COLETO CREEK POWER, LLC
Fannin, Texas

COAL COMBUSTION RESIDUALS
COLETO CREEK PRIMARY ASH POND
INFLOW DESIGN FLOOD CONTROL SYSTEM PLAN
5-Year Periodic Update

COLETO CREEK POWER PLANT
FANNIN, TEXAS

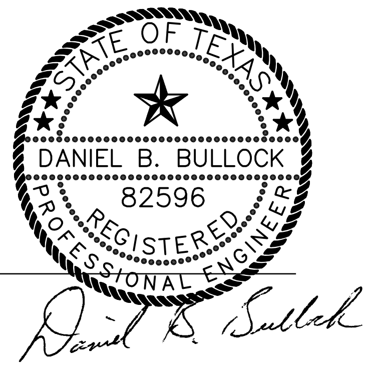
October 11, 2021

Bullock, Bennett & Associates, LLC
Engineering and Geoscience
Registrations: Engineering F-8542, Geoscience 50127
www.bbaengineering.com

Certification Statement 40 C.F.R. § 257.82 and 30 T.A.C. § 352.821—Inflow Design Flood Control System Plan for a CCR Surface Impoundment

CCR Unit: Coleto Creek Power, LLC; Coleto Creek Power Station; Coleto Creek Primary Ash Pond

I, Daniel Bullock, being a Registered Professional Engineer in good standing in the State of Texas, do hereby certify, to the best of my knowledge, information, and belief that the information contained in this plan has been prepared in accordance with the accepted practice of engineering. I certify, for the above referenced CCR Unit, that the information contained in the Inflow Design Flood Control System Plan, dated October 11, 2021, meets the requirements of 40 C.F.R. § 257.82 and 30 T.A.C. § 352.821.



Daniel B. Bullock, P.E. (TX 82596)

10-11-2021

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1.0 SITE SUMMARY

Coleto Creek Power, LLC operates the Coleto Creek Power Plant located at 45 FM 2987 near the city of Fannin in Goliad County, Texas (Figure 1). One boiler is operated at the facility to generate electricity for distribution to the area power grid. The boiler uses coal as the primary fuel and fuel oil as a backup fuel. There are two streams of coal combustion residuals (CCR) generated at this plant. Bottom ash is collected from the boiler, combined with water, and transferred in slurry form for disposal in the facility's surface impoundment (Primary Ash Pond). Fly ash is collected from the boiler exhaust and transported pneumatically to two storage silos. From there, the fly ash is loaded into enclosed dry haul hoppers for off-site beneficial use by a third party. Fly ash not meeting required beneficial reuse specifications is combined with water and pumped to the Coleto Creek Primary Ash Pond for disposal. Bottom ash in the Primary Ash Pond is routinely recovered for beneficial reuse via excavation, screening, and placement in covered dump trucks for transport off site.

The CCR slurry is pumped directly to the 190-acre Primary Ash Pond where the majority of solids settle out of the carrier water. The treated water can then flow into a 10-acre Secondary Pond. The facility's Texas Pollutant Discharge Elimination System (TPDES) Permit No. WQ0002159000 allows for the discharge of up to 0.64 million gallons per day (gpd) of water from the Secondary Pond to the adjacent Coleto Creek Reservoir. Because the Primary Ash Pond and Secondary Pond are hydraulically connected (a levee failure of the Secondary Pond and the associated rapid dewatering could impact the stability of the Primary Ash Pond), both ponds are considered in this assessment even though the Secondary Pond is not regulated under the CCR Rule.

Pursuant to Rule 30 T.A.C. § 352.821 (and by reference, 40 C.F.R. § 257.82(a)), "the owner or operator of an existing or new CCR surface impoundment…must design, construct, operate, and maintain an inflow design flood control system." 40 C.F.R. § 257.82(c) requires the owner or operator of existing CCR surface impoundments to "…prepare initial and periodic inflow design flood control system plans for the CCR unit." This *5-Year Periodic Inflow Design Flood Control System Plan* has been prepared to meet the requirements of the rule. This plan should be amended at any time that CCR management operations substantially change. In addition, this plan will be updated every five years in accordance with § 257.82(c)(4). A copy of this Plan will be maintained in the facility's operating record and publicly accessible internet site.

