REPORT

# Advanced Engineering Methods Feasibility Report

*Plant McDonough Ash Pond 3 and Ash Pond 4 (AP-3/4)*

Submitted to:

**Georgia Power Company**

241 Ralph McGill Boulevard
Atlanta, Georgia 30308

Submitted by:


**WSP USA Inc.**

5170 Peachtree Road Building 100 Suite 300

Atlanta, Georgia, USA 30341

+1 770 496-1893


May 2023

# Table of Contents

**1.0 INTRODUCTION ........ 1**

1.1 Background and Purpose ........ 1

1.2 Report Organization ........ 2

**2.0 CONCEPTUAL SITE MODEL ........ 2**

2.1 Regional and Hydrogeologic Setting ........ 3

2.2 Uppermost Groundwater Aquifer ........ 3

2.3 Groundwater Flow Conditions ........ 3

**3.0 OVERVIEW OF AP-3/4 CLOSURE MEASURES ........ 4**

**4.0 EVALUATION OF ADVANCED ENGINEERING METHODS ........ 5**

4.1 Overview ........ 5

4.2 Initial Screening of Technologies ........ 5

4.2.1 Subsurface Low-Permeability Barriers ........ 5

4.2.2 Groundwater Extraction Systems ........ 7

4.2.3 In-Situ Stabilization ........ 8

4.3 Groundwater Modeling Objectives ........ 8

4.4 Detailed Evaluation of Technologies ........ 9

4.4.1 AP-3/4 Closure Conditions ........ 10

4.4.2 Low-Permeability Barriers ........ 11

4.4.3 Groundwater Extraction Systems ........ 11

4.4.4 In-Situ Stabilization ........ 12

**5.0 COMPARISON OF OPTIONS ........ 12**

5.1 Relative Comparison of AEMs ........ 12

5.1.1 Low-Permeability Barrier Walls ........ 12

5.1.2 Groundwater Extraction Systems ........ 13

5.1.3 In-Situ Stabilization of Low Elevation CCR Materials ........ 13

5.2 Conclusions ........ 14

**6.0 REFERENCES ........ 15**

## Appendices

Appendix A Plant McDonough AEM Evaluation Groundwater Model Calculation Package

Appendix B Three-Dimensional Numerical Groundwater Modeling Summary Report

Appendix C Three-Dimensional Numerical Groundwater Modeling Summary Report Addendum

# 1.0 INTRODUCTION

## 1.1 Background and Purpose

Plant McDonough-Atkinson (Plant McDonough; the Plant) is a power generating facility, owned and operated by Georgia Power, located in Cobb County, GA. Plant McDonough historically operated as a coal fired facility, and four on-site CCR surface impoundments were utilized for CCR material over the duration of Plant McDonough's coal fired operations: Ash Pond 1 (AP-1), Ash Pond 2 (AP-2), Ash Pond 3 (AP-3), and Ash Pond 4 (AP-4). In 2011, Plant McDonough ceased coal-fired electric generating activities, and subsequently ceased placing CCR in the units.

This report is WSP USA Inc.'s (WSP's) report on the feasibility considerations of advanced engineering method (AEM) options for implementation as part of or following the closure in place of AP-3 and AP-4 as Combined CCR Unit AP-3/4 (see Figure 1-1), including presenting the feasibility considerations associated with Georgia Power's selection of the enhanced underdrain and temporary AEM wells as AEMs for the closure. Here, the term AEM is used to refer to engineering controls that are designed to enhance the protection of groundwater and closure effectiveness, and/or further minimize future maintenance of the closed CCR unit. This report summarizes the conceptual site model (CSM) for the Site and presents an initial screening of AEMs, evaluating the feasibility of various technologies and measures. The AEM option evaluation is then refined by comparing AEM relative effectiveness using a three-dimensional numerical groundwater flow model (groundwater model) constructed for the Site, implementability, and potential impacts associated with construction. The groundwater flow model calculations used to evaluate AEMs is presented in Appendix A.

AP-3 and AP-4 were constructed in 1969 and 1974, respectively, to receive and store CCR from the coal fired generating process at Plant McDonough as permitted wastewater treatment units and were used concurrently until 2011 to store sluiced fly ash and for dry ash stacking. The approximate preclosure CCR limits for AP-3 and AP-4 total 79 acres, consisting of a pre-closure CCR sluiced footprint of 64 acres and the 15-acre dry-stacked area in between. CCR placement in AP-3 and AP-4 ceased in 2011 after Plant McDonough retired its coal units. Historical details for Plant McDonough AP-3 and AP-4, including location coordinates and physical and engineering properties are presented in the Combined Unit AP-3/4 History of Construction located on Georgia Power's CCR Rule Compliance Information website for Plant McDonough. Currently, AP-3 and AP-4 are being consolidated and closed in place as combined unit AP-3/4 in accordance with 40 CFR §257.102(d), and the combined units are in the process of obtaining a solid waste permit under the Georgia Rules for Solid Waste Management, 391-3-4-.10. The closure design for AP-3/4 consists of an engineered final cover system that is designed to prevent the future impoundment of water, and includes measures to prevent infiltration, sloughing, minimize erosion from wind and water, and settling.


**Figure 1-1: Pre-Closure Plant McDonough Layout of Ash Ponds 1 through 4**

## 1.2 Report Organization

The report includes a discussion of the following:

- Section 2.0: A summary of the CSM
- Section 3.0: An overview of the AP-3/4 closure and the anticipated effects on post-closure conditions
- Section 4.0: A screening evaluation of AEM options considered for AP-3/4
- Section 5.0: A comparison of the screened AEM options
- Section 6.0: References

# 2.0 CONCEPTUAL SITE MODEL

The CSM, as summarized in the following sections, is presented in the Hydrogeologic Assessment Report (HAR) (Rev. 05, 2023) and is incorporated into this document by reference. The following section and subsections include a general description of regional geologic and hydrogeologic characteristics of formations that occur beneath the site. Figure 3a through 3j of the HAR presents a series of subsurface profiles for the site. Subsurface geologic profiles included as Figures 4 through 7 of the HAR present a summary of the geologic and hydrogeologic information for Plant McDonough.

## 2.1 Regional and Hydrogeologic Setting

The Site is located in the Piedmont/Blue Ridge geologic province, which contains some of the oldest rock formations in the southeastern United States. These late Precambrian to late Paleozoic rocks have undergone repeated cycles of igneous intrusions and extrusions, metamorphism, folding, faulting, shearing, and silicification. Rock outcrops near the site consist of biotite gneiss, porphyritic gneiss, mica schist, and quartzite.

Residual soils, primarily clayey/sandy silt, sandy silt with clay, and silty sand, occur as a variably-thick blanket overlying bedrock across most of the site. These residual saprolitic soils along with saprolitic transitionally or partially weathered rock, collectively the overburden, range between approximately 9 to 61 feet in thickness across the site, with an average thickness of approximately 38 feet. Saprolitic rock is considered to be transitionally weathered rock (TWR) or partially weathered rock (PWR). PWR is defined by Standard Penetration Test (SPT) blow counts that exceed 50 blows/six inches.

A regional, unconfined surficial aquifer system is present at the site, existing within the overburden soils and weathered and fractured upper bedrock (e.g., approximately the first 30 feet), depending on topographic location. Recharge primarily occurs through precipitation and subsequent infiltration. Generally, groundwater flow occurs through intergranular pore spaces in the overburden and is controlled by topography and top of rock variations. However, a relatively higher transmissive zone is interpreted to occur at the base of the overburden, at the interface of weathered bedrock and competent bedrock and is believed to be the primary groundwater flow path. The overburden has an average horizontal hydraulic conductivity of $10^{-4}$ centimeters per second (cm/s) and is interpreted to flow south-southeast.

A limited and localized bedrock aquifer system also occurs beneath the site. The upper bedrock is fractured and weathered, connected hydraulically with groundwater in overburden soils, and is considered part of the unconfined surficial aquifer. The silt/clay-rich soils of the overburden may act to retard recharge into the aquifer system. Deeper bedrock (i.e., approximately greater than 30 feet into the bedrock) is unweathered with few discontinuities (e.g., fractures) available to store groundwater.

## 2.2 Uppermost Groundwater Aquifer

Material types that comprise the uppermost groundwater aquifer include residual soils, saprolitic soils, saprolitic rock, PWR/TWR, and competent bedrock. Based on review of the logs, the screen/filter pack interval for most of the piezometers and monitoring wells installed on site provides connection to the overburden, indicating that the site is underlain by a regional groundwater aquifer that occurs within the overburden and upper bedrock depending on topographic location. Wells and piezometers to the east and south of AP-2 and AP-3/4 are screened in the upper bedrock while those south and west of AP-2 and 3/4 are screened in overburden.

Field hydraulic conductivity tests (i.e., slug tests) and soil classification testing and information from a range of the site geologic materials are summarized in detail in the Hydrogeologic Assessment Report (Golder, 2020a).

## 2.3 Groundwater Flow Conditions

A significant amount of groundwater flow occurs in the residual soils, saprolite, and TWR/PWR - i.e., overburden. This is typical of the Piedmont, as discussed in Fetter (1988). The significance of groundwater flow between the overburden soils and upper fractured bedrock is dependent on the degree of hydraulic connectivity between the units. Generally, the majority of groundwater flow across the site occurs laterally within the overburden soils and weathered/fractured bedrock, above a relatively competent un-fractured bedrock.

Though the majority of groundwater is moving laterally across/atop the un-fractured bedrock, locally, a downward vertical gradient is generally observed in topographically high areas and an upward vertical gradient is generally observed in topographic low areas.

Localized groundwater flow directions within this aquifer are influenced by topographic and top of rock variations on site. Water levels at the site pre-closure are influenced by the CCR Units and the man-made embankment dams and open water features. As illustrated by the potentiometric surface contour map developed from data from September 2022 (HAR Figure 7), the water table surface is a subdued reflection of topography at the site, with groundwater generally flowing towards the south and west of the ash ponds. As a result of ash pond operations and pond closure and dewatering activities groundwater flow in specific areas around AP-2 and 3/4 have seen localized flow patterns that are atypical to pre-closure and post-closure conditions. While the groundwater conditions during closure may be variable, it is expected that ongoing pond closure activities will soon restore groundwater flows to the predicted post closure directions. The top of rock surface also generally follows topography. Regionally, groundwater flow is influenced by topography and related top of rock variations on site. AP 3/4 is on a topographic high, creating radial flow around the ponds, with the exception of the one upland high upgradient northwest of AP-3/4. Currently, AP-2 is over excavated into subgrade soils, creating a topographic low point and low hydraulic gradient. Groundwater is interpreted to flow south-southeast from the topographic high northwest of AP-3/4 towards AP-2 and AP-1.

# 3.0 OVERVIEW OF AP-3/4 CLOSURE MEASURES

AP-3/4 is an inactive CCR surface impoundment being closed in place in accordance with the State of Georgia Solid Waste Management CCR Rule (391-3-4-.10) and the US EPA Standards for the Disposal of Coal Combustion Residuals in Landfills and Surface Impoundments (40 CFR 257, or the CCR Rule) to satisfy the requirements of § 257.102(d)(3)(ii), as presented in the Plant McDonough CCR Unit AP-2, AP-3/4 Solid Waste Handling Permit Application (Permit Application) submitted to the Georgia Environmental Protection Division (GA EPD), November 2018.

Combined CCR Unit AP-3/4 closure construction activities consist of liquid removal, consolidating CCR into a reduced footprint, and after the consolidated closure of AP-3 and AP-4 in place, lowering of the eastern dam containment structure. Consolidation is being conducted within the pre-closure limits of CCR of Combined Unit AP-3/4, by relocating CCR to the central portions of the contiguous AP-3 and AP-4. The Combined CCR Unit AP-3/4 closure is designed such that the final closed geometry provides for gravity drainage of surface water (e.g., precipitation) from the unit in a controlled manner. During closure construction, AP-3 and AP-4 are being dewatered as required to facilitate closure, and CCR is graded within the footprint of the impoundment to create a stable subgrade for the final cover system.

The final cover system consists of a 40-mil minimum thickness Polyethylene (PE) flexible membrane liner, ClosureTurf™ (combined geotextile and engineered turf layer), and Turf infill or other overlying protective layer systems (e.g., rip rap, articulated concrete block, etc.) The cover system design is graded to promote positive drainage and shed stormwater away from AP-3/4 via a series of drainage ditches toward three outfall locations. The closure plans for AP-3/4 include a comprehensive surface water management plan that utilizes three separate surface water attenuation ponds within the permit boundary for AP-3/4. As such, the majority of the pre-closure AP-4 dam is no longer needed for surface water storage in the closed condition, thus allowing the lowering of the crest of the AP-4 dam in the north and east, as approved by the Georgia Safe Dams Program (GASDP).

The final closure of the unit with this low-permeability cover system minimizes or eliminates infiltration, to the maximum extent feasible, resulting in lower groundwater levels in the area of the closed unit. Prior to installation of the cover system, the sub-grade is stabilized sufficiently to support the final cover system, and the CCR must satisfy applicable compaction and moisture content standards in accordance with the final design criteria. Details of the engineering and design components of the AP-3/4 closure and cover system are included in the Engineering Report included in Part B of the Permit Application (Golder, Revision 01 2020).

In addition to closure of AP-3/4, Georgia Power opted to close nearby CCR Unit Ash Pond 2 (AP-2) by removal of the CCR material from the unit; the CCR Removal Certification for AP-2 was submitted to EPD in March 2020 and acknowleged in October 2020 CCR material removed from AP-2 was consolidated within the final limits of AP-1 to aid in reaching final closure grades. The closure by removal activities at AP-2 result in beneficial reductions in groundwater levels and as a result lower hydraulic gradients, including in the AP-3 footprint. Closure of AP-2 and engineering measures implemented at AP-3/4 continue to lower groundwater levels in the vicinity of the CCR Units as compared to pre-closure conditions. As discussed in greater detail in the groundwater modelling reports and the later sections of this report, the closure and final cover installation of AP-3/4 alone has a significant positive effect on the groundwater elevations even without the incorporation of AEMs.

Groundwater model scenarios compared the relative effects of potential AEMs for AP-3/4 and are discussed in the subsequent sections of this report. The groundwater modeling scenarios included: (i) the baseline AP-3/4 closure conditions without the implementation of an AEM as a standalone condition, and (ii) the combined effects of the site CCR Unit closures with the addition of various AEMs.

# 4.0 EVALUATION OF ADVANCED ENGINEERING METHODS

## 4.1 Overview

The purpose of this section is to provide an overview of various AEMs that were considered to enhance in place closure of AP-3/4. For this report, AEMs are grouped into three categories: (i) low-permeability barriers (e.g., slurry walls, cutoff walls, etc.), (ii) groundwater extraction systems (extraction wells, underdrains, etc.) and (iii) in-situ stabilization.

The selection and design of an AEM generally depends on a variety of factors, including effectiveness, implementability, potential impacts associated with construction, and long-term operations and maintenance. In the following sections, potential AEM technologies for AP-3/4 are initially screened against these criteria. Eight AEM options are advanced through the initial screening and are evaluated in more detail to compare the relative effects on the post closure groundwater conditions (i.e., potentiometric surface and downgradient flow) resulting from potential implementation of each AEM.

As described above, this report describes the screening and feasibility level considerations relating to Georgia Power’s selection of AEMs for the site. These considerations support Georgia Power’s selection of the enhanced underdrain and temporary AEM wells as AEMs for the site, and these AEMs have been subject to more detailed design since selection.

## 4.2 Initial Screening of Technologies

### 4.2.1 Subsurface Low-Permeability Barriers

Subsurface low permeability barriers / walls typically include soil-bentonite, cement-bentonite, and soil-cement-bentonite mixtures to construct the below-grade barrier. Methods for the design and construction of barrier walls are well established, and when properly designed and installed, they can be an effective long-term solution for inhibiting groundwater migration (Gerber and Fayer, 1994).

The five types of low-permeability barriers initially screened for consideration at AP-3/4 include: slurry walls, grout curtains, deep soil mix (DSM) walls, sheet pile walls, vertically installed geomembrane barriers, and permeable reactive barriers (PRBs). The major design considerations for low permeability barriers are:

- Planned wall alignment limiting factors, including accessibility for intstallation, overhead and underground utility locations, and distance from existing slopes;
- Need for a working platform or bench (25 to 60 feet wide) along the entire alignment of the wall to allow for installation;
- The changes in subsurface groundwater conditions (e.g., potentiometric surface and flow direction) following the installation; and
- Ability of barrier walls to be effectively installed to reach the target depths below ground surface, especially in areas where penetration into saprolite and/or weathered bedrock is needed, which may require specialized or multi-stage equipment.

Based on the understanding of the site conditions, the use of grout curtains, sheet pile walls, PRBs, and geomembrane barriers are screened out due to one or more major implementability and/or effectiveness challenges associated with these AEMs. The following bullets summarize the reasons these AEM options were screened out:

- Grout curtains are typically installed via injection of grout from regularly spaced vertically drilled injection points. However, they are more difficult to implement than trenching and mixing operations, which would be viable at this site.
- PRBs consist of higher permeability zones filled with reactive media either as stand alone or integrated features into another low permeability feature. PRBs are used to provide for reactive treatment of waters passing through the barrier. PRBs however are less effective for lowering groundwater levels and/or reducing groundwater flows from the unit when compared to other barrier or extraction systems.
- Sheet piles are generally comprised of separate stiff low permeablity elements (made from metal, plastic, or fiber reinforced polymer (FRP)) installed in an interlocking sequence of vertically installed elements. Stiff or dense ground conditions as found in portions of the site across the target installation depths for the barrier would require the stiffer metal (as opposed to the less stiff inert plastic / FRP) sheet pile elements to reach design depths of penetration. Doing so can lead to unintended introduction of reactions by the introduction of significant metal in the subsurface. Additionally, sheet pile systems can see less effective barrier control along the sheet interlocks between elements as opposed to uniform section barrier systems (e.g. slurry walls, DSM, etc.)
- Vertically installed geomembrane systems are most practically / effectively installed in soft / loose ground conditions where installation is of a consistent depth of penetration. For sites like AP-3/4 that have stiff / dense subsurface conditions within the range of target depths of installation, and where the target depth and surface topographic conditions would require variable wall depths, these systems are considered less implemental than the other available systems.

The DSM and slurry wall options are considered the most constructible and effective of the barrier technologies, and are included in the below detailed evaluation of the relative effectiveness of the AEM scenarios using the groundwater flow model. For the AP-3/4 area, two depth options for an upgradient wall alignment (north and east) are evaluated to compare the relative effects on the potentiometric surface and the resulting downgradient flow. For both cases, the actual wall materials were not differentiated, and it was assumed that a hydraulic conductivity of 1 x $10^{-7}$ centimeters per second would be achieved, which is within the normal expected range of a slurry wall. Also, for both wall alignment options, the depth of the wall was variable, but extended from the ground surface, into the top of the partially weathered rock (PWR) for the shallow option, and through the PWR into the top of bedrock for the deep option.

A more detailed evaluation of the modelling of the DSM and slurry wall options is presented in Section 4.4.

### 4.2.2 Groundwater Extraction Systems

Configurations of groundwater extraction systems include groundwater extraction well arrays, interceptor trenches (both upgradient and downgradient to the Unit), and a combination of these elements in parallel with low-permeability barrier elements.

Conventional groundwater extraction systems generally involve installing an array of vertical extraction wells designed to extract groundwater. This is an active approach used to remove, divert, or contain groundwater. These extraction systems would be intended to reduce groundwater levels and flow through the area of AP-3/4 by lowering the groundwater elevation rather than by impeding groundwater flow.

An alternative to conventional vertical extraction wells is to install an interceptor trench in order to capture a continuous linear cross-section of the groundwater flow. As the groundwater flows into the trench, elevation-controlled pumps or sumps (typically installed at low points in the trench system) allow for the extraction of the groundwater from the trench, thereby resulting in a locally lower groundwater elevation. Interceptor trenches can offer more uniform control of groundwater levels if conditions support their installation (target depths able to be near surface at some point during construction, and/or ground contions that allow for continuous trenching / high permeability media (e.g., sand, gravel, etc.) installations) as compared to vertical extraction wells, which offer flexibility on depth installations but the potential for variations in controls between extraction points and the need to install separate pumping features per well.

The major design considerations for groundwater extraction systems are:

- Planned system alignment limiting factors, including accessibility, overhead and underground utility locations, distance from existing slopes, and surrounding features (e.g., the stream routed to the east of the closed CCR limits);
- The changes in subsurface groundwater conditions (e.g., groundwater levels and flow direction) following installation / operation;
- Ability of interceptor trenches to be effectively installed to reach the target depths below ground surface, especially in areas where penetration into saprolite and/or weathered bedrock is needed;
- Flow capacity of extraction features to convey the necessary throughput volume of water to provide effective controls, with interceptor trenches potentially allowing for significantly greater flow capacity than vertical wells for the same relative cost where installation is feasible; and

- Long term operations and maintenance considerations.  Trenches can typically be very effective with respect to maintenance as they can use either gravity (lowest maintenance) or a single / few extraction locations as compared to well systems that will require regular maintenance at each well location.

Both interceptor trench and well system options are are included in the below detailed evaluation of the relative effectiveness of the AEM scenarios using thegroundwater flow model.  Trenches are presented along the downgradient perimeter of the unit and in combination with low permeability barrier systems.  Evaluated well options include perimeter locations and other targeted portions of the closure footprint.  The depths of extraction systems considered are targeted to provide for groundwater lowering and flow control.  The depth of installation for trenches can be tens of feet shallower than wells for the same effective drawdown as they are continuous features that don't need to provide for extraction to the surface at each point.  The bottom depth of installation of vertical extraction wells is often set to accommodate the pumping infrastructure and storage capacity at the bottom of the well to allow for sufficient flow capacity and protection against clogging risks.  A more detailed evaluation of the modeling of these wells and trench drain options is presented in Section 4.4.

### 4.2.3 In-Situ Stabilization

In-situ Stabilization (ISS) is a technology applied to encapsulate and/or create a lower permeabilty and typically higher strength monolith in the subsurface. The major design considerations for in-situ stabilization are:

- ISS footprint limiting factors, including the size of the target footprint, surface obstructions that would prevent full coverage installation, accessibility, overhead and underground utility locations, and distance from existing slopes;
- Need for a relatively wide working platform along the entire footprint of the ISS treatment zone during installation;
- Ability of the selected method to effectively encapsulate the target CCR;
- The changes in subsurface groundwater conditions (e.g., groundwater levels and flow direction) following the installation; and
- The ability of the selected ISS installation method to reach the target depths of CCR below the potentiometric surface, which may require specialized equipment depending on the depth and penetration requirements.

In-situ stabilization typically involves many of the same installation constructability evaluations seen for slurry and DSM barrier wall evaluations, but with the target installation zone being within the CCR mass itself and not along the perimeter of the closed unit.  The targets for ISS AEM considerations at AP-3/4 were the potentially remnant portion of the CCR below the potentiometric surface immediately following closure, within lower elevation portions of the unit.  Implementation of ISS would have been most constructable during portions of construction that saw the lowest ground surface elevations over the footprints of installation rather than after final geometric slope shaping and capping of the unit.  Based on the potential viability of installing ISS early in construction, modeling results related to ISS are further presented in Section 4.4 below with respect to groundwater levels and flow controls.

## 4.3 Groundwater Modeling Objectives

The objective of the steady state numerical groundwater flow modeling is to simulate post-closure groundwater conditions at the Site with the incorporation of the AEM designs being evaluated.  The numerical groundwater model developed for the AP-3/4 area is described in detail in the Three-Dimensional Numerical Groundwater Modeling Summary Report Revision 5 (Model Report), included as Appendix A of the HAR (Rev. 05, Golder, 2023). A baseline pre-closure model representing site conditions circa January 2016 prior to the onset of closure was developed and used in comparison with the baseline closure model and models additionally incorporating AEM scenarios. In the baseline pre-closure model all CCR Units were inactive with Units 1, 2, and 3 having temporary soil cover over the CCR materials and with Unit 4 containing a combination of conditions with the northern portions of the Unit having a soil cover and the southern portions of the Unit having a water cover with a typical water surface elevation of nominally elevation 830 feet.

Groundwater levels are modelled for the long term steady state conditions and used to estimate the maximum depth of CCR materials and volume of CCR materials estimated to remain below the modelled groundwater levels post closure. Groundwater flow from the CCR is estimated by the model for scenarios in which the potentiometric surface is not at or below the bottom of the unit. The percent reductions for the depth and volume of CCR below the potentiometric surface for each scenario are estimated relative to the baseline pre-closure conditions, as is the change in flow from the Unit as quantified by measurement of the modelled flow to the east across the primary downgradient transect. Figures detailing isopach representations of the model results of CCR below the potentiometric surface and the location of the flow measurement transect are included in the AEM evaluation groundwater model result figures presented as part of Appendix A.

Groundwater flow models are simplified mathematical representations of complex natural systems. Therefore, all groundwater models have practical limits to their accuracy and associated uncertainties in model predictions. The construction, calibration, and results of the groundwater model are discussed in the Three-Dimensional Numerical Groundwater Modeling Summary Report Revision 05 dated October 2020 (Model Report; Golder 2020) included as Appendix A of the HAR Revision 05 (Golder, 2023) and the Three-Dimensional Numerical Groundwater Modeling Summary Report Addendum (Golder, 2021; included as Appendix B to this report for reference). The model calibration satisfies typical industry standards with a root mean square error of less than 10% and a mass balance discrepancy of less than 1.0 percent. The results from the modeled scenarios provides useful comparative information regarding relative groundwater elevations and flows to provide for quantitative sreening level evaluations of the modelled AEM scenarios, while more detailed design and field confirmation of conditions for the selected AEM elements would be undertaken prior to and during installation.

## 4.4 Detailed Evaluation of Technologies

The AEM scenarios that passed through the initial screening as described above are summarized in Table 4-1 and are further evaluated below using the predictive model. The following criteria are considered below:

- The maximum thickness of CCR below the potentiometric surface
- The post closure long term volume of CCR below the potentiometric surface
- The horizontal groundwater flow from the Unit through the downgradient transect to the East. This transect location was selected as the eastern boundary has the lowest elevation CCR materials post closure and represents the primary direction of potential flow from the CCR unit. A review of flow from the Unit in other directions predicted by the groundwater models confirmed that the use of quantitative values from the eastern transect provided for accurate, relative comparisons of AEM scenario effectiveness. Particle tracking is not presented in the evaluation results included in Appendix A because the modeling results for the selected AEMs indicates a potentiometric surface below the bottom of CCR.

- Implementability considerations, including constructability, operations and maintenance considerations, and potential impacts or adverse effects of the AEM.

**Table 4-1 Summary of AEM Modelled Scenarios**

| AEM Scenario # | Description of Modelled Scenario |
|---|---|
| 0 | Pre-closure (circa Jan 2016) conditions |
| 1 | Baseline closure / cap geometry modelled without an underdrain |
| 2 | Baseline closure / cap geometry with original design underdrain along the east |
| 3 | Shallow Upgradient Barrier with original design underdrain |
| 4 | Shallow Upgradient Barrier without Drain |
| 5 | Deep Upgradient Barrier with original design underdrain |
| 6 | Deep Upgradient Barrier without underdrain |
| 7 | Enhanced (Deepened) Underdrain to the east |
| 8 | Baseline Cap Geometry, with AEM Wells, Without Underdrain |
| 9 | Baseline Closure / Cap Geometry, with In-Situ Stabilization of low elevation CCR at east and southwest, with original design underdrain to the east |

Table 4-2 (attached) presents a summary of the predictive scenario results obtained from the groundwater flow modeling simulations, and includes commentary regarding the constructability and potential impacts of each modelled scenario.

### 4.4.1 AP-3/4 Closure Conditions

CCR within the outlying and lowest elevation portions of AP-3/4 are being removed during closure and consolidated into a smaller footprint within the central western portions of the Unit.

Water levels within AP-3/4 have been actively drawn down through sump and deep well pumping in preparation for and during closure activities at AP-3/4. The pre-closure pool level in AP-3/4 was approximately 830 ft elevation, and was lowered progressively by up to 70 feet throughout closure in step with the CCR excavations in AP-4.

Closure activities for AP-3/4 were initiated in the fourth quarter of 2016 with the installation of deep dewatering wells within AP-4 and progressed via the excavation of CCR in the closure by removal areas for consolidation in a reduced footprint within the central portions of the AP-3 area. The effectiveness of the baseline closure and the evaluated AEM scenarios are assessed by steady state model simulations in comparison to the baseline pre-closure conditions (Scenario 0) model results as reported in Table 4-2. The magnitude of groundwater flow across a simulated transect for each of the modelled post closure scenarios, and the change in volume and maximum height of CCR below the modelled potentiometric surface are reported in Table 4-2.

The simulated steady state modelling indicates that the baseline closure (Scenario 1), as compared to the baseline pre-closure conditions (Scenario 0), reduces the maximum potentiometric surface height above the bottom of the CCR unit by nominally 50 feet and lowers the approximate total volume of CCR below the potentiometric surface by approximately 97 percent.

### 4.4.2 Low-Permeability Barriers

Low permeability subsurface barrier scenarios advanced through initial screening, and further evaluation of the following four configurations of AEMs containing groundwater extraction systems was completed using numerical groundwater modelling:

- Scenario 3 – Shallow upgradient barrier wall coupled with the baseline AP-3/4 closure underdrain system to the east.
- Scenario 4 – Shallow upgradient barrier wall without inclusion of the baseline AP-3/4 closure underdrain system.
- Scenario 5 – Deep upgradient barrier wall coupled with inclusion of the baseline AP-3/4 closure underdrain system.
- Scenario 6 – Deep upgradient barrier wall without inclusion of the baseline AP-3/4 closure underdrain system.

Details representing how the underdrain system is modeled are included in Appendix A.

### 4.4.3 Groundwater Extraction Systems

Groundwater extraction system scenarios advanced through initial screening, and further evaluation of the following five configurations of AEMs containing groundwater extraction systems was completed using numerical groundwater modelling:

- Scenario 2 – Baseline Underdrain System to the East (underdrain elevation varies from 775 to 782 ft NAVD 88).
- Scenario 3 – Underdrain system to the east coupled with a shallow upgradient barrier wall.
- Scenario 5 – Underdrain system to the east coupled with a deep upgradient barrier wall.
- Scenario 7 – Enhanced (Deeper) Underdrain System to the East (underdrain elevation varies from 760 to 765 ft NAVD 88).
- Scenario 8 – Groundwater Extraction Well Network to the East and South.

For cases involving groundwater extraction wells, the wells were modelled at either their as-built conditions for well placements used during construction or placed 20 feet below the unit for new well locations to facilitate drawdown to the base of CCR within the Unit. Interceptor trenches were simulated using head dependent model boundary conditions that only remove water from the model. Trench depths were varied based on constructability (depth of installation, depth below the water table, dewatering and stabilization needs, access constraints) and effectiveness (reduction in groundwater levels in and flows from CCR). As an example of these considerations, the depth of the modeled enhanced underdrain AEM option was increased until the modelled results indicated a potentiometic surface below the bottom of the unit, and this configuration is evaluated as to whether this depth is constructable given the site conditions along the length of the trench. For the dewatering wells, the spacing of wells is set at the previously established effective radius of influence determined through early construction dewatering pumping and operational testing and monitoring, and well locations are varied to achieve a potentiometric surface below the unit with the lowest number of wells. The final scenario geometries modeled are presented in the groundwater model calculation package in Appendix A.

### 4.4.4 In-Situ Stabilization

In-situ stabilization (ISS) of the low elevation CCR materials was advanced through initial screening, and evaluation of one configurations of AEM ISS considering in-situ stabilization of the low elevation CCR materials to the east in AP-4 and the South in AP-3 was completed using numerical groundwater modelling:

- Scenario 9 – ISS of the low elevation CCR materials to the East and Southwest

The target footprint for ISS AEM considerations at AP-3/4 were the potentially remnant portion of the CCR below the potentiometric surface immediately following closure, within the lower elevation portions of the unit. The ISS footprint was varied through initial evaluations until the post treatment groundwater levels were observed to be below the limits of untreated CCR materials within the Unit. The final ISS scenario geometry modeled is presented in the groundwater model calculation package in Appendix A

# 5.0 COMPARISON OF OPTIONS

## 5.1 Relative Comparison of AEMs

Based on the modeled scenarios presented, improvement to groundwater elevations and flow conditions post closure at Unit AP-3/4 can be achieved by implementation of the AEM options. Below, each of these AEM options is compared to the pre-closure conditions and each other in terms of effectiveness and implementability.

### 5.1.1 Low-Permeability Barrier Walls

Four subsurface low-permeability subsurface barrier walls configurations were considered as AEM options for AP-3/4: shallow upgradient and deep upgradient barrier wall options, with and without the baseline AP-3/4 closure underdrain. The shallow and deep upgradient barrier wall AEMs were both estimated to reduce the volume of CCR below the potentiometric surface by 97% when installed without a drain and 98% when installed in combination with a shallow drain as compared to pre-closure conditions, representing an improvement over the proposed consolidated closure in place scenario without AEMs. Both low permeability barrier wall configurations were estimated to reduce horizontal groundwater flow downgradient of the Unit to the east to negligible modelled levels (herein defined as a model result of less than 0.01 gpm).

Implementability and constructability considerations for barrier wall option installations were outlined in detail in Section 4 and include:

Differing target depths (top of PWR vs top of rock) and required subsurface material penetrations (through the harder PWR for the deep option) for the shallow and deep barrier wall options are estimated to require differing installation technologies for each option. Additionally, the minimum working platform requirements for construction are larger than the unmodified available space at the crest of the embankment in the northern and eastern portions of AP-3/4, which would require significant modifications to the AP-3/4 embankments (including the AP-4 dam, a regulated structuremonitored by the Georgia Environmental Protection Division (GA EPD) Safe Dams Program).

### 5.1.2 Groundwater Extraction Systems

Incorporation of a groundwater extraction well network (AEM Scenario 8) was estimated to almost fully eliminate CCR below the potentiometric surface and flow across and through the unit post closure. The installation of a shallow underdrain groundwater extraction system (Scenario 2) is estimated to reduce the volume of CCR below the potentiometric surface by 98% over pre-closure closure conditions. The enhanced deeper underdrain selected by Georgia Power as an AEM (Scenario 7) is modelled to fully eliminate CCR below the potentiometric surface and flow through the Unit post closure.

It is noted that scenarios 3 and 5 included groundwater extraction systems in the form of drains combined with barrier wall elements. The comparative results of the groundwater modelling for these systems was discussed in Section 5.1.1, with the implementability and constructability considerations for those drains discussed below.

Implementability and constructability considerations for groundwater extraction system installations include:

- The target elevations of 775 to 782 ft (NAVD 88) for the underdrain, and 760 to 765 ft (NAVD 88) for the enhanced underdrain would require cutting into residuum and/or alluvium for installation. Although manageable, temporary dewatering and shoring technologies would likely be required for construction.
- Well installation and maintenance require access to each well location for both installation and maintenance during operations, and, as such, the wells were located on benches or other flat terrain within the closure geometry and not mid-slope along stacks.
- Long-term maintenance during construction and post-closure care of the system would be required for management of extracted water, and maintenance of any pumping equipment and conveyance systems installed.
- The incorporation of an interceptor trench underdrain with a single combined sump location simplifies the long term operations and maintenance with respect to the various groundwater extraction system options considered as it contains a single point of pumping versus the multiple locations needed in the vertical extraction well system options, and that the pumping point (sump) can be located at a higher elevation (due to the larger capacity of the sump area compared to individual well systems).

### 5.1.3 In-Situ Stabilization of Low Elevation CCR Materials

One ISS configuration was modelled as AEM scenario 9 for AP-3/4. The footprint of the ISS was varied until the modelled steady state groundwater elevations were shown to be below the non ISS stabilized CCR materials, resulting in a reduction of 100% in the volume of non ISS stabilized CCR below the potentiometric surface as compared to pre-closure conditions. The ISS configuration also has the effect to reduce horizontal groundwater flow through non ISS stabilized CCR materials to negligible modelled levels (herein defined as a model result of less than 0.01 gpm).

Implementability and constructability considerations for ISS include:

- In-situ stabilization typically involves many of the same installation constructability evaluations seen for slurry and DSM barrier wall evaluations, but with the target installation zone being within the CCR mass itself and not along the perimeter of the closed unit.
- ISS treatment would likely require deep ISS techniques such as large diameter augers or DSM technology.

- Variations in the in-situ make-up of CCR materials and chemistry may require variations in soil-cement-bentonite ISS mix recipes to achieve in-situ encapsulation of the CCR materials.
- The large area requiring treatment would delay completion of AP-3/4 closure construction.

## 5.2 Conclusions

Based on the evaluations presented in this report, the in-place closure of AP-3/4 along with the effects of removal of AP-2, provides significant (~97%) reductions in the volume of CCR below the potentiometric surface and greatly reduced groundwater flow through CCR Unit AP-3/4 to the east (calculated as 0.18 gpm). This combination is expected to enhance the overall groundwater quality in the vicinity of AP-3/4. The AEM options discussed in this report are each predicted to offer additional improvement in comparison to the baseline closure conditions and would enhance the protection of groundwater and closure effectiveness for the AP-3/4 closure.

The barrier wall options provide significant flow reductions but have less impact on the modelled volume and maximum depth of CCR below the long term modelled groundwater levels compared to the baseline closure scenario. Similarly, the ISS system was considered implementable but resulted in lower benefits with respect to lowering the groundwater table as compared to the effectiveness of the extraction system AEMs. The groundwater extraction system options all provide improvements with respect to both flow and lowering of the groundwater levels in the vicinity of the extraction features, with the enhanced underdrain option predicted to lower the potentiometric surface to below the bottom of the unit, thereby eliminating all groundwater flow through the unit.

The balance of implementation considerations and predicted effectiveness support Georgia Power’s selection of the enhanced (deepened) underdrain along the eastern side of the AP-3/4 closure as an AEM for implementation at Unit AP-3/4. The above summarized feasibility considerations also support Georgia Power’s decision to utilize a temporary groundwater well extraction system option as a temporary AEM measure to accelerate the rate at which the long-term, steady state potentiometric is reached at Unit AP-3/4.

Groundwater quality at AP-3/4 is and will continue to be monitored in accordance with federal and state requirements, and will be addressed through the regulatory assessment of corrective measures (ACM) process.

## 6.0 REFERENCES

Gerber, M.A. and Fayer, M.J. 1994. In Situ Remediation Integrated Program: Evaluation and Assessment of Containment Technology. Prepared by Pacific Northwest Laboratory for the U.S. Department of Energy, Office of Environmental Management, Office of Technology Development, Washington, D.C.

Golder, 2018. Plant McDonough Combined CCR Unit AP-3/4 Solid Waste Handling Permit Application, November 2018.

U.S. Environmental Protection Agency (USEPA), 2015. 40 CFR Parts 257 and 261. Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals from Electric Utilities; Final Rule, (referred to as the USEPA CCR (2015) rule).

WSP, 2023. Hydrogeologic Assessment Report, Plant McDonough-Atkinson Ash Pond 2 and Ash Pond 3/4, Revision 05, WSP USA Inc. April 2023.

# TABLE 4-2:
# SUMMARY OF FOCUSED AEM EVALUATION - AP3/4
## Plant McDonough-Atkinson

| Scenario No. | AP-3/4 Conditions | Enhancement | Description of Enhancement | Effectiveness | | | | | | Implementability Consideration | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Maximum Height of Potentiometric Surface Above Bottom of Unit (feet) | Volume of CCR Below the Potentiometric Surface (cubic yards) | Percent (%) Reduction in Volume of CCR Below the Potentiometric Surface | AP-3/4 Area of CCR Below the Potentiometric Surface (acres) | Percent (%) Reduction of Area of CCR Below the Potentiometric Surface | Modelled Flux Across Eastern Transect (GPM) | Constructability | Potential Impacts |
| 0 | Pre-closure conditions | - | - | 70.1 | 2,659,330 | - | 66.3 | - | N/A | - | - |
| **Modelled CCR Unit AP-3/4 Baseline Closure** | | | | | | | | | | | |
| 1 | Cover Installed | Baseline Closure | Baseline cap geometry, without underdrain | 21.3 | 78,541 | 97% | 5.8 | 91% | 0.18 | - | - |
| **Modelled CCR Unit AP-3/4 AEM Scenarios** | | | | | | | | | | | |
| 2 | Cover Installed | Shallow Underdrain | Baseline cap geometry, with underdrain | 17.5 | 53,957 | 98% | 4.7 | 93% | 0.04 | (i) long term O&M costs associated with possible treatment of groundwater. | - |
| 3 | Cover Installed | Shallow Upgradient Barrier and Underdrain | Upgradient barrier keyed into top-of-PWR, with underdrain | 17.3 | 54,084 | 98% | 4.8 | 93% | 0.00 | (i) long term O&M costs associated with possible treatment of groundwater. (ii) specialized equipment and costs needed to construct barrier wall. | (i) the slurry wall option has the potential to change upgradient groundwater levels and is shown to have limited influence on reducing groundwater levels and downgradient flow relative to other options. |
| 4 | Cover Installed | Shallow Upgradient Barrier without Underdrain | Upgradient barrier keyed into top-of-PWR, without underdrain | 21.0 | 77,689 | 97% | 5.8 | 91% | 0.00 | (i) specialized equipment and costs needed to construct barrier wall. | (i) the slurry wall option has the potential to change upgradient groundwater levels and is shown to have limited influence on reducing groundwater levels and downgradient flow relative to other options. |
| 5 | Cover Installed | Deep Upgradient Barrier and Underdrain | Upgradient barrier keyed into top-of-bedrock, with underdrain | 17.2 | 54,120 | 98% | 4.8 | 93% | 0.00 | (i) long term O&M costs associated with possible treatment of groundwater. (ii) specialized equipment and costs needed to key wall into bedrock for limited to negative benefit compared to wall keyed into top of PWR. | (i) the deep slurry wall option has the potential to further change upgradient groundwater levels and is shown to have limited influence on reducing groundwater levels and downgradient flow similar to the shallower wall keyed into PWR relative to other options. |
| 6 | Cover Installed | Deep Upgradient Barrier without Underdrain | Upgradient barrier keyed into top-of-bedrock, without underdrain | 20.6 | 75,338 | 97% | 5.7 | 91% | 0.00 | (i) specialized equipment and costs needed to key wall into bedrock for limited to negative benefit compared to wall keyed into top of PWR. | (i) the deep slurry wall option has the potential to further change upgradient groundwater levels and is shown to have limited influence on reducing groundwater levels and downgradient flow similar to the shallower wall keyed into PWR relative to other options. |
| 7 | Cover Installed | Enhanced Underdrain (selected AEM incorporated into closure design) | Baseline cap geometry, with enhanced underdrain | 0.0 | 0.0 | 100% | 0.0 | 100% | 0.00 | (i) long term O&M costs associated with possible treatment of groundwater, although long term collected water estimated to be non-contact. (ii) deeper trench may require enhanced construction techniques. | - |
| 8 | Cover Installed | Baseline Cap Geometry with AEM Wells without Underdrain | Baseline cap geometry, with underdrain removed and AEM wells added | 5.8 | 2,142 | 100% | 0.6 | 99% | 0.01 | (i) long term O&M costs associated with possible treatment of groundwater. | - |
| 9 | Cover Installed | In-situ Stabilization of (ISS) target CCR at east and southwest, with original design underdrain to the east | Baseline cap geometry, with underdrain, and In-Situ Stabilization of low elevation CCR materials | 17.3 | 54,448 | 98% | 4.7 | 93% | 0.05 | (i) long term O&M costs associated with possible treatment of groundwater. (ii) specialized equipment and costs needed to complete ISS. (iii) complex construction sequencing needed to complete ISS. | (i) the ISS option has the potential to increase groundwater levels above the levels of simliar scenarios without ISS, and is shown to have limited influence on reducing groundwater levels and downgradient flows relative to other options. |

**Notes:**
1. These values were obtained from groundwater flow modeling results. It is noted that groundwater flow models are necessarily simplified mathematical representations of complex natural systems. Because of this, all groundwater models have limits to their accuracy.
2. These model results are intended for use as relative comparisons between scenarios, and not as precise predictions of post -closure conditions.
3. Flux estimates were calculated in the model as the volume of water passing through a vertical plane per unit time for model Layer 1.

Created by: SJS 03/01/2023
Checked by: WEG 03/01/2023
Reviewed by: GLH 05/18/2023

# Signature Page

**WSP USA Inc.**

William Gottobrio, PG
*Senior Lead Consultant*

Gregory L. Hebeler, PhD, PE
*Technical Fellow – Geotechnical, Senior Vice President*

**APPENDIX A**

# Plant McDonough AEM Evaluation Groundwater Model Calculation Package

**REPORT**

# Groundwater Model AEM Evaluation Calculation Package

*Plant McDonough-Atkinson Ash Pond AP-3/4*

Submitted to:

**Georgia Power Company**

241 Ralph McGill Boulevard NE
Atlanta, Georgia 30308

Submitted by:


**WSP USA Inc.**

5170 Peachtree Road Building 100 Suite 300

Atlanta, Georgia, USA 30341

+1 770 496-1893


May 2023

# Table of Contents

**1.0 INTRODUCTION .......... 4**

1.1 Modeling Objective .......... 4

**2.0 MODEL CONSTRUCTION .......... 5**

2.1 Model Domain .......... 5

2.2 Model Grid and Layering .......... 5

2.3 Model Boundaries .......... 6

2.3.1 Model Recharge .......... 7

2.4 Hydraulic Conductivity Zone .......... 8

2.5 Model Calibration .......... 8

**3.0 PREDICTIVE SIMULATIONS .......... 8**

**4.0 CONCLUSIONS .......... 9**

**5.0 REFERENCES .......... 10**

# Tables & Figures

Table 1 Simulation Results

Figure 1-1 Location map
Figure 2-1 Model domain
Figure 2-2 Pre-closure model top elevation
Figure 2-3 Closure model top elevation
Figure 2-4 Pre-closure model boundary conditions
Figure 2-5 Closure model boundary conditions
Figure 2-6 Pre-closure model recharge zones
Figure 2-7 Closure model recharge zones
Figure 2-8 Pre-closure model hydraulic conductivity zones
Figure 2-9 Closure model hydraulic conductivity zones
Figure 3-1 AP-3/4 Scenario 0: Pre-closure (circa Jan 2016) conditions

Figure 3-2 AP-3/4 Scenario 1: Baseline Cap Geometry, without the AP3/4 underdrain
Figure 3-3 AP-3/4 Scenario 2: Baseline cap geometry, with the AP3/4 underdrain
Figure 3-4 AP-3/4 Scenario 3: Shallow upgradient barrier wall, with the AP3/4 underdrain
Figure 3-5 AP-3/4 Scenario 4: Shallow upgradient barrier wall, without the AP3/4 underdrain
Figure 3-6 AP-3/4 Scenario 5: Deep upgradient barrier wall, with the AP3/4 underdrain
Figure 3-7 AP-3/4 Scenario 6: Deep upgradient barrier wall, without the AP3/4 underdrain
Figure 3-8 AP-3/4 Scenario 7: Baseline cap geometry, with enhanced AP-3/4 underdrain
Figure 3-9 AP-3/4 Scenario 8: Baseline cap geometry, without underdrain, with extraction wells
Figure 3-10 AP-3/4 Scenario 9: Baseline cap geometry, with underdrain and in-situ stabilization (ISS) zones

# Attachment

Plant McDonough Pre-Closure Topography – January 2016

# 1.0 INTRODUCTION

Golder Associates USA Inc. (Golder) has prepared this Groundwater Model Calculation Package (Report) documenting the results of pre- and post-closure modeling performed in support of the Advanced Engineering Methods Feasibility Study for CCR Units Ash Pond 3 and Ash Pond 4, undergoing closure as Combined Unit AP-3/4 (AP-3/4) at Plant McDonough-Atkinson (Plant McDonough; Site), which is owned and operated by Georgia Power Company (GPC) and located in Cobb County, Georgia (Figure 1-1). The post-closure scenarios presented herein simulate potential post-closure conditions in AP-3/4 CCR for different Advanced Engineering Method (AEM) options.

