INFLOW DESIGN FLOOD CONTROL SYSTEM – REVISION 01
40 C.F.R. PART 257.82
CCR UNIT ASH POND 1 (AP-1)
PLANT MCDONOUGH, GEORGIA POWER COMPANY

United States Environmental Protection Agency's "Standards for the Disposal of Coal Combustion Residuals in Landfills and Surface Impoundments" Final Rule (40 C.F.R. Part 257), §257.82 requires the owner or operator of an existing CCR surface impoundment to design, construct, operate, and maintain an inflow design flood control system capable of adequately managing flow during and following the peak discharge of the specified inflow design flood.

CCR Unit Ash Pond 1 (AP-1), owned and operated by Georgia Power Company, is located at Plant McDonough-Atkinson (Plant McDonough) in Cobb County, Georgia. AP-1 no longer receives CCR and is in the process of obtaining a solid waste permit under the Georgia Rules for Solid Waste Management, 391-3-4-.10. Installation of the final cover system for Plant McDonough AP-1 was substantially completed Q1 2017, and AP-1 is undergoing additional closure construction in the near term in accordance with 40 C.F.R. §257.102(d), including the installation of a fully encompassing subsurface barrier wall and adjacent associated closure system upgrades.

Engineering analysis of AP-1 in its current condition demonstrates that the unit meets the inflow design flood control system requirements as demonstrated in the attached calculation package. AP-1 currently consists of nominally 31 acres of drainage area, and stormwater is routed over the closure system through a system of downslope and perimeter channels to two outfall points: the North and the South outfalls. The September 2021 conditions were evaluated for stormwater conveyance. Based on an engineering analysis, AP-1 is capable of adequately managing the inflow from the 100-year, 24-hour storm event without overtopping the embankment of any of the system's storm channels and has adequate spillway capacity to manage the resulting outflow.

I certify that the inflow design flood control plan for AP-1 was prepared in accordance with 40 CFR 257.82.

Gregory L. Hebeler, PhD, P.E.

Georgia Licensed Professional Engineer No. 034749

Golder Associates Inc.

Subject:	**H&H ANALYSIS: AP-1 INFLOW DESIGN FLOOD CONTROL STUDY**		
Date:	September 07, 2021	**Made By:**	EC/JDG
Project No.:	1777449	**Checked By:**	JDG / LS
Project Short Title:	AP1 DESIGN FLOOD INFLOW CONTROL	**Reviewed By:**	GLH

OBJECTIVE

This calculations sheet covers the hydrologic and hydraulic analysis for the existing conditions (as of September 2021) of the Plant McDonough Ash Pond No. 1 (AP-1) stormwater management system including analysis of the north and south outfalls as part of the site's September 2021 inflow design flood control study. The design storm for the analysis is the 100 year, 24 hour storm event as specified for low hazard structures.

METHOD

For this analysis, Golder used The National Engineering Handbook (NEH) part 630 (Hydrology) and the NRCS Technical Release No. 55 (Urban Hydrology for Small Watersheds).

CALCULATIONS

1) RAINFALL

The design storm precipitations are from the National Oceanic and Atmospheric Administration (NOAA) Precipitation Frequency Data Server (PFDS). The table below shows the precipitation events considered for this design.

Table 1. Design Storm Precipitation Depth

Agency	Event	Depth (in)	Distribution	ARC	Source
FEMA	100-year, 24 hour	7.52	Type II	II	NOAA Atlas 14

2) WATERSHED

The watershed draining to the AP1 north and south outfalls was delineated using the topography provided by Georgia Land Department and Metro Engineering and Surveying Co, Inc in 2018 updated to include changes to the closure system completed through early 2021. Subbasins draining to a pipe culvert internal to the AP-1 perimeter channel are separated in order to ensure that no over topping of the embankment occurs at each culvert location. The delineation of each basin is provided in the attached Figure 1.

