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Annual 2019 Groundwater and Cap Compliance Monitoring Report

BNSF Hillyard Dross Cap
Spokane, Washington

10 July 2019

Prepared for

BNSF Railway Company
605 Puyallup Avenue
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KJ Project No. 1996114.02

ANNUAL 2019
GROUNDWATER AND CAP COMPLIANCE MONITORING REPORT
BNSF Hillyard Dross Cap
Spokane, Washington

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Section 1: Introduction

This report summarizes the groundwater and compliance monitoring activities conducted during 2019 at the BNSF Railway Company (BNSF) Hillyard Dross Cap site (Site), located at the southwestern intersection of Wellesley Avenue and Ferrall Street in Spokane, Washington. The Site is also referred to as the Aluminum Recycling Corporation Site in the Washington State Department of Ecology (Ecology) Consent Decree No. 01202037-9 (Ecology 2001). The Site location relative to the surrounding area is illustrated on Figure 1. Major Site features are displayed on Figure 2.

1.1 Background

The Final Remedial Action Work Plan (FRAWP) for the Site was completed in 2001 (EMR 2001). The Final Cleanup Action Plan (FCAP), including the Operations and Maintenance Plan, was completed in July 2003 (GeoEngineers 2003). Ecology completed a second 5-year periodic review of the Site in March 2013. Ecology concluded that "contaminant concentrations are showing improvements" and "the measures that were taken for the original cleanup action remain protective today" (Ecology 2013). The 2013 Periodic Review is included as Appendix A. The contaminants of concern (COCs) for the Site include chloride, nitrate (as nitrogen), and nitrite (as nitrogen). The cleanup levels (CULs), which are defined in the FCAP, are 250 milligrams per liter (mg/L) for chloride, 10 mg/L for nitrate, and 1 mg/L for nitrite. Fluoride was also a COC at the Site prior to 2013. However, Ecology removed fluoride from the COC list in the 2013 5-year periodic review based on a statistical analysis of the data collected to date (see Appendix A).

In a 30 July 2014 email, Ecology requested that BNSF establish criteria for a data evaluation to determine whether compliance with the groundwater CULs was being achieved (Ecology 2014).

Ecology recommended conducting a statistical analysis of a rolling dataset to evaluate attainment of CULs. Based on Ecology's publication 94-49, "*Guidance on Sampling and Data Analysis Methods"*, attainment of CULs is evaluated by comparing the 95 percent upper confidence limit (95% UCL) of the mean (calculated from sampling data) to the CUL. Ecology recommended using a rolling data set of the most recent 20 samples (5 years of quarterly data) for the analysis. The constituent in the designated well is considered to have met the CUL if, after evaluating the last 20 samples at a given monitoring well, the 95% UCL of the mean is lower than the CUL and no single sample exceeds twice the CUL and less than 10% of the samples exceed the CUL. The statistical analysis will be conducted on an annual basis and reported to Ecology. The Ecology Model Toxics Control Act (MCTA) Stat program is used for the analysis. The results of the 2019 statistical analyses are presented in Section 2.4.

In a letter dated 5 July 2017 to Ecology, BNSF requested that the frequency of remedial cap inspection and groundwater monitoring at the Site be reduced to once per year, with both activities to be conducted in the second quarter. Ecology approved the requested change in a letter dated 25 July 2017. The annual groundwater monitoring event and cap inspection event field activities were performed in April and May 2019.

Section 2: 2019 Groundwater Sampling

2.1 General

Groundwater monitoring and sampling activities were conducted at the Site in April and May 2019. Groundwater levels were measured in each of the four groundwater monitoring wells (MW-3 through MW-6) in the monitoring network on 23 April 2019 and three wells (MW-4 through MW-6) were sampled on 23 April 2019. Dedicated submersible bladder pumps, outfitted with dedicated Teflon-lined tubing, were used for groundwater purging and sampling in wells MW-4 through MW-6.

Monitoring well MW-3 contained an insufficient amount of water in the well to use the submersible bladder pump on 23 April 2019; therefore, collection of a sample and water quality parameters was attempted with a disposable polyethylene bailer. High turbidity and a low water column prevented collection of a representative sample from the well. On 30 April 2019, well MW-3 was redeveloped by surging and jetting until a turbidity below 10 nephelometric turbidity units (NTU) was achieved. On 14 May 2019, the first bailer of water from MW-3 was clear and used to measure water quality field parameters; however, subsequent bailers were not full and contained turbid water. Well MW-3 was allowed to recharge overnight and the sample was collected from the first bailer of water retrieved from the well on 15 May 2019.

Well redevelopment logs and monitoring well sample logs are included in Appendix B. Field methods are summarized in Appendix C.

The groundwater samples were submitted to Pace Analytical National Center for Testing and Innovation in Mt. Juliet, Tennessee, for analysis of chloride, nitrate, and nitrite by U.S. Environmental Protection Agency (EPA) Method 300.0.

A summary of groundwater elevations from each monitoring event is presented in Table 1. The analytical results are summarized in Table 2. A copy of the laboratory report is presented in Appendix D.

2.2 Groundwater Elevation and Hydraulic Gradient Direction

Groundwater elevations, calculated from depth-to-water measurements collected on 23 April 2019, ranged from 1,866.48 feet (monitoring well MW-6) to 1,868.23 feet (monitoring well MW-4) (Table 1). The interpreted groundwater flow direction beneath the Site, at the time of the monitoring event, was north-northwest under a hydraulic gradient of approximately 0.001 feet per foot, which is consistent with historical data. Interpreted groundwater elevation contours and groundwater hydraulic gradient direction for the 23 April 2019 monitoring event are presented on Figure 3.

2.3 Groundwater Analytical Results

The analytical results for this event and previous sampling events are summarized in Table 2.

Chloride, nitrate, and nitrite were not reported at concentrations above the CULs in the April and May 2019 samples from wells MW-3 through MW-6. Chloride and nitrate were reported at

concentrations above the laboratory reporting limit in samples from wells MW-3 through MW-6. Nitrite was not reported above the laboratory reporting limit in the four wells sampled.

Figures 4, 5, and 6 present graphical representations of historical and current chloride, nitrate, and nitrite concentrations, respectively.

For quality control purposes, a duplicate sample was collected from monitoring well MW-5 during the 2019 sampling event. The results of the duplicate samples and parent samples were within acceptable limits and no qualifiers were added.

The laboratory reports were reviewed for quality control/quality assurance purposes and were found to be acceptable for their intended purpose.

2.4 2019 Groundwater Statistical Analysis

Statistical analysis was applied to results of the last 20 groundwater samples collected from monitoring wells MW-3 (nitrate-N) and MW-5 (nitrate-N and chloride). Nitrite-N has not been detected in the groundwater samples collected from Site monitoring wells since 2013. In addition, no analyte concentration exceeded the CULs in the last 20 samples collected from monitoring well MW-4 or MW-6. Therefore, statistical analyses were not performed on the datasets from these monitoring wells or for nitrite-N on any of the monitoring wells.

To perform the statistical analyses, the dataset from a date range of July 2010 to May 2019 was used for monitoring well MW-3 and October 2012 to April 2019 for monitoring well MW-5. A longer date range was required for monitoring well MW-3 because this well was dry during some sampling events and no samples could be collected.

Table 4 presents a summary of the statistical analysis. The MTCA Stat output files are included in Appendix E. Based on the results of the statistical analysis and data evaluation, the following conclusions are made:

- The 95% UCL of the mean nitrate-N concentration in the dataset of monitoring well MW-3 was 9.21 mg/L in 2019, which is less than the CUL of 10 mg/L. However, four samples out of the last 20 samples (20 percent) have nitrate-N concentrations that were above the CUL. Therefore, monitoring of nitrate-N concentrations in this well will continue.

- The 95% UCL of the mean nitrate-N concentration in the dataset of monitoring well MW-5 was 10.41 mg/L in 2019, which is greater than the CUL of 10 mg/L. The nitrate-N CUL has been exceeded in two samples (10 percent) collected during the last 20 sampling events. The maximum reported concentration of nitrate-N in well MW-5 was 41.80 mg/L, which is greater than twice the CUL. Therefore, monitoring of nitrate-N concentrations in this well will continue.

- The 95% UCL of the mean chloride concentration in the dataset of monitoring well MW-5 was 217 mg/L in 2019, which is less than the CUL of 250 mg/L. The chloride CUL has been exceeded in one sample (5 percent) collected during the last 20 sampling events. The maximum reported concentration of chloride in well MW-5 was 923 mg/L, which is

greater than twice the CUL. Therefore, monitoring of chloride concentrations in this well will continue.

Section 3: Operation and Maintenance Activities

3.1 General

The dross encapsulation cell (cap) and associated stormwater system were constructed between 2001 and 2003. The dross cap consists of a low permeability, 40-millimeter-thick, high-density polyethylene (HDPE) geomembrane placed over the graded and prepared dross and soil surface. The geomembrane is overlain by 18 to 30 inches of rounded gravel that acts as a drain to shed water off of the geomembrane. A woven, permeable HDPE geotextile fabric is placed above the gravel and covered with approximately 18 inches of topsoil. The topsoil was hydroseeded upon installation.

Stormwater from the dross cap is directed to a channel along the perimeter of the cap, which drains either directly to the stormwater retention pond or to a sump located in the western portion of the Site. Stormwater that drains to the sump is pumped to the retention pond. Secondary overflow from the retention pond is routed to an onsite drywell.

Operation and maintenance (O&M) activities in 2019 consisted of annual remedial component system checks performed consistent with the approved O&M Plan. The annual inspection was completed on 24 April 2019 and included assessment of the following: (1) the dross cap; (2) the stormwater conveyance, evaporation, and disposal system; and (3) other physical facilities such as access roads, setbacks, fencing, electrical system, and groundwater monitoring wells.

3.2 Dross Encapsulation Cell

No erosion or settlement of the dross cap was observed during 2019. Grasses and forbs were abundant on and surrounding the dross encapsulation cell during the growing season and were dormant during dry months, as is normal.

3.3 Stormwater Conveyance, Evaporation, and Disposal System

Stormwater conveyance, evaporation, and disposal system components were monitored in April 2019.

The evaporation pond that collects Site stormwater is located directly northeast of the dross encapsulation cell. Water level elevations measured in the pond are referenced to the North American Vertical Datum of 1988. Post-construction evaporation pond water level elevations are presented in Table 3. The evaporation pond was observed to be discharging to the overflow sump and drywell during April 2019.

3.4 Monitoring Wells

Monitoring wells MW-4, MW-5, and MW-6 were observed to be in good condition during the cap monitoring event conducted in 2019. Monitoring well MW-3 was redeveloped in April 2019 to remove sediment from the screened well interval to allow collection of lower turbidity (e.g., less than 10 NTU) groundwater samples. No physical damage to the well monuments was observed.

3.5 Other Physical Features

Other physical features such as access roads, setbacks, fencing, and the electrical system, appear to be in good condition in April 2019.

Section 4: Summary

4.1 Departures from Consent Decree

Tasks completed during 2019 did not deviate from tasks outlined in the Consent Decree for groundwater monitoring and cap monitoring activities.

4.2 Groundwater Elevations and Estimated Flow

Groundwater elevations measured in April 2019 are within the range of previous groundwater elevation measurements at the Site. The hydraulic gradient and estimated groundwater flow direction during the 2019 monitoring event was generally towards the north-northwest, which is consistent with the general groundwater flow direction in the unconfined aquifer underlying the Site and general area (Spokane Valley-Rathdrum Prairie Aquifer) (U.S. Geological Survey 1988).

4.3 Groundwater Analytical Results

Chloride, nitrate, and nitrite were reported at concentrations below their respective CULs or below the laboratory reporting limit in the samples collected from monitoring wells MW-3 through MW-6 in 2019. Prior to 2019, both chloride and nitrate were reported above the CULs in June 2018 in well MW-5. Chloride was also reported above the CUL in July 2012 in well MW-5. Nitrate was reported above the CUL in January 2017 in well MW-3 and in April 2017 in well MW-5. Nitrite has not been reported above its analytical method reporting limit since 2013 (a total of 17 monitoring events) in any of the groundwater samples collected.

4.4 Site Conditions

The network of groundwater monitoring wells at the Site appeared to be secure and in good condition with the exception of well MW-3. During the 2019 sampling event, a disposable bailer was used to purge and sample the well as there was insufficient water in well MW-3 to use a bladder pump. Using a bailer appeared to stir up sediment in the well, even after performing well redevelopment, resulting in highly turbid water in subsequent bailers retrieved from the well. If similar conditions are present during future sampling events, well MW-3 will be purged dry and allowed to recharge to 90% of its pre-purge water column, or overnight, whichever comes first, before collecting a groundwater sample.

Stormwater conveyance, evaporation, and disposal system components were found to be in good condition during this reporting period.

4.5 Planned Future Activities

The next annual groundwater monitoring and sampling event will be conducted in second quarter 2020.

Section 5: References

EMR, Inc. 2001. Final Remedial Action Work Plan for the Hillyard Dross Site, 3412 East Wellesley Avenue, Spokane, Washington. August 2001.

GeoEngineers, Inc. 2003. Final Cleanup Action Report - Aluminum Recycling Corporation Site, 3412 East Wellesley Avenue, Spokane, Washington.

United States Geological Survey. 1988. The Spokane Aquifer, Washington: Its Geologic Origin and Water-Bearing and Water-Quality Characteristics. U.S. Geological Survey Water Supply Paper 2265, 81 p.

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Washington State Department of Ecology. 2013. Periodic Review, Aluminum Recycling Corporation (FSID 627, CSID 1133).

Washington State Department of Ecology. 2014. Email Correspondence from Ecology to BNSF. 30 July 2014.

Washington State Department of Ecology. 2015. MTCA Stat 97 Site Module, Workbook for Calculating Compliance Statistics. Accessed January 2017.

Tables

Table 1: Summary of Groundwater Level Measurements

Well Number	Date Measured	Top of Casing Elevation[a] (feet)	Depth to Water[b] (feet)	Groundwater Elevation (feet)	Change in Elevation[c] (feet)
MW-3	6/30/1997	2,039.01	DRY	NA[d]	NA
MW-3	12/15/1998	2,039.01	176.16	1,862.85	NA
MW-3	2/22/1999	2,039.01	174.37	1,864.64	-1.79
MW-3	5/4/1999	2,039.01	171.21	1,867.80	-3.16
MW-3	7/28/1999	2,039.01	174.31	1,864.70	3.10
MW-3	12/8/1999	2,039.01	176.00	1,863.01	1.69
MW-3	6/20/2000	2,039.01	172.05	1,866.96	-3.95
MW-3	12/8/2000	2,039.01	176.65	1,862.36	4.60
MW-3	10/30/2002	2,039.01	DRY	NA	NA
MW-3	2/4/2003	2,039.01	DRY	NA	NA
MW-3	4/29/2003	2,039.01	172.37	1,866.64	4.28
MW-3	07/24/03	2,039.01	DRY	NA	NA
MW-3	10/30/03	2,039.01	DRY	NA	NA
MW-3	01/26/04	2,039.01	DRY	NA	NA
MW-3	4/16/2004	2,039.01	173.38	1,865.63	-0.91
MW-3	7/26/2004	2,039.01	176.45	1,862.56	-3.07
MW-3	10/15/2004	2,039.01	DRY	NA	NA
MW-3	1/28/2005	2,039.01	174.17	1,864.84	2.28
MW-3	4/29/2005	2,039.01	173.56	1,865.45	0.61
MW-3	7/20/2005	2,039.01	176.49	1,862.52	-2.93
MW-3	10/27/2005	2,039.01	DRY	NA	NA
MW-3	1/11/2006	2,039.01	175.31	1,863.70	1.18
MW-3	4/12/2006	2,039.01	173.11	1,865.90	2.20
MW-3	7/13/2006	2,039.01	174.24	1,864.77	-1.13
MW-3	10/24/2006	2,039.01	176.71	1,862.30	-2.47
MW-3	1/29/2007	2,039.01	174.57	1,864.44	2.14
MW-3	4/19/2007	2,039.01	170.08	1,868.93	4.49
MW-3	7/19/2007	2,039.01	176.11	1,862.90	-6.03
MW-3	9/13/2007	2,039.01	DRY	NA	NA
MW-3	10/29/2007	2,039.01	DRY	NA	NA
MW-3	1/30/2008 [e]	2,039.01	174.57	1,864.44	1.54
MW-3	4/22/2008	2,039.01	174.19	1,864.82	0.38
MW-3	7/23/2008	2,039.01	172.83	1,866.18	1.36
MW-3	10/22/2008	2,039.01	DRY	NA	NA
MW-3	1/29/2009	2,039.01	174.28	1,864.73	-1.45
MW-3	4/28/2009	2,039.01	171.43	1,867.58	2.85
MW-3	7/9/2009	2,039.01	174.09	1,864.92	-2.66
MW-3	10/29/2009	2,039.01	DRY	NA	NA
MW-3	1/19/2010	2,039.01	176.20	1,862.81	-2.11
MW-3	4/6/2010	2,039.01	175.52	1,863.49	0.68
MW-3	7/27/2010	2,039.01	175.26	1,863.75	0.26

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MW-3	10/20/2010	2,039.01	DRY	NA	NA
MW-3	1/18/2011	2,039.01	174.19	1,864.82	1.07
MW-3	4/21/2011	2,039.01	170.21	1,868.80	3.98
MW-3	7/14/2011	2,039.01	169.85	1,869.16	0.36
MW-3	10/6/2011	2,039.01	176.50	1,862.51	-6.65
MW-3	1/24/2012	2,039.01	176.01	1,863.00	0.49
MW-3	4/10/2012	2,039.01	171.43	1,867.58	4.58
MW-3	7/11/2012	2,039.01	171.23	1,867.78	0.20
MW-3	10/30/2012	2,039.01	DRY	NA	NA
MW-3	1/29/2013	2,039.01	174.86	1,864.15	-3.63
MW-3	4/11/2013	2,039.01	DRY	NA	NA
MW-3	10/24/2013	2,039.01	177.80	1,861.21	-2.94
MW-3	1/29/2014	2,039.01	175.67	1,863.34	2.13
MW-3	4/23/2014	2,039.01	170.72	1,868.29	4.95
MW-3	7/28/2014	2,039.01	175.14	1,863.87	-4.42
MW-3	10/29/2014	2,039.01	DRY	NA	NA
MW-3	1/28/2015	2,039.01	174.26	1,864.75	0.88
MW-3	4/14/2015	2,039.01	171.57	1,867.44	2.69
MW-3	7/14/2015	2,039.01	DRY	NA	NA
MW-3	10/27/2015	2,039.01	DRY	NA	NA
MW-3	1/26/2016	2,039.01	175.65	1,863.36	NA
MW-3	4/28/2016	2,039.01	170.76	1,868.25	4.89
MW-3	7/13/2016	2,039.01	175.72	1,863.29	-4.96
MW-3	10/12/2016	2,039.01	DRY	NA	NA
MW-3	1/31/2017	2,039.01	175.34	1,863.67	NA
MW-3	4/18/2017	2,039.01	167.18	1,871.83	8.16
MW-3	6/27/2018	2,039.01	172.34	1,866.67	-5.16
MW-3	4/30/2019	2,039.01	172.02	1,866.99	0.32
MW-4	12/15/1998	2,039.42	175.53	1,863.89	0.02
MW-4	2/22/1999	2,039.42	173.84	1,865.58	1.69
MW-4	5/4/1999	2,039.42	170.43	1,868.99	3.41
MW-4	7/28/1999	2,039.42	173.96	1,865.46	-3.53
MW-4	12/8/1999	2,039.42	175.50	1,863.92	-1.54
MW-4	6/15/2000	2,039.42	171.56	1,867.86	3.94
MW-4	12/7/2000	2,039.42	176.40	1,863.02	-4.84
MW-4	10/30/2002	2,039.42	NA	NA	NA
MW-4	2/4/2003	2,039.42	174.80	1,864.62	1.60
MW-4	4/29/2003	2,039.42	171.78	1,867.64	3.02
MW-4	7/24/2003	2,039.42	176.53	1,862.89	-4.75
MW-4	10/30/2003	2,039.42	177.05	1,862.37	-0.52
MW-4	1/26/2004	2,039.42	176.30	1,863.12	0.75

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Well Number	Date Measured	Top of Casing Elevation[(a)] (feet)	Depth to Water[(b)] (feet)	Groundwater Elevation (feet)	Change in Elevation[(c)] (feet)
MW-4	4/16/2004	2,039.42	172.61	1,866.81	3.69
MW-4	7/26/2004	2,039.42	176.08	1,863.34	-3.47
MW-4	10/15/2004	2,039.42	176.70	1,862.72	-0.62
MW-4	1/28/2005	2,039.42	173.48	1,865.94	3.22
MW-4	4/29/2005	2,039.42	172.98	1,866.44	0.50
MW-4	7/20/2005	2,039.42	176.11	1,863.31	-3.13
MW-4	10/27/2005	2,039.42	176.86	1,862.56	-0.75
MW-4	1/11/2006	2,039.42	174.57	1,864.85	2.29
MW-4	4/12/2006	2,039.42	172.33	1,867.09	2.24
MW-4	7/13/2006	2,039.42	173.94	1,865.48	-1.61
MW-4	10/24/2006	2,039.42	177.00	1,862.42	-3.06
MW-4	1/29/2007	2,039.42	174.03	1,865.39	2.97
MW-4	4/19/2007	2,039.42	170.23	1,869.19	3.80
MW-4	7/19/2007	2,039.42	175.79	1,863.63	-5.56
MW-4	9/13/2007	2,039.42	177.81	1,861.61	-2.02
MW-4	10/29/2007	2,039.42	176.87	1,862.55	0.94
MW-4	1/30/2008	2,039.42	175.73	1,863.69	1.14
MW-4	4/22/2008	2,039.42	173.54	1,865.88	2.19
MW-4	7/23/2008	2,039.42	172.55	1,866.87	0.99
MW-4	10/22/2008	2,039.42	176.17	1,863.25	-3.62
MW-4	1/29/2009	2,039.42	173.64	1,865.78	2.53
MW-4	4/28/2009	2,039.42	170.61	1,868.81	3.03
MW-4	7/9/2009	2,039.42	173.76	1,865.66	-3.15
MW-4	10/29/2009	2,039.42	176.65	1,862.77	-2.89
MW-4	1/19/2010	2,039.42	175.72	1,863.70	0.93
MW-4	4/6/2010	2,039.42	174.96	1,864.46	0.76
MW-4	7/27/2010	2,039.42	174.92	1,864.50	0.04
MW-4	10/20/2010	2,039.42	176.63	1,862.79	-1.71
MW-4	1/18/2011	2,039.42	173.58	1,865.84	3.05
MW-4	4/21/2011	2,039.42	169.50	1,869.92	4.08
MW-4	7/14/2011	2,039.42	169.48	1,869.94	0.02
MW-4	10/6/2011	2,039.42	176.10	1,863.32	-6.62
MW-4	1/24/2012	2,039.42	175.53	1,863.89	0.57
MW-4	4/10/2012	2,039.42	170.55	1,868.87	4.98
MW-4	7/11/2012	2,039.42	170.91	1,868.51	-0.36
MW-4	10/30/2012	2,039.42	176.01	1,863.41	-5.10
MW-4	1/29/2013	2,039.42	174.40	1,865.02	1.61
MW-4	4/11/2013	2,039.42	DRY	NA	NA
MW-4	10/24/2013	2,039.42	176.16	1,863.26	-1.76
MW-4	1/29/2014	2,039.42	175.40	1,864.02	0.76
MW-4	4/23/2014	2,039.42	170.09	1,869.33	5.31

