STORMWATER MANAGEMENT REPORT

for

PARKING STRUCTURE AT THE MONTEFIORE HEALTH SYSTEM NYACK CAMPUS
160 North Midland Avenue, Nyack, NY 10960

Prepared For:

Montefiore Health System Nyack Campus
160 North Midland Avenue
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17 March 2020
100754201

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EXECUTIVE SUMMARY

Langan Engineering and Environmental Services, Inc. has prepared this stormwater management report for the Montefiore Health System Nyack Campus parking structure project. The stormwater management design is in compliance with the guidelines contained in the New York Stormwater Management Design Manual (January 2015 edition).

The Montefiore Health System Nyack Campus is located at 160 North Midland Avenue in the Village of Nyack, Rockland County, New York. The property contains approximately 9 acres and is bound by New York State Route 9W to the west, Sickles Avenue to the south, North Midland Avenue to the east and 5th Avenue to the north. The property contains multiple on-grade parking lot areas with vehicular access from 5th Avenue, North Midland Avenue and New York State Route 9W.

The proposed parking structure project redevelops the existing on-grade parking lot area located adjacent to North Midland Avenue and Sickles Avenue. The redevelopment includes construction of a multi-level parking garage with an approximate 29,000 SF footprint and the reconstruction/reconfiguration of the remaining adjacent on-grade parking lot area surrounding the parking garage structure and the main access drive along the hospital building. Vehicular access to State Route 9W and North Midland Avenue will be maintained in the existing locations.

The stormwater management system has been designed in accordance with the redevelopment section of the New York Stormwater Management Design Manual (existing impervious area is being reduced) and consists of the following:

- A combination of runoff reduction, rain gardens, a green infrastructure practice, and alternative practices (approved mechanical treatment devices) are proposed to treat stormwater runoff for the water quality storm; and
- A subsurface collection system consisting of existing and proposed catch basins, manholes, and pipes designed to convey flow from the 25-year storm event.

1.0 INTRODUCTION

Langan Engineering and Environmental Services, Inc. has prepared this stormwater management report for the Montefiore Health System Nyack Campus parking structure project. The stormwater management design is in compliance with the guidelines contained in the New York Stormwater Management Design Manual (January 2015 edition). In accordance with the requirements of the State Pollution Discharge Elimination System (SPDES) program, a detailed Stormwater Pollution Prevention Plan will be prepared and submitted to the Village of Nyack for review and approval prior to the commencement of construction.

2.0 PROPERTY LOCATION/DESCRIPTION

The Montefiore Health System Nyack Campus is located at 160 North Midland Avenue in the Village of Nyack, Rockland County, New York (see Figure 1 in the Figures section of this report). The property contains approximately 9 acres and is bound by New York State Route 9W to the west, Sickles Avenue to the south, North Midland Avenue to the east and 5^{th} Avenue to the north. The property contains one main hospital building and a cancer center building and multiple on-grade parking lot areas with vehicular access from 5^{th} Avenue, North Midland Avenue and New York State Route 9W.

3.0 FLOODPLAIN

According to the National Flood Insurance Program Firm Map titled "Flood Insurance Rate Map for Rockland County, New York", Panel 181 of 207, Community Panel Number 36087C0181G with an effective date of March 3, 2014 (see Figure 2 in the Figures section of this report), the subject property is not located within a flood zone.

4.0 EXISTING CONDITIONS

The majority of the Montefiore Health System Nyack Campus is developed with buildings and parking fields. Slopes are generally mild throughout the majority of the property and approximate grades within the redevelopment area vary from elevation 203 (NAVD 1988 Datum) to elevation 188 (NAVD 1988 Datum). Stormwater runoff from the property is collected by an existing storm drainage system and is discharged to the existing storm drainage system within North Midland Avenue at two locations.

5.0 PROPOSED DEVELOPMENT

The proposed parking structure project at the Montefiore Health System Nyack Campus redevelops the existing on-grade parking lot area located adjacent to North Midland Avenue and Sickles Avenue. The redevelopment includes construction of a multi-level parking garage with an approximate 29,000 SF footprint and the reconstruction/reconfiguration of the remaining adjacent on-grade parking lot area surrounding the parking garage structure and the main access drive along the hospital building. Vehicular access to State Route 9W and North Midland Avenue will be maintained in the existing locations.

Slopes will continue to be mild throughout the majority of the property and grades will mimic existing grades wherever possible. Impervious area will be reduced in proposed conditions with the addition of several rain gardens and parking lot/building foundation plantings (see Figures 3 and 4 in the Figures section of this report).

The two existing stormwater discharge points from the property will be maintained in proposed conditions. Proposed discharge rates at connection points to the North Midland Avenue will match/reduce existing discharge rates.

6.0 STORMWATER MANAGEMENT

The Montefiore Health System Nyack Campus is currently developed and, therefore, the proposed parking structure project and parking lot reconstruction/reconfiguration are considered a "redevelopment" as defined in Chapter 9 of the New York Stormwater Management Design Manual. To be considered a redevelopment, the following criteria must be met:

1) An existing impervious area is disturbed and then reconstructed as either a pervious area or impervious surface, and

2) There is inadequate space for controlling stormwater runoff from the reconstructed areas.

6.1 Water Quantity Controls

There are no existing stormwater quantity controls within the redevelopment area of this project. The proposed redevelopment includes a net reduction in impervious coverage from 86.8% to 85.5% within the redevelopment area (see Figures 3 and 4 in the Figures section of this report). Existing stormwater runoff patterns will be maintained to the extent practical and post-development discharge rates will not exceed the pre-development discharge rates at the various analysis points. Therefore, the project is not required to provide stormwater quantity measures to address channel protection, overbank flooding and extreme storm design criteria.

6.1.1 Design Methodology

The hydrologic study was prepared using methods contained in the USDA Soil Conservation Service Publication TR-55 "Urban Hydrology for Small Watersheds." TR-55 outlines procedures for calculating peak rates of runoff resulting from precipitation events as well as procedures for developing runoff hydrographs.

The watershed was simulated as a series of contributing sub-areas and inflow and outflow structures. Area, curve number (CN), and time of concentration (Tc) were calculated for each contributing sub-area.

The curve number is a land-sensitive coefficient that dictates the relationship between total rainfall depth and direct storm runoff. Based on the coverage of soil groups and land use in the watershed, an average CN was determined for each sub-area for existing and proposed conditions.

The soils within the watershed were divided into hydrologic soil groups (A, B, C, and D) based on environmental/geotechnical subsurface investigations. The SCS classification system evaluates the runoff potential of a soil according to its infiltration and transmission rates. "A" soils have the lowest runoff potential, while "D" soils have the greatest runoff potential. Soils within the watershed are identified as Wethersfield-Urban land complex with a hydrologic soil group designation of "C" (see Figure 5 in the Figures section of this report).

The time of concentration, Tc, is defined as the time for runoff to travel from the hydraulically most distant point in the watershed to a point of interest. Values of the time of concentration were determined for existing and proposed conditions based on land cover and slope of the flow path using methods outlined in TR-55. A minimum time of concentration of 6 minutes was used in this study.

The design storm used for this study is the 24-hour SCS Type III cumulative rainfall distribution. Twenty-four (24) hour rainfall depths for the 1-year (2.79 inches), 10-year (5.09 inches) and 100-year (9.08) storms were analyzed (see Figure 6 in the Figures section of this report).

6.1.2 Hydrologic Results

A summary of existing and proposed runoff rates is provided in Table 1 below. The results show that existing runoff rates were not exceeded at any of the analysis points under proposed conditions. Refer to drawings CG201 and CG202 in the Drawings section of this report for the location of the analysis points and existing and proposed watershed areas and refer to Appendices A and B of this report for supporting hydrologic calculations.

Table 1 – 1-year Storm Event
Summary of Existing and Proposed Flow Rates at the Analysis Points

Analysis Point	Existing Flow Rate (cfs)	Proposed Flow Rate (cfs)	Difference (cfs)
AP-A	5.27	5.23	--0.04
AP-B	5.25	5.22	-0.03
AP-C	0.42	0.42	0.00

Table 2 – 10-year Storm Event
Summary of Existing and Proposed Flow Rates at the Analysis Points

Analysis Point	Existing Flow Rate (cfs)	Proposed Flow Rate (cfs)	Difference (cfs)
AP-A	10.00	9.96	-0.04
AP-B	9.89	9.84	-0.05
AP-C	0.88	0.88	0.00

Table 3 – 100-year Storm Event
Summary of Existing and Proposed Flow Rates at the Analysis Points

Analysis Point	Existing Flow Rate (cfs)	Proposed Flow Rate (cfs)	Difference (cfs)
AP-A	18.16	18.14	-0.02
AP-B	17.92	17.82	-0.10
AP-C	1.67	1.67	0.00

6.2 Water Quality Controls

There are no existing stormwater quality controls within the redevelopment area for this project. Although the project qualifies as a redevelopment project and standard practices would not be required, a combination of a reduction in impervious area resulting in a reduction in runoff, the use of multiple rain gardens, a green infrastructure practice, and alternative practices (approved manufactured treatment devices) are proposed to meet the water quality guidelines contained in the New York Stormwater Management Design Manual.

The water quality treatment volume is calculated using the following equation:

WQv = [(P) (Rv) (A)] / 12

Where:	WQV	=	water quality volume (acre-feet)
	P	=	90% Rainfall Event Number (see Figure 7 in the Figures section of this report)
	Rv	=	0.05 + 0.009(I), where I is percent impervious coverage
	A	=	site area in acres (contributing/redevelopment area)

This redevelopment project will meet the required water quality treatment by using the equation:

%WQv by Alternative Practice = (25 - (% IC + %WQv treatment by Standard Practice + % runoff reduction)) x 3

Where flow-based water quality measures are proposed such as a hydrodynamic separator, the WQv can be converted to a peak runoff rate using the methodology described in the New York Stormwater Management Manual. Supporting calculations for water quality volume and water quality peak runoff rates are located in Appendix C.

A state-approved alternative measure, a CDS unit, which is a hydrodynamic separator, will be used to treat the WQv by Alternative Practices percentage calculated from the equation above. The CDS unit will be located prior to one of the connection points to the North Midland Avenue drainage system. Supporting documentation for the CDS units are located in Appendices C and D.

Multiple rain gardens are proposed throughout the redevelopment area. These green infrastructure practices provide water quality benefits for its contributing watershed areas. Supporting calculations for the rain gardens are located in Appendices C and E of this report.

In addition to providing water quality measures, all new catch basin grates within the parking lot will be equipped with smaller openings on the curb pieces (eco "N" type) to prevent cans and plastic bottles from entering catch basins. The iron curbs and grates also educate the public to the detriments of pollution with messages permanently cast into their surfaces stating, "DUMP NO WASTE DRAINS TO WATERWAYS."

6.3 Runoff Reduction Volume

Although encouraged, meeting the Runoff Reduction Volume (RRv) sizing criteria is not required for redevelopment projects. However, impervious area will be reduced in proposed conditions, which will reduce the volume of runoff from the site.

7.0 STORM SEWER COLLECTION SYSTEM DESIGN

7.1 Design Criteria

The on-site subsurface storm sewer collection system is designed to convey the 25-year storm event.

7.2 Design Methodology

The storm sewer system was analyzed using the rational method for estimating runoff for the 25-year-design storms. The site was divided into sub-areas, each contributing runoff to an individual catch basin inlet or roof drain. Values for area, time of concentration, and runoff coefficient (c) were calculated for each contributing sub-area.

Values of time of concentration were chosen based on land cover and slope of the flow path from the hydraulically most distant point in the sub-area to the appropriate inlet. The average runoff coefficient, which is the ratio of peak runoff rate to the average rainfall rate for the period known as the time of concentration, was chosen using the following values:

Land Cover	Runoff Coefficient, c
Grass/Landscaping	0.30
Paved/Impervious	0.99

Rainfall intensities were taken from the rainfall intensity data for New York (Figure 8 – Rainfall Intensity-Duration-Frequency Data). Storm drainage pipes were then sized based on calculated flows using Manning's Equation and were verified by solving for the hydraulic grade line. Supporting calculations for the stormwater conveyance system are located in Appendix F of this report.

8.0 SOIL EROSION AND SEDIMENT CONTROL

Erosion control protection measures to be installed during construction are located on drawings CE101 and CE501, included in the Drawings section of this report and are in accordance with the guidelines contained in the latest version of the New York State Standards and Specifications for Erosion and Sediment Control. This plan represents a general overall erosion control protection scheme. Once detailed phasing documents are prepared, the erosion control measures will be phased to coincide with construction phasing and will be included in the future Stormwater Pollution Prevention Plan that will be developed for this project. Outlet protection for discharge pipes at rain gardens and erosion protection of sheet flow into rain gardens has been designed in accordance with the erosion control manual and is included in Appendix G of this report.

9.0 REFERENCES

Documents/Software:

1) New York State Stormwater Management Design Manual, New York Department of Environmental Conservation, January 2015.

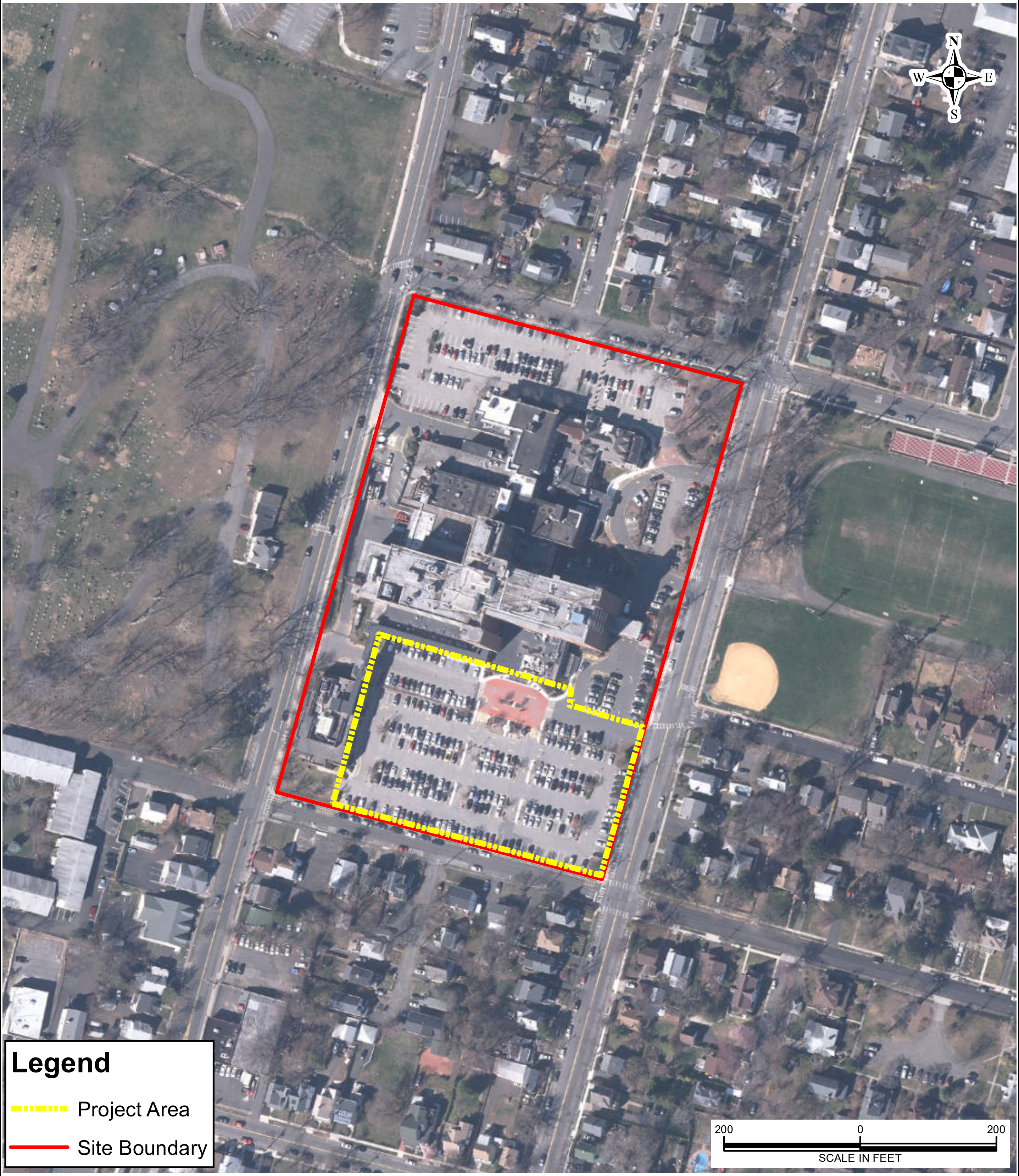
2) Hydrology Studio.

3) Stormwater Studio.

4) Urban Hydrology for Small Watersheds, TR-55, United States Department of Agriculture, June 1986.

5) New York State Standards and Specifications for Erosion and Sediment Control, New York State Department of Environmental Conservation, Division of Water, November 2016.

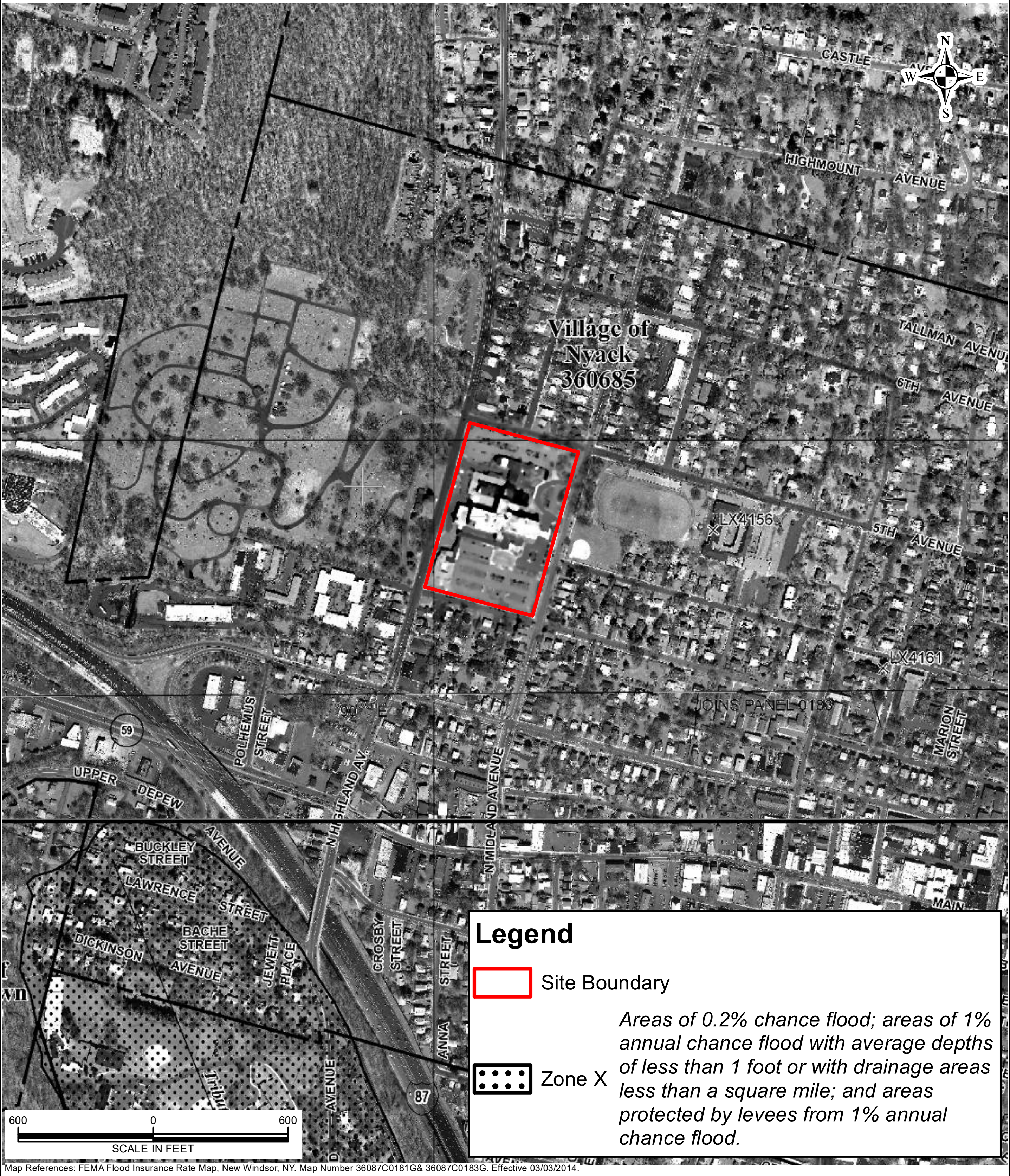
FIGURES



Map References: World Imagery basemap is provided through Langan's Esri ArcGIS software licensing and ArcGIS online.

LANGAN 300 Kimball Drive Parsippany, NJ 07054 T: 973.560.4900 F: 973.560.4901 www.langan.com Langan Engineering & Environmental Services, Inc. Langan Engineering, Environmental, Surveying, Landscape Architecture and Geology, D.P.C. Langan International LLC Collectively known as Langan NJ CERTIFICATE OF AUTHORIZATION No. 24GA27996400	Project NYACK HOSPITAL PARKING STRUCTURE BLOCK No. 1, LOT No. 74 VILLAGE OF NYACK ROCKLAND COUNTY NEW YORK	Drawing Title SITE LOCATION MAP	Project No. 100754201 Date 3/10/2019 Scale 1 " = 200 ' Drawn By IHB Checked By	Figure 1

Path: \\langan.com\data\PAR\data2\100754201\Project Data\ArcGIS\MXD\Civil_Figures\Figure 1 - Site Location Map.mxd



Map References: FEMA Flood Insurance Rate Map, New Windsor, NY. Map Number 36087C0181G& 36087C0183G. Effective 03/03/2014.

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Project	Drawing Title	Project No.	Figure
NYACK HOSPITAL PARKING STRUCTURE BLOCK No. 1, LOT No. 74 VILLAGE OF NYACK ROCKLAND COUNTY NEW YORK	FLOOD INSURANCE RATE MAP (FIRM)	100754201 Date: 3/10/2019 Scale: 1 " = 600 ' Drawn By: IHB Checked By:	2

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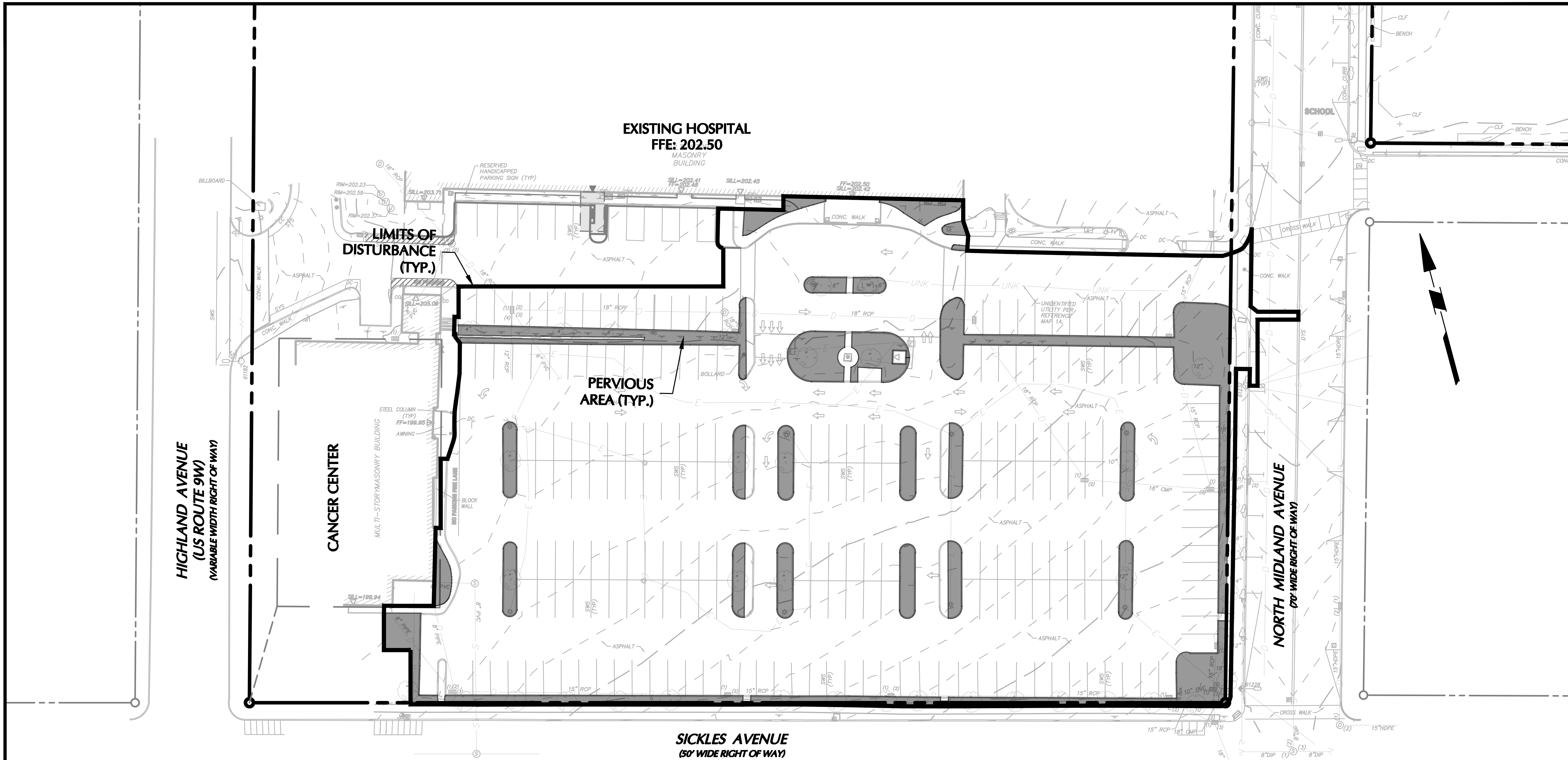

EXISTING LAND COVERAGE AREA WITHIN THE LIMITS OF DISTURBANCE (94,310 SF)	
PERVIOUS AREA*	12,480 SF
IMPERVIOUS AREA	81,830 SF

*SHADED AREA REPRESENTS PERVIOUS AREA

WARNING: IT IS A VIOLATION OF THE NYS EDUCATION LAW ARTICLE 145 FOR ANY PERSON, UNLESS HE IS ACTING UNDER THE DIRECTION OF A LICENSED PROFESSIONAL ENGINEER, TO ALTER THIS ITEM IN ANY WAY.

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SCALE: 1" = 50'

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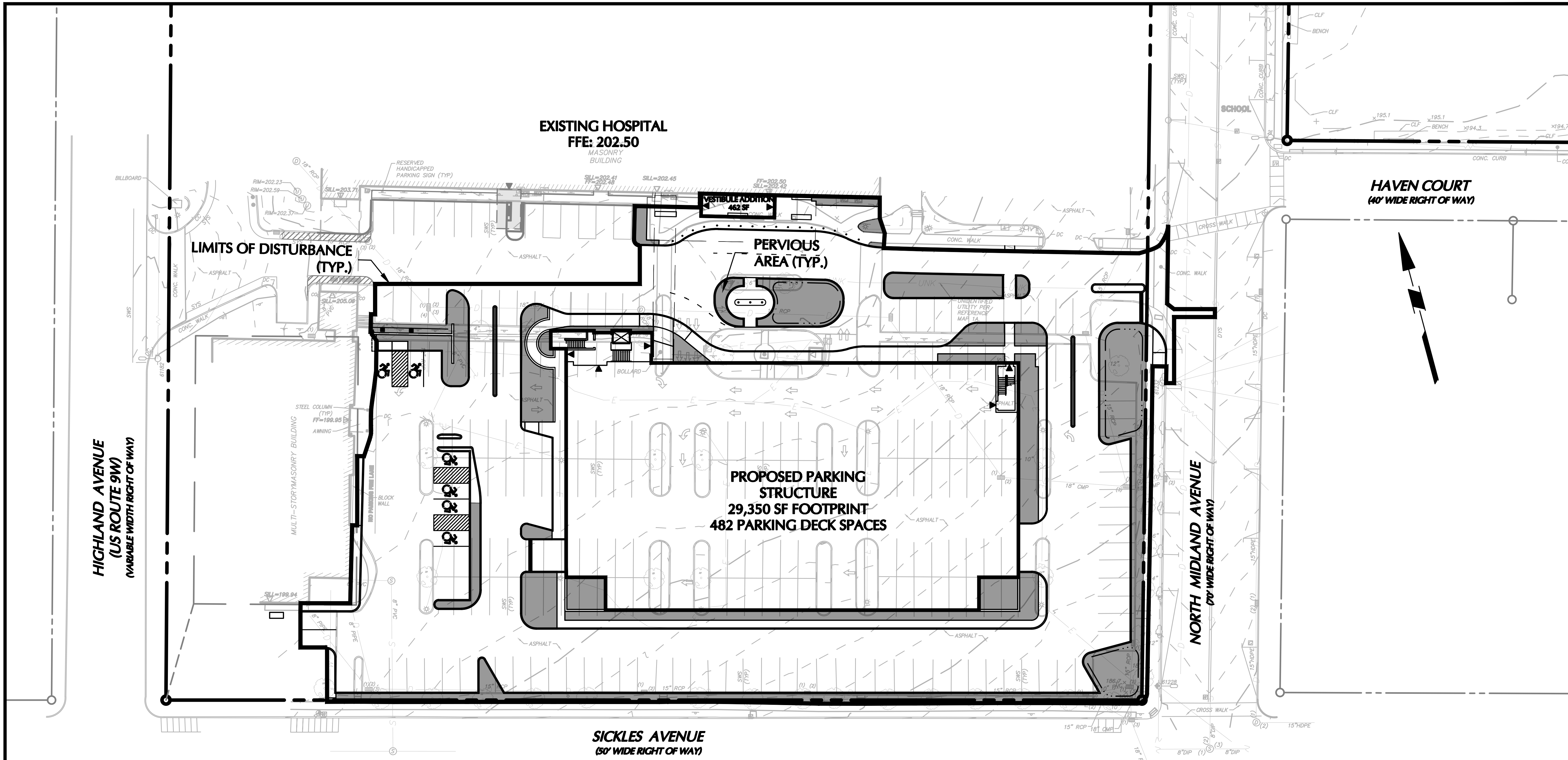
Project
NYACK HOSPITAL PARKING STRUCTURE
BLOCK No. 1, LOT No.74
VILLAGE OF NYACK
ROCKLAND COUNTY NEW YORK

Drawing Title
EXISTING COVERAGE AREA MAP

Project No. 100754201
Date 03/17/2020
Drawn By VP
Checked By LM

3

Filename: \\langan.com\data\PAR\data2\100754201\project data\CAD\01\sheetfiles\Figures\Figure 3 - Existing Pervious Coverage Map.dwg Date: 3/16/2020 Time: 17:46 User: vipatel Style Table: Langan.stb Layout: Existing Pervious Coverage



PROPOSED LAND COVERAGE AREA WITHIN THE LIMITS OF DISTURBANCE (94,310 SF)	
PERVIOUS AREA*	13,670 SF
IMPERVIOUS AREA	80,640 SF

* SHADED AREA REPRESENTS PERVIOUS AREA

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SCALE: 1" = 50'

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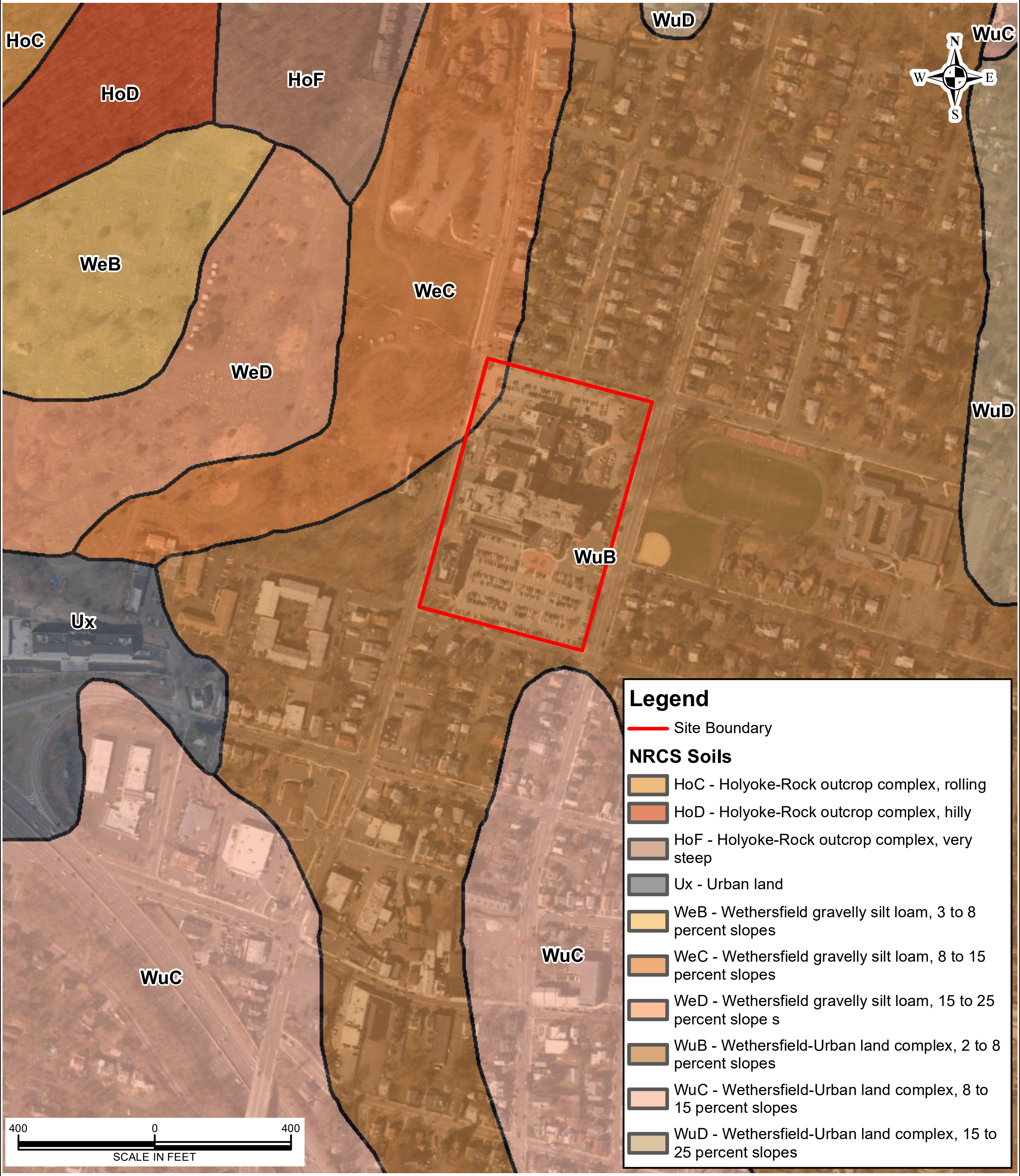
Project
NYACK HOSPITAL PARKING STRUCTURE
BLOCK No. 1, LOT No.74
VILLAGE OF NYACK
ROCKLAND COUNTY NEW YORK

Drawing Title
PROPOSED COVERAGE AREA MAP

Project No. 100754201
Date 03/17/2020
Drawn By VP
Checked By LM

4

Filename: \\langan.com\data\PAR\data2\100754201\project data\CAD\01\sheetfiles\Figures\Figure 4 - Proposed Pervious Coverage Map.dwg Date: 3/16/2020 Time: 17:50 User: vipatel Style Table: Langan.stb Layout: Proposed Pervious Coverage



Map References: NRCS Soil Survey data for Rockland County provided by the U.S. Department of Agricuture Web Soil Survey, last revised 2019; Aerial imagery by Langan's ESRI ArcGIS software licensing.

