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2017 Groundwater Monitoring Report
North Woodwaste Landfill
Arlington, Washington

Submitted to

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1. Introduction

This report presents quarterly groundwater data collected from February to September 2017 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 2017 was conducted in March, June, September, and December in accordance with the Washington State Department of Ecology (Ecology)-approved sampling and analysis plan (SAP) dated March 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 four monitoring wells to understand the flow direction and gradient of shallow groundwater.

2.1 Groundwater Elevations

Groundwater levels were measured at the four monitoring wells before pumping the wells for groundwater sampling. Groundwater elevation data for 2017 are summarized in Table 1.

Based on quarterly measurements in BXN-1, groundwater elevations were highest during June 2017 and lowest during December 2017. The static groundwater level in well BXN-1 fluctuated throughout the year by 3.12 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 2017 was toward the northwest and is consistent with the regional groundwater flow in the aquifer (Figure 4, Source: GSI Water Solutions, Inc.).

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 0.003 to 0.007 (Table 2). This slope results in velocity estimates of 0.9 to 4.1 feet per day. Table 2 shows the calculated hydraulic gradients and groundwater velocities during the 2017 monitoring events. The gradient and groundwater velocity are consistent with previous years.

3. Groundwater Quality

Groundwater monitoring events were conducted on March 9, 2017, for the first quarter; June 10-11, 2017, for the second quarter; September 17, 2017, for the third quarter; and December 14, 2017, for the fourth quarter. Groundwater sampling was performed using submersible bladder pumps and tubing dedicated to each well. Sampling procedures are described in Appendix C of EMCON's hydrogeologic report (EMCON, 1989).

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 and polynuclear aromatic hydrocarbons (PAHs) were collected semi-annually. In accordance with the latest SAP, groundwater samples were analyzed by ALS Environmental Laboratories (ALS) of Kelso, Washington and by AmTest Laboratories of Kirkland, WA, for the following:

- **Conventional Parameters:** pH, conductivity, ammonia as nitrogen, chemical oxygen demand (COD), chloride, total dissolved solids (TDS), sulfate, tannin and lignin, and total organic carbon (TOC)
- **Dissolved Metals:** Arsenic, barium, iron, manganese, and nickel
- **Pentachlorophenol (PCP)**
- **Polynuclear Aromatic Hydrocarbons (PAH)**

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 September 2017 are summarized in Table 3A. Field sampling records are included in Appendix A. The analytical data from 2007 through 2017 are summarized in Tables 3B and 3C. Laboratory analytical reports and chain-of-custody (COC) forms for the 2017 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 2017 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 March 2017 monitoring event field duplicate sample was collected from monitoring well BXN-1 and labeled as BXN-5; the September field duplicate sample was collected from BXN-4 and labeled as BXN-5. During the September sampling event, a field rinsate blank was collected after sampling all wells and labelled as BXN-6. The blank data, however, were not used to modify analytical results because dedicated tubing and pumps were used to sample each well, so no cross-contamination was possible.

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 and BXN-4 were qualified as estimated concentrations (J-flag):

- **March 2017:** 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 with the following exceptions. The March sampling lacked a sufficient number of sample bottles for all field blank analyses listed on COC; instead, only PCP and PAH analyses were performed on the field blank.

With the exception of pH and the September analysis of TOC at BXN-2, 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 field-analyzed pH results are used for trend analysis and statistical evaluation. The September TOC value from BXN-2 was flagged to indicate the holding time violation.

Matrix spike (MS) recoveries for the June analyses and the manganese MS for the Batch QC sample from the September monitoring event were outside laboratory control criteria, but recovery in the Laboratory Control Sample (LQS) was acceptable, which indicated the analytical batches were in control. No further corrective action was taken.

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, iron, and manganese in BXN-1
- Field pH in BXN-2

5.2 Concentration Trends over Time

Figures 5 through 20 show the concentration trends from 2007 through 2017 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): In 2017, 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-4 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. Conversely, Barium in BXN-4 and BXN-1 are decreasing and increasing, respectively.
- **Chemical Oxygen Demand (COD)** (Figure 8): 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 been relatively consistent and lower than BXN-1 and BXN-4. Values in BXN-4 and BXN-2 appear to be declining; COD at BXN-1 is increasing.

- **Chloride** (Figure 9): Chloride in BXN-4 has been higher than downgradient wells. Chloride in one downgradient well 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.
- **Copper** (Figure 10): Copper levels in BXN-4 have been consistently greater than downgradient wells. The trend line fitted to monitoring data for BXN-4 indicate copper concentrations are declining. Copper concentrations in downgradient wells are similar and also appear to be declining.
- **Iron** (Figure 11): Iron concentrations have been consistently higher in BXN-1 compared to the other wells. With the exception of November 2011, values in BXN-2 and BXN-4 have been consistently low.
- **Manganese** (Figure 12): Manganese concentrations have fluctuated in each well but appear to be increasing in BXN-1 and decreasing in BXN-2 and BXN-4. The recent increasing trend in manganese has resulted in highest concentrations in BXN-1. The lowest manganese levels are currently in the upgradient well.
- **Nickel** (Figure 13): 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 14): Nitrate plus nitrite concentrations in BXN-4 have fluctuated over the monitoring period and consistently been higher than downgradient wells. The trend line fitted to the monitoring data for BXN-4 indicate nitrate plus nitrite values are slightly declining. Levels in downgradient wells have consistently been low.
- **Field pH** (Figure 15): Field pH has been slightly acid and similar in all wells. With the exception of 2013-2014, pH has been fairly consistent over the monitoring period.
- **Sulfate** (Figure 16): Since 2007, sulfate concentrations in BXN-4 have been consistently greater than downgradient wells with the exception of December 2013. Despite fluctuations, 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 17): Tannin and lignin concentrations have fluctuated over the monitoring period and are highest in BXN-1. Values are increasing and peaked in BXN-1 in 2017. Conversely, tannin and lignin are relatively stable and low in BXN-2 and BXN-4.
- **Total Dissolved Solids (TDS)** (Figure 18): TDS concentrations have been low and similar in all wells. The lone exception is 2014 when TDS spiked in BXN-4.
- **Total Organic Carbon (TOC)** (Figure 19): TOC levels have been low and similar in all wells. The lone exception is in 2017 when TOC spiked in BXN-1.
- **Zinc** (Figure 20): Zinc levels in all wells have been similar over the monitoring period. Since peaking in all wells in 2007/2008, values have generally been declining. Zinc has been highest in BXN-1 and exhibited an unusual spike in 2017.

5.3 Comparison to Standards

Federal maximum contaminant levels (MCL) are established by EPA as the primary drinking water standards. Federal secondary standards (SMCLs) are non-enforceable guidelines for cosmetic and aesthetic purposes and are not considered to be a risk to human health.

In Washington, water quality standards for groundwater are provided in the Washington Administrative Code (WAC) 173-200-040 (Washington, 2003). Washington water quality standards are similar to the federal standards for most of the Site-related analytes where available, with the exception of arsenic, barium, cadmium, and copper. MCLs, SMCLs, and Washington water quality standards for groundwater are listed in Tables 3A, 3B, and 3C.

5.3.1 Comparison to MCLs

Of the monitored parameters, there are MCLs for total coliforms (no longer analyzed), arsenic, barium, cadmium (no longer analyzed), copper, iron, manganese, nitrate plus nitrite as nitrogen, PCP, and PAH. There were no detections in 2017 that exceeded the associated MCL, with the following exception:

- **Arsenic:** Concentrations in BXN-1 exceeded the MCL of 10 µg/L in first, second and third quarterly monitoring events in 2017, ranging from 15-47 µg/L.
- **Iron:** Concentrations in BXN-4 and BXN-1 exceeded the MCL of 300 µg/L in the first quarter and all quarters, respectively, in 2017 ranging from 1,270 to 52,200 µg/L.
- **Manganese:** Concentrations in all wells exceeded the MCL of 50 µg/L in all quarters in 2017 ranging from 1,960 to 5,350 µg/L.

Per the Snohomish Health District's request in a letter dated August 28, 2015, a dissolved arsenic plume delineation was performed in 2016. Because arsenic concentrations, groundwater gradient and velocity are consistent with previous years, the plume delineation was not repeated in 2017. A summary of 2016 arsenic modeling is presented below.

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 and the plume extent plotted in Figure 21. A description of the model inputs and results is provided in Appendix D.

5.3.2 Comparison to SMCLs

Among the monitored parameters, there are SMCLs for pH, chloride, TDS, sulfate, iron, manganese, and zinc. There were no detections in 2017 that exceeded the associated SMCL, with the following exceptions:

- **Field pH:** In all wells, pH levels were below the SMCL of 6.5 to 8.5 for all quarterly monitoring events in 2017, ranging from 5.93-6.50.

- **Iron:** See discussion in Section 5.3.2.
- **Manganese:** See discussion in Section 5.3.2.

5.3.3 Comparison to Washington State Standards

Washington water quality standards for groundwater are similar to the MCL or SMCL for Site-related compounds, with the exception of arsenic, barium, cadmium (no longer analyzed), copper, and PAH. Of these parameters, there were no detections in 2017 that exceeded the associated Washington standard, with the following exception:

- **Arsenic:** Arsenic concentrations exceeded Washington's water quality standard for groundwater of 0.05 µg/L in BXN-1 in the first, second, and fourth quarter monitoring events. Concentrations ranged from 15 to 47 µg/L.
- **Iron:** See discussion in Section 5.3.2.
- **Manganese:** See discussion in Section 5.3.2.

6. Summary

Quarterly groundwater monitoring samples were collected from one upgradient well (BXN-4) and two downgradient wells (BXN-1 through BXN-2) during 2017 at the North Landfill. The samples were analyzed for 10 groundwater quality parameters and 6 dissolved metals.

Groundwater samples collected during the 2017 monitoring events did not exceed the MCLs for any of the monitored parameters, with the exception of arsenic, iron and manganese. Concentrations of arsenic , iron and manganese in monitoring well BXN-1 exceeded the MCL in most quarterly monitoring events.

There were no exceedances of the SMCL for chloride, TDS, sulfate, or zinc during the monitoring events in 2017. Iron concentrations in BXN-4 and BXN-1 exceeded the SMCL and the Washington water quality standard for groundwater during the first and all quarters, respectively. In addition, all wells exceeded the SMCL and state standard for manganese during all monitoring events. Furthermore, all field pH measurements in downgradient wells were lower than the SMCL and state standard (6.5) in 2017.

7. References

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

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

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Tables

Table 1. Groundwater Elevation Summary for 2017

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	3/9/2017	47.00	48.50
						6/11/2017	45.82	49.68
						9/17/2017	48.45	47.05
						12/14/2017	48.94	46.56
BXN-2	2	57.24	10	47.24 - 57.24	93.01	3/9/2017	43.10	49.91
						6/11/2017	NM	#VALUE!
						9/17/2017	44.60	48.41
						12/14/2017	NM	#VALUE!
BXN-3	2	58.66	10	48.66 - 58.66	97.23	3/9/2017	NM	NM
						6/11/2017	NM	
						9/17/2017	NM	NM
						12/14/2017	NM	NM
BXN-4	2	51.74	10	41.74 - 51.74	98.76	3/9/2017	41.50	57.26
						6/11/2017	NM	
						9/17/2017	47.80	50.96
						12/14/2017	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)	Hydraulic Conductivity (K) (cm/sec)	Porosity (n_e)	Velocity (v_x) (cm/sec)	Velocity (v_x) (ft/day)
3/9/2017	0.007	0.030 to 0.060	0.30	0.0007 to 0.001	2.1 to 4.1
				0.0000 to 0.000	0.0 to 0.0
9/17/2017	0.003			0.000 to 0.001	0.9 to 1.7

Notes

cm = centimeter.

ft = feet.

NC = not calculated.

sec = second.

Table 3A. Summary of Groundwater Sampling Field Parameters: 2007 through 2017

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

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 2017

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		

Table 3B. Summary of Groundwater Conventional Parameters: 2007 through 2017

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

Date MCL/SMCL WA WQ Std	Chloride (mg/L) none/250 250									Nitrate + Nitrite as N (mg/L) 10/none 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									0.010 U		

Table 3B. Summary of Groundwater Conventional Parameters: 2007 through 2017

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		

Table 3B. Summary of Groundwater Conventional Parameters: 2007 through 2017

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							0.556									38		

Table 3B. Summary of Groundwater Conventional Parameters: 2007 through 2017

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											

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 2017

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

Date MCL/SMCL WA WQ Std	Arsenic, dissolved (ug/L) 10/none 0.05									Barium, dissolved (ug/L) 2000/none 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		

Table 3C. Summary of Groundwater Metals: 2007 through 2017

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

Date	Iron, dissolved									Manganese, dissolved								
	(µg/L)									(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		

Table 3C. Summary of Groundwater Metals: 2007 through 2017

Former J.H. Baxter North Woodwaste Landfill

Arlington, Washington

Date	Cadmium, dissolved (ug/L)									Copper, dissolved (ug/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		NT	22.3				1.1 J				10.0 U
11/13/2012	NT		NT		NT		NT		NT	20.8				10.0 U		10.0 U		10.0 U
2/12/2013	NT		NT		NT		NT		NT	17.4				1.1 J		0.8 J		10.0 U
6/4/2013	NT		NT		NT		NT		NT	22.1				2.4 J		4.0 U		4.0 U
8/27/2013	NT		NT		NT		NT		NT	19.2				1.7 J		1.0 J		4.0 U
12/2/2013	NT		NT		NT		NT		NT	16.7				2.5 J		2.3 J		4.0 U
3/17/2014	NT		NT		NT		NT		NT	13.1				4.0 U		4.0 U		4.0 U
6/2/2014	NT		NT		NT		NT		NT	10.2				1.4 J		1.6 J		4.0 U
9/29/2014	NT		NT		NT		NT		NT	16.6				4.0 U		4.0 U		1.2 J
11/17/2014	NT		NT		NT		NT		NT	15.0				4.0 U		4.0 U		1.0 J
2/25/2015	NT		NT		NT		NT		NT	13.1				1.73		0.82		0.03 J
9/14/2015	NT		NT		NT		NT		NT	15.2				2.2 J		0.9 J		4.0 U
12/7/2015	NT		NT		NT		NT		NT	8.7				4.0 U		4.0 U		
2/29/2016	NT		NT		NT		NT		NT	9.2				4.0 U		4.0 U		4.00 U
6/6/2016	NT		NT		NT		NT		NT	14.1				4.0 U		4.0 U		2.2 J
9/26/2016	NT		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		NT	NT	
6/11/2017	NT		NT		NT		NT		NT							2.1 U		
9/17/2017	NT		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		

Table 3C. Summary of Groundwater Metals: 2007 through 2017

Former J.H. Baxter North Woodwaste Landfill

Arlington, Washington

Date	Nickel, dissolved									Zinc, dissolved								
	(µg/L)									(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		

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 2017

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	0.13 U		NT		0.095 U		0.12 U		0.071 U
3/9/2017	0.5 U		NT		0.5 U		0.5 U	0.5 U	0.5 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 2017 samples collected as part of monitoring activities.

Data is not validated.

Table 4. Parameters Statistically Higher than Background: 1989 to 2017

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			2.96
Metals	Barium	1992	µg/L			5.6	20
Metals	Barium	1993	µg/L			84	29
Metals	Barium	1994	µg/L			89	32
Metals	Barium	1995	µg/L			124	49
Metals	Barium	2001	µg/L			104	147
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	2001	mg/L			7.38	15.2

Table 4. Parameters Statistically Higher than Background: 1989 to 2017

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	1989	mg/L	43			10
Conventionals	Chemical Oxygen Demand	1991	mg/L	33		45	12.25
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	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	6.125		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	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

Table 4. Parameters Statistically Higher than Background: 1989 to 2017

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	2009	µg/L		7,085		2,798
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	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	1.48	0.38	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.

