2018 Groundwater Monitoring Report
North Woodwaste Landfill
Arlington, Washington

Submitted to

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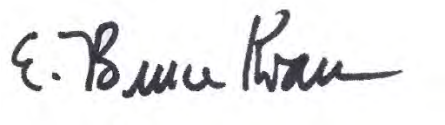
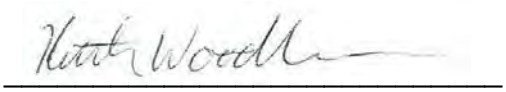


Bruce Kvam, Principal Biologist

Date: 23 April 2019



Keith Woodburne, LG (#2955)

Date: 23 April 2019

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1. Introduction

This report presents quarterly groundwater data collected from March to November 2018 by Jeff Lervick PLE LLC for J.H. Baxter & Co's (Baxter) closed North Woodwaste Landfill (North Landfill, Site), located at the northwest corner of 198th Street NE and 67th Avenue NE in Arlington, Snohomish County, Washington (Figure 1, Source: GSI Water Solutions, Inc.). Baxter closed the North Landfill in 1991; it is covered with a vegetated soil cap.

Four monitoring wells were installed in 1988. Monitoring wells BXN-1, BXN-2, and BXN-3 are located hydraulically downgradient of the North Landfill. Monitoring well BXN-4 is located hydraulically upgradient of the North Landfill (Figures 2 and 3, Source: GSI Water Solutions, Inc.). Monitoring well BXN-4 represents the background groundwater quality providing the benchmark to compare with the water quality data from the downgradient wells. Boring logs, groundwater monitoring procedures, and a summary of site conditions encountered during the installation of the monitoring wells are included in the hydrogeologic report prepared by Sweet-Edwards/EMCON, Inc. (EMCON, 1989).

Sampling in 2018 was conducted in March, June, September, and November in accordance with the Washington State Department of Ecology (Ecology)-approved sampling and analysis plan (SAP) dated March 2017 (GSI 2017). Groundwater samples were collected on a quarterly basis from monitoring well BXN-1 and on a semi-annual basis from the remaining wells. Each monitoring event included measuring groundwater levels and collecting groundwater samples from monitoring wells BXN-1, BXN-2, and BXN-4. Monitoring well BXN-3 was not sampled because it was damaged in 2010 and is currently inaccessible.

2. Hydrogeology

Semi-annual groundwater monitoring events included collecting groundwater level measurements at the three monitoring wells to understand the flow direction and gradient of shallow groundwater.

2.1 Groundwater Elevations

Groundwater levels were measured at the three monitoring wells before pumping the wells for groundwater sampling. Groundwater elevation data for 2018 are summarized in Table 1.

Based on quarterly measurements in BXN-1, groundwater elevations were highest during June 2018 and lowest during November 2018. The static groundwater level in well BXN-1 fluctuated between June and November by 3.34 feet.

Groundwater elevation contour maps for February 2016 (Figure 2, Source: GSI Water Solutions, Inc.) and September 2016 (Figure 3, Source: GSI Water Solutions, Inc.) are provided for reference. The groundwater flow direction throughout 2018 was toward the northwest and is consistent with the regional groundwater flow in the aquifer (Figure 4, Source: GSI Water Solutions, Inc.) and previous measurements of groundwater elevations in the North Woodwaste Landfill.

2.2 Groundwater Velocities

Groundwater velocities (v_x) were estimated using Darcy's law:

$v_x = - Ki / n_e$

Hydraulic conductivity (K) in the fine sand beneath the Site was estimated at 3×10^{-2} to 6×10^{-2} centimeters per second based on slug tests performed in monitoring wells BXN-3 and BXN-4 (EMCON, 1989). Porosity (n_e) was assumed to be 0.300 (i.e., 30 percent).

The gradient (i) between wells BXN-4 and BXN-1, which are 1,200 feet apart, was 0.007 to 0.008 (Table 2). This slope results in velocity estimates of 2.0 to 4.4 feet per day. Table 2 shows the calculated hydraulic gradients and groundwater velocities during the 2018 monitoring events. The gradient and groundwater velocity are similar to previous years.

3. Groundwater Quality

Groundwater monitoring events were conducted on March 17-18, 2018, for the first quarter; June 16, 2018, for the second quarter; September 29-30, 2018, for the third quarter; and November 17, 2018, for the fourth quarter. Groundwater sampling was performed using submersible bladder pumps and tubing dedicated to each well. Sampling procedures are described in the latest SAP (GSI 2017).

Field measurements were taken for pH, conductivity, temperature, oxidation-reduction potential (ORP), and dissolved oxygen before groundwater sampling. Groundwater samples for conventional parameters and dissolved metals were collected quarterly; samples for pentachlorophenol were collected annually. In accordance with the latest SAP, groundwater samples were analyzed by AmTest Laboratories of Kirkland, WA, for the following:

- **Conventional Parameters:** field pH, ammonia as nitrogen, chemical oxygen demand (COD), chloride, nitrate+nitrite as nitrogen, sulfate, tannin and lignin, total dissolved solids (TDS), and total organic carbon (TOC)
- **Dissolved Metals:** Arsenic, barium, iron, and manganese
- **Pentachlorophenol (PCP)**

3.1 Groundwater Sampling

Beginning in the second quarter of 2011, field duplicates were collected from the closed South Landfill, and equipment rinsate blanks were collected at the closed North Landfill (19600 67th Avenue NE, Arlington, Washington). Because groundwater samples were collected from both landfills on the same day, they are considered to be part of the same sampling event and the field quality control (QC) is applicable to both datasets.

Field measurements collected from February 2007 through November 2018 are summarized in Table 3A. Field sampling records are included in Appendix A. The analytical data from 2007 through 2018 are summarized in Tables 3B and 3C. Laboratory analytical reports and chain-of-custody (COC) forms for the 2018 groundwater monitoring events are included in Appendix B.

4. Data Review

This section describes the data review process to evaluate the adequacy and quality of the analytical data from the 2018 groundwater monitoring events. The objective of the data review is to identify estimated, unreliable, or invalid measurements. Information about the reliability of the data is critical to the interpretation of the results. The review was performed according to guidelines prepared by the U.S. Environmental Protection Agency (EPA; EPA, 2010).

4.1 Field Quality Assurance (QA) /QC

During the quarterly groundwater monitoring events, field duplicates were prepared and collected by field personnel in accordance with standard practice. The June 2018 monitoring event field duplicate sample was collected from monitoring well BXN-1 and labeled as BXN-101; the November field duplicate sample was collected from BXN-1 and labeled as BXN-5. During the March and September sampling events, a field rinsate blank was collected after sampling all wells and labelled as rinsate.

Field duplicate results aid in the assessment of sampling and analytical precision. Analytical results for the original and duplicate samples collected from each sampling event were evaluated using the relative percent difference (RPD). RPD is the difference between the two results divided by the mean and expressed as a percent. The RPD was calculated for an analyte when both the primary sample and duplicate sample had a detected concentration. For analytes with concentrations greater than or equal to five times the associated method reporting limit (MRL) and when the RPD is greater than 35 percent, the reported values are considered estimated concentrations. For analytes with concentrations less than five times the associated MRL, the reported values are considered estimated if the absolute difference between primary and duplicate is greater than the value of the MRL. The following analytes for the primary and duplicate samples at monitoring well BXN-1 were qualified as estimated concentrations (J-flag) after the RPD evaluation:

- **June 2018:** COD

4.2 Laboratory QA/QC

Sample coolers for each quarterly monitoring event arrived at the laboratories in good condition and with no broken bottles. The laboratory reports are complete and contain results for all samples and corresponding analyses requested on the COC forms. Laboratory QA/QC results, including duplicates, matrix spikes and matrix spikes duplicates, standards, and method blanks analyses are attached in Appendix B.

All analyses were performed within the required holding time for the parameters of interest. The samples were analyzed for pH between 1 and 3 days after collection. The method used for pH analysis, Standard Method 4500-H+ B (APHA, 1998), does not list an analysis holding time. The EPA method for pH analysis of water samples, Method 150.1 (EPA, 1999a), specifies that pH analyses be performed "as soon as possible preferably in the field at the time of

sampling." For that reason, the lab-analyzed pH results are used for trend analysis and statistical evaluation.

4.3 Statistical Analysis of Data

Groundwater sample analysis results were statistically evaluated to assess if there was a significant difference between the downgradient wells (BXN-1 and BXN-2) and the upgradient well (BXN-4). The following approach was used for performing the statistical analysis:

- **Non-Detects:** Non-detect results were replaced with a value of half the laboratory MRL.
- **Data Distribution:** The data are assumed to be normally distributed to meet key assumptions of the Student's t-test.
- **Parametric Hypothesis Testing:** Parametric hypothesis testing was performed using the Student's t-test for all parameters in both the upgradient and downgradient wells. For each comparison, the null hypothesis was that there was no difference between the downgradient and upgradient concentrations. The null hypothesis was tested using a two-tailed test at a significance level of 0.05. The t-test statistic (t_{stat}) was calculated from the average and variance of quarterly sampling results in a downgradient well and the upgradient well. Each quarterly sample was compared to the previous three quarterly samples to provide a four-sample running average. The average concentration in the downgradient well was significantly higher than the upgradient well if t_{stat} was greater than the critical test statistic (t_c). Similarly, the average concentration in the downgradient well was significantly lower than the upgradient well if t_{stat} was less than the negative value of the critical test statistic (t_c). The critical test statistic was computed using the percent point function (ppf). The ppf is the inverse of the cumulative distribution function.

Statistically significant detections above background well (BXN-4) concentrations are shown in **bold** in the tables included in Appendix C. Statistically significant detections below background concentrations are shown in gray in the tables included in Appendix C. Historical statistically higher values above background well concentrations since 1989 are shown in Table 4.

5. Discussion of Results

5.1 Statistical Results

Appendix C presents the results of the statistical analyses for each individual parameter tested in the groundwater samples from monitoring wells BXN-1, BXN-2, and BXN-4. Results show average concentration, variance, standard deviation, and the Student's t-test statistic. The parameters detected at a statistically higher concentration in specific downgradient wells compared to the upgradient well are:

- Arsenic, COD, TOC, iron, and manganese in BXN-1

5.2 Concentration Trends over Time

Figures 5 through 18 show well concentration trends from 2007 through 2018 for each of the following parameters:

- **Ammonia as Nitrogen** (Figure 5)**:** Ammonia concentrations in BXN-4 have been consistently greater than downgradient wells. The trend line fitted to monitoring data for BXN-4 indicate ammonia levels are declining. Ammonia concentrations in downgradient wells have been consistently low.
- **Arsenic** (Figure 6)**:** Arsenic concentrations in BXN-1 were higher than BXN-4, but levels in BXN-2 were similar to background. Concentrations at BXN-4 appear to be increasing. Concentrations in BXN-2 and BXN-1 have been consistently below the laboratory method detection limit over the monitoring period.
- **Barium** (Figure 7)**:** Barium concentrations in BXN-4 have consistently been greater than downgradient wells. Levels in BXN-2 have been consistently low. Barium in BXN-4 and BXN-1 are decreasing and increasing, respectively.
- **Chemical Oxygen Demand (COD)** (Figure 8)**:** Except for a spike in BXN-1 in September 2017, COD has been consistently low in all monitoring wells. COD was highest in the background well early in the monitoring period but is now highest at BXN-1. COD in BXN-1 and BXN-4 have fluctuated over the monitoring period. COD in BXN-2 has typically been lower than the other wells.
- **Chloride** (Figure 9)**:** Chloride in BXN-4 has usually been higher than downgradient wells, clearly in 2017 and 2018. Chloride in BXN-1 and the background well have fluctuated over the monitoring period. Chloride in BXN-2 has been relatively consistent and lower than BXN-1 and BXN-4. Values in all wells appear to be declining.
- **Iron** (Figure 10)**:** Iron concentrations have been consistently higher in BXN-1 compared to the other wells. With the exception of November 2009, values in BXN-2 and BXN-4 have been consistently low.
- **Manganese** (Figure 11)**:** Manganese concentrations have fluctuated in each well but appear to be increasing in BXN-1 and decreasing in BXN-2 and BXN-4. The increasing trend has resulted in BXN-1 concentrations exceeding other wells. Lowest manganese levels are currently in the upgradient well.
- **Nickel** (Figure 12)**:** Nickel concentrations in BXN-4 have consistently been greater than downgradient wells. Levels in BXN-1 and BXN-2 have been consistently low. Nickel levels in all wells appear to be decreasing.
- **Nitrate plus Nitrite as Nitrogen** (Figure 13): Nitrate plus nitrite concentrations in BXN-4 have fluctuated over the monitoring period and been consistently higher than downgradient wells. The trend line fitted to the monitoring data for BXN-4 indicate nitrate plus nitrite values are declining slightly. Levels in downgradient wells have consistently been low.
- **Pentachlorophenol (PCP):** Similar to 2017 monitoring, PCP was not detected in any wells in 2018.

- **Field pH** (Figure 14)**:** Field pH has been slightly acid and similar in all wells. With the exception of fluctuations in 2013-2014, pH has been fairly consistent over the monitoring period.
- **Sulfate** (Figure 15)**:** Since 2007, sulfate concentrations in BXN-4 have been consistently greater than downgradient wells with the exception of December 2013. Although fluctuating, the trend in sulfate levels in BXN-4 appears to be increasing. Sulfate concentrations in downgradient wells have remained low and seem to be declining.
- **Tannin and Lignin** (Figure 16)**:** Tannin and lignin concentrations are highest in BXN-1, where they have also fluctuated more over the monitoring period compared to the other wells. Values are increasing in BXN-1 and peaked in 2018. Conversely, tannin and lignin are relatively stable and low in BXN-2 and BXN-4.
- **Total Dissolved Solids (TDS)** (Figure 17)**:** TDS concentrations have been low and similar in all wells over the monitoring period. The lone exception is 2014 when TDS spiked in BXN-4.
- **Total Organic Carbon (TOC)** (Figure 18)**:** TOC levels have been low and similar in all wells. The lone exception occurred in 2017 and 2018 when TOC spiked in BXN-1 and BXN-2.

5.3 Comparison to Standards

In Washington, water quality standards for groundwater are provided in the Washington Administrative Code (WAC) 173-200-040 (Washington, 2003). Washington water quality standards for groundwater are listed in Tables 3A, 3B, and 3C.

5.3.1 Comparison to Washington State Standards

There were no detections in 2018 that exceeded Washington water quality standards for groundwater, with the following exception:

- **Arsenic:** Arsenic concentrations exceeded Washington's water quality standard for groundwater of 0.05 µg/L in BXN-1 in all quarters of 2018. Concentrations ranged from 14 to 31 µg/L.
- **Iron:** Concentrations in BXN-1 exceeded the state standard of 300 µg/L in all quarters in 2018, ranging from 34,700 to 67,600 µg/L.
- **Manganese:** Concentrations in all wells exceeded Washington's groundwater standard of 50 µg/L in all quarters in 2018 ranging from 1,280 to 7,422 µg/L.
- **Nitrate+Nitrite:** Levels in BXN-4 exceeded the state standard of 10 mg/L in March and September 2018.
- **Field pH:** In all wells, pH levels were generally below the groundwater standard of 6.5 to 8.5 for all quarterly monitoring events in 2018, ranging from 5.13-6.52.

Per the Snohomish Health District's request in a letter dated August 28, 2015, a dissolved arsenic plume delineation was performed in 2018. Arsenic is a naturally occurring element that can become mobilized by reduced geochemical conditions, such as those present at the Site. Once mixed with oxic downgradient waters, arsenic would immobilize through precipitation, sorption, or other complexing forces favorable for arsenic in more aerobic environments. However, to provide a conservative estimate of downgradient transport, arsenic was modeled as non-reactive solute using the Domenico equation for advection and dispersion. Calculations were performed with the Quick Domenico worksheet used by California and Pennsylvania to screen potential landfill impacts. A description of the model inputs and results is provided in Appendix D.

The Domenico model was run for the upper range of site hydraulic conductivity (Table 2). The model was set to a 10-year run period (3650 days), at which point the modeled concentration has reached the furthest downgradient extent given a constant source, the concentration being peak arsenic measured in 2018 (Table D-2). In 2018, the largest areal extent with arsenic concentrations meeting or exceeding the Washington groundwater standard of 5 µg/L is plotted in Figure 19. Figure 19 shows arsenic concentrations exceeding the groundwater standard were not found to persist greater than 110 feet downgradient of BXN-1.

6. Summary

Quarterly groundwater monitoring samples were collected from one upgradient well (BXN-4) and two downgradient wells (BXN-1 through BXN-2) during 2018 at the North Landfill. The samples were analyzed for 8 groundwater parameters and 4 dissolved metals.

Some groundwater samples collected during the 2018 monitoring events exceeded some Washington state standards for groundwater. Arsenic and iron concentrations in BXN-1 exceeded the standards for groundwater during all quarters. Nitrate+nitrite levels in BXN-4 exceeded 10 mg/L in March and September. In addition, all wells exceeded the state standard for manganese during all monitoring events. Furthermore, all field pH measurements in wells were lower than the standard (6.5) in 2018.

7. References

APHA. 1998. Standard Methods for the Examination of Water and Wastewater, 20th Edition. American Public Health Association.

EMCON. 1989. Hydrogeologic Report, J.H. Baxter North Woodwaste Landfill, Arlington, Washington. Prepared for J.H. Baxter by EMCON, Bothell, Washington. January 1989.

EPA. 1999a. Methods and Guidance for Analysis of Water, Version 2.0. U.S. Environmental Protection Agency. EPA-821-C-99-004. June 1999.

EPA. 1999b. USEPA CLP National Functional Guidelines for Organic Data Review, EPA-540-R-99-008. U.S. Environmental Protection Agency. October 1999.

EPA. 2010. USEPA CLP National Functional Guidelines for Inorganic Superfund Data Review, EPA-R-10-011. U.S. Environmental Protection Agency. January 2010.

GSI Water Solutions, Inc. (GSI) 2017. Revised groundwater sampling and analysis plan, north and south woodwaste landfills, Arlington, WA. Prepared for J.H. Baxter Co., Eugene, OR.

Washington. 2003. Washington Administrative Code (WAC) 173-200-040. Washington State Legislature. Last updated in 2003.

Tables

Table 1. Groundwater Elevation Summary for 2018

Former J.H. Baxter North Woodwaste Landfill

Arlington, Washington

Well ID	Inner Casing Diameter (inches)	Total Depth (ft bgs)	Screen Length (ft)	Screened Interval (ft bgs)	TOC Elevation (ft asd)	Date	Depth to Groundwater (ft below TOC)	Groundwater Elevation (ft asd)
BXN-1	2	58.18	10	48.18 - 58.18	95.50	3/18/2018	45.63	49.87
						6/16/2018	45.15	50.35
						9/30/2018	47.80	47.70
						11/17/2018	48.49	47.01
BXN-2	2	57.24	10	47.24 - 57.24	93.01	3/18/2018	41.90	51.11
						6/16/2018	NM	#VALUE!
						9/30/2018	43.93	49.08
						11/17/2018	NM	#VALUE!
BXN-3	2	58.66	10	48.66 - 58.66	97.23	3/18/2018	NM	NM
						6/16/2018	NM	NM
						9/30/2018	NM	NM
						11/17/2018	NM	NM
BXN-4	2	51.74	10	41.74 - 51.74	98.76	3/18/2018	39.50	59.26
						6/16/2018	NM	#VALUE!
						9/30/2018	42.78	55.98
						11/17/2018	NM	#VALUE!

Notes

bgs = below ground surface.

ft = feet.

asd = assumed site datum.

TOC = top of casing.

NM = not measured.

Table 2. Hydraulic Gradient and Groundwater Velocity btwn Wells BXN-4 and BXN-1

Former J.H. Baxter North Woodwaste Landfill

Arlington, Washington

Date	Gradient (i) (ft/ft)	Hydraulic Conductivity (K) (cm/sec)	Porosity (n_e)	Velocity (v_x) (cm/sec)	Velocity (v_x) (ft/day)
3/18/2018	0.008	0.030 to 0.060	0.30	0.0008 to 0.002	2.2 to 4.4
				0.0000 to 0.000	0.0 to 0.0
9/30/2018	0.007			0.001 to 0.001	2.0 to 3.9

Notes

Gradient = BXN-4 groundwater elevation - BXN-1 groundwater elevation.

cm = centimeter.

ft = feet.

NC = not calculated.

sec = second.

Table 3A. Summary of Groundwater Sampling Field Parameters: 2007 through 2018

Former J.H. Baxter North Woodwaste Landfill

Arlington, Washington

Date	pH (standard unit)				Conductivity (µS/cm)				Temperature (°C)				ORP (mV)				Dissolved Oxygen (mg/L)				Methane (percent)			
SMCL	6.5 - 8.5				--				--				--				--				--			
WA WQ Std	6.5 - 8.5				--				--				--				--				--			
Well ID	BXN-4	BXN-3	BXN-2	BXN-1	BXN-4	BXN-3	BXN-2	BXN-1	BXN-4	BXN-3	BXN-2	BXN-1	BXN-4	BXN-3	BXN-2	BXN-1	BXN-4	BXN-3	BXN-2	BXN-1	BXN-4	BXN-3	BXN-2	BXN-1
2/5/2007	7.17	7.33	7.12	7.07	117	369	391	449	11.4	12.2	11.1	11.1	165	47	200	88	4.90	7.60	8.90	10.20	NT	NT	NT	NT
4/18/2007	6.72	6.93	6.72	6.54	850	594	434	585	12.3	13.0	11.6	11.6	136	9	180	22	10.00	12.00	10.70	12.00	NT	NT	NT	NT
7/18/2007	6.72	6.96	6.86	6.74	961	543	586	789	13.0	13.2	12.3	12.5	138	-28	173	-1	2.04	2.96	3.07	2.07	0.0	0.0	0.0	0.0
10/10/2007	6.64	6.43	6.49	6.25	773	773	377	569	12.2	12.6	11.8	12.2	58	-11	146	9	2.79	2.93	2.01	2.44	0.0	0.0	0.0	0.0
1/10/2008	6.47	6.43	6.36	6.22	492	440	314	617	12.3	12.3	11.6	12.2	24	-20	161	-33	0.00	0.00	0.00	0.00	0.0	0.0	0.0	0.0
4/30/2008	6.33	6.35	6.24	6.04	99	551	432	585	12.5	12.5	11.8	11.9	72	-7	147	23	0.00	0.00	0.00	0.00	NT	NT	NT	NT
7/30/2008	6.47	6.60	6.10	6.39	1070	485	389	618	12.8	12.9	12.1	12.7	84	20	2	5	0.60	0.21	0.00	0.17	0.0	0.0	0.0	0.0
10/22/2008	6.90	6.61	6.77	6.47	709	647	276	458	12.8	13.3	12.3	12.8	48	28	116	9	0.09	0.10	0.18	0.08	NT	NT	NT	NT
2/1/2009	6.66	6.87	6.78	6.68	104	469	388	505	12.5	12.8	11.8	12.3	124	-14	244	-20	1.63	2.12	1.85	2.06	0.0	0.0	0.0	0.0
5/1/2009	6.42	6.55	6.52	6.38	728	511	475	484	12.8	12.8	12.0	12.0	142	34	178	28	1.18	0.37	0.21	0.20	NT	NT	NT	NT
8/1/2009	6.59	6.61	6.65	6.61	104	707	7	468	12.7	13.0	12.6	12.4	95	9	135	-36	4.10	5.07	5.43	5.39	0.0	0.0	0.0	0.0
11/1/2009	6.67	6.54	6.54	6.43	106	473	343	448	12.3	12.4	12.0	12.1	72	-6	131	0.33	2.86	3.43	3.53	2.49	NT	NT	NT	NT
2/10/2010	6.68	6.80	6.62	6.53	1100	467	430	599	12.5	12.5	11.9	11.9	105	13	102	6	0.34	0.13	0.28	0.17	NT	NT	NT	NT
5/26/2010	6.00	NT	6.09	5.86	796	NT	322	614	12.7	NT	12.0	11.8	112	NT	119	-26	0.51	NT	0.21	0.12	0.0	0.0	0.0	0.0
8/18/2010	6.03	NT	6.05	5.79	90	NT	390	750	12.5	NT	11.9	11.7	57	NT	73	-64	0.00	NT	0.00	0.00	NT	NT	NT	NT
11/18/2010	6.48	NT	6.41	6.45	384	NT	317	467	12.8	NT	12.2	12.3	17	NT	25	-53	0.19	NT	0.45	0.44	0.0	NT	0.0	0.0
2/9/2011	6.21	NT	6.07	5.87	150	NT	520	100	0.1*	NT	-1.2*	-0.6*	57	NT	238	-52	3.30	NT	3.50	3.20	NT	NT	NT	NT
5/17/2011	7.00	NT	6.74	6.69	724.0	NT	354.0	510	12.6	NT	12.0	12.2	118.0	NT	259.0	-14	0.20	NT	0.00	0.11	0	NT	0.0	0.0
8/24/2011	6.81	NT	6.82	6.76	175	NT	362	771	13.2	NT	12.0	11.9	127	NT	190	-49	0.34	NT	0.54	0.51	NT	NT	NT	NT
11/3/2011	6.47	NT	6.50	6.27	126	NT	482	784	12.2	NT	11.8	11.7	166	NT	170	-14	0.51	NT	0.44	0.65	0	NT	0.0	0.0
2/14/2012	6.32	NT	6.22	6.05	103	NT	314	431	12.6	NT	11.8	11.6	153	NT	179	-4	0.40	NT	0.00	0.19	NT	NT	NT	NT
5/2/2012	6.96	NT	6.85	6.58	716	NT	343	697	12.4	NT	11.8	11.7	104	NT	157	-39	0.00	NT	0.43	0.00	0.0	NT	0.0	0.0
8/21/2012	6.84	NT	6.74	NT	857	NT	374	NT	12.7	NT	12.1	NT	125	NT	230	NT	1.52	NT	1.64	NT	NT	NT	NT	NT
11/13/2012	6.41	NT	6.50	6.27	127	NT	279	613	12.3	NT	11.7	11.7	97	NT	237	-76	0.99	NT	0.50	1.76	NT	NT	NT	NT
2/12/2013	6.81	NT	6.84	6.77	800	NT	300	700	12.2	NT	11.7	11.3	125	NT	134	-86	0.55	NT	0.58	0.61	NT	NT	NT	NT
6/4/2013	6.38	NT	6.37	6.53	670	NT	360	640	12.5	NT	12.0	11.5	127	NT	133	-66	0.94	NT	0.95	1.33	NT	NT	NT	NT
8/27/2013	6.63	NT	7.11	8.78	820	NT	280	580	12.6	NT	12.1	12.4	130	NT	108	-71	1.82	NT	1.71	8.75	NT	NT	NT	NT
12/2/2013	7.45	NT	7.78	10.24	740	NT	390	630	12.2	NT	12.0	11.5	106	NT	90	-65	5.57	NT	5.36	6.45	NT	NT	NT	NT
3/17/2014	7.84	NT	8.39	10.64	920	NT	250	620	12.4	NT	11.9	11.5	90	NT	61	-73	4.33	NT	1.28	1.80	NT	NT	NT	NT
6/2/2014	6.50	NT	6.42	8.12	780	NT	340	490	12.7	NT	12.0	14.0	139	NT	133	3	3.30	NT	6.80	8.90	NT	NT	NT	NT
9/29/2014	5.20	NT	5.49	8.41	780	NT	420	570	12.7	NT	12.1	12.4	129	NT	109	-56	NT	NT	NT	0.00	NT	NT	NT	NT
11/17/2014	6.41	NT	6.78	6.36	763	NT	305	714	12.1	NT	11.8	11.2	4	NT	-76	-92	0.00	NT	0.00	8.64	NT	NT	NT	NT
2/23/2015	6.32	NT	6.34	6.26	368	NT	226	311	12.8	NT	12.5	12.4	88	NT	24	-30	0.00	NT	0.00	0.86	NT	NT	NT	NT
9/14/2015	6.39	NT	6.62	6.16	996	NT	285	584	13.7	NT	13.3	14.8	164	NT	101	-55	0.00	NT	0.00	0.00	NT	NT	NT	NT
12/7/2015	6.28	NT	6.26	6.12	977	NT	259	516	13.1	NT	13.0	12.3	131	NT	62	-66	0.81	NT	0.33	7.77	NT	NT	NT	NT
2/29/2016	6.14	NT	6.39	6.14	561	NT	374	396	13.3	NT	12.5	12.3	174	NT	71	-85	6.08	NT	0.00	3.29	NT	NT	NT	NT
6/6/2016	7.14	NT	7.43	7.36	557	NT	279	350	13.1	NT	12.6	12.2	90	NT	55	-28	0.00	NT	0.00	0.00	NT	NT	NT	NT
9/26/2016	6.06	NT	6.19	6.08	628	NT	242	497	15.0	NT	14.4	14.1	159	NT	107	-55	1.52	NT	1.32	7.45	NT	NT	NT	NT
3/9/2017	6.09	NT	6.43	6.00	702	NT	187	529	14.2	NT	12.5	12.2	119	NT	152	51	0.83	NT	0.69	0.48	NT	NT	NT	NT
6/11/2017	NT	NT	NT	5.94	NT	NT	NT	317	NT	NT	NT	12.4	NT	NT	NT	-44.1	NT	NT	NT	0.49	NT	NT	NT	NT
9/17/2017	6.29	NT	6.50	5.93	617	NT	265	281	13.3	NT	12.9	13.2	223	NT	248	-63.6	1.60	NT	0.22	0.45	NT	NT	NT	NT
12/14/2017	NT	NT	NT	6.46	NT	NT	NT	567	NT	NT	NT	11.7	NT	NT	NT	-41.7	NT	NT	NT	3.73	NT	NT	NT	NT
3/18/2018	6.27	NT	6.52	6.43	453	NT	146	416	13.8	NT	12.8	13.5	29.1	NT	NT	5.6	0.92	NT	0.39	0.24	NT	NT	NT	NT
6/16/2018	NT	NT	NT	6.46	NT	NT	NT	305	NT	NT	NT	15.0	NT	NT	NT	-119.7	NT	NT	NT	0.28	NT	NT	NT	NT
9/30/2018	5.91	NT	6.01	6.00	616	NT	199	692	12.9	NT	12.6	12.8	246	NT	232	-23	0.04	NT	0.13	0.15	NT	NT	NT	NT
11/17/2018	NT	NT	NT	6.48	NT	NT	NT	596	NT	NT	NT	14.1	NT	NT	NT	-32.9	NT	NT	NT	1.02	NT	NT	NT	NT

Notes

°C = degree Celsius. mg/L = milligram per liter. mV = millivolt. NT = not tested. µS/cm = microSiemen per centimeter. ORP = oxidation-reduction potential.

SMCL = Federal secondary maximum contaminant levels for drinking water. WA WQ Std = State of Washington's water quality standards for groundwater (WAC 173-200).

Table 3B. Summary of Groundwater Conventional Parameters: 2007 through 2018
Former J.H. Baxter North Woodwaste Landfill
Arlington, Washington

Date	pH (standard unit)									Conductivity (µS/cm)								
MCL/SMCL	6.5 - 8.5									--								
WA WQ Std	6.5 - 8.5									--								
Well ID	BXN-4	BXN-4 Dup	BXN-3	BXN-3 Dup	BXN-2	BXN-2 Dup	BXN-1	BXN-1 Dup	Field Blank	BXN-4	BXN-4 Dup	BXN-3	BXN-3 Dup	BXN-2	BXN-2 Dup	BXN-1	BXN-1 Dup	Field Blank
2/5/2007	6.72		6.77		6.64		6.65	6.73	5.79	1,180		432		458		571	578	4
4/18/2007	6.31		6.31		6.35		6.04	6.07	5.66	868		580		436		574	566	2
7/18/2007	6.47	6.48	6.67		6.55		6.48		6.04	846	850	479		523		679		2
10/10/2007	6.71	6.69	6.40		6.56		6.32		5.72	771	764	763		385		563		3
1/10/2008	6.62	6.65	6.67		6.68		6.38		5.10	975	1,000	448		311		619		5
4/30/2008	6.61	6.67	6.60		6.59		6.34		6.21	921	915	531		434		572		2,630
7/30/2008	6.41	6.48	6.55		6.76		6.38		5.30	1,180	1,170	549		468		657		4
10/22/2008	6.68	6.69	6.49		6.64		6.41			822	830	731		336		529		
2/1/2009	6.48	6.52	6.59		6.72		6.47		5.89	1,130	1,150	542		458		556		6
5/1/2009	6.33	6.34	6.46		6.33		6.25		5.64	684	681	462		446		422		2
8/1/2009	6.26	7.84	6.36		6.35		6.38		5.44	861	899	662		471		417		3
11/1/2009	6.53		6.53	6.56	6.47		6.35		6.40	957		471	470	343		434		3
2/10/2010	6.83	6.71	6.76		6.65		6.38		6.43	1,040	1,080	505		473		626		2 J
5/26/2010	6.33	6.36			6.37		6.17		4.93	813	819			333		599		4
8/18/2010	6.35				6.34		6.18	6.16	7.91	832				363		657	653	137
11/18/2010	6.49	6.53			6.44		6.23		6.00	1,010	948			341		475		3
2/9/2011	6.56				6.50		6.21			739				264		460		5
5/17/2011	6.59				6.47		6.40		6.06	638				371		423		3
8/24/2011	6.85				6.90		6.48		6.03	1,030				388		754		2 J
11/3/2011	6.73				6.56		6.41		7.33	1,110				444		714		2
2/14/2012	6.70				6.59		6.37		6.04	983				343		414		2
5/2/2012	6.87				6.76		6.41		6.86	583				318		575		3
8/21/2012	6.68				6.78				6.39	710				361				3
11/13/2012	6.89				7.10		6.81		7.42	1,120				284		589		2,490
2/12/2013	7.25				6.96		6.65		7.27	768				288		565		2 J
6/4/2013	7.25				7.12		6.69		7.32	817				431		647		2 J
8/27/2013	6.87				6.95		6.75		6.43	809				286		524		2 J
12/2/2013	7.14				6.87		6.92		6.20	732				415		548		2 J
3/17/2014	6.77				6.98		6.60		6.38	820				300		596		6.7
6/2/2014	6.78				6.78		6.59		5.97	782				337		490		1.7 J
9/29/2014	6.89				6.87		6.61		6.35	803				442		575		2.7
11/17/2014	6.98				6.99		6.64		7.77	626				283		511		3.4
2/25/2015	6.68				6.90		6.53		6.22	725				458		603		2.3
9/14/2015	6.66				6.95		6.55		7.00	973				293		546		1.6 J
12/7/2015	6.60				6.66		6.45			954				261		478		
2/29/2016	6.45				6.71		6.29		6.44	607				429		616		2.9
6/6/2016	6.37				6.80		6.64		5.80	604				341		358		1.5 J
9/26/2016	6.42				6.64		6.53		5.81	802				326		563		10.8
3/9/2017	6.64				6.54		6.48	6.50		704				463		488	494	
6/11/2017							6.49									444		
9/17/2017																		
12/14/2017																565		
3/18/2018																		
6/16/2018																		
9/30/2018																		
11/18/2018																		

Table 3B. Summary of Groundwater Conventional Parameters: 2007 through 2018
Former J.H. Baxter North Woodwaste Landfill
Arlington, Washington

Date	Chloride (mg/L)									Nitrate + Nitrite as N (mg/L)								
MCL/SMCL	none/250									10/none								
WA WQ Std	250									10								
Well ID	BXN-4	BXN-4 Dup	BXN-3	BXN-3 Dup	BXN-2	BXN-2 Dup	BXN-1	BXN-1 Dup	Field Blank	BXN-4	BXN-4 Dup	BXN-3	BXN-3 Dup	BXN-2	BXN-2 Dup	BXN-1	BXN-1 Dup	Field Blank
2/5/2007	82		5.4		12.4		10.3	10.1	0.2 U	32		0.27		0.51		0.04 J	0.04 J	0.03 J
4/18/2007	76		6.5		13.6		9.1	9.0	0.2 U	2.51		0.56		0.45		0.04 J	0.41	0.01 J
7/18/2007	67	73	4.7		10.9		5.6		0.2 U	1.37	1.43	0.15		0.38		0.04 J		0.01 J
10/10/2007	25.8	24.0	6.4		10.1		50		0.1 J	0.58	0.48	0.02		1.62		0.01		0.05 U
1/10/2008	49	50	7.6		8.4		49		0.2 U	8.55	8.65	0.86		1.88		0.02 J		0.05 U
4/30/2008	38	36	6.9		6.0		20.7		0.0 J	7.72	8.48	0.40		0.79		0.05 U		0.05 U
7/30/2008	103	102	5.9		8.4		14.3		0.2 U	14.6	13.90	1.72		0.60		0.02 J		0.05 U
10/22/2008	15.8	16.8	3.9		5.6		13.8			1.49	1.79	0.04 J		1.64		0.04 J		
2/1/2009	41	48	8.2		6.6		13.0		0.0 J	26.2	26.9	1.71		0.74		0.04 J		0.05
5/1/2009	50	51	11.1		34		20.2		0.2 U	2.99	2.90	2.27		0.59		0.05		0.02 J
8/1/2009	75	74	4.1		24.3		9.0		0.2 U	11.0	11.8	0.37		0.38		0.04 J		0.05 U
11/1/2009	49		7.1	6.2	10.2		34		0.2 U	13.8		0.55	0.56	1.50		0.02 J		0.05 U
2/10/2010	53	53	9.20		19.7		35		0.06 J	38	39	1.57		0.83		0.02 J		0.05 U
5/26/2010	43	44			17.3		26.2		0.04 J	15.6	16.0			1.69		0.08		0.04 J
8/18/2010	33				14.8		33	37	1.57	4.71				1.42		0.07	0.08	0.17
11/18/2010	72	72			8		25.1		0.40 U	12.2	11.5			0.94		0.02 J		0.05 U
2/9/2011	46				9.15		17		0.40 U	6.97				1.16		0.20		0.05 U
5/17/2011	15.6				9.9		9.88		0.40 U	1.94				0.57		0.05 J		0.01 J
8/24/2011	73				12.2		13.9		0.40 U	17.7				1.56		0.03 J		0.01 J
11/3/2011	63				24.4		105		0.40 U	26.90				1.11		0.03 J		0.05 U
2/14/2012	25.6				16.9		19.5		0.40 U	25.0				1.08		0.15		0.03 J
5/2/2012	15.1				12.3		54		0.40 U	2.92				1.06		0.03 J		0.05 U
8/21/2012	16.0				19.3				0.40 U	4.65				1.04				0.05 U
11/13/2012	79				8.5		28.1		0.40 U	21.9				2.11		0.05 U		0.05 U
2/12/2013	8.9				9.7		24.3		0.40 U	1.96				1.20		0.06		0.05 U
6/4/2013	13.0				10.5		5.8		0.40 U	2.00				0.93		0.05 U		0.05 U
8/27/2013	29.3				9.7		13.1		0.40 U	6.93 J				2.17		0.03 J		0.04 J
12/2/2013	4.11				9.4		11.3		0.40 U	4.69				1.02		0.10		0.01 J
3/17/2014	16.9				6.9		21.7		0.40 U	19.0				1.02		0.07 U		0.03 J
6/2/2014	23.7				19.5		13.7		0.40 U	22.5				1.56		0.05 U		0.05 U
9/29/2014	22.5				12.9		15.5		0.40 U	15.1				0.55		0.05 U		0.06
11/17/2014	17.6				5.84		37		0.40 U	8.36				2.34		0.05 U		0.03 J
2/25/2015	10.2				9.1		51		0.40 U	6.9				0.62		0.05 U		0.05 U
9/14/2015	52				5.16		15.4		0.20 U	12.3				2.76		0.03 J		0.05 U
12/7/2015	24.5				3.54		9.11			17.1				1.97		0.05 U		
2/29/2016	6.52				7.97		6.54		0.20 U	3.62				1.16		0.05 U		0.05 U
6/6/2016	27				6.27		6.29		0.20 U	0.851				1.47		0.05 U		0.05 U
9/26/2016	38				7.05		9.97		0.20 U	10.3				1.86		0.03 J		0.05 U
3/9/2017	13.2				7.32		9.49	9.61		5				0.65		0.05 U	0.04 J	
6/11/2017							5.75									0.05 U		
9/17/2017	22.0	22.8			5.47		3.25		0.20 U	9.84	9.27			2.02		0.96		0.039 J
12/14/2017							26.2									0.01 U		
3/18/2018	10.7				4.8		2.3		0.05 U	14.0				1.80		0.06		0.01 U
6/16/2018							7.8	7.19								0.01 U	0.01 U	
9/30/2018	37.5				5.1		10.5		0.09	21.0				2.40		0.01 U		0.01 U
11/18/2018							38.7	43.7								0.01 U	0.01 U	

Table 3B. Summary of Groundwater Conventional Parameters: 2007 through 2018
Former J.H. Baxter North Woodwaste Landfill
Arlington, Washington

Date	Solids, total dissolved (TDS) (mg/L)									Sulfate (mg/L)								
MCL/SMCL	none/500									none/250								
WA WQ Std	500									250								
Well ID	BXN-4	BXN-4 Dup	BXN-3	BXN-3 Dup	BXN-2	BXN-2 Dup	BXN-1	BXN-1 Dup	Field Blank	BXN-4	BXN-4 Dup	BXN-3	BXN-3 Dup	BXN-2	BXN-2 Dup	BXN-1	BXN-1 Dup	Field Blank
2/5/2007	739		284		290		360	363	5 U	24.1		11.1		20.0		11.8	11.3	0.2 U
4/18/2007	500		358		254		370	384	5 U	38		9.7		17.6		13.5	13.1	0.2 U
7/18/2007	474	481	304		294		400		5 U	25.5	25.4	18.7		14.1		9.7		0.2 U
10/10/2007	415	411	457		235		362		5 U	21.7	21.5	13.8		23.2		49		0.2 U
1/10/2008	511	517	229		207		315		5 U	32	34	15.0		19.3		15.2		0.2 U
4/30/2008	401	431	259		227		317		5 U	28.8	29.3	17.3		16.7		14.3		0.2 U
7/30/2008	641	773	325		262		373		5 U	28.7	28.8	12.7		19.7		9.7		0.2 U
10/22/2008	401	382	421		184		308			25.6	26.9	9.9		21.5		10.8		
2/1/2009	527	548	298		238		331		5 U	23.0	22.9	12.5		15.3		7.0		0.0 J
5/1/2009	425	438	308		291		278		7	32	32	19.6		16.9		8.6		0.2 U
8/1/2009	541	527	402		281		264		5 U	28.6	28.0	8.4		17.5		11.1		0.2 U
11/1/2009	515		269	266	204		258		5 U	24.3		17.8	14.7	21.8		10.7		0.2 U
2/10/2010	593	631	307		273		369		5	29.1	29.0	21.3		15.2		11.0		0.0 J
5/26/2010	128	420			182		333		5 U	28.1	28.6			18.9		12.3		0.4
8/18/2010	445				261		392	419	134	34				19.3		8.3	11.4	1.1
11/18/2010	488	473			169		240		5 U	41	42			14.9		15.3		0.4 U
2/9/2011	515				182		351		5 U	36				15.3		11.8		0.4 U
5/17/2011	371				200		328		5 U	39				15.9		7.2		0.4 U
8/24/2011	560				218		386		5 U	39				16.9		8.8		0.4 U
11/3/2011	593				300		403		5 U	39				16.0		13.5		0.4 U
2/14/2012	544				204		328		5 U	25.0				17.0		17.7		0.4 U
5/2/2012	346				222		431		6	30				18.7		14.2		0.4 U
8/21/2012	366				216				5 U	34				16.6				0.2 U
11/13/2012	536				158		328		5 U	34				16.4		8.9		0.2 U
2/12/2013	401				194		357		6	45				15.7		7.6		0.2 U
6/4/2013	374				243		377		5 U	54				18.6		3.8		0.2 U
8/27/2013	454				193		316		5 U	41				17.3		5.4		0.2 U
12/2/2013	413				261		320		6	16.2				19.2		10.7		0.2 U
3/17/2014	477				172		331		5 U	54				16.7		9.4		0.2 U
6/2/2014	NT				NT		NT		NT	37				18.9		11.1		0.2 U
9/29/2014	8,530 [1]				268		372		5 U	32				18.6		8.7		0.2 U
11/17/2014	NT				NT		NT		NT	33				19.2		14.4		0.2 U
2/25/2015	352				224		338		5 U	37				14.7		11.1		0.2 U
9/14/2015	485				139		322		5 U	43				20.3		10.2		0.2 U
12/7/2015	470				144		255			33				16.9		10.9		
2/29/2016	275				207		332		5 U	57				18.0		5.2		0.15 J
6/6/2016	314				181		186		5 U	42				21.2		10.3		0.2 U
9/26/2016	432				195		336		5.0 U	35				16.5		11.8		0.2 U
3/9/2017										41				12.4		8.9	8.8	
6/11/2017							252									7.3		
9/17/2017	375	380			178		175		1.5	41.9	42.2			19.6		3.0		0.2 U
12/14/2017							470									10.5		
3/18/2018	480				200		390		21	67.1 DE				15.2 E		3.4		0.1 U
6/16/2018							260	270								14.4	13.4	
9/30/2018	450				180		460		15	46.9				19.3		4.5		0.3
11/18/2018							460	420								5.7	6.7	