LANGAN 300 Kimball Drive Parsippany, NJ 07054 T: 973.560.4900 F: 973.560.4901 www.langan.com Langan Engineering & Environmental Services, Inc. Langan Engineering, Environmental, Surveying, Landscape Architecture and Geology, D.P.C. Langan International LLC Collectively known as Langan NJ CERTIFICATE OF AUTHORIZATION No. 24GA27996400	Project NYACK HOSPITAL PARKING STRUCTURE BLOCK No. 1, LOT No. 74 VILLAGE OF NYACK ROCKLAND COUNTY NEW YORK	Drawing Title SOIL SURVEY MAP	Project No. 100754201 Date 3/10/2019 Scale 1 " = 400 ' Drawn By IHB Checked By	Figure 5

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Extreme Precipitation Estimates

	5min	10min	15min	30min	60min	120min		1hr	2hr	3hr	6hr	12hr	24hr	48hr		1day	2day	4day	7day	10day	
1yr	0.33	0.51	0.63	0.83	1.03	1.29	1yr	0.89	1.24	1.48	1.83	2.26	2.79	3.18	1yr	2.47	3.06	3.55	4.26	4.91	1yr
2yr	0.41	0.63	0.78	1.01	1.27	1.58	2yr	1.10	1.49	1.81	2.24	2.77	3.41	3.84	2yr	3.02	3.69	4.25	5.03	5.71	2yr
5yr	0.47	0.73	0.91	1.22	1.56	1.98	5yr	1.35	1.83	2.28	2.83	3.49	4.28	4.87	5yr	3.79	4.68	5.41	6.27	7.04	5yr
10yr	0.52	0.82	1.04	1.41	1.83	2.34	10yr	1.58	2.15	2.71	3.37	4.15	5.09	5.83	10yr	4.50	5.60	6.51	7.42	8.25	10yr
25yr	0.61	0.96	1.23	1.70	2.26	2.92	25yr	1.95	2.66	3.40	4.24	5.24	6.40	7.40	25yr	5.66	7.12	8.31	9.27	10.19	25yr
50yr	0.69	1.10	1.41	1.98	2.66	3.45	50yr	2.29	3.13	4.04	5.05	6.24	7.62	8.88	50yr	6.74	8.54	9.99	10.98	11.95	50yr
100yr	0.77	1.25	1.62	2.29	3.12	4.09	100yr	2.70	3.68	4.80	6.02	7.43	9.08	10.65	100yr	8.04	10.24	12.03	13.00	14.03	100yr
200yr	0.88	1.43	1.86	2.66	3.68	4.86	200yr	3.18	4.33	5.71	7.18	8.87	10.83	12.78	200yr	9.58	12.29	14.49	15.40	16.48	200yr
500yr	1.05	1.72	2.25	3.26	4.57	6.08	500yr	3.95	5.37	7.17	9.05	11.20	13.68	16.29	500yr	12.11	15.66	18.54	19.27	20.40	500yr

Lower Confidence Limits

	5min	10min	15min	30min	60min	120min		1hr	2hr	3hr	6hr	12hr	24hr	48hr		1day	2day	4day	7day	10day	
1yr	0.28	0.43	0.52	0.70	0.86	1.14	1yr	0.75	1.11	1.26	1.68	2.12	2.32	2.89	1yr	2.06	2.78	3.33	3.87	4.32	1yr
2yr	0.38	0.59	0.73	0.99	1.22	1.47	2yr	1.05	1.44	1.68	2.17	2.70	3.30	3.73	2yr	2.92	3.59	4.11	4.86	5.54	2yr
5yr	0.43	0.67	0.83	1.14	1.45	1.73	5yr	1.25	1.69	1.97	2.56	3.15	4.02	4.51	5yr	3.56	4.33	5.01	5.84	6.53	5yr
10yr	0.48	0.73	0.91	1.27	1.64	1.94	10yr	1.41	1.90	2.22	2.86	3.52	4.55	5.19	10yr	4.03	4.99	5.80	6.60	7.25	10yr
25yr	0.54	0.82	1.02	1.46	1.92	2.27	25yr	1.65	2.22	2.60	3.34	4.09	5.48	6.27	25yr	4.85	6.03	7.18	7.86	8.37	25yr
50yr	0.60	0.91	1.13	1.62	2.18	2.56	50yr	1.88	2.51	2.94	3.78	4.58	6.30	7.23	50yr	5.58	6.95	8.36	8.96	9.32	50yr
100yr	0.66	1.00	1.25	1.81	2.48	2.90	100yr	2.14	2.84	3.33	4.29	5.15	7.27	8.32	100yr	6.43	8.00	9.74	10.22	10.38	100yr
200yr	0.73	1.10	1.40	2.02	2.82	3.29	200yr	2.44	3.21	3.78	4.89	5.81	8.42	9.61	200yr	7.45	9.24	11.36	11.66	11.52	200yr
500yr	0.85	1.27	1.63	2.37	3.37	3.89	500yr	2.91	3.81	4.49	5.85	6.84	10.24	11.65	500yr	9.06	11.20	13.92	13.87	13.20	500yr

Upper Confidence Limits

	5min	10min	15min	30min	60min	120min		1hr	2hr	3hr	6hr	12hr	24hr	48hr		1day	2day	4day	7day	10day	
1yr	0.37	0.57	0.70	0.94	1.15	1.40	1yr	1.00	1.37	1.65	2.14	2.47	2.99	3.41	1yr	2.64	3.28	3.83	4.61	5.28	1yr
2yr	0.42	0.64	0.79	1.07	1.32	1.59	2yr	1.14	1.55	1.81	2.34	2.94	3.53	4.00	2yr	3.12	3.85	4.39	5.21	5.95	2yr
5yr	0.50	0.78	0.97	1.33	1.69	2.02	5yr	1.46	1.97	2.34	3.02	3.82	4.56	5.23	5yr	4.03	5.03	5.85	6.73	7.51	5yr
10yr	0.59	0.91	1.13	1.58	2.04	2.43	10yr	1.76	2.38	2.81	3.65	4.67	5.65	6.46	10yr	5.00	6.21	7.27	8.32	9.16	10yr
25yr	0.74	1.12	1.39	1.99	2.61	3.11	25yr	2.26	3.04	3.62	4.72	6.11	7.40	8.54	25yr	6.55	8.21	9.48	10.88	11.77	25yr
50yr	0.86	1.32	1.64	2.35	3.17	3.77	50yr	2.73	3.69	4.37	5.74	7.46	9.05	10.54	50yr	8.01	10.13	11.74	13.34	14.25	50yr
100yr	1.03	1.55	1.94	2.81	3.85	4.55	100yr	3.32	4.45	5.29	6.99	9.12	11.09	13.00	100yr	9.82	12.50	14.56	16.35	17.26	100yr
200yr	1.21	1.83	2.31	3.35	4.67	5.49	200yr	4.03	5.37	6.39	8.48	11.15	13.59	16.07	200yr	12.03	15.45	18.04	20.05	20.91	200yr
500yr	1.53	2.28	2.93	4.26	6.06	7.06	500yr	5.23	6.90	8.19	10.97	14.53	17.80	21.24	500yr	15.75	20.42	23.98	26.29	27.01	500yr

Powered by ACIS
Northeast Regional Climate Center

Map References: Extreme Precipitation Tables provided through the Northeast Regional Climate Center, dated 10 March 2020.

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Langan International LLC
Collectively known as Langan
NJ CERTIFICATE OF AUTHORIZATION No. 24GA27996400

Project
NYACK HOSPITAL PARKING STRUCTURE
BLOCK No. 1, LOT No. 74
VILLAGE OF NYACK
ROCKLAND COUNTY NEW YORK

Drawing Title
EXTREME PRECIPITATION TABLES

Project No. 100754201
Date 3/10/2019
Scale
Drawn By IHB
Checked By

Figure 6

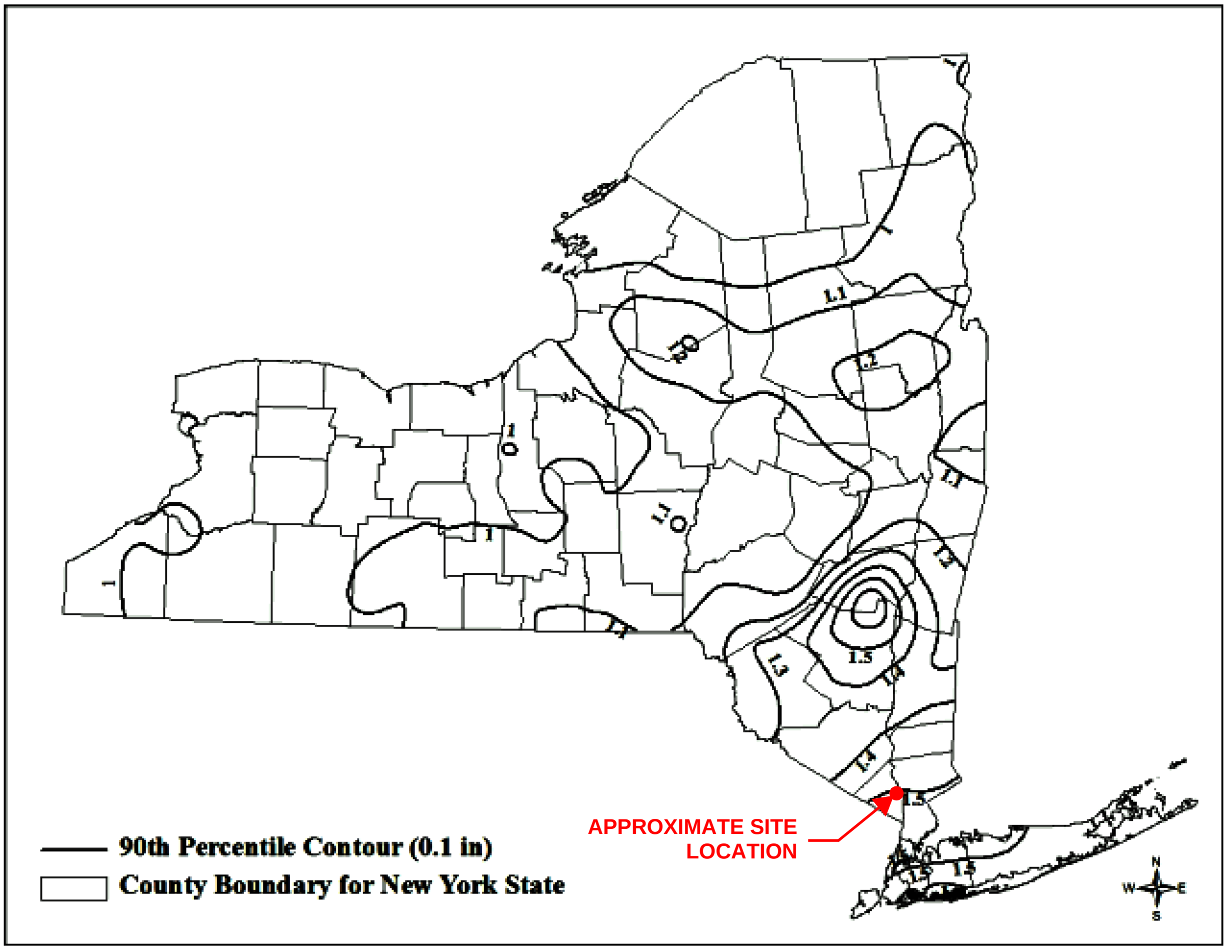
Path: \\langan.com\data\PAR\data2\100754201\Project Data\ArcGIS\MXD\Civil_Figures\Figure 6 - Extreme Precipitation Tables.mxd

New York State Stormwater Management Design Manual

Chapter 4: Unified Stormwater Sizing Criteria

Section 4.2 Water Quality Volume (WQv)

Figure 4.1: 90th Percentile Rainfall in New York State (NYSDEC, 2013)



Map References: 90th Percentile Rainfall Map provided through the New York State Stormwater Management Design (2013)

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Path: \\langan.com\data\PAR\data2\100754201\Project Data\ArcGIS\MXD\Civil_Figures\Figure 7 - Rainfall Event.mxd

NOAA Atlas 14, Volume 10, Version 3
Location name: Nyack, New York, USA*
Latitude: 41.096°, Longitude: -73.926°
Elevation: 201.72 ft**
* source: ESRI Maps
** source: USGS

N
W E
S

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sandra Pavlovic, Michael St. Laurent, Carl Trypaluk, Dale Unruh, Orlan Wilhite

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

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

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	4.38 (3.46-5.51)	5.15 (4.04-6.48)	6.40 (5.02-8.08)	7.43 (5.80-9.43)	8.86 (6.66-11.7)	9.95 (7.31-13.4)	11.1 (7.85-15.3)	12.2 (8.27-17.5)	13.8 (9.00-20.5)	15.1 (9.56-22.8)
10-min	3.10 (2.45-3.90)	3.65 (2.87-4.58)	4.54 (3.56-5.72)	5.27 (4.11-6.69)	6.28 (4.72-8.27)	7.04 (5.18-9.47)	7.83 (5.56-10.9)	8.66 (5.86-12.4)	9.80 (6.37-14.5)	10.7 (6.77-16.1)
15-min	2.44 (1.92-3.06)	2.86 (2.25-3.60)	3.55 (2.78-4.48)	4.13 (3.22-5.24)	4.92 (3.70-6.49)	5.52 (4.06-7.43)	6.14 (4.36-8.53)	6.80 (4.60-9.71)	7.69 (5.00-11.4)	8.39 (5.31-12.7)
30-min	1.69 (1.33-2.12)	1.98 (1.56-2.49)	2.45 (1.92-3.10)	2.85 (2.22-3.61)	3.39 (2.55-4.46)	3.80 (2.79-5.10)	4.22 (2.99-5.85)	4.66 (3.15-6.66)	5.25 (3.41-7.76)	5.71 (3.62-8.62)
60-min	1.08 (0.851-1.36)	1.26 (0.995-1.59)	1.57 (1.23-1.97)	1.81 (1.41-2.30)	2.16 (1.62-2.84)	2.42 (1.78-3.25)	2.69 (1.90-3.72)	2.96 (2.01-4.23)	3.33 (2.17-4.92)	3.62 (2.29-5.45)
2-hr	0.719 (0.570-0.898)	0.832 (0.660-1.04)	1.02 (0.804-1.28)	1.17 (0.921-1.48)	1.39 (1.05-1.81)	1.55 (1.14-2.07)	1.71 (1.22-2.36)	1.89 (1.28-2.68)	2.12 (1.39-3.12)	2.31 (1.47-3.46)
3-hr	0.555 (0.442-0.690)	0.644 (0.512-0.801)	0.789 (0.626-0.985)	0.909 (0.716-1.14)	1.07 (0.816-1.40)	1.20 (0.890-1.60)	1.33 (0.953-1.83)	1.47 (1.00-2.08)	1.66 (1.08-2.43)	1.81 (1.15-2.70)
6-hr	0.346 (0.278-0.427)	0.407 (0.326-0.503)	0.507 (0.405-0.629)	0.590 (0.469-0.736)	0.705 (0.540-0.916)	0.791 (0.592-1.05)	0.881 (0.638-1.21)	0.982 (0.671-1.38)	1.13 (0.737-1.64)	1.24 (0.793-1.84)
12-hr	0.205 (0.166-0.251)	0.248 (0.200-0.304)	0.317 (0.255-0.391)	0.375 (0.300-0.465)	0.455 (0.351-0.590)	0.515 (0.388-0.681)	0.578 (0.422-0.794)	0.651 (0.447-0.910)	0.759 (0.498-1.10)	0.848 (0.542-1.25)
24-hr	0.119 (0.097-0.145)	0.146 (0.119-0.178)	0.191 (0.155-0.234)	0.228 (0.184-0.281)	0.280 (0.217-0.360)	0.318 (0.241-0.419)	0.359 (0.264-0.491)	0.407 (0.280-0.564)	0.478 (0.315-0.686)	0.538 (0.345-0.786)
2-day	0.068 (0.056-0.082)	0.083 (0.068-0.101)	0.109 (0.089-0.133)	0.130 (0.106-0.159)	0.160 (0.125-0.205)	0.182 (0.139-0.238)	0.205 (0.152-0.279)	0.233 (0.161-0.321)	0.274 (0.181-0.391)	0.309 (0.199-0.449)
3-day	0.049 (0.041-0.060)	0.061 (0.050-0.073)	0.079 (0.065-0.095)	0.094 (0.076-0.114)	0.115 (0.090-0.146)	0.130 (0.100-0.169)	0.147 (0.109-0.199)	0.166 (0.115-0.228)	0.196 (0.130-0.278)	0.221 (0.143-0.320)
4-day	0.040 (0.033-0.048)	0.049 (0.040-0.058)	0.063 (0.052-0.076)	0.075 (0.061-0.090)	0.091 (0.071-0.115)	0.103 (0.079-0.134)	0.116 (0.086-0.157)	0.131 (0.091-0.180)	0.154 (0.103-0.219)	0.174 (0.113-0.252)
7-day	0.027 (0.022-0.032)	0.032 (0.027-0.039)	0.041 (0.034-0.049)	0.048 (0.040-0.059)	0.059 (0.046-0.074)	0.066 (0.051-0.085)	0.074 (0.055-0.099)	0.084 (0.058-0.114)	0.098 (0.065-0.138)	0.110 (0.071-0.157)
10-day	0.022 (0.018-0.026)	0.026 (0.021-0.031)	0.032 (0.027-0.039)	0.038 (0.031-0.045)	0.045 (0.036-0.057)	0.051 (0.039-0.065)	0.057 (0.042-0.075)	0.063 (0.044-0.086)	0.074 (0.049-0.103)	0.082 (0.053-0.117)
20-day	0.015 (0.013-0.018)	0.018 (0.015-0.021)	0.021 (0.018-0.025)	0.024 (0.020-0.029)	0.028 (0.023-0.035)	0.032 (0.025-0.040)	0.035 (0.026-0.046)	0.039 (0.027-0.052)	0.044 (0.029-0.061)	0.047 (0.031-0.067)
30-day	0.013 (0.011-0.015)	0.014 (0.012-0.017)	0.017 (0.014-0.020)	0.019 (0.016-0.023)	0.022 (0.018-0.027)	0.025 (0.019-0.031)	0.027 (0.020-0.035)	0.029 (0.021-0.039)	0.033 (0.022-0.045)	0.035 (0.023-0.049)
45-day	0.011 (0.009-0.012)	0.012 (0.010-0.014)	0.014 (0.012-0.016)	0.015 (0.013-0.018)	0.017 (0.014-0.021)	0.019 (0.015-0.024)	0.021 (0.016-0.027)	0.022 (0.016-0.030)	0.025 (0.017-0.034)	0.026 (0.017-0.037)
60-day	0.009 (0.008-0.011)	0.010 (0.009-0.012)	0.012 (0.010-0.014)	0.013 (0.011-0.015)	0.015 (0.012-0.018)	0.016 (0.013-0.020)	0.017 (0.013-0.022)	0.019 (0.013-0.025)	0.020 (0.014-0.028)	0.021 (0.014-0.030)

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

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

Please refer to NOAA Atlas 14 document for more information.

Back to Top

Map References: NOAA Atlas 14, Volume 10, Version 3.

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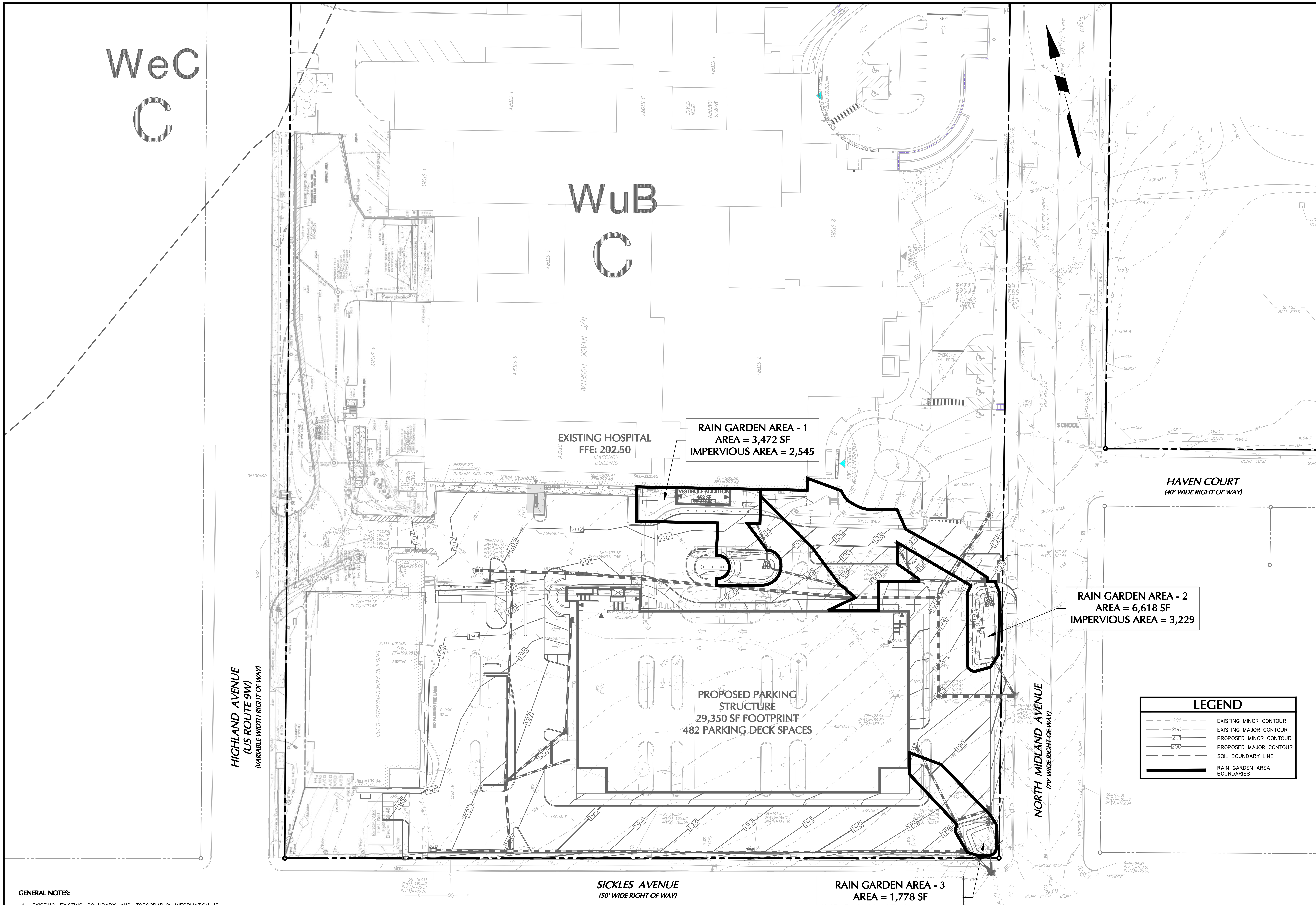
Langan International LLC
Collectively known as Langan
NJ CERTIFICATE OF AUTHORIZATION No. 24GA27996400

Project
NYACK HOSPITAL PARKING STRUCTURE
BLOCK No. 1, LOT No. 74
VILLAGE OF NYACK
ROCKLAND COUNTY NEW YORK

Drawing Title
RAINFALL INTENSITY- DURATION-FREQUENCY DATA

Project No. 100754201
Date 3/10/2019
Scale
Drawn By IHB
Checked By
Figure 8

Path: \\langan.com\data\PAR\data2\100754201\Project Data\ArcGIS\MXD\Civil_Figures\Figure 8 - Rainfall Intensity.mxd



GENERAL NOTES:

1. EXISTING EXISTING BOUNDARY AND TOPOGRAPHY INFORMATION IS BASED ON PLAN TITLED "EXISTING CONDITIONS PLAN", PREPARED BY LRC GROUP, DATED 08/22/2016; AND FIELD DATA OBTAINED BY LANGAN ENGINEERING, ENVIRONMENTAL, SURVEYING, LANDSCAPE ARCHITECTURE AND GEOLOGY, D.P.C. ON 1/23/2020.
2. ELEVATIONS SHOWN ARE REFERENCED TO THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD 88).
3. THE MERIDIAN OF THE SURVEY IS REFERENCED TO NEW YORK STATE PLANE COORDINATE EAST SYSTEM NAD1983 (2011) DERIVED USING SURVEY–GRADE GNSS EQUIPMENT.

WARNING:
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30 0 15 30
SCALE: 1" = 30'

Date	Description	No.

REVISIONS

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Project
NYACK HOSPITAL
PARKING STRUCTURE

BLOCK No. 1, LOT No.74
VILLAGE OF NYACK
ROCKLAND COUNTY NEW YORK

Drawing Title
RAIN GARDEN
DRAINAGE AREA

Project No. 100754201
Date 03/17/2020
Drawn By VP
Checked By LM
Drawing No. 9

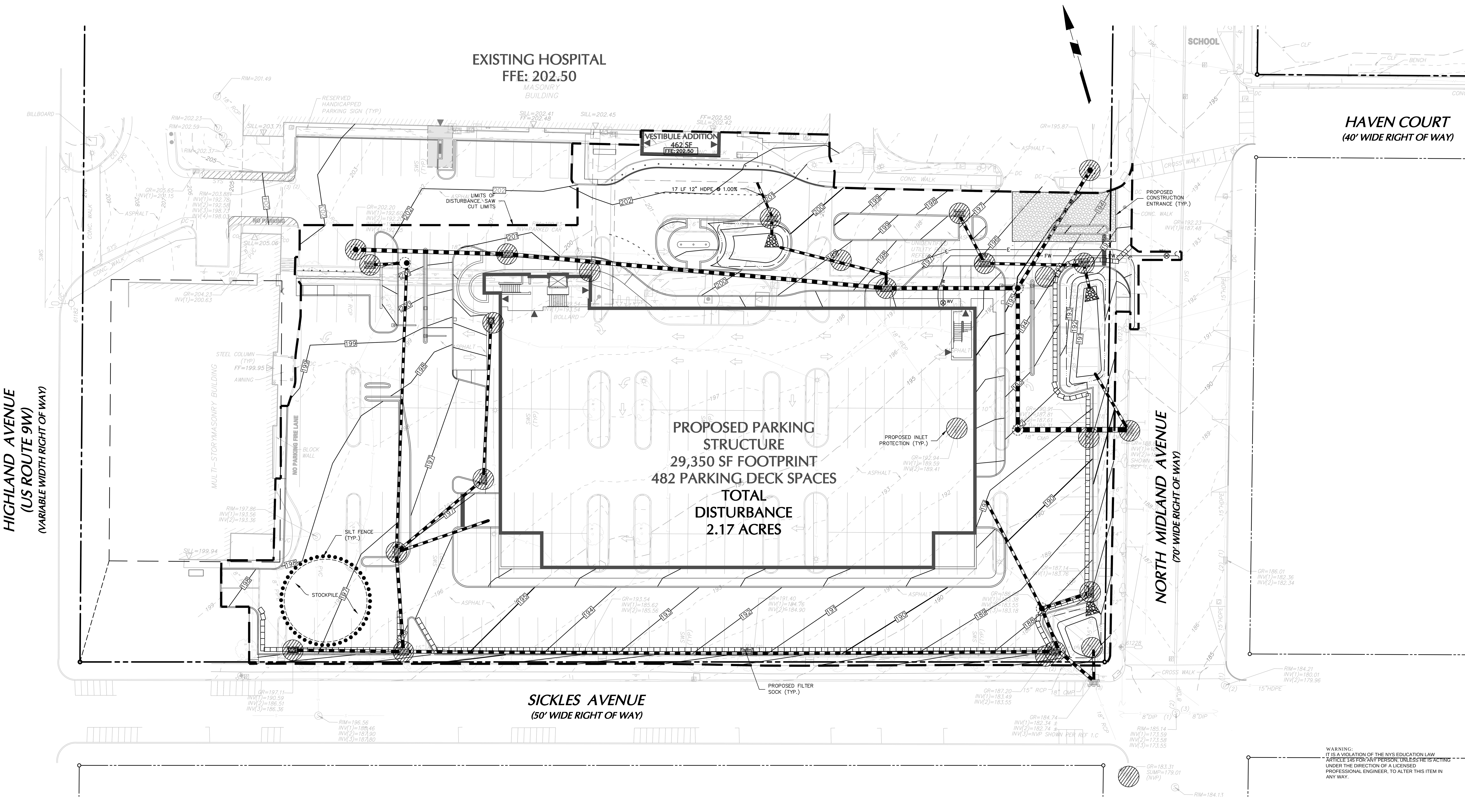
LANGAN
PROJECT NO. 100754201

Filename: \\langan.com\data\PAR\data2\100754201\project data\CAD\01\sheetfiles\Figures\Figure 9 - Rain Garden Drainage Area.dwg Date: 3/17/2020 Time: 21:20 User: vipatel Style Table: Langan.stb Layout: 9

DRAWINGS

GENERAL NOTES

1. EXISTING BOUNDARY AND TOPOGRAPHY INFORMATION IS BASED ON PLAN TITLED "EXISTING CONDITIONS PLAN", PREPARED BY LRC GROUP, DATED 08/22/2016; AND FIELD DATA OBTAINED BY LANGAN ENGINEERING, ENVIRONMENTAL, SURVEYING, LANDSCAPE ARCHITECTURE AND GEOLOGY, D.P.C. ON 1/23/2020.
2. ELEVATIONS SHOWN ARE REFERENCED TO THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD 88).
3. REFER TO CE501 FOR SOIL EROSION AND SEDIMENT CONTROL NOTES AND DETAILS.



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Date	Description	No.
REVISIONS		

SIGNATURE — DATE SIGNED
MICHAEL J. FOWLER
PROFESSIONAL ENGINEER NY Lic. No. 102374

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Project
NYACK HOSPITAL PARKING STRUCTURE
BLOCK No. 1, LOT No.74
VILLAGE OF NYACK
ROCKLAND COUNTY — NEW YORK

Drawing Title
SOIL EROSION & SEDIMENT CONTROL PLAN

Project No. 100754201
Date 03/17/2020
Drawn By VP
Checked By LM
Drawing No. CE101

PROJECT NO. 100754201

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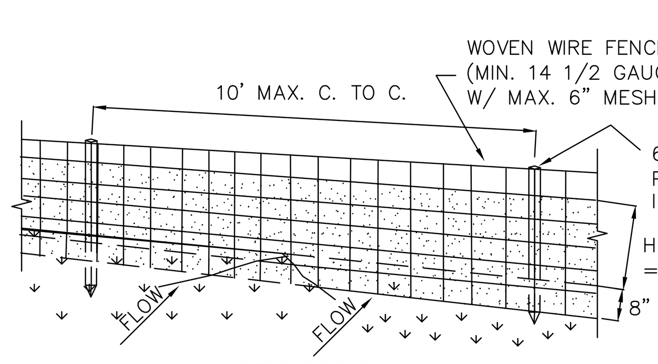
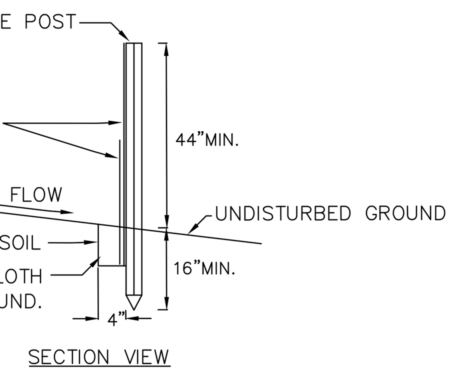


PERSPECTIVE VIEW

SLOPE STEEPNESS	MAXIMUM LENGTH (FT)
2:1	25
3:1	50
4:1	75
5:1 OR FLATTER	100



SECTION VIEW

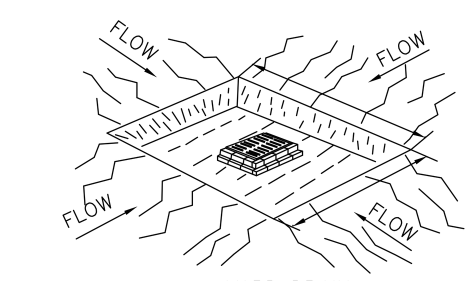
CONSTRUCTION SPECIFICATIONS

1. WOVEN WIRE FENCE TO BE FASTENED SECURELY TO FENCE POSTS WITH WIRE TIES OR STAPLES. POSTS SHALL BE STEEL EITHER "T" OR "U" TYPE OR HARDWOOD.
2. FILTER CLOTH TO BE TO BE FASTENED SECURELY TO WOVEN WIRE FENCE WITH TIES SPACED EVERY 24" AT TOP AND MID SECTION. FENCE SHALL BE WOVEN WIRE, 12 1/2 GAUGE, 6" MAXIMUM MESH OPENING.
3. WHEN TWO SECTIONS OF FILTER CLOTH ADJOIN EACH OTHER THEY SHALL BE OVER-LAPPED BY SIX INCHES AND FOLDED. FILTER CLOTH SHALL BE EITHER FILTER X, MIRAFI 100X, STABILINKA T140N, OR APPROVED EQUIVALENT.
4. PREFABRICATED UNITS SHALL BE GEOFAB, ENVIROFENCE, OR APPROVED EQUIVALENT.
5. MAINTENANCE SHALL BE PERFORMED AS NEEDED AND MATERIAL REMOVED WHEN "BULGES" DEVELOP IN THE SILT FENCE.

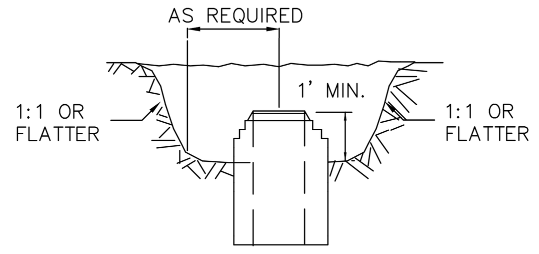
ADAPTED FROM NEW YORK STATE STANDARDS AND SPECIFICATIONS FOR EROSION AND SEDIMENT CONTROL

NTS

SILT FENCE



YARD DRAIN



CROSS SECTION

CONSTRUCTION SPECIFICATIONS

1. CLEAR THE AREA OF ALL DEBRIS THAT WILL HINDER EXCAVATION.

2. GRADE APPROACH TO THE INLET UNIFORMLY AROUND THE BASIN.

3. WEEP HOLES SHALL BE PROTECTED BY GRAVEL.

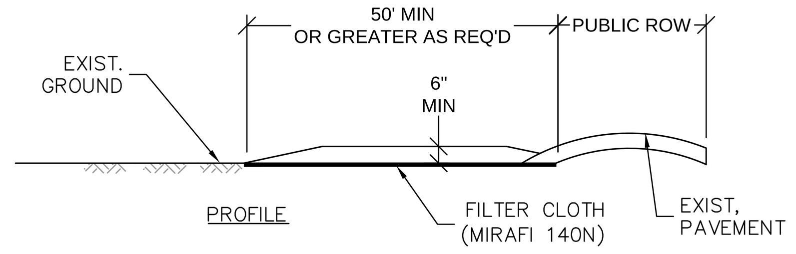
4. UPON STABILIZATION OF CONTRIBUTING DRAINAGE AREA, SEAL WEEP HOLES, FILL EXCAVATION WITH STABLE SOIL TO FINAL GRADE, COMPACT IT PROPERLY AND STABILIZE WITH PERMANENT SEEDING.

