Semiannual Report on the Progress of Remedy Selection – Ash Pond Complex

Gallatin Fossil Plant
Gallatin, Tennessee

Prepared for:
Tennessee Valley Authority
Chattanooga, Tennessee

Prepared by:

AECOM
Morrisville, North Carolina

January 15, 2020

Tennessee Valley Authority
Chattanooga, Tennessee

PROGRESS REPORT – SELECTION OF REMEDY
GALLATIN FOSSIL PLANT

Quality information

Prepared by

Anthony J. Limke, CPG
AECOM, Principal Geologist

Prepared by

Scott C. Veenstra
AECOM, Senior Project Manager

Reviewed by

David E. Skeggs, PE
AECOM, Principal Project Manager

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Acronyms

ACM	Assessment of Corrective Measures
APC	Ash Pond Complex
ASD	Alternate Source Demonstration
bgs	Below ground surface
CARA	Corrective Action and Risk Assessment
CAGWMP	Corrective Action Groundwater Monitoring Program
CBR	Closure by Removal
CCR	Coal Combustion Residuals
CFR	Title 40, Code of Federal Regulations
COC	Constituent of Concern
CRM	Cumberland River Mile
EAR	Environmental Assessment Report
EI	Environmental Investigation
ft	Feet
GAF	Gallatin Fossil Plant
GWPS	Groundwater Protection Standards
MNA	Monitored Natural Attenuation
msl	Mean sea level
mg/L	Milligram per liter
NPDES	National Pollutant Discharge Elimination System
NRL	North Rail Loop
PRB	Permeable Reactive Barrier
SSL	Statistically Significant Levels
TDEC	Tennessee Department of Environment and Conservation
TVA	Tennessee Valley Authority
USEPA	United States Environmental Protection Agency

1.0 Introduction

In accordance with the requirements in 40 CFR § 257.97(a), this report has been prepared to describe the current progress in selecting and designing a remedy for the Ash Pond Complex (APC) (including Ash Pond A, Ash Pond E, Middle Pond A, and Bottom Ash Pond)(hereinafter collectively referred to as CCR Multiunit or APC Multiunit) at the Tennessee Valley Authority (TVA) Gallatin Fossil Plant (GAF) in Gallatin, Sumner County, Tennessee.

1.1 Regulatory Background

On April 17, 2015, the U.S. Environmental Protection Agency (USEPA) published a rule that set forth national criteria for the management of coal combustion residuals (CCR) produced by electric utilities. The requirements can be found in Title 40, Code of Federal Regulations (40 CFR) Part 257, Subpart D. The rule includes requirements for monitoring groundwater, assessing corrective measures, and selecting a remedy if constituents listed in Appendix IV of the rule are detected in groundwater samples collected from downgradient monitoring wells at statistically significant levels (SSL) greater than groundwater protection standards (GWPS).

In January 2019, TVA completed an evaluation of whether there were SSLs over established GWPS as defined in 40 CFR § 257.95(h) for one or more Appendix IV constituents in accordance with 40 CFR § 257.95(g). At the APC Multiunit, assessment monitoring events in 2018 detected an SSL greater than the GWPS for arsenic in one well (GAF-410U), for cobalt in one well (GAF-450L), and for lithium in one well (GAF-452C). TVA has successfully demonstrated that a source other than the APC Multiunit caused the SSLs above GWPS for cobalt and lithium at wells GAF-450L and GAF-452C, respectively as allowed under 40 CFR § 257.95(g)(3)(ii). TVA has not been able to demonstrate that a source other than the APC Multiunit caused the SSL of arsenic. There were no new SSLs identified in 2019.

In accordance with 40 CFR § 257.96(a), TVA prepared the 2019 Assessment of Corrective Measures (ACM) Report for the APC Multiunit, added it to the operating record on July 15, 2019 and uploaded it to the CCR Rule Compliance Data and Information website on August 14, 2019. The ACM Report provided an assessment of the effectiveness of potential corrective measures in achieving the criteria provided in 40 CFR § 257.96(c). As described in Section 1.2, closure of the APC Multiunit is integrated into the ACM process. Four primary strategies were evaluated to address groundwater exhibiting concentrations above the arsenic GWPS:

- Monitored Natural Attenuation (MNA);
- In-Situ Physical/Chemical Treatment;
- Permeable Reactive Barriers (PRB); and
- Hydraulic Containment and Treatment.

Following preparation of the ACM Report, TVA began the process to select a remedy. Semiannual reports are required pursuant to 40 CFR § 257.97(a) to document progress toward

remedy selection and design. The CCR Rule contemplates that more investigation and consideration may be needed to evaluate and design the remedy before making the final selection. TVA will continue to review new data as it becomes available and implement changes to the groundwater monitoring and corrective action program as necessary to maintain compliance with 40 CFR § 257.90 through § 257.98.

At least 30 days prior to the selection of the remedy, the owner/operator must discuss the results of the ACM in a public meeting required by 40 CFR § 257.96(e). The selected remedy must, at a minimum, meet the requirements of 40 CFR § 257.97(b) and must consider the evaluation factors set forth in 40 CFR § 257.97(c) in the selection process. Once a final remedy is chosen, a final report describing the remedy and how it meets the standards set forth in 40 CFR § 257.97(b) will be prepared. The owner/operator must also provide a schedule for implementing the selected remedy that takes into account the factors set forth in 40 CFR § 257.97(d).

1.2 Overview of July 2019 Closure Plan

A revised Closure Plan has been prepared for the APC Multiunit as a result of an agreement between TVA and the Tennessee Department of Environment and Conservation (TDEC) as noted in Section 1.2.1. This Closure Plan was added to the operating record on July 19, 2019 and was posted on TVA's CCR Rule Compliance Data and Information website on August 19, 2019.

