PERIODIC INFLOW DESIGN FLOOD CONTROL SYSTEM PLAN
PLANT GASTON GYPSUM POND
ALABAMA POWER COMPANY

EPA's "Disposal of Coal Combustion Residuals from Electric Utilities Final Rule (40 C.F.R. Part 257 and Part 261) and the State of Alabama's ADEM Admin. Code Chapter 335-13-15 establish certain hydrologic and hydraulic capacity requirements for CCR surface impoundments. Per §257.82 and ADEM Admin. Code r. 335-13-15-.05(3), the owner or operator of an existing or new CCR surface impoundment or any lateral expansion of a CCR surface impoundment is required 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 must prepare a written plan documenting how the inflow flood control system has been designed and constructed to meet the requirements of the referenced sections of the rules. In addition, §257.82(f)(4) and ADEM Admin. Code r. 335-13-15-.05(3)(c)4. require a revision to the inflow design flood control system plan be prepared every 5 years.

The existing CCR surface impoundment referred to as the Plant Gaston Gypsum Pond is located at Alabama Power Company's Plant Gaston. The facility consists of a CCR storage area (Cell 1) and a sedimentation pond. The inflow design flood consists of the rainfall that falls within the limits of the surface impoundment and a nominal amount (relative to the rainfall) of process flows. Stormwater is temporarily stored within the limits of the surface impoundment and discharged through a stop log riser system connected to a 36-inch discharge pipe that routes discharges to the sedimentation pond.

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 group "D" should be used to best reflect the characteristics of the soils on site. This information was placed into Storm and Sanitary Sewer Analysis 2019 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 without overtopping the perimeter embankments.

The facility is operated subject to and in accordance with §257.3-3 and ADEM Admin. Code r. 335-13-4-.01(2)(a) and (b).

I hereby certify that the inflow design flood control system plan meets the requirements of 40 C.F.R. §257.82 and ADEM Admin. Code r. 335-13-15-.05(3).

10/15/2021

James C. Pegues, P.E.
Licensed State of Alabama, PE No. 16516

Inflow Design Control System Plan:
Hydrologic and Hydraulic Calculation Summary

for

Plant Gaston Gypsum Pond

Prepared by:

Southern Company Services
T&PS Environmental Solutions

Originator: 9/30/21
Curtis R. Upchurch Date

Reviewer: 10-7-21
Clay M. Campbell Date

Approval: 10/8/21
James C. Pegues Date

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) and the State of Alabama's ADEM Admin. Code 335-13-15, Rule (335-13-15-.05(3)).

2.0 Summary of Conclusions

A hydrologic and hydraulic model was developed for the Plant Gaston Gypsum Pond to determine the hydraulic capacity of the impoundment. The design storm for the Plant Gaston Gypsum 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 Gaston Gypsum Pond

Plant Gaston Area	Normal Pool El (ft)	Top of embankment El (ft)	Auxiliary Spillway Crest El (ft)	Peak Water Surface Elevation (ft)	Freeboard[1] (ft)	Peak Inflow (cfs)	Peak Outflow (cfs)
Gypsum Pond (cell)	414 to 416[2]	Varies – low point @ 419.7	N/A	418.5	1.2	440.1	32.6

[1]Freeboard is measured from the top of embankment to the peak water surface elevation
[2]Assumed the higher normal pool elevation of 416.0 in calculations for conservative approach.

3.0 Methodology

3.1 HYDROLOGIC ANALYSES

Plant Gaston Gypsum Pond is classified as a significant hazard structure. The design storm for a significant hazard structure is the 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 Gaston Gypsum Pond Storm Distribution

Hazard Classification	Return Frequency (years)	Storm Duration (hours)	Rainfall Total (Inches)	Rainfall Source	Storm Distribution
Significant	1000	24	13.9	NOAA Atlas 14	SCS Type III

The drainage area for Plant Gaston Gypsum Pond was delineated based on a topographic survey performed December 9, 2020. Run-off 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. Time of Concentration 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 Gypsum Pond and Sedimentation Pond is provided below in Tables 3(a) and 3(b).

