PERIODIC RUN-ON AND RUN-OFF CONTROL PLAN
PLANT GORGAS GYPSUM LANDFILL
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 run-on and run-off control requirements for CCR landfills. Per §257.81 and ADEM Admin. Code r. 335-13-15-.05(2), the owner or operator of an existing or new CCR landfill or any lateral expansion of a CCR landfill must design, construct, operate and maintain a run-on control system to prevent flow onto the active and/or closed portion of the CCR unit during the peak discharge from a 24-hour, 25-year storm. In addition, the owner or operator must design, construct, operate and maintain a run-off control system from the active and/or closed portion of the CCR unit to collect and control at least the water volume resulting from a 24-hour, 25-year storm. The owner or operator also must prepare a written plan documenting how the run-on and run-0ff control system plans have been designed and constructed to meet the requirements of the referenced sections of the rules. Each plan is to be supported by appropriate engineering calculations. In addition, §257.81(c)(4) and ADEM Admin. Code r. 335-13-15-.05(2)(c)4. require periodic run-on and run-off control system plans be prepared every 5 years.

The Gypsum Landfill is located at Alabama Power Company's Plant Gorgas within the permitted boundaries of the Plant's overall landfill facility. The facility is permitted for storage of a variety of CCR. The Gypsum Landfill covers approximately 15 acres.

The storm water flows have been calculated using the Natural Resources Conservation Service method (also known as the Soil Conservation Service (SCS)) method using 24-hour storm events. The storm water detention system has been designed in accordance with the Alabama Soil and Water Conservation Committee requirements as well as other local, city, and government codes. The post developed storm water discharge was designed to be less than the pre-developed storm water discharge in accordance with the requirements of the State of Alabama.

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).

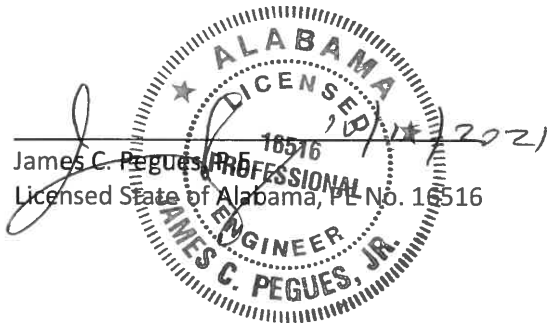
The NRCS provided information on the soil characteristics and hydrologic groups present at the site. It was determined that the site contains areas with hydrological soil groups "A" and "D". A composite curve number was created based on the land use and soil type of the entire drainage area. This information was placed into Hydraflow Hydrographs and used to generate appropriate precipitation curves and storm basin runoff values.

The Plant Gorgas Gypsum Landfill is designed and constructed with perimeter berms and drainage ditches around the cell that prevent stormwater run-on from surrounding areas during the peak discharge of a 24-hr, 25-yr storm from flowing onto the active portion of the landfill.

The leachate/runoff pond collects and controls the calculated amount of leachate generated from the leachate collection system of the disposal cell as well as the quantity of rainfall from a 24-hr, 100-yr storm event that falls directly into the leachate/runoff pond. The water collected in the leachate/runoff pond is pumped to a treatment system prior to discharge through a permitted NPDES discharge point.

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 run-on and run-off control system plan meets the requirements of 40 C.F.R. §257.81 and ADEM Admin. Code r. 335-13-15-.05(2).



10/12/2021

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

Run-on and Run-off Control System Plan for Landfills:
Calculation Summary

for

Plant Gorgas Gypsum Landfill Storage Facility

Prepared by:

Southern Company Services
Technical and Project Solutions

Originator: _____
Andrew E. Stricklin Date

Reviewer: _____ 10-7-21
Jason S. Wilson Date

Approval: _____ 10/7/21
James C. Pegues Date

1.0 Purpose of Calculation

The purpose of this calculation is to evaluate the Gypsum Landfill Storage Facility storage cell and Sediment Pond for compliance to EPA's Title 40 CFR Part 257.81 and ADEM's Admin. Code r. 335-13-15-.05(2). In accordance with these regulations, the facility must have run-on controls to prevent flow from the 24-hour, 25-year storm event from reaching the working face and also run-off controls to collect and control the water volume from the storm.

