

# 2018 Annual CCR Rule Groundwater Monitoring Report - Ash Pond Complex

Gallatin Fossil Plant  
Gallatin, Tennessee

Prepared for:

Tennessee Valley Authority  
Chattanooga, Tennessee

Prepared by:

AECOM  
1600 Perimeter Park  
Morrisville, NC 27560  
USA  
aecom.com

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## Introduction

This report documents groundwater compliance monitoring activities performed at the Tennessee Valley Authority (TVA) Gallatin Fossil Plant (GAF), Ash Pond Complex as required under the United States Environmental Protection Agency (USEPA) coal combustion residuals (CCR) Rule (40 Code of Federal Regulations [CFR] 257.90(e)). The groundwater monitoring system at the Ash Pond Complex is a multi-unit system (40 CFR 257.91(d)) designed to monitor the following four CCR surface impoundments: Ash Pond A, Ash Pond E, Middle Pond A, and the Bottom Ash Pond (**Figure 1**). This report covers the compliance activities performed in 2018 and presents the monitoring activities planned for 2019.

To comply with the CCR Rule, the following actions were taken in 2018:

- The 2017 Annual Groundwater Monitoring Report (AECOM, 2018) was completed in January 2018 and posted on TVA's publically accessible website as required by 257.90(e) and 257.107(h)(1).
- The Ash Pond Complex multi-unit groundwater monitoring system certification was updated in June 2018, and the updated certification was posted on TVA's publically-accessible website.
- A dedicated well pump was installed in well GAF-406L.
- Additional baseline samples were collected from groundwater monitoring well pair GAF-450C and GAF-450L to reach the minimum of eight baseline samples.
- Alternate source(s) of Appendix III parameters, including natural variability, were evaluated in accordance with 40 CFR 257.94(e)(2).
- In April 2018, TVA issued a notice establishing an Assessment monitoring program at the Ash Pond Complex, in accordance with 257.94(e)(3).
- Two Assessment monitoring events took place in 2018, in June and September.
- Assessment monitoring results were evaluated in accordance with the CCR Rule (257.95).
- In October 2018, Groundwater Protection Standards (GWPSs) were developed for Appendix IV parameters in accordance with 257.95(d)(2).

Problems encountered and resolution:

- Due to construction activities in the vicinity of well GAF-451C, the original above-grade well completion was converted to a flush-mount completion. This conversion had no effect on the subsurface portion of the well, but the top of casing elevation has changed. As the well is now in a high traffic area, TVA is considering appropriate locations for installation of a replacement well. The new top-of-casing elevation and construction specifications for the converted well are included in **Table 1**.
- During the gauging on September 17, 2018, water levels were inadvertently not measured at some wells. The reported water levels for these wells were obtained on the day the well was sampled, prior to purging and sampling.

The following activities are planned for 2019 to comply with CCR Rule groundwater monitoring requirements:

- Assessment monitoring will continue with two semi-annual monitoring events in 2019, in accordance with 257.95.
- In January 2019, and included in this report, the results of 2018 Assessment monitoring have been compared to the established GWPSs in accordance with 257.95(g).
- Alternate locations for a well to replace GAF-451C will be evaluated, and a replacement well may be installed at an alternate location.
- Alternate source(s), including natural variability, will continue to be evaluated where applicable in accordance with 257.95(g)(3)(ii).
- If Assessment monitoring results identify exceedances of the GWPSs (257.95(g)(3)(i)), TVA will initiate an assessment of corrective measures, in accordance with 40 CFR 257.96.
- Further field and desktop Site-Characterization Investigations may be performed to improve the Conceptual Site Model (CSM).
- TVA's third-party Quality Assurance Program to evaluate groundwater analytical data will be continued and improved using best practices concerning field methods and validation techniques, as well as the application of the most appropriate statistical methods.
- The groundwater analytical data obtained in 2019 will be evaluated using appropriate statistical methods. Changes to the monitoring program will be implemented, as needed, to maintain compliance with 40 CFR 257.90 through 257.98.
- TVA will comply with recordkeeping requirements as specified in 40 CFR 257.105(h), notification requirements specified in 40 CFR 257.106(h), and internet requirements as specified in 40 CFR 257.107(h).
- The next annual groundwater monitoring report, which will address groundwater monitoring activities undertaken in 2019, will be completed in January 2020.

## Groundwater Monitoring System

GAF is located in north-central Tennessee on Odoms Bend peninsula, just south of Gallatin, Tennessee. The GAF property consists of approximately 1,950 acres of land encompassing the majority of the peninsula, which is surrounded by the Cumberland River between approximate river miles 240.5 and 246.

The GAF is a coal-fired steam plant that operates four turbo-generating units. Starting in the early 1970s, fly ash and bottom ash (CCR) were sluiced to the Ash Pond Complex (APC). Water from the APC is directed through a series of stilling ponds (Stilling Ponds B, C and D), where it is clarified prior to discharge to the Cumberland River under a National Pollution Discharge Elimination System (NPDES) permit. In 2016, TVA converted to a dry ash handling process for fly ash and began trucking the combined fly ash and dry flue gas desulphurization (FGD) product from the newly constructed FGD 'scrubber' units to the newly constructed North Rail Loop (NRL) Landfill. TVA is in the process of converting to dry handling of bottom ash, at which time CCR will no longer be sluiced to the APC. More information related to the history of

construction for the CCR units comprising the APC can be found on TVA's publicly available website at the following links:

- Ash Pond A, Middle Pond A, and Bottom Ash Pond:  
[https://ccr.tva.gov/Plants/GAF/Surface%20Impoundment%20-%20Ash%20Pond%20A/Design%20Criteria/History%20of%20Construction/257-73\(c\)%20History%20of%20Construction\\_GAF\\_Ash%20Pond%20A.pdf](https://ccr.tva.gov/Plants/GAF/Surface%20Impoundment%20-%20Ash%20Pond%20A/Design%20Criteria/History%20of%20Construction/257-73(c)%20History%20of%20Construction_GAF_Ash%20Pond%20A.pdf),
- Ash Pond E: [https://ccr.tva.gov/Plants/GAF/Surface%20Impoundment%20-%20Ash%20Pond%20E/Design%20Criteria/History%20of%20Construction/257-73\(c\)%20History%20of%20Construction\\_GAF\\_Ash%20Pond%20E.pdf](https://ccr.tva.gov/Plants/GAF/Surface%20Impoundment%20-%20Ash%20Pond%20E/Design%20Criteria/History%20of%20Construction/257-73(c)%20History%20of%20Construction_GAF_Ash%20Pond%20E.pdf).

GAF is located within the Central Basin Aquifer area of Middle Tennessee. Groundwater in Central Tennessee that occurs within the stratigraphic interval between the bottom of the Devonian age Chattanooga Shale and the top of the Cambrian-Ordovician age Knox Group is known as the Central Basin Aquifer system. This aquifer system is an important source of drinking water for Central Tennessee, as it supplies most of the rural domestic wells and many public drinking wells in the Central Basin and surrounding region (Brahana and Bradley, 1986). Groundwater in the Central Basin Aquifer system occurs primarily in a shallow flow system of solution channels. These channels are highly irregular in their distribution throughout the solid rock mass and generally occur within 300 feet of the land surface. The solution channels are openings along joints and bedding planes that locally may be enlarged by dissolution of the limestones. These channels represent zones of secondary porosity and permeability in an otherwise nonporous and impermeable rock mass. Bedding planes are thought to be the major control in the formation of solution cavities, which have typically been found to be horizontally elongated (Brahana and Bradley, 1986).

The primary bedrock units at GAF that have developed water-bearing zones are the Carters and Lebanon Limestones, both members of the Stones River Group. Bentonite zones in the Carters Limestone play a significant role in the hydrology of the Central Basin Aquifer system. In areas where the bentonite layers are present, the downward movement of groundwater is restricted. Where the bentonite zones are eroded or otherwise breached by open joints or intersecting stream valleys, solution openings can form in the underlying limestone. Groundwater in these openings can receive recharge from precipitation. In contrast, shale units within the formations comprising the aquifer system typically act as local confining units for groundwater (Brahana and Bradley, 1986). As noted in a Tennessee Division of Geology publication (Newcombe, 1958): "Practically all ground water in the Central Basin of Tennessee is confined under artesian pressure in solution channels in the limestone. ...When a well penetrates the channel the confining pressure is released and the water rises in the well."

The Ash Pond Complex multi-unit groundwater monitoring well system contains 23 monitoring wells: 7 background monitoring wells and 16 downgradient monitoring wells. The monitoring well locations are shown on **Figure 1**, and monitoring well construction information is provided on **Table 1**.

The background monitoring wells (GAF-412C, GAF-412L, GAF-414L, GAF-426C, GAF-426L, GAF-427C, and GAF-427L) represent conditions unaffected by CCR (40 CFR 257.91 (a)(1) and (c)(1)). Four of the wells monitor groundwater conditions in the Lebanon Limestone, and three wells monitor groundwater in the shallower Carters Limestone (see **Table 1**). These background wells are not located directly upgradient from the Ash Pond Complex. Per the CCR Rule 257.91(a)(1), establishing background water quality may include sampling of wells that are not hydraulically upgradient of the CCR management unit. In the case of the Ash Pond

Complex, for the Carters Limestone, there is no groundwater present in the formation on the upgradient (south) side of the unit; for the Lebanon Limestone, flow is generally away from the ponds in all directions, so there is not an upgradient direction available for monitoring. As a result, it is necessary to use wells that are not directly hydraulically upgradient to establish background conditions. The background wells are hydraulically separated from the Ash Pond Complex by an area of low hydraulic head, so they represent conditions unaffected by CCR.

The downgradient monitoring wells (24, GAF-402C, GAF-402L, GAF-405C, GAF-406L, GAF-410U, GAF-416C, GAF-422C, GAF-446C, GAF-449L, GAF-450C, GAF-450L, GAF-451C, GAF-452C, GAF-452L, and GAF-453C) monitor groundwater downgradient near the waste boundary (40 CFR 257.91 (a)(2) and (c)(1)). There are ten downgradient monitoring wells completed in the Carters Limestone, five monitoring wells in the Lebanon Limestone, and one monitoring well screened in alluvium/unconsolidated materials (**Table 1**).

The primary target of monitoring is the Carters Limestone, with 10 wells located along the downgradient waste boundary of the unit. At least one well in the Lebanon Limestone on each downgradient side of the unit was also included in the network, typically paired with Carters wells, or where the first water-bearing zones were encountered in the Lebanon. Groundwater is typically not encountered in overburden in the area of the Ash Pond Complex, but the network includes one overburden well where groundwater was locally encountered.

The certification of the groundwater monitoring system required under 40 CFR 257.91(f) is included in the facility operating record and on the facility website:

<https://www.tva.com/Environment/Environmental-Stewardship/Coal-Combustion-Residuals/Gallatin>.

Since the previous Annual Report (AECOM, 2018), the monitoring system has been modified by the conversion of GAF-451C to a flush mount well completion. Due to construction activities in the vicinity of this well, the original above-grade well completion was converted to a flush-mount completion. This conversion had no effect on the subsurface portion of the well, but the top of casing elevation has changed. Information about the modified well is included on **Table 1**.

## Groundwater Sampling and Laboratory Analytical Results

The data obtained during the CCR Rule compliance monitoring in 2018 is presented in this section.

### Groundwater Monitoring

Low-flow groundwater sampling and analysis activities were conducted in accordance with the sampling and analysis program developed per 40 CFR 257.93.

Three additional baseline samples were collected from monitoring system wells GAF-450C and GAF-450L in 2018. The full set of eight baseline samples was not collected from these wells in 2016-2017 because the wells had not yet been installed upon initiation of the baseline sampling events. The additional baseline samples were collected in April, May, and June 2018 (**Table 2**).

The initial Assessment monitoring required by 257.95(b) at the Ash Pond Complex took place in June 2018. As required by the CCR Rule (257.95(d)), a second event was conducted in September 2018.

## Groundwater Flow

Groundwater levels were measured in each monitoring well prior to well purging/sampling as required by 40 CFR 257.93 (c). The water level gauging dates for each event are presented in **Table 2**, and tabulated water level data and calculated hydraulic heads are presented in **Table 3**. **Figure 2** and **Figure 3** present, respectively, maps for the Carters and Lebanon formations showing the generalized direction of the hydraulic gradient based on groundwater elevations measured in June 2018. Hydraulic gradients were characterized using the data in **Table 3** in addition to water levels measured in other wells at the site beyond those in the CCR Rule monitoring network.

