ENGINEERING REPORT FOR INACTIVE CCR LANDFILL

FORMER PLANT ARKWRIGHT – AP2-DAS LANDFILL

MACON-BIBB COUNTY, GEORGIA

FOR

Georgia Power

November 2018

JACOBS

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1. BACKGROUND AND OBJECTIVE

AP2-DAS Landfill was issued a Closure Certificate by the Environmental Protection Division (EPD) on July 30, 2010. Although this CCR unit has officially been closed, Georgia Power plans to remove the CCR waste from this CCR unit. After removal of CCR, the area will be regraded and revegetated. This engineering report has been included in the permit application to provide supporting documentation for the updated Closure Plan.

2. LOCATION RESTRICTION DEMONSTRATION

In accordance with the requirements of Georgia Solid Waste Management Rule 391-3-4-.10(9), an Inactive CCR Landfill permit application must include the location restriction demonstration requirements in 40 CFR 257.64 for unstable areas. Onsite soil conditions, local geologic/geomorphologic features, and human-made surface and subsurface features within the permit boundary were studied during the preparation of this CCR unit solid waste handling permit application. No unstable areas within the AP2-DAS Landfill permit boundary were identified. Additional information for the onsite conditions can be found in the Limited Hydrogeological Study. Any sub-surface human-made features that may be found during excavation of CCR will be evaluated by a professional engineer and changes will be made to the Closure Plan, if necessary. A certification from a Georgia-Registered Professional Engineer is included in Appendix A.

3. STORMWATER MANAGEMENT DURING EXCAVATION

The run-on and run-off control plan for AP2-DAS Landfill, which is included in the Closure Plan of this permit application, was prepared to comply with Solid Waste Management Rule 391-3-4-.10. The below documentation has been provided to demonstrate how the run-on and run-off controls were evaluated based on the current conceptual design for CCR removal. The run-on and run-off control systems will be further evaluated during development of construction drawings and will be modified based on field conditions, if needed.

3.1 General Description of Stormwater Management System

Stormwater control during CCR removal from the AP2-DAS Landfill has two goals:

1) Prevent the release of CCR contact stormwater run-off generated from the CCR excavation area, and
2) Minimize the quantity of this stormwater by controlling run-on from the portions of the site outside of the limits of CCR.

During CCR removal, a combination of containment berms, ditches, equalization basin storage, and pumping and piping (to be selected by the contactor as the work proceeds) will be utilized to collect and manage stormwater and contact water. The initial excavation, as shown in the Closure Plan drawings, establishes an equalization basin to store run-off originating from within the CCR excavation area. This basin will be sized to accommodate the CCR contact run-off (within the CCR excavation area) generated by the 100-year, 24-hour design storm event.

Overbank flooding of Beaverdam Creek and flooding influenced by the backwater conditions of the Ocmulgee River will not be entirely controlled once the southern limit of the CCR excavation proceeds below the 100-year flood plain elevation.

3.2 Design Criteria

Stormwater flows used for evaluating run-on and run-off controls were calculated using either the Rational Method or the Soil Conservation Service (SCS) Technical Release 55 (TR-55) procedures. The Rational and TR-55 Methods use land use data representative of the percent of a drainage area that is impervious, runoff coefficient and curve number, respectively, along with soil characteristics to predict the expected runoff from the drainage area. Rainfall distribution and precipitation values were taken from the Georgia Stormwater Management Manual and included references to National Oceanic and Atmospheric Administration data.

Berms and ditches will be necessary to divert the peak discharge from a 24-hour, 100-year storm around the CCR excavation area to an adequately sized outfall so that this surface water does not run-on to the active CCR excavation. The equalization basin has been evaluated for the 100-year runoff generated from within the CCR excavation. The calculation, presented in Appendix B, assumes that the basin is empty at the beginning of the storm event and that the CCR excavation area has reached its maximum size.

