2017 Groundwater Monitoring Report
South Woodwaste Landfill
Arlington, Washington

Submitted to

Snohomish Health District
3020 Rucker Avenue, Suite 104
Everett, Washington 98201

Prepared for

Jeff Lervick PLE LLC

P.O. Box 72

Stanwood, WA 98292

Prepared by

Kvam Aquatic Sciences, LLC

9314 NE 133rd Street

Kirkland, WA 98034

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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 South Woodwaste Landfill (South Landfill, Site), located at 6520 188th Street NE in Arlington, Snohomish County, Washington (Figure 1, Source: GSI Water Solutions, Inc.). Baxter closed the South Landfill in 1991; it is covered with a vegetated soil cap.

Four monitoring wells were installed in 1988. Monitoring wells BXS-1, BXS-2, and BXS-3 are located hydraulically downgradient of the South Landfill. Monitoring well BXS-4 is located hydraulically upgradient of the South Landfill (Figures 2 and 3, Source: GSI Water Solutions, Inc.). Monitoring well BXS-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 BXS-2 and on a semi-annual basis from the remaining wells.

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.

Groundwater elevations were highest in monitoring well BXS-2 during the June 2017 monitoring event. Groundwater elevations were lowest in this well during the December 2017 monitoring event. The static groundwater level in well BXS-2 fluctuated throughout the year by 4.5 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 x 10^{-2} to 6 x 10^{-2} centimeters per second based on slug tests performed in monitoring wells BXS-2 and BXS-4 (EMCON, 1989). Porosity (n_e) was assumed to be 0.300 (i.e., 30 percent).

The gradient (i) between wells BXS-2 and BXS-4, which are 1,080 feet apart, was 0.016 to 0.017 (Table 2). This slope results in velocity estimates of 4.5 to 11.3 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 BXS-1 and labeled as BXS-5. During the September sampling event, a field rinsate blank was collected after sampling all wells and labelled as BXS-6. The 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 BXS-1 were qualified as estimated concentrations (J-flag):

- **March 2017:** Ammonia, nitrate plus nitrite as nitrogen, COD, TOC, and iron
- **September 2017:** Tannin & lignin, barium, iron, manganese, and zinc

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. September lab analysis did not include PCP and PAH analyses for BXS-4 samples due to COC discrepancy.

With the exception of June BXS-2 samples, samples arrived at the lab below EPA's 6˚ Celsius (C) recommendation. Sample analyses were performed by ALS and AmTest.

With the exception of pH, 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.

Only TDS was detected in the method blanks above the MRL. Conductivity also was detected in the method blanks; however, it is not considered to affect data quality because it is a physical property of the water. Additionally, primary samples were within historical ranges for conductivity.

Laboratory duplicate RPDs were below laboratory limits or, for sample concentrations less than five times the MRL, the difference between parent and duplicate sample concentrations was less than the MRL, and as such, data were not modified. Analytical values derived from measurements close to the MDL are not subject to the same accuracy and precision criteria as results derived from measurements higher on the calibration range for the method.

Matrix spike (MS) recoveries were within laboratory limits, or the analyte concentration was significantly higher than the added spike concentration, preventing accurate evaluation of the spike recovery. The only exception was the manganese MS for the Batch QC sample from the September 2017 monitoring event that was outside the laboratory control criteria. Recovery in the Laboratory Control Sample (LQS) was acceptable, which indicated the analytical batch was 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 (BXS-1, BXS-2, and BXS-3) and the upgradient well (BXS-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 (BXS-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 BXS-1 through BXS-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:

- TDS, TOC, COD, conductivity, and nickel in BXS-3, BXS-2, and BXS-1
- Chloride in BXS-1
- Arsenic, barium, iron, and manganese in BXS-3
- Tannin and lignin, PCP in BXS-2
- Sulfate in BXS-1
- Ammonia in BXS-3

Additionally, field pH was statistically lower in the BXS-3, BXS-2, and BXS-1 compared to the upgradient well (BXS-4).

5.2 Concentration Trends over Time

Figures 5 through 18 show the concentration trends from 2007 through 2017 for each of the following parameters:

- **Ammonia as Nitrogen** (Figure 5)**:** In 2017, ammonia concentrations in BXS-3 were greater than BXS-4 (upgradient well). In fact, ammonia levels in BXS-3 have been greater than BXS-4 most years and consistently since 2011. In BXS-3, ammonia was at its lowest value in 2011, but increased annually until 2014. Concentrations have been on the decline since 2014. In BXS-1 and BXS-2, concentrations have been well below background concentrations with the exception of first quarter 2017.

- **Arsenic** (Figure 6)**:** In BXS-3, concentrations were above those detected in BXN-4 (upgradient well). Arsenic in BXS-4 has remained stable. Concentrations in BXS-3 have increased since 2007 but have fluctuated without a substantial increase since 2014. Concentrations in BXS-1 and BXS-2 were below background concentrations and have been consistent.
- **Barium** (Figure 7)**:** Barium concentrations in BXS-3 and BXS-2 have been regularly higher than those in BXS-4 (upgradient well). With the exception of third quarter 2009, background Barium has been consistent. Levels are highest in BXS-3 and are on an increasing trend. Concentrations in BXS-1, the most downgradient of the monitoring wells, continues to be below those in BXS-4 . Concentrations in BXS-1 and BXS-2 have been stable with the exception of third quarter 2009.
- **COD** (Figure 8)**:** In BXS-3, BXS-2, and BXS-1, COD concentrations were above those in BXS-4 (upgradient well). Levels in BXS-4 have been fairly stable. COD was highest in BXS-3 and has remained fairly consistent. COD concentrations in the other 2 downgradient wells are showing a slight decline.
- **Chloride** (Figure 9)**:** In BXS-2 and BXS-1, chloride concentrations have regularly been above those in BXS-4 (upgradient well). Chloride in BXS-4 has been consistent. Since 2012, concentrations in BXS-3 have been similar to background levels. Chloride levels in all downgradient wells appear to be decreasing.
- **Iron** (Figure 10)**:** Iron concentrations have been highest in BXS-3 and regularly higher than BXS-4 (upgradient well). Background concentrations and levels in other downgradient wells have been relatively consistent.
- **Manganese** (Figure 11)**:** Manganese concentrations in BXS-3 and BXS-2 have routinely been greater than those in BXS-4 (upgradient well). Concentrations are highest in BXS-3 and are decreasing. With the exception of increases in third quarter 2009 and 2017, manganese levels in other downgradient wells have been consistent.
- **Nickel** (Figure 12)**:** Since the 2nd quarter of 2013, nickel levels in all downgradient wells have been higher than those in BXS-4 (upgradient well). Concentrations have been highest in BXS-2. With the exception of an increase in third quarter 2009 and a smaller spike in 2017, nickel levels in all wells have been consistent.
- **Nitrate plus Nitrite as Nitrogen** (Figure 13): With the exception of first quarter 2017, nitrate+nitrite levels in downgradient wells have exceeded background. Concentrations in downgradient wells have exhibited a slightly decreasing trend since 2007.
- **Sulfate** (Figure 14)**:** In BXS-1, concentrations have been routinely above those in BXS-4 (upgradient well). Sulfate in BXS-4 has been consistent. Concentrations in BXS-2 and BXS-3 have been lower or similar to background with the exception of BXS-2, which spiked in 2017.
- **Tannin and Lignin** (Figure 15)**:** Tannin and lignin concentrations in BXS-3 and BXS-2 have regularly exceeded levels in BXS-4 (upgradient well). Concentrations are

highest in BXS-3 and appear to be increasing. Tannin and lignin in BXS-1 were slightly below the background concentration. Concentrations in downgradient wells continue to show stability.

- **TOC** (Figure 16)**:** TOC levels in BXS-3, BXS-2, and BXS-1 were consistently above those in BXS-4 (upgradient well). Concentrations have been stable in BXS-4. TOC is highest in BXS-3 and are showing a steady decline in all downgradient wells.
- **Field pH** (Figure 17)**:** Field pH has been consistently lower in wells BXS-1, BXS-2, and BXS-3 than BXS-4 (upgradient well). Field pH is decreasing in all wells, but less substantially in the downgradient wells.
- **TDS** (Figure 18)**:** In BXS-3, BXS-2, and BXS-1, TDS concentrations were higher than those present in BXS-4 (upgradient well). TDS in the background well has been consistent. Levels are highest in BXS-2 and showing a decreasing trend in all downgradient wells.
- **Zinc** (Figure 19): Zinc levels in all wells have been inconsistent over the monitoring period and show no clear pattern. Since 2016, levels have been low (<5µg/L) in all wells and more stable.

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, arsenic, barium, cadmium (no longer analyzed), copper, iron, manganese, nickel, zinc, 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 BXS-3 exceeded the MCL of 10 µg/L in first and third quarterly monitoring events in 2017, ranging from 161 to 181 µg/L.
- **PCP:** Concentrations in BXS-1 exceeded the MCL of 1 µg/L in first and third quarterly monitoring events in 2017, ranging from 21.5 to 25 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 20. 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 BXS-3, BXS-2, and BXS-1, pH levels were below the SMCL of 6.5 to 8.5 for all quarterly monitoring events in 2017, ranging from 5.81-6.36.
- **Iron:** In BXS-3 and BXS-2, concentrations exceeded the SMCL of 300 µg/L in the first and third quarter of 2017. Levels in BXS-3 and BXS-2 peaked at 112,000 and 328 µg/L, respectively.
- **Manganese:** In all four monitoring wells, concentrations exceeded the SMCL of 50 µg/L in all four quarterly monitoring events. Concentrations were highest in BXS-3, ranging from 6,460 to 8,730 µg/L.

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:** Except for BXS-2, arsenic concentrations exceeded Washington's water quality standard for groundwater of 0.05 µg/L in all quarterly monitoring events. Concentrations were highest in BXS-3, ranging from 161 to 181 µg/L.
- **Iron:** See discussion in Section 5.3.2.
- **Manganese:** See discussion in Section 5.3.2.
- **PAH:** In BXS-3 and BXS-1, cumulative PAHs exceeded Washington's water quality standard for groundwater of 0.01 µg/L in the third quarter of 2017. Levels in BXS-3 and BXS-1 peaked at 0.013 and 0.021 µg/L, respectively.

6. Summary

Quarterly groundwater monitoring samples were collected from one upgradient well (BXS-4) and three downgradient wells (BXS-1 through BXS-3) during 2017 at the Site. 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 and PCP. The concentrations of arsenic and PCP in monitoring wells BXS-3 and BXS-1, respectively, exceeded the MCL in two 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 BXS-3 and BXS-2 exceeded the SMCL during the first and third quarter. In addition, all wells exceeded the SMCL for manganese during all monitoring events. Furthermore, all field pH measurements in downgradient wells were lower than 6.5 in 2017.

There were also exceedances of the Washington water quality standard for groundwater. Arsenic, iron, manganese, and cumulative PAHs were present above the standard in most wells during 2017.

7. References

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Tables

Table 1. Groundwater Elevation Summary for 2017

Former J.H. Baxter South Woodwaste Landfill

Arlington, Washington

Well ID	Inner Casing Diameter (inches)	Total Depth (ft bgs)	Screen Length (ft)	Screened Interval (ft bgs)	TOC Elevation[1] (ft msl)	Date	Depth to Groundwater (ft below TOC)	Groundwater Elevation (ft msl)
BXS-1	2	47.90	10	37.90 - 47.90	142.65	3/9/2017	30.50	112.15
						6/24/2017	29.69	112.96
						9/17/2017	28.90	113.75
						12/14/2017	NM	NA
BXS-2	2	45.40	10	35.40 - 45.40	142.89	3/9/2017	31.00	111.89
						6/10/2017	30.42	112.47
						9/17/2017	34.70	108.19
						12/14/2017	34.93	107.96
BXS-3	2	44.15	10	34.15 - 44.15	142.07	3/9/2017	27.50	114.57
						6/11/2017	NM	NA
						9/17/2017	28.90	113.17
						12/14/2017	NM	NA
BXS-4	2	47.40	10	37.40 - 47.40	143.42	3/9/2017	13.70	129.72
						6/11/2017	NM	NA
						9/17/2017	18.40	125.02
						12/14/2017	NM	NA

Notes

bgs = below ground surface.

ft = feet.

msl = mean sea level.

TOC = top of casing.

[1] Wells resurveyed in October 2002.

Table 2. Hydraulic Gradient and Groundwater Velocity

Former J.H. Baxter South 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	0.017	0.0300 to 0.0600	0.300	0.002 -- 0.003	4.7 -- 9.4
9/17/2017	0.016			0.002 -- 0.003	4.4 -- 8.8

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 South Woodwaste Landfill
Arlington, Washington

Date	pH				Conductivity				Temperature				ORP				Dissolved Oxygen				Methane			
	(standard unit)				(µS/cm)				(°C)				(mV)				(mg/L)				(percent)			
SMCL	6.5 - 8.5				--				--				--				--				--			
WA WQ Std	6.5 - 8.5				--				--				--				--				--			
Well ID	BXS-4	BXS-3	BXS-2	BXS-1	BXS-4	BXS-3	BXS-2	BXS-1	BXS-4	BXS-3	BXS-2	BXS-1	BXS-4	BXS-3	BXS-2	BXS-1	BXS-4	BXS-3	BXS-2	BXS-1	BXS-4	BXS-3	BXS-2	BXS-1
2/5/2007	8.60	7.12	6.81	6.75	166	730	672	299	9.5	13.2	12.1	11.4	-40	-103	1	241	9.80	2.40	3.00	2.30	NT	NT	NT	NT
4/18/2007	8.09	6.62	6.47	6.31	176	808	796	379	9.5	13.1	12.3	11.7	-136	-113	45	187	1.20	1.80	1.20	0.80	NT	NT	NT	NT
7/18/2007	8.25	6.64	6.52	6.38	222	867	922	415	9.8	13.1	12.5	12.0	-145	-113	62	219	0.00	0.00	0.00	0.00	0.0	0.0	0.0	0.0
10/9/2007	7.83	6.30	6.19	6.02	199	810	804	495	9.8	12.8	12.5	12.0	-148	-97	40	226	0.00	0.00	0.00	0.00	0.0	0.0	0.0	0.0
1/9/2008	7.81	6.25	6.18	5.91	196	788	772	369	9.3	12.1	12.1	11.4	-147	-67	54	251	0.00	0.00	0.00	0.00	0.0	0.0	0.0	0.0
4/30/2008	7.66	6.23	6.10	5.98	201	846	794	485	9.1	12.9	12.2	11.8	-157	-126	32	138	0.00	0.00	0.08	0.15	NT	NT	NT	NT
7/29/2008	7.98	6.42	6.37	6.14	180	726	732	510	9.4	12.9	12.4	12.0	-150	-90	31	185	0.33	0.37	1.77	5.80	0.0	0.0	0.0	0.0
10/22/2008	8.32	6.55	6.48	6.28	177	722	733	496	9.6	12.7	12.4	12.0	-173	-93	20	157	0.07	0.12	0.14	1.10	NT	NT	NT	NT
2/1/2009	8.09	6.77	6.56	6.42	176	734	749	401	9.2	12.7	12.0	11.6	-154	-118	59	299	2.33	2.04	1.87	2.66	0.0	0.0	0.0	0.0
5/1/2009	8.25	6.44	6.35	6.33	185	736	812	335	9.4	13.2	12.6	12.0	-192	-99	86	121	1.21	0.08	0.10	0.53	NT	NT	NT	NT
8/1/2009	7.89	6.52	6.64	6.41	185	695	797	309	9.4	12.6	12.3	11.9	-172	-128	36	245	8.60	6.28	6.03	6.04	0.0	0.0	0.0	0.0
11/1/2009	7.96	6.50	6.46	6.37	192	755	815	315	9.3	12.2	12.0	11.5	-167	-98	52	257	6.73	2.86	1.98	1.18	NT	NT	NT	NT
2/10/2010	8.05	6.59	6.55	6.58	180	726	799	274	9.3	12.9	12.1	12.0	-183	-73	-3	74	0.11	0.17	0.31	1.23	NT	NT	NT	NT
5/26/2010	7.46	6.04	5.96	5.90	189	719	853	288	9.3	12.8	17.0	12.0	-247	-142	59	129	0.00	0.00	0.00	0.00	0.0	0.0	0.0	0.0
8/18/2010	7.63	5.98	5.87	5.94	230	690	833	309	9.7	12.5	12.3	12.3	-285	-51	141	258	0.00	0.18	0.38	0.93	NT	NT	NT	NT
11/18/2010	7.99	6.37	6.52	6.34	184	694	813	344	9.7	12.8	12.1	11.9	-287	-193	-42	-30	0.43	0.12	1.98	0.24	0.0	0.0	0.0	0.0
2/9/2011	8.02	6.22	6.16	6.24	187	710	844	334	9.5	12.8	11.9	12.0	-164	-128	36	-167	0.10	0.11	0.26	0.28	NT	NT	NT	NT
5/17/2011	7.99	6.24	6.20	6.25	183.0	732	929.0	315	9.9	12.8	12.2	12.6	-205.0	-120	32.0	158	0.36	0.38	0.43	0.45	0.2	0.1	0.0	0.0
8/24/2011	7.77	5.79	5.73	5.75	190	741	833	337	10.2	13.0	12.4	12.4	-172	-115	45	164	0.09	0.09	0.19	0.18	NT	NT	NT	NT
11/3/2011	8.36	6.43	6.37	6.46	192	673	852	346	9.8	12.5	12.0	12.0	-274	-140	39	150	1.12	1.04	1.19	1.29	0.1	0.0	0.0	0.0
2/14/2012	7.72	6.92	6.74	6.67	192	696	865	359	10.4	13.1	12.5	12.6	-142	-118	74	302	3.10	4.17	4.21	5.76	NT	NT	NT	NT
5/2/2012	6.97	5.70	5.65	5.06	193	693	914	319	10.4	13.1	12.7	12.6	-98	-49	141	396	1.37	1.86	2.23	3.94	0.0	0.0	0.0	0.0
8/21/2012	6.62	5.33	5.34	4.90	192	707	895	308	10.7	13.1	12.8	12.8	-84	-47	182	330	1.53	1.97	2.39	2.28	NT	NT	NT	NT
11/13/2012	7.68	6.29	6.26	6.10	147	520	641	239	12.5	12.5	12.9	10.5	-125	-82	216	439	2.39	4.73	7.79	6.45	NT	NT	NT	NT
2/12/2013	7.07	5.66	5.72	5.57	184	529	869	278	9.7	12.4	11.8	12.0	-118	-92	76	337	2.16	3.68	0.82	0.91	NT	NT	NT	NT
6/4/2013	7.32	5.92	5.84	5.69	190	635	892	271	10.1	12.2	12.0	12.2	-141	-99	90	313	0.83	2.62	1.52	0.44	NT	NT	NT	NT
8/25/2013	7.62	6.30	6.22	6.03	193	709	871	299	10.2	12.2	12.0	12.5	-119	-104	118	315	0.36	0.80	2.96	2.22	NT	NT	NT	NT
12/2/2013	7.39	5.88	5.66	5.63	198	699	882	313	9.8	11.9	11.6	12.1	-124	-112	135	328	1.02	5.46	5.74	2.36	NT	NT	NT	NT
3/17/2014	5.92	6.28	6.16	6.06	189	730	817	299	10.0	12.2	11.6	12.7	-112	-94	128	268	1.85	8.84	12.60	2.07	NT	NT	NT	NT
6/2/2014	7.47	5.72	5.79	5.64	213	793	952	318	10.1	12.3	12.2	13.3	-92	-86	84	213	0.15	0.00	0.00	0.00	NT	NT	NT	NT
9/29/2014	7.69	6.25	6.15	5.99	212	733	918	306	10.5	12.3	12.0	12.5	-126	-94	106	273	0.00	0.00	0.00	0.00	NT	NT	NT	NT
11/17/2014	7.48	5.99	5.88	5.69	192	675	822	285	10.2	11.9	11.6	12.2	-117	-77	111	285	0.00	10.75	0.71	0.00	NT	NT	NT	NT
2/23/2015	7.28	5.84	5.78	5.86	194	682	798	269	10.2	12.4	11.8	12.8	-102	-71	125	299	1.02	1.28	1.25	1.58	NT	NT	NT	NT
9/14/2015	7.50	6.26	6.24	6.02	196	674	778	268	10.8	12.2	11.9	13.3	-136	-107	142	114	1.09	1.33	1.32	1.23	NT	NT	NT	NT
12/7/2015	7.06	6.04	5.94	5.28	187	676	732	286	10.3	12.0	11.7	12.4	-143	-112	159	286	1.25	1.04	1.07	1.18	NT	NT	NT	NT
2/29/2016	6.98	6.00	5.95	5.86	196	644	795	280	10.5	12.4	11.8	12.4	-74	-102	153	365	1.37	0.92	0.98	1.15	NT	NT	NT	NT
6/16/2016	7.69	6.49	6.57	6.03	197	663	754	356	11.1	12.4	12.4	12.9	-162	-120	13.2	339	0.79	0.72	2.54	0.74	NT	NT	NT	NT
9/26/2016	6.84	6.19	6.10	5.81	189	627	637	344	11.8	12.5	12.5	12.8	-128	-153	148	315	0.75	0.75	2.97	0.90	NT	NT	NT	NT
3/8/2017	7.28	6.12	6.08	5.87	188	694	680	373	12.7	13.1	12.8	13.1	57	109	57	161	3.37	1.37	0.76	2.43	NT	NT	NT	NT
6/10/2017	NT	NT	6.36	NT	NT	NT	354	NT	NT	NT	12.4	NT	NT	NT	106	NT	NT	NT	2.90	NT	NT	NT	NT	NT
9/16/2017	6.97	6.18	6.12	NT	156	507	567	NT	12.9	12.8	12.3	NT	-146.4	-126	-120.9	NT	0.88	1.62	2.56	NT	NT	NT	NT	NT
12/14/2017	NT	NT	6.26	NT	NT	NT	587	NT	NT	NT	12.4	NT	NT	NT	78.9	NT	NT	NT	0.42	NT	NT	NT	NT	NT

Notes

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

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 South Woodwaste Landfill

Arlington, Washington

Date	pH									Conductivity									Chloride								
	(standard unit)									(µS/cm)									(mg/L)								
MCL/SMCL	6.5 - 8.5									--									250								
WA WQ Std	6.5 - 8.5									--									250								
Well ID	BXS-4	BXS-4 Dup	BXS-3	BXS-3 Dup	BXS-2	BXS-2 Dup	BXS-1	BXS-1 Dup	Field Blank	BXS-4	BXS-4 Dup	BXS-3	BXS-3 Dup	BXS-2	BXS-2 Dup	BXS-1	BXS-1 Dup	Field Blank	BXS-4	BXS-4 Dup	BXS-3	BXS-3 Dup	BXS-2	BXS-2 Dup	BXS-1	BXS-1 Dup	Field Blank
2/1/2007	7.81	7.90	6.38		6.36		6.36		5.79	193	192	517		743		338		4	1.6	1.6	3.1		4.9		6.4		0.2 U
4/18/2007	7.61	7.45	6.05		6.10		5.94		5.66	195	199	565		779		377		2	1.9	1.9	2.3		4.5		5.4		0.2 U
7/18/2007	7.69		6.34		6.96		6.28	6.23	6.04	201		518		798		410	401	2	1.7		2.8		4.1		5.1	5.0	0.2 U
10/9/2007	7.82	7.85	6.36		6.35		6.18		5.72	200	201	638		814		482		3	1.7	1.7	2.7		4.3		5.2		0.1 J
1/9/2008	7.75		6.41		6.46		6.23	6.25	5.10	215		681		747		375	360	5	2.0		3.1		4.5		5.8	5.8	0.2 U
4/30/2008	7.76		6.36		6.44		6.38	6.38	6.21	188		658		797		475	472	2,630	1.8		2.4		4.4		5.0	5.1	0.0 J
7/29/2008	7.83		6.32		6.45	6.40	6.27		5.30	206		659		853	865	592		4	1.8		2.8		4.2	4.4	4.5		0.2 U
10/22/2008	7.83		6.33		6.41	6.40	6.49			210		700		892	877	592			1.9		3.6		4.9	4.9	5.1		
2/1/2009	7.94		6.30		6.50		6.67	6.42	5.89	209		604		889		489	479	6	1.7		2.6		4.2		7.6	7.6	0.0 J
5/1/2009	7.92		6.29		6.29		6.38	6.30	5.64	171		496		768		357	328	2	2.2		4.5		6.1		7.3	7.3	0.2 U
8/1/2009	6.32		6.45	6.42	6.40		6.31		5.44	176		412	413	757		299		3	1.8		3.8	3.7	4.3		5.9		0.2 U
11/1/2009	7.66		6.41		6.41		6.42	6.42	6.40	194		598		823		299	314	3	1.9		3.3		4.4		6.5	6.6	0.2 U
2/10/2010	8.04		6.38		6.56	6.56	6.70		6.43	187		634		848	854	298		2 J	1.81		2.90		4.20	4.20	5.30		0.06 J
5/26/2010	7.87		6.26		6.33		6.41	6.48	4.93	192		461		881		297	300	4	1.88		3.40		4.10		5.90	6.00	0.04 J
8/18/2010	7.83		6.15		6.30		6.42	6.46	7.91	209		423		805		311	316	137	1.91		3.04		3.32		5.67	5.70	1.57
11/18/2010	7.72		5.99		6.27		6.35	6.34	6.00	172		543		901		377	364	3	1.57		2.74		3.21		5.38	5.29	0.40 U
2/9/2011	7.88		6.23		6.38		6.49	6.51		155		371		729		296	296	5	2.10		2.37		3.43		6.99	7.09	0.40 U
5/17/2011	7.79		6.28		6.42		6.32	6.50	6.06	219		377		801		321	310	3	1.65		2.07		3.05		6.17	5.94	0.40 U
8/24/2011	8.14		6.45		6.47		6.46	6.74	6.03	202		603		941		359	359	2 J	1.69		1.85		2.88		5.71	5.71	0.40 U
11/3/2011	7.78		6.35		6.49		6.75	6.57	7.33	195		505		884		360	361	2	1.93		2.49		3.38		6.01	5.74	0.40 U
2/14/2012	7.94		6.42		6.54		6.64	6.59	6.04	194		425		873		363	361	2	1.67		2.11		2.91		5.33	5.37	0.40 U
5/2/2012	7.91		6.35		6.68		6.70	6.59	6.86	168		435		925		329	288	3	1.66		1.50		2.97		5.70	5.65	0.40 U
8/21/2012	7.66		6.32		6.62		6.43	6.69	6.39	192		451		898		311	315	3	1.62		1.58		2.96		4.75	4.72	0.40 U
11/13/2012	8.09		6.62		6.63		6.81	6.77	7.42	193		463		867		316	326	2,490	1.63		1.69		3.00		4.80	4.80	0.40 U
2/12/2013	8.28		6.60		7.03		7.07	6.93	7.27	194		377		939		303	299	2 J	1.61		2.08		3.07		5.70	5.70	0.40 U
6/4/2013	8.21		6.60		6.75		6.94	6.78	7.32	202		516		945		290	299	2 J	1.62		1.98		3.00		3.60	3.60	0.40 U
8/27/2013	8.04		6.54		6.62		6.69	6.63	6.43	188		428		876		293	292	2 J	1.90		1.88		3.39		4.00	3.90	0.40 U
12/2/2013	8.13		6.58		6.88		6.93	6.79	6.20	193		513		866		312	310	2 J	1.54		1.57		2.65		3.56	3.56	0.40 U
3/17/2014	8.30		6.57		6.76		6.80	6.75	6.38	170		408		774		314	260	7	1.81		2.20 J		2.90		5.97	5.89	0.40 U
6/2/2014	8.00		6.44		6.42		6.52	6.48	5.97	192		4,790		861		290	292	2 J	1.64		1.73		2.74		5.23	5.18	0.40 U
9/29/2014	8.04		6.59		7.26		7.11	7.34	6.35	192		396		840		281	284	3	1.62		1.71		2.57		4.44	4.45	0.40 U
11/17/2014	7.61		6.23		6.69		7.04	6.75	7.77	190		406		819		281	294	3	2.02		1.76		3.16		5.04 J	0.52 J	0.40 U
2/23/2015	7.90 H		6.33 H		6.59 H		6.78 H	6.55 H	6.22 H	209		430		876		292	279	2 J	1.58		1.38		2.32		4.56	4.58	0.40 U
9/14/2015	7.92 H		6.31 H		6.61 H		6.71 H	6.51 H	7.00 H	204		348		807		283	280	2 J	1.93		1.87		2.54		5.41	5.51	0.20 U
12/7/2015	7.82 H		6.19 H		6.52 H		6.49 H	6.54 H		204		396		784		312	303		1.66		1.54		2.06		4.58	4.69	
2/29/2016	7.83		6.27		6.67		6.45	6.56	6.44	220		413		866		317	315	2.9	1.83		1.62		2.37		4.90	4.73	0.20 U
6/16/2016	8.06		6.24		6.55		6.57	6.63	5.80	216		450		817		397	396	1.5 J	1.97		1.57		2.52		3.44	3.45	0.20 U
9/26/2016	8.00		6.29		6.54		6.39	6.48	5.81	207		548		747		380	385	10.8	1.91		2.13		2.53		3.41	3.53	0.20 U
3/8/2017	7.7		6.42		6.42		6.80	6.40		198		425		704		396	398		1.97		1.77		2.16		3.01	3.04	
6/10/2017					6.96									445									5.71				
9/16/2017	7.84									195									2.00								
12/14/2017																							4.78				

Table 3B. Summary of Groundwater Conventional Parameters: 2007 through 2017
Former J.H. Baxter South Woodwaste Landfill
Arlington, Washington

Date	Nitrate + Nitrite as N									Solids, total dissolved (TDS)									Sulfate								
	(mg/L)									(mg/L)									(mg/L)								
MCL/SMCL	10									500									250								
WA WQ Std	10									500									250								
Well ID	BXS-4	BXS-4 Dup	BXS-3	BXS-3 Dup	BXS-2	BXS-2 Dup	BXS-1	BXS-1 Dup	Field Blank	BXS-4	BXS-4 Dup	BXS-3	BXS-3 Dup	BXS-2	BXS-2 Dup	BXS-1	BXS-1 Dup	Field Blank	BXS-4	BXS-4 Dup	BXS-3	BXS-3 Dup	BXS-2	BXS-2 Dup	BXS-1	BXS-1 Dup	Field Blank
2/1/2007	0.28	0.58	0.96		0.94		0.75		0.03 J	142	146	522		420		231		5 U	1.4	1.4	0.1 J		0.2 J		14.8		0.2 U
4/18/2007	0.23	1.21	0.20		0.63		0.85		0.01 J	151	140	493		490		229		5 U	1.3	1.3	0.2 U		0.2 U		13.9		0.2 U
7/18/2007	0.05 U		0.19		0.08		0.70	0.68	0.01 J	154		414		495		262	248	5 U	1.4		0.2 U		0.2 U		11.3	11.4	0.2 U
10/9/2007	0.05 U	0.05 U	0.17		0.05 U		0.47		0.05 U	159	151	476		478		294		5 U	1.3	1.3	0.1 J		0.1 J		9.4		0.2 U
1/9/2008	0.05 U		0.07		0.05 U		0.58	0.54	0.05 U	148		578		508		239	233	5 U	0.8		0.2 U		0.2 U		14.0	14.9	0.2 U
4/30/2008	0.05 U		0.05 U		0.05 U		0.74	0.73	0.05 U	118		496		430		265	256	5 U	1.3		0.1 J		0.2 J		9.6	9.7	0.2 U
7/29/2008	0.10		0.15		0.05 U	0.05 U	1.48		0.05 U	161		415		506	505	363		5 U	1.3		0.1 J		0.1 J	0.2	6.2		0.2 U
10/22/2008	0.05 U		0.10		0.03 J	0.01 J	0.51			139		465		478	491	323			1.1		0.1 J		0.2 J	0.4	6.7		
2/1/2009	0.05 U		0.17		0.01 J		0.99	1.02	0.05	136		461		498		261	263	5 U	1.4		0.1 J		0.1 J		6.4	6.4	0.0 J
5/1/2009	0.01 J		0.21		0.03 J		0.12	0.13	0.02 J	130		460		513		223	220	7	1.7		0.4		0.2 U		6.7	6.6	0.2 U
8/1/2009	0.05 U		0.17	0.17	0.02 J		0.11		0.05 U	119		378	425	491		178		5 U	1.1		0.1 J	0.1 J	0.1 J		13.9		0.2 U
11/1/2009	0.05 U		0.06		0.05 U		0.05 U	0.05 U	0.05 U	121		452		496		198	201	5 U	3.3		0.2 U		0.2 U		15.0	14.9	0.2 U
2/10/2010	0.05 U		0.13		0.05 U	0.05 U	0.04 J		0.05 U	152		422		518	501	186		5	1.6		0.1 J		0.1 J	0.1 J	19.6		0.0 J
5/26/2010	0.03 J		0.22		0.04 J		0.11	0.11	0.04 J	129		340		508		166	178	5 U	1.5		0.8		0.2 J		15.3	13.4	0.4
8/18/2010	0.04 J		0.18		0.04 J		0.14	0.14	0.17	202		381		564		250	241	134	1.6		0.8		1.1		14.1	14.0	1.1
11/18/2010	0.05 U		0.12		0.05 U		0.09	0.09	0.05 U	98		330		462		153	161	5 U	1.1		0.4 U		0.4 U		12.3	11.7	0.4 U
2/9/2011	0.05 U		190		0.05 U		0.05 U	0.05 U	0.05 U	165		377		512		211	216	5 U	1.5		1.0		1.3		15.2	15.4	0.4 U
5/17/2011	0.01 J		0.14		0.02 J		0.15	0.14	0.01 J	129		374		559		209	194	5 U	0.9		0.2 J		0.3 J		15.9	15.1	0.4 U
8/24/2011	0.01 J		0.10		0.01 J		0.06	0.06	0.01 J	128		399		550		188	199	5 U	1.0		0.4 J		0.6		16.2	16.7	0.4 U
11/3/2011	0.05 U		0.14		0.01 J		0.10	0.09	0.05 U	115		350		532		217	220	5 U	1.1		0.6		0.8		15.8	15.0	0.4 U
2/14/2012	0.03 J		0.13		0.02 J		0.08	0.08	0.03 J	131		344		518		214	269	5 U	0.9		0.3 J		0.4 J		15.7	15.6	0.4 U
5/2/2012	0.05 U		0.10		0.01 J		0.05 J	0.03 J	0.05 U	129		336		547		230	222	5.5	0.8		0.3 J		0.3 J		16.4	16.3	0.4 U
8/21/2012	0.05 U		0.10		0.05 U		0.05	0.07	0.05 U	119		376		569		189	210	5 U	0.8		0.4		0.5		14.7	14.6	0.2 U
11/13/2012	0.01 J		0.05 U		0.01 J		0.04 J	0.03 J	0.05 U	131		331		537		188	188	5 U	0.9		0.4		0.5		14.5	14.5	0.2 U
2/12/2013	0.02 J		0.13		0.05 U		0.09	0.09	0.05 U	107		288		539		160	174	5.5	0.8		0.2		0.3		14.3	14.6	0.2 U
6/4/2013	0.05 U		0.05		0.05 U		0.09	0.07	0.05 U	141		340		553		179	168	5 U	0.8		0.4		0.6		13.5	13.3	0.2 U
8/27/2013	0.02 J		0.03 J		0.02 J		0.13	0.14	0.04 J	141		349		574		201	189	5 U	0.8		0.1 J		0.2 J		12.7	12.6	0.2 U
12/2/2013	0.05 U		0.20		0.01 J		0.03 J	0.03 J	0.01 J	132		356		530		223	197	5.5	0.8		0.1 J		0.2 J		12.3	11.9	0.2 U
3/17/2014	0.05 U		0.18 U		0.05 U		0.13 U	0.13 U	0.03 J	137		332		504		176	184	5 U	1.0		2.0 Ui		0.3		12.7	12.7	0.2 U
6/2/2014	0.05 U		0.05 U		0.05 U		0.14	0.14	0.05 U	NT		NT		NT		NT	NT	NT	0.9		0.2 U		0.1 J		10.1	9.9	0.2 U
9/29/2014	0.05 U		0.05 U		0.05 U		0.05 U	0.05 U	0.06	131		312		513		169	162	5 U	0.8		0.1 J		0.2		7.2	7.0	0.2 U
11/17/2014	0.05 U		0.05 U		0.05 U		0.05 U	0.05 U	0.03 J	NT		NT		NT		NT	NT	NT	1.6		0.2 J*		0.3		8.4 J*	0.8 J*	0.2 U
2/23/2015	0.05 U		0.05 U		0.05 U		0.07	0.07	0.05 U	122		325		479		156	157	5 U	0.8		0.2		0.3		7.7	7.7	0.2 U
9/14/2015	0.05 U		0.03 J		0.05 U		0.16 J	0.09 J	0.05 U	111		267		430		140	147	5 U	1.2		0.4		0.5		9.7	9.9	0.2 U
12/7/2015	0.05 U		0.05 U		0.05 U		0.37	0.36		112		285		424		146	155		1.1		0.2 J		0.3		10.7	10.6	
2/29/2016	0.05 J		0.05 U		0.05 U		0.39	0.38	0.05 U	101		290		447		145	125	5 U	0.2 U		0.2 U		0.2 U		9.0	9.1	0.15 J
6/16/2016	0.05 U		0.05 U		0.05 U		0.22	0.14	0.05 U	118		301		443		190	197	5 U	1.1		0.4		0.5		6.9	7.5	0.2 U
9/26/2016	0.05 U		0.16		0.05		0.22	0.16	0.05 U	143		311		419		213	194	5.0 U	1.5		0.2 U		0.2		6.0	5.3	0.2 U
3/8/2017	0.359		0.04 J		0.05 U		0.26 J	0.57 J		128						226	221		2.1		0.1 J		0.2 J		4.3	4.6	
6/10/2017					0.165									252									7.36				
9/16/2017	0.055									139		216		406		193	188	2	1.86		0.2 U		0.2 U		5.62	5.65	ND U
12/14/2017					0.005 U									460									51.6				