Table 2-A. North Outfall Basin #1

Area and delineation	7.4	acres
Time of Concentration	12.2	minutes
CN Computation	89	

Table 2-B. North Outfall Basin #2

Area and delineation	10.8	acres
Time of Concentration	21.6	minutes
CN Computation	95	

Table 2-C. South Outfall Basin #1

Area and delineation	1.4	acres
Time of Concentration	12.1	minutes
CN Computation	95	

Table 2-D. South Outfall Basin #2

Area and delineation	1.8	acres
Time of Concentration	13.1	minutes
CN Computation	95	

Table 2-E. South Outfall Basin #3

Area and delineation	9.4	acres
Time of Concentration	15.8	minutes
CN Computation	95	

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2.1) Curve Number

The curve number (ARC II) was chosen based on the recommended curve numbers given in Table 9-1, 9-2, and 9-5 of the National Engineering Handbook (NEH) for each land use. The land use areas were delineated using ArcMap. ClosureTurf is assigned a curve number of 95 based on the maximum recommended value provided by WatershedGeo in the closure turf design guideline manual. The soil type of the watershed is considered type B (Moderately Low Runoff Potential) and D (high runoff potential). The land cover present in the watershed is listed below.

Impervious (roads/buildings)
Fair Grass Cover
Forest
Closure Turf

Table 3-A. Curve Number Sub-basin #2

Soil Group	Land Use	CN	Area	CNxArea
B	Impervious (roads/buildings)	98	0.35	34.3
	Gravel	95	2.1	199.5
	Fair Grass Cover	75	1.73	129.75
	Forest	60	0.4	24
D	Closure Turf	95	2.86	271.7
TOTALS			7.44	659.25
			CN	**89**

Table 3-B. Curve Number Sub-basin #3

Soil Group	Land Use	CN	Area	CNxArea
D	Closure Turf	95	10.75	1021.25
TOTALS			10.75	1021.25
			CN	**95**

Table 3-C. Curve Number South Sub-basin #1

Soil Group	Land Use	CN	Area	CNxArea
D	Geotextile Liner	95	1.2	114
	Gravel	95	0.2	19
TOTALS			1.4	133
			CN	**95**

Table 3-D. Curve Number South Sub-basin #2

Soil Group	Land Use	CN	Area	CNxArea
D	Geotextile Liner	95	1.79	170.05
TOTALS			1.79	170.05
			CN	**95**

Table 3-E. Curve Number South Sub-basin #3

Soil Group	Land Use	CN	Area	CNxArea
D	Geotextile Liner	95	9.42	894.9
TOTALS			9.42	894.9
			CN	**95**

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2.2) Time of Concentration

The time of concentration is calculated within Autodesk Storm and Sanitary Analysis 2019 (SSA) using the Velocity Method described in the NRCS technical release No. 55. The flow length and slope were estimated using the ArcMap Spatial Analysis tools and AutoCAD Civil 3D Watershed Analysis tools. Sheet, Concentrated, and Channel flows properties were determined using imagery information and the provided topography. Tables 3 exhibit the flow properties considered and the time of concentration results.

Table 4-A. Time of Concentration North Sub-basin #1

Flow Type	Flow Properties	segment 1	segment 2	segment 3
Sheet Flow	Flow Length (ft)	100.0	-	-
	Flow Slope (%)	30	-	-
	2yr-24hr rainfall (in)	3.73	-	-
	Manning's roughness	0.4 (Avg. Grass Cover)	-	-
	Computed Flow Time (min)	6.73	-	-
Shallow Concentr-ated Flow	Flow Length (ft)	394	47	234
	Flow Slope (%)	2.0	33.0	2.0
	Surface Type	Unpaved	Unpaved	Unpaved
	Flow Velocity (ft/sec)	2.28	9.27	2.28
	Computed Flow Time (min)	2.88	0.08	1.71
Channel Flow	Flow Length (ft)	422	-	-
	Channel Slope (%)	2.00	-	-
	Cross Section Area (ft2)	16.34	-	-
	Manning's roughness	0.02 (closure turf)	-	-
	Wetted perimeter (ft)	20.14	-	-
	Computed Flow Time (min)	0.77	-	-

TOTAL	**12.2 min**

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Table 4-B. Time of Concentration North Sub-basin #2