3.3 Run-On Prevention

Berms and ditches constructed for CCR removal will be utilized to control run-on from flowing into the excavation area. Details of the expected berms and ditches are described below. Calculations and drainage area maps are included in Appendix B.

a) Prior to CCR excavation, a diversion berm along the northern perimeter of the site will be installed to route drainage away from the excavation area. The associated ditch will be designed to manage the 100-year, 24-hour design storm. See Sheets 6 and 11 of the Closure Plan drawings for location and detail of the northern ditch. Detailed calculations are presented in Appendix B of this report.

b) As the excavation proceeds to the south, a run-on control ditch and berm system will be constructed to prevent non-contact CCR stormwater (not associated with river or creek flooding) from entering the CCR excavation area from land areas surrounding the CCR excavation. The ditch portion of this system will route base flows from the creek and wetland around the excavation and into Beaverdam Creek. See Sheets 7 and 11 of the Closure Plan drawings for location and detail of the diversion ditch. Additional detailed design will be completed prior to construction.

3.4 Stormwater Within Excavation

CCR contact stormwater run-off for the AP2-DAS Landfill will be managed via an equalization basin that will be constructed and maintained during removal of the CCR. The equalization basin will be completely contained within the excavation area and will provide a minimum volume equal to the 100-year runoff generated by the contributing CCR excavation area. The volume of this basin will increase as the work progresses and will be pumped out as needed to maintain sufficient volume for the area draining into the excavation, excluding flood events described in Section 3.1.

As excavation progresses, the site shall be graded such that all run-off from disturbed CCR excavation areas drain to the equalization basin or is pumped from low points created by the excavation. The greatest volume required, 250,000 cubic feet, occurs when the maximum CCR removal area is disturbed. This volume is based on the following hydrologic values:

- Disturbed Area - 10.25 Acres (conservatively estimated)
- Curve Number - 88
- Equalization Basin Footprint – 1.50 Acres with a Curve Number of 98
- Disturbed Area of CCR – 8.75 Acres with a Curve Number of 86 (This assumes the highest CN, which represents that most of the site is disturbed earth below the CCR.)

The collected water will be pumped from the equalization basin to onsite storage tanks, or removed by tanker truck, and transported to a permitted wastewater facility for treatment to maintain sufficient available volume. The combination of storage tanks and tanker truck removal will be determined by contractor based on the rate of progression of CCR excavation.

4. SUMMARY

AP2-DAS Landfill was closed under the previous Solid Waste Management Rules. Georgia Power plans to remove the CCR waste from this CCR unit. Evaluations have not revealed the presence of any unstable areas within the permit boundary. A combination of berms and ditches will be used to prevent stormwater run-on from adjacent land areas from entering the CCR excavation. Stormwater run-off will be stored in an equalization basin within the excavation area until pumped to onsite storage tanks or removed by tanker truck. Overbank flooding of Beaverdam Creek and flooding influenced by the backwater conditions of the Ocmulgee River are not entirely controlled once the southern limit of the CCR excavation proceeds below the 100-year flood plain elevation.

Appendix A. **PE Certification for Location Restriction Demonstration**

LOCATION RESTRICTION DEMONSTRATION

UNSTABLE AREAS

FORMER PLANT ARKWRIGHT – AP2-DAS LANDFILL

GEORGIA POWER COMPANY

Georgia's Solid Waste Management Rule 391-3-4-.10(9) requires that Inactive CCR Landfill solid waste handling permit applications meet requirements of (9)(c)3.(i) – (iv), including the location restriction demonstration requirements in 40 C.F.R. 257.64 for unstable areas.

Per § 257.64 of Subpart D - Standards for the Disposal of Coal Combustion Residuals in Landfills and Surface Impoundments, the owner or operator must demonstrate that the facility is not located within an unstable area or a demonstration must be made that recognized and generally accepted good engineering practices have been incorporated into the design of the CCR unit to ensure that the integrity of the structural components of the CCR unit will not be disrupted. As defined in § 257.53, an unstable area means a location that is susceptible to natural or human-induced events or forces capable of impairing the integrity, including structural components of some or all of the CCR unit that are responsible for preventing releases from such unit. Unstable areas can include poor foundation conditions, areas susceptible to mass movements, and karst terrains.

