LEE'S SUMMIT DOWNTOWN MARKET PRELIMINARY DEVLEOPMENT PLAN DRAINAGE STUDY

Lee's Summit, Missouri

Prepared for:

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1. GENERAL INFORMATION

The Lee's Summit Downtown Market is a proposed commercial development on approximately 6 acres. The project is located in the downtown area of Lee's Summit, MO located east of City Hall. The project lies in the southwest 1/4 of Section 5, Township 47N, Range 31W, in Lee's Summit, Jackson County, Missouri.

1.1. Project Location

The Lee's Summit Downtown Market development is located entirely in the city of Lee's Summit, Missouri. The area to be developed is bounded by City Hall and Douglas Street to the West, SE 2nd St to the North, SE Johnson Street to the East, SE 3rd Street to the South. The site discharges stormwater to the northeast, through public storm sewer, into a drainage ditch, ultimately discharging into Lake Jacomo.

Figure 1. Lee's Summit Downtown Market Location Map.

1.2. Federal Emergency Management Agency Floodplain Classification

FEMA Flood Boundary and Floodway Map Community Panel Number 29095C0436G classifies the Lee's Summit Downtown Market property as a "Zone X Unshaded" Area. This is the FEMA flood insurance rate zone that corresponds to areas outside the 0.2% annual chance floodplain. No Base Flood Elevations or depths are shown within this zone. Refer to Appendix E for the FIRM Map.

1.3. Soil Classifications

Soil maps published on the Natural Resources Conservation Service (NRCS) Web Soil Survey categorize soils on the Lee's Summit Downtown Market as shown in Table 1. Refer to Appendix D for a map of soils on the property.

Table 1. Soil Classifications

HSG	Symbol	Name	Slope
C	10082	Arisburg-Urban land complex	1-5%
D	10128	Sharpsburg-Urban land complex	2-5%
C	10180	Udarents-Urban land-Sampsel complex	2-5%
C	10181	Udarents-Urban land-Sampsel complex	5-9%
D	99012	Urban land	5-9%

2. METHODOLOGY

The storm drainage study will be analyzed in accordance with the February 15, 2006 edition of the Kansas City Metropolitan Chapter, American Public Works Association, (KCAPWA) Construction and Material Specifications, Section 5601.5.A.4.

The Existing Conditions hydrology will be evaluated in Section 3, and Proposed Conditions hydrology will be computed in Section 4. The Proposed Conditions discharge data for each stage of development will be compared to the Existing Conditions results; variations in quantity and rate of stormwater discharge between these models will represent the hydrologic impact generated by the proposed development. The overall stormwater management plan will be designed utilizing this information. Section 3 assumes current land use within the tributary sub-watersheds, and pre-development conditions within the project boundary. Section 4 assumes completion of the entire development. The program used is Autodesk Storm & Sanitary Analysis 2022 (SSA).

The following methods were used in this study to model Existing, Proposed (Micro) and Future (Macro) Conditions in for stormwater runoff:

- NRCS TR-55 Unit Hydrograph Method
- 1-,10-, and 100-year Return Frequency, 24-hr. Storm Precip. Depths (TP-40)
- ARC Type II Soil Moisture Conditions
- 24-Hour NRCS Type II Rainfall Distribution
- Runoff Curve Numbers per NRCS TR-55 (Tables 2-2a - 2-2c) and KCAPWA Section 5602.3
- NRCS TR-55 Methods for determination of Time of Concentration and Travel Time.
  NOTE: SSA models use "Time of Concentration" rather than "Lag Time" for computing subarea hydrology.

City code follows the February 16, 2011 version of APWA 5600, requiring comprehensive control to reduce flows to maximum allowable release rates. However, after conversations with the city, reaching maximum allowable release rates will cause an undue burden on the project, and a goal has been set of reducing post-development flows to pre-development rates.

Stormwater runoff models were created for the 1%, 10%, and 100% design storm events. The precipitation depths used in the analyses have been interpolated from the NOAA Atlas 14, Volume 8, Ver. The following Table 2 summarizes the rainfall depths used in this analysis:

Table 2. Precipitation Depths.

Return Period	24-Hour Precipitation Depth (in.)
Water Quality Volume	1.37
1-Year (100% Storm)	3.10
2-Year (50% Storm)	3.71
10-Year (10% Storm)	5.67
100-Year (1% Storm)	9.25

3. EXISTING CONDITIONS

To quantify the effects of development of this project, the following area and point of interest has been used for Existing and Proposed Conditions analyses. See Exhibit 301 in Appendix A, Existing Conditions Drainage Area Map.

Watershed A is the watershed from the entire site. The Downtown Market site has an existing box culvert travelling through the site that receives water from the entire watershed area, approximately 133 acres. 100% of the site discharges into the box culvert. The entirety of the watershed was analyzed in a previous storm study. For the purpose of this study, only the on-site area will be analyzed for impacts from proposed developments. The entire site flows into multiple inlets, which ultimately discharge into the storm box culvert. Thus, a single point is chosen as the outfall, which is location where all flows from the site have discharged into the box.

The following table summarizes the results of the Existing Conditions analysis. The Proposed Conditions data will be compared to these results in Section 4 of this report. Refer to Appendix C for output from and a schematic of the Existing Conditions model.

Curve Numbers (CN) were assumed as follows:

Cover Type	Soil Type	CN Value
Single-Family Residential	C	83
	D	87
Urban Commercial	C	94
	D	95
Multi-Family Residential	C	90
Impervious Pavement	Any	98
Turf	D	84

Table 3-1. Lee's Summit Downtown Market – Existing Conditions Subarea

The following tables summarize the results of the Existing Conditions analysis. With the prevalence of public storm sewer inlets around the site along with the majority of the site being impervious, a time of concentration (Tc) of 5 minutes is chosen.

Table 3-2. Lee's Summit Downtown Market – Existing Conditions Subarea

Subarea	Area (acres)	T_C (minutes)	Weighted Curve Number
A	6.43	5	93.49

Table 3-3 Lee's Summit Downtown Market – Existing Conditions Subarea Results

Subarea	Q_1 (cfs)	V_{R-1} (ac-ft)	Q_2 (cfs)	V_{R-2} (ac-ft)	Q_{10} (cfs)	V_{R-10} (ac-ft)	Q_{100} (cfs)	V_{R-100} (ac-ft)
A-1	23.44	1.285	28.86	1.602	46.07	2.633	77.03	4.537

* cfs – cubic feet per second

4. PROPOSED CONDITIONS

This section of analysis assumes completion of the Lee's Summit Downtown Market site. The mixed-use site includes construction of a multi-story apartment complex, open-air market area, commercial buildings, and associated parking and utilities.

4.1. PROPOSED CONDITIONS

The proposed development will result in no changes in overall tributary areas on the site. The development to occur on the site will increase the amount of impervious surface on the site. As a result of the increase in impervious surfaces, the CN value is increased, and thus the peak flows onsite are increased. To mitigate the increase in flows, detention must be installed on site. Due to the small site area and the lack of open space, an above ground detention basin will be infeasible, and underground detention in the form of isolator rows are proposed. To accurately model this, the area has been divided into two subareas, labeled **A_Detained** and **A_Undetained** in Proposed Drainage Area Map EX-302 (See Appendix A.) A_Undetained represents the area that will not enter the isolator row system, while A_Detained represents the area that will enter the isolator row system.

The following tables summarize the results of the Proposed Conditions analysis for the revised subareas within Watershed A. Tables 4-2 and 4-3 assume no detention is provided, to demonstrate the effects of development in this watershed. Refer to Appendix C for outputs from the Proposed Conditions SSA model.

Subarea	Area (acres)	T_C (minutes)	Weighted Curve Number
A_Detained	4.09	5	96.59
A_Undetained	2.34	5	93.77

Table 4-1. Lee's Summit Downtown Market –Proposed Conditions Subarea Data

Subarea	Q_1 (cfs)	V_{R-1} (ac-ft)	Q_2 (cfs)	V_{R-2} (ac-ft)	Q_{10} (cfs)	V_{R-10} (ac-ft)	Q_{100} (cfs)	V_{R-100} (ac-ft)
A_Detained	8.61	0.473	10.58	0.589	16.83	0.965	28.09	1.659
A_Undetained	16.10	0.924	19.46	1.131	30.17	1.795	49.63	3.013

Table 4-2 Lee's Summit Downtown Market –Proposed (No Detention) Conditions Subarea Results

Table 4-3 Lee's Summit Downtown Market –Proposed (No Detention) Conditions Outfall Results

Outfall	Q_1 (cfs)	V_{R-1} (ac-ft)	Q_2 (cfs)	V_{R-2} (ac-ft)	Q_{10} (cfs)	V_{R-10} (ac-ft)	Q_{100} (cfs)	V_{R-100} (ac-ft)
A	24.69	1.398	30.02	1.720	46.99	2.76	77.69	4.672

The following table compares the results of the Proposed Conditions analysis to the Existing Conditions from Section 3 at Outfall A. Positive values indicate an increase from Existing to Proposed conditions, while negative values indicate a decrease.

Table 4-4. Lee's Summit Downtown Market –Proposed (No Detention) vs. Existing Conditions Point of Interest Comparison

Point of Interest	Q_1 (cfs)	V_{R-1} (ac-ft)	Q_2 (cfs)	V_{R-2} (ac-ft)	Q_{10} (cfs)	V_{R-10} (ac-ft)	Q_{100} (cfs)	V_{R-100} (ac-ft)
Outfall A	+1.25	+1.113	+1.16	+1.118	+0.92	+0.127	+0.66	+0.135

As can be seen in the previous table, the flows increase with no detention. To mitigate the increases shown in the previous table, detention will be provided within the previously undeveloped area, to be constructed as part of the private development. Detention is intended to be constructed via underground isolator rows that will treat flows from the proposed developed site. Drainage areas for the proposed isolator rows can be found in Exhibit EX-302. To account for the increased flows on site, a system of 30 chambers of ADS MC3500 are proposed to reduce the increase of stormwater flow to pre-development levels. The chambers will be restricted by a weir plate set in a junction box to restrict flows into the chamber system.

The table below shows results for the proposed isolator rows.

Table 4-5. Lee's Summit Downtown Market – Proposed Conditions Detention Flow and Volume Results

Storm Event	Peak Q In (cfs)	TP In (hr)	Peak Q Out (cfs)	TP Out (hr)	Peak W.S.E. (ft)	Stored Volume (ac-ft)
1-Year	8.61	11.93	7.72	11.98	1003.54	0.073
2-Year	10.58	11.93	9.01	11.98	1003.82	0.082
10-Year	16.83	11.93	13.40	11.98	1005.12	0.122
100-Year	28.09	11.93	27.77	12.14	1006.64	0.150

The following table shows the results of the points of interest that are impacted by the constructed detention chambers.

Table 4-6. Lee's Summit Downtown Market –Proposed (With Detention) Conditions Point of Interest Results

Outfall	Q_1 (cfs)	V_{R-1} (ac-ft)	Q_2 (cfs)	V_{R-2} (ac-ft)	Q_{10} (cfs)	V_{R-10} (ac-ft)	Q_{100} (cfs)	V_{R-100} (ac-ft)
A	23.20	1.381	27.76	1.703	42.01	2.743	77.02	4.655

The following table compares the results of the Proposed Conditions analysis with the detention described above to the Existing Conditions from Section 3.

Table 4-7. Lee's Summit Downtown Market –Proposed (With Detention) vs. Existing Conditions Point Data

Subarea	Q_1 (cfs)	V_{R-1} (ac-ft)	Q_2 (cfs)	V_{R-10} (ac-ft)	Q_{10} (cfs)	V_{R-10} (ac-ft)	Q_{100} (cfs)	V_{R-100} (ac-ft)
Existing	23.44	1.285	28.86	1.602	46.07	2.633	77.03	4.537
Proposed	23.20	1.381	27.76	1.703	42.01	2.743	77.02	4.655
Difference	-0.24	+0.096	-1.10	+0.101	-4.06	+0.110	-0.01	+0.118

As shown in the table above, the proposed underground isolator system reduces flows in the 1-, 2-, 10- and 100-year storms to below pre-development conditions at Outfall A.

5. RESULTS

As shown in the discussion and tables in the previous sections, the proposed underground detention system adequately reduces the peak stormwater rates and do not negatively impact downstream areas. Table 6-1 below, summarizes the Proposed Conditions results and compares them with Existing conditions.

Table 6-1 Lee's Summit Downtown Market –Points of Interest Discharge Comparison

Outfall	Condition	Q_1 (cfs)	Q_2 (cfs)	Q_{10} (cfs)	Q_{100} (cfs)
Outfall A	Existing	279.96	350.13	575.48	978.28
	Proposed	279.90	350.02	575.24	978.22
	Difference	**-0.06**	**-0.11**	**-0.24**	**-0.06**

6. CONCLUSION

This Preliminary Development Plan Stormwater Drainage Study has been prepared for the proposed project to establish a comprehensive stormwater management plan for the site. The results of this analysis demonstrate that the proposed stormwater management plan for the project achieves compliance the stated goal of reducing peak flows for the 1-year, 2-year, 10-year and 100 year storm events to below the existing peak flow rates. As mentioned in Section 2, a waiver is requested to achieve pre-vs-post reduction, without achieving allowable rates, per APWA 2011. Based on information received, Olsson requests that this stormwater drainage report be approved.

APPENDIX A

Exhibits

LAND COVER LEGEND		
	TREATMENT	AREA (AC.)
	OPEN TURF	1.61
	IMPERVIOUS	4.82

N

0’ 50’ 100’
SCALE IN FEET

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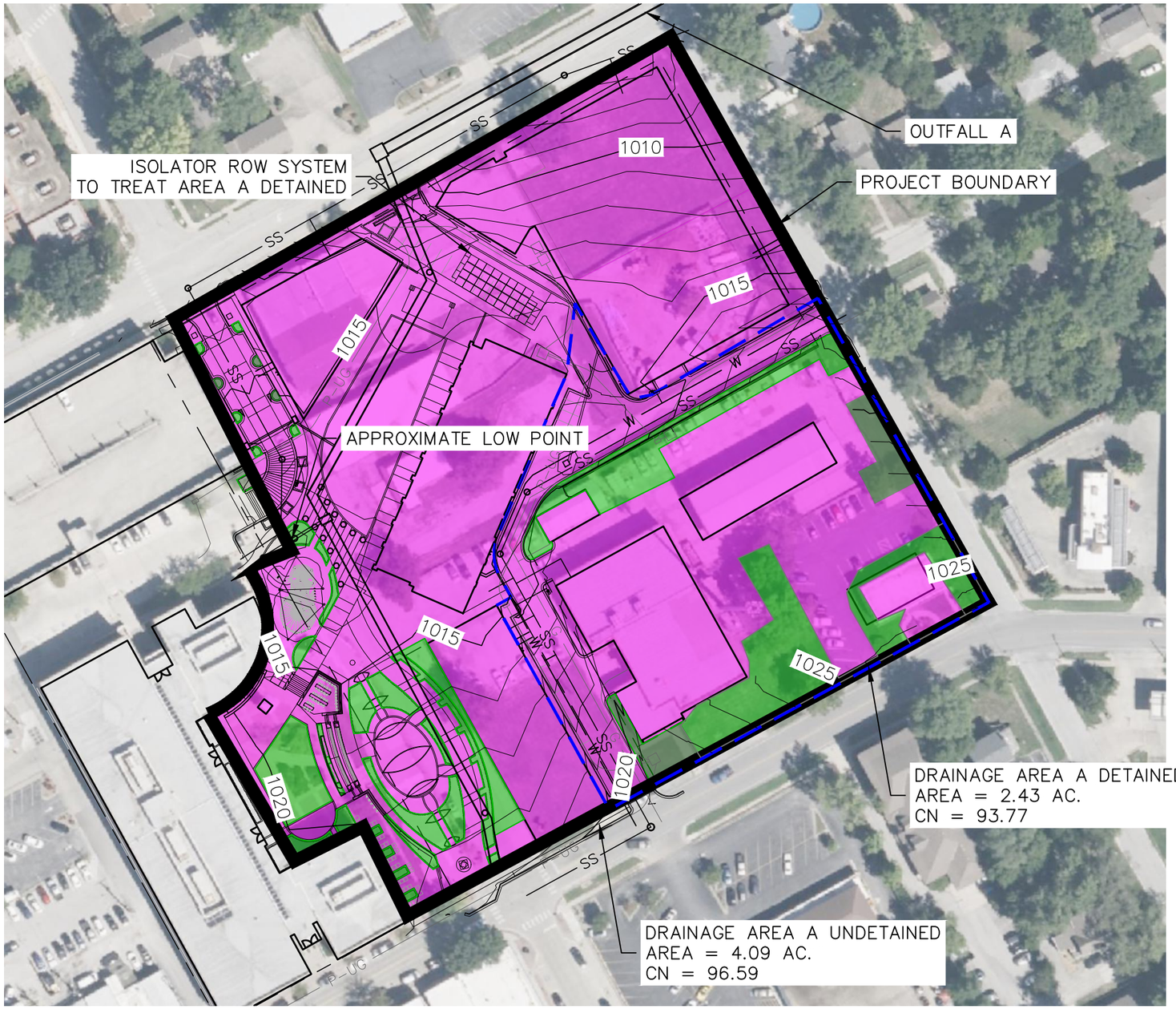
OLSSON - CIVIL ENGINEERING
MISSOURI CERTIFICATE OF AUTHORITY #

PROJECT NO: 022-03930	EXISTING CONDITIONS DRAINAGE AREA MAP	olsson 1301 Burlington Street North Kansas City, MO 64116 TEL 816.361.1177	EXHIBIT EX-301
DRAWN BY: DFG			
DATE: 08/23/2023			



LAND COVER LEGEND		
	TREATMENT	AREA (AC.)
	OPEN TURF	0.87
	IMPERVIOUS	5.56

DENOTES BOUNDARY OF FLOWS TO ISOLATOR ROWS

N

0’ 50’ 100’

SCALE IN FEET

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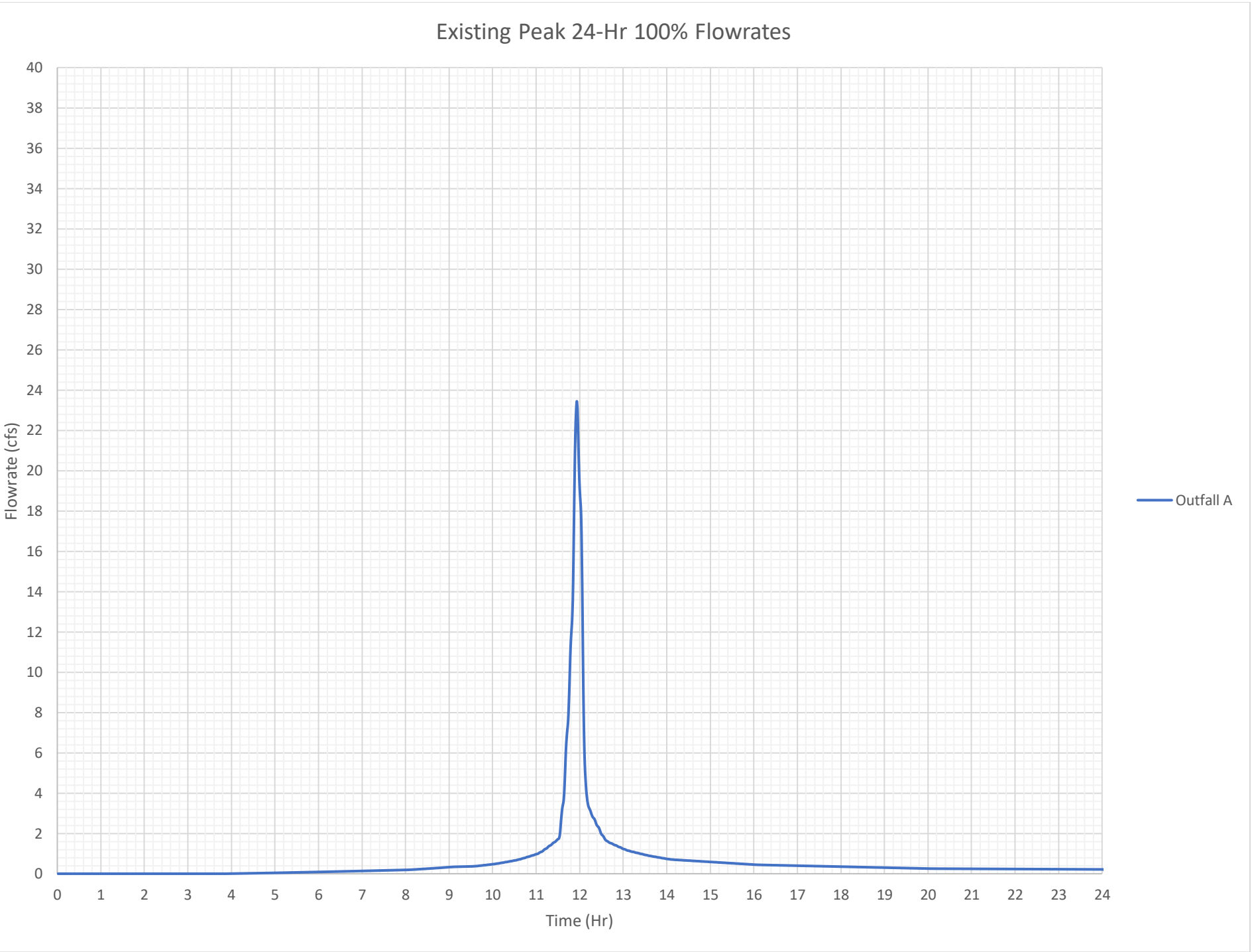
OLSSON - CIVIL ENGINEERING
MISSOURI CERTIFICATE OF AUTHORITY #

