# Compliance with the Closure Performance Standards Required by Coal Combustion Residuals (CCR) Rule
# Plant Wansley Ash Pond (AP-1)

The objective of this Report is to supplement the closure permit application submitted to the Georgia Environmental Protection Division (GA EPD) by Georgia Power Company (Georgia Power). This Report further demonstrates that the closure method selected for the CCR surface impoundment at Plant Wansley complies with the closure performance standards of both Federal and State CCR regulations (i.e., CCR Rule).

## I. Introduction to the regulated unit, closure method, and conceptual site model

### A. Regulated unit and site location

Plant Wansley (Site) is located on 5,200 acres, adjacent to the west bank of the Chattahoochee River, in Heard and Carroll Counties near Carrollton, Georgia. Constructed during the 1970s, the Plant has two coal-fired units capable of producing 1,840 megawatts of electricity. Northwest of the Plant, two ponds, separated by a 3,000-ft long, 105-ft high earthen Separator Dike, were constructed via valley fill: (i) a 590-acre storage water pond to provide water to the Plant; and (ii) a 343-acre CCR surface impoundment (AP-1) to receive CCR from Plant operations. Upon Plant startup in 1976, process flows, including sluiced ash, were conveyed from the Plant into AP-1. In 2008, two temporary gypsum storage cells were constructed on top of the CCR delta within AP-1, adjacent to the Separator Dike.

AP-1 served plant operations with CCR storage and water treatment, consistent with the Site's National Pollutant Discharge Elimination System (NPDES) permit, reliably since 1976. Sluicing of CCR into AP-1 ceased in Spring 2019 with the conversion to dry fly ash and closed loop bottom ash handling systems. The present inventory of CCR within AP-1 is approximately 16 million cubic yards. On November 20, 2018, Georgia Power submitted a permit application to GA EPD for the closure of AP-1.

### B. Summary of closure method

Pursuant to both Federal and State CCR regulations, Georgia Power will close AP-1. The proposed closure strategy utilizes a consolidation and in-place closure approach. Key closure steps include:

- Site preparation, including but not limited to, clearing trees, grading, construction of access roadways and construction laydown areas, and installation of a water treatment plant (WTP) for construction operations;
- Construction of a deep soil mix (DSM) containment structure with a concrete façade (e.g., diaphragm wall, secant pile wall, or similar) to bifurcate AP-1 into two areas: (i) a 205-acre Closure by Removal Area; and (ii) a 138-acre Closure in Place area, referred to as the Consolidation Area. The DSM structure will serve as the structural element for containment, while the concrete façade has been designed to be an Advanced Engineering Method (AEM). The concrete façade does not serve a structural purpose; rather, it was incorporated into the closure design specifically to enhance the closure by providing a physical impediment to flow of surface water and groundwater into and out of the Consolidation Area [presented in *Containment Structure Closure Drawings (DWG. No. 16 – 23[1])*];

[1] Drawing numbers presented herein are in reference to those presented in the permit application *Closure Drawings.*

- Removal of free liquids and in-situ dewatering or stabilization of the CCR, as necessary to facilitate construction, within the Consolidation Area;
- Removal of CCR from the Closure by Removal Area [presented in *CCR Removal Plan Closure Drawing (DWG No. 25)*];
- Dewatering and placement of the removed CCR within the Consolidation Area;
- Final grading of the Consolidation Area [presented in *Final Cover Grading Closure Drawings (DWG No. 8 – 11)*];
- Installation of a final cover system and surface water management system over the Consolidation Area [presented in *Cover System Details Closure Drawings (DWG No. 14 and 15)*]; and
- Post-closure care, including groundwater monitoring and reporting for a minimum of 30 years.

### C. Conceptual site model

AP-1 is underlain primarily by four lithologic units: (i) alluvial deposits; (ii) residual soils and saprolite; (iii) partially weathered rock (PWR); and (iv) bedrock. The alluvial and residual soils, saprolite, and PWR are collectively referred to as the regolith. The alluvial deposits are limited in aerial extent and therefore, the regolith at the Site consists predominantly of saprolite and PWR. The uppermost aquifer at AP-1 is an unconfined aquifer that occurs in the regolith and bedrock. While the aquifer characteristics of these units may vary, the groundwater is interpreted to be interconnected, and they effectively act as one unconfined aquifer system. Groundwater within the bedrock is primarily present in fractures that decrease in size and density with depth.

The saturated zone at the Site occurs primarily near the interface of the regolith and bedrock, depending on local topographic and lithologic characteristics. These localized conditions generally result in groundwater flow towards AP-1, between the topographically high ridgelines north and south of AP-1. The majority of the groundwater flow downgradient of AP-1 (i.e., further south of the southern ridgeline) is likely to occur through the PWR and upper fractured bedrock in southeasterly direction mimicking the general surface topography.