Based on conceptual plans, and subject to the completion of all necessary environmental reviews, TVA intends to close the APC Multiunit by following a closure-by-removal approach pursuant to 40 CFR § 257.102(c). Closure activities are anticipated to include pond drawdown, CCR dewatering, and CCR excavation and removal. CCR is expected to be transported and disposed of in an on-site permitted landfill and/or transported to a beneficial re-use facility for recycling and encapsulated beneficial use with the potential for some unusable CCR to be disposed of in an on-site or off-site landfill. Details of the CCR disposal options will be completed during detailed closure design, which will begin in 2020, and is subject to the completion of all necessary environmental reviews.

Consistent with the requirements of 40 CFR § 257.102(c), potentially impacted underlying material will be addressed. Post-excavation surfaces will be graded to promote positive drainage, and permanent vegetation or permanent stabilization will be established. Where needed, the APC perimeter berms may be excavated to allow the adjacent Cumberland River to combine with the existing ponds.

1.2.1 Summary of State Required Investigation and Remedy Selection Process

Since 2016, TVA has been conducting an environmental investigation of CCR disposal sites at its GAF coal-fired site in Tennessee under the oversight of TDEC through an Agreed Temporary Injunction (ATI) entered by the state court on January 21, 2016, in a lawsuit brought by the State

of Tennessee and TDEC against TVA pertaining to the GAF site. This ATI required TVA to conduct an Environmental Investigation (EI) at GAF, which began on July 18, 2016 and continues as of the date of this report. The APC Multiunit at GAF that is subject to the CCR Rule is included in the ATI.

Based upon an agreement between TDEC and TVA on June 13, 2019, resolving the lawsuit, the closure method for the APC Multiunit will be by removal of the CCR. The agreement requires CCR to be transported to a beneficial re-use facility for recycling and encapsulated beneficial use, transported and disposed of in an on-site permitted landfill, or transported and disposed of in an off-site permitted landfill. The agreement requires the EI to be completed and requires that TVA submit to TDEC for approval an environmental assessment report (EAR) that provides an analysis of the extent of CCR impacts, including groundwater impacts, at GAF. The EI/EAR process will be used to develop a plan for monitoring discharge locations during the removal action. Further, the agreement requires TVA to submit a Corrective Action/Risk Assessment (CARA) Plan to address groundwater contamination at the APC Multiunit.

1.3 Report Contents

Following this introduction, the progress report provides summaries of the GAF site characteristics, the groundwater assessment monitoring program, the findings of the ACM process, and the current progress of groundwater remedy selection.

2.0 Site Background and Characteristics

GAF is located at 1499 Steam Plant Road in Gallatin, Sumner County, Tennessee. The facility is located on the north bank of the Cumberland River and between Cumberland River Mile (CRM) 246 and 241.5. The Cumberland River is impounded by the Old Hickory Dam located approximately 23 miles downstream (CRM 216.2). GAF construction began in 1953. GAF began operations in 1956 with full operation in 1959, following completion of the fourth generating unit.

The coal combustion process at GAF historically generated by-products that included fly ash and bottom ash. CCR management units at GAF are depicted in **Figure 1**. The fly ash and bottom ash were managed at the former Non-Registered Site (NRS) from 1956 until approximately 1970. The NRS was closed in 1997 (TVA and Arcadis, 2014) and is not subject to the CCR Rule. In approximately 1970 until 2019, CCR was managed in the APC Multiunit in accordance with National Pollutant Discharge Elimination System (NPDES) Permit No.TN0005428 issued by the Tennessee Department of Environment and Conservation (TDEC). Approximately 11,440,000 cubic yards of CCR material is currently present in the APC Multiunit, with the majority present in Ash Pond A. The APC Multiunit covers approximately 383 acres.

The recently-constructed scrubber system (2013-2016) produces dry CCR material. The dry CCR material is managed in the 52-acre Class II Landfill (Tennessee Solid Waste Permit IDL83-0219) called the North Rail Loop (NRL) Landfill. Cell 1 of the landfill, which includes both a soil and geosynthetic liner system and groundwater monitoring well network, has been approved by

TDEC for operation and began receiving CCR in June 2016. The NRL Landfill is subject to the CCR Rule and remains in detection monitoring.

With the completion of the new Flow Management System, the APC has been removed from service. Process flows and NRL Landfill leachate have been rerouted to the Flow Management System. The Flow Management System effluent is released at Outfall 010.

2.1 Conceptual Site Model Summary

The geology and hydrology of the GAF site have been characterized during implementation of multiple investigations, including the NRL landfill hydrogeologic investigation, the EI, CCR Rule monitoring network development, and the NRL landfill expansion hydrogeologic investigation. These investigations provide a thorough understanding of the site geology and presence of water-bearing zones in which groundwater and potential contaminants would be present and migrating.

Site-wide geology consists of a series of relatively flat-lying units comprised of the following materials, from the surface downward: unconsolidated units including fill, alluvium, and residuum; and underlying bedrock units consisting of various limestone formations.

Unconsolidated units at the site consist of fill related to TVA's development of the peninsula, alluvial soils associated with the Cumberland River floodplain, and residuum soils associated with in-place weathering of bedrock at or near the surface. The unconsolidated materials are primarily alluvium, but water is also locally present in residuum. The alluvium generally has a high percentage of fines (silts and clays) and many wells have very poor yield. Within the clay alluvium, occasional lenses of sandy, more permeable materials are encountered (e.g., well S3, GAF-410U).

Bedrock beneath the GAF site consists of limestone of the Nashville Group (Bigby-Cannon and Hermitage) and the Stones River Group (Carters, Lebanon, and Ridley). The bedrock underlying the peninsula tends to be locally, but not extensively, fractured. Most fractures are nearly horizontal, parallel to bedding. Beneath the APC Multiunit and adjacent areas to the north and west, groundwater is present in fractures within the Lower Carters Limestone only where it is exposed near the ground surface and overlying confining layers are absent. The shallowest water-bearing zones in the Lower Carters Limestone were encountered at elevations between approximately 441 and 463 ft msl, and the deepest is at elevation 388 ft msl. Groundwater in these zones is generally under confined or semi-confined conditions. In the vicinity of sinkholes and swallow holes where recharge occurs, Lower Carters Limestone groundwater may be locally unconfined.

