GEI Consultants

Consulting
Engineers and
Scientists

Regulation Compliance Report

Run-on and Run-off Control Plan

Pleasant Prairie Power Plant Ash Landfill
Pleasant Prairie, Wisconsin

Submitted to:
We Energies
333 W. Everett Street, A231
Milwaukee, Wisconsin 53203

Submitted by:
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October 2016, Revision 0
Project 1610534

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1. Introduction

We Energies owns and operates a solid waste disposal facility adjacent to the Pleasant Prairie Power Plant (PPPP) in Section 9, Township 1 North, Range 22 East, in the village of Pleasant Prairie, Kenosha County, Wisconsin. The landfill property is bounded on the north by State Highway 50 (75th Street), on the south by Bain Station Road, and on the east and west by active rail lines. The We Energies PPPP Ash 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. 2786, FID# 230056310. The construction of Cell 1 was completed and the landfill was placed into operation in 2014.

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* and is defined as a CCR unit and existing CCR landfill in accordance with § 257.53. Future landfill cells are permitted by the WDNR in the conditionally approved Plan of Operation and defined as lateral expansions under § 257.53 when developed.

This report fulfills the requirements of § 257.81 - *Run-on and run-off controls for CCR landfills* for the PPPP Ash Landfill, Cell 1. 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 are 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 PPPP Ash Landfill is approximately 301,422 square feet or 6.92 acres in size. All precipitation that falls within 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 – Existing Grade Survey 10-30-2015 located in Appendix A – Existing Conditions Drawings, shows Cell 1 of the PPPP Ash Landfill.

The rainfall depth estimate for a 24-hour, 25-year storm for the PPPP Ash Landfill was determined following the procedures outlined in Precipitation-Frequency Atlas of the United States, Atlas 14, Volume 8, Version 2: Wisconsin. For the PPPP Ash Landfill a 24-hour, 25-year storm will result in 4.52 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 Cell 1.

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

Storm Recurrence Interval	Rainfall Depth (inches)	Cell 1 Lined Area (acres)	Run-off Volume (acre-ft)
24-hour, 25-year	4.52	6.92	2.61

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 to the landfill, perimeter berms have been established around the north, east and west sides of the landfill to direct stormwater away from the active landfill. Run-on stormwater sheet flows away from the perimeter berms to the drainage ditches that bound the site. The perimeter berms also allow access around the north, east, and west sides of the landfill. The access road constructed on top of the perimeter berms is graded to direct stormwater to the exterior of the berm away from the active landfill.

Along the south side of the landfill, an intercell berm was constructed to prevent run-on from south of the landfill and to prevent run-off of contact water from the landfill. A perimeter ditch along the outboard edge of the intercell berm directs run-on stormwater to the west and southwest away from the active area as shown on Drawing C-1 in Appendix A. The intercell berm will eventually be buried with CCR when the landfill is expanded southward with the construction of Cell 2. Stormwater drainage at the site is directed away from the landfill and eventually flows southward discharging to the unnamed tributaries of Jerome Creek.

A stormwater run-off model was completed to confirm that the current run-on control system on the south side of the intercell berm is sufficiently sized to manage a 24-hour, 25-year precipitation event. The rainfall depth estimate is 4.52 inches as previously discussed. HydroCAD 10.0 was used to model the stormwater on the south side of the Cell 1 intercell berm. The stormwater run-on calculations for the ditch south of the intercell berm are included in Appendix C: Stormwater Run-on Calculations. Based on stormwater run-on analysis the current run-on control system for Cell 1 of PPPP landfill will be able to handle the 24-hr, 25yr precipitation event without allowing any non-contact water to enter the limits of waste. The estimated peak water level in the channel on the west side is 0.8-feet, and corresponds to an elevation of 686.8 feet. The minimum height of the intercell berm is 687 feet; thus, the berm is high enough to not allow stormwater to enter the active Cell 1 area. The conveyance channel south of the intercell berm is adequately sized to prevent run-on to Cell 1 associated with the 24-hr, 25-yr precipitation event.

The south side of the landfill, including the area permitted by the state of Wisconsin for future lateral expansion, is protected from the 1-percent-annual-chance or greater flood hazard by a levee system that has been accredited by the Federal Emergency Management Agency (FEMA), as shown in Appendix D: Excerpts from the Kenosha County FIS. The floodplain levee was constructed to protect a portion of the permitted landfill space from being within the 100-year floodplain of the Unnamed Tributary No. 2 and No. 3 to Jerome Creek. Based on a review of current topography and FEMA Flood Levee Certification (GEI, 2013) the PPPP Ash

Landfill has an acceptable run-on control system that follows current engineering standards and is in compliance 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 over land from any part of a CCR landfill.*"

During the operation and filling of Cell 1, 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 temporary containment ditch along the perimeter edge of the cell, inside of the landfill. The contact water is then routed to a stormwater surge area. The stormwater surge area is located in the southwest corner of Cell 1 along the intercell berm. Contact water that collects in the surge area is allowed to infiltrate into the leachate collection system and disposed of in accordance with the landfill's Plan of Operations.

In general, temporary containment ditches at the perimeter of the landfill cell are a minimum of 24 inches deep and have a 3H:1V exterior slope and 2H:1V maximum interior side slope. The exterior slope of the ditch is the top of the granular drainage layer of the leachate collection system. Therefore, although contact stormwater will infiltrate once it reaches the perimeter ditch, for the stormwater modeling and sizing purposes, we have conservatively assumed that no infiltration takes place in the ditch. The interior slope is cut into the CCR disposed of in the landfill. Along the access road, a cattle bridge or cattle guard is installed to function as a hydraulic break and prevent stormwater from running down the road and escaping the site. The cattle bridge also allows for the continuation of the containment ditch. 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.

A stormwater run-off model was completed to confirm that the current run-off control system for the operation of Cell 1 at the PPPP Ash Landfill can adequately manage a 24-hour, 25-year precipitation event. The rainfall depth estimate is 4.52 inches as previously discussed. The stormwater flow was modeled using HydroCAD 10.0 to model the maximum operation filling condition, just before closure of the cell. This condition will have the steepest and longest slopes directing stormwater to the temporary containment ditches. The stormwater run-off calculations for Cell 1 of the landfill are included in Appendix E: Stormwater Run-off Calculations.

Based on the analysis, the run-off control system for Cell 1 of the PPPP Ash Landfill is able to contain, manage, and control the run-off from a 24-hour, 25-year precipitation event without allowing any contact water to escape the permitted limits of waste. The estimated peak water level in the west and east conveyance channel is 1.33 feet and 1.30 feet, respectively. The minimum depth of the channel is 2-feet-deep. The intercell stormwater surge area has a crest elevation of approximately El. 687 feet and the estimated water level associated with the 24-hour, 25-year storm in Cell 1 is El. 686.48 feet. Both the temporary stormwater containment ditches and the stormwater surge area are designed to contain, manage, and control the run-off from Cell 1 associated with a 24-hour, 25-year storm event.

5. Conclusion and Certification

The PPPP Ash Landfill is regulated under 40 CFR Part 257 Subpart D as an existing CCR landfill. The rule specifies that an existing CCR landfill must develop plans to meet certain meet operating criteria designated by October 17, 2016. This report documents the PPPP Ash 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 PPPP Landfill is either recycled for use as a dust control agent in the active landfill or hauled to the wastewater treatment facility at PPPP in accordance with the Plan of Operations; thus, it complies with § 257.3-3.

The rule specifies that the plan must be reviewed and updated every five (5) years maximum based on the completion date of this plan. In addition, the written plan must be amended whenever there is a change in conditions that would substantially affect the current written plan (lateral expansion or final cover construction). 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 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.

WISCONSIN
JOHN M. TRAST
31792
GREEN BAY, WISCONSIN
PROFESSIONAL ENGINEER

10/14/2016

6. References

AECOM (2012). Plan of Operation Modification, Pleasant Prairie Power Plant Ash Landfill, WDNR License #2786; FID # 230056310, Pleasant Prairie, Wisconsin. April 4, 2012.

GEI (2013). FEMA Floodplain Levee Certification. We Energies Pleasant Prairie Ash Landfill Floodplain Levee Certification, Pleasant Prairie, Wisconsin. June 5, 2013.

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

LEGEND

- EXISTING GROUND SURFACE CONTOUR
- ROAD, NON PAVED
- ROAD, PAVED
- FENCE
- TREES/BRUSH
- CULVERT
- BUILDINGS
- GAS PIPE
- FIBER COMMUNICATIONS
- OVERHEAD ELECTRIC
- ELECTRIC TOWER
- RAILROAD TRACKS
- LANDFILL LIMIT OF WASTE
- LANDFILL CELL BOUNDARY
- W-21 MONITORING WELL
- CP-100 SURVEY CONTROL MONUMENT
- STEEL POLE ELECTRIC TRANSMISSION TOWER
- RAILROAD TELEPHONE POLE
- MONUMENT FOUND
- GEOMEMBRANE ANCHOR TRENCH
- CO2 LEACHATE COLLECTION CLEANOUT
- VAULT 1 LEACHATE COLLECTION VAULT
- LEACHATE TRANSFER PIPE
- HW1A LEACHATE HEADWELL
- WISDOT E1 BITUMINOUS ASHphalt PAVEMENT
- 690 ASH CONTOUR (10/30/2015)
- 710 PROPOSED INTERMEDIATE CONTOUR
- PROPOSED INTERIM FILLING DITCH

NOTES:

1. HORIZONTAL DATUM BASED ON WISCONSIN STATE PLANE COORDINATES SOUTH ZONE, NAD 83.
2. VERTICAL DATUM BASED ON REFERENCE MARK, WISCONSIN DIVISION OF HIGHWAYS. ALUMINUM CAP SET IN TOP OF EAST END OF CONCRETE BRIDGE WALL, 2.7' ABOVE GROUND, ELEVATION 715.42. CAP IS LOCATED 1.2' WEST OF TOP BEVEL. THE CONCRETE BRIDGE IS LOCATED WHERE STH "50" CROSSES THE CP RAILROAD TRACKS ON THE NORTHWEST SIDE OF THE SITE. ELEVATIONS REFERENCED TO NAVD 88.

CONTROL POINT DATA

POINT #	NORTHING	EASTING	ELEVATION	DESCRIPTION
10	213741.91	2532958.45	715.42	BM B-30-48-78: ALUMINUM CAP ON TOP OF CONCRETE WALL
30	211877.98	2533092.40	684.09	CUT CROSS
31	210593.02	2533131.43	683.92	CUT CROSS
32	208734.70	2533178.76	681.48	MAG NAIL
33	209470.52	2534928.84	683.53	IPI1" W/CAP
34	211916.15	2534703.67	682.90	IPI1" W/CAP
35	213483.71	2533032.15	686.41	MAG NAIL
36	213452.09	2534118.49	687.83	MAG NAIL
100	212644.65	2533884.50	691.25	RBR W/CAP

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: 10/14/2016

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GEI Project 1610534

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

PLEASANT PRAIRIE POWER PLANT
ASH LANDFILL CELL 1

DWG. NO. C-1

SHEET NO. 1

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CROSS-SECTION A-A'
SCALE: 1"=10'

CROSS-SECTION B-B'
SCALE: 1"=10'

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: 10/14/2016

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

PLEASANT PRAIRIE POWER PLANT
ASH LANDFILL CELL 1
CROSS-SECTIONS

DWG. NO.
C-2

SHEET NO.
2

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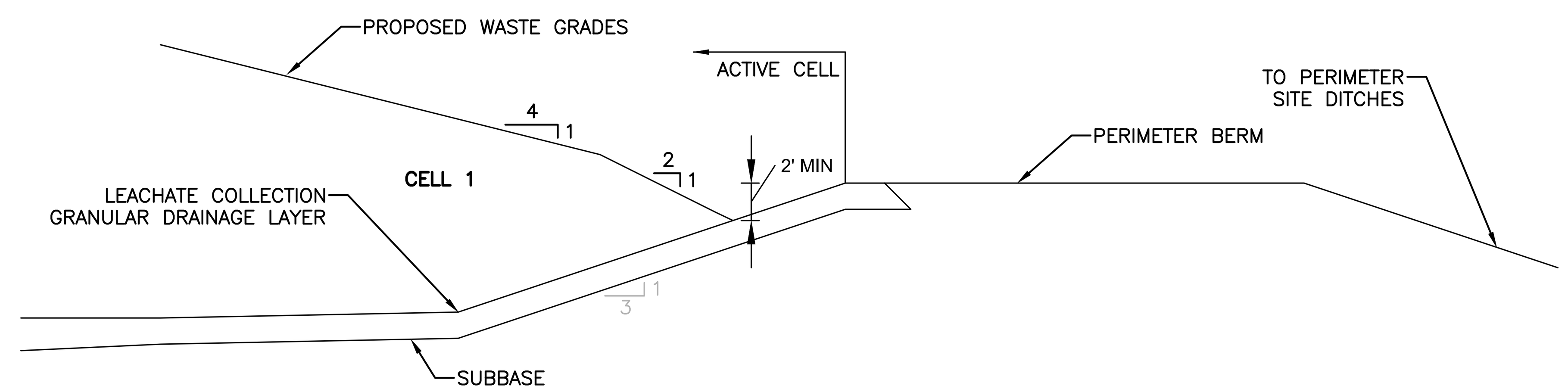
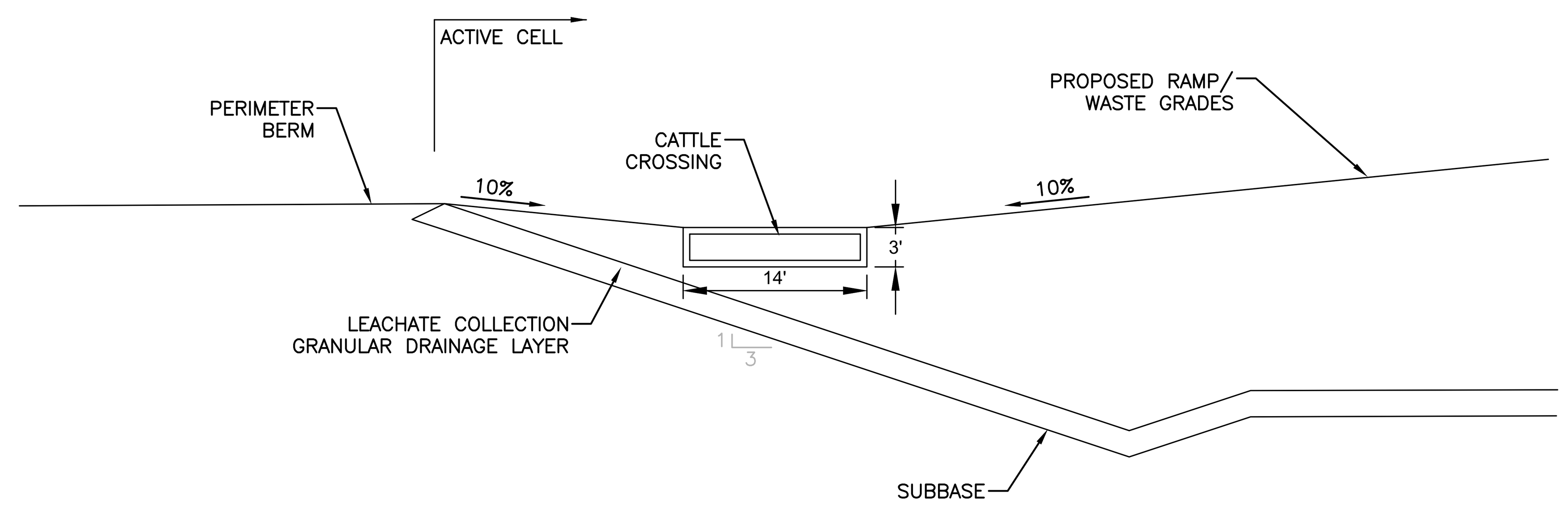