PROJECT NO: 022-03930	PROPOSED CONDITIONS DRAINAGE AREA MAP	EXHIBIT
DRAWN BY: DFG		EX-302
DATE: 08/23/2023		

olsson
1301 Burlington Street
North Kansas City, MO 64116
TEL 816.361.1177

APPENDIX B

Hydrographs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4
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26
28
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32
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38
40
Time (Hr)
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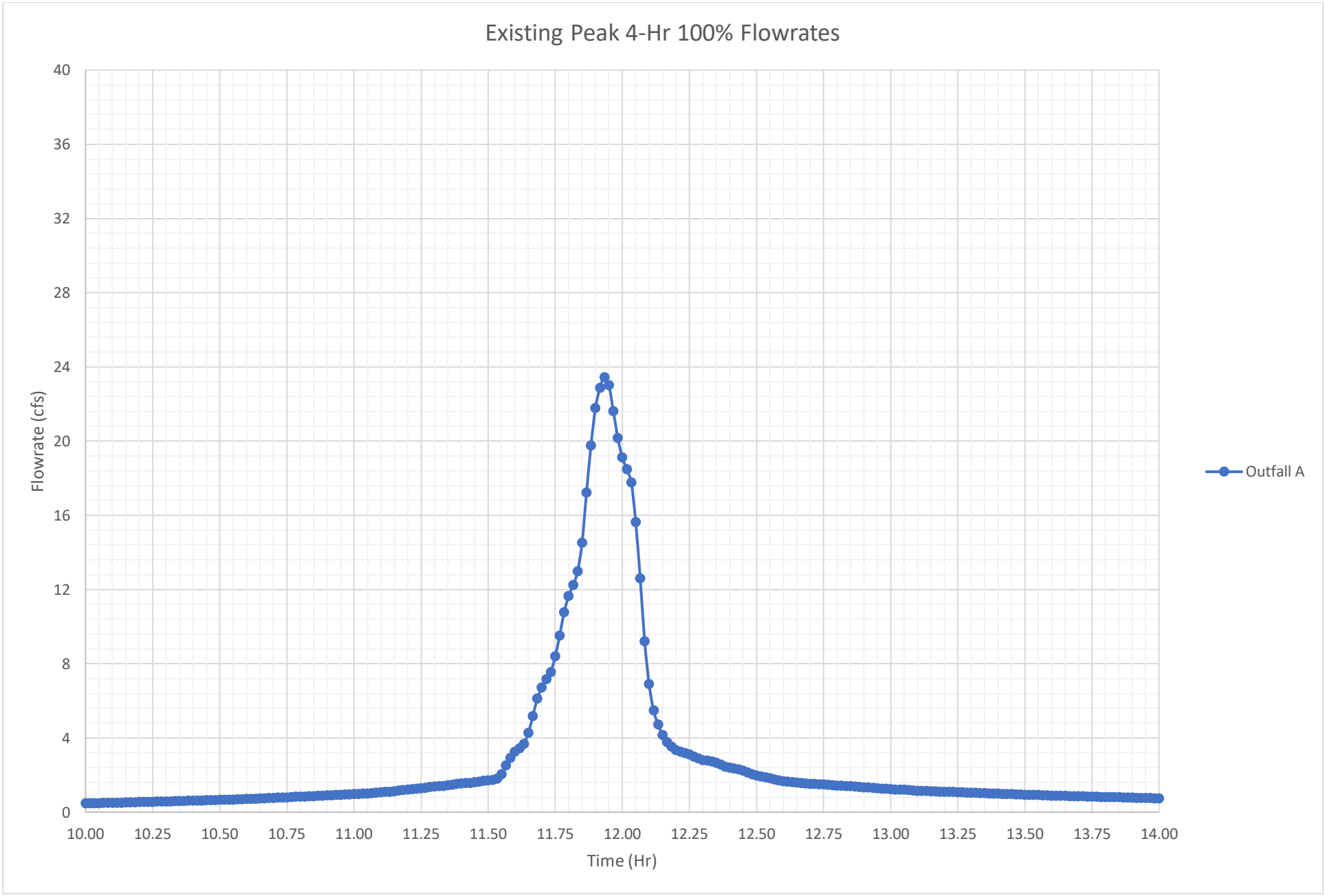
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Time (Hr)
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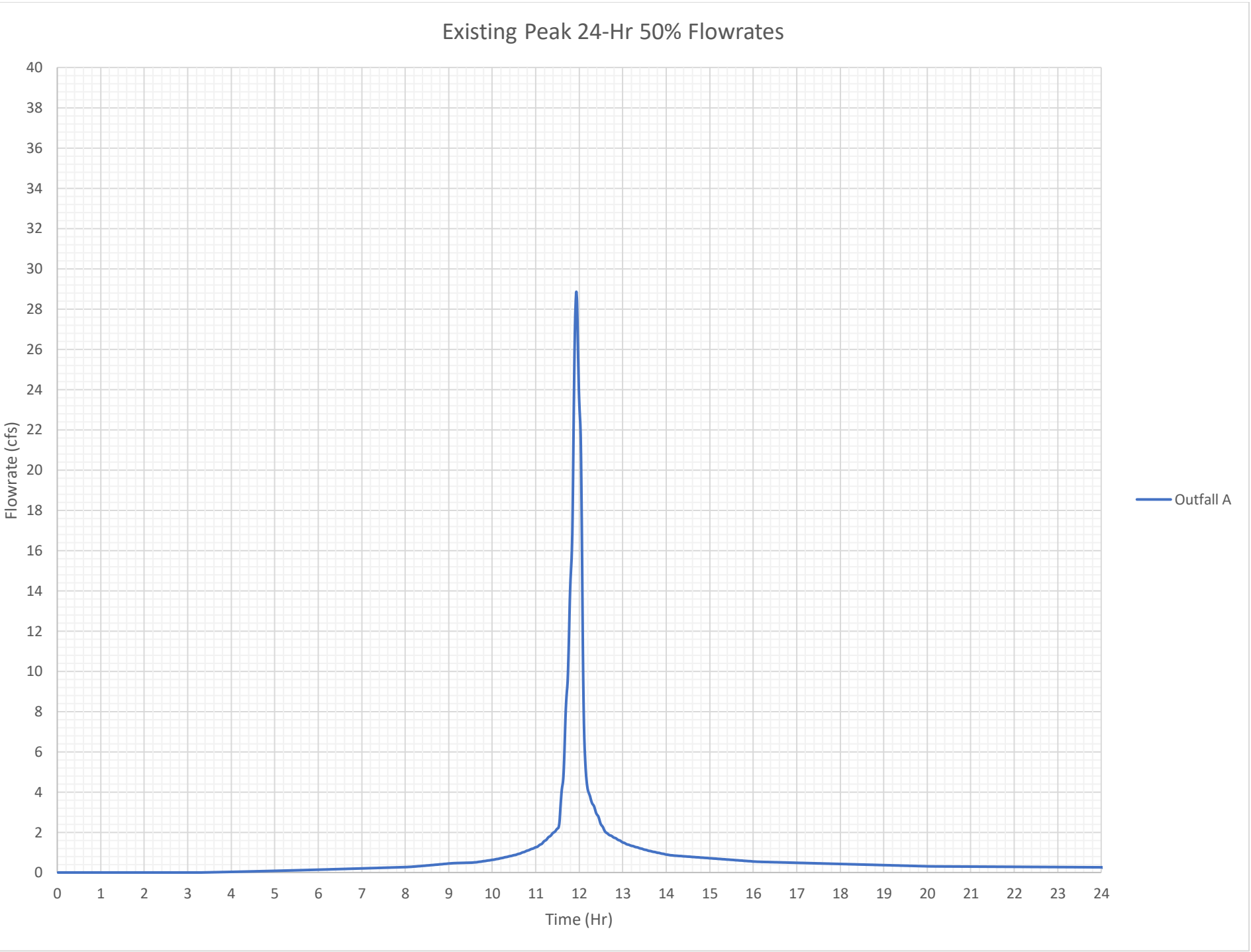
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Flowrate (cfs)
Time (Hr)
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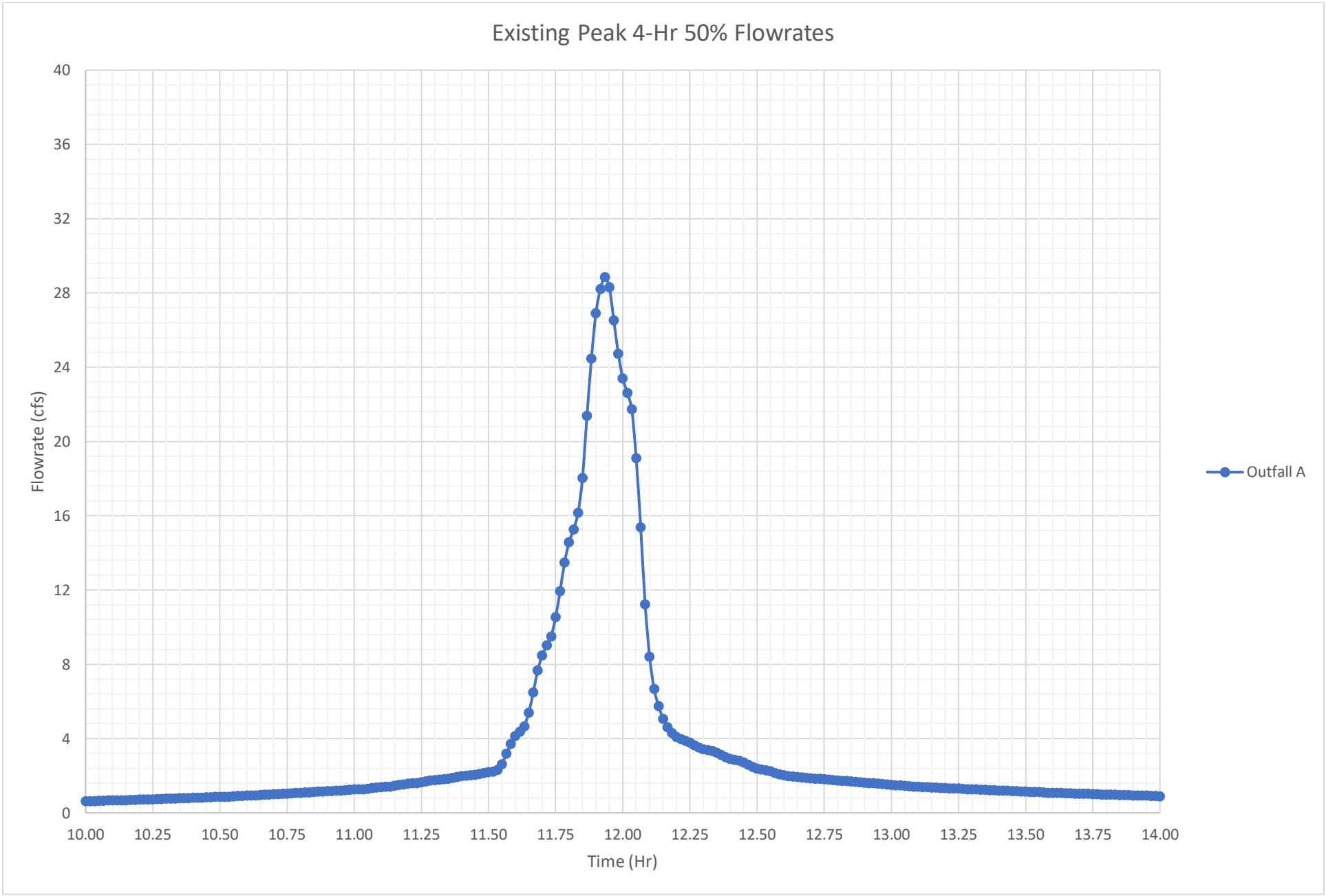
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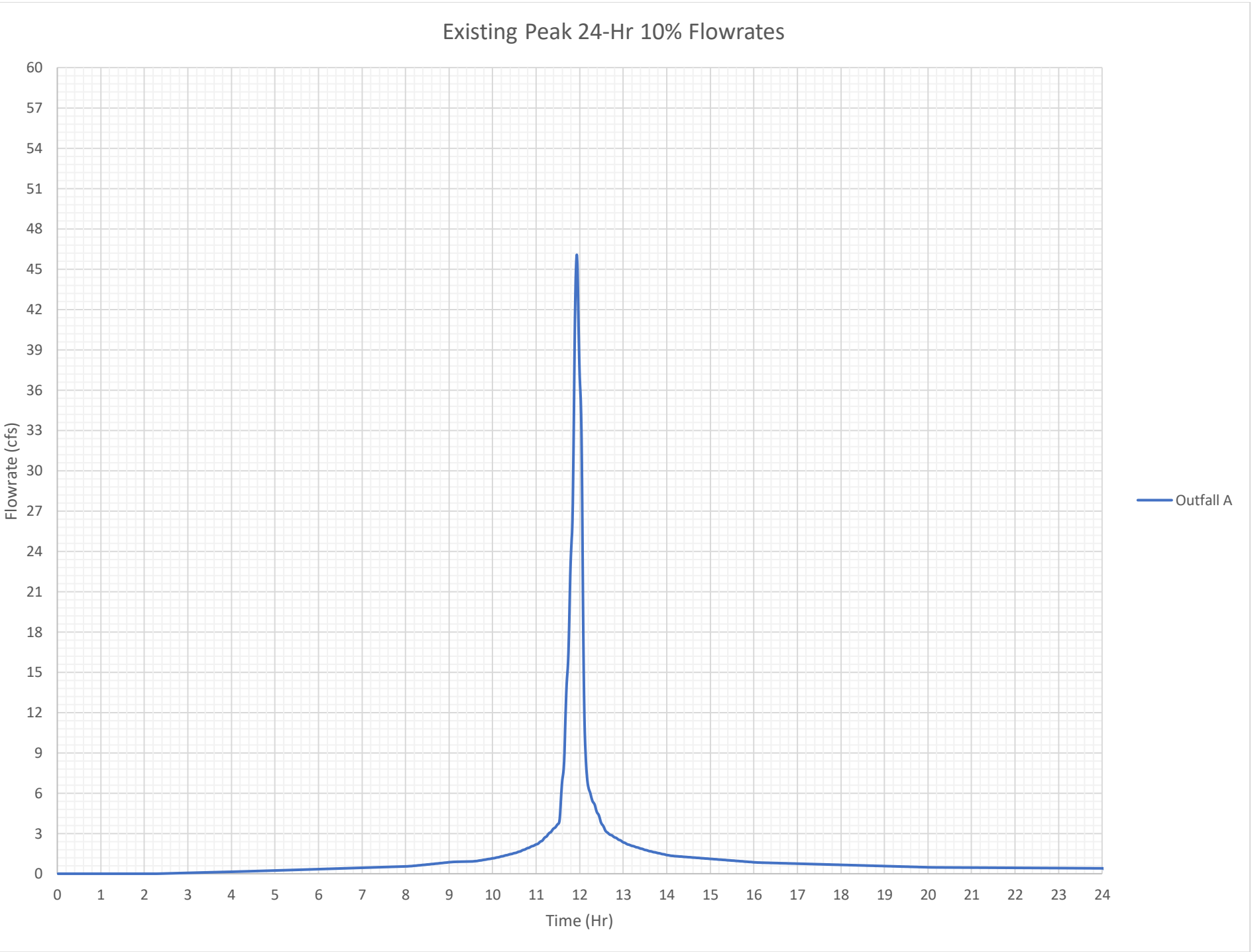
Time (Hr)
Outfall A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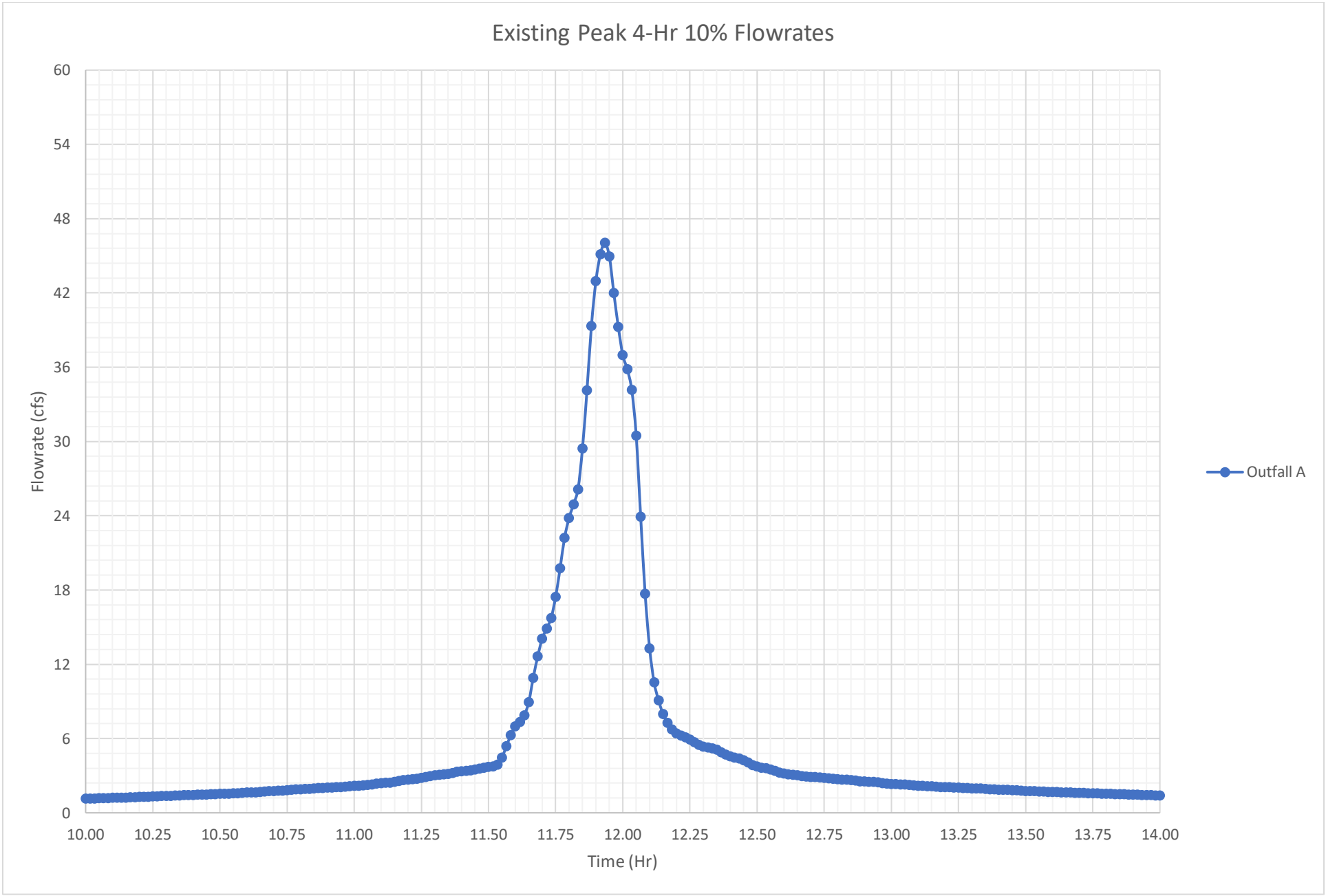
Outfall A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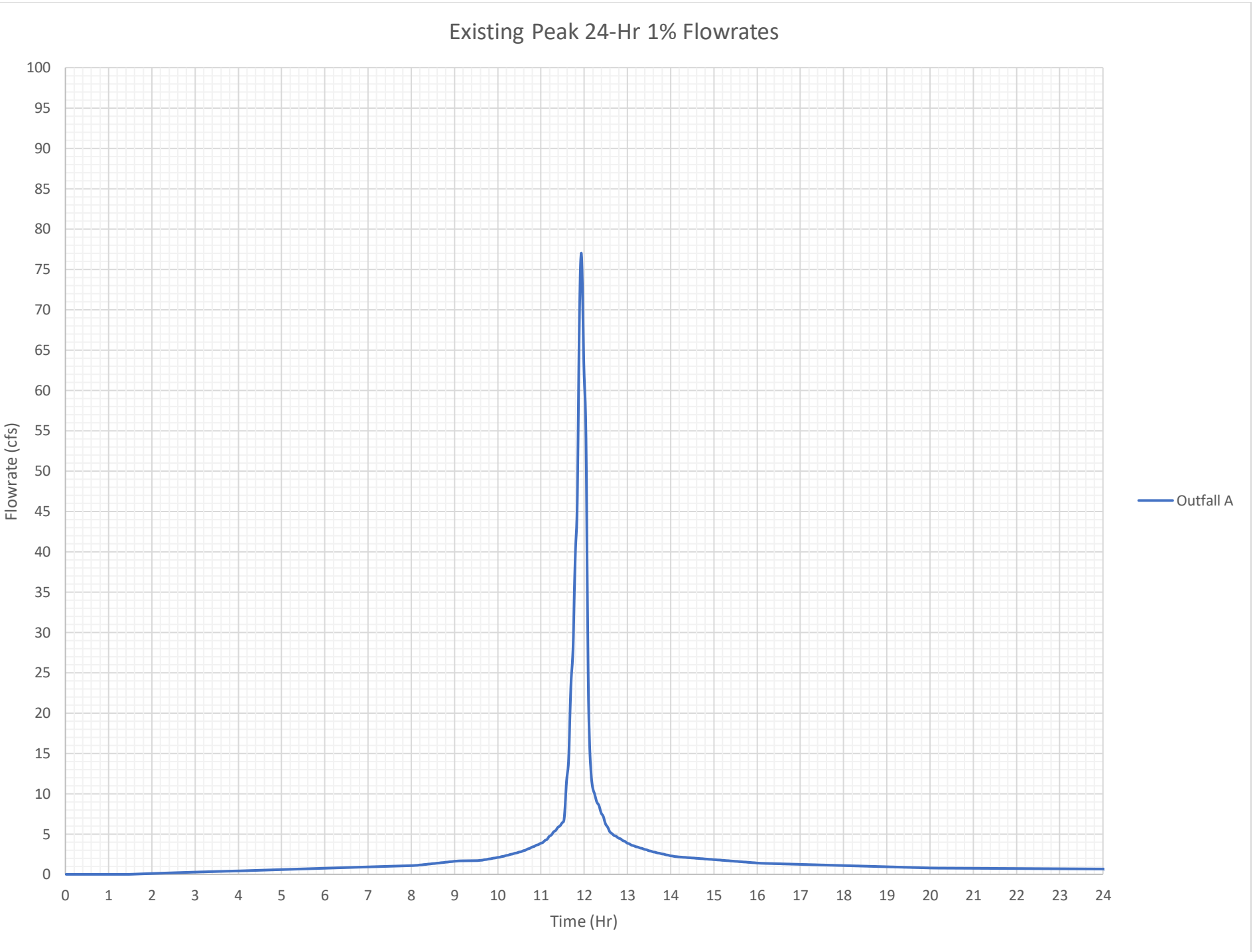
Time (Hr)
Outfall A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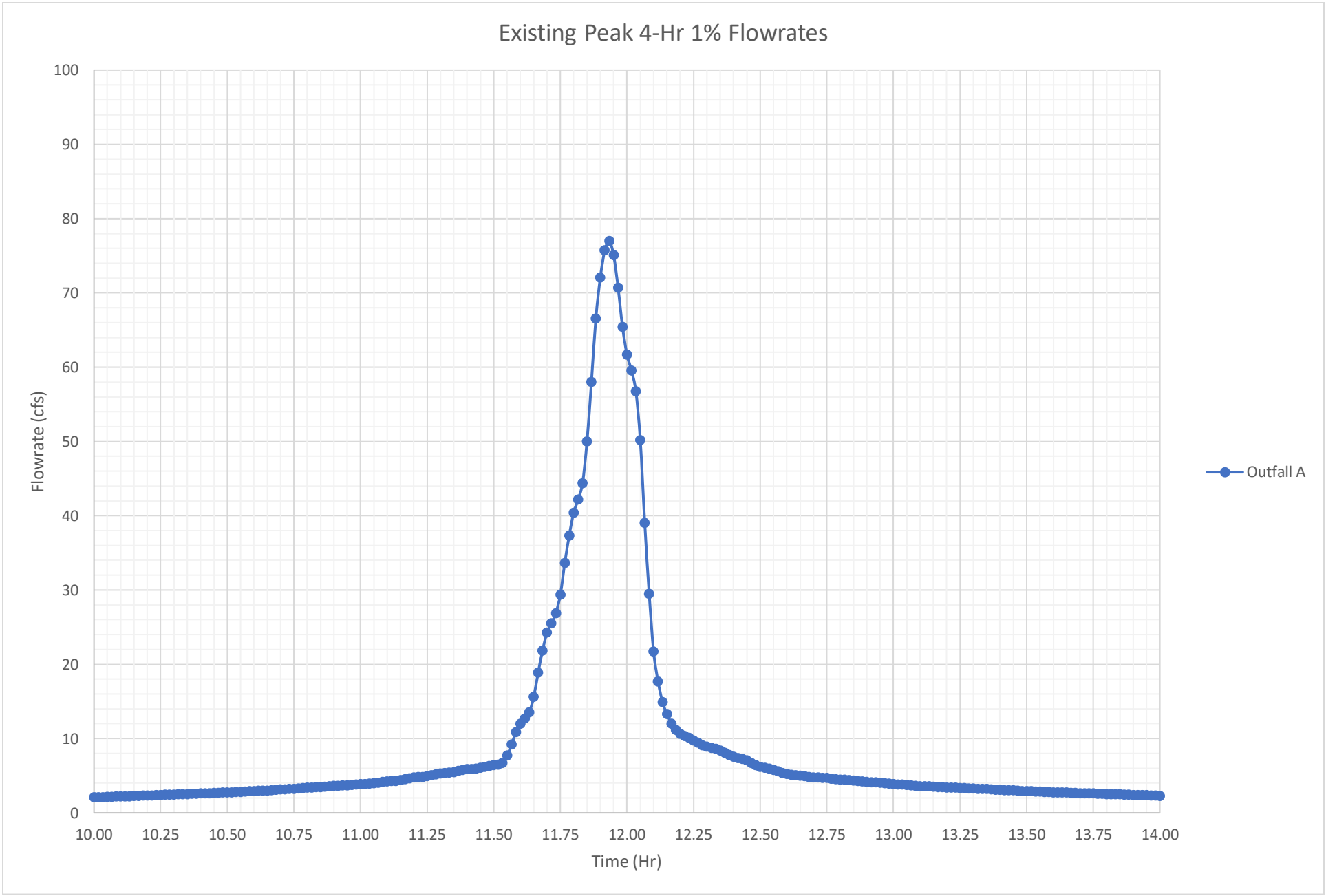
Time (Hr)
Outfall A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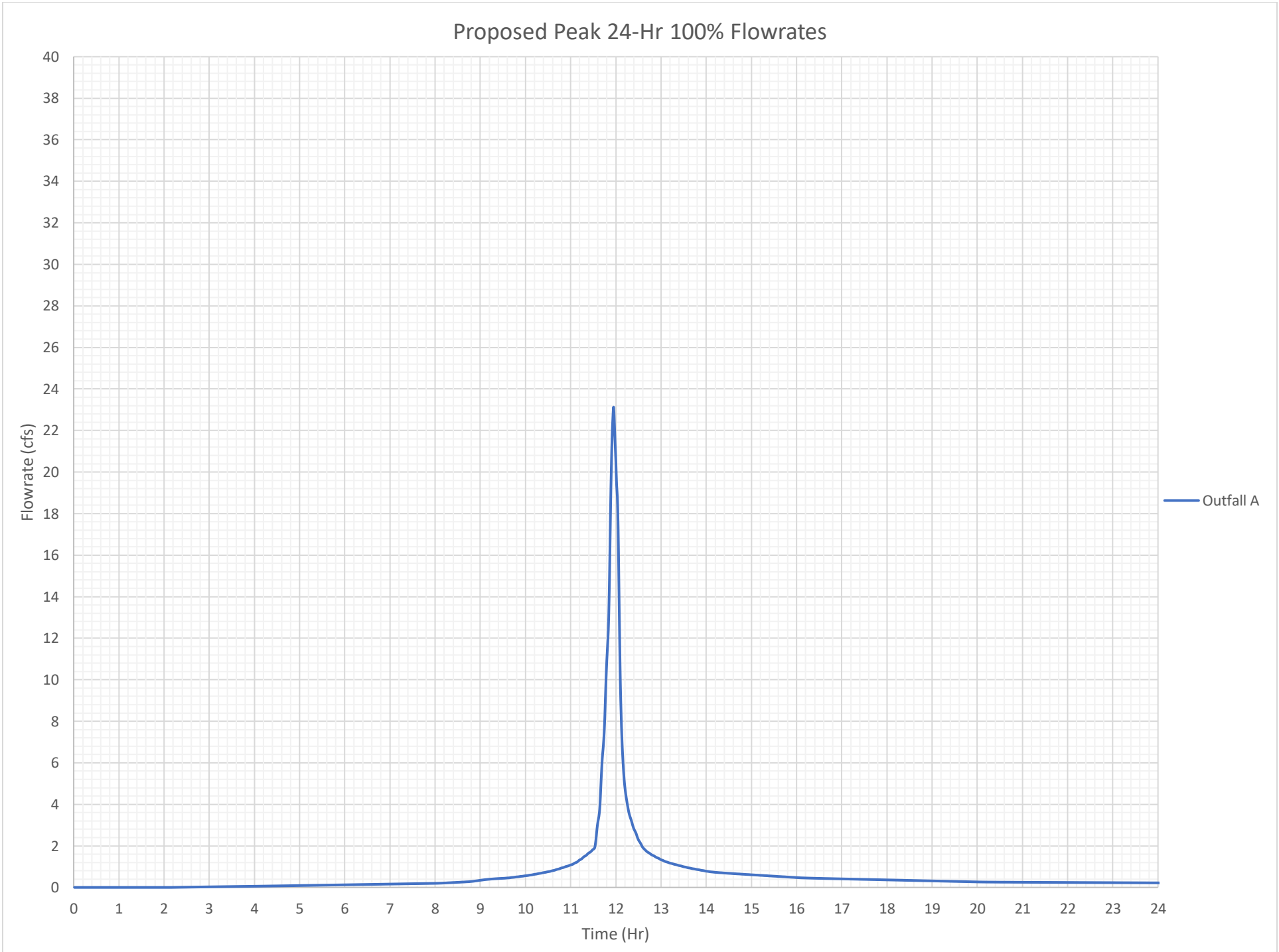
Time (Hr)
Outfall A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Flowrate (cfs)
Time (Hr)
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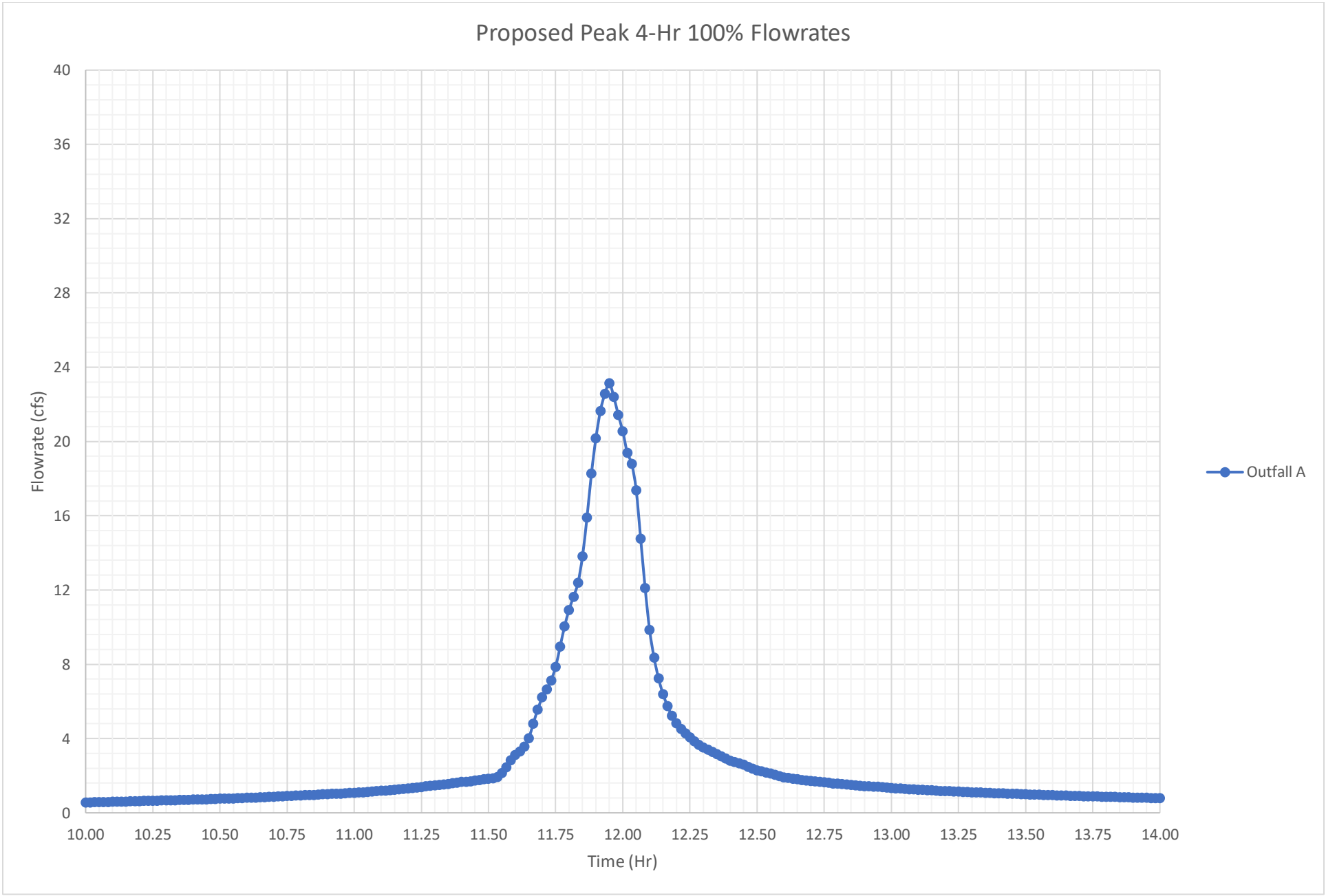
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Time (Hr)
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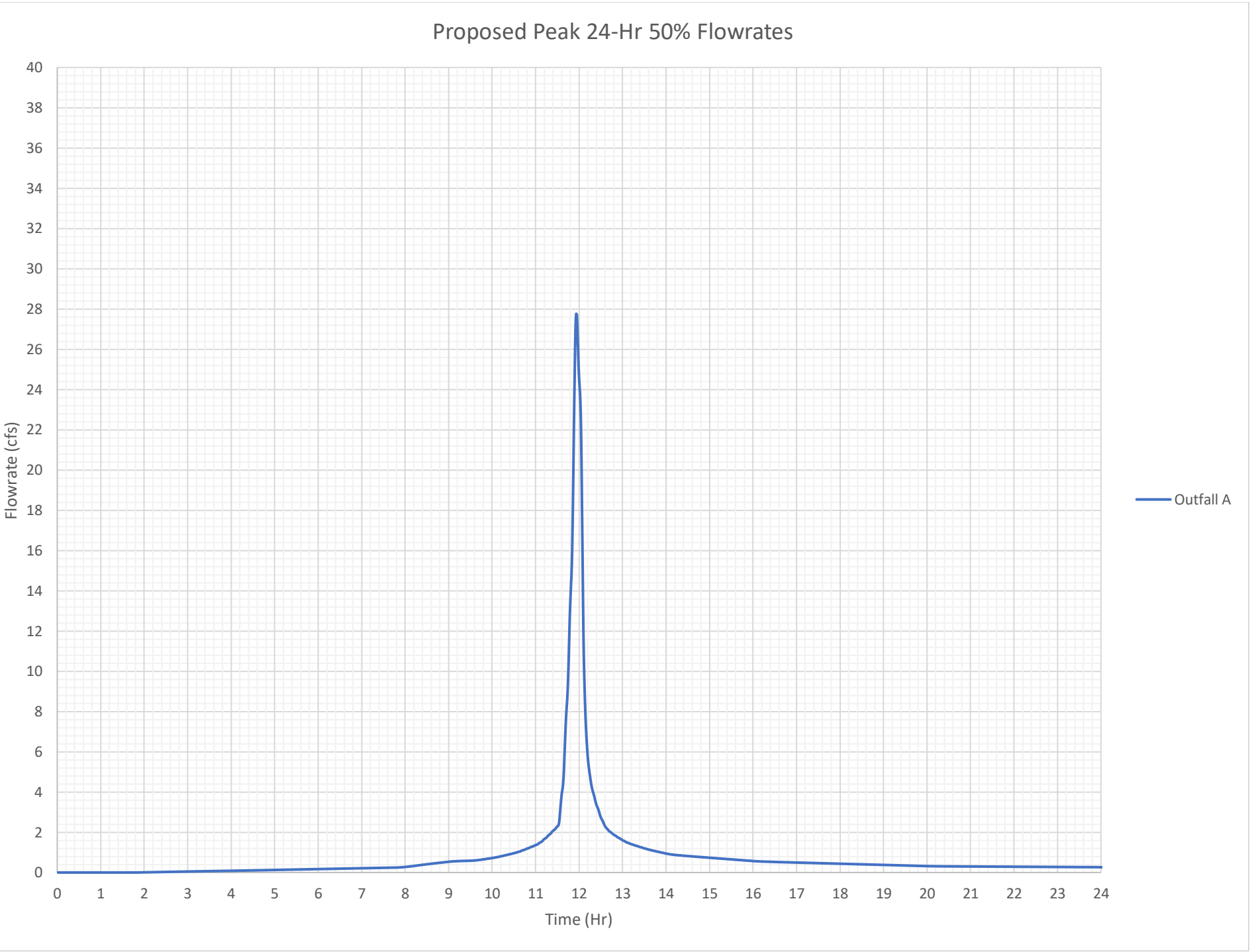
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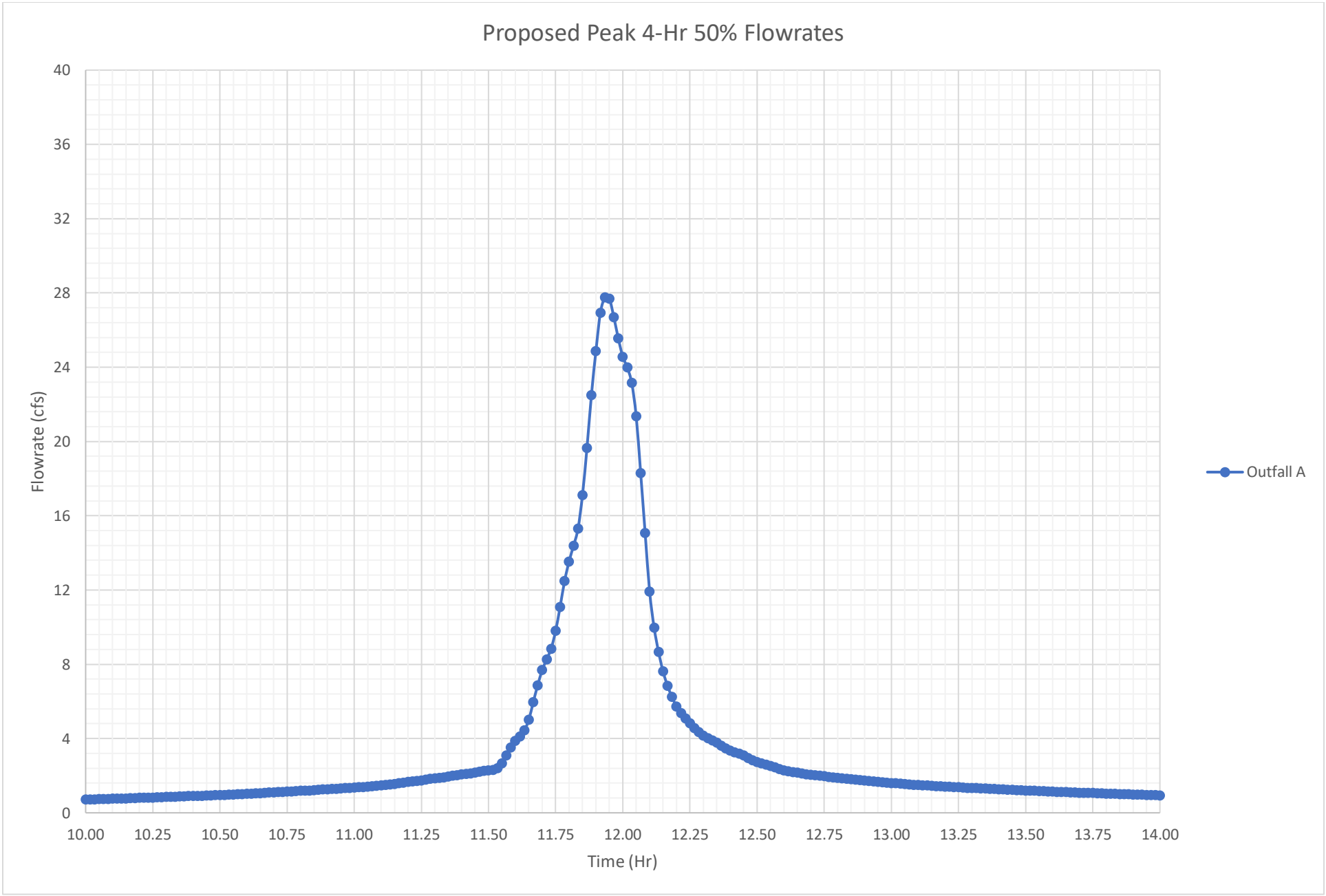
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Flowrate (cfs)
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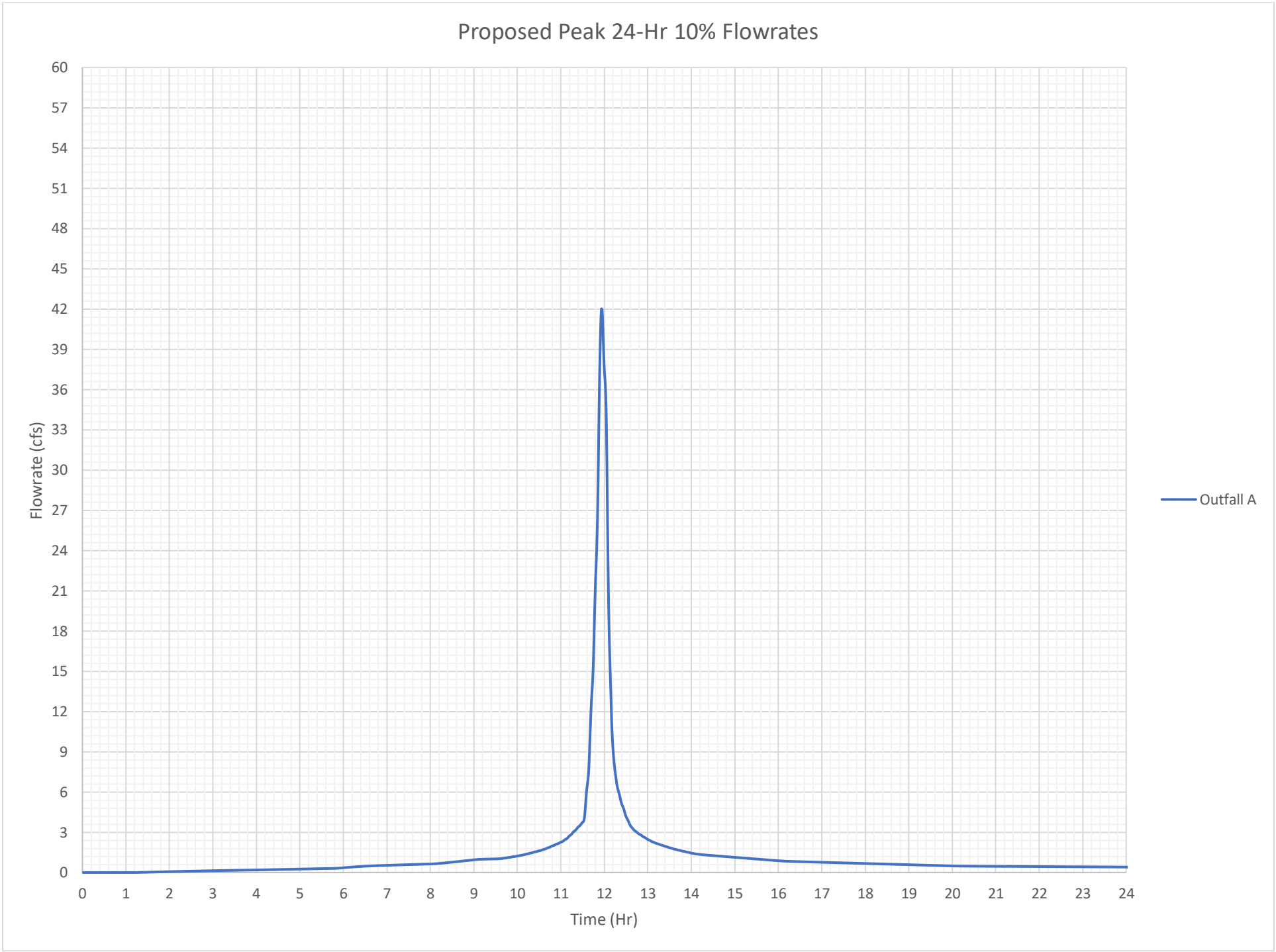
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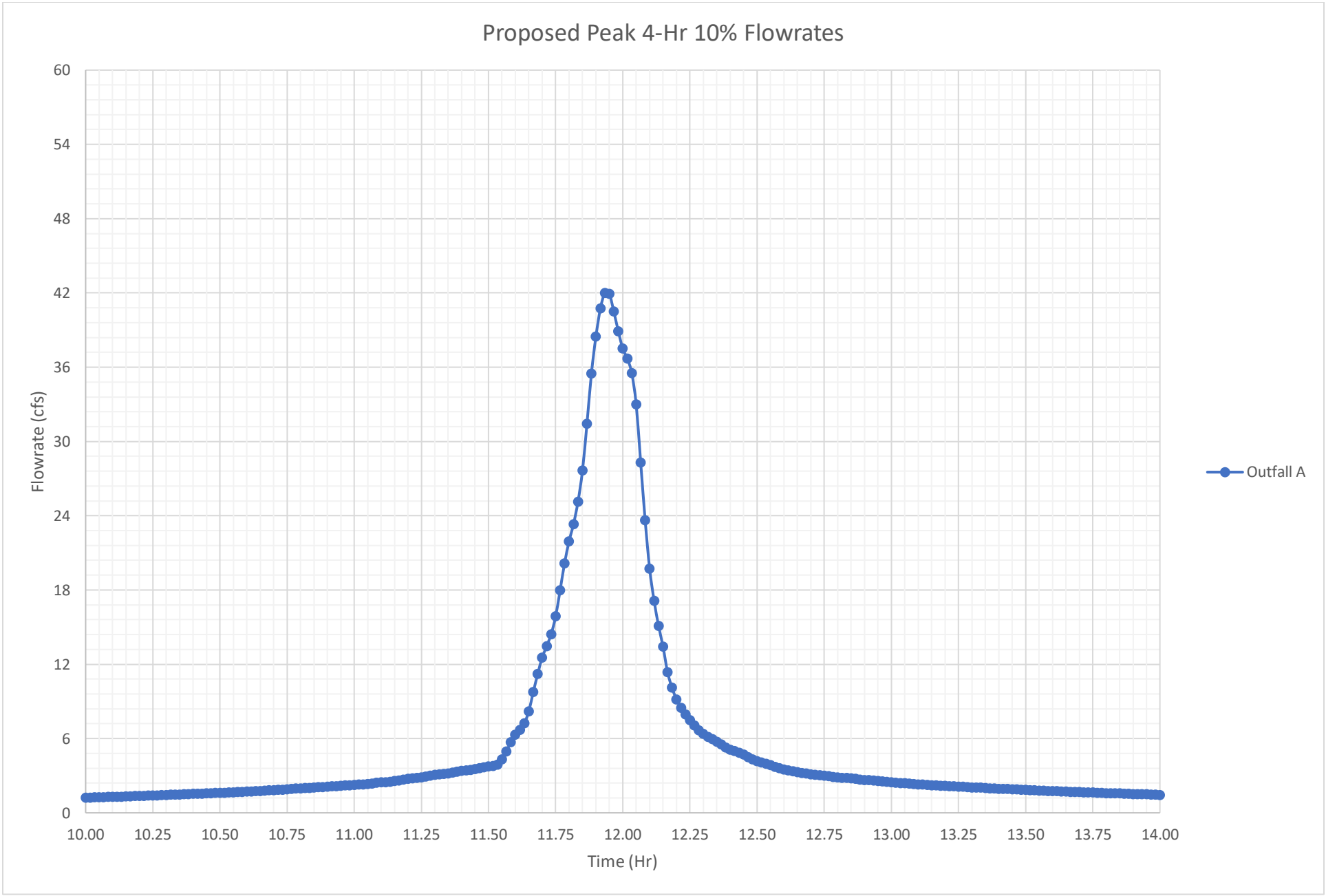
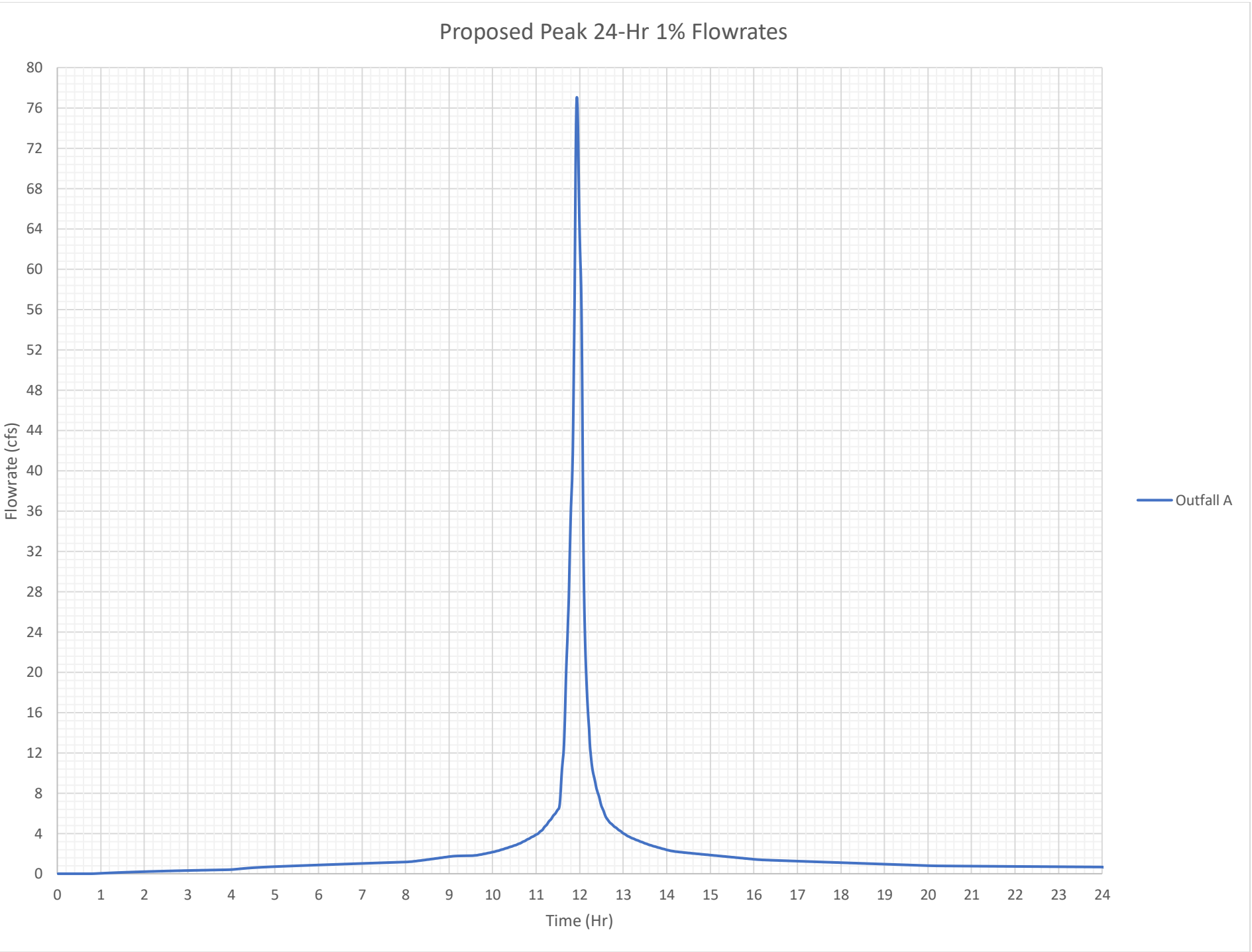
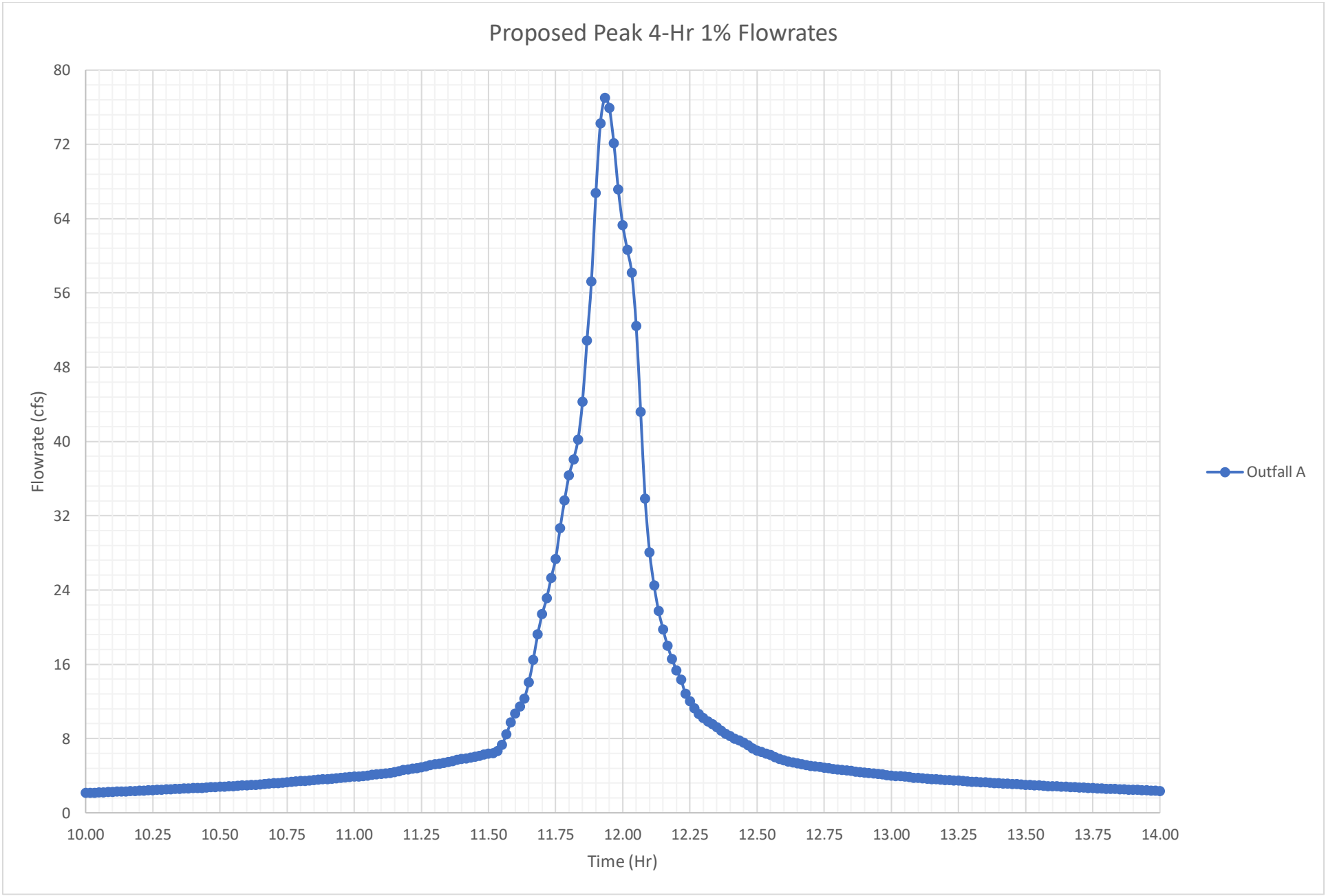
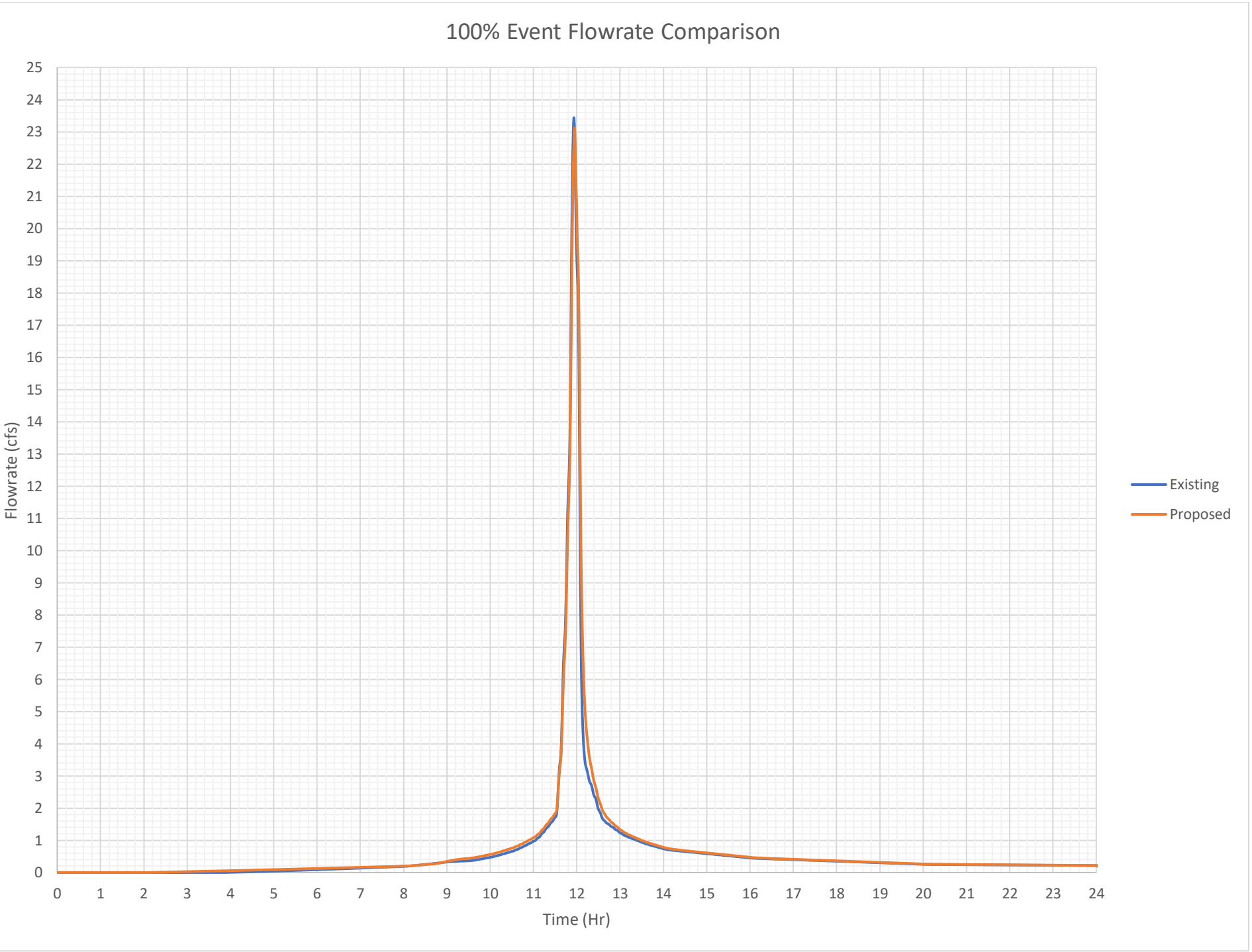
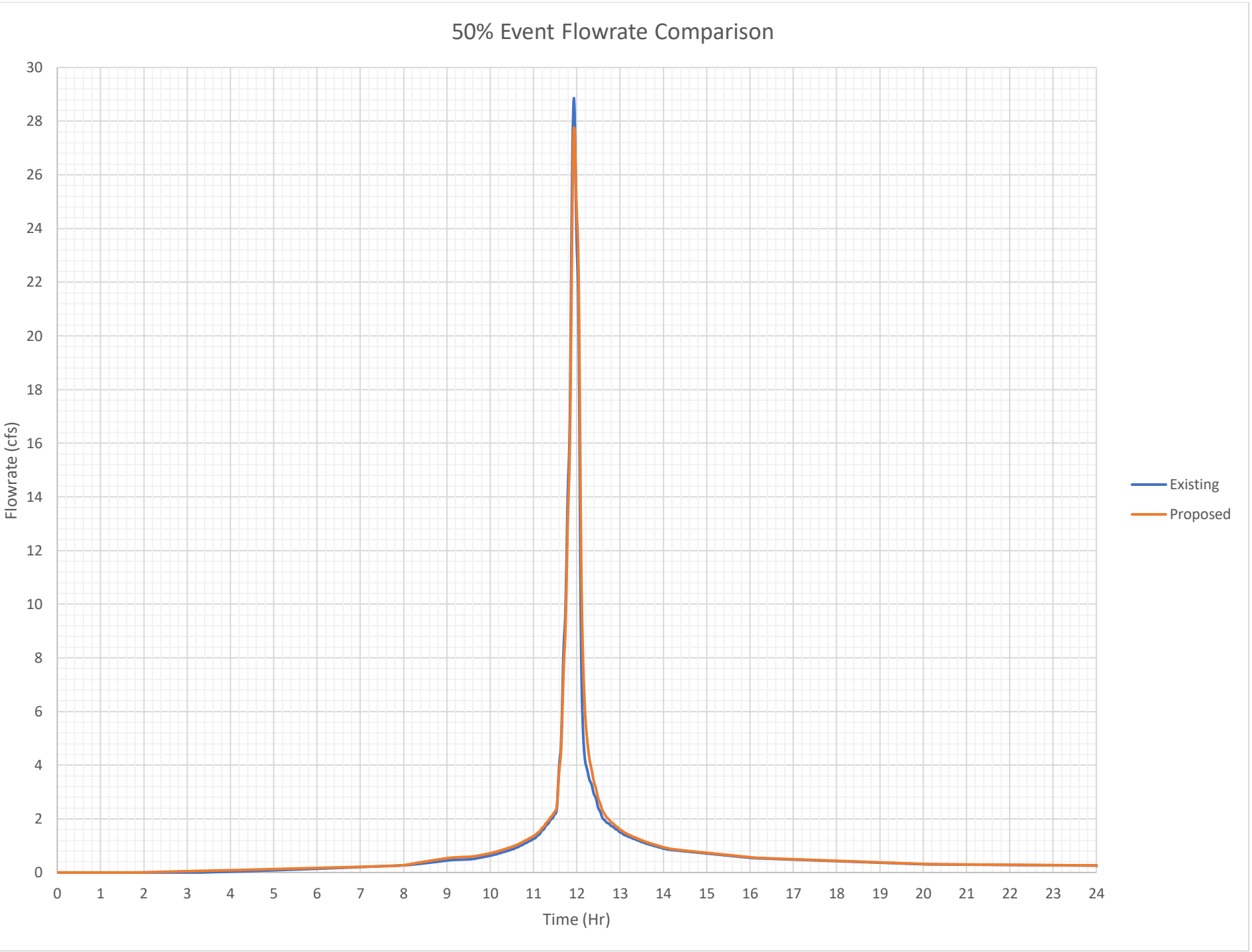
24
21
18
15
12
9
6
3
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
Time (Hr)
Outfall A

