RUN-ON AND RUN-OFF CONTROL SYSTEM PLAN

FOR THE:
SOUTHWESTERN ELECTRIC POWER COMPANY
FLINT CREEK POWER PLANT LANDFILL
CLASS 3N LANDFILL
PERMIT 0273-S3N-R2

PREPARED FOR:
SOUTHWESTERN ELECTRIC POWER COMPANY
428 TRAVIS STREET
SHREVEPORT, LOUISIANA 71101

PREPARED BY:
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TOLEDO, OHIO 43604

SEPTEMBER 2021

HULL
Environment / Energy / Infrastructure

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1.0 INTRODUCTION

This Run-on and Run-off Control System Plan (Plan) has been prepared for the Flint Creek Power Plant Landfill (Landfill) in Gentry, Arkansas, to comply with the requirements of Federal Regulation Title 40, Subpart §257.81. The Landfill is currently being operated under a Class 3 Non-Commercial Landfill permit modification issued by the Arkansas Department of Environmental Quality (ADEQ) on December 17, 2014 (permit 0273-S3N-R2).

Federal Regulation Title 40, Subpart §257.81 states that the Owner or Operator of an existing or new coal combustion residual (CCR) landfill or any lateral expansion of a CCR landfill must comply with the following:

a. Design, construct, operate, and maintain:

   1. A run-on control system to prevent flow onto the active portion of the CCR unit during the peak discharge from a 24-hour, 25-year storm; and

   2. A run-off control system from the active portion of the CCR unit to collect and control at least the water volume resulting from a 24-hour, 25-year storm.

b. Run-off from the active portion of the CCR unit must be handled in accordance with the surface water requirements under § 257.3-3.

c. Prepare a Run-on and Run-off Control System Plan for existing CCR landfills according to the following timelines:

   1. The initial run-on and run-off control system plan no later than October 17, 2016.

   2. Periodic run-on and run-off control system plans (from the date of the initial Plan) are placed in the Landfill's Operating Record every five years.

d. Obtain a certification from a qualified professional engineer stating that the initial and periodic run-on and run-off control system plans meet the requirements of §257.81.

e. Comply with the recordkeeping requirements specified in § 257.105(g), the notification requirements specified in § 257.106(g), and the internet requirements specified in § 257.107(g).

This Plan represents the 5-year revision of the original September 2016 Plan, as required by § 257.81(c)(4), and is in compliance with the requirements listed above. The design of the run-on and run-off control measures were completed as part of the current permit for the Landfill, which was obtained after submittal of the Intermediate Liner and Leachate Collection System Permit Modification application, dated March 2011 (Permit Modification). The Landfill has installed and is maintaining the run-on and run-off controls shown on Figures 1 and 2 in Appendix A.

Figure 3 in Appendix A provides information on additional controls that will be added in the upcoming construction project that is planned to begin in October 2021. The main work activities that affect the run-on and run-off controls for the Landfill include:

1. Construction of a compacted soil fill perimeter berm around Areas 2, 3 and 4 for contact water control during placement of the bottom ash protective cover over the Areas.

2. Removal of the existing Fabriform® letdown on the west side of the landfill near the Area 1 separation berm and placement of the vegetative soil cover to re-establish the final cover system.

3. Construction of the leachate collection system within Areas 2, 3, and 4.

4. Connection of Area 2 to Area 1 via removal of the existing Area 1 separation berm.

5. Construction of the interim contact water pipe and inlet controls to manage contact water during disposal activities.

6. Construction of a rain cover and wind ballast system over Areas 3 and/or 4, and installation of Fabriform® letdowns at the low points of Areas 3 and 4 to manage stormwater runoff from these areas prior to certifying them for filling activities.

2.0 RUN-ON CONTROLS

The Preamble from Subpart 257 of CFR 40 defines run-on as "any liquid that drains over land onto any part of a CCR landfill or any lateral expansion of a CCR landfill. In surface water hydrology, run-on is a quantity of surface run-off, or excess rain, snowmelt, or other sources of water, which flows from an upstream catchment area onto a specific downstream location." This section of this Plan describes the controls at the Landfill to manage run-on from outside the Landfill footprint and from inside the Landfill footprint, which are designed to manage the peak flow from a 24-hour, 25-year storm event.

2.1 Run-on Controls from Outside the Landfill Footprint

The Landfill is located in an area with gentle slopes that generally drain from northeast to southwest. Figures 1 and 2 in Appendix A shows the layout of the Landfill, nearby existing topography, and the run-on controls.

Perimeter ditches are located along the north and west sides of the Landfill to collect run-on and keep it away from the Landfill. Run-on that is collected by these ditches (north ditch and upstream portion of west ditch) is conveyed to either the West Sediment Basin or to stormwater culverts under Swepco Road at the southwest corner of the Landfill, which ultimately discharge to the Primary Ash Pond located southwest of the Landfill. Design calculations for the perimeter ditches are provided in the Permit Modification.

An existing intermittent stream located east of the Landfill collects run-on from the east and conveys it to stormwater culverts under Swepco Road at the southeast corner of the Landfill, which ultimately discharge to the Primary Ash Pond. The portion between the east side of the Landfill and the perennial stream, as well as the south side of the Landfill, slope away from the Landfill, thus not generating run-on to the Landfill.

2.2 Run-on Controls from Inside the Landfill Footprint

The Landfill, since obtaining approval from ADEQ for the Permit Modification in December 2014, is being developed in phases. Construction of the first phase began immediately after gaining the permit modification approval and was completed and certified in July 2016. The initial construction activities consisted of regrading the Landfill to improve surface water drainage and prepare to completely cover the entire Landfill with either a Final Cover System (on the outer landfill 4:1 slopes that have reached final permitted grades) or with an Intermediate Liner System (on the remainder of the Landfill, which is the center area that will receive waste during the remainder of the Landfill's life). Details for the Final Cover and Intermediate Liner systems are provided in the Permit Modification. Other components constructed in the first phase were a leachate collection pond, a leachate treatment system (under a wastewater permit that is separate from the Permit Modification), a contact water management pond and conveyance pipe, and surface water management structures (sediment basins, erosion control terraces, letdowns, etc.). Figure 2

depicts the general layout of the Landfill at the end of this first phase of construction. Detailed information on the first phase of construction is as follows:

1. The Area 1 Intermediate Liner and leachate collection system was completed and documented in a certification report submitted to ADEQ in February 2016 (Hull document # APO066.100.0021).

2. The leachate collection pond was construction and documented in a certification report submitted to ADEQ in August 2016 (Hull document # APO066.100.0022).

3. The Intermediate Liner System for Areas 2 through 4 was completed and documented in a certification report submitted to ADEQ in March 2017 (Hull document # APO066.100.0023).

4. The Final Cover System on the outer slopes was completed and documented in a certification report submitted to ADEQ in July 2017 (Hull document # APO066.100.0024). This portion of the Landfill does not generate run-on to the Landfill.

The existing Intermediate Liner System for Areas 2, 3 and 4, which is outside the active filling area (Area 1), did not have a leachate collection system installed during the initial phase of construction. The surface of Areas 2, 3, and 4 consists of an exposed 60 mil HDPE geomembrane. To keep stormwater (run-on) away from the active filling area, an area separation berm was constructed along the upstream side of Area 1, which conveys stormwater to the west perimeter ditch and, thus, minimizes leachate and contact water generation (see Figure 2).

As shown on Figure 3, an area separation berm will also be constructed along the upstream side of Area 2 during the upcoming construction event to control run-on away from Area 2. Once the bottom ash protective cover is installed over Areas 3 and 4, a geomembrane rain cover and wind ballast system will be installed over Areas 3 and 4 to ensure no contact water is generated from the areas. After the rain cover and wind ballast system is installed, Fabriform® letdowns will be installed at low points of Areas 3 and 4 to manage stormwater runoff from these areas.

Details for the area separation berm are provided in the Permit Modification. Calculations were performed to verify that the Area 1 and Area 2 separation berms will manage the peak flow from a 24-hour, 25-year storm event and are provided in Appendix B.

3.0 RUN-OFF CONTROLS

The Preamble from Subpart 257 of CFR 40 defines run-off as "any liquid that drains over land from any part of the CCR landfill." This section of this Plan describes the controls at the Landfill to manage run-off from the Landfill's Final Cover System and from the active filling area, which are designed to manage the peak flow from a 24-hour, 25-year storm event. Details for the run-off controls discussed below are provided in the Permit Modification and are shown on Figures 2 and 3.

3.1 Run-off Controls from Landfill's Final Cover System

The Landfill's Final Cover System has been designed to minimize stormwater infiltration into the Landfill, thus minimizing leachate generation. The surface of the Final Cover System consists of a vegetated cover to minimize erosion of the final cover soils. A subsurface drainage system (i.e., a double-sided geocomposite drainage net) is also part of the design to collect and convey stormwater that infiltrates through the final cover soils. Stormwater from the Final Cover System flows away from the active filling area and discharges to perimeter ditches and diversion berms via erosion control terraces and letdowns. The majority of the run-off from the Final Cover System is conveyed to either the North or West Sediment Basins. The small portions that are not conveyed to the Sediment Basins are conveyed directly to the stormwater culverts under Swepco Road on the southwest and southeast corners of the Landfill. All stormwater run-off from the Final Cover System is eventually discharged to the Primary Ash Pond. The design calculations for the run-off controls are provided in the Permit Modification.