Fractures in the Lebanon Limestone do appear to have some stratigraphic correlations. The upper fracture zone (L1) occurs approximately 26 to 42 feet below the top of the Lebanon Limestone, and the lower fracture zone (L2) occurs approximately 67 to 75 feet below the top of

the Lebanon Limestone. While the L1 and L2 fracture zones may be correlated between numerous boreholes, they represent a 10 to 15-foot thick section of one or more fractures that may be highly localized or could extend tens or hundreds of feet. The interconnection of fractures is not known, but it appears to be sufficient to allow lateral groundwater flow, and for the zone to be described as an aquifer. Throughout much of the peninsula except for where the Lower Carters Limestone is eroded or thin, the water-bearing zones within the Lebanon Limestone are confined.

Updated hydraulic head maps for the Unconsolidated Unit (**Figure 2**), Carters Aquifer (**Figure 3**), and Lebanon Aquifer (**Figure 4**) based upon July 15, 2019 manual water level gauging support the expected groundwater flow directions presented in the ACM Report.

Groundwater monitoring data was used to evaluate vertical gradients between the Lebanon Limestone and overlying Lower Carters Limestone. At most of the well pairs located adjacent to the Cumberland River and the hydraulic trough in the north, hydraulic heads indicate a vertically upward gradient, which would be expected given the plant's location adjacent to and surrounded by the Cumberland River; a regional location of groundwater discharge. To further examine vertical gradients, **Figure 5** shows a generalized geologic cross-section with potentiometric (hydraulic head) contour lines added. The cross-section extends roughly north-south through the hydraulic trough area and the APC Multiunit. There is a vertical component of flow downward in the south (e.g., GAF-405C/L), and upward north of the ponds (e.g., in the trough area), and there is therefore a transition from downward to upward vertical gradients between these two areas. In summary, the hydraulic head differences between water-bearing units are generally as expected, with downward gradients at locations away from the Cumberland River and where groundwater is perched, and upward gradients close to the Cumberland River and near the hydraulic trough north of the APC Multiunit. Due to the potentiometric surface data and horizontal hydraulic gradient, it is generally expected that the groundwater at the site flows to the Cumberland River.

3.0 Groundwater Assessment Monitoring Program

Groundwater assessment monitoring for the APC Multiunit is conducted at GAF in accordance with 40 CFR § 257.95. This section of the report summarizes the results of the groundwater assessment monitoring program to date for the APC Multiunit.

3.1 Groundwater Monitoring Network

In compliance with 40 CFR § 257.91, the APC Multiunit 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 6**.

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.

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)). The background wells are hydraulically separated from the APC Multiunit 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 10 downgradient monitoring wells completed in the Carters Limestone, five monitoring wells in the Lebanon Limestone, and one monitoring well screened in alluvium/unconsolidated materials.

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 CCR website: https://www.tva.gov/Environment/Environmental-Stewardship/Coal-Combustion-Residuals/Gallatin

3.2 Groundwater Characterization

Characterization of the nature and extent of the sole GWPS exceedance for arsenic in groundwater is understood from the assessment monitoring that was conducted in 2018 and 2019. Supplemental investigations may be conducted during the selection of remedy process to aid in selection and design of a remedy. Groundwater monitoring results are summarized below:

- Arsenic exceeded GWPS at GAF-410U, which is screened in alluvium/unconsolidated materials. The SSL concentration of arsenic detected at GAF-410U was 0.0214 milligrams per liter (mg/L). The calculated lower confidence limit on the mean SSL concentration of arsenic was 0.0219 mg/L. The published GWPS for arsenic is 0.010 mg/L. **Figure 7** presents a concentration trend plot for arsenic through April 2019.
- GAF-410U is screened in alluvium, which is localized in this area (**Figure 2**). Alluvium is not present and/or water-bearing zones are not found in overburden in the areas surrounding this well. Thus, its horizontal extent is defined by the limited extent of water in alluvium.
- In the vertical direction, a nearby well is screened in the underlying Carters Limestone (GAF-446C, **Figure 3**). This well is already part of the CCR Rule monitoring network,

and arsenic is not above the GWPS in this well. Thus, the vertical extent is defined by the existing well network.

Cobalt exceedances of the GWPS at GAF-450L and the lithium exceedance at GAF 452C are attributed to an alternate source for the SSLs: natural groundwater variability, as presented in the Alternate Source Demonstration (ASD) in AECOM (2019).

4.0 Assessment of Corrective Measures

TVA prepared the 2019 ACM Report for the APC Multiunit, added it to the operating record on July 15, 2019, and posted it on TVA's CCR Rule Compliance Data and Information website on August 14, 2019. The ACM Report provided an assessment of the effectiveness of potential corrective measures in achieving the criteria provided in 40 CFR § 257.96(c).

As described in Section 1.2, closure of the APC Multiunit will be by removal of the CCR, and closure represents the key source control measure for the purposes of remedy selection under § 257.97.

4.1 Planned Source Control Measures

The objectives of corrective measures under § 257.96(a) are to "prevent further releases [from the CCR Unit], to remediate any releases, and to restore affected areas to original conditions." Ultimately, in accordance with § 257.97(b)(3), the selected corrective measure must at a minimum "[c]ontrol the source(s) of releases so as to reduce or eliminate, to the maximum extent feasible, further releases of constituents in appendix IV to this part into the environment."

The Preamble (80 Fed. Reg. 21302, 21406) to the CCR Rule discusses that source control measures may include modifying operational procedures. TVA has already implemented operational changes such as reducing free water in Ash Pond E, constructing a new flow management system, and rerouting flows previously sent to the APC.

The APC Multiunit, which consists of unlined surface impoundments, has already ceased receiving flows. Stopping flows to the APC Multiunit and dewatering the ponds will lead to further control of the source and prevention of releases.

Closure-by-removal (CBR) of the APC Multiunit will serve as source control measures as required under 40 CFR § 257.97(b)(3). These measures will eliminate the potential for migration of CCR constituents to groundwater after completion of the removal efforts.

