INFLOW DESIGN FLOOD CONTROL SYSTEM PLAN
PLANT MILLER ASH POND
ALABAMA POWER COMPANY

Section 257.82 of EPA's regulations requires the owner or operator of an existing or new CCR surface impoundment or any lateral expansion of a CCR surface impoundment to design, construct, operate and maintain an inflow design flood control system capable of safely managing flow during and following the peak discharge of the specified inflow design flood. The owner or operator also has to prepare a written plan documenting how the inflow flood control system has been designed and constructed to meet the requirements of this section of the rule.

The existing CCR surface impoundment referred to as the Plant Miller Ash Pond is located at Alabama Power Company's Plant Miller. The facility consists of a 321 acre storage area. The inflow design flood consists primarily of the rainfall that falls within the limits of the surface impoundment, along with a nominal amount (relative to the rainfall) of process flows. It was determined that process flows into the pond were negligible in this analysis. Stormwater is temporarily stored within the limits of the surface impoundment and discharged through an 8-foot diameter concrete pipe.

The inflow design flood has been calculated using the Natural Resources Conservation Service method (also known as the Soil Conservation Service (SCS) method) using the 1000-yr storm event required for a Significant hazard potential facility. Runoff curve number data was determined using Table 2-2A from the Urban Hydrology for Small Watersheds (TR-55). Appendix A and B from the TR-55 were used to determine the rainfall distribution methodology. Precipitation values were determined from NOAA's Precipitation Frequency Data Server (Atlas-14).

The NRCS provided information on the soil characteristics and hydrologic groups present at the site. It was determined that the hydrological groups "B" and "D" should be used to best reflect the characteristics of the soils on site [may require multiple curve numbers depending upon presence of free water, exposed ash and/or vegetation; should be addressed in the calculation]. This information was placed into Hydrologic Engineering Center - Hydrologic Modeling System and used to generate appropriate precipitation curves, storm basin routing information, and resulting rating curves to evaluate surface impoundment capacity.

Calculations indicate the unit can safely store and pass the inflow design storm. Supporting calculations are attached for reference.

The facility is operated subject to and in accordance with § 257.3-3 of EPA's regulations.

I hereby certify that the inflow design flood control system plan meets the requirements of 40 C.F.R. Part 257.82.

10/17/16

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Inflow Design Control System Plan:
Hydrologic and Hydraulic Calculation Summary

for

Plant Miller Ash Pond

Prepared by:

Southern Company Services
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Reviewer: _____ 10/11/16
Jason S. Wilson Date

Approval: _____ 10/12/16
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1.0 Purpose of Calculation

The purpose of this report is to demonstrate the hydraulic capacity of the subject CCR impoundment in order to prepare an inflow design flood control plan as required by the United States Environmental Protection Agency's (EPA) final rule for Disposal of CCR from Electric Utilities (EPA 40 CFR 257).

2.0 Summary of Conclusions

A hydrologic and hydraulic model was developed for the Plant Miller Ash Pond to determine the hydraulic capacity of the impoundment. The design storm for the Plant Miller Ash Pond is a 1000-year rainfall event. Southern Company has selected a storm length of 24-hours for all inflow design flood control plans. The results of routing a 1000-year, 24-hour rainfall event through the impoundment are presented in Table 1 below:

Table 1-Flood Routing Results for Plant Miller Ash Pond

Plant Miller	Normal Pool El (ft)	Top of embankment El (ft)	Emergency Spillway Crest El (ft)	Peak Water Surface Elevation (ft	Freeboard* (ft)	Peak Inflow (cfs)	Peak Outflow (cfs)
Ash Pond	420.5	426.0	N/A	423.0	3.0	1745	405.6

*Freeboard is measured from the top of embankment to the peak water surface elevation

3.0 Methodology

3.1 HYDROLOGIC ANALYSES

The Plant Miller Ash Pond is classified as a significant hazard structure. The design storm for a significant hazard structure is a 1000-year rainfall event. A summary of the design storm parameters and rainfall distribution methodology for these calculations is summarized below in Table 2.