3.2 Run-off Controls for Contact Water Management System

Run-off generated within the active filling area will be managed as contact water and conveyed to the Contact Water Pond located southwest of the Landfill. As waste is placed in the active filling area, the outer 4:1 slopes will be covered in accordance with the permit to minimize contact water generation. Filling operations will occur in such way that the inner grades of the Landfill will be sloped for contact water to gravity-drain towards the Contact Water Pond inlet channels located on the southwest corner of the Landfill, and will ultimately discharge to the Contact Water Pond. The design calculations for the run-off controls are provided in the Permit Modification.

As part of the upcoming Area 2 leachate collection system construction activities, an interim contact water pipe will be installed to provide gravity flow of contact water from within Area 2 to the northern concrete inlet channel of the Contact Water Pond. The design of the interim contact water pipe is consistent with the maximum contact water design flow established in the Permit Modification. Appendix B-II contains calculations for the interim contact water pipe.

3.3 Leachate Collection and Management System

Leachate from the Landfill is collected via a 1.5-foot (minimum thickness) bottom ash drainage layer and perforated collection pipes, which all drain to the southwest corner of the Landfill, at which point the leachate pipe becomes solid and conveys leachate from the Landfill to the Leachate Pond. An on-site treatment system has been constructed (under a wastewater permit that is separate from the Permit Modification) to treat the Landfill's leachate prior to discharging it into the Contact Water Pond. The existing Area 1 leachate collection pipe and planned Area 2 leachate collection pipe are shown on Figures 2 and 3, respectively.

4.0 PLAN AMENDMENTS AND REVISIONS

In accordance with §257.81(c)(2), this Plan may be amended at any time, if desired by the owner or operator of the Landfill or if there is a change in conditions that substantially affect the written plan in effect (e.g., changes in the Landfill design, construction, operation, and/or maintenance). In such cases, amendments shall be made to the written plan and placed in the Landfill's operating record.

In accordance with §257.81(c)(4), the owner or operator must prepare periodic run-on and run-off control system plans every five years, at a minimum. This Plan represents the 5-year revision of the original September 2016 Plan, as required by § 257.81(c)(4). The original plan was placed in the Landfill's operating record on October 16, 2016.

All amendments resulting from changes in in the Landfill design, construction, operation, and/or maintenance shall be reviewed and certified by a qualified professional engineer in accordance with Section 5.0 of this Plan. All scheduled reviews and amended plans shall be recorded in the Plan Review Log provided in Appendix C. The five-year reviews shall be recorded even if no changes are made to the Plan as a result of the review.

5.0 PROFESSIONAL ENGINEER CERTIFICATION

The original plan and all reviews and amended plans must obtain certification from a qualified professional engineer stating that the initial and periodic run-on and run-off control system plans meet the requirements of §257.

The undersigned licensed Professional Engineer (P.E.) certifies that this Run-on and Run-off Control Plan has been prepared, reviewed, and/or revised in accordance with the current requirements of Federal Regulation Title 40, Subpart §257.81, including consideration of good engineering practice and industry standards. This certification in no way relieves the owner or operator of the Landfill of his/her duty to fully implement this Plan.

Signature _____ Seal

Name Angela M. Gerdeman

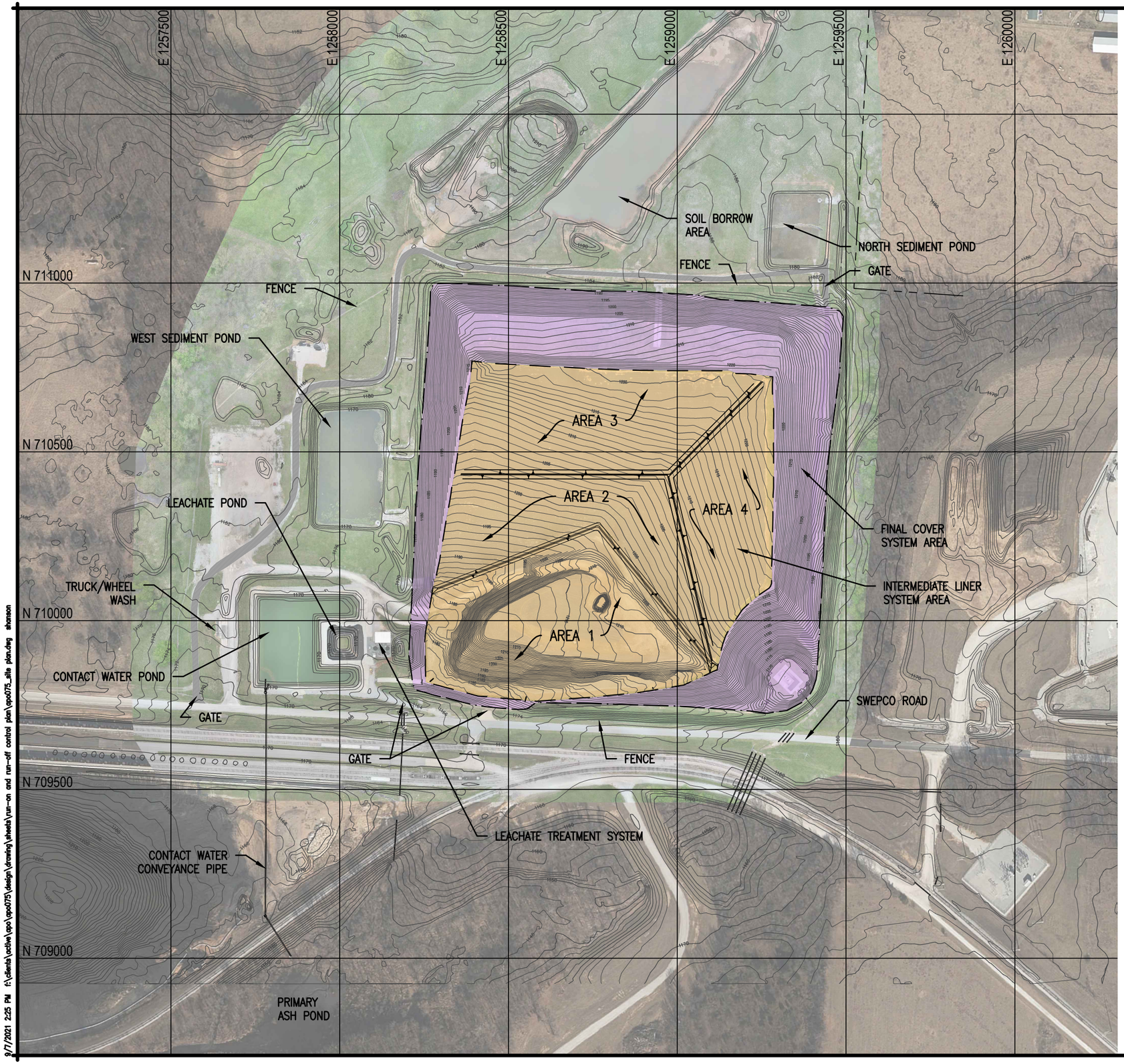
Registration Number 14070

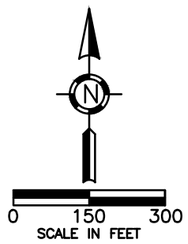
State Arkansas

Date 9-17-21 9-17-21

APPENDIX A

Figures





LEGEND

- PROPERTY BOUNDARY
- INDEX CONTOUR
- INTERMEDIATE CONTOUR
- CULVERT
- APPROXIMATE LIMIT OF FINAL COVER SYSTEM
- APPROXIMATE LIMIT OF INTERMEDIATE LINER SYSTEM
- APPROXIMATE LIMIT OF THE INTERMEDIATE LINER CONSTRUCTION AREA
- APPROXIMATE LIMIT OF THE FINAL COVER SYSTEM CONSTRUCTION AREA

NOTE:

1. THE TOPOGRAPHY WITHIN AREA 1 WAS OBTAINED FROM AN APRIL 27, 2021 FIELD SURVEY PERFORMED BY THE CIVIL LAB SECTION. THE EXISTING GRADES WITHIN AREAS 2, 3, AND 4 REPRESENT AS-BUILT TOP OF 60 MIL HDPE INTERMEDIATE LINER GRADES. THE EXISTING GRADES WITHIN THE LANDFILL'S OUTER FINAL COVER SYSTEM SLOPES REPRESENT AS-BUILT TOP OF VEGETATIVE SOIL GRADES. THE TOPOGRAPHY OUTSIDE THE LANDFILL LIMITS WAS OBTAINED FROM READILY AVAILABLE LIDAR FROM THE ARKANSAS DEPARTMENT OF TRANSFORMATION AND SHARED SERVICES (ARDT). PUBLISHED 2018. HORIZONTAL DATUM: NAD27 ARN. VERTICAL DATUM: NGVD29.