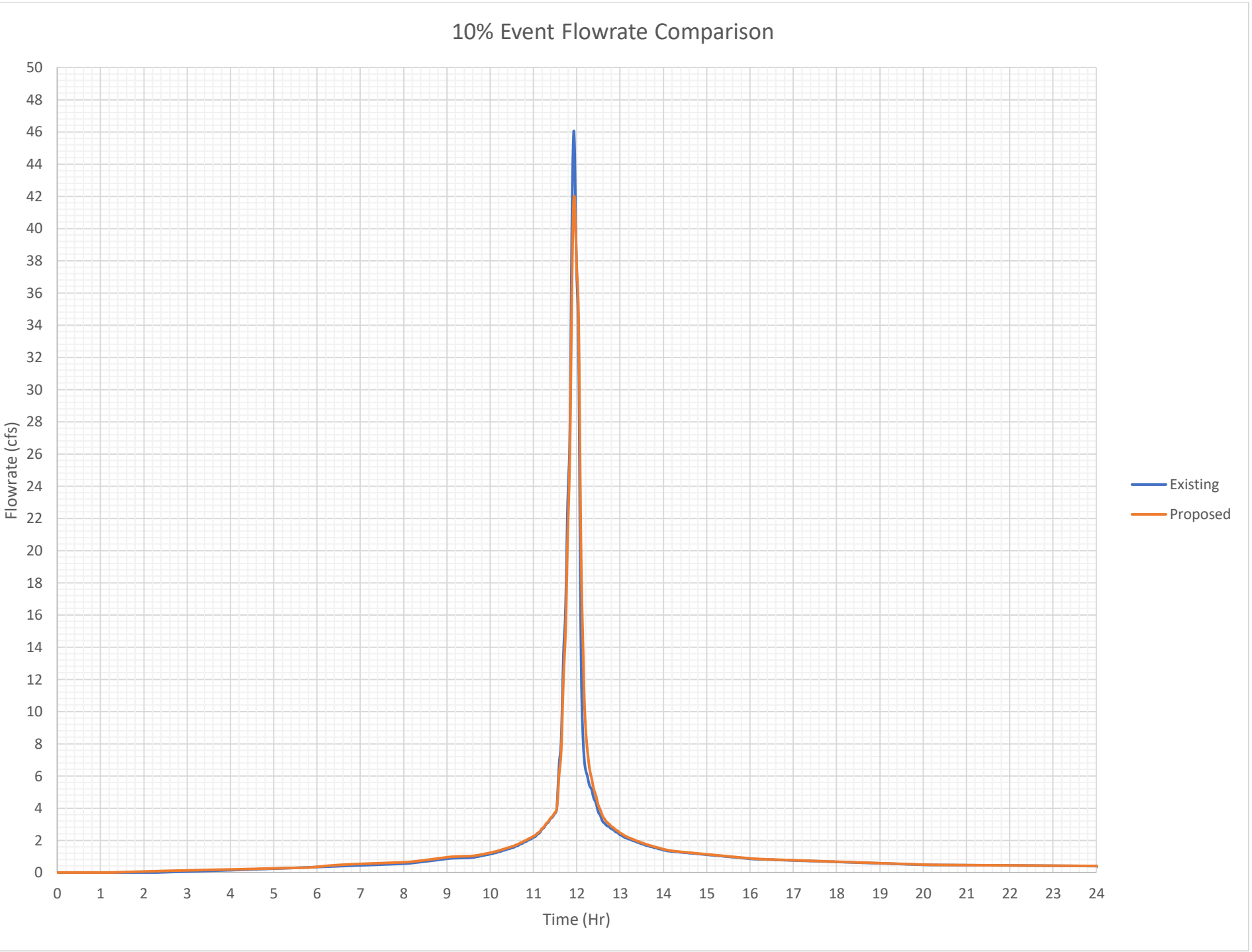

Proposed Peak 4-Hr 10% Flowrates
Flowrate (cfs)
60
54
48
42
36
30
24
18
12
6
0
10.00
10.25
10.50
10.75
11.00
11.25
11.50
11.75
12.00
12.25
12.50
12.75
13.00
13.25
13.50
13.75
14.00
Time (Hr)
Outfall A