1/3 TYPICAL PERIMETER BERM DETAIL
SCALE: 1"=10'



2/3 SECTION AT CELL ACCESS RAMP
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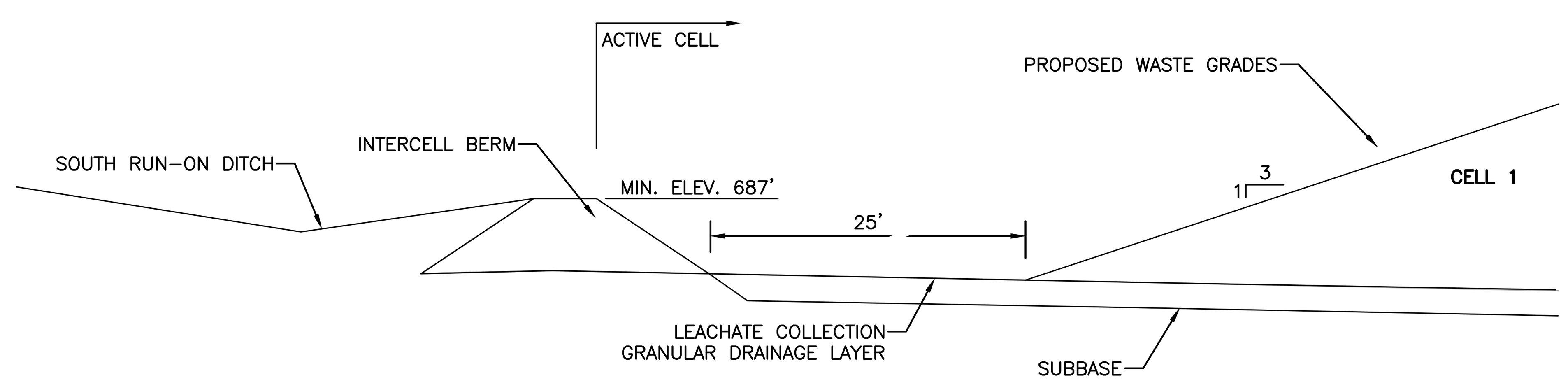

3/3 SECTION AT INTERCELL BERM
SCALE: 1"=10'

Attention:
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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:	10/7/2016

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

PLEASANT PRAIRIE POWER PLANT
ASH LANDFILL CELL 1
DETAILS

DWG. NO. C-3
SHEET NO. 3

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Appendix B

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

Client	We Energies			**Page**	1 of 4
Project	PPPP LF Run-on and Run-off Control Plan			**Rev.**	0
By	C. Fritsch	**Chk.**	J. Trast	**App.**	J. Trast
Date	09/19/2016	**Date**	10/7/2016	**Date**	10/7/2016
GEI Project No.	1610534	**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-hr, 25-yr precipitation event at Pleasant Prairie Power Plant (PPPP) landfill. The 24-hr, 25-yr precipitation event is required for the run-on and run-off control system plan for the landfill.

Procedure:

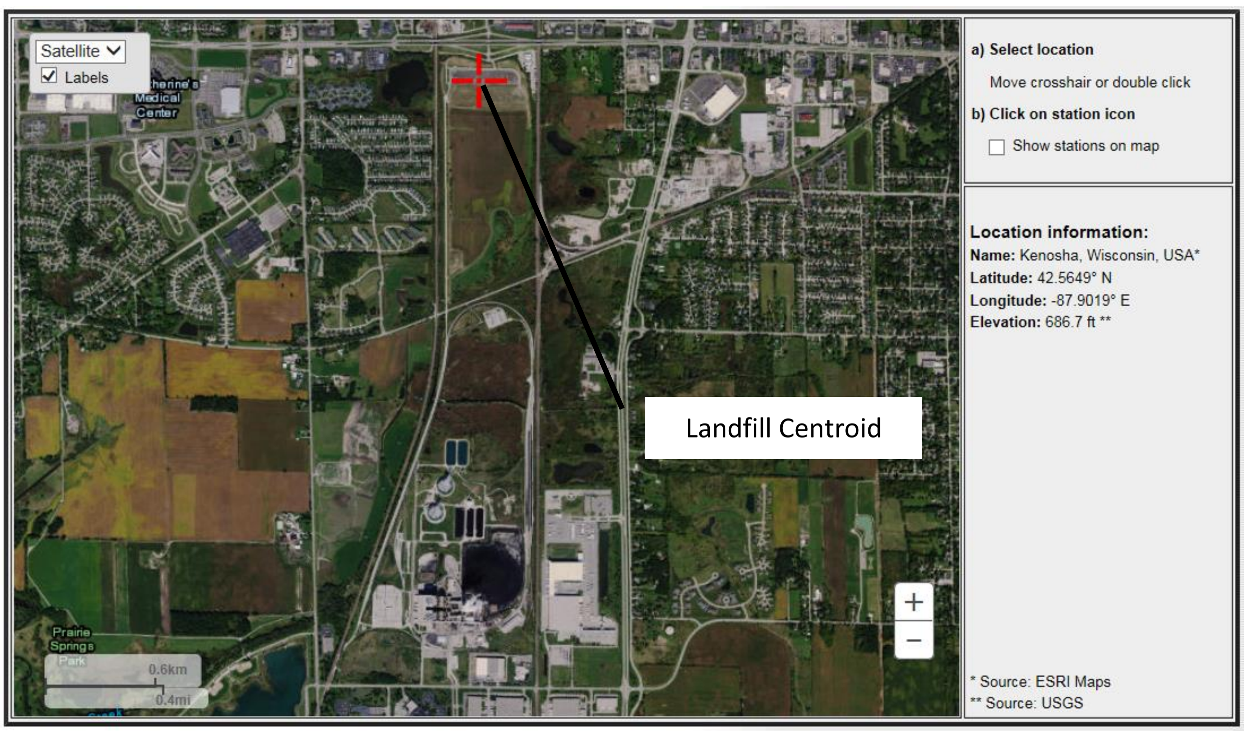
The rainfall depth estimation follows the procedures outlined in Precipitation-Frequency (PF) Atlas of the United States (Atlas 14, Volume 8, Version 2: Wisconsin).

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

42°33'53.64"N 42.5649°

87°54'6.84"W -87.9019°



	Client	We Energies			Page	2 of 4
GEI Consultants	Project	PPPP LF Run-on and Run-off Control Plan			Rev.	0
	By	C. Fritsch	Chk.	J. Trast	App.	J. Trast
	Date	09/19/2016	Date	10/7/2016	Date	10/7/2016
GEI Project No.	1610534	Document No.	N/A			
Subject	NOAA 14, Vol. 8 Rainfall Analysis and Run-off Volume					

Tabular Output from the PFDS:

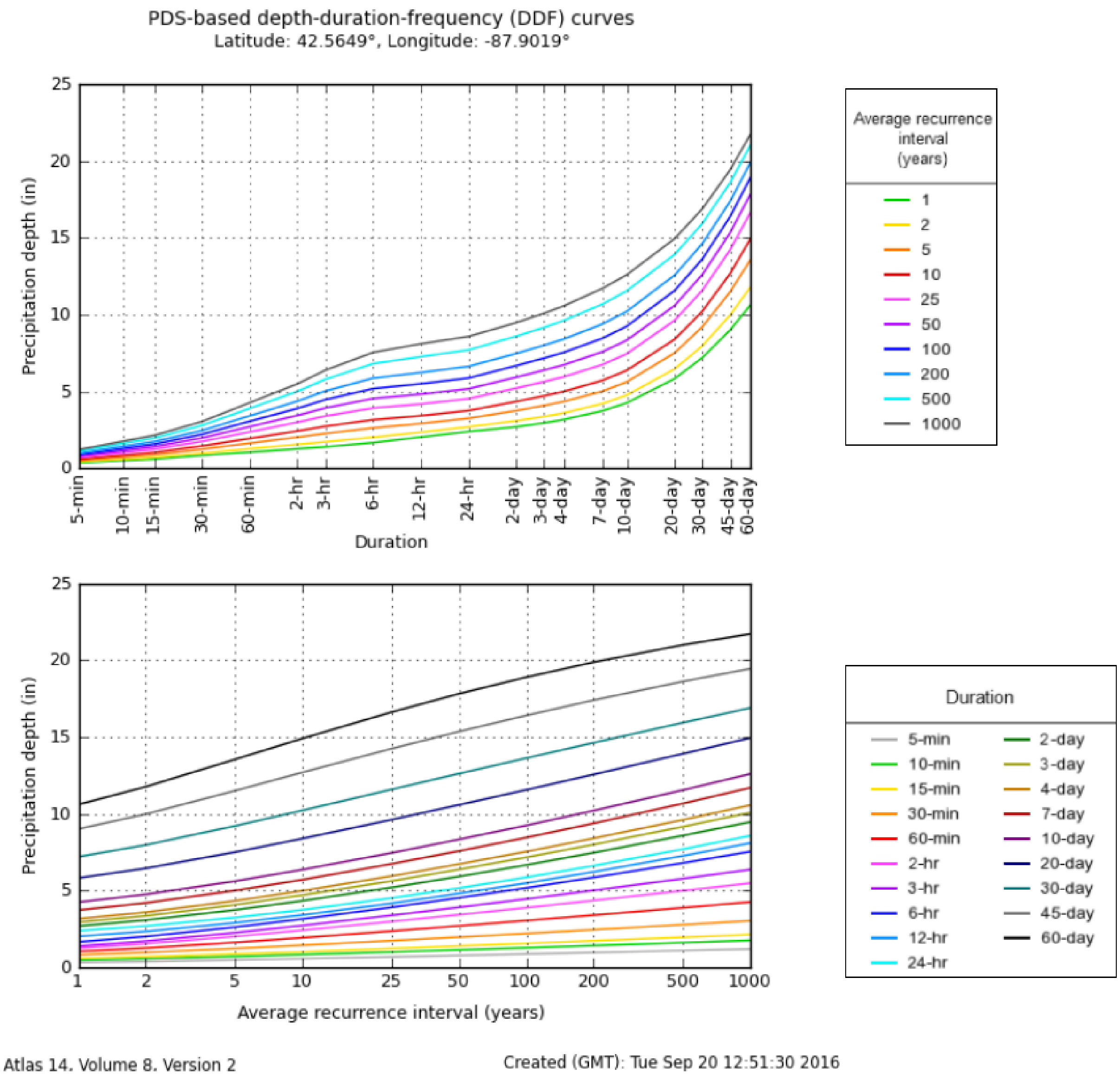
PDS-based precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**0.333** (0.266–0.415)	**0.392** (0.313–0.488)	**0.491** (0.390–0.611)	**0.573** (0.453–0.716)	**0.690** (0.529–0.879)	**0.782** (0.587–1.00)	**0.875** (0.636–1.14)	**0.971** (0.680–1.28)	**1.10** (0.743–1.48)	**1.20** (0.791–1.62)
10-min	**0.488** (0.390–0.607)	**0.575** (0.458–0.715)	**0.718** (0.571–0.895)	**0.840** (0.664–1.05)	**1.01** (0.775–1.29)	**1.14** (0.859–1.47)	**1.28** (0.932–1.67)	**1.42** (0.995–1.88)	**1.61** (1.09–2.16)	**1.76** (1.16–2.38)
15-min	**0.595** (0.475–0.740)	**0.701** (0.559–0.872)	**0.876** (0.696–1.09)	**1.02** (0.810–1.28)	**1.23** (0.945–1.57)	**1.40** (1.05–1.79)	**1.56** (1.14–2.03)	**1.73** (1.21–2.29)	**1.97** (1.33–2.64)	**2.14** (1.41–2.90)
30-min	**0.831** (0.663–1.03)	**0.982** (0.783–1.22)	**1.23** (0.980–1.54)	**1.44** (1.14–1.80)	**1.74** (1.34–2.22)	**1.97** (1.48–2.53)	**2.21** (1.61–2.87)	**2.45** (1.72–3.24)	**2.78** (1.88–3.73)	**3.03** (2.00–4.10)
60-min	**1.04** (0.833–1.30)	**1.26** (1.01–1.57)	**1.63** (1.29–2.03)	**1.93** (1.53–2.41)	**2.36** (1.81–3.02)	**2.70** (2.03–3.47)	**3.05** (2.22–3.97)	**3.41** (2.39–4.50)	**3.89** (2.63–5.22)	**4.26** (2.81–5.76)
2-hr	**1.26** (1.02–1.55)	**1.54** (1.24–1.90)	**2.02** (1.62–2.49)	**2.42** (1.94–2.99)	**2.99** (2.32–3.77)	**3.43** (2.61–4.36)	**3.89** (2.87–5.01)	**4.36** (3.10–5.70)	**5.00** (3.42–6.64)	**5.49** (3.67–7.35)
3-hr	**1.38** (1.13–1.69)	**1.71** (1.39–2.09)	**2.26** (1.83–2.76)	**2.73** (2.20–3.35)	**3.39** (2.66–4.26)	**3.92** (3.00–4.95)	**4.46** (3.31–5.71)	**5.02** (3.59–6.53)	**5.78** (4.00–7.64)	**6.37** (4.30–8.48)
6-hr	**1.66** (1.37–2.00)	**2.01** (1.66–2.43)	**2.62** (2.15–3.17)	**3.15** (2.57–3.82)	**3.92** (3.11–4.88)	**4.53** (3.53–5.68)	**5.18** (3.91–6.58)	**5.86** (4.26–7.56)	**6.80** (4.78–8.92)	**7.54** (5.16–9.94)
12-hr	**2.03** (1.69–2.41)	**2.34** (1.95–2.79)	**2.91** (2.41–3.47)	**3.41** (2.82–4.09)	**4.18** (3.38–5.17)	**4.81** (3.81–5.98)	**5.49** (4.21–6.93)	**6.22** (4.61–7.98)	**7.26** (5.19–9.45)	**8.09** (5.63–10.6)
24-hr	**2.39** (2.01–2.81)	**2.69** (2.27–3.17)	**3.25** (2.72–3.83)	**3.75** (3.13–4.44)	**4.52** (3.71–5.53)	**5.17** (4.14–6.35)	**5.86** (4.57–7.32)	**6.62** (4.97–8.40)	**7.70** (5.59–9.93)	**8.57** (6.06–11.1)
2-day	**2.69** (2.30–3.13)	**3.08** (2.62–3.58)	**3.75** (3.19–4.36)	**4.34** (3.67–5.07)	**5.21** (4.31–6.26)	**5.92** (4.80–7.17)	**6.67** (5.25–8.20)	**7.47** (5.68–9.34)	**8.58** (6.32–10.9)	**9.47** (6.80–12.1)
3-day	**2.94** (2.53–3.40)	**3.36** (2.88–3.88)	**4.08** (3.49–4.71)	**4.71** (4.01–5.46)	**5.63** (4.69–6.72)	**6.38** (5.21–7.67)	**7.17** (5.69–8.75)	**8.00** (6.14–9.94)	**9.16** (6.80–11.6)	**10.1** (7.31–12.8)
4-day	**3.17** (2.74–3.63)	**3.60** (3.11–4.13)	**4.34** (3.74–4.99)	**4.99** (4.28–5.76)	**5.95** (4.99–7.06)	**6.72** (5.52–8.04)	**7.54** (6.02–9.16)	**8.41** (6.49–10.4)	**9.61** (7.18–12.1)	**10.6** (7.71–13.4)
7-day	**3.73** (3.26–4.24)	**4.20** (3.66–4.78)	**5.00** (4.35–5.70)	**5.71** (4.94–6.52)	**6.74** (5.71–7.91)	**7.58** (6.29–8.97)	**8.45** (6.83–10.2)	**9.38** (7.33–11.5)	**10.7** (8.08–13.3)	**11.7** (8.65–14.7)
10-day	**4.25** (3.74–4.80)	**4.76** (4.17–5.37)	**5.62** (4.92–6.35)	**6.37** (5.55–7.22)	**7.45** (6.36–8.68)	**8.33** (6.97–9.79)	**9.24** (7.52–11.0)	**10.2** (8.04–12.4)	**11.5** (8.81–14.3)	**12.6** (9.39–15.8)
20-day	**5.82** (5.18–6.49)	**6.45** (5.74–7.20)	**7.50** (6.66–8.38)	**8.39** (7.41–9.39)	**9.62** (8.29–11.0)	**10.6** (8.96–12.2)	**11.6** (9.53–13.6)	**12.6** (10.0–15.1)	**13.9** (10.8–17.0)	**14.9** (11.3–18.5)
30-day	**7.20** (6.46–7.96)	**7.97** (7.14–8.82)	**9.21** (8.23–10.2)	**10.2** (9.10–11.4)	**11.6** (10.0–13.1)	**12.6** (10.7–14.4)	**13.6** (11.3–15.9)	**14.6** (11.8–17.4)	**15.9** (12.4–19.3)	**16.9** (12.9–20.8)
45-day	**9.02** (8.15–9.89)	**9.98** (9.02–11.0)	**11.5** (10.4–12.7)	**12.7** (11.4–14.0)	**14.2** (12.4–15.9)	**15.4** (13.2–17.4)	**16.4** (13.7–18.9)	**17.4** (14.1–20.5)	**18.6** (14.6–22.4)	**19.5** (15.0–23.8)
60-day	**10.6** (9.64–11.6)	**11.8** (10.7–12.8)	**13.5** (12.3–14.8)	**14.9** (13.4–16.4)	**16.6** (14.5–18.4)	**17.8** (15.3–20.0)	**18.9** (15.9–21.6)	**19.9** (16.2–23.2)	**21.0** (16.6–25.0)	**21.7** (16.9–26.4)

