October 2016 Project No. 1648164

Luminant
1601 Bryan Street
Dallas, Texas 75201

**RE: HYDROLOGIC & HYDRAULIC CAPACITY REQUIREMENTS
CCR SURFACE IMPOUNDMENTS, OAK GROVE SES
ROBERTSON COUNTY, TX**

1.0 INTRODUCTION

The "Disposal of Coal Combustion Residuals (CCR) from Electric Utilities rule" (40 Code of Federal Regulations (40 CFR) Part 257), effective October 19, 2015, requires that the owner or operator of all existing non-incised CCR surface impoundments conduct a hydrologic and hydraulic (H&H) evaluation. This letter provides the H&H assessment pursuant to §257.82 for the Oak Grove Steam Electric Station's (OGSES) CCR Surface Impoundments, identified as flue gas desulphurization (FGD) Ponds FGD-A, FGD-B, and FGD-C. As low hazard structures (pursuant to §257.73), it is required that the CCR impoundment's inflow design control system be adequate to manage flow from a 24-hour, 100-year return period inflow design flood.

2.0 INFLOW DESIGN CONTROL SYSTEM

The CCR surface impoundments (FGD-A, FGD-B and FGD-C) are ring dikes with no additional watershed area except direct rainfall on the footprint of each facility. Additional stormwater is pumped to the CCR impoundments from a series of sump pumps throughout the plant site. The pumped stormwater can be operationally controlled and sent to any of the three impoundments as excess storage volume exists. While water can be pumped out of the ponds during a storm event, this analysis assumes that during a major storm event, the rate of non-stormwater inflow equals the rate of pump discharge and as such are neglected from this analysis.

The US Weather Bureau's Technical Paper No. 40 (Hershfield, 1961) specifies a depth of 10.5 inches of rainfall for the 24-hour, 100-year return period. With a total surface impoundment footprint of about 38 acres, direct rainfall accumulation of 33 acre-feet occurs over all three CCR impoundments during the 100-year event. With a plant area of about 41 acres over mostly impervious surface, rainfall runoff of 35 acre-feet occurs from the plant to a series of sump pumps for subsequent pumping to the CCR impoundments. Between direct rainfall and pumping, a total of 68 acre-feet (33 + 35) of volume is sent to the three CCR surface impoundments.

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Luminant operates all three surface impoundments with an operational freeboard of 2 feet. With a total footprint area of about 38 acres, the three CCR impoundments have a total surcharge volume of 75 acre-feet to be used in the event of a major storm. During the course of the 24-hour, 100-year rainfall event, the surcharge volume is used for storm storage with 7 acre-feet (75-68) of free storage remaining at its conclusion.

3.0 CONCLUSION

Based on the conditions described above, each of the three CCR surface impoundments meet the hydraulic criteria specified in §257.82. The details of this analysis per CCR impoundment are attached to this letter.

Golder appreciates the opportunity to assist Luminant with this project. If you have any questions, or require further assistance from Golder, please contact the undersigned at (281) 821-6868.

Sincerely,

GOLDER ASSOCIATES INC.

Michael Chilson, PE (GA)
Senior Civil Engineer

Jeffrey B. Fassett, PE
Senior Consultant and Associate

MTC/JBF/kc

Attachments:

Figure 1 – Site Layout
Attachment 1 - Hydrologic Evaluation

Reference

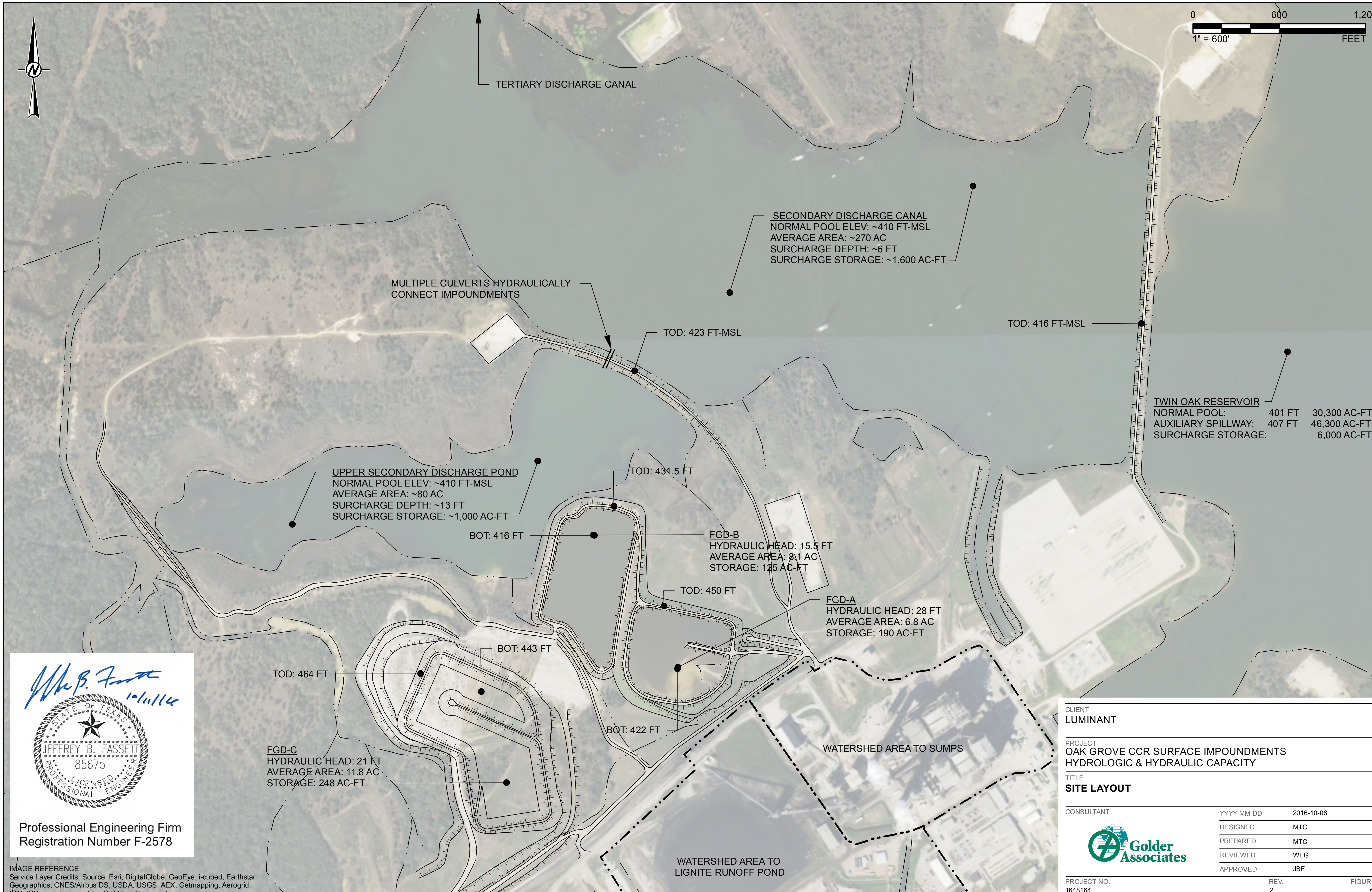
Hershfield, David M., (1961) Rainfall Frequency Atlas of the United States for Durations from 30 Minutes to 24 Hours and Return Period from 1 to 100 Years, Cooperative Studies Section, Hydrologic Services Division, US Weather Bureau Technical Paper No. 40 (TP-40).