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

Former J.H. Baxter South Woodwaste Landfill

Arlington, Washington

Date	Ammonia as N									Chemical Oxygen Demand (COD)									Tannin and Lignin								
	(mg/L)									(mg/L)									(mg/L)								
MCL/SMCL	--									--									--								
WA WQ Std	--									--									--								
Well ID	BXS-4	BXS-4 Dup	BXS-3	BXS-3 Dup	BXS-2	BXS-2 Dup	BXS-1	BXS-1 Dup	Field Blank	BXS-4	BXS-4 Dup	BXS-3	BXS-3 Dup	BXS-2	BXS-2 Dup	BXS-1	BXS-1 Dup	Field Blank	BXS-4	BXS-4 Dup	BXS-3	BXS-3 Dup	BXS-2	BXS-2 Dup	BXS-1	BXS-1 Dup	Field Blank
2/1/2007	0.50	0.52	0.93		0.05 U		0.05 U		0.03 J	5.0 U	5.0 U	75		36		6.0		50 U	0.30	0.40	4.10		1.10		0.16 J		0.09 J
4/18/2007	0.50	0.50	0.71		0.05 U		0.05 U		0.05 U	6.0	6.0	80		39		14.0		4.0 J	0.30	0.30	11.90		1.30		0.20 U		0.20 U
7/18/2007	0.50		0.74		0.05 U		0.05 U	0.05 U	0.05 U	5.0 U		67		31		5.0 U	6.0	5.0 U	0.30		13.40		1.30		0.12 J	0.13 J	0.20 U
10/9/2007	0.48	0.49	0.98		0.05 U		0.05 U		0.05 U	5.0 U	5.0 U	71		33		17.0		5.0 U	0.30	0.30	4.70		1.10		0.30		0.20 U
1/9/2008	0.55		0.41		0.05 U		0.05 U	0.05 U	0.02 J	5.0 U		61		35		12.0	13.0	5.0 U	0.30		8.00		1.20		0.30	0.30	0.06 J
4/30/2008	0.46		0.39		0.05 U		0.05 U	0.05 U	0.05 U	3.0 J		76		42		13.0	14.0	5.0 U	0.30		23		1.20		0.20	0.20	0.20 U
7/29/2008	0.48		0.75		0.05 U	0.05 U	0.05 U		0.08	6.0		75		37	35	24		9.0	0.20		11.50		1.20	1.20	0.20		0.20 U
10/22/2008	0.53		0.54		0.05 U	0.05 U	0.05 U			6.0		65		39	41	16.0			0.30		2.50		1.10	1.10	0.20		
2/1/2009	0.51		1.44		0.05 U		0.05 U	0.05 U	0.05 U	5.0 U		69		42		16.0	16.0	5.0 U	0.20		3.40		1.40		0.17 J	0.20	0.20 U
5/1/2009	0.61		1.08		0.05 U		0.05 U	0.05 U	0.05 U	22		70		38		13.0	11.0	5.0 U	0.30		3.50		0.90		0.30	0.30	0.20 U
8/1/2009	0.49		1.24	1.14	0.05 U		0.05 U		0.01 J	3.0 J		106	83	43		12.0		3.0 J	0.30		10.70	31	0.90		0.09 J		0.20 U
11/1/2009	0.54		0.56		0.03 J		0.05 J	0.18	0.02 J	5.0 U		66		42		13.7	13.7	5.0 U	0.39		20.10		1.32		0.19 J	0.18 J	0.04 J
2/10/2010	0.53		1.23		0.05 U	0.05 U	0.05 U		0.05 U	5.0 U		68		35	35	5.0 U		5.0 U	0.28		10.00		1.30	1.04	0.07 J		0.20 U
5/26/2010	0.56		0.97		0.03 J		0.03 J	0.02 J	0.05 U	3.3 J		74		41		11.0	10.5	5.0 U	0.32		31		1.10		0.11 J	0.11 J	0.20 U
8/18/2010	0.53		1.22		0.05 U		0.05 U	0.05 U	0.05 U	5.0 U		74		41		10.9	11.8	5.0 U	0.34		5.22		1.68		0.18 J	0.14 J	0.04 J
11/18/2010	0.50		1.02		0.05 U		0.05 U	0.05 U	0.05 U	5.6		68		42		14.7	12.2	7.6	0.36		13.10		1.43		0.15 J	0.16 J	0.04 J
2/9/2011	0.51		1.21		0.05 U		0.05 U	0.05 U	0.05 U	5.0 U		75		44		9.1	5.0 U	5.0 U	0.42		15.70		1.58		0.21	0.25	0.09 J
5/17/2011	0.54		0.70		0.05 U		0.05 U	0.05 U	0.05 U	3.4 J		71		45		8.2	9.7	5.0 U	0.30		15.00		0.46		0.10 J	0.14 J	0.20 U
8/24/2011	0.55		0.66		0.05 U		0.05 U	0.05 U	0.05 U	5.0 U		84		42		9.8	8.8	5.0 U	0.26		21		1.15		0.09 J	0.12 J	0.20 U
11/3/2011	0.57		0.05 U		0.04 J		0.05 U	0.05 U	0.05 U	5.0 U		69		38		4.7 J	7.6	5.0 U	0.36		7.70		1.51		0.24	0.24	0.07 J
2/14/2012	0.54		0.81		0.05 U		0.02 J	0.05 U	0.05 U	6.1		74		43		19.7	60	3.5 J	0.50		22		2.36		0.22	0.20	0.10 J
5/2/2012	0.54		0.56		0.05 U		0.05 U	0.05 U	0.05 U	5.0 U		63		42		8.4	5.0 U	5.0 U	0.41		50		1.46		0.13 J	0.18 J	0.20 U
8/21/2012	0.54		0.58		0.05 U		0.05 U	0.05 U	0.05 U	3.6 J		69		44		6.6	6.1	5.0 U	0.20 J		21		1.42		0.20 U	0.20 U	0.20 U
11/13/2012	0.51		0.93		0.05 U		0.05 U	0.05 U	0.05 U	5.0 U		65		38		5.9	10.3	5.0 U	0.33		12.70		1.63		0.17	0.27	0.20 U
2/12/2013	0.52		0.74		0.05 U		0.05 U	0.05 U	0.05 U	5.0 U		57		41		6.3	7.3	5.0 U	0.31		13.20		1.06		0.09 J	0.09 J	0.20 U
6/4/2013	0.53		1.01		0.05 U		0.05 U	0.05 U	0.05 U	5.0 U		63		41		5.9	7.4	5.0 U	0.25		13.10		1.73		0.06 J	0.07 J	0.20 U
8/27/2013	0.54		0.71		0.05 U		0.05 U	0.05 U	0.05 U	3.0 J		68		42		7.5	10.1	5.0 U	0.28		8.60		1.18		0.13 J	0.15 J	0.20 U
12/2/2013	0.55		0.82		0.05 U		0.05 U	0.05 U	0.05 U	5.0 U		65		37		6.7	5.2	5.0 U	0.18 J		5.75		1.38		0.10 J	0.20 U	0.20 U
3/17/2014	0.55		1.21		0.05 U		0.05 U	0.05 U	0.05 U	5.0 U		73		39		6.7	5.7	5.0 U	0.23		29		1.52		0.03 J	0.06 J	0.20 U
6/2/2014	0.58		0.91		0.05 U		0.05 U	0.05 J	0.05 U	5.0 U		71		40		7.1	7.6	5.0 U	0.28		20.80		1.27		0.20 U	1.15 J	0.12 J
9/29/2014	0.52		1.24		0.05 U		0.05 U	0.05 U	0.05 U	5.0 U		68		39		6.3	5.8	5.0 U	0.30		23		0.92		0.10 J	0.08 J	0.20 U
11/17/2014	0.55		1.08		0.05 U		0.05 U	0.05 U	0.05 U	5.0 U		65		34		5.6	6.6	5.0 U	0.29		20.50		1.37		0.11 J	0.10 J	0.20 U
2/23/2015	0.54		1.05		0.05 U		0.05 U	0.05 U	0.05 U	5.0 U		69		37		6.8	8.5	5.0 U	0.31		23		1.33		0.20 U	0.20 U	0.060 J
9/14/2015	0.54		1.00		0.05 U		0.05 U	0.05 U	0.03 J	5.0 U		82		40		8.2	6.6	5.0 U	0.22		4.49		1.34		0.09 J	0.08 J	0.20 U
12/7/2015	0.51		1.00		0.05 U		0.05 U	0.04 J		5.0 U		73		38		7.3	7.7		0.34		1.13		1.23		0.14 J	0.11 J	
2/29/2016	0.45		1.16		0.05 U		0.05 U	0.05 U	0.025 J	5.0 U		66		44		8.6	7.0	5.0 U	0.20		5.30		1.32		0.05 J	0.09 J	0.20 U
6/16/2016	0.53		1.13		0.05 U		0.05 U	0.10 U	0.028 J	4.8 J		76		45		12.1	10.6	5.0 U	0.21		7.80		1.19		0.09 J	0.09 J	0.20 U
9/26/2016	0.52		0.94		0.05 U		0.46	0.05 U	0.05 U	5.7		85		41		9.9	9.9	5.0 U	0.12 J		3.75		1.04		0.11 J	0.12 J	0.20 U
3/8/2017	0.05 U		0.88		0.05 U		0.05 U	0.31		9.7		71.1		34.9		9.7	ND U		0.15 J		49.50		1.18		0.13 J	0.13 J	
6/10/2017					0.05 U									4.8 J									1.00				
9/16/2017	0.536		0.993		0.05 U		0.05 U	0.05 U	0.259	3.6 J		70		35		8.2	9.3	ND U	0.2 J		18.5		1.26		0.12 J	0.08 J	ND U
12/14/2017					0.00 U									14									2.8				

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

Former J.H. Baxter South Woodwaste Landfill

Arlington, Washington

Date	Total Organic Carbon (TOC)									Total Coliforms									Pentachlorophenol									Polynuclear Aromatic Hydrocarbons								
	(mg/L)									MPN/100 mL									µg/L									µg/L								
MCL/SMCL	--									1/100 mL									1 µg/L/None									0.2 µg/L/None								
WA WQ Std	--									1/100 mL									--									0.01 µg/L								
Well ID	BXS-4	BXS-4 Dup	BXS-3	BXS-3 Dup	BXS-2	BXS-2 Dup	BXS-1	BXS-1 Dup	Field Blank	BXS-4	BXS-4 Dup	BXS-3	BXS-3 Dup	BXS-2	BXS-2 Dup	BXS-1	BXS-1 Dup	Field Blank	BXS-4	BXS-4 Dup	BXS-3	BXS-3 Dup	BXS-2	BXS-2 Dup	BXS-1	BXS-1 Dup	Field Blank	BXS-4	BXS-4 Dup	BXS-3	BXS-3 Dup	BXS-2	BXS-2 Dup	BXS-1	BXS-1 Dup	Field Blank
2/1/2007	1.10	1.00	28		15.60		3.60		0.08 J	1.0 U	1.0 U	1.0 U		1.0 U		1.0 U		1.0 U																		
4/18/2007	1.00	1.00	28		16.70		4.80		0.25 J	1.0 U	1.0 U	1.0 U		1.0 U		1.0 U		1.0 U																		
7/18/2007	0.90		29		15.60		5.20	5.20	0.07 J	1.0		6.0		2,420 >		1.0 U	1.0	1.0 U																		
10/9/2007	1.00	0.90	26		15.50		7.10		0.08 J	1.0 U	1.0 U	1.0 U		5.1		1.0 U		1.0 U																		
1/9/2008	0.80		24		15.80		6.00	6.10	0.14 J	1.0 U		1.0 U		1.0 U		1.0 U	1.0 U	3.1																		
4/30/2008	0.90		28		17.50		5.90	5.90	0.50 U	1.0 U		1.0 U		2.0		1.0 U	1.0 U	1.0 U																		
7/29/2008	0.90		28		15.90	16.20	8.30		0.50 U	1.0 U		1.0 U		249	71	1.0 U		18.7																		
10/22/2008	0.90		24		15.50	16.30	6.60			1.0 U		1.0 U		1.0 U	1.0 U	1.0 U		25																		
2/1/2009	0.90		22		16.60		5.20	5.20	0.50 U	1.0 U		1.0 U		17.5		1.0	1.0 U	1.0 U																		
5/1/2009	1.00		22		15.80		4.70	4.90	0.50 U	1.0 U		1.0		1.0		1.0 U	1.0 U	4.2																		
8/1/2009	1.10		29	28	16.90		5.10		0.17 J	1.0 U		1.0 U	1.0 U	1.0 U		1.0 U		1.0																		
11/1/2009	0.72		24		16.70		5.27	5.15	0.50 U	1.0 U		1.0 U		1.0 U		1.0 U	1.0 U	3.1																		
2/10/2010	0.77		24		17.10	16.50	3.91		0.50 U	1.0 U		1.0 U		1.0	1.0	1.0 U		1.0																		
5/26/2010	0.93		25		17.30		4.17	4.14	0.10 J	1.0 U		1.0 U		2.0		165	165	48																		
8/18/2010	0.81		22		15.30		3.70	3.46	0.50 U	1.0 U		1.0 U		1.0		9.7	3.0	18.9																		
11/18/2010	2.61		25		18.20		7.41	7.18	0.08 J	1.0		5.2		2.0		1.0	1.0 U	1.0																		
2/9/2011	1.15		22		17.20		4.37	4.16	0.50 U	1.0 U		1.0 U		1.0 U		1.0 U	1.0 U	1.0 U																		
5/17/2011	0.94		18.80		16.40		2.94	3.01	0.07 J	2.0		1.0 U		1.0 U		1.0 U	1.0	1.0 U																		
8/24/2011	0.67		26		14.20		2.98	3.06	0.50 U	1.0 U		1.0 U		18.1		1.0 U	1.0 U	1.0 U																		
11/3/2011	1.00		4.41		14.60		3.13	3.35	0.50 U	1.0 U		P		P		P		1.0 U																		
2/14/2012	1.19		22		15.40		3.09	3.28	0.08 J	2.0		1.0 U		5.2		1.0 U	1.0 U	1.0 U																		
5/2/2012	0.68		17.30		15.50		2.64	4.04	0.50 U																											
8/21/2012	0.84		19.30		14.80		2.51	2.56	0.50 U	1.0 U		1.0 U		1.0 U		2.0	1.0 U	1.0 U																		
11/13/2012	0.90		19.80		14.30		2.74	2.81	0.08 J	1.0 U		1.0 U		1.0		1.0 U		1.0 U																		
2/12/2013	0.73		15.40		15.50		2.54	2.46	0.50 U	1.0 U		10.0 U		1.0 U		1.0 U	1.0 U	1.0 U																		
6/4/2013	0.82		18.40		15.40		2.39	2.44	0.50 U																											
8/27/2013	0.88		18.90		14.60		2.54	2.49	0.50 U	1.0 U		1.0 U		1.0 U		1.0 U	1.0 U	1.0 U																		
12/2/2013	0.90		18.40		14.30		2.48	2.54	0.08 J	1.0 U		1.0 U		1.0 U		41 J	24 J	1.0 U																		
3/17/2014	0.84		20.40		13.30		2.29	2.23	0.50 U	1.0 U		1.0 U		1.0 U		1.0 U	1.0 U	1.0 U																		
6/2/2014	1.00 U		19.80		14.60		2.34	2.48	0.26 J	1.0 U		1.0 U		1.0 U		1.0 U	1.0 U	1.0 U																		
9/29/2014	0.78		19.50		14.00		2.25	2.15	0.50 U	1.0 U		1.0 U		1.0 U		1.0 U	1.0 U	1.0 U																		
11/17/2014	0.78		18.00		13.80		2.45	2.32	0.12 J	1.0 U		1.0 U		1.0 U		4.1	1.0 U	1.0 U																		
2/23/2015	0.81 U		19.00		14.50		2.47	2.44	0.25 J	1.0 U		1.0 U		1.0 U		1.0 U	1.0 U	1.0 U																		
9/14/2015	1.00 U		22		12.80		2.45 U	2.56 U	0.80 J	1.0 U		1.0 U		1.0 U		3.1	3.1	1.0 U																		
12/7/2015	0.94		17.10		12.80		3.00	2.78		1.0 U		1.0 U		1.0 U		2.0	3.1	1.0 U																		
2/29/2016	0.79		16.60		15.00		2.76	2.65	0.13 J	1.0 U		1.0 U		1.0 U		1.0 U	1.0 U	1.0 U																		
6/16/2016	0.85		19.60		13.60		3.06	3.07	0.27 J	1.0 U		1.0 U		1.0 U		1.0 U	1.0 U	1.0 U																		
9/26/2016	0.86		22		13.30		3.28	3.31	0.50 U	1.0 U		1.0 U		1.0 U		1.0 U	1.0 U	1.0 U																		
3/8/2017	2.96		19.0		14.10		3.82	0.37 J											0.8		ND U		ND U		49 D	41	ND U									0.1 J
6/10/2017					3.75																															
9/16/2017	1.06		21.3		14.7		3.47	3.29	ND U												ND U		ND U_i		32	11				0.013		0.007		0.030	0.013	
12/14/2017					11.0																															

µS/cm = microSiemen per centimeter. NT = not tested. mg/L = milligram per liter.

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

J* = result is an estimated concentration because of lab imprecision. U = analyte was not detected above the reported sample quantification limit.

MCL = Federal maximum contaminant levels for drinking water.

MPN = most probable number.

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 3C. Summary of Groundwater Metals: 2007 through 2017

Former J.H. Baxter South Woodwaste Landfill

Arlington, Washington

Date	Arsenic, dissolved								
	(µg/L)								
MCL/SMCL	10								
WA WQ Std	0.05								
Well ID	BXS-4	BXS-4 Dup	BXS-3	BXS-3 Dup	BXS-2	BXS-2 Dup	BXS-1	BXS-1 Dup	Field Blank
2/1/2007	6.8	5.8	145		1.1 B		5.0 U		5.0 U
4/18/2007	6.0	6.0	113		0.7 B		5.0 U		1.5 B
7/18/2007	5.4		113		5.0 U		5.0 U	5.0 U	5.0 U
10/9/2007	5.4	4.8 B	67		5.0 U		5.0 U		5.0 U
1/9/2008	6.7		43		5.0 U		5.0 U	5.0 U	0.7 U
4/30/2008	4.4 J		117		5.0 U		5.0 U	5.0 U	0.7 U
7/30/2008	5.4		111		0.8 J	5.0 U	5.0 U		0.6 U
10/22/2008	7.2		47		5.0 U	5.0 U	1.1 J		
2/1/2009	14.4		114		5.0 U		5.0 U	5.0 U	5.0 U
5/1/2009	6.2		120		1.6 J		0.6 J	0.7 J	5.0 U
8/1/2009	0.8 J		5.0 U	2.5 J	1.5 J		0.8 J		5.0 U
11/1/2009	6.0		64		5.0 U		5.0 U	5.0 U	5.0 U
2/10/2010	7.1		133		3.0 J	2.5 J	1.6 J		5.0 U
5/26/2010	5.5		149		0.9 J		5.0 U	5.0 U	5.0 U
8/18/2010	5.3		139		0.9 J		5.0 U	5.0 U	3.0 J
11/18/2010	5.6		186		5.0 U		5.0 U	5.0 U	5.0 U
2/9/2011	5.5		119		5.0 U		5.0 U	5.0 U	5.0 U
5/17/2011	6.2		139		1.1 J		5.0 U	5.0 U	5.0 U
8/24/2011	6.4		155		5.0 U		5.0 U	5.0 U	5.0 U
11/3/2011	6.2		156		1.0 J		5.0 U	0.6 J	5.0 U
2/14/2012	5.2		158		0.6 J		5.0 U	5.0 U	5.0 U
5/2/2012	5.8		133		0.9 J		5.0 U	5.0 U	5.0 U
8/21/2012	4.9 J		135		5.0 U		5.0 U	5.0 U	5.0 U
11/13/2012	6.2		170		5.0 U		5.0 U	5.0 U	5.0 U
2/12/2013	6.1		119		5.0 U		5.0 U	5.0 U	5.0 U
6/4/2013	6.8		138		1.5 J		5.0 U	1.1 J	1.1 J
8/27/2013	6.3		140		1.0 J		5.0 U	5.0 U	5.0 U
12/2/2013	6.4		164		1.3 J		5.0 U	5.0 U	5.0 U
3/17/2014	6.00		175		0.78		0.50 U	0.50 U	0.50 U
6/2/2014	6.00		157		0.70		0.20 J	0.30 J	0.50 U
9/29/2014	5.86		191		0.69		0.25 J	0.24 J	0.50 U
11/17/2014	5.7		174		0.7		0.3 J	0.3 J	0.5 U
2/23/2015	5.9		163		0.7		0.2 J	0.3 J	0.5 U
9/14/2015	5.9		185		0.6		0.5 U	0.2 J	0.5 U
12/7/2015	6.32		174		0.76		0.26 J	0.26 J	
2/29/2016	6.30		147		0.69		0.29 J	0.23 J	0.50 U
6/16/2016	6.1		138		0.7		0.3 J	0.3 J	0.50 U
9/26/2016	6.56		191		0.47 J		0.25 J	0.26 J	0.50 U
3/8/2017	ND U		161		ND U		ND U	ND U	
6/10/2017					ND U				
9/16/2017	8 J		181		ND U		ND U	ND U	ND U
12/14/2017							5.0		

Date	Barium, dissolved								
	(µg/L)								
MCL/SMCL	2,000								
WA WQ Std	1,000								
Well ID	BXS-4	BXS-4 Dup	BXS-3	BXS-3 Dup	BXS-2	BXS-2 Dup	BXS-1	BXS-1 Dup	Field Blank
2/1/2007	29	29	101		47		19.1		5.0 U
4/18/2007	26	26	74		40		25		3.0 B
7/18/2007	33		81		50		25	23	5.0 U
10/9/2007	29	29	83		48		27		5.0 U
1/9/2008	27		65		42		18.3	19.0	0.6 U
4/30/2008	28		111		42		22	23	0.6 U
7/30/2008	30		122		50	51	32		0.5 U
10/22/2008	27		72		42	43	25		
2/1/2009	30		125		50		23	23	5.0 U
5/1/2009	27		111		45		16.7	16.8	5.0 U
8/1/2009	229		15.6	23	40		230		5.0 U
11/1/2009	27		115		46		13.9	13.1	5.0 U
2/10/2010	28		132		50	52	14.3		5.0 U
5/26/2010	28		134		54		14.5	14.6	5.0 U
8/18/2010	26		119		48		14.9	14.3	1.5 J
11/18/2010	25		132		45		15.7	15.7	5.0 U
2/9/2011	29		142		54		16.9	16.6	5.0 U
5/17/2011	25		123		53		15.3	15.5	5.0 U
8/24/2011	24		120		47		15.8	15.3	5.0 U
11/3/2011	25		121		45		15.0	15.2	5.0 U
2/14/2012	27		136		48		16.7	16.3	0.6 J
5/2/2012	29		116		54		16.4	15.9	5.0 U
8/21/2012	28		114		53		15.3	15.5	5.0 U
11/13/2012	28		137		51		15.7	15.8	5.0 U
2/12/2013	26		90		55		13.9	14.2	5.0 U
6/4/2013	26		86		53		13.3	13.3	4.0 U
8/27/2013	28		115		54		16.1	15.2	4.0 U
12/2/2013	26		124		47		15.1	15.6	4.0 U
3/17/2014	27		140		50		15.4	15.5	4.0 U
6/2/2014	28		127		53		15.2	15	4.0 U
9/29/2014	28		135		50		14.9	15	4.0 U
11/17/2014	28		130		50		15.3	14.7	0.6 J
2/23/2015	28		127		47		13.1	13.3	0.1 J
9/14/2015	30		152		47		14.4	15.2	4.0 U
12/7/2015	28		162		44		13.2	13.4	
2/29/2016	29		115		48		14.5	14.6	4.0 U
6/16/2016	31		109		44		18.8	19.1	0.9 J
9/26/2016	31		128		32		17.7	18	4.0 U
3/8/2017	28.9		128		40.1		23	21.7	
6/10/2017					20.3				
9/16/2017	30		129		40.5		18.9 J	29.4 J	ND U
12/14/2017							35.2		

Date	Iron, dissolved								
	(µg/L)								
MCL/SMCL	300								
WA WQ Std	300								
Well ID	BXS-4	BXS-4 Dup	BXS-3	BXS-3 Dup	BXS-2	BXS-2 Dup	BXS-1	BXS-1 Dup	Field Blank
2/1/2007	39	37	110,000		846		20 U		20 U
4/18/2007	43	36	90,500		771		10.1 B		4.7 B
7/18/2007	38		88,100		699		20 U	20 U	20 U
10/9/2007	36	36	62,700		656		20 U		20 U
1/9/2008	41		35,500		608		7.8 J	8.2 J	3 U
4/30/2008	42		102,000		624		8.8 J	8.3 J	3 U
7/30/2008	35		96,800		593	591	20 U		4 U
10/22/2008	75		53,800		560	571	8.8 J		
2/1/2009	55		109,000		542		4.6 J	20 U	4.5 J
5/1/2009	52		102,000		473		6.1 J	4.9 J	20 U
8/1/2009	91		11.6 J	2,280	1,340		91		0.8 J
11/1/2009	44		59,700		480		4.7 J	4.2 J	20 U
2/10/2010	34		94,700		465	493	20 U		20 U
5/26/2010	44		104,000		451		3.5 J	8.9 J	20 U
8/18/2010	39		104,000		482		3.7 J	1.6 J	20 U
11/18/2010	20 U		116,000		420		8.7 J	6 J	20 U
2/9/2011	47		109,000		466		20 U	20 U	20 U
5/17/2011	56		110,000		470		11.7 J	13 J	6.8 J
8/24/2011	35		107,000		412		20 U	1 J	20 U
11/3/2011	42		100,000		388		7.7 J	7.6 J	20 U
2/14/2012	43		97,800		375		20 U	20 U	20 U
5/2/2012	55		97,900		430		20 J	20 J	20 U
8/21/2012	43		99,200		417		20 U	20 U	20 U
11/13/2012	78		98,100		395		20 U	20 U	20 U
2/12/2013	60		91,600		450		4.4 J	4.6 J	20 U
6/4/2013	58		93,500		416		3.7 J	5.9 J	4.1 J
8/27/2013	65		109,000		416		20 U	5.8 J	20 U
12/2/2013	56		107,000		400		20 U	3 J	20 U
3/17/2014	69		127,000		424		20 U	8.5 J	20 U
6/2/2014	52		118,000		421		20 U	20 U	20 U
9/29/2014	73		111,000		409		20 U	20 U	8.3 J
11/17/2014	70		120,000		421		20 U	20 U	40 U
2/23/2015	73		114,000		375		0.1 U	10.2 J	28 U
9/14/2015	54		122,000		358		6.4 J	3.9 J	20 U
12/7/2015	56		126,000		361		9 J	20 U	
2/29/2016	95		106,000		398		20 U	20 U	4.0 J
6/16/2016	55		108,000		359		3 J	3.8 J	20.0 U
9/26/2016	68		107,000		268		20 J	20 U	3.0 J
3/8/2017	498		112,000		279		71 J	37.0 J	
6/10/2017					8 J				
9/16/2017	839		108,000		328		11 J	65.0 J	ND U
12/14/2017							198		