Table 2. Plant Miller Ash Pond Storm Distribution

Hazard Classification	Return Frequency (years)	Storm Duration (hours)	Rainfall Total (Inches)	Rainfall Source	Storm Distribution
Significant	1000	24	14.5	NOAA Atlas 14	SCS Type III

The drainage area for the Plant Miller Ash Pond was delineated based on LiDAR data acquired for the Plant in 2016. Runoff characteristics were developed based on the Soil Conservation Service (SCS) methodologies as outlined in TR-55. An overall SCS curve number for the drainage area was developed based on the National Engineering Handbook Part 630, Chapter 9 which provides a breakdown of curve numbers for each

soil type and land use combination. Soil types were obtained from the USGS online soils database. Land use areas were delineated based on aerial photography. Time of Concentration and Lag Time calculations were developed based on the overland flow method as described in the National Engineering Handbook Part 630, Chapter 15.

A table of the pertinent basin characteristics of the Ash Pond is provided below in Table 3.

Table 3—Ash Pond Hydrologic Information

Drainage Basin Area (acres)	321
Hydrologic Curve Number, CN	98
Hydrologic Methodology	SCS Method
Time of Concentration (minutes)	66
Lag Time (minutes)	39.6
Hydrologic Software	USACE HEC-HMS

Runoff values were determined by importing the characteristics developed above into a hydrologic model with the US Army Corps of Engineers HEC-HMS program.

Process flows from Plant Miller were considered in this analysis. Based on normal plant operations, the Ash Pond receives an additional 32.7 MGD (51 cfs) of inflow from the Plant.

3.2 HYDRAULIC ANALYSES

Storage values for the Ash Pond were determined by developing a stage-storage relationship utilizing contour data. The spillway system at the Plant Miller Ash Pond consists of an overflow concrete riser connected to a discharge pipe. The primary spillway riser has an overtopping elevation of 420.0' and an invert elevation of 400.0'. A summary of spillway information is presented below in Table 4.

Table 4—Spillway Attribute Table

Spillway Component	US Invert El (feet)	DS Invert El (feet)	Dimension (ft)	Slope (ft/ft)	Length (ft)	Spillway Capacity (cfs)
Primary	400.0	393.4 8		3.6%	185.6	591

Based on the spillway attributes listed above, a rating curve was developed and inserted into HEC-HMS to determine the pond performance during the design storm. Results are shown in Table 1.

4.0 SUPPORTING INFORMATION

4.1 CURVE NUMBER

Land Use Description	Soil Type	CN	Area (acres)
Water	B/D	100	237
Impervious	B/D	98	4
Disturbed/Transitional	B/D	91	80
Total		**98**	**321**

4.2 STAGE-STORAGE TABLE

Notes	Elevation	Cumulative Storage (acre-ft)	Cumulative Flooded Surface Area (acres)
	336.0	0.0	0.5
	337.0	0.9	1.4
	338.0	2.6	2.2
	339.0	4.8	2.3
	340.0	7.3	2.6
	341.0	10.0	2.7
	342.0	12.7	2.8
	343.0	15.6	2.9
	344.0	18.6	3.0
	345.0	21.7	3.1
	346.0	24.8	3.2
	347.0	28.1	3.3
	348.0	31.4	3.4
	349.0	34.9	3.5
	350.0	38.4	3.6
	351.0	42.0	3.7
	352.0	45.8	3.8
	353.0	49.6	3.9
	354.0	53.5	4.0
	355.0	57.6	4.1
	356.0	61.7	4.2
	357.0	66.0	4.3
	358.0	70.3	4.5
	359.0	74.9	4.6
	360.0	79.6	4.8
	361.0	84.5	5.0
	362.0	89.7	7.3
	363.0	97.6	8.5
	364.0	106.9	11.1
	365.0	118.7	12.4
	366.0	131.7	14.5
	367.0	146.8	15.5