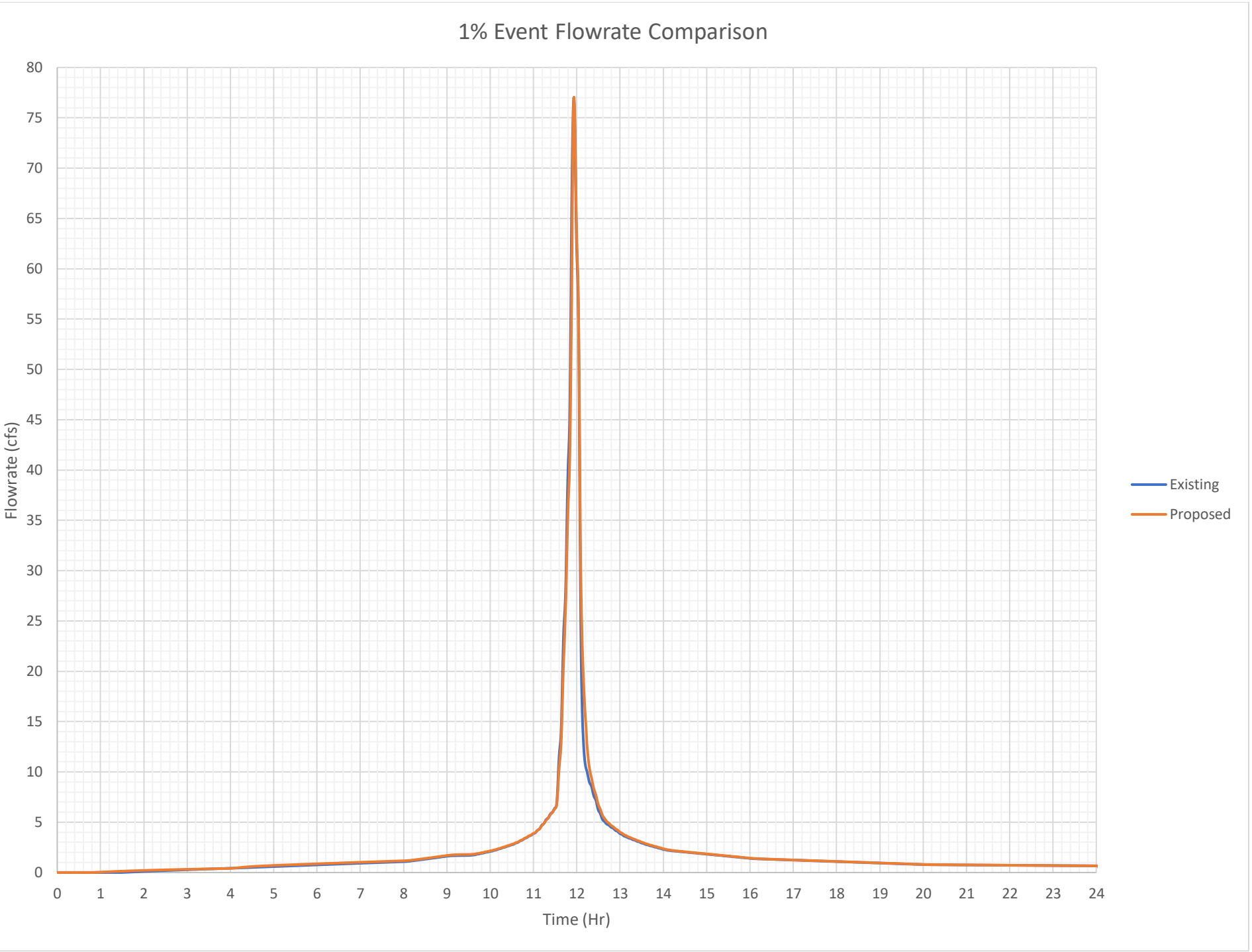

Proposed Peak 24-Hr 1% Flowrates
Flowrate (cfs)
0
4
8
12
16
20
24
28
32
36
40
44
48
52
56
60
64
68
72
76
80
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
Time (Hr)
Outfall A


Proposed Peak 4-Hr 1% Flowrates
Flowrate (cfs)
80
72
64
56
48
40
32
24
16
8
0
10.00
10.25
10.50
10.75
11.00
11.25
11.50
11.75
12.00
12.25
12.50
12.75
13.00
13.25
13.50
13.75
14.00
Time (Hr)
Outfall A


100% Event Flowrate Comparison
Flowrate (cfs)
Time (Hr)
Existing
Proposed
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25


50% Event Flowrate Comparison
Flowrate (cfs)
30
28
26
24
22
20
18
16
14
12
10
8
6
4
2
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
Time (Hr)
Existing
Proposed


10% Event Flowrate Comparison
Flowrate (cfs)
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
32
34
36
38
40
42
44
46
48
50
Time (Hr)
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
Existing
Proposed


1% Event Flowrate Comparison
Flowrate (cfs)
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
Time (Hr)
Existing
Proposed

APPENDIX C

Model Results

EXISTING CONDITIONS

1-YEAR EVENT

Project Description

File Name ..... Micro Existing Conditions.SPF

Project Options

Flow Units	CFS
Elevation Type	Elevation
Hydrology Method	SCS TR-55
Time of Concentration (TOC) Method	SCS TR-55
Link Routing Method	Hydrodynamic
Enable Overflow Ponding at Nodes	YES
Skip Steady State Analysis Time Periods	NO

Analysis Options

Start Analysis On	Feb 15, 2023	00:00:00
End Analysis On	Feb 18, 2023	00:00:00
Start Reporting On	Feb 15, 2023	00:00:00
Antecedent Dry Days	0	days
Runoff (Dry Weather) Time Step	0 01:00:00	days hh:mm:ss
Runoff (Wet Weather) Time Step	0 00:05:00	days hh:mm:ss
Reporting Time Step	0 00:01:00	days hh:mm:ss
Routing Time Step	5	seconds

Number of Elements

	Qty
Rain Gages	1
Subbasins	1
Nodes	1
Junctions	0
Outfalls	1
Flow Diversions	0
Inlets	0
Storage Nodes	0
Links	0
Channels	0
Pipes	0
Pumps	0
Orifices	0
Weirs	0
Outlets	0
Pollutants	0
Land Uses	0

Rainfall Details

SN	Rain Gage ID	Data Source	Data Source ID	Rainfall Type	Rain Units	State	County	Return Period (years)	Rainfall Depth (inches)	Rainfall Distribution
1		Time Series	1 Year	Cumulative	inches	Missouri	Jackson	1	3.10	SCS Type II 24-hr

Subbasin Summary

SN	Subbasin ID	Area (ac)	Peak Rate Factor	Weighted Curve Number	Total Rainfall (in)	Total Runoff (in)	Total Runoff Volume (ac-in)	Peak Runoff (cfs)	Time of Concentration (days hh:mm:ss)
1	A-1	6.43	484.00	93.49	3.10	2.40	15.41	23.44	0 00:05:00

Node Summary

SN	Element ID	Element Type	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Initial Water Elevation (ft)	Surcharge Elevation (ft)	Ponded Area (ft^2)	Peak Inflow (cfs)	Max HGL Elevation Attained (ft)	Max Surcharge Depth Attained (ft)	Min Freeboard Attained (ft)	Time of Peak Flooding Occurrence (days hh:mm)	Total Flooded Volume (ac-in)	Total Time Flooded (min)
1	Out-01	Outfall	0.00					0.00	0.00					

Subbasin Hydrology

Subbasin : A-1

Input Data

Area (ac) 6.43
Peak Rate Factor 484.00
Weighted Curve Number 93.49
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Paved roads with curbs & sewers	4.82	D	98.00
> 75% grass cover, Good	1.61	D	80.00
Composite Area & Weighted CN	6.43		93.49

Time of Concentration

TOC Method : SCS TR-55

Sheet Flow Equation :

Tc = (0.007 * ((n * Lf)^0.8)) / ((P^0.5) * (Sf^0.4))

Where :

Tc = Time of Concentration (hr)
n = Manning's roughness
Lf = Flow Length (ft)
P = 2 yr, 24 hr Rainfall (inches)
Sf = Slope (ft/ft)

Shallow Concentrated Flow Equation :

V = 16.1345 * (Sf^0.5) (unpaved surface)
V = 20.3282 * (Sf^0.5) (paved surface)
V = 15.0 * (Sf^0.5) (grassed waterway surface)
V = 10.0 * (Sf^0.5) (nearly bare & untilled surface)
V = 9.0 * (Sf^0.5) (cultivated straight rows surface)
V = 7.0 * (Sf^0.5) (short grass pasture surface)
V = 5.0 * (Sf^0.5) (woodland surface)
V = 2.5 * (Sf^0.5) (forest w/heavy litter surface)
Tc = (Lf / V) / (3600 sec/hr)

Where:

Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)

Channel Flow Equation :

V = (1.49 * (R^(2/3)) * (Sf^0.5)) / n
R = Aq / Wp
Tc = (Lf / V) / (3600 sec/hr)

Where :

Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
R = Hydraulic Radius (ft)
Aq = Flow Area (ft²)
Wp = Wetted Perimeter (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)
n = Manning's roughness

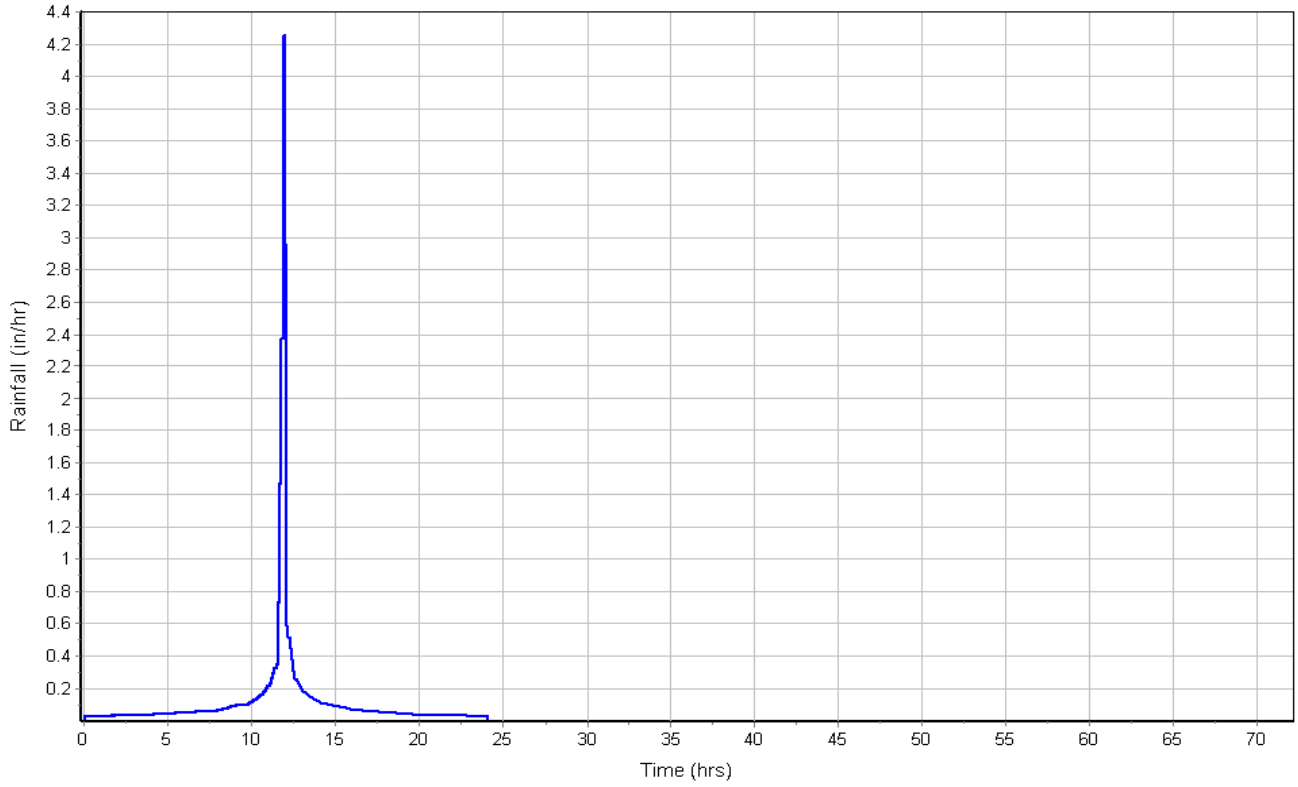
User-Defined TOC override (minutes): 5.00

Subbasin Runoff Results

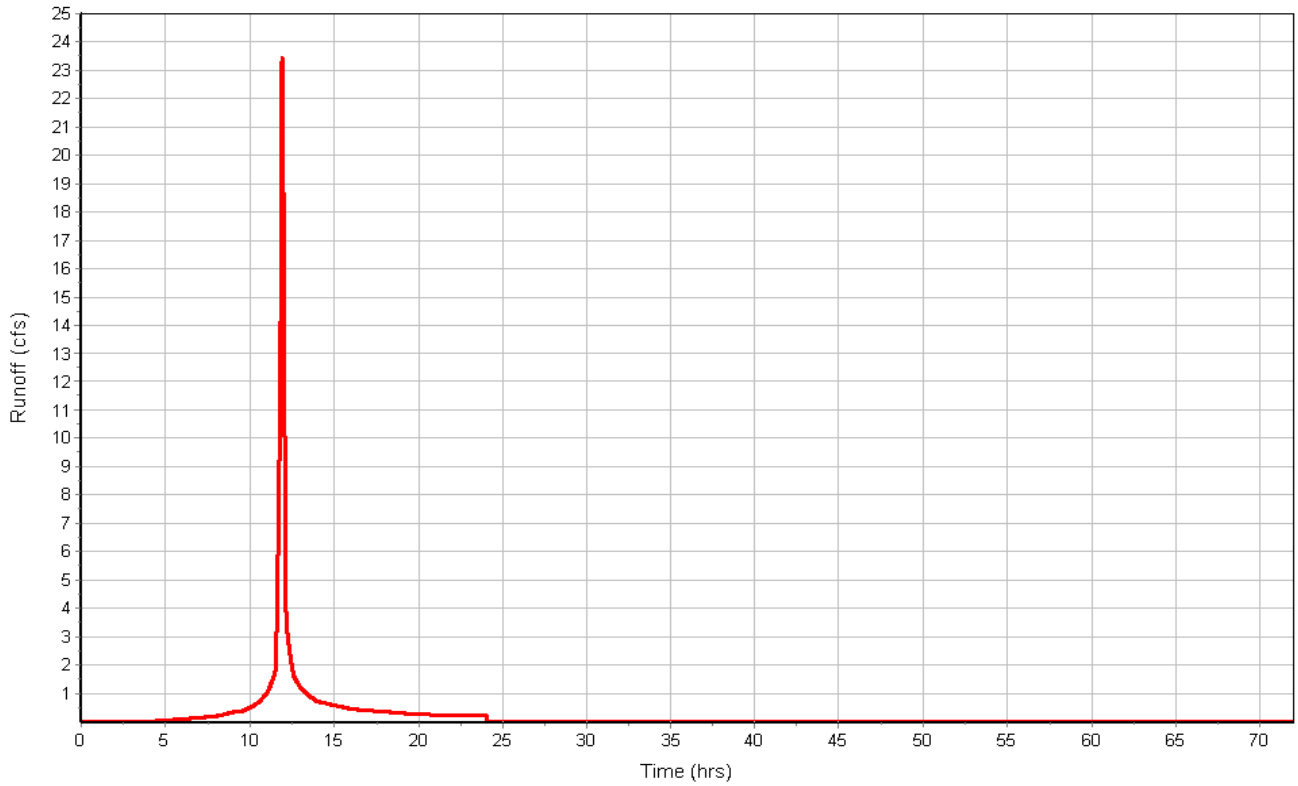
Total Rainfall (in) 3.10
Total Runoff (in) 2.40
Peak Runoff (cfs) 23.44
Weighted Curve Number 93.49
Time of Concentration (days hh:mm:ss) 0 00:05:00

Subbasin : A-1

Rainfall Intensity Graph



Runoff Hydrograph



2-YEAR EVENT

Project Description

File Name ..... Micro Existing Conditions.SPF

Project Options

Flow Units	CFS
Elevation Type	Elevation
Hydrology Method	SCS TR-55
Time of Concentration (TOC) Method	SCS TR-55
Link Routing Method	Hydrodynamic
Enable Overflow Ponding at Nodes	YES
Skip Steady State Analysis Time Periods	NO

Analysis Options

Start Analysis On	Feb 15, 2023	00:00:00
End Analysis On	Feb 18, 2023	00:00:00
Start Reporting On	Feb 15, 2023	00:00:00
Antecedent Dry Days	0	days
Runoff (Dry Weather) Time Step	0 01:00:00	days hh:mm:ss
Runoff (Wet Weather) Time Step	0 00:05:00	days hh:mm:ss
Reporting Time Step	0 00:01:00	days hh:mm:ss
Routing Time Step	5	seconds

Number of Elements

	Qty
Rain Gages	1
Subbasins	1
Nodes	1
Junctions	0
Outfalls	1
Flow Diversions	0
Inlets	0
Storage Nodes	0
Links	0
Channels	0
Pipes	0
Pumps	0
Orifices	0
Weirs	0
Outlets	0
Pollutants	0
Land Uses	0

Rainfall Details

SN	Rain Gage ID	Data Source	Data Source ID	Rainfall Type	Rain Units	State	County	Return Period (years)	Rainfall Depth (inches)	Rainfall Distribution
1		Time Series	2-Year	Cumulative	inches	Missouri	Jackson	2	3.71	SCS Type II 24-hr

Subbasin Summary

SN	Subbasin ID	Area (ac)	Peak Rate Factor	Weighted Curve Number	Total Rainfall (in)	Total Runoff (in)	Total Runoff Volume (ac-in)	Peak Runoff (cfs)	Time of Concentration (days hh:mm:ss)
1	A-1	6.43	484.00	93.49	3.71	2.99	19.21	28.86	0 00:05:00

Node Summary

SN	Element ID	Element Type	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Initial Water Elevation (ft)	Surcharge Elevation (ft)	Ponded Area (ft^2)	Peak Inflow (cfs)	Max HGL Elevation Attained (ft)	Max Surcharge Depth Attained (ft)	Min Freeboard Attained (ft)	Time of Peak Flooding Occurrence (days hh:mm)	Total Flooded Volume (ac-in)	Total Time Flooded (min)
1	Out-01	Outfall	0.00					0.00	0.00					

Subbasin Hydrology

Subbasin : A-1

Input Data

Area (ac) 6.43
Peak Rate Factor 484.00
Weighted Curve Number 93.49
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Paved roads with curbs & sewers	4.82	D	98.00
> 75% grass cover, Good	1.61	D	80.00
Composite Area & Weighted CN	6.43		93.49

Time of Concentration

TOC Method : SCS TR-55

Sheet Flow Equation :

Tc = (0.007 * ((n * Lf)^0.8)) / ((P^0.5) * (Sf^0.4))

Where :

Tc = Time of Concentration (hr)
n = Manning's roughness
Lf = Flow Length (ft)
P = 2 yr, 24 hr Rainfall (inches)
Sf = Slope (ft/ft)

Shallow Concentrated Flow Equation :

V = 16.1345 * (Sf^0.5) (unpaved surface)
V = 20.3282 * (Sf^0.5) (paved surface)
V = 15.0 * (Sf^0.5) (grassed waterway surface)
V = 10.0 * (Sf^0.5) (nearly bare & untilled surface)
V = 9.0 * (Sf^0.5) (cultivated straight rows surface)
V = 7.0 * (Sf^0.5) (short grass pasture surface)
V = 5.0 * (Sf^0.5) (woodland surface)
V = 2.5 * (Sf^0.5) (forest w/heavy litter surface)
Tc = (Lf / V) / (3600 sec/hr)

Where:

Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)

Channel Flow Equation :

V = (1.49 * (R^(2/3)) * (Sf^0.5)) / n
R = Aq / Wp
Tc = (Lf / V) / (3600 sec/hr)

Where :

Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
R = Hydraulic Radius (ft)
Aq = Flow Area (ft²)
Wp = Wetted Perimeter (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)
n = Manning's roughness

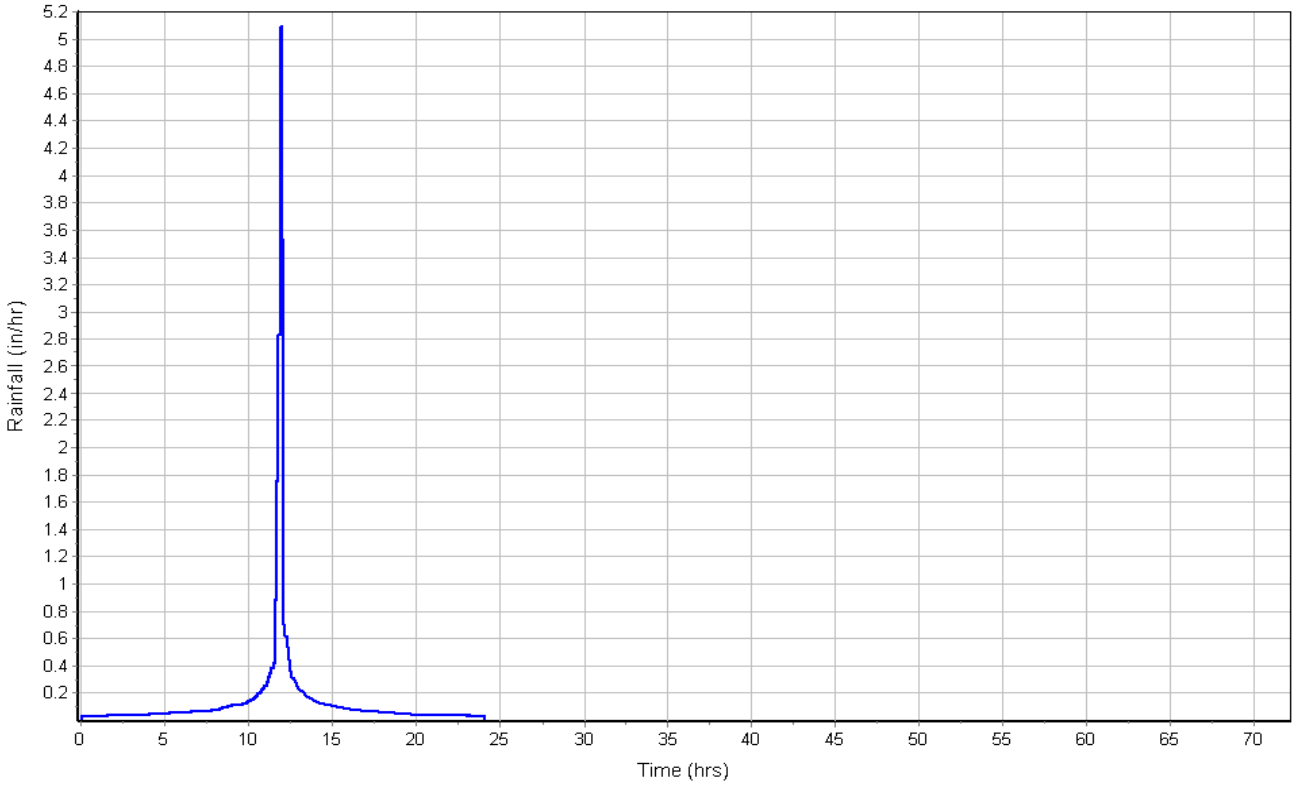
User-Defined TOC override (minutes): 5.00

Subbasin Runoff Results

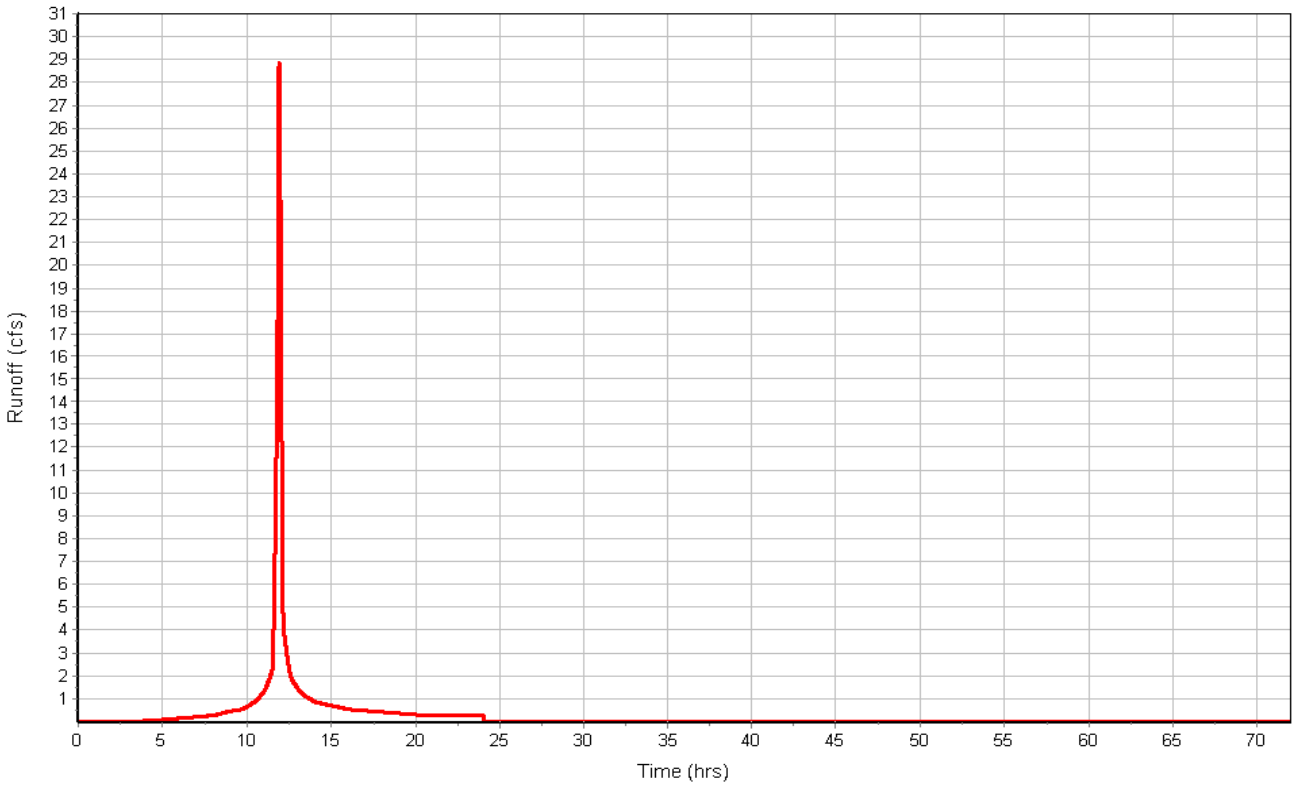
Total Rainfall (in) 3.71
Total Runoff (in) 2.99
Peak Runoff (cfs) 28.86
Weighted Curve Number 93.49
Time of Concentration (days hh:mm:ss) 0 00:05:00

Subbasin : A-1

Rainfall Intensity Graph



Runoff Hydrograph



10-YEAR EVENT

Project Description

File Name ..... Micro Existing Conditions.SPF

Project Options

Flow Units	CFS
Elevation Type	Elevation
Hydrology Method	SCS TR-55
Time of Concentration (TOC) Method	SCS TR-55
Link Routing Method	Hydrodynamic
Enable Overflow Ponding at Nodes	YES
Skip Steady State Analysis Time Periods	NO

Analysis Options

Start Analysis On	Feb 15, 2023	00:00:00
End Analysis On	Feb 18, 2023	00:00:00
Start Reporting On	Feb 15, 2023	00:00:00
Antecedent Dry Days	0	days
Runoff (Dry Weather) Time Step	0 01:00:00	days hh:mm:ss
Runoff (Wet Weather) Time Step	0 00:05:00	days hh:mm:ss
Reporting Time Step	0 00:01:00	days hh:mm:ss
Routing Time Step	5	seconds

Number of Elements

	Qty
Rain Gages	1
Subbasins	1
Nodes	1
Junctions	0
Outfalls	1
Flow Diversions	0
Inlets	0
Storage Nodes	0
Links	0
Channels	0
Pipes	0
Pumps	0
Orifices	0
Weirs	0
Outlets	0
Pollutants	0
Land Uses	0

Rainfall Details

SN	Rain Gage ID	Data Source	Data Source ID	Rainfall Type	Rain Units	State	County	Return Period (years)	Rainfall Depth (inches)	Rainfall Distribution
1		Time Series	10 Year	Cumulative	inches	Missouri	Jackson	10	5.67	SCS Type II 24-hr

Subbasin Summary

SN	Subbasin ID	Area (ac)	Peak Rate Factor	Weighted Curve Number	Total Rainfall (in)	Total Runoff (in)	Total Runoff Volume (ac-in)	Peak Runoff (cfs)	Time of Concentration (days hh:mm:ss)
1	A-1	6.43	484.00	93.49	5.67	4.91	31.58	46.07	0 00:05:00

