GEI Consultants

Consulting
Engineers and
Scientists

Regulation Compliance Report

Run-on and Run-off Control Plan

Weston Disposal Site No. 3
Town of Knowlton, Marathon County, Wisconsin

Submitted to:
WEC Energy Group – Business Services
333 W. Everett Street, A231
Milwaukee, Wisconsin 53203

Submitted by:
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3159 Voyager Drive
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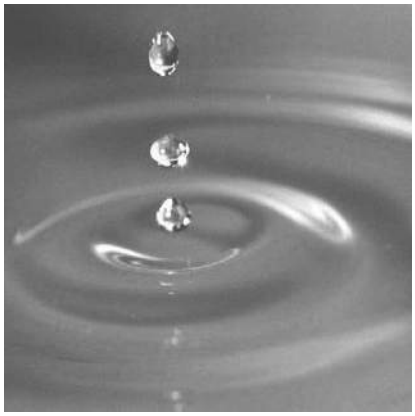
October 2021, Revision 1
Project 1803049



John M. Trast, P.E., D.GE.
Vice President

William S. Reybrock, P.E.
Project Professional

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Appendices

Revision Schedule

Revision 0 October 2016
Revision 1 October 2021: This plan was updated in accordance with § 257.81(c)(4) which required the owner or operator of the CCR unit to prepare periodic run-on and run-off control system plans every five years. Updated the existing site conditions and engineering calculations.

1. Introduction

WEC Energy Group (WEC) owns and operates the Weston Disposal Site No. 3 Landfill, located in the E 1/2 of the NW 1/4 and W 1/2 of the NE 1/4, Section 23, Township 26 North, Range 7 East, Town of Knowlton, Marathon County, Wisconsin. The WEC Weston Disposal Site No. 3 Landfill is regulated as an industrial waste landfill by the Wisconsin Department of Natural Resources (WDNR) under the provisions of Chapter 289 Wisconsin State Statues, and all applicable requirements of Chapters NR 500 of the Wisconsin Administrative Code. The design, construction, operation, closure, and post-closure care requirements are specified in the WDNR conditionally approved Plan of Operations, License No. 3067, FID No. 737025120. Cells 1 and 2 were constructed during the 2015 construction season. Construction included the new landfill cells and installation of a leachate force main, storage tanks, and load-out system in late December 2015. The construction of Cells 1 and 2 was approved by WDNR on April 22, 2016, and Cell 2 was placed into service on June 27, 2016. WEC has filled Cell 2 episodically since it was placed into service and has constructed approximately 2.7 acres of final cover system over the exterior slopes of Cell 2. Cell 1 was placed into service August 27, 2021.

In addition to the state regulations, the landfill is also required to comply with 40 CFR Part 257 Subpart D – *Standards for Disposal of Coal Combustion Residuals in Landfills and Surface Impoundments.* Weston Disposal Site No. 3 Landfill, Cells 1 and 2 are defined as a CCR units and existing CCR landfills in accordance with § 257.53 since construction commenced prior to October 14, 2015. Future landfill cells are permitted by the WDNR in the approved Plan of Operation and defined as lateral expansions under § 257.53 when constructed.

This report fulfills the requirements of § 257.81 - *Run-on and run-off controls for CCR landfills* for the Weston Disposal Site No. 3, Cells 1 and 2, which specifies that the owner or operator must complete the assessments every five years. In accordance with § 257.81(c)(1) this report describes how the run-on and run-off control systems have been designed and constructed to meet the applicable requirements and supported by appropriate engineering calculations.

This run-off and run-on system control plan includes the following sections:

Section 1 – Introduction
Section 2 – Storm and Stormwater Volume Determination
Section 3 – Run-on Control System
Section 4 – Run-off Control System
Section 5 – Conclusion and Certification
Section 6 – References

2. Storm and Stormwater Volume Determination

§ 257.81 *Run-on and run-off controls for CCR landfills* requires that 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 portion of the CCR unit during the peak discharge from a 24-hour, 25-year storm; and 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.

Cell 1 of the Weston Disposal Site No. 2 is approximately 6.6 acres in size, while Cell 2 is approximately 8.6 acres in size. All precipitation that falls into the permitted limits of waste is contained within the cell and handled as leachate. Any precipitation that falls outside the limits of waste is directed away from the active landfill. Drawing C-1 – Weston Disposal Site No. 3 Cells 1 and 2 located in Appendix A shows the proposed operational filling grades for Cells 1 and 2 of the Weston Disposal Site No. 3.

The rainfall estimate for a 24-hour, 25-year storm for the Weston Disposal Site No. 3 was determined following the procedures outlined in Precipitation-Frequency Atlas of the United States, Atlas 14, Volume 8, Version 2: Wisconsin. For the Weston Disposal Site No. 3 a 24-hour, 25-year storm will result in 4.47 inches of rainfall. Calculations for determining the 24-hour, 25-year storm event are included in Appendix B: NOAA 14, Vol. 8 Rainfall Analysis and Run-off Volume.

Table 2-1 summarizes the storm recurrence interval, rainfall depth, lined area of the CCR landfill, and minimum stormwater volume required to be managed within Cells 1 and 2.

Table 2-1 Summary of Rainfall Precipitation and Run-off Volume Data

Storm Recurrence Interval	Rainfall Depth (inches)	Cell 1 and 2 Active Area (acres)	Run-off Volume (acre-ft)
24-hour, 25-year	4.47	15.2	5.7

3. Run-on Control System

§ 257.81 (a)(1) requires a run-on control system to prevent flow onto the active portions of the CCR unit during the peak discharge from a 24-hour, 25-year storm. The federal rule defines "Run-on" as "*any rainwater, leachate, or other liquid that drains over land onto any part of a CCR landfill.*"

In order to control stormwater and prevent run-on into the active landfill, permanent perimeter berms have been established around the east and south sides of the landfill to direct stormwater run-on away from the landfill. Temporary intercell berms perform the same function on the west and north sides of Cell 1 and the west sides of Cell 2. Approximately 2.7 acres of the Cell 2 perimeter slopes on the south and east sides of Cell 2 have received final cover. The stormwater flow from the final cover is routed by to a perimeter ditch and discharges into Storm Water Basin No. 3.

Based on a review of current topography and stormwater calculations, Weston Disposal Site No. 3, Cells 1 and 2 have an acceptable run-on control system that follows current engineering standards and is compliant with § 257.81(a)(1).

4. Run-off Control System

§ 257.81 (a)(2) requires 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. The federal rule defines "Run-off" as "*any rainwater, leachate, or other liquid that drains overland from any part of a CCR landfill*."

During the operation and filling of Cells 1 and 2 precipitation within the landfill is handled as contact stormwater and treated as leachate in accordance with § 257.3-3. The contact stormwater is directed to the perimeter containment ditches on the inside of the perimeter berms and routed to a stormwater surge area along the Cell 2-3 intercell berm area, where it is allowed to infiltrate into the leachate collection system. The water is then managed as leachate in accordance with the landfill's Plan of Operations.

A stormwater run-off model was completed to confirm the current run-off control system for the operation of Cells 1 and 2 at the Weston Disposal Site No. 3 landfill can adequately manage a 24-hour, 25-year precipitation event. Stormwater flow was modeled using HydroCAD 10.0 to model the existing conditions. The stormwater run-off calculations for Cells 1 and 2 of the landfill are included in Appendix C: Stormwater Run-off Calculations.

In general, stormwater is conveyed off the slopes of Cells 1 and 2 as sheet flow until it is intercepted by temporary containment ditches. The temporary containment ditches at the perimeter of the landfill cell are a minimum of 2-feet-deep and have a 3H:1V exterior slope and 2H:1V interior side slope. The exterior slope of the ditch is the top of the granular drainage layer of the leachate collection system. The interior slope is cut into the CCR disposed of in the landfill. Upon closure of the landfill, the temporary stormwater containment ditch will be filled with soil or CCR prior to placement of the final cover system.

The results of the stormwater modeling calculations indicate that the perimeter ditches located along Cells 1 and 2 are able to contain and convey the flow of runoff resulting from the 25-year, 24-hour storm, and route it to one of the four detention areas. Appendix C shows that each of the four detention areas is able to contain the 25-year, 24-hour storm without overtopping.

Conclusion and Certification

The Weston Disposal Site No. 3 is regulated under 40 CFR Part 257 Subpart D as an existing CCR landfill. The Rule specifies that existing CCR landfills must develop plans to meet certain operating criteria designated by October 17, 2016, and that the owner or operator must also conduct and complete the assessments required by this section every five (5) years maximum based on the completion date of this plan. This report is the 5-year update to the original plan. The revised plan must be placed in the facility's operating record as required by §257.105(g). The owner or operator of the CCR unit must 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 report documents the Weston Disposal Site No. 3 landfill has an established run-on and run-off control system design capable of controlling the peak discharge from a 25-year, 24-hour storm event and complies with § 257.81 *Run-on and run-off controls for CCR landfills*. All leachate that is collected at the Weston Disposal Site No. 3 either recycled for use as a dust control within the active landfill or hauled to the wastewater treatment facility at Weston Power Plant in accordance with the approved operating plan complying with § 257.3-3.

The plan was completed under the direction of John M. Trast, P.E. I am a licensed professional engineer in the State of Wisconsin in accordance with the requirements of ch. A-E 4, Wisconsin Administrative Code; that this document has been prepared in accordance with the Rules of Professional Conduct in ch. A-E 8, Wisconsin Administrative Code; and that, to the best of my knowledge, all information contained in this document is correct and the document was prepared in compliance with all applicable requirements in 40 CFR Part 257 Subpart D.

5. References

Perica, S., D. Martin, S. Pavlovic, I. Roy, M. St. Laurent, C. Trypaluk, D. Unruh, M. Yekta, G. Bonnin (2013). NOAA Atlas 14 Volume 8 Version 2.0, *Precipitation-Frequency Atlas of the United States, Midwestern States*. National Oceanic and Atmospheric Administration, National Weather Service, Silver Spring, Maryland.

US Department of Commerce. National Oceanic and Atmospheric Administration, National Weather Service. (2016). Precipitation Frequency Data Server (PFDS). http://hdsc.nws.noaa.gov/hdsc/pdfs/.

Appendix A

Drawings

SCALE IN FEET

60' 0 60'

LEGEND

- EXISTING GROUND SURFACE CONTOUR
- ROAD, NON PAVED
- ROAD, PAVED
- FENCE
- CULVERT
- STRUCTURE
- POWER POLE
- LIGHT POLE
- MANHOLE
- POST
- OBJECT
- CP4 — SURVEY CONTROL MONUMENT
- CATCH BASIN ROUND (CB)
- MONITORING WELL (MW)
- SWAMP
- WATER
- TREE DECIDUOUS/CONIFEROUS
- BUSH
- BRUSH/HEDGE
- APPROXIMATE LANDFILL LIMIT OF WASTE
- APPROXIMATE LANDFILL CELL BOUNDARY
- GEOMEMBRANE LIMIT
- FM — LEACHATE FORCE MAIN
- LH2-2 — LEACHATE HEADWELL
- C102 — LEACHATE CLEANOUT
- P2B — PERIMETER ACCESS MANHOLE
- T-202 — TRANSFER MANHOLE
- STORM MANHOLE #3 — STORM WATER MANHOLE & DOWNSLOPE PIPE
- 6" DIA. NON-PERFORATED DRAIN PIPE
- 24" DIA. NON-PERFORATED DRAIN PIPE
- 4" DIA. NON-PERFORATED TOE DRAIN OUTLET & RIPRAP
- 4" DIA. PERFORATED SIDESLOPE INTERCEPT & TOE DRAIN WITH TOP OF PIPE ELEV.
- 1210 — PROPOSED SURFACE CONTOUR
- PROPOSED 2' HIGH BERM

NOTES:

1. THE TOPOGRAPHIC BASE MAP HAS BEEN CREATED FROM AERIAL PHOTOGRAPHY AND LIDAR ACQUISITION BY AERO-METRIC, INC., SHEBOYGAN, WI. DATE FLOWN: NOVEMBER 5, 2010.
2. PLAN OF OPERATION, WESTON DISPOSAL SITE NO. 3 EXPANSION, BY BY TRC ENVIRONMENTAL CORPORATION, MADISON, WISCONSIN, MARCH 2014.
3. EXISTING CONDITIONS WERE SURVEYED BY RIVERVIEW CONSTRUCTION, INC., GREEN BAY, WISCONSIN, MAY 5, 2020.
4. HORIZONTAL DATUM IS REFERENCED TO WISCONSIN STATE PLANE COORDINATE SYSTEM, CENTRAL ZONE, NORTH AMERICAN DATUM (NAD 83/2007), US SURVEY FEET.
5. VERTICAL DATUM IS NORTH AMERICAN VERTICAL DATUM 1988 (NAVD 88). CONTOUR INTERVAL IS 2 FEET.
6. APPROXIMATE PROPERTY BOUNDARY IS BASED ON EXETER DESIGN, INC. GROUND SURVEY, DATED OCTOBER 9, 2014.

CONTROL POINT COORDINATES AND ELEVATIONS

POINT I.D.	NORTH	EAST	ELEVATION	DESCRIPTION
CP1	325,993.77	2,061,281.40	1187.37	MONUMENT BRASS MHT-1000
CP2	325,688.83	2,062,529.07	1200.35	MONUMENT BRASS MHT-401
CP3	325,287.26	2,063,422.35	1202.18	MONUMENT BRASS MHT-101
CP4	324,365.46	2,062,993.43	1206.51	MONUMENT BRASS MHT-203

May 3, 2016

Attention:

0 1"

If this scale bar does not measure 1" then drawing is not original scale.

NO.	DATE	ISSUE/REVISION	APP
0	X	X	X

Designed: JXT
Checked: JXT
Drawn: JLC
Submittal Date: 10/8/2021

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333 WEST EVERETT STREET
MILWAUKEE, WISCONSIN

GEI Project 1600630

REGULATION COMPLIANCE REPORT
RUN-ON AND RUN-OFF CONTROL PLAN

DWG. NO. C-1

WESTON DISPOSAL SITE NO. 3
CELLS 1 & 2

SHEET NO. 1

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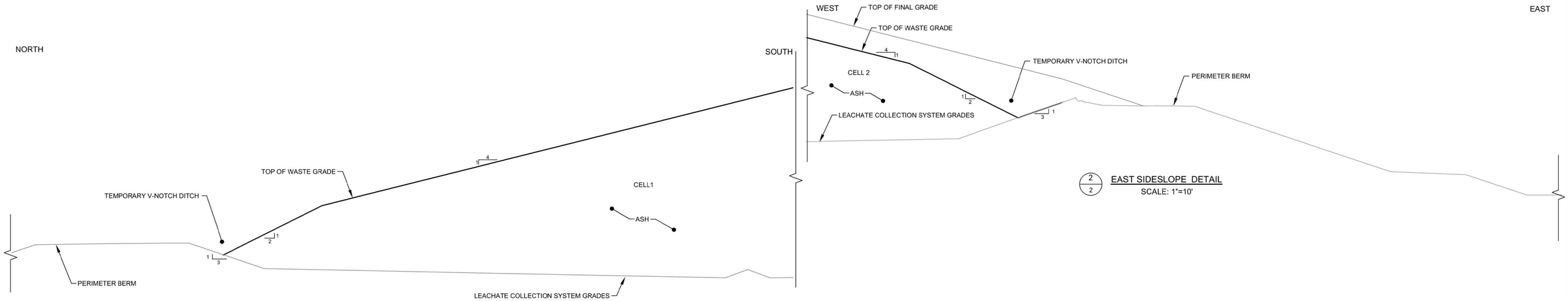
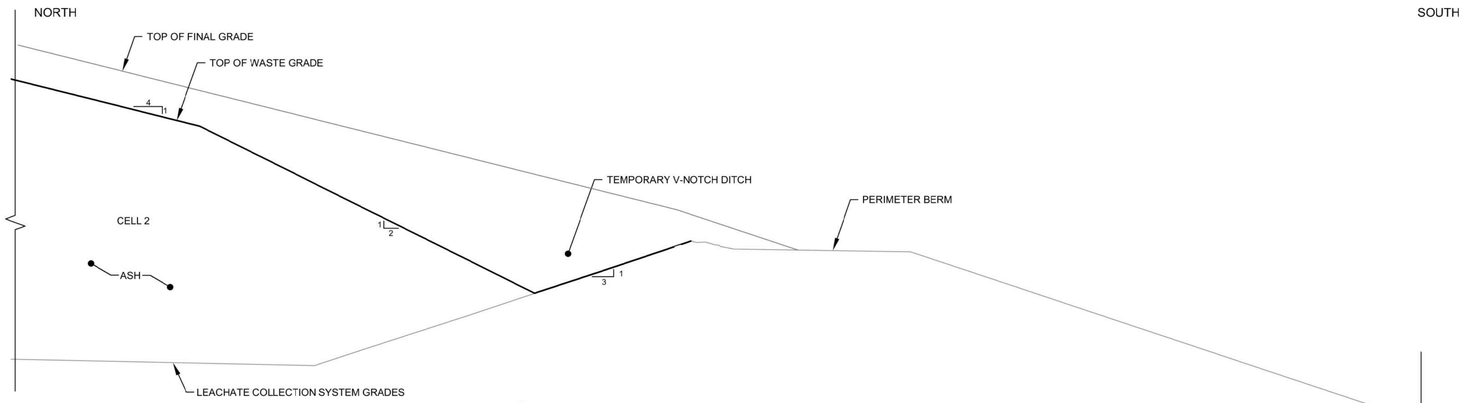