The AP2-DAS Landfill is located in Bibb County approximately six miles northwest of Macon, Georgia. A review of the site geology, hydrogeology, and information available of onsite surface and subsurface conditions confirmed that the CCR unit is not located within an unstable area having subsurface soil conditions, onsite geologic or geomorphologic features, and/or on-site human-made features or events (both surface and subsurface) that may result in significant differential settling of the foundation of the CCR unit.

I hereby certify, to the best of my knowledge and based on the information presented in the CCR Unit Solid Waste Handling Permit Application dated November 2018, that for Georgia Power's former Plant Arkwright – AP2-DAS Landfill, the unstable areas location restriction demonstration meets the requirements of 391-3-4-.10(9)(c)3.(i).

GEORGIA REGISTERED No. PE14390 PROFESSIONAL ENGINEER MICHAEL T. FEENEY

11-14-18

Michael T. Feeney, P.E.
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BRET MCCLELLAN No 1540 GEORGIA REGISTERED PROFESSIONAL GEOLOGIST

11/14/18

Bret McClellan, P.G.
Licensed State of Georgia, PG No. 1540

Appendix B. **Stormwater Management System Calculations**

Stormwater Calculations

AP2-DAS Landfill

This appendix presents stormwater calculations for AP2–DAS Landfill. Calculations are presented for flow depth and velocity in storm water conveyances, and the storage capacity of the equalization basin. Results are summarized below, and supporting details are on the following pages.

Ditch Calculations

The following output summarizes the Manning's equation calculations for the existing run on/off control ditches at the AP2-DAS Landfill. The FlowMaster software by Bentley was used to complete calculations based on the completed hydrology model of the site and cross sections taken from the recent aerial survey data.

The calculations are based on cross section and surface condition of the ditch as well as the longitudinal slope. The results include the existing data for each ditch, and also provide the calculated depth of flow and a velocity for the selected design storm flow rate.

Also attached to this Appendix are drainage area maps detailing the location of the modeled ditch cross sections and the associated drainage areas, and the hydrological calculation results for the drainage areas.

Summary of Ditch Calculations

		25 -Yr Event				100 -Yr Event			
Ditch Section	Actual Depth	Flow	Depth	Velocity	Notes	Flow	Depth	Velocity	Notes
Northern Diversion	3	22.5	1.5	3.4	OK	33.7	1.7	3.7	OK
Flow	CFS								
Depth	Feet								
Velocity	FPS								

Equilization Basin Storage Calculation

Elevation	Contour Area (SF)	Incremental Volume (CF)	Accumulated Volume (CF)
306	500		
308	3500	4000	4000
310	19900	23400	27400
312	27000	46900	74300
314	33700	60700	135000
316	40800	74500	209500
318	48200	89000	298500

The available storage volume in the equalization basin is 298,500 cubic feet. The volume required to store runoff within the CCR excavation from the 100-year, 24-hour storm is 250,000 cubic feet. Since the available volume is greater than the required volume, the equalization basin size is acceptable.

AP2-DAS Northern Diversion 25 yr Output

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.035	
Channel Slope	0.01000	ft/ft
Left Side Slope	3.00	ft/ft (H:V)
Right Side Slope	3.00	ft/ft (H:V)
Discharge	22.50	ft^3/s

Results

Normal Depth	1.49	ft
Flow Area	6.68	ft^2
Wetted Perimeter	9.43	ft
Hydraulic Radius	0.71	ft
Top Width	8.95	ft
Critical Depth	1.28	ft
Critical Slope	0.02219	ft/ft
Velocity	3.37	ft/s
Velocity Head	0.18	ft
Specific Energy	1.67	ft
Froude Number	0.69	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	1.49	ft
Critical Depth	1.28	ft
Channel Slope	0.01000	ft/ft
Critical Slope	0.02219	ft/ft