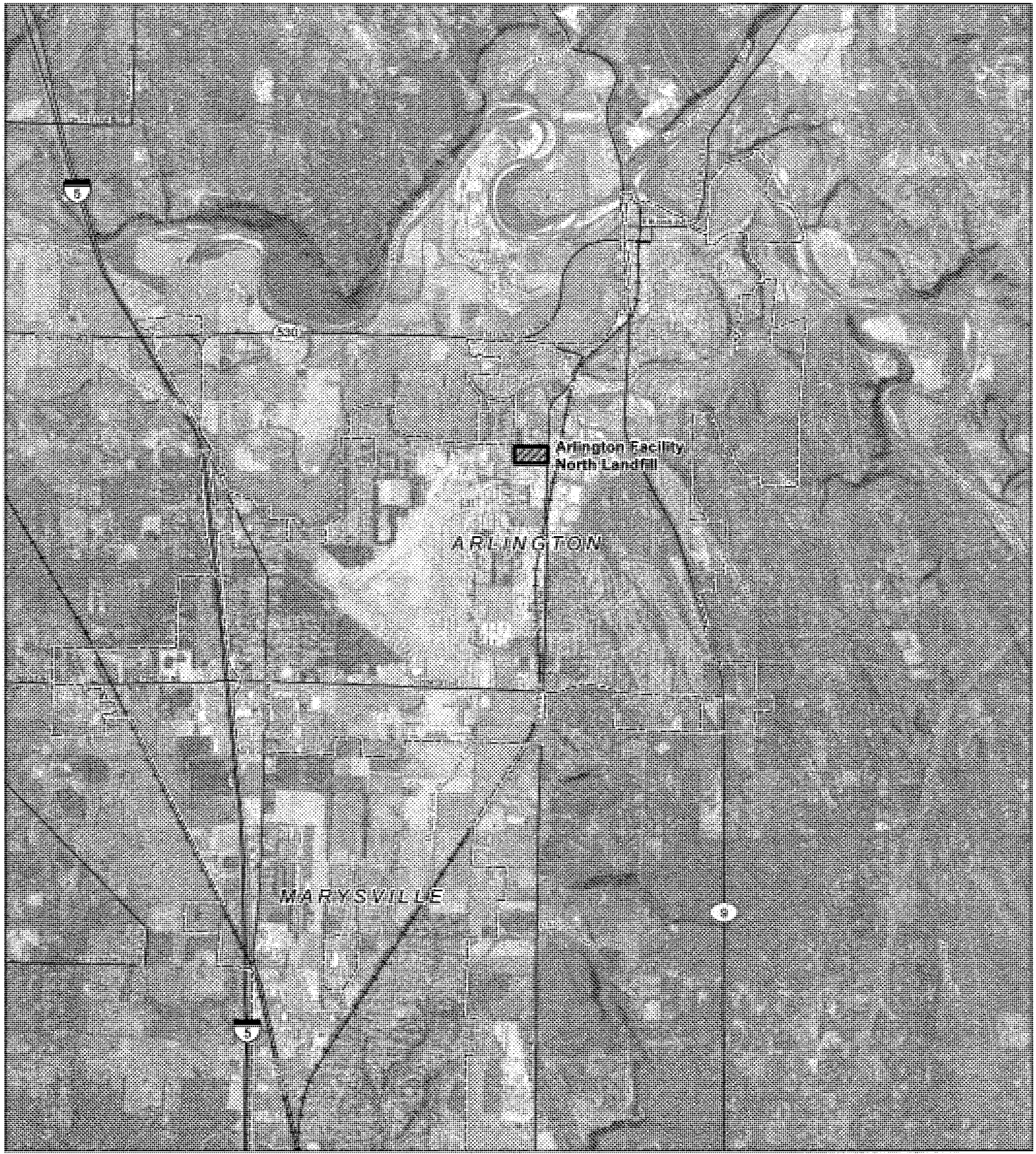
ND = not detected.

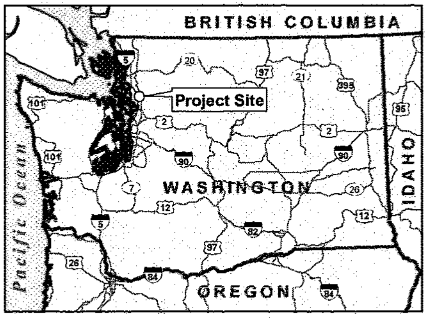
[1] Parameters listed only when at least one downgradient well has a higher mean value than the upgradient well.

[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

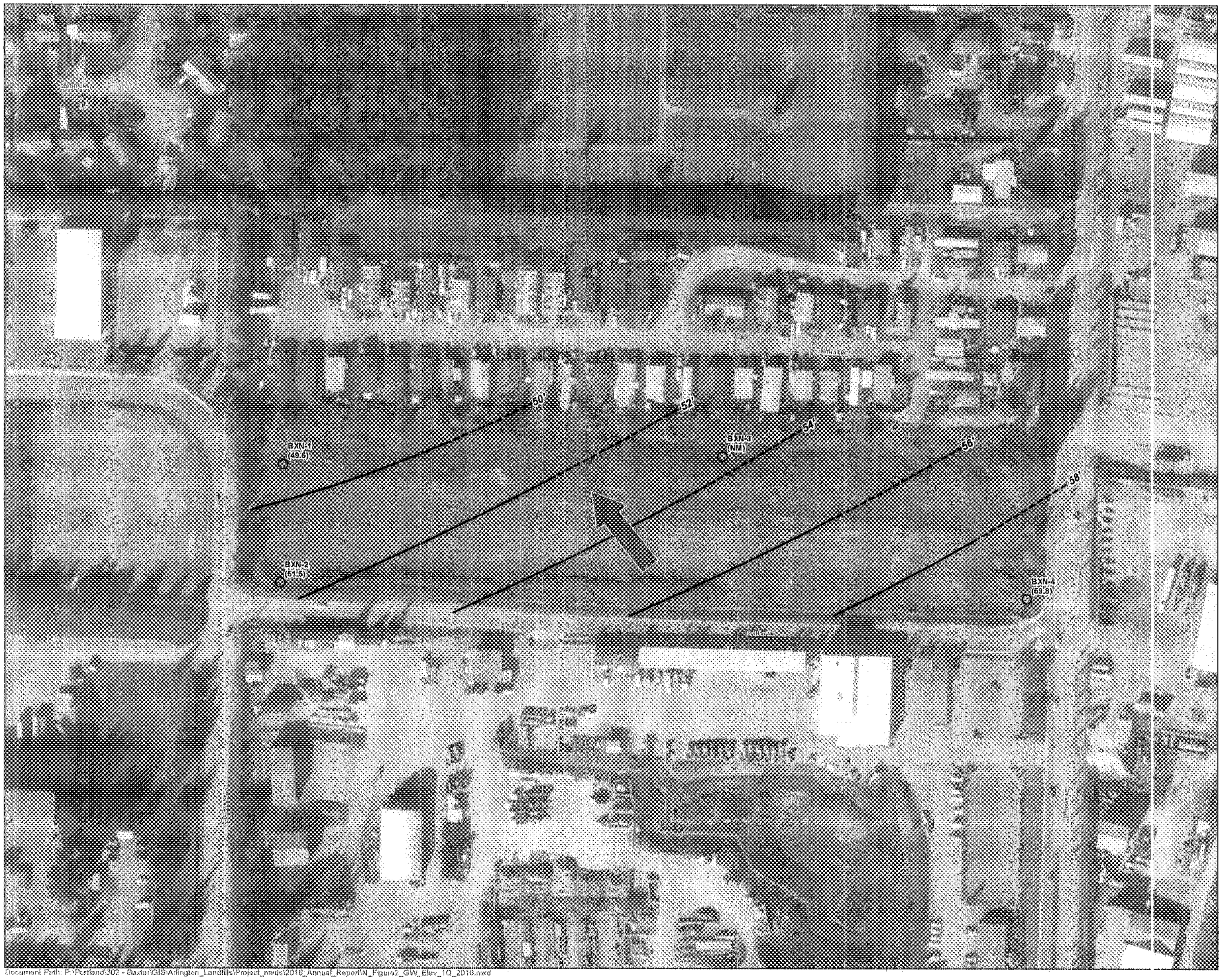
GSI Water Solutions, Inc.

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

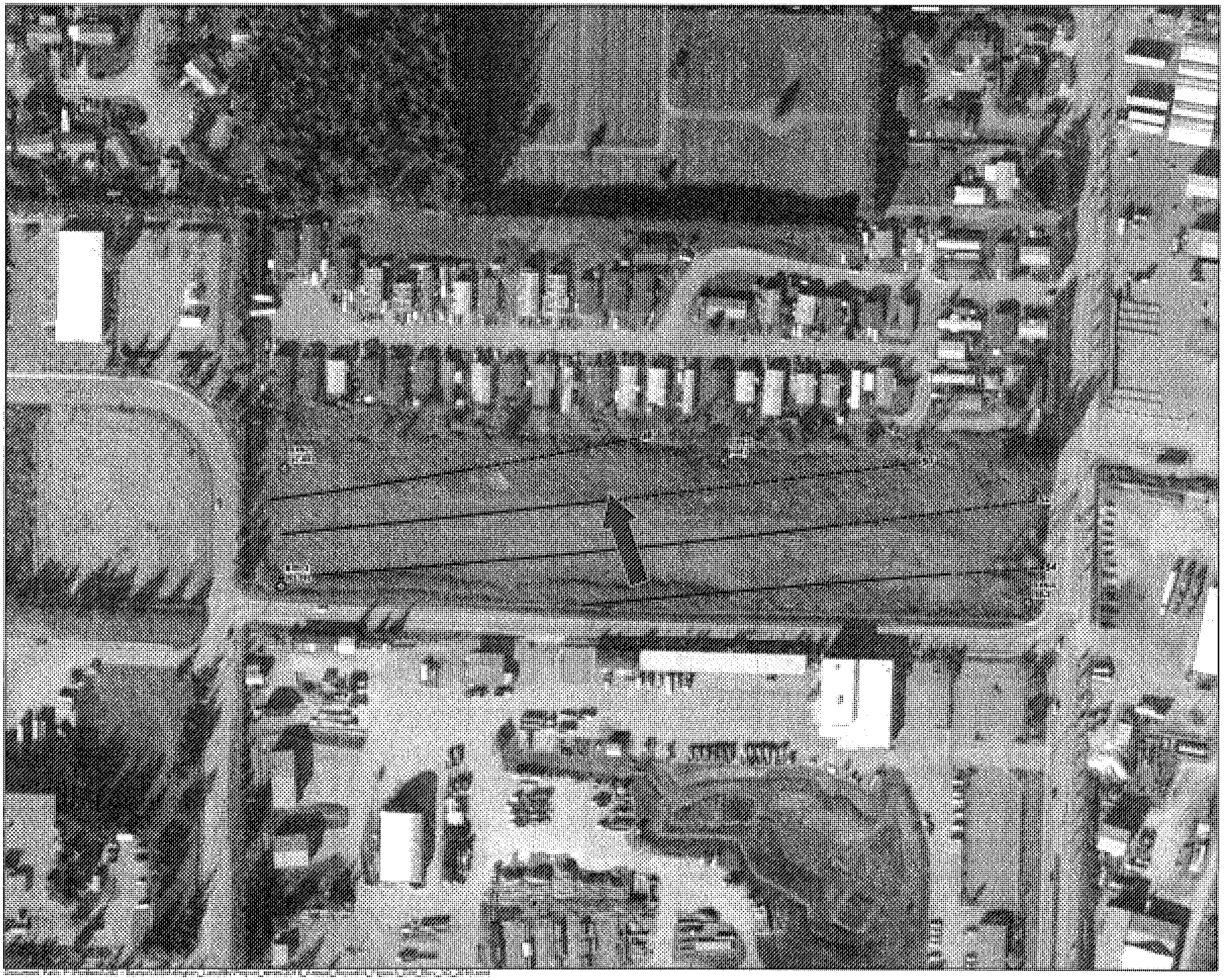


FIGURE 3

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:

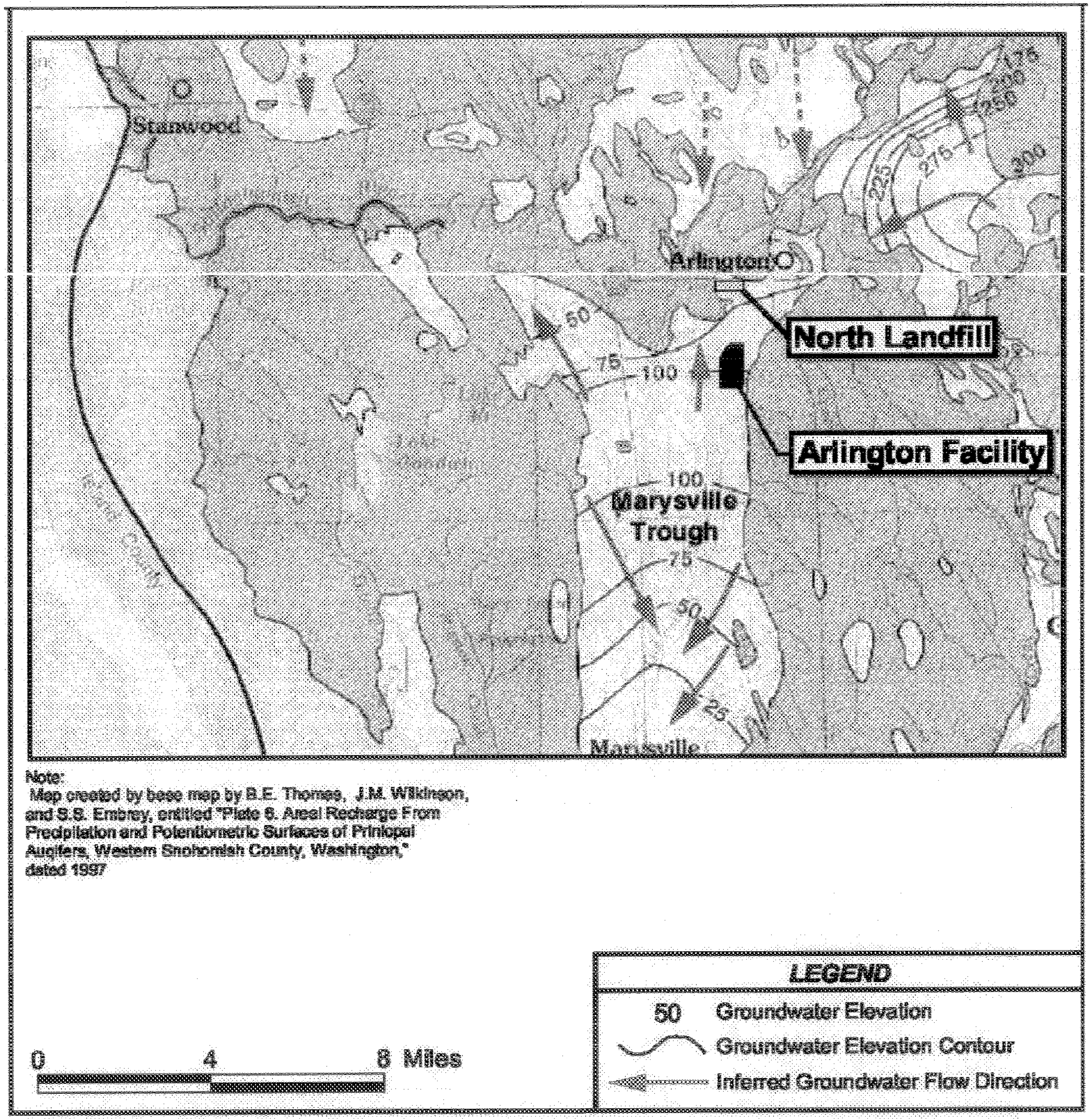
1. All elevations exist in NAVD88.
2. NM = not measured.
3. BXN-3 is damaged.

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.



Note:
Map created by base map by B.E. Thomas, J.M. Wilkinson, and S.S. Embrey, entitled "Plate 6. Areal Recharge From Precipitation and Potentiometric Surfaces of Prinicpal Aquifers, Western Snohomish County, Washington," dated 1997

N

FIGURE 4

Regional Groundwater Flow

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

GSI Water Solutions, Inc.