1/2 NORTH SIDESLOPE DETAIL
SCALE: 1"=10'

2/2 EAST SIDESLOPE DETAIL
SCALE: 1"=10'



3/2 SOUTH SIDESLOPE DETAIL
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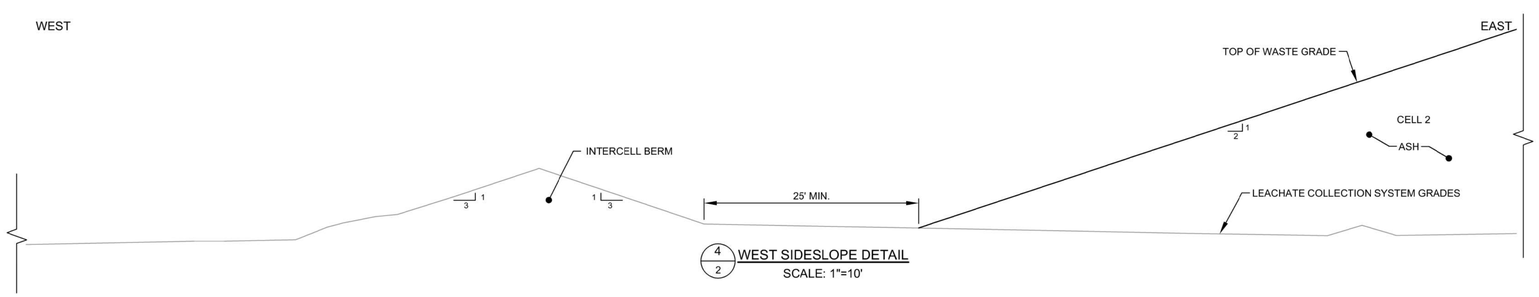

4/2 WEST SIDESLOPE DETAIL
SCALE: 1"=10'

Attention:

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NO.	DATE	ISSUE/REVISION	APP
0	X	X	X

Designed: JXT
Checked: JXT
Drawn: JLC
Submittal Date: 10/8/2021

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REGULATION COMPLIANCE REPORT
RUN-ON AND RUN-OFF CONTROL PLAN

DWG. NO. C-2

WESTON DISPOSAL SITE NO. 3
CELLS 1 & 2 DETAILS

SHEET NO. 3

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Appendix B

NOAA 14, Vol. 8 Rainfall Analysis and Run-off Volume

GEI Consultants	**Client**	WEC Energy Group			**Page**	1 of 4
	Project	Weston Disposal Site No. 3 Run-on and Run-off Control Plan			**Pg. Rev.**	
	By	W. Reybrock	**Chk.**	A. Schwoerer	**App.**	A. Schwoerer
	Date	06/21/2021	**Date**	08/23/2021	**Date**	08/23/2021
GEI Project No.	1803049	**Document No.**	N/A			
Subject	NOAA 14, Vol. 8 Rainfall Analysis and Run-off Volume					

Purpose:

The purpose of this calculation is to estimate the 24-hour, 25-year precipitation event at Weston Disposal Site No. 3. The 24-hour, 25-year precipitation event is required for the run-on and run-off control system plan for the landfill.

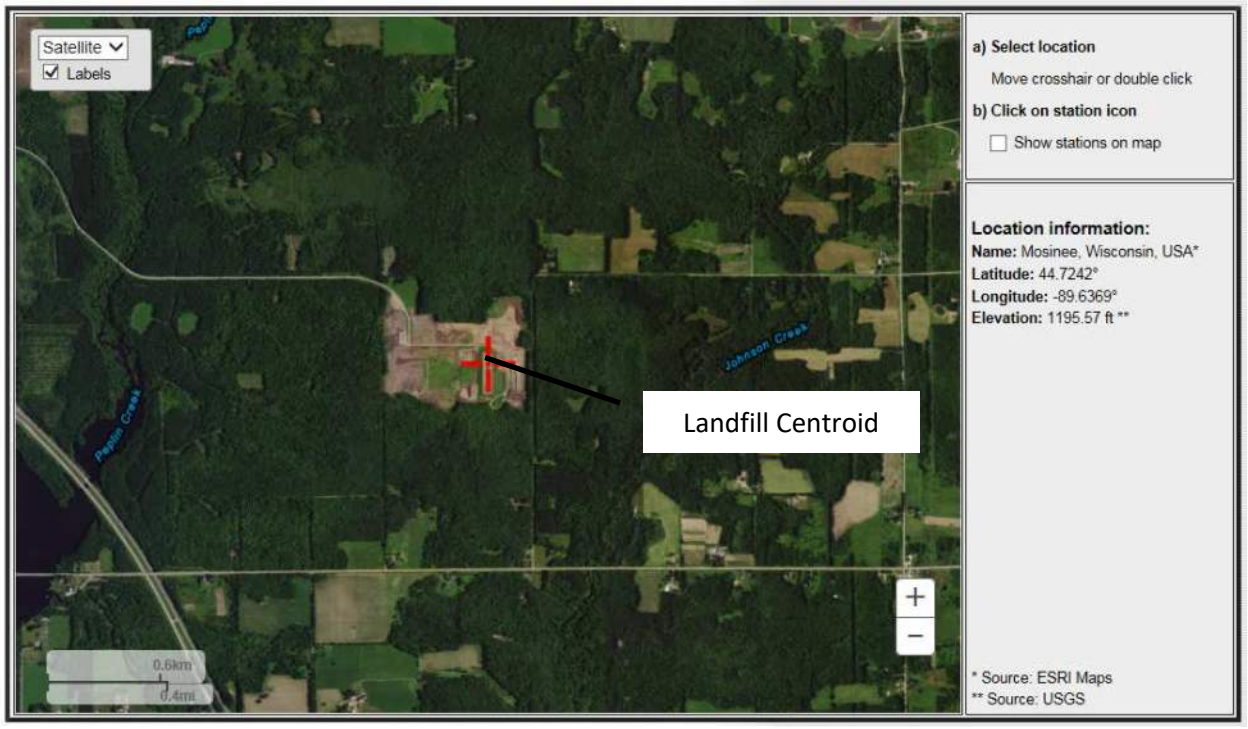
Procedure:

The rainfall depth estimation follows the procedures outlined in Precipitation-Frequency (PF) Atlas of the United States (Atlas 14, Volume 8, Version 2: Wisconsin).

As instructed in Atlas 14, the user is referred to the NOAA Precipitation Frequency Data Server (PFDS) http://hdsc.nws.noaa.gov/hdsc/pfds/index.html. The approximate center of the landfill was input into the PFDS and the PF estimates were returned.

Landfill Centroid Coordinates

44°43'27.12"N	44.7242°
89°38'12.84"W	-89.6369°



Tabular Output from the PFDS:

PDS-based precipitation frequency estimates with 90% confidence intervals (in inches)[1]

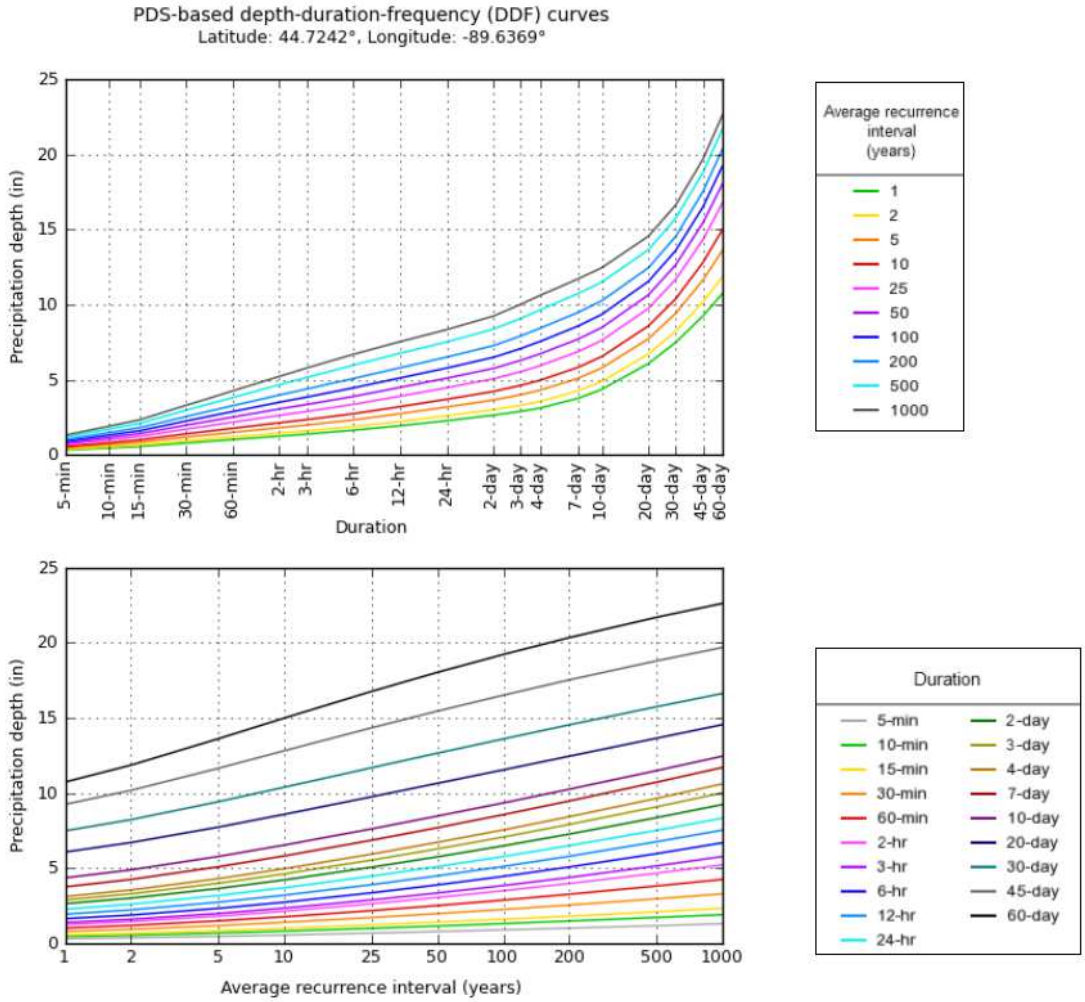
Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.315 (0.260–0.386)	0.372 (0.306–0.456)	0.470 (0.386–0.577)	0.557 (0.454–0.685)	0.684 (0.542–0.869)	0.788 (0.608–1.01)	0.897 (0.669–1.17)	1.01 (0.724–1.34)	1.18 (0.807–1.58)	1.31 (0.869–1.77)
10-min	0.462 (0.381–0.566)	0.545 (0.448–0.668)	0.688 (0.565–0.845)	0.815 (0.665–1.00)	1.00 (0.793–1.27)	1.15 (0.891–1.48)	1.31 (0.979–1.71)	1.49 (1.06–1.96)	1.72 (1.18–2.32)	1.91 (1.27–2.59)
15-min	0.563 (0.464–0.690)	0.664 (0.547–0.814)	0.839 (0.689–1.03)	0.994 (0.811–1.22)	1.22 (0.968–1.55)	1.41 (1.09–1.80)	1.60 (1.19–2.08)	1.81 (1.29–2.39)	2.10 (1.44–2.83)	2.33 (1.55–3.16)
30-min	0.793 (0.654–0.971)	0.934 (0.769–1.15)	1.18 (0.968–1.45)	1.40 (1.14–1.72)	1.72 (1.36–2.18)	1.98 (1.53–2.53)	2.26 (1.68–2.93)	2.55 (1.82–3.38)	2.96 (2.03–3.99)	3.29 (2.19–4.46)
60-min	1.02 (0.840–1.25)	1.19 (0.981–1.46)	1.50 (1.23–1.84)	1.77 (1.44–2.18)	2.18 (1.73–2.78)	2.52 (1.95–3.23)	2.88 (2.15–3.75)	3.27 (2.34–4.33)	3.82 (2.62–5.15)	4.26 (2.83–5.77)
2-hr	1.25 (1.03–1.51)	1.45 (1.20–1.76)	1.81 (1.50–2.20)	2.14 (1.76–2.61)	2.64 (2.12–3.34)	3.05 (2.38–3.88)	3.50 (2.64–4.52)	3.98 (2.88–5.24)	4.67 (3.24–6.25)	5.22 (3.52–7.01)
3-hr	1.38 (1.15–1.67)	1.60 (1.33–1.93)	1.99 (1.65–2.40)	2.35 (1.94–2.85)	2.89 (2.33–3.64)	3.35 (2.63–4.24)	3.85 (2.92–4.95)	4.39 (3.19–5.74)	5.16 (3.60–6.87)	5.78 (3.91–7.72)
6-hr	1.64 (1.38–1.96)	1.89 (1.58–2.26)	2.33 (1.95–2.79)	2.74 (2.28–3.29)	3.36 (2.73–4.20)	3.89 (3.08–4.88)	4.46 (3.41–5.69)	5.08 (3.73–6.60)	5.97 (4.22–7.89)	6.69 (4.58–8.86)
12-hr	1.94 (1.64–2.30)	2.23 (1.88–2.64)	2.74 (2.31–3.25)	3.21 (2.69–3.82)	3.91 (3.20–4.82)	4.49 (3.58–5.57)	5.12 (3.95–6.46)	5.80 (4.30–7.45)	6.76 (4.82–8.84)	7.54 (5.22–9.90)
24-hr	2.28 (1.94–2.67)	2.61 (2.22–3.06)	3.18 (2.70–3.74)	3.70 (3.13–4.37)	4.47 (3.68–5.45)	5.11 (4.11–6.26)	5.78 (4.50–7.21)	6.50 (4.86–8.26)	7.52 (5.42–9.74)	8.33 (5.84–10.8)
2-day	2.64 (2.27–3.07)	3.01 (2.58–3.50)	3.65 (3.12–4.25)	4.22 (3.59–4.93)	5.07 (4.20–6.10)	5.76 (4.67–6.99)	6.49 (5.10–8.01)	7.27 (5.49–9.15)	8.36 (6.09–10.7)	9.24 (6.55–11.9)
3-day	2.89 (2.49–3.34)	3.30 (2.84–3.81)	4.00 (3.44–4.63)	4.62 (3.95–5.37)	5.54 (4.62–6.63)	6.29 (5.12–7.59)	7.08 (5.58–8.69)	7.91 (6.01–9.90)	9.08 (6.66–11.6)	10.0 (7.15–12.9)
4-day	3.12 (2.69–3.58)	3.55 (3.07–4.09)	4.31 (3.71–4.97)	4.97 (4.26–5.75)	5.94 (4.96–7.07)	6.72 (5.50–8.08)	7.55 (5.98–9.23)	8.43 (6.43–10.5)	9.65 (7.10–12.2)	10.6 (7.61–13.6)
7-day	3.76 (3.27–4.29)	4.25 (3.70–4.86)	5.09 (4.42–5.83)	5.82 (5.02–6.68)	6.86 (5.77–8.09)	7.70 (6.33–9.15)	8.56 (6.83–10.4)	9.47 (7.28–11.7)	10.7 (7.96–13.5)	11.7 (8.47–14.9)
10-day	4.36 (3.81–4.95)	4.89 (4.27–5.56)	5.78 (5.03–6.58)	6.54 (5.66–7.47)	7.62 (6.42–8.91)	8.47 (6.99–10.0)	9.35 (7.49–11.2)	10.3 (7.92–12.6)	11.5 (8.58–14.4)	12.5 (9.07–15.7)
20-day	6.08 (5.35–6.83)	6.71 (5.90–7.54)	7.73 (6.79–8.71)	8.58 (7.50–9.70)	9.75 (8.27–11.2)	10.7 (8.86–12.4)	11.5 (9.33–13.7)	12.5 (9.71–15.1)	13.7 (10.3–16.9)	14.6 (10.7–18.2)
30-day	7.49 (6.63–8.37)	8.23 (7.28–9.20)	9.42 (8.31–10.6)	10.4 (9.11–11.7)	11.7 (9.95–13.4)	12.7 (10.6–14.6)	13.6 (11.0–16.0)	14.5 (11.4–17.5)	15.7 (11.9–19.3)	16.6 (12.3–20.7)
45-day	9.25 (8.22–10.3)	10.2 (9.04–11.3)	11.7 (10.3–13.0)	12.8 (11.3–14.3)	14.3 (12.2–16.3)	15.5 (13.0–17.7)	16.5 (13.5–19.3)	17.5 (13.8–20.9)	18.8 (14.3–22.9)	19.7 (14.7–24.4)
60-day	10.7 (9.57–11.9)	11.9 (10.6–13.1)	13.6 (12.1–15.1)	15.0 (13.3–16.7)	16.8 (14.3–18.9)	18.0 (15.2–20.6)	19.2 (15.7–22.3)	20.3 (16.1–24.1)	21.7 (16.6–26.3)	22.6 (17.0–27.9)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