[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.

GEI Consultants	**Client**	We Energies			**Page**	3 of 4
	Project	PPPP LF Run-on and Run-off Control Plan			**Rev.**	0
	By	C. Fritsch	**Chk.**	J. Trast	**App.**	J. Trast
	Date	09/19/2016	**Date**	10/7/2016	**Date**	10/7/2016
GEI Project No.	1610534	**Document No.**	N/A			
Subject	NOAA 14, Vol. 8 Rainfall Analysis and Run-off Volume					

Graphical Output from the PFDS:



Background:

The Cell 1 foot print covers approximately 301,422 square-feet (6.92 acres).

Regulations:

The PPPP Landfill 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 following is a summary of the determined runoff volume from Cell 1 of the PPPP landfill. The volume was conservatively assumed to be the equal to the surface area * the rainfall depth and does not include losses related to infiltration, evaporation, or depression storage

	Precipitation	
	inches	*feet*
24-hr, 25-yr	4.52	0.377
25-yr Inflow Volume	2.61	*(acre-feet)*

Appendix C

Stormwater Run-on Calculations

GEI Consultants	**Client**	We Energies			**Page**	1 of 1
	Project	PPPP LF Run-on and Run-off Control Plan			**Rev.**	0
	By	C. Fritsch	**Chk.**	J. Trast	**App.**	J. Trast
	Date	10/12/2016	**Date**	10/13/2016	**Date**	10/13/2016

GEI Project No.	1610534	**Document No.**	N/A
Subject	Stormwater Run-on Calculations		

Purpose:

The purpose of this calculation is to model the stormwater run-on associated with 24-hr, 25-yr precipitation event at Pleasant Prairie Power Plant (PPPP) landfill around Cell 1. In addition, this analysis was completed to confirm the current run-on control system for the construction of Cell 1 can adequately manage the 25-yr precipitation event.

Background:

Perimeter berms have been established around the landfill to prevent run-on to the facility and direct run-off away from the active landfill. The perimeter berm allows access around the north, east, and west sides of the landfill. The access road constructed on top of the perimeter berms is graded to direct stormwater to the exterior of the berm away from the active landfill. Along the south side of the landfill, an intercell berm was constructed to prevent run-on from south of the landfill and to prevent run-off of contact water from the landfill. The intercell berm will eventually be buried with ash when the landfill is expanded southward with the construction of Cell 2. Precipitation that falls on the intercell berm is directed to the south, away from the active landfill. Stormwater drainage at the site is directed away from the landfill and eventually flows southward discharging to the unnamed tributaries of Jerome Creek.

Design Criteria and Assumptions:

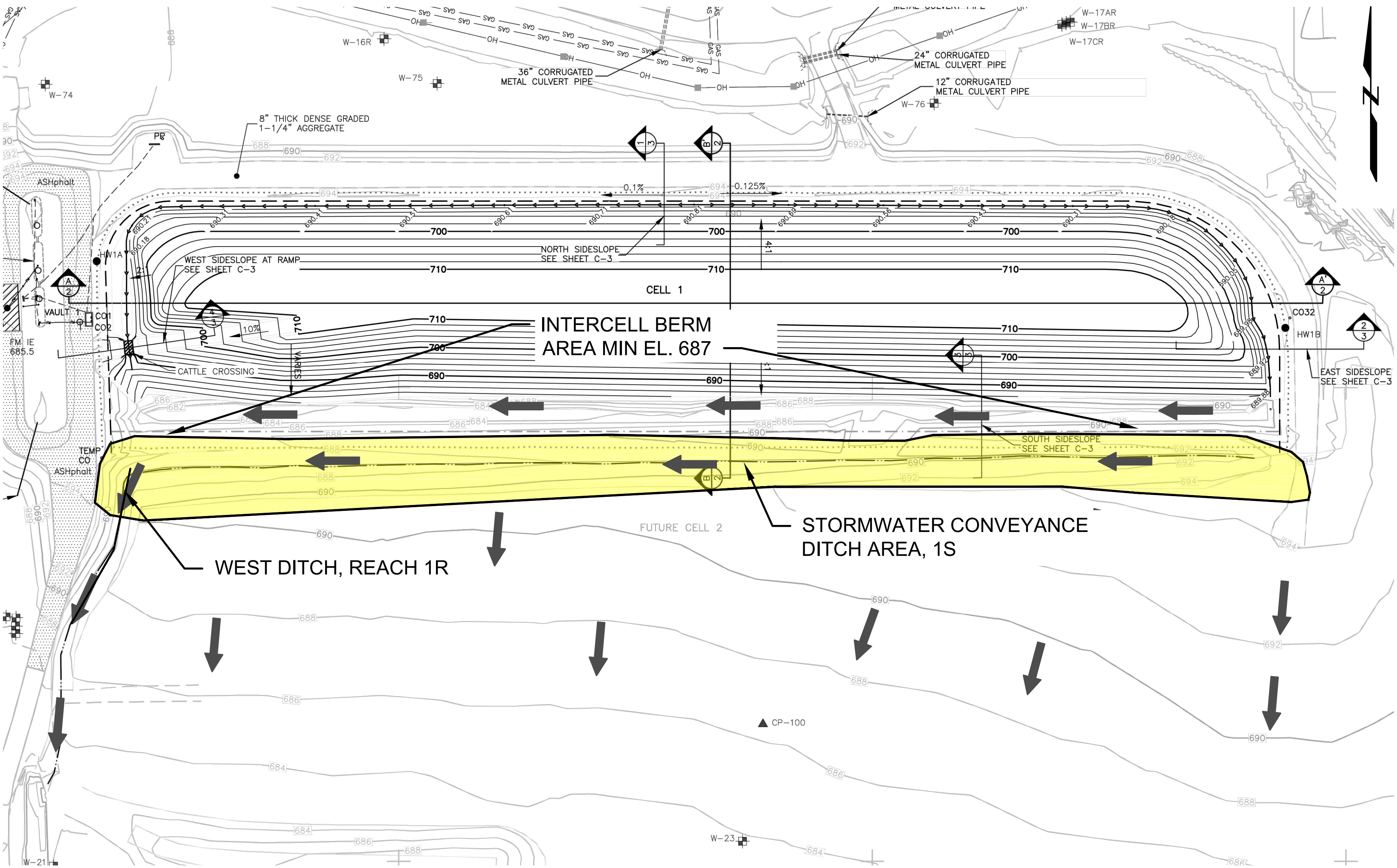
1. The rainfall depth estimation for the 24-hr, 25-yr event was determined to be 4.52 inches (included under a separated calculation package). The rainfall depth was determined by following procedures outlined in Precipitation-Frequency (PF) Atlas of the United States (Atlas 14, Volume 8, Version 2: Wisconsin).
2. Stormwater will be modeled to a temporary construction condition of Cell 1 prior to the commencement of Cell 2 construction.
3. HydroCAD 10.0 was used to model the stormwater on the south side of the Cell 1intercell berm to confirm the current conveyance ditch is adequately sized to manage the 25-yr precipitation event without allowing stormwater to enter Cell 1 of the landfill.
4. Subcatchment, and reach parameters are included in the attached HydroCAD Report.

Results:

The attached HydroCAD report includes input and output for the stormwater run-off model developed for drainage swale on south of the intercell berm. Based on stormwater run-on analysis the current run-on control system for Cell 1 of PPPP landfill will be able to handle the 24-hr, 25yr precipitation event without allowing any non-contact water to enter the limits of waste. The estimated peak water level in the channel on the west side is 0.8-feet, and corresponds to an elevation of 686.8 feet. The minimum height of the intercell berm is 687 feet; thus, the berm is high enough to not allow stormwater to enter the active Cell 1 area. The conveyance channel south of the intercell berm is adequately sized to prevent run-on to Cell 1 associated with the 24-hr, 25-yr precipitation event.

Attachments:

- Figure 1 –Stormwater Conveyance Diagram
- HydroCAD Summary Report

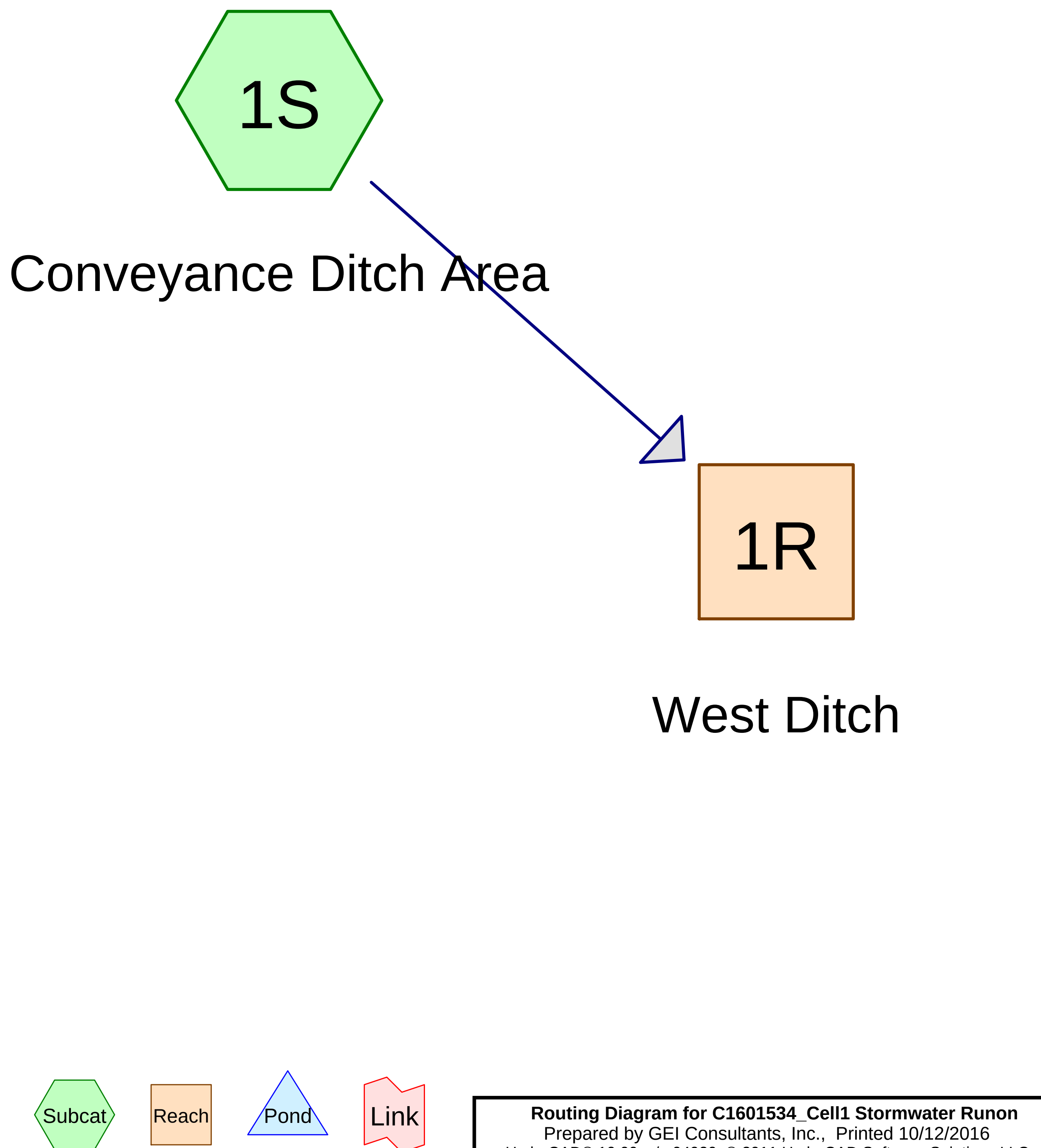


SOURCE:

1. PLAN BASED DWG C-1, PPPP ASH LANDFILL CELL 1

Run-on and Run-off Control Plan Pleasant Prairie Ash Landfill Cell #1 Pleasant Prairie, Wisconsin	GEI Consultants	Stormwater Flow Diagram	
We Energies Milwaukee, Wisconsin	Project 1610534	October 2016	Fig. 1

\\grb1v-fs01\ J:\Landfills\WE - P4\1610534_run-on run-off control plan\dwgs\1610534001_SW_Calc Figure.dwg - 10/12/2016



Routing Diagram for C1601534_Cell1 Stormwater Runon
Prepared by GEI Consultants, Inc., Printed 10/12/2016
HydroCAD® 10.00 s/n 04920 © 2011 HydroCAD Software Solutions LLC

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
2.026	86	Pasture/grassland/range, Poor, HSG C (1S)
2.026	**86**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
2.026	HSG C	1S
0.000	HSG D	
0.000	Other	
2.026		**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	2.026	0.000	0.000	2.026	Pasture/grassland/range, Poor	1S
0.000	**0.000**	**2.026**	**0.000**	**0.000**	**2.026**	**TOTAL AREA**	

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

Subcatchment 1S: Conveyance Ditch Area Runoff Area=88,245 sf 0.00% Impervious Runoff Depth=3.02"
Flow Length=1,232' Tc=19.4 min CN=86 Runoff=6.84 cfs 0.510 af

Reach 1R: West Ditch Avg. Flow Depth=0.80' Max Vel=1.96 fps Inflow=6.84 cfs 0.510 af
n=0.022 L=200.0' S=0.0025 '/' Capacity=377.56 cfs Outflow=6.66 cfs 0.510 af

Total Runoff Area = 2.026 ac Runoff Volume = 0.510 af Average Runoff Depth = 3.02"
100.00% Pervious = 2.026 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment 1S: Conveyance Ditch Area

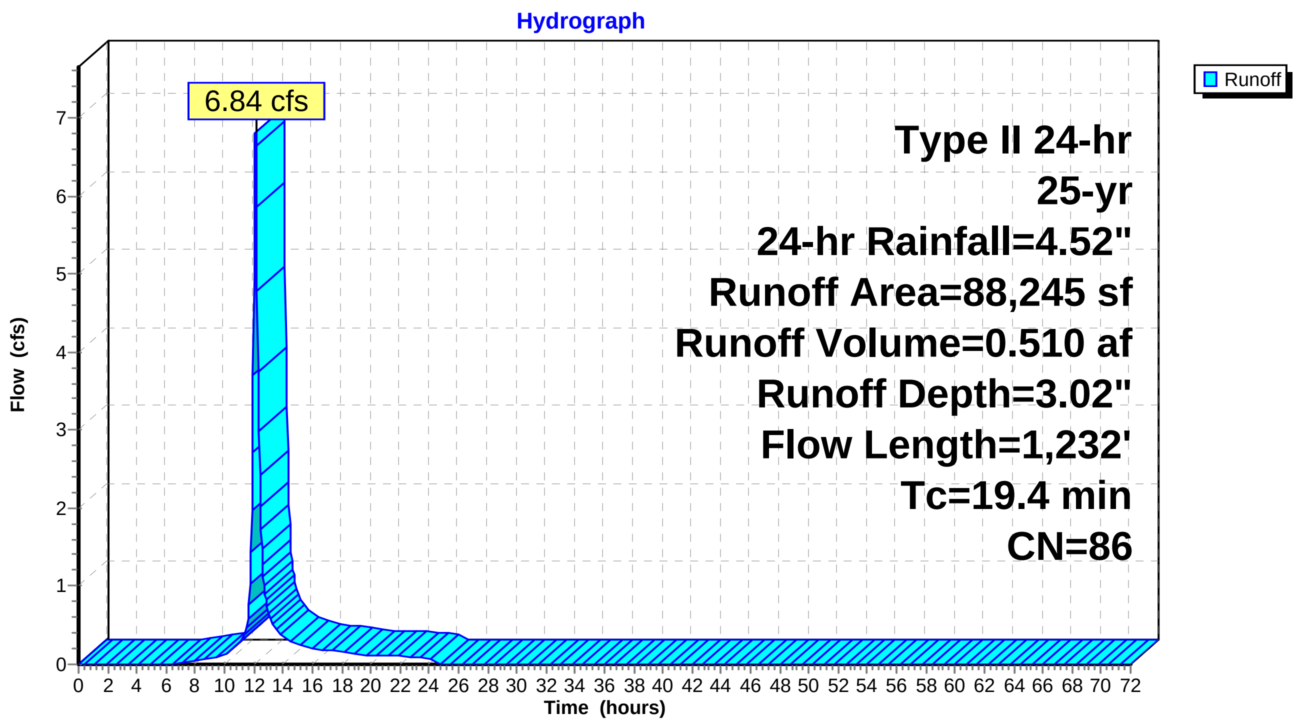
Runoff = 6.84 cfs @ 12.12 hrs, Volume= 0.510 af, Depth= 3.02"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr, 24-hr Rainfall=4.52"

Area (sf)	CN	Description
88,245	86	Pasture/grassland/range, Poor, HSG C
88,245		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.6	32	0.2500	0.34		**Sheet Flow, Side Slopes** Grass: Short n= 0.150 P2= 2.69"
17.8	1,200	0.0056	1.12		**Shallow Concentrated Flow, drainage swale** Grassed Waterway Kv= 15.0 fps
19.4	1,232	Total			

Subcatchment 1S: Conveyance Ditch Area



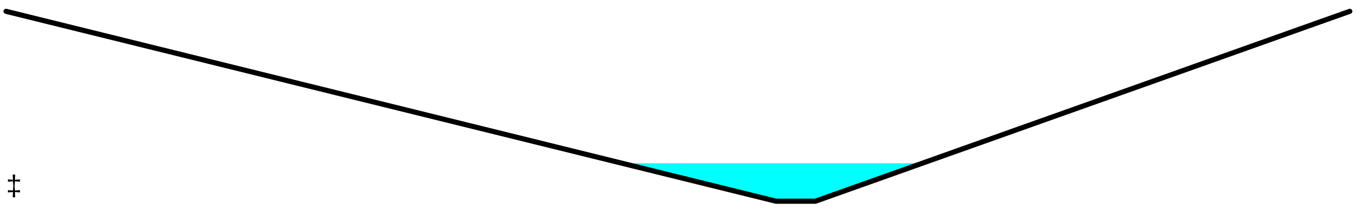
Summary for Reach 1R: West Ditch

Inflow Area = 2.026 ac, 0.00% Impervious, Inflow Depth = 3.02" for 25-yr, 24-hr event
Inflow = 6.84 cfs @ 12.12 hrs, Volume= 0.510 af
Outflow = 6.66 cfs @ 12.17 hrs, Volume= 0.510 af, Atten= 3%, Lag= 3.1 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.96 fps, Min. Travel Time= 1.7 min
Avg. Velocity = 0.72 fps, Avg. Travel Time= 4.7 min

Peak Storage= 691 cf @ 12.14 hrs
Average Depth at Peak Storage= 0.80'
Bank-Full Depth= 4.00' Flow Area= 70.4 sf, Capacity= 377.56 cfs

1.00' x 4.00' deep channel, n= 0.022 Earth, clean & straight
Side Slope Z-value= 4.9 3.4 '/' Top Width= 34.20'
Length= 200.0' Slope= 0.0025 '/'
Inlet Invert= 686.00', Outlet Invert= 685.50'



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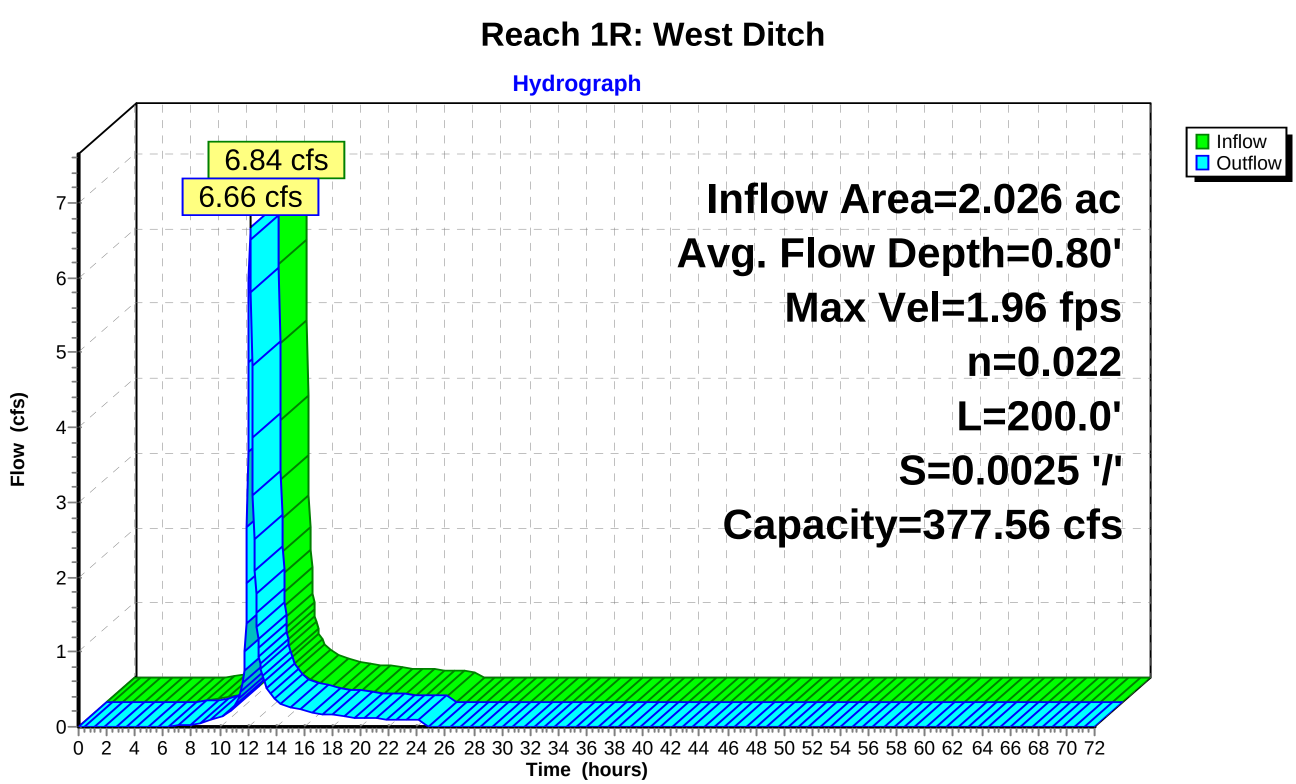


Appendix D

Excerpts from the Kenosha County FIS

FLOOD INSURANCE STUDY

VOLUME 1 OF 2

KENOSHA COUNTY, WISCONSIN,
AND INCORPORATED AREAS

Community Name	Community Number
Bristol, Village of	550595
*Genoa City, Village of	550465
Kenosha, City of	550209
Kenosha County, Unincorporated Areas	550523
Paddock Lake, Village of	550073
Pleasant Prairie, Village of	550613
Silver Lake, Village of	550210
Twin Lakes, Village of	550211

*No Special Flood Hazard Areas Identified

EFFECTIVE:
June 19, 2012

Federal Emergency Management Agency

FLOOD INSURANCE STUDY NUMBER
55059CV001A

TABLE 6 - SUMMARY OF DISCHARGES

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs) 10-PERCENT ANNUAL CHANCE	2-PERCENT ANNUAL CHANCE	1-PERCENT ANNUAL CHANCE	0.2-PERCENT ANNUAL CHANCE
UNNAMED TRIBUTARY NO. 2 TO DES PLAINES RIVER					
At Confluence with Des Plaines River	0.6	149	229	268	*
UNNAMED TRIBUTARY NO. 2 TO JEROME CREEK					
At Confluence with Jerome Creek	0.3	36	41	43	*
UNNAMED TRIBUTARY NO. 2 TO SALEM BRANCH BRIGHTON CREEK					
At Confluence with Salem Branch Brighton Creek	0.8	69	97	110	*
UNNAMED TRIBUTARY NO. 3 TO DUTCH GAP CANAL					
At Confluence with Dutch Gap Canal	3.5	63	106	129	*
UNNAMED TRIBUTARY NO. 3 TO JEROME CREEK					
At Confluence with Jerome Creek	0.7	19	23	25	*
Just upstream of divergence with Unnamed Tributary No. 2 to Jerome Creek	*	35	39	41	*
UNNAMED TRIBUTARY NO. 3 TO SALEM BRANCH BRIGHTON CREEK					
At Confluence with Salem Branch Brighton Creek	0.7	34	48	55	*
UNNAMED TRIBUTARY TO NO. 4 TO DUTCH GAP CANAL					
At Confluence with Dutch Gap Canal	1.6	35	62	77	*

FLOODING SOURCE		FLOODWAY				1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD 88)			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	WIDTH REDUCED FROM PRIOR STUDY (FEET)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
UNNAMED TRIBUTARY NO. 2 TO DES PLAINES RIVER (CONTINUED)									
K	8,380[1]	31	53	1.8	0	704.1	704.1	704.1	0.0
UNNAMED TRIBUTARY NO. 2 TO JEROME CREEK						588.9			
A	1,961[2]	33	107	0.4	0	680.8	680.8	680.8	0.0
B	2,109[2]	29	92	0.6	0	680.8	680.8	680.8	0.0
C	2,468[2]	93	260	0.3	0	680.9	680.9	680.9	0.0
D	2,780[2]	162	262	0.3	0	680.9	680.9	680.9	0.0
E	3,440[2]	172	217	0.3	0	680.9	680.9	680.9	0.0
F	4,000[2]	142	178	0.2	0	681.0	681.0	681.0	0.0
UNNAMED TRIBUTARY NO. 2 TO SALEM BRANCH BRIGHTON CREEK									
A	100[3]	*	*	*	*	752.1	*	*	*
B	950[3]	*	*	*	*	763.1	*	*	*
C	1,352[3]	*	*	*	*	768.3	*	*	*
D	1,621[3]	*	*	*	*	768.6	*	*	*
E	1,874[3]	*	*	*	*	772.7	*	*	*
F	2,767[3]	*	*	*	*	780.6	*	*	*
G	3,216[3]	*	*	*	*	789.1	*	*	*