4.0 CERTIFICATION

I hereby certify that this report has been prepared in general accordance with normally accepted civil engineering practices and in accordance with the requirements of 40 CFR 257.82.

Jeffrey B. Fassett, PE
Golder Associates Inc.
Firm Registration Number F-2578

FIGURE 1
SITE LAYOUT



10/11/16

STATE OF TEXAS
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IMAGE REFERENCE
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CLIENT
LUMINANT

PROJECT
OAK GROVE CCR SURFACE IMPOUNDMENTS
HYDROLOGIC & HYDRAULIC CAPACITY

TITLE
SITE LAYOUT

CONSULTANT
Golder Associates

YYYY-MM-DD	2016-10-06
DESIGNED	MTC
PREPARED	MTC
REVIEWED	WEG
APPROVED	JBF

PROJECT NO.	REV.	FIGURE
1648164	2	1

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

ATTACHMENT 1
HYDROLOGIC EVALUATION

CALCULATIONS

Subject:	**HYDROLOGIC EVALUATION**		
Date:	September 29 2016	**Made By:**	MTC
Project No.:	1648164	**Checked By:**	LDH
Project Short Title:	Luminant/OG CCR Unit Assessments/TX	**Reviewed By:**	JBF

100-Year Rainfall Depth (P) = 10.5 inches

PLANT HYDROLOGY

Plant Watershed Area (WSA) =	41	acres
Runoff Curve Number (CN) =	98	
Potential Watershed Retention (S) =	0.20	inches
Runoff Depth (Q) =	10.3	inches
Runoff Volume (RV) =	35.1	acre-feet

$$S = \frac{1000}{CN} - 10$$

$$Q = \frac{(P - 0.2S)^2}{(P + 0.8S)}$$

$$RV = \frac{A \cdot Q}{12}$$

FGD CAPACITY

	FGD-A	FGD-B	FGD-C	TOTAL	
Area (ResA) =	9.4	11.3	17.0	37.7	acres
Freeboard (FB) =	2	2	2	2	feet
Surcharge Volume (SurchargeV) =	18.8	22.6	34.0	75.4	acre-feet
Direct Rainfall Volume (DirectV) =	8.2	9.9	14.9	33.0	acre-feet
Sump Inflow from Plant (SumpV) =	8.7	10.5	15.8	35.1	acre-feet
Total Storm Inflow (StormV) =	17.0	20.4	30.7	68.0	acre-feet
Excess Storage (ExV) =	1.8	2.2	3.3	7.4	acre-feet

DirectV = ResA · P / 12	Rainfall volume falling directly on the pond
SumpV = fraction of RV	Fraction of Plant Runoff Volume (RV) being pumped to a particular pond
StormV = DirectV + SumpV	Total rainfall volume entering a pond from both direct rainfall and pump inflow
ExV = SurchargeV - StormV	Remaining pond volume after all sumps are fully depleted

OTHER INFLOWS and ASSUMPTIONS

• This analysis assumes non-stormwater inflows do not exceed the capacity of the discharge pumps.

• It further assumes that the discharge pumps, during the storm event, are used to keep up with non-stormwater inflows and do not contribute to excess storage.

• After a storm passes, the stored storm surcharge would be evacuated through the discharge pump system for operational uses. No other discharge devise was assumed in this analysis.

• This analysis assumes stormwater runoff from the coal pile and landfill would be stored in the Lignite Runoff Pond and at the landfill until adequate space exists within the FGD ponds.

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