2.0 Summary of Conclusions

2.1 Site Overview

The Plant Gorgas Gypsum Landfill Storage Facility is located on APC property in the northeast area of the plant. This facility was constructed in 2012-13 and has not received gypsum at this time. The landfill is sited in a valley covering approximately 49 acres and has one storage cell with a drainage area of approximately 30.3 acres. There are no off-site areas draining into the cell and only stormwater run-off from rain falling directly in the cell and on the surrounding slopes up to the ridge lines must be collected and controlled. There is a single concrete stoplog riser in the low point of the cell which conveys water to a Sediment Pond downstream via a 36 inch diameter HDPE pipe. Water collected in the Sediment Pond is pumped to the Low Volume Waste Water (LVWW) Pond. The Sediment Pond does have a spillway with an outfall to the Black Warrior River basin south of the site, however this structure is only to maintain dam integrity in the unlikely case of an overflow condition. The Sediment Pond drainage area is approximately 20.7 acres and receives only run-off from the gypsum storage cell and the sloped areas around the pond up to the surrounding ridge lines.

An overview of the Cell and Sediment Pond is provided in Table 1 below.

Table 1 - Landfill site characteristics

Pond Description	Cell	Sediment Pond
Size (Acres)	20.7	3.4
Outlet Type	Concrete stop log riser 6'x6', Ht=25', Crest L=3.0' with 36" HDPE pipe	16" suction line to pump
Outlets To	Sediment Pond	Pumped to LVWW Pond

2.2 Run-on Control System Plan

There is no stormwater run-on into the Cell or Sediment Pond other than flow from surrounding slopes at the perimeter of the cell and pond. Run-off from these areas has been included in these calculations. Note that any other areas where run-off was directed to the landfill area was diverted by the initial design which now prevents any water encroachment. For further

information on this hydraulic design, see SCS Calculation No. DC-GOR-ECS18932-001, Plant Gorgas Dry Gypsum Storage Facility Plans, Stormwater Management Calculations, 12/26/12.

2.3 Run-off Control System Plan

A hydrologic and hydraulic model was developed for the Plant Gorgas Gypsum Landfill Storage Facility Sediment Pond to determine the hydraulic capacity of the Cell and Sediment Pond. The design storm for the purposes of run-off control system plans is the 24-hour, 25-year rainfall event. The results of routing the design storm event through the landfill are presented in Table 2 below:

Table 2 - Flood Routing Results for Plant Gorgas Gypsum Landfill Storage Facility Sediment Pond

Plant Gorgas	Normal Pool El (ft)	Top of embankment El (ft)	Peak Water Surface Elevation (ft)	Freeboard* (ft)	Peak Inflow (cfs)	Peak Outflow (cfs)
Cell	359.0	385.0	360.7	24.3	N/A	10.6
Sediment Pond	335.0	355.0	345.9	9.1	64	0

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

3.0 Methodology

3.1 HYDROLOGIC ANALYSES

The design storm for all run-on/run-off analyses is a 24-hour, 25-year rainfall event. A summary of the design storm parameters and rainfall distribution methodology for these calculations is summarized below in Table 3.

Table 3 - Plant Gorgas Gypsum Landfill Sediment Pond Design Storm Distribution

Return Frequency (years)	Storm Duration (hours)	Rainfall Total (Inches)	Rainfall Source	Storm Distribution
25	24	7.15	NOAA Atlas 14	SCS Type III

The drainage area for the Plant Gorgas Gypsum Landfill Sediment Pond was determined based on a composite of Aerial Topo from March 2003, Field Topo August 2008 and Lidar Topo December 2011. 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 methods prescribed in TR-55. Soil types were obtained from the Natural Resources Conservation Service. Land use areas were delineated based on aerial photography. Times of Concentration were also developed based on methodologies prescribed in TR-55.

