INFLOW DESIGN FLOOD CONTROL SYSTEM PLAN
PLANT CRIST GYPSUM STORAGE AREA
GULF POWER COMPANY

EPA's "Disposal of Coal Combustion Residuals from Electric Utilities" Final Rule (40 C.F.R. Part 257 and Part 261), §257.82, requires the owner or operator of an existing or new CCR surface impoundment or any lateral expansion of a CCR surface impoundment 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 has to prepare a written plan documenting how the inflow flood control system has been designed and constructed to meet the requirements of this section of the rule.

The existing CCR surface impoundment, referred to as the Plant Crist Gypsum Storage Area, is located at Gulf Power Company's Plant Crist (Plant). The facility consists of a 14-acre gypsum storage pond. The inflow design flood consists of the rainfall that falls within the limits of the surface impoundment, runoff from approximately 4 acres of adjoining watershed, and a nominal amount (relative to rainfall) of process flows. Stormwater is temporarily stored within the limits of the surface impoundment and discharged through one of three locations. The facility was designed and constructed with the primary discharge structure being a concrete decant riser. Decant water from the gypsum cell enters the riser and flows into a HDPE pipe and to the sedimentation pond. The storage area was also constructed with a second discharge point via a HDPE pipe that collects water from a drainage trench on the floor of the gypsum storage cell and transports it to the sedimentation pond. The third discharge control is provided by a concrete box culvert with a headwall that also discharges into the sedimentation pond. There are no penetrations of the exterior embankments at the gypsum pond. Water from the entire system is recycled to the Plant for process water.

The inflow design flood has been calculated using the National Resources Conservations Service method (also known as the Soil Conservation Service (SCS) method) using the 100-yr storm event required for a Low 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 "B" should be used to best reflect the characteristics of the soils on site. This information was placed into Storm and Sanitary Sewer Analysis (StormNet) 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. A calculation summary is attached to this plan.

The facility is operated subject to and in accordance with § 257.3-3 of EPA's regulations.

I hereby certify that the inflow design flood control system plan meets the requirements of 40 C.F.R. Part 257.82.

10/17/16

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Inflow Design Control System Plan:
Hydrologic and Hydraulic Calculation Summary

for

***Plant Crist Gypsum Storage* Area**

Prepared by:

Southern Company Services
Technical Services

Originator: ______________________ 10/6/16
Curtis R. Upchurch Date

Reviewer: ______________________ 10/11/16
Jason S. Wilson Date

Approval: ______________________ 10/12/16
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).

2.0 Summary of Conclusions

A hydrologic and hydraulic model was developed for Plant Crist's Gypsum Cell 2 to determine the hydraulic capacity of the impoundment. (Original design plans called for two gypsum disposal cells. At the present time, only Cell 2 has been constructed. Cell 1 is a potential future cell.) The design storm for Plant Crist Gypsum Cell 2 is a 100-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 100-year, 24-hour rainfall event through the impoundment are presented in Table 1 below:

Table 1-Flood Routing Results for Plant Crist Gypsum Cell 2

Plant Crist Area	Normal Pool El (ft)	Top of embankment El (ft)	Emergency Spillway Crest El (ft)	Peak Water Surface Elevation (ft)	Freeboard *(ft)	Peak Inflow (cfs)	Peak Outflow (cfs)
Cell 2	108 to 112**	Varies, Low point EL. 121.8	115.90	114.0	7.8	245	24

*Freeboard is measured from the top of embankment to the peak water surface elevation

**A normal pool elevation of 112.0 was assumed in calculations.

3.0 Methodology

3.1 HYDROLOGIC ANALYSES

The Plant Crist Gypsum Cell 2 is classified as a low hazard structure. The design storm for a low hazard structure is a 100-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 Crist Gypsum Cell 2 Storm Distribution

Hazard Classification	Return Frequency (years)	Storm Duration (hours)	Rainfall Total (Inches)	Rainfall Source	Storm Distribution
Low	100	24	16.1	NOAA Atlas 14	SCS Type III

The drainage area for the Plant Crist Gypsum Cell 2 was delineated based on LiDAR data and surveys acquired for the Plant in 2016. Runoff characteristics were developed based on the Soil Conservation Service (SCS) methodologies as outlined in TR-55. An overall SCS curve number for the drainage areas 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. Land use areas were delineated based on aerial photography. 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 Cell 2, Sedimentation Pond, Return Water Pond and the Dewatering Facility is provided below in Tables 3(a), 3(b), 3(c) and (d).