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

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

Date	Manganese, dissolved (µg/L)									Cadmium, dissolved (µg/L)									Copper, dissolved (µg/L)								
MCL/SMCL	50									5									1,300								
WA WQ Std	50									10									1,000								
Well ID	BXS-4	BXS-4 Dup	BXS-3	BXS-3 Dup	BXS-2	BXS-2 Dup	BXS-1	BXS-1 Dup	Field Blank	BXS-4	BXS-4 Dup	BXS-3	BXS-3 Dup	BXS-2	BXS-2 Dup	BXS-1	BXS-1 Dup	Field Blank	BXS-4	BXS-4 Dup	BXS-3	BXS-3 Dup	BXS-2	BXS-2 Dup	BXS-1	BXS-1 Dup	Field Blank
2/1/2007	112	114	13,500		1,350		90		5 U	5.0 U	5.0 U	5.0 U		5.0 U		5.0 U		5.0 U	10.0 U	10.0 U	10.0 U		10.0 U		3.0 B		10.0 U
4/18/2007	107	106	13,500		1,330		123		1.6 B	5.0 U	5.0 U	2.9 B		0.7 B		1.9 B		5.0 U	10.0 U	10.0 U	10.0 U		10.0 U		10.0 U		10.0 U
7/18/2007	118		14,000		1,330		268	268	5 U	5.0 U		5.0 U		5.0 U		5.0 U	5.0 U		10.0 U		4.4 B		5.4 B		4.2 B	6.0 B	10.0 U
10/9/2007	121	120	14,700		1,280		353		2.7 B	5.0 U	5.0 U	5.0 U		5.0 U		5.0 U			10.0 U	10.0 U	10.0 U		10.0 U		10.0 U		10.0 U
1/9/2008	125		17,900		1,270		422	428	1.6 B	5.0 U		1.8 J		1.4 J		5.0 U	1.3 J		10.0 U		10.0 U		10.0 U		10.0 U	10.0 U	7.0 U
4/30/2008	110		12,600		1,150		240	234	0.3 B	5.0 U		5.0 U		1.1 J		5.0 U	0.7 J		10.0 U		10.0 U		10.0 U		10.0 U	10.0 U	7.0 U
7/30/2008	111		13,100		1,190	1,210	309		0.2 U	5.0 U		4.3 J		5.0 U	5.0 U	0.2 J			10.0 U		10.0 U		1.4 J	1.4 J	3.3 J		1.4 B
10/22/2008	111		15,400		1,290	1,300	297			5.0 U		5.0 U		5.0 U	5.0 U	5.0 U			10.0 U		10.0 U		10.0 U	10.0 U	10.0 U		
2/1/2009	120		11,800		1,250		175	174	0.2 J	5.0 U		1.2 J		5.0 U		0.2 J	0.3 J	0.2 J	10.0 U		10.0 U		2.1 J		1.6 J	2.6 J	10.0 U
5/1/2009	108		11,300		1,230		114	116	0.4 J	5.0 U		2.1 J		5.0 U		5.0 U	5.0 U	5.0 U	10.0 U		10.0 U		10.0 U		10.0 U	10.0 U	5.8 J
8/1/2009	4,220		7,870	2,540	2,500		4,180		0.2 J	5.0 U		5.0 U	5.0 U	5.0 U		5.0 U		5.0 U	22		10.0 U	10.0 U	10.0 U		21		10.0 U
11/1/2009	110		13,400		1,300		204	204	0.7 J	5.0 U		5.0 U		5.0 U		5.0 U	5.0 U	5.0 U	10.0 U		10.0 U		10.0 U		10.0 U	10.0 U	10.0 U
2/10/2010	116		11,200		1,260	1,330	36		5 U	5.0 U		5.0 U		5.0 U	5.0 U	5.0 U		5.0 U	1.3 J		2.0 J		3.8 J	4.1 J	3.9 J		10.0 U
5/26/2010	115		9,380		1,340		78	78	5 U	5.0 U		5.0 U		5.0 U		5.0 U	5.0 U	5.0 U	10.0 U		10.0 U		1.6 J		2.0 J	2.3 J	10.0 U
8/18/2010	108		9,670		1,310		48	47	5 U	5.0 U		3.0 J		5.0 U		5.0 U	5.0 U	5.0 U	4.2 J		6.9 J		4.4 J		4.0 J	6.8 J	10.0 U
11/18/2010	112		7,880		1,340		93	95	5 U	5.0 U		4.5 J		5.0 U		5.0 U	5.0 U	5.0 U	10.0 U		10.0 U		10.0 U		10.0 U	10.0 U	5.8 J
2/9/2011	125		9,610		1,400		159	160	0.2 J									5.0 U	10.0 U		3.3 J		10.0 U		2.0 J	2.0 J	10.0 U
5/17/2011	100		13,600		1,460		122	116	5 U									5.0 U	10.0 U		10.0 U		2.8 J		10.0 U	10.0 U	2.2 J
8/24/2011	97		14,000		1,340		144	136	5 U									5.0 U	10.0 U		10.0 U		10.0 U		10.0 U	10.0 U	10.0 U
11/3/2011	105				1,300		149	150	0.5 J	5.0 U		2.9 J		2.6 J		5.0 U		5.0 U	10.0 U		10.0 U		10.0 U		10.0 U	2.3 J	10.0 U
2/14/2012	114		8,650		1,510		252	242	0.3 J	5.0 U		5.0 U		5.0 U		5.0 U	5.0 U	5.0 U	10.0 U		5.2 J		1.7 J		1.7 J	2.9	10.0 U
5/2/2012	116		12,900		1,570		254	252	5 U	5.0 U		5.0 U		0.6 J		5.0 U	5.0 U	5.0 U	0.6 J		10.0 U		1.7 J		2.1 J	2.2	10.0 U
8/21/2012	113		14,000		1,510		201	200	5 U	NT		NT		NT		NT		NT	10.0 U		10.0 U		1.5 J		2.1 J	1.9	10.0 U
11/13/2012	119		9,650		1,550		242	244	5 U	NT		NT		NT		NT		NT	10.0 U		10.0 U		3.4 J		10.0 U	10.0 U	10.0 U
2/12/2013	110		10,700		1,610		220	220	5 U	NT		NT		NT		NT		NT	10.0 U		10.0 U		1.5 J		1.4 J	1.7 J	10.0 U
6/4/2013	118		14,800		1,680		212	209	6.2	NT		NT		NT		NT		NT	4.0 U		4.0 U		2.8 J		2.1 J	2.0 J	4.0 U
8/27/2013	119		14,200		1,700		224	219	0.5 J	NT		NT		NT		NT		NT	4.0 U		4.0 U		2.3 J		2.0 J	1.6 J	4.0 U
12/2/2013	111				1,580		217	221	0.1 J	NT		NT		NT		NT		NT	4.0 U		4.0 U		3.6 J		2.6 J	2.9 J	4.0 U
3/17/2014	119		10,400		1,640		287	282	0.3 J	NT		NT		NT		NT		NT	4.0 U		4.0 U		4.0 U		4.0 U	4.0 U	4.0 U
6/2/2014	116		12,300		1,680		253	250	1 U	NT		NT		NT		NT		NT	4.0 U		4.0 U		2.6 J		2.0 J	2.1 J	4.0 U
9/29/2014	118		7,310		1,650		240	241	0.6 J	NT		NT		NT		NT		NT	4.0 U		4.0 U		4.0 U		4.0 U	4.0 U	1.2 J
11/17/2014	115		8,620		1,680		265	267	0.2 J	NT		NT		NT		NT		NT	4.0 U		4.0 U		4.0 U		4.0 U	4.0 U	1.0 J
2/23/2015	120		10,100		1,580		311	301	0.96 J	NT		NT		NT		NT		NT	0.1 U		0.3		2.3		1.8	1.8	0.0 J
9/14/2015	114		5,290		1,570		238	268	1 U	NT		NT		NT		NT		NT	4.0 U		4.0 U		2.1 J		13.6	10.1	4.0 U
12/7/2015	110		5,990		1,500		321	330		NT		NT		NT		NT		NT	4.0 U		1.3 J		3.4 J		3.4 J	2.2 J	
2/29/2016	105		11,800		1,600		150	151	0.8 J	NT		NT		NT		NT	NT	NT	4.0 U		4.0 U		2.4 J		2.2 J	4.4	4.0 U
6/16/2016	118		13,900		1,580		249	272	1.0 U	NT		NT		NT		NT	NT	NT	4.0 U		4.0 U		4.0 U		8.3 U	4.0 U	2.2 J
9/26/2016	124		7,620		1,200		290	282	0.3 J	NT		NT		NT		NT	NT	NT	4.0 U		4.0 U		4.0 U		4.0 U	4.0 U	0.9 J
3/8/2017	74.3		8,730		1,540		667	501		NT		NT		NT		NT	NT	NT	NT		NT		NT		NT	NT	NT
6/10/2017					324					NT						NT	NT	NT					1.8 J				
9/16/2017	145		6,460		1,490		301 J	130 J	0.09 J	NT						NT	NT	NT	ND U		ND U		ND U		ND U	ND U	ND U
12/14/2017							1,417			NT						NT	NT	NT									

Table 3C. Summary of Groundwater Metals: 2007 through 2017
Former J.H. Baxter South Woodwaste Landfill
Arlington, Washington

Date	Nickel, dissolved									Zinc, dissolved								
	(µg/L)									(µg/L)								
MCL/SMCL	100									5,000								
WA WQ Std	--									5,000								
Well ID	BXS-4	BXS-4 Dup	BXS-3	BXS-3 Dup	BXS-2	BXS-2 Dup	BXS-1	BXS-1 Dup	Field Blank	BXS-4	BXS-4 Dup	BXS-3	BXS-3 Dup	BXS-2	BXS-2 Dup	BXS-1	BXS-1 Dup	Field Blank
2/1/2007	20.0 U	20.0 U	20.0 U		38		20.0 U		20.0 U	2.4 B	10.0 U	12.9		5.8 B		4.0 B		10.0 U
4/18/2007	20.0 U	20.0 U	18.2 B		34		10.4 B		20.0 U	10.0 U	10.0 U	8.5 B		30		10.0 U		10.0 U
7/18/2007	20.0 U		20.4		30		20.0 U	20.0 U	20.0 U	10.0 U		12.4		11.1		8.0 B	6.5 B	10.0 U
10/9/2007	20.0 U	20.0 U	20.0 U		31		20.0 U		20.0 U	10.0 U	12.9	15.9		22		7.9 B		10.0 U
1/9/2008	20.0 U		17.0 J		31		16.0 J	15.5 J	2.0 U	8.3 J		10.0 U		14.8		10.0 U	8.0 J	7.0 U
4/30/2008	20.0 U		20.2		32		11.1 J	11.8 J	2.0 U	10.0 U		10.0 U		10.0 U		10.0 U	10.0 U	7.0 U
7/30/2008	20.0 U		4.5 J		25	25	10.2 J		0.5 U	1.0 J		4.8 J		4.4 J	4.2 J	9.1 J		1.5 B
10/22/2008	20.0 U		23		32	32	15.5 J			10.0 U		3.9 J		6.2 J	7.1 J	12.1		
2/1/2009	20.0 U		20.6		32		10.7 J	10.5 J	20.0 U	1.5 J		2.1 J		6.5 J		3.6 J	3.5 J	1.6 J
5/1/2009	20.0 U		17.7 J		31		7.0 J	7.9 J	20.0 U	10.0 U		3.9 J		3.7 J		1.5 J	2.2 J	5.0 J
8/1/2009	104		49	27	134		109		20.0 U	3.8 J		2.6 J	2.4 J	10.0 U		3.4 J		2.4 J
11/1/2009	20.0 U		13.2 J		31		11.1 J	10.1 J	20.0 U	10.0 U		1.5 J		2.8 J		1.5 J	10.0 U	10.0 U
2/10/2010	20.0 U		23		32	34	5.9 J		20.0 U	10.0 U		1.6 J		5.3 J	5.8 J	1.7 J		10.0 U
5/26/2010	20.0 U		19.5 J		33		6.5 J	6.7 J	20.0 U	10.0 U		10.0 U		3.5 J		2.1 J	2.5 J	10.0 U
8/18/2010	20.0 U		12.5 J		30		6.8 J	5.5 J	20.0 U	10.0 U		10.0 U		1.7 J		10.0 U	10.0 U	1.9 J
11/18/2010	20.0 U		17.5 J		33		5.8 J	5.2 J	20.0 U	10.0 U		2.3 J		4.8 J		10.0 U	1.9 J	10.0 U
2/9/2011	20.0 U		20.8		34		10.0 J	9.6 J	20.0 U	0.4 J		20.0 U		4.9 J		3.1 J	2.5 J	0.3 J
5/17/2011	20.0 U		15.3 J		39		8.7 J	7.0 J	20.0 U									
8/24/2011	20.0 U		16.2 J		32		8.5 J	9.2 J	20.0 U	10.0 U		4.2 J		4.7 J		1.7 J	3.1 J	10.0 U
11/3/2011	20.0 U		11.2 J		31		10.6 J	10.1 J	20.0 U	10.0 U		3.0 J		4.0 J		1.0 J	1.3 J	10.0 U
2/14/2012	20.0 U		23		30		9.4 J	9.3 J	20.0 U	0.7 J		6.8 J		5.5 J		3.0 J	3.2 J	0.7 J
5/2/2012	20.0 U		13.0 J		34		9.2 J	8.9 J	20.0 U	0.4 J		10.0 U		4.3 J		2.5 J	2.3 J	10.0 U
8/21/2012	0.7 J		15.8 J		34		8.9 J	9.1 J	20.0 U	10.0 U		0.8 J		2.3 J		2.6 J	2.5 J	10.0 U
11/13/2012	20.0 U		13.6 J		32		8.8 J	9.7 J	20.0 U	10.0 U		0.8 J		3.8 J		2.7 J	2.3 J	10.0 U
2/12/2013	20.0 U		18.2 J		36		9.2 J	9.4 J	20.0 U	10.0 U		0.9 J		3.2 J		2.4 J	2.1 J	10.0 U
6/4/2013	0.4 J		18.4		37		8.5	8.4	4.0 U	4.0 U		2.7 J		3.8 J		2.4 J	2.5	4.0 U
8/27/2013	2.2 J		22		38		11.2	10.8	4.0 U	4.0 U		2.9 J		3.6 J		2.7 J	2.5 J	4.0 U
12/2/2013	5.4		25		38		12.8	13.5	4.0 U	4.0 U		1.9 J		3.7 J		3.1 J	3.1 J	4.0 U
3/17/2014	4.0 U		11.2		31		7.4	7.6	4.0 U	4.0 U		0.8 J		4.4		2.8 J	2.8 J	4.0 U
6/2/2014	2.2 J		21		39		10.9	10.4	4.0 U	4.0 U		1.3 J		3.4 J		2.2 J	2.2 J	4.0 U
9/29/2014	4.0 U		16.1		34		8.8	9.0	0.4 J	0.5 J		1.7 J		5.6		3.2 J	2.4 J	4.0 U
11/17/2014	1.1 J		19.7		36		10.0	10.1	4.0 U	5.0 U		2.3 J		4.4 J		2.1 J	2.6 J	5.0 U
2/23/2015	0.4 U		18.9		34		9.3	9.3	0.1 J	0.4 J		2.1		6.5		2.9	2.9	0.5 U
9/14/2015	4.0 U		18.0		31		7.7	8.3	0.4 J	4.0 U		2.0 J		3.1 J		362	268	4.0 U
12/7/2015	4.0 U		20.6		29		6.6	6.9		3.2 J		0.5 J		4.4		13.7 J	6.7 J	
2/29/2016	4.0 U		18.4		33		6.6	6.7	4.0 U	2.1 J		4.1		7.9		8.5	32	4.0 U
6/16/2016	0.4 U		20.8		32		9.2	9.8	4.0 U	4.3 U		4.0 U		4.0 U		13.0	6.6	1.0 J
9/26/2016	4.0 U		14.8		22		8.4	8.4	4.0 U	4.0 U		2.1 J		2.1 J		1.2 J	1.1 J	4.0 U
3/8/2017	3.5 J		15.3		30.2		17.4	14.0		NT		NT		NT		NT	NT	
6/10/2017					10.2									1.9 J				
9/16/2017	2.7 J		21.0		31		12.0	8.6	ND U	0.8 J		1.5 J		1.8 J		1.8 J	5.1 J	2.2 J
12/14/2017																		

µg/L = microgram per liter. B = detected in laboratory method blank. NT = not tested. 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.
J* = result is an estimated concentration because of lab imprecision.
MCL = Federal maximum contaminant levels for drinking water.
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).

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

Former J.H. Baxter South Woodwaste Landfill

Arlington, Washington

Analyte Group	Parameter[1]	Monitoring Period	Unit	Mean Value Downgradient[2,3]			Mean Value Upgradient[2]
				BXS-1	BXS-2	BXS-3	BXS-4
Conventionals	Ammonia as Nitrogen	2001	mg/L			0.10	0.50
Conventionals	Ammonia as Nitrogen	2007	mg/L			0.84	0.50
Conventionals	Ammonia as Nitrogen	2009	mg/L			1.08	0.54
Conventionals	Ammonia as Nitrogen	2010	mg/L			1.11	0.53
Conventionals	Ammonia as Nitrogen	2013	mg/L			0.82	0.53
Conventionals	Ammonia as Nitrogen	2014	mg/L			1.11	0.55
Conventionals	Ammonia as Nitrogen	2015	mg/L			1.03	0.53
Conventionals	Ammonia as Nitrogen	2016	mg/L			1.05	0.51
Conventionals	Carbon, Total Organic	1992	mg/L	3.6	5.0	18.7	1.5
Conventionals	Carbon, Total Organic	1993	mg/L		7.3	20.0	2.0
Conventionals	Carbon, Total Organic	1994	mg/L		8.6	22	2.3
Conventionals	Carbon, Total Organic	1995	mg/L		10.7	31	3.4
Conventionals	Carbon, Total Organic	1996	mg/L	4.9	12.7	39	2.3
Conventionals	Carbon, Total Organic	1997	mg/L		15.0		3.8
Conventionals	Carbon, Total Organic	1998	mg/L			32	10.8
Conventionals	Carbon, Total Organic	1999	mg/L		15.8	32	6.6
Conventionals	Carbon, Total Organic	2000	mg/L	8.1	15.2		1.0
Conventionals	Carbon, Total Organic	2001	mg/L	7.5	14.6	25	3.1
Conventionals	Carbon, Total Organic	2002	mg/L	6.4	13.8	22	2.0
Conventionals	Carbon, Total Organic	2003	mg/L		14.0	22	0.7
Conventionals	Carbon, Total Organic	2004	mg/L	5.1	14.7	23	0.9
Conventionals	Carbon, Total Organic	2005	mg/L	5.7	15.8	25	1.1
Conventionals	Carbon, Total Organic	2006	mg/L	5.1	14.5	28	1.0
Conventionals	Carbon, Total Organic	2007	mg/L	5.2	15.8	28	1.0
Conventionals	Carbon, Total Organic	2008	mg/L	6.7	16.2	26	0.9
Conventionals	Carbon, Total Organic	2009	mg/L	5.1	16.5	24	0.9
Conventionals	Carbon, Total Organic	2010	mg/L	4.8	17.0	24	1.3
Conventionals	Carbon, Total Organic	2011	mg/L	3.4	15.6	17.6	0.9
Conventionals	Carbon, Total Organic	2012	mg/L	2.8	15.0	19.7	0.9
Conventionals	Carbon, Total Organic	2013	mg/L	2.5	15	18	0.83
Conventionals	Carbon, Total Organic	2014	mg/L	2.3	13.9	19.4	0.9
Conventionals	Carbon, Total Organic	2015	mg/L	2.6	13.5	18.9	0.9
Conventionals	Carbon, Total Organic	2016	mg/L	3.0	13	19	0.88
Conventionals	Carbon, Total Organic	2017	mg/L		10.9	20.2	2.01
Conventionals	Chemical Oxygen Demand	1990	mg/L	28	41	98	2.2
Conventionals	Chemical Oxygen Demand	1993	mg/L			106	31
Conventionals	Chemical Oxygen Demand	1994	mg/L		30	83	22
Conventionals	Chemical Oxygen Demand	1995	mg/L			90	32
Conventionals	Chemical Oxygen Demand	1996	mg/L		41	98	16.0
Conventionals	Chemical Oxygen Demand	1997	mg/L		43	87	19.0
Conventionals	Chemical Oxygen Demand	1998	mg/L		51	98	20.1
Conventionals	Chemical Oxygen Demand	1999	mg/L			92	41
Conventionals	Chemical Oxygen Demand	2000	mg/L		44	71	13.6
Conventionals	Chemical Oxygen Demand	2001	mg/L	22	43	70	17.3
Conventionals	Chemical Oxygen Demand	2002	mg/L	19.0	38	60	18.0

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

Former J.H. Baxter South Woodwaste Landfill

Arlington, Washington

Analyte Group	Parameter[1]	Monitoring Period	Unit	Mean Value Downgradient[2,3]			Mean Value Upgradient[2]
				BXS-1	BXS-2	BXS-3	BXS-4
Conventionals	Chemical Oxygen Demand	2003	mg/L		37	56	2.9
Conventionals	Chemical Oxygen Demand	2004	mg/L		38	59	2.9
Conventionals	Chemical Oxygen Demand	2005	mg/L		43	70	8.4
Conventionals	Chemical Oxygen Demand	2006	mg/L	12.5	36	72	2.9
Conventionals	Chemical Oxygen Demand	2007	mg/L	9.9	35	73	3.4
Conventionals	Chemical Oxygen Demand	2008	mg/L	16.3	38	69	4.4
Conventionals	Chemical Oxygen Demand	2009	mg/L	13.7	41	78	7.5
Conventionals	Chemical Oxygen Demand	2010	mg/L	9.8	40	71	3.5
Conventionals	Chemical Oxygen Demand	2011	mg/L	8.0	42	75	4.6
Conventionals	Chemical Oxygen Demand	2012	mg/L		42	68	3.7
Conventionals	Chemical Oxygen Demand	2013	mg/L	6.6	40	63	4.5
Conventionals	Chemical Oxygen Demand	2014	mg/L	6.4	38	69	ND
Conventionals	Chemical Oxygen Demand	2015	mg/L	7.0	37	72	ND
Conventionals	Chemical Oxygen Demand	2016	mg/L	9.5	40	74	3.8
Conventionals	Chemical Oxygen Demand	2017	mg/L	8.3	29	71	6.7
Conventionals	Chloride	1989	mg/L	45	61	17.0	6.6
Conventionals	Chloride	1990	mg/L	23	14.5	6.8	2.2
Conventionals	Chloride	1992	mg/L	16.7	6.7	7.7	2.2
Conventionals	Chloride	1993	mg/L	12.1	6.6	12.8	2.3
Conventionals	Chloride	1994	mg/L	13.0	7.4	7.4	2.1
Conventionals	Chloride	1995	mg/L	14.0	10.0	9.6	1.9
Conventionals	Chloride	1996	mg/L	14.6	17.3	9.1	2.0
Conventionals	Chloride	1997	mg/L	12.6	14.8	35	2.0
Conventionals	Chloride	1998	mg/L	11.6	11.0	6.3	2.1
Conventionals	Chloride	1999	mg/L	10.0		6.1	2.2
Conventionals	Chloride	2000	mg/L	7.8	8.3	5.0	2.1
Conventionals	Chloride	2001	mg/L	5.9	7.4	4.7	2.1
Conventionals	Chloride	2002	mg/L	5.3	6.5	3.8	2.0
Conventionals	Chloride	2003	mg/L	4.6	5.5		2.0
Conventionals	Chloride	2004	mg/L		4.3	2.3	1.8
Conventionals	Chloride	2005	mg/L	4.5	4.4	3.7	1.8
Conventionals	Chloride	2006	mg/L	4.0	3.5	2.8	1.7
Conventionals	Chloride	2007	mg/L	5.5	4.4	2.7	1.7
Conventionals	Chloride	2008	mg/L	5.1	4.5	3.0	1.9
Conventionals	Chloride	2009	mg/L	6.8	4.8	3.6	1.9
Conventionals	Chloride	2010	mg/L	5.6	3.7	3.0	1.8
Conventionals	Chloride	2011	mg/L	6.2	3.2		1.8
Conventionals	Chloride	2012	mg/L		3.0		1.7
Conventionals	Chloride	2013	mg/L	4.2	3.0	1.9	1.7
Conventionals	Chloride	2014	mg/L	5.2	2.8	1.9	1.8
Conventionals	Chloride	2015	mg/L	4.9	2.5		1.8
Conventionals	Chloride	2016	mg/L	4.1	2.5		1.8
Conventionals	Chloride	2017	mg/L	3.2			2.0
Conventionals	Coliform, total	2010	mg/L		2.0		0.6
Conventionals	Coliform, total	2015	mg/L	2.4			ND

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

Former J.H. Baxter South Woodwaste Landfill

Arlington, Washington

Analyte Group	Parameter[1]	Monitoring Period	Unit	Mean Value Downgradient[2,3]			Mean Value Upgradient[2]
				BXS-1	BXS-2	BXS-3	BXS-4
Conventionals	Conductivity	1989	µS/cm	351	607	514	180
Conventionals	Conductivity	1990	µS/cm	366	624	500	214
Conventionals	Conductivity	1992	µS/cm	292	586	533	189
Conventionals	Conductivity	1993	µS/cm		487	526	173
Conventionals	Conductivity	1994	µS/cm	214	479	602	169
Conventionals	Conductivity	1995	µS/cm	333	623		149
Conventionals	Conductivity	1996	µS/cm	290	602	787	161
Conventionals	Conductivity	1997	µS/cm	326		765	169
Conventionals	Conductivity	1998	µS/cm	393	678	738	177
Conventionals	Conductivity	1999	µS/cm	406	786	748	177
Conventionals	Conductivity	2000	µS/cm	417	762	651	166
Conventionals	Conductivity	2001	µS/cm	493	878	886	193
Conventionals	Conductivity	2002	µS/cm	470	849	825	187
Conventionals	Conductivity	2004	µS/cm		821	853	198
Conventionals	Conductivity	2005	µS/cm	393	788	750	192
Conventionals	Conductivity	2006	µS/cm	414	773	785	191
Conventionals	Conductivity	2007	µS/cm	397	799	804	191
Conventionals	Conductivity	2008	µS/cm	465	758	771	189
Conventionals	Conductivity	2009	µS/cm	340	793	730	185
Conventionals	Conductivity	2010	µS/cm	304	825	707	196
Conventionals	Conductivity	2011	µS/cm	334	839	464	193
Conventionals	Conductivity	2012	µS/cm	330	891	444	187
Conventionals	Conductivity	2013	µS/cm	290	879	643	191
Conventionals	Conductivity	2014	µS/cm	292	824	1,500	186
Conventionals	Conductivity	2015	µS/cm	292	822	395	202
Conventionals	Conductivity	2016	µS/cm	352	817	427	210
Conventionals	Conductivity	2017	µS/cm	377	503	605	172
Conventionals	Nitrate + Nitrite as Nitrogen	1990	mg/L	0.72			0.10
Conventionals	Nitrate + Nitrite as Nitrogen	1993	mg/L	0.79			0.18
Conventionals	Nitrate + Nitrite as Nitrogen	1994	mg/L	0.50			ND
Conventionals	Nitrate + Nitrite as Nitrogen	1996	mg/L	1.65			ND
Conventionals	Nitrate + Nitrite as Nitrogen	1997	mg/L	0.75			ND
Conventionals	Nitrate + Nitrite as Nitrogen	1999	mg/L	0.43			ND
Conventionals	Nitrate + Nitrite as Nitrogen	2000	mg/L	0.33			0.10
Conventionals	Nitrate + Nitrite as Nitrogen	2002	mg/L	0.50			0.20
Conventionals	Nitrate + Nitrite as Nitrogen	2004	mg/L	0.85			0.06
Conventionals	Nitrate + Nitrite as Nitrogen	2005	mg/L	0.75			0.06
Conventionals	Nitrate + Nitrite as Nitrogen	2006	mg/L	0.71			0.04
Conventionals	Nitrate + Nitrite as Nitrogen	2007	mg/L	0.69			0.14
Conventionals	Nitrate + Nitrite as Nitrogen	2008	mg/L	0.83			0.04
Conventionals	Nitrate + Nitrite as Nitrogen	2009	mg/L	0.31		0.15	0.02
Conventionals	Nitrate + Nitrite as Nitrogen	2010	mg/L	0.09		0.16	0.03
Conventionals	Nitrate + Nitrite as Nitrogen	2011	mg/L	48			0.02
Conventionals	Nitrate + Nitrite as Nitrogen	2012	mg/L	0.05		0.09	0.02
Conventionals	Nitrate + Nitrite as Nitrogen	2013	mg/L	0.08		0.10	0.03

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

Former J.H. Baxter South Woodwaste Landfill

Arlington, Washington

Analyte Group	Parameter[1]	Monitoring Period	Unit	Mean Value Downgradient[2,3]			Mean Value Upgradient[2]
				BXS-1	BXS-2	BXS-3	BXS-4
Conventionals	Nitrate + Nitrite as Nitrogen	2014	mg/L	0.09		0.08	0.05
Conventionals	Nitrate + Nitrite as Nitrogen	2016	mg/L	0.30			0.04
Conventionals	pH	1992	--	6.1	6.3	6.4	7.9
Conventionals	pH	2000	--	6.1	6.4	6.5	7.9
Conventionals	pH	2001	--	6.1	6.4	6.7	7.9
Conventionals	Solids, Total Dissolved	1990	mg/L		397	436	228
Conventionals	Solids, Total Dissolved	1992	mg/L		352	351	147
Conventionals	Solids, Total Dissolved	1993	mg/L		330		141
Conventionals	Solids, Total Dissolved	1994	mg/L	161	330	418	134
Conventionals	Solids, Total Dissolved	1995	mg/L	188	361	492	141
Conventionals	Solids, Total Dissolved	1996	mg/L	224	423	604	153
Conventionals	Solids, Total Dissolved	1997	mg/L	236	456	613	150
Conventionals	Solids, Total Dissolved	1998	mg/L	273	473	562	137
Conventionals	Solids, Total Dissolved	1999	mg/L	256	524	517	156
Conventionals	Solids, Total Dissolved	2000	mg/L	297	544	527	140
Conventionals	Solids, Total Dissolved	2001	mg/L	261	299	346	135
Conventionals	Solids, Total Dissolved	2002	mg/L	298	466	518	145
Conventionals	Solids, Total Dissolved	2003	mg/L	291	525	572	132
Conventionals	Solids, Total Dissolved	2004	mg/L	228	439	493	127
Conventionals	Solids, Total Dissolved	2005	mg/L	255	516	449	135
Conventionals	Solids, Total Dissolved	2006	mg/L	259	507	526	145
Conventionals	Solids, Total Dissolved	2007	mg/L	254	471	476	152
Conventionals	Solids, Total Dissolved	2008	mg/L	298	481	489	142
Conventionals	Solids, Total Dissolved	2009	mg/L	215	500	438	127
Conventionals	Solids, Total Dissolved	2010	mg/L	189	513	368	145
Conventionals	Solids, Total Dissolved	2011	mg/L	206	538	375	134
Conventionals	Solids, Total Dissolved	2012	mg/L	205	543	347	128
Conventionals	Solids, Total Dissolved	2013	mg/L	191	549	333	103
Conventionals	Solids, Total Dissolved	2014	mg/L	173	509	322	134
Conventionals	Solids, Total Dissolved	2015	mg/L	153	462	297	119
Conventionals	Solids, Total Dissolved	2016	mg/L			296	119
Conventionals	Solids, Total Dissolved	2017	mg/L	206	373		134
Conventionals	Sulfate	1989	mg/L	5.9			2.3
Conventionals	Sulfate	1990	mg/L	6.6			1.9
Conventionals	Sulfate	1992	mg/L	9.1			2.0
Conventionals	Sulfate	1993	mg/L	10.0			2.0
Conventionals	Sulfate	1994	mg/L	11.8			1.9
Conventionals	Sulfate	1995	mg/L	12.0			1.8
Conventionals	Sulfate	1996	mg/L	10.7			1.7
Conventionals	Sulfate	1997	mg/L	11.8			1.6
Conventionals	Sulfate	1998	mg/L	9.5			1.3
Conventionals	Sulfate	1999	mg/L	7.8			1.4
Conventionals	Sulfate	2001	mg/L	7.5			1.4
Conventionals	Sulfate	2002	mg/L	7.3			1.4
Conventionals	Sulfate	2005	mg/L	10.1			1.3

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

Former J.H. Baxter South Woodwaste Landfill

Arlington, Washington

Analyte Group	Parameter[1]	Monitoring Period	Unit	Mean Value Downgradient[2,3]			Mean Value Upgradient[2]
				BXS-1	BXS-2	BXS-3	BXS-4
Conventionals	Sulfate	2006	mg/L	11.3			1.4
Conventionals	Sulfate	2007	mg/L	12.4			1.4
Conventionals	Sulfate	2008	mg/L	9.1			1.1
Conventionals	Sulfate	2009	mg/L	10.5			1.9
Conventionals	Sulfate	2010	mg/L	15.3			1.4
Conventionals	Sulfate	2011	mg/L	15.8			1.1
Conventionals	Sulfate	2012	mg/L	15.3			0.8
Conventionals	Sulfate	2013	mg/L	13.2			0.82
Conventionals	Sulfate	2014	mg/L	9.6			1.10
Conventionals	Sulfate	2015	mg/L	9.1			1.17
Conventionals	Sulfate	2016	mg/L	8.1			1.14
Conventionals	Sulfate	2017	mg/L	5.1			1.98
Conventionals	Tannin and Lignin	1990	mg/L			3.1	1.4
Conventionals	Tannin and Lignin	1993	mg/L		0.5		0.3
Conventionals	Tannin and Lignin	1994	mg/L		0.5	1.0	0.2
Conventionals	Tannin and Lignin	1995	mg/L			3.1	0.6
Conventionals	Tannin and Lignin	1996	mg/L		0.7	5.6	0.3
Conventionals	Tannin and Lignin	1998	mg/L			8.1	0.7
Conventionals	Tannin and Lignin	1999	mg/L			12.2	0.5
Conventionals	Tannin and Lignin	2000	mg/L		9.1	9.2	0.4
Conventionals	Tannin and Lignin	2002	mg/L		1.6	11.1	0.4
Conventionals	Tannin and Lignin	2003	mg/L			6.3	0.4
Conventionals	Tannin and Lignin	2004	mg/L		1.4		0.5
Conventionals	Tannin and Lignin	2005	mg/L			8.1	0.4
Conventionals	Tannin and Lignin	2006	mg/L			11.5	0.4
Conventionals	Tannin and Lignin	2007	mg/L		1.2	8.5	0.3
Conventionals	Tannin and Lignin	2008	mg/L		1.2	11.1	0.3
Conventionals	Tannin and Lignin	2009	mg/L		1.1	9.4	0.3
Conventionals	Tannin and Lignin	2010	mg/L		1.4	14.9	0.3
Conventionals	Tannin and Lignin	2011	mg/L		1.2	15.0	0.3
Conventionals	Tannin and Lignin	2012	mg/L		1.7	27	0.4
Conventionals	Tannin and Lignin	2013	mg/L		1.3	10.2	0.26
Conventionals	Tannin and Lignin	2014	mg/L		1.3	23	0.28
Conventionals	Tannin and Lignin	2015	mg/L		1.3	12.3	0.29
Conventionals	Tannin and Lignin	2016	mg/L		1.2	4.5	0.22
Conventionals	Tannin and Lignin	2017	mg/L		1.6		0.18
Organics	PCP	2017	µg/L		1.2		0.18
Organics	PCP	2017	µg/L		1.6		0.18
Metals	Arsenic	1996	µg/L			9.0	4.0
Metals	Arsenic	1997	µg/L			15.0	5.0
Metals	Arsenic	1998	µg/L			20.0	4.6
Metals	Arsenic	1999	µg/L			34	5.8
Metals	Arsenic	2002	µg/L			10.4	3.8
Metals	Arsenic	2007	µg/L			110	5.9
Metals	Arsenic	2008	µg/L			79	5.9

