechlorination occurs. The complete process can take months to a year or two depending on the amount of PCE sorbed to aquifer sediments. “Stalling” at DCE or VC may occur if optimal subsurface conditions are not maintained. Zero valent iron (ZVI) was also deployed in the source area. ZVI can reduce PCE to ethene and/or ethane without the production of DCE or VC intermediates, so stoichiometric (i.e., proportional) production of DCE and/or VC is not expected.
- Dissolved oxygen (DO) / oxidation/reduction potential (ORP) – DO should be depressed (near zero) and ORP should be in the negative range for reductive dechlorination to occur. A reducing environment should be generated and maintained by the injected ZVI and electron donors (emulsified vegetable oil and sodium lactate).
- Nitrate, sulfate – Reducing conditions should eliminate nitrate, and the majority of sulfate (in that order), therefore these parameters can be used to monitor geochemical conditions in addition to other indicators.
- Iron – Reducing conditions should change ferric iron (Fe+3) to ferrous (Fe+2).
- Total organic carbon (TOC) – TOC should be elevated (>10 ppm) where the electron donor has been injected and is set up (bound to soil) in the aquifer.

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- Methane, ethane, ethene – Methane is typically present in small amounts in most reduced soils, from anaerobic decomposition of other (natural) organics. Higher methane concentrations (> 1 mg/l) are observed where donor has been added, and is an indicator that methanogenic conditions are present. Ethene is the typical end product of complete dechlorination of VC, with ethane being produced from ethene in very anaerobic environments.
- Sodium – Sodium is an indicator of the injected sodium lactate, but unlike TOC, is a ‘conservative tracer’, meaning it migrates at the same rate as ground water (i.e., will not bind to soil), and is a good indicator of ground water flow rate and direction.
- vcrA – This genetic test is a rough measure of the population of vinyl chloride degrading bacteria (Vinyl Chloride Reductase), which were injected along with other HVOC degraders. These bacteria are among the hardest to cultivate and maintain in situ, hence the testing. The other degraders’ strength and viability can be evaluated based on the chemical data (e.g., decreases in PCE, increases in TCE, DCE, etc.).

Below is a summary of findings, 11 months after round 2 injections

Source area – PCE concentrations in source area wells continue to drop, generating DCE and VC as reductive dichlorination continues to occur. Only two wells (UCCMW-17 and 21) currently have PCE concentrations above cleanup levels. HVOC concentrations are above cleanup levels in five of the ten source area wells (MW-1, UCCMW-17, 18, 19, and 21); however, redox potential levels are generally favorable for these wells, except UCC-MW-17, which is upgradient of past injections. This increase may be due to the second round of injections pushing some HVOCs upgradient, or causing desorption of HVOCs from soil, and is likely temporary.

First injection row – During previous rounds of sampling before the second round of injections and immediately after, PCE concentrations and redox conditions in UCCMW-25 and UCCMW-7 were essentially unchanged, and it was thought that the first round of injections was too close to these wells, and the injected oil biobarrier had “set up” or bound to aquifer soils downgradient of these wells. The second round of injections was placed further north (upgradient), and appears to have been successful in deploying at or upgradient of these wells. Both wells continue to exhibit favorable early indicators of treatment as well as strong reducing conditions. Daughter products (TCE, DCE and VC) have increased in both wells after the second round of injections, indicating increased biological activity.

Well BI-3 has not been sampled since January 2016 due to it being damaged during construction activities. It was repaired and sampled during the most recent sampling event. BI-3 continues to show similar results to previous quarters sampled prior to the

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second round of injections, with vinyl chloride being the only HVOC above cleanup levels.

Second injection row – BB-2 remains mostly unchanged, with redox conditions remaining oxidative. This may suggest that perhaps the area may have been too close to the second round of injections, or the injections may not have been deep enough, as this well is screened slightly deeper than the others (to 19 feet).

UCCMW-8 responded to the second round of injections, with decreased ORP, and a marked decrease in PCE coupled with increased daughter products (TCE, DCE and VC).

Third injection row – All HVOCs in UCCMW-26 have dropped to below cleanup levels for the first time, and all HVOCS except VC are below cleanup levels in UCCMW-26, indicating success of the second round of injections. Some PCE daughter products have increased, and future cleanup level exceedances are still possible.

Summary & Recommendations

Results continue to be encouraging, with active treatment observed in most wells, as evidenced by decreasing PCE, increased daughter products, decreased daughter products in some wells, and anoxic/reducing conditions. Treatment continues to show its effectiveness in the source area. In addition, downgradient areas, including some that had not responded to the first round of injections, also appear to be responsive to the second round of injections. Interpretation of the monitoring results by area is summarized below:

- Source area – The source area continues to show positive signs of treatment, with overall decreasing HVOCs in most wells. Increased PCE in UCCMW-17 may be due to desorption of HVOCs from soil after the second round of injections, and is likely temporary. PCE concentrations in UCCMW-5, UCCMW-20, and UCCMW-21, downgradient of the source area, have decreased after the second round of injections placed further west.
- First injection row – The second round of injections (placed further upgradient), appears to have reached UCCMW-7 and UCCMW-25, which had not responded to the first round of injections, based on reducing conditions and other indicator parameters. HVOC concentrations in UCCMW-25 are essentially unchanged since the second injections, and are decreased in UCCMW-7, although HVOC concentrations in both wells are only slightly above cleanup levels. However, daughter products (TCE, DCE and VC) have increased in both wells after the second round of injections, indicating increased biological activity.
- Second injection row – UCCMW-8, which was unaffected by the first round of injections, is now responding to the second round of injections placed further west, with decreased ORP, and a marked decrease in PCE coupled with increased daughter products (TCE, DCE and VC). BB-2 however, appears unaffected by either round of treatment and this area may require further cleanup efforts.

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- Third injection row – Both wells UCCMW-26 and UCCMW-27 appear to be responding positively to treatment from the last round of injections, with most HVOCs below cleanup levels. Some PCE daughter products have increased, and future cleanup level exceedances are still possible.
- Problematic areas – The second injection row, UCCMW-8 and BB-2, may have been injected too close, or injections may have not been deep enough. Due to the site layout, access to inject further north was not possible (the Speedy Glass building and driveway just north of the second round injection area). However, treatment is likely occurring downgradient of these wells.

Overall, the second round of injections have been successful in reducing HVOC concentrations in the source area and downgradient wells. Data continues to show favorable indicators for continuing reductive dichlorination in almost all wells with HVOC impacts above cleanup levels. All the data gathered to date is sufficient to establish that this cleanup method is working, and that its implementation as an interim action can be carried forward as a final cleanup remedy under MTCA. Based on the approved interim action work plan, we recommend meeting with Ecology to discuss transitioning the site from Interim Action to finalizing the remedial investigation, and preparing a feasibility study and draft cleanup action plan.



We appreciate the opportunity to provide our services to you on this project. Please feel free to call us if you have any questions or need more information.

Sincerely,

HWA GEOSCIENCES INC.

A handwritten signature in black ink, appearing to read "Austin York".

Austin York
Geologist

A handwritten signature in purple ink, appearing to read "Arnie Sugar".

Arnie Sugar, LG, LHG
Principal Hydrogeologist

Attachments:

Excerpt from January 26 Technical Memo

Figure 1: Monitoring well and injection locations

Figure 2: PCE in ground water, last few rounds

Table 1: Analytical results for ground water samples

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EXCERPT FROM JANUARY 26 TECHNICAL MEMO

Second Round Bioremediation Plan

Additional injections of electron donor (emulsified edible oil with sodium lactate) and micro zero valent iron (mZVI) are planned in the following areas. Figure 1 shows past and planned injection sites. Details of the technology and process to be used can be found in the *Ultra Custom Cleaners, Interim Action Work Plan No. 2* dated November 7, 2014.

- Source area – In order to target the area monitored by wells UCCMW-21 and UCCMW-5, injections will be completed at:
 - The five easternmost, one-inch diameter injections wells (screened 8 -13 feet bgs)
 - Ten new, direct push injections east of the easternmost injection well, at depths of 9-13 and 14-18 feet bgs (injecting in two separate lifts at each location).

- First injection row – In order to target the area monitored by wells UCCMW-7 and UCCMW-25, a line of eight direct push injections north and upgradient of these wells will be completed, , at depths of 8-12 and 13-17 feet bgs (injecting in two separate lifts at each location).