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Well Number	Date Measured	Top of Casing Elevation[(a)] (feet)	Depth to Water[(b)] (feet)	Groundwater Elevation (feet)	Change in Elevation[(c)] (feet)
MW-4	7/28/2014	2,039.42	174.81	1,864.61	-4.72
MW-4	10/29/2014	2,039.42	176.28	1,863.14	-1.47
MW-4	1/28/2015	2,039.42	173.69	1,865.73	2.59
MW-4	4/14/2015	2,039.42	171.03	1,868.39	2.66
MW-4	7/14/2015	2,039.42	176.83	1,862.59	-5.80
MW-4	10/27/2015	2,039.42	177.47	1,861.95	-0.64
MW-4	1/26/2016	2,039.42	175.11	1,864.31	2.36
MW-4	4/28/2016	2,039.42	170.13	1,869.29	4.98
MW-4	7/13/2016	2,039.42	175.37	1,864.05	-5.24
MW-4	10/12/2016	2,039.42	177.27	1,862.15	-1.90
MW-4	1/31/2017	2,039.42	174.91	1,864.51	2.36
MW-4	4/18/2017	2,039.42	166.48	1,872.94	8.43
MW-4	6/27/2018	2,039.42	172.03	1,867.39	-5.55
MW-4	4/23/2019	2,039.42	171.19	1,868.23	0.84
MW-5	12/15/1998	2,041.80	177.61	1,864.19	NA
MW-5	2/22/1999	2,041.80	177.10	1,864.70	0.51
MW-5	5/4/1999	2,041.80	173.90	1,867.90	3.20
MW-5	7/28/1999	2,041.80	177.07	1,864.73	-3.17
MW-5	12/10/1999	2,041.80	178.82	1,862.98	-1.75
MW-5	6/20/2000	2,041.80	174.78	1,867.02	4.04
MW-5	12/8/2000	2,041.80	178.61	1,863.19	-3.83
MW-5	10/30/2002	2,041.80	DRY	NA	NA
MW-5	2/4/2003	2,041.80	178.00	1,863.80	0.61
MW-5	4/29/2003	2,041.80	175.01	1,866.79	2.99
MW-5	7/24/2003	2,041.80	179.69	1,862.11	-4.68
MW-5	10/30/2003	2,041.80	180.37	1,861.43	-0.68
MW-5	1/26/2004	2,041.80	179.49	1,862.31	0.88
MW-5	4/16/2004	2,041.80	176.02	1,865.78	3.47
MW-5	7/26/2004	2,041.80	179.19	1,862.61	-3.17
MW-5	10/15/2004	2,041.80	179.97	1,861.83	-0.78
MW-5	1/28/2005	2,041.80	176.88	1,864.92	3.09
MW-5	4/29/2005	2,041.80	176.32	1,865.48	0.56
MW-5	7/20/2005	2,041.80	179.27	1,862.53	-2.95
MW-5	10/27/2005	2,041.80	180.14	1,861.66	-0.87
MW-5	1/11/2006	2,041.80	177.99	1,863.81	2.15
MW-5	4/12/2006	2,041.80	175.71	1,866.09	2.28
MW-5	7/13/2006	2,041.80	177.04	1,864.76	-1.33
MW-5	10/24/2006	2,041.80	180.24	1,861.56	-3.20
MW-5	1/29/2007	2,041.80	177.28	1,864.52	2.96
MW-5	4/19/2007	2,041.80	173.61	1,868.19	3.67
MW-5	7/19/2007	2,041.80	178.90	1,862.90	-5.29

Table 1: Summary of Groundwater Level Measurements

Well Number	Date Measured	Top of Casing Elevation[(a)] (feet)	Depth to Water[(b)] (feet)	Groundwater Elevation (feet)	Change in Elevation[(c)] (feet)
MW-5	9/13/2007	2,041.80	180.97	1,860.83	-2.07
MW-5	10/29/2007	2,041.80	180.12	1,861.68	0.85
MW-5	1/30/2008	2,041.80	178.94	1,862.86	1.18
MW-5	4/22/2008	2,041.80	176.89	1,864.91	2.05
MW-5	7/23/2008	2,041.80	175.60	1,866.20	1.29
MW-5	10/22/2008	2,041.80	179.38	1,862.42	-3.78
MW-5	1/29/2009	2,041.80	176.98	1,864.82	2.40
MW-5	4/28/2009	2,041.80	174.12	1,867.68	2.86
MW-5	7/9/2009	2,041.80	176.85	1,864.95	-2.73
MW-5	10/29/2009	2,041.80	179.86	1,861.94	-3.01
MW-5	1/19/2010	2,041.80	178.91	1,862.89	0.95
MW-5	3/10/2010 [(f)]	2,041.80	178.51	1,863.29	0.40
MW-5	4/6/2010	2,041.80	178.21	1,863.59	0.30
MW-5	7/27/2010	2,041.80	178.05	1,863.75	0.16
MW-5	10/20/2010	2,041.80	179.84	1,861.96	-1.79
MW-5	1/18/2011	2,041.80	176.90	1,864.90	2.94
MW-5	4/21/2011	2,041.80	172.91	1,868.89	3.99
MW-5	7/14/2011	2,041.80	172.65	1,869.15	0.26
MW-5	10/6/2011	2,041.80	179.26	1,862.54	-6.61
MW-5	1/24/2012	2,041.80	178.77	1,863.03	0.49
MW-5	4/10/2012	2,041.80	174.14	1,867.66	4.63
MW-5	7/11/2012	2,041.80	174.03	1,867.77	0.11
MW-5	10/30/2012	2,041.80	179.20	1,862.60	-5.17
MW-5	1/29/2013	2,041.80	177.60	1,864.20	1.60
MW-5	4/11/2013	2,041.80	DRY	NA	NA
MW-5	10/24/2013	2,041.80	179.28	1,862.52	-1.68
MW-5	1/29/2014	2,041.80	178.40	1,863.40	0.88
MW-5	4/23/2014	2,041.80	173.48	1,868.32	4.92
MW-5	7/28/2014	2,041.80	177.92	1,863.88	-4.44
MW-5	10/29/2014	2,041.80	179.49	1,862.31	-1.57
MW-5	1/28/2015	2,041.80	176.99	1,864.81	2.50
MW-5	4/14/2015	2,041.80	174.31	1,867.49	2.68
MW-5	7/14/2015	2,041.80	179.97	1,861.83	-5.66
MW-5	10/27/2015	2,041.80	180.69	1,861.11	-0.72
MW-5	1/26/2016	2,041.80	178.38	1,863.42	2.31
MW-5	4/28/2016	2,041.80	173.49	1,868.31	4.89
MW-5	7/13/2016	2,041.80	178.51	1,863.29	-5.02
MW-5	10/12/2016	2,041.80	180.52	1,861.28	-2.01
MW-5	1/31/2017	2,041.80	178.11	1,863.69	2.41
MW-5	4/18/2017	2,041.80	169.91	1,871.89	8.20
MW-5	6/27/2018	2,041.80	175.12	1,866.68	-5.21
MW-5	4/23/2019	2,041.80	174.72	1,867.08	0.40

Table 1: Summary of Groundwater Level Measurements

Well Number	Date Measured	Top of Casing Elevation[(a)] (feet)	Depth to Water[(b)] (feet)	Groundwater Elevation (feet)	Change in Elevation[(c)] (feet)
MW-6	12/15/1998	2,042.73	177.20	1,865.53	NA
MW-6	2/22/1999	2,042.73	178.44	1,864.29	-1.24
MW-6	5/4/1999	2,042.73	175.37	1,867.36	3.07
MW-6	7/28/1999	2,042.73	178.33	1,864.40	-2.96
MW-6	12/10/1999	2,042.73	182.40	1,860.33	-4.07
MW-6	6/20/2000	2,042.73	176.16	1,866.57	6.24
MW-6	12/7/2000	2,042.73	180.97	1,861.76	-4.81
MW-6	10/30/2002	2,042.73	DRY	NA	NA
MW-6	2/4/2003	2,042.73	179.70	1,863.03	1.27
MW-6	4/29/2003	2,042.73	176.39	1,866.34	3.31
MW-6	7/24/2003	2,042.73	180.98	1,861.75	-4.59
MW-6	10/30/2003	2,042.73	181.77	1,860.96	-0.79
MW-6	1/26/2004	2,042.73	180.85	1,861.88	0.92
MW-6	4/16/2004	2,042.73	177.56	1,865.17	3.29
MW-6	7/26/2004	2,042.73	180.55	1,862.18	-2.99
MW-6	10/15/2004	2,042.73	181.39	1,861.34	-0.84
MW-6	1/28/2005	2,042.73	178.33	1,864.40	3.06
MW-6	4/29/2005	2,042.73	177.73	1,865.00	0.60
MW-6	7/20/2005	2,042.73	180.60	1,862.13	-2.87
MW-6	10/27/2005	2,042.73	181.54	1,861.19	-0.94
MW-6	1/11/2006	2,042.73	179.49	1,863.24	2.05
MW-6	4/12/2006	2,042.73	177.23	1,865.50	2.26
MW-6	7/13/2006	2,042.73	178.47	1,864.26	-1.24
MW-6	10/24/2006	2,042.73	181.64	1,861.09	-3.17
MW-6	1/29/2007	2,042.73	178.70	1,864.03	2.94
MW-6	4/19/2007	2,042.73	175.08	1,867.65	3.62
MW-6	7/19/2007	2,042.73	180.18	1,862.55	-5.10
MW-6	9/13/2007	2,042.73	182.37	1,860.36	-2.19
MW-6	10/29/2007	2,042.73	181.52	1,861.21	0.85
MW-6	1/30/2008	2,042.73	180.32	1,862.41	1.20
MW-6	4/22/2008	2,042.73	178.39	1,864.34	1.93
MW-6	7/23/2008	2,042.73	176.88	1,865.85	1.51
MW-6	10/22/2008	2,042.73	180.75	1,861.98	-3.87
MW-6	1/29/2009	2,042.73	178.41	1,864.32	2.34
MW-6	4/28/2009	2,042.73	175.65	1,867.08	2.76
MW-6	7/9/2009	2,042.73	178.15	1,864.58	-2.50
MW-6	10/29/2009	2,042.73	181.27	1,861.46	-3.12
MW-6	1/19/2010	2,042.73	180.34	1,862.39	0.93
MW-6	4/6/2010	2,042.73	179.68	1,863.05	0.66
MW-6	7/27/2010	2,042.73	179.36	1,863.37	0.32
MW-6	10/20/2010	2,042.73	181.23	1,861.50	-1.87

Table 1: Summary of Groundwater Level Measurements

Well Number	Date Measured	Top of Casing Elevation[(a)] (feet)	Depth to Water[(b)] (feet)	Groundwater Elevation (feet)	Change in Elevation[(c)] (feet)
MW-6	1/18/2011	2,042.73	178.39	1,864.34	2.84
MW-6	4/21/2011	2,042.73	174.43	1,868.30	3.96
MW-6	7/14/2011	2,042.73	174.00	1,868.73	0.43
MW-6	10/6/2011	2,042.73	180.63	1,862.10	-6.63
MW-6	1/24/2012	2,042.73	180.13	1,862.60	0.50
MW-6	4/10/2012	2,042.73	175.73	1,867.00	4.40
MW-6	7/11/2012	2,042.73	175.32	1867.41	0.41
MW-6	10/30/2012	2,042.73	180.59	1862.14	-5.27
MW-6	1/29/2013	2,042.73	178.94	1863.79	1.65
MW-6	4/11/2013	2,042.73	DRY	NA	NA
MW-6	10/24/2013	2,042.73	180.81	1861.92	-1.87
MW-6	1/29/2014	2,042.73	179.81	1862.92	1.00
MW-6	4/23/2014	2,042.73	174.96	1867.77	4.85
MW-6	7/28/2014	2,042.73	179.21	1863.52	-4.25
MW-6	10/29/2014	2,042.73	180.87	1861.86	-1.66
MW-6	1/28/2015	2,042.73	178.43	1864.30	2.44
MW-6	4/14/2015	2,042.73	175.72	1867.01	2.71
MW-6	7/14/2015	2,042.73	181.31	1861.42	-5.59
MW-6	10/27/2015	2,042.73	182.08	1,860.65	-0.77
MW-6	1/26/2016	2,042.73	179.80	1,862.93	2.28
MW-6	4/28/2016	2,042.73	174.94	1,867.79	4.86
MW-6	7/13/2016	2,042.73	179.80	1,862.93	-4.86
MW-6	10/12/2016	2,042.73	181.92	1,860.81	-2.12
MW-6	1/31/2017	2,042.73	179.44	1,863.29	2.48
MW-6	4/18/2017	2,042.73	171.41	1,871.32	8.03
MW-6	6/27/2018	2,042.73	176.40	1,866.33	-4.99
MW-6	4/23/2019	2,042.73	176.25	1,866.48	0.15

Notes:

(a) Top of well casing elevations were provided by EMR Inc.

(b) Depth to water measurements recorded relative to top of well casing.

(c) Change in groundwater elevation since previous event.

(d) NA = Elevation not available because well was dry.

(e) Anomalous groundwater elevation is a suspected measurement error.

(f) Monitoring well MW-5 was re-sampled on 10 March 2010 because of a laboratory error with respect to the sample collected 19 January 2010.

Table 2: Summary of Groundwater Analytical Results

Well Number	Date Sampled	Chloride[a] (mg/L)[b]	Nitrate-Nitrite[c] (mg/L)	Nitrate-Nitrogen[a] (mg/L)	Nitrite-Nitrogen[a] (mg/L)
Cleanup Level[n]		250	10	10	1
MW-3	06/30/97	**397**[d]	--	**83.80**	NA[e]
MW-3	12/15/98	181	--	**42.40**	NA
MW-3	07/28/99	134	--	**14.30**	NA
MW-3	06/20/00	61.1	--	9.58	NA
MW-3	04/29/03 [f]	68.4	--	6.37	ND[g]
MW-3	04/16/04	107	--	**13.20**	ND
MW-3	01/28/05	67.3	--	**14.40**	**1.14**
MW-3	04/29/05	75.4	--	**12.70**	***<5.00*** [h,i]
MW-3	01/11/06	93.3	--	**16.10**	<0.400
MW-3	04/12/06	62.6	--	6.16	<0.200
MW-3	07/13/06	5.03	--	**13.80**	<1.00
MW-3	10/24/06	50.2	--	**12.9 J** [j]	<0.200
MW-3	01/29/07	128	--	**23.0**	<0.200
MW-3	04/19/07	36.6	--	3.18	<0.200
MW-3	07/19/07 [k]	85.6	--	**19.40**	<0.0100
MW-3	01/30/08 [k]	74.5	--	**14.10**	<0.0100
MW-3	04/22/08	53.8	--	7.90	<0.200
MW-3	07/23/08	80.6	--	**11.30**	<0.200
MW-3	01/29/09	68.2	--	7.95	<0.200
MW-3	04/28/09	74.2	--	8.44	<0.200
MW-3	07/09/09	77.1	--	6.24	<0.200
MW-3	01/19/10	NS[l]	--	NS	NS
MW-3	04/07/10	40	--	7.50	**1.8**
MW-3	07/27/10	77	--	**13.00**	<0.60
MW-3	10/20/10	NS	--	NS	NS
MW-3	01/18/11	51	--	6.00	<0.60
MW-3	04/21/11	35	--	4.20	<0.60
MW-3	07/14/11	39	--	6.90	<0.60
MW-3	10/06/11	NS	--	NS	NS
MW-3	01/24/12	71	--	9.70	<0.60
MW-3	04/10/12	60	--	5.10	<0.60
MW-3	07/11/12	57	--	9.50	<0.60
MW-3	10/30/12	NS	--	NS	NS
MW-3	01/29/13	110	--	**15.00**	**3.8**
MW-3	04/11/13	37	--	4.70	***<6.0***
MW-3	10/24/13 [k]	NS	--	NS	NS
MW-3	01/29/14	67	--	8.10	<0.100
MW-3	04/23/14	43	--	5.60	<0.100
MW-3	07/28/14	60	--	**11.00**	<0.100
MW-3	10/29/14	NS	--	NS	NS
MW-3	01/28/15	25	--	2.50	<0.100
MW-3	04/14/15	44.00	--	6.27	<0.100
MW-3	07/14/15	NS	--	NS	NS

Table 2: Summary of Groundwater Analytical Results

Well Number	Date Sampled	Chloride[a] (mg/L)[b]	Nitrate-Nitrite[c] (mg/L)	Nitrate-Nitrogen[a] (mg/L)	Nitrite-Nitrogen[a] (mg/L)
Cleanup Level[n]		250	10	10	1
MW-3	10/27/15	NS	--	NS	NS
MW-3	01/26/16	44.8	--	6.51	<0.100
MW-3	04/28/16	34.7	--	4.67	<0.100
MW-3	07/13/16	51.90	--	9.83	<0.100
MW-3	10/12/16	NS	--	NS	NS
MW-3	01/31/17	86.10	--	**11.20**	<0.100
MW-3	04/18/17	21.20	--	4.57	<0.100
MW-3	06/27/18 [c]	NS	NS	NS	NS
MW-3	05/15/19	22.20	--	3.81	<0.100
MW-4	12/15/98	2.46	--	1.22	NA
MW-4	07/28/99	133.00	--	4.20	NA
MW-4	12/08/99	2.13	--	1.50	NA
MW-4	06/15/00	70.50	--	2.49	NA
MW-4	12/07/00	3.89	--	1.36	ND
MW-4	10/30/02	2.80	--	2.72	ND
MW-4	02/04/03 [e]	2.76	--	1.61	<0.100
MW-4	04/29/03	21.20	--	2.13	<0.500
MW-4	07/24/03	16.50	--	2.69	0.740
MW-4	10/30/03	1.97	--	2.59	<0.500
MW-4	01/26/04	2.65	--	1.96	<0.500
MW-4	04/16/04	2.25	--	1.03	<0.500
MW-4	07/26/04	14.70	--	4.43	<0.500
MW-4	10/15/04	4.60	--	2.79	ND
MW-4	01/28/05	5.18	--	3.23	ND
MW-4	04/29/05	106.00	--	6.20	***<5.0***
MW-4	07/20/05	48.30	--	**10.20**	***<5.0***
MW-4	10/27/05	2.47	--	2.40	<0.500
MW-4	01/11/06	1.97	--	0.68	<0.200
MW-4	04/12/06	1.80	--	0.57	<0.200
MW-4	07/13/06	41.00	--	5.25	<0.400
MW-4	10/24/06	5.44	--	1.11	<0.200
MW-4	01/29/07	28.50	--	4.59	<0.200
MW-4	04/19/07	28.20	--	4.37	<0.200
MW-4	07/19/07 [k]	16.60	--	6.11	<0.0100
MW-4	09/13/07	2.08	--	0.94	ND
MW-4	10/29/07	2.60	--	1.77	<0.0100
MW-4	01/30/08 [k]	4.70	--	6.25	<0.0100
MW-4	04/22/08	3.98	--	3.49	<0.200
MW-4	07/23/08	7.32	--	3.86	<0.200
MW-4	10/22/08	2.75	--	1.28	<0.200
MW-4	01/29/09	2.59	--	0.78	<0.200
MW-4	04/28/09	2.50	--	0.68	<0.200
MW-4	07/09/09	19.30	--	4.42	<0.100

Table 2: Summary of Groundwater Analytical Results

Well Number	Date Sampled	Chloride[a] (mg/L)[b]	Nitrate-Nitrite[c] (mg/L)	Nitrate-Nitrogen[a] (mg/L)	Nitrite-Nitrogen[a] (mg/L)
Cleanup Level[n]		250	10	10	1
MW-4	10/29/09	2.70	--	1.90	**1.4**[m]
MW-4	01/19/10	5.60	--	3.90	**1.8**
MW-4	04/07/10	3.20	--	1.40	**1.6**
MW-4	07/27/10	7.80	--	4.00	<0.60
MW-4	10/20/10	2.70	--	2.00	<0.60
MW-4	01/18/11	2.60	--	ND	<0.60
MW-4	04/21/11	2.40	--	ND	<0.60
MW-4	07/14/11	3.80	--	1.60	<0.60
MW-4	10/06/11	4.30	--	2.40	<0.60
MW-4	01/24/12	3.60	--	2.30	<0.60
MW-4	04/10/12	3.00	--	1.00	**1.3**
MW-4	07/11/12	4.70	--	2.70	<0.60
MW-4	10/30/12	2.80	--	2.40	<0.60
MW-4	01/29/13	3.60	--	2.30	**1.6**
MW-4	04/11/13	2.70	--	<0.90	***<6.0***
MW-4	10/24/13 [k]	2.60	--	1.40	<0.100
MW-4	01/29/14	5.50	--	2.50	<0.100
MW-4	04/23/14	3.20	--	0.93	<0.100
MW-4	07/28/14	5.90	--	2.90	<0.100
MW-4	10/29/14	3.80	--	2.70	<0.100
MW-4	01/28/15	3.20	--	0.92	<0.100
MW-4	04/14/15	3.55	--	1.55	<0.100
MW-4	07/14/15	4.47	--	2.36	<0.100
MW-4	10/27/15	3.70	--	1.58	<0.100
MW-4	01/26/16	5.16	--	1.89	<0.100
MW-4	04/28/16	3.32	--	0.98	<0.100
MW-4	07/13/16	3.39	--	1.75	<0.100
MW-4	10/12/16	3.25	--	1.49	<0.100
MW-4	01/31/17	3.29	--	4.93	<0.100
MW-4	04/18/17	2.88	--	0.94	<0.100
MW-4	06/27/18 [c]	4.41	2.7	2.70	--
MW-4	04/23/19	5.19	--	1.84	<0.100
MW-5	12/15/98	**690**	--	**19.40**	NA
MW-5	07/28/99	113	--	2.50	NA
MW-5	12/10/99	**432**	--	5.65	NA
MW-5	06/20/00	**257**	--	0.80	NA
MW-5	12/08/00	**518**	--	6.37	ND
MW-5	10/30/02	**1660**	--	**16.20**	ND
MW-5	02/04/03 [e]	227	--	8.39	<0.100
MW-5	04/29/03	**345**	--	ND	<0.500
MW-5	07/24/03	**928**	--	**11.10**	<0.500
MW-5	10/30/03	**1490**	--	ND	<0.500
MW-5	01/26/04	**1330**	--	**11.40**	ND