MAXIMUM DRAINAGE AREA 1 ACRE

ADAPTED FROM NEW YORK STATE STANDARDS AND SPECIFICATIONS FOR EROSION AND SEDIMENT CONTROL

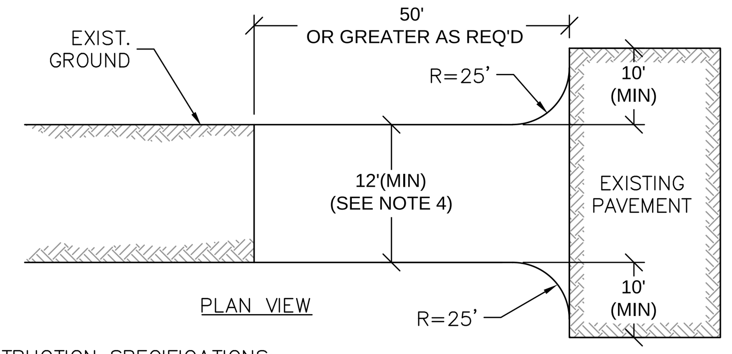
NTS

INLET PROTECTION



PROFILE

NOTE:
PROVIDE APPROPRIATE TRANSITION BETWEEN STABILIZED CONSTRUCTION ENTRANCE AND PUBLIC R.O.W.



PLAN VIEW

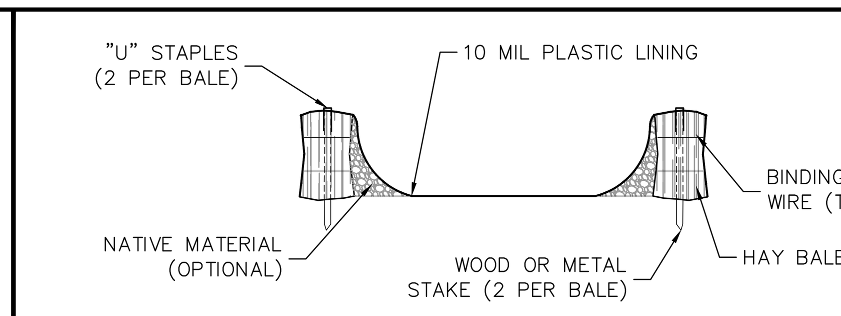
CONSTRUCTION SPECIFICATIONS:

1. STONE SIZE – USE 3" STONE (NYSDOT ITEM #623.11 SIZE DESIGNATION #2, OR RECLAIMED OR RECYCLED CONCRETE EQUIVALENT.
2. LENGTH – NOT LESS THAN 50 FEET
3. THICKNESS – NOT LESS THAN SIX (6) INCHES.
4. WIDTH – TWELVE (12) FOOT MINIMUM. BUT NOT LESS THAN THE FULL WIDTH AT POINTS WHERE INGRESS OR EGRESS OCCURS. TWENTY–FOUR (24) FOOT IF SINGLE ENTRANCE TO SITE.
5. FILTER CLOTH – WILL BE PLACED OVER THE ENTIRE AREA PRIOR TO PLACING OF STONE.
6. SURFACE WATER – ALL SURFACE WATER FLOWING OR DIVERTED TOWARD CONSTRUCTION ENTRANCES SHALL BE PIPED ACROSS THE ENTRANCE. IF PIPING IS IMPRACTICAL. A MOUNTABLE BERM WITH 5:1 SLOPES WILL BE PERMITTED
7. MAINTENANCE – THE ENTRANCE SHALL BE MAINTAINED IN A CONDITION WHICH WILL PREVENT TRACKING OR FLOWING OF SEDIMENT ONTO PUBLIC RIGHTS–OF–WAY. ALL SEDIMENT SPILLED, DROPPED, WASHED OR TRACTED ONTO PUBLIC RIGHTS–OF–WAY MUST BE REMOVED IMMEDIATELY.
8. WHEN WASHING IS REQUIRED, IT SHALL BE DONE ON A AREA STABILIZED WITH STONE AND WHICH DRAINS INTO AN APPROVED SEDIMENT TRAPPING DEVICE.
9. PERIODIC INSPECTION AND NEEDED MAINTENANCE SHALL BE PROVIDED AFTER EACH RAIN.

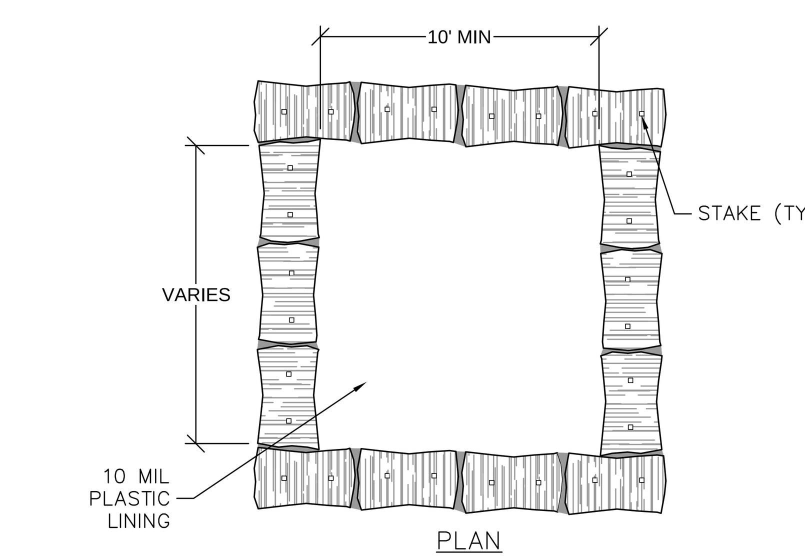
ADAPTED FROM NEW YORK STATE STANDARDS AND SPECIFICATIONS

NTS

STABILIZED CONSTRUCTION ACCESS



SECTION



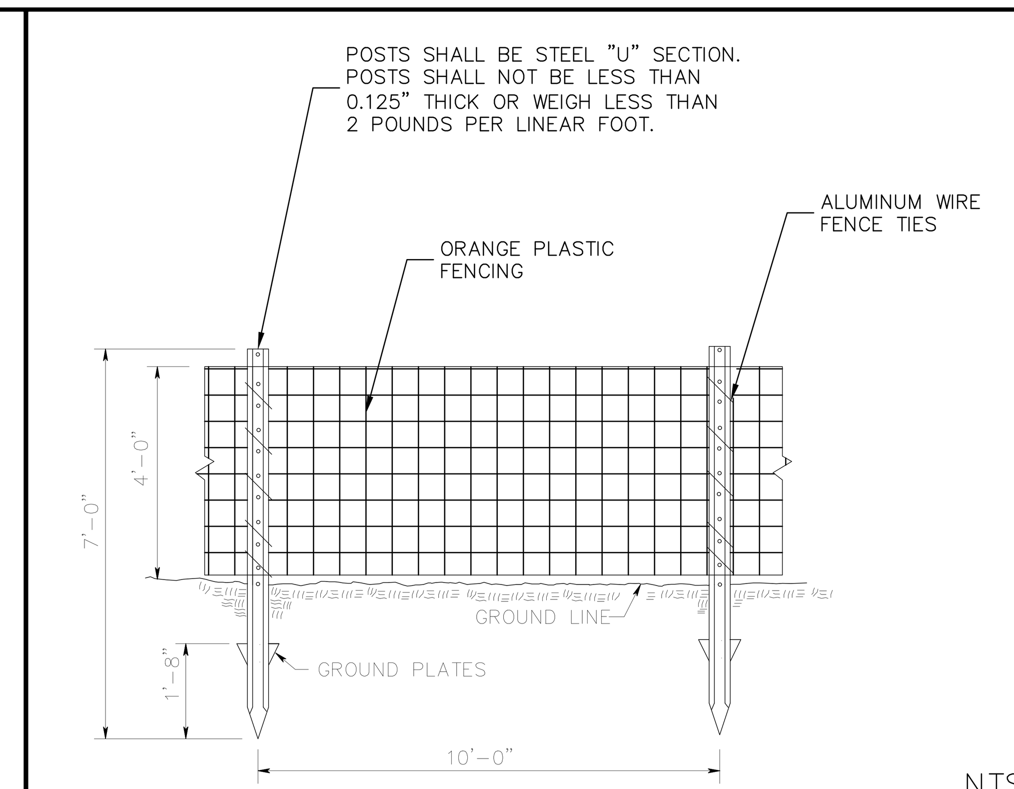
PLAN

NOTES:

1. CONCRETE WASHOUT SIGN TO BE INSTALLED WITHIN 30 FEET OF THE TEMPORARY CONCRETE WASHOUT FACILITY.
2. REMOVE HARDENED CONCRETE WHEN WITHIN 4" FROM TOP OF STRUCTURE.
3. CONSTRUCT NEW FACILITIES ONCE CURRENT FACILITIES ARE TWO–THIRDS FULL.
4. LINERS, HAYBALES, ET.C SHALL BE INSPECTED FOR DAMAGE. ANY DAMAGE SHALL BE REPAIRED PROMPTLY.

NTS

ABOVE GROUND TEMPORARY CONCRETE WASHOUT FACILITY

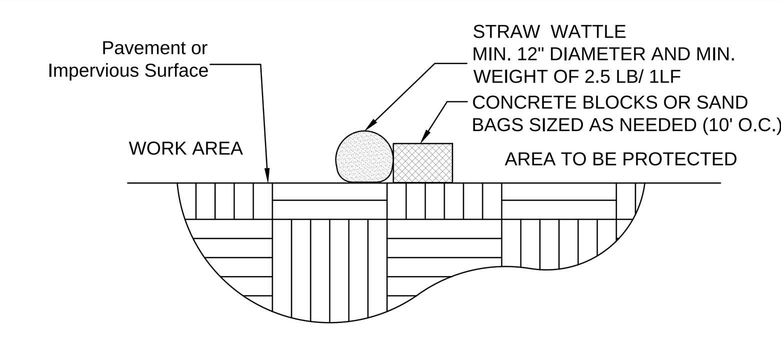


NTS

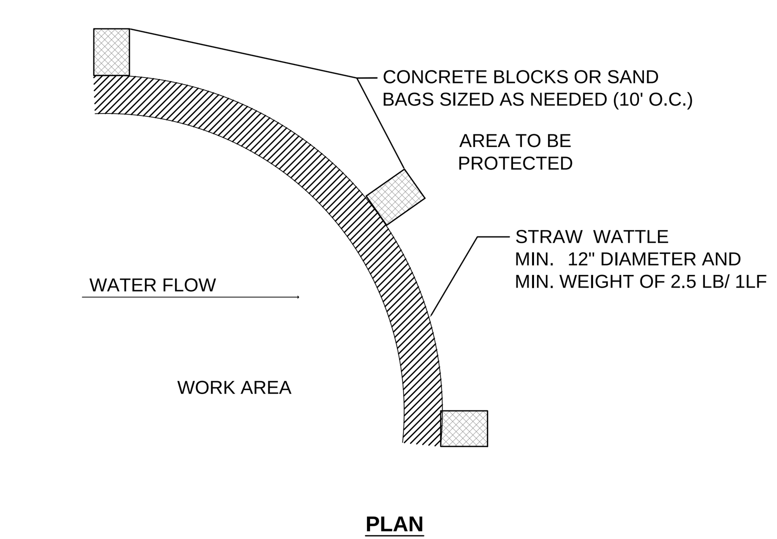
ORANGE CONSTRUCTION FENCE

CONTRACTOR SHALL SUBMIT SHOP DRAWINGS FOR ALL DETAILS TO THE OWNER'S ENGINEER FOR REVIEW.

CONTRACTOR SUBMITTAL NOTE



SECTION



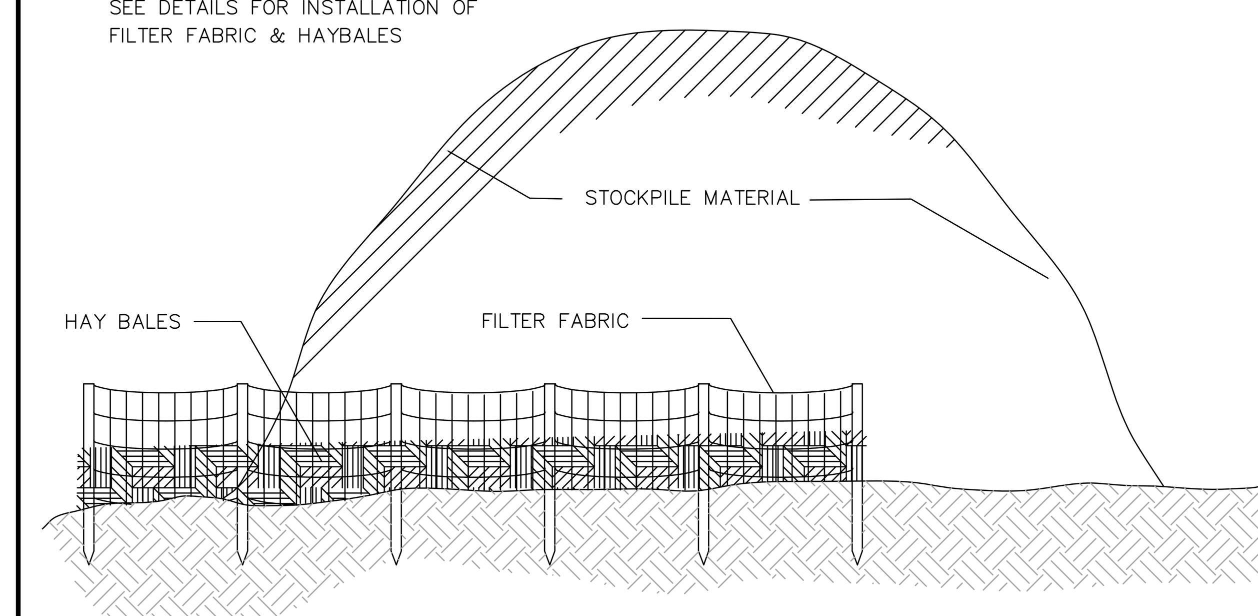
PLAN

REF.: FILTREXX

NTS

FILTER SOCK

NOTE:
SEE DETAILS FOR INSTALLATION OF FILTER FABRIC & HAYBALES



NTS

STOCKPILE DETAIL

NOTES

CONSTRUCTION SEQUENCING NOTES:

BULK GRADING

1. THE CONTRACTOR SHALL DELINEATE THE DISTURBANCE LIMITS WITH AN ORANGE CONSTRUCTION FENCE PRIOR TO THE COMMENCEMENT OF EACH PHASE TO ENSURE OVER CLEARING DOES NOT OCCUR.
2. INSTALL TREE PROTECTION MEASURES AS INDICATED ON THE PROJECT PLANS.
3. INSTALL PERIMETER EROSION AND SEDIMENT CONTROL MEASURES WITHIN THE DISTURBANCE LIMITS.
4. REMOVE EXISTING TREES, STUMPS, VEGETATION, AND ANY STRUCTURES INDICATED TO BE REMOVED WITHIN THE DISTURBANCE LIMITS IN ACCORDANCE WITH THE PROJECT PLANS. INSPECT AND REPAIR ANY DAMAGED EROSION CONTROL MEASURES. STOCKPILE EXCESS SOIL IN THE LOCATIONS SPECIFIED ON THE PLANS.
5. THE TEMPORARY SEDIMENT BASINS SHALL BE INSTALLED AT THE BEGINNING OF CUT AND FILL OPERATIONS. TEMPORARY DIVERSION MEASURES SHALL BE INSTALLED TO CONVEY STORMWATER RUNOFF TO THE PRACTICE.
6. AS BULK GRADING OPERATIONS PROGRESS, THE TEMPORARY SEDIMENT BASIN SHALL BE INSTALLED ALONG WITH TEMPORARY DIVERSION MEASURES TO CONVEY STORMWATER RUNOFF TO THE PRACTICE.
7. THE TEMPORARY SEDIMENT BASIN SHALL REMAIN IN PLACE UNTIL ALL SOIL DISTURBANCE ACTIVITIES HAVE BEEN COMPLETED.
8. ONCE ALL BULK GRADING ACTIVITIES HAVE BEEN COMPLETED, ANY COLLECTED SEDIMENT WITHIN THE TEMPORARY SEDIMENT BASINS SHALL BE REMOVED.
9. STABILIZE THE DISTURBED AREA PRIOR TO MOVING ONTO THE NEXT PHASE. THE BUILDING PAD WILL BE STABILIZED USING GRAVEL. THE PARKING AREA WILL BE STABILIZED USING SUBBASE MATERIAL. ALL OTHER AREAS WILL BE STABILIZED USING TEMPORARY SEED AND MULCH.

GENERAL CONSTRUCTION

1. BULK GRADING OPERATIONS SHALL OCCUR FIRST.
2. CONSTRUCT ALL SITE UTILITIES AND SERVICE CONNECTIONS AS SHOWN ON THE PROJECT PLANS. INSTALL INLET PROTECTION MEASURES AT ALL INLETS AND AT THE ENDS OF ALL EXPOSED STORMWATER PIPES AND RIP–RAP AT THE LOCATIONS SHOWN ON THE PROJECT PLANS.
3. PREPARE PAVEMENT SUBGRADE AND INSTALL SUBBASE MATERIAL. INLET PROTECTION MEASURES MAY BE REMOVED TEMPORARILY DURING THIS OPERATION, BUT NO MORE THAN 24 HOURS PRIOR TO PLACEMENT OF THE SUBBASE MATERIAL. INLET PROTECTION MEASURES SHALL BE REPLACED ONCE THE SUBBASE MATERIAL HAS BEEN INSTALLED.
4. FINALIZE PAVEMENT SUBGRADE PREPARATIONS.
5. FINISH GRADING AND STABILIZE ALL DISTURBED AREAS. ALL CATCH BASINS, DRAINAGE MANHOLES, AND DRAINAGE LINES SHALL BE CLEANED OF ANY ACCUMULATED SILT AND SEDIMENT.
6. REMOVE ALL ACCUMULATED SEDIMENT WITHIN THE TEMPORARY SEDIMENT BASINS. REMOVE THE TEMPORARY PERFORATED RISERS AND INSTALL THE PERMANENT OUTLET CONTROL STRUCTURES. FINISH GRADING THE WATER QUALITY BASINS AND BIORETENTION AREAS. ENSURE THAT ALL BIORETENTION PLANTING SOIL IS INSTALLED ONLY AFTER ALL TEMPORARY SEDIMENT BASINS HAVE BEEN CONVERTED TO PERMANENT PRACTICES AND STABILIZED. ALL PLANTING SHALL BE INSTALLED IN ACCORDANCE WITH THE MATERIAL.
7. INSTALL PROPOSED CURBING AND BINDER COURSE.
8. PLACE PAVEMENT TOP COURSE AND PAVEMENT MARKINGS, AS APPROPRIATE.
9. REMOVE ALL TEMPORARY EROSION AND SEDIMENT CONTROL MEASURES. IMMEDIATELY STABILIZE THE AREAS DISTURBED DURING THEIR REMOVAL. ESTABLISH PERMANENT VEGETATIVE COVER AND INSTALL ALL LANDSCAPING.

STABILIZATION OF DISTURBED SURFACES:

1. MULCH (INCLUDING GRAVEL MULCH) – MULCH OFFERS A FAST EFFECTIVE MEANS OF STABILIZATION. THIS CAN ALSO INCLUDE ROLLED EROSION CONTROL BLANKETS.
2. SPRAY ADHESIVES – THESE ARE PRODUCTS GENERALLY COMPOSED OF POLYMERS IN A LIQUID OR SOLID FORM THAT ARE MIXED WITH WATER TO FORM AN EMULSION THAT IS SPRAYED ON THE SOIL SURFACE WITH TYPICAL HYDROSEEDING EQUIPMENT. THE MIXING RATIOS AND APPLICATION RATES WILL BE IN ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS FOR THE SPECIFIC SOILS ON THE SITE. IN NO CASE SHOULD THE APPLICATION OF THESE ADHESIVES BE MADE ON WET SOILS OR IF THERE IS A PROBABILITY OF PRECIPITATION WITHIN 48 HOURS OF ITS PROPOSED USE. MATERIAL SAFETY DATA SHEETS WILL BE PROVIDED TO ALL APPLICATORS AND OTHERS WORKING WITH THE MATERIAL.
3. POLYMER ADDITIVES – THESE POLYMERS ARE MIXED WITH WATER AND APPLIED TO THE DRIVING SURFACE BY A WATER TRUCK WITH A GRAVITY FEED DRIP BAR, SPRAY BAR OR AUTOMATED DISTRIBUTOR TRUCK. THE MIXING RATIOS AND APPLICATION RATES WILL BE IN ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS. INCORPORATION OF THE EMULSION INTO THE SOIL WILL BE DONE TO THE APPROPRIATE DEPTH BASED ON EXPECTED TRAFFIC. COMPACTION AFTER INCORPORATION WILL BE BY VIBRATORY ROLLER TO A MINIMUM OF 95%. THE PREPARED SURFACE SHALL BE MOIST AND NO APPLICATION OF THE POLYMER WILL BE MADE IF THERE IS A PROBABILITY OF PRECIPITATION WITHIN 48 HOURS OF ITS PROPOSED USE. MATERIAL SAFETY DATA SHEETS WILL BE PROVIDED TO ALL APPLICATORS WORKING WITH THE MATERIAL.
4. BARRIERS – WOVEN GEOTEXTILES CAN BE PLACED ON THE DRIVING SURFACE TO EFFECTIVELY REDUCE DUST THROW AND PARTICLE MIGRATION ON HAUL ROADS. STONE CAN ALSO BE USED FOR CONSTRUCTION ROADS FOR EFFECTIVE DUST CONTROL.
5. SEEDING – REFER TO LANDSCAPE PLANS AND DETAILS.

EROSION & SEDIMENT CONTROL NOTES:

1. ALL EROSION AND SEDIMENT CONTROL MEASURES ARE TO BE IN COMPLIANCE WITH "NEW YORK STATE STANDARDS AND SPECIFICATIONS FOR EROSION AND SEDIMENT CONTROL", LATEST REVISIONS.
2. PRIOR TO THE COMMENCEMENT OF CONSTRUCTION, ALL EROSION AND SEDIMENT CONTROLS SHALL BE INSTALLED IN ACCORDANCE WITH THE PLANS. SITE PREPARATION ACTIVITIES SHALL BE PLANNED TO MINIMIZE THE SCOPE AND DURATION OF SOIL DISRUPTION. EXISTING VEGETATION SHALL BE PRESERVED AS MUCH AS IS PRACTICAL.
3. THE CONTRACTOR AND HIS/HER SUBCONTRACTOR(S) SHALL IDENTIFY THE TRAINED INDIVIDUAL THAT WILL BE RESPONSIBLE FOR THE IMPLEMENTATION AND MAINTENANCE OF THE EROSION AND SEDIMENT CONTROL MEASURES THROUGHOUT THE DURATION OF CONSTRUCTION.
4. PERMANENT TRAFFIC CORRIDORS SHALL BE ESTABLISHED AND "ROUTES OF CONVENIENCE" SHALL BE AVOIDED. STABILIZED CONSTRUCTION ENTRANCES SHALL BE INSTALLED AT ALL POINTS OF ENTRY ONTO THE PROJECT SITE.
5. DAMAGE TO SURFACE WATERS RESULTING FROM EROSION AND SEDIMENTATION SHALL BE MINIMIZED BY STABILIZING DISTURBED AREAS AND BY REMOVING SEDIMENT FROM CONSTRUCTION SITE DISCHARGES.
6. STOCKPILED TOPSOIL SHALL BE TEMPORARILY SEEDED, MULCHED, AND ENCLOSED WITH SILT FENCING. ALL GRASS SEED WILL CONTAIN AT LEAST 25 PERCENT RAPID GERMINATING PERENNIAL RYE GRASS.
7. EROSION AND SEDIMENT CONTROL INSPECTIONS:
   A. THE TRAINED INDIVIDUAL SHALL INSPECT ALL EROSION AND SEDIMENT CONTROL MEASURES ON A DAILY BASIS TO ENSURE PROPER PERFORMANCE. ANY SEDIMENT BUILD–UP SHALL BE CLEANED. ALL DAMAGES TO EROSION AND SEDIMENT CONTROLS SHALL BE REPAIRED EITHER AT THE BEGINNING OR AT THE END OF EACH WORKING DAY.
   B. THE QUALIFIED INSPECTOR SHALL CONDUCT SITE INSPECTIONS EVERY 7 DAYS DURING CONSTRUCTION. ANY DEFICIENCIES NOTED IN THE REPORTS SHALL BE CORRECTED IMMEDIATELY BY THE CONTRACTOR.
   C. IF SOIL DISTURBANCE ACTIVITIES ARE SUSPENDED FOR WINTER SHUTDOWN, TEMPORARY STABILIZATION MEASURES WILL BE APPLIED TO ALL DISTURBED AREAS. IN THIS CASE AND WITH THE APPROVAL OF THE NYSDEC AND THE TOWN, THE FREQUENCY OF INSPECTIONS BY THE QUALIFIED PROFESSIONAL MAY BE REDUCED TO AT LEAST ONE INSPECTION EVERY 30 CALENDAR DAYS.
   D. IF NYSDEC OR THE TOWN AUTHORIZES SOIL DISTURBANCES GREATER THAN 5–ACRES, THE QUALIFIED PROFESSIONAL WILL CONDUCT AT LEAST 2 SITE INSPECTIONS, SEPARATED BY AT LEAST 2 CALENDAR DAYS, EVERY 7 CALENDAR DAYS TO ENSURE THE STABILITY AND EFFECTIVENESS OF ALL PROTECTIVE MEASURES AND PRACTICES UNTIL SUCH TIME THAT LESS THAN 5–ACRES OF SOIL REMAIN DISTURBED.
8. THE CONTRACTOR IS RESPONSIBLE FOR CONTROLLING DUST BY SPRINKLING EXPOSED SOIL AREAS PERIODICALLY WITH WATER AS REQUIRED. THE CONTRACTOR IS TO SUPPLY ALL EQUIPMENT AND WATER.
9. EARTHWORK ACTIVITIES SHALL BE CONSISTENT WITH THE PLANS. THE EARTHWORK OPERATION AREAS SHALL BE STABILIZED ON AN ONGOING BASIS WITH NO AREAS, WHICH ARE NOT CURRENTLY UNDER CONSTRUCTION, LEFT WITHOUT AT LEAST TEMPORARY COVER FOR MORE THAN 48 HOURS.
10. EROSIVE MATERIAL TEMPORARILY STOCKPILED ON THE SITE DURING THE CONSTRUCTION PROCESS SHALL BE LOCATED IN AN AREA AWAY FROM STORM DRAINAGE AND SHALL BE PROPERLY PROTECTED BY A SURROUNDING SILT FENCE BARRIER.
11. FOLLOWING THE COMPLETION OF CONSTRUCTION ACTIVITIES IN ANY PORTION OF THE SITE, PERMANENT VEGETATION SHALL BE ESTABLISHED ON ALL EXPOSED SOILS.
12. IF CONSTRUCTION TAKES PLACE IN "WET SOILS", CURTAIN DRAINS OR SUBSURFACE DRAINAGE SHALL BE INSTALLED TO DEWATER THE SOILS. DEWATERING DISCHARGES WILL NOT BE DIRECTED INTO WETLANDS, WATER COURSES, WATER–BODIES, OR STORM SEWER SYSTEMS.
13. TEMPORARY DRAINAGE SWALES WITH A MINIMUM GRADE OF ONE PERCENT SHALL BE INSTALLED TO DIRECT RUNOFF AWAY FROM EXCAVATED AREAS. SWALES SHALL BE INSTALLED WITH STAKED AND SECURED HAY BALE BERMS TO PREVENT DOWNSTREAM SILTATION. LOCATION OF THE DRAINAGE SWALES AND HAY BALES WILL BE AT THE DIRECTION OF THE TOWN ENGINEER. SILT FENCE SHALL BE PROPERLY INSTALLED DOWN GRADE OF ALL DISTURBED AREAS. SILT FENCE SHALL BE INSTALLED ALONG CONTOURS TO FILTER SEDIMENT FROM RUNOFF. INSPECTION SHOULD BE FREQUENT AND REPAIR OR REPLACEMENT SHOULD BE MADE PROMPTLY AS NEEDED. SILT FENCE SHOULD BE REMOVED WHEN THEY HAVE SERVED THEIR USEFULNESS SO AS NOT TO BLOCK OR IMPEDE STORM FLOW OR DRAINAGE.
14. TEMPORARY EROSION AND SEDIMENT CONTROL MEASURES SHALL BE REMOVED WHEN ALL DISTURBED AREAS HAVE UNDERGONE FINAL STABILIZATION, UPGRADIENT SURFACES HAVE BEEN PROPERLY STABILIZED, AND ALL STORMWATER MANAGEMENT SYSTEMS ARE IN PLACE AND OPERABLE. ALL AREAS DISTURBED BY THE REMOVAL OF THE TEMPORARY EROSION AND SEDIMENT CONTROL MEASURES SHALL BE FILLED IN, TOPSOILED, SEEDED, AND MULCHED. FINAL STABILIZATION IS ACHIEVED WHEN ALL SOIL DISTURBING ACTIVITIES ARE COMPLETED AND A UNIFORM PERENNIAL VEGETATIVE COVER WITH A DENSITY OF 80 PERCENT COVERAGE IS ESTABLISHED, OR EQUIVALENT STABILIZATION MEASURES, SUCH AS PLACEMENT OF MULCH OR GEOTEXTILE, IS COMPLETED ON ALL AREAS NOT PAVED OR COVERED BY PERMANENT STRUCTURES. ENSURE THAT FINAL STABILIZATION OF ALL TRIBUTARY AREAS IS ACHIEVED PRIOR TO THE CONSTRUCTION OF THE BIORETENTION BASINS.

TYPE OF SOIL DISTURBANCE	SOIL RESTORATION REQUIREMENT	
NO SOIL DISTURBANCE	RESTORATION NOT REQUIRED	
MINIMAL SOIL DISTURBANCE (E.G., CLEARING AND GRUBBING ACTIVITIES)	RESTORATION NOT REQUIRED	
AREAS WHERE TOPSOIL IS STRIPPED ONLY (NO CHANGE IN GRADE)	APPLY 6" OF TOPSOIL IN TYPE A AND B SOILS	AERATE AND APPLY 6" OF TOPSOIL IN TYPE C AND D SOILS
AREAS OF CUT OR FILL	AERATE AND APPLY 6" TOPSOIL IN TYPE A AND B SOILS	APPLY FULL SOIL RESTORATION IN TYPE C AND D SOILS
HEAVY TRAFFIC AREAS ON SITE (ESPECIALLY IN 5' TO 25' AROUND BUILDINGS BUT NOT WITHIN 5' PERIMETER AROUND FOUNDATION WALLS)	APPLY FULL RESTORATION	
AREAS WHERE RUNOFF REDUCTION AND/OR INFILTRATION PRACTICES ARE APPLIED	RESTORATION MY NOT BE REQUIRED, BUT MAY BE APPLIED TO ENHANCE THE REDUCTION SPECIFIED FOR THE APPROPRIATE PRACTICE	
REDEVELOPMENT PROJECTS	SOIL RESTORATION IS REQUIRED ON REDEVELOPMENT PROJECTS IN AREAS WHERE EXISTING IMPERVIOUS AREA WILL BE CONVERTED TO PERVIOUS AREA	

PRIOR TO APPLYING FULL SOIL RESTORATION, ALL CONSTRUCTION ACTIVITY, INCLUDING CONSTRUCTION EQUIPMENT AND MATERIAL STORAGE, SITE CLEANUP AND TRAFFICKING, SHOULD BE FINISHED AND THE SITE CLOSED OFF TO FURTHER DISTURBANCE. FULL SOIL RESTORATION IS IMPLEMENTED IN A TWO PHASE PROCESS.

1. DEEP RIP THE AFFECTED THICKNESS OF EXPOSED SUBSOIL MATERIAL, AGGRESSIVELY FRACTURING IT BEFORE THE PROTECTED TOPSOIL IS REAPPLIED ON THE SITE.
2. DECOMPACT, SIMULTANEOUSLY THROUGH THE RESTORED TOPSOIL LAYER AND UPPER HALF OF THE AFFECTED SUBSOIL.

POLLUTION PREVENTION CONTROL NOTES:

GOOD HOUSEKEEPING PRACTICES ARE DESIGNED TO MAINTAIN A CLEAN AND ORDERLY WORK ENVIRONMENT. GOOD HOUSEKEEPING MEASURES SHALL BE MAINTAINED THROUGHOUT THE CONSTRUCTION PROCESS BY THOSE PARTIES INVOLVED WITH THE DIRECT CARE AND DEVELOPMENT OF THE SITE. THE FOLLOWING MEASURES SHOULD BE IMPLEMENTED TO CONTROL THE POSSIBLE EXPOSURE OF HARMFUL SUBSTANCES AND MATERIALS TO STORMWATER RUNOFF:

1. MATERIAL RESULTING FROM THE CLEARING AND GRUBBING OPERATION SHALL BE STOCKPILED AWAY FROM STORM DRAINAGE, WATER BODIES AND/OR WATERCOURSES AND SURROUNDED WITH ADEQUATE EROSION AND SEDIMENT CONTROL MEASURES. SOIL STOCKPILE LOCATIONS SHALL BE EXPOSED NO LONGER THAN 14 DAYS BEFORE SEEDING.
2. EQUIPMENT MAINTENANCE AREAS SHALL BE PROTECTED FROM STORMWATER FLOWS AND SHALL BE SUPPLIED WITH APPROPRIATE WASTE RECEPTACLES FOR SPENT CHEMICALS, SOLVENTS, OILS, GREASES, GASOLINE, AND ANY POLLUTANTS THAT MIGHT CONTAMINATE THE SURROUNDING HABITAT AND/OR WATER SUPPLY. EQUIPMENT WASH–DOWN ZONES SHALL BE LOCATED WITHIN AREAS DRAINING TO SEDIMENT CONTROL DEVICES.
3. THE USE OF DETERGENTS FOR LARGE–SCALE (I.E., VEHICLES, BUILDINGS, PAVEMENT SURFACES, ETC.) WASHING IS PROHIBITED.
4. MATERIAL STORAGE LOCATIONS AND FACILITIES (I.E., COVERED STORAGE AREAS, STORAGE SHEDS, ETC.) SHALL BE LOCATED ON–SITE AND SHALL BE STORED ACCORDING TO THE MANUFACTURER'S STANDARDS IN A DEDICATED STAGING AREA. CHEMICALS, PAINTS, SOLVENTS, FERTILIZERS, AND OTHER TOXIC MATERIAL MUST BE STORED IN WATERPROOF CONTAINERS. RUNOFF CONTAINING SUCH MATERIALS MUST BE COLLECTED, REMOVED FROM THE SITE, TREATED AND DISPOSED AT AN APPROVED SOLID WASTE OR CHEMICAL DISPOSAL FACILITY.
5. HAZARDOUS SPILLS SHALL BE IMMEDIATELY CONTAINED TO PREVENT SUCH POLLUTANTS FROM ENTERING THE SURROUNDING HABITAT AND/OR WATER SUPPLY. SPILL KITS SHALL BE PROVIDED ON–SITE AND SHALL BE DISPLAYED IN A PROMINENT LOCATION FOR EASE OF ACCESS AND USE. SPILLS GREATER THAN FIVE (5) GALLONS SHALL BE REPORTED TO THE NYSDEC RESPONSE UNIT AT 1–800–457–7362. IN ADDITION, A RECORD OF THE INCIDENT(S) AND/OR NOTIFICATIONS SHALL BE DOCUMENTED AND ATTACHED TO THE SWPPP.
6. PORTABLE SANITARY WASTE FACILITIES SHALL BE PROVIDED ON–SITE FOR WORKERS AND SHALL BE PROPERLY MAINTAINED.
7. DUMPSTERS AND/OR DEBRIS CONTAINERS SHALL BE LOCATED ON–SITE AND SHALL BE OF ADEQUATE SIZE TO MANAGE RESPECTIVE MATERIALS. REGULAR COLLECTION AND DISPOSAL OF WASTES SHALL OCCUR AS REQUIRED.
8. TEMPORARY CONCRETE WASHOUT FACILITIES SHOULD BE LOCATED A MINIMUM OF 50 FEET FROM STORM DRAIN INLETS, OPEN DRAINAGE FACILITIES, AND WATERCOURSES. EACH FACILITY SHOULD BE LOCATED AWAY FROM CONSTRUCTION TRAFFIC OR ACCESS AREAS TO PREVENT DISTURBANCE OR TRACKING. A SIGN SHOULD BE INSTALLED ADJACENT TO EACH WASHOUT FACILITY TO INFORM CONCRETE EQUIPMENT OPERATORS TO UTILIZE THE PROPER FACILITIES. WHEN TEMPORARY CONCRETE WASHOUT FACILITIES ARE NO LONGER REQUIRED FOR THE WORK, THE HARDENED CONCRETE SHALL BE REMOVED AND DISPOSED OF. MATERIALS USED TO CONSTRUCT THE TEMPORARY CONCRETE WASHOUT FACILITIES SHALL BE REMOVED AND DISPOSED OF. HOLES, DEPRESSIONS OR OTHER GROUND DISTURBANCE CAUSED BY THE REMOVAL OF THE TEMPORARY CONCRETE WASHOUT FACILITIES SHALL BE BACKFILLED AND/OR REPAIRED, SEEDED, AND MULCHED FOR FINAL STABILIZATION.
9. NON–STORMWATER COMPONENTS OF SITE DISCHARGE MUST BE CLEAN WATER. WATER USED FOR CONSTRUCTION, WHICH DISCHARGES FROM THE SITE, MUST ORIGINATE FROM A PUBLIC WATER SUPPLY OR PRIVATE WELL APPROVED BY THE HEALTH DEPARTMENT. WATER USED FOR CONSTRUCTION THAT DOES NOT ORIGINATE FROM AN APPROVED PUBLIC SUPPLY MUST NOT DISCHARGE FROM THE SITE. IT CAN BE RETAINED IN THE TEMPORARY SEDIMENT BASINS UNTIL IT EVAPORATES.
10. DISCHARGES FROM DEWATERING ACTIVITIES, INCLUDING DISCHARGES FROM DEWATERING TRENCHES AND EXCAVATIONS, MUST BE MANAGED BY APPROPRIATE CONTROL MEASURES.
11. WASTEWATER DISCHARGES FROM WASHOUT AND CLEANOUT OF STUCCO, PAINT, FORM RELEASE OILS, CURING COMPOUNDS, AND OTHER CONSTRUCTION MATERIALS IS PROHIBITED.

