

Storm Water & Erosion Control Calculations For: **Marathon County – New Highway Garage**

Kronenwetter, WI

Excel Job # 250008600

July 23, 2026

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07/24/2026

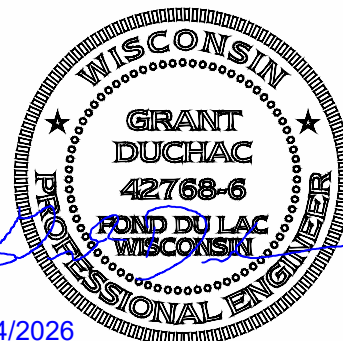


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Introduction

0.1 Existing Conditions

The proposed development site is located on the east side of Old Highway 51 in the Village of Kronenwetter, Wisconsin. The project site is bordered by a parking lot owned by Wisconsin Public Service to the north, the improved rural asphalt roadway of Gate of Heaven Drive to the south, and the unimproved Gate of Heaven Drive right-of-way to the east, beyond which are wooded lands and a cemetery.

Much of the project site consists of vacant open fields. The southernmost approximately 220 feet of the site was previously occupied by four single-family residential properties, and an additional single-family residence was located along Old Highway 51; all have recently been demolished by the property owner. Limited wooded areas remain along portions of the site perimeter, including along the northern and southern property boundaries.

The southern portion of the site is located within FEMA Flood Zone AE, as shown on the effective Flood Insurance Rate Map (FIRM) dated January 13, 2023. The Base Flood Elevation (BFE) for this portion of the site is 1,173.5 feet. Proposed development within this area will be designed to comply with all applicable floodplain regulations.

The majority of the relatively flat project site drains south toward shallow depressional areas, where runoff infiltrates into the native sandy soils. A portion of the site also drains west toward shallow depressions located along the Old Highway 51 right-of-way, where runoff similarly infiltrates into the native sandy soils. There are no defined roadside ditches along Gate of Heaven Drive, and only minimal ditch definition exists along Old Highway 51. Consequently, there is no defined drainage outfall from the site. As a result, runoff is retained on-site and infiltrates into the native sandy soils, with no existing surface drainage outlet from the property.

Existing site conditions are shown in Appendix A.

- Property Area: 25.25 acres

0.2 Proposed Project Overview

The proposed development will consist of three buildings and associated site improvements, including vehicle parking and maneuvering areas, vehicle staging areas, a truck scale, and a fueling area. Stormwater runoff from the proposed development will be directed to a proposed bioretention area located at the south end of the site.

Due to limited relief available for stormwater discharge from the site, the proposed stormwater management plan utilizes a large bioretention area to provide stormwater treatment, reduce peak runoff rates, and provide flood storage volume compensation. Proposed grassed swales

will provide pretreatment of runoff prior to discharge to the bioretention area. The bioretention area will satisfy applicable local and State of Wisconsin stormwater management requirements.

The proposed site can be seen in Appendix B.

- Disturbed Area: 25 acres

1.0 Design Criteria

1.1 Soils

Soil characteristics were determined using Web Soil Survey. See Table 1 for a summary of the soils and hydrologic ratings indicated by Web Soil Survey and Appendix D for the Web Soil Survey map.

Table 1: Web Soil Survey

MAP SYMBOL	SOIL TYPE	HYDROLOGIC RATING
3383B	Mahtomedi loamy sand	A

A total of forty-four (44) soil borings were completed across the project site. The borings encountered subsurface soils consisting primarily of fine sand with minimal silt content. The complete geotechnical investigation, including the boring logs, is provided in Appendix E.

1.2 Rainfall Data

NOAA Atlas 14, Village of Kronenwetter rainfall depths with a type II distribution were used for stormwater calculations.

Table 2: NOAA Atlas 14 24-hour Rainfall Depth

DESIGN STORM	RAINFALL DEPTH (INCHES)
1-YEAR	2.27
2-YEAR	2.60
10-YEAR	3.72
25-YEAR	4.49
100-YEAR	5.82

2.0 Stormwater Management Requirements

2.1 Peak Discharge

Village of Kronenwetter- Maintain or reduce the 1-yr, 2-yr, 10-yr, and 25-yr, 24-hour post development peak runoff discharge rates to the 1-yr, 2-yr, 10-yr, and 25-yr, 24-hour predevelopment peak runoff discharge rates respectively.

Wisconsin DNR- Maintain or reduce the 1-yr and 2-yr, 24-hour post development peak runoff discharge rates to the 1-yr and 2-yr, 24-hour predevelopment peak runoff discharge rates respectively.

Table 3: Maximum Predevelopment Curve Numbers

Predevelopment Condition	Hydrologic Soil Group			
	A	B	C	D
Woodland	30	55	70	77
Grassland	39	61	71	78
Cropland	55	69	78	83

A large bioretention basin will be used to reduce peak flows to predevelopment flows.

Table 4: Runoff Summary

	PREDEVELOPMENT	POST DEVELOPMENT		
DESIGN STORM	Peak Discharge (cfs)	To Bioretention basin (cfs)	Bioretention Pond discharge (cfs)	Difference Post to Pre
1 YR-24 HR	0.00	36.34	0.00	-0.00
2 YR-24 HR	0.00	47.03	0.00	-0.00
10 YR-24HR	0.00	86.13	0.00	-0.00
25 YR-24HR	0.21	114.38	0.00	-0.21
100 YR-24HR	1.20	164.28	0.00	-1.20

Table 5: Bioretention Summary

DESIGN STORM	POND RELEASE RATE (CFS)	STORAGE VOLUME (C.F.)	MAXIMUM ELEVATION (FT)
1 YR-24 HR	0.00	26,852	1,164.72
2 YR-24 HR	0.00	37,976	1,165.00
10 YR-24 HR	0.00	82,515	1,165.97
25 YR-24 HR	0.00	117,464	1,166.62
100 YR-24HR	0.00	184,139	1,167.66

Table 6: 100yr-24hr storm Bioretention summary

POND	EMERGENCY SPILLWAY ELEVATION (FT)	CALCULATED POND ELEVATION (FT)	POND DISCHARGE IN (CFS)	DISCHARGE EXIT POINT
	1,172.10	1,167.66	0.00	Infiltration

Table 4 shows that post development release rates will be less than predevelopment release rates for all design storms. See the construction plans for pond design and Appendix C for peak discharge calculations.

Therefore, peak discharge requirements are met.

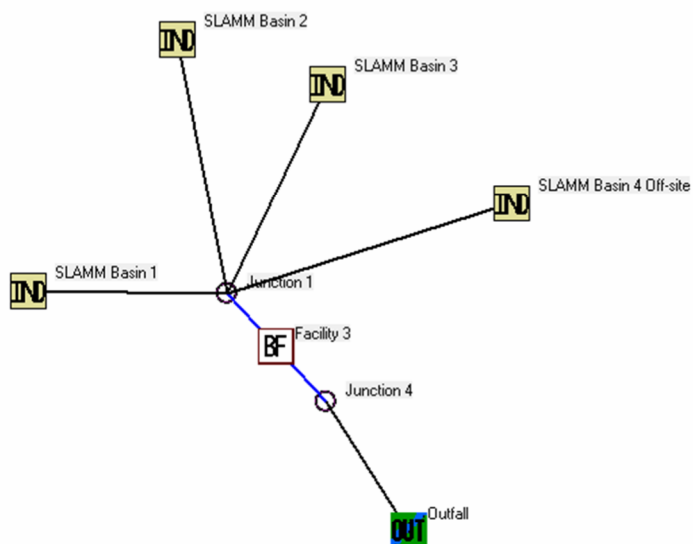
2.2 Stormwater Quality

Wisconsin DNR and Village of Kronenwetter- The site is considered a new development project and will be required to remove 80% of total suspended solids (TSS) from site runoff.

See Table 7 for a summary of stormwater quality requirements.

Table 7: Stormwater Quality Summary

TSS REMOVAL REQUIRED (LBS)	TSS REMOVAL PROVIDED (LBS)
5,426	6,783



Outfall Output Summary

	Runoff Volume (cu. ft.)	Percent Runoff Reduction	Runoff Coefficient (Rv)	Particulate Solids Conc. (mg/L)	Particulate Solids Yield (lbs)	Percent Particulate Solids Reduction
Total of All Land Uses without Controls	804794		0.26	135.0	6783	
Outfall Total with Controls	0	100.00 %	0.00	0	0	100.00 %
Current File Output: Annualized Total After Outfall Controls	0	Years in Model Run:	0.99		0	

Pollutant	Concen- tration - No Controls	Concen- tration - With Controls	Concen- tration Units	Pollutant Yield - No Controls	Pollutant Yield - With Controls	Pollutant Yield Units	Percent Yield Reduction
Particulate Solids	135.0	0	mg/L	6783	0	lbs	100.00 %
Particulate Phosphorus	0.1650	0	mg/L	8.291	0	lbs	100.00 %

Print Output Summary to .csv File

Print Output Summary to Text File

Print Output Summary to Printer

Total Area Modeled (ac)

30.370

A biofilter will clog. Review biofilter control practice summary tab to determine which biofilter it is.

Total Control Practice Costs

Capital Cost	N/A
Land Cost	N/A
Annual Maintenance Cost	N/A
Present Value of All Costs	N/A
Annualized Value of All Costs	N/A

Perform Outfall
Flow Duration
Curve Calculations

Receiving Water Impacts Due To Stormwater Runoff

(CWP Impervious Cover Model)

	Calculated Rv	Approximate Urban Stream Classification
Without Controls	0.26	Poor
With Controls	0.00	Good

A bioretention basin will be used to treat stormwater drainage from the site. SLAMM analysis was used to determine the quantity of suspended solids that will be removed by the proposed bioretention area. The proposed site will create 6,783 lbs of TSS and the proposed bioretention basins will reduce TSS to 000.0 lbs, which results in an 100.00% reduction in TSS release.

Since the proposed bioretention basin removes 100% of suspended solids, the removal rate is greater than the required 80%.

Therefore, stormwater quality requirements have been met.

2.3 Infiltration

Village of Kronenwetter requirements- Infiltrate sufficient runoff volume so that the post-development infiltration volume shall be at least 60% of the pre-development infiltration volume, based on an average annual rainfall. However, no more than 2% of the post-construction site is required as an effective infiltration area.

Wisconsin DNR requirements- Infiltrate sufficient runoff volume so that the post-development infiltration volume shall be at least 60% of the pre-development infiltration volume, based on an average annual rainfall. However, no more than 2% of the post-construction site is required as an effective infiltration area.

Site Proposed Infiltration – Although the proposed development is classified as a Type 2 Transportation Facility and stormwater infiltration from vehicle storage and loading areas would typically be prohibited under NR 151.124(3)(a)2, NR 151.124(3)(a)3, and Section 270-22.C.(3)(c)1.b of the Village of Kronenwetter Stormwater Management Ordinance, the site has no available surface drainage outlet. As a result, the proposed stormwater management plan utilizes grass swales as pretreatment to a large bioretention basin that will provide treatment of stormwater runoff prior to infiltration into the native sandy soils. This approach provides effective water quality treatment while preserving the site's existing hydrologic conditions and accommodating the lack of a feasible discharge location.

Area provided:

Grassed Biofiltration = 34,587 sf of surface area

The proposed development encompasses 1,103,518 square feet, resulting in a maximum required infiltration area of 22,070 square feet. Soil borings completed across the site consistently encountered fine sand with minimal silt content. Based on the Wisconsin DNR Evaluation for Infiltration Standard (1002), the site soils have an estimated infiltration rate of 3.60 in/hr.

Hydraulic modeling indicates that the maximum water surface elevation within the bioretention basin during the 100-year storm is Elevation 1,167.66 feet, occurring approximately 13.78 hours

into the event. This corresponds to a maximum ponding depth of 2.94 feet (35.3 inches) above the basin bottom. At an infiltration rate of 3.60 in/hr, this ponded depth would infiltrate in approximately 10 hours. Therefore, even under the 100-year storm event, the bioretention basin is expected to completely drain within 24 hours, satisfying the Wisconsin DNR maximum drawdown requirement.

Therefore, Infiltration requirements are met.

3.0 Storm Sewer Design

All storm sewer has been sized for the 100-yr 24-hour post development rainfall event.

See Appendix F, Appendix G, and Appendix H for pipe drainage areas and pipe sizing calculations.

3.1 Emergency Overflow Route

The ultimate emergency overflow route for the site is through a low point located on the south side of the bioretention basin to the right-of-way of Gate of Heaven Drive.

4.0 Erosion Control

The erosion control specifications, construction sequence, site stabilization notes, seeding notes, and dewatering notes will be included on sheet C0.2 of the construction plan set.

5.0 Floodplain Compensation

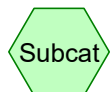
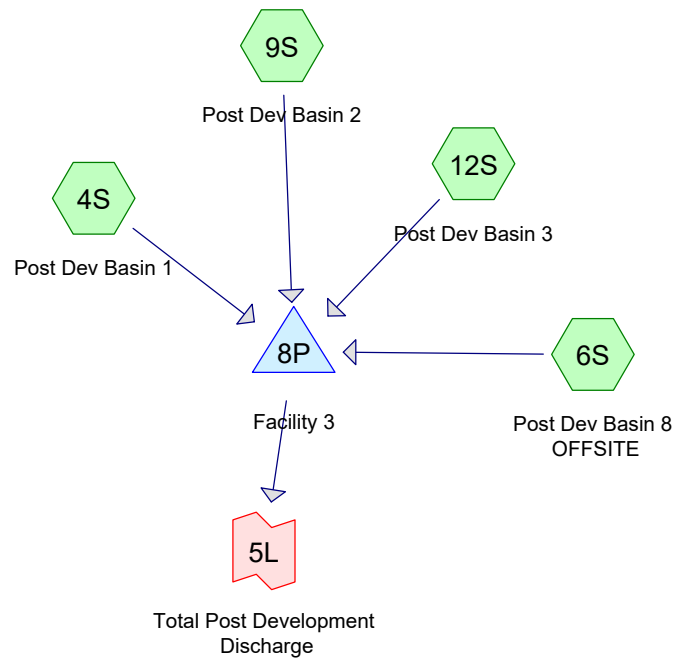
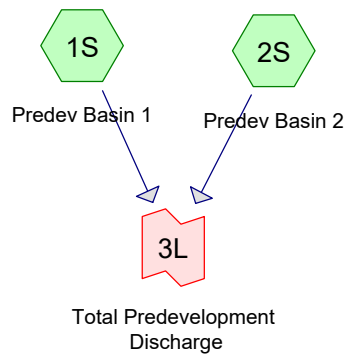
The calculations provided in Appendix J demonstrate that the post-development conditions will provide a greater volume of floodplain storage than exists under pre-development conditions per the village floodplain code. The calculated pre-developed on-site floodplain is 10,479 cu.yds. or 282,933 cu.ft. of storage between the Base Flood Elevation (BFE) of 1,173.5 feet and the existing ground elevations. Floodplain storage compensation will be provided within the proposed bioretention basin between the calculated 100-year water surface elevation and the Base Flood Elevation (BFE) of 1,173.5 feet. The available storage between the calculated 100-year water surface and the spillway elevation of 1,172.1 feet in the bioretention basin is 494,086 cu.ft., or 211,153 cu.ft. more than the existing on-site floodplain storage. This storage does not include additional storage above the spillway and additional floodplain storage compensation that is also provided within the proposed grassed drainage ditches that convey runoff to the bioretention basin. As a result, the proposed development will provide a net increase in floodplain storage, with no loss of flood storage capacity.

Appendix A: Pre-Development Basin Area(s)



Appendix B: Post Development Basin Area(s)

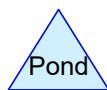
Appendix C: Peak Discharge Calculations



Subcat



Reach



Pond



Link

Routing Diagram for 250008600-Peak Discharge
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250008600-Peak Discharge

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Rainfall Events Listing

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	1-yr	Type II 24-hr		Default	24.00	1	2.27	2
2	2-yr	Type II 24-hr		Default	24.00	1	2.60	2
3	10-yr	Type II 24-hr		Default	24.00	1	3.72	2
4	25-yr	Type II 24-hr		Default	24.00	1	4.49	2
5	100-yr	Type II 24-hr		Default	24.00	1	5.82	2

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Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
12.214	39	>75% Grass cover, Good, HSG A (4S, 6S, 9S, 12S)
0.591	98	Asphalt/Concrete Pavement (2S)
0.050	98	Driveway (1S)
14.461	39	Grassland (1S, 2S)
12.563	98	Pavement (4S, 9S, 12S)
0.435	98	Roofs (1S, 2S)
5.599	98	Unconnected roofs, HSG A (12S)
9.797	30	Woodland (1S, 2S)
55.710	58	TOTAL AREA

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Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
17.813	HSG A	4S, 6S, 9S, 12S
0.000	HSG B	
0.000	HSG C	
0.000	HSG D	
37.897	Other	1S, 2S, 4S, 9S, 12S
55.710		TOTAL AREA

250008600-Peak Discharge

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Type II 24-hr 1-yr Rainfall=2.27"

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Summary for Subcatchment 1S: Predev Basin 1

Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Depth= 0.00"

Routed to Link 3L : Total Predevelopment Discharge

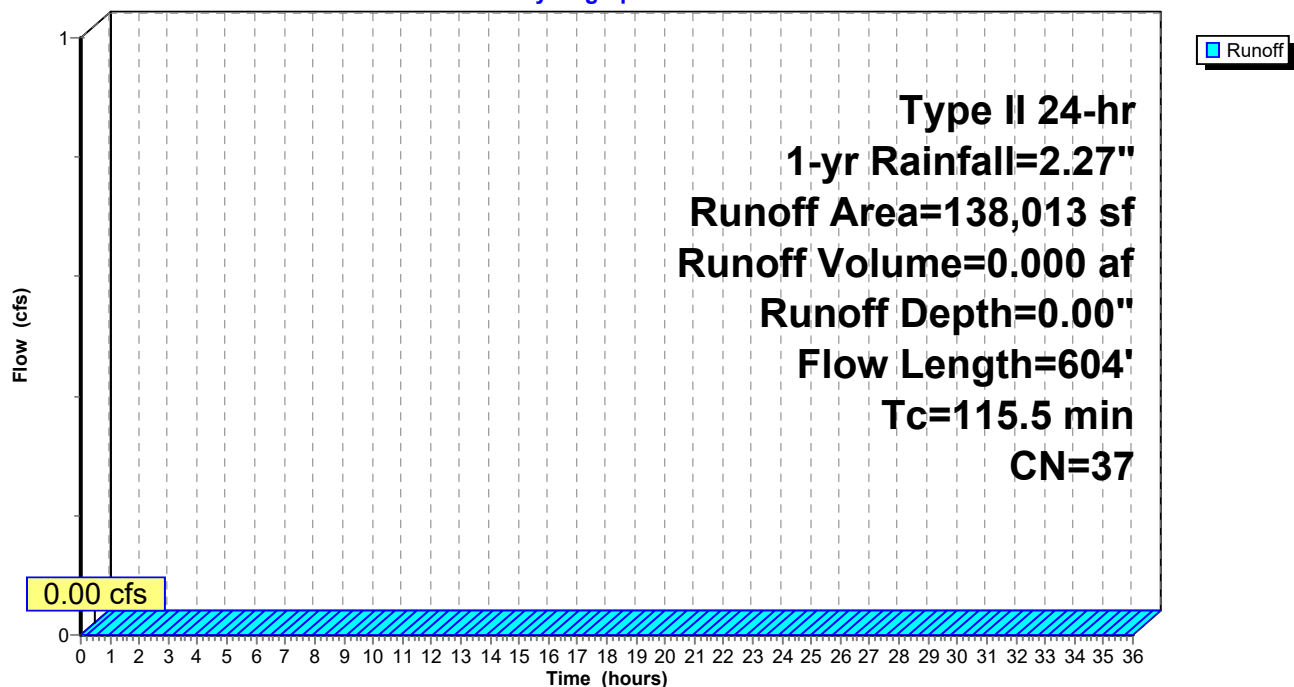
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type II 24-hr 1-yr Rainfall=2.27"

Area (sf)	CN	Description
* 81,247	39	Grassland
* 52,683	30	Woodland
* 1,886	98	Roofs
* 2,197	98	Driveway
138,013	37	Weighted Average
133,930		97.04% Pervious Area
4,083		2.96% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
93.8	100	0.0026	0.02		Sheet Flow, Sheet Flow
					Woods: Dense underbrush n= 0.800 P2= 2.60"
21.7	504	0.0060	0.39		Shallow Concentrated Flow, Shallow Concentrated Flow
					Woodland Kv= 5.0 fps
115.5	604	Total			

Subcatchment 1S: Predev Basin 1

Hydrograph



250008600-Peak Discharge

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Type II 24-hr 1-yr Rainfall=2.27"

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Summary for Subcatchment 2S: Predev Basin 2

Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Depth= 0.00"

Routed to Link 3L : Total Predevelopment Discharge

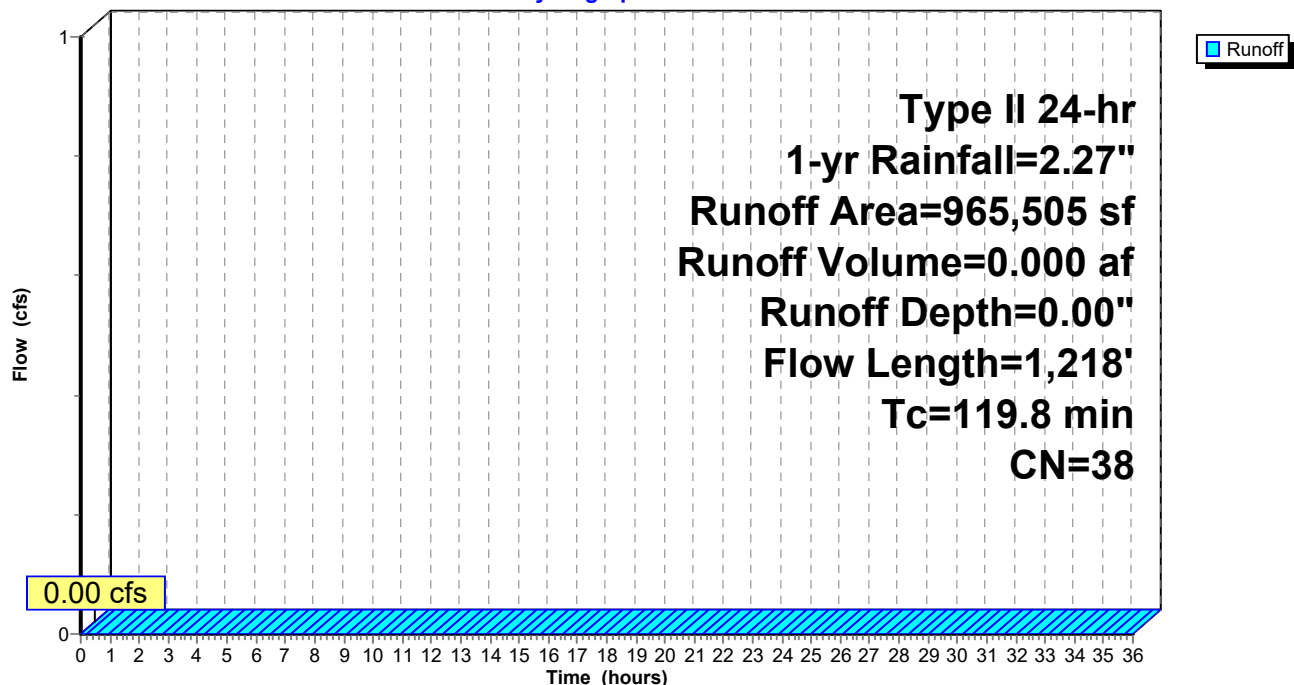
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type II 24-hr 1-yr Rainfall=2.27"

	Area (sf)	CN	Description
*	374,075	30	Woodland
*	548,653	39	Grassland
*	17,043	98	Roofs
*	25,734	98	Asphalt/Concrete Pavement
	965,505	38	Weighted Average
	922,728		95.57% Pervious Area
	42,777		4.43% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
71.6	100	0.0051	0.02		Sheet Flow, Sheet Flow
					Woods: Dense underbrush n= 0.800 P2= 2.60"
12.8	227	0.0035	0.30		Shallow Concentrated Flow, Shallow Concentrated Flow - Wood
					Woodland Kv= 5.0 fps
35.4	891	0.0036	0.42		Shallow Concentrated Flow, Shallow Concentrated Flow - Grass
					Short Grass Pasture Kv= 7.0 fps
119.8	1,218	Total			

Subcatchment 2S: Predev Basin 2

Hydrograph



250008600-Peak Discharge

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Type II 24-hr 1-yr Rainfall=2.27"

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Summary for Subcatchment 4S: Post Dev Basin 1

Runoff = 0.67 cfs @ 12.01 hrs, Volume= 0.047 af, Depth= 0.24"
Routed to Pond 8P : Facility 3

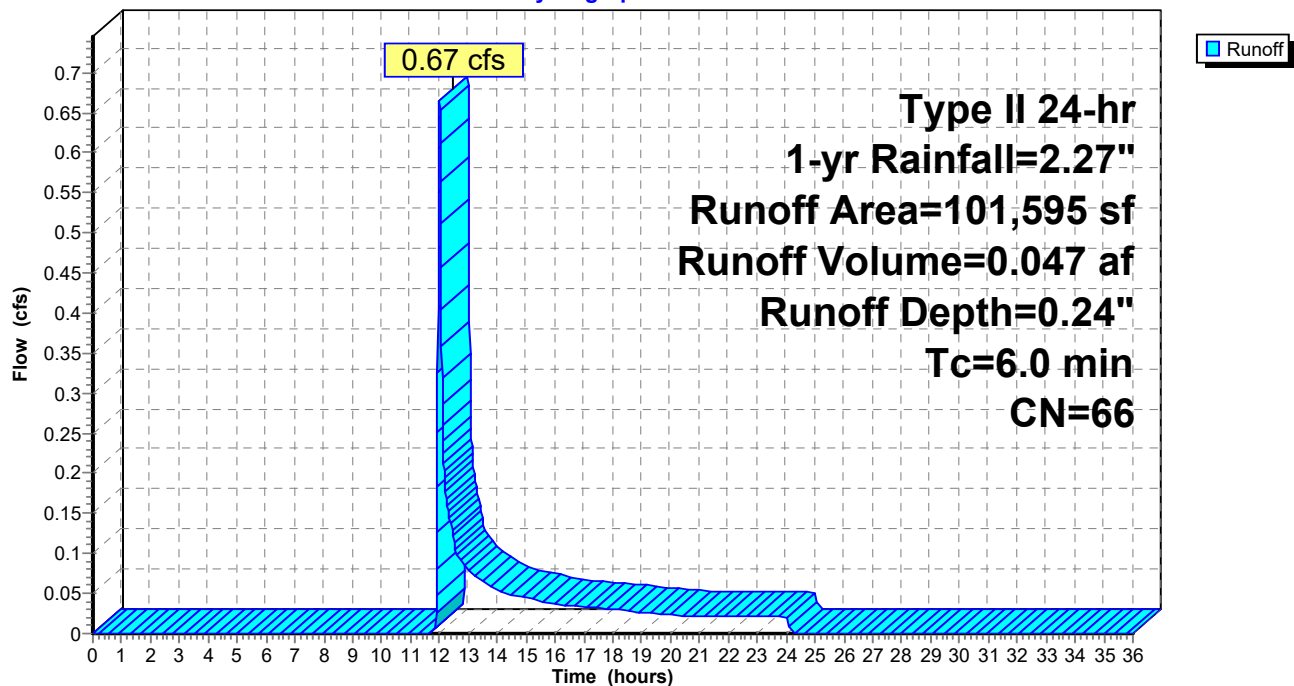
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type II 24-hr 1-yr Rainfall=2.27"

	Area (sf)	CN	Description
	0	98	Unconnected roofs, HSG A
*	46,660	98	Pavement
	54,935	39	>75% Grass cover, Good, HSG A
	101,595	66	Weighted Average
	54,935		54.07% Pervious Area
	46,660		45.93% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry,

Subcatchment 4S: Post Dev Basin 1

Hydrograph



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Type II 24-hr 1-yr Rainfall=2.27"

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Summary for Subcatchment 6S: Post Dev Basin 8 OFFSITE

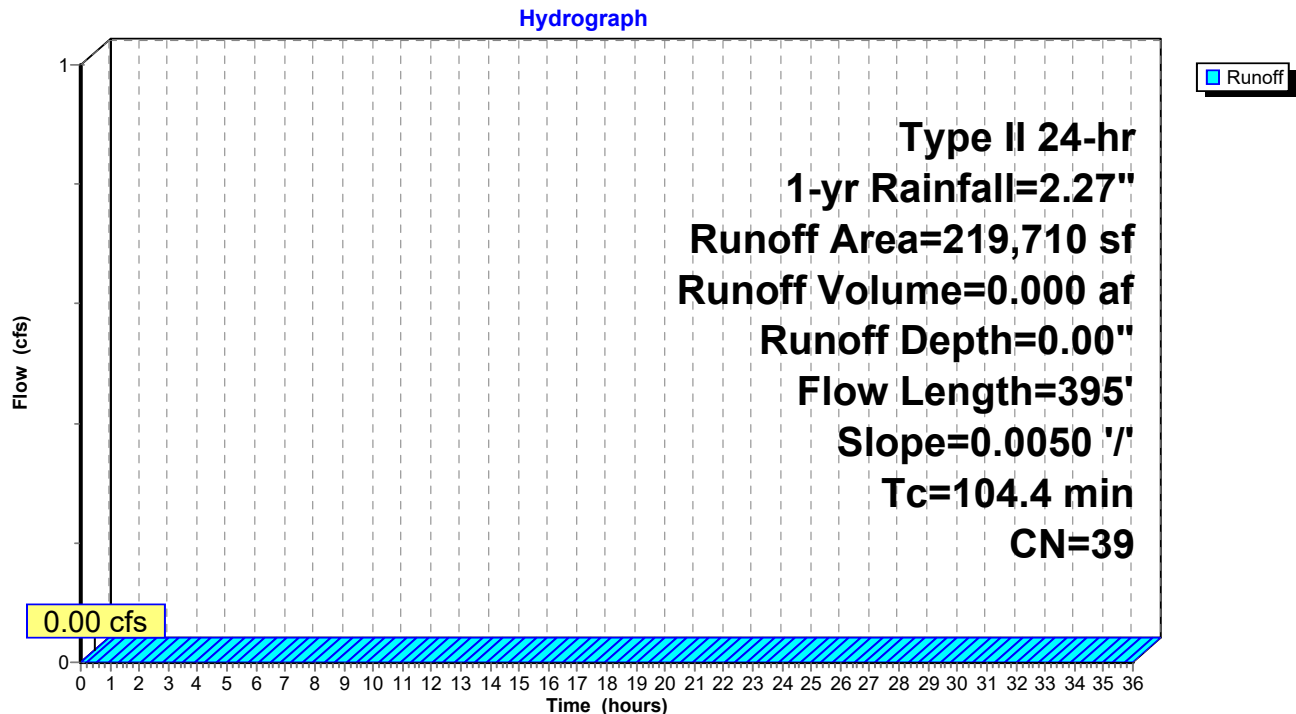
Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Depth= 0.00"

Routed to Pond 8P : Facility 3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type II 24-hr 1-yr Rainfall=2.27"

Area (sf)	CN	Description
0	98	Unconnected roofs, HSG A
* 0	98	Pavement
219,710	39	>75% Grass cover, Good, HSG A
219,710	39	Weighted Average
219,710		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
99.9	300	0.0050	0.05		Sheet Flow,
					Woods: Light underbrush n= 0.400 P2= 2.60"
4.5	95	0.0050	0.35		Shallow Concentrated Flow,
					Woodland Kv= 5.0 fps
104.4	395	Total			

Subcatchment 6S: Post Dev Basin 8 OFFSITE

250008600-Peak Discharge

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Type II 24-hr 1-yr Rainfall=2.27"

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Summary for Subcatchment 9S: Post Dev Basin 2

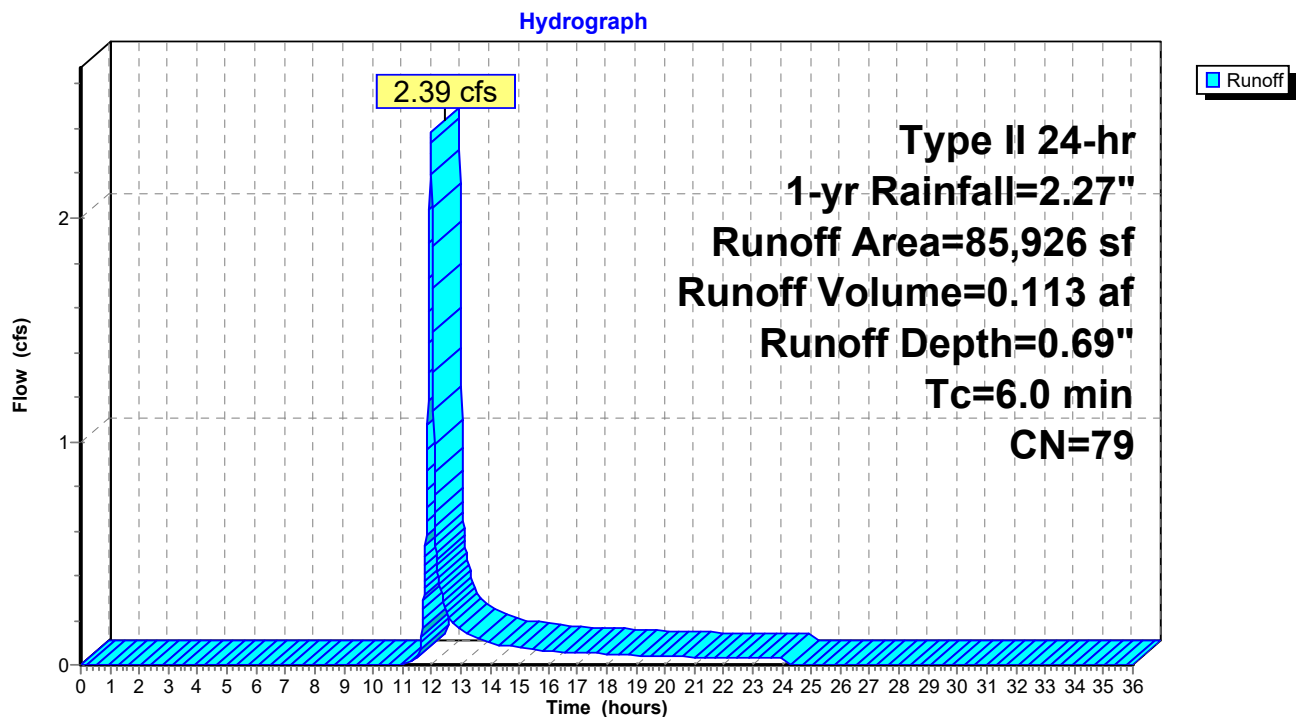
Runoff = 2.39 cfs @ 11.98 hrs, Volume= 0.113 af, Depth= 0.69"
Routed to Pond 8P : Facility 3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type II 24-hr 1-yr Rainfall=2.27"

	Area (sf)	CN	Description
	0	98	Unconnected roofs, HSG A
*	57,653	98	Pavement
	28,273	39	>75% Grass cover, Good, HSG A
*	0	96	Gravel
	85,926	79	Weighted Average
	28,273		32.90% Pervious Area
	57,653		67.10% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry,

Subcatchment 9S: Post Dev Basin 2



250008600-Peak Discharge

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Type II 24-hr 1-yr Rainfall=2.27"

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Summary for Subcatchment 12S: Post Dev Basin 3

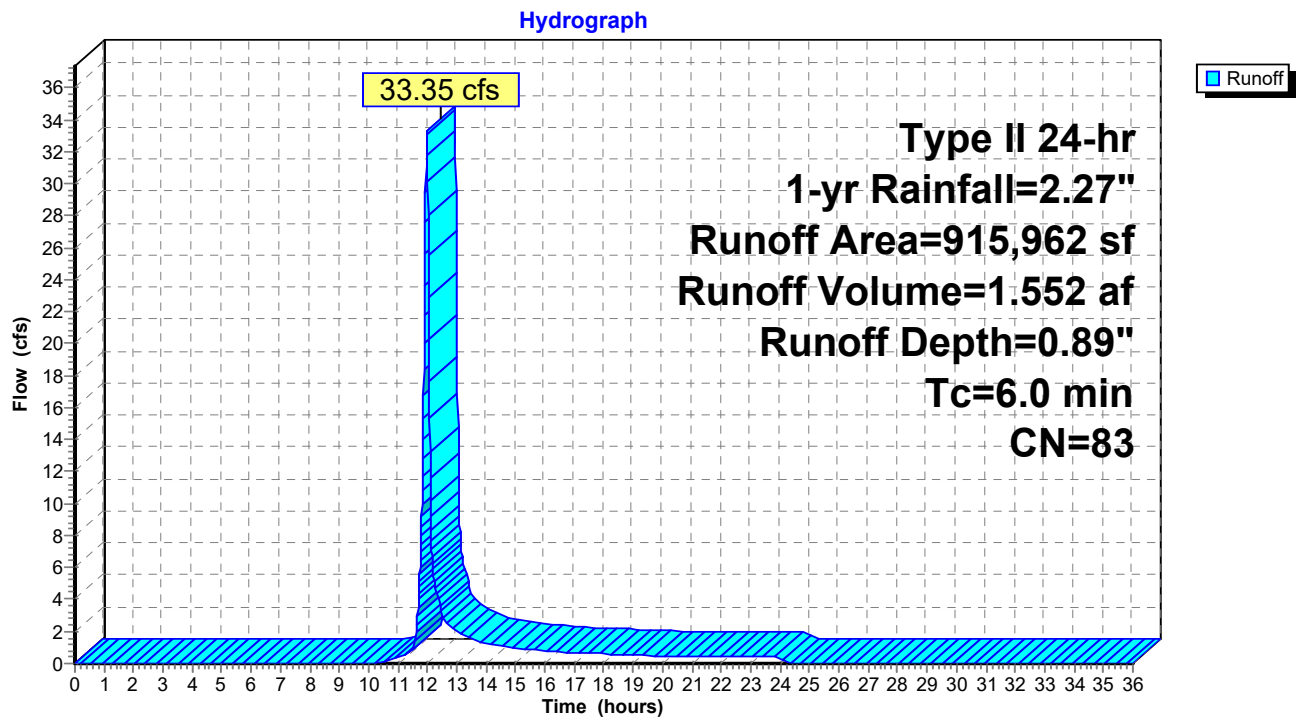
Runoff = 33.35 cfs @ 11.98 hrs, Volume= 1.552 af, Depth= 0.89"
Routed to Pond 8P : Facility 3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type II 24-hr 1-yr Rainfall=2.27"

	Area (sf)	CN	Description
	243,892	98	Unconnected roofs, HSG A
*	442,952	98	Pavement
	229,118	39	>75% Grass cover, Good, HSG A
*	0	96	Gravel
	915,962	83	Weighted Average
	229,118		25.01% Pervious Area
	686,844		74.99% Impervious Area
	243,892		35.51% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry,

Subcatchment 12S: Post Dev Basin 3



250008600-Peak Discharge

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Type II 24-hr 1-yr Rainfall=2.27"

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Summary for Pond 8P: Facility 3

Inflow Area = 30.376 ac, 59.79% Impervious, Inflow Depth = 0.68" for 1-yr event
 Inflow = 36.34 cfs @ 11.98 hrs, Volume= 1.711 af
 Outflow = 3.31 cfs @ 12.53 hrs, Volume= 1.711 af, Atten= 91%, Lag= 33.3 min
 Discarded = 3.31 cfs @ 12.53 hrs, Volume= 1.711 af
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
 Routed to Link 5L : Total Post Development Discharge

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
 Peak Elev= 1,164.72' @ 12.53 hrs Surf.Area= 39,748 sf Storage= 26,852 cf

Plug-Flow detention time= 64.5 min calculated for 1.711 af (100% of inflow)
 Center-of-Mass det. time= 64.5 min (915.0 - 850.5)

Volume	Invert	Avail.Storage	Storage Description
#1	1,164.00'	880,194 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,164.00	34,587	0	0
1,165.00	41,730	38,159	38,159
1,166.00	50,355	46,043	84,201
1,167.00	62,117	56,236	140,437
1,168.00	75,751	68,934	209,371
1,169.00	90,953	83,352	292,723
1,170.00	108,072	99,513	392,236
1,171.00	128,981	118,527	510,762
1,172.00	173,543	151,262	662,024
1,173.00	262,797	218,170	880,194

Device	Routing	Invert	Outlet Devices
#1	Discarded	1,164.00'	3.600 in/hr Exfiltration over Surface area Phase-In= 0.01'
#2	Primary	1,172.10'	15.0' long x 4.0' breadth Broad-Crested Rectangular Weir
			Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00
			2.50 3.00 3.50 4.00 4.50 5.00 5.50
			Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66
			2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Discarded OutFlow Max=3.31 cfs @ 12.53 hrs HW=1,164.72' (Free Discharge)

↑ **1=Exfiltration** (Exfiltration Controls 3.31 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=1,164.00' TW=0.00' (Dynamic Tailwater)

↑ **2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

250008600-Peak Discharge

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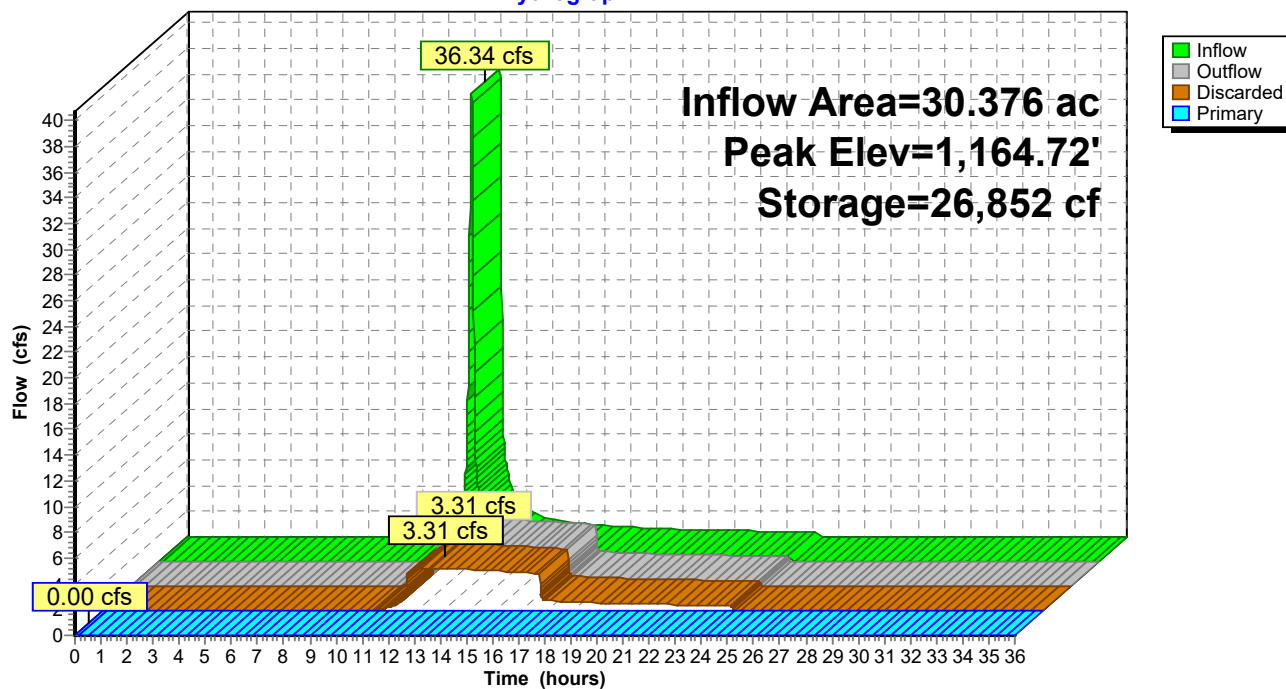
Type II 24-hr 1-yr Rainfall=2.27"

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Pond 8P: Facility 3

Hydrograph



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Type II 24-hr 1-yr Rainfall=2.27"

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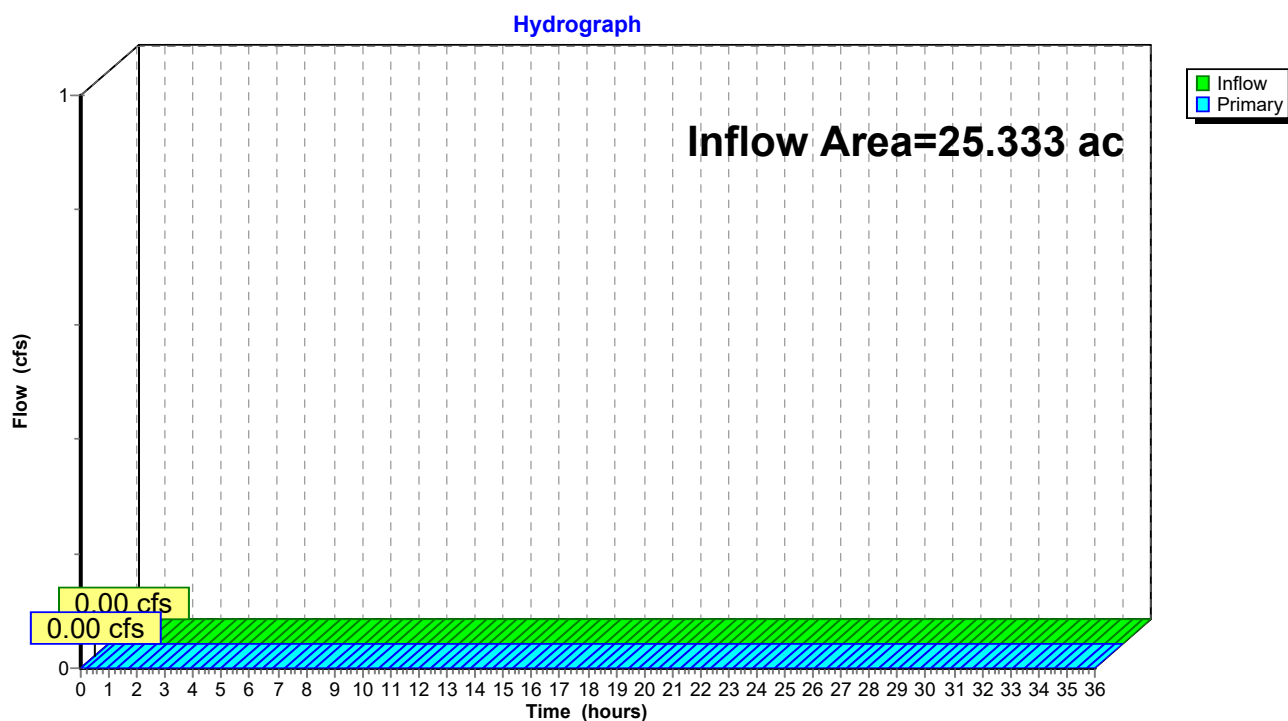
Page 13

Summary for Link 3L: Total Predevelopment Discharge

Inflow Area = 25.333 ac, 4.25% Impervious, Inflow Depth = 0.00" for 1-yr event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Link 3L: Total Predevelopment Discharge



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Type II 24-hr 1-yr Rainfall=2.27"

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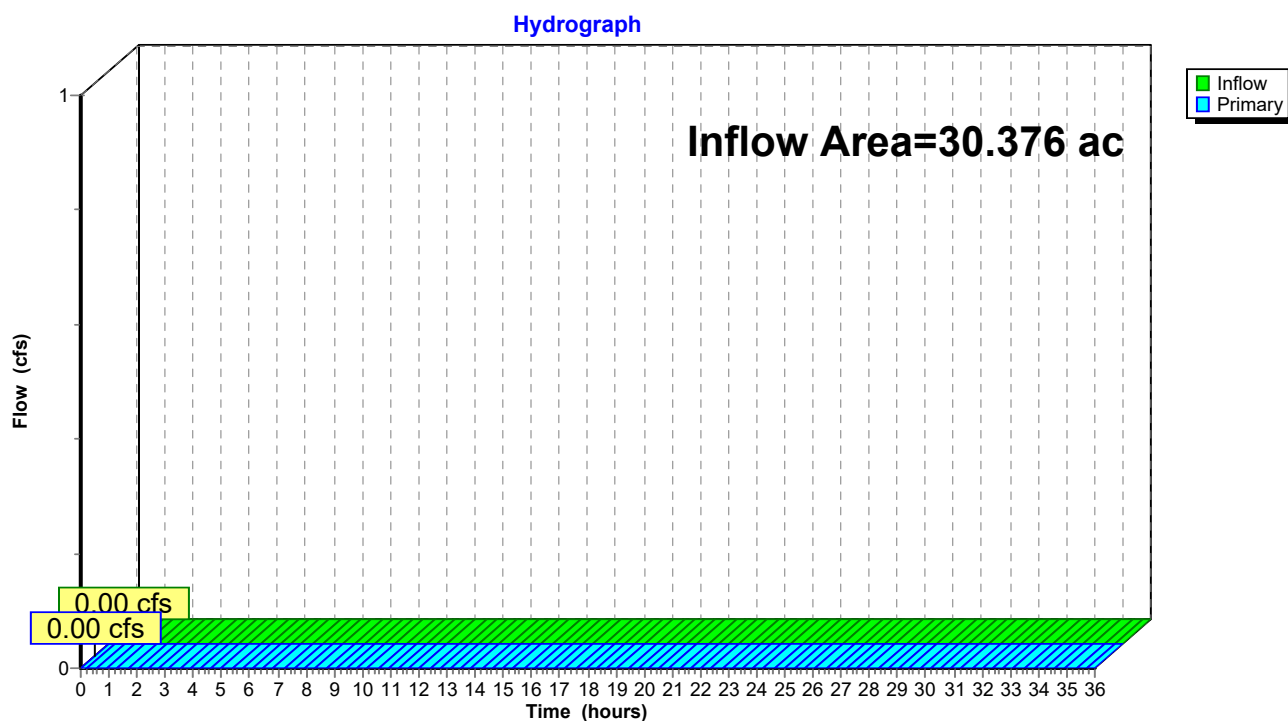
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Summary for Link 5L: Total Post Development Discharge

Inflow Area = 30.376 ac, 59.79% Impervious, Inflow Depth = 0.00" for 1-yr event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Link 5L: Total Post Development Discharge



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Type II 24-hr 2-yr Rainfall=2.60"

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Summary for Subcatchment 1S: Predev Basin 1

Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Depth= 0.00"

Routed to Link 3L : Total Predevelopment Discharge

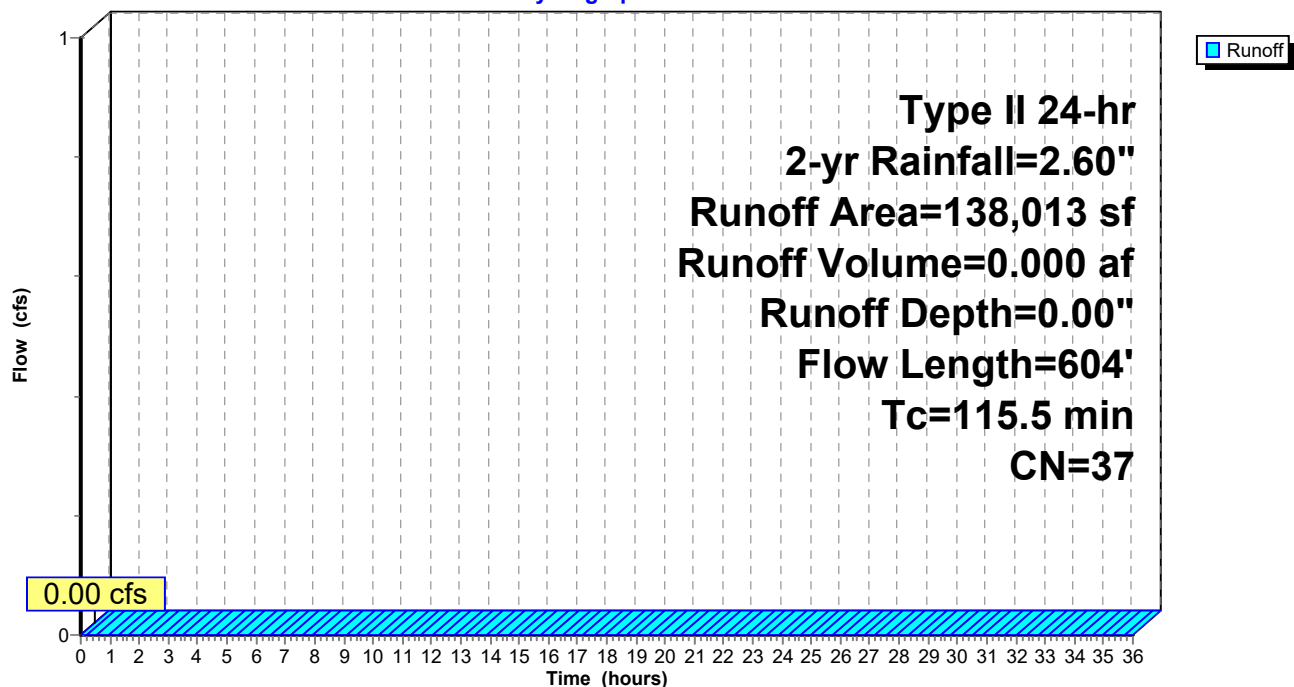
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type II 24-hr 2-yr Rainfall=2.60"

Area (sf)	CN	Description
* 81,247	39	Grassland
* 52,683	30	Woodland
* 1,886	98	Roofs
* 2,197	98	Driveway
138,013	37	Weighted Average
133,930		97.04% Pervious Area
4,083		2.96% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
93.8	100	0.0026	0.02		Sheet Flow, Sheet Flow
					Woods: Dense underbrush n= 0.800 P2= 2.60"
21.7	504	0.0060	0.39		Shallow Concentrated Flow, Shallow Concentrated Flow
					Woodland Kv= 5.0 fps
115.5	604	Total			

Subcatchment 1S: Predev Basin 1

Hydrograph



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Type II 24-hr 2-yr Rainfall=2.60"

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Summary for Subcatchment 2S: Predev Basin 2

Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Depth= 0.00"

Routed to Link 3L : Total Predevelopment Discharge

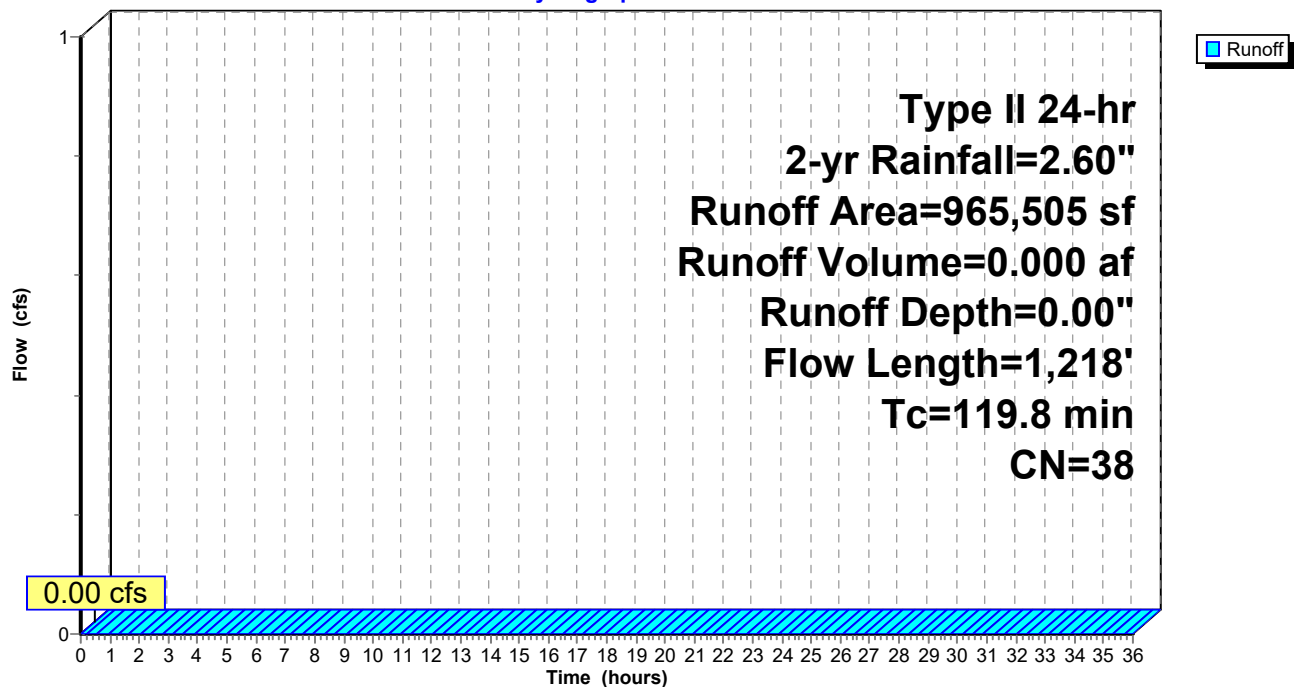
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type II 24-hr 2-yr Rainfall=2.60"

	Area (sf)	CN	Description
*	374,075	30	Woodland
*	548,653	39	Grassland
*	17,043	98	Roofs
*	25,734	98	Asphalt/Concrete Pavement
	965,505	38	Weighted Average
	922,728		95.57% Pervious Area
	42,777		4.43% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
71.6	100	0.0051	0.02		Sheet Flow, Sheet Flow
					Woods: Dense underbrush n= 0.800 P2= 2.60"
12.8	227	0.0035	0.30		Shallow Concentrated Flow, Shallow Concentrated Flow - Wood
					Woodland Kv= 5.0 fps
35.4	891	0.0036	0.42		Shallow Concentrated Flow, Shallow Concentrated Flow - Grass
					Short Grass Pasture Kv= 7.0 fps
119.8	1,218	Total			

Subcatchment 2S: Predev Basin 2

Hydrograph



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Type II 24-hr 2-yr Rainfall=2.60"

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Summary for Subcatchment 4S: Post Dev Basin 1

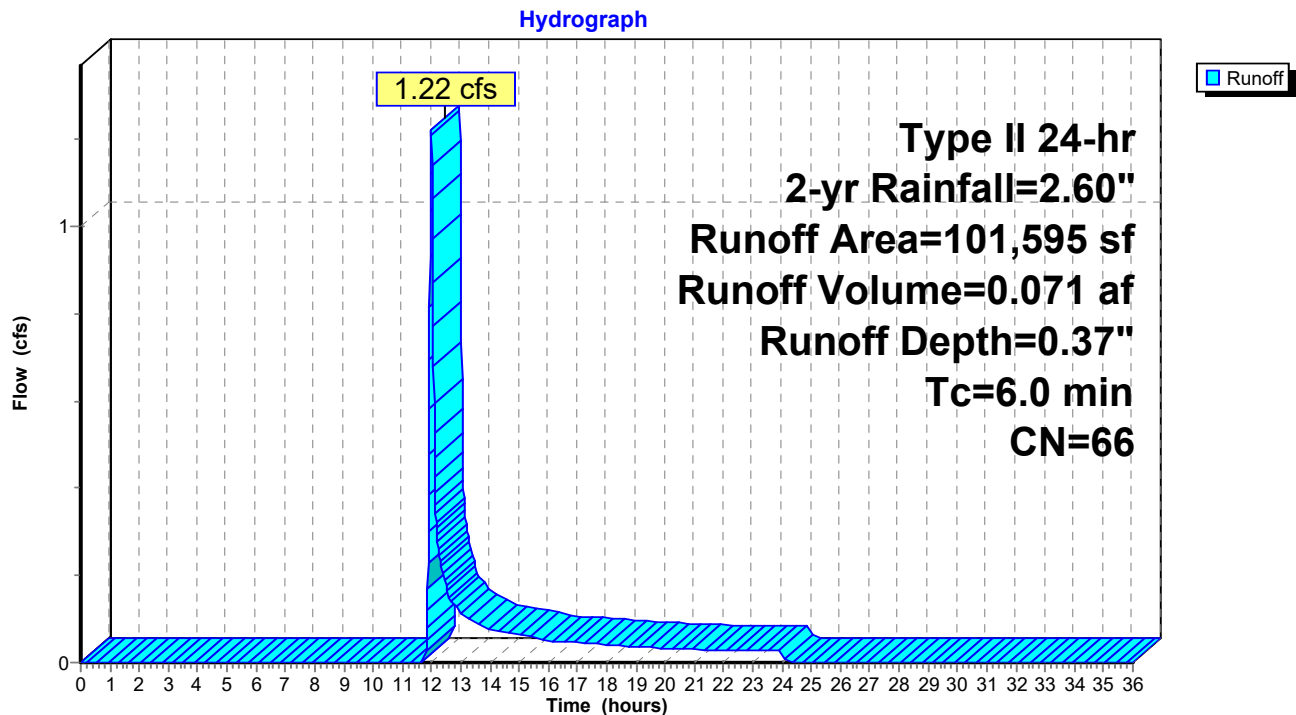
Runoff = 1.22 cfs @ 12.00 hrs, Volume= 0.071 af, Depth= 0.37"
Routed to Pond 8P : Facility 3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type II 24-hr 2-yr Rainfall=2.60"

	Area (sf)	CN	Description
	0	98	Unconnected roofs, HSG A
*	46,660	98	Pavement
	54,935	39	>75% Grass cover, Good, HSG A
	101,595	66	Weighted Average
	54,935		54.07% Pervious Area
	46,660		45.93% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry,

Subcatchment 4S: Post Dev Basin 1



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Type II 24-hr 2-yr Rainfall=2.60"

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Summary for Subcatchment 6S: Post Dev Basin 8 OFFSITE