## 1.1 Modeling Objective

The modeling objective is to simulate potential long-term (steady-state) hydraulic conditions in the AP-3/4 CCR assuming closure conditions corresponding to the following scenarios[1]:

- **Scenario 0: Pre-closure (circa Jan 2016) conditions** – Represents pre-closure hydraulic conditions in 2015/2016 prior to the installation of the final cover system at AP-1 or excavation of CCR at AP-2 or AP-3/4. Open water conditions were present in AP-2 and AP-3/4.
- **Scenario 1: Baseline Cap Geometry, without the AP3/4 underdrain** - Excavation of CCR in the eastern portion of AP-4 and addition of a ClosureTurf cover system over the remaining CCR in AP-3/4.
- **Scenario 2: Baseline cap geometry, with the AP3/4 underdrain** - Excavation of CCR in the eastern portion of AP-4, addition of a ClosureTurf cover system over the remaining CCR in AP-3/4, and addition of an underdrain at the eastern boundary of in-place CCR.
- **Scenario 3: Shallow upgradient barrier wall, with the AP3/4 underdrain** - Excavation of CCR in the eastern portion of AP-4, addition of a ClosureTurf cover system over the remaining CCR in AP-3/4, addition of underdrain at the eastern edge of remaining CCR, and addition of a shallow upgradient barrier wall keyed into the top of partially weathered rock (PWR).
- **Scenario 4: Shallow upgradient barrier wall, without the AP3/4 underdrain** - Excavation of CCR in the eastern portion of AP-4, addition of a ClosureTurf cover system over the remaining CCR in AP-3/4, and addition of a shallow upgradient barrier wall keyed into the top of PWR.
- **Scenario 5: Deep upgradient barrier wall, with the AP3/4 underdrain** - Excavation of CCR in the eastern portion of AP-4, addition of a ClosureTurf cover system over the remaining CCR in AP-3/4, addition of an underdrain at the eastern edge of remaining CCR, and addition of a deep upgradient barrier wall keyed into the top of bedrock.
- **Scenario 6: Deep upgradient barrier wall, without the AP3/4 underdrain** - Excavation of CCR in the eastern portion of AP-4, addition of a ClosureTurf cover system over the remaining CCR in AP-3/4, and addition of a deep upgradient barrier wall keyed into the top of bedrock.
- **Scenario 7: Baseline cap geometry, with enhanced AP-3/4 underdrain** - Excavation of CCR in the eastern portion of AP-4, addition of a ClosureTurf cover system over the remaining CCR in AP-3/4, and addition of a

[1] AP-1 is simulated as closed (baseline cover system plus fully encompassing barrier wall) for Scenarios 1a, 1b, and 2 through 6.

deepened underdrain at the eastern boundary of in-place CCR. Represents the current closure design, previously documented in the October 2020 Groundwater Modeling Summary Report (Golder, 2020b) and the November 2021 Groundwater Modeling Summary Report Addendum to the Plant McDonough CCR Unit AP-2, AP-3/4 Solid Waste Handling Permit Application (Model Report Addendum; Golder 2021).

- **Scenario 8: Baseline cap geometry, without underdrain, with extraction wells** - Excavation of CCR in the eastern portion of AP-4, addition of a ClosureTurf cover system over the remaining CCR in AP-3/4, and addition of fifteen (15) dewatering wells.
- **Scenario 9: Baseline cap geometry, with underdrain and in-situ stabilization (ISS) zones** – Excavation of CCR in the eastern portion of AP-4, addition of a ClosureTurf cover system over the remaining CCR in AP-3/4, addition of an underdrain at the eastern boundary of remaining CCR in AP-3/4, and in-situ stabilization of CCR on the southern side of AP-3 and eastern side of AP-4.

The volume, area, and maximum height of remaining CCR below the potentiometric surface were calculated for each scenario, as well as the horizontal groundwater flow through a transect in the northeastern corner of AP-3/4, to compare option efficacy.

# 2.0 MODEL CONSTRUCTION

Detailed model construction and calibration information were previously documented in the October 2020 Model Report that was included as Appendix A of the February 2022 Hydrogeologic Assessment Report (HAR), and the November 2021 Model Report Addendum. The following sections document changes to the previously documented closure model to facilitate simulation of the various AEM scenarios described above in Section 1.1. All model results reported in this Calculation Package are based on steady state hydrologic conditions.

## 2.1 Model Domain

The active model domain shown on Figure 2-1 covering 2.04 square miles applies to model layers 2 to 4. The domain includes the plant and adjoining areas to the west, north, and east. The Layer 1 active model domain denoted on Figure 2-1 is limited to the AP-1, AP-2, and AP-3/4 footprints. The western, northern, and eastern domain boundaries in model layers 2 to 4 are assigned as no flow. Layer 2 model cells along the southern boundary are assigned river boundary condition cells. Layer 3 and 4 along the southern model boundary are assigned as no flow.

## 2.2 Model Grid and Layering

The full model grid covers 3.23 square miles of which 2.04 square miles are active. The entire model grid consists of a finite difference grid with four layers of 500 rows and 450 columns. Grid cell and model layer thickness varies based on interpreted geologic unit thicknesses.

The model grid top in the pre-closure model presented in this calculation package represents the pre-closure ground surface. The pre-closure model top geometry is modified from the model top documented in Appendix A of the HAR and is consistent with an engineering drawing of the pre-closure Power Plant topography (Attachment). Layer 1 pre-closure bottom surface model geometry is modified from the October 2020 Model Report in AP-2 based on post removal topography shown on Figure 1 of the CCR Removal Certification Report dated February 2020 (Golder, 2020a). Post closure grading represented by closure model surfaces are unchanged from the

October 2020 Model Report. The pre-closure model grid top is shown on Figure 2-2, closure model grid top is shown on Figure 2-3.

## 2.3 Model Boundaries

The following boundary condition modifications were made to the previously documented closure model (2021 Closure Model) for the pre- and post-closure AEM scenarios:

- **Scenario 0: Pre-closure (circa Jan 2016) conditions** – Added constant head boundaries to reflect the pre-closure open water in AP-2 and the observed relatively constant pre-closure groundwater level of 830-foot elevation in AP-3/4. Boundary conditions shown on Figure 2-4.
- **Scenario 1: Baseline Cap Geometry, without the AP3/4 underdrain** – Removed enhanced underdrain.
- **Scenario 2: Baseline cap geometry, with the AP3/4 underdrain** – Removed enhanced underdrain, added shallow underdrain with stage from 782 to 775 ft NAVD88.
- **Scenario 3: Shallow upgradient barrier wall, with the AP3/4 underdrain** - Removed enhanced underdrain, added shallow underdrain with stage from 782 to 775 ft NAVD88 that slopes from N-S, added shallow upgradient barrier wall in layers 1-3. The simulated barrier wall is 3.0 ft thick with $10^{-7}$ cm/s hydraulic conductivity.
- **Scenario 4: Shallow upgradient barrier wall, without the AP3/4 underdrain** - Removed enhanced underdrain, added shallow upgradient barrier wall in layers 1-3. The simulated barrier wall is 3.0 ft thick with $10^{-7}$ cm/s hydraulic conductivity.
- **Scenario 5: Deep upgradient barrier wall, with the AP3/4 underdrain** - Removed enhanced underdrain, added shallow underdrain with stage from ~782 to 775 ft NAVD88 that slopes from N-S, added deep upgradient barrier wall in layers 1-4. The simulated barrier wall is 3.0 ft thick with $10^{-7}$ cm/s hydraulic conductivity.
- **Scenario 6: Deep upgradient barrier wall, without the AP3/4 underdrain** - Removed enhanced underdrain, added shallow upgradient barrier wall in layers 1-4. The simulated barrier wall is 3.0 ft thick with $10^{-7}$ cm/s hydraulic conductivity.
- **Scenario 7: Baseline cap geometry, with enhanced AP-3/4 underdrain** – No change to scenario as previously documented in the October 2020 Model Report and the [December] 2021 Model Report Addendum. The enhanced underdrain slopes N-S, with stages from ~765 to 760 ft NAVD88.
- **Scenario 8: Baseline cap geometry, without underdrain, with extraction wells** – Removed enhanced underdrain, added extraction wells in layers 1-4. Pumping well locations, pumping rates and applicable model layers are summarized in the table below.
- **Scenario 9: Baseline cap geometry, with underdrain and in-situ stabilization (ISS) zones** – Removed enhanced underdrain, added shallow underdrain with stage from 782 to 775 ft NAVD88, added new hydraulic conductivity zones in AP-3/4 to represent stabilized CCR (assumes uniform, low hydraulic conductivity of 2.6 x $10^{-7}$ cm/s.

| Name | Easting (NAD 83 ft) | Northing (NAD 83 ft) | Pumping Rate (gpm) | Top Layer | Bottom Layer |
|---|---|---|---|---|---|
| MTW-W-3 | 2203326.82 | 1393284.31 | 1.0 | 1 | 1 |
| MTW-13 | 2202904.00 | 1393856.00 | 1.0 | 1 | 1 |
| AE-1 | 2201938.01 | 1392352.40 | 1.0 | 1 | 3 |
| AE-2 | 2202395.20 | 1392425.10 | 1.0 | 1 | 2 |
| AE-3 | 2202484.86 | 1392468.57 | 1.0 | 1 | 2 |
| AE-4 | 2202459.50 | 1392582.90 | 1.0 | 1 | 2 |
| AE-5 | 2203355.94 | 1393702.56 | 1.0 | 1 | 3 |
| AE-6 | 2203294.36 | 1393778.12 | 1.0 | 1 | 3 |
| AE-7 | 2203210.12 | 1393879.51 | 1.0 | 1 | 2 |
| MTW-E-1 | 2203413.75 | 1393621.42 | 1.0 | 1 | 1 |
| MTW-E-2 | 2203478.43 | 1393545.62 | 1.0 | 1 | 1 |
| MTW-E-3 | 2203542.33 | 1393470.11 | 1.0 | 1 | 1 |
| MTW-E-4 | 2203605.76 | 1393394.31 | 1.0 | 1 | 1 |
| MTW-W-1 | 2203197.02 | 1393434.59 | 1.0 | 1 | 1 |
| MTW-W-2 | 2203264.23 | 1393361.22 | 1.0 | 1 | 1 |
| MTW-W-4 | 2203394.78 | 1393210.44 | 1.0 | 1 | 1 |
| MTW-09 | 2203147.00 | 1393519.00 | 1.0 | 1 | 1 |
| MTW-10 | 2203080.00 | 1393593.00 | 1.0 | 1 | 1 |
| MTW-11 | 2203026.00 | 1393675.00 | 1.0 | 1 | 1 |
| MTW-12 | 2202984.01 | 1393766.00 | 1.0 | 1 | 1 |
| MTW-14 | 2202808.01 | 1393844.00 | 1.0 | 1 | 1 |
| MTW-15 | 2203082.00 | 1393871.00 | 1.0 | 1 | 1 |
| DW-D1 | 2203002.82 | 1394309.46 | 4.0 | 4 | 4 |
| DW-D2 | 2203307.15 | 1394375.85 | 4.0 | 4 | 4 |
| DW-D3 | 2203753.52 | 1394363.71 | 4.0 | 4 | 4 |
| DW-D4 | 2204171.67 | 1394045.49 | 4.0 | 4 | 4 |

Boundary configurations for scenarios 2 through 8 are summarized on Figure 2-5. All post-closure scenarios include a fully encompassing barrier wall around AP-1 that extends down to the top of interpreted PWR.

### 2.3.1 Model Recharge

Pre-closure recharge values are modified from the 2021 Closure Model over AP-1 and AP-3/4 footprints based on updated interpretations. Pre-closure recharge zones and associated values are shown on Figure 2-6. Post-closure recharge zones are unchanged from the 2021 Closure Model. Post-closure model recharge zones are shown on Figure 2-7.

## 2.4 Hydraulic Conductivity Zone

Pre-closure hydraulic conductivity zones are unchanged from the 2021 Closure Model. Hydraulic conductivity zones shown on Figure 2-8 correlate to the interpreted extent of CCR, residuum-saprolite, PWR, and bedrock, respectively. A complete discussion of pre-closure model hydraulic property zones is found in the 2020 Model Report. Post-closure hydraulic conductivity zones for all post-closure simulation scenarios are unchanged from the 2021 Closure Model. Post-closure hydraulic property zones are shown on Figure 2-9.

## 2.5 Model Calibration

Model calibration is documented in the October 2020 Model Report. The model calibration meets industry standards, including a root mean square error less than 10 percent and a mass balance discrepancy of less than 1.0 percent. Refer to the October 2020 Model Report for a complete model calibration discussion.

# 3.0 PREDICTIVE SIMULATIONS

Eight steady-state dewatering simulations were conducted to analyze AEM options. Simulation results are summarized in Table 1 and presented below. Closure efficacy was determined by comparing each post-closure simulation scenario to pre-closure conditions. Modeled groundwater flow was calculated across a transect along the eastern boundary of the post closure limits of CCR for AP-3/4, adjacent to the location of the hydraulic barrier wall used in certain scenarios. The flow from the CCR Unit to the east was calculated from the model in gallons per minute (GPM) and was used as one of several evaluation metrics presented in Table 1 that are used to analyze FS closure alternatives.

- **Scenario 0: Pre-closure (circa Jan 2016) conditions (Figure 3-1)** - The pre-closure model represents conditions prior to closure activities (circa Jan 2016) and serves as a baseline for the closure and different AEM scenario models. CCR below the potentiometric surface covered an area of nearly 66.3 acres, with a maximum thickness of 70.1 feet and a total volume of 2,659,330 cubic yards. As the northeast portion of AP-3/4 in layer 1 contains constant-head (CHD) boundary conditions to represent pre-closure water levels, and the alignment of the transect used in the closure models with and without AEM implementations is within the pre-closure CCR limits it is not applicable to evaluate flow no flow was estimated across the northeastern transect for the pre-closure conditions.

- **Scenario 1: Baseline Cap Geometry, without the AP3/4 underdrain (Figure 3-2)** - The volume of CCR below the potentiometric surface decreased by 97%, with a remaining maximum thickness of 21.3 feet, and an area of 5.8 acres. The modelled flow across the northeastern transect is 0.18 GPM.

- **Scenario 2: Baseline cap geometry, with the AP3/4 underdrain (Figure 3-3)** - The volume of CCR below the potentiometric surface decreased by 98%, with a remaining maximum thickness of 17.5 feet, and an area of 4.7 acres. The modelled flow across the northeastern transect is 0.04 GPM.

- **Scenario 3: Shallow upgradient barrier wall, with the AP3/4 underdrain (Figure 3-4)** - The volume of CCR below the potentiometric surface decreased by 98%, with a remaining maximum thickness of 17.3 feet and an area of 4.8 acres. The modelled flow across the northeastern transect was negligible (defined herein as 0.01 gpm or less).

- **Scenario 4: Shallow upgradient barrier wall, without the AP3/4 underdrain (Figure 3-5)** - The volume of CCR below the potentiometric surface decreased by 97%, with a remaining maximum thickness of 21.0 feet, and an area of 5.8 acres. The modelled flow across the northeastern transect was negligible.
- **Scenario 5: Deep upgradient barrier wall, with the AP3/4 underdrain (Figure 3-6)** - The volume of CCR below the potentiometric surface decreased by 98%, with a remaining maximum thickness of 17.2 feet, and an area of 4.8 acres. The modelled flow across the northeastern transect was negligible.
- **Scenario 6: Deep upgradient barrier wall, without the AP3/4 underdrain (Figure 3-7)** - The volume of CCR below the potentiometric surface decreased by 97%, with a remaining maximum thickness of 20.6 feet, and an area of 5.7 acres. The modelled flow across the northeastern transect was negligible.
- **Scenario 7: Baseline cap geometry, with enhanced AP-3/4 underdrain (Figure 3-8)** - CCR below the potentiometric surface is effectively eliminated, with no appreciable remaining thickness. The modelled flow across the northeastern transect was negligible.
- **Scenario 8: Baseline cap geometry, without underdrain, with extraction wells (Figure 3-9)** – CCR below the potentiometric surface was reduced to a remaining maximum thickness of 5.8 feet, and an area of 0.6 acres. The modelled flow across the northeastern transect is 0.01 GPM.
- **Scenario 9: Baseline cap geometry, with underdrain and in-situ stabilization (ISS) zones (Figure 3-10)** – In this option all CCR would either be encapsulated with ISS or be modelled as above the potentiometric surface. The volume of CCR below the potentiometric surface is decreased by 98%, with a remaining maximum thickness of 17.3 feet, and an area of 4.7 acres, consisting entirely of CCR encapsulated via ISS treatment. The modelled flow across the northeastern transect is 0.05 GPM.

# 4.0 CONCLUSIONS

Each of the modeled closure design scenarios decrease AP-3/4 CCR saturation by at least 97 percent compared to the pre-closure model. The baseline cover system with enhanced underdrain (Scenario 6) is predicted to be the most effective at reducing the volume and extent of CCR below the potentiometric surface post-closure, as this scenario results in modelled desaturation of CCR and groundwater flow through CCR within AP-3/4 being negligible.

Closure AEM scenarios 2 through 5 have generally similar model predictions of CCR volume below the potentiometric surface, extent, and groundwater flow through AP-3/4. A baseline cover system without underdrain but with extraction wells (Scenario 7) is the second most effective design with a remaining maximum CCR thickness below the potentiometric surface of 6 feet and the footprint of that CCR approximately 90 percent additionally reduced beyond that of closure AEM design scenarios 1 through 5. The modelling results indicate the effectiveness of the groundwater extraction well and enhanced undrain systems (the selected AEMs) in supplementing the significant improvements provided by the baseline closure configuration.

# 5.0 REFERENCES

Golder, 2020a. *CCR Removal Certification Report, Plant McDonough-Atkinson CCR Unit AP-2,* Golder Associates, Inc., February 2020.

Golder, 2020b. *Appendix A – Three-Dimensional Numerical Groundwater Modeling Summary Report, Georgia Power – Plant McDonough, Cobb County, Georgia,* Golder Associates, Inc., October 2020, Rev 05.

Golder 2021. *Three-Dimensional Numerical Groundwater Modeling Summary Report Addendum, Georgia Power – Plant McDonough, Cobb County, Georgia,* Golder Associates, Inc., November 2021, Rev 0.

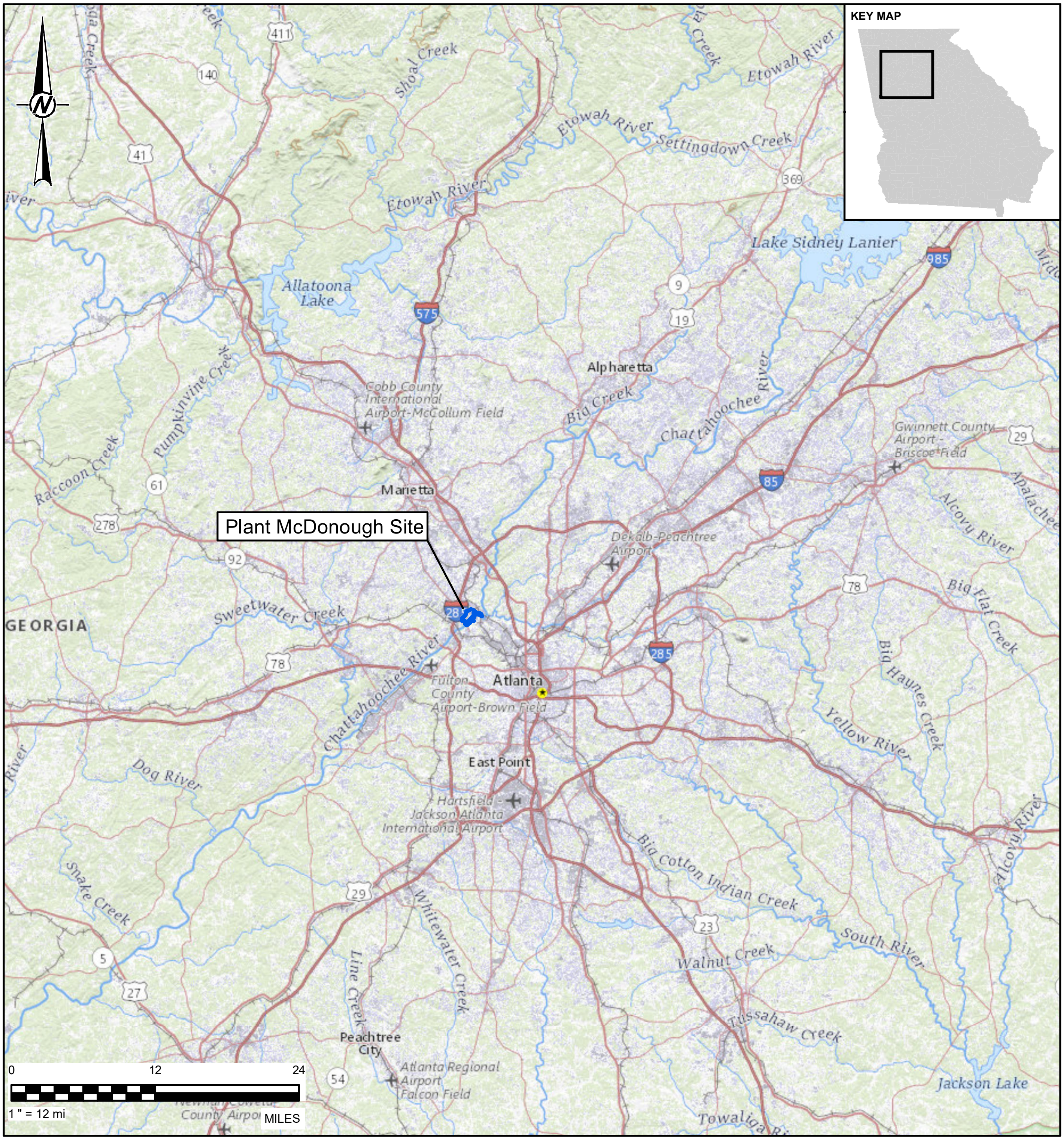
# TABLE & FIGURES

# TABLE 1
## SUMMARY OF FOCUSED AEM EVALUATION - AP3/4
Plant McDonough-Atkinson

| Scenario No. | AP-3/4 Conditions | Enhancement | Description of Enhancement | Effectiveness | | | | | | Implementability Consideration | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Maximum Height of Potentiometric Surface Above Bottom of Unit (feet) | Volume of CCR Below the Potentiometric Surface (cubic yards) | Percent (%) Reduction in Volume of CCR Below the Potentiometric Surface | AP-3/4 Area of CCR Below the Potentiometric Surface (acres) | Percent (%) Reduction of Area of CCR Below the Potentiometric Surface | Modelled Flux Across Eastern Transect (GPM) | Constructability | Potential Impacts |
| 0 | Pre-closure conditions | - | - | 70.1 | 2,659,330 | - | 66.3 | - | N/A | - | - |
| **Modelled CCR Unit AP-3/4 Baseline Closure** | | | | | | | | | | | |
| 1 | Cover Installed | Baseline Closure | Baseline cap geometry, without underdrain | 21.3 | 78,541 | 97% | 5.8 | 91% | 0.18 | - | - |
| **Modelled CCR Unit AP-3/4 AEM Scenarios** | | | | | | | | | | | |
| 2 | Cover Installed | Shallow Underdrain | Baseline cap geometry, with underdrain | 17.5 | 53,957 | 98% | 4.7 | 93% | 0.04 | (i) long term O&M costs associated with possible treatment of groundwater. | - |
| 3 | Cover Installed | Shallow Upgradient Barrier and Underdrain | Upgradient barrier keyed into top-of-PWR, with underdrain | 17.3 | 54,084 | 98% | 4.8 | 93% | 0.00 | (i) long term O&M costs associated with possible treatment of groundwater. (ii) specialized equipment and costs needed to construct barrier wall. | (i) the slurry wall option has the potential to change upgradient groundwater levels and is shown to have limited influence on reducing groundwater levels and downgradient flow relative to other options. |
| 4 | Cover Installed | Shallow Upgradient Barrier without Underdrain | Upgradient barrier keyed into top-of-PWR, without underdrain | 21.0 | 77,689 | 97% | 5.8 | 91% | 0.00 | (i) specialized equipment and costs needed to construct barrier wall. | (i) the slurry wall option has the potential to change upgradient groundwater levels and is shown to have limited influence on reducing groundwater levels and downgradient flow relative to other options. |
| 5 | Cover Installed | Deep Upgradient Barrier and Underdrain | Upgradient barrier keyed into top-of-bedrock, with underdrain | 17.2 | 54,120 | 98% | 4.8 | 93% | 0.00 | (i) long term O&M costs associated with possible treatment of groundwater. (ii) specialized equipment and costs needed to key wall into bedrock for limited to negative benefit compared to wall keyed into top of PWR. | (i) the deep slurry wall option has the potential to further change upgradient groundwater levels and is shown to have limited influence on reducing groundwater levels and downgradient flow similar to the shallower wall keyed into PWR relative to other options. |
| 6 | Cover Installed | Deep Upgradient Barrier without Underdrain | Upgradient barrier keyed into top-of-bedrock, without underdrain | 20.6 | 75,338 | 97% | 5.7 | 91% | 0.00 | (i) specialized equipment and costs needed to key wall into bedrock for limited to negative benefit compared to wall keyed into top of PWR. | (i) the deep slurry wall option has the potential to further change upgradient groundwater levels and is shown to have limited influence on reducing groundwater levels and downgradient flow similar to the shallower wall keyed into PWR relative to other options. |
| 7 | Cover Installed | Enhanced Underdrain (selected AEM incorporated into closure design) | Baseline cap geometry, with enhanced underdrain | 0.0 | 0.0 | 100% | 0.0 | 100% | 0.00 | (i) long term O&M costs associated with possible treatment of groundwater, although long term collected water estimated to be non-contact. (ii) deeper trench may require enhanced construction techniques. | - |
| 8 | Cover Installed | Baseline Cap Geometry with AEM Wells without Underdrain | Baseline cap geometry, with underdrain removed and AEM wells added | 5.8 | 2,142 | 100% | 0.6 | 99% | 0.01 | (i) long term O&M costs associated with possible treatment of groundwater. | - |
| 9 | Cover Installed | In-situ Stabilization of (ISS) target CCR at east and southwest, with original design underdrain to the east | Baseline cap geometry, with underdrain, and In-Situ Stabilization of low elevation CCR materials | 17.3 | 54,448 | 98% | 4.7 | 93% | 0.05 | (i) long term O&M costs associated with possible treatment of groundwater. (ii) specialized equipment and costs needed to complete ISS. (iii) complex construction sequencing needed to complete ISS. | (i) the ISS option has the potential to increase groundwater levels above the levels of simliar scenarios without ISS, and is shown to have limited influence on reducing groundwater levels and downgradient flows relative to other options. |

**Notes:**
1. These values were obtained from groundwater flow modeling results. It is noted that groundwater flow models are necessarily simplified mathematical representations of complex natural systems. Because of this, all groundwater models have limits to their accuracy.
2. These model results are intended for use as relative comparisons between scenarios, and not as precise predictions of post -closure conditions.
3. Flux estimates were calculated in the model as the volume of water passing through a vertical plane per unit time for model Layer 1.

Created by: SJS 03/01/2023
Checked by: WEG 03/01/2023
Reviewed by: GLH 05/18/2023




**LEGEND**

Property Boundary

**REFERENCE(S)**

1. BASEMAP FROM USGS THE NATIONAL MAP: NATIONAL BOUNDARIES DATASET, 3DEP ELEVATION PROGRAM, GEOGRAPHIC NAMES INFORMATION SYSTEM, NATIONAL HYDROGRAPHY DATASET, NATIONAL LAND COVER DATABASE, NATIONAL STRUCTURES DATASET, AND NATIONAL TRANSPORTATION DATASET; USGS GLOBAL ECOSYSTEMS; U.S. CENSUS BUREAU TIGER/LINE DATA; USFS ROAD DATA; NATURAL EARTH DATA; U.S. DEPARTMENT OF STATE HUMANITARIAN INFORMATION UNIT; AND NOAA NATIONAL CENTERS FOR ENVIRONMENTAL INFORMATION, U.S. COASTAL RELIEF MODEL. DATA REFRESHED AUGUST, 2021.

CLIENT
GEORGIA POWER COMPANY
SOUTHERN COMPANY SERVICES

PROJECT
ADVANCED ENGINEERING METHODS FEASIBILITY REPORT,
PLANT MCDONOUGH ASH POND 3 AND ASH POND 4 (AP-3/4)

TITLE
**LOCATION MAP**

CONSULTANT

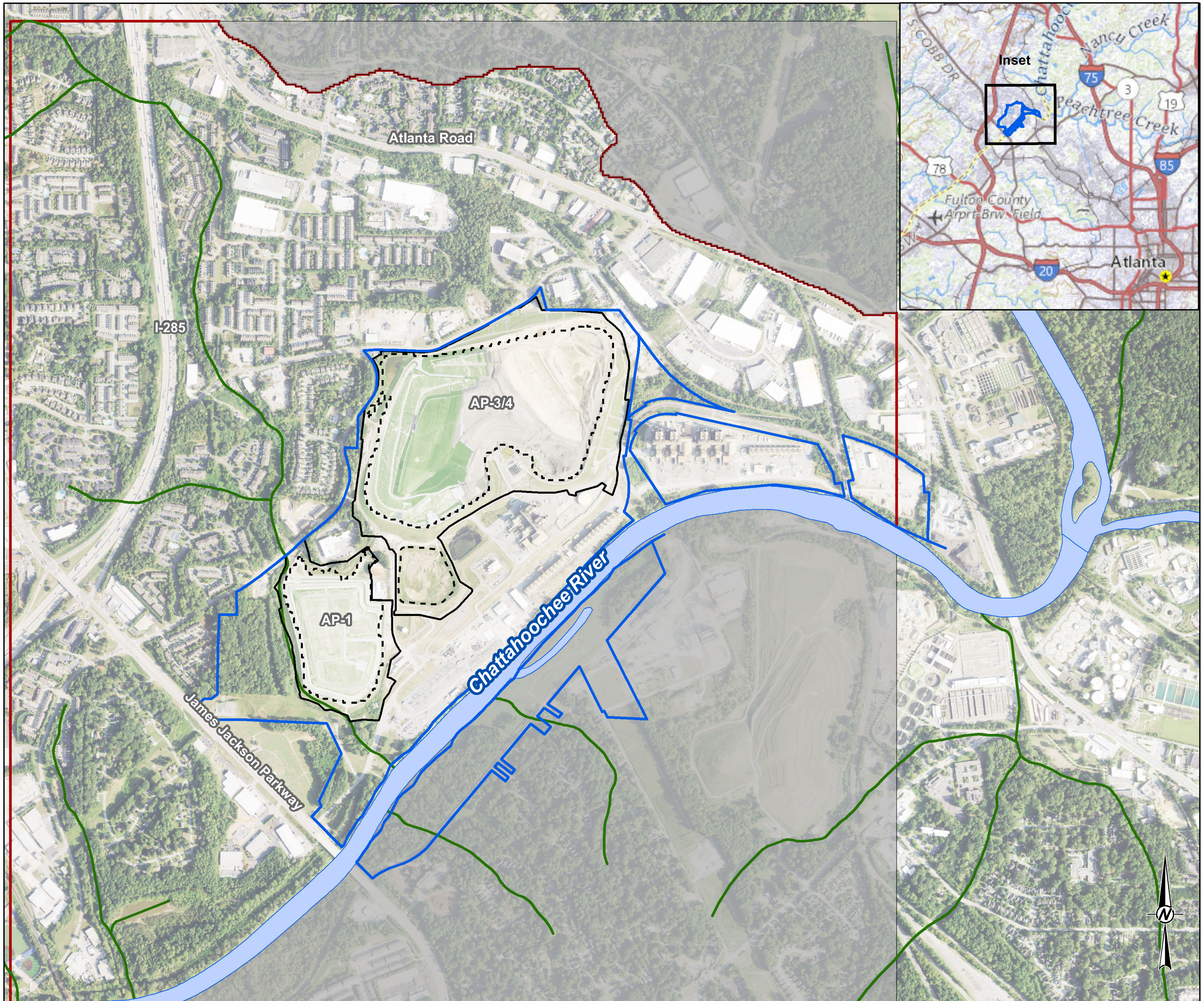
| | |
|---|---|
| YYYY-MM-DD | 2023-05-19 |
| DESIGNED | SJS |
| PREPARED | AFS |
| CHECKED | CB |
| REVIEWED / APPROVED | GLH |

| PROJECT NO. | SCS PROJECT ID | REV. | FIGURE |
|---|---|---|---|
| GL1777449-03 | MCD150170 | 0 | 1-1 |

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A

1 in

0




**LEGEND**

- Property Boundary
- Permitted Closure Extent
- Pre-Closure CCR Extents
- National Hydrography Dataset Streams
- National Hydrography Dataset River

**Model Domain**

- Active cells
- Unused cells

0 1,000 2,000 3,000

1 in = 1,000 feet Feet

**NOTE(S)**

1. CCR = COAL COMBUSTION RESIDUALS.

**REFERENCE(S)**

1. AERIAL IMAGERY FROM NAIP DATASET, DATED 2019-09-10 THROUGH 2019-10-04.
2. INSET BASEMAP FROM USGS THE NATIONAL MAP: NATIONAL BOUNDARIES DATASET, 3DEP ELEVATION PROGRAM, GEOGRAPHIC NAMES INFORMATION SYSTEM, NATIONAL HYDROGRAPHY DATASET, NATIONAL LAND COVER DATABASE, NATIONAL STRUCTURES DATASET, AND NATIONAL TRANSPORTATION DATASET; USGS GLOBAL ECOSYSTEMS; U.S. CENSUS BUREAU TIGER/LINE DATA; USFS ROAD DATA; NATURAL EARTH DATA; U.S. DEPARTMENT OF STATE HUMANITARIAN INFORMATION UNIT; AND NOAA NATIONAL CENTERS FOR ENVIRONMENTAL INFORMATION, U.S. COASTAL RELIEF MODEL. DATA REFRESHED AUGUST, 2021.

CLIENT
GEORGIA POWER COMPANY
SOUTHERN COMPANY SERVICES

PROJECT
ADVANCED ENGINEERING METHODS FEASIBILITY REPORT,
PLANT MCDONOUGH ASH POND 3 AND ASH POND 4 (AP-3/4)

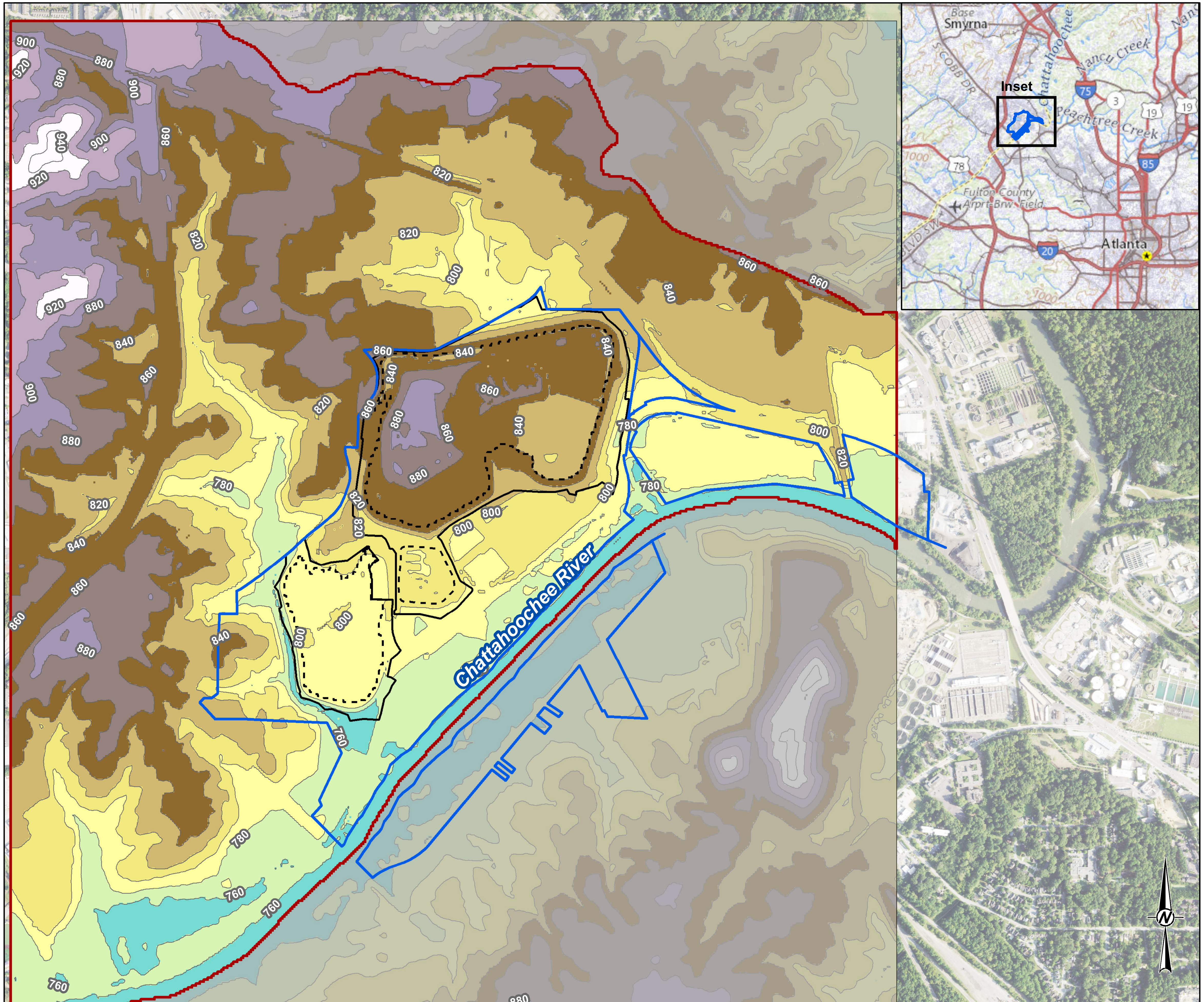
TITLE
**MODEL DOMAIN**

CONSULTANT
wsp

| | |
|---|---|
| YYYY-MM-DD | 2023-05-19 |
| DESIGNED | SJS |
| PREPARED | AFS |
| CHECKED | CB |
| REVIEWED / APPROVED | GLH |

| PROJECT NO. | SCS PROJECT ID | REV. | FIGURE |
|---|---|---|---|
| GL1777449-03 | MCD150170 | 0 | 2-1 |

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B




**LEGEND**

- Property Boundary
- Permitted Closure Extent
- Preclosure Ash Extents
- Preclosure Topo Contour

**Model Domain**

- Active cells
- Unused cells

**Preclosure Model Top Elevation (ft NAVD88)**

- 738.7 - 760
- 760 - 780
- 780 - 800
- 800 - 820
- 820 - 840
- 840 - 860
- 860 - 880
- 880 - 900
- 900 - 920
- 920 - 956

0 1,000 2,000 3,000

1 in = 1,000 feet Feet

NOTE(S)

1. CCR = COAL COMBUSTION RESIDUALS.
2. NAVD 88 = NORTH AMERICAN VERTICAL DATUM OF 1988.

REFERENCE(S)

1. AERIAL IMAGERY FROM NAIP DATASET, DATED 2019-09-10 THROUGH 2019-10-04.
2. INSET BASEMAP FROM USGS THE NATIONAL MAP: NATIONAL BOUNDARIES DATASET, 3DEP ELEVATION PROGRAM, GEOGRAPHIC NAMES INFORMATION SYSTEM, NATIONAL HYDROGRAPHY DATASET, NATIONAL LAND COVER DATABASE, NATIONAL STRUCTURES DATASET, AND NATIONAL TRANSPORTATION DATASET; USGS GLOBAL ECOSYSTEMS; U.S. CENSUS BUREAU TIGER/LINE DATA; USFS ROAD DATA; NATURAL EARTH DATA; U.S. DEPARTMENT OF STATE HUMANITARIAN INFORMATION UNIT; AND NOAA NATIONAL CENTERS FOR ENVIRONMENTAL INFORMATION, U.S. COASTAL RELIEF MODEL. DATA REFRESHED AUGUST, 2021.

CLIENT

GEORGIA POWER COMPANY
SOUTHERN COMPANY SERVICES

PROJECT

ADVANCED ENGINEERING METHODS FEASIBILITY REPORT, PLANT MCDONOUGH ASH POND 3 AND ASH POND 4 (AP-3/4)

TITLE

**PRE-CLOSURE MODEL TOP ELEVATION**

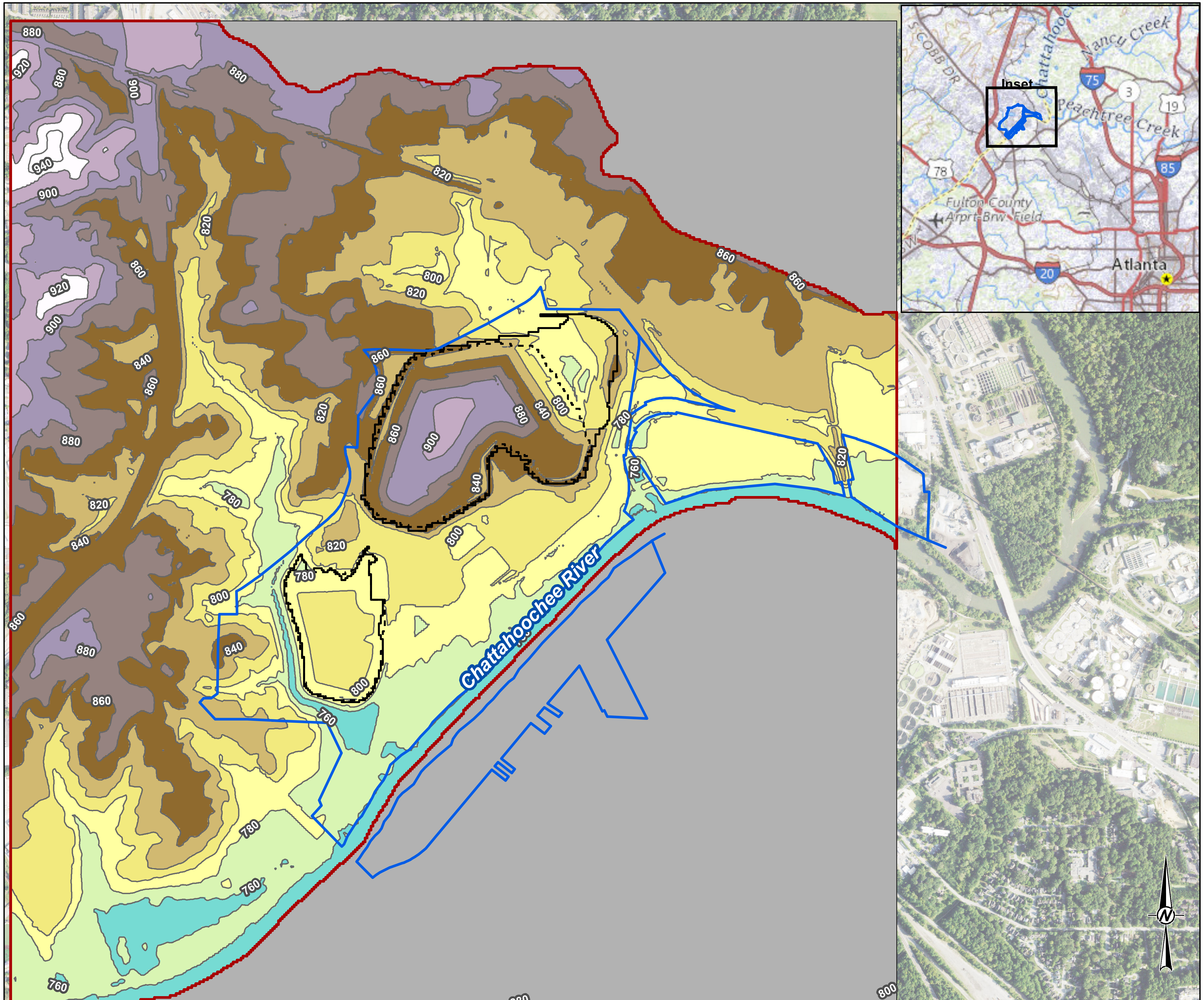
CONSULTANT

wsp

| | |
|---|---|
| YYYY-MM-DD | 2023-05-19 |
| DESIGNED | SJS |
| PREPARED | AFS |
| CHECKED | CB |
| REVIEWED / APPROVED | GLH |

| PROJECT NO. | SCS PROJECT ID | REV. | FIGURE |
|---|---|---|---|
| GL1777449-03 | MCD150170 | 0 | 2-2 |

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B




**LEGEND**

Property Boundary
Limits of Closure Turf
Elevation Contours (ft NAVD88)
Extent of CCR

**Model Domain**

Active cells
Unused cells

**Elevation (ft NAVD88)**

743 - 760
760 - 780
780 - 800
800 - 820
820 - 840
840 - 860
860 - 880
880 - 900
900 - 920
920 - 960

0 1,000 2,000 3,000
1 in = 1,000 feet
Feet

**NOTE(S)**
1. CCR = COAL COMBUSTION RESIDUALS.
2. NAVD 88 = NORTH AMERICAN VERTICAL DATUM OF 1988.

**REFERENCE(S)**
1. AERIAL IMAGERY FROM NAIP DATASET, DATED 2019-09-10 THROUGH 2019-10-04.
2. INSET BASEMAP FROM USGS THE NATIONAL MAP: NATIONAL BOUNDARIES DATASET, 3DEP ELEVATION PROGRAM, GEOGRAPHIC NAMES INFORMATION SYSTEM, NATIONAL HYDROGRAPHY DATASET, NATIONAL LAND COVER DATABASE, NATIONAL STRUCTURES DATASET, AND NATIONAL TRANSPORTATION DATASET; USGS GLOBAL ECOSYSTEMS; U.S. CENSUS BUREAU TIGER/LINE DATA; USFS ROAD DATA; NATURAL EARTH DATA; U.S. DEPARTMENT OF STATE HUMANITARIAN INFORMATION UNIT; AND NOAA NATIONAL CENTERS FOR ENVIRONMENTAL INFORMATION, U.S. COASTAL RELIEF MODEL. DATA REFRESHED AUGUST, 2021.