A table of the pertinent basin characteristics of the landfill is provided below in Tables 4(a) and 4(b):

Table 4(a)—Landfill Hydrologic Information (Gypsum Cell)

Drainage Basin Area (acres)	30.32
Hydrologic Curve Number, CN	94
Hydrologic Methodology	SCS Method
Time of Concentration (minutes)	17.7
Hydrologic Software	Hydraflow Hydrographs

Table 4(b)—Landfill Hydrologic Information (Sediment Pond)

Drainage Basin Area (acres)	18.25
Hydrologic Curve Number, CN	74
Hydrologic Methodology	SCS Method
Time of Concentration (minutes)	22.3
Hydrologic Software	Hydraflow Hydrographs

Run-off values were determined by importing the characteristics developed above into a hydrologic model in Hydraflow Hydrographs Extension of AutoCad Civil 3D, 2019.

3.2 HYDRAULIC ANALYSES

Storage values for the Sediment Pond were determined by developing a stage-storage relationship utilizing contour data. The spillway system at the Plant Gorgas Gypsum Landfill Sediment Pond consists of one primary spillway in the cell and in the Sediment Pond. The primary spillway in the cell is a 6-foot square stop log riser with a 3-foot crest section. In the Sediment Pond, the primary spillway is a trapezoidal weir located on the west dike. It is a reinforced concrete spillway with a 2-foot wide crest with a depth of 1-foot deep with 6:1 slopes on either end providing access along the perimeter dike. The spillway conveys flow to an existing downstream drainage channel. A summary of spillway information is presented below in Tables 5(a) and (b).

Table 5(a) – Cell Spillway Attribute Table

Spillway Component	US Invert El (feet)	DS Invert El (feet)	Dimension (ft)	Slope (ft/ft)	Length (ft)	Spillway Capacity (cfs)
Primary Spillway Stop log riser 8 foot square	356.0	354.0	Weir L = 3.0 ft., Weir EL 359.0 Outlet pipe = 36" diameter, HDPE	0.078	258	N/A*

Table 5(b) – Sediment Pond Spillway Attribute Table

Spillway Component	US Invert El (feet)	DS Invert El (feet)	Dimension (ft)	Slope (ft/ft)	Length (ft)	Spillway Capacity (cfs)
Primary Spillway	354.0	353.8	Trapezoidal (Concrete), Crest L=20', 6:1 S.S.	0.010	26.0	N/A*