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FIGURE 1
GENERAL SITE PLAN

FLINT CREEK POWER PLANT LANDFILL
RUN-ON AND RUN-OFF CONTROL PLAN
GENTRY, ARKANSAS

LAYOUT BY:	SAH
CHECKED BY:	AMG
DRAWN BY:	SAH
DATE:	9/7/2021
PROJECT NO.	AP0075
FIGURE NO.	1

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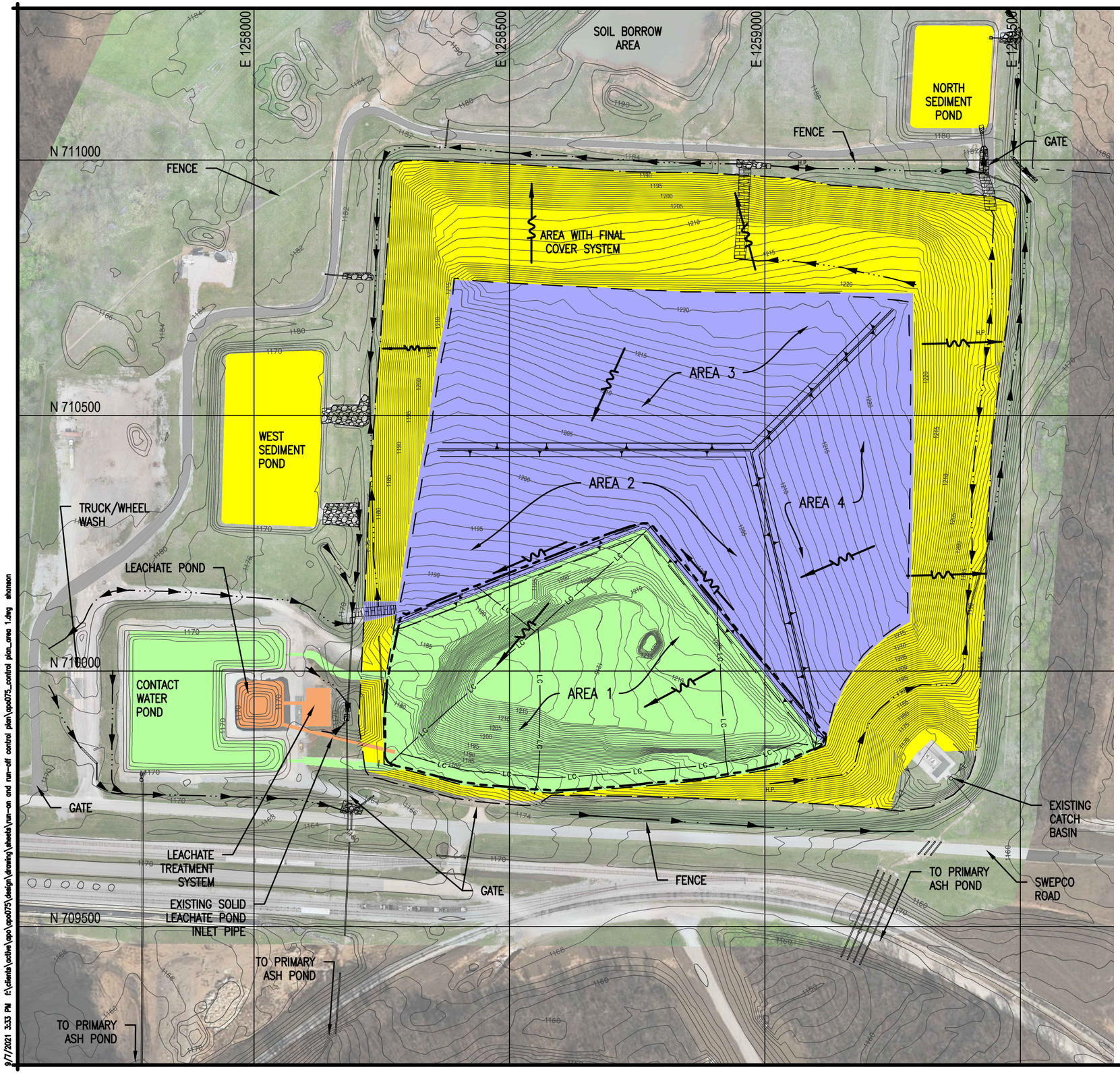

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LEGEND

- PROPERTY BOUNDARY
- 1205 INDEX CONTOUR
- INTERMEDIATE CONTOUR
- AREA 1 SEPARATION BERM
- LIMIT OF AREA 1
- EXISTING CONTACT WATER
- EXISTING STORMWATER RUN-ON
- EXISTING STORMWATER RUN-OFF
- LEACHATE MANAGEMENT COMPONENTS
- STORMWATER FLOW
- GENERAL FLOW DIRECTION
- LC LC EXISTING PERFORATED LEACHATE COLLECTION PIPE

NOTES:

1. THE TOPOGRAPHY WITHIN AREA 1 WAS OBTAINED FROM AN APRIL 27, 2021 FIELD SURVEY PERFORMED BY THE CIVIL LAB SECTION. THE EXISTING GRADES WITHIN AREAS 2, 3, AND 4 REPRESENT AS-BUILT TOP OF 60 MIL HDPE INTERMEDIATE LINER GRADES. THE EXISTING GRADES WITHIN THE LANDFILL'S OUTER FINAL COVER SYSTEM SLOPES REPRESENT AS-BUILT TOP OF VEGETATIVE SOIL GRADES. THE TOPOGRAPHY OUTSIDE THE LANDFILL LIMITS WAS OBTAINED FROM READILY AVAILABLE LIDAR FROM THE ARKANSAS DEPARTMENT OF TRANSFORMATION AND SHARED SERVICES (ARDT). PUBLISHED 2018. HORIZONTAL DATUM: NAD27 ARN. VERTICAL DATUM: NGVD29.
2. THE CONTACT WATER LIMITS SHOWN WITHIN AREA 1 REPRESENT THE WORST-CASE SCENARIO FOR CONTACT WATER GENERATION AT THIS STAGE OF DEVELOPMENT.

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FIGURE 2
AREA 1 RUN-ON AND RUN-OFF CONTROL PLAN

FLINT CREEK POWER PLANT LANDFILL
RUN-ON AND RUN-OFF CONTROL PLAN
GENTRY, ARKANSAS

LAYOUT BY:	SAH
CHECKED BY:	AMG
DRAWN BY:	SAH
DATE:	9/7/2021
PROJECT NO.	AP0075
FIGURE NO.	2

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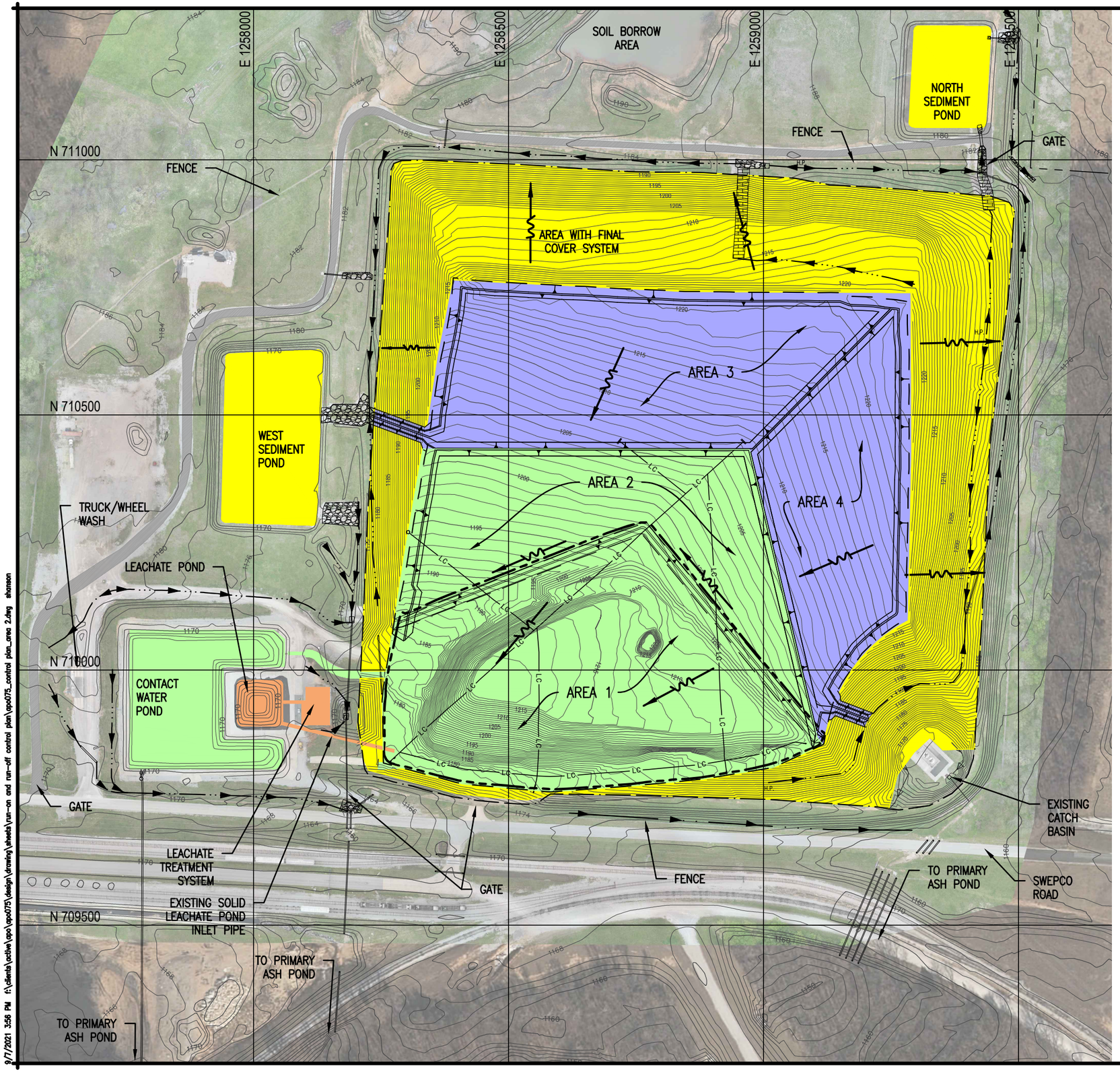