Table 2: Summary of Groundwater Analytical Results

Well Number	Date Sampled	Chloride[a] (mg/L)[b]	Nitrate-Nitrite[c] (mg/L)	Nitrate-Nitrogen[a] (mg/L)	Nitrite-Nitrogen[a] (mg/L)
Cleanup Level[n]		250	10	10	1
MW-5	04/16/04	**1260**	--	ND	***<25.0***
MW-5	07/26/04	**896**	--	**18.10**	<0.500
MW-5	10/15/04	**4810**	--	**43.60**	ND
MW-5	01/28/05	**970**	--	**32.80**	ND
MW-5	04/29/05	**1030**	--	**31.00**	***<25.0***
MW-5	07/20/05	**492**	--	**19.20**	***<10.0***
MW-5	10/27/05	**1020**	--	**31.50**	***<25.0***
MW-5	01/11/06	**650**	--	9.95	***<2.00***
MW-5	04/12/06	**902**	--	9.35	***<2.00***
MW-5	07/13/06	**740**	--	8.42	***<2.00***
MW-5	10/24/06	**644**	--	**10.9[h]**	0.48
MW-5	01/29/07	**587**	--	**18.50**	***<2.0***
MW-5	04/19/07	**693**	--	**11.10**	**1.18**
MW-5	07/19/07 [k]	122	--	5.89	0.0114
MW-5	09/13/07	**438**	--	**12.3**	ND
MW-5	10/29/07	**700**	--	**16.20**	0.0410
MW-5	01/30/08 [k]	**513**	--	**13.30**	<0.0100
MW-5	04/22/08	**546**	--	3.05	<0.200
MW-5	07/23/08	**914**	--	6.36	**1.80**
MW-5	10/22/08	**292**	--	**10.00**	<0.200
MW-5	01/29/09	**298**	--	9.43	<0.200
MW-5	04/28/09	**417**	--	**10.50**	0.83
MW-5	07/09/09	112	--	3.20	<0.100
MW-5	10/29/09	**290**	--	**11[k]**	**1.4[m]**
MW-5	01/19/10	**360**	--	**13[k]**	ND
MW-5	03/10/10	**330**	--	**14.00**	**1.1**
MW-5	04/07/10	**330**	--	**15.00**	<0.60
MW-5	07/27/10	48	--	5.50	<0.60
MW-5	10/20/10	**330**	--	**15.00**	<0.60
MW-5	01/18/11	**260**	--	**14.00**	<0.60
MW-5	04/21/11	**370**	--	**11.00**	<0.60
MW-5	07/14/11	**1500**	--	**24.00**	<0.60
MW-5	10/06/11	**320**	--	8.20	<0.60
MW-5	01/24/12	240	--	**13.00**	<0.60
MW-5	04/10/12	150	--	6.70	<0.60
MW-5	07/11/12	**680**	--	**14.00**	0.60
MW-5	10/30/12	69	--	1.30	0.60
MW-5	01/29/13	89	--	7.50	**1.3**
MW-5	04/11/13	160	--	8.70	***<3.0***
MW-5	10/24/13 [k]	140	--	9.10	<0.100
MW-5	10/24/13 (Dup)	140	--	9.20	<0.100
MW-5	01/29/14	130	--	9.40	<0.100
MW-5	01/29/14 (Dup)	130	--	9.40	<0.100

Table 2: Summary of Groundwater Analytical Results

Well Number	Date Sampled	Chloride[(a)] (mg/L)[(b)]	Nitrate-Nitrite[(c)] (mg/L)	Nitrate-Nitrogen[(a)] (mg/L)	Nitrite-Nitrogen[(a)] (mg/L)
Cleanup Level[(n)]		250	10	10	1
MW-5	04/23/14	120	--	7.20	<0.100
MW-5	04/23/14 (Dup)	120	--	7.20	<0.100
MW-5	07/28/14	25	--	4.00	<0.100
MW-5	07/28/14 (Dup)	25	--	4.00	<0.100
MW-5	10/29/14	44	--	4.20	<0.100
MW-5	10/29/14 (Dup)	43	--	4.20	<0.100
MW-5	01/28/15	160	--	7.60	<0.100
MW-5	01/28/15 (Dup)	160	--	7.70	<0.100
MW-5	04/14/15	47	--	4.15	<0.100
MW-5	04/14/15	47	--	3.87	<0.100
MW-5	07/14/15	65	--	5.43	<0.100
MW-5	07/14/15 (Dup)	66	--	5.46	<0.100
MW-5	10/27/15	99	--	5.83	<0.100
MW-5	10/27/15 (Dup)	102	--	6.32	<0.100
MW-5	01/26/16	89	--	6.04	<0.100
MW-5	01/26/16 (Dup)	88	--	5.99	<0.100
MW-5	04/28/16	26	--	2.49	<0.100
MW-5	04/28/16 (Dup)	26	--	2.50	<0.100
MW-5	07/13/16	152	--	5.35	<0.100
MW-5	07/13/16 (Dup)	153	--	5.35	<0.100
MW-5	10/12/16	149	--	3.61	<0.100
MW-5	10/12/16 (Dup)	148	--	3.62	<0.100
MW-5	01/31/17	15	--	3.80	<0.100
MW-5	01/31/17 (Dup)	15	--	3.89	<0.100
MW-5	04/18/17	83	--	**11.50**	<0.100
MW-5	04/18/17 (Dup)	83	--	**11.40**	<0.100
MW-5	06/27/18 (c)	**923 J**	**41.8**	**41.80**	--
MW-5	06/27/18 (Dup)	**1290 J**	**43.4**	**43.40**	--
MW-5	04/23/19	17	--	3.84	<0.100
MW-5	04/23/19 (Dup)	17	--	3.83	<0.100
MW-6	12/15/98	14.20	--	7.85	NA
MW-6	07/28/99	9.52	--	1.90	NA
MW-6	12/10/99	17.90	--	1.09	NA
MW-6	06/20/00	2.27	--	0.80	NA
MW-6	12/07/00	38.60	--	2.49	NA
MW-6	10/30/02	68.00	--	4.79	ND
MW-6	02/04/03 [(e)]	12.60	--	1.39	<0.100
MW-6	04/29/03	5.05	--	2.31	<0.500
MW-6	07/24/03	16.00	--	2.43	<0.500
MW-6	10/30/03	31.00	--	4.13	<0.500
MW-6	01/26/04	16.20	--	2.21	ND
MW-6	04/16/04	11.40	--	1.37	<0.500
MW-6	07/26/04	13.90	--	3.03	<0.500

Table 2: Summary of Groundwater Analytical Results

Well Number	Date Sampled	Chloride[a] (mg/L)[b]	Nitrate-Nitrite[c] (mg/L)	Nitrate-Nitrogen[a] (mg/L)	Nitrite-Nitrogen[a] (mg/L)
Cleanup Level[n]		250	10	10	1
MW-6	10/15/04	28.00	--	3.31	<0.500
MW-6	01/28/05	17.70	--	4.50	0.610
MW-6	04/29/05	5.80	--	8.20	***<5.0***
MW-6	07/20/05	17.50	--	7.60	***<5.0***
MW-6	10/27/05	21.10	--	1.73	<0.500
MW-6	01/11/06	14.20	--	1.61	<0.200
MW-6	04/12/06	10.30	--	1.21	<0.200
MW-6	07/13/06	2.07	--	0.89	<0.200
MW-6	10/24/06	5.73	--	0.68	<0.200
MW-6	01/29/07	13.10	--	1.52	<0.200
MW-6	04/19/07	8.08	--	1.18	0.250
MW-6	07/19/07 [k]	3.78	--	1.32	<0.0100
MW-6	09/13/07	45.60	--	4.61	ND
MW-6	10/29/07	30.00	--	2.47	<0.0100
MW-6	01/30/08 [k]	19.20	--	1.98	0.100
MW-6	04/22/08	14.40	--	1.04	0.980
MW-6	07/23/08	2.47	--	1.02	<0.200
MW-6	10/22/08	61.80	--	4.45	<0.200
MW-6	01/29/09	5.32	--	0.88	<0.200
MW-6	04/28/09	3.49	--	1.36	<0.200
MW-6	07/09/09	2.89	--	1.08	<0.100
MW-6	10/29/09	51.00	--	4.00	**1.5[m]**
MW-6	01/19/10	9.70	--	1.40	**1.4**
MW-6	04/07/10	4.80	--	1.80	**1.7**
MW-6	07/27/10	2.70	--	1.00	<0.60
MW-6	10/20/10	4.50	--	1.00	<0.60
MW-6	01/18/11	5.70	--	1.30	<0.60
MW-6	04/21/11	2.70	--	1.00	<0.60
MW-6	07/14/11	4.10	--	1.40	<0.60
MW-6	10/06/11	25.00	--	6.80	<0.60
MW-6	01/24/12	5.80	--	1.10	<0.60
MW-6	04/10/12	6.90	--	1.70	**1.2**
MW-6	07/11/12	2.70	--	ND	**1.2**
MW-6	10/30/12	31.00	--	4.80	<0.60
MW-6	01/29/13	16.00	--	2.70	**1.3**
MW-6	04/11/13	5.10	--	1.90	***<6.0***
MW-6	10/24/13 [k]	28.00	--	2.30	<0.100
MW-6	01/29/14	5.40	--	0.99	<0.100
MW-6	04/23/14	2.90	--	0.78	<0.100
MW-6	07/28/14	3.30	--	0.78	<0.100
MW-6	10/29/14	36.00	--	1.90	<0.100
MW-6	01/28/15	3.20	--	0.68	<0.100
MW-6	04/14/15	3.29	--	1.79	<0.100

Table 2: Summary of Groundwater Analytical Results

Well Number	Date Sampled	Chloride[(a)] (mg/L)[(b)]	Nitrate-Nitrite[(c)] (mg/L)	Nitrate-Nitrogen[(a)] (mg/L)	Nitrite-Nitrogen[(a)] (mg/L)
Cleanup Level[(n)]		250	10	10	1
MW-6	07/14/15	5.01	--	1.45	<0.100
MW-6	10/27/15	9.85	--	1.44	<0.100
MW-6	01/26/16	5.46	--	2.09	<0.100
MW-6	04/28/16	2.54	--	0.66	<0.100
MW-6	07/13/16	4.65	--	1.12	<0.100
MW-6	10/12/16	28.00	--	2.11	<0.100
MW-6	01/31/17	4.43	--	1.48	<0.100
MW-6	04/18/17	3.27	--	0.97	<0.100
MW-6	06/27/18 [(c)]	2.62	1.01	1.01	--
MW-6	04/23/19	4.37	--	1.34	<0.100

Notes:

(a) Analysis by U.S. Environmental Protection Agency (EPA) Method 300.0 except where noted.

(b) mg/L = milligrams per liter

(c) Nitrate-Nitrite analysis by EPA Method 353.2 and Chloride analysis by EPA Method 9056A for samples collected on 06/27/18. Based on correspondence with the analytical laboratory and analytical results for nitrite since 2013, it is assumed that the nitrate-nitrite analytical results are representative of nitrate concentrations in the water samples.

(d) Bold indicates analyte reported at a concentration that exceeds the cleanup level.

(e) NA = Not analyzed

(f) Groundwater monitoring conducted by EMR through 2002, GeoEngineers between 2003 and 2012, and Kennedy Jenks since 2013.

(g) ND = Not detected

(h) < = Analyte not detected above the indicated laboratory reporting limit.

(i) BOLD and Italicized indicates the laboratory reporting limit was greater than the cleanup level.

(j) Estimated value.

(k) On 07/09/07, 01/30/08, and 10/24/13, nitrite-nitrogen analysis was performed using EPA Method 353.2.

(l) NS = Not sampled

(m) Analysis performed outside of method-specified hold time because concentration of analyte in sample required a dilution.

(n) Cleanup level defined in the site Final Cleanup Action Plan (FCAP, GeoEnginers 2003).

(Dup) "Dup" = blind field duplicate sample

"J" indicates an estimated concentration based on either the being less than the laboratory reporting limit or data validation findings.

Table 3: Summary of Evaporation Pond Water Levels

Date Measured	Water Level Elevation[a] (feet)
8/26/2003	2,035.85
9/25/2003	2,035.64
10/30/2003	2,035.50
11/26/2003	2,035.60
12/22/2003	2,036.64
1/28/2004	2,038.77
02/20/04[b]	2,039.18
3/16/2004	2,039.08
4/19/2004	2,038.64
5/20/2004	2,038.10
6/16/2004	2,038.81
7/26/2004	2,037.98
8/23/2004	2,037.73
9/13/2004	2,037.48
10/15/2004	2,037.52
11/8/2004	2,037.48
12/15/2004	2,038.52
01/28/05[b]	2,039.12
2/16/2005	2,039.06
3/10/2005	2,039.00
4/20/2005	2,039.02
5/14/2005	2,038.93
6/9/2005	2,039.02
7/14/2005	2,038.77
8/15/2005	2,037.77
9/27/2005	2,036.85
10/21/2005	2,037.85
11/3/2006	2,038.02
12/16/2006	2,037.85
01/17/06[b]	2,039.10
02/03/06[b]	2,039.10
03/17/06[b]	2,039.10
04/14/06[b]	2,039.10
05/03/06[b]	2,039.10
6/7/2006	2,038.18
7/6/2006	2,038.85
8/31/2006	2,038.85
9/13/2006	2,038.77
10/30/2006	NM
11/13/2006	2,038.89
12/4/2006	2,038.93
01/04/07[b]	2,039.14
02/02/07[c]	NM

Table 3: Summary of Evaporation Pond Water Levels

Date Measured	Water Level Elevation[a] (feet)
03/06/07[b]	2,039.10
4/7/2007	2,036.87
5/3/2007	2,036.90
6/1/2007	2,038.94
07/03/07[c]	NM
8/1/2007	2,037.70
9/7/2007	2,037.07
10/9/2007	2,037.17
11/19/2007	2,037.24
12/20/2007	2,038.64
1/29/2008	2,039.39
2/6/2008	2,039.31
3/17/2008	2,039.39
04/04/08[b]	2,039.41
5/1/2008	2,039.27
6/16/2008	2,039.03
7/4/2008	2,038.69
8/5/2008	2,037.99
9/10/2008	2,037.59
10/7/2008	2,037.38
11/11/2008	2,037.56
12/5/2008	2,037.59
01/09/09[b]	2,039.57
02/22/09[b]	2,039.49
03/10/09[b]	2,039.55
04/09/09	2,039.39
5/4/2009	2,039.21
6/5/2009	2,038.79
7/10/2009	2,038.28
8/13/2009	2,037.69
9/8/2009	2,037.34
10/5/2009	2,036.65
11/12/2009	2,037.54
12/7/2009	2,037.75
01/19/10[b]	2,039.48
02/17/10[b]	2,039.49
03/08/10[b]	2,039.41
4/22/2010	2,039.32
5/12/2010	2,039.21
6/4/2010	2,039.30
7/30/2010	2,038.88
8/20/2010	2,038.47
9/9/2010	2,038.18

Table 3: Summary of Evaporation Pond Water Levels

Date Measured	Water Level Elevation[a] (feet)
10/11/2010	2,038.07
11/10/2010	2,038.42
12/10/10[b]	2,039.59
01/20/11[b]	2,039.49
02/17/11[b]	2,039.48
03/21/11[b]	2,039.49
04/09/11[b]	2,039.45
5/11/2011	2,039.39
06/10/11[b]	2,039.49
7/8/2011	2,039.09
8/8/2011	2,038.39
9/21/2011	2,037.39
10/12/2011	2,037.90
11/17/2011	2,037.89
12/9/2012	2,037.99
1/11/2012	2,038.29
02/16/12[b]	2,039.49
03/14/12[b]	2,039.49
04/07/12[b]	2,039.49
05/15/12[b]	2,039.37
6/12/2012	2,039.18
7/12/2012	2,038.79
8/22/2012	2,039.09
9/14/2012	2,037.51
10/22/2012	2,037.09
November 2012[b][d]	NA
12/12/12[b]	2,039.37
01/15/13[b]	2,039.27
10/24/2013	2,038.09
11/19/2013	2,038.09
12/18/2013	2,038.15
1/29/2014	2038.69
2/26/2014[b]	2,039.29
3/28/2014 [b]	2,039.23
4/23/2014	2,039.13
5/28/2014	2,038.84
6/17/2014	2,038.61
7/28/2014	2,038.12
8/21/2014	2,037.39
9/17/2014	2,038.39
10/24/2014	2,038.31
11/25/2014	2,037.52
12/11/2014	2,038.39

Table 3: Summary of Evaporation Pond Water Levels

Date Measured	Water Level Elevation[(a)] (feet)
1/29/2015	2,039.39
2/20/2015	2,039.36
3/31/2015	2,039.39
4/24/2015	2,039.20
5/22/2015	2,038.89
6/25/2015	2,038.30
7/14/2015	2,037.94
8/10/2015	2,037.44
9/30/2015	2,036.84
10/28/2015	2,036.69
11/23/2015	2,036.78
12/18/2015	2,037.99
1/26/2016	2,039.41
2/25/2016	2,039.37
3/21/2016	2,039.44
4/22/2016	2,039.22
5/27/2016	2,039.01
6/28/2016	2,038.49
7/19/2016	2,038.09
8/18/2016	2,037.59
9/23/2016	2,037.04
10/21/2016	2,037.95
11/14/2016	2,039.39
12/22/2016	2,039.45
1/31/2017	2,039.47
2/27/2017	2,039.53
3/16/2017	2,039.49
4/19/2017	2,039.53
5/17/2017	2,039.43
6/15/2017	2,038.95
6/27/2018	2,038.59
4/23/2019	2,039.48

Notes:
(a) Pond water surface elevation relative to NAVD 88. Water level elevation corresponds to the event gauge reading at the pond plus a base elevation of 2,036.59 feet mean sea level (MSL).
(b) Water within the pond was discharging to overflow sump.
(c) Not measured because the pond's staff gauge shifted position, requiring maintenance during subsequent operation and maintenance (O&M) visit.
(d) Water level was within normal range for the time of year. However, a precise water level is not available
NM = not measured.
NA = not available.

Table 4: Statistical Analysis Summary

Constituent	Well ID	No. of Samples	No. of Detections	Minimum Detected (mg/L)[b]	Maximum Detected (mg/L)	95% UCL[a]		
						Data Distribution	95% UCL Method	95% UCL (mg/L)
Nitrate-N	MW-3	20	20	2.50	15.00	Lognormal	Land	9.21
	MW-5	20	20	1.30	41.80	Lognormal	Land	10.41
Washington State Department of Ecology Model Toxics Control Act Cleanup Level								10
Chloride	MW-5	20	20	14.9	923	Lognormal	Land	217
Washington State Department of Ecology Model Toxics Control Act Cleanup Level								250

Notes:

(a) 95% UCL = 95 percent upper confidence limit on the mean. Statistical calculations were performed using Model Toxics Control Act Stat (accessed June 2019).

(b) mg/L = milligrams per liter

Figures

N:\BNSF Washington\Hillyard Dross\GIS\Events\2019 Events\Fig1 VicinityMap.mxd

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Legend

Approximate Site Location

N

0 625 1,250

Scale: Feet

Kennedy/Jenks Consultants

BNSF Railway Company
Hillyard Dross
Spokane, Washington

Vicinity Map

1996114*00
June 2019

Figure 1

N:\BNSF Washington\Hillyard Dross\GIS\Events\2019 Events\Fig2_SiteMap_REV.mxd

Note:
1. All locations are approximate.

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Legend

- Monitoring Well
- Drywell
- Site Features

N

0 75 150

Scale: Feet

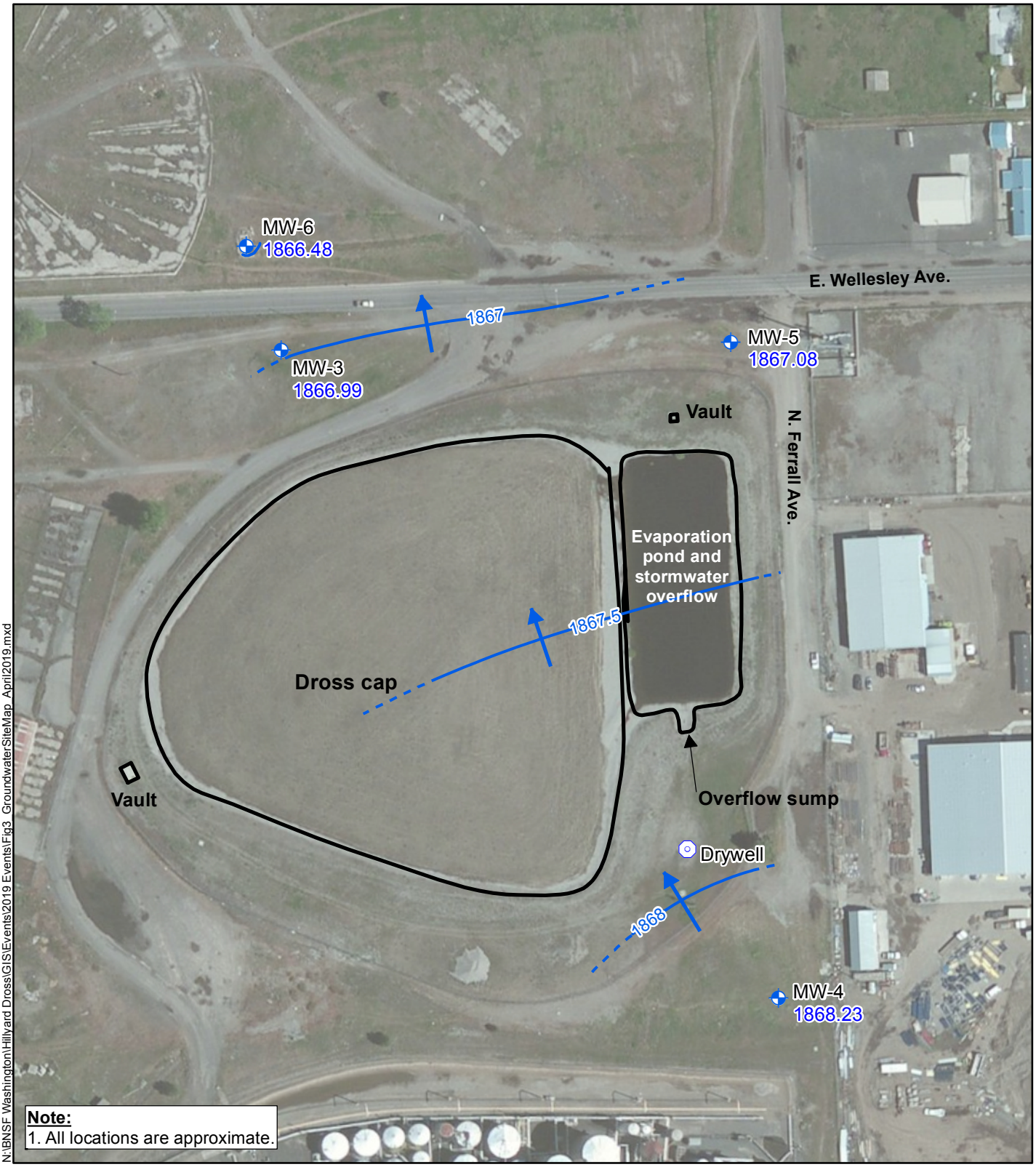
Kennedy/Jenks Consultants

BNSF Railway Company
Hillyard Dross
Spokane, Washington

Site Map

1996114*00
June 2019

Figure 2



Note:
1. All locations are approximate.