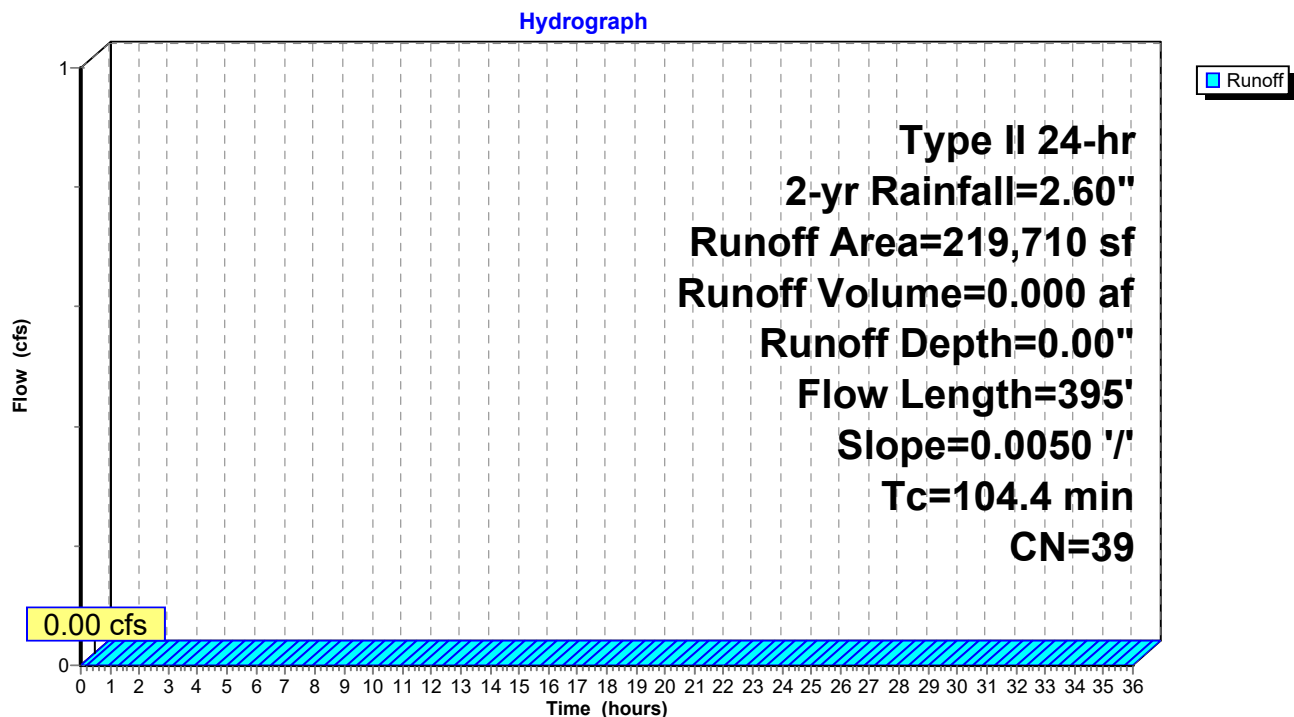
Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Depth= 0.00"

Routed to Pond 8P : Facility 3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type II 24-hr 2-yr Rainfall=2.60"

Area (sf)	CN	Description
0	98	Unconnected roofs, HSG A
* 0	98	Pavement
219,710	39	>75% Grass cover, Good, HSG A
219,710	39	Weighted Average
219,710		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
99.9	300	0.0050	0.05		Sheet Flow,
					Woods: Light underbrush n= 0.400 P2= 2.60"
4.5	95	0.0050	0.35		Shallow Concentrated Flow,
					Woodland Kv= 5.0 fps
104.4	395	Total			

Subcatchment 6S: Post Dev Basin 8 OFFSITE

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Type II 24-hr 2-yr Rainfall=2.60"

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Summary for Subcatchment 9S: Post Dev Basin 2

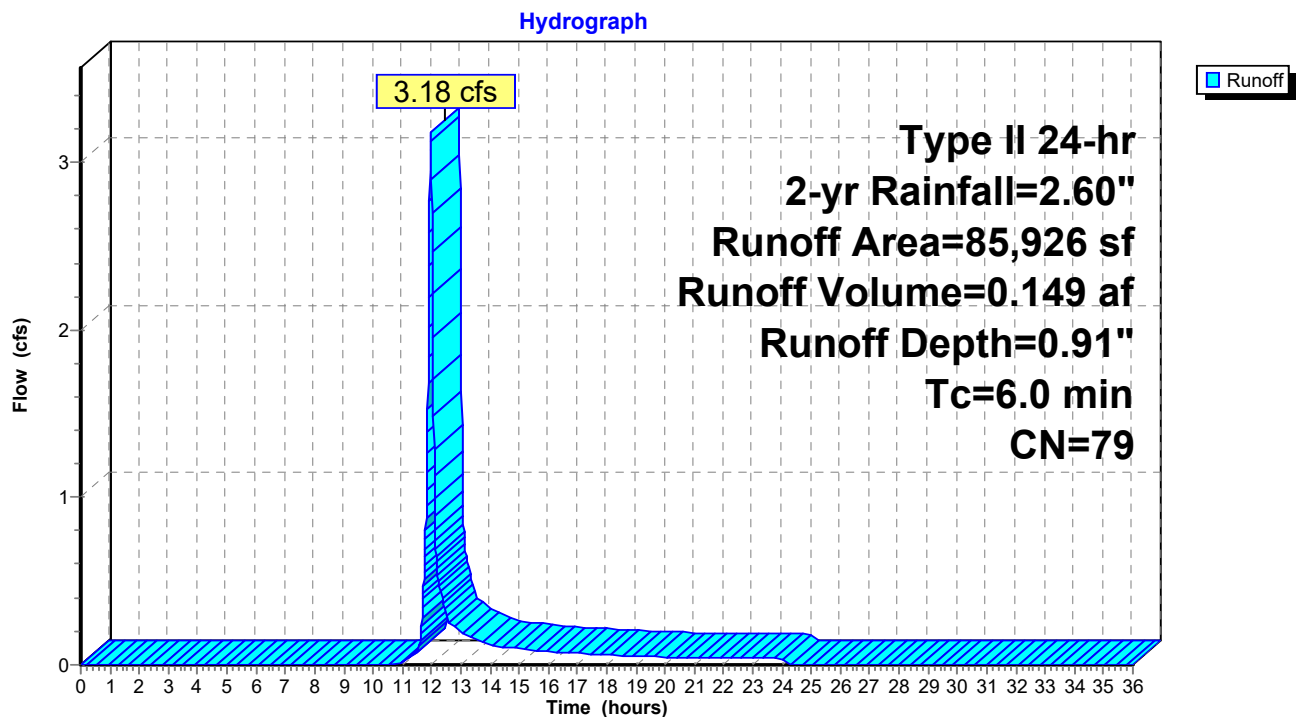
Runoff = 3.18 cfs @ 11.98 hrs, Volume= 0.149 af, Depth= 0.91"
Routed to Pond 8P : Facility 3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type II 24-hr 2-yr Rainfall=2.60"

	Area (sf)	CN	Description
	0	98	Unconnected roofs, HSG A
*	57,653	98	Pavement
	28,273	39	>75% Grass cover, Good, HSG A
*	0	96	Gravel
	85,926	79	Weighted Average
	28,273		32.90% Pervious Area
	57,653		67.10% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry,

Subcatchment 9S: Post Dev Basin 2



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Type II 24-hr 2-yr Rainfall=2.60"

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Summary for Subcatchment 12S: Post Dev Basin 3

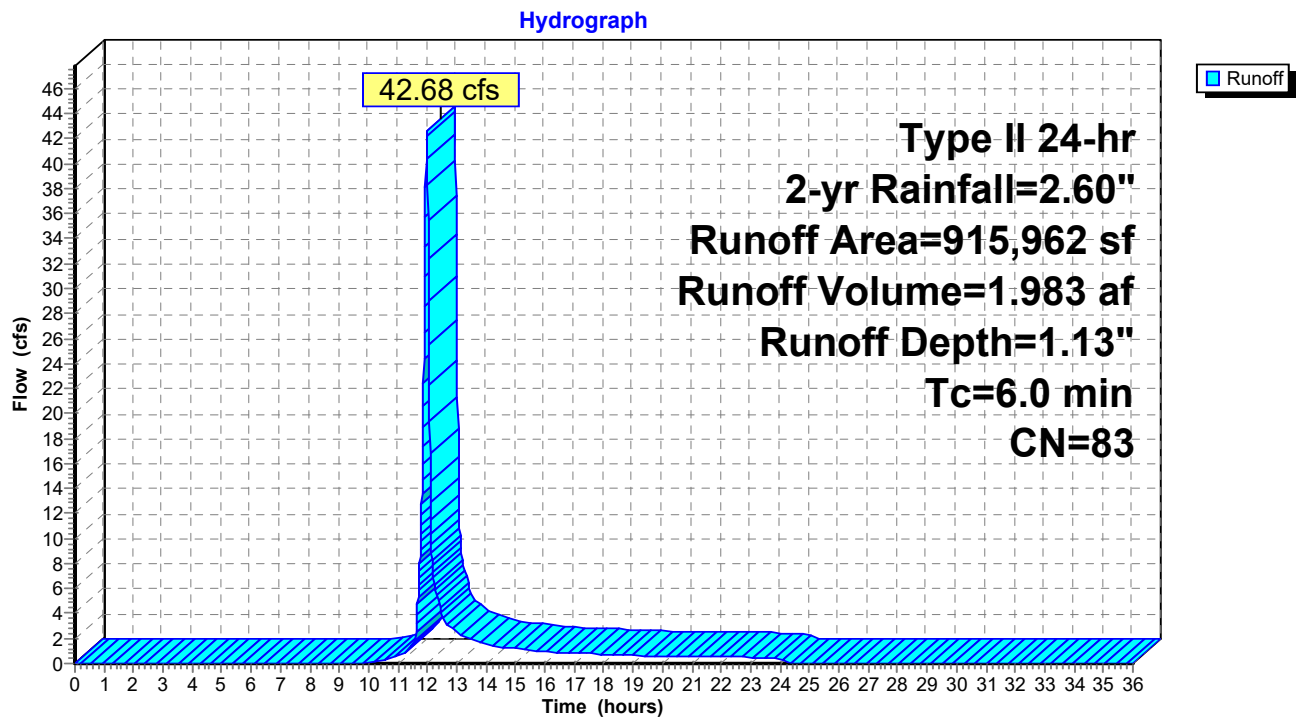
Runoff = 42.68 cfs @ 11.98 hrs, Volume= 1.983 af, Depth= 1.13"
Routed to Pond 8P : Facility 3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type II 24-hr 2-yr Rainfall=2.60"

	Area (sf)	CN	Description
	243,892	98	Unconnected roofs, HSG A
*	442,952	98	Pavement
	229,118	39	>75% Grass cover, Good, HSG A
*	0	96	Gravel
	915,962	83	Weighted Average
	229,118		25.01% Pervious Area
	686,844		74.99% Impervious Area
	243,892		35.51% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry,

Subcatchment 12S: Post Dev Basin 3



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Type II 24-hr 2-yr Rainfall=2.60"

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Summary for Pond 8P: Facility 3

Inflow Area = 30.376 ac, 59.79% Impervious, Inflow Depth = 0.87" for 2-yr event
 Inflow = 47.03 cfs @ 11.98 hrs, Volume= 2.203 af
 Outflow = 3.47 cfs @ 12.67 hrs, Volume= 2.203 af, Atten= 93%, Lag= 41.4 min
 Discarded = 3.47 cfs @ 12.67 hrs, Volume= 2.203 af
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
 Routed to Link 5L : Total Post Development Discharge

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
 Peak Elev= 1,165.00' @ 12.67 hrs Surf.Area= 41,699 sf Storage= 37,976 cf

Plug-Flow detention time= 94.6 min calculated for 2.203 af (100% of inflow)
 Center-of-Mass det. time= 94.6 min (937.8 - 843.2)

Volume	Invert	Avail.Storage	Storage Description
#1	1,164.00'	880,194 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,164.00	34,587	0	0
1,165.00	41,730	38,159	38,159
1,166.00	50,355	46,043	84,201
1,167.00	62,117	56,236	140,437
1,168.00	75,751	68,934	209,371
1,169.00	90,953	83,352	292,723
1,170.00	108,072	99,513	392,236
1,171.00	128,981	118,527	510,762
1,172.00	173,543	151,262	662,024
1,173.00	262,797	218,170	880,194

Device	Routing	Invert	Outlet Devices
#1	Discarded	1,164.00'	3.600 in/hr Exfiltration over Surface area Phase-In= 0.01'
#2	Primary	1,172.10'	15.0' long x 4.0' breadth Broad-Crested Rectangular Weir
			Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00
			2.50 3.00 3.50 4.00 4.50 5.00 5.50
			Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66
			2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Discarded OutFlow Max=3.47 cfs @ 12.67 hrs HW=1,165.00' (Free Discharge)

↑ **1=Exfiltration** (Exfiltration Controls 3.47 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=1,164.00' TW=0.00' (Dynamic Tailwater)

↑ **2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

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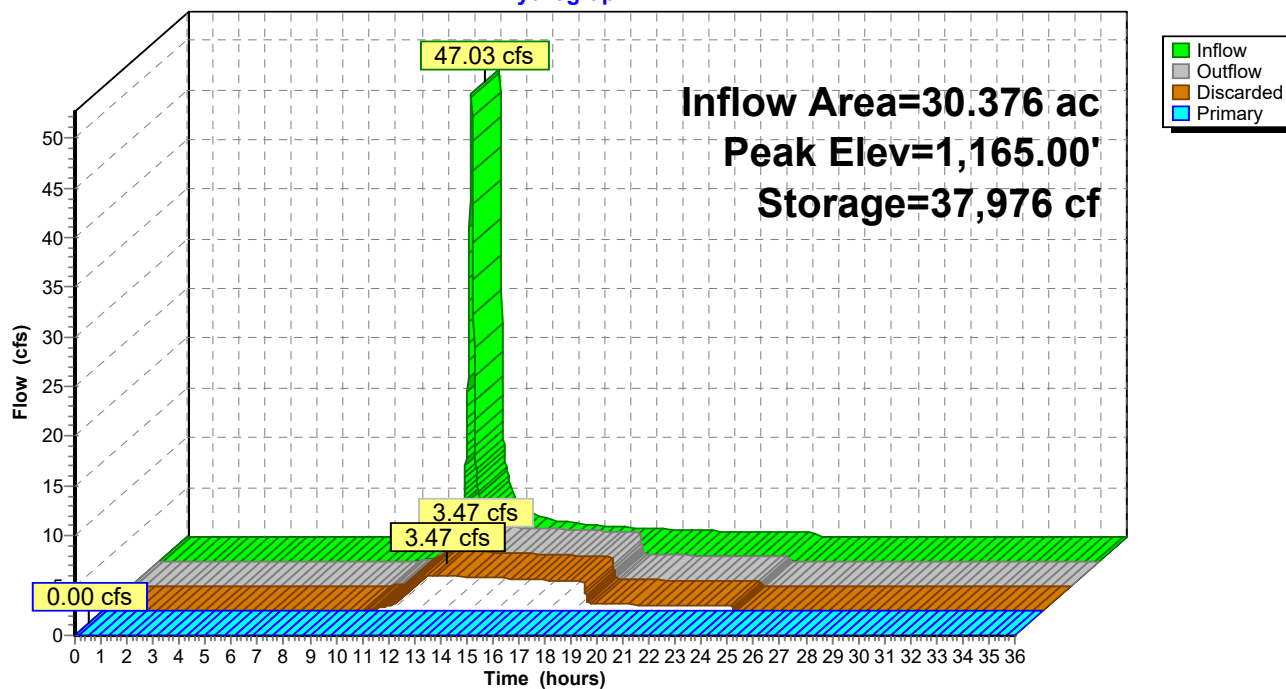
Type II 24-hr 2-yr Rainfall=2.60"

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Pond 8P: Facility 3

Hydrograph



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Type II 24-hr 2-yr Rainfall=2.60"

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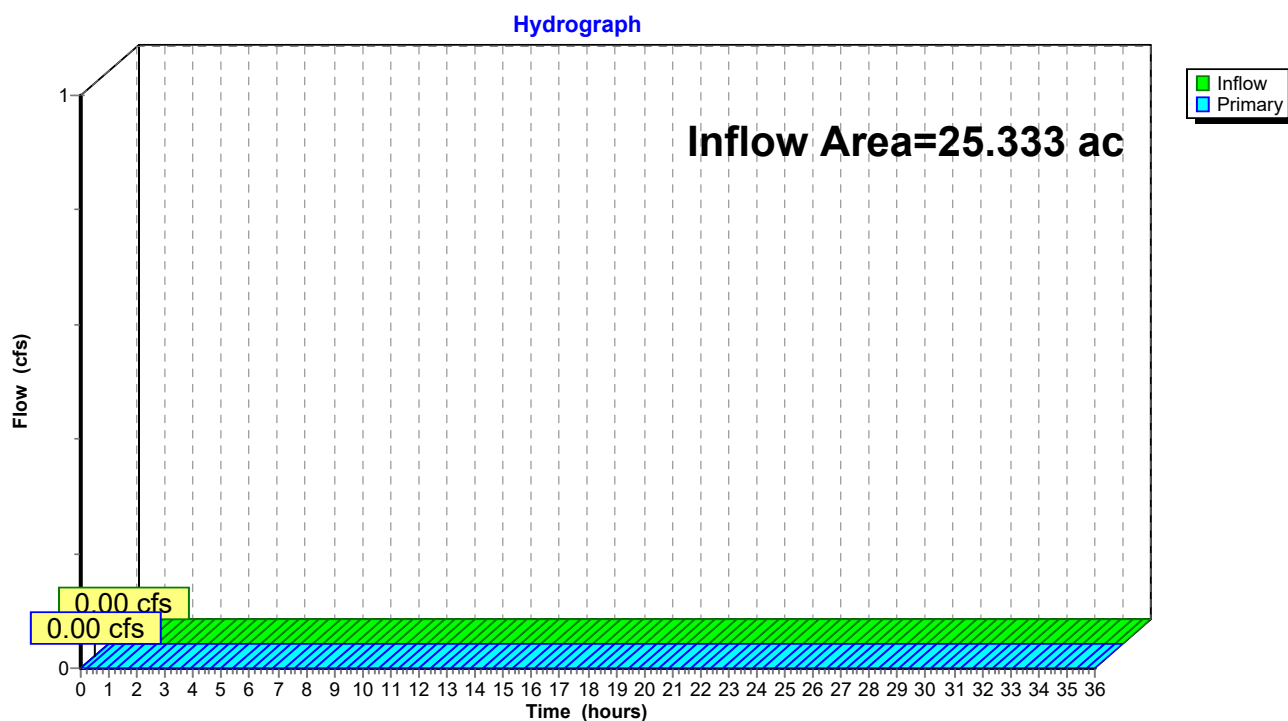
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Summary for Link 3L: Total Predevelopment Discharge

Inflow Area = 25.333 ac, 4.25% Impervious, Inflow Depth = 0.00" for 2-yr event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Link 3L: Total Predevelopment Discharge



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Type II 24-hr 2-yr Rainfall=2.60"

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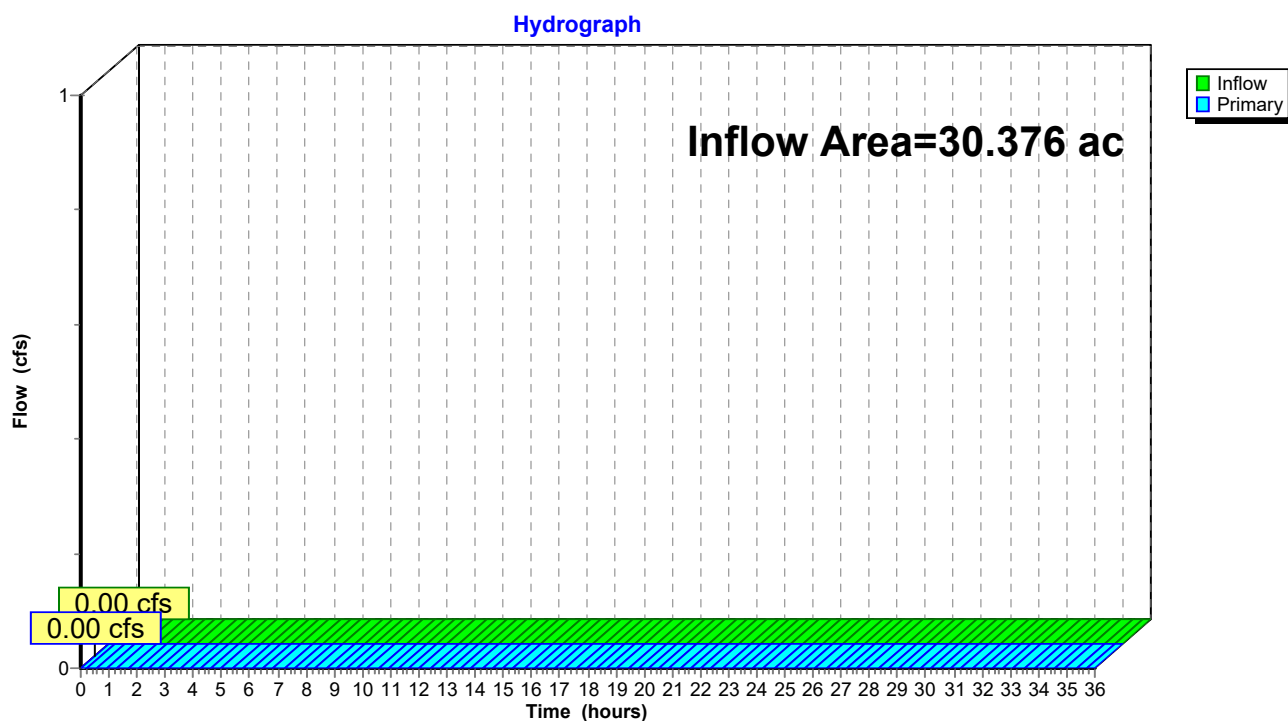
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Summary for Link 5L: Total Post Development Discharge

Inflow Area = 30.376 ac, 59.79% Impervious, Inflow Depth = 0.00" for 2-yr event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Link 5L: Total Post Development Discharge



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Type II 24-hr 10-yr Rainfall=3.72"

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Summary for Subcatchment 1S: Predev Basin 1

Runoff = 0.00 cfs @ 24.51 hrs, Volume= 0.002 af, Depth= 0.01"

Routed to Link 3L : Total Predevelopment Discharge

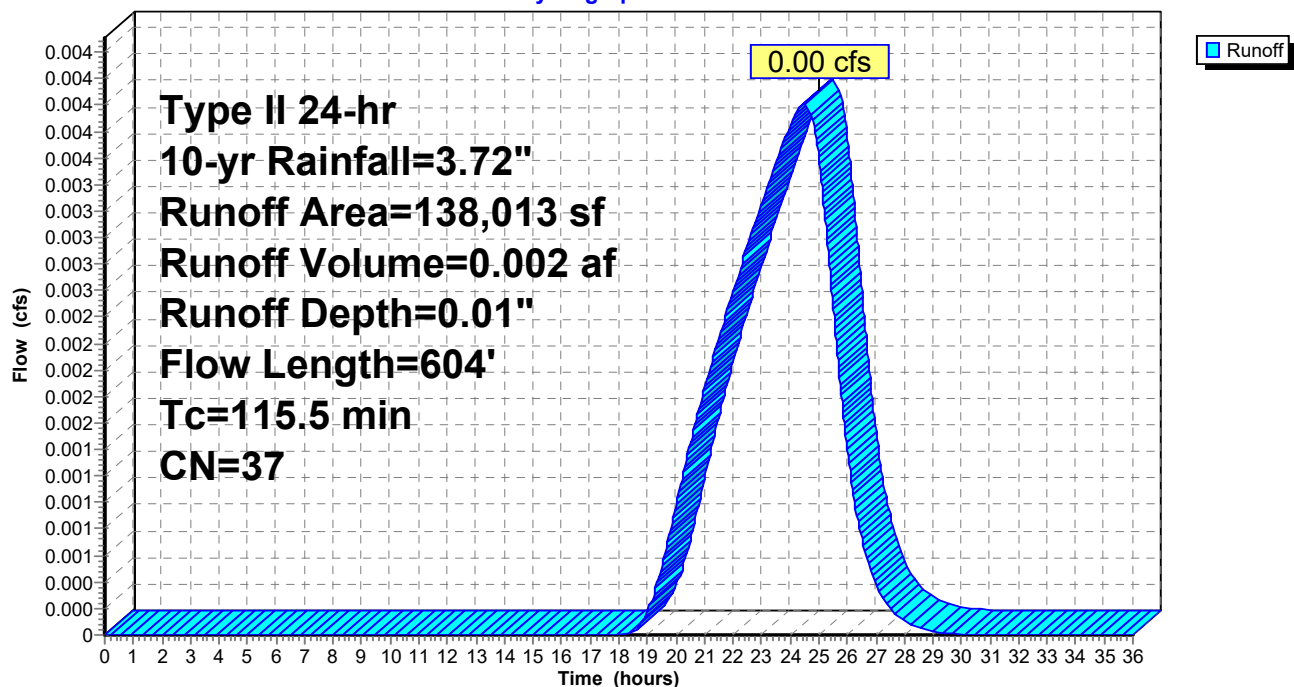
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type II 24-hr 10-yr Rainfall=3.72"

Area (sf)	CN	Description
* 81,247	39	Grassland
* 52,683	30	Woodland
* 1,886	98	Roofs
* 2,197	98	Driveway
138,013	37	Weighted Average
133,930		97.04% Pervious Area
4,083		2.96% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
93.8	100	0.0026	0.02		Sheet Flow, Sheet Flow
					Woods: Dense underbrush n= 0.800 P2= 2.60"
21.7	504	0.0060	0.39		Shallow Concentrated Flow, Shallow Concentrated Flow
					Woodland Kv= 5.0 fps
115.5	604	Total			

Subcatchment 1S: Predev Basin 1

Hydrograph



250008600-Peak Discharge

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Type II 24-hr 10-yr Rainfall=3.72"

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Summary for Subcatchment 2S: Predev Basin 2

Runoff = 0.05 cfs @ 24.36 hrs, Volume= 0.023 af, Depth= 0.01"

Routed to Link 3L : Total Predevelopment Discharge

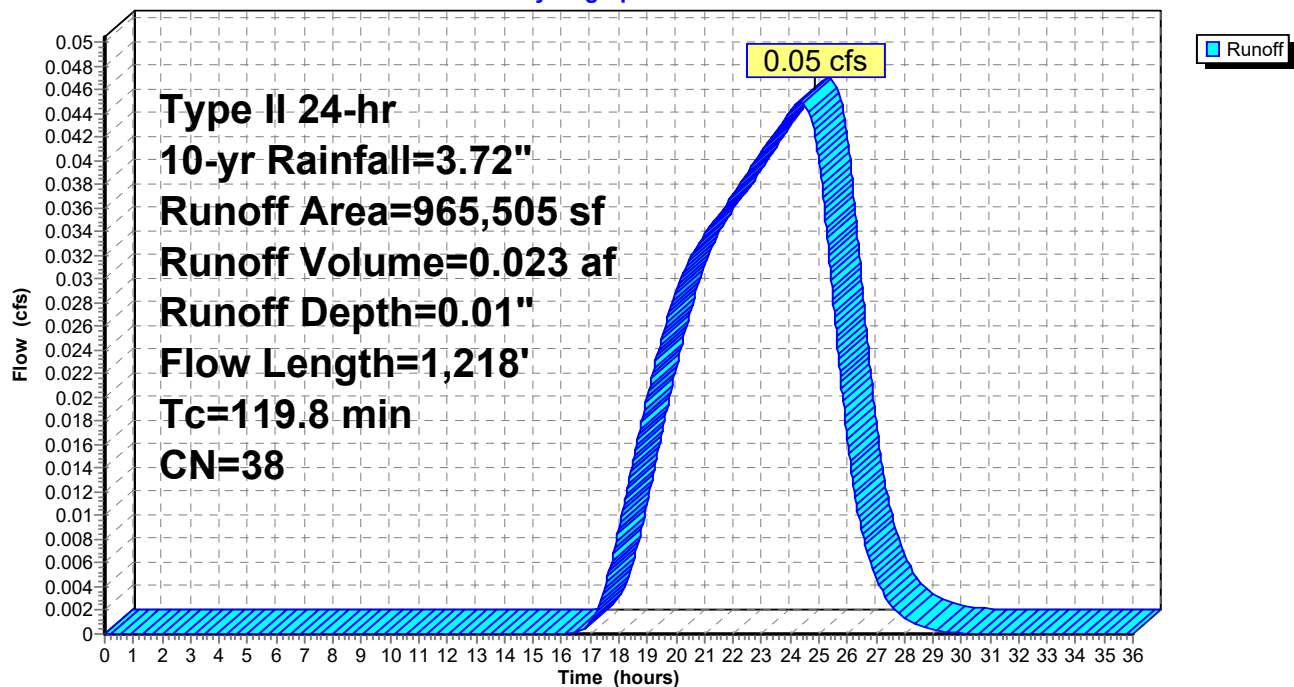
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type II 24-hr 10-yr Rainfall=3.72"

	Area (sf)	CN	Description
*	374,075	30	Woodland
*	548,653	39	Grassland
*	17,043	98	Roofs
*	25,734	98	Asphalt/Concrete Pavement
	965,505	38	Weighted Average
	922,728		95.57% Pervious Area
	42,777		4.43% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
71.6	100	0.0051	0.02		Sheet Flow, Sheet Flow Woods: Dense underbrush n= 0.800 P2= 2.60"
12.8	227	0.0035	0.30		Shallow Concentrated Flow, Shallow Concentrated Flow - Wood Woodland Kv= 5.0 fps
35.4	891	0.0036	0.42		Shallow Concentrated Flow, Shallow Concentrated Flow - Grass Short Grass Pasture Kv= 7.0 fps
119.8	1,218	Total			

Subcatchment 2S: Predev Basin 2

Hydrograph



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Type II 24-hr 10-yr Rainfall=3.72"

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Summary for Subcatchment 4S: Post Dev Basin 1

Runoff = 3.69 cfs @ 11.98 hrs, Volume= 0.179 af, Depth= 0.92"
Routed to Pond 8P : Facility 3

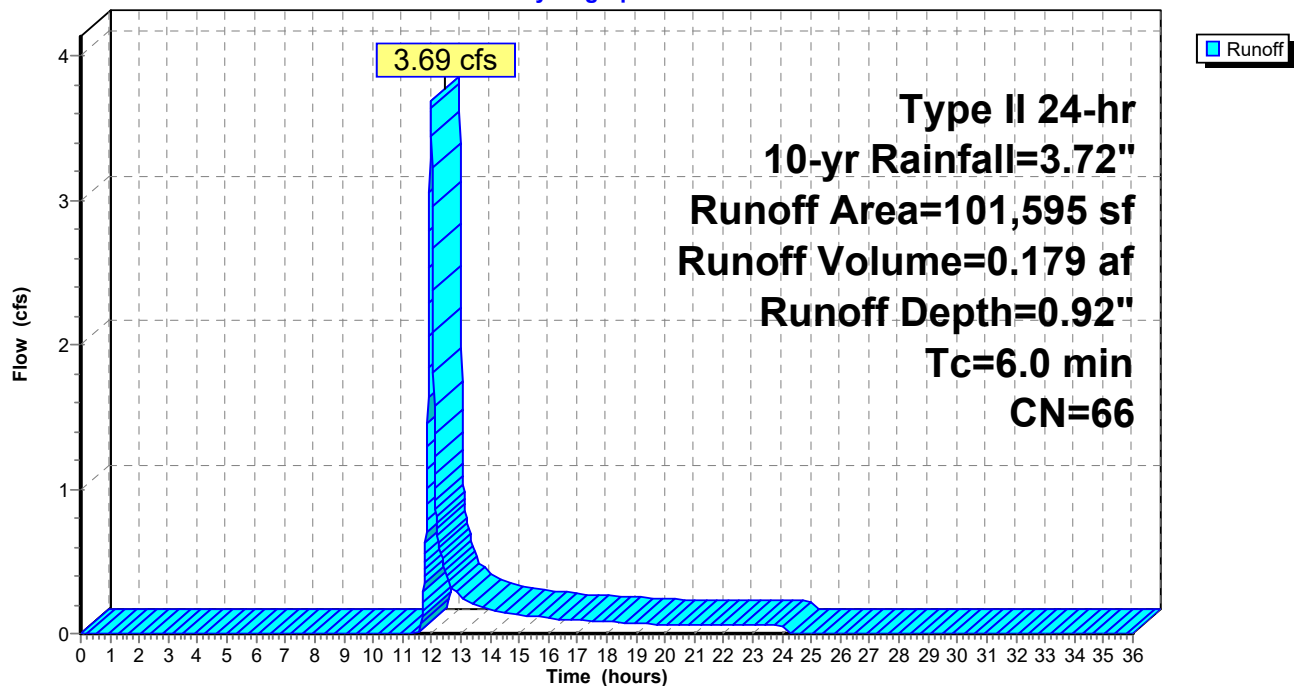
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type II 24-hr 10-yr Rainfall=3.72"

	Area (sf)	CN	Description
	0	98	Unconnected roofs, HSG A
*	46,660	98	Pavement
	54,935	39	>75% Grass cover, Good, HSG A
	101,595	66	Weighted Average
	54,935		54.07% Pervious Area
	46,660		45.93% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry,

Subcatchment 4S: Post Dev Basin 1

Hydrograph



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Type II 24-hr 10-yr Rainfall=3.72"

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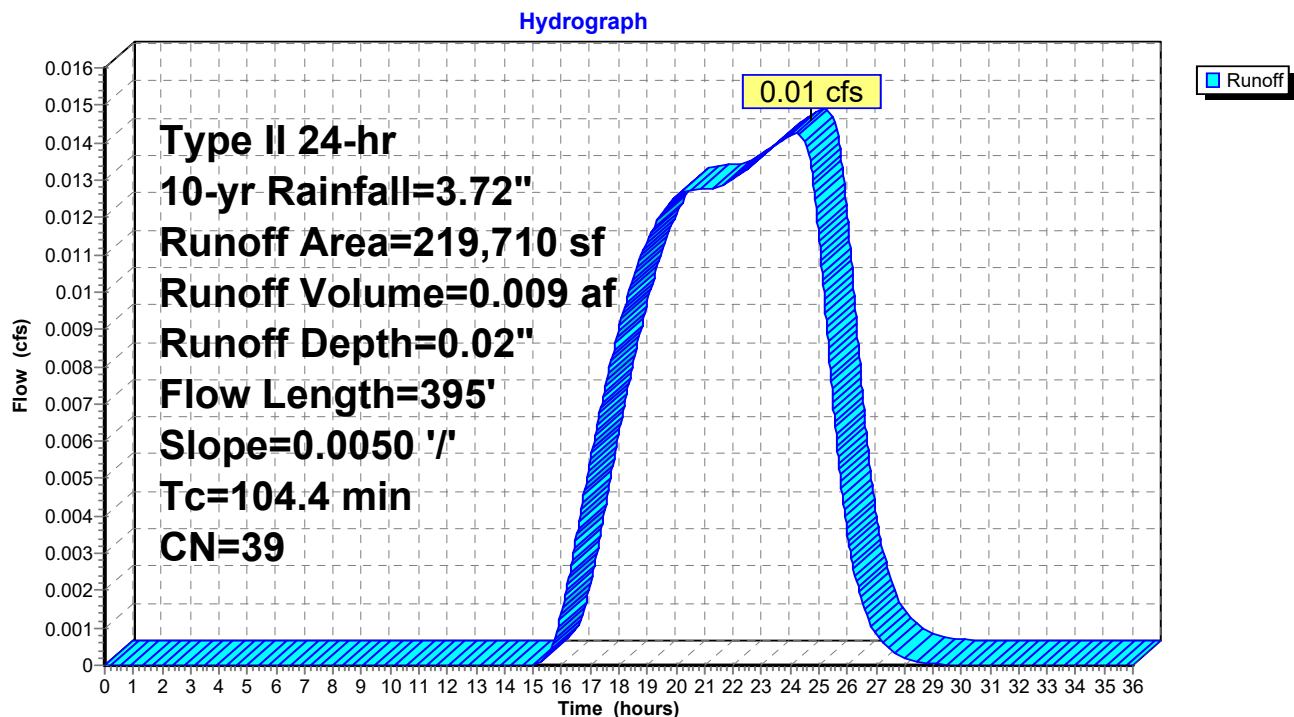
Summary for Subcatchment 6S: Post Dev Basin 8 OFFSITE

Runoff = 0.01 cfs @ 24.24 hrs, Volume= 0.009 af, Depth= 0.02"
Routed to Pond 8P : Facility 3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type II 24-hr 10-yr Rainfall=3.72"

Area (sf)	CN	Description
0	98	Unconnected roofs, HSG A
* 0	98	Pavement
219,710	39	>75% Grass cover, Good, HSG A
219,710	39	Weighted Average
219,710		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
99.9	300	0.0050	0.05		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 2.60"
4.5	95	0.0050	0.35		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
104.4	395	Total			

Subcatchment 6S: Post Dev Basin 8 OFFSITE

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Type II 24-hr 10-yr Rainfall=3.72"

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Summary for Subcatchment 9S: Post Dev Basin 2

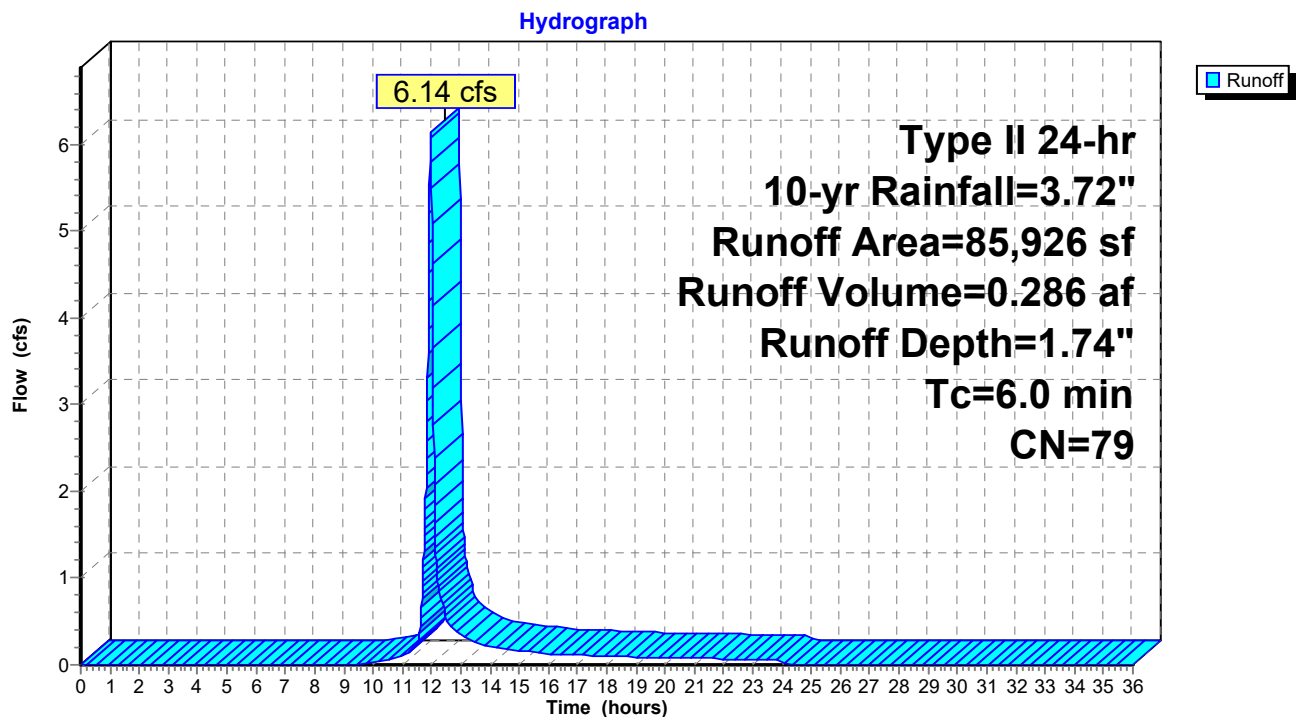
Runoff = 6.14 cfs @ 11.98 hrs, Volume= 0.286 af, Depth= 1.74"
Routed to Pond 8P : Facility 3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type II 24-hr 10-yr Rainfall=3.72"

	Area (sf)	CN	Description
	0	98	Unconnected roofs, HSG A
*	57,653	98	Pavement
	28,273	39	>75% Grass cover, Good, HSG A
*	0	96	Gravel
	85,926	79	Weighted Average
	28,273		32.90% Pervious Area
	57,653		67.10% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry,

Subcatchment 9S: Post Dev Basin 2



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Type II 24-hr 10-yr Rainfall=3.72"

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Summary for Subcatchment 12S: Post Dev Basin 3

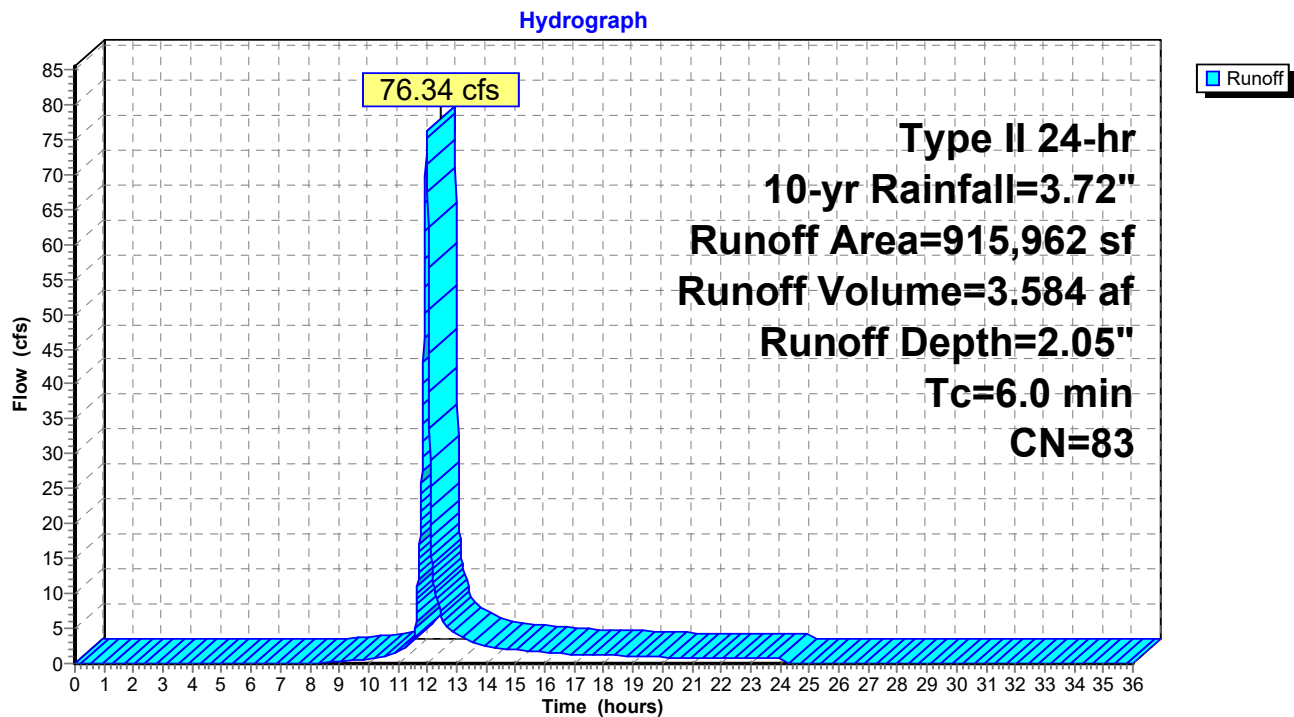
Runoff = 76.34 cfs @ 11.97 hrs, Volume= 3.584 af, Depth= 2.05"
Routed to Pond 8P : Facility 3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type II 24-hr 10-yr Rainfall=3.72"

	Area (sf)	CN	Description
	243,892	98	Unconnected roofs, HSG A
*	442,952	98	Pavement
	229,118	39	>75% Grass cover, Good, HSG A
*	0	96	Gravel
	915,962	83	Weighted Average
	229,118		25.01% Pervious Area
	686,844		74.99% Impervious Area
	243,892		35.51% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry,

Subcatchment 12S: Post Dev Basin 3



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Type II 24-hr 10-yr Rainfall=3.72"

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Summary for Pond 8P: Facility 3

Inflow Area = 30.376 ac, 59.79% Impervious, Inflow Depth = 1.60" for 10-yr event
 Inflow = 86.13 cfs @ 11.97 hrs, Volume= 4.058 af
 Outflow = 4.17 cfs @ 13.21 hrs, Volume= 4.058 af, Atten= 95%, Lag= 74.0 min
 Discarded = 4.17 cfs @ 13.21 hrs, Volume= 4.058 af
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
 Routed to Link 5L : Total Post Development Discharge

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
 Peak Elev= 1,165.97' @ 13.21 hrs Surf.Area= 50,065 sf Storage= 82,515 cf

Plug-Flow detention time= 201.5 min calculated for 4.057 af (100% of inflow)
 Center-of-Mass det. time= 201.4 min (1,028.6 - 827.1)

Volume	Invert	Avail.Storage	Storage Description
#1	1,164.00'	880,194 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,164.00	34,587	0	0
1,165.00	41,730	38,159	38,159
1,166.00	50,355	46,043	84,201
1,167.00	62,117	56,236	140,437
1,168.00	75,751	68,934	209,371
1,169.00	90,953	83,352	292,723
1,170.00	108,072	99,513	392,236
1,171.00	128,981	118,527	510,762
1,172.00	173,543	151,262	662,024
1,173.00	262,797	218,170	880,194

Device	Routing	Invert	Outlet Devices
#1	Discarded	1,164.00'	3.600 in/hr Exfiltration over Surface area Phase-In= 0.01'
#2	Primary	1,172.10'	15.0' long x 4.0' breadth Broad-Crested Rectangular Weir
			Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00
			2.50 3.00 3.50 4.00 4.50 5.00 5.50
			Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66
			2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Discarded OutFlow Max=4.17 cfs @ 13.21 hrs HW=1,165.97' (Free Discharge)

↑ **1=Exfiltration** (Exfiltration Controls 4.17 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=1,164.00' TW=0.00' (Dynamic Tailwater)

↑ **2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

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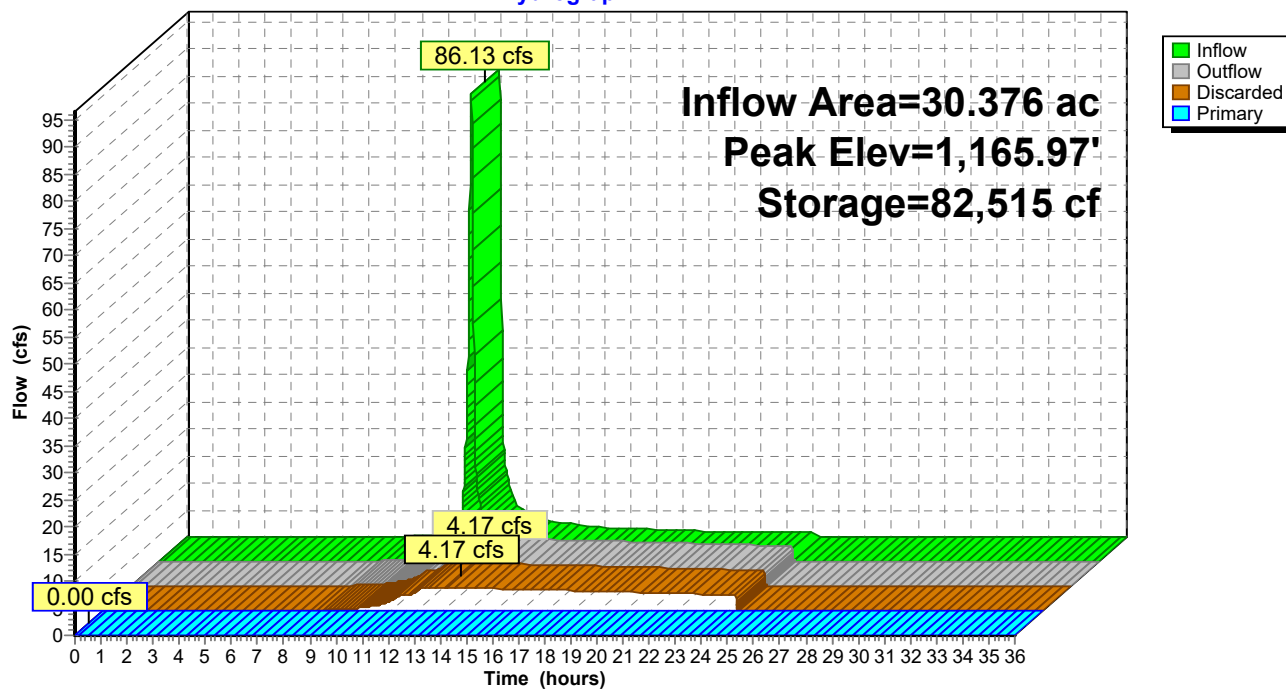
Type II 24-hr 10-yr Rainfall=3.72"

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Pond 8P: Facility 3

Hydrograph



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Type II 24-hr 10-yr Rainfall=3.72"

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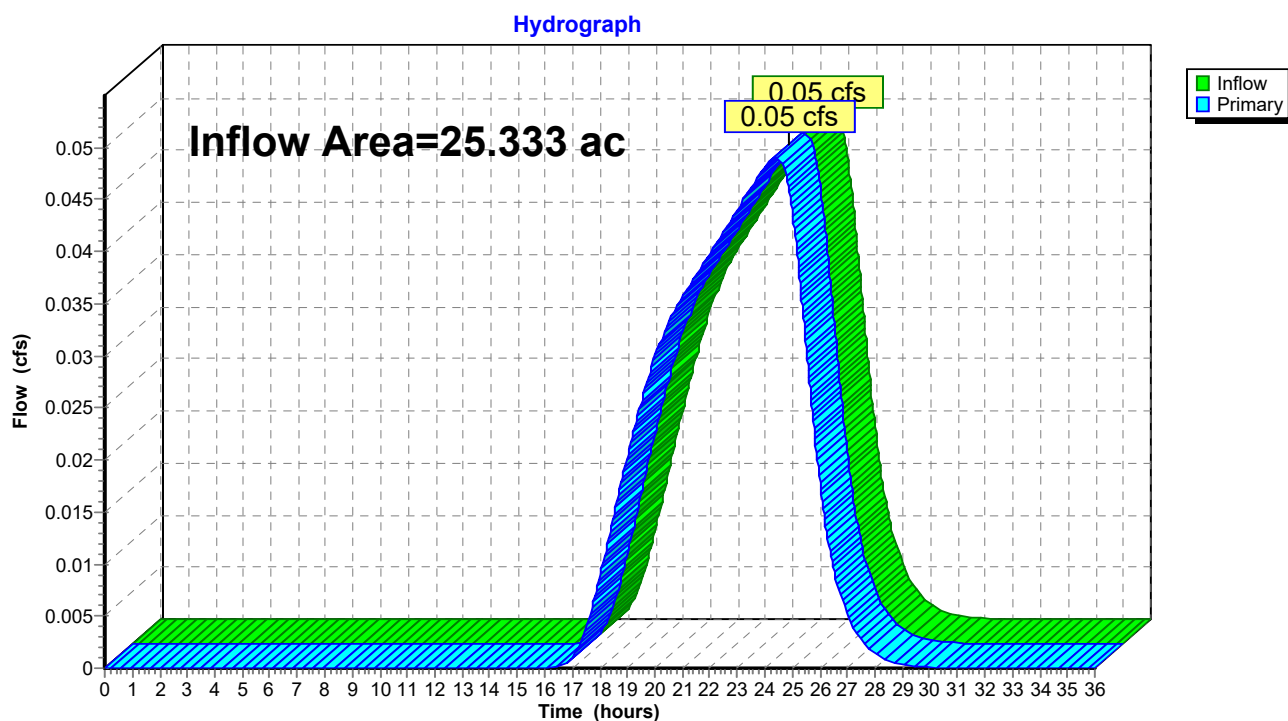
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Summary for Link 3L: Total Predevelopment Discharge

Inflow Area = 25.333 ac, 4.25% Impervious, Inflow Depth = 0.01" for 10-yr event
Inflow = 0.05 cfs @ 24.36 hrs, Volume= 0.024 af
Primary = 0.05 cfs @ 24.36 hrs, Volume= 0.024 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Link 3L: Total Predevelopment Discharge



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Type II 24-hr 10-yr Rainfall=3.72"

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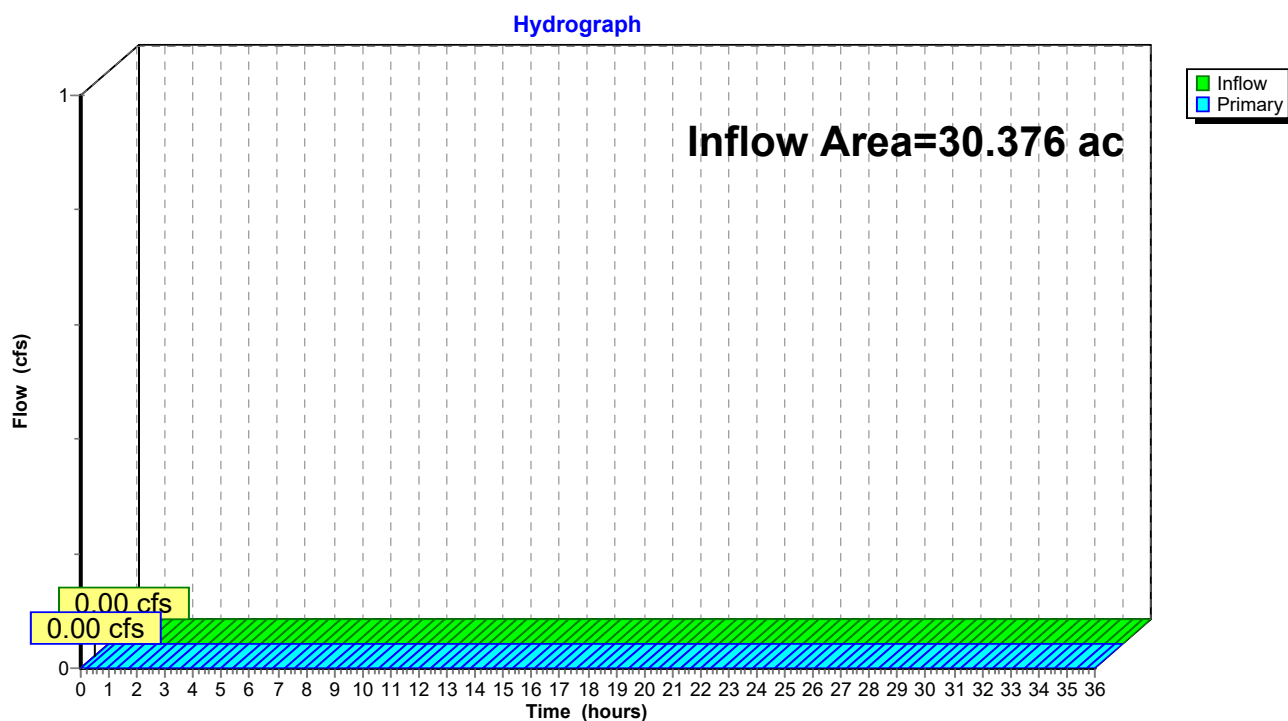
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Summary for Link 5L: Total Post Development Discharge

Inflow Area = 30.376 ac, 59.79% Impervious, Inflow Depth = 0.00" for 10-yr event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Link 5L: Total Post Development Discharge



250008600-Peak Discharge

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Type II 24-hr 25-yr Rainfall=4.49"

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Summary for Subcatchment 1S: Predev Basin 1

Runoff = 0.02 cfs @ 18.87 hrs, Volume= 0.017 af, Depth= 0.06"

Routed to Link 3L : Total Predevelopment Discharge

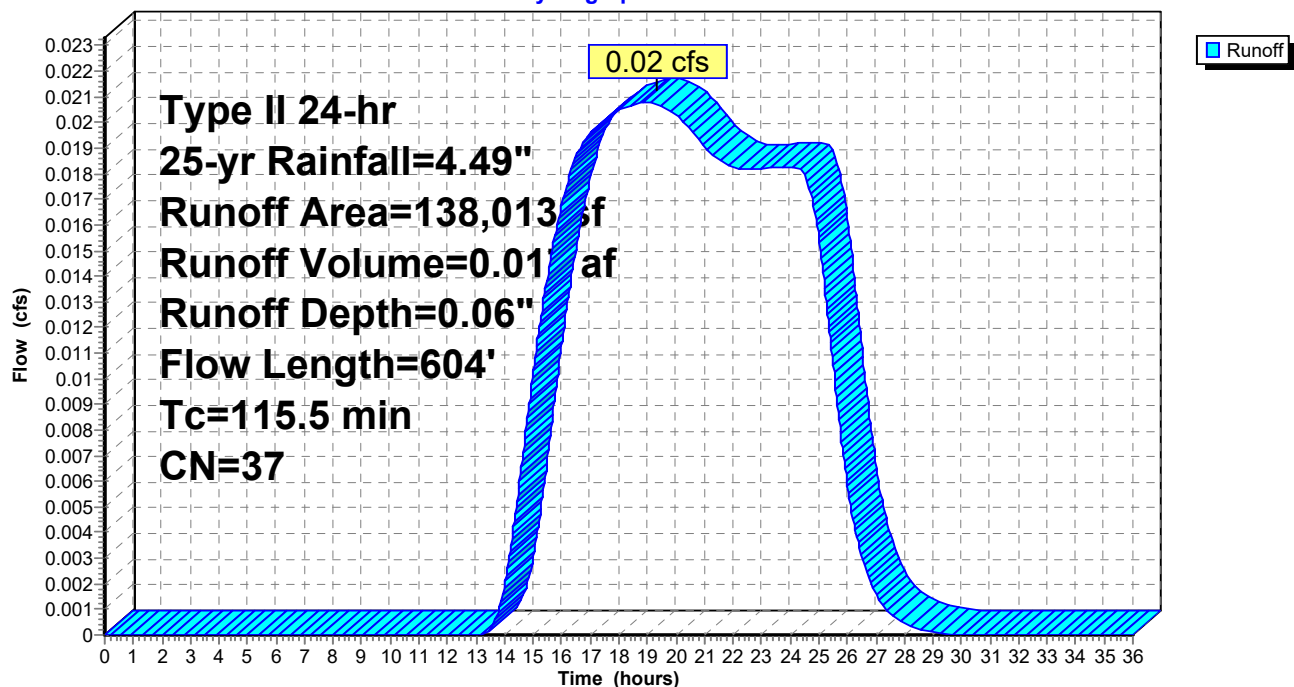
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-yr Rainfall=4.49"

Area (sf)	CN	Description
* 81,247	39	Grassland
* 52,683	30	Woodland
* 1,886	98	Roofs
* 2,197	98	Driveway
138,013	37	Weighted Average
133,930		97.04% Pervious Area
4,083		2.96% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
93.8	100	0.0026	0.02		Sheet Flow, Sheet Flow
					Woods: Dense underbrush n= 0.800 P2= 2.60"
21.7	504	0.0060	0.39		Shallow Concentrated Flow, Shallow Concentrated Flow
					Woodland Kv= 5.0 fps
115.5	604	Total			

Subcatchment 1S: Predev Basin 1

Hydrograph



250008600-Peak Discharge

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Type II 24-hr 25-yr Rainfall=4.49"

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Summary for Subcatchment 2S: Predev Basin 2

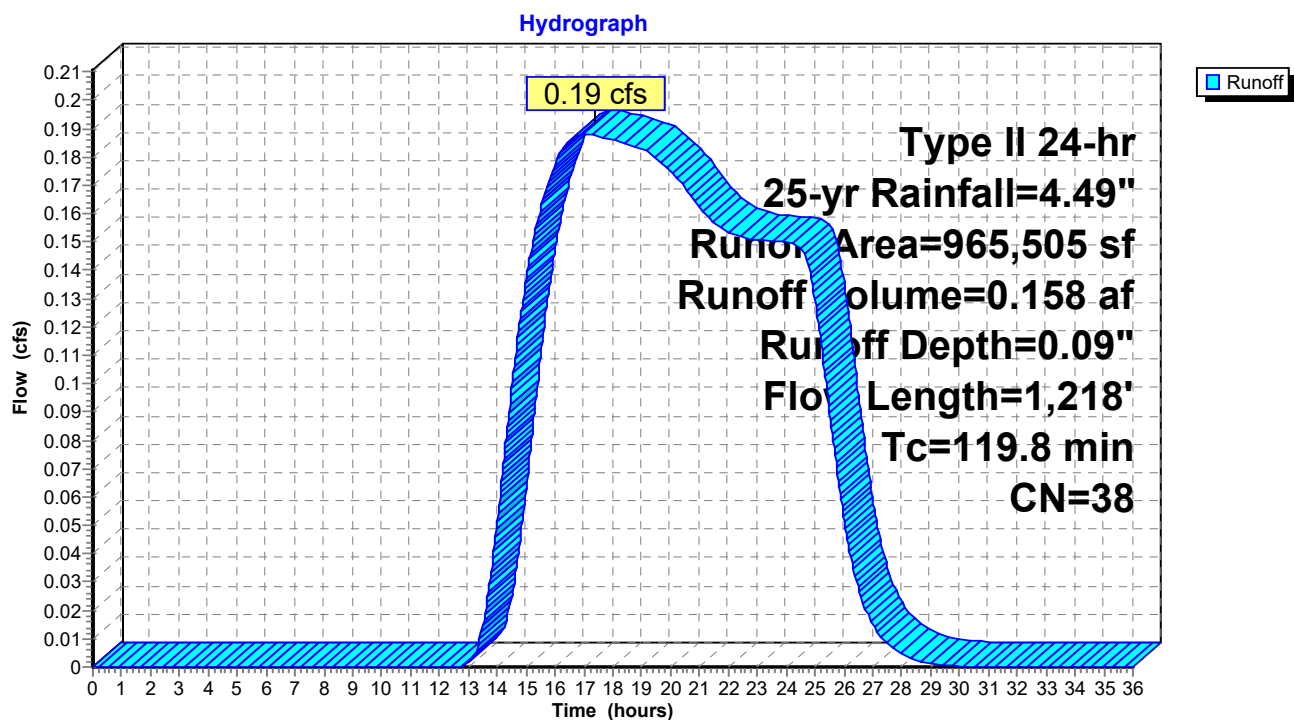
Runoff = 0.19 cfs @ 16.91 hrs, Volume= 0.158 af, Depth= 0.09"

Routed to Link 3L : Total Predevelopment Discharge

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-yr Rainfall=4.49"

	Area (sf)	CN	Description
*	374,075	30	Woodland
*	548,653	39	Grassland
*	17,043	98	Roofs
*	25,734	98	Asphalt/Concrete Pavement
	965,505	38	Weighted Average
	922,728		95.57% Pervious Area
	42,777		4.43% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
71.6	100	0.0051	0.02		Sheet Flow, Sheet Flow Woods: Dense underbrush n= 0.800 P2= 2.60"
12.8	227	0.0035	0.30		Shallow Concentrated Flow, Shallow Concentrated Flow - Wood Woodland Kv= 5.0 fps
35.4	891	0.0036	0.42		Shallow Concentrated Flow, Shallow Concentrated Flow - Grass Short Grass Pasture Kv= 7.0 fps
119.8	1,218	Total			

Subcatchment 2S: Predev Basin 2

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Type II 24-hr 25-yr Rainfall=4.49"

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Summary for Subcatchment 4S: Post Dev Basin 1