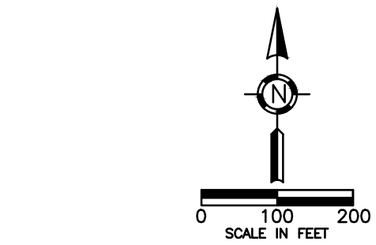

LEGEND

- PROPERTY BOUNDARY
- INDEX CONTOUR (1205)
- INTERMEDIATE CONTOUR
- AREA 1 SEPARATION BERM
- LIMIT OF AREA 1
- POTENTIAL LIMITS OF CONTACT WATER GENERATION (SEE NOTE 2)
- EXISTING STORMWATER RUN-ON
- EXISTING STORMWATER RUN-OFF
- LEACHATE MANAGEMENT COMPONENTS
- STORMWATER FLOW
- GENERAL FLOW DIRECTION
- LC — LC — PERFORATED LEACHATE COLLECTION PIPE

NOTES:

1. THE TOPOGRAPHY WITHIN AREA 1 WAS OBTAINED FROM AN APRIL 27, 2021 FIELD SURVEY PERFORMED BY THE CIVIL LAB SECTION. THE EXISTING GRADES WITHIN AREAS 2, 3, AND 4 REPRESENT AS-BUILT TOP OF 60 MIL HDPE INTERMEDIATE LINER GRADES. THE EXISTING GRADES WITHIN THE LANDFILL'S OUTER FINAL COVER SYSTEM SLOPES REPRESENT AS-BUILT TOP OF VEGETATIVE SOIL GRADES. THE TOPOGRAPHY OUTSIDE THE LANDFILL LIMITS WAS OBTAINED FROM READILY AVAILABLE LIDAR FROM THE ARKANSAS DEPARTMENT OF TRANSFORMATION AND SHARED SERVICES (ARDT). PUBLISHED 2018. HORIZONTAL DATUM: NAD27 ARN. VERTICAL DATUM: NGVD29.
2. THE CONTACT WATER LIMITS SHOWN WITHIN AREAS 1 AND 2 REPRESENT THE WORST-CASE SCENARIO FOR CONTACT WATER GENERATION DURING THIS STAGE OF DEVELOPMENT. HOWEVER, INTERIM SOIL COVER SHALL BE PLACED ON THE OUTER SLOPES OF THE LANDFILL AS FILLING PROGRESSES TO ENSURE THAT THE AREA GENERATING CONTACT WATER DOES NOT EXCEED THE CONTACT WATER POND'S DESIGN CAPACITY OF 10.44 ACRES. ADDITIONAL CONTROLS MAY BE ADDED TO MINIMIZE CONTACT WATER GENERATION, AS NEEDED.
3. THIS PLAN SHOWS RUN-ON AND RUN-OFF CONTROLS FOLLOWING THE UPCOMING CONSTRUCTION OF AREAS 2, 3, AND 4 (TO BEGIN FALL OF 2021). ONCE AREA 2 IS CONSTRUCTED AND CERTIFIED FOR WASTE PLACEMENT, AREAS 3 AND 4 WILL BE COVERED WITH A TEMPORARY RAIN COVER TO ENSURE NO CONTACT WATER IS GENERATED FROM THESE AREAS. THE RAIN COVER WILL BE REMOVED FROM EACH AREA AND THE AREAS WILL BE CERTIFIED ONCE ADDITIONAL DISPOSAL CAPACITY IS NEEDED.

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FIGURE 3
AREA 2 RUN-ON AND RUN-OFF CONTROL PLAN

FLINT CREEK POWER PLANT LANDFILL
RUN-ON AND RUN-OFF CONTROL PLAN
GENTRY, ARKANSAS

LAYOUT BY:	SAH
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DRAWN BY:	SAH
DATE:	9/7/2021
PROJECT NO.	AP0075
FIGURE NO.	3

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APPENDIX B

Calculations

APPENDIX B-I

Area Separation Berm Calculations

Hydrograph Summary Report

Hydraflow Hydrographs by Intelisolve v9.22

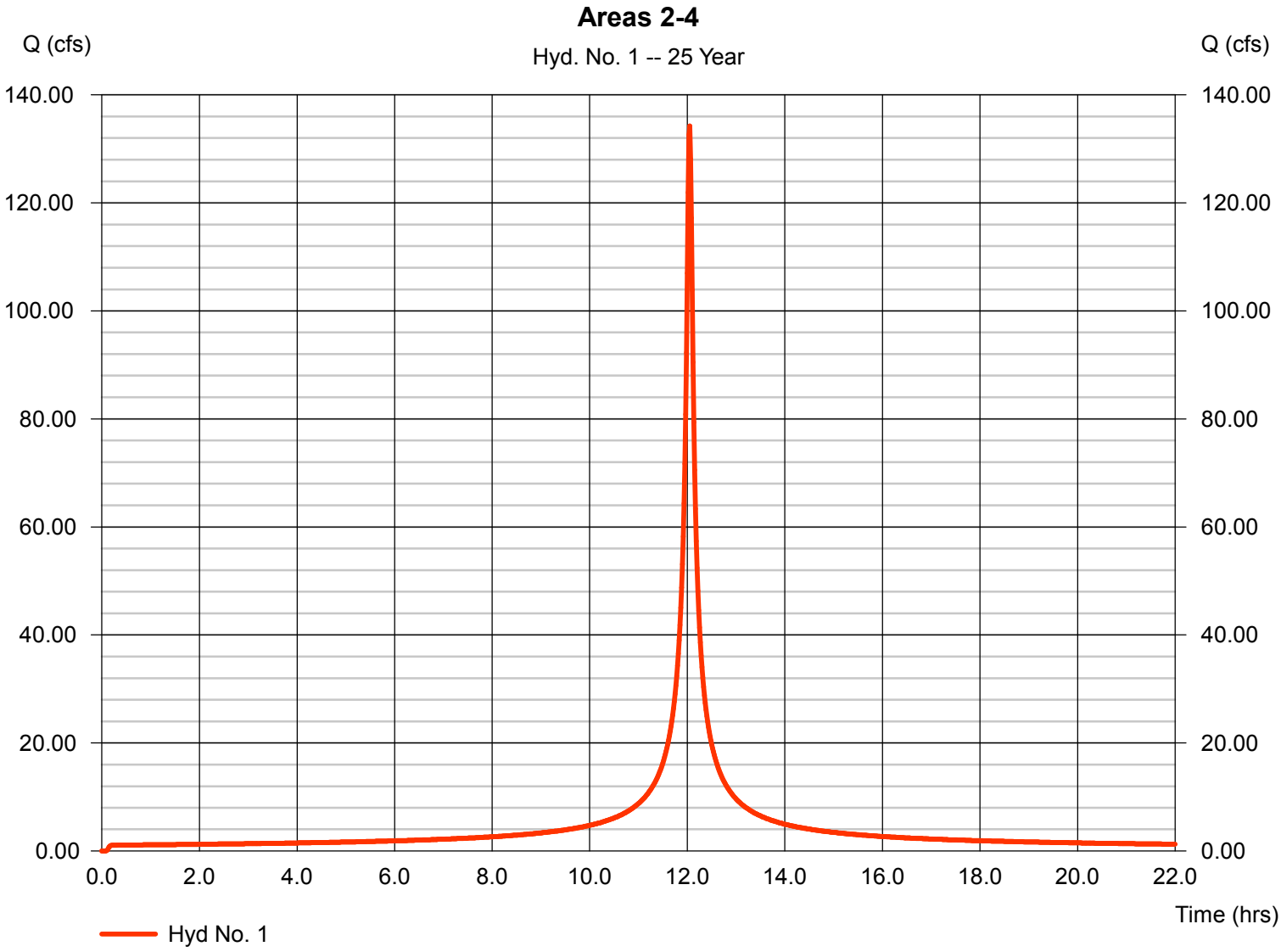
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph description
1	SCS Runoff	134.22	1	723	405,850	----	------	------	Areas 2-4

Hydrograph Report

Hyd. No. 1

Areas 2-4

Hydrograph type	=	SCS Runoff	Peak discharge	=	134.22 cfs
Storm frequency	=	25 yrs	Time to peak	=	12.05 hrs
Time interval	=	1 min	Hyd. volume	=	405,850 cuft
Drainage area	=	15.840 ac	Curve number	=	100
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	4.70 min
Total precip.	=	7.06 in	Distribution	=	Synthetic
Storm duration	=	24.00 hrs	Shape factor	=	484



TR55 Tc Worksheet

Hyd. No. 1

Areas 2-4

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.011		0.011		0.011		
Flow length (ft)	= 300.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 1.75		0.00		0.00		
Land slope (%)	= 4.00		0.00		0.00		
Travel Time (min)	**= 2.99**	**+**	**0.00**	**+**	**0.00**	**=**	**2.99**
Shallow Concentrated Flow							
Flow length (ft)	= 420.00		0.00		0.00		
Watercourse slope (%)	= 4.00		0.00		0.00		
Surface description	= Paved		Paved		Paved		
Average velocity (ft/s)	= 4.07		0.00		0.00		
Travel Time (min)	**= 1.72**	**+**	**0.00**	**+**	**0.00**	**=**	**1.72**
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	= 0.026		0.015		0.015		
Velocity (ft/s)	= 0.00		0.00		0.00		
Flow length (ft)	= 0.0		0.0		0.0		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

Total Travel Time, Tc ..... 4.70 min

Area 1 Cell Separation Berm

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.010	
Channel Slope	0.01000	ft/ft
Left Side Slope	2.00	ft/ft (H:V)
Right Side Slope	25.00	ft/ft (H:V)
Discharge	134.22	ft³/s

Results

Normal Depth	1.03	ft
Flow Area	14.19	ft²
Wetted Perimeter	27.95	ft
Hydraulic Radius	0.51	ft
Top Width	27.68	ft
Critical Depth	1.44	ft
Critical Slope	0.00165	ft/ft
Velocity	9.46	ft/s
Velocity Head	1.39	ft
Specific Energy	2.42	ft
Froude Number	2.33	
Flow Type	Supercritical	

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	1.03	ft
Critical Depth	1.44	ft
Channel Slope	0.01000	ft/ft
Critical Slope	0.00165	ft/ft

FROM PERMIT DRAWING AP0033.100.0144 - PLATE 1 CONTACT WATER AREAS PER PHASE, APPENDIX H-I.