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Legend

- Monitoring Well
- Drywell
- Groundwater flow direction
- Groundwater contour, dashed where inferred
- Site Features

N

0 75 150

Scale: Feet

Kennedy/Jenks Consultants

BNSF Railway Company
Hillyard Dross
Spokane, Washington

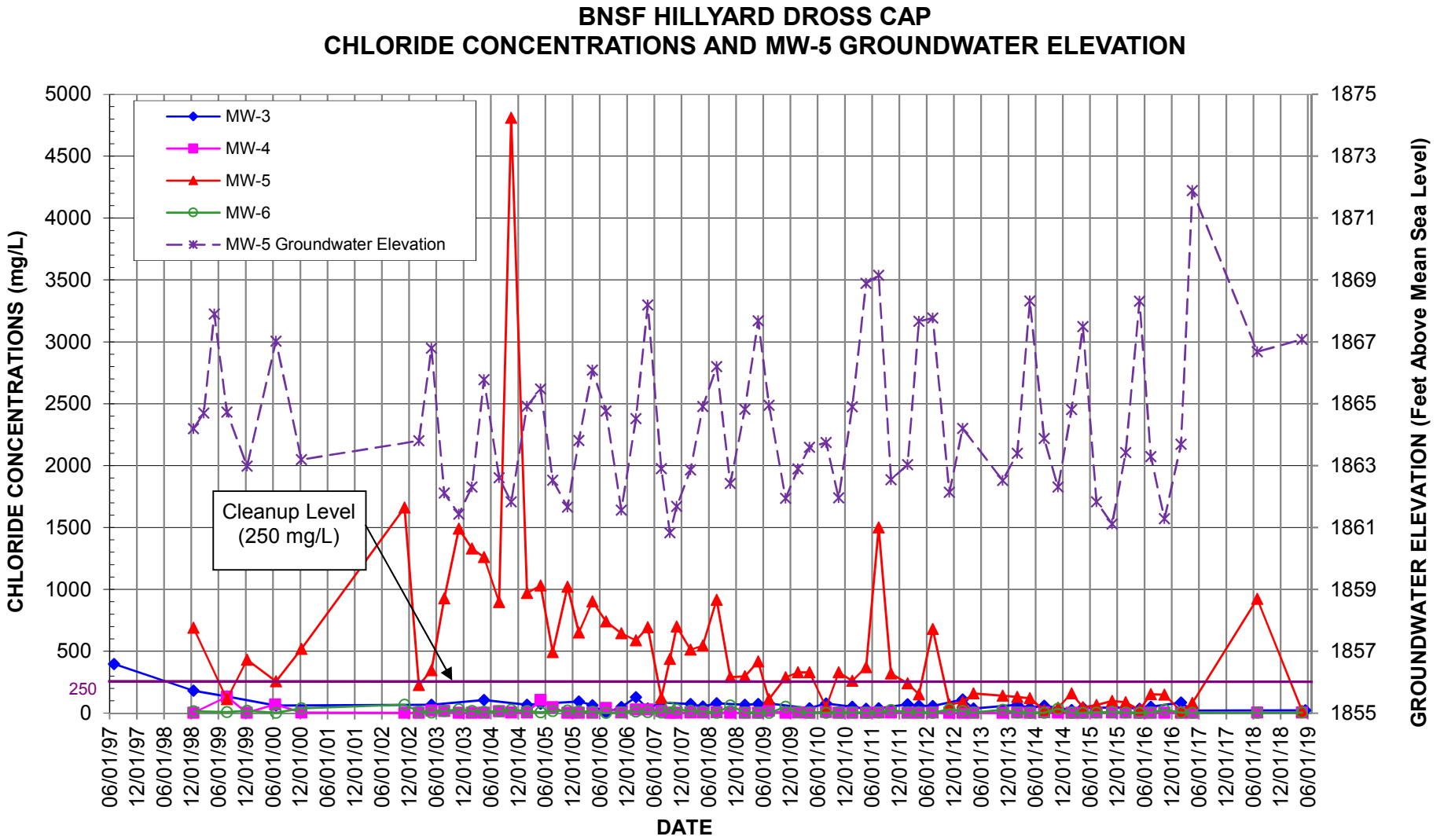
Groundwater Potentiometric Surface Contours: April 2019

1996114*00
June 2019

Figure 3

N:\BNSF Washington\Hillyard Dross\GIS\Events\2019 Events\Fig3_GroundwaterSiteMap_April2019.mxd

FIGURE 4



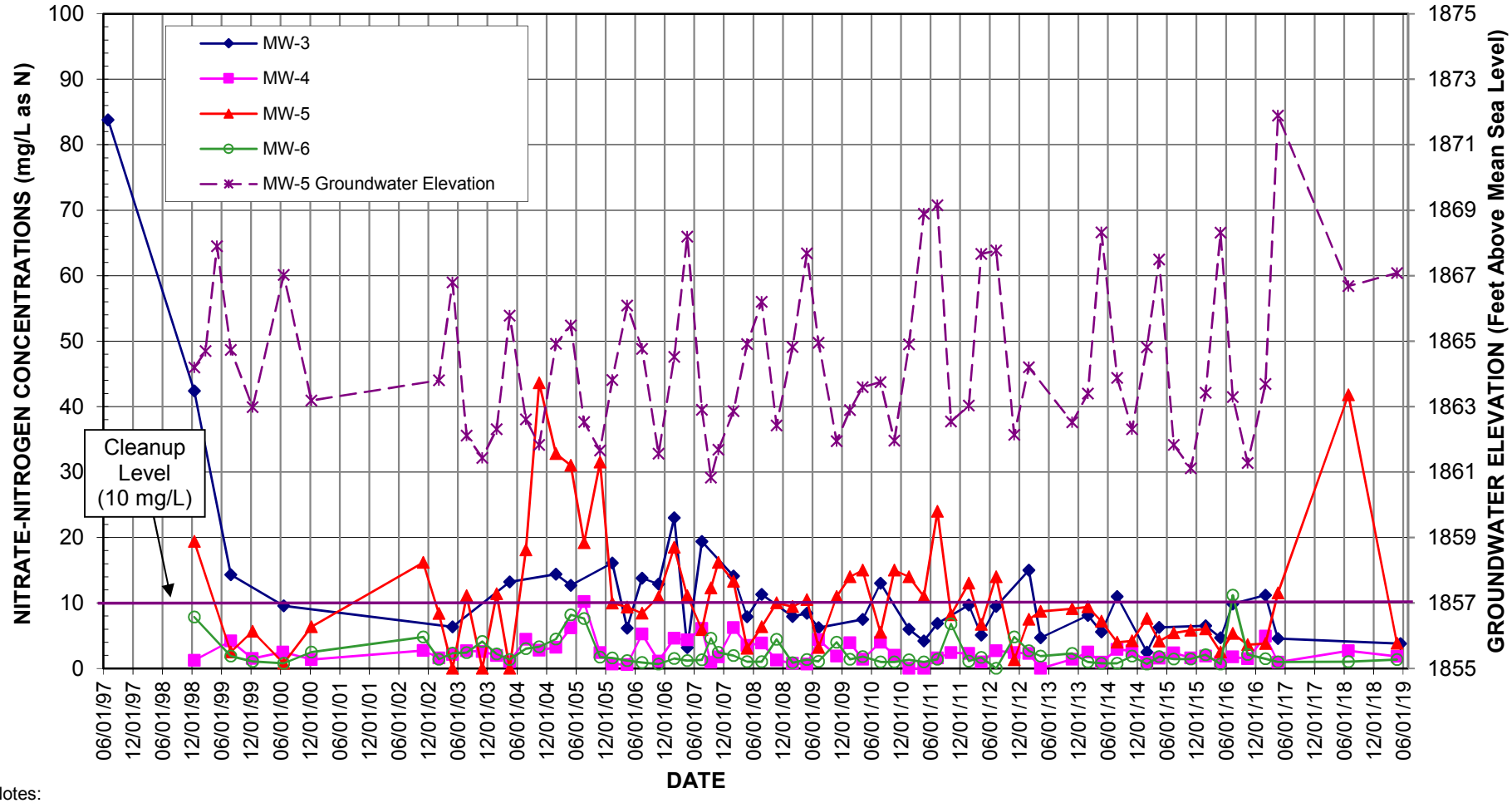
Notes:

1. Non-detectable concentrations are presented as zero.

M:\WP\2019\1996114.02_Hillyard_Dross_MON\Annual_Mon_Rpt_2019\2019 report Tables 1-4 Fig 4-6.xlsx

FIGURE 5

BNSF HILLYARD DROSS CAP
NITRATE-NITROGEN CONCENTRATIONS AND MW-5 GROUNDWATER ELEVATION



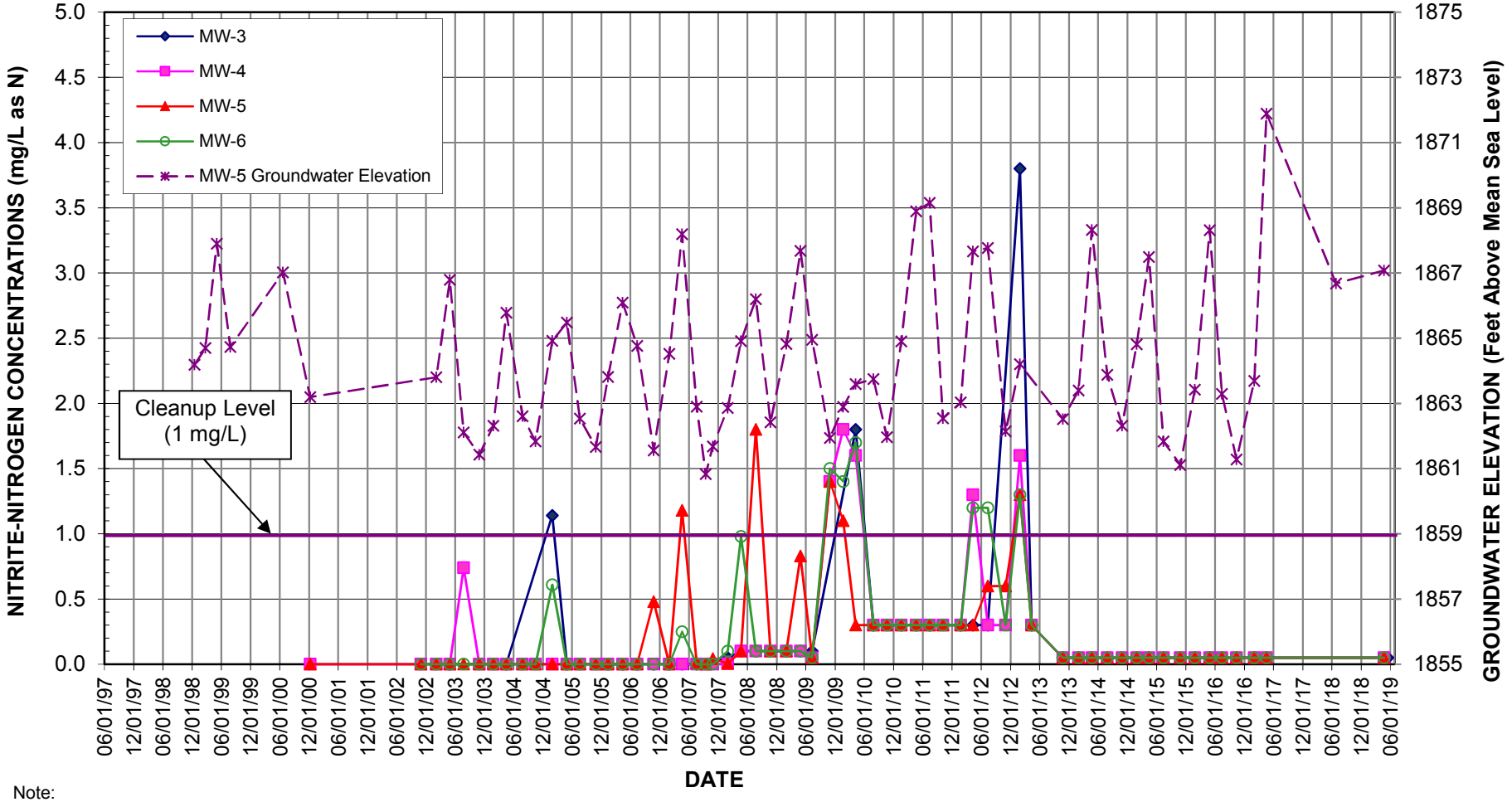
Notes:

1. Non-detectable concentrations are presented as zero.
2. June 2018 results include nitrite.

M:\WP\2019\1996114.02_Hillyard_Dross_MON\Annual_Mon_Rpt_2019\2019 report Tables 1-4 Fig 4-6.xlsx

FIGURE 6

BNSF HILLYARD DROSS CAP
NITRITE-NITROGEN CONCENTRATIONS AND MW-5 GROUNDWATER ELEVATION



Note:

1. Non-detectable concentrations are presented as half the laboratory reporting limit.

Appendix A

Washington State Department of Ecology 2013 Periodic Review

PERIODIC REVIEW

ALUMINUM RECYCLING CORPORATION

FSID 627

CSID 1133

Prepared by
Washington State Department of Ecology
Eastern Regional Office
Toxics Cleanup Program
Spokane, WA

March 2013

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1.0 INTRODUCTION

This report presents the Washington State Department of Ecology's (Ecology) second periodic review for the Aluminum Recycling Corporation Site (Site). This periodic review is required as part of the site cleanup process under the Model Toxics Control Act (MTCA), Ch. 70.105D RCW, implemented by Ecology. Periodic reviews evaluate post-cleanup site conditions and monitoring data to assure human health and the environment are being protected. They are required for sites where an institutional control is part of the cleanup action.

Cleanup actions were conducted at the Site by the Burlington Northern Santa Fe Railroad Corporation (BNSF) in 2003. These actions addressed contaminated soils, but residual groundwater contamination remained. Groundwater monitoring has been ongoing since completion of the cleanup action. The first periodic review was completed in 2008.

2.0 SUMMARY OF SITE CONDITIONS

2.1 SITE DESCRIPTION AND HISTORY

The eight-acre Site, located at 3412 E. Wellesley Avenue, Spokane, Washington, was initially used as a gravel pit for an asphalt plant (Figure 1). Beginning in 1954, Site use changed to an aluminum reprocessing facility using scrap aluminum and aluminum dross. Several lessees continued these operations until 1987, when the property was abandoned by all lessees with an estimated 65,000 cubic yards of dross material remaining on-site. BNSF retained ownership of the property throughout that timeframe.

The facility processed white dross, which was composed of aluminum skim and other materials derived from primary smelting operations. White dross, which contains various oxides, aluminum metal, carbides, and nitrides, was treated through the addition of salts, cryolite, and heat to separate out molten aluminum metal. The resulting residue after the secondary treatment was high-salt black dross. This material, along with a small volume of semi-processed white dross, was deposited on-site in various waste piles and in the former gravel pit. Approximately 65,000 cubic yards of dross remained on-site when the property was abandonded in 1987. When the black dross is wet, it generates ammonia odors and heat. This caused complaints from the public and one fire. Temporary surface stabilization measures had been taken to limit these reactions.

2.2 SITE INVESTIGATIONS AND CLEANUP

In 1985, Ecology completed a Preliminary Assessment (PA) of the property, and recommended dust and fumes be controlled; the dross materials be appropriately disposed of; and local water supply wells be sampled to ensure they hadn't been contaminated. Ecology then conducted a PA/Site Inspection (SI) Phase I in 1987. It concluded the Site was potentially contaminated with hazardous substances. No dangerous waste designation was completed at that time.

In 1988, BNSF performed a Site characterization study. Groundwater, soil, and deeper dross samples were collected, and surface stabilization and Site access restrictions occurred.

In 1989, a dross characterization study was done for BNSF. About 95% of the dross on-site could be considered a dangerous waste under Washington State regulations due to high concentrations of chloride, fluoride, and nitrate. Also, groundwater under the dross piles contained chloride, fluoride, and nitrate at levels exceeding state drinking water standards.

In 1991, Ecology completed a Site ranking using the Washington Ranking Method (WARM); the Site received a rank of 2 on a scale of 1 to 5, with 1 representing the greatest threat to human health and the environment. In 1996, BNSF's consultant reviewed the previous work and provided information on the physical and chemical properties of the dross, indicating it was not a dangerous waste according to bioassay testing. It also indicated the remaining salts were encapsulated and unable to be leached. Site access restrictions were also established.

BNSF and Ecology signed an Agreed Order in November 1998 to complete a Remedial Investigation/Feasibility Study (RI/FS) which was finalized one year later. Results indicated groundwater was contaminated with chloride, fluoride, nitrate, and nitrite. Soil was also contaminated where it was mixed with dross.

A Cleanup Action Plan (CAP) was prepared in 2000 which summarized investigations and contamination at the Site, and selected the remedy. The remedy, implemented in 2001, involved excavation and consolidation of dross and soil mixed with dross into an on-site pit, capping of the consolidation area with a low permeability multimedia cover system, and routing of surface water drainage into an on-site lined evaporation pond. Fencing, signs, and deed restrictions are maintained for the property. Four existing monitoring wells, installed prior to the RI/FS, are also sampled on a quarterly basis for chloride, fluoride, nitrate, and nitrite.

3.0 PERIODIC REVIEW

3.1 REGULATION

Under WAC 173-340-420, a periodic review of the cleanup action takes place at least every five years after the initiation of the cleanup action. A periodic review is required at sites where any of the following occur:

- Ecology conducts a cleanup action.
- Ecology approves a cleanup action under an order, agreed order, or consent decree.
- As resources permit, whenever Ecology issues a no further action opinion.

AND one of the following conditions exists:

- An institutional control and/or financial assurance is required as part of the cleanup action.
- Cleanup level is based on a practical quantitation limit as provided for in WAC 173-340-707.
- Modifications to the default equations or assumptions using site-specific information would significantly increase the concentration of hazardous substances remaining at the site after cleanup or the uncertainty in the ecological evaluation or the reliability of the cleanup action is such that additional review is necessary to assure long-term protection of human health and the environment.

When conducting a periodic review of a cleanup action and evaluating whether human health and the environment are being protected, the factors Ecology shall consider include [WAC 173-340-420(4)]:

- The effectiveness of ongoing or completed cleanup actions;
- New scientific information for individual hazardous substances of mixtures present at the site;
- New applicable state and federal laws for hazardous substances present at the site;
- Current and projected site use;
- Availability and practicability of higher preference technologies; and
- The availability of improved analytical techniques to evaluate compliance with cleanup levels.

Because the cleanup action was performed under a consent decree and institutional controls are required, the site is subject to periodic reviews at a frequency of no less than every five years. A periodic review was completed by Ecology in 2008. Ecology determined in that review the remedy remained protective and no changes were needed.

3.2 BASIS FOR REVIEW

This review is based on documents describing the actions listed in Section 2.2. These include periodic groundwater compliance monitoring reports submitted quarterly from 2008 through 2012.

3.3 THE EFFECTIVENESS OF ONGOING OR COMPLETED CLEANUP ACTIONS

An engineered cover system was placed over the dross materials remaining on the Site. This low-permeability cover was designed to minimize the infiltration of surface water and route it away from the emplaced waste. Although grasses were planted on the cover surface, they did not grow successfully. Despite that, surface erosion appears to be minimal. The lined evaporation pond, installed to capture surface runoff, functions well, and can handle high flow events without overflow. The cover system and evaporation pond are visually inspected on a monthly basis to ensure there is no significant deterioration.

Institutional controls at the Site include access restrictions and a restrictive covenant. Fencing and signs are checked and maintained on a monthly basis along with the cover and pond. The restrictive covenant, which limits the use of the Site, was recorded and is in place. These limitations include: maintenance of fences and signs; industrial use only; limitations on groundwater withdrawal and use; and restrictions on activities which would interfere with the performance of the remedy. These institutional controls have proven effective in limiting exposure and protecting the integrity of the remedy.

Groundwater contaminant concentrations have been monitored quarterly since June 1997 at four Site monitoring wells (Figure 2). Fluoride has been below cleanup levels throughout this review period at wells MW4, MW5, and MW6 (Figure 3, Table 1). MW3 has shown two detections exceeding cleanup levels. A statistical analysis of fluoride data at this well shows that the data is lognormal, and the upper one-sided 95% confidence limit (0.69 mg/L) does not exceed the cleanup level (0.96 mg/L). Additionally, no single sample concentration is greater than two times the cleanup level, and less than 10% of the sample concentrations exceed the cleanup level. (Tables 1 through 4) Therefore, the cleanup level for fluoride in groundwater at the Site has been achieved, and fluoride can be removed from future monitoring events.

Chloride has been below cleanup levels throughout this review period at MW3, MW4, and MW6 (Figure 4, Table 2). However, chloride has exceeded the cleanup level in 15 of 20 samples at MW5 during this evaluation period. A statistical analysis of chloride data at this well shows the data is lognormal, and the upper one-sided 95% confidence limit (617.1 mg/L) exceeds the cleanup level (250 mg/L), indicating the well has not yet achieved cleanup levels. However, the Mann-Kendall statistical test shows a slightly decreasing trend in chloride concentrations.

Nitrate was below cleanup levels throughout this review period at MW4 and MW6 (Figure 5, Table 3). The cleanup level was exceeded in 3 of 14 samples in MW3, and in 11 of 20 samples in MW5. The trend is decreasing at MW3 and slightly increasing at MW5. This represents an improvement since the last periodic review.

Nitrite has had more detections at all wells as compared to the last periodic review, including multiple exceedances at wells MW4, MW5, and MW6 (Figure 6, Table 4). The exceedances are frequently interspersed with non-detections, including a one year period with no detections at any wells between October 2010 and October 2011. Trends at these wells are unclear and unpredictable. However, the magnitude of the exceedances is not great; the maximum concentration is only 1.8 mg/L (cleanup level 1 mg/L).

Overall, contaminant concentrations are showing improvements.

3.4 New scientific information for individual hazardous substances or mixtures present at the Site

No new scientific information is available for chloride, nitrate, nitrite, or fluoride.

3.5 New applicable state and federal laws for hazardous substances present at the Site

No new federal or state laws exist that would apply to contaminants at the Site.

3.6 Current and projected Site and resource uses

The Site is currently vacant. Trespassing is discouraged by the presence of a chain-link fence at the Site perimeter. Regular Site inspections indicate the fencing does keep trespassers off the Site.

No change in land use is currently projected for the Site. When the CAP was originally written, it was anticipated a freeway would be built very near the Site. Accommodations were made during the design for rerouting train tracks and other issues specific to the freeway corridor. Work on this freeway has now started, and it is expected to reach areas proximal to the Site in the next five years. Initial conversations have begun with Washington State Department of Transportation (WDOT) representatives to ensure that freeway-related work will not impact the protectiveness of the cleanup action. If any work may impact the cleanup action, Ecology will work closely with WDOT and BNSF to ensure human health and the environment remain protected. Additional public outreach work would be performed for any plans that may change the cleanup action.

3.7 The availability and practicability of more permanent remedies

A “permanent” cleanup action is defined in MTCA as a cleanup action in which cleanup standards can be met without further action being required. Several remedial alternatives were evaluated in the CAP. Of these, the only remedy evaluated that would be more permanent would be removal and off-site disposal. No new technologies have been developed since the CAP that would be more permanent.

3.8 THE AVAILABILITY OF IMPROVED ANALYTICAL TECHNIQUES TO EVALUATE COMPLIANCE WITH CLEANUP LEVELS

No improved analytical techniques are available.

4.0 CONCLUSIONS

Ecology has determined the remedy at the Aluminum Recycling Corporation Site is generally protective of human health and the environment. The measures that were taken for the original cleanup action remain protective today. Continued inspections ensure the cap remains functioning, and compliance monitoring allows for groundwater impacts and trends to be measured. The existence of institutional controls in the form of deed restrictions confirms Site uses will remain consistent with the presence of contamination. Further periodic reviews will be required as long as institutional controls are in place at the Site, in accordance with WAC 173-340-420(7).