Graphical Output from the PFDS:



GEI Consultants	**Client**	WEC Energy Group			**Page**	4 of 4
	Project	Weston Disposal Site No. 3 Run-on and Run-off Control Plan			**Pg. Rev.**	
	By	W. Reybrock	**Chk.**	A. Schwoerer	**App.**	A. Schwoerer
	Date	06/21/2021	**Date**	08/23/2021	**Date**	08/23/2021
GEI Project No.	1803049	**Document No.**	N/A			
Subject	NOAA 14, Vol. 8 Rainfall Analysis and Run-off Volume					

Regulations:

The Weston Disposal Site No. 3 is regulated under 40 CFR Part 257 Subpart D – Standards for Disposal of Coal Combustion Residuals (CCR) in Landfills and Surface Impoundments as an existing landfill. The regulations specify that landfill must have the following plans in place:

- 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.
- 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.

Conclusion:

The 24-hour, 25-year storm for the Weston Disposal Site No. 3 is 4.47 inches. This value will be utilized in the stormwater run-off model (under a separate calculation package).

Appendix C

Stormwater Run-off Calculations

GEI Consultants	**Client**	WEC Energy Group			**Page**	1 of 2
	Project	WDS3 LF Run-on and Run-off Control Plan			**Rev.**	0
	By	W. Reybrock	**Chk.**	A. Schwoerer	**App.**	A. Schwoerer
	Date	10/11/2021	**Date**	10/11/2021	**Date**	10/11/2021
GEI Project No.	1803049	**Document No.**	N/A			
Subject	Stormwater Run-off Calculations					

Purpose:

The purpose of this calculation is to model the stormwater run-off associated with a 24-hour, 25-year precipitation event at Weston Disposal Site No. 3 (WDS3) from Cells 1 and 2. In addition, this analysis was completed to confirm the current run-off control system for the construction of Cells 1 and 2 can adequately manage the 24-hour, 25-year precipitation event.

Design Criteria and Assumptions:

1. The rainfall depth estimation for the 24-hour, 25-year precipitation event was determined to be 4.47 inches (included under a separate calculation package). The rainfall depth was determined by following procedures outlined in Precipitation-Frequency (PF) Atlas of the United States (Atlas 14, Volume 8, Version 2: Wisconsin).
2. The southeastern 2.7 acres of the cell that has already been closed flows south and east off Cell 2 as shown in Figure 1. Cell 1 has a total area of 6.6 acres, while Cell 2 has a total area of 8.6 acres.
3. The landfill surface was modeled as bare ash, assuming hydrologic soil group C and a Runoff Curve Number (CN) of 91.
4. Perimeter ditches were modeled as 3-foot deep V-shaped channels with sides of 2H:1V on one side and 3H:1V on the other side. Perimeter ditch slopes ranged from 0.5% to 1%.
5. The size and geometry of the Cells 1 and 2 ash slopes were obtained from Sheet C-1 from Appendix A of this report.
6. Stormwater on the active portion of the Cell was divided into 11 subcatchments and 4 stormwater ponding areas : north, west, middle, and stormwater ponding areas, as shown on Figure 1. Flow from all subcatchments will consist of sheet flow until it is collected by a conveyance channel at the toe of each slope. The main stormwater ponding area is 1P on the southwest corner of Cell 2. Ponding area 3P, will have a 12-in diameter culvert allowing flow to ponding area 2P, which will have a 12-in diameter culvert flowing to ponding area 1P. Ponding area 4P does not have culverts to any other ponding areas. In all four stormwater surge areas (1P, 2P, 3P, and 4P), the water infiltrates into leachate collection granular drainage layer and is treated as leachate. Stormwater subcatchments and the stormwater surge areas are shown on Figure 1.
7. HydroCAD 10.0 was used to model the stormwater associated with Cell 1 of the PPPP landfill.
8. Subcatchment, reach, and detention parameters are included in the attached HydroCAD Report.

Results:

In general, stormwater is conveyed off the slopes of Cells 1 and 2 as sheet flow until it is intercepted by temporary containment ditches. The temporary containment ditches at the perimeter of the landfill cell are a minimum of 2-feet-deep and have a 3H:1V exterior slope and 2H:1V interior side slope. The exterior slope of the ditch is the top of the granular drainage layer of the leachate collection system. The interior slope is cut into the CCR disposed of in the

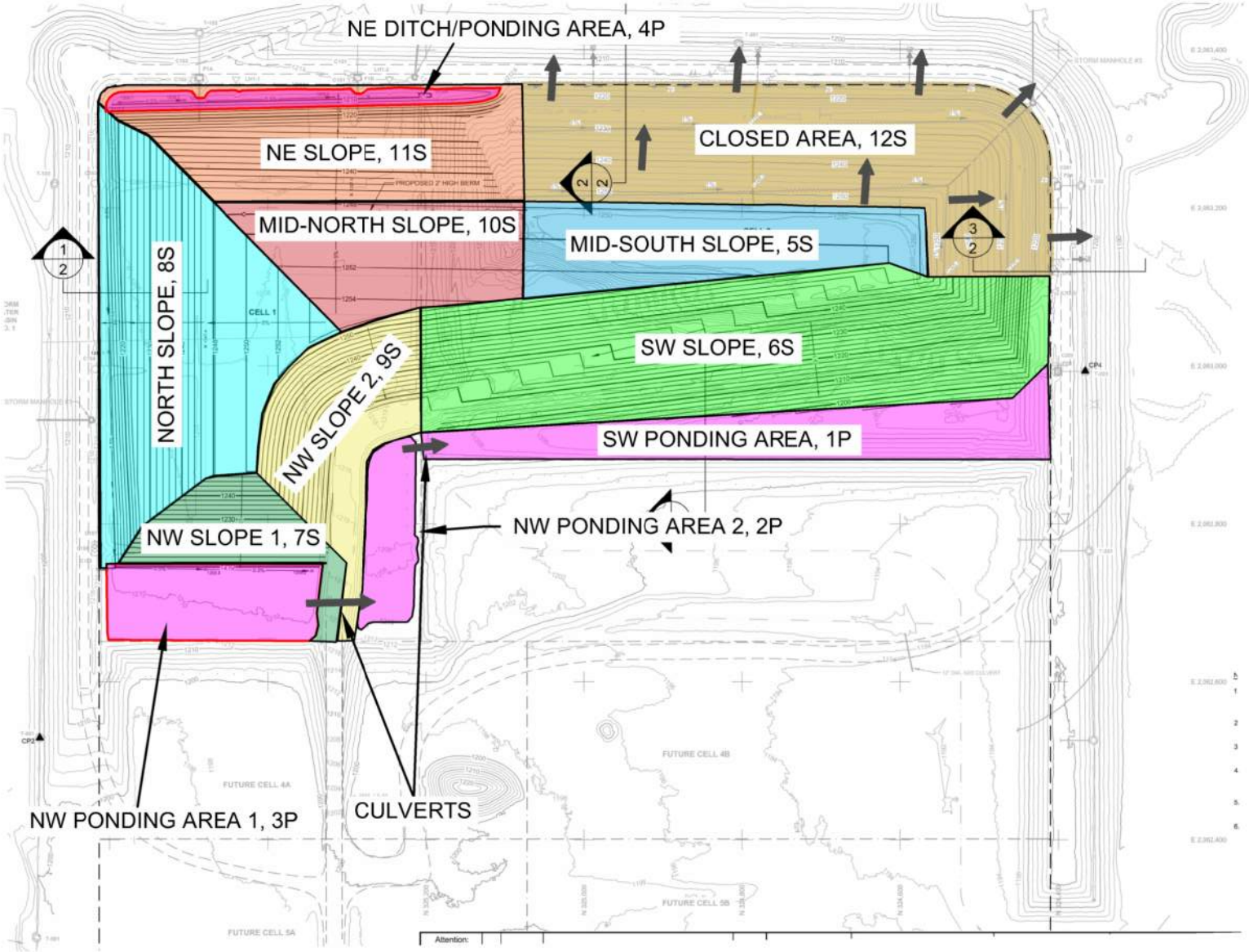
landfill. Upon closure of the landfill, the temporary stormwater containment ditch will be filled with soil or CCR prior to placement of the final cover system.

The results of the stormwater modeling calculations indicate that the perimeter ditches located along Cells 1 and 2 are able to contain and convey the flow of runoff resulting from the 25-year, 24-hour precipitation event, and route it to one of the four ponding areas. The table below shows the assumed starting elevations, the maximum ponding elevations, and amount of freeboard anticipated following the 25-year, 24-hour storm.

Stormwater Surge Area	Starting Elevation (ft)	Max Elevation (ft)	Top of Pond Elevation (ft)	Freeboard (ft)
SW Ponding Area, 1P	1196.00	1203.45	1208.00	4.55
NW Ponding Area 2, 2P	1208.00	1209.25	1210.00	0.75
NW Ponding Area 1, 3P	1209.00	1211.25	1212.00	0.75
NE Ditch/Ponding Area, 4P	1208.00	1212.89	1213.00	0.11

Attachments:

- Figure 1 –Stormwater Conveyance Diagram
- HydroCAD Summary Report

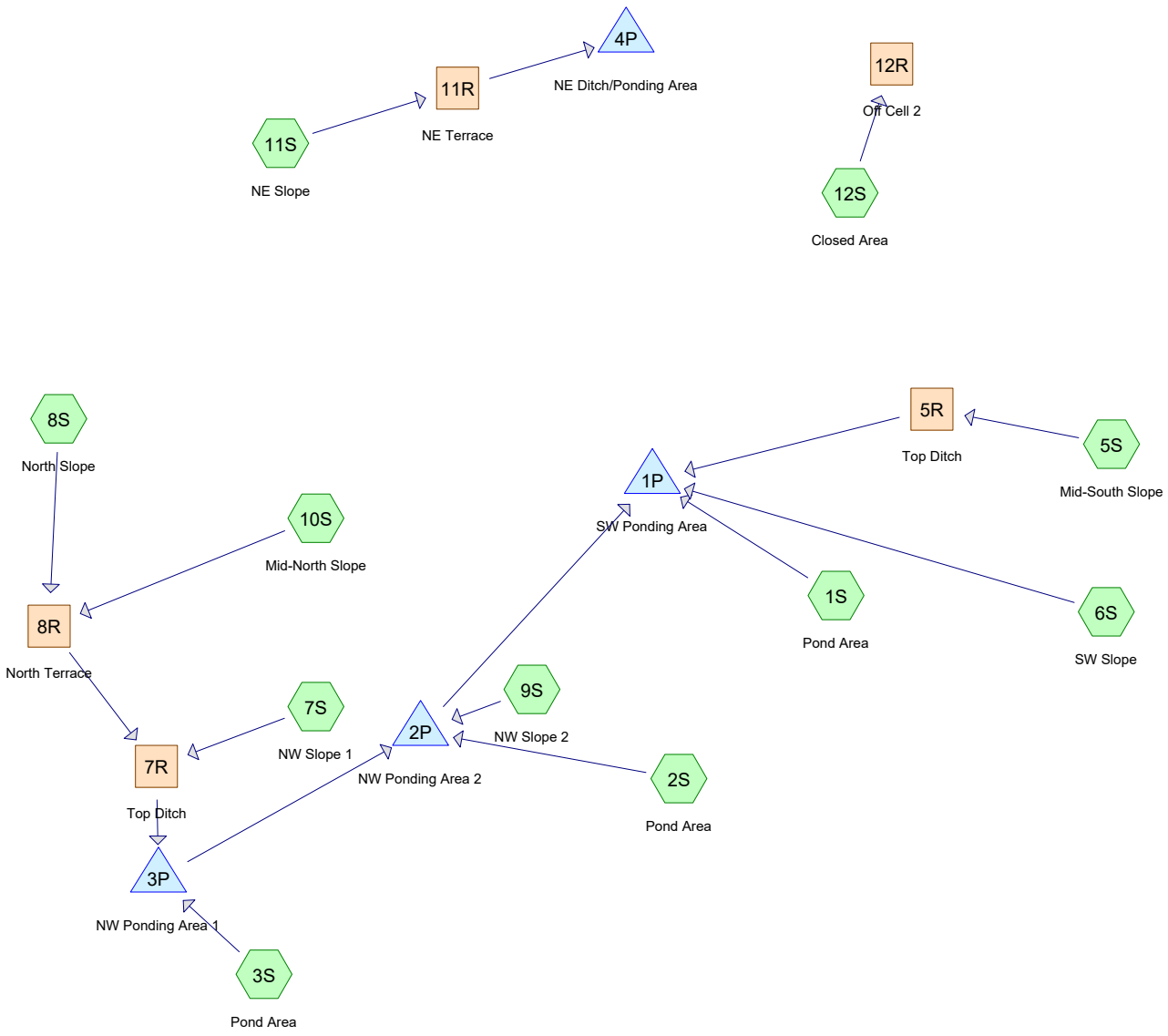


SOURCE:

1. PLAN BASED ON DWG. C-1, WESTON DISPOSAL SITE No. 3., SUBMITTAL DATE 10/08/2021

Run-on and Run-off Control Plan Weston Disposal Site No. 3 Marathon County, Wisconsin	GEI Consultants	Run-Off Stormwater Flow Diagram
We Energies Milwaukee, Wisconsin	Project 1803049	October 2021 Fig. 1

\\grb-pzcc-1\ J:\Landfills\WE - Weston Disposal Site No 3\1600630_run-on run-off control plan\dwg\2021\160063\0001_SW_Run-Off.dwg - 10/8/2021



Subcat Reach Pond Link

Routing Diagram for Cell 2 Runoff_2021_rev1
Prepared by GEI Consultants, Printed 10/8/2021