Table 3B. Summary of Groundwater Conventional Parameters: 2007 through 2018
Former J.H. Baxter North Woodwaste Landfill
Arlington, Washington

Date	Ammonia as N (mg/L)									Chemical Oxygen Demand (COD) (mg/L)								
MCL/SMCL	--									--								
WA WQ Std	--									--								
Well ID	BXN-4	BXN-4 Dup	BXN-3	BXN-3 Dup	BXN-2	BXN-2 Dup	BXN-1	BXN-1 Dup	Field Blank	BXN-4	BXN-4 Dup	BXN-3	BXN-3 Dup	BXN-2	BXN-2 Dup	BXN-1	BXN-1 Dup	Field Blank
2/5/2007	11.50		0.07		0.05 U		0.10	0.08	0.03 J	39		11.0		9.0		26.0	28.0	50 U
4/18/2007	10.10		0.08		0.05 U		0.07	0.04 J	0.05 U	35		26.0		12.0		29.0	21.0	4.0 J
7/18/2007	9.83	7.25	0.05 J		0.05 U		0.02 J		0.05 U	24.0	37	9.0		3.0 J		19.0		5.0 U
10/10/2007	12.30	12.40	0.02 J		0.05 U		0.12		0.05 U	34	34	5.0 U		17.0		32		5.0 U
1/10/2008	18.50	16.10	0.08		0.07		0.13		0.02 J	54	35	9.0		5.0 U		10.0		5.0 U
4/30/2008	14.20	14.10	0.05 U		0.05 U		0.05 U		0.05 U	14.0	15.0	9.0		7.0		11.0		5.0 U
7/30/2008	15.40	15.80	0.05 U		0.05 U		0.03 J		0.08	33	33	10.0		6.0		19.0		9.0
10/22/2008	12.90	13.60	0.03 J		0.05 U		0.05 J			18.0	18.0	13.0		5.0 U		9.0		
2/1/2009	15.90	15.90	0.06		0.05 U		0.22		0.05 U	39	27.0	10.0		5.0		38		5.0 U
5/1/2009	8.33	8.30	0.04 J		0.05 U		0.08		0.05 U	24.0	24.0	7.0		7.0		10.0		5.0 U
8/1/2009	10.40	10.70	0.02 J		0.05 U		0.06		0.01 J	50	57	15.0		5.0 J		14.0		3.0 J
11/1/2009	10.40		0.04 J	0.04 J	0.01 J		0.13		0.02 J	30		10.1	11.1	5.0 U		10.6		5.0 U
2/10/2010	6.64	6.41	0.03 J		0.05 U		0.13		0.05 U	14.9	16.4	5.0 U		5.0 U		19.9		5.0 U
5/26/2010	8.83	8.34			0.05 U		0.16		0.05 U	23.9	24.4			4.3 J		5.0 U		5.0 U
8/18/2010	7.89				0.05 U		0.19	0.17	0.05 U	24.1				4.2 J		21.7	19.4	5.0 U
11/18/2010	14.00	12.40			0.05 U		0.25		0.05 U	53	17.0			6.1		16.2		7.6
2/9/2011	6.73				0.05 U		0.16		0.05 U	34				7.0		24.6		5.0 U
5/17/2011	8.09				0.05 U		0.25		0.05 U	19.3				5.3		24.1		5.0 U
8/24/2011	10.20				0.05 U		0.44		0.05 U	22.4				4.4 J		33		5.0 U
11/3/2011	15.20				0.05 U		0.46		0.05 U	21.7				5.2		12.3		5.0 U
2/14/2012	13.40				0.05 U		0.23		0.05 U	29.8				9.1		12.6		3.5 J
5/2/2012	8.87				0.05 U		0.22		0.05 U	21.5				7.9		14.7		5.0 U
8/21/2012	12.50				0.05 U				0.05 U	17.9				4.1 J				5.0 U
11/13/2012	18.10				0.05 U		0.28		0.05 U	27.5				5.0 U		28.0		5.0 U
2/12/2013	10.10				0.05 U		0.32		0.05 U	13.0				3.1 J		31		5.0 U
6/4/2013	13.20				0.05 U		0.61		0.05 U	13.8				5.4		14.3		5.0 U
8/27/2013	12.30				0.05 U		0.27		0.05 U	19.6				5.5		45		5.0 U
12/2/2013	10.30				0.05 U		0.53		0.05 U	12.9				6.2		20.7		5.0 U
3/17/2014	10.10				0.05 U		0.54		0.05 U	11.3				4.1		27.8		5.0 U
6/2/2014	10.70				0.05 U		0.48		0.05 U	11.6				3.5		24.7		5.0 U
9/29/2014	13.70				0.05 U		0.49		0.05 U	13.2				4.9		23.4		5.0 U
11/17/2014	7.34				0.05 U		0.41		0.05 U	11.6				5.0 U		19.7		5.0 U
2/25/2015	8.40				0.05 U		0.26		0.05 U	10.8				7.9		19.9		5.0 U
9/14/2015	13.40				0.05 U		0.46		0.03 J	22.5				3.8 J		18.7		5.0 U
12/7/2015	0.05 U				0.24		0.05 U			16.0				5.8		15.5		
2/29/2016	5.69				0.05 U		0.26		0.025 J	8.6				3.2 J		62		5.0 U
6/6/2016	6.25				0.05 U		0.08 U		0.028 J	24.8				5.0 U		13.2		5.0 U
9/26/2016	8.78				0.05 U		0.45		0.05 U	27.1				4.7 J		29.7		5.0 U
3/9/2017	6.08				0.05 U		0.11	0.14		3.3 J				5.0 U		14.6 J	8.6 J	
6/11/2017							0.13									4.8 J		
9/17/2017	9.43	9.17			0.05 U		2.27		0.06	16.5	16.5			4.1 J		964		5.0 U
12/14/2017							0.56									38		
3/18/2018	3.8				0.01		0.40		0.01	10.0 U				10.0 U		76		10.0 U
6/16/2018							0.181	0.226								46 J	14.0 J	
9/30/2018	7.1				0.15		0.679		0.01 U	16.0				10 U		49		10.0 U
11/18/2018							0.581	0.578								10 U	12.0	

Table 3B. Summary of Groundwater Conventional Parameters: 2007 through 2018
Former J.H. Baxter North Woodwaste Landfill
Arlington, Washington

Date	Tannin and Lignin (mg/L)									Total Organic Carbon (TOC) (mg/L)									Total Coliforms MPN/100 mL								
MCL/SMCL	--									--									1/100 mL								
WA WQ Std	--									--									1/100 mL								
Well ID	BXN-4	BXN-4 Dup	BXN-3	BXN-3 Dup	BXN-2	BXN-2 Dup	BXN-1	BXN-1 Dup	Field Blank	BXN-4	BXN-4 Dup	BXN-3	BXN-3 Dup	BXN-2	BXN-2 Dup	BXN-1	BXN-1 Dup	Field Blank	BXN-4	BXN-4 Dup	BXN-3	BXN-3 Dup	BXN-2	BXN-2 Dup	BXN-1	BXN-1 Dup	Field Blank
2/5/2007	4.40		1.20		1.50		2.20	2.20	0.09 J	17.20		4.80		3.60		11.20	11.50	0.08 J	2.0		2.0		25.0		1.0 U	1.0 U	1.0 U
4/18/2007	2.30		2.00		1.60		2.00	2.10	0.20 U	12.60		8.30		3.50		9.20	7.40	0.25 J	4.1		1.0 U		70		1.0	1.0 U	1.0 U
7/18/2007	2.50	2.60	1.60		1.90		3.10		0.20 U	15.30	16.00	5.50		4.60		11.00		0.07 J	165	159	1,986		291		124		1.0 U
10/10/2007	3.70	3.60	1.80		1.90		1.30		0.20 U	13.70	13.30	5.60		5.10		6.80		0.08 J	2,420	345	276		2,420 >		73		1.0 U
1/10/2008	4.60	4.70	1.00		1.30		1.30		0.06 J	14.90	13.50	3.90		2.10		5.10		0.14 J	7.4	6.3	2.0		9.8		3.1		3.1
4/30/2008	3.10	2.60	1.20		1.80		1.70		0.20 U	4.40	10.60	3.30		2.80		5.10		0.50 U	1.0 U	1.0 U	1.0 U		1.0		1.0		1.0 U
7/30/2008	2.90	2.70	1.50		1.70		2.50		0.20 U	13.20	13.00	4.40		3.00		7.70		0.50 U	81	57	64		49		326		18.7
10/22/2008	3.60	3.50	1.60		1.20		0.70			6.80	7.00	5.90		1.80		3.40			5.2	2.0	1.0		3.1		2.0		24.9
2/1/2009	2.30	2.70	0.90		1.50		1.70		0.20 U	10.30	9.90	3.50		2.10		12.00		0.50 U	1.0 U	1.0 U	1.0 U		4.2		1.0 U		1.0 U
5/1/2009	1.60	1.50	1.00		1.70		1.00		0.20 U	9.60	9.30	3.60		2.50		4.50		0.50 U	2.0	1.0	2.0		3.1		8.7		4.2
8/1/2009	2.70	2.80	1.80		1.50		1.00		0.20 U	17.40	18.60	5.80		3.00		4.90		0.17 J	22.2	20.7	15.0		109		59		1.0
11/1/2009	3.34		1.34	1.45	1.09		2.26		0.04 J	12.30		3.69	3.72	1.56		3.22		0.50 U	1.0		4.1	6.3	6.3		11.0		3.1
2/10/2010	2.45	2.60	2.22		1.88		10.20		0.20 U	8.58	9.17	2.53		2.29		8.90		0.50 U	17.3	5.2	9.6		3.1		4.1		1.0
5/26/2010	2.10	1.97			1.26		7.99		0.20 U	10.10	10.10			1.73		6.17		0.10 J	3.1	6.3			83		16.4		48
8/18/2010	1.63				1.14		1.95	1.86	0.04 J	8.43				1.74		6.55	6.37	0.50 U	1.0 U				44		1.0 U	3.1	18.9
11/18/2010	2.63	2.51			1.15		1.24		0.04 J	13.90	13.70			4.03		6.89		0.08 J	116	93			16.1		21.3		1.0
2/9/2011	2.06				1.36		3.74		0.09 J	13.10				2.10		9.74		0.50 U	31				6.3		1.0 U		1.0 U
5/17/2011	1.08				1.32		3.90		0.20 U	6.60				2.13		6.65		0.07 J	6.3				2.0		1.0 U		1.0 U
8/24/2011	0.81				0.96		2.95		0.20 U	8.12				2.18		12.10		0.50 U	7.5				8.5		1.0 U		1.0 U
11/3/2011	1.39				1.34		1.65		0.07 J	8.44				2.59		3.54		0.50 U	P				P		1.0 U		1.0 U
2/14/2012	2.96				1.61		5.53		0.10 J	8.86				2.25		2.89		0.08 J	28.2				1.0		1.0 U		1.0 U
5/2/2012	1.37				1.24		10.80		0.20 U	6.26				2.52		4.33		0.50 U									
8/21/2012	1.40				1.20				0.20 U	5.96				1.63				0.50 U	1.0 U				6.3				1.0 U
11/13/2012	2.23				0.93		1.67		0.20 U	9.80				1.83		6.90		0.08 J	1.0 U				1.0 U		2,420		1.0 U
2/12/2013	1.33				0.72		1.62		0.20 U	5.43				1.45		8.20		0.50 U	1.0 U				3.1		20.0		1.0 U
6/4/2013	1.39				1.17		3.72		0.20 U	5.06				0.50 U		7.03		0.50 U									
8/27/2013	1.55				0.72		1.72		0.20 U	6.61				1.75		7.30		0.50 U	1.0 U				1,414		66		1.0 U
12/2/2013	1.68				0.66		1.00		0.20 U	4.62				2.87		5.40		0.08 J	1.0 U				14.8		1.0 U		1.0 U
3/17/2014	1.02				0.54		4.91		0.20 U	3.96				1.66		7.65		0.50 U	1.0 U				1.0 U		1.0 U		1.0 U
6/2/2014	0.20 U				0.92		0.65		0.12 J	3.86				1.47		6.06		0.26 J	1.0 U				1.0 U		1.0 U		1.0 U
9/29/2014	1.80				0.92		15.9		0.20 U	5.25				2.12		6.48		0.50 U	1.0 U				1.0 U		5.20		1.0 U
11/17/2014	1.38				0.56		11.4		0.20 U	3.93				1.48		5.21		0.12 J	1.0 U				1.0 U		1.00 U		1.0 U
2/25/2015	1.22				1.10		4.81		0.06 J	3.71				2.29		5.49		0.25 J	1.0 U				1.0 U		1.0 U		1.0 U
9/14/2015	1.77				0.51		1.76		0.20 U	7.86				1.70 U		4.10		0.80	11.1				8.7		165		1.0 U
12/7/2015	1.33				0.47		1.31			4.93				1.09		3.82			4.2				36		95		1.0 U
2/29/2016	0.54				0.77		3.78		0.20 U	3.22				1.81		17.00		0.13 J	1.0 U				NQ[2]		NQ[2]		1.0 U
6/6/2016	0.71				0.51		0.52		0.20 U	7.96				1.03		3.20		0.27 J	11.1				8.7		165		1.0 U
9/26/2016	1.53				0.66		2.00		0.20 U	8.61				1.55		7.47		0.50 U	1.0 U				1.0 U		1.0 U		1.0 U
3/9/2017	0.98				1.19		9.70	10.70		4.10				3.20		4.56	5.48										
6/11/2017							6.40									3.41											
9/17/2017	1.17	1.13			0.81		1.88		0.20 U	6.08	6.27			1.66 J		175		0.5 U									
12/14/2017							28									27											
3/18/2018	0.74				0.67		4.6		0.10 U	5.20				42.00		42		2.3									
6/16/2018							0.92	0.94								48	37										
9/30/2018	0.83				0.67		68		0.10 U	4.30				1.30		15		1.1									
11/18/2018							25	25								6.9	7.1										

Notes

MCL = Federal maximum contaminant levels for drinking water.
MPN = most probable number.
mg/L = milligram per liter.
NT = not tested.
SMCL = Federal secondary maximum contaminant levels for drinking water.
U = analyte was not detected at or above the MRL/MDL.
J = estimated concentration less than the MRL, but greater than or equal to the MDL.
WA WQ Std = State of Washington's water quality standards for groundwater (WAC 173-200).
[1] TDS in BXN-4 on September 29, 2014 appears erroneous as it is unusually high. Conductivity, which also measures TDS, was normal on this date supporting the conclusion that this measurement is erroneous.
[2] Total Coliforms were not quantified during lab analysis. Coliforms reported as present or not present. Analysis indicating the presence of coliforms are presented as NQ (not quantified).

Table 3C. Summary of Groundwater Metals: 2007 through 2018
Former J.H. Baxter North Woodwaste Landfill
Arlington, Washington

Date	Arsenic, dissolved (µg/L)									Barium, dissolved (µg/L)								
MCL/SMCL	10/none									2000/none								
WA WQ Std	0.05									1,000								
Well ID	BXN-4	BXN-4 Dup	BXN-3	BXN-3 Dup	BXN-2	BXN-2 Dup	BXN-1	BXN-1 Dup	Field Blank	BXN-4	BXN-4 Dup	BXN-3	BXN-3 Dup	BXN-2	BXN-2 Dup	BXN-1	BXN-1 Dup	Field Blank
2/5/2007	5.0 U		6.1		5.0 U		2.0 B	2.5 B	5.0 U	331		34		15.3		52	49	5.0 U
4/18/2007	5.0 U		6.4		5.0 U		4.2 B	4.4 B	1.5 B	178		39		12.0		41	41	3.0 B
7/18/2007	5.0 U	5.0 U	5.2		5.0 U		3.9 B		5.0 U	232	232	34		17.8		48		5.0 U
10/10/2007	5.0 U	5.0 U	4.7 B		5.0 U		3.0 B		5.0 U	171	176	51		12.6		50		5.0 U
1/10/2008	1.0 J	1.2 J	4.3 J		5.0 U		4.5 J		0.7 U	225	222	26.2		10.6		39		0.6 U
4/30/2008	5.0 U	5.0 U	4.3 J		1.1 J		3.5 J		0.7 U	187	195	31		12.5		30		0.6 U
7/30/2008	0.9 J	0.7 J	3.6 J		0.8 J		9.3		0.6 U	337	348	36		14.7		57		0.5 U
10/22/2008	5.0 U	5.0 U	5.0 U		5.0 U		4.3 J			145	140	41		9.2		29.3		
2/1/2009	5.0 U	5.0 U	3.7 J		1.3 J		9.3		5.0 U	278	269	40		14.1		46		5.0 U
5/1/2009	0.6 J	0.6 J	3.5 J		0.5 J		9.1		5.0 U	168	164	33		14.6		37		5.0 U
8/1/2009	0.8 J	6.1	0.9 J		6.0		6.1		5.0 U	15.6	25.1	43		36		38		5.0 U
11/1/2009	5.0 U		3.1 J	3.0 J	5.0 U		9.2		5.0 U	194		29.8	29.9	10.7		28.6		5.0 U
2/10/2010	5.0 U	1.1 J	3.3 J		1.6 J		10.6		5.0 U	273	292	33		16.0		44		5.0 U
5/26/2010	5.0 U	5.0 U			5.0 U		9.9		5.0 U	188	187			10.8		47		5.0 U
8/18/2010	5.0 U				5.0 U		11.5	12.0	3.0 J	173				9.4		44	44	1.5 J
11/18/2010	5.0 U	5.0 U			5.0 U		11.3		5.0 U	205	227			10.3		40		5.0 U
2/9/2011	5.0 U				5.0 U		13.6		5.0 U	231				10.6		64		5.0 U
5/17/2011	5.0 U				5.0 U		16.1		5.0 U	145				11.6		52		5.0 U
8/24/2011	5.0 U				5.0 U		18.7		5.0 U	202				11.6		70		5.0 U
11/3/2011	0.5 J				0.5 J		13.1		5.0 U	290				13.8		67		5.0 U
2/14/2012	5.0 U				5.0 U		9.0		5.0 U	220				10.9		47		0.6 J
5/2/2012	5.0 U				0.5 J		15.8		5.0 U	115				10.5		73		5.0 U
8/21/2012	5.0 U				5.0 U				5.0 U	150				11.0				5.0 U
11/13/2012	5.0 U				5.0 U		33		5.0 U	323				9.0		155		5.0 U
2/12/2013	5.0 U				5.0 U		26.6		5.0 U	130				9.2		121		5.0 U
6/4/2013	1.5 J				1.6 J		25.1		1.1 J	140				13.4		102		4.0 U
8/27/2013	5.0 U				5.0 U		27.8		5.0 U	171				9.2		107		4.0 U
12/2/2013	5.0 U				5.0 U		25.7		5.0 U	119				13.0		97		4.0 U
3/17/2014	0.50 U				0.50 U		24.5		0.50 U	165				10.0		93		4.0 U
6/2/2014	0.30 J				0.20 J		23.4		0.50 U	139				11.7		87		4.0 U
9/29/2014	0.34 J				0.21 J		21.8		0.50 U	165				15.2		89		4.0 U
11/17/2014	0.30 J				0.20 J		24		0.50 U	124				9.3		93		0.6 J
2/25/2015	0.42 J				0.21 J		23.2		0.50 U	125				14.4		68		0.1 J
9/14/2015	0.40 J				0.30 J		39		0.50 U	168				8.8		96		4.0 U
12/7/2015	0.35 J				0.22 J		22.5			182				7.9		55		
2/29/2016	0.35 J				0.27 J		28.2		0.50 U	102				12.5		85		4.0 U
6/6/2016	0.60				0.20 J		16.6		0.50 U	113				10.5		30.0		0.9 J
9/26/2016	0.40 J				0.50 U		12.6		0.50 U	163				0.6 J		70		4.0 U
3/9/2017	5.5 U				5.5 U		15 J	14 J		111				16.6		49.8	49.4	
6/11/2017							17									48		
9/17/2017	5.5 U	5.5 U			5.5 U		5.5 U		5.5 U	133	133			10.9		65		1.1 J
12/14/2017							47.0									127		
3/18/2018	5.0 U				5.0 U		31.0		5.0 U	163				6.5		107		0.5 U
6/16/2018							21.0	30.0								72	69.7	
9/30/2018	5.0 U				5.0 U		31.0		5.0 U	168				7.4		146		0.5 U
11/18/2018							14.0	16.0								127	122	

Table 3C. Summary of Groundwater Metals: 2007 through 2018
Former J.H. Baxter North Woodwaste Landfill
Arlington, Washington

Date	Iron, dissolved (µg/L)									Manganese, dissolved (µg/L)								
MCL/SMCL	300/300									50/50								
WA WQ Std	300									50								
Well ID	BXN-4	BXN-4 Dup	BXN-3	BXN-3 Dup	BXN-2	BXN-2 Dup	BXN-1	BXN-1 Dup	Field Blank	BXN-4	BXN-4 Dup	BXN-3	BXN-3 Dup	BXN-2	BXN-2 Dup	BXN-1	BXN-1 Dup	Field Blank
2/5/2007	35		7,600		20.0 U		7,000	6,200	20.0 U	7,270		2,460		5,900		3,200	2,910	5.0 U
4/18/2007	68		8,870		7.6 B		6,070	6,100	4.7 B	3,070		2,970		5,910		3,150	3,180	1.6 B
7/18/2007	48	51	5,900		20.0 U		8,980		20.0 U	3,380	3,340	1,960		8,030		3,960		5.0 U
10/10/2007	162	163	7,510		20.0 U		7,810		20.0 U	4,480	4,590	2,990		5,320		2,940		2.7 B
1/10/2008	444	406	4,510		11.0 J		9,010		3.0 U	6,600	6,750	1,690		4,460		3,000		1.6 B
4/30/2008	138	146	5,730		8.9 J		6,490		3.0 U	4,060	4,110	2,050		6,580		1,700		0.3 B
7/30/2008	149	158	3,960		11.9 J		22,300		4.0 U	4,560	4,720	1,860		6,880		3,640		0.2 U
10/22/2008	257	258	4,880		18.0 J		11,600			5,130	5,030	2,770		4,730		2,700		
2/1/2009	64	69	6,280		20.0 U		16,500		4.5 J	3,370	3,330	2,890		6,680		2,490		0.2 J
5/1/2009	105	110	4,800		11.7 J		13,400		20.0 U	2,460	2,490	2,170		7,330		2,000		0.4 J
8/1/2009	5.1 J	30	19.1 J		25,400		27,000		0.8 J	44	106	1,290		9,760		9,860		0.2 J
11/1/2009	135		3,760	3,570	6.7 J		10,300		20.0 U	5,320		1,540	1,530	4,570		2,340		0.7 J
2/10/2010	98	94	2,620		20.0 U		14,400		20.0 U	2,980	2,990	1,740		6,920		3,100		5.0 U
5/26/2010	89	91			9.4 J		15,400		20.0 U	1,910	1,970			3,900		3,310		5.0 U
8/18/2010	68				2.0 J		14,800	15,300	20.0 U	1,980				4,240		3,830	3,890	5.0 U
11/18/2010	736	222			3.8 J		11,700		20.0 U	3,890	3,720			4,260		3,270		5.0 U
2/9/2011	48				20.0 U		21,100		20.0 U	2,240				3,870		5,850		0.2 J
5/17/2011	49				13.9 J		20,300		6.8 J	1,160				4,900		5,200		5.0 U
8/24/2011	12.7 JN*				7.5 JN*		24,200		20.0 UN*	1,110				4,100		7,430		5.0 U
11/3/2011	29.9				21.2		14,900		20.0 U	1,840				5,030		3,940		0.5 J
2/14/2012	9.9 J				5.7 J		11,600		20.0 U	2,830				3,150		2,790		0.3 J
5/2/2012	21.0				3.9 J		23,100		20.0 U	1,450				3,300		5,310		5.0 U
8/21/2012	19.2 J				20.0 U				20.0 U	1,400				3,340				5.0 U
11/13/2012	14.5 J				20.0 U		33,100		20.0 U	2,510				2,490		3,160		5.0 U
2/12/2013	29.2				3.2 J		36,300		20.0 U	1,640				2,550		3,370		5.0 U
6/4/2013	225				9.20 J		45,600		4.10 J	1,530				3,840		6,370		6.2
8/27/2013	35				6.30 J		35,200		20.0 U	1,900				2,200		3,670		0.5 J
12/2/2013	102				5.80 J		36,900		20.0 U	2,500				2,710		3,470		0.1 J
3/17/2014	84				11.4 J		36,600		20.0 U	2,260				2,500		3,700		0.3 J
6/2/2014	25.7				20.0 U		35,800		20.0 U	1,870				2,960		3,730		1.0 U
9/29/2014	44				20.0 U		38,100		8.30 J	3,310				3,710		4,460		0.6 J
11/17/2014	67				40 U		39,900		40 U	2,330				2,220		3,930		0.2 J
2/25/2015	27				4.0 J		28,600		20.0 U	2,040				4,020		3,410		1.0 U
9/14/2015	23.2				4.0 U		40,000		20.0 U	3,550				2,240		5,190		1.0 U
12/7/2015	16 J				5.0 J		28,100			3,270				1,920		4,890		
2/29/2016	20 U				20.0 U		35,600		4.0 J	1,560				3,620		6,250		0.8 J
6/6/2016	18.1 J				3.0 J		11,800		20.0 U	1,440				2,970		2,360		1.0 U
9/26/2016	20 U				20.0 U		26,000		3.0 J	3,180				7.3		4,890		0.3 J
3/9/2017	1,270				4 J		23,300	23,900		1,960				5,350		4,050	3,900	
6/11/2017							24,900									3,750		
9/17/2017	47	54			10.5 U		951		10.5 U	2,450	2,430			3,360		3,120		0.55 U
12/14/2017							52,200									4,940		
3/18/2018	71				10.0		63,800		106	1,280				2,790		5,020		10.9
6/16/2018							34,700	37,500								4,073	3,928	
9/30/2018	10 U				10.0 U		67,600		16	2,366				2,748		7,422		5.0 U
11/18/2018							56,500	53,200								5,944	5,493	

Table 3C. Summary of Groundwater Metals: 2007 through 2018
Former J.H. Baxter North Woodwaste Landfill
Arlington, Washington

Date	Cadmium, dissolved (µg/L)									Copper, dissolved (µg/L)								
MCL/SMCL	5/none									1,300/1,000								
WA WQ Std	10									1,000								
Well ID	BXN-4	BXN-4 Dup	BXN-3	BXN-3 Dup	BXN-2	BXN-2 Dup	BXN-1	BXN-1 Dup	Field Blank	BXN-4	BXN-4 Dup	BXN-3	BXN-3 Dup	BXN-2	BXN-2 Dup	BXN-1	BXN-1 Dup	Field Blank
2/5/2007	5.0 U		5.0 U		5.0 U		5.0 U	5.0 U	5.0 U	24.5		10.0 U		10.0 U		10.0 U	10.0 U	10.0 U
4/18/2007	5.0 U		1.0 B		5.0 U		5.0 U	0.7 B	5.0 U	19.7		10.0 U		10.0 U		10.0 U	10.0 U	10.0 U
7/18/2007	5.0 U	5.0 U	5.0 U		5.0 U		5.0 U		5.0 U	24.4	27.4	10.0 U		6.0 B		7.5 B		10.0 U
10/10/2007	5.0 U	5.0 U	5.0 U		5.0 U		5.0 U		5.0 U	25.0	24.4	10.0 U		10.0 U		10.0 U		10.0 U
1/10/2008	1.1 J	2.2 J	1.5 J		1.5 J		1.8 J		0.6 U	16.1	18.3	10.0 U		10.0 U		10.0 U		7.0 U
4/30/2008	0.9 J	0.9 J	0.9 J		1.1 J		1.3 J		0.6 U	17.1	17.2	10.0 U		10.0 U		10.0 U		7.0 U
7/30/2008	0.3 J	0.4 J	0.3 J		0.2 J		0.9 J		0.2 U	20.0	20.9	10.0 U		1.8 J		1.8 J		1.4 B
10/22/2008	5.0 U	5.0 U	5.0 U		5.0 U		5.0 U			14.1	14.6	10.0 U		10.0 U		10.0 U		
2/1/2009	0.4 J	0.4 J	0.2 J		0.3 J		0.4 J		0.2 J	20.4	19.3	10.0 U		1.0 J		2.4 J		10.0 U
5/1/2009	5.0 U	5.0 U	5.0 U		5.0 U		5.0 U		5.0 U	14.8	14.1	10.0 U		10.0 U		10.0 U		5.8 J
8/1/2009	5.0 U	5.0 U	5.0 U		5.0 U		5.0 U		5.0 U	2.9 J	10.0 U	2.1 J		10.0 U		10.0 U		10.0 U
11/1/2009	5.0 U		5.0 U	5.0 U	5.0 U		5.0 U		5.0 U	17.5		10.0 U	10.0 U	10.0 U		10.0 U		10.0 U
2/10/2010	5.0 U	5.0 U	5.0 U		5.0 U		5.0 U		5.0 U	19.2	23.3	2.0 J		2.2 J		4.3 J		10.0 U
5/26/2010	5.0 U	5.0 U			5.0 U		5.0 U		5.0 U	20.0	19.6			10.0 U		0.8 J		10.0 U
8/18/2010	5.0 U				5.0 U		2.5 J	5.0 U	5.0 U	17.4				10.0 U		10.0 U	10.0 U	10.0 U
11/18/2010	5.0 U	5.0 U			5.0 U		2.3 J		5.0 U	5.7 J	13.9			6.7 J		9.5 J		5.8 J
2/9/2011										23.7				10.0 U		3.9 J		10.0 U
5/17/2011										19.1				3.8 J		4.8 J		2.2 J
8/24/2011										12.3				10.0 U		10.0 U		10.0 U
11/3/2011	5.0 U				5.0 U		2.9 J			15.8				10.0 U		10.0 U		10.0 U
2/14/2012	5.0 U				5.0 U		5.0 U		5.0 U	19.1				1.1 J		2.4 J		10.0 U
5/2/2012	5.0 U				5.0 U		5.0 U		5.0 U	20.4				1.7 J		10.0 U		10.0 U
8/21/2012	NT				NT		NT		NT	22.3				1.1 J				10.0 U
11/13/2012	NT				NT		NT		NT	20.8				10.0 U		10.0 U		10.0 U
2/12/2013	NT				NT		NT		NT	17.4				1.1 J		0.8 J		10.0 U
6/4/2013	NT				NT		NT		NT	22.1				2.4 J		4.0 U		4.0 U
8/27/2013	NT				NT		NT		NT	19.2				1.7 J		1.0 J		4.0 U
12/2/2013	NT				NT		NT		NT	16.7				2.5 J		2.3 J		4.0 U
3/17/2014	NT				NT		NT		NT	13.1				4.0 U		4.0 U		4.0 U
6/2/2014	NT				NT		NT		NT	10.2				1.4 J		1.6 J		4.0 U
9/29/2014	NT				NT		NT		NT	16.6				4.0 U		4.0 U		1.2 J
11/17/2014	NT				NT		NT		NT	15.0				4.0 U		4.0 U		1.0 J
2/25/2015	NT				NT		NT		NT	13.1				1.73		0.82		0.03 J
9/14/2015	NT				NT		NT		NT	15.2				2.2 J		0.9 J		4.0 U
12/7/2015	NT				NT		NT		NT	8.7				4.0 U		4.0 U		
2/29/2016	NT				NT		NT		NT	9.2				4.0 U		4.0 U		4.00 U
6/6/2016	NT				NT		NT		NT	14.1				4.0 U		4.0 U		2.2 J
9/26/2016	NT				NT		NT		NT	13.5				4.0 U		4.0 U		0.9 J
3/9/2017	NT				NT		NT		NT	NT				NT		NT	NT	
6/11/2017	NT				NT		NT		NT							2.1 U		
9/17/2017	NT				NT		NT		NT	10.1	10.4			2.1 U		2.1 U		2.1 U
12/14/2017	NT				NT		NT		NT	NT				NT		NT		NT
3/18/2018	NT				NT		NT		NT	NT				NT		NT		NT
6/16/2018	NT				NT		NT		NT	NT				NT		NT		NT
9/30/2018	NT				NT		NT		NT	NT				NT		NT		NT
11/18/2018	NT				NT		NT		NT	NT				NT		NT		NT

Table 3C. Summary of Groundwater Metals: 2007 through 2018
Former J.H. Baxter North Woodwaste Landfill
Arlington, Washington

Date	Nickel, dissolved (µg/L)									Zinc, dissolved (µg/L)								
MCL/SMCL	--									none/5000								
WA WQ Std	--									5,000								
Well ID	BXN-4	BXN-4 Dup	BXN-3	BXN-3 Dup	BXN-2	BXN-2 Dup	BXN-1	BXN-1 Dup	Field Blank	BXN-4	BXN-4 Dup	BXN-3	BXN-3 Dup	BXN-2	BXN-2 Dup	BXN-1	BXN-1 Dup	Field Blank
2/5/2007	188		41		52		50	53	20.0 U	2.5 B		2.9 B		3.3 B		2.6 B	4.5 B	10.0 U
4/18/2007	103		43		47		42	42	20.0 U	38		12.6		25.1		44	43	10.0 U
7/18/2007	120	125	40		64		36		20.0 U	7.0 B	5.6 B	3.7 B		5.9 B		9.8 B		10.0 U
10/10/2007	139	136	104		36		41		20.0 U	10.4	11.1	16.6		34		28.3		10.0 U
1/10/2008	109	111	40		32		41		2.0 U	10.0 U	10.0 U	10.0 U		10.0 U		7.1 J		7.0 U
4/30/2008	108	107	44		47		49		2.0 U	10.0 U	10.0 U	10.0 U		10.0 U		10.4		7.0 U
7/30/2008	95	99	52		39		31		0.5 U	3.2 J	3.1 J	1.2 J		3.4 J		3.3 J		1.5 B
10/22/2008	62	61	121		28.0		46			6.8 J	3.0 J	10.0 U		10.0 U		4.3 J		
2/1/2009	83	78	56		42		43		20.0 U	2.4 J	4.6 J	1.2 J		3.3 J		5.2 J		1.6 J
5/1/2009	63	63	68		47		37		20.0 U	2.5 J	1.7 J	10.0 U		3.1 J		4.7 J		5.0 J
8/1/2009	7.5 J	20.0 U	32		13.6 J		14.2 J		20.0 U	2.0 J	10.0 U	6.1 J		1.7 J		0.9 J		2.4 J
11/1/2009	74		70	71	32		25.7		20.0 U	1.7 J		10.0 U	10.0 U	10.0 U		4.0 J		10.0 U
2/10/2010	70	78	71		47		43		20.0 U	1.8 J	3.5 J	10.0 U		1.8 J		2.9 J		10.0 U
5/26/2010	62	62			28.4		42		20.0 U	7.3 J	1.5 J			1.3 J		7.3 J		10.0 U
8/18/2010	90				29.7		37	36	20.0 U	3.5 J				1.0 J		6.3 J	6.7 J	1.9 J
11/18/2010	117	104			29.3		42		20.0 U	10.0 U	10.0 U			10.0 U		10.0 U		10.0 U
2/9/2011	104				28.8		42		20.0 U	2.9 J				1.9 J		3.2 J		0.3 J
5/17/2011	70				37		37		20.0 U									
8/24/2011	88				32		26.3		20.0 U	3.1 J				1.6 J		2.0 J		10.0 U
11/3/2011	103				39		32		20.0 U	3.2 J				2.4 J		4.7 J		10.0 U
2/14/2012	123				24.8		32		20.0 U	3.8 J				1.6 J		3.4 J		0.7 J
5/2/2012	82				25.9		38		20.0 U	1.3 J				0.9 J		1.6 J		10.0 U
8/21/2012	78				26.7				20.0 U	10.0 U				10.0 U				10.0 U
11/13/2012	106				21.0		21.2		20.0 U	1.1 J				10.0 U		2.5 J		10.0 U
2/12/2013	82				22.7		24.4		20.0 U	1.1 J				10.0 U		2.0 J		10.0 U
6/4/2013	86				32		39		4.0 U	1.1 J				1.0 J		3.4 J		4.0 U
8/27/2013	90				22.2		27.3		4.0 U	1.3 J				2.4 J		2.0 J		4.0 U
12/2/2013	85				33		38		4.0 U	1.6 J				0.9 J		2.2 J		4.0 U
3/17/2014	63				20.4		31		4.0 U	1.4 J				0.8 J		2.1 J		4.0 U
6/2/2014	62				28.2		33		4.0 U	1.1 J				0.4 J		1.4 J		4.0 U
9/29/2014	80				34		45		0.4 J	2.4 J				1.2 J		2.2 J		4.0 U
11/17/2014	74				20.9		32		4.0 U	3.9 J				0.9 J		1.9 J		5.0 U
2/25/2015	68				28.8		32		0.1 J	1.9 J				1.0 J		2.5 J		0.5 U
9/14/2015	64				17.2		33		0.4 J	5.2				1.3 J		2.8 J		4.0 U
12/7/2015	57				12.2		45			3.2 J				1.6 J		2.6 J		
2/29/2016	58				26.7		42		4.0 U	2.2 J				1.3 J		4.2		4.0 U
6/6/2016	63				21.5		14.9		4.0 U	4.3				4.0 U		4.0 U		1.0 J
9/26/2016	92				4.0 U		22.2		4.0 U	1.9 J				0.5 J		19.0		4.0 U
3/9/2017	61				39		37.8	38.2		NT				NT		NT	NT	
6/11/2017							23									0.7 J		
9/17/2017	71	70			24.4		18.3		2.1 U	1.9 J	2.3 J			1.9 J		2.3 J		0.7 J
12/14/2017							2.1 U									NT		
3/18/2018	NT				NT		NT			NT				NT		NT		
6/16/2018	NT				NT		NT			NT				NT		NT		
9/30/2018	NT				NT		NT			NT				NT		NT		
11/18/2018	NT				NT		56	53		NT				NT		NT		

Notes

µg/L = microgram per liter. R = rejected value. NT = not tested.

B = detected in laboratory method blank.

J = result is an estimated concentration that is less than the method reporting limit, but greater than or equal to the method detection limit.

MCL = Federal maximum contaminant levels for drinking water.

SMCL = Federal secondary maximum contaminant levels for drinking water.

U = analyte was not detected at or above the MRL/MDL.

WA WQ Std = State of Washington's water quality standards for groundwater (WAC 173-200).

Table 3D. Summary of Groundwater Pentachlorophenol: 2009 to 2018

Former J.H. Baxter North Woodwaste Landfill

Arlington, Washington

Date	Pentachlorophenol (µg/L)								
MCL/SMCL							1/		
WA WQ Std							--		
	BXN-4	**BXN-4 Dup**	**BXN-3**	**BXN-3 Dup**	**BXN-2**	**BXN-2 Dup**	**BXN-1**	**BXN-1 Dup**	**Field Blank**
9/1/2009	0.5 U		1.5		0.5 U		0.5 U		NT
11/18/2009	0.5 U		0.5 U	0.5 U	0.24 J		0.5 U		NT
2/10/2010	0.5 U	0.5 U	0.5 U		0.5 U		0.5 U		0.5 U
8/21/2012	0.5 U		NT		0.5 U		NT		0.5 U
11/13/2012	0.5 U		NT		0.5 U		0.5 U		41
2/12/2013	0.5 U		NT		0.5 U		0.5 U		0.5 U
6/4/2013	0.5 U		NT		0.5 U		0.5 U		0.5 U
8/27/2013	0.5 U		NT		0.5 U		0.5 U		0.5 U
12/2/2013	0.5 U		NT		0.5 U		0.5 U		0.5 U
3/17/2014	0.5 U		NT		0.5 U		0.5 U		0.5 U
6/2/2014	0.5 U		NT		0.5 U		0.5 U		0.5 U
9/29/2014	0.19 NJ		NT		0.5 U		0.5 U		0.5 U
9/26/2016	0.1 U		NT		0.1 U		0.1 U		0.1 U
3/9/2017	0.5 U		NT		0.5 U		0.5 U	0.5 U	0.5 U
3/18/2018	0.2 U		NT		0.2 U		0.2 U		0.2 U

Notes:

µg/L = microgram per liter.

R = rejected value.

J = result is an estimated concentration that is less than the method reporting limit, but greater than or equal to the method detection limit.

MCL = Federal maximum contaminant levels for drinking water.

NJ = result is tentaitvely identified and the associated numerical valus is the estimated concentration in the sample.

SMCL = Federal secondary maximum contaminant levels for drinking water.

U = analyte was not detected above the reported sample quantification limit.

WA WQ Std = State of Washington's water quality standards for groundwater (WAC 173-200).

September 2009 samples collected by buyer's consultant and analyzed by ALS Laboratory Group, Everett, WA.

November 2009 and February 2010 samples collected as part of quarterly monitoring activities.

August and November 2012 samples collected as part of quarterly monitoring activities.

All 2013 through 2018 samples collected as part of monitoring activities.

Data is not validated.