CLIENT
GEORGIA POWER COMPANY
SOUTHERN COMPANY SERVICES

PROJECT
ADVANCED ENGINEERING METHODS FEASIBILITY REPORT,
PLANT MCDONOUGH ASH POND 3 AND ASH POND 4 (AP-3/4)

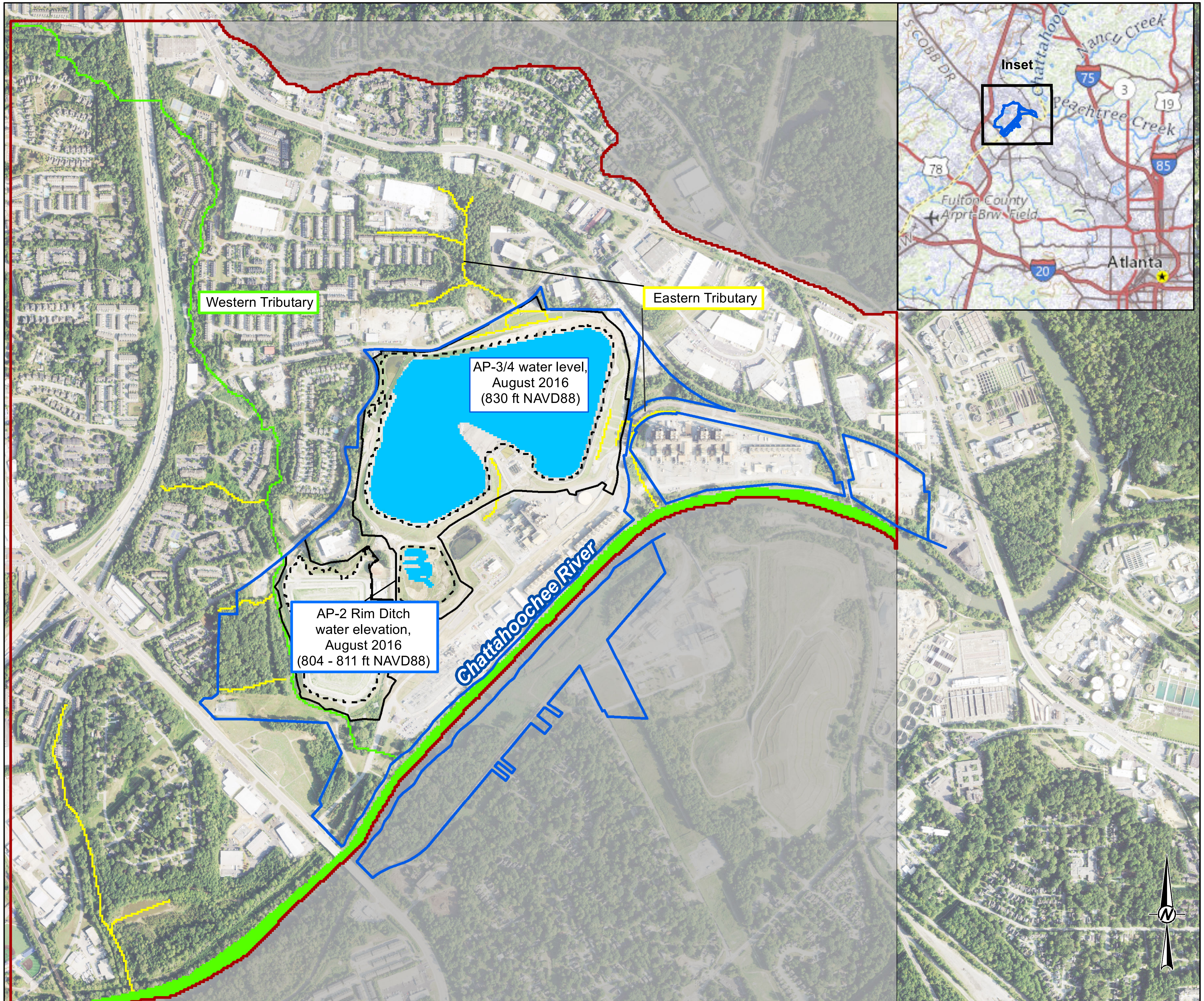
TITLE
**CLOSURE MODEL TOP ELEVATION**

CONSULTANT

wsp

| | |
|---|---|
| YYYY-MM-DD | 2023-05-22 |
| DESIGNED | SJS |
| PREPARED | AFS |
| CHECKED | CB |
| REVIEWED / APPROVED | GLH |

| PROJECT NO. | SCS PROJECT ID | REV. | FIGURE |
|---|---|---|---|
| GL1777449-03 | MCD150170 | 0 | 2-3 |




LEGEND

- Property Boundary
- Permitted Closure Extent
- Pre-Closure CCR Extents

**Model Domain**

- Active cells
- Unused cells

**Pre-closure Boundary Conditions**

- Constant Head
- Drain
- River

0 1,000 2,000 3,000

1 in = 1,000 feet Feet

**NOTE(S)**

1. CCR = COAL COMBUSTION RESIDUALS.
2. NAVD 88 = NORTH AMERICAN VERTICAL DATUM OF 1988.

**REFERENCE(S)**

1. AERIAL IMAGERY FROM NAIP DATASET, DATED 2019-09-10 THROUGH 2019-10-04.
2. INSET BASEMAP FROM USGS THE NATIONAL MAP: NATIONAL BOUNDARIES DATASET, 3DEP ELEVATION PROGRAM, GEOGRAPHIC NAMES INFORMATION SYSTEM, NATIONAL HYDROGRAPHY DATASET, NATIONAL LAND COVER DATABASE, NATIONAL STRUCTURES DATASET, AND NATIONAL TRANSPORTATION DATASET; USGS GLOBAL ECOSYSTEMS; U.S. CENSUS BUREAU TIGER/LINE DATA; USFS ROAD DATA; NATURAL EARTH DATA; U.S. DEPARTMENT OF STATE HUMANITARIAN INFORMATION UNIT; AND NOAA NATIONAL CENTERS FOR ENVIRONMENTAL INFORMATION, U.S. COASTAL RELIEF MODEL. DATA REFRESHED AUGUST, 2021.

CLIENT
GEORGIA POWER COMPANY
SOUTHERN COMPANY SERVICES

PROJECT
ADVANCED ENGINEERING METHODS FEASIBILITY REPORT, PLANT MCDONOUGH ASH POND 3 AND ASH POND 4 (AP-3/4)

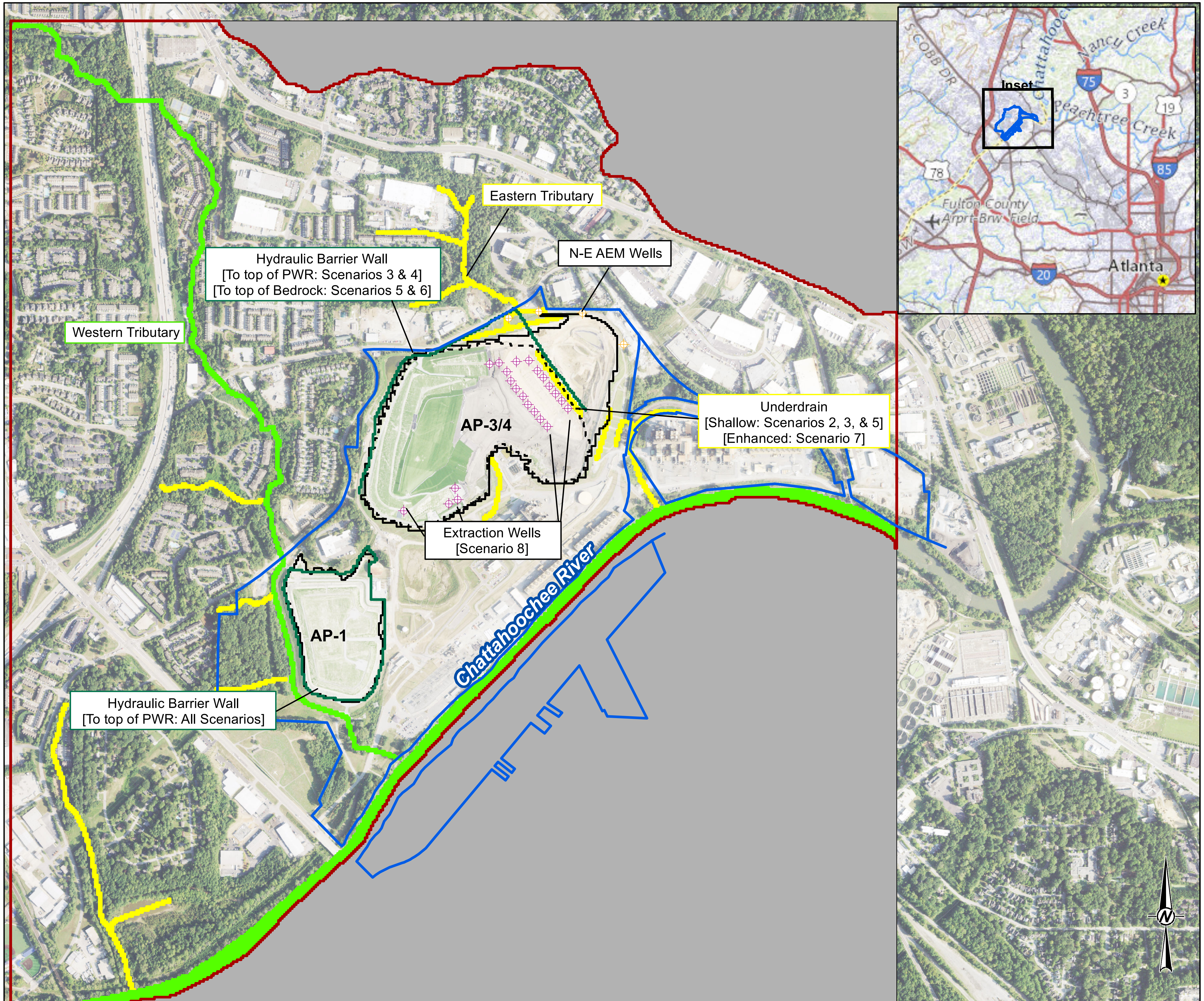
TITLE
**PRE-CLOSURE MODEL BOUNDARY CONDITIONS**

CONSULTANT

wsp

| | |
|---|---|
| YYYY-MM-DD | 2023-05-19 |
| DESIGNED | SJS |
| PREPARED | AFS |
| CHECKED | CB |
| REVIEWED / APPROVED | GLH |

| PROJECT NO. | SCS PROJECT ID | REV. | FIGURE |
|---|---|---|---|
| GL1777449-03 | MCD150170 | 0 | 2-4 |




**LEGEND**

- Extraction Wells
- N-E AEM Wells
- Property Boundary
- Limits of Closure Turf
- Hydraulic Barrier Wall
- Drain
- River
- Extent of CCR Post Closure

**Model Domain**

- Active cells
- Unused cells

0 | 1,000 | 2,000 | 3,000 Feet

1 in = 1,000 feet

**NOTE(S)**

1. CCR = COAL COMBUSTION RESIDUALS.
2. NAVD 88 = NORTH AMERICAN VERTICAL DATUM OF 1988.
3. AEM = ADVANCED ENGINEERING METHOD

**REFERENCE(S)**

1. AERIAL IMAGERY FROM NAIP DATASET, DATED 2019-09-10 THROUGH 2019-10-04.
2. INSET BASEMAP FROM USGS THE NATIONAL MAP: NATIONAL BOUNDARIES DATASET, 3DEP ELEVATION PROGRAM, GEOGRAPHIC NAMES INFORMATION SYSTEM, NATIONAL HYDROGRAPHY DATASET, NATIONAL LAND COVER DATABASE, NATIONAL STRUCTURES DATASET, AND NATIONAL TRANSPORTATION DATASET; USGS GLOBAL ECOSYSTEMS; U.S. CENSUS BUREAU TIGER/LINE DATA; USFS ROAD DATA; NATURAL EARTH DATA; U.S. DEPARTMENT OF STATE HUMANITARIAN INFORMATION UNIT; AND NOAA NATIONAL CENTERS FOR ENVIRONMENTAL INFORMATION, U.S. COASTAL RELIEF MODEL. DATA REFRESHED AUGUST, 2021.

CLIENT
GEORGIA POWER COMPANY
SOUTHERN COMPANY SERVICES

PROJECT
ADVANCED ENGINEERING METHODS FEASIBILITY REPORT,
PLANT MCDONOUGH ASH POND 3 AND ASH POND 4 (AP-3/4)

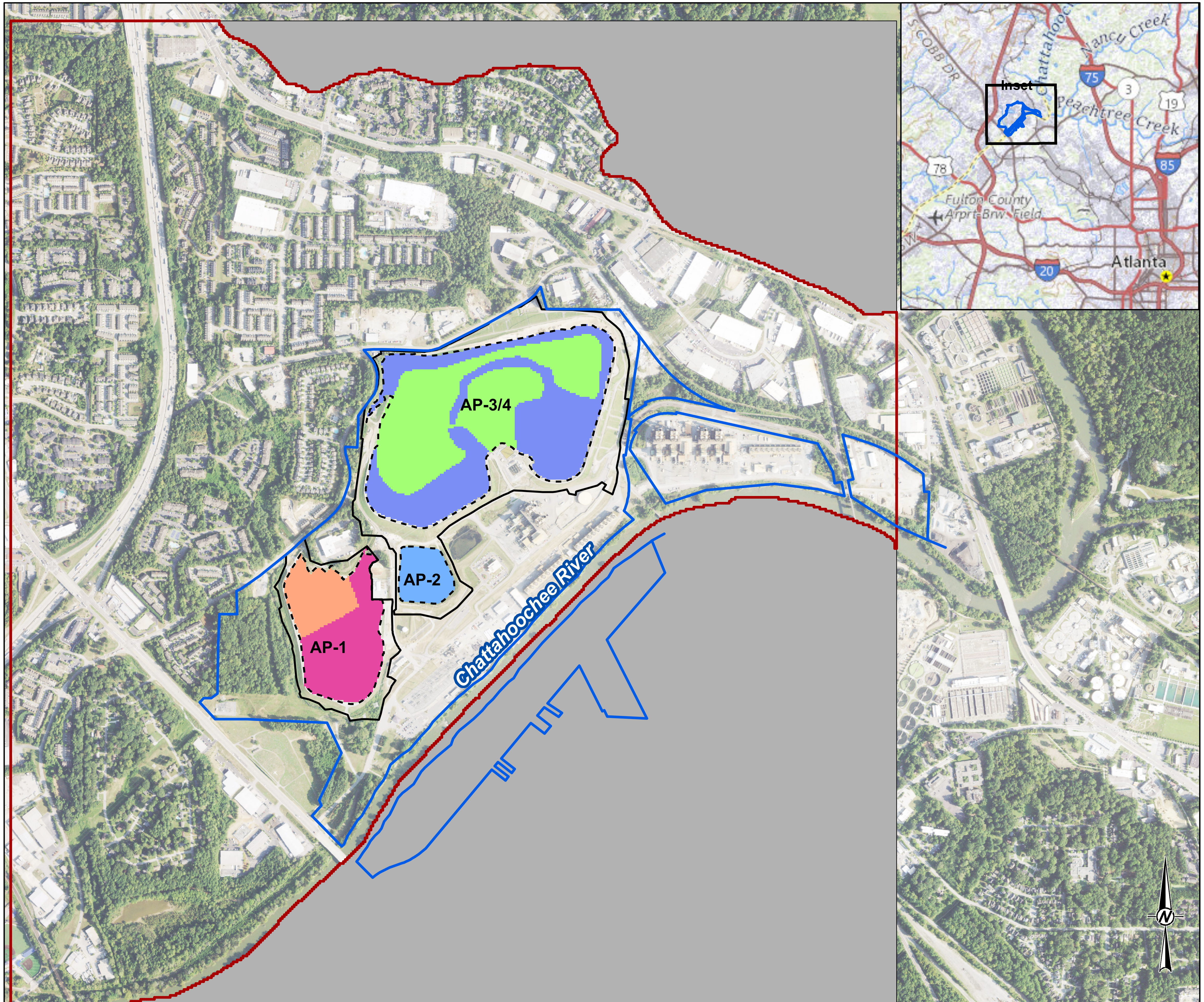
TITLE
**CLOSURE MODEL BOUNDARY CONDITIONS**

CONSULTANT

wsp

| | |
|---|---|
| YYYY-MM-DD | 2023-05-19 |
| DESIGNED | SJS |
| PREPARED | AFS |
| CHECKED | CB |
| REVIEWED / APPROVED | GLH |

| PROJECT NO. | SCS PROJECT ID | REV. | FIGURE |
|---|---|---|---|
| GL1777449-03 | MCD150170 | 0 | 2-5 |




**LEGEND**

Property Boundary

Permitted Closure Extent

Pre-Closure CCR Extents

**Model Domain**

Active cells

Unused cells

**Model Recharge Zones**

AP-1 Low Recharge (1.2 in/yr)

AP-2 High Recharge (2.41 in/yr)

AP-1 High Recharge (2.41 in/yr)

AP-3/4 High Recharge (2.41 in/yr)

AP-3/4 Low Recharge (1.2 in/yr)

Recharge in remaining model domain: 2.41 in/yr

0 1,000 2,000 3,000

1 in = 1,000 feet

Feet

**NOTE(S)**

1. CCR = COAL COMBUSTION RESIDUALS.

**REFERENCE(S)**

1. AERIAL IMAGERY FROM NAIP DATASET, DATED 2019-09-10 THROUGH 2019-10-04.
2. INSET BASEMAP FROM USGS THE NATIONAL MAP: NATIONAL BOUNDARIES DATASET, 3DEP ELEVATION PROGRAM, GEOGRAPHIC NAMES INFORMATION SYSTEM, NATIONAL HYDROGRAPHY DATASET, NATIONAL LAND COVER DATABASE, NATIONAL STRUCTURES DATASET, AND NATIONAL TRANSPORTATION DATASET; USGS GLOBAL ECOSYSTEMS; U.S. CENSUS BUREAU TIGER/LINE DATA; USFS ROAD DATA; NATURAL EARTH DATA; U.S. DEPARTMENT OF STATE HUMANITARIAN INFORMATION UNIT; AND NOAA NATIONAL CENTERS FOR ENVIRONMENTAL INFORMATION, U.S. COASTAL RELIEF MODEL. DATA REFRESHED AUGUST, 2021.

CLIENT

GEORGIA POWER COMPANY
SOUTHERN COMPANY SERVICES

PROJECT

ADVANCED ENGINEERING METHODS FEASIBILITY REPORT, PLANT MCDONOUGH ASH POND 3 AND ASH POND 4 (AP-3/4)

TITLE

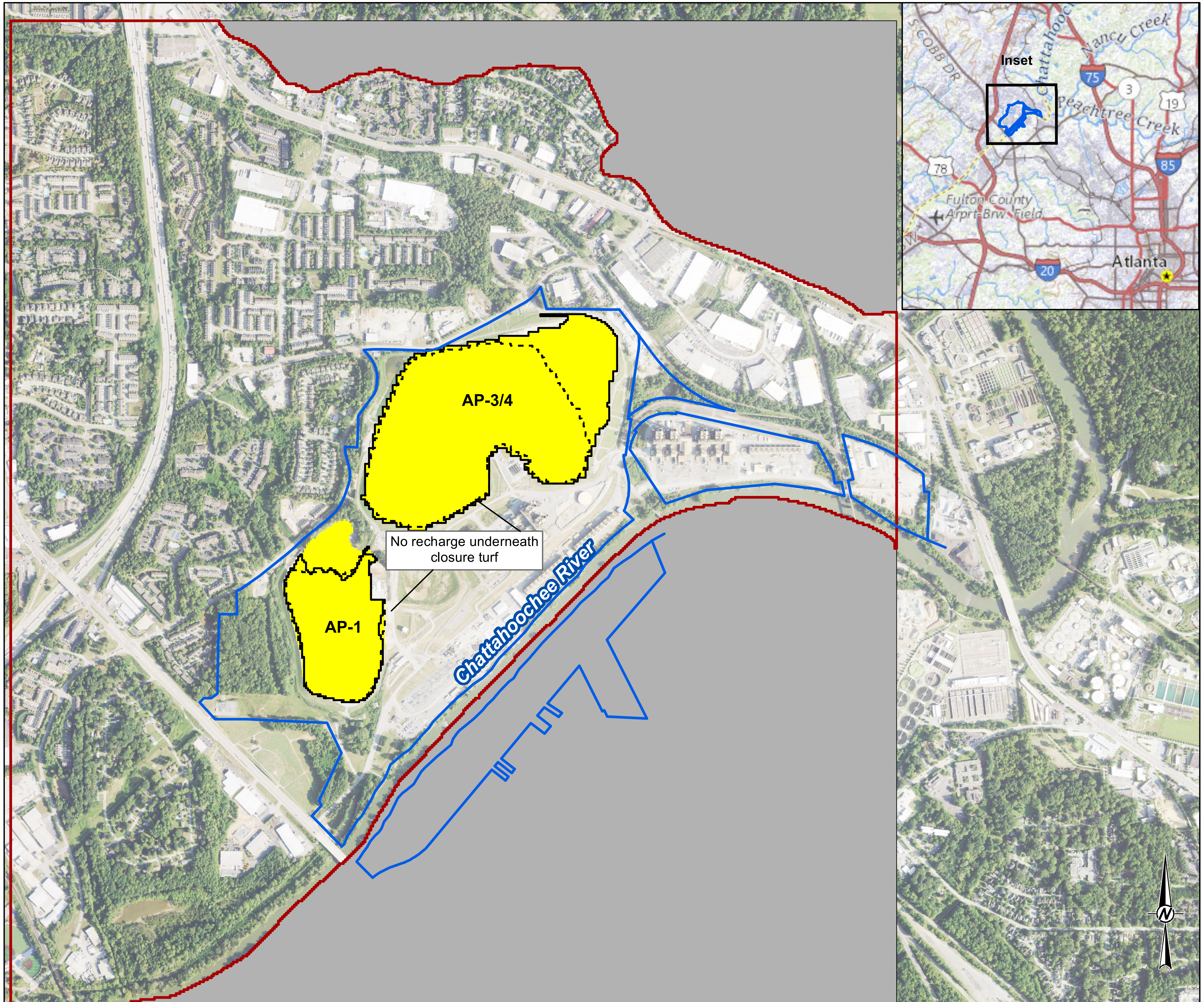
**PRE-CLOSURE MODEL RECHARGE ZONES**

CONSULTANT

wsp

| | |
|---|---|
| YYYY-MM-DD | 2023-05-19 |
| DESIGNED | SJS |
| PREPARED | AFS |
| CHECKED | CB |
| REVIEWED / APPROVED | GLH |

| PROJECT NO. | SCS PROJECT ID | REV. | FIGURE |
|---|---|---|---|
| GL1777449-03 | MCD150170 | 0 | 2-6 |




**LEGEND**

Property Boundary

Limits of Closure Turf

Extent of CCR Post Closure

**Model Domain**

Active cells

Unused cells

**Closure Model Recharge Zones**

No recharge (0 in/yr)

Recharge in remaining model domain: 2.41 in/yr

0 1,000 2,000 3,000

Feet

1 in = 1,000 feet

**NOTE(S)**

1. CCR = COAL COMBUSTION RESIDUALS.

**REFERENCE(S)**

1. AERIAL IMAGERY FROM NAIP DATASET, DATED 2019-09-10 THROUGH 2019-10-04.
2. INSET BASEMAP FROM USGS THE NATIONAL MAP: NATIONAL BOUNDARIES DATASET, 3DEP ELEVATION PROGRAM, GEOGRAPHIC NAMES INFORMATION SYSTEM, NATIONAL HYDROGRAPHY DATASET, NATIONAL LAND COVER DATABASE, NATIONAL STRUCTURES DATASET, AND NATIONAL TRANSPORTATION DATASET; USGS GLOBAL ECOSYSTEMS; U.S. CENSUS BUREAU TIGER/LINE DATA; USFS ROAD DATA; NATURAL EARTH DATA; U.S. DEPARTMENT OF STATE HUMANITARIAN INFORMATION UNIT; AND NOAA NATIONAL CENTERS FOR ENVIRONMENTAL INFORMATION, U.S. COASTAL RELIEF MODEL. DATA REFRESHED AUGUST, 2021.

CLIENT

GEORGIA POWER COMPANY
SOUTHERN COMPANY SERVICES

PROJECT

ADVANCED ENGINEERING METHODS FEASIBILITY REPORT, PLANT MCDONOUGH ASH POND 3 AND ASH POND 4 (AP-3/4)

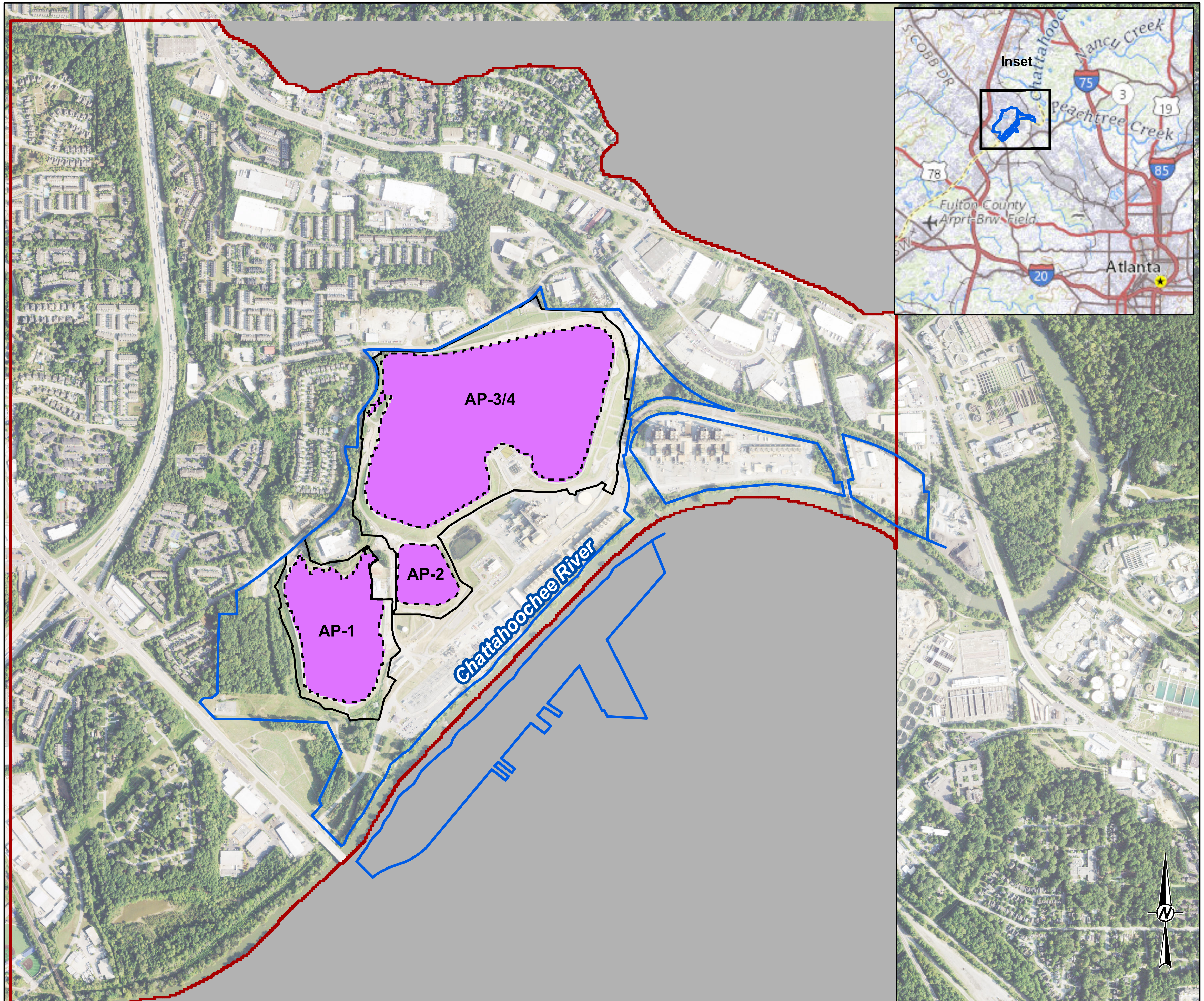
TITLE

**CLOSURE MODEL RECHARGE ZONES**

CONSULTANT

| | |
|---|---|
| YYYY-MM-DD | 2023-05-19 |
| DESIGNED | SJS |
| PREPARED | AFS |
| CHECKED | CB |
| REVIEWED / APPROVED | GLH |

| PROJECT NO. | SCS PROJECT ID | REV. | FIGURE |
|---|---|---|---|
| GL1777449-03 | MCD150170 | 0 | 2-7 |




**LEGEND**

- Property Boundary
- Permitted Closure Extent
- Pre-Closure CCR Extents

**Model Domain**

- Active cells
- Unused cells

**Layer 1 Hydraulic Conductivity**

- CCR: Kx = 0.55 ft/d, Ky = 0.55 ft/d

**Other model layers (not depicted)**

Layer 2 (residuum-saprolite): Kx = 0.7 ft/d, Ky = 0.7 ft/d

Layer 3 (partially weathered rock): Kx = 0.2 ft/d, Ky = 0.2 ft/d

Layer 4 (bedrock): Kx = 0.016 ft/d, Ky = 0.016 ft/d

0 1,000 2,000 3,000
1 in = 1,000 feet Feet

**NOTE(S)**

1. CCR = COAL COMBUSTION RESIDUALS.
2. NAVD 88 = NORTH AMERICAN VERTICAL DATUM OF 1988.

**REFERENCE(S)**

1. AERIAL IMAGERY FROM NAIP DATASET, DATED 2019-09-10 THROUGH 2019-10-04.
2. INSET BASEMAP FROM USGS THE NATIONAL MAP: NATIONAL BOUNDARIES DATASET, 3DEP ELEVATION PROGRAM, GEOGRAPHIC NAMES INFORMATION SYSTEM, NATIONAL HYDROGRAPHY DATASET, NATIONAL LAND COVER DATABASE, NATIONAL STRUCTURES DATASET, AND NATIONAL TRANSPORTATION DATASET; USGS GLOBAL ECOSYSTEMS; U.S. CENSUS BUREAU TIGER/LINE DATA; USFS ROAD DATA; NATURAL EARTH DATA; U.S. DEPARTMENT OF STATE HUMANITARIAN INFORMATION UNIT; AND NOAA NATIONAL CENTERS FOR ENVIRONMENTAL INFORMATION, U.S. COASTAL RELIEF MODEL. DATA REFRESHED AUGUST, 2021.

CLIENT
GEORGIA POWER COMPANY
SOUTHERN COMPANY SERVICES

PROJECT
ADVANCED ENGINEERING METHODS FEASIBILITY REPORT,
PLANT MCDONOUGH ASH POND 3 AND ASH POND 4 (AP-3/4)

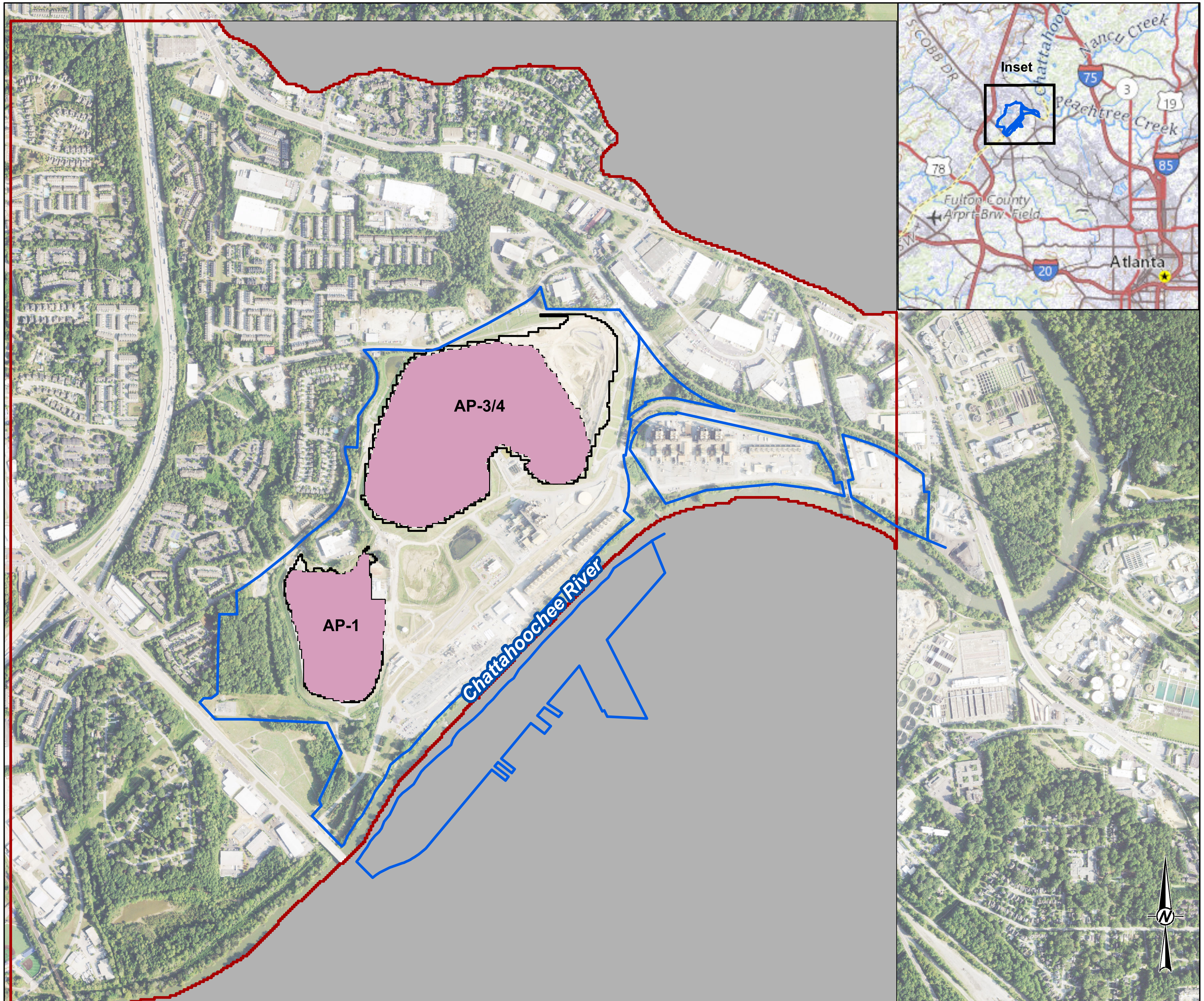
TITLE
**PRE-CLOSURE MODEL HYDRAULIC CONDUCTIVITY ZONES**

CONSULTANT

wsp

| | |
|---|---|
| YYYY-MM-DD | 2023-05-19 |
| DESIGNED | SJS |
| PREPARED | AFS |
| CHECKED | CB |
| REVIEWED / APPROVED | GLH |

| PROJECT NO. | SCS PROJECT ID | REV. | FIGURE |
|---|---|---|---|
| GL1777449-03 | MCD150170 | 0 | 2-8 |




**LEGEND**

- Property Boundary
- Limits of Closure Turf
- Extent of CCR

**Model Domain**

- Active cells
- Unused cells

**Layer 1 Hydraulic Conductivity**

- CCR: Kx = 0.55 ft/d, Ky = 0.55 ft/d

**Other model layers (not depicted)**

Layer 2 (residuum-saprolite): Kx = 0.70 ft/d, Ky = 0.70 ft/d

Layer 3 (partially weathered rock): Kx = 0.20 ft/d, Ky = 0.20 ft/d

Layer 4 (bedrock): Kx = 0.16 ft/d, Ky = 0.16 ft/d

0 1,000 2,000 3,000

1 in = 1,000 feet Feet

**NOTE(S)**

1. CCR = COAL COMBUSTION RESIDUALS.

**REFERENCE(S)**

1. AERIAL IMAGERY FROM NAIP DATASET, DATED 2019-09-10 THROUGH 2019-10-04.
2. INSET BASEMAP FROM USGS THE NATIONAL MAP: NATIONAL BOUNDARIES DATASET, 3DEP ELEVATION PROGRAM, GEOGRAPHIC NAMES INFORMATION SYSTEM, NATIONAL HYDROGRAPHY DATASET, NATIONAL LAND COVER DATABASE, NATIONAL STRUCTURES DATASET, AND NATIONAL TRANSPORTATION DATASET; USGS GLOBAL ECOSYSTEMS; U.S. CENSUS BUREAU TIGER/LINE DATA; USFS ROAD DATA; NATURAL EARTH DATA; U.S. DEPARTMENT OF STATE HUMANITARIAN INFORMATION UNIT; AND NOAA NATIONAL CENTERS FOR ENVIRONMENTAL INFORMATION, U.S. COASTAL RELIEF MODEL. DATA REFRESHED AUGUST, 2021.

CLIENT

GEORGIA POWER COMPANY
SOUTHERN COMPANY SERVICES

PROJECT

ADVANCED ENGINEERING METHODS FEASIBILITY REPORT, PLANT MCDONOUGH ASH POND 3 AND ASH POND 4 (AP-3/4)

TITLE

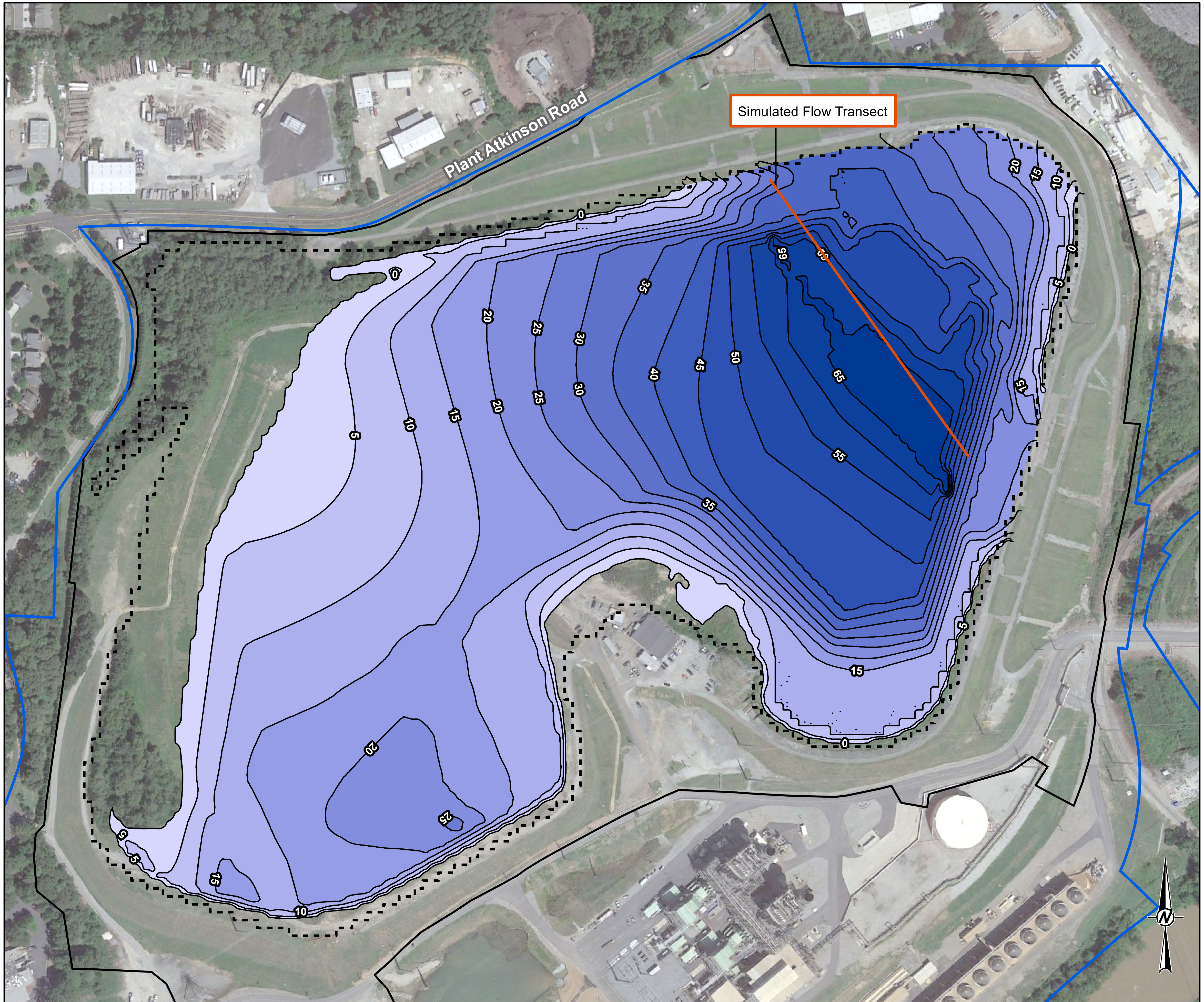
**CLOSURE MODEL HYDRAULIC CONDUCTIVITY ZONES**

CONSULTANT

wsp

| | |
|---|---|
| YYYY-MM-DD | 2023-05-19 |
| DESIGNED | SJS |
| PREPARED | AFS |
| CHECKED | CB |
| REVIEWED / APPROVED | GLH |

| PROJECT NO. | SCS PROJECT ID | REV. | FIGURE |
|---|---|---|---|
| GL1777449-03 | MCD150170 | 0 | 2-9 |




**LEGEND**

- Property Boundary
- Simulated Flow Transect
- Permitted Closure Extent
- Pre-Closure CCR Extent

**Thickness of CCR Below Potentiometric Surface (ft)**

- >0 - 5
- 5 - 10
- 10 - 15
- 15 - 20
- 20 - 25
- 25 - 30
- 30 - 35
- 35 - 40
- 40 - 45
- 45 - 50
- 50 - 55
- 55 - 60
- 60 - 65
- 65 - 70.1

0 250 500 750

1 in = 250 feet Feet

**NOTE(S)**

1. FINAL CLOSURE CONTOURS AND CLOSURE CONTOURS OUTSIDE FINAL LIMITS OF CCR OBTAINED FROM DRAWING TITLED AP-3/4 FINAL COVER ARMORING DELINEATION PLAN, REV. 0 OF THE PLANT MCDONOUGH-ATKINSON ASH POND 3 AND ASH POND 4 (AP-3/4) CLOSURE AND ASH POND 2 (AP-2) CLOSURE, SHEET 7 DATED NOVEMBER 2021.
2. CCR = COAL COMBUSTION RESIDUALS.
3. NAVD88 = NORTH AMERICAN VERTICAL DATUM OF 1988.