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
13.121	91	Newly graded area, HSG C (5S, 6S, 7S, 8S, 9S, 10S, 11S, 12S)
1.988	98	Water Surface, HSG C (1S, 2S, 3S)
15.109	**92**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
15.109	HSG C	1S, 2S, 3S, 5S, 6S, 7S, 8S, 9S, 10S, 11S, 12S
0.000	HSG D	
0.000	Other	
15.109		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.000	13.121	0.000	0.000	13.121	Newly graded area	5S, 6S, 7S, 8S, 9S, 10S, 11S, 12S
0.000	0.000	1.988	0.000	0.000	1.988	Water Surface	1S, 2S, 3S
0.000	**0.000**	**15.109**	**0.000**	**0.000**	**15.109**	**TOTAL AREA**	

Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Diam/Width (inches)	Height (inches)	Inside-Fill (inches)
1	2P	1,208.00	1,203.00	50.0	0.1000	0.013	12.0	0.0	0.0
2	3P	1,210.00	1,208.00	65.0	0.0308	0.013	12.0	0.0	0.0

Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment1S: Pond Area Runoff Area=46,160 sf 100.00% Impervious Runoff Depth=4.23"
Tc=0.0 min CN=98 Runoff=7.57 cfs 0.374 af

Subcatchment2S: Pond Area Runoff Area=14,567 sf 100.00% Impervious Runoff Depth=4.23"
Tc=0.0 min CN=98 Runoff=2.39 cfs 0.118 af

Subcatchment3S: Pond Area Runoff Area=25,866 sf 100.00% Impervious Runoff Depth=4.23"
Tc=0.0 min CN=98 Runoff=4.24 cfs 0.210 af

Subcatchment5S: Mid-South Slope Runoff Area=48,779 sf 0.00% Impervious Runoff Depth=3.47"
Flow Length=70' Slope=0.0500 '/' Tc=0.7 min CN=91 Runoff=7.26 cfs 0.324 af

Subcatchment6S: SW Slope Runoff Area=131,027 sf 0.00% Impervious Runoff Depth=3.47"
Flow Length=180' Slope=0.3300 '/' Tc=0.7 min CN=91 Runoff=19.49 cfs 0.870 af

Subcatchment7S: NW Slope 1 Runoff Area=23,549 sf 0.00% Impervious Runoff Depth=3.47"
Flow Length=110' Slope=0.3300 '/' Tc=0.5 min CN=91 Runoff=3.52 cfs 0.156 af

Subcatchment8S: North Slope Runoff Area=95,763 sf 0.00% Impervious Runoff Depth=3.47"
Flow Length=225' Tc=1.3 min CN=91 Runoff=13.89 cfs 0.636 af

Subcatchment9S: NW Slope 2 Runoff Area=42,752 sf 0.00% Impervious Runoff Depth=3.47"
Flow Length=150' Slope=0.3300 '/' Tc=0.6 min CN=91 Runoff=6.38 cfs 0.284 af

Subcatchment10S: Mid-North Slope Runoff Area=44,723 sf 0.00% Impervious Runoff Depth=3.47"
Flow Length=130' Slope=0.0500 '/' Tc=1.1 min CN=91 Runoff=6.55 cfs 0.297 af

Subcatchment11S: NE Slope Runoff Area=69,100 sf 0.00% Impervious Runoff Depth=3.47"
Flow Length=135' Slope=0.3300 '/' Tc=0.6 min CN=91 Runoff=10.31 cfs 0.459 af

Subcatchment12S: Closed Area Runoff Area=115,870 sf 0.00% Impervious Runoff Depth=3.47"
Flow Length=200' Slope=0.0500 '/' Tc=1.6 min CN=91 Runoff=16.57 cfs 0.769 af

Reach 5R: Top Ditch Avg. Flow Depth=0.98' Max Vel=2.60 fps Inflow=7.26 cfs 0.324 af
n=0.022 L=580.0' S=0.0043 '/' Capacity=124.23 cfs Outflow=6.06 cfs 0.324 af

Reach 7R: Top Ditch Avg. Flow Depth=1.53' Max Vel=3.32 fps Inflow=19.81 cfs 1.089 af
n=0.022 L=260.0' S=0.0038 '/' Capacity=117.35 cfs Outflow=19.02 cfs 1.089 af

Reach 8R: North Terrace Avg. Flow Depth=1.45' Max Vel=3.56 fps Inflow=20.44 cfs 0.932 af
n=0.022 L=585.0' S=0.0048 '/' Capacity=44.40 cfs Outflow=18.31 cfs 0.932 af

Reach 11R: NE Terrace Avg. Flow Depth=1.28' Max Vel=2.12 fps Inflow=10.31 cfs 0.459 af
n=0.022 L=500.0' S=0.0020 '/' Capacity=28.70 cfs Outflow=8.46 cfs 0.459 af

Reach 12R: Off Cell 2 Inflow=16.57 cfs 0.769 af
Outflow=16.57 cfs 0.769 af

Pond 1P: SW Ponding Area Peak Elev=1,203.45' Storage=142,884 cf Inflow=33.30 cfs 3.075 af
Outflow=0.00 cfs 0.000 af

Pond 2P: NW Ponding Area 2 Peak Elev=1,209.25' Storage=9,092 cf Inflow=10.09 cfs 1.509 af
12.0" Round Culvert n=0.013 L=50.0' S=0.1000 '/' Outflow=3.28 cfs 1.508 af

Pond 3P: NW Ponding Area 1 Peak Elev=1,211.25' Storage=30,882 cf Inflow=20.05 cfs 1.298 af
12.0" Round Culvert n=0.013 L=65.0' S=0.0308 '/' Outflow=3.27 cfs 1.107 af

Pond 4P: NE Ditch/Ponding Area Peak Elev=1,212.89' Storage=19,976 cf Inflow=8.46 cfs 0.459 af
Outflow=0.00 cfs 0.000 af

Total Runoff Area = 15.109 ac Runoff Volume = 4.495 af Average Runoff Depth = 3.57"
86.84% Pervious = 13.121 ac 13.16% Impervious = 1.988 ac

Summary for Subcatchment 1S: Pond Area

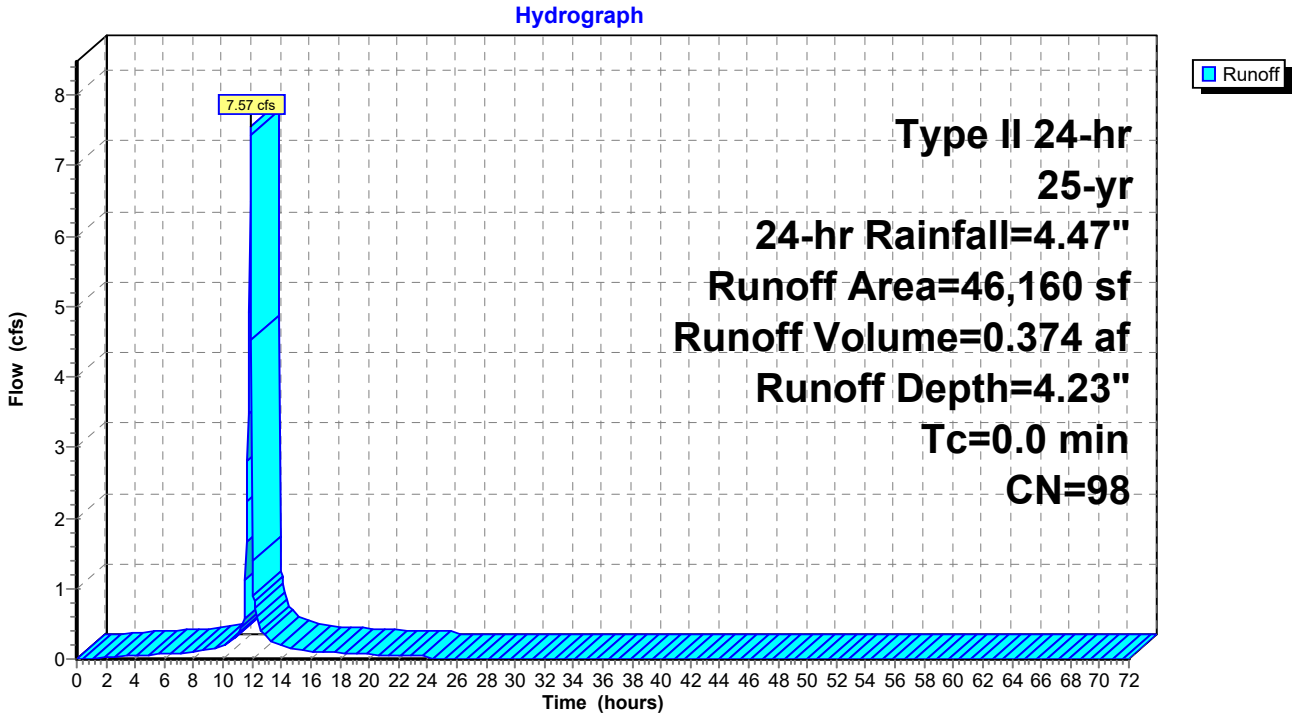
[46] Hint: Tc=0 (Instant runoff peak depends on dt)

Runoff = 7.57 cfs @ 11.89 hrs, Volume= 0.374 af, Depth= 4.23"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr, 24-hr Rainfall=4.47"

Area (sf)	CN	Description
46,160	98	Water Surface, HSG C
46,160		100.00% Impervious Area

Subcatchment 1S: Pond Area



Summary for Subcatchment 2S: Pond Area

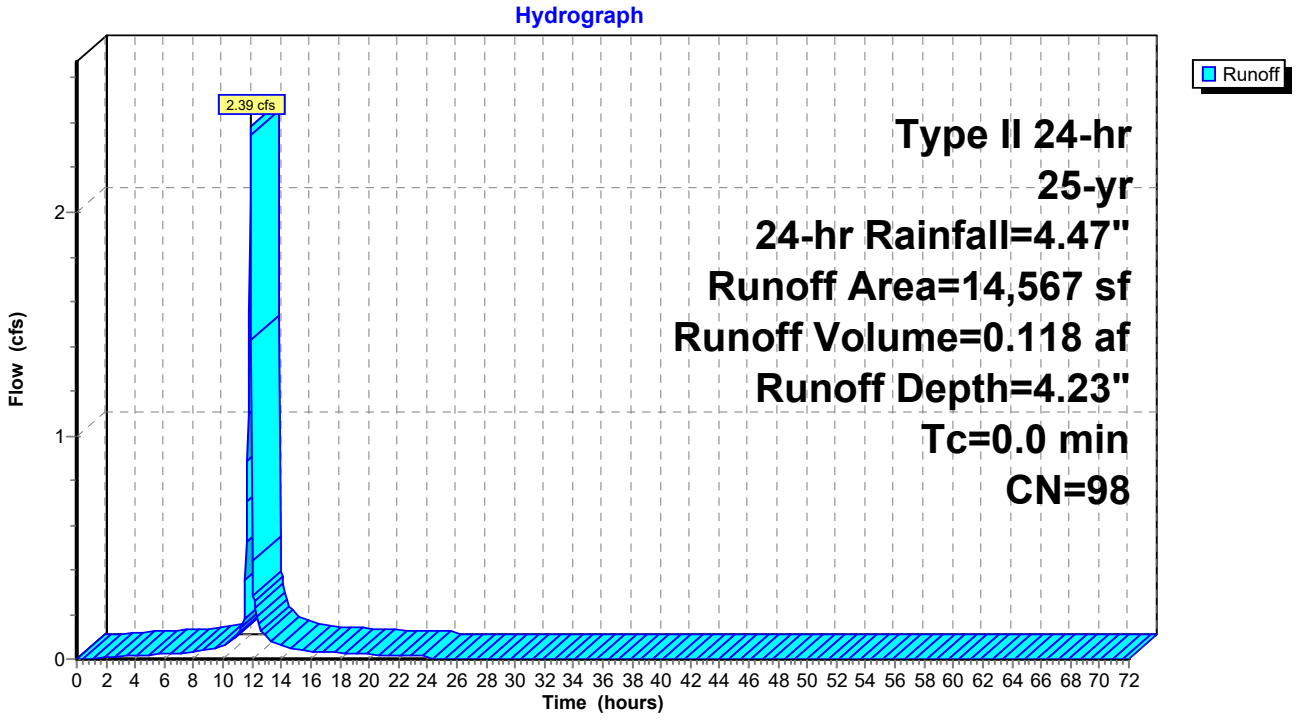
[46] Hint: Tc=0 (Instant runoff peak depends on dt)

Runoff = 2.39 cfs @ 11.89 hrs, Volume= 0.118 af, Depth= 4.23"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr, 24-hr Rainfall=4.47"

Area (sf)	CN	Description
14,567	98	Water Surface, HSG C
14,567		100.00% Impervious Area

Subcatchment 2S: Pond Area



Summary for Subcatchment 3S: Pond Area

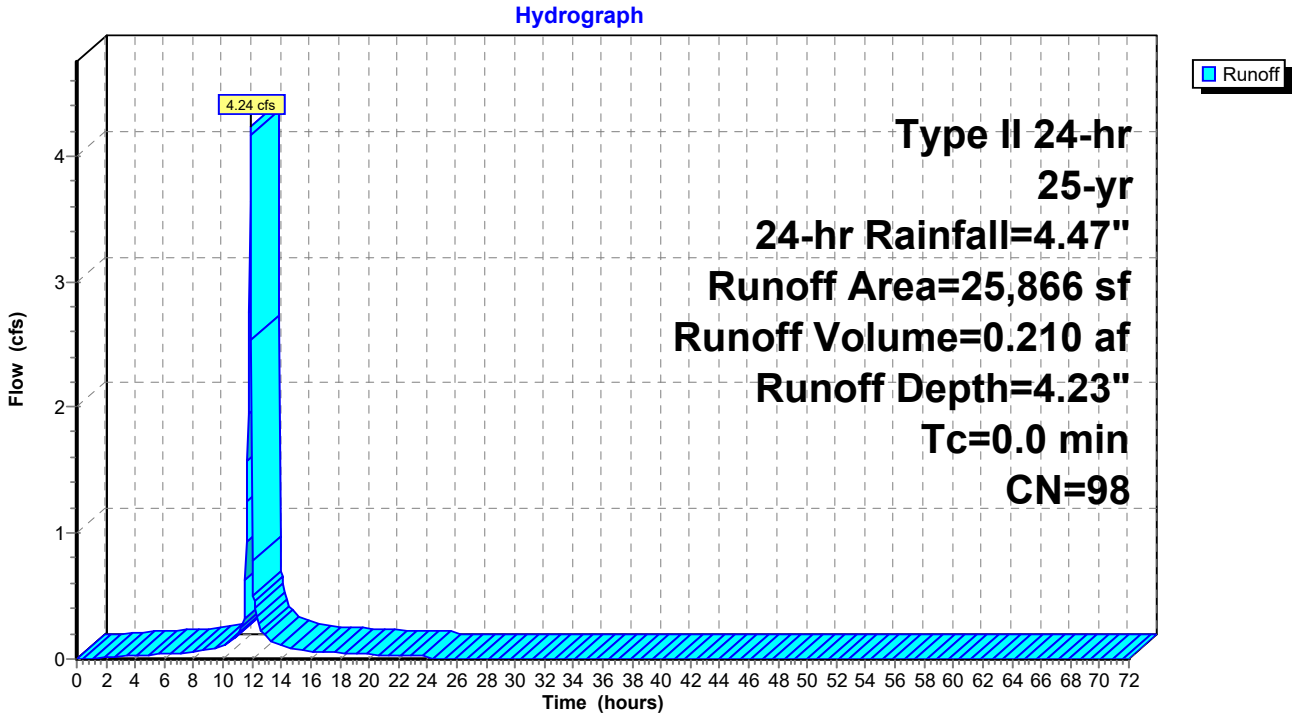
[46] Hint: Tc=0 (Instant runoff peak depends on dt)

Runoff = 4.24 cfs @ 11.89 hrs, Volume= 0.210 af, Depth= 4.23"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr, 24-hr Rainfall=4.47"

Area (sf)	CN	Description
25,866	98	Water Surface, HSG C
25,866		100.00% Impervious Area