SCALE 1" = 120'

Rainfall Events Listing (selected events)

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	25-YR	Type II 24-hr		Default	24.00	1	6.60	2

Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Area 2 Separation Berm - East Runoff Area=4.000 ac 100.00% Impervious Runoff Depth>6.35"
Flow Length=1,025' Tc=13.9 min CN=98 Runoff=29.42 cfs 2.115 af

Subcatchment 11S: Area 2 Separation Berm - West Runoff Area=5.900 ac 100.00% Impervious Runoff Depth>6.35"
Flow Length=1,055' Tc=6.0 min CN=98 Runoff=55.54 cfs 3.124 af

Reach 1R: Area 2 Separation Berm - Berm - East Avg. Flow Depth=0.60' Max Vel=6.04 fps Inflow=29.42 cfs 2.115 af
n=0.010 L=600.0' S=0.0084 '/' Capacity=4,640.51 cfs Outflow=28.95 cfs 2.113 af

Reach 10R: Area 2 Separation Berm - Berm - West Avg. Flow Depth=0.71' Max Vel=7.91 fps Inflow=55.54 cfs 3.124 af
n=0.010 L=630.0' S=0.0113 '/' Capacity=5,390.20 cfs Outflow=54.37 cfs 3.121 af

Total Runoff Area = 9.900 ac Runoff Volume = 5.240 af Average Runoff Depth = 6.35"
0.00% Pervious = 0.000 ac 100.00% Impervious = 9.900 ac

Summary for Subcatchment 1S: Area 2 Separation Berm - East

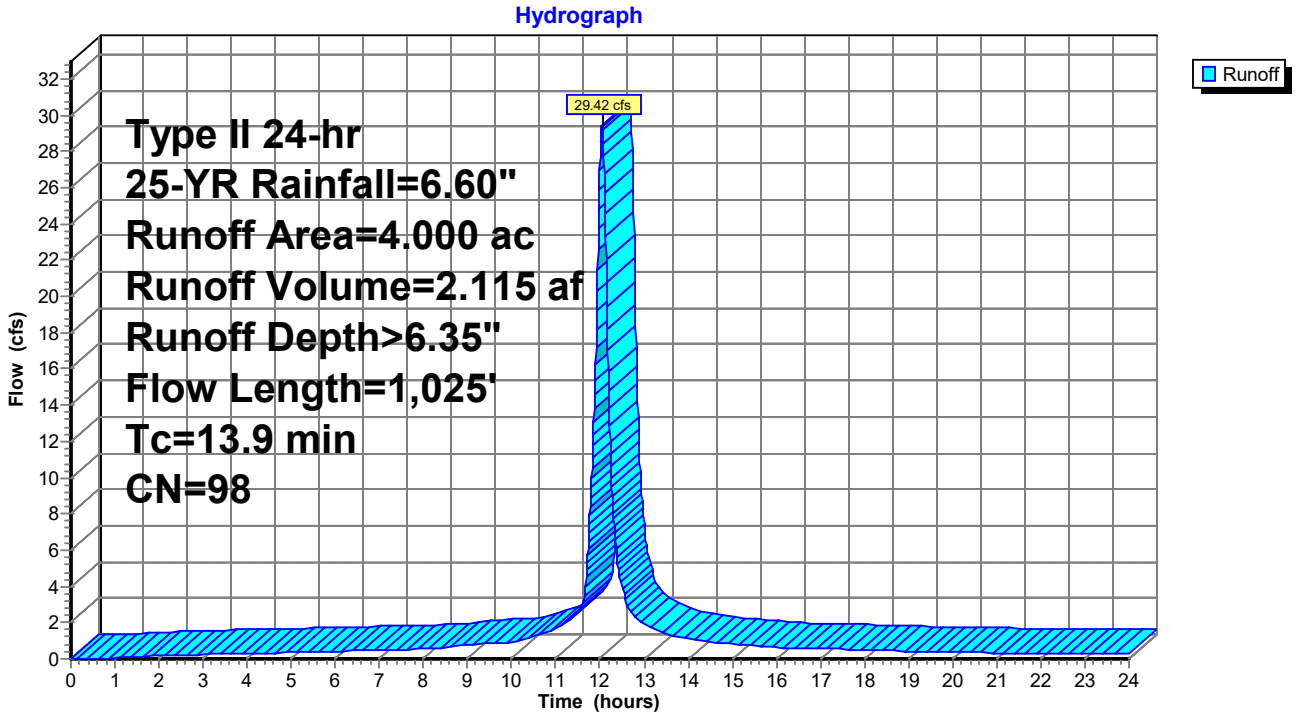
Runoff = 29.42 cfs @ 12.05 hrs, Volume= 2.115 af, Depth> 6.35"
Routed to Reach 1R : Area 2 Separation Berm - East

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-YR Rainfall=6.60"

	Area (ac)	CN	Description
*	4.000	98	
	4.000		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.8	100	0.0200	0.19		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.98"
3.9	325	0.0400	1.40		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
1.2	600	0.0084	8.55	461.88	**Channel Flow,** Area= 54.0 sf Perim= 108.5' r= 0.50' n= 0.010
13.9	1,025	Total			

Subcatchment 1S: Area 2 Separation Berm - East



Summary for Subcatchment 11S: Area 2 Separation Berm - West

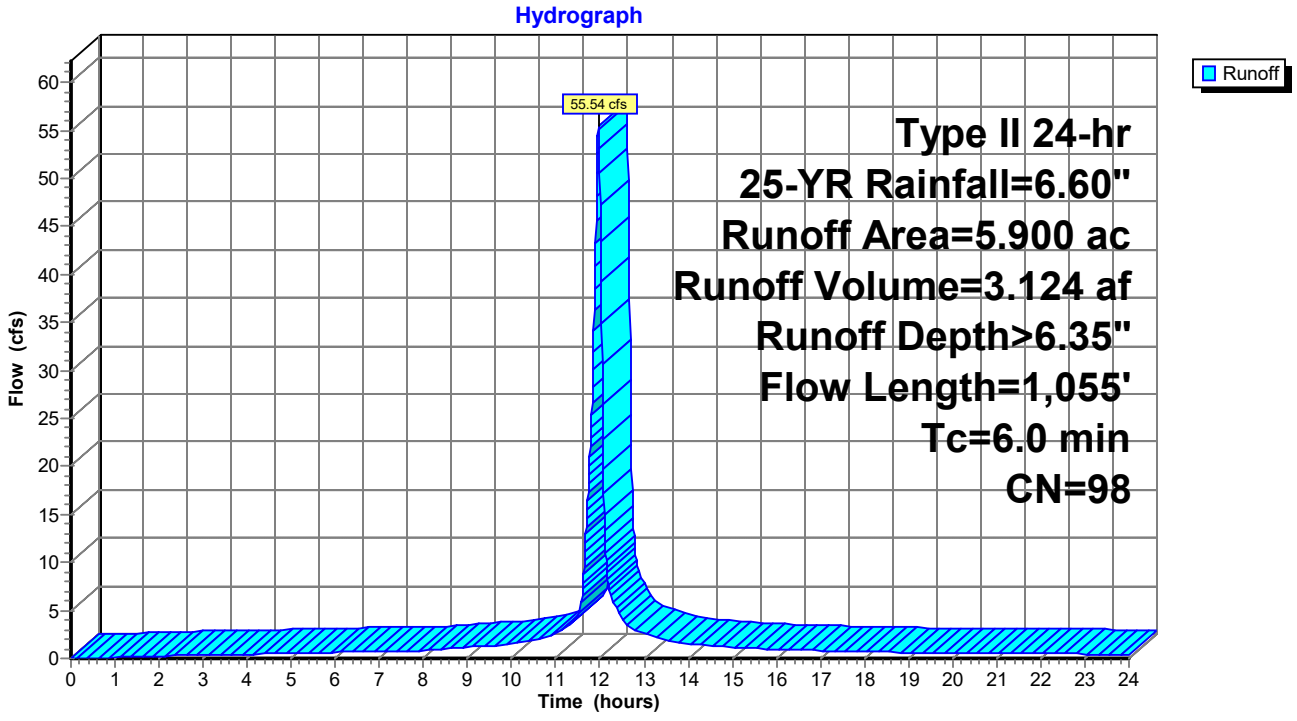
Runoff = 55.54 cfs @ 11.97 hrs, Volume= 3.124 af, Depth> 6.35"
Routed to Reach 10R : Area 2 Separation Berm - West

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-YR Rainfall=6.60"