Table 3(a) Plant Gaston Gypsum Pond Hydrologic Information

Drainage Basin Area (acres)	42.7
Hydrologic Curve Number, CN	88
Hydrologic Methodology	SCS Method
Time of Concentration (minutes)	12.0
Hydrologic Software	Storm and Sanitary Sewer Analysis, 2019 Autodesk, Inc.

Table 3(b) Plant Gaston Gypsum Pond - Sediment Pond Hydrologic Information

Drainage Basin Area (acres)	11.2
Hydrologic Curve Number, CN	97
Hydrologic Methodology	SCS Method
Time of Concentration (minutes)	5.0
Hydrologic Software	Storm and Sanitary Sewer Analysis, 2019 Autodesk, Inc.

Run-off values were determined by importing the characteristics developed above into a hydrologic model in Storm and Sanitary Analysis (SSA) by AutoCad Civil 3D, 2019.

Process flows from Plant Gaston were considered in this analysis. Based on normal plant operations, the gypsum pond receives 1.30 MGD (2.0 cfs) of flow from the Plant (gypsum slurry). The adjacent landfill sump which contributed 2.0 MGD (3.2 cfs) of flow to the Sediment Pond in the previous 2016 analysis is no longer active and has been omitted from the calculations.

3.2 HYDRAULIC ANALYSIS

Storage values for the Gypsum Pond were determined by developing a stage-storage relationship utilizing contour data for the Gypsum Pond and Sediment Pond. An arrangement of the site is shown in the attached drainage map in Section 4.5. Gypsum slurry is sluiced into the gypsum pond at the northwest corner into dewatering basins allowing for the settlement of gypsum. Flow from the dewatering basins along with run-off from the gypsum pond area during a storm event, flows to the stop log riser located at the east side near the midpoint of the pond. After passing over the stop log weir in the riser it flows thru a 36-inch diameter HDPE pipe to the east into a lined canal which runs to south leading to the sediment pond. The Sediment Pond does have an auxiliary discharge spillway at the west dike for an extreme storm event, but water levels are managed in the pond to prevent release as the site is a zero-discharge system. The outfall from the auxiliary spillway is to a channel which runs south and discharges into the Coosa River.

A summary of spillway information is presented below in Table 4.

Table 4(a)— Plant Gaston Gypsum Pond Spillway Attribute Table

Spillway Component	US Invert El (feet)	DS Invert El (feet)	Dimension	Slope (ft/ft)	Length (ft)
Principal Spillway Stop log riser 6 foot square	413.0	409.8	Weir L = 3.0 ft., Weir EL 432.0 Outlet pipe = 36" diameter, HDPE	0.0050	207

Table 4(b)— Plant Gaston Gypsum Pond - Sediment Pond Spillway Attribute Table

Spillway Component	US Invert El (feet)	DS Invert El (feet)	Dimension	Slope (ft/ft)	Length (ft)
Principal Spillway	414.5	414.11	Weir L = 3.0 ft., Weir EL 432.0 Outlet pipe = 36" diameter, HDPE	0.0200	19.4

Based on the spillway attributes listed above, rating curves were developed using Storm and Sanitary Analysis to determine the pond performance during the design storm. Results are shown in Table 1.

4.0 SUPPORTING INFORMATION

4.1 CURVE NUMBERS

4.1.1 GYPSUM POND

```
------------------
Subbasin Cell 1
------------------
                                                          Area          Soil
Soil/Surface Description                                (acres)        Group            CN
------------------------------------------------------------------------------------------
Gypsum                                                    35.91            -         86.00
Water in Cell                                              4.70            -         98.00
Aggregate Roads                                            2.10            -         91.00
Composite Area & Weighted CN                              42.71                      87.57
```