Node Summary

SN	Element ID	Element Type	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Initial Water Elevation (ft)	Surcharge Elevation (ft)	Ponded Area (ft^2)	Peak Inflow (cfs)	Max HGL Elevation Attained (ft)	Max Surcharge Depth Attained (ft)	Min Freeboard Attained (ft)	Time of Peak Flooding Occurrence (days hh:mm)	Total Flooded Volume (ac-in)	Total Time Flooded (min)
1	Out-01	Outfall	0.00					0.00	0.00					

Subbasin Hydrology

Subbasin : A-1

Input Data

Area (ac) 6.43
Peak Rate Factor 484.00
Weighted Curve Number 93.49
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Paved roads with curbs & sewers	4.82	D	98.00
> 75% grass cover, Good	1.61	D	80.00
Composite Area & Weighted CN	6.43		93.49

Time of Concentration

TOC Method : SCS TR-55

Sheet Flow Equation :

Tc = (0.007 * ((n * Lf)^0.8)) / ((P^0.5) * (Sf^0.4))

Where :

Tc = Time of Concentration (hr)
n = Manning's roughness
Lf = Flow Length (ft)
P = 2 yr, 24 hr Rainfall (inches)
Sf = Slope (ft/ft)

Shallow Concentrated Flow Equation :

V = 16.1345 * (Sf^0.5) (unpaved surface)
V = 20.3282 * (Sf^0.5) (paved surface)
V = 15.0 * (Sf^0.5) (grassed waterway surface)
V = 10.0 * (Sf^0.5) (nearly bare & untilled surface)
V = 9.0 * (Sf^0.5) (cultivated straight rows surface)
V = 7.0 * (Sf^0.5) (short grass pasture surface)
V = 5.0 * (Sf^0.5) (woodland surface)
V = 2.5 * (Sf^0.5) (forest w/heavy litter surface)
Tc = (Lf / V) / (3600 sec/hr)

Where:

Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)

Channel Flow Equation :

V = (1.49 * (R^(2/3)) * (Sf^0.5)) / n
R = Aq / Wp
Tc = (Lf / V) / (3600 sec/hr)

Where :

Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
R = Hydraulic Radius (ft)
Aq = Flow Area (ft²)
Wp = Wetted Perimeter (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)
n = Manning's roughness

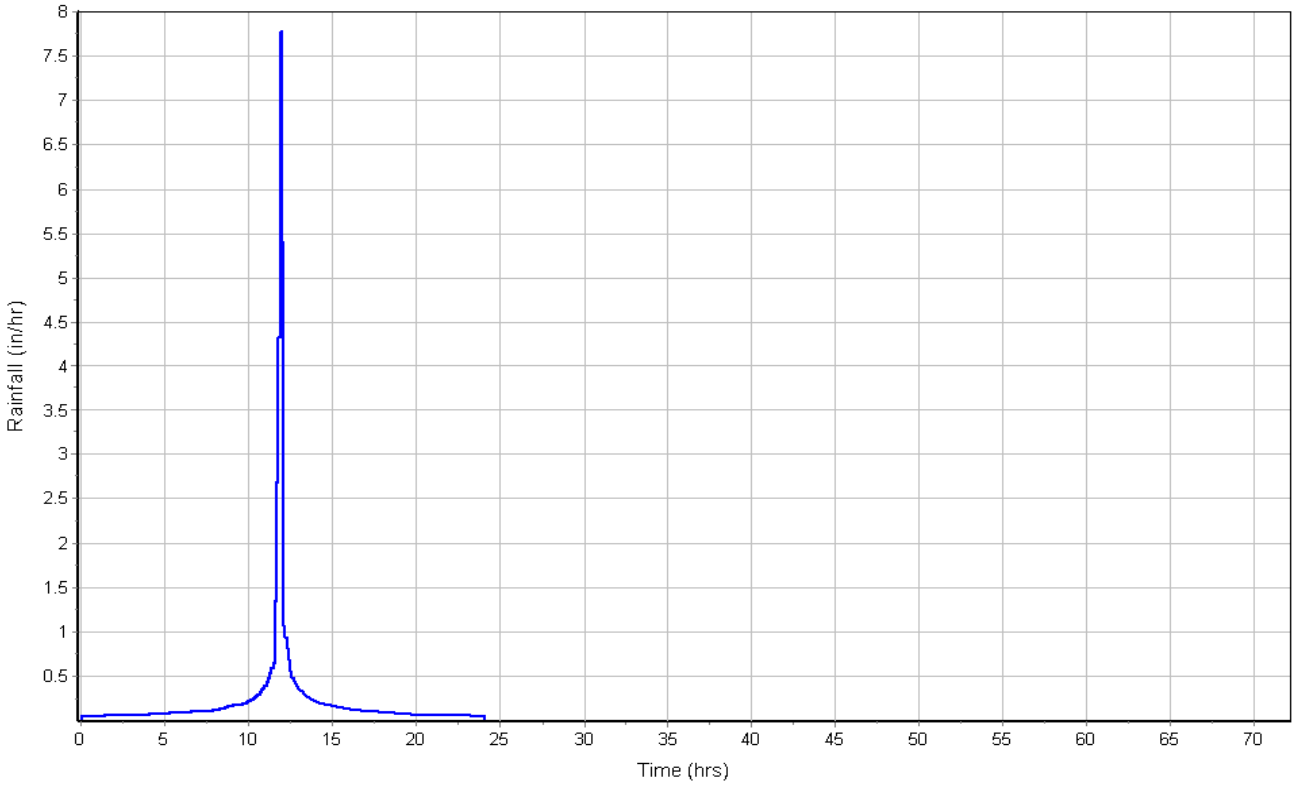
User-Defined TOC override (minutes): 5.00

Subbasin Runoff Results

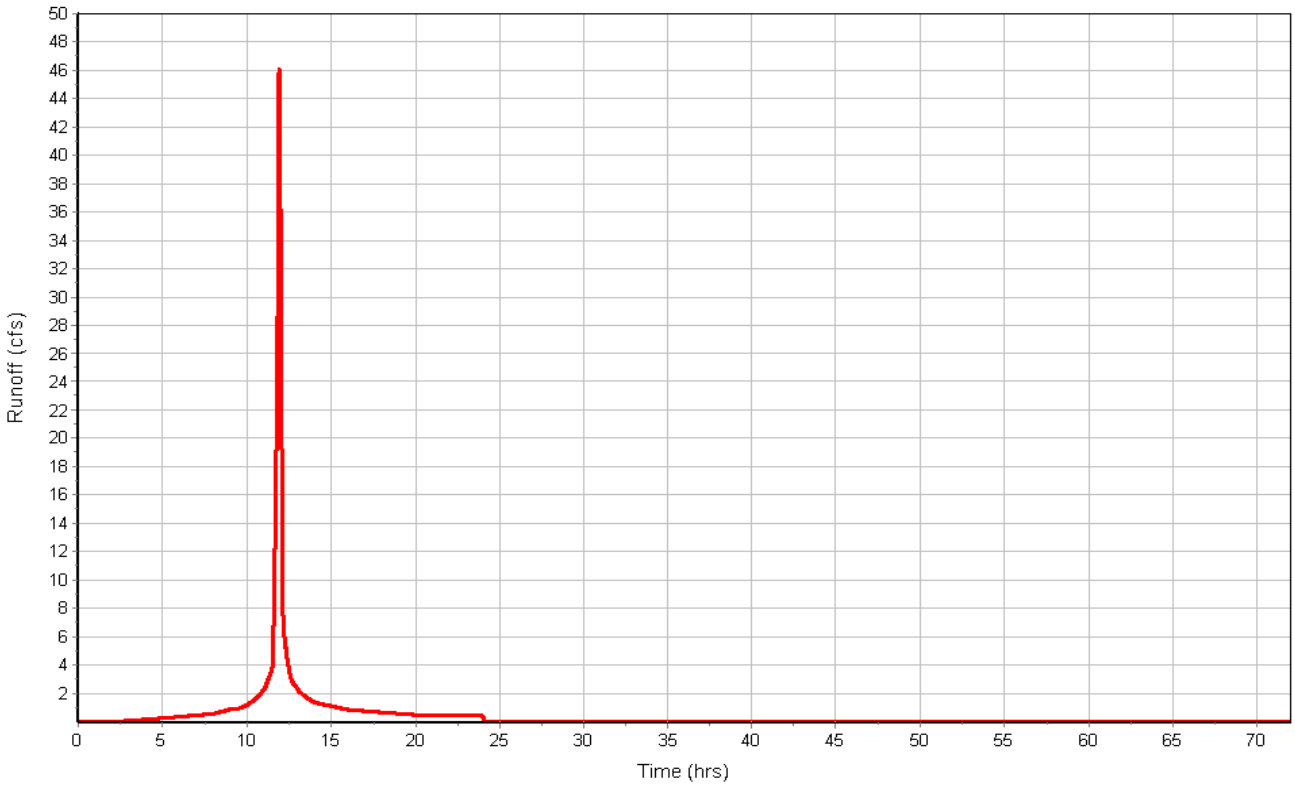
Total Rainfall (in) 5.67
Total Runoff (in) 4.91
Peak Runoff (cfs) 46.07
Weighted Curve Number 93.49
Time of Concentration (days hh:mm:ss) 0 00:05:00

Subbasin : A-1

Rainfall Intensity Graph



Runoff Hydrograph



100-YEAR EVENT

Project Description

File Name ..... Micro Existing Conditions.SPF

Project Options

Flow Units	CFS
Elevation Type	Elevation
Hydrology Method	SCS TR-55
Time of Concentration (TOC) Method	SCS TR-55
Link Routing Method	Hydrodynamic
Enable Overflow Ponding at Nodes	YES
Skip Steady State Analysis Time Periods	NO

Analysis Options

Start Analysis On	Feb 15, 2023	00:00:00
End Analysis On	Feb 18, 2023	00:00:00
Start Reporting On	Feb 15, 2023	00:00:00
Antecedent Dry Days	0	days
Runoff (Dry Weather) Time Step	0 01:00:00	days hh:mm:ss
Runoff (Wet Weather) Time Step	0 00:05:00	days hh:mm:ss
Reporting Time Step	0 00:01:00	days hh:mm:ss
Routing Time Step	5	seconds

Number of Elements

	Qty
Rain Gages	1
Subbasins	1
Nodes	1
Junctions	0
Outfalls	1
Flow Diversions	0
Inlets	0
Storage Nodes	0
Links	0
Channels	0
Pipes	0
Pumps	0
Orifices	0
Weirs	0
Outlets	0
Pollutants	0
Land Uses	0

Rainfall Details

SN	Rain Gage ID	Data Source	Data Source ID	Rainfall Type	Rain Units	State	County	Return Period (years)	Rainfall Depth (inches)	Rainfall Distribution
1		Time Series	100 Year	Cumulative	inches	Missouri	Jackson	100	9.25	SCS Type II 24-hr

Subbasin Summary

SN	Subbasin ID	Area (ac)	Peak Rate Factor	Weighted Curve Number	Total Rainfall (in)	Total Runoff (in)	Total Runoff Volume (ac-in)	Peak Runoff (cfs)	Time of Concentration (days hh:mm:ss)
1	A-1	6.43	484.00	93.49	9.25	8.46	54.42	77.03	0 00:05:00

Node Summary

SN	Element ID	Element Type	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Initial Water Elevation (ft)	Surcharge Elevation (ft)	Ponded Area (ft^2)	Peak Inflow (cfs)	Max HGL Elevation Attained (ft)	Max Surcharge Depth Attained (ft)	Min Freeboard Attained (ft)	Time of Peak Flooding Occurrence (days hh:mm)	Total Flooded Volume (ac-in)	Total Time Flooded (min)
1	Out-01	Outfall	0.00					0.00	0.00					

Subbasin Hydrology

Subbasin : A-1

Input Data

Area (ac) 6.43
Peak Rate Factor 484.00
Weighted Curve Number 93.49
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Paved roads with curbs & sewers	4.82	D	98.00
> 75% grass cover, Good	1.61	D	80.00
Composite Area & Weighted CN	6.43		93.49

Time of Concentration

TOC Method : SCS TR-55

Sheet Flow Equation :

Tc = (0.007 * ((n * Lf)^0.8)) / ((P^0.5) * (Sf^0.4))

Where :

Tc = Time of Concentration (hr)
n = Manning's roughness
Lf = Flow Length (ft)
P = 2 yr, 24 hr Rainfall (inches)
Sf = Slope (ft/ft)

Shallow Concentrated Flow Equation :

V = 16.1345 * (Sf^0.5) (unpaved surface)
V = 20.3282 * (Sf^0.5) (paved surface)
V = 15.0 * (Sf^0.5) (grassed waterway surface)
V = 10.0 * (Sf^0.5) (nearly bare & untilled surface)
V = 9.0 * (Sf^0.5) (cultivated straight rows surface)
V = 7.0 * (Sf^0.5) (short grass pasture surface)
V = 5.0 * (Sf^0.5) (woodland surface)
V = 2.5 * (Sf^0.5) (forest w/heavy litter surface)
Tc = (Lf / V) / (3600 sec/hr)

Where:

Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)

Channel Flow Equation :

V = (1.49 * (R^(2/3)) * (Sf^0.5)) / n
R = Aq / Wp
Tc = (Lf / V) / (3600 sec/hr)

Where :

Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
R = Hydraulic Radius (ft)
Aq = Flow Area (ft²)
Wp = Wetted Perimeter (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)
n = Manning's roughness

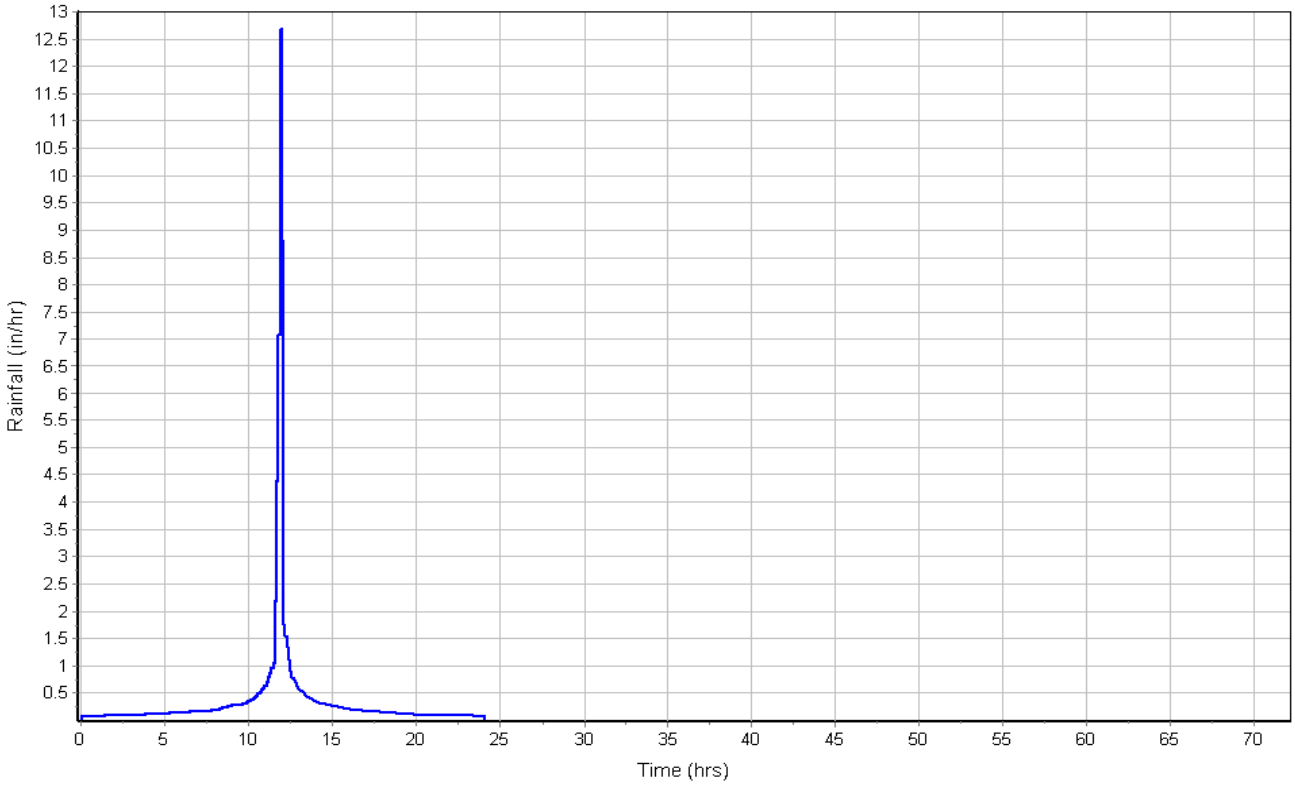
User-Defined TOC override (minutes): 5.00

Subbasin Runoff Results

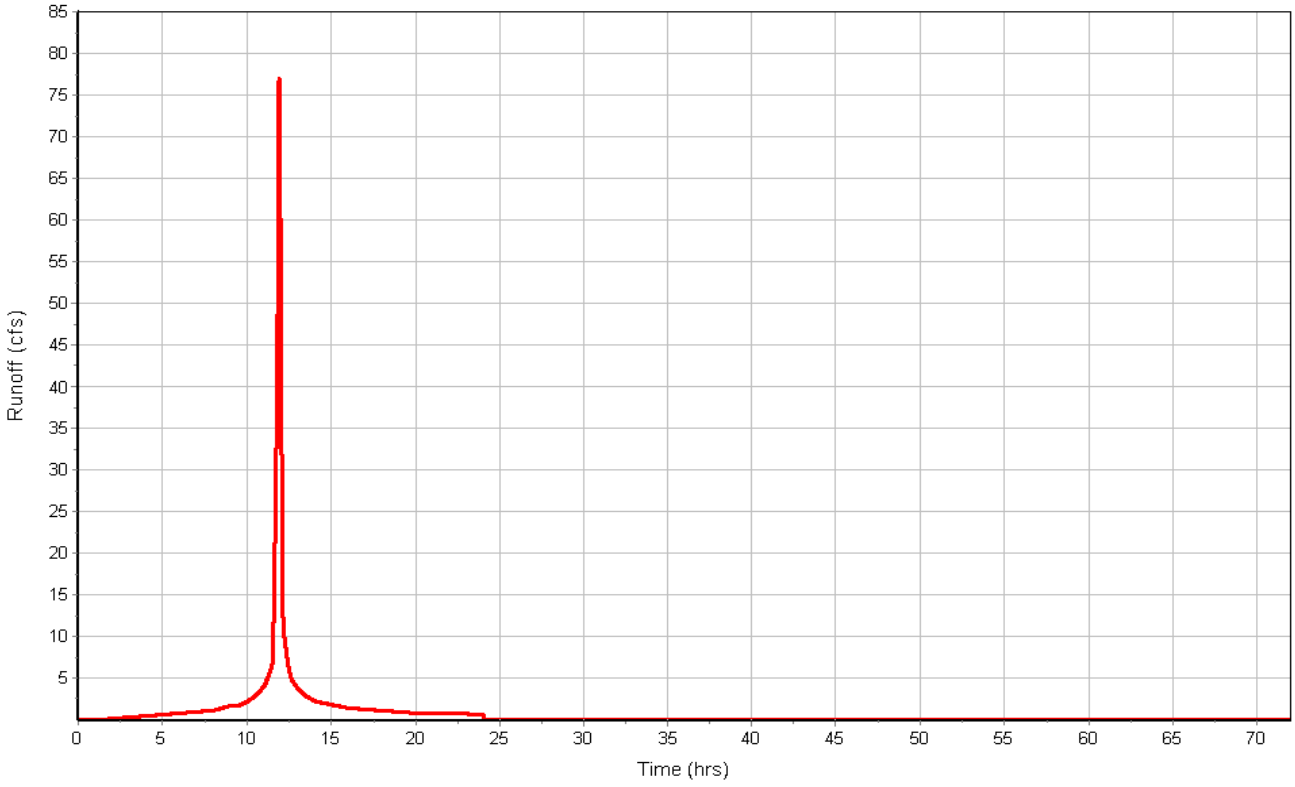
Total Rainfall (in) 9.25
Total Runoff (in) 8.46
Peak Runoff (cfs) 77.03
Weighted Curve Number 93.49
Time of Concentration (days hh:mm:ss) 0 00:05:00

Subbasin : A-1

Rainfall Intensity Graph



Runoff Hydrograph



PROPOSED CONDITIONS

1-YEAR EVENT

Project Description

File Name ..... Micro Proposed Conditions.SPF

Project Options

Flow Units ..... CFS
Elevation Type ..... Elevation
Hydrology Method ..... SCS TR-55
Time of Concentration (TOC) Method ..... SCS TR-55
Link Routing Method ..... Hydrodynamic
Enable Overflow Ponding at Nodes ..... YES
Skip Steady State Analysis Time Periods ... NO

Analysis Options

Start Analysis On ..... Feb 15, 2023 00:00:00
End Analysis On ..... Feb 18, 2023 00:00:00
Start Reporting On ..... Feb 15, 2023 00:00:00
Antecedent Dry Days ..... 0 days
Runoff (Dry Weather) Time Step ..... 0 01:00:00 days hh:mm:ss
Runoff (Wet Weather) Time Step ..... 0 00:05:00 days hh:mm:ss
Reporting Time Step ..... 0 00:01:00 days hh:mm:ss
Routing Time Step ..... 5 seconds

Number of Elements

	Qty
Rain Gages	1
Subbasins	2
Nodes	3
Junctions	1
Outfalls	1
Flow Diversions	0
Inlets	0
Storage Nodes	1
Links	3
Channels	0
Pipes	1
Pumps	0
Orifices	1
Weirs	1
Outlets	0
Pollutants	0
Land Uses	0

Rainfall Details

SN	Rain Gage ID	Data Source	Data Source ID	Rainfall Type	Rain Units	State	County	Return Period (years)	Rainfall Depth (inches)	Rainfall Distribution
1		Time Series	1 Year	Cumulative	inches	Missouri	Jackson	1	3.10	SCS Type II 24-hr

Subbasin Summary

SN	Subbasin ID	Area (ac)	Peak Rate Factor	Weighted Curve Number	Total Rainfall (in)	Total Runoff (in)	Total Runoff Volume (ac-in)	Peak Runoff (cfs)	Time of Concentration (days hh:mm:ss)
1	A_Undetained	4.09	484.00	96.59	3.10	2.71	11.10	16.10	0 00:05:00
2	A1 Detained	2.34	484.00	93.77	3.10	2.42	5.67	8.61	0 00:05:00

Node Summary

SN	Element ID	Element Type	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Initial Water Elevation (ft)	Surcharge Elevation (ft)	Ponded Area (ft^2)	Peak Inflow (cfs)	Max HGL Elevation Attained (ft)	Max Surcharge Depth Attained (ft)	Min Freeboard Attained (ft)	Time of Peak Flooding Occurrence (days hh:mm)	Total Flooded Volume (ac-in)	Total Time Flooded (min)
1	Jun-01	Junction	1002.00	1007.00	0.00	0.00	0.00	7.71	1002.52	0.00	7.23	0 00:00	0.00	0.00
2	Out-01	Outfall	995.00					23.20	995.49					
3	Stor-01	Storage Node	1001.00	1007.00	0.00		0.00	8.60	1003.54				0.00	0.00

Link Summary

SN	Element ID	Element Type	From (Inlet) Node	To (Outlet) Node	Length	Inlet Invert Elevation	Outlet Invert Elevation	Average Slope	Diameter or Height	Manning's Roughness	Peak Flow	Design Flow Capacity	Peak Flow/ Design Flow Ratio	Peak Flow Velocity	Peak Flow Depth	Peak Flow Depth/ Total Depth Ratio	Total Time Surcharged	Reported Condition
					(ft)	(ft)	(ft)	(%)	(in)		(cfs)	(cfs)		(ft/sec)	(ft)		(min)	
1	Link-01	Pipe	Jun-01	Out-01	200.00	1002.00	995.00	3.5000	36.000	0.0120	7.72	135.18	0.06	9.86	0.50	0.17	0.00	Calculated
2	Orifice-01	Orifice	Stor-01	Jun-01		1001.00	1002.00		18.000		7.71							
3	Weir-01	Weir	Stor-01	Jun-01		1001.00	1002.00				0.00							

Subbasin Hydrology

Subbasin : A_Undetained

Input Data

Area (ac) 4.09
Peak Rate Factor 484.00
Weighted Curve Number 96.59
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Paved roads with curbs & sewers	3.77	D	98.00
> 75% grass cover, Good	0.32	D	80.00
Composite Area & Weighted CN	4.09		96.59

Time of Concentration

TOC Method : SCS TR-55

Sheet Flow Equation :

Tc = (0.007 * ((n * Lf)^0.8)) / ((P^0.5) * (Sf^0.4))

Where :

Tc = Time of Concentration (hr)
n = Manning's roughness
Lf = Flow Length (ft)
P = 2 yr, 24 hr Rainfall (inches)
Sf = Slope (ft/ft)

Shallow Concentrated Flow Equation :

V = 16.1345 * (Sf^0.5) (unpaved surface)
V = 20.3282 * (Sf^0.5) (paved surface)
V = 15.0 * (Sf^0.5) (grassed waterway surface)
V = 10.0 * (Sf^0.5) (nearly bare & untilled surface)
V = 9.0 * (Sf^0.5) (cultivated straight rows surface)
V = 7.0 * (Sf^0.5) (short grass pasture surface)
V = 5.0 * (Sf^0.5) (woodland surface)
V = 2.5 * (Sf^0.5) (forest w/heavy litter surface)
Tc = (Lf / V) / (3600 sec/hr)

Where:

Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)

Channel Flow Equation :

V = (1.49 * (R^(2/3)) * (Sf^0.5)) / n
R = Aq / Wp
Tc = (Lf / V) / (3600 sec/hr)

Where :

Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
R = Hydraulic Radius (ft)
Aq = Flow Area (ft²)
Wp = Wetted Perimeter (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)
n = Manning's roughness

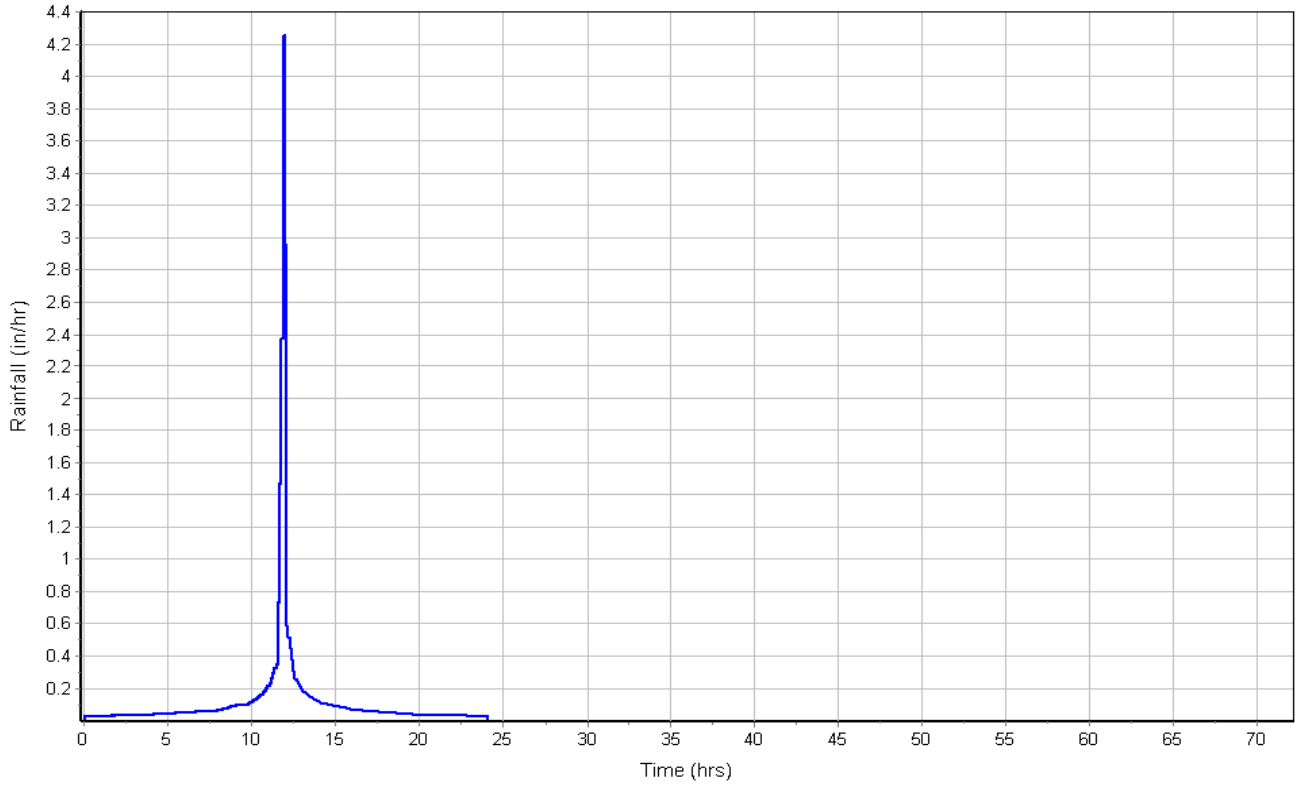
User-Defined TOC override (minutes): 5.00