[1]FEET ABOVE CONFLUENCE WITH UNNAMED TRIBUTARY NO. 1E TO DES PLAINES RIVER, [2]FEET ABOVE CONFLUENCE WITH JEROME CREEK, [3]FEET ABOVE CONFLUENCE WITH SALEM BRANCH BRIGHTON CREEK, *DATA NOT AVAILABLE

TABLE 9

FEDERAL EMERGENCY MANAGEMENT AGENCY

KENOSHA COUNTY, WI
AND INCORPORATED AREAS

FLOODWAY DATA

UNNAMED TRIBUTARY 2 TO DES PLAINES RIVER - UNNAMED TRIBUTARY NO. 2 TO JEROME CREEK - UNNAMED TRIBUTARY NO. 2 TO SALEM BRANCH BRIGHTON CREEK

FLOODING SOURCE		FLOODWAY				1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD 88)			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	WIDTH REDUCED FROM PRIOR STUDY (FEET)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
UNNAMED TRIBUTARY NO. 3 TO JEROME CREEK									
A	1,950[1]	5	11	2.3	0	680.5	680.5	680.5	0.0
B	2,200[1]	40	98	0.3	0	680.5	680.5	680.5	0.0
C	2,395[1]	4	12	2.1	0	680.5	680.5	680.5	0.0
D	2,515[1]	4	17	1.4	0	680.5	680.5	680.5	0.0
E	2,556[1]	4	15	1.6	0	588.9	680.6	680.6	0.0
F	2,946[1]	20	40	0.8	0	680.7	680.7	680.7	0.0
G	4,429[1]	3	9	4.8	0	681.0	681.0	681.0	0.0
H	4,504[1]	3	10	4.3	0	681.9	681.9	681.9	0.0
I	4,984[1]	472	302	0.2	0	682.3	682.3	682.3	0.0
J	6,879[1]	37	33	1.7	0	683.4	683.4	683.4	0.0
K	7,059[1]	122	38	1.8	0	684.0	684.0	684.0	0.0
L	7,185[1]	130	56	1.0	0	684.3	684.3	684.3	0.0
M	7,755[1]	8	19	2.2	0	687.7	687.7	687.7	0.0
UNNAMED TRIBUTARY NO. 3 TO SALEM BRANCH BRIGHTON CREEK									
A	201[2]	*	*	*	*	756.8	*	*	*
B	623[2]	*	*	*	*	762.8	*	*	*
C	898[2]	*	*	*	*	769.2	*	*	*
D	1,119[2]	*	*	*	*	771.0	*	*	*
E	1,463[2]	*	*	*	*	775.4	*	*	*
F	2,656[2]	*	*	*	*	789.9	*	*	*

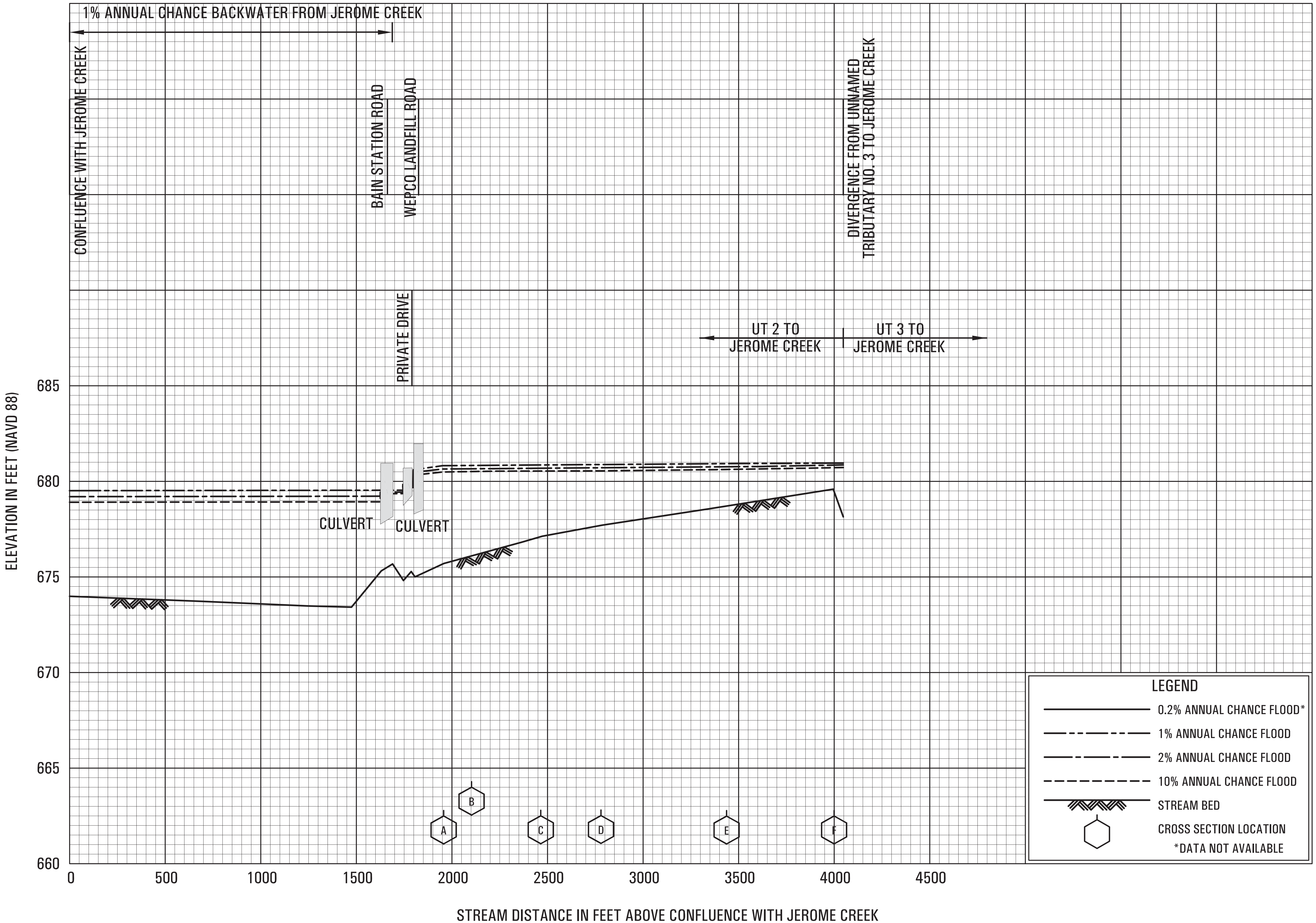
[1]FEET ABOVE CONFLUENCE WITH JEROME CREEK, [2]FEET ABOVE CONFLUENCE WITH SALEM BRANCH BRIGHTON CREEK, *DATA NOT AVAILABLE

TABLE 9

FEDERAL EMERGENCY MANAGEMENT AGENCY
KENOSHA COUNTY, WI
AND INCORPORATED AREAS

FLOODWAY DATA

UNNAMED TRIBUTARY NO. 3 TO JEROME CREEK - UNNAMED TRIBUTARY NO. 3 TO SALEM BRANCH BRIGHTON CREEK



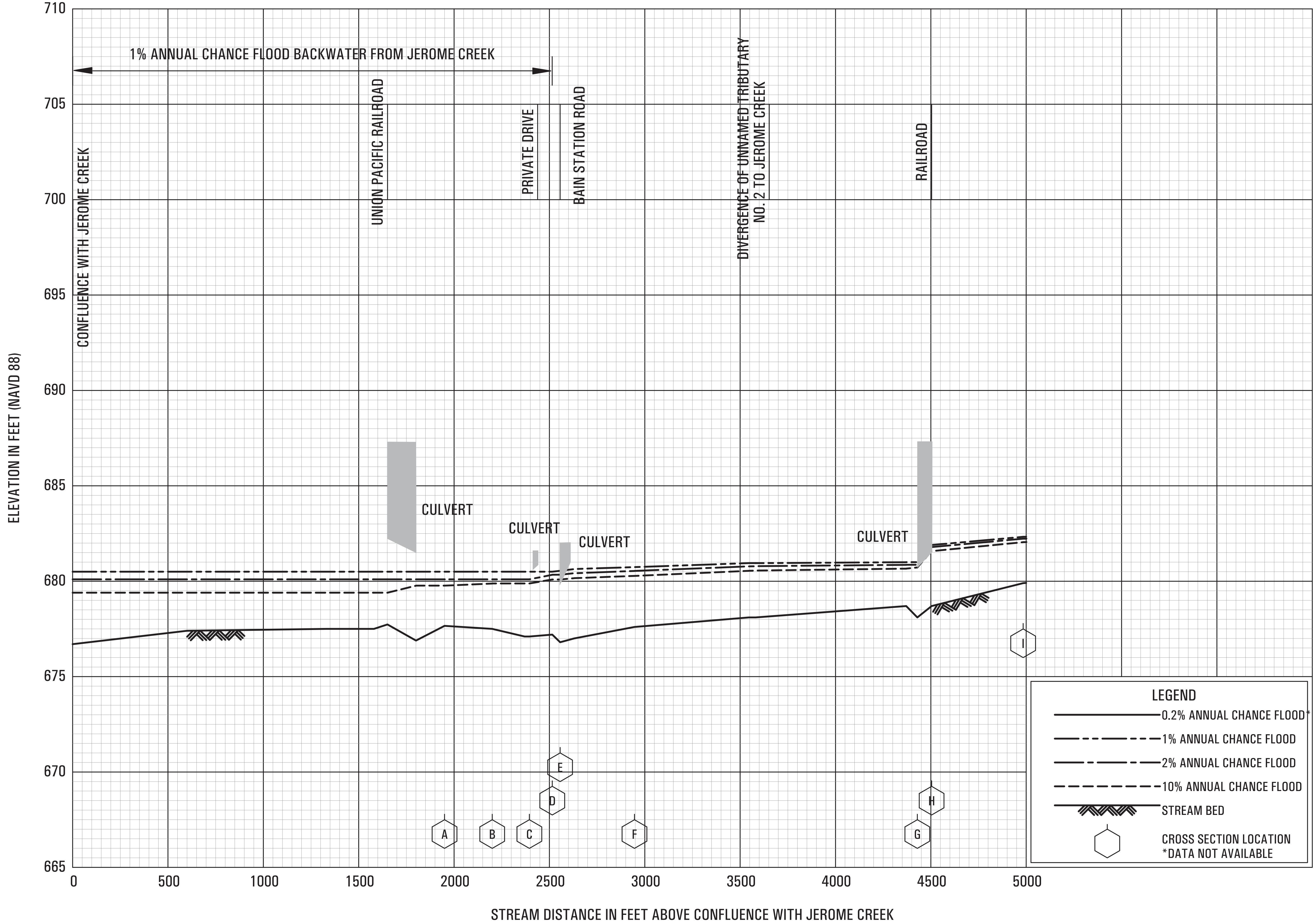
FLOOD PROFILES

UNNAMED TRIBUTARY NO. 2 TO JEROME CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

KENOSHA COUNTY, WI

AND INCORPORATED AREAS



FLOOD PROFILES

UNNAMED TRIBUTARY NO. 3 TO JEROME CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

KENOSHA COUNTY, WI

AND INCORPORATED AREAS

NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The **community map repository** should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevations** (BFEs) and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables contained within the Flood Insurance Study (FIS) Report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS Report should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

Coastal Base Flood Elevations shown on this map apply only landward of 0.0' North American Vertical Datum of 1988 (NAVD 88). Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations table in the Flood Insurance Study Report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations table should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study Report for this jurisdiction.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures**. Refer to Section 2.4 "Flood Protection Measures" of the Flood Insurance Study Report for information on flood control structures for this jurisdiction.

The **projection** used in the preparation of this map was Universal Transverse Mercator (UTM) zone 16N. The **horizontal datum** was NAD 83, GRS 1980 spheroid. Differences in datum, spheroid, projection or UTM zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

Flood elevations on this map are referenced to the North American Vertical Datum of 1988. These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum**. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at http://www.ngs.noaa.gov or contact the National Geodetic Survey at the following address:

NGS Information Services
NOAA, N/NGS12
National Geodetic Survey
SSMC-3, #9202
1315 East-West Highway
Silver Spring, Maryland 20910-3282
(301) 713-3242

To obtain current elevation, description, and/or location information for **bench marks** shown on this map, please contact the Information Services Branch of the National Geodetic Survey at **(301) 713- 3242**, or visit its website at http://www.ngs.noaa.gov.

Base map information shown on this FIRM was derived from the National Agriculture Imagery Program's (NAIP) digital orthoimagery produced by the USDA, Farm Service Agency. The orthophoto was collected in the summer of 2005 and produced at a resolution of 1 meter.

The **profile baselines** depicted on this map represent the hydraulic modeling baselines that match the flood profiles in the FIS report. As a result of improved topographic data, the **profile baseline**, in some cases, may deviate significantly from the channel centerline or appear outside the SFHA.

Based on updated topographic information, this map reflects more detailed and up-to-date **stream channel configurations and floodplain delineations** than those shown on the previous FIRM for this jurisdiction. As a result, the Flood Profiles and Floodway Data tables for multiple streams in the Flood Insurance Study Report (which contains authoritative hydraulic data) may reflect stream channel distances that differ from what is shown on the map. Also, the road to floodplain relationships for unrevised streams may differ from what is shown on previous maps.