Table 4. Parameters Statistically Higher than Background: 1989 to 2018

Former J.H. Baxter North Woodwaste Landfill, Arlington, Washington

Analyte Group	Parameter[1]	Monitoring Period	Unit	Mean Value Downgradient[2,3]			Mean Value Upgradient[2]
				BXN-1	BXN-2	BXN-3	BXN-4
Conventionals	Ammonia as Nitrogen	1989	mg/L			0.36	0.06
Conventionals	Ammonia as Nitrogen	1991	mg/L			0.595	0.04
Conventionals	Ammonia as Nitrogen	1992	mg/L			0.26	ND
Conventionals	Ammonia as Nitrogen	1993	mg/L			0.57	0.08
Conventionals	Ammonia as Nitrogen	1994	mg/L			0.23	ND
Conventionals	Ammonia as Nitrogen	1995	mg/L			0.23	ND
Metals	Arsenic	1991	µg/L			21	9
Metals	Arsenic	1992	µg/L			20	ND
Metals	Arsenic	1993	µg/L			27	3
Metals	Arsenic	1994	µg/L			32	2.5
Metals	Arsenic	1995	µg/L			31	2.5
Metals	Arsenic	1996	µg/L			27	2.5
Metals	Arsenic	1997	µg/L			17	2.5
Metals	Arsenic	1998	µg/L			19	2.5
Metals	Arsenic	1999	µg/L			18	2.5
Metals	Arsenic	2001	µg/L			18.5	2.5
Metals	Arsenic	2002	µg/L			19.83	1.41
Metals	Arsenic	2003	µg/L			16.73	1.33
Metals	Arsenic	2004	µg/L			13.73	2.07
Metals	Arsenic	2005	µg/L			12.63	2.33
Metals	Arsenic	2006	µg/L			6.53	3.53
Metals	Arsenic	2007	µg/L			5	ND (< 5 µg/L)
Metals	Arsenic	2008	µg/L	5.4		3.68	1.73
Metals	Arsenic	2009	µg/L	8.43		2.8	1.6
Metals	Arsenic	2010	µg/L	10.83			ND (<5 µg/L)
Metals	Arsenic	2011	µg/L	15.38			2
Metals	Arsenic	2012	µg/L	19.23			2.5
Metals	Arsenic	2013	µg/L	26.3			3.05
Metals	Arsenic	2014	µg/L	23.43			0.32
Metals	Arsenic	2015	µg/L	27.1			0.37
Metals	Arsenic	2016	µg/L	19.98			0.43
Metals	Arsenic	2017	µg/L	17.98			8.00
Metals	Arsenic	2018	µg/L	24.25			5.00
Metals	Barium	1993	µg/L			84	29
Metals	Barium	1994	µg/L			89	32
Metals	Barium	1995	µg/L			124	49
Conventionals	Carbon, Total Organic	1989	mg/L			12.6	2.52
Conventionals	Carbon, Total Organic	1991	mg/L	9.2		9.54	1.48
Conventionals	Carbon, Total Organic	2018	mg/L	33			4.7
Conventionals	Chemical Oxygen Demand	1989	mg/L	43			10
Conventionals	Chemical Oxygen Demand	1991	mg/L	33		45	12.25

Table 4. Parameters Statistically Higher than Background: 1989 to 2018

Former J.H. Baxter North Woodwaste Landfill, Arlington, Washington

Analyte Group	Parameter[1]	Monitoring Period	Unit	Mean Value Downgradient[2,3]			Mean Value Upgradient[2]
				BXN-1	BXN-2	BXN-3	BXN-4
Conventionals	Chemical Oxygen Demand	1992	mg/L		66		16
Conventionals	Chemical Oxygen Demand	2014	mg/L	23.9			11.9
Conventionals	Chemical Oxygen Demand	2015	mg/L	18.45			15.23
Conventionals	Chemical Oxygen Demand	2018	mg/L	52			13.00
Conventionals	Conductivity	1989	µS/cm	505		564	254
Conventionals	Conductivity	1991	µS/cm	449		597	229
Metals	Iron	1989	µg/L			38,670	7,770
Metals	Iron	1991	µg/L			38,670	7,770
Metals	Iron	1992	µg/L			26,300	14
Metals	Iron	1993	µg/L			39,050	30
Metals	Iron	1994	µg/L			52,500	54
Metals	Iron	1995	µg/L			53,400	52
Metals	Iron	1997	µg/L			35,600	50
Metals	Iron	1998	µg/L			22,300	190
Metals	Iron	2000	µg/L	4,160		19,850	35
Metals	Iron	2001	µg/L	2,788		25,875	58
Metals	Iron	2002	µg/L	3,333		35,519	47
Metals	Iron	2003	µg/L			25,225	130
Metals	Iron	2004	µg/L			23,175	87
Metals	Iron	2005	µg/L	3,275		20,925	131
Metals	Iron	2006	µg/L	4,463		9,648	102
Metals	Iron	2007	µg/L	7,465		7,470	78
Metals	Iron	2008	µg/L	12,350		4,770	213
Metals	Iron	2009	µg/L	12,350		3,715	77
Metals	Iron	2010	µg/L	14,075		873	248
Metals	Iron	2011	µg/L	20,125			35
Metals	Iron	2012	µg/L	22,600			16.15
Metals	Iron	2013	µg/L	38,500			16.025
Metals	Iron	2014	µg/L	37,600			55
Metals	Iron	2015	µg/L	28,100			33
Metals	Iron	2016	µg/L	25,375			17.03
Metals	Iron	2017	µg/L	25,488			327
Metals	Iron	2018	µg/L	55,650			38
Metals	Manganese	1989	µg/L	7,190		2,260	10
Metals	Manganese	1991	µg/L	7,190		2,260	10
Metals	Manganese	1992	µg/L	3,060		1,400	ND
Metals	Manganese	1993	µg/L	3,090	435	2,108	9
Metals	Manganese	1994	µg/L	2,650	2,200	2,070	149
Metals	Manganese	1995	µg/L			2,070	149
Metals	Manganese	2001	µg/L	1,848		3,938	6,328
Metals	Manganese	2009	µg/L		7,085		2,798

Table 4. Parameters Statistically Higher than Background: 1989 to 2018

Former J.H. Baxter North Woodwaste Landfill, Arlington, Washington

Analyte Group	Parameter[1]	Monitoring Period	Unit	Mean Value Downgradient[2,3]			Mean Value Upgradient[2]
				BXN-1	BXN-2	BXN-3	BXN-4
Metals	Manganese	2011	µg/L	5,605	4,475		1,588
Metals	Manganese	2012	µg/L	3,753	3,070		2,046
Metals	Manganese	2013	µg/L	4,220	2,825		157
Metals	Manganese	2014	µg/L	3,955	2,848		2,443
Metals	Manganese	2015	µg/L	4,890			3,270
Metals	Manganese	2017	µg/L	4,388			2,035
Metals	Manganese	2018	µg/L	5,615			1,823
Metals	Nickel	1993	µg/L		57	64	31
Metals	Nickel	1994	µg/L	75	62		39
Conventionals	Nitrate + Nitrite as Nitrogen	2000	mg/L	0.9	1.4		0.1
Conventionals	pH	1989	--			6.29	6.14
Conventionals	pH	1992	--		6.38	6.48	6.14
Conventionals	pH	1993	--			6.37	6.22
Conventionals	pH	2014	--		6.91		6.86
Conventionals	pH	2017	--		6.67		6.47
Conventionals	Solids, Total Dissolved	1991	mg/L	305		347	201
Conventionals	Solids, Total Dissolved	1996	mg/L			44	0.042
Conventionals	Solids, Total Dissolved	1999	mg/L	0.79		20	0.036
Conventionals	Solids, Total Dissolved	2001	mg/L			357	341
Conventionals	Sulfate	2001	mg/L	18.3			15.75
Conventionals	Sulfate	2002	mg/L	19.6			16.7
Conventionals	Tannin and Lignin	1991	mg/L	4.37		8.5	0.3
Conventionals	Tannin and Lignin	1992	mg/L	1.01			0.23
Conventionals	Tannin and Lignin	1993	mg/L			2.45	0.48
Conventionals	Tannin and Lignin	1994	mg/L	0.72		5.05	0.45
Conventionals	Tannin and Lignin	1996	mg/L			0.096	0.057
Conventionals	Tannin and Lignin	2001	mg/L			7.43	5.63
Conventionals	Tannin and Lignin	2011	mg/L	3.06			1.34
Conventionals	Tannin and Lignin	2014	mg/L	8.22			1.06
Metals	Zinc	2010	µg/L			5.28	4.4
Metals	Zinc	2013	µg/L	2.4			ND (<10 µg/L)

Notes:

µg/L = microgram per liter.

µS/cm = microSiemen per centimeter.

mg/L = milligram per liter.

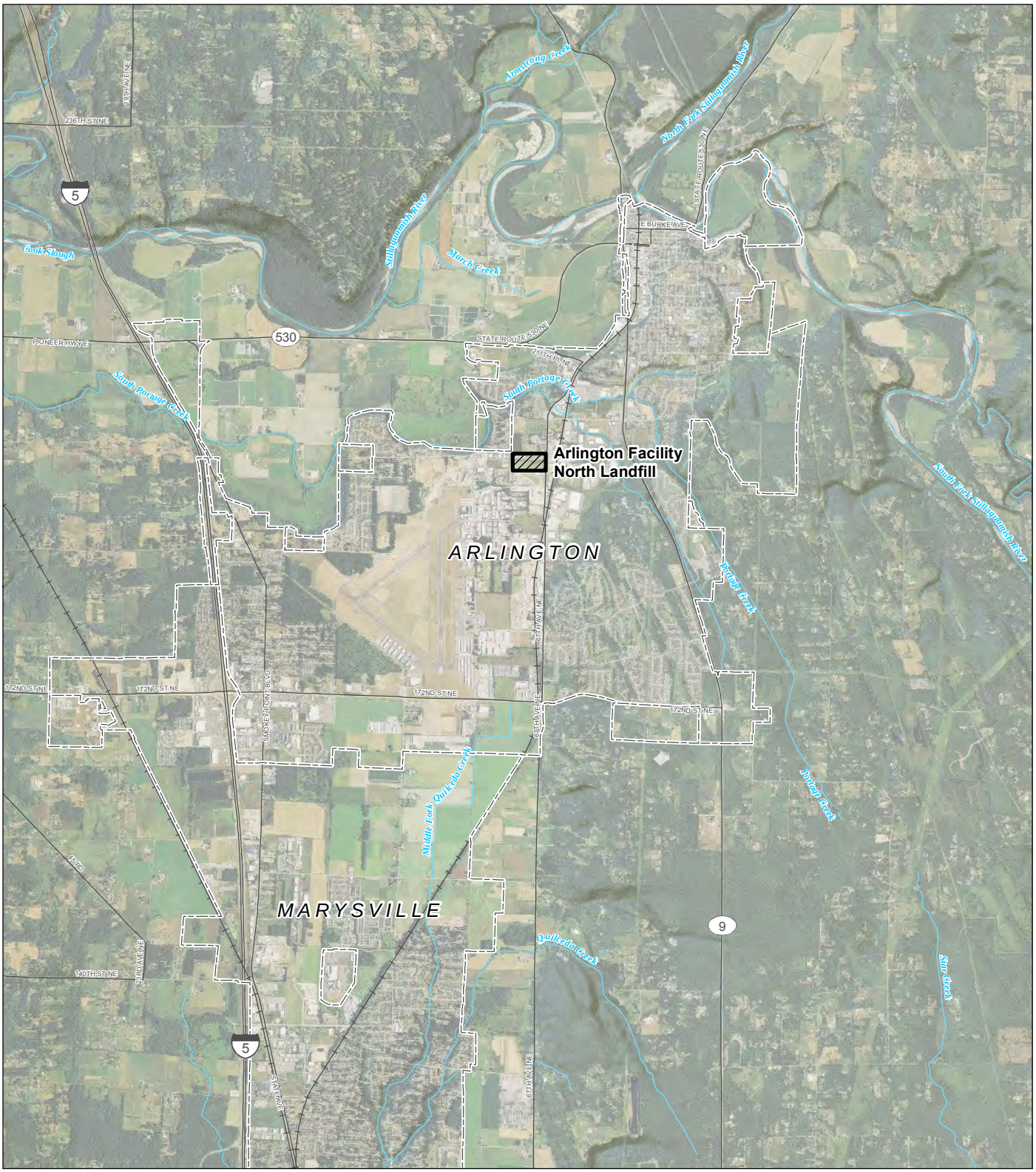
ND = not detected.

[1] Parameters listed only when at least one downgradient well has a higher mean value than the upgradient well.

[2] Mean values are yearly averages.

[3] Mean values in downgradient wells shown when exceeding the mean value of the upgradient well. Value in downgradient wells not shown if the mean value does not exceed the upgradient well's mean value.

Figures



LEGEND

- Cities
- Railroads
- Major Roads
- Watercourses

MAP NOTES:
Date: March 31, 2015
Data Sources: Air photo taken on July 15, 2013 by the USDA

FIGURE 1

Site Vicinity Map

Former J.H. Baxter North Woodwaste Landfill
Arlington, Washington

N

0 0.5 1
Miles

GSI Water Solutions, Inc.

Document Path: P:\Portland\302 - Baxter\GIS\Arlington_Landfills\Project_mxds\North\2014_Annual_Report\Figure1_Site_Vicinity_Map.mxd

FIGURE 2

Groundwater Elevation Contour Map: First Quarter 2016

Former J.H. Baxter
North Woodwaste Landfill
Arlington, Washington

LEGEND

- Monitoring Well (February 2016 Groundwater Elevation)
- Groundwater Elevation Contours (dashed where inferred)
- Direction of Groundwater Flow

NOTES:

1. All elevations exist in NAVD88.
2. NM = not measured.
3. BXN-3 is damaged.

N

0 75 150 225
Feet

Date: March 28, 2017
Data Sources: AMEC, ESRI, Air photo taken on July 15, 2013 by the USDA

GSI Water Solutions, Inc.

Document Path: P:\Portland\302 - Baxter\GIS\Arlington_Landfills\Project_mxds\2016_Annual_Report\N_Figure2_GW_Elev_1Q_2016.mxd

FIGURE 3

Groundwater Elevation Contour Map: Third Quarter 2016

Former J.H. Baxter
North Woodwaste Landfill
Arlington, Washington

LEGEND

- Monitoring Well (September 2016 Groundwater Elevation)
- Groundwater Elevation Contours (dashed where inferred)
- Direction of Groundwater Flow

NOTES:

1. All elevations exist in NAVD88.
2. NM = not measured.
3. BXN-3 is damaged.

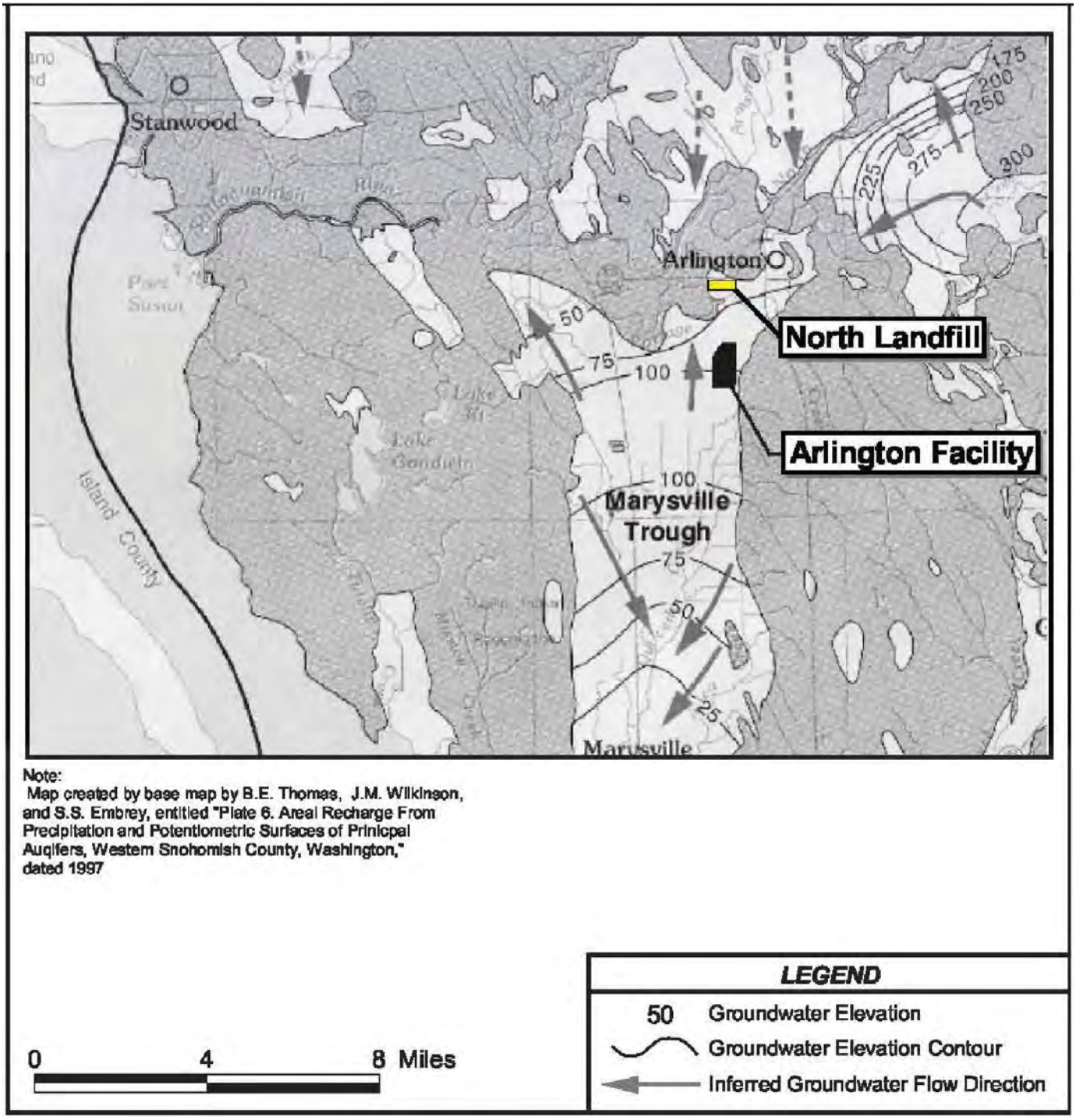
N

0 75 150 225
Feet

Date: March 28, 2017
Data Sources: AMEC, ESRI, Air photo taken on July 15, 2013 by the USDA

GSI Water Solutions, Inc.

Document Path: P:\Portland\302 - Baxter\GIS\Arlington_Landfills\Project_mxds\2016_Annual_Report\N_Figure3_GW_Elev_3Q_2016.mxd



N

FIGURE 4

Regional Groundwater Flow

Former J.H. Baxter North Woodwaste Landfill
Arlington, Washington

MAP NOTES:
Date: April 13, 2015
Data Sources: AMEC Figure 4 from 2013 Annual Report

GSI Water Solutions, Inc.

Document Path: P:\Portland\302 - Baxter\GIS\Arlington_Landfills\Project_mxds\North\2014_Annual_Report\Figure4_Regional_GW_Flow.mxd

