Periodic Update to the Brame Bottom Ash Pond Inflow Design Flood Control System Plan

Cleco Power, LLC

Rodemacher Unit 2
Project No. 135539

Revision 1
10/14/2021

Periodic Update to the Brame Bottom Ash Pond Inflow Design Flood Control System Plan

prepared for

Cleco Power, LLC
Rodemacher Unit 2
Rapides Parish, Louisiana

Project No. 135359

Revision 1
10/14/2021

prepared by

Burns & McDonnell Engineering Company, Inc.
Kansas City, Missouri

INDEX AND CERTIFICATION

Cleco Power, LLC
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Certification

I hereby certify, as a Professional Engineer in the state of Louisiana, that the information in this document was assembled under my direct supervisory control. This report is not intended or represented to be suitable for reuse by the Cleco Power, LLC or others without specific verification or adaptation by the Engineer.

Jason

Jason C. Eichenberger, P.E.
Louisiana License #42246

Date: October 14, 2021

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LIST OF ABBREVIATIONS

Abbreviation	Term/Phrase/Name
ac	acre
BMcD	Burns & McDonnell
Brame	Brame Energy Center
CCR	Coal Combustion Residual
CFR	Code of Federal Regulations
cfs	cubic feet per second
Cleco	Cleco Power, LLC
CY	cubic yard
ELG	Effluent Limitations Guidelines
EPA	Environmental Protection Agency
ft	feet
GPM	Gallons per Minute
hr	hour
in	inch
LDOTD	Louisiana Department of Transportation and Development
LPDES	Louisiana Pollutant Discharge Elimination System
LSU	Louisiana State University
MGD	Million Gallons per Day
min	minute
NAD 83	North American Datum of 1983
NAVD 88	North American Vertical Datum of 1988

Abbreviation	**Term/Phrase/Name**
NGVD 29	National Geodetic Vertical Datum of 1929
NRCS	Natural Resources Conservation Service
PFDS	Precipitation Frequency Data Server
RCRA	Resource Conservations and Recovery Act
SCS	Soil Conservation Service
U.S.C.	United States Code
USDA	US Department of Agriculture

1.0 INTRODUCTION

On April 17, 2015, the Environmental Protection Agency (EPA) issued the final version of the federal Coal Combustion Residual (CCR) Rule to regulate the disposal of CCR materials generated at coal-fired units. The rule will be administered as part of the Resource Conservation and Recovery Act [RCRA, 42 United States Code (U.S.C.) §6901 et seq.], using the Subtitle D approach.

The existing CCR impoundments at Cleco Power, LLC’s (Cleco’s) Brame Energy Center (Brame) are subject to the CCR Rule and as such must meet the hydrologic and hydraulic capacity requirements outlined in 40 Code of Federal Regulations (CFR) §257.82. This report serves as the periodic update to the inflow design flood control system plan for the Bottom Ash Pond at Brame.

This inflow design flood control system plan is in addition to, not in place of, any other applicable site permits, environmental standards, or work safety practices.

2.0 PLAN OBJECTIVES

Per 40 CFR §257.82, the inflow design flood control system plan must contain documentation (including supporting engineering calculations) that the inflow design flood control system has been designed and constructed to:

- Adequately manage flow into the CCR unit during and following the peak discharge of the inflow design flood,
- Adequately manage flow from the CCR unit to collect and control the peak discharge resulting from the inflow design flood, and
- Handle discharge from the CCR surface impoundment in accordance with the surface water requirements described in 40 CFR §257.3-3.

Per 40 CFR §257.82(c)(5), Cleco must obtain certification from a qualified professional engineer that the inflow design flood control system plan, and subsequent updates to the plan, meet the requirements of 40 CFR §257.82. This sealed document serves as that certification.

3.0 EXISTING CONDITIONS

Brame is located northwest of Alexandria in Rapides Parish, Louisiana. The Bottom Ash Pond is a 42.25-acre diked pond with approximately 1,100,000 CY of capacity. A site plan is included in Appendix A. The impoundment is surrounded by a 20-foot-wide perimeter dike with a crest elevation of approximately 106 feet. The dike on the southeast side is shared with the Fly Ash Pond.