Flow Type	Flow Properties	segment 1	segment 2	segment 3
Sheet Flow	Flow Length (ft)	100.0	-	-
	Flow Slope (%)	1.6	-	-
	2yr-24hr rainfall (in)	3.73	-	-
	Manning's roughness	0.22 (closure turf)	-	-
	Computed Flow Time (min)	13.48	-	-
Shallow Concentr-ated Flow	Flow Length (ft)	338	122	90
	Flow Slope (%)	3.8	0.5	17.6
	Surface Type	Unpaved	Unpaved	Unpaved
	Flow Velocity (ft/sec)	3.15	1.14	6.77
	Computed Flow Time (min)	1.79	1.78	0.22
Channel Flow	Flow Length (ft)	919.00	-	-
	Channel Slope (%)	0.50	-	-
	Cross Section Area (ft2)	10.00	-	-
	Manning's roughness	0.02 (closure turf)	-	-
	Wetted perimeter (ft)	18.00	-	-
	Computed Flow Time (min)	4.30	-	-

TOTAL	**21.6 min**

Table 4-C. Time of Concentration South Sub-basin #1

Flow Type	Flow Properties	segment 1	segment 2	segment 3
Sheet Flow	Flow Length (ft)	100	-	-
	Flow Slope (%)	3.00	-	-
	2yr-24hr rainfall (in)	3.73	-	-
	Manning's roughness	0.22 (Closure Turf)	-	-
	Computed Flow Time (min)	10.48	-	-
Shallow Concentr-ated Flow	Flow Length (ft)	274	-	-
	Flow Slope (%)	3.00	-	-
	Surface Type	Unpaved	-	-
	Flow Velocity (ft/sec)	2.79	-	-
	Computed Flow Time (min)	1.64	-	-
Channel Flow	Flow Length (ft)	-	-	-
	Channel Slope (%)	-	-	-
	Cross Section Area (ft2)	-	-	-
	Manning's roughness	-	-	-
	Wetted perimeter (ft)	-	-	-
	Computed Flow Time (min)	-	-	-

TOTAL	**12.1 min**

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Table 4-D. Time of Concentration South Sub-basin #2

Flow Type	Flow Properties	segment 1	segment 2	segment 3
Sheet Flow	Flow Length (ft)	100.0	-	-
	Flow Slope (%)	3	-	-
	2yr-24hr rainfall (in)	3.73	-	-
	Manning's roughness	0.22 (Closure Turf)	-	-
	Computed Flow Time (min)	10.48	-	-
Shallow Concentr-ated Flow	Flow Length (ft)	280	-	-
	Flow Slope (%)	3.0	-	-
	Surface Type	Unpaved	-	-
	Flow Velocity (ft/sec)	2.79	-	-
	Computed Flow Time (min)	1.67	-	-
Channel Flow	Flow Length (ft)	371	-	-
	Channel Slope (%)	1.00	-	-
	Cross Section Area (ft2)	8.00	-	-
	Manning's roughness	0.02 (Closure Turf)	-	-
	Wetted perimeter (ft)	10.00	-	-
	Computed Flow Time (min)	0.96	-	-

TOTAL	**13.1 min**

Table 4-E. Time of Concentration South Sub-basin #3

Flow Type	Flow Properties	segment 1	segment 2	segment 3
Sheet Flow	Flow Length (ft)	100.0	-	-
	Flow Slope (%)	3.0	-	-
	2yr-24hr rainfall (in)	3.73	-	-
	Manning's roughness	0.22 (Closure Turf)	-	-
	Computed Flow Time (min)	10.48	-	-
Shallow Concentr-ated Flow	Flow Length (ft)	220	96	270
	Flow Slope (%)	3.0	16.1	1.0
	Surface Type	Unpaved	Unpaved	Unpaved
	Flow Velocity (ft/sec)	2.79	6.47	1.61
	Computed Flow Time (min)	1.31	0.25	2.80
Channel Flow	Flow Length (ft)	370	-	-
	Channel Slope (%)	1.00	-	-
	Cross Section Area (ft2)	8.00	-	-
	Manning's roughness	0.02 (Closure Turf)	-	-
	Wetted perimeter (ft)	10.00	-	-
	Computed Flow Time (min)	0.96	-	-

TOTAL	**15.8 min**

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4) SITE MODEL HYDRAULIC COMPONENT SUMMARY

4.1) Outfall Hydraulics

The current north and south outfall locations are modelled as nodes within the site hydraulic model (the invert of each outfall node is 79 feet-msl). Each outfall consists of an overflow weir spillway which is modelled as a trapezoidal weir connection within the SSA model. Each overflow weir provides 20 feet of weir length at the weir invert and an estimated weir coefficient of 2.6.