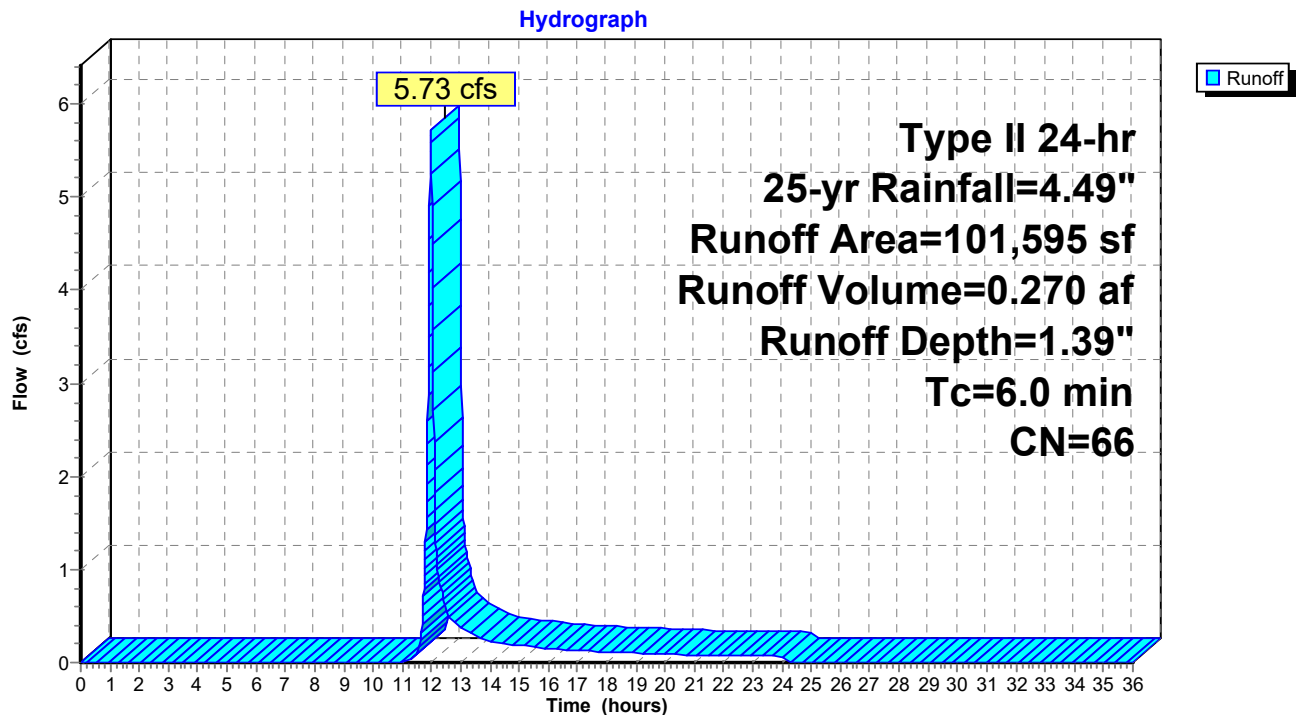
Runoff = 5.73 cfs @ 11.98 hrs, Volume= 0.270 af, Depth= 1.39"
Routed to Pond 8P : Facility 3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-yr Rainfall=4.49"

	Area (sf)	CN	Description
	0	98	Unconnected roofs, HSG A
*	46,660	98	Pavement
	54,935	39	>75% Grass cover, Good, HSG A
	101,595	66	Weighted Average
	54,935		54.07% Pervious Area
	46,660		45.93% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry,

Subcatchment 4S: Post Dev Basin 1



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Type II 24-hr 25-yr Rainfall=4.49"

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Summary for Subcatchment 6S: Post Dev Basin 8 OFFSITE

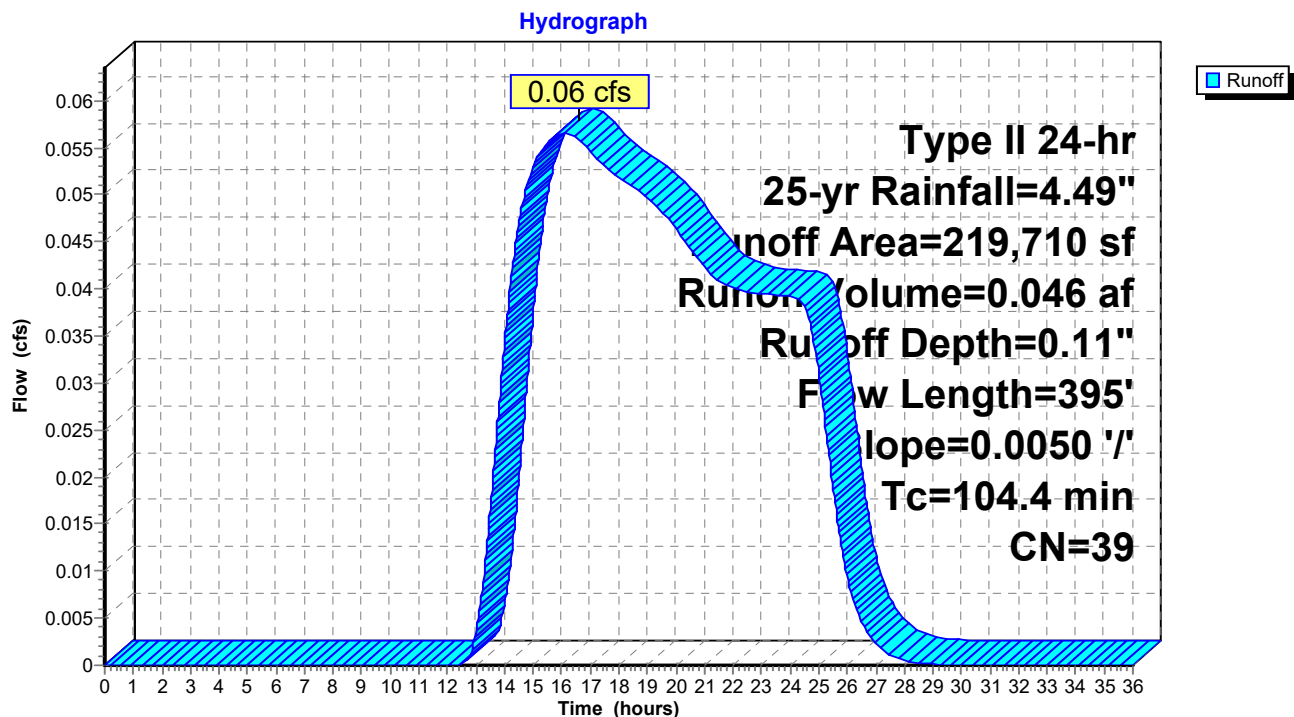
Runoff = 0.06 cfs @ 16.12 hrs, Volume= 0.046 af, Depth= 0.11"
Routed to Pond 8P : Facility 3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-yr Rainfall=4.49"

Area (sf)	CN	Description
0	98	Unconnected roofs, HSG A
* 0	98	Pavement
219,710	39	>75% Grass cover, Good, HSG A
219,710	39	Weighted Average
219,710		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
99.9	300	0.0050	0.05		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 2.60"
4.5	95	0.0050	0.35		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
104.4	395	Total			

Subcatchment 6S: Post Dev Basin 8 OFFSITE



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Type II 24-hr 25-yr Rainfall=4.49"

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Summary for Subcatchment 9S: Post Dev Basin 2

Runoff = 8.32 cfs @ 11.97 hrs, Volume= 0.389 af, Depth= 2.37"
Routed to Pond 8P : Facility 3

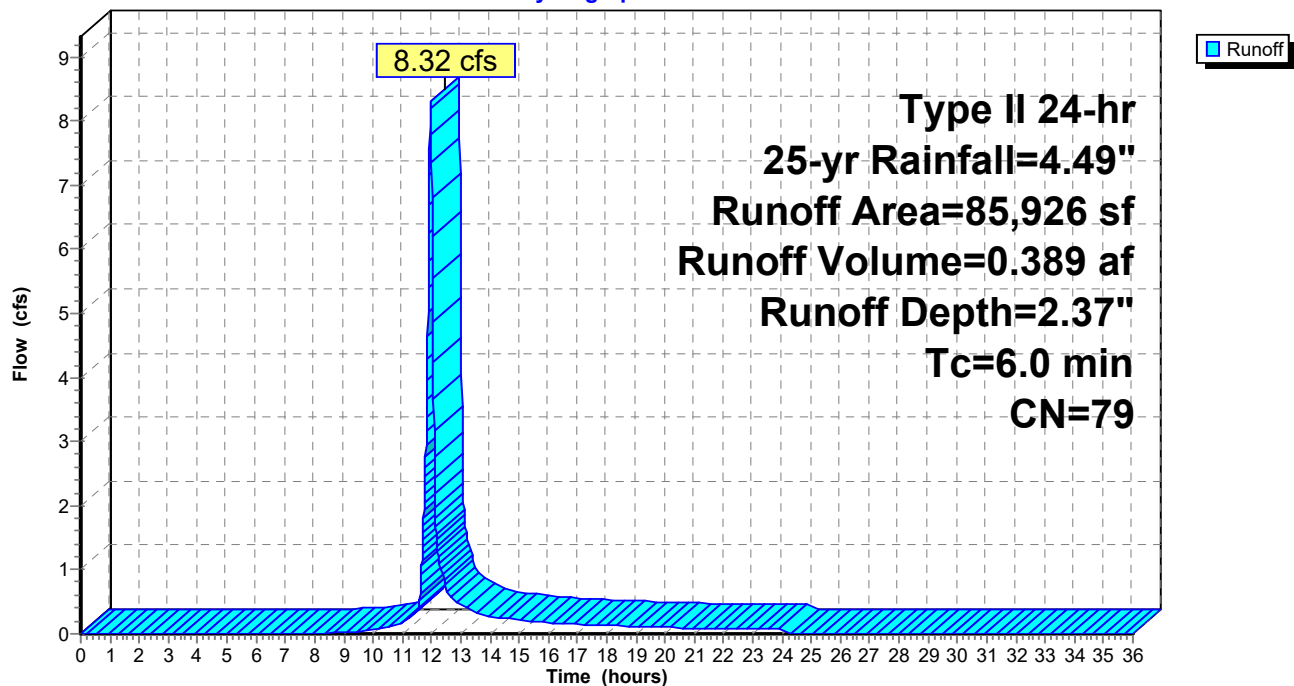
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-yr Rainfall=4.49"

	Area (sf)	CN	Description
	0	98	Unconnected roofs, HSG A
*	57,653	98	Pavement
	28,273	39	>75% Grass cover, Good, HSG A
*	0	96	Gravel
	85,926	79	Weighted Average
	28,273		32.90% Pervious Area
	57,653		67.10% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry,

Subcatchment 9S: Post Dev Basin 2

Hydrograph



250008600-Peak Discharge

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Type II 24-hr 25-yr Rainfall=4.49"

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Summary for Subcatchment 12S: Post Dev Basin 3

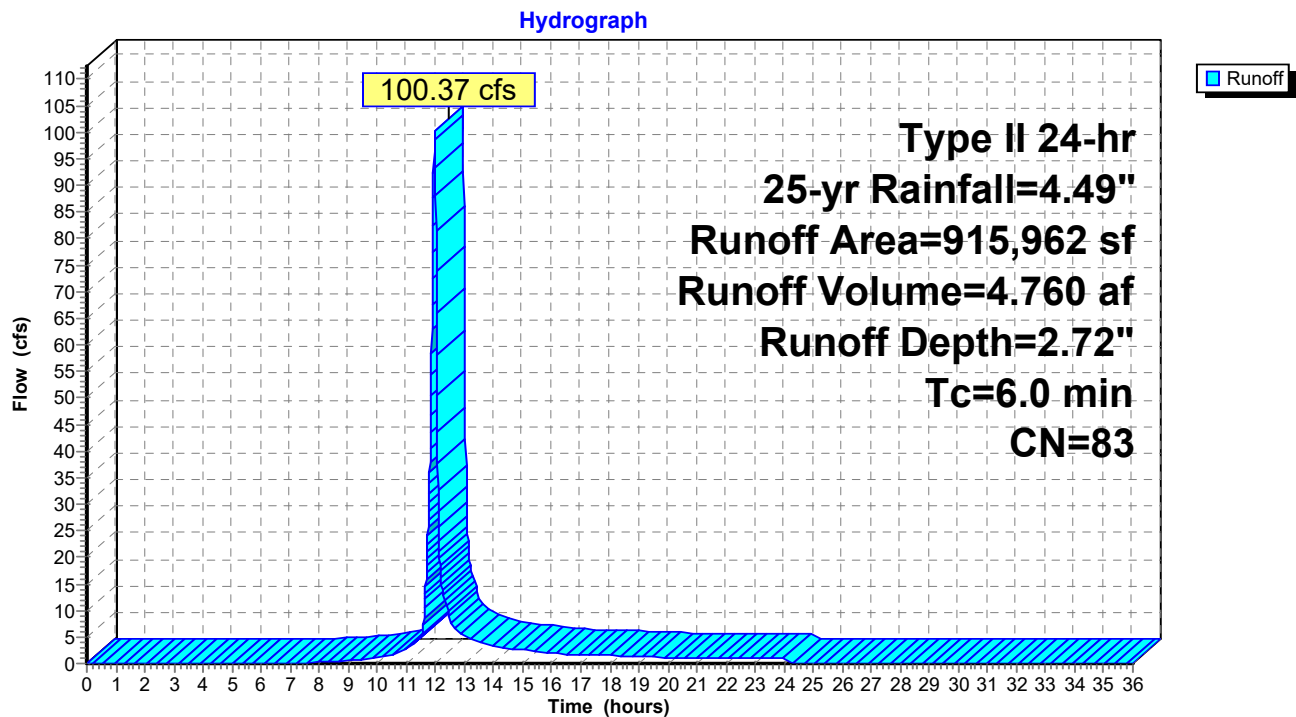
Runoff = 100.37 cfs @ 11.97 hrs, Volume= 4.760 af, Depth= 2.72"
Routed to Pond 8P : Facility 3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-yr Rainfall=4.49"

	Area (sf)	CN	Description
	243,892	98	Unconnected roofs, HSG A
*	442,952	98	Pavement
	229,118	39	>75% Grass cover, Good, HSG A
*	0	96	Gravel
	915,962	83	Weighted Average
	229,118		25.01% Pervious Area
	686,844		74.99% Impervious Area
	243,892		35.51% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry,

Subcatchment 12S: Post Dev Basin 3



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Type II 24-hr 25-yr Rainfall=4.49"

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Summary for Pond 8P: Facility 3

Inflow Area = 30.376 ac, 59.79% Impervious, Inflow Depth = 2.16" for 25-yr event
 Inflow = 114.38 cfs @ 11.97 hrs, Volume= 5.466 af
 Outflow = 4.80 cfs @ 13.44 hrs, Volume= 5.466 af, Atten= 96%, Lag= 87.8 min
 Discarded = 4.80 cfs @ 13.44 hrs, Volume= 5.466 af
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
 Routed to Link 5L : Total Post Development Discharge

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
 Peak Elev= 1,166.62' @ 13.44 hrs Surf.Area= 57,603 sf Storage= 117,464 cf

Plug-Flow detention time= 266.3 min calculated for 5.464 af (100% of inflow)
 Center-of-Mass det. time= 266.2 min (1,087.0 - 820.8)

Volume	Invert	Avail.Storage	Storage Description
#1	1,164.00'	880,194 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,164.00	34,587	0	0
1,165.00	41,730	38,159	38,159
1,166.00	50,355	46,043	84,201
1,167.00	62,117	56,236	140,437
1,168.00	75,751	68,934	209,371
1,169.00	90,953	83,352	292,723
1,170.00	108,072	99,513	392,236
1,171.00	128,981	118,527	510,762
1,172.00	173,543	151,262	662,024
1,173.00	262,797	218,170	880,194

Device	Routing	Invert	Outlet Devices
#1	Discarded	1,164.00'	3.600 in/hr Exfiltration over Surface area Phase-In= 0.01'
#2	Primary	1,172.10'	15.0' long x 4.0' breadth Broad-Crested Rectangular Weir
			Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00
			2.50 3.00 3.50 4.00 4.50 5.00 5.50
			Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66
			2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Discarded OutFlow Max=4.80 cfs @ 13.44 hrs HW=1,166.62' (Free Discharge)

↑ **1=Exfiltration** (Exfiltration Controls 4.80 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=1,164.00' TW=0.00' (Dynamic Tailwater)

↑ **2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

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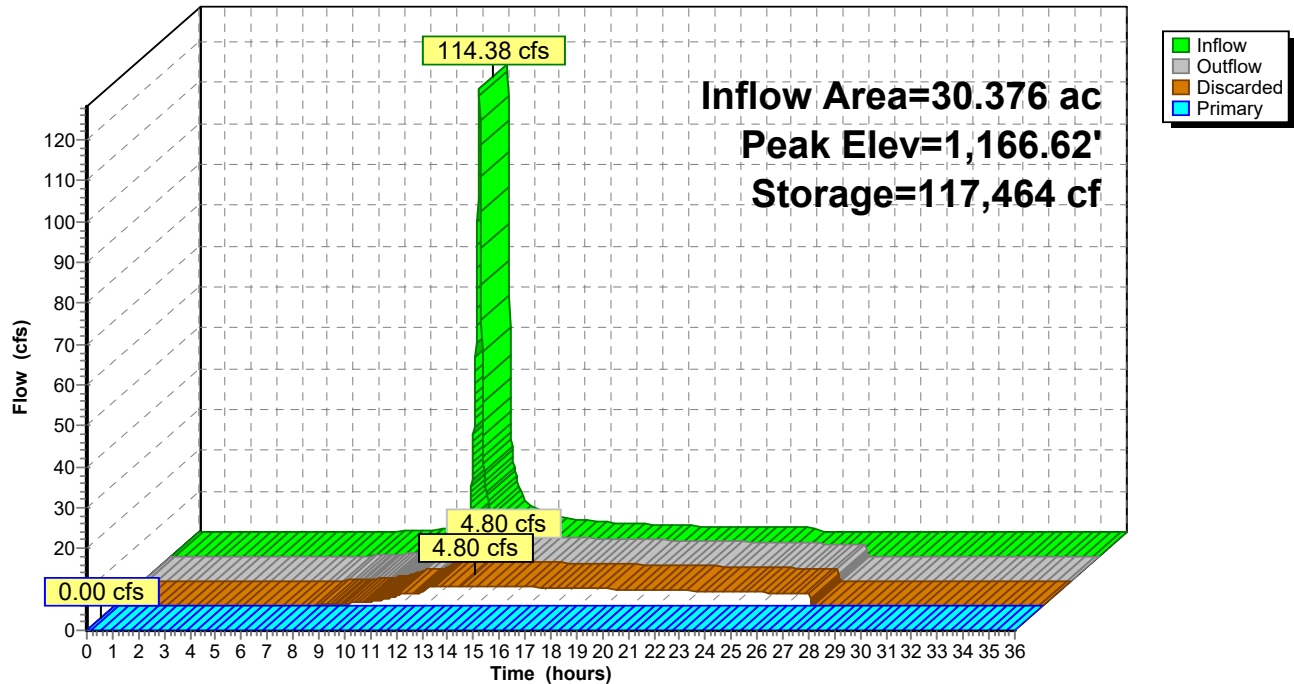
Type II 24-hr 25-yr Rainfall=4.49"

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Pond 8P: Facility 3

Hydrograph



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Type II 24-hr 25-yr Rainfall=4.49"

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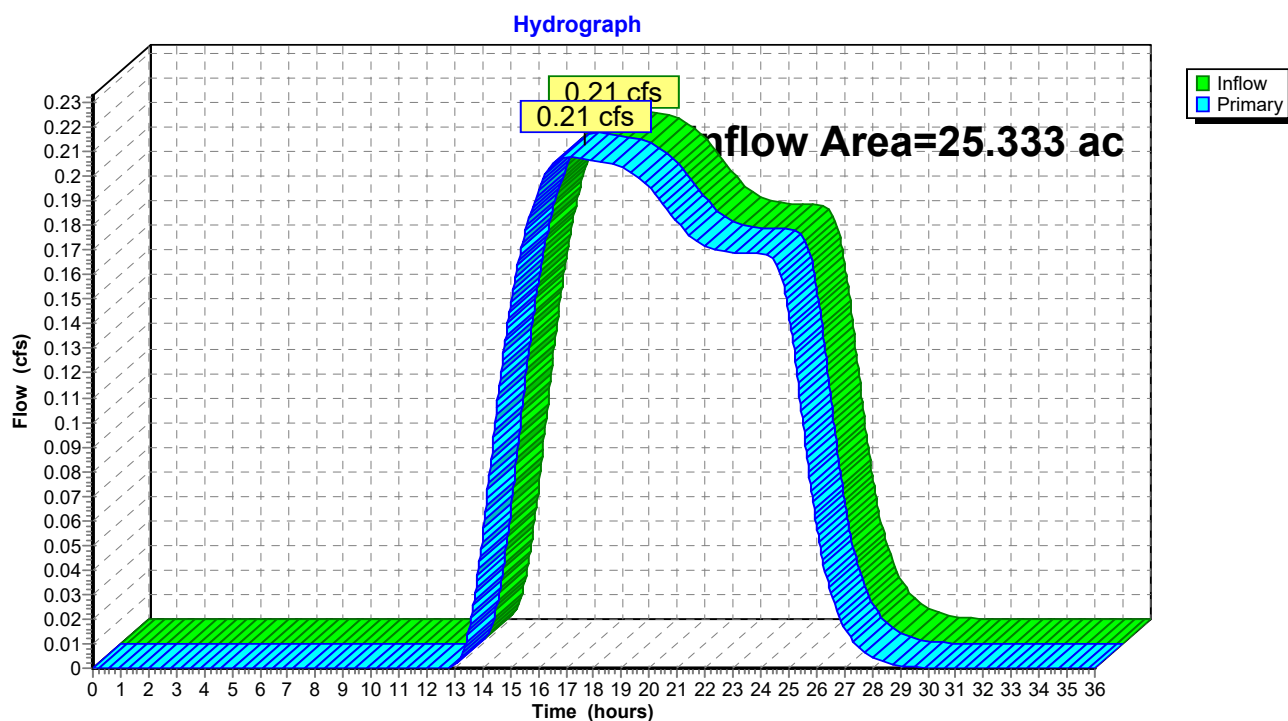
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Summary for Link 3L: Total Predevelopment Discharge

Inflow Area = 25.333 ac, 4.25% Impervious, Inflow Depth = 0.08" for 25-yr event
Inflow = 0.21 cfs @ 17.17 hrs, Volume= 0.176 af
Primary = 0.21 cfs @ 17.17 hrs, Volume= 0.176 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Link 3L: Total Predevelopment Discharge



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Type II 24-hr 25-yr Rainfall=4.49"

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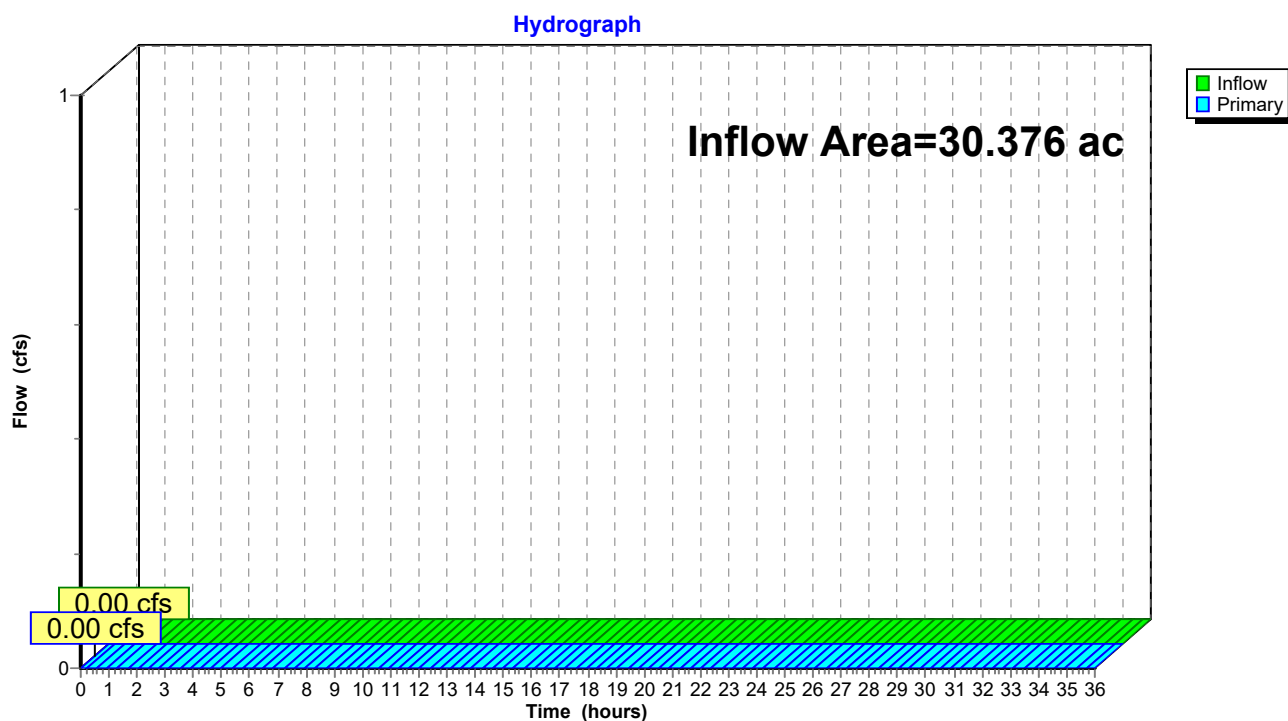
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Summary for Link 5L: Total Post Development Discharge

Inflow Area = 30.376 ac, 59.79% Impervious, Inflow Depth = 0.00" for 25-yr event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Link 5L: Total Post Development Discharge



250008600-Peak Discharge

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Type II 24-hr 100-yr Rainfall=5.82"

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Summary for Subcatchment 1S: Predev Basin 1

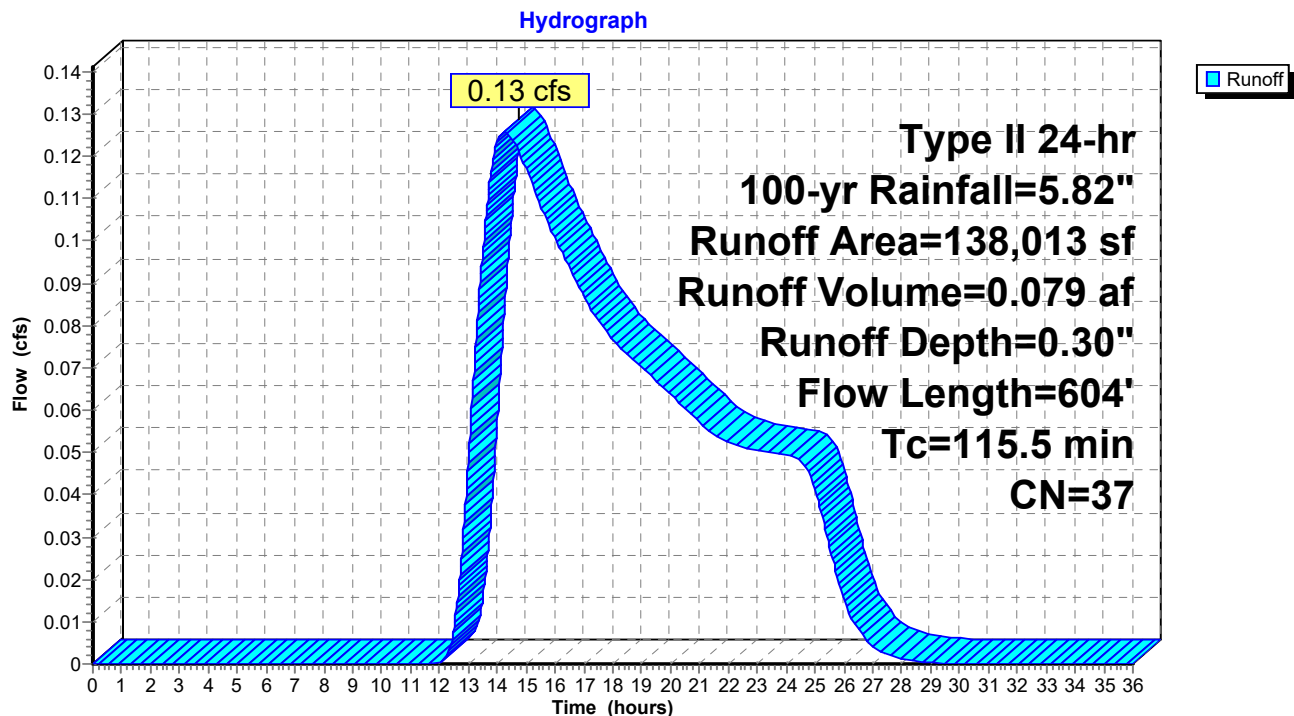
Runoff = 0.13 cfs @ 14.25 hrs, Volume= 0.079 af, Depth= 0.30"

Routed to Link 3L : Total Predevelopment Discharge

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-yr Rainfall=5.82"

Area (sf)	CN	Description
* 81,247	39	Grassland
* 52,683	30	Woodland
* 1,886	98	Roofs
* 2,197	98	Driveway
138,013	37	Weighted Average
133,930		97.04% Pervious Area
4,083		2.96% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
93.8	100	0.0026	0.02		Sheet Flow, Sheet Flow
					Woods: Dense underbrush n= 0.800 P2= 2.60"
21.7	504	0.0060	0.39		Shallow Concentrated Flow, Shallow Concentrated Flow
					Woodland Kv= 5.0 fps
115.5	604	Total			

Subcatchment 1S: Predev Basin 1

250008600-Peak Discharge

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Type II 24-hr 100-yr Rainfall=5.82"

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Summary for Subcatchment 2S: Predev Basin 2

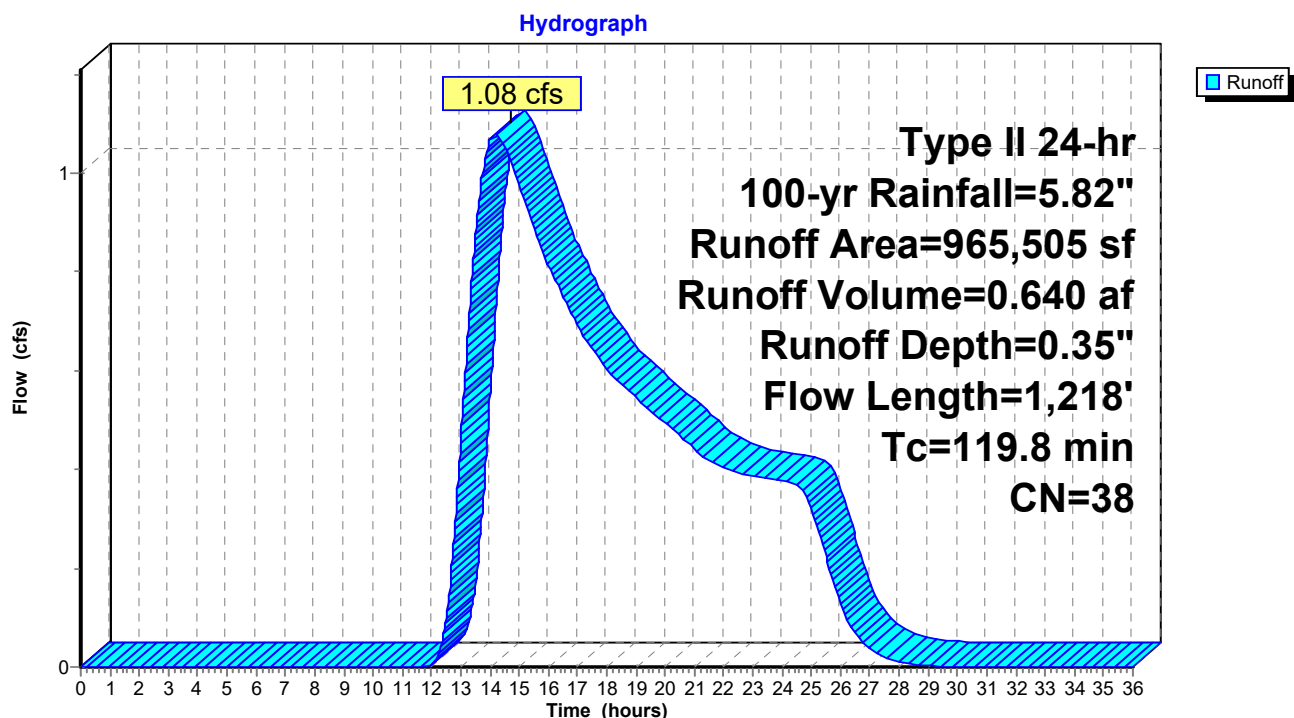
Runoff = 1.08 cfs @ 14.24 hrs, Volume= 0.640 af, Depth= 0.35"

Routed to Link 3L : Total Predevelopment Discharge

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-yr Rainfall=5.82"

	Area (sf)	CN	Description
*	374,075	30	Woodland
*	548,653	39	Grassland
*	17,043	98	Roofs
*	25,734	98	Asphalt/Concrete Pavement
	965,505	38	Weighted Average
	922,728		95.57% Pervious Area
	42,777		4.43% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
71.6	100	0.0051	0.02		Sheet Flow, Sheet Flow Woods: Dense underbrush n= 0.800 P2= 2.60"
12.8	227	0.0035	0.30		Shallow Concentrated Flow, Shallow Concentrated Flow - Wood Woodland Kv= 5.0 fps
35.4	891	0.0036	0.42		Shallow Concentrated Flow, Shallow Concentrated Flow - Grass Short Grass Pasture Kv= 7.0 fps
119.8	1,218	Total			

Subcatchment 2S: Predev Basin 2

250008600-Peak Discharge

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Type II 24-hr 100-yr Rainfall=5.82"

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Summary for Subcatchment 4S: Post Dev Basin 1

Runoff = 9.65 cfs @ 11.98 hrs, Volume= 0.449 af, Depth= 2.31"
Routed to Pond 8P : Facility 3

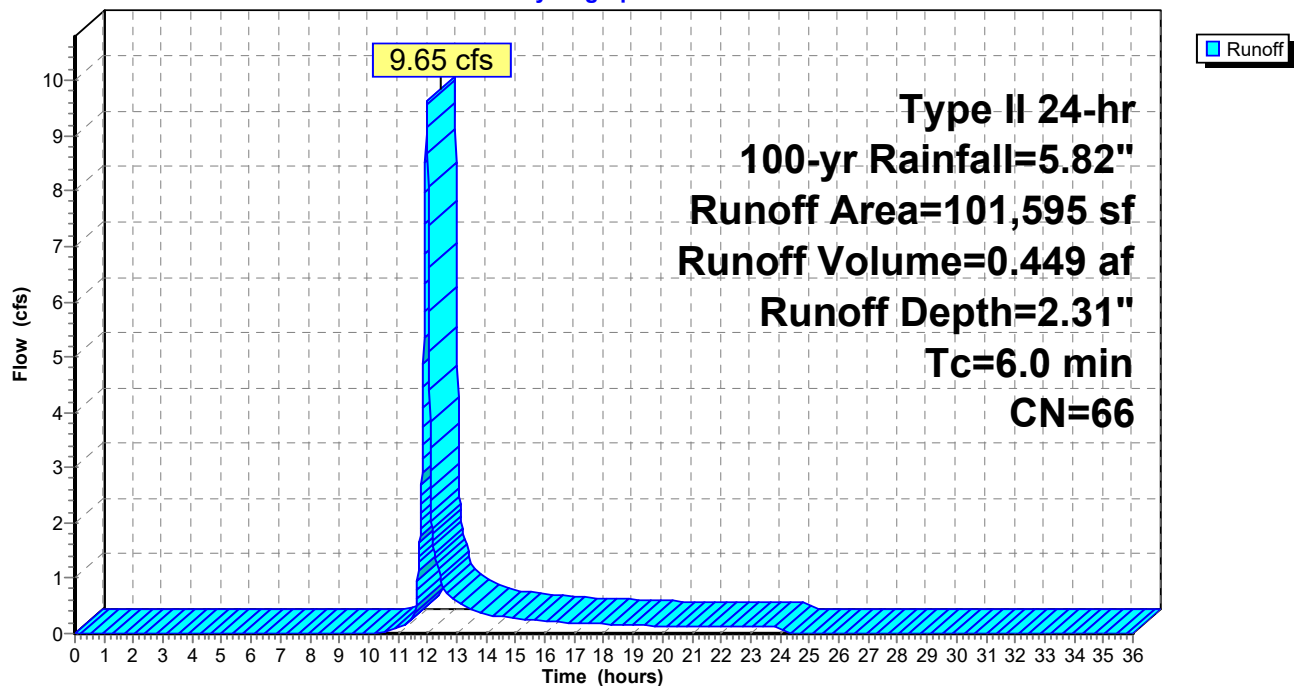
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-yr Rainfall=5.82"

	Area (sf)	CN	Description
	0	98	Unconnected roofs, HSG A
*	46,660	98	Pavement
	54,935	39	>75% Grass cover, Good, HSG A
	101,595	66	Weighted Average
	54,935		54.07% Pervious Area
	46,660		45.93% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry,

Subcatchment 4S: Post Dev Basin 1

Hydrograph



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Type II 24-hr 100-yr Rainfall=5.82"

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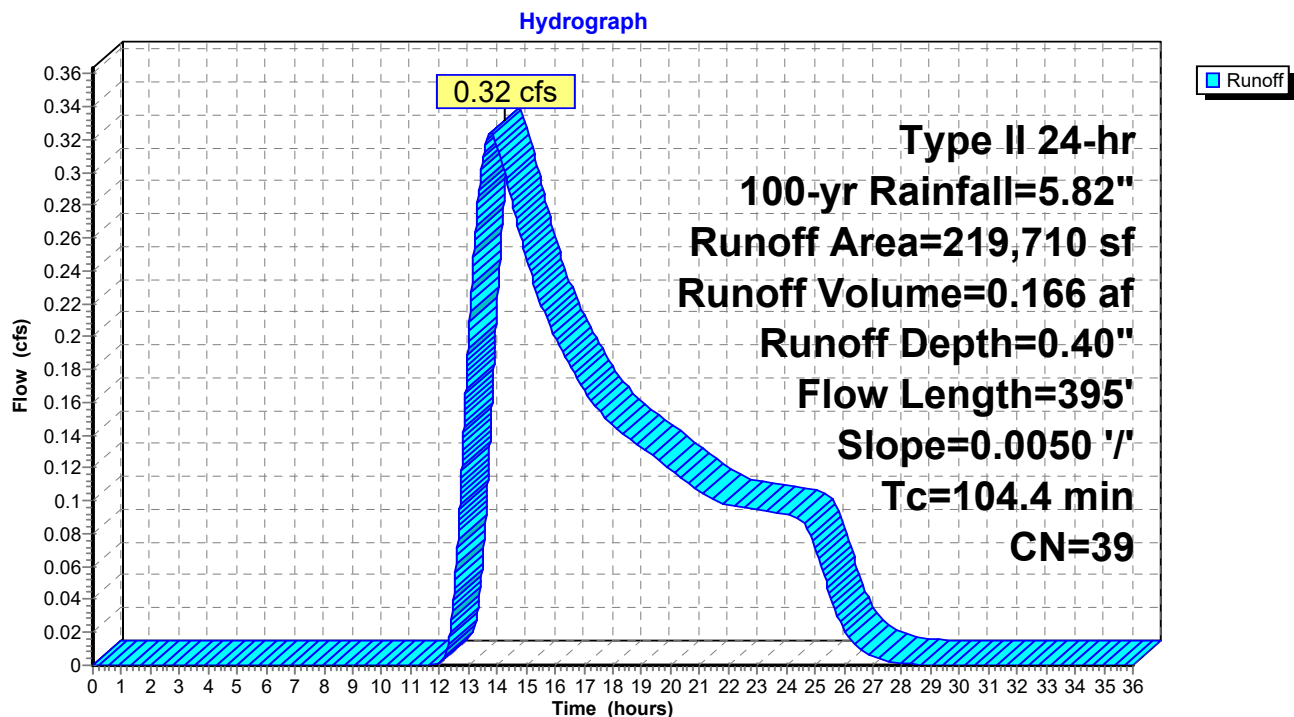
Summary for Subcatchment 6S: Post Dev Basin 8 OFFSITE

Runoff = 0.32 cfs @ 13.80 hrs, Volume= 0.166 af, Depth= 0.40"
Routed to Pond 8P : Facility 3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-yr Rainfall=5.82"

Area (sf)	CN	Description
0	98	Unconnected roofs, HSG A
* 0	98	Pavement
219,710	39	>75% Grass cover, Good, HSG A
219,710	39	Weighted Average
219,710		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
99.9	300	0.0050	0.05		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 2.60"
4.5	95	0.0050	0.35		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
104.4	395	Total			

Subcatchment 6S: Post Dev Basin 8 OFFSITE

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Type II 24-hr 100-yr Rainfall=5.82"

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Summary for Subcatchment 9S: Post Dev Basin 2

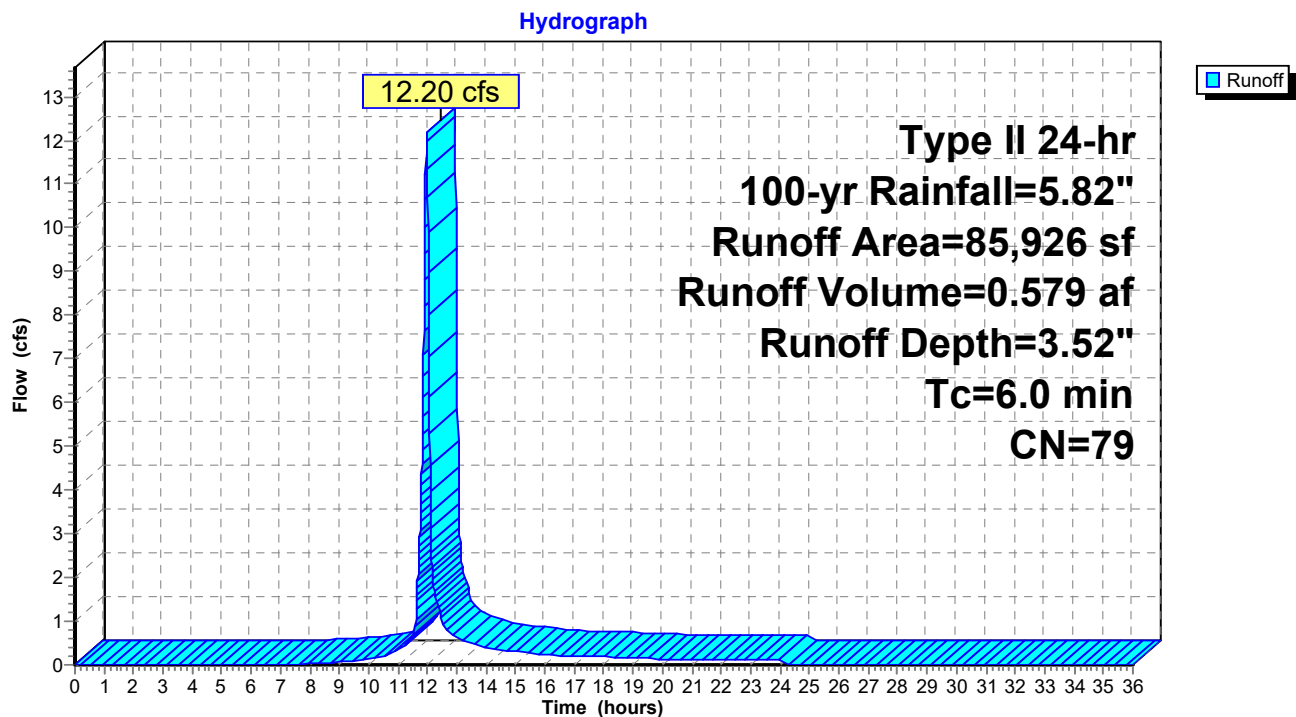
Runoff = 12.20 cfs @ 11.97 hrs, Volume= 0.579 af, Depth= 3.52"
Routed to Pond 8P : Facility 3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-yr Rainfall=5.82"

	Area (sf)	CN	Description
	0	98	Unconnected roofs, HSG A
*	57,653	98	Pavement
	28,273	39	>75% Grass cover, Good, HSG A
*	0	96	Gravel
	85,926	79	Weighted Average
	28,273		32.90% Pervious Area
	57,653		67.10% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry,

Subcatchment 9S: Post Dev Basin 2



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Type II 24-hr 100-yr Rainfall=5.82"

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Summary for Subcatchment 12S: Post Dev Basin 3

Runoff = 142.47 cfs @ 11.97 hrs, Volume= 6.877 af, Depth= 3.92"

Routed to Pond 8P : Facility 3

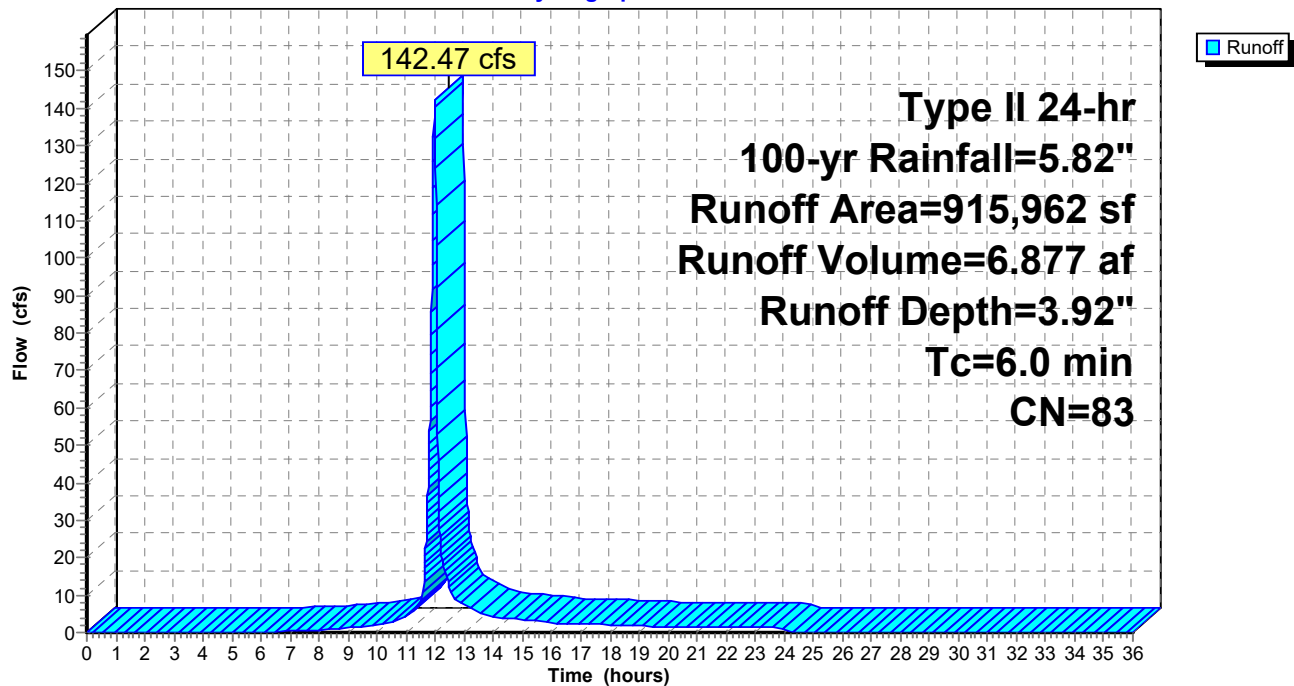
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-yr Rainfall=5.82"

	Area (sf)	CN	Description
	243,892	98	Unconnected roofs, HSG A
*	442,952	98	Pavement
	229,118	39	>75% Grass cover, Good, HSG A
*	0	96	Gravel
	915,962	83	Weighted Average
	229,118		25.01% Pervious Area
	686,844		74.99% Impervious Area
	243,892		35.51% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry,

Subcatchment 12S: Post Dev Basin 3

Hydrograph



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Type II 24-hr 100-yr Rainfall=5.82"

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Summary for Pond 8P: Facility 3

Inflow Area = 30.376 ac, 59.79% Impervious, Inflow Depth = 3.19" for 100-yr event
 Inflow = 164.28 cfs @ 11.97 hrs, Volume= 8.070 af
 Outflow = 5.92 cfs @ 13.78 hrs, Volume= 8.070 af, Atten= 96%, Lag= 108.5 min
 Discarded = 5.92 cfs @ 13.78 hrs, Volume= 8.070 af
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
 Routed to Link 5L : Total Post Development Discharge

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
 Peak Elev= 1,167.66' @ 13.78 hrs Surf.Area= 71,065 sf Storage= 184,139 cf

Plug-Flow detention time= 355.1 min calculated for 8.070 af (100% of inflow)
 Center-of-Mass det. time= 355.1 min (1,167.7 - 812.7)

Volume	Invert	Avail.Storage	Storage Description
#1	1,164.00'	880,194 cf	Custom Stage Data (Prismatic) Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,164.00	34,587	0	0
1,165.00	41,730	38,159	38,159
1,166.00	50,355	46,043	84,201
1,167.00	62,117	56,236	140,437
1,168.00	75,751	68,934	209,371
1,169.00	90,953	83,352	292,723
1,170.00	108,072	99,513	392,236
1,171.00	128,981	118,527	510,762
1,172.00	173,543	151,262	662,024
1,173.00	262,797	218,170	880,194

Device	Routing	Invert	Outlet Devices
#1	Discarded	1,164.00'	3.600 in/hr Exfiltration over Surface area Phase-In= 0.01'
#2	Primary	1,172.10'	15.0' long x 4.0' breadth Broad-Crested Rectangular Weir
Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00			
2.50 3.00 3.50 4.00 4.50 5.00 5.50			
Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66			
2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32			

Discarded OutFlow Max=5.92 cfs @ 13.78 hrs HW=1,167.66' (Free Discharge)

↑ **1=Exfiltration** (Exfiltration Controls 5.92 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=1,164.00' TW=0.00' (Dynamic Tailwater)

↑ **2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

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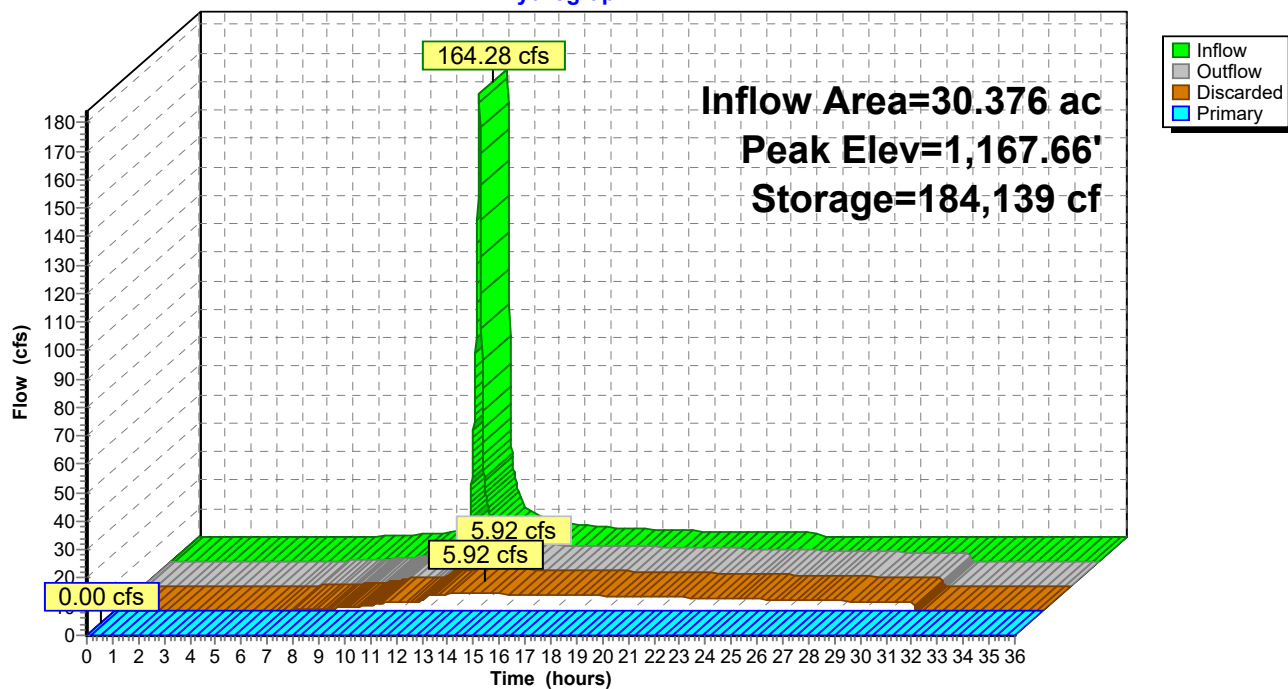
Type II 24-hr 100-yr Rainfall=5.82"

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Pond 8P: Facility 3

Hydrograph



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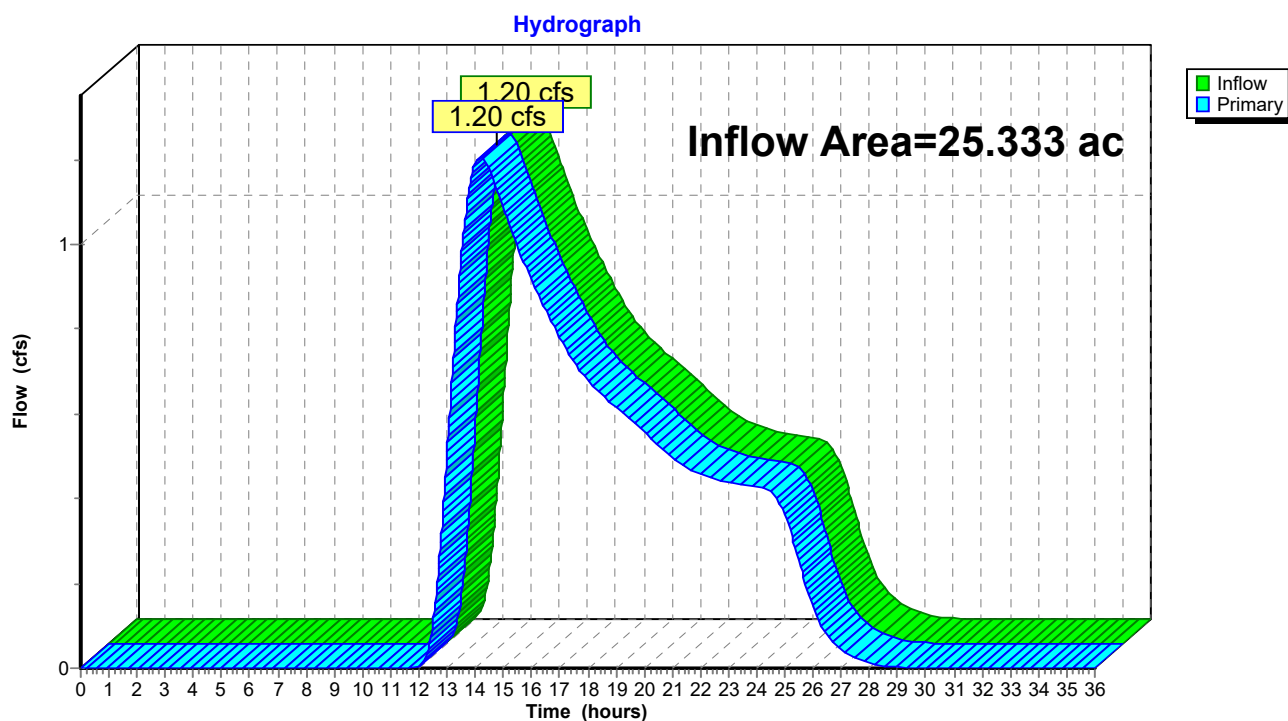
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Summary for Link 3L: Total Predevelopment Discharge

Inflow Area = 25.333 ac, 4.25% Impervious, Inflow Depth = 0.34" for 100-yr event
Inflow = 1.20 cfs @ 14.24 hrs, Volume= 0.719 af
Primary = 1.20 cfs @ 14.24 hrs, Volume= 0.719 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Link 3L: Total Predevelopment Discharge



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Type II 24-hr 100-yr Rainfall=5.82"

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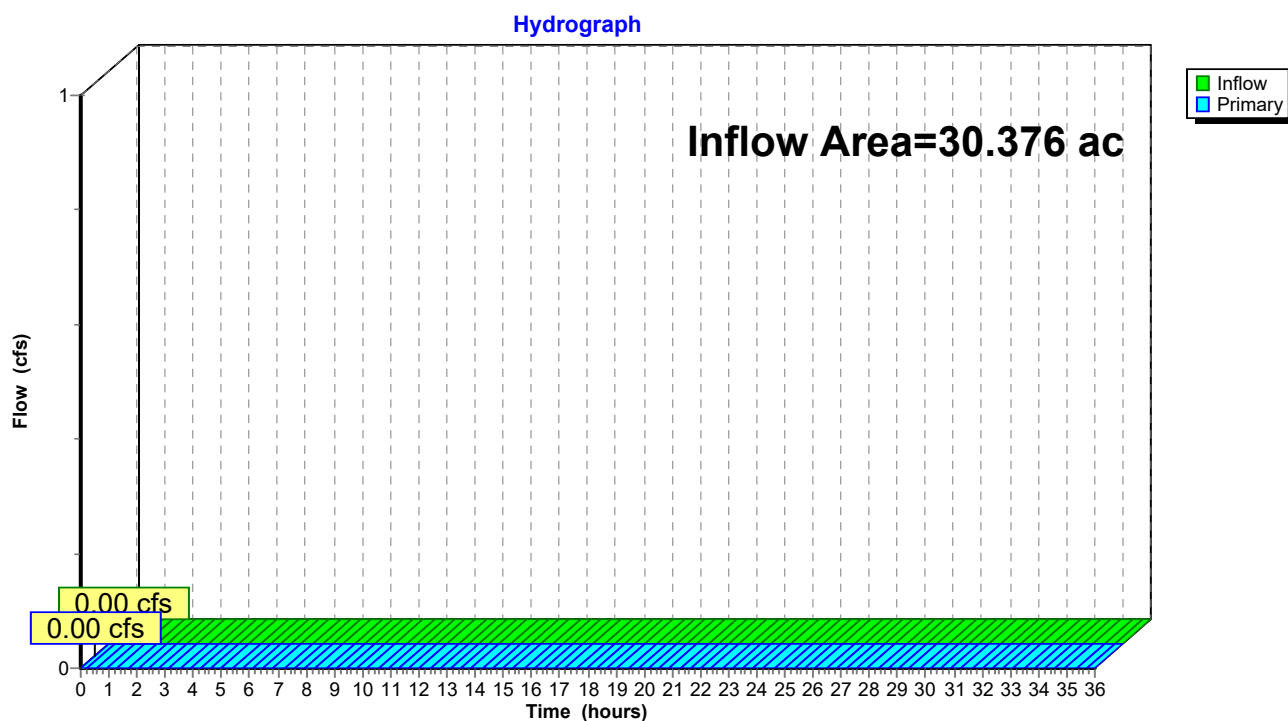
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Summary for Link 5L: Total Post Development Discharge

Inflow Area = 30.376 ac, 59.79% Impervious, Inflow Depth = 0.00" for 100-yr event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Link 5L: Total Post Development Discharge



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Multi-Event Tables

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Events for Subcatchment 1S: Predev Basin 1

Event	Rainfall (inches)	Runoff (cfs)	Volume (acre-feet)	Depth (inches)
1-yr	2.27	0.00	0.000	0.00
2-yr	2.60	0.00	0.000	0.00
10-yr	3.72	0.00	0.002	0.01
25-yr	4.49	0.02	0.017	0.06
100-yr	5.82	0.13	0.079	0.30

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Multi-Event Tables

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Events for Subcatchment 2S: Predev Basin 2

Event	Rainfall (inches)	Runoff (cfs)	Volume (acre-feet)	Depth (inches)
1-yr	2.27	0.00	0.000	0.00
2-yr	2.60	0.00	0.000	0.00
10-yr	3.72	0.05	0.023	0.01
25-yr	4.49	0.19	0.158	0.09
100-yr	5.82	1.08	0.640	0.35

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Multi-Event Tables

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Events for Subcatchment 4S: Post Dev Basin 1

Event	Rainfall (inches)	Runoff (cfs)	Volume (acre-feet)	Depth (inches)
1-yr	2.27	0.67	0.047	0.24
2-yr	2.60	1.22	0.071	0.37
10-yr	3.72	3.69	0.179	0.92
25-yr	4.49	5.73	0.270	1.39
100-yr	5.82	9.65	0.449	2.31

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Multi-Event Tables

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Events for Subcatchment 6S: Post Dev Basin 8 OFFSITE

Event	Rainfall (inches)	Runoff (cfs)	Volume (acre-feet)	Depth (inches)
1-yr	2.27	0.00	0.000	0.00
2-yr	2.60	0.00	0.000	0.00
10-yr	3.72	0.01	0.009	0.02
25-yr	4.49	0.06	0.046	0.11
100-yr	5.82	0.32	0.166	0.40

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Multi-Event Tables

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Events for Subcatchment 9S: Post Dev Basin 2

Event	Rainfall (inches)	Runoff (cfs)	Volume (acre-feet)	Depth (inches)
1-yr	2.27	2.39	0.113	0.69
2-yr	2.60	3.18	0.149	0.91
10-yr	3.72	6.14	0.286	1.74
25-yr	4.49	8.32	0.389	2.37
100-yr	5.82	12.20	0.579	3.52

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Multi-Event Tables

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Events for Subcatchment 12S: Post Dev Basin 3

Event	Rainfall (inches)	Runoff (cfs)	Volume (acre-feet)	Depth (inches)
1-yr	2.27	33.35	1.552	0.89
2-yr	2.60	42.68	1.983	1.13
10-yr	3.72	76.34	3.584	2.05
25-yr	4.49	100.37	4.760	2.72
100-yr	5.82	142.47	6.877	3.92

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Multi-Event Tables

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Events for Pond 8P: Facility 3

Event	Inflow (cfs)	Outflow (cfs)	Discarded (cfs)	Primary (cfs)	Elevation (feet)	Storage (cubic-feet)
1-yr	36.34	3.31	3.31	0.00	1,164.72	26,852
2-yr	47.03	3.47	3.47	0.00	1,165.00	37,976
10-yr	86.13	4.17	4.17	0.00	1,165.97	82,515
25-yr	114.38	4.80	4.80	0.00	1,166.62	117,464
100-yr	164.28	5.92	5.92	0.00	1,167.66	184,139

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Multi-Event Tables

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Events for Link 3L: Total Predevelopment Discharge

Event	Inflow (cfs)	Primary (cfs)	Elevation (feet)
1-yr	0.00	0.00	0.00
2-yr	0.00	0.00	0.00
10-yr	0.05	0.05	0.00
25-yr	0.21	0.21	0.00
100-yr	1.20	1.20	0.00

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Multi-Event Tables

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Events for Link 5L: Total Post Development Discharge

Event	Inflow (cfs)	Primary (cfs)	Elevation (feet)
1-yr	0.00	0.00	0.00
2-yr	0.00	0.00	0.00
10-yr	0.00	0.00	0.00
25-yr	0.00	0.00	0.00
100-yr	0.00	0.00	0.00

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- 25 Subcat 1S: Predev Basin 1
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- 35 Subcat 1S: Predev Basin 1
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Appendix D: Web Soil Survey Map



United States
Department of
Agriculture

NRCS

Natural
Resources
Conservation
Service

A product of the National
Cooperative Soil Survey,
a joint effort of the United
States Department of
Agriculture and other
Federal agencies, State
agencies including the
Agricultural Experiment
Stations, and local
participants

Custom Soil Resource Report for Marathon County, Wisconsin

Marathon County - New Highway
Garage



Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (<http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/>) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (<https://offices.sc.egov.usda.gov/locator/app?agency=nrcs>) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report Soil Map



Custom Soil Resource Report

MAP LEGEND

Area of Interest (AOI)

 Area of Interest (AOI)

Soils

 Soil Map Unit Polygons

 Soil Map Unit Lines

 Soil Map Unit Points

Special Point Features

 Blowout

 Borrow Pit

 Clay Spot

 Closed Depression

 Gravel Pit

 Gravelly Spot

 Landfill

 Lava Flow

 Marsh or swamp

 Mine or Quarry

 Miscellaneous Water

 Perennial Water

 Rock Outcrop

 Saline Spot

 Sandy Spot

 Severely Eroded Spot

 Sinkhole

 Slide or Slip

 Sodic Spot

 Spoil Area

 Stony Spot

 Very Stony Spot

 Wet Spot

 Other

 Special Line Features

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 1:20,000.