Groundwater assessment monitoring as required by 40 CFR 257.96(b) will continue until a groundwater remedy is selected. Once a remedy is selected, a Corrective Action Groundwater

Monitoring Program (CAGWMP) will be instituted to document the effectiveness of the corrective action remedy.

4.2 Potential Remedial Technologies

Subject to all necessary environmental reviews, the APC Multiunit will be closed-by-removal in accordance with 40 CFR § 257.102 and applicable state law.

In addition to this source control measure, four primary strategies have been evaluated to address groundwater exhibiting concentrations above the arsenic GWPS including the following:

- Monitored Natural Attenuation (MNA);
- In-Situ Physical/Chemical Treatment;
- Permeable Reactive Barriers (PRB); and
- Hydraulic Containment and Treatment.

The ACM Report provides a more detailed description of each of these corrective measures. The effectiveness of each potential corrective measure was assessed in accordance with 40 CFR § 257.96(c) and all are considered feasible for remediating groundwater at the APC Multiunit.

5.0 Selection of Remedy: Current Progress

A remedy to address SSLs in groundwater will be selected in accordance with 40 CFR § 257.97 and the CARA Plan required by the agreement between TDEC and TVA. At this point in the selection process, each of the corrective measures presented in Section 4.2 meets the requirements of the remedy as defined in 40 CFR § 257.97.

In support of the remedy selection process, additional investigation is needed, as described below.

5.1 Data requirements for design of groundwater corrective action

Characterization of the arsenic impacts in accordance with 40 CFR § 257.95(g) is complete in the vicinity of well GAF-410U. However, additional data obtained through the on-going EI may further refine the characterization of the horizontal extent of arsenic impacts downgradient of the APC Multiunit.

In order to further refine the targeted areas for corrective measures, develop detailed remedy cost estimates, and finalize the alternative for the APC Multiunit, the currently available site-specific data may require further refinement. To this end, some potential data gap investigations

have been identified below. It is noted that additional data collection requirements may include on-going EI work that is reported separately.

Current activities to further evaluate MNA:

- Supplemental Groundwater Flow Modeling Simulations – The existing groundwater flow model developed for the EI is currently being refined based on expanded groundwater elevation data gained from the ongoing EI and NRL landfill expansion hydrogeologic characterization efforts. These flow model refinements are expected to be completed in the first quarter of 2020.
- Supplemental Groundwater Fate and Transport Modeling Simulations – The refined groundwater flow model must first be calibrated to more recent existing conditions before groundwater fate and transport modeling can be performed. Fate and transport modeling is expected to start in the first quarter of 2020 following completion of the above groundwater flow simulations. The fate and transport model will be used to further evaluate the estimated time for natural attenuation mechanisms to reduce the arsenic concentrations to below GWPS.

Potential future activities to evaluate In-situ Physical/Chemical Treatment:

- Groundwater Treatability Study – For in-situ treatment of groundwater, treatability studies will be needed to evaluate technologies for the treatment of arsenic.

Potential future activities to evaluate PRB:

- Groundwater Treatability Study – For in-situ treatment of groundwater, treatability studies will be needed to evaluate PRB amendments for the treatment of arsenic.
- Supplemental Geotechnical Investigation – Additional geotechnical investigation would consist of geotechnical drilling to evaluate the subsurface conditions in areas considered for a PRB. Boring data would be used to further evaluate the length and depth of the PRB.

Potential future activities to evaluate Hydraulic Containment and Treatment:

- Wastewater Treatment Capacity Study – Evaluation of the existing on-site wastewater treatment system capacity is needed to understand options for extracted groundwater treatment should the hydraulic containment and treatment option be considered. A site-wide evaluation of on-site wastewater treatment needs, and existing system capabilities is planned as part of the APC Multiunit closure design which will began in the first quarter of 2020.
- Groundwater Treatability Study – For ex-situ treatment of extracted groundwater, treatability studies will be needed to evaluate technologies for the treatment of arsenic.

- Supplemental Groundwater Flow Modeling Simulations –The groundwater flow model could be used to simulate a variety of groundwater extraction scenarios. Initial extraction simulations would be based upon the existing understanding of the hydraulic characteristics of the subsurface. The purpose of this flow modeling would be to optimize hydraulic containment of the arsenic impacted groundwater while balancing physical site constraints and extracted groundwater existing treatment capacity.
- Supplemental Hydraulic Properties Evaluation – This evaluation could be necessary if the existing understanding of the hydraulic characteristics of the subsurface are not sufficient to evaluate hydraulic capture geometry and potential groundwater recovery rates. If needed, installation of new wells and performance of pumping tests to evaluate hydraulic capture geometry and potential groundwater recovery rates would feed back into the groundwater flow modeling simulations for groundwater extraction. These data would inform the feasibility, design, and implementation of any groundwater recovery systems.

