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2016 Annual Industrial Wastewater Reuse Report for the Idaho National Laboratory Site's Materials and Fuels Complex Industrial Waste Ditch and Industrial Waste Pond

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Idaho National Laboratory

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Idaho Falls, Idaho 83415

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ABSTRACT

This report describes conditions, as required by the state of Idaho Industrial Wastewater Reuse Permit (WRU-I-0160-01, Modification 1, formerly LA-000160-01), for the wastewater reuse site at the Idaho National Laboratory Site's Materials and Fuels Complex Industrial Waste Ditch and Industrial Waste Pond from November 1, 2015, through October 31, 2016. The report contains the following information:

- Facility and system description
- Permit required effluent monitoring data and loading rates
- Groundwater monitoring data
- Status of special compliance conditions
- Issues/Noncompliances
- Discussion of the facility's environmental impacts

During the 2016 reporting year, an estimated 7.607 million gallons of wastewater were discharged to the Industrial Waste Ditch and Industrial Waste Pond, which is well below the permit limit of 17 million gallons per year.

The concentrations of all permit-required analytes in the samples from the downgradient monitoring wells were below the applicable Idaho Department of Environmental Quality's groundwater quality standard levels. In the case of total iron and total manganese concentrations, when the groundwater quality standard is exceeded, the filtered sample result is used to demonstrate compliance. For this reporting year, both the filtered and unfiltered concentrations of iron and manganese were below their respective groundwater quality standard levels of 0.3 mg/L and 0.05mg/L, respectively; therefore, only the unfiltered results are reported in this document.

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ACRONYMS

BEA	Battelle Energy Alliance, LLC
bls	below land surface
CFR	Code of Federal Regulations
DEQ	Idaho Department of Environmental Quality
gpm	gallons per minute
GW	prefix for groundwater monitoring well serial number
IDAPA	Idaho Administrative Procedures Act
INL	Idaho National Laboratory
IWD	Industrial Waste Ditch
IWP	Industrial Waste Pond
IWRP	Industrial Wastewater Reuse Permit
MFC	Materials and Fuels Complex
MG	million gallons
MS	matrix spike
MU	prefix for management unit serial number location
NA	Not Applicable
PCS	Primary Constituent Standard
R&MS	Regulatory and Monitoring Services
SCS	Secondary Constituent Standard
TN	total nitrogen
TSS	total suspended solids
WW	prefix for wastewater monitoring location serial number

2016 Annual Industrial Wastewater Reuse Report for the Idaho National Laboratory Site's Materials and Fuels Complex Industrial Waste Ditch and Industrial Waste Pond

1. INTRODUCTION

The Materials and Fuels Complex (MFC) Industrial Waste Ditch (IWD) and associated Industrial Waste Pond (IWP) is an industrial wastewater reuse facility operated by Battelle Energy Alliance, LLC (BEA) under Industrial Wastewater Reuse Permit (IWRP) WRU-I-0160-01, Modification 1 (formerly LA-000160-01), issued by the Idaho Department of Environmental Quality (DEQ). The initial permit was issued in April 2010; Modification 1 was issued in June 2012 (Neher 2010; Neher 2012). The permit's expiration date was April 30, 2015 (Neher 2012).

As required by the IWRP, the permit renewal application is to be submitted six months prior to the IWRP expiration date. The renewal application, designation of Responsible Official and Authorized Representative form, and facility information form were submitted to DEQ on October 28, 2014 (Miller 2014).

On January 23, 2015, DEQ responded (Rackow 2015) with a letter stating that the application package was substantially complete with an effective date of January 20, 2015. A timely and sufficient application for permit renewal shall administratively extend the terms and conditions of an expired permit. An application is considered timely and sufficient once DEQ has determined the application complete and the effective date is prior to the expiration of the current permit (IDAPA 58.01.17.400.10). Therefore, the MFC IWD and IWP continue to be operated in accordance with IWRP WRU-I-0160-01.

The annual report summarizes the facility system and operation, monitoring data, special compliance conditions, issues/noncompliances, and environmental impacts for the 2016 reporting year (November 1, 2015, through October 31, 2016).

2. FACILITY, SYSTEM DESCRIPTION, AND OPERATION

The MFC is located on approximately 60 acres in the southeastern portion of the Idaho National Laboratory (INL), approximately 30 miles west of Idaho Falls, Idaho, in Bingham County. The MFC consists of buildings and structures for research and development of nuclear technologies, nuclear environmental management, and space radioactive power sources.

The IWP is located near the northwest corner of the MFC. The IWP was first excavated in 1959 and has a design capacity of 285 million gallons (MG) at a maximum water depth of 13 feet. The IWP receives industrial wastewater from the Industrial Waste Pipeline, stormwater runoff from MFC and immediate areas, and industrial wastewater from Ditch C. Most of the industrial wastewater generated at MFC flows through collection piping to a lift station where it is pumped into the Industrial Waste Pipeline and discharged to the pond (Figure 1). A flow meter and composite sampler are located on the pipeline near the western boundary of MFC (Figure 1, WW-016001).The maximum hydraulic loading rate allowed by the permit for both discharges, IWP and Ditch C, is 17 MG/year.

Wastewater from the Industrial Waste Pipeline consists primarily of noncontact cooling water, boiler blowdown, cooling tower overflow, air wash flows, and steam condensate. Small amounts of industrial wastewater from the MFC facility process holdup tanks may also be discharged to the IWP system, once approved by the facility supervisor and environmental compliance staff.

Wastewater transported to Ditch C via the Industrial Waste Water Underground Pipe consists of cooling water blowdown, intermittent reverse osmosis effluent, and floor drains and a laboratory sink discharges. The wastewater discharged to Ditch C seldom flows more than a few tens of feet past the sampling point (WW-016002) before it evaporates, infiltrates, or is taken up by plants.

In 2016, a portion of the Industrial Waste Water Underground Pipe was decommissioned and relocated due to the MFC transformer refurbishment project. The construction specifications and drawings were submitted to DEQ on April 27, 2016 (Miller 2016a), resubmitted on May 12, 2016 (Miller 2016b), and approved on May 23, 2016 (Rackow 2016) as required in Section F of the permit. Construction began September 7, 2016 and finished November 17, 2016. As specified in the construction plans, several hundred feet of the Industrial Waste Water Underground Pipe was abandoned in place and rerouted north of the transformer yard (Figure 1).

Figure 1. Materials and Fuels Complex Ditch C and Industrial Waste Pond.

3. EFFLUENT MONITORING

This section describes the sampling and analytical methods used in the MFC IWP and Ditch C monitoring programs. Effluent monitoring and flow data is provided.