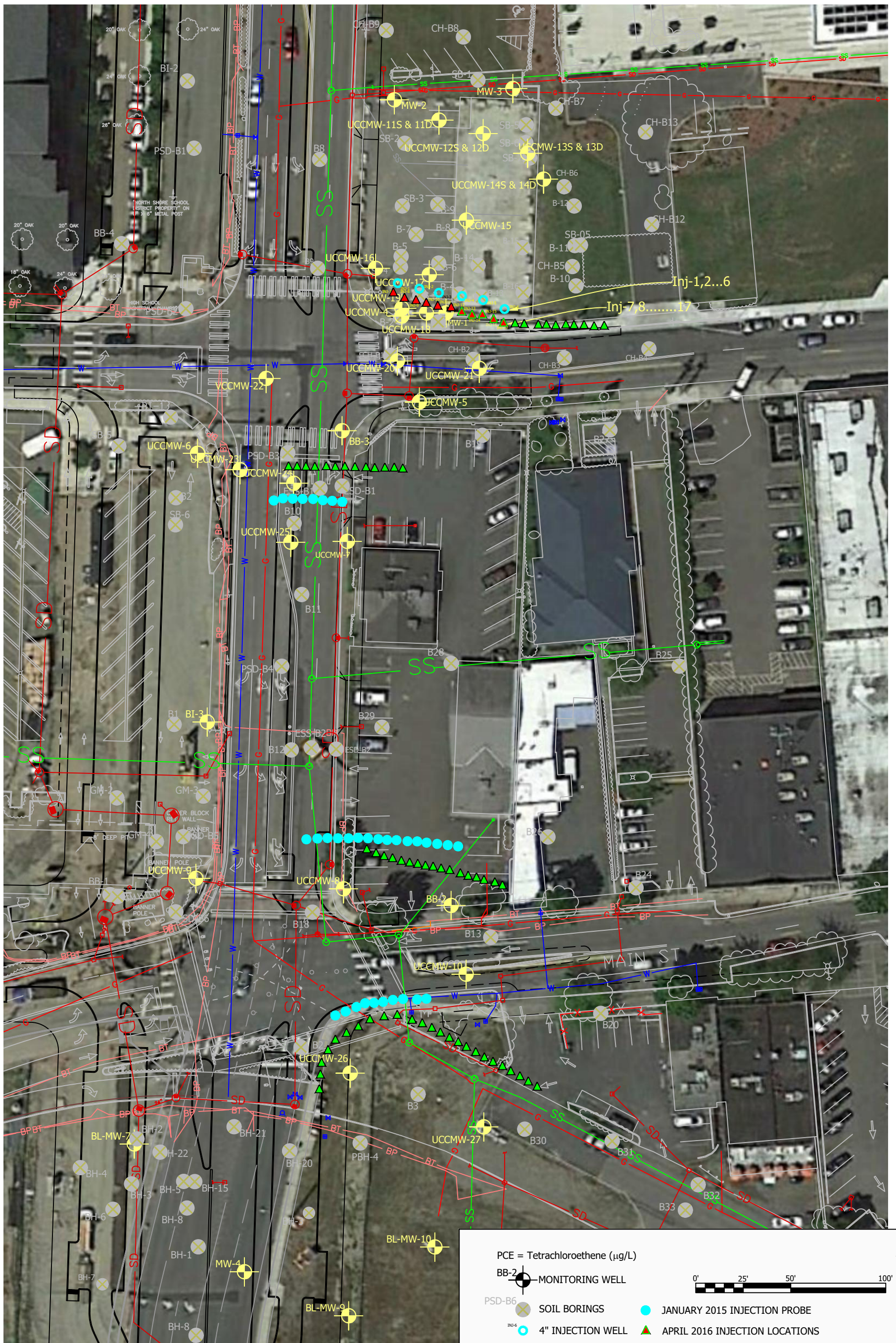
- Second injection row – In order to target the area monitored by wells BB-2 and UCCMW-8, a line of 17 direct push injections east of and overlapping the initial line of injections will be completed, at depths of 8-12 and 13-17 feet bgs (injecting in two separate lifts at each location).

- Third injection row – In order to target the area monitored by UCCMW-26 and UCCMW-27, a line of 25 direct push injections east of and overlapping the initial line of injections will be completed, at depths of 8-12 and 13-17 feet bgs (injecting in two separate lifts at each location).

Injection protocol for each location will include the following elements:

- Mix hydrant water with granular zero-valent iron (ZVI) for approximately 24 hours to remove chlorine and create anoxic water (oxidation/reduction potential [ORP] < - 100 mV, dissolved oxygen [DO] < 0.5 mg/L) in a tank large enough for the next day's injection volume.
- Inject 100 gallons emulsified oil (5% oil:water) with micro ZVI (0.08 lbs/gallon) plus dispersant (500 ml/100lbs mZVI) in anaerobic water
- Inject bioaugmentation culture (approximately 1 liter/ 200 gallons injected at wells, and 1liter/ 150 gallons injected at direct push injection sites)
- Inject remainder of emulsified oil with micro ZVI (approximately 1,060 gallons per well, 442 gallons per DP probe)

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BASE MAP PROVIDED BY:



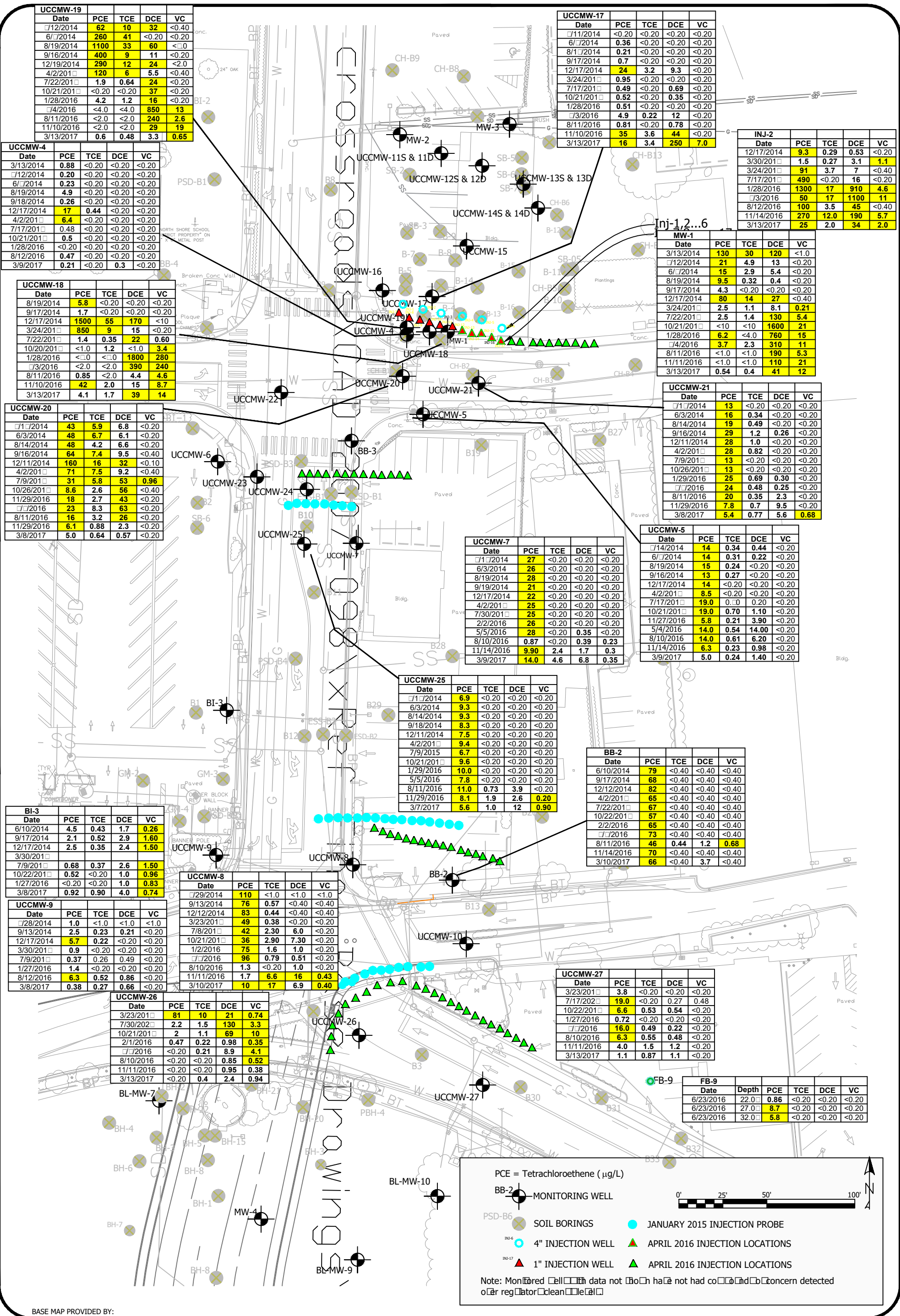
HWA GEOSCIENCES INC.

ULTRA CUSTOM CARE CLEANERS SITE
BOTHELL, WASHINGTON

SITE
PLAN

DRAWN BY
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UCCMW-19	Date	PCE	TCE	DCE	VC
	7/12/2014	62	10	32	<0.40
	6/7/2014	260	41	<0.20	<0.20
	8/19/2014	1100	33	60	<1.0
	9/16/2014	400	9	11	<0.20
	12/19/2014	290	12	24	<2.0
	4/2/2016	120	6	5.5	<0.40
	7/22/2016	1.9	0.64	24	<0.20
	10/21/2016	<0.20	<0.20	37	<0.20
	1/28/2016	4.2	1.2	16	<0.20
	7/4/2016	<4.0	<4.0	850	13
	8/11/2016	<2.0	<2.0	240	2.6
	11/10/2016	<2.0	<2.0	29	19
	3/13/2017	0.6	0.48	3.3	0.65

UCCMW-17	Date	PCE	TCE	DCE	VC
	7/11/2014	<0.20	<0.20	<0.20	<0.20
	6/7/2014	0.36	<0.20	<0.20	<0.20
	8/1/2014	0.21	<0.20	<0.20	<0.20
	9/17/2014	0.7	<0.20	<0.20	<0.20
	12/17/2014	24	3.2	9.3	<0.20
	3/24/2016	0.95	<0.20	<0.20	<0.20
	7/17/2016	0.49	<0.20	0.69	<0.20
	10/21/2016	0.52	<0.20	0.35	<0.20
	1/28/2016	0.51	<0.20	<0.20	<0.20
	7/3/2016	4.9	0.22	12	<0.20
	8/11/2016	0.81	<0.20	0.78	<0.20
	11/10/2016	35	3.6	44	<0.20
	3/13/2017	16	3.4	250	7.0

INJ-2	Date	PCE	TCE	DCE	VC
	12/17/2014	9.3	0.29	0.53	<0.20
	3/30/2016	1.5	0.27	3.1	1.1
	3/24/2016	91	3.7	7	<0.40
	7/17/2016	490	<0.20	16	<0.20
	1/28/2016	1300	17	910	4.6
	7/3/2016	50	17	1100	11
	8/12/2016	100	3.5	45	<0.40
	11/14/2016	270	12.0	190	5.7
	3/13/2017	25	2.0	34	2.0