Subcatchment 3S: Pond Area



Summary for Subcatchment 5S: Mid-South Slope

[49] Hint: Tc<2dt may require smaller dt

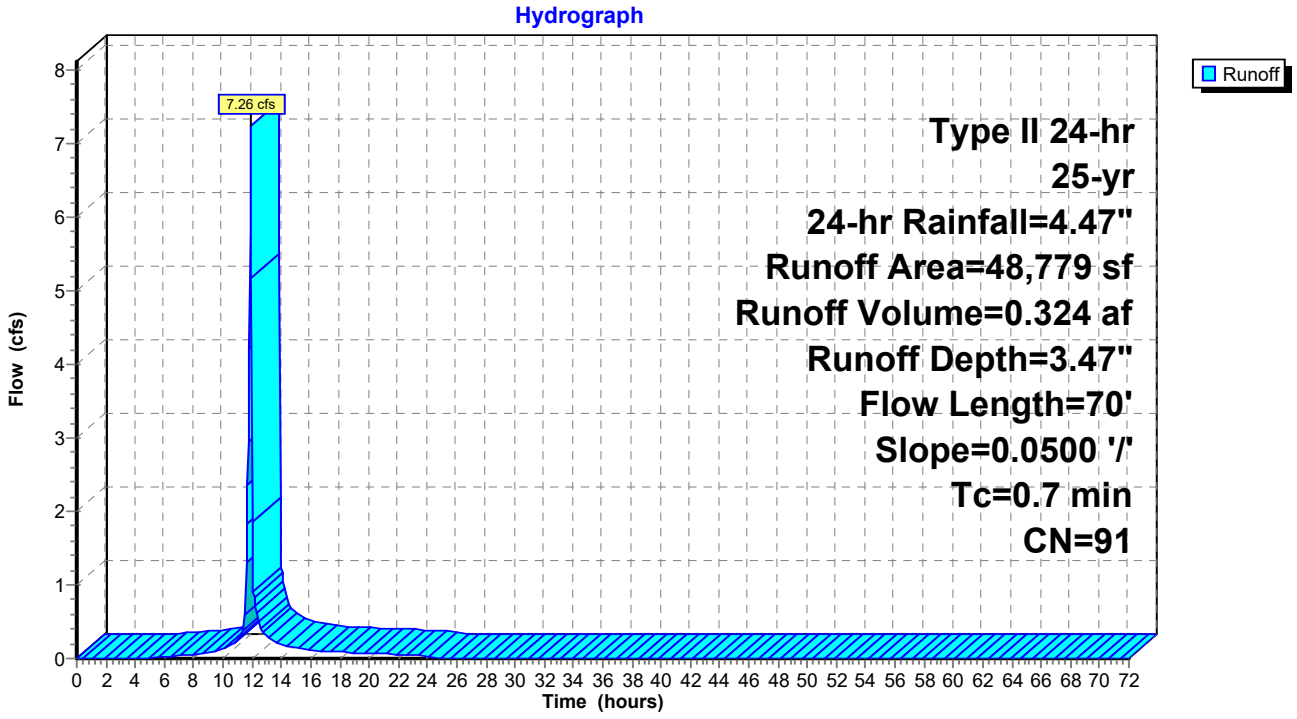
Runoff = 7.26 cfs @ 11.90 hrs, Volume= 0.324 af, Depth= 3.47"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr, 24-hr Rainfall=4.47"

Area (sf)	CN	Description
48,779	91	Newly graded area, HSG C
48,779		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.7	70	0.0500	1.67		**Sheet Flow, Upper Slopes** Smooth surfaces n= 0.011 P2= 2.61"

Subcatchment 5S: Mid-South Slope



Summary for Subcatchment 6S: SW Slope

[49] Hint: Tc<2dt may require smaller dt

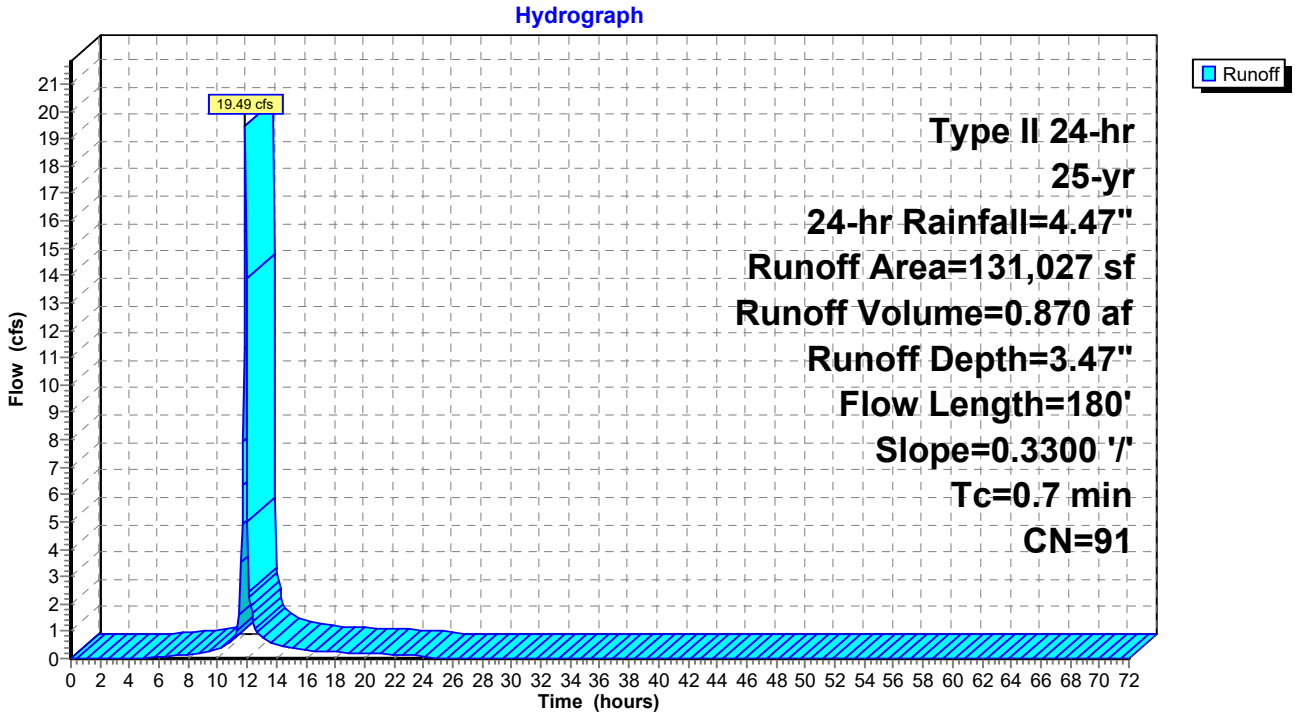
Runoff = 19.49 cfs @ 11.90 hrs, Volume= 0.870 af, Depth= 3.47"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr, 24-hr Rainfall=4.47"

Area (sf)	CN	Description
131,027	91	Newly graded area, HSG C
131,027		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.7	180	0.3300	4.29		**Sheet Flow, SW Slope** Smooth surfaces n= 0.011 P2= 2.61"

Subcatchment 6S: SW Slope



Summary for Subcatchment 7S: NW Slope 1

[49] Hint: Tc<2dt may require smaller dt

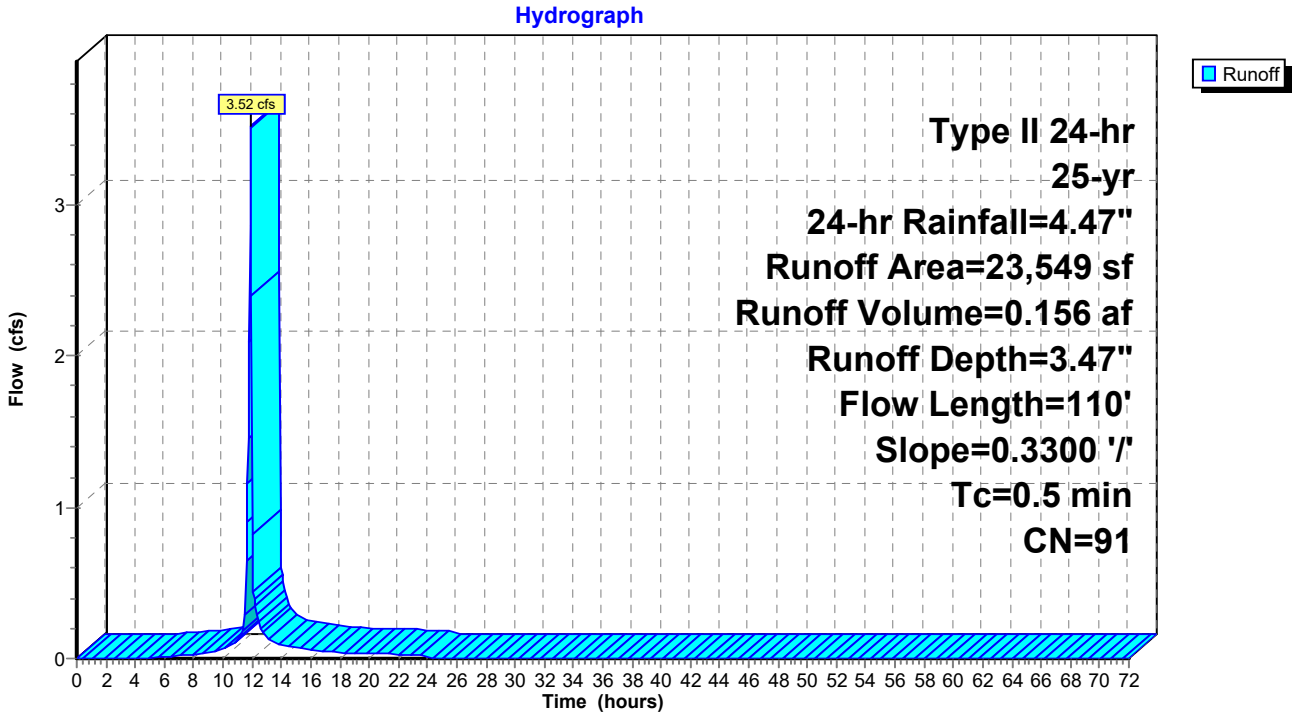
Runoff = 3.52 cfs @ 11.89 hrs, Volume= 0.156 af, Depth= 3.47"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr, 24-hr Rainfall=4.47"

Area (sf)	CN	Description
23,549	91	Newly graded area, HSG C
23,549		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	110	0.3300	3.89		**Sheet Flow, NW Slope 1** Smooth surfaces n= 0.011 P2= 2.61"

Subcatchment 7S: NW Slope 1



Summary for Subcatchment 8S: North Slope

[49] Hint: Tc<2dt may require smaller dt

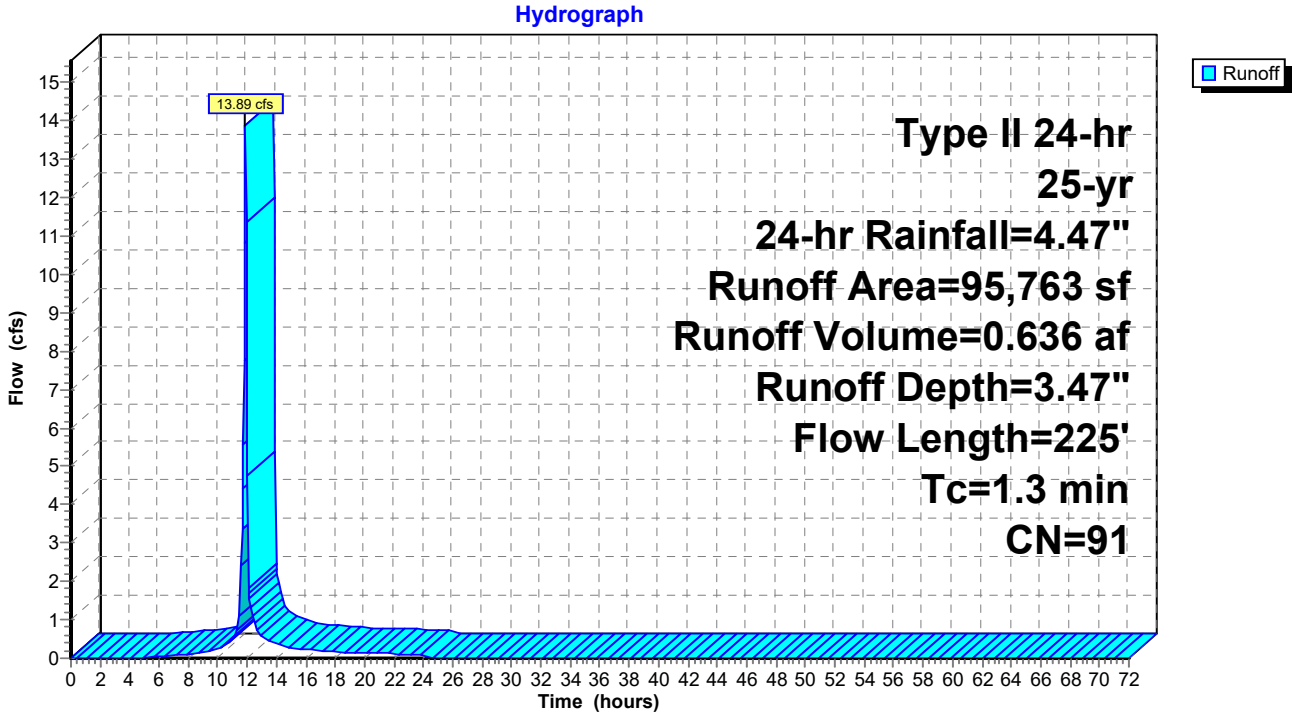
Runoff = 13.89 cfs @ 11.90 hrs, Volume= 0.636 af, Depth= 3.47"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr, 24-hr Rainfall=4.47"

Area (sf)	CN	Description
95,763	91	Newly graded area, HSG C
95,763		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.6	150	0.3300	4.13		**Sheet Flow, North Slope** Smooth surfaces n= 0.011 P2= 2.61"
0.7	75	0.0500	1.69		**Sheet Flow, 5%** Smooth surfaces n= 0.011 P2= 2.61"
1.3	225	Total			

Subcatchment 8S: North Slope



Summary for Subcatchment 9S: NW Slope 2

[49] Hint: Tc<2dt may require smaller dt

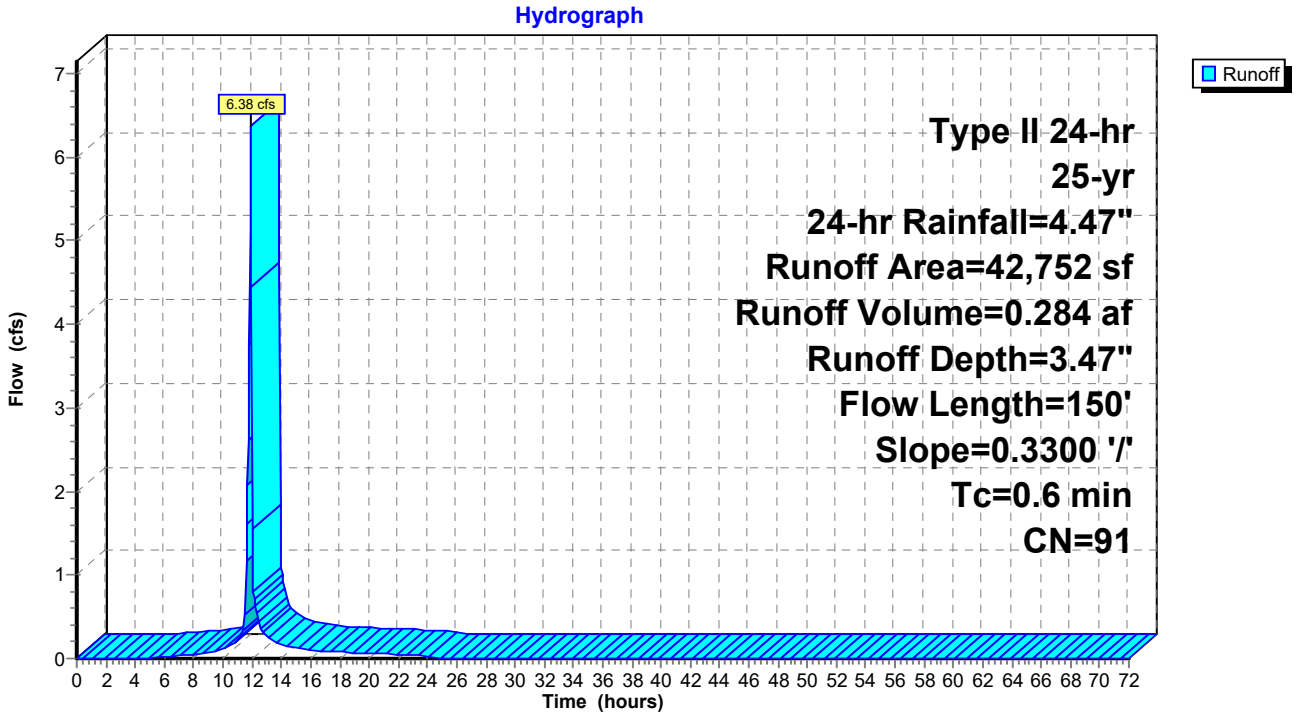
Runoff = 6.38 cfs @ 11.89 hrs, Volume= 0.284 af, Depth= 3.47"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr, 24-hr Rainfall=4.47"