5.0 REFERENCES CITED

Washington State Department of Ecology, 2001, Model Toxics Cleanup Act Regulation Chapter 173-340 WAC

FIGURES

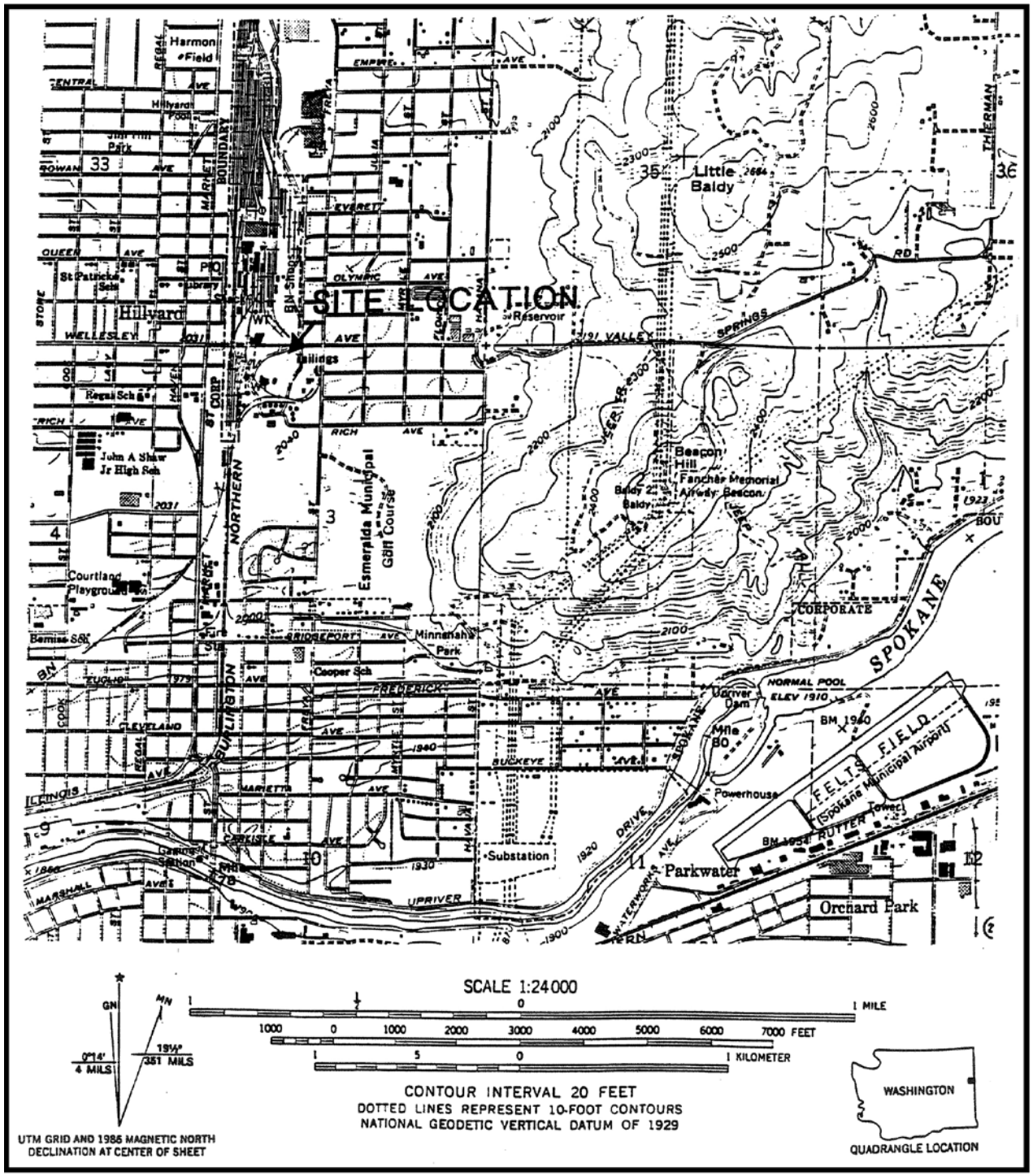


Figure 1. Site Map

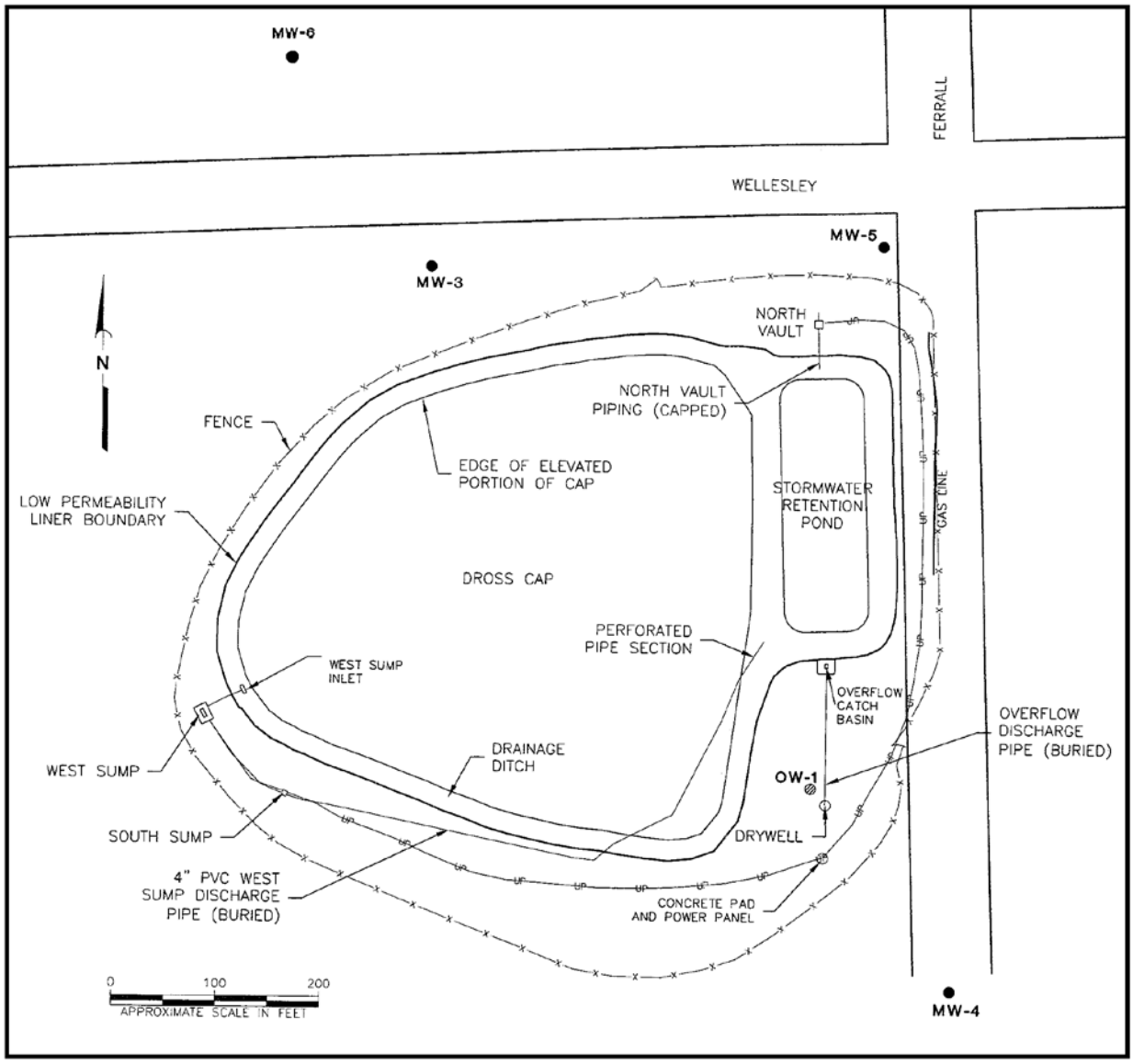


Figure 2. Well Locations and Final Site Configuration

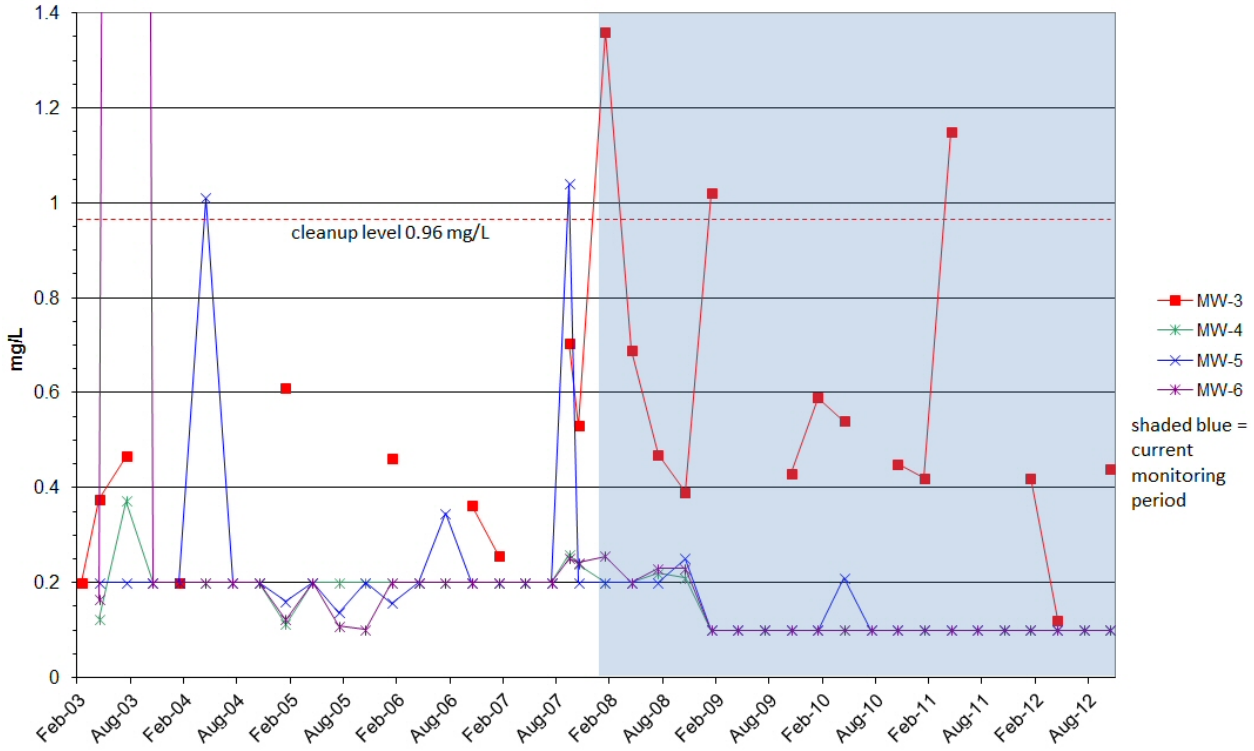


Figure 3. Fluoride Concentrations

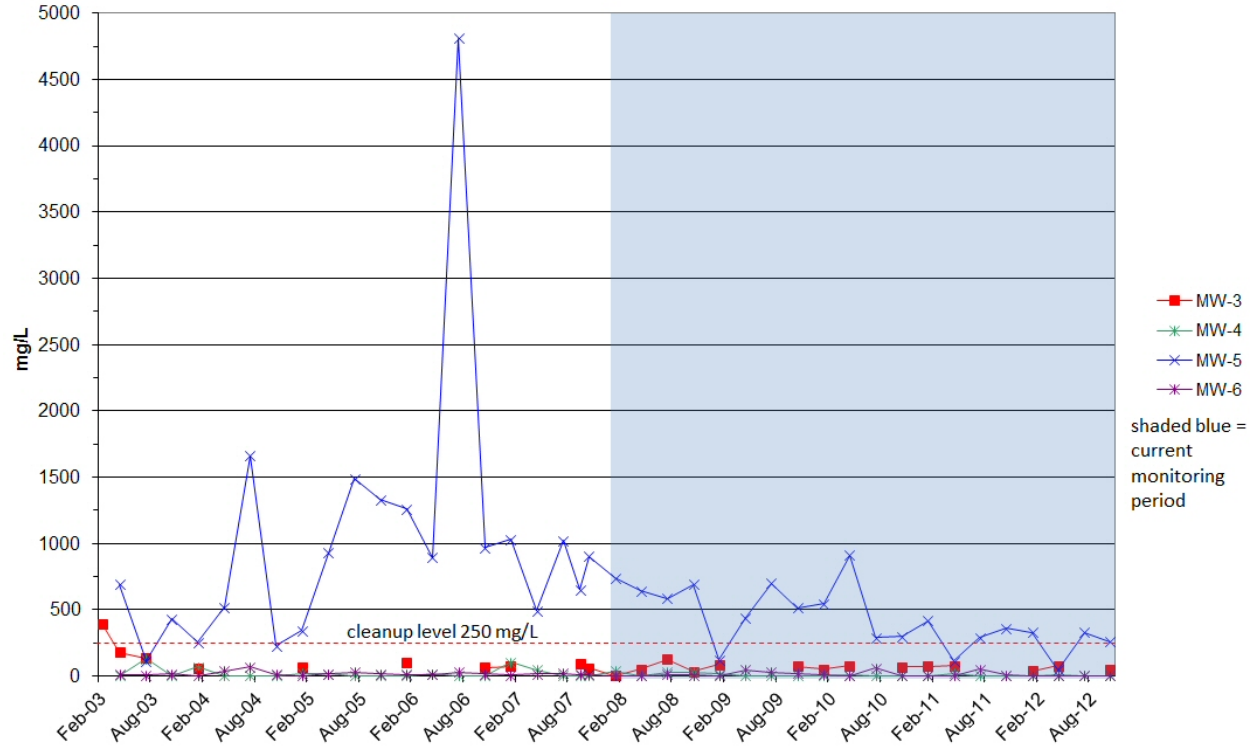


Figure 4. Chloride Concentrations

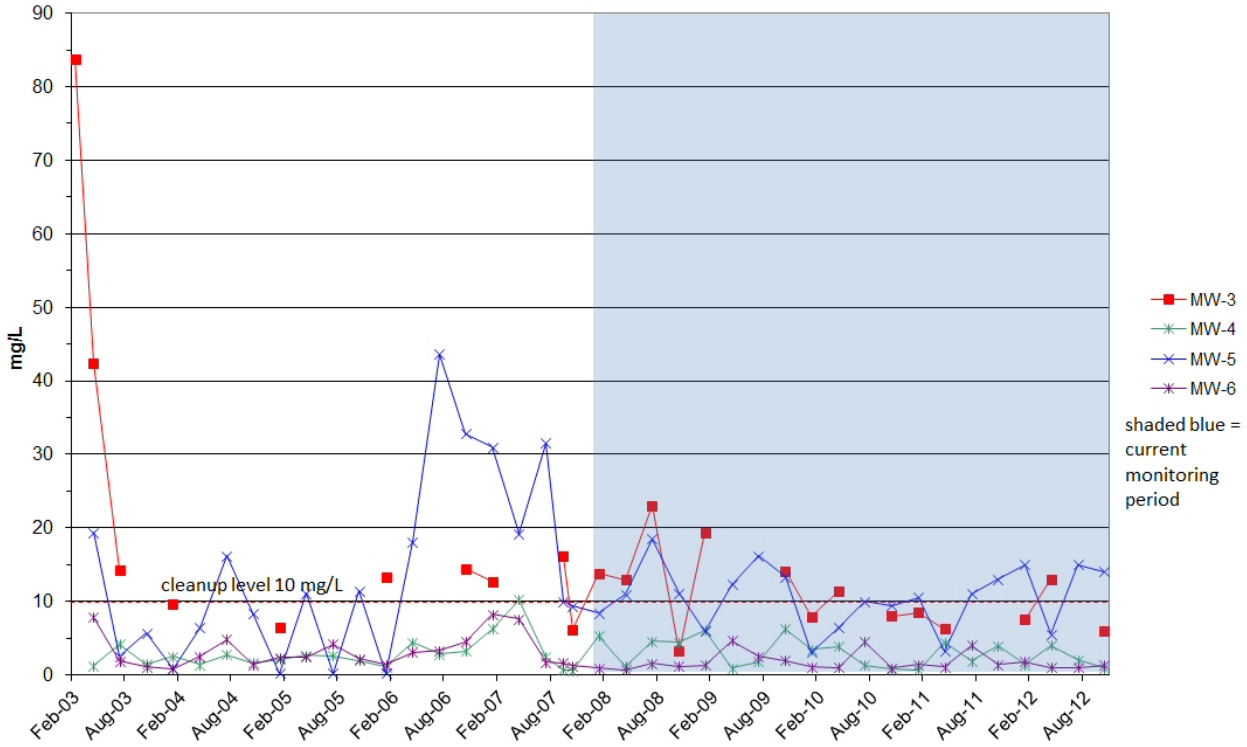


Figure 5. Nitrate Concentrations

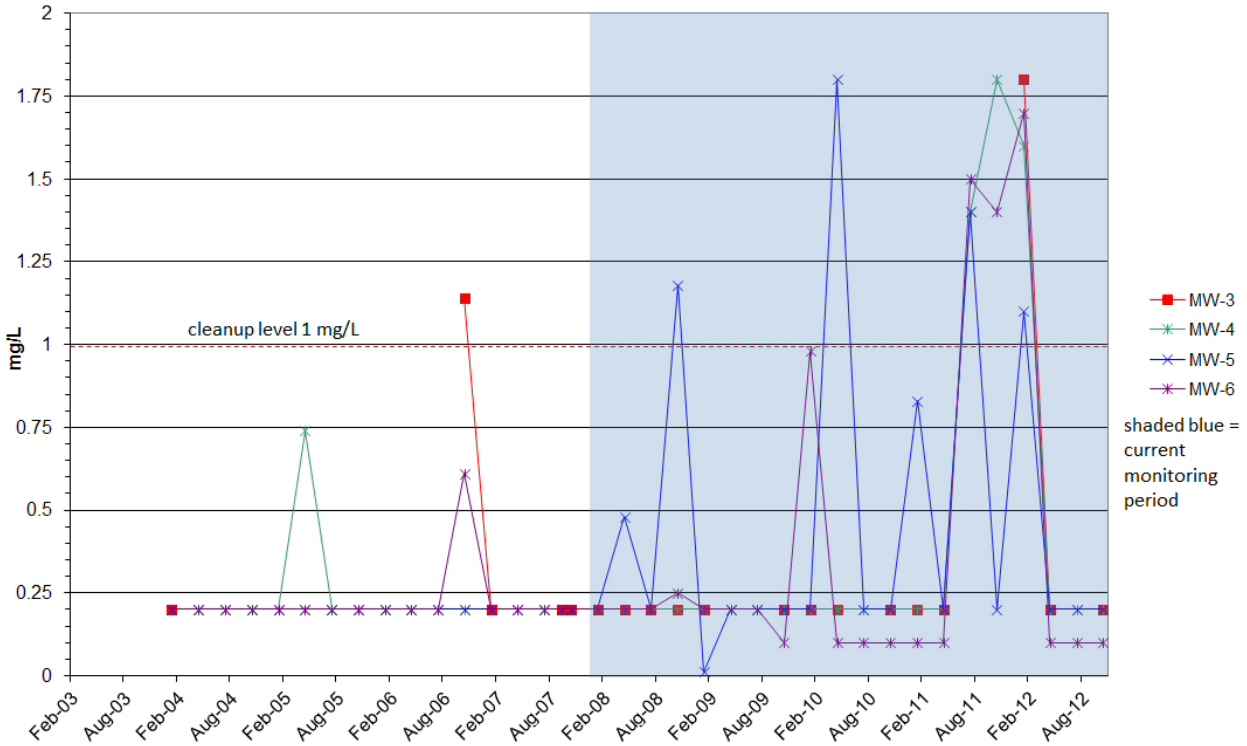


Figure 6. Nitrite Concentrations

TABLES

Date	Fluoride	Chloride	Nitrate	Nitrite
1/30/2008	0.43	74.5	14.1	0.2
4/22/2008	0.59	53.8	7.9	0.2
7/23/2008	0.54	80.6	11.3	0.2
10/22/2008	NS	NS	NS	NS
1/29/2009	0.45	68.2	7.95	0.2
4/28/2009	0.42	74.2	8.44	0.2
7/9/2009	1.15	77.1	6.24	0.2
10/29/2009	NS	NS	NS	NS
1/19/2010	NS	NS	NS	NS
4/7/2010	0.42	40	7.5	1.8
7/27/2010	0.12	77	13	0.2
10/20/2010	NS	NS	NS	NS
1/18/2011	0.44	51	6	0.2
4/21/2011	1.2	35	4.2	0.2
7/14/2011	0.41	39	6.9	0.2
10/6/2011	NS	NS	NS	NS
1/24/2012	0.31	71	9.7	0.2
4/10/2012	0.38	60	5.1	0.2
7/11/2012	0.26	57	9.5	0.2
10/30/2012	NS	NS	NS	NS

NS = not sampled

Table 1. MW3 Groundwater Results

Date	Fluoride	Chloride	Nitrate	Nitrite
1/30/2008	0.1	4.7	6.25	0.2
4/22/2008	0.1	3.98	3.49	0.2
7/23/2008	0.1	7.32	3.86	0.2
10/22/2008	0.1	2.75	1.28	0.2
1/29/2009	0.1	2.59	0.78	0.2
4/28/2009	0.1	2.5	0.68	0.2
7/9/2009	0.1	19.3	4.42	0.2
10/29/2009	0.1	2.7	1.9	1.4
1/19/2010	0.1	5.6	3.9	1.8
4/7/2010	0.1	3.2	1.4	1.6
7/27/2010	0.1	7.8	4	0.2
10/20/2010	0.1	2.7	2	0.2
1/18/2011	0.1	2.6	0.9	0.2
4/21/2011	0.21	2.4	0.9	0.2
7/14/2011	0.1	3.8	1.6	0.2
10/6/2011	0.1	4.3	2.4	0.2
1/24/2012	0.1	3.6	2.3	0.2
4/10/2012	0.1	3	1	1.3
7/11/2012	0.1	4.7	2.7	0.2
10/30/2012	0.1	2.8	2.4	0.2

NS = not sampled

Table 2. MW4 Groundwater Results

Date	Fluoride	Chloride	Nitrate	Nitrite
1/30/2008	0.1	513	13.3	0.2
4/22/2008	0.1	546	3.05	0.2
7/23/2008	0.21	914	6.36	1.8
10/22/2008	0.1	292	10	0.2
1/29/2009	0.1	298	9.43	0.2
4/28/2009	0.1	417	10.5	0.83
7/9/2009	0.1	112	3.2	0.2
10/29/2009	0.1	290	11	1.4
1/19/2010	0.1	360	13	0.2
4/7/2010	0.1	330	15	1.1
7/27/2010	0.1	48	5.5	0.2
10/20/2010	0.1	330	15	0.2
1/18/2011	0.1	260	14	0.2
4/21/2011	0.1	370	11	0.2
7/14/2011	0.1	1500	24	0.2
10/6/2011	0.1	320	8.2	0.2
1/24/2012	0.1	240	13	0.2
4/10/2012	0.1	150	6.7	0.2
7/11/2012	0.1	680	14	0.6
10/30/2012	0.1	69	1.3	0.6

NS = not sampled

Table 3. MW5 Groundwater Results

Date	Fluoride	Chloride	Nitrate	Nitrite
1/30/2008	0.1	19.2	1.98	0.1
4/22/2008	0.1	14.4	1.04	0.98
7/23/2008	0.1	2.47	1.02	0.1
10/22/2008	0.1	61.8	4.45	0.1
1/29/2009	0.1	5.32	0.88	0.1
4/28/2009	0.1	3.49	1.36	0.1
7/9/2009	0.1	2.89	1.08	0.1
10/29/2009	0.1	51	4	1.5
1/19/2010	0.1	9.7	1.4	1.4
4/7/2010	0.1	4.8	1.8	1.7
7/27/2010	0.1	2.7	1	0.1
10/20/2010	0.1	4.5	1	0.1
1/18/2011	0.1	5.7	1.3	0.1
4/21/2011	0.1	2.7	1	0.1
7/14/2011	0.16	4.1	1.4	0.1
10/6/2011	0.1	25	6.8	0.1
1/24/2012	0.1	5.8	1.1	0.1
4/10/2012	0.1	6.9	1.7	1.2
7/11/2012	0.1	2.7	0.2	1.2
10/30/2012	0.1	31	4.8	0.1

NS = not sampled

Table 4. MW6 Groundwater Results

Appendix B

Well Redevelopment and Monitoring Well Sampling Field Logs

Monitoring Well Sampling Field Log

SPOKANE ENVIRONMENTAL SOLUTIONS

Well Number: MW-4

Date: 4/23/19

Project Information	
Project Name:	BNSF Hillyard Jross
Project Number:	119611-4

Sampling Information	
Field Team:	Fbio
Purge Method:	Low Flow
Sampling Method:	Low Flow
Water Quality Meter:	Model: U-52
	Serial Number:
Purge Water Disposition:	

Comments

Well Construction Information

Stick-up or Flush	Well Diameter (in)	Total Depth (ft btoc)	Screen Interval (ft bgs or btoc)
	2		

Monitoring Information

Initial DTW (ft btoc)	Saturated Screen Interval (ft bgs or btoc)	Pump Intake Depth (ft btoc): (Mid Sat. Screen Interval)
171.19		

Sample Containers

Number	Type	Preservative	Analytical Parameters	Filtered?