**REFERENCE(S)**

1. AERIAL IMAGERY FROM GOOGLE EARTH DATED 2021-10-22.

CLIENT
GEORGIA POWER COMPANY
SOUTHERN COMPANY SERVICES

PROJECT
ADVANCED ENGINEERING METHODS FEASIBILITY REPORT, PLANT MCDONOUGH ASH POND 3 AND ASH POND 4 (AP-3/4)

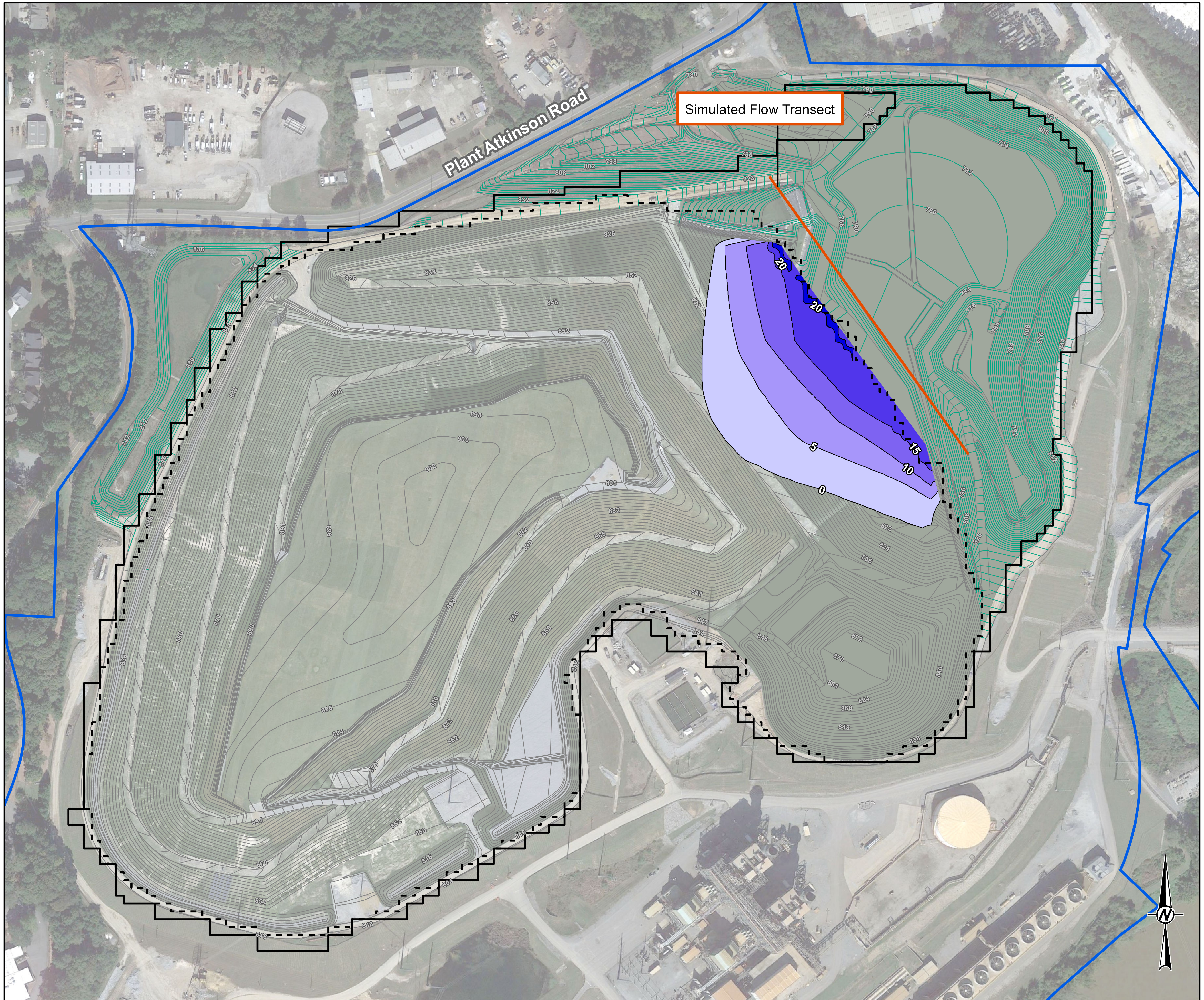
TITLE
**AP-3/4 SCENARIO 0: PRE-CLOSURE (CIRCA JAN 2016) CONDITIONS**

CONSULTANT

| | |
|---|---|
| YYYY-MM-DD | 2023-05-22 |
| DESIGNED | SJS |
| PREPARED | AFS |
| CHECKED | CB |
| REVIEWED / APPROVED | GLH |

| PROJECT NO. | SCS PROJECT ID | REV. | FIGURE |
|---|---|---|---|
| GL1777449-03 | MCD150170 | 0 | 3-1 |

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B




LEGEND

- Property Boundary
- Limits of Closure Turf
- Final Closure Contours (ft NAVD88)
- Closure Contours Outside Final Limits of CCR (ft NAVD 88)
- Simulated Flow Transect
- Extent of CCR Post Closure

**Thickness of CCR Below Potentiometric Surface (ft)**

- >0 - 5
- 5 - 10
- 10 - 15
- 15 - 20
- 20 - 21.3

0 250 500 750

1 in = 250 feet Feet

NOTE(S)
1. FINAL CLOSURE CONTOURS AND CLOSURE CONTOURS OUTSIDE FINAL LIMITS OF CCR OBTAINED FROM DRAWING TITLED AP-3/4 FINAL COVER ARMORING DELINEATION PLAN, REV. 0 OF THE PLANT MCDONOUGH-ATKINSON ASH POND 3 AND ASH POND 4 (AP-3/4) CLOSURE AND ASH POND 2 (AP-2) CLOSURE, SHEET 7 DATED NOVEMBER 2021.
2. CCR = COAL COMBUSTION RESIDUALS.
3. NAVD88 = NORTH AMERICAN VERTICAL DATUM OF 1988.

REFERENCE(S)
1. AERIAL IMAGERY FROM GOOGLE EARTH DATED 2021-10-22.

CLIENT
GEORGIA POWER COMPANY
SOUTHERN COMPANY SERVICES

PROJECT
ADVANCED ENGINEERING METHODS FEASIBILITY REPORT, PLANT MCDONOUGH ASH POND 3 AND ASH POND 4 (AP-3/4)

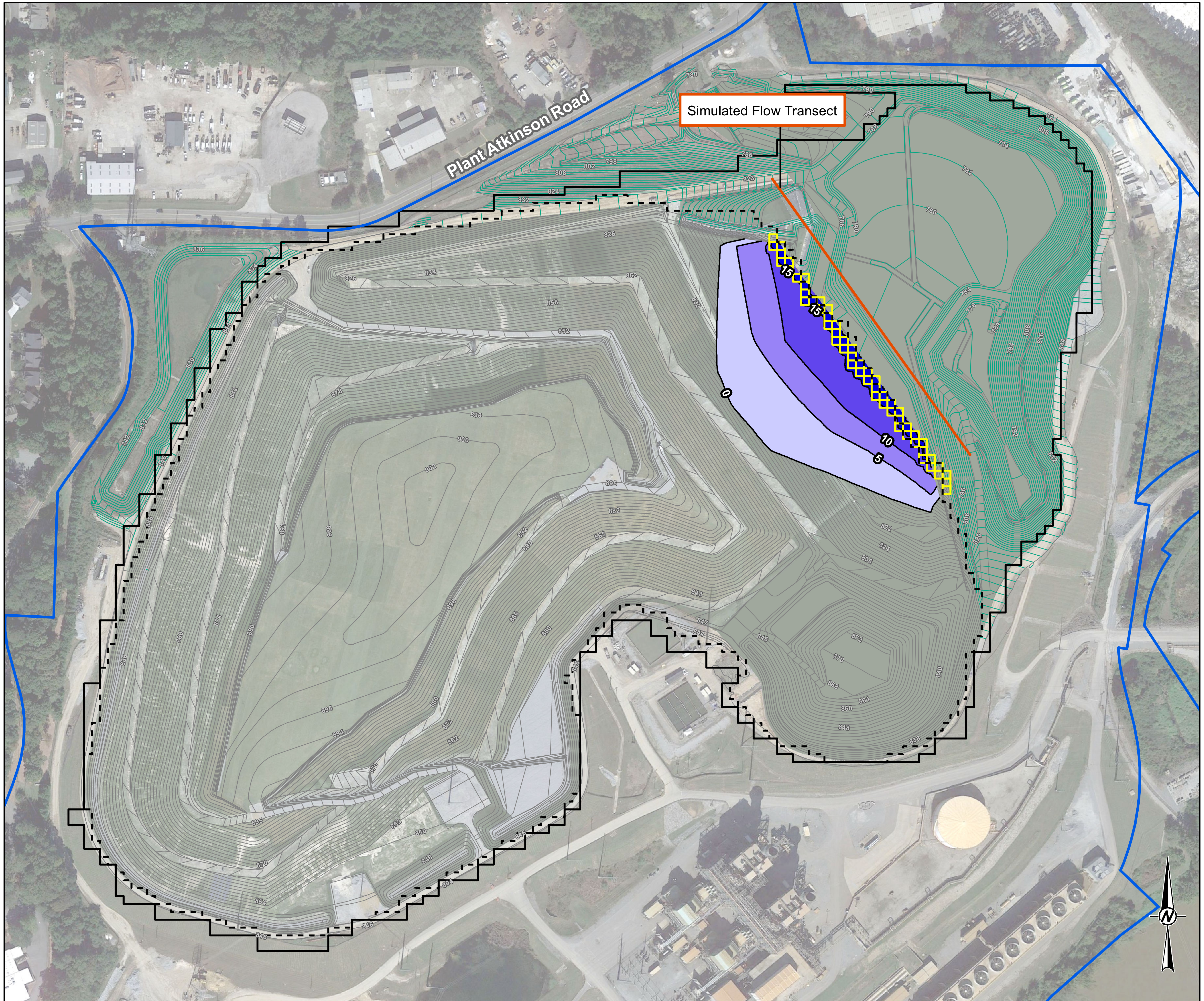
TITLE
**AP-3/4 SCENARIO 1: BASELINE CAP GEOMETRY, WITHOUT THE AP3/4 UNDERDRAIN**

CONSULTANT

| | |
|---|---|
| YYYY-MM-DD | 2023-05-22 |
| DESIGNED | SJS |
| PREPARED | AFS |
| CHECKED | CB |
| REVIEWED / APPROVED | GLH |

| PROJECT NO. | SCS PROJECT ID | REV. | FIGURE |
|---|---|---|---|
| GL1777449-03 | MCD150170 | 0 | 3-2 |

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B




**LEGEND**

- Property Boundary
- Limits of Closure Turf
- Final Closure Contours (ft NAVD88)
- Closure Contours Outside Final Limits of CCR (ft NAVD 88)
- Simulated Flow Transect
- Underdrain
- Extent of CCR Post Closure

**Thickness of CCR Below Potentiometric Surface (ft)**

- >0 - 5
- 5 - 10
- 10 - 15
- 15 - 17.5

0 250 500 750
1 in = 250 feet
Feet

NOTE(S)
1. FINAL CLOSURE CONTOURS AND CLOSURE CONTOURS OUTSIDE FINAL LIMITS OF CCR OBTAINED FROM DRAWING TITLED AP-3/4 FINAL COVER ARMORING DELINEATION PLAN, REV. 0 OF THE PLANT MCDONOUGH-ATKINSON ASH POND 3 AND ASH POND 4 (AP-3/4) CLOSURE AND ASH POND 2 (AP-2) CLOSURE, SHEET 7 DATED NOVEMBER 2021.
2. CCR = COAL COMBUSTION RESIDUALS.
3. NAVD88 = NORTH AMERICAN VERTICAL DATUM OF 1988.

REFERENCE(S)
1. AERIAL IMAGERY FROM GOOGLE EARTH DATED 2021-10-22.

CLIENT
GEORGIA POWER COMPANY
SOUTHERN COMPANY SERVICES

PROJECT
ADVANCED ENGINEERING METHODS FEASIBILITY REPORT, PLANT MCDONOUGH ASH POND 3 AND ASH POND 4 (AP-3/4)

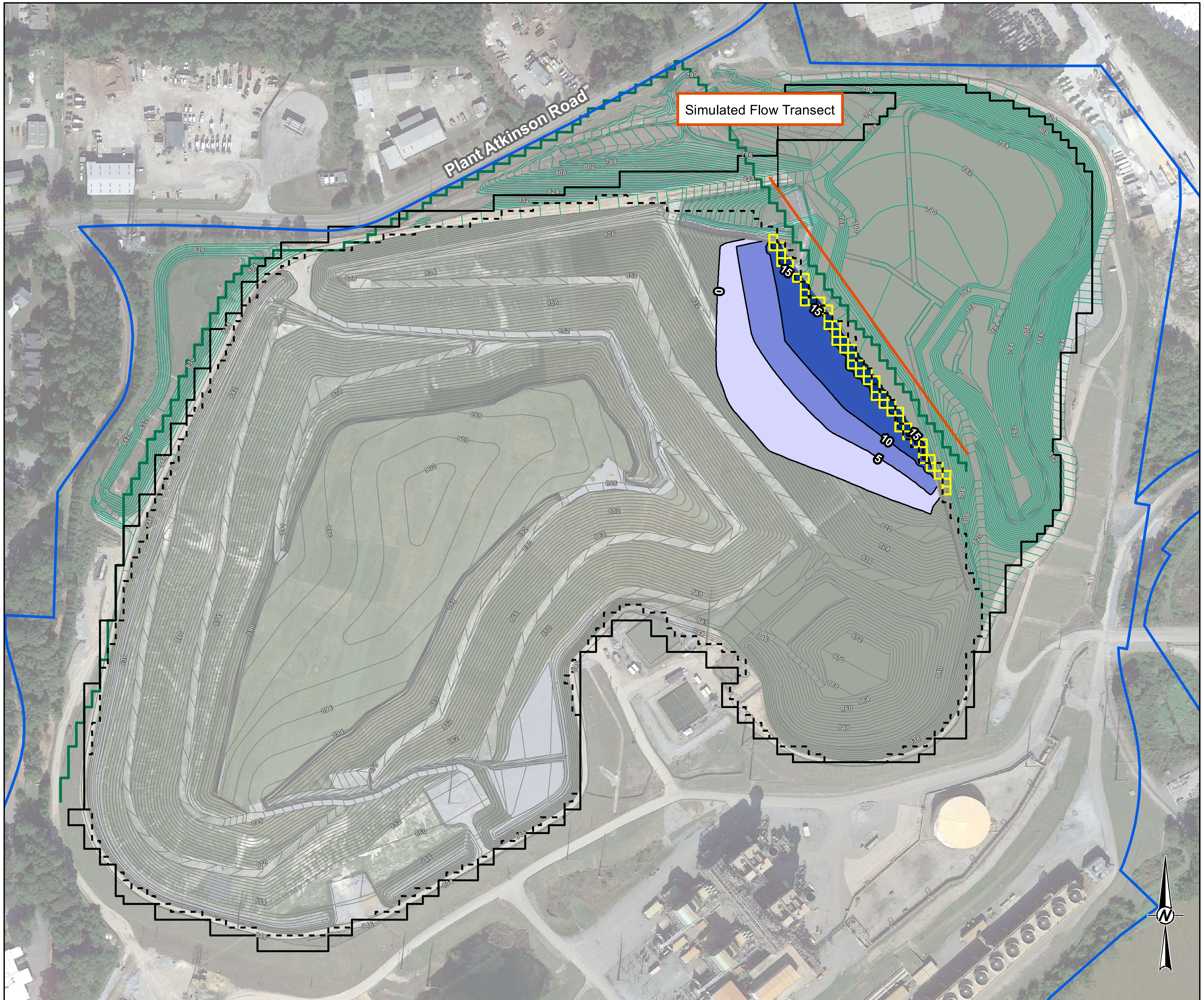
TITLE
**AP-3/4 SCENARIO 2: BASELINE CAP GEOMETRY, WITH THE AP3/4 UNDERDRAIN**

CONSULTANT

| | |
|---|---|
| YYYY-MM-DD | 2023-05-22 |
| DESIGNED | SJS |
| PREPARED | SJS |
| CHECKED | CB |
| REVIEWED / APPROVED | GLH |

| PROJECT NO. | SCS PROJECT ID | REV. | FIGURE |
|---|---|---|---|
| GL1777449-03 | MCD150170 | 0 | 3-3 |

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B




**LEGEND**

- Property Boundary
- Limits of Closure Turf
- Hydraulic barrier wall
- Final Closure Contours (ft NAVD88)
- Simulated Flow Transect
- Closure Contours Outside Final Limits of CCR (ft NAVD 88)
- Extent of CCR Post Closure
- Underdrain

**Thickness of CCR Below Potentiometric Surface (ft)**

- 0 - 5
- 5 - 10
- 10 - 15
- 15 - 17.3

0 250 500 750
1 in = 250 feet
Feet

**NOTE(S)**

1. FINAL CLOSURE CONTOURS AND CLOSURE CONTOURS OUTSIDE FINAL LIMITS OF CCR OBTAINED FROM DRAWING TITLED AP-3/4 FINAL COVER ARMORING DELINEATION PLAN, REV. 0 OF THE PLANT MCDONOUGH-ATKINSON ASH POND 3 AND ASH POND 4 (AP-3/4) CLOSURE AND ASH POND 2 (AP-2) CLOSURE, SHEET 7 DATED NOVEMBER 2021.
2. CCR = COAL COMBUSTION RESIDUALS.
3. NAVD88 = NORTH AMERICAN VERTICAL DATUM OF 1988.

**REFERENCE(S)**

1. AERIAL IMAGERY FROM GOOGLE EARTH DATED 2021-10-22.

CLIENT
GEORGIA POWER COMPANY
SOUTHERN COMPANY SERVICES

PROJECT
ADVANCED ENGINEERING METHODS FEASIBILITY REPORT, PLANT MCDONOUGH ASH POND 3 AND ASH POND 4 (AP-3/4)

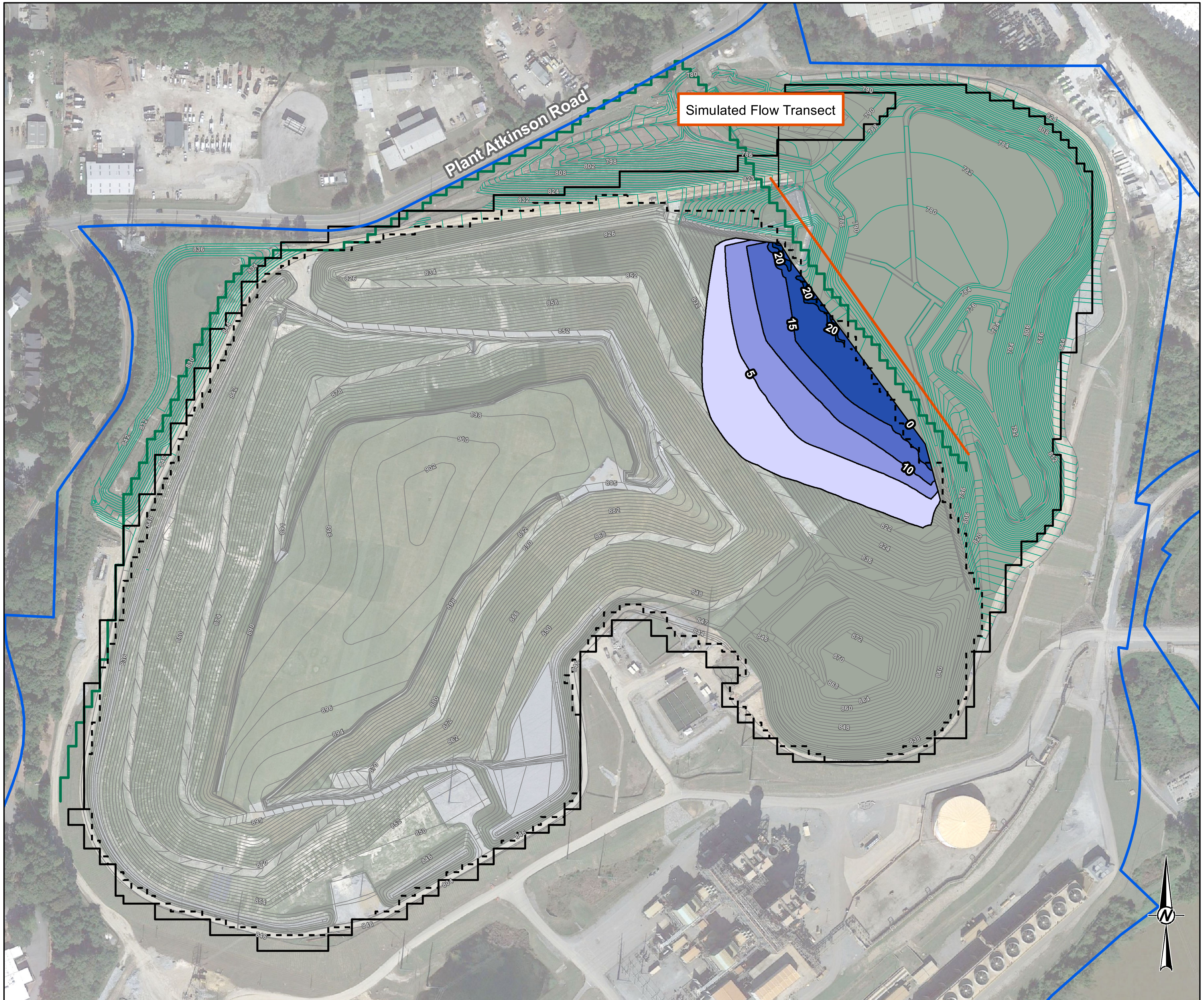
TITLE
**AP-3/4 SCENARIO 3: SHALLOW UPGRADIENT BARRIER WALL, WITH THE AP3/4 UNDERDRAIN**

CONSULTANT
wsp

| | |
|---|---|
| YYYY-MM-DD | 2023-05-22 |
| DESIGNED | SJS |
| PREPARED | AFS |
| CHECKED | CB |
| REVIEWED / APPROVED | GLH |

| PROJECT NO. | SCS PROJECT ID | REV. | FIGURE |
|---|---|---|---|
| GL1777449-03 | MCD150170 | 0 | 3-4 |

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B




**LEGEND**

- Property Boundary
- Limits of Closure Turf
- Final Closure Contours (ft NAVD88)
- Closure Contours Outside Final Limits of CCR (ft NAVD 88)
- Simulated Flow Transect
- Hydraulic Barrier Wall
- Extent of CCR Post Closure

**Thickness of CCR Below Potentiometric Surface (ft)**

- >0 - 5
- 5 - 10
- 10 - 15
- 15 - 20
- 20 - 21.0

0 250 500 750

1 in = 250 feet

Feet

**NOTE(S)**

1. FINAL CLOSURE CONTOURS AND CLOSURE CONTOURS OUTSIDE FINAL LIMITS OF CCR OBTAINED FROM DRAWING TITLED AP-3/4 FINAL COVER ARMORING DELINEATION PLAN, REV. 0 OF THE PLANT MCDONOUGH-ATKINSON ASH POND 3 AND ASH POND 4 (AP-3/4) CLOSURE AND ASH POND 2 (AP-2) CLOSURE, SHEET 7 DATED NOVEMBER 2021.
2. CCR = COAL COMBUSTION RESIDUALS.
3. NAVD88 = NORTH AMERICAN VERTICAL DATUM OF 1988.

**REFERENCE(S)**

1. AERIAL IMAGERY FROM GOOGLE EARTH DATED 2021-10-22.

CLIENT

GEORGIA POWER COMPANY
SOUTHERN COMPANY SERVICES

PROJECT

ADVANCED ENGINEERING METHODS FEASIBILITY REPORT, PLANT MCDONOUGH ASH POND 3 AND ASH POND 4 (AP-3/4)

TITLE

**AP-3/4 SCENARIO 4: SHALLOW UPGRADIENT BARRIER WALL, WITHOUT THE AP3/4 UNDERDRAIN**

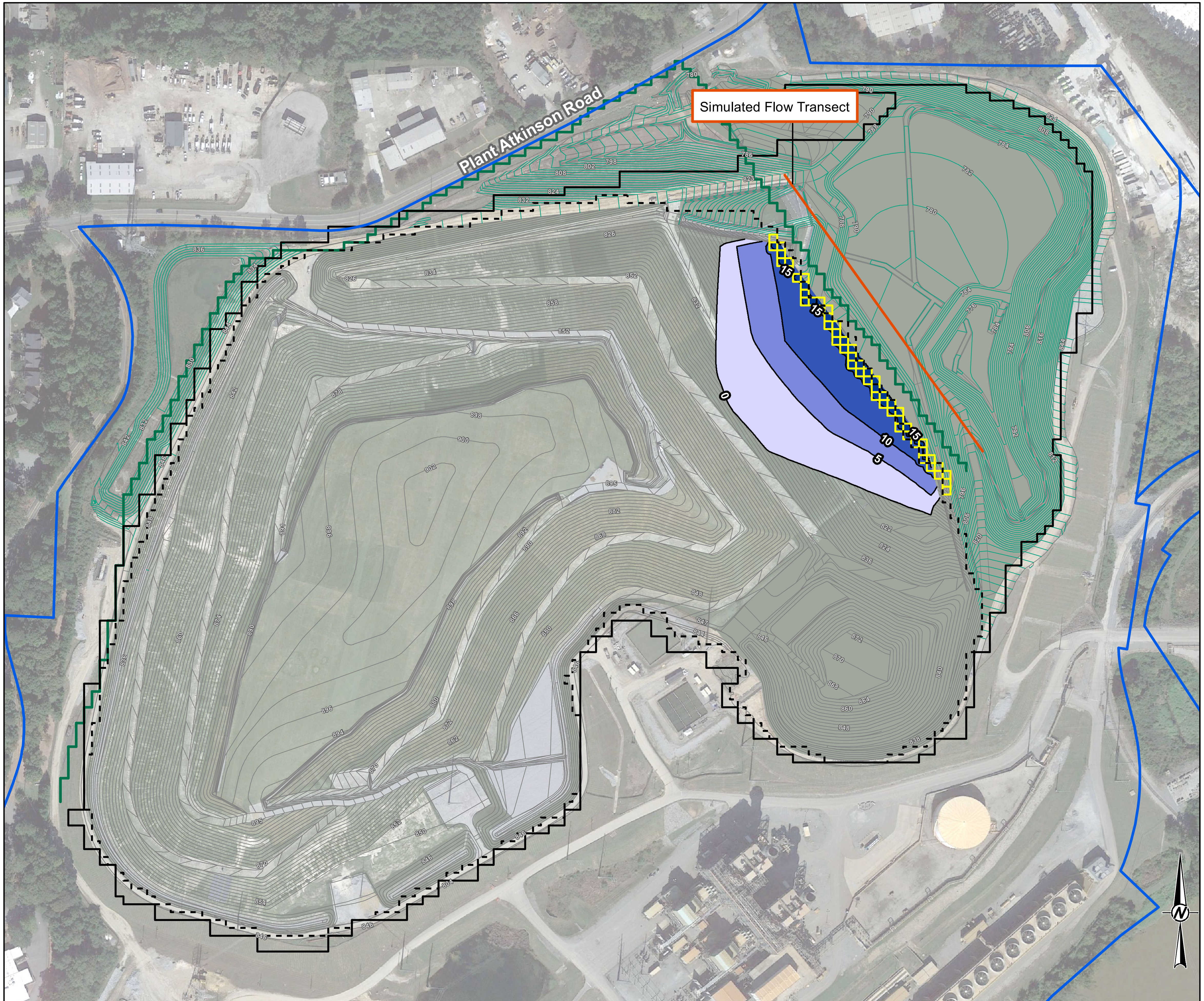
CONSULTANT

wsp

| | |
|---|---|
| YYYY-MM-DD | 2023-05-22 |
| DESIGNED | SJS |
| PREPARED | AFS |
| CHECKED | CB |
| REVIEWED / APPROVED | GLH |

| PROJECT NO. | SCS PROJECT ID | REV. | FIGURE |
|---|---|---|---|
| GL1777449-03 | MCD150170 | 0 | 3-5 |

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B




**LEGEND**

- Property Boundary
- Limits of Closure Turf
- Final Closure Contours (ft NAVD88)
- Simulated Flow Transect
- Closure Contours Outside Final Limits of CCR (ft NAVD 88)
- Extent of CCR Post Closure

**Thickness of CCR Below Potentiometric Surface (ft)**

- >0 - 5
- 5 - 10
- 10 - 15
- 15 - 17.2

0 250 500 750

1 in = 250 feet

Feet

NOTE(S)
1. FINAL CLOSURE CONTOURS AND CLOSURE CONTOURS OUTSIDE FINAL LIMITS OF CCR OBTAINED FROM DRAWING TITLED AP-3/4 FINAL COVER ARMORING DELINEATION PLAN, REV. 0 OF THE PLANT MCDONOUGH-ATKINSON ASH POND 3 AND ASH POND 4 (AP-3/4) CLOSURE AND ASH POND 2 (AP-2) CLOSURE, SHEET 7 DATED NOVEMBER 2021.
2. CCR = COAL COMBUSTION RESIDUALS.
3. NAVD88 = NORTH AMERICAN VERTICAL DATUM OF 1988.

REFERENCE(S)
1. AERIAL IMAGERY FROM GOOGLE EARTH DATED 2021-10-22.

CLIENT
GEORGIA POWER COMPANY
SOUTHERN COMPANY SERVICES

PROJECT
ADVANCED ENGINEERING METHODS FEASIBILITY REPORT, PLANT MCDONOUGH ASH POND 3 AND ASH POND 4 (AP-3/4)

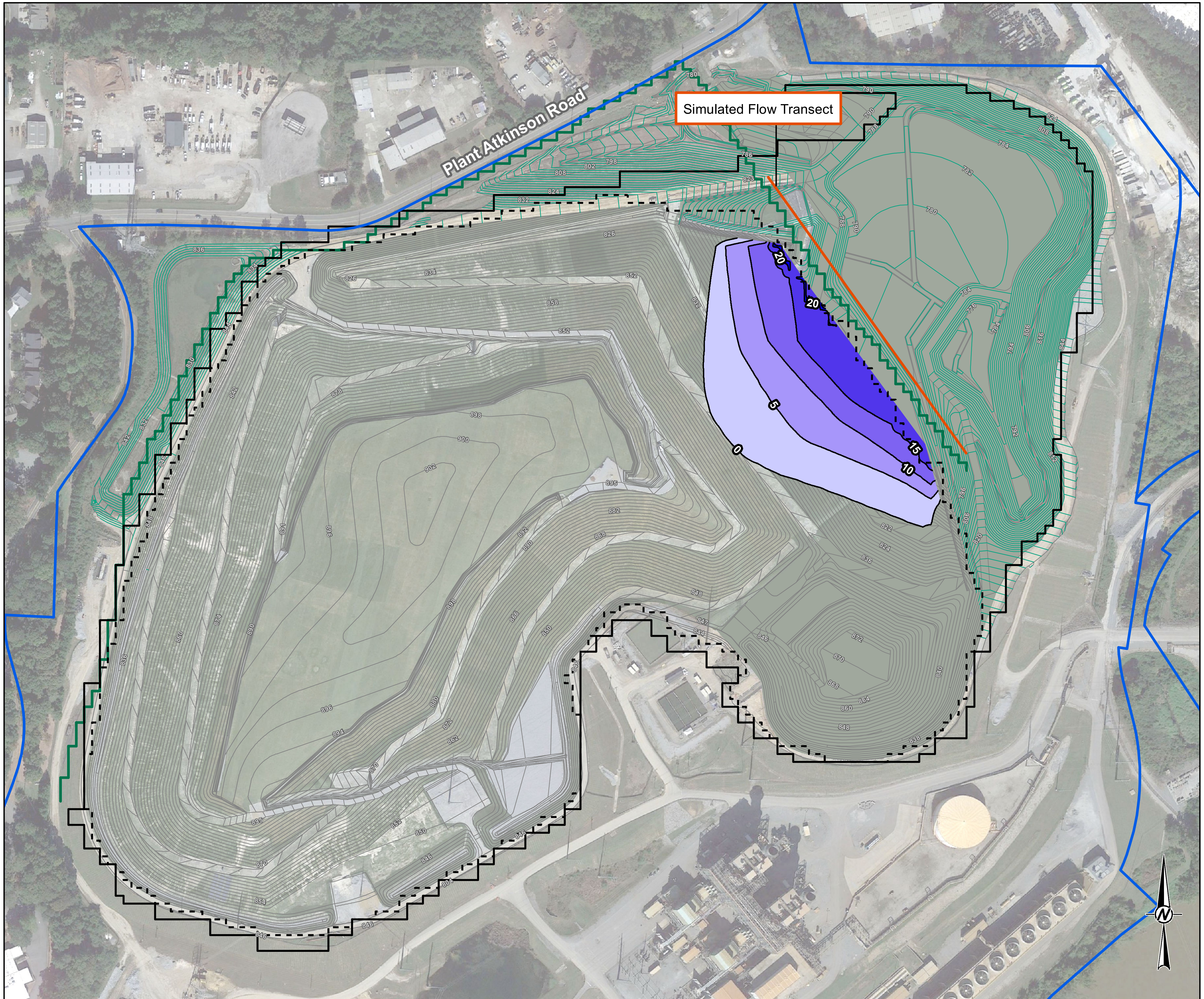
TITLE
**AP-3/4 SCENARIO 5: DEEP UPGRADIENT BARRIER WALL, WITH THE AP3/4 UNDERDRAIN**

CONSULTANT

| | |
|---|---|
| YYYY-MM-DD | 2023-05-22 |
| DESIGNED | SJS |
| PREPARED | AFS |
| CHECKED | CB |
| REVIEWED / APPROVED | GLH |

| PROJECT NO. | SCS PROJECT ID | REV. | FIGURE |
|---|---|---|---|
| GL1777449-03 | MCD150170 | 0 | 3-6 |

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B




**LEGEND**

- Property Boundary
- Limits of Closure Turf
- Final Closure Contours (ft NAVD88)
- Closure Contours Outside Final Limits of CCR (ft NAVD 88)
- Hydraulic barrier wall
- Simulated Flow Transect
- Extent of CCR Post Closure

**Thickness of CCR Below Potentiometric Surface (ft)**

- >0 - 5
- 5 - 10
- 10 - 15
- 15 - 20
- 20 - 20.6

0 250 500 750

1 in = 250 feet

Feet

**NOTE(S)**

1. FINAL CLOSURE CONTOURS AND CLOSURE CONTOURS OUTSIDE FINAL LIMITS OF CCR OBTAINED FROM DRAWING TITLED AP-3/4 FINAL COVER ARMORING DELINEATION PLAN, REV. 0 OF THE PLANT MCDONOUGH-ATKINSON ASH POND 3 AND ASH POND 4 (AP-3/4) CLOSURE AND ASH POND 2 (AP-2) CLOSURE, SHEET 7 DATED NOVEMBER 2021.
2. CCR = COAL COMBUSTION RESIDUALS.
3. NAVD88 = NORTH AMERICAN VERTICAL DATUM OF 1988.

**REFERENCE(S)**

1. AERIAL IMAGERY FROM GOOGLE EARTH DATED 2021-10-22.

CLIENT
GEORGIA POWER COMPANY
SOUTHERN COMPANY SERVICES

PROJECT
ADVANCED ENGINEERING METHODS FEASIBILITY REPORT, PLANT MCDONOUGH ASH POND 3 AND ASH POND 4 (AP-3/4)

TITLE
**AP-3/4 SCENARIO 6: DEEP UPGRADIENT BARRIER WALL, WITHOUT THE AP3/4 UNDERDRAIN**

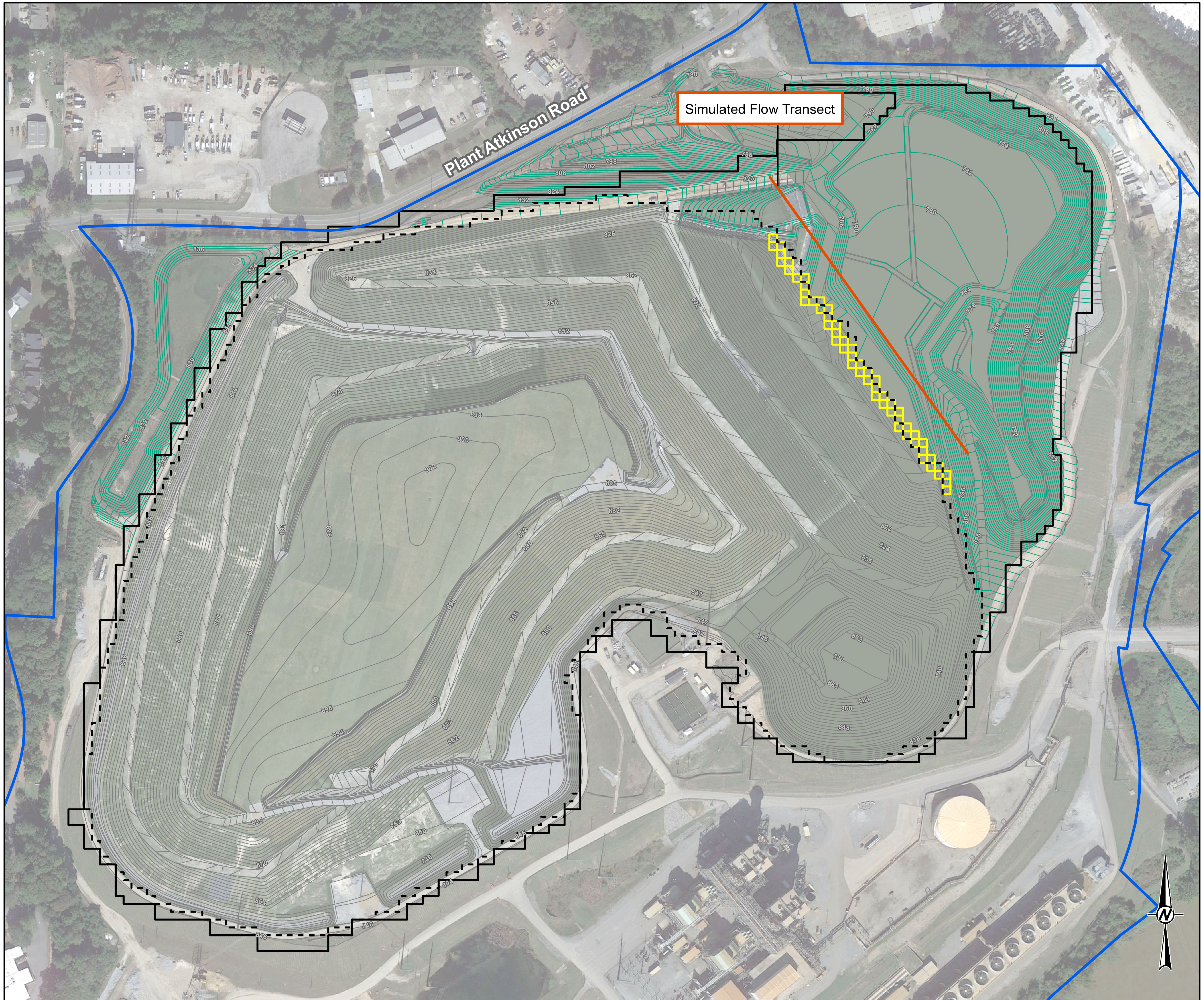
CONSULTANT

wsp

| | |
|---|---|
| YYYY-MM-DD | 2023-05-22 |
| DESIGNED | SJS |
| PREPARED | AFS |
| CHECKED | CB |
| REVIEWED / APPROVED | GLH |

| PROJECT NO. | SCS PROJECT ID | REV. | FIGURE |
|---|---|---|---|
| GL1777449-03 | MCD150170 | 0 | 3-7 |

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B




**LEGEND**

- Property Boundary
- Limits of Closure Turf
- Extent of CCR Post Closure
- Final Closure Contours (ft NAVD88)
- Closure Contours Outside Final Limits of CCR (ft NAVD 88)
- Simulated Flow Transect
- Underdrain

0 250 500 750
1 in = 250 feet
Feet

**NOTE(S)**

1. FINAL CLOSURE CONTOURS AND CLOSURE CONTOURS OUTSIDE FINAL LIMITS OF CCR OBTAINED FROM DRAWING TITLED AP-3/4 FINAL COVER ARMORING DELINEATION PLAN, REV. 0 OF THE PLANT MCDONOUGH-ATKINSON ASH POND 3 AND ASH POND 4 (AP-3/4) CLOSURE AND ASH POND 2 (AP-2) CLOSURE, SHEET 7 DATED NOVEMBER 2021.
2. CCR = COAL COMBUSTION RESIDUALS.
3. NAVD88 = NORTH AMERICAN VERTICAL DATUM OF 1988.
4. ENHANCED UNDERDRAIN (765 FT TO 760 FT NAVD88) PROMOTES EFFECTIVE DESATURATION.

**REFERENCE(S)**

1. AERIAL IMAGERY FROM GOOGLE EARTH DATED 2021-10-22.

CLIENT
GEORGIA POWER COMPANY
SOUTHERN COMPANY SERVICES

PROJECT
ADVANCED ENGINEERING METHODS FEASIBILITY REPORT, PLANT MCDONOUGH ASH POND 3 AND ASH POND 4 (AP-3/4)

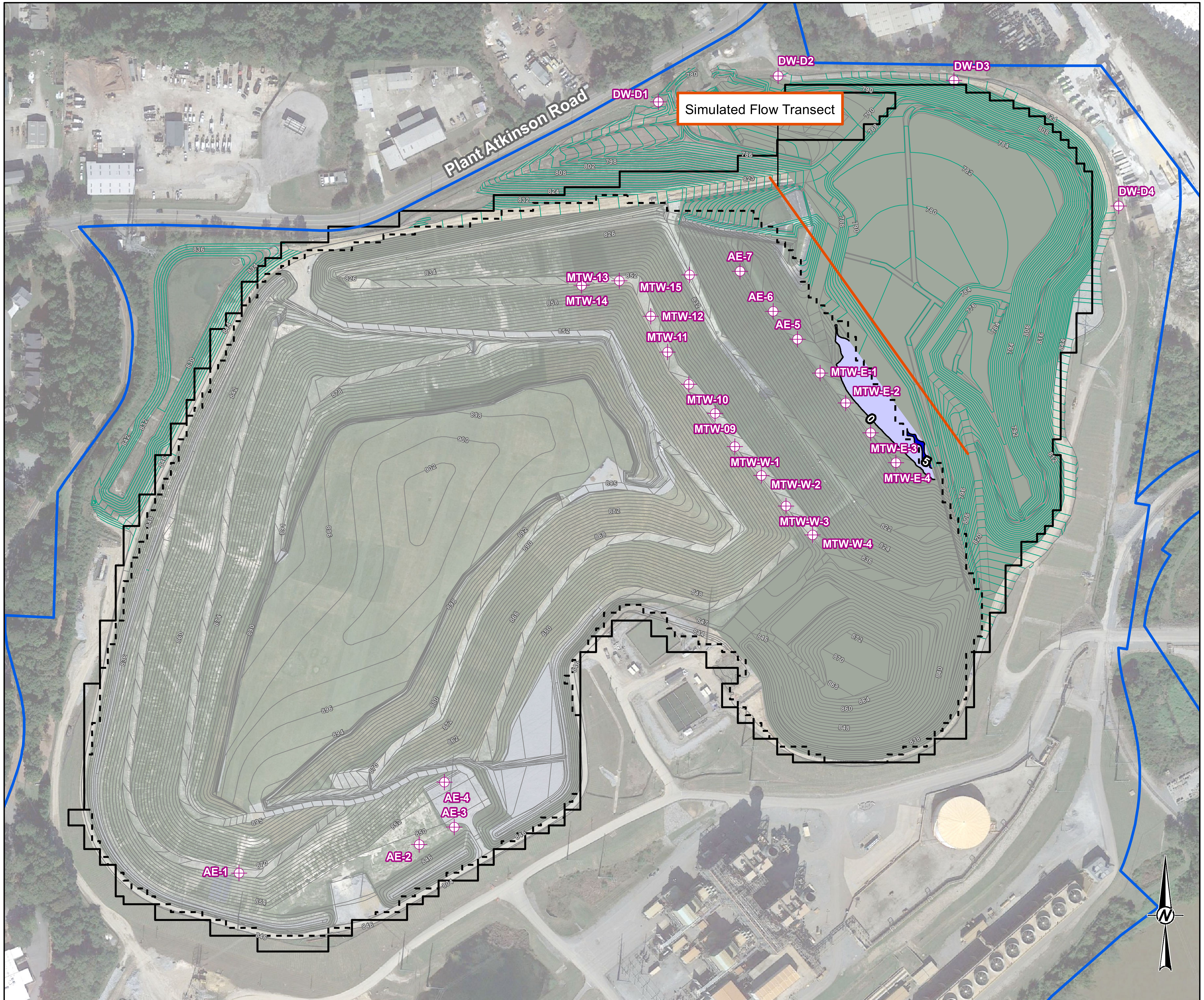
TITLE
**AP-3/4 SCENARIO 7: BASELINE CAP GEOMETRY, WITH ENHANCED AP-3/4 UNDERDRAIN**

CONSULTANT

| | |
|---|---|
| YYYY-MM-DD | 2023-05-22 |
| DESIGNED | SJS |
| PREPARED | AFS |
| CHECKED | CB |
| REVIEWED / APPROVED | GLH |

| PROJECT NO. | SCS PROJECT ID | REV. | FIGURE |
|---|---|---|---|
| GL1777449-03 | MCD150170 | 0 | 3-8 |

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B
0 1 in




**LEGEND**

- Extraction Wells
- Property Boundary
- Limits of Closure Turf
- Extent of CCR Post Closure
- Final Closure Contours (ft NAVD88)
- Closure Contours Outside Final Limits of CCR (ft NAVD 88)
- Simulated Flow Transect

**Thickness of CCR Below Potentiometric Surface (ft)**

- 0 - 5
- 5 - 5.8

0 250 500 750

1 in = 250 feet Feet

**NOTE(S)**

1. FINAL CLOSURE CONTOURS AND CLOSURE CONTOURS OUTSIDE FINAL LIMITS OF CCR OBTAINED FROM DRAWING TITLED AP-3/4 FINAL COVER ARMORING DELINEATION PLAN, REV. 0 OF THE PLANT MCDONOUGH-ATKINSON ASH POND 3 AND ASH POND 4 (AP-3/4) CLOSURE AND ASH POND 2 (AP-2) CLOSURE, SHEET 7 DATED NOVEMBER 2021.
2. CCR = COAL COMBUSTION RESIDUALS.
3. NAVD88 = NORTH AMERICAN VERTICAL DATUM OF 1988.