3.1 Sampling Program and Analytical Methods

Environmental professionals from Regulatory and Monitoring Services (R&MS) perform the monthly and quarterly effluent monitoring required in Section G of the permit. Effluent samples were collected monthly from the Industrial Waste Pipeline (sampling location WW-016001) prior to discharge to the IWP (Figure 1). In addition, quarterly grab samples were collected from the effluent discharging into Ditch C from the Industrial Waste Water Underground Pipe (WW-016002). All samples were collected according to established programmatic sampling procedures.

Effluent samples are randomly scheduled within the constraints of the sampling staff and laboratory availability. Samples are typically collected early in the month (first or second week) and on a Tuesday or Wednesday of the selected week to ensure the laboratory can receive the samples during normal working hours in order to meet temperature and holding time requirements. This also allows time in the month to collect samples in the event there are issues with the original samples, sampling equipment, flow meter, etc., during a preselected week following a randomly generated sampling schedule to represent normal operating conditions. On occasion, the sampling schedule must be changed. This was the case for the sampling events originally scheduled for the Industrial Waste Pipeline on January 6, February 3, and April 12. These events were rescheduled for January 19, February 4, and April 19. For these sampling events, R&MS personnel were not available for the originally scheduled sampling dates.

All samples were analyzed using methods identified in 40 Code of Federal Regulations (CFR) 136, "Guidelines Establishing Test Procedures for the Analysis of Pollutants," 40 CFR 141, "National Primary Drinking Water Regulations," 40 CFR 143, "National Secondary Drinking Water Regulations," or approved by the DEQ.

The hydrogen ion activity (pH) of the samples was measured with a calibrated meter at the time of sample collection. All other permit required samples were submitted under full chain of custody to GEL Laboratories in Charleston, South Carolina for analyses beginning January 2016. Prior samples were submitted to Southwest Research Institute's Analytical and Environmental Chemistry Department located in San Antonio, Texas.

3.2 Effluent Monitoring Results

3.2.1 Industrial Waste Pipeline

Effluent samples were collected monthly from the Industrial Waste Pipeline (WW-016001) prior to discharge to the IWP. All Industrial Waste Pipeline effluent samples were collected as 24-hour flow proportional composite samples as required by the permit. Sample results are presented in Table 1.

Section F of the IWRP specifies effluent permit limits based on a 30-day average for total nitrogen (TN) and total suspended solids (TSS) of 20 mg/L and 100 mg/L, respectively. Total nitrogen is calculated as the sum of total Kjeldahl nitrogen (TKN) and nitrate plus nitrite, as nitrogen. For the cases where TKN was reported as a negative value, TKN was assumed zero in the total calculation. The maximum TN was 3.186 mg/L in the July 2016 sample and the maximum TSS result was 3.6 mg/L reported in the January 2016 sample, both significantly lower than the permit limits. However, nitrate+nitrite (as nitrogen) was slightly elevated compared to previous reporting years (2012-2015) with a maximum of 2.94 mg/L compared to a previous maximum of 2.80mg/L in 2014.

No permit limits are specified for the other required analytes at the Industrial Waste Pipeline. The concentrations of total dissolved solids, sulfate, chloride, total phosphorus, and sodium were slightly elevated in the effluent compared to previous years. All other constituents including arsenic, barium, cadmium, chromium, fluoride, iron, lead, manganese, mercury, selenium, silver and zinc remained at typical levels with many at or near the laboratory instrument's minimum detection levels (Table 1).

Several effluent sample results were qualified during data validation. Although the reported concentrations may be considered questionable, inaccurate, or imprecise, the estimated values are provided in Table 1. These qualified data are discussed below:

- The January 19, 2016, February 4, 2016, May 4, 2016, and June 15, 2016, nitrate+nitrite as nitrogen results were assigned a J qualification due to out of range matrix spike (MS) recovery of 85.4%, 124%, 126%, and 115%, respectively. The MS recovery for these samples was outside the 90-110% acceptance criteria. The J flag denotes the data is detected at the reported concentration, but the reported concentration is an estimate due to out of range MS recoveries. A MS is an aliquot of a field sample that has been fortified (spiked) with known quantities of pertinent analytes before being processed in an identical manner as is required for the unspiked version of the same field sample.
- The February 4, 2016, TKN result was assigned a UJ qualification to denote a non-detect analyte concentration that is an estimate due to a positive blank detection and low MS recovery of 88.2%. The MS recovery for this sample was outside the 90-110% acceptance criteria.
- The March 17, 2016 TKN result was assigned a J qualification from the laboratory to designated an estimated result.
- The May 4, 2016, August 4, 2016 and October 11, 2016 (duplicate sample) TKN results were assigned a J qualification because of MS recovery of 112%, 122%, and 121%, respectively. The MS recoveries for these samples were outside the 90-110% acceptance criteria.
- The April 19, 2016, July 21, 2016, September 15, 2016 (sample and duplicate sample) and October 11, 2016 TSS results were assigned a J qualification from the laboratory due to reduced aliquots requiring detection and reporting limits to be adjusted. The J qualifier denotes an estimated result.
- The May 4, 2016 TDS result was assigned a J qualification because of a high laboratory duplicate sample (LDS) of 48.6% which is outside the +/- 20% acceptance criteria.
- The July 21, 2016 chloride result was assigned a J qualification because of a MS recovery of 113% which is outside the 90-110% acceptance criteria.
- The February 4, 2016 and September 15, 2016 sulfate results were assigned a J qualification because of high MS recovery of 112% which is outside the 90-110% acceptance criteria.
- The November 3, 2015 and December 3, 2015 barium, chromium (December only), lead, selenium, and zinc result was assigned a J qualification from the laboratory to designated an estimated result.
- November 3, 2015 sodium sample was J flagged in the table but not reported here?

3.2.2 Industrial Waste Water Underground Pipe Discharge to Ditch C

Grab samples were collected quarterly from the wastewater discharging into Ditch C from the Industrial Waste Water Underground Pipe (Figure 1). The analytical results are summarized in Table 2.

Section F of the IWRP specifies effluent permit limits based on a 30-day average for TN and TSS of 20 mg/L and 100 mg/L, respectively. Total nitrogen is calculated as the sum of total TKN and nitrate plus nitrite nitrogen. The maximum TN was in the third quarter (July 2016) regular sample at 8.68 mg/L.

Total suspended solids concentrations are typically less than 4 mg/L. For the 2016 reporting year, the maximum TSS result was 7.4 mg/L for the sample collected in the first quarter (March 2016). The remaining grab sample results from samples collected in the second, third, and fourth quarters were all less than 4 mg/L.