Well Purge Data

Time	Volume Purged (L)	Purge Rate (L/min) (<0.5 L/min)	DTW (ft btoc)	Temp. (°C)	Conductivity (uS/cm) ms/cm	D.O. (mg/L)	pH	ORP (mV)	Turbidity (NTUs)	Clarity/Color/ Remarks
	Pump On		Initial	-	±3%	±10%	±0.1	±10mv	±10%	<= Stabilization Criteria
12:15	3.0	0.250		16.06	0.450	2.87	8.12	211	0.0	
12:20		(		12.85	0.478	2.19	8.16	209	0.0	
12:25				12.42	0.398	1.53	8.12	208	0.0	
12:30				12:23	0.321	2.05	8.16	207	0.0	
12:35				12.17	0.295	2.23	8.30	211	0.0	

Start Sampling	12:55	Sample ID:	Sample Time:
End Sampling	12:40	QA/QC Sample ID:	QA/QC Sample Time:

Note: bgs= below ground surface btoc=below top of casing DTW=depth to water
Clarity: VC=very cloudy Cl=cloudy SC=slightly cloudy AC=almost clear C=clear CC=crystal clear

HD-MW4-042319 12:35

Monitoring Well Sampling Field Log

SPOKANE ENVIRONMENTAL SOLUTIONS

Well Number: MW-5

Date: 4/23/19

Project Information	
Project Name:	BNSF Hillyard Dross
Project Number:	1996114

Sampling Information	
Field Team:	Flavio
Purge Method:	Low Flow
Sampling Method:	Low Flow
Water Quality Meter:	Model: U-52
	Serial Number:
Purge Water Disposition:	

Comments

Well Construction Information

Stick-up or Flush	Well Diameter (in)	Total Depth (ft btoc)	Screen Interval (ft bgs or btoc)
	2		

Monitoring Information

Initial DTW (ft btoc)	Saturated Screen Interval (ft bgs or btoc)	Pump Intake Depth (ft btoc): (Mid Sat. Screen Interval)
174.72		

Sample Containers

Number	Type	Preservative	Analytical Parameters	Filtered?
2				

Well Purge Data

Time	Volume Purged (L)	Purge Rate (L/min) (<0.5 L/min)	DTW (ft btoc)	Temp. (°C)	Conductivity (µS/cm) ~~mS/cm~~	D.O. (mg/L)	pH	ORP (mV)	Turbidity (NTUs)	Clarity/Color/ Remarks
	Pump On		Initial	-	±3%	±10%	±0.1	±10mv	±10%	<= Stabilization Criteria
11:15	2	.250		12.83	4.94	2.92	7.66	224	4.0	
11:20		"		12.70	3.91	2.61	7.71	226	4.0	
11:25		"		12.17	1.58	2.41	7.88	208	2.5	
11:30		⎜		11.90	1.14	1.92	7.99	204	0.2	
11:35		⎜		11.66	0.498	2.21	8.13	206	0.0	
11:40		⎜		11.84	0.461	2.19	8.14	201	0.0	
11:45		⎜		11:80	0.452	2.16	8.11	203	0.0	

Start Sampling	10:00	Sample ID:	Sample Time:
End Sampling	11:50	QA/QC Sample ID:	QA/QC Sample Time:

Note: bgs= below ground surface btoc=below top of casing DTW=depth to water
Clarity: VC=very cloudy Cl=cloudy SC=slightly cloudy AC=almost clear C=clear CC=crystal clear

HD-MW5-042319 @ 11:45

D-20190423 ~~HD-DUP-042319~~ @ 14:30

FB-20190423 @ 12:55

Monitoring Well Sampling Field Log

SPOKANE ENVIRONMENTAL SOLUTIONS

Well Number: MW-6

Date: 4/23/19

Project Information	
Project Name:	BNSF Hillyard Dross
[redacted] Project Number:	1996114

Sampling Information	
Field Team:	Flavio
Purge Method:	Low Flow
Sampling Method:	Low Flow
Water Quality Meter:	Model: U-52
	Serial Number:
Purge Water Disposition:	

Comments

Well Construction Information

Stick-up or Flush	Well Diameter (in)	Total Depth (ft btoc)	Screen Interval (ft bgs or btoc)
	2		

Monitoring Information

Initial DTW (ft btoc)	Saturated Screen Interval (ft bgs or btoc)	Pump Intake Depth (ft btoc): (Mid Sat. Screen Interval)
176.25		

Sample Containers

Number	Type	Preservative	Analytical Parameters	Filtered?
2				

Well Purge Data

Time	Volume Purged (L)	Purge Rate (L/min) (<0.5 L/min)	DTW (ft btoc)	Temp. (°C)	Conductivity (uS/cm)	D.O. (mg/L)	pH	ORP (mV)	Turbidity (NTUs)	Clarity/Color/ Remarks
	Pump On		Initial	-	±3%	±10%	±0.1	±10mv	±10%	<= Stabilization Criteria
13:10	34.0	0.250		13.25	0.231	3.50	8.26	196	10.6	
13:15				13.08	0.231	2.68	8.30	193	6.8	
13:20				13.21	0.233	2.65	8.33	194	5.4	
13:25				13.27	0.230	2.80	8.32	196	2.6	
13:30				13.50	0.230	2.58	8.32	197	2.7	
13:35				13.43	0.229	3.25	8.32	199	1.9	
13:40										

Start Sampling	12:45	Sample ID:	Sample Time:
End Sampling	13:50	QA/QC Sample ID:	QA/QC Sample Time:

Note: bgs= below ground surface btoc=below top of casing DTW=depth to water
Clarity: VC=very cloudy Cl=cloudy SC=slightly cloudy AC=almost clear C=clear CC=crystal clear

HD-MW6-042319- 13:40

pump was removed @ approx. 9:20

Hillyard Ross 4/23/19

Sunny Fair

9:12 on site

HD-MW5-042319 @ 11:45
~~#~~D20190423 @ 14:30
FB-20190423 @ 12:55
HD-MW-4-042319 @ 12:35
HD-MW6-042319 @ 13:40
HD-MW3-042319 @ 15:25

MW-6 → pump was removed @ approx 09:20 AM

sampled MW-5 while letting MW-6 ~~Rest~~ to settle Turbidity

	MONTHLY INSPECTION LOG		File Number
	Project Hillyard Dross Cap Inspection		Date 04/24/19
	Owner BNSF		Site Map on Reverse
Staff Participating Flavio Ishihara	Temperature 60°F	Arrival 11:25	
Prepared By	Weather Conditions Sunny	Departure 11:53	

SYSTEM COMPONENT		CONDITIONS GOOD	CONDITIONS BAD	Notes/Urgency	Recommended Action
Fence	Chain Link	✓			
	Barbed Wire	✓			
	Gates	✓			
Cap Soil and Vegetation	East Quadrant	✓			
	North Quadrant	✓			
	West Quadrant	✓			
	South Quadrant	✓			
Stormwater System	Pond	✓			
	W Sump/Pump	✓			
	West Sump/Level	✓			
	West Sump Intake	✓			
	Overflow Sump	✓			
	Drywell	✓			
Other Systems	Electrical	✓			
	Meter/Reading	2343			
	Monitoring Wells	✓			
	Roads	✓			

		YES	NO	Notes/Urgency	Recommended Action
Restrictive Covenant	Unauthorized Access		✓		
	Unauthorized Excavations		✓		
	Unauthorized Wells		✓		
	Unauthorized Water Withdrawls		✓		
	Unauthorized Uses/Activities		✓		

Notes

Pond overflowing into Drywell
- 2 existing 55gl Drums by entrance gate
- 1-55gl Deum containing purgewater.

Use Back for Additional Comments

Signature

Date 04/24/19

Hillyard Dross 04/30/19. PI

08:00
MW-3

8:20
Depth to water 171.40
Depth to Bottom 177 LOST probe

Probe on water level meter broke in the well

15:00 Removed Probe.

15:20 commence bailing water

16:30 : bailed 5.0 gl

commence pumping @ ~~16:45~~ 17:15
4.5 l/min
112.5.0 l
25 min

17:20
Temp 15.40°C
pH 8.06
ORP 152 mV
Cond 0.465 ms/cm
Turb * 350 NTU
DO 4.48 mg/l

17:35
Temp 13.99
pH 7.82
ORP 189
Cond 0.502
Turb 5.5 NTU
DO 3.31

17:40
Temp 13.88
pH 7.81
ORP 192
Cond 0.504
Turb 4.2
DO 3.09

END pump @ 17:40
Depth to water 171.34
to Bottom 177.12

Rite in the Rain

Summary of Well Redevelopment Field Parameters - Well MW-3
BNSF Hillyard Dross Cap, Spokane, Washington

			Initial				Initial		Development			Final		Final	
Well#	Start time	Date	Depth to water (feet btoc)	Total Depth (feet btoc)	Start Pump	Stop Pump			Time (min)	Volume (L)	Rate (L/m)			Depth to water (feet btoc)	Total Depth (feet btoc)
MW-3	8:20	04/30/19	171.40	177.00	17:15	17:40	Time	17:20	25	112.5	4.5	Time	17:40	171.34	177.12
							Temp (°C)	15.4				Temp (°C)	13.88		
							pH	8.06				pH	7.81		
							ORP (mv)	152				ORP (mv)	192		
							Cond (ms/cm)	0.465				Cond (ms/cm)	0.504		
							Turb (NTU)	350				Turb (NTU)	4.2		
							DO (mg/L)	4.48				DO (mg/L)	3.09		

Time	17:35
Temp (°C)	13.99
pH	7.82
ORP (mv)	189
Cond (ms/cm)	0.502
Turb (NTU)	5.5
DO (mg/L)	3.31

PARK WATER 5/14/19
08:00

~~MW-11~~

09:00	MW-11	63.60
09:20	MW-16	61.61
09:30	MW-4	60.12
09:50	MW-7	61.34
10:50	MW-14	61.99
12:08	MW-19	61.39
13:15	MW-6	61.04

MW-3 Hillyard
Temp 15.21 15:00
pH 8.17
ORP 133
cond 0454
Turb 41.9 NTU
DO 6.73

purge ~~E~~ about 16:30
1.5 gallons

Only first bale comes clean

5/15/19
Hillyard Dross
8:30 MW3- samples

MW-3

HD-MW3-051519 @
9:00

Sample collected from
first bale.

end 10:00

Rite in the Rain

Appendix C

Field Methods

Appendix C

Field Methods

General

Groundwater monitoring activities completed at the Hillyard Dross Cap facility followed standard U.S. Environmental Protection Agency (EPA) low-flow methods and procedures. Procedures were consistent with those previously conducted during recent sampling events. Known deviations from the Washington State Department of Ecology (Ecology) approved sampling methods [documented in EMR's *Final Remedial Action Work Plan* (FRAWP) finalized on 22 April 2003] were related to purge water disposal, sampling equipment and methods, decontamination methods, and instrument calibration and included the following:

- Purge water was containerized within a labeled 55-gallon drum located within the fenced portion of the Site.
- Sampling was performed at monitoring wells MW-4 through MW-6 using low-flow sampling methods and dedicated bladder pumps.
- Instrument calibration was performed consistent with manufacturer's recommendations, rather than with the procedures detailed in the FRAWP.

Groundwater Elevations

Depths to groundwater were measured relative to the monitoring well casing rims using an electronic water level indicator. Prior to groundwater sample collection, water level measurements were collected from each well. After removing the well cap, sufficient time was allowed for the water level to equilibrate with the ambient air pressure. Prior to water level measuring, the existing reference point on the well casing was determined. A water level indicator probe was slowly lowered into the well until the sound from the indicator was audible. The probe was then slowly pulled out a few inches, and dropped back down at smaller increments until the water level could be determined to within 0.01 foot. The water level was measured based on an existing reference point on the well casing. Following sampling activities, the total depth of the well was then measured and recorded to the nearest 0.01 foot by allowing the measuring tape to contact the base of the well. The probe of the water level indicator was decontaminated between wells with a detergent wash, a tap water rinse, and a distilled water rinse. Groundwater table elevations were calculated by subtracting the depth to the groundwater table from the casing rim elevations. Groundwater table elevations measured during this reporting period are presented in the report.

Groundwater Sampling

Groundwater purging and sampling was performed consistent with EPA's low-flow groundwater sampling procedure, as described in EPA (1996) and Puls and Barcelona (1996). Dedicated submersible bladder pumps, outfitted with dedicated Teflon-lined tubing, were used for groundwater purging and sampling. During purging activities, water quality parameters, including pH, conductivity, temperature, turbidity, and oxidation-reduction potential and dissolved oxygen, were measured using a YSI 556 MPS multi-parameter meter equipped with a flow-through cell and recorded. The meter was calibrated on a daily basis in a manner consistent with manufacturer procedures. Groundwater samples were collected after 1) water quality parameters had stabilized or 2) a maximum purge time of 1 hour was achieved. During purging and sampling, drawdown was not allowed to exceed 0.3 foot and purge rate was not allowed to exceed 400 milliliters per minute.

Water quality parameter stabilization criteria include the following:

- Turbidity: ±10 percent for values greater than 5 nephelometric turbidity units (NTU)
- Dissolved oxygen: ±10 percent
- Conductivity: ±3 percent
- pH: ±0.1 unit
- Temperature: ±3 percent.

After groundwater quality stabilization criteria were satisfied, the pump's discharge tubing was disconnected from the flow-through cell and groundwater samples were collected for analysis of the following compounds in the following order: chloride, nitrate-nitrogen, and nitrite-nitrogen. Each sample was decanted into sample containers supplied by the analytical laboratory. Groundwater samples collected for chemical analysis were kept cool during onsite storage and transport to the analytical laboratory. Chain-of-custody procedures were observed during transport of the groundwater samples.

Monitoring well MW-3 not sampled as insufficient groundwater was present.

Purge water was retained in a labeled 55-gallon drum stored within the fenced portion of the Site.

References

Puls, R.W. and Barcelona, M.J. 1996. Low-flow (minimal drawdown) ground-water sampling procedures: EPA Ground Water Issue, April, pp. 1-9.

U.S. Environmental Protection Agency. Region 1. 1996. Low stress (low-flow) purging and sampling procedure for the collection of ground water samples from monitoring wells. EPA SOP No. GW 0001, Revision No. 2. July 30, 1996.

Appendix D

Laboratory Analytical Report

DATA VALIDATION SUMMARY
BNSF Hillyard Dross

Laboratory Reports included in Data Validation	Dates	Sample IDs
Laboratory: ESC SDG: L1091941 Analyses: Anions	**Report Date:** 4/26/2019 **Sample Dates:** 4/23/2019 **Validation Date:** 6/5/2019	Aqueous Samples: HD-MW4-042319, HD-MW5-042319, HD-MW6-042319 Field Duplicates: D-20190423 (duplicate of HD-MW5-042319) Field Blank: FB-20190423 Trip Blank: Not Collected

Criteria	(Yes or No)	Comment
Chain-of-Custody (COC) – Chain-of-custody protocol followed?	Yes	
Temperature Blank – Sample temperature criteria met?	Yes	
Holding times – Samples analyzed within specified holding time?	Yes	
Laboratory method blank samples – Analytes present in method blank samples?	Yes	See note.
Field/Equipment blank samples – Analytes present in field/equipment blank samples?	No	
Trip blank samples – Analytes present in trip blank samples?	NA	
Matrix Spikes (MS)/Matrix Spike Duplicate (MSD) samples – Control limits met?	Yes	
Surrogate percent recoveries – Control limits met?	Yes	
Laboratory Control Sample (LCS) – Control limits met?	Yes	
Laboratory duplicate samples (if applicable) – Control limits met?	Yes	
Field duplicate samples (if submitted) – Relative percent differences within control limits?	Yes	
Other Issues?	No	See note.

Temperature Note: Samples arrived at a temperature of 0.6 degrees Celsius (°C) which was within the recommended temperature of 0- 6°C.
Method Blank Note: Nitrate was detected in the method blank in batch WG1271082. The associated results are much higher than the concentration detected in the method blank, so no action was taken.
Other Note: Sample HD-MW3-032319 was included on the COC but not analyzed based on communication with project staff, no action was taken.
Samples were collected for analysis by Method 353.2 as a backup to be analyzed in the event that the holding time for Method 300.0 could not be met. These samples were not analyzed.
SUMMARY
Overall, the findings with respect to the quality assurance/quality control (QA/QC) data do not adversely affect the use of the analytical results.

DATA VALIDATION SUMMARY
BNSF Hillyard Dross

Laboratory Reports included in Data Validation	Dates	Sample IDs
Laboratory: ESC SDG: L1099353 Analyses: Anions	**Report Date:** 5/29/2019 **Sample Dates:** 5/15/2019 **Validation Date:** 6/10/2019	Aqueous Samples: HD-MW3-051519 Field Duplicates: Not Collected. Field Blank: Not Collected. Trip Blank: Not Collected

Criteria	(Yes or No)	Comment
Chain-of-Custody (COC) – Chain-of-custody protocol followed?	Yes	
Temperature Blank – Sample temperature criteria met?	Yes	
Holding times – Samples analyzed within specified holding time?	Yes	
Laboratory method blank samples – Analytes present in method blank samples?	No	
Field/Equipment blank samples – Analytes present in field/equipment blank samples?	NA	Not collected.
Trip blank samples – Analytes present in trip blank samples?	NA	Not collected.
Matrix Spikes (MS)/Matrix Spike Duplicate (MSD) samples – Control limits met?	Yes	
Surrogate percent recoveries – Control limits met?	NA	
Laboratory Control Sample (LCS) – Control limits met?	Yes	
Laboratory duplicate samples (if applicable) – Control limits met?	Yes	
Field duplicate samples (if submitted) – Relative percent differences within control limits?	NA	Not collected.
Other Issues?	No	See note.

Temperature Note: Samples arrived at a temperature of 4.0 degrees Celsius (°C) which was within the recommended temperature of 0- 6°C.
Other Note: A sample was collected for analysis by Method 353.2 as a backup to be analyzed in the event that the holding time for Method 300.0 could not be met. This samples was not analyzed.
SUMMARY
Overall, the findings with respect to the quality assurance/quality control (QA/QC) data do not adversely affect the use of the analytical results.

Pace Analytical®
National Center for Testing & Innovation

ANALYTICAL REPORT

April 26, 2019

Kennedy/Jenks Con-BNSF Region 1

Sample Delivery Group:	L1091941
Samples Received:	04/24/2019
Project Number:	1996114-00
Description:	BNSF Hillyard Dross

Report To: Diane Tackett
32001 32nd Ave S.
Suite 100
Federal Way, WA 98001

Entire Report Reviewed By:

Mark W. Beasley
Project Manager

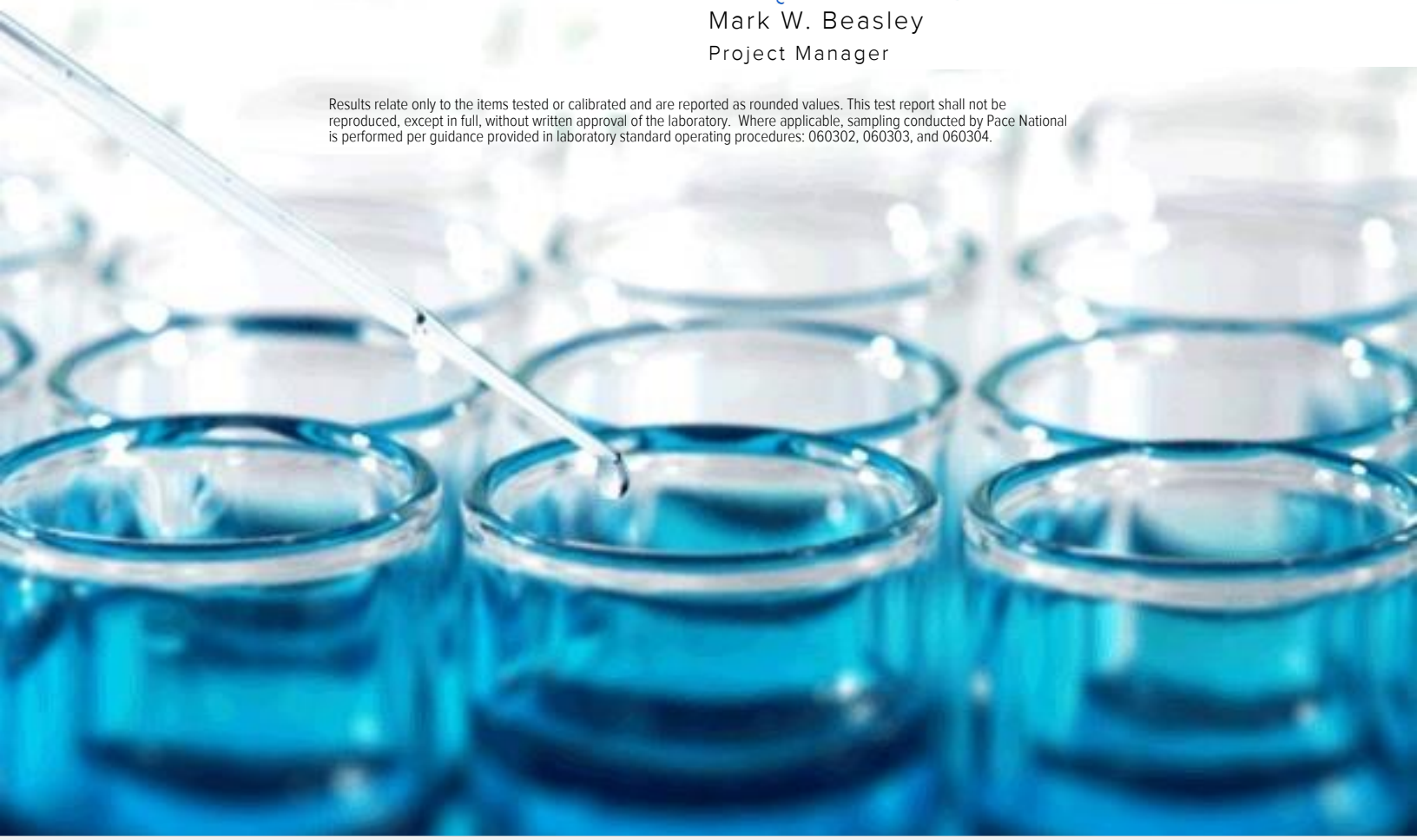


TABLE OF CONTENTS

HD-MW4-042319 L1091941-01 WW

Collected by: Flavio | Collected date/time: 04/23/19 12:35 | Received date/time: 04/24/19 08:45

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Wet Chemistry by Method 300.0	WG1271082	1	04/24/19 21:01	04/24/19 21:01	ST	Mt. Juliet, TN

HD-MW5-042319 L1091941-02 WW

Collected by: Flavio | Collected date/time: 04/23/19 11:45 | Received date/time: 04/24/19 08:45

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Wet Chemistry by Method 300.0	WG1271082	1	04/24/19 21:16	04/24/19 21:16	ST	Mt. Juliet, TN

D-20190423 L1091941-03 WW

Collected by: Flavio | Collected date/time: 04/23/19 14:30 | Received date/time: 04/24/19 08:45

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Wet Chemistry by Method 300.0	WG1271082	1	04/24/19 21:30	04/24/19 21:30	ST	Mt. Juliet, TN

FB-20190423 L1091941-04 WW

Collected by: Flavio | Collected date/time: 04/23/19 12:55 | Received date/time: 04/24/19 08:45

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Wet Chemistry by Method 300.0	WG1271082	1	04/24/19 21:44	04/24/19 21:44	ST	Mt. Juliet, TN

HD-MW6-042319 L1091941-05 WW

Collected by: Flavio | Collected date/time: 04/23/19 13:40 | Received date/time: 04/24/19 08:45

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Wet Chemistry by Method 300.0	WG1271082	1	04/24/19 22:28	04/24/19 22:28	ST	Mt. Juliet, TN

All sample aliquots were received at the correct temperature, in the proper containers, with the appropriate preservatives, and within method specified holding times, unless qualified or notated within the report. Where applicable, all MDL (LOD) and RDL (LOQ) values reported for environmental samples have been corrected for the dilution factor used in the analysis. All Method and Batch Quality Control are within established criteria except where addressed in this case narrative, a non-conformance form or properly qualified within the sample results. By my digital signature below, I affirm to the best of my knowledge, all problems/anomalies observed by the laboratory as having the potential to affect the quality of the data have been identified by the laboratory, and no information or data have been knowingly withheld that would affect the quality of the data.