2.0 HYDRAULIC ANALYSIS

According to §257.82(a)(1) and (2), the inflow design flood control system must adequately manage flow into the CCR unit during and following the peak discharge of the inflow design flood as defined by the CCR rule. In addition, the inflow design flood control system must adequately manage flow from the CCR unit to collect and control the peak discharge resulting from the inflow design flood. As noted in the *Coleto Creek Power Station 5 Year Hazard Classification Assessment, 2021* (BBA, 2021), the Primary Ash Pond is classified as having a Low Hazard Potential. The inflow design flood, therefore, is defined in § 257.82(a)(3)(iii) as the 24-hour, 100-year flood.

The Coleto Creek Primary Ash Pond and Secondary Pond are currently operated as a relatively closed system. The ponds are surrounded by dikes that range from approximately four (4) to 39 ft above grade for the Primary Ash Pond and up to 56 ft for the Secondary Pond (Sargent & Lundy Engineers, 1978). The only sources of storm water accumulation, therefore, are the rain that falls within the surface impoundment boundary and incidental runoff from the dike crest. No other facility storm water is reportedly pumped into the ponds. Water from the ponds can be siphoned from the Secondary Pond at a maximum rate of approximately 0.64 million gpd and discharged to the adjacent "hot side" of the Coleto Creek Reservoir. Water levels in the pond are currently maintained below approximate elevation 136 ft NAVD88.

Bullock, Bennett and Associates, LLC (BBA) contracted T. Baker Smith (TBS) (formerly Naismith Marine Services) to complete a land and bathymetric site survey in August 2021 for the purpose of evaluating current conditions at the ponds and to obtain approximate as-built dike cross sections in areas of interest. Figure 2 provides the results of the August 2021 survey. Based on the 2021 survey the crest height generally appears to be constructed to elevation 140 ft NAVD88; however, areas were identified to be as low as approximate elevation 139.74 ft. This lower elevation is used to evaluate available capacity in the ponds.

The staff gauge elevation was measured during a site topography and bathymetry survey conducted in 2016. The survey found that the staff gauge mark of 140.0 corresponds to an elevation of approximately 140.4 ft NAVD88.

Because no significant inflow of outside storm water occurs and no conventional spillway is present, the surface impoundment must be operated so that it can contain the entirety of the design storm as well as the inflow of water/CCR from normal plant operations that occurs during the same period. The Primary Ash Pond is currently partially full of CCR, and water storage capacity remains primarily in the north portion of the pond, between approximate elevations 106 ft and 139.74 ft NAVD88 (the lowest dike crest elevation recorded in the recent survey). The estimated available capacity of the Primary Ash Pond and Secondary Pond based on 2021 survey data is 2,238,600 cy (breach elevation 139.74 ft) and 324,700 cy (breach elevation 139.68), respectively.

Maximum precipitation values for a 100-year, 24-hour storm were evaluated from various data sources. The most applicable and appropriate value was obtained from the National Oceanic and Atmospheric Administration (NOAA) Atlas 14 Precipitation Frequency Data Server (retrieved October 1st, 2021 from https://hdsc.nws.noaa.gov/hdsc/pfds/pfds_map_cont.html?bkmrk=tx). The total rainfall for the 100-year design storm is listed as 13.20 inches in a 24-hour period. This rainfall amount was applied to the entire impoundment as a National Resources Conservation Service (NRCS) type III storm event.

The hydraulic model for the impoundment was developed using the Hydrologic Engineering Center River Analysis System (HEC-RAS), version 6.0. This version of HEC-RAS provided the ability to model the storm water flow and infiltration characteristics using a 2-dimensional (2D), gridded geometry. The geometry grid was applied over the entire impoundment terrain, including perimeter conveyance channels, Primary and Secondary ponds, and the perimeter dike roads. The 2D model captured storm water flow direction, depth, and velocity, incorporating specific terrain features and elevations, and the timing of flow interactions across the impoundment surface.

The 2D model included soil and land cover data that were used to account for storm water infiltration into the impoundment. Soil data was obtained from the Gridded Soil Survey Geographic Database, provided by the NRCS (retrieved September 7th, 2021 from https://datagateway.nrcs.usda.gov/GDGOrder.aspx). Land cover data was obtained from the National Land Cover Database 2019 (retrieved September 8th, 2021 from https://www.mrlc.gov). The soil and land cover data were combined to develop NRCS curve number values that accounted for the hydrologic infiltration characteristics of the impoundment.