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

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

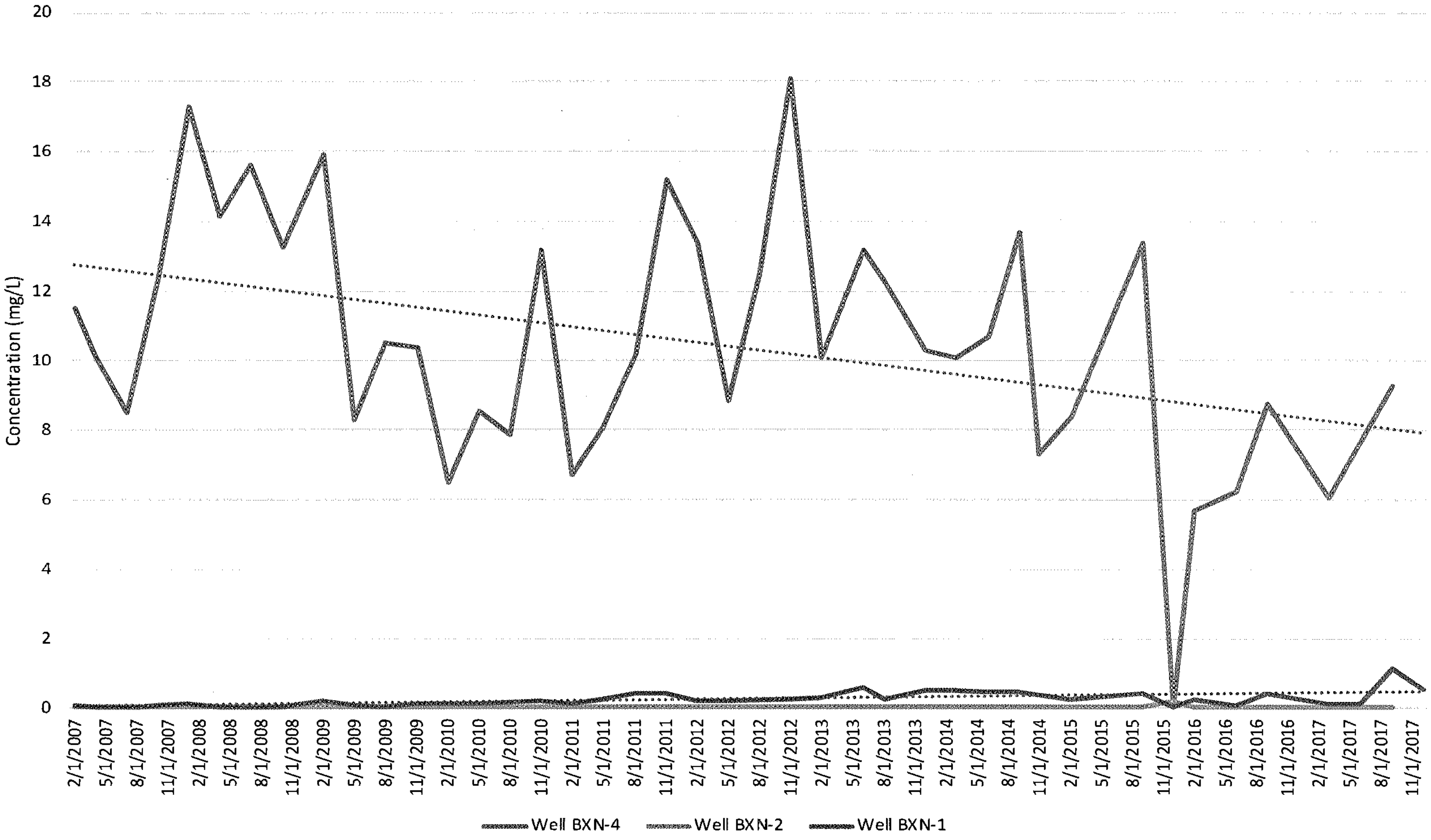


Figure 6
Arsenic Trend
North Wells

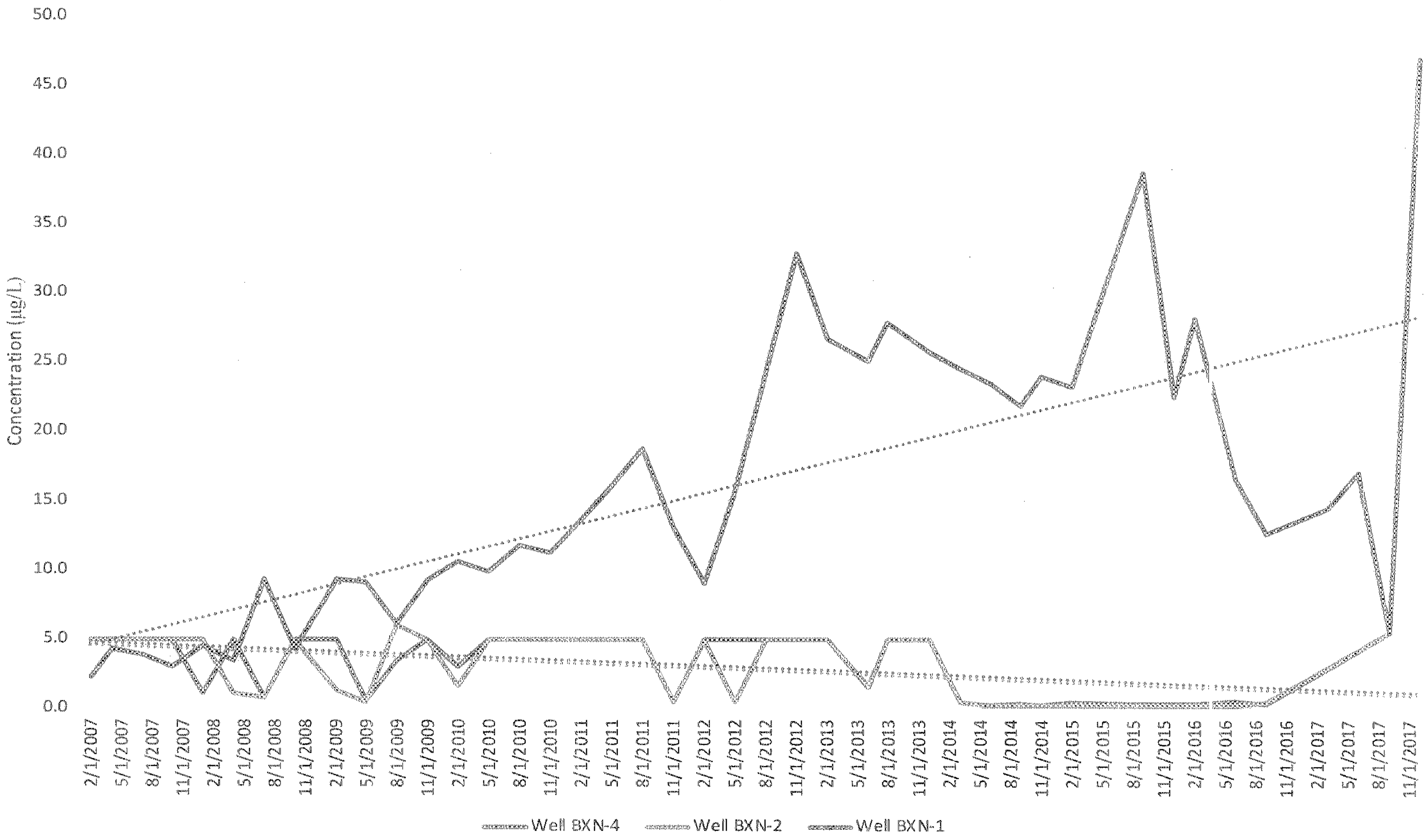


Figure 7
Barium Trend
North Wells

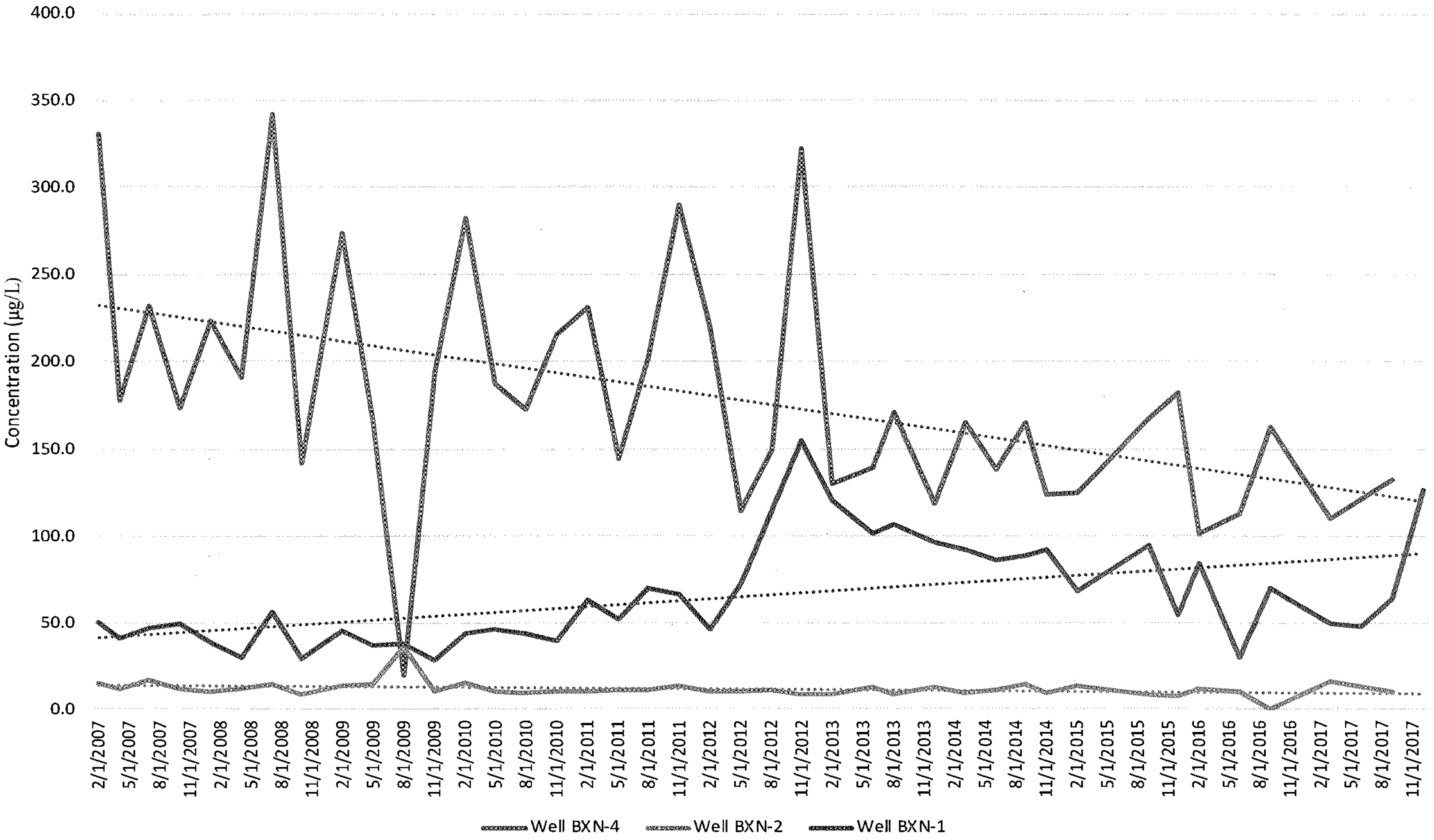


Figure 8
COD Trend
North Wells

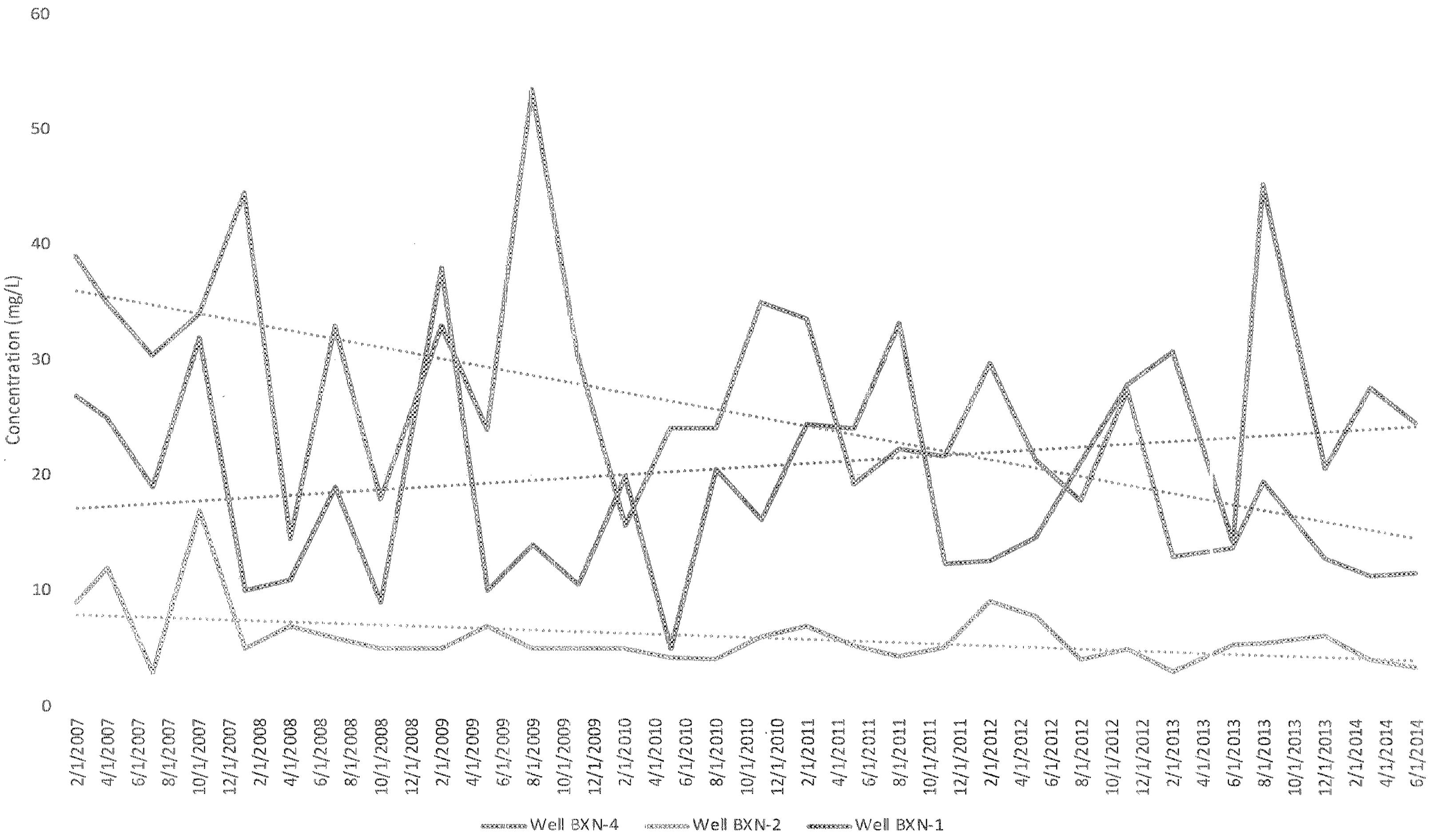


Figure 9
Chloride Trend
North Wells

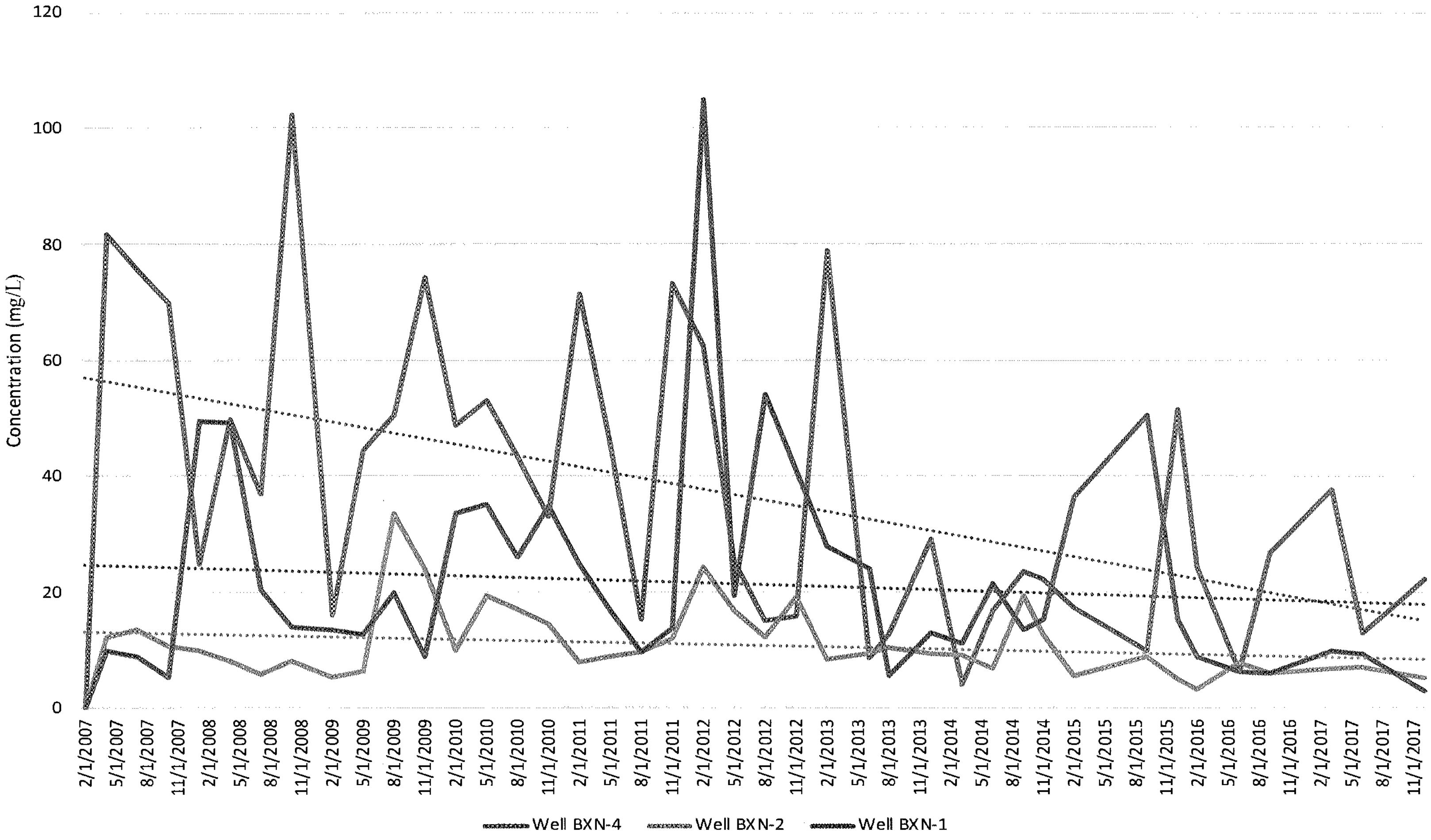