Total dissolved solids were elevated in the effluent to Ditch C and ranged from 546 mg/L to 687 mg/L (Table 2). For comparison purposes only, the Ground Water Quality Rule (IDAPA 58.01.11) Secondary Constituent Standards (SCS) for TDS is 500 mg/L. The TDS concentrations for the 2016 permit year remained within historical ranges.

Iron, manganese, and zinc were elevated at 1.204 mg/L, 0.0047mg/L, and 0.364 mg/L, respectively, during the first quarter sampling in Ditch C. Figure 2 shows the variability of iron, manganese, and zinc concentrations in Ditch C from January 2012 through July 2016. The iron concentrations in the effluent from the Industrial Waste Pipeline and the Industrial Waste Water Underground Pipe are typically less than half of the SCS, 0.3 mg/L, for iron and below or slightly above the laboratory instrument detection level for manganese. All other metals remained at low levels with many at or near the laboratory instrument's minimum detection levels.

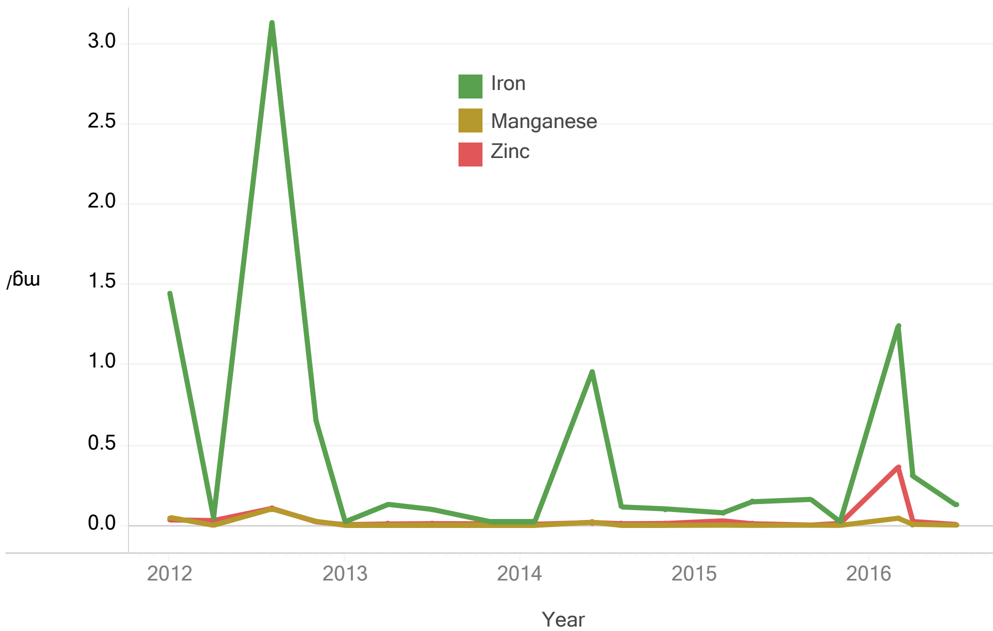

Figure 2. Materials and Fuels Complex Ditch C effluent concentrations for iron, manganese, and zinc for January 2012 to July 2016.

A few effluent sample results from Ditch C were qualified during data validation and laboratory reporting. Although the reported concentrations may be considered questionable, inaccurate, or imprecise, the estimated values are provided in Table 2. These qualified data are discussed below.

- The first quarter nitrate + nitrite as nitrogen result was J qualified due to low MS recovery of 89.7% which is outside the 90-110% acceptance criteria.
- The first and third quarter chloride results were J qualified due to high MS recovery of 113% which is outside the 90-110% acceptance criteria.
- The third quarter TSS result was J qualified by the laboratory to designate an estimated result.
- The fourth quarter arsenic, barium, chromium, lead, selenium, and zinc results were J qualified by the laboratory to designate an estimated result.

Table 1. Analytical results for 24-hour composite samples collected from the Industrial Waste Pipeline (WW-016001).

Sample Month	November	December	January	February	March	April	May	June	July	August	September[a]	October
Sample Date	11/03/15	12/03/15	01/19/16	02/04/16	03/17/2016	04/19/16	05/04/16	06/15/16	07/21/16	08/04/16	09/15/2016	10/11/2016
Nitrite + nitrate as nitrogen (mg/L)	2.04	2.09	1.93 J[b]	2.11 J	2.41	2.42	2.69 J	2.89 J	2.94	2.82	2.29 (2.23)	2.49
Total Kjeldahl nitrogen (mg/L)	0.112	0.135	-0.0197 U[c]	0.168 UJ[d]	0.0631 J	0.0181 U	0.213 J	0.263	0.246	0.187 J	-0.00338 U (-0.0154 U)	0.0589 J
Total nitrogen[e] (mg/L)	2.152	2.225	1.93	2.278	2.473	2.438	2.903	3.153	3.186	3.007	2.29 (2.23)	2.55
Total suspended solids (mg/L)	4 U	4 U	3.6	1.4 J	-0.3 U	1.1 J	0.8 U	0.4 U	0.7 J	0.2 U	1.2 J (1.0 J)	1.2 J
Total dissolved solids (mg/L)	250	327	230	453	341	256	181 J	273	394	469	366 (370)	261
Chloride (mg/L)	18.7	72.9	17.9	73.0	68.3	24.9	37.7	26.7	103 J	139	78.8 (81.0)	38.6
Fluoride (mg/L)	0.563	0.637	0.607	0.620	0.645	0.592	0.675	0.614	0.727	0.717	0.700 (0.676)	0.541
pH	8.38	8.28	8.93	7.98	8.01	8.26	8.62	7.91	8.11	7.49	7.32	7.42
Total phosphorous (mg/L)	0.173	0.458	0.122	0.102 U	0.167	0.347	0.516	0.291	0.11	0.202	0.636 (0.619)	0.496
Sulfate (mg/L)	17.1	17.9	17.9	19.3 J	18.5	18.3	18.7	20.3	24.9	24.1	19.3 J (19.0 J)	18.1
Arsenic (mg/L)	0.005 U	0.005 U	0.00233	0.00222	0.00206	0.00198	0.0017 U	0.00173	0.00267	0.00275	0.00214 (0.00212)	0.00215
Barium (mg/L)	0.038 J	0.0402 J	0.0363	0.0403	0.0357	0.0361	0.0374	0.0407	0.0416	0.0416	0.0373 (0.0371)	0.0375
Cadmium (mg/L)	0.001 U	0.001 U	0.00011 U	0.00011 U	0.00011 U	0.00011 U	0.00011 U	0.00011 U	0.00011 U	0.00011 U	0.0003 U (0.0003 U)	0.0003 U