For the purposes of this evaluation, it was assumed that no water was discharged to Coleto Creek Reservoir during the design storm event. Based on the wind and wave run-up estimates (Section 3.0), 1.7 ft of freeboard is required above the containment elevation of the design storm event. Therefore, since the low point of the perimeter dike is approximately elevation 139.7 ft, containment of the design storm event should be within or below elevation 138.0 ft (maximum surcharge pool elevation). The results of the HEC-RAS 2D model showed that with a Primary Ash Pond starting elevation of 136.1 ft (maximum storage pool), the pooled water surface reached a maximum elevation of 137.3 feet. The primary ash pond is, therefore, capable of containing the design storm event. The secondary pond reached a maximum depth elevation of 137.1 feet, also containing the design storm event. The HEC-RAS 2D model demonstrated the impoundment is capable of containing the entire 100 year, 24-hour design storm event.

3.0 WIND AND WAVE RUN-UP ANALYSIS

Wind and wave run-up effects were estimated using guidance contained in the document *Freeboard Criteria and Guidelines for Computing Freeboard Allowances for Storage Dams* (USBR, 1981). Equation 3 of USBR was used to calculate wave run-up as follows:

$$R_s = \frac{H_s}{0.4 + (H_s/L)^{0.5} \cot \Theta}$$

where:
R_s = wave run-up
H_s = significant wave height, 1.8 ft
L = deep water wavelength, 27.08 ft
Θ = angle of upstream face of the dam with the horizon, 18 deg

H_s was calculated using Figure 9 in the USBR guidelines. Figure 9 determines significant wave height from the effective fetch (Fe) and the design wave velocity. Effective fetch is estimated to be ½ of wave fetch (F). F was determined to be the longest over water tangent normal to the dam and was measured at 3,818 ft (.72 mi) which leaves Fe at 1,909 ft (0.36 miles). Design wind velocity was determined from Figure 3 of the USBR guidelines, Fastest Mile of Record-Summer. This measurement was used because it yielded the highest velocity and therefore the most conservative measurement. Wind velocity was determined to be 63 mph. After applying the wind velocity ratio (wind over water) from Table 2 of 1.08 for a Fe of 0.5 miles (rounded up), the design wind velocity was determined to be 68 mph.

L was calculated using the Equation 2, $L = 5.12T^2$, with T being wave period. T was found with Figure 10 of USBR to be 2.3 seconds. When applied to the equation, L is determined to be 27.08 ft. Θ is 18 degrees as the dam has a side slope of approximately 3 horizontal to 1 vertical.

When all variables are applied to equation 3 of the USBR guidelines, the wave run-up is calculated to be 1.5 ft.

The wind setup in feet is calculated using Equation 4 of the USBR guidelines as follows:

$$S = \frac{U^2F}{1400D}$$

where:
U = design wind velocity over water in miles per hour, 68 mph
F = wind fetch in miles, 0.72 miles
D = average water depth along the central radial in feet, conservatively estimated to equal 10 ft

The wind setup is calculated to equal 0.2 ft.

The required freeboard is the wave run-up plus the wind setup. The total required freeboard, therefore, is 1.7 ft.

4.0 SUMMARY

The Coleto Creek Primary Ash Pond is considered an existing CCR surface impoundment that is regulated under 30 T.A.C. Chapter 352 which incorporates, by reference, Federal CCR rules codified in 40 C.F.R. Part 257 Subpart D. Section 257.82(c) requires that existing CCR surface impoundment prepare a written *Inflow Design Flood Control System Plan* to ensure that the surface impoundment is operated such that inflows to and from the impoundment from a design storm are adequately controlled. Because the Primary Ash Pond has a Low Hazard classification, the design storm is the 100-year, 24-hour rain event.

Using the estimated rainfall accumulation associated with the design storm event, wind and wave run-up estimates, and maximum storage pool elevation of 136.1 ft NAVD88 (staff gauge elevation of 135.7 ft), HEC-RAS hydrologic modeling indicates that the Primary Ash Pond would provide containment for the design storm and allow 1.7 ft of additional freeboard for wave action. The East and West channels located within the dry side of the pond should be maintained to allow the cumulative flow of ash sluice water and peak rainwater flow from the design 100-year storm into the "wet" side of the Primary Ash Pond.