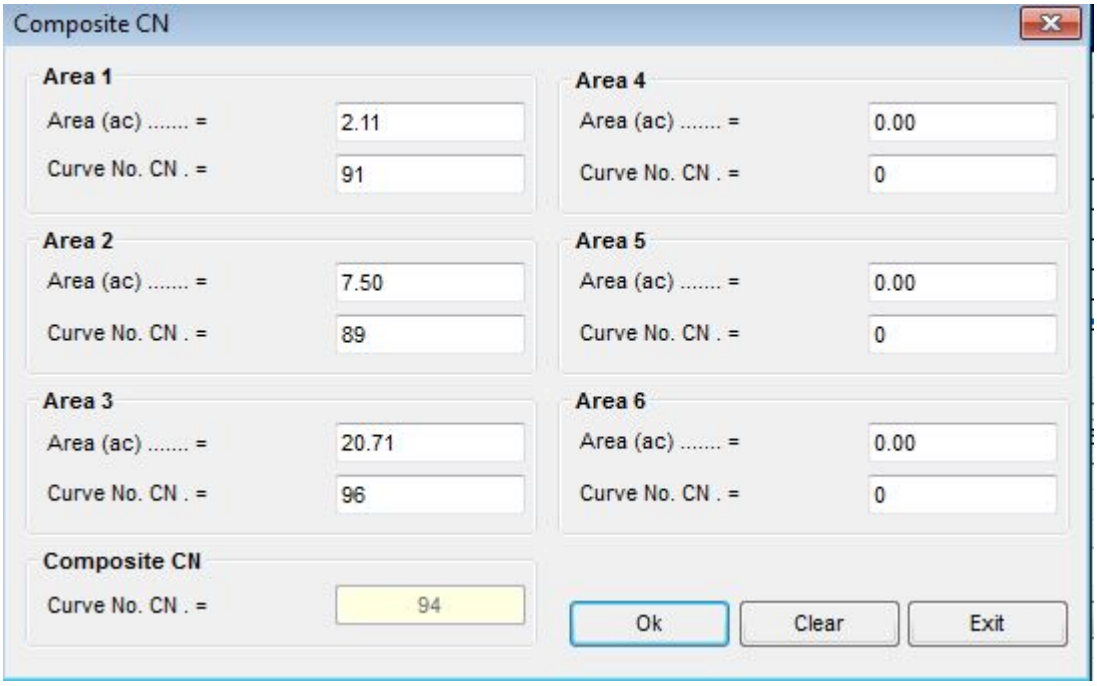
*N/A = Not available

Based on the spillway attributes listed above, a rating curve was developed and inserted into Hydraflow Hydrographs software to analyze pond performance during the design storm. Results are shown in Table 2.

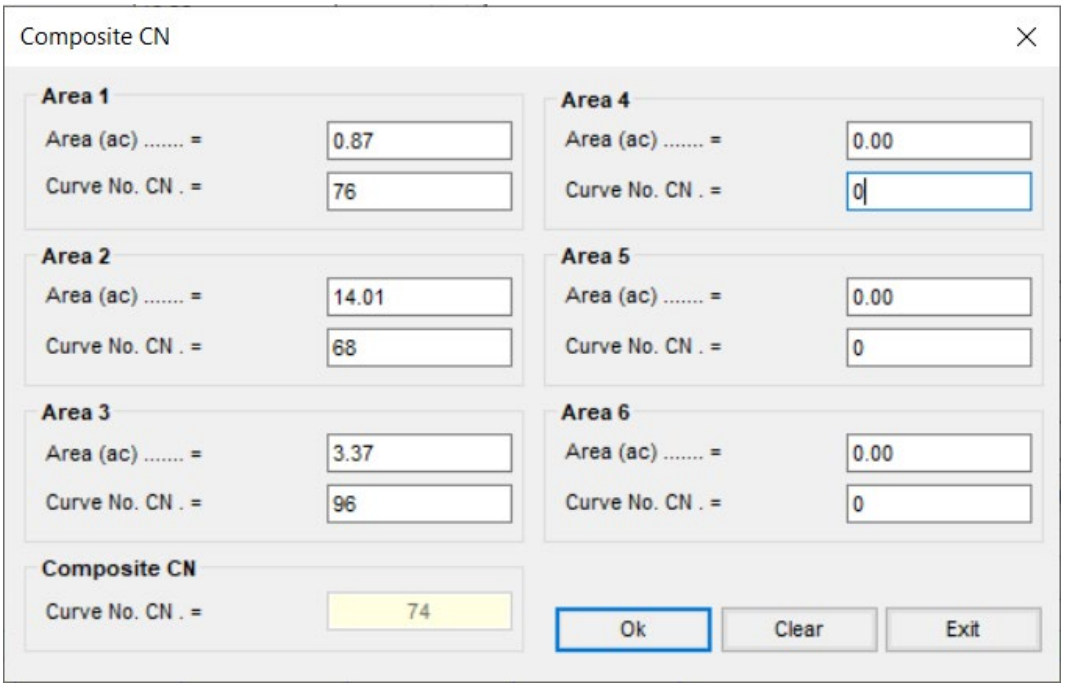
4.0 SUPPORTING INFORMATION

4.1 CURVE NUMBER

4.1.1 GYPSUM CELL



4.1.2 SEDIMENT POND AREA



4.2 STAGE-STORAGE TABLE

4.2.1 SEDIMENT POND

Pond Name: Sediment Pond

Row	Stage	Elevation	Contour Area	Incremental Storage	Total Storage	Total Discharge
	(ft)	(ft)	(sqft)	(cuft)	(cuft)	(cfs)
0	0.00	335.00	69,661	0.000	0.000	0.000
1	5.00	340.00	86,860	391,303	391,303	0.000
2	10.00	345.00	105,472	480,830	872,133	0.000
3	15.00	350.00	125,499	577,428	1,449,560	0.000
4	19.00	354.00	142,538	536,074	1,985,634	0.000
5	20.00	355.00	146,939	144,739	2,130,373	52.00
6						
7						
8						
9						
10						
11						
12						
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14						
15						
16						
17						
18						
19						
20						