At GAF, a dye trace study was performed, which provides information on groundwater velocities in the vicinity of the Ash Pond Complex. When dye was detected in a potential receptor location, apparent groundwater velocities were calculated. The velocities calculated during dye trace studies are presented in **Appendix A**. During the test, there were also dyes injected that did not appear to move away from the injection locations and were not detected at receptor locations (e.g., GAF-405C). Because the dyes were not detected, apparent velocities could not be calculated, but these results indicate little flow and low velocities in these areas. Overall, the dye trace study indicated a wide range of velocities, from very slow (e.g., GAF-405C) to very fast (e.g., locations north of the Ash Pond Complex; GAF-410U).

## Sampling Results

Groundwater samples were submitted to TestAmerica Laboratories for analysis. The field parameters measured and the laboratory analytical results are presented in **Tables 4 and 5**. **Table 4** contains the results of the additional baseline sampling, and **Table 5** contains the results of the Assessment monitoring sampling. **Appendix C** provides a summary of the background concentrations as specified by 257.95(d)(3).

## Statistical Evaluation

As described in the 2017 Annual Report, statistical evaluation of the October 2017 Detection monitoring results identified statistically significant increases (SSIs) over background for some parameters in some downgradient wells. Potential Alternate Source(s) for these SSIs were evaluated, but sufficient evidence demonstrating alternate source(s) for all SSIs could not be identified within the 90-day time frame (257.94(e)(2)). As a result of these findings, TVA initiated an Assessment monitoring program.

Under the Assessment monitoring program, GWPSs were established for Appendix IV parameters detected in the June 2018 monitoring event. The CCR Rule specifies that the GWPS is the published Maximum Contaminant Level (MCL). For parameters without a MCL, the CCR Rule provides published values of the GWPS. Both the MCLs and published GWPSs are provided on **Table 1** in **Appendix B**. However, the CCR Rule states if background is higher than these published values, then the GWPS becomes background.

Background concentrations were calculated using the statistical methods as certified under the CCR Rule for the GAF Ash Pond Complex (dated November 14, 2017). As a result, the GWPS for lithium is the background value, as shown on **Table 1** in **Appendix B**. GWPSs for all other detected Appendix IV parameters are the published GWPS/MCL.

In January 2019, the 2018 Assessment monitoring results were compared to the established GWPSs to identify statistically significant levels (SSLs) in accordance with 257.95(g). Based on recommendations in the USEPA's Unified Guidance (USEPA, 2009), SSLs were identified where there was 95% confidence that the mean concentration of an Appendix IV parameter in a well exceeded the GWPS. Where an individual Assessment monitoring result was greater than the GWPS, upper and lower confidence levels on the mean were calculated using data collected during baseline and Assessment monitoring at that well. The results and identified SSLs are provided on **Table 6**.

### Narrative Discussion of Transition between Monitoring Programs

In 2018, groundwater monitoring at the Ash Pond Complex transitioned from Detection to Assessment monitoring. Two Assessment monitoring events were conducted in 2018. GWPSs were established for Appendix IV parameters (**Appendix B**).

In January 2019, the Assessment monitoring results were compared to the established GWPSs to identify SSLs over GWPSs. Where applicable, evaluation of potential alternate sources of Appendix IV parameters may be undertaken (257.95(g)(3)(ii)). If SSLs are shown to be attributed to other sources (including natural variability), semi-annual Assessment monitoring will continue. If TVA is unable to demonstrate that the SSLs are due to a source other than the CCR unit, TVA will undertake the actions specified in 257.95(g), including to establish and initiate an assessment of corrective measures as specified in 257.96.

### References

- AECOM, 2018. 2017 Annual CCR Rule Groundwater Monitoring Report – Ash Pond Complex, Gallatin Fossil Plant, Gallatin, Tennessee. January 2018.
- Brahana and Bradley, 1986. *Preliminary Delineation and Description of the Regional Aquifers of Tennessee – The Central Basin Aquifer System*. Prepared by the United States Geological Survey in cooperation with the USEPA. USGS Water Resources Investigations Report 82-4002.
- Newcombe, Roy, Jr. 1958, reprinted 1998. *Ground Water in the Central Basin of Tennessee*. State of Tennessee, Department of Conservation, Division of Geology, Report of Investigations No. 4.
- USEPA. March 2009. Unified Guidance for Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities. EPA 530/R-09-007

## Quality Information

Prepared by

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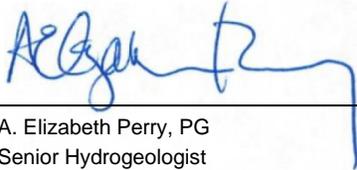


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Chris Garlington, PG  
Hydrogeologist

Reviewed by

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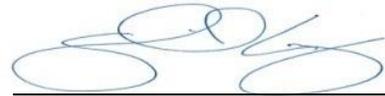


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A. Elizabeth Perry, PG  
Senior Hydrogeologist

Reviewed by

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Gabriel W. Lang, PE  
Program Manager

## Figures

- Figure 1 Ash Pond Complex Monitoring System Wells
- Figure 2 Generalized Hydraulic Gradients - Carters Aquifer, June 18, 2018
- Figure 3 Generalized Hydraulic Gradients - Lebanon Aquifer, June 18, 2018

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- Table 1 Well Construction Information – Ash Pond Complex (Multi-Unit)
- Table 2 Groundwater Sampling Summary – Ash Pond Complex, 2018
- Table 3 Groundwater Elevation Summary – Ash Pond Complex, 2018
- Table 4 Additional Baseline Sampling Groundwater Analytical Results – Ash Pond Complex
- Table 5 Assessment Monitoring Groundwater Analytical Results – Ash Pond Complex
- Table 6 Statistically Significant Levels (SSLs) Above GWPSs – Ash Pond Complex

## Appendices

- Appendix A Dye Trace Velocity Table
- Appendix B Memorandum: Groundwater Protection Standards
- Appendix C Appendix III and IV Background Concentration Ranges

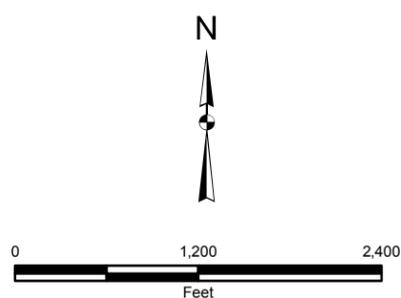
## Figures



**LEGEND**

- CCR Rule Monitoring System - Background Well
- CCR Rule Monitoring System - Downgradient Well
- TVA Gallatin Fossil Plant Property Boundary (Approximate)
- Ash Pond Complex
- Stilling Ponds

NOTE: Aerial image dated February 2017

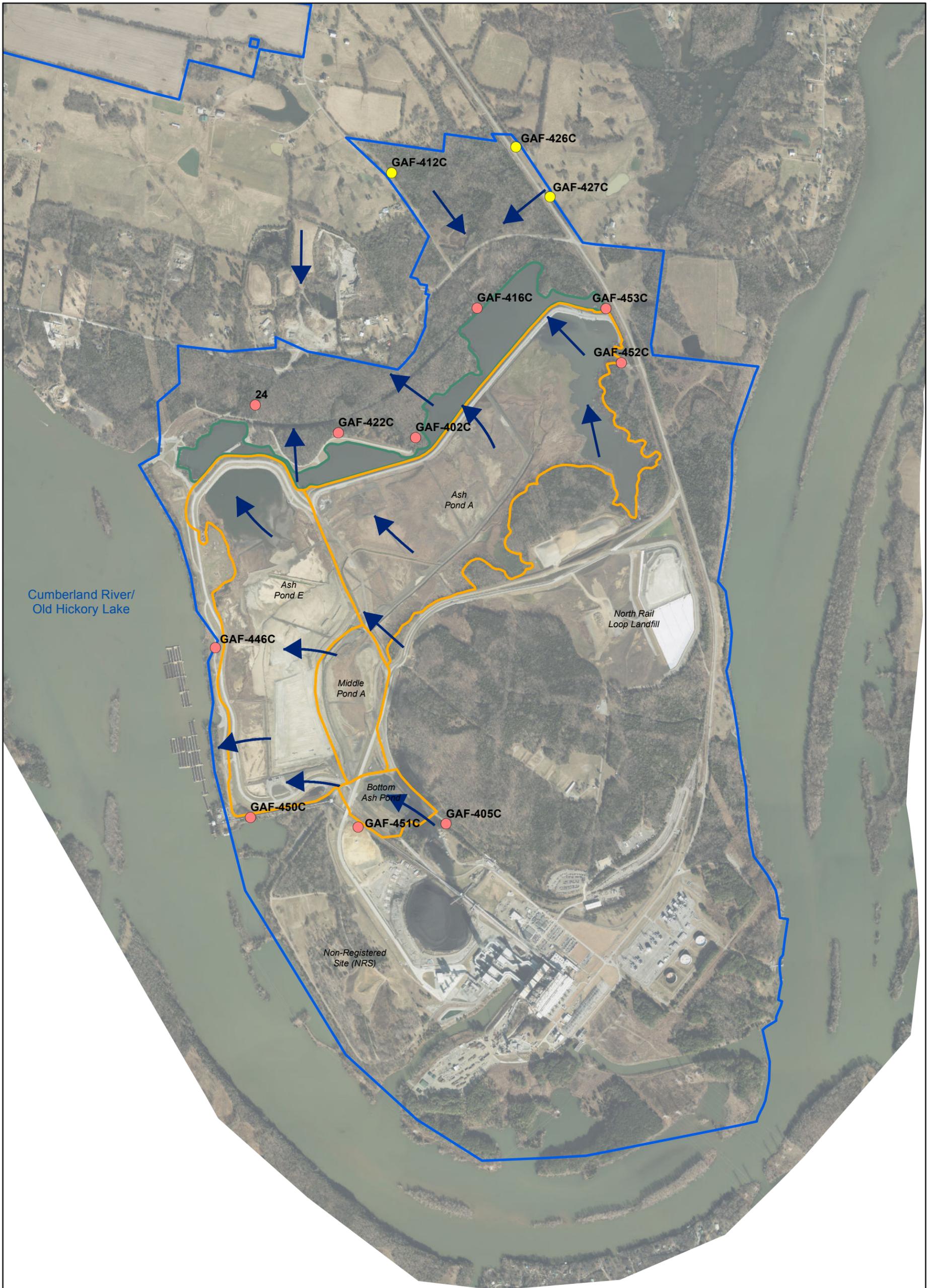


**AECOM**

**Figure 1**

**ASH POND COMPLEX  
MONITORING SYSTEM WELLS**

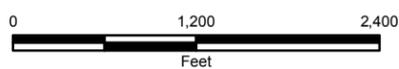
DRAWN BY: MARK.P.SMITH	REVIEWED BY: C.GARLINGTON	APPROVED BY:	REVISION NUMBER: REV. 0
<b>GALLATIN FOSSIL PLANT TENNESSEE VALLEY AUTHORITY</b>			
DATE: 1/2/2018	DEPT: FOSSIL AND HYDRO ENGINEERING		



**LEGEND**

- CCR Rule Monitoring System - Background Well (Carters)
- CCR Rule Monitoring System - Downgradient Well (Carters)
- ➔ Hydraulic Gradient
- Ash Pond Complex
- Stilling Ponds
- TVA Gallatin Fossil Plant Property Boundary (Approximate)

