Gainesville Regional Utilities

Deerhaven Generating Station

Coal Combustion Residuals Surface Impoundment System Inflow Design Flood Control System Plan (Version 1.0)

Prepared for:
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Table of Contents

List of Figures

List of Tables

1 Introduction

1.1 Overview

Title 40 of the Code of Federal Regulations (CFR) under Part 257, Subpart D (herein referred to as the CCR Rule) includes requirements for CCR surface impoundments, which are defined under §257.53 as "a natural topographic depression, man-made excavation, or diked area, which is designed to hold an accumulation of CCR and liquids, and the unit treats, stores, or disposes of CCR." Gainesville Regional Utilities (GRU) Deerhaven Generating Station (DGS) has a process pond system including two ash ponds and two pump back ponds. Ash sluice water is discharged at the ash ponds, bottom ash precipitates out, and the remaining decant water gravity flows to the adjacent pump back ponds. The ash ponds are designed to de-water and hold precipitated ash, which is periodically dredged from the units; the ash ponds are considered part of a CCR surface impoundment system. However, the pump back ponds were specifically designed to store decant water from the ash ponds following sedimentation – these ponds were not designed to hold ash and to date have not accumulated anything beyond de minimis ash quantities. Therefore, the pump back ponds are not considered CCR surface impoundments as defined in the CCR Rule.

40 CFR §257.82 of the CCR Rule requires that GRU design, construct, operate and maintain an inflow design flood control system that can manage the flow into and from the surface impoundments under a specified inflow design flood which is dependent on the site's hazard classification potential. Based on an initial assessment conducted by UES (2016), the surface impoundment system at DGS is classified as low hazard potential; a 100-year, 24-hour inflow design flood was selected for this analysis.

This memorandum presents an overview of the ash and pump back pond system, describes the specific inflows and outflows associated with each pond, discusses the selection of the inflow design flood, and presents the results of the hydrologic and hydraulic capacity analysis conducted by IWCS.

2 Description of Ponds

These ponds were constructed by means of raised dikes and do not have spillways or other infrastructure which direct discharge over the top of the dikes during an overtopping event. Water leaves the ash ponds by means of gravity drainage through subsurface culverts which discharge into adjacent pump back ponds. The two pump back ponds are connected to each other through a subsurface culvert. Water in the pump back ponds is discharged by means of a pump station (located in Pump Back Cell #1) equipped with five pumps which direct water to a variety of plant locations.

For the purpose of a conservative engineering estimate, this pond capacity analysis was performed assuming that any infrastructure which allows water to discharge (i.e., leave the ponds) from any of the ash ponds is offline, while all inflows are discharging into the ash ponds over the course of the design flood. For analyzing the capacity of the pump back ponds, it was assumed that precipitation would be the only inflow for these ponds; isolation valves which connect each ash and pump back pond pair will be closed in the event of a power failure or during any circumstance which takes the pump back pond pumps offline (GRU 2015). There are also two front-end treatment (FET) lime sludge settling ponds located adjacent to the four ponds discussed in this analysis. These two FET lime sludge ponds are hydraulically connected to the pump back ponds through gravity drainage similar to the connection between the ash and pump back ponds. The isolation valves which connect the lime sludge ponds to the pump back ponds will also be closed if the pump station is offline (GRU 2015).

An April 2015 survey of the topography of the ponds and dikes (also referred herein to as *embankments*) conducted by Degrove Surveyors, Inc. (DSI), was used to validate the dimensions and configurations of the ponds as previously documented in Burns and McDonnell (1981); these drawings were certified as conforming to construction records. A total of 16 points (e.g., invert of a corrugated metal pipe) or areas shown in Burns and McDonnell (1981) with a single elevation were selected for comparison between the two drawings sets. As presented in DSI (2015), these points generally only deviated within a few inches of the elevations presented in Burns and McDonnell (1981), with a maximum deviation of 10.4 inches (i.e., embankment top); for the purposes of this analysis, the Burns and McDonnell (1981) drawing set was generally used to select the geometry of the ponds used in the capacity estimates. However, one notable deviation identified by DSI (2015) was that the lowest elevation of the embankment surrounding Ash Cell #1 in the southwest corner is 194.86 National Geodetic Vertical Datum of 1929 (NGVD 29); this is the maximum water elevation used for estimating the capacity of the ash ponds.