Subbasin Runoff Results

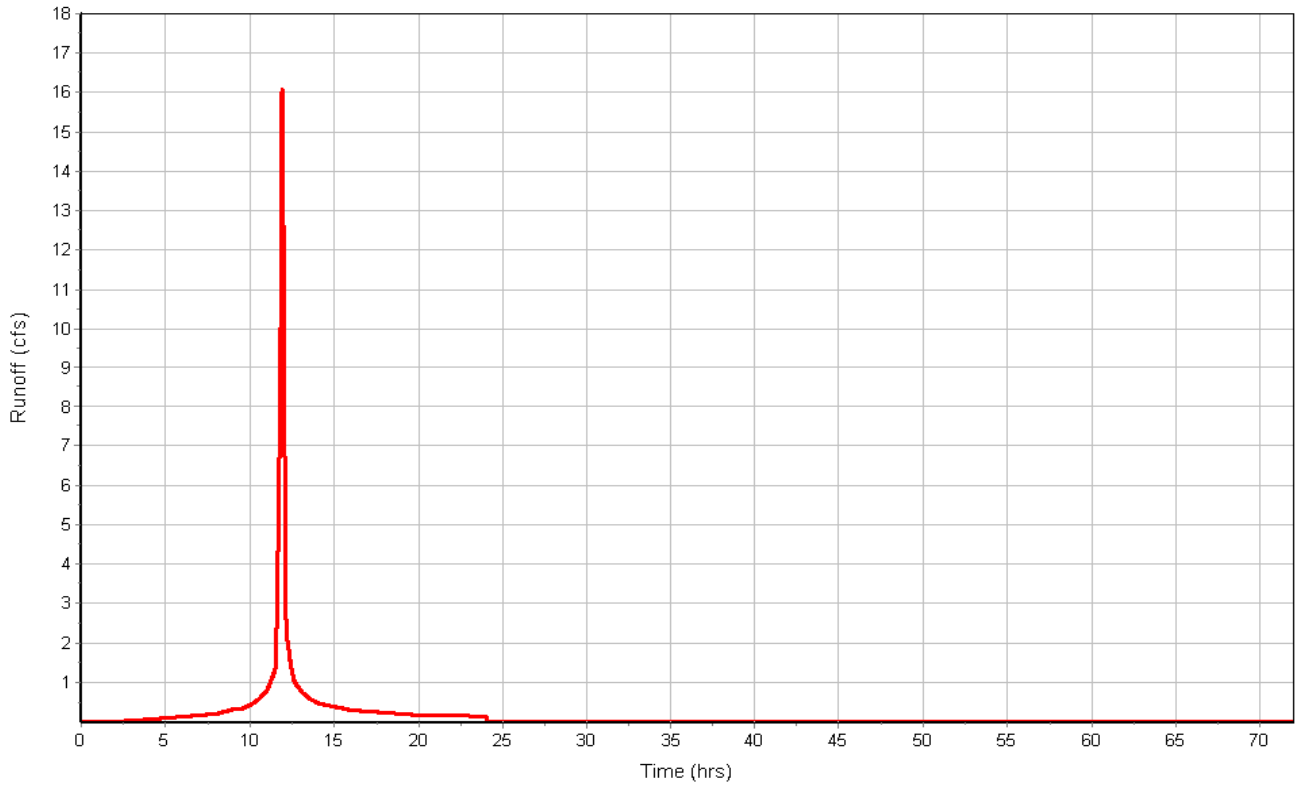
Total Rainfall (in) 3.10
Total Runoff (in) 2.71
Peak Runoff (cfs) 16.10
Weighted Curve Number 96.59
Time of Concentration (days hh:mm:ss) 0 00:05:00

Subbasin : A_Undetained

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : A1 Detained

Input Data

Area (ac) 2.34
Peak Rate Factor 484.00
Weighted Curve Number 93.77
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
> 75% grass cover, Good	0.55	D	80.00
Paved parking & roofs	1.79	D	98.00
Composite Area & Weighted CN	2.34		93.77

Time of Concentration

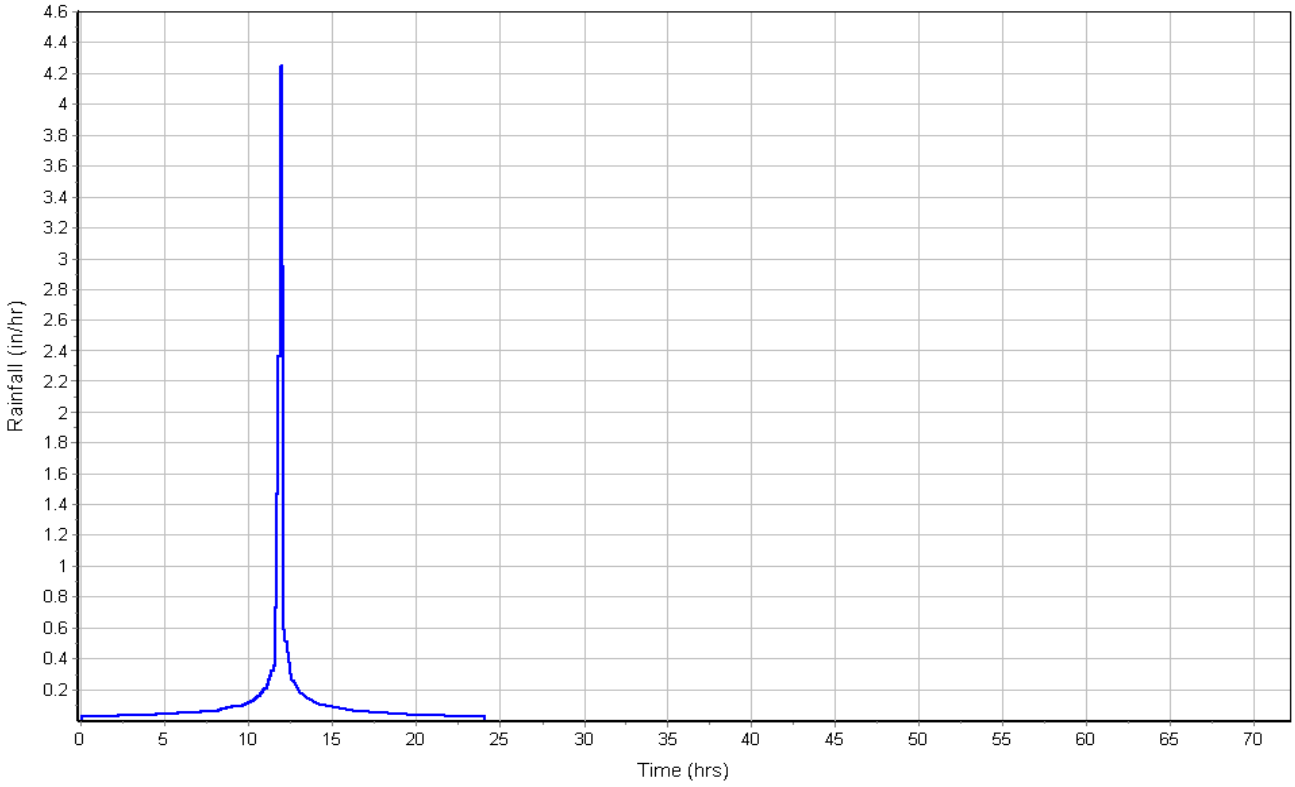
User-Defined TOC override (minutes): 5

Subbasin Runoff Results

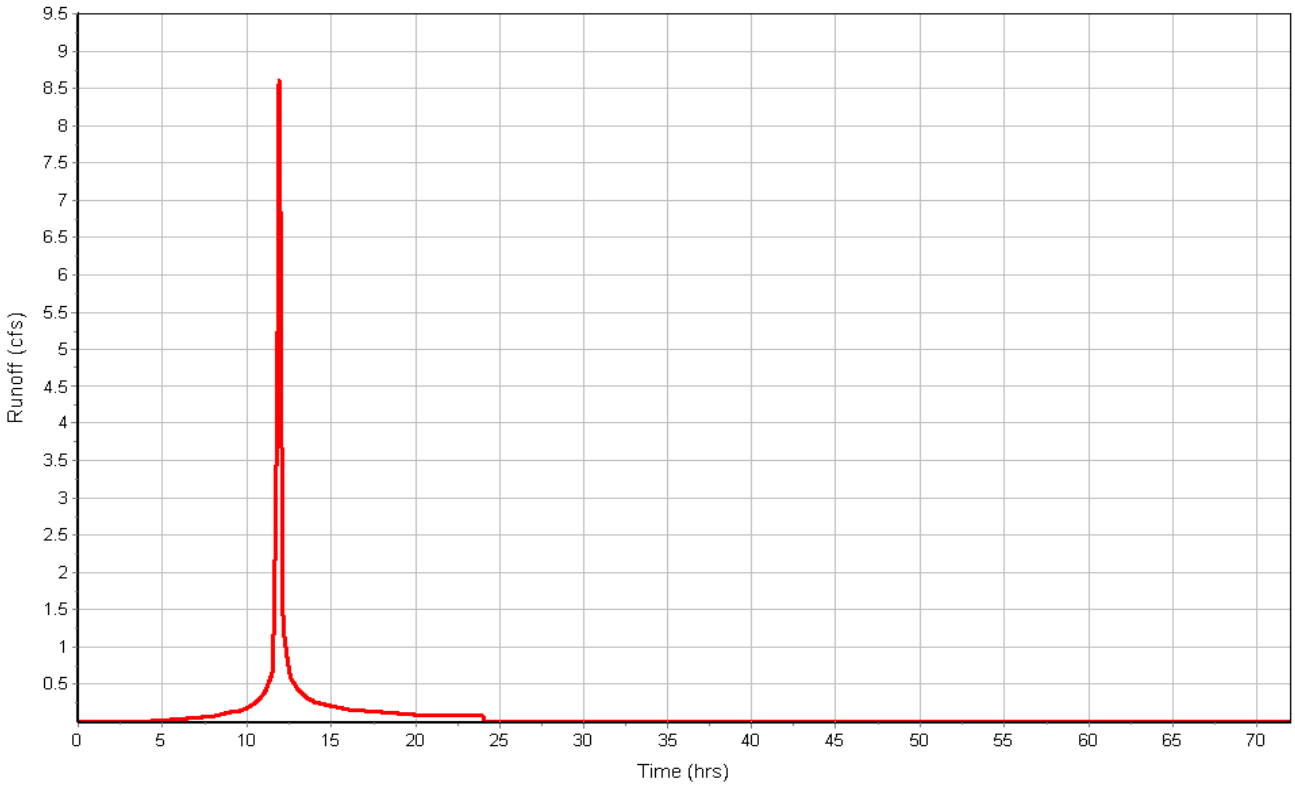
Total Rainfall (in) 3.10
Total Runoff (in) 2.42
Peak Runoff (cfs) 8.61
Weighted Curve Number 93.77
Time of Concentration (days hh:mm:ss) 0 00:05:00

Subbasin : A1 Detained

Rainfall Intensity Graph



Runoff Hydrograph



Junction Input

SN	Element ID	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Ground/Rim (Max) Offset (ft)	Initial Water Elevation (ft)	Initial Water Depth (ft)	Surcharge Elevation (ft)	Surcharge Depth (ft)	Ponded Area (ft^2)	Minimum Pipe Cover (in)
1	Jun-01	1002.00	1007.00	5.00	0.00	-1002.00	0.00	-1007.00	0.00	0.00

Junction Results

SN	Element ID	Peak Inflow (cfs)	Peak Lateral Inflow (cfs)	Max HGL Elevation Attained (ft)	Max HGL Depth Attained (ft)	Max Surcharge Depth Attained (ft)	Min Freeboard Attained (ft)	Average HGL Elevation Attained (ft)	Average HGL Depth Attained (ft)	Time of Max HGL Occurrence (days hh:mm)	Time of Peak Flooding Occurrence (days hh:mm)	Total Flooded Volume (ac-in)	Total Time Flooded (min)
1	Jun-01	7.71	0.00	1002.52	0.52	0.00	7.23	1002.02	0.02	0 11:57	0 00:00	0.00	0.00

Pipe Input

SN	Element ID	Length (ft)	Inlet Invert Elevation (ft)	Inlet Invert Offset (ft)	Outlet Invert Elevation (ft)	Outlet Invert Offset (ft)	Total Drop (ft)	Average Slope (%)	Pipe Shape	Pipe Diameter or Height (in)	Pipe Width (in)	Manning's Roughness	Entrance Losses	Exit/Bend Losses	Additional Losses	Initial Flow (cfs)	Flap Gate	No. of Barrels
1	Link-01	200.00	1002.00	0.00	995.00	0.00	7.00	3.5000	CIRCULAR	36.000	36.000	0.0120	0.5000	0.5000	0.0000	0.00	No	1

Pipe Results

SN	Element ID	Peak Flow	Time of Peak Flow Occurrence	Design Flow Capacity	Peak Flow/ Design Flow Ratio	Peak Flow Velocity	Travel Time	Peak Flow Depth	Peak Flow Depth/ Total Depth Ratio	Total Time Surcharged	Froude Number	Reported Condition
		(cfs)	(days hh:mm)	(cfs)		(ft/sec)	(min)	(ft)		(min)		
1	Link-01	7.72	0 11:58	135.18	0.06	9.86	0.34	0.50	0.17	0.00		Calculated

2-YEAR EVENT

Project Description

File Name ..... Micro Proposed Conditions.SPF

Project Options

Flow Units ..... CFS
Elevation Type ..... Elevation
Hydrology Method ..... SCS TR-55
Time of Concentration (TOC) Method ..... SCS TR-55
Link Routing Method ..... Hydrodynamic
Enable Overflow Ponding at Nodes ..... YES
Skip Steady State Analysis Time Periods ... NO

Analysis Options

Start Analysis On ..... Feb 15, 2023 00:00:00
End Analysis On ..... Feb 18, 2023 00:00:00
Start Reporting On ..... Feb 15, 2023 00:00:00
Antecedent Dry Days ..... 0 days
Runoff (Dry Weather) Time Step ..... 0 01:00:00 days hh:mm:ss
Runoff (Wet Weather) Time Step ..... 0 00:05:00 days hh:mm:ss
Reporting Time Step ..... 0 00:01:00 days hh:mm:ss
Routing Time Step ..... 5 seconds

Number of Elements

	Qty
Rain Gages	1
Subbasins	2
Nodes	3
Junctions	1
Outfalls	1
Flow Diversions	0
Inlets	0
Storage Nodes	1
Links	3
Channels	0
Pipes	1
Pumps	0
Orifices	1
Weirs	1
Outlets	0
Pollutants	0
Land Uses	0

Rainfall Details

SN	Rain Gage ID	Data Source	Data Source ID	Rainfall Type	Rain Units	State	County	Return Period (years)	Rainfall Depth (inches)	Rainfall Distribution
1		Time Series	2-Year	Cumulative	inches	Missouri	Jackson	2	3.71	SCS Type II 24-hr

Subbasin Summary

SN	Subbasin ID	Area (ac)	Peak Rate Factor	Weighted Curve Number	Total Rainfall (in)	Total Runoff (in)	Total Runoff Volume (ac-in)	Peak Runoff (cfs)	Time of Concentration (days hh:mm:ss)
1	A_Undetained	4.09	484.00	96.59	3.71	3.32	13.57	19.46	0 00:05:00
2	A1 Detained	2.34	484.00	93.77	3.71	3.02	7.06	10.58	0 00:05:00

Node Summary

SN	Element ID	Element Type	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Initial Water Elevation (ft)	Surcharge Elevation (ft)	Ponded Area (ft^2)	Peak Inflow (cfs)	Max HGL Elevation Attained (ft)	Max Surcharge Depth Attained (ft)	Min Freeboard Attained (ft)	Time of Peak Flooding Occurrence (days hh:mm)	Total Flooded Volume (ac-in)	Total Time Flooded (min)
1	Jun-01	Junction	1002.00	1007.00	0.00	0.00	0.00	9.01	1002.56	0.00	7.19	0 00:00	0.00	0.00
2	Out-01	Outfall	995.00					27.76	995.53					
3	Stor-01	Storage Node	1001.00	1007.00	0.00		0.00	10.57	1003.82				0.00	0.00

Link Summary

SN	Element ID	Element Type	From (Inlet) Node	To (Outlet) Node	Length	Inlet Invert Elevation	Outlet Invert Elevation	Average Slope	Diameter or Height	Manning's Roughness	Peak Flow	Design Flow Capacity	Peak Flow/ Design Flow Ratio	Peak Flow Velocity	Peak Flow Depth	Peak Flow Depth/ Total Depth Ratio	Total Time Surcharged	Reported Condition
					(ft)	(ft)	(ft)	(%)	(in)		(cfs)	(cfs)		(ft/sec)	(ft)		(min)	
1	Link-01	Pipe	Jun-01	Out-01	200.00	1002.00	995.00	3.5000	36.000	0.0120	9.01	135.18	0.07	10.25	0.55	0.18	0.00	Calculated
2	Orifice-01	Orifice	Stor-01	Jun-01		1001.00	1002.00		18.000		9.01							
3	Weir-01	Weir	Stor-01	Jun-01		1001.00	1002.00				0.00							

Subbasin Hydrology

Subbasin : A_Undetained

Input Data

Area (ac) 4.09
Peak Rate Factor 484.00
Weighted Curve Number 96.59
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Paved roads with curbs & sewers	3.77	D	98.00
> 75% grass cover, Good	0.32	D	80.00
Composite Area & Weighted CN	4.09		96.59

Time of Concentration

TOC Method : SCS TR-55

Sheet Flow Equation :

Tc = (0.007 * ((n * Lf)^0.8)) / ((P^0.5) * (Sf^0.4))

Where :

Tc = Time of Concentration (hr)
n = Manning's roughness
Lf = Flow Length (ft)
P = 2 yr, 24 hr Rainfall (inches)
Sf = Slope (ft/ft)

Shallow Concentrated Flow Equation :

V = 16.1345 * (Sf^0.5) (unpaved surface)
V = 20.3282 * (Sf^0.5) (paved surface)
V = 15.0 * (Sf^0.5) (grassed waterway surface)
V = 10.0 * (Sf^0.5) (nearly bare & untilled surface)
V = 9.0 * (Sf^0.5) (cultivated straight rows surface)
V = 7.0 * (Sf^0.5) (short grass pasture surface)
V = 5.0 * (Sf^0.5) (woodland surface)
V = 2.5 * (Sf^0.5) (forest w/heavy litter surface)
Tc = (Lf / V) / (3600 sec/hr)

Where:

Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)

Channel Flow Equation :

V = (1.49 * (R^(2/3)) * (Sf^0.5)) / n
R = Aq / Wp
Tc = (Lf / V) / (3600 sec/hr)

Where :

Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
R = Hydraulic Radius (ft)
Aq = Flow Area (ft²)
Wp = Wetted Perimeter (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)
n = Manning's roughness

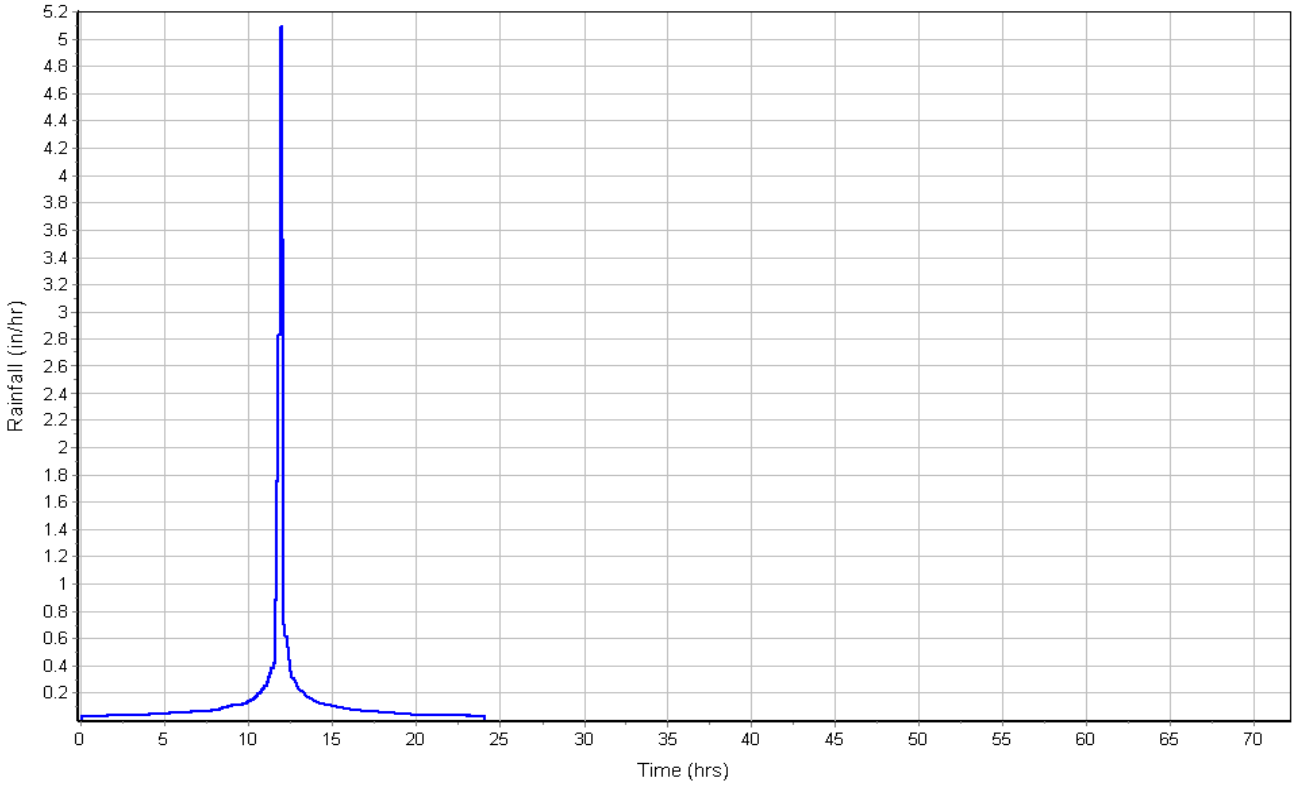
User-Defined TOC override (minutes): 5.00

Subbasin Runoff Results

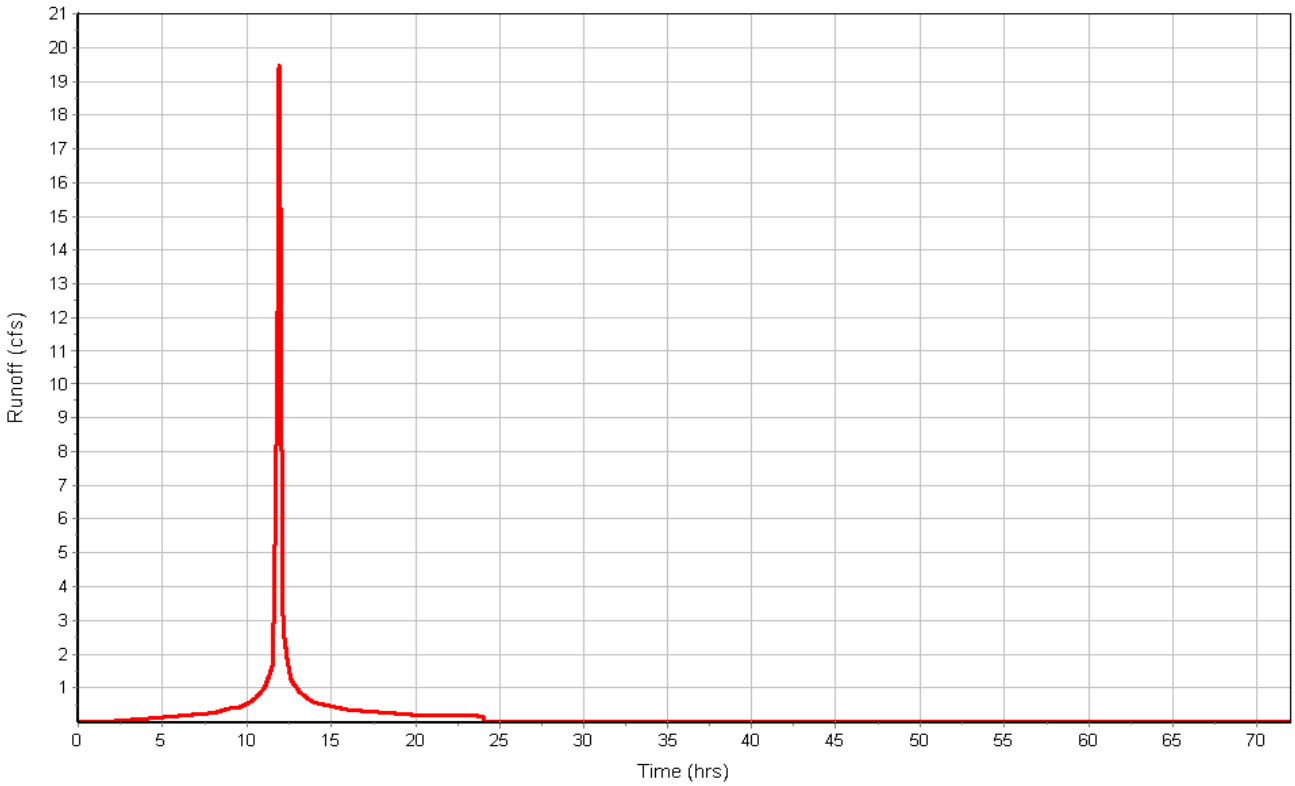
Total Rainfall (in) 3.71
Total Runoff (in) 3.32
Peak Runoff (cfs) 19.46
Weighted Curve Number 96.59
Time of Concentration (days hh:mm:ss) 0 00:05:00

Subbasin : A_Undetained

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : A1 Detained

Input Data

Area (ac) 2.34
Peak Rate Factor 484.00
Weighted Curve Number 93.77
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
> 75% grass cover, Good	0.55	D	80.00
Paved parking & roofs	1.79	D	98.00
Composite Area & Weighted CN	2.34		93.77

Time of Concentration

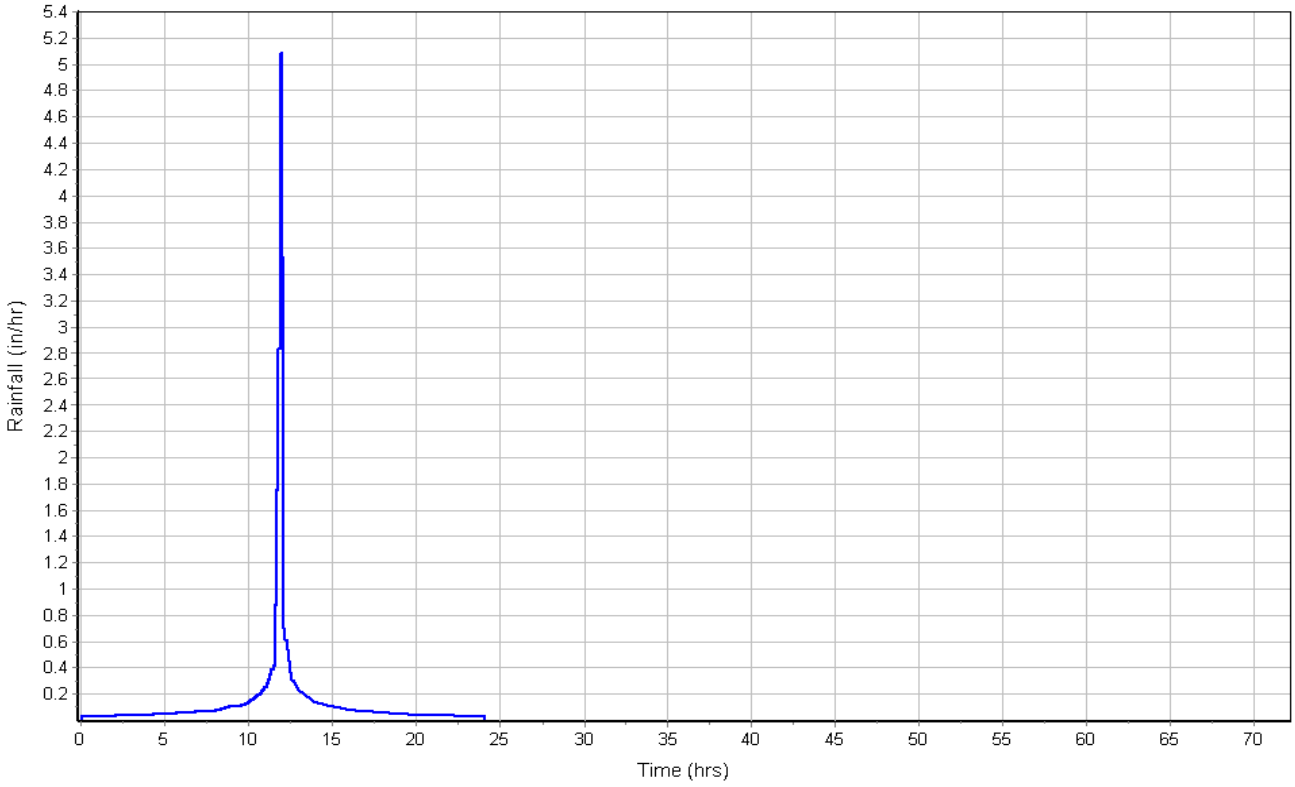
User-Defined TOC override (minutes): 5

Subbasin Runoff Results

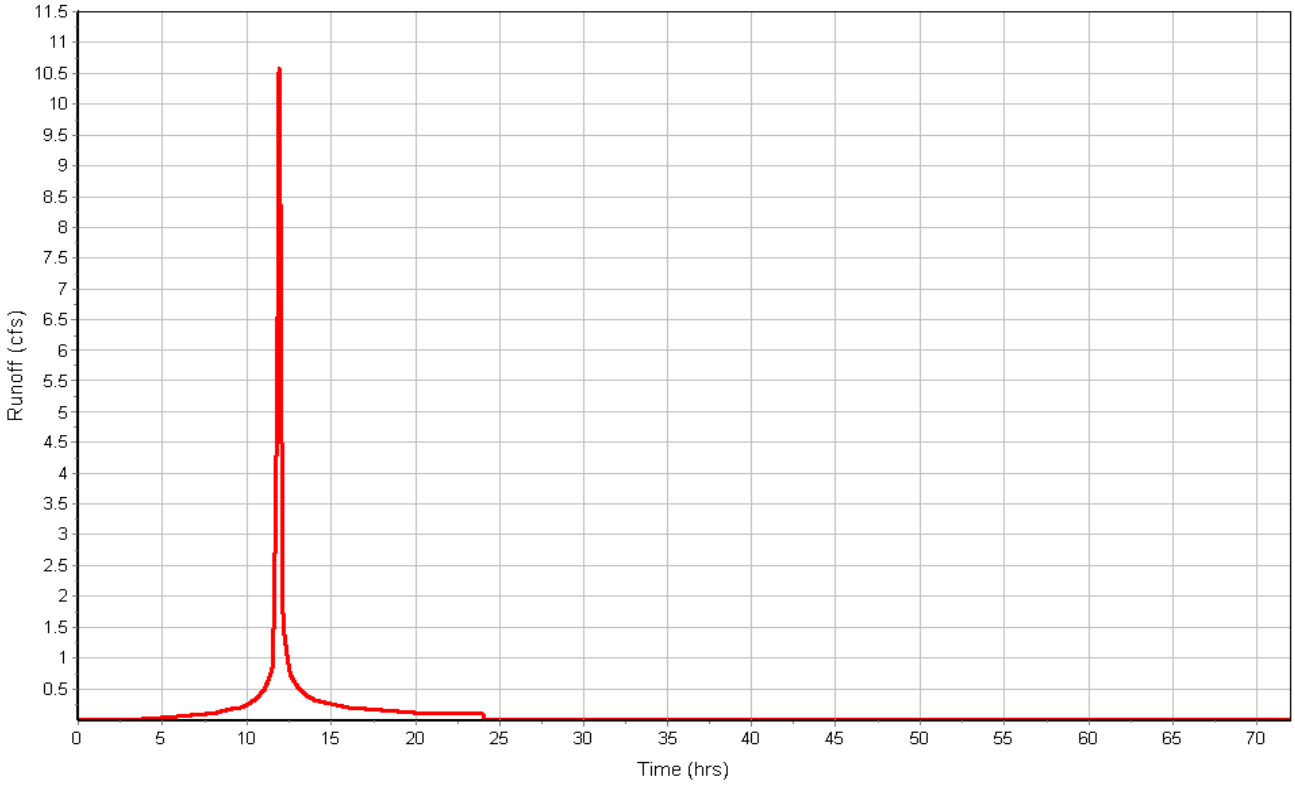
Total Rainfall (in) 3.71
Total Runoff (in) 3.02
Peak Runoff (cfs) 10.58
Weighted Curve Number 93.77
Time of Concentration (days hh:mm:ss) 0 00:05:00