4.1.2 SEDIMENT POND

Subbasin Sediment Pond Basin

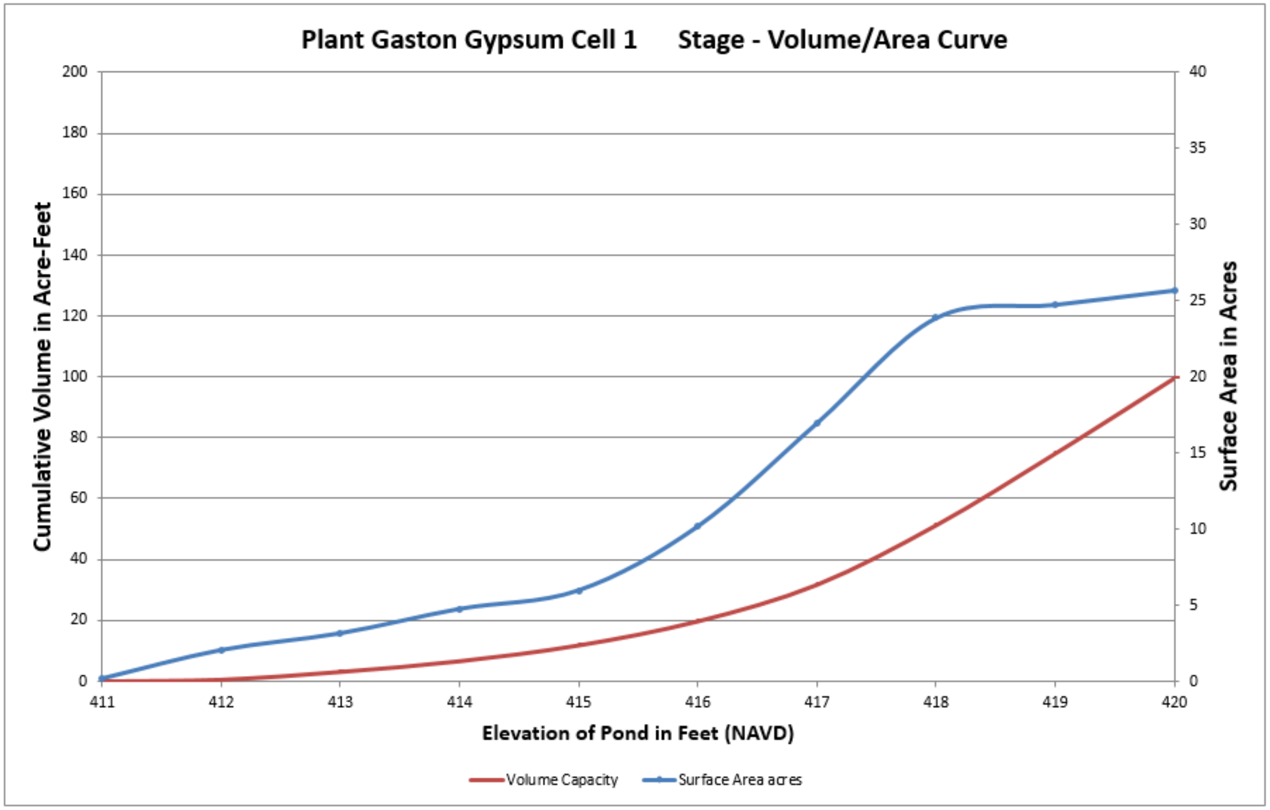
Soil/Surface Description	Area (acres)	Soil Group	CN
Water & Liner Surface	10.27	-	98.00
Aggregate Road	0.92	D	91.00
Composite Area & Weighted CN	11.19		97.42