UCCMW-4	Date	PCE	TCE	DCE	VC
	3/13/2014	0.88	<0.20	<0.20	<0.20
	7/12/2014	0.20	<0.20	<0.20	<0.20
	6/7/2014	0.23	<0.20	<0.20	<0.20
	8/19/2014	4.9	<0.20	<0.20	<0.20
	9/18/2014	0.26	<0.20	<0.20	<0.20
	12/17/2014	17	0.44	<0.20	<0.20
	4/2/2016	6.4	<0.20	<0.20	<0.20
	7/17/2016	0.48	<0.20	<0.20	<0.20
	10/21/2016	0.5	<0.20	<0.20	<0.20
	1/28/2016	<0.20	<0.20	<0.20	<0.20
	8/12/2016	0.47	<0.20	<0.20	<0.20
	3/9/2017	0.21	<0.20	0.3	<0.20

MW-1	Date	PCE	TCE	DCE	VC
	3/13/2014	130	30	120	<1.0
	7/12/2014	21	4.9	13	<0.20
	6/7/2014	15	2.9	5.4	<0.20
	8/19/2014	9.5	0.32	0.4	<0.20
	9/17/2014	4.3	<0.20	<0.20	<0.20
	12/17/2014	80	14	27	<0.40
	3/24/2016	2.5	1.1	8.1	0.21
	7/22/2016	2.5	1.4	130	5.4
	10/21/2016	<10	<10	1600	21
	1/28/2016	6.2	<4.0	760	15
	7/4/2016	3.7	2.3	310	11
	8/11/2016	<1.0	<1.0	190	5.3
	11/11/2016	<1.0	<1.0	110	21
	3/13/2017	0.54	0.4	41	12

UCCMW-18	Date	PCE	TCE	DCE	VC
	8/19/2014	5.8	<0.20	<0.20	<0.20
	9/17/2014	1.7	<0.20	<0.20	<0.20
	12/17/2014	1500	55	170	<1.0
	3/24/2016	850	9	15	<0.20
	7/22/2016	1.4	0.35	22	0.60
	10/20/2016	<1.0	1.2	<1.0	3.4
	1/28/2016	<1.0	<1.0	1800	280
	7/3/2016	<2.0	<2.0	390	240
	8/11/2016	0.85	<2.0	4.4	4.6
	11/10/2016	42	2.0	15	8.7
	3/13/2017	4.1	1.7	39	14

UCCMW-21	Date	PCE	TCE	DCE	VC
	7/1/2014	13	<0.20	<0.20	<0.20
	6/3/2014	16	0.34	<0.20	<0.20
	8/14/2014	19	0.49	<0.20	<0.20
	9/16/2014	29	1.2	0.26	<0.20
	12/11/2014	28	1.0	<0.20	<0.20
	4/2/2016	28	0.82	<0.20	<0.20
	7/9/2016	13	<0.20	<0.20	<0.20
	10/26/2016	13	<0.20	<0.20	<0.20
	1/29/2016	25	0.69	0.30	<0.20
	7/7/2016	24	0.48	0.25	<0.20
	8/11/2016	20	0.35	2.3	<0.20
	11/29/2016	7.8	0.7	9.5	<0.20
	3/8/2017	5.4	0.77	5.6	0.68

UCCMW-20	Date	PCE	TCE	DCE	VC
	7/1/2014	43	5.9	6.8	<0.20
	6/3/2014	48	6.7	6.1	<0.20
	8/14/2014	48	4.2	6.6	<0.20
	9/16/2014	64	7.4	9.5	<0.40
	12/11/2014	160	16	32	<0.10
	4/2/2016	71	7.5	9.2	<0.40
	7/9/2016	31	5.8	53	0.96
	10/26/2016	8.6	2.6	56	<0.40
	11/29/2016	18	2.7	43	<0.20
	7/7/2016	23	8.3	63	<0.20
	8/11/2016	16	3.2	26	<0.20
	11/29/2016	6.1	0.88	2.3	<0.20
	3/8/2017	5.0	0.64	0.57	<0.20

UCCMW-7	Date	PCE	TCE	DCE	VC
	7/1/2014	27	<0.20	<0.20	<0.20
	6/3/2014	26	<0.20	<0.20	<0.20
	8/19/2014	28	<0.20	<0.20	<0.20
	9/19/2014	21	<0.20	<0.20	<0.20
	12/17/2014	22	<0.20	<0.20	<0.20
	4/2/2016	25	<0.20	<0.20	<0.20
	7/30/2016	25	<0.20	<0.20	<0.20
	2/2/2016	26	<0.20	<0.20	<0.20
	5/5/2016	28	<0.20	0.35	<0.20
	8/10/2016	0.87	<0.20	0.39	0.23
	11/14/2016	9.90	2.4	1.7	0.3
	3/9/2017	14.0	4.6	6.8	0.35

UCCMW-5	Date	PCE	TCE	DCE	VC
	7/14/2014	14	0.34	0.44	<0.20
	6/7/2014	14	0.31	0.22	<0.20
	8/19/2014	15	0.24	<0.20	<0.20
	9/16/2014	13	0.27	<0.20	<0.20
	12/17/2014	14	<0.20	<0.20	<0.20
	4/2/2016	8.5	<0.20	<0.20	<0.20
	7/17/2016	19.0	0.0	0.20	<0.20
	10/21/2016	19.0	0.70	1.10	<0.20
	11/27/2016	5.8	0.21	3.90	<0.20
	5/4/2016	14.0	0.54	14.00	<0.20
	8/10/2016	14.0	0.61	6.20	<0.20
	11/14/2016	6.3	0.23	0.98	<0.20
	3/9/2017	5.0	0.24	1.40	<0.20

UCCMW-25	Date	PCE	TCE	DCE	VC
	7/1/2014	6.9	<0.20	<0.20	<0.20
	6/3/2014	9.3	<0.20	<0.20	<0.20
	8/14/2014	9.3	<0.20	<0.20	<0.20
	9/18/2014	8.3	<0.20	<0.20	<0.20
	12/11/2014	7.5	<0.20	<0.20	<0.20
	4/2/2016	9.4	<0.20	<0.20	<0.20
	7/9/2016	6.7	<0.20	<0.20	<0.20
	10/21/2016	9.6	<0.20	<0.20	<0.20
	1/29/2016	10.0	<0.20	<0.20	<0.20
	5/5/2016	7.8	<0.20	<0.20	<0.20
	8/11/2016	11.0	0.73	3.9	<0.20
	11/29/2016	8.1	1.9	2.6	0.20
	3/7/2017	5.6	1.0	12	0.90

BB-2	Date	PCE	TCE	DCE	VC
	6/10/2014	79	<0.40	<0.40	<0.40
	9/17/2014	68	<0.40	<0.40	<0.40
	12/12/2014	82	<0.40	<0.40	<0.40
	4/2/2016	65	<0.40	<0.40	<0.40
	7/22/2016	67	<0.40	<0.40	<0.40
	10/22/2016	57	<0.40	<0.40	<0.40
	2/2/2016	65	<0.40	<0.40	<0.40
	7/7/2016	73	<0.40	<0.40	<0.40
	8/11/2016	46	0.44	1.2	0.68
	11/14/2016	70	<0.40	<0.40	<0.40
	3/10/2017	66	<0.40	3.7	<0.40

BI-3	Date	PCE	TCE	DCE	VC
	6/10/2014	4.5	0.43	1.7	0.26
	9/17/2014	2.1	0.52	2.9	1.60
	12/17/2014	2.5	0.35	2.4	1.50
	3/30/2016				
	7/9/2016	0.68	0.37	2.6	1.50
	10/22/2016	0.52	<0.20	1.0	0.96
	1/27/2016	<0.20	<0.20	1.0	0.83
	3/8/2017	0.92	0.90	4.0	0.74

UCCMW-8	Date	PCE	TCE	DCE	VC
	7/29/2014	110	<1.0	<1.0	<1.0
	9/13/2014	76	0.57	<0.40	<0.40
	12/12/2014	83	0.44	<0.40	<0.40
	3/23/2016	49	0.38	<0.20	<0.20
	7/8/2016	42	2.30	6.0	<0.20
	10/21/2016	36	2.90	7.30	<0.20
	1/2/2016	75	1.6	1.0	<0.20
	7/7/2016	96	0.79	0.51	<0.20
	8/10/2016	1.3	<0.20	1.0	<0.20
	11/11/2016	1.7	6.6	16	0.43
	3/10/2017	10	17	6.9	0.40

UCCMW-27	Date	PCE	TCE	DCE	VC
	3/23/2016	3.8	<0.20	<0.20	<0.20
	7/17/2016	19.0	<0.20	0.27	0.48
	10/22/2016	6.6	0.53	0.54	<0.20
	1/27/2016	0.72	<0.20	<0.20	<0.20
	7/7/2016	16.0	0.49	0.22	<0.20
	8/10/2016	6.3	0.55	0.48	<0.20
	11/11/2016	4.0	1.5	1.2	<0.20
	3/13/2017	1.1	0.87	1.1	<0.20