Figure 5
Ammonia Trend
North Wells

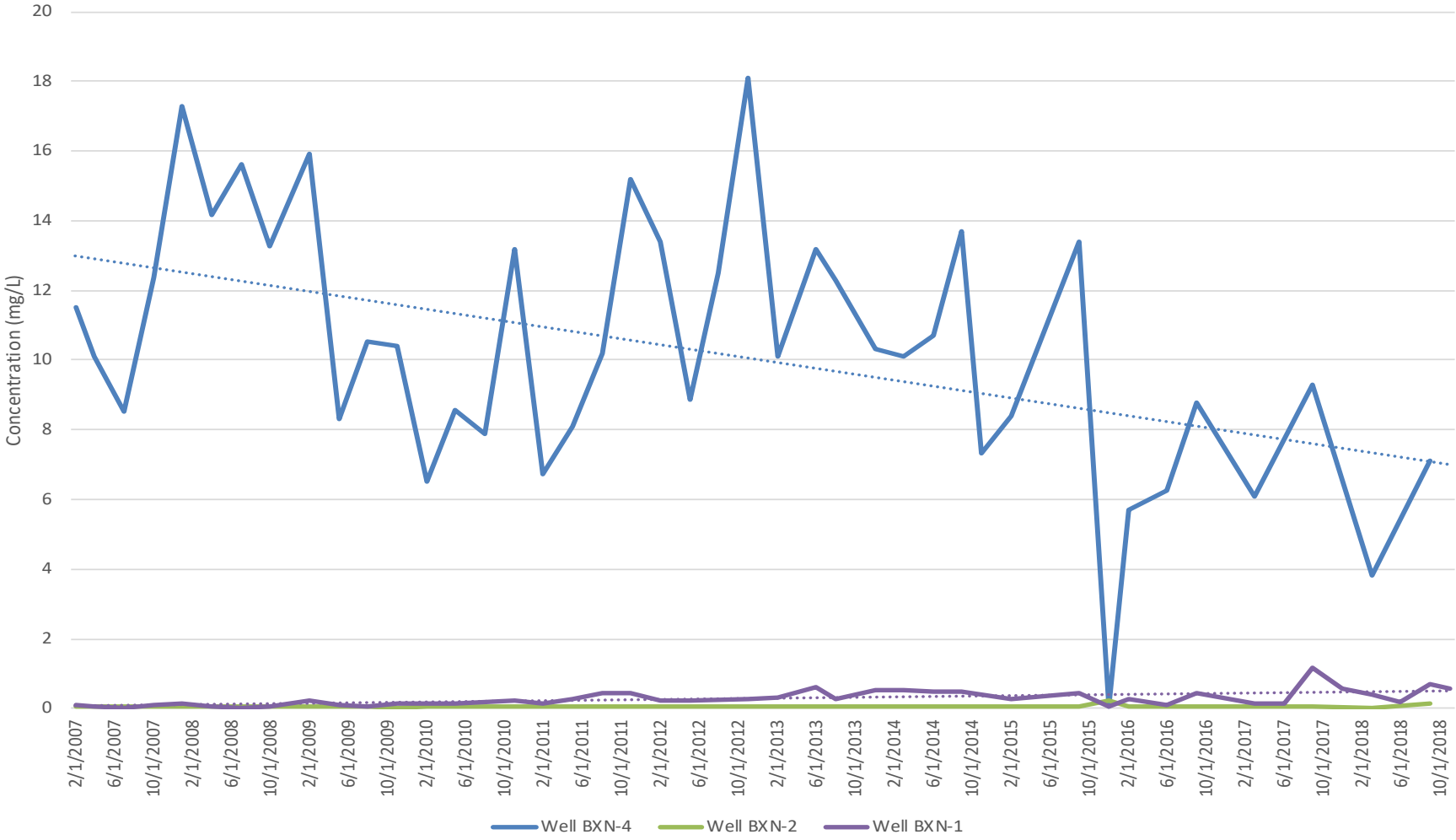


Figure 6
Arsenic Trend
North Wells

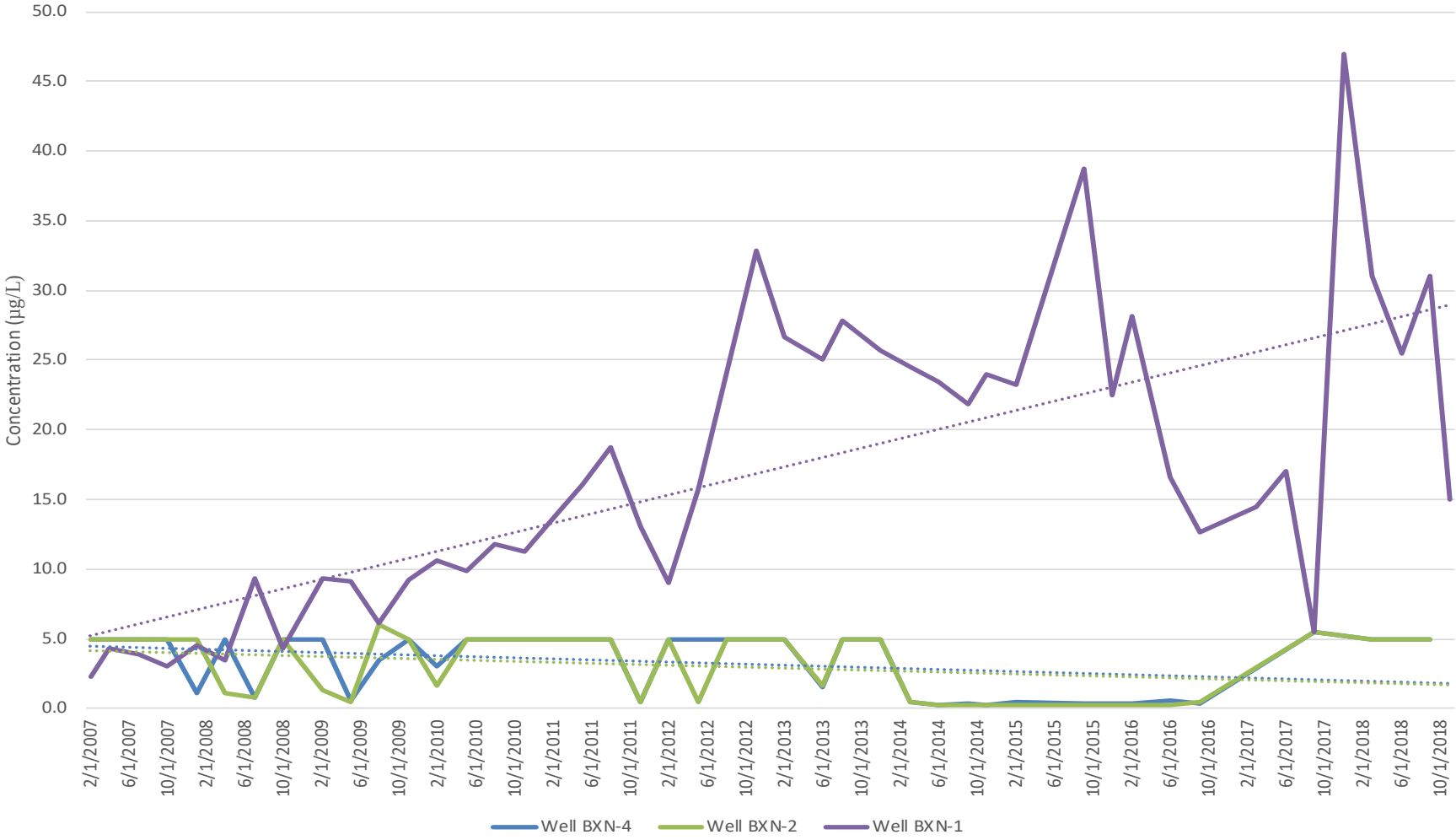


Figure 7
Barium Trend
North Wells

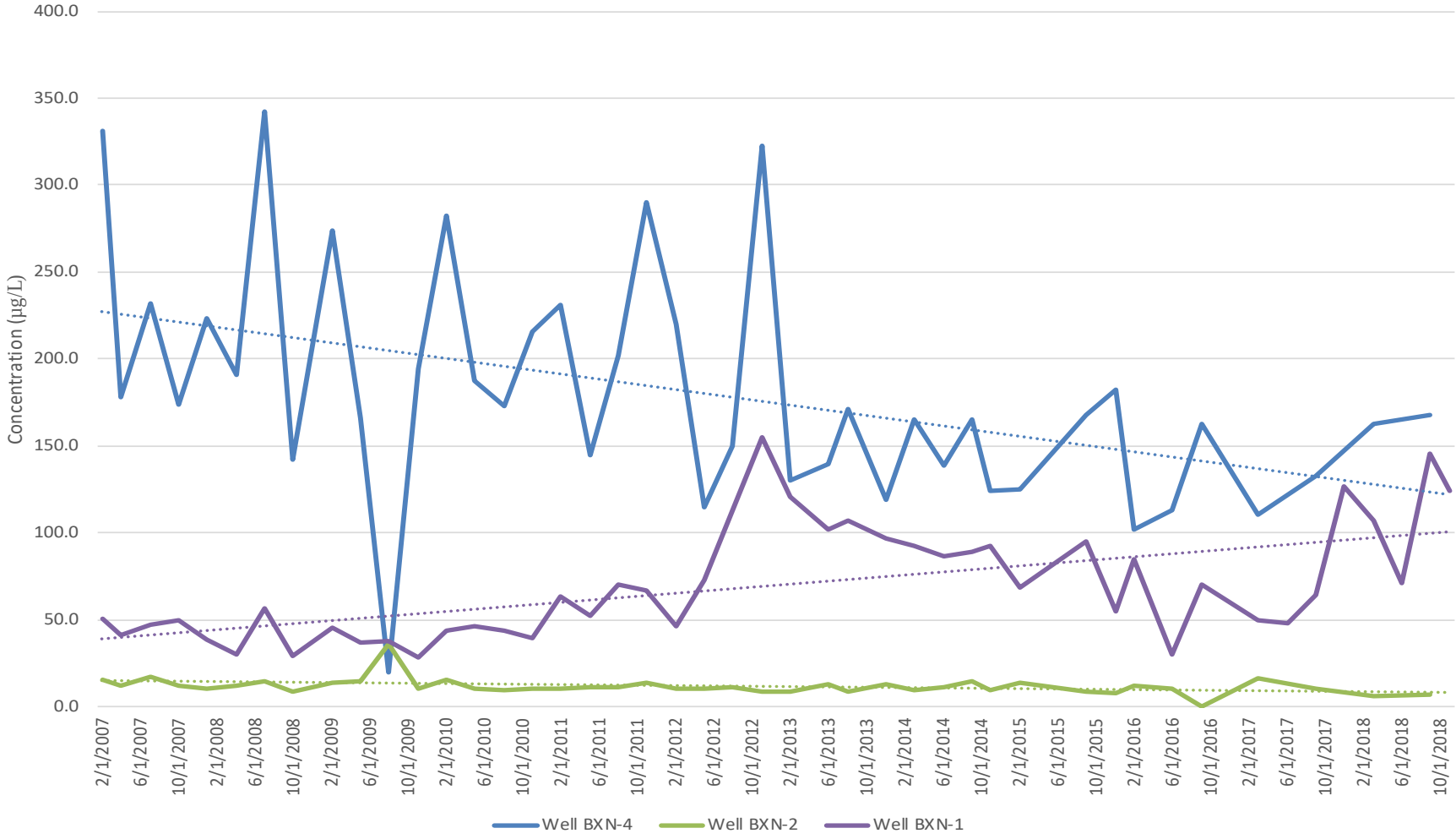


Figure 8
COD Trend
North Wells

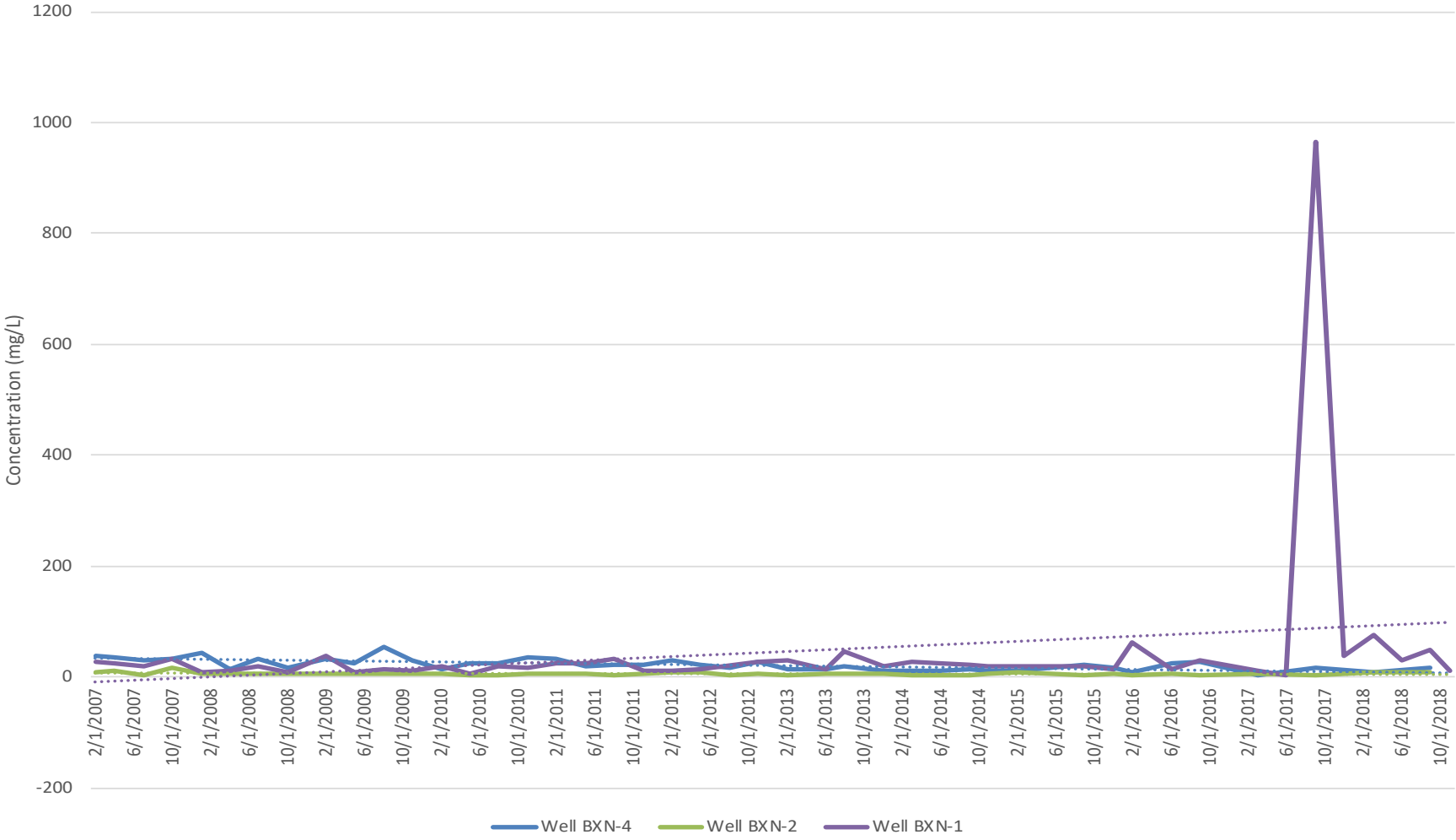


Figure 9
Chloride Trend
North Wells

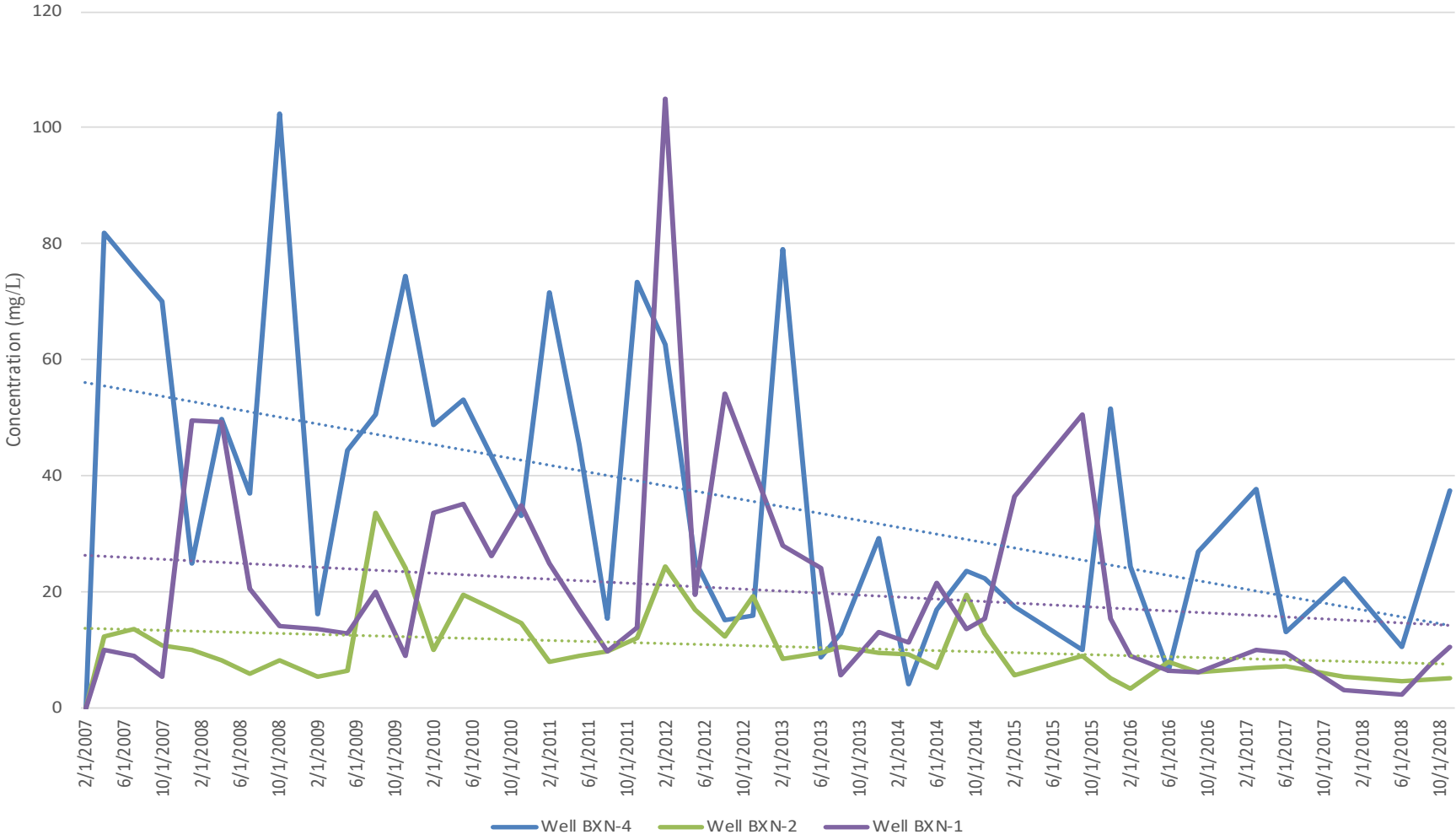


Figure 10
Iron Trend
North Wells

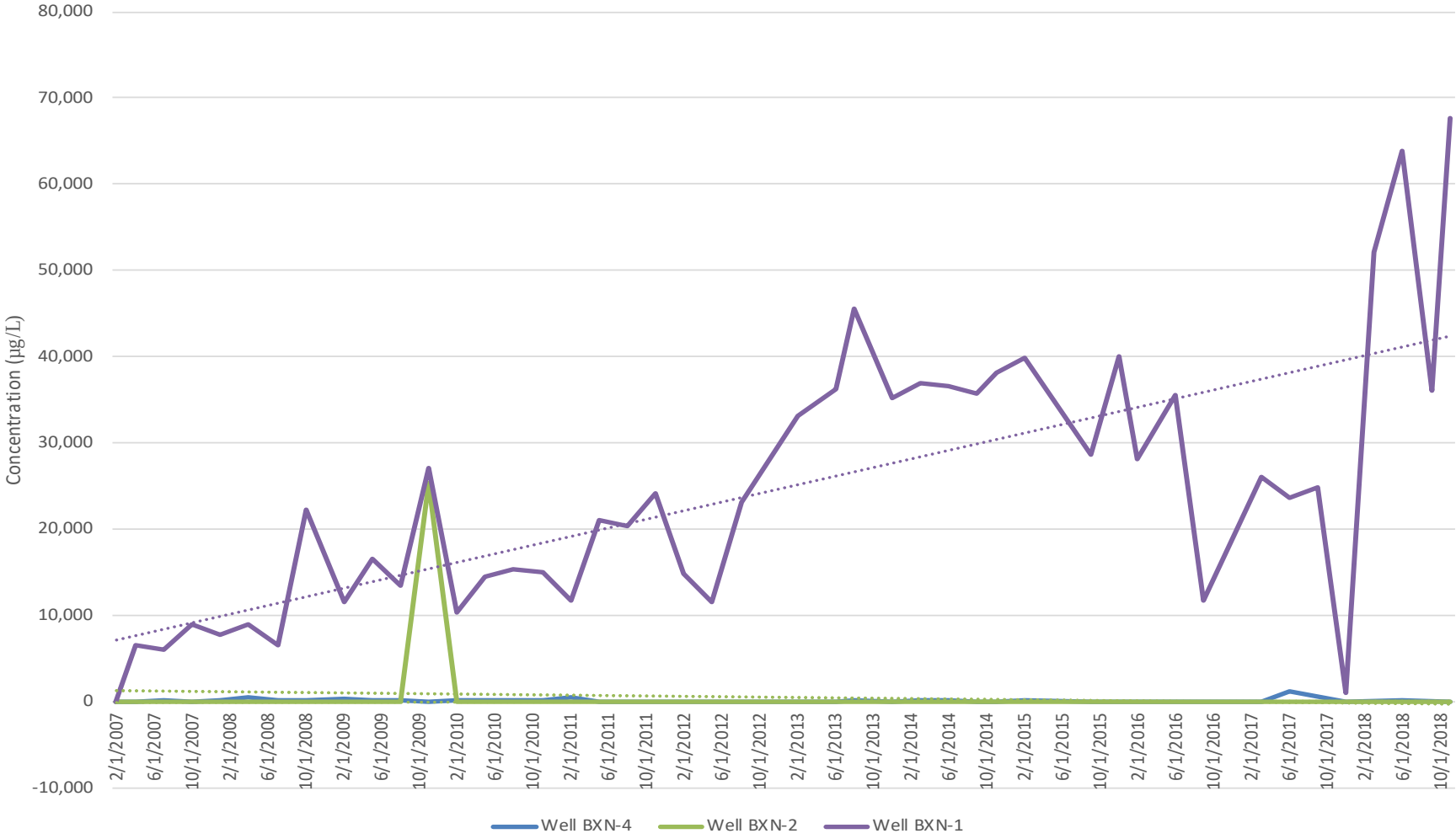


Figure 11
Manganese Trend
North Wells

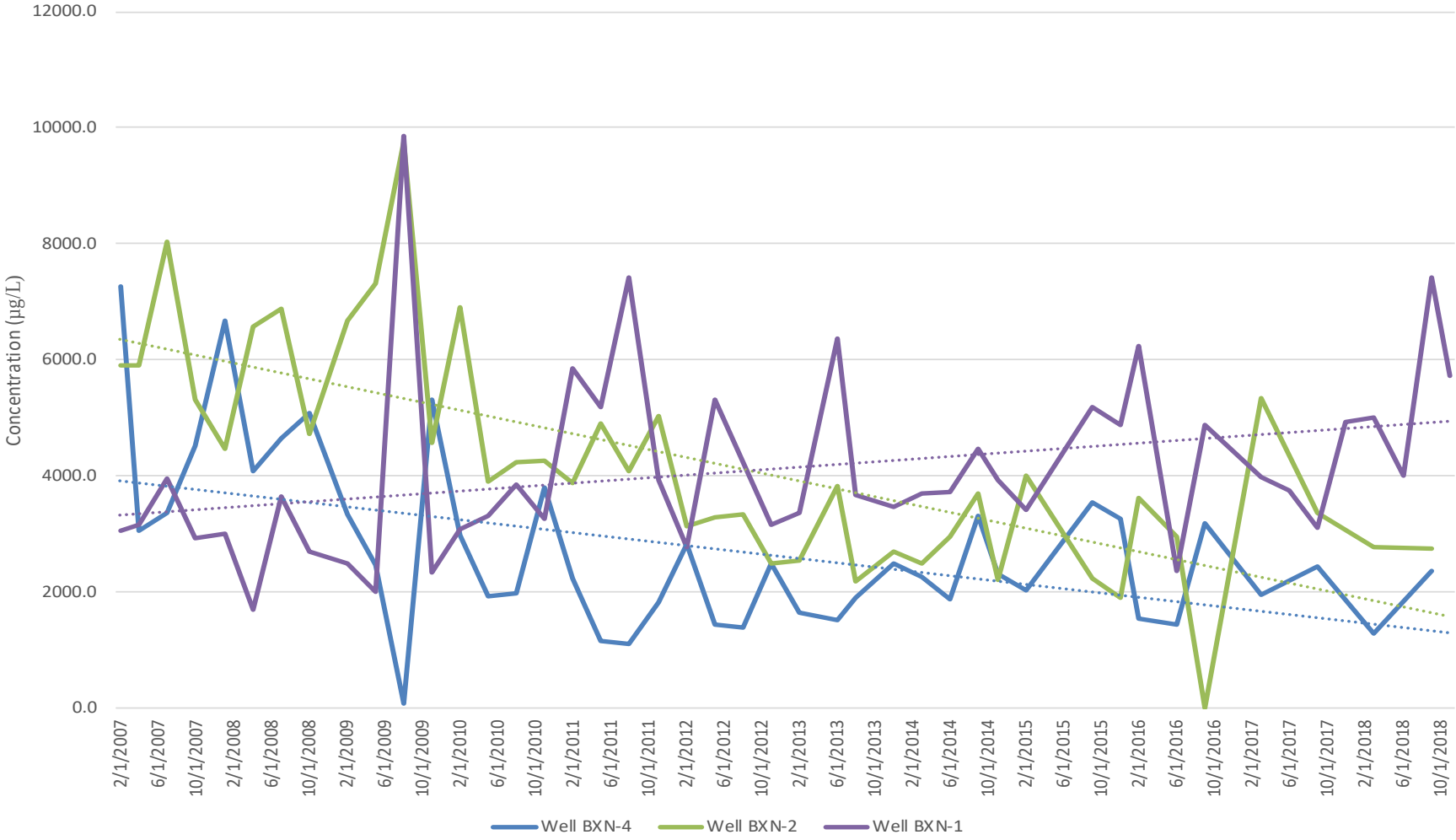


Figure 12
Nickel Trend
North Wells

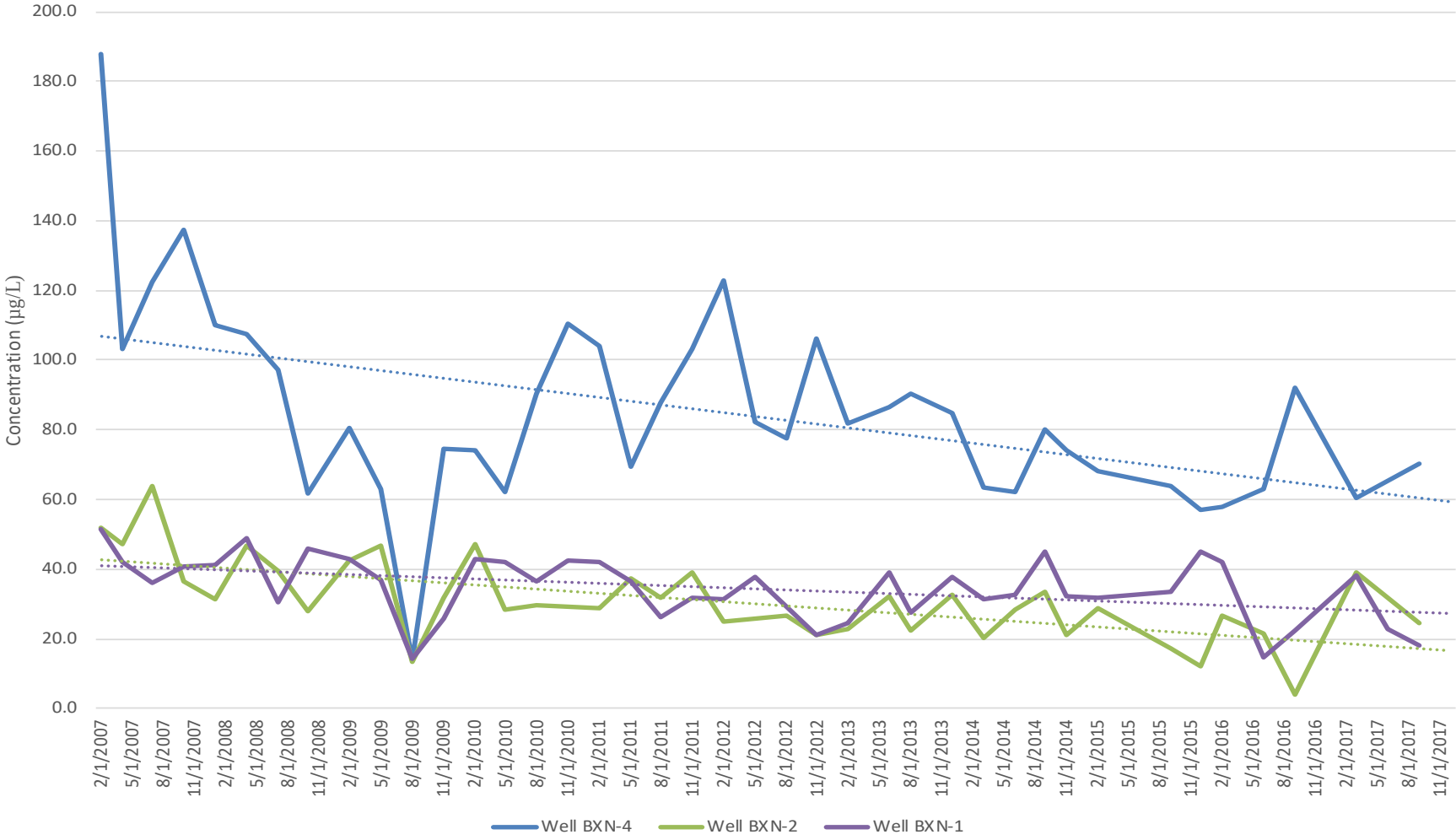


Figure 13
Nitrate+Nitrite Trend
North Wells

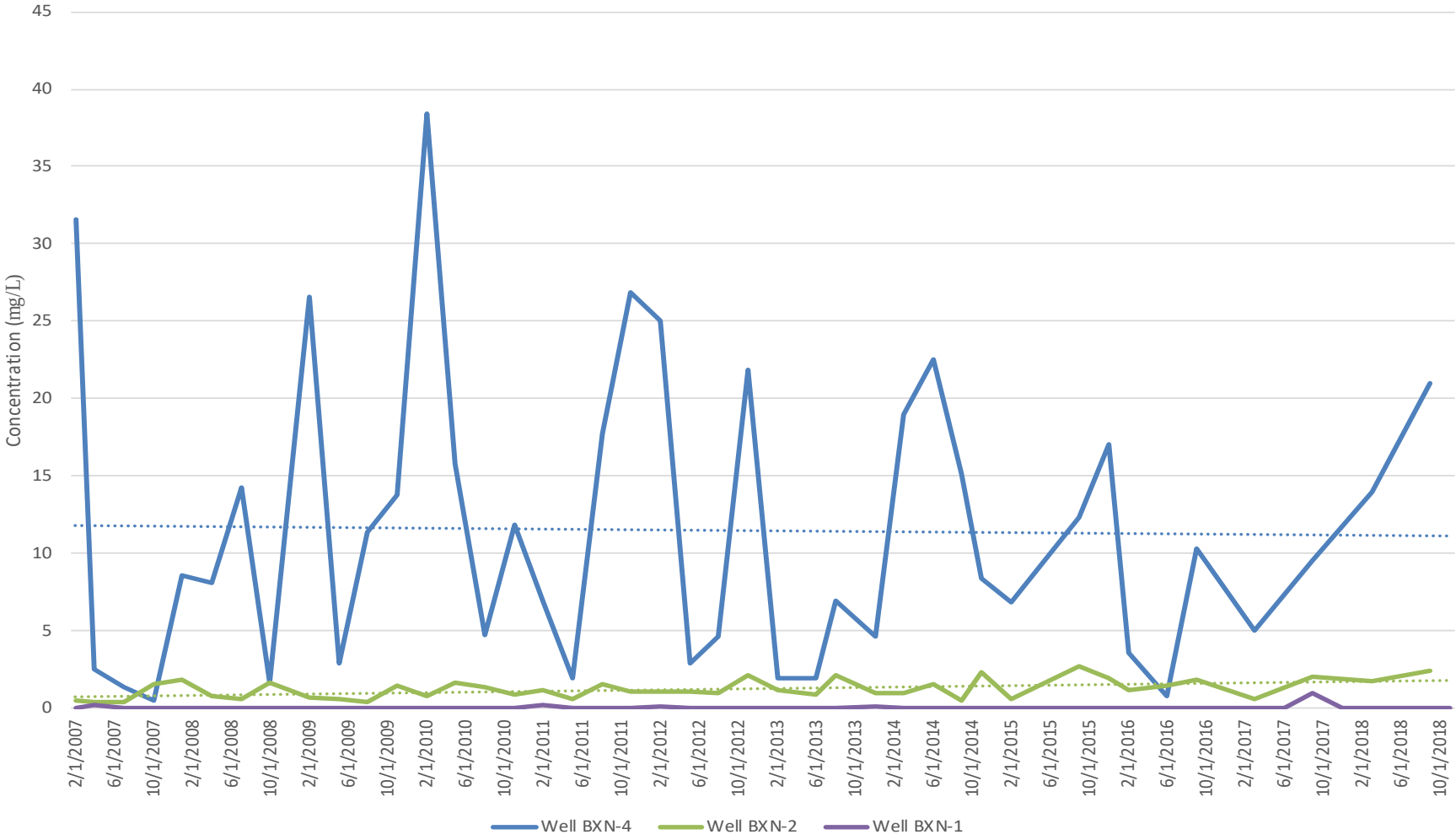


Figure 14
Field pH Trend
North Wells

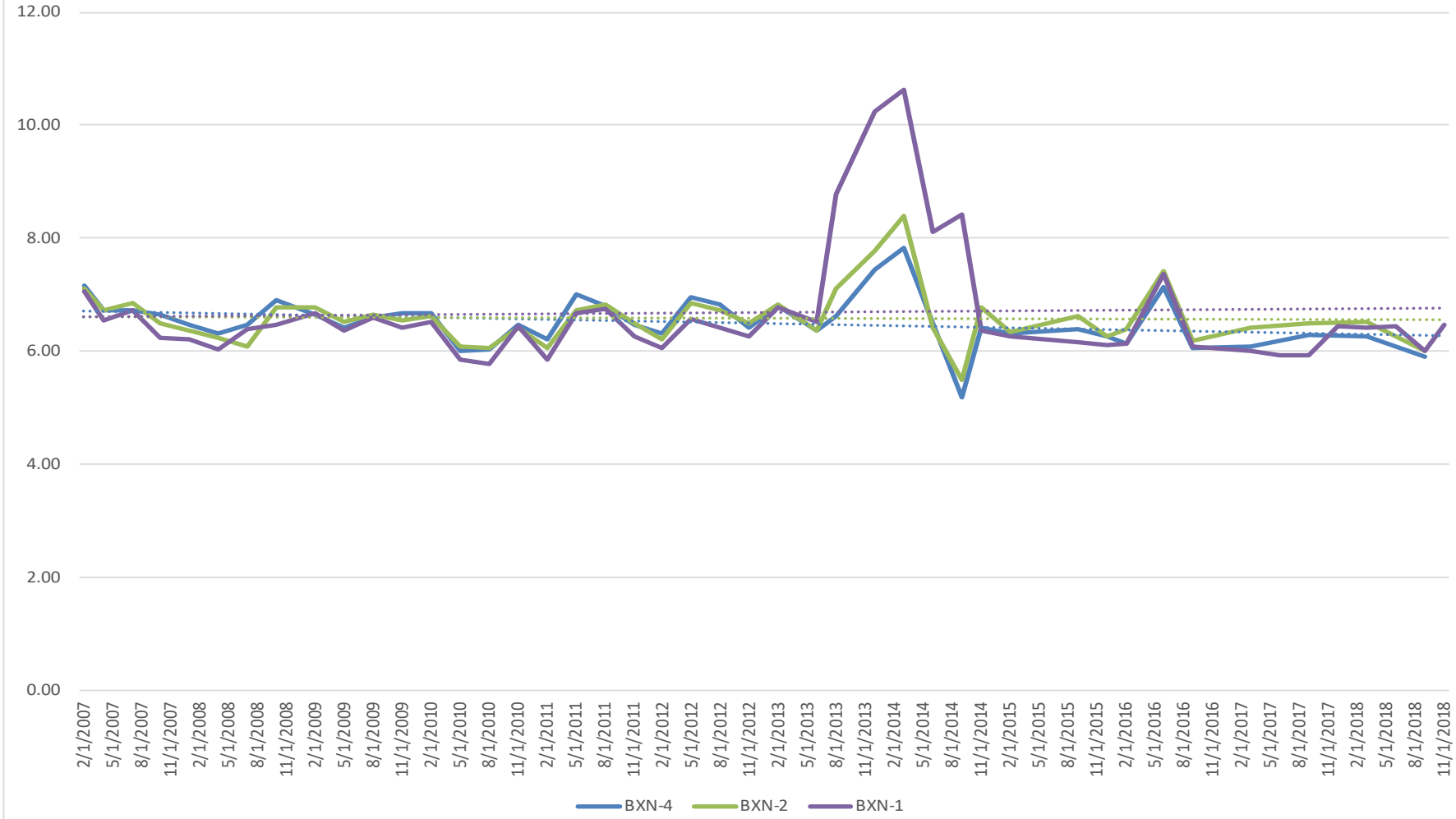


Figure 15
Sulfate Trend
North Wells

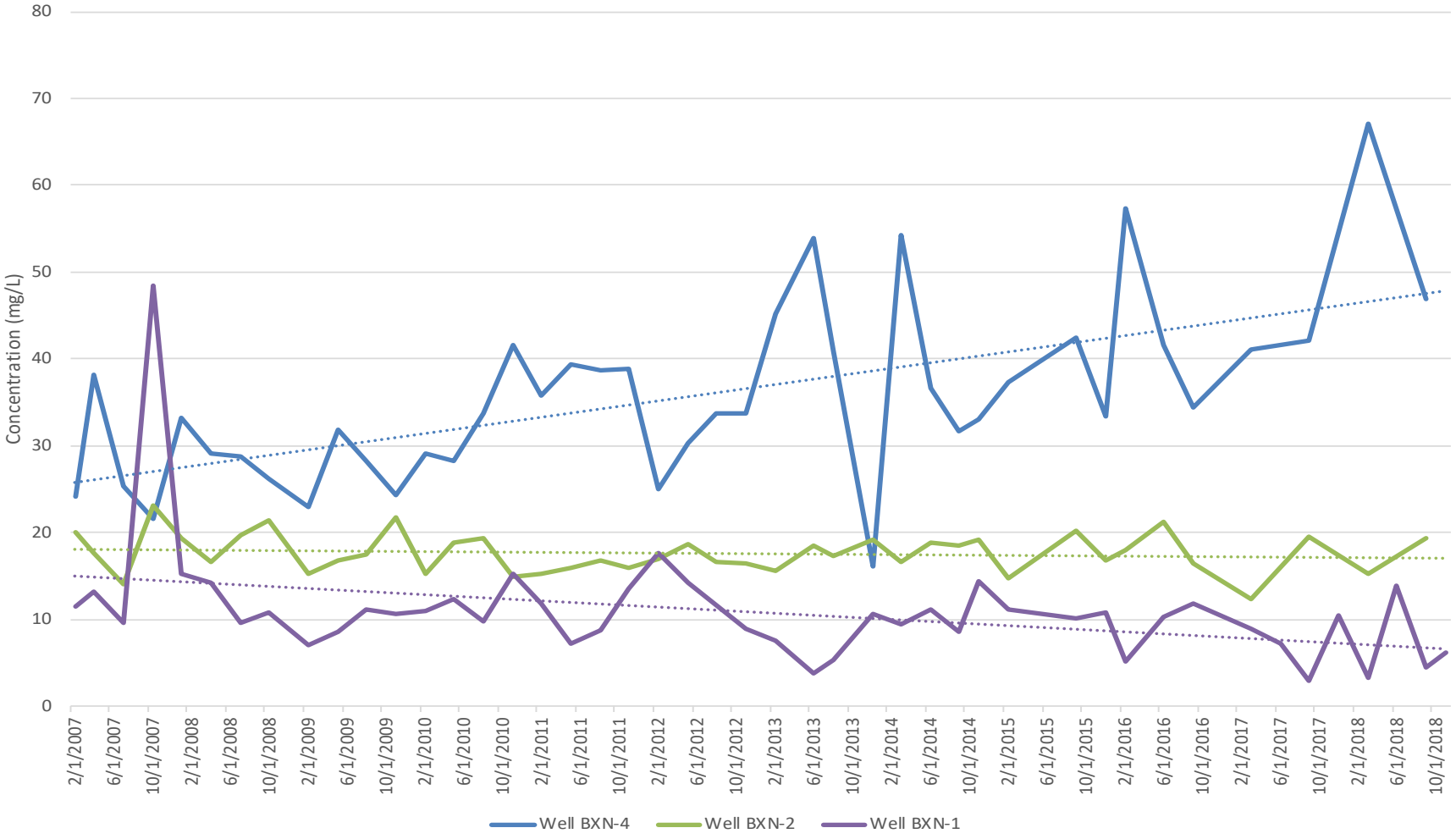


Figure 16
Tannin & Lignin Trend
North Wells

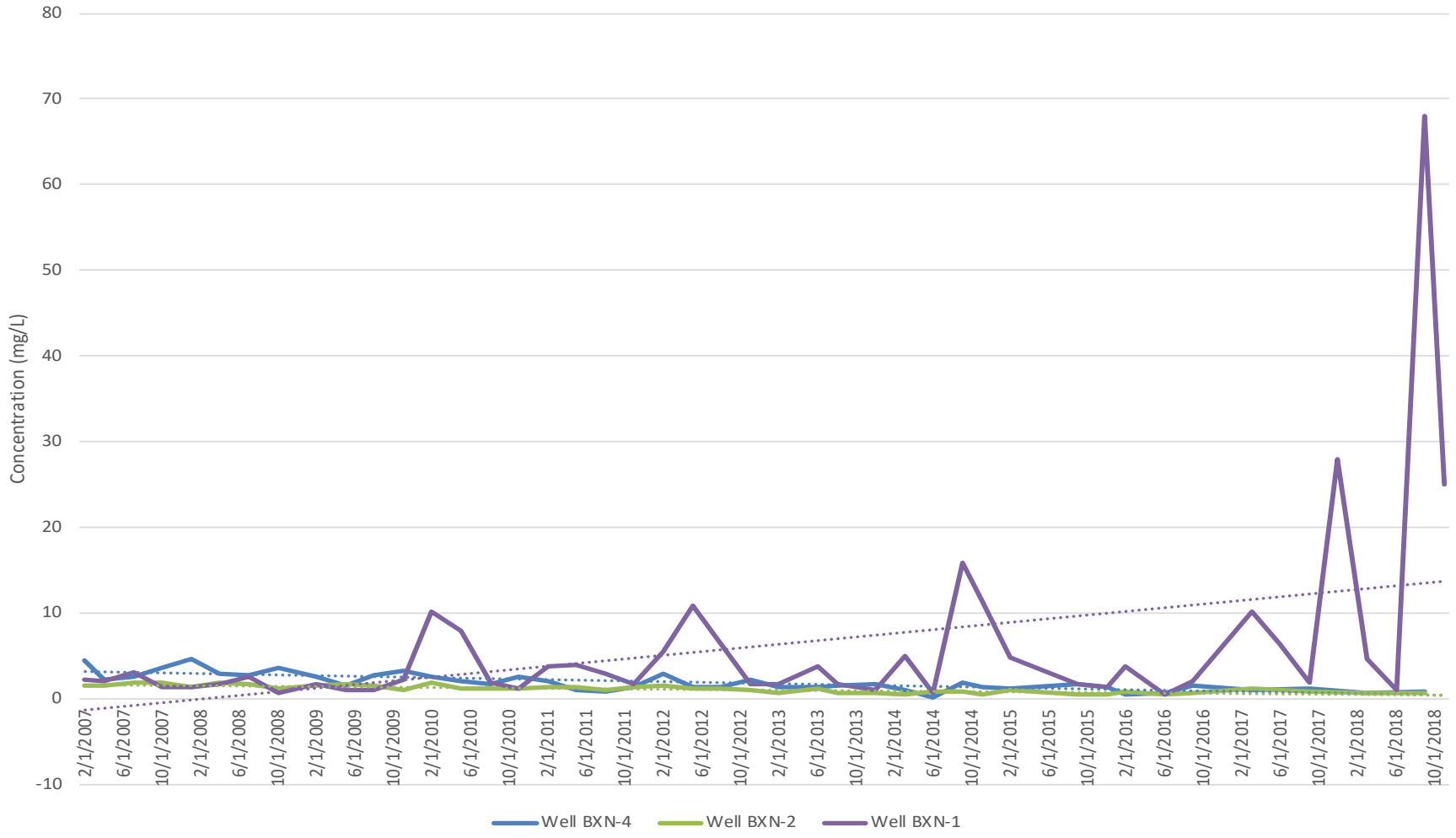


Figure 17
TDS Trend
North Wells

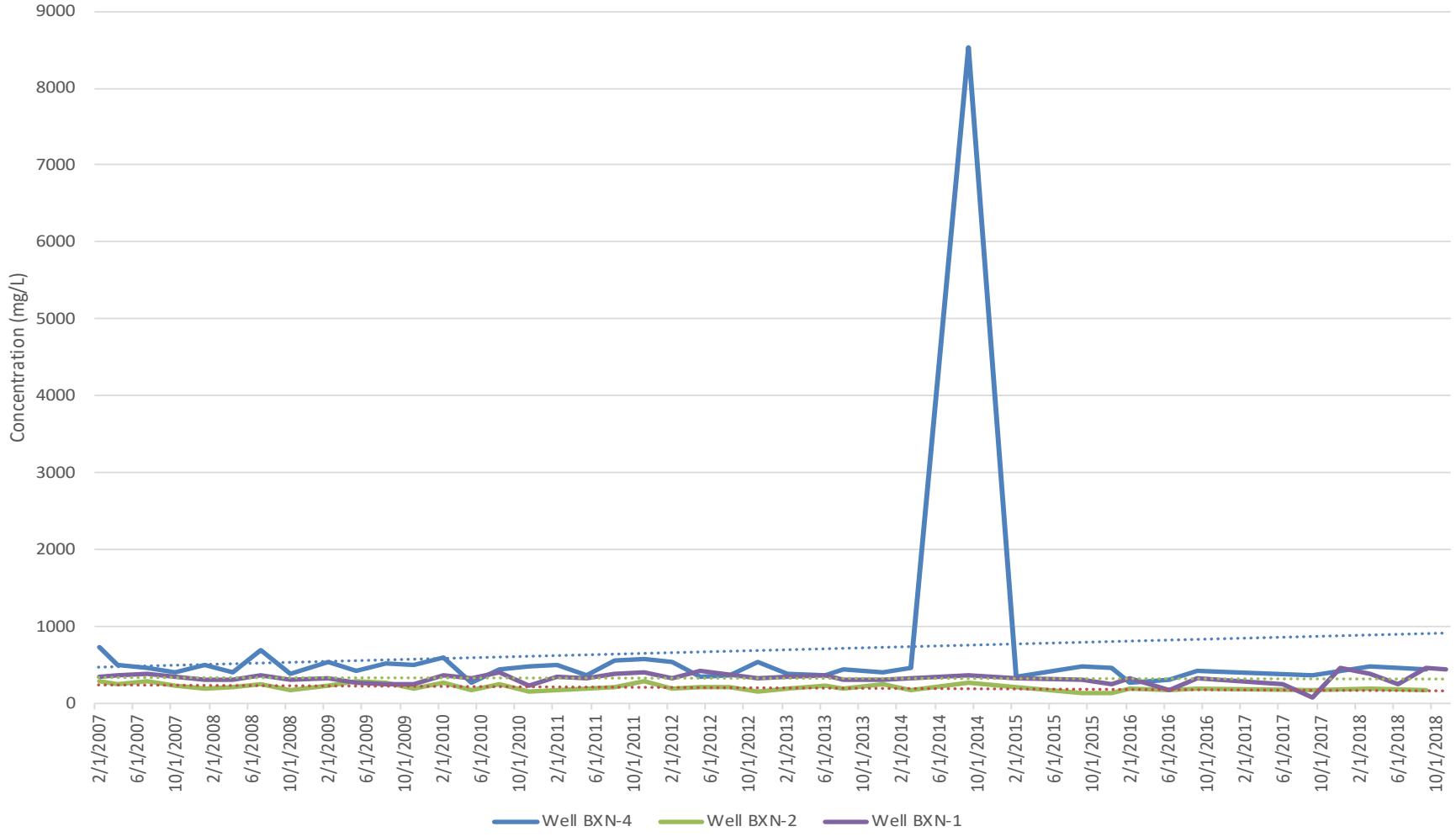


Figure 18
TOC Trend
North Wells

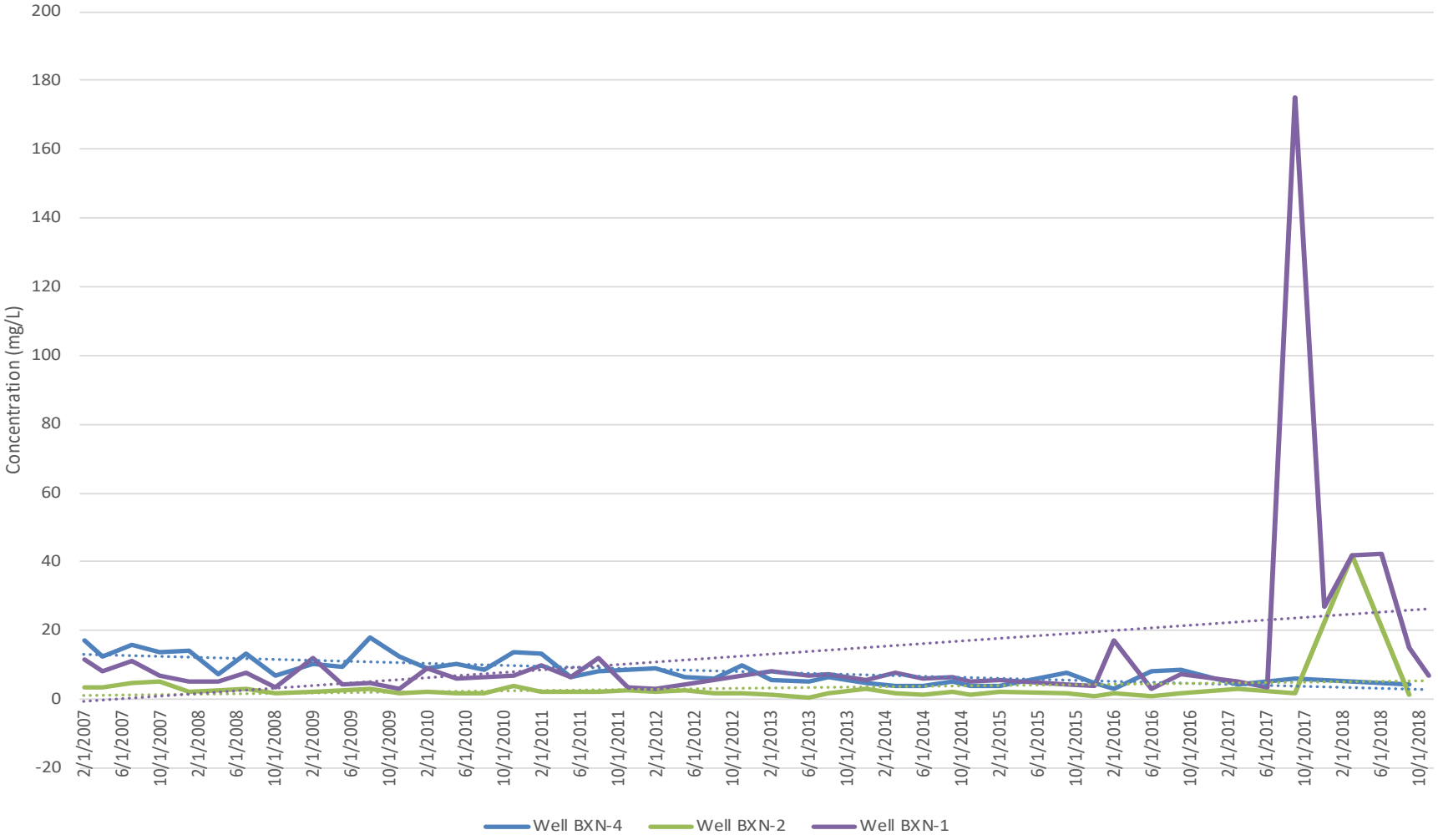


FIGURE 19

Arsenic Isopleth Map: 2018

Former J.H. Baxter
North Woodwaste Landfill
Arlington, Washington

LEGEND

- Monitoring Well (Peak 2018 Arsenic Concentration)
- Arsenic Contours (dashed where inferred)
- Modeled Source Area
- Direction of Groundwater Flow

NOTES:

1. Arsenic contouring estimated using Quick Domenico approximation.
2. NM = not measured.
3. U = undetected.
4. BXN-3 is damaged.
5. Concentrations in micrograms/L.
6. Data from peak arsenic detections per well in 2018.

N

0 75 150 225
Feet

Date: April 21, 2015
Data Sources: AMEC, ESRI, Air photo taken on July 15, 2013 by the USDA

GSI Water Solutions, Inc.

Appendix A

2018 Groundwater Monitoring Field Forms

Woodwaste Landfill Monitoring

Date: 3-18-18 Well ID: BXN-1 Tech: Kvam

Depth to Water: 45.63 Depth to Bottom: _____ Well Size: 2"

Purge type: (Low-Flow)/Standard Well type: Flush mount/(Standpipe)

Sample Analysis:

Flow Rate:

Start time: 1210

Time	Flow rate	Volume Removed	DTW	pH	(µS/cm) COND	(°C) TEMP	ORP	(mg/L) DO
1210			45.63	6.44	305	10.36	89.1	4.98
1213				6.34	360	11.62	26.4	1.70
1216				6.43	385	12.33	4.8	0.57
1219				6.44	406	13.21	2.4	0.37
1222				6.44	422	14.05	5.0	0.28
1225			45.61	6.43	416	13.52	5.6	0.24

All Parameters Stable at: 1225 Total Volume Removed:

Sample time: ~~1230~~ 1305

Signature: Brian Kvam Date: 3-18-18 Time: 1310

Rinsate samples collected @ BXN-1

Woodwaste Landfill Monitoring

Date: 3-18-18 Well ID: BXN-2 Tech: KVam

Depth to Water: 41.9 Depth to Bottom: _____ Well Size: 2"

Purge type: (Low-Flow)/Standard Well type: Flush mount/(Standpipe)

Sample Analysis:

Flow Rate:

Start time: 1023

Time	Flow rate	Volume Removed	DTW	pH	(µS/cm) COND	(°C) TEMP	ORP	(mg/L) DO
1023			41.9	6.72	132	10.75		12.54
1026				6.56	140	12.54		1.08
1029				6.54	145	12.98		0.83
1032				6.53	146	12.93		0.48
1035			41.91	6.52	146	12.76		0.39

All Parameters Stable at: 1035 Total Volume Removed:

Sample time: 1040

Signature: Bruce Kram Date: 3-18-18 Time: 3-18-18

Woodwaste Landfill Monitoring

Date: 3-18-18 Well ID: BXN-4 Tech: KVam

Depth to Water: 39.50 Depth to Bottom: _____ Well Size: 2"

Purge type: (Low-Flow)/Standard Well type: Flush mount/(Standpipe)

Sample Analysis:

Flow Rate:

Start time: 1339

Time	Flow rate	Volume Removed	DTW	pH	(µS/cm) COND	(°C) TEMP	ORP	(mg/L) DO
1339			39.50	6.28	365	12.32	55.3	4.00
1342				6.28	426	12.76	39.3	1.39
1345				6.28	443	12.83	34.0	1.12
1348			39.50	6.27	453	13.81	29.1	0.92

All Parameters Stable at: 1348 Total Volume Removed:

Sample time: 1350

Signature: Bruce Kvam Date: 3-18-18 Time: 1355

Woodwaste Landfill Monitoring

Date: 6-16-19 Well ID: BXN-1 Tech: Kram

Depth to Water: 45.15' Depth to Bottom: _____ Well Size: 2"

Purge type: Low-Flow/Standard Well type: Flush mount/Standpipe

Sample Analysis:

Flow Rate:

Start time: 1100

Time	15.0V Flow rate	Volume Removed	DTW	PH	(µS/cm) COND	(°C) TEMP	ORP	(mg/L) DO	(NTUs) Turb
1102			45.15	6.39		13.9	-98.7	1.48	53.0
1107		0.60g	↓	6.45	294	14.8	-113.9	0.54	83.0
1111		1.10g	↓	6.46	306	15.0	-118.9	0.31	21.5
1116		1.45g	45.15	6.46	305	15.0	-119.7	0.28	8.4

All Parameters Stable at: 1116 Total Volume Removed:

Sample time: 1137

Signature: [signature] Date: 6-16-19 Time: 1150

BXN 101 samples (field replicates) are noticeably less turbid
BXN 101 samples collected @ 1147

Woodwaste Landfill Monitoring

Date: 9-30-18 Well ID: BXN-1 Tech: Kvam

Depth to Water: 47.8 Depth to Bottom: _____ Well Size: 2"

Purge type: (Low-Flow)/Standard Well type: Flush mount/(Standpipe)

Sample Analysis:

Flow Rate:

Start time: 1108

Time	Flow rate	Volume Removed	DTW	pH	(µs/cm) COND	(°C) TEMP	ORP	(mg/L) DO	(NTUs) Turbidity
1109			47.80	5.73	616	12.7	21	0.99	0.0
1114			47.85	5.95	696	12.49	-18	0.00	78.7
1119			47.84	5.99	691	12.57	-23	0.03	800
1124			47.84	6.00	692	12.77	-23	0.15	164

All Parameters Stable at: 1124 Total Volume Removed:

Sample time: 1125

Signature: Bruce Kvam Date: 9-30-18 Time: 1130

1150 mL / 3 min = flow rate (12.1 v)

Rinsate samples collected @ 1157.
(particulate matter in VOA (TOC sample bottle))

Woodwaste Landfill Monitoring

Date: 9-30-18 Well ID: BXN-2 Tech: Kvam

Depth to Water: 43.93' Depth to Bottom: _____ Well Size: 2"

Purge type: (Low-Flow)/Standard Well type: Flush mount/(Standpipe)

Sample Analysis:

Flow Rate:

Start time: 1000

Time	Flow rate	Volume Removed	DTW	pH	(µs/cm) COND	(°C) TEMP	ORP	(mg/L) DO	(NTUs) Turbidity
1005			43.93	6.31		12.77	227	11.39	13.5 NTUs
1010			43.93	6.07	196	12.67	231	0.43	69.4
1015			43.95	6.01	198	12.57	232	0.11	3.4
1020			43.95	6.01	199	12.57	232	0.13	2.1

All Parameters Stable at: Total Volume Removed:

Sample time: 1031

Signature: Bruce Kvam Date: 9-30-18 Time: 1025

1.2 g/3 min = flow rate

Woodwaste Landfill Monitoring

Date: 9-30-18 Well ID: BXN-4 Tech: Kvam

Depth to Water: 42.78' Depth to Bottom: _____ Well Size: 2"

Purge type: Low-Flow/Standard Well type: Flush mount/Standpipe

Sample Analysis:

Flow Rate:

Start time: 0842

Time	Flow rate	Volume Removed	DTW	pH	(µs/cm) COND	(°C) TEMP	ORP	(mg/L) DO	(NTUs) Turbidity
0844			42.78'	5.05	~~271~~	15.09	271		
0850			42.85'	5.77	430	14.09	280	0.86	5.1
0855			42.85'	5.60	374	13.93	283	0.98	5.1
0900			42.85'	5.51	479	13.86	284	0.07	4.8
0905			42.85'	5.92	620	13.23	252	0.05	3.3
0910			42.85'	5.91	616	12.85	246	0.04	2.9

All Parameters Stable at: ~~0905~~ 0910 Total Volume Removed:

Sample time: 0911

Signature: Bruce Kvam Date: 9-30-18 Time: 0915

Woodwaste Landfill Monitoring

Date: 11-17-18 Well ID: BXN-1 Tech: EBK

Depth to Water: 48.49 Depth to Bottom: _____ Well Size: 2.5"

Purge type: (Low-Flow)/Standard Well type: Flush mount/(Standpipe)

Sample Analysis:

Flow Rate:

A Start time: 1246

Time	Flow rate	Volume Removed	DTW	pH	(µs/cm) COND	(°C) TEMP	ORP	(mg/L) DO	
1247			48.49	6.49	509	13.22	16.2	26.00	GW noticeably turbid light gray color
1252				6.44	540	13.87	-15.2	3.64	
1257				6.47	578	14.19	-23.8	1.80	lighter gray color
1302				6.45	594	14.29	-26.9	1.34	very light gray color
1307				6.46	592	13.99	-36.7	1.15	colorless; Ø noticeable
1312		3.0	48.49	6.48	596	14.14	-32.9	1.02	turbidity

All Parameters Stable at: 1312 Total Volume Removed: 3.0 gallons

Sample time: 1314

Signature: Bruce Kaa Date: 11-17-18 Time: 1318

* 15.2 voltage output needed to start ~~flow~~ pump

A - using YSI 556 MPS w/ flow-thru cell

BXN-5 sample @ 1315

Appendix B

2018 Laboratory Reports

AmTest Chain of Custody Record

AMTEST LABORATORIES

13600 NE 126th PL, Suite C, Kirkland, WA 98034
Ph (425) 885-1664 Fx (425) 820-0245
www.amtestlab.com

Chain of Custody No. 31608

Client Name & Address:	Invoice To:
Kvam Aquatic Sciences, LLC 9314 NE 133rd Street Kirkland, WA 98034	Kvam Aquatic Sciences, LLC
Contact Person: Bruce Kvam	Invoice Contact:
Phone No: (206) 953-6904	PO Number:
Fax No:	Invoice Ph/Fax:
E-mail: b.kvam@comcast.net	Invoice E-mail:
Report Delivery: (Choose all that apply) Mail / Fax / (Email) / Posted Online	Data posted to online account: YES / NO Web Login ID:

Special Instructions:

Requested TAT: **(Rush must be pre-approved by lab)**
(Standard) RUSH (5 Day / 3 Day / 48 HR / 24 HR)

Temperature upon Receipt:

Project Name: Arlington Groundwater

Project Number:

AmTest ID	Client ID (35 characters max)	Date Sampled	Time Sampled	Matrix	No. of containers	Analysis Requested: 350.1 NH3	6010C ICP	300 IC	SM 5550 B TPH	SM 2430 C TOC	SM 5310 TOC	353.2 NOx	8151A Mod. PCP only		QA/QC
4490	BXS-1	3-17-18	1320	G	5	X	X	X	X	X	X				
91	BXS-2	3-17-18	1400	G	5	X	X	X	X	X	X				
92	BXS-3	3-18-18	0920	G	5	X	X	X	X	X	X				
93	BXN-1	3-18-18	1305	G	5	X	X	X	X	X	X	X	X		
94	BXN-1 Rinsate	3-18-18	1230	G	5	X	X	X	X	X	X	X	X		
95	BXN-2	3-18-18	1040	G	5	X	X	X	X	X	X	X	X		
96	BXN-4	3-18-18	1350	G	5	X	X	X	X	X	X	X	X		
97	BXS-102	3-17-18	1410	G	5	X	X	X	X	X	X				

	Date	Time		Date	Time
Collected/Relinquished By: Bruce Kvam / Bruce Kvam	3-19-18	0710	Received By:	3/19/18	710
Relinquished By:	Date	Time	Received By:	Date	Time
Relinquished By:	Date	Time	Received By:	Date	Time

COMMENTS:

Am Test Inc.
13600 NE 126TH PL
Suite C
Kirkland, WA 98034
(425) 885-1664

Professional Analytical Services

Mar 4 2019
KVAM AQUATIC SCIENCES LLC
9314 NE 133RD ST
KIRKLAND, WA 98034
Attention: BRUCE KVAM

Dear BRUCE KVAM:

Enclosed please find the analytical data for your ARLINGTON GROUNDWATER project.

The following is a cross correlation of client and laboratory identifications for your convenience.

CLIENT ID	MATRIX	AMTEST ID	TEST
BXS-1	Water	18-A004490	DEM, MIN, NUT, CONV, MET
BXS-2	Water	18-A004491	DEM, MIN, NUT, CONV, MET
BXS-3	Water	18-A004492	DEM, MIN, NUT, CONV, MET
BXN-1 RINSATE	Water	18-A004493	DEM, MIN, NUT, CONV, MET, D5-N, 2-FBP, D14-T
BXN-1	Water	18-A004494	DEM, MIN, NUT, CONV, MET, D5-N, 2-FBP, D14-T
BXN-2	Water	18-A004495	DEM, MIN, NUT, CONV, MET, D5-N, 2-FBP, D14-T
BXN-4	Water	18-A004496	DEM, MIN, NUT, CONV, MET, D5-N, 2-FBP, D14-T
BXS-102	Water	18-A004497	DEM, MIN, NUT, CONV, MET

Your samples were received on Monday, March 19, 2018. At the time of receipt, the samples were logged in and properly maintained prior to the subsequent analysis.

The analytical procedures used at AmTest are well documented and are typically derived from the protocols of the EPA, USDA, FDA or the Army Corps of Engineers.

Following the analytical data you will find the Quality Control (QC) results.

Please note that the detection limits that are listed in the body of the report refer to the Practical Quantitation Limits (PQL's), as opposed to the Method Detection Limits (MDL's).

If you should have any questions pertaining to the data package, please feel free to contact me.

Sincerely,

Kathy Fugiel
President

BACT = Bacteriological
CONV = Conventionals
MET = Metals
ORG = Organics
NUT=Nutrients
DEM=Demand
MIN=Minerals

Am Test Inc.
13600 NE 126TH PL
Suite C
Kirkland, WA 98034
(425) 885-1664
www.amtestlab.com

Professional Analytical Services

ANALYSIS REPORT

KVAM AQUATIC SCIENCES LLC
9314 NE 133RD ST
KIRKLAND, WA 98034
Attention: BRUCE KVAM
Project Name: ARLINGTON GROUNDWATER
All results reported on an as received basis.