4.2 STAGE-STORAGE TABLES & CURVES

4.2.1 GYPSUM POND:

Gaston Gypsum Cell 1 Stage/Storage

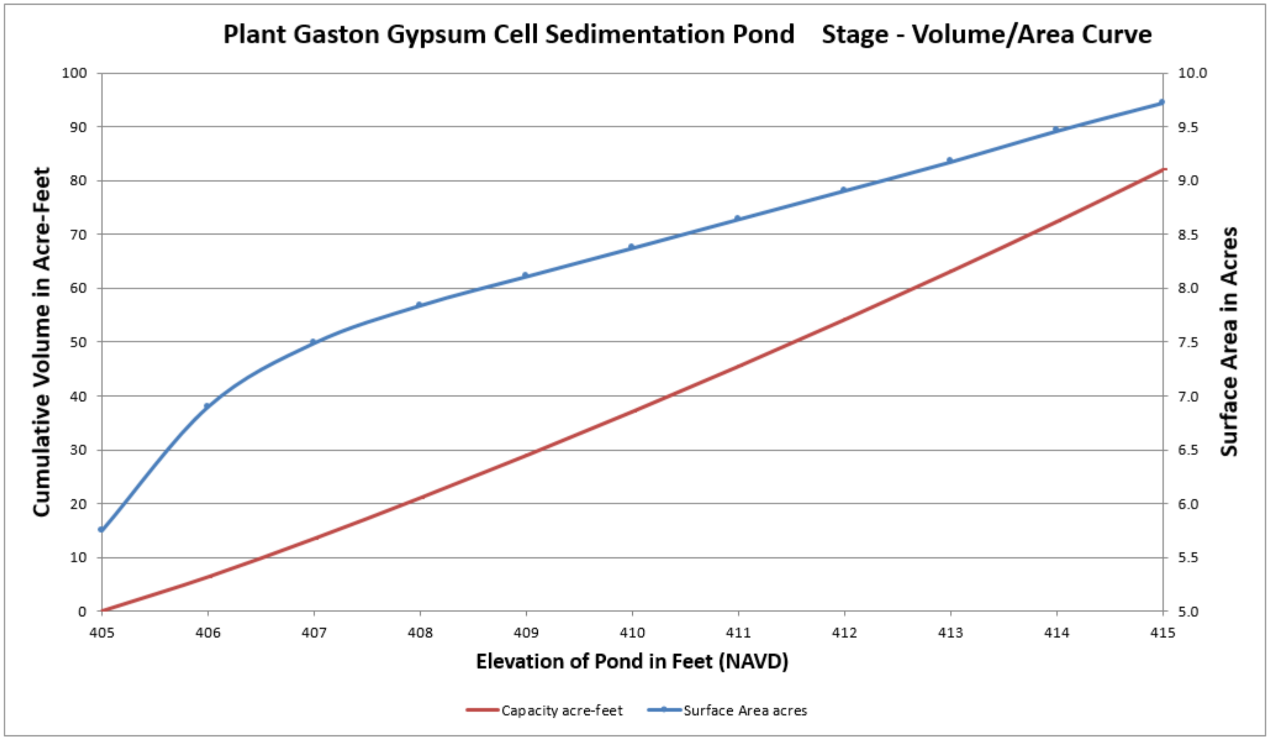
Contour Elevation	Surface Area acres	Volume Capacity acre-feet
411	0.16	0.00
412	2.04	0.52
413	3.14	3.07
414	4.75	6.59
415	5.97	11.79
416	10.18	19.69
417	16.97	31.71
418	23.88	51.25
419	24.75	74.83
420	25.69	99.61



4.2.2 SEDIMENT POND

Gaston Gypsum Cell 1 Pond Stage/Storage

Contour Elevation	Surface Area acres	Volume Capacity acre-feet
405	5.75	0.00
406	6.90	6.33
407	7.49	13.44
408	7.84	21.01
409	8.11	28.89
410	8.37	37.04
411	8.64	45.45
412	8.91	54.14
413	9.18	63.10
414	9.46	72.34
415	9.72	81.96



4.3 TIME OF CONCENTRATION

FORMULAS FOR SHEET FLOW, SHALLOW CONCENTRATED FLOW, CHANNEL FLOW, AND FLOW THRU WATER:

SCS TR-55 Time of Concentration Computations Report	
==	
Sheet Flow Equation	Channel Flow Equation
-------------------	---------------------
Tc = (0.007 * ((n * Lf)^0.8)) / ((P^0.5) * (Sf^0.4))	V = (1.49 * (R^(2/3)) * (Sf^0.5)) / n
	R = Aq / Wp
Where:	Tc = (Lf / V) / (3600 sec/hr)
Tc = Time of Concentration (hrs)	
n = Manning's Roughness	Where:
Lf = Flow Length (ft)	Tc = Time of Concentration (hrs)
P = 2 yr, 24 hr Rainfall (inches)	Lf = Flow Length (ft)
Sf = Slope (ft/ft)	R = Hydraulic Radius (ft)
	Aq = Flow Area (ft^2)
Shallow Concentrated Flow Equation	Wp = Wetted Perimeter (ft)
----------------------------------	V = Velocity (ft/sec)
V = 16.1345 * (Sf^0.5) (unpaved surface)	Sf = Slope (ft/ft)
V = 20.3282 * (Sf^0.5) (paved surface)	n = Manning's Roughness
V = 15.0 * (Sf^0.5) (grassed waterway surface)	
V = 10.0 * (Sf^0.5) (nearly bare & untilled surface)	Water Travel Velocity Equation
V = 9.0 * (Sf^0.5) (cultivated straight rows surface)	---------------------
V = 7.0 * (Sf^0.5) (short grass pasture surface)	V = (g*D)^0.5
V = 5.0 * (Sf^0.5) (woodland surface)	Tc = ((Lf / V) /60sec/min)
V = 2.5 * (Sf^0.5) (forest w/heavy litter surface)	
Tc = (Lf / V) / (3600 sec/hr)	Where:
	Tc = Time of Concentration (hrs)
Where:	D = Mean Depth (ft)
Tc = Time of Concentration (hrs)	g = Gravitational Constant (32.2 ft/sec)
Lf = Flow Length (ft)	Lf = Flow Length (ft)
V = Velocity (ft/sec)	R = Hydraulic Radius (ft)
Sf = Slope (ft/ft)	V = Velocity (ft/sec)

4.3.1 GYPSUM CELL 1

```
------------------
Subbasin Cell 1
------------------

Sheet Flow Computations
-----------------------
                                          Subarea A       Subarea B       Subarea C
        Manning's Roughness:                   0.01            0.00            0.00
        Flow Length (ft):                     98.00            0.00            0.00
        Slope (%):                             1.30            0.00            0.00
        2 yr, 24 hr Rainfall (in):             4.11            4.11            4.11
        Velocity (ft/sec):                     1.31            0.00            0.00
        Computed Flow Time (minutes):          1.25            0.00            0.00

Shallow Concentrated Flow Computations
--------------------------------------
                                          Subarea A       Subarea B       Subarea C
        Flow Length (ft):                     61.00            0.00            0.00
        Slope (%):                             1.00            0.00            0.00
        Surface Type:                         Paved         Unpaved         Unpaved
        Velocity (ft/sec):                     2.03            0.00            0.00
        Computed Flow Time (minutes):          0.50            0.00            0.00

Channel Flow Computations
-------------------------
                                          Subarea A       Subarea B       Subarea C
        Manning's Roughness:                   0.02            0.02            0.02
        Flow Length (ft):                    582.00         1226.00         1068.00
        Channel Slope (%):                     1.00            0.24            0.38
        Cross Section Area (ft²):             20.34           28.12           27.61
        Wetted Perimeter (ft):                32.91           25.59           21.11
        Velocity (ft/sec):                     5.41            3.89            5.49
        Computed Flow Time (minutes):          1.79            5.26            3.24
===================================================================================
        Total TOC (minutes):                  12.04
===================================================================================
```