Table 3(a)—Cell 2 Hydrologic Information

Drainage Basin Area (acres)	18.1
Hydrologic Curve Number, CN	97
Hydrologic Methodology	SCS Method
Time of Concentration (minutes)	5
Hydrologic Software	Storm and Sanitary Sewer Analysis, 2013 Autodesk, Inc.

Table 3(b)—Future Cell 1 Site Hydrologic Information

Drainage Basin Area (acres)	2.4
Hydrologic Curve Number, CN	84
Hydrologic Methodology	SCS Method
Time of Concentration (minutes)	5
Hydrologic Software	Storm and Sanitary Sewer Analysis, 2013 Autodesk, Inc.

Table 3(c)—Sedimentation Pond Hydrologic Information

Drainage Basin Area (acres)	5.7
Hydrologic Curve Number, CN	97
Hydrologic Methodology	SCS Method
Time of Concentration (minutes)	5
Hydrologic Software	Storm and Sanitary Sewer Analysis, 2013 Autodesk, Inc.

Table 3(d)— Return Water Pond Hydrologic Information

Drainage Basin Area (acres)	4.6
Hydrologic Curve Number, CN	94
Hydrologic Methodology	SCS Method
Time of Concentration (minutes)	5
Hydrologic Software	Storm and Sanitary Sewer Analysis, 2013 Autodesk, Inc.

Table 3(d)—Dewater Facility Hydrologic Information

Drainage Basin Area (acres)	4.8
Hydrologic Curve Number, CN	93
Hydrologic Methodology	SCS Method
Time of Concentration (minutes)	6.5
Hydrologic Software	Storm and Sanitary Sewer Analysis, 2013 Autodesk, Inc.

Runoff values were determined by importing the characteristics developed above into a hydrologic model in Storm and Sanitary Sewer Analysis (StormNet) by AutoCad Civil 3D, 2013.

Process flows from Plant Crist were considered in this analysis. Based on normal plant operations, the Cell 2 receives an additional 1.37 MGD (2.12 cfs) of inflow from the Plant. It is assumed for these calculations that during the storm event the Return Water Pond pumps are not pumping water back to the Plant.

3.2 HYDRAULIC ANALYSES

Storage values for Cell 2, the Sedimentation Pond and Return Water Pond were determined by developing a stage-storage relationship utilizing contour data. A summary of spillway information for Cell 2 is presented below in Table 4. Note that for this analysis, additional spillways and other structures downstream of Cell 2 were modeled to evaluate Cell 2's performance but are not listed in this table.

Table 4—Cell 2 Spillway Attribute Table

Spillway Component	US Invert El (feet)	DS Invert El (feet)	Dimension	Slope (ft/ft)	Length (ft)	Spillway Capacity (cfs)
Cell 2 Primary 1 Stop Log riser	95.5 (Outlet pipe)	93.4 (Outlet pipe)	6' X 6' Stop log riser, Crest L=3.0' Ht.= 14.7' w/ Outlet pipe 30" diameter CPP	0.0066 (Outlet pipe)	320.0 (Outlet pipe)	24.5
Cell 2 Auxiliary 1 CD 7'x5'	115.90	115.79	Double box Culvert, 2 @ 7' W x 5' H	0.0030	36.0	N/A

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

4.0 SUPPORTING INFORMATION

4.1 CURVE NUMBERS

Gypsum Cell 2

Subbasin Cell 2 Area

Soil/Surface Description	Area (acres)	Soil Group	CN
Gravel roads	1.57	B	84.00
Cell with areas above water surface	16.56	-	92.00
Composite Area & Weighted CN	18.13		91.31

Future Cell 1 Area

Subbasin Future Cell 1 Area

Soil/Surface Description	Area (acres)	Soil Group	CN
Paved roads with curbs & sewers	0.33	B	98.00
Gravel roads	1.09	B	89.00
50 - 75% grass cover, Fair	0.99	B	74.00
Composite Area & Weighted CN	2.41		84.07

Sediment Pond

Subbasin Sediment Pond Area

Soil/Surface Description	Area (acres)	Soil Group	CN
Pond & Paved roads	5.11	B	98.00
Gravel roads	0.56	B	84.00
Composite Area & Weighted CN	5.67		96.62

Return Water Pond

Subbasin Return Water Pond Area

Soil/Surface Description	Area (acres)	Soil Group	CN
Paved roads with curbs & sewers	3.21	B	98.00
Gravel roads	1.41	B	84.00
Composite Area & Weighted CN	4.62		93.73