Date Received: 03/19/18
Date Reported: 3/ 4/19

AMTEST Identification Number **18-A004490**
Client Identification **BXS-1**
Sampling Date **03/17/18, 13:20**

Conventionals

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Total Dissolved Solids	240	mg/l		1	SM 2540C	DS	03/19/18
Tannin and Lignin	0.20	mg/l		0.1	SM 5550B	DS	03/22/18

Demand

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Total Organic Carbon	14.	mg/l		0.5	SM 5310B	DS	03/19/18
Chemical Oxygen Demand	< 10	mg/l		10	EPA 410.4	DS	03/21/18

Minerals

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Chloride	4.10	mg/l		0.05	EPA 300.0	JC	03/19/18
Sulfate	9.06	mg/l		0.1	EPA 300.0	JC	03/19/18

Nutrients

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Ammonia Nitrogen	0.006	mg/l		0.02	EPA 350.1	JC	03/27/18

Dissolved Metals

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Dissolved Arsenic	< 0.005	mg/l		0.005	EPA 200.7	KQ	03/20/18
Dissolved Barium	0.0164	mg/l		0.0005	EPA 200.7	KQ	03/20/18

Total Metals

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Iron	0.037	mg/l		0.01	EPA 200.7	KQ	03/21/18
Manganese	0.198	mg/l		0.005	EPA 200.7	KQ	03/21/18
Nickel	< 0.005	mg/l		0.005	EPA 200.7	KQ	03/21/18

AMTEST Identification Number **18-A004491**
Client Identification **BXS-2**
Sampling Date **03/17/18, 14:00**

Conventionals

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Total Dissolved Solids	450	mg/l		1	SM 2540C	DS	03/19/18
Tannin and Lignin	1.9	mg/l		0.1	SM 5550B	DS	03/22/18

Demand

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Total Organic Carbon	59.	mg/l		0.5	SM 5310B	DS	03/19/18
Chemical Oxygen Demand	19.	mg/l		10	EPA 410.4	DS	03/21/18

Minerals

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Chloride	2.20	mg/l		0.05	EPA 300.0	JC	03/19/18
Sulfate	0.29	mg/l		0.1	EPA 300.0	JC	03/19/18

KVAM AQUATIC SCIENCES LLC
Project Name: ARLINGTON GROUNDWATER
AmTest ID: 18-A004491

Nutrients

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Ammonia Nitrogen	0.012	mg/l		0.02	EPA 350.1	JC	03/27/18

Dissolved Metals

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Dissolved Arsenic	< 0.005	mg/l		0.005	EPA 200.7	KQ	03/20/18
Dissolved Barium	0.0380	mg/l		0.0005	EPA 200.7	KQ	03/20/18

Total Metals

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Iron	0.317	mg/l		0.01	EPA 200.7	KQ	03/21/18
Manganese	1.62	mg/l		0.005	EPA 200.7	KQ	03/21/18
Nickel	< 0.005	mg/l		0.005	EPA 200.7	KQ	03/21/18

AMTEST Identification Number **18-A004492**
Client Identification **BXS-3**
Sampling Date **03/18/18, 09:20**

Conventionals

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Total Dissolved Solids	440	mg/l		1	SM 2540C	DS	03/19/18
Tannin and Lignin	2.2	mg/l		0.1	SM 5550B	DS	03/22/18

Demand

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Total Organic Carbon	54.	mg/l		0.5	SM 5310B	DS	03/19/18
Chemical Oxygen Demand	40.	mg/l		10	EPA 410.4	DS	03/21/18

Minerals

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Chloride	2.20	mg/l		0.05	EPA 300.0	JC	03/19/18
Sulfate	0.22	mg/l		0.1	EPA 300.0	JC	03/19/18

Nutrients

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Ammonia Nitrogen	0.847	mg/l		0.02	EPA 350.1	JC	03/27/18

Dissolved Metals

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Dissolved Arsenic	0.096	mg/l		0.005	EPA 200.7	KQ	03/20/18
Dissolved Barium	0.0497	mg/l		0.0005	EPA 200.7	KQ	03/20/18

Total Metals

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Iron	109.	mg/l		0.01	EPA 200.7	KQ	03/21/18
Manganese	7.93	mg/l		0.005	EPA 200.7	KQ	03/21/18
Nickel	< 0.005	mg/l		0.005	EPA 200.7	KQ	03/21/18

AMTEST Identification Number **18-A004493**
Client Identification **BXN-1 RINSATE**
Sampling Date **03/18/18, 13:05**

Conventionals

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Total Dissolved Solids	21.	mg/l		1	SM 2540C	DS	03/19/18
Tannin and Lignin	< 0.1	mg/l		0.1	SM 5550B	DS	03/22/18

Demand

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Total Organic Carbon	2.3	mg/l		0.5	SM 5310B	DS	03/19/18
Chemical Oxygen Demand	< 10	mg/l		10	EPA 410.4	DS	03/21/18

Minerals

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Chloride	< 0.05	mg/l		0.05	EPA 300.0	JC	03/19/18
Sulfate	< 0.1	mg/l		0.1	EPA 300.0	JC	03/19/18

Nutrients

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Ammonia Nitrogen	0.006	mg/l		0.02	EPA 350.1	JC	03/27/18
Total Nitrate + Nitrite	< 0.01	mg/l		0.02	EPA 353.2	JC	03/20/18

Dissolved Metals

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Dissolved Arsenic	< 0.005	mg/l		0.005	EPA 200.7	KQ	03/20/18
Dissolved Barium	< 0.0005	mg/l		0.0005	EPA 200.7	KQ	03/20/18

Total Metals

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Iron	0.106	mg/l		0.01	EPA 200.7	KQ	03/21/18
Manganese	0.0109	mg/l		0.005	EPA 200.7	KQ	03/21/18

Polynuclear Aromatic Hydrocarbons (PAH)

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Liq/Liq Ext.	Y				EPA 3520	DP	03/22/18

Semi-Volatile Surrogates

ANALYTE	% RECOVERY	LIMITS	DATE
D5-Nitrobenzene	90.6 %	10.0 - 142.	4/ 3/18
2-Fluorobiphenyl	117. %	23.6 - 122.	4/ 3/18
D14-Terphenyl	172. %	11.0 - 178.	4/ 3/18

Miscellaneous

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANLST	DATE
Pentachlorophenol	< 0.2	ug/l		0.2	EPA 625-SIM	NNL	04/03/18

AMTEST Identification Number **18-A004494**
Client Identification **BXN-1**
Sampling Date **03/18/18, 12:30**

Conventionals

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Total Dissolved Solids	390	mg/l		1	SM 2540C	DS	03/19/18
Tannin and Lignin	4.6	mg/l		0.1	SM 5550B	DS	03/22/18

Demand

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Total Organic Carbon	42.	mg/l		0.5	SM 5310B	DS	03/19/18
Chemical Oxygen Demand	76.	mg/l		10	EPA 410.4	DS	03/21/18

Minerals

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Chloride	2.30	mg/l		0.05	EPA 300.0	JC	03/19/18
Sulfate	3.35	mg/l		0.1	EPA 300.0	JC	03/19/18

Nutrients

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Ammonia Nitrogen	0.401	mg/l		0.02	EPA 350.1	JC	03/27/18
Total Nitrate + Nitrite	0.058	mg/l		0.02	EPA 353.2	JC	03/20/18

Dissolved Metals

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Dissolved Arsenic	0.031	mg/l		0.005	EPA 200.7	KQ	03/20/18
Dissolved Barium	0.107	mg/l		0.0005	EPA 200.7	KQ	03/20/18

Total Metals

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Iron	63.8	mg/l		0.01	EPA 200.7	KQ	03/21/18
Manganese	5.02	mg/l		0.005	EPA 200.7	KQ	03/21/18

Polynuclear Aromatic Hydrocarbons (PAH)

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Liq/Liq Ext.	Y				EPA 3520	DP	03/22/18

Semi-Volatile Surrogates

ANALYTE	% RECOVERY	LIMITS	DATE
D5-Nitrobenzene	84.6 %	10.0 - 142.	4/ 3/18
2-Fluorobiphenyl	109. %	23.6 - 122.	4/ 3/18
D14-Terphenyl	170. %	11.0 - 178.	4/ 3/18

Miscellaneous

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANLST	DATE
Pentachlorophenol	< 0.2	ug/l		0.2	EPA 625-SIM	NNL	04/03/18

AMTEST Identification Number **18-A004495**
Client Identification **BXN-2**
Sampling Date **03/18/18, 10:40**

Conventionals

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Total Dissolved Solids	200	mg/l		1	SM 2540C	DS	03/19/18
Tannin and Lignin	0.67	mg/l		0.1	SM 5550B	DS	03/22/18

Demand

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Total Organic Carbon	42.	mg/l		0.5	SM 5310B	DS	03/19/18
Chemical Oxygen Demand	< 10	mg/l		10	EPA 410.4	DS	03/21/18

Minerals

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Chloride	4.80	mg/l		0.05	EPA 300.0	JC	03/19/18
Sulfate	15.2	mg/l	E	0.1	EPA 300.0	JC	03/19/18

Nutrients

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Ammonia Nitrogen	0.006	mg/l		0.02	EPA 350.1	JC	03/27/18
Total Nitrate + Nitrite	1.8	mg/l		0.02	EPA 353.2	JC	03/20/18

Dissolved Metals

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Dissolved Arsenic	< 0.005	mg/l		0.005	EPA 200.7	KQ	03/20/18
Dissolved Barium	0.0065	mg/l		0.0005	EPA 200.7	KQ	03/20/18

Total Metals

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Iron	0.010	mg/l		0.01	EPA 200.7	KQ	03/21/18
Manganese	2.79	mg/l		0.005	EPA 200.7	KQ	03/21/18

Polynuclear Aromatic Hydrocarbons (PAH)

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Liq/Liq Ext.	Y				EPA 3520	DP	03/22/18

Semi-Volatile Surrogates

ANALYTE	% RECOVERY	LIMITS	DATE
D5-Nitrobenzene	99.7 %	10.0 - 142.	4/ 3/18
2-Fluorobiphenyl	127. %	23.6 - 122.	4/ 3/18
D14-Terphenyl	174. %	11.0 - 178.	4/ 3/18

Miscellaneous

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANLST	DATE
Pentachlorophenol	< 0.2	ug/l		0.2	EPA 625-SIM	NNL	04/03/18

AMTEST Identification Number **18-A004496**
Client Identification **BXN-4**
Sampling Date **03/18/18, 13:50**

Conventionals

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Total Dissolved Solids	480	mg/l		1	SM 2540C	DS	03/19/18
Tannin and Lignin	0.74	mg/l		0.1	SM 5550B	DS	03/22/18

Demand

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Total Organic Carbon	5.2	mg/l		0.5	SM 5310B	DS	03/22/18
Chemical Oxygen Demand	< 10	mg/l		10	EPA 410.4	DS	03/21/18

Minerals

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Chloride	10.7	mg/l		0.05	EPA 300.0	JC	03/21/18
Sulfate	67.1	mg/l	DE	0.5	EPA 300.0	JC	03/21/18

Nutrients

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Ammonia Nitrogen	3.80	mg/l		0.02	EPA 350.1	JC	03/27/18
Total Nitrate + Nitrite	14.	mg/l		0.02	EPA 353.2	JC	03/20/18

Dissolved Metals

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Dissolved Arsenic	< 0.005	mg/l		0.005	EPA 200.7	KQ	03/20/18
Dissolved Barium	0.163	mg/l		0.0005	EPA 200.7	KQ	03/20/18

Total Metals

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Iron	0.071	mg/l		0.01	EPA 200.7	KQ	03/21/18
Manganese	1.28	mg/l		0.005	EPA 200.7	KQ	03/21/18

Polynuclear Aromatic Hydrocarbons (PAH)

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Liq/Liq Ext.	Y				EPA 3520	DP	03/22/18

Semi-Volatile Surrogates

ANALYTE	% RECOVERY	LIMITS	DATE
D5-Nitrobenzene	98.7 %	10.0 - 142.	4/ 3/18
2-Fluorobiphenyl	127. %	23.6 - 122.	4/ 3/18
D14-Terphenyl	172. %	11.0 - 178.	4/ 3/18

Miscellaneous

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANLST	DATE
Pentachlorophenol	< 0.2	ug/l		0.2	EPA 625-SIM	NNL	04/03/18

AMTEST Identification Number **18-A004497**
Client Identification **BXS-102**
Sampling Date **03/17/18, 14:10**

Conventionals

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Total Dissolved Solids	460	mg/l		1	SM 2540C	DS	03/19/18
Tannin and Lignin	1.8	mg/l		0.1	SM 5550B	DS	03/22/18

Demand

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Total Organic Carbon	16.	mg/l		0.5	SM 5310B	DS	03/22/18
Chemical Oxygen Demand	19.	mg/l		10	EPA 410.4	DS	03/21/18

Minerals

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Chloride	2.20	mg/l		0.05	EPA 300.0	JC	03/20/18
Sulfate	0.36	mg/l		0.1	EPA 300.0	JC	03/20/18

Nutrients

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Ammonia Nitrogen	0.015	mg/l		0.02	EPA 350.1	JC	03/27/18

Dissolved Metals

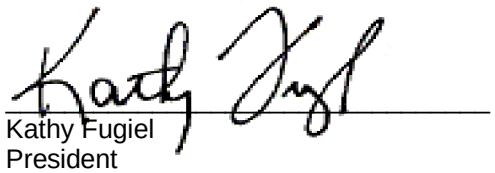
PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Dissolved Arsenic	< 0.005	mg/l		0.005	EPA 200.7	KQ	03/20/18
Dissolved Barium	0.0376	mg/l		0.0005	EPA 200.7	KQ	03/20/18

KVAM AQUATIC SCIENCES LLC
Project Name: ARLINGTON GROUNDWATER
AmTest ID: 18-A004497

Total Metals

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Iron	0.338	mg/l		0.01	EPA 200.7	KQ	03/21/18
Manganese	1.58	mg/l		0.005	EPA 200.7	KQ	03/21/18
Nickel	< 0.005	mg/l		0.005	EPA 200.7	KQ	03/21/18

E = The result is an estimate amount because the value exceeded the instrument calibration range.
D = The reported value is from a dilution.



Kathy Fugiel
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Professional Analytical Services

QC Summary for sample numbers: 18-A004490 to 18-A004497

DUPLICATES

SAMPLE #	ANALYTE	UNITS	SAMPLE VALUE	DUP VALUE	RPD
18-A004474	Total Organic Carbon	mg/l	1.1	1.4	24.
18-A004619	Total Organic Carbon	mg/l	6.2	7.0	12.
18-A004495	Chloride	mg/l	4.80	4.80	0.00
18-A004623	Chloride	mg/l	5.50	5.50	0.00
18-A004394	Ammonia Nitrogen	mg/l	0.219	0.210	4.2
18-A004403	Ammonia Nitrogen	mg/l	0.028	0.027	3.6
18-A004492	Ammonia Nitrogen	mg/l	0.847	0.847	0.00
18-A004602	Ammonia Nitrogen	mg/l	0.052	0.048	8.0
18-A004623	Ammonia Nitrogen	mg/l	0.254	0.250	1.6
18-A004728	Ammonia Nitrogen	mg/l	0.053	0.046	14.
18-A004783	Ammonia Nitrogen	mg/l	0.164	0.158	3.7
18-A004807	Ammonia Nitrogen	mg/l	0.015	0.012	22.
18-A004817	Ammonia Nitrogen	mg/l	< 0.005	0.006	
18-A004315	Total Nitrate + Nitrite	mg/l	< 0.01	0.000	
18-A004400	Total Nitrate + Nitrite	mg/l	0.43	0.43	0.00
18-A004411	Total Nitrate + Nitrite	mg/l	0.51	0.50	2.0
18-A004496	Total Nitrate + Nitrite	mg/l	14.	14.	0.00
18-A004490	Total Dissolved Solids	mg/l	240	250	4.1
18-A004497	Total Dissolved Solids	mg/l	460	450	2.2
18-A004495	Sulfate	mg/l	15.2	15.1	0.66
18-A004465	Sulfate	mg/l	< 0.1	< 0.1	
18-A004623	Sulfate	mg/l	5.70	5.80	1.7

MATRIX SPIKES

SAMPLE #	ANALYTE	UNITS	SAMPLE VALUE	SMPL+ SPK	SPK AMT	RECOVERY
18-A004475	Total Organic Carbon	mg/l	0.79	51.	50.	100.42 %
18-A004621	Total Organic Carbon	mg/l	3.4	55.	50.	103.20 %
18-A004495	Chemical Oxygen Demand	mg/l	< 10	92.	100	92.00 %
18-A004495	Chemical Oxygen Demand	mg/l	< 10	92.	100	92.00 %
18-A004615	Chemical Oxygen Demand	mg/l	< 10	81.	100	81.00 %
18-A004615	Chemical Oxygen Demand	mg/l	< 10	86.	100	86.00 %
18-A004495	Chloride	mg/l	4.80	6.50	2.00	85.00 %
18-A004623	Chloride	mg/l	5.50	7.30	2.00	90.00 %
18-A004394	Ammonia Nitrogen	mg/l	0.219	1.18	1.00	96.10 %
18-A004404	Ammonia Nitrogen	mg/l	0.019	0.934	1.00	91.50 %
18-A004492	Ammonia Nitrogen	mg/l	0.847	1.78	1.00	93.30 %
18-A004602	Ammonia Nitrogen	mg/l	0.052	0.978	1.00	92.60 %
18-A004623	Ammonia Nitrogen	mg/l	0.254	1.18	1.00	92.60 %
18-A004728	Ammonia Nitrogen	mg/l	0.053	0.922	1.00	86.90 %
18-A004807	Ammonia Nitrogen	mg/l	0.015	0.924	1.00	90.90 %

QC Summary for sample numbers: 18-A004490 to 18-A004497...

MATRIX SPIKES continued....

SAMPLE #	ANALYTE	UNITS	SAMPLE VALUE	SMPL+ SPK	SPK AMT	RECOVERY
18-A004817	Ammonia Nitrogen	mg/l	< 0.005	0.909	1.00	90.90 %
18-A004315	Total Nitrate + Nitrite	mg/l	< 0.01	1.0	1.0	100.00 %
18-A004400	Total Nitrate + Nitrite	mg/l	0.43	1.5	1.0	107.00 %
18-A004411	Total Nitrate + Nitrite	mg/l	0.51	1.6	1.0	109.00 %
18-A004496	Total Nitrate + Nitrite	mg/l	14.	120	100	106.00 %
18-A004495	Sulfate	mg/l	15.2	33.3	20.0	90.50 %
18-A004465	Sulfate	mg/l	< 0.1	2.06	2.00	103.00 %
18-A004623	Sulfate	mg/l	5.70	8.00	2.00	115.00 %
18-A004495	Tannin and Lignin	mg/l	0.67	2.0	1.0	133.00 %
18-A004495	Tannin and Lignin	mg/l	0.67	2.0	1.0	133.00 %
18-A004497	Tannin and Lignin	mg/l	1.8	3.0	1.0	120.00 %
18-A004497	Tannin and Lignin	mg/l	1.8	3.0	1.0	120.00 %
18-A004495	Dissolved Arsenic	mg/l	< 0.005	1.90	2.00	95.00 %
18-A004495	Dissolved Arsenic	mg/l	< 0.005	1.91	2.00	95.50 %
18-A004497	Dissolved Arsenic	mg/l	< 0.005	1.91	2.00	95.50 %
18-A004497	Dissolved Arsenic	mg/l	< 0.005	1.91	2.00	95.50 %
18-A004495	Dissolved Barium	mg/l	0.0065	2.12	2.00	105.68 %
18-A004495	Dissolved Barium	mg/l	0.0065	2.14	2.00	106.68 %
18-A004497	Dissolved Barium	mg/l	0.0376	2.19	2.00	107.62 %
18-A004497	Dissolved Barium	mg/l	0.0376	2.17	2.00	106.62 %
18-A004493	Iron	mg/l	0.106	11.2	11.0	100.86 %
18-A004493	Iron	mg/l	0.106	11.3	11.0	101.76 %
18-A004604	Iron	mg/l	0.027	23.7	22.0	107.60 %
18-A004604	Iron	mg/l	0.027	23.7	22.0	107.60 %
18-A004493	Manganese	mg/l	0.0109	1.00	1.00	98.91 %
18-A004493	Manganese	mg/l	0.0109	1.01	1.00	99.91 %
18-A004513	Nickel	mg/l	< 0.005	0.759	1.00	75.90 %
18-A004513	Nickel	mg/l	< 0.005	0.759	1.00	75.90 %
18-A004494	Pentachlorophenol	ug/l	< 0.2	5.1	10.	51.00 %
18-A004494	Pentachlorophenol	ug/l	< 0.2	5.6	10.	56.00 %

MATRIX SPIKE DUPLICATES

SAMPLE #	ANALYTE	UNITS	SAMPLE + SPK	MSD VALUE	RPD
Spike	Chemical Oxygen Demand	mg/l	92.	92.	0.00
Spike	Chemical Oxygen Demand	mg/l	81.	86.	6.0
Spike	Tannin and Lignin	mg/l	2.0	2.0	0.00
Spike	Tannin and Lignin	mg/l	3.0	3.0	0.00
Spike	Dissolved Arsenic	mg/l	1.90	1.91	0.52
Spike	Dissolved Arsenic	mg/l	1.91	1.91	0.00
Spike	Dissolved Barium	mg/l	2.12	2.14	0.94
Spike	Dissolved Barium	mg/l	2.19	2.17	0.92
Spike	Iron	mg/l	11.2	11.3	0.89
Spike	Iron	mg/l	23.7	23.7	0.00
Spike	Manganese	mg/l	1.00	1.01	1.0
Spike	Nickel	mg/l	0.759	0.759	0.00
Spike	Pentachlorophenol	ug/l	5.1	5.6	9.3

QC Summary for sample numbers: 18-A004490 to 18-A004497...

STANDARD REFERENCE MATERIALS

ANALYTE	UNITS	TRUE VALUE	MEASURED VALUE	RECOVERY
Total Organic Carbon	mg/l	50.	49.	98.0 %
Total Organic Carbon	mg/l	50.	53.	106. %
Chemical Oxygen Demand	mg/l	100	100	100. %
Chloride	mg/l	5.00	4.86	97.2 %
Chloride	mg/l	5.00	4.82	96.4 %
Chloride	mg/l	5.00	4.84	96.8 %
Chloride	mg/l	5.00	4.90	98.0 %
Ammonia Nitrogen	mg/l	1.00	0.966	96.6 %
Ammonia Nitrogen	mg/l	1.00	0.948	94.8 %
Ammonia Nitrogen	mg/l	1.00	0.953	95.3 %
Ammonia Nitrogen	mg/l	1.00	0.957	95.7 %
Total Nitrate + Nitrite	mg/l	1.0	1.0	100. %
Total Nitrate + Nitrite	mg/l	1.0	0.98	98.0 %
Total Dissolved Solids	mg/l	350	360	103. %
Total Dissolved Solids	mg/l	350	370	106. %
Sulfate	mg/l	5.00	5.06	101. %
Sulfate	mg/l	5.00	4.98	99.6 %
Sulfate	mg/l	5.00	4.95	99.0 %
Sulfate	mg/l	5.00	5.00	100. %
Sulfate	mg/l	5.00	5.00	100. %
Sulfate	mg/l	5.00	5.00	100. %
Sulfate	mg/l	5.00	5.00	100. %
Tannin and Lignin	mg/l	1.0	1.1	110. %
Dissolved Arsenic	mg/l	2.00	2.00	100. %
Dissolved Barium	mg/l	0.800	0.846	106. %
Iron	mg/l	4.00	4.19	105. %
Iron	mg/l	4.00	4.10	102. %
Manganese	mg/l	0.800	0.866	108. %
Nickel	mg/l	0.800	0.731	91.4 %
Nickel	mg/l	0.800	0.728	91.0 %
Pentachlorophenol	ug/l	5.0	4.4	88.0 %

BLANKS

ANALYTE	UNITS	RESULT
Total Organic Carbon	mg/l	< 0.5
Total Organic Carbon	mg/l	< 0.5
Chemical Oxygen Demand	mg/l	< 10
Chloride	mg/l	< 0.05
Chloride	mg/l	< 0.05
Chloride	mg/l	< 0.05
Chloride	mg/l	< 0.05
Ammonia Nitrogen	mg/l	< 0.005
Ammonia Nitrogen	mg/l	< 0.005
Ammonia Nitrogen	mg/l	< 0.005

QC Summary for sample numbers: 18-A004490 to 18-A004497...

BLANKS continued....

ANALYTE	UNITS	RESULT
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrate + Nitrite	mg/l	< 0.01
Total Nitrate + Nitrite	mg/l	< 0.01
Total Dissolved Solids	mg/l	< 1
Total Dissolved Solids	mg/l	1.0
Sulfate	mg/l	< 0.1
Sulfate	mg/l	< 0.1
Sulfate	mg/l	< 0.1
Sulfate	mg/l	< 0.1
Sulfate	mg/l	< 0.1
Sulfate	mg/l	< 0.1
Sulfate	mg/l	< 0.1
Tannin and Lignin	mg/l	< 0.1
Dissolved Arsenic	mg/l	< 0.005
Dissolved Barium	mg/l	< 0.0005
Iron	mg/l	< 0.01
Iron	mg/l	< 0.01
Manganese	mg/l	< 0.005
Nickel	mg/l	< 0.005
Nickel	mg/l	< 0.005
Pentachlorophenol	ug/l	< 0.2

AMTEST LABORATORIES

AmTest Chain of Custody Record

13600 NE 126th PL, Suite C, Kirkland, WA 98034
Ph (425) 885-1664 Fx (425) 820-0245
www.amtestlab.com

Chain of Custody No. 31608

Client Name & Address:	Invoice To:
Kvam Aquatic Sciences, LLC 9314 NE 133rd Street Kirkland, WA 98034	Kvam Aquatic Sciences, LLC
Contact Person: Bruce Kvam	Invoice Contact:
Phone No: (206) 953-6904	PO Number:
Fax No:	Invoice Ph/Fax:
E-mail: b.kvam@comcast.net	Invoice E-mail:
Report Delivery: (Choose all that apply) Mail / Fax / (Email) / Posted Online	Data posted to online account: YES / NO Web Login ID:

Special Instructions:

Requested TAT: **(Rush must be pre-approved by lab)**
(Standard) RUSH (5 Day / 3 Day / 48 HR / 24 HR)

Temperature upon Receipt:

Project Name: Arlington Groundwater

Project Number:

AmTest ID	Client ID (35 characters max)	Date Sampled	Time Sampled	Matrix	No. of containers	Analysis Requested: 350.1 NH3	6010C ICP	300 IC	SM 5550 B TPH-D	SM 2430 C TOC	SM 5310 TOC	353.2 NOx	8151A Mod. PCP only		QA/QC
4490	BXS-1	3-17-18	1320	G	5	X	X	X	X	X	X				
91	BXS-2	3-17-18	1400	G	5	X	X	X	X	X	X				
92	BXS-3	3-18-18	0920	G	5	X	X	X	X	X	X				
93	BXN-1	3-18-18	1305	G	5	X	X	X	X	X	X	X	X		
94	BXN-1 Rinsate	3-18-18	1230	G	5	X	X	X	X	X	X	X	X		
95	BXN-2	3-18-18	1040	G	5	X	X	X	X	X	X	X	X		
96	BXN-4	3-18-18	1350	G	5	X	X	X	X	X	X	X	X		
97	BXS-102	3-17-18	1410	G	5	X	X	X	X	X	X				

	Date	Time		Date	Time
Collected/Relinquished By: Bruce Kvam / Bruce Kvam	3-19-18	0710	Received By: Aaron Y	3/19/18	710
Relinquished By:	Date	Time	Received By:	Date	Time
Relinquished By:	Date	Time	Received By:	Date	Time

COMMENTS:

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13600 NE 126th PL
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(425) 885-1664
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Professional Analytical Services

QC Summary for sample numbers: 18-A004490 to 18-A004497

DUPLICATES

SAMPLE #	ANALYTE	UNITS	SAMPLE VALUE	DUP VALUE	RPD
18-A004474	Total Organic Carbon	mg/l	1.1	1.4	24.
18-A004619	Total Organic Carbon	mg/l	6.2	7.0	12.
18-A004495	Chloride	mg/l	4.80	4.80	0.00
18-A004623	Chloride	mg/l	5.50	5.50	0.00
18-A004394	Ammonia Nitrogen	mg/l	0.219	0.210	4.2
18-A004403	Ammonia Nitrogen	mg/l	0.028	0.027	3.6
18-A004492	Ammonia Nitrogen	mg/l	0.847	0.847	0.00
18-A004602	Ammonia Nitrogen	mg/l	0.052	0.048	8.0
18-A004623	Ammonia Nitrogen	mg/l	0.254	0.250	1.6
18-A004728	Ammonia Nitrogen	mg/l	0.053	0.046	14.
18-A004783	Ammonia Nitrogen	mg/l	0.164	0.158	3.7
18-A004807	Ammonia Nitrogen	mg/l	0.015	0.012	22.
18-A004817	Ammonia Nitrogen	mg/l	< 0.005	0.006	
18-A004315	Nitrate + Nitrite	mg/l	< 0.01	0.000	
18-A004400	Nitrate + Nitrite	mg/l	0.43	0.43	0.00
18-A004411	Nitrate + Nitrite	mg/l	0.51	0.50	2.0
18-A004496	Nitrate + Nitrite	mg/l	14.	14.	0.00
18-A004490	Total Dissolved Solids	mg/l	240	250	4.1
18-A004497	Total Dissolved Solids	mg/l	460	450	2.2

MATRIX SPIKES

SAMPLE #	ANALYTE	UNITS	SAMPLE VALUE	SMPL+ SPK	SPK AMT	RECOVERY
18-A004475	Total Organic Carbon	mg/l	0.79	51.	50.	100.42 %
18-A004621	Total Organic Carbon	mg/l	3.4	55.	50.	103.20 %
18-A004495	Chemical Oxygen Demand	mg/l	< 10	92.	100	92.00 %
18-A004495	Chemical Oxygen Demand	mg/l	< 10	92.	100	92.00 %
18-A004615	Chemical Oxygen Demand	mg/l	< 10	81.	100	81.00 %
18-A004615	Chemical Oxygen Demand	mg/l	< 10	86.	100	86.00 %
18-A004495	Chloride	mg/l	4.80	6.50	2.00	85.00 %
18-A004623	Chloride	mg/l	5.50	7.30	2.00	90.00 %
18-A004394	Ammonia Nitrogen	mg/l	0.219	1.18	1.00	96.10 %
18-A004404	Ammonia Nitrogen	mg/l	0.019	0.934	1.00	91.50 %
18-A004492	Ammonia Nitrogen	mg/l	0.847	1.78	1.00	93.30 %
18-A004602	Ammonia Nitrogen	mg/l	0.052	0.978	1.00	92.60 %
18-A004623	Ammonia Nitrogen	mg/l	0.254	1.18	1.00	92.60 %
18-A004728	Ammonia Nitrogen	mg/l	0.053	0.922	1.00	86.90 %
18-A004807	Ammonia Nitrogen	mg/l	0.015	0.924	1.00	90.90 %
18-A004817	Ammonia Nitrogen	mg/l	< 0.005	0.909	1.00	90.90 %
18-A004315	Nitrate + Nitrite	mg/l	< 0.01	1.0	1.0	100.00 %
18-A004400	Nitrate + Nitrite	mg/l	0.43	1.5	1.0	107.00 %

QC Summary for sample numbers: 18-A004490 to 18-A004497...

MATRIX SPIKES continued....

SAMPLE #	ANALYTE	UNITS	SAMPLE VALUE	SMPL+ SPK	SPK AMT	RECOVERY
18-A004411	Nitrate + Nitrite	mg/l	0.51	1.6	1.0	109.00 %
18-A004496	Nitrate + Nitrite	mg/l	14.	120	100	106.00 %
18-A004495	Tannin and Lignin	mg/l	0.67	2.0	1.0	133.00 %
18-A004495	Tannin and Lignin	mg/l	0.67	2.0	1.0	133.00 %
18-A004497	Tannin and Lignin	mg/l	1.8	3.0	1.0	120.00 %
18-A004497	Tannin and Lignin	mg/l	1.8	3.0	1.0	120.00 %
18-A004495	Dissolved Arsenic	mg/l	< 0.005	1.90	2.00	95.00 %
18-A004495	Dissolved Arsenic	mg/l	< 0.005	1.91	2.00	95.50 %
18-A004497	Dissolved Arsenic	mg/l	< 0.005	1.91	2.00	95.50 %
18-A004497	Dissolved Arsenic	mg/l	< 0.005	1.91	2.00	95.50 %
18-A004495	Dissolved Barium	mg/l	0.0065	2.12	2.00	105.68 %
18-A004495	Dissolved Barium	mg/l	0.0065	2.14	2.00	106.68 %
18-A004497	Dissolved Barium	mg/l	0.0376	2.19	2.00	107.62 %
18-A004497	Dissolved Barium	mg/l	0.0376	2.17	2.00	106.62 %
18-A004493	Iron	mg/l	0.106	11.2	11.0	100.86 %
18-A004493	Iron	mg/l	0.106	11.3	11.0	101.76 %
18-A004604	Iron	mg/l	0.027	23.7	22.0	107.60 %
18-A004604	Iron	mg/l	0.027	23.7	22.0	107.60 %
18-A004493	Manganese	mg/l	0.0109	1.00	1.00	98.91 %
18-A004493	Manganese	mg/l	0.0109	1.01	1.00	99.91 %
18-A004494	Pentachlorophenol	ug/l	< 0.2	5.1	10.	51.00 %
18-A004494	Pentachlorophenol	ug/l	< 0.2	5.6	10.	56.00 %

MATRIX SPIKE DUPLICATES

SAMPLE #	ANALYTE	UNITS	SAMPLE + SPK	MSD VALUE	RPD
Spike	Chemical Oxygen Demand	mg/l	92.	92.	0.00
Spike	Chemical Oxygen Demand	mg/l	81.	86.	6.0
Spike	Tannin and Lignin	mg/l	2.0	2.0	0.00
Spike	Tannin and Lignin	mg/l	3.0	3.0	0.00
Spike	Dissolved Arsenic	mg/l	1.90	1.91	0.52
Spike	Dissolved Arsenic	mg/l	1.91	1.91	0.00
Spike	Dissolved Barium	mg/l	2.12	2.14	0.94
Spike	Dissolved Barium	mg/l	2.19	2.17	0.92
Spike	Iron	mg/l	11.2	11.3	0.89
Spike	Iron	mg/l	23.7	23.7	0.00
Spike	Manganese	mg/l	1.00	1.01	1.0
Spike	Pentachlorophenol	ug/l	5.1	5.6	9.3

STANDARD REFERENCE MATERIALS

ANALYTE	UNITS	TRUE VALUE	MEASURED VALUE	RECOVERY
Total Organic Carbon	mg/l	50.	49.	98.0 %
Total Organic Carbon	mg/l	50.	53.	106. %
Chemical Oxygen Demand	mg/l	100	100	100. %
Chloride	mg/l	5.00	4.86	97.2 %
Chloride	mg/l	5.00	4.82	96.4 %
Chloride	mg/l	5.00	4.84	96.8 %
Chloride	mg/l	5.00	4.90	98.0 %
Ammonia Nitrogen	mg/l	1.00	0.966	96.6 %
Ammonia Nitrogen	mg/l	1.00	0.948	94.8 %
Ammonia Nitrogen	mg/l	1.00	0.953	95.3 %

QC Summary for sample numbers: 18-A004490 to 18-A004497...

STANDARD REFERENCE MATERIALS continued....

ANALYTE	UNITS	TRUE VALUE	MEASURED VALUE	RECOVERY
Ammonia Nitrogen	mg/l	1.00	0.957	95.7 %
Nitrate + Nitrite	mg/l	1.0	1.0	100. %
Nitrate + Nitrite	mg/l	1.0	0.98	98.0 %
Total Dissolved Solids	mg/l	350	360	103. %
Total Dissolved Solids	mg/l	350	370	106. %
Tannin and Lignin	mg/l	1.0	1.1	110. %
Dissolved Arsenic	mg/l	2.00	2.00	100. %
Dissolved Barium	mg/l	0.800	0.846	106. %
Iron	mg/l	4.00	4.19	105. %
Iron	mg/l	4.00	4.10	102. %
Manganese	mg/l	0.800	0.866	108. %
Pentachlorophenol	ug/l	5.0	4.4	88.0 %

BLANKS

ANALYTE	UNITS	RESULT
Total Organic Carbon	mg/l	< 0.5
Total Organic Carbon	mg/l	< 0.5
Chemical Oxygen Demand	mg/l	< 10
Chloride	mg/l	< 0.05
Chloride	mg/l	< 0.05
Chloride	mg/l	< 0.05
Chloride	mg/l	< 0.05
Ammonia Nitrogen	mg/l	< 0.005
Ammonia Nitrogen	mg/l	< 0.005
Ammonia Nitrogen	mg/l	< 0.005
Ammonia Nitrogen	mg/l	< 0.005
Nitrate + Nitrite	mg/l	< 0.01
Nitrate + Nitrite	mg/l	< 0.01
Total Dissolved Solids	mg/l	< 1
Total Dissolved Solids	mg/l	1.0
Tannin and Lignin	mg/l	< 0.1
Dissolved Arsenic	mg/l	< 0.005
Dissolved Barium	mg/l	< 0.0005
Iron	mg/l	< 0.01
Iron	mg/l	< 0.01
Manganese	mg/l	< 0.005
Pentachlorophenol	ug/l	< 0.2

Am Test Inc.
13600 NE 126TH PL
Suite C
Kirkland, WA 98034
(425) 885-1664

Professional Analytical Services

Mar 4 2019
KVAM AQUATIC SCIENCES LLC
9314 NE 133RD ST
KIRKLAND, WA 98034
Attention: BRUCE KVAM

Dear BRUCE KVAM:

Enclosed please find the analytical data for your ARLINGTON GROUNDWATER project.

The following is a cross correlation of client and laboratory identifications for your convenience.

CLIENT ID	MATRIX	AMTEST ID	TEST
BXN-1	Water	18-A010414	DEM, MIN, NUT, CONV, MET
BXS-2	Water	18-A010415	DEM, MIN, NUT, CONV, MET
BXN-101	Water	18-A010416	DEM, MIN, NUT, CONV, MET

Your samples were received on Monday, June 18, 2018. At the time of receipt, the samples were logged in and properly maintained prior to the subsequent analysis.

The analytical procedures used at AmTest are well documented and are typically derived from the protocols of the EPA, USDA, FDA or the Army Corps of Engineers.

Following the analytical data you will find the Quality Control (QC) results.

Please note that the detection limits that are listed in the body of the report refer to the Practical Quantitation Limits (PQL's), as opposed to the Method Detection Limits (MDL's).

If you should have any questions pertaining to the data package, please feel free to contact me.

Sincerely,

Kathy Fugiel
President

BACT = Bacteriological
CONV = Conventionals
MET = Metals
ORG = Organics
NUT=Nutrients
DEM=Demand
MIN=Minerals

Am Test Inc.
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www.amtestlab.com

Professional Analytical Services

ANALYSIS REPORT

KVAM AQUATIC SCIENCES LLC
9314 NE 133RD ST
KIRKLAND, WA 98034
Attention: BRUCE KVAM
Project Name: ARLINGTON GROUNDWATER
All results reported on an as received basis.

Date Received: 06/18/18
Date Reported: 3/ 4/19

AMTEST Identification Number **18-A010414**
Client Identification **BXN-1**
Sampling Date **06/16/18, 11:37**

Conventionals

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Total Dissolved Solids	260	mg/l		1	SM 2540C	JH	06/20/18
Tannin and Lignin	0.92	mg/l		0.1	SM 5550B	JH	07/03/18

Demand

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Total Organic Carbon	48.	mg/l		0.5	SM 5310B	NNL	06/20/18
Chemical Oxygen Demand	46.	mg/l		10	EPA 410.4	JH	07/05/18

Minerals

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Chloride	7.77	mg/l		0.05	EPA 300.0	JC	06/18/18
Sulfate	14.4	mg/l		0.1	EPA 300.0	JC	06/18/18

Nutrients

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Ammonia Nitrogen	0.181	mg/l		0.02	EPA 350.1	JC	06/20/18
Total Nitrate + Nitrite	< 0.01	mg/l		0.02	EPA 353.2	JC	06/30/18

Dissolved Metals

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Dissolved Arsenic	0.021	mg/l		0.005	EPA 200.7	KQ	06/26/18
Dissolved Barium	0.0720	mg/l		0.0005	EPA 200.7	KQ	06/26/18
Dissolved Iron	34.7	mg/l		0.01	EPA 200.7	KQ	06/26/18
Dissolved Manganese	4.073	mg/l		0.005	EPA 200.7	KQ	06/26/18

AMTEST Identification Number **18-A010415**
Client Identification **BXS-2**
Sampling Date **06/16/18, 13:55**

Conventionals

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Total Dissolved Solids	430	mg/l		1	SM 2540C	JH	06/18/18
Tannin and Lignin	1.5	mg/l		0.1	SM 5550B	JH	07/03/18

Demand

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Total Organic Carbon	30.	mg/l		0.5	SM 5310B	NNL	06/20/18
Chemical Oxygen Demand	27.	mg/l		10	EPA 410.4	JH	07/05/18

Minerals

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Chloride	2.20	mg/l		0.05	EPA 300.0	JC	06/20/18
Sulfate	0.50	mg/l		0.1	EPA 300.0	JC	06/20/18

Nutrients

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Ammonia Nitrogen	< 0.005	mg/l		0.02	EPA 350.1	JC	06/20/18

Dissolved Metals

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Dissolved Arsenic	< 0.005	mg/l		0.005	EPA 200.7	KQ	06/26/18
Dissolved Barium	0.0357	mg/l		0.0005	EPA 200.7	KQ	06/26/18
Dissolved Nickel	< 0.005	mg/l		0.005	EPA 200.7	KQ	06/26/19

AMTEST Identification Number **18-A010416**
Client Identification **BXN-101**
Sampling Date **06/16/18, 11:47**

Conventionals

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Total Dissolved Solids	270	mg/l		1	SM 2540C	JH	06/18/18
Tannin and Lignin	0.94	mg/l		0.1	SM 5550B	JH	07/03/18

Demand

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Total Organic Carbon	37.	mg/l		0.5	SM 5310B	NNL	06/20/18
Chemical Oxygen Demand	14.	mg/l		10	EPA 410.4	JH	07/05/18

Minerals

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Chloride	7.19	mg/l		0.05	EPA 300.0	JC	06/18/18
Sulfate	13.4	mg/l		0.1	EPA 300.0	JC	06/18/18

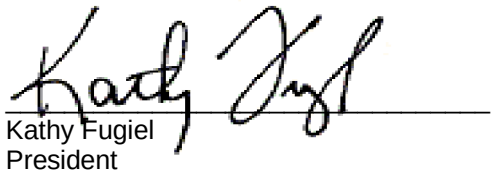
Nutrients

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Ammonia Nitrogen	0.226	mg/l		0.02	EPA 350.1	JC	06/20/18
Total Nitrate + Nitrite	< 0.01	mg/l		0.02	EPA 353.2	JC	06/30/18

KVAM AQUATIC SCIENCES LLC
Project Name: ARLINGTON GROUNDWATER
AmTest ID: 18-A010416

Dissolved Metals

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Dissolved Arsenic	0.030	mg/l		0.005	EPA 200.7	KQ	06/26/18
Dissolved Barium	0.0697	mg/l		0.0005	EPA 200.7	KQ	06/26/18
Dissolved Iron	37.5	mg/l		0.01	EPA 200.7	KQ	06/26/18
Dissolved Manganese	3.928	mg/l		0.005	EPA 200.7	KQ	06/26/18



Kathy Fugiel
President

Am Test Inc.
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(425) 885-1664
www.amtestlab.com

Professional Analytical Services

QC Summary for sample numbers: 18-A010414 to 18-A010416

DUPLICATES

SAMPLE #	ANALYTE	UNITS	SAMPLE VALUE	DUP VALUE	RPD
18-A009440	Total Organic Carbon	mg/l	< 0.5	0.94	
18-A010416	Chloride	mg/l	7.19	7.56	5.0
18-A010526	Chloride	mg/l	< 0.05	< 0.05	
18-A009532	Ammonia Nitrogen	mg/l	1.30	1.30	0.00
18-A009767	Ammonia Nitrogen	mg/l	< 0.005	< 0.005	
18-A009956	Ammonia Nitrogen	mg/l	< 0.005	< 0.005	
18-A010054	Ammonia Nitrogen	mg/l	< 0.005	< 0.005	
18-A010151	Ammonia Nitrogen	mg/l	< 0.005	0.008	
18-A010185	Ammonia Nitrogen	mg/l	< 0.005	< 0.005	
18-A010401	Ammonia Nitrogen	mg/l	0.147	0.127	15.
18-A010516	Ammonia Nitrogen	mg/l	< 0.005	< 0.005	
18-A010157	Total Nitrate + Nitrite	mg/l	< 0.01	< 0.01	
18-A010514	Total Nitrate + Nitrite	mg/l	0.097	0.087	11.
18-A010524	Total Nitrate + Nitrite	mg/l	0.12	0.13	8.0
18-A010539	Total Nitrate + Nitrite	mg/l	0.059	0.060	1.7
18-A010698	Total Nitrate + Nitrite	mg/l	0.064	0.065	1.6
18-A010712	Total Nitrate + Nitrite	mg/l	< 0.01	< 0.01	
18-A010762	Total Nitrate + Nitrite	mg/l	< 0.01	< 0.01	
18-A010974	Total Nitrate + Nitrite	mg/l	0.27	0.26	3.8
18-A010981	Total Nitrate + Nitrite	mg/l	0.34	0.34	0.00
18-A011074	Total Nitrate + Nitrite	mg/l	< 0.01	< 0.01	
18-A011095	Total Nitrate + Nitrite	mg/l	< 0.01	< 0.01	
18-A010456	Total Dissolved Solids	mg/l	390	400	2.5
18-A010416	Sulfate	mg/l	13.4	13.4	0.00

MATRIX SPIKES

SAMPLE #	ANALYTE	UNITS	SAMPLE VALUE	SMPL+ SPK	SPK AMT	RECOVERY
18-A010714	Chemical Oxygen Demand	mg/l	< 10	81.	100	81.00 %
18-A010714	Chemical Oxygen Demand	mg/l	< 10	81.	100	81.00 %
18-A011137	Chemical Oxygen Demand	mg/l	49.	140	100	91.00 %
18-A011137	Chemical Oxygen Demand	mg/l	49.	130	100	81.00 %
18-A010416	Chloride	mg/l	7.19	24.9	20.0	88.55 %
18-A010526	Chloride	mg/l	< 0.05	1.87	2.00	93.50 %
18-A009532	Ammonia Nitrogen	mg/l	1.30	2.40	1.00	110.00 %
18-A009767	Ammonia Nitrogen	mg/l	< 0.005	0.911	1.00	91.10 %
18-A009956	Ammonia Nitrogen	mg/l	< 0.005	0.896	1.00	89.60 %
18-A010054	Ammonia Nitrogen	mg/l	< 0.005	0.890	1.00	89.00 %
18-A010151	Ammonia Nitrogen	mg/l	< 0.005	0.854	1.00	85.40 %
18-A010185	Ammonia Nitrogen	mg/l	< 0.005	0.872	1.00	87.20 %
18-A010401	Ammonia Nitrogen	mg/l	0.147	1.04	1.00	89.30 %

QC Summary for sample numbers: 18-A010414 to 18-A010416...