SPEDES GENERAL PERMIT COMPLIANCE NOTES:

1. THE NOTICE OF INTENT (NOI) AND SIGNED MS4 SWPPP ACCEPTANCE FORM (IF APPLICABLE) SHALL BE FILED WITH THE NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION (NYSDEC). A COPY OF THE NOI, SIGNED MS4 SWPPP ACCEPTANCE FORM (IF APPLICABLE), AND THE NOI ACKNOWLEDGEMENT SHALL BE MAINTAINED AT THE SITE IN THE LOG BOOK.
2. THE CONTRACTOR SHALL BE RESPONSIBLE FOR COMPLYING WITH THE FOLLOWING:
   A. THE CONTRACTOR AND HIS/HER SUBCONTRACTORS SHALL READ AND UNDERSTAND THE CONDITIONS OF THE "NYSDEC SPDES GENERAL PERMIT FOR STORM WATER DISCHARGES FROM CONSTRUCTION ACTIVITIES" (NYSDEC SPDES GENERAL PERMIT) IN EFFECT.
   B. THE CONTRACTOR AND HIS/HER SUBCONTRACTORS SHALL READ AND SIGN THE CERTIFICATION STATEMENT PROVIDED IN THE APPENDICES OF THE STORMWATER POLLUTION PREVENTION PLAN (SWPPP).
   C. THE CONTRACTOR AND HIS/HER SUBCONTRACTORS SHALL IDENTIFY THE TRAINED INDIVIDUAL(S) THAT WILL BE RESPONSIBLE FOR THE IMPLEMENTATION AND MAINTENANCE OF THE SWPPP. THE TRAINED INDIVIDUAL(S) SHALL READ AND SIGN THE CERTIFICATION STATEMENT PROVIDED IN THE SWPPP. A COPY OF THE SIGNED CERTIFICATION STATEMENT SHALL BE PLACED IN THE SITE LOG BOOK AND GIVEN TO THE TOWN FOR THEIR RECORDS.
   D. THE TRAINED INDIVIDUAL(S) SHALL PROVIDE DOCUMENTATION THAT HE/SHE HAS RECEIVED TRAINING IN PROPER EROSION AND SEDIMENT CONTROL PRINCIPLES FROM A SOIL AND WATER CONSERVATION DISTRICT, OR OTHER NYSDEC ENDORSED ENTITY TO THE TOWN FOR THEIR RECORDS.
   E. THE CONTRACTOR SHALL OBTAIN ALL REQUIRED PERMITS NECESSARY FOR THE WORK OUTLINED HEREIN.
   F. THE TRAINED CONTRACTOR SHALL BE RESPONSIBLE FOR IMPLEMENTATION OF ALL STORMWATER POLLUTION PREVENTION MEASURES OUTLINED IN THE SWPPP AND PROJECT PLANS.
   G. THE CONTRACTOR SHALL HOLD A PRE–CONSTRUCTION CONFERENCE WITH THE OWNER (AND/OR OWNER'S REPRESENTATIVES), TRAINED INDIVIDUAL(S), TOWN ENGINEER, TOWN WATER SUPERINTENDENT, AND THE QUALIFIED PROFESSIONAL AT LEAST ONE WEEK PRIOR TO COMMENCEMENT OF CONSTRUCTION.
   H. THE CONTRACTOR OR OWNER SHALL HAVE THE QUALIFIED PROFESSIONAL, AS DEFINED WITHIN THE NYSDEC SPDES GENERAL PERMIT, CONDUCT AN INITIAL SITE ASSESSMENT AND CERTIFY THAT THE APPROPRIATE EROSION AND SEDIMENT CONTROL STRUCTURES AS DEPICTED ON THE PLANS HAVE BEEN ADEQUATELY INSTALLED AND IMPLEMENTED PRIOR TO COMMENCEMENT OF CONSTRUCTION. REFER TO SWPPP FOR THE INITIAL SITE ASSESSMENT GUIDELINES.
   I. THE CONTRACTOR SHALL MAINTAIN A RECORD OF ALL EROSION AND SEDIMENT CONTROL INSPECTION REPORTS AT THE SITE IN A LOG BOOK. THE SITE LOG BOOK SHALL BE MAINTAINED ON–SITE AND BE MADE AVAILABLE TO THE PERMITTING AUTHORITY.
3. ONCE CONSTRUCTION ACTIVITIES ARE COMPLETE, THE OWNER/OPERATOR SHALL HAVE A QUALIFIED PROFESSIONAL CONDUCT A FINAL SITE ASSESSMENT TO DETERMINE IF THE SITE MEETS THE FINAL STABILIZATION CRITERIA AS DEFINED WITHIN THE NYSDEC SPDES GENERAL PERMIT. IF THE SITE IS DETERMINED TO MET THE FINAL STABILIZATION CRITERIA, A NOTICE OF TERMINATION (NOT) SHALL BE COMPLETED AND SUBMITTED TO THE NYSDEC TO TERMINATE COVERAGE UNDER THE SPDES GENERAL PERMIT.

Date	Description	No.

REVISIONS

SIGNATURE DATE SIGNED
MICHAEL J. FOWLER
PROFESSIONAL ENGINEER NY Lic. No. 102374

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Project
NYACK HOSPITAL PARKING STRUCTURE
BLOCK No. 1, LOT No.74
VILLAGE OF NYACK
ROCKLAND COUNTY NEW YORK

Drawing Title
SOIL EROSION & SEDIMENT CONTROL NOTES & DETAILS

Project No. 100754201
Date 03/17/2020
Drawn By VP
Checked By LM
Drawing No. CE501

PROJECT NO. 100754201

GRADING NOTES

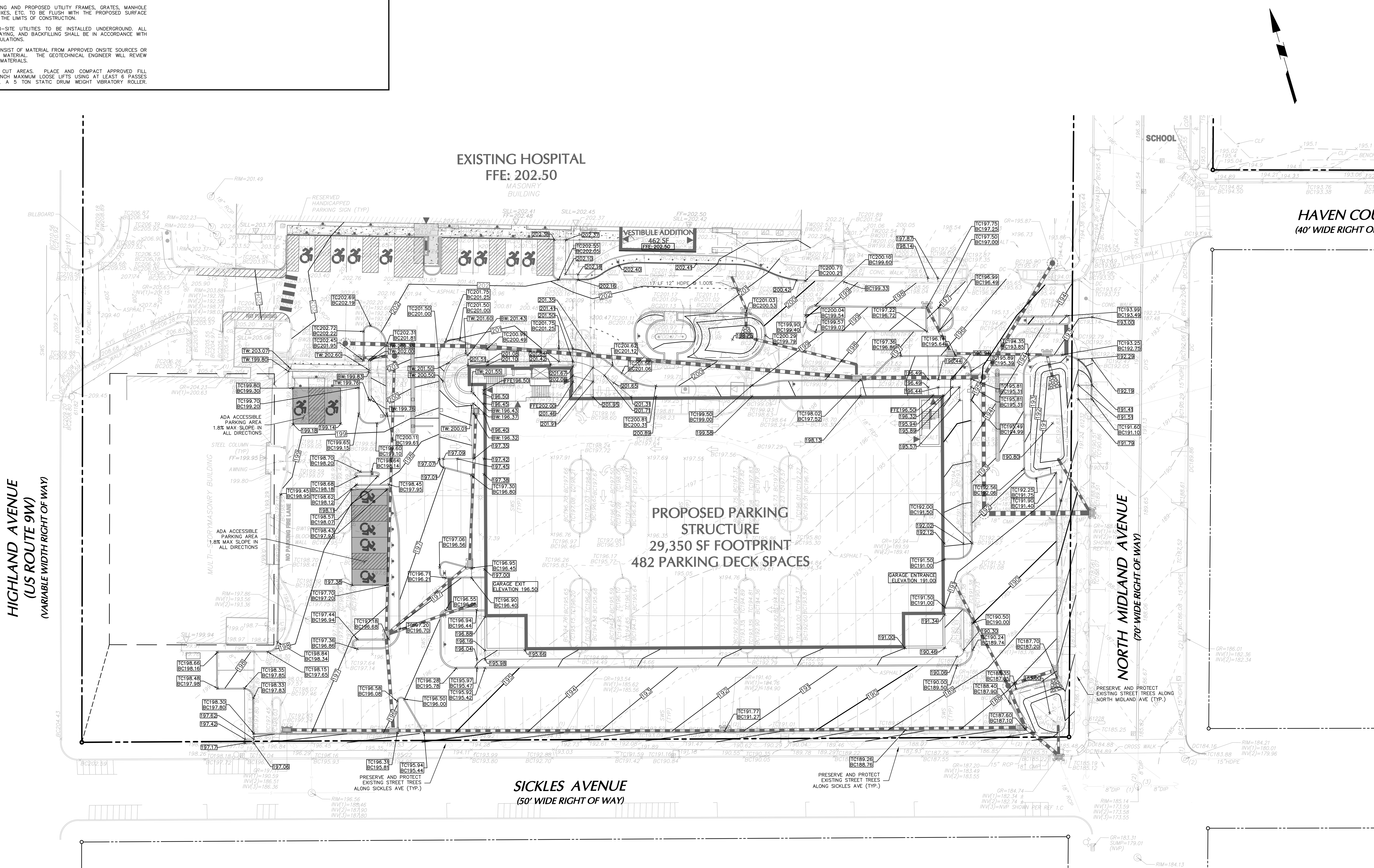
1. EXISTING BOUNDARY AND TOPOGRAPHY INFORMATION IS BASED ON FIELD DATA OBTAINED BY LANGAN ENGINEERING, ENVIORNMENTAL, SURVEYING, LANDSCAPE ARCHITECT AND GEOLOGY, D.P.C ON 1/23/2020.
2. ELEVATIONS SHOWN ARE REFERENCED TO THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD 88).
3. THE MERIDIAN OF THE SURVEY IS REFERENCED TO NEW YORK STATE PLANE COORDINATE EAST SYSTEM NAD1983 (2011) DERIVED USING SURVEY–GRADE GNSS EQUIPMENT.
4. PROPOSED PARKING GARAGE, MAIN HOSPITAL ENTRANCE EXPANSION AND PEDESTRIAN BRIDGE SHOWN SHOWN ARE PER ARCHITECTURAL PLANS TITLED "MONTEFIORE HEALTH SYSTEM NYACK CAMPUS – PARKING STRUCTURE" PREPARED BY POMARICO DESIGN STUDIO ARCHITECTURE, PLLC, DATED 01/31/2020.
5. ONCE EXISTING UTILITIES TO REMAIN ARE LOCATED, ANY POTENTIAL CONFLICTS WITH OTHER UTILITIES, RELOCATED UTILITY POLES, ETC. SHALL BE BROUGHT TO THE ATTENTION OF THE ENGINEER IMMEDIATELY.
6. THE CONTRACTOR IS SPECIFICALLY CAUTIONED THAT THE LOCATION AND/OR ELEVATION OF EXISTING UTILITIES AS SHOWN ON THESE PLANS IS BASED ON RECORDS OF THE VARIOUS UTILITY COMPANIES AND, WHERE POSSIBLE, MEASUREMENTS TAKEN IN THE FIELD. THE INFORMATION IS NOT TO BE RELIED ON AS BEING EXACT OR COMPLETE. THE CONTRACTOR MUST CALL ALL THE APPROPRIATE UTILITY COMPANIES HAVING UNDERGROUND UTILITIES ON SITE OR IN RIGHT–OF–WAYS AT LEAST 72 HOURS BEFORE ANY EXCAVATION OR GRADING TO REQUEST EXACT FIELD LOCATION OF UTILITIES. IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO RELOCATE ALL EXISTING UTILITIES WHICH CONFLICT WITH THE PROPOSED IMPROVEMENTS SHOWN ON THE PLANS. THE CONTRACTOR SHALL VERIFY ALL EXISTING CONDITIONS, UTILITY LOCATIONS, DEPTHS AND INVERTS PRIOR TO CONSTRUCTION. ANY CONDITIONS FOUND TO DIFFER FROM THOSE SHOWN BY THESE DRAWINGS SHALL BE IMMEDIATELY BROUGHT TO THE ATTENTION OF LANGAN ENGINEERING. CALL BEFORE YOU DIG– 1–800–272–1000.
7. ADJUST ALL EXISTING AND PROPOSED UTILITY FRAMES, GRATES, MANHOLE COVERS, VALVE BOXES, ETC. TO BE FLUSH WITH THE PROPOSED SURFACE ELEVATIONS WITHIN THE LIMITS OF CONSTRUCTION.
8. ALL PROPOSED ON–SITE UTILITIES TO BE INSTALLED UNDERGROUND. ALL TRENCHING, PIPE LAYING, AND BACKFILLING SHALL BE IN ACCORDANCE WITH FEDERAL OSHA REGULATIONS.
9. SITE FILL SHALL CONSIST OF MATERIAL FROM APPROVED ONSITE SOURCES OR APPROVED OFFSITE MATERIAL. THE GEOTECHNICAL ENGINEER WILL REVIEW AND APPROVE ALL MATERIALS.
10. PROOF ROLL ALL CUT AREAS. PLACE AND COMPACT APPROVED FILL MATERIALS IN 12–INCH MAXIMUM LOOSE LIFTS USING AT LEAST 6 PASSES WITH, AT MINIMUM, A 5 TON STATIC DRUM WEIGHT VIBRATORY ROLLER. COMPACT TO AT LEAST 95% OF THE MAXIMUM DRY DENSITY AS DETERMINED BY ASTM D1557.
11. PARKING LOT SUBGRADES SHALL BE FIRM AND NON–YIELDING. SOFT AREAS AND UNSUITABLE MATERIAL SHALL BE REMOVED AND REPLACED WITH APPROVED MATERIALS AND AS DIRECTED BY THE GEOTECHNICAL ENGINEER.
12. PIPE BEDDING MATERIAL SHALL BE AASHTO NO. 67 PROCESSED SAND AND GRAVEL FREE FROM DEBRIS, CLAY LUMPS, ORGANIC, OR OTHER DELETERIOUS MATERIALS, AND COMPLYING WITH THE FOLLOWING GRADATION REQUIREMENTS:
   <u>SIEVE SIZE PERCENT PASSING (BY WEIGHT)</u>
   1 INCH 100
   ¾ INCH 90–100
   ⅜ INCH 20–55
   #4 0–10
   #8 0–5
13. NO TOPSOIL SHALL BE REMOVED FROM THE SITE OR USED AS SPOIL. REMOVED TOPSOIL MUST BE REDISTRIBUTED THROUGHOUT THE SITE AND UTILIZED AS SUCH.
14. ANY STORMWATER FACILITIES SHOWN TO REMAIN SHOULD BE INSPECTED, REPAIRED AND CLEANED AS NECESSARY.
15. STORMWATER MANAGEMENT FACILITIES SHALL BE MAINTAINED REGULARLY TO INSURE CONTINUAL FUNCTIONING OF THE SYSTEM AT DESIGN CAPACITY. SEE THE STORMWATER POLLUTION PREVENTION PLAN FOR MAINTENANCE SCHEDULE, INSTRUCTIONS AND PROCEDURES.
16. ALL PROPOSED SIDEWALKS, CURB RAMPS, A.D.A.–ACCESSIBLE PARKING STALLS AND ROUTES SHALL BE CONSTRUCTED IN ACCORDANCE WITH THE A.D.A. REQUIREMENTS. THESE INCLUDE, BUT ARE NOT LIMITED TO MAXIMUM 2% CROSS SLOPE, MAXIMUM 5% RUNNING SLOPE AND MAXIMUM 8.33% (1:12) RAMP SLOPE.

LEGEND

	EXISTING	PROPOSED
PROPERTY LINE		
SPOT ELEVATION	x 201.50	114.00
CONTOUR	246	252
STORM MANHOLE		
CATCH BASIN	OR	
STORM SEWER PIPE	OR D	

LANGAN

PROJECT NO. 100754201



Date	Description	No.

REVISIONS

SIGNATURE DATE SIGNED
MICHAEL J. FOWLER
PROFESSIONAL ENGINEER NY Lic. No. 102374

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Project

NYACK HOSPITAL PARKING STRUCTURE

BLOCK No. 1, LOT No.74
VILLAGE OF NYACK
ROCKLAND COUNTY NEW YORK

Drawing Title

GRADING PLAN

Project No. 100754201
Date 2/12/2020
Drawn By BMW
Checked By LM
Drawing No. CG101

WARNING:
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SCALE: 1" = 20'

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STORM DRAINAGE AND UTILITY NOTES

1. EXISTING BOUNDARY AND TOPOGRAPHY INFORMATION IS BASED ON FIELD DATA OBTAINED BY LANGAN ENGINEERING, ENVIORNMENTAL, SURVEYING, LANDSCAPE ARCHITECT AND GEOLOGY, D.P.C ON 1/23/2020.
2. ELEVATIONS SHOWN ARE REFERENCED TO THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD 88).
3. THE MERIDIAN OF THE SURVEY IS REFERENCED TO NEW YORK STATE PLANE COORDINATE EAST SYSTEM NAD1983 (2011) DERIVED USING SURVEY-GRADE GNSS EQUIPMENT.
4. PROPOSED PARKING GARAGE, MAIN HOSPITAL ENTRANCE EXPANSION AND PEDESTRIAN BRIDGE SHOWN SHOWN ARE PER ARCHITECTURAL PLANS TITLED "MONTEFIORE HEALTH SYSTEM NYACK CAMPUS – PARKING STRUCTURE" PREPARED BY POMARICO DESIGN STUDIO ARCHITECTURE, PLLC, DATED 01/31/2020.

GENERAL UTILITY NOTES:

U1. THE CONTRACTOR IS ALERTED TO THE RULES AND REGULATIONS OF NEW YORK STATE CODE RULE 753 PROTECTION OF UNDERGROUND UTILITIES ALSO KNOWN AS INDUSTRIAL CODE 53 AND IS DIRECTED TO COMPLY WITH IT. THE CONTRACTOR SHALL NOTIFY AND COOPERATE WITH ALL UTILITY COMPANIES ALONG THE LINE OF THE PROPOSED WORK THREE (3) WORKING DAY PRIOR TO CONSTRUCTION. CONTRACTORS SHALL NOT PROCEED WITH WORK IN STREETS WHERE UTILITIES HAVE NOT BEEN LOCATED AND MARKED BY UTILITY COMPANIES. CONTRACTOR SHALL CALL #811 TO REQUEST UTILITY MARKOUT PRIOR TO CONSTRUCTION. THE CONTRACTOR, FOR THE PURPOSE OF SAFETY, SHALL NOTIFY THE UTILITY COMPANIES INVOLVED IF ANY OF THEIR UTILITIES ARE EXPOSED AND/OR UNDERMINED DURING THE COURSE OF CONSTRUCTION. THE CITY SHALL NOT BE LIABLE FOR ANY COST INCURRED BY THE CONTRACTOR AS A RESULT OF THE COMPLIANCE, NONCOMPLIANCE OR IMPROPER COMPLIANCE BY THE FRANCHISED OPERATOR OF UNDERGROUND FACILITIES, WITH SUB PART 53-3 OF THE INDUSTRIAL CODE.

U2. THE CONTRACTOR SHALL SCHEDULE AND COORDINATE HIS OPERATIONS WITH THE VARIOUS COMPANIES OR AGENCIES WHOSE INTERESTS ARE AFFECTED BY THIS PROJECT.

U3. THE LOCATION OF EXISTING UTILITIES AS SHOWN ON THE PLANS IS BASED ON INFORMATION AVAILABLE WHEN THESE PLANS WERE PREPARED AND SHOULD BE CONSIDERED APPROXIMATE. EXACT LOCATIONS SHALL BE VERIFIED IN THE FIELD AND ARE THE RESPONSIBILITY OF THE CONTRACTOR. THE ENGINEER MAKES NO GUARANTEE ALL SITE UTILITIES ARE SHOWN ON THIS PLAN. ANY UNEXPECTED BURIED UTILITIES SHALL BE COORDINATED WITH THE OWNER BEFORE REMOVAL.

U4. CONTRACTOR IS RESPONSIBLE FOR ANY SHORING REQUIRED DURING EXCAVATION, WHICH SHALL BE PERFORMED IN ACCORDANCE WITH CURRENT OSHA STANDARDS.

U5. IN DISTURBED AREAS OUTSIDE THE PROPERTY LINE, CONTRACTOR SHALL NEATLY SAWCUT EDGES OF TRENCHES, MINIMIZE TRENCH WIDTH, AND RESTORE SURFACE COVER SECTIONS IN KIND UNLESS OTHERWISE SPECIFIED.

U6. PAVEMENT RESTORATION WITHIN PUBLIC STREETS MUST BE PERFORMED IN ACCORDANCE WITH THE NYC DOT STANDARDS AND REGULATIONS UPON COMPLETION OF EACH RESPECTIVE PORTION OF UTILITY WORK.

U7. WHERE EXISTING UTILITIES ARE TO BE CROSSED BY PROPOSED CONSTRUCTION, TEST PITS SHALL BE DUG BY THE CONTRACTOR PRIOR TO CONSTRUCTION TO ASCERTAIN EXISTING INVERTS, MATERIALS AND SIZES, SUCH THAT CONFLICTS MAY BE AVOIDED. THESE TEST PITS SHALL BE EXCAVATED AT THE START OF CONSTRUCTION, PRIOR TO THE CONSTRUCTION OF ANY UTILITIES. THE CONTRACTOR WILL NOTIFY LANGAN 48 HOURS PRIOR TO THE TEST PIT EXCAVATION AND WILL PROVIDE THE ENGINEER WITH THE RESULTS OF THESE EXPLORATIONS WITHIN 24 HOURS OF THEIR COMPLETION.

U8. PER THE GEOTECHNICAL REPORT, THE EXISTING SITE SOILS ARE CORROSIVE TO CAST IRON PIPE AND DUCTILE IRON PIPE. THE CONTRACTOR SHALL ENCASE ANY PROPOSED DUCTILE IRON PIPE IN POLYETHYLENE ENCASEMENT.

U9. PER THE GEOTECHNICAL REPORT, FLEXIBLE CONNECTIONS MAY BE NECESSARY BETWEEN ON-GRADE-SUPPORTED UTILITIES AND BUILDING PILE-SUPPORTED UTILITIES. REFER TO MEP PLANS FOR LOCATIONS AND DETAILS.

WATER SERVICE NOTES:

W1. ALL WATER MAINS SHOWN ON THESE PLANS SHALL BE CONSTRUCTED IN ACCORDANCE WITH THE RULES AND REGULATIONS OF THE NYCDEP AND THE CITY OF NEW YORK.

W2. PRIOR TO STARTING WORK, THE CONTRACTOR SHALL SUBMIT IN WRITING THE NAMES OF ALL VENDORS AND MANUFACTURERS HE INTENDS TO USE. THE CONTRACTOR SHALL SUBMIT ONLY ONE (1) VENDOR OR MANUFACTURER FOR EACH PRODUCT THAT IS TO BE INCORPORATED IN THE CONTRACT. THE USE OF MULTIPLE VENDORS OR MANUFACTURERS TO SUPPLY THE SAME PRODUCT WILL BE PROHIBITED.

W3. INSTALLER IS TO CONTACT THE NYC DEP CONSTRUCTION COMPLIANCE UNIT AT (718) 595-5188 TO GIVE TWO WEEKS ADVANCE NOTICE PRIOR TO INSTALLATION.

W4. ALL WATER MAINS SHOWN ON THESE PLANS SHALL BE CLASS 52 CEMENT LINED DUCTILE IRON PIPE FOR 3- AND 4-INCH PIPES AND CLASS 56 CEMENT LINED DUCTILE IRON PIPE FOR PIPES LARGER THAN 4-INCHES, UNLESS OTHERWISE SPECIFIED. THE MANUFACTURER'S MARK, THE YEAR OF MANUFACTURE, THE LETTERS: "WSNY", AND THE LETTERS "DI" OR "DUCTILE" SHALL BE CAST ON THE PIPE. ALL MARKINGS SHALL BE CLEAR AND LEGIBLE AND CAST NEAR THE BELL. PRIOR TO WET TAP, CONTRACTOR SHALL CONSULT WITH THE NYCDEP FOR COORDINATION. ALL DUCTILE IRON PIPES SHALL BE WRAPPED IN POLYETHYLENE ENCASEMENT.

W4. COVER FROM TOP OF WATER MAIN TO FINISH GRADE SHALL BE AT LEAST FOUR FEET AND NOT MORE THAN FIVE FEET.

W5. THE WATER MAIN PIPE TRENCH SHALL NOT BE BACKFILLED UNTIL THE PIPE, FITTINGS AND JOINTS HAVE PASSED THE OPEN TRENCH TEST. THE TEST MUST BE CONDUCTED AT STREET PRESSURE AND THE DEP MUST BE NOTIFIED PRIOR TO THE TEST TO CONFIRM THEIR INSPECTION REQUIREMENTS.

W6. VALVE AND VALVE BOXES INSTALLED ON WATER MAINS SHALL MEET NYCDEP STANDARDS. VALVES SHALL BE DESIGNED FOR A MINIMUM OF 150 PSI WORKING PRESSURE AND SHALL BE NON-RISING STEM GATE VALVES THAT OPEN COUNTER-CLOCKWISE. ALL VALVES SHALL HAVE CAST INTEGRAL WITH EITHER THE BONNET OR BODY, THE LETTERS "WSNY", THE MANUFACTURER'S NAME MARK. MEET, THE SIZE OF THE VALVE, THE YEAR OF MANUFACTURE, THE COUNTRY OF MANUFACTURE AND THE RATED PRESSURE. THE CASTING SHALL ALSO BEAR THE MARKINGS IDENTIFYING THE FOUNDRY SHOP. A STAMPED STAINLESS STEEL TAG SHOWING THE SERIAL NUMBER OF THE VALVE SHALL BE ATTACHED TO THE VALVE BODY OR BONNET. IN ADDITION, THE SERIAL NUMBER SHALL ALSO BE STAMPED LEGIBLY ON THE VALVE'S BONNET AND BODY. THERE SHALL BE A "HEAT" NUMBER FOR THE DISCS, BODY AND BONNET CAST IN 1/4-INCH HIGH RAISED LETTERS/NUMBERS.

W7. ALL WATER MAINS SHALL BE PRESSURE TESTED AND LEAKAGE TESTED IN ACCORDANCE WITH AWWA C600. THE CONTRACTOR SHALL PROVIDE TEST RESULTS TO THE OWNER.

W8. ALL INSTALLED WATER MAINS SHALL BE DISINFECTED IN ACCORDANCE WITH AWWA C651.

W9. NO CONNECTIONS CAN BE MADE TO THE WATER MAINS WITHOUT PRIOR DEP APPROVAL.

W10. CONTRACTOR IS REQUIRED TO OBTAIN ALL WORK PERMITS PRIOR TO WATER MAIN CONSTRUCTION INCLUDING BUT NOT LIMITED TO NYCDEP WET TAP, MAIN TAPPING, AND NYCDOT STREET OPENING PERMITS.

W11. WHERE A SHUTDOWN OF EXISTING CITY WATER MAIN IS NEEDED IN ORDER TO CONNECT AN INTERNAL WATER MAIN TO THE CITY MAIN, THE SHUTDOWN MUST BE REQUESTED AT LEAST FORTY-EIGHT (48) HOURS IN ADVANCE. TO SCHEDULE THE SHUTDOWN, INSTALLER HAS TO CONTACT TO NYCDEP LOCAL TAPPING OFFICE. CHARGES FOR SHUTDOWN WILL BE BASED ON THE DEPARTMENTS LABOR AND EQUIPMENT COSTS. THE APPLICANT'S CONTRACTOR SHALL NOTIFY CONSUMERS PRIOR TO WATER MAIN SHUTDOWN. SHUTDOWN SHALL NOT BE MADE PRIOR TO NINE (9) AM. SHUTDOWN SHALL NOT BE MADE WHEN THE TEMPERATURE AT 8 AM IS LOWER THAN THIRTY-TWO (32) DEGREES FAHRENHEIT. SHUTDOWN SHALL NOT BE MADE UNLESS THE DEPARTMENT'S INSPECTOR IS PRESENT. THE CONTRACTOR MUST RESTORE WATER AT THE END OF THE WORKING DAY, BUT NO LATER THAN 5:00 PM. INSTALLER SHALL OBTAIN CONFIRMATION OF DATE OF SHUTDOWN BY NYCDEP BEFORE START OF WORK.

W12. HYDRANTS ON WATER MAINS SHALL BE STANDARD DEPARTMENT HYDRANTS WITH DRAIN BASES, FENDERS, VALVE BOXES, COVERS AND SHALL BE PAINTED ACCORDING TO NYCDEP STANDARDS.

W13. WHERE THE DEPTH TO THE BOTTOM OF THE SEWER CRADLE IS LESS THAN TEN (10) FEET, THE CLEARANCE BETWEEN THE OUTSIDE OF THE WATER MAIN AND THE CENTERLINE OF THE SEWER SHOULD NOT BE LESS THAN SIX (6) FEET PLUS ONE HALF THE SEWER DIAMETER. IF THIS REQUIREMENT CANNOT BE MET A PRE-AND-POST-CONSTRUCTION TV-INSPECTION OF THE EXISTING SEWER IS REQUIRED. TAPES AND REPORT OF THE PRE-AND-POST-CONSTRUCTION TV-INSPECTION (OR VISUAL INSPECTION FOR SEWERS 54-INCH DIAMETER AND LARGER) SHALL BE SENT TO THE NYCDEP/BWSO, ATTENTION: DIVISION OF REVIEW AND CONSTRUCTION COMPLIANCE, FOR EVALUATION AND ACTION AS NEEDED.

W14. THE ALIGNMENT OF THE WATER MAINS SHOWN AND THE LOCATION OF THE VALVES ARE SHOWN APPROXIMATELY. THE EXACT ALIGNMENTS SHALL BE DETERMINED IN THE FIELD AND ADJUSTMENTS CAN BE MADE TO AVOID UTILITIES AS WORK 2PROGRESSES.

W15. ALL DUCTILE IRON PIPES WITH RESTRAINED JOINTS SHALL BE FURNISHED, DELIVERED, INSTALLED, AND TESTED IN ACCORDANCE WITH THE LATEST NYCDEP STANDARD WATER MAIN SPECIFICATIONS, THE LATEST NYCDEP SPECIFICATION FOR DUCTILE IRON PIPE, AND AS APPROVED BY THE ENGINEER.

W16. PRIOR TO CONNECTING THE NEW MAINS TO THE EXISTING MAINS, ALL RESTRAINT REQUIREMENTS, WITH UNBALANCED PRESSURE CONDITIONS GENERATED BY MODIFIED PIPE GEOMETRY AND NEWLY INSTALLED VALVES AND FITTINGS MUST BE FULLY MET. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ANY DAMAGE TO PROPERTY AND PERSONNEL INJURED CAUSED BY NEGLIGENCE OR OMISSION REGARDING COMPLIANCE WITH THE RESTRAINT REQUIREMENTS. FOR TYPICAL MINIMUM LENGTHS OF REQUIRED RESTRAINT, SEE TABLE A8-2 IN "STANDARD SPECIFICATION FOR DUCTILE-IRON PIPE WITH PUSH-ON JOINTS AND DUCTILE-IRON FITTINGS WITH MECHANICAL JOINTS THROUGH 48", LATEST REVISION.

W17. BACKFLOW PREVENTERS (BFP) FOR FIRE SERVICE SHALL CONSIST OF 10-INCH ZURN WILKINS MODEL 350DA DOUBLE CHECK DETECTOR ASSEMBLY OR APPROVED EQUAL. BFP FOR DOMESTIC SERVICE SHALL CONSIST OF 4-INCH ZURN WILKINS MODEL 350DA DOUBLE CHECK DETECTOR ASSEMBLY OR APPROVED EQUAL.

W18. FIRE WATER METER SHALL CONSIST OF 10-INCH NEPTUNE HP FIRE SERVICE TURBINE OR APPROVED EQUAL. DOMESTIC WATER METER SHALL CONSIST OF 4-INCH ELSTER EVOQ4 ELECTRONIC METER OR APPROVED EQUAL.

W19. THE DISTANCE BETWEEN THE PROPERTY LINE AND VALVES SHALL BE EQUAL TO 2 FEET.

W20. PER THE GEOTECHNICAL REPORT, THE EXISTING SITE SOILS ARE CORROSIVE TO CAST IRON PIPE AND DUCTILE IRON PIPE. THE CONTRACTOR SHALL ENCASE ANY PROPOSED DUCTILE IRON PIPE IN POLYETHYLENE ENCASEMENT.

STORM DRAINAGE NOTES:

SD1. ALL STORMWATER IMPROVEMENTS SHALL BE CONSTRUCTED IN ACCORDANCE WITH THE MOST RECENT EDITION OF NEW YORK STATE STORMWATER MANAGEMENT DESIGN MANUAL AND ITS APPENDICES.

SD2. ALL STORM SEWERS SHOWN HEREON SHALL BE HDPE WITH WATERTIGHT JOINTS.

SD3. ALL DRAINAGE STRUCTURES AND STORM SEWER PIPES SHALL MEET HEAVY DUTY TRAFFIC (H20) LOADING.

SD4. ABBREVIATIONS
HDPE = HIGH DENSITY POLYETHYLENE
DIP = DUCTILE IRON PIPE
INV = INVERT
LF = LINEAR FEET
GR = GRATE ELEVATION
FG = FINISHED GRADE
RIM = RIM ELEVATION
MH = MANHOLE
CB = CATCH BASIN

SD5. PROPOSED STORM DRAINAGE PIPING SHALL BE TEMPORARILY PROTECTED WITH A MINIMUM OF TWO FEET OF COVER DURING CONSTRUCTION.