The crystalline bedrock at the Site consists of the following mapped bedrock units: Schist-Amphibolite, Quartzite, Garnet Schist, Long Island Creek Gneiss, Button Schist, Muscovite Schist, Amphibolite, and Biotite Schist. These units steeply-dip to the east-southeast and are marked by three mapped faults. There is no evidence of rock movement along these faults during the Holocene Epoch (i.e., within the last approximately 12,000 years).

Geologic units in the bedrock exhibit varying properties such as foliation, jointing, or weathering that contribute to the hydraulic properties affecting the groundwater flow through the rock. The quartzite unit is reported to be the most transmissive bedrock unit at the Site. This unit may represent a preferential flow pathway for groundwater due to higher fracture density. The Long Island Creek Gneiss, in contrast, is described as poorly weathered, weakly foliated, and poorly jointed, resulting in this unit functioning more as a barrier to flow rather than a transmissive zone. The Long Island Creek Gneiss, present along the southern ridgeline, acts as a natural hydraulic barrier that minimizes groundwater flow in the bedrock along the southeast boundary of AP-1. A more detailed discussion of the hydrogeologic conditions and the conceptual site model for groundwater flow is provided in the *Hydrogeologic Assessment Report Revision 01 (HAR Rev 01)*, dated November 2019.

## II. CCR Rule performance standards

With the consolidation and in-place closure approach selected for AP-1, the CCR Rule closure performance standards for leaving CCR in place [40 C.F.R. § 257.102(d)] apply. This section of the CCR Rule outlines the minimum technical, drainage, stabilization, and final cover system requirements that the owner, Georgia Power, must ensure. The CCR Rule requires a description of how the final cover system is designed in accordance with and will achieve the performance standards [40 C.F.R. § 257.102(b)(iii)]. The following subsections describe how the closure design meets the closure requirements when leaving CCR in place.

### A. Post-closure infiltration of liquids performance standard [40 C.F.R. § 257.102(d)(1)(i)]

The first requirement of 40 C.F.R. § 257.102(d) [i.e.,(d)(1)(i)] stipulates that AP-1 must be closed in a manner that will control, minimize or eliminate, to the maximum extent feasible, post-closure infiltration of liquids into the waste and releases of CCR, leachate, or contaminated run-off to the ground or surface waters or to the atmosphere. In the preamble to the CCR Rule, EPA states that the infiltration performance standard requires owners and operators to ensure the integrity of the final cover in selecting the final design, including accounting for any conditions that may cause the cover system not to perform as designed [84 Fed. Reg. at 21,413].

*Post-closure infiltration*

The United States Geologic Survey[2] defines infiltration as the movement of water from the land surface into the subsurface. Infiltration is further defined in the text titled *Groundwater*[3] (Freeze and Cherry) as "the entry into soil of water made available at the ground surface, together with the associated flow away from the ground surface within the unsaturated zone." EPA also says that infiltration is how "water applied to the soil surface through rainfall and irrigation events subsequently enters the soil" and that "this term can be used in the estimation of water available for downward percolation…."[4].

Based on these and other technical definitions of infiltration, to meet the performance standard, the engineered final cover system must control, minimize, or eliminate, to the maximum extent feasible, the vertical migration of water from the surface of the consolidated closure area into the underlying CCR. This performance standard does not address lateral movement of water in the subsurface because that lateral movement is not considered infiltration. Lateral migration of groundwater is discussed in a subsequent section.

The engineered final cover systems described in the permit application will: (i) eliminate ponding of water on top of the consolidated and covered CCR through grading and stormwater conveyance features; and (ii) virtually eliminate infiltration of precipitation into the underlying CCR by installation of an essentially impermeable geomembrane as part of the final cover system. Two final cover system designs, soil/geosynthetic and ClosureTurf®, are presented in the closure permit application where it is shown how they meet the baseline (i.e., prescriptive) requirements of 40 C.F.R. § 257.102(d)(3). The soil/geosynthetic final cover system, presented in *Cover System Details I Closure Drawing (DWG No. 14)*, will consist of (from bottom to top) a minimum 40-mil thick textured high-density polyethylene (HDPE) or linear low-density polyethylene (LLDPE) geomembrane, a double-sided geocomposite drainage layer, an 18-inch thick protective soil layer, and a 6-inch thick vegetative soil layer. *Cover System Details II*

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[2] https://www.usgs.gov/special-topic/water-science-school/science/dictionary-water-terms?qt-science_center_objects=0#qt-science_center_objects
[3] Freeze and Cherry, Groundwater 1979
[4] https://www.epa.gov/water-research/infiltration-models

*Closure Drawing (DWG No. 15)* depicts the ClosureTurf® cover system consisting of (from bottom to top) a 50-mil thick HDPE or LLDPE geomembrane, an engineered turf layer, and a minimum 0.5-inch thickness of sand infill. Regardless of the final cover system selected, it will be installed over the entire Consolidation Area, eliminating direct exposure of CCR to precipitation and other potential sources of infiltration water.