Dewatering/Wastewater Treatment Area

Subbasin CB-001 Subbasin

Soil/Surface Description	Area (acres)	Soil Group	CN
Paved & Bldgs.	0.24	B	98.00
Aggregate Surfaced	0.48	B	85.00
Composite Area & Weighted CN	0.72		89.33

Subbasin CB-002 Subbasin

Soil/Surface Description	Area (acres)	Soil Group	CN
Paved and Bldgs.	0.53	B	98.00
Aggregate Surfaced	0.53	B	85.00
Composite Area & Weighted CN	1.06		91.50

Subbasin CB-003 Basin

Soil/Surface Description	Area (acres)	Soil Group	CN
Paviing & Bldgs	0.07	B	98.00
Aggregate Surface	0.10	B	85.00
Composite Area & Weighted CN	0.17		90.35

Subbasin CB-004 Subbasin

Soil/Surface Description	Area (acres)	Soil Group	CN
Paving & Bldgs.	0.13	B	98.00
Aggregate Surfaced	0.06	B	85.00
Composite Area & Weighted CN	0.19		93.89

Subbasin CB-005 Basin

Soil/Surface Description	Area (acres)	Soil Group	CN
Paved and Bldgs.	0.44	B	98.00
Aggregate Surfacing	0.12	B	85.00
Composite Area & Weighted CN	0.56		95.21

Subbasin CB-010 Subbasin

Soil/Surface Description	Area (acres)	Soil Group	CN
Paved & Bldgs.	0.24	B	98.00
Composite Area & Weighted CN	0.24		98.00

Dewatering/Wastewater Treatment Area, cont.

Subbasin CB-011 Subbasin

Soil/Surface Description	Area (acres)	Soil Group	CN
Paved & Bldgs.	0.20	B	98.00
Aggregate Surfaced	0.20	B	85.00
Composite Area & Weighted CN	0.40		91.50

Subbasin CB-012 Subbasin

Soil/Surface Description	Area (acres)	Soil Group	CN
Paved & Bldgs.	0.11	B	98.00
Aggregate Surfaced	0.06	B	85.00
Composite Area & Weighted CN	0.17		93.41

Subbasin CB-013 Subbasin

Soil/Surface Description	Area (acres)	Soil Group	CN
Paved & Bldgs.	0.28	B	98.00
Aggregate Surfaced	0.25	B	85.00
Composite Area & Weighted CN	0.53		91.87