SD6. THE CONTRACTOR SHALL SUBMIT SHOP DRAWINGS FOR ALL PRODUCTS (PIPES, STRUCTURES, COVERS/GRATES, ETC.) INCLUDING MATERIAL SPECIFICATIONS FOR FILL MATERIAL. ALL SITE-RELATED SHOP DRAWINGS SUBMITTED TO THE OWNER'S ENGINEER SHALL BEAR THE APPROVAL STAMP OF THE GENERAL CONTRACTOR.

SD7. WHERE MANUFACTURER'S NAMES AND PRODUCT NUMBERS ARE INDICATED ON DRAWINGS, IT SHALL BE CONSTRUED TO MEAN THE ESTABLISHMENT OF QUALITY AND PERFORMANCE STANDARDS OF SUCH ITEMS. ALL OTHER PRODUCTS SHALL BE SUBMITTED TO THE OWNER'S ENGINEER FOR APPROVAL BEFORE THEY SHALL BE DEEMED EQUAL.

SD8. DRAINAGE STRUCTURES SHALL BE PRECAST CONCRETE MEETING THE REQUIREMENTS OF SECTION 706-04 OF THE NYSDOT STANDARD SPECIFICATIONS. FOR ADDITIONAL DETAILS SEE NYSDOT STANDARD SHEET NOS. M604-5R1, M604-6R1, M604-7, AND M604-8R1.

SD9. STEPS ARE REQUIRED FOR ALL DRAINAGE STRUCTURES OVER 4 FEET DEEP. STEPS SHALL MEET THE REQUIREMENTS OF SECTION 725 OF THE NYSDOT STANDARD SPECIFICATIONS.

SD10. THE CONTRACTOR WILL BE REQUIRED TO CLEAN ANY ACCUMULATION OF SILT, DEBRIS OR FOREIGN MATTER OF ANY KIND AND THE STORMWATER SYSTEM SHALL BE KEPT CLEAN OF ANY SUCH ACCUMULATION UNTIL FINAL ACCEPTANCE OF WORK. NO ADDITIONAL PAYMENT WILL BE MADE FOR THIS WORK.

SD11. CONTRACTOR SHALL SUBMIT AN AS-BUILT SURVEY OF THE STORM DRAINAGE SYSTEM TO THE OWNER. THE SURVEY SHALL BE SUBMITTED INDICATING MANHOLE AND CATCH BASIN LOCATIONS, SIZE, DRAINAGE PIPE MATERIALS, INVERTS, LENGTHS, AND SLOPES. THE AS-BUILT SURVEY SHALL INCLUDE A BENCH MARK BASED OFF A DATUM INDICATED ON THESE PLANS.

SD12. WATER QUALITY UNITS SHALL BE AS NOTED ON THE PLANS. ALTERNATIVE WATER QUALITY UNITS MAY BE PRESENTED TO THE ENGINEER BUT MUST INCLUDE TREATMENT CALCULATIONS IN COMPLIANCE WITH THE MOST RECENT EDITION OF NEW YORK STATE STORMWATER MANAGEMENT DESIGN MANUAL AND ITS APPENDICES.

SD14. CONTRACTOR TO REVIEW AND PERFORM WORK IN ACCORDANCE TO STORMWATER POLLUTION PREVENTION PLAN (SWPPP) FOR THE SUBJECT SITE.

ELECTRIC SERVICE NOTES:

E1. ELECTRIC SERVICE TO BE CONSTRUCTED IN ACCORDANCE WITH CON EDISON SPECIFICATIONS.

E2. ALL UNDERGROUND ELECTRICAL SERVICE RELATED INSTALLATIONS SHALL BE COORDINATED BY THE CONTRACTOR WITH CON EDISON. ELECTRICAL CONDUIT SHALL BE SCHEDULE 40 PVC OR AS REQUIRED BY CON EDISON. THE MINIMUM BURIAL DEPTH OF ELECTRICAL CONDUIT SHALL BE 2 FEET.

E3. UNDERGROUND ELECTRIC DUCT BANKS SHALL BE ENCASED IN CAST-IN-PLACE CONCRETE. ALTERNATELY, UNDERGROUND ELECTRIC MAY BE INSTALLED IN A PRECAST CONCRETE DUCT BANK, AFTER A PROFILE IS PREPARED BY CONTRACTOR TO VERIFY CROSSINGS.

E4. ALL TRENCHES TO BE BACKFILLED IN ACCORDANCE WITH CON EDISON SPEC EO-1181 REV 6.

E5. CONTRACTOR SHALL ENTER MANHOLES WITH 10' OF 5" RGS CONDUIT AND THEN CONTINUE UNDERGROUND RUN IN 5" HDPE OR FRE CONDUIT.

E6. ANCHOR AND DOWNGUY ASSEMBLIES SHALL BE INSTALLED IN ACCORDANCE WITH CON EDISON SPEC EO-5907-B REV 13.

E7. ALL SWEEPS SHALL BE 36" RADIUS MINIMUM. TRANSITION SPLICES TO RISERS SHALL BE IN ACCORDANCE WITH DETAILS ON CON EDISON SPEC EO-5907-B REV 13.

E8. FURNISH AND INSTALL ½" EHS STRAND WITH 5" GALVANIZED RINGS AND SADDLES. NOMINAL SPACING OF RINGS AND SADDLES AT 18"-24". FURNISH AND INSTALL CON EDISON SPEC EO-7558E, 15KV, 500KCMIL COPPER, JACKETED FLAT STRAP CABLE OR APPROVED EQUAL. CON EDISON SHALL REVIEW AND APPROVE ALL CABLE SUBMITTALS.

E9. PROVIDE RACKING AS REQUIRED ON EACH LONG WALL OF EACH MANHOLE. FURNISH 3 RACKS PER SIDE. FEEDERS SHALL BE ARCPROOFED WITH SCOTCH 77 FIRE-PROOFING TAPE WHEN MORE THAN ONE FEEDER OCCUPIES A MANHOLE. BIND ARC TAPE WITH GLASS CLOTH TAPE AT BEGINNING AND END.

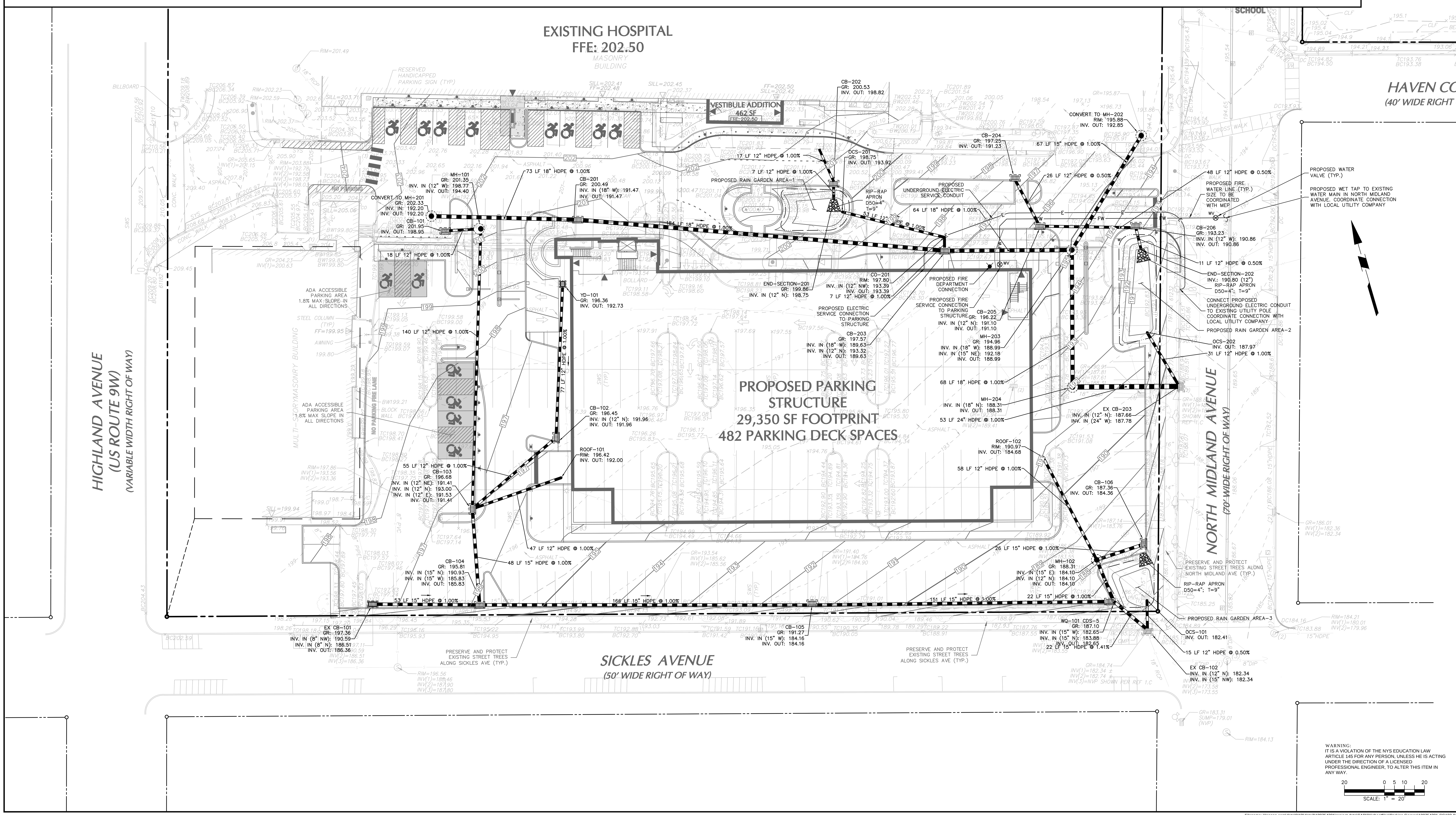
E10. THE CON EDISON DETAIL STANDARDS REFERENCED ARE FOR INFORMATIONAL PURPOSES ONLY. THE CONTRACTOR SHALL REVIEW ALL APPLICABLE DETAILS REQUIRED BY CON EDISON WITH CON EDISON PRIOR TO PURCHASING ANY EQUIPMENT.

LEGEND

	EXISTING	PROPOSED
PROPERTY LINE		
SPOT ELEVATION	x 201.50	114.00
CONTOUR	246	252
STORM MANHOLE		
CATCH BASIN	OR	
STORM SEWER PIPE	OR	

LANGAN

PROJECT NO. 100754201



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20 0 5 10 20
SCALE: 1" = 20'

Date	Description	No.

REVISIONS

SIGNATURE DATE SIGNED
MICHAEL J. FOWLER
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Project
NYACK HOSPITAL
PARKING STRUCTURE
BLOCK No. 1, LOT No.74
VILLAGE OF NYACK
ROCKLAND COUNTY NEW YORK

Drawing Title
DRAINAGE AND UTILITY PLAN

Project No. 100754201
Date 03/17/2020
Drawn By VP
Checked By LM
Drawing No. CG102

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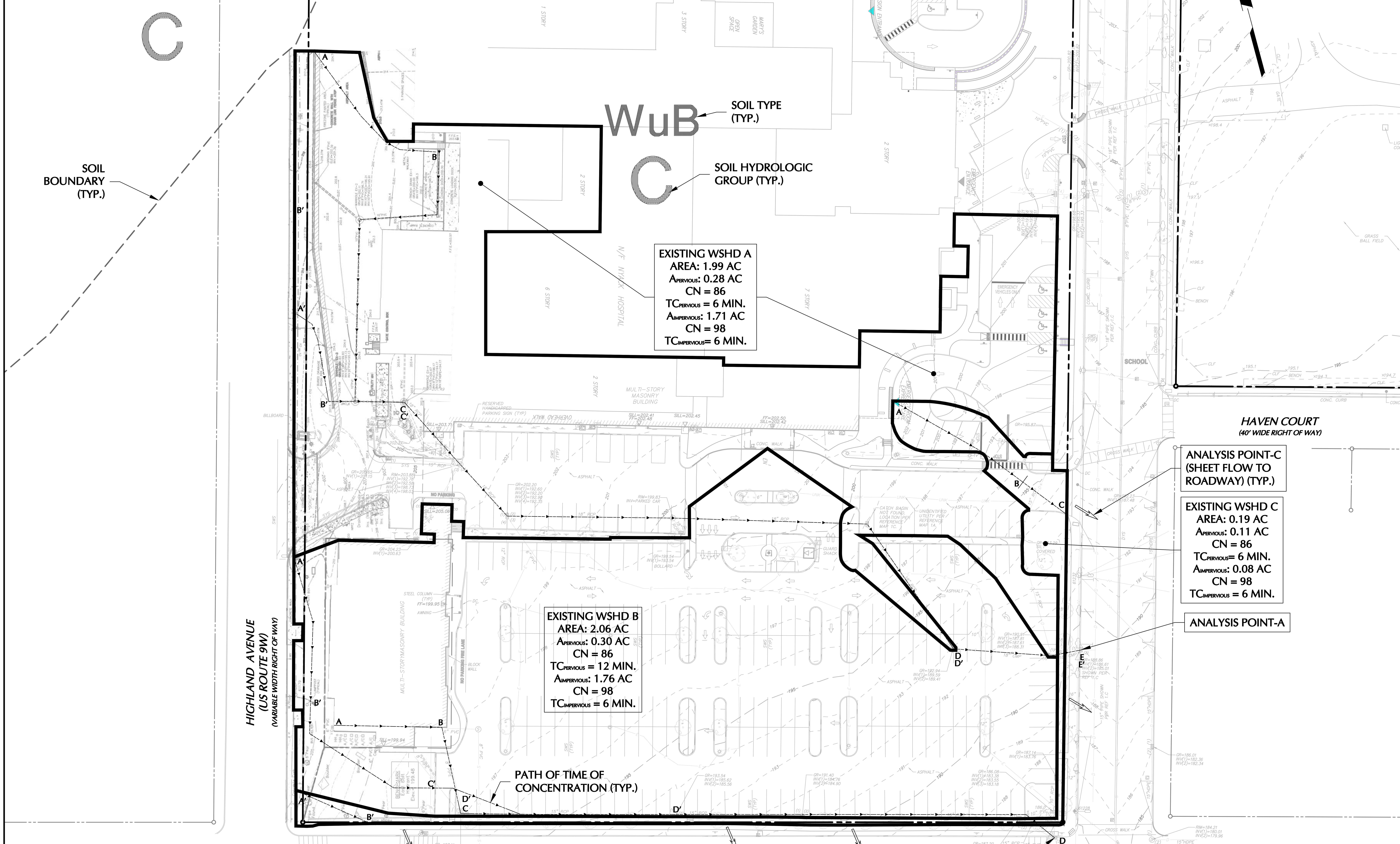
LEGEND

201	EXISTING MINOR CONTOUR
200	EXISTING MAJOR CONTOUR
	SOIL BOUNDARY LINE
	WATERSHED BOUNDARY LINE
	PATH OF TIME OF CONCENTRATION



GENERAL NOTES:

1. EXISTING EXISTING BOUNDARY AND TOPOGRAPHY INFORMATION IS BASED ON PLAN TITLED "EXISTING CONDITIONS PLAN", PREPARED BY LRC GROUP, DATED 08/22/2016; AND FIELD DATA OBTAINED BY LANGAN ENGINEERING, ENVIRONMENTAL, SURVEYING, LANDSCAPE ARCHITECTURE AND GEOLOGY, D.P.C. ON 1/23/2020.
2. ELEVATIONS SHOWN ARE REFERENCED TO THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD 88).
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30 0 15 30
SCALE: 1" = 30'

Date	Description	No.

REVISIONS

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Project
NYACK HOSPITAL PARKING STRUCTURE
BLOCK No. 1, LOT No.74
VILLAGE OF NYACK
ROCKLAND COUNTY NEW YORK

Drawing Title
EXISTING WATERSHED AREA MAP

Project No. 100754201
Date 03/17/2020
Drawn By VP
Checked By LM
Drawing No. CG201

PROJECT NO. 100754201

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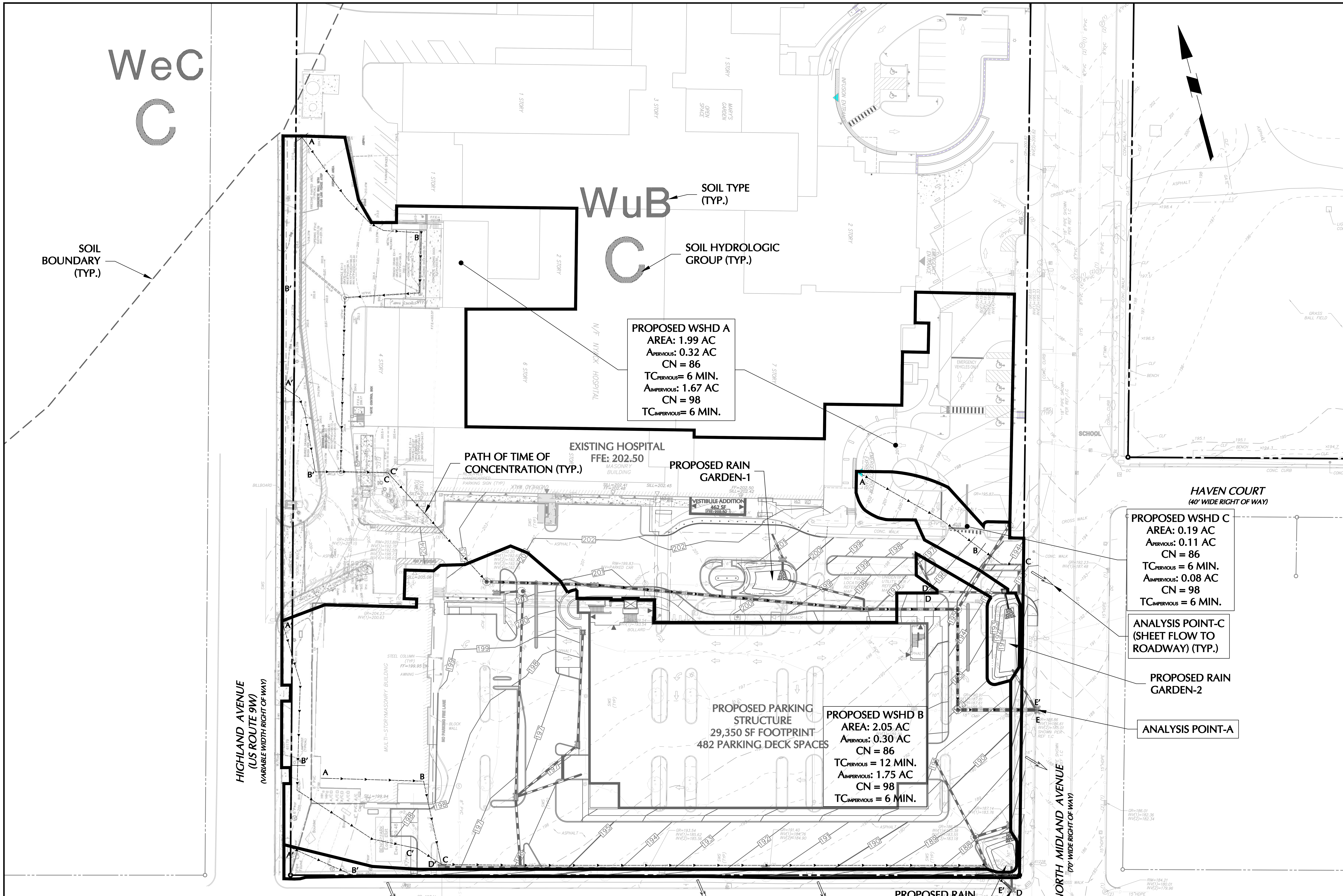

LEGEND

201	EXISTING MINOR CONTOUR
200	EXISTING MAJOR CONTOUR
201	PROPOSED MINOR CONTOUR
200	PROPOSED MAJOR CONTOUR
	SOIL BOUNDARY LINE
	WATERSHED BOUNDARY LINE
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SCALE: 1" = 30'

LANGAN

PROJECT NO. 100754201

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Project

NYACK HOSPITAL PARKING STRUCTURE

BLOCK No. 1, LOT No.74
VILLAGE OF NYACK
ROCKLAND COUNTY NEW YORK

Drawing Title

PROPOSED WATERSHED AREA MAP

Project No. 100754201	Drawing No. CG202
Date 03/17/2020	
Drawn By VP	
Checked By LM	

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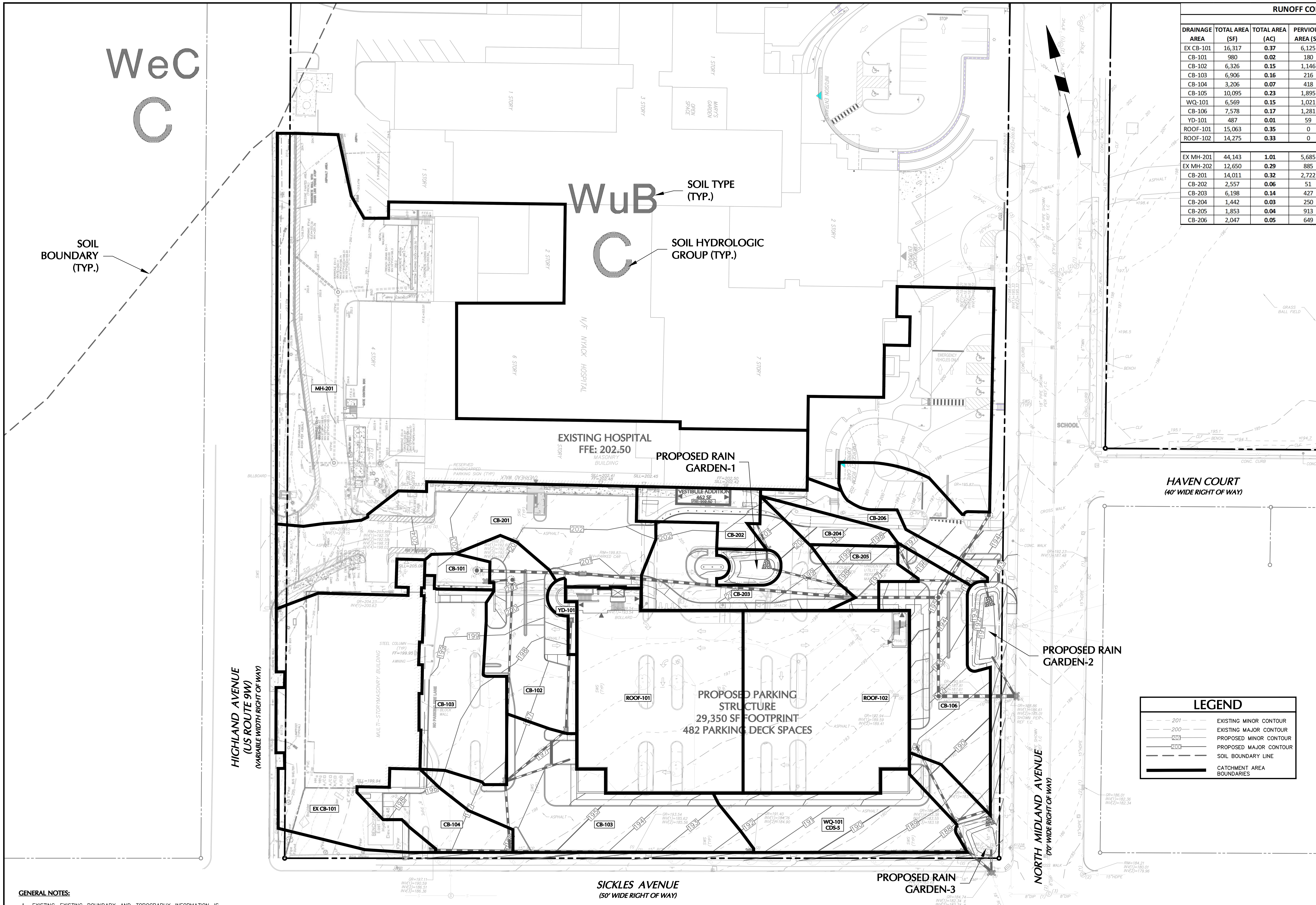
RUNOFF COEFFICIENT TABLE- ONSITE								
100-SERIES								
DRAINAGE AREA	**TOTAL AREA (SF)**	**TOTAL AREA (AC)**	**PERVIOUS AREA (SF)**	**GRASS AREA (AC)**	**IMPERVIOUS AREA (AC)**	**GRASS (0.30)**	**IMPERVIOUS (0.99)**	**C VALUE**
EX CB-101	16,317	**0.37**	6,125	0.14	0.23	0.04	0.23	**0.73**
CB-101	980	**0.02**	180	0.00	0.02	0.00	0.02	**0.86**
CB-102	6,326	**0.15**	1,146	0.03	0.12	0.01	0.12	**0.87**
CB-103	6,906	**0.16**	216	0.00	0.15	0.00	0.15	**0.97**
CB-104	3,206	**0.07**	418	0.01	0.06	0.00	0.06	**0.90**
CB-105	10,095	**0.23**	1,895	0.04	0.19	0.01	0.19	**0.86**
WQ-101	6,569	**0.15**	1,021	0.02	0.13	0.01	0.13	**0.88**
CB-106	7,578	**0.17**	1,281	0.03	0.14	0.01	0.14	**0.87**
YD-101	487	**0.01**	59	0.00	0.01	0.00	0.01	**0.91**
ROOF-101	15,063	**0.35**	0	0.00	0.35	0.00	0.34	**0.99**
ROOF-102	14,275	**0.33**	0	0.00	0.33	0.00	0.32	**0.99**
200-SERIES								
EX MH-201	44,143	**1.01**	5,685	0.13	0.88	0.04	0.87	**0.90**
EX MH-202	12,650	**0.29**	885	0.02	0.27	0.01	0.27	**0.94**
CB-201	14,011	**0.32**	2,722	0.06	0.26	0.02	0.26	**0.86**
CB-202	2,557	**0.06**	51	0.00	0.06	0.00	0.06	**0.98**
CB-203	6,198	**0.14**	427	0.01	0.13	0.00	0.13	**0.94**
CB-204	1,442	**0.03**	250	0.01	0.03	0.00	0.03	**0.87**
CB-205	1,853	**0.04**	913	0.02	0.02	0.01	0.02	**0.65**
CB-206	2,047	**0.05**	649	0.01	0.03	0.00	0.03	**0.77**



GENERAL NOTES:

1. EXISTING EXISTING BOUNDARY AND TOPOGRAPHY INFORMATION IS BASED ON PLAN TITLED "EXISTING CONDITIONS PLAN", PREPARED BY LRC GROUP, DATED 08/22/2016; AND FIELD DATA OBTAINED BY LANGAN ENGINEERING, ENVIRONMENTAL, SURVEYING, LANDSCAPE ARCHITECTURE AND GEOLOGY, D.P.C. ON 1/23/2020.
2. ELEVATIONS SHOWN ARE REFERENCED TO THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD 88).
3. THE MERIDIAN OF THE SURVEY IS REFERENCED TO NEW YORK STATE PLANE COORDINATE EAST SYSTEM NAD1983 (2011) DERIVED USING SURVEY-GRADE GNSS EQUIPMENT.

30 0 15 30
SCALE: 1" = 30'

Date	Description	No.
REVISIONS		

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Project

NYACK HOSPITAL PARKING STRUCTURE

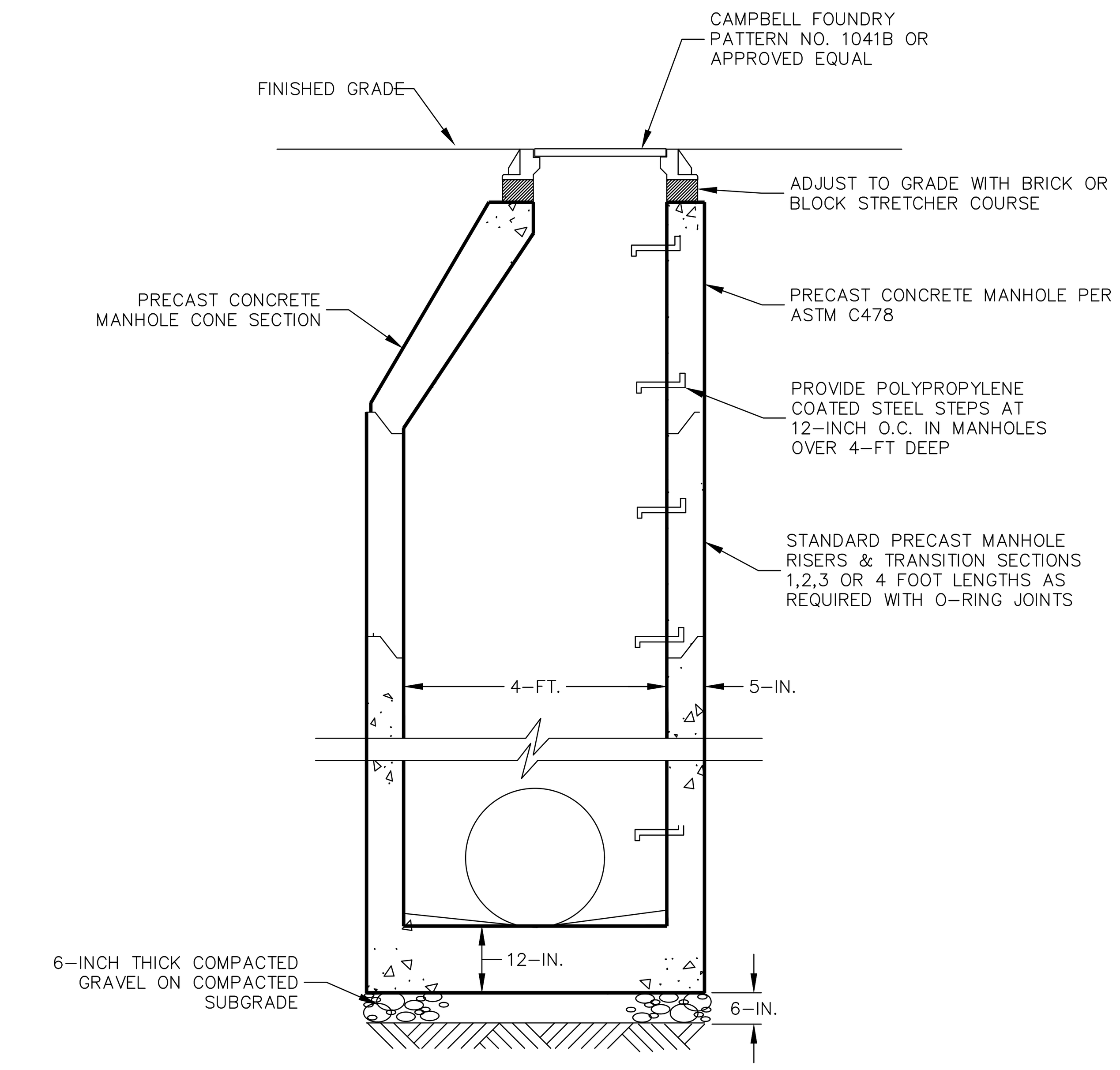
BLOCK No. 1, LOT No.74
VILLAGE OF NYACK
ROCKLAND COUNTY **NEW YORK**

Drawing Title

PROPOSED CATCHMENT AREA PLAN

Project No. 100754201
Date 03/17/2020
Drawn By VP
Checked By LM
Drawing No. CG203

PROJECT NO. 100754201

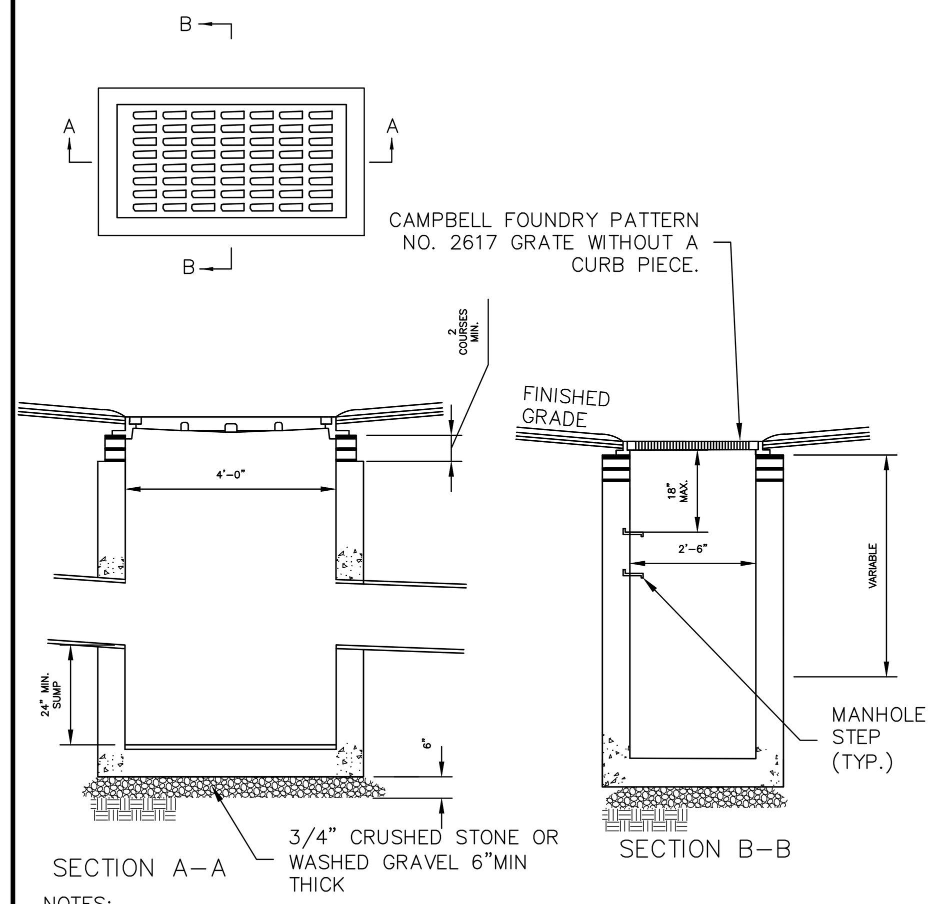


NOTES:

1. SOIL CONDITIONS BELOW MANHOLE FOOTING DEEMED UNSUITABLE BY FIELD ENGINEER SHALL BE EXCAVATED TO SUITABLE MATERIAL OR A MAXIMUM OF TWO ADDITIONAL FEET AND FILLED WITH 3/4" STONE.
2. INTERIOR STRUCTURE DIMENSIONS SHOWN ARE MINIMUM VALUES. PROVIDE DIMENSIONS AS NEEDED TO ACCOMMODATE 6-INCH CLEARANCE FROM SIDE WALLS OF BASIN TO OUTSIDE OF PIPE PENETRATION.
3. SEE C-210 SERIES DRAWINGS FOR STORM PIPE SIZES, STRUCTURE ORIENTATION; RIM AND INVERT ELEVATIONS.