Sample Month	November	December	January	February	March	April	May	June	July	August	September[a]	October
Sample Date	11/03/15	12/03/15	01/19/16	02/04/16	03/17/2016	04/19/16	05/04/16	06/15/16	07/21/16	08/04/16	09/15/2016	10/11/2016
Chromium (mg/L)	0.0025 U	0.00274 J	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002	0.002 U	0.003 U (0.003 U)	0.003 U
Iron[f] (mg/L)	0.0627	0.149	0.033 U	0.0412	0.0369	0.127	0.266	0.099	0.154	0.0717	0.158 (0.155)	0.229
Lead (mg/L)	0.000312 J	0.000253 J	0.0005 U	0.0005 U	0.0005 U	0.0005 U	0.0005 U	0.0005 U	0.0005 U	0.0005 U	0.0005 U (0.0005 U)	0.00139
Manganese[f] (mg/L)	0.0025 U	0.0025 U	0.001 U	0.00145	0.001 U	0.00151	0.00389	0.00205	0.00342	0.00247	0.00449 (0.00435)	0.00435
Mercury (mg/L)	0.0002 U	0.0002 U	0.000067 U	0.000067 U	0.000067 U	0.000067 U	0.000067 U	0.000067 U	0.000067 U	0.000067 U	0.000067 U (0.000067 U)	0.000067 U
Selenium (mg/L)	0.000579 J	0.000587 J	0.0015 U	0.0015 U	0.0015 U	0.0015 U	0.0015 U	0.0015 U	0.0015 U	0.0015 U	0.002 U (0.002 U)	0.002 U
Silver (mg/L)	0.005 U	0.005 U	0.0001 U	0.000299	0.0002 U	0.0002 U	0.0002 U	0.00112	0.000687	0.00132	0.0004 U (0.0004 U)	0.0004 U
Sodium[f] (mg/L)	20.5 J	54.5	19.7	65.5	51.6	30.3	32.4	29.8	79.1	98.6	64.6 (63.3)	37.2
Zinc (mg/L)	0.0126 J	0.0158 J	0.0125	0.0117	0.0106	0.0157	0.0219	0.0179	0.0169	0.0193	0.0358 (0.0356)	0.0214

a. Results for field duplicate sample collected in September are in parentheses.
b. J flag indicates the associated value is an estimate and may be inaccurate or imprecise.
c. U flag indicates that the result was reported as below the instrument detection limit by the analytical laboratory.
d. UJ flag indicates the sample was analyzed for, but was not detected. The associated value is an estimate and may be inaccurate or imprecise.
e. Total nitrogen is calculated as the sum of the total Kjeldahl nitrogen (TKN) and nitrite nitrogen plus nitrate as nitrogen. For results reported as a negative value, results were assumed zero in the total calculation.
f. Permit-required analyte for groundwater monitoring but not for effluent monitoring.

Table 2. Analytical results for quarterly grab samples collected from the wastewater discharged to Ditch C from the Industrial Waste Water Underground Pipe (WW-016002).

Calendar Quarter	Fourth 2015	First 2016	Second 2016	Third 2016
Sample Date	11/03/15	03/17/16	04/19/16	07/21/16
Nitrite + nitrate as nitrogen (mg/L)	5.41	4.22 J[a]	5.75	7.68
Total Kjeldahl nitrogen (mg/L)	0.694	0.893	0.86	1.0
Total nitrogen[b] (mg/L)	6.104	5.113	6.61	8.68
Total suspended solids (mg/L)	4 U[c]	7.4	0.8 U	0.8 J
Total dissolved solids (mg/L)	619	546	587	687
Chloride (mg/L)	48.2	42.6 J	46.9	67.0 J
Fluoride (mg/L)	1.41	1.07	1.39	1.72
pH	8.39	7.99	8.38	8.36
Total phosphorus (mg/L)	0.836	2.97	2.53	0.739
Sulfate (mg/L)	44.7	29.5	43.2	59.0
Arsenic (mg/L)	0.00546 J	0.00397	0.00437	0.00612
Barium (mg/L)	0.0911 J	0.0733	0.0872	0.0993
Cadmium (mg/L)	0.001 U	0.000232	0.000185	0.00011 U
Chromium (mg/L)	0.00369 J	0.00641	0.00564	0.00534
Iron[d] (mg/L)	0.025 U	1.240	0.309	0.127
Lead (mg/L)	0.000274 J	0.00376	0.0013	0.0005 U
Manganese[d] (mg/L)	0.0025 U	0.0047	0.00863	0.00431
Mercury (mg/L)	0.0002 U	0.000067 U	0.000067 U	0.000067 U
Selenium (mg/L)	0.00132 J	0.0015 U	0.0015 U	0.00216
Silver (mg/L)	0.005 U	0.0002 U	0.0002 U	0.0002 U
Sodium[d] (mg/L)	47.9	43.6	61.4	75.2
Zinc (mg/L)	0.0147 J	0.364	0.0262	0.00811

a. J flag indicates the associated value is an estimate and may be inaccurate or imprecise.
b. Total nitrogen is the sum of nitrate/nitrite and total Kjeldahl nitrogen.
c. U flag indicates that the result was reported as below the instrument detection limit by the analytical laboratory.
d. Permit-required analyte for groundwater monitoring but not for effluent monitoring.

3.3 Flow Volumes and Hydraulic Loading Rates

3.3.1 Industrial Waste Pipeline to the Industrial Waste Pond

Section G of the permit requires a flow meter to measure the monthly volume of flow to the IWP from the Industrial Waste Pipeline to the nearest 0.000 MG. Monthly flow volumes are recorded from the flow meter located at the effluent sampling point WW-016001. Table 3 summarizes the monthly and annual flow data from the Industrial Waste Pipeline.

Table 3. Volume of wastewater discharged from the Industrial Waste Pipeline to the Industrial Waste Pond.

	Average (gpm[a])	Total (MG[b])
November 2015	14.9	0.642
December 2015	14.1	0.629[c]
January 2016	19.0	0.850[c]
February 2016	17.4	0.726
March 2016	18.4	0.821
April 2016	12.1	0.521
May 2016	9.3	0.414
June 2016	9.5	0.411
July 2016	10.6	0.472
August 2016	10.5	0.469
September 2016	9.5	0.408
October 2016	19.0	0.848[c]
TOTAL		7.212

a. gpm—gallons per minute.
b. MG—million gallons.
c. Estimate.