AP2-DAS Northern Diversion Output

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.035	
Channel Slope	0.01000	ft/ft
Left Side Slope	3.00	ft/ft (H:V)
Right Side Slope	3.00	ft/ft (H:V)
Discharge	33.70	ft^3/s

Results

Normal Depth	1.74	ft
Flow Area	9.04	ft^2
Wetted Perimeter	10.98	ft
Hydraulic Radius	0.82	ft
Top Width	10.41	ft
Critical Depth	1.51	ft
Critical Slope	0.02103	ft/ft
Velocity	3.73	ft/s
Velocity Head	0.22	ft
Specific Energy	1.95	ft
Froude Number	0.71	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	1.74	ft
Critical Depth	1.51	ft
Channel Slope	0.01000	ft/ft
Critical Slope	0.02103	ft/ft

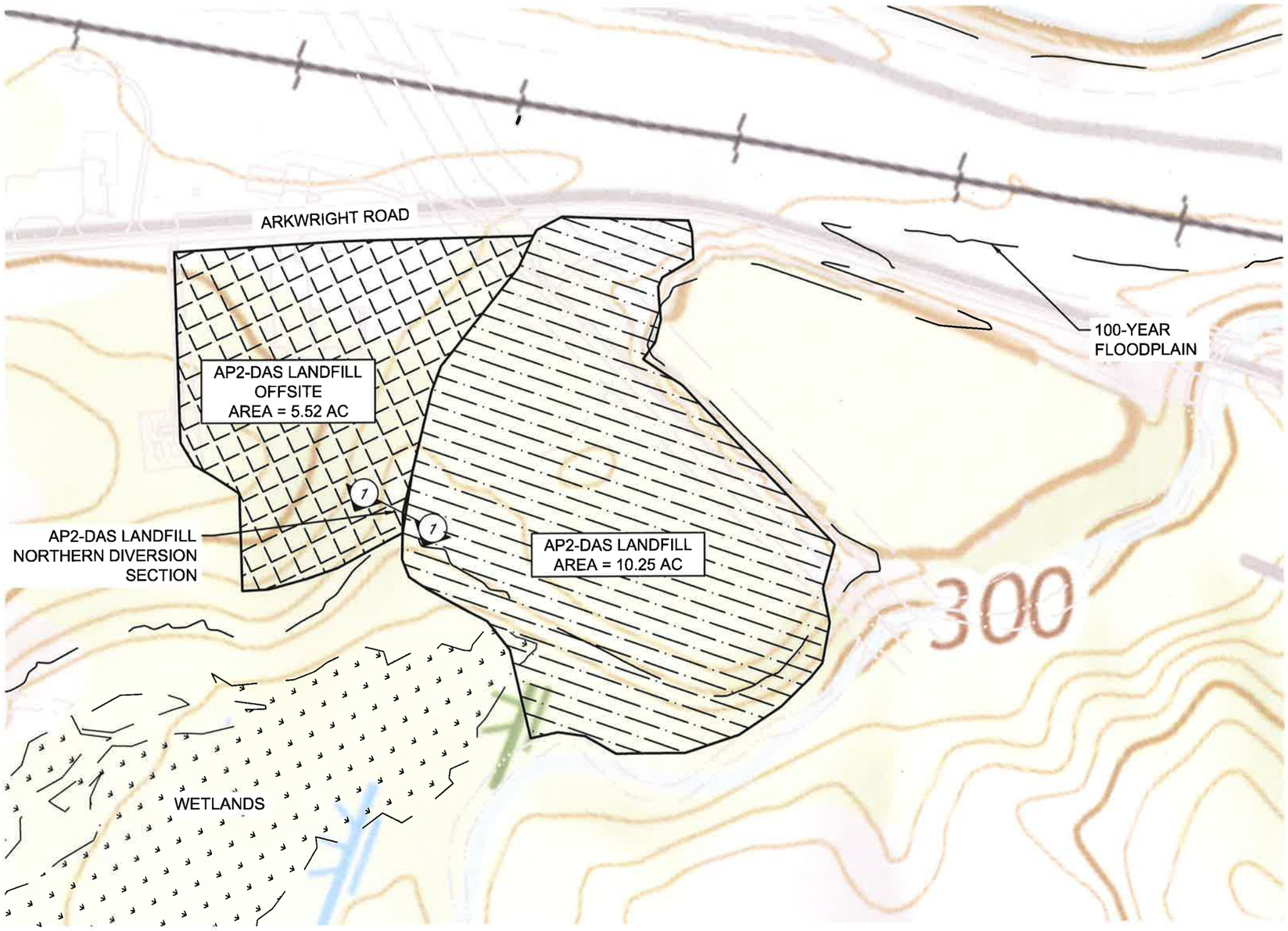
Hydrology

