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2016 Annual Reuse Report for the Idaho National Laboratory Site's Advanced Test Reactor Complex Cold Waste Ponds

February 2017

The INL is a U.S. Department of Energy National Laboratory
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ABSTRACT

This report describes conditions and information, as required by the state of Idaho, Department of Environmental Quality Reuse Permit I-161-02, for the Advanced Test Reactor Complex Cold Waste Ponds located at Idaho National Laboratory from November 1, 2015–October 31, 2016. The effective date of Reuse Permit I-161-02 is November 20, 2014 with an expiration date of November 19, 2019. This report contains the following information:

- Facility and system description
- Permit required effluent monitoring data and loading rates
- Permit required groundwater monitoring data
- Status of compliance activities
- Issues
- Discussion of the facility's environmental impacts.

During the 2016 permit year, 180.99 million gallons of wastewater were discharged to the Cold Waste Ponds. This is well below the maximum annual permit limit of 375 million gallons.

As shown by the groundwater sampling data, sulfate and total dissolved solids concentrations are highest in well USGS-065, which is the closest downgradient well to the Cold Waste Ponds. Sulfate and total dissolved solids concentrations decrease rapidly as the distance downgradient from the Cold Waste Ponds increases. Although concentrations of sulfate and total dissolved solids are significantly higher in well USGS-065 than in the other monitoring wells, both parameters remained below the Ground Water Quality Rule Secondary Constituent Standards in well USGS-065.

The facility was in compliance with the Reuse Permit during the 2016 permit year.

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ACRONYMS

ATR	Advanced Test Reactor
CCN	correspondence control number
CFR	Code of Federal Regulations
CTS	Commitment Tracking System
CWPs	Cold Waste Pond(s)
DEQ	Idaho Department of Environmental Quality
EPA	U.S. Environmental Protection Agency
FM	flow measurement or monitoring description or identifier
GW	prefix for groundwater reporting serial number
IDAPA	Idaho Administrative Procedures Act
INL	Idaho National Laboratory
MDL	method detection limit
MG	million gallons
MS	matrix spike
MU	prefix for management unit reporting environmental serial number
NA	Not Applicable
NAVD	North American Vertical Datum
OOS	out of service
PCS	Primary Constituent Standard
PO	Plan of Operation
QAPP	Quality Assurance Project Plan
RL	reporting limit
R&MS	Regulatory and Monitoring Services
RPD	relative percent difference
SCS	Secondary Constituent Standard
s.u.	standard units for pH
TDS	total dissolved solids
TKN	total Kjeldahl nitrogen
TN	total nitrogen
TRA	prefix for groundwater reporting (well) common designation number
USGS	prefix for groundwater reporting (well) common designation number
WW	prefix for wastewater reporting serial number

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1. INTRODUCTION

The Advanced Test Reactor (ATR) Complex Cold Waste Ponds (CWPs) is a reuse facility operated by Battelle Energy Alliance, LLC at Idaho National Laboratory (INL) under Reuse Permit No. I-161-02 issued by the State of Idaho Department of Environmental Quality (DEQ) on November 20, 2014 (Neher 2014) and expires on November 19, 2019.

This 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 ATR Complex (Figure 1) is located on approximately 100 acres in the southwestern portion of INL, approximately 47 miles west of Idaho Falls, Idaho, in Butte County. The ATR Complex consists of buildings and structures utilized to conduct research associated with developing, testing, and analyzing materials used in nuclear and reactor applications and both radiological and nonradiological laboratory analyses.

The CWPs are located approximately 450 ft from the southeast corner of the ATR Complex compound and approximately 3/4 of a mile northwest of the Big Lost River channel (Figure 1). The existing CWPs were excavated in 1982. The CWPs consist of two cells, each with dimensions of 180 × 430 ft across the top of the berms, and a depth of 10 ft. Total surface area for the two cells at the top of the berms is approximately 3.55 acres. Maximum capacity is approximately 10,220,000 gal (31.3 acre ft).

Wastewater discharged to the CWPs consists primarily of noncontact cooling tower blowdown, once-through cooling water for air conditioning units, coolant water from air compressors, secondary system drains, and other nonradioactive drains throughout the ATR Complex. The wastewater flows through collection piping to the TRA-764 Cold Waste Sample Pit (Figure 2) where the flow rate is recorded and compliance monitoring samples are collected. The wastewater then flows to the Cold Waste Sump Pit (TRA-703). The sump pit contains submersible pumps that route the water to the appropriate pond through 8-in. valves.

Wastewater enters the ponds through concrete inlet basins located near the west end. Most of the water percolates into the porous ground within a short distance from the inlet basins. The entire floor of a pond is rarely submerged. If the water level rises significantly in a pond (e.g., 5 ft), the flow would be diverted to the adjacent pond, allowing the first pond to dry out. An overflow pipe connects the two ponds at the 9-ft level.

Normal operation is to route the wastewater to one pond at a time. Historically, the flow to the ponds was switched annually. Section 4.2 of the Reuse Permit states "DEQ recommends each basin be operated using periods of wetting and drying cycles at set frequencies that provide for both anaerobic and aerobic treatment of the wastewater through the vadose zone."

Beginning in February 2015, the frequency for switching ponds was increased to approximately monthly. The dates when the effluent flow to the ponds were switched can be found in Appendix A. The change in frequency is based on a modeled vadose zone drain-out period for the zone above the shallow perched water zone below the CWPs.

There are no existing or planned cross-connections or interconnections between the Cold Waste System wastewater and any water supplies (potable or nonpotable) that would require backflow prevention devices or methods.

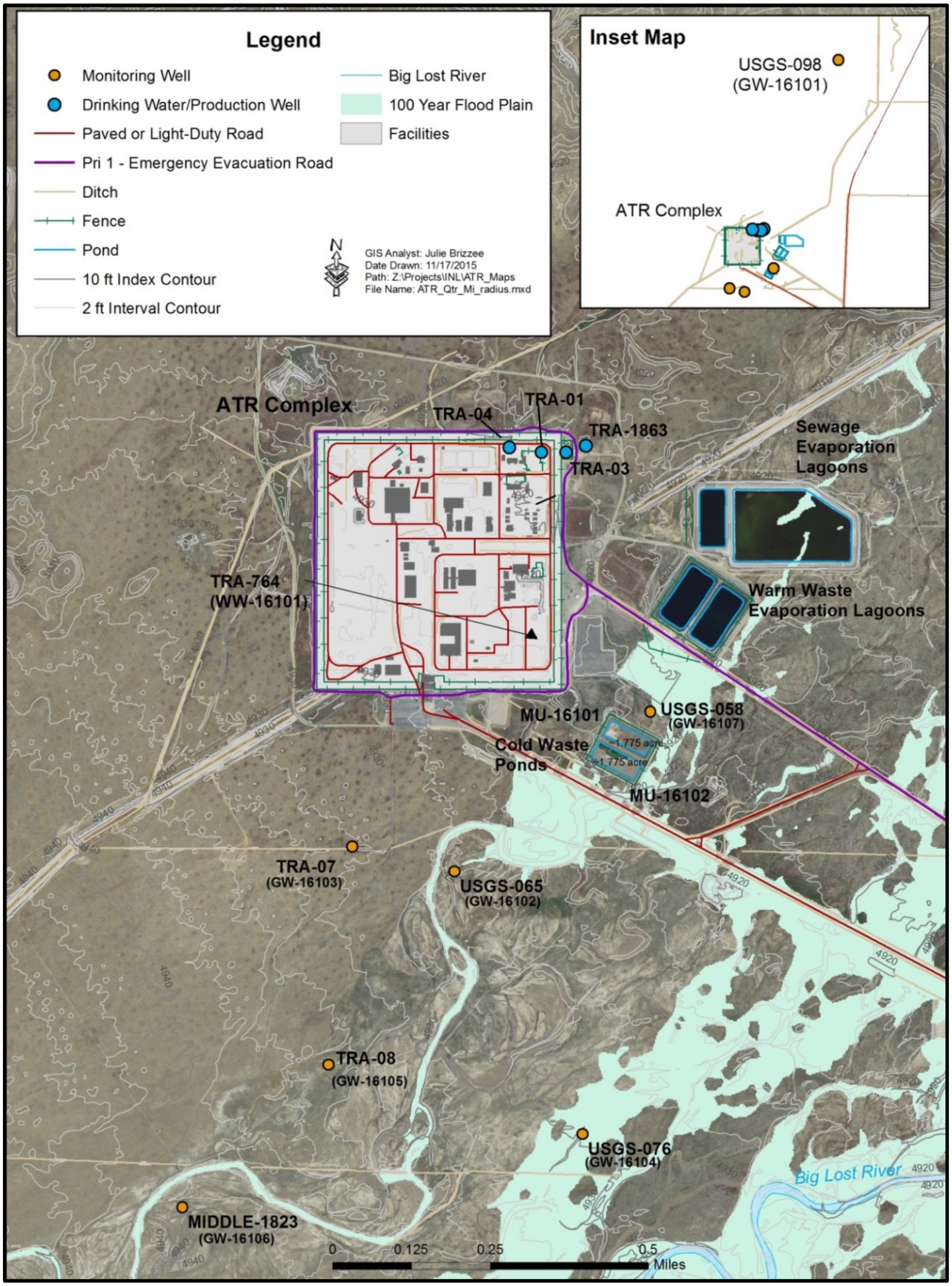

Figure 1. Advanced Test Reactor Complex facility map showing location of the Cold Waste Ponds, monitoring and drinking water wells, Big Lost River, and other associated surface features.