Monthly flow readings for the Industrial Waste Pipeline are typically recorded from the flow totalizer during the last working shift of each month by MFC operations personnel. The deviations noted in Table 3 for the months of December, January, and October are flows that were conservatively estimated due to issues with the recorded value. See Section 5.2 for additional information.

3.3.2 Industrial Waste Water Underground Pipeline to Ditch C

As required by Section G of the permit, the monthly flow from the Industrial Waste Water Underground Pipeline to Ditch C was visually estimated by Environmental Support personnel. Table 4 summarizes the monthly and annual flow data.

Table 4. Volume of wastewater discharged from the Industrial Waste Water Underground Pipe to Ditch C.

	Average[a] (gpm[b])	Total (MG[c])
November 2015	1	0.043
December 2015	1	0.045
January 2016	1	0.045
February 2016	1	0.042
March 2016	0.5	0.022
April 2016	1	0.043
May 2016	0.5	0.022
June 2016	0.5	0.022
July 2016	0.5	0.022
August 2016	0.5	0.022
September 2016	0.5	0.022
October 2016	1	0.045
TOTAL		0.395

a. Average of multiple visual flow estimates during the month.

b. gpm—gallons per minute.

c. MG—million gallons.

3.3.3 Summary

The permit (Section F) specifies the following:

- Application season is year round.
- Maximum hydraulic loading rate is 17 MG per year.

Total effluent flow volume was an estimated 7.607 MG for the reporting period.

4. GROUNDWATER MONITORING

The groundwater monitoring sections provide information concerning the INL sampling program, analytical methods used, monitoring results, and water table information.

4.1 Sampling Program

The IWRP for the MFC Ditch C and IWP identifies three INL compliance wells. The permit requires the collection of groundwater samples in April or May and September or October. In 2016, R&MS personnel collected groundwater samples in May and September.

The R&MS personnel use project-specific sampling and analysis plans and procedures that govern sampling activities and quality control protocols. The permit identifies a specified list of parameters that are to be analyzed in the groundwater samples. Constituent concentrations in the compliance wells are limited by primary constituent standards (PCS) and secondary constituent standards (SCS) specified in IDAPA 58.01.11, "Ground Water Quality Rule." All permit-required samples were collected and reported.

Conductivity, temperature, and pH of the samples were measured at the time of sample collection by R&MS personnel using a calibrated meter. All other permit required groundwater samples were submitted under full chain of custody for analysis to GEL Laboratories in Charleston, South Carolina.

4.2 Analytical Methods

Analytical methods specified in 40 CFR 141, "National Primary Drinking Water Regulations," 40 CFR 143, "National Secondary Drinking Water Regulations," 40 CFR 136, "Guidelines Establishing Test Procedures for the Analysis of Pollutants," or those approved by DEQ were used for analysis of all permit-required parameters.

4.3 Monitoring Wells

To evaluate potential impacts to groundwater from the wastewater discharges to the MFC IWP, the permit requires that groundwater samples be collected from the Snake River Plain Aquifer at three monitoring wells (see Figures 3 and 4):

- ANL-MON-A-012 (GW-016001, upgradient well)
- ANL-MON-A-013 (GW-016002, downgradient well)
- ANL-MON-A-014 (GW-016003, downgradient well)

Prior to sampling, wells were purged a minimum of three casing volumes or one casing volume if three successive measurements for pH and specific conductance, taken at least one minute apart, had pH values within 0.2 units of each other and specific conductance readings within 10%.

4.4 Groundwater Monitoring Results

Table 5 shows the static water table elevations and depths to the water table, measured prior to purging and sampling, and the analytical results for all parameters specified by the permit for the three monitoring wells.

The concentrations of all permit-required analytes were below their respective groundwater quality standards in IDAPA 58.01.11 for the unfiltered samples collected during the 2016 reporting year (Table 5).

New pumps were installed in wells ANL-MON-A-012 and ANL-MON-A-013 in May 2014. After the old pumps were removed, the wells were videoed prior to installation of the new pumps. The videos show some corrosion of the 8-inch carbon steel casing, a reddish colored buildup on the stainless steel screen near the pump inlets, and sediment in the bottom of both wells that may contribute to the iron concentrations.

The concentrations of chloride, nitrate+nitrite (as nitrogen), phosphorus, and sodium appear to be elevated in the effluent from the Industrial Waste Pipeline and Ditch C; however, the concentrations of these constituents in the downgradient monitoring wells are nearly indistinguishable from the concentrations in the upgradient well (ANL-MON-A-012).

Several groundwater sample results were qualified during data validation. Although the reported concentrations may be considered questionable, inaccurate, or imprecise, the estimated values are provided in Table 5. These qualified data are discussed below:

- The chloride results for samples collected on May 2, 2016 and May 3, 2016, from all three monitoring wells were assigned a J qualification because of high MS recovery of 112% which is outside the the 90-110% acceptance per USEPA Methods and GDE-8511, sec. 4.3.9.5.4.The chloride results for samples collected on September 12, 2016 and September 13, 2016, from all three monitoring wells were assigned a J qualification because of high MS recovery of 113% which is outside the 90-110% acceptance per USEPA Methods and GDE-8511, sec. 4.3.9.5.4.
- The sulfate results for samples collected on September 12, 2016 and September 13, 2016, from all three monitoring wells were assigned a J qualification because of high MS recovery of 114% which is outside the 90-110% acceptance per USEPA Methods and GDE-8511, sec. 4.3.9.5.4.
- The iron results for samples collected on September 12, 2016 and September 13, 2016, from all three monitoring wells were assigned a J qualification because of high relative percent difference (RPD) from the laboratory duplicate sample (LDS). The reported 59.7 RPD was greater than +/-20% recovery criteria per GDE-8511, sec. 4.3.11.6.2.
- The total phosphorous results from samples collected May 2, 2016 and May 3, 2016 from ANL-MON-A-012 and ANL-MON-A-013 were assigned a J qualifier by the laboratory to indicate an estimated result. The total phosphorus results from samples collected September 12, 2016 and September 13, 2016, from ANL-MON-A-012 was assigned a J qualifier by the laboratory to indicate an estimated result.
- The TDS results from samples May 2, 2016 and May 3, 2016, from all three monitoring wells were assigned a J qualification because of high relative percent difference (RPD) from the laboratory duplicate sample (LDS). The reported 48.6 RPD was greater than +/-20% recovery criteria per GDE-8511, sec. 4.3.11.6.3.

4.5 Water Table Information

Depth to water and water table elevations for the May and September 2016 sampling events are shown in Figure 3 and Figure 4, respectively. The elevations are referenced to the National Geodetic Vertical Datum of 1929. In addition, the figures show the inferred general groundwater flow direction in the vicinity of the MFC. The general groundwater flow direction at the INL Site is to the southwest.