Area (sf)	CN	Description
42,752	91	Newly graded area, HSG C
42,752		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.6	150	0.3300	4.13		**Sheet Flow, NW Slope 2** Smooth surfaces n= 0.011 P2= 2.61"

Subcatchment 9S: NW Slope 2



Summary for Subcatchment 10S: Mid-North Slope

[49] Hint: Tc<2dt may require smaller dt

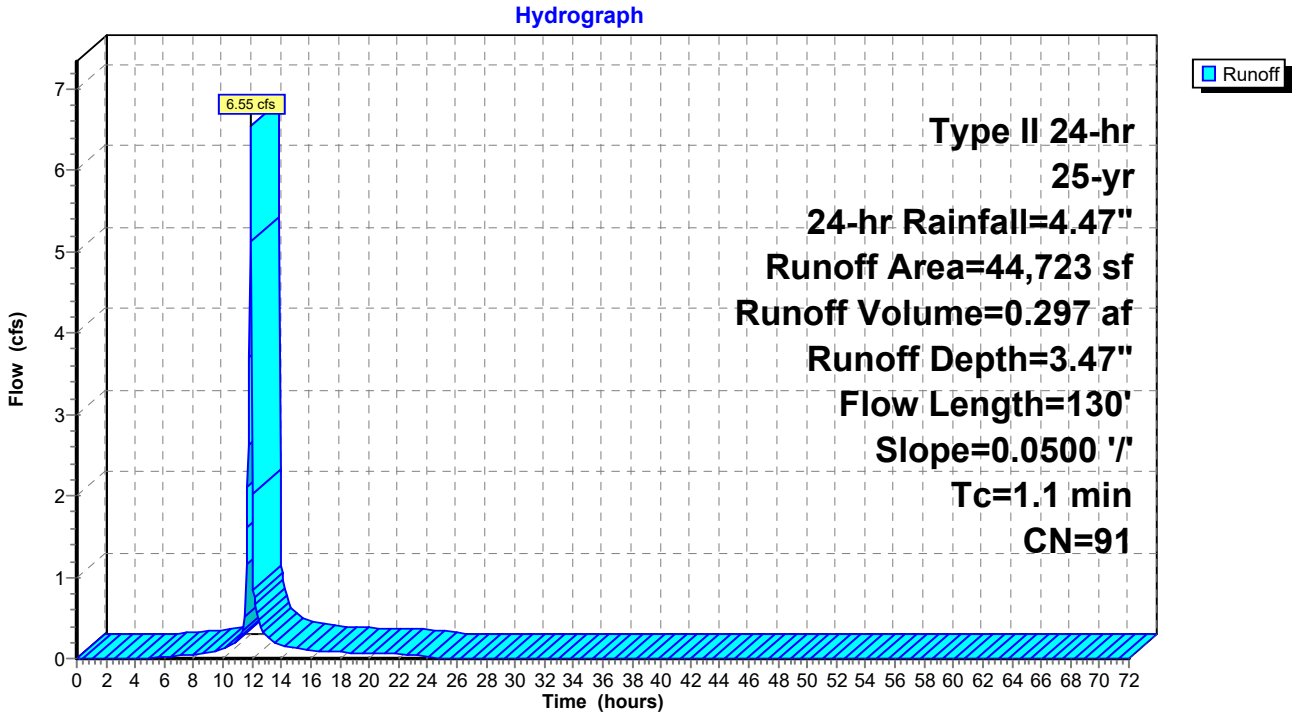
Runoff = 6.55 cfs @ 11.90 hrs, Volume= 0.297 af, Depth= 3.47"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr, 24-hr Rainfall=4.47"

Area (sf)	CN	Description
44,723	91	Newly graded area, HSG C
44,723		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.1	130	0.0500	1.89		**Sheet Flow, Upper Slopes** Smooth surfaces n= 0.011 P2= 2.61"

Subcatchment 10S: Mid-North Slope



Summary for Subcatchment 11S: NE Slope

[49] Hint: Tc<2dt may require smaller dt

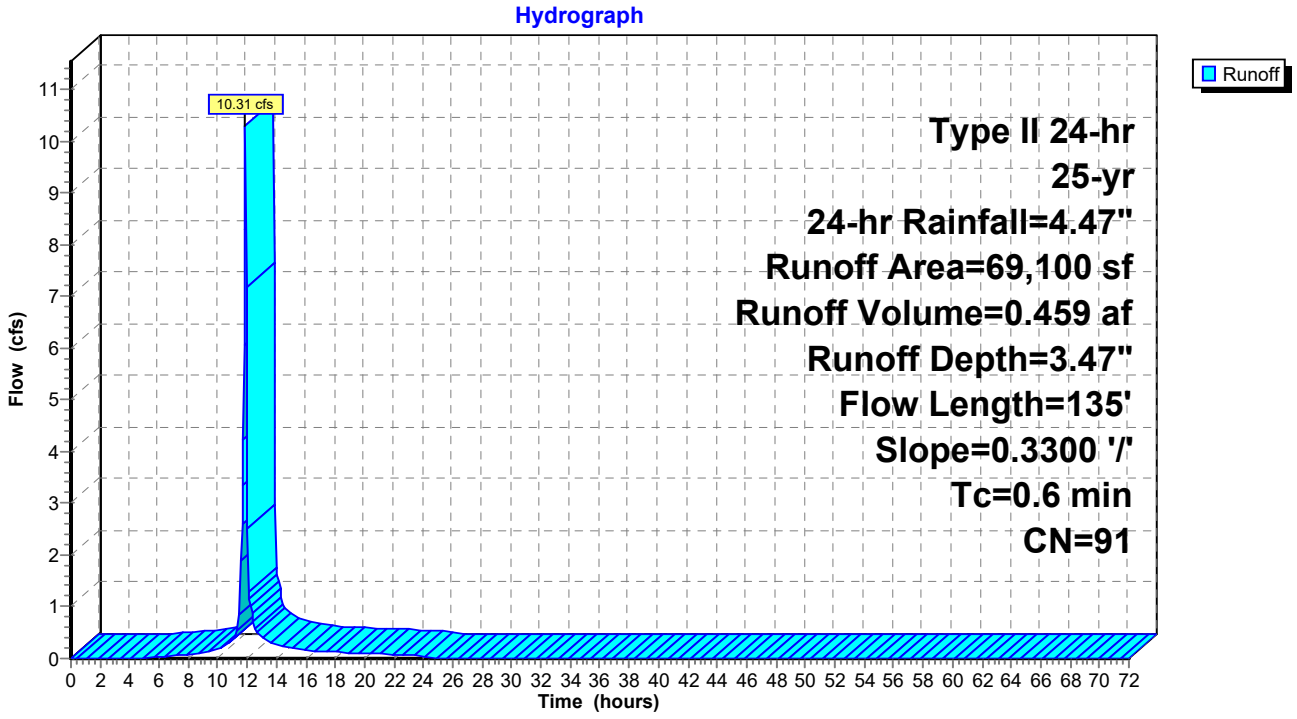
Runoff = 10.31 cfs @ 11.89 hrs, Volume= 0.459 af, Depth= 3.47"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr, 24-hr Rainfall=4.47"

Area (sf)	CN	Description
69,100	91	Newly graded area, HSG C
69,100		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.6	135	0.3300	4.05		**Sheet Flow, North Slope** Smooth surfaces n= 0.011 P2= 2.61"

Subcatchment 11S: NE Slope



Summary for Subcatchment 12S: Closed Area

[49] Hint: Tc<2dt may require smaller dt

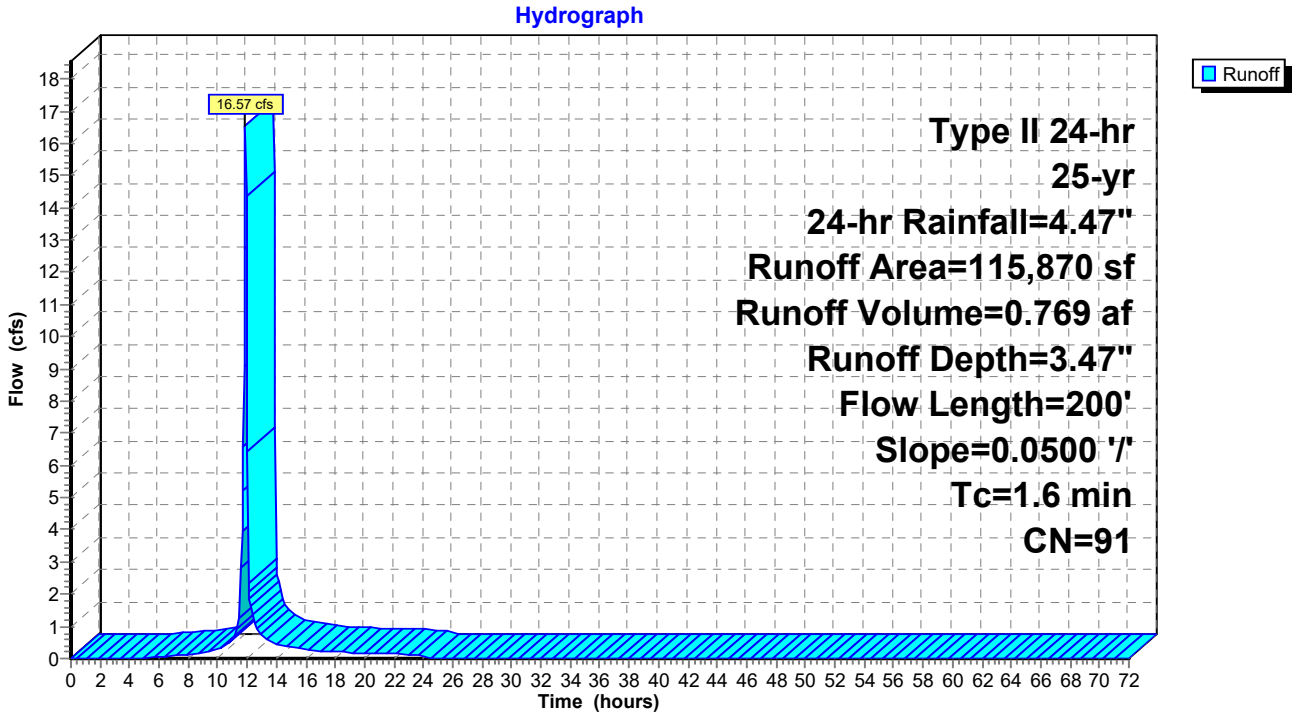
Runoff = 16.57 cfs @ 11.91 hrs, Volume= 0.769 af, Depth= 3.47"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr, 24-hr Rainfall=4.47"

Area (sf)	CN	Description
115,870	91	Newly graded area, HSG C
115,870		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.6	200	0.0500	2.06		**Sheet Flow, Upper Slopes** Smooth surfaces n= 0.011 P2= 2.61"

Subcatchment 12S: Closed Area



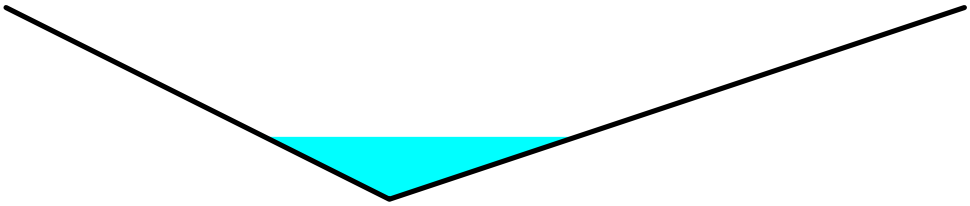
Summary for Reach 5R: Top Ditch

Inflow Area = 1.120 ac, 0.00% Impervious, Inflow Depth = 3.47" for 25-yr, 24-hr event
Inflow = 7.26 cfs @ 11.90 hrs, Volume= 0.324 af
Outflow = 6.06 cfs @ 11.99 hrs, Volume= 0.324 af, Atten= 17%, Lag= 5.7 min

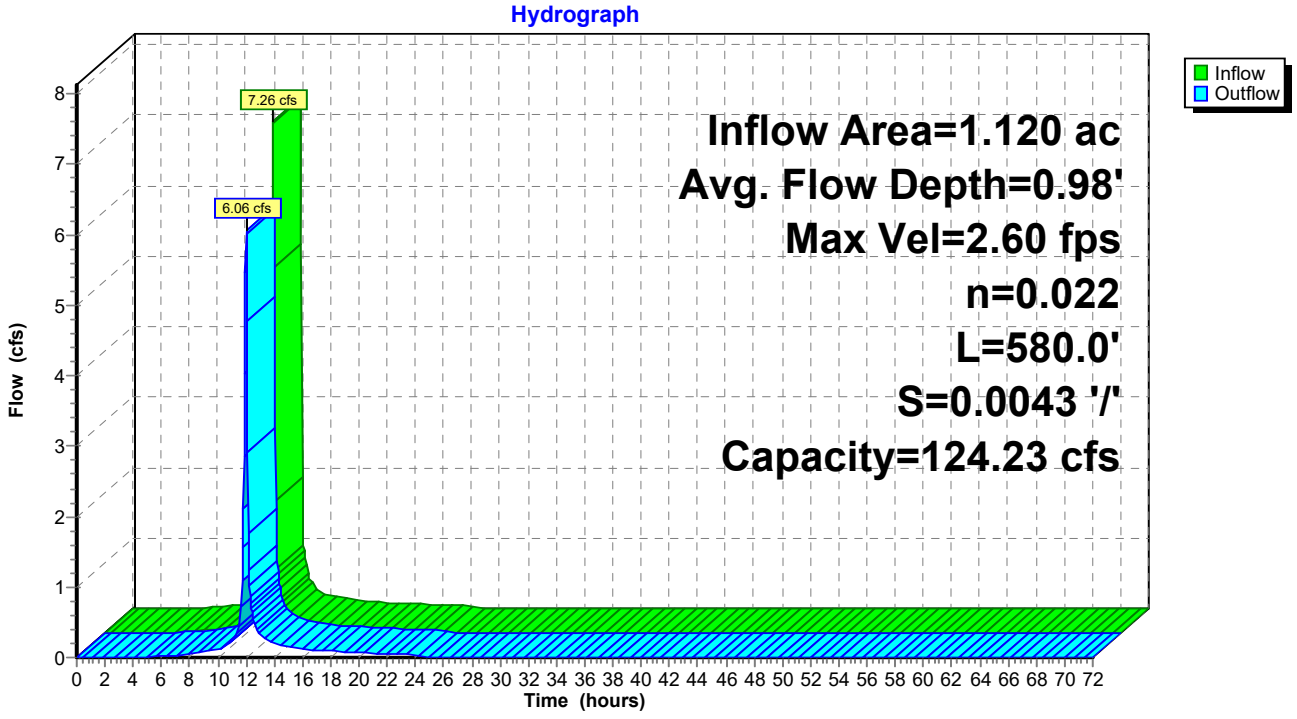
Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.60 fps, Min. Travel Time= 3.7 min
Avg. Velocity = 0.84 fps, Avg. Travel Time= 11.6 min