NOTE: Aerial image dated February 2017



**AECOM**

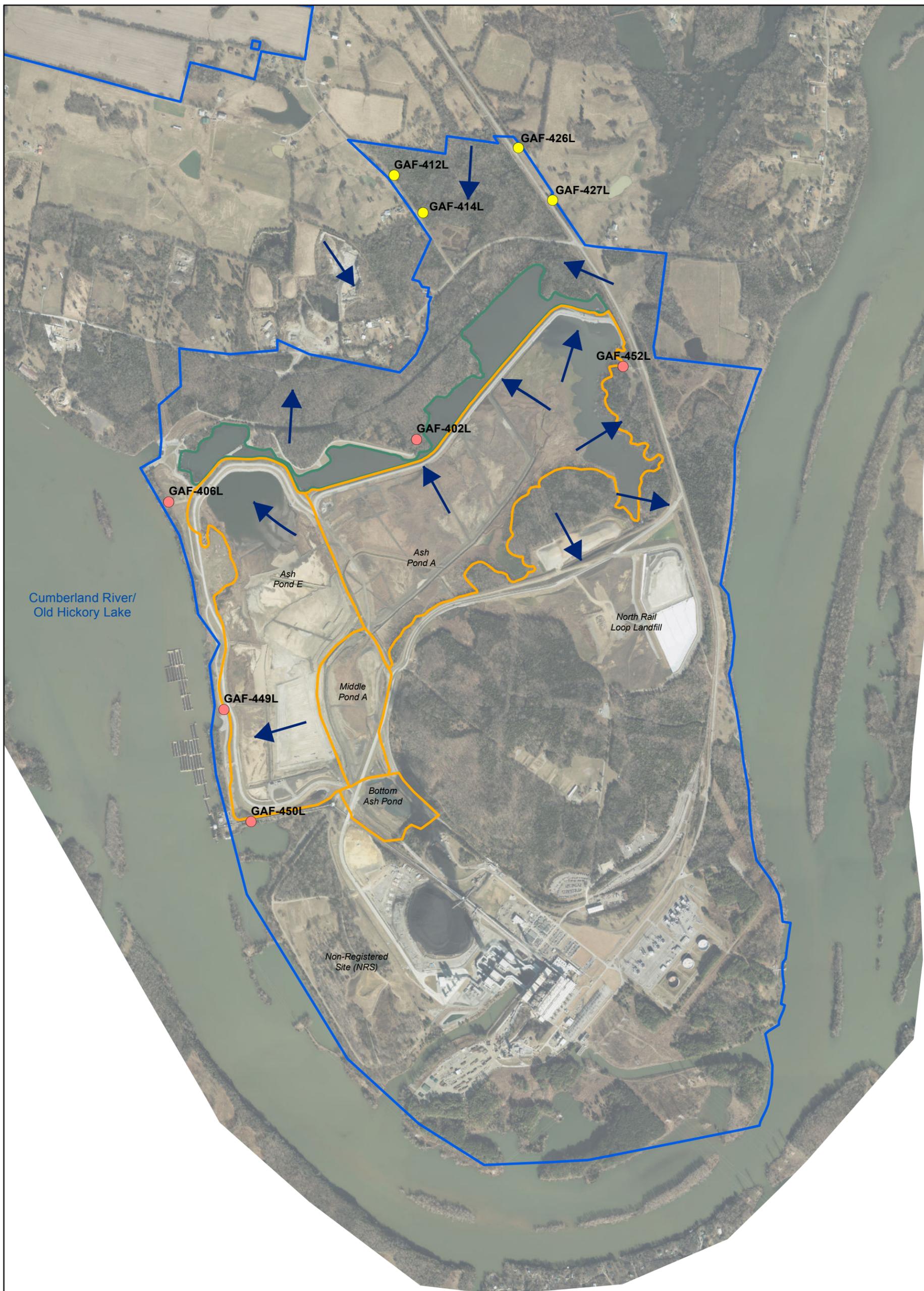
**Figure 2**

**GENERALIZED HYDRAULIC GRADIENTS -  
CARTERS AQUIFER, JUNE 18, 2018**

DRAWN BY: MARK.P.SMITH	REVIEWED BY: C.GARLINGTON	APPROVED BY:	REVISION NUMBER: REV. 0
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**GALLATIN FOSSIL PLANT  
TENNESSEE VALLEY AUTHORITY**

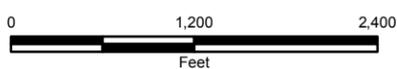
DATE: 1/25/2019	DEPT: FOSSIL AND HYDRO ENGINEERING
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**LEGEND**

- CCR Rule Monitoring System - Background Well (Lebanon)
- CCR Rule Monitoring System - Downgradient Well (Lebanon)
- ➔ Hydraulic Gradient
- Ash Pond Complex
- Stilling Ponds
- TVA Gallatin Fossil Plant Property Boundary (Approximate)

NOTE: Aerial image dated February 2017



**AECOM**

**Figure 3**

**GENERALIZED HYDRAULIC GRADIENTS - LEBANON AQUIFER, JUNE 18, 2018**

DRAWN BY: MARK.P.SMITH	REVIEWED BY: C.GARLINGTON	APPROVED BY:	REVISION NUMBER: REV. 0
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**GALLATIN FOSSIL PLANT  
TENNESSEE VALLEY AUTHORITY**

DATE: 1/25/2019	DEPT: FOSSIL AND HYDRO ENGINEERING
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## Tables

**Table 1**  
**Well Construction Information - Ash Pond Complex (Multi-Unit)**  
**CCR Rule Groundwater Monitoring System**  
**TVA Gallatin Fossil Plant**  
**Gallatin, Tennessee**

Well ID	UNID #	Position Relative to CCR Unit	Top of Casing Elevation (ft)	Ground Elevation (ft)	Screened Interval (ft btoc)	Screened Formation	Total Well Depth (ft btoc)	Pump Intake Depth (ft btoc)	Well Diameter (in) / Material	Well Co-ordinates	
										TN State Plane NAD27 Northing (ft)	TN State Plane NAD27 Easting (ft)
24	GAF-00-GW-43-005	Downgradient	464.13	461.6	20.3 - 30.3	Carters Limestone	30.5	25	2-in PVC	707910.82	1878249.14
GAF-402C	GAF-00-GW-43-010	Downgradient	464.03	460.3	18.8 - 28.8	Carters Limestone	29.2	24	4-in PVC	707480.11	1880332.05
GAF-402L	GAF-00-GW-43-011	Downgradient	464.93	460.8	75.2 - 85.2	Lebanon Limestone	85.7	80	2-in PVC	707494.16	1880320.69
GAF-405C	GAF-00-GW-43-014	Downgradient	486.46	482.7	23.2 - 41.8	Carters Limestone	41.8	31	2-in PVC	702448.03	1880730.21
GAF-406L	GAF-00-GW-43-015	Downgradient	471.54	467.5	48.0 - 58.0	Lebanon Limestone	58.4	52	2-in PVC	706683.23	1877107.46
GAF-410U	GAF-00-GW-43-017	Downgradient	458.51	455.2	22.0 - 32.0	Unconsolidated	32.2	27	2-in PVC	704888.96	1877749.25
GAF-412C	GAF-00-GW-43-018	Background	477.64	473.9	43.6 - 63.6	Carters Limestone	63.9	54	4-in PVC	710931.17	1880022.99
GAF-412L	GAF-00-GW-43-019	Background	477.58	473.7	109.5 - 129.5	Lebanon Limestone	129.5	123	4-in PVC	710929.65	1880028.63
GAF-414L	GAF-00-GW-43-021	Background	481.45	478.6	93.2 - 103.2	Lebanon Limestone	103.2	98	4-in PVC	710438.90	1880406.55
GAF-416C	GAF-00-GW-43-023	Downgradient	466.87	464.2	32.0 - 52.0	Carters Limestone	52.3	42	2-in PVC	709168.17	1881134.07
GAF-422C	GAF-00-GW-43-028	Downgradient	463.78	460.1	19.6 - 35.6	Carters Limestone	35.7	31	4-in PVC	707542.45	1879330.87
GAF-426C	GAF-00-GW-43-029	Background	505.58	501.7	40.3 - 60.3	Carters Limestone	60.4	57	4-in PVC	711267.94	1881639.45
GAF-426L	GAF-00-GW-43-030	Background	506.83	502.6	176.7 - 186.7	Lebanon Limestone	187.0	183	2-in PVC	711281.94	1881642.00
GAF-427C	GAF-00-GW-43-031	Background	489.76	485.7	60.5 - 70.5	Carters Limestone	71.0	68	4-in PVC	710614.65	1882083.09
GAF-427L	GAF-00-GW-43-032	Background	488.41	484.2	144.4 - 159.4	Lebanon Limestone	159.9	152	4-in PVC	710606.97	1882087.73
GAF-446C	GAF-00-GW-43-034	Downgradient	461.06	457.3	23.9 - 33.9	Carters Limestone	34.4	29	4-in PVC	704742.14	1877728.58
GAF-449L	GAF-00-GW-43-036	Downgradient	463.09	458.2	61.3 - 71.3	Lebanon Limestone	71.8	68	4-in PVC	703982.89	1877822.35
GAF-450C	GAF-00-GW-43-050	Downgradient	466.73	463.7	51.2 - 57.2	Carters Limestone	57.2	55	4-in PVC	702528.53	1878184.63
GAF-450L	GAF-00-GW-43-051	Downgradient	466.62	463.6	77.6 - 95.5	Lebanon Limestone	95.5	95	3-in PVC	702526.39	1878174.14
GAF-451C	GAF-00-GW-43-037	Downgradient	485.62	486.0	48.8 - 58.8	Carters Limestone	59.3	56	4-in PVC	702406.33	1879585.84
GAF-452C	GAF-00-GW-43-038	Downgradient	484.13	480.6	102.3 - 112.3	Carters Limestone	112.4	109	4-in PVC	708455.27	1883011.13
GAF-452L	GAF-00-GW-43-039	Downgradient	484.31	480.7	159.7 - 169.7	Lebanon Limestone	170.4	167	4-in PVC	708438.06	1883004.23
GAF-453C	GAF-00-GW-43-040	Downgradient	467.78	464.2	49.5 - 59.5	Carters Limestone	59.8	56	4-in PVC	709163.45	1882810.94

**Notes:**

Elevation information from DDS Survey; elevation in National Geodetic Vertical Datum 1929.

Well co-ordinates based on North America Datum of 1927

Well construction information based on data provided by TVA Well Inventory, Revision 6, September 26, 2018, except for GAF-451C.

Well GAF-451C was converted to a flush-mount surface completion in August 2018, and TOC and ground surface elevations were re-surveyed.

ft btoc - feet below top of casing

in - inches (inside diameter)

**Table 2**  
**Groundwater Sampling Summary - Ash Pond Complex, 2018**  
**CCR Rule Groundwater Monitoring**  
**TVA Gallatin Fossil Plant**  
**Gallatin, Tennessee**

Sample Dates	Groundwater Gauging Date	Monitoring Program	Parameters Sampled	Number of Wells Sampled
April 24, 2018	April 16, 2018	Baseline Monitoring (257.94(b))	Appendix III, Appendix IV, major ions and field parameters	Background: 0 Downgradient: 2
May 22, 2018	May 21, 2018	Baseline Monitoring (257.94(b))	Appendix III, Appendix IV, major ions and field parameters	Background: 0 Downgradient: 2
June 19-25, 2018	June 18, 2018	Assessment Monitoring (257.95)	Appendix IV, major ions and field parameters	Background: 7 Downgradient: 16
June 19-25, 2018	June 18, 2018	Baseline Monitoring (257.94(b))	Appendix III, Appendix IV, major ions and field parameters	Background: 0 Downgradient: 2
September 18-27, 2018	September 17-21, 2018	Assessment Monitoring (257.95)	Appendix IV, major ions and field parameters	Background: 7 Downgradient: 16

**Notes:**

**Appendix III Constituents:** Boron, Calcium, Chloride, Fluoride, pH, Sulfate, Total Dissolved Solids (TDS)

**Appendix IV Constituents:** Antimony, Arsenic, Barium, Beryllium, Cadmium, Chromium, Cobalt, Fluoride, Lead, Lithium, Mercury, Molybdenum, Radium 226 + 228, Selenium, Thallium

**Table 3**  
**Groundwater Elevation Summary - Ash Pond Complex, 2018**  
**CCR Rule Groundwater Monitoring**  
**TVA Gallatin Fossil Plant**  
**Gallatin, Tennessee**