5.2 Semiannual Reporting, Public Meeting, Remedy Selection, and Final Report

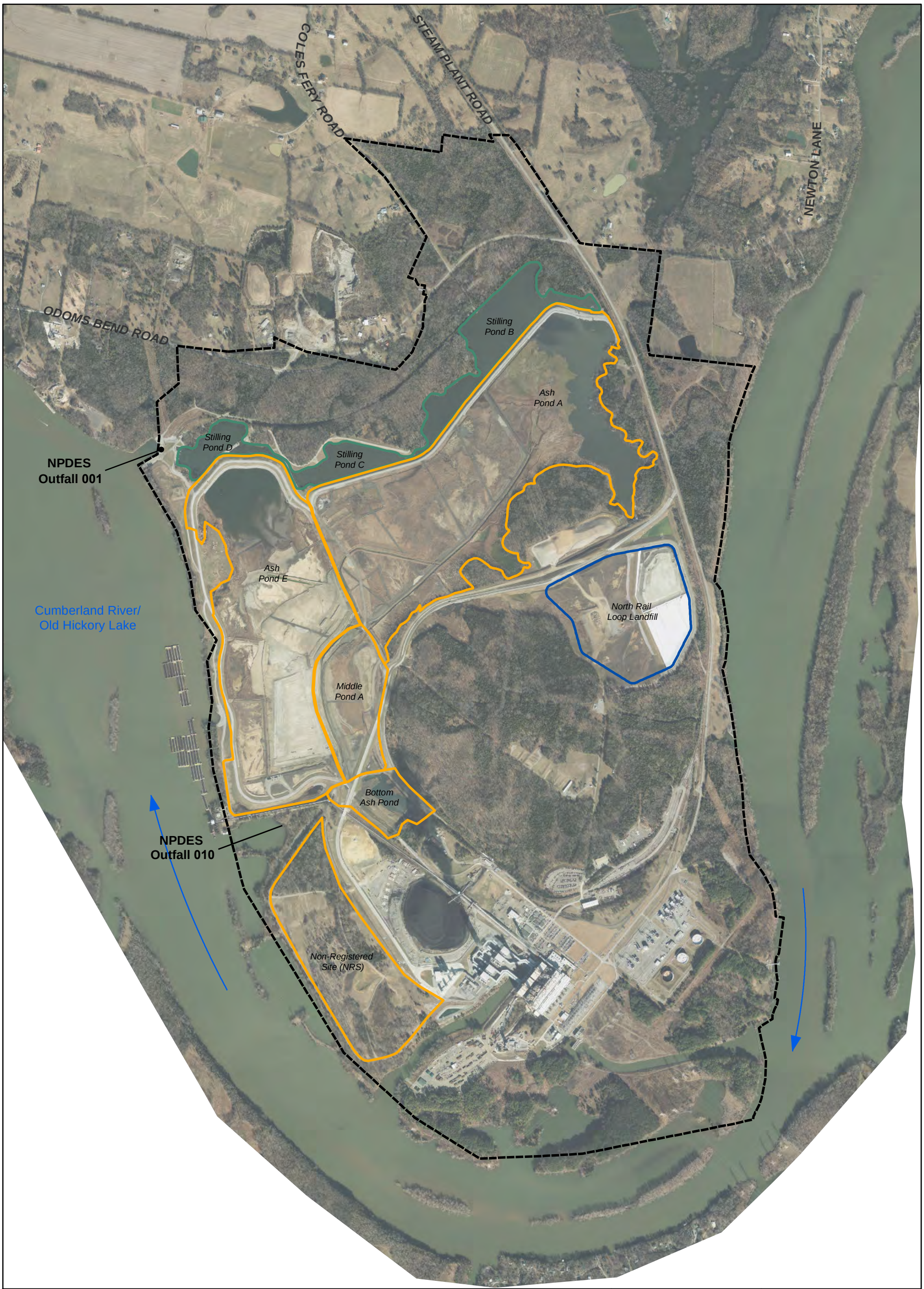
Progress toward the selection of the remedy will be documented in semiannual reports in accordance with 40 CFR § 257.97(a). At least 30 days prior to selecting a remedy, a public meeting to discuss the results of the corrective measures assessment will be conducted as required by 40 CFR § 257.96(e). A final report will be produced after the remedy is selected. This final report will describe the remedy and how it meets the standards specified in 40 CFR § 257.97(b) and 257.97(c). Recordkeeping requirements specified in 40 CFR § 257.105(h), notification requirements specified in 40 CFR § 257.106(h), and internet requirements specified in 40 CRF § 257.107(h) will be complied with as required by 40 CFR § 257.96(f).

6.0 References

AECOM, 2019. *Appendix IV Alternate Source Demonstration – Ash Pond Complex.* May 15, 2019.

TVA and Arcadis, 2014. *Groundwater Assessment Monitoring Project Summary and Risk Assessment Report. TVA Gallatin Fossil Plant. Non-registered Site #83-1324.* November 24, 2014.

Figures



LEGEND

- Cumberland River Flow Direction
- TVA Gallatin Fossil Plant Property Boundary (Approximate)
- CCR Management Units
- North Rail Loop (NRL) Landfill
- Stilling Ponds

N

0 1,200 2,400

Feet

NOTE: Aerial image dated February 2017

AECOM

Figure 1

OVERVIEW OF
CCR MANAGEMENT AREAS

DRAFT

DRAWN BY:	REVIEWED BY:	APPROVED BY:	REVISION NUMBER:
MARK.P.SMITH	SCHEIPC		REV. 9

GALLATIN FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY

DATE:	DEPT:
4/24/2017	FOSSIL AND HYDRO ENGINEERING

GAF-512U
454.10

GAF-420U
462.07

Stilling
Pond B

Ash
Pond A

Stilling
Pond D

Stilling
Pond C

23
445.24

RIVER STAGE
ON 7/15/2019
445.42

RIVER STAGE
ON 7/15/2019
445.42

Ash
Pond E

North Rail
Loop Landfill

GAF-410U
453.91

Middle
Pond A

Bottom
Ash Pond

GAF-447U
449.21

460
450
470
480
490

20
450.92

GAF-439U
469.85

GAF-440U
490.47

GAF-448U
461.15

GAF-441U
490.33

Non-Registered
Site (NRS)

GAF-442U
468.19

19R
451.71

GAF-489U
420.06

GAF-444U
449.49

22
446.52

GAF-436U
440.40

GAF-432U
445.19

LEGEND:

- **22** Well ID
- **446.52** Groundwater Elevation (feet MSL) on 9/15/2019
- Well Location
- Groundwater Elevation Contour in Unconsolidated Unit, Dashed where Inferred
- TVA Gallatin Fossil Plant Property Boundary (Approximate)
- CCR Management Units
- Estimated Extent of Groundwater in Unconsolidated Unit
- Groundwater Flow Direction

N

0 1,200 2,400
Feet

NOTE: Aerial image dated February 2017

AECOM

Figure 2

HYDRAULIC HEAD
UNCONSOLIDATED UNIT,
JULY 15, 2019

DRAWN BY:	REVIEWED BY:	APPROVED BY:	REVISION NUMBER:
MARK.P.SMITH	C.GARLINGTON		REV. 0

GALLATIN FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY

DATE:	DEPT:
9/11/2019	FOSSIL AND HYDRO ENGINEERING

Document Path: Q:\DCS\Projects_URS\Jobs\4_Projects\TVA\Gallatin_General\EIP\11.0 GIS_2017_Report_MXDs\GAF_2017_GW_Overburden_JULY2019_11_17_portrait.mxd