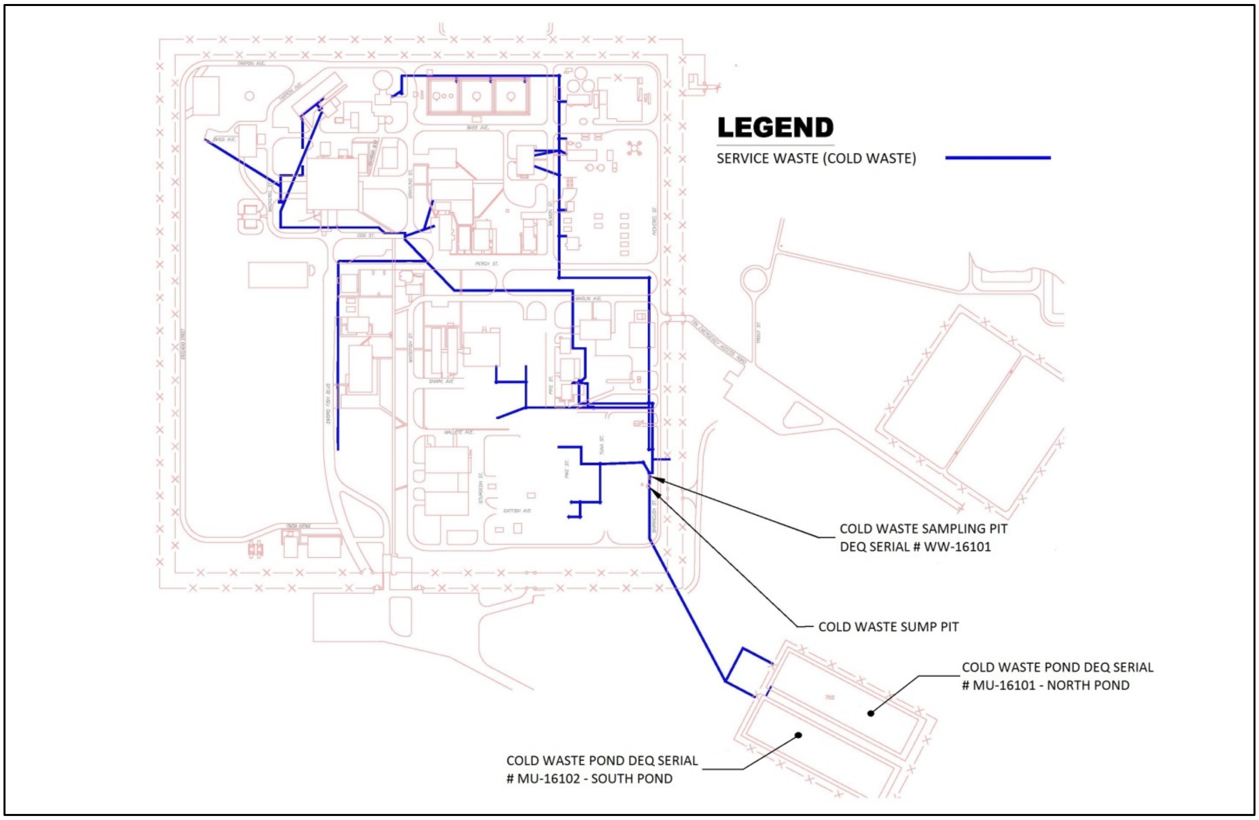

Figure 2. Advanced Test Reactor Complex Cold Waste system flow schematic.

3. COLD WASTE PONDS EFFLUENT MONITORING

This section describes the sampling and analytical methods used in the ATR Complex CWPs effluent monitoring program. Effluent monitoring and flow data for wastewater discharged to the ATR Complex CWPs are provided.

3.1 Sampling Program and Analytical Methods

Battelle Energy Alliance, LLC, Regulatory and Monitoring Services (R&MS) personnel monitor effluent discharges at the ATR Complex CWPs. The R&MS program involves sampling, analysis, and data interpretation carried out under a quality assurance program. A Quality Assurance Project Plan (QAPP), as required by the Reuse Permit, was submitted to DEQ on May 18, 2015 (Miller 2015a).

The QAPP identifies the scope of monitoring, the organization and individuals involved, data quality objectives, monitoring procedures, and specific quality control measures. The purpose of the QAPP is to ensure data of sufficient quantity and quality are collected to meet permit and regulatory expectations.

Regulatory and Monitoring Services personnel collect monthly effluent samples as required in Section 5.1.1 of the Reuse Permit. Effluent samples were collected from the TRA-764 Cold Waste Sample Pit (sampling location WW-16101) prior to discharge to the CWPs. All samples were collected according to established programmatic sampling procedures. These procedures are now identified in the QAPP.

Effluent sampling events are randomly scheduled within the constraints of the sampling staff and laboratory availability. Effluent samples are typically collected early in the month (first or second week) and on a Tuesday or Wednesday of the selected week. This ensures the laboratory can receive the samples during normal working hours so that temperature control and holding time requirements are met. 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. The WW-16101 January sampling event, originally scheduled for January 13, 2016, was rescheduled to January 21, 2016, due to unavailability of sampling staff.

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

Permit required effluent pH and conductivity analyses are performed at the time of sample collection by R&MS personnel using a calibrated meter. 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

The permit year covered in this report is November 1, 2015–October 31, 2016.

Effluent samples were collected monthly from the TRA-764 Cold Waste Sample Pit (prior to discharge to the CWPs) during the permit year. Effluent samples were collected as 24-hour flow proportional composite samples. All samples were collected and analyzed as required by the permit (Table 1).

Total nitrogen is a permit required parameter. Total nitrogen is calculated as the sum of total Kjeldahl nitrogen (TKN) and nitrate plus nitrite nitrogen. There are no permit limits for total nitrogen.

Although, there are no effluent permit limits for total dissolved solids (TDS) or sulfate, these parameters are found at elevated levels in groundwater monitoring well USGS-065. A summary comparison of these parameters with the Ground Water Quality Rule Secondary Constituent Standards (SCS) found in Idaho Administrative Procedures Act (IDAPA) 58.01.11.200.01.b. is provided below:

The TDS SCS is 500 mg/L. The TDS concentration in the effluent to the CWPs ranged from 189 mg/L in the April 2016 sample to 1,300 mg/L in the March 2016 sample (Table 1). Concentrations of TDS in the effluent were above the SCS level in 3 out of the 12 months.

Similar to the TDS effluent levels, sulfate concentrations were above the SCS of 250 mg/L in 3 of the 12 monthly samples (Table 1). Sulfate ranged from a minimum of 20.1 mg/L in the April 2016 sample to a maximum of 628 mg/L in the March 2016 sample.

The ATR evaporative cooling process evaporates approximately one-half of the water volume and concentrates naturally occurring TDS and additives in the blowdown discharged to the CWPs. Elevated sulfate levels are generated by reactions between sulfuric acid additives placed in the cooling water and calcium and magnesium carbonates in the water.

The metals concentrations in the CWPs effluent remained at low levels (Table 1).

Table 1. Advanced Test Reactor Complex Cold Waste Ponds effluent (WW-16101) data for samples collected in accordance with Reuse Permit I-161-02.

Sample Month	November	December	January	February	March	April	May	June	July[a]	August	September	October
Sample Date	11/10/15	12/08/15	01/21/16	02/09/16	03/08/16	04/12/16	05/10/16	06/21/16	07/12/16	08/17/16	09/07/16	10/18/16
Nitrite + nitrate as nitrogen (mg/L)	0.875	2.92	0.877	0.879 J[b]	3.91	0.981 J	0.929	1.08	0.895 [0.91]	0.92	0.955	3.11
Total Kjeldahl nitrogen (mg/L)	0.176	1.03	0.0942 J	-0.0457 U[c]	1.11	0.0272	-0.00597 U	0.0367 J	-0.0648 U [-0.0135 U]	-0.0169 UJ[d]	-0.0693 U	0.309
Total nitrogen[e] (mg/L)	1.051	3.95	0.971	0.879	5.02	1.0082	0.929	1.1167	0.895 [0.91]	0.92	0.955	3.419
pH (s.u.)	8.06	7.87	7.71	7.76	7.26	7.87	7.82	7.33	7.27	7.18	7.17	7.10
Electrical conductivity (µS/cm)	463	1,320	427	511	1,453	399	380	468	389	448	486	1164
Chloride (mg/L)	15.8	39.7	9.62	13.5	42	9.84 J	9.56	12.9	9.65 [9.67]	9.89	13.1	34.1
Sulfate (mg/L)	42.8	546	23	46.4	628	20.1	21.8	56.2	21.9 [21.8]	21.9	33.2	461
Total dissolved solids (mg/L)	254	1,000	310	316	1,300	189 J	234 J	249	200 [217]	211	211 J	833 J
Aluminum, filtered (mg/L)	0.025 U	0.025 U	0.015 U	0.015 U	0.015 U	0.015 U	0.015 U	0.065	0.015 U [0.015 U]	0.0265	0.0015 U	0.015 U
Chromium, total (mg/L)	0.00527 J	0.0106	0.00446	0.00519	0.0126	0.00346	0.00307	0.00396	0.00404 [0.00363]	0.00416	0.00407	0.00969
Chromium, filtered (mg/L)	0.00519 J	0.0105	0.00408	0.00501	0.0134	0.00354	0.00273	0.00294	0.00376 [0.00388]	0.00333	0.00412	0.00922
Iron, filtered (mg/L)	0.025 U	0.0253	0.0488	0.033 U	0.033 U	0.033 U	0.100	0.103	0.033 U [0.033 U]	0.0779	0.093	0.033 U
Manganese, filtered (mg/L)	0.0025 U	0.00303	0.001 U	0.001 U	0.00204	0.001 U	0.001 U	0.001 U	0.001 U [0.001 U]	0.001 U	0.001 U	0.0019

a. Results shown in brackets are from field duplicate samples collected in July.

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 TKN, nitrite nitrogen, and nitrate nitrogen. For results reported below the laboratory instrument detection limit and with a negative value, the sample result is considered zero when used in the calculation.