Peak Storage= 1,383 cf @ 11.93 hrs
Average Depth at Peak Storage= 0.98'
Bank-Full Depth= 3.00' Flow Area= 22.5 sf, Capacity= 124.23 cfs

0.00' x 3.00' deep channel, n= 0.022 Earth, clean & straight
Side Slope Z-value= 2.0 3.0 '/' Top Width= 15.00'
Length= 580.0' Slope= 0.0043 '/'
Inlet Invert= 1,240.50', Outlet Invert= 1,238.00'



Reach 5R: Top Ditch



Summary for Reach 7R: Top Ditch

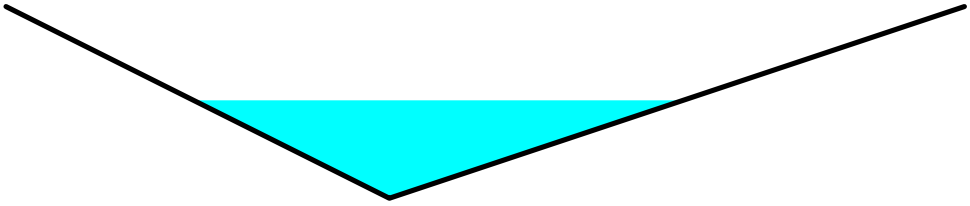
[62] Hint: Exceeded Reach 8R OUTLET depth by 0.41' @ 12.05 hrs

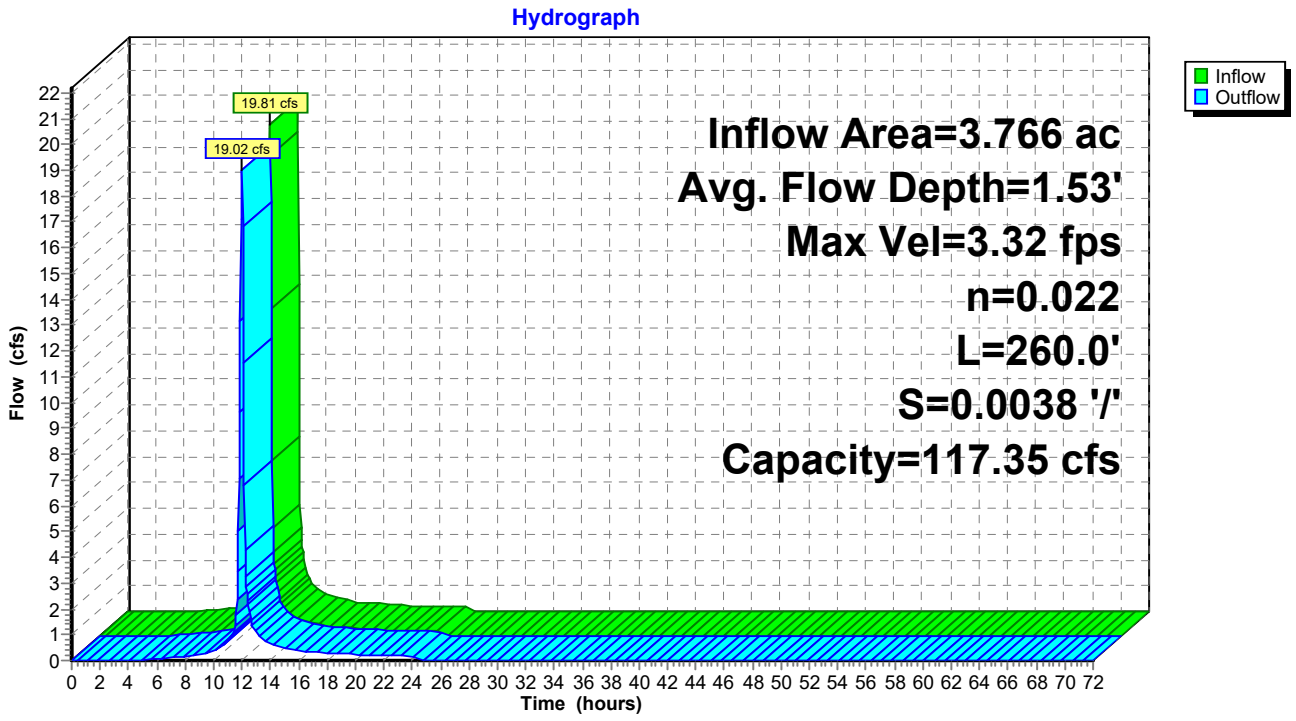
Inflow Area = 3.766 ac, 0.00% Impervious, Inflow Depth = 3.47" for 25-yr, 24-hr event
Inflow = 19.81 cfs @ 11.96 hrs, Volume= 1.089 af
Outflow = 19.02 cfs @ 12.00 hrs, Volume= 1.089 af, Atten= 4%, Lag= 2.2 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.32 fps, Min. Travel Time= 1.3 min
Avg. Velocity = 1.05 fps, Avg. Travel Time= 4.1 min

Peak Storage= 1,530 cf @ 11.98 hrs
Average Depth at Peak Storage= 1.53'
Bank-Full Depth= 3.00' Flow Area= 22.5 sf, Capacity= 117.35 cfs

0.00' x 3.00' deep channel, n= 0.022 Earth, clean & straight
Side Slope Z-value= 2.0 3.0 '/' Top Width= 15.00'
Length= 260.0' Slope= 0.0038 '/'
Inlet Invert= 1,209.20', Outlet Invert= 1,208.20'





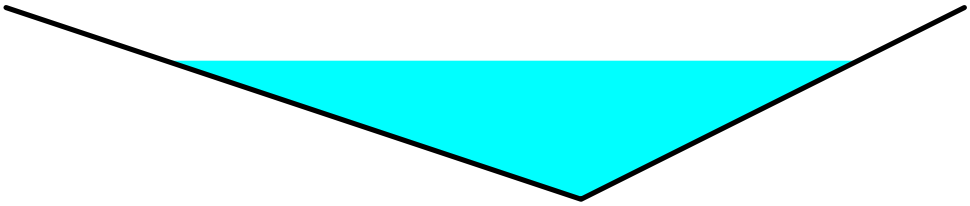
Summary for Reach 8R: North Terrace

Inflow Area = 3.225 ac, 0.00% Impervious, Inflow Depth = 3.47" for 25-yr, 24-hr event
Inflow = 20.44 cfs @ 11.90 hrs, Volume= 0.932 af
Outflow = 18.31 cfs @ 11.98 hrs, Volume= 0.932 af, Atten= 10%, Lag= 4.7 min

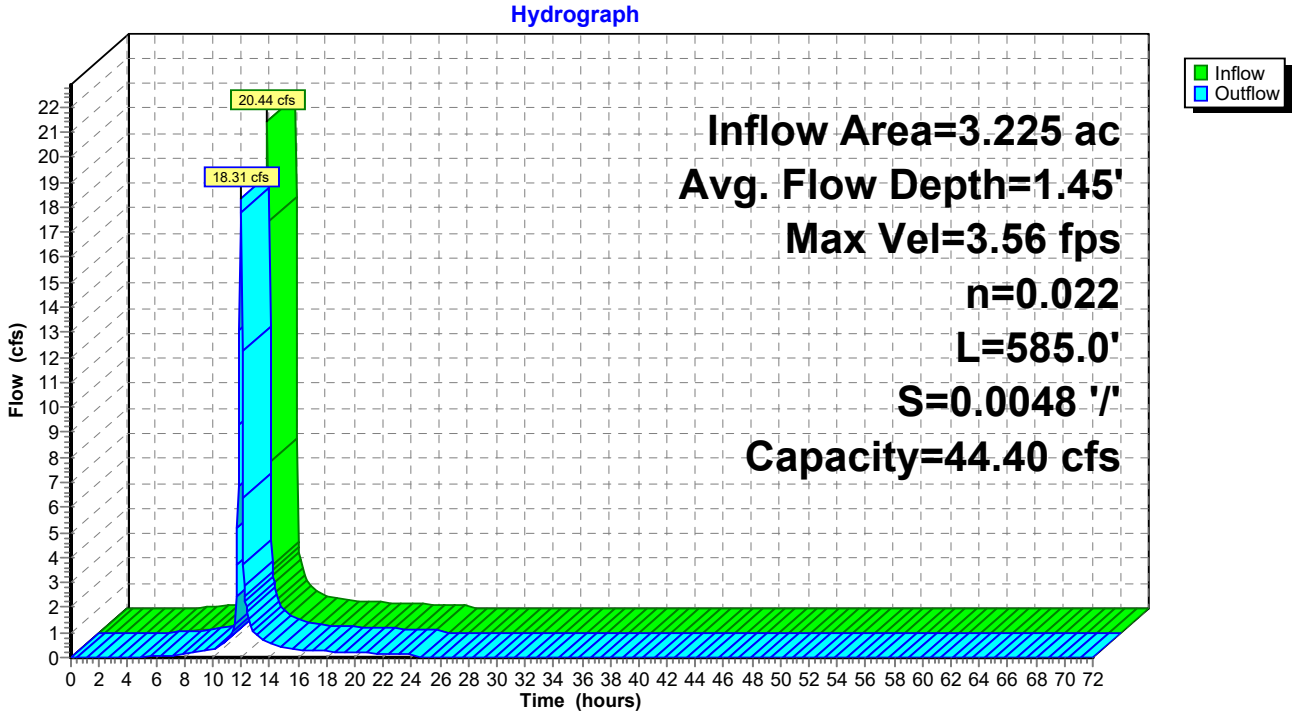
Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.56 fps, Min. Travel Time= 2.7 min
Avg. Velocity = 1.10 fps, Avg. Travel Time= 8.9 min

Peak Storage= 3,052 cf @ 11.93 hrs
Average Depth at Peak Storage= 1.45'
Bank-Full Depth= 2.00' Flow Area= 10.0 sf, Capacity= 44.40 cfs

0.00' x 2.00' deep channel, n= 0.022 Earth, clean & straight
Side Slope Z-value= 3.0 2.0 '/' Top Width= 10.00'
Length= 585.0' Slope= 0.0048 '/'
Inlet Invert= 1,212.00', Outlet Invert= 1,209.20'



Reach 8R: North Terrace



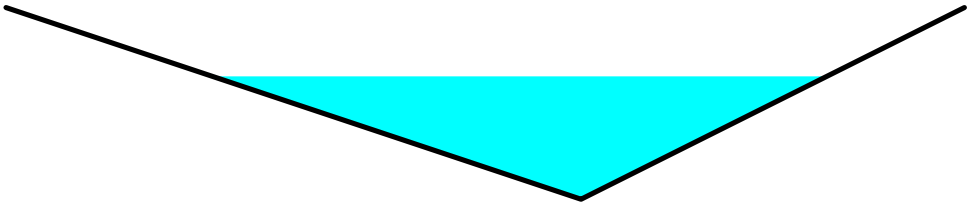
Summary for Reach 11R: NE Terrace

Inflow Area = 1.586 ac, 0.00% Impervious, Inflow Depth = 3.47" for 25-yr, 24-hr event
Inflow = 10.31 cfs @ 11.89 hrs, Volume= 0.459 af
Outflow = 8.46 cfs @ 11.99 hrs, Volume= 0.459 af, Atten= 18%, Lag= 5.9 min

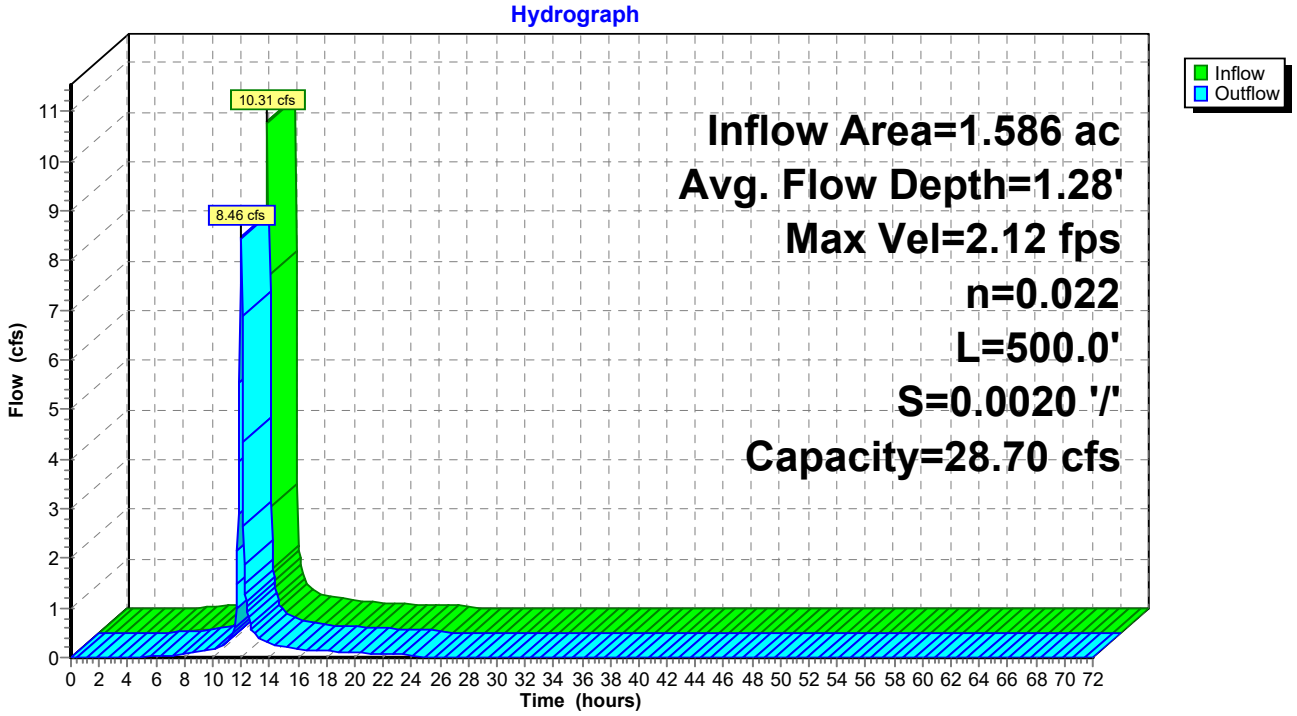
Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.12 fps, Min. Travel Time= 3.9 min
Avg. Velocity = 0.64 fps, Avg. Travel Time= 13.0 min

Peak Storage= 2,052 cf @ 11.93 hrs
Average Depth at Peak Storage= 1.28'
Bank-Full Depth= 2.00' Flow Area= 10.0 sf, Capacity= 28.70 cfs

0.00' x 2.00' deep channel, n= 0.022 Earth, clean & straight
Side Slope Z-value= 3.0 2.0 '/' Top Width= 10.00'
Length= 500.0' Slope= 0.0020 '/'
Inlet Invert= 1,209.00', Outlet Invert= 1,208.00'