GAF-426C

GAF-412C
446.33

GAF-427C
448.55

UG-7
445.28

GAF-414C
445.36

GAF-511C
447.31

GAF-498CL
453.16

GAF-407C

GAF-508C
452.10

25
445.29

DG-6
451.39

450

GAF-415C
445.98

GAF-416C
446.33

GAF-453C
454.17

GAF-455C
454.09

DG-5
451.29

446

Stilling
Pond B

Ash
Pond A

GAF-452C
454.57

24
445.16

GAF-422C
445.42

GAF-402C
448.61

GAF-456C
455.94

Stilling
Pond D

Stilling
Pond C

450

455

RIVER STAGE
ON 7/15/2019
445.42

Ash
Pond E

460

GAF-458C
461.97

GAF-457C
465.90

RIVER STAGE
ON 7/15/2019
445.42

GAF-459C
461.74

North Rail
Loop Landfill

GAF-446C
453.55

465

Middle
Pond A

470

475

SRL196C
487.57

SRL193M
470.60

SRL193C
470.23

Bottom
Ash Pond

GAF-405C
482.94

GAF-404C

SRL170C
470.57

GAF-450C
447.73

GAF-451CR
476.17

GAF-451C
476.24

SRL125M
470.23

480

475

470

NOTE: Some wells have very low yield and/or represent perched groundwater, and may not be representative of the groundwater flow system.

Investigations are on-going; interpretations subject to change.

LEGEND:

GAF-405C Well Screened in Carters Limestone
482.94 Hydraulic Head feet MSL on 7/15/2019

- Well Screened in Carters Limestone
- Groundwater Flow Direction
- Hydraulic Head Contour in Aquifer, Dashed where Inferred
- TVA Gallatin Fossil Plant Property Boundary (Approximate)
- Ash Pond Complex
- North Rail Loop (NRL) Landfill
- Stilling Ponds

- Estimated Extent of Lower Carters Limestone Aquifer
- Presence of Carters Aquifer Unknown
- 1st Water Encountered in Lebanon; Contiguous with Carters Aquifer

NOTE: Aerial image dated February 2017

N

0 1,200 2,400
Feet

AECOM

Figure 3

HYDRAULIC HEADS
CARTERS AQUIFER,
JULY 15, 2019

DRAWN BY:	REVIEWED BY:	APPROVED BY:	REVISION NUMBER:
MARK.P.SMITH	C.GARLINGTON	E.PERRY	REV. 1

GALLATIN FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY

DATE:	DEPT:
10/1/2019	FOSSIL AND HYDRO ENGINEERING

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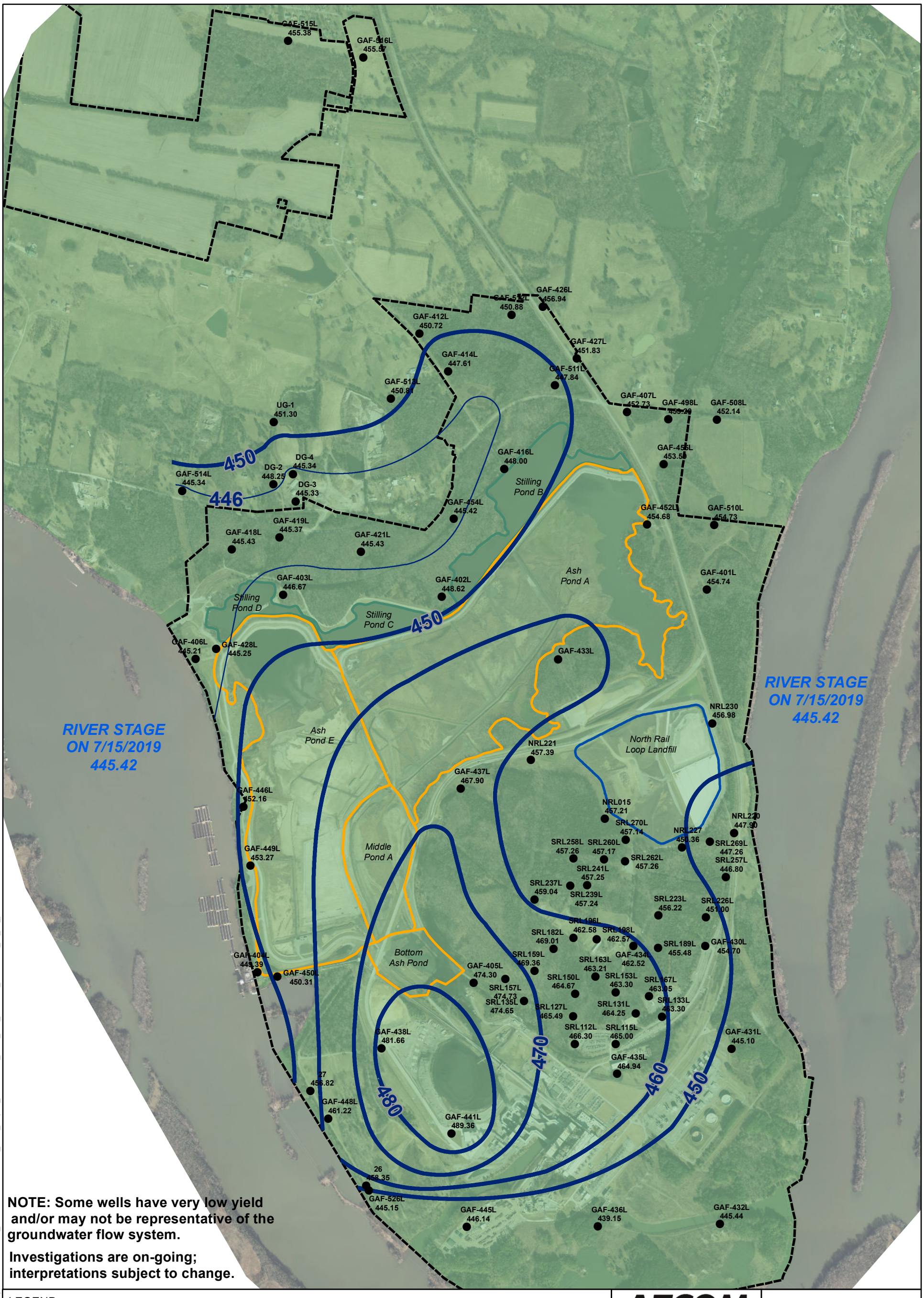

NOTE: Some wells have very low yield and/or may not be representative of the groundwater flow system.