UCCMW-9	Date	PCE	TCE	DCE	VC
	7/28/2014	1.0	<1.0	<1.0	<1.0
	9/13/2014	2.5	0.23	0.21	<0.20
	12/17/2014	5.7	0.22	<0.20	<

			FIELD PARAMETERS							LABORATORY RESULTS											NOTES				
Sample Location	Screened Depth, (ft bgs)	Sample Date	Depth to Water (ft bgs)	pH (units)	Conductivity (uS)	Temperature (°C)	Diss. Oxygen (mg/L)	Fe ²⁺ (mg/L)	Redox Potential (millivolt)	Tetrachloroethene (µg/L)	Trichloroethene (µg/L)	(cis) 1,2-Dichloroethene (µg/L)	Vinyl Chloride (µg/L)	Nitrate (mg/L)	Sulfate (mg/L)	Total Organic Carbon (mg/L)	Methane (µg/L)	Ethane (µg/L)	Ethene (µg/L)	Total Sodium (ug/L)	Dissolved Sodium (ug/L)	Chloride Reductase (vcrA) Gene Copies/Liter			
MTCA Method A/B Cleanup Level (Table 720-1, WAC 173-340-900)									5	5	16 (B)	0.2	NA	NA	NA	NA	NA	NA	NA						
Source Area																									
MW-1	5-15	3/13/2014	7.75	6.27	568	12.5	7.9			130	30	120	<1.0	4.4	27	<1.0	<0.50	<0.50	<0.50				Baseline		
		5/12/2014	8.56	6.09	517	15.0	3.17	0.0	+323	21	4.9	13	<0.20	6.0	13	<1.0	<0.50	<0.50	<0.50				Baseline		
		6/5/2014	8.77	5.94	604	15.0	4.05			15	2.9	5.4	<0.20										2 weeks after first chem-ox injection		
		8/19/2014	9.05	5.56	6.04	20.1	25.68			9.5	0.32	0.4	<0.20										2 weeks after second chem-ox injection		
		9/17/2014	9.37	5.91	504	18.5	9.14			4.3	<0.20	<0.20	<0.20										6 weeks after second chem-ox injection		
		12/17/2014	10.14	4.85	3295	13.5	2.24			80	14	27	<0.40											4 months after second chem-ox injection	
		3/24/2015	9.88	5.65	1511	13.51	0.00		-135.1	2.5	1.1	8.1	0.21	<0.050	30	840	110	65	52	210000				5 weeks after first in situ bio injections	
		7/22/2015		5.11	1489	19.43	0.00	2.0	-112.7	2.5	1.4	130	5.4	0.16	<50	550					66000	57000		5 months after first in situ bio injections	
		10/21/2015	11.26	6.34	1297	15.94	0.00	1.4	-119	<10	<10	1600	21	0.27	<25	320	7700	<500	<0.5	59000	61000			9 months after first in situ bio injections	
		1/28/2016		5.97	544	13.2	4.10	2.0	-90.3	6.2	<4.0	760	15	<0.050	<5.0	190	6000	<22	<9.8	60000	62000			12 months after first in situ bio injections	
		5/4/2016	9.78	5.77	2123	14.23	0.00	4.0	-98.1	3.7	2.3	310	11	0.77	<25	2400	5000	<67	7.7	310000				5 weeks after second in situ bio injections	
		8/11/2016	9.69	6.14	1379	16.81	0.79		-177.9	<1.0	<1.0	190	5.3	0.12	<25	650	6400	<91	<8.7	130000				4 months after second in situ bio injections	
11/11/2016	8.88	6.23	1300	17.3	0.22	6.0	-114	<1.0	<1.0	110	21	0.14	<5.0	460	12000	<160	6.1	150000	140000			7 months after second in situ bio injections			
3/13/2017	8.1	6.2	732	11.83	0.56	4.0	-91.1	0.54	0.4	41	12	0.13	<25	260	18000	<100	<11	100000	88000			11 months after second in situ bio injections			
UCCMW-4	35-40	3/13/2014	9.45	6.70	675	14.3	4.61			0.88	<0.20	<0.20	<0.20	<0.05	8.1	<1.0	<0.50	<0.50	<0.50			Baseline			
		5/12/2014	8.30	6.83	523	15.7	0.16	0.0	+247	0.20	<0.20	<0.20	<0.20	<0.05	<5	<1	1.9	<0.5	<0.5				Baseline		
		6/5/2014	8.18	6.71	589	16.0	0.20			0.23	<0.20	<0.20	<0.20										2 weeks after first chem-ox injection		
		8/19/2014	8.2	6.93	340	22.2	0.37			4.9	<0.20	<0.20	<0.20										2 weeks after second chem-ox injection		
		9/18/2014	8.41	6.95	361	18.9	0.60			0.26	<0.20	<0.20	<0.20										6 weeks after second chem-ox injection		
		12/17/2014	9.24	6.51	288	14.5	1.32			17	0.44	<0.20	<0.20											4 months after second chem-ox injection	
		4/2/2015	9.21	7.19	248	15.0	1.24		+126.7	6.4	<0.20	<0.20	<0.20											5 weeks after first in situ bio injections	
		7/17/2015		6.48	229	17.0	0.01		-12.3	0.48	<0.20	<0.20	<0.20												5 months after first in situ bio injections
		10/21/2015	10.20	7.35	196	20.5	2.05		-29.1	0.5	<0.20	<0.20	<0.20												9 months after first in situ bio injections
		1/28/2016		6.87	134	14.49	3.59		-25.9	<0.20	<0.20	<0.20	<0.20											12 months after first in situ bio injections	
		8/12/2016	9.05	6.72	178	17.47	4.02		-0.9	0.47	<0.20	<0.20	<0.20											4 months after second in situ bio injections	
		3/9/2017	7.47	7.57	265	13.38	0.42		-140.9	0.21	<0.20	0.3	<0.20											10 months after second in situ bio injections	
UCCMW-17	10-20	5/11/2014	8.16	6.20	351	14.6	2.03	0.0	-100	<0.20	<0.20	<0.20	<0.20	3.1	11	<1.0	1.5	<0.50	<0.50			Baseline			
		6/5/2014	8.19	6.05	621	14.7	4.85			0.36	<0.20	<0.20	<0.20										2 weeks after first chem-ox injection		
		8/15/2014	8.45	6.10	563	17.0	28.84			0.21	<0.20	<0.20	<0.20										2 weeks after second chem-ox injection		
		9/17/2014	8.78	6.40	645	19.1	8.64			0.7	<0.20	<0.20	<0.20											6 weeks after second chem-ox injection	
		12/17/2014	9.80	6.93	376	14.8	3.25			24	3.2	9.3	<0.20											4 months after second chem-ox injection	
		3/24/2015	9.47	5.80	271	15.1	50.0		197.5	0.95	<0.20	<0.20	<0.20											5 weeks after first in situ bio injections	
		7/17/2015		5.46	227	17.5	43.9		88.6	0.49	<0.20	0.69	<0.20											5 months after first in situ bio injections	
		10/21/2015	10.82	6.77	174	19.3	38.1		63.4	0.52	<0.20	0.35	<0.20											9 months after first in situ bio injections	
		1/28/2016		5.75	112	15.31	5.53	0.0	104.3	0.51	<0.20	<0.20	<0.20	3.2	17	1.1	10	<0.50	<0.50	9100	9400			12 months after first in situ bio injections	
		5/3/2016	9.35	5.80	222	20.53	7.23		125.0	4.9	0.22	12	<0.20											5 weeks after second in situ bio injections	
		8/11/2016	9.21	5.80	185	17.39	2.50		2.19	0.81	<0.20	0.78	<0.20	1.8	19	1.0	<0.50	<0.50	<0.50	17000				4 months after second in situ bio injections	
		11/10/2016	8.65	5.72	293	18.6	8.24	0.0	49.30	35	3.6	44	<0.20											7 months after second in situ bio injections	
3/13/2017	7.82	6.15	324	13.09	1.46	0.8	60.8	16	3.4	250	7.0	3.6	30	7.0	450	<5.2	1.5	31000	30000			10 months after second in situ bio injections			
UCCMW-18	10-20	8/19/2014	8.68	5.82	480	20.8	NA			5.8	<0.20	<0.20	<0.20										2 weeks after second chem-ox injection		
		9/17/2014	8.99	5.93	759	19.2	6.63			1.7	<0.20	<0.20	<0.20										6 weeks after second chem-ox injection		
		12/17/2014	9.83	6.01	372	14.1	1.02			1500	55	170	<10											4 months after second chem-ox injection	
		3/24/2015	9.54	5.56	1252	14.8	0.00		-144.7	850	9	15	<0.20	<0.050	<5.0	670	19	8.5	10	170000		8.00E+04		5 weeks after first in situ bio injections	
		7/22/2015		5.64	489	20.8	0.00	1.0	-210.1	1.4	0.35	22	0.60	0.29	75	31				29000	28000			5 months after first in situ bio injections	
		10/20/2015	10.89	6.26	263	17.9	3.72	0.8	-106.9	<1.0	1.2	<1.0	3.4	1.2	13	21	4000	<250	<0.50				4.00E+04	9 months after first in situ bio injections	
		1/28/2016		6.10	790	13.95	3.05	1.0	-87.4	<5.0	<5.0	1800	280	1.1	<10	250	12000	<110	<15	27000	28000			12 months after first in situ bio injections	
		5/3/2016	9.45	5.66	379	15.57	4.17	3.0	5.4	<2.0	<2.0	390	240	2.0	<20	67	5500	<67	240	20000					5 weeks after second in situ bio injections
		8/11/2016	9.32	6.14	211	16.29	2.35		-73.3	0.85	<0.20	4.4	4.6	1.9	10	13	12000	<94	8.7	12000					4 months after second in situ bio injections
		11/10/2016	8.74	6.19	479	18.6	0.67	3.0	-59.6	42	2.0	15	8.7	2.5	<10	46	11000	<130	78	21000	22000	5.00E+06		7 months after second in situ bio injections	
		3/13/2017	8.89	6.38	588	12.72	0.48	4.0	-81.2	4.1	1.7	39	14	0.35	<25	59	14000	<120	43	44000	40000			10 months after second in situ bio injections	
		UCCMW-19	10-20	5/12/2014	8.12	6.31	440	15.2	1.46	0.0	-166	62	10	32	<0.40	3.6	17	<1.0	15	3.3	1.7	19000	18000		Baseline
6/5/2014	8.13			5.98	1011	16.3	5.32			260	41	<0.20	<0.20											2 weeks after first chem-ox injection	
8/19/2014	8.34			6.07	1072	21.6	29.85			1100	33	60	<5.0											2 weeks after second chem-ox injection	
9/16/2014	8.60			6.14	1004	20.9	7.95			400	9	11	<0.20											6 weeks after second chem-ox injection	
12/19/2014	9.27			6.08	334	14.0	2.07			290	12	24	<2.0											4 months after second chem-ox injection	
4/2/2015	9.07			5.75	459	14.5	0.00		-65.9	120	6	5.5	<0.40	0.76	5.6	490	<0.50	<0.50	0.70	22000				5 weeks after first in situ bio injections	
7/22/2015				5.65																					