4.3 TIME OF CONCENTRATION

4.3.1 GYPSUM CELL AREA

TR55 Tc Worksheet

Hyd. No. 1

Gyp. Stack Area

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.150		0.011		0.011		
Flow length (ft)	= 300.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 4.00		0.00		0.00		
Land slope (%)	= 1.80		0.00		0.00		
Travel Time (min)	**= 22.01**	**+**	**0.00**	**+**	**0.00**	**=**	**22.01**
Shallow Concentrated Flow							
Flow length (ft)	= 130.00		0.00		0.00		
Watercourse slope (%)	= 20.00		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	= 7.22		0.00		0.00		
Travel Time (min)	**= 0.30**	**+**	**0.00**	**+**	**0.00**	**=**	**0.30**
Channel Flow							
X sectional flow area (sqft)	= 0.00		0.00		0.00		
Wetted perimeter (ft)	= 0.00		0.00		0.00		
Channel slope (%)	= 0.00		0.00		0.00		
Manning's n-value	= 0.015		0.015		0.015		
Velocity (ft/s)	= 0.00						
			0.00				
					0.00		
Flow length (ft)	({0})0.0		0.0		0.0		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**
Total Travel Time, Tc							**22.30 min**

4.3.2 SEDIMENT POND AREA

TR55 Tc Worksheet

Hyd. No. 4

Sediment Pond Area

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.150		0.011		0.011		
Flow length (ft)	= 190.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 4.00		0.00		0.00		
Land slope (%)	= 1.80		0.00		0.00		
Travel Time (min)	**= 15.28**	**+**	**0.00**	**+**	**0.00**	**=**	**15.28**
Shallow Concentrated Flow							
Flow length (ft)	= 500.00		210.00		0.00		
Watercourse slope (%)	= 6.25		33.33		0.00		
Surface description	= Unpaved		Unpaved		Paved		
Average velocity (ft/s)	= 4.03		9.32		0.00		
Travel Time (min)	**= 2.07**	**+**	**0.38**	**+**	**0.00**	**=**	**2.44**
Channel Flow							
X sectional flow area (sqft)	= 0.00		0.00		0.00		
Wetted perimeter (ft)	= 0.00		0.00		0.00		
Channel slope (%)	= 0.00		0.00		0.00		
Manning's n-value	= 0.015		0.015		0.015		
Velocity (ft/s)	= 0.00						
			0.00				
					0.00		
Flow length (ft)	({0})0.0		0.0		0.0		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**
Total Travel Time, Tc							**17.70 min**