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

Former J.H. Baxter South Woodwaste Landfill

Arlington, Washington

Analyte Group	Parameter[1]	Monitoring Period	Unit	Mean Value Downgradient[2,3]			Mean Value Upgradient[2]
				BXS-1	BXS-2	BXS-3	BXS-4
Metals	Arsenic	2009	µg/L			75	6.9
Metals	Arsenic	2010	µg/L			152	5.9
Metals	Arsenic	2011	µg/L			142	6.1
Metals	Arsenic	2012	µg/L			149	5.5
Metals	Arsenic	2013	µg/L			140	6.4
Metals	Arsenic	2014	µg/L			174	5.9
Metals	Arsenic	2015	µg/L			174	6.0
Metals	Arsenic	2016	µg/L			163	6.3
Metals	Arsenic	2017	µg/L			171	9.3
Metals	Barium	1993	µg/L			38	28
Metals	Barium	1994	µg/L		38	51	25
Metals	Barium	1995	µg/L		45	58	27
Metals	Barium	1996	µg/L		48	74	26
Metals	Barium	1997	µg/L		50	58	21.0
Metals	Barium	1998	µg/L		51	65	26
Metals	Barium	1999	µg/L		51	58	27
Metals	Barium	2000	µg/L			88	27
Metals	Barium	2001	µg/L	28	51	60	27
Metals	Barium	2002	µg/L		50	78	28
Metals	Barium	2003	µg/L		46	55	29
Metals	Barium	2004	µg/L		48	71	23
Metals	Barium	2005	µg/L		44	88	29
Metals	Barium	2006	µg/L		46	95	31
Metals	Barium	2007	µg/L		46	85	29
Metals	Barium	2008	µg/L		44	93	28
Metals	Barium	2009	µg/L		45	92	78
Metals	Barium	2011	µg/L		50	127	26
Metals	Barium	2012	µg/L		51	126	28
Metals	Barium	2013	µg/L		52	104	26
Metals	Barium	2014	µg/L		51	133	28
Metals	Barium	2015	µg/L		47	143	28
Metals	Barium	2016	µg/L		42	129	30
Metals	Barium	2017	µg/L			129	29
Metals	Cadmium	2002	µg/L		1.1	1.1	ND
Metals	Copper	1993	µg/L			8	5
Metals	Copper	2015	µg/L		2		2
Metals	Iron	1990	µg/L		140	1,950	48
Metals	Iron	1994	µg/L		748	1,950	45
Metals	Iron	1995	µg/L		1,120	341	50
Metals	Iron	1996	µg/L		1,520	9,490	46
Metals	Iron	1997	µg/L		1,220	17,800	50
Metals	Iron	1998	µg/L		1,130	20,700	56
Metals	Iron	1999	µg/L		950	34,500	30
Metals	Iron	2000	µg/L		665	37,740	48
Metals	Iron	2001	µg/L		715	6,538	43

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

Former J.H. Baxter South Woodwaste Landfill

Arlington, Washington

Analyte Group	Parameter[1]	Monitoring Period	Unit	Mean Value Downgradient[2,3]			Mean Value Upgradient[2]
				BXS-1	BXS-2	BXS-3	BXS-4
Metals	Iron	2002	µg/L		729	10,474	42
Metals	Iron	2003	µg/L		814		42
Metals	Iron	2004	µg/L		784		38
Metals	Iron	2005	µg/L		758	10,013	43
Metals	Iron	2006	µg/L		813	47,648	40
Metals	Iron	2007	µg/L		743	87,825	39
Metals	Iron	2008	µg/L		596	72,025	48
Metals	Iron	2009	µg/L		709	67,678	60
Metals	Iron	2010	µg/L		455	104,675	31
Metals	Iron	2011	µg/L		434	106,500	45
Metals	Iron	2012	µg/L		404	98,250	55
Metals	Iron	2013	µg/L		421	100,275	60
Metals	Iron	2014	µg/L		419	119,000	66
Metals	Iron	2015	µg/L		379	120,500	63
Metals	Iron	2016	µg/L		379	111,750	69
Metals	Iron	2017	µg/L			110,000	669
Metals	Lead	1993	µg/L			2	1
Metals	Manganese	1989	µg/L	210	580	1,100	120
Metals	Manganese	1990	µg/L		650	1,820	99
Metals	Manganese	1993	µg/L		570		110
Metals	Manganese	1994	µg/L		670	1,110	120
Metals	Manganese	1995	µg/L		834	3,780	122
Metals	Manganese	1996	µg/L		1,120	10,800	121
Metals	Manganese	1997	µg/L		1,510	13,000	90
Metals	Manganese	1998	µg/L	175	1,650	13,800	126
Metals	Manganese	1999	µg/L	200	1,420	14,800	116
Metals	Manganese	2000	µg/L	331	1,450	15,025	124
Metals	Manganese	2001	µg/L	426	1,513	15,350	119
Metals	Manganese	2002	µg/L	430	1,502	15,763	119
Metals	Manganese	2003	µg/L		1,523	15,750	113
Metals	Manganese	2004	µg/L		1,420	16,625	103
Metals	Manganese	2005	µg/L		1,305	13,503	112
Metals	Manganese	2006	µg/L		1,330	15,275	113
Metals	Manganese	2007	µg/L		1,323	13,925	114
Metals	Manganese	2008	µg/L	317	1,225	14,750	114
Metals	Manganese	2009	µg/L		1,570	11,093	1,140
Metals	Manganese	2010	µg/L			9,533	113
Metals	Manganese	2011	µg/L	144	1,375	12,403	107
Metals	Manganese	2012	µg/L	237	1,535	11,300	116
Metals	Manganese	2013	µg/L	218	1,643	13,233	115
Metals	Manganese	2014	µg/L	261	1,663	9,658	117
Metals	Manganese	2015	µg/L	284	1,583	7,500	115
Metals	Manganese	2016	µg/L	253	1,470	9,078	114
Metals	Manganese	2017	µg/L			7,595	460
Metals	Nickel	1993	µg/L		18.0		1.0

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

Former J.H. Baxter South Woodwaste Landfill

Arlington, Washington

Analyte Group	Parameter[1]	Monitoring Period	Unit	Mean Value Downgradient[2,3]			Mean Value Upgradient[2]
				BXS-1	BXS-2	BXS-3	BXS-4
Metals	Nickel	1994	µg/L		18.0		ND
Metals	Nickel	1995	µg/L		21.0	30	ND
Metals	Nickel	1996	µg/L			25	ND
Metals	Nickel	1997	µg/L		34	20.0	ND
Metals	Nickel	1998	µg/L		43	29	ND
Metals	Nickel	1999	µg/L		36	22	ND
Metals	Nickel	2000	µg/L		37		ND
Metals	Nickel	2001	µg/L	20.3	38	17.5	10.0
Metals	Nickel	2002	µg/L	21	39	24	5.5
Metals	Nickel	2003	µg/L		37		10.0
Metals	Nickel	2004	µg/L		41		10.0
Metals	Nickel	2005	µg/L		36		10.0
Metals	Nickel	2006	µg/L		34		10.0
Metals	Nickel	2007	µg/L		33		10.0
Metals	Nickel	2008	µg/L		30	16.1	10.0
Metals	Nickel	2009	µg/L		57		34
Metals	Nickel	2011	µg/L		31		12.5
Metals	Nickel	2012	µg/L		32	16.3	7.7
Metals	Nickel	2013	µg/L	10	37	21.0	7
Metals	Nickel	2014	µg/L	9	35	17.1	3
Metals	Nickel	2015	µg/L	8	32	19.3	1
Metals	Nickel	2016	µg/L	19	29	7.7	2
Metals	Nickel	2017	µg/L	13	23	18.2	3
Metals	Zinc	2002	µg/L	8.0	6.8		ND
Metals	Zinc	2005	µg/L	10.0			5.0
Metals	Zinc	2007	µg/L	6.2	17.3	12.4	4.4
Metals	Zinc	2008	µg/L		7.6		4.8
Metals	Zinc	2014	µg/L		4.5	6.1	3.4
Metals	Zinc	2015	µg/L		4.6	6.1	2.0
Metals	Zinc	2016	µg/L		4.4		2.9

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

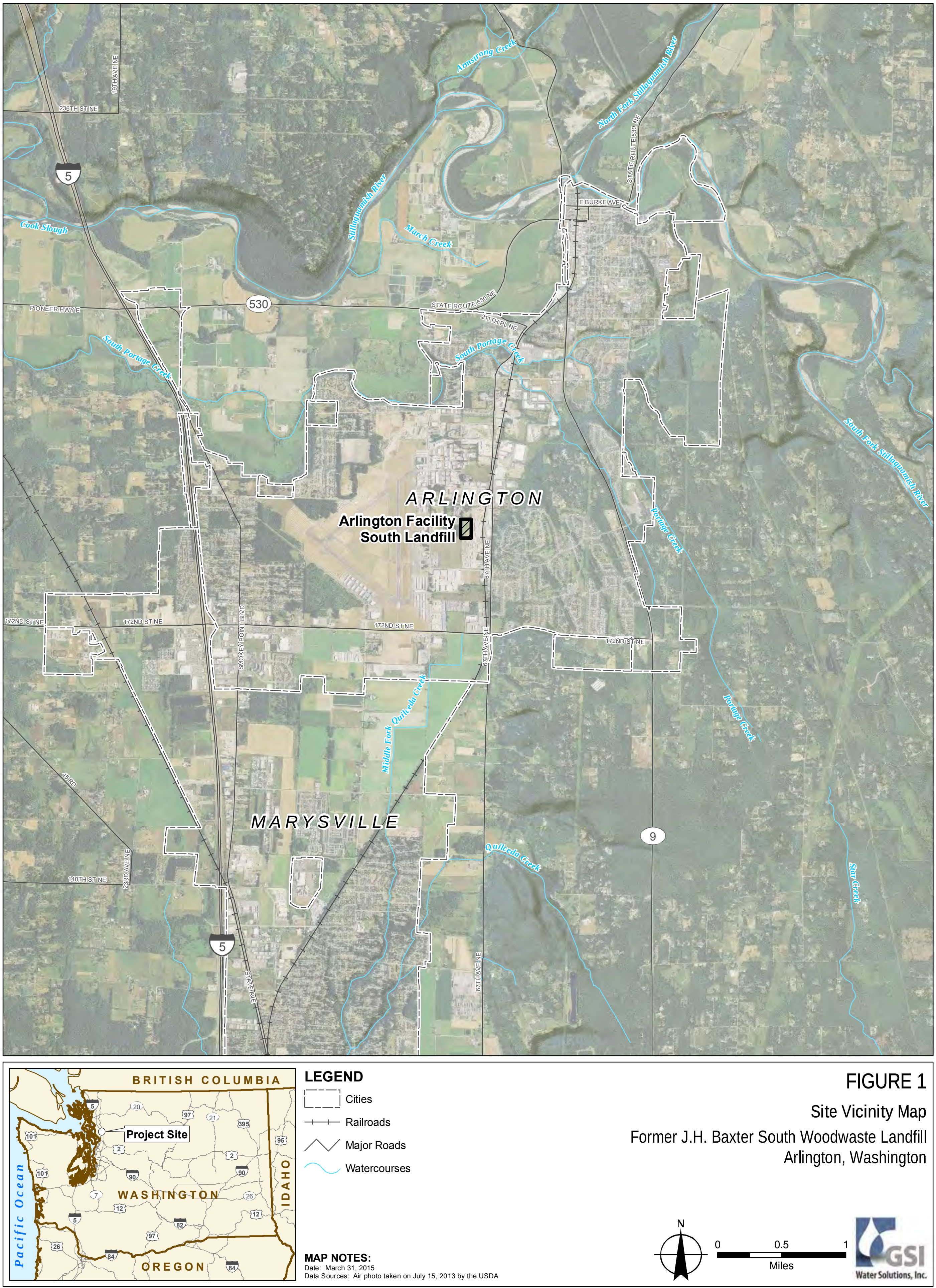


FIGURE 1

Site Vicinity Map

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

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

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

FIGURE 2

Groundwater Elevation Contour Map: First Quarter 2016

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

LEGEND

∼ Groundwater Elevation Contours (dashed where inferred)

● Monitoring Well (February 2016 Groundwater Elevation)

→ Direction of Groundwater Flow

NOTES:

1. All elevations exist in NAVD88.

N

0 100 200 300

Feet

MAP NOTES:
Date: 3/23/2017
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\S_FigureX_GW_Elev_1Q_2016.mxd

FIGURE 3

Groundwater Elevation Contour Map:
Third Quarter 2016

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

LEGEND

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

NOTES:

1. All elevations exist in NAVD88.

N

0 100 200 300

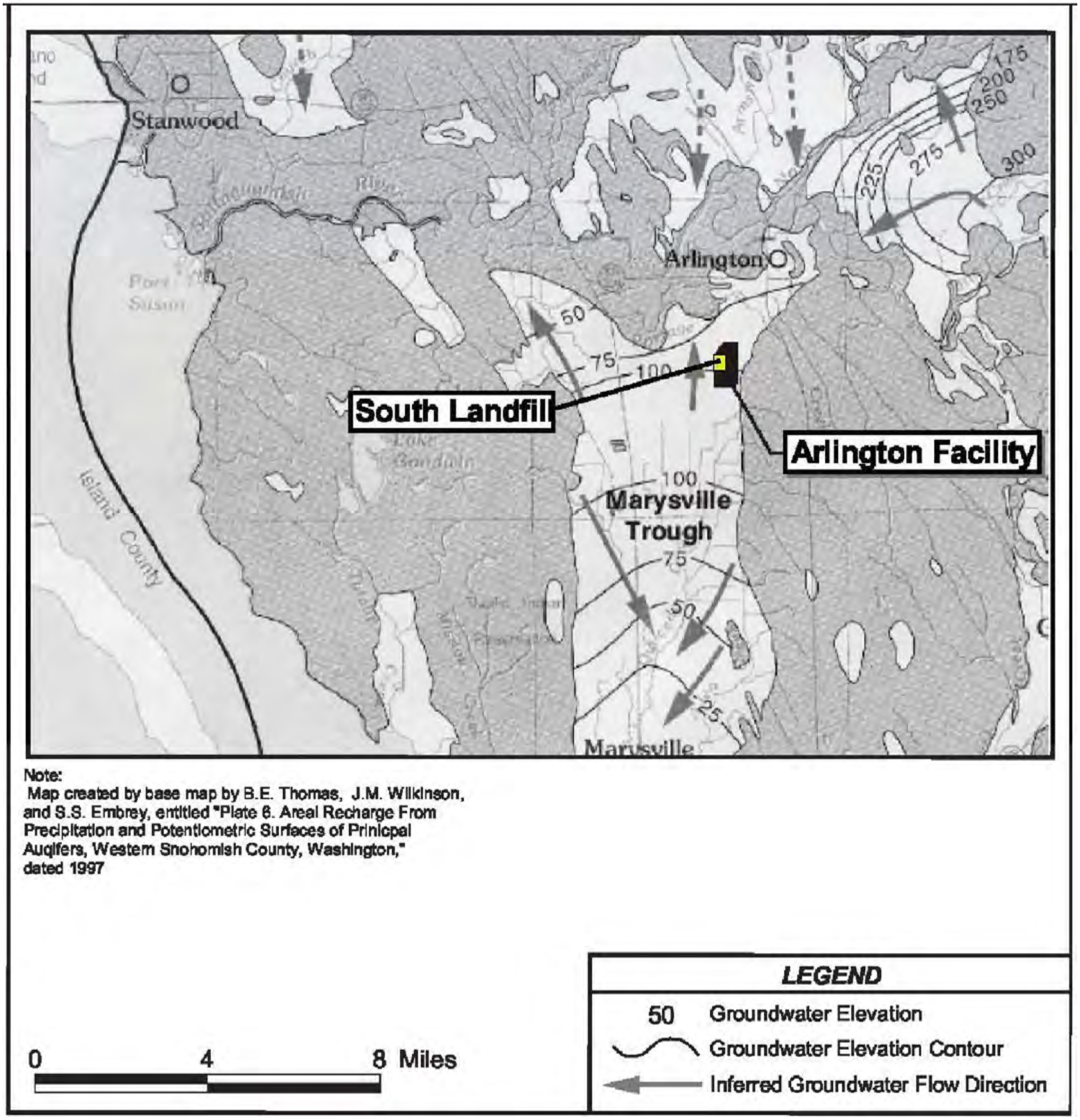
Feet

MAP NOTES:

Date: 3/23/2017
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\S_FigureX_GW_Elev_3Q_2016.mxd



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 Auqifers, Western Snohomish County, Washington," dated 1997

FIGURE 4

Regional Groundwater Flow

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

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

GSI Water Solutions, Inc.

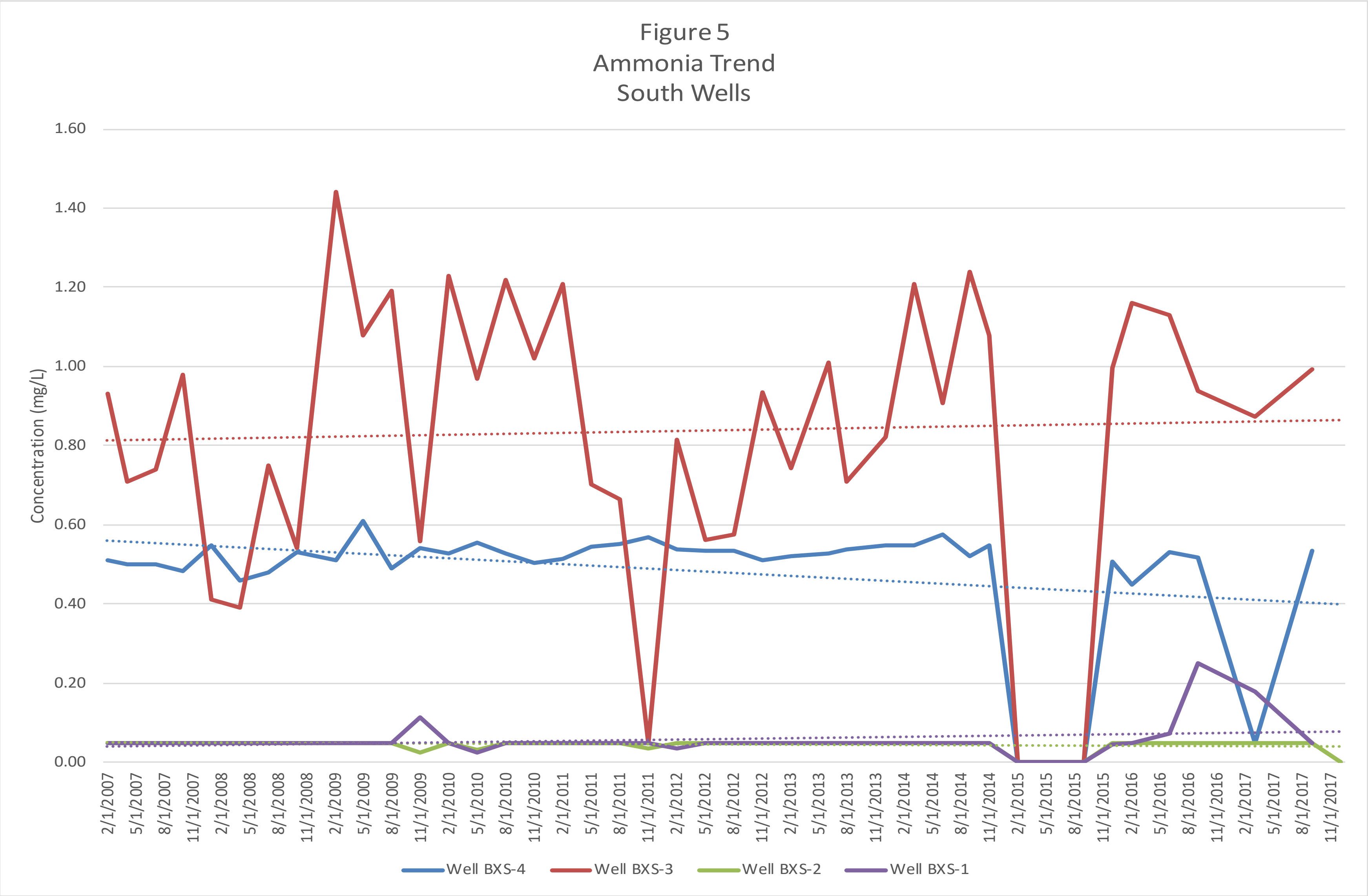


Figure 5
Ammonia Trend
South Wells
Concentration (mg/L)
1.60
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
2/1/2007
5/1/2007
8/1/2007
11/1/2007
2/1/2008
5/1/2008
8/1/2008
11/1/2008
2/1/2009
5/1/2009
8/1/2009
11/1/2009
2/1/2010
5/1/2010
8/1/2010
11/1/2010
2/1/2011
5/1/2011
8/1/2011
11/1/2011
2/1/2012
5/1/2012
8/1/2012
11/1/2012
2/1/2013
5/1/2013
8/1/2013
11/1/2013
2/1/2014
5/1/2014
8/1/2014
11/1/2014
2/1/2015
5/1/2015
8/1/2015
11/1/2015
2/1/2016
5/1/2016
8/1/2016
11/1/2016
2/1/2017
5/1/2017
8/1/2017
11/1/2017
Well BXS-4
Well BXS-3
Well BXS-2
Well BXS-1

Figure 6
Arsenic Trend
South Wells

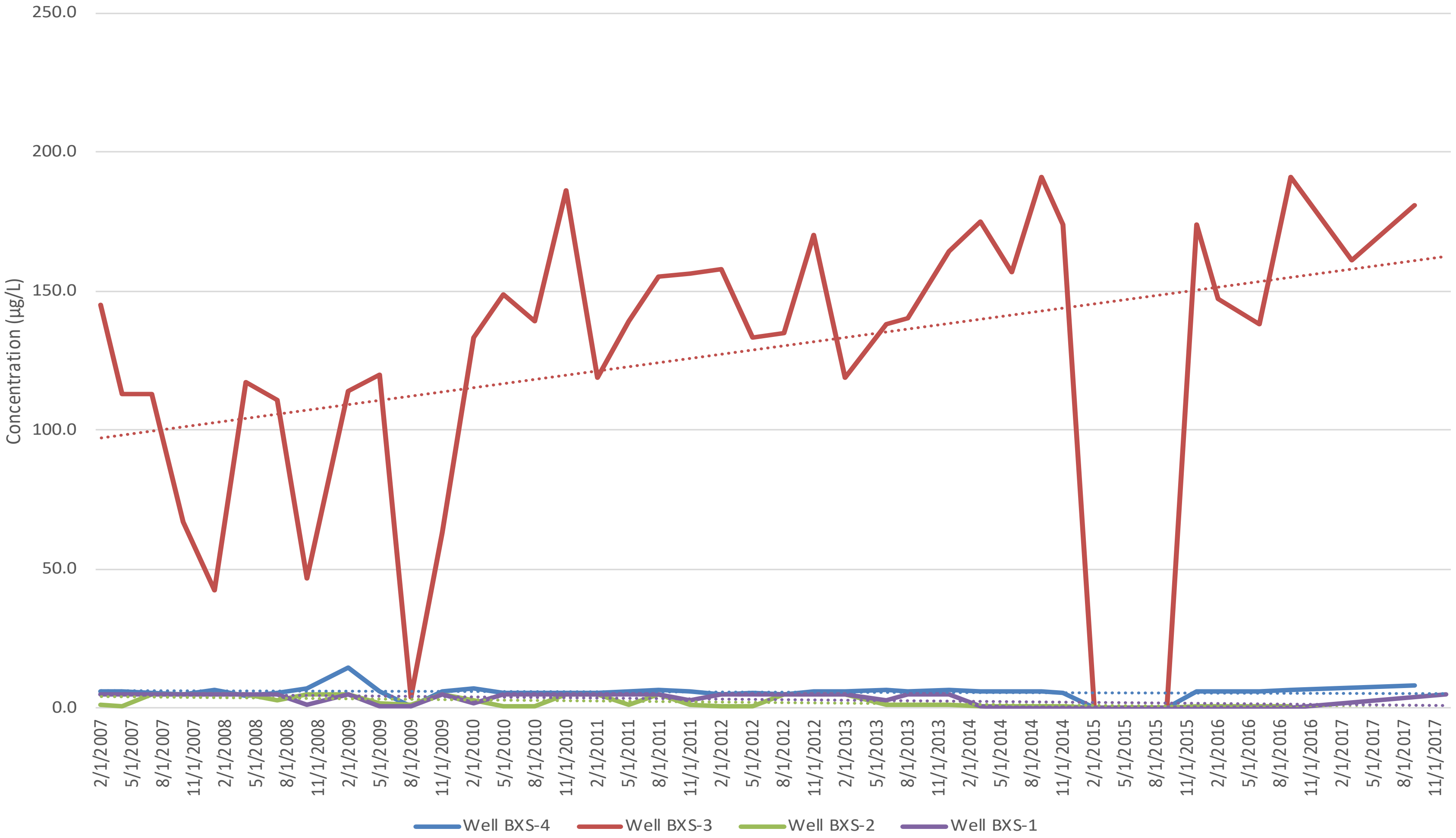


Figure 7
Barium Trend
South Wells

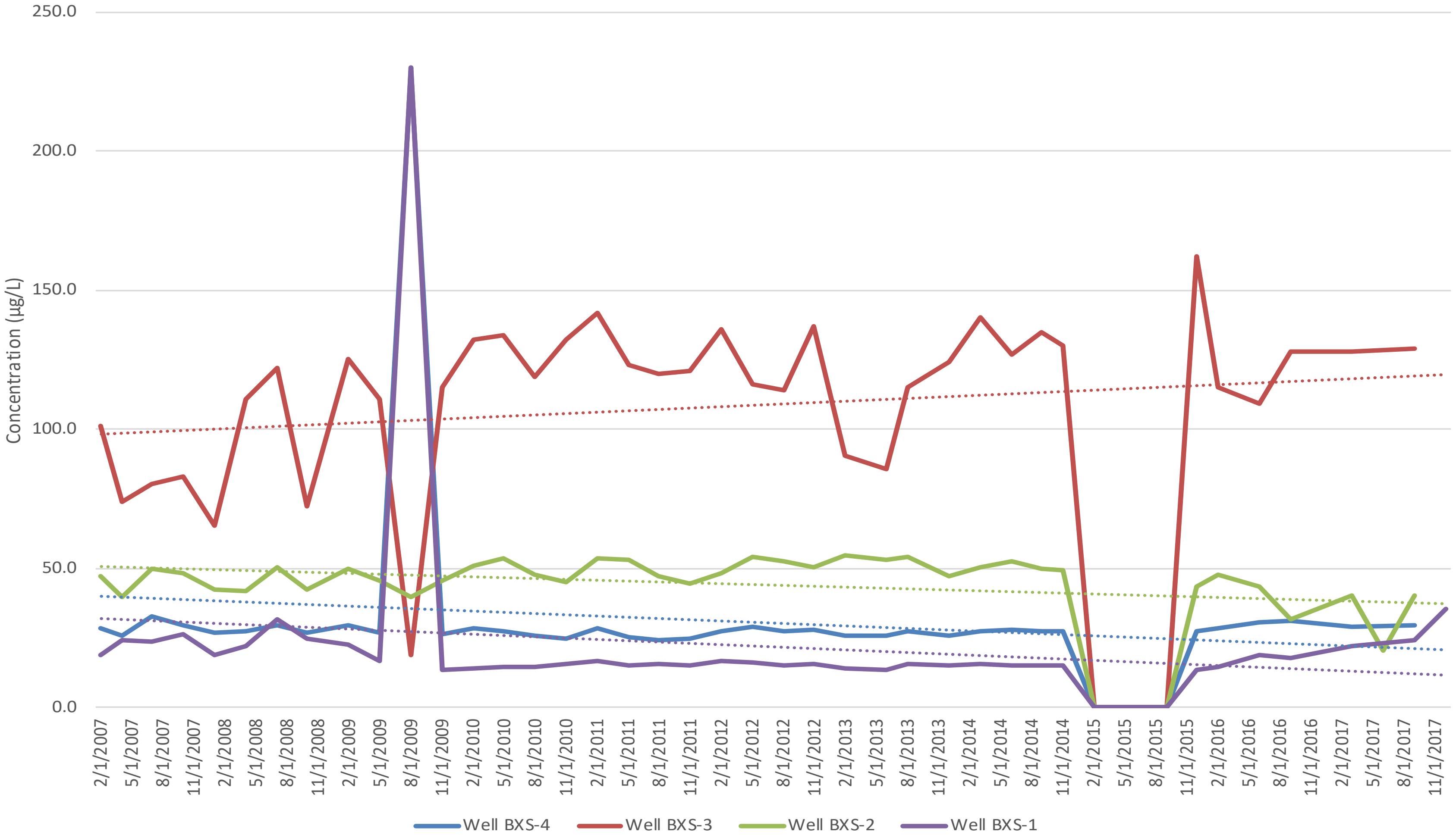
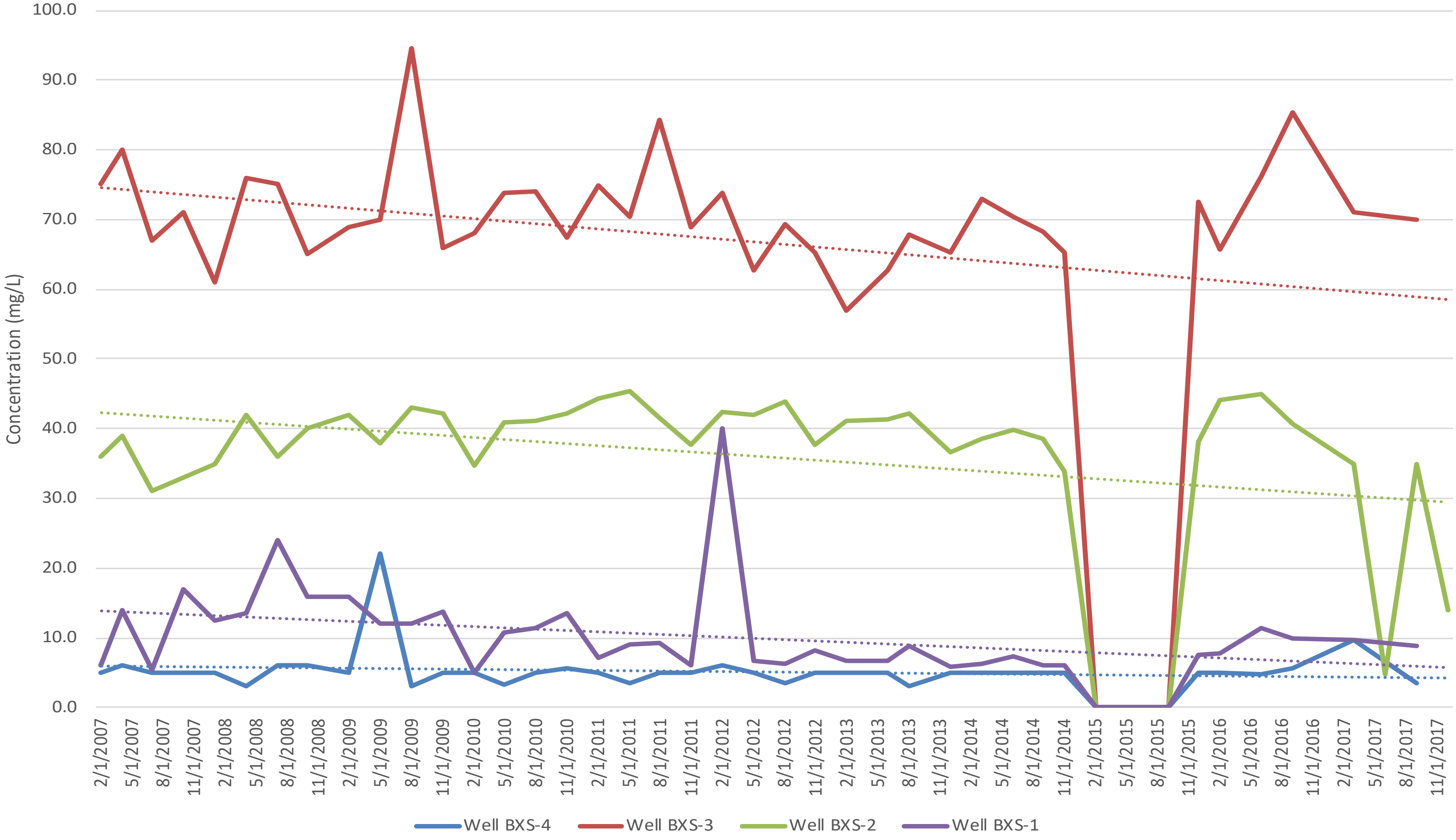


Figure 8
Chemical Oxygen Demand Trend
South Wells



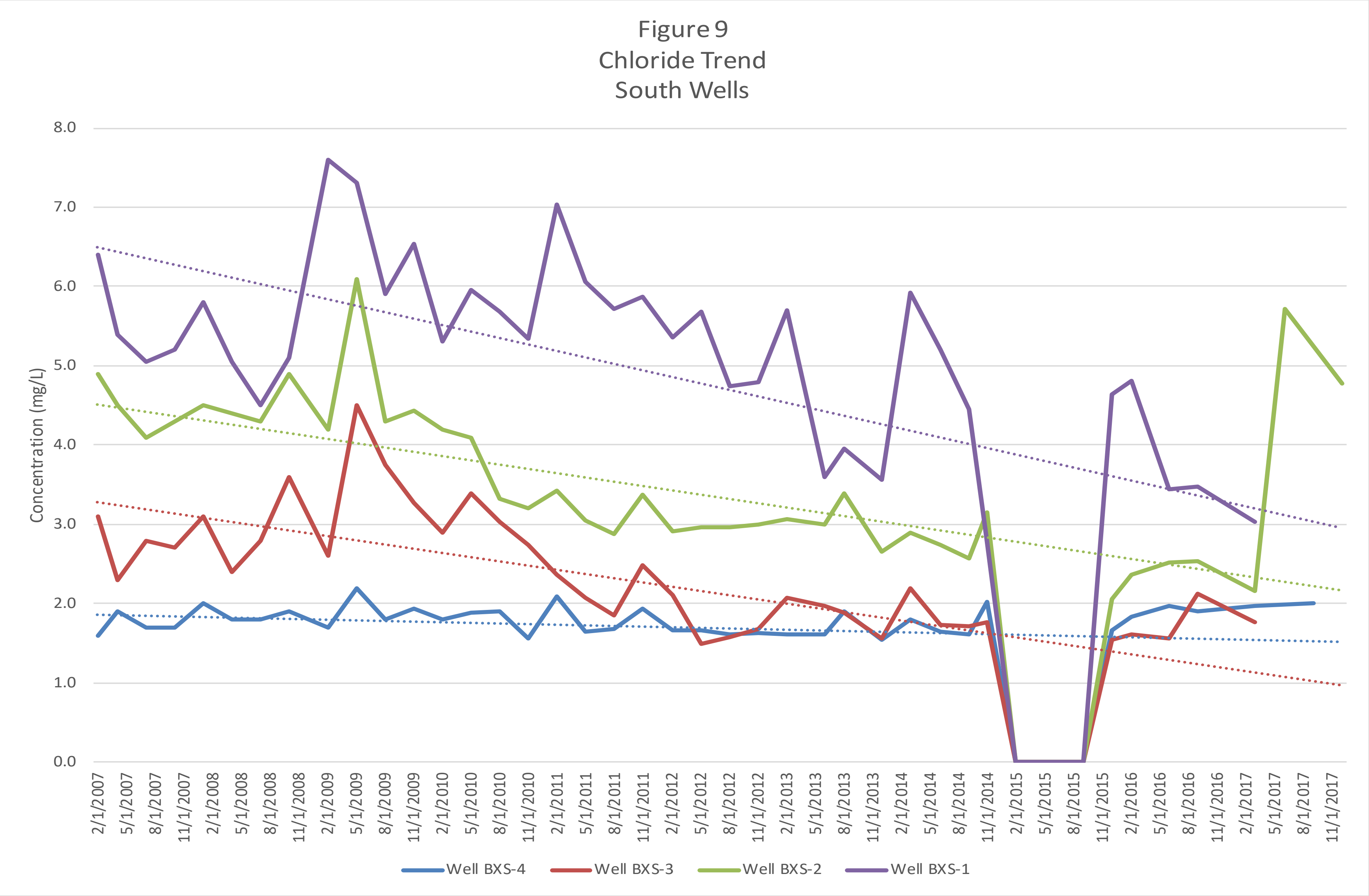


Figure 9
Chloride Trend
South Wells
Concentration (mg/L)
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
2/1/2007
5/1/2007
8/1/2007
11/1/2007
2/1/2008
5/1/2008
8/1/2008
11/1/2008
2/1/2009
5/1/2009
8/1/2009
11/1/2009
2/1/2010
5/1/2010
8/1/2010
11/1/2010
2/1/2011
5/1/2011
8/1/2011
11/1/2011
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8/1/2013
11/1/2013
2/1/2014
5/1/2014
8/1/2014
11/1/2014
2/1/2015
5/1/2015
8/1/2015
11/1/2015
2/1/2016
5/1/2016
8/1/2016
11/1/2016
2/1/2017
5/1/2017
8/1/2017
11/1/2017
Well BXS-4
Well BXS-3
Well BXS-2
Well BXS-1