A *Final Cover Hydrologic Evaluation of Landfill Performance (HELP) Analysis and Equivalency Demonstration* calculation package was developed for the Site. (Note that all calculation packages mentioned herein are presented in the GA EPD permit application *Engineering Report.*) The reduction in infiltration through both final cover system alternatives was evaluated by comparing the infiltration rate through the alternatives to the infiltration rate through the prescriptive cover system for two conditions: (i) a 10 percent post-settlement final cover slope and drainage length of 220 ft to represent the western portion of the Consolidation Area; and (ii) a 15 percent post-settlement final cover slope and drainage length of 170 ft to represent the eastern portion of the Consolidation Area. The prescriptive cover system was modeled as a 6-inch thick vegetative cover layer underlain by an 18-inch thick infiltration layer with a hydraulic conductivity as determined by 40 C.F.R. § 257.102(d)(3)(i)(A) (i.e., $1 \times 10^{-5}$ centimeters per second (cm/sec), because that is a lower conductivity than the natural subsoils below AP-1). The infiltration rates through the final cover system alternatives (i.e. soil/geosynthetic and ClosureTurf®) were calculated to be 99.999% lower than for the prescriptive cover system. This analysis shows that the proposed final cover system alternatives are in fact superior in terms of their hydrologic performance compared to the prescriptive cover system.

Infiltration potential is also reduced through grading of the subgrade upon which the final cover system will be installed, and through installation of stormwater conveyance features presented in *Closure Drawing 8*. The stormwater management system components include the final cover system, and final cover slopes, benches, downchutes, and channels. The stormwater management system has been designed (using hydrologic and hydraulic procedures presented in the Urban Hydrology for Small Wetlands Technical Release 55 (TR-55) [Soil Conservation Service (SCS), 1986]; Manning's kinematic equation; and other recognized engineering procedures encoded in HydroCAD™ software) to shed surface water off the final cover, prevent ponding of precipitation on the cover and virtually eliminate infiltration of water into the underlying CCR. Further details of the surface water management features are provided in the *Final Closure Surface Water Management System Design* calculation package.

The permit application *CQA Plan* outlines testing and quality assurance requirements to ensure that not only do the final cover system components meet the design specifications, but that they are installed properly.

As highlighted above and presented in more detail in the GA EPD permit application, the AP-1 closure design includes measures to ensure the infiltration performance standard is met, as required by 40 C.F.R. § 257.102(d)(1)(i).

*Lateral migration*

Controlling or minimizing lateral migration of groundwater is not in the closure performance standards of the CCR Rule because lateral migration is, by definition, not infiltration. However, the selected AP-1 closure method will control and minimize lateral migration into and out of the Consolidation Area to the maximum extent feasible as shown by the following lines of evidence.

The containment structure for AP-1 closure will be constructed of materials with a horizontal hydraulic conductivity ($K_h$) in the range of $1 \times 10^{-6}$ cm/sec (DSM structure) to $1 \times 10^{-7}$ cm/sec or less (concrete façade). This range of hydraulic conductivities is consistent with those of low permeability vertical hydraulic control structures such as slurry walls. The 3,500-ft long containment structure, specifically the concrete façade, located along the northwestern limit of the final consolidated closure footprint, will serve as a low permeability physical barrier wall and will significantly reduce the lateral migration of groundwater relative to the pre-closure condition of the CCR unit. The containment structure will be keyed into the native residual soil and saprolite which will significantly inhibit water from the Closure by Removal area as well as shallow groundwater in the residual soil and saprolite from moving into the Consolidation Area. The constructed containment wall (i.e., the DSM and concrete façade), in conjunction with the poorly-jointed Long Island Creek Gneiss on the south of AP-1 and the existing low permeability Separator Dike to the east, will result in the Consolidation Area being enclosed around most of its perimeter with three low-permeability structures or geological units that will minimize groundwater flow into and out of the Consolidation Area. Additionally, the final cover system will prevent infiltration into the unit and further reduce hydraulic gradients and groundwater flux (the rate of groundwater flow per unit area).

A three-dimensional steady state groundwater flow model was constructed to simulate hydrogeologic conditions at the Site. Once calibrated, the model was used to evaluate the relative effectiveness of the proposed consolidated in-place closure of AP-1 as described above. Results from the modeling simulations indicate that under the designed in-place closure conditions, the majority of the groundwater outflow from the Consolidation Area is eliminated relative to the baseline existing conditions (*HAR Rev 01 Appendix G*). Details of the groundwater flow model and predictive scenarios are provided in the *HAR Rev 01*. This model will be subject to refinement, including any refinements to the closure design and as additional site data is collected.