Gauging Date	2018-04-16			2018-05-21			2018-06-18			2018-09-17		
Well ID	Reference Elevation (ft AMSL)	Water Level Measurement (ft)	Hydraulic Head (ft AMSL)	Reference Elevation (ft AMSL)	Water Level Measurement (ft)	Hydraulic Head (ft AMSL)	Reference Elevation (ft AMSL)	Water Level Measurement (ft)	Hydraulic Head (ft AMSL)	Reference Elevation (ft AMSL)	Water Level Measurement (ft)	Hydraulic Head (ft AMSL)
24	464.13	17.97	446.16	464.13	18.62	445.51	464.13	19.79	444.34	464.13	19.84	444.29
GAF-402C	464.03	13.80	450.23	464.03	14.99	449.04	464.03	16.17	447.86	464.03	16.29	447.74
GAF-402L	464.93	15.27	449.66	464.93	16.88	448.05	464.93	17.08	447.85	464.93	17.20	447.73
GAF-405C	486.46	3.76	482.70	486.46	8.74	477.72	486.46	9.65	476.81	486.46	9.43	477.03
GAF-406L	471.54	26.00	445.54	471.54	25.92	445.62	471.54	27.05	444.49	471.54	27.02 (b)	444.52
GAF-410U	458.51	4.39	454.12	458.51	4.34	454.17	458.51	6.80	451.71	458.51	7.74 (c)	450.77
GAF-412C	477.64	30.35	447.29	477.64	31.57	446.07	477.64	32.51	445.13	477.64	32.72	444.92
GAF-412L	477.58	25.55	452.03	477.58	26.63	450.95	477.58	27.63	449.95	477.58	28.13	449.45
GAF-414L	481.45	32.48	448.97	481.45	34.03	447.42	481.45	35.26	446.19	481.45	35.81	445.64
GAF-416C	466.87	18.17	448.70	466.87	20.25	446.62	466.87	21.37	445.50	466.87	21.60	445.27
GAF-422C	463.78	17.88	445.90	463.78	18.09	445.69	463.78	19.38	444.40	463.78	19.42	444.36
GAF-426C	505.58	36.89	468.69	505.58	45.59	459.99	505.58	47.36	458.22	505.58	48.11	457.47
GAF-426L	506.83	44.18	462.65	506.83	47.91	458.92	506.83	51.58	455.25	506.83	55.33	451.50
GAF-427C	489.76	34.60	455.16	489.76	42.10	447.66	489.76	44.38	445.38	489.76	45.04	444.72
GAF-427L	488.41	30.93	457.48	488.41	35.29	453.12	488.41	39.79	448.62	488.41	42.77	445.64
GAF-446C	461.06	5.94	455.12	461.06	7.06	454.00	461.06	9.39	451.67	461.06	10.55 (c)	450.51
GAF-449L	463.09	8.87	454.22	463.09	10.32	452.77	463.09	12.12	450.97	463.09	11.85 (c)	451.24
GAF-450C	466.73	18.06	448.67	466.73	18.78	447.95	466.73	19.75	446.98	466.73	19.89	446.84
GAF-450L	466.62	16.07	450.55	466.62	16.80	449.82	466.62	17.73	448.89	466.62	17.79	448.83
GAF-451C	490.17	12.09	478.08	490.17	13.78	476.39	490.17	14.43	475.74	485.62	9.96	475.66
GAF-452C	484.13	26.59	457.54	484.13	28.32	455.81	484.13	30.65	453.48	484.13	33.15	450.98
GAF-452L	484.31	26.72	457.59	484.31	28.46	455.85	484.31	30.77	453.54	484.31	33.20	451.11
GAF-453C	467.78	9.81	457.97	467.78	11.96	455.82	467.78	15.54	452.24	467.78	18.03	449.75
<b>Surface Water ID</b>												
CUMBERLAND RIVER (a)	NA	NA	445.63	NA	NA	445.77	NA	NA	444.50	NA	NA	444.45

**Notes:**  
AMSLS - above mean sea level  
ft - feet  
NA - Not applicable or data not available

(a) Data downloaded from TVA's iSite Central Database  
(b) Groundwater depth gauged on 9/20/2018 prior to purging and sampling  
(c) Groundwater depth gauged on 9/21/2018 prior to purging and sampling

**Table 4**  
**Additional Baseline Sampling Groundwater Analytical Results - Ash Pond Complex**  
**CCR Rule Groundwater Monitoring**  
**TVA Gallatin Fossil Plant**  
**Gallatin, Tennessee**

Monitoring Well ID			GAF-450C	GAF-450C	GAF-450C	GAF-450L	GAF-450L	GAF-450L	GAF-450L
Sample Date			4/24/2018	5/22/2018	6/19/2018	4/24/2018	5/22/2018	5/22/2018	6/19/2018
Well Location			Downgradient	Downgradient	Downgradient	Downgradient	Downgradient	Downgradient	Downgradient
Sample ID			GAF-GW-450C-04242018	GAF-GW-450C-05222018	GAF-GW-450C-06192018	GAF-GW-450L-04242018	GAF-GW-450L-05222018	GAF-GW-903-05222018	GAF-GW-450L-06192018
Sample Type			N	N	N	N	N	FD	N
Analyte	CASNO	Units	Result	Result	Result	Result	Result	Result	Result
<b>Field Parameters</b>									
Dissolved Oxygen	DO	MG/L	0.29	4.47	0.29	0.14	0.34	NA	0.32
Oxidation Reduction Potential	ORP	MV	-75.5	-62.1	-70.5	-68.0	-29.7	NA	-65.0
pH, Field	PHFLD	pH units	6.71	6.84	6.30	6.70	6.85	NA	6.20
Specific Conductance, Field	CONDSPECFLD	umhos/cm	1059	960	1028	985	940	NA	980
Temperature	TEMP	deg C	16.7	17.7	19.0	16.4	18.6	NA	19.0
Turbidity, field	TURB-FIELD	NTU	6.49	0.87	0.75	4.86	0.26	NA	0.25
<b>General Chemistry</b>									
Alkalinity, Carbonate (CaCO3)	ALKC	MG/L	5.00 U	5.00 U	5.00 U				
Alkalinity, Total as CaCO3	ALK	MG/L	311	326	298	305	344	316	298
Alkalinity, Bicarbonate (CaCO3)	ALKB	MG/L	311	326	298	305	344	316	298
Total Dissolved Solids	TDS	MG/L	771	791	791	717	741	720	785
Chloride	16887-00-6	MG/L	12.4	9.86	10.1	13.3	9.81	9.76	9.90
Fluoride	16984-48-8	MG/L	0.122	0.112	0.112	0.148	0.139	0.136	0.140
Sulfate	14808-79-8	MG/L	326	289	319	295	308	285	314
<b>Metals, Total</b>									
Antimony	7440-36-0	MG/L	0.00112 U	0.00112 U	0.00112 U				
Arsenic	7440-38-2	MG/L	0.00590	0.00827	0.00679	0.00856	0.00923	0.00974	0.00865
Barium	7440-39-3	MG/L	0.0385	0.0403	0.0396	0.0425	0.0465	0.0469	0.0451
Beryllium	7440-41-7	MG/L	0.0000570 U	0.0000570 U	0.0000570 U				
Boron	7440-42-8	MG/L	6.55	6.64	5.91	8.16	7.44	7.59	6.55
Cadmium	7440-43-9	MG/L	0.000125 U	0.000125 U	0.000125 U				
Calcium	7440-70-2	MG/L	179	182 J	187	158	160 J	160 J	171
Chromium	7440-47-3	MG/L	0.00109 U*	0.00176 U*	0.00184 U*	0.000913 U*	0.00176 U*	0.00161 U*	0.00198 U*
Cobalt	7440-48-4	MG/L	0.00560	0.00708	0.00762	0.0102	0.0114	0.0115	0.0120
Lead	7439-92-1	MG/L	0.0000940 U	0.0000940 U	0.0000940 U				
Lithium	7439-93-2	MG/L	0.00256 U	0.00342 U*	0.00256 U				
Magnesium	7439-95-4	MG/L	10.1	10.0	10.2	8.74	9.02	9.29	9.76
Mercury	7439-97-6	MG/L	0.0000653 U	0.0000653 U	0.0000653 U				
Molybdenum	7439-98-7	MG/L	0.0174	0.0223	0.0200	0.0322	0.0310	0.0317	0.0284
Potassium	7440-09-7	MG/L	4.03	4.48	4.44	5.22	5.21	5.36	5.26
Selenium	7782-49-2	MG/L	0.000813 U	0.000813 U	0.000813 U				
Sodium	7440-23-5	MG/L	45.1	50.2	48.7	56.7	54.7	56.4	53.5
Thallium	7440-28-0	MG/L	0.0000630 U	0.0000630 U	0.0000630 U				
<b>Radiological</b>									
Radium 226 + Radium 228	RA226/228	pCi/L	0.506 UJ	0.518 UJ	0.193 UJ	0.140 UJ	0.920 U*	1.21 U*	0.489 UJ
Radium 228	15262-20-1	pCi/L	0.401 UJ	0.391 U	0.124 UJ	0.0202 UJ	0.728 U*	1.06 U*	0.406 UJ
Radium 226	13982-63-3	pCi/L	0.106 U	0.127 UJ	0.0692 U	0.119 U	0.192 UJ	0.151 UJ	0.0831 U

**Table 4**  
**Additional Baseline Sampling Groundwater Analytical Results - Ash Pond Complex**  
**CCR Rule Groundwater Monitoring**  
**TVA Gallatin Fossil Plant**  
**Gallatin, Tennessee**

**Notes and Acronymns**

FD	-	field duplicate sample
MG/L	-	milligrams per liter
MV	-	millivolts
N	-	primary sample
NA	-	not analyzed for the specified analysis or insufficient sample volume for analysis
NTU	-	nephelometric turbidity units
pCi/L	-	picoCuries per liter
umhos/cm	-	microMhos per centimeter

**Qualifier Definitions**

U	-	The analyte was analyzed for but not detected. The associated numerical value is at or below the reporting limit.
U*	-	This result should be considered "not detected" because it was detected in a rinsate blank or laboratory blank at a similar level.
J	-	Quantitation is approximate due to limitations identified during data validation.
UJ	-	This analyte was not detected, but the reporting or detection limit may or may not be higher due to a bias identified during data validation.

**Table 5**  
**Assessment Monitoring Groundwater Analytical Results - Ash Pond Complex**  
**CCR Rule Groundwater Monitoring**  
**TVA Gallatin Fossil Plant**  
**Gallatin, Tennessee**

Monitoring Well ID			24	24	GAF-402C	GAF-402C	GAF-402L	GAF-402L
Sample Date			6/19/2018	9/20/2018	6/19/2018	9/19/2018	6/19/2018	9/18/2018
Well Location			Downgradient	Downgradient	Downgradient	Downgradient	Downgradient	Downgradient
Sample ID			GAF-GW-24-06192018	GAF-GW-24-09202018	GAF-GW-402C-06192018	GAF-GW-402C-09192018	GAF-GW-402L-06192018	GAF-GW-402L-09182018
Sample Type			N	N	N	N	N	N
Analyte	CASNO	Units	Result	Result	Result	Result	Result	Result
<b>Field Parameters</b>								
Dissolved Oxygen	DO	MG/L	0.44	1.85	0.10	0.39	0.09	0.79
Oxidation Reduction Potential	ORP	MV	145.2	-158.7	22.8	-225.8	-74.0	-206.5
pH, Field	PHFLD	pH units	6.76	6.67	7.14	7.06	7.19	7.13
Specific Conductance, Field	CONDSPECFLD	umhos/cm	875	1107	396.1	411.2	622.9	654
Temperature	TEMP	deg C	15.2	16.4	16.0	17.7	17.1	18.5
Turbidity, field	TURB-FIELD	NTU	0.21	0.36	0.52	0.31	68.5	77.3
<b>General Chemistry</b>								
Alkalinity, Carbonate (CaCO3)	ALKC	MG/L	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
Alkalinity, Total as CaCO3	ALK	MG/L	388	408	192	170	320	307
Alkalinity,Bicarbonate (CaCO3)	ALKB	MG/L	388	408	192	170	320	307
Total Dissolved Solids	TDS	MG/L	714	791 J	268	229	423	347 J
Chloride	16887-00-6	MG/L	1.35	2.26	6.65	5.84	21.8	17.3
Fluoride	16984-48-8	MG/L	0.0369 J	0.0288 J	0.259	0.306	0.310	0.240
Sulfate	14808-79-8	MG/L	210	265	50.9	32.4	55.0	53.5
<b>Metals, Total</b>								
Antimony	7440-36-0	MG/L	0.00112 U	0.00112 U	0.00112 U	0.00112 U	0.00112 U	0.00112 U
Arsenic	7440-38-2	MG/L	0.000432 J	0.000323 U	0.00235	0.00963	0.00330	0.00275
Barium	7440-39-3	MG/L	0.00967 J	0.00820 J	0.0566	0.0615	0.284	0.284
Beryllium	7440-41-7	MG/L	0.0000570 U	0.0000570 U	0.0000570 U	0.0000570 U	0.000116 J	0.0000570 U
Boron	7440-42-8	MG/L	0.0819 U*	0.0638 J	0.183	0.255	0.234	0.264
Cadmium	7440-43-9	MG/L	0.000125 U	NA	0.000125 U	NA	0.000125 U	NA
Calcium	7440-70-2	MG/L	223	224	82.5	61.5	92.5	88.0
Chromium	7440-47-3	MG/L	0.00161 U*	NA	0.00157 U*	NA	0.00436 U*	NA
Cobalt	7440-48-4	MG/L	0.0000870 J	0.0000750 U	0.000380 J	0.000838	0.00117	0.00101
Lead	7439-92-1	MG/L	0.0000940 U	0.0000940 U	0.0000940 U	0.0000940 U	0.00237	0.00185
Lithium	7439-93-2	MG/L	0.00256 U	0.00256 U	0.00256 U	0.00389 U*	0.0134	0.0123
Magnesium	7439-95-4	MG/L	9.03	8.71	5.74	5.01	24.9	22.6
Mercury	7439-97-6	MG/L	0.0000653 U	NA	0.0000653 U	NA	0.0000653 U	NA
Molybdenum	7439-98-7	MG/L	0.00286 J	0.00281 U*	0.0223	0.0307	0.00382 J	0.00361 J
Potassium	7440-09-7	MG/L	0.956	1.00	1.42	1.78	3.04	2.63
Selenium	7782-49-2	MG/L	0.000813 U	NA	0.000813 U	NA	0.000813 U	NA
Sodium	7440-23-5	MG/L	1.08	1.17	7.72	7.66	22.2	18.3
Thallium	7440-28-0	MG/L	0.0000630 U	0.0000630 U	0.0000630 U	0.0000720 J	0.0000630 U	0.0000630 U
<b>Radiological</b>								
Radium 226 + Radium 228	RA226/228	pCi/L	0.554 J	0.384 UJ	0.753 UJ	0.742 U	0.722 J	1.15 U*
Radium 228	15262-20-1	pCi/L	0.554 J	0.384 UJ	0.464 UJ	0.689 U	0.558 J	0.971 U*
Radium 226	13982-63-3	pCi/L	-0.0416 U	-0.0271 UJ	0.289 U	0.0526 U	0.164 U	0.177 U