4.4 RESULTS

4.4.1 GYPSUM CELL AREA

Hydrograph Report

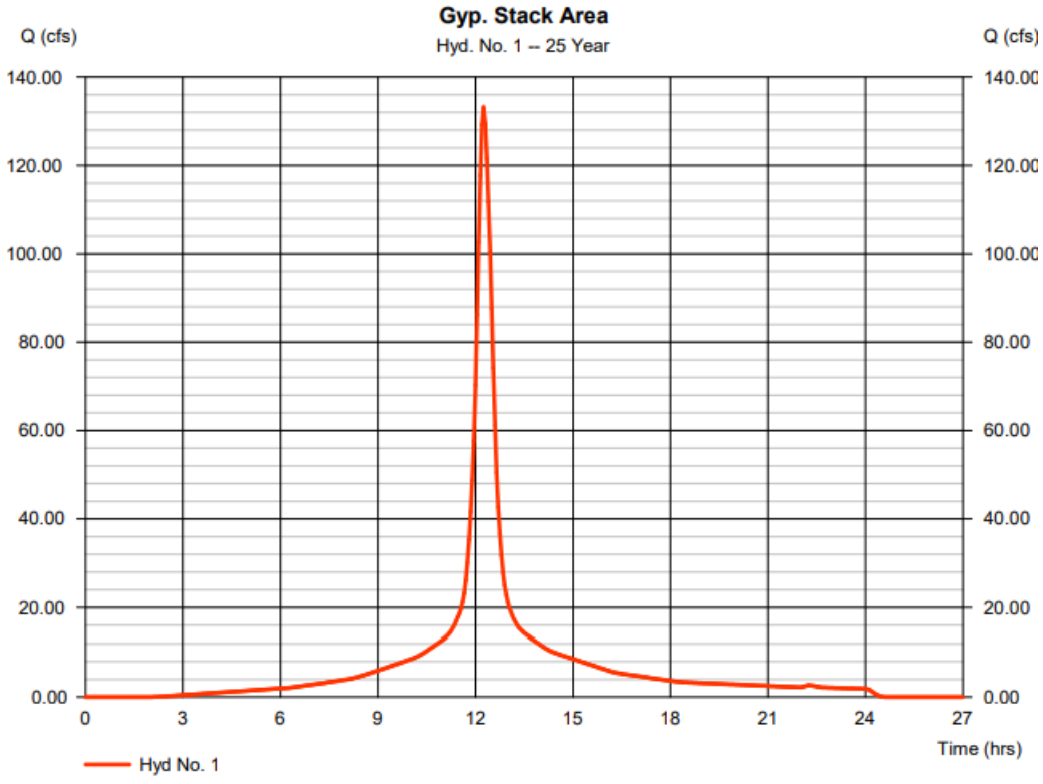
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v12 — Friday, 05 / 21 / 2021

Hyd. No. 1

Gyp. Stack Area

Hydrograph type	= SCS Runoff	Peak discharge	= 133.20 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.25 hrs
Time interval	= 3 min	Hyd. volume	= 690,779 cuft
Drainage area	= 30.320 ac	Curve number	= 94*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 22.30 min
Total precip.	= 7.15 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(2.110 x 91) + (7.500 x 89) + (20.710 x 96)] / 30.320



4.4.2 GYPSUM CELL ROUTING

Hydrograph Report

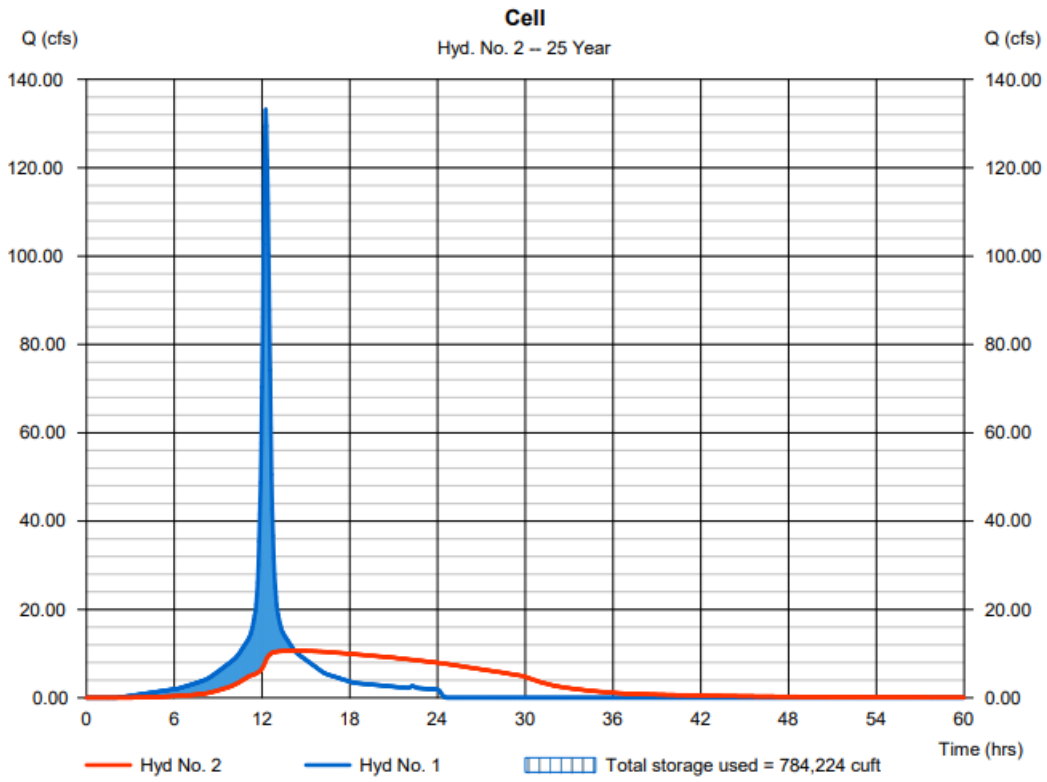
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v12 — Friday, 05 / 21 / 2021