NTS

STORM MANHOLE

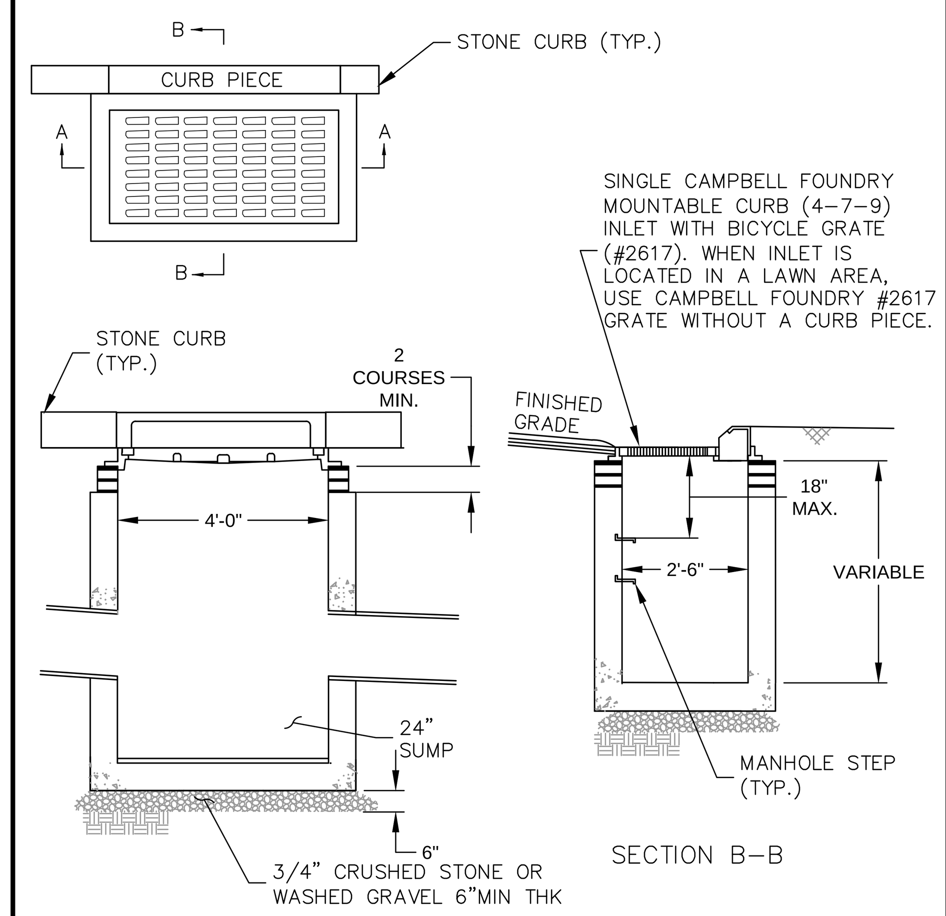


NOTES:

1. THE CONTRACTOR SHALL SUBMIT SHOP DWGS. FOR EACH STRUCTURE FOR THE ENGINEERS REVIEW PRIOR TO FABRICATION.
2. STRUCTURE SHALL BE CERTIFIED AS CONFORMING TO ASTM-C913 LATEST REVISION.
3. STEPS NOT REQUIRED FOR STRUCTURES LESS THAN 4' DEEP.
4. FOR STRUCTURES WITH PIPE DIAMETERS EXCEEDING MAXIMUMS, PROVIDE CONCRETE SLAB AS NOTED.
5. STRUCTURAL DESIGN (WALL AND SLAB THICKNESS AND ALL REINFORCING) BY PRECASTER AND SHALL MEET STATE DEPARTMENT OF TRANSPORTATION STANDARDS AND SUPPORT HS-20 LOADING AS REQUIRED.
6. DETAIL INDICATES MINIMUM STRUCTURE DIMENSIONS. LARGER DIMENSIONS MAY BE REQUIRED FOR LARGER PIPES.

NTS

DRAIN INLET

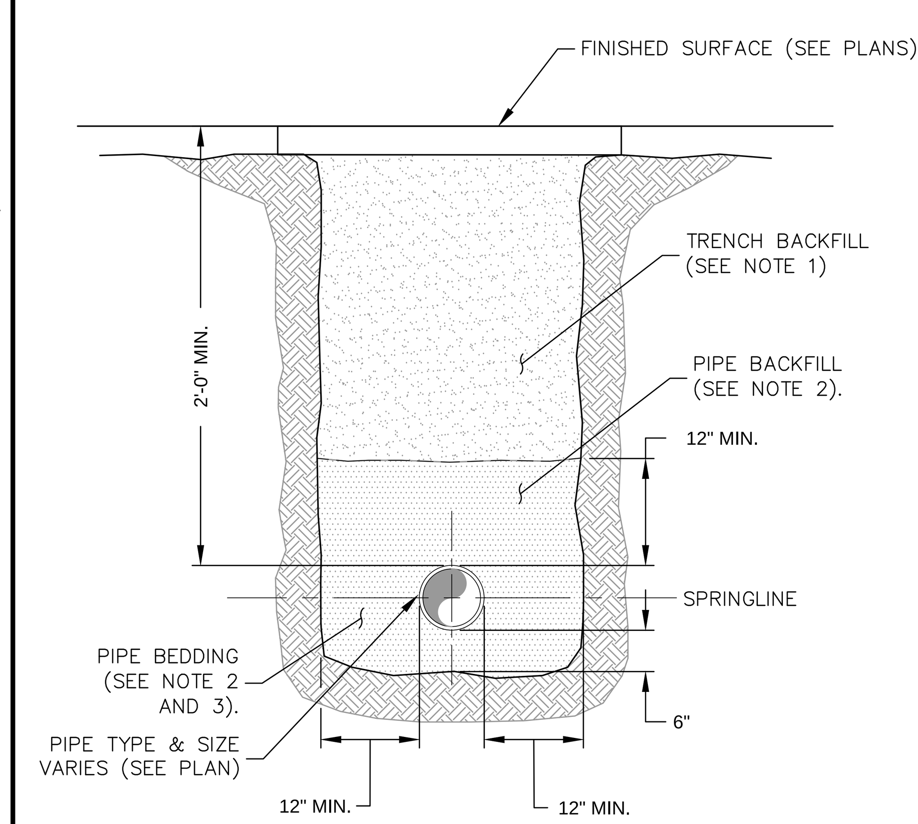


NOTES:

1. THE CONTRACTOR SHALL SUBMIT SHOP DWGS. FOR EACH STRUCTURE FOR THE ENGINEERS APPROVAL PRIOR TO FABRICATION.
2. STRUCTURE SHALL BE CERTIFIED AS CONFORMING TO ASTM-C913 LATEST REVISION.
3. STEPS NOT REQUIRED FOR STRUCTURES LESS THAN 4' DEEP.
4. FOR STRUCTURES WITH PIPE DIAMETERS EXCEEDING MAXIMUMS, PROVIDE CONCRETE SLAB AS NOTED.
5. STRUCTURAL DESIGN (WALL AND SLAB THICKNESS AND ALL REINFORCING) BY PRECASTER AND SHALL MEET STATE DEPARTMENT OF TRANSPORTATION STANDARDS AND SUPPORT HS-20 LOADING AS REQUIRED.
6. DETAIL INDICATES MINIMUM STRUCTURE DIMENSIONS. LARGER DIMENSIONS MAY BE REQUIRED FOR LARGER PIPES.

NTS

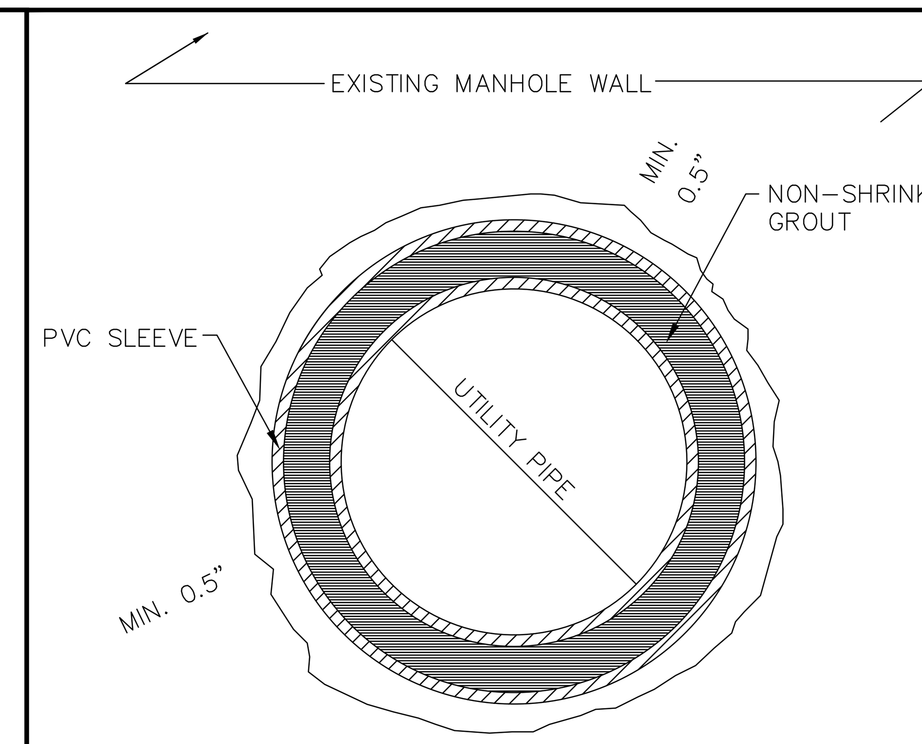
CATCH BASIN



NOTES:
1. PREDOMINATELY GRANULAR FILL MATERIAL. MAX. PARTICLE SIZE 4". COMPACT IN MAX. 8" LOOSE LIFTS TO 95% MODIFIED PROCTOR DENSITY USING ONSITE MATERIALS.
2. MIXTURE OF CRUSHED STONE AND GRAVEL, FREE OF SOFT, NONDURABLE PARTICLES, ORGANIC MATERIALS AND ELONGATED PARTICLES. MAX. PARTICLE SIZE ¾". COMPACT IN MAX. 6" LOOSE LIFTS.
3. WHEN IN LEDGE, USE AASHTO NO. 67 OR EQUAL PROCESSED SAND AND GRAVEL FREE OF DEBRIS, CLAY LUMPS, ORGANIC, OR OTHER DELETERIOUS MATERIAL. COMPACT TO THE SPRINGLINE IN MAX. 6" LOOSE LIFTS.
4. TRENCHING SHALL BE IMPLEMENTED IN ACCORDANCE WITH O.S.H.A. STANDARDS.

NTS

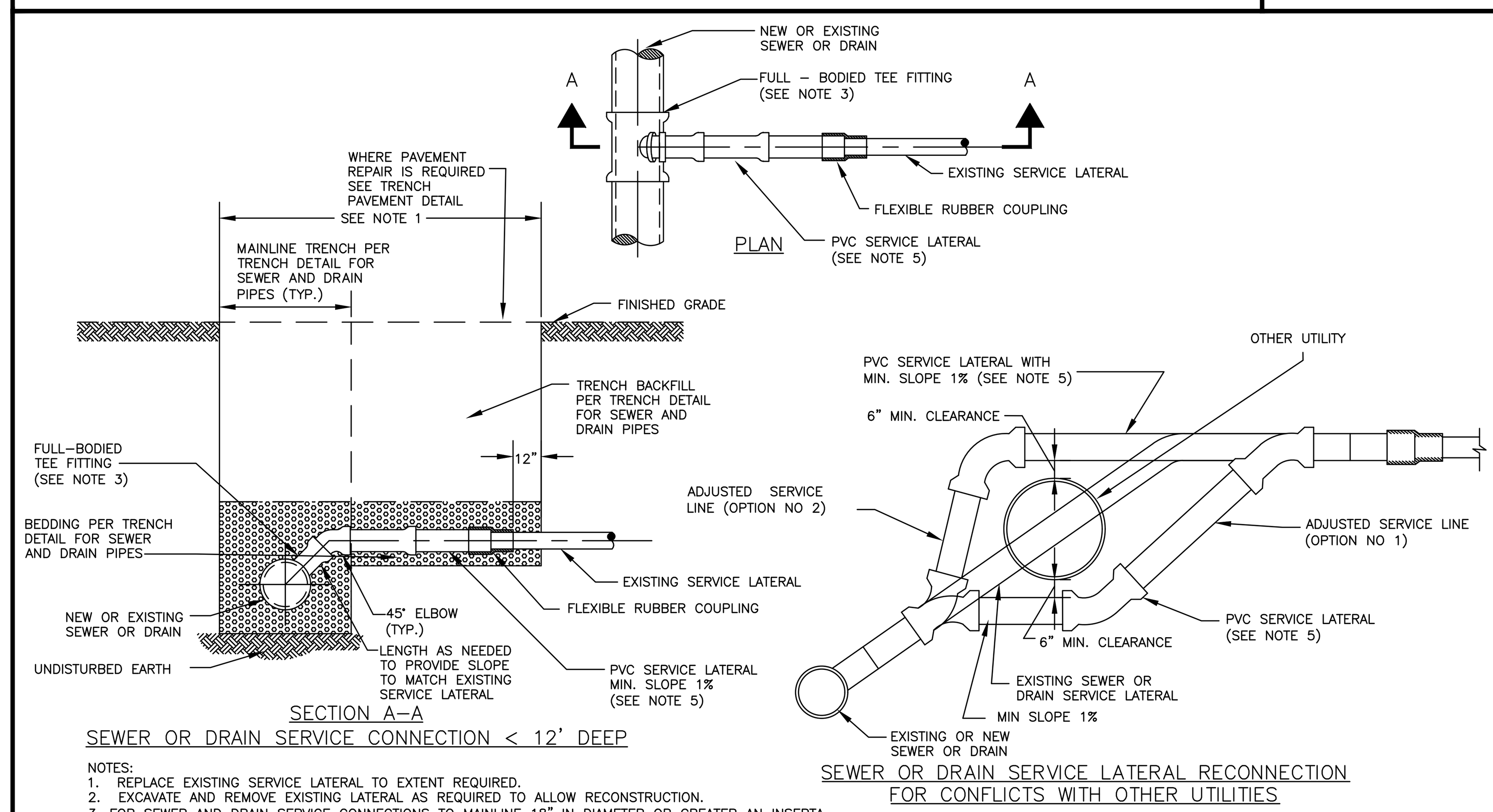
DRAINAGE PIPE TRENCH



1. CORE-DRILL OPENING IN EXISTING MANHOLE/CATCH BASIN WALL TO ACCOMODATE PVC SLEEVE WITH MIN. 0.5" CLEARANCE ALL AROUND.
2. SET SLEEVE IN POSITION USING NON-SHRINK GROUT TO ASTM 1107 (SIKA GROUT 212, MANUFACTURED BY SIKA, OR APPROVED EQUIVALENT).
3. AFTER GROUT HAS SET, SET UTILITY IN POSITION.
4. SEAL USING POLYURETHANE SEALANT (SIKA FLEX-2C-NF/SL SEALANT, OR APPROVED EQUIVALENT), APPLIED FROM EITHER END TO FILL SLEEVE.
5. CONTROL WATER LEVELS FROM INITIAL CORE-DRILLING TO END OF RECOMMENDED SET TIME OR POLYURETHANE SEALANT.

NTS

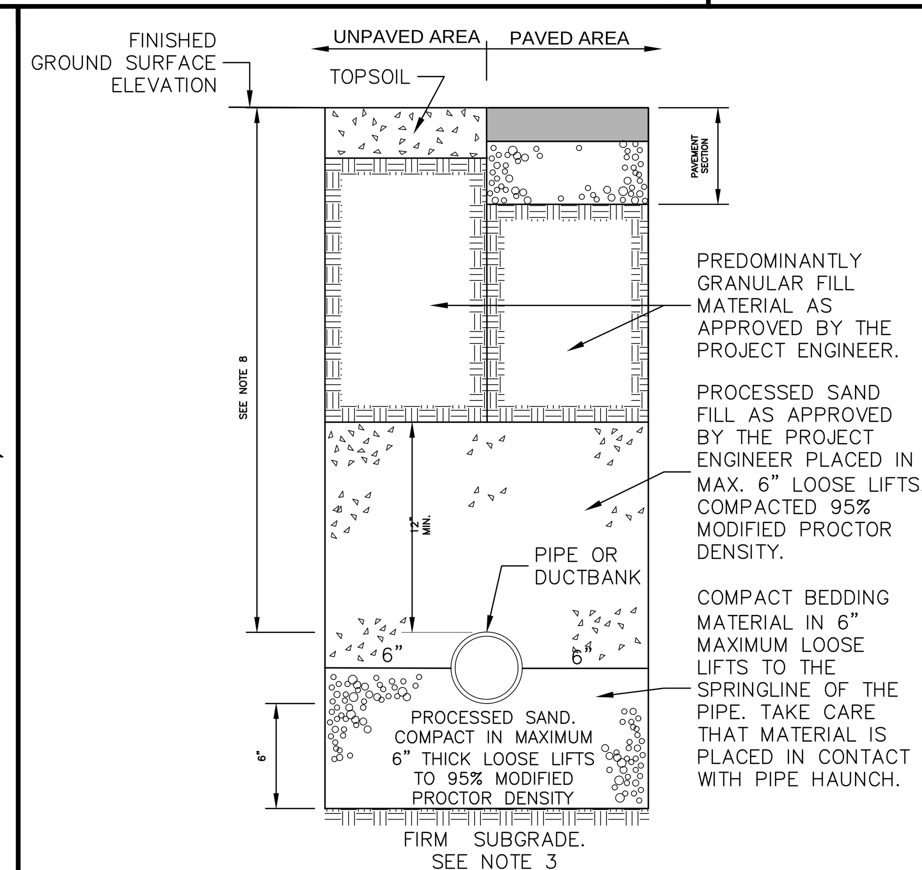
UTILITY PIPE CONNECTION INTO EXISTING STRUCTURE



NOTES:
1. REPLACE EXISTING SERVICE LATERAL TO EXTENT REQUIRED.
2. EXCAVATE AND REMOVE EXISTING LATERAL AS REQUIRED TO ALLOW RECONSTRUCTION.
3. FOR SEWER AND DRAIN SERVICE CONNECTIONS TO MAINLINE 18" IN DIAMETER OR GREATER AN INSERTA TEE OR EQUAL MAY BE USED.
4. FOR SERVICE CONNECTIONS > 12' DEEP FROM INVERT OF MAINLINE PIPE TO FINISHED GRADE, SEE CHIMNEY DETAIL.
5. SEWER AND DRAIN LATERALS SHALL BE SIZED TO FIT ANTICIPATED FLOWS BUT SHALL NOT BE LESS THAN 6" FOR SEWER SERVICES AND 8" FOR DRAIN SERVICES

NTS

ROOF LEADER CONNECTION



SAND BEDDING MATERIAL (GAS, ELECTRIC, AND TELEPHONE): PROCESSED SAND FREE FROM DEBRIS, CLAY LUMPS, ORGANIC, OR OTHER DELETERIOUS MATERIAL, AND COMPLYING WITH THE FOLLOWING GRADATION REQUIREMENTS UNLESS OTHERWISE SPECIFIED BY LOCAL UTILITY COMPANY:

U.S. SIEVE SIZE	PERCENT PASSING (BY WEIGHT)
3/8 Inch	100
No. 4	94–100
No. 16	45–85
No. 50	3–29
No. 100	0–10

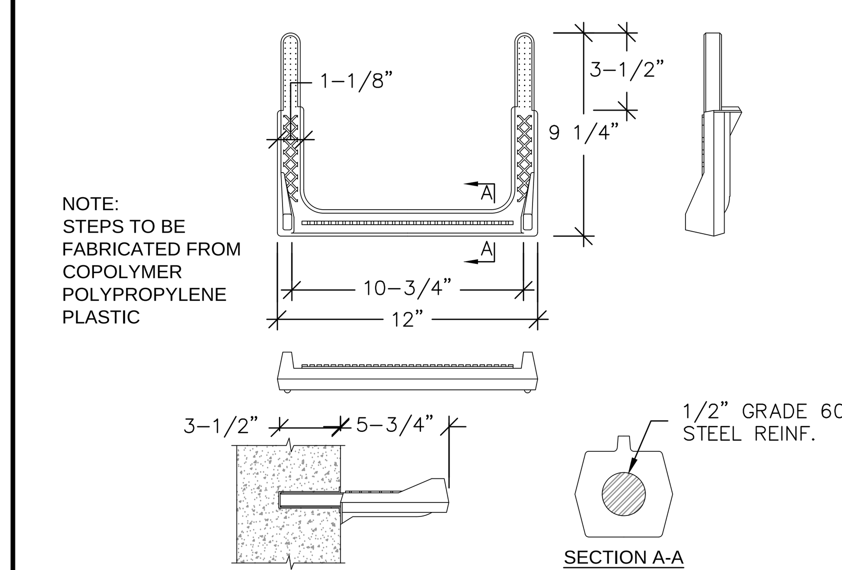
NOTES:

1. ALL TRENCH EXCAVATIONS ARE TO BE DONE IN COMPLIANCE WITH OSHA REGULATIONS.
2. MINIMUM TRENCH WIDTH TO BE AT LEAST 6 INCHES FROM EDGE OF PIPE OUTER EDGE OF MULTIPLE PIPES IN TRENCH OR DUCT BANK TO EDGE OF TRENCH WALL.
3. IF SOFT SOIL IS ENCOUNTERED AT BEDDING SUBGRADE, THE SOFT SOIL IS TO BE REMOVED (TO A MAXIMUM DEPTH OF 2 FT) AND REPLACED WITH ¾" CLEAN CRUSHED STONE.
4. MATERIAL EXCAVATED FROM THE TRENCH MAY BE USED FOR BACKFILL PROVIDED IT IS PREDOMINATELY SAND AND IS AT WATER CONTENT THAT THE MATERIAL CAN BE READILY COMPACTED TO DENSITY REQUIRED.
5. WITHIN PUBLIC RIGHT OF WAY BENEATH PAVEMENT, THE BACKFILL MATERIAL SHALL BE CLEAN CRUSHED STONE EQUIVALENT TO AASHTO NO. 67 OR ¾" STONE, UNLESS AUTHORITY HAVING JURISDICTION REQUIRES OTHERWISE.
6. BACKFILL SHALL BE PLACED IN MAXIMUM 8" LOOSE LIFTS COMPACTED UTILIZING A WALK BEHIND VIBRATING ROLLER TO A MINIMUM DENSITY EQUAL TO 95% MODIFIED PROCTOR DENSITY IN PAVED AREAS AND 92% IN UNPAVED AREAS.
7. IN AREAS WHERE THERE IS NOT SUFFICIENT WIDTH FOR A DOUBLE DRUM WALK BEHIND COMPACTOR THE LIFT THICKNESS SHALL BE ADJUSTED AS NECESSARY TO ACHIEVE COMPACTION WITH APPROPRIATE EQUIPMENT.
8. THE MINIMUM DEPTH OF COVER SHALL BE THAT REQUIRED BY UTILITY PROVIDER.

NTS

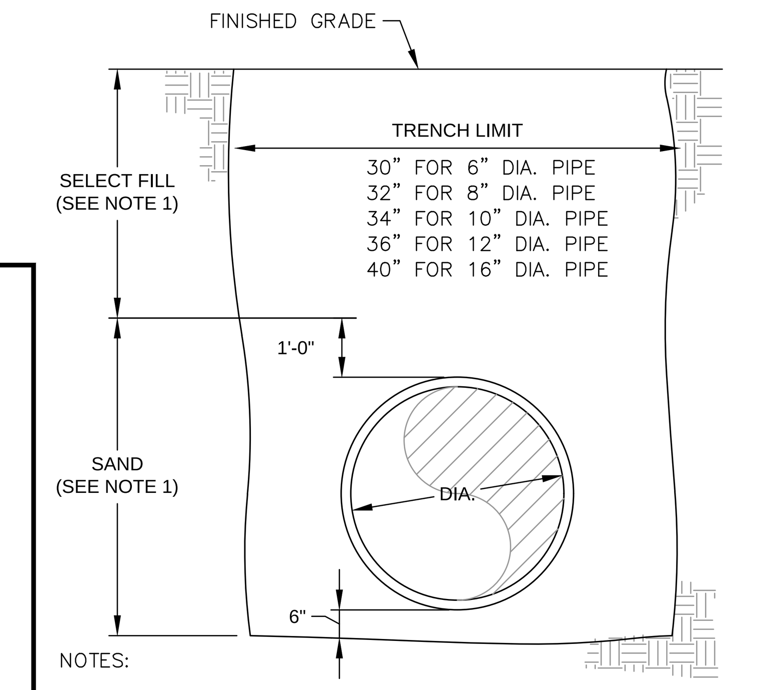
TRENCH DETAIL FOR ELECTRIC, CABLE, AND TELEPHONE

NOTE:
STEPS TO BE FABRICATED FROM COPOLYMER POLYPROPYLENE PLASTIC



NTS

POLYPROPYLENE MANHOLE STEP

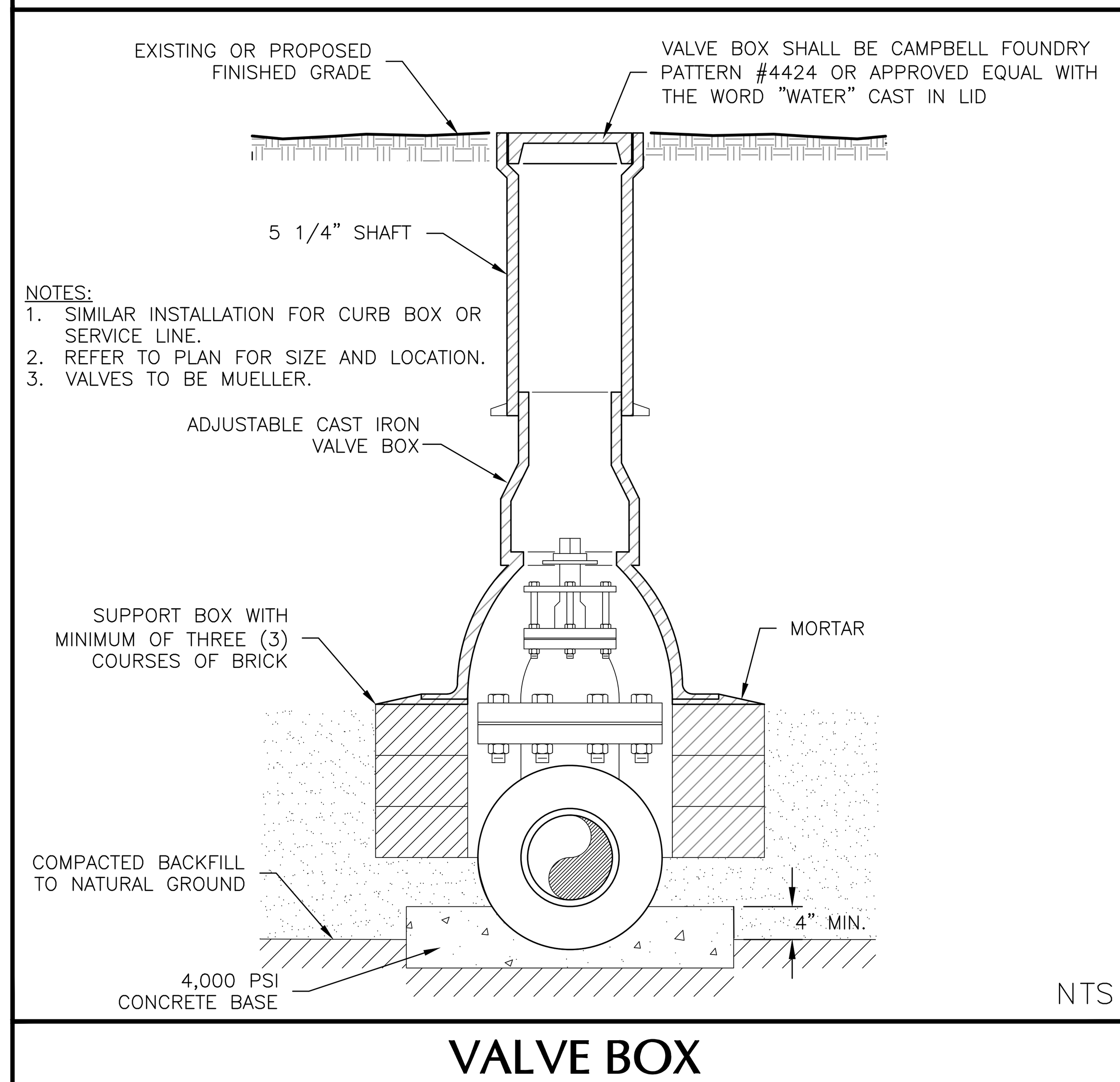


NOTES:

1. SELECT FILL
SHALL BE MATERIAL FREE FROM CINDERS, ASHES, REFUSE, VEGETABLE OR ORGANIC MATTER, BOULDERS, ROCKS AND STONES, ASPHALT, OR ANY OTHER MATERIAL DEEMED UNSUITABLE BY THE ENGINEER. STONES NOT GREATER THAN 8 INCHES IN THEIR GREATEST DIMENSION MAY BE USED, UNLESS OTHERWISE SPECIFIED, BUT MAY NOT COMPRISE MORE THAN 1% BY VOLUME OF THE BACKFILL MATERIAL.
2. SAND BACKFILL TO 1 FOOT ABOVE TOP OF PIPE. IN A WET OR ROCK TRENCH, GRAVEL MAY BE SPECIFIED BY THE ENGINEER IN LIEU OF SAND.

NTS

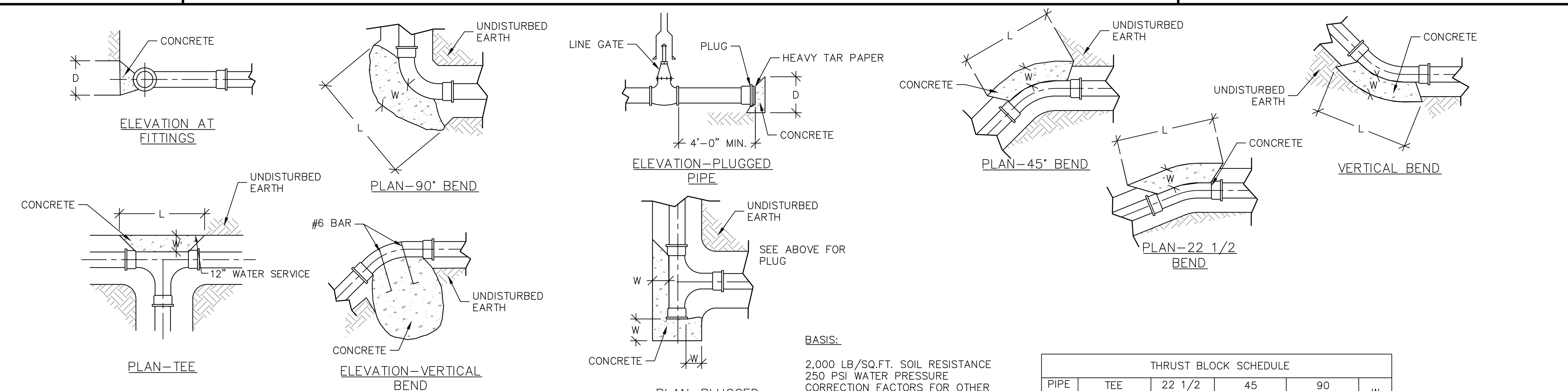
TRENCH DETAIL FOR WATER MAIN



NOTES:
1. SIMILAR INSTALLATION FOR CURB BOX OR SERVICE LINE.
2. REFER TO PLAN FOR SIZE AND LOCATION.
3. VALVES TO BE MUELLER.

NTS

VALVE BOX



BASIS:

2,000 LB/SQ.FT. SOIL RESISTANCE
250 PSI WATER PRESSURE
CORRECTION FACTORS FOR OTHER SOILS:

SOFT CLAY	4
SAND	2
SAND & GRAVEL	1.33
SHALE	0.4

THRUST BLOCK SCHEDULE

PIPE SIZE	TEE L	TEE D	22 1/2 L	22 1/2 D	45 L	45 D	90 L	90 D	W
6"	18"	15"	15"	12"	15"	12"	15"	15"	21"
8"	2'	18"	18"	12"	18"	12"	2'	18"	2'

NOTES:

1. IF SOFT MATERIALS ARE ENCOUNTERED, THE THRUST BLOCKS SIZES SHALL BE ADJUSTED ACCORDINGLY.
2. CONCRETE TO BE 5,000 PSI.

NTS

THRUST BLOCKS

Date	Description	No.