**Table 5**  
**Assessment Monitoring Groundwater Analytical Results - Ash Pond Complex**  
**CCR Rule Groundwater Monitoring**  
**TVA Gallatin Fossil Plant**  
**Gallatin, Tennessee**

Monitoring Well ID			GAF-405C	GAF-405C	GAF-406L	GAF-406L	GAF-410U	GAF-410U
Sample Date			6/21/2018	9/27/2018	6/21/2018	9/20/2018	6/21/2018	9/21/2018
Well Location			Downgradient	Downgradient	Downgradient	Downgradient	Downgradient	Downgradient
Sample ID			GAF-GW-405C-06212018	GAF-GW-405C-09272018	GAF-GW-406L-06212018	GAF-GW-406L-09202018	GAF-GW-410U-06212018	GAF-GW-410U-09212018
Sample Type			N	N	N	N	N	N
Analyte	CASNO	Units	Result	Result	Result	Result	Result	Result
<b>Field Parameters</b>								
Dissolved Oxygen	DO	MG/L	0.60	0.63	0.17	0.31	0.16	0.26
Oxidation Reduction Potential	ORP	MV	-91.7	-153.4	83.9	-173.0	-64.4	-162.9
pH, Field	PHFLD	pH units	7.06	7.13	6.85	6.98	6.67	6.82
Specific Conductance, Field	CONDSPECFLD	umhos/cm	658	660	724	746	642	707
Temperature	TEMP	deg C	18.2	17.8	17.3	17.8	18.8	18.9
Turbidity, field	TURB-FIELD	NTU	18.9	21.2	4.34	3.03	1.26	0.38
<b>General Chemistry</b>								
Alkalinity, Carbonate (CaCO3)	ALKC	MG/L	5.00 U					
Alkalinity, Total as CaCO3	ALK	MG/L	317	296	294	282	313	324
Alkalinity,Bicarbonate (CaCO3)	ALKB	MG/L	317	296	294	282	313	324
Total Dissolved Solids	TDS	MG/L	483	411	521	461 J	438	445
Chloride	16887-00-6	MG/L	3.76	2.56	6.13	4.51	6.15	6.51
Fluoride	16984-48-8	MG/L	0.0937 J	0.0759 J	0.175	0.134	0.172	0.103
Sulfate	14808-79-8	MG/L	111	92.2	167	154	95.5	110
<b>Metals, Total</b>								
Antimony	7440-36-0	MG/L	0.00112 U					
Arsenic	7440-38-2	MG/L	0.000782 U*	0.000424 J	0.000786 U*	0.000686 J	0.0254	0.0214
Barium	7440-39-3	MG/L	0.0619	0.0600	0.0382	0.0345	0.0664	0.0693
Beryllium	7440-41-7	MG/L	0.0000570 U					
Boron	7440-42-8	MG/L	0.114 U*	0.133	0.368	0.353	7.62	10.3
Cadmium	7440-43-9	MG/L	0.000125 U	NA	0.000125 U	NA	0.000125 U	NA
Calcium	7440-70-2	MG/L	132	121	145	132	103	108
Chromium	7440-47-3	MG/L	0.00206 U*	NA	0.00167 U*	NA	0.00154 U*	NA
Cobalt	7440-48-4	MG/L	0.000266 J	0.000163 J	0.000570	0.000769	0.00169	0.00162
Lead	7439-92-1	MG/L	0.000407 J	0.000938 J	0.000612 J	0.000369 U*	0.0000940 U	0.0000940 U
Lithium	7439-93-2	MG/L	0.00256 U					
Magnesium	7439-95-4	MG/L	11.2	9.23	9.89	8.75	5.84	5.87
Mercury	7439-97-6	MG/L	0.0000653 U	NA	0.0000653 U	NA	0.0000653 U	NA
Molybdenum	7439-98-7	MG/L	0.000581 J	0.000474 U	0.00333 J	0.00495 U*	0.0412	0.0390
Potassium	7440-09-7	MG/L	2.55	1.81	2.72	2.36	2.03	2.00
Selenium	7782-49-2	MG/L	0.000813 U	NA	0.000813 U	NA	0.000813 U	NA
Sodium	7440-23-5	MG/L	7.38	6.02	8.72	7.76	35.0	31.5
Thallium	7440-28-0	MG/L	0.0000630 U					
<b>Radiological</b>								
Radium 226 + Radium 228	RA226/228	pCi/L	1.52 J	0.928 J	0.865 U	1.26 U*	1.11 J	0.936 U
Radium 228	15262-20-1	pCi/L	0.947	0.810	0.457 U	1.11 U*	1.03	0.483 U
Radium 226	13982-63-3	pCi/L	0.577 UJ	0.119 U	0.409 U	0.150 UJ	0.0866 U	0.453 U

**Table 5**  
**Assessment Monitoring Groundwater Analytical Results - Ash Pond Complex**  
**CCR Rule Groundwater Monitoring**  
**TVA Gallatin Fossil Plant**  
**Gallatin, Tennessee**

Monitoring Well ID			GAF-412C	GAF-412C	GAF-412L	GAF-412L	GAF-414L	GAF-414L
Sample Date			6/22/2018	9/19/2018	6/22/2018	9/19/2018	6/22/2018	9/19/2018
Well Location			Background	Background	Background	Background	Background	Background
Sample ID			GAF-GW-412C-06222018	GAF-GW-412C-09192018	GAF-GW-412L-06222018	GAF-GW-412L-09192018	GAF-GW-414L-06222018	GAF-GW-414L-09192018
Sample Type			N	N	N	N	N	N
Analyte	CASNO	Units	Result	Result	Result	Result	Result	Result
<b>Field Parameters</b>								
Dissolved Oxygen	DO	MG/L	0.68	0.2	4.4	0.23	0.24	0.48
Oxidation Reduction Potential	ORP	MV	-132.6	24.6	-300.6	-190.2	-152.5	50.5
pH, Field	PHFLD	pH units	6.79	6.86	7.41	7.45	7.36	7.50
Specific Conductance, Field	CONDSPECFLD	umhos/cm	685	718	706	933	1051	959
Temperature	TEMP	deg C	16.2	16.7	16.4	17.6	15.8	16.0
Turbidity, field	TURB-FIELD	NTU	0.41	0.35	0.44	0.18	1.04	0.46
<b>General Chemistry</b>								
Alkalinity, Carbonate (CaCO3)	ALKC	MG/L	5.00 U					
Alkalinity, Total as CaCO3	ALK	MG/L	424	418	357	308	313	302
Alkalinity,Bicarbonate (CaCO3)	ALKB	MG/L	424	418	357	308	313	302
Total Dissolved Solids	TDS	MG/L	499	469	542	571	651	732
Chloride	16887-00-6	MG/L	14.7	14.6	88.5	111	181	190
Fluoride	16984-48-8	MG/L	0.253	0.224	1.80	1.21	0.862	0.672
Sulfate	14808-79-8	MG/L	32.0	39.1	8.61	11.5	21.3	33.4
<b>Metals, Total</b>								
Antimony	7440-36-0	MG/L	0.00112 U					
Arsenic	7440-38-2	MG/L	0.000323 U	0.000449 J	0.000323 U	0.000323 U	0.00122	0.00170
Barium	7440-39-3	MG/L	0.140	0.151	0.214	0.333	0.352	0.438
Beryllium	7440-41-7	MG/L	0.0000570 U					
Boron	7440-42-8	MG/L	0.0388 J	0.0536 J	0.290	0.282	0.178	0.221
Cadmium	7440-43-9	MG/L	0.000125 U	NA	0.000125 U	NA	0.000125 U	NA
Calcium	7440-70-2	MG/L	128	118	26.4	43.3	65.9	84.9
Chromium	7440-47-3	MG/L	0.000631 U	NA	0.000631 U	NA	0.000631 U	NA
Cobalt	7440-48-4	MG/L	0.0000750 U					
Lead	7439-92-1	MG/L	0.0000940 U					
Lithium	7439-93-2	MG/L	0.0112	0.0148	0.142	0.148	0.0982	0.101
Magnesium	7439-95-4	MG/L	18.6	19.5	17.1	24.3	27.5	34.6
Mercury	7439-97-6	MG/L	0.0000653 U	NA	0.0000653 U	NA	0.0000653 U	NA
Molybdenum	7439-98-7	MG/L	0.000474 U					
Potassium	7440-09-7	MG/L	1.21	1.49	5.88	6.22	2.63	3.43
Selenium	7782-49-2	MG/L	0.000813 U	NA	0.000813 U	NA	0.000813 U	NA
Sodium	7440-23-5	MG/L	9.82	11.0	117	135	94.8	110
Thallium	7440-28-0	MG/L	0.0000630 U					
<b>Radiological</b>								
Radium 226 + Radium 228	RA226/228	pCi/L	0.369 U	1.03 U	0.736 U	2.05 J	1.57 J	1.64 J
Radium 228	15262-20-1	pCi/L	0.209 U	0.515 U	0.457 U	0.983	1.15	1.03
Radium 226	13982-63-3	pCi/L	0.160 U	0.512 U	0.280 U	1.06 U*	0.422 U	0.613 U

**Table 5**  
**Assessment Monitoring Groundwater Analytical Results - Ash Pond Complex**  
**CCR Rule Groundwater Monitoring**  
**TVA Gallatin Fossil Plant**  
**Gallatin, Tennessee**

Monitoring Well ID			GAF-416C	GAF-416C	GAF-422C	GAF-422C	GAF-422C	GAF-422C
Sample Date			6/20/2018	9/20/2018	6/20/2018	6/20/2018	9/19/2018	9/19/2018
Well Location			Downgradient	Downgradient	Downgradient	Downgradient	Downgradient	Downgradient
Sample ID			GAF-GW-416C-06202018	GAF-GW-416C-09202018	GAF-GW-903A-06202018	GAF-GW-422C-06202018	GAF-GW-422C-09192018	GAF-GW-903-09192018
Sample Type			N	N	FD	N	N	FD
Analyte	CASNO	Units	Result	Result	Result	Result	Result	Result
<b>Field Parameters</b>								
Dissolved Oxygen	DO	MG/L	0.20	0.40	NA	0.13	0.20	NA
Oxidation Reduction Potential	ORP	MV	-53.2	-78.4	NA	-62.8	-168.4	NA
pH, Field	PHFLD	pH units	7.26	7.19	NA	6.79	7.14	NA
Specific Conductance, Field	CONDSPECFLD	umhos/cm	338.7	358.7	NA	860	698	NA
Temperature	TEMP	deg C	19.1	19.6	NA	17.0	18.6	NA
Turbidity, field	TURB-FIELD	NTU	2.34	4.00	NA	6.12	14.6	NA
<b>General Chemistry</b>								
Alkalinity, Carbonate (CaCO3)	ALKC	MG/L	5.00 U	5.00 U				
Alkalinity, Total as CaCO3	ALK	MG/L	182	180	246	274	180	180
Alkalinity,Bicarbonate (CaCO3)	ALKB	MG/L	182	180	246	274	180	180
Total Dissolved Solids	TDS	MG/L	196	187 J	596	595	479	481
Chloride	16887-00-6	MG/L	8.75	6.76	7.36	7.24	5.48	5.61
Fluoride	16984-48-8	MG/L	0.223	0.180	0.232	0.240	0.252	0.262
Sulfate	14808-79-8	MG/L	26.7	17.0	295	302	186	188
<b>Metals, Total</b>								
Antimony	7440-36-0	MG/L	0.00112 U	0.00112 U				
Arsenic	7440-38-2	MG/L	0.00236	0.00228	0.00294	0.00288	0.00887	0.00925
Barium	7440-39-3	MG/L	0.0451	0.0387	0.0401	0.0402	0.0311	0.0325
Beryllium	7440-41-7	MG/L	0.0000570 U	0.0000570 U				
Boron	7440-42-8	MG/L	0.432	0.384	0.381	0.367	0.366	0.380
Cadmium	7440-43-9	MG/L	0.000125 U	NA	0.000125 U	0.000125 U	NA	NA
Calcium	7440-70-2	MG/L	56.2	47.3	171	170	117	121
Chromium	7440-47-3	MG/L	0.00141 U*	NA	0.00143 U*	0.00157 U*	NA	NA
Cobalt	7440-48-4	MG/L	0.000283 J	0.000306 J	0.00292	0.00299	0.00254	0.00261
Lead	7439-92-1	MG/L	0.0000940 U	0.000169 U*	0.0000940 U	0.0000940 U	0.0000940 U	0.0000940 U
Lithium	7439-93-2	MG/L	0.00265 U*	0.00256 U	0.00256 U	0.00256 U	0.00260 U*	0.00256 U
Magnesium	7439-95-4	MG/L	4.85	4.33	9.83	9.88	7.22	7.40
Mercury	7439-97-6	MG/L	0.0000653 U	NA	0.0000653 U	0.0000653 U	NA	NA
Molybdenum	7439-98-7	MG/L	0.0648	0.0653	0.0287	0.0290	0.0457	0.0479
Potassium	7440-09-7	MG/L	3.21	3.05	2.27	2.26	2.18	2.22
Selenium	7782-49-2	MG/L	0.000813 U	NA	0.000813 U	0.000813 U	NA	NA
Sodium	7440-23-5	MG/L	9.19	8.54	8.01	7.80	7.24	7.50
Thallium	7440-28-0	MG/L	0.0000630 U	0.0000730 U*	0.0000630 U	0.0000630 U	0.0000630 U	0.0000630 U
<b>Radiological</b>								
Radium 226 + Radium 228	RA226/228	pCi/L	0.592 U	0.468 UJ	0.253 U	0.510 U	0.119 UJ	0.505 U
Radium 228	15262-20-1	pCi/L	0.592 U	0.414 UJ	0.167 U	0.314 U	0.0195 UJ	0.505 U
Radium 226	13982-63-3	pCi/L	-0.0689 U	0.0546 UJ	0.0853 U	0.195 U	0.0993 U	-0.294 U