Figure 10
Copper Trend
North Wells

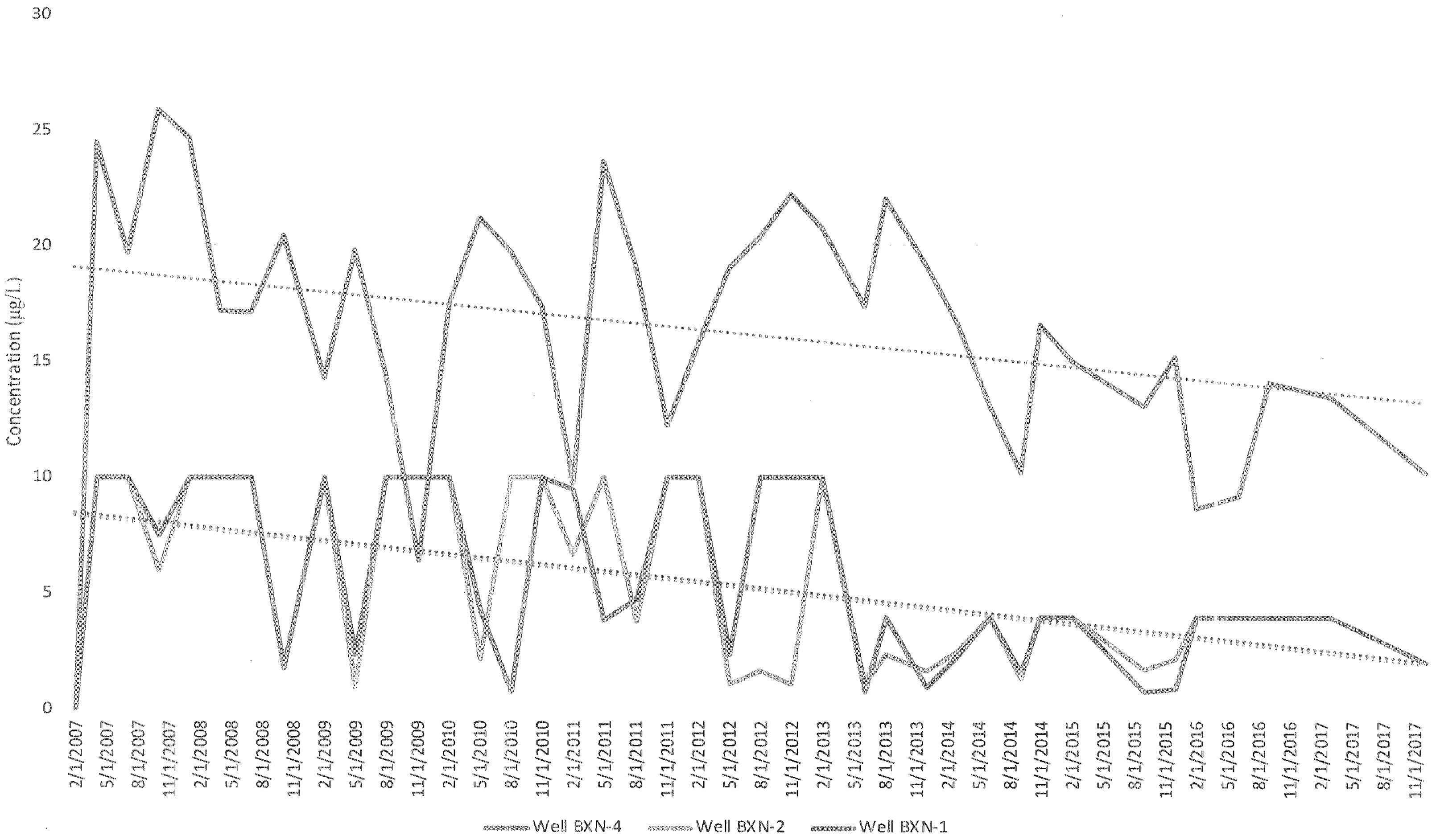


Figure 11
Iron Trend
North Wells

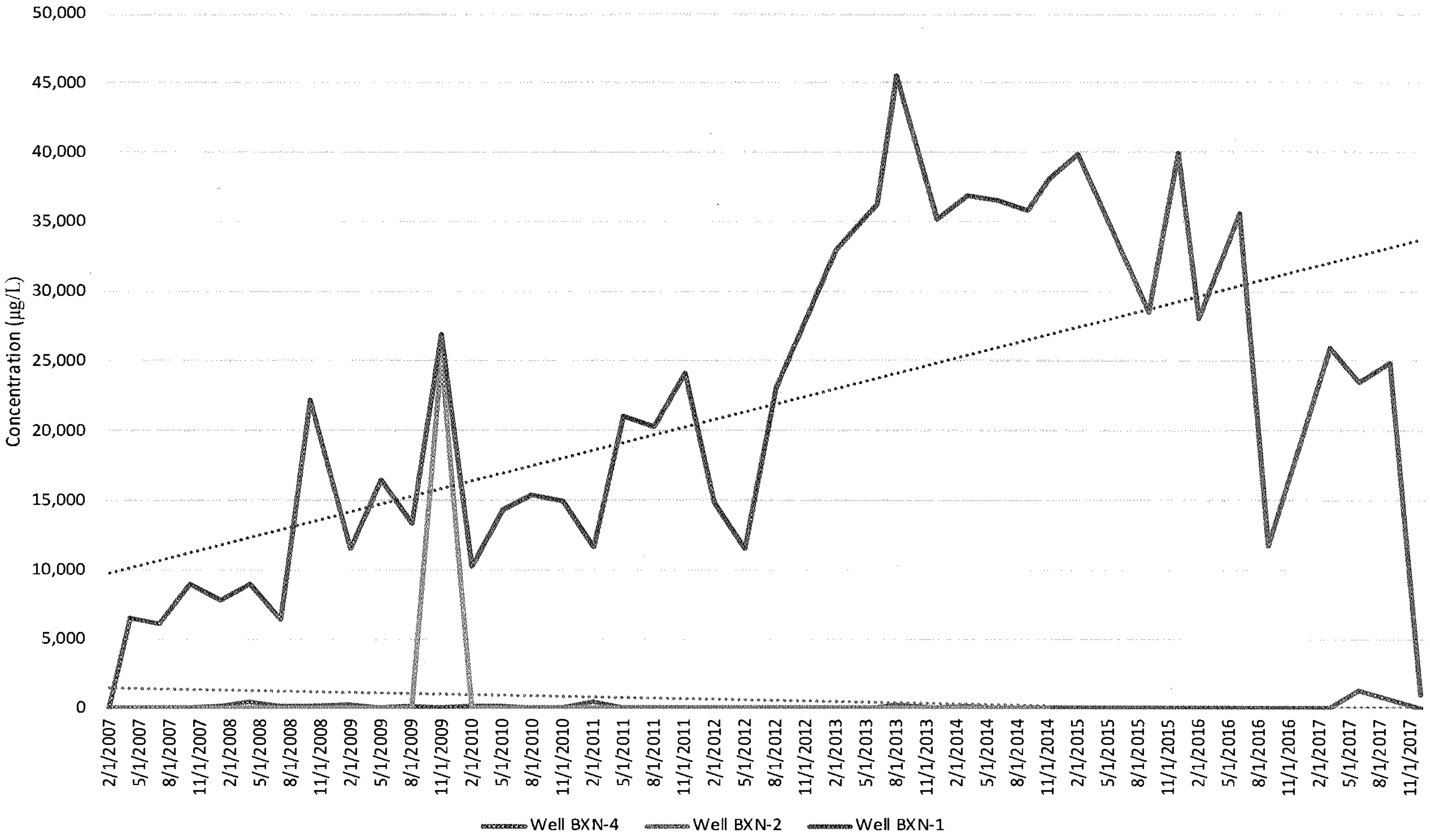


Figure 12
Manganese Trend
North Wells

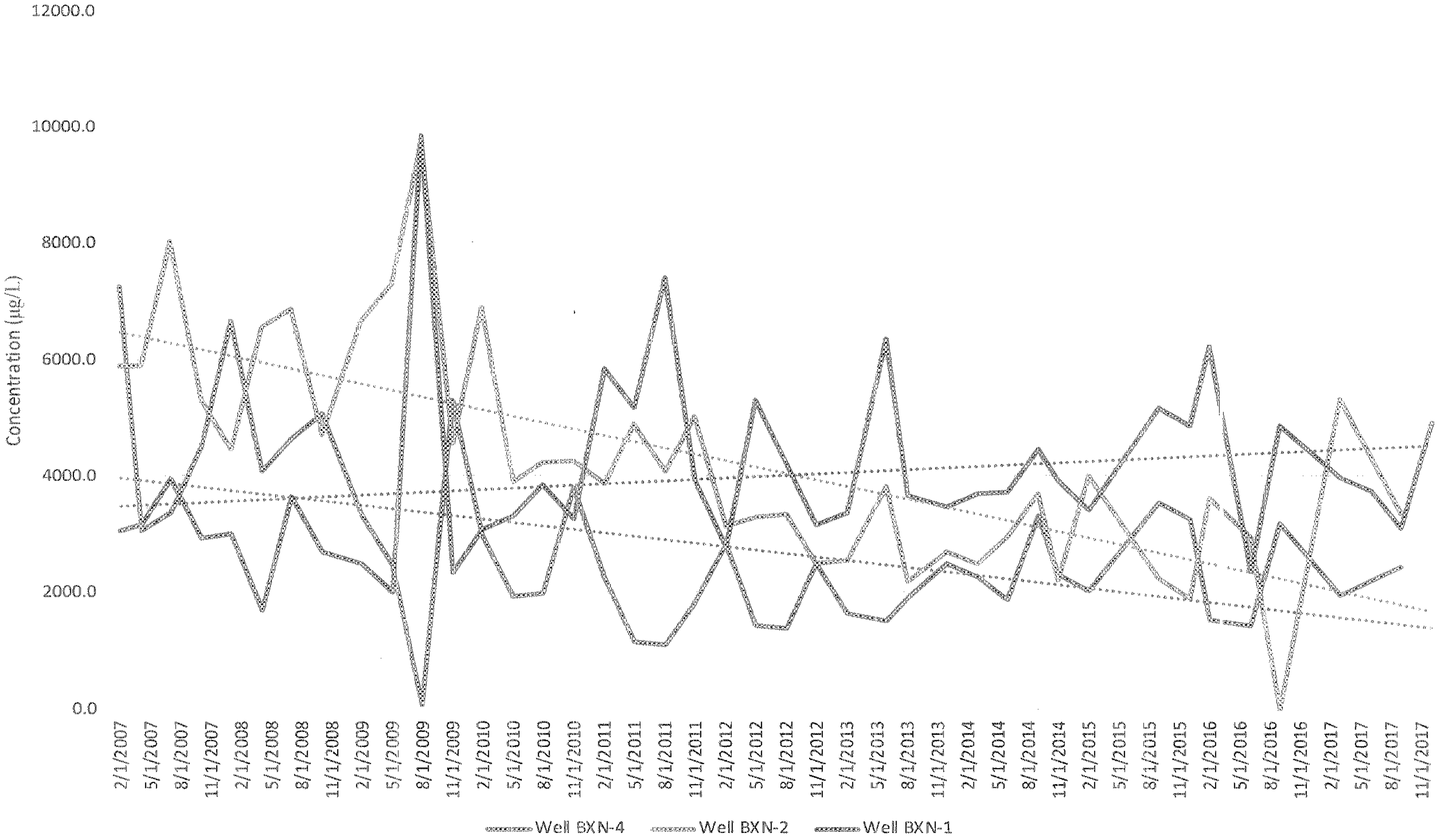


Figure 13
Nickel Trend
North Wells

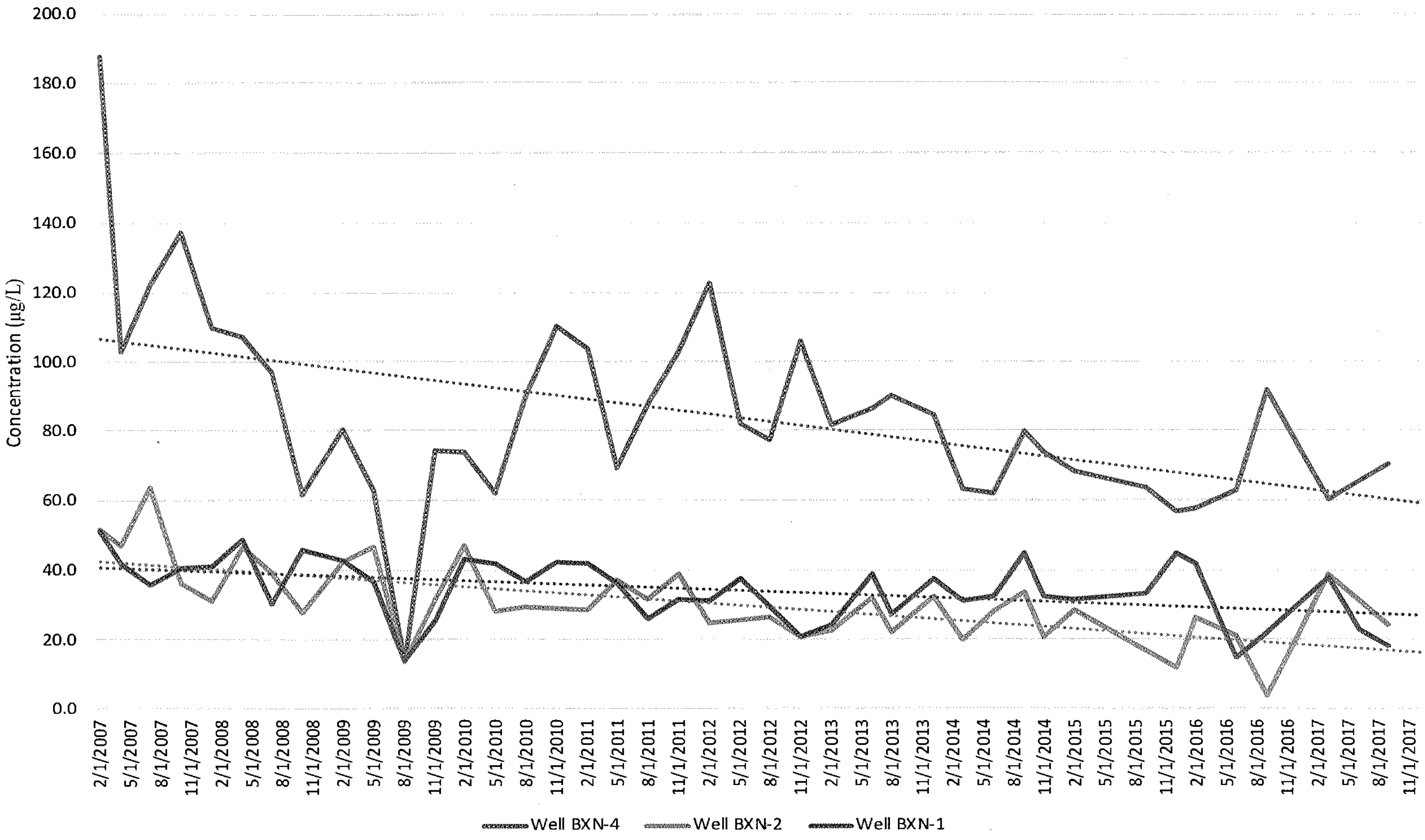


Figure 14
Nitrate+Nitrite Trend
North Wells

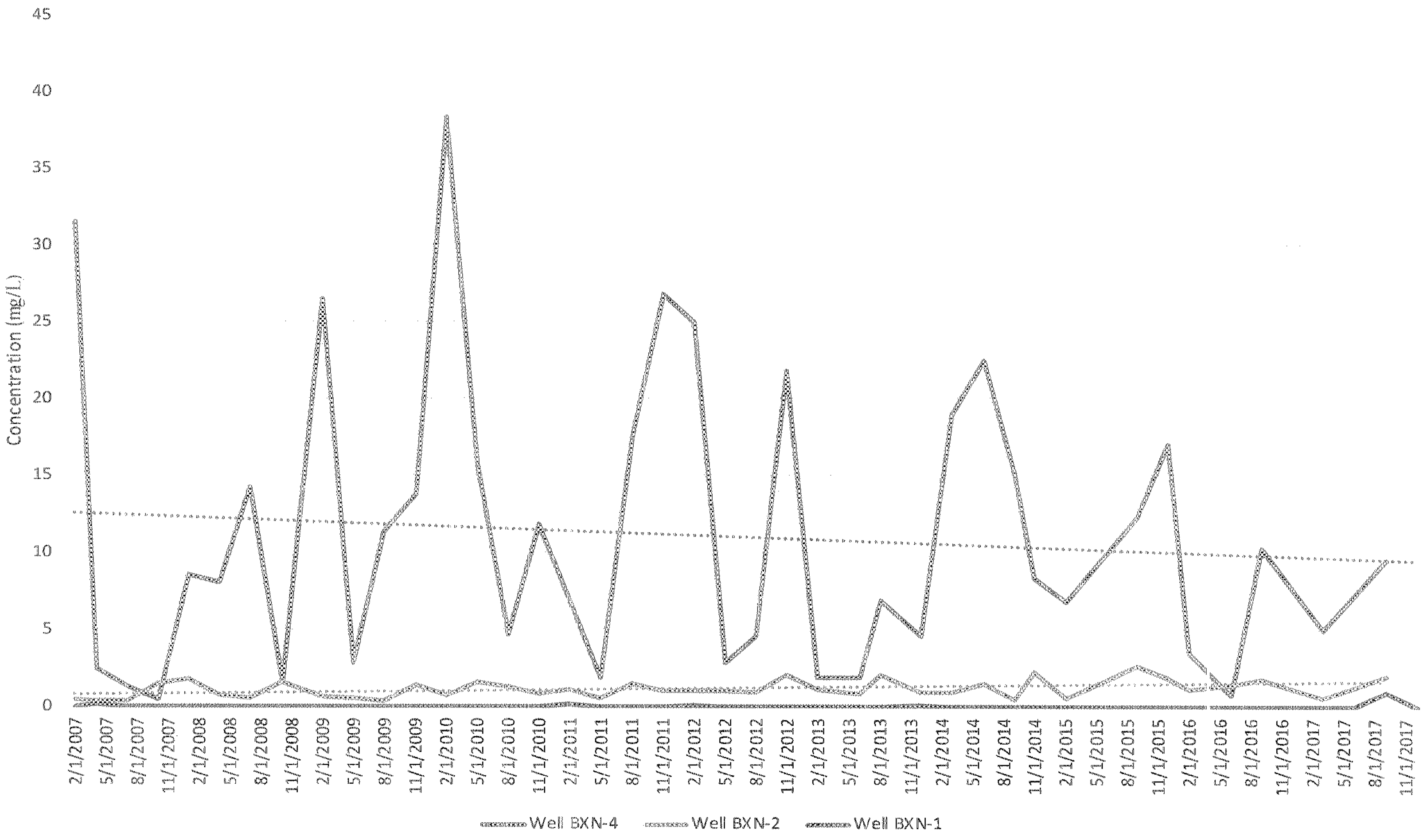


Figure 15
Field pH Trend
North Wells

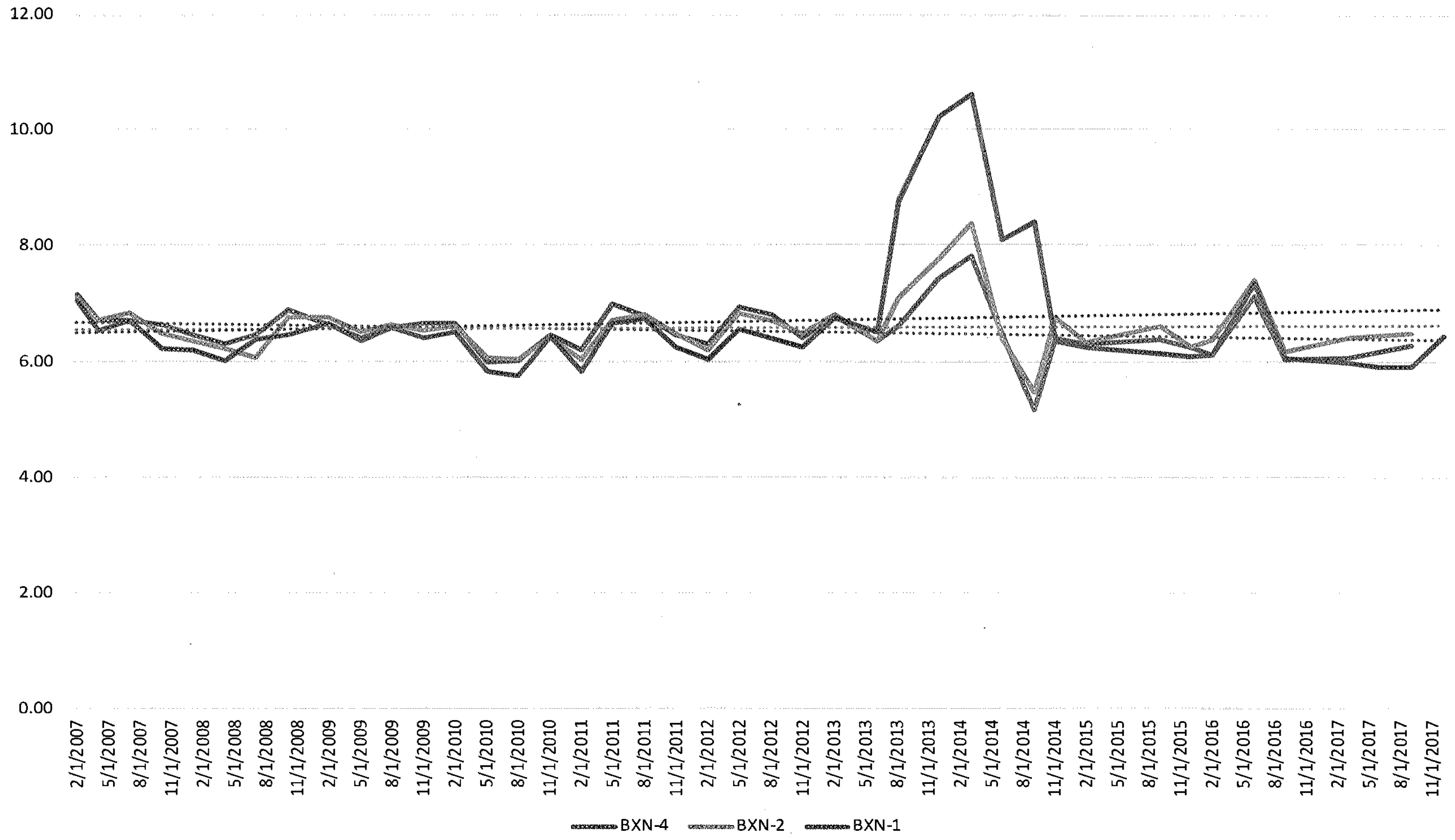