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: Marathon County, Wisconsin
Survey Area Data: Version 23, Sep 10, 2025

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

Date(s) aerial images were photographed: Jun 7, 2023—Jun 8, 2023

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.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
3383B	Mahtomedi loamy sand, 0 to 6 percent slopes	30.6	100.0%
Totals for Area of Interest		30.6	100.0%

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

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An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Marathon County, Wisconsin

3383B—Mahtomedi loamy sand, 0 to 6 percent slopes

Map Unit Setting

National map unit symbol: ggwn
Elevation: 600 to 1,950 feet
Mean annual precipitation: 22 to 36 inches
Mean annual air temperature: 36 to 48 degrees F
Frost-free period: 80 to 170 days
Farmland classification: Not prime farmland

Map Unit Composition

Mahtomedi and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Mahtomedi

Setting

Landform: Outwash plains, stream terraces
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Tread
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Sandy outwash

Typical profile

Ap - 0 to 8 inches: loamy sand
Bw1 - 8 to 18 inches: sand
Bw2 - 18 to 24 inches: sand
C - 24 to 60 inches: sand

Properties and qualities

Slope: 0 to 6 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Excessively drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 15 percent
Available water supply, 0 to 60 inches: Low (about 4.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4s
Hydrologic Soil Group: A
Ecological site: F090BY019WI - Dry Sandy Upland
Forage suitability group: Low AWC, adequately drained (G090AY002WI)
Other vegetative classification: Pinus strobus - Quercus spp. / Gaultheria procumbens - Ceanothus americanus, Eastern White Pine - Oak spp. / Wintergreen - New Jersey Tea (PQGCe), Pinus strobus - Acer rubrum /

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Vaccinium angustifolium - Amphicarpa bracteata , Eastern White Pine - Red Maple / Low Sweet Blueberry - Hog-peanut (PArVAm), Low AWC, adequately drained (G090AY002WI)

Hydric soil rating: No

Minor Components

Mahtomedi, moderately well drained

Percent of map unit: 5 percent

Landform: Depressions, outwash plains, stream terraces

Landform position (two-dimensional): Toeslope, summit

Landform position (three-dimensional): Tread

Down-slope shape: Concave, linear

Across-slope shape: Concave, linear

Ecological site: F090BY019WI - Dry Sandy Upland

Other vegetative classification: Low AWC, adequately drained (G090AY002WI)

Hydric soil rating: No

Chetek

Percent of map unit: 3 percent

Landform: Outwash plains, stream terraces

Landform position (two-dimensional): Summit

Landform position (three-dimensional): Tread

Down-slope shape: Convex

Across-slope shape: Convex

Ecological site: F090BY021WI - Dry Loamy Upland

Other vegetative classification: Low AWC, adequately drained (G090AY002WI)

Hydric soil rating: No

Graycalm

Percent of map unit: 2 percent

Landform: Recessionial moraines, lake plains, outwash plains

Landform position (two-dimensional): Summit

Down-slope shape: Convex

Across-slope shape: Convex

Ecological site: F090AY019WI - Dry Sandy Upland

Other vegetative classification: Low AWC, adequately drained (G090AY002WI),

Pinus strobus - Acer rubrum / Vaccinium angustifolium - Amphicarpa bracteata , Eastern White Pine - Red Maple / Low Sweet Blueberry - Hog-peanut (PArVAm)

Hydric soil rating: No

Soil Information for All Uses

Soil Properties and Qualities

The Soil Properties and Qualities section includes various soil properties and qualities displayed as thematic maps with a summary table for the soil map units in the selected area of interest. A single value or rating for each map unit is generated by aggregating the interpretive ratings of individual map unit components. This aggregation process is defined for each property or quality.

Soil Qualities and Features

Soil qualities are behavior and performance attributes that are not directly measured, but are inferred from observations of dynamic conditions and from soil properties. Example soil qualities include natural drainage, and frost action. Soil features are attributes that are not directly part of the soil. Example soil features include slope and depth to restrictive layer. These features can greatly impact the use and management of the soil.

Hydrologic Soil Group (Marathon County - New Highway Garage)

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.

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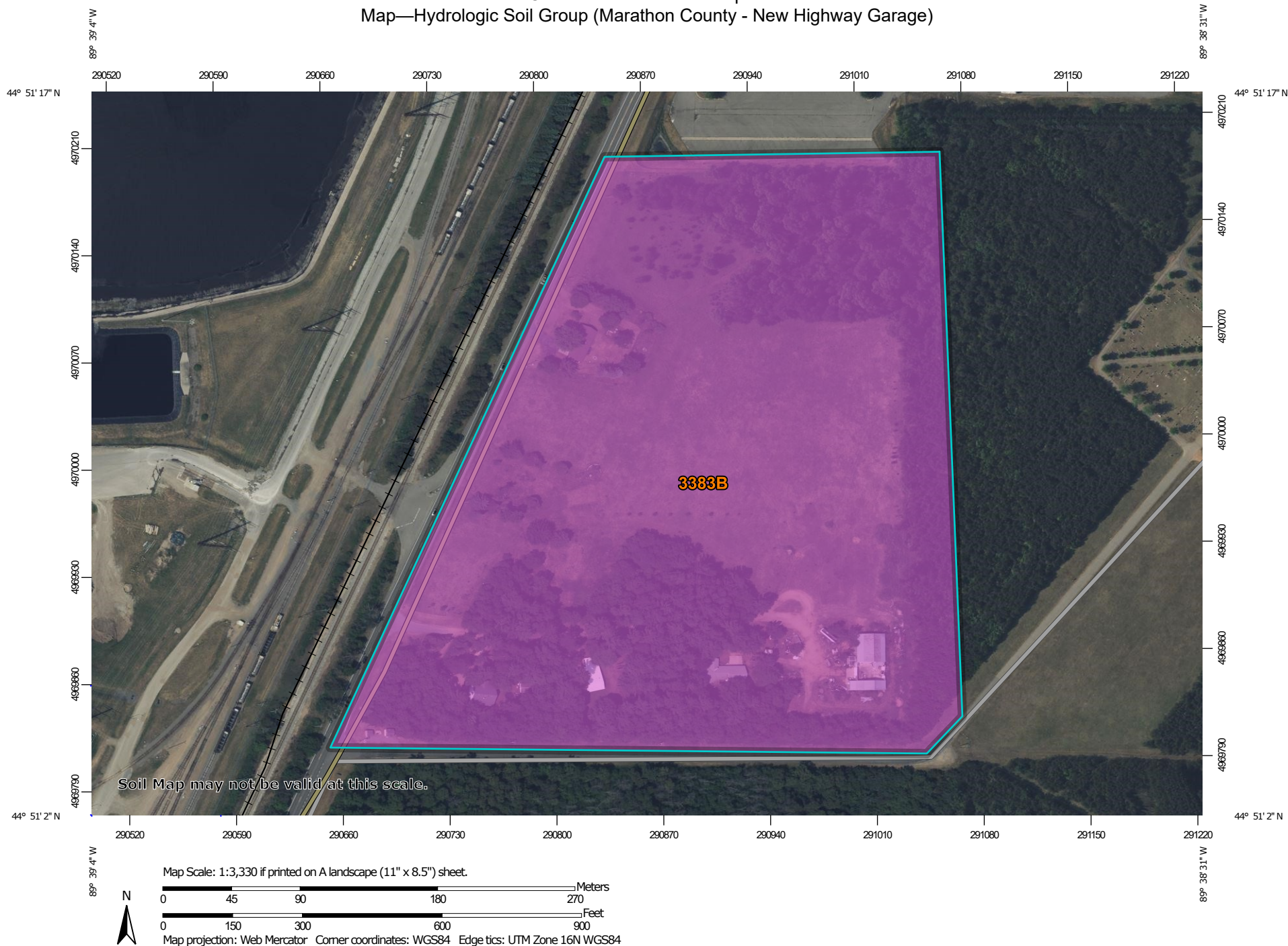
Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

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.

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Map—Hydrologic Soil Group (Marathon County - New Highway Garage)



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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 1:20,000.

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: Marathon County, Wisconsin
Survey Area Data: Version 23, Sep 10, 2025

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

Date(s) aerial images were photographed: Jun 7, 2023—Jun 8, 2023

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.

Table—Hydrologic Soil Group (Marathon County - New Highway Garage)

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
3383B	Mahtomedi loamy sand, 0 to 6 percent slopes	A	30.6	100.0%
Totals for Area of Interest			30.6	100.0%

Rating Options—Hydrologic Soil Group (Marathon County - New Highway Garage)*Aggregation Method:* Dominant Condition*Component Percent Cutoff:* None Specified*Tie-break Rule:* Higher

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- United States Department of Agriculture, Natural Resources Conservation Service. National range and pasture handbook. <http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/landuse/rangepasture/?cid=stelprdb1043084>

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Appendix E: Geotechnical Report & Stormwater Soil Evaluation

Point of Beginning

GEOTECHNICAL ENGINEERING REPORT



MARATHON COUNTY HWY SHOP FACILITY

VILLAGE OF KRONENWETTER, WISCONSIN

APRIL 2, 2026 | PROJECT NO. 25.2082

Marathon County Department of
Facilities and Capital Management
1100 Lakeview Drive, Door 43
Wausau, WI 54403

STEVENS POINT OFFICE 4941 KIRSCHLING COURT, STEVENS POINT, WI 54481
GREEN BAY OFFICE 1497 6TH STREET - SUITE C, GREEN BAY, WI 54304
SUN PRAIRIE OFFICE 1261 W MAIN STREET - SUITE 102, SUN PRAIRIE, WI 53590
EMAIL INFO@POBINC.COM • **CALL** 715.344.9999 • **VISIT** POBINC.COM

DRILL it.



4941 Kirschling Court, Stevens Point, WI 54481
1497 6th Street - Suite C, Green Bay, WI 54304
1261 W Main Street - Suite 102, Sun Prairie, WI 53590

April 2, 2026

Marathon County Department of
Facilities and Capital Management
Attn: Troy Torgerson
1100 Lakeview Drive, Door 43
Wausau, WI 54403

RE: Marathon County Hwy Shop Facility – Village of Kronenwetter, Wisconsin

Dear Mr. Torgerson:

We appreciate the opportunity to perform the subsurface exploration and provide this geotechnical engineering report for the above-referenced project.

This report has been prepared in accordance with our understanding of the project requirements and within the scope of our geotechnical services.

We trust the information and recommendations presented will assist in the design and development of the project. Please contact us if further clarification or additional services are needed.

Sincerely,

Michael Frede

Michael Frede, P.E.
Director of Geotechnical Engineering

Enclosure

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EXECUTIVE SUMMARY

This report summarizes the results of our geotechnical engineering services associated with the proposed new Marathon County highway shop facility to be constructed in the Village of Kronenwetter, Wisconsin.

PROJECT DESCRIPTION

The project consists of constructing the following:

- Main Building
 - One Story with Mezzanines
 - Slab-on-Grade Floor
- Equipment Storage Building
 - One Story
 - Slab-on-Grade Floor
- Salt Storage Building
 - Slab-on-Grade Floor
- Ancillary Facilities
- Asphalt and Concrete Pavements
- Stormwater Management Systems

STRUCTURAL CONSIDERATIONS

- The buildings can be supported by conventional, shallow foundation systems designed using an allowable bearing capacity of 2,500 psf.
 - A higher value can be used if additional soil improvement is implemented.
- The building floor slabs and equipment pads can be designed using a subgrade modulus value of 70 pci.
 - A higher value can be used if additional soil improvement is implemented.
- Retaining walls design parameters for the existing soils and aggregate backfill are provided.

CIVIL CONSIDERATIONS

- Minimum pavement sections should consist of the following:
 - Asphalt Pavement
 - Traffic Class I = 4 inches of asphalt over 10 inches of base course.
 - Traffic Class II = 5 inches of asphalt over 12 inches of base course.
 - Portland Cement Concrete (PCC) Pavement
 - Non-Traffic Areas = 5 inches of PCC over 6 inches of base course.
 - Heavy Truck = 7 inches of PCC over 6 inches of base course.
 - Geotextile fabric between the base course materials and prepared subgrade.
- The stormwater management systems can be designed using an infiltration rate of 3.60 inches per hour (in/hr) based on Table 2 standards.
 - Field infiltration testing could be conducted to possibly increase the design infiltration rate.



CONSTRUCTION CONSIDERATIONS

- Soil improvements should be planned below structural elements and pavements.
 - Undocumented fills exist in the project area that could cause excessive settlements of structural elements and pavements.
 - Low-strength native soils exist that could cause excessive settlements of structural elements and pavements.
- The soils at the estimated foundation bearing elevations exhibit variable strengths that can produce differential settlements if not considered in the structural design.
- Clean sand (small quantities of fines) soil exists that will pose construction challenges.
- Cobbles exist within the soil profile that could cause construction challenges for excavations.
- The property has a development history, and efforts should be taken during site grading to identify any structural elements that need to be removed.



PROJECT DESCRIPTION

Marathon County is preparing to construct a new highway shop facility in Kronenwetter, Wisconsin. The location of the project is illustrated in Figure 1 in Appendix A.

The proposed development plan consists of the following:

- Main Building
 - One Story with Mezzanines
 - The structure is planned to be supported by conventional, shallow, column and wall spread footings.
 - Slab-on-Grade Floor
 - The floor elevation was not provided but estimated to be about 1175 feet.
- Equipment Storage Building
 - One Story
 - The structure is planned to be supported by conventional, shallow, column and wall spread footings.
 - Slab-on-Grade Floor
 - The floor elevation was not provided but estimated to be about 1173 feet.
- Salt Storage Building
 - One Story
 - The structure is planned to be supported by conventional, shallow, wall spread footings.
 - Slab-on-Grade Floor
 - The floor elevation was not provided but estimated to be about 1176 feet.
- Ancillary Facilities
- Asphalt and Concrete Pavements
- Stormwater Management Systems
- The development concept is illustrated in Figure 2 in Appendix A and described in greater detail in relevant sections of the Request for Proposals included in Appendix E.

SITE DESCRIPTION

The development area includes eight parcels located at the northeast corner of Old Hwy 51 and Gate of Heaven Drive in the Village of Kronenwetter, Marathon County, Wisconsin.

- The project area is illustrated on Figure 3 (Project Topographic Survey).
- The project area totals 24.5 acres.
- Five of the parcels are currently developed, with most of the land currently undeveloped.
 - Additional structures may have existed within the project boundaries.
- The ground surface is relatively flat, sloping downward from the northeast corner to the south with an elevation difference of about 4 feet. (1777 feet to 1173 feet).



SCOPE OF SERVICES

SUBSURFACE EXPLORATION

The drilling program consisted of forty-four borings:

- Three borings (B-1, B-2, and B-3) drilled to depths of 20 feet within the salt storage building footprint.
- Fifteen borings (B-4 through B-18) drilled to depths of 20 feet within the main building footprint.
- One boring (B-19) drilled to a depth of 20 feet at the fuel island.
- One boring (B-20) drilled to a depth of 20 feet at the truck scale.
- Nine borings (B-21 through B-29) drilled to depths of 20 feet within the equipment storage building footprint.
- Eight borings (P-1 through B-8) drilled to depths of 10 feet in the pavement areas.
- Seven borings (SW-1 through SW-7) drilled to depths of 10 feet in the stormwater areas.
- The boring locations are illustrated on the Boring Location Diagram (Figure 2) in Appendix A.
- The ground surface at the boring locations were measured by a Point of Beginning field crew.
- The drilling and sampling procedures are described in Appendix D.

ADDITIONAL FIELD TESTING

- None

LABORATORY TESTING

The laboratory testing program consisted of the following:

- All samples were visually examined and classified based on their physical characteristics as defined by the Unified Soil Classification System (USCS).
 - The boring logs are included in Appendix B.
 - The USCS summary is included in Appendix B.
- The samples from the stormwater areas were classified according to the US Department of Agriculture (USDA) soil classification system for stormwater management design.
 - The classifications are presented on the *Soil and Site Evaluation – Stormwater Infiltration* form included in Appendix B.
- Water content testing on all samples.
 - The laboratory test results are presented on the boring logs.
- Sieve analysis testing on four samples from the stormwater areas.
 - The laboratory test results are presented on the boring logs.
 - The full sieve analysis reports are included in Appendix C.
 - The P200 (percent passing the no. 200 sieve) results are presented on the boring logs.
- Typical laboratory procedures are described in Appendix D.



SUBSURFACE CONDITIONS

SOIL CONDITIONS

The subsurface conditions encountered at the boring locations are summarized below. For detailed descriptions of the geologic conditions encountered at the boring locations, please refer to the attached logs in Appendix B. The general geologic profiles are also illustrated on five cross sections (Figures 4 through 8) in Appendix A. The size of the project and typical geologic variability between boring locations warrants considering all soil conditions when designing the various structural and civil elements of the development.

General Soil Conditions

- Surface Material
 - Topsoil at all boring locations except two (SW-6 and SW-7).
 - 0 to 18 inches
 - The average was 10.7 inches
- Undocumented Fill Soil
 - Undocumented fills were encountered at six boring locations (B-18, B-28, P-5, P-8, SW-6, and SW-7) to depths of about 1.5 to 9 feet.
 - The fills consisted of sand, with minimal fines (silt), soil layers.
 - The fills are “undocumented” because no reports were provided to indicate they were placed and compacted sufficiently to support structural elements.
 - The fills were likely placed when the property was originally developed and generated from on-site grading activities.
 - Deeper fill soils could exist in other areas within the property, including former building areas.
- Native Coarse-Grained (Sand) Soils
 - Layers of mostly fine sand, with minimal fines (silt), were encountered at all sample locations.
 - The medium and coarse sand content varied in the layers.
 - The fine gravel content varied in the sand layers.

Physical Soil Characteristics

- Undocumented Fill Soils
 - Ten sand fill samples were collected.
 - The samples exhibited very loose to medium dense relative densities.
 - The N-values ranged from 2 to 11.
 - The overall average was 5.
 - Three samples (30%) were less than 4 (very loose).
 - One sample (10%) exceeded 10 (medium dense).
 - The moisture content of the samples ranged from 2.2% to 11.2%.
 - The average was 5.7%.
 - Typically, moisture contents are considered high if they are above 15% in sand soils.



- The samples were all described as slightly moist and moist.
- Native Coarse-Grained Soils
 - Two hundred and twenty-four native sand samples were collected.
 - The samples exhibited very loose to dense relative densities.
 - The N-values ranged from 2 to sampler refusal (50 blows for less than 6 inches of penetration).
 - The overall average was 14.
 - Three samples (1%) were less than 4 (very loose).
 - These samples were collected in the top 3 feet of the soil profile.
 - Very loose soils reflect allowable bearing capacities less than 1,000 psf.
 - Forty samples (18%) were less than 10 (loose).
 - 80% of these samples were collected in the top 5 feet of the soil profile.
 - Loose soils reflect allowable bearing capacities less than 2,000 psf.
 - Three samples (1%) were greater than 30 (dense and very dense).
 - These samples encountered cobbles.
 - The moisture content of the samples ranged from 1.2% to 7.2%.
 - The average was 3.1%.
 - Typically, moisture contents are considered high if they are above 15% in sand soils.
 - The samples were all described as slightly moist and moist.

BEDROCK CONDITIONS

- No bedrock was encountered.
- A review of the State of Wisconsin well logs in the immediate vicinity of the project area indicated that bedrock exists at a depth greater than 90 feet.

GROUNDWATER CONDITIONS

- No perched water or groundwater was encountered at the boring locations.
- Fluctuations in the groundwater table elevation occur with variations in precipitation, evapotranspiration, surface runoff, etc.



ANALYSIS AND RECOMMENDATIONS

There are five primary issues that should be considered when planning this project.

- Soil improvements should be planned to address low-strength soils below structural elements and pavements.
 - Undocumented fills exist in the project area that can be a concern, potentially causing excessive total and/or differential settlements.
 - Low-strength (very loose and loose sand) native soils exist in the shallower portions of the soil profile.
 - Refer to Figures 4 through 8) in Appendix B for the location of undocumented fills and low-strength native soils within the soil profile.
 - The most cost-effective soil improvement method is likely the removal and replacement of unsuitable soils during mass grading operations.
- The soils at the estimated foundation bearing elevations exhibit variable strengths (refer to Figures 4 through 6).
 - The footings are expected to bear upon variable-strength native soils and engineered fill.
 - Variable bearing soils can produce differential settlements if not considered in the structural design.
- Clean sand (small quantities of fines) soil exists that will pose construction challenges.
- Cobbles exist within the soil profile that could pose construction challenges for excavations.
- The property has a development history, and efforts should be taken during site grading to identify any structural elements that need to be removed.

STRUCTURAL CONSIDERATIONS

Foundation Design

- Net Allowable Bearing Capacity = 2,500 psf
 - Equivalent N-value = 10
 - The above allowable bearing capacity is conservative due to the variable strength bearing conditions.
 - The above allowable bearing capacity assumes soil improvement within the building areas occurs due to the presence of undocumented fill and low-strength native soils.
 - The most likely method of soil improvement is over-excavation and replacement.
 - The depth of over-excavation is estimated to be 0 to 7 feet (possibly deeper in unexplored areas), with an average of 1.5 feet.
 - A higher value could be utilized if additional soil improvement is implemented.
 - This recommendation is based on the assumptions illustrated in Figures 4 through 6.
- Estimated Settlement (Properly Designed and Constructed)
 - Total = less than 1 inch
 - Differential = less than $\frac{3}{4}$ inch
- Design Safety Factor = 3
- Minimum Foundation Dimensions



- Columns: 30 inches
- Continuous: 18 inches
- Sliding Resistance (allowable coefficient of friction) = 0.35
- Minimum Footing Depth
 - Perimeter Footings and Interior Footings in Unheated Areas = 48 inches below exterior grade.
 - Exterior footings can bear at shallower depths by following ASCE 32-01 (American Society of Civil Engineers, Design and Construction of Frost-Protected Shallow Foundations, 2001).
 - Interior Footings (not subject to frost) can bear directly beneath the floor slab.

Seismic Design

- Seismic Site Classification = D
- The soil conditions present at the property, and knowledge of the general geologic profile in the area, were utilized in determining the Seismic Design Category (SDC) for structures.
- The Site Class was determined based on the expected average properties of the soil within 100 feet of the surface.
- Additional seismic classification notes are provided in Appendix D.

Floor Slab Design

- Subgrade Modulus = 70 pci
 - This value is conservative due to the variable strength bearing conditions.
 - A higher value could be utilized if additional soil improvement is planned.
 - This value assumes that the slab bears on a minimum 2 feet of improved soil or engineered fill.
- Floor Slab Support = 6 inches of base course meeting material specifications of WisDOT Section 310, Open Graded Base Course
- These recommendations can also be utilized for equipment pads.

Retaining Wall Design

- Assuming the adjacent soils consist of native fine sand soils, the following values are appropriate:

<i>Retaining Wall Design Parameters</i>	
Soil Unit Weight	100 pcf
Angle of Internal Friction	27°
Soil Cohesion	0 psf
<i>Earth Pressure Coefficient</i>	
At Rest Design Parameters	0.55
Active Design Parameters	0.37
Passive Design Parameters	2.70

- If backfill envelopes are sloped more than 45° and the backfill consists of crushed aggregate, the following values are appropriate.



<i>Retaining Wall Design Parameters</i>	
Soil Unit Weight	140 pcf
Angle of Internal Friction	42°
Soil Cohesion	0 psf
<i>Earth Pressure Coefficient</i>	
At Rest Design Parameters	0.29
Active Design Parameters	0.17
Passive Design Parameters	5.83

- An active earth pressure condition will develop for walls that are free to rotate at least 0.001 times the height of the wall.
- An at-rest condition will develop for walls that will be restrained.
- A passive condition will develop for walls that rotate towards the soil.
 - A minimum safety factor of 2.0 is recommended in passive earth pressure calculations.
- The upper 2 feet of soil in frost protected areas and 4 feet of soil in other areas should be ignored.
- All retaining walls will be vertical.
- The excavations adjacent to the walls will range from a vertical cut to a 30° slope.
- Clean, free-draining crushed aggregate fill (P200 <6%) is used as backfill within 2 feet behind the walls.
- The backfill condition at the ground surface is level.
- The retaining wall design should also consider surface and subgrade surcharge loading.
- Special attention should be paid during placement of backfill against below-grade and retaining walls.
 - Inadequate placement and compaction of backfill will result in at-grade structural elements and slab/pavement settlement and distress.
 - To achieve a balance between minimizing excessive pressures against the walls during construction and reducing the settlement of the wall backfill, the granular backfill should be compacted using vibratory methods and confirmed with field observations.
 - Where backfill supports structural elements, sidewalks, or pavements, the upper 4 feet should be compacted to 95% of the maximum dry density (Modified Proctor).
 - Lifts of 4 to 6 inches can be effective in achieving compaction requirements.
 - Drainage should be provided behind the walls to prevent the buildup of hydrostatic pressures.
 - Drainage pipes should be installed along the perimeter of below-grade walls that are exposed to the elements, slightly above the footings, and allowed to drain either by gravity or to a sump pit and pump system.
 - The drainage pipes (4-inch slotted) should be surrounded by a minimum of 6 inches of drainage aggregate.
 - A filter should be installed either between the soil and stone backfill or on the tubing (filter sock).
 - The drainpipes should be interconnected at 15 to 20 feet spacings. Water stops should be used in all construction and expansion joints.



- Cleanouts should be provided for the drainage pipes and the system checked periodically to confirm it is functioning properly.
- A relatively impermeable barrier at the ground surface is recommended, such as a minimum 2-foot-thick clay cap or Bituminous or Portland cement concrete (e.g., walkways and drives) to minimize surface water infiltration into backfill against walls.
 - The impermeable barrier should slope away from the structure at a minimum 2 percent grade.

CIVIL CONSIDERATIONS

Pavement Design

- Undocumented fills and shallow, low-strength native soils exist in the project area.
 - Therefore, greater than normal distress, faster deterioration, overall reduced service life, and increased maintenance are anticipated.
- To reduce the potential for localized settlements and provide more consistent subgrade support, a geotextile fabric (e.g., SKAPS W315) should be placed below the base course materials in areas subjected to traffic loads.
- The Wisconsin Asphalt Pavement Association (WAPA) Design Guide should be utilized to design the new asphalt surface pavements.
- Asphalt Pavement
 - The Wisconsin Asphalt Pavement Association (WAPA) Design Guide should be utilized to design the new asphalt surface pavements.
 - Hot Mix Asphalt (HMA) and base course materials should be placed and compacted following the project requirements and guidelines of WisDOT Standard Specifications for Highway and Structure Construction, section 460.3.
 - It has been assumed that Traffic Class I is suitable for areas that are mainly used by light passenger vehicles and Traffic Class II for medium-loaded areas.
 - The minimum pavement section should consist of the following:

<i>Material</i>	<i>Traffic Class I</i>	<i>Traffic Class II</i>	<i>WisDOT Specification</i>
Asphalt Surface Course	2 inches	2 inches	Section 460
Asphalt Binder Course	2 inches	3 inches	Section 460
Dense Graded Base Course	10 inches	12 inches	Section 305

- Portland Cement Concrete (PCC) Pavement
 - Surface PCC pavements that are not subjected to vehicle traffic should be a minimum of 5 inches with a minimum of 6-inches of dense graded aggregate base course.
 - PCC Pavement sections that experience heavy truck traffic, equipment or truck parking areas, entrances and exit aprons, or trash-dumpster loading zones should consist of a minimum



thickness of 7 inches over a minimum of 6-inch-thick crushed dense graded aggregate base course.

- The reinforcement details for PCC layers and final pavement sections should be designed by the project design engineer.
- The pavement sections above are not intended to support on-going construction traffic.
- The pavement recommendations assume the subgrade is prepared as described in this report.
 - Additional corrective action may be warranted at the time of construction, depending on the site conditions.

Stormwater Management Design

- Stormwater management system design parameters are based on the soils encountered at SW-1 through SW-7.
 - The classifications for the boring samples are presented on the *Soil and Site Evaluation – Stormwater Infiltration* form in Appendix E.
 - The infiltration rate for the predominant soil ("Sand") is 3.60 inches per hour (in/hr) based on Table 2 standards.
 - Field infiltration testing could be conducted to possibly increase the infiltration rate.

CONSTRUCTION CONSIDERATIONS

Subgrade Preparation

- All organic, loose, wet, disturbed, or otherwise unsuitable surface soils should be stripped from structural and engineered fill areas prior to any construction activities.
- Large structural areas should be proof-rolled to identify low-strength or disturbed areas that need to be removed or improved.
- Clean sand soils will be sensitive to disturbances from construction activity that can cause significant reduction in soil strength and support capabilities.
 - Care should be taken during construction to protect these soils from disturbance from equipment.
- Placing a working subbase layer of 3-inch crushed stone or utilizing a cement stabilization program could be beneficial in areas subjected to construction traffic and to reduce the potential need to strip disturbed soils.
- Cobbles may be encountered in excavations that could cause construction challenges.
- The property has a development history, and efforts should be taken during site grading to identify any buried structural elements and utilities.
 - Buried structural elements from former buildings, associated backfill materials, and utilities could be present in the project area.
 - Efforts should be taken during site grading to identify any existing elements and undocumented fills.
 - Existing foundations should be removed to a depth of at least 4 feet below proposed foundations.



- Existing concrete slabs below a depth of 4 feet should be removed or broken into minimum 1-foot pieces to avoid water pooling.
- Utilities should be properly abandoned.
- Care should also be taken to minimize disturbance of existing native soil that would require additional subgrade restoration.

Engineered Fill and Backfill

- Engineered (compacted and tested) Fill
 - Inorganic Materials
 - Free of Deleterious Debris
 - Non-Frozen
 - Maximum 3 inches in Size
 - Placed in 8 to 10-inch Loose Lifts
 - Minimum Compaction
 - Structural Areas= 95 percent of the Maximum Dry Density (Modified Proctor)
 - Non-Structural Areas = 90 percent of the Maximum Dry Density (Modified Proctor)
 - Moisture Content = $3 \pm$ percent of the Optimum Moisture
 - Placed on Tested and Passing Subgrade Soils
 - Testing Frequency (where not specified by local ordinance)
 - One test per lift for every 2,500 square feet of compacted fill in building areas.
 - One test per lift for every 5,000 square feet of compacted fill in pavement areas.
 - One test per 100 linear feet of compacted utility trench backfill.
- Imported Fill
 - Fine-Grained Soil (Clay)
 - Suitable for mass grading only.
 - Silt soil should not be used.
 - Coarse-Grained Soil (Sand, Gravel)
 - Suitable for utility and foundation backfill and mass grading.
 - Processed (Crushed and Screened) Aggregate
 - Suitable for all applications.
- On-site soil can be reused as engineered fill if they meet the specifications in this report.

Foundation Evaluation

- To manage the risk of excessive total or differential settlements, any low-strength soils below foundations should be removed or improved.
 - Soil strengths can be determined in the footing excavations with the use of a Dynamic Cone Penetrometer (DCP), converting the values to allowable bearing capacities.
- Exposed foundation and subgrade soils should be observed, tested, and documented by a representative of the geotechnical engineer.
 - All excavations should be evaluated to confirm the exposed materials are consistent with those identified in this report.



- If unanticipated conditions are encountered, the geotechnical engineer should be notified immediately.
- The base of all foundation excavations should be free of water and loose soil, prior to placing concrete.
- Concrete should be placed soon after excavating to reduce bearing soil disturbance.
- Care should be taken to prevent wetting or drying of the bearing materials during construction.
- Excessively wet or dry material or any loose/disturbed material in the bottom of the footing excavations should be removed/reconditioned before foundation concrete is placed.
- Sensitive soils exposed at the surface of footing excavations may require surficial compaction with hand-held dynamic compaction equipment prior to placing structural fill, steel, and/or concrete.
- Should surficial compaction not be adequate, construction of a working surface consisting of either crushed aggregate or a lean concrete mud mat may be required prior to the placement of reinforcing steel and construction of foundations.
- If unsuitable bearing soils are observed at the base of the planned footing excavation, the excavation should be extended deeper to suitable soils, and the footings could bear directly on these soils at the lower level or on lean concrete backfill placed in the excavations.
 - The lean concrete replacement zone can be the same width as the footing width.
- Alternatively, over-excavation for structural fill placement below footings should be conducted as shown below.
 - The over-excavation should be backfilled up to the footing base elevation with crushed aggregate meeting the requirements of WisDOT Section 305 placed, as recommended in the Earthwork section

Groundwater Management

- Excavations will likely not encounter perched water or groundwater.

Surface Water Management

- Surface water should not be allowed to collect in excavations or on prepared subgrades during or after construction.
- Areas should be sloped to facilitate removal of collected surface runoff.
- Positive site drainage should be provided to reduce infiltration of surface water around the perimeter of structures and within pavement areas.

Excavation Safety

- Excavation walls may need to be sloped or braced for stability and safety reasons.
- The Owner and Contractor should be aware of, and become familiar with, applicable local, state, and federal safety regulations, including current OSHA Excavation and Trench Safety Standards.
- Construction-site safety generally is the responsibility of the Contractor, who should also be responsible for the means, methods, and sequencing of construction operations.



- The Contractor should be aware that slope height, slope inclination, or excavation depths should in no case exceed those specified in local, state, or federal safety regulations, (e.g., OSHA Health and Safety Standards for Excavations, 29 CFR Part 1926), or successor regulations.
- The soils encountered in the borings are Type C when applying the OSHA regulations.
- OSHA regulations are strictly enforced, and if they are not followed, the Owner, Contractor, and/or earthwork Subcontractor(s) could be liable for substantial penalties.

GENERAL QUALIFICATIONS

- Our services for this project are intended for the sole benefit and exclusive use of our client and for the specific application to the project described and are provided in accordance with generally accepted geotechnical engineering practices, with no third-party beneficiaries intended. Any use or reliance of the information by third parties is done solely at their own risk. No warranties, either expressed or implied, are intended or made.
- The findings, analysis, and recommendations presented in this report are based on our understanding of the project, a reasonable geotechnical scope approved by the client, and our engineering judgment.
- Should the details of the project change, Point of Beginning should be notified and provided with the opportunity to review the applicability of the collected information and modify our recommendations, as needed.
- The nature and extent of geologic variations may not become evident during or after construction. If the actual site subsurface conditions differ from the inferred conditions described in this report, the recommendations in this report may need to be revised.
- The recommendations in this report are only valid for the exact and specific locations at which field investigation or laboratory testing was completed. All other areas and regions of the site that are not evaluated will be at the risk of the individual or entity using this Report.
- Site characteristics as provided are for design purposes and not to estimate construction costs. Any party charged with estimating construction costs should seek their own site characterization for specific purposes to obtain the specific level of detail necessary for costing.
- Site safety, excavation support, and dewatering requirements/design are the responsibility of others.
- Construction and site development activities have the potential to affect adjacent properties. Such impacts can include damage due to vibration, modification of groundwater/surface water flow during construction, foundation movement due to undermining or subsidence from excavation, and noise or air-quality concerns. Evaluation of these items on nearby properties are commonly associated with contractor means and methods and are not addressed in this report. The owner and contractor should consider a preconstruction/precondition survey of surrounding developments.



APPENDICES

APPENDIX A

Diagrams

APPENDIX B

Geologic Information

APPENDIX C

Laboratory Reports

APPENDIX D

General Notes & Procedures

APPENDIX E

Additional Documents



APPENDIX A

FIGURE 1 – PROJECT LOCATION DIAGRAM

FIGURE 2 – PROJECT TOPOGRAPHIC SURVEY

FIGURE 3 – BORING LOCATION DIAGRAM

FIGURE 4 – NORTH BUILDING AREA - GEOLOGIC CROSS SECTION

FIGURE 5 – CENTER BUILDING AREA - GEOLOGIC CROSS SECTION

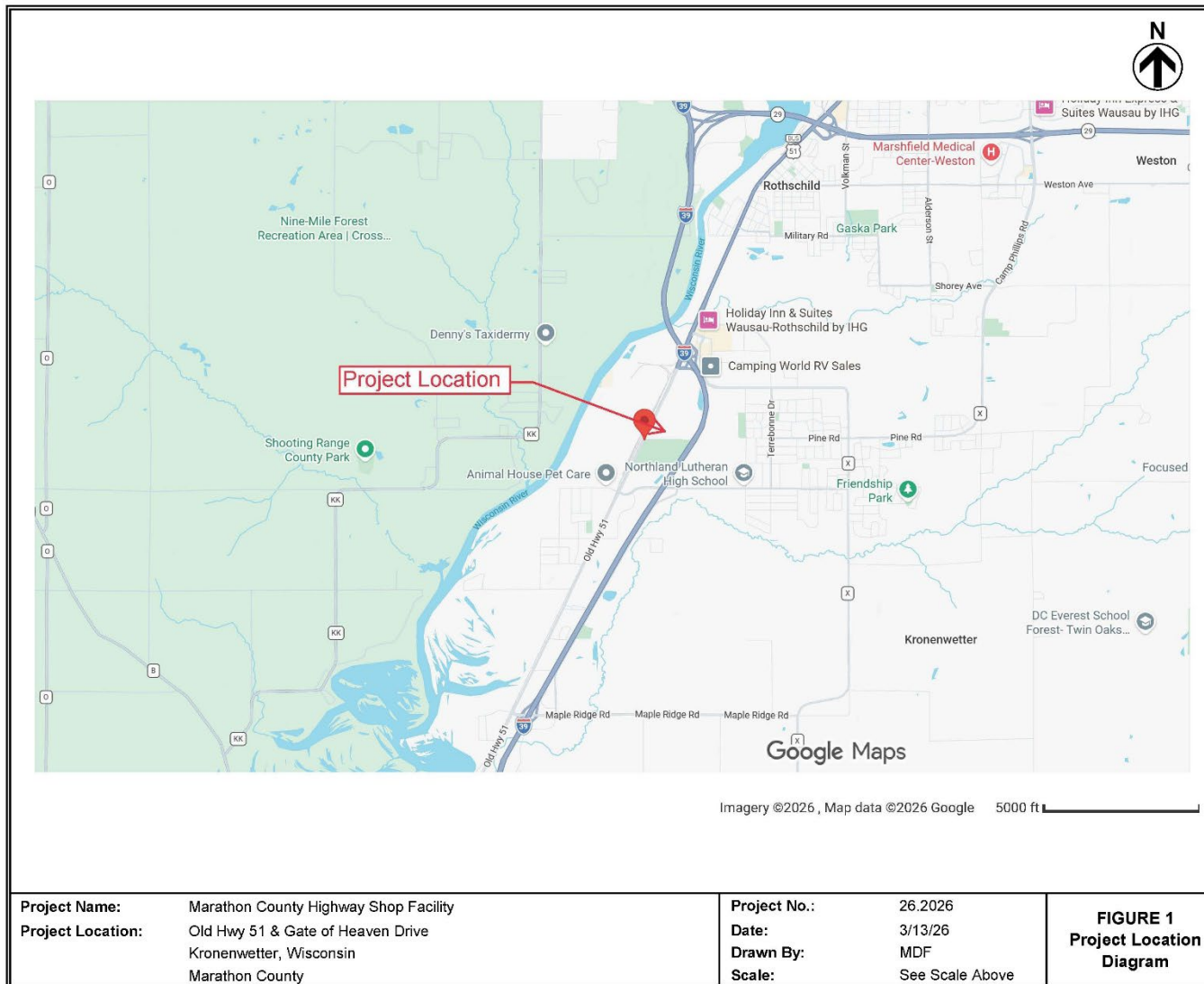
FIGURE 6 – SOUTH BUILDING AREA - GEOLOGIC CROSS SECTION

FIGURE 7 – PAVEMENT AREAS - GEOLOGIC CROSS SECTION

FIGURE 8 – STORMWATER AREAS - GEOLOGIC CROSS SECTION

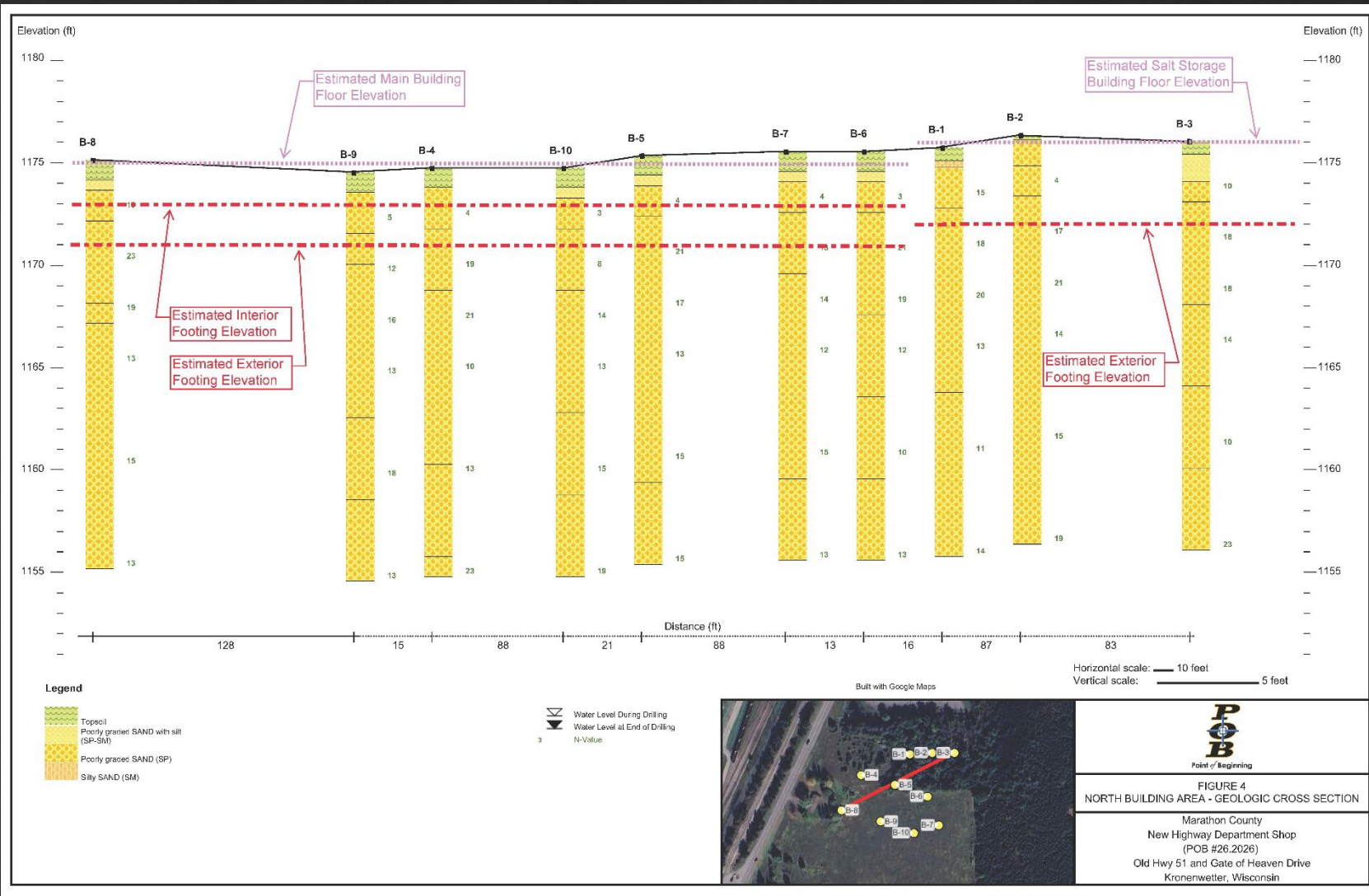


Point of Beginning

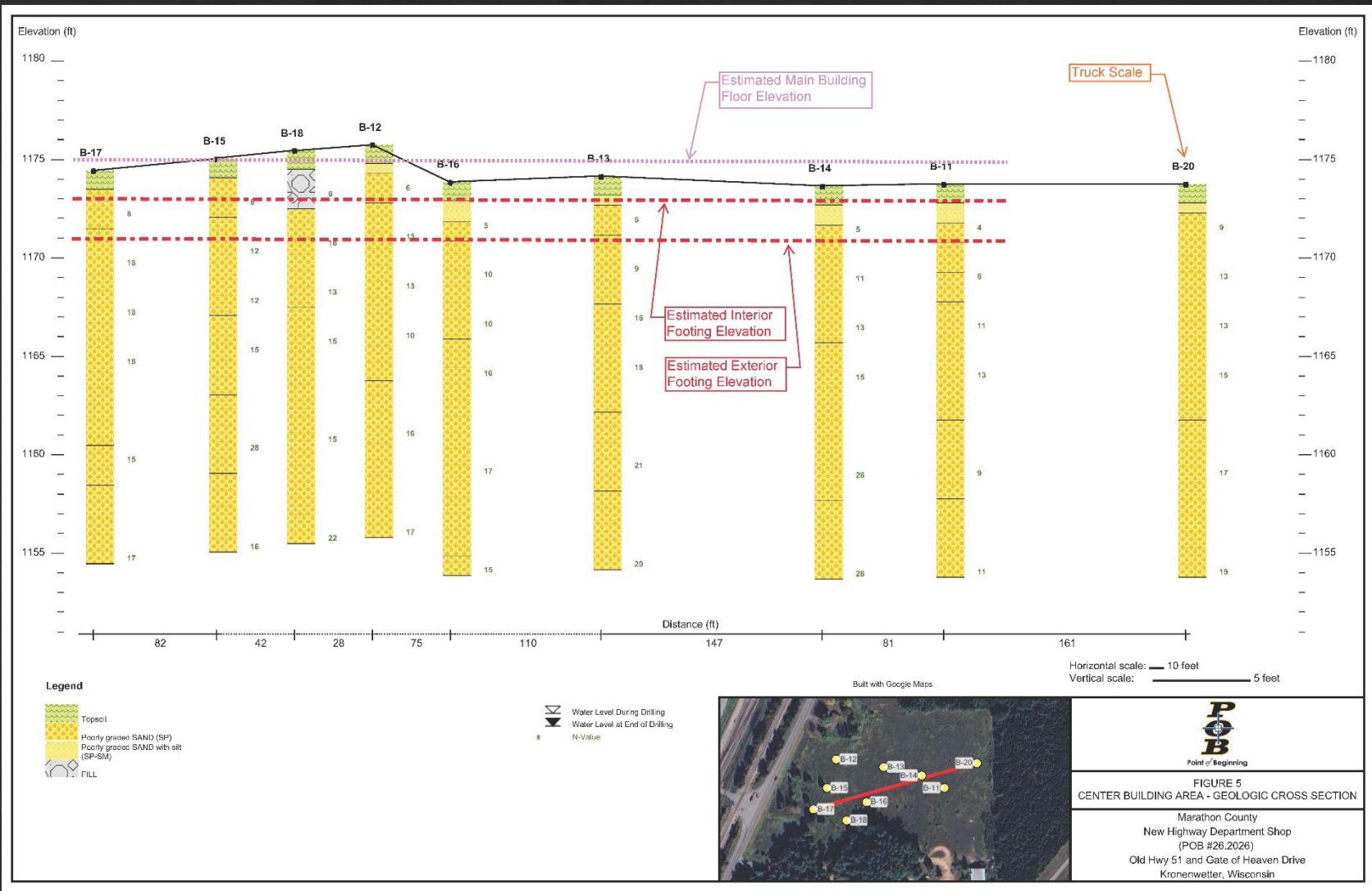




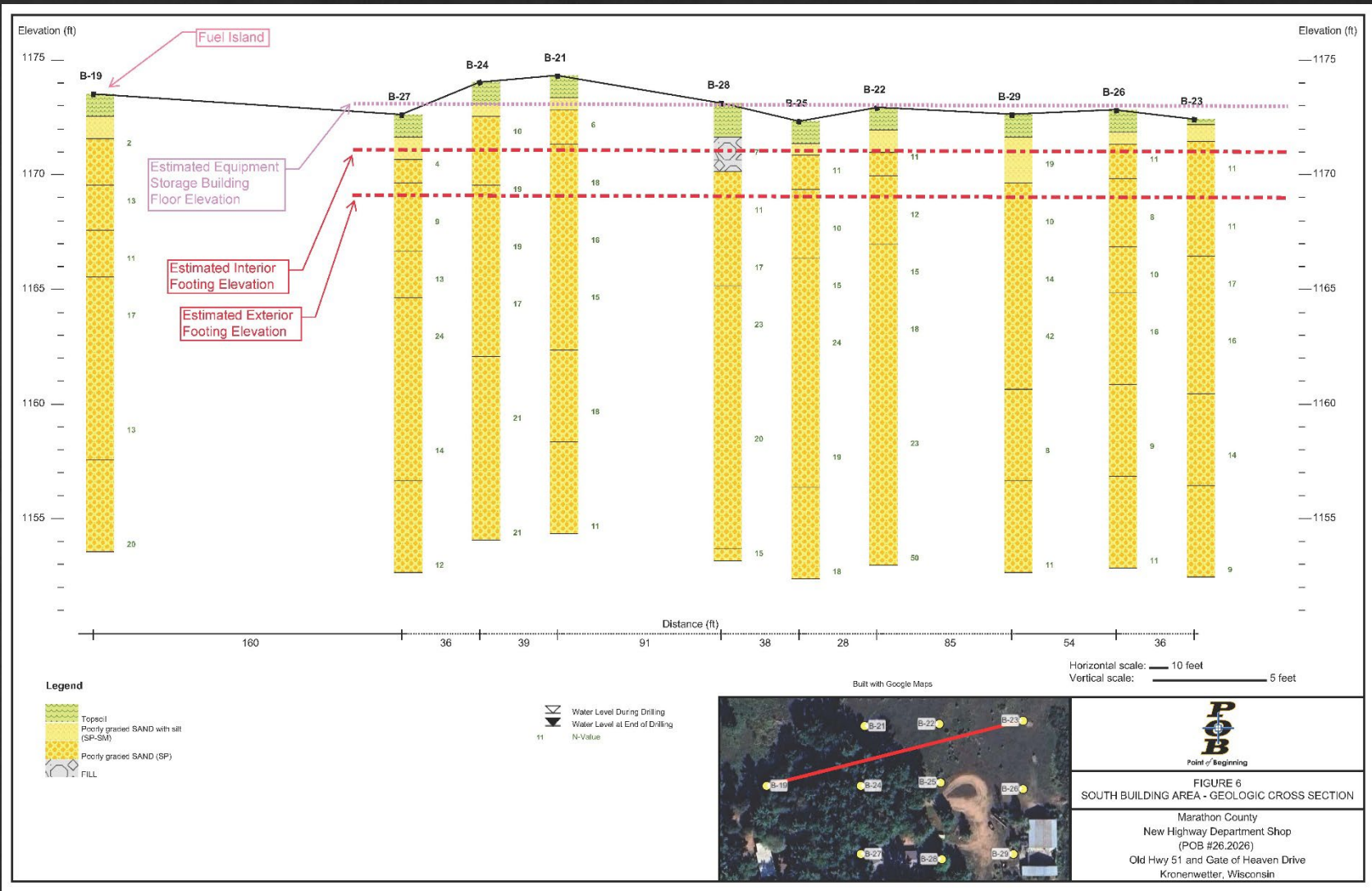
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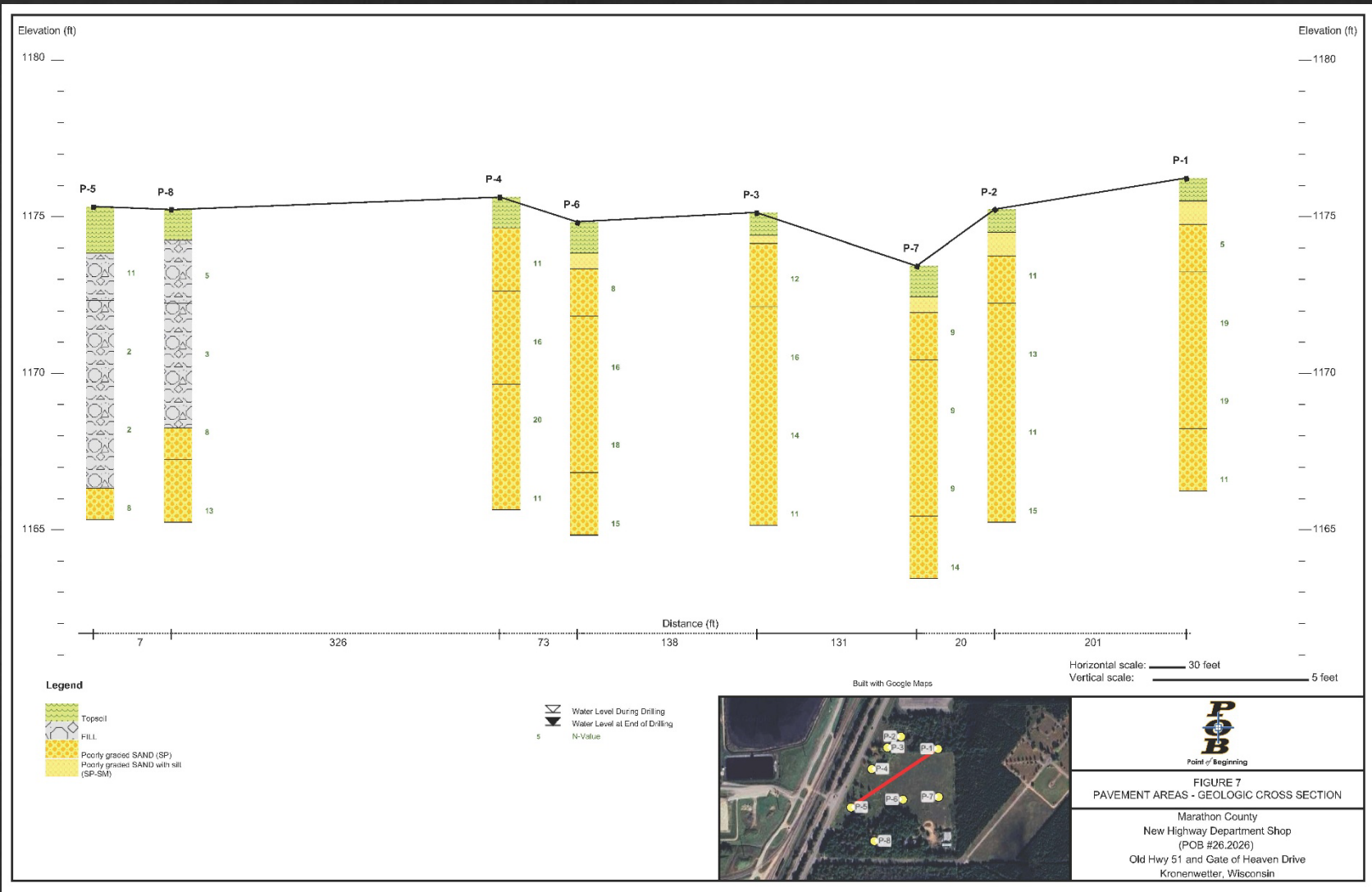
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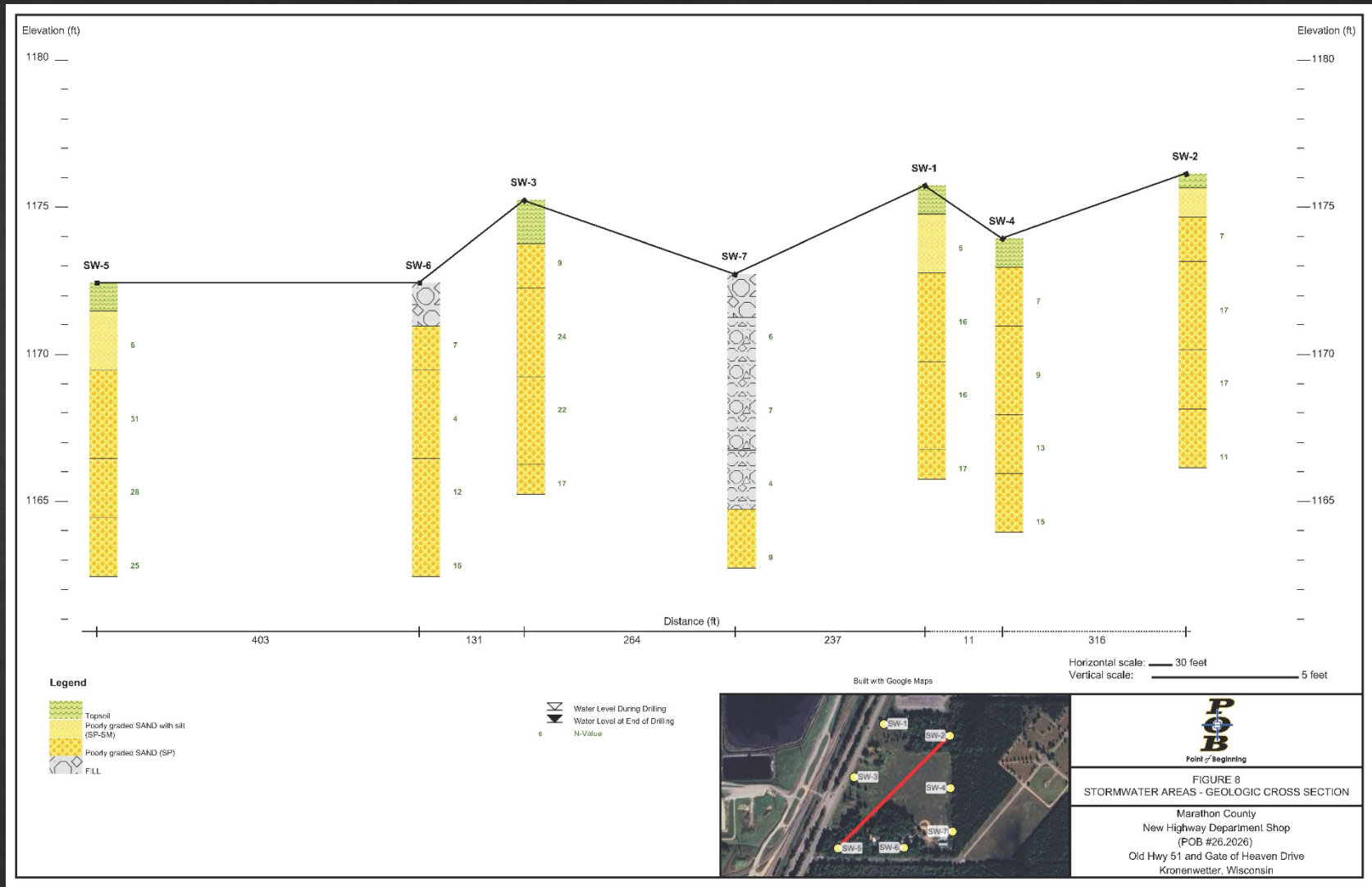
Point of Beginning



Point of Beginning



Point of Beginning



APPENDIX B

BORING LOGS

Building Areas

Salt Storage Building (B-1, B-2, and B-3)

Main Building (B-4 through B-18)

Fuel Island (B-19)

Truck Scale (B-20)

Equipment Storage Building (B-21 through B-29)

Pavement Areas (P-1 through P-8)

Stormwater Areas (SW-1 through SW-7)

LEGEND

USCS



	Client: Marathon County Project: New Highway Department Shop, (POB #26.2026) Address: Old Hwy 51 and Gate of Heaven Drive, Kronenwetter, WI	BORING LOG Boring No. B-1 Page: 1 of 1
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Drilling Start Date: 3/11/26 Drilling End Date: 3/11/26 Drilling Company: POB Drilling Method: Hollow Stem Auger Drilling Equipment: Mobile B-57 Driller: Dakota Ciriacks Logged By: Neil Henriksen	Boring Depth (ft): 20 Boring Diameter (in): 3.25 Sampling Method(s): Split Spoon DTW During Drilling (ft): N/A DTW After Drilling (ft): N/A Ground Surface Elev. (ft): 1175.7 Location (Lat, Long): 44.85394, -89.64567
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DEPTH (ft)	LITHOLOGY	WATER LEVEL	COLLECT				SOIL/ROCK VISUAL DESCRIPTION	Moisture Content (%)	Dry Density (pcf)	Liquid Limit	Plastic Limit	Plasticity Index (PI)	#200 Sieve (%)	Pocket Penetrometer (tsf)	Unconfined Compressive Strength (tsf)	ELEVATION (ft)
			Sample Type	Blow Counts	Recovery (ft)	N Value RQD%										
0							(0.00') Topsoil: 8 inches of Dark Brown Silty Sand Topsoil									1175
7	SS		4	0.67	15		(0.67') Silty SAND (SM); mostly fine grained sand, trace fine gravel, little silt, poorly graded, medium dense, slightly moist, brown	3.9								
8																
6	SS		6	1.30	18		(1.00') Poorly graded SAND (SP); mostly fine-coarse grained sand, few fine gravel, trace silt, medium dense, slightly moist, brown	2.6								
8																
10							(3.00') Poorly graded SAND (SP); mostly fine-coarse grained sand, few fine gravel, trace silt, medium dense, slightly moist, light brown									
7	SS		7	1.50	20			3.1								1170
9																
11																
4	SS		4	1.30	13			2.7								
5																
8																
10																1165
12							(12.00') Poorly graded SAND (SP); mostly fine-medium grained sand, few fine gravel, trace silt, medium dense, slightly moist, light brown									
4	SS		4	1.40	11			3.2								
5																
6																1160
15																
3	SS		3	1.40	14			2								
5																
9																
20							(20.00') Boring terminated									1155
25																