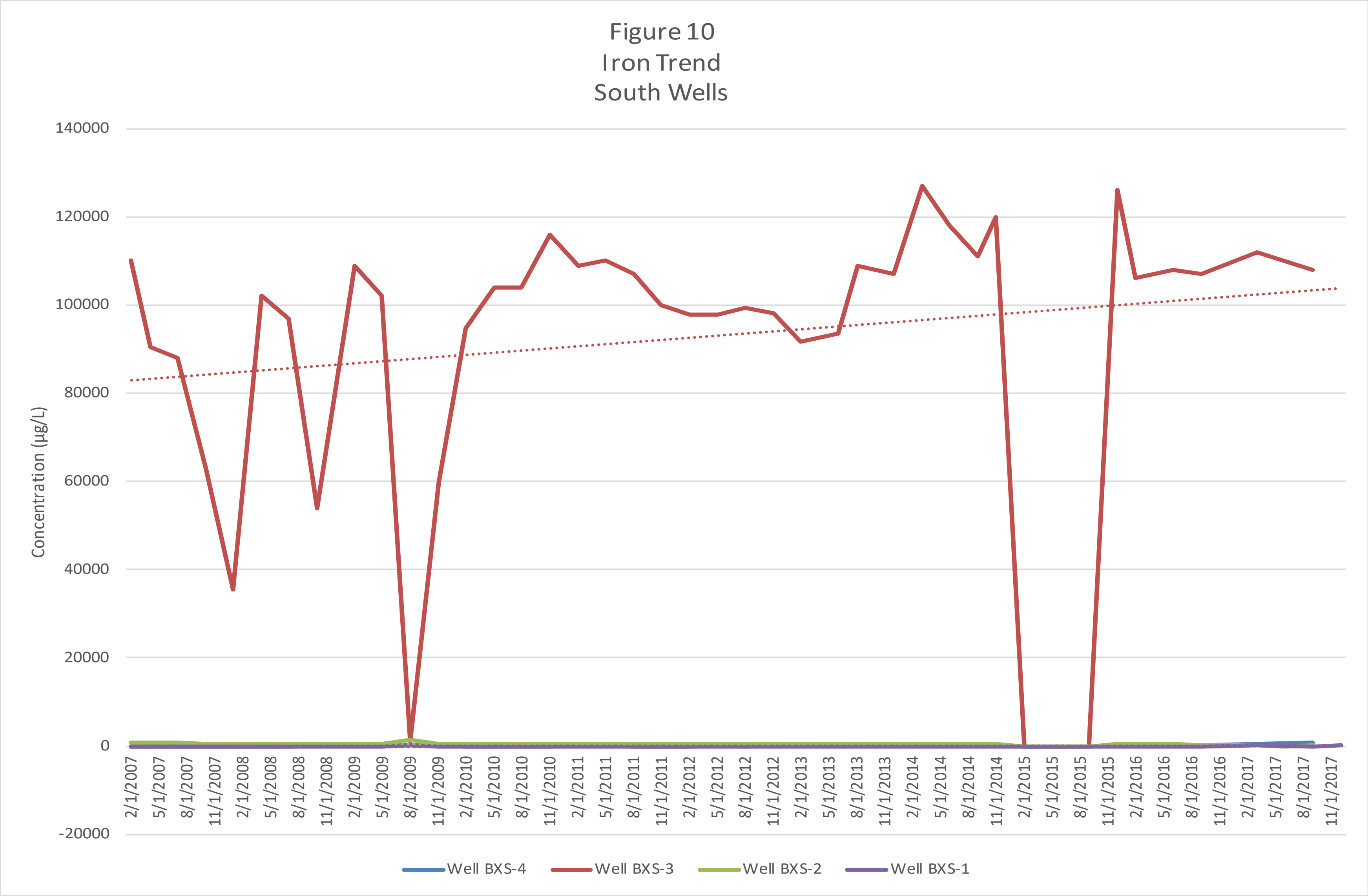
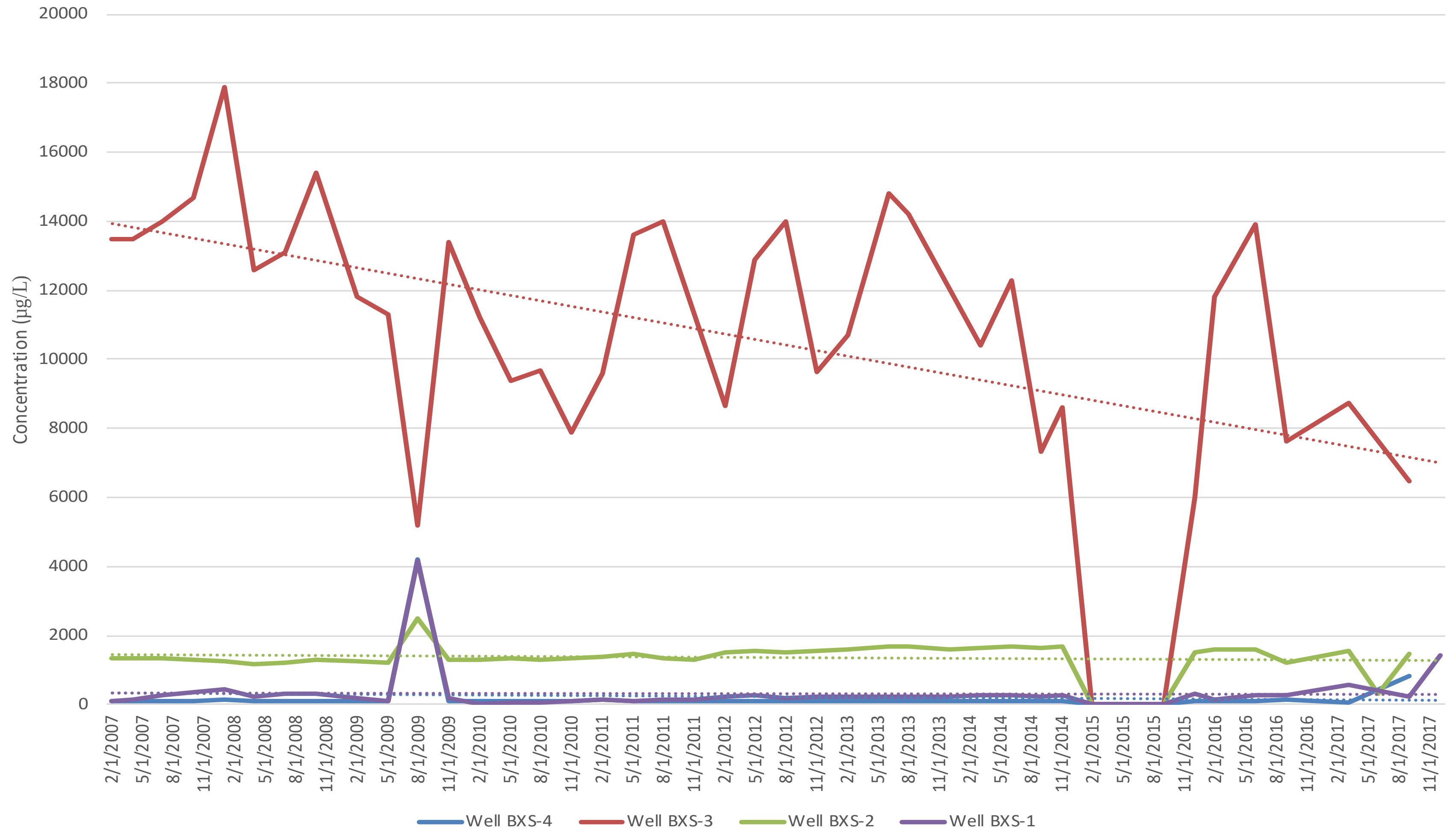


Figure 10
Iron Trend
South Wells

Figure 11

Manganese Trend

South Wells



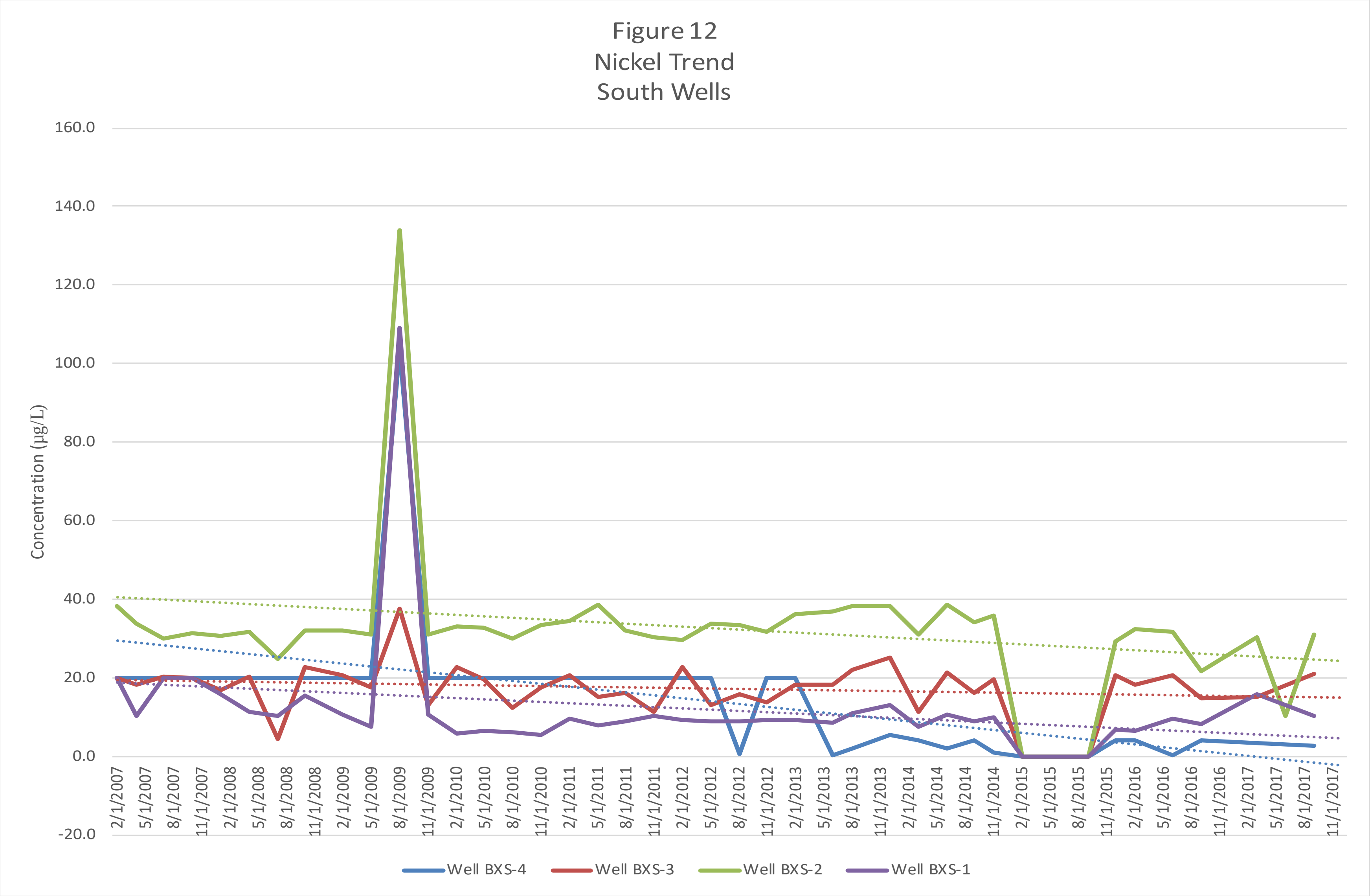


Figure 12
Nickel Trend
South Wells
Concentration (µg/L)
160.0
140.0
120.0
100.0
80.0
60.0
40.0
20.0
0.0
-20.0
2/1/2007
5/1/2007
8/1/2007
11/1/2007
2/1/2008
5/1/2008
8/1/2008
11/1/2008
2/1/2009
5/1/2009
8/1/2009
11/1/2009
2/1/2010
5/1/2010
8/1/2010
11/1/2010
2/1/2011
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8/1/2011
11/1/2011
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8/1/2013
11/1/2013
2/1/2014
5/1/2014
8/1/2014
11/1/2014
2/1/2015
5/1/2015
8/1/2015
11/1/2015
2/1/2016
5/1/2016
8/1/2016
11/1/2016
2/1/2017
5/1/2017
8/1/2017
11/1/2017
Well BXS-4
Well BXS-3
Well BXS-2
Well BXS-1

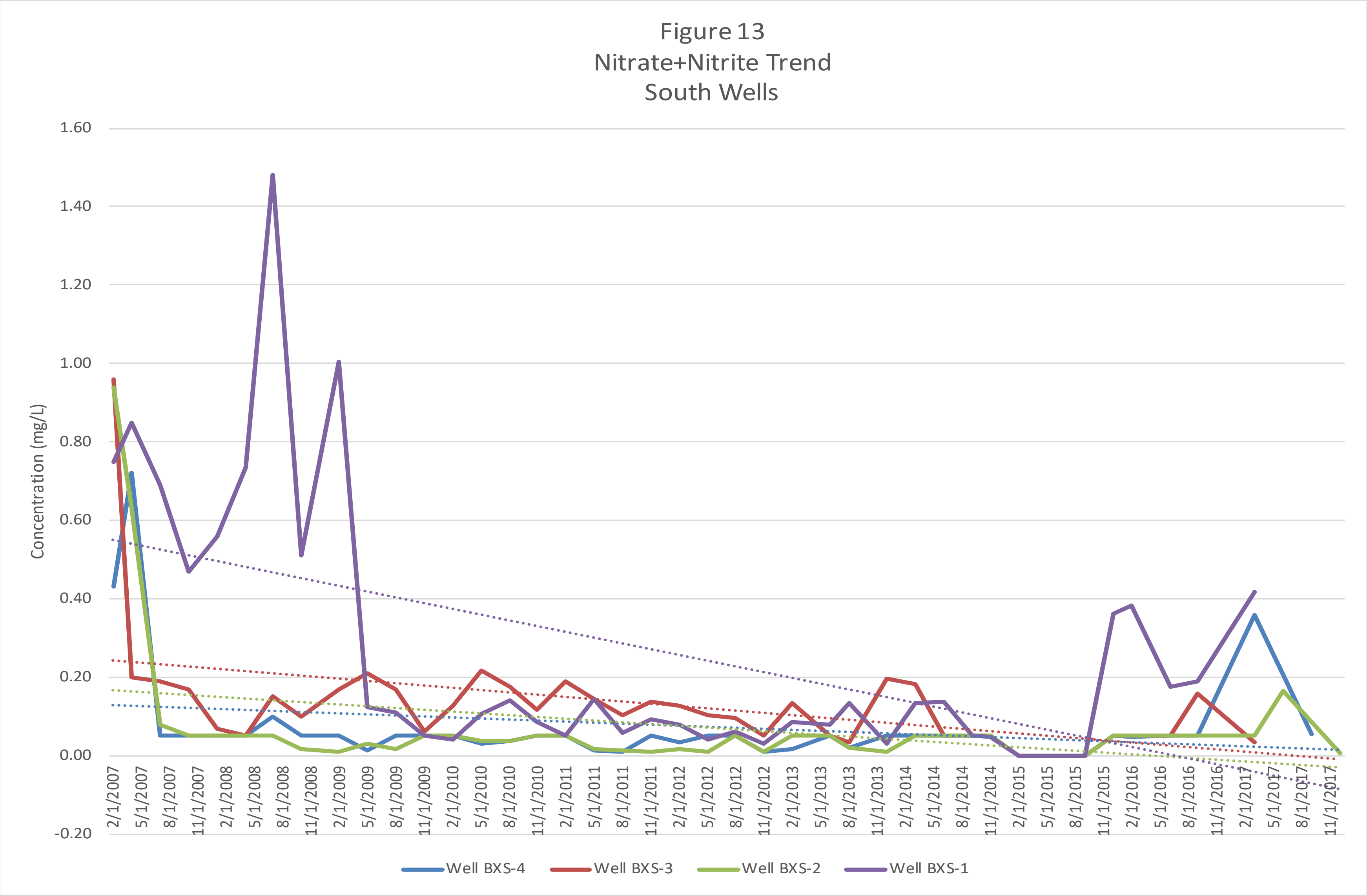
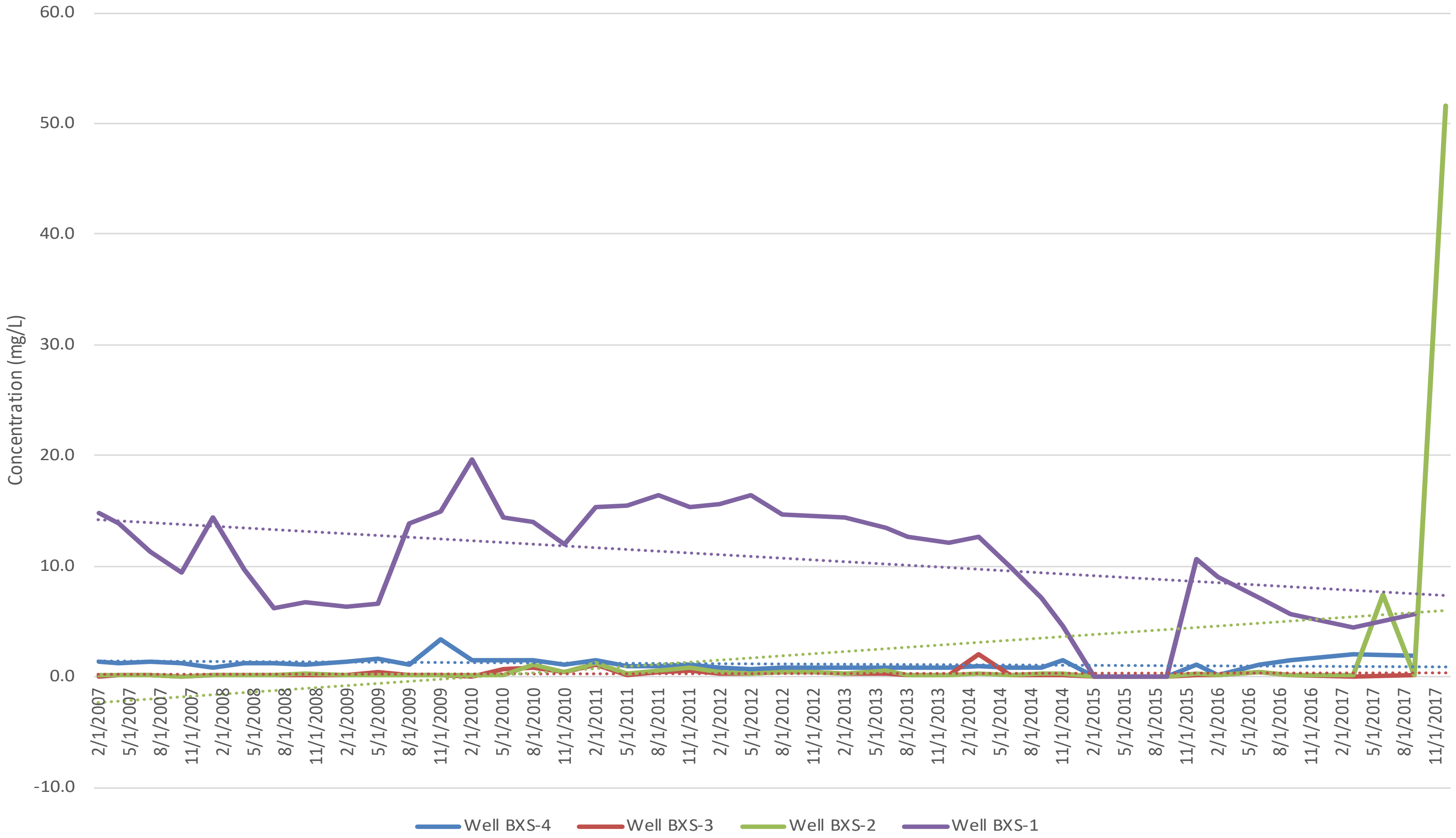


Figure 13
Nitrate+Nitrite Trend
South Wells

Figure 14
Sulfate Trend
South Wells



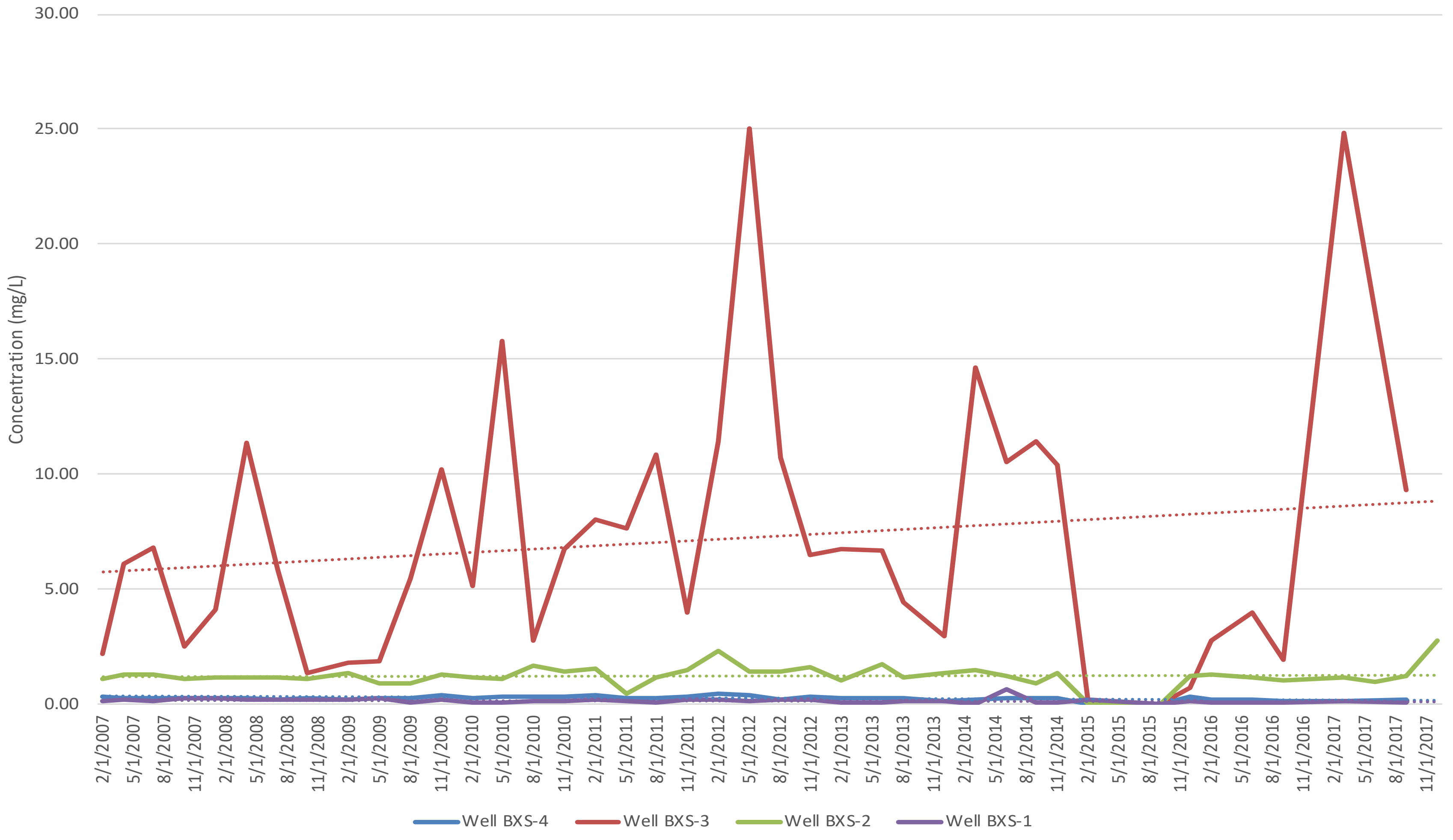


Figure 15
Tannin and Lignin Trend
South Wells

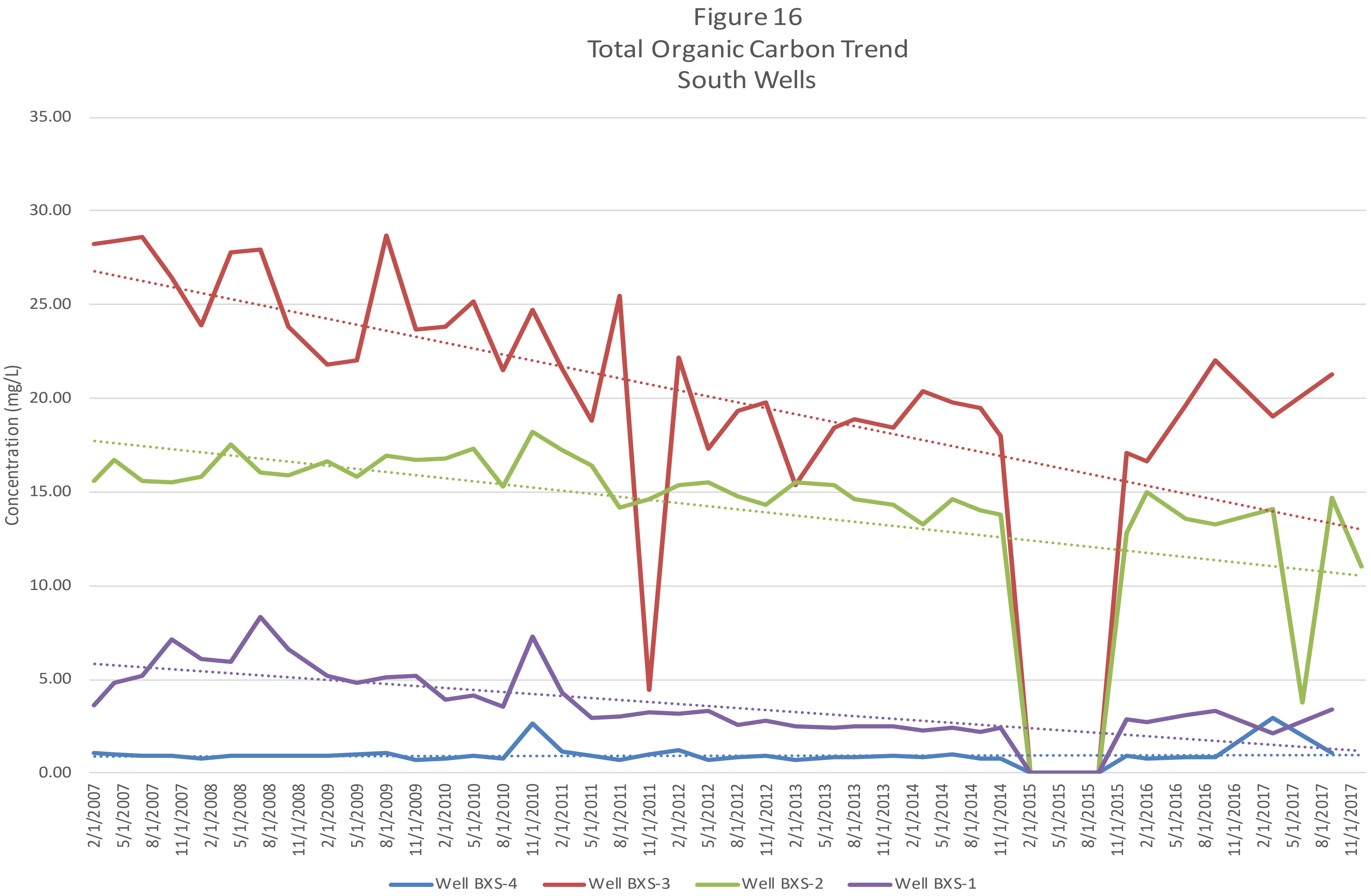
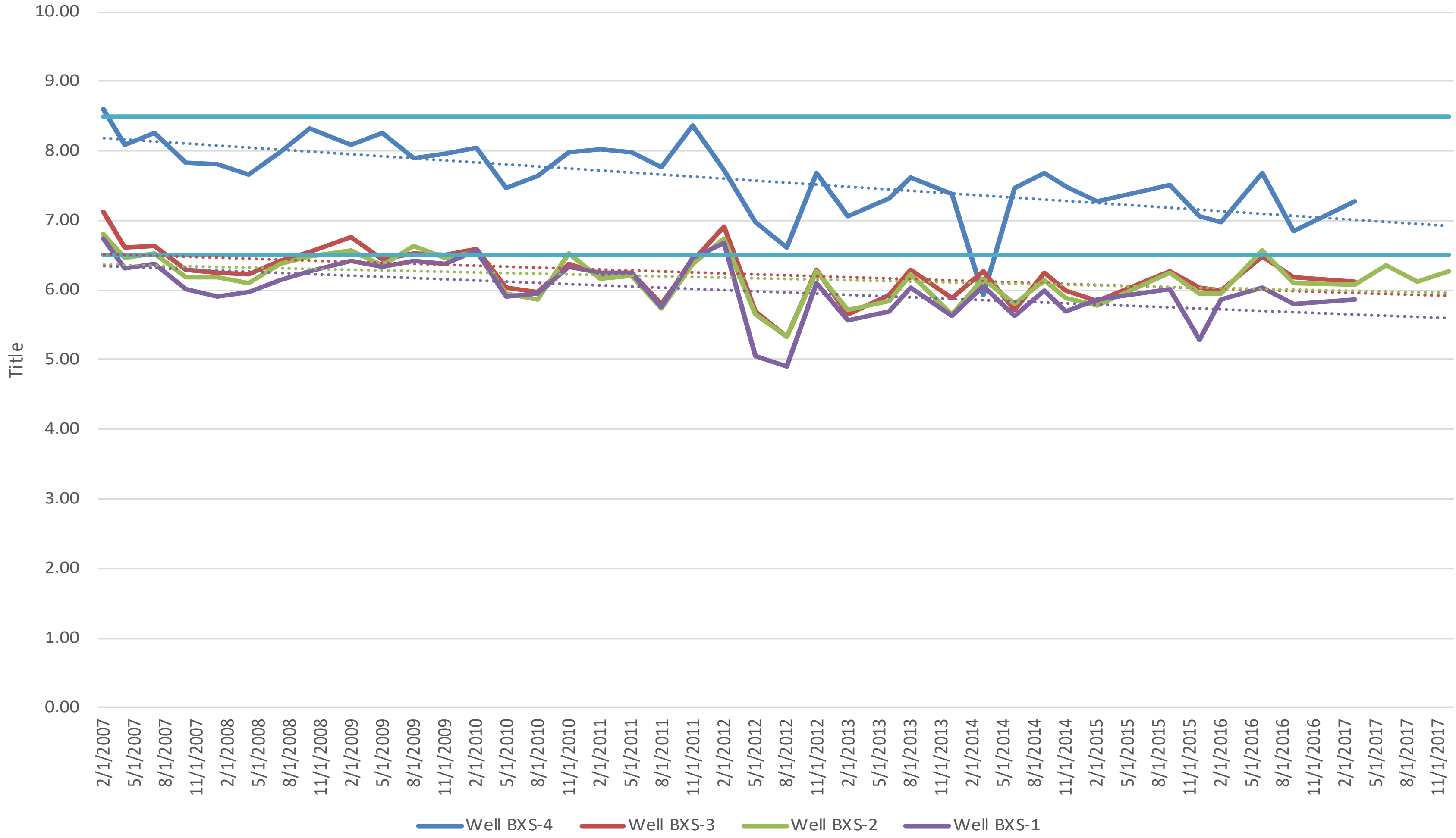