5.0 REFERENCES

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NOAA. (June 1977). *NOAA Technical Memorandum NWS Hydro-35: 5- to 60-Minute Precipitation Frequency for the Eastern and Central United States.* National Oceanic and Atmospheric Administration, Silver Spring, MD.

S&L. (December 1, 1978). *Design and Construction Summary of Coal Pile and Wastewater Pond Facilities Coleto Creek Power Station - Unit 1. Report prepared for Central Power and Light Company. Report SL-3689.* Sargent & Lundy Engineers.

USBR. (1981). *Freeboard Criteria and Guidelines for Computing Feeboard Allowances for Storage Dams, ACER Technical Memorandum No. 2.* Assistant Commissioner-Engineering and Research, U.S. Department of the Interior, Bureau of Reclamation.

FIGURES

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APPROXIMATE SCALE: 1" = 3000'

0 750 1500 3000

SOURCE: AERIAL PHOTO PROVIDED BY BING, PHOTO TAKEN 2021.

STATE OF TEXAS
DANIEL B. BULLOCK
82596
REGISTERED
PROFESSIONAL ENGINEER

10-11-2021

Coleto Creek Power, LLC

Figure 1

SITE LOCATION MAP

PROJECT: 21424-1	BY: RCAD-RR	DATE: OCT 2021	CHECKED: DBB

Bullock, Bennett & Associates, LLC
Engineering and Geoscience
Texas Registrations: Engineering F-8542, Geoscience 50127

Plot Date: 10/11/21 - 1:23pm, Plotted by: Admin
Drawing Path: K:\clients\bba\Coleto Ck\21424-1\, Drawing Name: C-ST-PL103.dwg

SOURCES:

AERIAL PHOTO PROVIDED BY TBS, MAXAR TECHNOLOGIES, TEXAS GENERAL LAND OFFICE, PHOTO TAKEN 2021.

TOPOGRAPHIC MAP WAS PROVIDED BY: T. BAKER SMITH (TBS), 412 S. VAN AVE., HOUMA, LA 70363, (985) 868-1050, SEPTEMBER 2021. DATUM: TEXAS SOUTH CENTRAL ZONE, US FEET. DATUM: NAD83.

VERTICAL DATUM: NAVD88
REFERENCE MONUMENT "SCHROEDER"
N: 13,484,797.62
E: 2,539,540.98
ELEV:175.0' NAVD88

REFERENCE MONUMENT "NMS SET 1"
(SET ALUMINUM DISK)
N: 13,450,038.01
E: 2,543,208.41
ELEV:135.7' NAVD88

STATE OF TEXAS
DANIEL B. BULLOCK
82596
REGISTERED PROFESSIONAL ENGINEER

10-11-2021

Coleto Creek Power, LLC

Figure 2

SITE TOPOGRAPHY MAP

PROJECT: 21424-1	BY: RCAD-RR	DATE: OCT 2021	CHECKED: DBB

Bullock, Bennett & Associates, LLC
Engineering and Geoscience
Texas Registrations: Engineering F-8542, Geoscience 50127