REVISIONS

SIGNATURE — DATE SIGNED
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PROFESSIONAL ENGINEER NY Lic. No. 102374

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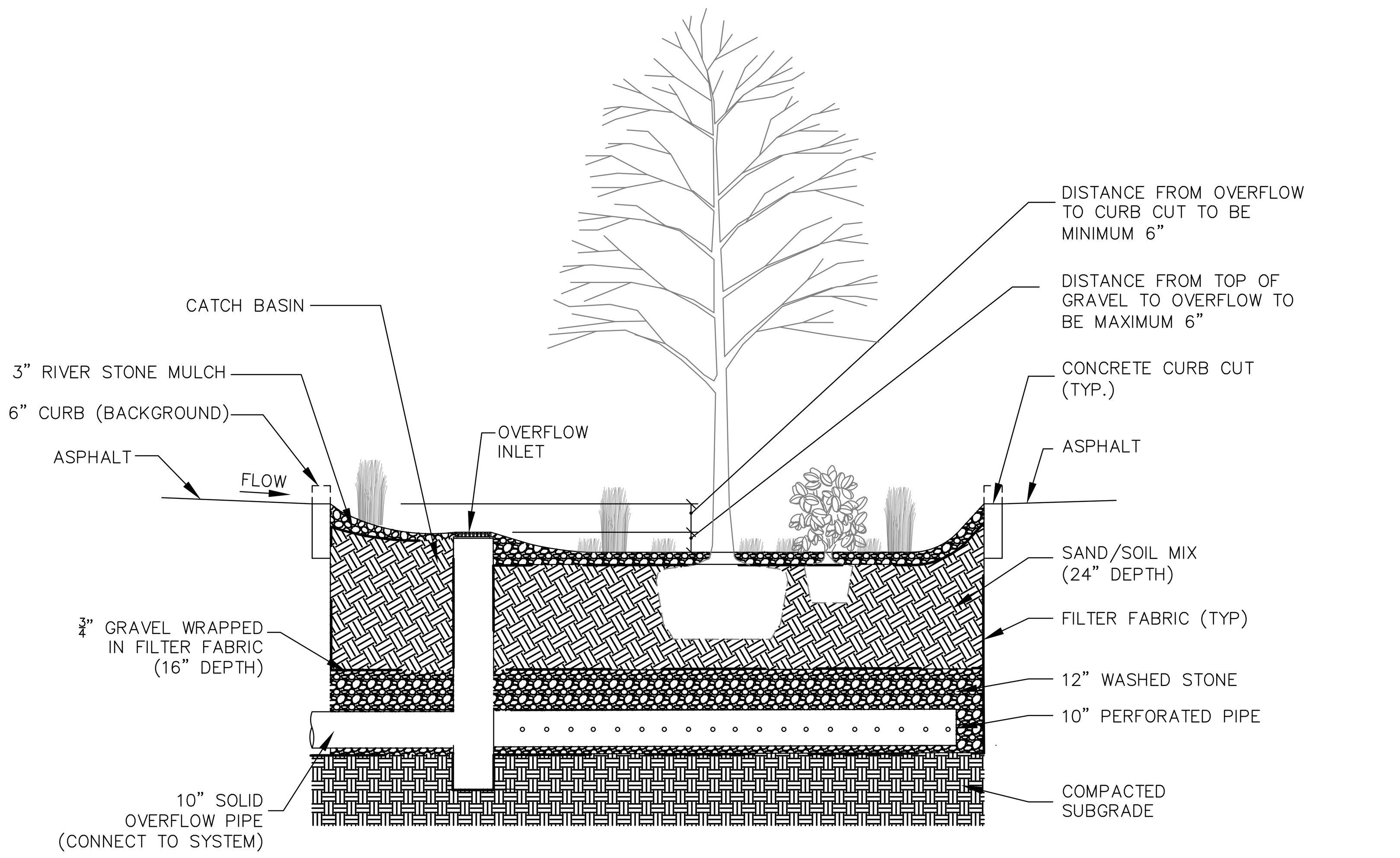
Project
NYACK HOSPITAL PARKING STRUCTURE
BLOCK No. 1, LOT No.74
VILLAGE OF NYACK
ROCKLAND COUNTY NEW YORK

Drawing Title
DETAILS II

Project No. 100754201
Date 03/17/2020
Drawn By VP
Checked By LM
Drawing No. CS502

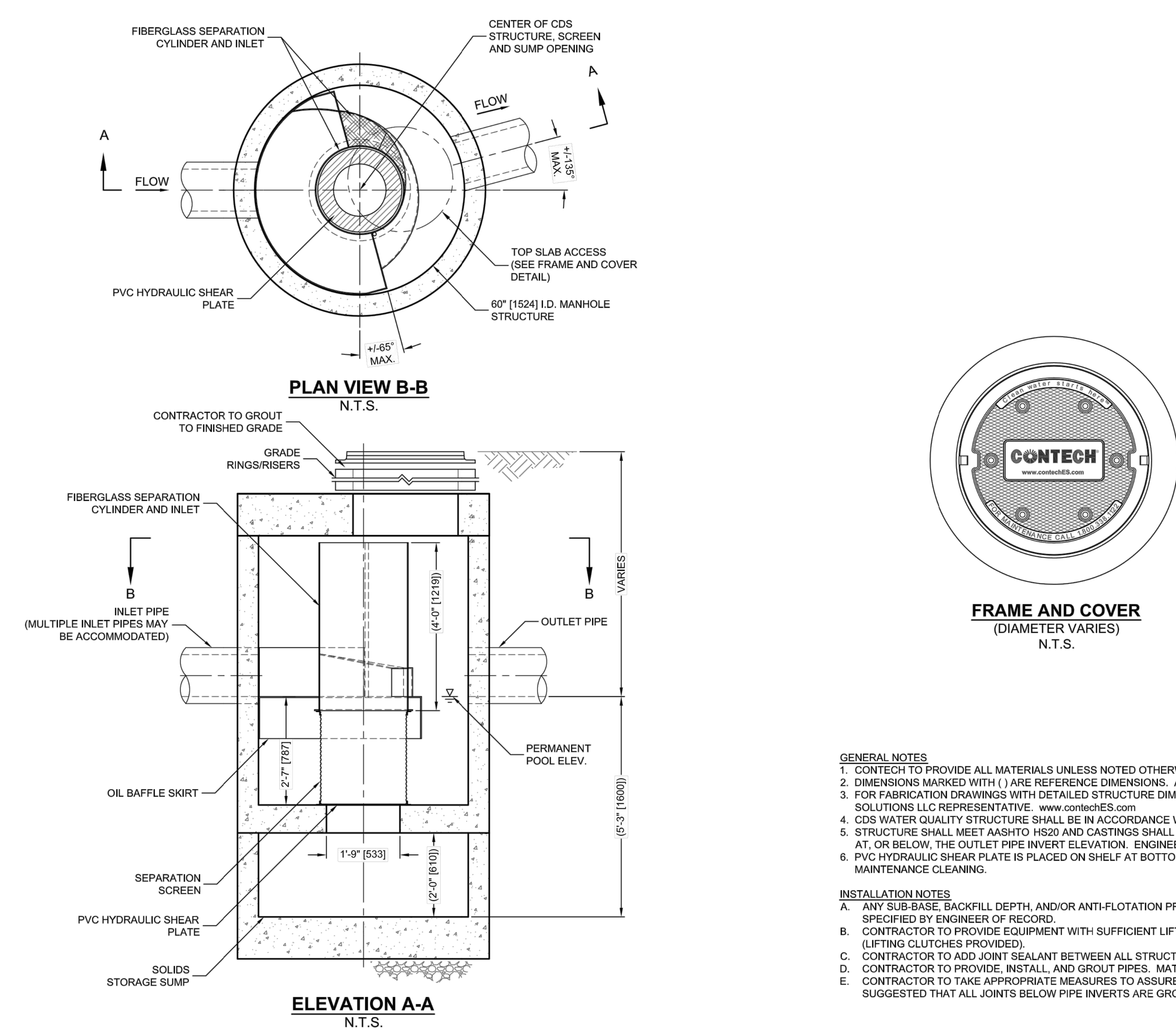
PROJECT NO. 100754201



NOTES:
1. REFER TO GRADING AND DRAINAGE PLANS FOR EXACT LOCATION OF CATCH BASINS AND MANHOLES.
2. INVERTS PROVIDED ON GRADING AND DRAINAGE PLANS.
3. SAND/ SOIL MIX SHALL BE A 80/20 MIX.

NTS

TYPICAL RAIN GARDEN DETAIL



GENERAL NOTES
1. CONTECH TO PROVIDE ALL MATERIALS UNLESS NOTED OTHERWISE.
2. DIMENSIONS MARKED WITH ( ) ARE REFERENCE DIMENSIONS. ACTUAL DIMENSIONS MAY VARY.
3. FOR FABRICATION DRAWINGS WITH DETAILED STRUCTURE DIMENSIONS AND WEIGHTS, PLEASE CONTACT YOUR CONTECH ENGINEERED SOLUTIONS LLC REPRESENTATIVE. www.contechES.com
4. CDS WATER QUALITY STRUCTURE SHALL BE IN ACCORDANCE WITH ALL DESIGN DATA AND INFORMATION CONTAINED IN THIS DRAWING.
5. STRUCTURE SHALL MEET AASHTO HS20 AND CASTINGS SHALL MEET HS20 (AASHTO M 306) LOAD RATING, ASSUMING GROUNDWATER ELEVATION AT, OR BELOW, THE OUTLET PIPE INVERT ELEVATION. ENGINEER OF RECORD TO CONFIRM ACTUAL GROUNDWATER ELEVATION.
6. PVC HYDRAULIC SHEAR PLATE IS PLACED ON SHELF AT BOTTOM OF SCREEN CYLINDER. REMOVE AND REPLACE AS NECESSARY DURING MAINTENANCE CLEANING.

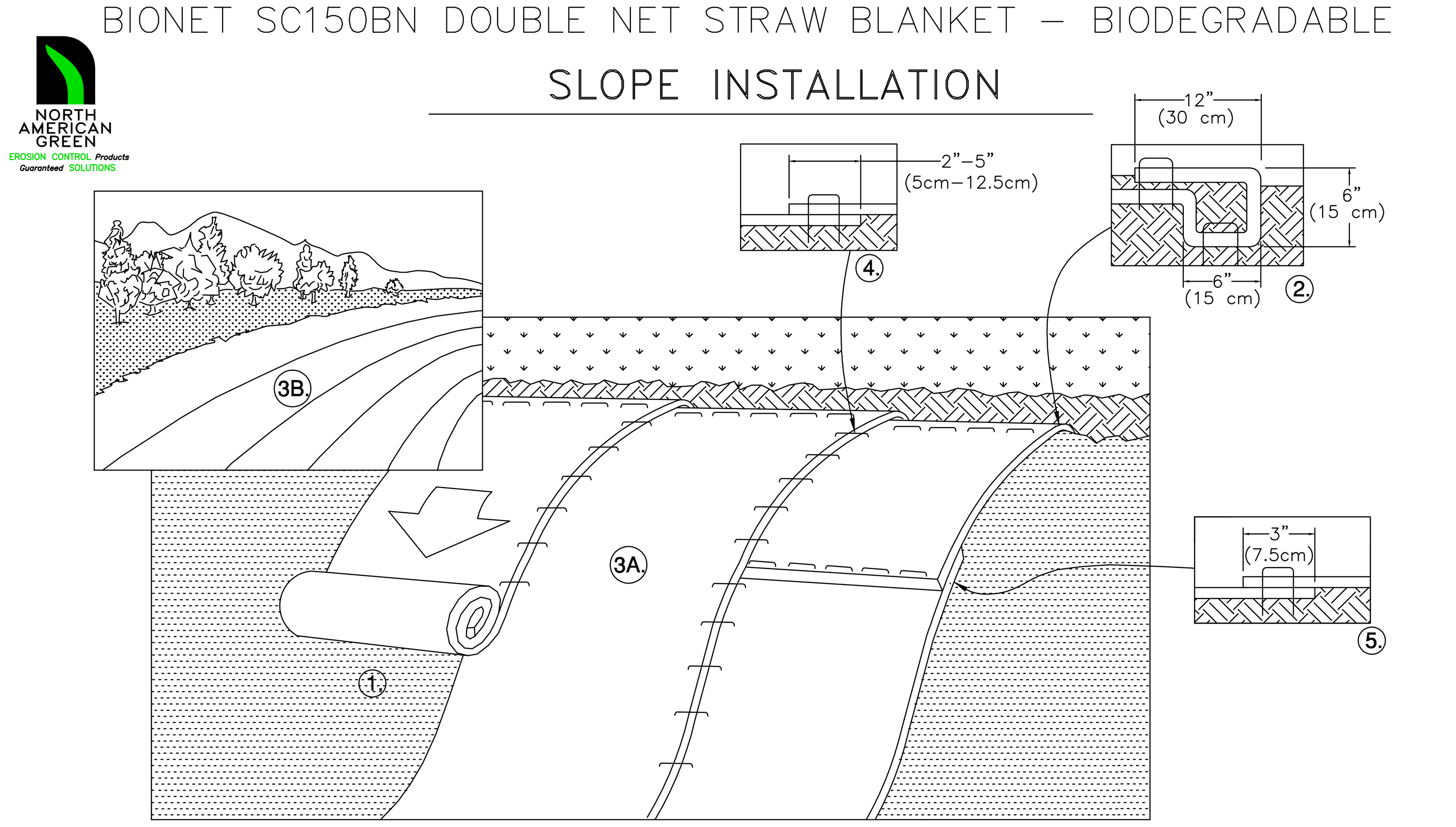
INSTALLATION NOTES
A. ANY SUB-BASE, BACKFILL DEPTH, AND/OR ANTI-FLOTATION PROVISIONS ARE SITE-SPECIFIC DESIGN CONSIDERATIONS AND SHALL BE SPECIFIED BY ENGINEER OF RECORD.
B. CONTRACTOR TO PROVIDE EQUIPMENT WITH SUFFICIENT LIFTING AND REACH CAPACITY TO LIFT AND SET THE CDS MANHOLE STRUCTURE (LIFTING CLUTCHES PROVIDED).
C. CONTRACTOR TO ADD JOINT SEALANT BETWEEN ALL STRUCTURE SECTIONS, AND ASSEMBLE STRUCTURE.
D. CONTRACTOR TO PROVIDE, INSTALL, AND GROUT PIPES. MATCH PIPE INVERTS WITH ELEVATIONS SHOWN.
E. CONTRACTOR TO TAKE APPROPRIATE MEASURES TO ASSURE UNIT IS WATER TIGHT, HOLDING WATER TO FLOWLINE INVERT MINIMUM. IT IS SUGGESTED THAT ALL JOINTS BELOW PIPE INVERTS ARE GROUTED.

NTS

TYPICAL CONTECH WATER QUALITY UNIT (CDS-5)

BIONET SC150BN DOUBLE NET STRAW BLANKET – BIODEGRADABLE

SLOPE INSTALLATION



1. PREPARE SOIL BEFORE INSTALLING ROLLED EROSION CONTROL PRODUCTS (RECP's), INCLUDING ANY NECESSARY APPLICATION OF LIME, FERTILIZER, AND SEED.
NOTE: WHEN USING CELL-O-SEED DO NOT SEED PREPARED AREA. CELL-O-SEED MUST BE INSTALLED WITH PAPER SIDE DOWN.
2. BEGIN AT THE TOP OF THE SLOPE BY ANCHORING THE RECP's IN A 6" (15 CM) DEEP X 6" (15 CM) WIDE TRENCH WITH APPROXIMATELY 12" (30cm) OF RECP's EXTENDED BEYOND THE UP-SLOPE PORTION OF THE TRENCH. ANCHOR THE RECP's WITH A ROW OF STAPLES/STAKES APPROXIMATELY 12" (30 CM) APART IN THE BOTTOM OF THE TRENCH. BACKFILL AND COMPACT THE TRENCH AFTER STAPLING. APPLY SEED TO COMPACTED SOIL AND FOLD REMAINING 12" (30 CM) PORTION OF RECP's BACK OVER SEED AND COMPACTED SOIL. SECURE RECP's OVER COMPACTED SOIL WITH A ROW OF STAPLES/STAKES SPACED APPROXIMATELY 12" (30 CM) APART ACROSS THE WIDTH OF THE RECP's.
3. ROLL THE RECP's (A.) DOWN OR (B.) HORIZONTALLY ACROSS THE SLOPE. RECP's WILL UNROLL WITH APPROPRIATE SIDE AGAINST THE SOIL SURFACE. ALL RECP's MUST BE SECURELY FASTENED TO SOIL SURFACE BY PLACING STAPLES/STAKES IN APPROPRIATE LOCATIONS AS SHOWN IN THE STAPLE PATTERN GUIDE. WHEN USING THE DOT SYSTEM™, STAPLES/STAKES SHOULD BE PLACED THROUGH EACH OF THE COLORED DOTS CORRESPONDING TO THE APPROPRIATE STAPLE PATTERN.
4. THE EDGES OF PARALLEL RECP's MUST BE STAPLED WITH APPROXIMATELY 2" – 5" (5 CM – 12.5 CM) OVERLAP DEPENDING ON RECP's TYPE.
5. CONSECUTIVE RECP's SPLICED DOWN THE SLOPE MUST BE PLACED END OVER END (SHINGLE STYLE) WITH AN APPROXIMATE 3" (7.5 CM) OVERLAP. STAPLE THROUGH OVERLAPPED AREA, APPROXIMATELY 12" (30 CM) APART ACROSS ENTIRE RECP's WIDTH.
NOTE:
*IN LOOSE SOIL CONDITIONS, THE USE OF STAPLE OR STAKE LENGTHS GREATER THAN 6" (15 CM) MAY BE NECESSARY TO PROPERLY SECURE THE RECP's.

NOTE:
CONTRACTOR TO PROVIDE EROSION CONTROL BLANKET ON ALL SLOPES 3:1 OR STEEPER.

NTS

EROSION CONTROL BLANKET FOR RAIN GARDEN SEEDING

LANGAN

PROJECT NO. 100754201

Date	Description	No.

REVISIONS

SIGNATURE DATE SIGNED
MICHAEL J. FOWLER
PROFESSIONAL ENGINEER NY Lic. No. 102374

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Project

NYACK HOSPITAL
PARKING STRUCTURE

BLOCK No. 1, LOT No.74
VILLAGE OF NYACK
ROCKLAND COUNTY NEW YORK

Drawing Title

DETAILS III

Project No.	Drawing No.
100754201	CS503
Date: 03/17/2020	
Drawn By: VP	
Checked By: LM	

APPENDIX A

EXISTING WATERSHED ANALYSIS

CN AND Tc SHEETS

Project	Nyack Hospital - Parking Structure	By	VP	Date	3/17/2020
Location	Nyack, New York	Checked	LM	Date	3/17/2020

Circle one: (Present) Developed

Existing Watershed - A (Impervious)

1. Runoff Curve Number (CN)

Soil Name and hydrologic group (Appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN [1] Table 2-2	CN [1] Figure 2-3	CN [1] Figure 2-4	Area [x] acres [ ] mi^2 [ ] %	Product of CN x area
	Impervious	**98**			**1.71**	**167.58**
				Totals =	**1.71**	**167.58**

1) Use only one CN source per line

$$\text{CN (weighted)} = \frac{\text{total product}}{\text{total area}} = \frac{167.58}{1.71} = 98.00$$

Use CN = **98**

Project	NYACK HOSPITAL - PARKING STRUCTURE	By	VP	Date	3/17/2020
Location	VILLAGE OF NYACK, NY	Checked	LM	Date	3/17/2020

Circle One: (Present) Developed

Circle One: (T_c) T_t through subarea **WATERSHED A - IMPERVIOUS**

NOTES: Space for as many as two segments per flow type can be used for each worksheet.

Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c Only)

	Unit	Segment 1	Segment 2	Total
Segment ID		A-B		
1. Surface description (table 3-1)		ASPHALT		
2. Manning's roughness coeff., n (table 3-1)		0.011		
3. Flow Length, L (total L ≤ 150 ft)	ft	100		
4. Two-yr 24-hr rainfall, P_2	in	3.41		
5. Land slope, s	ft/ft	0.065		
6. $T_t = \frac{0.007(nL)^{0.8}}{P_2^{0.5} s^{0.4}}$ Compute T_t	hr	0.012	+	= 0.012

Shallow concentrated flow

	Unit	Segment 1	Segment 2	Total
Segment ID				
7. Surface description (paved or unpaved)		-		
8. Flow length, L	ft	0		
9. Watercourse slope, s	ft/ft	0		
10. Average velocity, V (figure 3-1)	ft/s	0		
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr	0.000	+	= 0.000

Channel flow

	Unit	B-C (10" PIPE)	C-D (18" RCP)	D-E (18" CMP)	Total
Segment ID		B-C (10" PIPE)	C-D (18" RCP)	D-E (18" CMP)	
12. Cross sectional flow area, a	ft^2	0.55	1.77	1.77	
13. Wetted perimeter, p_w	ft	2.60	4.71	4.71	
14. Hydraulic radius, r $r = \frac{a}{p_w}$ Compute r	ft	0.21	0.38	0.38	
15. Channel slope, s	ft/ft	0.008	0.018	0.035	
16. Manning's roughness coeff., n		0.011	0.013	0.024	
17. $V = \frac{1.49\ r^{2/3}\ s^{1/2}}{n}$ Compute V	ft/s	4.30	8.01	6.05	
18. Flow length, L	ft	252	433	84	
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr	0.016	+ 0.015	0.004	= 0.035

20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, 19) — hr **0.047**

Minutes **2.84**

Say 6 Minutes

Project **Nyack Hospital - Parking Structure** By **VP** Date **3/17/2020**

Location **Nyack, New York** Checked **LM** Date **3/17/2020**

Circle one: (Present) Developed **Existing Watershed - A (Pervious)**

1. Runoff Curve Number (CN)

Soil Name and hydrologic group (Appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN [1]			Area [x] acres [ ] mi^2 [ ] %	Product of CN x area
		Table 2-2	Figure 2-3	Figure 2-4		
C	**Open Space (good)**	**86**			**0.28**	**24.08**
				Totals =	**0.28**	**24.08**

1) Use only one CN source per line

$$CN\ (weighted) = \frac{\text{total product}}{\text{total area}} = \frac{24.08}{0.28} = 86.00$$

Use CN = **86**

Project	NYACK HOSPITAL - PARKING STRUCTURE	By	VP	Date	3/17/2020
Location	VILLAGE OF NYACK, NY	Checked	LM	Date	3/17/2020

Circle One: (Present) Developed

Circle One: (T_c) T_t through subarea **WATERSHED A - PERVIOUS**

NOTES: Space for as many as two segments per flow type can be used for each worksheet.

Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c Only)

	Unit	Segment ID A'-B'	Segment 2		Total
1. Surface description (table 3-1)		GRASS			
2. Manning's roughness coeff., n (table 3-1)		0.240			
3. Flow Length, L (total L ≤ 150 ft)	ft	63			
4. Two-yr 24-hr rainfall, P_2	in	3.41			
5. Land slope, s	ft/ft	0.103			
6. $T_t = \frac{0.007(nL)^{0.8}}{P_2^{0.5}s^{0.4}}$ Compute T_t	hr	0.083	+	=	0.083

Shallow concentrated flow

	Unit	Segment ID	Segment 2		Total
7. Surface description (paved or unpaved)					
8. Flow length, L	ft				
9. Watercourse slope, s	ft/ft				
10. Average velocity, V (figure 3-1)	ft/s				
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr		+	=	0.000

Channel flow

	Unit	B'-C' (8" CMP)	C'-D' (18" RCP)	D'-E' (18" CMP)	Total
12. Cross sectional flow area, a	ft^2	0.35	1.77	1.77	
13. Wetted perimeter, p_w	ft	2.10	4.71	4.71	
14. Hydraulic radius, r $r = \frac{a}{p_w}$ Compute r	ft	0.17	0.38	0.38	
15. Channel slope, s	ft/ft	0.02	0.018	0.035	
16. Manning's roughness coeff., n		0.024	0.013	0.024	
17. $V = \frac{1.49\ r^{2/3}\ s^{1/2}}{n}$ Compute V	ft/s	2.66	8.01	6.05	
18. Flow length, L	ft	50	433	84	
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr	0.005	+ 0.015	0.004	= 0.024

20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, 19)	hr	0.107
	Minutes	6

Say 6 Minutes

Project **Nyack Hospital - Parking Structure** By **VP** Date **3/17/2020**

Location **Nyack, New York** Checked **LM** Date **3/17/2020**

Circle one: (Present) Developed **Existing Watershed - B (Impervious)**

1. Runoff Curve Number (CN)

Soil Name and hydrologic group (Appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN [1] Table 2-2	CN [1] Figure 2-3	CN [1] Figure 2-4	Area [x] acres [ ] mi^2 [ ] %	Product of CN x area
	Impervious	**98**			**1.76**	**172.48**
				Totals =	**1.76**	**172.48**

1) Use only one CN source per line

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{172.48}{1.76}$ = 98.00 Use CN = **98**

Project	NYACK HOSPITAL - PARKING STRUCTURE	By	VP	Date	3/17/2020
Location	VILLAGE OF NYACK, NY	Checked	LM	Date	3/17/2020

Circle One: (Present) Developed

Circle One: (T_c) T_t through subarea — WATERSHED B - IMPERVIOUS

NOTES: Space for as many as two segments per flow type can be used for each worksheet.

Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c Only)

	Unit				
Segment ID		A-B			
1. Surface description (table 3-1)		ROOF			
2. Manning's roughness coeff., n (table 3-1)		0.011			
3. Flow Length, L (total L ≤ 150 ft)	ft	70			
4. Two-yr 24-hr rainfall, P_2	in	3.41			
5. Land slope, s	ft/ft	0.010			
6. $T_t = \frac{0.007(nL)^{0.8}}{P_2^{0.5}s^{0.4}}$ Compute T_t	hr	0.019	+	=	0.019

Shallow concentrated flow

	Unit				
Segment ID					
7. Surface description (paved or unpaved)					
8. Flow length, L	ft				
9. Watercourse slope, s	ft/ft				
10. Average velocity, V (figure 3-1)	ft/s				
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr		+	=	0.000

Channel flow

	Unit					
Segment ID		B-C (8" PIPE)	C-D (15" RCP)			
12. Cross sectional flow area, a	ft^2	0.35	1.23			
13. Wetted perimeter, p_w	ft	2.10	3.93			
14. Hydraulic radius, r $r = \frac{a}{p_w}$ Compute r	ft	0.17	0.31			
15. Channel slope, s	ft/ft	0.01	0.01			
16. Manning's roughness coeff., n		0.011	0.013			
17. $V = \frac{1.49\ r^{2/3}\ s^{1/2}}{n}$ Compute V	ft/s	4.10	5.28			
18. Flow length, L	ft	57	392			
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr	0.004 +	0.021		=	0.024

20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, 19) — hr **0.044**

Minutes **2.63**

Say 6 Minutes

Project **Nyack Hospital - Parking Structure** By **VP** Date **3/17/2020**

Location **Nyack, New York** Checked **LM** Date **3/17/2020**

Circle one: (Present) Developed **Existing Watershed - B (Pervious)**

1. Runoff Curve Number (CN)

Soil Name and hydrologic group (Appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN [1]			Area [x] acres [ ] mi^2 [ ] %	Product of CN x area
		Table 2-2	Figure 2-3	Figure 2-4		
C	**Open Space (good)**	**86**			**0.30**	**25.80**
					Totals = **0.30**	**25.80**

1) Use only one CN source per line

$$CN\ (weighted) = \frac{\text{total product}}{\text{total area}} = \frac{25.80}{0.30} = 86.00$$

Use CN = **86**

Project	NYACK HOSPITAL - PARKING STRUCTURE	By	VP	Date	3/17/2020
Location	VILLAGE OF NYACK, NY	Checked	LM	Date	3/17/2020

Circle One: (Present) Developed

Circle One: (T_c) T_t through subarea — WATERSHED B - PERVIOUS

NOTES: Space for as many as two segments per flow type can be used for each worksheet.

Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c Only)

Step	Description	Unit	Segment 1	Segment 2	Total
	Segment ID		A'-B'		
1.	Surface description (table 3-1)		GRASS		
2.	Manning's roughness coeff., n (table 3-1)		0.240		
3.	Flow Length, L (total L ≤ 150 ft)	ft	100		
4.	Two-yr 24-hr rainfall, P_2	in	3.41		
5.	Land slope, s	ft/ft	0.050		
6.	$T_t = \frac{0.007(nL)^{0.8}}{P_2^{0.5}s^{0.4}}$ Compute T_t	hr	0.160	+	= 0.160

Shallow concentrated flow

Step	Description	Unit	Segment 1	Segment 2	Total
	Segment ID		B'-C'	C'-D'	
7.	Surface description (paved or unpaved)		UNPAVED	PAVED	
8.	Flow length, L	ft	107	159	
9.	Watercourse slope, s	ft/ft	0.033	0.027	
10.	Average velocity, V (figure 3-1)	ft/s	3	3.33	
11.	$T_t = \frac{L}{3600\ V}$ Compute T_t	hr	0.010	+ 0.013	= 0.023

Channel flow

Step	Description	Unit	Segment 1	Segment 2	Segment 3	Total
	Segment ID		D'-E' (15" RCP)			
12.	Cross sectional flow area, a	ft^2	1.23			
13.	Wetted perimeter, p_w	ft	3.93			
14.	Hydraulic radius, r; $r = \frac{a}{p_w}$ Compute r	ft	0.31			
15.	Channel slope, s	ft/ft	0.01			
16.	Manning's roughness coeff., n		0.013			
17.	$V = \frac{1.49\ r^{2/3}\ s^{1/2}}{n}$ Compute V	ft/s	5.28			
18.	Flow length, L	ft	252			
19.	$T_t = \frac{L}{3600\ V}$ Compute T_t	hr	0.013	+		= 0.013

20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, 19)	hr	0.196
	Minutes	12

Say 12 Minutes

Project **Nyack Hospital - Parking Structure** By **VP** Date **3/17/2020**

Location **Nyack, New York** Checked **LM** Date **3/17/2020**

Circle one: (Present) Developed **Existing Watershed - C (Impervious)**

1. Runoff Curve Number (CN)

Soil Name and hydrologic group (Appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN [1] Table 2-2	CN [1] Figure 2-3	CN [1] Figure 2-4	Area [x] acres [ ] mi^2 [ ] %	Product of CN x area
	Impervious	**98**			**0.08**	**7.84**
				Totals =	**0.08**	**7.84**

1) Use only one CN source per line

$$CN\ (weighted) = \frac{\text{total product}}{\text{total area}} = \frac{7.84}{0.08} = 98.00$$

Use CN = **98**

Project	NYACK HOSPITAL - PARKING STRUCTURE	By	VP	Date	3/17/2020
Location	VILLAGE OF NYACK, NY	Checked	LM	Date	3/17/2020

Circle One: (Present) Developed

Circle One: (T_c) T_t through subarea — WATERSHED C - IMPERVIOUS

NOTES: Space for as many as two segments per flow type can be used for each worksheet.

Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c Only)

		Unit	Segment 1	+	Segment 2	=	Total
Segment ID			A-B				
1. Surface description (table 3-1)			ASPHALT				
2. Manning's roughness coeff., n (table 3-1)			0.011				
3. Flow Length, L (total L ≤ 150 ft)		ft	100				
4. Two-yr 24-hr rainfall, P_2		in	3.41				
5. Land slope, s		ft/ft	0.068				
6. $T_t = \frac{0.007(nL)^{0.8}}{P_2^{0.5} s^{0.4}}$	Compute T_t	hr	0.012	+		=	0.012

Shallow concentrated flow

		Unit	Segment 1	+	Segment 2	=	Total
Segment ID			B-C				
7. Surface description (paved or unpaved)			PAVED				
8. Flow length, L		ft	34				
9. Watercourse slope, s		ft/ft	0.07				
10. Average velocity, V (figure 3-1)		ft/s	5.1				
11. $T_t = \frac{L}{3600\ V}$	Compute T_t	hr	0.002	+		=	0.002

Channel flow

		Unit	Segment 1	Segment 2	Segment 3	=	Total
Segment ID							
12. Cross sectional flow area, a		ft^2					
13. Wetted perimeter, p_w		ft					
14. Hydraulic radius, r	$r = \frac{a}{p_w}$ Compute r	ft					
15. Channel slope, s		ft/ft					
16. Manning's roughness coeff., n							
17. $V = \frac{1.49\ r^{2/3}\ s^{1/2}}{n}$	Compute V	ft/s					
18. Flow length, L		ft					
19. $T_t = \frac{L}{3600\ V}$	Compute T_t	hr		+		=	0.000

20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, 19) — hr **0.014**

Minutes **0.83**

Say 6 Minutes

Project **Nyack Hospital - Parking Structure** By **VP** Date **3/17/2020**

Location **Nyack, New York** Checked **LM** Date **3/17/2020**

Circle one: (Present) Developed **Existing Watershed - C (Pervious)**

1. Runoff Curve Number (CN)

Soil Name and hydrologic group (Appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN [1] Table 2-2	CN [1] Figure 2-3	CN [1] Figure 2-4	Area [x] acres [ ] mi^2 [ ] %	Product of CN x area
C	**Open Space (good)**	**86**			**0.11**	**9.46**
				Totals =	**0.11**	**9.46**

1) Use only one CN source per line

CN (weighted) = $\frac{\text{total product}}{\text{total area}}$ = $\frac{9.46}{0.11}$ = 86.00 Use CN = **86**

Project	NYACK HOSPITAL - PARKING STRUCTURE	By	VP	Date	3/17/2020
Location	VILLAGE OF NYACK, NY	Checked	LM	Date	3/17/2020

Circle One: **(Present)** Developed

Circle One: **(T_c)** T_t through subarea — WATERSHED C - PERVIOUS

NOTES: Space for as many as two segments per flow type can be used for each worksheet.

Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c Only)

	Unit	Segment 1	Segment 2	Total
Segment ID		A'-B'		
1. Surface description (table 3-1)		GRASS		
2. Manning's roughness coeff., n (table 3-1)		0.240		
3. Flow Length, L (total L ≤ 150 ft)	ft	53		
4. Two-yr 24-hr rainfall, P_2	in	3.41		
5. Land slope, s	ft/ft	0.100		
6. $T_t = \frac{0.007(nL)^{0.8}}{P_2^{0.5}s^{0.4}}$ Compute T_t	hr	0.073	+	= 0.073

Shallow concentrated flow

	Unit	Segment 1	Segment 2	Total
Segment ID				
7. Surface description (paved or unpaved)				
8. Flow length, L	ft			
9. Watercourse slope, s	ft/ft			
10. Average velocity, V (figure 3-1)	ft/s			
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr		+	= 0.000

Channel flow

	Unit	Segment 1	Segment 2	Segment 3	Total
Segment ID					
12. Cross sectional flow area, a	ft^2				
13. Wetted perimeter, p_w	ft				
14. Hydraulic radius, r $r = \frac{a}{p_w}$ Compute r	ft				
15. Channel slope, s	ft/ft				
16. Manning's roughness coeff., n					
17. $V = \frac{1.49\ r^{2/3}\ s^{1/2}}{n}$ Compute V	ft/s				
18. Flow length, L	ft				
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr		+		= 0.000

20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, 19) — hr: **0.073**; Minutes: **4**

Say 6 Minutes

EXISTING RUNOFF HYDROGRAPHS

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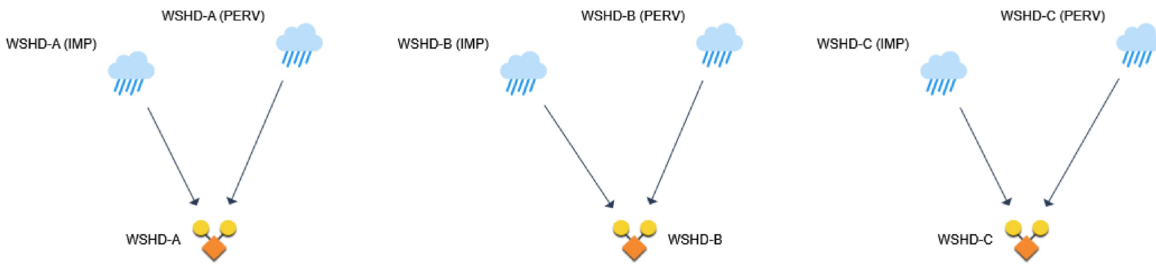
Basin Model

Hydrology Studio v 3.0.0.14

Project Name: NYACK HOSPITAL

03-17-2020



Hydrograph 1-yr Summary

Hydrology Studio v 3.0.0.14

Project Name: NYACK HOSPITAL

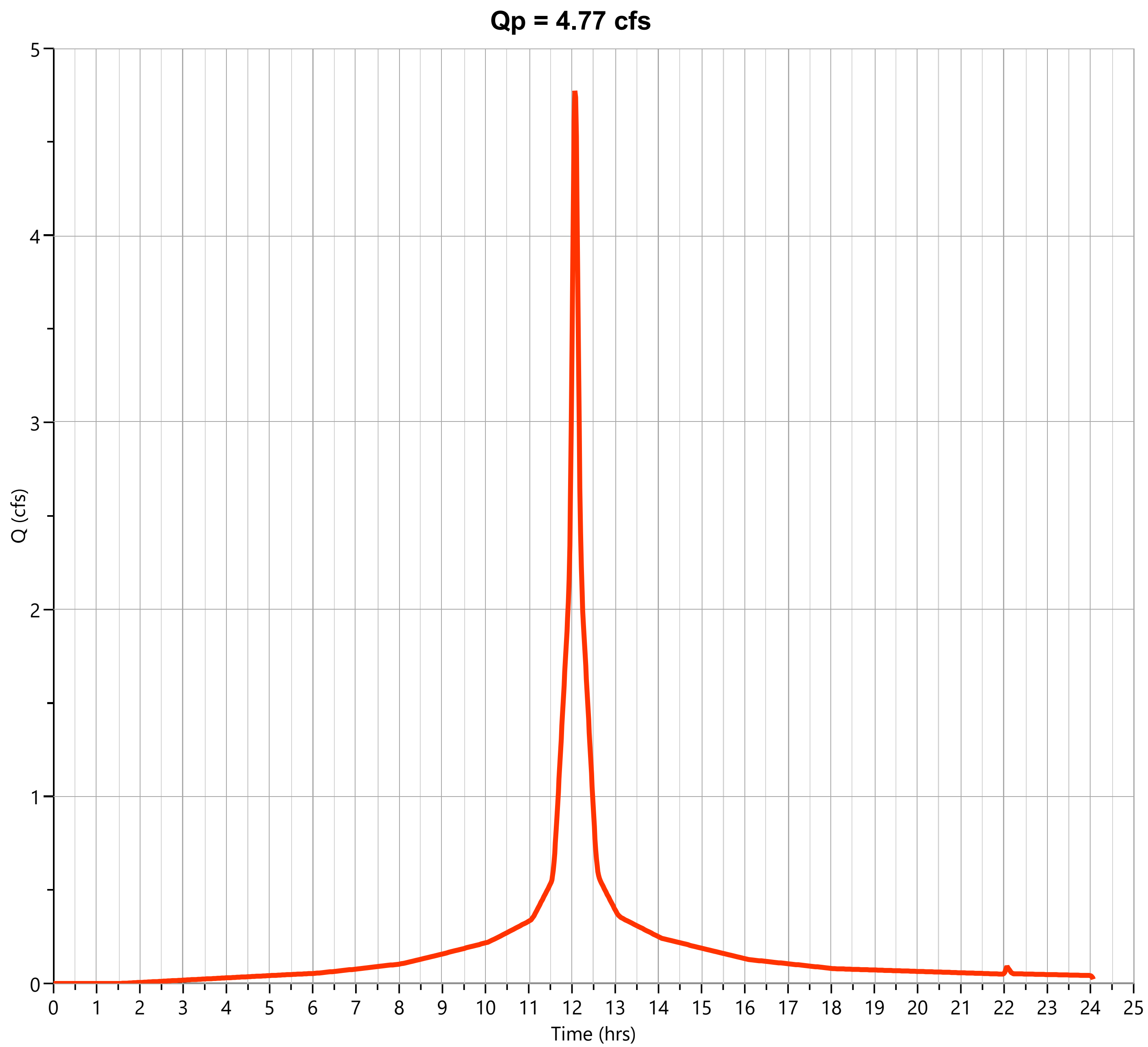
03-17-2020

Hyd. No.	Hydrograph Type	Hydrograph Name	Peak Flow (cfs)	Time to Peak (hrs)	Hydrograph Volume (cuft)	Inflow Hyd(s)	Maximum Elevation (ft)	Maximum Storage (cuft)
1	NRCS Runoff	WSHD-A (IMP)	4.773	12.07	16,382	----		
2	NRCS Runoff	WSHD-A (PERV)	0.505	12.08	1,556	----		
3	Junction	WSHD-A	5.274	12.07	17,938	1, 2		
5	NRCS Runoff	WSHD-B (IMP)	4.912	12.07	16,861	----		
6	NRCS Runoff	WSHD-B (PERV)	0.423	12.15	1,591	----		
7	Junction	WSHD-B	5.248	12.07	18,452	5, 6		
9	NRCS Runoff	WSHD-C (IMP)	0.223	12.07	766	----		
10	NRCS Runoff	WSHD-C (PERV)	0.198	12.08	611	----		
11	Junction	WSHD-C	0.420	12.07	1,378	9, 10		

