Inflow Design Flood Control System Plan, Revision 1

Drains Pond System CCR Surface Impoundment, Coal Creek Station

Submitted to:

Great River Energy

Coal Creek Station, 2875 Third Street SW, Underwood, North Dakota

Submitted by:

Golder Associates Inc.

7245 W Alaska Drive, Suite 200, Lakewood, Colorado, USA 80226

+1 303 980-0540

21451024-8-R-0

October 13, 2021

Table of Contents

1.0 INTRODUCTION **1**

1.1 Site Background 1

2.0 REQUIREMENTS FOR HYDROLOGIC AND HYDRAULIC CAPACITY SYSTEMS **1**

3.0 INFLOW DESIGN FLOOD CONTROL SYSTEM **2**

3.1 Flood Control Calculation 2

4.0 REVISION HISTORY **2**

5.0 CERTIFICATION **3**

6.0 REFERENCES **4**

APPENDICES

APPENDIX A
Inflow Flood Control Calculation

1.0 INTRODUCTION

Golder Associates Inc. (Golder), a member of WSP, has prepared this inflow design flood control system plan for the Drains Pond System CCR Surface Impoundment (Drains Pond System) at Great River Energy's (GRE's) Coal Creek Station (CCS). The United States Environmental Protection Agency's (USEPA's) Coal Combustion Residuals (CCR) Rule, 40 Code of Federal Regulations (CFR) Part 257 (USEPA 2015) requires an inflow design flood control plan be completed as specified in 40 CFR 257.82(c)(3)(i). Per 40 CFR 257.82(c)(4), inflow design flood control plans must be revisited every five years. This document serves as the current version of the inflow design flood control system plan.

The Drains Pond System is also regulated by the North Dakota Department of Environmental Quality (NDDEQ) under Permit 0033. The NDDEQ requires an inflow design flood control system plan as part of the application for a permit, as described in Section 33.1-20-08-05.3.c.3.a. of the North Dakota Administrative Code (NDAC 2020). This inflow design flood control system plan satisfies the state-specific requirement.

1.1 Site Background

The east cell of the Drains Pond System was closed by removal of CCR in the winter of 2019/2020 by removing sediment containing CCR material above the composite liner and protective cover system. A Notification of Closure (Golder 2020) of the east cell of the Drains Pond System was submitted in March 2020. After closure, the east cell was returned to operation as a non-CCR surface impoundment for the management of site process water. The east cell is not used to treat, store, or dispose of CCR.

Although the east cell of the Drains Pond System is no longer a CCR Surface Impoundment, the operation of this cell is critical to the overall operation of the Drains Pond System and is part of the inflow flood control system plan.

2.0 REQUIREMENTS FOR HYDROLOGIC AND HYDRAULIC CAPACITY SYSTEMS

In accordance with 40 CFR 257.82(a)(1) and NDAC Section 33.1-20-08-05.3.a.1., "the inflow design flood control system must adequately manage flow into the CCR unit during and following the peak discharge from the inflow design flood." Further, per 40 CFR 257.82(a)(2) and NDAC Section 33.1-20-08-05.3.a.2., "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." The requirements for appropriate inflow design floods are as follows:

- For a high hazard potential CCR surface impoundment, the probable maximum flood.
- For a significant hazard potential CCR surface impoundment, the 1,000-year flood.
- For a low hazard potential CCR surface impoundment, the 100-year flood.
- For an incised CCR surface impoundment, the 25-year flood.

The Drains Pond System is classified as a low hazard potential CCR surface impoundment, and the inflow design flood control system plan is based on the 24-hour, 100-year storm event. The 24-hour, 100-year storm event is approximately 4.82 inches for the site (NOAA 2016). However, this inflow design flood control system plan uses the more conservative 4.95 inches that was used in the 2016 (Revision 0) version of this report. The inflow design flood control system designed for and operated at the Drains Pond System is described below.