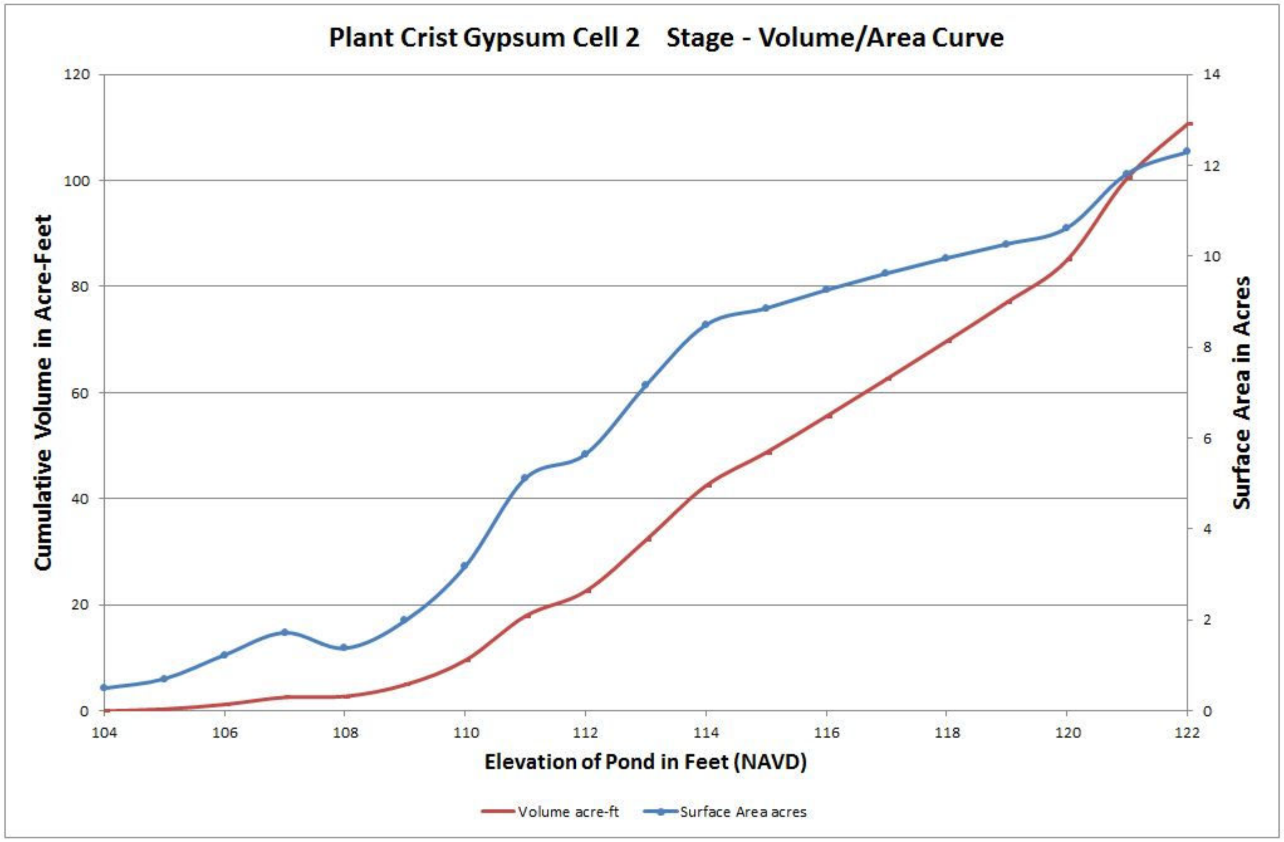
Subbasin CB-015 Subbasin

Soil/Surface Description	Area (acres)	Soil Group	CN
Aggregate Surfaced	0.12	B	85.00
Paved roads and Roofs	0.67	B	98.00
Composite Area & Weighted CN	0.79		96.03