Figure 1 shows an aerial view of the arrangement of the ponds. Access roads are located at the top of each of the dikes surrounding each of the ponds. Two FET lime sludge ponds, located in the upper right hand corner of Figure 1, also gravity drain into the pump back ponds. These FET lime sludge ponds are not included in this analysis as these ponds are not directly connected to the ash ponds.

Table 1 presents the catchment area and critical water level elevations of each pond for each pond type. The maximum operating level and surrounding dike elevations of the ponds are described in GRU (2015). The catchment area of each pond is the area which will collect and divert precipitation for storage at that pond and was calculated using the dimensions presented in the Burns and McDonnell (1981) (i.e., Y 70, Rev 3) drawing set. As shown in DSI (2015), the surrounding access roads typically crest at the road center; each pond catchment area includes the area encompassed by an imaginary line that runs down the center of the roads encircling each pond. It should be noted that the critical elevations and catchment areas are the same for each pond type.

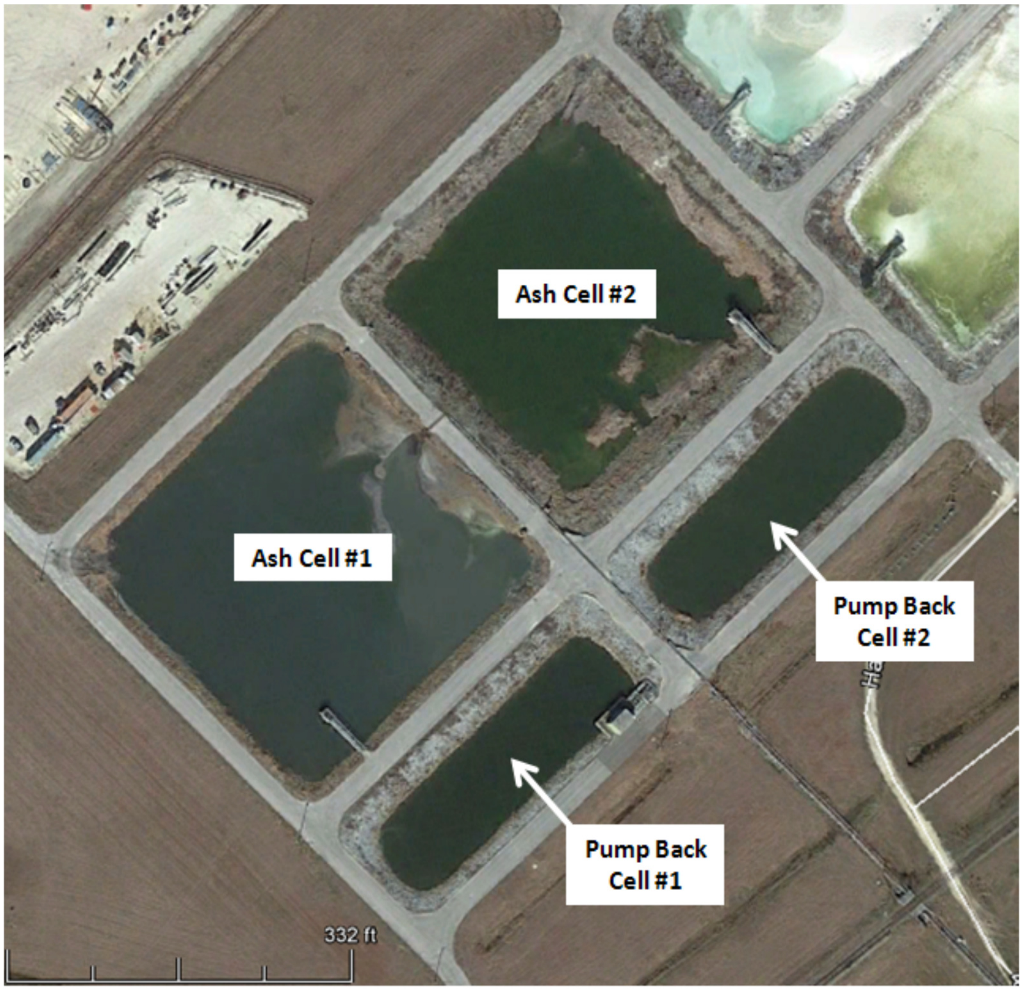

Figure 1. Aerial View of the Site Ponds (2012 Google Earth Imagery)

Table 1. Pond Water Levels and Catchment Areas per Pond

Location	**Maximum Operating Elevation (Feet NGVD)**	**Surrounding Dike Elevation (Feet NGVD)**	**Catchment Area (Square Feet)**
Ash Ponds	193	194.86	136,000
Pump Back Ponds	186	188	57,000

Figure 2 presents the process water inflow and outflow data for the ponds averaged over 6 years.