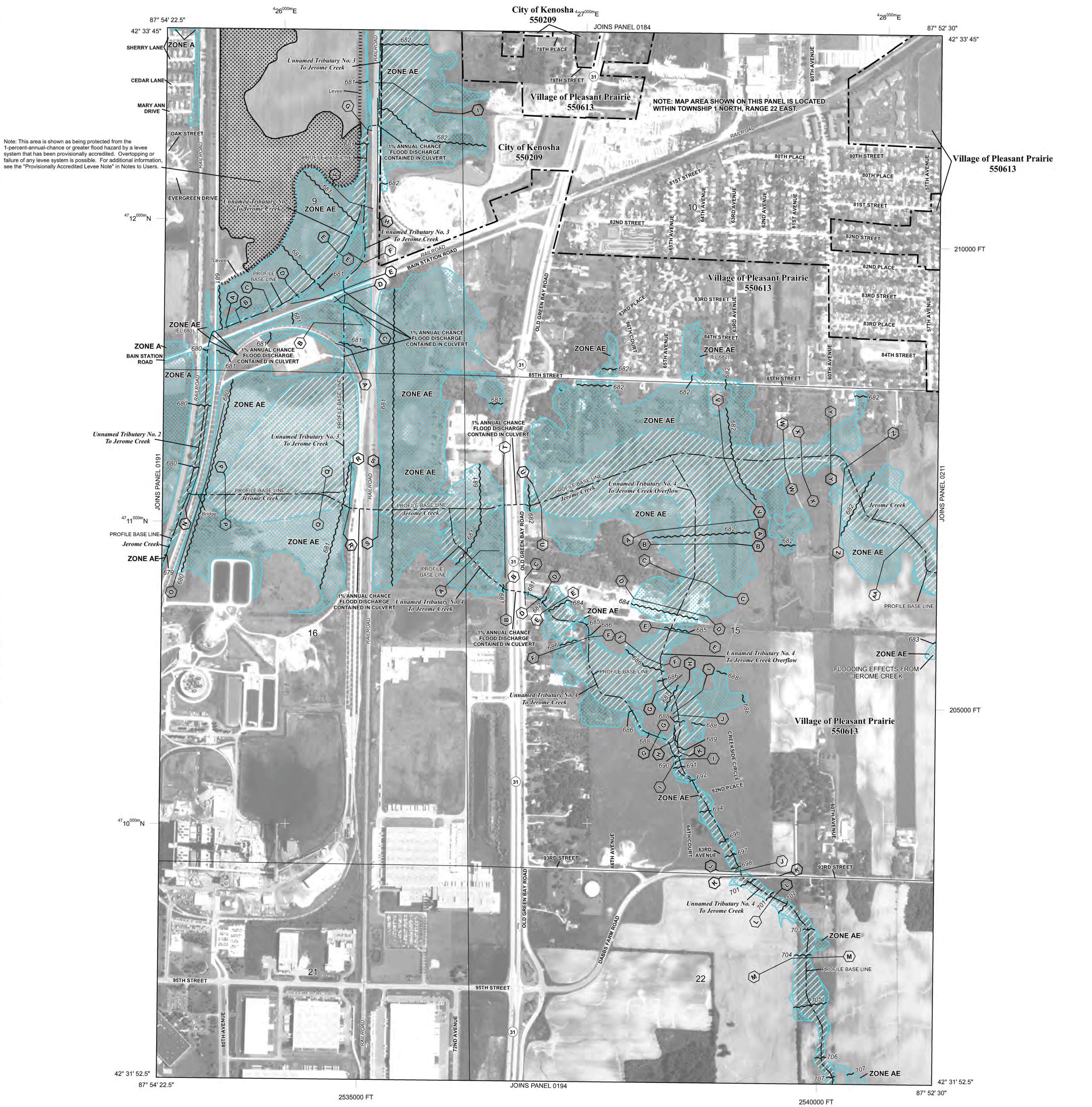
Corporate limits shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels; community map repository addresses; and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

For information on available products associated with this FIRM visit the **Map Service Center** (MSC) website at http://msc.fema.gov. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this map. Many of these products can be ordered or obtained directly from the MSC website.

If you have **questions about this map**, how to order products or the National Flood Insurance Program in general, please call the FEMA Map Information eXchange (FMIX) at **1 -877-FEMA-MAP** (1-877-336-2627) or visit the FEMA website at http://www.fema.gov/business/nfip.

Provisionally Accredited Levee Notes to Users: Check with your local community to obtain more information, such as the estimated level of protection provided (which may exceed the 1-percent-annual-chance level) and Emergency Action Plan, on the levee system shown as providing protection for areas on this panel. To maintain accreditation, the levee owner or community is required to submit the data and documentation necessary to comply with Section 65.10 of the NFIP regulations by August 11, 2012. If the community or owner does not provide the necessary data and documentation or if the data and documentation provided indicate the levee system does not comply with Section 65.10 requirements, FEMA will revise the flood hazard and risk information for this area to reflect de-accreditation of the levee system. To mitigate flood risk in residual risk areas, property owners and residents are encouraged to consider flood insurance and floodproofing or other protective measures. For more information on flood insurance, interested parties should visit the FEMA website at ww.fema.gov/business/nfip/index.shtm.



LEGEND

SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

ZONE A	No Base Flood Elevations determined.
ZONE AE	Base Flood Elevations determined.
ZONE AH	Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
ZONE AO	Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
ZONE AR	Special Flood Hazard Areas formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
ZONE A99	Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
ZONE V	Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
ZONE VE	Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

ZONE X Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

ZONE X Areas determined to be outside the 0.2% annual chance floodplain.

ZONE D Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

1% Annual Chance Floodplain Boundary

0.2% Annual Chance Floodplain Boundary

Floodway boundary

Zone D boundary

CBRS and OPA boundary

Boundary dividing Special Flood Hazard Area Zones and boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths, or flood velocities.

513	Base Flood Elevation line and value; elevation in feet*
(EL 987)	Base Flood Elevation value where uniform within zone; elevation in feet*

*Referenced to the North American Vertical Datum of 1988

A — A	Cross section line
23 - - - 23	Transect line
	Culvert
	Bridge
45° 02' 08", 93° 02' 12"	Geographic coordinates referenced to the North American Datum of 1983 (NAD 83) Western Hemisphere
3100000 FT	5000-foot ticks: Wisconsin State Plane South Zone (FIPS Zone 4803), Lambert Conformal Conic projection
$^{49}89^{000m}$ N	1000-meter Universal Transverse Mercator grid values, zone 16N
DX5510 ×	Bench mark (see explanation in Notes to Users section of this FIRM panel)
• FT1,000	River Station

MAP REPOSITORIES
Refer to Map Repositories list on Map Index

EFFECTIVE DATE OF COUNTYWIDE
FLOOD INSURANCE RATE MAP
June 19, 2012

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL

For community map revision history prior to countywide mapping, refer to the Community Map History table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

MAP SCALE 1" = 500'

250 0 500 1000 FEET
150 0 150 300 METERS

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0192D

FIRM
FLOOD INSURANCE RATE MAP
KENOSHA COUNTY, WISCONSIN AND INCORPORATED AREAS

PANEL 192 OF 331
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
KENOSHA, CITY OF	550209	0192	D
PLEASANT PRAIRIE, VILLAGE OF	550613	0192	D

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
55059C0192D

EFFECTIVE DATE
JUNE 19, 2012

Federal Emergency Management Agency

Appendix E

Stormwater Run-off Calculations

<table>
<tr><td rowspan="4"></td><td>Client</td><td colspan="3">We Energies</td><td>Page</td><td>1 of 1</td></tr>
<tr><td>Project</td><td colspan="3">PPPP LF Run-on and Run-off Control Plan</td><td>Rev.</td><td>0</td></tr>
<tr><td>By</td><td>C. Fritsch</td><td>Chk.</td><td>J. Trast</td><td>App.</td><td>J. Trast</td></tr>
<tr><td>Date</td><td>09/27/2016</td><td>Date</td><td>10/7/2016</td><td>Date</td><td>10/7/2016</td></tr>
<tr><td>GEI Project No.</td><td>1610534</td><td>Document No.</td><td colspan="4">N/A</td></tr>
<tr><td>Subject</td><td colspan="6">Stormwater Run-off Calculations</td></tr>
</table>

Purpose:

The purpose of this calculation is to model the stormwater run-off associated with 24-hr, 25-yr precipitation event at Pleasant Prairie Power Plant (PPPP) landfill from Cell 1. In addition, this analysis was completed to confirm the current run-off control system for the construction of Cell 1 can adequately manage the 25-yr precipitation event.

Design Criteria and Assumptions:

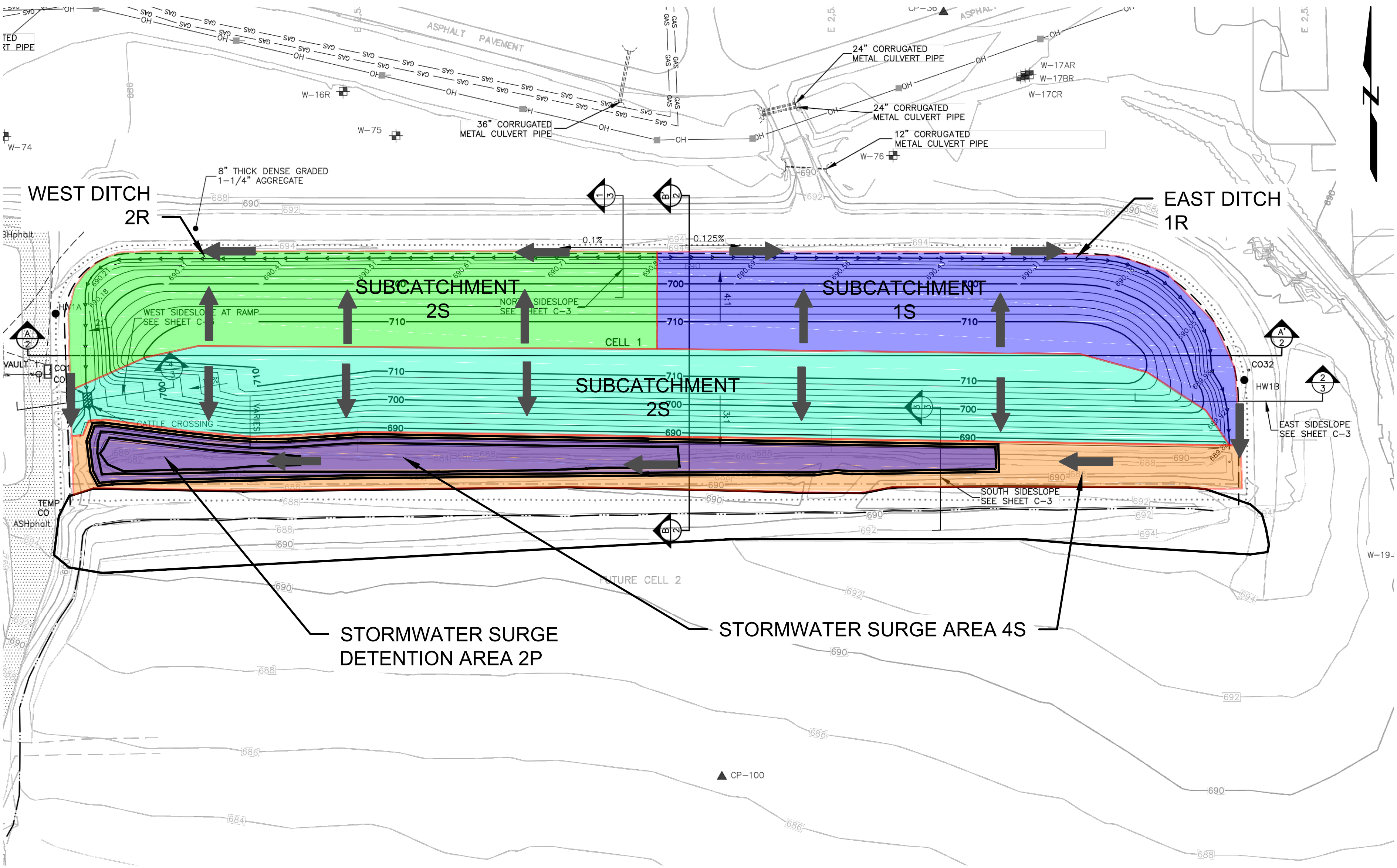
1. The rainfall depth estimation for the 24-hr, 25-yr event was determined to be 4.52 inches (included under a separated calculation package). The rainfall depth was determined by following procedures outlined in Precipitation-Frequency (PF) Atlas of the United States (Atlas 14, Volume 8, Version 2: Wisconsin).
2. Stormwater will be modeled to a temporary construction condition of Cell 1 prior to the commencement of Cell 2 construction.
3. Stormwater on the Cell was divided into four subcatchments: northwest, northeast, south, and stormwater surge area, as shown on Figure 1. Flow from the northwest and northeast subcatchments will consist of sheet flow until it is collected by a conveyance channel at the toe of the slope. The stormwater is then transported in the conveyance channels into an intercell stormwater surge area. From the intercell stormwater surge area the water infiltrates into leachate collection granular drainage layer and is treated as leachate. The south subcatchment consists of sheet flow and is transported directly into the intercell stormwater surge area. Stormwater flowlines, subcatchments, and the intercell stormwater surge area are shown on Figure 1.
4. HydroCAD 10.0 was used to model the stormwater associated with Cell 1 of the PPPP landfill.
5. Subcatchment, reach, and detention parameters are included in the attached HydroCAD Report.

Results:

The attached HydroCAD report includes input and output for the stormwater run-off model developed for Cell 1 of the PPPP landfill. Based on stormwater run-off analysis the current run-off control system for Cell 1 of PPPP landfill will be able to handle the 24-hr, 25yr precipitation event without allowing any contact water to escape the permitted limits of waste. The estimated peak water level in the west and east conveyance channel is 1.33 feet and 1.30 feet, respectively. The minimum depth of the channel is 2 foot high. The intercell stormwater surge area has a minimum liner crest elevation of approximately El. 686.5 feet (berm height El. 687 feet), and the estimated water level associated with the stormwater from Cell 1 is El. 686.48 feet. Both the conveyance channels and the pond area are designed to handle the run-off from Cell 1 associated with the 24-hr, 25-yr precipitation event.