4.2 STAGE-STORAGE TABLES & CURVES

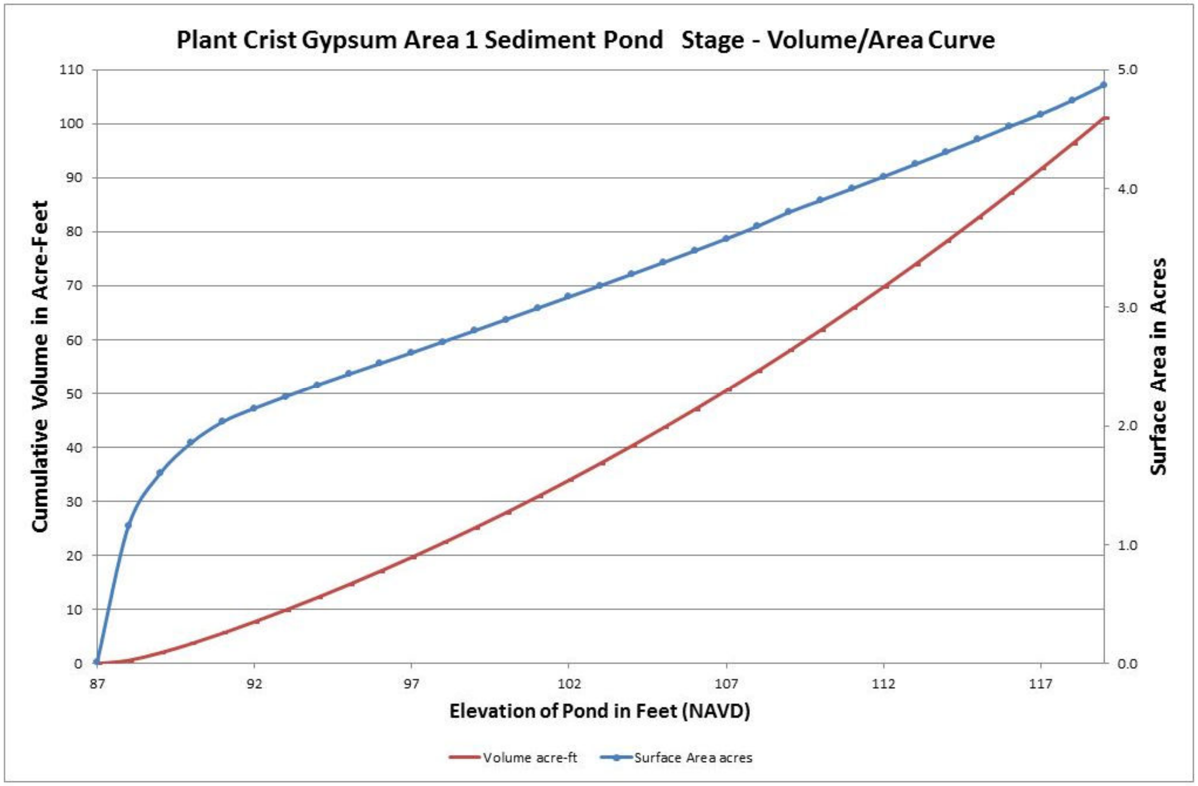
4.2.1 GYPSUM CELL 2

Contour Elevation	Surface Area acres	Volume acre-ft
104	0.50	0.00
105	0.71	0.35
106	1.23	1.23
107	1.72	2.59
108	1.38	2.76
109	1.98	4.95
110	3.18	9.54
111	5.11	17.90
112	5.65	22.59
113	7.16	32.20
114	8.49	42.46
115	8.86	48.71
116	9.26	55.54
117	9.62	62.56
118	9.96	69.72
119	10.27	77.03
120	10.62	84.99
121	11.82	100.47
122	12.29	110.63