*Post-closure releases of CCR, leachate, or contaminated run-off*

The AP-1 closure design will control, minimize or eliminate, to the maximum extent feasible, releases of CCR, leachate, or contaminated run-off to the ground or surface waters or to the atmosphere, as required by the performance standard in 40 C.F.R. § 257.102(d)(1)(i). The defined term "groundwater" is not included among the media listed in this performance standard. Matters related to potential CCR groundwater impacts are instead regulated by other parts of the CCR Rule. Thus, the basis for evaluating compliance with this performance standard is the degree to which the closure design controls, minimizes, or eliminates these releases to the ground, surface waters, and the atmosphere.

After closure, the Consolidation Area will have: (i) the Storage Water Pond to the east; and (ii) an industrial wastewater pond in the Closure by Removal Area to the west. The existing earthen Separator Dike, the DSM containment structure with concrete façade, and other closure elements (e.g. final cover system and associated stormwater management features) will control, minimize or eliminate the release of CCR, leachate, or contaminated run-off (defined as any rainwater, leachate, or other liquid that drains over land from any part of a CCR unit) to the ground, surface waters, and the atmosphere, including to the Storage Water Pond and to the west. As detailed in the *Material Properties and Major Design Parameters* calculation package, the Separator Dike is a Category II dam structure, according to Georgia Safe Dams Program, and consists of lean clays. The dike has had no known seepage or stability issues over its operating history (i.e., since construction in 1974). The stability of the Separator Dike is further demonstrated in the *Slope Stability Analysis* calculation package. Critical sections of the Separator Dike were analyzed to ensure it meets or exceeds the design requirements on static short-term [undrained] factor of safety (FoS) greater than 1.30, long-term static [drained] FoS greater than 1.50, and seismic [drained] FoS greater than 1.00, as detailed in the *Closure Stability* calculation package.

The DSM containment structure in the northwest side of the Consolidation Area is designed to be the primary structural member to contain the consolidated CCR. The concrete façade, to be placed on the outside of the DSM structure, is designed to function as a low-permeability physical barrier (i.e., as an

AEM to further isolate consolidated CCR from the surrounding environment both physically and hydraulically). The *Containment Structure Design* calculation package provides extensive design analyses of the stability of the containment structure under short- and long-term applied loads. The design satisfies requirements for external stability (sliding, overturning, bearing capacity, and internal crushing), global stability, and settlement. The design analysis results were further verified with a PLAXIS 2D finite element model. The concrete façade was designed with a hydraulic conductivity of $1 \times 10^{-7}$ cm/sec or less, which will greatly impede any liquid migration through the DSM and into the industrial wastewater pond remaining after closure has been completed (*HAR Rev 01 Appendix G*). Finally, the final cover system, as previously described, has been designed to provide a robust physical barrier isolating the consolidated CCR from the surface environment and eliminating the generation of contaminated run-off.

Additionally, measures for maintaining fugitive dust control during construction are provided in the permit application *Closure Plan.* Measures are designed and will be monitored throughout construction to minimize potential releases of CCR to the atmosphere to the maximum extent feasible.

With the design of the final cover system (including a geomembrane that completely covers the CCR within the Consolidation Area *Closure Drawing 8*), along with the operating requirements of the *Closure Plan* and testing and quality assurance requirements of the *CQA Plan* to ensure components meet the design specifications, there will not be a pathway for the release of CCR, leachate, or contaminated run-off to the ground, surface water, or atmosphere.

As highlighted above and presented in more detail in the GA EPD permit application, the AP-1 closure design includes measures that ensures the post-closure releases performance standard is met, as required by 40 C.F.R. § 257.102(d)(1)(i).

### B. Future impoundment of water, sediment, or slurry [40 C.F.R. § 257.102(d)(1)(ii)]

The closure design must preclude the probability of future impoundment of water, sediment, or slurry [40 C.F.R. § 257.102(d)(1)(ii)]. This performance standard is met if the closure method precludes the probability of future surface accumulation of water, sediment, or slurry. The standard is based on existing Mine Safety and Health Administration (MSHA) regulations for closures of impoundments under MSHA jurisdiction [75 Fed. Reg. at 35,128 & 35,208 (June 21, 2010)]. Specifically, the CCR Rule performance standard uses the same language as the MSHA regulation [30 C.F.R. § 77.216]. Both require closure plans to “preclude the probability of future impoundment of water, sediment, or slurry.” According to MSHA, precluding surface accumulations through capping satisfies this standard because, as stated in MSHA’s Coal Mine Impoundment Inspection and Plan Review Handbook (October 2007), meeting this standard is “typically done by breaching and/or capping” which eliminate surface accumulations. EPA also indicates that the impoundment performance standard is met by precluding future surface accumulations through final cover system grades that promote surface water runoff [80 Fed. Reg. at 21,411]. Understanding “future impoundment” as referring to surface accumulations is also consistent with the definition of a “CCR surface impoundment” as “a natural topographic depression, man-made excavation, or diked area, which is designed to hold an accumulation of CCR and liquids” [40 C.F.R. § 257.53].