3.0 INFLOW DESIGN FLOOD CONTROL SYSTEM

The lined footprint of the Drains Pond System is approximately 17.5 acres. The west cell is used for bottom ash handling and dewatering. Water from the west cell decants through buried pipelines to the center cell, which is hydraulically connected to the east cell through three buried 24-inch pipelines. Piping from the east cell is routed to dedicated pumps that allow water levels within the Drains Pond System to be controlled via pumping water to the evaporation ponds, to the underground injection well, or back to the plant for reuse. The Drains Pond System manages flow into the impoundment by maintaining adequate freeboard within the impoundment. There are no spillways or other overflow structures associated with the Drains Pond System.

During a storm event, the Drains Pond System collects and contains stormwater from its own footprint, run-off from plant areas that are directed to the system, and run-off from the Upstream Raise 91 CCR Surface Impoundment (Upstream Raise 91) via a series of gravity drainage pipes, perimeter drainage ditches, and culverts that passively transfer CCR conveyance water.

3.1 Flood Control Calculation

Calculations supporting the inflow design flood control plan for the Drains Pond System are included in Appendix A. Golder delineated subbasins for the areas with stormwater run-off reporting to the Drains Pond System, including areas from the plant, Upstream Raise 91, and the Drains Pond System. Run-off volumes were estimated using curve number methodology described in Technical Release 55 (U.S. Soil Conservation Service 1986). Accumulated run-off volumes were then used to estimate the water level rise within the center and east cells of the Drains Pond System, to check that the system can contain the run-off volume within the desired pond elevation range without overtopping embankments (the elevation cannot increase substantially within the west cell of the Drains Pond System since the west cell passively drains to the center cell). Curve numbers and contributing areas assumed for the analysis were conservatively estimated based on information from GRE and guidance outlined in Technical Release 55.

The calculations included in Appendix A estimate that approximately 50 acre-feet of run-off is expected to collect within the Drains Pond System during the 24-hour, 100-year storm event. Assuming the center and east cells are at the design operating level (elevation 1916 feet), the storm event run-off will raise the water level approximately 4 feet (elevation 1920 feet), leaving approximately 2 feet of remaining freeboard to the top of the berms (elevation 1922 feet).

During or following the storm event, water can be pumped from the Drains Pond System to the evaporation ponds, the underground injection well, or back to the plant for reuse to lower the water level in the Drains Pond System back to the design operating level (elevation 1916 feet).

4.0 REVISION HISTORY

A history of revisions to this document:

Revision 0 – Published October 13, 2016.

Revision 1 – 5-Year Update: Published October 13, 2021

5.0 CERTIFICATION

The undersigned attest to the completeness and accuracy of this inflow design flood control plan, and certify that the plan meets the requirements of 40 CFR 257.82(c) and Section 33.1-20-08-05.3.c. of the North Dakota Administrative Code.

Signature Page

Golder Associates Inc.

Craig Schuettpelz, PE
Senior Engineer

Todd Stong, PE
Associate and Senior Consultant

CS/TS/mb

Golder and the G logo are trademarks of Golder Associates Corporation

https://golderassociates.sharepoint.com/sites/140044/project files/6 deliverables/21451024/reports/8-r-dps_inflow_rev1/8-r-0/21451024-8-r-0-dps_inflow_rev1_13oct21.docx

6.0 REFERENCES

Golder. 2020. Notification of Closure – Drains Pond System East Cell – Coal Creek Station, Underwood, North Dakota. March.

NOAA (National Oceanic and Atmospheric Administration). 2016. Hydrometeorological Design Studies Center Precipitation Frequency Data Server (PFDS). Retrieved April 30, 2021, from https://hdsc.nws.noaa.gov/hdsc/pfds/.

NDAC (North Dakota Administrative Code). 2020. Chapter 33.1-20-08 – Disposal of Coal Combustion Residuals in Landfills and Surface Impoundments.