The pond receives bottom ash, economizer ash, sluice water, and other process flows from Rodemacher Unit 2. CCR material is sluiced to the pond at 2.16 million gallons per day (MGD) for approximately 12 hours each day. The pool elevation is managed through the use of a pump that operates on a float system. The low operating level is 90 feet and high operating level is 96 feet (NAVD 88). Periodically a separate, manually operated pump is used to pump rainfall collected in the adjacent Fly Ash Pond into the Bottom Ash Pond; however, flow from the Fly Ash Pond has not been included as part of this analysis because rainfall collected in the Fly Ash Pond will be retained in the Fly Ash Pond until plant operators turn on the pump.

Excess water collected in the Bottom Ash Pond is pumped through a 24-inch corrugated metal pipe to an overflow channel where it can be discharged into Lake Rodemacher via permitted LPDES Outfall 401. The invert elevation of the corrugated metal pipe is 102.6 feet.

4.0 DESIGN BASIS / FLOOD CONTROL SYSTEM

4.1 Hazard Potential Classification

Per 40 CFR §257.73, Cleco has determined the Brame Bottom Ash Pond to be a significant hazard potential CCR surface impoundment.

4.2 Inflow Design Flood System Criteria

4.2.1 Capacity Criteria

The CCR Rule requires CCR surface impoundments to have adequate hydrologic and hydraulic capacity to manage flows for the inflow design flood. For this analysis, the criteria was interpreted as being the top of the surface impoundment dike should not be overtopped during the inflow design flood event.

4.2.2 Freeboard Criteria

The CCR documentation further discusses that operating freeboard must be adequate to meet performance standards, but a specific freeboard is not defined.

4.2.3 Flood Routing Design Criteria

The inflow design flood for this analysis is a 1,000-year flood event per 40 CFR §257.82(a)(3)(ii).

4.3 Project Mapping

Project mapping for this analysis consisted of an inventory of stormwater assets that contribute to the surface impoundment. Three primary sources of information were utilized: construction record drawings, plant operational information, and survey data.

4.3.1 Mapping Sources

Survey data utilized included LIDAR topography from the Louisiana State University (LSU) Atlas Lidar Downloader, retrieved in January of 2016. Construction record drawings of the surface impoundment and owner-provided information were also utilized in the analysis.

4.3.2 Vertical Datum

Mapping sources referenced were in the North American Vertical Datum of 1988 (NAVD 88).

4.3.3 Horizontal Coordinate System

Data from the LSU Atlas Lidar which was utilized as the basis for mapping and modeling efforts is in the Louisiana State Plane North, North American Datum of 1983 (NAD 83) coordinate system.

5.0 HYDROLOGIC AND HYDRAULIC CAPACITY

HEC-HMS 4.0 was used to model reservoir characteristics under the design storm event. Inputs to the HEC-HMS model were assumed to be as follows.

5.1 Pond Inflows

5.1.1 Runoff

5.1.1.1 Recurrence Interval and Rainfall Duration

The inflow flood design event for this study, as dictated by the hazard potential classification, was a 1,000-year flood event. Because a storm duration is not specified under 40 CFR §257.82 or other pertinent inflow flood design sections within the CCR Rule, a 24-hour storm duration was utilized.

5.1.1.2 Rainfall Distribution and Depth

The Soil Conservation Service (SCS) Type III rainfall distribution was used for computations associated with this evaluation. Precipitation data was acquired from the NOAA Precipitation Frequency Data Server (PFDS). Precipitation depth for the inflow design flood event is 22.6 inches.

5.1.1.3 Subbasin Characteristics

Calculations were determined based on the watershed parameters shown in Table 5-1. Refer to Appendix B for more detailed calculations.

Table 5-1: Watershed Runoff Calculated Data for Brame Bottom Ash Pond

Component	Value	Unit
Watershed Area	45.4	ac
SCS Storm Depth: 1,000-yr, 24-hr	22.6	in
Weighted Curve Number	91	-
Initial Abstraction	0.198	in
Time of Concentration	8.80	min
Basin Lag Time	6.00	min

5.1.2 Process Flows

When conducting the hydraulic analysis, it was assumed that the pond level is at the high operating level (96.0 feet) prior to the storm event. All discharge into the pond is considered to be additional flow above the initial elevation. It was assumed sluicing operations would be maintained for the duration of the storm event control period.

5.2 Pond Outflows

Stage discharge information was not included in this model. To be conservative, it was assumed the Bottom Ash Pond pump system would be inoperable for the duration of the storm event control period.

6.0 RESULTS

The pond was modeled for a 1,000-year, 24-hour storm event with initial elevation set at the high operating level, no discharge, and the pond being 50% full of bottom ash up to the top of the dike.