4.2) Internal Pipe Culvert Hydraulic Summary

Pipe culverts are currently present at three points of the AP-1 closure stormwater management system within the closure system's perimeter channel as summarized in Table 4-A. Each location is modelled to confirm that no overtopping of the external embankment occurs at each culvert location and to provide an accurate inflow estimate at each outfall location.

Table 5-A. Pipe Culvert Summary

Culvert ID	Culvert Description	Model Inputs	
North Culvert 1	Triple barrel 24" diameter SDR17 HDPE pipe culvert upstream of the north outfall	Length	40 feet
		Inlet Invert elev.	780.4 ft-msl
		Outlet Invert elev.	779.5 ft-msl
		Manning's n	0.012
South Culvert 1	24" diameter SDR17 HDPE pipe culvert upstream of the south outfall	Length	57 feet
		Inlet Invert elev.	786.1 ft-msl
		Outlet Invert elev.	785.6 ft-msl
		Manning's n	0.012
South Culvert 2	42" diameter SDR17 HDPE pipe culvert upstream of the south outfall	Length	90 feet
		Inlet Invert elev.	782.0 ft-msl
		Outlet Invert elev.	781.4 ft-msl
		Manning's n	0.012

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5) SITE MODEL RESULTS

Tables 6-A through 6-E summarize the model results at each point of interest. At each location sufficient system hydraulic capacity exists to maintain adequate freeboard during the design storm event (100 year, 24 hour storm).

Table 6-A. North Outfall Model Results

100yr, 24 Hour Storm	Maximum WSE (ft)	780.2	ft-msl
	Available Freeboard (ft)	8.8	ft
	Peak Inflow (cfs)	102	cfs
	Peak Outflow (cfs)	102	cfs

Table 6-B. South Outfall Model Results

100yr, 24 Hour Storm	Maximum WSE (ft)	780.1	ft-msl
	Available Freeboard (ft)	8.9	ft
	Peak Inflow (cfs)	89	cfs
	Peak Outflow (cfs)	89	cfs

Table 6-C. North Culvert 1 Model Results

100yr, 24 Hour Storm	Maximum WSE (ft)	783.8	ft-msl
	Available Freeboard (ft)	5.2	ft
	Peak Inflow (cfs)	71	cfs
	Peak Outflow (cfs)	55	cfs

Table 6-D. South Culvert 1 Model Results

100yr, 24 Hour Storm	Maximum WSE (ft)	787.9	ft-msl
	Available Freeboard (ft)	1.1	ft
	Peak Inflow (cfs)	12	cfs
	Peak Outflow (cfs)	8	cfs

Table 6-E. South Culvert 2 Model Results

100yr, 24 Hour Storm	Maximum WSE (ft)	784.1	ft-msl
	Available Freeboard (ft)	4.9	ft
	Peak Inflow (cfs)	22	cfs
	Peak Outflow (cfs)	19	cfs