Table 5. Summary of groundwater quality data collected for the Industrial Wastewater Reuse Permit for the Materials and Fuels Complex Industrial Waste Ditch and Pond.

WELL NAME	ANL-MON-A-012 (GW-016001)		ANL-MON-A-013 (GW-016002)		ANL-MON-A-014 (GW-016003)		PCS/SCS[a]
Sample Date	05/02/2016	09/12/2016	05/03/2016	09/13/2016	05/03/2016	09/13/2016	
Water Table Depth (ft bls)	659.63	662.24	648.10	650.50	647.22	649.68	NA[b]
Water Table Elevation (ft above mean sea level)[c]	4473.07	4470.46	4472.27	4469.87	4470.86	4468.40	NA
pH	8.14	7.40	7.92	7.34	7.87	7.43	6.5 to 8.5 (SCS)
Temperature (°C)	14.8	12.5	14.5	12.6	14.9	12.6	None
Conductivity (µS/cm)	354	380	395	390	381	377	None
Nitrate as nitrogen (mg/L)	2.05	2.04	2.07	2.07	2.17	2.11	10 (PCS)
Phosphorus (mg/L)	0.0222 J[d]	0.0395 J	0.0325 J	0.0523	0.02 J	0.0559	None
Total dissolved solids (mg/L)	95.7 J	216	51.4 J	234	164 J	217	500 (SCS)
Sulfate (mg/L)	17.3	17.8 J	19.4	18.8 J	19.5	18.7 J	250 (SCS)
Arsenic (mg/L)	0.0017 U[e]	0.00171	0.0017 U	0.00198	0.00171	0.00186	0.05 (PCS)
Barium (mg/L)	0.0389	0.039	0.037	0.0355	0.0362	0.0348	2 (PCS)
Cadmium (mg/L)	0.00011 U	0.0003 U	0.00011 U	0.0003 U	0.00011 U	0.0003 U	0.005 (PCS)
Chloride (mg/L)	16.3 J	16.8 J	16.7 J	17.9 J	16.6 J	17.4 J	250 (SCS)
Chromium (mg/L)	0.002 U	0.003 U	0.00263	0.003 U	0.00259	0.003 U	0.1 (PCS)
Iron (mg/L)	0.0582	0.03 J	0.153	0.188 J	0.03 U	0.03 J	0.3 (SCS)
Lead (mg/L)	0.00005 U	0.0005 U	0.00005 U	0.0005 U	0.00005 U	0.0005 U	0.015 (PCS)
Manganese (mg/L)	0.00273	0.001 U	0.0317	0.00412	0.001 U	0.001 U	0.05 (SCS)
Mercury (mg/L)	0.000067 U	0.000067 U	0.000067 U	0.000067 U	0.000067 U	0.000067 U	0.002 (PCS)
Selenium (mg/L)	0.0015 U	0.002 U	0.0015 U	0.002 U	0.0015 U	0.002 U	0.05 (PCS)
Silver (mg/L)	0.0002 U	0.0004 U	0.0002 U	0.0004 U	0.0002 U	0.0004 U	0.1 (SCS)
Sodium (mg/L)	18.0	17.0	18.8	17.0	19.1	17.3	None
Zinc (mg/L)	0.0102	0.0035 U	0.0035 U	0.0035 U	0.0035 U	0.0035 U	5 (SCS)

a. Primary Constituent Standard (PCS) or Secondary Constituent Standard (SCS) from IDAPA 58.01.11 (Ground Water Quality Rule).
b. NA-Not applicable.
c. Elevations are given in the National Geodetic Vertical Datum of 1929. See EDW
d. J flag indicates the associated value is an estimate and may be inaccurate or imprecise. See Section 4.4 for additional discussion.
e. U flag indicates the result was reported as below the instrument detection limit by the analytical laboratory.