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 November 10, 2015, filtered and unfiltered chromium sample results were qualified with a J flag by the laboratory. The J flag indicates the analyte was detected at or above the laboratory's reporting limit but below the requested detection limit.
- The TKN result for the sample collected on January 21, 2016, was qualified with a J flag by the laboratory to designate an estimated result.
- The February 9, 2016, nitrate/nitrite sample result was J flagged during data validation. The nitrate/nitrite sample result was greater than the method detection limit (MDL) and outside the matrix spike (MS) 90%-110% recovery criteria per the EPA Method and the Inorganic Analyses Data Validation for INL (GDE-8511), section 4.3.9.5.4 at 89.1%. The J flag for the February 9, 2016, nitrate/nitrite sample denotes the data is detected at the reported concentration, but the reported concentration is an estimate due to low MS recovery.
- The April 12, 2016, nitrate/nitrite sample result was J flagged during data validation. The nitrate/nitrite sample result was greater than the MDL and outside the MS 90%-110% recovery criteria per the EPA Method and the Inorganic Analyses Data Validation for INL (GDE-8511), section 4.3.9.5.4 at 115%. The J flag for the April 12, 2016, nitrate/nitrite sample denotes the data is detected at the reported concentration, but the reported concentration is an estimate due to high MS recovery.
- The April 12, 2016, chloride sample result was J flagged during data validation. The chloride sample result was greater than the MDL and outside the MS 90%-110% recovery criteria per the EPA Method and the Inorganic Analyses Data Validation for INL (GDE-8511), section 4.3.9.5.4 at 120%. The J flag for the April 12, 2016, chloride sample denotes the data is detected at the reported concentration, but the reported concentration is an estimate due to high MS recovery.
- The May 10, 2016, and April 12, 2016, TDS sample results were J flagged during data validation. The J flag denotes that TDS is detected at the reported concentration, but the reported concentration is an estimate due to the laboratory duplicate sample not meeting the relative percent difference (RPD) requirement of ±5%, or exhibited an absolute difference less than 5 times the reporting limit (RL) for sample and duplicate results <20 times the RL as outlined in GDE-8511, Section 4.3.11.6.3.
- The June 21, 2016, TKN sample result was J flagged during data validation. The TKN sample result was greater than the MDL and outside the MS 90%-110% recovery criteria per the EPA Method and the Inorganic Analyses Data Validation for INL (GDE-8511), section 4.3.9.5.4 at 113%. The J flag for the June 21, 2016, TKN sample denotes the data is detected at the reported concentration, but the reported concentration is an estimate due to high MS recovery.
- The August 17, 2016, TKN sample result was U flagged by the laboratory and J flagged during data validation. The August 17, 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 high MS recovery of 113%. The MS recovery for this sample was outside the 90-110% acceptance criteria.
- The September 7, 2016, TDS sample result was J flagged during data validation. The J flag denotes the TDS is detected at the reported concentration, but the reported concentration is an

estimate due to the laboratory duplicate sample not meeting the ±5% RPD requirement, as outlined in GDE-8511, Section 4.3.11.6.3.

- The October 18, 2016, TDS sample result was J flagged during data validation. The duplicate sample results were outside the ±5% RPD requirements, and exhibited an absolute difference greater than 5 times the reporting limit for the sample and duplicate results greater than 20 times the reporting limit, as outlined in GDE-8511, Section 4.3.11.6.3. The J flag denotes the TDS is detected at the reported concentration, but the reported concentration is an estimate due to the high duplicate sample recovery.

3.3 Flow Volumes and Hydraulic Loading Rates

Daily flow readings were taken by ATR Complex CWPs Operations during the 2016 permit year, as required by Section 5.1.2 of the Reuse Permit, at the TRA-764 Cold Waste Sample Pit where the flow meter (FM-16101) is located. The flow meter measures flow to the North Pond (MU-16101) and to the South Pond (MU-16102). All flow readings were recorded in gallons per day.

Table 2 summarizes monthly and annual flow data. Daily effluent flow data is provided in Appendix A.

Table 2. Cold Waste Ponds flow summaries.

Month	North Pond (MU-16101) (MG)[a]	South Pond (MU-16102) (MG)	Monthly Total for Both Ponds (MG)
November 2015	11.17	1.11	12.28
December 2015	0.00	10.88	10.88
January 2016	19.22	0.00	19.22
February 2016	0.63	11.49	12.12
March 2016	10.02	0.00	10.02
April 2016	1.85	15.77	17.62
May 2016	17.11	1.22	18.33
June 2016	0.00	16.80	16.80
July 2016	18.57	0.00	18.57
August 2016	0.00	19.27	19.27
September 2016	12.01	2.51	14.52
October 2016	0.75	10.61	11.36
Annual Total	**91.33**	**89.66**	**180.99**
a. MG-million gallons. Reuse Permit I-161-02 requires monthly flow volumes to be report to the nearest 0.00 MG.			

Section 4.2 of the permit requires that the total annual volume discharged to the North and South Ponds shall not exceed a 5-year moving annual average of 300 million gallons (MG)/year. No single year shall exceed 375 MG/yr. Annual hydraulic loading data from previous reporting years are used to determine compliance with the moving annual average. Figure 3 shows that the 5-year moving average is below the permit limit.

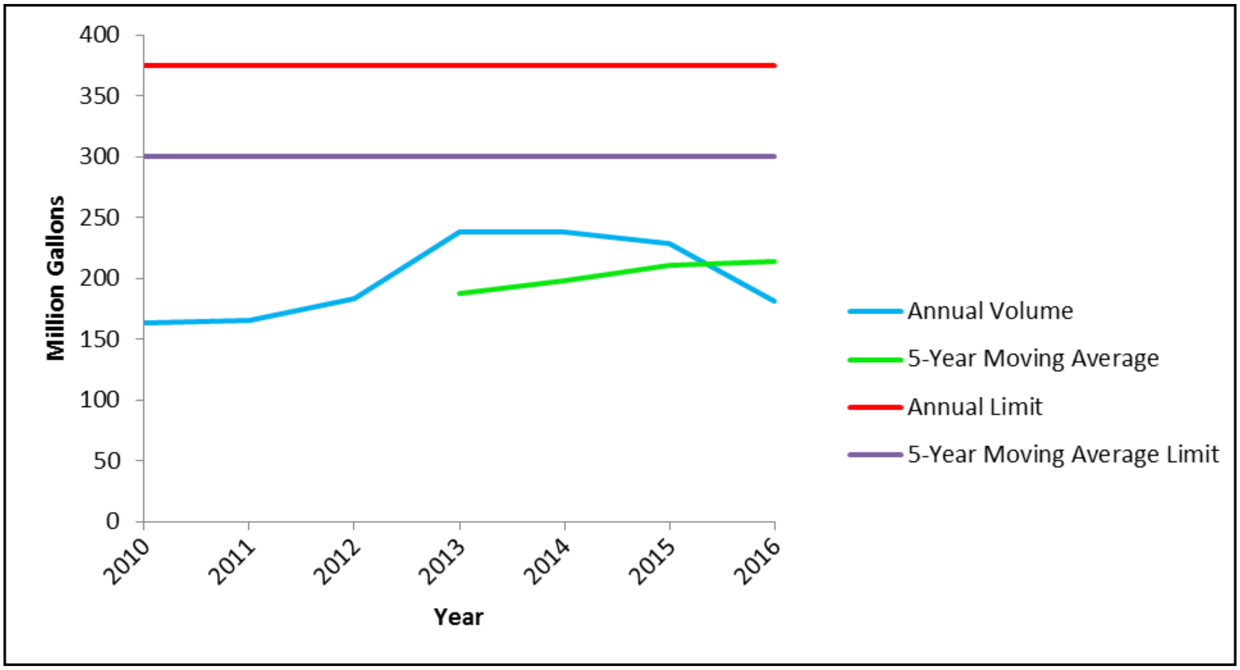

Figure 3. Advanced Test Reactor Complex Cold Waste Ponds wastewater 5-year moving average.

For permit year 2016, the total volume discharged to the North and South ponds was 91.33 MG and 89.66 MG, respectively. The total annual volume discharged to both ponds was 180.99 MG and significantly less than the maximum Reuse Permit annual limit of 375 MG.

3.3.1 Flow Meter Calibration

Calibration is performed annually and was performed on May 31, 2016, by the ATR Complex maintenance organization. The calibrations were performed to +/- 2% of full scale (full scale = 1400 gpm). The as found calibration of the flow meter was determined to be satisfactory.

4. GROUNDWATER MONITORING

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

4.1 Sampling Program

The ATR Complex CWPs Reuse Permit identifies six INL compliance wells. The permit requires that groundwater samples be collected from these six compliance wells semiannually in April or May and September or October.

The R&MS personnel collected groundwater samples in May and September 2016. The R&MS personnel use project-specific sampling and analysis plans and procedures that govern sampling activities and quality control protocols. The 2016 groundwater sampling was conducted in accordance with the QAPP that was submitted to DEQ on May 18, 2015 (Miller 2015a). 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 SCS specified in IDAPA 58.01.11, “Ground Water Quality Rule” with the exception of chromium. In accordance with the Reuse Permit, Section 5.2.2, footnote a., “compliance with the Primary Constituent Standard for Chromium, under this permit, shall not apply.”

As required by the Reuse Permit, unfiltered samples were collected and analyzed for nitrate + nitrite, as nitrogen, TKN, TDS, pH, electrical conductivity, chloride, chromium, and sulfate. Filtered samples were collected and analyzed for aluminum, chromium, iron, and manganese.

Groundwater pH and conductivity analyses are performed at the time of sample collection by R&MS personnel using a calibrated meter(s). All other permit required groundwater samples are submitted under full chain of custody to GEL Laboratories in Charleston, South Carolina for analysis.

4.2 Analytical Methods

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

4.3 Monitoring Wells

To measure potential impacts to groundwater from the ATR Complex CWPs, the permit requires that groundwater samples be collected from six monitoring wells located in the Snake River Plain Aquifer (Figure 1):

- USGS-098 (GW-16101)
- USGS-065 (GW-16102)
- USGS-076 (GW-16104)
- TRA-08 (GW-16105)
- Middle-1823 (GW-16106)
- USGS-058 (GW-16107).