Subbasin : A1 Detained

Rainfall Intensity Graph



Runoff Hydrograph



Junction Input

SN	Element ID	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Ground/Rim (Max) Offset (ft)	Initial Water Elevation (ft)	Initial Water Depth (ft)	Surcharge Elevation (ft)	Surcharge Depth (ft)	Ponded Area (ft^2)	Minimum Pipe Cover (in)
1	Jun-01	1002.00	1007.00	5.00	0.00	-1002.00	0.00	-1007.00	0.00	0.00

Junction Results

SN	Element ID	Peak Inflow (cfs)	Peak Lateral Inflow (cfs)	Max HGL Elevation Attained (ft)	Max HGL Depth Attained (ft)	Max Surcharge Depth Attained (ft)	Min Freeboard Attained (ft)	Average HGL Elevation Attained (ft)	Average HGL Depth Attained (ft)	Time of Max HGL Occurrence (days hh:mm)	Time of Peak Flooding Occurrence (days hh:mm)	Total Flooded Volume (ac-in)	Total Time Flooded (min)
1	Jun-01	9.01	0.00	1002.56	0.56	0.00	7.19	1002.02	0.02	0 11:59	0 00:00	0.00	0.00

Pipe Input

SN	Element ID	Length (ft)	Inlet Invert Elevation (ft)	Inlet Invert Offset (ft)	Outlet Invert Elevation (ft)	Outlet Invert Offset (ft)	Total Drop (ft)	Average Slope (%)	Pipe Shape	Pipe Diameter or Height (in)	Pipe Width (in)	Manning's Roughness	Entrance Losses	Exit/Bend Losses	Additional Losses	Initial Flow (cfs)	Flap Gate	No. of Barrels
1	Link-01	200.00	1002.00	0.00	995.00	0.00	7.00	3.5000	CIRCULAR	36.000	36.000	0.0120	0.5000	0.5000	0.0000	0.00	No	1

Pipe Results

SN	Element ID	Peak Flow	Time of Peak Flow Occurrence	Design Flow Capacity	Peak Flow/ Design Flow Ratio	Peak Flow Velocity	Travel Time	Peak Flow Depth	Peak Flow Depth/ Total Depth Ratio	Total Time Surcharged	Froude Number	Reported Condition
		(cfs)	(days hh:mm)	(cfs)		(ft/sec)	(min)	(ft)		(min)		
1	Link-01	9.01	0 11:59	135.18	0.07	10.25	0.33	0.55	0.18	0.00		Calculated

10-YEAR EVENT

Project Description

File Name ..... Micro Proposed Conditions.SPF

Project Options

Flow Units	CFS
Elevation Type	Elevation
Hydrology Method	SCS TR-55
Time of Concentration (TOC) Method	SCS TR-55
Link Routing Method	Hydrodynamic
Enable Overflow Ponding at Nodes	YES
Skip Steady State Analysis Time Periods	NO

Analysis Options

Start Analysis On	Feb 15, 2023	00:00:00
End Analysis On	Feb 18, 2023	00:00:00
Start Reporting On	Feb 15, 2023	00:00:00
Antecedent Dry Days	0	days
Runoff (Dry Weather) Time Step	0 01:00:00	days hh:mm:ss
Runoff (Wet Weather) Time Step	0 00:05:00	days hh:mm:ss
Reporting Time Step	0 00:01:00	days hh:mm:ss
Routing Time Step	5	seconds

Number of Elements

	Qty
Rain Gages	1
Subbasins	2
Nodes	3
Junctions	1
Outfalls	1
Flow Diversions	0
Inlets	0
Storage Nodes	1
Links	3
Channels	0
Pipes	1
Pumps	0
Orifices	1
Weirs	1
Outlets	0
Pollutants	0
Land Uses	0

Rainfall Details

SN	Rain Gage ID	Data Source	Data Source ID	Rainfall Type	Rain Units	State	County	Return Period (years)	Rainfall Depth (inches)	Rainfall Distribution
1		Time Series	10 Year	Cumulative	inches	Missouri	Jackson	10	5.67	SCS Type II 24-hr

Subbasin Summary

SN	Subbasin ID	Area (ac)	Peak Rate Factor	Weighted Curve Number	Total Rainfall (in)	Total Runoff (in)	Total Runoff Volume (ac-in)	Peak Runoff (cfs)	Time of Concentration (days hh:mm:ss)
1	A_Undetained	4.09	484.00	96.59	5.67	5.27	21.54	30.17	0 00:05:00
2	A1 Detained	2.34	484.00	93.77	5.67	4.94	11.57	16.83	0 00:05:00

Node Summary

SN	Element ID	Element Type	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Initial Water Elevation (ft)	Surcharge Elevation (ft)	Ponded Area (ft^2)	Peak Inflow (cfs)	Max HGL Elevation Attained (ft)	Max Surcharge Depth Attained (ft)	Min Freeboard Attained (ft)	Time of Peak Flooding Occurrence (days hh:mm)	Total Flooded Volume (ac-in)	Total Time Flooded (min)
1	Jun-01	Junction	1002.00	1007.00	0.00	0.00	0.00	13.40	1002.70	0.00	7.05	0 00:00	0.00	0.00
2	Out-01	Outfall	995.00					42.01	995.64					
3	Stor-01	Storage Node	1001.00	1007.00	0.00		0.00	16.82	1005.12				0.00	0.00

Link Summary

SN	Element ID	Element Type	From (Inlet) Node	To (Outlet) Node	Length	Inlet Invert Elevation	Outlet Invert Elevation	Average Slope	Diameter or Height	Manning's Roughness	Peak Flow	Design Flow Capacity	Peak Flow/ Design Flow Ratio	Peak Flow Velocity	Peak Flow Depth	Peak Flow Depth/ Total Depth Ratio	Total Time Surcharged	Reported Condition
					(ft)	(ft)	(ft)	(%)	(in)		(cfs)	(cfs)		(ft/sec)	(ft)		(min)	
1	Link-01	Pipe	Jun-01	Out-01	200.00	1002.00	995.00	3.5000	36.000	0.0120	13.40	135.18	0.10	11.41	0.67	0.22	0.00	Calculated
2	Orifice-01	Orifice	Stor-01	Jun-01		1001.00	1002.00		18.000		13.40							
3	Weir-01	Weir	Stor-01	Jun-01		1001.00	1002.00				0.00							

Subbasin Hydrology

Subbasin : A_Undetained

Input Data

Area (ac) 4.09
Peak Rate Factor 484.00
Weighted Curve Number 96.59
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Paved roads with curbs & sewers	3.77	D	98.00
> 75% grass cover, Good	0.32	D	80.00
Composite Area & Weighted CN	4.09		96.59

Time of Concentration

TOC Method : SCS TR-55

Sheet Flow Equation :

Tc = (0.007 * ((n * Lf)^0.8)) / ((P^0.5) * (Sf^0.4))

Where :

Tc = Time of Concentration (hr)
n = Manning's roughness
Lf = Flow Length (ft)
P = 2 yr, 24 hr Rainfall (inches)
Sf = Slope (ft/ft)

Shallow Concentrated Flow Equation :

V = 16.1345 * (Sf^0.5) (unpaved surface)
V = 20.3282 * (Sf^0.5) (paved surface)
V = 15.0 * (Sf^0.5) (grassed waterway surface)
V = 10.0 * (Sf^0.5) (nearly bare & untilled surface)
V = 9.0 * (Sf^0.5) (cultivated straight rows surface)
V = 7.0 * (Sf^0.5) (short grass pasture surface)
V = 5.0 * (Sf^0.5) (woodland surface)
V = 2.5 * (Sf^0.5) (forest w/heavy litter surface)
Tc = (Lf / V) / (3600 sec/hr)

Where:

Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)

Channel Flow Equation :

V = (1.49 * (R^(2/3)) * (Sf^0.5)) / n
R = Aq / Wp
Tc = (Lf / V) / (3600 sec/hr)

Where :

Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
R = Hydraulic Radius (ft)
Aq = Flow Area (ft²)
Wp = Wetted Perimeter (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)
n = Manning's roughness

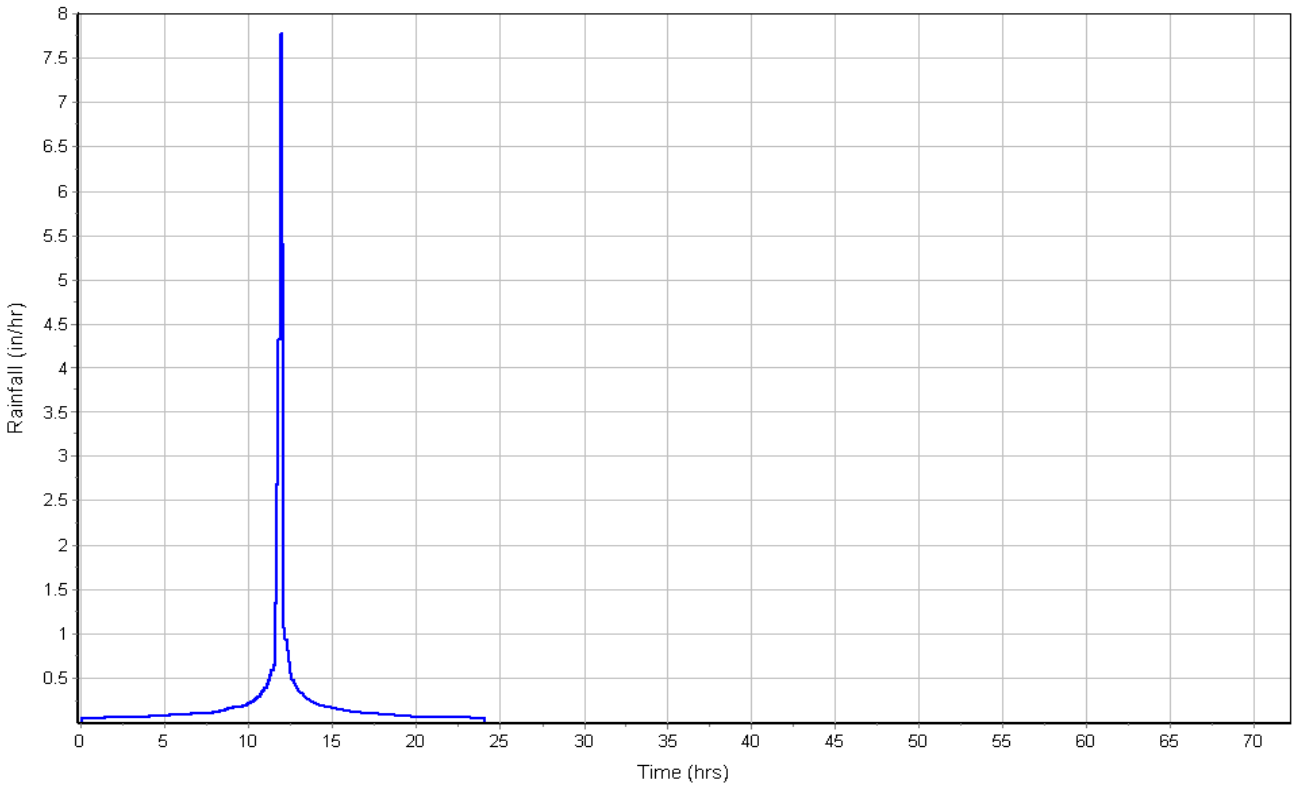
User-Defined TOC override (minutes): 5.00

Subbasin Runoff Results

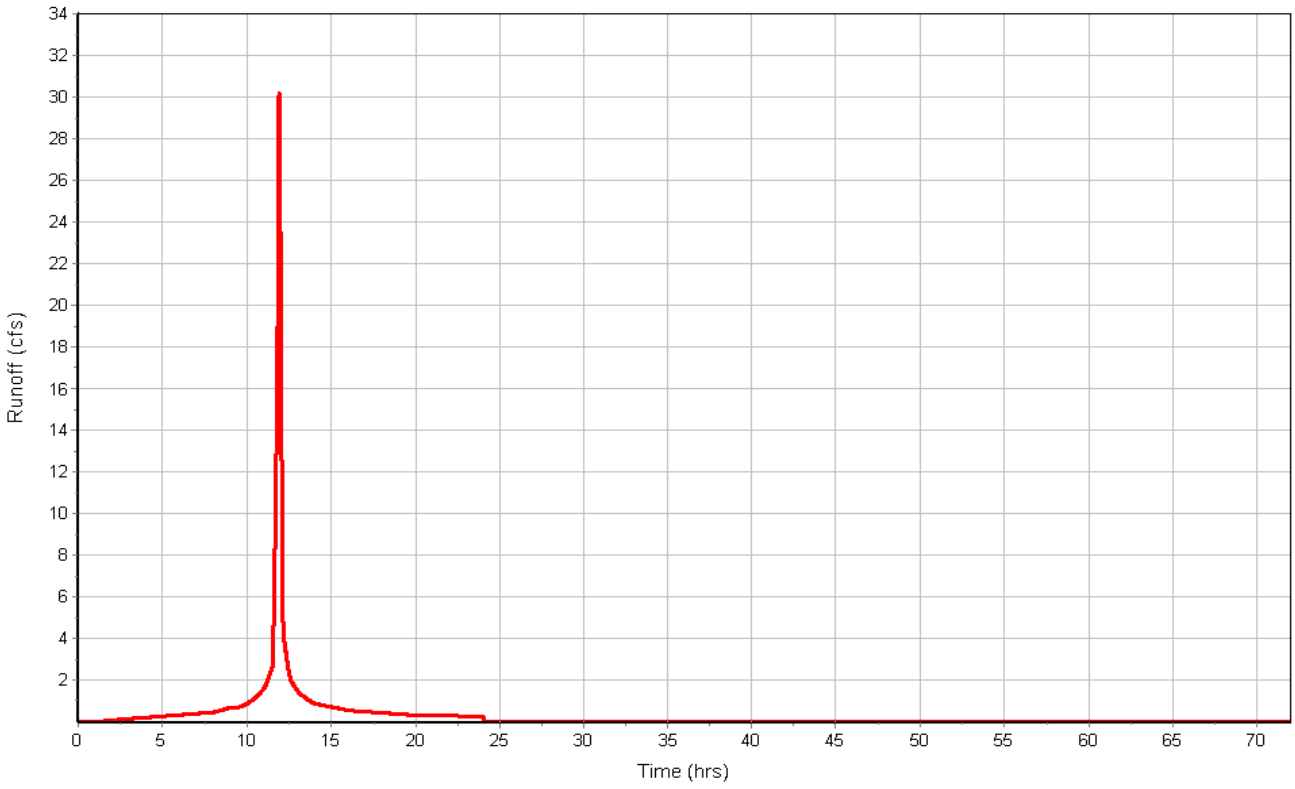
Total Rainfall (in) 5.67
Total Runoff (in) 5.27
Peak Runoff (cfs) 30.17
Weighted Curve Number 96.59
Time of Concentration (days hh:mm:ss) 0 00:05:00

Subbasin : A_Undetained

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : A1 Detained

Input Data

Area (ac) 2.34
Peak Rate Factor 484.00
Weighted Curve Number 93.77
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
> 75% grass cover, Good	0.55	D	80.00
Paved parking & roofs	1.79	D	98.00
Composite Area & Weighted CN	2.34		93.77

Time of Concentration

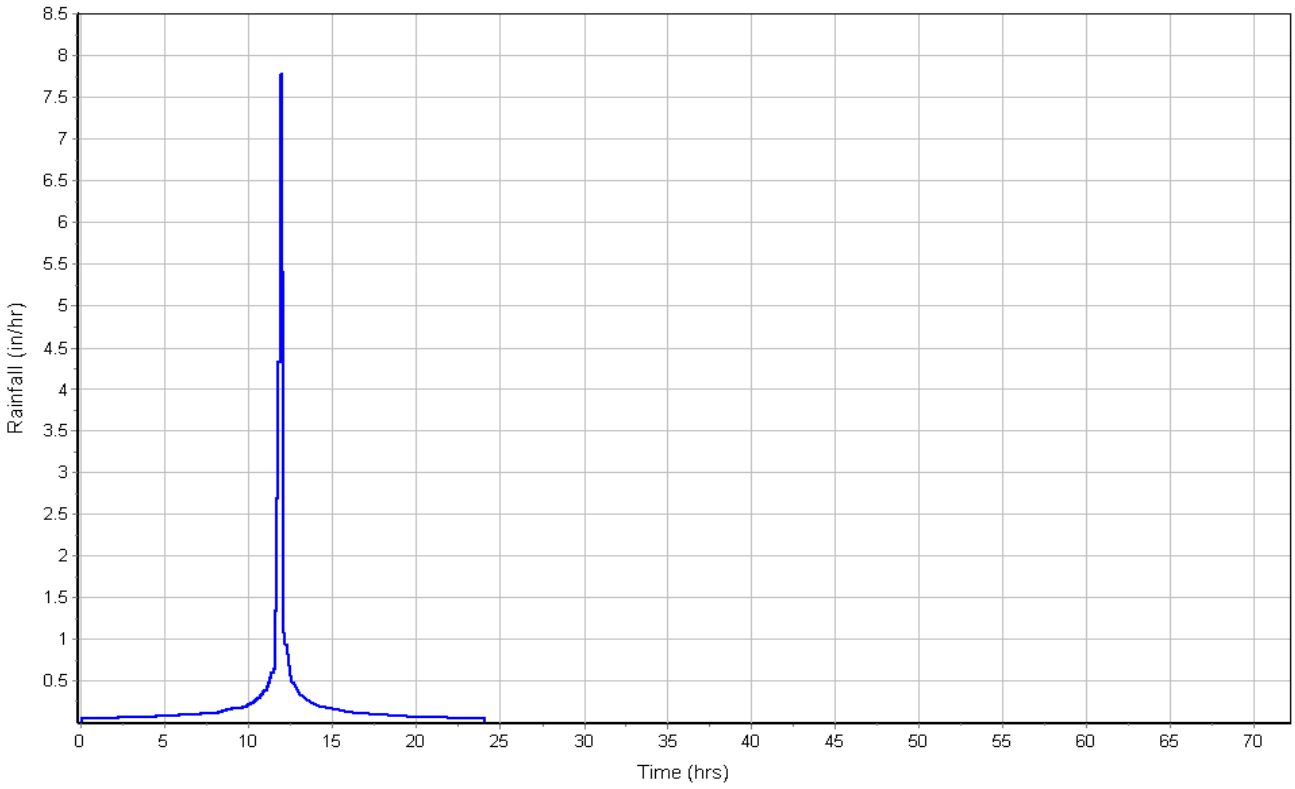
User-Defined TOC override (minutes): 5

Subbasin Runoff Results

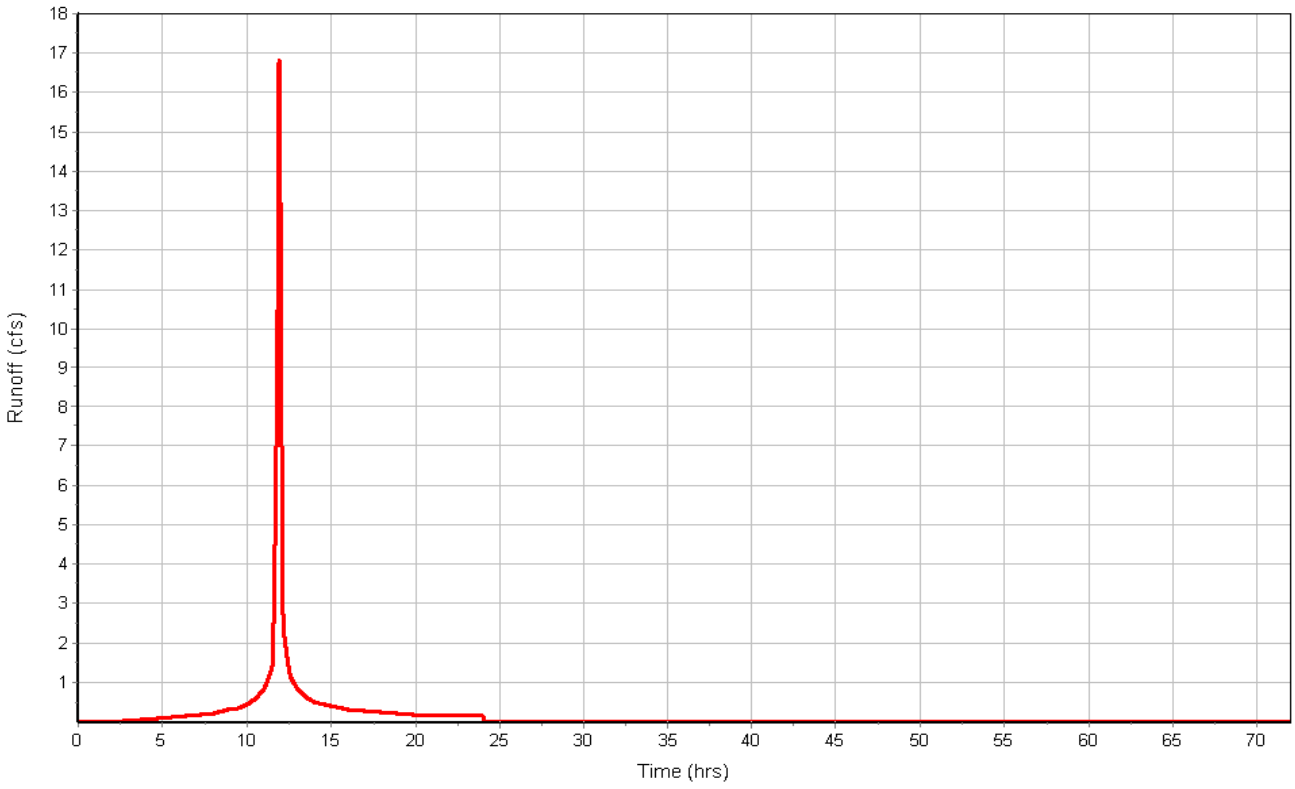
Total Rainfall (in) 5.67
Total Runoff (in) 4.94
Peak Runoff (cfs) 16.83
Weighted Curve Number 93.77
Time of Concentration (days hh:mm:ss) 0 00:05:00

Subbasin : A1 Detained

Rainfall Intensity Graph



Runoff Hydrograph



Junction Input

SN	Element ID	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Ground/Rim (Max) Offset (ft)	Initial Water Elevation (ft)	Initial Water Depth (ft)	Surcharge Elevation (ft)	Surcharge Depth (ft)	Ponded Area (ft^2)	Minimum Pipe Cover (in)
1	Jun-01	1002.00	1007.00	5.00	0.00	-1002.00	0.00	-1007.00	0.00	0.00

Junction Results

SN	Element ID	Peak Inflow (cfs)	Peak Lateral Inflow (cfs)	Max HGL Elevation Attained (ft)	Max HGL Depth Attained (ft)	Max Surcharge Depth Attained (ft)	Min Freeboard Attained (ft)	Average HGL Elevation Attained (ft)	Average HGL Depth Attained (ft)	Time of Max HGL Occurrence (days hh:mm)	Time of Peak Flooding Occurrence (days hh:mm)	Total Flooded Volume (ac-in)	Total Time Flooded (min)
1	Jun-01	13.40	0.00	1002.70	0.70	0.00	7.05	1002.03	0.03	0 12:00	0 00:00	0.00	0.00

Pipe Input

SN	Element ID	Length (ft)	Inlet Invert Elevation (ft)	Inlet Invert Offset (ft)	Outlet Invert Elevation (ft)	Outlet Invert Offset (ft)	Total Drop (ft)	Average Slope (%)	Pipe Shape	Pipe Diameter or Height (in)	Pipe Width (in)	Manning's Roughness	Entrance Losses	Exit/Bend Losses	Additional Losses	Initial Flow (cfs)	Flap Gate	No. of Barrels
1	Link-01	200.00	1002.00	0.00	995.00	0.00	7.00	3.5000	CIRCULAR	36.000	36.000	0.0120	0.5000	0.5000	0.0000	0.00	No	1

Pipe Results

SN	Element ID	Peak Flow (cfs)	Time of Peak Flow Occurrence (days hh:mm)	Design Flow Capacity (cfs)	Peak Flow/ Design Flow Ratio	Peak Flow Velocity (ft/sec)	Travel Time (min)	Peak Flow Depth (ft)	Peak Flow Depth/ Total Depth Ratio	Total Time Surcharged (min)	Froude Number	Reported Condition
1	Link-01	13.40	0 12:00	135.18	0.10	11.41	0.29	0.67	0.22	0.00		Calculated

100-YEAR EVENT

Project Description

File Name ..... Micro Proposed Conditions.SPF

Project Options

Flow Units	CFS
Elevation Type	Elevation
Hydrology Method	SCS TR-55
Time of Concentration (TOC) Method	SCS TR-55
Link Routing Method	Hydrodynamic
Enable Overflow Ponding at Nodes	YES
Skip Steady State Analysis Time Periods	NO

Analysis Options

Start Analysis On	Feb 15, 2023	00:00:00
End Analysis On	Feb 18, 2023	00:00:00
Start Reporting On	Feb 15, 2023	00:00:00
Antecedent Dry Days	0	days
Runoff (Dry Weather) Time Step	0 01:00:00	days hh:mm:ss
Runoff (Wet Weather) Time Step	0 00:05:00	days hh:mm:ss
Reporting Time Step	0 00:01:00	days hh:mm:ss
Routing Time Step	5	seconds

Number of Elements

	Qty
Rain Gages	1
Subbasins	2
Nodes	3
Junctions	1
Outfalls	1
Flow Diversions	0
Inlets	0
Storage Nodes	1
Links	3
Channels	0
Pipes	1
Pumps	0
Orifices	1
Weirs	1
Outlets	0
Pollutants	0
Land Uses	0

Rainfall Details

SN	Rain Gage ID	Data Source	Data Source ID	Rainfall Type	Rain Units	State	County	Return Period (years)	Rainfall Depth (inches)	Rainfall Distribution
1		Time Series	100 Year	Cumulative	inches	Missouri	Jackson	100	9.25	SCS Type II 24-hr

Subbasin Summary

SN	Subbasin ID	Area (ac)	Peak Rate Factor	Weighted Curve Number	Total Rainfall (in)	Total Runoff (in)	Total Runoff Volume (ac-in)	Peak Runoff (cfs)	Time of Concentration (days hh:mm:ss)
1	A_Undetained	4.09	484.00	96.59	9.25	8.84	36.15	49.63	0 00:05:00
2	A1 Detained	2.34	484.00	93.77	9.25	8.50	19.89	28.09	0 00:05:00

Node Summary

SN	Element ID	Element Type	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Initial Water Elevation (ft)	Surcharge Elevation (ft)	Ponded Area (ft^2)	Peak Inflow (cfs)	Max HGL Elevation Attained (ft)	Max Surcharge Depth Attained (ft)	Min Freeboard Attained (ft)	Time of Peak Flooding Occurrence (days hh:mm)	Total Flooded Volume (ac-in)	Total Time Flooded (min)
1	Jun-01	Junction	1002.00	1007.00	0.00	0.00	0.00	27.75	1003.06	0.00	6.69	0 00:00	0.00	0.00
2	Out-01	Outfall	995.00					77.04	995.92					
3	Stor-01	Storage Node	1001.00	1007.00	0.00		0.00	28.08	1006.64				0.00	0.00