Mark W. Beasley
Project Manager

Wet Chemistry by Method 300.0

Analyte	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch
	ug/l		ug/l	ug/l		date / time	
Chloride	5190		51.9	1000	1	04/24/2019 21:01	WG1271082
Nitrate	1840		22.7	100	1	04/24/2019 21:01	WG1271082
Nitrite	U		27.7	100	1	04/24/2019 21:01	WG1271082

Wet Chemistry by Method 300.0

Analyte	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch
	ug/l		ug/l	ug/l		date / time	
Chloride	17000		51.9	1000	1	04/24/2019 21:16	WG1271082
Nitrate	3840		22.7	100	1	04/24/2019 21:16	WG1271082
Nitrite	U		27.7	100	1	04/24/2019 21:16	WG1271082

Wet Chemistry by Method 300.0

Analyte	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch
	ug/l		ug/l	ug/l		date / time	
Chloride	16800		51.9	1000	1	04/24/2019 21:30	WG1271082
Nitrate	3830		22.7	100	1	04/24/2019 21:30	WG1271082
Nitrite	U		27.7	100	1	04/24/2019 21:30	WG1271082

Wet Chemistry by Method 300.0

Analyte	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch
	ug/l		ug/l	ug/l		date / time	
Chloride	U		51.9	1000	1	04/24/2019 21:44	WG1271082
Nitrate	U		22.7	100	1	04/24/2019 21:44	WG1271082
Nitrite	U		27.7	100	1	04/24/2019 21:44	WG1271082

Wet Chemistry by Method 300.0

Analyte	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch
	ug/l		ug/l	ug/l		date / time	
Chloride	4370		51.9	1000	1	04/24/2019 22:28	WG1271082
Nitrate	1340		22.7	100	1	04/24/2019 22:28	WG1271082
Nitrite	U		27.7	100	1	04/24/2019 22:28	WG1271082

Method Blank (MB)

(MB) R3405147-1 04/24/19 16:57

Analyte	MB Result ug/l	MB Qualifier	MB MDL ug/l	MB RDL ug/l
Chloride	U		51.9	1000
Nitrate	26.3	J	22.7	100
Nitrite	U		27.7	100

L1091917-03 Original Sample (OS) • Duplicate (DUP)

(OS) L1091917-03 04/24/19 18:23 • (DUP) R3405147-3 04/24/19 18:37

Analyte	Original Result ug/l	DUP Result ug/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Chloride	8410	8430	1	0.285		20
Nitrate	893	900	1	0.714		20
Nitrite	ND	0.000	1	0.000		20

L1091941-04 Original Sample (OS) • Duplicate (DUP)

(OS) L1091941-04 04/24/19 21:44 • (DUP) R3405147-6 04/24/19 21:59

Analyte	Original Result ug/l	DUP Result ug/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Chloride	U	0.000	1	0.000		20
Nitrate	U	0.000	1	0.000		20
Nitrite	U	0.000	1	0.000		20

Laboratory Control Sample (LCS)

(LCS) R3405147-2 04/24/19 17:12

Analyte	Spike Amount ug/l	LCS Result ug/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
Chloride	40000	40200	101	90.0-110	
Nitrate	8000	8290	104	90.0-110	
Nitrite	8000	8030	100	90.0-110	

L1091917-03 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1091917-03 04/24/19 18:23 • (MS) R3405147-4 04/24/19 18:51 • (MSD) R3405147-5 04/24/19 19:06

Analyte	Spike Amount ug/l	Original Result ug/l	MS Result ug/l	MSD Result ug/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Chloride	50000	8410	58800	58300	101	99.7	1	80.0-120			0.943	20
Nitrate	5000	893	5880	5830	99.6	98.7	1	80.0-120			0.777	20
Nitrite	5000	ND	5130	5080	103	102	1	80.0-120			1.06	20

L1091941-04 Original Sample (OS) • Matrix Spike (MS)

(OS) L1091941-04 04/24/19 21:44 • (MS) R3405147-7 04/24/19 22:13

Analyte	Spike Amount ug/l	Original Result ug/l	MS Result ug/l	MS Rec. %	Dilution	Rec. Limits %	MS Qualifier
Chloride	50000	U	50700	101	1	80.0-120	
Nitrate	5000	U	5050	101	1	80.0-120	
Nitrite	5000	U	5140	103	1	80.0-120	

Guide to Reading and Understanding Your Laboratory Report

The information below is designed to better explain the various terms used in your report of analytical results from the Laboratory. This is not intended as a comprehensive explanation, and if you have additional questions please contact your project representative.

Abbreviations and Definitions

MDL	Method Detection Limit.
ND	Not detected at the Reporting Limit (or MDL where applicable).
RDL	Reported Detection Limit.
Rec.	Recovery.
RPD	Relative Percent Difference.
SDG	Sample Delivery Group.
U	Not detected at the Reporting Limit (or MDL where applicable).
Analyte	The name of the particular compound or analysis performed. Some Analyses and Methods will have multiple analytes reported.
Dilution	If the sample matrix contains an interfering material, the sample preparation volume or weight values differ from the standard, or if concentrations of analytes in the sample are higher than the highest limit of concentration that the laboratory can accurately report, the sample may be diluted for analysis. If a value different than 1 is used in this field, the result reported has already been corrected for this factor.
Limits	These are the target % recovery ranges or % difference value that the laboratory has historically determined as normal for the method and analyte being reported. Successful QC Sample analysis will target all analytes recovered or duplicated within these ranges.
Original Sample	The non-spiked sample in the prep batch used to determine the Relative Percent Difference (RPD) from a quality control sample. The Original Sample may not be included within the reported SDG.
Qualifier	This column provides a letter and/or number designation that corresponds to additional information concerning the result reported. If a Qualifier is present, a definition per Qualifier is provided within the Glossary and Definitions page and potentially a discussion of possible implications of the Qualifier in the Case Narrative if applicable.
Result	The actual analytical final result (corrected for any sample specific characteristics) reported for your sample. If there was no measurable result returned for a specific analyte, the result in this column may state “ND” (Not Detected) or “BDL” (Below Detectable Levels). The information in the results column should always be accompanied by either an MDL (Method Detection Limit) or RDL (Reporting Detection Limit) that defines the lowest value that the laboratory could detect or report for this analyte.
Uncertainty (Radiochemistry)	Confidence level of 2 sigma.
Case Narrative (Cn)	A brief discussion about the included sample results, including a discussion of any non-conformances to protocol observed either at sample receipt by the laboratory from the field or during the analytical process. If present, there will be a section in the Case Narrative to discuss the meaning of any data qualifiers used in the report.
Quality Control Summary (Qc)	This section of the report includes the results of the laboratory quality control analyses required by procedure or analytical methods to assist in evaluating the validity of the results reported for your samples. These analyses are not being performed on your samples typically, but on laboratory generated material.
Sample Chain of Custody (Sc)	This is the document created in the field when your samples were initially collected. This is used to verify the time and date of collection, the person collecting the samples, and the analyses that the laboratory is requested to perform. This chain of custody also documents all persons (excluding commercial shippers) that have had control or possession of the samples from the time of collection until delivery to the laboratory for analysis.
Sample Results (Sr)	This section of your report will provide the results of all testing performed on your samples. These results are provided by sample ID and are separated by the analyses performed on each sample. The header line of each analysis section for each sample will provide the name and method number for the analysis reported.
Sample Summary (Ss)	This section of the Analytical Report defines the specific analyses performed for each sample ID, including the dates and times of preparation and/or analysis.

Qualifier	Description
J	The identification of the analyte is acceptable; the reported value is an estimate.

Pace National is the only environmental laboratory accredited/certified to support your work nationwide from one location. One phone call, one point of contact, one laboratory. No other lab is as accessible or prepared to handle your needs throughout the country. Our capacity and capability from our single location laboratory is comparable to the collective totals of the network laboratories in our industry. The most significant benefit to our one location design is the design of our laboratory campus. The model is conducive to accelerated productivity, decreasing turn-around time, and preventing cross contamination, thus protecting sample integrity. Our focus on premium quality and prompt service allows us to be YOUR LAB OF CHOICE.
* Not all certifications held by the laboratory are applicable to the results reported in the attached report.
* Accreditation is only applicable to the test methods specified on each scope of accreditation held by Pace National.

State Accreditations

Alabama	40660	Nebraska	NE-OS-15-05
Alaska	17-026	Nevada	TN-03-2002-34
Arizona	AZ0612	New Hampshire	2975
Arkansas	88-0469	New Jersey–NELAP	TN002
California	2932	New Mexico [1]	n/a
Colorado	TN00003	New York	11742
Connecticut	PH-0197	North Carolina	Env375
Florida	E87487	North Carolina [1]	DW21704
Georgia	NELAP	North Carolina [3]	41
Georgia [1]	923	North Dakota	R-140
Idaho	TN00003	Ohio–VAP	CL0069
Illinois	200008	Oklahoma	9915
Indiana	C-TN-01	Oregon	TN200002
Iowa	364	Pennsylvania	68-02979
Kansas	E-10277	Rhode Island	LAO00356
Kentucky [1 6]	90010	South Carolina	84004
Kentucky [2]	16	South Dakota	n/a
Louisiana	AI30792	Tennessee [1 4]	2006
Louisiana [1]	LA180010	Texas	T104704245-18-15
Maine	TN0002	Texas [5]	LAB0152
Maryland	324	Utah	TN00003
Massachusetts	M-TN003	Vermont	VT2006
Michigan	9958	Virginia	460132
Minnesota	047-999-395	Washington	C847
Mississippi	TN00003	West Virginia	233
Missouri	340	Wisconsin	9980939910
Montana	CERT0086	Wyoming	A2LA

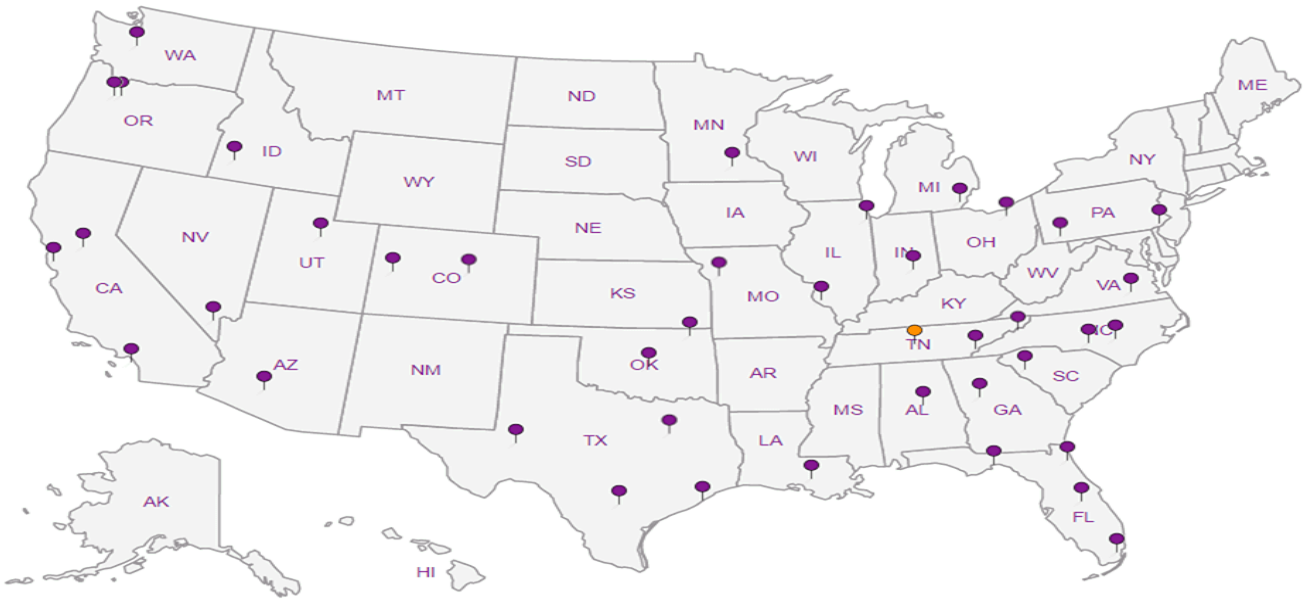
Third Party Federal Accreditations

A2LA – ISO 17025	1461.01	AIHA-LAP,LLC EMLAP	100789
A2LA – ISO 17025 [5]	1461.02	DOD	1461.01
Canada	1461.01	USDA	P330-15-00234
EPA–Crypto	TN00003		

[1] Drinking Water [2] Underground Storage Tanks [3] Aquatic Toxicity [4] Chemical/Microbiological [5] Mold [6] Wastewater n/a Accreditation not applicable

Our Locations

Pace National has sixty-four client support centers that provide sample pickup and/or the delivery of sampling supplies. If you would like assistance from one of our support offices, please contact our main office. Pace National performs all testing at our central laboratory.



Kennedy/Jenks Con-BNSF Region 1

32001 32nd Ave S.
Suite 100
Federal Way, WA 98001

Billing Information:
Accounts Payable
32001 32nd Ave. S.,Ste. 100
Federal Way, WA 98001

Report to: Diane Tackett & Alice Robinson

Email To: dianetackett@KennedyJenks.com, ryanhultgren@KennedyJenks.com,

Project Description: BNSF Hillyard Dross

City/State Collected: SPOKANE, WA

Phone: 253-835-6432
Fax:

Client Project # 19961140-00

Lab Project # BNSF1KEN-HILLYARD

Collected by (print): Flavio

Site/Facility ID #

P.O. #

Collected by (signature):

Immediately Packed on Ice N ___ Y ✓

Rush? (Lab MUST Be Notified)
___ Same Day ___ Five Day
___ Next Day ___ 5 Day (Rad Only)
___ Two Day ___ 10 Day (Rad Only)
___ Three Day

Quote #

Date Results Needed: STANDARD TA

Pres Chk

Analysis / Container / Preservative

Sample ID	Comp/Grab	Matrix *	Depth	Date	Time	No. of Cntrs	***Cl, NO2, NO3*** 125mlHDPE-NoPres	NO2NO3 250mlHDPE-H2SO4									Remarks	Sample # (lab only)
HD-MW4-042319		WW		04/23/19	12:35	2	X	X										-01
HD-MW5-042319		WW		04/23/19	11:45	2	X	X										-02
D-20190423		WW		04/23/19	14:30	2	X	X										-03
FB-20190423		WW		04/23/19	12:55	2	X	X										-04
HD-MW6-042319		WW		04/23/19	13:40	2	X	X										-05
HD-MW3-042319		WW		04/23/19	15:25	2	X	X										-06
		WW																
		WW																
		WW																

RAD SCREEN: <0.5 mR/hr

Chain of Custody Page ___ of ___

Pace Analytical® National Center for Testing & Innovation

12065 Lebanon Rd
Mount Juliet, TN 37122
Phone: 615-758-5858
Phone: 800-767-5859
Fax: 615-758-5859

L# 1091941

F161

Acctnum: BNSF1KEN
Template: T149152
Prelogin: P704334
TSR: 134 - Mark W. Beasley
PB:
Shipped Via:

* Matrix:
SS - Soil AIR - Air F - Filter
GW - Groundwater B - Bioassay
WW - WasteWater
DW - Drinking Water
OT - Other_____

Remarks: SHORT HOLD TIME

pH _____ Temp _____

Flow _____ Other _____

Samples returned via:
__ UPS __ FedEx __ Courier _____

Tracking # 4168 6469 9084

Sample Receipt Checklist
COC Seal Present/Intact: NP ___Y ___N
COC Signed/Accurate: ___Y ___N
Bottles arrive intact: ___Y ___N
Correct bottles used: ___Y ___N
Sufficient volume sent: ___Y ___N
If Applicable
VOA Zero Headspace: ___Y ___N
Preservation Correct/Checked: ___Y ___N

Relinquished by : (Signature)	Date:	Time:	Received by: (Signature)	Trip Blank Received: Yes (No) HCL / MeoH TBR
Flavio Schuh	04/23/19	16:15		
Relinquished by : (Signature)	Date:	Time:	Received by: (Signature)	Temp: 0.6 °C Bottles Received: 12
				If preservation required by Login: Date/Time
Relinquished by : (Signature)	Date:	Time:	Received for lab by: (Signature)	Date: 4/24/19 Time: 845
			KWillis	Hold: Condition: NCF / OK

Andy Vann

From: Mark Beasley
Sent: Wednesday, April 24, 2019 1:00 PM
To: Login
Cc: Olivia Studebaker
Subject: L1091941 *BNSF1KEN*

Login:

1) Remove all NO2NO3 analysis

2) Place L1091941-06 on hold

Thanks
Mark

From: Alice Robinson [mailto:AliceRobinson@kennedyjenks.com]
Sent: Wednesday, April 24, 2019 9:26 AM
To: Mark Beasley
Cc: Ryan Hultgren
Subject: Re: ARF for BNSF Hillyard Dross - T149152

Hi Mark,

Please do not analyze that sample (MW-3).

Thanks!

Pace Analytical®
National Center for Testing & Innovation

ANALYTICAL REPORT

May 29, 2019

Kennedy/Jenks Con-BNSF Region 1

Sample Delivery Group:	L1099353
Samples Received:	05/16/2019
Project Number:	
Description:	BNSF Hillyard Dross

Report To:

Ryan Hultgren
32001 32nd Ave S.
Suite 100
Federal Way, WA 98001

Entire Report Reviewed By:

Mark W. Beasley
Project Manager

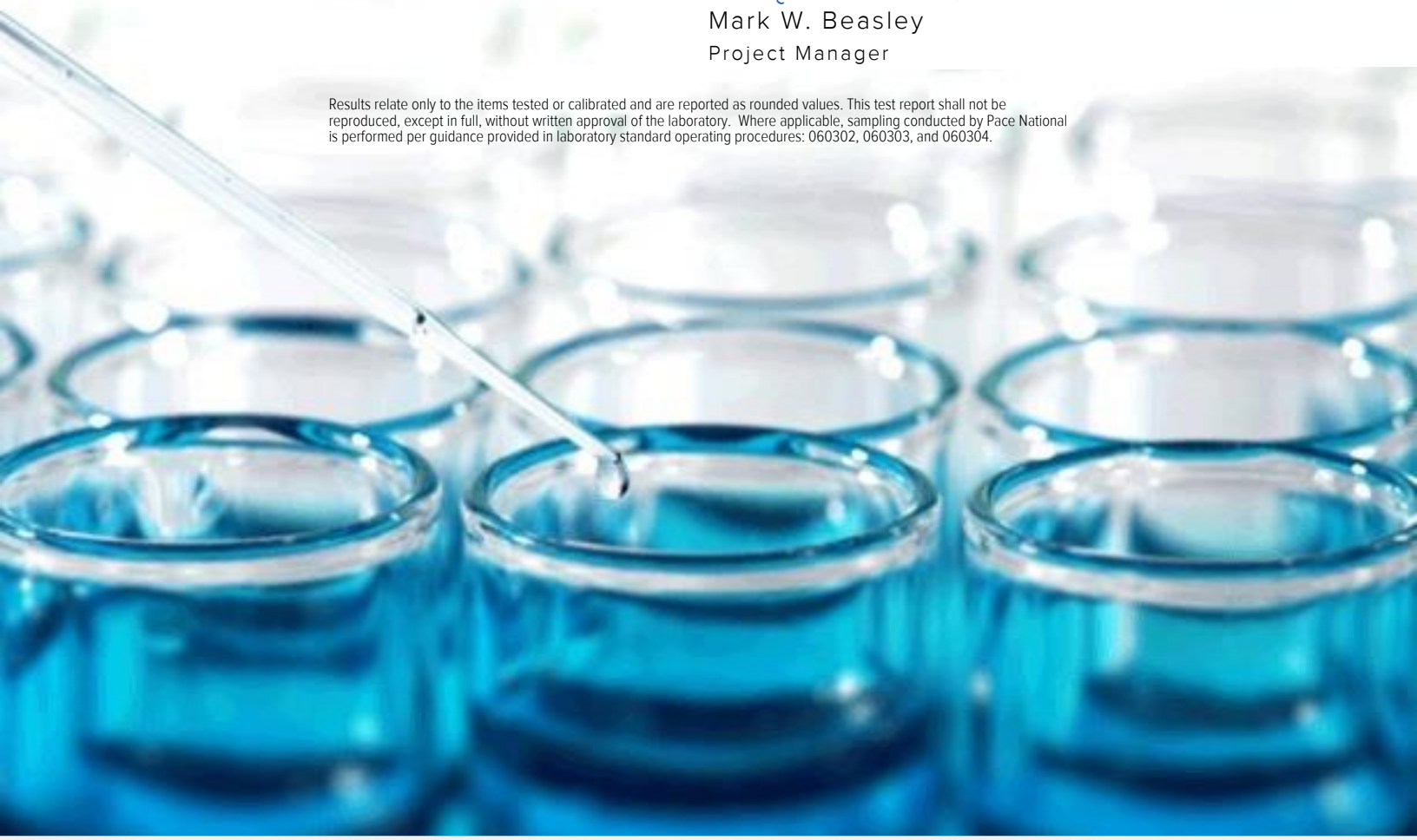


TABLE OF CONTENTS

HD-MW3-051519 L1099353-01 WW

Collected by	Collected date/time	Received date/time
Flavio	05/15/19 09:00	05/16/19 08:45

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Wet Chemistry by Method 300.0	WG1282062	1	05/16/19 17:30	05/16/19 17:30	NJM	Mt. Juliet, TN

All sample aliquots were received at the correct temperature, in the proper containers, with the appropriate preservatives, and within method specified holding times, unless qualified or notated within the report. Where applicable, all MDL (LOD) and RDL (LOQ) values reported for environmental samples have been corrected for the dilution factor used in the analysis. All Method and Batch Quality Control are within established criteria except where addressed in this case narrative, a non-conformance form or properly qualified within the sample results. By my digital signature below, I affirm to the best of my knowledge, all problems/anomalies observed by the laboratory as having the potential to affect the quality of the data have been identified by the laboratory, and no information or data have been knowingly withheld that would affect the quality of the data.