Table 1
Ultra Custom Care Cleaners Site
Ground Water Analytical Data

Sample Location	Screened Depth, (ft bgs)	Sample Date	Depth to Water (ft bgs)	pH (units)	Conductivity (uS)	Temperature (°C)	Diss. Oxygen (mg/L)	Fe ²⁺ (mg/L)	Redox Potential (millivolt)	Tetrachloroethene (µg/L)	Trichloroethene (µg/L)	(cis) 1,2-Dichloroethene (µg/L)	Vinyl Chloride (µg/L)	Nitrate (mg/L)	Sulfate (mg/L)	Total Organic Carbon (mg/L)	Methane (µg/L)	Ethane (µg/L)	Ethene (µg/L)	Total Sodium (ug/L)	Dissolved Sodium (ug/L)	Chloride Reductase (vcrA) Gene Copies/Liter				
MTCA Method A/B Cleanup Level (Table 720-1, WAC 173-340-900)										5	5	16 (B)	0.2	NA	NA	NA	NA	NA	NA							
UCCMW-20	8-18	3/9/2017	7.38	7.16	297	10.51	0.85	3.0	-151.9	0.6	0.48	3.3	0.65	0.11	<25	18	4100	<35	<5.5	19000	19000		10 months after second in situ bio injections			
		5/15/2014	7.61	6.28	221	14.2	28.89	0.0	328	43	5.9	6.8	<0.20	2.1	11	1.0	<0.50	<0.50	<0.50				Baseline			
		6/3/2014	7.88	6.07	380	15.3	8.04			48	6.7	6.1	<0.20											2 weeks after first chem-ox injection		
		8/14/2014	7.99	5.44	548	19.3	9.28			48	4.2	6.6	<0.20											2 weeks after second chem-ox injection		
		9/16/2014	8.31	5.56	388	20.2	9.34			64	7.4	9.5	<0.40											6 weeks after second chem-ox injection		
		12/11/2014	8.61	5.53	334	13.1	7.10			160	16	32	<0.10												4 months after second chem-ox injection	
		4/2/2015	8.74	6.11	176	12.7	12.90			71	7.5	9.2	<0.40		4.8	28	1.9	<0.50	<0.50	<0.50	11000			5 weeks after first in situ bio injections		
		7/9/2015		5.63	767	20.1	0.00	2.8	-122.8	31	5.8	53	0.96	0.055	<5.0	88	5.4	4.3	6.1	23000	22000		5 months after first in situ bio injections			
		10/26/2015	10.01	5.55	434	16.1	0.00	0.8	-57.6	8.6	2.6	56	<0.40	0.076	<5.0	11	37	5.6	<0.50	<0.50	25000	26000		9 months after first in situ bio injections		
		1/29/2016		5.99	204	11.84	1.63	2.0	13	18	2.7	43	<0.20	1.5	23	2.7	1.8	<0.50	<0.50	16000	15000		12 months after first in situ bio injections			
		5/5/2016	8.59	6.01	223	14.70	2.50	2.0	121	23	8.3	63	<0.20	2.3	19	2.1	0.78	<0.50	<0.50	16000			5 weeks after second in situ bio injections			
8/11/2016	8.45	5.84	191	16.54	2.25		7.6	16	3.2	26	<0.20	1.3	24	2.4	1.3	<0.50	<0.50	12000			4 months after second in situ bio injections					
11/29/2016	7.30	6.32	146.9	14.20	2.53	0.8	10.3	6.1	0.88	2.3	<0.20	1.5	19	2.1	3.0	<0.50	<0.50	9700	9700		7 months after second in situ bio injections					
3/8/2017	6.99	6.45	219	9.70	5.75	2.4	27.5	5.0	0.64	0.57	<0.20	2.5	89	2.5	0.98	<0.50	<0.50	19000	19000		10 months after second in situ bio injections					
UCCMW-21	12-22	5/15/2014	10.38	6.81	614	14.6	15.00	0.0	-318	13	<0.20	<0.20	<0.20	1.3	49	3.0	5.4	1.4	1.0				Baseline			
		6/3/2014	11.67	6.09	611	13.9	8.77			16	0.34	<0.20	<0.20										2 weeks after first chem-ox injection			
		8/14/2014	11.81	6.22	378	15.9	8.2			19	0.49	<0.20	<0.20										2 weeks after second chem-ox injection			
		9/16/2014	12.18	6.34	578	17.4	6.65			29	1.2	0.26	<0.20											6 weeks after second chem-ox injection		
		12/11/2014	12.66	6.03	356	14.4	6.98			28	1.0	<0.20	<0.20											4 months after second chem-ox injection		
		4/2/2015	12.73	6.23	237	15.02	24.5		98.0	28	0.82	<0.20	<0.20	3.6	31	6.1	<0.50	<0.50	<0.50	9700			5 weeks after first in situ bio injections			
		7/9/2015		5.61	475	17.58	25.5	0.0	89.3	13	<0.20	<0.20	<0.20	3.0	100	6.5	0.65	<0.50	<0.50	26000	25000		5 months after first in situ bio injections			
		10/26/2015	14.23	6.30	319	15.37	27.8	0.0	94.8	13	<0.20	<0.20	<0.20	2.5	45	4.3	2.30	<0.50	<0.50	22000	21000		9 months after first in situ bio injections			
		1/29/2016		5.75	146	13.59	4.95	0.0	148.9	25	0.69	0.30	<0.20	2.9	16	1.9	9.7	<0.50	<0.50	13000	13000		12 months after first in situ bio injections			
		5/5/2016	10.91	5.57	231	15.30	4.15	0.0	138.0	24	0.48	0.25	<0.20	2.9	26	3.3	<0.50	<0.50	<0.50	15000			5 weeks after second in situ bio injections			
		8/11/2016	12.57	5.83	481	14.91	2.15		-97.4	20	0.35	2.3	<0.20	0.2	18	19	8.10	<1.0	<0.98	26000			4 months after second in situ bio injections			
11/29/2016	11.30	6.26	357.9	14.70	0.27	4.0	-91.2	7.8	0.7	9.5	<0.20	0.2	12	13	5.3	<1.2	<0.50	17000	17000		7 months after second in situ bio injections					
3/8/2017	11.71	6.40	315	13.05	0.60	3.8	-167.2	5.4	0.77	5.6	0.68	0.1	12	5.5	1100	<1.5	<1.4	21000	21000		10 months after second in situ bio injections					
BB-3	10-20	3/13/2014	7.94	6.11	710	12.4	9.80			0.3	<0.20	<0.20	<0.20	3.5	20	<1.0	<0.50	<0.50	<0.50				Baseline			
		5/14/2014	8.42	6.48	567	13.7	9.01	0.0	360	0.21	<0.2	<0.2	<0.20	2.6	18	<1.0	<0.50	<0.50	<0.50				Baseline			
		6/4/2014	7.76	6.33	569	17.5	4.38			<0.20	<0.20	<0.20	<0.20										2 weeks after first chem-ox injection			
		8/19/2014	10.18	6.03	318	17.6	6.71			0.75	<0.20	<0.20	<0.20											2 weeks after second chem-ox injection		
		9/19/2014	11.39	6.74	335	18.5	3.17			0.42	<0.20	<0.20	<0.20											6 weeks after second chem-ox injection		
		12/12/2014		6.99	263	15.5	2.40			1.5	<0.20	<0.20	<0.20												4 months after second chem-ox injection	
		4/2/2015	6.19	6.93	320	13.93	6.93			<0.20	<0.20	<0.20	<0.20												5 weeks after first in situ bio injections	
		7/9/2015		6.16	350	19.50	10.95		81	<0.20	<0.20	<0.20	<0.20												5 months after first in situ bio injections	
		1/27/2016		6.25	170	13.99	16.36		140.1	<0.20	<0.20	<0.20	<0.20												12 months after first in situ bio injections	
		8/10/2016	7.45	5.70	194	17.48	7.71		24.4	0.25	<0.20	<0.20	<0.20												4 months after second in situ bio injections	
		3/7/2017	4.89	6.50	178	11.18	7.07		38.2	0.32	<0.20	0.65	<0.20												10 months after second in situ bio injections	
UCCMW-5	10-20	5/14/2014	9.79	5.98	357	13.8	9.60	0.0	376	14	0.34	0.44	<0.20	0.77	9.4	1.7	<0.50	<0.50	<0.50				Baseline			
		6/5/2014	9.94	5.98	382	14.8	5.35			14	0.31	0.22	<0.20											2 weeks after first chem-ox injection		
		8/19/2014	10.33	5.8	465	19.1	14.10			15	0.24	<0.20	<0.20											2 weeks after second chem-ox injection		
		9/16/2014	10.59	6.20	855	21.0	6.56			13	0.27	<0.20	<0.20												6 weeks after second chem-ox injection	
		12/17/2014	11.20	6.13	286	13.5	2.28			14	<0.20	<0.20	<0.20												4 months after second chem-ox injection	
		4/2/2015	11.04	6.95	150	12.6	15.75		52.0	8.5	<0.20	<0.20	<0.20												5 weeks after first in situ bio injections	
		7/17/2015		5.40	180	18.5	16.01		62.1	19	0.50	0.20	<0.20												5 months after first in situ bio injections	
		9/23/2015	12.39	6.13	212	17.9	4.59		49.2																	7 months after first in situ bio injections
		10/21/2015	12.52	6.10	215	19.2	3.33		83.5	19	0.70	1.10	<0.20													9 months after first in situ bio injections
		1/27/2016		6.19	82	12.07	13.65		135.8	5.8	0.21	3.90	<0.20													12 months after first in situ bio injections
		5/4/2016	10.90	6.07	148	14.30	3.05	0.00	23.5	14.0	0.54	14	<0.20	0.18	12	0.71	<0.50	<0.50	2.1	20000					5 weeks after second in situ bio injections	
8/10/2016	10.76	5.31	151	17.64	2.95		69.4	14.0	0.61	6.2	<0.20												4 months after second in situ bio injections			
11/14/2016	10.06	6.22	137	16.80	5.25	0.00	39	6.3	0.23	0.98	<0.20	0.31	11	1.5	0.58	<0.50	<0.50	8800	10000		7 months after second in situ bio injections					
3/9/2017	9.08	7.33	114	10.02	1.35		-49.1	5.0	0.24	1.40	<0.20												10 months after second in situ bio injections			
UCCMW-24	8-18	5/15/2014	4.70	6.31	486	15.0	7.50	0.0	7.0	2.2	<0.20	<0.20	<0.20	2.6	18	1.7	3.9	1.2	0.71				Baseline			
		6/3/2014	3.20	6.18	556	14.9	8.75			2.2	<0.20	<0.20	<0.20											2 weeks after first chem-ox injection		
		8/14/2014	5.61	6.10	425	17.5	7.45			2.5	<0.20	<0.20	<0.20											2 weeks after second chem-ox injection		
		9/18/2014	5.74	5.85	449	19.0	8.53			2.4	<0.20	<0.20	<0.20												6 weeks after second chem-ox injection	
		12/11/2014	5.58	6.55	294	15.0	6.70																			