**Table 5**  
**Assessment Monitoring Groundwater Analytical Results - Ash Pond Complex**  
**CCR Rule Groundwater Monitoring**  
**TVA Gallatin Fossil Plant**  
**Gallatin, Tennessee**

Monitoring Well ID			GAF-426C	GAF-426C	GAF-426L	GAF-426L
Sample Date			6/21/2018	9/20/2018	6/21/2018	9/20/2018
Well Location			Background	Background	Background	Background
Sample ID			GAF-GW-426C-06212018	GAF-GW-426C-09202018	GAF-GW-426L-06212018	GAF-GW-426L-09202018
Sample Type			N	N	N	N
Analyte	CASNO	Units	Result	Result	Result	Result
<b>Field Parameters</b>						
Dissolved Oxygen	DO	MG/L	3.60	0.43	0.39	0.86
Oxidation Reduction Potential	ORP	MV	24.1	-19.8	-133.4	-109.1
pH, Field	PHFLD	pH units	6.61	6.81	6.52	6.86
Specific Conductance, Field	CONDSPECFLD	umhos/cm	1009	1075	1155	1251
Temperature	TEMP	deg C	17.6	18	17.7	20.2
Turbidity, field	TURB-FIELD	NTU	0.35	0.63	0.50	0.43
<b>General Chemistry</b>						
Alkalinity, Carbonate (CaCO3)	ALKC	MG/L	5.00 U	5.00 U	5.00 U	5.00 U
Alkalinity, Total as CaCO3	ALK	MG/L	439	404	467	420
Alkalinity,Bicarbonate (CaCO3)	ALKB	MG/L	439	404	467	420
Total Dissolved Solids	TDS	MG/L	779	763 J	792	839 J
Chloride	16887-00-6	MG/L	36.7	55.4	91.9	92.4
Fluoride	16984-48-8	MG/L	0.321	0.276	0.404	0.328
Sulfate	14808-79-8	MG/L	228	211	165	209
<b>Metals, Total</b>						
Antimony	7440-36-0	MG/L	0.00112 U	0.00112 U	0.00112 U	0.00112 U
Arsenic	7440-38-2	MG/L	0.000600 U*	0.000468 J	0.00199	0.00144
Barium	7440-39-3	MG/L	0.0396	0.0378	0.114	0.0834
Beryllium	7440-41-7	MG/L	0.0000570 U	0.0000570 U	0.0000570 U	0.0000570 U
Boron	7440-42-8	MG/L	0.0606 U*	0.0523 J	0.0780 U*	0.0793 J
Cadmium	7440-43-9	MG/L	0.000125 U	NA	0.000125 U	NA
Calcium	7440-70-2	MG/L	141	136	131	128
Chromium	7440-47-3	MG/L	0.00201 U*	NA	0.00202 U*	NA
Cobalt	7440-48-4	MG/L	0.000140 J	0.000813	0.00116	0.000709
Lead	7439-92-1	MG/L	0.0000940 U	0.0000940 U	0.0000940 U	0.0000940 U
Lithium	7439-93-2	MG/L	0.0149	0.0146	0.0162	0.0198
Magnesium	7439-95-4	MG/L	58.9	52.0	31.1	31.1
Mercury	7439-97-6	MG/L	0.0000653 U	NA	0.0000653 U	NA
Molybdenum	7439-98-7	MG/L	0.00256 J	0.00312 U*	0.00256 J	0.00304 U*
Potassium	7440-09-7	MG/L	4.01	3.94	28.0	30.9
Selenium	7782-49-2	MG/L	0.000813 U	NA	0.000813 U	NA
Sodium	7440-23-5	MG/L	36.8	43.0	96.6	92.2
Thallium	7440-28-0	MG/L	0.0000630 U	0.0000630 U	0.0000630 U	0.0000630 U
<b>Radiological</b>						
Radium 226 + Radium 228	RA226/228	pCi/L	0.464 U	0.645 UJ	0.222 U	2.10 J
Radium 228	15262-20-1	pCi/L	0.125 U	0.509 UJ	0.222 U	1.95 J
Radium 226	13982-63-3	pCi/L	0.339 U	0.136 UJ	-0.1450 U	0.148 UJ

**Table 5**  
**Assessment Monitoring Groundwater Analytical Results - Ash Pond Complex**  
**CCR Rule Groundwater Monitoring**  
**TVA Gallatin Fossil Plant**  
**Gallatin, Tennessee**

Monitoring Well ID			GAF-427C	GAF-427C	GAF-427L	GAF-427L
Sample Date			6/22/2018	9/26/2018	6/22/2018	9/26/2018
Well Location			Background	Background	Background	Background
Sample ID			GAF-GW-427C-06222018	GAF-GW-427C-09262018	GAF-GW-427L-06222018	GAF-GW-427L-09262018
Sample Type			N	N	N	N
Analyte	CASNO	Units	Result	Result	Result	Result
<b>Field Parameters</b>						
Dissolved Oxygen	DO	MG/L	0.35	1.69	0.34	0.71
Oxidation Reduction Potential	ORP	MV	-83.8	-111.3	20.5	-152.3
pH, Field	PHFLD	pH units	6.96	7.32	6.77	7.18
Specific Conductance, Field	CONDSPECFLD	umhos/cm	728	722	657	669
Temperature	TEMP	deg C	16.8	17.0	17.7	17.7
Turbidity, field	TURB-FIELD	NTU	2.52	0.54	0.55	0.54
<b>General Chemistry</b>						
Alkalinity, Carbonate (CaCO3)	ALKC	MG/L	5.00 U	5.00 U	5.00 U	5.00 U
Alkalinity, Total as CaCO3	ALK	MG/L	366	366	333	316
Alkalinity,Bicarbonate (CaCO3)	ALKB	MG/L	366	366	333	316
Total Dissolved Solids	TDS	MG/L	450	417	429	406
Chloride	16887-00-6	MG/L	12.8	11.9	14.0	10.8
Fluoride	16984-48-8	MG/L	0.815	0.765	0.347	0.273
Sulfate	14808-79-8	MG/L	35.1	37.5	46.1	47.1
<b>Metals, Total</b>						
Antimony	7440-36-0	MG/L	0.00112 U	0.00446	0.00112 U	0.00112 U
Arsenic	7440-38-2	MG/L	0.00130	0.000888 J	0.000323 U	0.000378 J
Barium	7440-39-3	MG/L	0.434	0.315	0.0905	0.0928
Beryllium	7440-41-7	MG/L	0.0000570 U	0.0000570 U	0.0000570 U	0.0000570 U
Boron	7440-42-8	MG/L	0.249	0.159	0.0690 J	0.0720 J
Cadmium	7440-43-9	MG/L	0.000125 U	NA	0.000125 U	NA
Calcium	7440-70-2	MG/L	90.1	99.8	94.7	91.5
Chromium	7440-47-3	MG/L	0.000631 U	NA	0.000631 U	NA
Cobalt	7440-48-4	MG/L	0.00250	0.00176	0.000415 J	0.000458 J
Lead	7439-92-1	MG/L	0.000627 U*	0.000110 J	0.0000940 U	0.0000940 U
Lithium	7439-93-2	MG/L	0.0266	0.0363	0.0112	0.00814
Magnesium	7439-95-4	MG/L	31.3	29.5	27.2	25.9
Mercury	7439-97-6	MG/L	0.0000653 U	NA	0.0000653 U	NA
Molybdenum	7439-98-7	MG/L	0.000912 J	0.00168 J	0.000474 U	0.000474 U
Potassium	7440-09-7	MG/L	7.16	17.2	1.64	1.64
Selenium	7782-49-2	MG/L	0.000813 U	NA	0.000813 U	NA
Sodium	7440-23-5	MG/L	9.96	11.5	10.6	11.0
Thallium	7440-28-0	MG/L	0.0000630 U	0.0000630 U	0.0000630 U	0.0000630 U
<b>Radiological</b>						
Radium 226 + Radium 228	RA226/228	pCi/L	1.28 J	0.945 J	0.391 U	0.874 J
Radium 228	15262-20-1	pCi/L	0.895	0.281 U	0.249 U	0.874
Radium 226	13982-63-3	pCi/L	0.381 U	0.665	0.142 U	-0.0537 U

**Table 5**  
**Assessment Monitoring Groundwater Analytical Results - Ash Pond Complex**  
**CCR Rule Groundwater Monitoring**  
**TVA Gallatin Fossil Plant**  
**Gallatin, Tennessee**