NOTES:

	Client: Marathon County Project: New Highway Department Shop, (POB #26.2026) Address: Old Hwy 51 and Gate of Heaven Drive, Kronenwetter, WI	BORING LOG Boring No. B-2 Page: 1 of 1
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Drilling Start Date: 3/11/26 Drilling End Date: 3/11/26 Drilling Company: POB Drilling Method: Hollow Stem Auger Drilling Equipment: Mobile B-57 Driller: Dakota Ciriacks Logged By: Neil Henriksen	Boring Depth (ft): 20 Boring Diameter (in): 3.25 Sampling Method(s): Split Spoon DTW During Drilling (ft): N/A DTW After Drilling (ft): N/A Ground Surface Elev. (ft): 1176.3 Location (Lat, Long): 44.85395, -89.64530
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DEPTH (ft)	LITHOLOGY	WATER LEVEL	COLLECT				SOIL/ROCK VISUAL DESCRIPTION	Moisture Content (%)	Dry Density (pcf)	Liquid Limit	Plastic Limit	Plasticity Index (PI)	#200 Sieve (%)	Pocket Penetrometer (tsf)	Unconfined Compressive Strength (tsf)	ELEVATION (ft)	
			Sample Type	Blow Counts	Recovery (ft)	N Value RQD%											
0							(0.00') Topsoil: 3 inches of Dark Brown Silty Sand Topsoil										
2	SS		2	1.50	4		(0.25') Poorly graded SAND (SP); mostly fine-medium grained sand, trace fine gravel, trace silt, loose, moist, brown	5.2									1175
4	SS		2	1.20	17		(1.50') Poorly graded SAND (SP); mostly fine-medium grained sand, few fine gravel, trace silt, loose, moist, brown	2.9									
6	SS		7	1.40	21		(3.00') Poorly graded SAND (SP); mostly fine-coarse grained sand, few fine gravel, trace silt, medium dense, slightly moist, light brown	2.7									1170
8	SS		5	0.80	14			2									1165
10																	
12	SS		4	1.20	15			2.2									1160
14																	
16	SS		5	1.50	19			2.1									1155
18							(20.00') Boring terminated										
20																	
22																	
24																	
26																	

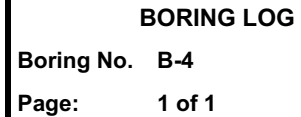
NOTES:

	Client: Marathon County Project: New Highway Department Shop, (POB #26.2026) Address: Old Hwy 51 and Gate of Heaven Drive, Kronenwetter, WI	BORING LOG Boring No. B-3 Page: 1 of 1
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Drilling Start Date: 3/11/26 Drilling End Date: 3/11/26 Drilling Company: POB Drilling Method: Hollow Stem Auger Drilling Equipment: Mobile B-57 Driller: Dakota Ciriacks Logged By: Neil Henriksen	Boring Depth (ft): 20 Boring Diameter (in): 3.25 Sampling Method(s): Split Spoon DTW During Drilling (ft): N/A DTW After Drilling (ft): N/A Ground Surface Elev. (ft): 1176 Location (Lat, Long): 44.85395, -89.64494
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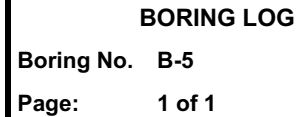
DEPTH (ft)	LITHOLOGY	WATER LEVEL	COLLECT				SOIL/ROCK VISUAL DESCRIPTION	Moisture Content (%)	Dry Density (pcf)	Liquid Limit	Plastic Limit	Plasticity Index (PI)	#200 Sieve (%)	Pocket Penetrometer (tsf)	Unconfined Compressive Strength (tsf)	ELEVATION (ft)	
			Sample Type	Blow Counts	Recovery (ft)	N Value RQD%											
0							(0.00') Topsoil: 7 inches of Dark Brown Silty Sand Topsoil										1175
			SS	4	1.50	10	(0.67') Poorly graded SAND with silt (SP-SM); mostly fine-medium grained sand, trace fine gravel, few silt, medium dense, slightly moist, brown	4.6									
				4													
				6													
			SS	4	1.10	18	(2.00') Poorly graded SAND (SP); mostly fine-medium grained sand, few fine gravel, trace silt, medium dense, slightly moist, brown	2.1									
5				9													
			SS	4	1.20	18	(3.00') Poorly graded SAND with gravel (SP); mostly fine-coarse grained sand, little fine-coarse gravel, trace silt, medium dense, slightly moist, light brown	2.7									1170
				8													
				10													
			SS	3	1.20	14	(8.00') Poorly graded SAND (SP); mostly fine-coarse grained sand, few fine gravel, trace silt, medium dense, slightly moist, light brown	2.2									1165
10				6													
				8													
			SS	4	1.30	10	(12.00') Poorly graded SAND (SP); mostly fine-medium grained sand, trace fine gravel, trace silt, medium dense, slightly moist, light brown	2.3									1160
15				5													
				5													
			SS	6	0.25	23	(16.00') Poorly graded SAND (SP); mostly fine-medium grained sand, few fine-coarse gravel, trace silt, medium dense, slightly moist, light brown	2.8									1155
20				11													
				12			(20.00') Boring terminated										
25																	

NOTES:



Boring Depth (ft):	20
Boring Diameter (in):	3.25
Sampling Method(s):	Split Spoon
DTW During Drilling (ft):	N/A
DTW After Drilling (ft):	N/A
Ground Surface Elev. (ft):	1174.7
Location (Lat, Long):	44.85369, -89.64647

NOTES:



Boring Depth (ft):	20
Boring Diameter (in):	3.25
Sampling Method(s):	Split Spoon
DTW During Drilling (ft):	N/A
DTW After Drilling (ft):	N/A
Ground Surface Elev. (ft):	1175.3
Location (Lat, Long):	44.85358, -89.64592

NOTES:

	Client: Marathon County Project: New Highway Department Shop, (POB #26.2026) Address: Old Hwy 51 and Gate of Heaven Drive, Kronenwetter, WI	BORING LOG Boring No. B-6 Page: 1 of 1
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Drilling Start Date: 3/11/26 Drilling End Date: 3/11/26 Drilling Company: POB Drilling Method: Hollow Stem Auger Drilling Equipment: Mobile B-57 Driller: Dakota Ciriacks Logged By: Neil Henriksen	Boring Depth (ft): 20 Boring Diameter (in): 3.25 Sampling Method(s): Split Spoon DTW During Drilling (ft): N/A DTW After Drilling (ft): N/A Ground Surface Elev. (ft): 1175.5 Location (Lat, Long): 44.85344, -89.64538
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DEPTH (ft)	LITHOLOGY	WATER LEVEL	COLLECT				SOIL/ROCK VISUAL DESCRIPTION	Moisture Content (%)	Dry Density (pcf)	Liquid Limit	Plastic Limit	Plasticity Index (PI)	#200 Sieve (%)	Pocket Penetrometer (tsf)	Unconfined Compressive Strength (tsf)	ELEVATION (ft)	
			Sample Type	Blow Counts	Recovery (ft)	N Value RQD%											
0							(0.00') Topsoil: 12 inches of Dark Brown Silty Sand Topsoil										1175
			SS	1	1.50	3	(1.00') Poorly graded SAND with silt (SP-SM); mostly fine-medium grained sand, trace fine gravel, few silt, very loose, slightly moist, brown	3.7									
				1													
				2													
			SS	6	1.10	21	(1.50') Poorly graded SAND (SP); mostly fine-medium grained sand, few fine gravel, trace silt, very loose, slightly moist, brown	2.1									
5				10													
				11													
			SS	5	1.30	19	(3.00') Poorly graded SAND with gravel (SP); mostly fine-coarse grained sand, little fine-coarse gravel, trace silt, medium dense, slightly moist, light brown	3									1170
				9													
				10													
			SS	4	1.40	12	(8.00') Poorly graded SAND (SP); mostly fine-medium grained sand, trace fine gravel, trace silt, medium dense, slightly moist, light brown	3.2									1165
10				5													
				7													
			SS	3	1.30	10	(12.00') Poorly graded SAND (SP); mostly fine-coarse grained sand, few fine-coarse gravel, trace silt, medium dense, slightly moist, light brown	2.7									1160
15				4													
				6													
			SS	4	0.80	13	(16.00') Poorly graded SAND with gravel (SP); mostly medium-coarse grained sand, little fine-coarse gravel, trace silt, medium dense, slightly moist, brown	2.6									1155
20				6													
				7													
							(20.00') Boring terminated										
25																	

NOTES:

	Client: Marathon County Project: New Highway Department Shop, (POB #26.2026) Address: Old Hwy 51 and Gate of Heaven Drive, Kronenwetter, WI	BORING LOG Boring No. B-7 Page: 1 of 1
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Drilling Start Date: 3/12/26 Drilling End Date: 3/12/26 Drilling Company: POB Drilling Method: Hollow Stem Auger Drilling Equipment: Mobile B-57 Driller: Dakota Ciriacks Logged By: Neil Henriksen	Boring Depth (ft): 20 Boring Diameter (in): 3.25 Sampling Method(s): Split Spoon DTW During Drilling (ft): N/A DTW After Drilling (ft): N/A Ground Surface Elev. (ft): 1175.5 Location (Lat, Long): 44.85311, -89.64520
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DEPTH (ft)	LITHOLOGY	WATER LEVEL	COLLECT				SOIL/ROCK VISUAL DESCRIPTION	Moisture Content (%)	Dry Density (pcf)	Liquid Limit	Plastic Limit	Plasticity Index (PI)	#200 Sieve (%)	Pocket Penetrometer (tsf)	Unconfined Compressive Strength (tsf)	ELEVATION (ft)	
			Sample Type	Blow Counts	Recovery (ft)	N Value RQD%											
0							(0.00') Topsoil: 12 inches of Dark Brown Silty Sand Topsoil										1175
			SS	2	1.50	4	(1.00') Poorly graded SAND with silt (SP-SM); mostly fine-medium grained sand, trace fine gravel, few silt, loose, moist, brown	5									
				2													
				2													
			SS	4	1.30	13	(1.50') Poorly graded SAND (SP); mostly fine grained sand, trace fine gravel, trace silt, loose, moist, light brown	6									
5				6													
				7													
			SS	5	1.50	14	(3.00') Poorly graded SAND (SP); mostly fine-medium grained sand, few fine gravel, trace silt, medium dense, moist, light brown	3.4									1170
				7													
				7			(6.00') Poorly graded SAND (SP); mostly fine-coarse grained sand, few fine-coarse gravel, trace silt, medium dense, slightly moist, light brown										
			SS	4	1.40	12											
10				6				3									1165
				6													
			SS	6	0.10	15											
15				7													
				8													1160
							(16.00') Poorly graded SAND (SP); mostly fine-medium grained sand, trace fine gravel, trace silt, medium dense, slightly moist, light brown										
			SS	4	1.20	13											
20				6				2.6									
				7			(20.00') Boring terminated										1155
25																	

NOTES:

	Client: Marathon County Project: New Highway Department Shop, (POB #26.2026) Address: Old Hwy 51 and Gate of Heaven Drive, Kronenwetter, WI	BORING LOG Boring No. B-8 Page: 1 of 1
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Drilling Start Date: 3/10/26 Drilling End Date: 3/10/26 Drilling Company: POB Drilling Method: Hollow Stem Auger Drilling Equipment: Mobile B-57 Driller: Dakota Ciriacks Logged By: Neil Henriksen	Boring Depth (ft): 20 Boring Diameter (in): 3.25 Sampling Method(s): Split Spoon DTW During Drilling (ft): N/A DTW After Drilling (ft): N/A Ground Surface Elev. (ft): 1175.1 Location (Lat, Long): 44.85328, -89.64680
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DEPTH (ft)	LITHOLOGY	WATER LEVEL	COLLECT				SOIL/ROCK VISUAL DESCRIPTION	Moisture Content (%)	Dry Density (pcf)	Liquid Limit	Plastic Limit	Plasticity Index (PI)	#200 Sieve (%)	Pocket Penetrometer (tsf)	Unconfined Compressive Strength (tsf)	ELEVATION (ft)
			Sample Type	Blow Counts	Recovery (ft)	N Value RQD%										
0							(0.00') Topsoil: 11.5 inches of Dark Brown Silty Sand Topsoil									1175
1			SS	4	1.50	10	(1.00') Poorly graded SAND with silt and gravel (SP-SM); mostly fine grained sand, little fine-coarse gravel, few silt, medium dense, slightly moist, brown	4.6								
2				4												
3				6												
4			SS	6	1.20	23	(1.50') Poorly graded SAND (SP); mostly fine-medium grained sand, few fine-coarse gravel, trace silt, medium dense, slightly moist, brown	2.6								1170
5				10												
6				13												
7			SS	6	1.40	19	(3.00') Poorly graded SAND (SP); mostly fine-coarse grained sand, few fine-coarse gravel, trace silt, medium dense, slightly moist, light brown	3.1								
8				9												
9				10			(7.00') Poorly graded SAND (SP); mostly fine-medium grained sand, trace fine gravel, trace silt, medium dense, slightly moist, light brown	3.1								
10			SS	5	1.30	13	(8.00') Poorly graded SAND (SP); mostly fine-coarse grained sand, few fine-coarse gravel, trace silt, medium dense, slightly moist, light brown	2.6								1165
11				6												
12				7												
13				7												
14			SS	7	0.80	15		2.5								1160
15				7												
16				8												
17																
18																
19																
20			SS	6	1.20	13		2.8								1155
21				7												
22				6												
23																
24																
25							(20.00') Boring terminated									

NOTES:

	Client: Marathon County Project: New Highway Department Shop, (POB #26.2026) Address: Old Hwy 51 and Gate of Heaven Drive, Kronenwetter, WI	BORING LOG Boring No. B-9 Page: 1 of 1
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Drilling Start Date: 3/12/26 Drilling End Date: 3/12/26 Drilling Company: POB Drilling Method: Hollow Stem Auger Drilling Equipment: Mobile B-57 Driller: Dakota Ciriacks Logged By: Neil Henriksen	Boring Depth (ft): 20 Boring Diameter (in): 3.25 Sampling Method(s): Split Spoon DTW During Drilling (ft): N/A DTW After Drilling (ft): N/A Ground Surface Elev. (ft): 1174.5 Location (Lat, Long): 44.85315, -89.64615
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DEPTH (ft)	LITHOLOGY	WATER LEVEL	COLLECT				SOIL/ROCK VISUAL DESCRIPTION	Moisture Content (%)	Dry Density (pcf)	Liquid Limit	Plastic Limit	Plasticity Index (PI)	#200 Sieve (%)	Pocket Penetrometer (tsf)	Unconfined Compressive Strength (tsf)	ELEVATION (ft)
			Sample Type	Blow Counts	Recovery (ft)	N Value RQD%										
0							(0.00') Topsoil: 13 inches of Dark Brown Silty Sand Topsoil									
1	SS		2	1.50	5	(1.00') Poorly graded SAND (SP); mostly fine-medium grained sand, few fine-coarse gravel, trace silt, loose, slightly moist, brown	3.1									
2																
3																
4	SS		2	1.50	12	(3.00') Poorly graded SAND (SP); mostly fine grained sand, trace fine gravel, trace silt, medium dense, slightly moist, light brown	3.3									1170
5																
6																
7	SS		4	1.30	16	(4.50') Poorly graded SAND (SP); mostly fine-coarse grained sand, few fine-coarse gravel, trace silt, medium dense, slightly moist, light brown	2.8									
8																
9																
10	SS		3	1.40	13		2.7									1165
11																
12																
13	SS		6	1.40	18	(12.00') Poorly graded SAND with gravel (SP); mostly fine-coarse grained sand, little fine-coarse gravel, trace silt, medium dense, slightly moist, light brown	2.9									1160
14																
15																
16	SS		4	1.30	13	(16.00') Poorly graded SAND (SP); mostly fine-coarse grained sand, few fine-coarse gravel, trace silt, medium dense, slightly moist, light brown	2.5									1155
17																
18																
19	SS		4	1.30	13											
20																
21																
22	SS		4	1.30	13											
23																
24																
25	SS		4	1.30	13											
26																
27																
28	SS		4	1.30	13											
29																
30																
31	SS		4	1.30	13											
32																
33																
34	SS		4	1.30	13											
35																
36																
37	SS		4	1.30	13											
38																
39																
40	SS		4	1.30	13											
41																
42																
43	SS		4	1.30	13											
44																
45																
46	SS		4	1.30	13											
47																
48																
49	SS		4	1.30	13											
50																
51																
52	SS		4	1.30	13											
53																
54																
55	SS		4	1.30	13											
56																
57																
58	SS		4	1.30	13											
59																
60																
61	SS		4	1.30	13											
62																
63																
64	SS		4	1.30	13											
65																
66																
67	SS		4	1.30	13											
68																
69																
70	SS		4	1.30	13											
71																
72																
73	SS		4	1.30	13											
74																
75																
76	SS		4	1.30	13											
77																
78																
79	SS		4	1.30	13											
80																
81																
82	SS		4	1.30	13											
83																
84																
85	SS		4	1.30	13											
86																
87																
88	SS		4	1.30	13											
89																
90																
91	SS		4	1.30	13											
92																
93																
94	SS		4	1.30	13											
95																
96																
97	SS		4	1.30	13											
98																
99																
100	SS		4	1.30	13											
101																
102																
103	SS		4	1.30	13											
104																
105																
106	SS		4	1.30	13											
107																
108																
109	SS		4	1.30	13											
110																
111																
112	SS		4	1.30	13											
113																
114																
115																

	Client: Marathon County Project: New Highway Department Shop, (POB #26.2026) Address: Old Hwy 51 and Gate of Heaven Drive, Kronenwetter, WI	BORING LOG Boring No. B-10 Page: 1 of 1
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Drilling Start Date: 3/12/26 Drilling End Date: 3/12/26 Drilling Company: POB Drilling Method: Hollow Stem Auger Drilling Equipment: Mobile B-57 Driller: Dakota Ciriacks Logged By: Neil Henriksen	Boring Depth (ft): 20 Boring Diameter (in): 3.25 Sampling Method(s): Split Spoon DTW During Drilling (ft): N/A DTW After Drilling (ft): N/A Ground Surface Elev. (ft): 1174.7 Location (Lat, Long): 44.85302, -89.64561
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DEPTH (ft)	LITHOLOGY	WATER LEVEL	COLLECT				SOIL/ROCK VISUAL DESCRIPTION	Moisture Content (%)	Dry Density (pcf)	Liquid Limit	Plastic Limit	Plasticity Index (PI)	#200 Sieve (%)	Pocket Penetrometer (tsf)	Unconfined Compressive Strength (tsf)	ELEVATION (ft)	
			Sample Type	Blow Counts	Recovery (ft)	N Value RQD%											
0							(0.00') Topsoil: 12 inches of Dark Brown Silty Sand Topsoil										
1			SS	1	1.50	3	(1.00') Poorly graded SAND with silt (SP-SM); mostly fine-medium grained sand, few fine-coarse gravel, few silt, very loose, moist, brown	5.1									
2				2													
3			SS	3	1.00	8	(1.50') Poorly graded SAND (SP); mostly fine-medium grained sand, trace fine-coarse gravel, trace silt, very loose, moist, brown	3.5									1170
4				3													
5			SS	4	1.20	14	(3.00') Poorly graded SAND (SP); mostly fine-medium grained sand, trace fine gravel, trace silt, loose, slightly moist, light brown	3									
6				6													
7			SS	6	1.10	13	(6.00') Poorly graded SAND (SP); mostly fine-coarse grained sand, few fine-coarse gravel, trace silt, medium dense, slightly moist, light brown	2.2									1165
8				6													
9				7													
10																	
11			SS	4	1.00	15	(12.00') Poorly graded SAND (SP); mostly fine-medium grained sand, trace fine gravel, trace silt, medium dense, slightly moist, light brown	3.2									1160
12				6													
13				9													
14																	
15																	
16																	
17																	
18																	
19			SS	5	1.30	19	(16.00') Poorly graded SAND with gravel (SP); mostly fine-coarse grained sand, little fine-coarse gravel, trace silt, medium dense, slightly moist, light brown	1.9									1155
20				8													
21				11													
22																	
23																	
24																	
25																	1150
							(20.00') Boring terminated										

NOTES:

	Client: Marathon County Project: New Highway Department Shop, (POB #26.2026) Address: Old Hwy 51 and Gate of Heaven Drive, Kronenwetter, WI	BORING LOG Boring No. B-11 Page: 1 of 1
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Drilling Start Date: 3/12/26 Drilling End Date: 3/12/26 Drilling Company: POB Drilling Method: Hollow Stem Auger Drilling Equipment: Mobile B-57 Driller: Dakota Ciriacks Logged By: Neil Henriksen	Boring Depth (ft): 20 Boring Diameter (in): 3.25 Sampling Method(s): Split Spoon DTW During Drilling (ft): N/A DTW After Drilling (ft): N/A Ground Surface Elev. (ft): 1173.7 Location (Lat, Long): 44.85260, -89.64541
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DEPTH (ft)	LITHOLOGY	WATER LEVEL	COLLECT				SOIL/ROCK VISUAL DESCRIPTION	Moisture Content (%)	Dry Density (pcf)	Liquid Limit	Plastic Limit	Plasticity Index (PI)	#200 Sieve (%)	Pocket Penetrometer (tsf)	Unconfined Compressive Strength (tsf)	ELEVATION (ft)	
			Sample Type	Blow Counts	Recovery (ft)	N Value RQD%											
0							(0.00') Topsoil: 12.5 inches of Dark Brown Silty Sand Topsoil										
1	SS		1	1.50	4		(1.00') Poorly graded SAND with silt (SP-SM); mostly fine-medium grained sand, few fine-coarse gravel, trace silt, loose, slightly moist, brown	2.7									
2			2														
3	SS		1	1.40	6		(2.00') Poorly graded SAND (SP); mostly fine-medium grained sand, trace fine gravel, trace silt, loose, slightly moist, light brown	3.5									
4			2														
5	SS		4	1.50	11		(3.00') Poorly graded SAND (SP); mostly fine grained sand, trace fine gravel, trace silt, loose, slightly moist, light brown	3									
6			4														
7	SS		7	1.30	13		(4.50') Poorly graded SAND (SP); mostly fine-coarse grained sand, few fine-coarse gravel, trace silt, loose, slightly moist, light brown	2.8									
8			4														
9	SS		6				(6.00') Poorly graded SAND (SP); mostly fine-coarse grained sand, few fine-coarse gravel, trace silt, medium dense, slightly moist, light brown										
10			7														
11																	
12	SS		4	1.30	9		(12.00') Poorly graded SAND (SP); mostly fine-coarse grained sand, few fine-coarse gravel, trace silt, medium dense, slightly moist, light brown	3.1									
13			4														
14			5														
15																	
16																	
17																	
18																	
19	SS		6	0.50	11		(16.00') Poorly graded SAND (SP); mostly fine-coarse grained sand, few fine-coarse gravel, trace silt, medium dense, slightly moist, light brown										
20			6														
21			5														
22							(20.00') Boring terminated										
23																	
24																	
25																	

NOTES:

	Client: Marathon County Project: New Highway Department Shop, (POB #26.2026) Address: Old Hwy 51 and Gate of Heaven Drive, Kronenwetter, WI	BORING LOG Boring No. B-12 Page: 1 of 1
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Drilling Start Date: 3/10/26 Drilling End Date: 3/10/26 Drilling Company: POB Drilling Method: Hollow Stem Auger Drilling Equipment: Mobile B-57 Driller: Dakota Ciriacks Logged By: Neil Henriksen	Boring Depth (ft): 20 Boring Diameter (in): 3.25 Sampling Method(s): Split Spoon DTW During Drilling (ft): N/A DTW After Drilling (ft): N/A Ground Surface Elev. (ft): 1175.7 Location (Lat, Long): 44.85293, -89.64720
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DEPTH (ft)	LITHOLOGY	WATER LEVEL	COLLECT				SOIL/ROCK VISUAL DESCRIPTION	Moisture Content (%)	Dry Density (pcf)	Liquid Limit	Plastic Limit	Plasticity Index (PI)	#200 Sieve (%)	Pocket Penetrometer (tsf)	Unconfined Compressive Strength (tsf)	ELEVATION (ft)
			Sample Type	Blow Counts	Recovery (ft)	N Value RQD%										
0							(0.00') Topsoil: 10 inches of Dark Brown Silty Sand Topsoil									1175
1	SS		3	1.50	6		(1.00') Poorly graded SAND with silt and gravel (SP-SM); mostly fine-medium grained sand, little fine-coarse gravel, few silt, loose, slightly moist, brown	3.5								
2			3													
3			3													
4	SS		4	1.30	13		(1.50') Poorly graded SAND (SP); mostly fine-medium grained sand, trace fine gravel, trace silt, loose, slightly moist, brown	2.6								
5			6													
6			7													
7	SS		5	1.40	13		(3.00') Poorly graded SAND (SP); mostly fine-medium grained sand, trace fine gravel, trace silt, medium dense, slightly moist, light brown	3								1170
8			6													
9			7													
10	SS		4	1.40	10			3.3								1165
11			5													
12																
13																
14																
15	SS		4	0.33	16		(12.00') Poorly graded SAND (SP); mostly fine-medium grained sand, few fine-coarse gravel, trace silt, medium dense, slightly moist, light brown	3.7								1160
16			8													
17			8													
18			8													
19	SS		8		17											
20			9				(20.00') Boring terminated									1155
21																
22																
23																
24																
25																

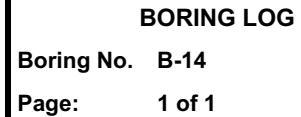
NOTES:

	Client: Marathon County Project: New Highway Department Shop, (POB #26.2026) Address: Old Hwy 51 and Gate of Heaven Drive, Kronenwetter, WI	BORING LOG Boring No. B-13 Page: 1 of 1
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Drilling Start Date: 3/10/26 Drilling End Date: 3/10/26 Drilling Company: POB Drilling Method: Hollow Stem Auger Drilling Equipment: Mobile B-57 Driller: Dakota Ciriacks Logged By: Neil Henriksen	Boring Depth (ft): 20 Boring Diameter (in): 3.25 Sampling Method(s): Split Spoon DTW During Drilling (ft): N/A DTW After Drilling (ft): N/A Ground Surface Elev. (ft): 1174.1 Location (Lat, Long): 44.85284, -89.64642
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DEPTH (ft)	LITHOLOGY	WATER LEVEL	COLLECT				SOIL/ROCK VISUAL DESCRIPTION	Moisture Content (%)	Dry Density (pcf)	Liquid Limit	Plastic Limit	Plasticity Index (PI)	#200 Sieve (%)	Pocket Penetrometer (tsf)	Unconfined Compressive Strength (tsf)	ELEVATION (ft)	
			Sample Type	Blow Counts	Recovery (ft)	N Value RQD%											
0							(0.00') Topsoil: 11 inches of Dark Brown Silty Sand Topsoil										
1			SS	2	1.50	6	(1.00') Poorly graded SAND with silt (SP-SM); mostly fine-medium grained sand, few fine-coarse gravel, few silt, loose, slightly moist, brown	4.9									
2				3													
3				3													
4			SS	3	1.40	9	(1.50') Poorly graded SAND (SP); mostly fine-coarse grained sand, trace fine gravel, trace silt, loose, slightly moist, brown	3.6									1170
5				4													
6				5			(3.00') Poorly graded SAND (SP); mostly fine-medium grained sand, trace fine gravel, trace silt, loose, slightly moist, light brown										
7			SS	5	1.50	16											
8				7													
9				9			(6.50') Poorly graded SAND (SP); mostly fine-coarse grained sand, few fine-coarse gravel, trace silt, medium dense, slightly moist, light brown	3									
10			SS	5	1.50	18											1165
11				8													
12				10													
13				10													
14							(12.00') Poorly graded SAND (SP); mostly fine-coarse grained sand, few fine-coarse gravel, trace silt, medium dense, moist, light brown										1160
15			SS	6	0.50	21											
16				10													
17				11													
18							(16.00') Poorly graded SAND with gravel (SP); mostly fine-coarse grained sand, little fine-coarse gravel, trace silt, medium dense, slightly moist, brown										1155
19			SS	7	1.40	20											
20				9													
21				11													
22							(20.00') Boring terminated	2.7									
23																	
24																	1150
25																	

NOTES:



Boring Depth (ft):	20
Boring Diameter (in):	3.25
Sampling Method(s):	Split Spoon
DTW During Drilling (ft):	N/A
DTW After Drilling (ft):	N/A
Ground Surface Elev. (ft):	1173.6
Location (Lat, Long):	44.85274, -89.64579

NOTES:

	Client: Marathon County Project: New Highway Department Shop, (POB #26.2026) Address: Old Hwy 51 and Gate of Heaven Drive, Kronenwetter, WI	BORING LOG Boring No. B-15 Page: 1 of 1
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Drilling Start Date: 3/10/26 Drilling End Date: 3/10/26 Drilling Company: POB Drilling Method: Hollow Stem Auger Drilling Equipment: Mobile B-57 Driller: Dakota Ciriacks Logged By: Neil Henriksen	Boring Depth (ft): 20 Boring Diameter (in): 3.25 Sampling Method(s): Split Spoon DTW During Drilling (ft): N/A DTW After Drilling (ft): N/A Ground Surface Elev. (ft): 1175 Location (Lat, Long): 44.85260, -89.64735
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DEPTH (ft)	LITHOLOGY	WATER LEVEL	COLLECT				SOIL/ROCK VISUAL DESCRIPTION	Moisture Content (%)	Dry Density (pcf)	Liquid Limit	Plastic Limit	Plasticity Index (PI)	#200 Sieve (%)	Pocket Penetrometer (tsf)	Unconfined Compressive Strength (tsf)	ELEVATION (ft)
			Sample Type	Blow Counts	Recovery (ft)	N Value RQD%										
0							(0.00') Topsoil: 12.5 inches of Dark Silty Sand Topsoil									1175
	SS		4	1.50	8		(1.00') Poorly graded SAND (SP); mostly fine-medium grained sand, few fine-coarse gravel, trace silt, loose, slightly moist, brown	4.3								
			4													
			4													
	SS		5	1.40	12		(3.00') Poorly graded SAND (SP); mostly fine-medium grained sand, trace fine gravel, trace silt, medium dense, slightly moist, light brown	4.8								1170
5			6													
			6													
	SS		4	1.40	12			3.5								
			5													
			7													
	SS		5	1.20	15		(8.00') Poorly graded SAND (SP); mostly fine-coarse grained sand, few fine-coarse gravel, trace silt, medium dense, slightly moist, light brown	3.4								1165
10			7													
			8													
							(12.00') Poorly graded SAND with gravel (SP); mostly fine-medium grained sand, little fine-coarse gravel, trace silt, medium dense, slightly moist, light brown									
	SS		9	0.50	28			2.5								1160
15			14													
			14													
							(16.00') Poorly graded SAND with gravel (SP); mostly fine-coarse grained sand, little fine-coarse gravel, trace silt, medium dense, slightly moist, light brown									
	SS		10	0.80	16			2.1								1155
20			8													
			8				(20.00') Boring terminated									
25																

NOTES:

	Client: Marathon County Project: New Highway Department Shop, (POB #26.2026) Address: Old Hwy 51 and Gate of Heaven Drive, Kronenwetter, WI	BORING LOG Boring No. B-16 Page: 1 of 1
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Drilling Start Date: 3/10/26 Drilling End Date: 3/10/26 Drilling Company: POB Drilling Method: Hollow Stem Auger Drilling Equipment: Mobile B-57 Driller: Dakota Ciriacks Logged By: Neil Henriksen	Boring Depth (ft): 20 Boring Diameter (in): 3.25 Sampling Method(s): Split Spoon DTW During Drilling (ft): N/A DTW After Drilling (ft): N/A Ground Surface Elev. (ft): 1173.8 Location (Lat, Long): 44.85243, -89.64670
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DEPTH (ft)	LITHOLOGY	WATER LEVEL	COLLECT				SOIL/ROCK VISUAL DESCRIPTION	Moisture Content (%)	Dry Density (pcf)	Liquid Limit	Plastic Limit	Plasticity Index (PI)	#200 Sieve (%)	Pocket Penetrometer (tsf)	Unconfined Compressive Strength (tsf)	ELEVATION (ft)	
			Sample Type	Blow Counts	Recovery (ft)	N Value RQD%											
0							(0.00') Topsoil: 14 inches of Dark Brown Silty Sand Topsoil										
			SS	2	1.50	5	(1.00') Poorly graded SAND with silt (SP-SM); mostly fine grained sand, few fine-coarse gravel, few silt, loose, slightly moist, brown	4.8									
				3													
				2													
			SS	4	1.50	10	(2.00') Poorly graded SAND (SP); mostly fine-medium grained sand, few fine-coarse gravel, trace silt, loose, slightly moist, brown	4									1170
5				4													
			SS	4	1.40	10	(3.00') Poorly graded SAND (SP); mostly fine-medium grained sand, trace fine gravel, trace silt, medium dense, slightly moist, light brown	3.9									
				4													
			SS	4	1.40	16	(8.00') Poorly graded SAND (SP); mostly fine-coarse grained sand, few fine-coarse gravel, trace silt, medium dense, slightly moist, light brown	2.8									1165
10				8													
				8													
			SS	5	1.20	17		3.1									1160
15				8													
				9													
			SS	6	1.20	15	(19.00') Poorly graded SAND with gravel (SP); mostly fine-coarse grained sand, little fine-coarse gravel, trace silt, medium dense, slightly moist, light brown	3.1									1155
20				5													
				10			(20.00') Boring terminated										
																	1150
25																	

NOTES:

	Client: Marathon County Project: New Highway Department Shop, (POB #26.2026) Address: Old Hwy 51 and Gate of Heaven Drive, Kronenwetter, WI	BORING LOG Boring No. B-17 Page: 1 of 1
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Drilling Start Date: 3/10/26 Drilling End Date: 3/10/26 Drilling Company: POB Drilling Method: Hollow Stem Auger Drilling Equipment: Mobile B-57 Driller: Dakota Ciriacks Logged By: Neil Henriksen	Boring Depth (ft): 20 Boring Diameter (in): 3.25 Sampling Method(s): Split Spoon DTW During Drilling (ft): N/A DTW After Drilling (ft): N/A Ground Surface Elev. (ft): 1174.4 Location (Lat, Long): 44.85235, -89.64758
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DEPTH (ft)	LITHOLOGY	WATER LEVEL	COLLECT				SOIL/ROCK VISUAL DESCRIPTION	Moisture Content (%)	Dry Density (pcf)	Liquid Limit	Plastic Limit	Plasticity Index (PI)	#200 Sieve (%)	Pocket Penetrometer (tsf)	Unconfined Compressive Strength (tsf)	ELEVATION (ft)	
			Sample Type	Blow Counts	Recovery (ft)	N Value RQD%											
0							(0.00') Topsoil: 13 inches of Dark Brown Silty Sand Topsoil										
1			SS	5	1.30	8	(1.00') Poorly graded SAND (SP); mostly fine-medium grained sand, few fine-coarse gravel, trace silt, loose, slightly moist, brown	4.7									
2				4													
3				4													
4			SS	6	1.40	18	(3.00') Poorly graded SAND (SP); mostly fine-coarse grained sand, few fine-coarse gravel, trace silt, medium dense, slightly moist, light brown	2.5									1170
5				8													
6				10													
7			SS	5	1.40	18		2.2									
8				8													
9				10													
10			SS	5	1.30	16		3.1									1165
11				7													
12				9													
13																	
14			SS	5	1.10	15	(14.00') Poorly graded SAND (SP); mostly fine-medium grained sand, trace fine gravel, trace silt, medium dense, slightly moist, light brown	2.5									1160
15				7													
16				8			(16.00') Poorly graded SAND with gravel (SP); mostly fine-coarse grained sand, little fine-coarse gravel, trace silt, medium dense, slightly moist, light brown										
17																	
18																	
19			SS	7	1.30	17		3.2									1155
20				8													
21				9			(20.00') Boring terminated										
22																	
23																	
24																	
25																	1150

NOTES:

	Client: Marathon County Project: New Highway Department Shop, (POB #26.2026) Address: Old Hwy 51 and Gate of Heaven Drive, Kronenwetter, WI	BORING LOG Boring No. B-18 Page: 1 of 1
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Drilling Start Date: 3/10/26 Drilling End Date: 3/10/26 Drilling Company: POB Drilling Method: Hollow Stem Auger Drilling Equipment: Mobile B-57 Driller: Dakota Ciriacks Logged By: Neil Henriksen	Boring Depth (ft): 20 Boring Diameter (in): 3.25 Sampling Method(s): Split Spoon DTW During Drilling (ft): N/A DTW After Drilling (ft): N/A Ground Surface Elev. (ft): 1175.4 Location (Lat, Long): 44.85222, -89.64703
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DEPTH (ft)	LITHOLOGY	WATER LEVEL	COLLECT				SOIL/ROCK VISUAL DESCRIPTION	Moisture Content (%)	Dry Density (pcf)	Liquid Limit	Plastic Limit	Plasticity Index (PI)	#200 Sieve (%)	Pocket Penetrometer (tsf)	Unconfined Compressive Strength (tsf)	ELEVATION (ft)	
			Sample Type	Blow Counts	Recovery (ft)	N Value RQD%											
0							(0.00') Topsoil: 10 inches of Dark Brown Silty Sand Topsoil										1175
			SS	6	1.10	6	(1.00') Fill: Poorly graded SAND (SP); mostly fine-medium grained sand, few fine-coarse gravel, trace silt, loose, slightly moist, brown	3.7									
			SS	5	1.50	16	(3.00') Poorly graded SAND (SP); mostly fine-medium grained sand, trace fine gravel, trace silt, medium dense, slightly moist, light brown	3.3									
5			SS	5	1.40	13		4.4									1170
			SS	4	1.40	15	(8.00') Poorly graded SAND (SP); mostly fine-coarse grained sand, few fine-coarse gravel, trace silt, medium dense, slightly moist, light brown	3.4									
10																	1165
			SS	5	0.75	15		2.6									
15																	1160
			SS	7		22											
20				10			(20.00') Boring terminated										1155
				12													
25																	

NOTES:

	Client: Marathon County Project: New Highway Department Shop, (POB #26.2026) Address: Old Hwy 51 and Gate of Heaven Drive, Kronenwetter, WI	BORING LOG Boring No. B-19 Page: 1 of 1
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Drilling Start Date: 3/10/26 Drilling End Date: 3/10/26 Drilling Company: POB Drilling Method: Hollow Stem Auger Drilling Equipment: Mobile B-57 Driller: Dakota Ciriacks Logged By: Neil Henriksen	Boring Depth (ft): 20 Boring Diameter (in): 3.25 Sampling Method(s): Split Spoon DTW During Drilling (ft): N/A DTW After Drilling (ft): N/A Ground Surface Elev. (ft): 1173.5 Location (Lat, Long): 44.85185, -89.64714
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DEPTH (ft)	LITHOLOGY	WATER LEVEL	COLLECT				SOIL/ROCK VISUAL DESCRIPTION	Moisture Content (%)	Dry Density (pcf)	Liquid Limit	Plastic Limit	Plasticity Index (PI)	#200 Sieve (%)	Pocket Penetrometer (tsf)	Unconfined Compressive Strength (tsf)	ELEVATION (ft)	
			Sample Type	Blow Counts	Recovery (ft)	N Value RQD%											
0							(0.00') Topsoil: 10 inches of Dark Brown Silty Sand Topsoil										
1			SS	2	1.50	2	(1.00') Poorly graded SAND with silt (SP-SM); mostly fine grained sand, trace fine gravel, few silt, very loose, moist, brown	6.6									
2				1													
3				1													
4			SS	4	1.30	13	(2.00') Poorly graded SAND (SP); mostly fine-medium grained sand, trace fine gravel, trace silt, very loose, moist, brown	4.2									1170
5				6													
6				7													
7			SS	4	1.50	11	(4.00') Poorly graded SAND (SP); mostly fine-coarse grained sand, few fine-coarse gravel, trace silt, medium dense, slightly moist, brown	5									
8				5													
9				6													
10			SS	5	1.20	17	(6.00') Poorly graded SAND (SP); mostly fine-medium grained sand, trace fine gravel, trace silt, medium dense, moist, light brown	2.6									1165
11				8													
12				9			(8.00') Poorly graded SAND with gravel (SP); mostly fine-coarse grained sand, little fine-coarse gravel, trace silt, medium dense, slightly moist, light brown										
13																	
14																	
15			SS	6	1.10	13		2.3									1160
16				6													
17				7													
18																	
19																	
20			SS	7	0.67	20	(16.00') Poorly graded SAND with gravel (SP); mostly fine-medium grained sand, little fine-coarse gravel, trace silt, medium dense, slightly moist, brown										1155
21				9													
22				11													
23																	
24																	
25																	1150
							(20.00') Boring terminated	2.7									

NOTES:

	Client: Marathon County Project: New Highway Department Shop, (POB #26.2026) Address: Old Hwy 51 and Gate of Heaven Drive, Kronenwetter, WI	BORING LOG Boring No. B-20 Page: 1 of 1
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Drilling Start Date: 3/12/26 Drilling End Date: 3/12/26 Drilling Company: POB Drilling Method: Hollow Stem Auger Drilling Equipment: Mobile B-57 Driller: Dakota Ciriacks Logged By: Neil Henriksen	Boring Depth (ft): 20 Boring Diameter (in): 3.25 Sampling Method(s): Split Spoon DTW During Drilling (ft): N/A DTW After Drilling (ft): N/A Ground Surface Elev. (ft): 1173.7 Location (Lat, Long): 44.85289, -89.64488
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DEPTH (ft)	LITHOLOGY	WATER LEVEL	COLLECT				SOIL/ROCK VISUAL DESCRIPTION	Moisture Content (%)	Dry Density (pcf)	Liquid Limit	Plastic Limit	Plasticity Index (PI)	#200 Sieve (%)	Pocket Penetrometer (tsf)	Unconfined Compressive Strength (tsf)	ELEVATION (ft)	
			Sample Type	Blow Counts	Recovery (ft)	N Value RQD%											
0							(0.00') Topsoil: 14 inches of Dark Brown Silty Sand Topsoil										
1			SS	3	1.50	9	(1.00') Poorly graded SAND with silt (SP-SM); mostly fine-medium grained sand, few fine-coarse gravel, few silt, loose, slightly moist, brown	4.3									
2				4													
3				5													
4			SS	4	1.50	13	(1.50') Poorly graded SAND (SP); mostly fine-coarse grained sand, few fine-coarse gravel, trace silt, loose, slightly moist, light brown	2.5									1170
5				6													
6				7													
7			SS	5	1.50	13		3.4									
8				6													
9				7													
10			SS	4	1.40	15		2.6									1165
11				6													
12				9													
13																	
14																	
15			SS	5	1.00	17	(12.00') Poorly graded SAND with gravel (SP); mostly fine-coarse grained sand, little fine-coarse gravel, trace silt, medium dense, slightly moist, light brown	2.7									1160
16				7													
17				10													
18																	
19																	
20			SS	7	1.40	19		3.3									1155
21				10													
22				9													
23							(20.00') Boring terminated										
24																	
25																	1150

NOTES:

	Client: Marathon County Project: New Highway Department Shop, (POB #26.2026) Address: Old Hwy 51 and Gate of Heaven Drive, Kronenwetter, WI	BORING LOG Boring No. B-21 Page: 1 of 1
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Drilling Start Date: 3/10/26 Drilling End Date: 3/10/26 Drilling Company: POB Drilling Method: Hollow Stem Auger Drilling Equipment: Mobile B-57 Driller: Dakota Ciriacks Logged By: Neil Henriksen	Boring Depth (ft): 20 Boring Diameter (in): 3.25 Sampling Method(s): Split Spoon DTW During Drilling (ft): N/A DTW After Drilling (ft): N/A Ground Surface Elev. (ft): 1174.3 Location (Lat, Long): 44.85220, -89.64633
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DEPTH (ft)	LITHOLOGY	WATER LEVEL	COLLECT				SOIL/ROCK VISUAL DESCRIPTION	Moisture Content (%)	Dry Density (pcf)	Liquid Limit	Plastic Limit	Plasticity Index (PI)	#200 Sieve (%)	Pocket Penetrometer (tsf)	Unconfined Compressive Strength (tsf)	ELEVATION (ft)	
			Sample Type	Blow Counts	Recovery (ft)	N Value RQD%											
0							(0.00') Topsoil: 11 inches of Dark Brown Silty Sand Topsoil										
1			SS	2	1.50	6	(1.00') Poorly graded SAND with silt (SP-SM); mostly fine grained sand, trace fine gravel, few silt, loose, slightly moist, brown	2.7									
2				3													
3				3													
4			SS	5	1.40	18	(1.50') Poorly graded SAND (SP); mostly fine grained sand, trace fine gravel, trace silt, loose, slightly moist, light brown	2.2									1170
5				8													
6				10													
7			SS	4	1.50	16	(3.00') Poorly graded SAND (SP); mostly fine-coarse grained sand, few fine-coarse gravel, trace silt, medium dense, slightly moist, light brown	2.3									
8				7													
9				9													
10			SS	5	1.30	15		3.1									1165
11				7													
12				8													
13																	
14			SS	5	0.80	18	(12.00') Poorly graded SAND with gravel (SP); mostly fine-coarse grained sand, little fine-coarse gravel, trace silt, medium dense, slightly moist, light brown	2.3									1160
15				8													
16				10													
17																	
18																	
19			SS	3	1.30	11	(16.00') Poorly graded SAND (SP); mostly fine-medium grained sand, trace fine gravel, trace silt, medium dense, slightly moist, light brown	2.5									1155
20				5													
21				6			(20.00') Boring terminated										
22																	
23																	
24																	
25																	1150

NOTES:

	Client: Marathon County Project: New Highway Department Shop, (POB #26.2026) Address: Old Hwy 51 and Gate of Heaven Drive, Kronenwetter, WI	BORING LOG Boring No. B-22 Page: 1 of 1
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Drilling Start Date: 3/9/26 Drilling End Date: 3/9/26 Drilling Company: POB Drilling Method: Hollow Stem Auger Drilling Equipment: Mobile B-57 Driller: Dakota Ciriacks Logged By: Neil Henriksen	Boring Depth (ft): 20 Boring Diameter (in): 3.25 Sampling Method(s): Split Spoon DTW During Drilling (ft): N/A DTW After Drilling (ft): N/A Ground Surface Elev. (ft): 1172.9 Location (Lat, Long): 44.85221, -89.64571
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DEPTH (ft)	LITHOLOGY	WATER LEVEL	COLLECT				SOIL/ROCK VISUAL DESCRIPTION	Moisture Content (%)	Dry Density (pcf)	Liquid Limit	Plastic Limit	Plasticity Index (PI)	#200 Sieve (%)	Pocket Penetrometer (tsf)	Unconfined Compressive Strength (tsf)	ELEVATION (ft)	
			Sample Type	Blow Counts	Recovery (ft)	N Value RQD%											
0							(0.00') Topsoil: 11.5 inches of Dark Brown Silty Sand Topsoil										
1			SS	3	1.50	11	(1.00') Poorly graded SAND with silt (SP-SM); mostly fine grained sand, trace fine gravel, few silt, medium dense, slightly moist, brown	2.5									1170
2				4													
3				7													
4			SS	3	1.10	12	(2.00') Poorly graded SAND (SP); mostly fine-medium grained sand, few fine-coarse gravel, trace silt, medium dense, slightly moist, brown	3.3									
5				5													
6				7													
7			SS	5	1.30	15	(3.00') Poorly graded SAND (SP); mostly fine-medium grained sand, trace fine gravel, trace silt, medium dense, slightly moist, light brown	3.2									
8				7													
9				8													
10			SS	5	1.30	18	(6.00') Poorly graded SAND (SP); mostly fine-coarse grained sand, few fine-coarse gravel, trace silt, medium dense, slightly moist, light brown	3.2									1165
11				9													
12				9													
13																	
14																	
15			SS	5	1.00	23		2.9									1160
16				9													
17				14													
18																	
19																	
20			SS	50			(18.5') Cobble @18.5 feet										1155
21																	
22																	
23																	
24																	
25							(20.00') Boring terminated										1150

NOTES:

	Client: Marathon County Project: New Highway Department Shop, (POB #26.2026) Address: Old Hwy 51 and Gate of Heaven Drive, Kronenwetter, WI	BORING LOG Boring No. B-23 Page: 1 of 1
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Drilling Start Date: 3/9/26 Drilling End Date: 3/9/26 Drilling Company: POB Drilling Method: Hollow Stem Auger Drilling Equipment: Mobile B-57 Driller: Dakota Ciriacks Logged By: Neil Henriksen	Boring Depth (ft): 20 Boring Diameter (in): 3.25 Sampling Method(s): Split Spoon DTW During Drilling (ft): N/A DTW After Drilling (ft): N/A Ground Surface Elev. (ft): 1172.4 Location (Lat, Long): 44.85223, -89.64502
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DEPTH (ft)	LITHOLOGY	WATER LEVEL	COLLECT				SOIL/ROCK VISUAL DESCRIPTION	Moisture Content (%)	Dry Density (pcf)	Liquid Limit	Plastic Limit	Plasticity Index (PI)	#200 Sieve (%)	Pocket Penetrometer (tsf)	Unconfined Compressive Strength (tsf)	ELEVATION (ft)	
			Sample Type	Blow Counts	Recovery (ft)	N Value RQD%											
0							(0.00') Topsoil: 3 inches of Dark Brown Silty Sand Topsoil										
4	SS		4	1.50	11		(0.25') Poorly graded SAND with silt (SP-SM); mostly fine-medium grained sand, few fine-coarse gravel, few silt, medium dense, slightly moist, brown	4.4									1170
5																	
6																	
7	SS		3	1.30	11		(1.00') Poorly graded SAND (SP); mostly fine-coarse grained sand, few fine-coarse gravel, trace silt, medium dense, slightly moist, brown	3.7									
8																	
9	SS		5	1.30	17		(6.00') Poorly graded SAND (SP); mostly fine-coarse grained sand, few fine-coarse gravel, trace silt, medium dense, slightly moist, light brown	2									1165
10																	
11	SS		5	1.40	16			2.5									
12																	
13																	
14	SS		3	1.20	14		(12.00') Poorly graded SAND (SP); mostly fine-medium grained sand, trace fine gravel, trace silt, medium dense, slightly moist, light brown	2.2									1160
15																	
16																	
17																	
18																	
19	SS		4	1.40	9		(16.00') Poorly graded SAND (SP); mostly fine-medium grained sand, trace fine gravel, trace silt, loose, slightly moist, light brown										1155
20								3.6									
21							(20.00') Boring terminated										
22																	
23																	
24																	
25																	1150

NOTES:

	Client: Marathon County Project: New Highway Department Shop, (POB #26.2026) Address: Old Hwy 51 and Gate of Heaven Drive, Kronenwetter, WI	BORING LOG Boring No. B-24 Page: 1 of 1
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Drilling Start Date: 3/9/26 Drilling End Date: 3/9/26 Drilling Company: POB Drilling Method: Hollow Stem Auger Drilling Equipment: Mobile B-57 Driller: Dakota Ciriacks Logged By: Neil Henriksen	Boring Depth (ft): 20 Boring Diameter (in): 3.25 Sampling Method(s): Split Spoon DTW During Drilling (ft): N/A DTW After Drilling (ft): N/A Ground Surface Elev. (ft): 1174 Location (Lat, Long): 44.85185, -89.64636
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DEPTH (ft)	LITHOLOGY	WATER LEVEL	COLLECT				SOIL/ROCK VISUAL DESCRIPTION	Moisture Content (%)	Dry Density (pcf)	Liquid Limit	Plastic Limit	Plasticity Index (PI)	#200 Sieve (%)	Pocket Penetrometer (tsf)	Unconfined Compressive Strength (tsf)	ELEVATION (ft)	
			Sample Type	Blow Counts	Recovery (ft)	N Value RQD%											
0							(0.00') Topsoil: 12.5 inches of Dark Brown Silty Sand Topsoil										
1			SS	5	1.50	10	(1.00') Poorly graded SAND with silt (SP-SM); mostly fine grained sand, few fine-coarse gravel, few silt, medium dense, slightly moist, brown	4.7									
2				5													
3				5													
4			SS	6	1.40	19	(1.50') Poorly graded SAND (SP); mostly fine grained sand, trace fine gravel, trace silt, medium dense, slightly moist, light brown	3.4									1170
5				9													
6				10													
7			SS	5	1.50	19	(4.50') Poorly graded SAND (SP); mostly fine-coarse grained sand, few fine-coarse gravel, few silt, medium dense, slightly moist, light brown	2.7									
8				9													
9				10													
10			SS	5	1.50	17		1.9									1165
11				8													
12				9													
13																	
14																	
15			SS	5	1.20	21	(12.00') Poorly graded SAND with gravel (SP); mostly fine-coarse grained sand, little fine-coarse gravel, trace silt, medium dense, slightly moist, light brown	3									1160
16				8													
17				13													
18																	
19																	
20			SS	7	1.40	21		1.7									1155
21				9													
22				12													
23							(20.00') Boring terminated										
24																	
25																	1150

NOTES:

	Client: Marathon County Project: New Highway Department Shop, (POB #26.2026) Address: Old Hwy 51 and Gate of Heaven Drive, Kronenwetter, WI	BORING LOG Boring No. B-25 Page: 1 of 1
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Drilling Start Date: 3/9/26 Drilling End Date: 3/9/26 Drilling Company: POB Drilling Method: Hollow Stem Auger Drilling Equipment: Mobile B-57 Driller: Dakota Ciriacks Logged By: Neil Henriksen	Boring Depth (ft): 20 Boring Diameter (in): 3.25 Sampling Method(s): Split Spoon DTW During Drilling (ft): N/A DTW After Drilling (ft): N/A Ground Surface Elev. (ft): 1172.3 Location (Lat, Long): 44.85187, -89.64570
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DEPTH (ft)	LITHOLOGY	WATER LEVEL	COLLECT				SOIL/ROCK VISUAL DESCRIPTION	Moisture Content (%)	Dry Density (pcf)	Liquid Limit	Plastic Limit	Plasticity Index (PI)	#200 Sieve (%)	Pocket Penetrometer (tsf)	Unconfined Compressive Strength (tsf)	ELEVATION (ft)
			Sample Type	Blow Counts	Recovery (ft)	N Value RQD%										
0							(0.00') Topsoil: 11 inches of Dark Brown Silty Sand Topsoil									
1			SS	4	1.40	11	(1.00') Poorly graded SAND with silt (SP-SM); mostly fine grained sand, few fine-coarse gravel, few silt, medium dense, slightly moist, brown	2.8								1170
2				5												
3			SS	3	1.40	10	(1.50') Poorly graded SAND (SP); mostly fine-medium grained sand, trace fine gravel, trace silt, medium dense, slightly moist, brown	3.8								
4				5												
5			SS	4	1.50	15	(3.00') Poorly graded SAND (SP); mostly fine grained sand, trace fine gravel, trace silt, medium dense, slightly moist, light brown	3.8								
6				6												
7			SS	7	1.10	24	(6.00') Poorly graded SAND (SP); mostly fine-coarse grained sand, few fine-coarse gravel, trace silt, medium dense, slightly moist, light brown	2.3								
8				11												
9				13												
10																
11																
12																
13																
14			SS	7		19										
15				9												
16				10												
17																
18																
19							(16.00') Poorly graded SAND (SP); mostly fine-coarse grained sand, few fine-coarse gravel, trace silt, medium dense, slightly moist, light brown									
20			SS	5	1.20	18		2.6								
21				7												
22				11												
23							(20.00') Boring terminated									
24																
25																

NOTES:

	Client: Marathon County Project: New Highway Department Shop, (POB #26.2026) Address: Old Hwy 51 and Gate of Heaven Drive, Kronenwetter, WI	BORING LOG Boring No. B-26 Page: 1 of 1
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Drilling Start Date: 3/9/26 Drilling End Date: 3/9/26 Drilling Company: POB Drilling Method: Hollow Stem Auger Drilling Equipment: Mobile B-57 Driller: Dakota Ciriacks Logged By: Neil Henriksen	Boring Depth (ft): 20 Boring Diameter (in): 3.25 Sampling Method(s): Split Spoon DTW During Drilling (ft): N/A DTW After Drilling (ft): N/A Ground Surface Elev. (ft): 1172.8 Location (Lat, Long): 44.85183, -89.64502
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DEPTH (ft)	LITHOLOGY	WATER LEVEL	COLLECT				SOIL/ROCK VISUAL DESCRIPTION	Moisture Content (%)	Dry Density (pcf)	Liquid Limit	Plastic Limit	Plasticity Index (PI)	#200 Sieve (%)	Pocket Penetrometer (tsf)	Unconfined Compressive Strength (tsf)	ELEVATION (ft)	
			Sample Type	Blow Counts	Recovery (ft)	N Value RQD%											
0							(0.00') Topsoil: 10 inches of Dark Brown Silty Sand Topsoil										
1			SS	9	1.50	11	(1.00') Poorly graded SAND with silt (SP-SM); mostly fine-medium grained sand, few fine-coarse gravel, few silt, medium dense, slightly moist, brown	2.4									1170
2			SS	2	1.30	8	(1.50') Poorly graded SAND (SP); mostly fine-medium grained sand, trace fine gravel, trace silt, medium dense, slightly moist, light brown	2.8									
3				5			(3.00') Poorly graded SAND (SP); mostly fine-medium grained sand, trace fine gravel, trace silt, loose, slightly moist, light brown										
4			SS	5	1.30	10	(6.00') Poorly graded SAND (SP); mostly fine-medium grained sand, trace fine gravel, trace silt, medium dense, slightly moist, light brown	2.3									1165
5				5			(8.00') Poorly graded SAND with gravel (SP); mostly fine-coarse grained sand, little fine-coarse gravel, trace silt, medium dense, slightly moist, light brown	2.4									
6			SS	8	1.40	16											
7				8													
8				8													
9							(12.00') Poorly graded SAND (SP); mostly fine-medium grained sand, trace fine gravel, trace silt, loose, slightly moist, light brown	2.3									1160
10			SS	2	1.30	9											
11				3													
12				6			(16.00') Poorly graded SAND (SP); mostly fine-coarse grained sand, few fine-coarse gravel, trace silt, loose, slightly moist, light brown										1155
13																	
14																	
15																	
16																	
17																	
18																	
19																	
20			SS	3	1.20	11		1.8									
21				5			(20.00') Boring terminated										
22				6													
23																	
24																	
25																	1150

NOTES:

	Client: Marathon County Project: New Highway Department Shop, (POB #26.2026) Address: Old Hwy 51 and Gate of Heaven Drive, Kronenwetter, WI	BORING LOG Boring No. B-27 Page: 1 of 1
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Drilling Start Date: 3/9/26 Drilling End Date: 3/9/26 Drilling Company: POB Drilling Method: Hollow Stem Auger Drilling Equipment: Mobile B-57 Driller: Dakota Ciriacks Logged By: Neil Henriksen	Boring Depth (ft): 20 Boring Diameter (in): 3.25 Sampling Method(s): Split Spoon DTW During Drilling (ft): N/A DTW After Drilling (ft): N/A Ground Surface Elev. (ft): 1172.6 Location (Lat, Long): 44.85145, -89.64636
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DEPTH (ft)	LITHOLOGY	WATER LEVEL	COLLECT				SOIL/ROCK VISUAL DESCRIPTION	Moisture Content (%)	Dry Density (pcf)	Liquid Limit	Plastic Limit	Plasticity Index (PI)	#200 Sieve (%)	Pocket Penetrometer (tsf)	Unconfined Compressive Strength (tsf)	ELEVATION (ft)	
			Sample Type	Blow Counts	Recovery (ft)	N Value RQD%											
0							(0.00') Topsoil: 12 inches of Dark Brown Silty Sand Topsoil										
			SS	2	1.50	4	(1.00') Poorly graded SAND with silt (SP-SM); mostly fine grained sand, trace fine gravel, few silt, loose, slightly moist, brown	3.5									1170
				2													
				2													
			SS	2	1.10	9	(2.00') Poorly graded SAND (SP); mostly fine grained sand, trace fine gravel, trace silt, loose, slightly moist, brown	1.5									
5				4													
				5													
			SS	3	1.30	13	(3.00') Poorly graded SAND (SP); mostly fine grained sand, trace fine gravel, trace silt, loose, slightly moist, light brown	1.8									1165
				5													
				8													
			SS	6	1.20	24	(6.00') Poorly graded SAND (SP); mostly fine-medium grained sand, trace fine gravel, trace silt, medium dense, slightly moist, light brown	1.6									
10				11			(8.00') Poorly graded SAND with gravel (SP); mostly fine-coarse grained sand, little fine-coarse gravel, trace silt, medium dense, slightly moist, light brown										
				13													
																	1160
			SS	6	1.20	14		1.7									
15				6													
				8													
							(16.00') Poorly graded SAND (SP); mostly fine-medium grained sand, trace fine gravel, trace silt, medium dense, slightly moist, light brown										1155
			SS	4	1.50	12		2.3									
20				5			(20.00') Boring terminated										
				7													1150
25																	

NOTES:



Client: **Marathon County**
Project: **New Highway Department Shop,
(POB #26.2026)**
Address: **Old Hwy 51 and Gate of Heaven
Drive, Kronenwetter, WI**

BORING LOGBoring No. **B-28**Page: **1 of 1**

Drilling Start Date: **3/9/26**
Drilling End Date: **3/9/26**
Drilling Company: **POB**
Drilling Method: **Hollow Stem Auger**
Drilling Equipment: **Mobile B-57**
Driller: **Dakota Ciriacks**
Logged By: **Neil Henriksen**

Boring Depth (ft): **20**
Boring Diameter (in): **3.25**
Sampling Method(s): **Split Spoon**
DTW During Drilling (ft): **N/A**
DTW After Drilling (ft): **N/A**
Ground Surface Elev. (ft): **1173.1**
Location (Lat, Long): **44.85142, -89.64569**