The selected AP-1 closure option will preclude the probability of future impoundment of water, sediment, or slurry by providing positive drainage for surface water runoff from the cover system over the containment structure and back into the remaining pond in the Closure by Removal Area (*Closure Drawings 8 – 11*), as well as by limiting surface water run-on. Surface water conveyance structures will be designed to safely transmit the design flows for discharge while resisting erosion. Complete details on the stormwater management system design are presented in the *Final Closure Surface Water Management System Design* calculation package.

Final cover grades will range from 5 percent to 15 percent except for surface water drainage conveyance features on the final cover system (i.e., valleys and perimeter channels), which will have slopes generally ranging from 0.5 percent to 1.0 percent, post settlement. Surface water runoff from the final cover system generally starts on the 10 to 15 percent (%) side slopes. This runoff flows to benches with 1% longitudinal slopes that convey the flows to downchutes. Flow is conveyed from benches to downchutes by transition features, located at downchute and bench intersections. Downchutes discharge into perimeter channels along the containment structure or perimeter channels around the remaining perimeter of the Consolidation Area. The perimeter channels along the containment structure convey flow to five trapezoidal concrete outflow weirs atop the containment structure. The perimeter channels around the remaining perimeter of the Consolidation Area convey flow directly to two trapezoidal concrete outflow weirs at the ends of the containment structure. The outflow weirs discharge to the Closure by Removal Area, without the discharged water ever having contacted CCR.

The surface water management system is designed to meet the criteria identified from the following documents as well as design considerations based on general engineering practices from industry technical literature:

- "Georgia Stormwater Management Manual" (GSMM) [Atlanta Regional Commission (ARC), 2016];
- "Manual for Erosion and Sediment Control in Georgia" (Green Book) [Georgia Soil and Water Conservation Commission (GSWCC), 2016];
- "Drainage Design for Highways" (Drainage Manual) [Georgia Department of Transportation (GDOT), 2016a];
- "ClosureTurf® Design Guidelines Manual" (ClosureTurf® Manual) [WatershedGeo, 2017]; and
- the CCR Rule.

Surface water flow rates, depths, and volumes were calculated using hydrologic and hydraulic procedures presented in the Urban Hydrology for Small Wetlands TR-55 [SCS, 1986]; Manning's kinematic equation; and other recognized engineering procedures encoded in HydroCAD™ software. Channels and downchutes were conservatively designed to convey the 100-year (yr), 24-hour (hr) storm event with at least 6 inches of freeboard. Benches were designed in accordance with the criteria for channels and downchutes to convey the 100-yr, 24-hr design storm event with at least 6 inches of freeboard. Surface water pipes were conservatively designed to convey the 25-yr, 24-hr design storm event with at least 18 inches of freeboard and the 100-yr, 24-hr design storm event with at least 6 inches of freeboard. Outlet protection was designed as riprap aprons in accordance with guidance provided for rock outlet protection in the GSMM; riprap gradation was selected based on the surface water pipes outlet discharge rate and velocity for the 100-yr, 24-hr storm event. Additional details are provided in the *Final Closure Surface Water Management System Design* calculation package.

To ensure the integrity of the final cover system and drainage features, a *Final Cover Settlement* calculation package was prepared. The following criteria from the CCR Rule, technical literature, and engineering practice were selected with respect to defining allowable settlements for the final cover system.

- The post-settlement grades of the final cover system side slopes have been designed to be between 3 percent and 33 percent;
- The post-settlement grades of the drainage channel have been designed to be not be less than 0.5 percent nor greater than approximately 33 percent;

- Differential settlements of the final cover system have been designed to not cause a grade reversal; and
- Differential settlements of the final cover system have been designed to not cause tensile strains that exceed an allowable tensile strain of 5 percent for the geomembrane component of the final cover system [Berg and Bonaparte, 1993].

As highlighted above and presented in more detail in the GA EPD permit application, the AP-1 closure design includes measures that ensures the requirement to preclude the probability of future impoundment of water, sediment, or slurry are met, as required by 40 C.F.R. § 257.102(d)(1)(ii).