Notes	Elevation	Cumulative Storage (acre-ft)	Cumulative Flooded Surface Area (acres)
	368.0	162.8	16.8
	369.0	180.2	17.8
	370.0	198.4	19.0
	371.0	217.9	19.9
	372.0	238.3	21.1
	373.0	259.8	22.1
	374.0	282.5	23.8
	375.0	306.9	25.0
	376.0	332.5	26.4
	377.0	359.5	27.6
	378.0	387.7	28.9
	379.0	417.1	30.0
	380.0	447.7	31.2
	381.0	479.4	32.3
	382.0	512.2	33.5
	383.0	546.2	34.5
	384.0	581.1	35.5
	385.0	617.1	36.4
	386.0	654.0	37.4
	387.0	691.8	38.2
	388.0	730.4	39.2
	389.0	770.0	40.0
	390.0	810.4	40.9
	391.0	851.8	41.8
	392.0	894.0	42.8
	393.0	937.2	43.7
	394.0	981.4	45.1
	395.0	1027.0	46.1
	396.0	1073.6	47.1
	397.0	1121.1	48.0
	398.0	1169.6	49.0
	399.0	1219.1	50.0

Notes	Elevation	Cumulative Storage (acre-ft)	Cumulative Flooded Surface Area (acres)
	400.0	1269.6	51.2
	401.0	1321.4	52.3
	402.0	1374.2	53.5
	403.0	1428.2	54.5
	404.0	1483.2	55.6
	405.0	1539.3	56.5
	406.0	1596.3	57.6
	407.0	1654.4	58.5
	408.0	1713.4	59.6
	409.0	1773.4	60.5
	410.0	1834.4	61.5
	411.0	1896.4	62.4
	412.0	1959.3	63.4
	413.0	2023.2	64.5
	414.0	2088.2	65.5
	415.0	2154.3	66.6
	416.0	2221.3	67.6
	417.0	2289.4	68.7
	418.0	2358.6	69.7
	419.0	2428.9	70.9
	420.0	2500.4	72.0
Normal Pool	420.5	2536.8	74.2
	421.0	2573.3	76.3
	422.0	2654.2	89.9
	423.0	2746.1	93.9
	424.0	2842.9	101.4
	425.0	2945.3	103.5
Top of Dam	426.0	3049.8	107.9

4.3 TIME OF CONCENTRATION

Segment Type	Length	Manning's (n) Value / K Value	Slope (ft/ft)	Channel Width (ft)	Velocity (fps)	Time (minutes)
Sheet Flow	100	0.4[1]	0.163	--	0.203	8.207
Shallow Concentrated Flow	585	5.0[2]	0.146	--	1.908	5.115
Channel Flow	1,494	0.051[1]	0.004	18.0	2.149	11.586
Channel Flow	549	0.035[1]	0.008	19.0	4.517	2.025
Pipe Flow	75	0.015[1]	0.005	--	5.679	0.220
Channel Flow	2,078	0.035[1]	0.002	24.0	2.197	15.769
Pipe Flow	71	0.015[1]	0.028	--	13.809	0.085
Channel Flow	2,344	0.035[1]	0.001	25.0	1.702	22.961
Total Tc						65.966

[1] Manning's (n) value
[2] K Value

Lag Time = 0.6 x Time of Concentration (min)