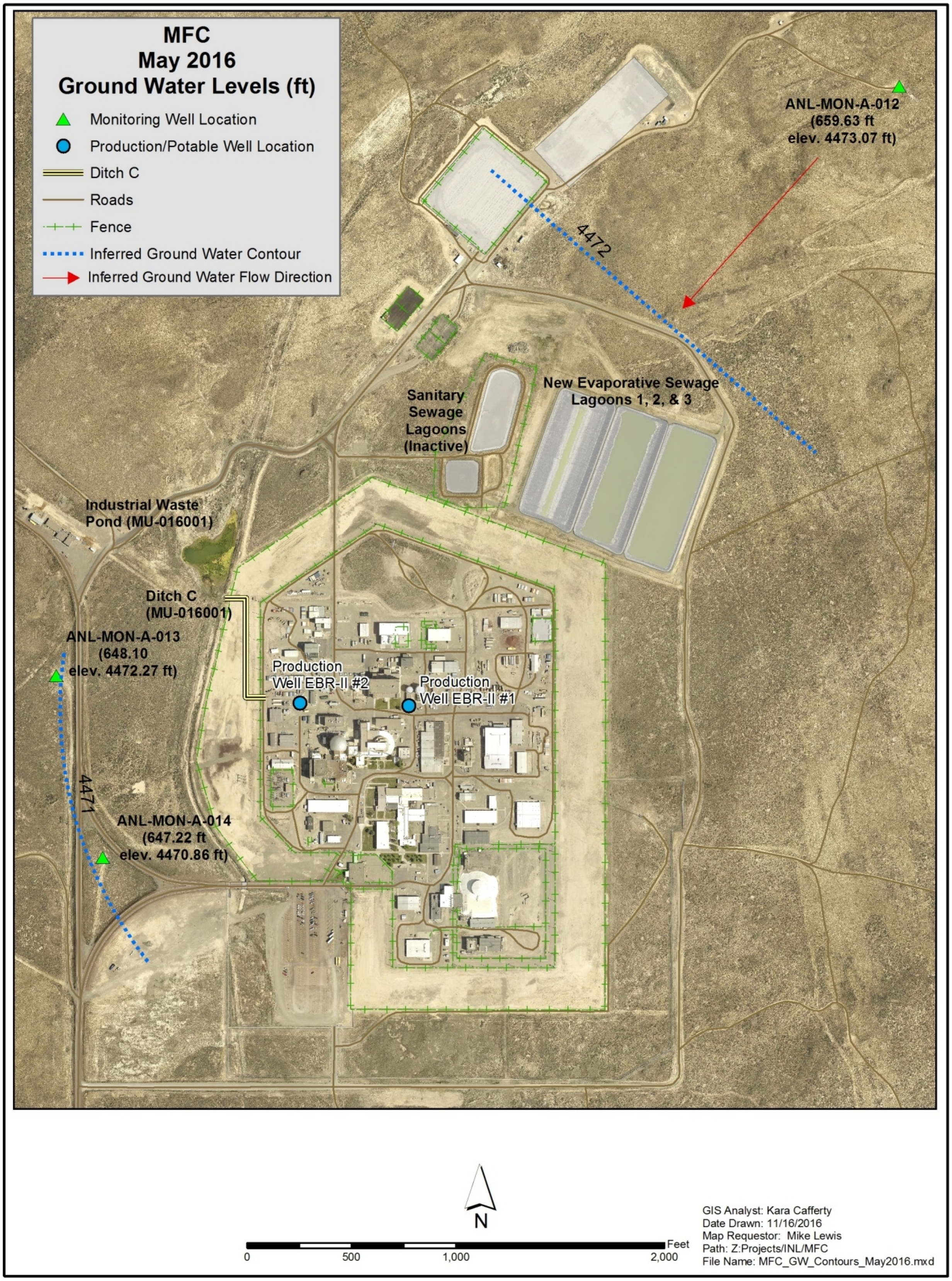

Figure 3. Groundwater contour map based on the May 2016 water level measurements.

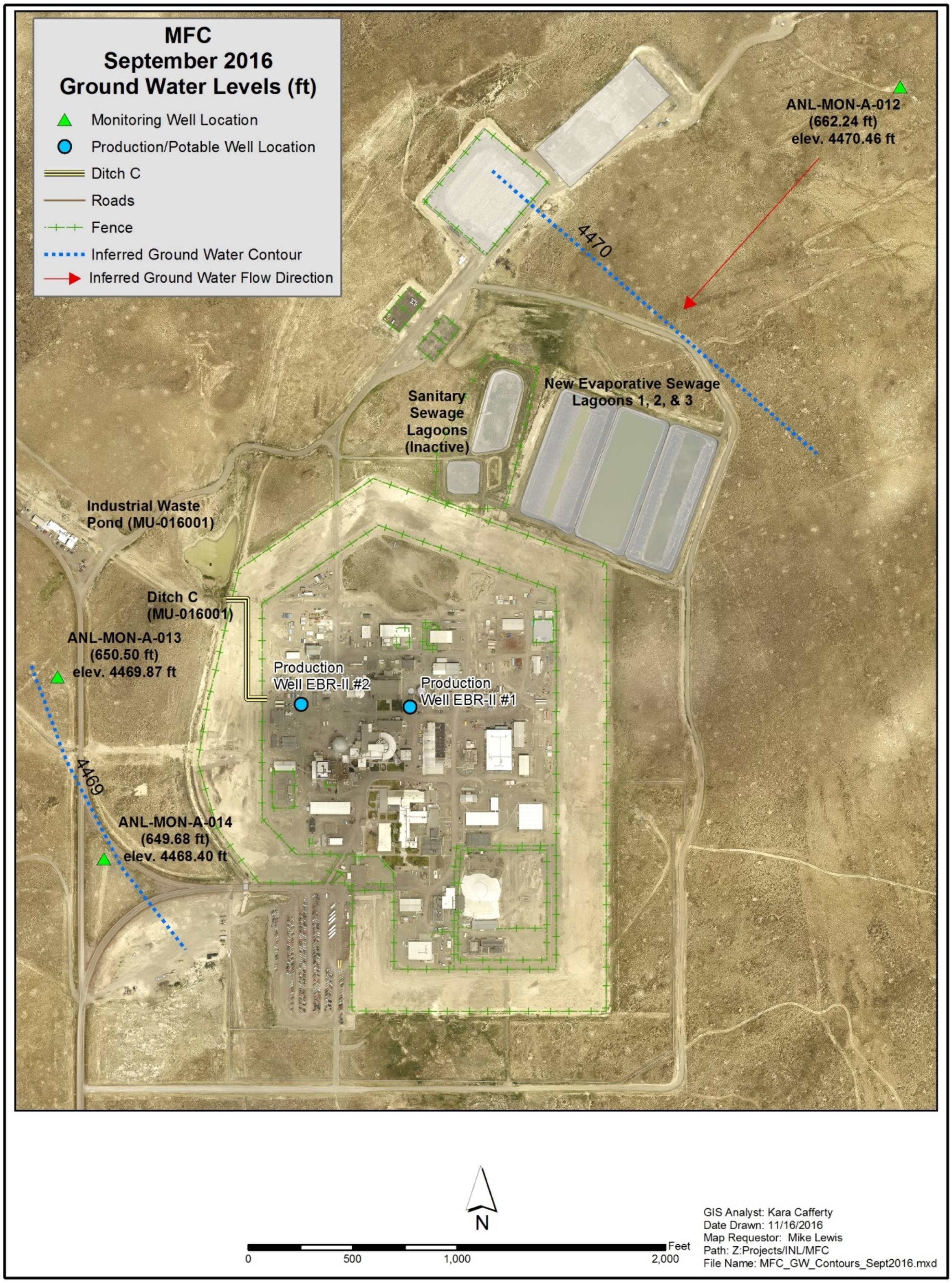

Figure 4. Groundwater contour map based on the September 2016 water level measurements.

5. PERMIT YEAR SUMMARIES

This section provides information and status associated with permit required compliance activities. Noncompliance issues are also addressed in this section.

5.1 Status of Permit Required Compliance Activities

Section E of the IWRP identifies two compliance activities: preparation of a Plan of Operation and a Waste Solids Management Plan. Section H, Paragraph 5, of the permit requires that DEQ be notified within 30 days of completing any work described in Section E, and that the annual report shall provide the status of compliance activities still in progress at the end of the permit year.

Compliance Activity CA-160-01: This compliance activity to submit a final Operation and Maintenance Manual was completed in June 2011 with the approval letter from the DEQ (Rackow 2011).

Compliance Activity CA-160-02: This compliance activity requires a Waste Solids Management Plan shall be submitted to DEQ as needed. The compliance activity states:

"A Waste Solids Management Plan shall be submitted for DEQ review and shall be approved by DEQ prior to any dredging or removal of solids, mud, or sludge from the Industrial Waste Pond. The plan shall outline actions associated with the removal (dredging) of solids in the Industrial Waste Pond. The plan shall include: specific information used in the determining the need for removal of solids, responsible person(s) for the decision, and a complete SOP for the removal of the solids."

The due date for CA-160-02 is as needed, review and approval required prior to removal of any waste solids. Currently there are not any plans to remove solids from the pond.

5.2 Issues/Noncompliances

The Wastewater Reuse Permit (WRU-I-0160-01, Modification 1) for the Materials and Fuels Complex Industrial Waste Ditch and Industrial Waste Pond requires monthly flow volumes to be recorded from the Industrial Waste Pipeline (IWP) flow meter.