Investigations are on-going; interpretations subject to change.

LEGEND:

GAF-432L Well Screened in Lebanon Limestone
445.44 Hydraulic Head feet MSL on 9/15/2019

- Well Screened in Lebanon Limestone
- Hydraulic Head Contour in Aquifer
- TVA Gallatin Fossil Plant Property Boundary (Approximate)
- Ash Pond Complex
- North Rail Loop (NRL) Landfill
- Stilling Ponds
- Estimated Extent of Lebanon Limestone Aquifer

N

0 1,200 2,400
Feet

NOTE: Aerial image dated February 2017

AECOM

Figure 4

HYDRAULIC HEADS
LEBANON AQUIFER,
JULY 15, 2019

DRAWN BY:	REVIEWED BY:	APPROVED BY:	REVISION NUMBER:
MARK.P.SMITH	C.GARLINGTON	E.PERRY	REV. 0

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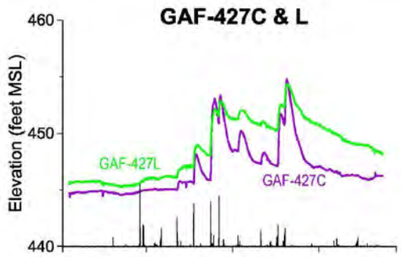

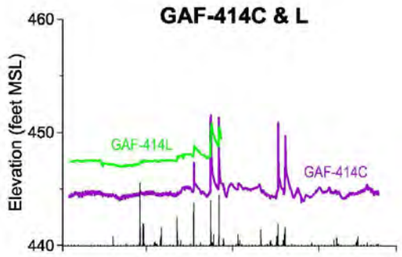

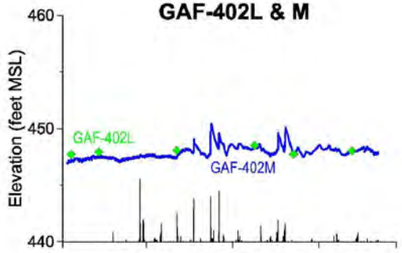

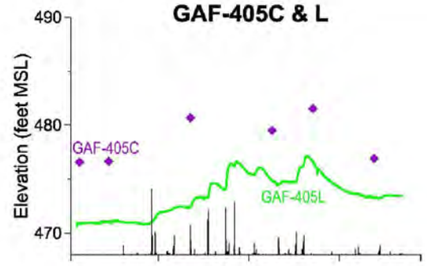

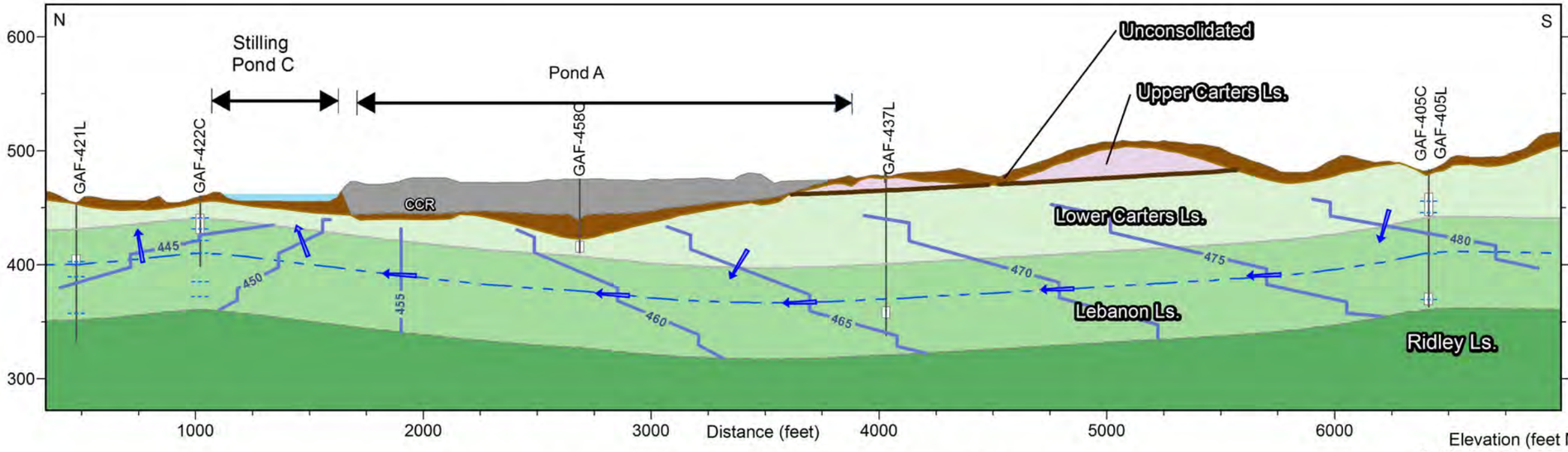

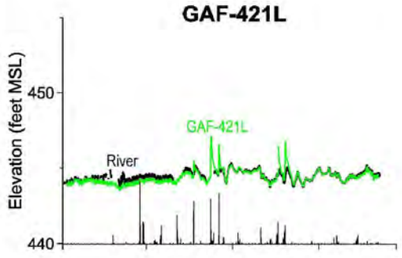

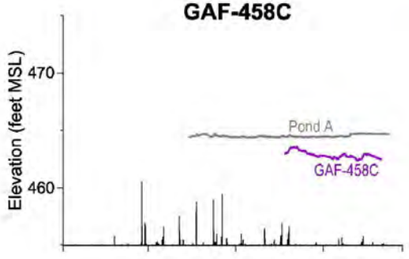

LEGEND

- Bentonite
- Equipotential Lines
- Approximate Location of the Upper Water Bearing Lebanon Ls. Fractures (Confined)
- Boring or Well
- Well Screen
- Arrows represent direction of groundwater flow
- Water-bearing Zone