**REFERENCE(S)**

1. AERIAL IMAGERY FROM GOOGLE EARTH DATED 2021-10-22.

CLIENT
GEORGIA POWER COMPANY
SOUTHERN COMPANY SERVICES

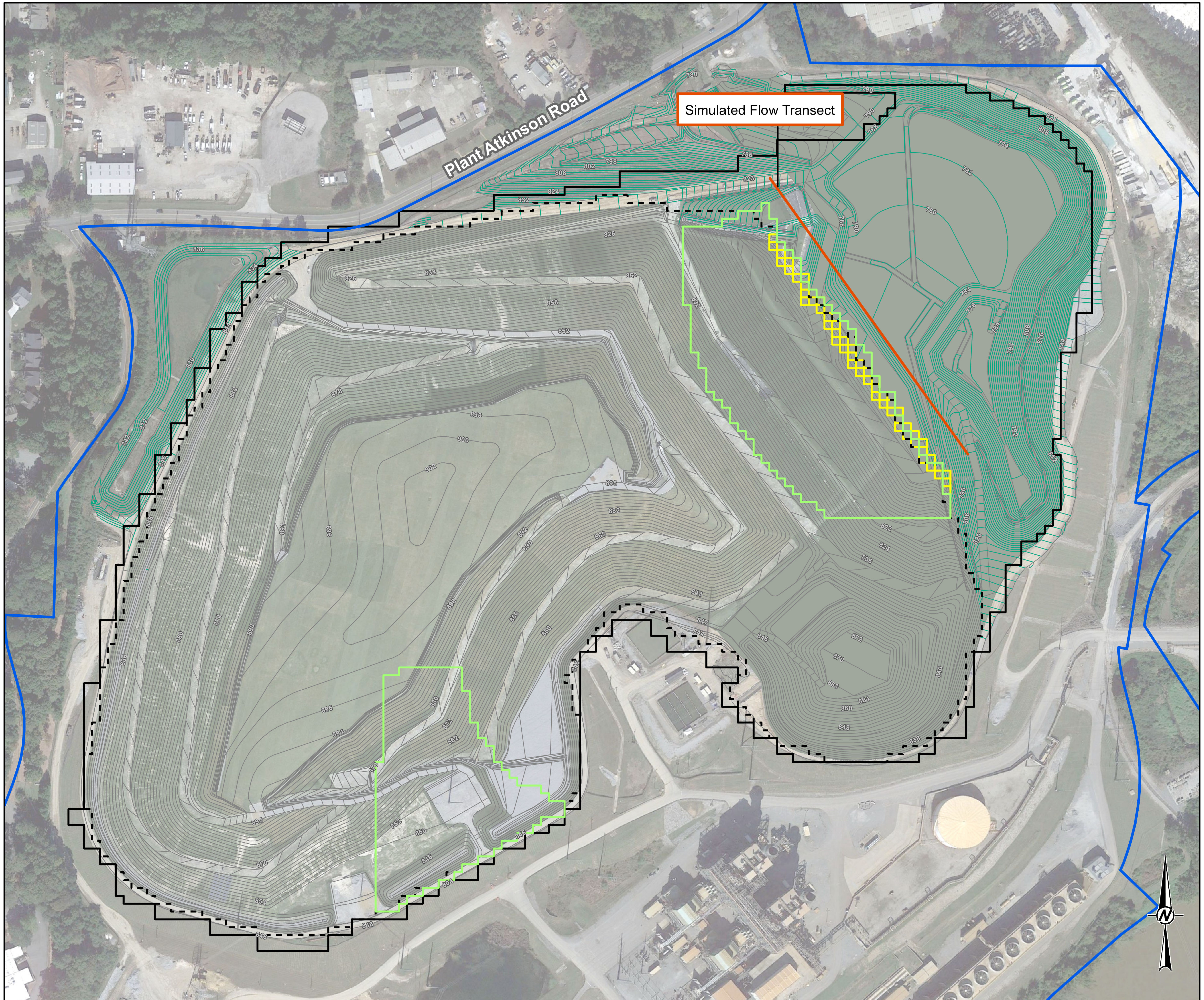
PROJECT
ADVANCED ENGINEERING METHODS FEASIBILITY REPORT, PLANT MCDONOUGH ASH POND 3 AND ASH POND 4 (AP-3/4)

TITLE
**AP-3/4 SCENARIO 8: BASELINE CAP GEOMETRY, WITHOUT UNDERDRAIN, WITH EXTRACTION WELLS**

CONSULTANT

| | |
|---|---|
| YYYY-MM-DD | 2023-05-22 |
| DESIGNED | SJS |
| PREPARED | AFS |
| CHECKED | CB |
| REVIEWED / APPROVED | GLH |

| PROJECT NO. | SCS PROJECT ID | REV. | FIGURE |
|---|---|---|---|
| GL1777449-03 | MCD150170 | 0 | 3-9 |




**LEGEND**

- Property Boundary
- In-Situ Stabilization (ISS) Zone
- Limits of Closure Turf
- Final Closure Contours (ft NAVD88)
- Closure Contours Outside Final Limits of CCR (ft NAVD 88)
- Simulated Flow Transect
- Extent of CCR Post Closure
- Underdrain

**Saturated CCR Thickness (ft)**

- >0 - 5
- 5 - 10
- 10 - 15
- 15 - 17.3

0 250 500 750

1 in = 250 feet

Feet

**NOTE(S)**

1. FINAL CLOSURE CONTOURS AND CLOSURE CONTOURS OUTSIDE FINAL LIMITS OF CCR OBTAINED FROM DRAWING TITLED AP-3/4 FINAL COVER ARMORING DELINEATION PLAN, REV. 0 OF THE PLANT MCDONOUGH-ATKINSON ASH POND 3 AND ASH POND 4 (AP-3/4) CLOSURE AND ASH POND 2 (AP-2) CLOSURE, SHEET 7 DATED NOVEMBER 2021.
2. CCR = COAL COMBUSTION RESIDUALS.
3. NAVD88 = NORTH AMERICAN VERTICAL DATUM OF 1988.

**REFERENCE(S)**

1. AERIAL IMAGERY FROM GOOGLE EARTH DATED 2021-10-22.

CLIENT
GEORGIA POWER COMPANY
SOUTHERN COMPANY SERVICES

PROJECT
ADVANCED ENGINEERING METHODS FEASIBILITY REPORT, PLANT MCDONOUGH ASH POND 3 AND ASH POND 4 (AP-3/4)

TITLE
**AP-3/4 SCENARIO 9: BASELINE CAP GEOMETRY, WITH UNDERDRAIN AND IN-SITU STABILIZATION (ISS) ZONES**

CONSULTANT

| | |
|---|---|
| YYYY-MM-DD | 2023-05-22 |
| DESIGNED | SJS |
| PREPARED | AFS |
| CHECKED | CB |
| REVIEWED / APPROVED | GLH |

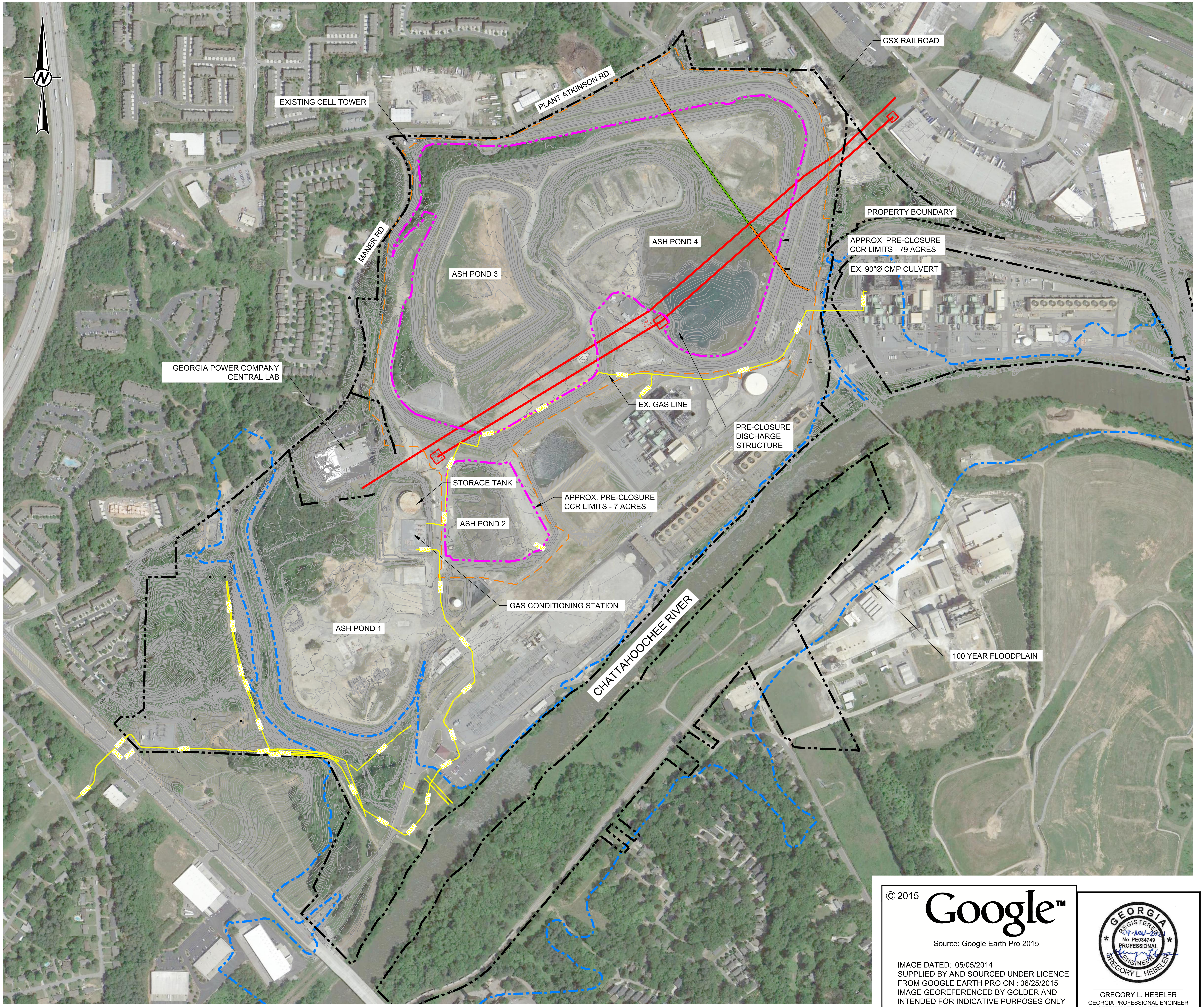
| PROJECT NO. | SCS PROJECT ID | REV. | FIGURE |
|---|---|---|---|
| GL1777449-03 | MCD150170 | 0 | 3-10 |

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

**ATTACHMENT**

# Plant McDonough Pre-Closure Topography - January 2016

ATTORNEY-CLIENT PRIVILEGED COMMUNICATON




## LEGEND

- PRE-CLOSURE CONTOURS
- PROPERTY BOUNDARY MARKERS/LIMITS
- EXISTING STREAM DIVERSION CULVERT UNDER EMBANKMENTS
- EXISTING STREAM DIVERSION CULVERT-CONCRETE ENCASED SECTION
- EXISTING OVERHEAD ELECTRIC LINES TO REMAIN & TO BE PROTECTED
- APPROXIMATE PRE-CLOSURE CCR LIMITS
- EXISTING GAS LINE
- PROPOSED PERMIT BOUNDARY AP-2, AP-3/4
- 100 YEAR FLOODPLAIN

## REFERENCES

1. THE PRE-CLOSURE TOPOGRAPHY AND CONTOUR ELEVATIONS WERE PROVIDED BY GEORGIA POWER LAND DEPARTMENT AND METRO ENGINEERING AND SURVEYING CO, INC. THE DATE OF THE SURVEY PROVIDED AND SHOWN ON THIS SET OF PLANS IS 10-16-2012. REFER TO THE SURVEY DRAWING TITLED "TOPOGRAPHIC MAP PREPARED FOR GEORGIA POWER COMPANY PLANT MCDONOUGH - GEORGIA STATE PLANE WEST SURVEY FEET - DATE OF PHOTOGRAPHY 10-26-12. PROJECT NO. 13225 - 01-13-2013."

2. REVISED PRE-CLOSURE TOPOGRAPHY & CONTOUR ELEVATIONS WERE PROVIDED BY GEORGIA POWER LAND DEPARTMENT. THE DATA SHOWN IS AN UPDATE TO THE PLANS DONE ON 10-16-2012 & THE ONSITE CHANGES SINCE THAT 2012 SURVEY. THE REVISED SURVEY WAS DONE ON 1-12-2016 & MERGED WITH THE DATA ON 10-16-2012. GEORGIA POWER COMPANY PLANT MCDONOUGH ASH PONDS - GEORGIA STATE PLANE WEST SURVEY FEET - DATE OF SURVEY 1-12-2016 - LAND ENG. PROJECT # 20160020.

3. IMAGE TAKEN FROM GOOGLE EARTH PRO ON JUNE 25, 2015. IMAGE DATED MAY 05. 2014.

FOR PERMITTING PURPOSES
NOT FOR CONSTRUCTION

0 300 600
1" = 300' FEET

© 2015 Google™
Source: Google Earth Pro 2015

IMAGE DATED: 05/05/2014
SUPPLIED BY AND SOURCED UNDER LICENCE FROM GOOGLE EARTH PRO ON : 06/25/2015
IMAGE GEOREFERENCED BY GOLDER AND INTENDED FOR INDICATIVE PURPOSES ONLY

GEORGIA REGISTERED PROFESSIONAL ENGINEER No. PE034749 GREGORY L. HEBELER

GREGORY L. HEBELER
GEORGIA PROFESSIONAL ENGINEER
CERTIFICATE NUMBER 034749

CLIENT
GEORGIA POWER COMPANY

Georgia Power

PROJECT
PLANT MCDONOUGH - ATKINSON
ASH POND 3 AND ASH POND 4 (AP-3/4) CLOSURE
& ASH POND 2 (AP-2) CLOSURE

TITLE
**PRE-CLOSURE CONDITIONS SITE MAP**

CONSULTANT
GOLDER
MEMBER OF WSP

| | |
|---|---|
| YYYY-MMM | 2021-NOV |
| DESIGNED | GLH |
| PREPARED | RMS |
| CHECKED | LS |
| REVIEWED / APPROVED | GLH |

| PROJECT NO. | REV. | SHEET |
|---|---|---|
| 1777449 | 0 | 2 |

Path: \\atlanta\cadd\Southern Company\1777449 Plant McDonough Permitting\AP-3&4 - AP-2\AP-3&4\PRODUCTION\ | File Name: 1777449 02 PRE-CLOSURE COND-AERIAL.dwg

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI D

**APPENDIX B**

# Three-Dimensional Numerical Groundwater Modeling Summary Report

# for

# Plant McDonough CCR Unit AP-3/4

# Appendix A-Three-Dimensional Numerical Groundwater Modeling Summary Report

*Georgia Power- Plant McDonough, Cobb County, Georgia*

Submitted to:

**Georgia Power**
Environmental Affairs
241 Ralph McGill Boulevard
Atlanta, Georgia 30308

Submitted by:


**Golder Associates Inc.**
5170 Peachtree Road
Building 100 Suite 300
Atlanta, Georgia, USA 30341

+1 770 496-1893


166849618

October 2020

Rev05

# Table of Contents

**1.0 INTRODUCTION ........ 1**

1.1 Site History ........ 1

1.2 Current Conditions ........ 1

**2.0 GROUNDWATER MODEL CONSTRUCTION ........ 2**

2.1 Geologic and Hydrogeologic conditions ........ 2

2.2 Model Code ........ 2

2.3 Model Grid ........ 2

2.4 Model Layers ........ 2

2.5 Boundary Conditions ........ 3

2.5.1 Drain Boundaries ........ 3

2.5.2 Unused Model Cells ........ 3

2.5.3 River Boundaries ........ 3

2.5.4 Wall Boundaries ........ 3

2.6 Recharge ........ 3

2.6.1 Baseline Conditions Recharge ........ 4

2.6.2 Closure Conditions Recharge ........ 4

2.7 Aquifer Parameters ........ 4

2.7.1 Hydraulic Conductivity ........ 4

2.7.1.1 Model Hydraulic Conductivity ........ 4

**3.0 MODEL CALIBRATION ........ 5**

3.1 Calibration Points ........ 5

3.2 Comparison of Observed and Predicted Heads ........ 6

3.3 Sensitivity Analysis ........ 7

**4.0 FLOW MODEL RESULTS ........ 8**

4.1 Baseline Conditions Model ........ 8

4.2 Closure Conditions Model ........ 9

**5.0 SUMMARY OF GROUNDWATER MODEL FINDINGS ........ 9**

**6.0 REFERENCES ........ 10**

**TABLES**

Table 2-1 – Model Hydraulic Conductivity

Table 3-1 – Calibration Targets

Table 3-2 – PEST Sensitivity Results

**FIGURES**

Figure 1-1 – Site Location Map

Figure 2-1 – Model Domain and Boundary Conditions

Figure 2-2 – Model Cross Sections – East-West & North-South

Figure 2-3 – Baseline Conditions Model Recharge Zones (Layer 1Figure 2-4 –Closure Model Recharge Zones (Layer 1)

Figure 2-4 –Closure Conditions Model Recharge Zones (Layer 1)

Figure 2-5 – Model Layer 1 Hydraulic Conductivity

Figure 3-1 – Calibration Target Locations and Baseline Conditions Model Simulated Groundwater Elevations

Figure 3-2 – 2016 Observed Groundwater Elevations and Contours

Figure 3-3 – Model Calibration Summary

Figure 4-1 – Baseline Conditions Modeled Groundwater Elevation Contours

Figure 4-2 –Closure Conditions Model Conditions Water Table and Model Layer 2 Modeled Groundwater Elevation Contours

Figure 4-3 –Closure Conditions Model Conditions Model Layer 3 and 4 Modeled Groundwater Elevation Contours

Figure 4-4 –Closure Conditions Model versus Baseline Modeled Groundwater Elevation Change

# 1.0 INTRODUCTION

This document presents a summary of Golder Associates Inc. (Golder) groundwater modeling for Georgia Power Company (GPC) Plant McDonough (Site) located in Cobb County, Georgia (Figure 1-1). The summary is developed from Golder model files and model descriptions available in Golder project files. Golder understands that Southern Company Services (SCS) is aiding in finalizing closure for four Coal Combustion Residual (CCR) ponds at the Site. The primary objectives of the groundwater modeling are to compare groundwater flow conditions at closure to baseline groundwater flow conditions and to evaluate the monitoring well network relative to the groundwater flow at the Site. To meet these objectives a groundwater flow model was developed to evaluate the following conditions at the Site:

- Baseline Groundwater Flow Conditions - August 2016 (Baseline Conditions) – Steady state flow conditions after the initial capping of Ash Pond 1 (AP-1). At the time of model development, groundwater data only includes data measured up to August 2016. As such, calibration and development of this model utilizes the August 2016 dataset.
- Groundwater Flow Conditions at Closure (Closure Conditions) – Capping of Combined Unit AP-3/4 (previously AP-3 and AP-4), barrier wall installed completely around AP-1, and installation of an underdrain at AP-3/4.

## 1.1 Site History

Plant McDonough is located in southeast Cobb County, Georgia (GA), and is owned and operated by the GPC. The Site operated as a coal-fired power plant until 2012 when the coal-fired units were replaced with three 840 megawatt combined cycle natural gas units. The property occupies approximately 390 acres and is bounded on the southeast by the Chattahoochee River. There are currently four ash ponds; Ash Pond 1 (AP-1), Ash Pond 2 (AP-2), and Combined Unit AP-3/4.

## 1.2 Current Conditions

The Site is currently in the process of closing its four ash ponds (AP-1, AP-2 and AP-3/4). The planned closure strategy for each pond is as follows:

- AP-1, inactive since 1968, has recently been closed in place with a Subtitle D Compliant engineered turf system for the closure cap.
- AP-2 was closed through removal of CCR. The majority of CCR removal from AP-2 was completed in 2016 and remnant CCR removal from AP-2 was completed in 2019.
- Ash Pond 3/4 are currently undergoing closure by a combination of closure by removal and closure in place with partial removal of ash. Ash will be removed from a line extending from 50 feet west of the existing stream diversion culvert beneath Ash Pond 4 and all points east of the culvert within AP-4, and from the areas in the northwest corner of AP-3 is being removed and consolidated in the remaining AP-3/4 footprint. The ponds were used for dry ash stacking operation from 1995 until the plant conversion to natural gas was completed in 2012.

# 2.0 GROUNDWATER MODEL CONSTRUCTION

## 2.1 Geologic and Hydrogeologic conditions

Refer to the Hydrogeologic Assessment Report for details regarding the conceptual site hydrogeologic model, local geologic conditions, and general background information.

## 2.2 Model Code

Model input files were created using a combination of Environmental System Research Institute ArcMAP-10.4.1 and the Environmental Simulations Inc. Groundwater Vistas 7 (GV) graphical user interface. A steady state groundwater flow model was developed using the MODFLOW-NWT finite difference model code (Niswonger, Panday, & Ibaraki, 2011), which is an enhanced version of the MODFLOW code (McDonald & Harbaugh, 1988). The MODFLOW-NWT code is designed to better solve problems involving unconfined aquifers, cell drying and rewetting and surface water/groundwater interactions.

## 2.3 Model Grid

The full model domain is 3.23 square miles (2,066 acres) and consists of a finite difference grid with 500 rows and 450 columns (900,000 total cells; 600,705 active cells) (Figure 2-1). The primary axis of the model grid is oriented north to south (0-degree rotation), parallel to the inferred groundwater flow direction. The grid cell length and width are a uniform 20 feet (ft) x 20 ft. Grid cell thickness is variable based on observed geologic unit thicknesses from historical monitoring/piezometer installation. The model layers are discussed in greater detail in Section 2.4.

## 2.4 Model Layers

Based on geologic and hydrogeologic conditions previously discussed, the model was divided into four hydrogeologic layers to represent ash, overburden, partially weathered rock (PWR), and bedrock as summarized below:

- **Model Top** – Represents surface topography of the ash and ground surface plus 1.0 ft outside ash boundaries; ranges in elevation from approximately 744 to 955 ft-mean sea level (msl). The elevations for the model top were determined using a combination of 2-ft contour survey data provided by GPC Land Department and Metro Engineering and Surveying from 10-16-2012 and Cobb County LiDAR data provided by Cobb County in April 2015. For Closure Conditions, the proposed final AP-3/4 closure grading was also used in conjunction with the previously listed sources.
- **Layer 1** – Ash; variable thickness based on as-built drawings. Layer 1 cells beyond ash pond boundaries are unused and constant thickness except at drain and river cells.
- **Layer 2** – Overburden; variable thickness based on historical subsurface investigation activities.
- **Layer 3** – PWR; variable thickness based on historical subsurface investigation activities.
- **Layer 4** - Bedrock; variable thickness based on historical subsurface investigation activities.
- **Model Bottom** – Bottom of model set at elevation 670 ft-msl.

South-North (model column 250) and West-East cross-sections through AP-3/4 (model row 210; Figure 2-2) depict the model stratigraphy and model layer geometry.

## 2.5 Boundary Conditions

The following sections describe the boundary conditions used in the model, including drains, unused cell boundaries, river boundaries, and wall boundaries (Figure 2-1).

### 2.5.1 Drain Boundaries

Drain boundaries were used to represent creeks, drainage ditches, and ash impoundment toe drains. Drain boundaries were defined using a combination of 2-ft contour survey data provided by GPC Land Department and Metro Engineering and Surveying from 10-16-2012 and Cobb County LiDAR data provided by Cobb County in April 2015.

### 2.5.2 Unused Model Cells

The model implicitly places unused cells (inactive) on the bottom, top, and sides of the model unless another boundary condition is specified. This is due to the fact that MODFLOW does not compute inter-cell flow through the outside edge of the grid. In areas within the grid, cells can also be specified as unused. Unused cells are used in the following manner within the Site model:

- **Northeast Corner –** Unused cells are placed at a groundwater divide. These unused cells are present in Layers 1 through 4.
- **Southern Corner –** Unused cells are placed south of a hydraulic feature and river boundary . These unused cells are present in Layers 1 through 4.
- **Layer 1 –** In order to explicitly model the ash, separate from other lithologic units, cells are unused outside of ash pond limits. These used cells are present in Layer 1. The active model boundary can be viewed in Figure 2-1.

### 2.5.3 River Boundaries

A river boundary was placed in Layer 2 of the model representing a hydraulic feature south of the Site area (Golder, 2019). Water levels in the river boundary vary linearly and the slope is defined using USGS stage data from an upstream gage and a downstream gage. The river boundary stage within the model boundary ranges from 745.47 to 741.90 ft-msl. An additional river boundary was included to characterize an unnamed hydraulic feature to the west of the site. This river boundary was defined using Cobb County LiDAR data provided by Cobb County in April 2015.

### 2.5.4 Wall Boundaries

A wall boundary is defined as a horizontal flow barrier that is placed into the model along cell boundaries. The boundary condition is inserted into layer 2 of the Closure Conditions simulation to simulate a barrier wall from ground surface to the top of PWR that completely surrounds AP-1.

## 2.6 Recharge

Recharge rates were applied to the highest active layer of the model. Three zones are defined based on current land use:

- All areas outside of ponds,
- Capped ponds,

- Uncapped ponds or uncapped portions of ponds.

The parameter values in these zones vary for each scenario as follows:

### 2.6.1 Baseline Conditions Recharge

Recharge for all areas outside the ponds is 2.41 inches per year (in/yr) based on average annual rainfall data for the Atlanta area and the topography variations within the model domain. The site is not in a recharge zone that provides significant recharge to the local aquifer as defined by Georgia Department of Natural Resources' Digital Environmental Atlas of Georgia. AP-1 recharge is zero, representing a capped condition. AP-3/4 recharge is 10.73 in/yr (Figure 2-3).

### 2.6.2 Closure Conditions Recharge

Recharge for all areas outside the ponds is 2.41 in/yr. AP-1 is closed in the baseline conditions and the recharge is set to zero. AP-3/4 pond recharge is zero except at the stormwater pond within the AP-3/4 footprint where the recharge is 10.73 in/yr (Figure 2-4).

## 2.7 Aquifer Parameters

The following sections describe the aquifer parameters used in the modeling.

### 2.7.1 Hydraulic Conductivity

The hydraulic conductivity (K) terms used in the model include $K_x$ (longitudal K), $K_y$ (transverse K), and $K_z$ (vertical K). Longitudinal and transverse K were were considered equivalent in all layers of the model and are hereafter combined into a single term ($K_{xy}$). The hydraulic conductivity terms used for each scenario are described in the following sections.

#### *2.7.1.1 Model Hydraulic Conductivity*

Hydraulic conductivity zone values are the same in all models and are summarized in Table 2-1 below. Information regarding field measured values can be seen in sources as cited in addition to Table GW-2 in the Hydrogeologic Assessment Report.

**Table 2-1 – Model Hydraulic Conductivity**

| Zone | Layer | Hydraulic Conductivity (ft/d) | Source |
|---|---|---|---|
| **Ash** | 1 | 0.55 (horizontal)<br>0.037 (vertical) | AP-3/4 CPT dissipation and aquifer testing data (Golder,2016) |
| **Overburden** | 1 & 2 | 0.70 (horizontal)<br>0.14 (vertical) | Historical slug testing (Golder, 2016) |
| **PWR** | 3 | 0.2 (horizontal)<br>0.02 (vertical) | Model calibration |
| **Bedrock** | 4 | 0.16 (horizontal)<br>0.016 (vertical) | Model calibration |

**Notes:**
ft/d = feet per day

The layer 1 areal zone extent varies between models. Conductivity zones include:

- Ash - Limited to within footprint of ash ponds.

- Overburden - Includes northern portion of AP-1 and fringes of AP-1 and AP-3/4 in Layer 1 and all of Layer 2.
- PWR – Includes all of model layer 3.
- Bedrock – Includes all of model layer 4.

The overburden zone value is assigned to all of layer 2. The PWR zone value is assigned to all of layer 3. The bedrock zone value is assigned to all of layer 4. The areal extent of zone values in layer 1 varies between models.

The ash conductivity value is assigned to the entire AP-3/4 area in the Baseline Conditions model. At AP-1 the northern portion of the pond is assigned the overburden value and the southern portion is assigned the ash value (Figure 2-5). Two hydraulic conductivity zones are assigned to AP-3/4 in the Baseline Conditions model and Closure Conditions model. The eastern portion is assigned the overburden value, the western portion is assigned the ash value. AP-1 conductivity zones in the Baseline Conditions model and Closure Conditions Model are unchanged from the Baseline Conditions model.

# 3.0 MODEL CALIBRATION

Model calibration consists of successive refinement of the model input data from initial assumptions/estimates to improve the fit between observed and model-predicted results. Model calibration should consider parameters such as hydraulic head, hydraulic conductivity, spatial boundary conditions (head/stage and fluxes), and the location and magnitude of applied stresses, such as recharge and drainage.

The purpose of the calibration effort for the Site was to simulate "steady-state" groundwater flow conditions that approximate the general flow patterns inferred from groundwater level measurements collected in August 2016. The model was calibrated through trial-and-error adjustment of model parameter values within reasonable ranges based on available site-specific data and literature references. Parameters that were included in model calibration include: hydraulic conductivity, recharge, drain boundary conductance, and river boundary conductance. The resultant calibrated model is described in the following sections.

## 3.1 Calibration Points

Groundwater level data for 35 monitoring points were entered as calibration points. Calibration target locations are shown on Figure 3-1. Measured water levels from August 2016 were used for calibration and are presented in Table 3-1 and on Figure 3-2. The calibration point elevations were assigned to the model row, column, and layer corresponding to the well location and screened interval for comparison to model groundwater level elevations.

**Table 3-1 - Calibration Targets**

| Target Name | Easting (NAD 83 ft) | Northing (NAD 83 ft) | Model Layer | Observed Head Aug. 2016 (ft)[1] | Computed Head (ft NAVD 88) | Weight | Group | Residual (ft) |
|---|---|---|---|---|---|---|---|---|
| **USGS-10EE02** | 2204179.513 | 1395565.891 | 2 | 824 | 823.02 | 1 | 1 | 0.98 |
| **B25** | 2201479.84 | 1392826.91 | 2 | 821.63 | 811.78 | 1 | 1 | 9.85 |
| **B2** | 2202118.693 | 1393956.841 | 2 | 822.66 | 823.58 | 1 | 1 | -0.92 |
| **B3** | 2202411.143 | 1394043.541 | 2 | 811.85 | 814.08 | 1 | 1 | -2.23 |
| **B4** | 2202662.203 | 1394170.481 | 2 | 797.89 | 797.51 | 1 | 1 | 0.38 |
| **B5** | 2202962.793 | 1394309.251 | 2 | 785.98 | 789.55 | 1 | 1 | -3.57 |

| Target Name | Easting (NAD 83 ft) | Northing (NAD 83 ft) | Model Layer | Observed Head Aug. 2016 (ft)[1] | Computed Head (ft NAVD 88) | Weight | Group | Residual (ft) |
|---|---|---|---|---|---|---|---|---|
| **B6** | 2203255.163 | 1394424.071 | 2 | 787.4 | 787.50 | 1 | 1 | -0.10 |
| **B7** | 2203595.173 | 1394373.411 | 2 | 799.54 | 802.44 | 1 | 1 | -2.90 |
| **B8** | 2203881.823 | 1394325.091 | 2 | 812 | 808.59 | 1 | 1 | 3.41 |
| **B9** | 2204166.953 | 1394056.261 | 2 | 810.4 | 805.77 | 1 | 1 | 4.63 |
| **B10** | 2204197.803 | 1393818.471 | 2 | 802.79 | 798.70 | 1 | 1 | 4.09 |
| **B11** | 2204167.653 | 1393547.501 | 2 | 791.49 | 789.44 | 1 | 1 | 2.05 |
| **B12** | 2204125.013 | 1393151.161 | 2 | 765.72 | 767.96 | 1 | 1 | -2.24 |
| **B13** | 2204084.663 | 1392881.611 | 2 | 760.19 | 770.78 | 1 | 1 | -10.59 |
| **B14** | 2204013.213 | 1392575.341 | 2 | 770.41 | 772.35 | 1 | 1 | -1.94 |
| **B15** | 2203675.773 | 1392544.701 | 2 | 786.06 | 789.44 | 1 | 1 | -3.38 |
| **B16** | 2203313.213 | 1392596.211 | 2 | 802.6 | 802.75 | 1 | 1 | -0.15 |
| **B17** | 2203049.043 | 1392645.881 | 2 | 809.35 | 809.35 | 1 | 1 | 0.00 |
| **B18** | 2202874.993 | 1392521.151 | 2 | 809.19 | 809.90 | 1 | 1 | -0.71 |
| **B19** | 2202875.673 | 1392380.731 | 2 | 804.25 | 805.67 | 1 | 1 | -1.42 |
| **B20** | 2202315.153 | 1392164.351 | 2 | 802.21 | 806.60 | 1 | 1 | -4.39 |
| **B21** | 2202062.543 | 1392068.121 | 2 | 802.74 | 802.95 | 1 | 1 | -0.21 |
| **B22** | 2201790.513 | 1392124.821 | 2 | 805.02 | 802.35 | 1 | 1 | 2.67 |
| **B23** | 2201582.863 | 1392242.101 | 2 | 804.61 | 802.52 | 1 | 1 | 2.09 |
| **B24** | 2201451.513 | 1392480.231 | 2 | 806.65 | 805.11 | 1 | 1 | 1.54 |
| **B27** | 2201744.773 | 1393423.511 | 2 | 830.16 | 827.61 | 1 | 1 | 2.55 |
| **B28** | 2201677.593 | 1391970.421 | 2 | 793.3 | 796.47 | 1 | 1 | -3.17 |
| **B29** | 2201420.25 | 1391891.93 | 3 | 790.87 | 788.62 | 1 | 1 | 2.25 |
| **B31** | 2200926.823 | 1392035.971 | 3 | 764.17 | 773.46 | 1 | 1 | -9.29 |
| **B37** | 2200919.393 | 1390483.941 | 2 | 753.01 | 751.89 | 1 | 1 | 1.12 |
| **B38** | 2201147.653 | 1390364.531 | 2 | 751.24 | 749.57 | 1 | 1 | 1.67 |
| **B39** | 2201538.453 | 1390303.391 | 2 | 751.82 | 752.07 | 1 | 1 | -0.25 |
| **B40** | 2201826.763 | 1390625.631 | 2 | 760.98 | 759.75 | 1 | 1 | 1.23 |
| **B41** | 2201749.843 | 1390922.381 | 3 | 774.74 | 766.81 | 1 | 1 | 7.93 |
| **B42** | 2201866.973 | 1391328.161 | 2 | 778.08 | 778.91 | 1 | 1 | -0.83 |

**Notes:**
ft = feet
NAD 83 = North American Datum of 1983 (Georgia West State Plane Coordinate System)
NAVD 88 = North American Vertical Datum of 1988
[1] Observed Head recorded for USGS-10EE02 was recorded on June 16, 1992.

## 3.2 Comparison of Observed and Predicted Heads

Observed hydraulic head elevations were compared to simulated hydraulic head elevations. The groundwater flow model was considered calibrated when the following criteria were met:

- Residual mean (RM; mean of the value of target residuals):
  - Target = 0.0 ft

  - Model Result = 0.0 ft
- Absolute residual mean (ARM; mean of the absolute value of target residuals):
  - Target = 7.89 ft (less than 10% of the observed range in hydraulic head [78.92 ft]).
  - Model Result = 2.76 ft
- Root mean square error (RMSE; square root of the mean of the squared value of target residuals):
  - Target = 7.89 ft (less than 10% of the observed range in hydraulic head [78.92 ft]).
  - Model Result = 3.87 ft
- Mass balance discrepancy (Md):
  - Target = less than 1%.
  - Model Result = -0.04%.
- Residual Distribution:
  - Target = Hydraulic head errors randomly distributed in space.
  - Model Result = Hydraulic head errors randomly distributed in space.

Figure 3-1 depicts the simulated groundwater elevation contours for the Baseline Conditions for Layer 2 (Overburden). Modeled Baseline Conditions and observed potentiometric heads for August 2016 are summarized in Table 3-1. Model residual values plotted on Figure 3-3, show that the predicted potentiometric heads closely match the observed head conditions. Simulated groundwater elevations are consistent with the interpreted water table contour map presented in the Hydrogeologic Assessment Report.

## 3.3 Sensitivity Analysis

The parameter estimation (PEST) code (Watermark Numerical Computing, 2016) was used to assess the model's sensitivity to changes in aquifer parameters. The PEST code contains an algorithm that uses the sensitivity of targets to guide the selection of model parameter values. The goal of PEST is minimization of a mathematical objective function, typically the residual sum of squares (RSS; phi in PEST terms), to achieve a close fit between observed and model-calculated groundwater levels while maintaining reasonable values for model parameters and stresses. A lower value of phi represents a better match between the model and target observations.

PEST was used to evaluate the following model parameters in the Baseline Conditions presented in Table 3-2:

- $K_{xy}$: Overburden, PWR, Ash, Bedrock
- Recharge Zones 1 and 3 (areas outside the pond limits)
- Recharge Zone 6 (AP-3/4)

PEST results are evaluated using the overall reduction in phi as well as the overall sensitivity of each parameter (reported as a percentage by PEST). Parameters with a sensitivity greater than 1% are generally considered sensitive.

Sensitivity analysis results (Table 3-2) indicate that the model is sensitive to the $K_{xy}$ of the Layer 2 (overburden) and recharge in Zones 3 (vegetated pervious areas) and 6 (AP-3/4). The model is less sensitive to $K_{xy}$ of Zones 3, 4 and 5 and recharge in Zone 1.

**Table 3-2: PEST Sensitivity Results**

| Parameter | Model Value (feet/day) | Sensitivity (%) | Comment |
|---|---|---|---|
| **Kx Zone 2 (Overburden)** | 8.68E-01 | 3.69 | Sensitive |
| **Kx Zone 3 (Saprolite)** | 2.81E-03 | 0.02 | Not sensitive |
| **Kx Zone 4 (Ash)** | 7.00E-01 | 0.17 | Not sensitive |
| **Kx Zone 5 (Bedrock)** | 1.00E-04 | 0.01 | Not sensitive |
| **Recharge Zone 1 (Vegetated Pervious Areas)** | 2.70E-06 | 0.01 | Not sensitive |
| **Recharge Zone 3 (Vegetated Pervious Areas)** | 6.26E-04 | 1.82 | Sensitive |
| **Recharge Zone 6 (AP-3/4)** | 1.00E-03 | 2.27 | Sensitive |

# 4.0 FLOW MODEL RESULTS

The following sections summarize the results of the groundwater flow modeling.

## 4.1 Baseline Conditions Model

The Baseline Conditions simulates August 2016 site conditions. The model is steady state which conceptually represents long-term average hydraulic conditions with no changes in hydraulic stress within the model domain. North of the facility model predicted flow is from the northwest corner of the model domain to the south and southeast toward simulated river boundary condition cells. Predicted flow in the southern portion of the model is from the southeast corner of the model north and northwest toward simulated river boundary condition cells. Model predicted water table elevation contours are shown on Figure 4-1. Figure 4-1 shows simulated groundwater elevations are affected by surface water and drainage features and AP-3/4. Simulated groundwater flow is captured by river boundary condition cells to the west and south of the facility. Simulated groundwater is also captured by drain boundary condition cells that represent smaller scale features in the model.

A large groundwater sink is present north of AP-3/4. The sink is associated with the unnamed creek immediately north of the pond and with an ash impoundment toe drain adjoining the pond. The sink extends into the bedrock and to the bottom of the model domain. The sink captures groundwater in a portion of the model domain north of AP-3/4, including groundwater in a portion of AP-3/4.

The model predicts groundwater mounding in the northwest corner of AP-3/4. The predicted mound is caused by a combination of higher recharge in the pond compared to other portions of the model and a higher pond bottom elevation. The effect of the mound extends to the bottom of the model.

Layer 3 and 4 model predicted water level elevations have a similar pattern to layer 2. The layer 2 groundwater sink and mound extend through layer 3 to the bottom of layer 4. Model predicted layer 3 and 4 water level elevation contours are shown on Figure 4-1. A model-wide mass balance was completed and resulted in a model-wide mass balance error for both the Baseline Conditions and the Closure Conditions models of less than 1%.

## 4.2 Closure Conditions Model

The Closure Conditions model simulates a steady state representation of the capping of AP-3/4 and AP-1 and a barrier wall installed around AP-1. The barrier wall is simulated as extending from ground surface to the bottom of layer 2, the bottom of the saprolite-soil unit. The wall is assigned a thickness of 3 ft and a hydraulic conductivity of $2.6 \times 10^{-4}$ ft/d. Assigned recharge for AP-3/4 is zero, expect for a small area in the northeast portion of the pond which represents a stormwater detention basin.

The results of the simulation of Layer 1 and Layer 2 are shown on Figure 4-2. The results of the simulation of Layer 3 and Layer 4 are shown on Figure 4-3. The direction of groundwater flow is expected to transition from semi-radial to southerly. Two small groundwater sinks are present to occur in Layer 2, within the same area as the single large sink within the Baseline Conditions model. One of the sinks extends to Layer 3 covering a very small area. The sink does not extend to Layer 4.

The pond capping of AP-3/4 and AP-1 are predicted to reduce water table elevations over a large portion of the site as shown on Figure 4-4. Figure 4-4 shows simulated water table elevation reductions in layer 2, which corresponds to the layer where the water table is present outside the ponds. The reductions are relative to the steady-state, Baseline Conditions model predictions. Simulated water level reductions greater than 40 ft occur beneath and in the vicinity of AP-3/4. Simulated water level elevation reductions in layers 3 and 4 are similar in magnitude and extent to layer 2. The maximum layer 4 simulated water level elevation reduction is 39 ft. Layer 3 and 4 water level simulated elevation reductions are shown on Figure 4-4.

The wall is predicted to reduce flow across the western side of AP-1 in the overburden (Layer 2) by 74 percent compared to the Baseline Conditions model. The wall is predicted to reduce flow across the southern side of AP-1 in the overburden (Layer 2) by 70 percent compared to the Baseline Conditions model. The model predicts that the construction of a barrier wall will increase flow in the PWR (Layer 3). GPC plans to update and refine the model by incorporating data collected at the site since August 2016. The model report will be updated as appropriate.

# 5.0 SUMMARY OF GROUNDWATER MODEL FINDINGS

Model simulated groundwater flow patterns are consistent with the conceptual model of groundwater flow in the Site area. The models simulate groundwater flow from north to south across the Site. Key findings from model results are summarized as follows:

- Model calibration results show that the predicted potentiometric heads closely match the observed heads.
- Installation of a cap over AP-3/4 will reduce recharge in the AP-3/4 area. Simulated water level elevations are predicted to decline across the plant site by up to 40 ft with the maximum decline occurring under AP-3/4. The simulated water level declines are great enough to desaturate large portions of the overburden and saprolite beneath the plant.
- AP-3/4 capping and installation of a wall around AP-1 are predicted to decrease groundwater flow through AP-1 CCR material. Simulated flow through AP-1 CCR material is reduced by 74 percent when AP-3/4 is

capped and a wall is installed around AP-1. Water levels are predicted to drop up to 10 ft, in the AP-1 area and up to 40 ft in the AP-3/4 area.

## 6.0 REFERENCES


Fetter, C. (2001). *Applied Hydrogeology*, Fourth Edition. Upper Saddle River, New Jersey: Prentice Hall.

Freeze, R.A. and Cherry, J.A. (1979). *Groundwater.* Englewood Cliffs, NJ: Prentice Hall, 604 p.

Golder Associates, Inc. (2016). *Data Report on Investigations for Closure of AP-3/4 Plant McDonough-Atkinson, Atlanta, GA.*

Golder Associates, Inc. (2019). Plant McDonough-Atkinson (CCR Unit AP-1, CCR Unit AP-2, and Combined CCR Unit AP-3/4, Hydrogeologic Assessment Report, October 2020.

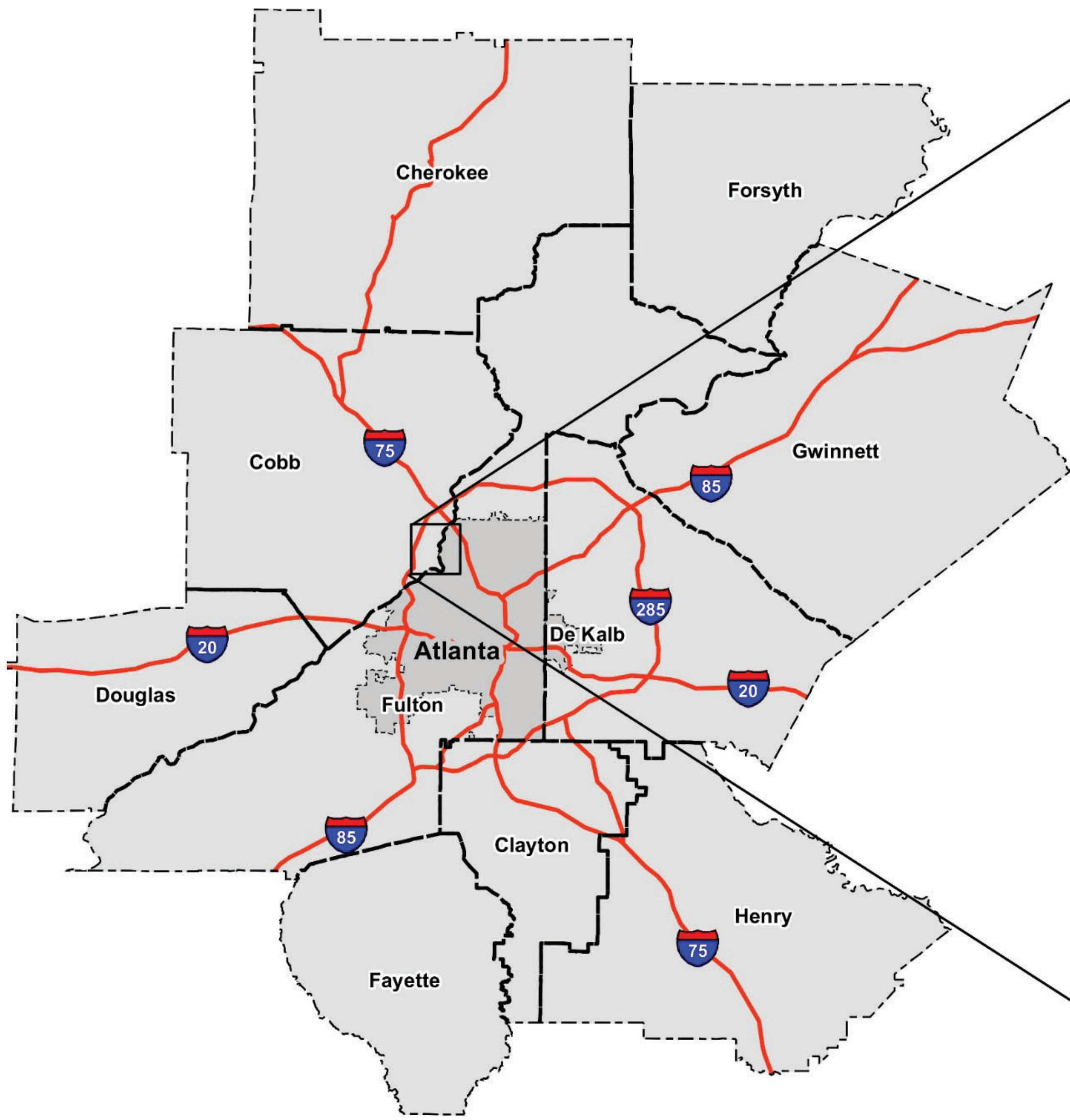
McDonald, M. G., & Harbaugh, A. W. (1988). Chapter A1, A Modular Three-Dimensional Finite-Difference Ground-Water Flow Model. In *Techniques of Water-Resources Investigations of the United States Geological Survey* (p. 586). Washington: United States Geological Survey Printing Office.