### C. Slope stability of final cover system [40 C.F.R. § 257.102(d)(1)(iii)]

AP-1 closure design must include measures that provide for major slope stability to prevent the sloughing or movement of the final cover system during the closure and post-closure care period. Stability analyses conducted as part of the design of the AP-1 closure are presented in the *Closure Stability* calculation package (site response, pseudo-static coefficients, liquefaction potential, static and seismic slope stability), *Final Cover Settlement* calculation package, and *Final Cover Veneer Stability* calculation package.

The final cover system design includes measures to maintain the final cover system stability during the closure and post-closure care periods, in accordance with this performance standard. Slope stability analyses have been completed to confirm the stability of the consolidated CCR under both closure and post-closure conditions. Slope stability factor of safety design criteria will be achieved for static, seismic, liquefaction, and end-of-construction conditions. Additionally, the veneer stability of the final cover system was evaluated to verify that minimum interface shear strengths needed to meet design criteria can be achieved for each interface within the cover system, for both static and seismic conditions.

As highlighted above and presented in more detail in the GA EPD permit application, the AP-1 closure design includes measures that provide for major slope stability to prevent the sloughing or movement of the final cover system during the closure and post-closure care periods, as required by 40 C.F.R. § 257.102(d)(1)(iii).

### D. Minimizes the need for further maintenance [40 C.F.R. § 257.102(d)(1)(iv)]

The maintenance performance standard [40 C.F.R. § 257.102(b)(iii), (d)(1)(iv)] is met because the final cover system has been designed to need minimal maintenance after placement. The 30 year post-closure care period provides sufficient time to ensure that the final cover system is properly maintained [80 Fed. Reg. at 21,426].

The AP-1 final cover system is designed to minimize the need for further maintenance of the CCR Unit by consolidating CCR within the Consolidation Area from 343-acres to 138-acres, thereby reducing the total area requiring maintenance. The final cover system and stormwater management components of the closure have been designed of durable and proven materials. Installation of the final cover system on relatively shallow grades (as described previously) will further limit the need for cover system maintenance. Maintenance will also be minimized by erosion control measures designed to resist erosive effects during the peak design storm event as demonstrated by calculations provided in the *Engineering Report*. Slope stability analyses that were completed based on the final cover system grades indicates that factors of safety meet or exceed industry standards. Thus, slope stability issues will not be a source of future maintenance requirements.

Additionally, long-term settlement of the final cover system (i.e, *Final Cover System Settlement* calculation package) has been evaluated to ensure that post-closure settlements will be small enough that they will not result in settlement-related maintenance requirements. The post-closure surface water management system includes perimeter channels, downchutes, benches, and surface water pipes. The system was designed to meet design criteria developed from the GSMM, the Manual for Erosion and Sediment Control in Georgia (Green Book), the ClosureTurf® Design Manual, and other accepted engineering practices. In general, the surface water management system was designed for the collection and conveyance of flows from the 100-yr, 24-hr storm event with 6 inches of freeboard. As shown in the calculations and modeling results, the design of the perimeter channels, downchutes, benches, and surface water pipes meet the required design criteria.

Finally, construction and testing will follow the *CQA Plan* to ensure that construction materials and procedures conform to the technical specifications. This conformance will minimize the need for long-term maintenance.

As highlighted above and presented in more detail in the GA EPD permit application, the AP-1 closure design satisfies the CCR Rule requirement to minimize the need for future maintenance, as required by 40 C.F.R. § 257.102(d)(1)(iv).

### E. Completed in the shortest amount of time consistent with recognized and generally accepted good engineering practices [40 C.F.R. § 257.102(d)(1)(v)]

Closure of AP-1 is to be completed in the shortest amount of time consistent with recognized and generally accepted good engineering practices. Table 1 on the following page presents the anticipated closure schedule, as presented in the *Closure Plan*. The order and duration of individual closure activities will allow for closure construction in the shortest time possible consistent with recognized and generally accepted good engineering practices.