All six wells are Reuse Permit compliance points. Wells with sufficient water volume are purged to a minimum of three casing volumes or one well volume with three successive field measurements, taken not less than one minute apart, for pH, conductivity, and temperature and meet the following conditions: temperature must be within 1^{o}C of each other, and conductivity values must be within 10% of each other (LI-330).

Groundwater monitoring well TRA-07 (GW-16103) was required under the previous permit as a compliance point monitoring well. However, under the current Reuse Permit Section 5.2.1 "Ground Water Monitoring Point Descriptions" table references TRA-07 in the table's footnotes as "not required under this permit". Therefore, no samples or water level information were obtained from this well.

4.4 Groundwater Monitoring Results

Table 3 shows the 2016 reporting year water table elevations and depth to water table, determined prior to purging and sampling, and the analytical results for all parameters specified by the permit for the six aquifer wells. For well USGS-058, the Reuse Permit only requires sampling, analysis, and reporting of TDS and sulfate.

The permit-required parameters were below their respective Ground Water Quality Rule (IDAPA 58.01.11) PCSs or SCSs during the 2016 reporting year for all six wells.

The 2016 aluminum, iron, and manganese concentrations in the filtered samples from all five wells were significantly lower than their respective SCS. Filtered aluminum, iron and manganese concentrations in the five monitoring wells were typically below the laboratory instrument minimum detection limits or just slightly above.

Monitoring well USGS-065 is a downgradient well located southwest of the CWPs. Sulfate and TDS concentrations in this well are consistently high but less than the applicable sulfate and TDS SCS of 250 mg/L and 500 mg/L, respectively. Sulfate and TDS concentrations were highest in the September 21, 2016 samples at 150 mg/L and 407 mg/L, respectively.

Sulfate and TDS concentrations in the other five wells, including USGS-058, were significantly lower than those in well USGS-065. Well USGS-058, slightly upgradient of the North Pond, showed sulfate and TDS concentrations similar to well Middle-1823 which is the downgradient well located farthest from the CWPs.

Although some of the reported concentrations may be considered questionable, inaccurate, or imprecise, the estimated values are provided in Table 3. These qualified data are discussed below:

- For September 2016, wells USGS-065 and USGS-076 TKN sample results were assigned a J flag because the MS result was 83.1% and outside the 90%-110% recovery criteria, per EPA methods and GDE-8511, Section 4.3.9.5.4. Wells Middle-1823, TRA-08, and USGS-098 were assigned a UJ flag for the TKN results. The UJ flag denotes the sample concentration was below the laboratory minimum detection limit and did not meet the MS recovery criteria as discussed above.
- All September 2016, groundwater chloride and sulfate sample results were assigned a J flag during validation. The J flag was assigned because the reported sample concentration was less than the MDL and the MS results were outside the 90%-110% recovery criteria, per EPA methods and GDE-8511, Section 4.3.9.5.4. The MS recovery for chloride and sulfate were 113% and 114%, respectively.
- All September 2016, groundwater iron sample results were assigned a UJ flag. The UJ flag denotes the sample concentration was below the laboratory instruments minimum detection level and the RPD of the laboratory duplicate sample result of 59.7% was above the acceptance criteria of ±20%, per GDE-8511, Section 4.3.11.6.2.

During the previous reporting year, the May 6, 2015, chromium sample concentration in well USGS-098 was 0.149 mg/L in the unfiltered sample and above the chromium PCS of 0.1 mg/L. The chromium concentration in the unfiltered sample collected on October 13, 2015, from USGS-098 was 0.0064 mg/L. For 2016, all of the chromium sample results (filtered and unfiltered) were an order of magnitude lower than the PCS which supports the 2015 annual reuse report conclusion that the May 6, 2015, chromium sample concentration may have been an anomaly. Chromium concentrations in the filtered and unfiltered samples from the other four (not required for USGS-058) monitoring wells were all significantly lower than the PCS.

4.5 Water Table Information

Depth to water and water table elevations for the May and September, 2016 sampling events are shown in Figure 4 and Figure 5, respectively. The elevations are presented in North American Vertical Datum of 1988 (NAVD 88). In addition, the figures show the inferred general groundwater flow direction in the vicinity of the ATR Complex. In this area, the flow is in a south to southwest direction. The general groundwater flow direction at the INL Site is to the southwest.

Table 3. Advanced Test Reactor Complex Cold Waste Ponds aquifer monitoring well data for the 2016 reporting year.

WELL NAME	USGS-098 (GW-16101)		USGS-065 (GW-16102)		USGS-076 (GW-16104)		TRA-08 (GW-16105)		Middle-1823 (GW-16106)		USGS-058 (GW-16107)		PCS/SCS[a]
Sample Date	05/10/16	09/19/16	05/11/16	09/21/16	05/11/16	09/20/16	05/10/16	09/20/16	05/10/16	09/19/16	05/11/16	09/21/16	
Water Table Depth (ft below ground surface)	429.70	430.43	476.62	477.66	485.04	485.98	490.24	491.19	494.56	495.49	472.98	473.90	NA[b]
Water Table Elevation (above mean sea level in ft)[c]	4459.69	4458.96	4451.90	4450.86	4448.17	4447.23	4448.82	4447.87	4448.31	4447.38	4448.91	4447.99	NA
Borehole Correction Factor (ft)[d]	2.53	2.53	NA	NA	NA	NA	0.63	0.63	NA	NA	NA	NA	NA
Nitrite + nitrate as nitrogen (mg/L)	1.09 [1.09][e]	1.1	1.77	1.45	1.09	1.02	1.07	0.975	1.05	1.01	NR[f]	NR	NA
Total Kjeldahl nitrogen (mg/L)	-0.0305 U[g] [-0.0434 U]	-0.0944 UJ[h]	0.00679 U	0.0361 J[i]	-0.0291 U	0.0387 J	-0.0577 U	-0.0775 UJ	-0.0168 U	-0.0848 UJ	NR	NR	NA
Total nitrogen[j] (mg/L)	1.09 [1.09]	1.1	<1.777	1.4861	1.09	1.0587	1.07	0.975	1.05	1.01	NR	NR	NA
pH (s.u.)	7.84	7.31	7.94	7.47	7.98	7.79	7.86	7.77	7.90	7.84	NR	NR	6.5 to 8.5
Electrical conductivity (µS/cm)	409	371	600	605	466	433	418	418	432	413	NR	NR	NA
Chloride (mg/L)	13.3 [13.3]	14 J	17	17.7 J	11.8	11.9 J	10.4	10.7 J	10.3	10.5 J	NR	NR	250 (SCS)
Sulfate (mg/L)	21.3 [21.5]	21.7 J	146	150 J	34.3	34.5 J	46.5	45.5 J	35.4	34.8 J	35.9	33.1 J	250 (SCS)
Total dissolved solids (mg/L)	207 [200]	230	323	407	194	240	217	259	220	237	216	239	500 (SCS)
Aluminum, filtered (mg/L)	0.015 U [0.015 U]	0.015 U	0.015 U	0.015 U	0.015 U	0.015 U	0.0205	0.0425	0.015 U	0.015 U	NR	NR	0.2 (SCS)
Chromium[j], total (mg/L)	0.00566 [0.006]	0.00688	0.0747	0.082	0.011	0.0114	0.0285	0.0683	0.00923	0.0102	NR	NR	0.1 (PCS)
Chromium[j], filtered (mg/L)	0.00581 [0.00602]	0.0062	0.0751	0.0801	0.0115	0.0111	0.0183	0.0197	0.00919	0.0104	NR	NR	0.1 (PCS)
Iron, filtered (mg/L)	0.030 U [0.030 U]	0.030 UJ	0.030 U	0.030 UJ	0.030 U	0.030 UJ	0.030 U	0.03 UJ	0.030 U	0.030 UJ	NR	NR	0.3 (SCS)
Manganese, filtered (mg/L)	0.001 U [0.001 U]	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001U	0.00155	0.00267	NR	NR	0.05 (SCS)

a. Primary constituent standards (PCS) and secondary constituent standards (SCS) in groundwater referenced in the Ground Water Quality Rule, IDAPA 58.01.11.200.01.a and b. In accordance with Reuse Permit I-161-02, Section 5.2.2, footnote a., compliance with the PCS for chromium, under the Reuse Permit, shall not apply.

b. NA- Not applicable.

c. Elevation data provided using the North American Vertical Datum of 1988 (NAVD 88).

d. The United States Geological Survey performed gyroscopic surveys on wells TRA-08 and USGS-098 circa 2002 to 2005. The surveys revealed these two wells were not perfectly straight or vertical which can cause the water level measurements to be greater than the true distance from the measuring point on the well to the water table. The water table elevations for these two wells have been adjusted using the borehole correction factors that were determined from the gyroscopic surveys.

e. Results shown in brackets are the results from field duplicate samples.

f. NR indicates the parameter is not required by the Reuse Permit.

g. U flag indicates that the result was reported as below the instrument detection limit by the analytical laboratory.

h. UJ flag indicates the sample was analyzed for, but was not detected. The associated value is an estimate and may be inaccurate or imprecise.

i. J flag indicates the associated value is an estimate and may be inaccurate or imprecise.

j. 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 to be zero in the total calculation. For positive results reported below the instrument detection limit, the detection limit for that parameter is used in the calculation. The resulting total nitrogen is then reported as a less than (<) number.