Under the assumed conditions, the pond was able to contain runoff from the 1,000-year, 24-hour storm without overtopping. The results of the modeled storm event are as follows:

Table 6-1: Modeled Pond Design

Component	Property	Value	Unit
Subbasin Watershed	Peak Discharge	762.6	cfs
	Runoff Volume	21.45	in
Source Sluice Flow	Peak Discharge	3.3	cfs
Reservoir Bottom Ash Pond - 50% full of ash	Initial EL	96.0	ft
	Peak Inflow	765.9	cfs
	Peak Discharge	0.0	cfs
	Peak Elevation	104.3	ft
	Peak Storage (storage above initial EL)	143.9	ac-ft

After a significant storm event, excess water collected in the Bottom Ash Pond can be discharged via pumping to the permitted LPDES Outfall 401 similar to current operations.

7.0 PERIODIC ASSESSMENT AND AMENDMENT

Cleco placed the initial plan in the CCR Operating Record by October 17, 2016. Periodic inflow design flood control system plans are required every five years. This report serves as the first periodic update to the inflow design flood control system plan. Cleco may publish revised plans at shorter intervals, noting, however, the deadline for publishing the next revision will be maintained as five years after publishing the previous revision. Cleco may amend the plan at any time and is required to do so whenever there is a change in conditions which would affect the current plan. All amendments and revisions must be placed on the CCR public website. A record of revisions made to this document is included in Section 8.0.

8.0 RECORD OF REVISIONS AND UPDATES

Revision Number	Date	Revisions Made	By Whom
0	10/14/2016	Initial Issue	Burns & McDonnell
1	10/14/2021	Periodic Update to the Initial Plan	Burns & McDonnell