Monitoring Well ID			GAF-446C	GAF-446C	GAF-446C	GAF-446C	GAF-449L	GAF-449L
Sample Date			6/19/2018	6/19/2018	9/21/2018	9/21/2018	6/20/2018	9/21/2018
Well Location			Downgradient	Downgradient	Downgradient	Downgradient	Downgradient	Downgradient
Sample ID			GAF-GW-446C-06192018	GAF-GW-903B-06192018	GAF-GW-903B-09212018	GAF-GW-446C-09212018	GAF-GW-449L-06202018	GAF-GW-449L-09212018
Sample Type			N	FD	FD	N	N	N
Analyte	CASNO	Units	Result	Result	Result	Result	Result	Result
<b>Field Parameters</b>								
Dissolved Oxygen	DO	MG/L	0.30	NA	NA	1.30	0.37	0.31
Oxidation Reduction Potential	ORP	MV	-43.2	NA	NA	-71.5	-53.6	-187.6
pH, Field	PHFLD	pH units	5.53	NA	NA	6.87	6.18	6.96
Specific Conductance, Field	CONDSPECFLD	umhos/cm	737	NA	NA	837	616	706
Temperature	TEMP	deg C	17.8	NA	NA	19.0	18.5	20.1
Turbidity, field	TURB-FIELD	NTU	1.23	NA	NA	1.78	0.14	5.60
<b>General Chemistry</b>								
Alkalinity, Carbonate (CaCO3)	ALKC	MG/L	5.00 U					
Alkalinity, Total as CaCO3	ALK	MG/L	334	354	298	318	246	220
Alkalinity,Bicarbonate (CaCO3)	ALKB	MG/L	334	354	298	318	246	220
Total Dissolved Solids	TDS	MG/L	557	544	538	545	455	466
Chloride	16887-00-6	MG/L	7.79	7.71	7.48	7.43	8.64	7.83
Fluoride	16984-48-8	MG/L	0.105	0.116	0.0596 J	0.0482 J	0.127	0.0668 J
Sulfate	14808-79-8	MG/L	163	161	152	150	185	169
<b>Metals, Total</b>								
Antimony	7440-36-0	MG/L	0.00118 J	0.00112 U				
Arsenic	7440-38-2	MG/L	0.00439	0.00432	0.00471	0.00467	0.00161 U*	0.00171 U*
Barium	7440-39-3	MG/L	0.0705	0.0705	0.0704	0.0711	0.0385	0.0419
Beryllium	7440-41-7	MG/L	0.0000570 U					
Boron	7440-42-8	MG/L	6.02	6.07	8.62	8.93	10.9	12.2
Cadmium	7440-43-9	MG/L	0.000125 U	0.000125 U	NA	NA	0.000125 U	NA
Calcium	7440-70-2	MG/L	125	123	122	125	94.6	100
Chromium	7440-47-3	MG/L	0.00160 U*	0.00156 U*	NA	NA	0.00135 U*	NA
Cobalt	7440-48-4	MG/L	0.00301	0.00309	0.00258	0.00272	0.00427	0.00387
Lead	7439-92-1	MG/L	0.0000940 U					
Lithium	7439-93-2	MG/L	0.00256 U	0.00256 U	0.00256 U	0.00256 U	0.00332 U*	0.00256 U
Magnesium	7439-95-4	MG/L	7.46	7.52	7.07	7.26	3.55	3.68
Mercury	7439-97-6	MG/L	0.0000653 U	0.0000653 U	NA	NA	0.0000653 U	NA
Molybdenum	7439-98-7	MG/L	0.0509	0.0515	0.0530	0.0543	0.0411	0.0419
Potassium	7440-09-7	MG/L	2.73	2.71	2.65	2.71	3.07	3.06
Selenium	7782-49-2	MG/L	0.000813 U	0.000813 U	NA	NA	0.000813 U	NA
Sodium	7440-23-5	MG/L	48.9	48.2	43.3	44.6	44.5	41.9
Thallium	7440-28-0	MG/L	0.0000880 J	0.000104 J	0.0000780 J	0.0000870 J	0.000107 J	0.0000860 J
<b>Radiological</b>								
Radium 226 + Radium 228	RA226/228	pCi/L	0.572 UJ	0.886 UJ	0.858 J	0.703 J	0.249 U	0.846 J
Radium 228	15262-20-1	pCi/L	0.168 UJ	0.370 UJ	0.599 J	0.0752 UJ	-0.1300 U	0.635
Radium 226	13982-63-3	pCi/L	0.405 U	0.516 U	0.258 U	0.628	0.249 U	0.211 U

**Table 5**  
**Assessment Monitoring Groundwater Analytical Results - Ash Pond Complex**  
**CCR Rule Groundwater Monitoring**  
**TVA Gallatin Fossil Plant**  
**Gallatin, Tennessee**

Monitoring Well ID			GAF-450C	GAF-450C	GAF-450L	GAF-450L	GAF-451C	GAF-451C
Sample Date			6/19/2018	9/18/2018	6/19/2018	9/18/2018	6/25/2018	9/26/2018
Well Location			Downgradient	Downgradient	Downgradient	Downgradient	Downgradient	Downgradient
Sample ID			GAF-GW-450C-06192018	GAF-GW-450C-09182018	GAF-GW-450L-06192018	GAF-GW-450L-09182018	GAF-GW-451C-06252018	GAF-GW-451C-09262018
Sample Type			N	N	N	N	N	N
Analyte	CASNO	Units	Result	Result	Result	Result	Result	Result
<b>Field Parameters</b>								
Dissolved Oxygen	DO	MG/L	0.29	0.53	0.32	0.10	0.93	0.39
Oxidation Reduction Potential	ORP	MV	-70.5	34.2	-65.0	82.6	-84.7	-232.7
pH, Field	PHFLD	pH units	6.30	6.81	6.20	6.65	6.35	6.92
Specific Conductance, Field	CONDSPECFLD	umhos/cm	1028	1081	980	1078	1062	1266
Temperature	TEMP	deg C	19.0	18.60	19.0	19.0	20.6	19.8
Turbidity, field	TURB-FIELD	NTU	0.75	0.84	0.25	0.41	2.38	0.85
<b>General Chemistry</b>								
Alkalinity, Carbonate (CaCO3)	ALKC	MG/L	5.00 U					
Alkalinity, Total as CaCO3	ALK	MG/L	298	283	298	293	416	506
Alkalinity,Bicarbonate (CaCO3)	ALKB	MG/L	298	283	298	293	416	506
Total Dissolved Solids	TDS	MG/L	791	734 J	785	816 J	785	903
Chloride	16887-00-6	MG/L	10.1	9.40	9.90	9.80	29.4	19.4
Fluoride	16984-48-8	MG/L	0.112	0.0862 J	0.140	0.118	0.468	0.469
Sulfate	14808-79-8	MG/L	319	344	314	355	210	266
<b>Metals, Total</b>								
Antimony	7440-36-0	MG/L	0.00112 U	0.00112 U	0.00112 U	0.00112 U	0.00145 J	0.00112 U
Arsenic	7440-38-2	MG/L	0.00679	0.00637	0.00865	0.00900	0.000725 J	0.00156
Barium	7440-39-3	MG/L	0.0396	0.0397	0.0451	0.0432	0.0331	0.0389
Beryllium	7440-41-7	MG/L	0.0000570 U					
Boron	7440-42-8	MG/L	5.91	6.03	6.55	7.23	0.0473 J	0.0512 J
Cadmium	7440-43-9	MG/L	0.000125 U	NA	0.000125 U	NA	0.000125 U	NA
Calcium	7440-70-2	MG/L	187	176	171	173	157	178
Chromium	7440-47-3	MG/L	0.00184 U*	NA	0.00198 U*	NA	0.000631 U	NA
Cobalt	7440-48-4	MG/L	0.00762	0.00751	0.0120	0.0116	0.0000750 U	0.0000920 J
Lead	7439-92-1	MG/L	0.0000940 U	0.000163 J				
Lithium	7439-93-2	MG/L	0.00256 U	0.00256 U	0.00256 U	0.00256 U	0.00806	0.00671
Magnesium	7439-95-4	MG/L	10.2	9.73	9.76	8.89	54.9	60.0
Mercury	7439-97-6	MG/L	0.0000653 U	NA	0.0000653 U	NA	0.0000653 U	NA
Molybdenum	7439-98-7	MG/L	0.0200	0.0189	0.0284	0.0261	0.000528 J	0.000474 U
Potassium	7440-09-7	MG/L	4.44	4.35	5.26	5.51	2.46	2.69
Selenium	7782-49-2	MG/L	0.000813 U	NA	0.000813 U	NA	0.000813 U	NA
Sodium	7440-23-5	MG/L	48.7	39.3	53.5	50.0	15.3	14.8
Thallium	7440-28-0	MG/L	0.0000630 U					
<b>Radiological</b>								
Radium 226 + Radium 228	RA226/228	pCi/L	0.193 UJ	1.46 U*	0.489 UJ	0.394 U	0.948 U	0.806 J
Radium 228	15262-20-1	pCi/L	0.124 UJ	1.19 U*	0.406 UJ	0.389 U	0.352 U	0.732
Radium 226	13982-63-3	pCi/L	0.0692 U	0.269 U	0.0831 U	0.00496 U	0.596 U	0.0740 U

**Table 5**  
**Assessment Monitoring Groundwater Analytical Results - Ash Pond Complex**  
**CCR Rule Groundwater Monitoring**  
**TVA Gallatin Fossil Plant**  
**Gallatin, Tennessee**

Monitoring Well ID			GAF-452C	GAF-452C	GAF-452L	GAF-452L	GAF-453C	GAF-453C
Sample Date			6/21/2018	9/20/2018	6/21/2018	9/20/2018	6/25/2018	9/25/2018
Well Location			Downgradient	Downgradient	Downgradient	Downgradient	Downgradient	Downgradient
Sample ID			GAF-GW-452C-06212018	GAF-GW-452C-09202018	GAF-GW-452L-06212018	GAF-GW-452L-09202018	GAF-GW-453C-06252018	GAF-GW-453C-09252018
Sample Type			N	N	N	N	N	N
Analyte	CASNO	Units	Result	Result	Result	Result	Result	Result
<b>Field Parameters</b>								
Dissolved Oxygen	DO	MG/L	6.6	0.73	3.9	0.81	1.34	0.77
Oxidation Reduction Potential	ORP	MV	-165.9	-93.1	-126.6	-74.0	-137.1	-74.1
pH, Field	PHFLD	pH units	6.98	7.10	7.05	7.09	6.44	7.13
Specific Conductance, Field	CONDSPECFLD	umhos/cm	815	804	538.2	548	802	768
Temperature	TEMP	deg C	18.0	17.8	18.2	18.4	19.7	18.8
Turbidity, field	TURB-FIELD	NTU	0.57	0.30	0.22	0.45	0.62	0.34
<b>General Chemistry</b>								
Alkalinity, Carbonate (CaCO3)	ALKC	MG/L	5.00 U					
Alkalinity, Total as CaCO3	ALK	MG/L	337	524	520	344	327	296
Alkalinity,Bicarbonate (CaCO3)	ALKB	MG/L	337	524	520	344	327	296
Total Dissolved Solids	TDS	MG/L	401	507 J	596	333 J	599	627
Chloride	16887-00-6	MG/L	14.6	7.80	5.13	3.61	8.49	5.51
Fluoride	16984-48-8	MG/L	0.886	0.665	0.409	0.333	0.334	0.254
Sulfate	14808-79-8	MG/L	49.1	46.1	34.5	33.6	167	181
<b>Metals, Total</b>								
Antimony	7440-36-0	MG/L	0.00112 U					
Arsenic	7440-38-2	MG/L	0.00770	0.00334	0.00159 U*	0.000911 J	0.00435	0.00293
Barium	7440-39-3	MG/L	0.248	0.197	0.0862	0.0704	0.0984	0.100
Beryllium	7440-41-7	MG/L	0.0000570 U					
Boron	7440-42-8	MG/L	0.261	0.212	0.0964 U*	0.0889	0.0729 J	0.0425 J
Cadmium	7440-43-9	MG/L	0.000125 U	NA	0.000125 U	NA	0.000125 U	NA
Calcium	7440-70-2	MG/L	79.8	59.6	85.4	71.1	114	136
Chromium	7440-47-3	MG/L	0.00196 U*	NA	0.00182 U*	NA	0.000631 U	NA
Cobalt	7440-48-4	MG/L	0.0000750 U	0.0000750 U	0.000265 J	0.0000990 J	0.0000750 U	0.0000810 J
Lead	7439-92-1	MG/L	0.0000940 U	0.0000950 U*	0.0000940 U	0.0000940 U	0.0000940 U	0.0000940 U
Lithium	7439-93-2	MG/L	0.0896	0.0970	0.0155	0.0174	0.00832	0.00404 J
Magnesium	7439-95-4	MG/L	30.3	26.3	29.0	26.3	16.1	16.8
Mercury	7439-97-6	MG/L	0.0000653 U	NA	0.0000653 U	NA	0.0000653 U	NA
Molybdenum	7439-98-7	MG/L	0.000474 U					
Potassium	7440-09-7	MG/L	6.09	5.09	3.70	3.23	1.89	1.70
Selenium	7782-49-2	MG/L	0.000813 U	NA	0.000813 U	NA	0.000813 U	NA
Sodium	7440-23-5	MG/L	106	79.7	10.9	8.18	52.5	26.2
Thallium	7440-28-0	MG/L	0.0000630 U	0.0000760 U*	0.0000630 U	0.0000630 U	0.0000630 U	0.0000630 U
<b>Radiological</b>								
Radium 226 + Radium 228	RA226/228	pCi/L	2.03	1.65 J	0.821 U	0.534 UJ	0.902 U	0.326 U
Radium 228	15262-20-1	pCi/L	1.13	1.08 U*	0.204 U	0.427 UJ	0.499 U	0.116 U
Radium 226	13982-63-3	pCi/L	0.898	0.570 J	0.617 U	0.107 UJ	0.403 U	0.210 U

**Table 5**  
**Assessment Monitoring Groundwater Analytical Results - Ash Pond Complex**  
**CCR Rule Groundwater Monitoring**  
**TVA Gallatin Fossil Plant**  
**Gallatin, Tennessee**

**Notes and Acronyms**

FD	-	field duplicate sample
MG/L	-	milligrams per liter
MV	-	millivolts
N	-	primary sample
NA	-	not analyzed for the specified analysis or insufficient sample volume for analysis
NTU	-	nephelometric turbidity units
pCi/L	-	picoCuries per liter
umhos/cm	-	microMhos per centimeter
UPL	-	upper prediction limit

**Qualifier Definitions**

U	-	The analyte was analyzed for but not detected. The associated numerical value is at or below the reporting limit.
U*	-	This result should be considered "not detected" because it was detected in a rinsate blank or laboratory blank at a similar level.
J	-	Quantitation is approximate due to limitations identified during data validation.
UJ	-	This analyte was not detected, but the reporting or detection limit may or may not be higher due to a bias identified during data validation.