MATRIX SPIKES continued....

SAMPLE #	ANALYTE	UNITS	SAMPLE VALUE	SMPL+ SPK	SPK AMT	RECOVERY
18-A010516	Ammonia Nitrogen	mg/l	< 0.005	0.861	1.00	86.10 %
18-A010157	Total Nitrate + Nitrite	mg/l	< 0.01	1.0	1.0	100.00 %
18-A010514	Total Nitrate + Nitrite	mg/l	0.097	1.1	1.0	100.30 %
18-A010524	Total Nitrate + Nitrite	mg/l	0.12	1.2	1.0	108.00 %
18-A010539	Total Nitrate + Nitrite	mg/l	0.059	1.1	1.0	104.10 %
18-A010698	Total Nitrate + Nitrite	mg/l	0.064	1.1	1.0	103.60 %
18-A010712	Total Nitrate + Nitrite	mg/l	< 0.01	1.0	1.0	100.00 %
18-A010762	Total Nitrate + Nitrite	mg/l	< 0.01	1.0	1.0	100.00 %
18-A010974	Total Nitrate + Nitrite	mg/l	0.27	1.3	1.0	103.00 %
18-A010981	Total Nitrate + Nitrite	mg/l	0.34	1.4	1.0	106.00 %
18-A011074	Total Nitrate + Nitrite	mg/l	< 0.01	1.1	1.0	110.00 %
18-A011095	Total Nitrate + Nitrite	mg/l	< 0.01	1.0	1.0	100.00 %
18-A010416	Sulfate	mg/l	13.4	30.9	20.0	87.50 %
18-A010414	Tannin and Lignin	mg/l	0.92	2.7	2.0	89.00 %
18-A010414	Tannin and Lignin	mg/l	0.92	2.5	2.0	79.00 %
18-A010416	Dissolved Arsenic	mg/l	0.030	1.91	2.00	94.00 %
18-A010416	Dissolved Arsenic	mg/l	0.030	1.90	2.00	93.50 %
18-A010416	Dissolved Barium	mg/l	0.0697	2.10	2.00	101.52 %
18-A010416	Dissolved Barium	mg/l	0.0697	2.09	2.00	101.02 %
18-A010718	Dissolved Barium	mg/l	0.0019	1.99	2.00	99.40 %
18-A010718	Dissolved Barium	mg/l	0.0019	1.98	2.00	98.90 %
18-A010718	Dissolved Iron	mg/l	< 0.01	23.0	22.0	104.54 %
18-A010718	Dissolved Iron	mg/l	< 0.01	23.0	22.0	104.54 %
18-A010718	Dissolved Manganese	mg/l	< 0.005	2.046	2.000	102.30 %
18-A010718	Dissolved Manganese	mg/l	< 0.005	2.055	2.000	102.75 %

MATRIX SPIKE DUPLICATES

SAMPLE #	ANALYTE	UNITS	SAMPLE + SPK	MSD VALUE	RPD
Spike	Chemical Oxygen Demand	mg/l	81.	81.	0.00
Spike	Chemical Oxygen Demand	mg/l	140	130	7.4
Spike	Tannin and Lignin	mg/l	2.7	2.5	7.7
Spike	Dissolved Arsenic	mg/l	1.91	1.90	0.52
Spike	Dissolved Barium	mg/l	2.10	2.09	0.48
Spike	Dissolved Barium	mg/l	1.99	1.98	0.50
Spike	Dissolved Iron	mg/l	23.0	23.0	0.00
Spike	Dissolved Manganese	mg/l	2.046	2.055	0.44

STANDARD REFERENCE MATERIALS

ANALYTE	UNITS	TRUE VALUE	MEASURED VALUE	RECOVERY
Total Organic Carbon	mg/l	50.	48.	96.0 %
Chemical Oxygen Demand	mg/l	100	100	100. %
Chemical Oxygen Demand	mg/l	100	97.	97.0 %
Chloride	mg/l	5.00	4.52	90.4 %
Chloride	mg/l	5.00	5.08	102. %
Ammonia Nitrogen	mg/l	1.00	0.986	98.6 %
Ammonia Nitrogen	mg/l	1.00	0.914	91.4 %
Ammonia Nitrogen	mg/l	1.00	1.02	102. %
Total Nitrate + Nitrite	mg/l	1.0	1.0	100. %
Total Nitrate + Nitrite	mg/l	1.0	1.0	100. %
Total Nitrate + Nitrite	mg/l	1.0	1.0	100. %

QC Summary for sample numbers: 18-A010414 to 18-A010416...

STANDARD REFERENCE MATERIALS continued....

ANALYTE	UNITS	TRUE VALUE	MEASURED VALUE	RECOVERY
Total Nitrate + Nitrite	mg/l	1.0	1.0	100. %
Total Dissolved Solids	mg/l	350	340	97.1 %
Sulfate	mg/l	5.00	4.55	91.0 %
Sulfate	mg/l	5.00	5.19	104. %
Tannin and Lignin	mg/l	0.80	0.81	101. %
Dissolved Arsenic	mg/l	2.00	1.87	93.5 %
Dissolved Barium	mg/l	0.800	0.802	100. %
Dissolved Iron	mg/l	4.00	4.02	100. %
Dissolved Iron	mg/l	4.00	4.02	100. %
Dissolved Manganese	mg/l	0.8000	0.8366	105. %
Dissolved Manganese	mg/l	0.8000	0.8372	105. %
Dissolved Nickel	mg/l	0.800	0.806	101. %

BLANKS

ANALYTE	UNITS	RESULT
Total Organic Carbon	mg/l	< 0.5
Chemical Oxygen Demand	mg/l	< 10
Chemical Oxygen Demand	mg/l	< 10
Chloride	mg/l	< 0.05
Chloride	mg/l	< 0.05
Ammonia Nitrogen	mg/l	< 0.005
Ammonia Nitrogen	mg/l	< 0.005
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrate + Nitrite	mg/l	< 0.01
Total Nitrate + Nitrite	mg/l	< 0.01
Total Nitrate + Nitrite	mg/l	< 0.01
Total Nitrate + Nitrite	mg/l	< 0.01
Total Dissolved Solids	mg/l	< 1
Sulfate	mg/l	< 0.1
Sulfate	mg/l	< 0.1
Tannin and Lignin	mg/l	< 0.1
Dissolved Arsenic	mg/l	< 0.005
Dissolved Barium	mg/l	< 0.0005
Dissolved Iron	mg/l	< 0.01
Dissolved Iron	mg/l	< 0.01
Dissolved Manganese	mg/l	< 0.005
Dissolved Manganese	mg/l	< 0.005
Dissolved Nickel	mg/l	< 0.005

AMTEST LABORATORIES

AmTest Chain of Custody Record

13600 NE 126th PL, Suite C, Kirkland, WA 98034
Ph (425) 885-1664 Fx (425) 820-0245
www.amtestlab.com

Chain of Custody No. 31609

Client Name & Address:	Invoice To:
Kram Aquatic Sciences, LLC 9314 NE 133rd Street Kirkland, WA 98034	Kram Aquatic Sciences, LLC
Contact Person: Bruce Kram	Invoice Contact:
Phone No: (206) 953-6904	PO Number:
Fax No:	Invoice Ph/Fax:
E-mail:	Invoice E-mail:
Report Delivery: (Choose all that apply) Mail / Fax / (Email) / Posted Online	Data posted to online account: YES / NO Web Login ID:

Special Instructions:

Requested TAT: **(Rush must be pre-approved by lab)**
(Standard) RUSH (5 Day / 3 Day / 48 HR / 24 HR)

Temperature upon Receipt: 3.0°

Project Name: Arlington Groundwater
Project Number:

AmTest ID	Client ID (35 characters max)	Date Sampled	Time Sampled	Matrix	No. of containers	Analysis Requested: 350.1 NH3	6010C Fe & Mn	300 Cl	353.2 Nox	SM 5550 B TIC	SM 2320 C TIC	SM 5310 TOC			QA/QC
10[illegible]4	BXN-1	6-16-18	1137	G		X	X	X	X	X	X	X			
15	BXS-2	6-16-18	1355	G		X	X	X		X	X	X			
16	BXN-101	6-16-18	1147	G		X	X	X	X	X	X	X			

Collected/Relinquished By:	Date	Time	Received By:	Date	Time
Bruce Kram / Bruce Kram	6-18-18	0759	[signature]	6/18/18	759
Relinquished By:	Date	Time	Received By:	Date	Time
Relinquished By:	Date	Time	Received By:	Date	Time

COMMENTS:
BXS-2 250mL (HNO_3 preserved) = HOLD DO NOT ANALYZE
Diss As; ba Total Fe & Mn

AmTest Chain of Custody Record

AMTEST LABORATORIES

13600 NE 126th PL, Suite C, Kirkland, WA 98034
Ph (425) 885-1664 Fx (425) 820-0245
www.amtestlab.com

Chain of Custody No. [illegible]

Client Name & Address:	Invoice To:
Kram Aquatic Sciences, LLC 9314 NE 133rd Street Kirkland, WA 98034	Kram Aquatic Sciences, LLC
Contact Person: Bruce Kram	Invoice Contact:
Phone No: (206) 953-6904 (calls+text)	PO Number:
Fax No:	Invoice Ph/Fax:
E-mail: b.kram@comcast.net	Invoice E-mail:
Report Delivery: (Choose all that apply) Mail / Fax / (Email) / Posted Online	Data posted to online account: YES / NO Web Login ID:

Special Instructions:

Requested TAT: **(Rush must be pre-approved by lab)**
(Standard) RUSH (5 Day / 3 Day / 48 HR / 24 HR)

Temperature upon Receipt: 8.0

Project Name: Arlington Groundwater

Project Number:

AmTest ID	Client ID (35 characters max)	Date Sampled	Time Sampled	Matrix	No. of containers	Analysis Requested: 350.1	6010C	300	SM 5310B	SM 2340C	SM 5310	353.2			QA/QC
18204	BXS-1	9-29-18	0900	G	4	X	X	X	X	X	X				
05	BXS-2	"	1119	G	4	X	X	X	X	X	X				
06	BXS-3	↓	1019	G	4	X	X	X	X	X	X				
07	BXN-1	9-30-18	1108	G	4	X	X	X	X	X	X	X			
08	BXS-103	9-29-18	1050	G	4	X	X	X	X	X	X				
09	BXN-2	9-30-18	1000	G	4	X	X	X	X	X	X	X			
10	BXN-4	"	0842	G	4	X	X	X	X	X	X	X			
11	Rinsate	↓	1157	G	4	X	X	X	X	X	X	X			

Collected/Relinquished By:	Date	Time	Received By:	Date	Time
Bruce Kram	10-1-18	9:47		10/1/18	9:47
Relinquished By:	Date	Time	Received By:	Date	Time
Relinquished By:	Date	Time	Received By:	Date	Time

COMMENTS:

CLIENT

Am Test Inc.
13600 NE 126TH PL
Suite C
Kirkland, WA 98034
(425) 885-1664

Professional Analytical Services

Mar 4 2019
KVAM AQUATIC SCIENCES LLC
9314 NE 133RD ST
KIRKLAND, WA 98034
Attention: BRUCE KVAM

Dear BRUCE KVAM:

Enclosed please find the analytical data for your ARLINGTON GROUNDWATER project.

The following is a cross correlation of client and laboratory identifications for your convenience.

CLIENT ID	MATRIX	AMTEST ID	TEST
BXS-1	Water	18-A018204	DEM, MIN, NUT, CONV, MET
BXS-2	Water	18-A018205	DEM, MIN, NUT, CONV, MET
BXS-3	Water	18-A018206	DEM, MIN, NUT, CONV, MET
BXN-1	Water	18-A018207	DEM, MIN, NUT, CONV, MET
BXS-103	Water	18-A018208	DEM, MIN, NUT, CONV, MET
BXN-2	Water	18-A018209	DEM, MIN, NUT, CONV, MET
BXN-4	Water	18-A018210	DEM, MIN, NUT, CONV, MET
RINSATE	Water	18-A018211	DEM, MIN, NUT, CONV, MET

Your samples were received on Monday, October 1, 2018. At the time of receipt, the samples were logged in and properly maintained prior to the subsequent analysis.

The analytical procedures used at AmTest are well documented and are typically derived from the protocols of the EPA, USDA, FDA or the Army Corps of Engineers.

Following the analytical data you will find the Quality Control (QC) results.

Please note that the detection limits that are listed in the body of the report refer to the Practical Quantitation Limits (PQL's), as opposed to the Method Detection Limits (MDL's).

If you should have any questions pertaining to the data package, please feel free to contact me.

Sincerely,

Kathy Fugiel
President

BACT = Bacteriological
CONV = Conventionals
MET = Metals
ORG = Organics
NUT=Nutrients
DEM=Demand
MIN=Minerals

Am Test Inc.
13600 NE 126TH PL
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www.amtestlab.com

Professional Analytical Services

ANALYSIS REPORT

KVAM AQUATIC SCIENCES LLC
9314 NE 133RD ST
KIRKLAND, WA 98034
Attention: BRUCE KVAM
Project Name: ARLINGTON GROUNDWATER
All results reported on an as received basis.

Date Received: 10/01/18
Date Reported: 3/ 4/19

AMTEST Identification Number **18-A018204**
Client Identification **BXS-1**
Sampling Date **09/29/18, 09:00**

Conventionals

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Total Dissolved Solids	200	mg/l		1	SM 2540C	MJ	10/08/18
Tannin and Lignin	0.20	mg/l		0.1	SM 5550B	MJ	10/08/18

Demand

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Total Organic Carbon	2.6	mg/l		0.5	SM 5310B	MJ	10/08/18
Chemical Oxygen Demand	27.	mg/l		10	EPA 410.4	MJ	10/08/18

Minerals

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Chloride	5.70	mg/l		0.05	EPA 300.0	JC	10/01/18
Sulfate	10.9	mg/l		0.1	EPA 300.0	JC	10/01/18

Nutrients

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Ammonia Nitrogen	< 0.005	mg/l		0.02	EPA 350.1	JC	10/01/18
Total Nitrate + Nitrite	0.20	mg/l		0.02	EPA 353.2	JC	10/02/18

Dissolved Metals

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Dissolved Arsenic	< 0.005	mg/l		0.005	EPA 200.7	KQ	10/02/18
Dissolved Barium	0.0161	mg/l		0.0005	EPA 200.7	KQ	10/02/18
Dissolved Iron	< 0.01	mg/l		0.01	EPA 200.7	KQ	10/02/18
Dissolved Manganese	0.2500	mg/l		0.005	EPA 200.7	KQ	10/02/18
Dissolved Nickel	0.012	mg/l		0.005	EPA 200.7	KQ	10/02/18

AMTEST Identification Number **18-A018205**
Client Identification **BXS-2**
Sampling Date **09/29/18, 11:19**

Conventionals

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Total Dissolved Solids	420	mg/l		1	SM 2540C	MJ	10/08/18
Tannin and Lignin	1.5	mg/l		0.1	SM 5550B	MJ	10/08/18

Demand

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Total Organic Carbon	11.	mg/l		0.5	SM 5310B	MJ	10/08/18
Chemical Oxygen Demand	38.	mg/l		10	EPA 410.4	MJ	10/08/18

Minerals

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Chloride	2.30	mg/l		0.05	EPA 300.0	JC	10/02/18
Sulfate	0.34	mg/l		0.1	EPA 300.0	JC	10/02/18

Nutrients

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Ammonia Nitrogen	< 0.005	mg/l		0.02	EPA 350.1	JC	10/01/18
Total Nitrate + Nitrite	< 0.01	mg/l		0.02	EPA 353.2	JC	10/02/18

Dissolved Metals

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Dissolved Arsenic	0.006	mg/l		0.005	EPA 200.7	KQ	10/02/18
Dissolved Barium	0.0346	mg/l		0.0005	EPA 200.7	KQ	10/02/18
Dissolved Iron	0.105	mg/l		0.01	EPA 200.7	KQ	10/02/18
Dissolved Manganese	1.416	mg/l		0.005	EPA 200.7	KQ	10/02/18
Dissolved Nickel	0.032	mg/l		0.005	EPA 200.7	KQ	10/02/18

AMTEST Identification Number **18-A018206**
Client Identification **BXS-3**
Sampling Date **09/29/18, 10:19**

Conventionals

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Total Dissolved Solids	210	mg/l		1	SM 2540C	MJ	10/08/18
Tannin and Lignin	62.	mg/l		0.1	SM 5550B	MJ	10/08/18

Demand

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Total Organic Carbon	19.	mg/l		0.5	SM 5310B	MJ	10/08/18
Chemical Oxygen Demand	49.	mg/l		10	EPA 410.4	MJ	10/08/18

Minerals

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Chloride	0.11	mg/l		0.05	EPA 300.0	JC	10/02/18
Sulfate	< 0.1	mg/l		0.1	EPA 300.0	JC	10/02/18

Nutrients

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Ammonia Nitrogen	0.844	mg/l		0.02	EPA 350.1	JC	10/01/18
Total Nitrate + Nitrite	< 0.01	mg/l		0.02	EPA 353.2	JC	10/02/18

Dissolved Metals

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Dissolved Arsenic	0.054	mg/l		0.005	EPA 200.7	KQ	10/02/18
Dissolved Barium	0.0295	mg/l		0.0005	EPA 200.7	KQ	10/02/18
Dissolved Iron	71.1	mg/l		0.01	EPA 200.7	KQ	10/02/18
Dissolved Manganese	5.654	mg/l		0.005	EPA 200.7	KQ	10/02/18
Dissolved Nickel	0.026	mg/l		0.005	EPA 200.7	KQ	10/02/18

AMTEST Identification Number **18-A018207**
Client Identification **BXN-1**
Sampling Date **09/30/18, 11:08**

Conventionals

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Total Dissolved Solids	460	mg/l		1	SM 2540C	MJ	10/08/18
Tannin and Lignin	68.	mg/l		0.1	SM 5550B	MJ	10/08/18

Demand

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Total Organic Carbon	15.	mg/l		0.5	SM 5310B	MJ	10/08/18
Chemical Oxygen Demand	49.	mg/l		10	EPA 410.4	MJ	10/08/18

Minerals

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Chloride	10.5	mg/l		0.05	EPA 300.0	JC	10/01/18
Sulfate	4.50	mg/l		0.1	EPA 300.0	JC	10/01/18

Nutrients

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Ammonia Nitrogen	0.679	mg/l		0.02	EPA 350.1	JC	10/01/18
Total Nitrate + Nitrite	< 0.01	mg/l		0.02	EPA 353.2	JC	10/02/18

Dissolved Metals

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Dissolved Arsenic	0.031	mg/l		0.005	EPA 200.7	KQ	10/02/18
Dissolved Barium	0.146	mg/l		0.0005	EPA 200.7	KQ	10/02/18
Dissolved Iron	67.6	mg/l		0.01	EPA 200.7	KQ	10/02/18
Dissolved Manganese	7.422	mg/l		0.005	EPA 200.7	KQ	10/02/18

AMTEST Identification Number **18-A018208**
Client Identification **BXS-103**
Sampling Date **09/29/18, 10:50**

Conventionals

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Total Dissolved Solids	260	mg/l		1	SM 2540C	MJ	10/08/18
Tannin and Lignin	57.	mg/l		0.1	SM 5550B	MJ	10/08/18

Demand

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Total Organic Carbon	19.	mg/l		0.5	SM 5310B	MJ	10/08/18
Chemical Oxygen Demand	62.	mg/l		10	EPA 410.4	MJ	10/08/18

Minerals

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Chloride	2.30	mg/l		0.05	EPA 300.0	JC	10/02/18
Sulfate	0.15	mg/l		0.1	EPA 300.0	JC	10/02/18

Nutrients

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Ammonia Nitrogen	0.842	mg/l		0.02	EPA 350.1	JC	10/01/18
Total Nitrate + Nitrite	< 0.01	mg/l		0.02	EPA 353.2	JC	10/02/18

Dissolved Metals

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Dissolved Arsenic	0.051	mg/l		0.005	EPA 200.7	KQ	10/02/18
Dissolved Barium	0.0304	mg/l		0.0005	EPA 200.7	KQ	10/02/18
Dissolved Iron	69.6	mg/l		0.01	EPA 200.7	KQ	10/02/18
Dissolved Manganese	5.711	mg/l		0.005	EPA 200.7	KQ	10/02/18
Dissolved Nickel	0.026	mg/l		0.005	EPA 200.7	KQ	10/02/18

AMTEST Identification Number **18-A018209**
Client Identification **BXN-2**
Sampling Date **09/30/18, 10:00**

Conventionals

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Total Dissolved Solids	180	mg/l		1	SM 2540C	MJ	10/08/18
Tannin and Lignin	0.67	mg/l		0.1	SM 5550B	MJ	10/08/18

Demand

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Total Organic Carbon	1.3	mg/l		0.5	SM 5310B	MJ	10/08/18
Chemical Oxygen Demand	< 10	mg/l		10	EPA 410.4	MJ	10/08/18

Minerals

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Chloride	5.10	mg/l		0.05	EPA 300.0	JC	10/01/18
Sulfate	19.3	mg/l		0.1	EPA 300.0	JC	10/01/18

Nutrients

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Ammonia Nitrogen	0.147	mg/l		0.02	EPA 350.1	JC	10/01/18
Total Nitrate + Nitrite	2.4	mg/l		0.02	EPA 353.2	JC	10/02/18

Dissolved Metals

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Dissolved Arsenic	< 0.005	mg/l		0.005	EPA 200.7	KQ	10/02/18
Dissolved Barium	0.0074	mg/l		0.0005	EPA 200.7	KQ	10/02/18
Dissolved Iron	< 0.01	mg/l		0.01	EPA 200.7	KQ	10/02/18
Dissolved Manganese	2.748	mg/l		0.005	EPA 200.7	KQ	10/02/18

AMTEST Identification Number **18-A018210**
Client Identification **BXN-4**
Sampling Date **09/30/18, 08:42**

Conventionals

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Total Dissolved Solids	450	mg/l		1	SM 2540C	MJ	10/08/18
Tannin and Lignin	0.83	mg/l		0.1	SM 5550B	MJ	10/08/18

Demand

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Total Organic Carbon	4.3	mg/l		0.5	SM 5310B	MJ	10/08/18
Chemical Oxygen Demand	16.	mg/l		10	EPA 410.4	MJ	10/08/18

Minerals

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Chloride	37.5	mg/l		0.05	EPA 300.0	JC	10/01/18
Sulfate	46.9	mg/l		0.1	EPA 300.0	JC	10/01/18

Nutrients

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Ammonia Nitrogen	7.10	mg/l		0.02	EPA 350.1	JC	10/08/18
Total Nitrate + Nitrite	21.	mg/l		0.02	EPA 353.2	JC	10/02/18

Dissolved Metals

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Dissolved Arsenic	< 0.005	mg/l		0.005	EPA 200.7	KQ	10/02/18
Dissolved Barium	0.168	mg/l		0.0005	EPA 200.7	KQ	10/02/18
Dissolved Iron	< 0.01	mg/l		0.01	EPA 200.7	KQ	10/02/18
Dissolved Manganese	2.366	mg/l		0.005	EPA 200.7	KQ	10/02/18

AMTEST Identification Number **18-A018211**
Client Identification **RINSATE**
Sampling Date **09/30/18, 11:57**

Conventionals

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Total Dissolved Solids	15.	mg/l		1	SM 2540C	MJ	10/08/18
Tannin and Lignin	< 0.1	mg/l		0.1	SM 5550B	MJ	10/08/18

Demand

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Total Organic Carbon	1.1	mg/l		0.5	SM 5310B	MJ	10/08/18
Chemical Oxygen Demand	< 10	mg/l		10	EPA 410.4	MJ	10/08/18

Minerals

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Chloride	0.09	mg/l		0.05	EPA 300.0	JC	10/02/18
Sulfate	0.25	mg/l		0.1	EPA 300.0	JC	10/02/18

Nutrients

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Ammonia Nitrogen	< 0.005	mg/l		0.02	EPA 350.1	JC	10/01/18
Total Nitrate + Nitrite	< 0.01	mg/l		0.02	EPA 353.2	JC	10/02/18

KVAM AQUATIC SCIENCES LLC
Project Name: ARLINGTON GROUNDWATER
AmTest ID: 18-A018211

Dissolved Metals

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Dissolved Arsenic	< 0.005	mg/l		0.005	EPA 200.7	KQ	10/02/18
Dissolved Barium	< 0.0005	mg/l		0.0005	EPA 200.7	KQ	10/02/18
Dissolved Iron	0.016	mg/l		0.01	EPA 200.7	KQ	10/02/18
Dissolved Manganese	< 0.005	mg/l		0.005	EPA 200.7	KQ	10/02/18

Kathy Fugiel
President

Am Test Inc.
13600 NE 126th PL
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Professional Analytical Services

QC Summary for sample numbers: 18-A018204 to 18-A018211

DUPLICATES

SAMPLE #	ANALYTE	UNITS	SAMPLE VALUE	DUP VALUE	RPD
18-A017850	Ammonia Nitrogen	mg/l	0.039	0.038	2.6
18-A018022	Ammonia Nitrogen	mg/l	0.006	< 0.005	
18-A018163	Ammonia Nitrogen	mg/l	< 0.005	< 0.005	
18-A018202	Ammonia Nitrogen	mg/l	< 0.005	< 0.005	
18-A018211	Ammonia Nitrogen	mg/l	< 0.005	< 0.005	
18-A018382	Ammonia Nitrogen	mg/l	0.256	0.255	0.39
18-A018457	Ammonia Nitrogen	mg/l	< 0.005	< 0.005	
18-A018479	Ammonia Nitrogen	mg/l	0.148	0.143	3.4
18-A018162	Total Nitrate + Nitrite	mg/l	3.0	2.9	3.4
18-A018209	Total Nitrate + Nitrite	mg/l	2.4	2.3	4.3
18-A018211	Total Nitrate + Nitrite	mg/l	< 0.01	< 0.01	
18-A017575	Total Dissolved Solids	mg/l	18.	18.	0.00
18-A018210	Total Dissolved Solids	mg/l	450	470	4.3
18-A018480	Total Dissolved Solids	mg/l	220	210	4.7

MATRIX SPIKES

SAMPLE #	ANALYTE	UNITS	SAMPLE VALUE	SMPL+ SPK	SPK AMT	RECOVERY
18-A018450	Total Organic Carbon	mg/l	0.57	51.	50.	100.86 %
18-A017844	Chemical Oxygen Demand	mg/l	< 10	110	100	110.00 %
18-A017844	Chemical Oxygen Demand	mg/l	< 10	110	100	110.00 %
18-A018205	Chemical Oxygen Demand	mg/l	38.	170	100	132.00 %
18-A018205	Chemical Oxygen Demand	mg/l	38.	180	100	142.00 %
18-A018211	Chemical Oxygen Demand	mg/l	< 10	110	100	110.00 %
18-A018211	Chemical Oxygen Demand	mg/l	< 10	100	100	100.00 %
18-A017850	Ammonia Nitrogen	mg/l	0.039	1.04	1.00	100.10 %
18-A018022	Ammonia Nitrogen	mg/l	0.006	1.00	1.00	99.40 %
18-A018163	Ammonia Nitrogen	mg/l	< 0.005	1.00	1.00	100.00 %
18-A018202	Ammonia Nitrogen	mg/l	< 0.005	0.989	1.00	98.90 %
18-A018211	Ammonia Nitrogen	mg/l	< 0.005	0.996	1.00	99.60 %
18-A018382	Ammonia Nitrogen	mg/l	0.256	1.31	1.00	105.40 %
18-A018479	Ammonia Nitrogen	mg/l	0.148	1.24	1.00	109.20 %
18-A018162	Total Nitrate + Nitrite	mg/l	3.0	8.1	5.0	102.00 %
18-A018209	Total Nitrate + Nitrite	mg/l	2.4	3.4	1.0	100.00 %
18-A018211	Total Nitrate + Nitrite	mg/l	< 0.01	1.0	1.0	100.00 %
18-A018265	Tannin and Lignin	mg/l	0.28	0.50	0.20	110.00 %
18-A018265	Tannin and Lignin	mg/l	0.28	0.52	0.20	120.00 %
18-A018204	Dissolved Arsenic	mg/l	< 0.005	2.03	2.00	101.50 %
18-A018204	Dissolved Arsenic	mg/l	< 0.005	2.02	2.00	101.00 %
18-A018211	Dissolved Arsenic	mg/l	< 0.005	2.06	2.00	103.00 %
18-A018211	Dissolved Arsenic	mg/l	< 0.005	2.04	2.00	102.00 %

QC Summary for sample numbers: 18-A018204 to 18-A018211...

MATRIX SPIKES continued....

SAMPLE #	ANALYTE	UNITS	SAMPLE VALUE	SMPL+ SPK	SPK AMT	RECOVERY
18-A017850	Dissolved Barium	mg/l	0.0382	1.96	2.00	96.09 %
18-A017850	Dissolved Barium	mg/l	0.0382	1.99	2.00	97.59 %
18-A018204	Dissolved Barium	mg/l	0.0161	2.01	2.00	99.70 %
18-A018204	Dissolved Barium	mg/l	0.0161	2.03	2.00	100.70 %
18-A018211	Dissolved Barium	mg/l	< 0.0005	2.09	2.00	104.50 %
18-A018211	Dissolved Barium	mg/l	< 0.0005	2.06	2.00	103.00 %
18-A017850	Dissolved Iron	mg/l	0.713	23.8	22.0	104.94 %
18-A017850	Dissolved Iron	mg/l	0.713	24.2	22.0	106.76 %
18-A018211	Dissolved Iron	mg/l	0.016	23.1	26.0	88.78 %
18-A018211	Dissolved Iron	mg/l	0.016	23.2	26.0	89.17 %
18-A017850	Dissolved Manganese	mg/l	1.799	3.766	2.000	98.35 %
18-A017850	Dissolved Manganese	mg/l	1.799	3.815	2.000	100.80 %
18-A018211	Dissolved Manganese	mg/l	< 0.005	2.117	2.000	105.85 %
18-A018211	Dissolved Manganese	mg/l	< 0.005	2.099	2.000	104.95 %
18-A017850	Dissolved Nickel	mg/l	0.008	1.808	2.000	90.00 %
18-A017850	Dissolved Nickel	mg/l	0.008	1.807	2.000	89.95 %

MATRIX SPIKE DUPLICATES

SAMPLE #	ANALYTE	UNITS	SAMPLE + SPK	MSD VALUE	RPD
Spike	Chemical Oxygen Demand	mg/l	110	110	0.00
Spike	Chemical Oxygen Demand	mg/l	170	180	5.7
Spike	Chemical Oxygen Demand	mg/l	110	100	9.5
Spike	Tannin and Lignin	mg/l	0.50	0.52	3.9
Spike	Dissolved Arsenic	mg/l	2.03	2.02	0.49
Spike	Dissolved Arsenic	mg/l	2.06	2.04	0.98
Spike	Dissolved Barium	mg/l	1.96	1.99	1.5
Spike	Dissolved Barium	mg/l	2.01	2.03	0.99
Spike	Dissolved Barium	mg/l	2.09	2.06	1.4
Spike	Dissolved Iron	mg/l	23.8	24.2	1.7
Spike	Dissolved Iron	mg/l	23.1	23.2	0.43
Spike	Dissolved Manganese	mg/l	3.766	3.815	1.3
Spike	Dissolved Manganese	mg/l	2.117	2.099	0.85
Spike	Dissolved Nickel	mg/l	1.808	1.807	0.06

STANDARD REFERENCE MATERIALS

ANALYTE	UNITS	TRUE VALUE	MEASURED VALUE	RECOVERY
Total Organic Carbon	mg/l	50.	51.	102. %
Chemical Oxygen Demand	mg/l	100	92.	92.0 %
Chemical Oxygen Demand	mg/l	100	95.	95.0 %
Chloride	mg/l	5.00	4.71	94.2 %
Chloride	mg/l	5.00	4.54	90.8 %
Ammonia Nitrogen	mg/l	1.00	1.05	105. %
Ammonia Nitrogen	mg/l	1.00	1.04	104. %
Ammonia Nitrogen	mg/l	1.00	0.961	96.1 %
Ammonia Nitrogen	mg/l	1.00	0.963	96.3 %
Total Nitrate + Nitrite	mg/l	1.0	1.0	100. %
Total Nitrate + Nitrite	mg/l	1.0	1.0	100. %
Total Dissolved Solids	mg/l	200	200	100. %
Total Dissolved Solids	mg/l	350	360	103. %
Sulfate	mg/l	5.00	4.95	99.0 %

QC Summary for sample numbers: 18-A018204 to 18-A018211...

STANDARD REFERENCE MATERIALS continued....

ANALYTE	UNITS	TRUE VALUE	MEASURED VALUE	RECOVERY
Sulfate	mg/l	5.00	4.83	96.6 %
Tannin and Lignin	mg/l	0.40	0.40	100. %
Dissolved Arsenic	mg/l	2.00	1.95	97.5 %
Dissolved Barium	mg/l	0.800	0.770	96.2 %
Dissolved Barium	mg/l	0.800	0.790	98.8 %
Dissolved Iron	mg/l	4.00	4.06	102. %
Dissolved Iron	mg/l	4.00	4.03	101. %
Dissolved Manganese	mg/l	0.8000	0.7900	98.8 %
Dissolved Manganese	mg/l	0.8000	0.8040	100. %
Dissolved Nickel	mg/l	0.800	0.798	99.8 %
Dissolved Nickel	mg/l	0.800	0.838	105. %

BLANKS

ANALYTE	UNITS	RESULT
Total Organic Carbon	mg/l	< 0.5
Chemical Oxygen Demand	mg/l	< 10
Chemical Oxygen Demand	mg/l	< 10
Chloride	mg/l	< 0.05
Chloride	mg/l	< 0.05
Ammonia Nitrogen	mg/l	< 0.005
Ammonia Nitrogen	mg/l	< 0.005
Ammonia Nitrogen	mg/l	< 0.005
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrate + Nitrite	mg/l	< 0.01
Total Nitrate + Nitrite	mg/l	< 0.01
Total Dissolved Solids	mg/l	< 1
Total Dissolved Solids	mg/l	< 1
Sulfate	mg/l	< 0.1
Sulfate	mg/l	< 0.1
Tannin and Lignin	mg/l	< 0.1
Dissolved Arsenic	mg/l	< 0.05
Dissolved Barium	mg/l	< 0.0005
Dissolved Barium	mg/l	< 0.0005
Dissolved Iron	mg/l	< 0.01
Dissolved Iron	mg/l	< 0.01
Dissolved Manganese	mg/l	< 0.005
Dissolved Manganese	mg/l	< 0.005
Dissolved Nickel	mg/l	< 0.005
Dissolved Nickel	mg/l	< 0.005

AMTEST LABORATORIES

AmTest Chain of Custody Record

13600 NE 126th PL, Suite C, Kirkland, WA 98034
Ph (425) 885-1664 Fx (425) 820-0245
www.amtestlab.com

Chain of Custody No. [illegible]

Client Name & Address:	Invoice To:
Kram Aquatic Sciences, LLC 9314 NE 133rd Street Kirkland, WA 98034	Kram Aquatic Sciences, LLC
Contact Person: Bruce Kram	Invoice Contact:
Phone No: (206) 953-6904 (calls/text)	PO Number:
Fax No:	Invoice Ph/Fax:
E-mail: b.kram@comcast.net	Invoice E-mail:
Report Delivery: (Choose all that apply) Mail / Fax / (Email) / Posted Online	Data posted to online account: YES / NO Web Login ID:
Special Instructions:	
Requested TAT: **(Rush must be pre-approved by lab)** (Standard) RUSH (5 Day / 3 Day / 48 HR / 24 HR)	Temperature upon Receipt: 8.0

Project Name: Arlington Groundwater

Project Number:

AmTest ID	Client ID (35 characters max)	Date Sampled	Time Sampled	Matrix	No. of containers	Analysis Requested: 352.1	6010C	300	SM5310B	SM2320C	SM 5310	353.2			QA/QC
18204	BXS-1	9-29-18	0900	G	4	X	X	X	X	X	X				
05	BXS-2	↓	1119	G	4	X	X	X	X	X	X				
06	BXS-3	↓	1019	G	4	X	X	X	X	X	X				
07	BXN-1	9-30-18	1108	G	4	X	X	X	X	X	X	X			
08	BXS-103	9-29-18	1050	G	4	X	X	X	X	X	X				
09	BXN-2	9-30-18	1000	G	4	X	X	X	X	X	X	X			
10	BXN-4	↓	0842	G	4	X	X	X	X	X	X	X			
11	Rinsate	↓	1157	G	4	X	X	X	X	X	X	X			

Collected/Relinquished By:	Date	Time	Received By:	Date	Time
Bruce Kram	10-1-18	9:47		10/1/18	9:47
Relinquished By:	Date	Time	Received By:	Date	Time
Relinquished By:	Date	Time	Received By:	Date	Time

COMMENTS:

CLIENT

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Professional Analytical Services

QC Summary for sample numbers: 18-A018204 to 18-A018211

DUPLICATES

SAMPLE #	ANALYTE	UNITS	SAMPLE VALUE	DUP VALUE	RPD
18-A017850	Ammonia Nitrogen	mg/l	0.039	0.038	2.6
18-A018022	Ammonia Nitrogen	mg/l	0.006	< 0.005	
18-A018163	Ammonia Nitrogen	mg/l	< 0.005	< 0.005	
18-A018202	Ammonia Nitrogen	mg/l	< 0.005	< 0.005	
18-A018211	Ammonia Nitrogen	mg/l	< 0.005	< 0.005	
18-A018382	Ammonia Nitrogen	mg/l	0.256	0.255	0.39
18-A018457	Ammonia Nitrogen	mg/l	< 0.005	< 0.005	
18-A018479	Ammonia Nitrogen	mg/l	0.148	0.143	3.4
18-A018162	Total Nitrate + Nitrite	mg/l	3.0	2.9	3.4
18-A018209	Total Nitrate + Nitrite	mg/l	2.4	2.3	4.3
18-A018211	Total Nitrate + Nitrite	mg/l	< 0.01	< 0.01	
18-A017575	Total Dissolved Solids	mg/l	18.	18.	0.00
18-A018210	Total Dissolved Solids	mg/l	450	470	4.3
18-A018480	Total Dissolved Solids	mg/l	220	210	4.7

MATRIX SPIKES

SAMPLE #	ANALYTE	UNITS	SAMPLE VALUE	SMPL+ SPK	SPK AMT	RECOVERY
18-A018450	Total Organic Carbon	mg/l	0.57	51.	50.	100.86 %
18-A017844	Chemical Oxygen Demand	mg/l	< 10	110	100	110.00 %
18-A017844	Chemical Oxygen Demand	mg/l	< 10	110	100	110.00 %
18-A018205	Chemical Oxygen Demand	mg/l	38.	170	100	132.00 %
18-A018205	Chemical Oxygen Demand	mg/l	38.	180	100	142.00 %
18-A018211	Chemical Oxygen Demand	mg/l	< 10	110	100	110.00 %
18-A018211	Chemical Oxygen Demand	mg/l	< 10	100	100	100.00 %
18-A017850	Ammonia Nitrogen	mg/l	0.039	1.04	1.00	100.10 %
18-A018022	Ammonia Nitrogen	mg/l	0.006	1.00	1.00	99.40 %
18-A018163	Ammonia Nitrogen	mg/l	< 0.005	1.00	1.00	100.00 %
18-A018202	Ammonia Nitrogen	mg/l	< 0.005	0.989	1.00	98.90 %
18-A018211	Ammonia Nitrogen	mg/l	< 0.005	0.996	1.00	99.60 %
18-A018382	Ammonia Nitrogen	mg/l	0.256	1.31	1.00	105.40 %
18-A018479	Ammonia Nitrogen	mg/l	0.148	1.24	1.00	109.20 %
18-A018162	Total Nitrate + Nitrite	mg/l	3.0	8.1	5.0	102.00 %
18-A018209	Total Nitrate + Nitrite	mg/l	2.4	3.4	1.0	100.00 %
18-A018211	Total Nitrate + Nitrite	mg/l	< 0.01	1.0	1.0	100.00 %
18-A018265	Tannin and Lignin	mg/l	0.28	0.50	0.20	110.00 %
18-A018265	Tannin and Lignin	mg/l	0.28	0.52	0.20	120.00 %
18-A018204	Dissolved Arsenic	mg/l	< 0.005	2.03	2.00	101.50 %
18-A018204	Dissolved Arsenic	mg/l	< 0.005	2.02	2.00	101.00 %
18-A018211	Dissolved Arsenic	mg/l	< 0.005	2.06	2.00	103.00 %
18-A018211	Dissolved Arsenic	mg/l	< 0.005	2.04	2.00	102.00 %

QC Summary for sample numbers: 18-A018204 to 18-A018211...

MATRIX SPIKES continued....