Hyd. No. 2

Cell

Hydrograph type	= Reservoir	Peak discharge	= 10.64 cfs
Storm frequency	= 25 yrs	Time to peak	= 14.25 hrs
Time interval	= 3 min	Hyd. volume	= 690,748 cuft
Inflow hyd. No.	= 1 - Gyp. Stack Area	Max. Elevation	= 360.39 ft
Reservoir name	= Gypsum Cell	Max. Storage	= 784,224 cuft

Storage Indication method used. Wet pond routing start elevation = 359.00 ft.



4.4.3 SEDIMENT POND AREA

Hydrograph Report

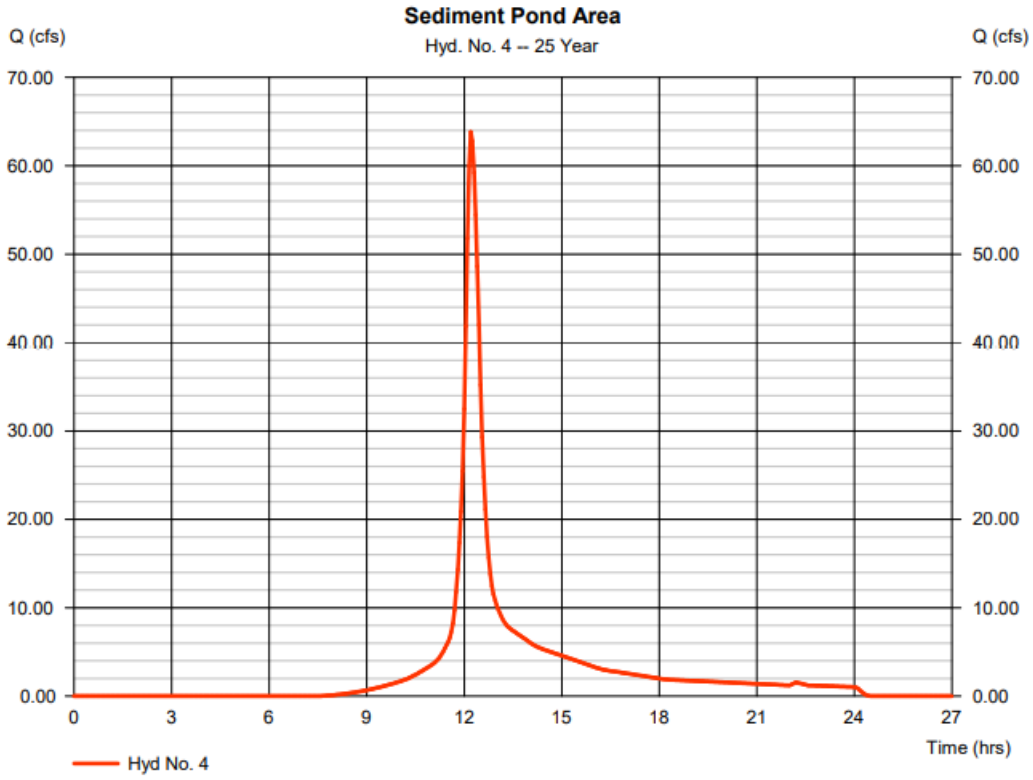
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v12 — Friday, 05 / 21 / 2021