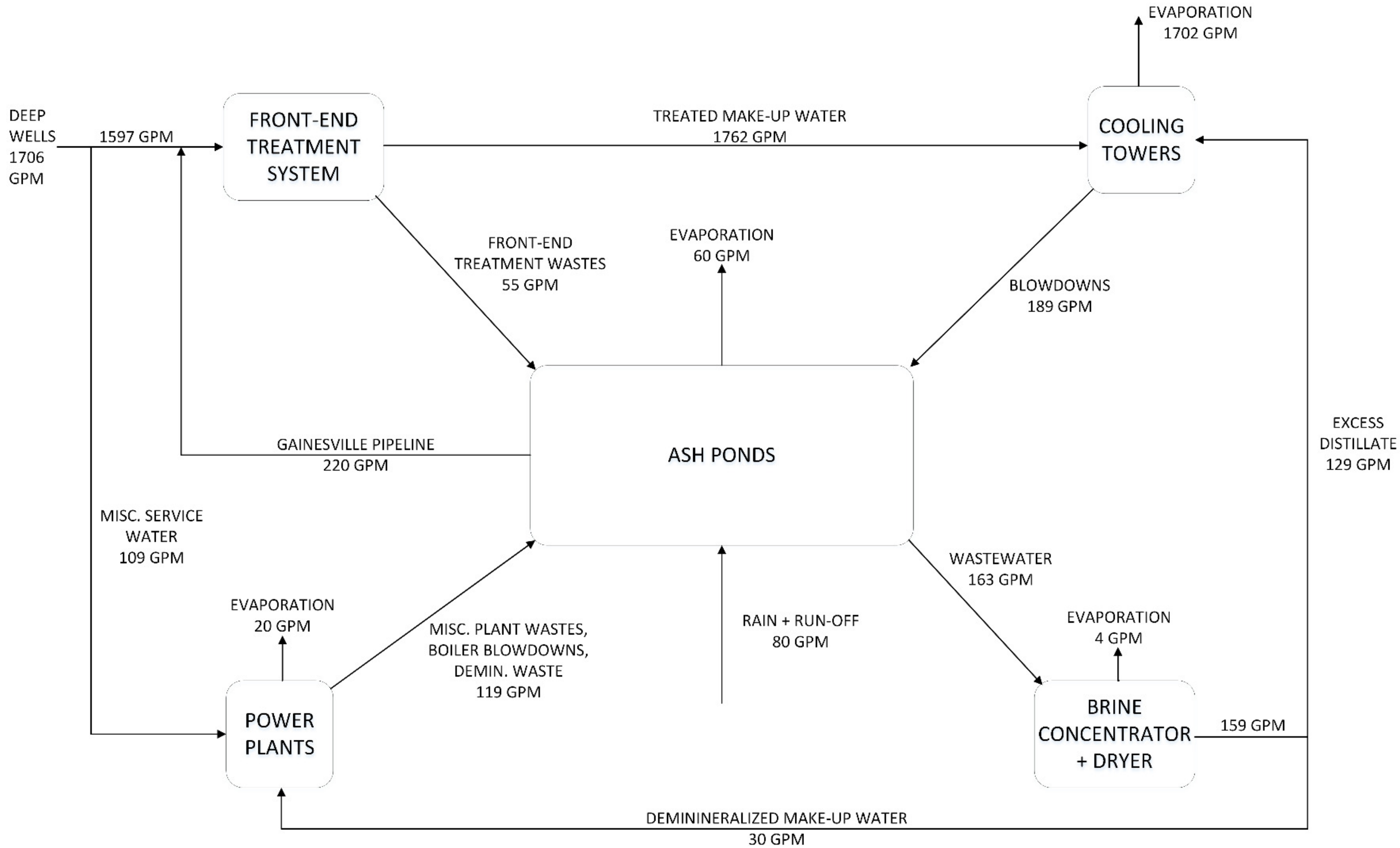

Figure 2. Average Inflows and Outflows for the Deerhaven Generating Station Surface Impoundments

3 Ash Ponds

The ash ponds serve as settling basins to precipitate bottom ash which is sluiced from the site's coal-fired combustion unit (i.e., Unit 2). The ash ponds also serve as temporary storage for a variety of site process blowdowns (i.e., wastewater streams) before they are treated on-site. Ash Cell #1 has 3 process water intake points and Ash Cell #2 has 2 intake points. Each ash pond has a single discharge point.