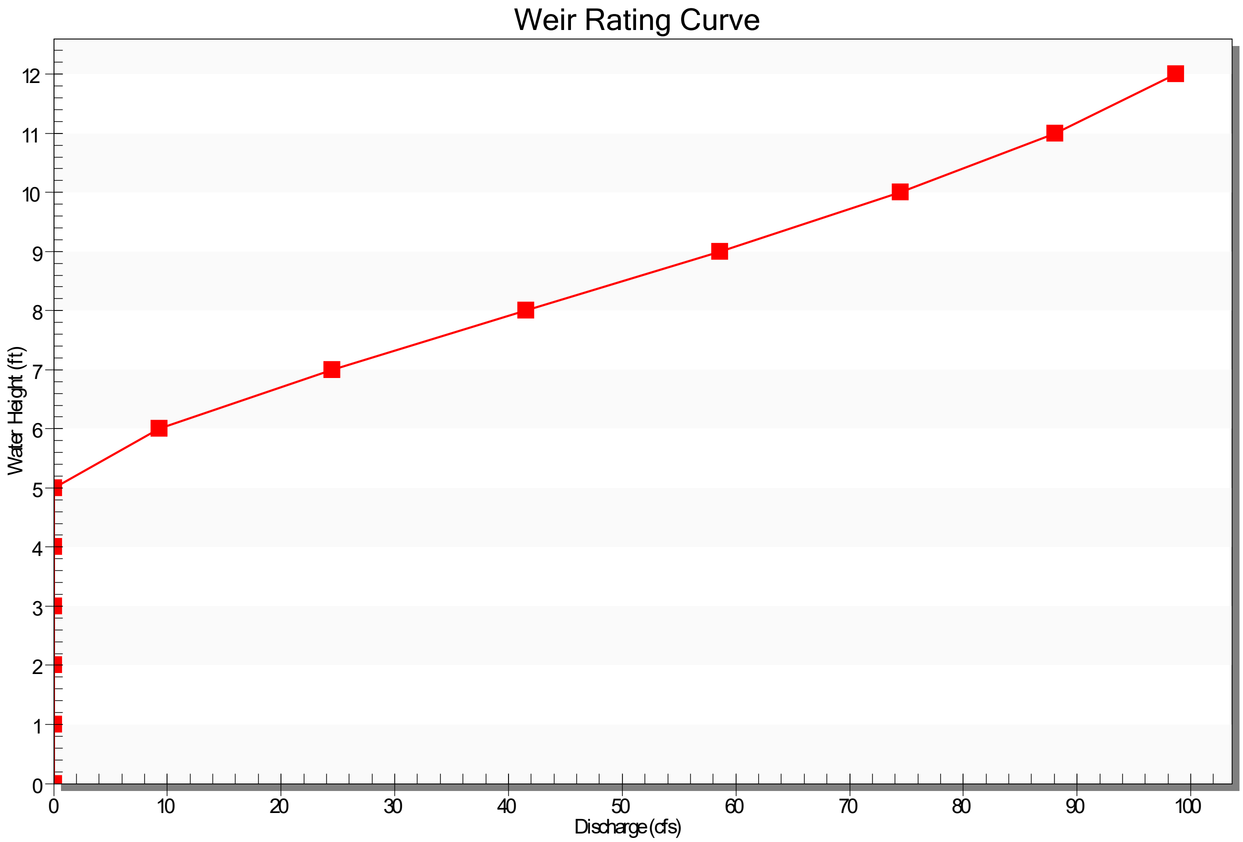
4.3.2 SEDIMENTATION POND

```
--------------------------------
Subbasin Sediment Pond Basin
--------------------------------

        User-Defined TOC override (minutes):      5.00
```