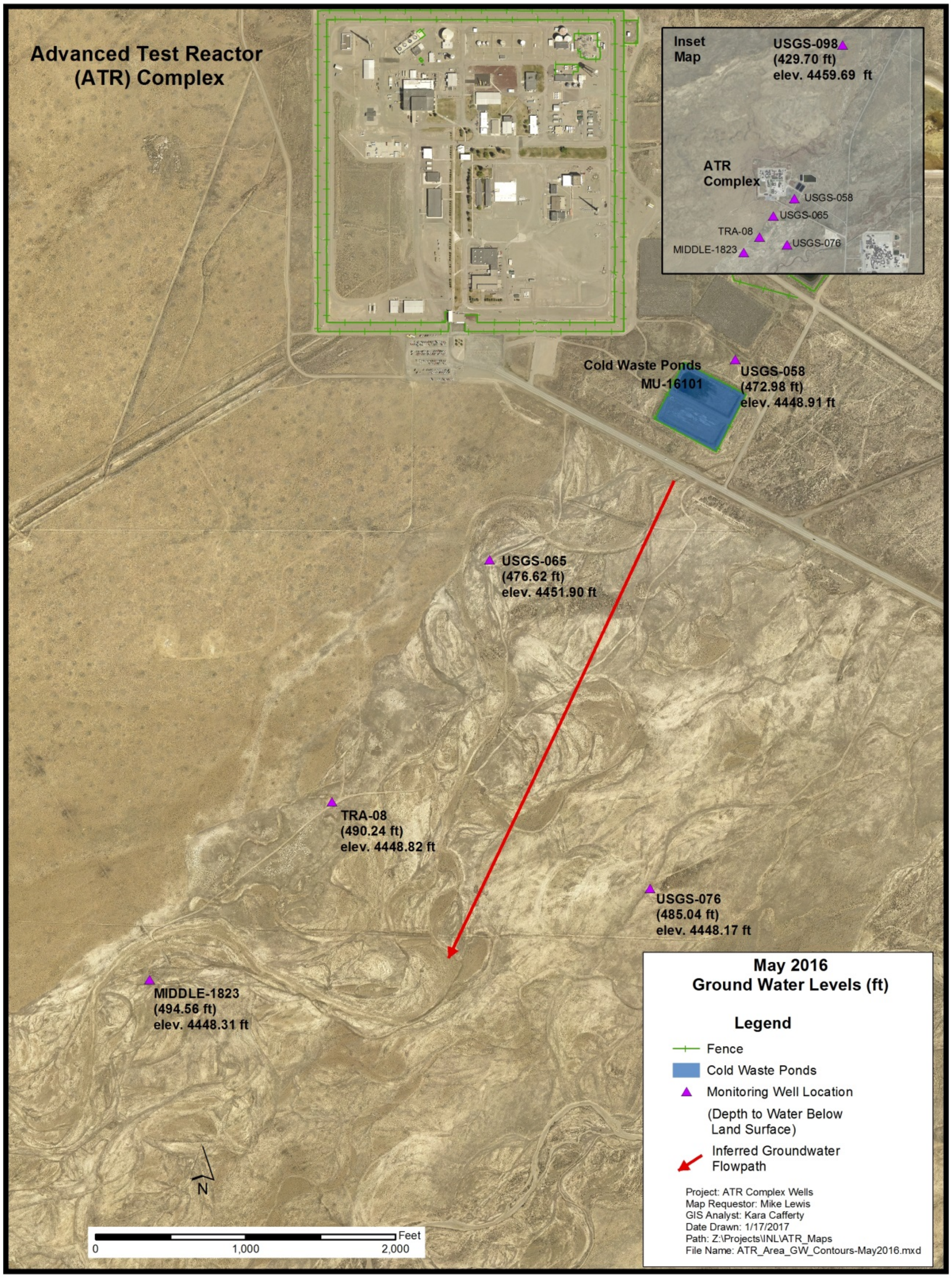

Figure 4. Map showing depths and elevations based on the May 2016 water level measurements.

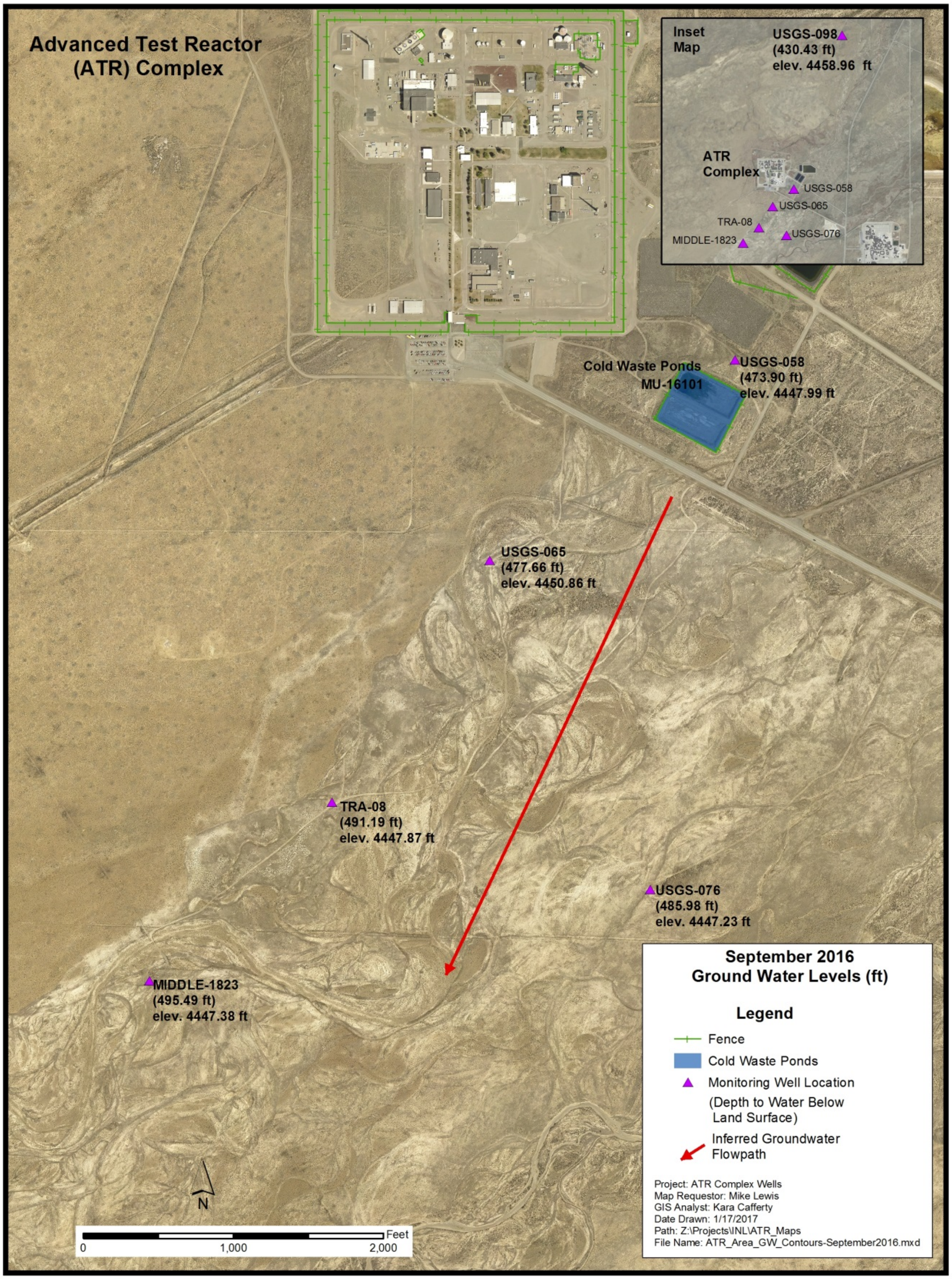

Figure 5. Map showing depths and elevations based on the September 2016 water level measurements.

5. PERMIT YEAR SUMMARIES

This section provides information and status associated with permit required compliance activities and noncompliance issues.

5.1 Status of Permit Required Compliance Activities

Section 3 of the Reuse Permit identifies four compliance activities (CA-161-01 through 04) discussed below:

CA-161-01 – Within 12 months of permit issuance, the permittee shall submit for review and approval a Plan of Operation (PO) that reflects current operations and incorporates the requirements of the Reuse Permit. The PO shall be updated as needed to reflect current operations. The permittee shall notify DEQ of material changes to the PO and copies shall be kept on site and made available to DEQ upon request.

The PO was submitted to DEQ on November 19, 2015 (Miller 2015b). Approval of the PO from DEQ has not been received.

CA-161-02 – Within 6 months of permit issuance, the permittee is required to prepare and implement a Quality Assurance Project Plan (QAPP) that incorporates all monitoring and reporting required by the permit. A copy of the QAPP and a written notice that the QAPP has been implemented shall be provided to DEQ.

A copy of the QAPP and the implementation notice were submitted to DEQ on May 18, 2015 (Miller 2015a).

CA-161-03 – Twelve months prior to permit expiration, the permittee shall contact DEQ and schedule a pre-application workshop to discuss the compliance status of the facility and the content required for the reuse permit application package.

This requirement has been added to the INL electronic Commitment Tracking System (CTS). This system provides automatic reminders to those responsible for completing the action. The first reminder date for this activity is May 18, 2018.

CA-161-04 – Six months prior to permit expiration the permittee shall submit to DEQ a complete permit renewal application package, which fulfills the requirements specified at the pre-application workshop identified in CA-161-03.

The first CTS reminder date for this activity is also May 18, 2018.

5.2 Noncompliance/Issues

There were no permit noncompliances for the 2016 reporting year. However, there was an issue with a non-contact cooling water leak.

On June 8, 2016, at the ATR Complex, water was discovered ponding through cracks in the pavement near building TRA-614 (Office Building/Bunkhouse). The water was first suspected to be a leak in the lawn sprinkler system. On June 13, 2016, after further investigation, it was determined the leak was coming from a 2” Cold Waste system service connection to TRA-614, although there are no cold waste water sources in TRA-614. However, there is a 2” Cold Waste system service connection from TRA-628 (Engineering Office Building) that connects into the service connection from TRA-614. From this point, the line runs approximately 170’ before tying into a 10” Cold Waste system line. It was suspected that there was a restriction in this 2” drain line prior to where it ties into the 10” line, causing non-contact cooling water from the heat pumps in TRA-628 to backup into the TRA-614 service connection.