Niswonger, R. G., Panday, S., & Ibaraki, M. (2011). MODFLOW-NWT, A Newton Formulation for MODFLOW 2005: U.S. Geological Survey Techniques and Methods 6-A37. Reston, Virginia: United States Geological Survey.

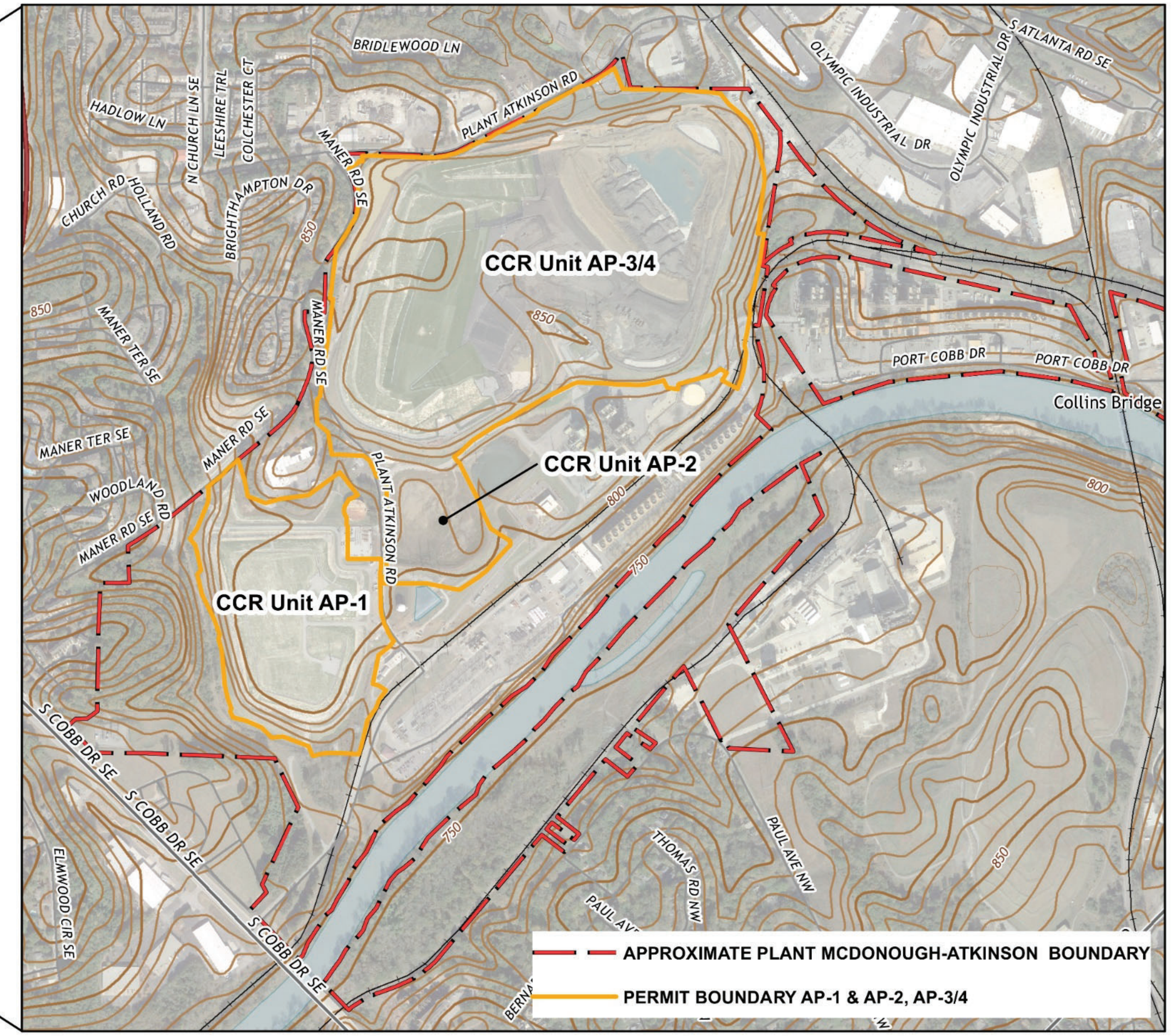
Peck, M., & Painter, J. (2016). Groundwater conditions in Georgia, 2012–14: U.S. Geological Survey Scientific Investigations Report 2016–5161. 55 p.

Watermark Numerical Computing. (2016). *PEST, Model-Independent Parameter Estimation, User Manual Part I: PEST, SENSAN and Global Optimisers, 6th Edition.*

# Figures




## SITE VICINITY MAP




REF: USGS 7.5 MINUTE SERIES TPOGRAPHIC QUADRANGLE:
MABLETON, GA 1992 & NORTHWEST ATLANTA, GA 1993

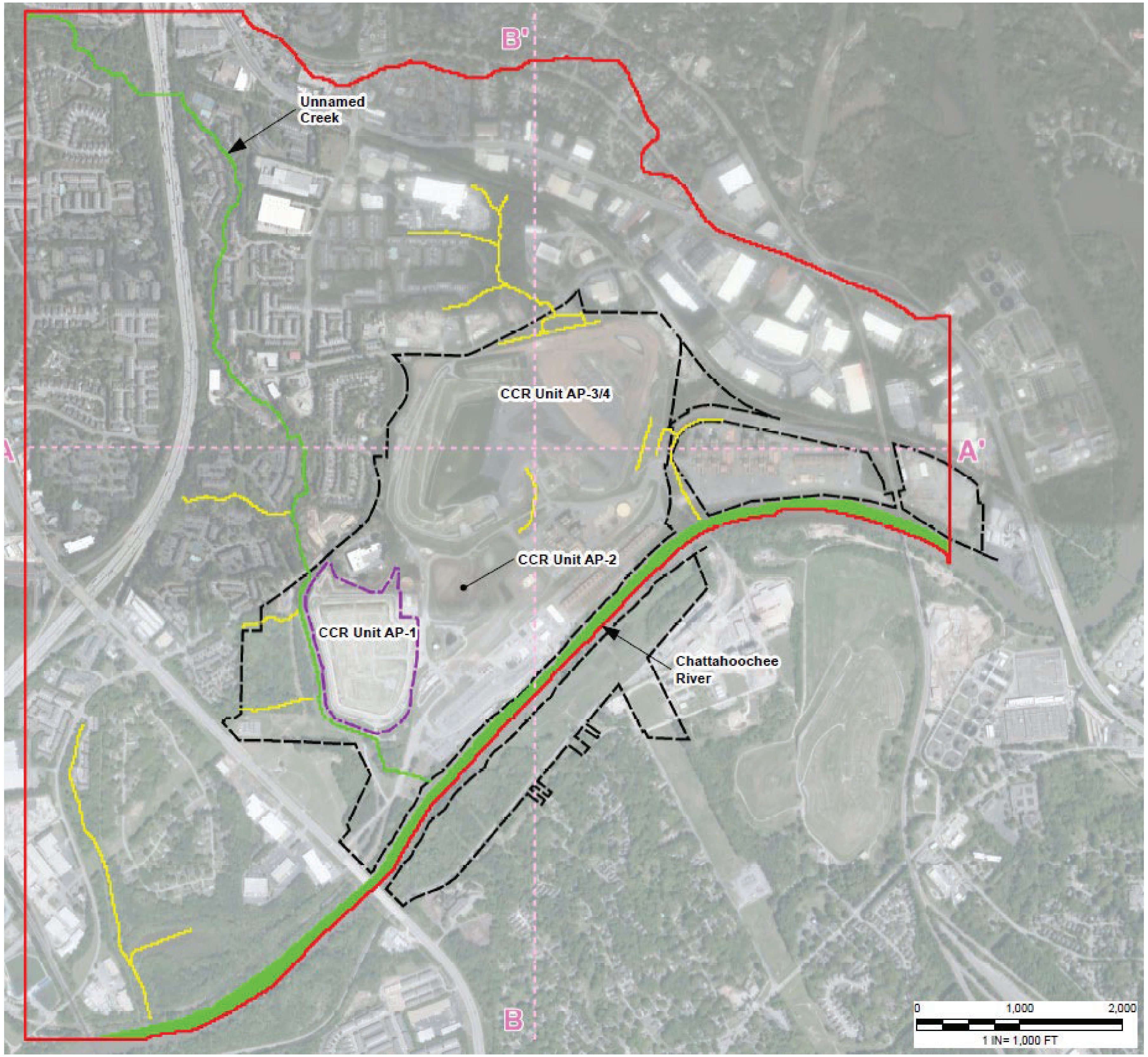
## SITE LOCATION MAP

0 1,000 2,000

1 IN= 1000 FT

| | | | |
|---|---|---|---|
| CLIENT<br>GEORGIA POWER COMPANY/<br>SOUTHERN COMPANY SERVICES | Georgia Power | PROJECT<br>PLANT MCDONOUGH | |
| CONSULTANT<br>GOLDER | YYYY-MM-DD 2019-10-11<br>DESIGNED JRJ<br>PREPARED JRJ<br>CHECKED WEG<br>REVIEWED/APPROVED GLH | TITLE<br>SITE LOCATION MAP | |
| | | PROJECT NO. 1668496 | CONTROL / REV. A / FIGURE 1-1 |

1 in IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

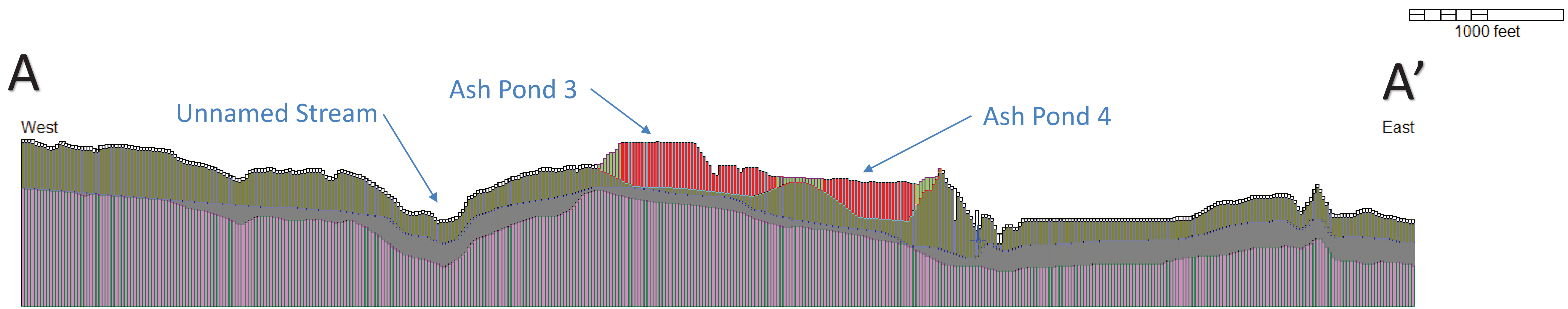



**Legend**

- Drain Boundary
- River Boundary
- Constant Head Boundary
- Active Model Boundary
- Plant Boundary (Approximate)
- Model Cross Section Transect
- AP-1 Barrier Wall

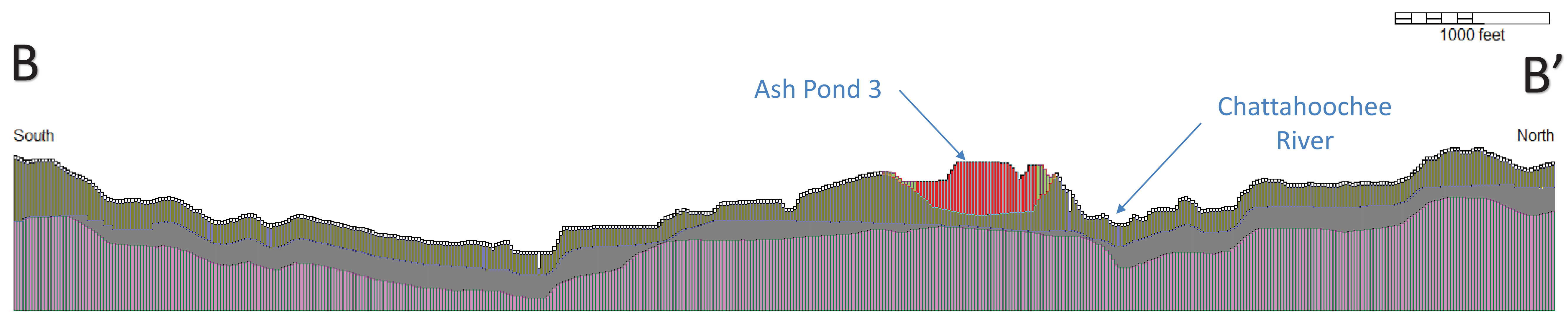
| | | | |
|---|---|---|---|
| CLIENT<br>GEORGIA POWER COMPANY/<br>SOUTHERN COMPANY SERVICES | Georgia Power | | PROJECT<br>PLANT MCDONOUGH |
| CONSULTANT<br>GOLDER | YYYY-MM-DD | 2019-10-11 | TITLE<br>MODEL DOMAIN AND BOUNDARY CONDITIONS |
| | DESIGNED | JRJ | |
| | PREPARED | JRJ | |
| | CHECKED | WEG | |
| | REVIEWED/APPROVED | GLH | PROJECT NO. 1668496 · CONTROL · REV. A · FIGURE 2-1 |

## Model Cross Section – West to East (Row 210)




5 times Vertical Exaggeration

## Model Cross Section – South to North (Column 250)



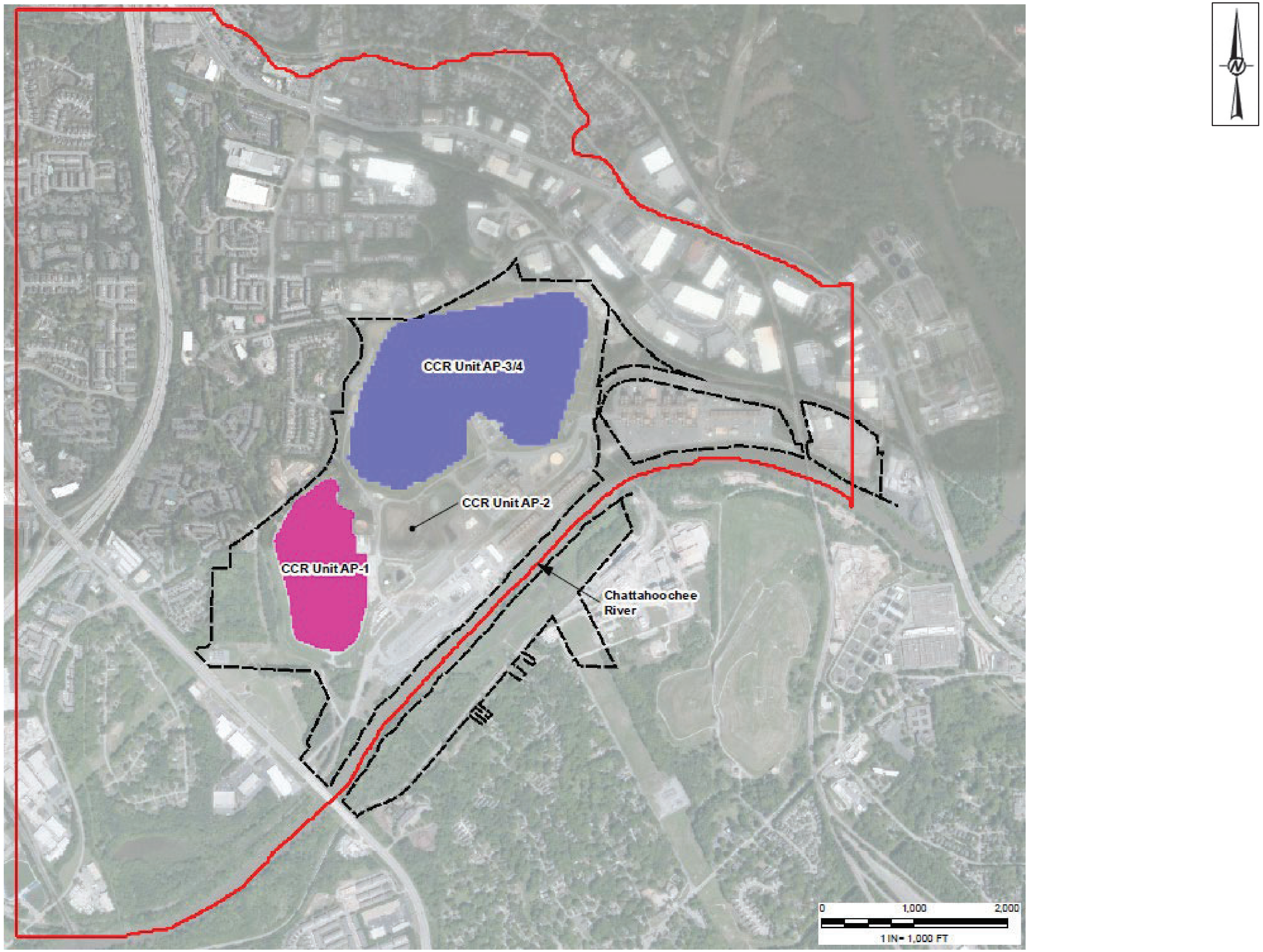

5 times Vertical Exaggeration

**Legend**

**Hydraulic Conductivity (feet/day)**

- Ash – 0.55 ft/d
- Overburden – 0.73 ft/d
- Bedrock - 0.16 ft/d
- Weathered Bedrock – 0.2 ft/d

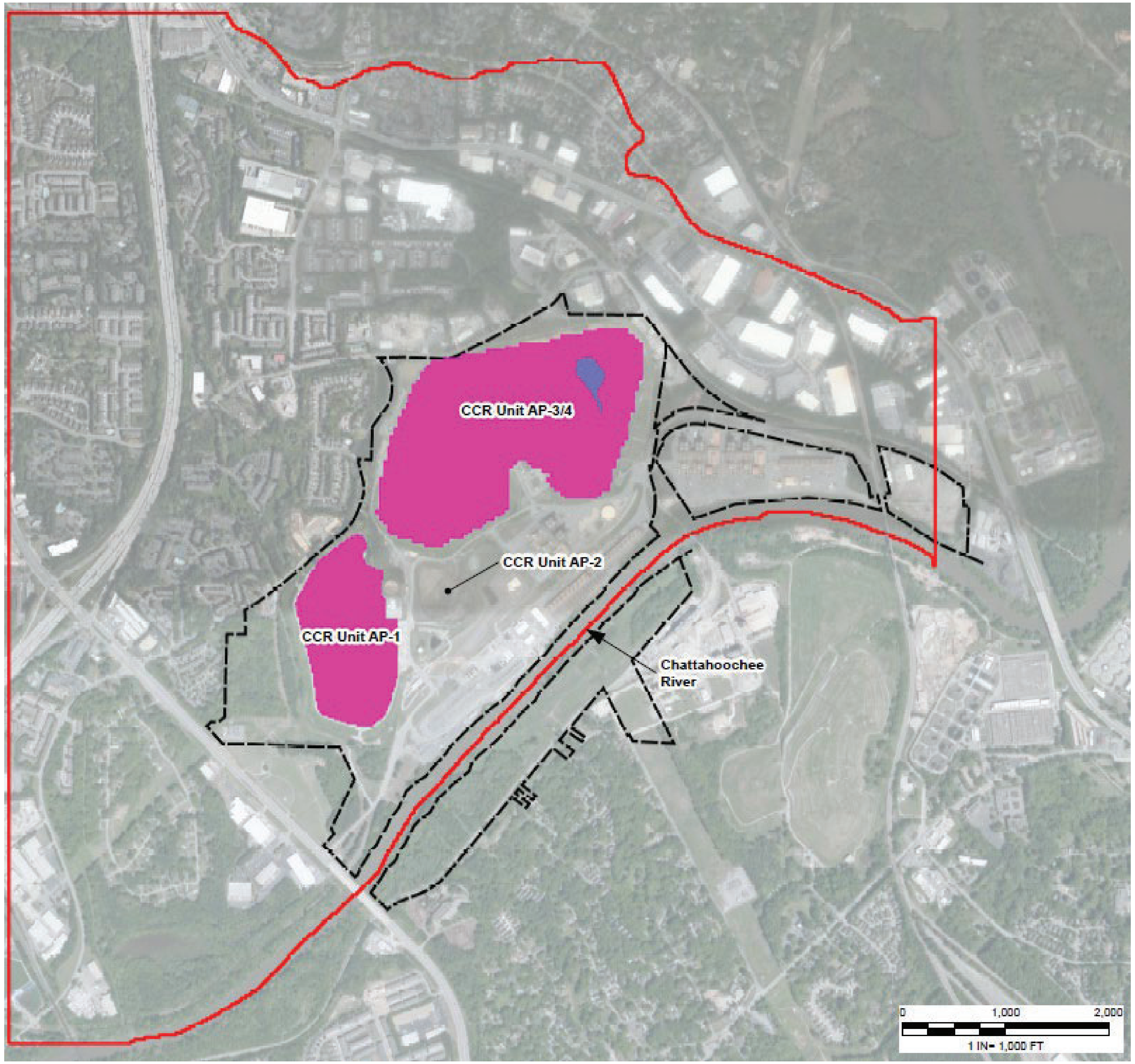
| | |
|---|---|
| CLIENT | GEORGIA POWER COMPANY/ SOUTHERN COMPANY SERVICES — Georgia Power |
| PROJECT | PLANT MCDONOUGH |
| CONSULTANT | GOLDER |
| YYYY-MM-DD | 2019-10-11 |
| DESIGNED | JRJ |
| PREPARED | JRJ |
| CHECKED | WEG |
| REVIEWED/APPROVED | GLH |
| TITLE | MODEL CROSS SECTIONS – EAST-WEST & NORTH-SOUTH |
| PROJECT NO. | 1668496 |
| CONTROL | |
| REV. | A |
| FIGURE | 2-2 |




**Legend**

- Ash Pond 1: No Recharge
- Ash Ponds 3 & 4: Recharge = 10.73 in/yr
- Rest of Model Domain: Recharge = 2.41 in/yr
- Active Model Boundary
- Plant Boundary (Approximate)

| | | | |
|---|---|---|---|
| CLIENT | GEORGIA POWER COMPANY/ SOUTHERN COMPANY SERVICES | Georgia Power | |
| PROJECT | PLANT MCDONOUGH | | |
| CONSULTANT | GOLDER | YYYY-MM-DD | 2019-10-11 |
| | | DESIGNED | JRJ |
| | | PREPARED | JRJ |
| | | CHECKED | WEG |
| | | REVIEWED/APPROVED | GLH |
| TITLE | PRE-CLOSURE MODEL RECHARGE ZONES (LAYER 1) | | |
| PROJECT NO. | CONTROL | REV. | FIGURE |
| 1668496 | | A | 2-3 |




**Legend**

- No Recharge
- Recharge = 10.73 in/yr
- Rest of Model Domain: Recharge = 2.41 in/yr
- Active Model Boundary
- Plant Boundary (Approximate)

CLIENT
GEORGIA POWER COMPANY/
SOUTHERN COMPANY SERVICES

Georgia Power

CONSULTANT

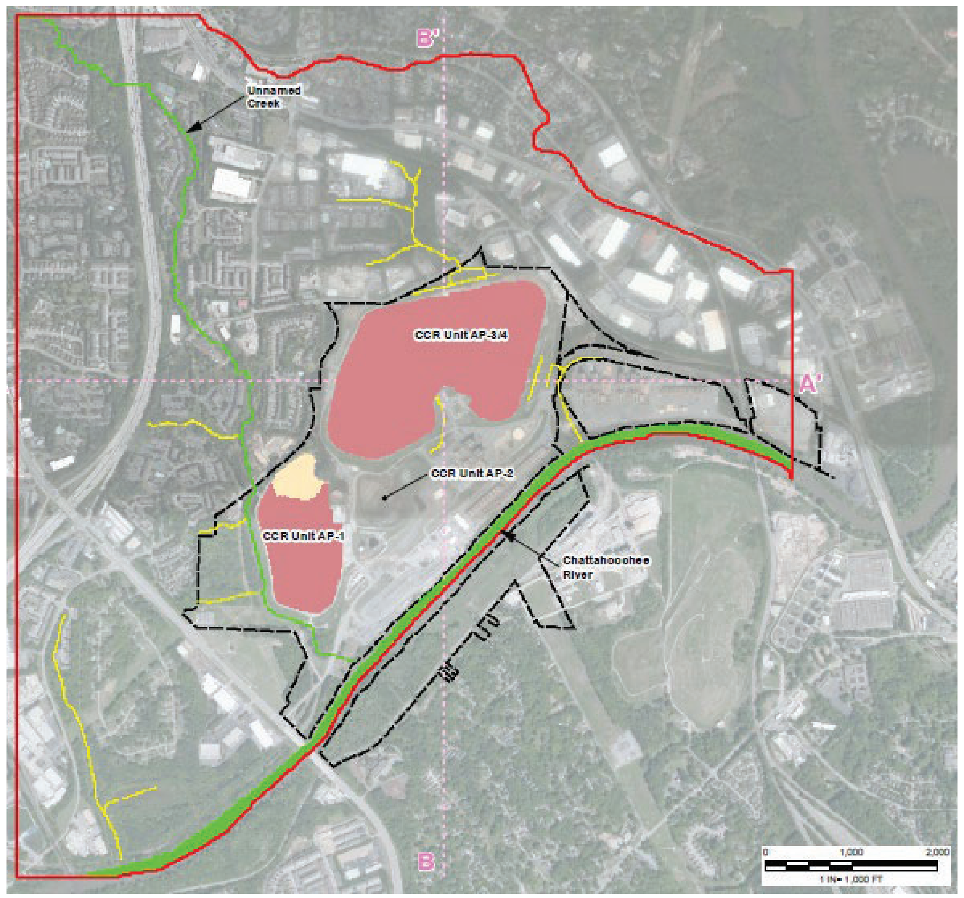
GOLDER

| | |
|---|---|
| YYYY-MM-DD | 2019-10-11 |
| DESIGNED | JRJ |
| PREPARED | JRJ |
| CHECKED | WEG |
| REVIEWED/APPROVED | GLH |

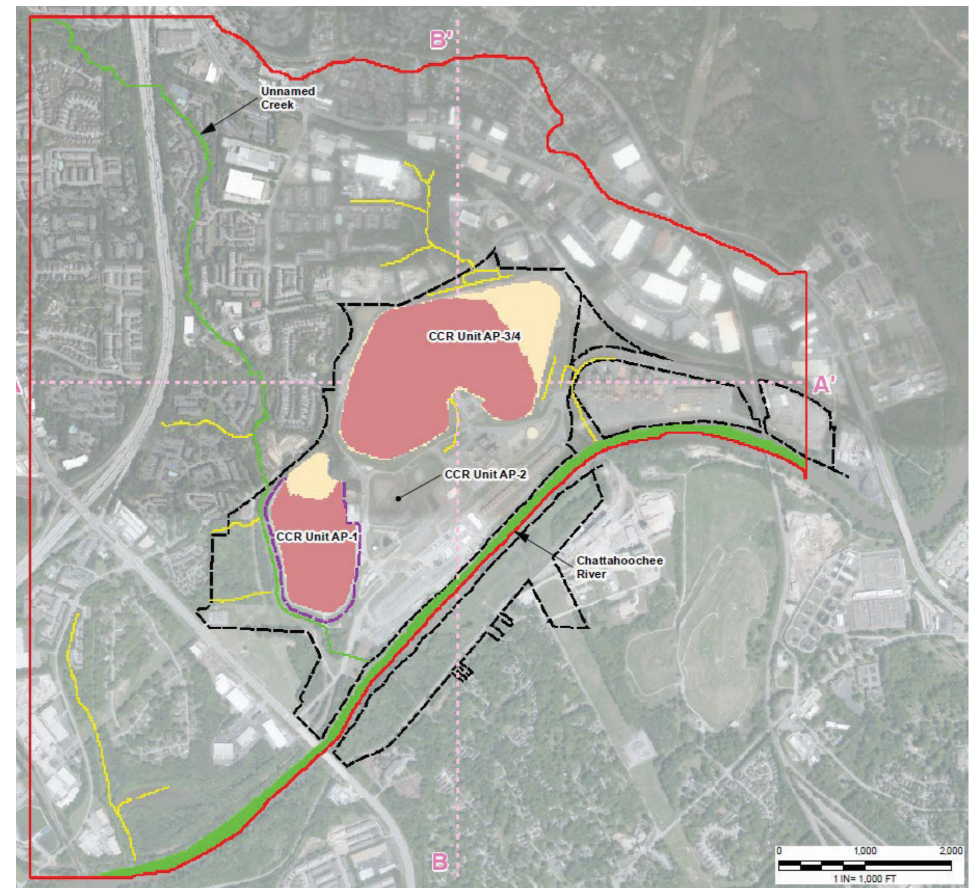
PROJECT
PLANT MCDONOUGH

TITLE
AP-1 BARRIER WALL CLOSURE MODEL RECHARGE ZONES (LAYER 1)

| PROJECT NO. | CONTROL | REV. | FIGURE |
|---|---|---|---|
| 1668496 | | A | 2-4 |




Base Model - Layer 1 Hydraulic Conductivity




AP-1 Barrier Wall Closure Model - Layer 1 Hydraulic Conductivity

## Legend

***Ash (Model Zone 1)***
$K_{xy}$ = 0.73 ft/d
$K_z$ = 0.14 ft/d

***Ash (Model Zone 4)***
$K_{xy}$ = 0.55 ft/d
$K_z$ = 0.037 ft/d

***Overburden (Model Layer 2 - not depicted)***
$K_{xy}$ = 0.73 ft/d
$K_z$ = 0.14 ft/d

***Saprolite (Model Layer 3 - not depicted)***
$K_{xy}$ = 0.2 ft/d
$K_z$ = 0.02 ft/d

***Bedrock (Model Layer 4 - not depicted)***
$K_{xy}$ = 0.16 ft/d
$K_z$ = 0.016 ft/d

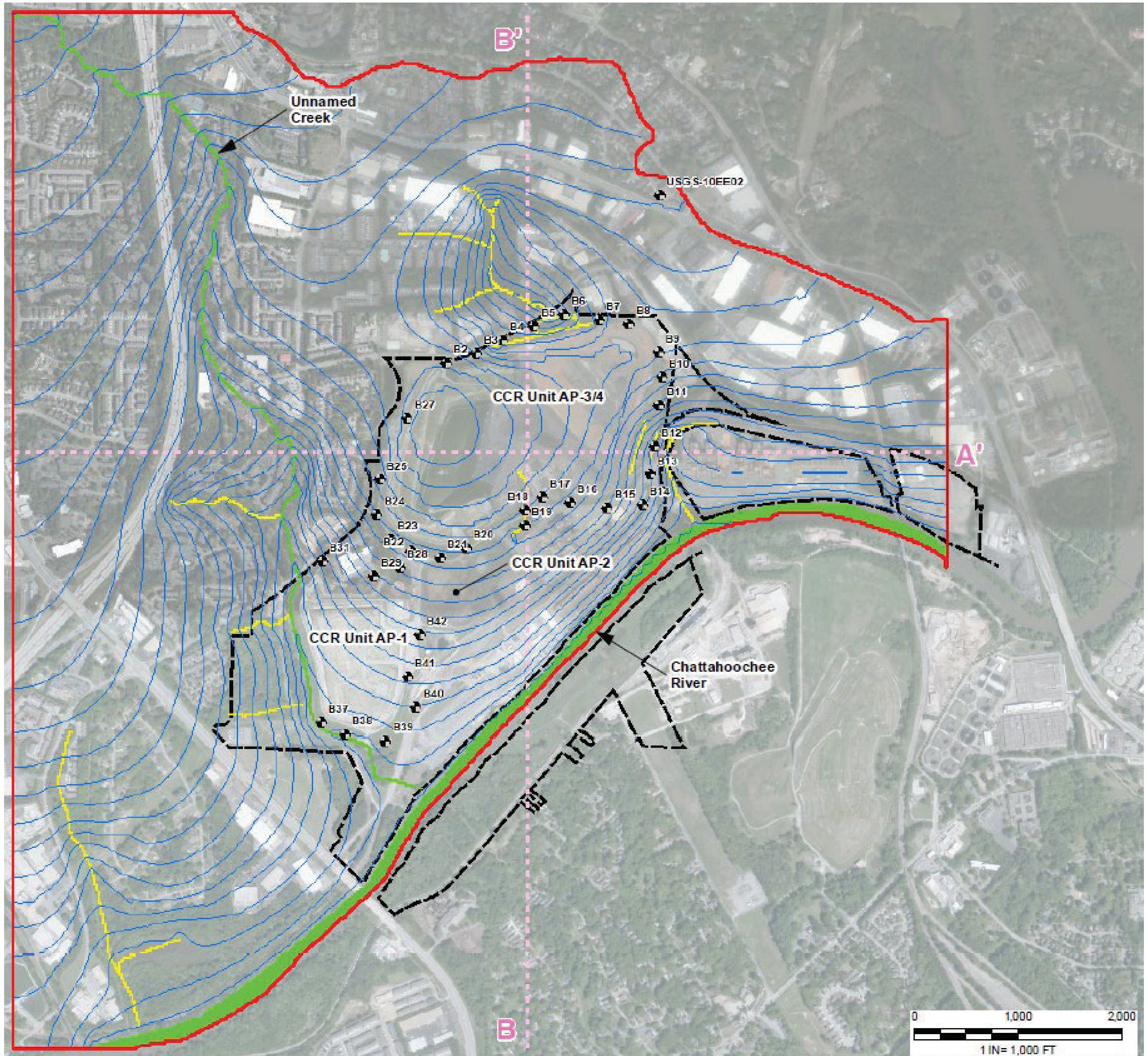
Active Model Boundary

Plant Boundary (Approximate)

**Notes**:
$K_{xy}$ = Horizontal and transverse hydraulic conductivity
$K_z$ = Vertical hydraulic conductivity

| | | | |
|---|---|---|---|
| CLIENT | GEORGIA POWER COMPANY/ SOUTHERN COMPANY SERVICES | Georgia Power | |
| PROJECT | PLANT MCDONOUGH | | |
| CONSULTANT | GOLDER | YYYY-MM-DD | 2019-10-11 |
| | | DESIGNED | JRJ |
| | | PREPARED | JRJ |
| | | CHECKED | WEG |
| | | REVIEWED/APPROVED | GLH |
| TITLE | MODEL LAYER 1 HYDRAULIC CONDUCTIVITY | | |
| PROJECT NO. 1668496 | CONTROL | REV. A | FIGURE 2-5 |

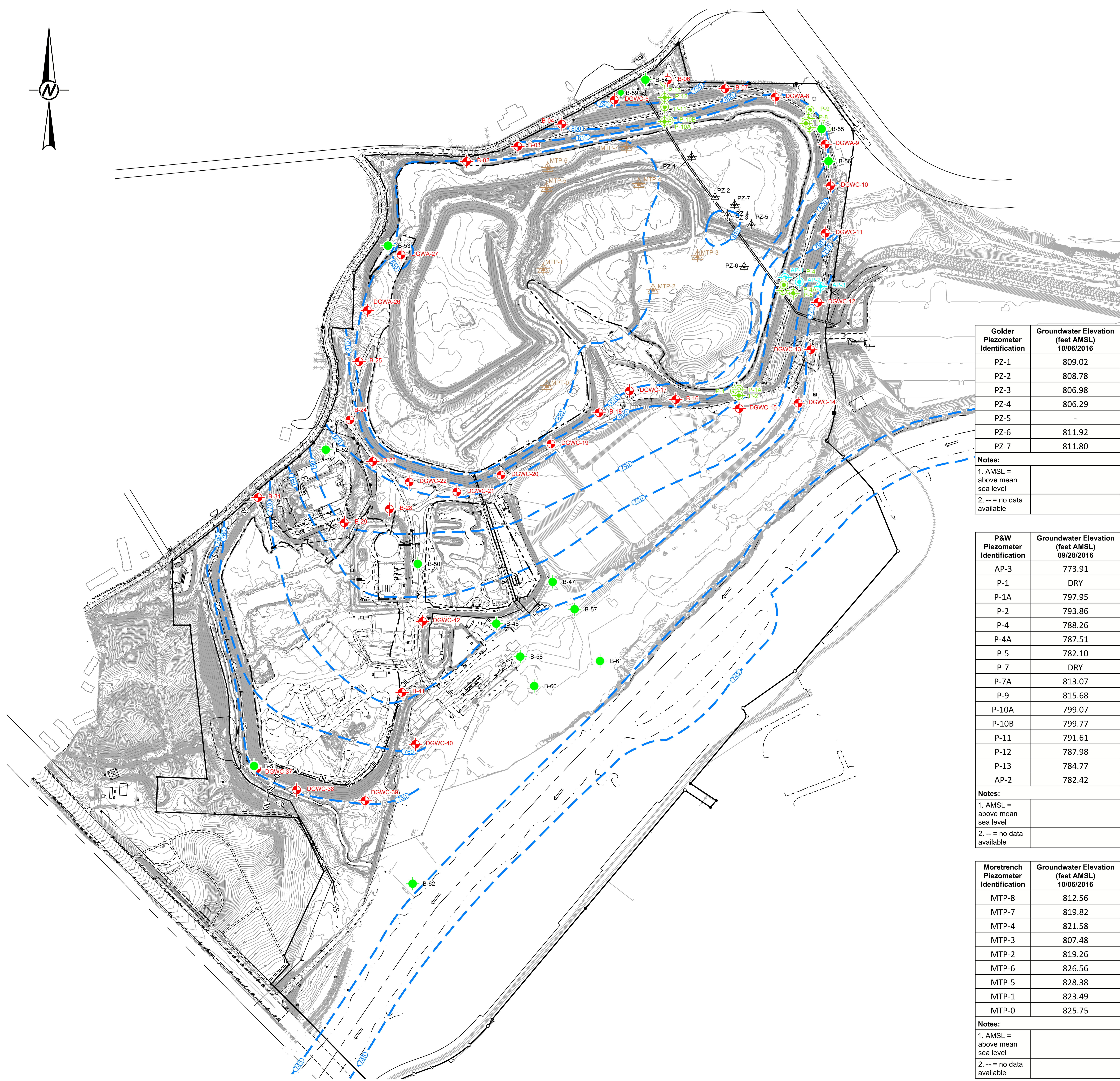
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B




## Legend

- Monitoring Well
- Drain Boundary
- River Boundary
- Constant Head Boundary
- Active Model Boundary
- Plant Boundary (Approximate)
- Simulated Groundwater Elevation (ft)

| | | | |
|---|---|---|---|
| CLIENT<br>GEORGIA POWER COMPANY/<br>SOUTHERN COMPANY SERVICES | Georgia Power | PROJECT<br>PLANT MCDONOUGH | |
| CONSULTANT<br>GOLDER | YYYY-MM-DD: 2019-10-11<br>DESIGNED: JRJ<br>PREPARED: JRJ<br>CHECKED: WEG<br>REVIEWED/APPROVED: GLH | TITLE<br>CALIBRATION TARGET LOCATIONS AND PRE-CLOSURE BASE MODEL<br>LAYER 2 SIMULATED GROUNDWATER ELEVATIONS | |
| | | PROJECT NO. 1668496 | CONTROL / REV. A / FIGURE 3-1 |



| Golder Piezometer Identification | Groundwater Elevation (feet AMSL) 10/06/2016 |
|---|---|
| PZ-1 | 809.02 |
| PZ-2 | 808.78 |
| PZ-3 | 806.98 |
| PZ-4 | 806.29 |
| PZ-5 | - |
| PZ-6 | 811.92 |
| PZ-7 | 811.80 |
| Notes: | |
| 1. AMSL = above mean sea level | |
| 2. -- = no data available | |

| P&W Piezometer Identification | Groundwater Elevation (feet AMSL) 09/28/2016 |
|---|---|
| AP-3 | 773.91 |
| P-1 | DRY |
| P-1A | 797.95 |
| P-2 | 793.86 |
| P-4 | 788.26 |
| P-4A | 787.51 |
| P-5 | 782.10 |
| P-7 | DRY |
| P-7A | 813.07 |
| P-9 | 815.68 |
| P-10A | 799.07 |
| P-10B | 799.77 |
| P-11 | 791.61 |
| P-12 | 787.98 |
| P-13 | 784.77 |
| AP-2 | 782.42 |
| Notes: | |
| 1. AMSL = above mean sea level | |
| 2. -- = no data available | |

| Moretrench Piezometer Identification | Groundwater Elevation (feet AMSL) 10/06/2016 |
|---|---|
| MTP-8 | 812.56 |
| MTP-7 | 819.82 |
| MTP-4 | 821.58 |
| MTP-3 | 807.48 |
| MTP-2 | 819.26 |
| MTP-6 | 826.56 |
| MTP-5 | 828.38 |
| MTP-1 | 823.49 |
| MTP-0 | 825.75 |
| Notes: | |
| 1. AMSL = above mean sea level | |
| 2. -- = no data available | |

| E&CE Piezometer Identification | Groundwater Elevation (feet AMSL) 10/06/2016 |
|---|---|
| B-2 | 822.29 |
| B-3 | 811.10 |
| B-4 | 797.53 |
| DGWC-5 | 785.92 |
| B-6 | 787.32 |
| B-7 | 798.52 |
| DGWA-8 | 810.49 |
| DGWA-9 | 809.47 |
| DGWC-10 | 802.15 |
| DGWC-11 | 791.42 |
| DGWC-12 | 765.63 |
| DGWC-13 | 760.01 |
| DGWC-14 | 770.13 |
| DGWC-15 | 785.78 |
| B-16 | 802.41 |
| DGWC-17 | 809.12 |
| B-18 | 809.44 |
| DGWC-19 | 804.57 |
| DGWC-20 | 801.97 |
| DGWC-21 | 802.31 |
| DGWC-22 | 804.02 |
| B-23 | 803.97 |
| B-24 | 805.95 |
| B-25 | 822.05 |
| DGWA-26 | 828.35 |
| DGWA-27 | 829.38 |
| B-28 | 792.37 |
| B-29 | 790.48 |
| B-31 | 763.68 |
| DGWC-37 | 752.85 |
| DGWC-38 | 751.16 |
| DGWC-39 | 751.94 |
| DGWC-40 | 761.44 |
| B-41 | 774.12 |
| DGWC-42 | 777.08 |
| AP1-14 | - |
| AP4-01 | - |
| B-47 | 778.10 |
| B-48 | 771.34 |
| B-50 | 782.17 |
| B-51 | 753.57 |
| B-52 | 797.50 |
| B-53 | 840.66 |
| B-54 | 781.03 |
| B-55 | 813.06 |
| B-56 | 807.31 |
| B-57 | 767.73 |
| B-58 | 765.90 |
| B-59 | 782.60 |
| B-60 | 748.68 |
| B-61 | 759.87 |
| B-62 | 741.77 |
| Notes: | |
| 1. AMSL = above mean sea level | |
| 2. -- = no data available | |

## LEGEND

EXISTING CONTOURS

PROPERTY BOUNDARY MARKERS/LIMITS

APPROXIMATE CELL LIMITS

GROUNDWATER SURFACE CONTOURS

BH — P & W 1977 PIEZOMETERS (SEE REFERENCE)

BH — AT&E 1981 BORINGS (SEE REFERENCE)

BH — E&CE 2012 GROUNDWATER MONITORING WELLS (SEE REFERENCE)

E&CS 2013 GROUNDWATER MONITORING WELLS (SEE REFERENCE)

GOLDER 2015 BORING LOCATIONS

GOLDER 2015 CPT LOCATIONS

PZ-1 — GOLDER 2015 PIEZOMETER LOCATION

GOLDER 2015 ASH DEWATERING WELLS

B-51 — GOLDER MONITORING WELLS

GOLDER PIPE CORRIDOR DEWATERING WELL

MTP-3 — MORETRENCH PIEZOMETER

MORETRENCH DEWATERING WELL

## NOTES

1.GROUNDWATER SURFACE CONTOUR INTERVAL = 10 FEET

2. GROUNDWATER CONTOURS BASED ON LINEAR INTERPOLATION BETWEEN AND EXTRAPOLATION FROM KNOWN DATA, TOPOGRAPHIC CONTOURS, AND KNOWN FIELD CONDITIONS, THEREFORE, GROUNDWATER CONTOURS MAY NOT REFLECT ACTUAL CONDITIONS.

## REFERENCES


1. THE EXISTING TOPOGRAPHY AND CONTOUR ELEVATIONS WERE PROVIDED BY GEORGIA LAND DEPARTMENT AND METRO ENGINEERING AND SURVEYING CO, INC. THE DATE OF THE SURVEY PROVIDED AND SHOWN ON THIS SET OF PLANS IS 10-16-2012. REFER TO THE SURVEY DRAWING TITLED "TOPOGRAPHIC MAP PREPARED FOR GEORGIA POWER COMPANY PLANT MCDONOUGH - GEORGIA STATE PLANE WEST SURVEY FEET - DATE OF PHOTOGRAPHY 10-26-12. PROJECT NO. 13225 - 01-13-2013."
2. THE REVISED TOPOGRAPHY & CONTOUR ELEVATIONS WERE PROVIDED BY GEORGIA POWER LAND DEPARTMENT. THE DATA SHOWN IS AN UPDATE TO THE PLANS DONE ON 10-16-2012 & THE ONSITE CHANGES SINCE THAT 2012 SURVEY. THE REVISED SURVEY WAS DONE ON 1-12-2016 & MERGED WITH THE DATA ON 10-16-2012.
GEORGIA POWER COMPANY PLANT MCDONOUGH ASH PONDS - GEORGIA STATE PLANE WEST SURVEY FEET - DATE OF SURVEY 1-12-2016 - LAND ENG. PROJECT # 20160020.
3. LAW ENGINEERING GEOTECHNICAL INVESTIGATION REPORT (1968).
4. PATTERSON AND DEWAR ENGINEERS PIEZOMETER INSTALLATION REPORT (1977).
5. ATLANTA TESTING AND ENGINEERING GEOTECHNICAL REPORT (1981).
6. GOLDER ASSOCIATES SITE INVESTIGATION (2006).
7. E AND CS PLANT MCDONOUGH HYDROGEOLOGICAL INVESTIGATION (2012).
8. E AND CS ASH POND 3 AND 4 CLOSURE BORINGS (2013).
9. GOLDER 2015 INVESTIGATION LOCATIONS SURVEYED BY LOWERY AND ASSOCIATES ON 11/12/15.