Figure 16
Total Organic Carbon Trend
South Wells
Concentration (mg/L)
35.00
30.00
25.00
20.00
15.00
10.00
5.00
0.00
2/1/2007
5/1/2007
8/1/2007
11/1/2007
2/1/2008
5/1/2008
8/1/2008
11/1/2008
2/1/2009
5/1/2009
8/1/2009
11/1/2009
2/1/2010
5/1/2010
8/1/2010
11/1/2010
2/1/2011
5/1/2011
8/1/2011
11/1/2011
2/1/2012
5/1/2012
8/1/2012
11/1/2012
2/1/2013
5/1/2013
8/1/2013
11/1/2013
2/1/2014
5/1/2014
8/1/2014
11/1/2014
2/1/2015
5/1/2015
8/1/2015
11/1/2015
2/1/2016
5/1/2016
8/1/2016
11/1/2016
2/1/2017
5/1/2017
8/1/2017
11/1/2017
Well BXS-4
Well BXS-3
Well BXS-2
Well BXS-1

Figure 17
pH Trend
South Wells



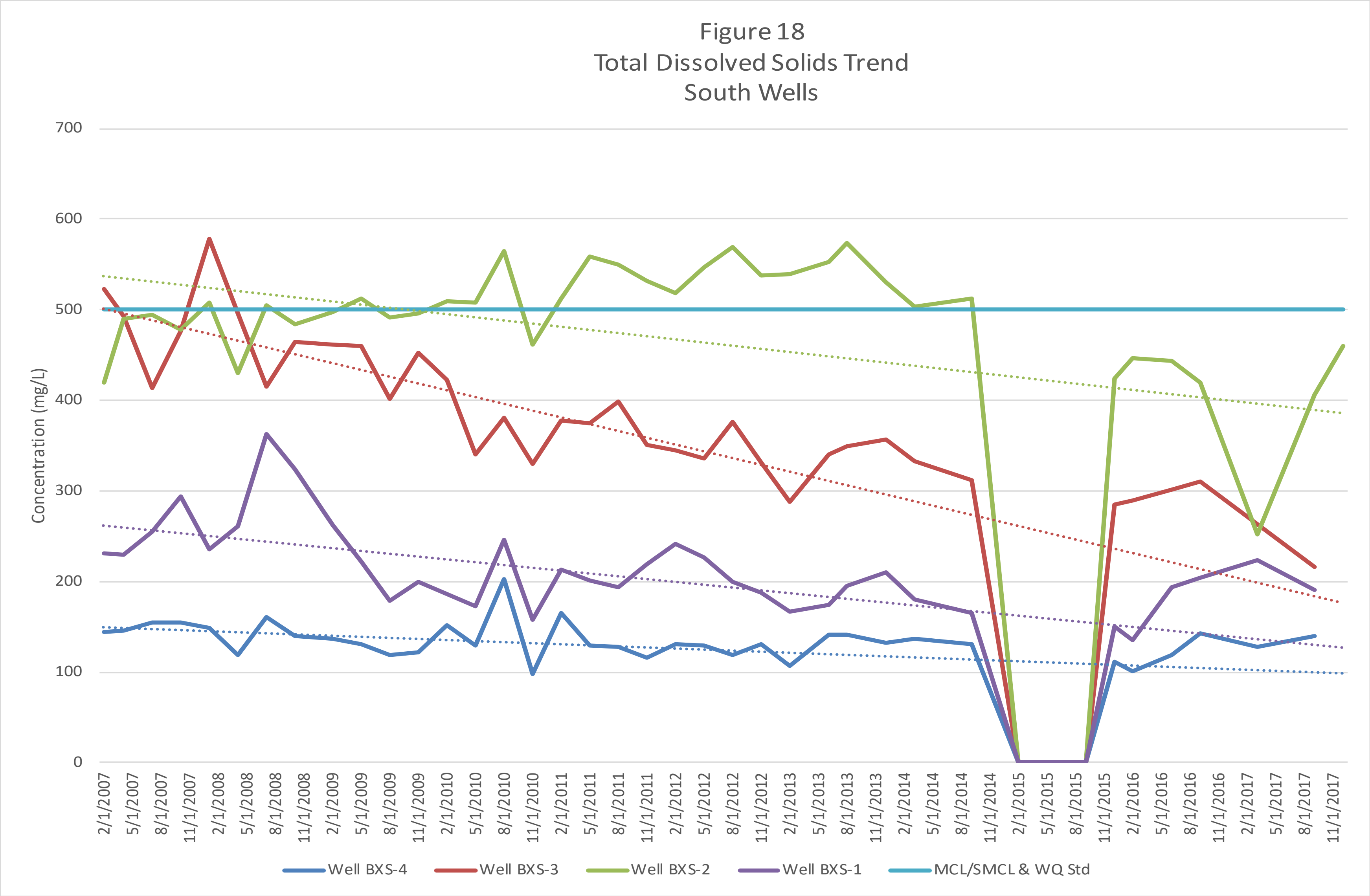


Figure 18
Total Dissolved Solids Trend
South Wells

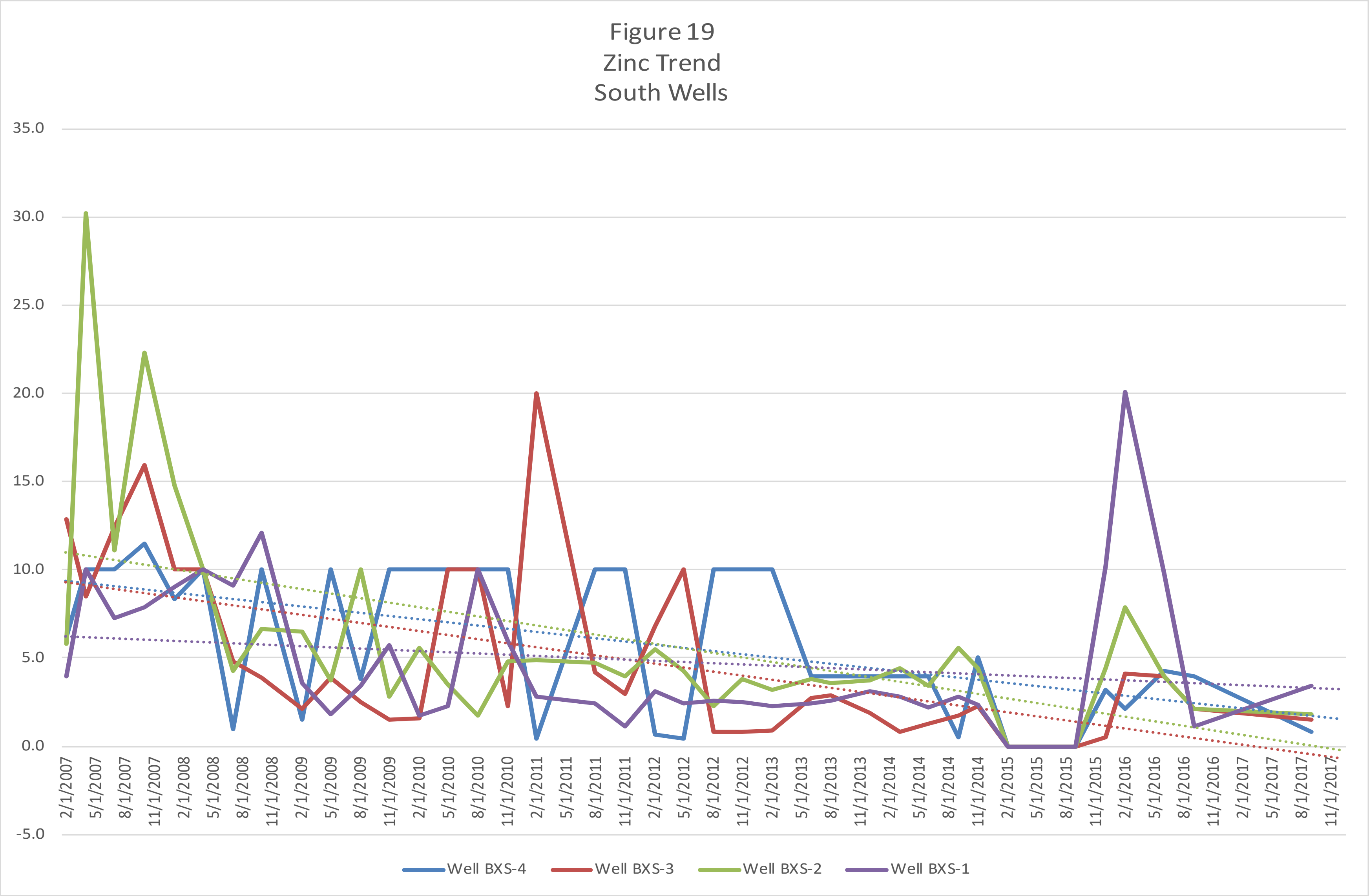


Figure 19
Zinc Trend
South Wells

FIGURE 20

Arsenic Isopleth Map: Third Quarter 2016

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

LEGEND

- ● Monitoring Well (September 2016 Arsenic Concentration)
- ～ Arsenic Contours (dashed where inferred)
- ▨ Modeled Source Area
- → Direction of Groundwater Flow

NOTES:

1. All elevations exist in NAVD88.
2. Arsenic contouring estimated using Quick Domenico approximately.
3. Concentrations in ug/L.
4. Data from highest arsenic detection (third quarter 2016) depicted.

N

0 100 200 300
Feet

Date: March 30, 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\S_Figure20_Arsenic_3Q_2016.mxd

Appendix A

2017 Groundwater
Monitoring Field Forms

FIELD ENVIRONMENTAL INSTRUMENTS, INC.

Date: 3/8/17 Well ID: BXS-1 Tech:

Depth to Water: 30.5 Depth to Bottom: 49 Well Size: 2'

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

Sample Analysis: See CoC

Flow Rate: 400mL

Start time: 1011

Time	Flow rate	Volume Removed	DTW	PH	COND	TEMP	ORP	DO
1014	400	1200	30.5	5.90	328	12.03	155	3.50
1017	↓	2400	30.5	5.87	347	12.78	159	2.97
1020	↓	4800	30.5	5.87	360	12.96	160	2.80
1023	↓	6000	30.5	5.86	368	13.05	161	2.64
1026	↓	7200	30.5	5.37	373	13.10	161	2.43

BXN-5 DUPLICATE @ 10:29

All Parameters Stable at: 1026

Sample time: 1027

Signature:

Total Volume Removed: 7.2 L

Date: 3/8 Time: 1028

FIELD ENVIRONMENTAL INSTRUMENTS, INC.

Date: 7/9 Well ID: BXS-2 Tech:

Depth to Water: 31 Depth to Bottom: 52.00 Well Size: 2"

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

Sample Analysis: See COC

Flow Rate: 400 mL

Start time: 1219

Time	Flow rate	Volume Removed	DTW	PH	COND	TEMP	ORP	DO
1222	400	1200	31.00	7.25	.001	11.07	101	4.18
1225		2400	31.00	6.09	651	12.96	124	1.80
1228		4800	31.00	6.07	647	302	115	0.97
1231		6000	31.00	6.06	648	12.91	78	0.79
1233		7200	31.00	6.08	671	12.85	64	0.79
				6.08	680	12.82	57	0.76

All Parameters Stable at: 1233 Total Volume Removed: 7.2

Sample time: 1234

Signature: RK Date: 3/9 Time: 1235

FIELD ENVIRONMENTAL INSTRUMENTS, INC.

Date: 3/9 Well ID: BXS 3 Tech:

Depth to Water: ~~27~~ 3 Depth to Bottom: 42.50 Well Size: 2"

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

Sample Analysis: See CoC

Flow Rate: 400 mL

Start time: 1311

Time	Flow rate	Volume Removed	DTW	PH	COND	TEMP	ORP	DO
1314	400	1200	27.5	5.82	688	12.53	76	1.72
1317		2400	27.5	6.10	681	12.84	102	1.50
1320		3600	27.5	6.14	687	13.04	107	1.54
1323		4800	27.5	6.12	693	13.04	108	1.40
1326		6000	27.5	6.12	694	13.14	109	1.37

Field blank @ 1345
(Equipment blank)

All Parameters Stable at: 1326 Total Volume Removed: 6 L

Sample time: 1329

Signature: Date: 3/9/17 Time: 1326

FIELD ENVIRONMENTAL INSTRUMENTS, INC.

Date: 3/8/17 Well ID: ~~BSX-4~~ BXS-4 Tech:

Depth to Water: 13.7 Depth to Bottom: 47.50 Well Size: 2'

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

Sample Analysis: See COC

Flow Rate: 400mL/min

Start time: 1054

Time	Flow rate	Volume Removed	DTW	PH	COND	TEMP	ORP	DO
1057	400	1200	13.7	7.08	188	11.53	127	4.08
1100		2400	16.3	7.13	187	12.50	98	1.17
1103		4800	16.3	7.22	188	12.54	45	3.93
1106		6000	~~3~~ 16.3	7.25	189	12.22	18	3.45
1109		7200	16.3	7.28	188	12.65	57	3.37

All Parameters Stable at: 1109 Total Volume Removed: 7.2L

Sample time: 1110

Signature:

Date: 3/8/17 Time: 1111

FIELD ENVIRONMENTAL INSTRUMENTS, INC.

Date: 6/24/17 Well ID: GXS-1 Tech: Matt

Depth to Water: 29.69 Depth to Bottom: 49.00 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
0811	300ml/m	900	29.69	6.02	384	12.2	1.74	2.71
0814	↓	1800	29.69	6.12	392	12.4	1.60	2.10
0817		2700	29.69	6.19	380	12.4	1.42	2.02
0820		3600	29.69	6.20	372	12.4	1.38	1.89
0823		4500	29.69	6.20	376	12.4	1.33	1.74
0826		5400	29.69	6.21	382	12.4	1.36	1.80

All Parameters Stable at: 0829 Total Volume Removed:

Sample time: 0830

Signature: Matt Date: 6/24/17 Time: 0831

FIELD ENVIRONMENTAL INSTRUMENTS, INC.

Date: 6/10/17 Well ID: BXS-2 Tech: MH

Depth to Water: 3042 Depth to Bottom: 5200 Well Size: 2

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

Sample Analysis: LANDFILL Suite

Flow Rate: 300

Start time: 1030

Time	Flow rate	Volume Removed	DTW	PH	COND	TEMP	ORP	DO
1033	300	900	30.44	7.04	335	13.13	32	6.46
1036		1800	30.46	6.57	342	12.65	52	4.82
1039		2700	30.46	6.40	351	12.44	79	3.57
1042		3600	30.46	6.38	353	12.4	85	3.06
1045		4500	30.46	6.37	354	12.39	97	2.94
1048		5400	30.46	6.36	354	12.37	106	2.90

All Parameters Stable at:

Total Volume Removed: 5.4L

Sample time: 1049

Signature: MH

Date: 6/10/17 Time: 1050

FIELD ENVIRONMENTAL INSTRUMENTS, INC.

Date: 9-16 Well ID: BX9-2 Tech:

Depth to Water: 347 Depth to Bottom: 49 Well Size: 2

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

Sample Analysis:

Flow Rate: 300 ml/m

Start time: 0850

Time	Flow rate	Volume Removed	DTW	PH	COND	TEMP	ORP	DO
0850	900		34.7					
0853	1800		34.7	6.12	559	12.22	-74.2	3.36
0856	2700		34.7	6.07	560	1229	-94.6	4.79
0859	3600		34.7	6.09	567	12.33	-110.4	3.21
0902	4500		34.7	6.11	567	12.32	-115.8	2.87
0905	5400		34.7	6.12	567	12.31	-120.9	2.56

All Parameters Stable at: 0905

Total Volume Removed: 5.4L

Sample time:

Signature:

Date: 9-16 Time: 0906

FIELD ENVIRONMENTAL INSTRUMENTS, INC.

Date: 9-16 Well ID: BXS-3 Tech: Rod

Depth to Water: 28.9 Depth to Bottom: 45.5 Well Size: 2

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

Sample Analysis:

Flow Rate: 300 ml/m

Start time: 0923

Time	Flow rate	Volume Removed	DTW	PH	COND	TEMP	ORP	DO
0923	900		28.9					
0926	1800		28.9	6.00	493	12.54	-84.2	1.62
0929	2700		28.9	605	501	12.65	-102.1	1.52
0932	3600		28.9	6.12	504	12.70	-1127	1.60
0935	4500		28.9	6.17	507	12.75	-122.6	1.59
0938	5400		28.9	6.18	507	12.78	-126.3	1.62

All Parameters Stable at: 0938

Total Volume Removed:

Sample time:

Signature: Date: 9-16 Time: 0939

FIELD ENVIRONMENTAL INSTRUMENTS, INC.

Date: 9-16 Well ID: 13XS-4 Tech: Rod

Depth to Water: 18.4 Depth to Bottom: 49.7 Well Size: ______

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

Sample Analysis:

Flow Rate: 300 ml/m

Start time: 1003

Time	Flow rate	Volume Removed	DTW	PH	COND	TEMP	ORP	DO
1003	900		18.4					
1006	1800		18.4	7.13	158	12.57	-144.2	2.87
1009	2700		18.4	6.71	154	12.58	-132.9	1.16
1012	3600		18.4	6.81	154	12.87	-141.4	.94
1015	4500		18.4	6.83	155	12.88	-144.7	.90
1018	5400		18.4	6.97	156	12.90	-146.4	.88

All Parameters Stable at: 1018 Total Volume Removed: 5.4 L

Sample time:

Signature: Date: 9.16 Time: 1019

Woodwaste Landfill Monitoring

Date: 12/14/17 Well ID: BXS-2 Tech: Kram

Depth to Water: 34.93' Depth to Bottom: 52.00' Well Size: 2"

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

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

Flow Rate:

Start time: 1128

Time	Flow rate	Volume Removed	DTW	PH	COND	TEMP	ORP	DO
1128			34.93	6.23	578	12.3	136.6	0.82
1132			34.77	6.26	587	12.3	109.9	0.72
1136				6.26	583	12.3	96.6	0.87
1141			34.71	6.26	584	12.4	86.2	0.59
1144				6.26	585	12.4	82.9	0.55
1148			34.63	6.26	587	12.4	78.9	0.42

All Parameters Stable at: 1148 Total Volume Removed:

Sample time: 1150

Signature:

Date: 12/14/17 Time: 1150

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 South Woodwaste Landfill
Arlington, Washington

Student's T-Test Formula (*t*):

$$\frac{\bar{x} - m_0}{\sqrt{[\,(s^1/n) + (s^2/n)\,]}}$$

Critical Statistic:

$t_c = 2.447$ $v = 6$

$t_c = 2.776$ $v = 4$

$t_c = 12.706$ $v = 1$

BXS-4 (Upgradient Well)				
Date	Ammonia Concentration[1]	Number of Samples (n)	Average Concentration (m_0)	Sample Variance (s^1)
11/17/2014	0.55	--	--	--
2/23/2015	0.54	--	--	--
9/14/2015	0.54	--	--	--
12/7/2015	0.51	4	0.53	0.00028
2/29/2016	0.45	4	0.51	0.00161
6/16/2016	0.53	4	0.51	0.00152
9/26/2016	0.52	4	0.50	0.00128
3/8/2017	0.03	4	0.38	0.05767
6/10/2017	--	3	0.36	0.08336
9/16/2017	0.54	3	0.36	0.08511
12/14/2017	--	2	0.28	0.13261

BXS-3 (Downgradient Well)						
Date	Ammonia Concentration[1]	Number of Samples (n)	Average Concentration ($\bar{x}$)	Sample Variance (s^2)	Sample Standard Deviation (s)	Student's T-Test Statistic (t)[2]
11/17/2014	1.08	--	--	--	--	--
2/23/2015	1.05	--	--	--	--	--
9/14/2015	1.00	--	--	--	--	--
12/7/2015	1.00	4	1.03	0.002	0.04	**23.05**
2/29/2016	1.16	4	1.05	0.006	0.08	**12.70**
6/16/2016	1.13	4	1.07	0.007	0.09	**12.09**
9/26/2016	0.94	4	1.06	0.011	0.11	**10.00**
3/8/2017	0.88	4	1.03	0.019	0.14	**4.66**
6/10/2017	--	3	0.98	0.017	0.13	**3.42**
9/16/2017	0.99	3	0.94	0.003	0.06	**3.35**
12/14/2017	--	2	0.94	0.006	0.08	2.48

BXS-2 (Downgradient Well)						
Date	Ammonia Concentration[1]	Number of Samples (n)	Average Concentration ($\bar{x}$)	Sample Variance (s^2)	Sample Standard Deviation (s)	Student's T-Test Statistic (t)[2]
11/17/2014	0.05	--	--	--	--	--
2/23/2015	0.05	--	--	--	--	--
9/14/2015	0.05	--	--	--	--	--
12/7/2015	0.05	4	0.05	0.000	0.00	-57.24
2/29/2016	0.05	4	0.05	0.000	0.00	-22.81
6/16/2016	0.05	4	0.05	0.000	0.00	-23.39
9/26/2016	0.05	4	0.05	0.000	0.00	-25.24
3/8/2017	0.025	4	0.04	0.000	0.01	-2.81
6/10/2017	0.025	4	0.04	0.000	0.01	-1.92
9/16/2017	0.025	4	0.03	0.000	0.01	-1.96
12/14/2017	0.0025	4	0.02	0.000	0.01	-1.02

Table C-1. Statistical Analysis of Groundwater Quality Results for Downgradient Wells: Ammonia

Former J.H. Baxter South Woodwaste Landfill

Arlington, Washington

BXS-1 (Downgradient Well)						
Date	**Ammonia Concentration[1]**	**Number of Samples (n)**	**Average Concentration ($\bar{x}$)**	**Sample Variance (s^2)**	**Sample Standard Deviation (s)**	**Student's T-Test Statistic (t)[2]**
11/17/2014	0.05	--	--	--	--	--
2/23/2015	0.05	--	--	--	--	--
9/14/2015	0.041	--	--	--	--	--
12/7/2015	0.05	4	0.05	0.000	0.00	-55.56
2/29/2016	0.02	4	0.04	0.000	0.01	-42.46
6/16/2016	0.05	4	0.04	0.000	0.01	-42.35
9/26/2016	0.46	4	0.15	0.044	0.21	-3.38
3/8/2017	0.17	4	0.18	0.040	0.20	-3.25
6/10/2017	--	3	0.23	0.044	0.21	-2.26
9/16/2017	0.025	3	0.22	0.049	0.22	-2.21
12/14/2017	--	2	0.10	0.011	0.10	-5.54

Notes

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

m_0 = average concentration for upgradient well.

n = number of samples.

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 reporting limit (MRL) is used.

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

Table C-2. Statistical Analysis of Groundwater Quality Results for Downgradient Wells: Chloride

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

Student's T-Test Formula (*t*):

$$\frac{\bar{x} - m_0}{\sqrt{[\,(s^1/n) + (s^2/n)\,]}}$$

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

BXS-4 (Upgradient Well)				
Date	**Chloride Concentration[1]**	**Number of Samples (n)**	**Average Concentration (m_0)**	**Sample Variance (s^1)**
11/17/2014	2.02	--	--	--
2/23/2015	1.58	--	--	--
9/14/2015	1.93	--	--	--
12/7/2015	1.66	4	1.80	0.04442
2/29/2016	1.83	4	1.75	0.02527
6/16/2016	1.97	4	1.85	0.01909
9/26/2016	1.91	4	1.84	0.01809
3/8/2017	1.97	4	1.92	0.00440
6/10/2017	--	3	1.95	0.00120
9/16/2017	2.00	3	1.96	0.00210
12/14/2017	--	2	1.99	0.00045

BXS-3 (Downgradient Well)						
Date	**Chloride Concentration[1]**	**Number of Samples (n)**	**Average Concentration $(\bar{x})$**	**Sample Variance (s^2)**	**Sample Standard Deviation (s)**	**Student's T-Test Statistic (t)[2]**
11/17/2014	1.76	--	--	--	--	--
2/23/2015	1.38	--	--	--	--	--
9/14/2015	1.87	--	--	--	--	--
12/7/2015	1.54	4	1.64	0.048	0.22	-1.05
2/29/2016	1.62	4	1.60	0.042	0.20	-1.14
6/16/2016	1.57	4	1.65	0.023	0.15	-1.93
9/26/2016	2.13	4	1.72	0.078	0.28	-0.82
3/8/2017	1.77	4	1.77	0.064	0.25	-1.13
6/10/2017	--	3	1.82	0.081	0.28	-0.77
9/16/2017	--	2	1.95	0.065	0.25	-0.05
12/14/2017	--	1	1.77	#DIV/0!	#DIV/0!	*

BXS-2 (Downgradient Well)						
Date	**Chloride Concentration[1]**	**Number of Samples (n)**	**Average Concentration $(\bar{x})$**	**Sample Variance (s^2)**	**Sample Standard Deviation (s)**	**Student's T-Test Statistic (t)[2]**
11/17/2014	3.16	--	--	--	--	--
2/23/2015	2.32	--	--	--	--	--
9/14/2015	2.54	--	--	--	--	--
12/7/2015	2.06	4	2.52	0.221	0.47	**2.81**
2/29/2016	2.37	4	2.32	0.039	0.20	**4.50**
6/16/2016	2.52	4	2.37	0.049	0.22	**4.02**
9/26/2016	2.53	4	2.37	0.048	0.22	**4.10**
3/8/2017	2.16	4	2.40	0.030	0.17	**5.13**
6/10/2017	5.71	4	3.23	2.763	1.66	1.54
9/16/2017	--	3	3.47	3.809	1.95	1.34
12/14/2017	4.78	3	4.22	3.389	1.84	2.10

Table C-2. Statistical Analysis of Groundwater Quality Results for Downgradient Wells: Chloride

Former J.H. Baxter South Woodwaste Landfill

Arlington, Washington

BXS-1 (Downgradient Well)						
Date	**Chloride Concentration[1]**	**Number of Samples (n)**	**Average Concentration ($\bar{x}$)**	**Sample Variance (s^2)**	**Sample Standard Deviation (s)**	**Student's T-Test Statistic (t)[2]**
11/17/2014	5.04	--	--	--	--	--
2/23/2015	4.56	--	--	--	--	--
9/14/2015	5.41	--	--	--	--	--
12/7/2015	4.58	4	4.90	0.166	0.41	**13.52**
2/29/2016	4.90	4	4.86	0.157	0.40	**14.56**
6/16/2016	3.44	4	4.58	0.697	0.83	**6.46**
9/26/2016	3.41	4	4.08	0.594	0.77	**5.73**
3/8/2017	3.03	4	3.70	0.680	0.82	**4.29**
6/10/2017	--	3	3.29	0.052	0.23	**10.07**
9/16/2017	--	2	3.22	0.072	0.27	**6.57**
12/14/2017	--	1	3.03	#DIV/0!	#DIV/0!	*

Notes

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

m_0 = average concentration for upgradient well.

n = number of samples.

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 reporting limit (MRL) is used.

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

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

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

Student's T-Test Formula (*t*):

$$\frac{\bar{x} - m_0}{\sqrt{[\,(s^1/n) + (s^2/n)\,]}}$$

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

$t_c = 4.303$ $v = 2$
$t_c = 12.706$ $v = 1$

BXS-4 (Upgradient Well)				
Date	**TOC Concentration[1]**	**Number of Samples (n)**	**Average Concentration (m_0)**	**Sample Variance (s^1)**
11/17/2014	0.78	--	--	--
2/23/2015	0.81	--	--	--
9/14/2015	1.00	--	--	--
12/7/2015	0.94	4	0.88	0.01096
2/29/2016	0.79	4	0.89	0.01030
6/16/2016	0.85	4	0.90	0.00870
9/26/2016	0.86	4	0.86	0.00380
3/8/2017	2.96	4	1.37	1.13163
6/10/2017	--	3	1.56	1.47703
9/16/2017	1.06	3	1.63	1.34333
12/14/2017	--	2	2.01	1.80500

BXS-3 (Downgradient Well)						
Date	**TOC 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	18.00	--	--	--	--	--
2/23/2015	19.00	--	--	--	--	--
9/14/2015	21.50	--	--	--	--	--
12/7/2015	17.10	4	18.90	3.607	1.90	**18.95**
2/29/2016	16.6	4	18.55	4.937	2.22	**15.88**
6/16/2016	19.6	4	18.70	5.207	2.28	**15.59**
9/26/2016	22.00	4	18.83	6.202	2.49	**14.42**
3/8/2017	19.00	4	19.30	4.920	2.22	**14.58**
6/10/2017	--	3	20.20	2.520	1.59	**16.15**
9/16/2017	21.30	3	20.77	2.463	1.57	**16.99**
12/14/2017	--	2	20.15	2.645	1.63	**12.16**

BXS-2 (Downgradient Well)						
Date	**TOC 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	13.80	--	--	--	--	--
2/23/2015	14.50	--	--	--	--	--
9/14/2015	12.80	--	--	--	--	--
12/7/2015	12.80	4	13.48	0.689	0.83	**30.10**
2/29/2016	15	4	13.78	1.309	1.14	**22.44**
6/16/2016	13.6	4	13.55	1.077	1.04	**24.29**
9/26/2016	13.30	4	13.68	0.889	0.94	**27.12**
3/8/2017	14.10	4	14.00	0.553	0.74	**19.47**
6/10/2017	3.75	4	11.19	24.694	4.97	**3.73**
9/16/2017	14.70	4	11.46	26.766	5.17	**3.68**
12/14/2017	11.00	4	10.89	25.271	5.03	**3.30**

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

Former J.H. Baxter South Woodwaste Landfill

Arlington, Washington

BXS-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	2.45	--	--	--	--	--
2/23/2015	2.47	--	--	--	--	--
9/14/2015	2.45	--	--	--	--	--
12/7/2015	3.00	4	2.59	0.074	0.27	**11.74**
2/29/2016	2.65	4	2.64	0.065	0.25	**12.76**
6/16/2016	3.07	4	2.79	0.086	0.29	**12.19**
9/26/2016	3.31	4	3.01	0.074	0.27	**14.70**
3/8/2017	2.10	4	2.78	0.281	0.53	**7.11**
6/10/2017	--	3	2.83	0.410	0.64	**5.26**
9/16/2017	3.38	3	2.93	0.518	0.72	**4.94**
12/14/2017	--	2	2.74	0.819	0.91	2.93

Notes

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

m_0 = average concentration for upgradient well.

n = number of samples.

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 reporting limit (MRL) is used.

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

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

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

Student's T-Test Formula (*t*):

$$\frac{\bar{x} - m_0}{\sqrt{[\,(s^1/n) + (s^2/n)\,]}}$$

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

BXS-4 (Upgradient Well)				
Date	**COD Concentration[1]**	**Number of Samples (n)**	**Average Concentration (m_0)**	**Sample Variance (s^1)**
11/17/2014	2.5	--	--	--
2/23/2015	2.5	--	--	--
9/14/2015	2.5	--	--	--
12/7/2015	2.5	4	2.50	0.00000
2/29/2016	5	4	3.13	1.56250
6/16/2016	4.8	4	3.70	1.92667
9/26/2016	5.7	4	4.50	1.92667
3/8/2017	9.7	4	6.30	5.28667
6/10/2017	--	3	6.73	6.80333
9/16/2017	3.6	3	6.33	9.60333
12/14/2017	--	2	6.65	18.60500

BXS-3 (Downgradient Well)						
Date	**COD Concentration[1]**	**Number of Samples (n)**	**Average Concentration ($\bar{x}$)**	**Sample Variance (s^2)**	**Sample Standard Deviation (s)**	**Student's T-Test Statistic (t)[2]**
11/17/2014	65.2	--	--	--	--	--
2/23/2015	69.3	--	--	--	--	--
9/14/2015	81.9	--	--	--	--	--
12/7/2015	72.6	4	72.25	50.550	7.11	**19.62**
2/29/2016	65.7	4	72.38	48.263	6.95	**19.62**
6/16/2016	76.1	4	74.08	45.883	6.77	**20.36**
9/26/2016	85.4	4	74.95	67.203	8.20	**16.95**
3/8/2017	71.1	4	74.58	70.116	8.37	**15.73**
6/10/2017	--	3	77.53	52.663	7.26	**15.90**
9/16/2017	70.0	3	75.50	73.810	8.59	**13.12**
12/14/2017	--	2	70.55	0.605	0.78	**20.62**

BXS-2 (Downgradient Well)						
Date	**COD Concentration[1]**	**Number of Samples (n)**	**Average Concentration ($\bar{x}$)**	**Sample Variance (s^2)**	**Sample Standard Deviation (s)**	**Student's T-Test Statistic (t)[2]**
11/17/2014	33.9	--	--	--	--	--
2/23/2015	36.9	--	--	--	--	--
9/14/2015	39.6	--	--	--	--	--
12/7/2015	38.2	4	37.15	5.910	2.43	**28.51**
2/29/2016	44.1	4	39.70	9.820	3.13	**21.68**
6/16/2016	44.9	4	41.70	10.887	3.30	**21.23**
9/26/2016	40.6	4	41.95	9.737	3.12	**21.93**
3/8/2017	34.9	4	41.13	20.709	4.55	**13.66**
6/10/2017	4.8	4	31.30	328.887	18.14	**2.67**
9/16/2017	35.0	4	28.83	263.629	16.24	**2.71**
12/14/2017	14.0	4	22.18	231.709	15.22	1.89

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

Former J.H. Baxter South Woodwaste Landfill

Arlington, Washington

BXS-1 (Downgradient Well)						
Date	**COD Concentration**[1]	**Number of Samples (n)**	**Average Concentration ($\bar{x}$)**	**Sample Variance (s^2)**	**Sample Standard Deviation (s)**	**Student's T-Test Statistic (t)**[2]
11/17/2014	5.6	--	--	--	--	--
2/23/2015	6.8	--	--	--	--	--
9/14/2015	8.2	--	--	--	--	--
12/7/2015	7.3	4	6.98	1.176	1.08	**8.25**
2/29/2016	8.6	4	7.73	0.676	0.82	**11.19**
6/16/2016	12.1	4	9.05	4.430	2.10	**5.08**
9/26/2016	9.9	4	9.48	4.189	2.05	**4.86**
3/8/2017	6.1	4	9.18	6.289	2.51	**3.73**
6/10/2017	--	3	9.37	9.213	3.04	**2.78**
9/16/2017	8.8	3	8.27	3.823	1.96	**3.34**
12/14/2017	--	2	7.45	3.645	1.91	2.19

Notes

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

m_0 = average concentration for upgradient well.

n = number of samples.

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 reporting limit (MRL) is used.