DEPTH (ft)	LITHOLOGY	COLLECT				SOIL/ROCK VISUAL DESCRIPTION	Moisture Content (%)	Dry Density (pcf)	Liquid Limit	Plastic Limit	Plasticity Index (PI)	#200 Sieve (%)	Pocket Penetrometer (tsf)	Unconfined Compressive Strength (tsf)	ELEVATION (ft)
		Sample Type	Blow Counts	Recovery (ft)	N Value RQD%										
0						(0.00') Topsoil: 18 inches of Dark Brown Silty Sand Topsoil									
		SS	6	1.50	7										
			4			(1.50') Fill: Poorly graded SAND with silt (SP-SM); mostly fine grained sand, few fine-coarse gravel, few silt, loose, moist, dark brown	10.6								1170
			3												
		SS	2	1.20	11	(3.00') Poorly graded SAND (SP); mostly fine-medium grained sand, trace fine gravel, trace silt, medium dense, slightly moist, light brown	1.2								
5			4												
			7												
		SS	5	1.50	17		2								
			7												
			10												
		SS	7	1.00	23	(8.00') Poorly graded SAND with gravel (SP); mostly fine-coarse grained sand, little fine-coarse gravel, trace silt, medium dense, slightly moist, light brown	1.8								1165
10			11												
			12												
		SS	6	1.10	20		2.2								1160
15			8												
			12												
		SS	4	1.30	15		3.1								1155
20			6			(19.50') Poorly graded SAND (SP); mostly fine-medium grained sand, trace fine gravel, trace silt, medium dense, slightly moist, light brown									
			9			(20.00') Boring terminated									
															1150
25															

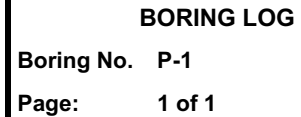
NOTES:

	Client: Marathon County Project: New Highway Department Shop, (POB #26.2026) Address: Old Hwy 51 and Gate of Heaven Drive, Kronenwetter, WI	BORING LOG Boring No. B-29 Page: 1 of 1
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Drilling Start Date: 3/9/26 Drilling End Date: 3/9/26 Drilling Company: POB Drilling Method: Hollow Stem Auger Drilling Equipment: Mobile B-57 Driller: Dakota Ciriacks Logged By: Neil Henriksen	Boring Depth (ft): 20 Boring Diameter (in): 3.25 Sampling Method(s): Split Spoon DTW During Drilling (ft): N/A DTW After Drilling (ft): N/A Ground Surface Elev. (ft): 1172.6 Location (Lat, Long): 44.85145, -89.64510
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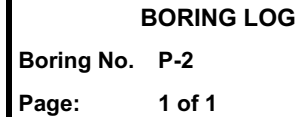
DEPTH (ft)	LITHOLOGY	WATER LEVEL	COLLECT				SOIL/ROCK VISUAL DESCRIPTION	Moisture Content (%)	Dry Density (pcf)	Liquid Limit	Plastic Limit	Plasticity Index (PI)	#200 Sieve (%)	Pocket Penetrometer (tsf)	Unconfined Compressive Strength (tsf)	ELEVATION (ft)	
			Sample Type	Blow Counts	Recovery (ft)	N Value RQD%											
0							(0.00') Topsoil: 12 inches of Dark Brown Silty Sand Topsoil										
1			SS	16	1.50	19	(1.00') Poorly graded SAND with silt (SP-SM); mostly fine grained sand, trace fine gravel, few silt, medium dense, moist, brown	5.7									1170
2				8													
3			SS	3	1.40	10	(3.00') Poorly graded SAND (SP); mostly fine-medium grained sand, trace fine gravel, trace silt, medium dense, slightly moist, light brown	2.5									
4				4													
5			SS	4	1.40	14		2.1									1165
6				6													
7				8													
8			SS	9		42	(8.5') Cobble @8.5 feet										
9				15													
10				27													
11																	
12							(12.00') Poorly graded SAND (SP); mostly fine-medium grained sand, trace fine gravel, trace silt, loose, slightly moist, light brown										1160
13			SS	3	1.00	8		2.3									
14				4													
15				4													
16							(16.00') Poorly graded SAND (SP); mostly fine-medium grained sand, trace fine gravel, trace silt, medium dense, slightly moist, light brown										1155
17																	
18			SS	3	1.40	11		2.3									
19				5													
20				6			(20.00') Boring terminated										1150
21																	
22																	
23																	
24																	
25																	

NOTES:



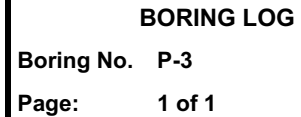
Boring Depth (ft):	10
Boring Diameter (in):	3.25
Sampling Method(s):	Split Spoon
DTW During Drilling (ft):	N/A
DTW After Drilling (ft):	N/A
Ground Surface Elev. (ft):	1176.2
Location (Lat, Long):	44.85360, -89.64518

NOTES:



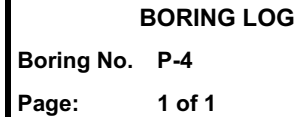
Boring Depth (ft):	10
Boring Diameter (in):	3.25
Sampling Method(s):	Split Spoon
DTW During Drilling (ft):	N/A
DTW After Drilling (ft):	N/A
Ground Surface Elev. (ft):	1175.2
Location (Lat, Long):	44.85389, -89.64639

NOTES:



Boring Depth (ft):	10
Boring Diameter (in):	3.25
Sampling Method(s):	Split Spoon
DTW During Drilling (ft):	N/A
DTW After Drilling (ft):	N/A
Ground Surface Elev. (ft):	1175.1
Location (Lat, Long):	44.85363, -89.64685

NOTES:



Boring Depth (ft):	10
Boring Diameter (in):	3.25
Sampling Method(s):	Split Spoon
DTW During Drilling (ft):	N/A
DTW After Drilling (ft):	N/A
Ground Surface Elev. (ft):	1175.6
Location (Lat, Long):	44.85313, -89.64736

NOTES:

	Client: Marathon County Project: New Highway Department Shop, (POB #26.2026) Address: Old Hwy 51 and Gate of Heaven Drive, Kronenwetter, WI	BORING LOG Boring No. P-5 Page: 1 of 1
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Drilling Start Date: 3/9/26 Drilling End Date: 3/9/26 Drilling Company: POB Drilling Method: Hollow Stem Auger Drilling Equipment: Mobile B-57 Driller: Dakota Ciriacks Logged By: Neil Henriksen	Boring Depth (ft): 10 Boring Diameter (in): 3.25 Sampling Method(s): Split Spoon DTW During Drilling (ft): N/A DTW After Drilling (ft): N/A Ground Surface Elev. (ft): 1175.3 Location (Lat, Long): 44.85223, -89.64806
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DEPTH (ft)	LITHOLOGY	WATER LEVEL	COLLECT				SOIL/ROCK VISUAL DESCRIPTION	Moisture Content (%)	Dry Density (pcf)	Liquid Limit	Plastic Limit	Plasticity Index (PI)	#200 Sieve (%)	Pocket Penetrometer (tsf)	Unconfined Compressive Strength (tsf)	ELEVATION (ft)	
			Sample Type	Blow Counts	Recovery (ft)	N Value RQD%											
0							(0.00') Topsoil: 18 inches of Dark Brown Silty Sand Topsoil										1175
			SS	4	1.50	11											
				5			(1.50') Fill: Poorly graded SAND (SP); mostly fine-medium grained sand, few fine-coarse gravel, trace silt, loose, slightly moist, brown	2.2									
				6													
			SS	2	0.20	2	(3.00') Fill: Poorly graded SAND (SP); mostly fine-medium grained sand, few fine-coarse gravel, trace silt, very loose, slightly moist, brown	3.7									1170
5				1													
				1													
			SS	1	0.50	2											
				1													
				1													
			SS	2	0.67	8											
10				3			(9.00') Poorly graded SAND (SP); mostly fine-coarse grained sand, few fine-coarse gravel, trace silt, loose, slightly moist, light brown	3.1									1165
				5			(10.00') Boring terminated										
15																	1160
20																	1155
25																	

NOTES:

	Client: Marathon County Project: New Highway Department Shop, (POB #26.2026) Address: Old Hwy 51 and Gate of Heaven Drive, Kronenwetter, WI	BORING LOG Boring No. P-6 Page: 1 of 1
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Drilling Start Date: 3/10/26 Drilling End Date: 3/10/26 Drilling Company: POB Drilling Method: Hollow Stem Auger Drilling Equipment: Mobile B-57 Driller: Dakota Ciriacks Logged By: Neil Henriksen	Boring Depth (ft): 10 Boring Diameter (in): 3.25 Sampling Method(s): Split Spoon DTW During Drilling (ft): N/A DTW After Drilling (ft): N/A Ground Surface Elev. (ft): 1174.8 Location (Lat, Long): 44.85241, -89.64634
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DEPTH (ft)	LITHOLOGY	WATER LEVEL	COLLECT				SOIL/ROCK VISUAL DESCRIPTION	Moisture Content (%)	Dry Density (pcf)	Liquid Limit	Plastic Limit	Plasticity Index (PI)	#200 Sieve (%)	Pocket Penetrometer (tsf)	Unconfined Compressive Strength (tsf)	ELEVATION (ft)	
			Sample Type	Blow Counts	Recovery (ft)	N Value RQD%											
0							(0.00') Topsoil: 10.5 inches of Dark Brown Silty Sand Topsoil										
1			SS	3	1.30	8	(1.00') Poorly graded SAND with silt (SP-SM); mostly fine grained sand, trace fine gravel, few silt, loose, slightly moist, brown	3.2									
2				4													
3				4													
4			SS	5	1.20	16	(1.50') Poorly graded SAND (SP); mostly fine-medium grained sand, trace fine gravel, trace silt, loose, slightly moist, light brown	3.2									1170
5				8													
6				8													
7			SS	5	1.30	18	(3.00') Poorly graded SAND (SP); mostly fine-medium grained sand, trace fine gravel, trace silt, medium dense, slightly moist, light brown	2.7									
8				8													
9				10													
10			SS	5	1.40	15	(8.00') Poorly graded SAND (SP); mostly fine-coarse grained sand, few fine-coarse gravel, trace silt, medium dense, slightly moist, light brown	1.9									1165
11				7													
12				8			(10.00') Boring terminated										
13																	
14																	1160
15																	
16																	
17																	
18																	
19																	
20																	1155
21																	
22																	
23																	
24																	
25																	1150

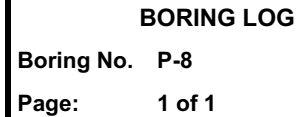
NOTES:

	Client: Marathon County Project: New Highway Department Shop, (POB #26.2026) Address: Old Hwy 51 and Gate of Heaven Drive, Kronenwetter, WI	BORING LOG Boring No. P-7 Page: 1 of 1
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Drilling Start Date: 3/12/26 Drilling End Date: 3/12/26 Drilling Company: POB Drilling Method: Hollow Stem Auger Drilling Equipment: Mobile B-57 Driller: Dakota Ciriacks Logged By: Neil Henriksen	Boring Depth (ft): 10 Boring Diameter (in): 3.25 Sampling Method(s): Split Spoon DTW During Drilling (ft): N/A DTW After Drilling (ft): N/A Ground Surface Elev. (ft): 1173.4 Location (Lat, Long): 44.85248, -89.64515
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DEPTH (ft)	LITHOLOGY	WATER LEVEL	COLLECT				SOIL/ROCK VISUAL DESCRIPTION	Moisture Content (%)	Dry Density (pcf)	Liquid Limit	Plastic Limit	Plasticity Index (PI)	#200 Sieve (%)	Pocket Penetrometer (tsf)	Unconfined Compressive Strength (tsf)	ELEVATION (ft)	
			Sample Type	Blow Counts	Recovery (ft)	N Value RQD%											
0							(0.00') Topsoil: 10 inches of Dark Brown Silty Sand Topsoil										
1			SS	3	1.50	9	(1.00') Poorly graded SAND with silt (SP-SM); mostly fine-medium grained sand, few fine-coarse gravel, few silt, loose, slightly moist, brown	3.9									
2				4													
3				5													
4			SS	3	1.40	9	(1.50') Poorly graded SAND (SP); mostly fine-medium grained sand, few fine-coarse gravel, trace silt, loose, slightly moist, light brown	4.5									1170
5				4													
6				5													
7			SS	3	1.50	9	(3.00') Poorly graded SAND (SP); mostly fine-medium grained sand, trace fine gravel, trace silt, loose, slightly moist, light brown	4.3									
8				4													
9				5													
10			SS	4	1.20	14	(8.00') Poorly graded SAND (SP); mostly fine-coarse grained sand, few fine-coarse gravel, trace silt, medium dense, slightly moist, light brown	2.7									1165
11				6													
12				8			(10.00') Boring terminated										
13																	
14																	
15																	
16																	
17																	
18																	
19																	
20																	
21																	
22																	
23																	
24																	
25																	

NOTES:



Boring Depth (ft):	10
Boring Diameter (in):	3.25
Sampling Method(s):	Split Spoon
DTW During Drilling (ft):	N/A
DTW After Drilling (ft):	N/A
Ground Surface Elev. (ft):	1175.2
Location (Lat, Long):	44.85144, -89.64728

NOTES:

	Client: Marathon County Project: New Highway Department Shop, (POB #26.2026) Address: Old Hwy 51 and Gate of Heaven Drive, Kronenwetter, WI	BORING LOG Boring No. SW-1 Page: 1 of 1
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Drilling Start Date: 3/11/26 Drilling End Date: 3/11/26 Drilling Company: POB Drilling Method: Hollow Stem Auger Drilling Equipment: Mobile B-57 Driller: Dakota Ciriacks Logged By: Neil Henriksen	Boring Depth (ft): 10 Boring Diameter (in): 3.25 Sampling Method(s): Split Spoon DTW During Drilling (ft): N/A DTW After Drilling (ft): N/A Ground Surface Elev. (ft): 1175.7 Location (Lat, Long): 44.85418, -89.64684
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DEPTH (ft)	LITHOLOGY	WATER LEVEL	COLLECT				SOIL/ROCK VISUAL DESCRIPTION	Moisture Content (%)	Dry Density (pcf)	Liquid Limit	Plastic Limit	Plasticity Index (PI)	#200 Sieve (%)	Pocket Penetrometer (tsf)	Unconfined Compressive Strength (tsf)	ELEVATION (ft)	
			Sample Type	Blow Counts	Recovery (ft)	N Value RQD%											
0							(0.00') Topsoil: 14 inches of Dark Brown Silty Sand Topsoil										1175
1	SS		3	1.20	5		(1.00') Poorly graded SAND with silt (SP-SM); mostly fine-medium grained sand, few fine-coarse gravel, few silt, loose, moist, dark brown (7.5YR 3/4)	7.2									
2			2														
3			3														
4	SS		5	1.00	16		(3.00') Poorly graded SAND (SP); mostly fine-medium grained sand, trace fine gravel, trace silt, medium dense, slightly moist, light brown (7.5YR 6/4)	3.1									
5			7														
6			9														
7	SS		5	1.50	16		(6.00') Poorly graded SAND (SP); mostly fine-medium grained sand, trace fine gravel, trace silt, medium dense, slightly moist, light brown (7.5YR 6/4)	2.2					1.3				1170
8			8														
9			8														
10	SS		4	1.40	17		(9.00') Poorly graded SAND with gravel (SP); mostly fine-coarse grained sand, little fine-coarse gravel, trace silt, medium dense, slightly moist, light brown (7.5YR 6/4)	2.5									1165
11			7														
12			10														
13							(10.00') Boring terminated										
14																	1160
15																	
16																	
17																	
18																	
19																	
20																	
21																	
22																	
23																	
24																	
25																	1155

NOTES:

	Client: Marathon County Project: New Highway Department Shop, (POB #26.2026) Address: Old Hwy 51 and Gate of Heaven Drive, Kronenwetter, WI	BORING LOG Boring No. SW-2 Page: 1 of 1
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Drilling Start Date: 3/11/26 Drilling End Date: 3/11/26 Drilling Company: POB Drilling Method: Hollow Stem Auger Drilling Equipment: Mobile B-57 Driller: Dakota Ciriacks Logged By: Neil Henriksen	Boring Depth (ft): 10 Boring Diameter (in): 3.25 Sampling Method(s): Split Spoon DTW During Drilling (ft): N/A DTW After Drilling (ft): N/A Ground Surface Elev. (ft): 1176.1 Location (Lat, Long): 44.85390, -89.64466
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DEPTH (ft)	LITHOLOGY	WATER LEVEL	COLLECT				SOIL/ROCK VISUAL DESCRIPTION	Moisture Content (%)	Dry Density (pcf)	Liquid Limit	Plastic Limit	Plasticity Index (PI)	#200 Sieve (%)	Pocket Penetrometer (tsf)	Unconfined Compressive Strength (tsf)	ELEVATION (ft)	
			Sample Type	Blow Counts	Recovery (ft)	N Value RQD%											
0							(0.00') Topsoil: 7 inches of Dark Brown Silty Sand Topsoil										1175
1			SS	2	1.40	7	(0.50') Poorly graded SAND with silt (SP-SM); mostly fine-medium grained sand, few fine-coarse gravel, few silt, loose, slightly moist, brown (7.5YR 5/4)	4									
2				3													
3				4													
4			SS	5	1.20	17	(1.50') Poorly graded SAND (SP); mostly fine-medium grained sand, trace fine gravel, trace silt, loose, slightly moist, light brown (7.5YR 6/4)	3.8									
5				8													
6				9													
7			SS	6	1.20	17	(3.00') Poorly graded SAND with gravel (SP); mostly fine-coarse grained sand, little fine-coarse gravel, trace silt, medium dense, slightly moist, light brown (7.5YR 6/4)	2.9									1170
8				8													
9				9													
10			SS	3	1.40	11	(6.00') Poorly graded SAND with gravel (SP); mostly fine-coarse grained sand, little fine-coarse gravel, trace silt, medium dense, slightly moist, light brown (7.5YR 6/4)	2.4									
11				4													
12				7													
13							(8.00') Poorly graded SAND with gravel (SP); mostly fine-coarse grained sand, little fine-coarse gravel, trace silt, medium dense, slightly moist, light brown (7.5YR 6/4)										1165
14																	
15							(10.00') Boring terminated										
16																	1160
17																	
18																	
19																	
20																	1155
21																	
22																	
23																	
24																	
25																	

NOTES:

	Client: Marathon County Project: New Highway Department Shop, (POB #26.2026) Address: Old Hwy 51 and Gate of Heaven Drive, Kronenwetter, WI	BORING LOG Boring No. SW-3 Page: 1 of 1
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Drilling Start Date: 3/10/26 Drilling End Date: 3/10/26 Drilling Company: POB Drilling Method: Hollow Stem Auger Drilling Equipment: Mobile B-57 Driller: Dakota Ciriacks Logged By: Neil Henriksen	Boring Depth (ft): 10 Boring Diameter (in): 3.25 Sampling Method(s): Split Spoon DTW During Drilling (ft): N/A DTW After Drilling (ft): N/A Ground Surface Elev. (ft): 1175.2 Location (Lat, Long): 44.85294, -89.64783
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DEPTH (ft)	LITHOLOGY	WATER LEVEL	COLLECT				SOIL/ROCK VISUAL DESCRIPTION	Moisture Content (%)	Dry Density (pcf)	Liquid Limit	Plastic Limit	Plasticity Index (PI)	#200 Sieve (%)	Pocket Penetrometer (tsf)	Unconfined Compressive Strength (tsf)	ELEVATION (ft)	
			Sample Type	Blow Counts	Recovery (ft)	N Value RQD%											
0							(0.00') Topsoil: 16 inches of Dark Brown Silty Sand Topsoil										1175
4			SS	3	1.50	9	(1.50') Poorly graded SAND with gravel (SP); mostly fine-medium grained sand, little fine-coarse gravel, trace silt, loose, slightly moist, strong brown (7.5YR 5/8)	4.1									
5			SS	7	1.20	24	(3.00') Poorly graded SAND (SP); mostly fine-coarse grained sand, few fine-coarse gravel, trace silt, medium dense, slightly moist, yellowish brown (10YR 5/6)	3.1					2				1170
6			SS	6	1.40	22	(6.00') Poorly graded SAND (SP); mostly fine-medium grained sand, trace fine gravel, trace silt, medium dense, slightly moist, strong brown (7.5YR 5/6)	4.9									
10			SS	5	1.50	17	(9.00') Poorly graded SAND (SP); mostly fine-medium grained sand, few fine-coarse gravel, trace silt, medium dense, slightly moist, yellowish brown (10YR 5/6)	4									1165
							(10.00') Boring terminated										
15																	1160
20																	1155
25																	

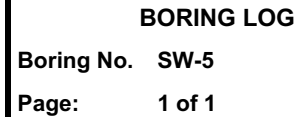
NOTES:

	Client: Marathon County Project: New Highway Department Shop, (POB #26.2026) Address: Old Hwy 51 and Gate of Heaven Drive, Kronenwetter, WI	BORING LOG Boring No. SW-4 Page: 1 of 1
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Drilling Start Date: 3/12/26 Drilling End Date: 3/12/26 Drilling Company: POB Drilling Method: Hollow Stem Auger Drilling Equipment: Mobile B-57 Driller: Dakota Ciriacks Logged By: Neil Henriksen	Boring Depth (ft): 10 Boring Diameter (in): 3.25 Sampling Method(s): Split Spoon DTW During Drilling (ft): N/A DTW After Drilling (ft): N/A Ground Surface Elev. (ft): 1173.9 Location (Lat, Long): 44.85267, -89.64465
--	--

DEPTH (ft)	LITHOLOGY	WATER LEVEL	COLLECT				SOIL/ROCK VISUAL DESCRIPTION	Moisture Content (%)	Dry Density (pcf)	Liquid Limit	Plastic Limit	Plasticity Index (PI)	#200 Sieve (%)	Pocket Penetrometer (tsf)	Unconfined Compressive Strength (tsf)	ELEVATION (ft)	
			Sample Type	Blow Counts	Recovery (ft)	N Value RQD%											
0							(0.00') Topsoil: 12.5 inches of Dark Brown Silty Sand Topsoil										
1	SS		2	1.50	7		(1.00') Poorly graded SAND (SP); mostly fine-medium grained sand, trace fine gravel, trace silt, loose, slightly moist, brown (7.5YR 5/4)	3.5									
2																	
3																	
4																	
5	SS		3	1.20	9		(3.00') Poorly graded SAND (SP); mostly fine grained sand, trace fine gravel, trace silt, loose, slightly moist, light brown (7.5YR 6/4)	3.7									1170
6																	
7																	
8																	
10	SS		4	1.50	13		(6.00') Poorly graded SAND (SP); mostly fine-coarse grained sand, few fine-coarse gravel, trace silt, medium dense, slightly moist, brown (7.5YR 5/4)	2.9									
11																	
12																	
13																	
15	SS		4	1.30	15		(8.00') Poorly graded SAND (SP); mostly fine-coarse grained sand, few fine-coarse gravel, trace silt, medium dense, slightly moist, brown (7.5YR 5/4)	3.5									1165
16																	
17																	
18																	
20							(10.00') Boring terminated										1160
25																	1150

NOTES:



Boring Depth (ft):	10
Boring Diameter (in):	3.25
Sampling Method(s):	Split Spoon
DTW During Drilling (ft):	N/A
DTW After Drilling (ft):	N/A
Ground Surface Elev. (ft):	1172.4
Location (Lat, Long):	44.85126, -89.64838

NOTES:

			Client: Marathon County Project: New Highway Department Shop, (POB #26.2026) Address: Old Hwy 51 and Gate of Heaven Drive, Kronenwetter, WI			BORING LOG Boring No. SW-6 Page: 1 of 1			
Drilling Start Date: 3/9/26 Drilling End Date: 3/9/26 Drilling Company: POB Drilling Method: Hollow Stem Auger Drilling Equipment: Mobile B-57 Driller: Dakota Ciriacks Logged By: Neil Henriksen						Boring Depth (ft): 10 Boring Diameter (in): 3.25 Sampling Method(s): Split Spoon DTW During Drilling (ft): N/A DTW After Drilling (ft): N/A Ground Surface Elev. (ft): 1172.4 Location (Lat, Long): 44.85127, -89.64619			

DEPTH (ft)	LITHOLOGY	WATER LEVEL	COLLECT				SOIL/ROCK VISUAL DESCRIPTION	Moisture Content (%)	Dry Density (pcf)	Liquid Limit	Plastic Limit	Plasticity Index (PI)	#200 Sieve (%)	Pocket Penetrometer (tsf)	Unconfined Compressive Strength (tsf)	ELEVATION (ft)	
			Sample Type	Blow Counts	Recovery (ft)	N Value RQD%											
0							(0.00') Fill: Poorly graded SAND with silt (SP-SM); mostly fine-medium grained sand, trace fine gravel, few silt, loose, slightly moist, dark brown (7.5YR 3/4)										
			SS	4	1.50	7	(1.50') Poorly graded SAND (SP); mostly fine-medium grained sand, trace fine gravel, trace silt, loose, slightly moist, brownish yellow (10YR 6/6)	3									1170
				4													
				3													
			SS	1	1.00	4	(3.00') Poorly graded SAND (SP); mostly fine-medium grained sand, trace fine gravel, trace silt, loose, slightly moist, light yellowish brown (10YR 6/4)	2.2									
5				2													
				2													
			SS	3	1.30	12	(6.00') Poorly graded SAND (SP); mostly fine-medium grained sand, trace fine gravel, trace silt, medium dense, slightly moist, light yellowish brown (10YR 6/4)	2.2									1165
				5													
				7													
			SS	5	1.20	16											
10				7													
				9													
							(10.00') Boring terminated	2.9									
																	1160
																	1155
																	1150
25																	

NOTES:

	Client: Marathon County Project: New Highway Department Shop, (POB #26.2026) Address: Old Hwy 51 and Gate of Heaven Drive, Kronenwetter, WI	BORING LOG Boring No. SW-7 Page: 1 of 1
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Drilling Start Date: 3/9/26 Drilling End Date: 3/9/26 Drilling Company: POB Drilling Method: Hollow Stem Auger Drilling Equipment: Mobile B-57 Driller: Dakota Ciriacks Logged By: Neil Henriksen	Boring Depth (ft): 10 Boring Diameter (in): 3.25 Sampling Method(s): Split Spoon DTW During Drilling (ft): N/A DTW After Drilling (ft): N/A Ground Surface Elev. (ft): 1172.7 Location (Lat, Long): 44.85166, -89.64458
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DEPTH (ft)	LITHOLOGY	WATER LEVEL	COLLECT				SOIL/ROCK VISUAL DESCRIPTION	Moisture Content (%)	Dry Density (pcf)	Liquid Limit	Plastic Limit	Plasticity Index (PI)	#200 Sieve (%)	Pocket Penetrometer (tsf)	Unconfined Compressive Strength (tsf)	ELEVATION (ft)	
			Sample Type	Blow Counts	Recovery (ft)	N Value RQD%											
0							(0.00') Fill: Poorly graded SAND (SP); mostly fine grained sand, trace fine gravel, trace silt, loose, moist, brown (7.5YR 4/3)	6.2									
3			SS	3	1.50	6	(1.50') Fill: Poorly graded SAND with silt (SP-SM); mostly fine-medium grained sand, few fine-coarse gravel, few silt, loose, moist, brown (7.5YR 4/3)										1170
4			SS	3		7											
5				4													
6				3													
7				4													
8				1	0.50	4	(6.00') Fill: Poorly graded SAND with silt (SP-SM); mostly fine-medium grained sand, few fine-coarse gravel, few silt, loose, moist, brown (7.5YR 4/3)	11.2									1165
9				2													
10				2			(8.00') Poorly graded SAND (SP); mostly fine-coarse grained sand, few fine-coarse gravel, trace silt, loose, slightly moist, dark yellowish brown (10YR 4/4)	3.2					1.8				
11				3													
12				6			(10.00') Boring terminated										
13																	1160
14																	
15																	1155
16																	
17																	
18																	
19																	1150
20																	
21																	
22																	
23																	
24																	
25																	

NOTES:



BORING AND WELL LOG LEGEND

	SURFACE		Volume Descriptors
	ASPHALT		Trace = <5%
	CONCRETE		Few = 5-10%
	FILL		Little = 15-25%
	TOPSOIL		Some = 30-45%
	AIR		Mostly = >=50%
	ICE		
	USCS		Water Levels
	Well-graded GRAVEL (GW)		Water Level During Drilling
	Poorly graded GRAVEL (GP)		Water Level at End of Drilling/in Completed Well
	Silty GRAVEL (GM)		
	Clayey GRAVEL (GC)		Well/Boring Completion
	Silty, Clayey GRAVEL (GC-GM)		Cap
	Well-graded GRAVEL with silt (GW-GM)		Riser
	Poorly graded GRAVEL with silt (GP-GM)		Screen
	Well-graded GRAVEL with clay (GW-GC)		End Plug
	Poorly graded GRAVEL with clay (GP-GC)		Annular Seal
	Well-graded SAND (SW)		Sanitary Seal (Bentonite Slurry/Chips/Pellets/Powder, Other)
	Poorly graded SAND (SP)		Filter Pack (Sand, Gravel, Other)
	Silty SAND (SM)		Backfill
	Clayey SAND (SC)		Sample Type
	Silty, Clayey SAND (SC-SM)		Grab
	Well-graded SAND with silt (SW-SM)		Encore
	Poorly graded SAND with silt (SP-SM)		Split Spoon
	Well-graded SAND with clay (SW-SC)		Shelby Tube
	Poorly graded SAND with clay (SP-SC)		Core Barrel
	SILT (ML)		Direct Push
	Lean CLAY (CL)		Lab Sample and ID
	Silty CLAY (CL-ML)		Rock
	Organic SOIL (OL)		IGNEOUS Rock
	Elastic SILT (MH)		METAMORPHIC Rock
	Fat CLAY (CH)		SEDIMENTARY Rock
	Organic SOIL (OH)		Agglomerate
	Organic SOIL (OL/OH)		Andesite
	PEAT (PT)		Basalt
	BEDROCK		Diorite
	WATER		Gabbro
	Non-USCS		Granite
	Gravel		Rhyolite
	Sand		Tuff
	Silt		Volcanic breccia
	Clayey silt		Gneiss
	Silt & clay		Granulite
	Clay & silt		Hornfels
	Silty clay		Marble
	Clay		Phyllite
	Boulders		Quartzite
	Cobbles		Schist
	Peastone		Serpentinite
	Glacial till		Skarn
	Iron ore		Slate
	Wood		Amphibolite
	Peat		Breccia
	Partially Weathered Rock (PWR)		Chalk
	Saprolite		Chert
	Ash		Claystone
	Waste		Coal
	Mud		Conglomerate
	Alluvium		Diatomite
	Colluvium		Dolomite
	Residuum		Evaporite
	Soil/Rock Contact Lines		Graywacke
	Inferred		Limestone
	Abrupt		Mudstone
	Gradational		Sandstone
			Shale
			Siltstone

Major Component of Sample	Size Range	Description of Components Present in Sample	Percent of Dry Weight
Boulders	Over 8" (200 mm)	Trace	<5
Cobbles	8" to 3" (200 to 75 mm)	Few	5 - 10
Gravel	3" to #4 sieve (75 to 4.76 mm)	Little	15 - 25
Sand	#4 to #200 sieve (4.76 to 0.074 mm)	Some	30 - 45
Silt	Passing #200 sieve (0.074 to 0.005 mm)		
Clay	Smaller than 0.005 mm		

Consistency of Fine-Grained Soils

Unconfined Compressive Strength, Q_u , tsf	Consistency
<0.25	Very Soft
0.25 - 0.49	Soft
0.50 - 0.99	Medium Stiff
1.00 - 1.99	Stiff
2.00 - 3.99	Very Stiff
>4.00	Hard

Relative Density of Coarse-Grained Soils

N, Blows per 12 inches	Relative Density
0 - 3	Very Loose
4 - 9	Loose
10 - 29	Medium Dense
30 - 49	Dense
50 - 80	Very Dense
>80	Extremely Dense

UNIFIED SOIL CLASSIFICATION AND SYMBOL CHART

COARSE-GRAINED SOILS (more than 50% of material is larger than No. 200 sieve size.)			
GRAVELS More than 50% of coarse fraction larger than No. 4 sieve size	Clean Gravels (Less than 5% fines)		
		GW	Well-graded gravels, gravel-sand mixtures, little or no fines
		GP	Poorly-graded gravels, gravel-sand mixtures, little or no fines
	Gravels with fines (More than 12% fines)		
		GM	Silty gravels, gravel-sand-silt mixtures
		GC	Clayey gravels, gravel-sand-clay mixtures
SANDS 50% or more of coarse fraction smaller than No. 4 sieve size	Clean Sands (Less than 5% fines)		
		SW	Well-graded sands, gravelly sands, little or no fines
		SP	Poorly graded sands, gravelly sands, little or no fines
	Sands with fines (More than 12% fines)		
		SM	Silty sands, sand-silt mixtures
		SC	Clayey sands, sand-clay mixtures
FINE-GRAINED SOILS (50% or more of material is smaller than No. 200 sieve size.)			
SILTS AND CLAYS Liquid limit less than 50%		ML	Inorganic silts and very fine sands, rock flour, silty of clayey fine sands or clayey silts with slight plasticity
		CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
		OL	Organic silts and organic silty clays of low plasticity
SILTS AND CLAYS Liquid limit 50% or greater		MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts
		CH	Inorganic clays of high plasticity, fat clays
		OH	Organic clays of medium to high plasticity, organic silts
HIGHLY ORGANIC SOILS		PT	Peat and other highly organic soils

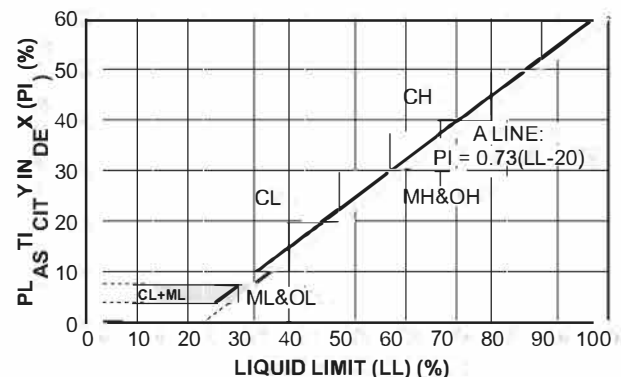
LABORATORY CLASSIFICATION CRITERIA

GW	$C_u = \frac{D_{60}}{D_{10}}$ greater than 4; $C_c = \frac{D_{30}}{D_{10} \times D_{60}}$ between 1 and 3	
GP	Not meeting all gradation requirements for GW	
GM	Atterberg limits below "A" line or P.I. less than 4	Above "A" line with P.I. between 4 and 7 are borderline cases
GC	Atterberg limits above "A" line with P.I. greater than 7	requiring use of dual symbols
SW	$C_u = \frac{D_{60}}{D_{10}}$ greater than 4; $C_c = \frac{D_{30}}{D_{10} \times D_{60}}$ between 1 and 3	
SP	Not meeting all gradation requirements for GW	
SM	Atterberg limits below "A" line or P.I. less than 4	Limits plotting in shaded zone with P.I. between 4 and 7 are borderline cases
SC	Atterberg limits above "A" line with P.I. greater than 7	requiring use of dual symbols.

Determine percentages of sand and gravel from grain-size curve. Depending on percentage of fines (fraction smaller than No. 200 sieve size), coarse-grained soils are classified as follows:

Less than 5 percent GW, GP, SW, SP
More than 12 percent GM, GC, SM, SC
5 to 12 percent Borderline cases requiring dual symbols

PLASTICITY CHART



UNIFIED SOIL CLASSIFICATION SYSTEM



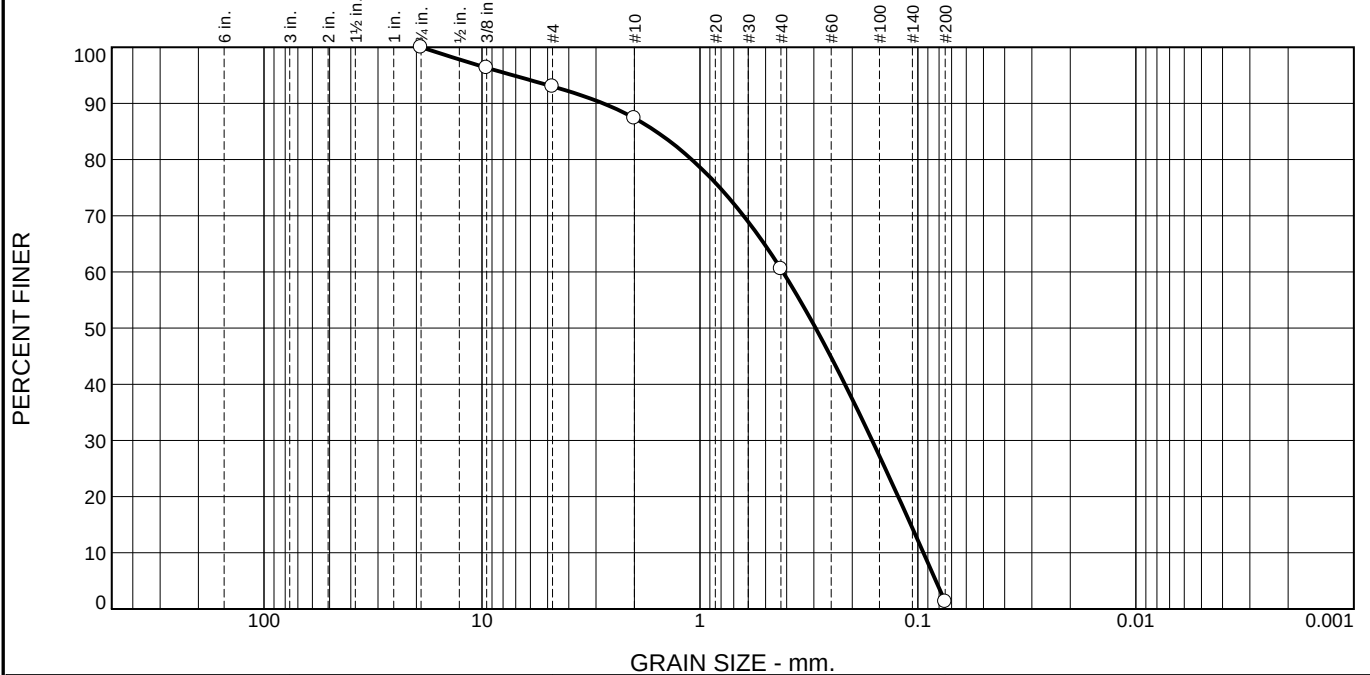
APPENDIX C

LABORATORY REPORTS

Sieve Analysis Reports



Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	7.0	5.6	26.9	59.2	1.3	

TEST RESULTS			
Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3/4	100.0		
3/8	96.4		
#4	93.0		
#10	87.4		
#40	60.5		
#200	1.3		

* (no specification provided)

Material Description

Brown Sand

Atterberg Limits (ASTM D 4318)

PL= _____ LL= _____ PI= _____

Classification

USCS (D 2487)= SP AASHTO (M 145)= _____

Coefficients

D₉₀= 2.7763 D₈₅= 1.5875 D₆₀= 0.4165
D₅₀= 0.2946 D₃₀= 0.1621 D₁₅= 0.1077
D₁₀= 0.0943 C_u= 4.42 C_c= 0.67

Remarks

Date Received: _____ Date Tested: 3/13/26

Tested By: NH

Checked By: _____

Title: _____

Source of Sample: SW-1 Depth: 6.0-7.5
Sample Number: S-3

Date Sampled: 3/11/26

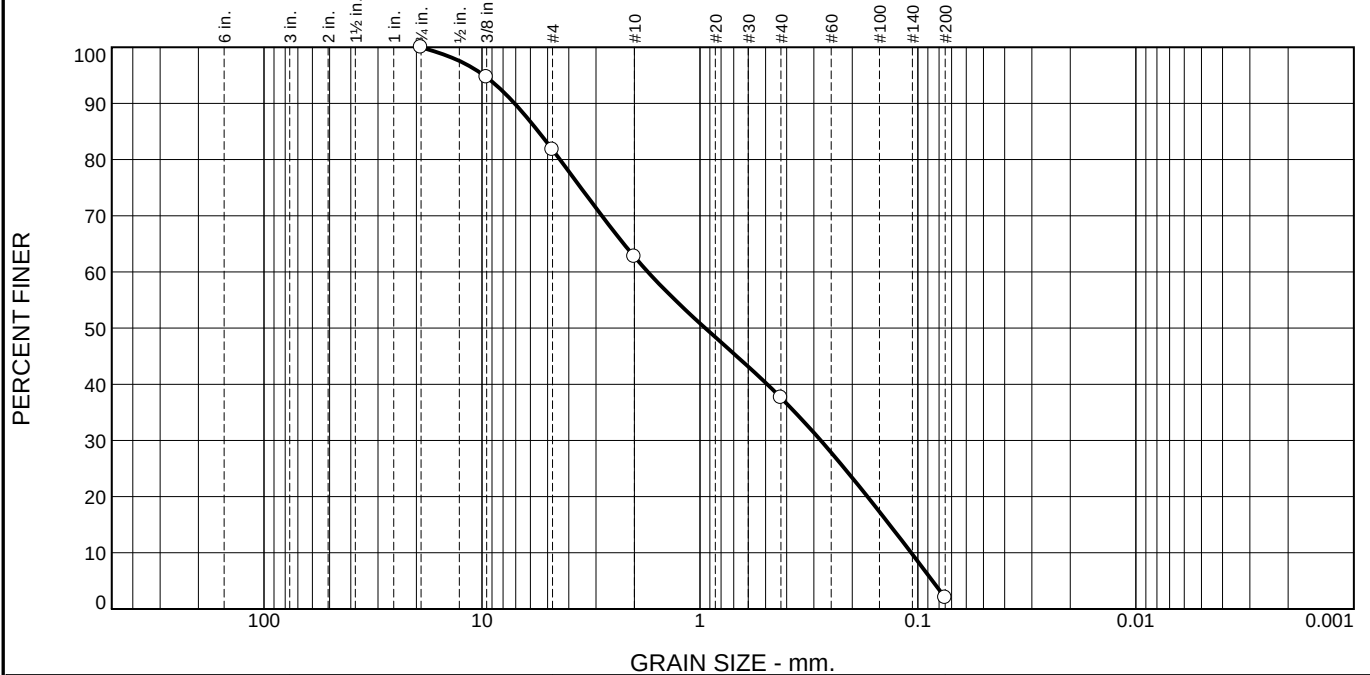
Point of Beginning, Inc.

Stevens Point, Wisconsin

Client: Marathon County
Project: New Highway Department Facilities

Project No: 26.2026

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	18.2	19.1	25.1	35.6	2.0	

TEST RESULTS			
Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3/4	100.0		
3/8	94.7		
#4	81.8		
#10	62.7		
#40	37.6		
#200	2.0		

* (no specification provided)

Material Description

Brown Sand

Atterberg Limits (ASTM D 4318)

PL= _____ LL= _____ PI= _____

Classification

USCS (D 2487)= SP AASHTO (M 145)= _____

Coefficients

D₉₀= 7.0854 D₈₅= 5.5111 D₆₀= 1.7328
D₅₀= 0.9458 D₃₀= 0.2792 D₁₅= 0.1349
D₁₀= 0.1074 C_u= 16.14 C_c= 0.42

Remarks

Date Received: _____ Date Tested: 3/13/26

Tested By: NH

Checked By: _____

Title: _____

Source of Sample: SW-3 Depth: 3.5-5.0
Sample Number: S-2

Date Sampled: 3/10/26

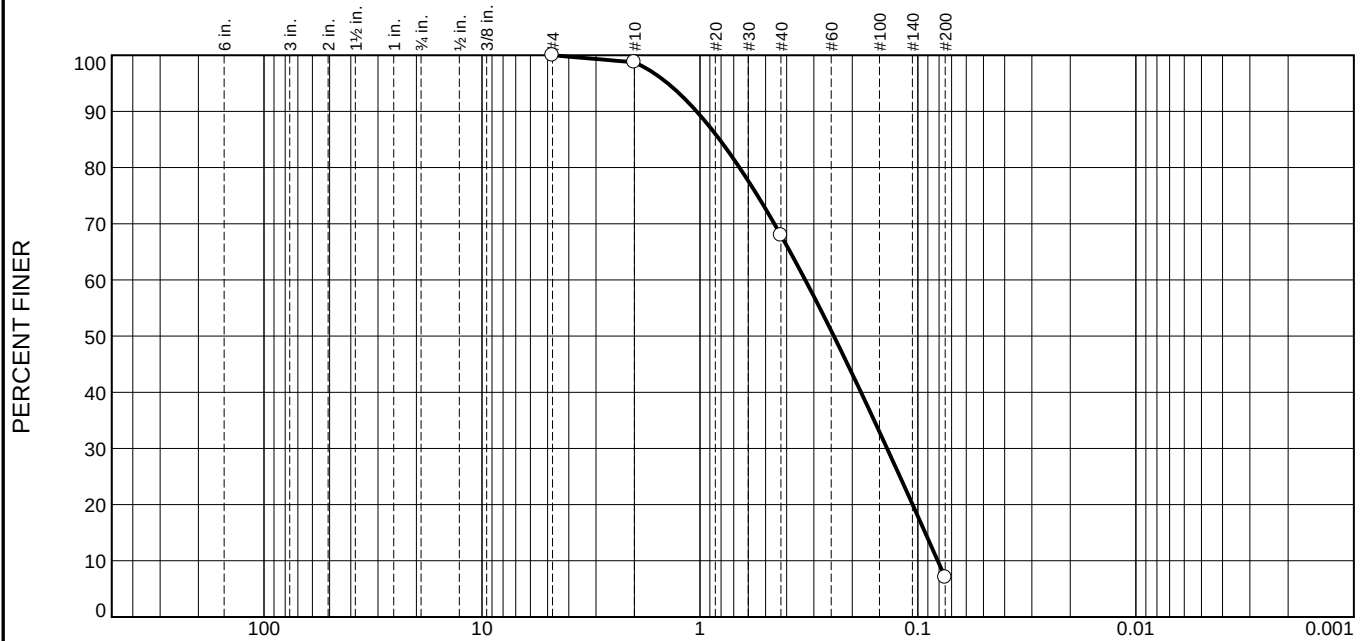
Point of Beginning, Inc.

Stevens Point, Wisconsin

Client: Marathon County
Project: New Highway Department Facilities

Project No: 26.2026

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	1.3	30.8	60.8	7.1	

TEST RESULTS			
Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
#4	100.0		
#10	98.7		
#40	67.9		
#200	7.1		

* (no specification provided)

Material Description

Brown Sand

Atterberg Limits (ASTM D 4318)

PL= _____ LL= _____ PI= _____

Classification

USCS (D 2487)= SP AASHTO (M 145)= _____

Coefficients

D₉₀= 1.0354 D₈₅= 0.8126 D₆₀= 0.3287
D₅₀= 0.2429 D₃₀= 0.1384 D₁₅= 0.0926
D₁₀= 0.0811 C_u= 4.05 C_c= 0.72

Remarks

Date Received: _____ Date Tested: 3/10/26

Tested By: NH

Checked By: _____

Title: _____

Source of Sample: SW-5 Depth: 1.0-2.5
Sample Number: S-1

Date Sampled: 3/9/26

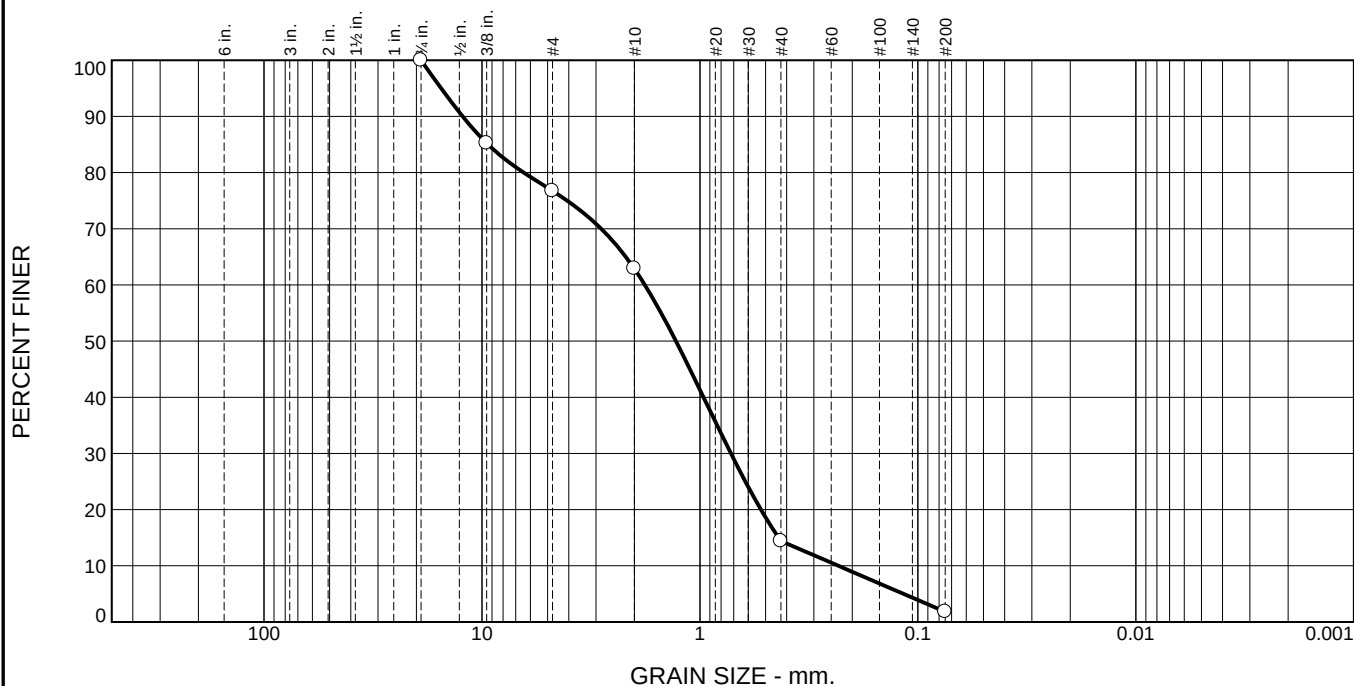
Point of Beginning, Inc.

Stevens Point, Wisconsin

Client: Marathon County
Project: New Highway Department Facilities

Project No: 26.2026

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	23.3	13.8	48.5	12.6	1.8	

TEST RESULTS			
Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3/4	100.0		
3/8	85.2		
#4	76.7		
#10	62.9		
#40	14.4		
#200	1.8		

* (no specification provided)

Material Description

Brown Sand

Atterberg Limits (ASTM D 4318)

PL= _____ LL= _____ PI= _____

Classification

USCS (D 2487)= SW AASHTO (M 145)= _____

Coefficients

D₉₀= 12.2681 D₈₅= 9.3865 D₆₀= 1.7888
D₅₀= 1.2892 D₃₀= 0.7207 D₁₅= 0.4357
D₁₀= 0.2318 C_u= 7.72 C_c= 1.25

Remarks

Date Received: _____ Date Tested: 3/10/26

Tested By: NH

Checked By: _____

Title: _____

Source of Sample: SW-7 Depth: 8.5-10.0
Sample Number: S-4

Date Sampled: 3/9/26

Point of Beginning, Inc.

Stevens Point, Wisconsin

Client: Marathon County
Project: New Highway Department Facilities

Project No: 26.2026

APPENDIX D

GENERAL NOTES & PROCEDURES

Drilling Procedures

Borings are drilled with a track- or truck-mounted rotary drill rig using one of a variety of drilling methods, depending on the soil conditions.

After each boring is completed, the open boreholes are either backfilled with the auger cuttings or bentonite chips, depending on government regulations or project specifications. The boreholes at the ground surface may also be capped with asphalt or concrete.

Hand-Auger Drilling (HA) - A fluted sampling device on the end of a T-Probe is advanced into the soil to the desired sample depth and then manually extracted to recover a disturbed sample. Sampling to depths greater than 3 to 5 feet can be difficult, depending on the soils encountered.

Solid-Stem Auger Drilling (AD) - Continuous flight augers are advanced to create a borehole. With solid-stem auger drilling, casing and drilling fluids are not used to maintain an open borehole. Therefore, this method is suitable in soils that will maintain an open borehole when the augers are removed. Typically, soil-stem drilling is not appropriate below the groundwater table. Soil samples can be collected at any interval.

Hollow-Stem Auger Drilling (HS) - Continuous flight augers are advanced by a truck- or track-mounted drill rig to create a borehole. Hollow-stem augers have open stems that allow a soil sampling tool to be used without removing the augers from the borehole. This drilling method is not appropriate below the groundwater table when sand soils are encountered.

Rotary Drilling (RD) - Various auger bits attached to drill rod, in conjunction with circulating drilling fluid, are used to advance the borehole. Surface casing is used to maintain borehole stability and to facilitate the circulation of the drilling fluid. The borehole will remain open due to the presence of dense drilling fluid (mud) when the auger bit and drill rod are removed. This drilling method is appropriate in soils that do not maintain an open borehole during drilling.

Diamond Core Drilling (DD) - A double-tube or triple-tube core barrel with a diamond bit is advanced through bedrock or cemented material to create an in-situ cylinder material that can be extracted. When the core barrel has proceeded to the desired core run length, the core sample is retained by a core catcher and retrieved.

Soil Sampling Procedures

Representative soil samples are collected during the drilling process using one of a variety of sampling methods. Typically, soil samples are obtained in the upper 10 feet of each boring and at intervals of 5 feet thereafter.



Field logs for each boring, which describe the method of borehole advancement, sampling methods, sample depths, and other observations regarding soil and groundwater conditions, are prepared at the time of drilling. The field logs are utilized by geotechnical staff as an aid in preparing the final boring logs.

Auger Sampling (AS) - Soil samples are obtained as cuttings from the auger flights as they are lifted from the borehole. Auger samples provide a general indication of subsurface conditions; however, they do not provide undisturbed samples, nor do they provide samples from specific depths. Due to the possible loss of soil components, or the mixing of soil components from various elevations, auger samples may not be representative of in-situ soil conditions.

Split-Barrel Sampling (SS) - ASTM Standard D-1586 - A 2-inch-O.D. split-barrel sampler is driven into the soil 18 inches by a 140-pound weight free-falling 30 inches. The first 6 inches of penetration is usually considered a seating drive. The Standard Penetration Resistance (SPT) value (N-Value) is the number of blows over the final 12 inches of driving. This value provides an indication of the in-place relative density of coarse-grained (sand and gravel) soils. The N-Value should be considered qualitative, since many variables can affect the results. A representative portion of the soil sample is recovered from the split-barrel sampler, placed in a sample jar, and delivered to a laboratory for further examination and possible testing. The ASTM standard is attached.

Shelby Tube Sampling Procedure (ST) - ASTM Standard D-1587 - A 2- or 3-inch-diameter thin-walled seamless steel tube having a sharp cutting edge is hydraulically pushed into the soil to obtain a relatively undisturbed sample. This procedure is generally used for fine-grained (clay and silt) soils. The Shelby tubes are carefully handled to minimize sample disturbance and delivered to a laboratory where the soil is extruded from the tube for further examination and possible testing. The ASTM standard is attached.

Miscellaneous Procedures

Soil Classification - The samples collected were evaluated in accordance with the Unified Soil Classification System (USCS). A summary of the USCS is included in Appendix B.

The descriptions presented on the boring logs are a representation of the subsurface conditions, based on visual soil classifications of soil samples and laboratory test results. The stratigraphic lines on the logs are approximate and the transition between the layers may be gradual rather than distinct.

Boring Location Layout - If the boring locations are not staked by the project civil engineer ahead of drilling, geotechnical staff will lay out the borings either by visibly referencing site features or utilizing handheld GPS equipment. The boring location accuracy, if not pre-staked, will be 10 feet.

Boring Surface Elevations - If the surface elevations at the boring locations are not provided by the project civil engineer, they will be obtained using a variety of methods, including topographic survey interpolation, the USGS website database, government GIS websites, or handheld GPS equipment. The accuracy of the surface elevations will be ½ foot if surveyed and 1 foot if interpolated from website/plan resources.



Point of Beginning

Subsurface Water Observation - Subsurface water (groundwater and perched water) observations will be recorded during drilling and at the completion of drilling. Any recorded observations will be approximate and accurate to 2 feet. Water level measurements refer only to those observed at the times and locations indicated and may vary with time.





Standard Test Method for Penetration Test and Split-Barrel Sampling of Soils¹

This standard is issued under the fixed designation D 1586; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

This standard has been approved for use by agencies of the Department of Defense.

1. Scope *

1.1 This test method describes the procedure, generally known as the Standard Penetration Test (SPT), for driving a split-barrel sampler to obtain a representative soil sample and a measure of the resistance of the soil to penetration of the sampler.

1.2 *This standard does not purport to address all of the safety problems, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.* For a specific precautionary statement, see 5.4.1.

1.3 The values stated in inch-pound units are to be regarded as the standard.

NOTE 1—Practice D 6066 can be used when testing loose sands below the water table for liquefaction studies or when a higher level of care is required when drilling these soils. This practice provides information on drilling methods, equipment variables, energy corrections, and blow-count normalization.

2. Referenced Documents

2.1 ASTM Standards:

- D 2487 Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)²
- D 2488 Practice for Description and Identification of Soils (Visual-Manual Procedure)²
- D 4220 Practices for Preserving and Transporting Soil Samples²
- D 4633 Test Method for Stress Wave Energy Measurement for Dynamic Penetrometer Testing Systems²
- D 6066 Practice for Determining the Normalized Penetration Resistance Testing of Sands for Evaluation of Liquefaction Potential³

3. Terminology

3.1 Definitions of Terms Specific to This Standard:

3.1.1 *anvil*—that portion of the drive-weight assembly

which the hammer strikes and through which the hammer energy passes into the drill rods.

3.1.2 *cathead*—the rotating drum or windlass in the rope-cathead lift system around which the operator wraps a rope to lift and drop the hammer by successively tightening and loosening the rope turns around the drum.

3.1.3 *drill rods*—rods used to transmit downward force and torque to the drill bit while drilling a borehole.

3.1.4 *drive-weight assembly*—a device consisting of the hammer, hammer fall guide, the anvil, and any hammer drop system.

3.1.5 *hammer*—that portion of the drive-weight assembly consisting of the 140 ± 2 lb (63.5 ± 1 kg) impact weight which is successively lifted and dropped to provide the energy that accomplishes the sampling and penetration.

3.1.6 *hammer drop system*—that portion of the drive-weight assembly by which the operator accomplishes the lifting and dropping of the hammer to produce the blow.

3.1.7 *hammer fall guide*—that part of the drive-weight assembly used to guide the fall of the hammer.

3.1.8 *N-value*—the blowcount representation of the penetration resistance of the soil. The N-value, reported in blows per foot, equals the sum of the number of blows required to drive the sampler over the depth interval of 6 to 18 in. (150 to 450 mm) (see 7.3).

3.1.9 ΔN —the number of blows obtained from each of the 6-in. (150-mm) intervals of sampler penetration (see 7.3).

3.1.10 *number of rope turns*—the total contact angle between the rope and the cathead at the beginning of the operator's rope slackening to drop the hammer, divided by 360° (see Fig. 1).

3.1.11 *sampling rods*—rods that connect the drive-weight assembly to the sampler. Drill rods are often used for this purpose.

3.1.12 *SPT*—abbreviation for standard penetration test, a term by which engineers commonly refer to this method.

4. Significance and Use

4.1 This test method provides a soil sample for identification purposes and for laboratory tests appropriate for soil obtained from a sampler that may produce large shear strain disturbance in the sample.

4.2 This test method is used extensively in a great variety of geotechnical exploration projects. Many local correlations and

¹ This method is under the jurisdiction of ASTM Committee D-18 on Soil and Rock and is the direct responsibility of Subcommittee D18.02 on Sampling and Related Field Testing for Soil Investigations.

Current edition approved Jan. 10, 1999. Published March 1999. Originally published as D 1586 – 58 T. Last previous edition D 1586 – 98.

² *Annual Book of ASTM Standards*, Vol 04.08.

³ *Annual Book of ASTM Standards*, Vol 04.09.

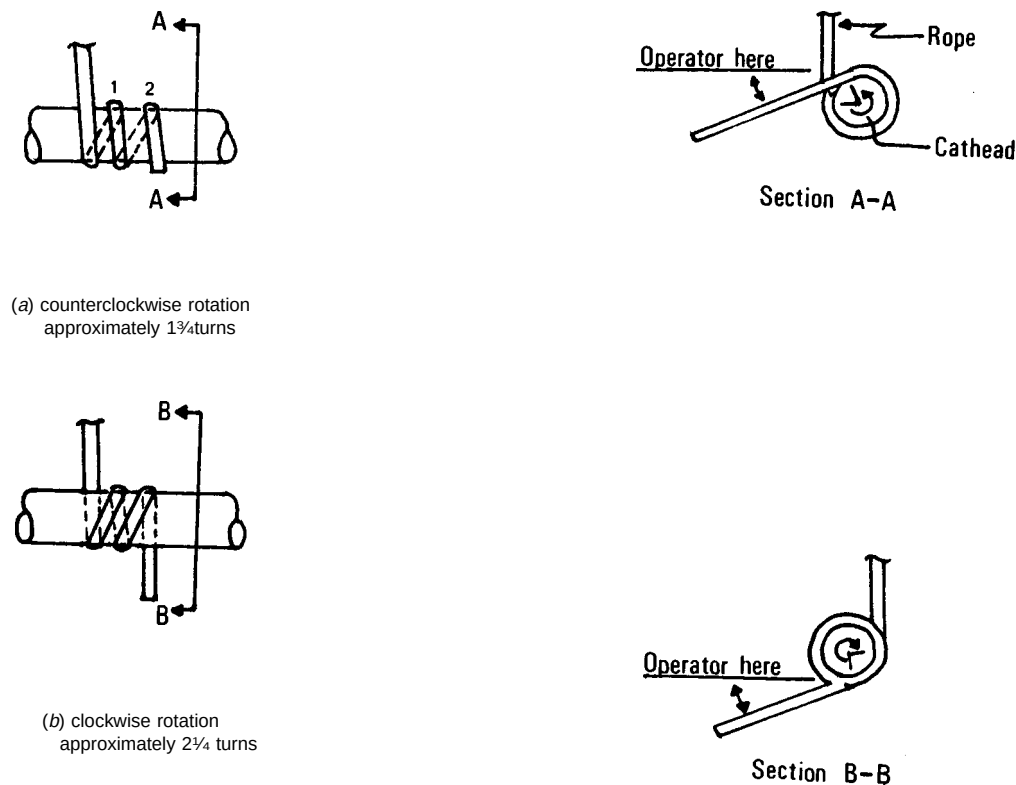


FIG. 1 Definitions of the Number of Rope Turns and the Angle for (a) Counterclockwise Rotation and (b) Clockwise Rotation of the Cathead

widely published correlations which relate SPT blowcount, or N -value, and the engineering behavior of earthworks and foundations are available.

5. Apparatus

5.1 *Drilling Equipment*—Any drilling equipment that provides at the time of sampling a suitably clean open hole before insertion of the sampler and ensures that the penetration test is performed on undisturbed soil shall be acceptable. The following pieces of equipment have proven to be suitable for advancing a borehole in some subsurface conditions.

5.1.1 *Drag, Chopping, and Fishtail Bits*, less than 6.5 in. (162 mm) and greater than 2.2 in. (56 mm) in diameter may be used in conjunction with open-hole rotary drilling or casing-advancement drilling methods. To avoid disturbance of the underlying soil, bottom discharge bits are not permitted; only side discharge bits are permitted.