Link Summary

SN	Element ID	Element Type	From (Inlet) Node	To (Outlet) Node	Length	Inlet Invert Elevation	Outlet Invert Elevation	Average Slope	Diameter or Height	Manning's Roughness	Peak Flow	Design Flow Capacity	Peak Flow/ Design Flow Ratio	Peak Flow Velocity	Peak Flow Depth	Peak Flow Depth/ Total Depth Ratio	Total Time Surcharged	Reported Condition
					(ft)	(ft)	(ft)	(%)	(in)		(cfs)	(cfs)		(ft/sec)	(ft)		(min)	
1	Link-01	Pipe	Jun-01	Out-01	200.00	1002.00	995.00	3.5000	36.000	0.0120	27.77	135.18	0.21	13.61	0.99	0.33	0.00	Calculated
2	Orifice-01	Orifice	Stor-01	Jun-01		1001.00	1002.00		18.000		16.48							
3	Weir-01	Weir	Stor-01	Jun-01		1001.00	1002.00				11.27							

Subbasin Hydrology

Subbasin : A_Undetained

Input Data

Area (ac) 4.09
Peak Rate Factor 484.00
Weighted Curve Number 96.59
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Paved roads with curbs & sewers	3.77	D	98.00
> 75% grass cover, Good	0.32	D	80.00
Composite Area & Weighted CN	4.09		96.59

Time of Concentration

TOC Method : SCS TR-55

Sheet Flow Equation :

Tc = (0.007 * ((n * Lf)^0.8)) / ((P^0.5) * (Sf^0.4))

Where :

Tc = Time of Concentration (hr)
n = Manning's roughness
Lf = Flow Length (ft)
P = 2 yr, 24 hr Rainfall (inches)
Sf = Slope (ft/ft)

Shallow Concentrated Flow Equation :

V = 16.1345 * (Sf^0.5) (unpaved surface)
V = 20.3282 * (Sf^0.5) (paved surface)
V = 15.0 * (Sf^0.5) (grassed waterway surface)
V = 10.0 * (Sf^0.5) (nearly bare & untilled surface)
V = 9.0 * (Sf^0.5) (cultivated straight rows surface)
V = 7.0 * (Sf^0.5) (short grass pasture surface)
V = 5.0 * (Sf^0.5) (woodland surface)
V = 2.5 * (Sf^0.5) (forest w/heavy litter surface)
Tc = (Lf / V) / (3600 sec/hr)

Where:

Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)

Channel Flow Equation :

V = (1.49 * (R^(2/3)) * (Sf^0.5)) / n
R = Aq / Wp
Tc = (Lf / V) / (3600 sec/hr)

Where :

Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
R = Hydraulic Radius (ft)
Aq = Flow Area (ft²)
Wp = Wetted Perimeter (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)
n = Manning's roughness

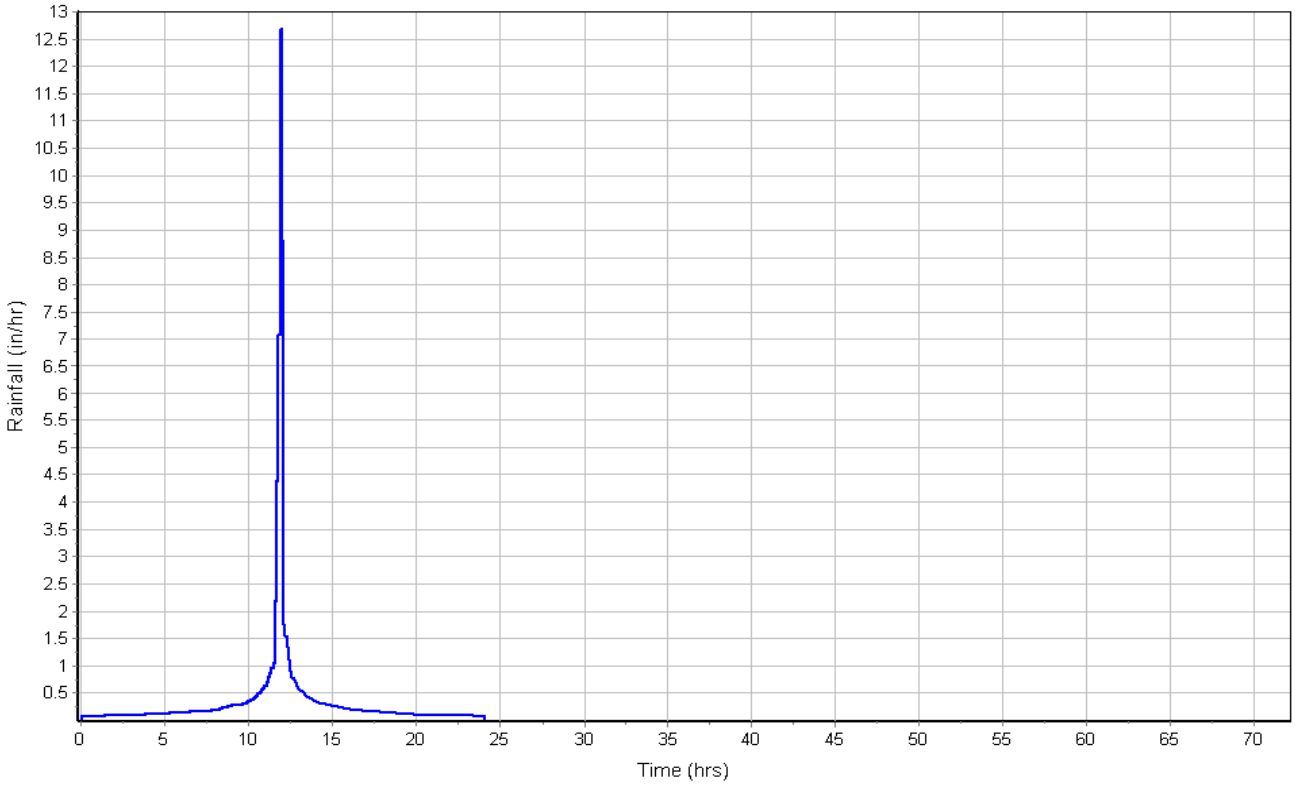
User-Defined TOC override (minutes): 5.00

Subbasin Runoff Results

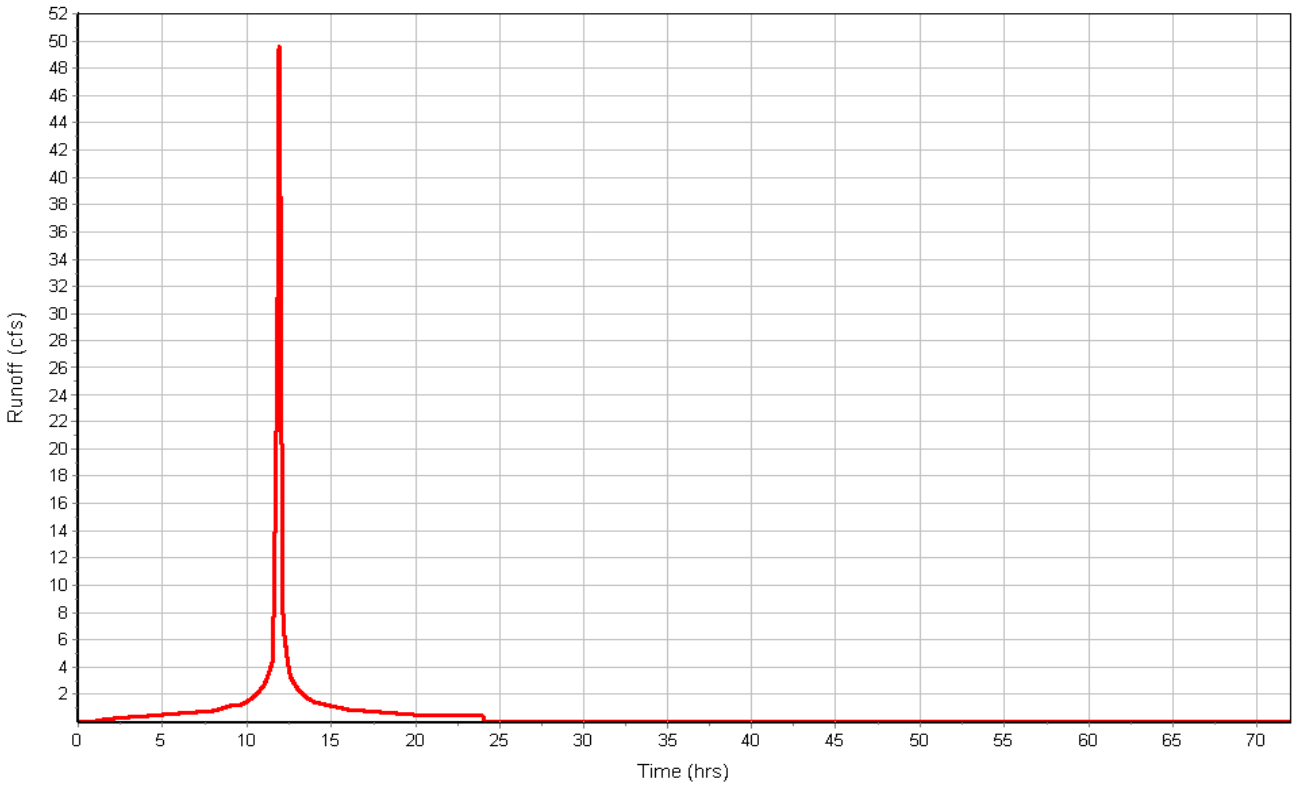
Total Rainfall (in) 9.25
Total Runoff (in) 8.84
Peak Runoff (cfs) 49.63
Weighted Curve Number 96.59
Time of Concentration (days hh:mm:ss) 0 00:05:00

Subbasin : A_Undetained

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : A1 Detained

Input Data

Area (ac)	2.34
Peak Rate Factor	484.00
Weighted Curve Number	93.77
Rain Gage ID	Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
> 75% grass cover, Good	0.55	D	80.00
Paved parking & roofs	1.79	D	98.00
Composite Area & Weighted CN	2.34		93.77

Time of Concentration

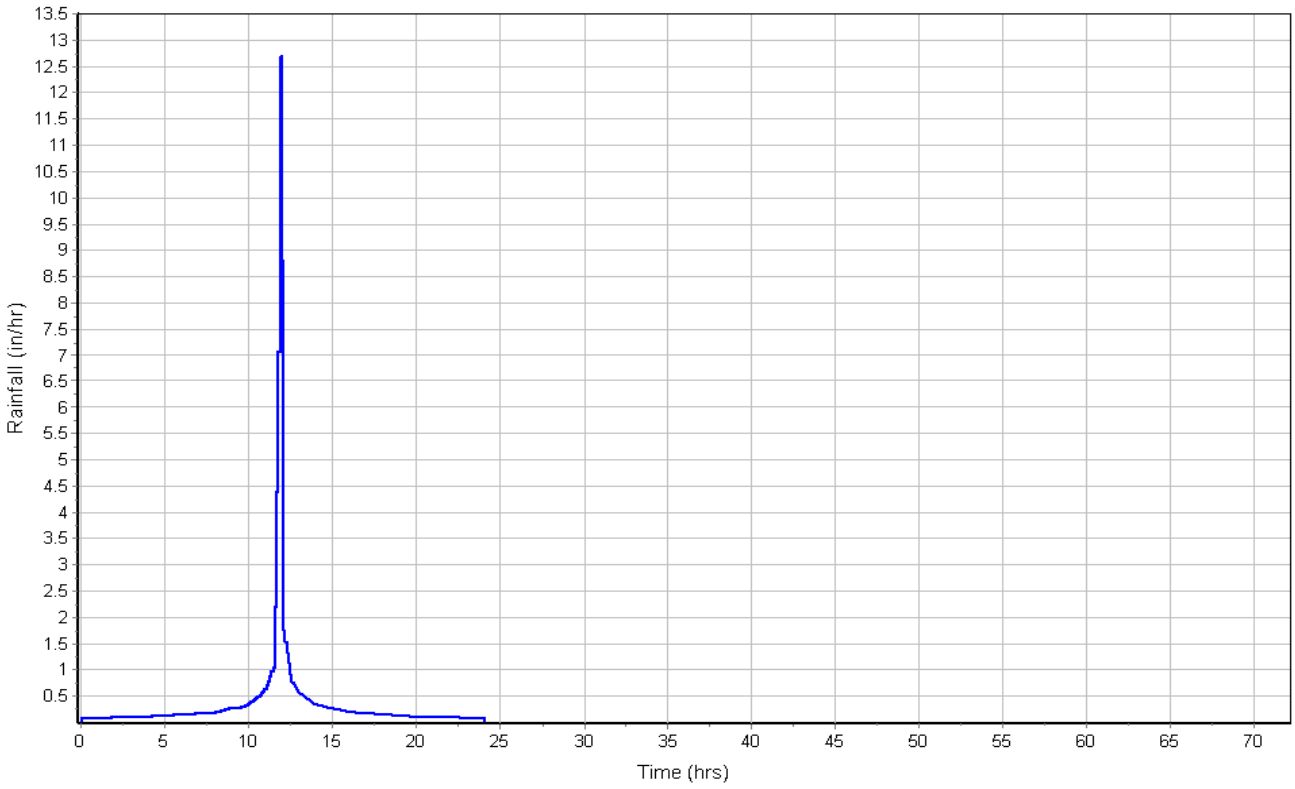
User-Defined TOC override (minutes): 5

Subbasin Runoff Results

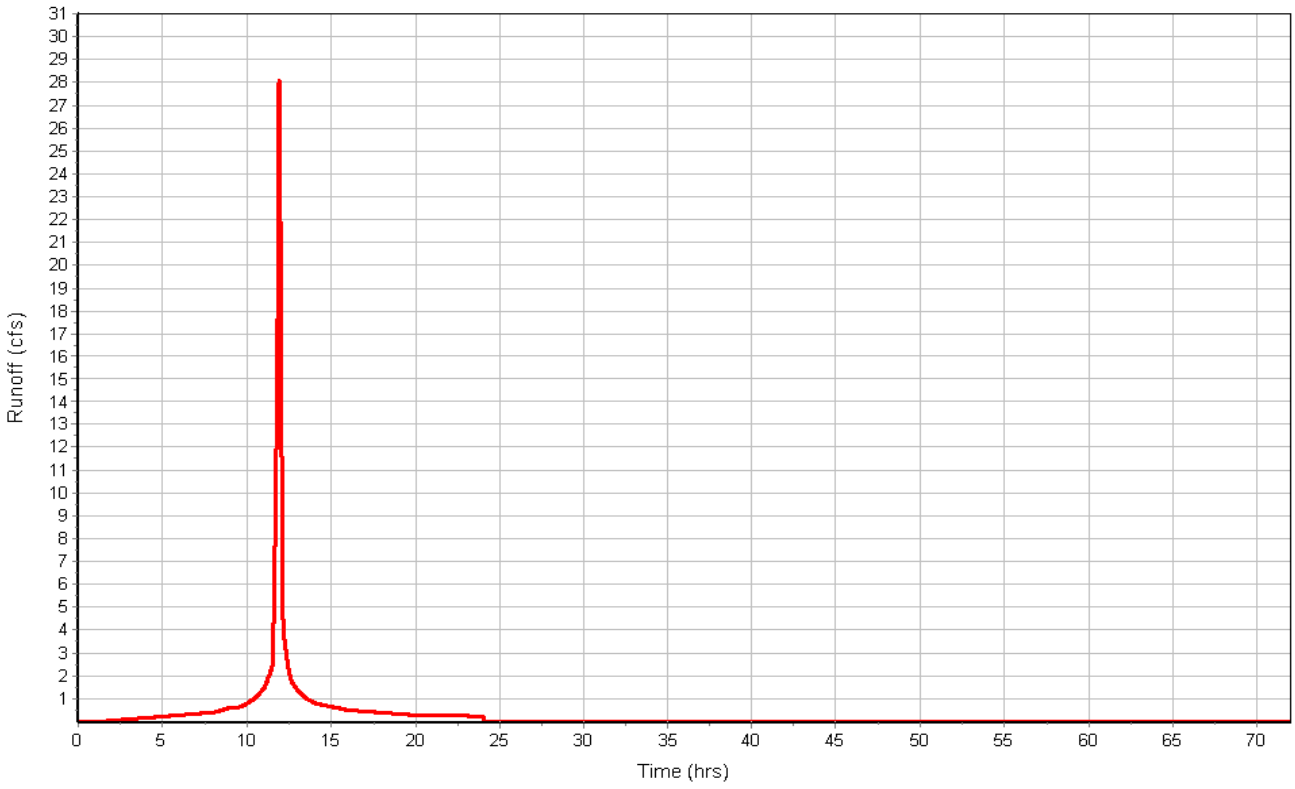
Total Rainfall (in)	9.25
Total Runoff (in)	8.50
Peak Runoff (cfs)	28.09
Weighted Curve Number	93.77
Time of Concentration (days hh:mm:ss)	0 00:05:00

Subbasin : A1 Detained

Rainfall Intensity Graph



Runoff Hydrograph



Junction Input

SN	Element ID	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Ground/Rim (Max) Offset (ft)	Initial Water Elevation (ft)	Initial Water Depth (ft)	Surcharge Elevation (ft)	Surcharge Depth (ft)	Ponded Area (ft^2)	Minimum Pipe Cover (in)
1	Jun-01	1002.00	1007.00	5.00	0.00	-1002.00	0.00	-1007.00	0.00	0.00

Junction Results

SN	Element ID	Peak Inflow (cfs)	Peak Lateral Inflow (cfs)	Max HGL Elevation Attained (ft)	Max HGL Depth Attained (ft)	Max Surcharge Depth Attained (ft)	Min Freeboard Attained (ft)	Average HGL Elevation Attained (ft)	Average HGL Depth Attained (ft)	Time of Max HGL Occurrence (days hh:mm)	Time of Peak Flooding Occurrence (days hh:mm)	Total Flooded Volume (ac-in)	Total Time Flooded (min)
1	Jun-01	27.75	0.00	1003.06	1.06	0.00	6.69	1002.04	0.04	0 11:56	0 00:00	0.00	0.00

Pipe Input

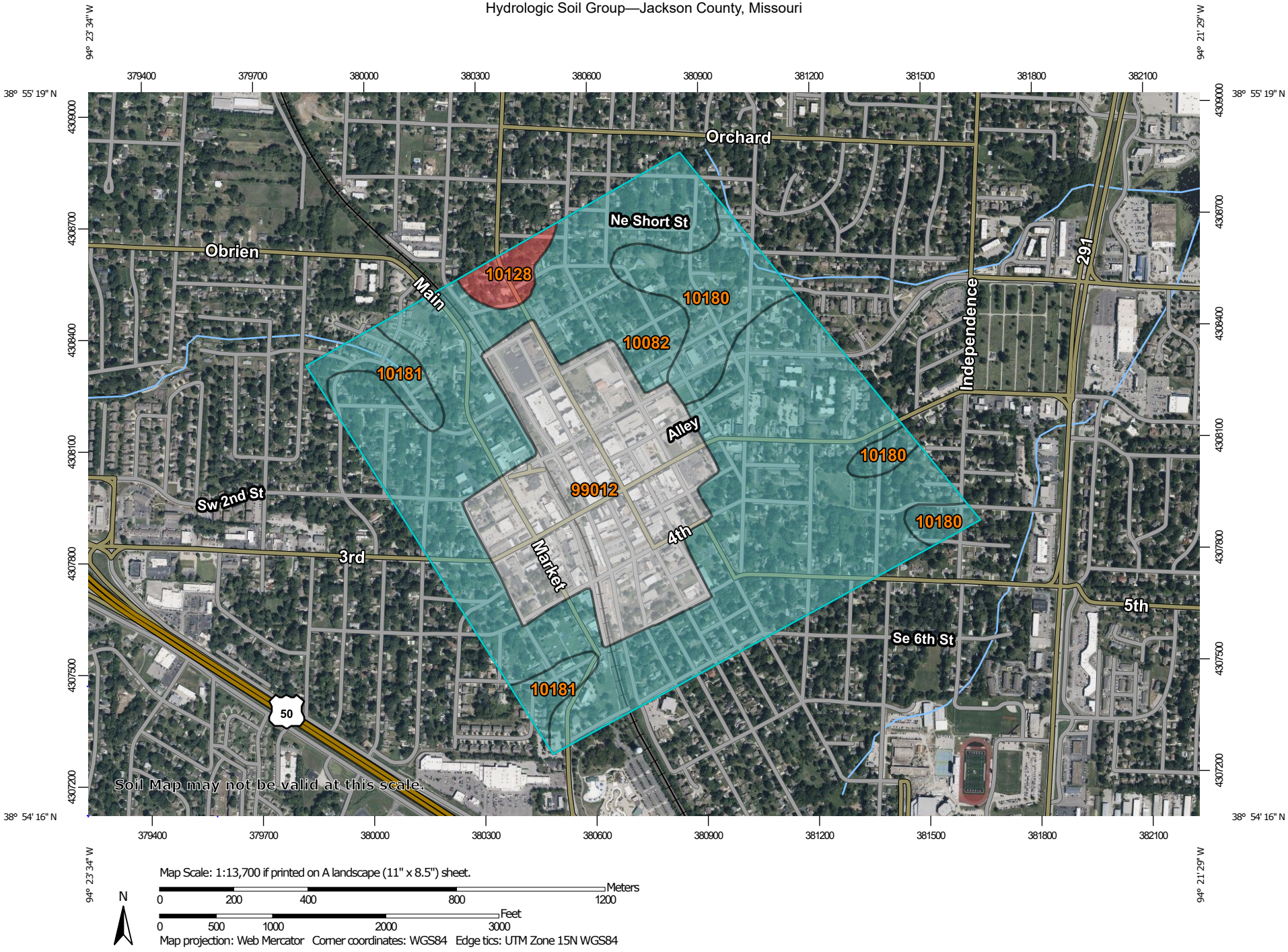
SN	Element ID	Length (ft)	Inlet Invert Elevation (ft)	Inlet Invert Offset (ft)	Outlet Invert Elevation (ft)	Outlet Invert Offset (ft)	Total Drop (ft)	Average Slope (%)	Pipe Shape	Pipe Diameter or Height (in)	Pipe Width (in)	Manning's Roughness	Entrance Losses	Exit/Bend Losses	Additional Losses	Initial Flow (cfs)	Flap Gate	No. of Barrels
1	Link-01	200.00	1002.00	0.00	995.00	0.00	7.00	3.5000	CIRCULAR	36.000	36.000	0.0120	0.5000	0.5000	0.0000	0.00	No	1

Pipe Results

SN	Element ID	Peak Flow	Time of Peak Flow Occurrence	Design Flow Capacity	Peak Flow/ Design Flow Ratio	Peak Flow Velocity	Travel Time	Peak Flow Depth	Peak Flow Depth/ Total Depth Ratio	Total Time Surcharged	Froude Number	Reported Condition
		(cfs)	(days hh:mm)	(cfs)		(ft/sec)	(min)	(ft)		(min)		
1	Link-01	27.77	0 11:56	135.18	0.21	13.61	0.24	0.99	0.33	0.00		Calculated

APPENDIX D

Soil Maps



Map Scale: 1:13,700 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 200 400 800 1200

Feet: 0 500 1000 2000 3000

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 15N WGS84

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Rating Polygons

A

A/D

B

B/D

C

C/D

D

Not rated or not available

Soil Rating Lines

A

A/D

B

B/D

C

C/D

D

Not rated or not available

Soil Rating Points

A

A/D

B

B/D

C

C/D

D

Not rated or not available

Water Features

Streams and Canals

Transportation

Rails

Interstate Highways

US Routes

Major Roads

Local Roads

Background

Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Jackson County, Missouri
Survey Area Data: Version 24, Aug 31, 2022

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Aug 30, 2022—Sep 8, 2022

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
10082	Arisburg-Urban land complex, 1 to 5 percent slopes	C	232.8	60.9%
10128	Sharpsburg-Urban land complex, 2 to 5 percent slopes	D	6.9	1.8%
10180	Udarents-Urban land-Sampsel complex, 2 to 5 percent slopes	C	33.7	8.8%
10181	Udarents-Urban land-Sampsel complex, 5 to 9 percent slopes	C	15.5	4.0%
99012	Urban land, upland, 5 to 9 percent slopes		93.4	24.4%
Totals for Area of Interest			**382.3**	**100.0%**

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

APPENDIX E

FEMA

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.

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 Missouri State Plane West Zone (FIPS zone 2403). 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 U.S.D.A Farm Service National Agriculture ImageryProgram (NAIP) dated 2014. Produced at scale of 1:24,000.

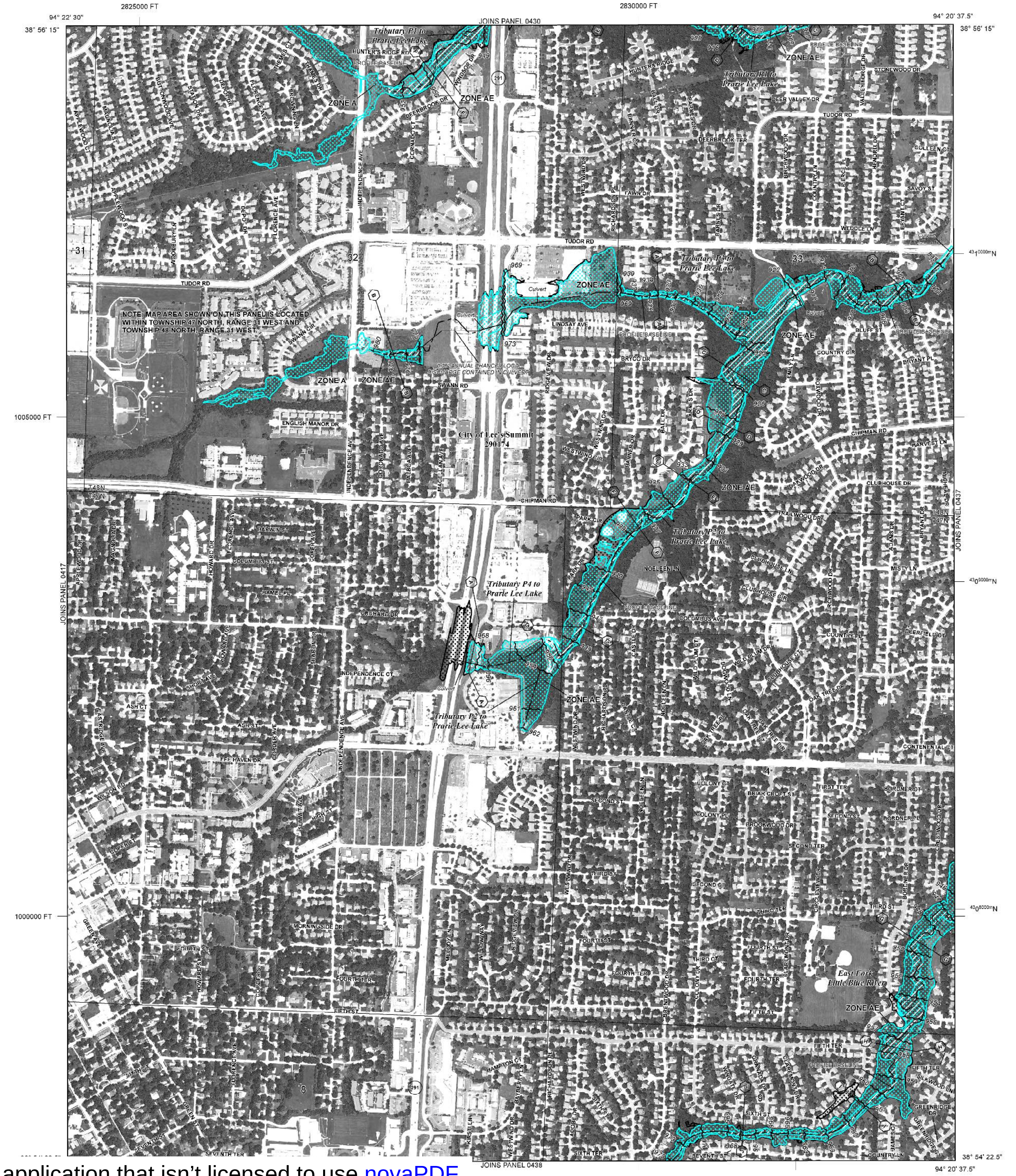
The **profile baselines** depicted on this map represent the hydraulic modeling baselines that match the flood profiles in the FIS report. As a result of improved topographic data, the **profile baseline**, in some cases, may deviate significantly from the channel centerline or appear outside the SFHA.

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.



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: Missouri State Plane West Zone (FIPS Zone 2403), Transverse Mercator projection
DX5510 ×	Bench mark (see explanation in Notes to Users section of this FIRM panel)
• M1.5	River Mile

MAP REPOSITORIES
Refer to Map Repositories list on Map Index

EFFECTIVE DATE OF COUNTYWIDE
FLOOD INSURANCE RATE MAP
September 29, 2006

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL
January 20, 2017 - to change Special Flood Hazard Areas.

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 0436G

FIRM

FLOOD INSURANCE RATE MAP

JACKSON COUNTY, MISSOURI

AND INCORPORATED AREAS

PANEL 436 OF 625

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
LEE'S SUMMIT, CITY OF	290174	0436	G

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
29095C0436G

MAP REVISED
JANUARY 20, 2017

Federal Emergency Management Agency

LEE'S SUMMIT DOWNTOWN MARKET
PRELIMARY DEVELOPMENT PLAN
DRAINAGE STUDY

Lee's Summit, MO

August 2023

Olsson Project No. 022-00393