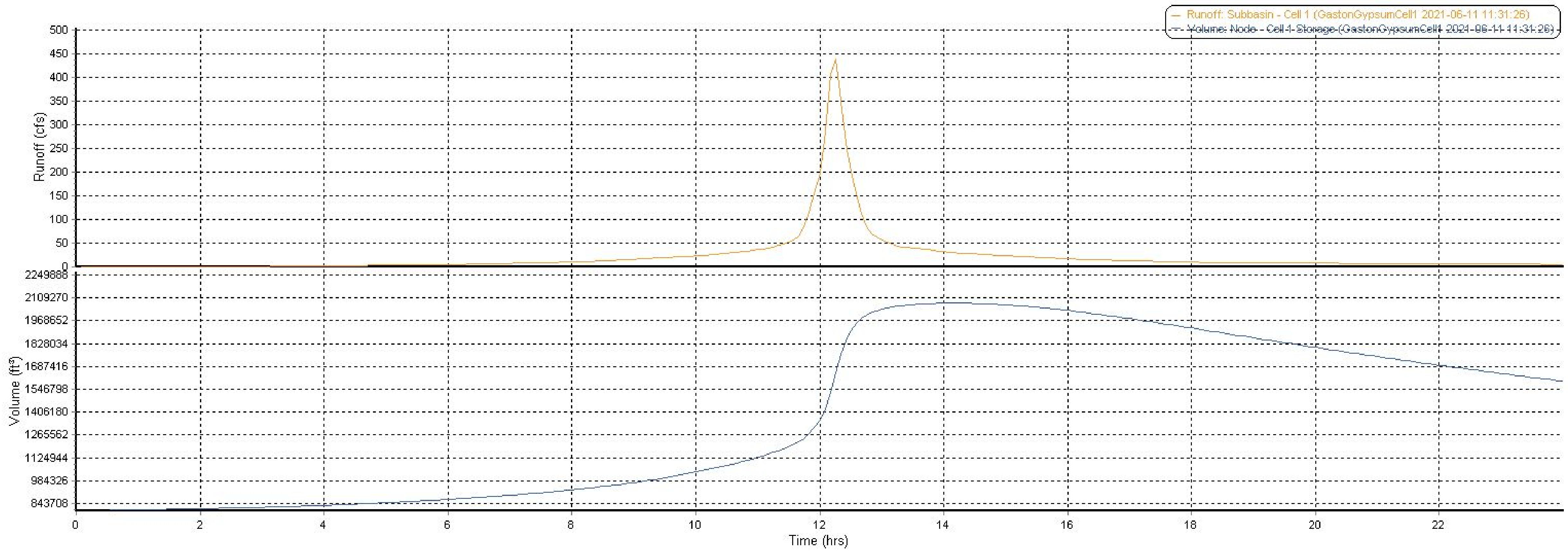
4.4 RATING CURVES

4.4.1 GYPSUM CELL STOP LOG RISER

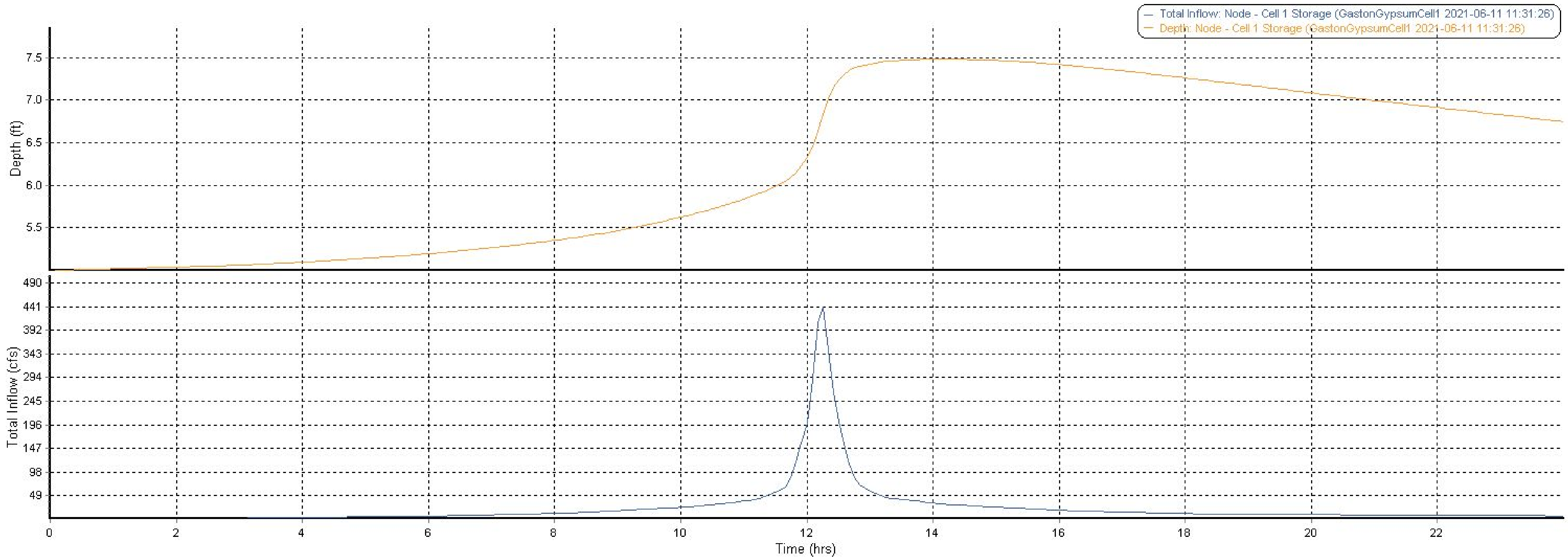


4.4.2 GYPSUM POND RATING CURVES

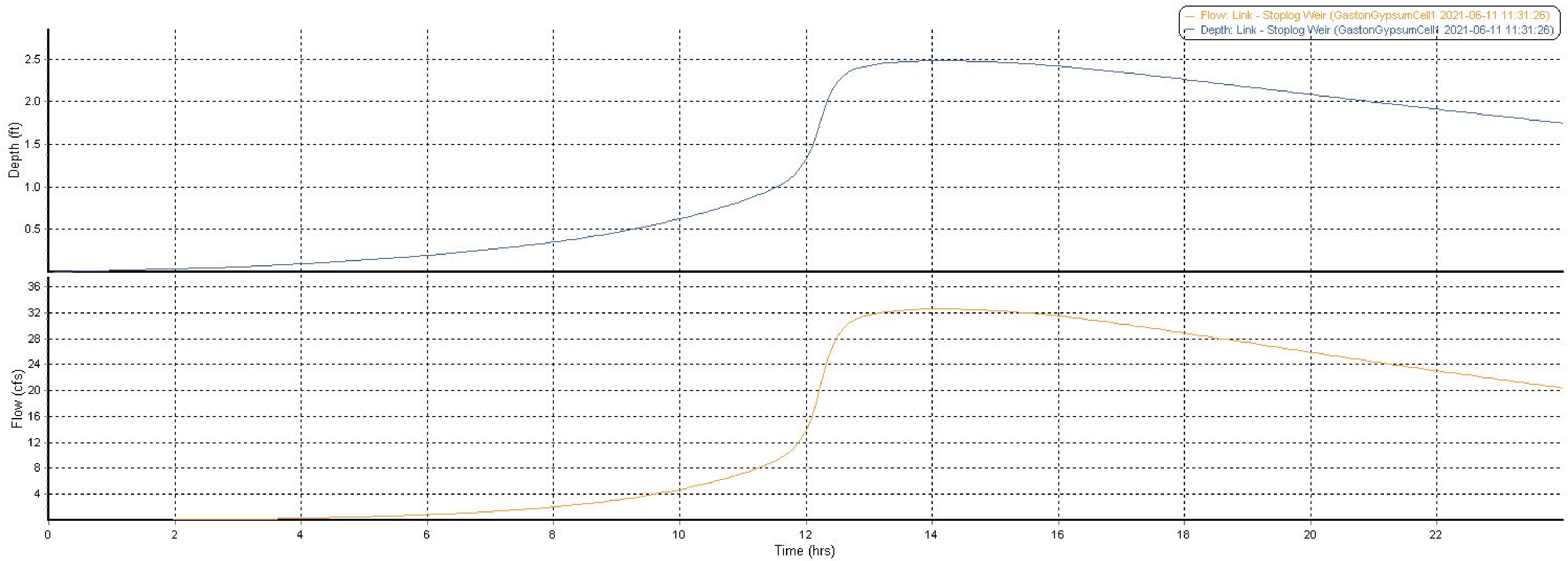
4.4.2.1 GYPSUM POND - RUNOFF AND VOLUME VS TIME



4.4.2.2 GYPSUM POND - INFLOW VS TIME
GYPSUM POND - DEPTH VS TIME



4.4.2.3 GYPSUM POND STOP LOG RISER - FLOW VS TIME
GYPSUM POND STOP LOG RISER - DEPTH VS TIME



4.5 DRAINAGE MAP