Hyd. No. 4

Sediment Pond Area

Hydrograph type	= SCS Runoff	Peak discharge	= 63.82 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.20 hrs
Time interval	= 3 min	Hyd. volume	= 285,098 cuft
Drainage area	= 18.250 ac	Curve number	= 74*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 17.70 min
Total precip.	= 7.15 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.870 x 76) + (14.010 x 68) + (3.370 x 96)] / 18.250



4.4.4 SEDIMENT POND ROUTING (NO DISCHARGE)

Hydrograph Report

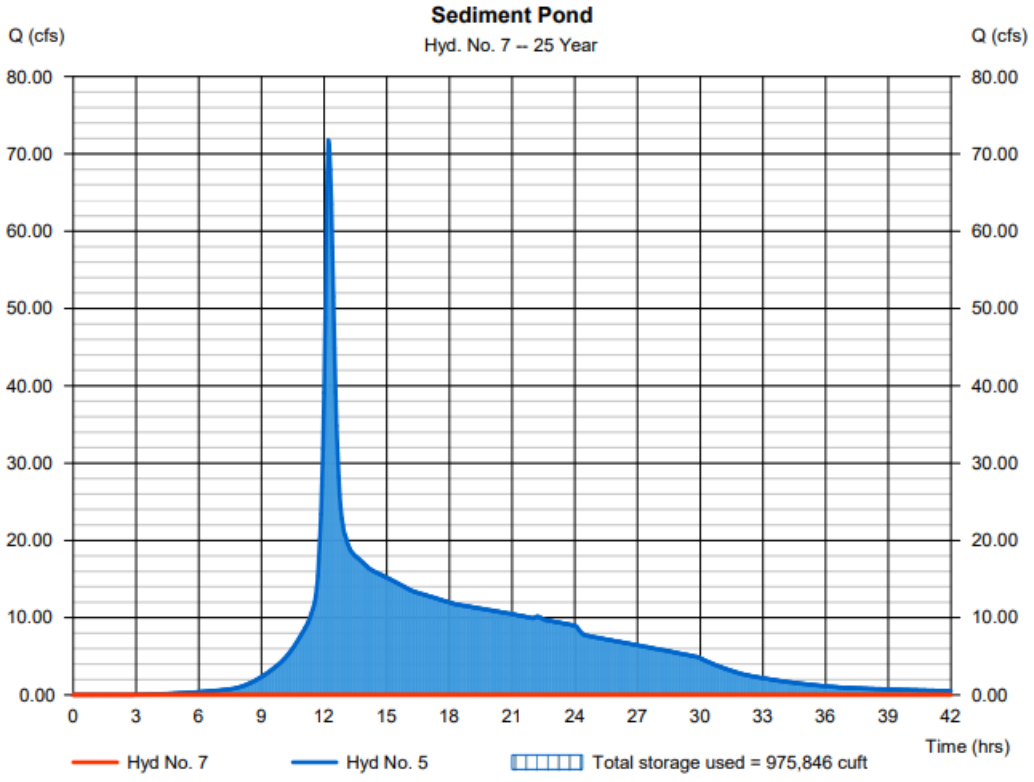
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v12 — Friday, 05 / 21 / 2021

Hyd. No. 7

Sediment Pond

Hydrograph type	= Reservoir	Peak discharge	= 0.000 cfs
Storm frequency	= 25 yrs	Time to peak	= n/a
Time interval	= 3 min	Hyd. volume	= 0 cuft
Inflow hyd. No.	= 5 - Flow into Sediment Pond	Max. Elevation	= 345.90 ft
Reservoir name	= Sediment Pond	Max. Storage	= 975,846 cuft

Storage Indication method used.



4.5 DRAINAGE BASIN