Reach 11R: NE Terrace



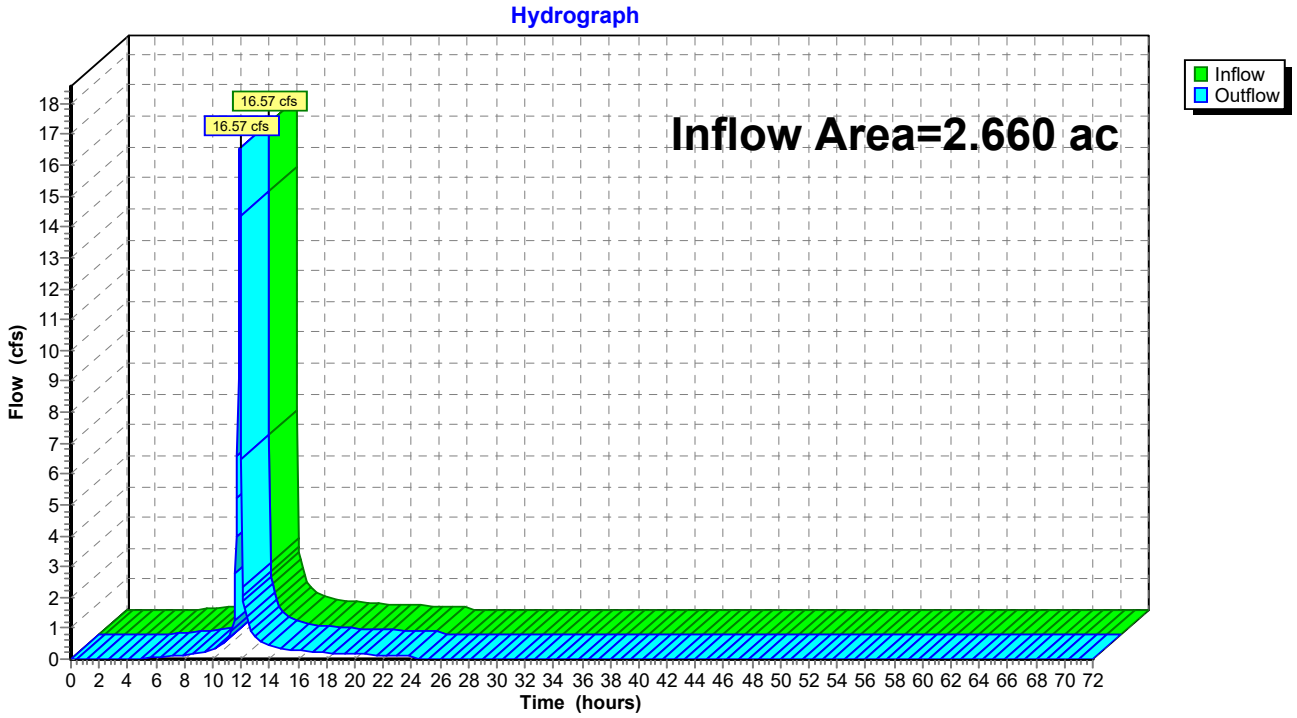
Summary for Reach 12R: Off Cell 2

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 2.660 ac, 0.00% Impervious, Inflow Depth = 3.47" for 25-yr, 24-hr event
Inflow = 16.57 cfs @ 11.91 hrs, Volume= 0.769 af
Outflow = 16.57 cfs @ 11.91 hrs, Volume= 0.769 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Reach 12R: Off Cell 2



Summary for Pond 1P: SW Ponding Area

[79] Warning: Submerged Pond 2P Primary device # 1 OUTLET by 0.45'

Inflow Area = 10.863 ac, 18.30% Impervious, Inflow Depth = 3.40" for 25-yr, 24-hr event
Inflow = 33.30 cfs @ 11.90 hrs, Volume= 3.075 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min

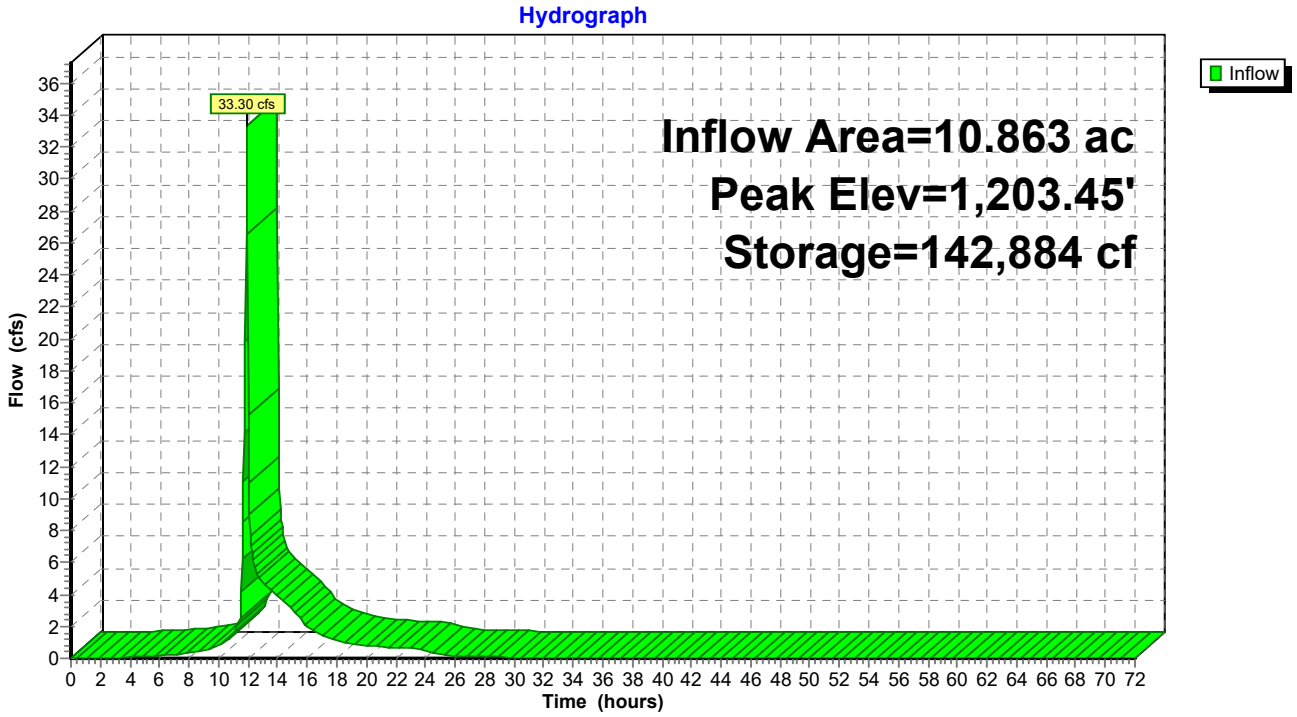
Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Starting Elev= 1,196.00' Surf.Area= 6,415 sf Storage= 8,935 cf
Peak Elev= 1,203.45' @ 72.00 hrs Surf.Area= 32,462 sf Storage= 142,884 cf (133,949 cf above start)

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	1,194.00'	342,222 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,194.00	2,520	0	0
1,196.00	6,415	8,935	8,935
1,198.00	11,611	18,026	26,961
1,200.00	18,014	29,625	56,586
1,202.00	25,896	43,910	100,496
1,204.00	34,935	60,831	161,327
1,206.00	44,960	79,895	241,222
1,208.00	56,040	101,000	342,222

Pond 1P: SW Ponding Area



Summary for Pond 2P: NW Ponding Area 2

[79] Warning: Submerged Pond 3P Primary device # 1 OUTLET by 1.25'

Inflow Area = 5.675 ac, 16.36% Impervious, Inflow Depth > 3.19" for 25-yr, 24-hr event
Inflow = 10.09 cfs @ 11.90 hrs, Volume= 1.509 af
Outflow = 3.28 cfs @ 13.02 hrs, Volume= 1.508 af, Atten= 67%, Lag= 67.3 min
Primary = 3.28 cfs @ 13.02 hrs, Volume= 1.508 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 1,209.25' @ 13.02 hrs Surf.Area= 11,938 sf Storage= 9,092 cf

Plug-Flow detention time= 41.4 min calculated for 1.507 af (100% of inflow)
Center-of-Mass det. time= 40.4 min (956.7 - 916.3)

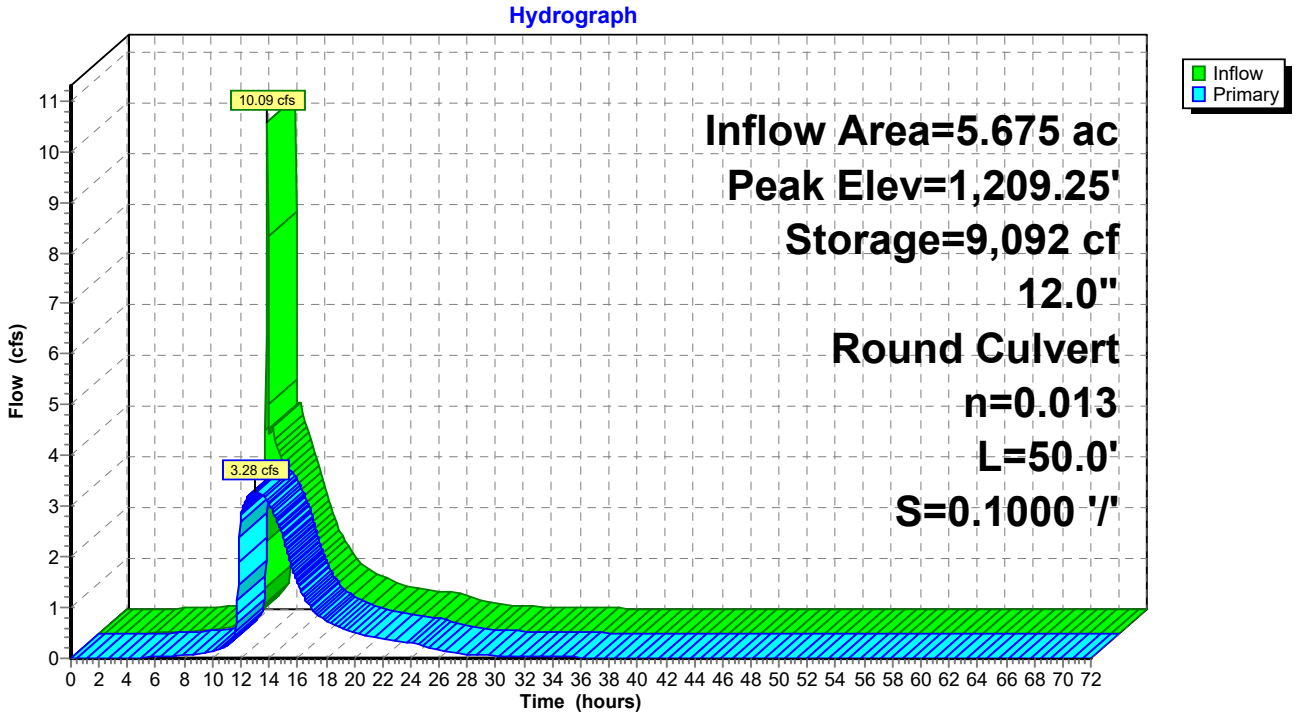
Volume	Invert	Avail.Storage	Storage Description
#1	1,208.00'	18,987 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,208.00	1,315	0	0
1,209.00	11,046	6,181	6,181
1,210.00	14,566	12,806	18,987

Device	Routing	Invert	Outlet Devices
#1	Primary	1,208.00'	**12.0" Round Culvert** L= 50.0' Ke= 0.500 Inlet / Outlet Invert= 1,208.00' / 1,203.00' S= 0.1000 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=3.28 cfs @ 13.02 hrs HW=1,209.25' (Free Discharge)
1=Culvert (Inlet Controls 3.28 cfs @ 4.18 fps)

Pond 2P: NW Ponding Area 2



Summary for Pond 3P: NW Ponding Area 1

[63] Warning: Exceeded Reach 7R INLET depth by 1.42' @ 12.70 hrs

Inflow Area = 4.360 ac, 13.62% Impervious, Inflow Depth = 3.57" for 25-yr, 24-hr event
Inflow = 20.05 cfs @ 11.98 hrs, Volume= 1.298 af
Outflow = 3.27 cfs @ 12.30 hrs, Volume= 1.107 af, Atten= 84%, Lag= 19.0 min
Primary = 3.27 cfs @ 12.30 hrs, Volume= 1.107 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 1,211.25' @ 12.30 hrs Surf.Area= 22,685 sf Storage= 30,882 cf

Plug-Flow detention time= 250.3 min calculated for 1.106 af (85% of inflow)
Center-of-Mass det. time= 184.5 min (969.4 - 784.9)

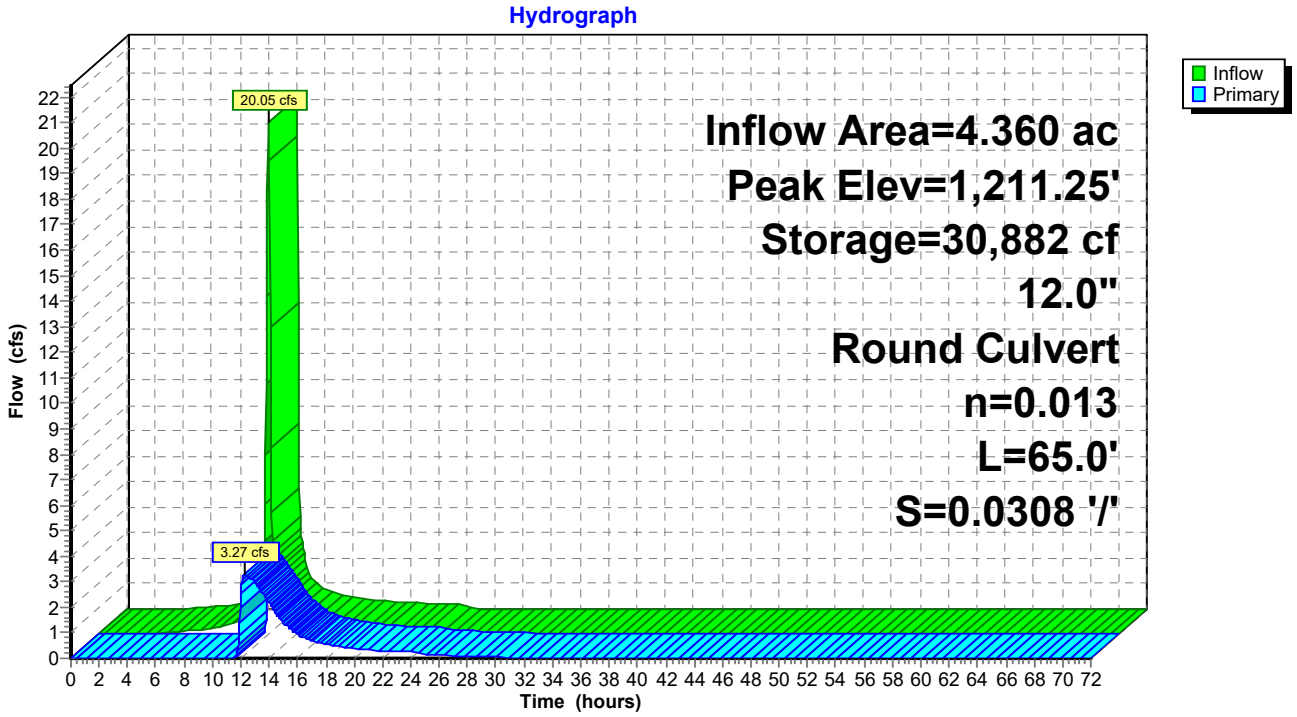
Volume	Invert	Avail.Storage	Storage Description
#1	1,209.00'	49,170 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,209.00	3,389	0	0
1,210.00	12,897	8,143	8,143
1,211.00	21,635	17,266	25,409
1,212.00	25,886	23,761	49,170

Device	Routing	Invert	Outlet Devices
#1	Primary	1,210.00'	**12.0" Round Culvert** L= 65.0' Ke= 0.500 Inlet / Outlet Invert= 1,210.00' / 1,208.00' S= 0.0308 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=3.27 cfs @ 12.30 hrs HW=1,211.25' (Free Discharge)
↑—**1=Culvert** (Inlet Controls 3.27 cfs @ 4.16 fps)

Pond 3P: NW Ponding Area 1



Summary for Pond 4P: NE Ditch/Ponding Area

[63] Warning: Exceeded Reach 11R INLET depth by 3.89' @ 53.40 hrs

Inflow Area = 1.586 ac, 0.00% Impervious, Inflow Depth = 3.47" for 25-yr, 24-hr event
Inflow = 8.46 cfs @ 11.99 hrs, Volume= 0.459 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 1,212.89' @ 46.55 hrs Surf.Area= 10,241 sf Storage= 19,976 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	1,208.00'	21,144 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,208.00	100	0	0
1,209.00	200	150	150
1,210.00	2,825	1,513	1,663
1,211.00	4,990	3,908	5,570
1,212.00	7,804	6,397	11,967
1,213.00	10,549	9,177	21,144

Pond 4P: NE Ditch/Ponding Area