0 300 600
1" = 300' FEET

| REV | DATE | REVISION DESCRIPTION | DES | CADD | CHK | RVW |
|---|---|---|---|---|---|---|
| 1 | 2020-11-02 | UPDATE TITLE BLOCK | GLH | AVR | LS | GLH |
| 0 | 2016-09-27 | ISSUED | SEP | KNJ | GLH | GLH |

CLIENT
GEORGIA POWER COMPANY /
SOUTHERN COMPANY SERVICES

Southern Company

PROJECT
PLANT MCDONOUGH

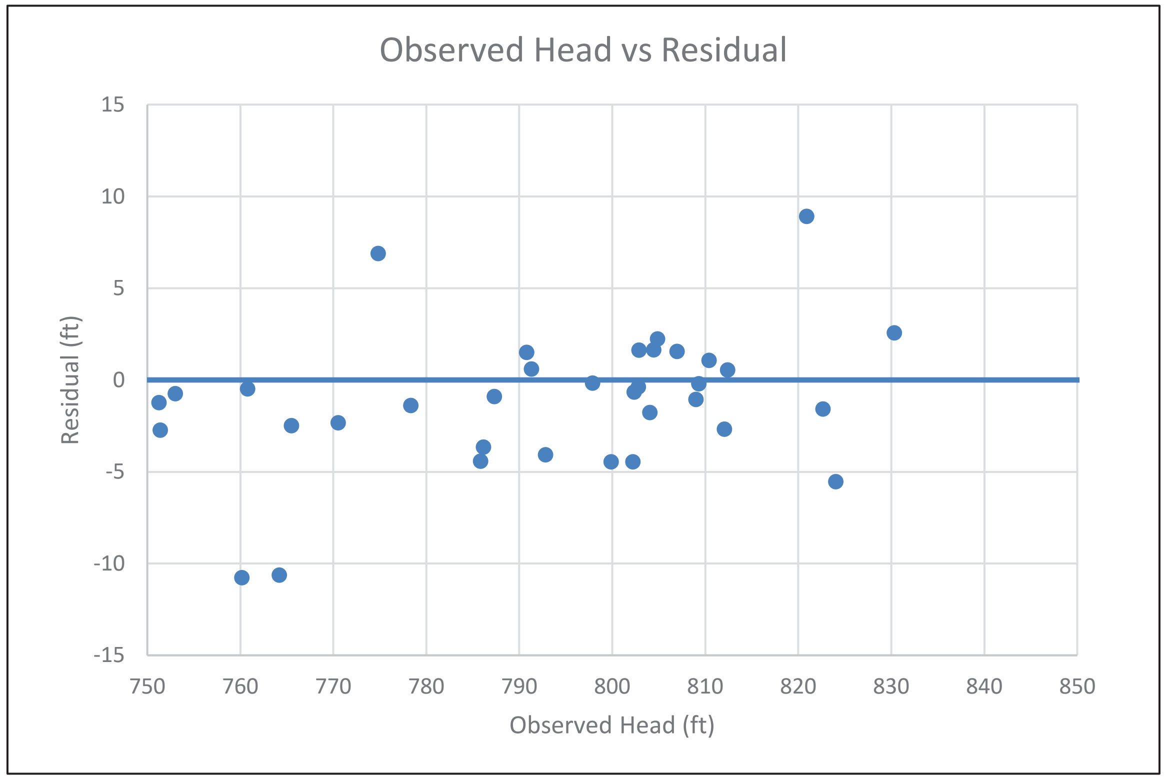
TITLE
**2016 OBSERVED GROUNDWATER ELEVATIONS AND CONTOURS**

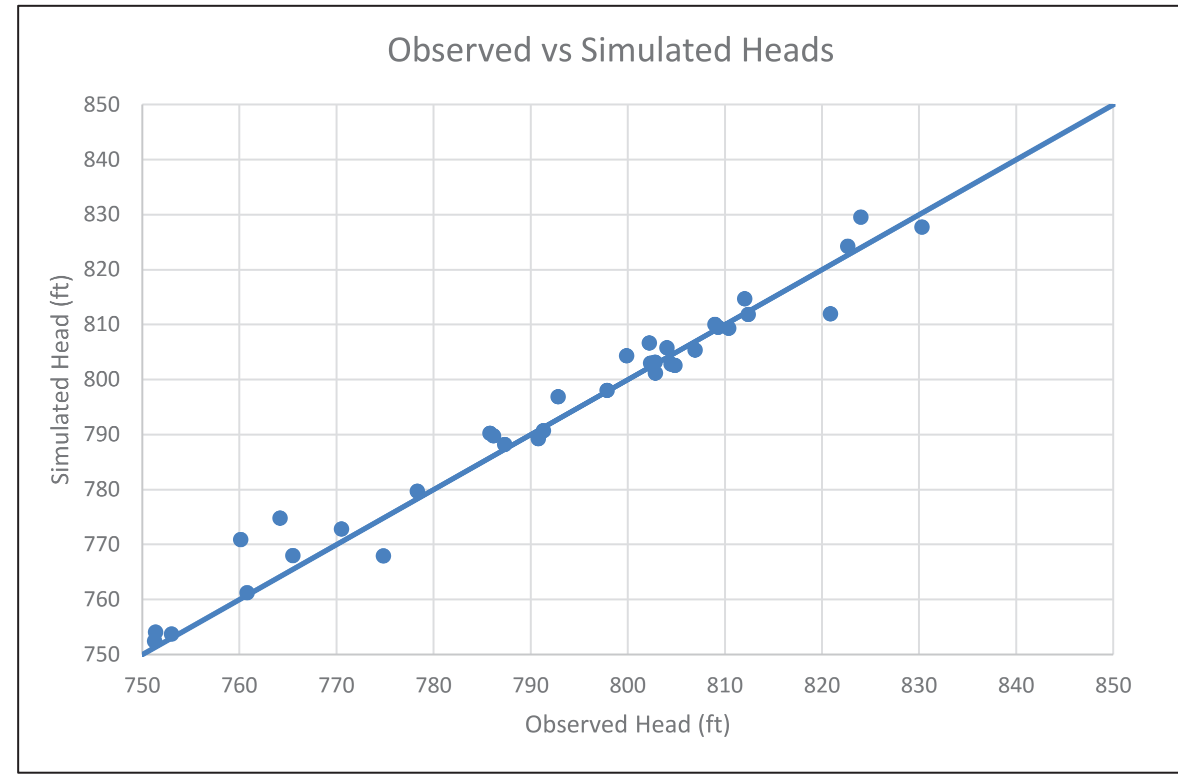
CONSULTANT

GOLDER

| | |
|---|---|
| YYYY-MM-DD | 2016/09/27 |
| DESIGNED | KNJ |
| PREPARED | SEP |
| CHECKED | GLH |
| REVIEWED/APPROVED | GLH |

| PROJECT NO. | PROJECT ID | REV. | FIGURE |
|---|---|---|---|
| 1668496 | MCD15017 | 1 | 3-2 |




CLIENT
GEORGIA POWER COMPANY/
SOUTHERN COMPANY SERVICES

Georgia Power

CONSULTANT

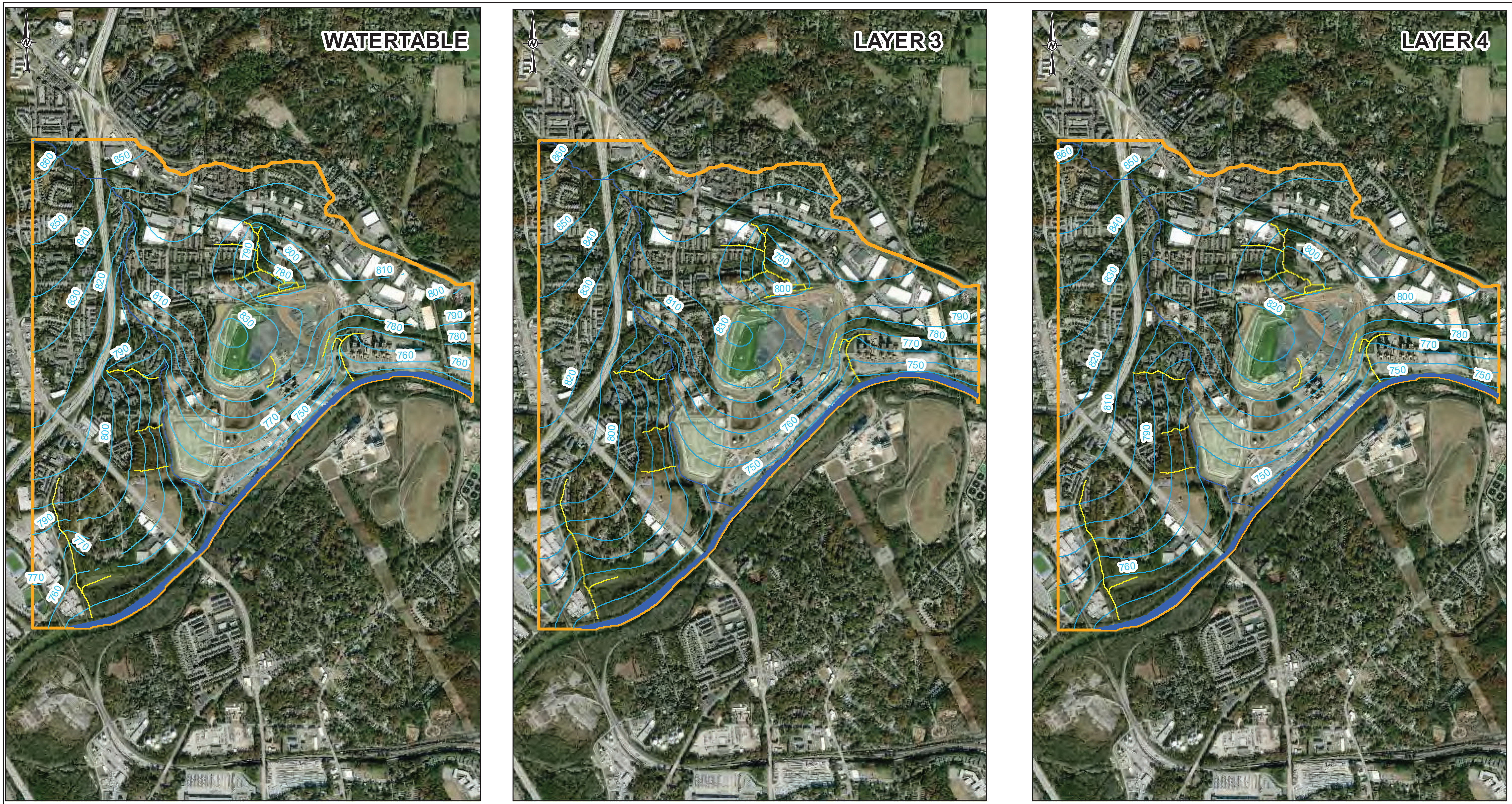
GOLDER

| | |
|---|---|
| YYYY-MM-DD | 2019-10-11 |
| DESIGNED | JRJ |
| PREPARED | JRJ |
| CHECKED | WEG |
| REVIEWED/APPROVED | GLH |

PROJECT
PLANT MCDONOUGH

TITLE
**MODEL CALIBRATION SUMMARY**

| PROJECT NO. | CONTROL | REV. | FIGURE |
|---|---|---|---|
| 1668496 | | A | 3-3 |




NOTES:

LEGEND

River Boundary Conditions

Drain Boundary

Groundwater Elevation Contour (ft)

Model Area

0 0.125 0.25 0.5 0.75 1 Miles

SERVICE LAYER CREDITS: SOURCE: ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRID, IGN, AND THE GIS USER COMMUNITY

CLIENT
GEORGIA POWER COMPANY/
SOUTHERN COMPANY SERVICES

Georgia Power

CONSULTANT

GOLDER

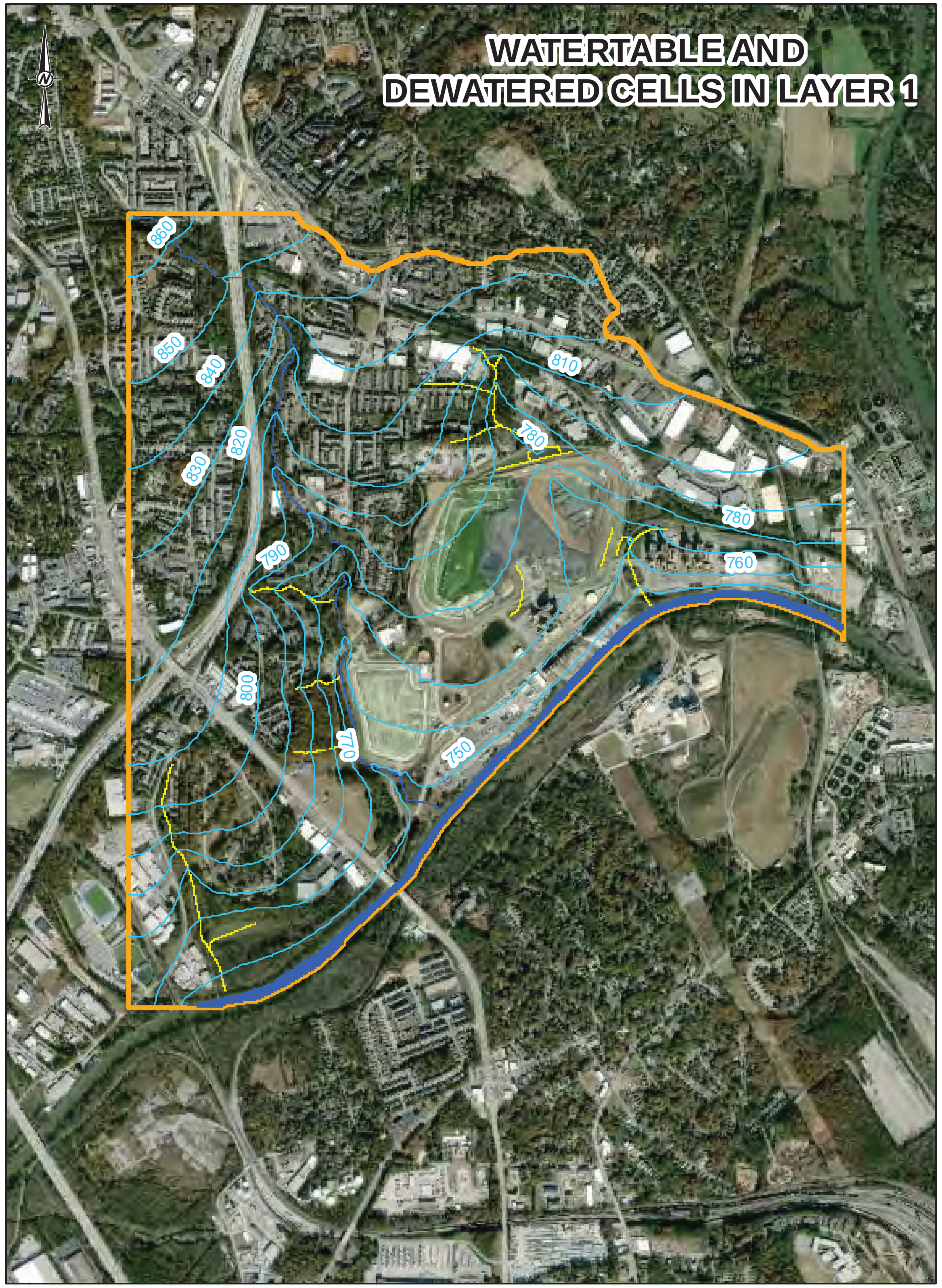
| | |
|---|---|
| YYYY-MM-DD | 2020-02-26 |
| DESIGNED | CB |
| PREPARED | JRJ |
| CHECKED | CB |
| REVIEWED/APPROVED | CB |

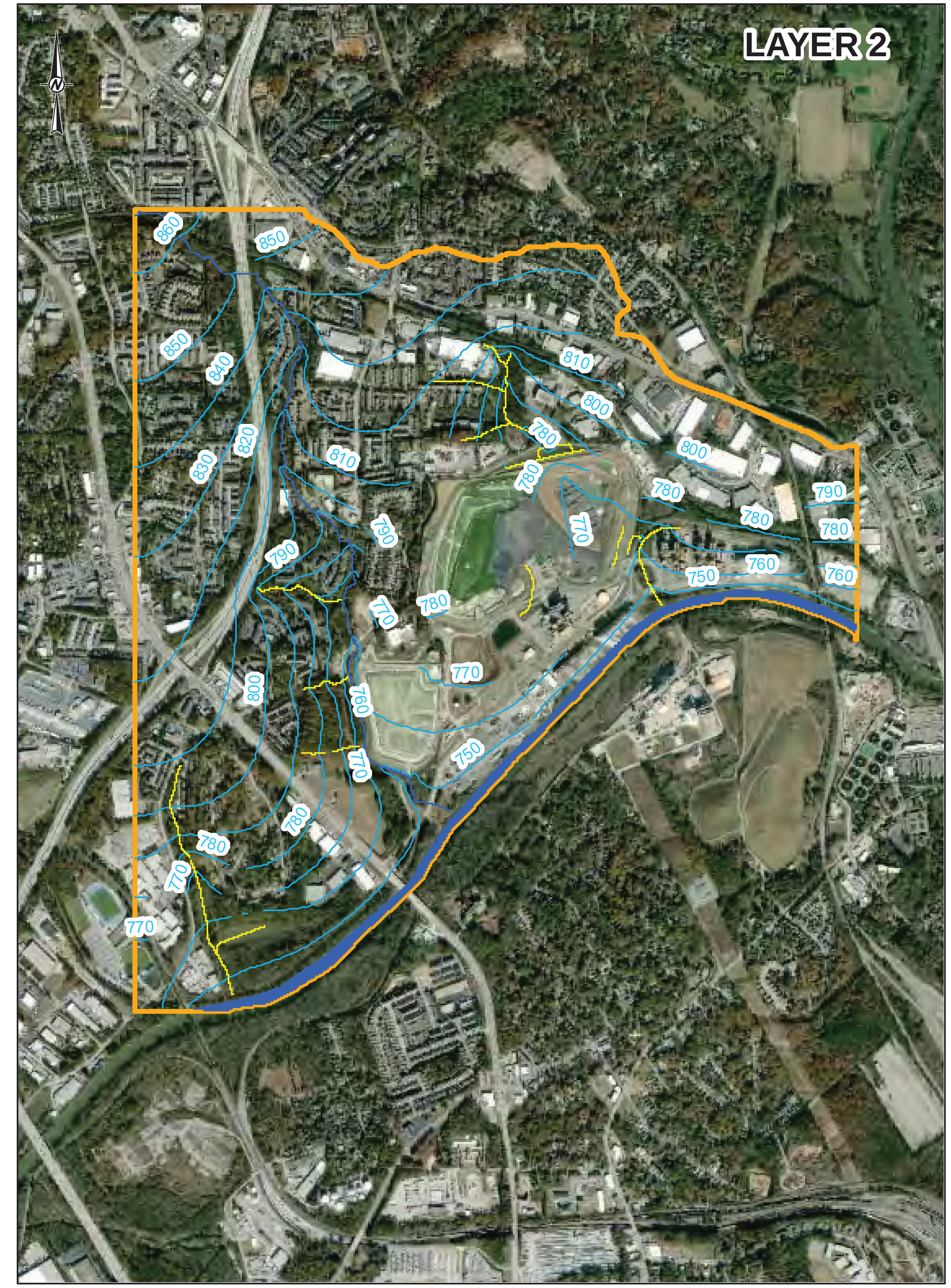
PROJECT
PLANT MCDONOUGH

TITLE
**Baseline Conditions Modeled Groundwater Elevation Contours**

| PROJECT NO. | PHASE | REV. | FIGURE |
|---|---|---|---|
| 1661841 | 3 | 0 | **4-1** |

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B




NOTES:

LEGEND

River Boundary Conditions

Drain Boundary

Groundwater Elevation Contour (ft)

Model Area

0 0.125 0.25 0.5 0.75 1
Miles

SERVICE LAYER CREDITS: SOURCE: ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRID, IGN, AND THE GIS USER COMMUNITY

CLIENT
GEORGIA POWER COMPANY/
SOUTHERN COMPANY SERVICES

Georgia Power

PROJECT
PLANT MCDONOUGH

CONSULTANT

GOLDER

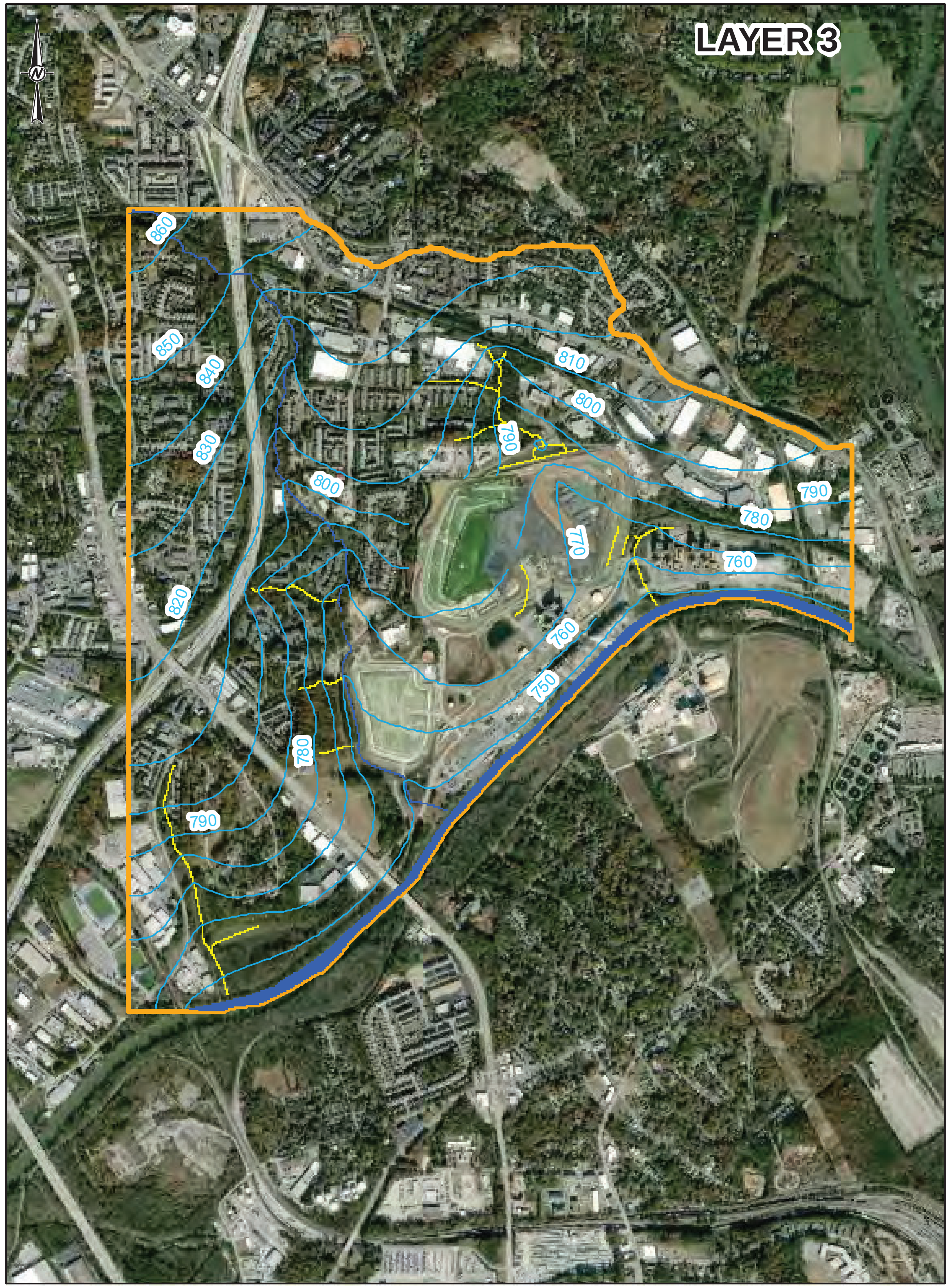
| | |
|---|---|
| YYYY-MM-DD | 2020-02-26 |
| DESIGNED | CB |
| PREPARED | JRJ |
| CHECKED | CB |
| REVIEWED/APPROVED | CB |

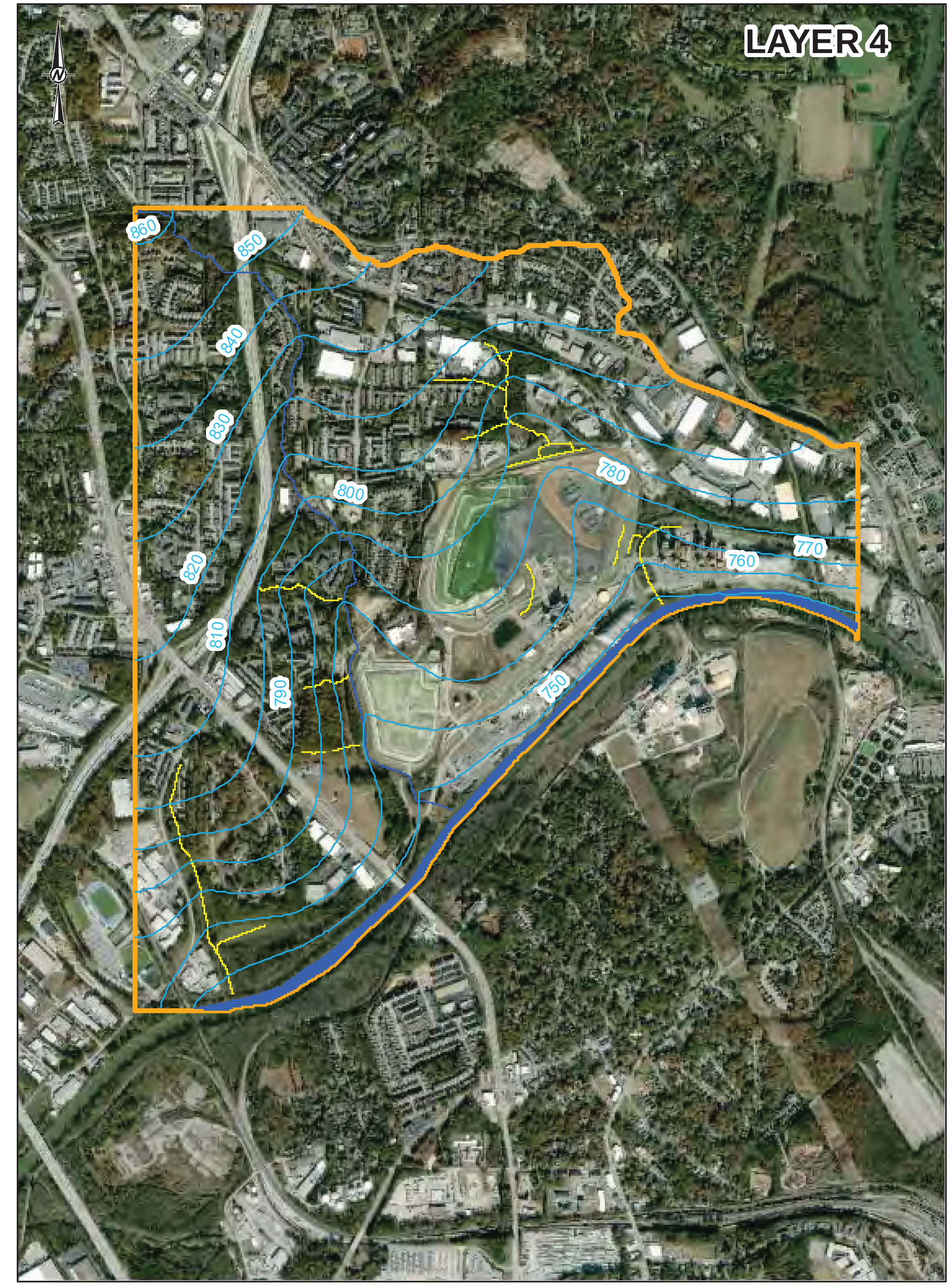
TITLE
**Closure Conditions Model Conditions Water Table and Model Layer 2 Modeled Groundwater Elevation Contours**

| PROJECT NO. | PHASE | REV. | FIGURE |
|---|---|---|---|
| 1661841 | 3 | 0 | **4-2** |

PATH: C:\Users\JRJones\Desktop\1661841_3_005_F_5_5_Rev0_GW_levels_OPTION_4B_L1_L2~.mxd PRINTED ON: 2020-03-03 AT: 2:40:31 PM

1 in IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B




LEGEND

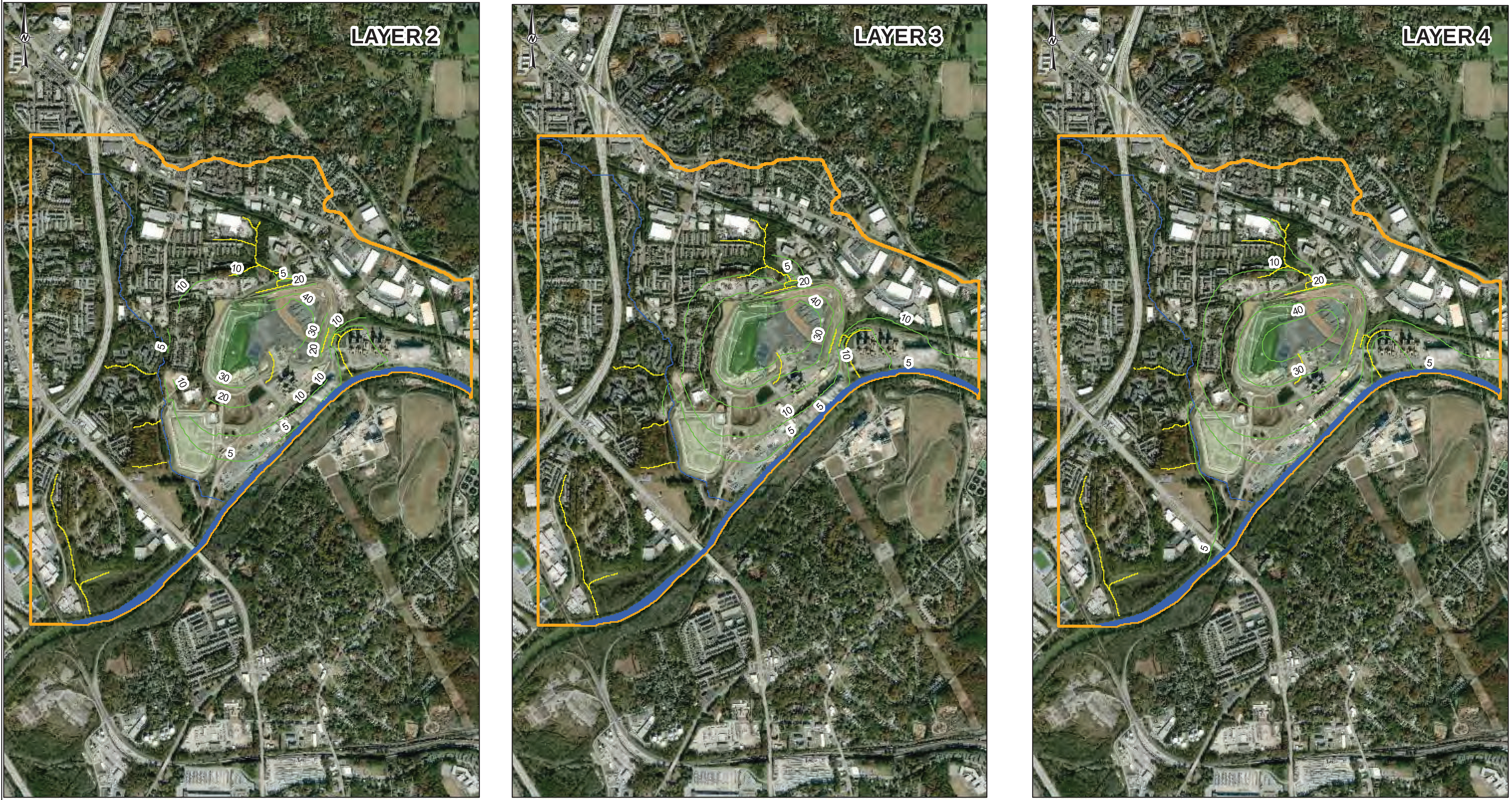
- River Boundary Conditions
- Drain Boundary
- Groundwater Elevation Contour (ft)
- Model Area

0 0.125 0.25 0.5 0.75 1 Miles

SERVICE LAYER CREDITS: SOURCE: ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRID, IGN, AND THE GIS USER COMMUNITY

| | |
|---|---|
| CLIENT | GEORGIA POWER COMPANY/ SOUTHERN COMPANY SERVICES |
| | Georgia Power |
| PROJECT | PLANT MCDONOUGH |
| CONSULTANT | GOLDER |
| YYYY-MM-DD | 2020-02-26 |
| DESIGNED | CB |
| PREPARED | JRJ |
| CHECKED | CB |
| REVIEWED/APPROVED | CB |
| TITLE | **Closure Conditions Model Conditions Model Layer 3 and 4 Modeled Groundwater Elevation Contours** |
| PROJECT NO. | 1661841 |
| PHASE | 3 |
| REV. | 0 |
| FIGURE | 4-3 |

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B




NOTES:

LEGEND

- River Boundary Conditions
- Drain Boundary
- Drawdown (ft)
- Model Area

0 0.125 0.25 0.5 0.75 1 Miles



| | | | |
|---|---|---|---|
| CLIENT | GEORGIA POWER COMPANY/ SOUTHERN COMPANY SERVICES | PROJECT | PLANT MCDONOUGH |
| CONSULTANT | GOLDER | TITLE | **Closure Conditions Model versus Baseline Modeled Groundwater Elevation Change** |
| YYYY-MM-DD | 2020-02-26 | | |
| DESIGNED | CB | | |
| PREPARED | JRJ | | |
| CHECKED | CB | | |
| REVIEWED/APPROVED | CB | | |

| PROJECT NO. | PHASE | REV. | FIGURE |
|---|---|---|---|
| 1661841 | 3 | 0 | 4-4 |

**APPENDIX C**

# Three-Dimensional Numerical Groundwater Modeling Summary Report

# for

# Plant McDonough CCR Unit AP-3/4 - Addendum

REPORT

# Three-Dimensional Numerical Groundwater Modeling Summary Report Addendum

*Georgia Power - Plant McDonough, Cobb County, Georgia*

Submitted to:

**Georgia Power**

Environmental Affairs
241 Ralph McGill Boulevard
Atlanta, Georgia 30308

Submitted by:


**Golder Associates Inc.**

5170 Peachtree Road Building 100 Suite 300, Atlanta, Georgia, USA 30341

+1 770 496-1893



Project No. 1777449

Rev0

November 22, 2021

# Table of Contents

**1.0 INTRODUCTION** .......... **3**

1.1 Closure Model .......... 3

1.2 Addendum Closure Model .......... 4

**2.0 PREDICTIVE SIMULATION AND RESULTS** .......... **5**

**3.0 REFERENCES** .......... **5**

**TABLE**

Table 1 – Summary of Modeling Results

**FIGURES**

Figure 1 – Site Location Map

Figure 2 – AP-1 Model Boundary Conditions

Figure 3 – Closure Conditions Model Domain Groundwater Table

Figure 4 – AP-1 Closure Conditions Groundwater Table

Figure 5 – AP-1 Closure Conditions Groundwater Elevation (Layer 2)

Figure 6 – AP-1 Closure Conditions Groundwater Elevation (Layer 3)

Figure 7 – AP-1 Closure Conditions Groundwater Elevation (Layer 4)

Figure 8 – AP-1 Groundwater Flow Transect Locations

# 1.0 INTRODUCTION

This *Three-Dimensional Numerical Groundwater Modeling Summary Report Addendum* (Addendum) was prepared by Golder Associates Inc. (Golder) to document updates to the steady state numerical groundwater flow model associated with the Advanced Engineering Method (AEM) at CCR Unit Ash Pond 1 (AP-1) at the Georgia Power Company (Georgia Power) Plant McDonough-Atkinson (Plant McDonough; Site) located in Cobb County, Georgia (see Figure 1).

AP-1 is currently capped and in the process of closure to minimize infiltration and erosion and to meet or exceed the requirements of § 257.102(d)(3)(ii). As discussed in the Plant McDonough AP-1 Solid Waste Handling Permit Application submitted to the Georgia Environmental Protection Division (EPD) in September 2021 (Golder, 2021a), the AP-1 closure will include an AEM consisting of a fully encompassing subsurface vertical barrier wall (barrier wall) constructed from the ground surface to the top of partially weathered rock (PWR). Predicted post-closure groundwater flow conditions for AP-1 were previously simulated using a Closure Model that is documented in the Model Report submitted to EPD in 2020 as an Appendix to the Hydrogeological Assessment Report (HAR) (Golder, 2020a). The HAR was submitted to EPD as Revision 03 in September 2021 (Golder, 2021b).

This Addendum documents revised post-closure groundwater flow model predictions based on updates to the AP-1 closure-by-removal area grading and subsurface barrier wall alignment, as documented in the Plant McDonough-Atkinson Coal Combustion Residual (CCR) Surface Impoundments (CCR Unit AP-1 and CCR Unit AP-2, CCR Unit AP-3/4) Permit applications (AP-1 Permit (Golder, 2021a) and AP-2, AP-3/4 Permit (Golder, 2020b with 2021 revisions). The updated model is hereafter referred to as the Addendum Closure Model.

The Addendum Closure Model, which focuses on AP-1, also includes updates to AP-2 and AP-3/4 closure designs (also located in the Closure Model domain) based on the November 2021 AP-2, AP-3/4 Permit application Response to EDP Comments and revised Closure Drawings. Revised closure design for AP-2 and AP-3/4 include backfilling of AP-2 with soil, minor grading changes in the CCR excavation portion of AP-3/4, and the as-built depth of the AP-3/4 underdrain.

The following sections provide a brief overview of the previously submitted Closure Model and describe model updates and results of the Addendum Closure Model.

## 1.1 Closure Model

The conceptual site model (CSM) and Baseline and Closure Models construction, calibration, and results were previously documented in the Three-Dimensional Numerical Groundwater Modeling Summary Report Revision 3 (Model Report), included as Appendix A of the HAR (Golder, 2021b).

The Baseline and Closure Models presented in the Model Report are as follows:

- The Baseline Model is a calibrated groundwater flow model that simulates August 2016 steady state flow conditions, after the initial cover installation at AP-1 and prior to the final cover installation at AP-3/4. This model serves as the basis for the predictive Closure Model.

- The Closure Model is a modified version of the Baseline Model that simulates final cover installation at AP-1 over a consolidated CCR footprint and installation of a fully encompassing barrier wall reflecting the original 2018 AP-1 Permit Closure Design barrier alignment and depth; closure of AP-2 by removing CCR without backfilling; and installation of final cover at AP-3/4 over a consolidated footprint and a proposed AEM underdrain.

## 1.2 Addendum Closure Model

The objective of this addendum is to document the results of the Addendum Closure Model. The Addendum Closure Model updates focus primarily on the incorporation of the updated barrier wall design for AP-1, but they also include updates to cover alignments and/or grading at AP-2 and AP-3/4. Updates incorporated into the Addendum Closure Model are as follows:

- AP-1: Updated geometry of the final cover system and updated alignment of the fully encompassing subsurface barrier wall based on the November 2021 Closure Drawings as part of the Permit application. The proposed barrier wall will extend from the ground surface (top of Model Layer 1) to the top of PWR (Model Layer 3) along the alignment from the 2021 AP-1 Permit application, as shown in Figure 2.

  The barrier wall is simulated in the Addendum Closure Model using Horizontal-Flow-Barrier (HFB) model boundary conditions and are assigned the same wall thickness and hydraulic conductivity as in the previous Closure Model, which is consistent with the expected wall construction.

- AP-2: Updated grading based on backfilling with soil. The ground surface (top of Layer 1) in the model within AP-2 is updated to reflect backfilling with soil[1].

- AP-3/4: Updated alignments for the final cover system and the underdrain AEM to reflect as-built conditions[2]. The AP-3/4 AEM underdrain is simulated using drain model boundary conditions, and the drain stage and hydraulic conductivity are updated to reflect as-built conditions.

Additionally, all areas with final cover are assigned a recharge of zero, consistent with the Closure Model, and all AP-1 CCR (Layer 1) outside the limits of the 2021 Permit barrier wall alignment were removed from the Addendum Closure Model consistent with the proposed barrier wall construction plans.

Results of the Addendum Closure Model are compared to results of the Baseline and Closure Models documented in the 2020 Model Report. The following metrics are used to evaluate AP-1 and AP-3/4 post-closure predictions[3]: (i) maximum height of the potentiometric surface above the bottom of AP-1; (ii) volume of CCR below the potentiometric surface; (iii) percent reduction in volume of CCR below the potentiometric surface; and (iv) percent reduction in AP-1 downgradient groundwater flow.

---

[1] AP-2 soil backfill was assigned the same properties as Overburden (see Model Report). Flow fields proximal to AP-2 are unchanged as compared to the Closure Model.

[2] AP-3/4 temporary dewatering wells are not included in the Addendum Closure Model, as they will only be used during construction and for a temporary period at the beginning of post closure. This approach is consistent with the Closure Model submitted to EPD in 2020.

[3] The Addendum Closure Model predicts that AP-3/4 CCR will desaturate due to the presence of the underdrain AEM in the as-bult configuration.

# 2.0 PREDICTIVE SIMULATION AND RESULTS

Simulated model-wide water table elevation contours (10-ft contour interval) for the Closure Model and Addendum Closure Model are presented in Figure 3. Predicted post-closure water levels across the Site are similar in the Closure Model and Addendum Closure Model, as depicted in Figure 3.

Review of simulated more detailed groundwater elevation contours (2-ft contour interval) near AP-1 in Layers 1 through 4 (Figures 4 through 7, respectively) indicates water levels in AP-1 decreased by approximately one to two feet in the Addendum Closure Model compared to the Closure Model.

The predicted reduction in saturated volume of AP-1 CCR in the Addendum Closure Model as compared to the Baseline Model is 31%, as summarized in Table 1. The predicted reductions in simulated flow across the western and southern side of AP-1 in overburden (Layer 2) in the Addendum Closure Model as compared to the Baseline Model are 84% and 72%, respectively, as summarized in Table 1[4]. The predicted reduction in saturated volume of AP-3/4 CCR in the Addendum Closure Model as compared to the Baseline Model is 100%.

Plant McDonough CCR Unit Addendum Closure Conditions are predicted to reduce the potentiometric surface elevation within the units, the volume of saturated CCR, and flow across the Unit boundaries including the elimination of saturation and flow across CCR in Unit AP-3/4. These reductions are more pronounced in the Addendum Closure Model and result in more favorable predicted post-closure conditions with respect to closure objectives.

# 3.0 REFERENCES

Golder, 2020a. Appendix A -Three-Dimensional Numerical Groundwater Modeling Summary Report, Revision 5, Golder Associates Inc. November 2020.

Golder, 2020b. Plant McDonough-Atkinson CCR Surface Impoundments (CCR Unit AP-2, Combined CCR Unit AP-3/4) Cobb County, Georgia Part A Section 2 – Permit Application Revision 1, Golder Associates Inc. November 2020, with 2021 Revisions.

Golder, 2021a. Plant McDonough-Atkinson CCR Surface Impoundments (CCR Unit AP-1) Cobb County, Georgia Part A Section 2 – Permit Application, Golder Associates Inc. September 2021.

Golder, 2021b. Hydrogeologic Assessment Report, Plant McDonough-Atkinson Ash Pond 1, Ash Pond 2, and Ash Pond 3/4, Revision 3, Golder Associates Inc. September 2021.

[4] Flow estimates were calculated in the model.

# TABLE

**TABLE 1: SUMMARY OF AP-1 MODELING RESULTS**
Groundwater Model Addendum
Plant McDonough-Atkinson

| Model Scenario | CCR Unit Conditions | Maximum Height of Potentiometric Surface Above Bottom of Unit (feet) | Volume of CCR Below the Potentiometric Surface (cubic yards) | Percent (%) Reduction in Volume of CCR Below the Potentiometric Surface | Percent (%) Reduction in Downgradient Groundwater Flux Across A Transect | Percent (%) Reduction in Downgradient Groundwater Flux Across B Transect |
|---|---|---|---|---|---|---|
| **CCR Unit AP-1 Results** | | | | | | |
| Baseline | Cover installed | 16.0 | 205,800 | - | - | - |
| Closure | Cover installed, fully encompassing barrier wall | 13.0 | 163,100 | 21% | 74% | 70% |
| Addendum Closure | Cover installed, fully encompassing barrier wall with updated alignment | 12.0 | 142,300 | 31% | 84% | 72% |
| **CCR Unit AP-3/4 Results** | | | | | | |
| Baseline | AP-3/4 Pre-Closure Conditions | 49.2 | 1,528,300 | - | - | - |
| Closure (4) | Consolidated CCR Footprint, Cover installed, AEM Underdrain | 1.0 | 200 | 99.99% | ~100% | |
| Addendum Closure | Consolidated CCR Footprint, Cover installed, AEM Underdrain with As-Built Conditions | 0.0 | 0 | 100% | 100% | |

**Notes:**

1. These values were obtained from groundwater flow modeling results. It is noted that groundwater flow models are necessarily simplified mathematical representations of complex natural systems. Because of this, all groundwater models have limits to their accuracy.