USEPA (United States Environmental Protection Agency). 2015. Code of Federal Regulations Title 40 Part 257: Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals from Electric Utilities. April 17.

U.S. Soil Conservation Service. 1986. Technical Release 55 – Urban hydrology for small watersheds. Washington D.C.: United States Department of Agriculture. June.

APPENDIX A

Inflow Flood Control Calculation

1.0 OBJECTIVE

Compare the estimated run-off volume resulting from the 100-year 24-hour design storm event to the capacity of the Drains Pond System to check that the system can contain the runoff volume.

2.0 METHOD

Golder delineated subbasins for the areas reporting to the Drains Pond System at GRE's Coal Creek Station, including areas from the plant, Ash Pond 91 Raise, and the Drains Pond System. The Drains Pond System consists of three cells (west, center, and east). Runoff volumes were estimated using curve number methodology described in TR-55 (U. S. Soil Conservation Service, 1986) to check that the system can contain the runoff volume within the desired pond elevation range. Curve numbers and contributing areas assumed for the analysis were conservatively estimated based on information from GRE and guidance outlined in TR-55.

3.0 ASSUMPTIONS

- Design storm event is the 24-hour, 100-year storm depth of 4.95 inches.
- SCS curve number were assumed as:
  - 94 for hardened fly ash
  - 89 for gravel areas around the plant
  - 74 for grassed, open space areas
  - 98 for roof and pond areas
- Contributing areas were assumed to include the majority of the plant area, the Drains Pond System cells, and Phase A of Ash Pond 91 (Phase A represents the maximum contributing area prior to placement of final cover and considers runoff from the 15% and 20% slopes around the landfill reporting to a perimeter ditch at the toe). Phase A areas assume that rainfall on the cap of the Ash Pond 91 the landfill is contained within a working pool.
- The Drains Pond System water elevation is maintained at elevation 1916 prior to the storm event.
- The maximum desired water elevation is 1920 feet, which is the top of the composite liner in the center and east cells of the Drains Pond System and allows for two feet of freeboard from the top of the berms.

4.0 CALCULATIONS

Table 1 shows the estimated runoff volume resulting from the design storm event. Table 2 shows the stage-storage capacity relationship of the Drains Pond System and a comparison of the capacity and the expected runoff volume from the design storm event.

Ash Pond 91/ Ash Pond 91 Raise is now
referred to as Upstream Raise 91 (10/13/2021)