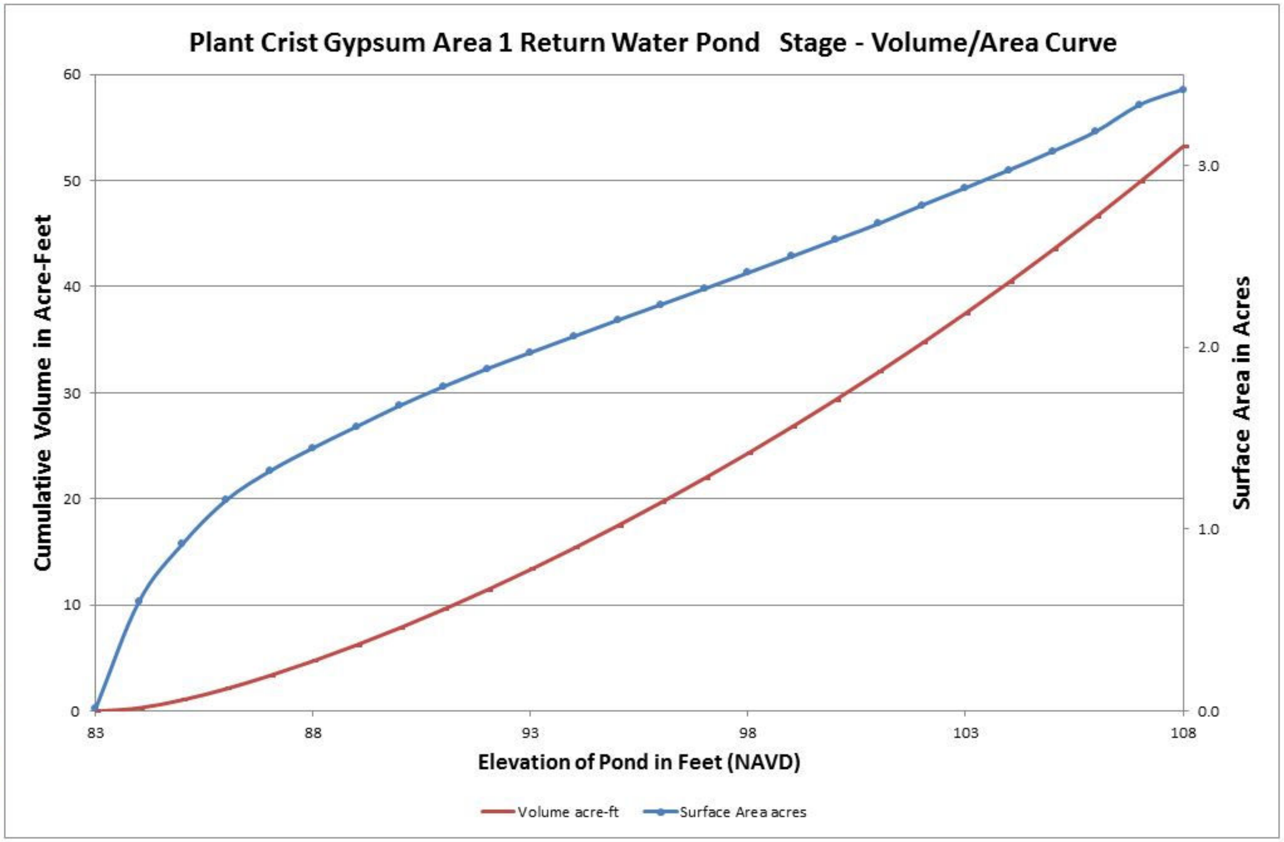
4.2.2 SEDIMENTATION POND

Contour Elevation	Surface Area acres	Volume acre-ft
87	0.01	0.00
88	1.16	0.58
89	1.60	1.96
90	1.86	3.69
91	2.03	5.63
92	2.15	7.72
93	2.25	9.92
94	2.34	12.21
95	2.44	14.60
96	2.53	17.08
97	2.62	19.66
98	2.71	22.32
99	2.80	25.08
100	2.90	27.93
101	2.99	30.87
102	3.09	33.91
103	3.18	37.05
104	3.28	40.28
105	3.38	43.61
106	3.48	47.03
107	3.58	50.56
108	3.68	54.19
109	3.80	57.93
110	3.90	61.78
111	4.00	65.73
112	4.10	69.78
113	4.20	73.93
114	4.31	78.19
115	4.41	82.55
116	4.52	87.01
117	4.62	91.58
118	4.74	96.27
119	4.87	101.07



4.2.3 RETURN WATER POND

Contour Elevation	Surface Area acres	Volume acre-ft
83	0.01	0.00
84	0.60	0.31
85	0.92	1.07
86	1.16	2.11
87	1.32	3.35
88	1.45	4.73
89	1.56	6.24
90	1.68	7.86
91	1.78	9.59
92	1.88	11.43
93	1.97	13.35
94	2.06	15.37
95	2.15	17.47
96	2.24	19.66
97	2.32	21.94
98	2.41	24.31
99	2.50	26.76
100	2.59	29.31
101	2.68	31.94
102	2.78	34.67
103	2.88	37.50
104	2.98	40.43
105	3.08	43.45
106	3.19	46.59
107	3.33	49.85
108	3.42	53.22



4.3 TIME OF CONCENTRATION

(All subbasin Tc's calculated < 5.0 min.)

Cell 2

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Subbasin Cell 2 Area
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        User-Defined TOC override (minutes):      5.00
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Future Cell 1 Area

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Subbasin Future Cell 1 Area
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        User-Defined TOC override (minutes):      5.00
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Sediment Pond Area

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Subbasin Sediment Pond Area
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        User-Defined TOC override (minutes):      5.00
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Return Water Pond Area

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Subbasin Return Water Pond Area
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        User-Defined TOC override (minutes):      5.00
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Return Water Pond Area

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Subbasin Return Water Pond Area
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        User-Defined TOC override (minutes):      5.00
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Dewater Facility and WWT Area

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Subbasin CB-001 Subbasin
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        User-Defined TOC override (minutes):      5.00

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Subbasin CB-002 Subbasin
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        User-Defined TOC override (minutes):      5.00

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Subbasin CB-003 Basin
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        User-Defined TOC override (minutes):      5.00

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Subbasin CB-004 Subbasin
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        User-Defined TOC override (minutes):      5.00

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Subbasin CB-005 Basin
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        User-Defined TOC override (minutes):      5.00

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Subbasin CB-010 Subbasin
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        User-Defined TOC override (minutes):      5.00

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Subbasin CB-011 Subbasin
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        User-Defined TOC override (minutes):      5.00

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Subbasin CB-012 Subbasin
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        User-Defined TOC override (minutes):      5.00

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Subbasin CB-013 Subbasin
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        User-Defined TOC override (minutes):      5.00