Attachments:

- Figure 1 –Stormwater Conveyance Diagram
- HydroCAD Summary Report

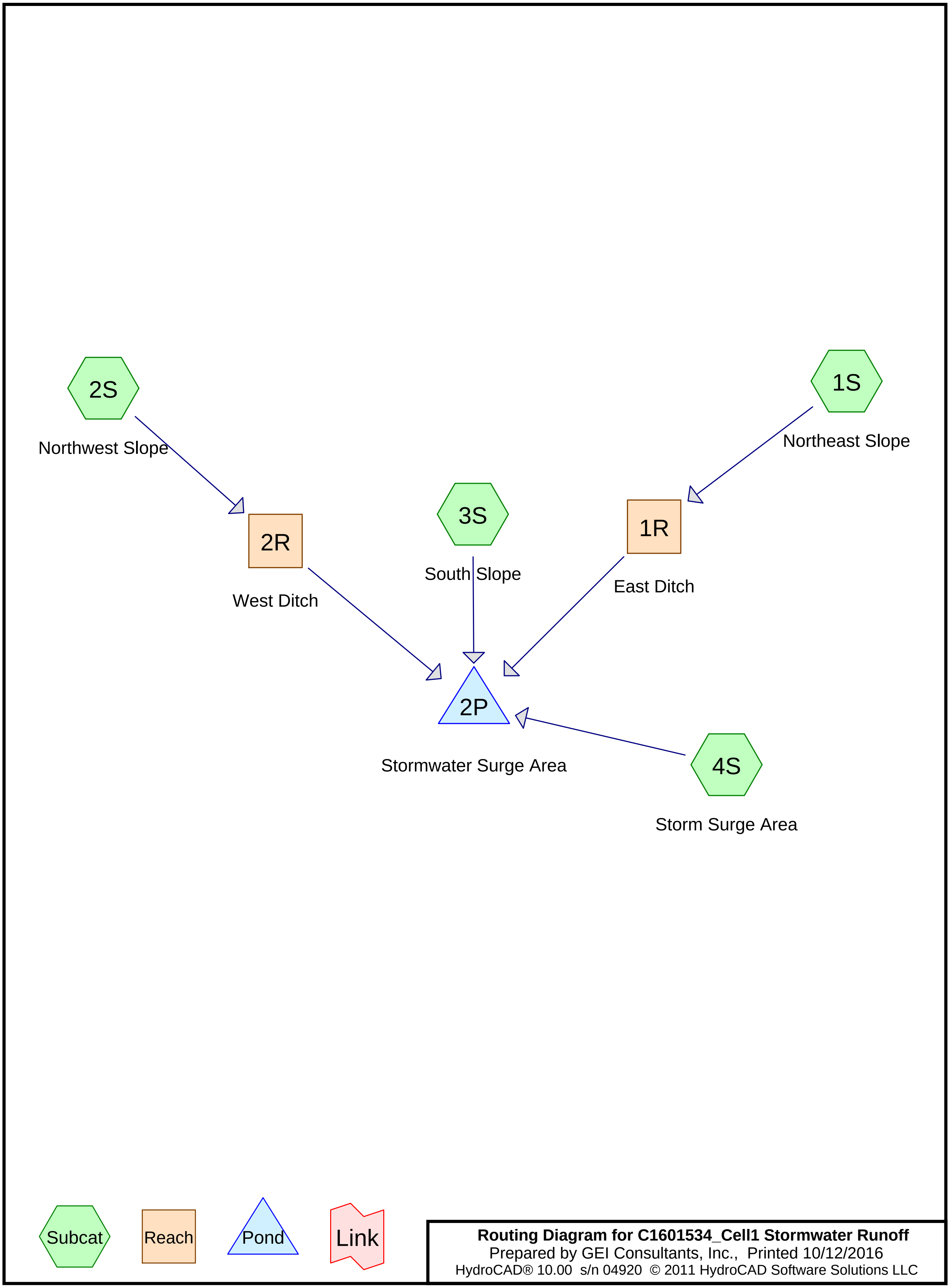


SOURCE:

1. PLAN BASED DWG C-1, PPPP ASH LANDFILL CELL 1

Run-on and Run-off Control Plan Pleasant Prairie Ash Landfill Cell #1 Pleasant Prairie, Wisconsin	GEI Consultants	Stormwater Flow Diagram
We Energies Milwaukee, Wisconsin	Project 1610534	October 2016 Fig. 1

\\grb1v-fs01\ J:\Landfills\WE - P4\1610534_run-on run-off control plan\dwgs\1610534001_SW_Calc Figure.dwg - 10/12/2016


2S
Northwest Slope
1S
Northeast Slope
2R
West Ditch
3S
South Slope
1R
East Ditch
2P
Stormwater Surge Area
4S
Storm Surge Area
Subcat
Reach
Pond
Link
Routing Diagram for C1601534_Cell1 Stormwater Runoff
Prepared by GEI Consultants, Inc., Printed 10/12/2016
HydroCAD® 10.00 s/n 04920 © 2011 HydroCAD Software Solutions LLC

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
6.941	91	Newly graded area, HSG C (1S, 2S, 3S, 4S)
6.941	**91**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
6.941	HSG C	1S, 2S, 3S, 4S
0.000	HSG D	
0.000	Other	
6.941		**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	6.941	0.000	0.000	6.941	Newly graded area	1S, 2S, 3S, 4S
0.000	**0.000**	**6.941**	**0.000**	**0.000**	**6.941**	**TOTAL AREA**	

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

Subcatchment 1S: Northeast Slope Runoff Area=65,209 sf 0.00% Impervious Runoff Depth=3.52"
Flow Length=100' Tc=1.3 min CN=91 Runoff=9.58 cfs 0.439 af

Subcatchment 2S: Northwest Slope Runoff Area=64,652 sf 0.00% Impervious Runoff Depth=3.52"
Flow Length=100' Tc=1.3 min CN=91 Runoff=9.50 cfs 0.435 af

Subcatchment 3S: South Slope Runoff Area=104,504 sf 0.00% Impervious Runoff Depth=3.52"
Flow Length=92' Tc=1.1 min CN=91 Runoff=15.51 cfs 0.703 af

Subcatchment 4S: Storm Surge Area Runoff Area=68,000 sf 0.00% Impervious Runoff Depth=3.52"
Tc=0.0 min CN=91 Runoff=10.31 cfs 0.458 af

Reach 1R: East Ditch Avg. Flow Depth=1.30' Max Vel=1.70 fps Inflow=9.58 cfs 0.439 af
n=0.022 L=742.0' S=0.0013 '/' Capacity=22.72 cfs Outflow=6.90 cfs 0.439 af

Reach 2R: West Ditch Avg. Flow Depth=1.33' Max Vel=1.54 fps Inflow=9.50 cfs 0.435 af
n=0.022 L=754.0' S=0.0010 '/' Capacity=20.24 cfs Outflow=6.68 cfs 0.435 af

Pond 2P: Stormwater Surge Area Peak Elev=686.48' Storage=88,625 cf Inflow=30.71 cfs 2.035 af
Outflow=0.00 cfs 0.000 af

Total Runoff Area = 6.941 ac Runoff Volume = 2.035 af Average Runoff Depth = 3.52"
100.00% Pervious = 6.941 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment 1S: Northeast Slope

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

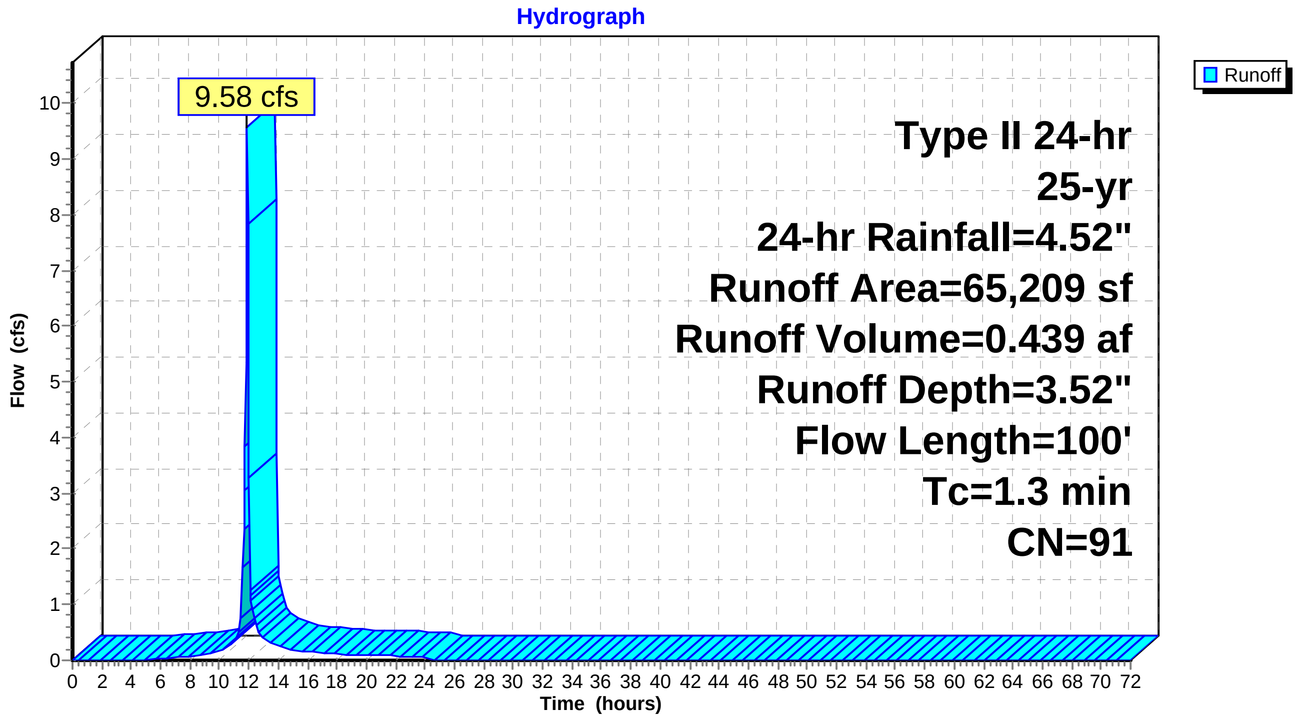
Runoff = 9.58 cfs @ 11.90 hrs, Volume= 0.439 af, Depth= 3.52"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr, 24-hr Rainfall=4.52"

	Area (sf)	CN	Description
*	65,209	91	Newly graded area, HSG C
	65,209		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.9	32	0.0050	0.58		**Sheet Flow, Top of Slope** Smooth surfaces n= 0.011 P2= 2.69"
0.4	68	0.2500	3.21		**Sheet Flow, Side Slope** Smooth surfaces n= 0.011 P2= 2.69"
1.3	100	Total			

Subcatchment 1S: Northeast Slope



Summary for Subcatchment 2S: Northwest Slope

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

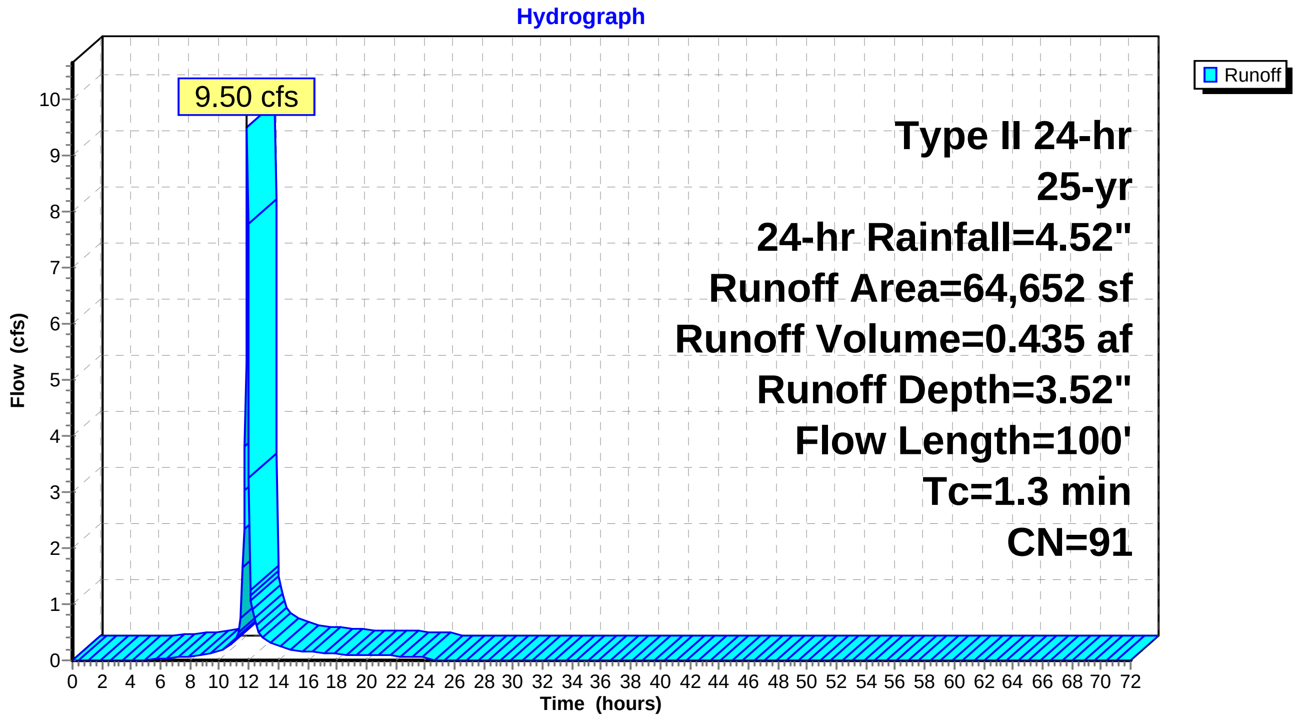
Runoff = 9.50 cfs @ 11.90 hrs, Volume= 0.435 af, Depth= 3.52"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr, 24-hr Rainfall=4.52"

	Area (sf)	CN	Description
*	64,652	91	Newly graded area, HSG C
	64,652		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.9	32	0.0050	0.58		**Sheet Flow, Top of slope** Smooth surfaces n= 0.011 P2= 2.69"
0.4	68	0.2500	3.21		**Sheet Flow, Side Slope** Smooth surfaces n= 0.011 P2= 2.69"
1.3	100	Total			

Subcatchment 2S: Northwest Slope



Summary for Subcatchment 3S: South Slope

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

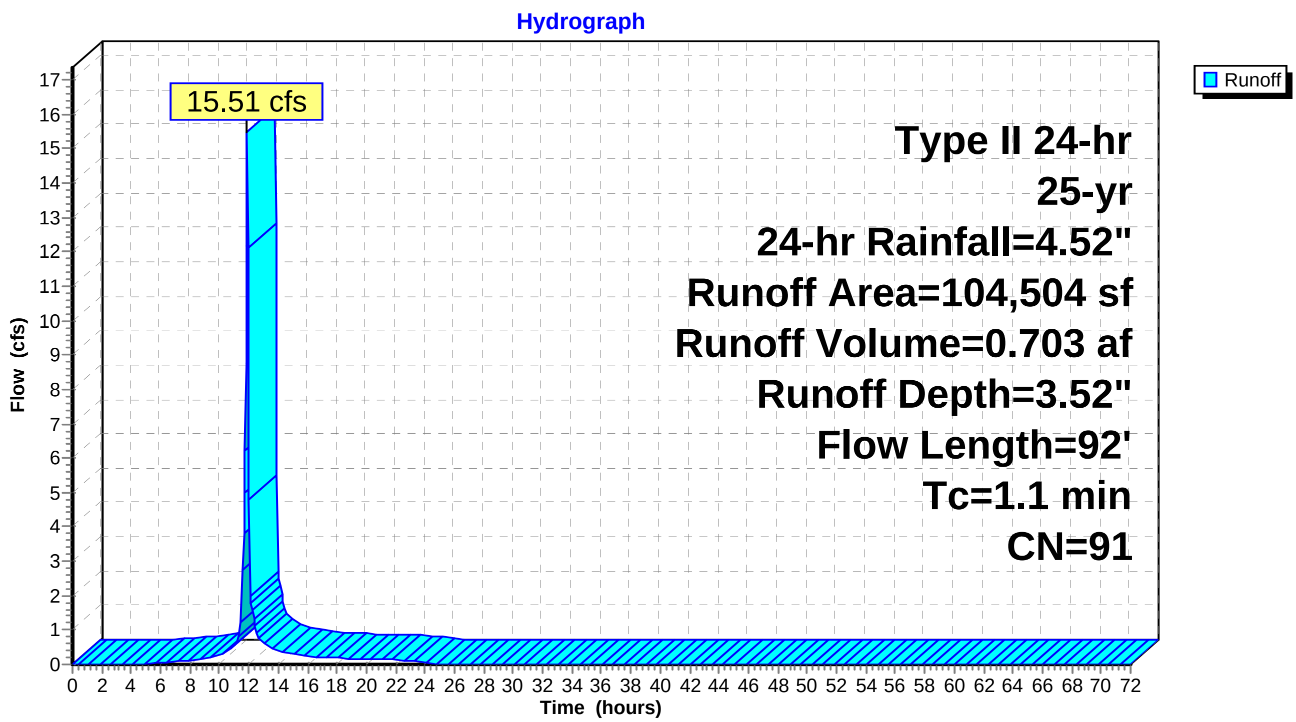
Runoff = 15.51 cfs @ 11.90 hrs, Volume= 0.703 af, Depth= 3.52"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr, 24-hr Rainfall=4.52"