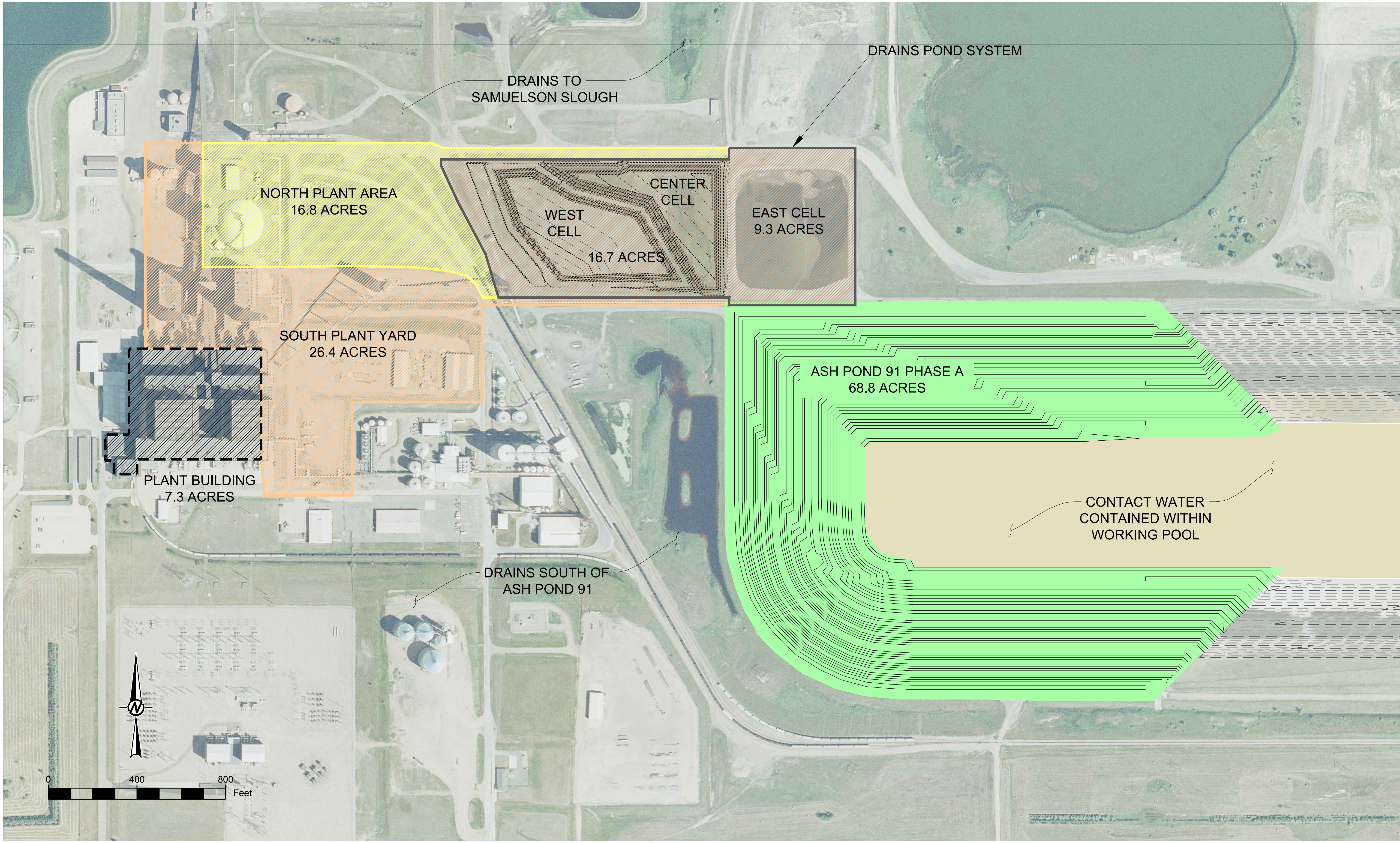
5.0 RESULTS/CONCLUSIONS

Table 1 shows that approximately 49.6 acre-feet of water is expected to runoff into the Drains Pond System during the design storm event. Table 2 shows the capacity of the Drains Pond System above elevation 1916 feet (design operating level). Combining the expected run-off with the Drains Pond System capacity indicates that the design storm event will raise the water level approximately 4 feet (elevation 1920 feet), leaving approximately 2 feet of remaining freeboard to the top of the berms at El. 1922 feet. During or following the storm event, water can be pumped from the Drains Pond System to the evaporation ponds, the underground injection well, or back to the plant for reuse to lower the water level in the Drains Pond system back to the design operating level (elevation 1916 feet).

6.0 REFERENCES

U. S. Soil Conservation Service. (1986). *Urban hydrology for small watersheds.* Washington D. C.: United States Department of Agriculture.

FIGURES



Golder Associates

DRAINS POND SYSTEM
INFLOW FLOOD CONTROL CALCULATION

FIGURE 1

TABLES

TABLE 1

GRE CCS
Drains Pond Sytem Runoff Volume Calculations
PROJECT NO.: 1649586

Date:	9/29/16
By:	KAC
Chkd:	TJS
Apprvd:	CCS

Design Storm 100 -Year Reccurence Interval

Storm Duration (hours)	2-Year Depth (inches)	100 -Year Depth (inches)	Storm Distribution
24	1.9	4.95	II