Operations personnel verified TRA-628 as the water source by isolating the non-contact cooling water supply for the TRA-628 heat pumps. Once isolated, the water on the surface began to dry up. Approximately 50 to 55 gpm of non-contact cooling water was flowing through the heat pumps. The volume from the leak is unknown, but it was estimated that approximately one gpm or less was observed leaking at the surface and no evidence of sink holes in the area. The only pollutant added to the non-contact cooling water is heat. Other than the non-contact cooling water from the heat pumps, there are no other water sources in building TRA-628 that discharge into the 2" Cold Waste system service connection.

On July 14, 2016, the location of the leak was excavated. It was confirmed the source of the leak was non-contact cooling water for TRA-628 from a section of pipe in the service connection for TRA-614. Approximately two feet of pipe was removed. Soft plugs were installed upstream and downstream of the service connection (Lewis 2016).

A camera inspection in both the upstream and downstream legs of the TRA-614 service connection was performed on July 18, 2016. The upstream section of pipe appeared to be blocked by either corrosion or a plug. The camera inspection was repeated on August 1, 2016. The upstream leg of the pipe was found to be capped approximately 12.75 feet upstream from the removed section of pipe. The downstream leg did not appear to have any restriction or corrosion similar to the section of pipe removed (Lewis 2016).

Welding permanent blanks on both the upstream and downstream legs of the service connection, thus permanently isolating TRA-614 from the Cold Waste system, was proposed to DEQ. The DEQ agreed this approach was acceptable and that engineering plans and specifications were not required to be submitted to DEQ for review and approval (Rackow 2016). The isolation was completed on August 26, 2016.

5.3 Department of Environmental Quality Annual Inspection

On October 12, 2016, personnel from the DEQ Boise office inspected the ATR Complex CWPs to determine compliance with Reuse Permit No. I-161-02. DEQ found the ATR Complex CWPs in substantial compliance with the Reuse Permit (John 2016).

Reuse facilities and structures visited during the inspection included monitoring well USGS-098, TRA-703 (Cold Waste Sump Pit), TRA-764 (Cold Waste Sampling Pit), and the CWPs. Current operations were discussed including a planned future upgrade to the pump system, flow meter calibration date, dates and timing for switching flow to the ponds, monitoring activities, laboratory used for sample analysis, etc. DEQ reviewed laboratory and data validation reports.

DEQ provided two recommendations:

1. INL should contact the Idaho Falls Regional Office to discuss the interpretation of Item 8 in Section 6.1.2 of the Reuse Permit. This section requires "All laboratory analytical reports and chain of custody forms" are to be submitted in the annual report.

2. "The facility should continue to update DEQ on the progress of the installation of a new control system for the pumps."

6. ENVIRONMENTAL IMPACTS

The Reuse Permit allows 300 MG/year as a 5-year annual average, not to exceed 375 MG annually. The total volume discharged to the CWPs for this period (November 1, 2015–October 31, 2016) was 180.99 MG. No runoff occurred from the application area.

Total nitrogen concentrations in the effluent ranged between 0.879 mg/L in the February 2016 sample to 5.02 mg/L in the March 2016 sample (Table 1). Nitrogen can be lost or removed from the soil by leaching, ammonia volatilization, and denitrification. Total nitrogen in the nearest downgradient well

(USGS-065) from the CWPs was less than 1.777 mg/L in the May 2016 sample and 1.4861 mg/L in the September 2016 sample. The upgradient well (USGS-098) had total nitrogen (TN) concentrations in the May and September 2016 samples of 1.09 mg/L and 1.1 mg/L, respectively. The impact of TN on the groundwater from the CWPs appears to be minimal.

Sulfate and TDS concentrations (Table 1) in the effluent have the potential to impact groundwater. Sulfate has high solubility and tends to move at a similar velocity as the groundwater (DEQ 2007). Sulfate and TDS sampling began in 2015 for wells USGS-098 and USGS-058. Sampling wells USGS-098 and USGS-058 was not required by the previous permit.

Sulfate concentrations in the 2016 permit year effluent monthly samples ranged from a low of 20.1 mg/L in the April 2016 sample to a high of 628 mg/L in the March 2016 sample. The TDS effluent concentrations ranged from a low of 189 mg/L in the April 2016 sample to a high of 1,300 mg/L in the March 2016 sample. There are no Reuse Permit effluent limits for sulfate and TDS. However, as discussed below, there are groundwater quality standards for these two parameters.

Figures 6 and 7 show the sulfate and TDS concentrations in samples collected from the Reuse Permit CWPs monitoring wells. Sulfate and TDS data were not available for Well TRA-08 for October 2009 due to insufficient water available to collect a representative sample. Where a duplicate sample was collected, the average of the original sample and the duplicate sample were used in generating the graphs.

Well USGS-065 has the highest sulfate concentrations of the six monitoring wells (Figure 6). Of the six wells, USGS-065 is the closest downgradient well to the CWPs. As shown in Figure 6, the sulfate concentration in well USGS-065 has remained below the SCS of 250 mg/L.

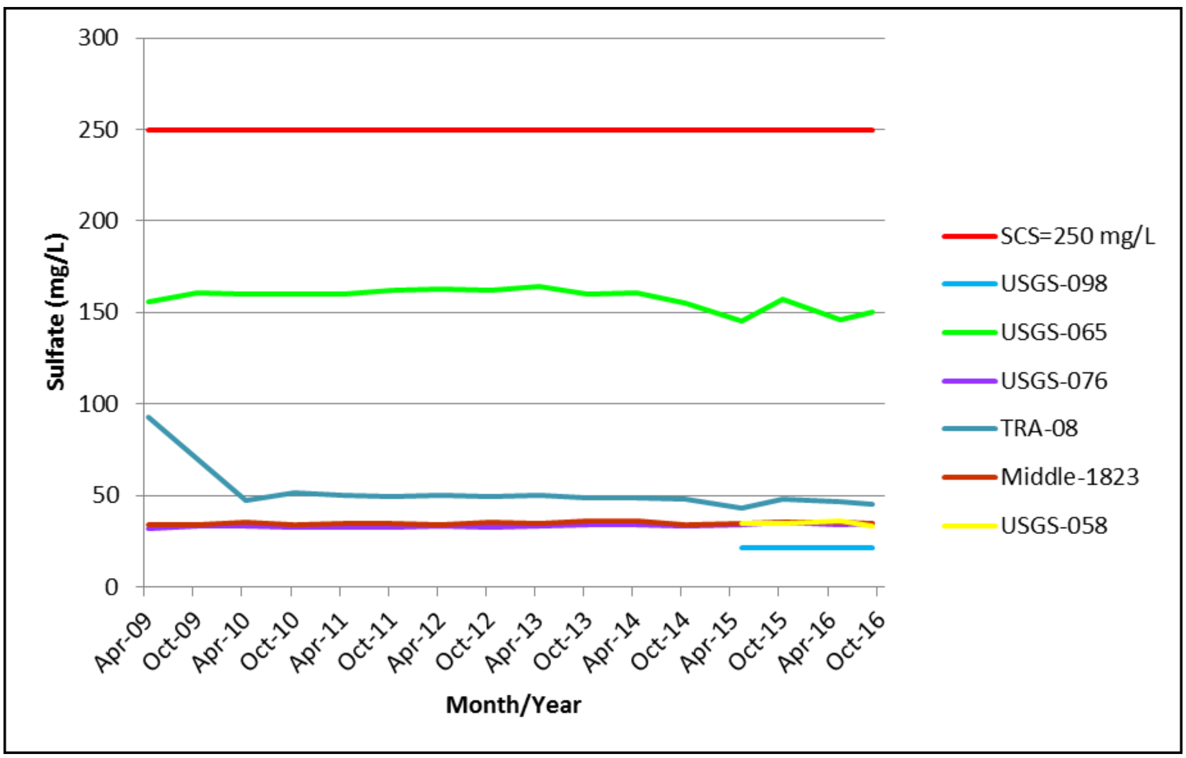

Figure 6. Sulfate concentrations in the Cold Waste Ponds monitoring wells.

Similar to sulfate, the highest TDS concentration is in well USGS-065 (Figure 7). The highest TDS concentration in USGS-065 occurred in April 2012 at 471 mg/L. The TDS concentration in USGS-065 has remained below the SCS of 500 mg/L (Figure 7).

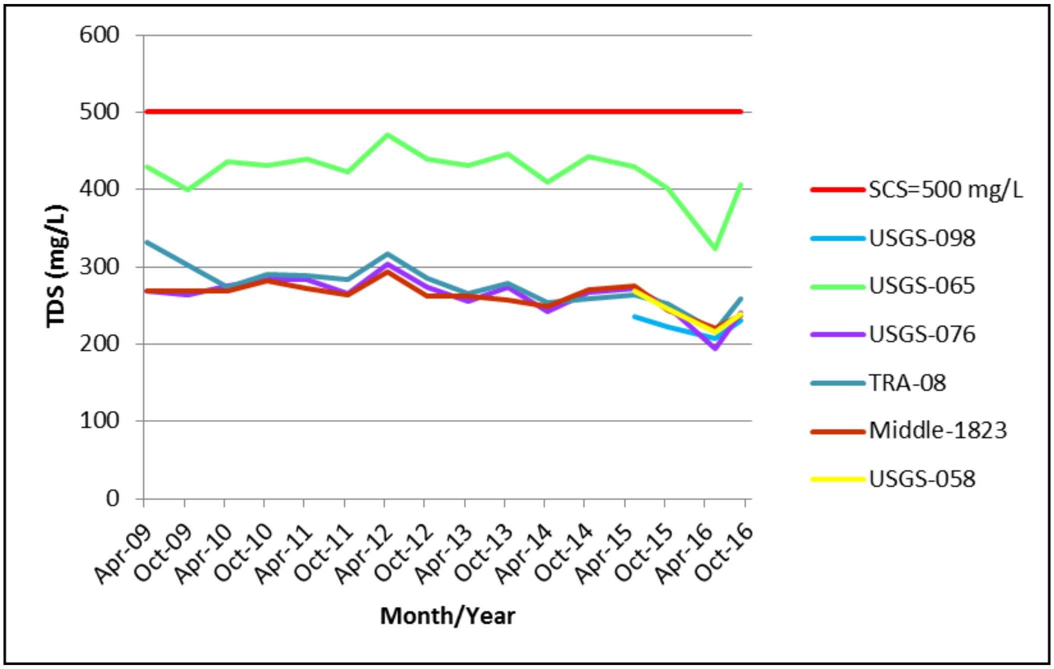

Figure 7. Total dissolved solids concentrations in the Cold Waste Ponds monitoring wells.