Figure 16
Sulfate Trend
North Wells

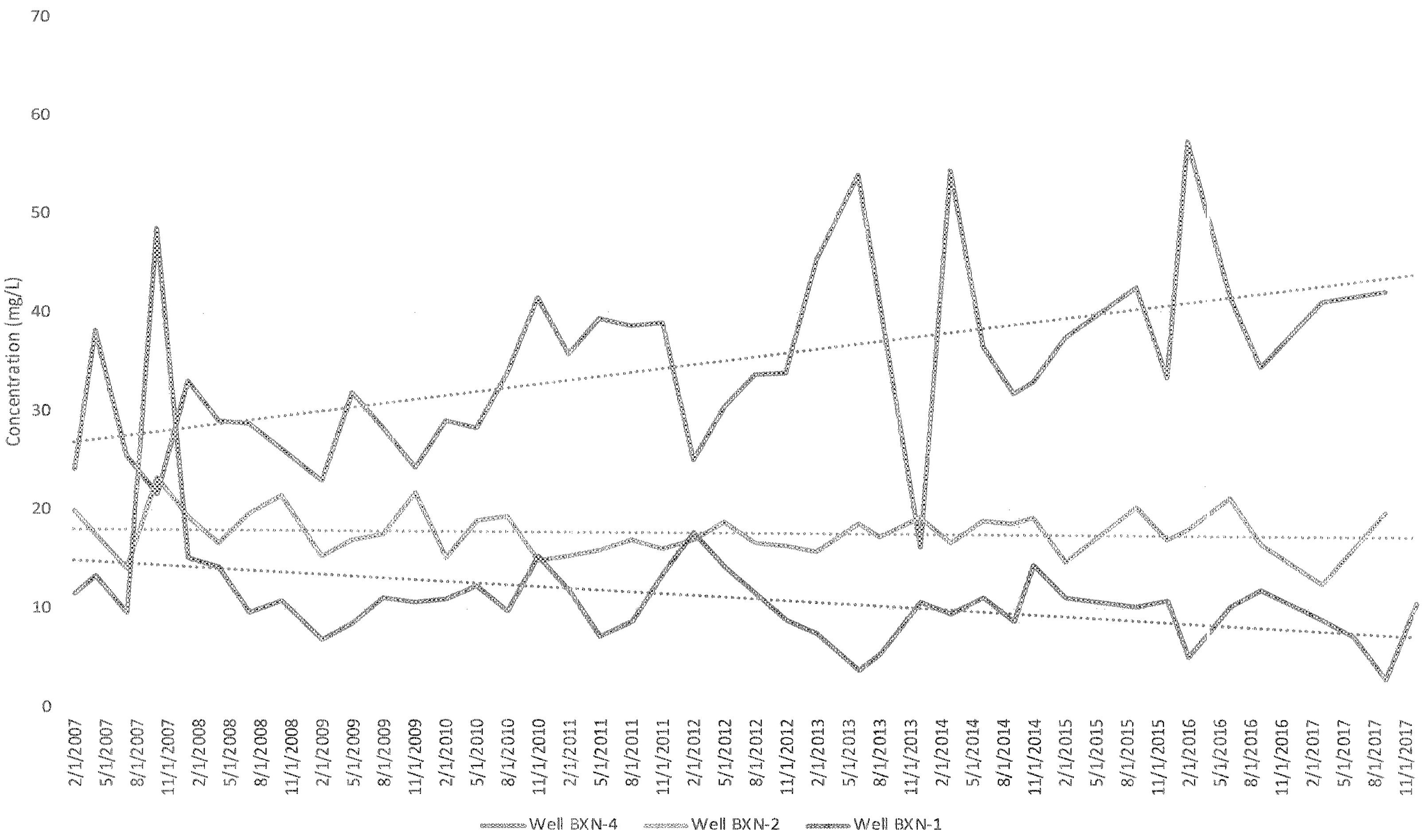


Figure 17
Tannin & Lignin Trend
North Wells

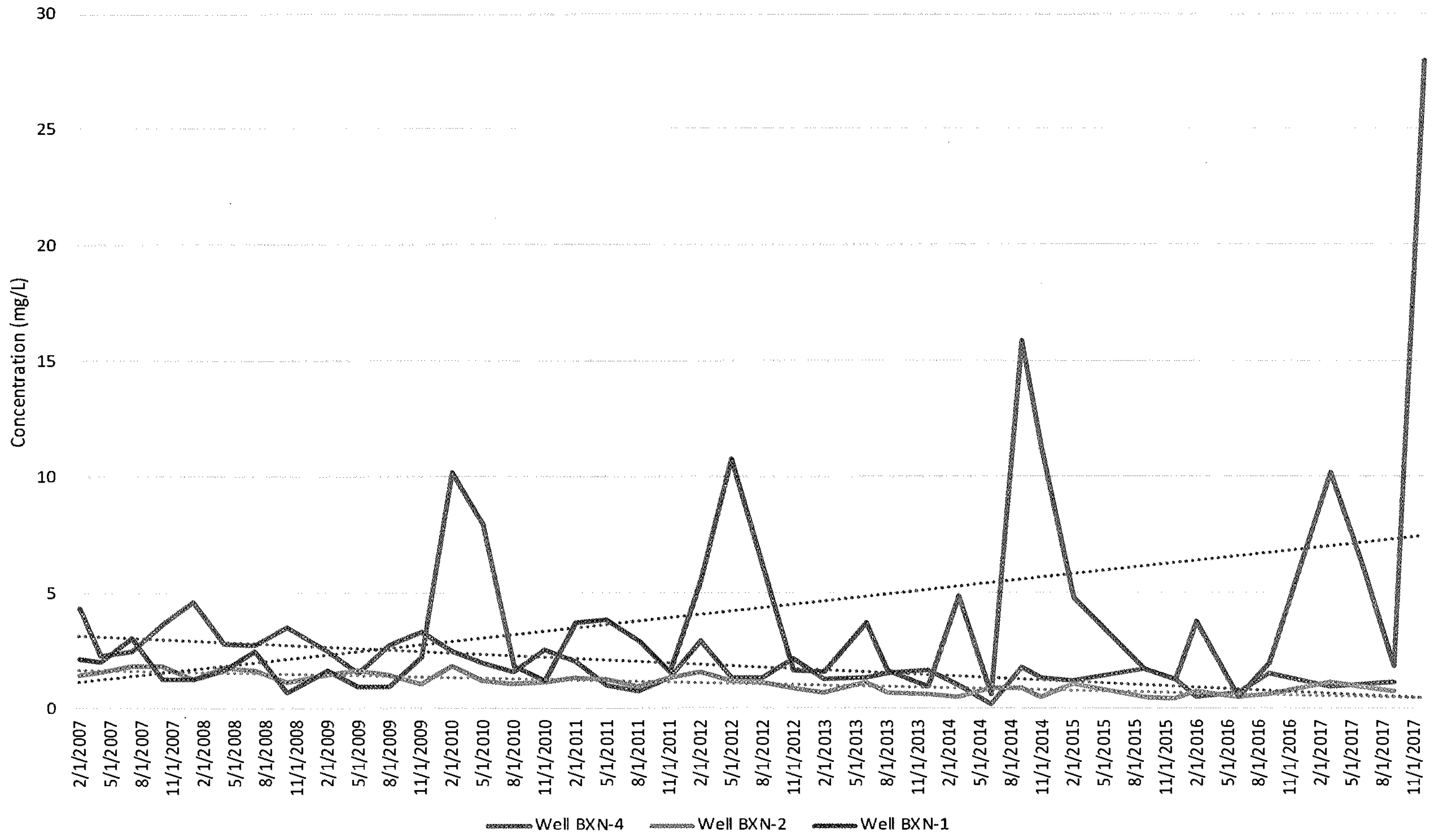


Figure 18
TDS Trend
North Wells

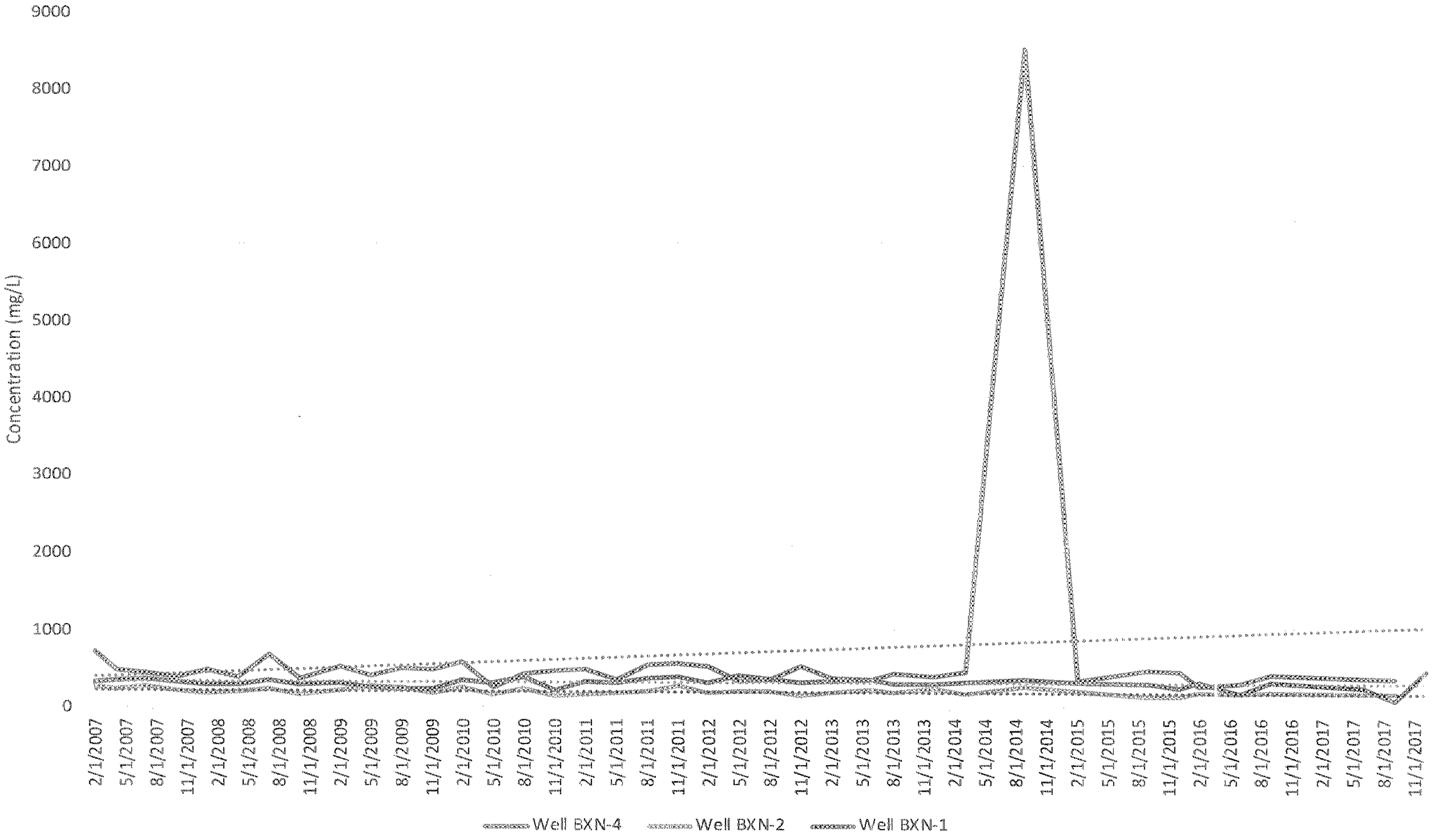


Figure 19
TOC Trend
North Wells

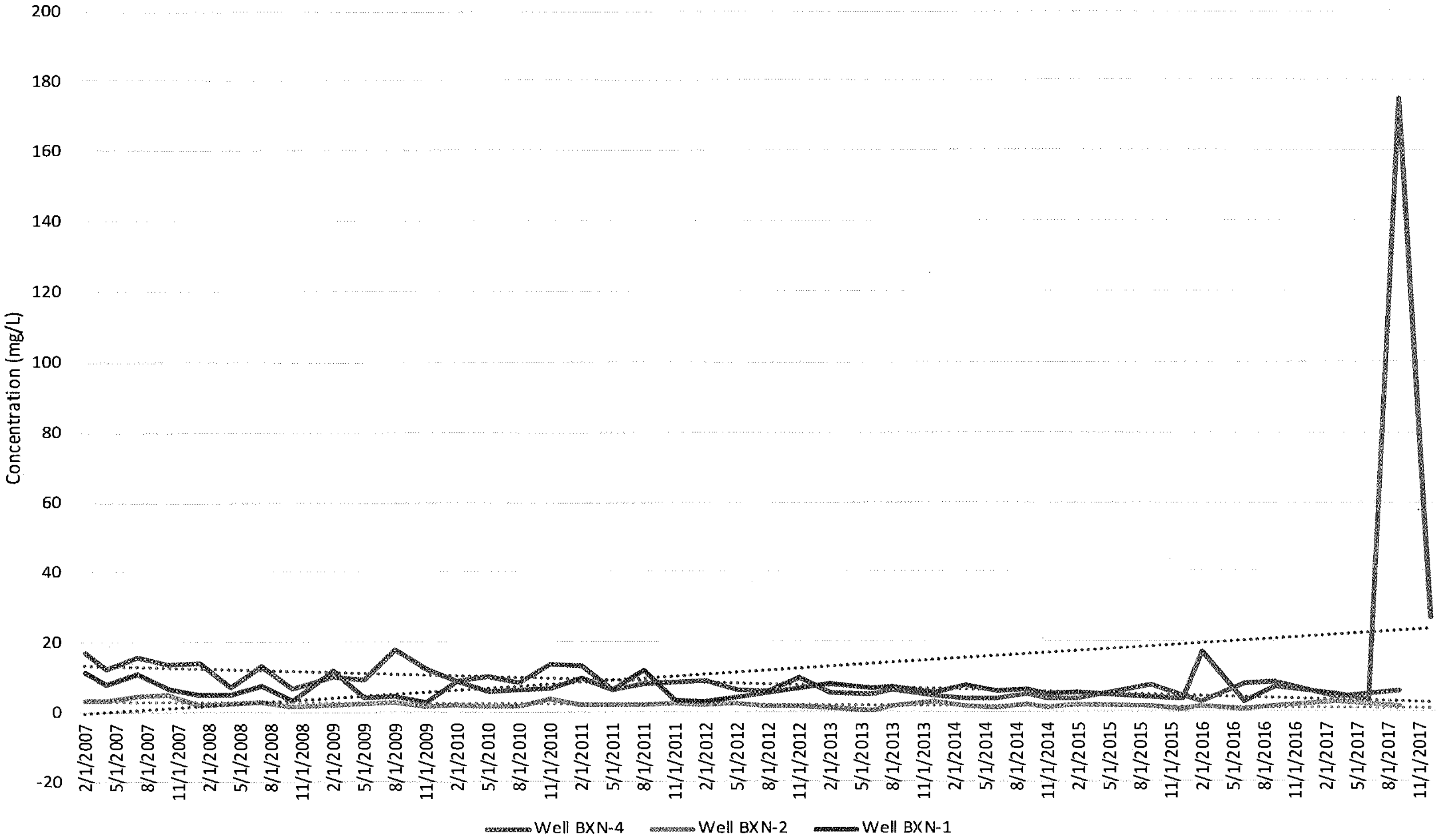
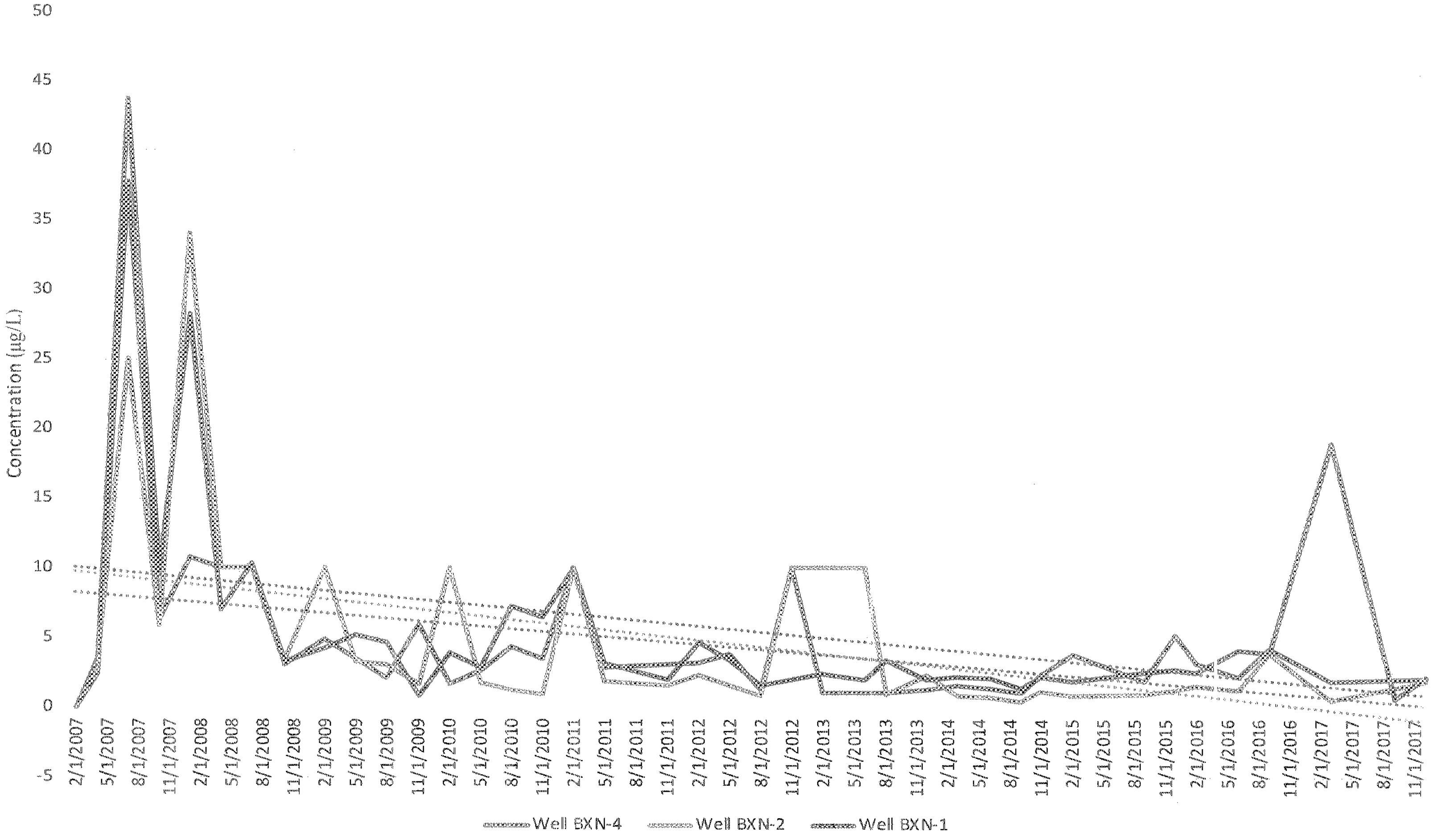


Figure 20
Zinc Trend
North Wells



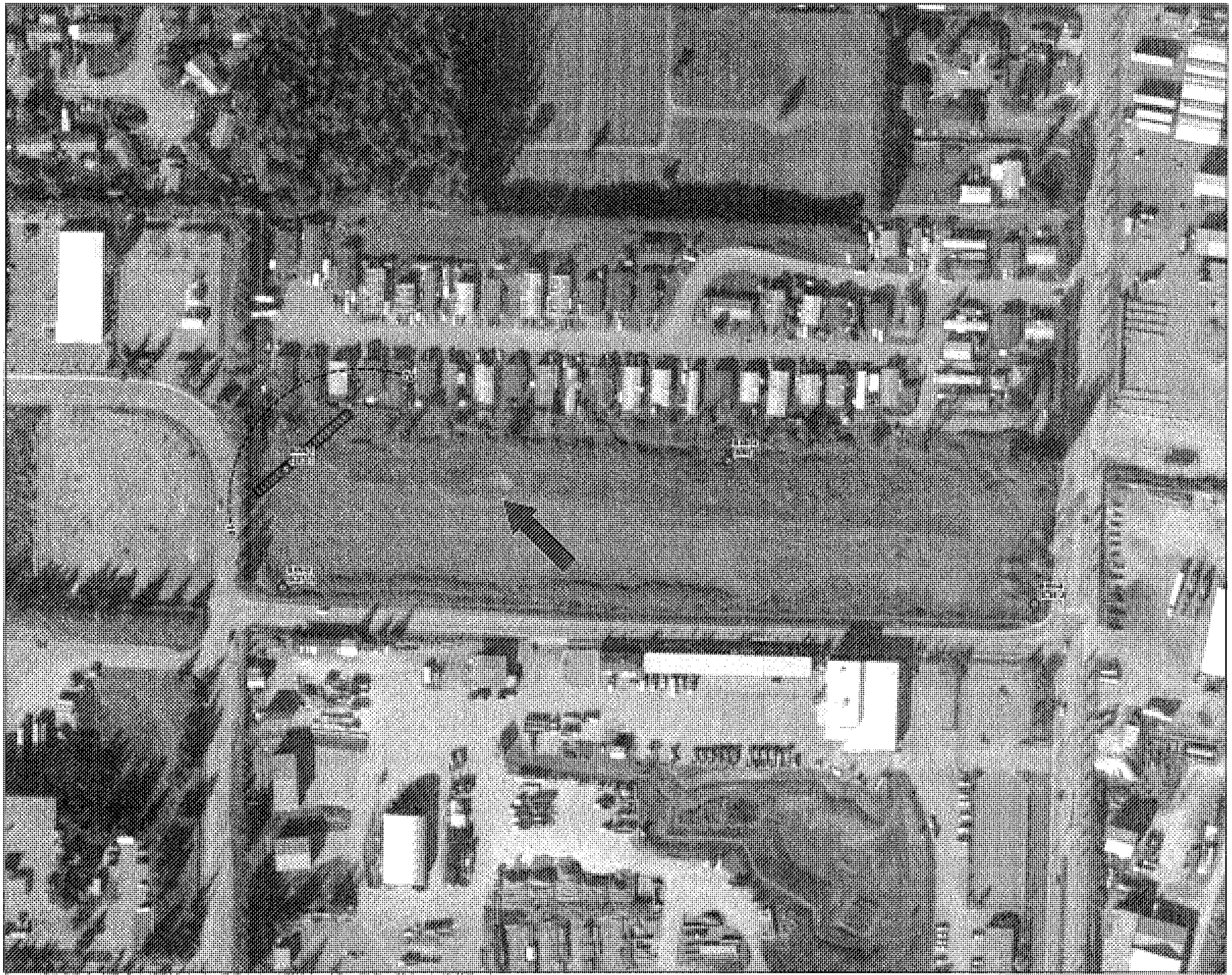


FIGURE 21

Arsenic Isopleth Map: First Quarter 2016

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

LEGEND

- ● Monitoring Well (February 2016 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. BXN-3 is damaged.
4. Concentrations in ug/L.
5. Data from highest arsenic detection (first quarter 2016) depicted.

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.

Appendix A

2017 Groundwater Monitoring Field Forms

FIELD ENVIRONMENTAL INSTRUMENTS, INC.