Plot Date: 10/11/21 - 1:25pm, Plotted by: Admin
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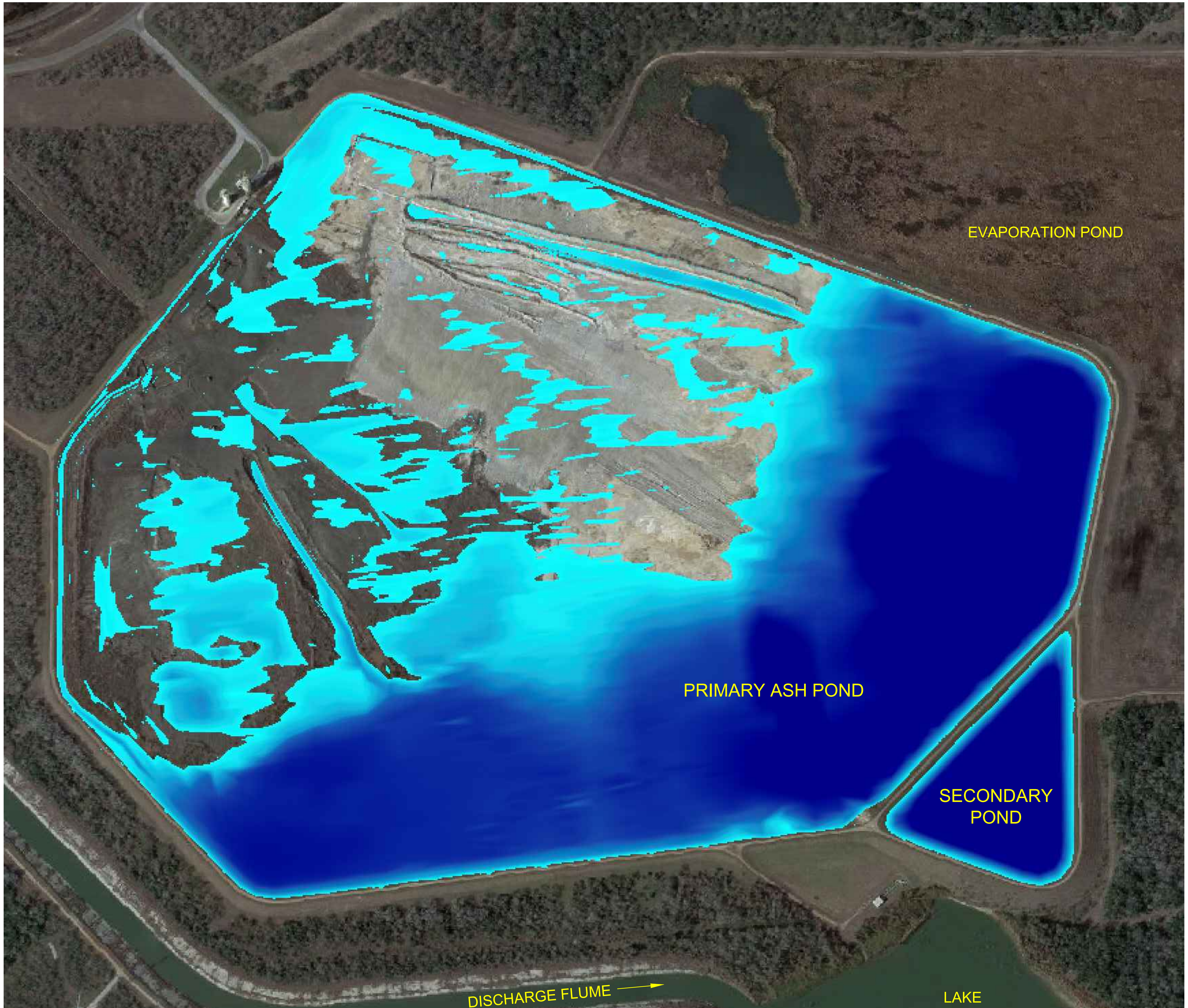


N

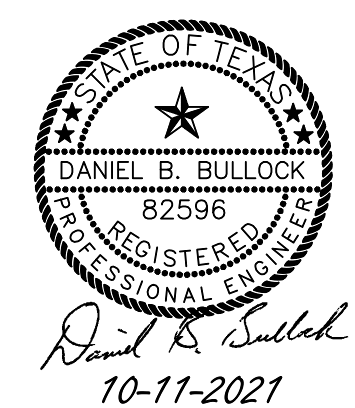
APPROXIMATE SCALE IN FEET

0 200 400 800

NOTES:

MAXIMUM STORAGE POOL ELEVATION OF 136.1 FT NAVD88. MAXIMUM SURCHARGE POOL ELEVATION OF 137.3 FT NAVD88 IN PRIMARY ASH POND.

ROADWAY WATER IS INDICATIVE OF POOLED STORMWATER, NOT OVERTOPPING.