				CN = 94	CN = 89	CN = 98	CN = 74	CN = 98				
Subbasin ID	Subbasin Area (ft^2)	Subbasin Area (acres)	Subbasin Area (sq mile)	Fly Ash (newly graded areas, no vegetation) (acres)	Gravel, HSG C (acres)	Roof (acres)	Grass Open Space, Good, HSG C (acres)	Pond Area (acres)	Composite SCS Curve No.	$S = \frac{1000}{CN} - 10$	Unit Runoff Q (in)	Runoff Volume (ac-ft)
Ash Pond 91 Raise	2,996,893	68.8	0.107	68.8					CN = 94	0.64	4.26	24.4
West and Center Cells	726,581	16.7	0.026		7.0			9.7	CN = 94	0.64	4.26	5.9
East Cell	404,796	9.3	0.015		2.0			7.3	CN = 96	0.42	4.48	3.5
North Plant Yard	732,646	16.8	0.026		5.5	1.9	9.5		CN = 82	2.20	3.03	4.3
South Plant Yard	1,150,168	26.4	0.041		19.8	6.6			CN = 91	0.99	3.93	8.7
Plant Building	317,309	7.3	0.011			7.3			CN = 98	0.20	4.71	2.9
Total:	6,328,393	145.3	0.227									49.6

TABLE 2

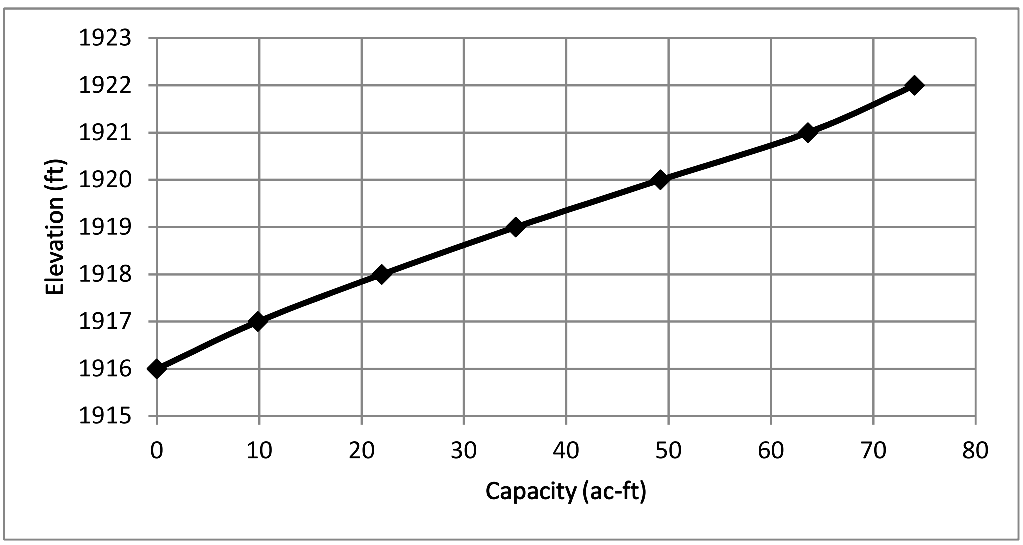
GRE CCS
Drains Pond System Pond Capacities
PROJECT NO.: 1649586

Date:	9/29/16
By:	KAC
Chkd:	TJS
Apprvd:	CCS

Combined Drains Pond System Capacity
Includes the east and center cells of the Drains Pond System, and ponding within the perimeter channel of the Ash Pond 91 Raise.

Elevation (ft)	Incremental Capacity (ac-ft)	Capacity (ac-ft)
1916	0.0	0
1917	9.9	9.9
1918	12.1	22.0
1919	13.1	35.1
1920	14.1	49.2
1921	14.4	63.6
1922	10.4	74.0
Total	74.0	

Runoff (ac-ft)	49.6
Elevation (ft)	**1920.0**
Reserve Capacity (ac-ft)	24.5



GOLDER
MEMBER OF WSP

golder.com