Area (sf)	CN	Description
104,504	91	Newly graded area, HSG C
104,504		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.8	26	0.0050	0.55		**Sheet Flow, Top of Slope** Smooth surfaces n= 0.011 P2= 2.69"
0.3	66	0.3330	3.57		**Sheet Flow, Side Slope** Smooth surfaces n= 0.011 P2= 2.69"
1.1	92	Total			

Subcatchment 3S: South Slope



Summary for Subcatchment 4S: Storm Surge Area

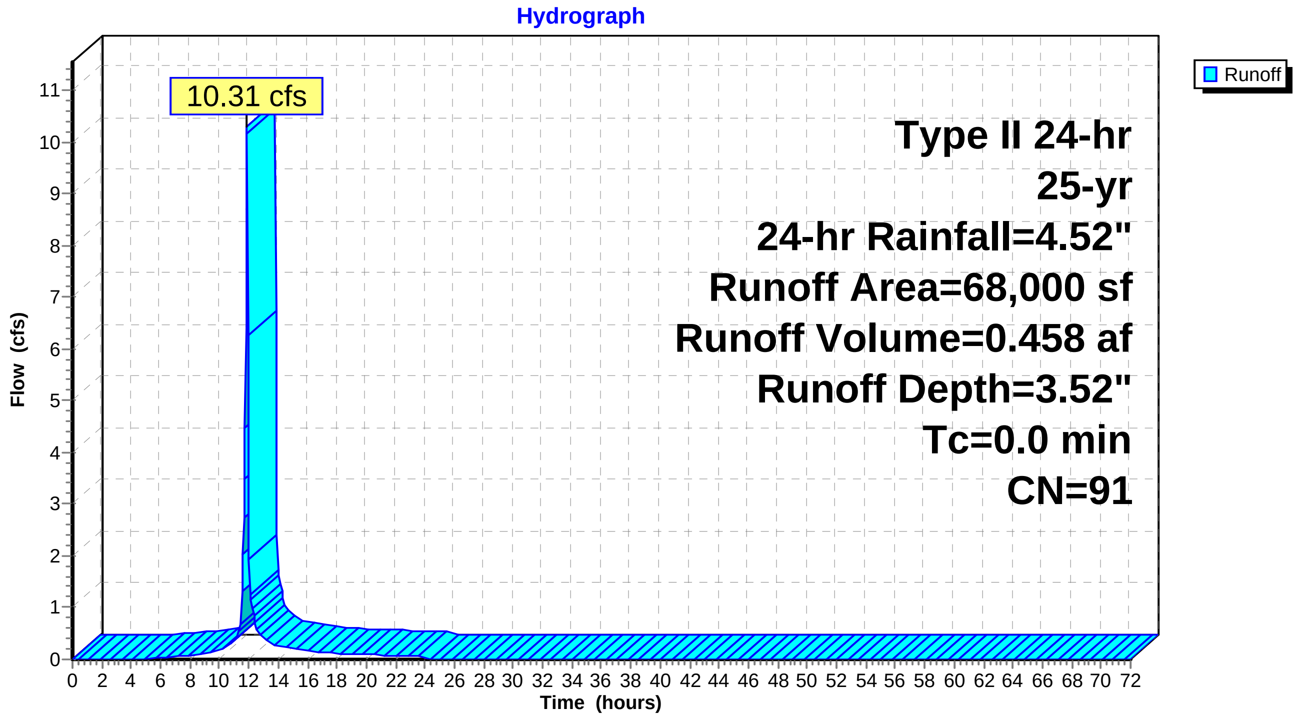
[46] Hint: Tc=0 (Instant runoff peak depends on dt)

Runoff = 10.31 cfs @ 11.89 hrs, Volume= 0.458 af, Depth= 3.52"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr, 24-hr Rainfall=4.52"

Area (sf)	CN	Description
68,000	91	Newly graded area, HSG C
68,000		100.00% Pervious Area

Subcatchment 4S: Storm Surge Area



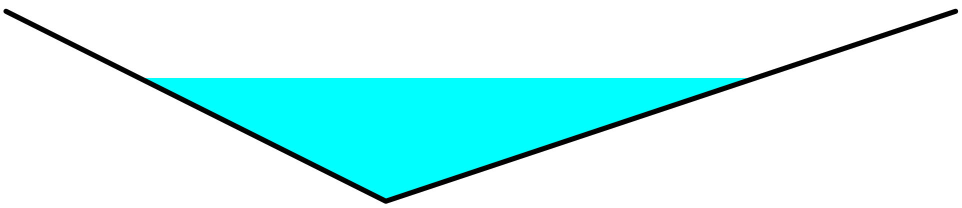
Summary for Reach 1R: East Ditch

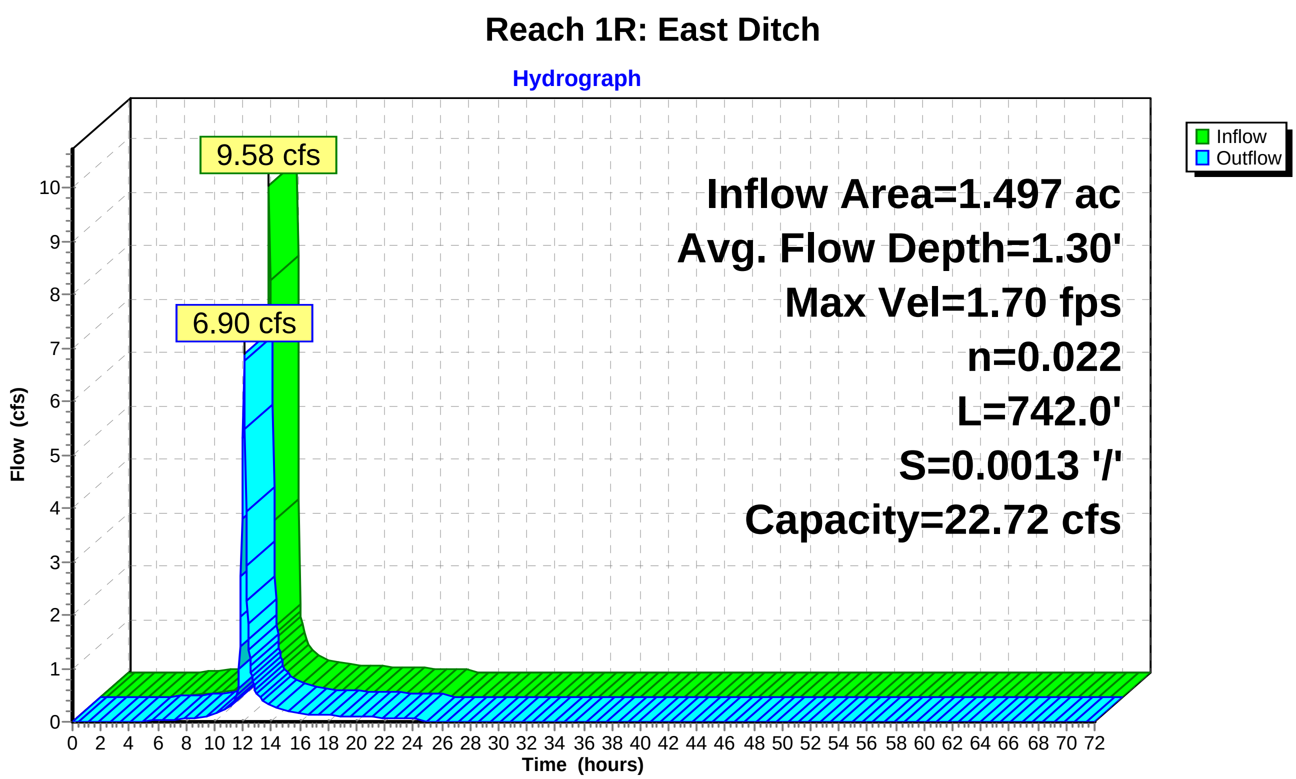
Inflow Area = 1.497 ac, 0.00% Impervious, Inflow Depth = 3.52" for 25-yr, 24-hr event
Inflow = 9.58 cfs @ 11.90 hrs, Volume= 0.439 af
Outflow = 6.90 cfs @ 12.08 hrs, Volume= 0.439 af, Atten= 28%, Lag= 10.5 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.70 fps, Min. Travel Time= 7.3 min
Avg. Velocity = 0.48 fps, Avg. Travel Time= 25.9 min

Peak Storage= 3,126 cf @ 11.96 hrs
Average Depth at Peak Storage= 1.30'
Bank-Full Depth= 2.00' Flow Area= 10.0 sf, Capacity= 22.72 cfs

0.00' x 2.00' deep channel, n= 0.022 Earth, clean & straight
Side Slope Z-value= 2.0 3.0 '/' Top Width= 10.00'
Length= 742.0' Slope= 0.0013 '/'
Inlet Invert= 690.81', Outlet Invert= 689.88'





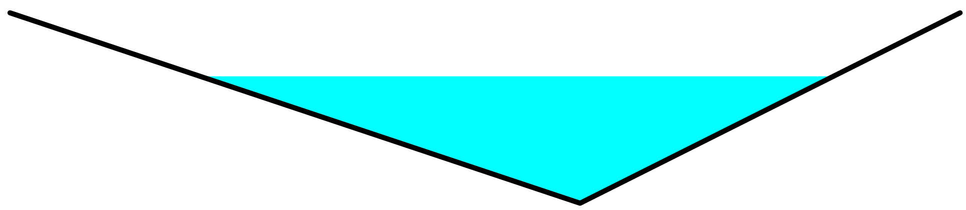
Summary for Reach 2R: West Ditch

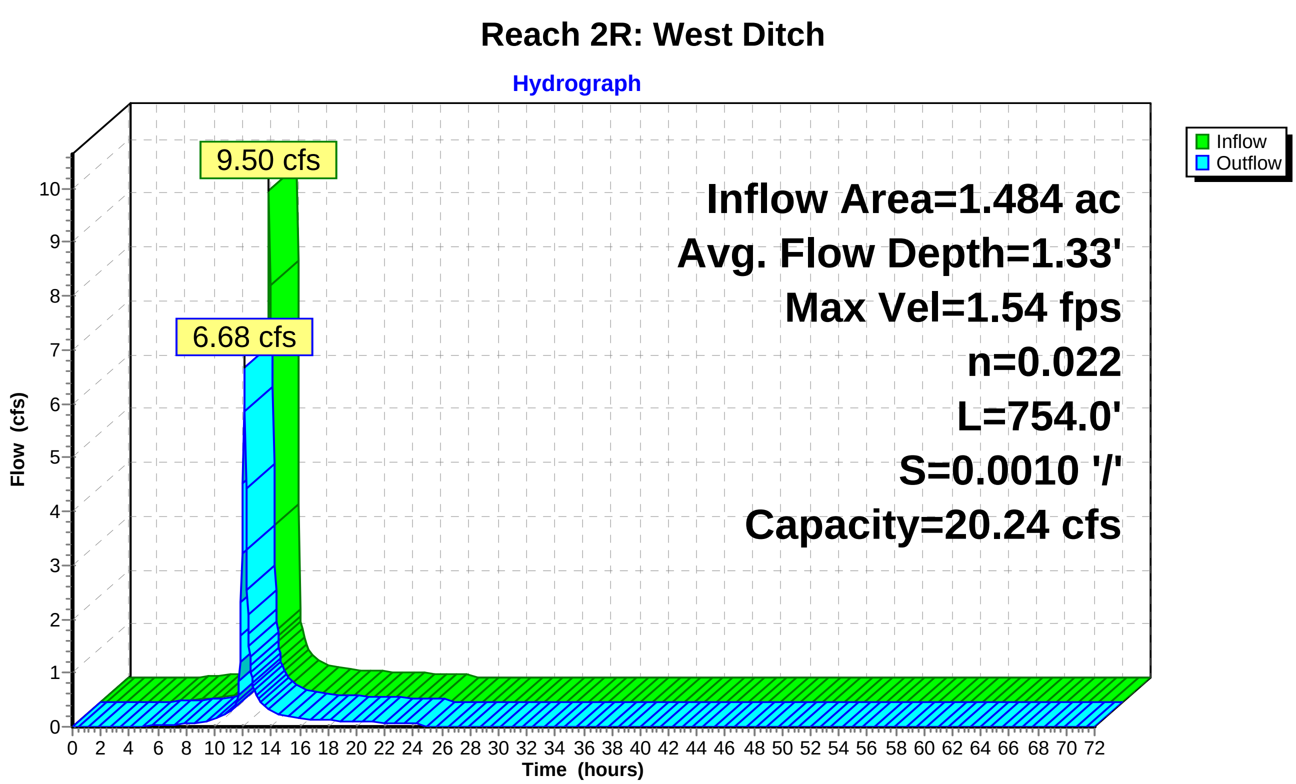
Inflow Area = 1.484 ac, 0.00% Impervious, Inflow Depth = 3.52" for 25-yr, 24-hr event
Inflow = 9.50 cfs @ 11.90 hrs, Volume= 0.435 af
Outflow = 6.68 cfs @ 12.10 hrs, Volume= 0.435 af, Atten= 30%, Lag= 11.7 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.54 fps, Min. Travel Time= 8.1 min
Avg. Velocity = 0.42 fps, Avg. Travel Time= 29.7 min

Peak Storage= 3,346 cf @ 11.96 hrs
Average Depth at Peak Storage= 1.33'
Bank-Full Depth= 2.00' Flow Area= 10.0 sf, Capacity= 20.24 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= 754.0' Slope= 0.0010 '/'
Inlet Invert= 690.81', Outlet Invert= 690.06'





Summary for Pond 2P: Stormwater Surge Area

Inflow Area = 6.941 ac, 0.00% Impervious, Inflow Depth = 3.52" for 25-yr, 24-hr event
Inflow = 30.71 cfs @ 11.90 hrs, Volume= 2.035 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= 686.48' @ 70.50 hrs Surf.Area= 36,959 sf Storage= 88,625 cf

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

Volume	Invert	Avail.Storage	Storage Description
#1	682.00'	108,851 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
682.00	4,400	0	0
684.00	16,616	21,016	21,016
686.00	34,111	50,727	71,743
687.00	40,105	37,108	108,851

Pond 2P: Stormwater Surge Area