Issues

The volume recorded for December 2015, was later found to be erroneous. To calculate the volume discharged for the current month, the total volume recorded for the previous month is subtracted from the volume recorded at the end of the current month. While performing the calculation, it became clear that the value recorded for December 2015, could not have been correct. After speaking with the inspector and postulating the common recording errors, no obvious cause for the error was identified, and a subsequent reading was taken on January 12, 2016. The volumes for December 2015 and January 2016 were then estimated by multiplying the average daily flow by the number of days without a correct flow reading (12/9/2015 to 12/31/ 2015 (22 days) and 1/1/ 2016 to 1/12/ 2016 (12 days) The monthly volumes for December 2015 and January 2016 are therefore the combination of estimation and reported readings in order to account for every day.

Noncompliances

On October 31, 2016, it was discovered that the flow meter digital display was not operational. Operations personnel began investigating the issue immediately. The last time the flow meter display was confirmed operational was on October 13, 2016, during the annual Idaho Department of Environmental Quality (DEQ) inspection of the industrial wastewater system; however, the flow volume was not recorded at that time. The cause of the power failure to the flow meter display was determined and it was returned to service on November 2, 2016. On November 3, 2016, DEQ was contacted and informed that the monthly (October 2016) flow volume could not be retrieved from the IWP flow meter as required by the permit. Per the conversation, DEQ was provided an email to document the issue and explain the corrective actions (Lewis 2016).

The October flow measurement was conservatively estimated at 848,160 gallons using the high flow rate (19 gpm) from the previous 12 months. As a result, the total flow volume, including the flow to Ditch C, of 7.607 million gallons for the 2016 report year is estimated to be approximately 450,000 gallons higher than the actual flow, but still significantly lower than the 17 MG/year limit.

6. ENVIRONMENTAL IMPACTS

There are a variety of ways the environment can be impacted or associated with the operation of the IWP. These include aquifer recharge, wildlife habitat, and water source for native wildlife. Nitrogen and solids loading may also be an impact to the environment from operation. Nitrogen can be lost or removed from the soil by leaching, ammonia volatilization, and denitrification, while high solids loadings has the potential to reduce the infiltration capacity of soil.

The IWRP specifies a maximum hydraulic loading rate of 17 MG/year. The total estimated volume discharged to the MFC IWD and IWP during the reporting period (November 1, 2015, through October 31, 2016) was 7.607 MG.

The IWRP also specifies effluent permit limits based on a 30-day average for TN and TSS of 20 mg/L and 100 mg/L, respectively. Total nitrogen is calculated as the sum of TKN and nitrate plus nitrite, as nitrogen. The maximum calculated TN discharged from the Industrial Waste Pipeline was 3.186 mg/L in the July 2016 sample. The highest calculated TN concentration in the effluent discharged to Ditch C was 7.68 mg/L observed in the third quarter sample. All TSS effluent sample results from the Industrial Waste Pipeline were less than 4 mg/L. The highest TSS concentration in the effluent discharged to Ditch C was 7.4 mg/L from the sample collected during the first quarter. No permit limits are specified for the other required analytes for the effluent from the Industrial Waste Pipeline or the discharge to Ditch C.

The concentrations of the permit-required analytes in the groundwater samples were all below the respective groundwater quality standards in IDAPA 58.01.11 as required by the IWRP. Unfiltered results met compliance standards and eliminated the need to report filtered sample results. The concentrations of chloride, nitrate (as nitrogen), phosphorus, and sodium appear to be elevated in the effluent from the Industrial Waste Pipeline and the discharge to Ditch C compared to previous years; however, the concentrations of these constituents in the downgradient monitoring wells are nearly indistinguishable from concentrations in the upgradient well (Figure 5).

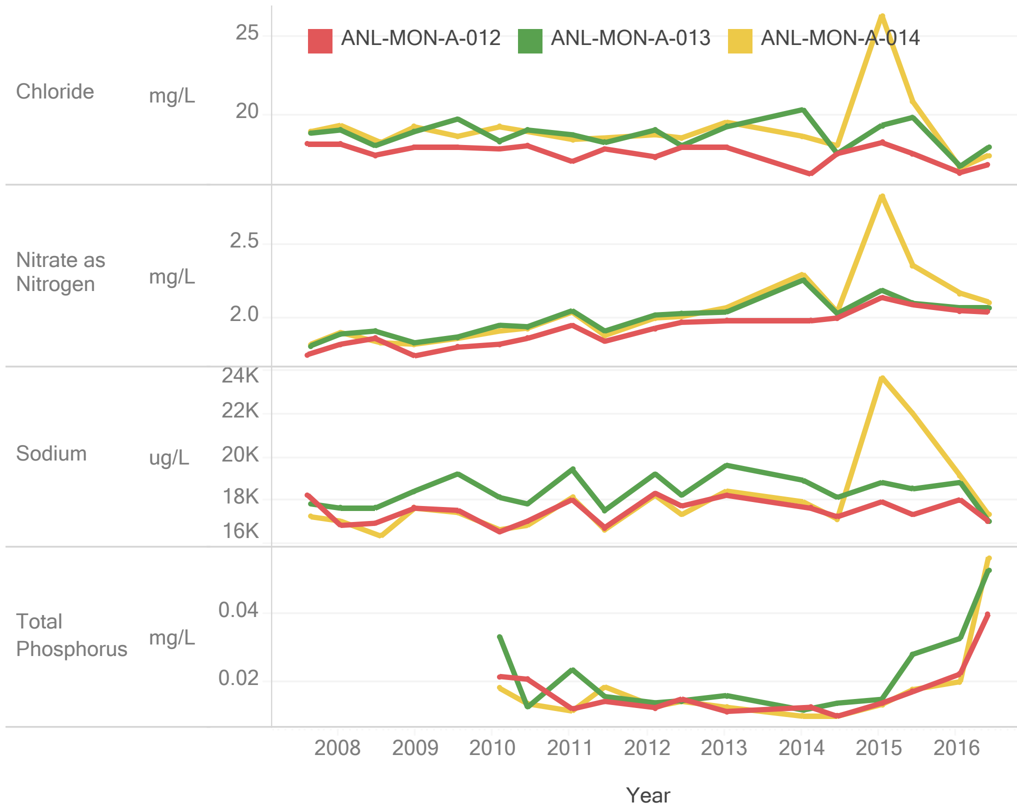

Figure 5. Groundwater concentrations for chloride, nitrate (as nitrogen), sodium, and total phosphorous.

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