The following output summarizes the Hydrologic calculations for the AP2-DAS Landfill. The calculations were completed using the Hydroflow Hydragraphs software to determine flow rates and total runoff volumes for the relevant design storms.

The calculations use drainage area, land use, flow times and rainfall intensities to compute runoff hydrographs representing runoff rates over time. These variables were determined based on-site visits, aerial topography, estimations of impervious land cover, and local rainfall data available from NOAA.

Each hydrograph represents runoff over time, and the total storm runoff volume for the specific drainage basin. The peak flow rates are used to size stormwater conveyances, and the total volume is used to determine the Equilization Basin volume.

Included in this Appendix are drainage area maps associated with the runoff hydrographs detailed in the model and represented in the output.



LEGEND

DITCH SECTION - PLAN

0 200' 400'

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JACOBS	FORMER PLANT ARKWRIGHT AP2-DAS LANDFILL	PROJECT NO.: 35DK9203 DATE: NOVEMBER 2018 SCALE: AS SHOWN
	DRAINAGE AREA MAP	FIGURE NO.: 1

Hydrograph Return Period Recap

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066

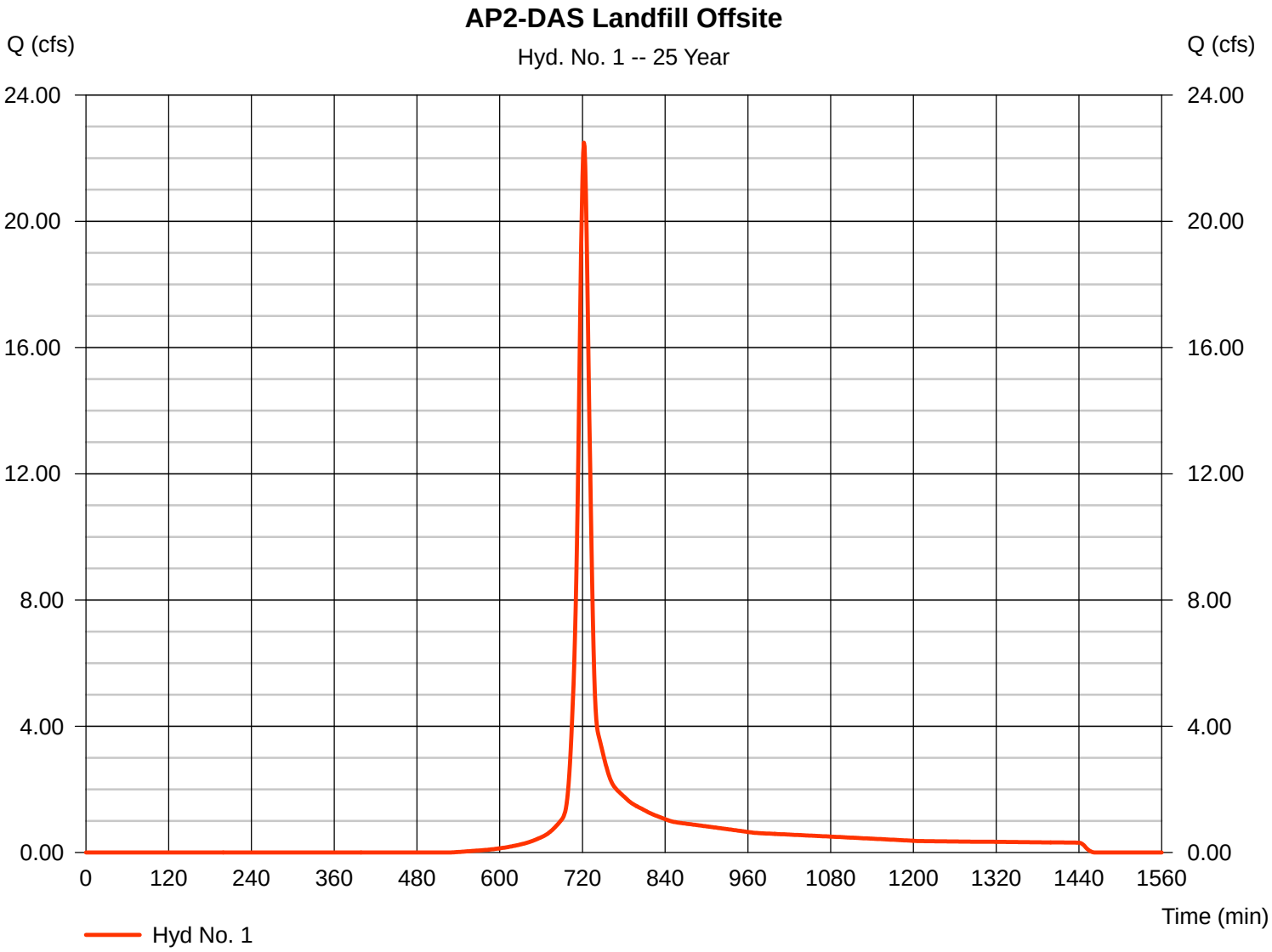
Hyd. No.	Hydrograph type (origin)	Inflow Hyd(s)	Peak Outflow (cfs)								Hydrograph description
			1-Yr	2-Yr	3-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr	
1	SCS Runoff	------	6.014	8.174	-------	12.29	16.27	22.49	-------	33.69	AP2-DAS Landfill Offsite
5	SCS Runoff	------	38.18	45.41	-------	58.13	69.54	86.35	-------	114.95	AP2-DAS Landfill