SAMPLE #	ANALYTE	UNITS	SAMPLE VALUE	SMPL+ SPK	SPK AMT	RECOVERY
18-A017850	Dissolved Barium	mg/l	0.0382	1.96	2.00	96.09 %
18-A017850	Dissolved Barium	mg/l	0.0382	1.99	2.00	97.59 %
18-A018204	Dissolved Barium	mg/l	0.0161	2.01	2.00	99.70 %
18-A018204	Dissolved Barium	mg/l	0.0161	2.03	2.00	100.70 %
18-A018211	Dissolved Barium	mg/l	< 0.0005	2.09	2.00	104.50 %
18-A018211	Dissolved Barium	mg/l	< 0.0005	2.06	2.00	103.00 %

MATRIX SPIKE DUPLICATES

SAMPLE #	ANALYTE	UNITS	SAMPLE + SPK	MSD VALUE	RPD
Spike	Chemical Oxygen Demand	mg/l	110	110	0.00
Spike	Chemical Oxygen Demand	mg/l	170	180	5.7
Spike	Chemical Oxygen Demand	mg/l	110	100	9.5
Spike	Tannin and Lignin	mg/l	0.50	0.52	3.9
Spike	Dissolved Arsenic	mg/l	2.03	2.02	0.49
Spike	Dissolved Arsenic	mg/l	2.06	2.04	0.98
Spike	Dissolved Barium	mg/l	1.96	1.99	1.5
Spike	Dissolved Barium	mg/l	2.01	2.03	0.99
Spike	Dissolved Barium	mg/l	2.09	2.06	1.4

STANDARD REFERENCE MATERIALS

ANALYTE	UNITS	TRUE VALUE	MEASURED VALUE	RECOVERY
Total Organic Carbon	mg/l	50.	51.	102. %
Chemical Oxygen Demand	mg/l	100	92.	92.0 %
Chemical Oxygen Demand	mg/l	100	95.	95.0 %
Chloride	mg/l	5.00	4.71	94.2 %
Chloride	mg/l	5.00	4.54	90.8 %
Ammonia Nitrogen	mg/l	1.00	1.05	105. %
Ammonia Nitrogen	mg/l	1.00	1.04	104. %
Ammonia Nitrogen	mg/l	1.00	0.961	96.1 %
Ammonia Nitrogen	mg/l	1.00	0.963	96.3 %
Total Nitrate + Nitrite	mg/l	1.0	1.0	100. %
Total Nitrate + Nitrite	mg/l	1.0	1.0	100. %
Total Dissolved Solids	mg/l	200	200	100. %
Total Dissolved Solids	mg/l	350	360	103. %
Sulfate	mg/l	5.00	4.95	99.0 %
Sulfate	mg/l	5.00	4.83	96.6 %
Tannin and Lignin	mg/l	0.40	0.40	100. %
Dissolved Arsenic	mg/l	2.00	1.95	97.5 %
Dissolved Barium	mg/l	0.800	0.770	96.2 %
Dissolved Barium	mg/l	0.800	0.790	98.8 %

BLANKS

ANALYTE	UNITS	RESULT
Total Organic Carbon	mg/l	< 0.5
Chemical Oxygen Demand	mg/l	< 10
Chemical Oxygen Demand	mg/l	< 10
Chloride	mg/l	< 0.05
Chloride	mg/l	< 0.05
Ammonia Nitrogen	mg/l	< 0.005
Ammonia Nitrogen	mg/l	< 0.005

QC Summary for sample numbers: 18-A018204 to 18-A018211...

BLANKS continued....

ANALYTE	UNITS	RESULT
Ammonia Nitrogen	mg/l	< 0.005
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrate + Nitrite	mg/l	< 0.01
Total Nitrate + Nitrite	mg/l	< 0.01
Total Dissolved Solids	mg/l	< 1
Total Dissolved Solids	mg/l	< 1
Sulfate	mg/l	< 0.1
Sulfate	mg/l	< 0.1
Tannin and Lignin	mg/l	< 0.1
Dissolved Arsenic	mg/l	< 0.05
Dissolved Barium	mg/l	< 0.0005
Dissolved Barium	mg/l	< 0.0005

AMTEST LABORATORIES

AmTest Chain of Custody Record

13600 NE 126th PL, Suite C, Kirkland, WA 98034
Ph (425) 885-1664 Fx (425) 820-0245
www.amtestlab.com

Chain of Custody No. 32520

Client Name & Address:	Invoice To:
Kram Aquatic Sciences, LLC 9314 NE 133rd Street Kirkland, WA 98034	Kram Aquatic Sciences, LLC
Contact Person: Bruce Kram	Invoice Contact:
Phone No: (206) 953-6904 (call or text)	PO Number:
Fax No:	Invoice Ph/Fax:
E-mail: b.kram@comcast.net	Invoice E-mail:
Report Delivery: (Choose all that apply) Mail / Fax / (Email) / Posted Online	Data posted to online account: YES / NO Web Login ID:
Special Instructions:	
Requested TAT: **(Rush must be pre-approved by lab)** (Standard) RUSH (5 Day / 3 Day / 48 HR / 24 HR)	Temperature upon Receipt: 4.7

Project Name: Arlington Groundwater

Project Number:

AmTest ID	Client ID (35 characters max)	Date Sampled	Time Sampled	Matrix	No. of containers	Analysis Requested: 350.1 NH3	6010 C Tot Sol	300 IC	353.2 NO4	SM 5530B TA	SM 2430 C TD	SM 5310 TOC			QA/QC
20659	BXS-3	11-17-18	1022	G	4	X	X	X		X	X	X			
60	BXN-1	↓	1314	G	4	X	X	X	X	X	X	X			
61	BXN-5	↓	1315	G	4	X	X	X	X	X	X	X			

Collected/Relinquished By:	Date	Time	Received By:	Date	Time
Bruce Kram	11-19-18	1042	AS	11/19/18	10:42
Relinquished By:	Date	Time	Received By:	Date	Time
Relinquished By:	Date	Time	Received By:	Date	Time

COMMENTS:

CLIENT

Am Test Inc.
13600 NE 126TH PL
Suite C
Kirkland, WA 98034
(425) 885-1664
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Professional Analytical Services

ANALYSIS REPORT

KVAM AQUATIC SCIENCES LLC
9314 NE 133RD ST
KIRKLAND, WA 98034
Attention: BRUCE KVAM
Project Name: ARLINGTON GROUNDWATER
All results reported on an as received basis.

Date Received: 11/19/18
Date Reported: 12/13/18

AMTEST Identification Number **18-A020659**
Client Identification **BXS-3**
Sampling Date **11/17/18, 10:22**

Conventionals

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Total Dissolved Solids	330	mg/l		1	SM 2540C	JH	11/26/18
Tannin and Lignin	50.	mg/l		0.1	SM 513	MJ	12/11/18

Demand

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Total Organic Carbon	22.	mg/l		0.5	SM 5310B	MJ	11/29/18
Chemical Oxygen Demand	54.	mg/l		10	EPA 410.4	JH	11/28/18

Minerals

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Chloride	8.50	mg/l		0.05	EPA 300.0	JC	11/19/18
Sulfate	2.00	mg/l		0.1	EPA 300.0	JC	11/19/18

Nutrients

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Ammonia Nitrogen	0.824	mg/l		0.005	EPA 350.1	JC	11/20/18

KVAM AQUATIC SCIENCES LLC
Project Name: ARLINGTON GROUNDWATER
AmTest ID: 18-A020659

Dissolved Metals

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Dissolved Arsenic	0.082	mg/l		0.005	EPA 200.7	KQ	11/27/18
Dissolved Barium	0.0255	mg/l		0.0005	EPA 200.7	KQ	11/27/18
Dissolved Iron	81.8	mg/l		0.01	EPA 200.7	KQ	11/27/18
Dissolved Manganese	4.890	mg/l		0.005	EPA 200.7	KQ	11/27/18
Dissolved Nickel	0.043	mg/l		0.005	EPA 200.7	KQ	11/27/18

AMTEST Identification Number **18-A020660**
Client Identification **BXN-1**
Sampling Date **11/17/18, 13:14**

Conventionals

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Total Dissolved Solids	460	mg/l		1	SM 2540C	JH	11/26/18
Tannin and Lignin	25.	mg/l		0.1	SM 513	MJ	12/11/18

Demand

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Total Organic Carbon	6.9	mg/l		0.5	SM 5310B	MJ	11/30/18
Chemical Oxygen Demand	< 10	mg/l		10	EPA 410.4	JH	11/28/18

Minerals

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Chloride	38.7	mg/l		0.05	EPA 300.0	JC	11/19/18
Sulfate	5.70	mg/l		0.1	EPA 300.0	JC	11/19/18

Nutrients

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Ammonia Nitrogen	0.581	mg/l		0.005	EPA 350.1	JC	11/20/18
Total Nitrate + Nitrite	< 0.01	mg/l		0.01	EPA 353.2	JC	11/26/18

KVAM AQUATIC SCIENCES LLC
Project Name: ARLINGTON GROUNDWATER
AmTest ID: 18-A020660

Dissolved Metals

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Dissolved Arsenic	0.014	mg/l		0.005	EPA 200.7	KQ	11/27/18
Dissolved Barium	0.127	mg/l		0.0005	EPA 200.7	KQ	11/27/18
Dissolved Iron	56.5	mg/l		0.01	EPA 200.7	KQ	11/27/18
Dissolved Manganese	5.944	mg/l		0.005	EPA 200.7	KQ	11/27/18
Dissolved Nickel	0.056	mg/l		0.005	EPA 200.7	KQ	11/27/18

AMTEST Identification Number **18-A020661**
Client Identification **BXN-5**
Sampling Date **11/17/18, 13:15**

Conventionals

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Total Dissolved Solids	420	mg/l		1	SM 2540C	JH	11/26/18
Tannin and Lignin	25.	mg/l		0.1	SM 513	MJ	12/11/18

Demand

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Total Organic Carbon	7.1	mg/l		0.5	SM 5310B	MJ	11/30/18
Chemical Oxygen Demand	12.	mg/l		10	EPA 410.4	JH	11/28/18

Minerals

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Chloride	43.7	mg/l		0.05	EPA 300.0	JC	11/19/18
Sulfate	6.70	mg/l		0.1	EPA 300.0	JC	11/19/18

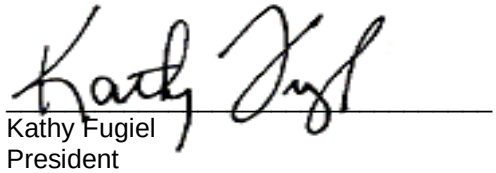
Nutrients

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Ammonia Nitrogen	0.578	mg/l		0.005	EPA 350.1	JC	11/20/18
Total Nitrate + Nitrite	< 0.01	mg/l		0.01	EPA 353.2	JC	11/26/18

KVAM AQUATIC SCIENCES LLC
Project Name: ARLINGTON GROUNDWATER
AmTest ID: 18-A020661

Dissolved Metals

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Dissolved Arsenic	0.016	mg/l		0.005	EPA 200.7	KQ	11/27/18
Dissolved Barium	0.122	mg/l		0.0005	EPA 200.7	KQ	11/27/18
Dissolved Iron	53.2	mg/l		0.01	EPA 200.7	KQ	11/27/18
Dissolved Manganese	5.493	mg/l		0.005	EPA 200.7	KQ	11/27/18
Dissolved Nickel	0.053	mg/l		0.005	EPA 200.7	KQ	11/27/18



Kathy Fugiel
President

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Professional Analytical Services

QC Summary for sample numbers: 18-A020659 to 18-A020661

DUPLICATES

SAMPLE #	ANALYTE	UNITS	SAMPLE VALUE	DUP VALUE	RPD
18-A020581	Total Organic Carbon	mg/l	0.60	0.51	16.
18-A021244	Total Organic Carbon	mg/l	0.58	0.52	11.
18-A020661	Chloride	mg/l	43.7	42.5	2.8
18-A020524	Ammonia Nitrogen	mg/l	0.016	0.013	21.
18-A020580	Ammonia Nitrogen	mg/l	0.010	0.010	0.00
18-A020649	Ammonia Nitrogen	mg/l	0.012	0.010	18.
18-A020654	Ammonia Nitrogen	mg/l	0.016	0.014	13.
18-A020721	Total Nitrate + Nitrite	mg/l	1.6	1.6	0.00
18-A020730	Total Nitrate + Nitrite	mg/l	0.041	0.051	22.
18-A020828	Total Nitrate + Nitrite	mg/l	0.22	0.27	20.
18-A020653	Total Dissolved Solids	mg/l	< 1	< 1	
18-A020791	Total Dissolved Solids	mg/l	490	490	0.00
18-A020661	Sulfate	mg/l	6.70	6.50	3.0

MATRIX SPIKES

SAMPLE #	ANALYTE	UNITS	SAMPLE VALUE	SMPL+ SPK	SPK AMT	RECOVERY
18-A020659	Total Organic Carbon	mg/l	22.	70.	50.	96.00 %
18-A021313	Total Organic Carbon	mg/l	< 0.5	48.	50.	96.00 %
18-A021182	Chemical Oxygen Demand	mg/l	43.	96.	50.	106.00 %
18-A021182	Chemical Oxygen Demand	mg/l	43.	98.	50.	110.00 %
18-A020661	Chloride	mg/l	43.7	61.8	20.0	90.50 %
18-A020524	Ammonia Nitrogen	mg/l	0.016	0.961	1.00	94.50 %
18-A020580	Ammonia Nitrogen	mg/l	0.010	1.01	1.00	100.00 %
18-A020649	Ammonia Nitrogen	mg/l	0.012	0.984	1.00	97.20 %
18-A020654	Ammonia Nitrogen	mg/l	0.016	0.928	1.00	91.20 %
18-A020721	Total Nitrate + Nitrite	mg/l	1.6	2.6	1.0	100.00 %
18-A020730	Total Nitrate + Nitrite	mg/l	0.041	0.95	1.0	90.90 %
18-A020828	Total Nitrate + Nitrite	mg/l	0.22	1.2	1.0	98.00 %
18-A020661	Sulfate	mg/l	6.70	28.1	20.0	107.00 %
18-A021413	Tannin and Lignin	mg/l	0.12	0.48	0.25	144.00 %
18-A021413	Tannin and Lignin	mg/l	0.12	0.46	0.25	136.00 %
18-A021428	Tannin and Lignin	mg/l	5.9	14.	6.2	130.64 %
18-A021428	Tannin and Lignin	mg/l	5.9	14.	6.2	130.64 %
18-A021430	Tannin and Lignin	mg/l	< 0.1	0.24	0.25	96.00 %
18-A021430	Tannin and Lignin	mg/l	< 0.1	0.27	0.25	108.00 %
18-A020411	Dissolved Barium	mg/l	0.0485	2.15	2.00	105.08 %
18-A020411	Dissolved Barium	mg/l	0.0485	2.15	2.00	105.08 %
18-A020411	Dissolved Iron	mg/l	< 0.01	23.7	22.0	107.73 %
18-A020411	Dissolved Iron	mg/l	< 0.01	23.6	22.0	107.27 %
18-A020845	Dissolved Iron	mg/l	0.078	23.7	22.0	107.37 %

QC Summary for sample numbers: 18-A020659 to 18-A020661...

MATRIX SPIKES continued....

SAMPLE #	ANALYTE	UNITS	SAMPLE VALUE	SMPL+ SPK	SPK AMT	RECOVERY
18-A020845	Dissolved Iron	mg/l	0.078	23.6	22.0	106.92 %
18-A020846	Dissolved Iron	mg/l	0.052	23.4	22.0	106.13 %
18-A020846	Dissolved Iron	mg/l	0.052	23.6	22.0	107.04 %
18-A020411	Dissolved Manganese	mg/l	0.0332	2.258	2.000	111.24 %
18-A020411	Dissolved Manganese	mg/l	0.0332	2.260	2.000	111.34 %
18-A020580	Dissolved Manganese	mg/l	0.0288	2.276	2.000	112.36 %
18-A020580	Dissolved Manganese	mg/l	0.0288	2.281	2.000	112.61 %
18-A020411	Dissolved Nickel	mg/l	0.016	2.088	2.000	103.60 %
18-A020411	Dissolved Nickel	mg/l	0.016	2.079	2.000	103.15 %

MATRIX SPIKE DUPLICATES

SAMPLE #	ANALYTE	UNITS	SAMPLE + SPK	MSD VALUE	RPD
Spike	Chemical Oxygen Demand	mg/l	96.	98.	2.1
Spike	Tannin and Lignin	mg/l	0.48	0.46	4.3
Spike	Tannin and Lignin	mg/l	14.	14.	0.00
Spike	Tannin and Lignin	mg/l	0.24	0.27	12.
Spike	Dissolved Barium	mg/l	2.15	2.15	0.00
Spike	Dissolved Iron	mg/l	23.7	23.6	0.42
Spike	Dissolved Iron	mg/l	23.7	23.6	0.42
Spike	Dissolved Iron	mg/l	23.4	23.6	0.85
Spike	Dissolved Manganese	mg/l	2.258	2.260	0.09
Spike	Dissolved Manganese	mg/l	2.276	2.281	0.22
Spike	Dissolved Nickel	mg/l	2.088	2.079	0.43

STANDARD REFERENCE MATERIALS

ANALYTE	UNITS	TRUE VALUE	MEASURED VALUE	RECOVERY
Total Organic Carbon	mg/l	50.	48.	96.0 %
Total Organic Carbon	mg/l	50.	47.	94.0 %
Chemical Oxygen Demand	mg/l	100	98.	98.0 %
Chloride	mg/l	5.00	5.45	109. %
Ammonia Nitrogen	mg/l	1.00	1.04	104. %
Ammonia Nitrogen	mg/l	1.00	1.02	102. %
Total Nitrate + Nitrite	mg/l	1.0	0.92	92.0 %
Total Nitrate + Nitrite	mg/l	1.0	0.91	91.0 %
Total Dissolved Solids	mg/l	200	220	110. %
Sulfate	mg/l	5.00	5.34	107. %
Tannin and Lignin	mg/l	0.50	0.54	108. %
Tannin and Lignin	mg/l	0.50	0.49	98.0 %
Tannin and Lignin	mg/l	0.50	0.46	92.0 %
Dissolved Arsenic	mg/l	2.00	1.94	97.0 %
Dissolved Barium	mg/l	0.800	0.786	98.2 %
Dissolved Barium	mg/l	0.800	0.774	96.8 %
Dissolved Barium	mg/l	0.800	0.777	97.1 %
Dissolved Iron	mg/l	4.00	4.16	104. %
Dissolved Iron	mg/l	4.00	4.11	103. %
Dissolved Iron	mg/l	4.00	4.09	102. %
Dissolved Iron	mg/l	4.00	4.08	102. %
Dissolved Manganese	mg/l	0.8000	0.8447	106. %
Dissolved Manganese	mg/l	0.8000	0.8477	106. %
Dissolved Manganese	mg/l	0.8000	0.8484	106. %

QC Summary for sample numbers: 18-A020659 to 18-A020661...

STANDARD REFERENCE MATERIALS continued....

ANALYTE	UNITS	TRUE VALUE	MEASURED VALUE	RECOVERY
Dissolved Nickel	mg/l	0.800	0.806	101. %
Dissolved Nickel	mg/l	0.800	0.785	98.1 %
Dissolved Nickel	mg/l	0.800	0.774	96.8 %

BLANKS

ANALYTE	UNITS	RESULT
Total Organic Carbon	mg/l	< 0.5
Total Organic Carbon	mg/l	< 0.5
Chemical Oxygen Demand	mg/l	< 10
Chloride	mg/l	< 0.05
Ammonia Nitrogen	mg/l	< 0.005
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrate + Nitrite	mg/l	< 0.01
Total Nitrate + Nitrite	mg/l	< 0.01
Total Dissolved Solids	mg/l	< 1
Sulfate	mg/l	< 0.1
Tannin and Lignin	mg/l	< 0.1
Tannin and Lignin	mg/l	< 0.1
Tannin and Lignin	mg/l	< 0.1
Dissolved Arsenic	mg/l	< 0.005
Dissolved Barium	mg/l	0.0008
Dissolved Barium	mg/l	0.0011
Dissolved Barium	mg/l	0.0010
Dissolved Iron	mg/l	< 0.01
Dissolved Iron	mg/l	< 0.01
Dissolved Iron	mg/l	< 0.01
Dissolved Iron	mg/l	< 0.01
Dissolved Manganese	mg/l	< 0.005
Dissolved Manganese	mg/l	< 0.005
Dissolved Manganese	mg/l	< 0.005
Dissolved Nickel	mg/l	< 0.005
Dissolved Nickel	mg/l	< 0.005
Dissolved Nickel	mg/l	< 0.005

Appendix C

Statistical Analysis of Groundwater Data

Table C-1. Statistical Analysis of Groundwater Quality Results for Downgradient Wells: Ammonia
Former J.H. Baxter North Woodwaste Landfill
Arlington, Washington

Student's T-Test Formula: $$\frac{\bar{x} - m_0}{\sqrt{[(s^1/n) + (s^2/n)]}}$$

Critical Statistic: $t_c = 2.447$ $v = 6$
$t_c = 2.571$ $v = 5$
$t_c = 2.776$ $v = 4$
$t_c = 3.182$ $v = 3$
$t_c = 4.303$ $v = 2$
$t_c = 12.706$ $v = 1$

BXN-4 (Upgradient Well)				
Date	Ammonia Concentration[1]	Number of Samples (n)	Average Concentration (m_0)	Sample Variance (s^1)
11/17/2014	7.34	--	--	--
2/25/2015	8.40	--	--	--
9/14/2015	13.40	--	--	--
12/7/2015	0.03	4	7.29	30.449
2/29/2016	5.69	4	6.88	31.076
6/6/2016	6.25	4	6.34	30.051
9/26/2016	8.78	4	5.19	13.646
3/9/2017	6.08	4	6.70	1.978
6/11/2017	--	3	7.04	2.287
9/17/2017	9.30	3	8.05	2.988
12/14/2017	--	2	7.69	5.184
3/18/2018	3.8	2	6.55	15.125
6/16/2018	--	2	6.55	15.125
9/30/2018	7.1	2	5.45	5.445
11/18/2018	--	2	5.45	5.445

BXN-2 (Downgradient Well)						
Date	Ammonia Concentration[1]	Number of Samples (n)	Average Concentration ($\bar{x}$)	Sample Variance (s^2)	Sample Standard Deviation (s)	Student's T-Test Statistic (t)[2]
11/17/2014	0.025	--	--	--	--	--
2/25/2015	0.025	--	--	--	--	--
9/14/2015	0.03	--	--	--	--	--
12/7/2015	0.02	4	0.02	0.000	0.00	-2.63
2/29/2016	0.03	4	0.02	0.000	0.00	-2.46
6/6/2016	0.03	4	0.02	0.000	0.00	-2.30
9/26/2016	0.03	4	0.02	0.000	0.00	-2.79
3/9/2017	0.03	4	0.03	0.000	0.00	-9.49
6/11/2017	--	3	0.03	0.000	0.00	-8.03
9/17/2017	0.03	3	0.03	0.000	0.00	-8.04
12/14/2017	--	2	0.03	0.000	0.00	-4.76
3/18/2018	0.01	2	0.02	0.000	0.01	-2.38
6/16/2018	--	2	0.02	0.000	0.01	-2.38
9/30/2018	0.15	2	0.08	0.010	0.10	-3.25
11/18/2018	--	2	0.08	0.010	0.10	-3.25

Table C-1. Statistical Analysis of Groundwater Quality Results for Downgradient Wells: Ammonia
Former J.H. Baxter North Woodwaste Landfill
Arlington, Washington

BXN-1 (Downgradient Well)						
Date	**Ammonia Concentration[1]**	**Number of Samples (n)**	**Average Concentration ($\bar{x}$)**	**Sample Variance (s^2)**	**Sample Standard Deviation (s)**	**Student's T-Test Statistic (t)[2]**
11/17/2014	0.405	--	--	--	--	--
2/25/2015	0.262	--	--	--	--	--
9/14/2015	0.46	--	--	--	--	--
12/7/2015	0.025	4	0.29	0.038	0.19	-2.54
2/29/2016	0.264	4	0.25	0.032	0.18	-2.38
6/6/2016	0.084	4	0.21	0.039	0.20	-2.24
9/26/2016	0.454	4	0.21	0.038	0.19	-2.69
3/9/2017	0.11	4	0.23	0.029	0.17	-9.14
6/11/2017	0.13	4	0.19	0.030	0.17	-7.80
9/17/2017	2.27	4	0.74	1.064	1.03	-6.51
12/14/2017	0.556	4	0.77	1.047	1.02	-4.10
3/18/2018	0.4	4	0.84	0.941	0.97	-2.05
6/16/2018	0.18	4	0.85	0.918	0.96	-2.04
9/30/2018	0.68	4	0.45	0.046	0.22	-3.02
11/18/2018	0.58	4	0.46	0.048	0.22	-3.02

Table C-2. Statistical Analysis of Groundwater Quality Results for Downgradient Wells: Chloride
Former J.H. Baxter North Woodwaste Landfill
Arlington, Washington

Student's T-Test Formula: $\frac{\bar{x} - m_0}{\sqrt{[(s^1/n) + (s^2/n)]}}$

Critical Statistic: $t_c = 2.447$ $v = 6$
$t_c = 2.571$ $v = 5$
$t_c = 2.776$ $v = 4$
$t_c = 3.182$ $v = 3$
$t_c = 4.303$ $v = 2$
$t_c = 12.706$ $v = 1$

BXN-4 (Upgradient Well)				
Date	Chloride Concentration[1]	Number of Samples (n)	Average Concentration (m_0)	Sample Variance (s^1)
11/17/2014	17.60	--	--	--
2/25/2015	10.20	--	--	--
9/14/2015	51.70	--	--	--
12/7/2015	24.50	4	26.00	327.647
2/29/2016	6.52	4	23.23	420.386
6/6/2016	27.00	4	27.43	345.010
9/26/2016	37.80	4	23.96	168.411
3/9/2017	13.20	4	21.13	196.228
6/11/2017	--	3	26.00	152.040
9/17/2017	22.40	3	24.47	154.493
12/14/2017	--	2	17.80	42.320
3/18/2018	10.7	2	16.55	68.445
6/16/2018	--	2	16.55	68.445
9/30/2018	37.5	2	24.10	359.120
11/18/2018	--	2	24.10	359.120

BXN-2 (Downgradient Well)						
Date	Chloride Concentration[1]	Number of Samples (n)	Average Concentration ($\bar{x}$)	Sample Variance (s^2)	Sample Standard Deviation (s)	Student's T-Test Statistic $(t)^2$
11/17/2014	5.84	--	--	--	--	--
2/25/2015	9.10	--	--	--	--	--
9/14/2015	5.16	--	--	--	--	--
12/7/2015	3.54	4	5.91	5.453	2.34	-2.20
2/29/2016	7.97	4	6.44	6.488	2.55	-1.84
6/6/2016	6.27	4	5.74	3.477	1.86	-2.38
9/26/2016	7.05	4	6.21	3.645	1.91	-1.95
3/9/2017	7.32	4	7.15	0.495	0.70	-1.99
6/11/2017	--	3	6.88	0.297	0.55	-2.68
9/17/2017	5.47	3	6.61	0.999	1.00	-2.48
12/14/2017	--	2	6.40	1.711	1.31	-2.43
3/18/2018	4.8	2	5.14	0.224	0.47	-1.95
6/16/2018	--	2	5.14	0.224	0.47	-1.95
9/30/2018	5.1	2	4.95	0.045	0.21	-1.43
11/18/2018	--	2	4.95	0.045	0.21	-1.43

Table C-2. Statistical Analysis of Groundwater Quality Results for Downgradient Wells: Chloride
Former J.H. Baxter North Woodwaste Landfill
Arlington, Washington

BXN-1 (Downgradient Well)						
Date	**Chloride Concentration[1]**	**Number of Samples (n)**	**Average Concentration ($\bar{x}$)**	**Sample Variance (s^2)**	**Sample Standard Deviation (s)**	**Student's T-Test Statistic (t)[2]**
11/17/2014	36.50	--	--	--	--	--
2/25/2015	50.60	--	--	--	--	--
9/14/2015	15.40	--	--	--	--	--
12/7/2015	9.11	4	27.90	366.188	19.14	0.14
2/29/2016	6.54	4	20.41	418.868	20.47	-0.21
6/6/2016	6.29	4	9.34	17.973	4.24	-1.95
9/26/2016	9.97	4	7.98	3.389	1.84	-1.76
3/9/2017	9.55	4	8.09	3.769	1.94	-1.84
6/11/2017	5.75	4	7.89	4.741	2.18	-2.51
9/17/2017	3.25	4	7.13	10.294	3.21	-2.36
12/14/2017	26.2	4	11.19	106.876	10.34	-0.96
3/18/2018	2.3	4	9.38	127.931	11.31	-0.88
6/16/2018	7.8	4	9.88	124.069	11.14	-0.83
9/30/2018	10.5	4	11.69	105.165	10.25	-0.86
11/18/2018	38.7	4	14.82	265.123	16.28	-0.59

Table C-3. Statistical Analysis of Groundwater Quality Results for Downgradient Wells: Total Organic Carbon (TOC)

Former J.H. Baxter North Woodwaste Landfill

Arlington, Washington

Student's T-Test Formula: $\frac{\bar{x} - m_0}{\sqrt{[(s^1/n) + (s^2/n)]}}$

Critical Statistic: $t_c = 2.447$ $v = 6$; $t_c = 2.571$ $v = 5$; $t_c = 2.776$ $v = 4$; $t_c = 3.182$ $v = 3$; $t_c = 4.303$ $v = 2$; $t_c = 12.706$ $v = 1$

BXN-4 (Upgradient Well)				
Date	TOC Concentration[1]	Number of Samples (n)	Average Concentration (m_0)	Sample Variance (s^1)
11/17/2014	3.93	--	--	--
2/25/2015	3.71	--	--	--
9/14/2015	7.86	--	--	--
12/7/2015	4.93	4	5.11	3.649
2/29/2016	3.22	4	4.93	4.332
6/6/2016	7.96	4	5.99	5.391
9/26/2016	8.61	4	5.83	4.601
3/9/2017	4.10	4	6.01	5.506
6/11/2017	--	3	6.71	4.088
9/17/2017	6.18	3	6.30	5.095
12/14/2017	--	2	5.14	2.163
3/18/2018	5.20	2	5.69	0.480
6/16/2018	--	2	5.69	0.480
9/30/2018	4.30	2	4.75	0.405
11/18/2018	--	2	4.75	0.405

BXN-2 (Downgradient Well)						
Date	TOC Concentration[1]	Number of Samples (n)	Average Concentration ($\bar{x}$)	Sample Variance (s^2)	Sample Standard Deviation (s)	Student's T-Test Statistic (t)[2]
11/17/2014	1.48	--	--	--	--	--
2/25/2015	2.29	--	--	--	--	--
9/14/2015	1.70	--	--	--	--	--
12/7/2015	1.09	4	1.64	0.251	0.50	-3.51
2/29/2016	1.81	4	1.72	0.243	0.49	-3.00
6/6/2016	1.03	4	1.41	0.164	0.40	-3.89
9/26/2016	1.55	4	1.37	0.140	0.37	-4.10
3/9/2017	3.20	4	1.90	0.859	0.93	-3.26
6/11/2017	--	3	1.93	1.284	1.13	-3.58
9/17/2017	1.66	3	2.14	0.851	0.92	-2.95
12/14/2017	--	2	2.43	1.186	1.09	-2.09
3/18/2018	42	2	21.83	813.658	28.52	0.80
6/16/2018	--	2	21.83	813.658	28.52	0.80
9/30/2018	1.3	2	21.65	828.245	28.78	0.83
11/18/2018	--	2	21.65	828.245	28.78	0.83

Table C-3. Statistical Analysis of Groundwater Quality Results for Downgradient Wells: Total Organic Carbon (TOC)

Former J.H. Baxter North Woodwaste Landfill

Arlington, Washington

BXN-1 (Downgradient Well)						
Date	**TOC Concentration[1]**	**Number of Samples (n)**	**Average Concentration ($\bar{x}$)**	**Sample Variance (s^2)**	**Sample Standard Deviation (s)**	**Student's T-Test Statistic (t)[2]**
11/17/2014	5.21	--	--	--	--	--
2/25/2015	5.49	--	--	--	--	--
9/14/2015	4.10	--	--	--	--	--
12/7/2015	3.82	4	4.66	0.670	0.82	-0.44
2/29/2016	17.00	4	7.60	39.783	6.31	0.80
6/6/2016	3.20	4	7.03	44.320	6.66	0.29
9/26/2016	7.47	4	7.87	40.576	6.37	0.61
3/9/2017	5.02	4	8.17	37.694	6.14	0.66
6/11/2017	3.41	4	4.78	3.889	1.97	-1.27
9/17/2017	175.00	4	47.73	7202.31	84.87	0.98
12/14/2017	27.00	4	52.61	6773.54	82.30	1.15
3/18/2018	42	4	61.85	5942.23	77.09	1.46
6/16/2018	48	4	73.00	4702.00	68.57	1.96
9/30/2018	15	4	33.00	222.00	14.90	**3.79**
11/18/2018	6.9	4	27.98	403.40	20.08	2.31

Table C-4. Statistical Analysis of Groundwater Quality Results for Downgradient Wells: Chemical Oxygen Demand (COD)

Former J.H. Baxter North Woodwaste Landfill

Arlington, Washington

Student's T-Test Formula: $\frac{\bar{x} - m_0}{\sqrt{[(s^1/n) + (s^2/n)]}}$

Critical Statistic: $t_c = 2.447$ $v=6$; $t_c = 2.571$ $v=5$; $t_c = 2.776$ $v=4$; $t_c = 3.182$ $v=3$; $t_c = 4.303$ $v=2$; $t_c = 12.706$ $v=1$

BXN-4 (Upgradient Well)				
Date	COD Concentration[1]	Number of Samples (n)	Average Concentration (m_0)	Sample Variance (s^1)
11/17/2014	11.6	--	--	--
2/25/2015	10.8	--	--	--
9/14/2015	22.5	--	--	--
12/7/2015	16.0	4	15.23	28.749
2/29/2016	8.6	4	14.48	38.249
6/6/2016	24.8	4	17.98	52.949
9/26/2016	27.1	4	19.13	72.116
3/9/2017	3.3	4	15.95	138.897
6/11/2017	--	3	18.40	172.330
9/17/2017	16.5	3	15.63	142.173
12/14/2017	--	2	9.90	87.120
3/18/2018	10	2	13.25	21.125
6/16/2018	--	2	13.25	21.125
9/30/2018	16	2	13.00	18.000
11/18/2018	--	2	13.00	18.000

BXN-2 (Downgradient Well)						
Date	COD Concentration[1]	Number of Samples (n)	Average Concentration ($\bar{x}$)	Sample Variance (s^2)	Sample Standard Deviation (s)	Student's T-Test Statistic (t)[2]
11/17/2014	2.5	--	--	--	--	--
2/25/2015	7.9	--	--	--	--	--
9/14/2015	3.8	--	--	--	--	--
12/7/2015	5.8	4	5.00	5.580	2.36	-3.49
2/29/2016	3.2	4	5.83	4.203	2.05	-2.65
6/6/2016	2.5	4	4.80	2.000	1.41	-3.55
9/26/2016	4.7	4	4.05	2.203	1.48	-3.50
3/9/2017	5.0	4	3.85	1.430	1.20	-2.04
6/11/2017	--	3	4.07	1.863	1.37	-1.88
9/17/2017	4.1	3	4.60	0.210	0.46	-1.60
12/14/2017	--	2	4.55	0.405	0.64	-0.81
3/18/2018	10	2	7.05	17.405	4.17	-1.41
6/16/2018	--	2	7.05	17.405	4.17	-1.41
9/30/2018	10	2	10.00	0.000	0.00	-1.00
11/18/2018	--	2	10.00	0.000	0.00	-1.00

Table C-4. Statistical Analysis of Groundwater Quality Results for Downgradient Wells: Chemical Oxygen Demand (COD)

Former J.H. Baxter North Woodwaste Landfill

Arlington, Washington

BXN-1 (Downgradient Well)						
Date	**COD Concentration[1]**	**Number of Samples (n)**	**Average Concentration ($\bar{x}$)**	**Sample Variance (s^2)**	**Sample Standard Deviation (s)**	**Student's T-Test Statistic (t)[2]**
11/17/2014	19.7	--	--	--	--	--
2/25/2015	19.9	--	--	--	--	--
9/14/2015	18.7	--	--	--	--	--
12/7/2015	15.5	4	18.45	4.143	2.04	1.12
2/29/2016	62.4	4	29.13	495.549	22.26	1.27
6/6/2016	13.2	4	27.45	547.977	23.41	0.77
9/26/2016	29.7	4	30.20	514.060	22.67	0.91
3/9/2017	11.6	4	29.23	556.083	23.58	1.01
6/11/2017	4.8	4	14.83	111.603	10.56	-0.39
9/17/2017	964.0	4	252.53	225086.73	474.43	1.00
12/14/2017	38.0	4	254.60	223870.99	473.15	1.03
3/18/2018	76	4	270.70	214475.03	463.11	1.11
6/16/2018	46	4	281.00	207596.00	455.63	1.18
9/30/2018	49	4	52.25	272.25	16.50	**4.47**
11/18/2018	10	4	45.25	734.25	27.10	2.32

Table C-6. Statistical Analysis of Groundwater Quality Results for Downgradient Wells: Nitrate + Nitrite as Nitrogen

Former J.H. Baxter North Woodwaste Landfill

Arlington, Washington

Student's T-Test Formula: $$\frac{\bar{x} - m_0}{\sqrt{[(s^1/n) + (s^2/n)]}}$$

Critical Statistic:

$t_c = 2.447$	$v = 6$
$t_c = 2.571$	$v = 5$
$t_c = 2.776$	$v = 4$
$t_c = 3.182$	$v = 3$
$t_c = 4.303$	$v = 2$
$t_c = 12.706$	$v = 1$

BXN-4 (Upgradient Well)				
Date	$NO_3 + NO_2$ Concentration[1]	Number of Samples (n)	Average Concentration (m_0)	Sample Variance (s^1)
11/17/2014	8.36	--	--	--
2/25/2015	6.90	--	--	--
9/14/2015	12.30	--	--	--
12/7/2015	17.10	4	11.17	20.857
2/29/2016	3.62	4	9.98	35.338
6/6/2016	0.85	4	8.47	56.906
9/26/2016	10.30	4	7.97	52.796
3/9/2017	5.00	4	4.94	15.732
6/11/2017	--	3	5.38	22.431
9/17/2017	9.55	3	8.28	8.226
12/14/2017	--	2	7.28	10.351
3/18/2018	14	2	11.78	9.901
6/16/2018	--	2	11.78	9.901
9/30/2018	21	2	17.50	24.500
11/18/2018	--	2	17.50	24.500

BXN-2 (Downgradient Well)						
Date	$NO_3 + NO_2$ Concentration[1]	Number of Samples (n)	Average Concentration ($\bar{x}$)	Sample Variance (s^2)	Sample Standard Deviation (s)	Student's T-Test Statistic (t)[2]
11/17/2014	2.340	--	--	--	--	--
2/25/2015	0.617	--	--	--	--	--
9/14/2015	2.760	--	--	--	--	--
12/7/2015	1.970	4	1.92	0.861	0.93	-3.97
2/29/2016	1.160	4	1.63	0.880	0.94	-3.58
6/6/2016	1.470	4	1.84	0.488	0.70	-2.87
9/26/2016	1.860	4	1.62	0.138	0.37	-2.77
3/9/2017	0.650	4	1.29	0.261	0.51	-1.83
6/11/2017	--	3	1.33	0.381	0.62	-1.47
9/17/2017	2.020	3	1.51	0.561	0.75	-3.96
12/14/2017	--	2	1.34	0.938	0.97	-2.50
3/18/2018	1.8	2	1.91	0.024	0.16	-4.43
6/16/2018	--	2	1.91	0.024	0.16	-4.43
9/30/2018	2.4	2	2.10	0.180	0.42	-4.38
11/18/2018	--	2	2.10	0.180	0.42	-4.38

Table C-6. Statistical Analysis of Groundwater Quality Results for Downgradient Wells: Nitrate + Nitrite as Nitrogen

Former J.H. Baxter North Woodwaste Landfill

Arlington, Washington

BXN-1 (Downgradient Well)						
Date	$NO_3 + NO_2$ Concentration[1]	Number of Samples (n)	Average Concentration ($\bar{x}$)	Sample Variance (s^2)	Sample Standard Deviation (s)	Student's T-Test Statistic (t)[2]
11/17/2014	0.025	--	--	--	--	--
2/25/2015	0.025	--	--	--	--	--
9/14/2015	0.032	--	--	--	--	--
12/7/2015	0.050	4	0.03	0.000	0.01	-4.88
2/29/2016	0.050	4	0.04	0.000	0.01	-4.35
6/6/2016	0.050	4	0.05	0.000	0.01	-3.69
9/26/2016	0.034	4	0.05	0.000	0.01	-3.47
3/9/2017	0.045	4	0.04	0.000	0.01	-2.47
6/11/2017	0.050	4	0.04	0.000	0.01	-1.95
9/17/2017	0.096	4	0.06	0.001	0.03	-4.97
12/14/2017	0.005	4	0.05	0.001	0.04	-3.18
3/18/2018	0.058	4	0.05	0.001	0.04	-5.27
6/16/2018	0.005	4	0.04	0.002	0.04	-5.27
9/30/2018	0.005	4	0.02	0.001	0.03	-4.99
11/18/2018	0.005	4	0.02	0.001	0.03	-4.99

Table C-7. Statistical Analysis of Groundwater Quality Results for Downgradient Wells: Field pH
Former J.H. Baxter North Woodwaste Landfill
Arlington, Washington

Student's T-Test Formula: $\frac{\bar{x} - m_0}{\sqrt{[(s^1/n) + (s^2/n)]}}$

Critical Statistic: $t_c = 2.447$ $v = 6$
$t_c = 2.571$ $v = 5$
$t_c = 2.776$ $v = 4$
$t_c = 3.182$ $v = 3$
$t_c = 4.303$ $v = 2$
$t_c = 12.706$ $v = 1$

BXN-4 (Upgradient Well)				
Date	pH Concentration[1]	Number of Samples (n)	Average Concentration (m_0)	Sample Variance (s^1)
11/17/2014	6.41	--	--	--
2/25/2015	6.32	--	--	--
9/14/2015	6.39	--	--	--
12/7/2015	6.28	4	6.35	0.004
2/29/2016	6.45	4	6.36	0.006
6/6/2016	6.37	4	6.37	0.005
9/26/2016	6.42	4	6.38	0.006
3/9/2017	6.64	4	6.47	0.014
6/11/2017	--	3	6.48	0.021
9/17/2017	--	2	6.53	0.024
12/14/2017	--	1	6.64	#DIV/0!
3/18/2018	6.27	1	6.27	#DIV/0!
6/16/2018	--	1	6.27	#DIV/0!
9/30/2018	5.91	2	6.09	0.065
11/18/2018	--	2	6.09	0.065

BXN-2 (Downgradient Well)						
Date	pH Concentration[1]	Number of Samples (n)	Average Concentration ($\bar{x}$)	Sample Variance (s^2)	Sample Standard Deviation (s)	Student's T-Test Statistic (t)[2]
11/17/2014	6.78	--	--	--	--	--
2/25/2015	6.34	--	--	--	--	--
9/14/2015	6.62	--	--	--	--	--
12/7/2015	6.26	4	6.50	0.059	0.24	1.20
2/29/2016	6.71	4	6.48	0.047	0.22	1.09
6/6/2016	6.80	4	6.60	0.056	0.24	1.84
9/26/2016	6.64	4	6.60	0.056	0.24	1.82
3/9/2017	6.54	4	6.67	0.012	0.11	**2.51**
6/11/2017	--	3	6.66	0.017	0.13	1.63
9/17/2017	--	2	6.59	0.005	0.07	0.50
12/14/2017	--	1	6.54	#DIV/0!	#DIV/0!	*
3/18/2018	6.52	1	6.52	#DIV/0!	#DIV/0!	*
6/16/2018	--	1	6.52	#DIV/0!	#DIV/0!	*
9/30/2018	6.01	2	6.27	0.130	0.36	0.56
11/18/2018	--	2	6.27	0.130	0.36	0.56

Table C-7. Statistical Analysis of Groundwater Quality Results for Downgradient Wells: Field pH
Former J.H. Baxter North Woodwaste Landfill
Arlington, Washington