Date: 3/9 Well ID: BXW-1 Tech: Rod

Depth to Water: 47.00 Depth to Bottom: 51.60 Well Size: 2"

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

Sample Analysis: SEE COC ; Duplicate BXW-5 @ 1110

Flow Rate: 400 mL/min

Start time: 1050

Time	Flow rate	Volume Removed	DTW	PH	COND	TEMP	ORP	DO
1053	400mL	1200	47.00	6.04	503	11.38	39	0.55
1056		2400	47.00	6.02	516	12.06	45	0.50
1059		4800	47.00	6.01	528	12.13	50	0.49
1102		6000	47.00	6.00	529	12.15	51	0.49
1105	↓	7200	47.00	6.00	529	12.16	51	0.48
BXW 5	@ 1110							

All Parameters Stable at: 1105 Total Volume Removed: 7200

Sample time: 1107

Signature: R K Date: 3/9 Time: 1110

FIELD ENVIRONMENTAL INSTRUMENTS, INC.

Date: 3/9/16 Well ID: Bru-2 Tech:

Depth to Water: 43.1 Depth to Bottom: 57.24 Well Size: 2"

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

Sample Analysis: Sec Epc

Flow Rate: 400 ML/M

Start time: 1010

Time	Flow rate	Volume Removed	DTW	PH	COND	TEMP	ORP	DO
1013	400	1200	43.1	6.32	379	12.89	105	.83
1016		2400	43.1	6.23	431	13.02	110	0.78
1019		4800	43.7	6.19	458	13.01	112	0.61
1021		6000	43.7	6.22	460	12.39	112	0.69
1024		7200	43.7	6.43	187	12.54	152	0.69

All Parameters Stable at: ~~1024~~ 1025 Total Volume Removed: 7.2L

Sample time: 1025

Signature: RK Date: 3/9/17 Time: 1024

10:85

FIELD ENVIRONMENTAL INSTRUMENTS, INC.

Date: 3/9/17 Well ID: 6XW-4 Tech: RK

Depth to Water: 43.4 Depth to Bottom: 5177 Well Size: 2"

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

Sample Analysis: See CoC

Flow Rate: 400 ml/m

Start time: 1124

Time	Flow rate	Volume Removed	DTW	PH	COND	TEMP	ORP	DO
11:27	400	1200	41.5	6.07	753	12.66	66	1.75
11:30		2400	41.5	6.18	728	13.94	91	0.88
11:33		3600	41.6	6.16	724	14.06	107	0.04
11:36		4800	41.5	6.12	712	14.12	112	0.03
11:39		6000	41.5	6.09	702	14.15	119	0.03

All Parameters Stable at: 1135

Total Volume Removed: 6 L

Sample time: 1140

Signature:

Date: 3/9/17 Time: 1139

11:4

FIELD ENVIRONMENTAL INSTRUMENTS, INC.

Date: 6/11/17 Well ID: BXN-1 Tech: MH

Depth to Water: 45.82 Depth to Bottom: 51.60 Well Size: 2

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

Sample Analysis: Full Landfill Suite

Flow Rate: 300 ml/m

Start time: 0900

Time	Flow rate	Volume Removed	DTW	PH	COND	TEMP	ORP	DO
0903	300	900	45.83	5.91	361	12.3	-25.2	1.49
0906		1800	45.86	5.92	308	12.4	-38.8	0.54
0909		2700	45.86	5.93	311	12.4	-41.7	0.52
0912		3600	45.86	5.93	311	12.4	-43.4	0.52
0915		4500	45.86	5.94	315	12.4	-44.4	0.51
0918	✓	5400	45.86	5.94	317	12.4	-44.1	0.49

All Parameters Stable at: 0918

Total Volume Removed: 5.4L

Sample time: 0919

Signature:

Date: 6/11/17 Time: 0920

FIELD ENVIRONMENTAL INSTRUMENTS, INC.

Date: 9/12/17 Well ID: BXAS-1 Tech:

Depth to Water: 48.45 Depth to Bottom: 51.60 Well Size: 2

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

Sample Analysis:

Flow Rate:

Start time:

Time	Flow rate	Volume Removed	DTW	PH	COND	TEMP	ORP	DO
0910	500							
0913	1800		48.45	6.01	282	12.5	-50.1	0.42
0916	2700		48.45	6.00	274	13.1	-60.1	0.42
0919	3600		48.45	5.94	274	13.2	-47.3	0.45
0922	4800		48.45	5.93	279	13.2	-63.1	0.45
0925	5400		48.45	5.93	281	13.2	-63.6	0.45

All Parameters Stable at: Total Volume Removed:

Sample time: 0926

Signature: Date: Time:

FIELD ENVIRONMENTAL INSTRUMENTS, INC.

Date: 9-17 Well ID: BXN-2 Tech:

Depth to Water: 44.6 Depth to Bottom: 57.2 Well Size:

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

Sample Analysis:

Flow Rate: 300 ml/m

Start time: 0820

Time	Flow rate	Volume Removed	DTW	PH	COND	TEMP	ORP	DO
0820	900		44.6					
0823	1800		44.6	6.84	263	12.9	254.9	1.21
0826	2700		44.6	6.75	260	12.9	2542	1.13
0829	3600		44.6	6.58	265	12.9	2534	.46
0832	4500		44.6	6.50	269	12.9	252.3	.29
0835	5400		44.6	6.50	265	12.9	248.4	.22

All Parameters Stable at: 0835 Total Volume Removed: 5.4L

Sample time:

Signature: Date: 9-17 Time: 0836

FIELD ENVIRONMENTAL INSTRUMENTS, INC.

Date: 9-17 Well ID: BXN-4 Tech: Rd

Depth to Water: 44.0 Depth to Bottom: 51.4 Well Size: 2

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

Sample Analysis:

Flow Rate: 300 ml/m

Start time: 0955

Time	Flow rate	Volume Removed	DTW	PH	COND	TEMP	ORP	DO
0955	900		47.8					
0958	1800		47.6	6.58	608	14.2	196	4.58
1001	2700		4.78	6.31	573	13.3	224	4.40
1004	3600		47.8	6.31	549	13.3	225	2.3
1007	4500		47.8	6.31	621	13.3	224	1.8
1010	5400		47.6	6.28	622	13.3	224	1.7
			47.8	6.29	617	13.3	223	1.6

BXN-3 duplicate of BXN-~~3~~ 4
Time @ 1012

All Parameters Stable at: 1010 Total Volume Removed: 5.4L

Sample time:

Signature: Rd Date: 9-17 Time: 1011

Woodwaste Landfill Monitoring

Date: 12/14/17 Well ID: BXN-1 Tech: Kvam

Depth to Water: 48.94' Depth to Bottom: 51.6' Well Size: 2"

Purge type: Low-Flow/Standard * Well type: Flush mount/[✓ Standpipe]

Sample Analysis: TDS, T&L, TOC, COD, Cl, SO4, NH3, NO3+NO2, As-Ba-Fe-Mn-Ni

Flow Rate:

Start time: 1228

Time	Flow rate	Volume Removed	DTW	PH	COND	TEMP	ORP	DO
1228			48.94					
1305			48.94					
1318		1.5 gals	48.94	6.46	565	11.7	-41.7	3.73

All Parameters Stable at:

Total Volume Removed: 1.5 gallons

Sample time: ~~1450~~ 1310+

Signature: Bruce Kvam

Date: 12/14/17 Time: 1320

\+ samples collected w/ bailer

* well purged w/ bailer

Appendix B

2017 Laboratory Reports

(Separate Files)

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

BXN-2 (Downgradient Well)						
Date	Ammonia Concentration[1]	Number of Samples (n)	Average Concentration (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

BXN-1 (Downgradient Well)						
Date	Ammonia Concentration[1]	Number of Samples (n)	Average Concentration (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

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

BXN-2 (Downgradient Well)						
Date	Chloride Concentration[1]	Number of Samples (n)	Average Concentration (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

BXN-1 (Downgradient Well)						
Date	Chloride Concentration[1]	Number of Samples (n)	Average Concentration (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

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:
$t_c = 2.447$ $\nu = 6$
$t_c = 2.571$ $\nu = 5$
$t_c = 2.776$ $\nu = 4$
$t_c = 3.182$ $\nu = 3$
$t_c = 4.303$ $\nu = 2$
$t_c = 12.706$ $\nu = 1$

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

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

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

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

BXN-2 (Downgradient Well)						
Date	COD Concentration[1]	Number of Samples (n)	Average Concentration (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

BXN-1 (Downgradient Well)						
Date	COD Concentration[1]	Number of Samples (n)	Average Concentration (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

Table C-5. Statistical Analysis of Groundwater Quality Results for Downgradient Wells: Field Conductivity

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	Field Conductivity Concentration^1	Number of Samples (n)	Average Concentration (m_0)	Sample Variance (s^1)
11/17/2014	763	--	--	--
2/25/2015	725	--	--	--
9/14/2015	973	--	--	--
12/7/2015	954	4	853.75	16,360.92
2/29/2016	607	4	814.75	31,882.92
6/6/2016	604	4	784.50	42,783.00
9/26/2016	802	4	741.75	28,604.25
3/9/2017	704	4	679.25	8854.25
6/11/2017	--	3	703.33	9801.33
9/17/2017	--	2	753.00	4802.00
12/14/2017	--	1	704.00	#DIV/0!

BXN-2 (Downgradient Well)						
Date	Field Conductivity 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	305	--	--	--	--	--
2/25/2015	458	--	--	--	--	--
9/14/2015	293	--	--	--	--	--
12/7/2015	261	4	329.25	7,712.25	87.82	-6.76
2/29/2016	429	4	360.25	9,551.58	97.73	-5.65
6/6/2016	341	4	331.00	5,349.33	73.14	-6.16
9/26/2016	326	4	339.25	4,785.58	69.18	-5.54
3/9/2017	463	4	389.75	4,448.92	66.70	-5.02
6/11/2017	--	3	376.67	5,646.33	75.14	-4.55
9/17/2017	--	2	394.50	9,384.50	96.87	-4.26
12/14/2017	--	1	463.00	#DIV/0!	#DIV/0!	*

BXN-1 (Downgradient Well)						
Date	Field Conductivity 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	714	--	--	--	--	--
2/25/2015	603	--	--	--	--	--
9/14/2015	546	--	--	--	--	--
12/7/2015	478	4	585.25	9,978.25	99.89	-3.31
2/29/2016	616	4	560.75	3,967.58	62.99	-3.56
6/6/2016	358	4	499.50	12,073.00	109.88	-3.38
9/26/2016	563	4	503.75	12,672.25	112.57	-2.79
3/9/2017	491	4	507.00	12,491.33	111.76	-2.36
6/11/2017	444	4	464.00	7,388.67	85.96	-3.35
9/17/2017	--	3	499.33	3,592.33	59.94	-4.23
12/14/2017	565	3	500.00	3,721.00	61.00	*

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

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

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

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!

BXN-2 (Downgradient Well)						
Date	pH Concentration[1]	Number of Samples (n)	Average Concentration (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!	*

BXN-1 (Downgradient Well)						
Date	pH Concentration[1]	Number of Samples (n)	Average Concentration (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	*

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!

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!	*

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	*

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

BXN-2 (Downgradient Well)						
Date	Sulfate Concentration[1]	Number of Samples (n)	Average Concentration (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

BXN-1 (Downgradient Well)						
Date	Sulfate Concentration[1]	Number of Samples (n)	Average Concentration (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

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:

$t_c = 2.447$ $\nu=6$

$t_c = 2.571$ $\nu=5$

$t_c = 2.776$ $\nu=4$

$t_c = 3.182$ $\nu=3$

$t_c = 4.303$ $\nu=2$

$t_c = 12.706$ $\nu=1$

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

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

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

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

BXN-2 (Downgradient Well)						
Date	Arsenic Concentration[1]	Number of Samples (n)	Average Concentration (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

BXN-1 (Downgradient Well)						
Date	Arsenic Concentration[1]	Number of Samples (n)	Average Concentration (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

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

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

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

Table C-13. Statistical Analysis of Groundwater Quality Results for Downgradient Wells: Copper

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	Copper Concentration[1]	Number of Samples (n)	Average Concentration (m_0)	Sample Variance (s^2)
11/17/2014	15.0	--	--	--
2/25/2015	13.1	--	--	--
9/14/2015	15.2	--	--	--
12/7/2015	8.7	4	13.00	9.113
2/29/2016	9.2	4	11.55	9.790
6/6/2016	14.1	4	11.80	11.073
9/26/2016	13.5	4	11.38	7.943
3/9/2017	--	3	12.27	7.143
6/11/2017	--	3	13.80	0.180
9/17/2017	10.30	2	11.90	5.120
12/14/2017	--	1	10.30	#DIV/0!

BXN-2 (Downgradient Well)						
Date	Copper Concentration[1]	Number of Samples (n)	Average Concentration (x)	Sample Variance (s^2)	Sample Standard Deviation (s)	Student's T-Test Statistic (t)[2]
11/17/2014	2.0	--	--	--	--	--
2/25/2015	1.7	--	--	--	--	--
9/14/2015	2.2	--	--	--	--	--
12/7/2015	2.0	4	1.98	0.037	0.19	-7.28
2/29/2016	2.0	4	1.98	0.037	0.19	-6.33
6/6/2016	2.0	4	2.05	0.010	0.10	-6.46
9/26/2016	2.0	4	2.00	0.000	0.00	-6.21
3/9/2017	--	3	2.00	0.000	0.00	-6.65
6/11/2017	--	3	2.00	0.000	0.00	-48.17
9/17/2017	2.1	2	2.05	0.005	0.07	-6.15
12/14/2017	--	1	2.10	#DIV/0!	#DIV/0!	*

BXN-1 (Downgradient Well)						
Date	Copper Concentration[1]	Number of Samples (n)	Average Concentration (x)	Sample Variance (s^2)	Sample Standard Deviation (s)	Student's T-Test Statistic (t)[2]
11/17/2014	2.0	--	--	--	--	--
2/25/2015	0.8	--	--	--	--	--
9/14/2015	0.9	--	--	--	--	--
12/7/2015	2.0	4	1.43	0.434	0.66	-7.49
2/29/2016	2.0	4	1.43	0.434	0.66	-6.55
6/6/2016	2.0	4	1.73	0.303	0.55	-6.57
9/26/2016	2.0	4	2.00	0.000	0.00	-6.21
3/9/2017	--	3	2.00	0.000	0.00	-6.65
6/11/2017	--	3	2.00	0.000	0.00	-48.17
9/17/2017	2.1	2	2.05	0.005	0.07	-6.15
12/14/2017	--	1	2.10	#DIV/0!	#DIV/0!	*

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

BXN-2 (Downgradient Well)						
Date	Iron Concentration[1]	Number of Samples (n)	Average Concentration (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

BXN-1 (Downgradient Well)						
Date	Iron Concentration[1]	Number of Samples (n)	Average Concentration (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

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^2)**
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

BXN-2 (Downgradient Well)						
Date	**Manganese Concentration^1**	**Number of Samples (n)**	**Average Concentration (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

BXN-1 (Downgradient Well)						
Date	**Manganese Concentration^1**	**Number of Samples (n)**	**Average Concentration (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**

Table C-16. Statistical Analysis of Groundwater Quality Results for Downgradient Wells: Nickel

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	**Nickel Concentration[1]**	**Number of Samples (n)**	**Average Concentration (m_0)**	**Sample Variance (s^1)**
11/17/2014	74.0	--	--	--
2/25/2015	68.3	--	--	--
9/14/2015	63.7	--	--	--
12/7/2015	57.0	4	65.75	51.777
2/29/2016	57.9	4	61.73	28.029
6/6/2016	62.8	4	60.35	11.483
9/26/2016	92.1	4	67.45	276.550
3/9/2017	61.0	4	68.45	252.683
6/11/2017	--	3	71.97	304.823
9/17/2017	70.5	3	74.53	254.003
12/14/2017	--	2	65.75	45.125

BXN-2 (Downgradient Well)						
Date	**Nickel 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	20.9	--	--	--	--	--
2/25/2015	28.8	--	--	--	--	--
9/14/2015	17.2	--	--	--	--	--
12/7/2015	12.2	4	19.78	48.909	6.99	-9.16
2/29/2016	26.7	4	21.23	61.669	7.85	-8.55
6/6/2016	21.5	4	19.40	38.127	6.17	-11.63
9/26/2016	2.0	4	15.60	118.180	10.87	-5.22
3/9/2017	39.0	4	22.30	236.993	15.39	-4.17
6/11/2017	--	3	20.83	342.583	18.51	-3.48
9/17/2017	24.4	3	21.80	347.320	18.64	-3.72
12/14/2017	--	2	31.70	106.580	10.32	**-3.91**

BXN-1 (Downgradient Well)						
Date	**Nickel 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	32.4	--	--	--	--	--
2/25/2015	31.8	--	--	--	--	--
9/14/2015	33.4	--	--	--	--	--
12/7/2015	45.2	4	35.70	40.547	6.37	-6.25
2/29/2016	41.9	4	38.08	42.209	6.50	-5.64
6/6/2016	14.9	4	33.85	184.310	13.58	-3.79
9/26/2016	22.2	4	31.05	219.030	14.80	-3.27
3/9/2017	37.8	4	29.20	162.913	12.76	-3.85
6/11/2017	23.0	4	24.48	92.196	9.60	-4.25
9/17/2017	18.3	4	25.33	73.382	8.57	-4.85
12/14/2017	0.0	4	19.78	242.810	15.58	-5.04

Table C-17. Statistical Analysis of Groundwater Quality Results for Downgradient Wells: Zinc

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	Zinc Concentration[1]	Number of Samples (n)	Average Concentration (m_0)	Sample Variance (s^2)
11/17/2014	3.9	--	--	--
2/25/2015	1.9	--	--	--
9/14/2015	5.2	--	--	--
12/7/2015	3.2	4	3.55	1.886
2/29/2016	2.2	4	3.13	2.214
6/6/2016	4.3	4	3.73	1.702
9/26/2016	1.9	4	2.90	1.180
3/9/2017	--	3	2.80	1.710
6/11/2017	--	2	3.10	2.880
9/17/2017	2.1	2	2.00	0.020
12/14/2017	--	1	2.10	#DIV/0!