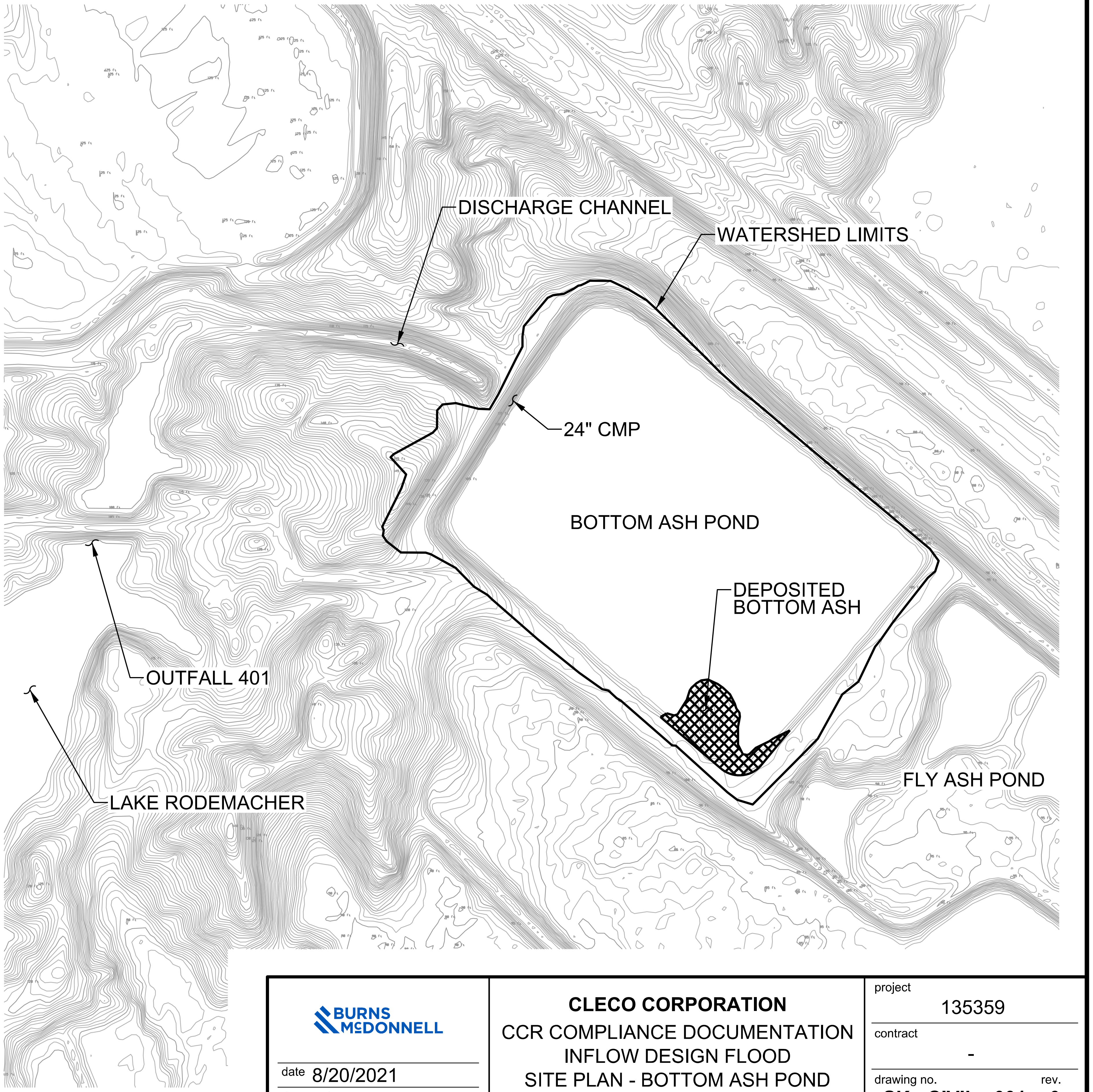
APPENDIX A – SITE PLAN

NOTES:

1. EXISTING CONTOURS PER LOUISIANA STATE UNIVERSITY ATLAS LIDAR DOWNLOADER, RETRIEVED JANUARY 2016

2. ASH POND OPERATING CHARACTERISTICS ARE AS FOLLOWS:

	WATERSHED AREA (AC)	HIGH OPERATING LEVEL (FT)
BOTTOM ASH POND	45.4	96.0



N

0 400' 800'
SCALE IN FEET

BURNS McDONNELL

date 8/20/2021

designed A. MYERS

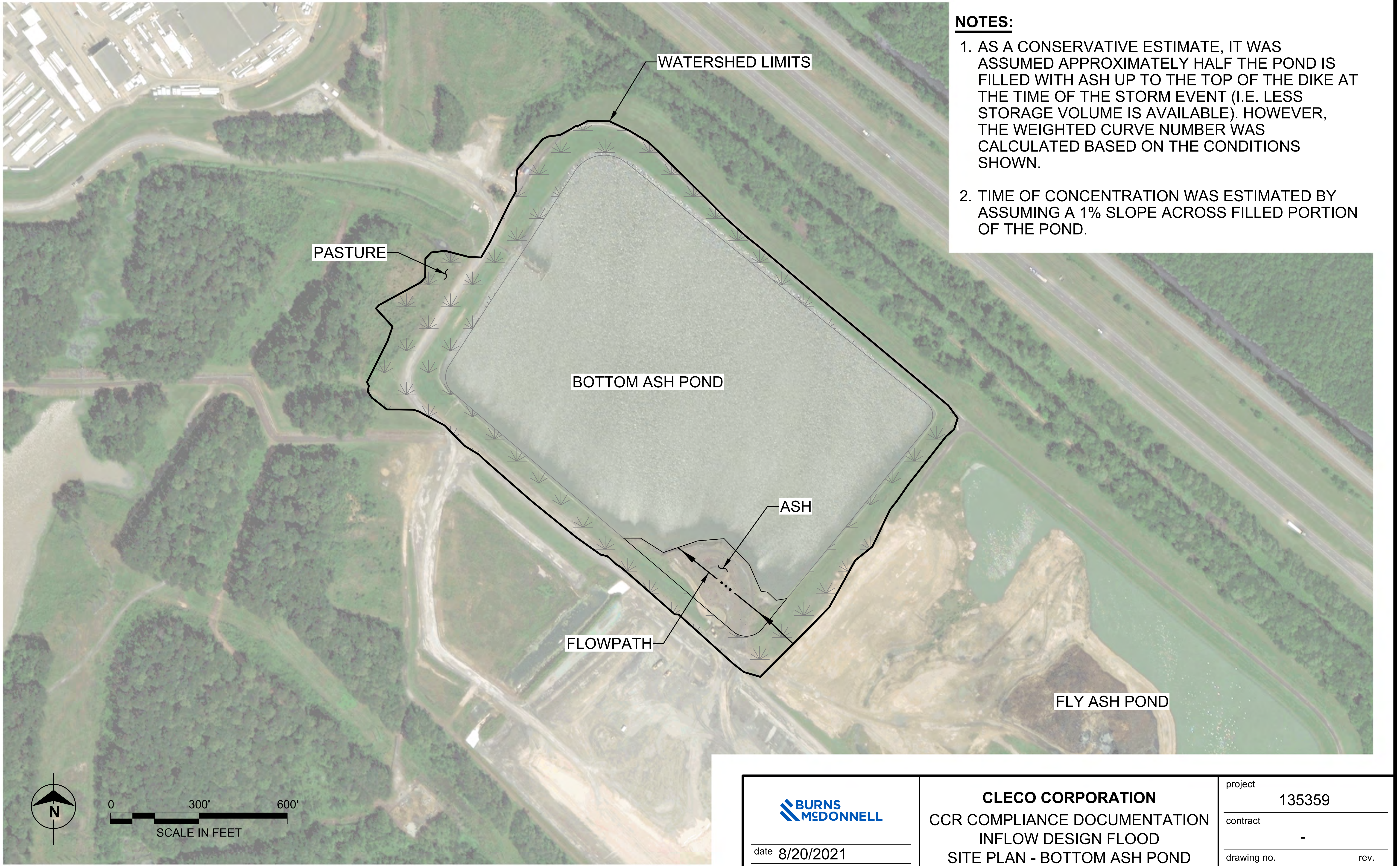
CLECO CORPORATION
CCR COMPLIANCE DOCUMENTATION
INFLOW DESIGN FLOOD
SITE PLAN - BOTTOM ASH POND