Hydrograph Report

Hyd. No. 1

AP2-DAS Landfill Offsite

Hydrograph type	=	SCS Runoff	Peak discharge	=	22.49 cfs
Storm frequency	=	25 yrs	Time to peak	=	722 min
Time interval	=	1 min	Hyd. volume	=	60,533 cuft
Drainage area	=	5.520 ac	Curve number	=	70
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	14.00 min
Total precip.	=	6.27 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484



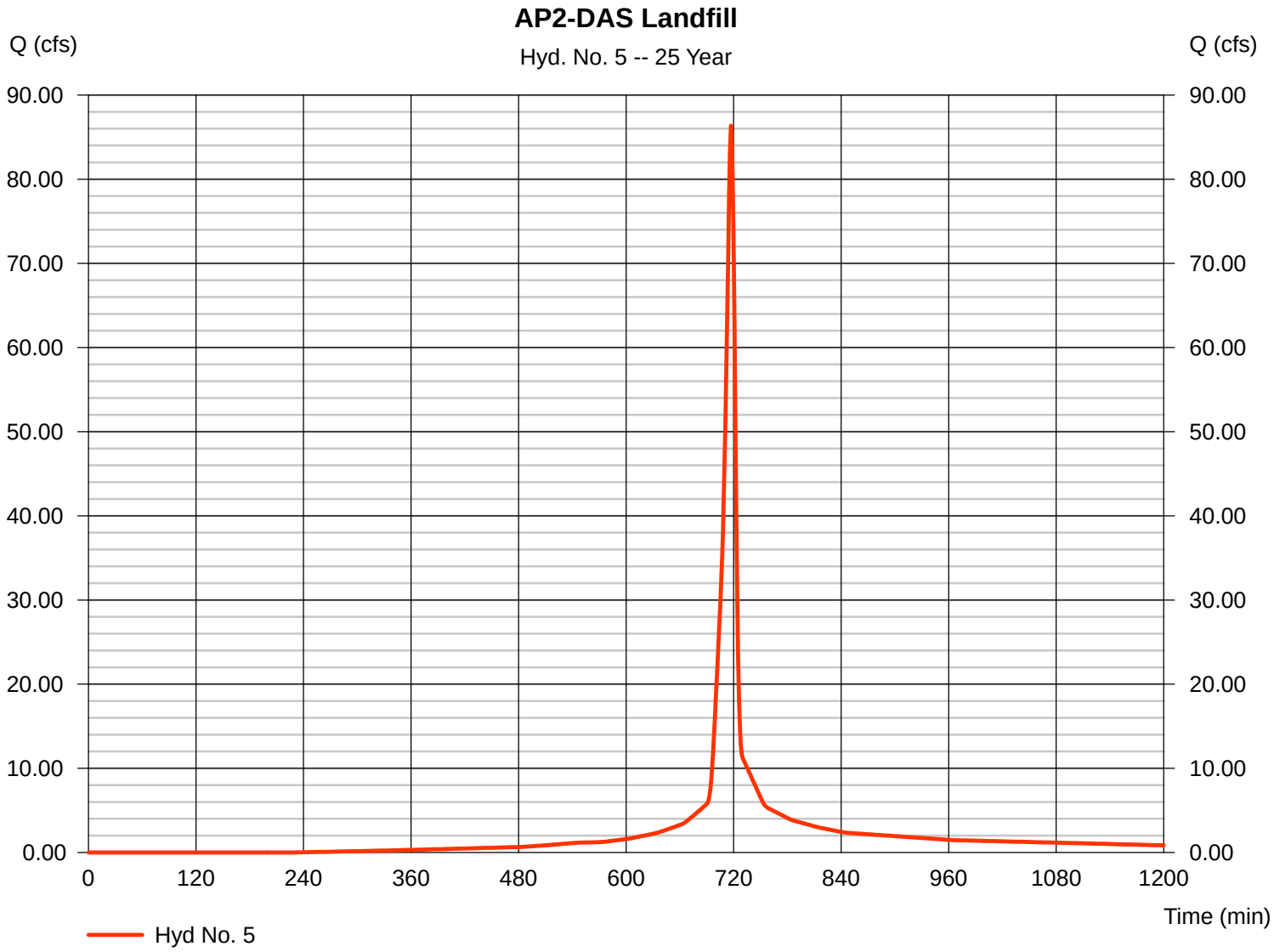
Hydrograph Report

Hyd. No. 5

AP2-DAS Landfill

Hydrograph type	=	SCS Runoff	Peak discharge	=	86.35 cfs
Storm frequency	=	25 yrs	Time to peak	=	717 min
Time interval	=	1 min	Hyd. volume	=	187,487 cuft
Drainage area	=	10.250 ac	Curve number	=	88*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	USER	Time of conc. (Tc)	=	6.00 min
Total precip.	=	6.27 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(8.750 x 86) + (1.500 x 98)] / 10.250