Sample Location	Screened Depth, (ft bgs)	Sample Date	Depth to Water (ft bgs)	pH (units)	Conductivity (uS)	Temperature (°C)	Diss. Oxygen (mg/L)	Fe ⁺² (mg/L)	Redox Potential (millivolt)	Tetrachloroethene (µg/L)	Trichloroethene (µg/L)	(cis) 1,2-Dichloroethene (µg/L)	Vinyl Chloride (µg/L)	Nitrate (mg/L)	Sulfate (mg/L)	Total Organic Carbon (mg/L)	Methane (µg/L)	Ethane (µg/L)	Ethene (µg/L)	Total Sodium (ug/L)	Dissolved Sodium (ug/L)	Chloride Reductase (vcrA) Gene Copies/Liter		
MTCA Method A/B Cleanup Level (Table 720-1, WAC 173-340-900)										5	5	16 (B)	0.2	NA	NA	NA	NA	NA	NA					
UCCMW-7	8-18	5/15/2014	5.95	6.23	393	14.1	7.84	0.0	352	27	<0.20	<0.20	<0.20	2.2	28	<1.0	<0.50	<0.50	<0.50			Baseline		
		6/3/2014	6.02	6.13	513	14.3	3.98			26	<0.20	<0.20	<0.20									2 weeks after first chem-ox injection		
		8/19/2014	6.31	6.13	300	16.3	8.93			28	<0.20	<0.20	<0.20										2 weeks after second chem-ox injection	
		9/19/2014	6.38	7.05	329	17.2	4.34			21	<0.20	<0.20	<0.20										6 weeks after second chem-ox injection	
		12/17/2014	6.60	6.09	302	14.6	2.41			22	<0.20	<0.20	<0.20										4 months after second chem-ox injection	
		4/2/2015	6.34	6.25	238	14.8	NA		-22.5	25	<0.20	<0.20	<0.20		3.5	22	4	<0.50	<0.50	<0.50	10000			5 weeks after first in situ bio injections
		7/30/2015	6.16	6.12	405	17.5	NA	0.0	96.4	25	<0.20	<0.20	<0.20		3.7	110	14	<0.50	<0.50	<0.50	10000	10000		5 months after first in situ bio injections
		10/21/2015	7.39	6.20	275	18.1	22	0.0	123.2	24	<0.20	<0.20	<0.20		3.1	65	7.8	<0.50	<0.50	<0.50	10000	11000		9 months after first in situ bio injections
		2/2/2016		5.93	192	15.0	11.00	0.0	144.4	26	<0.20	<0.20	<0.20		3	67	7.1	25	<0.50	<0.50	12000	12000		12 months after first in situ bio injections
		5/5/2016	6.75	5.87	336	15.76	15.05	0.0	97.5	28	<0.20	0.35	<0.20		2.8	110	9.5	<0.50	<0.50	<0.50	15000			5 weeks after second in situ bio injections
8/10/2016	5.26	6.39	190	18.32	1.13		-109.9	0.87	<0.20	3.9	0.23	<0.050	9.4	9.5	2400	32	3.2	14000			4 months after second in situ bio injections			
11/14/2016	4.7	6.22	320	15.9	0.18	3.4	-30.7	9.90	2.4	1.7	0.3	0.09	23	4	1200	<14	<14	14000	15000		7 months after second in situ bio injections			
3/7/2017	4.22	6.5	297	10.38	0.68	3.8	-130.8	14.0	4.6	6.8	0.35	0.13	30	6.4	2000	<21	<2.3	16000	16000		10 months after second in situ bio injections			
UCCMW-25	8-18	5/15/2014	4.12	6.08	424	15.3	6.40	0.0	255	6.9	<0.20	<0.20	<0.20	3.9	24	<1.0	<0.50	<0.50	<0.50			Baseline		
		6/3/2014	5.15	6.10	636	14.7	6.29			9.3	<0.20	<0.20	<0.20										2 weeks after first chem-ox injection	
		8/14/2014	5.21	6.29	554	16.6	5.13			9.3	<0.20	<0.20	<0.20										2 weeks after second chem-ox injection	
		9/18/2014	5.49	5.87	383	18.4	8.73			8.3	<0.20	<0.20	<0.20											6 weeks after second chem-ox injection
		12/11/2014	5.30	6.68	331	15.7	4.43			7.5	<0.20	<0.20	<0.20											4 months after second chem-ox injection
		4/2/2015	5.56	6.12	321	14.3	36.58		113	9.4	<0.20	<0.20	<0.20	2.4	67	12	<0.50	<0.50	<0.50	15000				5 weeks after first in situ bio injections
		7/9/2015	6.51	5.54	429	17.0	34.30	0.0	100	6.7	<0.20	<0.20	<0.20	<0.050	110	11	<0.50	<0.50	<0.50	14000	13000		5 months after first in situ bio injections	
		10/21/2015	6.80	6.50	230	17.1	8.60	0.0	76	9.6	<0.20	<0.20	<0.20	1.8	23	3.7	0.84	<0.50	<0.50	28000	28000		9 months after first in situ bio injections	
		1/29/2016		6.42	168	14.75	3.80	0.0	87.0	10.0	<0.20	<0.20	<0.20	4.4	14	2.3	1.4	<0.50	<0.50	29000	31000		12 months after first in situ bio injections	
		5/5/2016	6.90	6.19	198	15.28	8.62	0.0	116.8	7.8	<0.20	<0.20	<0.20	1.8	21	2.3	0.84	<0.50	<0.50	32000				5 weeks after second in situ bio injections
8/11/2016	4.99	6.03	749	17.18	0.76		-37.5	11	0.73	3.9	<0.20	0.3	<5.0	130	1500	<18	6.3	59000			4 months after second in situ bio injections			
11/29/2016	4.03	6.32	298.9	17.50	0.15	0.0	-89.9	8.1	1.9	2.6	0.20	<0.050	<10	6.2	1400	<32	<1.8	32000	33000		7 months after second in situ bio injections			
3/7/2017	3.96	6.42	343	12.14	0.74	3.2	-134.4	5.6	1.0	12	0.90	<0.050	<5.0	14	11000	<90	<11	45000	42000		10 months after second in situ bio injections			
BI-3	5-10	6/10/2014	4.27	6.39	493	15.4	1.55	0.0	238	4.5	0.43	1.7	0.26	1.3	10	1.8	128	<1.2	<1.1			2 weeks after first chem-ox injection		
		9/17/2014	4.17	6.32	394	19.8	0.25			2.1	0.52	2.9	1.6										6 weeks after second chem-ox injection	
		12/17/2014	3.83	6.77	295	12.00	0.32			2.5	0.35	2.4	1.5											4 months after second chem-ox injection
		3/30/2015	4.30	6.17	204	14.03	0.00		-29.6															5 weeks after first in situ bio injections
		7/9/2015		5.86	209	20.31	0.00		-118.3	0.68	0.37	2.6	1.5											5 months after first in situ bio injections
		10/22/2015	4.92	6.69	213	18.79	0.00		-59.5	0.52	<0.20	1.0	0.96											9 months after first in situ bio injections
		1/27/2016		7.1	128	12.41	4.63		-72.6	<0.20	<0.20	1.0	0.83											12 months after first in situ bio injections
		3/8/2017	1.49	6.59	224	10.81	1.96		-78.7	0.92	0.90	4.0	0.74											11 months after second in situ bio injections
Second Injection Row																								
UCCMW-8	5-15	5/29/2014	6.07	6.52	490	13.9	1.87	0.0	283	110	<1.0	<1.0	<1.0	2.3	18	<1.0	<0.50	<0.50	<0.50			Baseline		
		9/13/2014	6.29	6.5	289	19.1	1.00			76	0.57	<0.40	<0.40										6 weeks after second chem-ox injection	
		12/12/2014	5.51	6.97	257	14.6	1.30			83	0.44	<0.40	<0.40										4 months after second chem-ox injection	
		3/23/2015	5.80	6.12	180	12.7	0.00		-90.1	49	0.38	<0.20	<0.20	0.24	6.2	2.7	48	<0.50	<0.50	5400			5 weeks after first in situ bio injections	
		7/8/2015		5.75	237	17.8	0.00		61.2	42	2.3	6.0	<0.20	0.97	15	1.2	<0.50	<0.50	<0.50	14000			5 months after first in situ bio injections	
		10/21/2015	7.00	6.41	217	18.2	0.00	0.0	84.6	36	2.9	7.3	<0.20	0.71	16	1.8	110	<10	<0.50	12000	12000		9 months after first in situ bio injections	
		2/2/2016		6.11	112	12.58	2.55	0.0	106.1	75	1.6	1.0	<0.20	2.2	16	1.4	65	<1.1	<0.58	13000	12000		12 months after first in situ bio injections	
		5/5/2016	6.12	6.08	219	13.99	1.01	0.0	89.7	96	0.79	0.51	<0.20	0.35	19	31	4.1	<0.50	<0.50	16000			5 weeks after second in situ bio injections	
		8/10/2016	3.03	6.04	194	16.73	1.19		26.5	1.3	<0.20	1.0	<0.20	0.94	16	3.8	15.0	<0.50	<0.50	11000			4 months after second in situ bio injections	
		11/11/2016	4.97	6.86	285	15.70	0.14	0.4	27.5	1.7	6.6	16	0.43	<0.050	22	4.8	160.0	<3.2	<0.50	13000	13000		7 months after second in situ bio injections	
3/10/2017	4.46	6.63	193	11.59	0.82	0.8	8.1	10.0	17	6.9	0.40	0.50	20	3.1	570.0	<9.2	<1.1	13000	13000		10 months after second in situ bio injections			
UCCMW-9		5/28/2014	6.75	6.51	1164	16.2	0.52	0.0	276	1.0	<1.0	<1.0	<1.0	1.0	19	2.0	16.0	<1.0	<1.0			Baseline		
		9/13/2014	6.71	6.75	611	22.8	0.46			2.5	0.23	0.21	<0.20										6 weeks after second chem-ox injection	
		12/17/2014	6.09	6.30	523	10.8	0.72			5.7	0.22	<0.20	<0.20										4 months after second chem-ox injection	
		3/30/2015	6.58	6.00	366	12.8	0.12		-45.5	0.9	<0.20	<0.20	<0.20										5 weeks after first in situ bio injections	
		7/9/2015		5.95	389	20.4	0.13		-39.8	0.37	0.26	0.49	<0.20											5 months after first in situ bio injections
		1/27/2016		6.64	282	9.64	8.48		72.5	1.4	<0.20	<0.20	<0.20											12 months after first in situ bio injections
		8/12/2016	3.78	6.31	338	19.71	0.83		46	6.3	0.52	0.86	<0.20											4 months after second in situ bio injections
3/8/2017	3.91	7.08	258	10.60	0.58		-80.5	0.38	0.27	0.66	<0.20											10 months after second in situ bio injections		
UCCMW-10	5-15	6/13/2014	6.15	5.70	736	17.0	0.60	0.0	261	0.90	<0.20	<0.20	<0.20	2.0	24	9.2	48.6	<1.2	<1.1			2 weeks after first chem-ox injection		
		9/18/2014	6.02	5.75	414	21.6	0.37			0.29	<0.20	<0.20	<0.20										2 weeks after second chem-ox injection	
		12/11/2014	5.2	5.65	469	14.0	0.49			1.3	<0.20	<0.20	<0.20										4	