project 135359

contract -

drawing no. **SK - CIVIL - 001**

rev. **0**



NOTES:

1. AS A CONSERVATIVE ESTIMATE, IT WAS ASSUMED APPROXIMATELY HALF THE POND IS FILLED WITH ASH UP TO THE TOP OF THE DIKE AT THE TIME OF THE STORM EVENT (I.E. LESS STORAGE VOLUME IS AVAILABLE). HOWEVER, THE WEIGHTED CURVE NUMBER WAS CALCULATED BASED ON THE CONDITIONS SHOWN.
2. TIME OF CONCENTRATION WAS ESTIMATED BY ASSUMING A 1% SLOPE ACROSS FILLED PORTION OF THE POND.

BURNS McDONNELL

date 8/20/2021

designed A. MYERS

CLECO CORPORATION

CCR COMPLIANCE DOCUMENTATION
INFLOW DESIGN FLOOD
SITE PLAN - BOTTOM ASH POND

project 135359

contract -

drawing no. **SK - CIVIL - 002**

rev. **0**

APPENDIX B – ENGINEERING CALCULATIONS

BURNS McDONNELL

CLECO Corporation
Inflow Design Flood Control System Plan
Brame Bottom Ash Pond
BMcD Project Number : 135359

WORKSHEET TITLE:	Inflow Design Flood - Brame Bottom Ash Pond	**CALCULATION NO.:**	135359 - C - 002
CREATED:	8/20/2021	**REVISION:**	A
PERFORMED BY:	A. MYERS	**REVIEWED BY:**	J. Eichenberger
OBJECTIVE:	Determine capacity of pond to maintain a 1,000-year, 24-hour storm event using SCS Curve Number Method		

REFERENCES:

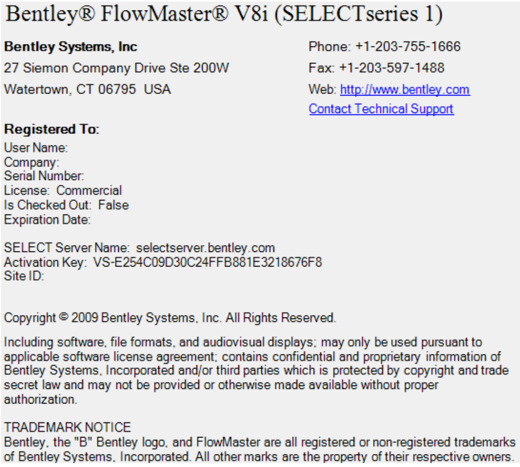
1 Lindeburg, M. (2008). Civil engineering reference manual for the PE exam. 11th ed. Belmont, CA: Professional Publications, Inc.