	Area (ac)	CN	Description
*	5.900	98	
	5.900		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.9	100	0.0280	1.76		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.98"
1.4	325	0.0380	3.96		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
1.1	630	0.0113	9.92	535.71	**Channel Flow, Berm 2 West** Area= 54.0 sf Perim= 108.5' r= 0.50' n= 0.010
2.6					**Direct Entry, Make min Tc 6 min**
6.0	1,055	Total			

Subcatchment 11S: Area 2 Separation Berm - West



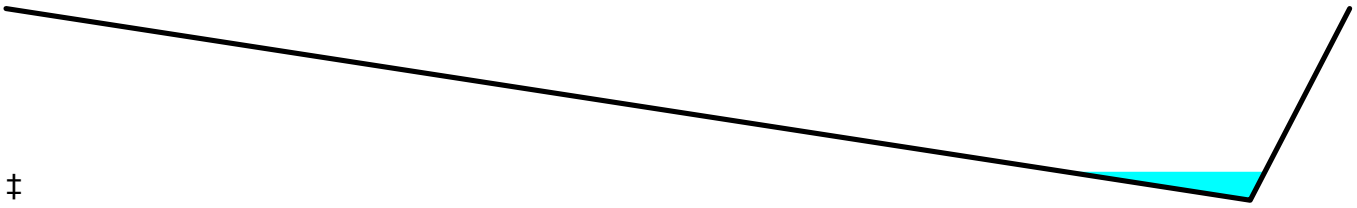
Summary for Reach 1R: Area 2 Separation Berm - East

Inflow Area = 4.000 ac,100.00% Impervious, Inflow Depth > 6.35" for 25-YR event
Inflow = 29.42 cfs @ 12.05 hrs, Volume= 2.115 af
Outflow = 28.95 cfs @ 12.10 hrs, Volume= 2.113 af, Atten= 2%, Lag= 2.8 min
Routed to nonexistent node 2R

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs / 3
Max. Velocity= 6.04 fps, Min. Travel Time= 1.7 min
Avg. Velocity = 2.32 fps, Avg. Travel Time= 4.3 min

Peak Storage= 2,878 cf @ 12.07 hrs
Average Depth at Peak Storage= 0.60' , Surface Width= 16.09'
Bank-Full Depth= 4.00' Flow Area= 216.0 sf, Capacity= 4,640.51 cfs

0.00' x 4.00' deep channel, n= 0.010
Side Slope Z-value= 25.0 2.0 '/' Top Width= 108.00'
Length= 600.0' Slope= 0.0084 '/'
Inlet Invert= 1,208.49', Outlet Invert= 1,203.45'



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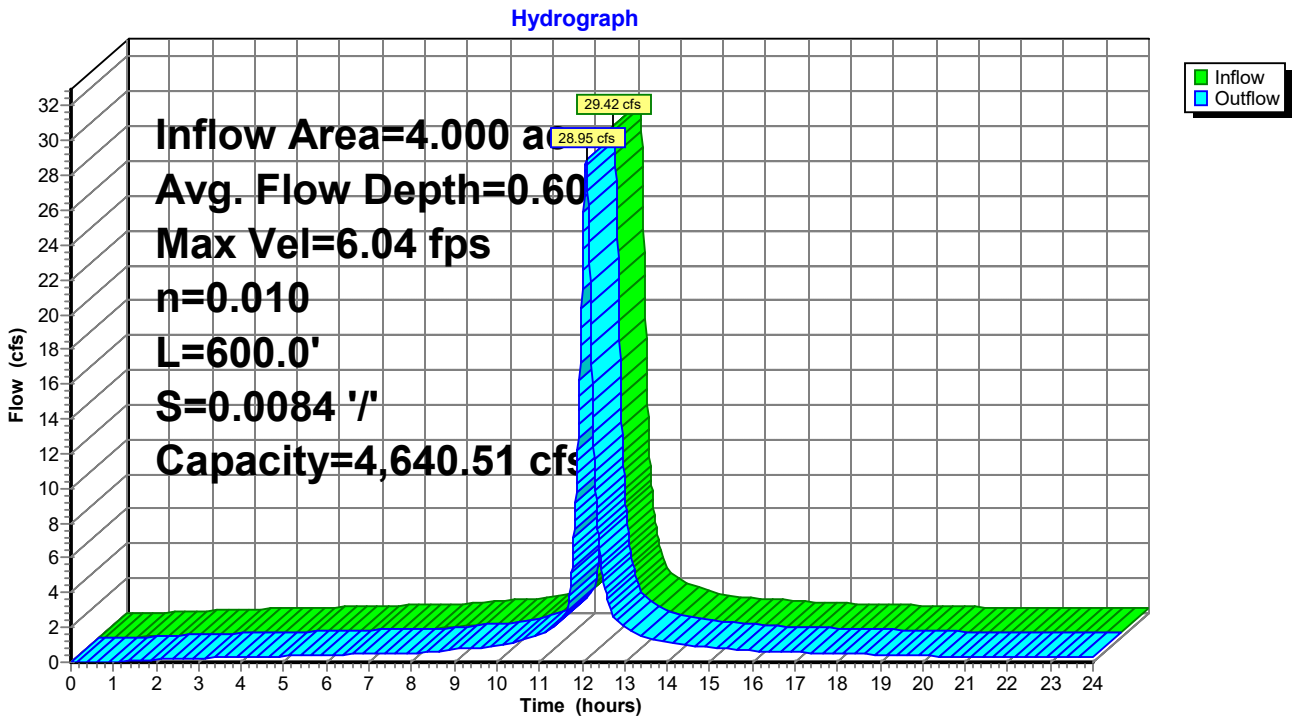


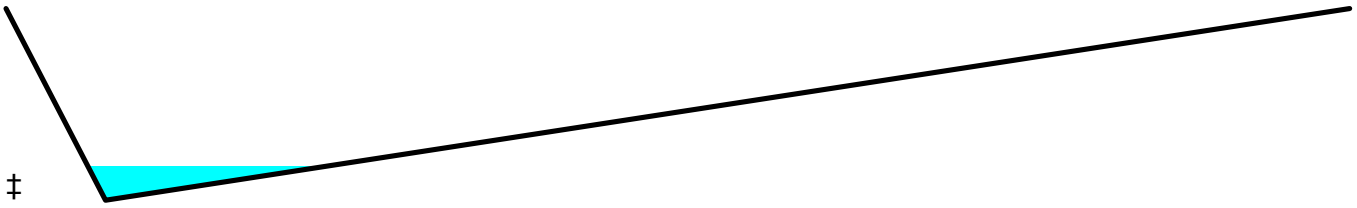
Summary for Reach 10R: Area 2 Separation Berm - West

Inflow Area = 5.900 ac,100.00% Impervious, Inflow Depth > 6.35" for 25-YR event
Inflow = 55.54 cfs @ 11.97 hrs, Volume= 3.124 af
Outflow = 54.37 cfs @ 12.00 hrs, Volume= 3.121 af, Atten= 2%, Lag= 2.2 min
Routed to nonexistent node 11R

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs / 3
Max. Velocity= 7.91 fps, Min. Travel Time= 1.3 min
Avg. Velocity = 2.85 fps, Avg. Travel Time= 3.7 min

Peak Storage= 4,334 cf @ 11.98 hrs
Average Depth at Peak Storage= 0.71' , Surface Width= 19.27'
Bank-Full Depth= 4.00' Flow Area= 216.0 sf, Capacity= 5,390.20 cfs

0.00' x 4.00' deep channel, n= 0.010
Side Slope Z-value= 2.0 25.0 '/' Top Width= 108.00'
Length= 630.0' Slope= 0.0113 '/'
Inlet Invert= 1,208.49', Outlet Invert= 1,201.35'