Sample Location	Screened Depth, (ft bgs)	Sample Date	Depth to Water (ft bgs)	pH (units)	Conductivity (uS)	Temperature (°C)	Diss. Oxygen (mg/L)	Fe ²⁺ (mg/L)	Redox Potential (millivolt)	Tetrachloroethene (µg/L)	Trichloroethene (µg/L)	(cis) 1,2-Dichloroethene (µg/L)	Vinyl Chloride (µg/L)	Nitrate (mg/L)	Sulfate (mg/L)	Total Organic Carbon (mg/L)	Methane (µg/L)	Ethane (µg/L)	Ethene (µg/L)	Total Sodium (ug/L)	Dissolved Sodium (ug/L)	Chloride Reductase (vcrA) Gene Copies/Liter					
MTCA Method A/B Cleanup Level (Table 720-1, WAC 173-340-900)										5	5	16 (B)	0.2	NA	NA	NA	NA	NA	NA								
BB-2	9-19	3/9/2017	3.94	7.48	245	11.33	0.91		-156.4	14.0	<0.20	1.8	<0.20										10 months after second in situ bio injections				
		6/10/2014	5.53	6.63	459	14.9	2.70	0.0	269	79	<0.40	<0.40	<0.40	3.2	9.4	<1.0	<0.70	<1.20	<1.10				2 weeks after first chem-ox injection				
		9/17/2014	5.86	6.9	306	18.6	1.85			68	<0.40	<0.40	<0.40										6 weeks after second chem-ox injection				
		12/12/2014	5.01	6.99	263	15.5	2.40			82	<0.40	<0.40	<0.40										4 months after second chem-ox injection				
		4/2/2015	5.31	6.39	192	15.44	56.2			65	<0.40	<0.40	<0.40	3.5	8.6	<1.0	<0.50	<0.50	<0.50	13000			5 weeks after first in situ bio injections				
		7/22/2015		5.75	203	18.99	3.6	0.0	118.2	67	<0.40	<0.40	<0.40	3.4	8.9	<1.0					14000	12000	5 months after first in situ bio injections				
		10/22/2015	6.92	6.51	189	17.6	2.5	0.0	69.4	57	<0.40	<0.40	<0.40	3.0	9.4	<1.0	2.7	<0.50	<0.50	13000	14000	9 months after first in situ bio injections					
		2/2/2016		6.21	118	14.71	5.99	0.0	90.1	65	<0.40	<0.40	<0.40	3.3	8.8	<1.0	9.1	<0.50	<0.50	14000	14000	12 months after first in situ bio injections					
		5/5/2016	5.51	6.36	160	15.15	3.18	0.0	57.9	73	<0.40	<0.40	<0.40	3.6	9.3	<1.0	<0.50	<0.50	<0.50	14000			5 weeks after second in situ bio injections				
		8/11/2016	4.35	5.84	269	17.59	0.85		2.8	46	0.44	1.2	0.68	0.36	5.7	1.7	2200	<44	<3.4	19000			4 months after second in situ bio injections				
11/14/2016	4.2	6.32	204	17.7	0.75	0.0	47.4	70	<0.40	<0.40	<0.40	1.7	9.9	<1.0	290	<3.6	<0.64	14000	15000		7 months after second in situ bio injections						
3/10/2017	3.72	6.52	182	13.8	0.87	0.0	42.9	66	<0.40	3.7	<0.40		1.9	9.2	1.6	1800	<19	<2.3	15000	15000		10 months after second in situ bio injections					
Third Injection Row																											
EFGB-1		9/29/2014								20	<0.20	<0.20	<0.20										DP boring same loc as UCCMW-26				
UCCMW-26	5-15	3/23/2015	5.43	5.72	574	12.3	4.73		-201.1	81	10	21	0.74	0.14	<5.0	200	2100	0.86	0.82	30000			5 weeks after first in situ bio injections				
		7/30/1025		5.97	377	20.0	0.00	1.6	-113.9	2.2	1.5	130	3.3	0.054	<5.0	42	12000	<0.50	<0.50	18000	18000		5 months after first in situ bio injections				
		10/21/2015	6.97	6.18	424	18.5	0.00	1.2	-72.7	2	1.1	69	10	0.18	<5.0	26	21000	<1000	<5	18000	19000		9 months after first in situ bio injections				
		2/1/2016		6.47	1214	11.14	4.50	2.8	-127.5	0.47	0.22	0.98	0.35	0.77	<5.0	61	11000	<110	<14	110000	95000		12 months after first in situ bio injections				
		5/5/2016	5.81	5.92	405	14.20	1.40	2.4	53.3	<0.20	0.21	0.89	4.1	0.10	<5.0	70	10000	<120	<7.9	45000			5 weeks after second in situ bio injections				
		8/10/2016	4.21	6.37	872	18.39	3.19		-127.5	<0.20	<0.20	0.85	0.52	0.15	<10	28	11000	<130	<20	41000			4 months after second in situ bio injections				
		11/11/2016	8.88	6.77	1420	16.90	0.17	4.6	-129.8	<0.20	<0.20	0.95	0.38	0.06	<5.0	42	12000	<160	6.10	68000	68000		7 months after second in situ bio injections				
3/13/2017	4.57	6.68	805	11.12	0.46	3.2	-81	<0.20	0.4	2.4	0.94		<0.050	<25	27	11000	<95	<9.8	51000	46000		10 months after second in situ bio injections					
EFGB-2		9/29/2014								17	<0.20	<0.20	<0.20										DP boring same loc as UCCMW-27				
UCCMW-27	5-15	3/23/2015	5.30	7.38	923	12.4	0.23		-251.7	3.8	<0.20	<0.20	<0.20										5 weeks after first in situ bio injections				
		7/17/2025		5.73	379	21.3	0.00		36.6	19.0	<0.20	0.27	0.48											5 months after first in situ bio injections			
		10/22/2015	7.01	6.58	540	17.8	0.00		44.5	6.6	0.53	0.54	<0.20											9 months after first in situ bio injections			
		1/27/2016		6.39	760	11.99	2.44		-32.3	0.72	<0.20	<0.20	<0.20											12 months after first in situ bio injections			
		5/5/2016	5.65	6.41	444	13.74	1.86	2.0	156.9	16.0	0.49	0.22	<0.20	0.54	47	8.5	730	<8.4	<0.89	23000			5 weeks after second in situ bio injections				
		8/10/2016	4.76	6.05	421	17.86	2.56		-21.30	6.3	0.55	0.48	<0.20											4 months after second in situ bio injections			
		11/11/2016	4.40	8.47	780	17.20	0.13	4.8	-2.20	4.0	1.5	1.2	<0.20	<0.050	18	8.3	3600	<50	<2.2	31000	31000		7 months after second in situ bio injections				
3/13/2017	4.17	6.69	540	10.92	0.77		-60.9	1.1	0.87	1.1	<0.20											10 months after second in situ bio injections					
Other Wells																											
INJ-1	8-23	9/21/2015	9.71	5.8	220	19.37	1.65		-141.4														8 months after first in situ bio injections				
INJ-2	8-23	12/17/2014								9.3	0.29	0.53	<0.20	7.1	55	5.7	1.0	<0.50	<0.50	22000			4 months after second chem-ox injection				
		3/30/2015								1.5	0.27	3.1	1.1										5 weeks after first in situ bio injections				
		3/24/2015	9.25	5.66	332	14.75	8.15		105.8	91	3.7	7	<0.40										5 months after first in situ bio injections				
		7/17/2015		5.16	293	18.07	35.42		89.9	490	<0.20	16	<0.20											9 months after first in situ bio injections			
		1/28/2016		5.89	276	14.02	5.49		23.3	1300	17	910	4.6											12 months after first in situ bio injections			
		5/3/2016	9.16	5.92	518	17.12	0.67		-18.3	50	17	1100	11											5 weeks after second in situ bio injections			
		8/12/2016	9.02	5.03	239	17.82	3.00		30.9	100	3.5	45	<0.40											4 months after second in situ bio injections			
		11/14/2016	6.42	5.95	326	17.9	0.19		32.9	270	12.0	190	5.7											7 months after second in situ bio injections			
3/13/2017	7.42	6.29	365	10.81	0.74		20	25	2.0	34	2.0											10 months after second in situ bio injections					
INJ-3	8-23	9/21/2015	10.85	6.16	369	18.91	4.29		-212.3														8 months after first in situ bio injections				
INJ-4	8-23	2/2/2015	10.64	6.26	642	14.3	5.52			2.1	0.28	0.54	<0.20	6.2	49	4.4	0.73	<0.50	<0.50	27000			right after first in situ bio injections				
INJ-5	8-23	9/23/2015	11.66	6.33	475	23.19	0.00		-210.9														8 months after first in situ bio injections				
INJ-6	8-23	2/2/2015	10.46	6.53	557	15.1	6.50			18	0.33	<0.20	<0.20	7.0	91	2.9	0.65	<0.50	<0.50	21000			right after first in situ bio injections				
INJ-7	8-13	9/21/2015	9.66	6.19	858	19.86	0.26		-96.2														8 months after first in situ bio injections				
INJ-8	8-13																										
INJ-9	8-13	9/21/2015																					8 months after first in situ bio injections				
		10/21/2015	10.5	5.96	756	21.24	0.00		-56.9	<0.20	<0.20	400	10										Well pumped dry, insufficient volume for field parameters				
INJ-10	8-13																										
INJ-11	8-13	9/23/2015	10.85	6.27	1287	19.1	0.37		-106.9														8 months after first in situ bio injections				
INJ-12	8-13																										
INJ-13	8-13	9/23/2015	11.47	6.3	445	23.23	0.00		-89.9														8 months after first in situ bio injections				
INJ-14	8-13																										
INJ-15	8-13	9/23/2015	11.6	6.54	855	22.77	1.40		-82.6														8 months after first in situ bio injections				
INJ-16	8-13																										
INJ-17	8-13	9/23/2015	-	-	-	-	-		-														8 months after first in situ bio injections				
MW-2	3-13	5/11/2014	6.28	6.22	663	14.0	3.45	0.0	208	<0.20	<0.20	<0.20	<0.20	8.0	36	4.9	20	<0.50	<0.50				Baseline				
		6/2/2014	6.32	5.91	685	15.6	3.31			0.26	<0.20	<0.20	<0.20										2 weeks after first chem-ox injection				
		8/13/2014	6.66	5.99	200	17.9	NA			<0.20	<0.20	<0.20	<0.20														