2 US Department of Agriculture. (no date). Custom soils resouces report for Rapides Parish, LA. Retrieved from http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx

3 National Oceanic and Atmospheric Administration. (2021). NOAA Atlas 14, Volume 9, Version 2. [Point precipitation frequency estimates for Lena, LA, Station Boyce 3 WNW (16-1232), US]. Retrieved from http://hdsc.nws.noaa.gov/hdsc/pfds/pfds_map_cont.html?bkmrk=la

SOFTWARE:

1



Bentley® FlowMaster® V8i (SELECTseries 1)

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License: Commercial
Is Checked Out: False
Expiration Date:

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Activation Key: VS-E254C09D30C24FFB881E3218676F8
Site ID:

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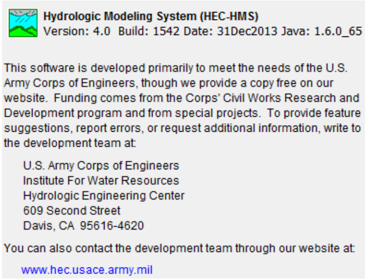

Hydrologic Modeling System (HEC-HMS)
Version: 4.0 Build: 1542 Date: 31Dec2013 Java: 1.6.0_65

This software is developed primarily to meet the needs of the U.S. Army Corps of Engineers, though we provide a copy free on our website. Funding comes from the Corps' Civil Works Research and Development program and from special projects. To provide feature suggestions, report errors, or request additional information, write to the development team at:

U.S. Army Corps of Engineers
Institute For Water Resources
Hydrologic Engineering Center
609 Second Street
Davis, CA 95616-4620

You can also contact the development team through our website at:
www.hec.usace.army.mil

ASSUMPTIONS:

1	Design storm is 1,000 years (significant hazard classification per 2016 hazard potential classification)	
2	Max intensity duration is 5 minutes	
3	Soils are generally sandy loam or loamy fine sand, Hydrologic Soil Group B	Reference 2
4	Bottom Ash Pond is 50% full of sediment up to the top of dike at the time of the storm event	
5	Ash modeled as Hydrologic Soil Group C	
6	Sluicing operations are maintained / discharge pump is inoperable over duration of storm event.	

EQUATIONS:

1	Rational Method	
	$Q = CIA_d$	Reference 1, p. 20-13, eq. 20.36
2	Sheet Flow Travel Time	
	$t_{sheet} = 0.007*(nL)^{0.8}/\sqrt{(P_2)}*S_{decimal}{}^{0.4}$	Reference 1, p. 20-3, eq. 20.6
3	Shallow Flow Travel Time	
	$t_{shallow} = L/v_{shallow}$	Reference 1, p. 20-3, section 5
4	Velocity of Shallow Flow	
	$v_{shallow} = 16.1345\sqrt{(S_{decimal})}$	Reference 1, p. 20-3, eq. 20.7, [unpaved]
5	Channel Flow Travel Time	
	$t_{channel} = L/v_{channel}$	Reference 1, p. 20-3, section 5
6	Time of Concentration	
	$t_c = t_{sheet} + t_{shallow} + t_{channel}$	Reference 1, p. 20-3, eq. 20.5
7	Lag Time	
	$t_{lag} = 0.6*t_c$	Reference 1, p.20-11, eq. 20.27
8	Soil Water Storage Capacity	
	$S = (1000/CN) -10$	Reference 1, p. 20-19, eq. 20.43
9	Initial Abstraction	
	$I_a = 0.2*S$	Reference 1, p. 20-15, eq. 20.38

10 Weighted Curve Number

$CN_W = (CN_i*A_i)/A_T$

11 Weighted Rational Runoff Coefficient

$C_W = (C_i*A_i)/A_T$

VARIABLES:

1	Q	peak runoff rate, cfs
2	C	rational runoff coefficient, unitless
3	I	rainfall intensity, in/hr
4	A_d	total drainage area, ac or mi^2
5	t_{sheet}	sheet flow travel time, min
6	n	Manning's roughness coefficient, unitless
7	L	hydraulic length of the watershed, ft
8	P_2	2yr 24hr rainfall, in
9	$S_{decimal}$	slope, ft/ft
10	$t_{shallow}$	shallow concentrated flow travel time, min
11	$v_{shallow}$	shallow velocity, ft/s
12	$t_{channel}$	channel flow travel time, min
13	$v_{channel}$	channel velocity, ft/s
14	t_c	time of concentration, min
15	t_{lag}	lag time, hrs
16	S	soil water storage capacity, in
17	CN	curve number, unitless
18	I_a	initial abstraction, in
19	CN_W	weighted curve number, unitless
20	A_T	total area, ac
21	C_W	weighted rational runoff coefficient, unitless
22	CN_{WT}	total weighted curve number, unitless
23	C_{WT}	weighted rational runoff coefficient, unitless