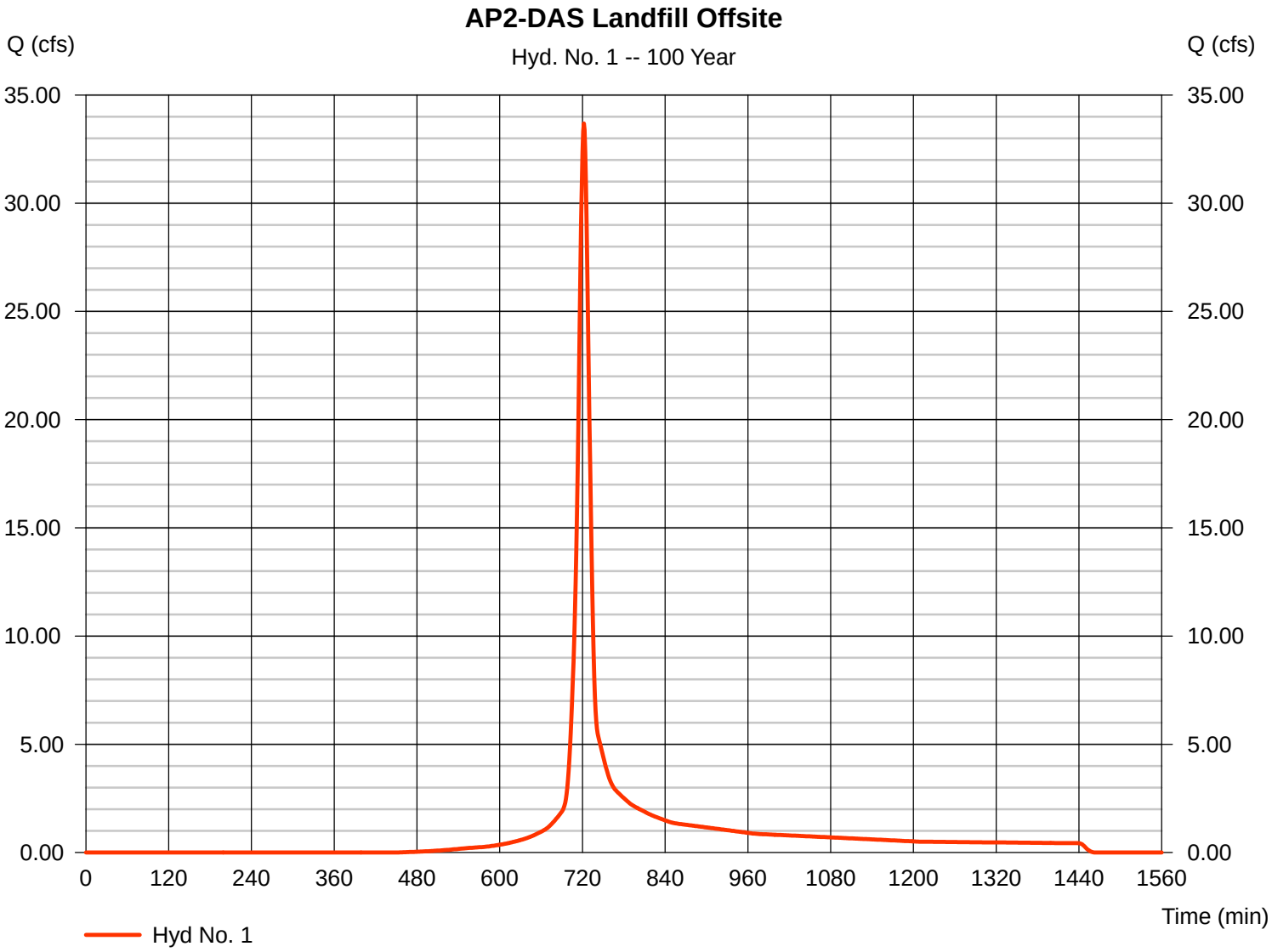


Hydrograph Report

Hyd. No. 1

AP2-DAS Landfill Offsite

Hydrograph type	=	SCS Runoff	Peak discharge	=	33.69 cfs
Storm frequency	=	100 yrs	Time to peak	=	722 min
Time interval	=	1 min	Hyd. volume	=	90,660 cuft
Drainage area	=	5.520 ac	Curve number	=	70
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	14.00 min
Total precip.	=	8.07 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484



Hydrograph Report

Hyd. No. 5

AP2-DAS Landfill

Hydrograph type	=	SCS Runoff	Peak discharge	=	114.95 cfs
Storm frequency	=	100 yrs	Time to peak	=	717 min
Time interval	=	1 min	Hyd. volume	=	254,649 cuft
Drainage area	=	10.250 ac	Curve number	=	88*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	USER	Time of conc. (Tc)	=	6.00 min
Total precip.	=	8.07 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(8.750 x 86) + (1.500 x 98)] / 10.250