BXN-2 (Downgradient Well)						
Date	Zinc Concentration[1]	Number of Samples (n)	Average Concentration (x)	Sample Variance (s^2)	Sample Standard Deviation (s)	Student's T-Test Statistic (t)[2]
11/17/2014	0.9	--	--	--	--	--
2/25/2015	1.0	--	--	--	--	--
9/14/2015	1.3	--	--	--	--	--
12/7/2015	1.6	4	1.19	0.107	0.33	-3.35
2/29/2016	1.3	4	1.29	0.071	0.27	-2.43
6/6/2016	2.0	4	1.55	0.110	0.33	-3.23
9/26/2016	0.5	4	1.35	0.403	0.64	-2.46
3/9/2017	--	3	1.27	0.563	0.75	-1.76
6/11/2017	--	2	1.25	1.125	1.06	-1.31
9/17/2017	1.9	2	1.20	0.980	0.99	-1.13
12/14/2017	--	1	1.90	#DIV/0!	#DIV/0!	*

BXN-1 (Downgradient Well)						
Date	Zinc Concentration[1]	Number of Samples (n)	Average Concentration (x)	Sample Variance (s^2)	Sample Standard Deviation (s)	Student's T-Test Statistic (t)[2]
11/17/2014	1.9	--	--	--	--	--
2/25/2015	2.5	--	--	--	--	--
9/14/2015	2.8	--	--	--	--	--
12/7/2015	2.6	4	2.46	0.151	0.39	-1.54
2/29/2016	4.2	4	3.03	0.622	0.79	-0.12
6/6/2016	2.0	4	2.90	0.867	0.93	-1.03
9/26/2016	19.0	4	6.95	65.397	8.09	0.99
3/9/2017	--	3	8.40	85.480	9.25	1.04
6/11/2017	0.7	3	7.23	104.263	10.21	0.69
9/17/2017	2.3	3	7.33	102.723	10.14	0.91
12/14/2017	--	2	1.50	1.280	1.13	*

Table C-17. Statistical Analysis of Groundwater Quality Results for Downgradient Wells: Zinc

Former J.H. Baxter North Woodwaste Landfill

Arlington, Washington

Notes

$\bar{x}$ = average concentration for downgradient well.

m_0 = average concentration for upgradient well.

n = number of samples.

NO_2 = nitrite;

s^1 = sample variance in upgradient well.

s^2 = sample variance in downgradient well.

s = sample standard deviation.

t = Student's T-Test statistic.

-- = analysis not applicable.

* = statistic with no/zero difference.

[1] For non-detect concentrations, half of the method reporting limit is used; when field replicate is collected, the average of the 2 samples is used

[2] Statistic in **bold** or *gray* is a statistically valid detection (according to the Student's T-Test).

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. The wood shaving/bark woodwaste provides organic content which fuels 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 (BXS-3) suggest that the process of mineral desorption may be occurring within the Site.

As the reduced site groundwater blends with the more aerobic and oxidizing background aquifer, it can be expected that downgradient groundwater rapidly returns to aerobic conditions. A multitude of complexing and precipitation processes occur in oxic groundwater conditions that 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. As show in the figure, a positive oxidation potential and increasing pH correspond to greater propensity for arsenic precipitation and sorption.

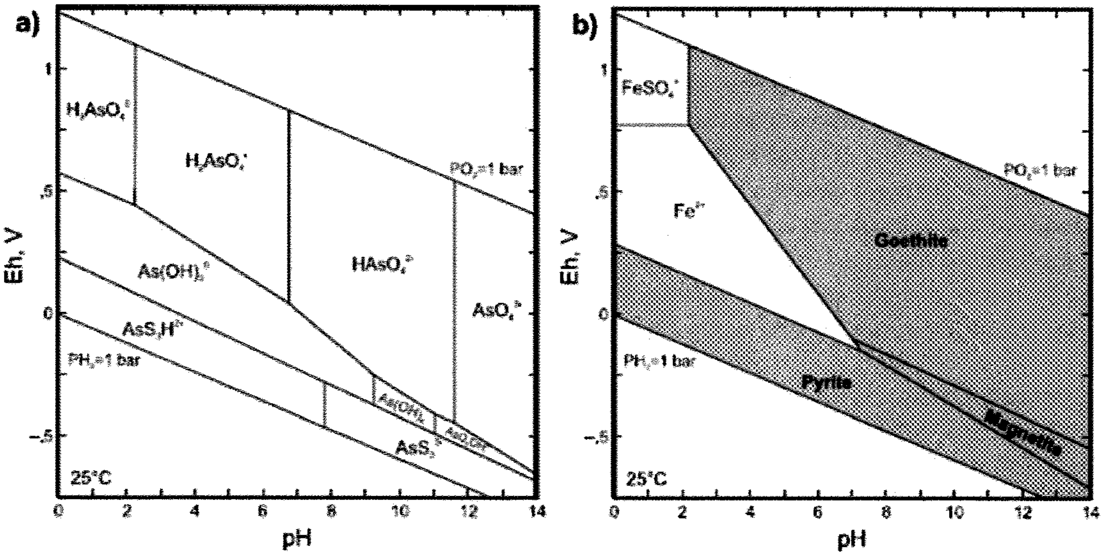


Figure D-2. Eh-pH diagrams for arsenic and iron at 25°C for coupled iron- and sulfate-reducing systems. These paired diagrams show the relative distribution of potentially adsorbing arsenic species (left) relative to representative types of Fe-bearing sorbents (right) that are predicted to occur as a 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 conservative 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 6,000 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 evaluated using the highest observed arsenic concentration in 2016 (BXS-3, 3rd Quarter 2016) as well as the highest calculated site hydraulic conductivity (Table 2). The models were set to a 10 year run period, at which point the concentrations of the models have reached the furthest downgradient extent (given a constant source). The modeled source area was set to a width of 100 feet about BXS-3; other downgradient wells BXS-2 and BXS-1 have not exhibited elevated levels of arsenic nor as significant concentrations of dissolved metals. Comparing observed concentrations in BXS-2 to the modeled values, it can be seen that the model provides a more conservative estimate of the plume dimensions.

The largest areal extent with arsenic concentrations meeting or exceeding the maximum contaminant level (MCL) of 10 µg/L are plotted in Figure 20. Arsenic concentrations exceeding the MCL were not found to persist greater than 325 feet downgradient of BXS-3 (Table D-2) using the Domenico model.

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.

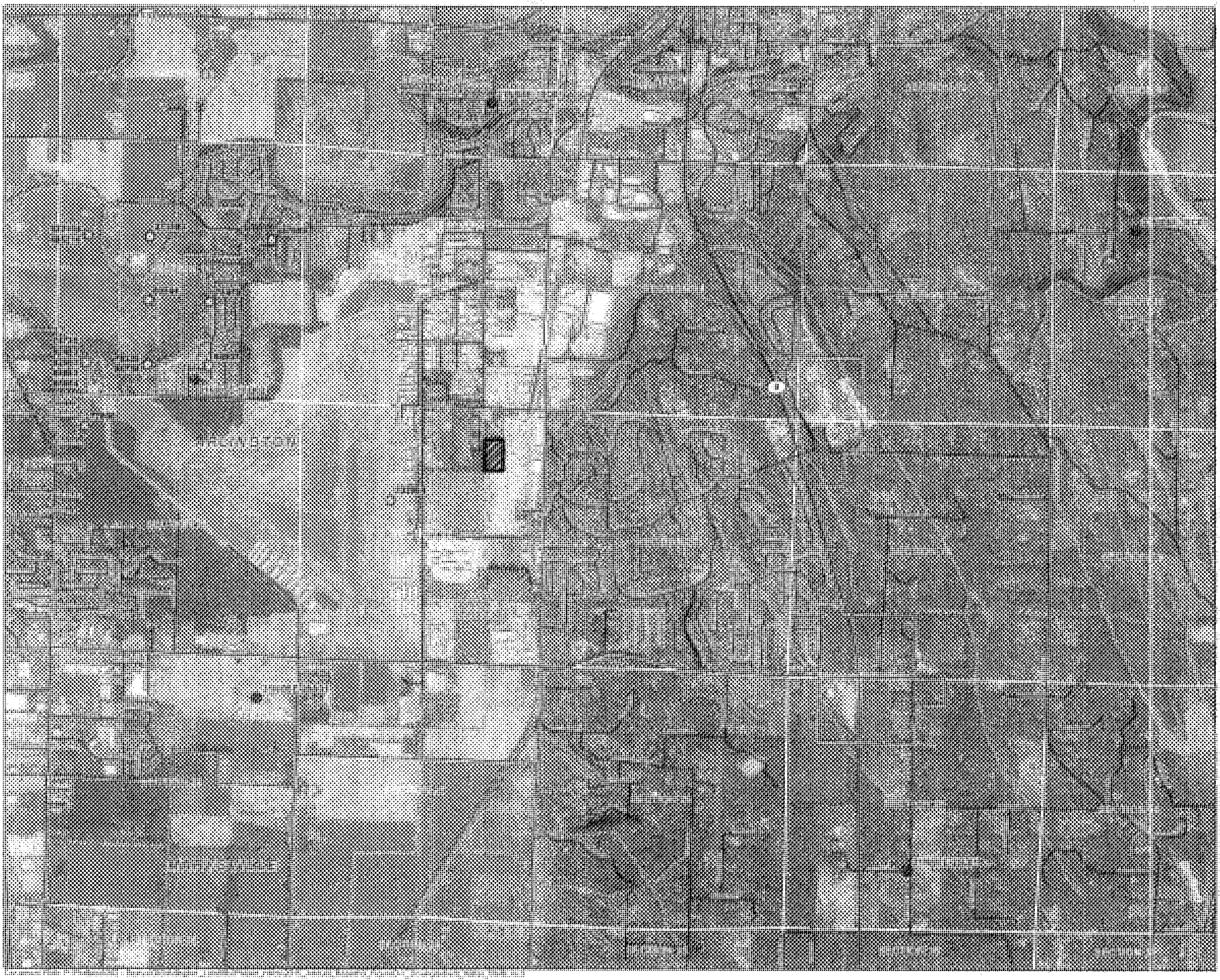
United States Environmental Protection Agency (EPA) 1996. Soil screening guidance: technical background document E-25pp EPA/540/R-95/128, PB96-963502.

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

FIGURE D-1

Location of Potable Water Wellls Downgradient of South Landfill

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



NOTE:
USGS = United States Geological Survey

MAP NOTES:
Date: March 21, 2016
Data Sources: WADOE, US BLM, USGS, ESRI,
Air photo taken on September 28, 2015 by the USDA

GSI Water Solutions, Inc.

Table D-1. Background Groundwater Conditions

Former J.H. Baxter South Woodwaste Landfill

Arlington, Washington

USGS Well Name	USGS Well ID	Date Sampled	Hydrologic Unit Code	Latitude	Longitude	Surface Elevation (ft amsl)	Well Depth (ft)	Temp. (°C)	pH	Dissolved Oxygen (mg/L)	Organic Carbon, filtered (mg/L)	Dissolved Iron (µg/L)	Dissolved Manganese (µg/L)	Arsenic (µg/L)
31N/05E-25L01	480827122062701	7/27/1993	17110008	48.1406553	-122.1087496	460	79	11.4	8	0	0.2	230	84	4
31N/05E-10Q01	480903122094701	8/11/1993	17110008	48.1498214	-122.1651414	115	16.5	12.6	7.5	5.5	0.5	10	<1	2
31N/05E-13D02	481001122100801	7/30/1993	17110008	48.1678773	-122.1709758	125	48	11.2	7	9.6	0.2	<1	<1	<3
31N/05E-28A01	481039122065901	7/27/1993	17110008	48.1773229	-122.0898614	370	25	12.5	6.5	5.9	0.5	<1	62	<1
31N/05E-16Q02	481103122084001	7/27/1993	17110008	48.183989	-122.1456976	90	79	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: 3/15/2017 Prepared by: SK

Contaminant: Arsenic

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

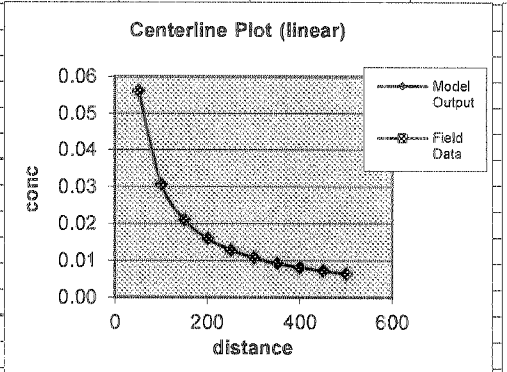
SOURCE CONC (MG/L)	Ax (ft)	Ay (ft)	Az (ft) >=.001	LAMBDA day-1	SOURCE WIDTH (ft)	SOURCE THICKNESS (ft)	Time (days) (days)
0.191	3.23E+02	4.20E+01	1.94E+00	0.00E+00	100	10	3650

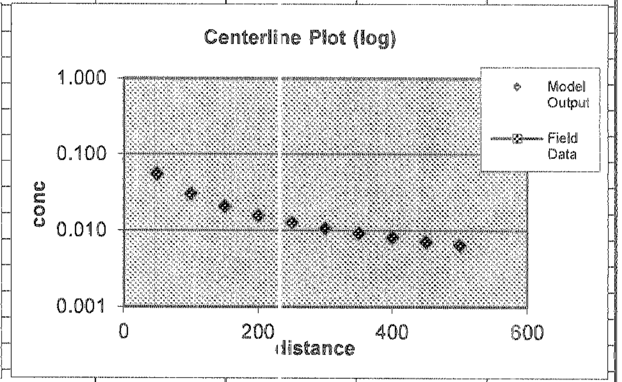
Hydraulic Cond (ft/day)	Hydraulic Gradient (ft/ft)	Porosity (dec. frac.)	Soil Bulk Density (g/cm^3)	KOC	Frac. Org. Carb.	Retard-ation (R)	V (=K*i/n*R) (ft/day)
1.70E+02	0.02	0.3	1.7	1	1.00E-03	1.005666667	11.26947299

Point Concentration

x(ft)	y(ft)	z(ft)
1000	0	0

	x(ft)	y(ft)	z(ft)
Conc. At	1000	0	0
at	3650	days =	0.003 mg/l


Centerline Plot (linear)


Centerline Plot (log)

AREAL MODEL CALCULATION DOMAIN

Length (ft) 500

Width (ft) 150

	50	100	150	200	250	300	350	400	450	500
150	0.006	0.009	0.009	0.009	0.008	0.007	0.006	0.006	0.005	0.005
75	0.033	0.023	0.017	0.014	0.011	0.010	0.009	0.008	0.007	0.006
0	0.056	0.031	0.021	0.016	0.013	0.011	0.009	0.008	0.007	0.007
-75	0.033	0.023	0.017	0.014	0.011	0.010	0.009	0.008	0.007	0.006
-150	0.006	0.009	0.009	0.009	0.008	0.007	0.006	0.006	0.005	0.005

Field Data:	Centerline C Concentration								
	Distance from Source								