5.1.2 *Roller-Cone Bits*, less than 6.5 in. (162 mm) and greater than 2.2 in. (56 mm) in diameter may be used in conjunction with open-hole rotary drilling or casing-advancement drilling methods if the drilling fluid discharge is deflected.

5.1.3 *Hollow-Stem Continuous Flight Augers*, with or without a center bit assembly, may be used to drill the boring. The inside diameter of the hollow-stem augers shall be less than 6.5 in. (162 mm) and greater than 2.2 in. (56 mm).

5.1.4 *Solid, Continuous Flight, Bucket and Hand Augers*, less than 6.5 in. (162 mm) and greater than 2.2 in. (56 mm) in

diameter may be used if the soil on the side of the boring does not cave onto the sampler or sampling rods during sampling.

5.2 *Sampling Rods*—Flush-joint steel drill rods shall be used to connect the split-barrel sampler to the drive-weight assembly. The sampling rod shall have a stiffness (moment of inertia) equal to or greater than that of parallel wall “A” rod (a steel rod which has an outside diameter of $1\frac{5}{8}$ in. (41.2 mm) and an inside diameter of $1\frac{1}{8}$ in. (28.5 mm)).

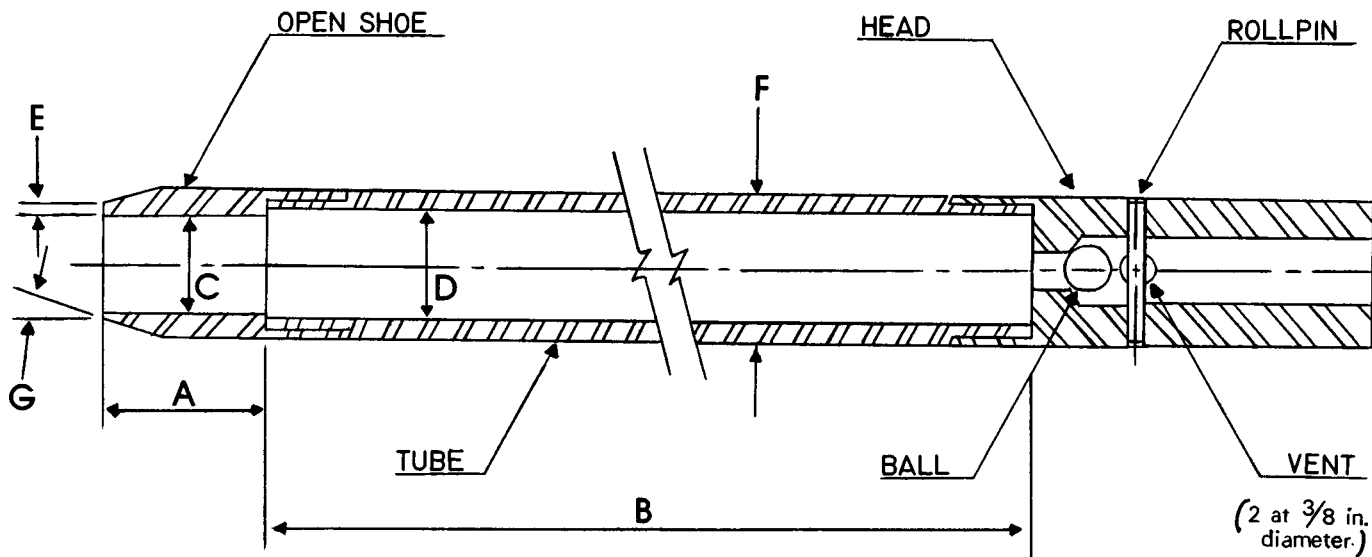
NOTE 2—Recent research and comparative testing indicates the type rod used, with stiffness ranging from “A” size rod to “N” size rod, will usually have a negligible effect on the N -values to depths of at least 100 ft (30 m).

5.3 *Split-Barrel Sampler*—The sampler shall be constructed with the dimensions indicated in Fig. 2. The driving shoe shall be of hardened steel and shall be replaced or repaired when it becomes dented or distorted. The use of liners to produce a constant inside diameter of $1\frac{3}{8}$ in. (35 mm) is permitted, but shall be noted on the penetration record if used. The use of a sample retainer basket is permitted, and should also be noted on the penetration record if used.

NOTE 3—Both theory and available test data suggest that N -values may increase between 10 to 30 % when liners are used.

5.4 Drive-Weight Assembly:

5.4.1 *Hammer and Anvil*—The hammer shall weigh 140 ± 2 lb (63.5 ± 1 kg) and shall be a solid rigid metallic mass. The hammer shall strike the anvil and make steel on steel contact when it is dropped. A hammer fall guide permitting a free fall



- A = 1.0 to 2.0 in. (25 to 50 mm)
 B = 18.0 to 30.0 in. (0.457 to 0.762 m)
 C = 1.375 ± 0.005 in. (34.93 ± 0.13 mm)
 D = $1.50 \pm 0.05 - 0.00$ in. ($38.1 \pm 1.3 - 0.0$ mm)
 E = 0.10 ± 0.02 in. (2.54 ± 0.25 mm)
 F = $2.00 \pm 0.05 - 0.00$ in. ($50.8 \pm 1.3 - 0.0$ mm)
 G = 16.0° to 23.0°

The $1\frac{1}{2}$ in. (38 mm) inside diameter split barrel may be used with a 16-gage wall thickness split liner. The penetrating end of the drive shoe may be slightly rounded. Metal or plastic retainers may be used to retain soil samples.

FIG. 2 Split-Barrel Sampler

shall be used. Hammers used with the cathead and rope method shall have an unimpeded overlift capacity of at least 4 in. (100 mm). For safety reasons, the use of a hammer assembly with an internal anvil is encouraged.

NOTE 4—It is suggested that the hammer fall guide be permanently marked to enable the operator or inspector to judge the hammer drop height.

5.4.2 *Hammer Drop System*—Rope-cathead, trip, semi-automatic, or automatic hammer drop systems may be used, providing the lifting apparatus will not cause penetration of the sampler while re-engaging and lifting the hammer.

5.5 *Accessory Equipment*—Accessories such as labels, sample containers, data sheets, and groundwater level measuring devices shall be provided in accordance with the requirements of the project and other ASTM standards.

6. Drilling Procedure

6.1 The boring shall be advanced incrementally to permit intermittent or continuous sampling. Test intervals and locations are normally stipulated by the project engineer or geologist. Typically, the intervals selected are 5 ft (1.5 m) or less in homogeneous strata with test and sampling locations at every change of strata.

6.2 Any drilling procedure that provides a suitably clean and stable hole before insertion of the sampler and assures that the penetration test is performed on essentially undisturbed soil shall be acceptable. Each of the following procedures have proven to be acceptable for some subsurface conditions. The subsurface conditions anticipated should be considered when selecting the drilling method to be used.

6.2.1 Open-hole rotary drilling method.

6.2.2 Continuous flight hollow-stem auger method.

6.2.3 Wash boring method.

6.2.4 Continuous flight solid auger method.

6.3 Several drilling methods produce unacceptable borings.

The process of jetting through an open tube sampler and then sampling when the desired depth is reached shall not be permitted. The continuous flight solid auger method shall not be used for advancing the boring below a water table or below the upper confining bed of a confined non-cohesive stratum that is under artesian pressure. Casing may not be advanced below the sampling elevation prior to sampling. Advancing a boring with bottom discharge bits is not permissible. It is not permissible to advance the boring for subsequent insertion of the sampler solely by means of previous sampling with the SPT sampler.

6.4 The drilling fluid level within the boring or hollow-stem augers shall be maintained at or above the in situ groundwater level at all times during drilling, removal of drill rods, and sampling.

7. Sampling and Testing Procedure

7.1 After the boring has been advanced to the desired sampling elevation and excessive cuttings have been removed, prepare for the test with the following sequence of operations.

7.1.1 Attach the split-barrel sampler to the sampling rods and lower into the borehole. Do not allow the sampler to drop onto the soil to be sampled.

7.1.2 Position the hammer above and attach the anvil to the top of the sampling rods. This may be done before the sampling

rods and sampler are lowered into the borehole.

7.1.3 Rest the dead weight of the sampler, rods, anvil, and drive weight on the bottom of the boring and apply a seating blow. If excessive cuttings are encountered at the bottom of the boring, remove the sampler and sampling rods from the boring and remove the cuttings.

7.1.4 Mark the drill rods in three successive 6-in. (0.15-m) increments so that the advance of the sampler under the impact of the hammer can be easily observed for each 6-in. (0.15-m) increment.

7.2 Drive the sampler with blows from the 140-lb (63.5-kg) hammer and count the number of blows applied in each 6-in. (0.15-m) increment until one of the following occurs:

7.2.1 A total of 50 blows have been applied during any one of the three 6-in. (0.15-m) increments described in 7.1.4.

7.2.2 A total of 100 blows have been applied.

7.2.3 There is no observed advance of the sampler during the application of 10 successive blows of the hammer.

7.2.4 The sampler is advanced the complete 18 in. (0.45 m) without the limiting blow counts occurring as described in 7.2.1, 7.2.2, or 7.2.3.

7.3 Record the number of blows required to effect each 6 in. (0.15 m) of penetration or fraction thereof. The first 6 in. is considered to be a seating drive. The sum of the number of blows required for the second and third 6 in. of penetration is termed the "standard penetration resistance," or the "*N*-value." If the sampler is driven less than 18 in. (0.45 m), as permitted in 7.2.1, 7.2.2, or 7.2.3, the number of blows per each complete 6-in. (0.15-m) increment and per each partial increment shall be recorded on the boring log. For partial increments, the depth of penetration shall be reported to the nearest 1 in. (25 mm), in addition to the number of blows. If the sampler advances below the bottom of the boring under the static weight of the drill rods or the weight of the drill rods plus the static weight of the hammer, this information should be noted on the boring log.

7.4 The raising and dropping of the 140-lb (63.5-kg) hammer shall be accomplished using either of the following two methods:

7.4.1 By using a trip, automatic, or semi-automatic hammer drop system which lifts the 140-lb (63.5-kg) hammer and allows it to drop 30 ± 1.0 in. ($0.76 \text{ m} \pm 25 \text{ mm}$) unimpeded.

7.4.2 By using a cathead to pull a rope attached to the hammer. When the cathead and rope method is used the system and operation shall conform to the following:

7.4.2.1 The cathead shall be essentially free of rust, oil, or grease and have a diameter in the range of 6 to 10 in. (150 to 250 mm).

7.4.2.2 The cathead should be operated at a minimum speed of rotation of 100 RPM, or the approximate speed of rotation shall be reported on the boring log.

7.4.2.3 No more than $2\frac{1}{4}$ rope turns on the cathead may be used during the performance of the penetration test, as shown in Fig. 1.

NOTE 5—The operator should generally use either $1\frac{3}{4}$ or $2\frac{1}{4}$ rope turns, depending upon whether or not the rope comes off the top ($1\frac{3}{4}$ turns) or the bottom ($2\frac{1}{4}$ turns) of the cathead. It is generally known and accepted that $2\frac{3}{4}$ or more rope turns considerably impedes the fall of the hammer and should not be used to perform the test. The cathead rope should be maintained in a relatively dry, clean, and unfrayed condition.

7.4.2.4 For each hammer blow, a 30-in. (0.76-m) lift and drop shall be employed by the operator. The operation of pulling and throwing the rope shall be performed rhythmically without holding the rope at the top of the stroke.

7.5 Bring the sampler to the surface and open. Record the percent recovery or the length of sample recovered. Describe the soil samples recovered as to composition, color, stratification, and condition, then place one or more representative portions of the sample into sealable moisture-proof containers (jars) without ramming or distorting any apparent stratification. Seal each container to prevent evaporation of soil moisture. Affix labels to the containers bearing job designation, boring number, sample depth, and the blow count per 6-in. (0.15-m) increment. Protect the samples against extreme temperature changes. If there is a soil change within the sampler, make a jar for each stratum and note its location in the sampler barrel.

8. Report

8.1 Drilling information shall be recorded in the field and shall include the following:

8.1.1 Name and location of job,

8.1.2 Names of crew,

8.1.3 Type and make of drilling machine,

8.1.4 Weather conditions,

8.1.5 Date and time of start and finish of boring,

8.1.6 Boring number and location (station and coordinates, if available and applicable),

8.1.7 Surface elevation, if available,

8.1.8 Method of advancing and cleaning the boring,

8.1.9 Method of keeping boring open,

8.1.10 Depth of water surface and drilling depth at the time of a noted loss of drilling fluid, and time and date when reading or notation was made,

8.1.11 Location of strata changes,

8.1.12 Size of casing, depth of cased portion of boring,

8.1.13 Equipment and method of driving sampler,

8.1.14 Type sampler and length and inside diameter of barrel (note use of liners),

8.1.15 Size, type, and section length of the sampling rods, and

8.1.16 Remarks.

8.2 Data obtained for each sample shall be recorded in the field and shall include the following:

8.2.1 Sample depth and, if utilized, the sample number,

8.2.2 Description of soil,

8.2.3 Strata changes within sample,

8.2.4 Sampler penetration and recovery lengths, and

8.2.5 Number of blows per 6-in. (0.15-m) or partial increment.

9. Precision and Bias

9.1 *Precision*—A valid estimate of test precision has not been determined because it is too costly to conduct the necessary inter-laboratory (field) tests. Subcommittee D18.02 welcomes proposals to allow development of a valid precision statement.

9.2 *Bias*—Because there is no reference material for this test method, there can be no bias statement.

9.3 Variations in *N*-values of 100 % or more have been

observed when using different standard penetration test apparatus and drillers for adjacent borings in the same soil formation. Current opinion, based on field experience, indicates that when using the same apparatus and driller, *N*-values in the same soil can be reproduced with a coefficient of variation of about 10 %.

9.4 The use of faulty equipment, such as an extremely massive or damaged anvil, a rusty cathead, a low speed cathead, an old, oily rope, or massive or poorly lubricated rope sheaves can significantly contribute to differences in *N*-values obtained between operator-drill rig systems.

9.5 The variability in *N*-values produced by different drill rigs and operators may be reduced by measuring that part of the hammer energy delivered into the drill rods from the sampler and adjusting *N* on the basis of comparative energies. A method for energy measurement and *N*-value adjustment is given in Test Method D 4633.

10. Keywords

10.1 blow count; in-situ test; penetration resistance; split-barrel sampling; standard penetration test

SUMMARY OF CHANGES

(1) Added note to Section 1, Scope. The note refers to a related standard, Practice D 6066.

(2) Added Practice D 6066 to Section 2 on Referenced Documents.

The American Society for Testing and Materials takes no position respecting the validity of any patent rights asserted in connection with any item mentioned in this standard. Users of this standard are expressly advised that determination of the validity of any such patent rights, and the risk of infringement of such rights, are entirely their own responsibility.

This standard is subject to revision at any time by the responsible technical committee and must be reviewed every five years and if not revised, either reapproved or withdrawn. Your comments are invited either for revision of this standard or for additional standards and should be addressed to ASTM Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee, which you may attend. If you feel that your comments have not received a fair hearing you should make your views known to the ASTM Committee on Standards, 100 Barr Harbor Drive, West Conshohocken, PA 19428.



Standard Practice for Thin-Walled Tube Sampling of Soils for Geotechnical Purposes¹

This standard is issued under the fixed designation D 1587; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

This standard has been approved for use by agencies of the Department of Defense.

1. Scope *

1.1 This practice covers a procedure for using a thin-walled metal tube to recover relatively undisturbed soil samples suitable for laboratory tests of engineering properties, such as strength, compressibility, permeability, and density. Thin-walled tubes used in piston, plug, or rotary-type samplers should comply with Section 6.3 of this practice which describes the thin-walled tubes.

NOTE 1—This practice does not apply to liners used within the samplers.

1.2 This Practice is limited to soils that can be penetrated by the thin-walled tube. This sampling method is not recommended for sampling soils containing gravel or larger size soil particles cemented or very hard soils. Other soil samplers may be used for sampling these soil types. Such samplers include driven split barrel samplers and soil coring devices (D 1586, D 3550, and D 6151). For information on appropriate use of other soil samplers refer to D 6169.

1.3 This practice is often used in conjunction with fluid rotary drilling (D 1452/D 5783) or hollow-stem augers (D 6151). Subsurface geotechnical explorations should be reported in accordance with practice (D 5434). This practice discusses some aspects of sample preservation after the sampling event. For information on preservation and transportation process of soil samples, consult Practice D 4220. This practice does not address environmental sampling; consult D 6169 and D 6232 for information on sampling for environmental investigations.

1.4 The values stated in inch-pound units are to be regarded as the standard. The SI values given in parentheses are provided for information purposes only. The tubing tolerances presented in Table 2 are from sources available in North America. Use of metric equivalent is acceptable as long as thickness and proportions are similar to those required in this standard.

1.5 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the*

responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

1.6 This practice offers a set of instructions for performing one or more specific operations. This document cannot replace education or experience and should be used in conjunction with professional judgment. Not all aspects of this practice may be applicable in all circumstances. This ASTM standard is not intended to represent or replace the standard of care by which the adequacy of a given professional service must be judged, nor should this document be applied without consideration of a project's many unique aspects. The word "Standard" in the title of this document means only that the document has been approved through the ASTM consensus process.

2. Referenced Documents

2.1 ASTM Standards:

- D 653 Standard Terminology Relating to Soil, Rock, and Contained Fluids²
- D 1452 Practice for Soil Investigation and Sampling by Auger Borings²
- D 1586 Penetration Resistance and Split Barrel Sampling of Soils²
- D 2488 Practice for Description and Identification of Soils (Visual-Manual Procedure)²
- D 3550 Practice for Ring-Lined Barrel Sampling of Soils²
- D 3740 Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction²
- D 4220 Practices for Preserving and Transporting Soil Samples²
- D 5434 Guide for Field Logging of Subsurface Explorations of Soil and Rock³
- D 5783 Guide for Use of Rotary Drilling with Water-Based Drilling Fluid for Geoenvironmental Exploration and the Installation of Subsurface Water-Quality Monitoring Devices³
- D 6151 Practice for Using Hollow-Stem Augers for Geotechnical Exploration and Soil Sampling³
- D 6169 Guide for Selection of Soil and Rock Sampling

¹ This practice is under the jurisdiction of ASTM Committee D18 on Soil and Rock and is the direct responsibility of Subcommittee D18.02 on Sampling and Related Field Testing for Soil Investigations.

Current edition approved August 10, 2000. Published December 2000. Originally published as D 1587–58T. Last previous edition D 1587–83.

² Annual Book of ASTM Standards, Vol 04.08.

³ Annual Book of ASTM Standards, Vol 04.09.

***A Summary of Changes section appears at the end of this standard.**

TABLE 1 Suitable Thin-Walled Steel Sample Tubes^A

Outside diameter (D_o):			
in.	2	3	5
mm	50.8	76.2	127
Wall thickness:			
Bwg	18	16	11
in.	0.049	0.065	0.120
mm	1.24	1.65	3.05
Tube length:			
in.	36	36	54
m	0.91	0.91	1.45
Inside clearance ratio, %	<1	<1	<1

^A The three diameters recommended in Table 1 are indicated for purposes of standardization, and are not intended to indicate that sampling tubes of intermediate or larger diameters are not acceptable. Lengths of tubes shown are illustrative. Proper lengths to be determined as suited to field conditions.

TABLE 2 Dimensional Tolerances for Thin-Walled Tubes

Nominal Tube Diameters from Table 1 ^A Tolerances						
Size Outside Diameter	2 in.	50.8 mm	3 in.	76.2 mm	5 in.	127 mm
Outside diameter, D_o	+0.007 -0.000	+0.179 -0.000	+0.010 -0.000	+0.254 -0.000	+0.015 -0.000	0.381 -0.000
Inside diameter, D_i	+0.000 -0.007	+0.000 -0.179	+0.000 -0.010	+0.000 -0.254	+0.000 -0.015	+0.000 -0.381
Wall thickness	± 0.007	± 0.179	± 0.010	± 0.254	± 0.015	± 0.381
Ovality	0.015	0.381	0.020	0.508	0.030	0.762
Straightness	0.030/ft	2.50/m	0.030/ft	2.50/m	0.030/ft	2.50/m

^A Intermediate or larger diameters should be proportional. Specify only two of the first three tolerances; that is, D_o and D_i , or D_o and Wall thickness, or D_i and Wall thickness.

Devices Used With Drill Rigs for Environmental Investigations³

D 6232 Guide for Selection of Sampling Equipment for Waste and Contaminated Media Data Collection Activities⁴

3. Terminology

3.1 Definitions:

3.1.1 For common definitions of terms in this standard, refer to Terminology D 653.

3.2 Definitions of Terms Specific to This Standard:

3.2.1 *inside clearance ratio, %*—the ratio of the difference in the inside diameter of the tube, D_i , minus the inside diameter of the cutting edge, D_e , to the inside diameter of the tube, D_i expressed as a percentage (see Fig. 1).

3.2.2 *ovality*—the cross section of the tube that deviates from a perfect circle.

4. Summary of Practice

4.1 A relatively undisturbed sample is obtained by pressing a thin-walled metal tube into the in-situ soil at the bottom of a boring, removing the soil-filled tube, and applying seals to the soil surfaces to prevent soil movement and moisture gain or loss.

5. Significance and Use

5.1 This practice, or Practice D 3550 with thin wall shoe, is used when it is necessary to obtain a relatively undisturbed

specimen suitable for laboratory tests of engineering properties or other tests that might be influenced by soil disturbance.

NOTE 2—The quality of the result produced by this standard is dependent on the competence of the personnel performing it, and the suitability of the equipment and facilities used. Agencies that meet the criteria of Practice D 3740 are generally considered capable of competent and objective sampling. Users of this practice, are cautioned that compliance with Practice D 3740 does not in itself assure reliable results. Reliable results depend on many factors; Practice D 5740 provides a means of evaluating some of those factors.

6. Apparatus

6.1 *Drilling Equipment*—When sampling in a boring, any drilling equipment may be used that provides a reasonably clean hole; that minimizes disturbance of the soil to be sampled; and that does not hinder the penetration of the thin-walled sampler. Open borehole diameter and the inside diameter of driven casing or hollow stem auger shall not exceed 3.5 times the outside diameter of the thin-walled tube.

6.2 *Sampler Insertion Equipment*, shall be adequate to provide a relatively rapid continuous penetration force. For hard formations it may be necessary, although not recommended, to drive the thin-walled tube sampler.

6.3 *Thin-Walled Tubes*, should be manufactured to the dimensions as shown in Fig. 1. They should have an outside diameter of 2 to 5 in. (50 to 130 mm) and be made of metal having adequate strength for the type of soil to be sampled. Tubes shall be clean and free of all surface irregularities including projecting weld seams. Other diameters may be used but the tube dimensions should be proportional to the tube designs presented here.

6.3.1 *Length of Tubes*—See Table 1 and 7.4.1.

6.3.2 *Tolerances*, shall be within the limits shown in Table 2.

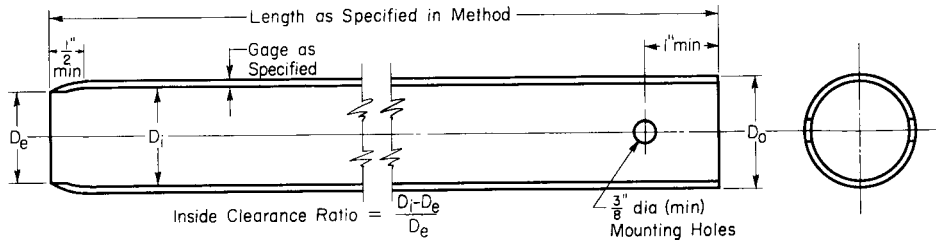
6.3.3 *Inside Clearance Ratio*, should be not greater than 1 % unless specified otherwise for the type of soil to be sampled. Generally, the inside clearance ratio used should increase with the increase in plasticity of the soil being sampled, except for sensitive soils or where local experience indicates otherwise. See 3.2.1 and Fig. 1 for definition of inside clearance ratio.

6.3.4 *Corrosion Protection*—Corrosion, whether from galvanic or chemical reaction, can damage or destroy both the thin-walled tube and the sample. Severity of damage is a function of time as well as interaction between the sample and the tube. Thin-walled tubes should have some form of protective coating, unless the soil is to be extruded less than 3 days. The type of coating to be used may vary depending upon the material to be sampled. Plating of the tubes or alternate base metals may be specified. Galvanized tubes are often used when long term storage is required. Coatings may include a light coat of lubricating oil, lacquer, epoxy, Teflon, zinc oxide, and others.

NOTE 3—Most coating materials are not resistant to scratching by soils that contain sands. Consideration should be given for prompt testing of the sample because chemical reactions between the metal and the soil sample can occur with time.

6.4 *Sampler Head*, serves to couple the thin-walled tube to the insertion equipment and, together with the thin-walled tube,

⁴ Annual Book of ASTM Standards, Vol 11.04.



NOTE 1—Minimum of two mounting holes on opposite sides for D_o smaller than 4 in. (101.6 mm).

NOTE 2—Minimum of four mounting holes equally spaced for D_o 4 in. (101.6 mm) and larger.

NOTE 3—Tube held with hardened screws or other suitable means.

NOTE 4—2-in (50.8 mm) outside-diameter tubes are specified with an 18-gage wall thickness to comply with area ratio criteria accepted for “undisturbed samples.” Users are advised that such tubing is difficult to locate and can be extremely expensive in small quantities. Sixteen-gage tubes are generally readily available.

Metric Equivalent Conversions

in.	mm
3/8	9.53
1/2	12.7
1	25.4
2	50.8
3	76.2
4	101.6
5	127

FIG. 1 Thin-Walled Tube for Sampling

comprises the thin-walled tube sampler. The sampler head shall contain a venting area and suitable check valve with the venting area to the outside equal to or greater than the area through the check valve. In some special cases, a check valve may not be required but venting is required to avoid sample compression. Attachment of the head to the tube shall be concentric and coaxial to assure uniform application of force to the tube by the sampler insertion equipment.

7. Procedure

7.1 Remove loose material from the center of a casing or hollow stem auger as carefully as possible to avoid disturbance of the material to be sampled. If groundwater is encountered, maintain the liquid level in the borehole at or above ground water level during the drilling and sampling operation.

7.2 Bottom discharge bits are not permitted. Side discharge bits may be used, with caution. Jetting through an open-tube sampler to clean out the borehole to sampling elevation is not permitted.

NOTE 4—Roller bits are available in downward-jetting and diffused-jet configurations. Downward-jetting configuration rock bits are not acceptable. Diffuse-jet configurations are generally acceptable.

7.3 Lower the sampling apparatus so that the sample tube’s bottom rests on the bottom of the hole and record depth to the bottom of the sample tube to the nearest 0.1-ft (.03 m)

7.3.1 Keep the sampling apparatus plumb during lowering, thereby preventing the cutting edge of the tube from scraping the wall of the borehole.

7.4 Advance the sampler without rotation by a continuous relatively rapid downward motion and record length of advancement to the nearest 1 in. (25 mm).

7.4.1 Determine the length of advance by the resistance and condition of the soil formation, but the length shall never

exceed 5 to 10 diameters of the tube in sands and 10 to 15 diameters of the tube in clays. In no case shall a length of advance be greater than the sample-tube length minus an allowance for the sampler head and a minimum of 3-in. (75 mm) for sludge and end cuttings.

NOTE 5—The mass of sample, laboratory handling capabilities, transportation problems, and commercial availability of tubes will generally limit maximum practical lengths to those shown in Table 1.

7.5 When the soil formation is too hard for push-type insertion, the tube may be driven or Practice D 3550 may be used. If driving methods are used, the data regarding weight and fall of the hammer and penetration achieved must be shown in the report. Additionally, that tube must be prominently labeled a “driven sample.”

7.6 Withdraw the sampler from the soil formation as carefully as possible in order to minimize disturbance of the sample. The tube can be slowly rotated to shear the material at the end of the tube, and to relieve water and/or suction pressures and improve recovery. Where the soil formation is soft, a delay before withdraw of the sampler (typically 5 to 30 minutes) may improve sample recovery.

8. Sample Measurement, Sealing and Labeling

8.1 Upon removal of the tube, remove the drill cuttings in the upper end of the tube and measure the length of the soil sample recovered to the nearest 0.25 in. (5 mm) in the tube. Seal the upper end of the tube. Remove at least 1 in. (25 mm) of material from the lower end of the tube. Use this material for soil description in accordance with Practice D 2488. Measure the overall sample length. Seal the lower end of the tube. Alternatively, after measurement, the tube may be sealed without removal of soil from the ends of the tube.

8.1.1 Tubes sealed over the ends, as opposed to those sealed

with expanding packers, should be provided with spacers or appropriate packing materials, or both prior to sealing the tube ends to provide proper confinement. Packing materials must be nonabsorbent and must maintain their properties to provide the same degree of sample support with time.

8.1.2 Depending on the requirements of the investigation, field extrusion and packaging of extruded soil samples can be performed. This allows for physical examination and classification of the sample. Samples are extruded in special hydraulic jacks equipped with properly sized platens to extrude the core in a continuous smooth speed. In some cases, further extrusion may cause sample disturbance reducing suitability for testing of engineering properties. In other cases, if damage is not significant, cores can be extruded and preserved for testing (D 4220). Bent or damaged tubes should be cut off before extruding.

8.2 Prepare and immediately affix labels or apply markings as necessary to identify the sample (see Section 9). Assure that the markings or labels are adequate to survive transportation and storage.

NOTE 6—Top end of the tube should be labeled “top”.

9. Field Log

9.1 Record the information that may be required for preparing field logs in general accordance to ASTM D 5434 “Guide for Field Logging of Subsurface Explorations of Soil and Rock”. This guide is used for logging explorations by drilling and sampling. Some examples of the information required include;

- 9.1.1 Name and location of the project,
- 9.1.2 Boring number,
- 9.1.3 Log of the soil conditions,
- 9.1.4 Surface elevation or reference to a datum to the nearest foot (0.5 m) or better,
- 9.1.5 Location of the boring,
- 9.1.6 Method of making the borehole,
- 9.1.7 Name of the drilling foreman and company, and
- 9.1.8 Name of the drilling inspector(s).
- 9.1.9 Date and time of boring-start and finish,
- 9.1.10 Depth to groundwater level: date and time measured,
- 9.2 Recording the appropriate sampling information is required as follows:
 - 9.2.1 Depth to top of sample to the nearest 0.1 ft. (.03 m) and number of sample,
 - 9.2.2 Description of thin-walled tube sampler: size, type of metal, type of coating,
 - 9.2.3 Method of sampler insertion: push or drive,
 - 9.2.4 Method of drilling, size of hole, casing, and drilling fluid used,
 - 9.2.5 Soil description in accordance with Practice D 2488,
 - 9.2.6 Length of sampler advance (push), and
 - 9.2.7 Recovery: length of sample obtained.

10. Keywords

10.1 geologic investigations; sampling; soil exploration; soil investigations; subsurface investigations; undisturbed

SUMMARY OF CHANGES

In accordance with committee D18 policy, this section identifies the location of changes to this standard since the last edition, 1994, which may impact the use of this standard.

(1) Editorial corrections to various sections based on comments received from Committee Balloting

- (2) Added D 6232 to Section 2.
- (3) Changed Note 7 to Section 8.1.2.
- (4) Renumbered Note 8.

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APPENDIX E

ADDITIONAL DOCUMENTS

Pages from the Request for Proposals

Soil and Site Evaluation – Stormwater Infiltration Form



1. INTRODUCTION AND HISTORY

Marathon County Facilities and Capital Management is requesting proposals from qualified firms for Geotech services for the construction of a new highway department shop, located at 2312 Old Highway 51, Kronenwetter, WI 54455. The proposed project will include multiple buildings of varying construction types, a fuel island, multiple exterior storage bunkers, loading dock, and truck scale. Most of the exterior vehicle parking will be located near the offices of the main building with the remainder of the interior vehicle and equipment parking located at the tempered storage building and throughout the site.

Building 1 (Main Building ~ 140,000 S.F.) consists of a one-story office (16,000 S.F.) w/mezzanine, one-story repair garage w/mezzanine, and one-story parking garage. The office portion will be steel structure conventionally framed with slab will be on grade with frost wall (no basement). Mezzanine will be built with precast plank with concrete topping, supported with load-bearing CMU below. Roof will be flat profile with steel beam and structure. Exterior walls are composed of bypassing light gauge steel studs with stone veneer and large office windows.

The one-story repair garage (50,000 S.F.) will be built with load-bearing precast walls with spread footing foundation (no basement). Mezzanine will be built with precast plank with concrete topping, supported with load-bearing CMU. Roof will be a flat profile with steel beam structure and small portion with precast plank roof. The parking garage (74,000 S.F.) will be built with load-bearing precast walls with spread footing foundation. Roof will be a flat profile with steel beam structure.

Building 2 (Tempered Storage - 67,500 S.F.) consists of a one-story pre-engineered storage building with 35' overhangs on both eave edges.; roof will be gabled with metal panel roof. Floor slab will be on grade with frost wall (no basement). It is intended to house heavy machinery and other heavy-duty equipment and has been laid out to allow for future additions. One half of the building will be heated and the other half is ambient temperature. Out buildings on the site will consist of an above ground fuel island station, salt storage building with multiple exterior storage bunkers and 8~10 brine tanks, vehicle scale, pad generator and electrical transformer, and multiple infiltration ponds.

Marathon County Highway Department is actively grubbing the site of vegetation and razing existing residential structures. Coordinate soil boring locations and access directly with Marathon County

2. SCOPE OF WORK

Structural Requirements

Borings for Design of Building Structure (B-X)

The proposed Main Building area encompasses the borings at locations B-04 through B-18 with future addition areas at boring locations B-07 and B-11. Recessed loading docks with retaining walls are located near boring B-08. The proposed Salt Storage Building area encompasses the borings at locations B-01 through B-03. The proposed Equipment Storage Building area encompasses the borings at locations B-21 through B-29 with future addition areas at boring locations B-21, B-24, and B-27. The proposed Truck Scale is located at boring B-20 and the proposed fuel island/canopy is located at boring B-19.

Foundation Loads

Testing and report should be based on these estimated maximum building loads:

- Interior building column: 350 kips
- Perimeter building column: 175 kips
- Structural exterior wall: 15 kip/ft
- Structural interior wall: 15 kip/ft
- Slab on grade
 - Area load: 1,200 psf
 - Forklift axle load: 20 kips
 - AASHTO HS-20 loads 32 kip/axle

Report Requirements

The report should include the following in addition to general site and foundation recommendations:

- Soil classification
 - Description and general historical geological information
 - Identification per the Unified Soil Classification System
- Soil design values for structural design
 - Net allowable soil bearing capacity
 - Subgrade modulus for foundations/slabs
 - Coefficient of friction or cohesion to resist sliding
 - Equivalent lateral soil pressures for below grade walls (active, at-rest and passive)
- Other
 - Provide estimates on expected total and differential foundation settlements
 - Seismic site classification A through F (itemize cost if field test is required)

Civil Requirements

Borings (C-X)

Borings SW-1 through SW-7 are for possible ditch and infiltration pond areas and are for determining soil infiltration feasibility. Information and testing for these borings shall be done in accordance with DNR Guidelines, Chapter 1002.

The proposed borings P-1 through P-8 are for possible paved areas.

Report Requirements

The report should include the following in addition to general site and foundation recommendations:

- Pavement recommendation
- Ground water elevation and flood plain elevation
- Recommendations for below grade drainage systems
- Recommendations for dewatering during and post construction

Boring depths

Borings shall extend the following minimum depth below proposed finish floor or existing grade, whichever is deeper:

- Structural Borings
 - Building Structure (B-X) 20'-0"
 - Civil Borings
 - Pavement (P-X) 10'-0"
-

- Storm Water (SW-X) 10'-0"
- Infiltration (I-X) N/A

If inconsistent soil profiles are discovered by your drilling crew, please call Excel Engineering, Inc. while the crew is still on site to discuss and obtain authorization to do additional borings or depth.



Soil and Site Evaluation – Stormwater Infiltration

In accordance with SPS 382.365, 385, Wis. Adm. Code, and WDNR Standard 1002

Personal information you provide may be used for secondary purposes [Privacy Law, s. 15.04(1)(m)]

Page 1 of 4

Attach a complete site plan on paper not less than 8 ½ x 11 inches in size. Plan must include, but is not limited to: vertical and horizontal reference point (BM); direction and percent of slope; scale or dimensions; north arrow; and BM referenced to nearest road. PLEASE PRINT ALL INFORMATION		COUNTY MARATHON
		PARCEL ID 145-2707-022-0968
PROPERTY OWNER MARATHON COUNTY	PROPERTY LOCATION Govt. Lot <u> </u> , <u>SW</u> ¼, <u>NW</u> ¼, S <u>2</u> , T <u>27</u> N, R <u>7</u> E Lot #, Block #, Subd. Name or CSM #: <u> </u>	
PROPERTY OWNER'S MAILING ADDRESS 500 FOREST ST	Municipality: <u>KRONENWETTER</u> ☐ City ☐ Village ☐ Town	
CITY, STATE, ZIP CODE WAUSAU, WI 54403	Nearest Road: OLD HWY 51	
Drainage area <u> </u> ☐ sq. ft. ☐ acres Test site suitable for (check all that apply): ☐ Site not suitable ☐ Bioretention ☐ Reuse ☐ Subsurface Dispersal System ☐ Irrigation ☐ Other <u> </u>	HYDRAULIC APPLICATION TEST METHOD ☐ Morphological Evaluation ☐ Double Ring Infiltrometer ☐ Other: (specify) <u> </u>	SOIL MOISTURE Date of soil borings: <u>3/9/26 - 3/12/26</u> USDA-NRCS WETS VALUE: ☐ Dry = 1 ☐ Normal = 2 ☐ Wet = 3

SW-1 #OBS. ☐ Pit ☐ Boring Ground Surface Elevation 1175.7 ft. Elevation of Limiting Factor NA ft.

Horizon	Depth in.	Dominant Color Munsell	Redox Description Qu. Sz. Cont. Color	Texture	Structure Gr. Sz. Sh.	Consistence	Boundary	% Rock Frags.	% Fines	Hydraulic App. Rate Inches/Hr.
A	0-14			TOPSOIL						
B	14-36	7.5YR 3/4		S	0, F-VC, GR	M, L	G, W	5-10	5-10	3.60
C1	36-108	7.5YR 6/4		S	0, F-C	M, L	G, W	0-5	0-5	3.60
C2	108-120	7.5YR 6/4		S	0, F-VC, GR	M, L	G, W	15-25	0-5	3.60

Comments:

SW-2 #OBS. ☐ Pit ☒ Boring Ground Surface Elevation 1176.1 ft. Elevation of Limiting Factor NA ft.

Horizon	Depth in.	Dominant Color Munsell	Redox Description Qu. Sz. Cont. Color	Texture	Structure Gr. Sz. Sh.	Consistence	Boundary	% Rock Frags.	% Fines	Hydraulic App. Rate Inches/Hr.
A	0-7			TOPSOIL						
B	7-18	7.5YR 5/4		S	0, F-VC, GR	M, L	G, W	5-10	5-10	3.60
C1	18-36	7.5YR 6/4		S	0, F-C, GR	M, L	G, W	0-5	0-5	3.60
C2	36-120	7.5YR 6/4		S	0, F-VC, GR	M, L	G, W	15-25	0-5	3.60

Comments:

SW-3 #OBS. ☐ Pit ☒ Boring Ground Surface Elevation 1175.2 ft. Elevation of Limiting Factor NA ft.

Horizon	Depth in.	Dominant Color Munsell	Redox Description Qu. Sz. Cont. Color	Texture	Structure Gr. Sz. Sh.	Consistence	Boundary	% Rock Frags.	% Fines	Hydraulic App. Rate Inches/Hr.
A	0-16			TOPSOIL						
B	16-36	7.5YR 5/8		S	0, F-VC, GR	M, L	G, W	15-25	0-5	3.60
C1	36-72	10YR 5/6		S	0, F-VC, GR	M, L	G, W	5-10	0-5	3.60
C2	72-108	7.5YR 5/6		S	0, F-C, GR	M, L	G, W	0-5	0-5	3.60
C3	108-120	10YR 5/6		S	0, F-VC, GR	M, L	G, W	5-10	0-5	3.60

Comments:

SW-4 #OBS. ☐ Pit ☒ Boring Ground Surface Elevation 1173.9 ft. Elevation of Limiting Factor NA ft.

Horizon	Depth in.	Dominant Color Munsell	Redox Description Qu. Sz. Cont. Color	Texture	Structure Gr. Sz. Sh.	Consistence	Boundary	% Rock Frags.	% Fines	Hydraulic App. Rate Inches/Hr.
A	0-13			TOPSOIL						
B	13-36	7.5YR 5/4		S	0, F-C, GR	M, L	G, W	0-5	0-5	3.60
C1	36-72	7.5YR 5/4		S	0, F-M, GR	M, L	G, W	0-5	0-5	3.60
C2	72-120	7.5YR 5/4		S	0, F-VC, GR	M, L	G, W	5-10	0-5	3.60

Comments:

SW-5 #OBS. ☐ Pit ☒ Boring Ground Surface Elevation 1172.4 ft. Elevation of Limiting Factor NA ft.

Horizon	Depth in.	Dominant Color Munsell	Redox Description Qu. Sz. Cont. Color	Texture	Structure Gr. Sz. Sh.	Consistence	Boundary	% Rock Frags.	% Fines	Hydraulic App. Rate Inches/Hr.
A	0-10			TOPSOIL						
B	10-36	7.5YR 5/8		S	0, F-M, GR	M, L	G, W	0-5	5-10	3.60
C1	36-84	10YR 6/4		S	0, F-C, GR	M, L	G, W	0-5	0-5	3.60
C2	84-120	10YR 6/4		S	0, F-VC, GR	M, L	G, W	5-10	0-5	3.60

Comments:

SW-6 #OBS. ☐ Pit ☒ Boring Ground Surface Elevation 1172.4 ft. Elevation of Limiting Factor NA ft.

Horizon	Depth in.	Dominant Color Munsell	Redox Description Qu. Sz. Cont. Color	Texture	Structure Gr. Sz. Sh.	Consistence	Boundary	% Rock Frags.	% Fines	Hydraulic App. Rate Inches/Hr.
FILL	0-18	7.5YR 3/4		S	0, F-C, GR	M, L	G, W	0-5	5-10	3.60
B	18-36	10YR 6/6		S	0, F-C, GR	M, L	G, W	0-5	0-5	3.60
C	36-120	10YR 6/4		S	0, F-C, GR	M, L	G, W	0-5	0-5	3.60

Comments:

SW-7 #OBS. ☐ Pit ☒ Boring Ground Surface Elevation 1172.7 ft. Elevation of Limiting Factor NA ft.

Horizon	Depth in.	Dominant Color Munsell	Redox Description Qu. Sz. Cont. Color	Texture	Structure Gr. Sz. Sh.	Consistence	Boundary	% Rock Frags.	% Fines	Hydraulic App. Rate Inches/Hr.
FILL1	0-18	7.5YR 4/3		S	0, F-M, GR	M, L	G, W	0-5	0-5	3.60
FILL2	18-84	7.5YR 4/3		S	0, F-C, GR	M, L	G, W	5-10	5-10	3.60
C	84-120	10YR 4/4		S	0, F-VC, GR	M, L	G, W	5-10	0-5	3.60

Comments:

#OBS. ☐ Pit ☐ Boring Ground Surface Elevation _____ ft. Elevation of Limiting Factor _____ ft.

Horizon	Depth in.	Dominant Color Munsell	Redox Description Qu. Sz. Cont. Color	Texture	Structure Gr. Sz. Sh.	Consistence	Boundary	% Rock Frags.	% Fines	Hydraulic App. Rate Inches/Hr.

Comments:

#OBS. ☐ Pit ☐ Boring Ground Surface Elevation _____ ft. Elevation of Limiting Factor _____ ft.

Horizon	Depth in.	Dominant Color Munsell	Redox Description Qu. Sz. Cont. Color	Texture	Structure Gr. Sz. Sh.	Consistence	Boundary	% Rock Frags.	% Fines	Hydraulic App. Rate Inches/Hr.

Comments:

Overall Site Comments:

MICHAEL FREDE, P.E.	<i>Michael Frede</i>	25897-6
_____ Name (Please Print)	_____ Signature	_____ Credential Number
4941 KIRSCHLING CT., STEVENS POINT, WI	3/926 - 3/12/26	715-344-9999
_____ Address	_____ Date Evaluation Conducted	_____ Phone Number

Appendix F: Storm Sewer Basin Map



STORM SEWER BASIN MAP



SCALE: 1"= 150' (AT 11"X17" SHEET SIZE)



Appendix G: Storm Sewer TR-55 Calculations

10 - Year

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Hydrograph Reports..... 2

Hydrograph No. 1, SCS Runoff, Storm Basin A..... 2

Hydrograph No. 2, SCS Runoff, Storm Basin B..... 3

Hydrograph No. 3, SCS Runoff, Storm Basin C..... 4

Hydrograph No. 4, SCS Runoff, Storm Basin D..... 5

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Hydrograph No. 7, SCS Runoff, Storm Basin G..... 16

Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	5.338	2	716	12,574	-----	-----	-----	Storm Basin A
2	SCS Runoff	5.388	2	716	12,693	-----	-----	-----	Storm Basin B
3	SCS Runoff	6.546	2	716	15,422	-----	-----	-----	Storm Basin C
4	SCS Runoff	12.54	2	716	29,538	-----	-----	-----	Storm Basin D
5	SCS Runoff	3.978	2	716	9,372	-----	-----	-----	Storm Basin E
6	SCS Runoff	6.202	2	716	12,531	-----	-----	-----	Storm Basin F
7	SCS Runoff	3.823	2	718	7,704	-----	-----	-----	Storm Basin G
Pipes Hydraflow.gpw					Return Period: 10 Year			Thursday, 07 / 23 / 2026	

Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021

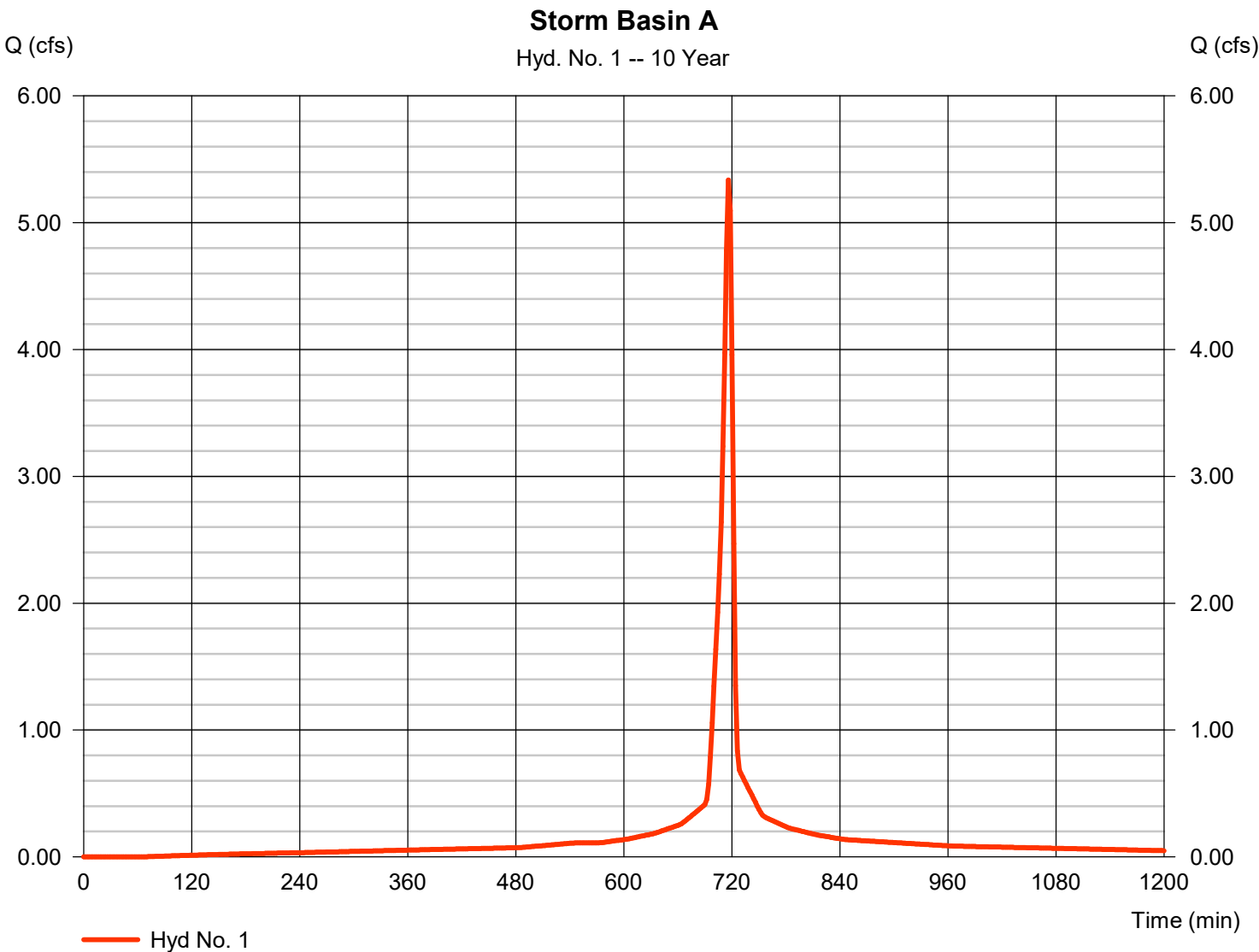
Thursday, 07 / 23 / 2026

Hyd. No. 1

Storm Basin A

Hydrograph type	= SCS Runoff	Peak discharge	= 5.338 cfs
Storm frequency	= 10 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 12,574 cuft
Drainage area	= 1.060 ac	Curve number	= 98*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 6.00 min
Total precip.	= 3.72 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(1.060 x 98)] / 1.060



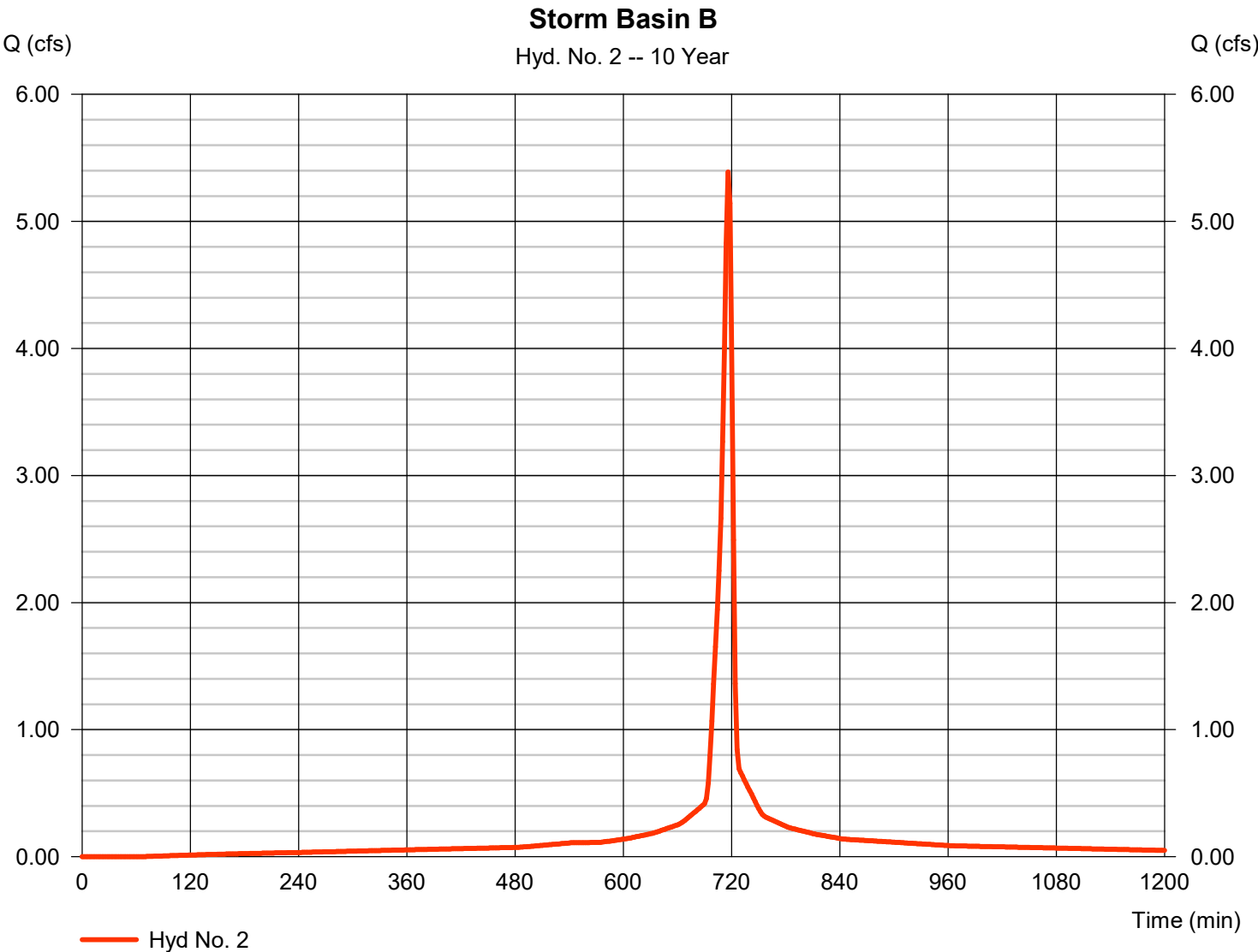
Hydrograph Report

Hyd. No. 2

Storm Basin B

Hydrograph type	= SCS Runoff	Peak discharge	= 5.388 cfs
Storm frequency	= 10 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 12,693 cuft
Drainage area	= 1.070 ac	Curve number	= 98*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 6.00 min
Total precip.	= 3.72 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(1.070 x 98)] / 1.070



Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021

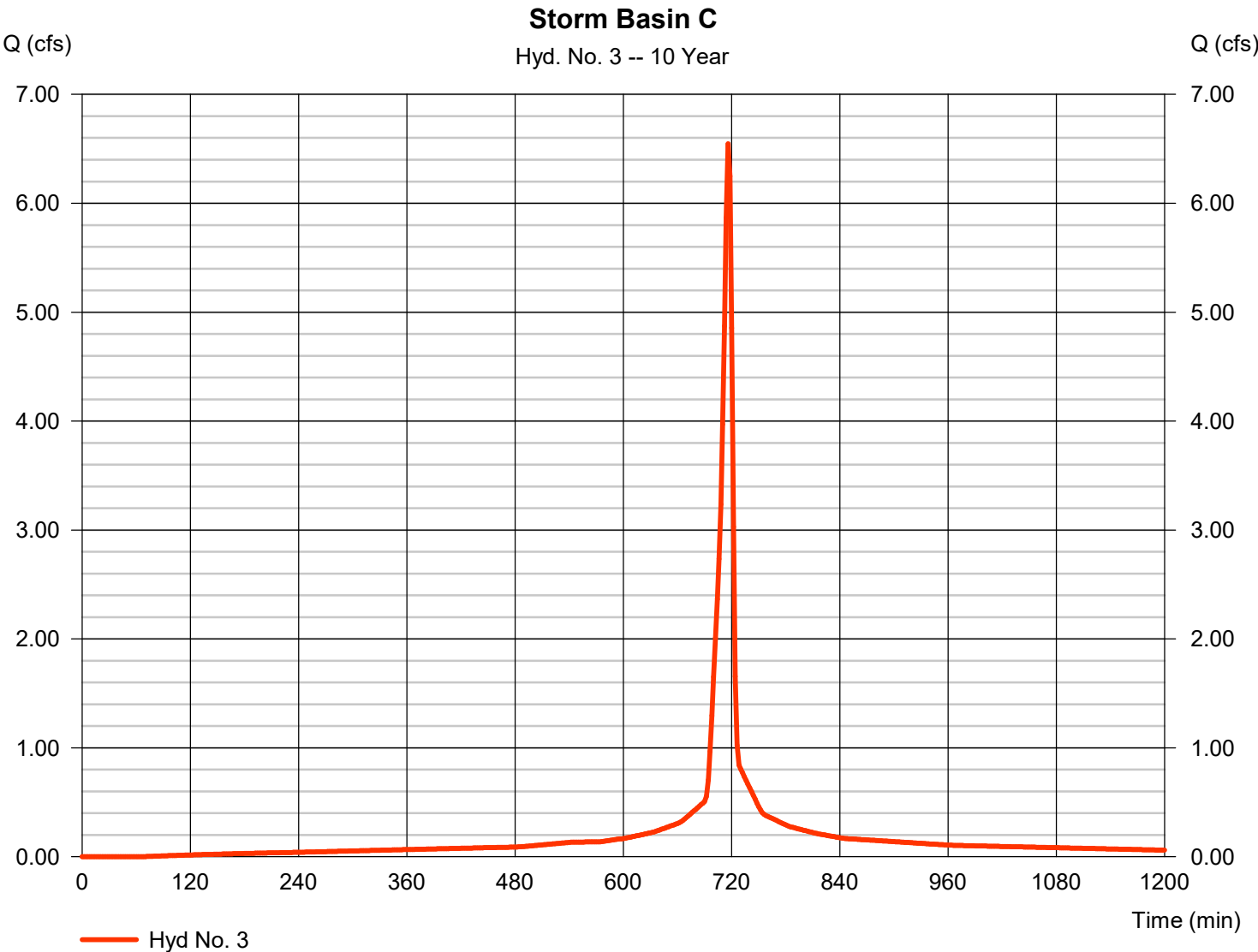
Thursday, 07 / 23 / 2026

Hyd. No. 3

Storm Basin C

Hydrograph type	= SCS Runoff	Peak discharge	= 6.546 cfs
Storm frequency	= 10 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 15,422 cuft
Drainage area	= 1.300 ac	Curve number	= 98*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 6.00 min
Total precip.	= 3.72 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(1.300 x 98)] / 1.300



Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021

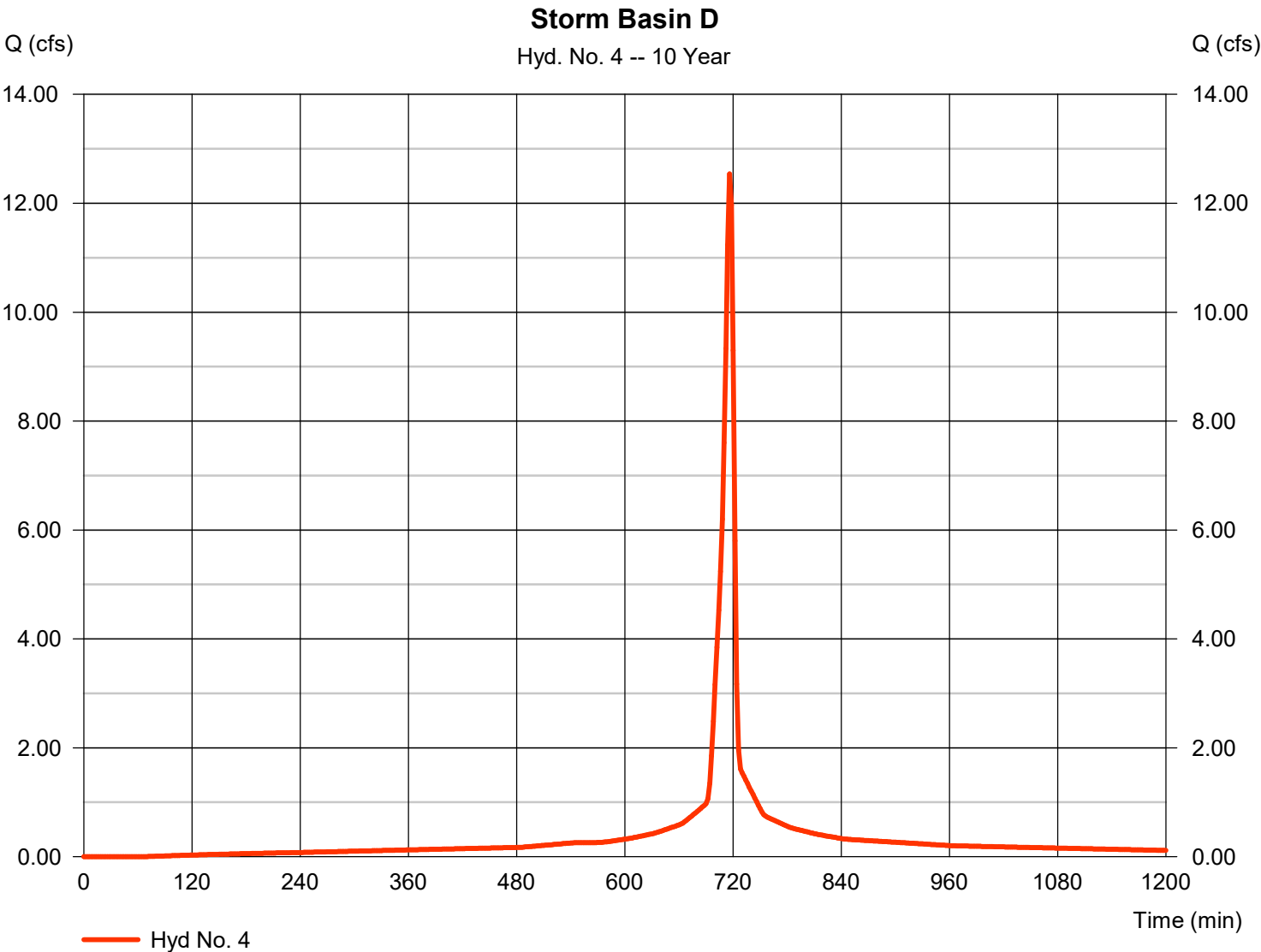
Thursday, 07 / 23 / 2026

Hyd. No. 4

Storm Basin D

Hydrograph type	= SCS Runoff	Peak discharge	= 12.54 cfs
Storm frequency	= 10 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 29,538 cuft
Drainage area	= 2.490 ac	Curve number	= 98*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 6.00 min
Total precip.	= 3.72 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(2.490 x 98)] / 2.490



Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021

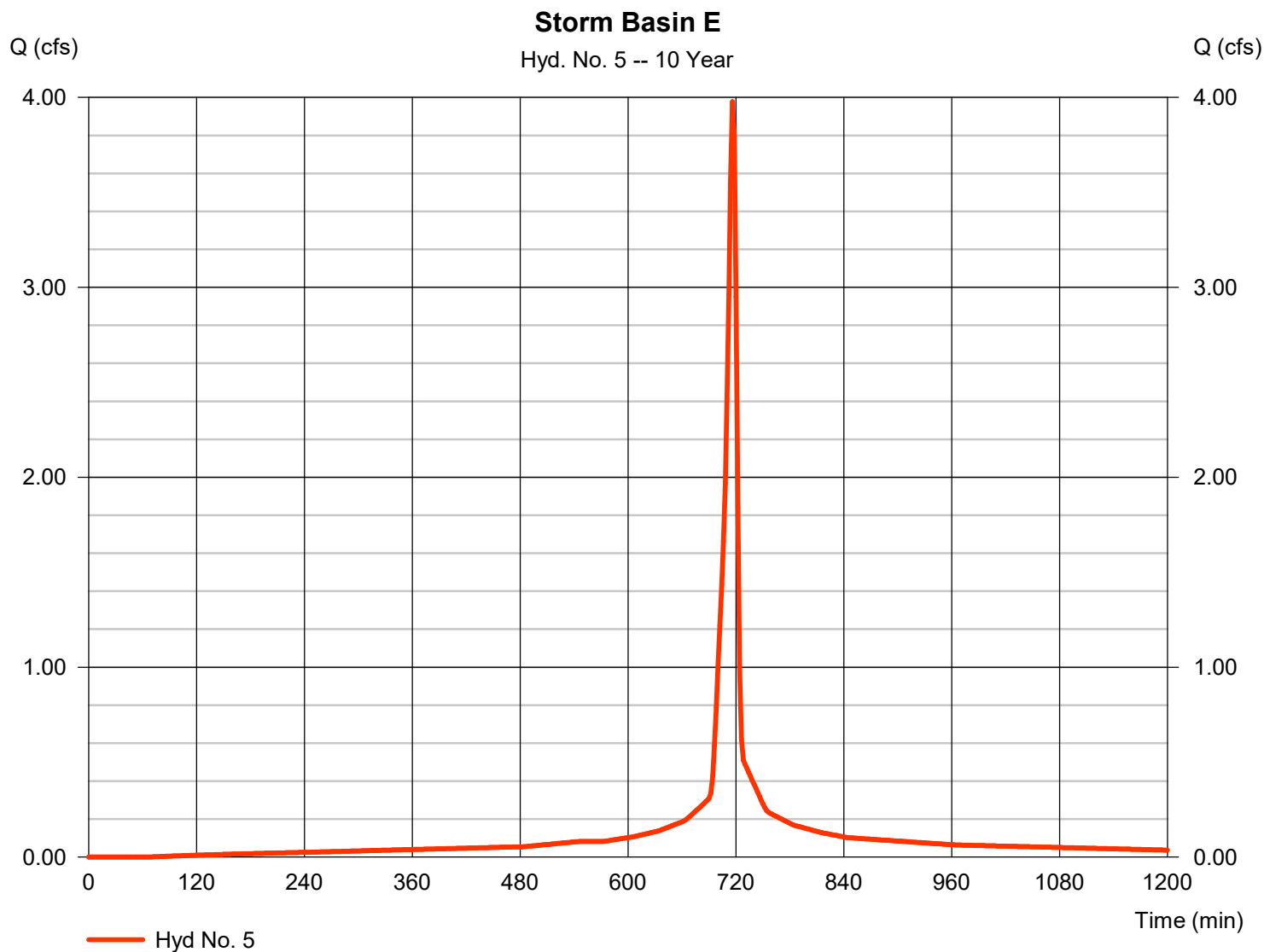
Thursday, 07 / 23 / 2026

Hyd. No. 5

Storm Basin E

Hydrograph type	= SCS Runoff	Peak discharge	= 3.978 cfs
Storm frequency	= 10 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 9,372 cuft
Drainage area	= 0.790 ac	Curve number	= 98*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 6.00 min
Total precip.	= 3.72 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = $[(0.790 \times 98)] / 0.790$



Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021

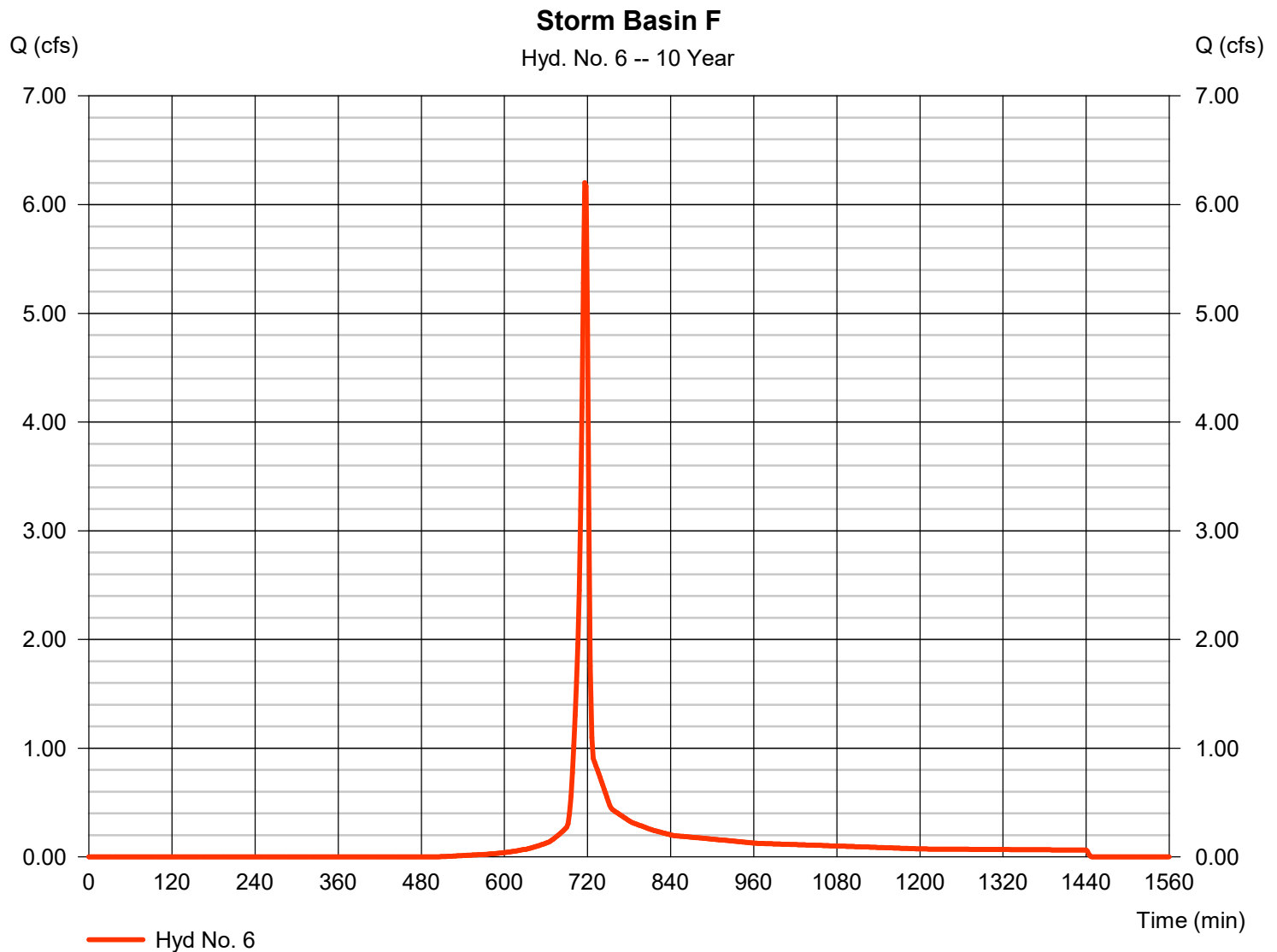
Thursday, 07 / 23 / 2026

Hyd. No. 6

Storm Basin F

Hydrograph type	= SCS Runoff	Peak discharge	= 6.202 cfs
Storm frequency	= 10 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 12,531 cuft
Drainage area	= 1.950 ac	Curve number	= 81*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 6.00 min
Total precip.	= 3.72 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = $[(1.400 \times 98) + (0.550 \times 39)] / 1.950$



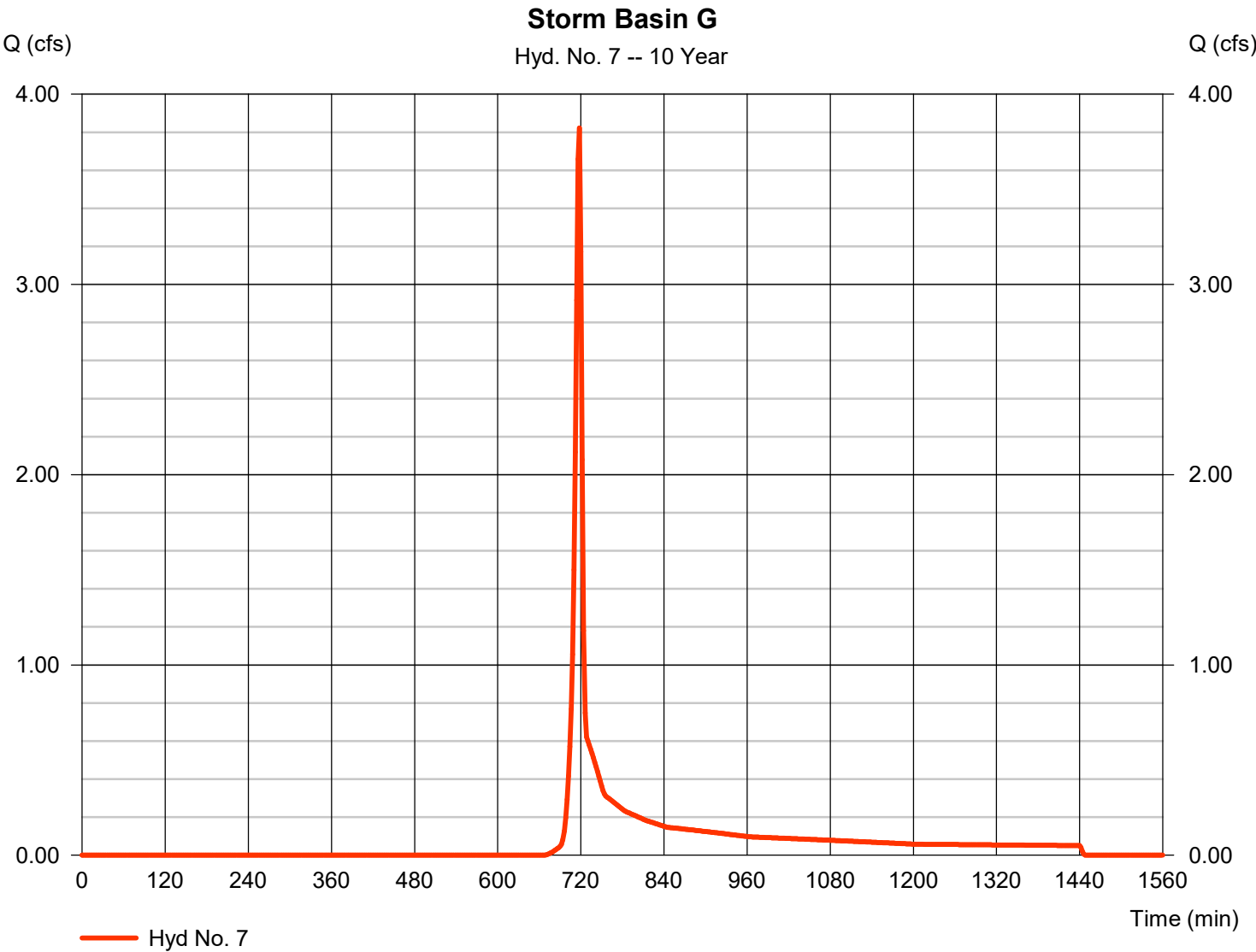
Hydrograph Report

Hyd. No. 7

Storm Basin G

Hydrograph type	= SCS Runoff	Peak discharge	= 3.823 cfs
Storm frequency	= 10 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 7,704 cuft
Drainage area	= 2.080 ac	Curve number	= 69*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 6.00 min
Total precip.	= 3.72 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(1.070 x 98) + (1.010 x 39)] / 2.080



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	8.396	2	716	20,136	-----	-----	-----	Storm Basin A
2	SCS Runoff	8.475	2	716	20,326	-----	-----	-----	Storm Basin B
3	SCS Runoff	10.30	2	716	24,695	-----	-----	-----	Storm Basin C
4	SCS Runoff	19.72	2	716	47,301	-----	-----	-----	Storm Basin D
5	SCS Runoff	6.257	2	716	15,007	-----	-----	-----	Storm Basin E
6	SCS Runoff	12.00	2	716	24,687	-----	-----	-----	Storm Basin F
7	SCS Runoff	9.062	2	718	18,211	-----	-----	-----	Storm Basin G
Pipes Hydraflow.gpw					Return Period: 100 Year			Thursday, 07 / 23 / 2026	

Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021

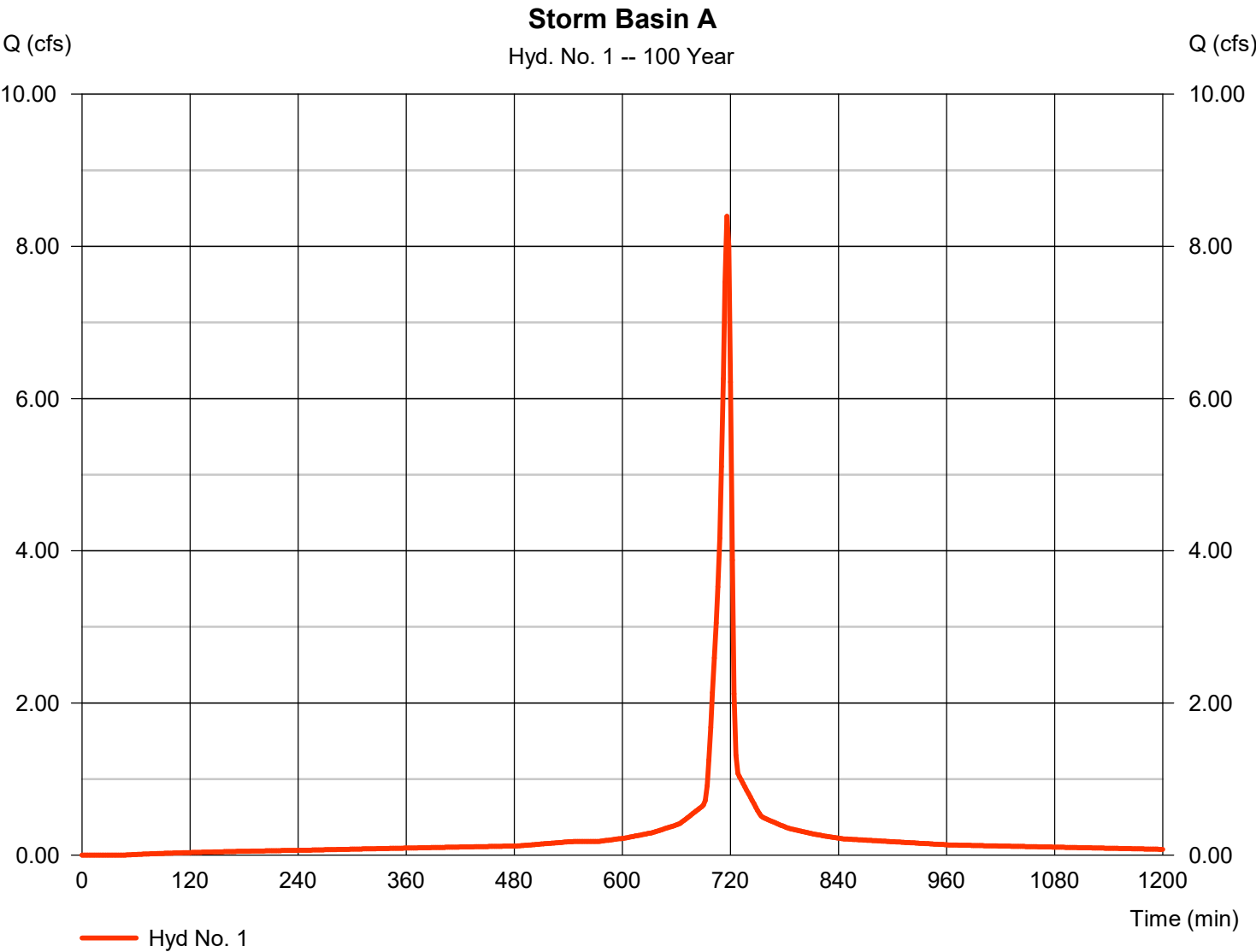
Thursday, 07 / 23 / 2026

Hyd. No. 1

Storm Basin A

Hydrograph type	= SCS Runoff	Peak discharge	= 8.396 cfs
Storm frequency	= 100 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 20,136 cuft
Drainage area	= 1.060 ac	Curve number	= 98*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 6.00 min
Total precip.	= 5.82 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(1.060 x 98)] / 1.060



Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021

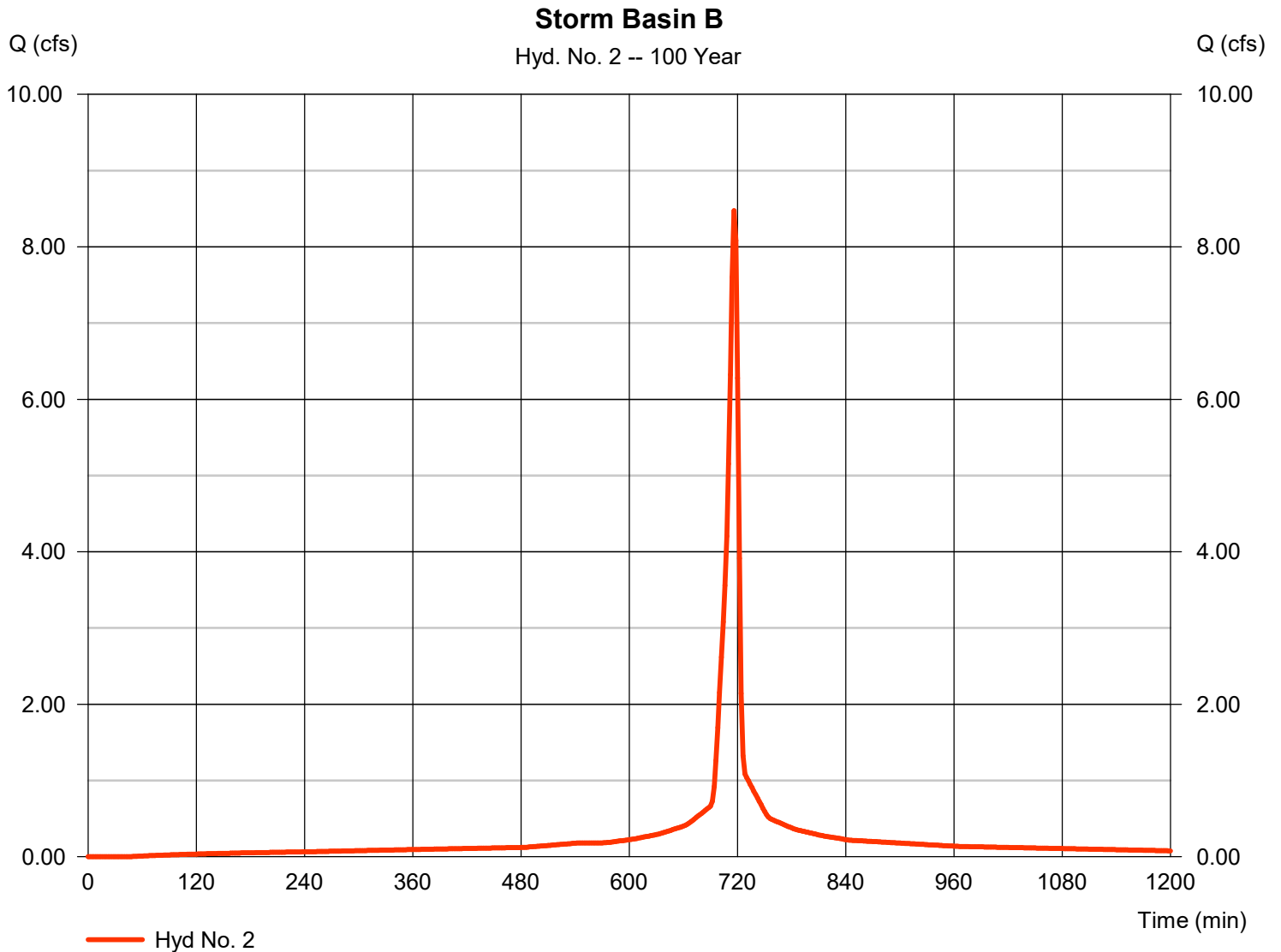
Thursday, 07 / 23 / 2026

Hyd. No. 2

Storm Basin B

Hydrograph type	= SCS Runoff	Peak discharge	= 8.475 cfs
Storm frequency	= 100 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 20,326 cuft
Drainage area	= 1.070 ac	Curve number	= 98*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 6.00 min
Total precip.	= 5.82 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = $[(1.070 \times 98)] / 1.070$



Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021

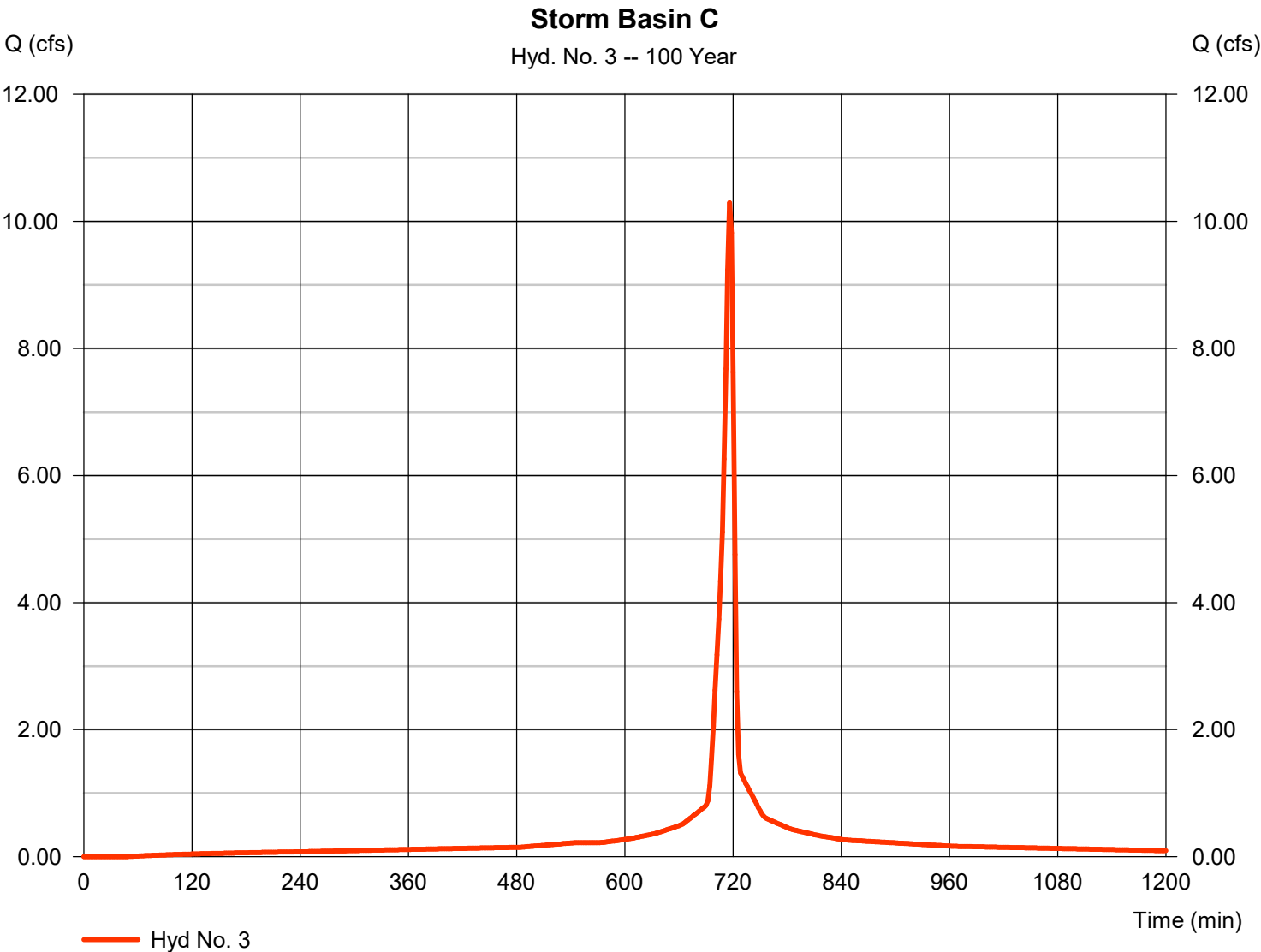
Thursday, 07 / 23 / 2026

Hyd. No. 3

Storm Basin C

Hydrograph type	= SCS Runoff	Peak discharge	= 10.30 cfs
Storm frequency	= 100 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 24,695 cuft
Drainage area	= 1.300 ac	Curve number	= 98*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 6.00 min
Total precip.	= 5.82 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(1.300 x 98)] / 1.300



Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021

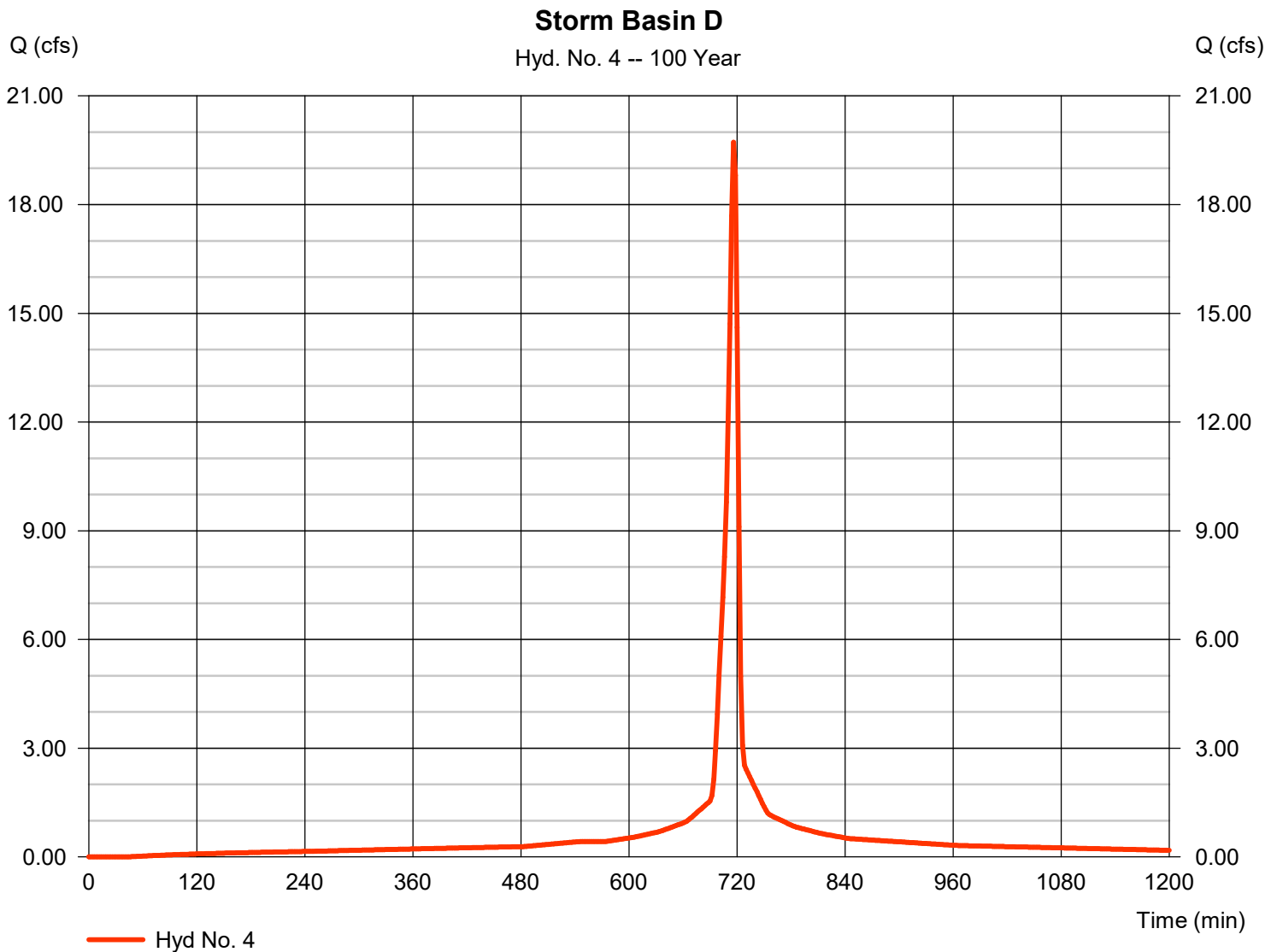
Thursday, 07 / 23 / 2026

Hyd. No. 4

Storm Basin D

Hydrograph type	= SCS Runoff	Peak discharge	= 19.72 cfs
Storm frequency	= 100 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 47,301 cuft
Drainage area	= 2.490 ac	Curve number	= 98*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 6.00 min
Total precip.	= 5.82 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = $[(2.490 \times 98)] / 2.490$



Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021

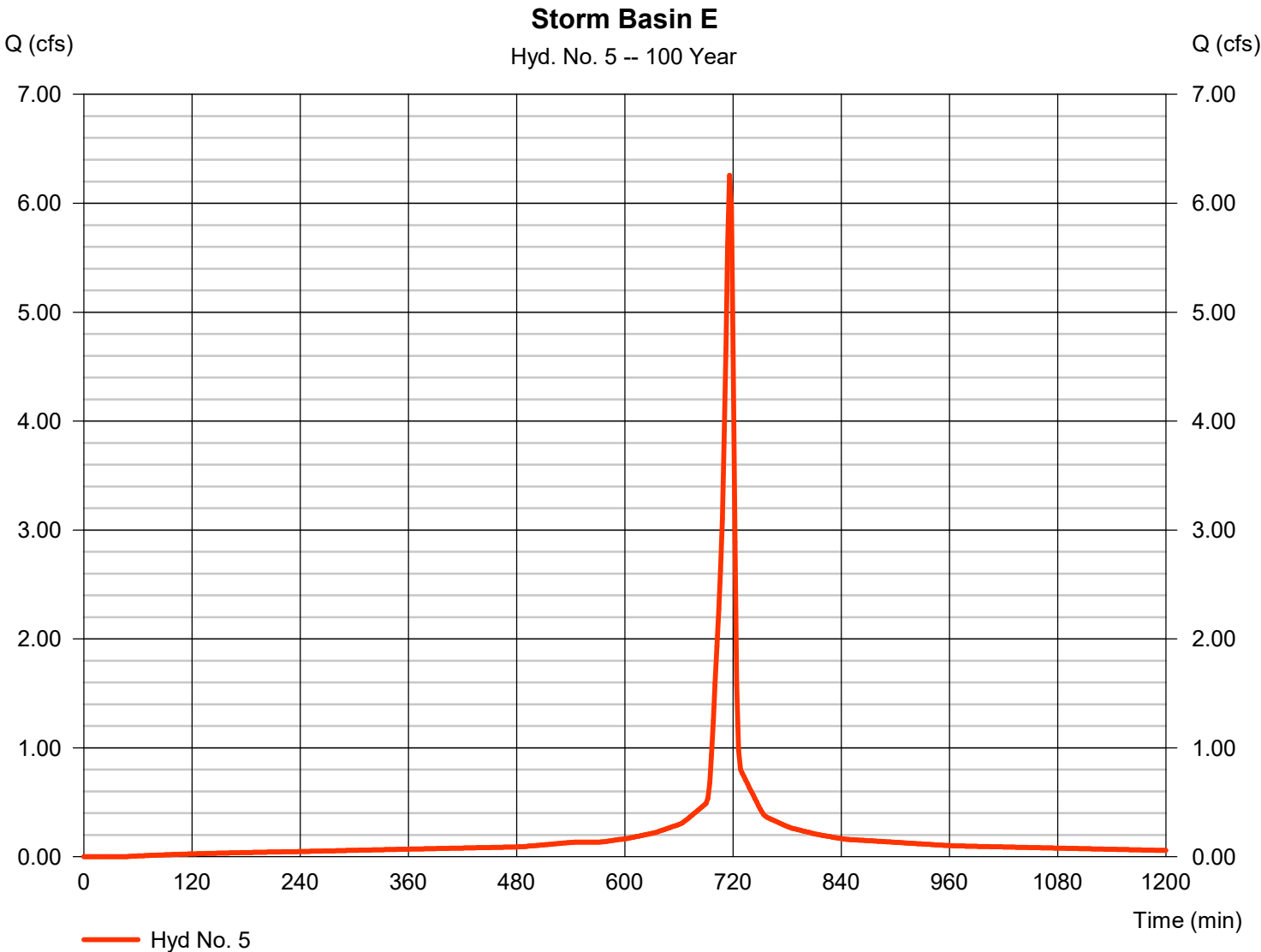
Thursday, 07 / 23 / 2026

Hyd. No. 5

Storm Basin E

Hydrograph type	= SCS Runoff	Peak discharge	= 6.257 cfs
Storm frequency	= 100 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 15,007 cuft
Drainage area	= 0.790 ac	Curve number	= 98*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 6.00 min
Total precip.	= 5.82 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.790 x 98)] / 0.790



Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021

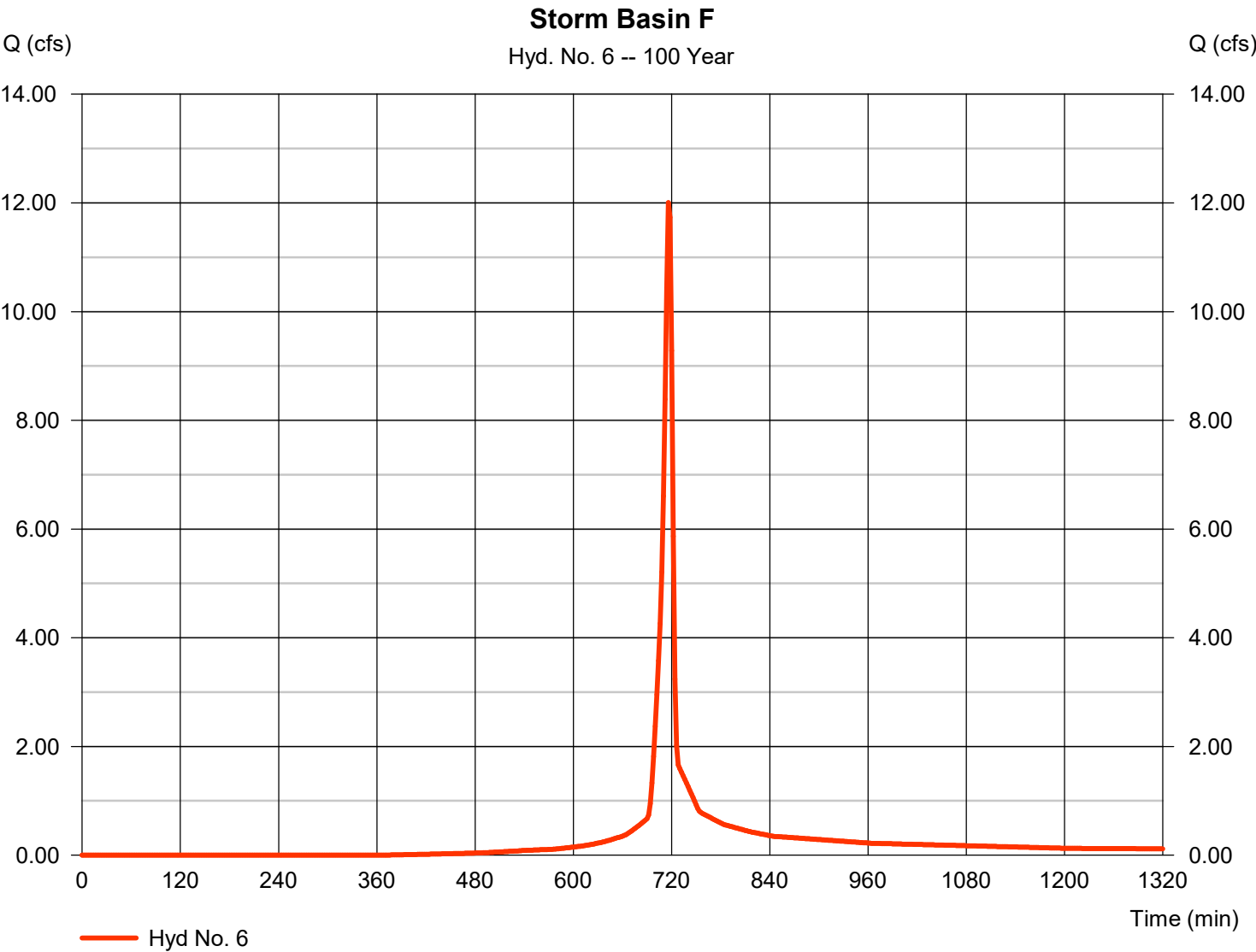
Thursday, 07 / 23 / 2026

Hyd. No. 6

Storm Basin F

Hydrograph type	= SCS Runoff	Peak discharge	= 12.00 cfs
Storm frequency	= 100 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 24,687 cuft
Drainage area	= 1.950 ac	Curve number	= 81*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 6.00 min
Total precip.	= 5.82 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(1.400 x 98) + (0.550 x 39)] / 1.950



Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021

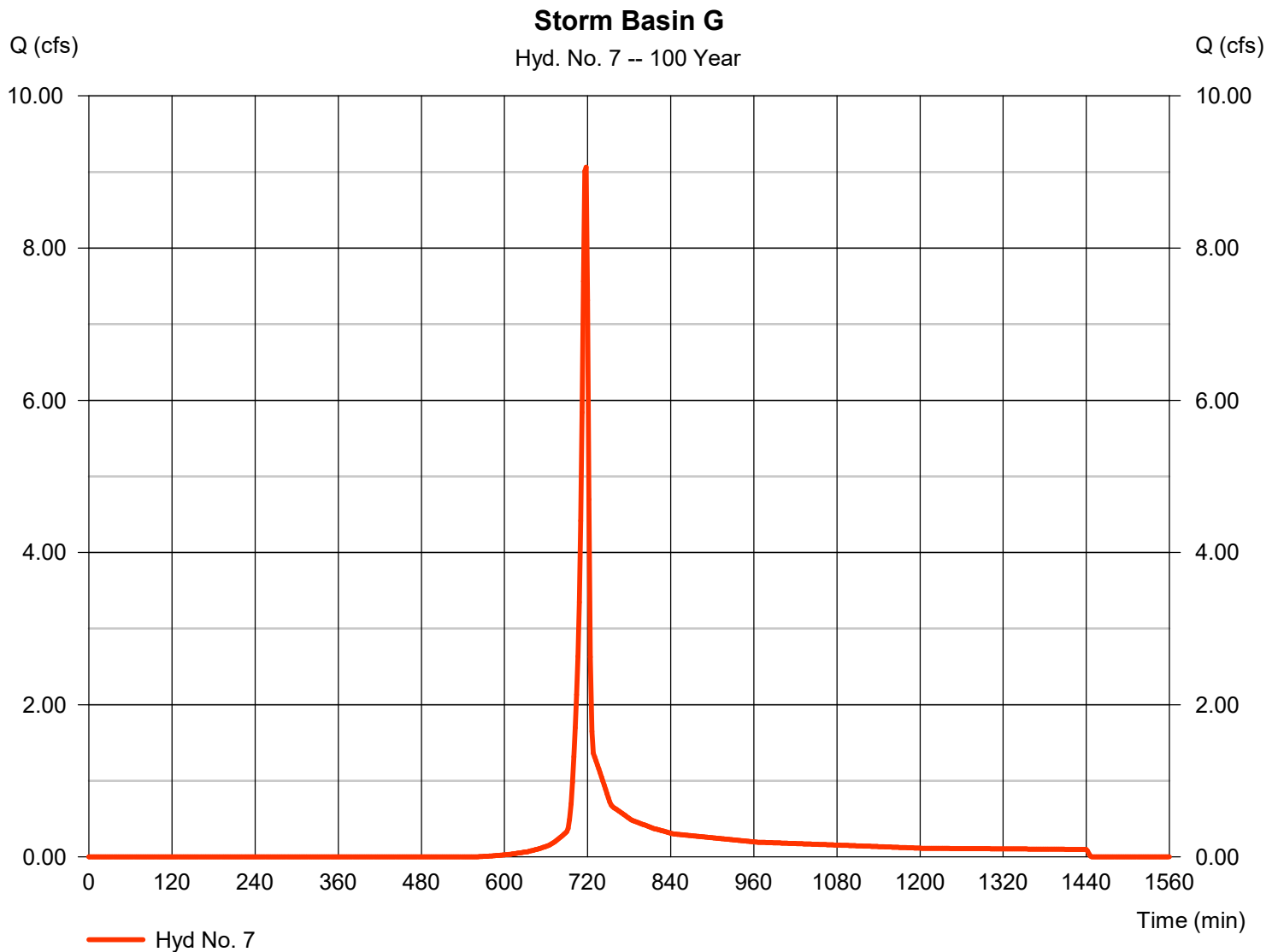
Thursday, 07 / 23 / 2026

Hyd. No. 7

Storm Basin G

Hydrograph type	= SCS Runoff	Peak discharge	= 9.062 cfs
Storm frequency	= 100 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 18,211 cuft
Drainage area	= 2.080 ac	Curve number	= 69*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 6.00 min
Total precip.	= 5.82 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = $[(1.070 \times 98) + (1.010 \times 39)] / 2.080$



Appendix H: Storm Sewer Manning's Spreadsheet

Excel Engineering Project No.

250008600

Project Name Marathon County Highway Garage

Pipe Data					Pipe Capacity (100-yr, 24-hr)				
Pipe ID	Diameter (FT)	Pipe Qty.	Slope (FT/FT)	Manning's n	Basin ID	Total Flow (cfs)	Total Flow (gpm)	Full Flow Capacity (cfs)	Full Flow Capacity (gpm)
A	3.5	1	0.003	0.012	A,B,C,D,E	53.15	23,853	59.86	26,865
B	1.5	1	0.006	0.012	A	8.40	3,768	8.84	3,967
C	2	1	0.005	0.012	A,B	16.87	7,572	17.38	7,798
D	3	1	0.003	0.012	C,D,E	36.28	16,281	39.68	17,810
E	2.5	1	0.004	0.012	D,E	25.98	11,658	28.18	12,647
F	1.5	1	0.004	0.012	E	6.26	2,808	7.22	3,239
G	2	1	0.008	0.012	F,G	21.06	9,453	21.98	9,864
H	1.5	1	0.006	0.012	G	9.06	4,067	9.13	4,097

Full Flow Capacity based off Manning's Equation

$$Q = \frac{1.49}{n} R^{2/3} S^{1/2} a$$

Where:

Q = Full Flow Capacity of Pipe (cfs)
n = manning's roughness coefficient
R = hydraulic radius (ft) (D/4)
s = hydraulic gradient, slope (ft/ft)
a = flow area (sq. ft.)

Typical Manning's n

HDPE 0.012
PVC 0.012
Concrete 0.013
CMP 0.024

*Total Flow calculated via TR-55 hydrologic calculations. Reference Storm Pipe Basin Map & TR-55 Calculations

Appendix I: SLAMM Input/ Output Information

Data file name: \\job-files\2025 Job Files\250008600 Marathon County - New Highway Garage\250008604 Civil\storm water report and calculations\SLAMM\250008600.
WinSLAMM Version 10.5.0

Rain file name: J:\Programs\civil\WinSLAMM\v10.5.0\Parameter Files\WisReg - Green Bay WI 1969.ran

Particulate Solids Concentration file name: J:\Programs\civil\WinSLAMM\v10.5.0\Parameter Files\v10.1 WI_AVG01.pscx

Runoff Coefficient file name: J:\Programs\civil\WinSLAMM\v10.5.0\Parameter Files\WI_SL06 Dec06.rsvx

Residential Street Delivery file name: J:\Programs\civil\WinSLAMM\v10.5.0\Parameter Files\WI_Res and Other Urban Dec06.std

Institutional Street Delivery file name: J:\Programs\civil\WinSLAMM\v10.5.0\Parameter Files\WI_Com Inst Indust Dec06.std

Commercial Street Delivery file name: J:\Programs\civil\WinSLAMM\v10.5.0\Parameter Files\WI_Com Inst Indust Dec06.std

Industrial Street Delivery file name: J:\Programs\civil\WinSLAMM\v10.5.0\Parameter Files\WI_Com Inst Indust Dec06.std

Other Urban Street Delivery file name: J:\Programs\civil\WinSLAMM\v10.5.0\Parameter Files\WI_Res and Other Urban Dec06.std

Freeway Street Delivery file name: J:\Programs\civil\WinSLAMM\v10.5.0\Parameter Files\Freeway Dec06.std

Apply Street Delivery Files to Adjust the After Event Load Street Dirt Mass Balance: False

Pollutant Relative Concentration file name: J:\Programs\civil\WinSLAMM\v10.5.0\Parameter Files\WI_GEO03.ppdx

Source Area PSD and Peak to Average Flow Ratio File: J:\Programs\civil\WinSLAMM\v10.5.0\Parameter Files\NURP Source Area PSD Files.csv

Cost Data file name:

Seed for random number generator: -42

Study period starting date: 01/02/69

Study period ending date: 12/28/69

Start of Winter Season: 11/25

End of Winter Season: 03/29

Date: 07-21-2026

Time: 16:01:50

Site information:

LU# 1 - Industrial: SLAMM Basin 1 Total area (ac): 2.330

13 - Paved Parking 1: 1.030 ac. Disconnected Normal Sandy PSD File: C:\WinSLAMM Files\NURP.cpz Source Area PSD File: C:\WinSLAMM Files\NURP.cpz

31 - Sidewalks 1: 0.050 ac. Connected PSD File: C:\WinSLAMM Files\NURP.cpz Source Area PSD File: C:\WinSLAMM Files\NURP.cpz

45 - Large Landscaped Areas 1: 1.250 ac. Normal Sandy PSD File: C:\WinSLAMM Files\NURP.cpz Source Area PSD File: C:\WinSLAMM Files\NURP.cpz

LU# 2 - Industrial: SLAMM Basin 2 Total area (ac): 1.970

13 - Paved Parking 1: 1.320 ac. Disconnected Normal Sandy PSD File: C:\WinSLAMM Files\NURP.cpz Source Area PSD File: C:\WinSLAMM Files\NURP.cpz

45 - Large Landscaped Areas 1: 0.650 ac. Normal Sandy PSD File: C:\WinSLAMM Files\NURP.cpz Source Area PSD File: C:\WinSLAMM Files\NURP.cpz

LU# 3 - Industrial: SLAMM Basin 3 Total area (ac): 21.030

1 - Roofs 1: 5.600 ac. Pitched Connected PSD File: C:\WinSLAMM Files\NURP.cpz Source Area PSD File: C:\WinSLAMM Files\NURP.cpz

13 - Paved Parking 1: 6.470 ac. Connected PSD File: C:\WinSLAMM Files\NURP.cpz Source Area PSD File: C:\WinSLAMM Files\NURP.cpz

14 - Paved Parking 2: 3.700 ac. Disconnected Normal Sandy PSD File: C:\WinSLAMM Files\NURP.cpz Source Area PSD File: C:\WinSLAMM Files\NURP.cpz

45 - Large Landscaped Areas 1: 5.260 ac. Normal Sandy PSD File: C:\WinSLAMM Files\NURP.cpz Source Area PSD File: C:\WinSLAMM Files\NURP.cpz

LU# 4 - Industrial: SLAMM Basin 4 Off-site Total area (ac): 5.040

45 - Large Landscaped Areas 1: 5.040 ac. Normal Sandy PSD File: C:\WinSLAMM Files\NURP.cpz Source Area PSD File: C:\WinSLAMM Files\NURP.cpz

Control Practice 1: Biofilter CP# 1 (DS) - Facility 3

1. Top area (square feet) = 107885

2. Bottom area (square feet) = 34587

3. Depth (ft): 11

4. Biofilter width (ft) - for Cost Purposes Only: 10

5. Infiltration rate (in/hr) = 3.6

6. Random infiltration rate generation? No

7. Infiltration rate fraction (side): 0.01

8. Infiltration rate fraction (bottom): 1

9. Depth of biofilter that is rock filled (ft) 0

10. Porosity of rock filled volume = 0

11. Engineered soil infiltration rate: 3.6

12. Engineered soil depth (ft) = 2

13. Engineered soil porosity = 0.27

14. Percent solids reduction due to flow through engineered soil = 80

15. Biofilter peak to average flow ratio = 3.8

16. Number of biofiltration control devices = 1

17. Particle size distribution file: Not needed - calculated by program

18. Initial water surface elevation (ft): 0

Soil Data Soil Type Fraction in Eng. Soil

User-Defined Media Type 1.000

Biofilter Outlet/Discharge Characteristics:

Outlet type: Broad Crested Weir

1. Weir crest length (ft): 15

2. Weir crest width (ft): 4

3. Height of datum to bottom of weir opening: 10.1

Data file name: \\job-files\2025 Job Files\250008600 Marathon County - New Highway Garage\250008604 Civil\storm water report and calculations\SLAMM\250008600.
WinSLAMM Version 10.5.0
Rain file name: J:\Programs\civil\WinSLAMM\v10.5.0\Parameter Files\WisReg - Green Bay WI 1969.ran
Particulate Solids Concentration file name: J:\Programs\civil\WinSLAMM\v10.5.0\Parameter Files\v10.1 WI_AVG01.pscx
Runoff Coefficient file name: J:\Programs\civil\WinSLAMM\v10.5.0\Parameter Files\WI_SL06 Dec06.rsvx
Pollutant Relative Concentration file name: J:\Programs\civil\WinSLAMM\v10.5.0\Parameter Files\WI_GEO03.ppd
Residential Street Delivery file name: J:\Programs\civil\WinSLAMM\v10.5.0\Parameter Files\WI_Res and Other Urban Dec06.std
Institutional Street Delivery file name: J:\Programs\civil\WinSLAMM\v10.5.0\Parameter Files\WI_Com Inst Indust Dec06.std
Commercial Street Delivery file name: J:\Programs\civil\WinSLAMM\v10.5.0\Parameter Files\WI_Com Inst Indust Dec06.std
Industrial Street Delivery file name: J:\Programs\civil\WinSLAMM\v10.5.0\Parameter Files\WI_Com Inst Indust Dec06.std
Other Urban Street Delivery file name: J:\Programs\civil\WinSLAMM\v10.5.0\Parameter Files\WI_Res and Other Urban Dec06.std
Freeway Street Delivery file name: J:\Programs\civil\WinSLAMM\v10.5.0\Parameter Files\Freeway Dec06.std
Apply Street Delivery Files to Adjust the After Event Load Street Dirt Mass Balance: False
Source Area PSD and Peak to Average Flow Ratio File: J:\Programs\civil\WinSLAMM\v10.5.0\Parameter Files\NURP Source Area PSD Files.csv
Cost Data file name:
Seed for random number generator: -42
Study period starting date: 01/02/69 Study period ending date: 12/28/69
Start of Winter Season: 11/25 End of Winter Season: 03/29
Model Run Start Date: 01/02/69 Model Run End Date: 12/28/69
Date of run: 07-21-2026 Time of run: 15:59:44
Total Area Modeled (acres): 30.370
Years in Model Run: 0.99

	Runoff Volume (cu ft)	Percent Runoff Volume Reduction	Particulate Solids Conc. (mg/L)	Particulate Solids Yield (lbs)	Percent Particulate Solids Reduction
Total of all Land Uses without Controls:	804794	-	135.0	6783	-
Outfall Total with Controls:	0	100.00%	0	0	100.00%
Annualized Total After Outfall Controls:	0			0	

Pollutant	Conc. No Controls	Conc. With Controls	Conc. Units	Pollutant Yield No Controls	Pollutant Yield With Controls	Pol. Yield Units	Percent Reduction
Particulate Solids	135.0	0	mg/L	6783	0	lbs	100.00 %
Particulate Phosphorus	0.1650	0	mg/L	8.291	0	lbs	100.00 %

Biofilter # 1 is expected to clog in 10.5 years.. Percent Solids Reduction due to Engineered Media = 80

Appendix J: Flood Plain Compensation Calculations

Existing floodplain storage calculated between floodplain elevation of 1,173.5 and the existing ground surface:

- 10,094 cu.yds.

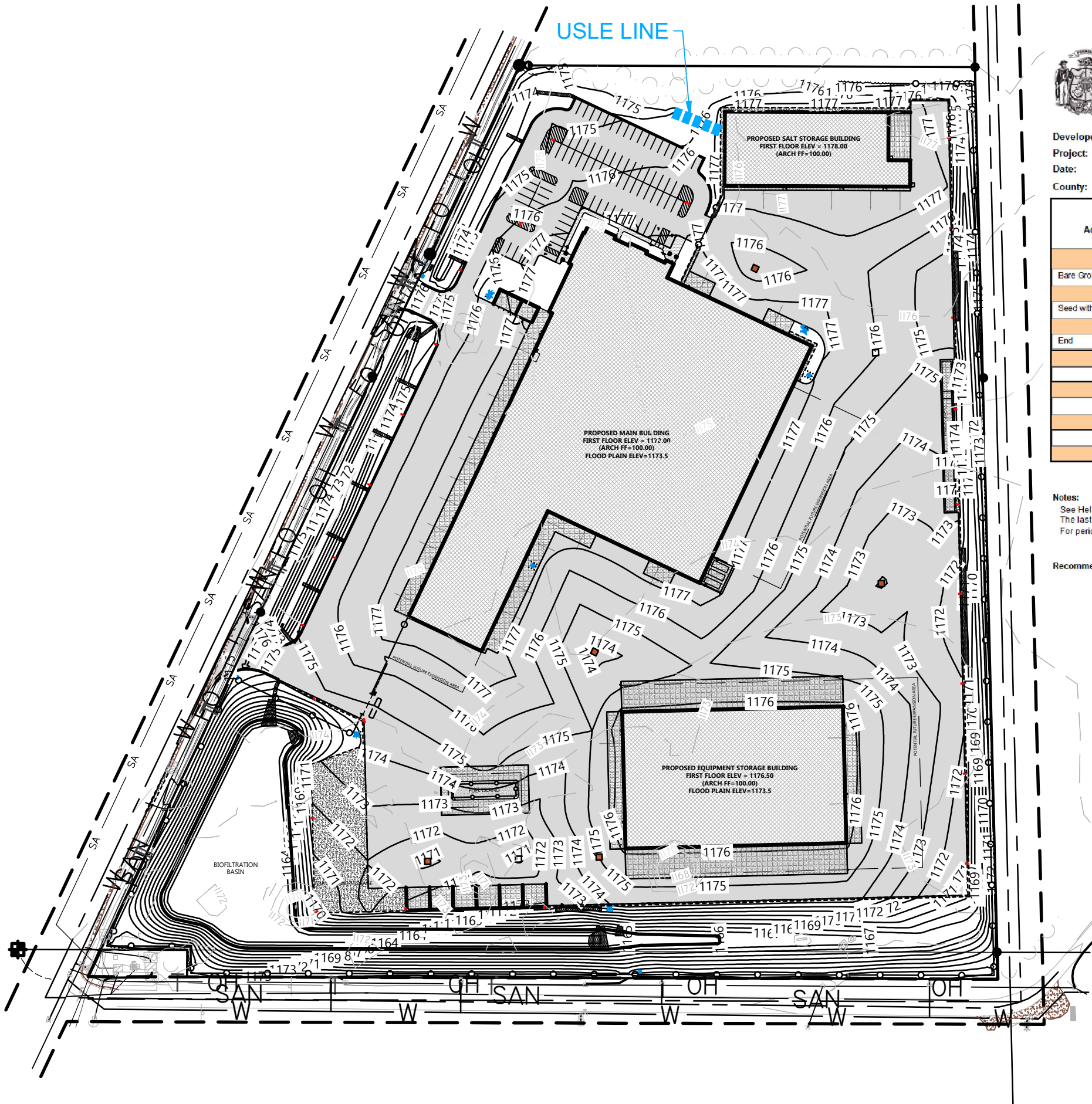
Name	B	Mid-Ordinat...	Cut Factor	Fill Factor	Style	2d Area[Sq....	Cut[adjusted](...	Fill[adjusted](...	Net[adjusted](...	Net Graph
☐ PG vs. EG			1.000	1.000	_NO DISPLAY	917479.77	36822.97	33615.73	3207.23<Cut>	
☒ eg vs flood			1.000	1.000	_NO DISPLAY	445227.45	385.20	10479.29	10094.09<Fill>	

Bioretention basin available volume between calculated 100-yr storm elevation and spillway:

- 494,086 cu.ft.

	Contour		Sum of		Sum of
Elevation (ft)	Area (sf)	Volume (cf)	Volumes (cf)	Volume (ac-ft)	Volumes (ac-ft)
1167.66	69277	-na-	-na-	-na-	-na-
1168	75751	24646.54	24646.54	0.5658	0.5658
1169	90953	83236.15	107882.69	1.9108	2.4766
1170	108072	99389.47	207272.16	2.2817	4.7583
1171	128981	118372.39	325644.55	2.7175	7.4758
1172	173843	150854.93	476499.49	3.4632	10.9389
1172.1	177904	17586.94	494086.43	0.4037	11.3427
Volumes based on $V = (1/3 * (Elev2-Elev1) * (Area1 + Area2 + \sqrt{Area1 * Area2}))$					

Appendix K: USLE Map and Calculations





Soil Loss & Sediment Discharge Calculation Tool

for use on Construction Sites in the State of Wisconsin

WDNR Version 2.1 (12-05-2024)



Developer: _____

Project: Marathon County Highway Garage

Date: 07/21/26

County: Marathon

YEAR 1

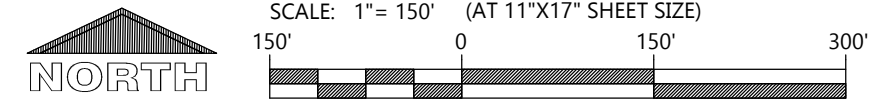
Activity (1)	Begin Date (2)	End Date (3)	Period % R (4)	Annual R Factor (5)	Sub Soil Texture (6)	Soil Erodibility K Factor (7)	Slope (%) (8)	Slope Length (ft) (9)	LS Factor (10)	Land Cover C Factor (11)	Soil loss A (tons/acre) (12)	SDF (13)	Sediment Control Practice (14)	Sediment Discharge (t/ac) (15)
Bare Ground	04/05/27	10/03/27	86.9%	130	Sand	0.15	3.5%	66	0.29	1.00	5.0	0.967	Silt Fence	2.9
Seed with Mulch or Er	10/03/27	04/03/28	12.8%	130	Sand	0.15	3.5%	66	0.29	0.10	0.1	0.967	Silt Fence	0.0
End	04/03/28	-----	-----	-----	-----	-----	3.5%	66	0.29	-----	-----	0.000	-----	0.0
-----	-----	-----	-----	-----	-----	-----	3.5%	66	0.29	-----	-----	0.000	-----	0.0
-----	-----	-----	-----	-----	-----	-----	3.5%	0	-----	-----	-----	0.000	-----	0.0
-----	-----	-----	-----	-----	-----	-----	0.0%	0	-----	-----	-----	0.000	-----	0.0
TOTAL											5.0		TOTAL	2.9
													% Reduction Required	NONE

Notes:
See Help Page for further descriptions of variables and items in drop-down boxes.
The last land disturbing activity on each sheet must be 'End'. This is either 12 months from the start of construction or final stabilization.
For periods of construction that exceed 12 months, please demonstrate that 5 tons/acre/year is not exceeded in any given 12 month period.

Recommended Permanent Seeding Dates:
4/15-6/1 and Thaw-6/30 8/1-8/21 Turf, introduced grasses and legumes
Native Grasses, forbs, and legumes

NOTE: THIS TOOL ONLY ADDRESSED SOIL EROSION DUE TO SHEET FLOW. MEASURES TO CONTROL CHANNEL EROSION MAY ALSO BE REQUIRED TO MEET SEDIMENT DISCHARGE REQUIREMENTS.

Designed By:	KD
Date	7/23/2026



Appendix L: Post Construction Operation and Maintenance Plan

The owner of the property affected shall inspect and maintain the following stormwater management systems frequently, especially after heavy rainfalls, but at least on an annual basis unless otherwise specified.

STORMWATER FACILITY	TYPE OF ACTION
1. Lawn and Landscaped Areas	All lawn areas shall be kept clear of any materials that block the flow of stormwater. Rills and small gullies shall immediately be filled and seeded or have sod placed in them. The lawn shall be kept mowed, tree seedlings shall be removed, and litter shall be removed from landscaped areas.
2. Swales	All grassed swales showing signs of erosion, scour, or channelization shall be repaired, reinforced, and revegetated immediately. All swales shall be repaired to the original plan requirements. Mowing shall take place no less than twice per year at a height of no less than three inches. Grasses shall not be allowed to grow to a height that permits branching or bending. Mowing shall only take place when the ground is dry and able to support machinery.
3. Rip Rap	All rip rap showing signs of erosion or scour shall be repaired, reinforced, and revegetated immediately. Rip rap should be kept clean of vegetation and sediment. All rip rap shall be repaired to the construction plan requirements.
4. Catch Basin/Curb Inlet Grates	The grate openings to these structures must be cleared of any clogging or the blocking of stormwater flow from getting into the stormwater conveyance system of any kind.
5. Bio-Retention Infiltration Basin	Inspections shall occur at minimum every 3 months. Inspections shall include the spreader, overflow spillway, and the condition of vegetation. To maintain vegetation, the first mowing of newly planted seed shall occur once it reaches a height of 10 to 12 inches. Mowing shall reduce the height of plants to 5 to 6 inches. After establishment, if burning cannot be accommodated, mowing shall occur once in the fall after November 1 st . Mowing shall reduce the height of plants to 5 to 6 inches. If burning can take place, beginning the second year, burning shall occur in the early spring prior to May 1 st , or in late fall after November 1 st . Burning shall be done two consecutive years and then up to three years can pass before the next burning. Under no circumstances shall burning occur every other year. If standing water is observed over 50% of the basin floor 3 days after rainfall, the basin is considered clogged. If this ever occurs, remove the top 2 to 3 inches, chisel plow and add topsoil and compost. If deep tilling is used, the basin shall be drained and soils dried to a depth of 8 inches. Replant with turf grass. If clogging again occurs, the basin shall be replanted with prairie style vegetation. During winter conditions,

	all draw down devices in the pond shall be opened to discourage the infiltration of high levels of chlorides. For enclosed basins, the use of chloride deicers shall be limited in the upland areas of the basin. Trash shall be removed as quickly as possible once observed.
6. Record of Maintenance	The operation and maintenance plan shall remain onsite and be available for inspection when requested by WDNR. When requested, the owner shall make available for inspection all maintenance records to the department or agent for the life of the system.