Sample Location	Screened Depth, (ft bgs)	Sample Date	Depth to Water (ft bgs)	pH (units)	Conductivity (uS)	Temperature (°C)	Diss. Oxygen (mg/L)	Fe ⁺² (mg/L)	Redox Potential (millivolt)	Tetrachloroethene (µg/L)	Trichloroethene (µg/L)	(cis) 1,2-Dichloroethene (µg/L)	Vinyl Chloride (µg/L)	Nitrate (mg/L)	Sulfate (mg/L)	Total Organic Carbon (mg/L)	Methane (µg/L)	Ethane (µg/L)	Ethene (µg/L)	Total Sodium (ug/L)	Dissolved Sodium (ug/L)	Vinyl Chloride Reductase (vcrA) Gene Copies/Liter	
MTCA Method A/B Cleanup Level (Table 720-1, WAC 173-340-900)										5	5	16 (B)	0.2	NA	NA	NA	NA	NA	NA				
Trip Blank		6/6/2014								<0.20	<0.20	<0.20	<0.20										
Trip Blank		9/15/2014								<0.20	<0.20	<0.20	<0.20										
Trip Blank		9/17/2014								<0.20	<0.20	<0.20	<0.20										
Dup1		9/15/2014								3.1	<0.20	<0.20	<0.20										Duplicate of UCCMW-15 9/15/2014
Dup2		9/19/2014								4.4	<0.20	<0.20	<0.20										Duplicate of UCCMW-4 9/19/2014
Dup 1014		10/8/2014								<0.20	<0.20	<0.20	<0.20										Duplicate of UCCMW-12D 10/8/2014
Trip Blank		10/8/2014								<0.20	<0.20	<0.20	<0.20										
DUP 101714		10/17/2014								0.41	<0.20	<0.20	<0.20										
TB		11/3/2014								<0.20	<0.20	<0.20	<0.20										
DUP		11/3/2014								1.2	<0.20	<0.20	<0.20										Duplicate of UCCMW-13S 11/3/2014
TB		11/14/2014								<0.20	<0.20	<0.20	<0.20										
DUP		11/14/2014								<0.20	<0.20	<0.20	<0.20										Duplicate of UCCMW-14D 11/14/2014
DUP 112114		11/21/2014								1.1	<0.20	<0.20	<0.20										Duplicate of UCCMW-13S on 11/21/2014
TB		12/18/2014								<0.20	<0.20	<0.20	<0.20										
DUP1014		12/18/2014								<0.20	<0.20	<0.20	<0.20										
Dup 21215		2/12/2015								0.70	<0.20	<0.20	<0.20										Duplicate of UCCMW 13D on 2/12/2015
TB		3/30/2015								<0.20	<0.20	<0.20	<0.20										
DUP		3/24/2015								0.85	<0.20	<0.20	<0.20										Duplicate of UCCMW 17 on 3/24/2015
TB		7/17/2015								<0.20	<0.20	<0.20	<0.20										
TB		7/22/2015								<0.20	<0.20	<0.20	<0.20										
UCCDUP-102115		10/21/2015								<0.20	<0.20	41	<0.20										Duplicate of UCCMW-19 on 10/21/15
TB		10/21/2015								<0.20	<0.20	<0.20	<0.20										
TB		10/21/2015								<0.20	<0.20	<0.20	<0.20										
TB		10/26/2015								<0.20	<0.20	<0.20	<0.20										
DUP-0128		1/28/2016								5.2	<4.0	680	12										Duplicate of MW-1 on 1/28/2016
TB		1/28/2016								<0.20	<0.20	<0.20	<0.20										
DUP-0504		5/4/2016								3.8	2.1	310	12	0.19	2200	<25	6100	<67	5.2	300000			Duplicate of MW-1 on 5/4/2016
TB		5/4/2016								<0.20	<0.20	<0.20	<0.20										
DUP-0812		8/12/2016								<0.20	<0.20	240	2.6	0.053	7.4	39	7200	<81	<8.4	24000			Duplicate of MW-19 on 8/12/2016
TB		8/12/2016								<0.20	<0.20	<0.20	<0.20										
DUP-11-11-16		11/11/2016								1.7	6.6	16	0.43	0.06	22	4.7	160	<2.3	<0.50	12000	13000		Duplicate of MW-8 on 11/11/2016
DUP-0313		3/13/2017								23	2.0	36	2.1										Duplicate of INJ-2 on 3/13/2017
TB		3/8/2017								<0.20	<0.20	<0.20	<0.20										

< – Analyte not detected at laboratory's listed reporting limit
Bold indicates analyte detected at a concentration greater than the laboratory reporting limit
Yellow highlight indicates analyte meets or exceeds MTCA cleanup level
 Blank – not analyzed or not measured at that sampling location
 NA – Not applicable
 1 – The MTCA Method A ground water cleanup level for gasoline range hydrocarbons is 800 µg/L if benzene is present; the cleanup level is 1000 µg/L if benzene is not detectable