| TABLE 1 - ANTICIPATED CLOSURE SCHEDULE FOR ASH POND AP-1 | | | | | | | | | | | | | | | | | | | | | | |
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| **PLANT WANSLEY, GEORGIA POWER COMPANY, HEARD AND CARROLL COUNTIES, GEORGIA** | | | | | | | | | | | | | | | | | | | | | | |
| **Closure Activity** | **Year 1** | | **Year 2** | | **Year 3** | | **Year 4** | | **Year 5** | | **Year 6** | | **Year 7** | | **Year 8** | | **Year 9** | | **Year 10** | | **Year 11** | |
| Notify GA EPD of intent to close | | | | | | | | | | | | | | | | | | | | | | |
| Provide GA EPD with date of final CCR receipt | | | | | | | | | | | | | | | | | | | | | | |
| Prepare accurate legal description of permit boundary | | | | | | | | | | | | | | | | | | | | | | |
| Prepare and develop the contractor laydown areas | | | | | | | | | | | | | | | | | | | | | | |
| Install and maintain erosion and sediment control systems serving disturbed areas | | | | | | | | | | | | | | | | | | | | | | |
| Construct access platform | | | | | | | | | | | | | | | | | | | | | | |
| Construct deep soil mixing | | | | | | | | | | | | | | | | | | | | | | |
| Construct concrete façade | | | | | | | | | | | | | | | | | | | | | | |
| CCR excavation and dewatering | | | | | | | | | | | | | | | | | | | | | | |
| Complete final grading and install final cover system | | | | | | | | | | | | | | | | | | | | | | |
| Conduct site revegetation and restoration | | | | | | | | | | | | | | | | | | | | | | |
| Provide notice of closure within 30 days of closure completion | | | | | | | | | | | | | | | | | | | | | | |
| Prepare boundary survey and accurate legal description of final CCR management boundary | | | | | | | | | | | | | | | | | | | | | | |
| Provide the closure report to GAEPD | | | | | | | | | | | | | | | | | | | | | | |
| Submit to GAEPD confirmation that the notation on the property deed has been recorded | | | | | | | | | | | | | | | | | | | | | | |

### F. Stability for the final cover system [40 C.F.R. § 257.102(d)(2)]

40 C.F.R. § 257.102(d)(2) describes drainage and stabilization work that must be performed, as applicable, prior to placement of the final cover system. This work is required for the purpose of ensuring that the final cover system subgrade will provide sufficient support for the cover system. Specifically, the performance standard calls for the elimination of free liquids by removing liquid waste or solidifying the remaining wastes and waste residues, and stabilizing the remaining wastes to a sufficient degree to support the final cover system. Consistent with standard good engineering practices, the performance standard requires the removal of standing water and additional liquids as needed to accomplish a stable in place closure, considering other stabilization work that may be performed, if necessary. Prior to installing the AP-1 final cover system in accordance with [40 C.F.R. § 257.102(d)(2)], free liquids will be eliminated by removing liquid wastes. The remaining wastes will be stabilized as may be necessary to support the final cover system.

*Removal of free liquids*

Free liquids are defined as "liquids that readily separate from the solid portion of waste under ambient temperature and pressure." In the CCR Rule, the requirement to eliminate free liquids by removing liquid wastes is focused on eliminating ponded water. Removal of ponded water facilitates the proper installation of the final cover system. EPA has also identified other benefits of removing ponded water. Specifically, the EPA has stated: "[d]uring operations, free liquids that are ponded in the impoundment create a strong hydraulic head that acts to increase infiltration through the base of the impoundment. The removal of free liquids and capping during closure reduces the hydraulic head…." [see EPA, Human and Ecological Risk Assessment of Coal Combustion Residuals, Appendix K at K-1 (Dec. 2014)]. Unlike ponded water, groundwater, for example, is not considered free liquid as it is defined separately from free liquids as "water below the land surface in a zone of saturation" [40 C.F.R. § 257.53]. Accordingly, the free liquids requirement of the CCR Rule will be addressed by removing ponded water and implementing an *Ash Pond Dewatering Plan* approved by GA EPD as summarized below.

During normal operations, the CCR pond received approximately eight different process flows from the Plant, as well as additional natural inflows associated with precipitation and watershed runoff. In Spring 2019, incoming Plant process flows to AP-1 ceased. Since then, the water level in the impoundment has been generally maintained at the lowest operating elevation of its operational history, approximately 781.5 ft NAVD 88. This is more than 15 ft lower than the typical level of the pond during normal operations. The pond will be maintained at this lower level until the start of closure construction. When closure construction of AP-1 is initiated, the outlet structure will be closed to prevent the discharge of flows from AP-1.

CCR-contact water that needs to be removed from AP-1 during closure construction period to maintain desired water levels will be treated at the onsite WTP prior to discharge through the NPDES permitted Outfall 01C. Georgia Power will develop a written *Ash Pond Dewatering Plan* to describe treatment processes, monitoring and best management practices necessary to comply with the NPDES Permit. The *Ash Pond Dewatering Plan* will be submitted to the GA EPD Watershed Protection Branch for review and approval prior to commencing dewatering activities. The current lowest operating pool elevation, along with closure activities (e.g. containment structure installation, CCR consolidation, and CCR grading to the approve final cover grades) will ensure the elimination of ponded water and other liquids within the

Consolidation Area as needed to support a stable closure and provide for the stable and secure installation of the final cover system.

Noncontact stormwater will be managed in accordance with applicable stormwater and erosion and sediment control requirements and will be conveyed through appropriate stormwater management features and erosion and sediment controls.