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

Table C-5. Statistical Analysis of Groundwater Quality Results for Downgradient Wells: Total Coliform

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

Student's T-Test Formula (*t*):

$$\frac{\bar{x} - m_0}{\sqrt{[\,(s^1/n) + (s^2/n)\,]}}$$

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

$t_c = 4.303$ $v = 2$
$t_c = 12.706$ $v = 1$

BXS-4 (Upgradient Well)				
Date	**Total Coliforms Concentration[1]**	**Number of Samples (n)**	**Average Concentration (m_0)**	**Sample Variance (s^1)**
11/17/2014	0.5	--	--	--
2/23/2015	0.5	--	--	--
9/14/2015	0.5	--	--	--
12/7/2015	0.5	4	0.50	0.00000
2/29/2016	0.5	4	0.50	0.00000
6/16/2016	0.5	4	0.50	0.00000
9/26/2016	0.5	4	0.50	0.00000
3/8/2017	--	--	--	--
6/10/2017	--	--	--	--
9/16/2017	--	--	--	--
12/14/2017	--	--	--	--

BXS-3 (Downgradient Well)						
Date	**Total Coliforms 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	0.5	--	--	--	--	--
2/23/2015	0.5	--	--	--	--	--
9/14/2015	0.5	--	--	--	--	--
12/7/2015	0.5	4	0.50	0.00000	0.00	*
2/29/2016	0.5	4	0.50	0.000	0.00	*
6/16/2016	0.5	4	0.50	0.000	0.00	*
9/26/2016	0.5	4	0.50	0.000	0.00	*
3/8/2017	--	--	--	--	--	--
6/10/2017	--	--	--	--	--	--
9/16/2017	--	--	--	--	--	--
12/14/2017	--	--	--	--	--	--

BXS-2 (Downgradient Well)						
Date	**Total Coliforms 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	0.5	--	--	--	--	--
2/23/2015	0.5	--	--	--	--	--
9/14/2015	0.5	--	--	--	--	--
12/7/2015	0.5	4	0.50	0.00000	0.00	*
2/29/2016	0.5	4	0.50	0.000	0.00	*
6/16/2016	0.5	4	0.50	0.000	0.00	*
9/26/2016	0.5	4	0.50	0.000	0.00	*
3/8/2017	--	--	--	--	--	--
6/10/2017	--	--	--	--	--	--
9/16/2017	--	--	--	--	--	--
12/14/2017	--	--	--	--	--	--

Table C-5. Statistical Analysis of Groundwater Quality Results for Downgradient Wells: Total Coliform

Former J.H. Baxter South Woodwaste Landfill

Arlington, Washington

BXS-1 (Downgradient Well)						
Date	**Total Coliforms 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	4.1	--	--	--	--	--
2/23/2015	0.5	--	--	--	--	--
9/14/2015	3.1	--	--	--	--	--
12/7/2015	2.0	4	2.43	2.383	1.54	**2.49**
2/29/2016	0.5	4	1.53	1.603	1.27	1.62
6/16/2016	0.5	4	1.53	1.603	1.27	1.62
9/26/2016	0.5	4	0.88	0.563	0.75	1.00
3/8/2017	--	--	--	--	--	--
6/10/2017	--	--	--	--	--	--
9/16/2017	--	--	--	--	--	--
12/14/2017	--	--	--	--	--	--

Notes

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

m_0 = average concentration for upgradient well.

n = number of samples.

NT = not tested.

s^1 = sample variance in upgradient well.

s^2 = sample variance in downgradient well.

t = Student's T-Test statistic.

t = Student T-Test statistic.

-- = analysis not applicable.

[1] For non-detect concentrations, half of the reporting limit (MRL) is used.

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

Table C-6. Statistical Analysis of Groundwater Quality Results for Downgradient Wells: Field Conductivity

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

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

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

$t_c = 4.303$ $v = 2$
$t_c = 12.706$ $v = 1$

BXS-4 (Upgradient Well)				
Date	**Conductivity Concentration[1]**	**Number of Samples (n)**	**Average Concentration (m_0)**	**Sample Variance (s^1)**
11/17/2014	190	--	--	--
2/23/2015	209	--	--	--
9/14/2015	204	--	--	--
12/7/2015	204	4	201.75	66.92
2/29/2016	220	4	209.25	56.92
6/16/2016	216	4	211.00	68.00
9/26/2016	207	4	211.75	56.25
3/8/2017	188	4	207.75	202.92
6/10/2017	--	3	203.67	204.33
9/16/2017	156	3	183.67	664.33
12/14/2017	--	2	172.00	512.00

BXS-3 (Downgradient Well)						
Date	**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	406	--	--	--	--	--
2/23/2015	430	--	--	--	--	--
9/14/2015	348	--	--	--	--	--
12/7/2015	396	4	395.00	1,185.33	34.43	**10.92**
2/29/2016	413	4	396.75	1,248.92	35.34	**10.38**
6/16/2016	450	4	401.75	1,792.25	42.33	**8.85**
9/26/2016	548	4	451.75	4,625.58	68.01	**7.02**
3/8/2017	694	4	526.25	15,750.92	125.50	**5.04**
6/10/2017	--	3	564.00	15,076.00	122.78	**5.05**
9/16/2017	507	3	583.00	9,661.00	98.29	**6.81**
12/14/2017	--	2	600.50	17,484.50	132.23	**4.52**

BXS-2 (Downgradient Well)						
Date	**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	819	--	--	--	--	--
2/23/2015	876	--	--	--	--	--
9/14/2015	807	--	--	--	--	--
12/7/2015	784	4	821.50	1,531.00	39.13	**31.01**
2/29/2016	866	4	833.25	2,004.92	44.78	**27.48**
6/16/2016	817	4	818.50	1,193.67	34.55	**34.21**
9/26/2016	747	4	803.50	2,553.67	50.53	**23.17**
3/8/2017	680	4	692.80	40,827.70	202.06	**4.79**
6/10/2017	354	4	633.00	32,814.50	181.15	**4.72**
9/16/2017	567	4	587.00	22,234.50	149.11	**5.31**
12/14/2017	587	4	502.67	16,676.33	129.14	**4.97**

Table C-6. Statistical Analysis of Groundwater Quality Results for Downgradient Wells: Field Conductivity

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

BXS-1 (Downgradient Well)						
Date	**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	281	--	--	--	--	--
2/23/2015	292	--	--	--	--	--
9/14/2015	283	--	--	--	--	--
12/7/2015	312	4	292.00	200.67	14.17	**11.03**
2/29/2016	317	4	301.00	260.67	16.15	**10.30**
6/16/2016	397	4	327.25	2,386.92	48.86	**4.69**
9/26/2016	380	4	351.50	1,877.67	43.33	**6.36**
3/8/2017	373	4	366.75	1,201.58	34.66	**8.49**
6/10/2017	--	3	383.33	152.33	12.34	**16.48**
9/16/2017	--	2	376.50	24.50	4.95	**12.61**
12/14/2017	--	1	373.00	#DIV/0!	#DIV/0!	*

Notes

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

m_0 = average concentration for upgradient well.

n = number of samples.

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 reporting limit (MRL) is used.

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

Table C-7. Statistical Analysis of Groundwater Quality Results for Downgradient Wells: Nitrate+Nitrite as Nitrogen

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

Student's T-Test Formula (*t*):

$$\frac{\bar{x} - m_0}{\sqrt{[\,(s^1/n) + (s^2/n)\,]}}$$

Critical Statistic:

$t_c = 2.447$ $v = 6$
$t_c = 2.571$ $v = 5$
$t_c = 2.776$ $v = 4$
$t_c = 3.182$ $v = 3$

$t_c = 4.303$ $v = 2$
$t_c = 12.706$ $v = 1$

BXS-4 (Upgradient Well)				
Date	Nitrate, Nitrite as N Concentration[1]	Number of Samples (n)	Average Concentration (m_0)	Sample Variance (s^1)
11/17/2014	0.025	--	--	--
2/23/2015	0.025	--	--	--
9/14/2015	0.025	--	--	--
12/7/2015	0.025	4	0.03	0.00000
2/29/2016	0.05	4	0.03	0.00016
6/16/2016	0.05	4	0.04	0.00021
9/26/2016	0.05	4	0.04	0.00016
3/8/2017	0.36	4	0.13	0.02403
6/10/2017	--	3	0.15	0.03203
9/16/2017	0.06	3	0.16	0.03103
12/14/2017	--	2	0.21	0.04500

BXS-3 (Downgradient Well)						
Date	Nitrate, Nitrite as N 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	--	--	--	--	--
2/23/2015	0.025	--	--	--	--	--
9/14/2015	0.026	--	--	--	--	--
12/7/2015	0.025	4	0.03	0.000	0.00	1.00
2/29/2016	0.05	4	0.03	0.000	0.01	0.03
6/16/2016	0.05	4	0.04	0.000	0.01	0.02
9/26/2016	0.160	4	0.07	0.004	0.06	0.89
3/8/2017	0.040	4	0.08	0.003	0.06	-0.64
6/10/2017	--	3	0.08	0.004	0.07	-0.63
9/16/2017	--	2	0.10	0.007	0.08	-0.48
12/14/2017	--	1	0.04	#DIV/0!	#DIV/0!	*

BXS-2 (Downgradient Well)						
Date	Nitrate, Nitrite as N 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	--	--	--	--	--
2/23/2015	0.025	--	--	--	--	--
9/14/2015	0.025	--	--	--	--	--
12/7/2015	0.025	4	0.03	0.000	0.00	*
2/29/2016	0.025	4	0.03	0.000	0.00	-1.00
6/16/2016	0.025	4	0.03	0.000	0.00	-1.73
9/26/2016	0.025	4	0.03	0.000	0.00	-3.00
3/8/2017	0.025	4	0.03	0.000	0.00	-1.32
6/10/2017	0.17	4	0.06	0.005	0.07	-0.84
9/16/2017	--	3	0.07	0.007	0.08	-0.74
12/14/2017	0.005	3	0.07	0.008	0.09	-0.90

Table C-7. Statistical Analysis of Groundwater Quality Results for Downgradient Wells: Nitrate+Nitrite as Nitrogen

Former J.H. Baxter South Woodwaste Landfill

Arlington, Washington

BXS-1 (Downgradient Well)						
Date	**Nitrate, Nitrite as N 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	--	--	--	--	--
2/23/2015	0.070	--	--	--	--	--
9/14/2015	0.155	--	--	--	--	--
12/7/2015	0.368	4	0.15	0.023	0.15	1.70
2/29/2016	0.39	4	0.25	0.025	0.16	**2.71**
6/16/2016	0.22	4	0.28	0.013	0.11	**4.28**
9/26/2016	0.22	4	0.30	0.009	0.09	**5.50**
3/8/2017	0.42	4	0.31	0.012	0.11	1.96
6/10/2017	--	3	0.29	0.013	0.12	1.08
9/16/2017	--	2	0.32	0.020	0.14	1.15
12/14/2017	--	1	0.42	#DIV/0!	#DIV/0!	*

Notes

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

m_0 = average concentration for upgradient well.

n = number of samples.

NO_2 = nitrite.

NO_3 = nitrate.

s^1 = sample variance in upgradient well.

t = Student's T-Test statistic.

s = sample standard deviation.

t = Student T-Test statistic.

[1] For non-detect concentrations, half of the reporting limit (MRL) is used.

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

[2] Statistic in **bold** or *gray* is a statistically valid detection (according to the Student T-Test).

Table C-8. Statistical Analysis of Groundwater Quality Results for Downgradient Wells: Field pH

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

Student's T-Test Formula (*t*):

$$\frac{\bar{x} - m_0}{\sqrt{\,[\,(s^1/n) + (s^2/n)\,]}}$$

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

BXS-4 (Upgradient Well)				
Date	Field pH Concentration^1	Number of Samples (n)	Average Concentration (m_0)	Sample Variance (s^1)
11/17/2014	7.48	--	--	--
2/23/2015	7.28	--	--	--
9/14/2015	7.50	--	--	--
12/7/2015	7.06	4	7.33	0.04227
2/29/2016	6.98	4	7.21	0.05477
6/16/2016	7.69	4	7.31	0.11729
9/26/2016	6.84	4	7.14	0.14149
3/8/2017	7.28	4	7.20	0.14149
6/10/2017	--	3	7.27	0.18070
9/16/2017	6.97	3	7.03	0.05110
12/14/2017	--	2	7.13	0.04805

BXS-3 (Downgradient Well)						
Date	Field pH Concentration^1	Number of Samples (n)	Average Concentration ($\bar{x}$)	Sample Variance (s^2)	Sample Standard Deviation (s)	Student's T-Test Statistic $(t)^2$
11/17/2014	5.99	--	--	--	--	--
2/23/2015	5.84	--	--	--	--	--
9/14/2015	6.26	--	--	--	--	--
12/7/2015	6.04	4	6.03	0.030	0.17	-9.64
2/29/2016	6.00	4	6.04	0.030	0.17	-8.04
6/16/2016	6.49	4	6.20	0.051	0.23	-5.41
9/26/2016	6.19	4	6.18	0.049	0.22	-4.41
3/8/2017	6.12	4	6.20	0.044	0.21	-4.64
6/10/2017	--	3	6.27	0.039	0.20	-3.71
9/16/2017	6.18	3	6.16	0.001	0.04	-6.55
12/14/2017	--	2	6.15	0.002	0.04	-6.18

BXS-2 (Downgradient Well)						
Date	Field pH Concentration^1	Number of Samples (n)	Average Concentration ($\bar{x}$)	Sample Variance (s^2)	Sample Standard Deviation (s)	Student's T-Test Statistic $(t)^2$
11/17/2014	5.88	--	--	--	--	--
2/23/2015	5.78	--	--	--	--	--
9/14/2015	6.24	--	--	--	--	--
12/7/2015	5.94	4	5.96	0.039	0.20	-9.60
2/29/2016	5.95	4	5.98	0.037	0.19	-8.12
6/16/2016	6.57	4	6.18	0.089	0.30	-4.99
9/26/2016	6.10	4	6.14	0.088	0.30	-4.19
3/8/2017	6.08	4	6.18	0.074	0.27	-4.41
6/10/2017	6.36	4	6.28	0.054	0.23	-3.65
9/16/2017	6.12	4	6.17	0.017	0.13	-5.92
12/14/2017	6.26	4	6.21	0.017	0.13	-5.48

Table C-8. Statistical Analysis of Groundwater Quality Results for Downgradient Wells:
Field pH

Former J.H. Baxter South Woodwaste Landfill

Arlington, Washington

BXS-1 (Downgradient Well)						
Date	Field pH Concentration[1]	Number of Samples (n)	Average Concentration ($\bar{x}$)	Sample Variance (s^2)	Sample Standard Deviation (s)	Student's T-Test Statistic (t)[2]
11/17/2014	5.69	--	--	--	--	--
2/23/2015	5.86	--	--	--	--	--
9/14/2015	6.02	--	--	--	--	--
12/7/2015	5.28	4	5.71	0.101	0.32	-8.54
2/29/2016	5.86	4	5.76	0.106	0.33	-7.53
6/16/2016	6.03	4	5.80	0.125	0.35	-7.38
9/26/2016	5.81	4	5.75	0.105	0.32	-7.28
3/8/2017	5.87	4	5.89	0.009	0.10	-11.03
6/10/2017	--	3	5.90	0.013	0.11	-10.16
9/16/2017	--	2	5.84	0.002	0.04	-12.16
12/14/2017	--	1	5.87	#DIV/0!	#DIV/0!	*

Notes

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

m_0 = average concentration for upgradient well.

n = number of samples.

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 reporting limit (MRL) is used.

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

Table C-9. Statistical Analysis of Groundwater Quality Results for Downgradient Wells: Total Dissolved Solids (TDS)

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

Student's T-Test Formula (*t*):

$$\frac{\bar{x} - m_0}{\sqrt{[\,(s^1/n) + (s^2/n)\,]}}$$

Critical Statistic:

$t_c = 2.447$ $v = 6$
$t_c = 2.571$ $v = 5$
$t_c = 2.776$ $v = 4$
$t_c = 3.182$ $v = 3$

$t_c = 4.303$ $v = 2$
$t_c = 12.706$ $v = 1$

BXS-4 (Upgradient Well)				
Date	**TDS Concentration[1]**	**Number of Samples (n)**	**Average Concentration (m_0)**	**Sample Variance (s^1)**
11/17/2014	NT	--	--	--
2/23/2015	122	--	--	--
9/14/2015	111	--	--	--
12/7/2015	112	--	--	--
2/29/2016	101	4	111.50	73.67
6/16/2016	118	4	110.50	49.67
9/26/2016	143	4	118.50	316.33
3/8/2017	128	4	122.50	311.00
6/10/2017	--	3	129.67	158.33
9/16/2017	139	3	136.67	60.33
12/14/2017	--	2	133.50	60.50

BXS-3 (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]**
11/17/2014	NT	--	--	--	--	--
2/23/2015	325	--	--	--	--	--
9/14/2015	267	--	--	--	--	--
12/7/2015	285	--	--	--	--	--
2/29/2016	290	4	291.75	588.92	24.27	**14.01**
6/16/2016	301	4	285.75	200.92	14.17	**22.14**
9/26/2016	311	4	296.75	134.92	11.62	**16.78**
3/8/2017	--	3	300.67	110.33	10.50	**16.65**
6/10/2017	--	2	306.00	50.00	7.07	**19.99**
9/16/2017	216	2	263.50	4512.50	67.18	2.66
12/14/2017	--	1	216.00	#DIV/0!	#DIV/0!	*

BXS-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]**
11/17/2014	NT	--	--	--	--	--
2/23/2015	479	--	--	--	--	--
9/14/2015	430	--	--	--	--	--
12/7/2015	424	--	--	--	--	--
2/29/2016	447	4	445.00	608.67	24.67	**25.53**
6/16/2016	443	4	436.00	116.67	10.80	**50.48**
9/26/2016	419	4	433.25	190.92	13.82	**27.95**
3/8/2017	--	3	436.33	229.33	15.14	**25.27**
6/10/2017	252	3	371.33	10824.33	104.04	**3.99**
9/16/2017	406	3	359.00	8629.00	92.89	**4.13**
12/14/2017	460	3	372.67	11649.33	107.93	**3.82**

Table C-9. Statistical Analysis of Groundwater Quality Results for Downgradient Wells: Total Dissolved Solids (TDS)

Former J.H. Baxter South Woodwaste Landfill

Arlington, Washington

BXS-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}
11/17/2014	NT	--	--	--	--	--
2/23/2015	157	--	--	--	--	--
9/14/2015	144	--	--	--	--	--
12/7/2015	151	--	--	--	--	--
2/29/2016	135	4	146.75	89.58	9.46	**5.52**
6/16/2016	194	4	156.00	684.67	26.17	**3.36**
9/26/2016	204	4	171.00	1104.67	33.24	**2.79**
3/8/2017	224	4	189.25	1463.58	38.26	**3.17**
6/10/2017	--	3	207.33	233.33	15.28	**6.80**
9/16/2017	191	3	206.33	276.33	16.62	**6.58**
12/14/2017	--	2	207.50	544.50	23.33	4.25

Notes

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

m_0 = average concentration for upgradient well.

n = number of samples.

NT = not tested.

s^1 = sample variance in upgradient well.

s^2 = sample variance in downgradient well.

t = Student's T-Test statistic.

t = Student T-Test statistic.

-- = analysis not applicable.

[1] For non-detect concentrations, half of the reporting limit (MRL) is used.

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

Table C-10. Statistical Analysis of Groundwater Quality Results for Downgradient Wells: Sulfate

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

Student's T-Test Formula (*t*):

$$t = \frac{\bar{x} - m_0}{\sqrt{[(s^1/n) + (s^2/n)]}}$$

Critical Statistic:

$t_c = 2.447$ $v = 6$
$t_c = 2.571$ $v = 5$
$t_c = 2.776$ $v = 4$
$t_c = 3.182$ $v = 3$

$t_c = 4.303$ $v = 2$
$t_c = 12.706$ $v = 1$

BXS-4 (Upgradient Well)				
Date	Sulfate Concentration[1]	Number of Samples (n)	Average Concentration (m_0)	Sample Variance (s^1)
11/17/2014	1.56	--	--	--
2/23/2015	0.81	--	--	--
9/14/2015	1.20	--	--	--
12/7/2015	1.09	4	1.17	0.09630
2/29/2016	1.2	4	1.08	0.03390
6/16/2016	1.05	4	1.14	0.00590
9/26/2016	1.50	4	1.21	0.04140
3/8/2017	2.10	4	1.46	0.21563
6/10/2017	--	3	1.55	0.27750
9/16/2017	1.86	3	1.82	0.09120
12/14/2017	--	2	1.98	0.02880

BXS-3 (Downgradient Well)						
Date	Sulfate Concentration[1]	Number of Samples (n)	Average Concentration ($\bar{x}$)	Sample Variance (s^2)	Sample Standard Deviation (s)	Student's T-Test Statistic (t)[2]
11/17/2014	0.18	--	--	--	--	--
2/23/2015	0.22	--	--	--	--	--
9/14/2015	0.39	--	--	--	--	--
12/7/2015	0.18	4	0.24	0.010	0.10	-5.66
2/29/2016	1.16	4	0.49	0.209	0.46	-2.38
6/16/2016	1.13	4	0.72	0.254	0.50	-1.65
9/26/2016	0.94	4	0.85	0.210	0.46	-1.42
3/8/2017	0.10	4	0.83	0.248	0.50	-1.85
6/10/2017	--	3	0.72	0.300	0.55	-1.88
9/16/2017	0.10	3	0.38	0.235	0.48	-4.37
12/14/2017	--	2	0.10	0.000	0.00	-15.67

BXS-2 (Downgradient Well)						
Date	Sulfate Concentration[1]	Number of Samples (n)	Average Concentration ($\bar{x}$)	Sample Variance (s^2)	Sample Standard Deviation (s)	Student's T-Test Statistic (t)[2]
11/17/2014	0.33	--	--	--	--	--
2/23/2015	0.34	--	--	--	--	--
9/14/2015	0.46	--	--	--	--	--
12/7/2015	0.27	4	0.35	0.006	0.08	-5.09
2/29/2016	0.5	4	0.39	0.011	0.11	-6.42
6/16/2016	0.48	4	0.43	0.011	0.11	-10.79
9/26/2016	0.20	4	0.36	0.023	0.15	-6.70
3/8/2017	0.20	4	0.35	0.028	0.17	-4.53
6/10/2017	7.36	4	2.06	12.502	3.54	0.28
9/16/2017	0.10	4	1.97	12.938	3.60	0.08
12/14/2017	51.60	4	14.82	612.948	24.76	1.04

Table C-10. Statistical Analysis of Groundwater Quality Results for Downgradient Wells: Sulfate

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

BXS-1 (Downgradient Well)						
Date	**Sulfate Concentration[1]**	**Number of Samples (n)**	**Average Concentration ($\bar{x}$)**	**Sample Variance (s^2)**	**Sample Standard Deviation (s)**	**Student's T-Test Statistic (t)[2]**
11/17/2014	8.42	--	--	--	--	--
2/23/2015	7.74	--	--	--	--	--
9/14/2015	9.66	--	--	--	--	--
12/7/2015	10.70	4	9.13	1.727	1.31	**11.80**
2/29/2016	9.00	4	9.28	1.537	1.24	**13.09**
6/16/2016	6.87	4	9.06	2.616	1.62	**9.78**
9/26/2016	6.00	4	8.14	4.495	2.12	**6.51**
3/8/2017	4.50	4	6.59	3.534	1.88	**5.30**
6/10/2017	--	3	5.79	1.437	1.20	**5.61**
9/16/2017	5.64	3	5.38	0.613	0.78	**7.35**
12/14/2017	--	2	5.07	0.650	0.81	**5.30**

Notes

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

m_0 = average concentration for upgradient well.

n = number of samples.

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 reporting limit (MRL) is used.

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

Table C-11. Statistical Analysis of Groundwater Quality Results for Downgradient Wells: Tannin and Lignin

Former J.H. Baxter South Woodwaste Landfill

Arlington, Washington

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

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

BXS-4 (Upgradient Well)				
Date	**Tanin and Lignin Concentration[1]**	**Number of Samples (n)**	**Average Concentration (m_0)**	**Sample Variance (s^1)**
11/17/2014	0.29	--	--	--
2/23/2015	0.31	--	--	--
9/14/2015	0.22	--	--	--
12/7/2015	0.34	4	0.29	0.00260
2/29/2016	0.2	4	0.27	0.00463
6/16/2016	0.21	4	0.24	0.00429
9/26/2016	0.12	4	0.22	0.00829
3/8/2017	0.15	4	0.17	0.00180
6/10/2017	--	3	0.16	0.00210
9/16/2017	0.20	3	0.16	0.00163
12/14/2017	--	2	0.18	0.00125

BXS-3 (Downgradient Well)						
Date	**Tanin and 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	20.50	--	--	--	--	--
2/23/2015	23.00	--	--	--	--	--
9/14/2015	4.49	--	--	--	--	--
12/7/2015	1.13	4	12.28	122.498	11.07	2.17
2/29/2016	5.30	4	8.48	96.962	9.85	1.67
6/16/2016	7.80	4	4.68	7.586	2.75	**3.22**
9/26/2016	3.75	4	4.50	7.816	2.80	**3.06**
3/8/2017	49.50	4	16.59	484.221	22.01	1.49
6/10/2017	--	3	20.35	641.393	25.33	1.38
9/16/2017	18.50	3	23.92	545.271	23.35	1.76
12/14/2017	--	2	34.00	480.500	21.92	2.18

BXS-2 (Downgradient Well)						
Date	**Tanin and 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	1.37	--	--	--	--	--
2/23/2015	1.33	--	--	--	--	--
9/14/2015	1.34	--	--	--	--	--
12/7/2015	1.23	4	1.32	0.004	0.06	**25.91**
2/29/2016	1.32	4	1.31	0.003	0.05	**24.47**
6/16/2016	1.19	4	1.27	0.005	0.07	**21.17**
9/26/2016	1.04	4	1.20	0.014	0.12	**13.20**
3/8/2017	1.18	4	1.18	0.013	0.11	**16.59**
6/10/2017	1.00	4	1.10	0.009	0.10	**17.10**
9/16/2017	1.26	4	1.12	0.015	0.12	**14.84**
12/14/2017	2.80	4	1.56	0.695	0.83	**3.32**

Table C-11. Statistical Analysis of Groundwater Quality Results for Downgradient Wells: Tannin and Lignin

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

BXS-1 (Downgradient Well)						
Date	**Tanin and 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	0.11	--	--	--	--	--
2/23/2015	0.15	--	--	--	--	--
9/14/2015	0.09	--	--	--	--	--
12/7/2015	0.14	4	0.12	0.001	0.03	-5.78
2/29/2016	0.05	4	0.11	0.002	0.05	-3.89
6/16/2016	0.09	4	0.09	0.001	0.04	-3.99
9/26/2016	0.11	4	0.10	0.001	0.04	-2.43
3/8/2017	0.13	4	0.10	0.001	0.03	-2.75
6/10/2017	--	3	0.11	0.000	0.02	-1.73
9/16/2017	0.10	3	0.11	0.000	0.02	-1.74
12/14/2017	--	2	0.12	0.000	0.02	-2.06

Notes

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

m_0 = average concentration for upgradient well.

n = number of samples.

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 reporting limit (MRL) is used.

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

Table C-12. Statistical Analysis of Groundwater Quality Results for Downgradient Wells: PAH

Former J.H. Baxter South Woodwaste Landfill

Arlington, Washington

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

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

BXS-4 (Upgradient Well)				
Date	PAH Concentration[1]	Number of Samples (n)	Average Concentration (m_0)	Sample Variance (s^1)
11/17/2014	--	--	--	--
2/23/2015	--	--	--	--
9/14/2015	--	--	--	--
12/7/2015	--	--	--	--
2/29/2016	--	--	--	--
6/16/2016	--	--	--	--
9/26/2016	--	--	--	--
3/8/2017	--	--	--	--
6/10/2017	--	--	--	--
9/16/2017	--	--	--	--
12/14/2017	--	--	--	--

BXS-3 (Downgradient Well)						
Date	PAH 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	--	--	--	--	--	--
2/23/2015	--	--	--	--	--	--
9/14/2015	--	--	--	--	--	--
12/7/2015	--	--	--	--	--	--
2/29/2016	--	--	--	--	--	--
6/16/2016	--	--	--	--	--	--
9/26/2016	--	--	--	--	--	--
3/8/2017	--	--	--	--	--	--
6/10/2017	--	--	--	--	--	--
9/16/2017	0.01	1	0.01	#DIV/0!	#DIV/0!	*
12/14/2017	--	--	--	--	--	--

BXS-2 (Downgradient Well)						
Date	PAH 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	--	--	--	--	--	--
2/23/2015	--	--	--	--	--	--
9/14/2015	--	--	--	--	--	--
12/7/2015	--	--	--	--	--	--
2/29/2016	--	--	--	--	--	--
6/16/2016	--	--	--	--	--	--
9/26/2016	--	--	--	--	--	--
3/8/2017	--	--	--	--	--	--
6/10/2017	--	--	--	--	--	--
9/16/2017	0.01	1	0.01	#DIV/0!	#DIV/0!	*
12/14/2017	--	--	--	--	--	--

BXS-1 (Downgradient Well)						
Date	PAH 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	--	--	--	--	--	--
2/23/2015	--	--	--	--	--	--
9/14/2015	--	--	--	--	--	--
12/7/2015	--	--	--	--	--	--
2/29/2016	--	--	--	--	--	--
6/16/2016	--	--	--	--	--	--
9/26/2016	--	--	--	--	--	--
3/8/2017	--	--	--	--	--	--
6/10/2017	--	--	--	--	--	--
9/16/2017	0.01	1	0.01	#DIV/0!	#DIV/0!	*
12/14/2017	--	--	--	--	--	--

Notes

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

m_0 = average concentration for upgradient well.

n = number of samples.

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 reporting limit (MRL) is used.

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

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

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

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

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

$t_c = 4.303$ $v = 2$
$t_c = 12.706$ $v = 1$

BXS-4 (Upgradient Well)				
Date	**PCP Concentration[1]**	**Number of Samples (n)**	**Average Concentration (m_0)**	**Sample Variance (s^1)**
11/17/2014	--	--	--	--
2/23/2015	--	--	--	--
9/14/2015	--	--	--	--
12/7/2015	--	--	--	--
2/29/2016	--	--	--	--
6/16/2016	--	--	--	--
9/26/2016	--	--	--	--
3/8/2017	0.15	1	0.15	#DIV/0!
6/10/2017	--	1	0.15	#DIV/0!
9/16/2017	0.20	2	0.18	0.00125
12/14/2017	--	2	0.18	0.00125

BXS-3 (Downgradient Well)						
Date	**PCP 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	--	--	--	--	--	--
2/23/2015	--	--	--	--	--	--
9/14/2015	--	--	--	--	--	--
12/7/2015	--	--	--	--	--	--
2/29/2016	--	--	--	--	--	--
6/16/2016	--	--	--	--	--	--
9/26/2016	--	--	--	--	--	--
3/8/2017	49.50	1	49.50	#DIV/0!	#DIV/0!	*
6/10/2017	--	1	49.50	#DIV/0!	#DIV/0!	*
9/16/2017	18.50	2	34.00	480.500	21.92	2.18
12/14/2017	--	2	34.00	480.500	21.92	2.18

BXS-2 (Downgradient Well)						
Date	**PCP 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	--	--	--	--	--	--
2/23/2015	--	--	--	--	--	--
9/14/2015	--	--	--	--	--	--
12/7/2015	--	--	--	--	--	--
2/29/2016	--	--	--	--	--	--
6/16/2016	--	--	--	--	--	--
9/26/2016	--	--	--	--	--	--
3/8/2017	1.18	1	1.18	#DIV/0!	#DIV/0!	*
6/10/2017	1.00	2	1.09	0.016	0.13	*
9/16/2017	1.26	3	1.15	0.018	0.13	**12.02**
12/14/2017	2.80	4	1.56	0.695	0.83	**3.32**

BXS-1 (Downgradient Well)						
Date	**PCP 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	--	--	--	--	--	--
2/23/2015	--	--	--	--	--	--
9/14/2015	--	--	--	--	--	--
12/7/2015	--	--	--	--	--	--
2/29/2016	--	--	--	--	--	--
6/16/2016	--	--	--	--	--	--
9/26/2016	--	--	--	--	--	--
3/8/2017	0.13	1	0.13	#DIV/0!	#DIV/0!	*
6/10/2017	--	1	0.13	#DIV/0!	#DIV/0!	*
9/16/2017	0.10	2	0.12	0.000	0.02	-2.06
12/14/2017	--	2	0.12	0.000	0.02	-2.06

Notes

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

m_0 = average concentration for upgradient well.

n = number of samples.

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 reporting limit (MRL) is used.