**Table 6**  
**Statistically Significant Levels (SSLs) Above GWPSs – Ash Pond Complex**  
**CCR Rule Groundwater Monitoring**  
**TVA Gallatin Fossil Plant**  
**Gallatin, Tennessee**

Appendix IV Parameter	GWPS (a)	Downgradient wells with Assessment monitoring results above GWPSs (b)	Calculated LCL on the mean (c)	SSL (d) LCL>GWPS
Antimony (mg/l)	0.006	None	NA	NA
Arsenic (mg/l)	0.010	GAF-410U	0.0219	<b>Yes</b>
Barium (mg/l)	2	None	NA	NA
Beryllium (mg/l)	0.004	None	NA	NA
Cadmium (mg/l)	0.005	None	NA	NA
Chromium (mg/l)	0.100	None	NA	NA
Cobalt (mg/l)	0.006	GAF-450C	0.0056	No
		GAF-450L	0.0083	<b>Yes</b>
Fluoride (mg/l)	4	None	NA	NA
Lead (mg/l)	0.015	None	NA	NA
Lithium (mg/l)	Carters: 0.045	GAF-452C	0.0729	<b>Yes</b>
	Lebanon: 0.189	None	NA	NA
Mercury (mg/l)	0.002	None	NA	NA
Molybdenum (mg/l)	0.100	None	NA	NA
Radium-226+228 (pCi/l)	5	None	NA	NA
Selenium (mg/l)	0.050	None	NA	NA
Thallium (mg/l)	0.002	None	NA	NA

**Notes:**

mg/l – milligrams per liter

NA – Not applicable

pCi/l – picoCuries per liter

(a) Groundwater Protection Standards (GWPSs) shown are the maximum of site background or the published GWPS (as published in the Federal Register July 30, 2018; 257.95(h)(2))/MCL (257.95(h)(3)). GWPSs documented in notice dated 10/15/2018.

(b) Assessment monitoring events in June and September 2018 (per 257.95(b) and (d)).

(c) Lower confidence limit (LCL) on the mean of 12 sampling events between November 2016 and September 2018; only 9 samples available for GAF-450C and GAF-450L. Upper confidence limit (UCL) not shown as it is greater than LCL.

(d) SSL is statistically significant level over GWPS.

## Appendix A

### Dye Trace Velocity Table

**Table 3**  
**Phase 1 Dye Trace Summary**  
**TVA Gallatin Fossil Plant**

Injection Point	Injection Date	Dye	Dye Recovery Location	Dye Recovery Confidence Level	Detection Date	Number Of Detections	Previous Non-detect Sample Date	Straight-line Distance (ft)	Travel Time - Low (days)	Travel Time - High (days)	Apparent Velocity Low (ft/day)	Apparent Velocity High (ft/day)
A0-SH-3	4/11/2017 17:55	Rhodamine WT (3 gallons)	DS-31-1	HIGH	4/12/17 7:30	1	NA	1,311	NA	0.6	2,316	NA
			DS-32-1	HIGH	4/12/2017 7:30	2	NA	1,540	NA	0.6	2,721	NA
			DS-26-3	HIGH	4/14/2017 13:50	1	NA	9,134	NA	2.8	3,228	NA
			DS-26-6	HIGH	4/14/2017 13:50	1	NA	9,134	NA	2.8	3,228	NA
C1-SH-15	4/12/17 7:50	Fluorescein (2 gallons)	DS-1	HIGH	4/20/17 8:40	2	4/14/17 9:40	11,657	8.03	2.1	1,451	5,614
			DS-2	HIGH	4/20/17 8:50	1	4/14/17 9:55	8,147	8.04	2.1	1,013	3,904
			DS-7	HIGH	4/20/17 9:00	1	4/14/17 10:05	6,747	8.05	2.1	838	3,222
			DS-3	HIGH	4/20/17 9:10	2	4/14/17 10:30	6,217	8.06	2.1	772	2,945
			DS-4	HIGH	4/20/17 9:15	2	4/14/17 10:25	6,077	8.06	2.1	754	2,883
			DS-6	HIGH	4/20/17 9:25	2	4/14/17 10:20	6,247	8.07	2.1	774	2,969
			DS-8	HIGH	4/20/17 9:30	2	4/14/17 10:05	5,547	8.07	2.1	687	2,649
			DS-9	HIGH	5/17/17 11:45	1	5/9/17 13:30	5,552	35.16	27.2	158	204
			GAF-414C	HIGH	4/24/2017 13:15	8	4/14/2017 13:18	420	12.23	2.2	34	189
			GAF-415C	HIGH	4/24/2017 12:35	1	4/14/2017 15:45	1,320	12.20	2.3	108	567
			GAF-421L	HIGH	4/24/2017 13:15	11	4/14/2017 16:15	3,020	12.23	2.4	247	1,285
			GAF-419L	HIGH	5/22/2017 9:45	2	5/15/2017 10:05	3,520	40.08	33.1	88	106
			GAF-428L	LOW	5/22/17 11:15	1	5/15/17 11:55	5,150	40.14	33.2	128	155
			D2-CV-1	HIGH	5/31/17 8:15	5	5/22/17 9:45	3,690	49.02	40.1	75	92
GAF-416C	LOW	6/28/17 9:10	1	6/14/17 10:25	1,625	77.06	63.1	21	26			
GAF-407L	LOW	6/28/17 16:10	1	6/15/17 10:30	2,173	77.35	64.1	28	34			
D2-SH-22	4/19/17 10:00	Eosine (2 gallons)	D2-CV-1	HIGH	4/24/17 11:20	7	4/19/17 13:55	230	5.06	0.2	45	1,409
			GAF-23	LOW	5/31/17 16:15	1	5/22/17 11:55	1,960	42.26	33.1	46	59
			DS-16-6	LOW	6/28/17 10:15	1	6/21/17 10:10	6,640	70.01	63.0	95	105
GAF-405C	5/12/17 8:55	Sulphorhodamine B (2 gallons)	Dye Not Recovered as of 7/6/17	NA	NA	NA	NA	NA	NA	NA	NA	
GAF-459C	5/10/17 9:40	Pyranine (2 gallons)	GAF-410U	HIGH	5/15/2017 12:20	7	5/8/2017 13:50	1,120	5.11	NA	219	NA
			GAF-446C	HIGH	5/22/2017 12:05	6	5/15/2017 12:30	1,160	12.10	5.1	96	227
			GAF-458C	HIGH	6/21/2017 12:00	2	6/14/2017 11:50	1,100	42.10	35.1	26	31
GAF-456C	5/23/17 8:55	Phloxine B (8 pounds)	Dye Not Recovered as of 7/6/17	NA	NA	NA	NA	NA	NA	NA	NA	

**Table Source:**  
Hydrogeology Inc, September 2017. *TVA Gallatin Phase Zero/Phase 1 Dye Trace Study*,  
Table 3, Prepared for AECOM

## **Appendix B**

### **Memorandum: Groundwater Protection Standards**

## Memorandum

To	Tennessee Valley Authority	Page	1
CC			
Subject	Gallatin Fossil Plant, Ash Pond Complex CCR Rule Groundwater Protection Standards		
From	A Elizabeth Perry, PG Chris Garlington		
Date	October 15, 2018		

In accordance with federal regulations for management of coal combustion residuals (the CCR Rule; 40 CFR 257), the Tennessee Valley Authority (TVA) is monitoring groundwater at the Ash Pond Complex at its Gallatin Fossil Plant (GAF) in Gallatin, Tennessee. The first Assessment groundwater monitoring event was conducted at GAF in June 2018. The CCR Rule requires TVA to develop groundwater protection standards (GWPSs) for Appendix IV parameters that were detected during that sampling event. This memorandum presents those GWPSs.

The samples collected during the Assessment monitoring event in June 2018 were analyzed for (among other things) the parameters listed in the CCR Rule Appendix IV. GWPSs have been developed for all Appendix IV parameters, including those that were detected and those that were not detected. Table 1 lists the Appendix IV parameters, and notes which were detected in at least one monitoring well.

The CCR Rule specifies that the GWPS is the published Maximum Contaminant Level (MCL). For parameters without a MCL, the CCR Rule provides published values of the GWPS. Both the MCLs and published GWPSs are provided on Table 1. However, the CCR Rule states that if background is higher than these published values, then the GWPS becomes background.

Background concentrations were calculated using the statistical methods as certified under the CCR Rule for the GAF Ash Pond Complex (dated November 14, 2017). As a result, the GWPS for lithium is the background value, as shown on Table 1. GWPSs for all other Appendix IV parameters are the published GWPS/MCL.

**Table 1: Groundwater Protection Standards, GAF Ash Pond Complex**

Appendix IV Parameter	Detected June 2018	MCL	Published GWPS (a)	Background	Final GWPS (b)
Antimony (mg/l)	Yes	0.006	NA	NA	0.006
Arsenic (mg/l)	Yes	0.010	NA	NA	0.010
Barium (mg/l)	Yes	2	NA	NA	2
Beryllium (mg/l)	Yes	0.004	NA	NA	0.004
Cadmium (mg/l)	No	0.005	NA	NA	0.005
Chromium (mg/l)	No	0.100	NA	NA	0.100
Cobalt (mg/l)	Yes	NA	0.006	NA	0.006
Fluoride (mg/l)	Yes	4	NA	NA	4
Lead (mg/l)	Yes	NA	0.015	NA	0.015
Lithium (mg/l)	Yes	NA	0.040	0.045/0.189 (c)	0.045/0.189 (c)
Mercury (mg/l)	No	0.002	NA	NA	0.002
Molybdenum (mg/l)	Yes	NA	0.100	NA	0.100
Radium-226+228 (pCi/l)	Yes	5	NA	NA	5
Selenium (mg/l)	No	0.050	NA	NA	0.050
Thallium (mg/l)	Yes	0.002	NA	NA	0.002

NA – Not applicable

(a) As published in the Federal Register July 30, 2018; 257.95(h)(2).

(b) Final GWPS is the maximum of background or the published GWPS/MCL (257.95(h)(3)).

(c) Separate background values are calculated for the two different geologic units: the Carters Limestone and Lebanon Limestone, respectively.

## **Appendix C**

### **Appendix III and IV Background Concentration Ranges**

**Appendix C**  
**Background Groundwater Concentrations**  
**CCR Rule Groundwater Monitoring - Ash Pond Complex**  
**TVA Gallatin Fossil Plant**  
**Gallatin, Tennessee**

Appendix III & Appendix IV Constituents	Units	Lebanon		Carters	
		Minimum Concentration	Maximum Concentration	Minimum Concentration	Maximum Concentration
Antimony	mg/l	ND	0.000929 J	ND	0.00446
Arsenic	mg/l	ND	0.00199	ND	0.00173
Barium	mg/l	0.0308	0.518	0.0327	0.434
Beryllium	mg/l	All not detected		All not detected	
Boron	mg/l	0.0326 J	0.455	0.0325 J	0.249
Cadmium	mg/l	All not detected		All not detected	
Calcium	mg/l	24.2	154	84.5	147
Chloride	mg/l	5.89	330	4.13	65.3
Chromium	mg/l	ND	0.00774	ND	0.000475 J
Cobalt	mg/l	ND	0.00212	ND	0.0025
Fluoride	mg/l	0.203	2.3	0.195	0.815
Lead	mg/l	ND	0.00009	ND	0.000588 J
Lithium	mg/l	0.0077	0.189	0.0067	0.0363
Mercury	mg/l	ND	0.00281	ND	0.0002 U
Molybdenum	mg/l	ND	0.00749	ND	0.00931
pH, Field	mg/l	6.52	8.09	6.61	7.71
Radium-226 + Radium-228	pCi/l	ND	2.35	ND	1.28
Selenium	mg/l	ND	0.000443 J	ND	0.00086 J
Sulfate	mg/l	4.49	275	28.1	322
Thallium	mg/l	ND	0.000059 J	ND	0.000065 J
Total Dissolved Solids	mg/l	354	864	319	843

**Notes**

ND – minimum concentration is not detected. Detection limits vary.

Specific sample results are provided in Tables 4 & 5 of this report and in the 2017 Annual Report.

Concentration ranges based on samples collected from November 2016 through September 2018.

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AECOM  
1600 Perimeter Park  
Morrisville, NC 27560  
T: 919.461.1100  
[aecom.com](http://aecom.com)