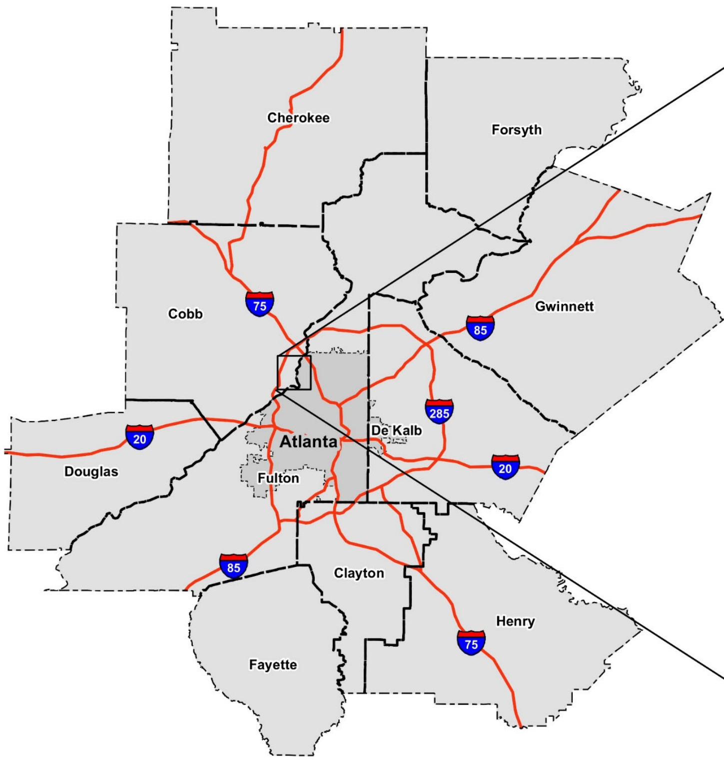
2. These model results were intended for use as relative comparisons between scenarios, and not as precise predictions of post-closure conditions.

3. Flux estimates were calculated in the model as the volume of water passing through a vertical plane per unit time. Transect locations are depicted in Figure 8. AP-3/4 downgradient flux is shown to reduce by 100% due to the complete desaturation of the CCR in AP-3/4.

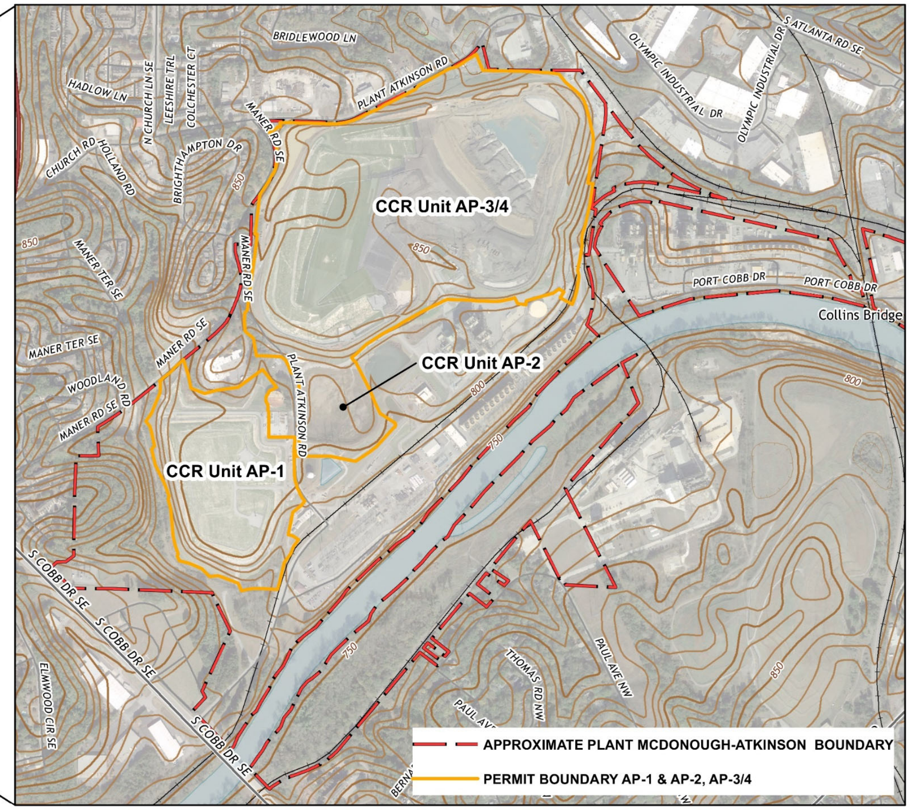
4. The Closure Model indicated de minimis saturated CCR in AP-3/4 because of the geometric conceptualization of the underdrain model boundary condition. The Addendum Closure Model boundary conditions represent the as-built underdrain condition and geometry and predicts complete de-saturation of CCR in AP-3/4.

Created by: KSG 07/21/2021
Checked by: WEG 07/29/2021
Revised by: KSG / GLH 08/27/2021
Revised by: CB 11/22/2021

# FIGURES




## SITE VICINITY MAP




REF: USGS 7.5 MINUTE SERIES TPOGRAPHIC QUADRANGLE:
MABLETON, GA 1992 & NORTHWEST ATLANTA, GA 1993

## SITE LOCATION MAP

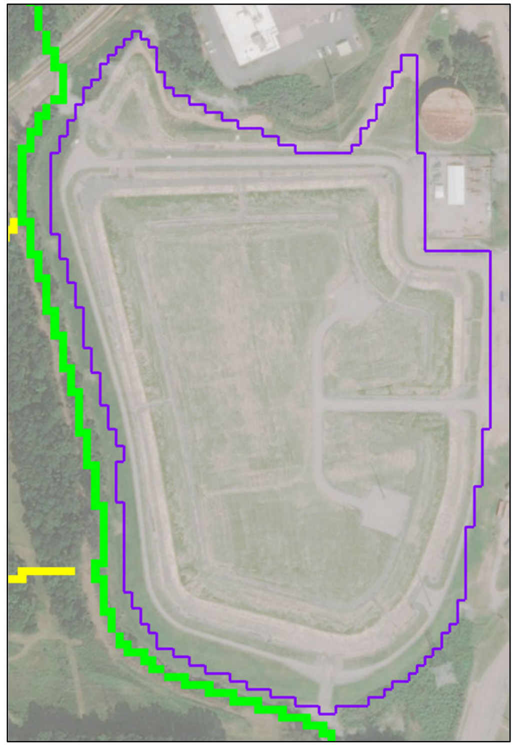
0 1,000 2,000

1 IN= 1000 FT

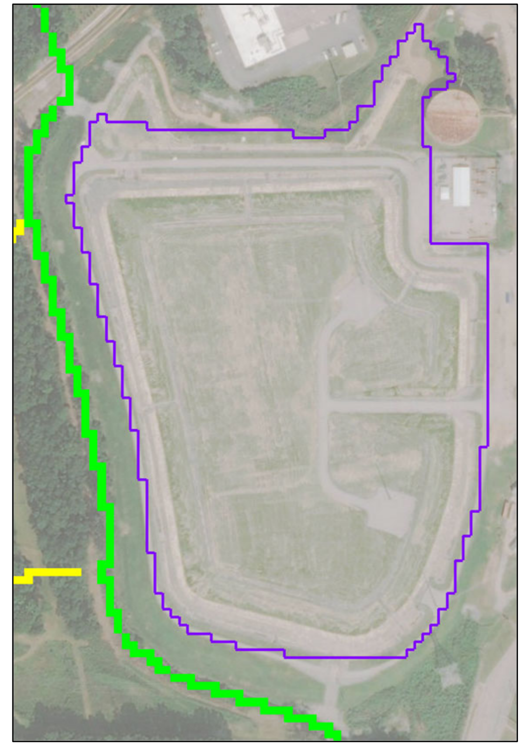
| | | | |
|---|---|---|---|
| CLIENT<br>SOUTHERN COMPANY SERVICES | Southern Company | PROJECT<br>PLANT MCDONOUGH - ATKINSON<br>GROUNDWATER MODEL ADDENDUM | Georgia Power |
| CONSULTANT<br>GOLDER MEMBER OF WSP | YYYY-MM-DD 2021-08-27<br>DESIGNED KSG<br>PREPARED KSG<br>CHECKED WEG<br>REVIEWED/APPROVED CAB | TITLE<br>SITE LOCATION MAP | |
| | | PROJECT NO. 1777449 | CONTROL - REV. 0 FIGURE 1 |

## BASELINE MODEL

## CLOSURE MODEL



## ADDENDUM CLOSURE MODEL



0' 300' 600'

SCALE IN FEET

**LEGEND**

- DRAIN BOUNDARY CONDITION
- RIVER BOUNDARY CONDITION
- BARRIER WALL BOUNDARY CONDITION

**NOTES**

1. GROUNDWATER MODEL CONSTRUCTION AND CALIBRATION ARE DESCRIBED IN REFERENCE 1.

**REFERENCES**


1. HYDROGEOLOGICAL ASSESSMENT REPORT GEORGIA POWER COMPANY PLANT MCDONOUGH-ATKINSON, APPENDIX A, GOLDER ASSOCIATES INC. 2021.


CLIENT
SOUTHERN COMPANY SERVICES

Southern Company

PROJECT
PLANT MCDONOUGH - ATKINSON
GROUNDWATER MODEL ADDENDUM

Georgia Power

CONSULTANT

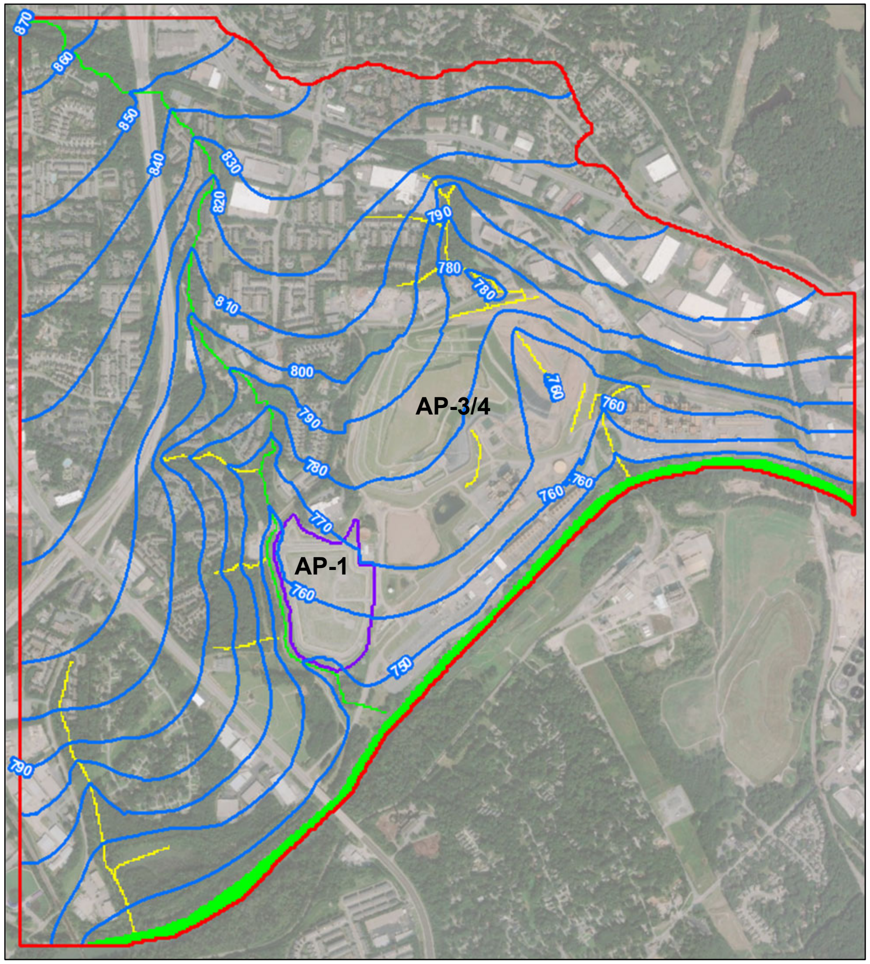
GOLDER MEMBER OF WSP

| | |
|---|---|
| YYYY-MM-DD | 2021-08-27 |
| DESIGNED | KSG |
| PREPARED | KSG |
| CHECKED | WEG |
| REVIEWED/APPROVED | CAB |

TITLE
AP-1 MODEL BOUNDARY CONDITIONS

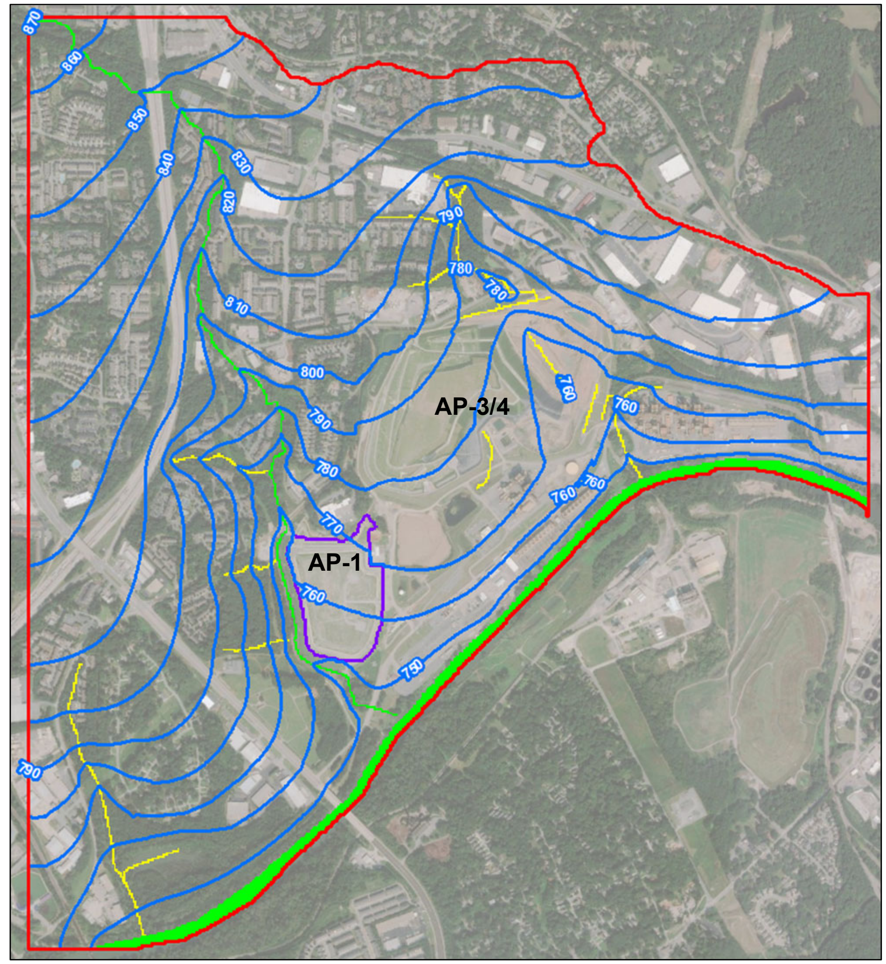
| PROJECT NO. | CONTROL | REV. | FIGURE |
|---|---|---|---|
| 1777449 | - | 0 | 2 |

## CLOSURE MODEL




CONTOUR INTERVAL = 10 FT

## ADDENDUM CLOSURE MODEL




CONTOUR INTERVAL = 10 FT

2000'' 4000'

SCALE IN FEET

**LEGEND**

- DRAIN BOUNDARY CONDITION
- RIVER BOUNDARY CONDITION
- BARRIER WALL BOUNDARY CONDITION
- ACTIVE MODEL DOMAIN
- 850 GROUNDWATER ELEVATION CONTOUR

**NOTES**

1. GROUNDWATER MODEL CONSTRUCTION AND CALIBRATION ARE DESCRIBED IN REFERENCE 1.

**REFERENCES**

1. HYDROGEOLOGICAL ASSESSMENT REPORT GEORGIA POWER COMPANY PLANT MCDONOUGH-ATKINSON, APPENDIX A, GOLDER ASSOCIATES INC. 2021.

CLIENT
SOUTHERN COMPANY SERVICES

Southern Company

CONSULTANT

GOLDER MEMBER OF WSP

| | |
|---|---|
| YYYY-MM-DD | 2021-08-27 |
| DESIGNED | KSG |
| PREPARED | KSG |
| CHECKED | WEG |
| REVIEWED/APPROVED | CAB |

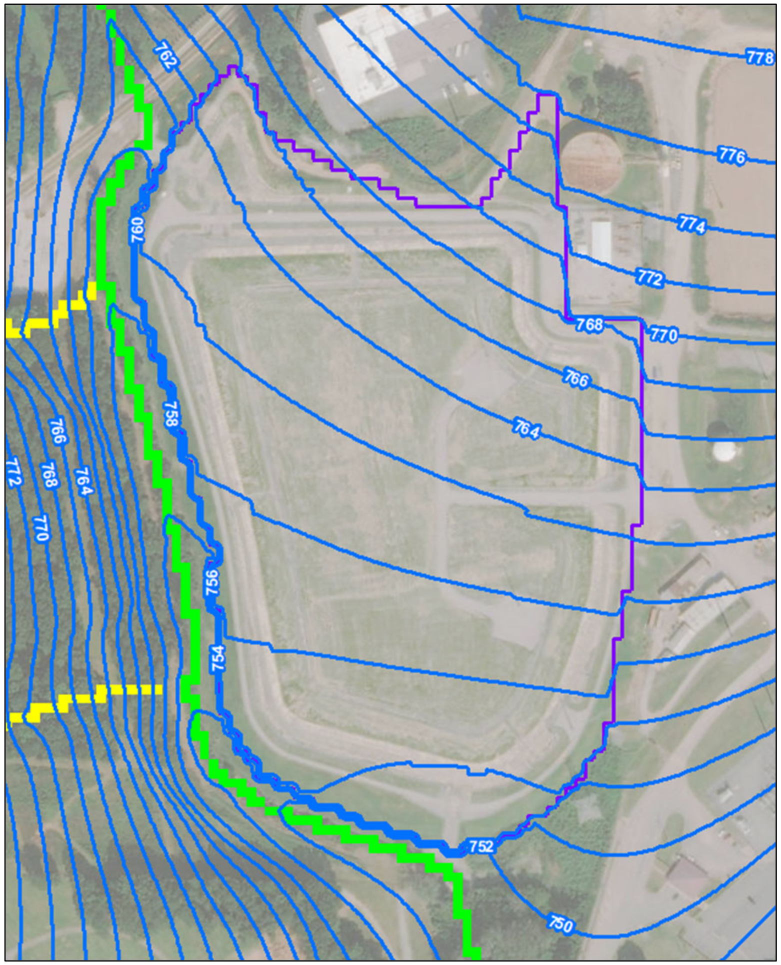
PROJECT
PLANT MCDONOUGH - ATKINSON
GROUNDWATER MODEL ADDENDUM

Georgia Power

TITLE
CLOSURE CONDITIONS MODEL DOMAIN GROUNDWATER TABLE

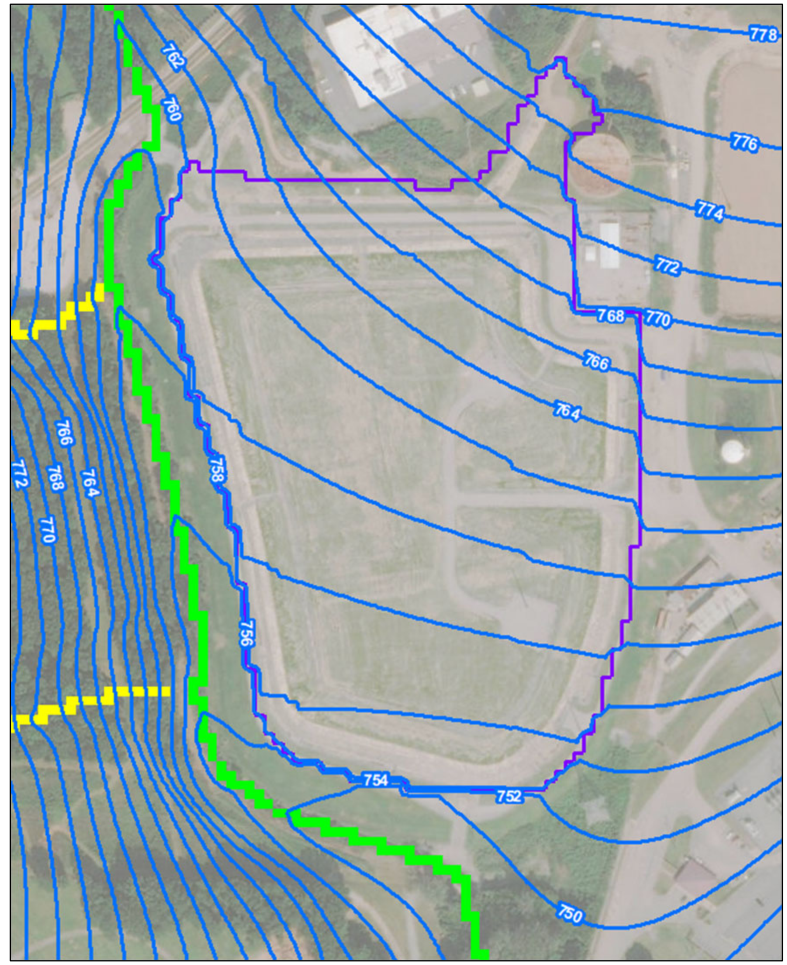
| PROJECT NO. | CONTROL | REV. | FIGURE |
|---|---|---|---|
| 1777449 | - | 0 | 3 |

## CLOSURE MODEL (LAYER 1)




CONTOUR INTERVAL = 2 FT

## ADDENDUM CLOSURE MODEL (LAYER 1)




CONTOUR INTERVAL = 2 FT

0' 200' 400'

SCALE IN FEET

**LEGEND**

DRAIN BOUNDARY CONDITION

RIVER BOUNDARY CONDITION

BARRIER WALL BOUNDARY CONDITION

850 GROUNDWATER ELEVATION CONTOUR

**NOTES**

1. GROUNDWATER MODEL CONSTRUCTION AND CALIBRATION ARE DESCRIBED IN REFERENCE 1.

**REFERENCES**


1. HYDROGEOLOGICAL ASSESSMENT REPORT GEORGIA POWER COMPANY PLANT MCDONOUGH-ATKINSON, APPENDIX A, GOLDER ASSOCIATES INC. 2021.


CLIENT
SOUTHERN COMPANY SERVICES

Southern Company

PROJECT
PLANT MCDONOUGH - ATKINSON
GROUNDWATER MODEL ADDENDUM

Georgia Power

CONSULTANT

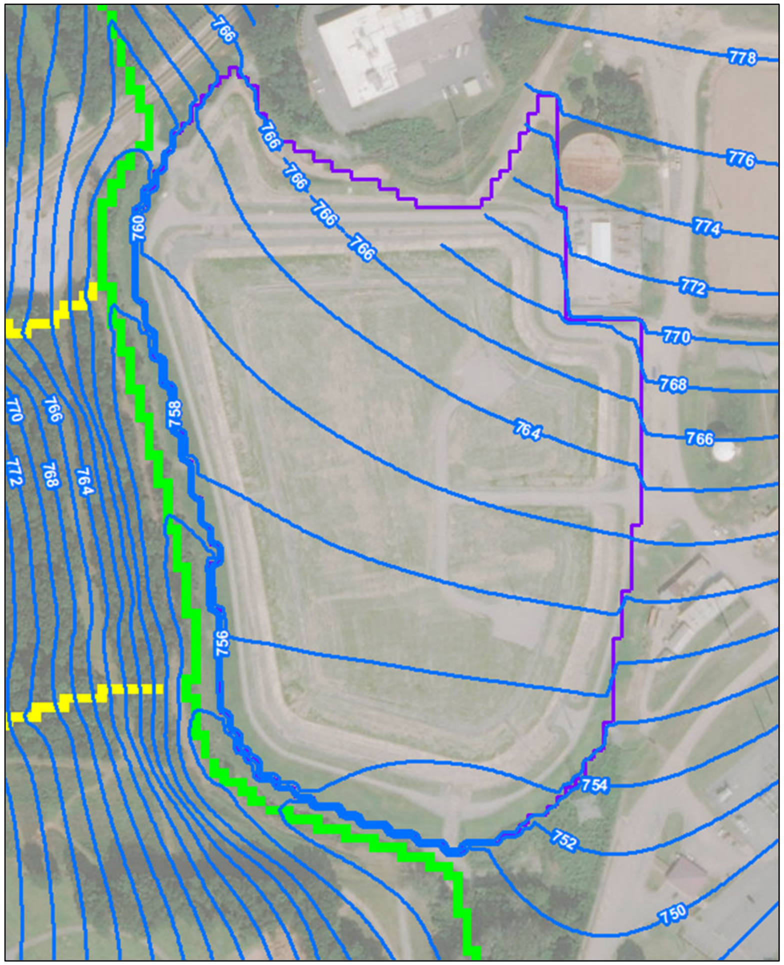
GOLDER MEMBER OF WSP

| | |
|---|---|
| YYYY-MM-DD | 2021-08-27 |
| DESIGNED | KSG |
| PREPARED | KSG |
| CHECKED | WEG |
| REVIEWED/APPROVED | CAB |

TITLE
AP-1 CLOSURE CONDITIONS GROUNDWATER TABLE

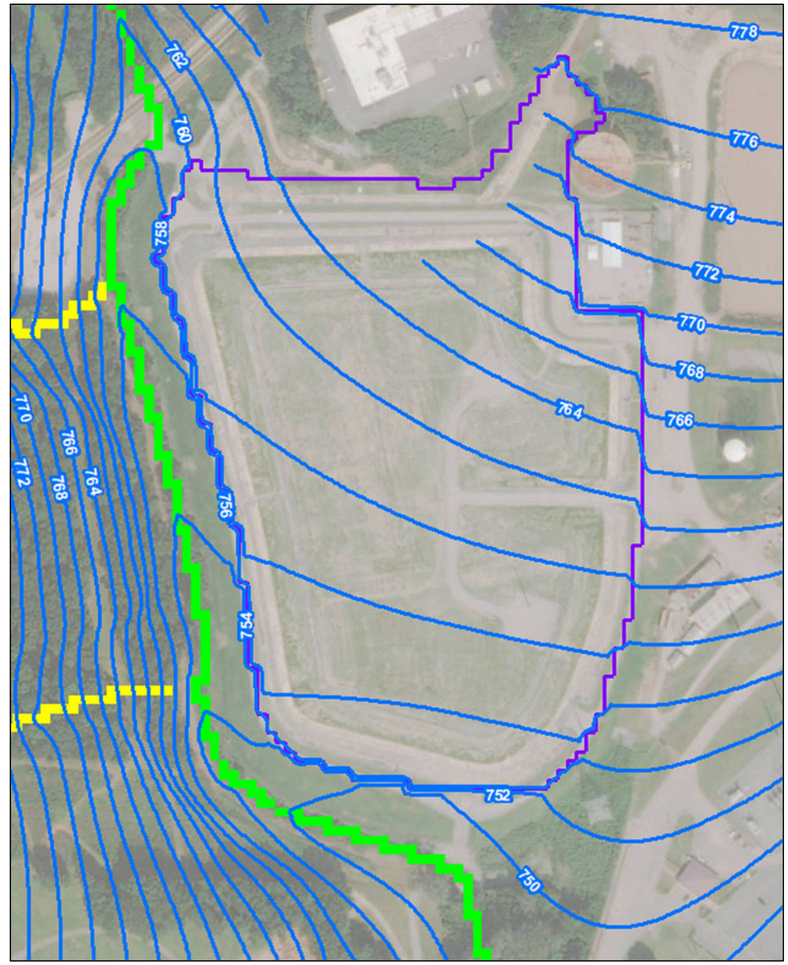
| PROJECT NO. | CONTROL | REV. | FIGURE |
|---|---|---|---|
| 1777449 | - | 0 | 4 |

## CLOSURE MODEL (LAYER 2)




CONTOUR INTERVAL = 2 FT

## ADDENDUM CLOSURE MODEL (LAYER 2)




CONTOUR INTERVAL = 2 FT

0' 200' 400'

SCALE IN FEET

**LEGEND**

- DRAIN BOUNDARY CONDITION
- RIVER BOUNDARY CONDITION
- BARRIER WALL BOUNDARY CONDITION
- 850 GROUNDWATER ELEVATION CONTOUR

**NOTES**

1. GROUNDWATER MODEL CONSTRUCTION AND CALIBRATION ARE DESCRIBED IN REFERENCE 1.

**REFERENCES**


1. HYDROGEOLOGICAL ASSESSMENT REPORT GEORGIA POWER COMPANY PLANT MCDONOUGH-ATKINSON, APPENDIX A, GOLDER ASSOCIATES INC. 2021.


CLIENT
SOUTHERN COMPANY SERVICES

Southern Company

CONSULTANT

GOLDER
MEMBER OF WSP

| | |
|---|---|
| YYYY-MM-DD | 2021-08-27 |
| DESIGNED | KSG |
| PREPARED | KSG |
| CHECKED | WEG |
| REVIEWED/APPROVED | CAB |

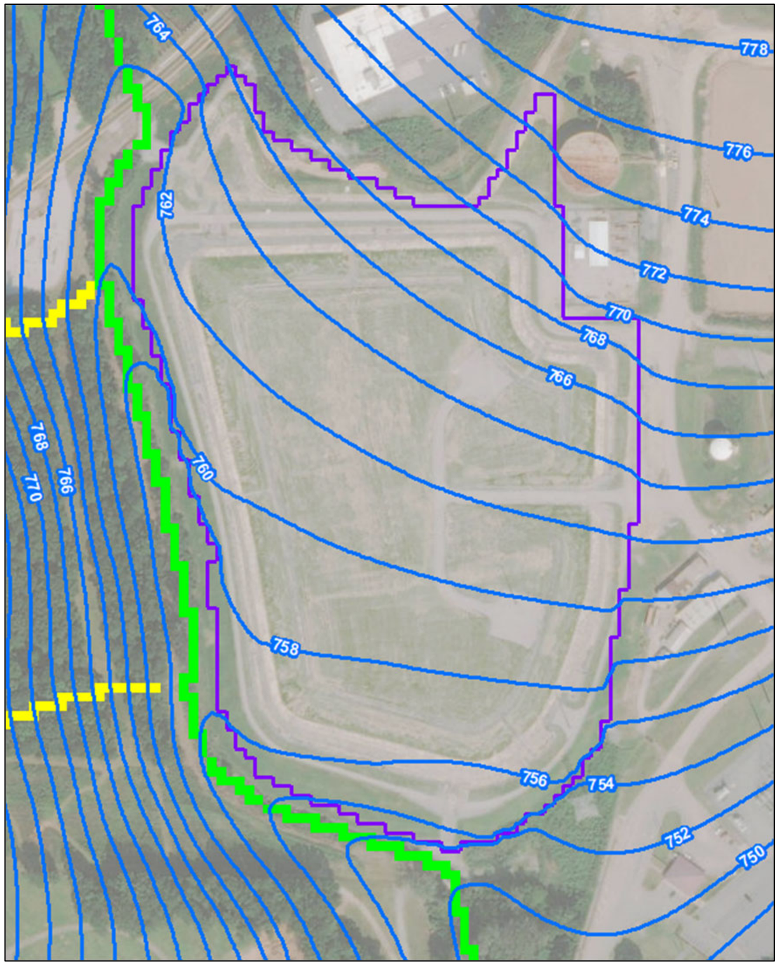
PROJECT
PLANT MCDONOUGH - ATKINSON
GROUNDWATER MODEL ADDENDUM

Georgia Power

TITLE
AP-1 CLOSURE CONDITIONS GROUNDWATER ELEVATION (LAYER 2)

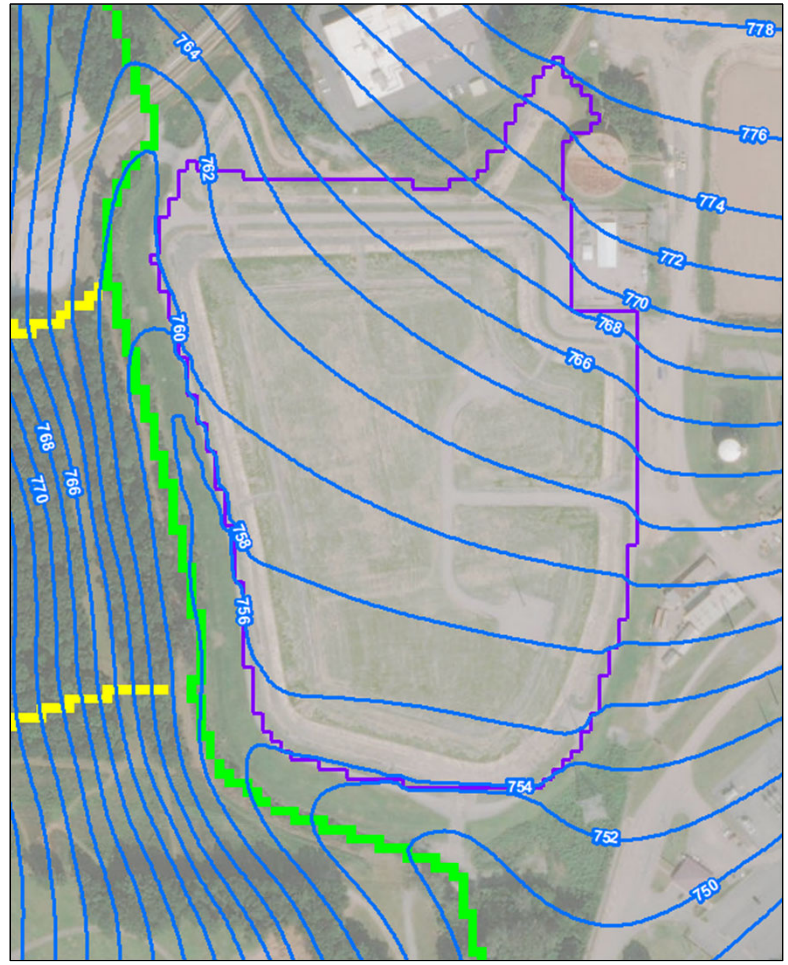
| PROJECT NO. | CONTROL | REV. | FIGURE |
|---|---|---|---|
| 1777449 | - | 0 | 5 |

## CLOSURE MODEL (LAYER 3)




CONTOUR INTERVAL = 2 FT

## ADDENDUM CLOSURE MODEL (LAYER 3)




CONTOUR INTERVAL = 2 FT

0' 200' 400'

SCALE IN FEET

**LEGEND**

- DRAIN BOUNDARY CONDITION
- RIVER BOUNDARY CONDITION
- BARRIER WALL BOUNDARY CONDITION
- 850 GROUNDWATER ELEVATION CONTOUR

**NOTES**

1. GROUNDWATER MODEL CONSTRUCTION AND CALIBRATION ARE DESCRIBED IN REFERENCE 1.

**REFERENCES**


1. HYDROGEOLOGICAL ASSESSMENT REPORT GEORGIA POWER COMPANY PLANT MCDONOUGH-ATKINSON, APPENDIX A, GOLDER ASSOCIATES INC. 2021.


CLIENT
SOUTHERN COMPANY SERVICES

Southern Company

CONSULTANT
GOLDER
MEMBER OF WSP

| | |
|---|---|
| YYYY-MM-DD | 2021-08-27 |
| DESIGNED | KSG |
| PREPARED | KSG |
| CHECKED | WEG |
| REVIEWED/APPROVED | CAB |

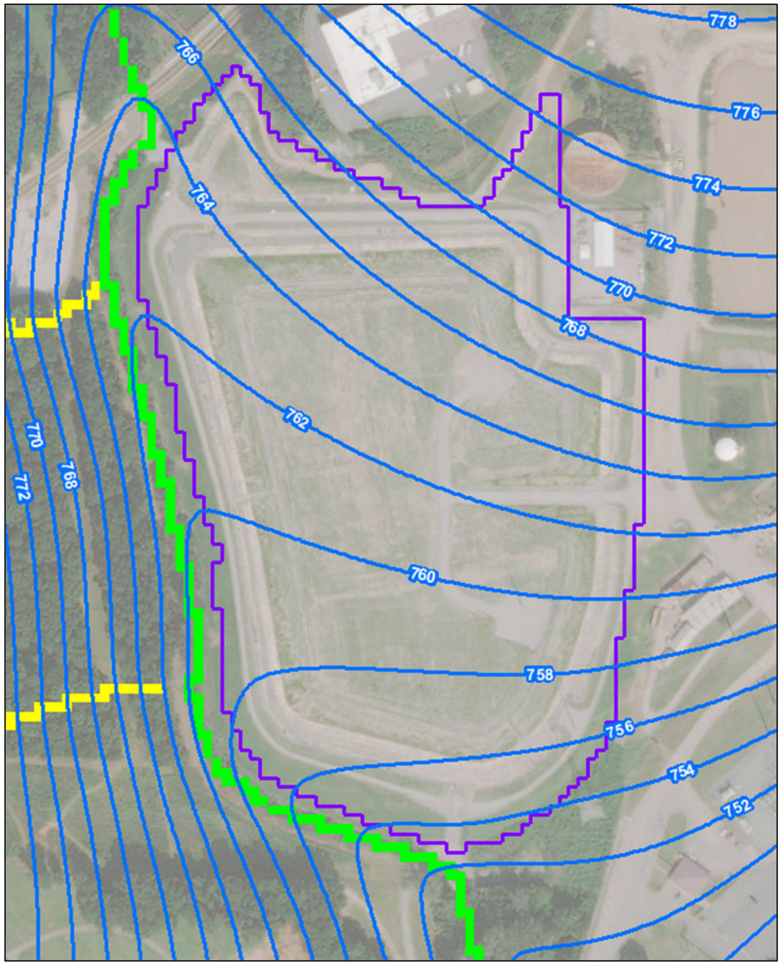
PROJECT
PLANT MCDONOUGH - ATKINSON
GROUNDWATER MODEL ADDENDUM

Georgia Power

TITLE
AP-1 CLOSURE CONDITIONS GROUNDWATER ELEVATION (LAYER 3)

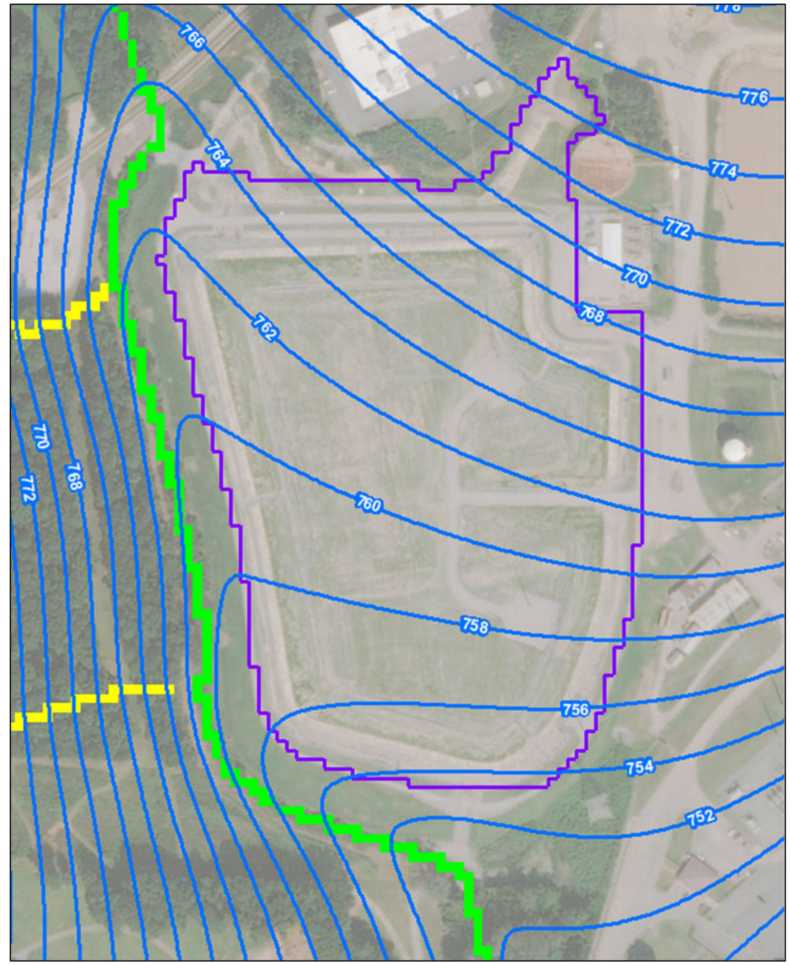
| PROJECT NO. | CONTROL | REV. | FIGURE |
|---|---|---|---|
| 1777449 | - | 0 | 6 |

## CLOSURE MODEL (LAYER 4)




CONTOUR INTERVAL = 2 FT

## ADDENDUM CLOSURE MODEL (LAYER 4)




CONTOUR INTERVAL = 2 FT

0' 200' 400'

SCALE IN FEET

**LEGEND**

- DRAIN BOUNDARY CONDITION
- RIVER BOUNDARY CONDITION
- BARRIER WALL BOUNDARY CONDITION
- 850 GROUNDWATER ELEVATION CONTOUR

**NOTES**

1. GROUNDWATER MODEL CONSTRUCTION AND CALIBRATION ARE DESCRIBED IN REFERENCE 1.

**REFERENCES**


1. HYDROGEOLOGICAL ASSESSMENT REPORT GEORGIA POWER COMPANY PLANT MCDONOUGH-ATKINSON, APPENDIX A, GOLDER ASSOCIATES INC. 2021.


CLIENT
SOUTHERN COMPANY SERVICES

Southern Company

CONSULTANT

GOLDER MEMBER OF WSP

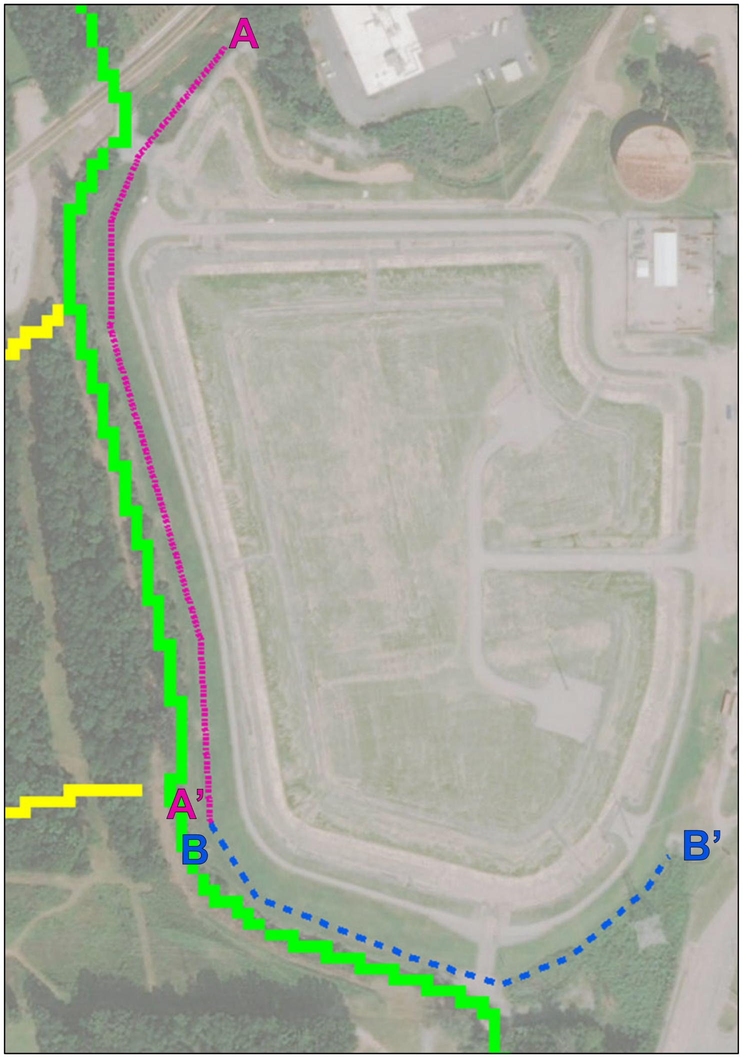
| | |
|---|---|
| YYYY-MM-DD | 2021-08-27 |
| DESIGNED | KSG |
| PREPARED | KSG |
| CHECKED | WEG |
| REVIEWED/APPROVED | CAB |

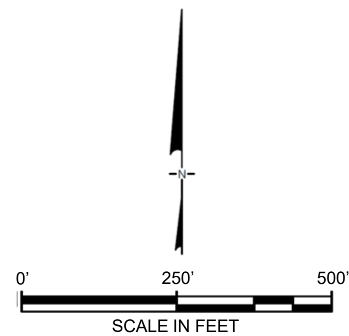
PROJECT
PLANT MCDONOUGH - ATKINSON
GROUNDWATER MODEL ADDENDUM

Georgia Power

TITLE
AP-1 CLOSURE CONDITIONS GROUNDWATER ELEVATION (LAYER 4)

| PROJECT NO. | CONTROL | REV. | FIGURE |
|---|---|---|---|
| 1777449 | - | 0 | 7 |




**LEGEND**

- DRAIN BOUNDARY CONDITION
- RIVER BOUNDARY CONDITION
- BARRIER WALL BOUNDARY CONDITION
- FLUX TRANSECT A-A'
- FLUX TRANSECT B-B'

**NOTES**

1. GROUNDWATER MODEL CONSTRUCTION AND CALIBRATION ARE DESCRIBED IN REFERENCE 1.

**REFERENCES**


1. HYDROGEOLOGICAL ASSESSMENT REPORT GEORGIA POWER COMPANY PLANT MCDONOUGH-ATKINSON, APPENDIX A, GOLDER ASSOCIATES INC. 2021.


CLIENT
SOUTHERN COMPANY SERVICES

Southern Company

CONSULTANT

GOLDER
MEMBER OF WSP

| | |
|---|---|
| YYYY-MM-DD | 2021-08-27 |
| DESIGNED | KSG |
| PREPARED | KSG |
| CHECKED | WEG |
| REVIEWED/APPROVED | CAB |

PROJECT
PLANT MCDONOUGH - ATKINSON
GROUNDWATER MODEL ADDENDUM

Georgia Power

TITLE
AP-1 GROUNDWATER FLOW TRANSECT LOCATIONS

| PROJECT NO. | CONTROL | REV. | FIGURE |
|---|---|---|---|
| 1777449 | - | 0 | 8 |

wsp.com