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

Table C-12. Statistical Analysis of Groundwater Quality Results for Downgradient Wells: Arsenic

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

Student's T-Test Formula (t):

$$\frac{\bar{x} - m_0}{\sqrt{[\,(s^1/n) + (s^2/n)\,]}}$$

Critical Statistic:

$t_c = 2.447$ $v = 6$
$t_c = 2.571$ $v = 5$
$t_c = 2.776$ $v = 4$
$t_c = 3.182$ $v = 3$

$t_c = 4.303$ $v = 2$
$t_c = 12.706$ $v = 1$

BXS-4 (Upgradient Well)				
Date	Arsenic Concentration[1]	Number of Samples (n)	Average Concentration (m_0)	Sample Variance (s^1)
11/17/2014	5.70	--	--	--
2/23/2015	5.90	--	--	--
9/14/2015	5.90	--	--	--
12/7/2015	6.32	4	5.96	0.06810
2/29/2016	6.3	4	6.11	0.05610
6/16/2016	6.1	4	6.16	0.03877
9/26/2016	6.56	4	6.32	0.03547
3/8/2017	10.50	4	7.37	4.40357
6/10/2017	--	3	7.72	5.84920
9/16/2017	8.00	3	8.35	3.97453
12/14/2017	--	2	9.25	3.12500

BXS-3 (Downgradient Well)						
Date	Arsenic Concentration[1]	Number of Samples (n)	Average Concentration ($\bar{x}$)	Sample Variance (s^2)	Sample Standard Deviation (s)	Student's T-Test Statistic (t)[2]
11/17/2014	174	--	--	--	--	--
2/23/2015	163	--	--	--	--	--
9/14/2015	185	--	--	--	--	--
12/7/2015	174	4	174.00	80.667	8.98	**37.40**
2/29/2016	147	4	167.25	262.917	16.21	**19.87**
6/16/2016	138	4	161.00	490.000	22.14	**13.99**
9/26/2016	191	4	162.50	595.000	24.39	**12.81**
3/8/2017	161	4	159.25	537.583	23.19	**13.05**
6/10/2017	--	3	163.33	706.333	26.58	**10.10**
9/16/2017	181	3	177.67	233.333	15.28	**19.04**
12/14/2017	--	2	171.00	200.000	14.14	**16.05**

BXS-2 (Downgradient Well)						
Date	Arsenic Concentration[1]	Number of Samples (n)	Average Concentration ($\bar{x}$)	Sample Variance (s^2)	Sample Standard Deviation (s)	Student's T-Test Statistic (t)[2]
11/17/2014	0.70	--	--	--	--	--
2/23/2015	0.70	--	--	--	--	--
9/14/2015	0.60	--	--	--	--	--
12/7/2015	0.76	4	0.69	0.004	0.07	-39.11
2/29/2016	0.69	4	0.69	0.004	0.07	-44.07
6/16/2016	0.7	4	0.69	0.004	0.07	-52.66
9/26/2016	0.47	4	0.66	0.016	0.13	-49.86
3/8/2017	10.50	4	3.09	24.415	4.94	-1.59
6/10/2017	10.50	4	5.54	32.778	5.73	-0.68
9/16/2017	5.50	4	6.74	23.042	4.80	-0.61
12/14/2017	--	3	8.83	8.333	2.89	-0.20

Table C-12. Statistical Analysis of Groundwater Quality Results for Downgradient Wells: Arsenic

Former J.H. Baxter South Woodwaste Landfill

Arlington, Washington

BXS-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	0.30	--	--	--	--	--
2/23/2015	0.20	--	--	--	--	--
9/14/2015	0.50	--	--	--	--	--
12/7/2015	0.26	4	0.32	0.017	0.13	*-38.69*
2/29/2016	0.29	4	0.31	0.017	0.13	*-42.84*
6/16/2016	0.30	4	0.34	0.012	0.11	*-51.63*
9/26/2016	0.25	4	0.28	0.001	0.02	*-63.69*
3/8/2017	10.50	4	2.84	26.113	5.11	-1.64
6/10/2017	--	3	3.68	34.851	5.90	-1.10
9/16/2017	5.50	3	5.42	26.271	5.13	-0.92
12/14/2017	5.00	3	7.00	9.250	3.04	-1.04

Notes

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

m_0 = average concentration for upgradient well.

n = number of samples.

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 reporting limit (MRL) is used.

[2] Statistic in **bold** or *gray* is a statistically valid detection (according to the Student T-Test).

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

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

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

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

BXS-4 (Upgradient Well)				
Date	**Barium Concentration[1]**	**Number of Samples (n)**	**Average Concentration (m_0)**	**Sample Variance (s^1)**
11/17/2014	27.7	--	--	--
2/23/2015	27.7	--	--	--
9/14/2015	30.0	--	--	--
12/7/2015	27.7	4	28.28	1.32250
2/29/2016	28.6	4	28.50	1.18000
6/16/2016	30.5	4	29.20	1.64667
9/26/2016	31.2	4	29.50	2.64667
3/8/2017	28.9	4	29.80	1.56667
6/10/2017	--	3	30.20	1.39000
9/16/2017	30.0	3	30.03	1.32333
12/14/2017	--	2	29.45	0.60500

BXS-3 (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	130	--	--	--	--	--
2/23/2015	127	--	--	--	--	--
9/14/2015	152	--	--	--	--	--
12/7/2015	162	4	142.75	288.917	17.00	**13.44**
2/29/2016	115	4	139.00	472.667	21.74	**10.15**
6/16/2016	109	4	134.50	697.667	26.41	**7.96**
9/26/2016	128	4	128.50	561.667	23.70	**8.33**
3/8/2017	128	4	120.00	91.333	9.56	**18.72**
6/10/2017	--	3	121.67	120.333	10.97	**14.36**
9/16/2017	129	3	128.33	0.333	0.58	**132.28**
12/14/2017	--	2	128.50	0.500	0.71	**133.26**

BXS-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	49.6	--	--	--	--	--
2/23/2015	47.0	--	--	--	--	--
9/14/2015	46.6	--	--	--	--	--
12/7/2015	43.7	4	46.73	5.836	2.42	**13.79**
2/29/2016	47.8	4	46.28	3.196	1.79	**16.99**
6/16/2016	43.5	4	45.40	4.567	2.14	**13.00**
9/26/2016	31.9	4	41.73	46.829	6.84	**3.48**
3/8/2017	40.1	4	40.83	45.329	6.73	**3.22**
6/10/2017	20.3	4	33.95	106.517	10.32	0.72
9/16/2017	40.5	4	33.20	89.667	9.47	0.66
12/14/2017	--	3	33.63	133.373	11.55	0.63

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

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

BXS-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	15.3	--	--	--	--	--
2/23/2015	13.1	--	--	--	--	--
9/14/2015	14.4	--	--	--	--	--
12/7/2015	13.2	4	14.00	1.100	1.05	-18.34
2/29/2016	14.5	4	13.80	0.567	0.75	-22.25
6/16/2016	18.8	4	15.23	6.029	2.46	-10.09
9/26/2016	17.7	4	16.05	6.937	2.63	-8.69
3/8/2017	22.4	4	18.35	10.617	3.26	-6.56
6/10/2017	--	3	19.63	6.043	2.46	-6.71
9/16/2017	24.2	3	21.43	11.263	3.36	-4.20
12/14/2017	35.2	3	27.27	48.013	6.93	-0.54

Notes

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

m_0 = average concentration for upgradient well.

n = number of samples.

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 reporting limit (MRL) is used.

[2] Statistic in **bold** or *gray* is a statistically valid detection (according to the Student T-Test).

Table C-14. Statistical Analysis of Groundwater Quality Results for Downgradient Wells: Copper

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

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

Critical Statistic:

$t_c = 2.447$ $v = 6$

$t_c = 2.571$ $v = 5$

$t_c = 2.776$ $v = 4$

$t_c = 3.182$ $v = 3$

$t_c = 4.303$ $v = 2$

$t_c = 12.706$ $v = 1$

BXS-4 (Upgradient Well)				
Date	**Copper Concentration[1]**	**Number of Samples (n)**	**Average Concentration (m_0)**	**Sample Variance (s^1)**
11/17/2014	2.0	--	--	--
2/23/2015	0.1	--	--	--
9/14/2015	2.0	--	--	--
12/7/2015	2.0	4	1.53	0.87423
2/29/2016	2.0	4	1.53	0.87423
6/16/2016	1.1	4	1.78	0.20250
9/26/2016	2.0	4	1.78	0.20250
3/8/2017	--	3	1.70	0.27000
6/10/2017	--	2	1.55	0.40500
9/16/2017	2.1	2	2.05	0.00500
12/14/2017	--	1	2.10	#DIV/0!

BXS-3 (Downgradient Well)						
Date	**Copper 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	2.0	--	--	--	--	--
2/23/2015	0.3	--	--	--	--	--
9/14/2015	2.0	--	--	--	--	--
12/7/2015	1.3	4	1.41	0.618	0.79	-0.20
2/29/2016	2.0	4	1.41	0.618	0.79	-0.20
6/16/2016	1.1	4	1.60	0.220	0.47	-0.54
9/26/2016	2.0	4	1.60	0.220	0.47	-0.54
3/8/2017	--	3	1.70	0.270	0.52	0.00
6/10/2017	--	2	1.55	0.405	0.64	0.00
9/16/2017	2.1	2	2.05	0.005	0.07	0.00
12/14/2017	--	1	2.10	#DIV/0!	#DIV/0!	*

BXS-2 (Downgradient Well)						
Date	**Copper 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	2.0	--	--	--	--	--
2/23/2015	2.3	--	--	--	--	--
9/14/2015	2.1	--	--	--	--	--
12/7/2015	3.4	4	2.46	0.415	0.64	1.63
2/29/2016	2.4	4	2.56	0.333	0.58	1.86
6/16/2016	3.7	4	2.90	0.593	0.77	**2.52**
9/26/2016	1.9	4	2.85	0.710	0.84	2.25
3/8/2017	1.8	4	2.45	0.763	0.87	1.42
6/10/2017	--	3	2.47	1.143	1.07	1.20
9/16/2017	2.1	3	1.93	0.023	0.15	-1.15
12/14/2017	--	2	1.95	0.045	0.21	*

Table C-14. Statistical Analysis of Groundwater Quality Results for Downgradient Wells: Copper

Former J.H. Baxter South Woodwaste Landfill

Arlington, Washington

BXS-1 (Downgradient Well)						
Date	**Copper 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	2.0	--	--	--	--	--
2/23/2015	1.8	--	--	--	--	--
9/14/2015	13.6	--	--	--	--	--
12/7/2015	3.4	4	5.20	31.912	5.65	1.28
2/29/2016	2.2	4	5.25	31.496	5.61	1.31
6/16/2016	8.3	4	6.88	27.063	5.20	1.95
9/26/2016	1.2	4	3.78	9.909	3.15	1.26
3/8/2017	--	3	3.90	14.770	3.84	0.98
6/10/2017	--	2	4.75	25.205	5.02	0.89
9/16/2017	2.1	2	1.65	0.405	0.64	-0.88
12/14/2017	--	1	2.10	#DIV/0!	#DIV/0!	*****

Notes

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

m_0 = average concentration for upgradient well.

n = number of samples.

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 reporting limit (MRL) is used.

[2] Statistic in **bold** or *gray* is a statistically valid detection (according to the Student T-Test).

Table C-15. Statistical Analysis of Groundwater Quality Results for Downgradient Wells: Iron

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

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

Critical Statistic:

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

BXS-4 (Upgradient Well)				
Date	**Iron Concentration[1]**	**Number of Samples (n)**	**Average Concentration (m_0)**	**Sample Variance (s^1)**
11/17/2014	70.0	--	--	--
2/23/2015	73.2	--	--	--
9/14/2015	53.5	--	--	--
12/7/2015	56.0	4	63.18	97.39
2/29/2016	95	4	69.43	367.39
6/16/2016	55.2	4	64.93	403.09
9/26/2016	68.0	4	68.55	345.21
3/8/2017	498.0	4	179.05	45488.14
6/10/2017	--	3	207.07	63522.61
9/16/2017	839.0	3	468.33	149270.33
12/14/2017	--	2	668.50	58140.50

BXS-3 (Downgradient Well)						
Date	**Iron Concentration[1]**	**Number of Samples (n)**	**Average Concentration ($\bar{x}$)**	**Sample Variance (s^2)**	**Sample Standard Deviation (s)**	**Student's T-Test Statistic (t)[2]**
11/17/2014	120,000	--	--	--	--	--
2/23/2015	114,000	--	--	--	--	--
9/14/2015	122,000	--	--	--	--	--
12/7/2015	126,000	4	120,500	25,000,000	5,000	**48.17**
2/29/2016	106,000	4	117,000	78,666,667	8,869	**26.37**
6/16/2016	108,000	4	115,500	99,666,667	9,983	**23.13**
9/26/2016	107,000	4	111,750	90,916,667	9,535	**23.43**
3/8/2017	112,000	4	108,250	6,916,667	2,630	**81.92**
6/10/2017	--	3	109,000	7,000,000	2,646	**70.90**
9/16/2017	108,000	3	109,000	7,000,000	2,646	**70.31**
12/14/2017	--	2	110,000	8,000,000	2,828	**54.47**

BXS-2 (Downgradient Well)						
Date	**Iron Concentration[1]**	**Number of Samples (n)**	**Average Concentration ($\bar{x}$)**	**Sample Variance (s^2)**	**Sample Standard Deviation (s)**	**Student's T-Test Statistic (t)[2]**
3/17/2014	424	--	--	--	--	--
6/2/2014	421	--	--	--	--	--
9/29/2014	409	--	--	--	--	--
11/17/2014	421	4	419	44	6.7	**59.75**
2/23/2015	375	4	407	473	21.7	**23.25**
9/14/2015	358	4	391	856	29.3	**18.36**
12/7/2015	361	4	379	848	29.1	**17.96**
3/8/2017	279	4	343	1890	43.5	1.51
6/10/2017	8	4	252	27794	166.7	0.26
9/16/2017	328	4	244	25889	160.9	-0.95
12/14/2017	--	3	205	29707	172.4	-2.35

Table C-15. Statistical Analysis of Groundwater Quality Results for Downgradient Wells: Iron

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

BXS-1 (Downgradient Well)						
Date	Iron Concentration[1]	Number of Samples (n)	Average Concentration ($\bar{x}$)	Sample Variance (s^2)	Sample Standard Deviation (s)	Student's T-Test Statistic (t)[2]
11/17/2014	10.0	--	--	--	--	--
2/23/2015	10.0	--	--	--	--	--
9/14/2015	6.4	--	--	--	--	--
12/7/2015	9.0	4	8.85	2.890	1.70	-10.85
2/29/2016	10.0	4	8.85	2.890	1.70	-6.30
6/16/2016	3.0	4	7.10	9.773	3.13	-5.69
9/26/2016	10.0	4	8.00	11.333	3.37	-6.41
3/8/2017	54.0	4	19.25	547.583	23.40	-1.49
6/10/2017	--	3	22.33	764.333	27.65	-1.26
9/16/2017	38.0	3	34.00	496.000	22.27	-1.94
12/14/2017	198.0	3	96.67	7765.333	88.12	-3.21

Notes

$\bar{x}$ = average concentration for downgradient well.
m_0 = average concentration for upgradient well.
n = number of samples.
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 reporting limit (MRL) is used.

[2] Statistic in **bold** or *gray* is a statistically valid detection (according to the Student T-Test).

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

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

Student's T-Test Formula (*t*):

$$\frac{\bar{x} - m_0}{\sqrt{[(s^1/n) + (s^2/n)]}}$$

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

BXS-4 (Upgradient Well)				
Date	**Manganese Concentration[1]**	**Number of Samples (n)**	**Average Concentration (m_0)**	**Sample Variance (s^1)**
11/17/2014	115	--	--	--
2/23/2015	120	--	--	--
9/14/2015	114	--	--	--
12/7/2015	110	4	114.75	16.91667
2/29/2016	105	4	112.25	40.25000
6/16/2016	118	4	111.75	30.91667
9/26/2016	124	4	114.25	70.91667
3/8/2017	74	4	105.33	490.68917
6/10/2017	--	3	105.43	735.96333
9/16/2017	145	3	114.43	1318.26333
12/14/2017	--	2	109.65	2499.24500

BXS-3 (Downgradient Well)						
Date	**Manganese Concentration[1]**	**Number of Samples (n)**	**Average Concentration ($\bar{x}$)**	**Sample Variance (s^2)**	**Sample Standard Deviation (s)**	**Student's T-Test Statistic (t)[2]**
11/17/2014	8,620	--	--	--	--	--
2/23/2015	10,100	--	--	--	--	--
9/14/2015	5,290	--	--	--	--	--
12/7/2015	5,990	4	7,500	5,059,533	2,249	**6.57**
2/29/2016	11,800	4	8,295	9,962,033	3,156	**5.19**
6/16/2016	13,900	4	9,245	18,144,700	4,260	**4.29**
9/26/2016	4,620	4	9,078	20,023,492	4,475	**4.01**
3/8/2017	8,730	4	9,763	16,260,558	4,032	**4.79**
6/10/2017	--	3	9,083	21,623,233	4,650	**3.34**
9/16/2017	6,460	3	6,603	4,238,433	2,059	**5.46**
12/14/2017	--	2	7,595	2,576,450	1,605	**6.59**

BXS-2 (Downgradient Well)						
Date	**Manganese Concentration[1]**	**Number of Samples (n)**	**Average Concentration ($\bar{x}$)**	**Sample Variance (s^2)**	**Sample Standard Deviation (s)**	**Student's T-Test Statistic (t)[2]**
11/17/2014	1,680	--	--	--	--	--
2/23/2015	1,580	--	--	--	--	--
9/14/2015	1,570	--	--	--	--	--
12/7/2015	1,500	4	1,583	5,492	74.11	**39.55**
2/29/2016	1,600	4	1,563	1,892	43.49	**65.99**
6/16/2016	1,580	4	1,563	1,892	43.49	**66.17**
9/26/2016	1,200	4	1,470	34,267	185.11	**14.63**
3/8/2017	1,540	4	1,480	35,467	188.33	**14.50**
6/10/2017	324	4	1,161	340,431	583.46	**3.61**
9/16/2017	1,490	4	1,139	317,316	563.31	**3.63**
12/14/2017	--	3	1,118	473,452	688.08	2.53

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

Former J.H. Baxter South Woodwaste Landfill

Arlington, Washington

BXS-1 (Downgradient Well)						
Date	**Manganese Concentration[1]**	**Number of Samples (n)**	**Average Concentration ($\bar{x}$)**	**Sample Variance (s^2)**	**Sample Standard Deviation (s)**	**Student's T-Test Statistic (t)[2]**
11/17/2014	265	--	--	--	--	--
2/23/2015	311	--	--	--	--	--
9/14/2015	238	--	--	--	--	--
12/7/2015	321	4	284	1525	39.05	**8.61**
2/29/2016	150	4	255	6269	79.17	**3.53**
6/16/2016	249	4	240	4915	70.11	**3.55**
9/26/2016	290	4	253	5539	74.42	**3.68**
3/8/2017	584	4	318	34842	186.66	2.17
6/10/2017	--	3	374	33390	182.73	2.43
9/16/2017	216	3	363	37889	194.65	2.17
12/14/2017	1417	3	739	378619	615.32	1.75

Notes

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

m_0 = average concentration for upgradient well.

n = number of samples.

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 reporting limit (MRL) is used.

[2] Statistic in **bold** or *gray* is a statistically valid detection (according to the Student T-Test).

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

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

Student's T-Test Formula (*t*):

$$\frac{\bar{x} - m_0}{\sqrt{[\,(s^1/n) + (s^2/n)\,]}}$$

Critical Statistic:

$t_c = 2.447$ $v = 6$
$t_c = 2.571$ $v = 5$
$t_c = 2.776$ $v = 4$
$t_c = 3.182$ $v = 3$

$t_c = 4.303$ $v = 2$
$t_c = 12.706$ $v = 1$

BXS-4 (Upgradient Well)				
Date	Nickel Concentration^1	Number of Samples (n)	Average Concentration (m_0)	Sample Variance (s^1)
11/17/2014	1.1	--	--	--
2/23/2015	0.4	--	--	--
9/14/2015	2.0	--	--	--
12/7/2015	2.0	4	1.37	0.62890
2/29/2016	2.0	4	1.59	0.67240
6/16/2016	0.4	4	1.60	0.64000
9/26/2016	2.0	4	1.60	0.64000
3/8/2017	3.5	4	1.98	1.60250
6/10/2017	--	3	1.97	2.40333
9/16/2017	2.7	3	2.73	0.56333
12/14/2017	--	2	3.10	0.32000

BXS-3 (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	19.7	--	--	--	--	--
2/23/2015	18.9	--	--	--	--	--
9/14/2015	18.0	--	--	--	--	--
12/7/2015	20.6	4	19.30	1.233	1.11	**26.29**
2/29/2016	18.4	4	18.98	1.309	1.14	**24.70**
6/16/2016	20.8	4	19.45	2.117	1.45	**21.50**
9/26/2016	14.8	4	18.65	7.770	2.79	**11.76**
3/8/2017	15.3	4	17.33	7.902	2.81	**9.96**
6/10/2017	--	3	16.97	11.083	3.33	**7.07**
9/16/2017	21.0	3	17.03	11.863	3.44	**7.03**
12/14/2017	--	2	18.15	16.245	4.03	**5.23**

BXS-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	35.8	--	--	--	--	--
2/23/2015	34.1	--	--	--	--	--
9/14/2015	30.5	--	--	--	--	--
12/7/2015	29.3	4	32.43	9.222	3.04	**19.79**
2/29/2016	32.5	4	31.60	4.520	2.13	**26.34**
6/16/2016	31.8	4	31.03	2.009	1.42	**36.16**
9/26/2016	21.6	4	28.80	24.927	4.99	**10.76**
3/8/2017	30.2	4	29.03	25.429	5.04	**10.41**
6/10/2017	10.2	4	23.45	98.090	9.90	**4.27**
9/16/2017	31.0	4	23.25	93.797	9.68	**4.22**
12/14/2017	--	3	23.80	138.880	11.78	3.04

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

Former J.H. Baxter South Woodwaste Landfill

Arlington, Washington

BXS-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	10.0	--	--	--	--	--
2/23/2015	9.3	--	--	--	--	--
9/14/2015	7.7	--	--	--	--	--
12/7/2015	6.6	4	8.40	2.355	1.53	**8.14**
2/29/2016	6.6	4	7.55	1.607	1.27	**7.89**
6/16/2016	9.2	4	7.53	1.516	1.23	**8.07**
9/26/2016	8.4	4	7.70	1.720	1.31	**7.94**
3/8/2017	15.7	4	9.98	15.749	3.97	**3.84**
6/10/2017	--	3	11.10	16.030	4.00	**3.68**
9/16/2017	10.3	3	11.47	14.343	3.79	**3.92**
12/14/2017	--	2	13.00	14.580	3.82	**3.63**

Notes

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

m_0 = average concentration for upgradient well.

n = number of samples.

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 reporting limit (MRL) is used.

[2] Statistic in **bold** or *gray* is a statistically valid detection (according to the Student T-Test).

Table C-18. Statistical Analysis of Groundwater Quality Results for Downgradient Wells: Zinc

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

Student's T-Test Formula (*t*):

$$\frac{\bar{x} - m_0}{\sqrt{[\,(s^1/n) + (s^2/n)\,]}}$$

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

$t_c = 4.303$ $v = 2$
$t_c = 12.706$ $v = 1$

BXS-4 (Upgradient Well)				
Date	**Zinc Concentration[1]**	**Number of Samples (n)**	**Average Concentration (m_0)**	**Sample Variance (s^1)**
11/17/2014	2.5	--	--	--
2/23/2015	0.4	--	--	--
9/14/2015	2.0	--	--	--
12/7/2015	3.2	4	2.03	1.41583
2/29/2016	2.1	4	1.93	1.32917
6/16/2016	4.3	4	2.90	1.16667
9/26/2016	2.0	4	2.90	1.16667
3/8/2017	--	4	2.80	1.69000
6/10/2017	--	2	3.15	2.64500
9/16/2017	0.8	2	1.40	0.72000
12/14/2017	--	1	0.80	#DIV/0!

BXS-3 (Downgradient Well)						
Date	**Zinc 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	2.3	--	--	--	--	--
2/23/2015	2.1	--	--	--	--	--
9/14/2015	2.0	--	--	--	--	--
12/7/2015	0.5	4	1.73	0.682	0.83	-0.41
2/29/2016	4.1	4	2.18	2.183	1.48	0.27
6/16/2016	2.8	4	2.35	2.270	1.51	-0.59
9/26/2016	2.1	4	2.38	2.249	1.50	-0.57
3/8/2017	--	3	3.00	1.030	1.01	0.23
6/10/2017	--	2	2.45	0.245	0.49	-0.58
9/16/2017	1.5	2	1.80	0.180	0.42	0.60
12/14/2017	--	1	1.50	#DIV/0!	#DIV/0!	*

BXS-2 (Downgradient Well)						
Date	**Zinc 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	4.4	--	--	--	--	--
2/23/2015	6.5	--	--	--	--	--
9/14/2015	3.1	--	--	--	--	--
12/7/2015	4.4	4	4.60	1.980	1.41	**2.79**
2/29/2016	7.9	4	5.48	4.576	2.14	**2.92**
6/16/2016	3.3	4	4.68	4.949	2.22	1.44
9/26/2016	2.1	4	4.43	6.249	2.50	1.12
3/8/2017	--	3	4.43	9.373	3.06	0.87
6/10/2017	1.9	3	2.43	0.573	0.76	-0.58
9/16/2017	1.9	3	1.97	0.013	0.12	0.94
12/14/2017	--	2	1.90	0.000	0.00	*

Table C-18. Statistical Analysis of Groundwater Quality Results for Downgradient Wells: Zinc

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

BXS-1 (Downgradient Well)						
Date	**Zinc 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	2.1	--	--	--	--	--
2/23/2015	2.9	--	--	--	--	--
9/14/2015	362.0	--	--	--	--	--
12/7/2015	13.7	4	95.18	31,670	177.96	1.05
2/29/2016	2.1	4	95.18	31,670	177.96	1.05
6/16/2016	13.0	4	97.70	31,075	176.28	1.08
9/26/2016	1.2	4	7.50	46	6.77	1.34
3/8/2017	--	3	5.43	43	6.57	0.68
6/10/2017	--	2	7.10	70	8.34	0.66
9/16/2017	3.5	2	2.35	3	1.63	0.73
12/14/2017	--	1	3.50	#DIV/0!	#DIV/0!	*

Notes

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

m_0 = average concentration for upgradient well.

n = number of samples.

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 reporting limit (MRL) is used.

[2] Statistic in **bold** or *gray* is a statistically valid detection (according to the Student 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.

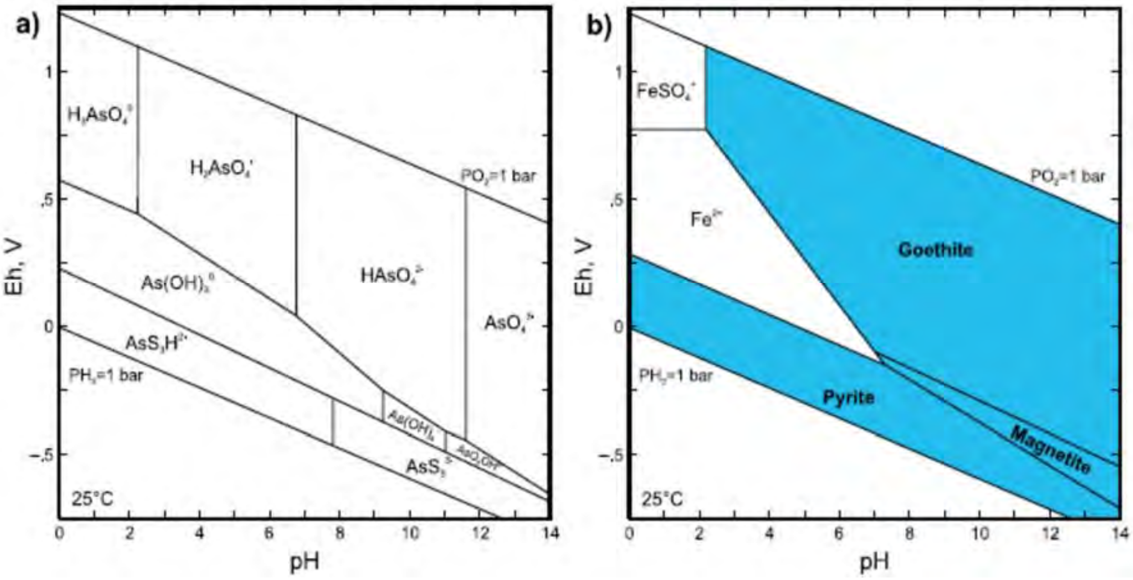


Figure D-2. Eh-pH diagrams for arsenic and iron at 25°C for coupled iron- and sulfate-reducing systems. These paired diagrams show the relative distribution of potentially adsorbing arsenic species (left) relative to representative types of Fe-bearing sorbents (right) that are predicted to occur as a 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

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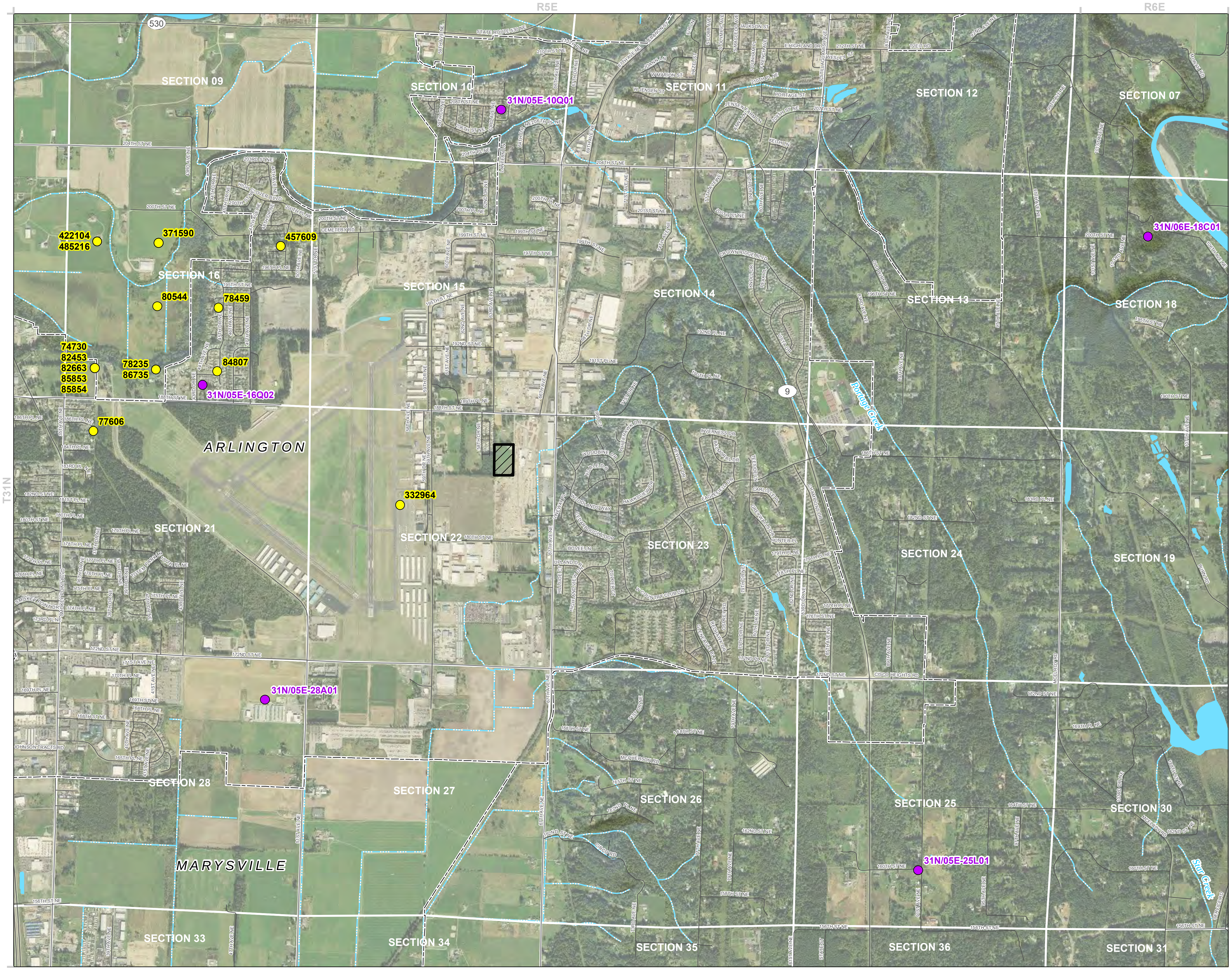

FIGURE D-1

Location of Potable Water Wellls Downgradient of South Landfill

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

LEGEND

- ▨ Approximate Boundary of South Landfill
- ● Downgradient Potable Water Wells
- ● Background USGS Wells
- Cities
- Roads
- Watercourses
- Waterbodies

NOTE:
USGS = United States Geological Survey

N

0 1,000 2,000 3,000
Feet

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.

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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

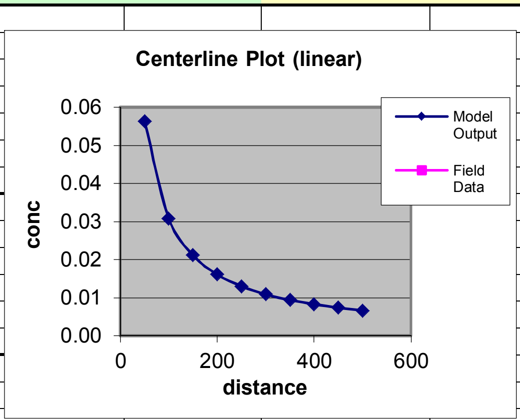
SOURCE CONC (MG/L)	Ax (ft)	Ay (ft)	Az (ft) >=.001	LAMBDA day-1	SOURCE WIDTH (ft)	SOURCE THICKNESS (ft)	Time (days) (days)
0.191	3.23E+02	4.20E+01	1.94E+00	0.00E+00	100	10	3650

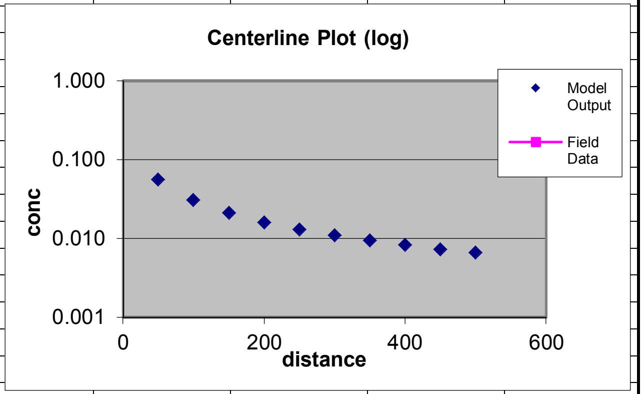
Hydraulic Cond (ft/day)	Hydraulic Gradient (ft/ft)	Porosity (dec. frac.)	Soil Bulk Density (g/cm^3)	KOC	Frac. Org. Carb.	Retard-ation (R)	V (=K*i/n*R) (ft/day)
1.70E+02	0.02	0.3	1.7	1	1.00E-03	1.005666667	11.26947299

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





AREAL CALCULATION
MODEL 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						