3.1 Inflows

Table 2 presents the major categories and total daily discharge rate of the inflows which may be directed to either of the ash ponds as shown in Figure 2. The ash ponds receive a total of 522,800 gallons per day of from FET system wastes, cooling tower blowdowns and other miscellaneous power plant wastes. It is assumed that both the ash ponds are available to receive the plant process water during and following the storm event.

Table 2. Ash Pond Average Daily Inflow Rates

Inflows	Discharge Rate (gallons per day)
FET System Wastes	79,200
Cooling Tower Blowdowns	272,200
Power Plant Wastes	171,400
Total	**522,800**

It should be noted that water may also be periodically pumped to Ash Cell #1 from three onsite runoff ponds. However, these flows are not included in this analysis because these pumps will not be operated if Ash Cell #1 was operating at or above its maximum allowed elevation (i.e., 193' NGVD) or if the pumps for the pump back ponds were offline (GRU 2015).

There is a dedicated pump in the pump station (in standby mode), which automatically engages when the water level in the pump back ponds reaches a critical level, pumping water from the pump back ponds to the ash ponds at a nominal 1,200 gallons per minute (US EPA (2014) Appendix A). As described in GRU (2015), the fail-safe automatic pump will be taken offline in the event process water is not pumped out of the pump back ponds due to events such as shutdown of the brine concentrator and dryer, power outage, or pump failure.

3.2 Outflows

The water loss associated with evaporation was not included in pond capacity modeling for a conservative analysis. Each ash pond has a single discharge point, known as a stoplog structure. The structure is a raised rectangular concrete vault, located about 50-feet away from the edge of the ponds. One of the walls of the structure consists of horizontally-arranged, 1-foot wide wooden planks. These planks are used to retain bottom ash in the ponds while allowing water to decant into the stoplog structure. The decanted process water is discharged into the adjacent pump back pond via a 12-inch, ductile iron pipe located at the interior bottom of the stoplog structure. There is an isolation valve which can be closed to hydraulically isolate each ash pond from the adjacent pump back pond. As described previously, this analysis assumes that this discharge point is closed to model a worst-case scenario for the ash ponds.

4 Pump Back Ponds

The pump back ponds provide storage for ash sluice decant water, lime sludge decant water, and other blowdown water prior to pumping to onsite treatment or use for additional bottom ash sluicing. The pump control building and adjacent pump station can be seen in Figure 1 in the right-most corner of Pump Back Cell #1. As described previously, the pump back ponds at DGS are not CCR surface impoundments. Although not required by the CCR rule, a hydrologic and hydraulic capacity analysis of these ponds was conducted to identify additional operational provision(s) required to prevent the uncontrolled release of process water and ash from the ash ponds during or following a 100-year, 24-hour storm event.

4.1 Inflows

The only potential process inflows to the pump back ponds are the discharges from the ash pond and lime sludge pond stoplog structures. As described previously, the isolation valves connecting the ash and lime sludge ponds to the pump back ponds will be closed in the event of a pump station shutdown (GRU 2015).

4.2 Outflows

There are five pumps at the pump station located in Pump Back Cell #1. As described in GRU (2006), three of these pumps have nominal capacities of 1,200 gallons per minute while the other two have nominal capacities of 300 gallons per minute. It is assumed that the pump station including the ash recycle pump (which automatically engages and returns liquid to the ash ponds when the liquid level in the pump back ponds becomes excessive) is shut down and there is no outflow from the pump back ponds.

5 Analysis Methodology

This capacity analysis compares the precipitation volume collected over each pond's catchment area expected from a 100-year, 24-hour design storm to the pond capacity available under worst-case scenario operating conditions. These conditions would provide capacity between the maximum allowable operating water level (i.e., 193' and 186' NGVD 29 for the ash and pump back ponds, respectively) to the lowest level of the dike crest surrounding the ponds (i.e., 194.86' and 188' NGVD 29 for the ash and pump back ponds, respectively). For the purpose of a conservative estimate, the analysis excludes the removal of water as a result of discharge, and includes all the inflows as described in the preceding sections.