Lag Time = 0.6 x 65.966 min = 39.6 min

4.4 RATING CURVE

Time (Hours)	Water Surface Elevation (feet)	Outlet Discharge (cfs)	Available Freeboard (feet)
1.0	420.5	27.5	5.5
1.5	420.5	28.8	5.5
2.0	420.5	30.0	5.5
2.5	420.5	31.7	5.5
3.0	420.6	33.9	5.4
3.5	420.6	36.4	5.4
4.0	420.6	39.0	5.4
4.5	420.6	41.8	5.4
5.0	420.7	44.7	5.3
5.5	420.7	47.6	5.3
6.0	420.7	50.6	5.3
6.5	420.8	53.7	5.2
7.0	420.8	56.8	5.2
7.5	420.8	60.0	5.2
8.0	420.9	63.3	5.1
8.5	420.9	66.8	5.1
9.0	420.9	75.1	5.1
9.5	421.0	75.1	5.0
10.0	421.0	80.5	5.0
10.5	421.1	87.4	4.9

Time (Hours)	Water Surface Elevation (feet)	Outlet Discharge (cfs)	Available Freeboard (feet)
11.0	421.1	95.5	4.9
11.5	421.2	104.7	4.8
12.0	421.3	115.4	4.7
12.5	421.4	128.5	4.6
13.0	421.5	148.1	4.5
13.5	422.0	212.9	4.0
14.0	422.6	327.9	3.4
14.5	422.9	389.9	3.1
15.0	**423.0**	**405.6**	**3.0**
15.5	**423.0**	**405.2**	**3.0**
16.0	**423.0**	**397.2**	**3.0**
16.5	422.9	385.5	3.1
17.0	422.8	372.1	3.2
17.5	422.8	357.7	3.2
18.0	422.7	342.6	3.3
18.5	422.6	327.5	3.4
19.0	422.5	312.6	3.5
19.5	422.4	298.7	3.6
20.0	422.4	285.5	3.6
20.5	422.3	272.8	3.7
21.0	422.2	260.8	3.8
21.5	422.2	249.5	3.8
22.0	422.1	238.8	3.9
22.5	422.0	228.6	4.0
23.0	422.0	219.2	4.0
23.5	421.9	210.8	4.1
24.0	421.8	188.1	4.2
24.5	421.7	181.1	4.3
25.0	421.7	173.3	4.3
25.5	421.6	165.1	4.4
26.0	421.6	157.1	4.4
26.5	421.5	149.6	4.5
27.0	421.5	142.6	4.5
27.5	421.5	136.6	4.5
28.0	421.4	131.0	4.6
28.5	421.4	125.8	4.6
29.0	421.3	120.9	4.7
29.5	421.3	116.3	4.7
30.0	421.3	112.1	4.7
30.5	421.2	108.1	4.8
31.0	421.2	104.3	4.8

Time (Hours)	Water Surface Elevation (feet)	Outlet Discharge (cfs)	Available Freeboard (feet)
31.5	421.2	100.8	4.8
32.0	421.2	97.6	4.8
32.5	421.1	94.5	4.9
33.0	421.1	91.7	4.9
33.5	421.1	89.0	4.9
34.0	421.1	86.5	4.9
34.5	421.0	84.2	5.0
35.0	421.0	82.0	5.0
35.5	421.0	80.0	5.0
36.0	421.0	78.1	5.0
36.5	421.0	76.6	5.0
37.0	421.0	75.2	5.0
37.5	421.0	73.9	5.0
38.0	420.9	72.7	5.1
38.5	420.9	71.5	5.1
39.0	420.9	70.4	5.1
39.5	420.9	69.4	5.1
40.0	420.9	68.4	5.1
40.5	420.9	67.5	5.1
41.0	420.9	66.6	5.1
41.5	420.9	65.7	5.1
42.0	420.9	64.9	5.1
42.5	420.9	64.2	5.1
43.0	420.9	63.5	5.1
43.5	420.9	62.8	5.1
44.0	420.8	62.2	5.2
44.5	420.8	61.6	5.2
45.0	420.8	61.0	5.2
45.5	420.8	60.5	5.2
46.0	420.8	59.9	5.2
46.5	420.8	59.5	5.2
47.0	420.8	59.0	5.2
47.5	420.8	58.6	5.2
48.0	420.8	58.2	5.2

4.5 DRAINAGE BASIN