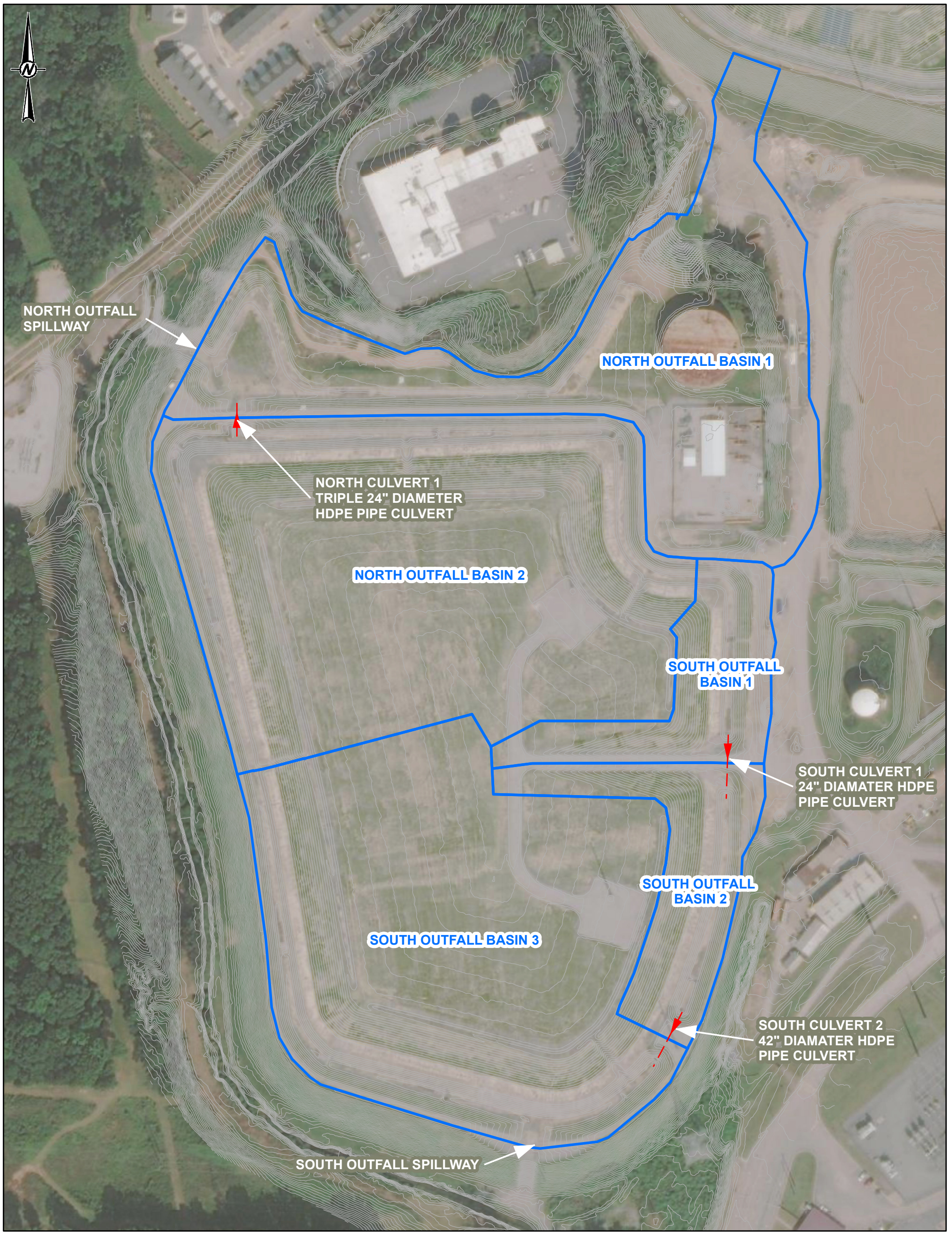
6) References

GASDP(2015), *Engineer Guidelines.*

NRCS(1986), *Technical Release No. 55 (Urban Hydrology for Small Watersheds).*

NRCS(1993), *National Engineering Handbook Part 630 (Hydrology)* .

Autodesk(2013), *Autodesk Storm and Sanitary Analysis User's Guide.*



LEGEND

- EXISTING TOPOGRAPHY 1 FOOT CONTOURS
- MODELLED PIPE CULVERT
- SITE DRAINAGE BASIN

0 160 320
Feet
1 " = 160 feet

REFERENCE(S)

1. AERIAL IMAGERY: GOOGLE, 2018
2. CONTOURS DERIVED FROM LIDAR DATA COLLECTED MARCH 3, 2018 BY COOPER BARNETT PAGE

NOTE(S)

CLIENT
SOUTHERN COMPANY

PROJECT
AP-1 INFLOW DESIGN FLOOD CONTROL STUDY

TITLE
SITE TOPOGRAPHY AND BASIN MAP

CONSULTANT
GOLDER

YYYY-MM-DD	2021-09-08
DESIGNED	JDG
PREPARED	JDG
REVIEWED	LS
APPROVED	GLH

PROJECT NO.	CONTROL	REV.	FIGURE
1777449		0	1

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