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Subbasin CB-015 Subbasin
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        User-Defined TOC override (minutes):      5.00
```

4.4 RATING CURVES

4.4.1 CELL 2 STOP LOG WEIR

Weir Report

Hydraflow Express Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. Wednesday, Sep 28 2016

Stop Log Riser

Rectangular Weir

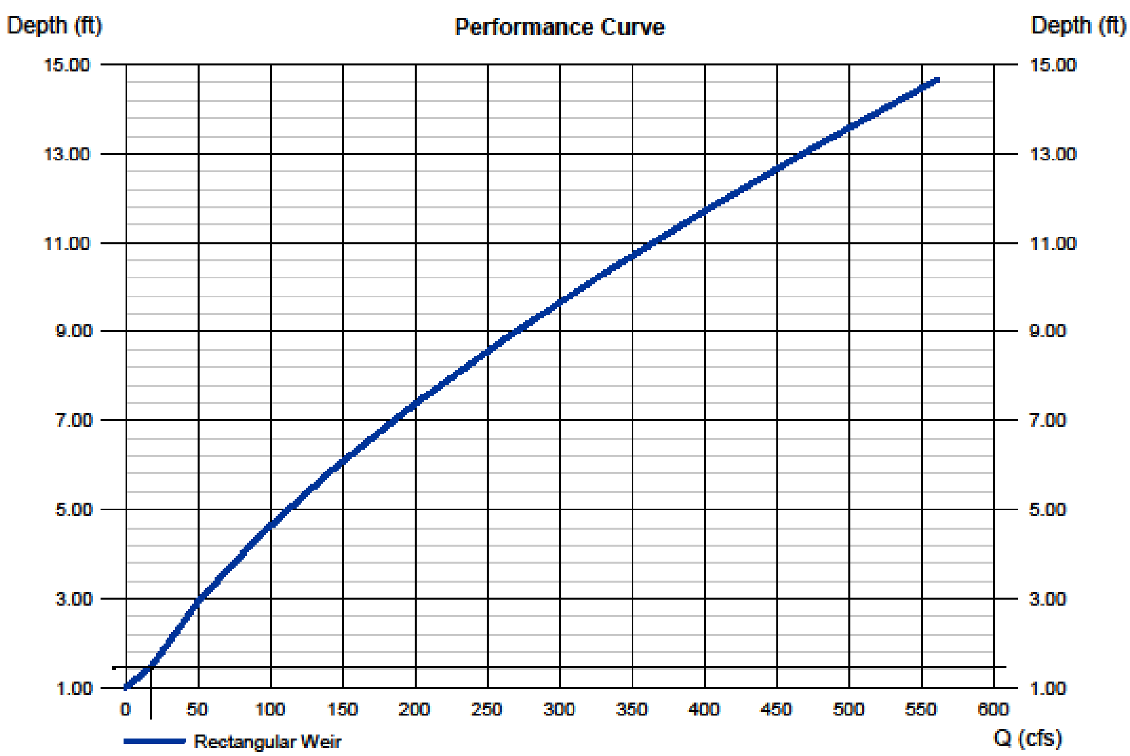
Crest	= Sharp
Bottom Length (ft)	= 3.00
Total Depth (ft)	= 14.67