Mark W. Beasley
Project Manager

Wet Chemistry by Method 300.0

Analyte	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch
	ug/l		ug/l	ug/l		date / time	
Chloride	22200		51.9	1000	1	05/16/2019 17:30	WG1282062
Nitrate	3810		22.7	100	1	05/16/2019 17:30	WG1282062
Nitrite	U		27.7	100	1	05/16/2019 17:30	WG1282062

Method Blank (MB)

(MB) R3412077-1 05/16/19 09:19

Analyte	MB Result ug/l	MB Qualifier	MB MDL ug/l	MB RDL ug/l
Chloride	U		51.9	1000
Nitrate	U		22.7	100
Nitrite	U		27.7	100

L1099336-01 Original Sample (OS) • Duplicate (DUP)

(OS) L1099336-01 05/16/19 12:16 • (DUP) R3412077-3 05/16/19 12:33

Analyte	Original Result ug/l	DUP Result ug/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Chloride	29600	29200	20	1.25		20
Nitrate	22400	22500	20	0.520		20
Nitrite	ND	0.000	20	0.000		20

Laboratory Control Sample (LCS)

(LCS) R3412077-2 05/16/19 09:37

Analyte	Spike Amount ug/l	LCS Result ug/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
Chloride	40000	40100	100	90.0-110	
Nitrate	8000	8180	102	90.0-110	
Nitrite	8000	7940	99.2	90.0-110	

L1099326-03 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1099326-03 05/16/19 15:25 • (MS) R3412077-4 05/16/19 15:43 • (MSD) R3412077-5 05/16/19 16:01

Analyte	Spike Amount ug/l	Original Result ug/l	MS Result ug/l	MSD Result ug/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Chloride	50000	4930	54400	54600	99.0	99.3	1	80.0-120			0.275	20
Nitrate	5000	ND	4980	5000	98.1	98.5	1	80.0-120			0.459	20
Nitrite	5000	ND	4980	5000	99.5	100	1	80.0-120			0.485	20

L1099443-01 Original Sample (OS) • Matrix Spike (MS)

(OS) L1099443-01 05/16/19 19:18 • (MS) R3412077-7 05/16/19 19:54

Analyte	Spike Amount ug/l	Original Result ug/l	MS Result ug/l	MS Rec. %	Dilution	Rec. Limits %	MS Qualifier
Nitrate	5000	204	5180	99.5	1	80.0-120	
Nitrite	5000	ND	4990	99.9	1	80.0-120	

Guide to Reading and Understanding Your Laboratory Report

The information below is designed to better explain the various terms used in your report of analytical results from the Laboratory. This is not intended as a comprehensive explanation, and if you have additional questions please contact your project representative.

Abbreviations and Definitions

MDL	Method Detection Limit.
ND	Not detected at the Reporting Limit (or MDL where applicable).
RDL	Reported Detection Limit.
Rec.	Recovery.
RPD	Relative Percent Difference.
SDG	Sample Delivery Group.
U	Not detected at the Reporting Limit (or MDL where applicable).
Analyte	The name of the particular compound or analysis performed. Some Analyses and Methods will have multiple analytes reported.
Dilution	If the sample matrix contains an interfering material, the sample preparation volume or weight values differ from the standard, or if concentrations of analytes in the sample are higher than the highest limit of concentration that the laboratory can accurately report, the sample may be diluted for analysis. If a value different than 1 is used in this field, the result reported has already been corrected for this factor.
Limits	These are the target % recovery ranges or % difference value that the laboratory has historically determined as normal for the method and analyte being reported. Successful QC Sample analysis will target all analytes recovered or duplicated within these ranges.
Original Sample	The non-spiked sample in the prep batch used to determine the Relative Percent Difference (RPD) from a quality control sample. The Original Sample may not be included within the reported SDG.
Qualifier	This column provides a letter and/or number designation that corresponds to additional information concerning the result reported. If a Qualifier is present, a definition per Qualifier is provided within the Glossary and Definitions page and potentially a discussion of possible implications of the Qualifier in the Case Narrative if applicable.
Result	The actual analytical final result (corrected for any sample specific characteristics) reported for your sample. If there was no measurable result returned for a specific analyte, the result in this column may state “ND” (Not Detected) or “BDL” (Below Detectable Levels). The information in the results column should always be accompanied by either an MDL (Method Detection Limit) or RDL (Reporting Detection Limit) that defines the lowest value that the laboratory could detect or report for this analyte.
Uncertainty (Radiochemistry)	Confidence level of 2 sigma.
Case Narrative (Cn)	A brief discussion about the included sample results, including a discussion of any non-conformances to protocol observed either at sample receipt by the laboratory from the field or during the analytical process. If present, there will be a section in the Case Narrative to discuss the meaning of any data qualifiers used in the report.
Quality Control Summary (Qc)	This section of the report includes the results of the laboratory quality control analyses required by procedure or analytical methods to assist in evaluating the validity of the results reported for your samples. These analyses are not being performed on your samples typically, but on laboratory generated material.
Sample Chain of Custody (Sc)	This is the document created in the field when your samples were initially collected. This is used to verify the time and date of collection, the person collecting the samples, and the analyses that the laboratory is requested to perform. This chain of custody also documents all persons (excluding commercial shippers) that have had control or possession of the samples from the time of collection until delivery to the laboratory for analysis.
Sample Results (Sr)	This section of your report will provide the results of all testing performed on your samples. These results are provided by sample ID and are separated by the analyses performed on each sample. The header line of each analysis section for each sample will provide the name and method number for the analysis reported.
Sample Summary (Ss)	This section of the Analytical Report defines the specific analyses performed for each sample ID, including the dates and times of preparation and/or analysis.

Qualifier	Description

The remainder of this page intentionally left blank, there are no qualifiers applied to this SDG.

Pace National is the only environmental laboratory accredited/certified to support your work nationwide from one location. One phone call, one point of contact, one laboratory. No other lab is as accessible or prepared to handle your needs throughout the country. Our capacity and capability from our single location laboratory is comparable to the collective totals of the network laboratories in our industry. The most significant benefit to our one location design is the design of our laboratory campus. The model is conducive to accelerated productivity, decreasing turn-around time, and preventing cross contamination, thus protecting sample integrity. Our focus on premium quality and prompt service allows us to be YOUR LAB OF CHOICE.
* Not all certifications held by the laboratory are applicable to the results reported in the attached report.
* Accreditation is only applicable to the test methods specified on each scope of accreditation held by Pace National.

State Accreditations

Alabama	40660	Nebraska	NE-OS-15-05
Alaska	17-026	Nevada	TN-03-2002-34
Arizona	AZ0612	New Hampshire	2975
Arkansas	88-0469	New Jersey–NELAP	TN002
California	2932	New Mexico [1]	n/a
Colorado	TN00003	New York	11742
Connecticut	PH-0197	North Carolina	Env375
Florida	E87487	North Carolina [1]	DW21704
Georgia	NELAP	North Carolina [3]	41
Georgia [1]	923	North Dakota	R-140
Idaho	TN00003	Ohio–VAP	CL0069
Illinois	200008	Oklahoma	9915
Indiana	C-TN-01	Oregon	TN200002
Iowa	364	Pennsylvania	68-02979
Kansas	E-10277	Rhode Island	LAO00356
Kentucky [1 6]	90010	South Carolina	84004
Kentucky [2]	16	South Dakota	n/a
Louisiana	AI30792	Tennessee [1 4]	2006
Louisiana [1]	LA180010	Texas	T104704245-18-15
Maine	TN0002	Texas [5]	LAB0152
Maryland	324	Utah	TN00003
Massachusetts	M-TN003	Vermont	VT2006
Michigan	9958	Virginia	460132
Minnesota	047-999-395	Washington	C847
Mississippi	TN00003	West Virginia	233
Missouri	340	Wisconsin	9980939910
Montana	CERT0086	Wyoming	A2LA

Third Party Federal Accreditations

A2LA – ISO 17025	1461.01	AIHA-LAP,LLC EMLAP	100789
A2LA – ISO 17025 [5]	1461.02	DOD	1461.01
Canada	1461.01	USDA	P330-15-00234
EPA–Crypto	TN00003		

[1] Drinking Water [2] Underground Storage Tanks [3] Aquatic Toxicity [4] Chemical/Microbiological [5] Mold [6] Wastewater n/a Accreditation not applicable

Our Locations

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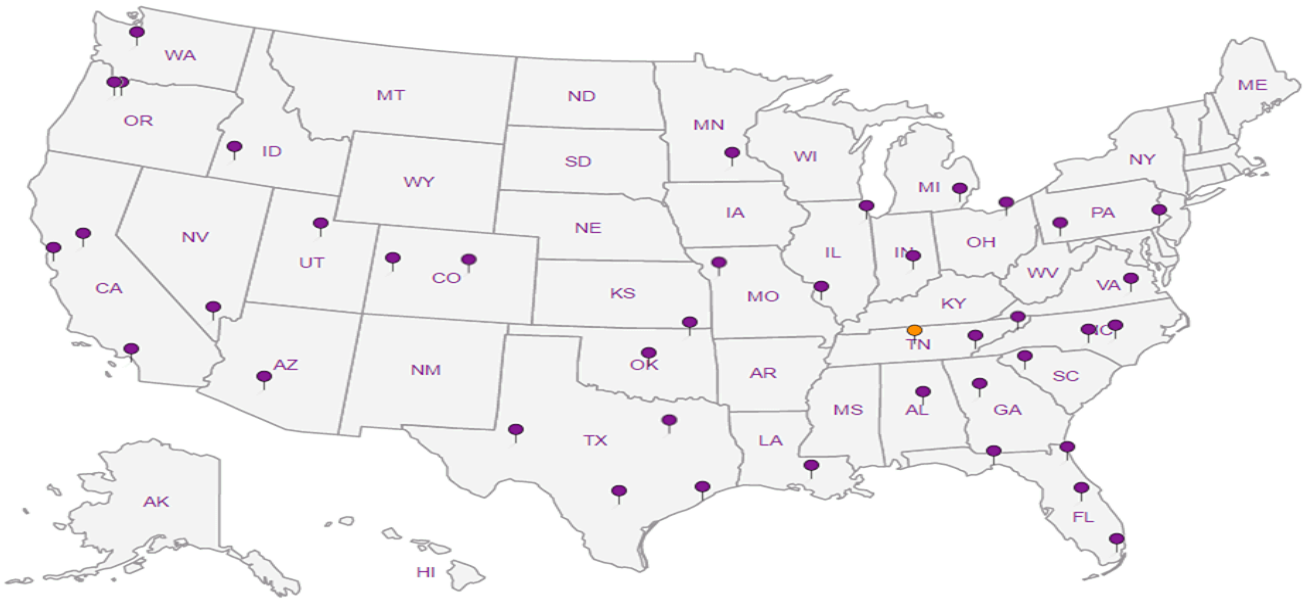

CHAIN-OF-CUSTODY Analytical Request Document

Pace Analytical®

Chain-of-Custody is a LEGAL DOCUMENT - Complete all relevent fields

LAB USE ONLY- Affix Workorder/Login Label Here or List Pace Workorder Number or MTJL Log-in Number Here

ALL SHADED AREAS are for LAB USE ONLY

Company: KENNEDY/JENKS BNSF-1

Billing Information: ACC PAYABLE 32001 32ND AVE S, STE 100 FEDERAL WAY, WA 98001

Address: 421 SW 6TH AVE, STE 1000 PORTLAND, OR 97204

Report To: RYAN HULTGREN

Email To: RYANHULTGREN@KENNEDYJENKS.COM

Copy To:

Site Collection Info/Address:

Customer Project Name/Number: BNSF - HILLYARD

State: WA County/City: SPOKANE Time Zone Collected: [✓] PT [ ] MT [ ] CT [ ] ET

Phone: ~~50~~ 253-835-6432

Email:

Site/Facility ID #:

Compliance Monitoring? [ ] Yes [ ] No

Collected By (print): Flavio

Collected By (signature):

Purchase Order #:

Quote #:

DW PWS ID #:

DW Location Code:

Sample Disposal: [ ] Dispose as appropriate [ ] Return [ ] Archive: _____ [ ] Hold: _____

Turnaround Date Required: STANDARD TAT

Rush: [ ] Same Day [ ] Next Day [ ] 2 Day [ ] 3 Day [ ] 4 Day [ ] 5 Day (Expedite Charges Apply)

Immediately Packed on Ice: [✓] Yes [ ] No

Field Filtered (if applicable): [ ] Yes [✓] No

Analysis: _____

Matrix Codes (Insert in Matrix box below): Drinking Water (DW), Ground Water (GW), Wastewater (WW), Product (P), Soil/Solid (SL), Oil (OL), Wipe (WP), Air (AR), Tissue (TS), Bioassay (B), Vapor (V), Other (OT)

Container Preservative Type **

Lab Project Manager:

** Preservative Types: (1) nitric acid, (2) sulfuric acid, (3) hydrochloric acid, (4) sodium hydroxide, (5) zinc acetate, (6) methanol, (7) sodium bisulfate, (8) sodium thiosulfate, (9) hexane, (A) ascorbic acid, (B) ammonium sulfate, (C) ammonium hydroxide, (D) TSP, (U) Unpreserved, (O) Other _____

Analyses

Cl, NO2, NO3 - NO PRES. L2

NO2 NO3 - H2SO4

Customer Sample ID	Matrix *	Comp / Grab	Collected (or Composite Start) Date	Collected (or Composite Start) Time	Composite End Date	Composite End Time	Res Cl	# of Ctns
HD-MW3-051519	GW		5/15/19	09:00				2

Lab Profile/Line:

Lab Sample Receipt Checklist:

Custody Seals Present/Intact	Y N	NA
Custody Signatures Present	Y N	NA
Collector Signature Present	Y N	NA
Bottles Intact	Y N	NA
Correct Bottles	Y N	NA
Sufficient Volume	Y N	NA
Samples Received on Ice	Y N	NA
VOA - Headspace Acceptable	Y N	NA
USDA Regulated Soils	Y N	NA
Samples in Holding Time	Y N	NA
Residual Chlorine Present	Y N	NA
Cl Strips:		
Sample pH Acceptable	Y N	NA
pH Strips:		
Sulfide Present	Y N	NA
Lead Acetate Strips:		

LAB USE ONLY:
Lab Sample # / Comments:

1099353 -01

Customer Remarks / Special Conditions / Possible Hazards:

Type of Ice Used: Wet Blue Dry None

Packing Material Used:

Radchem sample(s) screened (<500 cpm): Y N NA

SHORT HOLDS PRESENT (<72 hours): Y N N/A

Lab Tracking #: 1023 1349 2180

Samples received via: FEDEX UPS Client Courier Pace Courier

Lab Sample Temperature Info:

Temp Blank Received: Y N NA

Therm ID#: AT01C

Cooler 1 Temp Upon Receipt: 3.9 oC

Cooler 1 Therm Corr. Factor: +0.1 oC

Cooler 1 Corrected Temp: 4.0 oC

Comments:

RAD SCREEN: <0.5 mR/hr

Relinquished by/Company: (Signature)	Date/Time:	Received by/Company: (Signature)	Date/Time:
	5/15/19 09:20		
Relinquished by/Company: (Signature)	Date/Time:	Received by/Company: (Signature)	Date/Time:
Relinquished by/Company: (Signature)	Date/Time:	Received by/Company: (Signature)	Date/Time:
			5/16/19 0845

E231

Table #:

Acctnum:

Template:

Prelogin:

PM:

PB:

Trip Blank Received: Y N NA HCL MeOH TSP Other

Non Conformance(s): YES / NO

Page: _____ of: _____

Appendix E

2019 MTCA Stat Output

2.5	1/28/15
3.81	5/15/19
4.2	4/21/11
4.57	4/18/17
4.67	4/28/16
4.7	4/11/13
5.1	4/10/12
5.6	4/23/14
6	1/18/11
6.27	4/14/15
6.51	1/26/16
6.9	7/14/11
8.1	1/29/14
9.5	7/11/12
9.7	1/24/12
9.83	7/13/16
11	7/28/14
11.2	1/31/17
13	7/27/10
15	1/29/13

MW-3 Nitrate: 2019

Number of samples		Uncensored values	
Uncensored	20	Mean	7.41
Censored		Lognormal mean	7.47
Detection limit or PQL		Std. devn.	3.36633895
Method detection limit		Median	6.39
TOTAL	20	Min.	2.5
		Max.	15

Lognormal distribution?		Normal distribution?	
r-squared is:	0.979	r-squared is:	0.941

Recommendations:

Use lognormal distribution.

UCL (Land's method) is 9.21085071193826

69	10/30/12
89	1/29/13
160	4/11/13
140	10/24/13
130	1/29/14
120	4/23/14
25	7/28/14
44	10/29/14
160	1/28/15
47.4	4/14/15
65.4	7/14/15
98.7	10/27/15
88.7	1/26/16
26.3	4/28/16
152	7/13/16
149	10/12/16
14.9	1/31/17
82.6	4/18/17
923	6/27/18
17	4/23/19

MW-5 Chloride: 2019

Number of samples			Uncensored values	
Uncensored	20		Mean	130.10
Censored			Lognormal mean	125.37
Detection limit or PQL			Std. devn.	193.066059
Method detection limit			Median	88.85
TOTAL	20		Min.	14.9
			Max.	923

Lognormal distribution?		Normal distribution?	
r-squared is:	0.920	r-squared is:	0.441

Recommendations:
Use lognormal distribution.

UCL (Land's method) is 217.093325159967

1.3	10/30/12	MW-5 Nitrate: 2019
7.5	1/29/13	
8.7	4/11/13	
9.1	10/24/13	
9.4	1/29/14	
7.2	4/23/14	
4	7/28/14	
4.2	10/29/14	
7.6	1/28/15	
4.15	4/14/15	
5.43	7/14/15	
5.83	10/27/15	
6.04	1/26/16	
2.49	4/28/16	
5.35	7/13/16	
3.61	10/12/16	
3.8	1/31/17	
11.5	4/18/17	
41.8	6/27/18	
3.84	4/23/19	

Number of samples		Uncensored values		
Uncensored	20	Mean	7.64	
Censored		Lognormal mean	7.34	
Detection limit or PQL		Std. devn.	8.44095567	
Method detection limit		Median	5.63	
TOTAL	20	Min.	1.3	
		Max.	41.8	

Lognormal distribution?		Normal distribution?	
r-squared is:	0.897	r-squared is:	0.489

Recommendations:

Reject BOTH lognormal and normal distributions. See Statistics Guidance.

UCL (Land's method) is 10.411035745694

UCL Statistics for Uncensored Full Data Sets

User Selected Options	
Date/Time of Computation	ProUCL 5.16/11/2019 2:37:17 PM
From File	MW5Nitrate.xls
Full Precision	OFF
Confidence Coefficient	95%
mber of Bootstrap Operations	2000

Nitrate

General Statistics

Total Number of Observations	20	Number of Distinct Observations	20
		Number of Missing Observations	0
Minimum	1.3	Mean	7.642
Maximum	41.8	Median	5.63
SD	8.441	Std. Error of Mean	1.887
Coefficient of Variation	1.105	Skewness	3.81

Normal GOF Test

Shapiro Wilk Test Statistic	0.52	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.905	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.318	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.192	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		95% UCLs (Adjusted for Skewness)	
95% Student's-t UCL	10.91	95% Adjusted-CLT UCL (Chen-1995)	12.46
		95% Modified-t UCL (Johnson-1978)	11.17

Gamma GOF Test

A-D Test Statistic	1.11	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.753	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.196	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.196	etected data appear Gamma Distributed at 5% Significance Lev

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics

k hat (MLE)	1.95	k star (bias corrected MLE)	1.691
Theta hat (MLE)	3.918	Theta star (bias corrected MLE)	4.519
nu hat (MLE)	78.02	nu star (bias corrected)	67.65
MLE Mean (bias corrected)	7.642	MLE Sd (bias corrected)	5.876
		Approximate Chi Square Value (0.05)	49.72
Adjusted Level of Significance	0.038	Adjusted Chi Square Value	48.5

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	10.4	95% Adjusted Gamma UCL (use when n<50)	10.66

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.923	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.905	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.147	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.192	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

	A	B	C	D	E	F	G	H	I	J	K	L
58	**Lognormal Statistics**											
59					Minimum of Logged Data	0.262				Mean of logged Data		1.756
60					Maximum of Logged Data	3.733				SD of logged Data		0.69
61												
62	**Assuming Lognormal Distribution**											
63					95% H-UCL	10.45				90% Chebyshev (MVUE) UCL		10.81
64					95% Chebyshev (MVUE) UCL	12.43				97.5% Chebyshev (MVUE) UCL		14.67
65					99% Chebyshev (MVUE) UCL	19.08						
66												
67	**Nonparametric Distribution Free UCL Statistics**											
68	**Data appear to follow a Discernible Distribution at 5% Significance Level**											
69												
70	**Nonparametric Distribution Free UCLs**											
71					95% CLT UCL	10.75				95% Jackknife UCL		10.91
72					95% Standard Bootstrap UCL	10.58				95% Bootstrap-t UCL		16.43
73					95% Hall's Bootstrap UCL	23.29				95% Percentile Bootstrap UCL		11.04
74					95% BCA Bootstrap UCL	13.25						
75					90% Chebyshev(Mean, Sd) UCL	13.3				95% Chebyshev(Mean, Sd) UCL		15.87
76					97.5% Chebyshev(Mean, Sd) UCL	19.43				99% Chebyshev(Mean, Sd) UCL		26.42
77												
78	**Suggested UCL to Use**											
79					95% Adjusted Gamma UCL	10.66						
80												
81	When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test											
82	When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL											
83												
84	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
85	Recommendations are based upon data size, data distribution, and skewness.											
86	These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).											
87	owever, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statisticia											
88												