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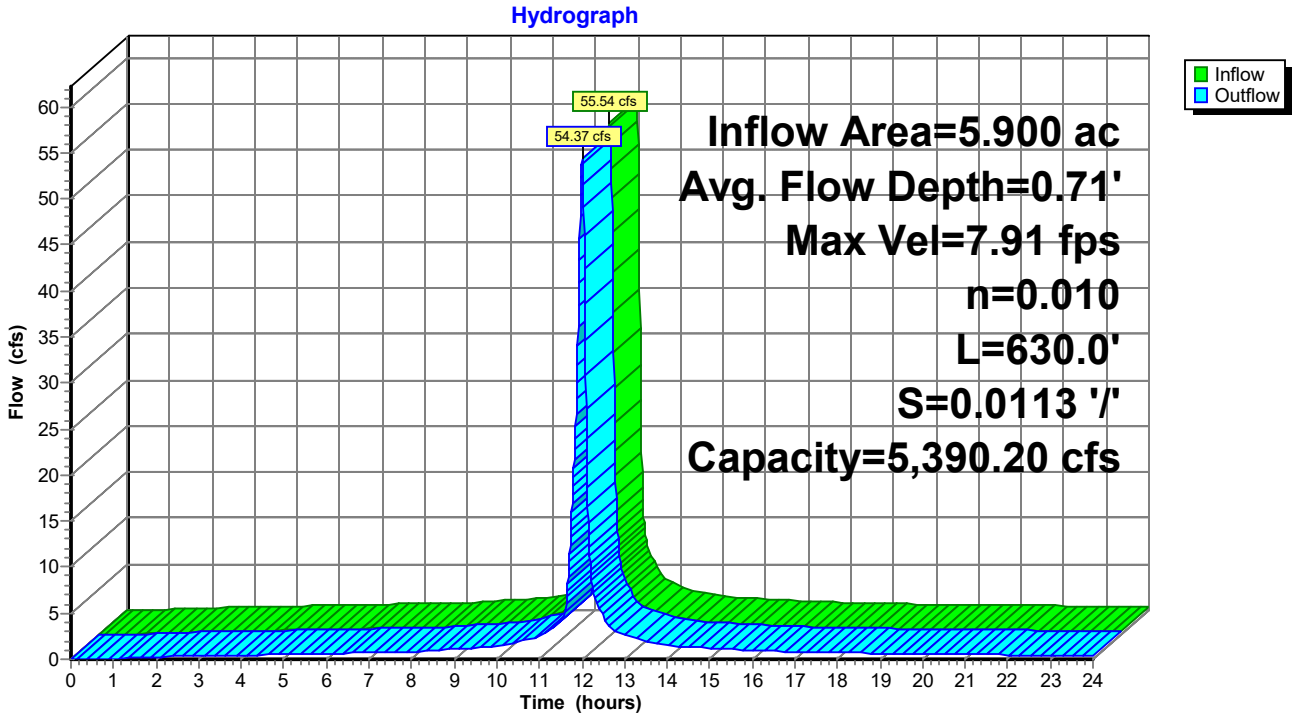
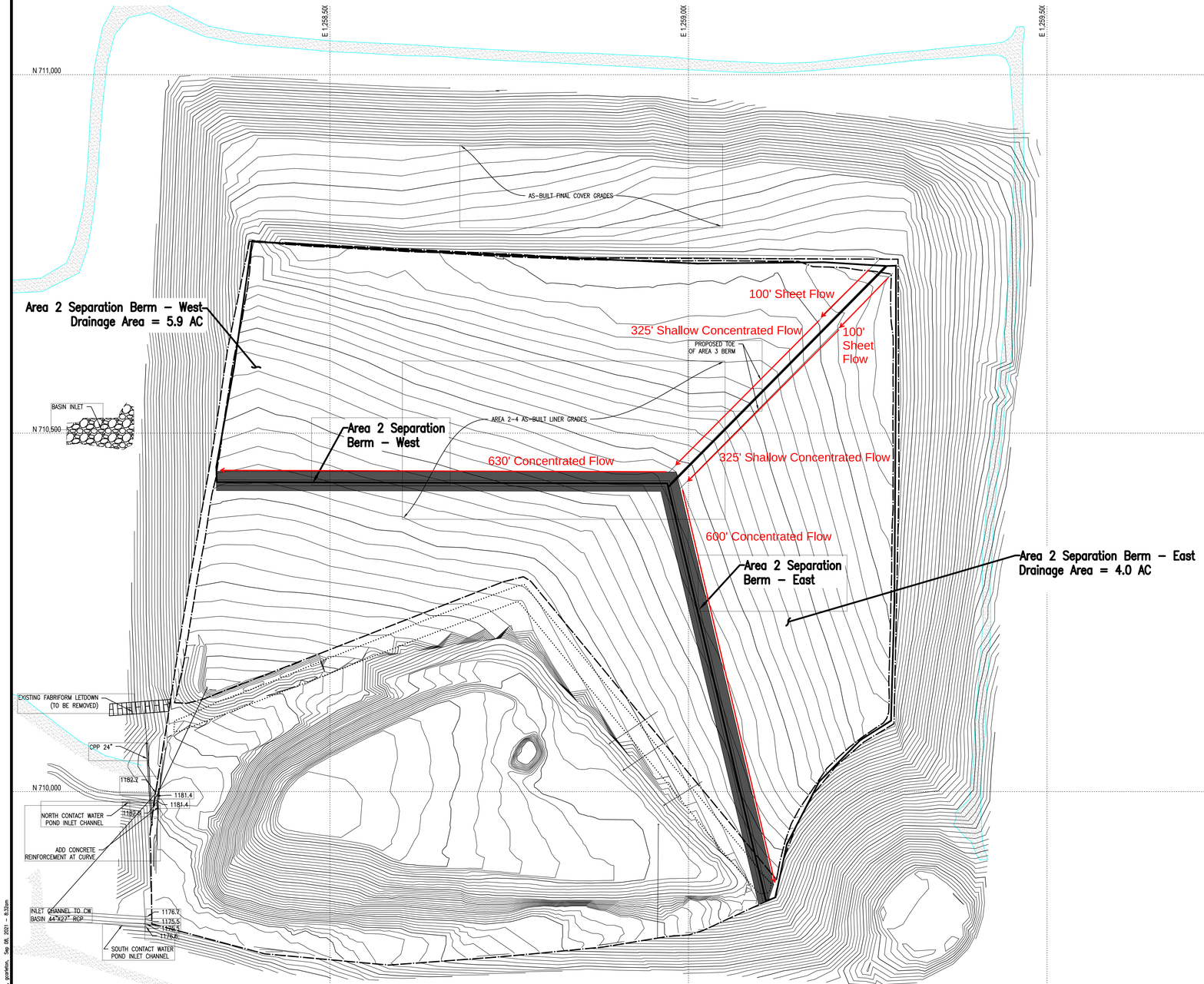
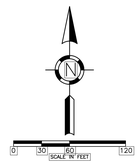
Reach 10R: Area 2 Separation Berm - West







GENERAL NOTES

1. THE TOPOGRAPHY WITHIN AREA 1 PROVIDED BY CRAFTON TULL (DATE OF PHOTOGRAPHY: APRIL 1, 2020). ADDITIONAL INTERMEDIATE LINER, FINAL COVER, AND AREA 2-4 OBTAINED FROM CERTIFICATION REPORTS.

LEGEND – EXISTING

LC — LEACHATE COLLECTION PIPE (AREA 1)

LEGEND – PROPOSED

LEACHATE COLLECTION PIPE

REFERENCE DRAWINGS

DATE	NO.	DESCRIPTION	APPD.

REVISIONS

PRELIMINARY - NOT FOR CONSTRUCTION - DRAFT

NOTE:

THE GRADES SHOWN REPRESENT THE PRACTICAL WASTE GRADES AT THE END OF AREA 2-4 FILLING.

HULL
Environment / Energy / Infrastructure
219 S. Erie Street
Toledo, OH 43604
Phone: (419) 385-2018
Fax: (419) 242-1851
www.hullinc.com

SIGNATURE

DATE

PROJECT NO.:	AP0063
FILE NO.:	AP0063_PGR009-CW
LAYOUT BY:	SAH
DRAWN BY:	SAH
CHECKED BY:	AMG
SCALE:	AS NOTED
SUBMITTAL DATE:	APRIL 2020

SOUTHWESTERN ELECTRIC POWER COMPANY (SWEPCO)
FLINT CREEK POWER PLANT
GENTRY ARKANSAS
FLINT CREEK POWER PLANT LANDFILL

AREA 2-4 FILLING PLAN

DWG. NO. AP0063_PGR009-CW Pipe

SCALE:	
DR:	
CH:	
ENGR.:	
ENGR.:	
ENGR.:	
DATE:	9/8/21

APPROVED BY

CIVIL ENGINEERING DIVISION

AEP AMERICAN ELECTRIC POWER
1 RIVERSIDE PLAZA
COLUMBUS, OH 43215

APPENDIX B-II

Interim Contact Water Pipe Calculations

FLINT CREEK POWER PLANT LANDFILL
CONTACT WATER PIPE SIZING

OBJECTIVE

The purpose of this calculation is to determine an appropriate size and pipe specification for a contact water culvert designed to be installed as part of the Flint Creek Power Plant Landfill (Landfill) development of Areas 2, 3 and 4. This calculation is based on previous calculations and concepts from the March 2014 Final Approved Permit Application (Permit). The proposed Contact Water culvert pipe will convey contact water from the Landfill into the northern contact water concrete channel, which conveys contact water into the contact water pond, and from the contact water pond to the bottom ash pond.

ASSUMPTIONS

Within the Permit, calculations were submitted that detailed the design parameters for the construction of the Landfill. The following conclusions from the Permit will be used in this calculation:

- The largest allowable open area of the Landfill is 10.44 acres (Phase 3 from Permit)
- The 25-year, 24-hour storm is the design storm
- The peak flow from 10.44 acres during the design storm is 55.73 cubic feet per second (cfs)
    - Based on Appendix H-I, Attachment D of the Permit
- The concrete contact water channels are trapezoidal with a 6-foot bottom width, 2H:1V side slopes, and 2-foot height. Approximate slope of the channels is 1.7%
- The concrete channels can handle a 56 cfs discharge at a normal depth of 0.72', allowing for over 1 foot of freeboard.

Other information used:

- As-builts show an invert elevation of 1181.4 for the northern concrete contact water channel
- Approximate ground (top of geomembrane) elevation near culvert inlet is 1185.0 +/-
    - However, assume the pipe inlet sits on 1.5 feet of protective cover.
- Based on the manual for the Design of PE Piping Systems, a minimum bury depth for DR 17 pipe is 3 feet without doing any calculations. An absolute minimum cover of 1.5 feet is required.
- Based on Chapter 6, Section 3 of the PE Pipe design document, try a DR-17 pipe with 1.5 feet of cover, with an H-20 vehicle loading (16,000 lbs).

CALCULATIONS

Pipe Material Selection and Design

Based on the location, slopes, joint requirements, and contact water, an HDPE pipe is the most appropriate pipe to use for this application. The DR of the pipe must be selected based on the heavy traffic loads that will traverse the culvert over time. Additionally, with the size of the pipe and the requirement to turn the pipe so it discharges into the existing concrete channel, HDPE will allow for a pre-fabricated 115-degree elbow at a minimum 3.5-foot radius (along centerline) with a large pipe (this will allow for easy cleanout rather than a short radius bend).