Calculations

Weir Coeff. Cw	= 3.33
Compute by:	Q vs Depth
No. Increments	= 10

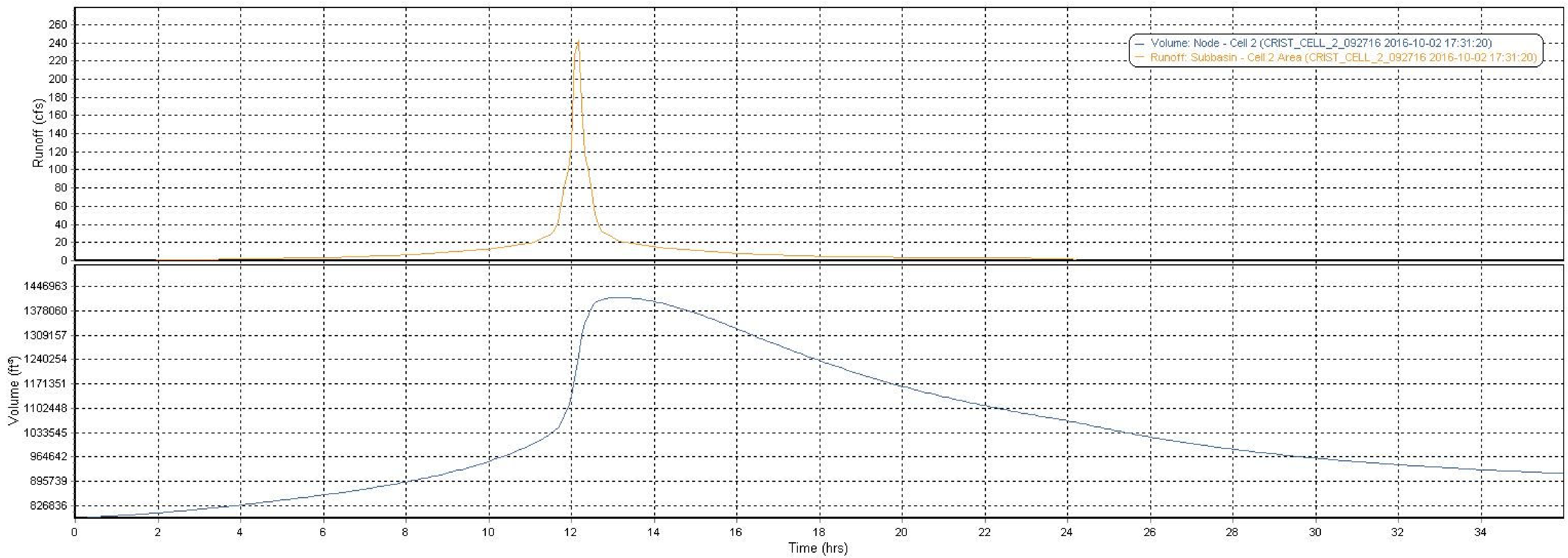
Highlighted

Depth (ft)	= 1.47
Q (cfs)	= 17.75
Area (sqft)	= 4.40
Velocity (ft/s)	= 4.03
Top Width (ft)	= 3.00

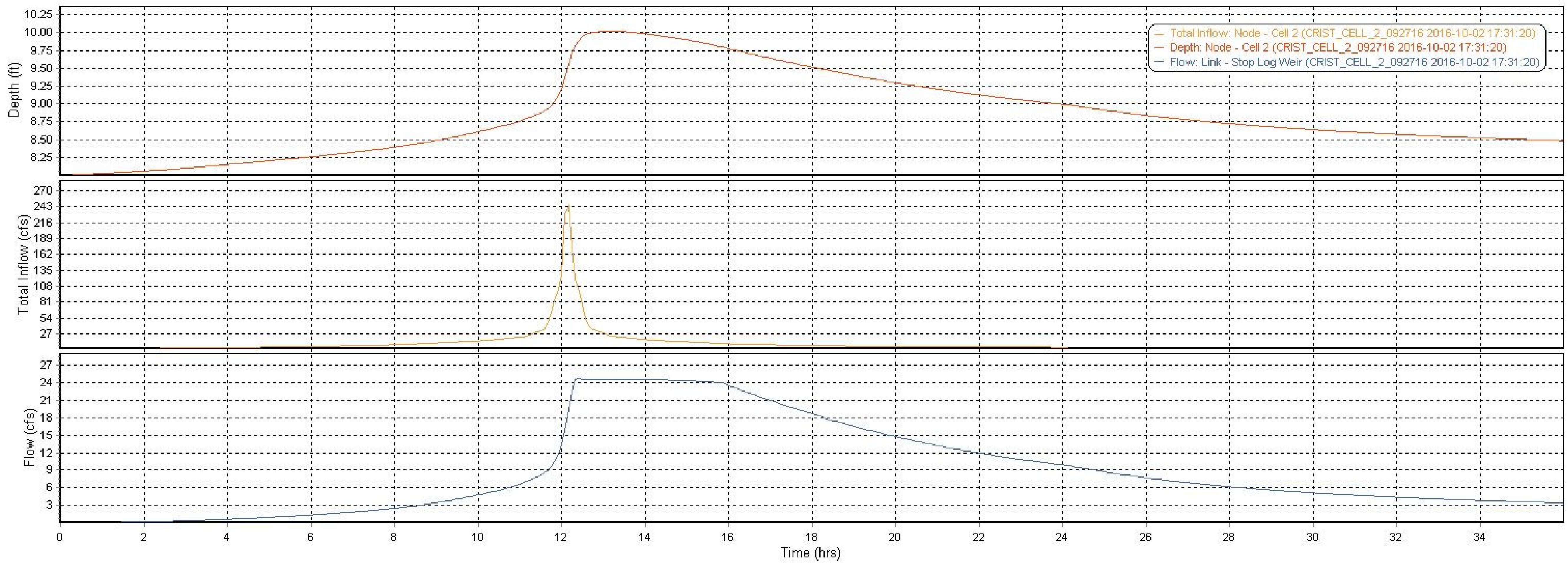


4.5 CURVES

4.5.1 CELL 2 RUNOFF AND STORAGE CURVES



4.5.2 CELL 2 - CELL DEPTH/TIME
CELL 2 – CELL INFLOW VS TIME
CELL 2 - DISCHARGE WEIR (STOP LOG RISER) FLOW VS TIME



4.6 DRAINAGE MAP