Coleto Creek Power, LLC

Figure 3

HEC-RAS MODELING RESULTS

PROJECT: 21424-1	BY: RCAD-RR	DATE: OCT 2021	CHECKED: DBB

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Plot Date: 10/11/21 - 1:23pm, Plotted by: Admin
Drawing Path: K:\clients\bba\Coleto Ck\21424-1\, Drawing Name: C-ST-PL105.dwg

APPENDIX A

HEC-RAS MODEL INPUTS

HEC-RAS MODEL INPUTS
Coleto Creek Primary Ash Pond
Inflow Design Flood

Primary Ash Pond Water Surface Elevations

Starting Water Surface Elevation	136.1 feet
Maximum Ponding Water Surface Elevation	137.3 feet

Secondary Pond Water Surface Elevations

Starting Water Surface Elevation	136.1 feet
Maximum Ponding Water Surface Elevation	137.0 feet

Manning’s n Coefficients

Land Cover Classification	Manning’s n
Brush-weed-grass mix	0.05
Open Water	0.04
Developed, Open Space	0.04
Developed, Low Intensity	0.1
Developed, Medium Intensity	0.12
Developed, High Intensity	0.15
Barren Land Rock/Sand/Clay	0.025
Mixed Forest	0.16
Grassland/Herbaceous	0.035
Woody Wetlands	0.12
Channel 2	0.025
Channel 1	0.025
Central Brush Bare Mix	0.037
West Channel Vegetation	0.037

HEC-RAS MODEL INPUTS
Coleto Creek Primary Ash Pond
Inflow Design Flood

NRCS Curve Numbers

Land Cover: Soil Type	CN Value
Brush-weed-grass mix : NoData	77
Brush-weed-grass mix : D	77
Brush-weed-grass mix : C/D	74
Brush-weed-grass mix : C	70
Brush-weed-grass mix : Ash Material	35
Open Water : NoData	100
Open Water : D	100
Open Water : C/D	100
Open Water : C	100
Open Water : Ash Material	100
Developed, Open Space : NoData	84
Developed, Open Space : D	84
Developed, Open Space : C/D	82
Developed, Open Space : C	79
Developed, Open Space : Ash Material	49
Developed, Low Intensity : NoData	82
Developed, Low Intensity : D	82
Developed, Low Intensity : C/D	80
Developed, Low Intensity : C	77
Developed, Low Intensity : Ash Material	46
Developed, Medium Intensity : NoData	84
Developed, Medium Intensity : D	84
Developed, Medium Intensity : C/D	82
Developed, Medium Intensity : C	79
Developed, Medium Intensity : Ash Material	51
Developed, High Intensity : NoData	95
Developed, High Intensity : D	95
Developed, High Intensity : C/D	95
Developed, High Intensity : C	94
Developed, High Intensity : Ash Material	89
Barren Land Rock/Sand/Clay : NoData	94
Barren Land Rock/Sand/Clay : D	94
Barren Land Rock/Sand/Clay : C/D	93
Barren Land Rock/Sand/Clay : C	91
Barren Land Rock/Sand/Clay : Ash Material	77
Mixed Forest : NoData	79
Mixed Forest : D	79
Mixed Forest : C/D	76

HEC-RAS MODEL INPUTS
Coleto Creek Primary Ash Pond
Inflow Design Flood

NRCS Curve Numbers (cont'd)

Mixed Forest : C	73
Mixed Forest : Ash Material	36
Grassland/Herbaceous : NoData	77
Grassland/Herbaceous : D	77
Grassland/Herbaceous : C/D	74
Grassland/Herbaceous : C	70
Grassland/Herbaceous : Ash Material	35
Woody Wetlands : NoData	86
Woody Wetlands : D	86
Woody Wetlands : C/D	86
Woody Wetlands : C	86
Woody Wetlands : Ash Material	86
Channel 2 : NoData	94
Channel 2 : D	94
Channel 2 : C/D	93
Channel 2 : C	91
Channel 2 : Ash Material	77
Channel 1 : NoData	94
Channel 1 : D	94
Channel 1 : C/D	93
Channel 1 : C	91
Channel 1 : Ash Material	77
Central Brush Bare Mix : NoData	86
Central Brush Bare Mix : D	86
Central Brush Bare Mix : C/D	85
Central Brush Bare Mix : C	80
Central Brush Bare Mix : Ash Material	56
West Channel Vegetation : NoData	86
West Channel Vegetation : D	86
West Channel Vegetation : C/D	85
West Channel Vegetation : C	80
West Channel Vegetation : Ash Material	56