BXN-1 (Downgradient Well)						
Date	pH Concentration[1]	Number of Samples (n)	Average Concentration ($\bar{x}$)	Sample Variance (s^2)	Sample Standard Deviation (s)	Student's T-Test Statistic (t)[2]
11/17/2014	6.36	--	--	--	--	--
2/25/2015	6.26	--	--	--	--	--
9/14/2015	6.16	--	--	--	--	--
12/7/2015	6.12	4	6.23	0.012	0.11	-2.03
2/29/2016	6.29	4	6.21	0.006	0.08	-3.03
6/6/2016	6.64	4	6.30	0.056	0.24	-0.57
9/26/2016	6.53	4	6.40	0.055	0.23	0.12
3/9/2017	6.49	4	6.49	0.021	0.15	0.19
6/11/2017	6.49	4	6.54	0.005	0.07	0.67
9/17/2017	--	3	6.50	0.001	0.02	-0.24
12/14/2017	6.46	3	6.48	0.000	0.02	*
3/18/2018	6.43	4	6.46	0.001	0.03	*
6/16/2018	6.46	4	6.45	0.000	0.02	*
9/30/2018	6.00	4	6.34	0.051	0.23	1.17
11/18/2018	6.48	4	6.34	0.053	0.23	1.18

Table C-8. Statistical Analysis of Groundwater Quality Results for Downgradient Wells: Total Dissolved Solids (TDS)
Former J.H. Baxter North Woodwaste Landfill
Arlington, Washington

Student's T-Test Formula: $$\frac{\bar{x} - m_0}{\sqrt{[(s^1/n) + (s^2/n)]}}$$

Critical Statistic: $t_c = 2.447$ $v = 6$
$t_c = 2.571$ $v = 5$
$t_c = 2.776$ $v = 4$
$t_c = 3.182$ $v = 3$
$t_c = 4.303$ $v = 2$

BXN-4 (Upgradient Well)				
Date	**TDS Concentration[1]**	**Number of Samples (n)**	**Average Concentration (m_0)**	**Sample Variance (s^1)**
9/29/2014	8530	--	--	--
2/25/2015	352	--	--	--
9/14/2015	485	--	--	--
12/7/2015	470	4	2459.25	16383095.583
2/29/2016	275	4	395.50	9991.000
6/6/2016	314	4	386.00	11454.000
9/26/2016	432	4	372.75	8658.250
3/9/2017	--	3	340.33	6682.333
6/11/2017	--	2	373.00	6962.000
9/17/2017	377.5	2	404.75	1485.125
12/14/2017	--	1	377.50	#DIV/0!
3/18/2018	200	2	288.75	15753.125
6/16/2018	--	2	288.75	15753.125
9/30/2018	280	2	240.00	3200.000
11/18/2018	--	2	240.00	3200.000

BXN-2 (Downgradient Well)						
Date	**TDS Concentration[1]**	**Number of Samples (n)**	**Average Concentration ($\bar{x}$)**	**Sample Variance (s^2)**	**Sample Standard Deviation (s)**	**Student's T-Test Statistic (t)[2]**
9/29/2014	268	--	--	--	--	--
2/25/2015	224	--	--	--	--	--
9/14/2015	139	--	--	--	--	--
12/7/2015	144	4	193.75	3966.917	62.98	-38.35
2/29/2016	207	4	178.50	1877.667	43.33	-3.98
6/6/2016	181	4	167.75	1035.583	32.18	-4.16
9/26/2016	195	4	181.75	746.250	27.32	-3.69
3/9/2017	--	3	194.33	169.333	13.01	-3.06
6/11/2017	--	2	188.00	98.000	9.90	-3.11
9/17/2017	178	2	186.50	144.500	12.02	-7.65
12/14/2017	--	1	178.00	#DIV/0!	#DIV/0!	*
3/18/2018	480	2	329.00	45602.000	213.55	0.23
6/16/2018	--	2	329.00	45602.000	213.55	0.23
9/30/2018	450	2	465.00	450.000	21.21	**5.27**
11/18/2018	--	2	465.00	450.000	21.21	**5.27**

Table C-8. Statistical Analysis of Groundwater Quality Results for Downgradient Wells: Total Dissolved Solids (TDS)
Former J.H. Baxter North Woodwaste Landfill
Arlington, Washington

BXN-1 (Downgradient Well)						
Date	**TDS Concentration[1]**	**Number of Samples (n)**	**Average Concentration ($\bar{x}$)**	**Sample Variance (s^2)**	**Sample Standard Deviation (s)**	**Student's T-Test Statistic (t)[2]**
9/29/2014	372	--	--	--	--	--
2/25/2015	338	--	--	--	--	--
9/14/2015	322	--	--	--	--	--
12/7/2015	255	4	321.75	2414.917	49.14	-38.38
2/29/2016	332	4	311.75	1474.917	38.40	-1.56
6/6/2016	186	4	273.75	4590.917	67.76	-1.86
9/26/2016	336	4	277.25	5090.250	71.35	-1.56
3/9/2017	--	3	284.67	7305.333	85.47	-0.82
6/11/2017	252	3	258.00	5652.000	75.18	-1.57
9/17/2017	175	3	254.33	6484.333	80.53	-2.79
12/14/2017	470	3	299.00	23413.000	153.01	*
3/18/2018	390	4	321.75	17678.917	132.96	0.30
6/16/2018	260	4	323.75	17322.917	131.62	0.32
9/30/2018	460	4	395.00	9366.667	96.78	1.53
11/18/2018	460	4	392.50	8891.667	94.30	1.52

Table C-9. Statistical Analysis of Groundwater Quality Results for Downgradient Wells: Sulfate
Former J.H. Baxter North Woodwaste Landfill
Arlington, Washington

Student's T-Test Formula: $$\frac{\bar{x} - m_0}{\sqrt{[(s^1/n) + (s^2/n)]}}$$

Critical Statistic: $t_c = 2.447$ $v = 6$
$t_c = 2.571$ $v = 5$
$t_c = 2.776$ $v = 4$
$t_c = 3.182$ $v = 3$
$t_c = 4.303$ $v = 2$
$t_c = 12.706$ $v = 1$

BXN-4 (Upgradient Well)				
Date	Sulfate Concentration[1]	Number of Samples (n)	Average Concentration (m_0)	Sample Variance (s^1)
11/17/2014	33.00	--	--	--
2/25/2015	37.40	--	--	--
9/14/2015	42.50	--	--	--
12/7/2015	33.40	4	36.58	19.549
2/29/2016	57.40	4	42.68	110.236
6/6/2016	41.70	4	43.75	99.737
9/26/2016	34.50	4	41.75	122.403
3/9/2017	6.08	4	34.92	461.080
6/11/2017	--	3	27.43	354.720
9/17/2017	9.43	3	16.67	241.237
12/14/2017	--	2	7.76	5.611
3/18/2018	67.1	2	38.27	1662.914
6/16/2018	--	2	38.27	1662.914
9/30/2018	46.9	2	57.00	204.020
11/18/2018	--	2	57.00	204.020

BXN-2 (Downgradient Well)						
Date	Sulfate Concentration[1]	Number of Samples (n)	Average Concentration ($\bar{x}$)	Sample Variance (s^2)	Sample Standard Deviation (s)	Student's T-Test Statistic $(t)^2$
11/17/2014	19.20	--	--	--	--	--
2/25/2015	14.70	--	--	--	--	--
9/14/2015	20.30	--	--	--	--	--
12/7/2015	16.90	4	17.78	6.209	2.49	-7.41
2/29/2016	18.00	4	17.48	5.429	2.33	-10.08
6/6/2016	21.20	4	19.10	3.967	1.99	-10.17
9/26/2016	16.50	4	18.15	4.537	2.13	-9.62
3/9/2017	12.40	4	17.03	13.349	3.65	-1.64
6/11/2017	--	3	16.70	19.390	4.40	-0.96
9/17/2017	19.60	3	16.17	13.043	3.61	-0.05
12/14/2017	--	2	16.00	25.920	5.09	2.08
3/18/2018	15.2	2	17.40	9.680	3.11	-0.72
6/16/2018	--	2	17.40	9.680	3.11	-0.72
9/30/2018	19.3	2	17.25	8.405	2.90	-3.86
11/18/2018	--	2	17.25	8.405	2.90	-3.86

Table C-9. Statistical Analysis of Groundwater Quality Results for Downgradient Wells: Sulfate
Former J.H. Baxter North Woodwaste Landfill
Arlington, Washington

BXN-1 (Downgradient Well)						
Date	**Sulfate Concentration[1]**	**Number of Samples (n)**	**Average Concentration ($\bar{x}$)**	**Sample Variance (s^2)**	**Sample Standard Deviation (s)**	**Student's T-Test Statistic (t)[2]**
11/17/2014	14.40	--	--	--	--	--
2/25/2015	11.10	--	--	--	--	--
9/14/2015	10.20	--	--	--	--	--
12/7/2015	10.90	4	11.65	3.510	1.87	-10.38
2/29/2016	5.16	4	9.34	7.914	2.81	-12.72
6/6/2016	10.30	4	9.14	7.136	2.67	-13.40
9/26/2016	11.80	4	9.54	8.906	2.98	-12.08
3/9/2017	8.90	4	9.04	8.093	2.84	-2.39
6/11/2017	7.30	4	9.58	3.703	1.92	-1.64
9/17/2017	2.97	4	7.74	13.592	3.69	-0.98
12/14/2017	10.50	4	7.42	10.498	3.24	-0.14
3/18/2018	3.4	4	6.04	12.625	3.55	-1.12
6/16/2018	13.9	4	7.69	29.048	5.39	-1.06
9/30/2018	4.5	4	8.08	24.816	4.98	-4.70
11/18/2018	5.7	4	6.88	22.816	4.78	-4.83

Table C-10. Statistical Analysis of Groundwater Quality Results for Downgradient Wells: Tannin and Lignin
Former J.H. Baxter North Woodwaste Landfill
Arlington, Washington

Student's T-Test Formula: $$\frac{\bar{x} - m_0}{\sqrt{[(s^1/n) + (s^2/n)]}}$$

Critical Statistic: $t_c = 2.447$ $v = 6$
$t_c = 2.571$ $v = 5$
$t_c = 2.776$ $v = 4$
$t_c = 3.182$ $v = 3$
$t_c = 4.303$ $v = 2$
$t_c = 12.706$ $v = 1$

BXN-4 (Upgradient Well)				
Date	Tannin + Lignin Concentration[1]	Number of Samples (n)	Average Concentration (m_0)	Sample Variance (s^1)
11/17/2014	1.38	--	--	--
2/25/2015	1.22	--	--	--
9/14/2015	1.77	--	--	--
12/7/2015	1.33	4	1.43	0.057
2/29/2016	0.54	4	1.22	0.259
6/6/2016	0.71	4	1.09	0.322
9/26/2016	1.53	4	1.03	0.227
3/9/2017	0.98	4	0.94	0.188
6/11/2017	--	3	1.07	0.175
9/17/2017	1.17	3	1.23	0.078
12/14/2017	--	2	1.08	0.018
3/18/2018	0.74	2	0.96	0.092
6/16/2018	--	2	0.96	0.092
9/30/2018	0.83	2	0.79	0.004
11/18/2018	--	2	0.79	0.004

BXN-2 (Downgradient Well)						
Date	Tannin + Lignin Concentration[1]	Number of Samples (n)	Average Concentration ($\bar{x}$)	Sample Variance (s^2)	Sample Standard Deviation (s)	Student's T-Test Statistic $(t)^2$
11/17/2014	0.56	--	--	--	--	--
2/25/2015	1.10	--	--	--	--	--
9/14/2015	0.51	--	--	--	--	--
12/7/2015	0.47	4	0.66	0.087	0.30	-4.02
2/29/2016	0.77	4	0.71	0.084	0.29	-1.72
6/6/2016	0.51	4	0.57	0.019	0.14	-1.79
9/26/2016	0.66	4	0.60	0.019	0.14	-1.71
3/9/2017	1.19	4	0.78	0.085	0.29	-0.60
6/11/2017	--	3	0.79	0.128	0.36	-0.90
9/17/2017	0.81	3	0.89	0.075	0.27	-1.51
12/14/2017	--	2	1.00	0.072	0.27	-0.35
3/18/2018	0.67	2	0.74	0.010	0.10	-0.95
6/16/2018	--	2	0.74	0.010	0.10	-0.95
9/30/2018	0.67	2	0.67	0.000	0.00	-2.56
11/18/2018	--	2	0.67	0.000	0.00	-2.56

Table C-10. Statistical Analysis of Groundwater Quality Results for Downgradient Wells: Tannin and Lignin
Former J.H. Baxter North Woodwaste Landfill
Arlington, Washington

BXN-1 (Downgradient Well)						
Date	**Tannin + Lignin Concentration[1]**	**Number of Samples (n)**	**Average Concentration ($\bar{x}$)**	**Sample Variance (s^2)**	**Sample Standard Deviation (s)**	**Student's T-Test Statistic (t)[2]**
11/17/2014	11.40	--	--	--	--	--
2/25/2015	4.81	--	--	--	--	--
9/14/2015	1.76	--	--	--	--	--
12/7/2015	1.31	4	4.82	21.660	4.65	1.46
2/29/2016	3.78	4	2.92	2.750	1.66	1.96
6/6/2016	0.52	4	1.84	1.931	1.39	1.01
9/26/2016	2	4	1.90	1.932	1.39	1.19
3/9/2017	10.2	4	4.13	18.179	4.26	1.49
6/11/2017	6.4	4	4.78	19.292	4.39	1.68
9/17/2017	1.88	4	5.12	15.892	3.99	1.95
12/14/2017	28	4	11.62	130.812	11.44	1.84
3/18/2018	4.6	4	10.22	143.954	12.00	1.54
6/16/2018	0.92	4	8.85	165.417	12.86	1.23
9/30/2018	68	4	25.38	951.143	30.84	1.59
11/18/2018	25	4	24.63	948.153	30.79	1.55

Table C-11. Statistical Analysis of Groundwater Quality Results for Downgradient Wells: Arsenic
Former J.H. Baxter North Woodwaste Landfill
Arlington, Washington

Student's T-Test Formula: $\frac{\bar{x} - m_0}{\sqrt{[(s^1/n) + (s^2/n)]}}$

Critical Statistic: $t_c = 2.447$ $v = 6$
$t_c = 2.571$ $v = 5$
$t_c = 2.776$ $v = 4$
$t_c = 3.182$ $v = 3$
$t_c = 4.303$ $v = 2$
$t_c = 12.706$ $v = 1$

BXN-4 (Upgradient Well)				
Date	Arsenic Concentration[1]	Number of Samples (n)	Average Concentration (m_0)	Sample Variance (s^1)
11/17/2014	0.30	--	--	--
2/25/2015	0.42	--	--	--
9/14/2015	0.40	--	--	--
12/7/2015	0.35	4	0.37	0.003
2/29/2016	0.35	4	0.38	0.001
6/6/2016	0.60	4	0.43	0.014
9/26/2016	0.40	4	0.43	0.014
3/9/2017	10.50	4	2.96	25.262
6/11/2017	--	3	3.83	33.343
9/17/2017	5.50	3	5.47	25.503
12/14/2017	--	2	8.00	12.500
3/18/2018	5	2	5.25	0.125
6/16/2018	--	2	5.25	0.125
9/30/2018	5	2	5.00	0.000
11/18/2018	--	2	5.00	0.000

BXN-2 (Downgradient Well)						
Date	Arsenic Concentration[1]	Number of Samples (n)	Average Concentration ($\bar{x}$)	Sample Variance (s^2)	Sample Standard Deviation (s)	Student's T-Test Statistic (t)[2]
11/17/2014	0.20	--	--	--	--	--
2/25/2015	0.21	--	--	--	--	--
9/14/2015	0.30	--	--	--	--	--
12/7/2015	0.22	4	0.23	0.002	0.05	-3.82
2/29/2016	0.27	4	0.25	0.002	0.04	-4.70
6/6/2016	0.20	4	0.25	0.002	0.05	-2.78
9/26/2016	0.25	4	0.24	0.001	0.03	-3.09
3/9/2017	10.50	4	2.81	26.318	5.13	-0.04
6/11/2017	--	3	3.65	35.193	5.93	-0.04
9/17/2017	5.50	3	5.42	26.271	5.13	-0.01
12/14/2017	--	2	8.00	12.500	3.54	0.00
3/18/2018	5	2	5.25	0.125	0.35	0.00
6/16/2018	--	2	5.25	0.125	0.35	0.00
9/30/2018	5	2	5.00	0.000	0.00	*
11/18/2018	--	2	5.00	0.000	0.00	*

Table C-11. Statistical Analysis of Groundwater Quality Results for Downgradient Wells: Arsenic
Former J.H. Baxter North Woodwaste Landfill
Arlington, Washington

BXN-1 (Downgradient Well)						
Date	**Arsenic Concentration[1]**	**Number of Samples (n)**	**Average Concentration ($\bar{x}$)**	**Sample Variance (s^2)**	**Sample Standard Deviation (s)**	**Student's T-Test Statistic (t)[2]**
11/17/2014	24.00	--	--	--	--	--
2/25/2015	23.20	--	--	--	--	--
9/14/2015	38.70	--	--	--	--	--
12/7/2015	22.50	4	27.10	60.180	7.76	**6.89**
2/29/2016	28.20	4	28.15	55.910	7.48	**7.43**
6/6/2016	16.60	4	26.50	88.580	9.41	**5.54**
9/26/2016	12.60	4	19.98	46.603	6.83	**5.73**
3/9/2017	14.50	4	17.98	49.136	7.01	**3.48**
6/11/2017	17.00	4	15.18	4.149	2.04	**3.25**
9/17/2017	5.50	4	12.40	24.407	4.94	1.81
12/14/2017	47.00	4	21.00	324.833	18.02	1.39
3/18/2018	31.0	4	25.13	321.396	17.93	2.22
6/16/2018	21.0	4	26.13	303.729	17.43	2.39
9/30/2018	31.0	4	32.50	115.667	10.75	**5.11**
11/18/2018	14.0	4	24.25	68.917	8.30	**4.64**

Table C-12. Statistical Analysis of Groundwater Quality Results for Downgradient Wells: Barium
Former J.H. Baxter North Woodwaste Landfill
Arlington, Washington

Student's T-Test Formula: $\frac{\bar{x} - m_0}{\sqrt{[(s^1/n) + (s^2/n)]}}$

Critical Statistic: $t_c = 2.447$ $v = 6$
$t_c = 2.571$ $v = 5$
$t_c = 2.776$ $v = 4$
$t_c = 3.182$ $v = 3$
$t_c = 4.303$ $v = 2$
$t_c = 12.706$ $v = 1$

BXN-4 (Upgradient Well)				
Date	Barium Concentration[1]	Number of Samples (n)	Average Concentration (m_0)	Sample Variance (s^1)
11/17/2014	124.0	--	--	--
2/25/2015	125.0	--	--	--
9/14/2015	168.0	--	--	--
12/7/2015	182.0	4	149.75	882.917
2/29/2016	102.0	4	144.25	1381.583
6/6/2016	113.0	4	141.25	1571.583
9/26/2016	163.0	4	140.00	1488.667
3/9/2017	111.00	4	122.25	760.917
6/11/2017	--	3	129.00	868.000
9/17/2017	133.00	3	135.67	681.333
12/14/2017	--	2	122.00	242.000
3/18/2018	163	2	148.00	450.000
6/16/2018	--	2	148.00	450.000
9/30/2018	168	2	165.50	12.500
11/18/2018	--	2	165.50	12.500

BXN-2 (Downgradient Well)						
Date	Barium Concentration[1]	Number of Samples (n)	Average Concentration ($\bar{x}$)	Sample Variance (s^2)	Sample Standard Deviation (s)	Student's T-Test Statistic (t)[2]
11/17/2014	9.3	--	--	--	--	--
2/25/2015	14.4	--	--	--	--	--
9/14/2015	8.8	--	--	--	--	--
12/7/2015	7.9	4	10.10	8.553	2.92	-9.35
2/29/2016	12.5	4	10.90	9.407	3.07	-8.93
6/6/2016	10.5	4	9.93	4.109	2.03	-8.82
9/26/2016	0.6	4	7.88	27.069	5.20	-8.76
3/9/2017	16.6	4	10.05	46.137	6.79	-7.90
6/11/2017	--	3	9.23	65.203	8.07	-6.79
9/17/2017	10.9	3	9.37	65.763	8.11	-8.00
12/14/2017	--	2	13.75	16.245	4.03	-9.53
3/18/2018	6.5	2	8.70	9.680	3.11	-9.19
6/16/2018	--	2	8.70	9.680	3.11	-9.19
9/30/2018	7.4	2	6.95	0.405	0.64	-62.42
11/18/2018	--	2	6.95	0.405	0.64	-62.42

Table C-12. Statistical Analysis of Groundwater Quality Results for Downgradient Wells: Barium
Former J.H. Baxter North Woodwaste Landfill
Arlington, Washington

BXN-1 (Downgradient Well)						
Date	**Barium Concentration[1]**	**Number of Samples (n)**	**Average Concentration ($\bar{x}$)**	**Sample Variance (s^2)**	**Sample Standard Deviation (s)**	**Student's T-Test Statistic (t)[2]**
11/17/2014	92.8	--	--	--	--	--
2/25/2015	68.3	--	--	--	--	--
9/14/2015	95.5	--	--	--	--	--
12/7/2015	55.3	4	77.98	378.222	19.45	-4.04
2/29/2016	84.9	4	76.00	315.747	17.77	-3.94
6/6/2016	30.0	4	66.43	879.076	29.65	-3.57
9/26/2016	70.0	4	60.05	547.363	23.40	-4.23
3/9/2017	49.6	4	58.63	573.536	23.95	-3.48
6/11/2017	48.0	4	49.40	267.573	16.36	-4.22
9/17/2017	64.8	4	58.10	120.253	10.97	-4.84
12/14/2017	127.0	4	72.35	1384.703	37.21	-2.30
3/18/2018	107	4	86.70	1337.827	36.58	-2.59
6/16/2018	70.9	4	92.43	878.109	29.63	-2.64
9/30/2018	146	4	112.73	1031.036	32.11	-3.25
11/18/2018	124.5	4	112.10	1008.807	31.76	-3.32

Table C-14. Statistical Analysis of Groundwater Quality Results for Downgradient Wells: Iron
Former J.H. Baxter North Woodwaste Landfill
Arlington, Washington

Student's T-Test Formula: $$\frac{\bar{x} - m_0}{\sqrt{[(s^1/n) + (s^2/n)]}}$$

Critical Statistic: $t_c = 2.447$ $v = 6$
$t_c = 2.571$ $v = 5$
$t_c = 2.776$ $v = 4$
$t_c = 3.182$ $v = 3$
$t_c = 4.303$ $v = 2$
$t_c = 12.706$ $v = 1$

BXN-4 (Upgradient Well)				
Date	Iron Concentration[1]	Number of Samples (n)	Average Concentration (m_0)	Sample Variance (s^1)
11/17/2014	66.5	--	--	--
2/25/2015	27.0	--	--	--
9/14/2015	23.2	--	--	--
12/7/2015	16.0	4	33.18	514.39
2/29/2016	10.0	4	19.05	57.21
6/6/2016	18.1	4	16.83	29.84
9/26/2016	10.0	4	13.53	17.30
3/9/2017	1270.0	4	327.03	395215.40
6/11/2017	--	3	432.70	525819.87
9/17/2017	51.0	3	443.67	512540.33
12/14/2017	--	2	660.50	742980.50
3/18/2018	71	2	61.00	200.00
6/16/2018	--	2	61.00	200.00
9/30/2018	5	2	38.00	2178.00
11/18/2018	--	2	38.00	2178.00

BXN-2 (Downgradient Well)						
Date	Iron Concentration[1]	Number of Samples (n)	Average Concentration ($\bar{x}$)	Sample Variance (s^2)	Sample Standard Deviation (s)	Student's T-Test Statistic $(t)^2$
11/17/2014	10.0	--	--	--	--	--
2/25/2015	2.0	--	--	--	--	--
9/14/2015	2.0	--	--	--	--	--
12/7/2015	5.0	4	4.75	14.250	3.77	-2.47
2/29/2016	10.0	4	4.75	14.250	3.77	-1.24
6/6/2016	3.0	4	5.00	12.667	3.56	-1.03
9/26/2016	10.0	4	7.00	12.667	3.56	-0.57
3/9/2017	4.0	4	6.75	14.250	3.77	-1.02
6/11/2017	--	3	5.67	14.333	3.79	-1.02
9/17/2017	10.5	3	8.17	13.083	3.62	-1.05
12/14/2017	--	2	7.25	21.125	4.60	-1.07
3/18/2018	10	2	10.25	0.125	0.35	-5.07
6/16/2018	--	2	10.25	0.125	0.35	-5.07
9/30/2018	5	2	7.50	12.500	3.54	-0.92
11/18/2018	--	2	7.50	12.500	3.54	-0.92

Table C-14. Statistical Analysis of Groundwater Quality Results for Downgradient Wells: Iron
Former J.H. Baxter North Woodwaste Landfill
Arlington, Washington

BXN-1 (Downgradient Well)						
Date	**Iron Concentration[1]**	**Number of Samples (n)**	**Average Concentration ($\bar{x}$)**	**Sample Variance (s^2)**	**Sample Standard Deviation (s)**	**Student's T-Test Statistic (t)[2]**
11/17/2014	39,900	--	--	--	--	--
2/25/2015	28,600	--	--	--	--	--
9/14/2015	40,000	--	--	--	--	--
12/7/2015	28,100	4	34,150	44,896,667	6700.50	**10.18**
2/29/2016	35,600	4	33,075	33,035,833	5747.68	**11.50**
6/6/2016	11,800	4	28,875	153,715,833	12398.22	**4.66**
9/26/2016	26,000	4	25,375	98,882,500	9943.97	**5.10**
3/9/2017	23,900	4	24,325	95,662,500	9780.72	**4.90**
6/11/2017	24,900	4	21,650	43,856,667	6622.44	**6.36**
9/17/2017	951	4	18,938	144,523,634	12021.80	**3.07**
12/14/2017	52,200	4	25,488	439,487,600	20963.96	2.36
3/18/2018	63,800	4	35,463	795,255,950	28200.28	2.51
6/16/2018	34,700	4	37,913	750,255,984	27390.80	2.76
9/30/2018	67,600	4	54,575	218,469,167	14780.70	**7.38**
11/18/2018	56,500	4	55,650	216,283,333	14706.57	**7.56**

Table C-15. Statistical Analysis of Groundwater Quality Results for Downgradient Wells: Manganese
Former J.H. Baxter North Woodwaste Landfill
Arlington, Washington

Student's T-Test Formula: $\frac{\bar{x} - m_0}{\sqrt{[(s^1/n) + (s^2/n)]}}$

Critical Statistic: $t_c = 2.447$ $v = 6$
$t_c = 2.571$ $v = 5$
$t_c = 2.776$ $v = 4$
$t_c = 3.182$ $v = 3$
$t_c = 4.303$ $v = 2$
$t_c = 12.706$ $v = 1$

BXN-4 (Upgradient Well)				
Date	**Manganese Concentration[1]**	**Number of Samples (n)**	**Average Concentration (m_0)**	**Sample Variance (s^1)**
11/17/2014	2,330	--	--	--
2/25/2015	2,040	--	--	--
9/14/2015	3,550	--	--	--
12/7/2015	3,270	4	2,798	527,292
2/29/2016	1,560	4	2,605	915,500
6/6/2016	1,440	4	2,455	1,231,500
9/26/2016	3,180	4	2,363	995,625
3/9/2017	1,960	4	2,035	632,100
6/11/2017	--	3	2,193	797,733
9/17/2017	2,440	3	2,527	377,733
12/14/2017	--	2	2,200	115,200
3/18/2018	1,280	2	1,860	672,800
6/16/2018	--	2	1,860	672,800
9/30/2018	2,366	2	1,823	589,698
11/18/2018	--	2	1,823	589,698

BXN-2 (Downgradient Well)						
Date	**Manganese Concentration[1]**	**Number of Samples (n)**	**Average Concentration ($\bar{x}$)**	**Sample Variance (s^2)**	**Sample Standard Deviation (s)**	**Student's T-Test Statistic $(t)^2$**
11/17/2014	2,220	--	--	--	--	--
2/25/2015	4,020	--	--	--	--	--
9/14/2015	2,240	--	--	--	--	--
12/7/2015	1,920	4	2,600	917,600	957.91	-0.33
2/29/2016	3,620	4	2,950	1,052,933	1026.13	0.49
6/6/2016	2,970	4	2,688	579,558	761.29	0.35
9/26/2016	7	4	2,129	2,491,884	1578.57	-0.25
3/9/2017	5,350	4	2,987	4,954,453	2225.86	0.81
6/11/2017	--	3	2,776	7,164,406	2676.64	0.36
9/17/2017	3,360	3	2,906	7,290,857	2700.16	0.24
12/14/2017	--	2	4,355	1,980,050	1407.14	2.11
3/18/2018	2,790	2	3,075	162,450	403.05	1.88
6/16/2018	--	2	3,075	162,450	403.05	1.88
9/30/2018	2,748	2	2,769	882	29.70	1.74
11/18/2018	--	2	2,769	882	29.70	1.74

Table C-15. Statistical Analysis of Groundwater Quality Results for Downgradient Wells: Manganese
Former J.H. Baxter North Woodwaste Landfill
Arlington, Washington

BXN-1 (Downgradient Well)						
Date	**Manganese Concentration[1]**	**Number of Samples (n)**	**Average Concentration ($\bar{x}$)**	**Sample Variance (s^2)**	**Sample Standard Deviation (s)**	**Student's T-Test Statistic (t)[2]**
11/17/2014	3,930	--	--	--	--	--
2/25/2015	3,410	--	--	--	--	--
9/14/2015	5,190	--	--	--	--	--
12/7/2015	4,890	4	4,355	685,700	828.07	**2.83**
2/29/2016	6,250	4	4,935	1,373,967	1172.16	**3.08**
6/6/2016	2,360	4	4,673	2,717,092	1648.36	2.23
9/26/2016	4,890	4	4,598	2,636,092	1623.60	2.35
3/9/2017	4,050	4	4,388	2,648,692	1627.48	**2.60**
6/11/2017	3,750	4	3,763	1,107,025	1052.15	2.13
9/17/2017	3,120	4	3,953	540,825	735.41	**2.79**
12/14/2017	4,940	4	3,965	572,700	756.77	**3.94**
3/18/2018	5,020	4	4,208	862,892	928.92	**3.16**
6/16/2018	4,073	4	4,288	790,459	889.08	**3.32**
9/30/2018	7,422	4	5,364	2,066,719	1437.61	**3.93**
11/18/2018	5,944	4	5,615	2,035,093	1426.57	**4.23**

References

California Regional Water Quality Control Board – Los Angeles Region (SWRCB) 1999. Domenico Spreadsheet Analytical Model Manual. December 1.

EPA 2007. *Monitored Natural Attenuation of Inorganic Contaminants in Groundwater: Volume 2*. EPA/600/R-07/140. Pg. 57-70. October.

United States Environmental Protection Agency (EPA) 1996. Soil screening guidance: technical background document E-25pp EPA/540/R-95/128, PB96-963502.

USGS 2006. "Redox conditions in Contaminated Ground Water". Scientific Investigations Report 2006-5056.

Appendix D

Arsenic Transport Model and Calculations (Source: GSI Water Solutions, Inc.)

Arsenic Transport Model and Calculations

Naturally occurring arsenic can become mobilized in landfill groundwater interactions due enhanced microbial activity around disposed organic material. Arsenic is used in some wood preservation applications and can become a source of arsenic leaching from treated waste materials, however, the woodwaste disposed at J.H. Baxter's North and South Landfill consists of almost entirely of wood shavings and some intermixed bark. The woodwaste in turn provides organic content which can fuel microbial induced anaerobic groundwater conditions. The observation of low pH, negative oxidation reduction potential (ORP), low dissolved oxygen content, and diminishing concentrations of sulfate across the Site indicate the occurrence of these reduced conditions (USGS, 2006). Consequently, arsenic bearing minerals such as orpiment (arsenic sulfide) or arsenic rich pyrite (iron sulfides) can become unstable, allowing the dissolution or desorption of previously immobile arsenic (EPA, 2007). High concentrations of dissolved iron and manganese in the downgradient well (BXN-1) suggest that the process of mineral desorption may be occurring within the Site.

As the reduced site groundwater blends with the more aerobic and oxidative background aquifer it is expected that downgradient groundwater rapidly returns to aerobic conditions. A multitude of complexing and precipitation processes can occur in oxic groundwater conditions to reduce arsenic mobility. Additional groundwater water quality data was taken from United States Geologic Survey (USGS) monitored wells in the proximity to landfill to better determine background aquifer conditions (Figure D-1). The water quality data found (Table D-1) indicates that reduced site groundwater will mix with a generally higher pH and oxygenated background aquifer (high dissolved oxygen generally associated with positive oxidation potential values). These oxidizing conditions, in turn, induce more rapid sorption and precipitation of arsenic. Figure D-2 below demonstrates the mineral solubility of some common arsenic bearing minerals (pyrite and goethite) and their sorbing characteristics relative to oxidation potential (Eh) and pH that is likely ongoing downgradient of the Site. As show in the figure, a positive oxidation potential and increasing pH correspond to greater propensity for arsenic sorption.

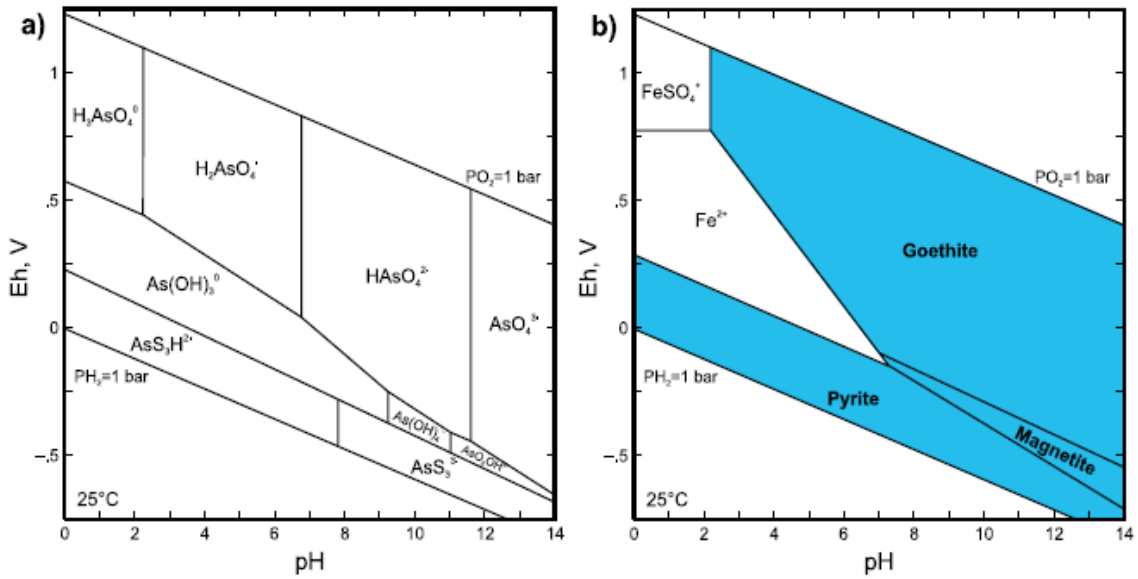


Figure D-2. Eh-pH diagrams for arsenic and iron at 25°C for coupled iron- and sulfate-reducing

systems. These paired diagrams show the relative distribution of potentially adsorbing arsenic species (left) relative to representative types of Fe-bearing sorbents (right) that are predicted to occur as a function of Eh and pH. (Figure 6.4, EPA 2007).

Conservative Solute Transport Model

To quantify the potential offsite migration of dissolved arsenic a conservative modeling approach was taken. Using the Quick Domenico model, an advection-dispersion calculation for solute transport, arsenic was modeled as if no redox or sorptive forces were occurring. As previously noted, the redox conditions of arsenic once mixed with the more oxic background aquifer the mobile arsenic fraction will likely be rapidly reduced. This conservative approach provides a "worst case" scenario for the persistence of the highest observed concentration of arsenic.

The Domenico model was developed using the Site's most recent groundwater data in conjunction with guidance from the Domenico Spreadsheet Analytical Model Manual developed by the California Regional Water Quality Board (SWRCB). Some of the assumptions in our calculation and this model include:

- The finite source dimension, delineated by interwell arsenic concentrations.
- Steady state source at the highest observed arsenic concentration.
- Contaminant concentration estimated at the centerline of the plume.
- No retardation (e.g., sorption) in transport process.

The sensitive parameters involved in the Domenico advection-dispersion model are conductivity and dispersivity. Generally, dispersivity values were scaled to the nearest downgradient monitoring well or receptor point, however, very large dispersion values are generally considered less conservative. The results of a water well survey, conducted on March 10, 2016 using the Washington Department of Ecology's Well Log Database, indicated the nearest downgradient water well is approximately 3,000 feet northwest of the landfill (Figure D-1). Consequently, the upper range of the United States Environmental Protection Agency (US EPA) recommended longitudinal dispersivity of 323 feet was selected (EPA 1996; SWRCB 1999). Associated transverse and vertical dispersivity values were calculated using this method.

The Domenico model was run for the upper range of site hydraulic conductivity (Table 2). The model was set to a 10-year run period (3650 days), at which point the modeled concentration has reached the furthest downgradient extent given a constant source (Table D-2). The largest areal extent with arsenic concentrations meeting or exceeding the Washington groundwater standard of 5 µg/L is plotted in Figure 21. Arsenic concentrations exceeding the groundwater standard were not found to persist greater than 110 feet downgradient of BXN-1.

References

California Regional Water Quality Control Board – Los Angeles Region (SWRCB) 1999. Domenico Spreadsheet Analytical Model Manual. December 1.

EPA 2007. *Monitored Natural Attenuation of Inorganic Contaminants in Groundwater: Volume 2*. EPA/600/R-07/140. Pg. 57-70. October.

United States Environmental Protection Agency (EPA) 1996. Soil screening guidance: technical background document E-25pp EPA/540/R-95/128, PB96-963502.

USGS 2006. "Redox conditions in Contaminated Ground Water". Scientific Investigations Report 2006-5056.

FIGURE D-1

Location of Potable Water Wellls Downgradient of North Landfill

Former J.H. Baxter North Woodwaste Landfill
Arlington, Washington

LEGEND

- Approximate Boundary of North Landfill
- Downgradient Potable Water Wells
- Roads
- Watercourses
- Waterbodies

N

0 250 500 750
Feet

MAP NOTES:
Date: March 14, 2016
Data Sources: WADOE, US BLM, USGS, ESRI,
Air photo taken on September 28, 2015 by the USDA

GSI Water Solutions, Inc.

Document Path: P:\Portland\302 - Baxter\GIS\Arlington_Landfills\Project_mxds\2015_Annual_Report\N_FigureD-1_Downgradient_Water_Wells.mxd

Table D-1. Background Groundwater Conditions

Former J.H. Baxter North Woodwaste Landfill

Arlington, Washington

USGS Well ID	Hydrologic Unit Code	Surface Elevation (ft amsl)	Well Depth (ft)	Date Sampled	Temp. (°C)	pH (unfiltered)	Dissolved Oxygen (mg/L)	Organic Carbon, filtered (mg/L)	Dis. Iron (µg/L)	Dis. Manganese (µg/L)	Arsenic (µg/L)
480827122062701	17110008	460	79	7/27/1993	11.4	8	0	0.2	230	84	4
480903122094701	17110008	115	16.5	8/11/1993	12.6	7.5	5.5	0.5	10	<1	2
481001122100801	17110008	125	48	7/30/1993	11.2	7	9.6	0.2	<1	<1	<3
481039122065901	17110008	370	25	7/27/1993	12.5	6.5	5.9	0.5	<1	62	<1
481103122084001	17110008	90	79	7/27/1993	11.4	7	5	55	<1	96	10

Notes:

- AMSL = above mean sea level (NGVD29)

Table D-2

ADVECTIVE TRANSPORT WITH THREE DIMENSIONAL DISPERSION,1ST ORDER DECAY and RETARDATION - WITH CALIBRATION TOOL

Project:	Arsenic Conservative Solute Transport						
Date:	4/21/2019	Prepared by:	EBK				
		Contaminant:	Arsenic				

SOURCE CONC (MG/L)	Ax (ft)	Ay (ft)	Az (ft) >=.001	LAMBDA day-1	SOURCE WIDTH (ft)	SOURCE THICKNESS (ft)	Time (days) (days)
0.031	3.23E+02	4.20E+01	1.94E+00	1.00E-03	100	10	3650

Hydraulic Cond (ft/day)	Hydraulic Gradient (ft/ft)	Porosity (dec. frac.)	Soil Bulk Density (g/cm^{3})	KOC	Frac. Org. Carb.	Retard-ation (R)	V (=K*i/n*R) (ft/day)
1.70E+02	0.05	0.3	1.7	1	1.00E-03	1.005666667	28.17368247

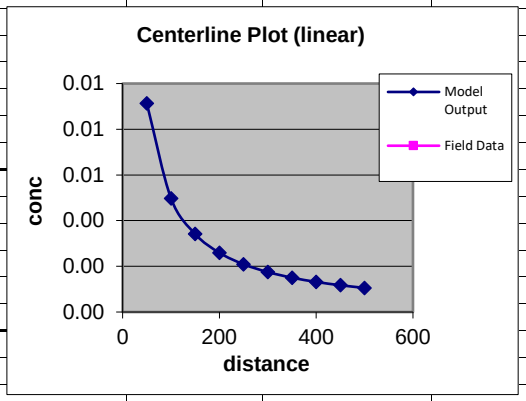
NEW QUICK_DOMENICO.XLS

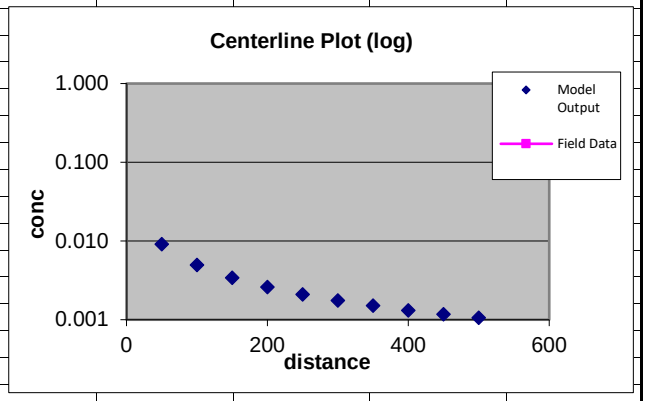
SPREADSHEET APPLICATION OF
"AN ANALYTICAL MODEL FOR
MULTIDIMENSIONAL TRANSPORT OF A
DECAYING CONTAMINANT SPECIES"
P.A. Domenico (1987)
Modified to Include Retardation

Point Concentration

x(ft)	y(ft)	z(ft)
110	0	0

	x(ft)	y(ft)	z(ft)
Conc. At	110	0	0
at	3650	days =	
			0.005
			mg/l





	AREAL MODEL	CALCULATION DOMAIN
	Length (ft)	500
	Width (ft)	100

	50	100	150	200	250	300	350	400	450	500
100	0.003	0.003	0.002	0.002	0.002	0.001	0.001	0.001	0.001	0.001
50	0.007	0.004	0.003	0.002	0.002	0.002	0.001	0.001	0.001	0.001
0	0.009	0.005	0.003	0.003	0.002	0.002	0.002	0.001	0.001	0.001
-50	0.007	0.004	0.003	0.002	0.002	0.002	0.001	0.001	0.001	0.001
-100	0.003	0.003	0.002	0.002	0.002	0.001	0.001	0.001	0.001	0.001
Field Data:	Centerline C	Concentration								
	Distance from Source									