Chapter 6 of the PE Pipe Design Document was utilized to calculate the minimum DR size of pipe needed for a shallow culvert with live load from heavy trucks (H-20). Refer to a separate pdf titled "Buried PE Pipe Design_JAH Calc" for those calculations. A 30" IPS DR 17 pipe, with 18" minimum cover was tried. Calculations for vehicular loading with shallow cover, deflection, and pipe wall compressive stress were performed. Based on those calculations, a 30" DR pipe can be installed at that minimum depth. However,

based on the potential for rutting since it's a gravel haul road, a 24" minimum depth will be suggested on the construction plans.

Contact Water Culvert Pipe Sizing

The required flow rate (Q_{req}) of the proposed contact water culvert pipe will be based on the peak flow from the largest open Area of the Landfill, per the Permit calculations (i.e., 56 cfs).

Since a 30" IPS DR 17 pipe worked for the minimum bury requirement, Flowmaster was used to determine the minimum slope needed to obtain a maximum flow capacity (Q_C) of a 30-inch HDPE IPS Pipe (inside diameter of 26.26 inches, or 2.19 feet) flowing full. The minimum required slope was calculated to be a 3.2% grade (see pages 4 and 5 of these calculations). The actual slope will meet these requirements.

CONCLUSION

The above calculations show that the proposed 30" HDPE IPS pipe at a slope of at least 3.2% will be sufficient for the contact water culvert pipe for the estimated peak flows determined by the previous Permit calculations and concepts, as well as should hold up under the haul road if it has a minimum cover of 24" under the haul road.

PIPE MATERIAL SPEC SHEET

PE 3608/3408 IPS HDPE PIPE SIZES

Pressure Rating		DR 17 (100psi)			DR 19 (89psi)			DR 21 (80psi)			DR 26 (65psi)			DR 32.5 (50psi)		
Nominal Size	Actual O.D.	Min. wall	Average I.D.	Weight lb/lf	Min. wall	Average I.D.	Weight lb/lf	Min. wall	Average I.D.	Weight lb/lf	Min. wall	Average I.D.	Weight lb/lf	Min. wall	Average I.D.	Weight lb/lf
3/4"	1.050"	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
1"	1.315"	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
1 1/4"	1.660"	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
1 1/2"	1.900"	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
2"	2.375"	0.140"	2.079"	0.429	---	---	---	---	---	---	---	---	---	---	---	---
3"	3.500"	0.206"	3.064"	0.932	---	---	---	---	---	---	---	---	---	---	---	---
4"	4.500"	0.265"	3.939"	1.540	0.237"	3.998"	1.387	0.214"	4.046"	1.262	0.173"	4.133"	1.030	0.138"	4.206"	0.831
5"	5.375"	0.316"	4.705"	2.197	0.283"	4.775"	1.980	0.256"	4.832"	1.801	0.207"	4.937"	1.470	0.165"	5.024"	1.186
5"	5.563"	0.327"	4.869"	2.353	0.293"	4.942"	2.120	0.265"	5.001"	1.929	0.214"	5.109"	1.574	0.171"	5.200"	1.270
6"	6.625"	0.390"	5.799"	3.338	0.349"	5.886"	3.007	0.315"	5.956"	2.736	0.255"	6.085"	2.233	0.204"	6.193"	1.801
7"	7.125"	0.419"	6.236"	3.860	0.375"	6.330"	3.478	0.339"	6.406"	3.165	0.274"	6.544"	2.582	0.219"	6.660"	2.083
8"	8.625"	0.507"	7.549"	5.657	0.454"	7.663"	5.097	0.411"	7.754"	4.637	0.332"	7.922"	3.784	0.265"	8.062"	3.053
10"	10.750"	0.632"	9.409"	8.788	0.566"	9.551"	7.918	0.512"	9.665"	7.204	0.413"	9.873"	5.878	0.331"	10.049"	4.742
12"	12.750"	0.750"	11.160"	12.362	0.671"	11.327"	11.138	0.607"	11.463"	10.134	0.490"	11.710"	8.269	0.392"	11.918"	6.671
14"	14.000"	0.824"	12.254"	14.905	0.737"	12.438"	13.429	0.667"	12.587"	12.218	0.538"	12.858"	9.970	0.431"	13.087"	8.044
16"	16.00"	0.941"	14.005"	19.467	0.842"	14.215"	17.540	0.762"	14.385"	15.959	0.615"	14.695"	13.022	0.492"	14.956"	10.506
18"	18.00"	1.059"	15.755"	24.638	0.947"	15.992"	22.199	0.857"	16.183"	20.198	0.692"	16.532"	16.480	0.554"	16.826"	13.296
20"	20.00"	1.176"	17.506"	30.418	1.053"	17.768"	27.406	0.952"	17.981"	24.936	0.769"	18.369"	20.346	0.615"	18.695"	16.415
22"	22.00"	1.294"	19.256"	36.805	1.158"	19.545"	33.162	1.048"	19.779"	30.172	0.846"	20.206"	24.619	0.677"	20.565"	19.863
24"	24.00"	1.412"	21.007"	43.801	1.263"	21.322"	39.465	1.143"	21.577"	35.907	0.923"	22.043"	29.299	0.738"	22.434"	23.638
26"	26.00"	1.529"	22.758"	51.406	1.368"	23.099"	46.316	1.238"	23.375"	42.141	1.000"	23.880"	34.385	0.800"	24.304"	27.742
28"	28.00"	1.647"	[illegible]	59.618	1.474"	24.876"	53.716	1.333"	25.173"	48.874	1.077"	25.717"	39.879	0.862"	26.174"	32.174
30"	30.00"	1.76[illegible]	26.259"	[illegible]8.439	1.579"	26.653"	61.664	1.429"	26.971"	56.105	1.154"	27.554"	45.779	0.923"	28.043"	36.934
32"	32.00"	1.882"	[illegible]	77.869	1.684"	28.429"	70.160	1.524"	28.770"	63.835	1.231"	29.391"	52.086	0.985"	29.913"	42.023
34"	34.00"	2.000"	29.760"	87.907	1.789"	30.206"	79.204	1.619"	30.568"	72.064	1.308"	31.228"	58.814	1.046"	31.782"	47.440
36"	36.00"	2.118"	31.511"	98.553	1.895"	31.983"	88.796	1.714"	32.366"	80.791	1.385"	33.065"	65.922	1.108"	33.652"	53.186
42"	42.00"	2.471"	36.762"	134.141	2.211"	37.314"	120.861	2.000"	37.760"	109.966	1.615"	38.575"	89.727	1.292"	39.260"	72.392
48"	48.00"	2.824"	42.014"	175.205	2.526"	42.644"	157.857	2.286"	43.154"	143.629	1.846"	44.086"	117.194	1.477"	44.869"	94.552
54"	54.00"	3.176"	47.266"	222.547	2.842"	47.975"	199.791	2.571"	48.549"	182.298	2.077"	49.597"	148.324	1.662"	50.478"	119.668
63"	62.99"	---	---	---	---	---	---	3.000"	56.631"	247.800	2.423"	57.854"	202.010	1.938"	58.881"	162.980

NOTE:

- Items highlighted in Blue indicates standard stocking items that are more readily available.
- Pressures are based on using water at 23°C (73°F).
- Average inside diameter calculated using nominal OD and minimum wall plus 6% for use in estimating fluid flows. Actual ID will vary.
- Service factors should be utilized to compensate for the effect of liquids other than water, and for other temperatures.
- Other piping sizes or DR's may be available upon request.
- Standard Lengths: 40' for 2"-24" / 50' for 26" and larger / Coils available for 3/4"-6"(8" by special order)

Page 2 of 2

Worksheet for Flint Creek - 3.2% - 30" DR 17 Contact Water Culvert

Project Description

Friction Method	Manning Formula
Solve For	Full Flow Capacity

Input Data

Roughness Coefficient	0.012	
Channel Slope	0.03200	ft/ft
Normal Depth	2.19	ft
Diameter	2.19	ft
Discharge	55.84	ft³/s

Results

Discharge	55.84	ft³/s
Normal Depth	2.19	ft
Flow Area	3.77	ft²
Wetted Perimeter	6.88	ft
Hydraulic Radius	0.55	ft
Top Width	0.00	ft
Critical Depth	2.16	ft
Percent Full	100.0	%
Critical Slope	0.02895	ft/ft
Velocity	14.82	ft/s
Velocity Head	3.42	ft
Specific Energy	5.61	ft
Froude Number	0.00	
Maximum Discharge	60.07	ft³/s
Discharge Full	55.84	ft³/s
Slope Full	0.03200	ft/ft
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
Average End Depth Over Rise	0.00	%

Worksheet for Flint Creek - 3.2% - 30" DR 17 Contact Water Culvert

GVF Output Data

Normal Depth Over Rise	100.00	%
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	2.19	ft
Critical Depth	2.16	ft
Channel Slope	0.03200	ft/ft
Critical Slope	0.02895	ft/ft

APPENDIX C

Plan Review Log

Run-On and Run-Off Plan Amendment Log

By	Date	Amendment Description	PE Certification Required?	PE Name	Licensing State: Registration No.
Hull & Associates, Inc.	9/8/2016	Initial Plan	Yes	Angela M. Gerdeman	AR 14070
Hull & Associates, LLC.	9/17/21	5-Year Plan Revision	Yes	Angela M. Gerdeman	AR 14070