CALCULATIONS:

1 Establish drainage area

	Bottom Ash Pond	
A_d (ac)	45.4	Measured in Microstation, see SK-CIVIL-001 in Appendix A. Area delineated using contours generated from the LSU Atlas Lidar.
A_d (mi^2)	0.071	Conversion from ac to mi^2

2 Establish rainfall data (assume SCS Type III distribution)

SCS Storm	Depth (in)	
1000yr, 24hr	22.6	Reference 3

3 Establish CN, percent impervious cover, and initial abstraction. Assume antecedent moisture condition (AMC) II - average conditions.

	Bottom Ash Pond			
Land Description	CN_i*	A_i** (ac)	CN_W	
Open space, fair condition	69	12.7	19	Equation 10
Open space, poor condition (ash)	86	1.8	3	Equation 10
Pond	100	30.8	68	Equation 10
A_T (ac)		45.4		Sum
CN_{WT}			91	Sum
S (in)			0.99	Equation 8
I_a (in)			0.198	Equation 9

*Reference 1, Table 20.4, p. 20-17 and Assumptions 4 & 5

**Measured in Microstation, see SK-CIVIL-002 in Appendix A. Adjusted ash area based on Assumption 4.

4 Establish Time of Concentration and Basin Lag time for SCS Unit Hydrograph Transform

Subbasin	Bottom Ash Pond	
Sheet Flow		
n	0.13	Reference 1, p. 20-3, Table 20.1 - range (natural)
L (ft)	114	Measured in Microstation, see SK-CIVIL-002 in Appendix A
P_2 (in)	5.13	Reference 3, 2yr 24hr rainfall
$S_{decimal}$ (ft/ft)	0.05	Assumed 1% slope across ash
t_{sheet} (hrs)	0.09	Equation 2
t_{sheet} (min)	5.31	Conversion from hrs to min
Sheet Flow		
n	0.011	Reference 1, p. 20-3, Table 20.1 - smooth surfaces (bare soil)
L (ft)	186	Measured in Microstation, see SK-CIVIL-002 in Appendix A
P_2 (in)	5.13	Reference 3, 2yr 24hr rainfall
$S_{decimal}$ (ft/ft)	0.01	Assumed 1% slope across ash
t_{sheet} (hrs)	0.03	Equation 2
t_{sheet} (min)	2.07	Conversion from hrs to min

Shallow Flow		
$S^*_{decimal}$ (ft/ft)	0.01	Assumed 1% slope across ash
$v_{shallow}$ (ft/s)	1.00	Reference 4, Figure 15-4
L* (ft)	209	Measured in Microstation, see SK-CIVIL-002 in Appendix A
$t_{shallow}$ (s)	209.00	Equation 3
$t_{shallow}$ (min)	3.48	Conversion from s to min
Time of Concentration		
t_c (min)	8.80	Equation 6
Lag Time		
t_{lag} (min)	6.00	Equation 7

5 Run HEC-HMS with input parameters: all discharge into ponds (rainfall + sluice flow @ 2.16 MGD, 12 hr/day) is additional flow above initial elevation (EL 96.0) with sluicing operations are maintained over the duration of the storm event control period. Elevation-area data for the pond is as noted below.

EL	area* (ac)
96.0	16.653
97.0	16.818
98.0	16.983
99.0	17.149
100.0	17.315
101.0	17.482
102.0	17.650
103.0	17.818
104.0	17.987
105.0	18.157

*Measured in Microstation and adjusted based on pond being 50% full of ash

RESULTS:

Component	Subbasin		Reservoir				
Property	Peak Discharge (cfs)	Runoff Volume (in)	Initial EL*	Peak Inflow (cfs)	Peak Discharge (cfs)	Peak Elevation (ft)	Peak Storage** (ac-ft)
Bottom Ash Pond	762.6	21.45	96.0	765.9	0.0	104.3	143.9

*High operating level per CCR Annual Inspection Report

**Peak storage reflects storage above initial EL

CONCLUSION:

Under the modeled conditions, the Bottom Ash Pond can accept inflows from the design flood event and sluicing operations without overtopping.

CREATE AMAZING.

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