A Mann-Kendall trend analysis was performed on sulfate and TDS in the groundwater wells. Sulfate concentrations were found to be stable in wells USGS-058, USGS-098, and Middle-1823 at the 90% confidence level (Table 4). The sulfate trend appears to be decreasing in wells TRA-08 and USGS-065 but increasing in well USGS-076 at the 90% confidence level.

In groundwater wells Middle-1823, TRA-08, USGS-065, and USGS-076, there appears to be a decreasing trend in TDS concentrations at the 90% confidence level (Table 5). For wells USGS-058 and USGS-098, the analysis shows there is no trend for TDS at the 90% confidence level (Table 5).

Table 4. Mann-Kendall trend analysis results for sulfate in the groundwater monitoring wells.

Well Name	# Samples	Trend ≥ 80% Confidence	Trend ≥ 90% Confidence	Stability Check (if no trend at 80% confidence)
USGS-098	4	No Trend	No Trend	Stable
USGS-065	10	Decreasing	Decreasing	NA[a]
USGS-076	10	Increasing	Increasing	NA
TRA-08	10	Decreasing	Decreasing	NA
Middle-1823	10	No Trend	No Trend	Stable
USGS-058	4	No Trend	No Trend	Stable

a. Not applicable.

Table 5. Mann-Kendall trend analysis results for total dissolved solids in the groundwater monitoring wells.

Well Name	# Samples	Trend ≥ 80% Confidence	Trend ≥ 90% Confidence	Stability Check
USGS-098	4	No Trend	No Trend	Stable
USGS-065	10	Decreasing	Decreasing	NA[a]
USGS-076	10	Decreasing	Decreasing	NA
TRA-08	10	Decreasing	Decreasing	NA
Middle-1823	10	Decreasing	Decreasing	NA
USGS-058	4	Decreasing	No Trend	NA

a. Not applicable.

With the exception of USGS-065, sulfate and TDS concentrations in the groundwater wells (Figures 6 and 7) are only slightly elevated when compared to the concentrations in background well USGS-098. The sulfate and TDS quickly dissipate with distance from the ponds. This can be seen when comparing the 2016 permit year sulfate and TDS concentrations found in Wells USGS-065 and Middle-1823 (Figures 6 and 7). Well USGS-065, located approximately 1,200 ft downgradient of the CWPs, had a maximum sulfate concentration of 150 mg/L and a TDS concentration of 407 mg/L. Well Middle-1823, located approximately 4,000 ft downgradient from the CWPs, had maximum sulfate and TDS concentrations of 35.4 mg/L and 237 mg/L, respectively. The concentrations of sulfate and TDS in Well Middle-1823 are similar to the concentrations in the up/cross gradient Well USGS-076 (Figures 6 and 7).

As stated above, sulfate and TDS have SCSs for groundwater quality. The SCSs are generally based on aesthetic qualities including odor, taste, color, and foaming (EPA 1992). Sulfate is listed for causing a "salty taste" in drinking water. Total dissolved solids are listed for "hardness, deposits, colored water, staining, and salty taste." The nearest drinking water well is located approximately 3 miles downgradient of the CWPs. Because the higher levels of sulfate and TDS are localized near the CWPs and their SCSs are based on aesthetics, impacts to human health and the environment are expected to be minimal.

Groundwater sample results for aluminum, chromium, iron, and manganese, in wells USGS-065, USGS-076, TRA-08, and Middle-1823, were significantly lower than the applicable PCS or SCS (Table 3).

There are positive impacts to the environment associated with the operation of the CWPs. These include returning a significant portion of the industrial wastewater to the aquifer and providing needed water for several native animal species in an otherwise semi-arid environment.

7. REFERENCES

40 CFR 136, "Guidelines Establishing Test Procedures for the Analysis of Pollutants," *Code of Federal Regulations*, Office of the Federal Register, July 2016.

40 CFR 141, "National Primary Drinking Water Regulations," *Code of Federal Regulations*, Office of the Federal Register, July 2016.

40 CFR 143, "National Secondary Drinking Water Regulations," *Code of Federal Regulations*, Office of the Federal Register, July 2016.

DEQ, 2007, Guidance for Reclamation and Reuse of Municipal and Industrial Wastewater, Idaho Department of Environmental Quality, September 2007.

EPA, 1992, *Secondary Drinking Water Regulations: Guidance for Nuisance Chemicals*, EPA 810/K-92-001.

GDE-8511, "Inorganic Analyses Data Validation for INL," Revision 0, January 25, 2007.

IDAPA 58.01.11, 2016, "Ground Water Quality Rule," Idaho Department of Environmental Quality, March 2016.

John, A., DEQ, to T. A. Miller, INL, October 24, 2016, "I-161-02 INL ATR Cold Waste Ponds, 2016 Inspection," CCN 239279.

Lewis, M. G., INL, to T. Rackow, DEQ, August 3, 2016, "Response to DEQ Request Concerning Non-Contact Cooling Water Leak at the Advanced Test Reactor Complex," CCN 238534.

LI-330, 2015, "Groundwater Monitoring for the Advanced Test Reactor Complex Cold Waste Pond Industrial Wastewater Reuse Permit," Revision 4, February 27, 2015.

Miller, T. A., INL, to G. Eager, DEQ, May 18, 2015a, "Reuse Permit I-161-02 Compliance Activity CA-161-02 Quality Assurance Project Plan Transmittal," CCN 235805.

Miller, T. A., INL, to G. Eager, DEQ, November 19, 2015b, "Reuse Permit I-160-02 Compliance Activity CA-161-01 Plan of Operation Transmittal," CCN 237051.

Neher, E., DEQ, to R. Boston, DOE-ID, November 20, 2014, "I-161-02 INL ATR Cold Waste Ponds, Final Permit," CCN 234522.

Rackow, T., DEQ, to M. G. Lewis, INL, August 3, 2016, "Response to DEQ Request Concerning Non-Contact Cooling Water Leak at the Advanced Test Reactor Complex," CCN 238534.

Appendix A

Daily Discharge Volumes to the Advanced Test Reactor Complex Cold Waste Ponds

Appendix A

Daily Discharge Volumes to the Advanced Test Reactor Complex Cold Waste Ponds

Table A-1. Daily discharge volumes to the ATR Complex CWPs for the 2016 permit year.

Date	North Pond (gal)	South Pond (gal)
11/01/15	OOS	577,940
11/02/15	OOS	527,770
11/03/15	584,760	OOS
11/04/15	634,430	OOS
11/05/15	426,000	OOS
11/06/15	693,400	OOS
11/07/15	480,540	OOS
11/08/15	499,500	OOS
11/09/15	650,650	OOS
11/10/15	700,190	OOS
11/11/15	543,260	OOS
11/12/15	289,020	OOS
11/13/15	289,140	OOS
11/14/15	353,890	OOS
11/15/15	349,340	OOS
11/16/15	330,980	OOS
11/17/15	349,480	OOS
11/18/15	334,750	OOS
11/19/15	378,600	OOS
11/20/15	345,500	OOS
11/21/15	335,000	OOS
11/22/15	333,900	OOS
11/23/15	260,300	OOS
11/24/15	279,900	OOS
11/25/15	281,900	OOS
11/26/15	286,180	OOS
11/27/15	275,530	OOS
11/28/15	263,300	OOS
11/29/15	268,760	OOS
11/30/15	349,390	OOS
12/01/15	OOS	329,040
12/02/15	OOS	365,010
12/03/15	OOS	373,580
12/04/15	OOS	355,180
12/05/15	OOS	346,090
12/06/15	OOS	354,950
12/07/15	OOS	325,870
12/08/15	OOS	362,530
12/09/15	OOS	333,810

Date	North Pond (gal)	South Pond (gal)
12/10/15	OOS	344,080
12/11/15	OOS	347,300
12/12/15	OOS	345,700
12/13/15	OOS	337,400
12/14/15	OOS	384,150
12/15/15	OOS	334,410
12/16/15	OOS	392,440
12/17/15	OOS	352,200
12/18/15	OOS	343,400
12/19/15	OOS	356,300
12/20/15	OOS	386,250
12/21/15	OOS	289,930
12/22/15	OOS	359,270
12/23/15	OOS	342,960
12/24/15	OOS	339,880
12/25/15	OOS	354,410
12/26/15	OOS	346,000
12/27/15	OOS	345,000
12/28/15	OOS	349,500
12/29/15	OOS	378,000
12/30/15	OOS	336,000
12/31/15	OOS	364,960
01/01/16	434,030	OOS
01/02/16	733,710	OOS
01/03/16	593,910	OOS
01/04/16	545,740	OOS
01/05/16	593,600	OOS
01/06/16	623,760	OOS
01/07/16	605,600	OOS
01/08/16	502,680	OOS
01/09/16	664,500	OOS
01/10/16	463,610	OOS
01/11/16	698,430	OOS
01/12/16	635,010	OOS
01/13/16	760,060	OOS
01/14/16	619,050	OOS
01/15/16	569,550	OOS
01/16/16	669,300	OOS
01/17/16	619,250	OOS