The following equation was used to estimate the cubic feet of capacity for each pond type associated with its top two feet of freeboard:

$$V = LBD - H(L+B)D^2 + \frac{4}{3}H^2D^3$$

Where,

L = the length of the pond between the top interior edges of the embankment (feet)

B = the width of the pond between the top interior edges of the embankment (feet)

D = the depth of water above the maximum operating elevation when the pond surface is at the surrounding dike elevation (feet)

H = the internal side slope configuration given as horizontal:vertical (unitless)

6 Inflow Design Flood

A 100-year, 24-hour storm for Gainesville releases 9.73 inches of precipitation (NOAA 2015). In the absence of spillways or other constructed fail-safe drainage structures, the capacity analysis evaluates each pond's ability to accept the inflow volume associated with this precipitation over each pond's catchment area as presented in Table 1.

7 Results

Figure 2 presents the precipitation inflow associated with 100-year, 24-hour storm; the process water inflows from the plant; and the remaining capacity for the ash and pump back ponds following the storm event. The ponds have adequate capacity to store the process water inflows and inflow associated with a 100-year 24-hour storm and provide an additional 1.8 days of capacity for process water inflows following the storm event. This capacity assumes no discharge of water from the ash ponds.

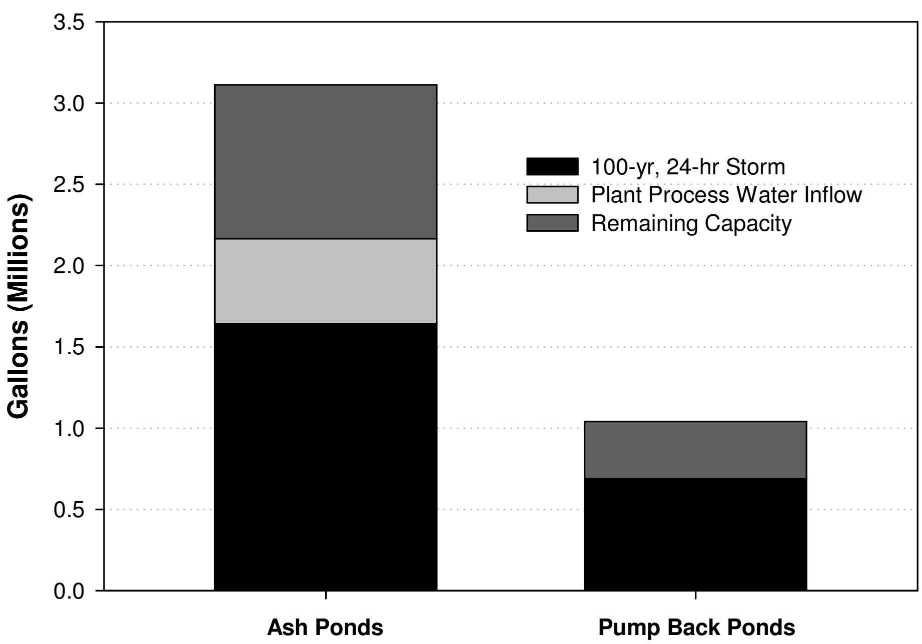

Figure 3. Total Occupied and Remaining Capacity Following a 100-year, 24-Hour Design Storm (by Pond Type)

8 References

Burns & McDonnell (1981). Deerhaven Generating Station - Unit 2 Construction, Contract 29C – Yard Structures III. Drawing set conforming to construction records. Prepared for the City of Gainesville, Florida – Alachua County Regional Utilities Board. Revised 1 July 1981.

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GRU (2006). Pond System Operating Manual: Deerhaven Generating Station Unit 2, Rev. 0. Prepared by Gainesville Regional Utilities, 17 July 2006.

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UES (2016). Geotechnical Consulting Services: Coal Combustion Residual (CCR) Impoundment Initial Hazard Potential Classification. Prepared by Universal Engineering Sciences for Innovative Waste Consulting Services, LLC. September 2016.

US EPA (2014). Assessment of Dam Safety of Coal Combustion Surface Impoundments – Gainesville Regional Utilities, Deerhaven Plant, Florida. Final report prepared for the United States Environmental Protection Agency by CDM Smith, May 2014.

9 Professional Engineer Certification

This plan was prepared under the supervision, direction and control of the undersigned registered professional engineer (PE). The undersigned PE is familiar with the requirements of 40 CFR 257.82. The undersigned PE certifies that this inflow design flood control system plan meets the requirements of 40 CFR 257.82. This certification was prepared per the requirement of 40 CFR 257.82(c)(5).

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Date: 10/14/16

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