*Stabilization sufficient to support final cover*

The removal of CCR contact water as described above is expected to provide sufficient support for the final cover system (e.g., a firm and unyielding CCR surface as defined in the *CQA Plan*). However, if needed for further stabilization, in-situ liquid removal (i.e., using passive trenches, well points, deep wells, or other suitable means) or other methods (e.g., shallow admixture stabilization) may be utilized as discussed in the permit application *Dewatering Analysis* to facilitate construction access onto the CCR delta. As detailed in the *Closure Stability* and *Geotextile Tube Stability* calculation packages, analyses of the stability of both the final Consolidation Area configuration and geotextile tubes that may be used as part of closure indicate that these further stabilization measures will not be needed to provide support for the final cover system. The dewatering, compacting, and grading of the removed CCR will be sufficient for final cover system support.

Confirmation of adequate subgrade stability will be established in accordance with the procedures and testing described in the *CQA Plan*. Additional details regarding CCR contact and non-contact water management, closure design features and preparation of the subgrade for final cover system installation are presented in the *Closure Plan*.

As highlighted above and presented in more detail in the GA EPD permit application, the AP-1 closure design meets the CCR Rule requirement [40 C.F.R. § 257.102(d)(2)] for drainage and stabilization of AP-1 prior to installation of the final cover system.

### G. Final cover system [40 C.F.R. § 257.102(d)(3)]

The final cover system must meet the requirements of 40 C.F.R. § 257.102(d)(3), which allows for either a prescriptive or alternative final cover system design. Both final cover system alternatives presented in the permit application in *Cover System Details I & II Closure Drawing (DWG No. 14 and 15*) (i.e., soil/geosynthetic and ClosureTurf®) meet requirements of the alternative design [40 C.F.R. § 257.102(d)(3)(ii)(A) through (C)].

Both final cover system alternatives meet the infiltration requirements [40 C.F.R. § 257.102(d)(3)(ii)(A)]. The permeability of the final cover must be less than or equal to the permeability of any bottom liner system or natural subsoils present, or a permeability no greater than $1 \times 10^{-5}$ cm/sec, whichever is less. As presented in the *Material Properties and Major Design Parameters* calculation package, the hydraulic conductivity of the native residual soils and saprolite beneath AP-1 is estimated to be $1.1 \times 10^{-5}$ cm/sec on average, which is greater than $1 \times 10^{-5}$ cm/sec. Thus, the final cover system must have a hydraulic conductivity equal to or less than $1 \times 10^{-5}$ cm/sec. As presented in the *Final Cover HELP Analysis and Equivalency Demonstration* calculation package, the geomembrane component of both final cover system alternatives has an equivalent hydraulic conductivity on the order of $10^{-13}$ cm/sec. In addition, an alternative final cover system must reduce infiltration by at least as much as the 18-inch, earthen material infiltration layer included in the prescriptive cover system, and the infiltration rates through the final cover system alternatives (i.e. soil/geosynthetic and ClosureTurf®) were calculated to be 99.999% less than for the prescriptive cover system.

Second, the final cover system must provide an erosion layer protect against wind or water erosion [40 C.F.R. § 257.102(d)(3)(ii)(B). To meet this requirement, the soil/geosynthetic final cover system will include a 6-inch erosion layer and native plant growth. Erosion resistance for the ClosureTurf® final cover system is the engineered turf, with details provided in the *ClosureTurf* calculation package. Finally, [40 C.F.R. § 257.102(d)(3)(ii)(C)] requires that the integrity of the final cover system must be maintained through a design that accommodates settlement and subsidence. As demonstrated in the *Final Cover Settlement* calculation package, the AP-1 closure design satisfies this CCR Rule requirement.

As highlighted above and presented in more detail in the GA EPD permit application, the AP-1 closure design meets the CCR Rule requirement [40 C.F.R. § 257.102(d)(3)] for final cover system design.

## III. Professional Engineer Certification

As required by 40 C.F.R. § 257.102(b)(4), a Georgia-registered professional engineer, has certified that the design in the Permit Application meets the requirements of the CCR Rule. Additionally, the certification is reaffirmed as provided by the engineer stamp on this report.

*"I certify that this document was prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person who manages the system and those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I do hereby certify that the requirements of the United States Environmental Protection Agency Standards for the Disposal of Coal Combustion Residuals in Landfills and Surface Impoundments (40 C.F.R. Subpart D) and Georgia Environmental Protection Division Solid Waste Rule for Management of Coal Combustion Residuals (391-3-4-.10) have been met."*


**ATTEST:**

Geosyntec Consultants, Inc.
**Engineering Firm**

Cuneyt Gokmen, P.E.
**Name of Professional Engineer**

**Signature**

11 September 2020
**Date**