Date	North Pond (gal)	South Pond (gal)
01/18/16	615,850	OOS
01/19/16	718,270	OOS
01/20/16	641,390	OOS
01/21/16	841,080	OOS
01/22/16	578,500	OOS
01/23/16	655,200	OOS
01/24/16	614,070	OOS
01/25/16	667,090	OOS
01/26/16	620,840	OOS
01/27/16	619,450	OOS
01/28/15	576,180	OOS
01/29/16	610,020	OOS
01/30/16	480,530	OOS
01/31/16	654,530	OOS
02/01/16	633,300	OOS
02/02/16	OOS	655,590
02/03/16	OOS	681,860
02/04/16	OOS	673,160
02/05/16	OOS	635,580
02/06/16	OOS	704,160
02/07/16	OOS	731,250
02/08/16	OOS	630,570
02/09/16	OOS	558,060
02/10/16	OOS	205,520
02/11/16	OOS	274,900
02/12/16	OOS	369,700
02/13/16	OOS	340,900
02/14/16	OOS	323,200
02/15/16	OOS	273,730
02/16/16	OOS	264,370
02/17/16	OOS	315,770
02/18/16	OOS	274,040
02/19/16	OOS	253,370
02/20/16	OOS	297,760
02/21/16	OOS	251,470
02/22/16	OOS	343,290
02/23/16	OOS	358,200
02/24/16	OOS	400,650
02/25/16	OOS	323,150
02/26/16	OOS	322,280
02/27/16	OOS	353,550
02/28/16	OOS	332,220
02/29/16	OOS	338,020
03/01/16	327,610	OOS
03/02/16	347,220	OOS
03/03/16	439,130	OOS

Date	North Pond (gal)	South Pond (gal)
03/04/16	255,080	OOS
03/05/16	378,080	OOS
03/06/16	363,400	OOS
03/07/16	274,610	OOS
03/08/16	270,700	OOS
03/09/16	246,500	OOS
03/10/16	316,370	OOS
03/11/16	227,150	OOS
03/12/16	285,830	OOS
03/13/16	276,450	OOS
03/14/16	365,170	OOS
03/15/16	312,130	OOS
03/16/16	347,800	OOS
03/17/16	383,390	OOS
03/18/16	334,800	OOS
03/19/16	314,390	OOS
03/20/16	327,230	OOS
03/21/16	361,090	OOS
03/22/16	346,320	OOS
03/23/16	338,160	OOS
03/24/16	380,120	OOS
03/25/16	375,020	OOS
03/26/16	327,670	OOS
03/27/16	343,510	OOS
03/28/16	405,410	OOS
03/29/16	270,400	OOS
03/30/16	232,230	OOS
03/31/16	245,170	OOS
04/01/16	731,540	OOS
04/02/16	533,750	OOS
04/03/16	588,720	OOS
04/04/16	OOS	600,880
04/05/16	OOS	862,600
04/06/16	OOS	628,370
04/07/16	OOS	577,000
04/08/16	OOS	598,900
04/09/16	OOS	591,700
04/10/16	OOS	551,130
04/11/16	OOS	631,550
04/12/16	OOS	500,550
04/13/16	OOS	579,900
04/14/16	OOS	611,710
04/15/16	OOS	590,630
04/16/16	OOS	586,740
04/17/16	OOS	525,720
04/18/16	OOS	620,600

Date	North Pond (gal)	South Pond (gal)
04/19/16	OOS	592,620
04/20/16	OOS	583,600
04/21/16	OOS	655,790
04/22/16	OOS	571,330
04/23/16	OOS	588,710
04/24/16	OOS	585,450
04/25/16	OOS	603,070
04/26/16	OOS	531,690
04/27/16	OOS	238,440
04/28/16	OOS	590,000
04/29/16	OOS	670,690
04/30/16	OOS	501,950
05/01/16	OOS	647,050
05/02/16	OOS	575,110
05/03/16	596,990	OOS
05/04/16	615,790	OOS
05/05/16	721,450	OOS
05/06/16	464,690	OOS
05/07/16	636,880	OOS
05/08/16	679,660	OOS
05/09/16	489,740	OOS
05/10/16	621,370	OOS
05/11/16	620,760	OOS
05/12/16	681,790	OOS
05/13/16	497,800	OOS
05/14/16	616,400	OOS
05/15/16	554,080	OOS
05/16/16	562,380	OOS
05/17/16	665,220	OOS
05/18/16	509,500	OOS
05/19/16	653,800	OOS
05/20/16	631,370	OOS
05/21/16	568,500	OOS
05/22/16	542,890	OOS
05/23/16	564,910	OOS
05/24/16	565,340	OOS
05/25/16	624,820	OOS
05/26/16	668,980	OOS
05/27/16	544,430	OOS
05/28/16	534,770	OOS
05/29/16	581,960	OOS
05/30/16	488,730	OOS
05/31/16	602,800	OOS
06/01/16	OOS	504,390
06/02/16	OOS	623,600
06/03/16	OOS	488,210

Date	North Pond (gal)	South Pond (gal)
06/04/16	OOS	587,390
06/05/16	OOS	572,110
06/06/16	OOS	519,530
06/07/16	OOS	558,820
06/08/16	OOS	636,080
06/09/16	OOS	475,680
06/10/16	OOS	556,110
06/11/16	OOS	557,060
06/12/16	OOS	552,720
06/13/16	OOS	553,380
06/14/16	OOS	562,940
06/15/16	OOS	584,680
06/16/16	OOS	583,000
06/17/16	OOS	604,490
06/18/16	OOS	596,010
06/19/16	OOS	569,500
06/20/16	OOS	675,580
06/21/16	OOS	654,920
06/22/16	OOS	635,000
06/23/16	OOS	597,100
06/24/16	OOS	546,910
06/25/16	OOS	608,280
06/26/16	OOS	420,270
06/27/16	OOS	199,440
06/28/16	OOS	466,430
06/29/16	OOS	749,420
06/30/16	OOS	562,880
07/01/16	542,680	OOS
07/02/16	660,350	OOS
07/03/16	732,240	OOS
07/04/16	435,000	OOS
07/05/16	616,250	OOS
07/06/16	647,440	OOS
07/07/16	631,070	OOS
07/08/16	592,500	OOS
07/09/16	624,800	OOS
07/10/16	578,230	OOS
07/11/16	724,420	OOS
07/12/16	480,590	OOS
07/13/16	701,730	OOS
07/14/16	446,000	OOS
07/15/16	575,070	OOS
07/16/16	613,140	OOS
07/17/16	638,580	OOS
07/18/16	600,160	OOS
07/19/16	567,500	OOS

Date	North Pond (gal)	South Pond (gal)
07/20/16	602,830	OOS
07/21/16	603,080	OOS
07/22/16	428,340	OOS
07/23/16	561,120	OOS
07/24/16	683,860	OOS
07/25/16	555,270	OOS
07/26/16	666,520	OOS
07/27/16	606,930	OOS
07/28/16	617,140	OOS
07/29/16	627,500	OOS
07/30/16	635,200	OOS
07/31/16	570,630	OOS
08/01/16	OOS	654,580
08/02/16	OOS	626,060
08/03/16	OOS	595,660
08/04/16	OOS	671,090
08/05/16	OOS	624,750
08/06/16	OOS	495,250
08/07/16	OOS	712,710
08/08/16	OOS	595,120
08/09/16	OOS	693,020
08/10/16	OOS	595,340
08/11/16	OOS	598,220
08/12/16	OOS	676,200
08/13/16	OOS	603,010
08/14/16	OOS	642,420
08/15/16	OOS	614,350
08/16/16	OOS	555,310
08/17/16	OOS	666,000
08/18/16	OOS	607,490
08/19/16	OOS	658,580
08/20/16	OOS	564,290
08/21/16	OOS	648,180
08/22/16	OOS	625,970
08/23/16	OOS	660,130
08/24/16	OOS	525,310
08/25/16	OOS	681,270
08/26/16	OOS	680,900
08/27/16	OOS	522,310
08/28/16	OOS	567,480
08/29/16	OOS	629,100
08/30/16	OOS	676,540
08/31/16	OOS	607,060
09/01/16	OOS	625,760
09/02/16	OOS	640,420
09/03/16	OOS	618,210

Date	North Pond (gal)	South Pond (gal)
09/04/16	OOS	626,900
09/05/16	605,070	OOS
09/06/16	575,400	OOS
09/07/16	601,540	OOS
09/08/16	757,850	OOS
09/09/16	471,870	OOS
09/10/16	636,550	OOS
09/11/16	633,710	OOS
09/12/16	626,590	OOS
09/13/16	524,530	OOS
09/14/16	639,030	OOS
09/15/16	727,490	OOS
09/16/16	369,660	OOS
09/17/16	146,300	OOS
09/18/16	178,520	OOS
09/19/16	242,300	OOS
09/20/16	405,940	OOS
09/21/16	403,260	OOS
09/22/16	418,370	OOS
09/23/16	366,630	OOS
09/24/16	367,000	OOS
09/25/16	390,650	OOS
09/26/16	383,100	OOS
09/27/16	389,580	OOS
09/28/16	365,270	OOS
09/29/16	400,190	OOS
09/30/16	387,150	OOS
10/01/16	396,150	OOS
10/02/16	349,790	OOS
10/03/16	OOS	348,740
10/04/16	OOS	414,540
10/05/16	OOS	395,240
10/06/16	OOS	424,480
10/07/16	OOS	383,770
10/08/16	OOS	371,990
10/09/16	OOS	371,860
10/10/15	OOS	377,890
10/11/16	OOS	379,820
10/12/16	OOS	384,490
10/13/16	OOS	424,480
10/14/16	OOS	369,280
10/15/16	OOS	405,810
10/16/16	OOS	393,230
10/17/16	OOS	397,880
10/18/16	OOS	380,140
10/19/16	OOS	416,600

Date	North Pond (gal)	South Pond (gal)
10/20/16	OOS	487,420
10/21/16	OOS	250,920
10/22/16	OOS	446,290
10/23/16	OOS	333,650
10/24/16	OOS	418,250
10/25/16	OOS	325,350
10/26/16	OOS	322,970

Date	North Pond (gal)	South Pond (gal)
10/27/16	OOS	241,780
10/28/16	OOS	264,490
10/29/16	OOS	298,560
10/30/16	OOS	281,500
10/31/16	OOS	297,680

a. OOS indicates pond was out of service. The respective pond is operable, but not receiving effluent.