Notes:

1. Section based on Geologic Cross Section C-C' (see Appendix of EAR)
2. Equipotential lines shown here represent an interpretation of the groundwater flow system in the vicinity of the APC, based on water level data from 1/23/2017.
3. The geologic units are not all water-bearing at all locations, including locations on this section. For example, there are no water-bearing zones in the Carters Limestone in the vicinity of GAF-437L, but there are such zones elsewhere south of the APC. The L1 and L2 Lebanon fracture zones are variably water-bearing.
4. Investigations are on-going; interpretations subject to change.

AECOM

Figure 5

EXAMPLE NORTH-SOUTH CROSS SECTION WITH HYDRAULIC HEADS

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MCKINNEYR	SCHEIPC	KEYSV	REV. 1

GALLATIN FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY

DATE: 4/27/2017 DEPT: FOSSIL AND HYDRO ENGINEERING

Document Path: M:\USCHA3_Data\200\TVA\GAF\RobbiGIS\CrossSectionCCSpecialReq.mxd

LEGEND

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

N

0 1,200 2,400

Feet

NOTE: Aerial image dated February 2017

AECOM

Figure 6

CCR RULE MONITORING SYSTEM
ASH POND COMPLEX (APC)

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MARK.P.SMITH	C.GARLINGTON		REV. 0

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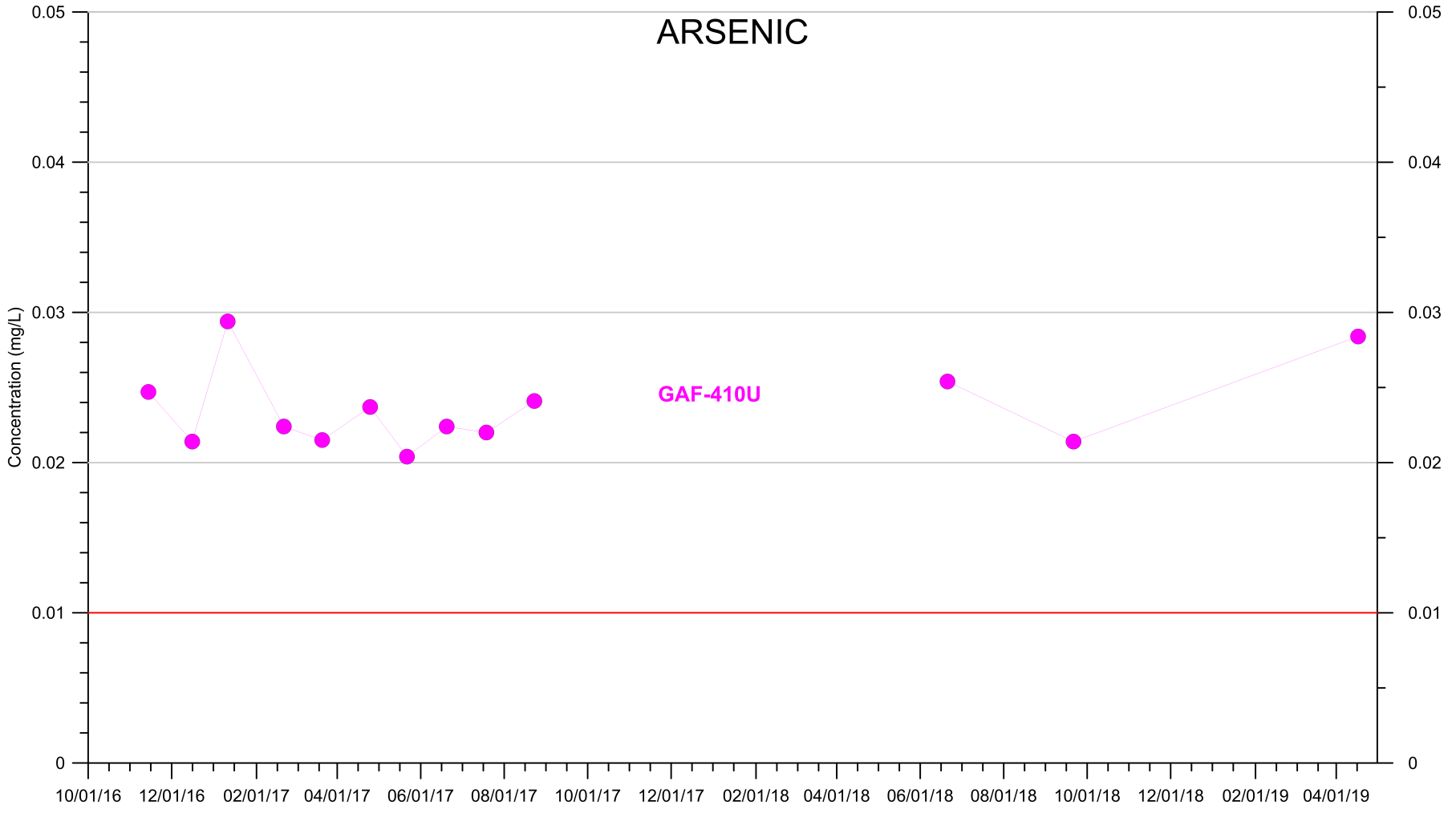

Legend

GAF-410U — MCL

NOTES:
Total data only
Does not include U-flagged data

AECOM

Figure 7

Concentration Trend Plots

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