Hydrograph Report

WSHD-A (IMP) Hyd. No. 1

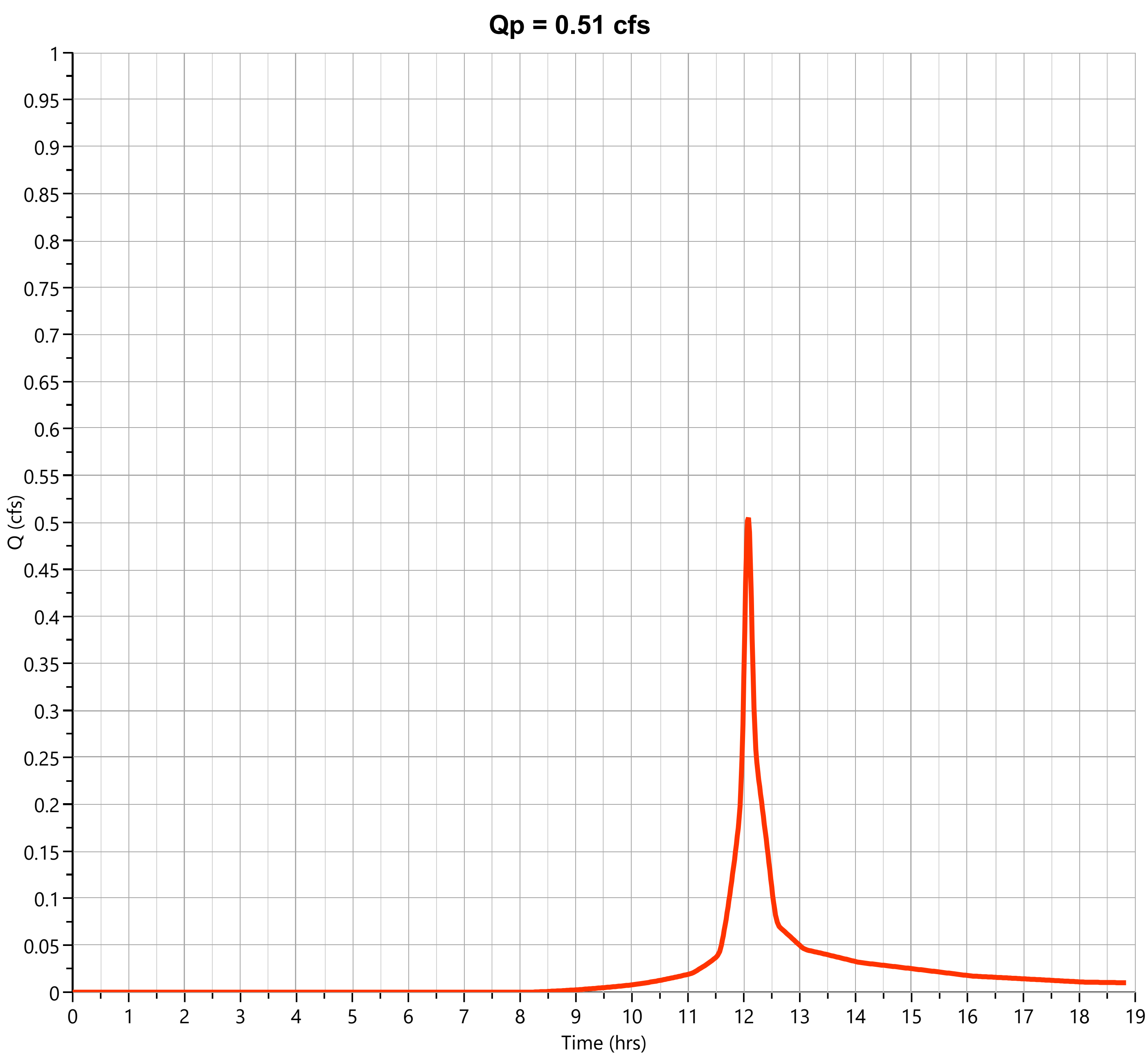
Hydrograph Type	= NRCS Runoff	Peak Flow	= 4.773 cfs
Storm Frequency	= 1-yr	Time to Peak	= 12.07 hrs
Time Interval	= 1 min	Runoff Volume	= 16,382 cuft
Drainage Area	= 1.71 ac	Curve Number	= 98
Tc Method	= User	Time of Conc. (Tc)	= 6.0 min
Total Rainfall	= 2.79 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



WSHD-A (PERV)

Hyd. No. 2

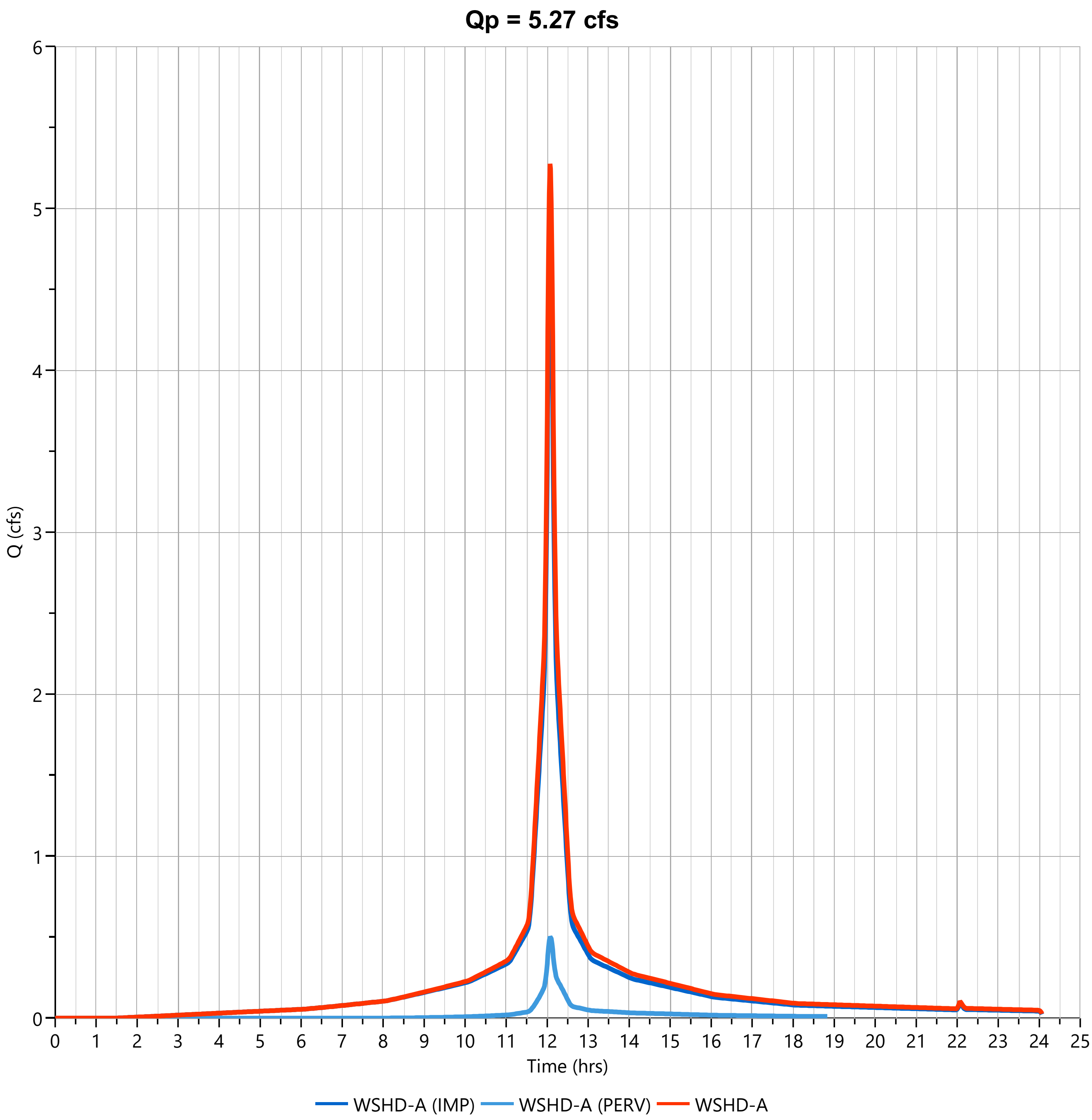
Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.505 cfs
Storm Frequency	= 1-yr	Time to Peak	= 12.08 hrs
Time Interval	= 1 min	Runoff Volume	= 1,556 cuft
Drainage Area	= 0.28 ac	Curve Number	= 86
Tc Method	= User	Time of Conc. (Tc)	= 6.0 min
Total Rainfall	= 2.79 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



WSHD-A

Hyd. No. 3

Hydrograph Type	= Junction	Peak Flow	= 5.274 cfs
Storm Frequency	= 1-yr	Time to Peak	= 12.07 hrs
Time Interval	= 1 min	Hydrograph Volume	= 17,938 cuft
Inflow Hydrographs	= 1, 2	Total Contrib. Area	= 1.99 ac

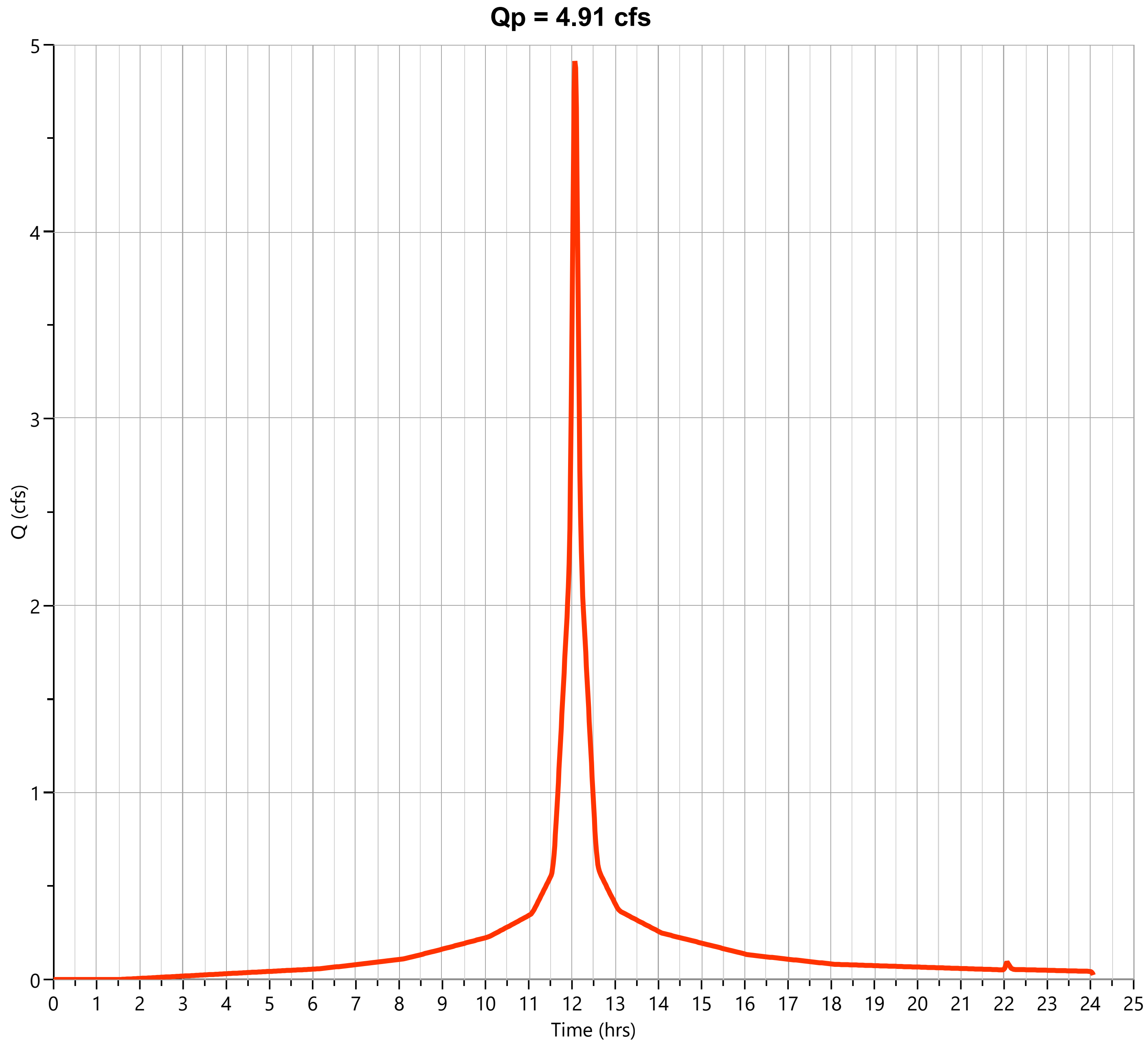


Hydrograph Report

WSHD-B (IMP)

Hyd. No. 5

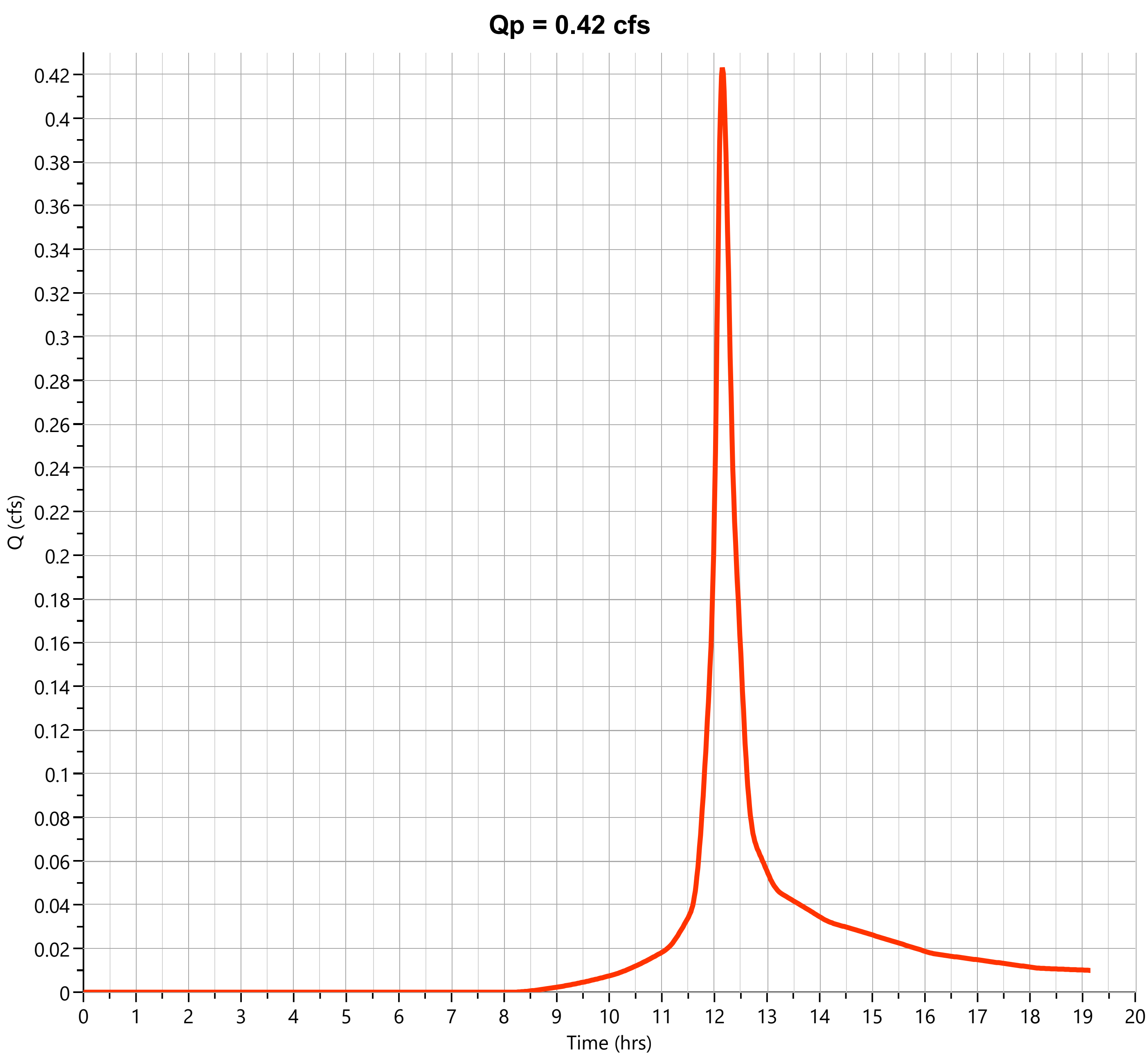
Hydrograph Type	= NRCS Runoff	Peak Flow	= 4.912 cfs
Storm Frequency	= 1-yr	Time to Peak	= 12.07 hrs
Time Interval	= 1 min	Runoff Volume	= 16,861 cuft
Drainage Area	= 1.76 ac	Curve Number	= 98
Tc Method	= User	Time of Conc. (Tc)	= 6.0 min
Total Rainfall	= 2.79 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

WSHD-B (PERV) Hyd. No. 6

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.423 cfs
Storm Frequency	= 1-yr	Time to Peak	= 12.15 hrs
Time Interval	= 1 min	Runoff Volume	= 1,591 cuft
Drainage Area	= 0.3 ac	Curve Number	= 86
Tc Method	= User	Time of Conc. (Tc)	= 12.0 min
Total Rainfall	= 2.79 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484

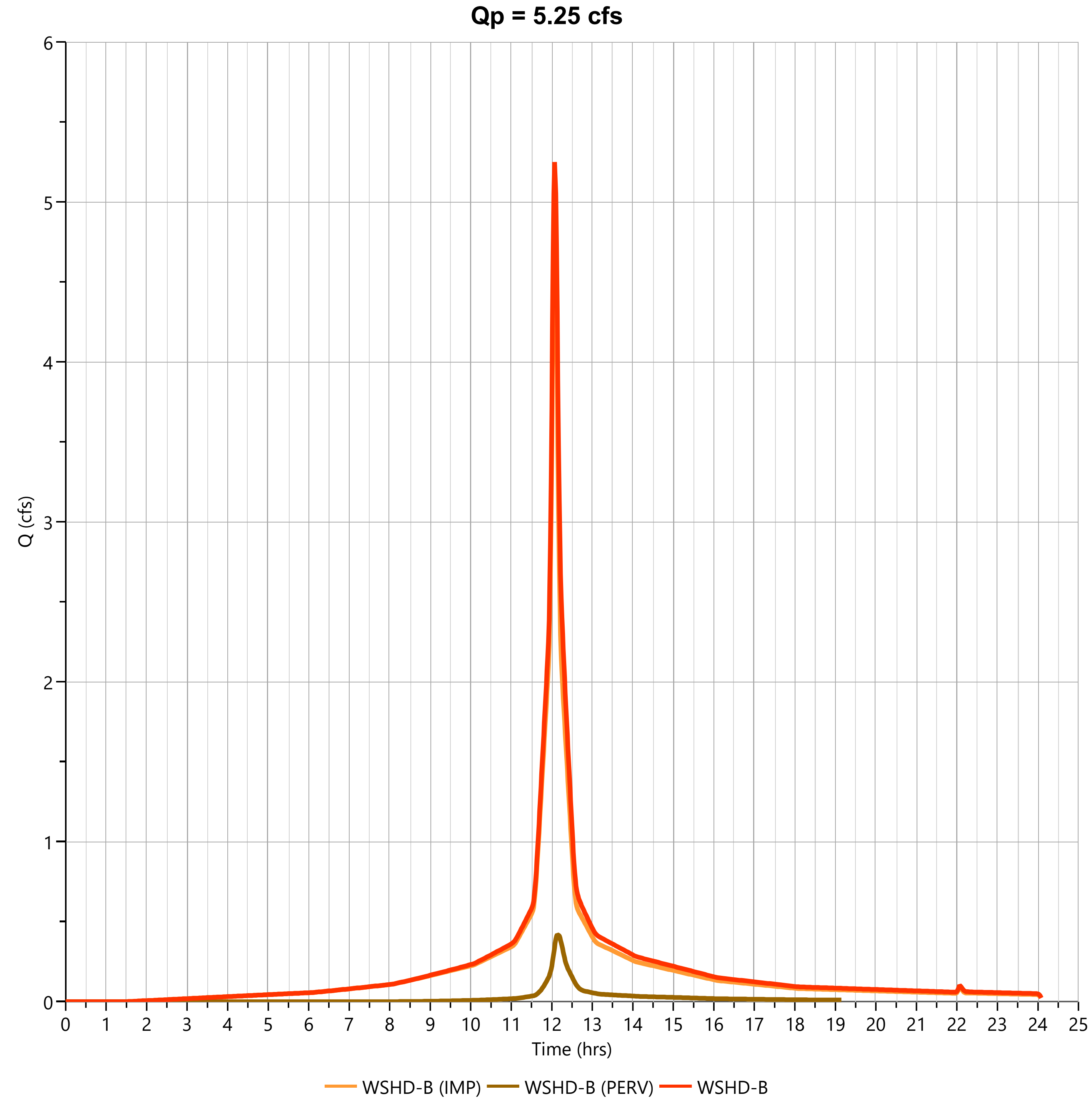


Hydrograph Report

WSHD-B

Hyd. No. 7

Hydrograph Type	= Junction	Peak Flow	= 5.248 cfs
Storm Frequency	= 1-yr	Time to Peak	= 12.07 hrs
Time Interval	= 1 min	Hydrograph Volume	= 18,452 cuft
Inflow Hydrographs	= 5, 6	Total Contrib. Area	= 2.06 ac



Hydrograph Report

Project Name: NYACK HOSPITAL

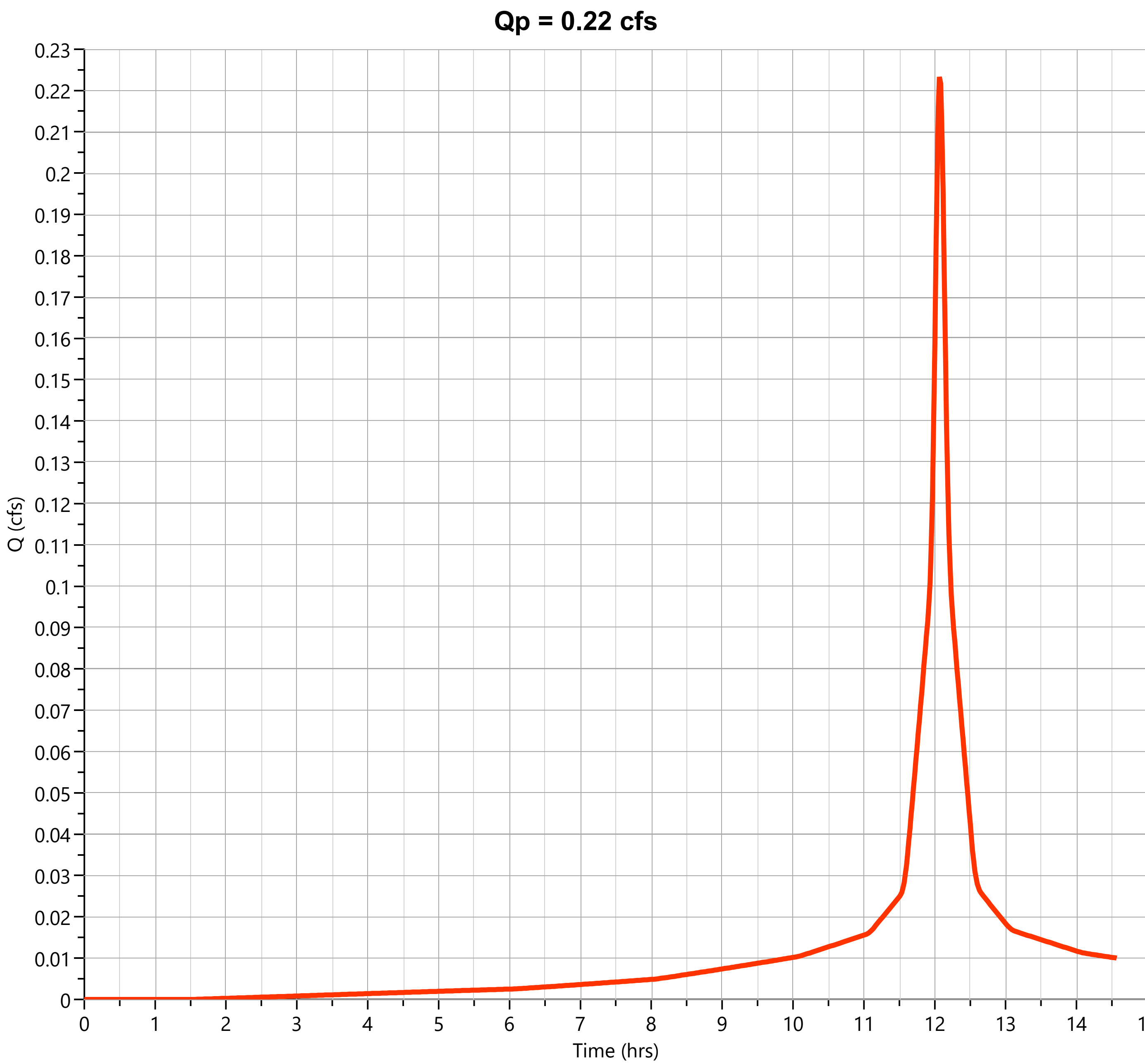
Hydrology Studio v 3.0.0.14

03-17-2020

WSHD-C (IMP)

Hyd. No. 9

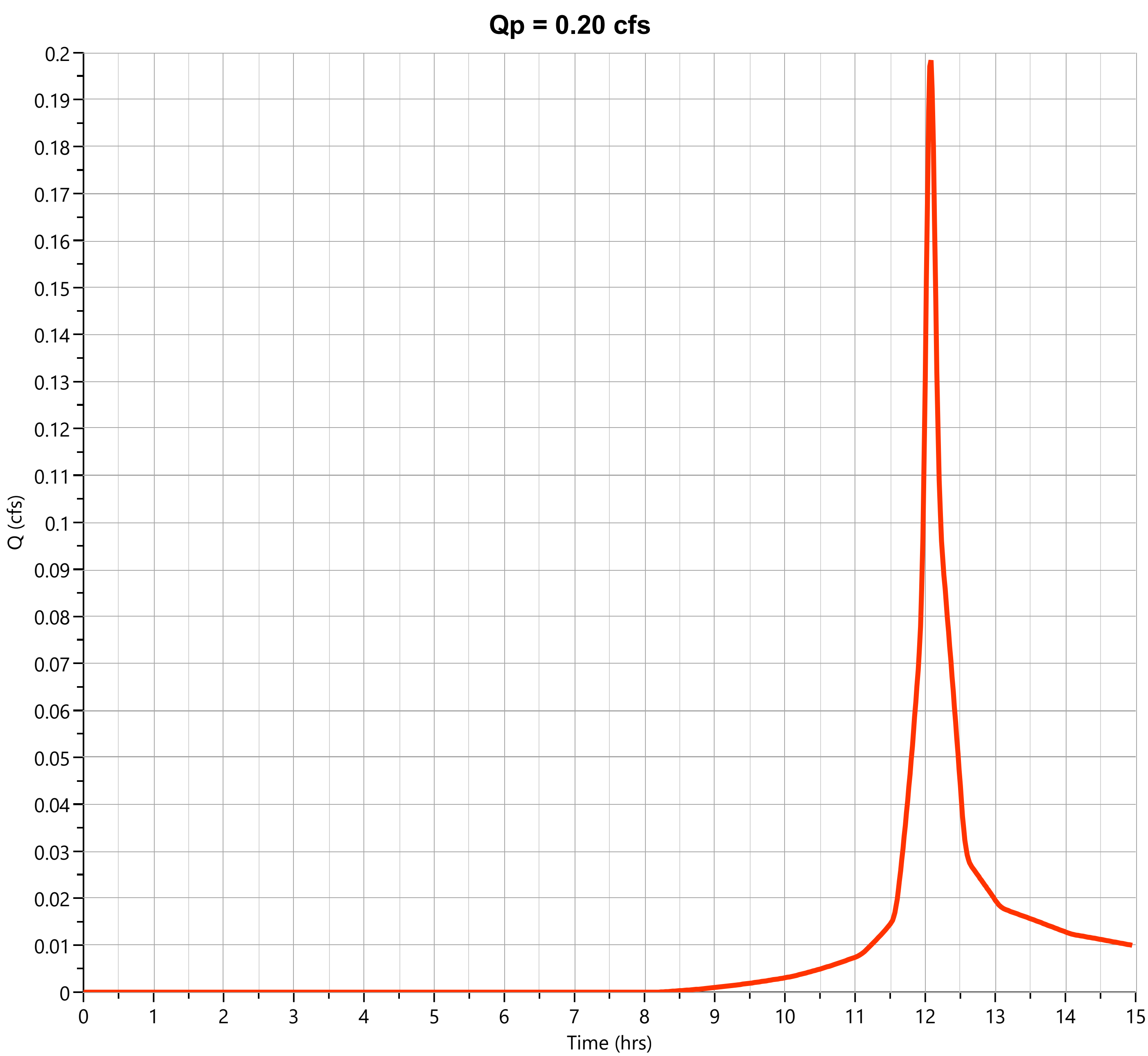
Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.223 cfs
Storm Frequency	= 1-yr	Time to Peak	= 12.07 hrs
Time Interval	= 1 min	Runoff Volume	= 766 cuft
Drainage Area	= 0.08 ac	Curve Number	= 98
Tc Method	= User	Time of Conc. (Tc)	= 6.0 min
Total Rainfall	= 2.79 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



WSHD-C (PERV)

Hyd. No. 10

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.198 cfs
Storm Frequency	= 1-yr	Time to Peak	= 12.08 hrs
Time Interval	= 1 min	Runoff Volume	= 611 cuft
Drainage Area	= 0.11 ac	Curve Number	= 86
Tc Method	= User	Time of Conc. (Tc)	= 6.0 min
Total Rainfall	= 2.79 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



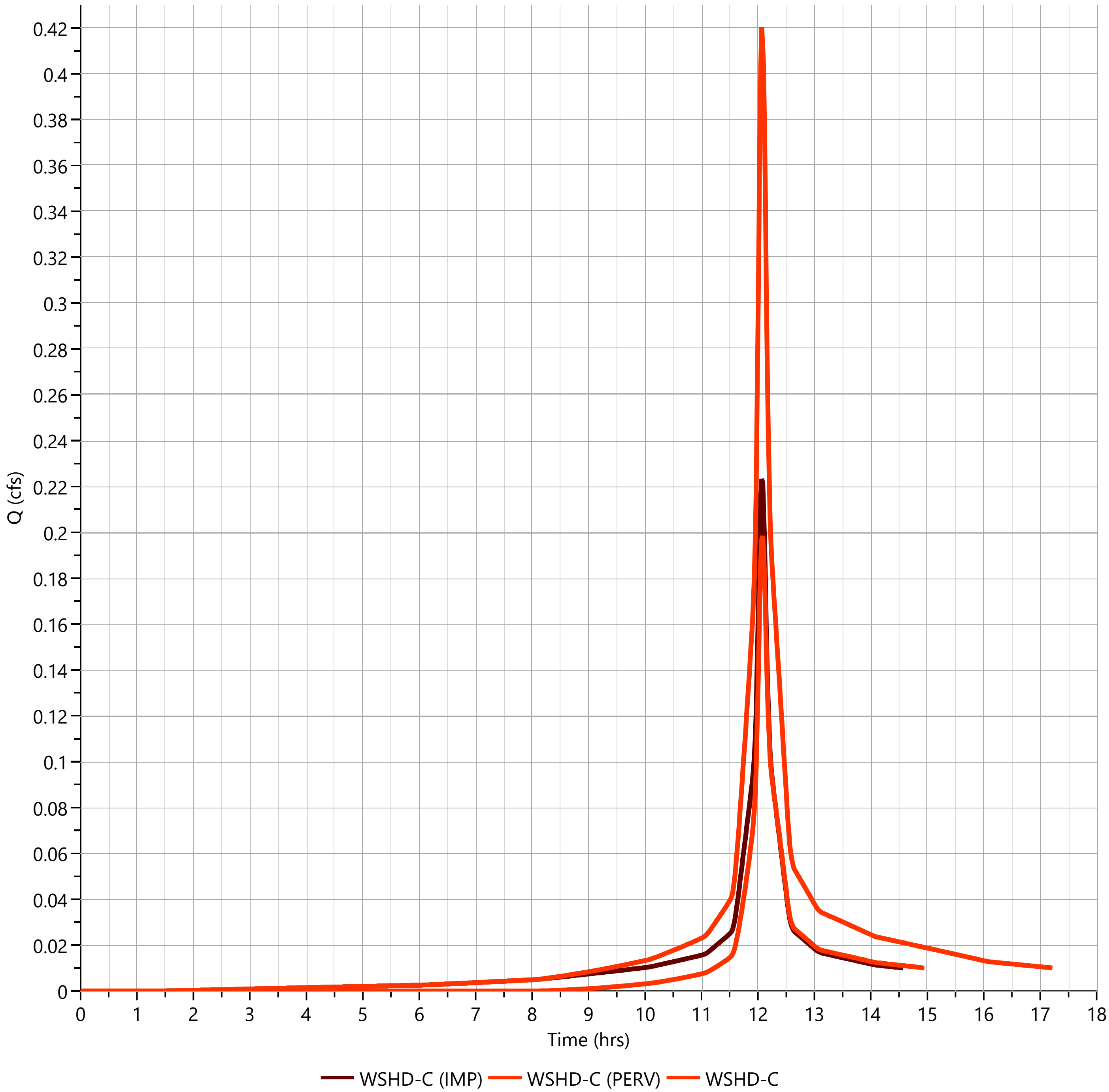
Hydrograph Report

WSHD-C

Hyd. No. 11

Hydrograph Type	= Junction	Peak Flow	= 0.420 cfs
Storm Frequency	= 1-yr	Time to Peak	= 12.07 hrs
Time Interval	= 1 min	Hydrograph Volume	= 1,378 cuft
Inflow Hydrographs	= 9, 10	Total Contrib. Area	= 0.19 ac

Qp = 0.42 cfs



Hydrograph 10-yr Summary

Project Name: NYACK HOSPITAL

Hydrology Studio v 3.0.0.14

03-17-2020

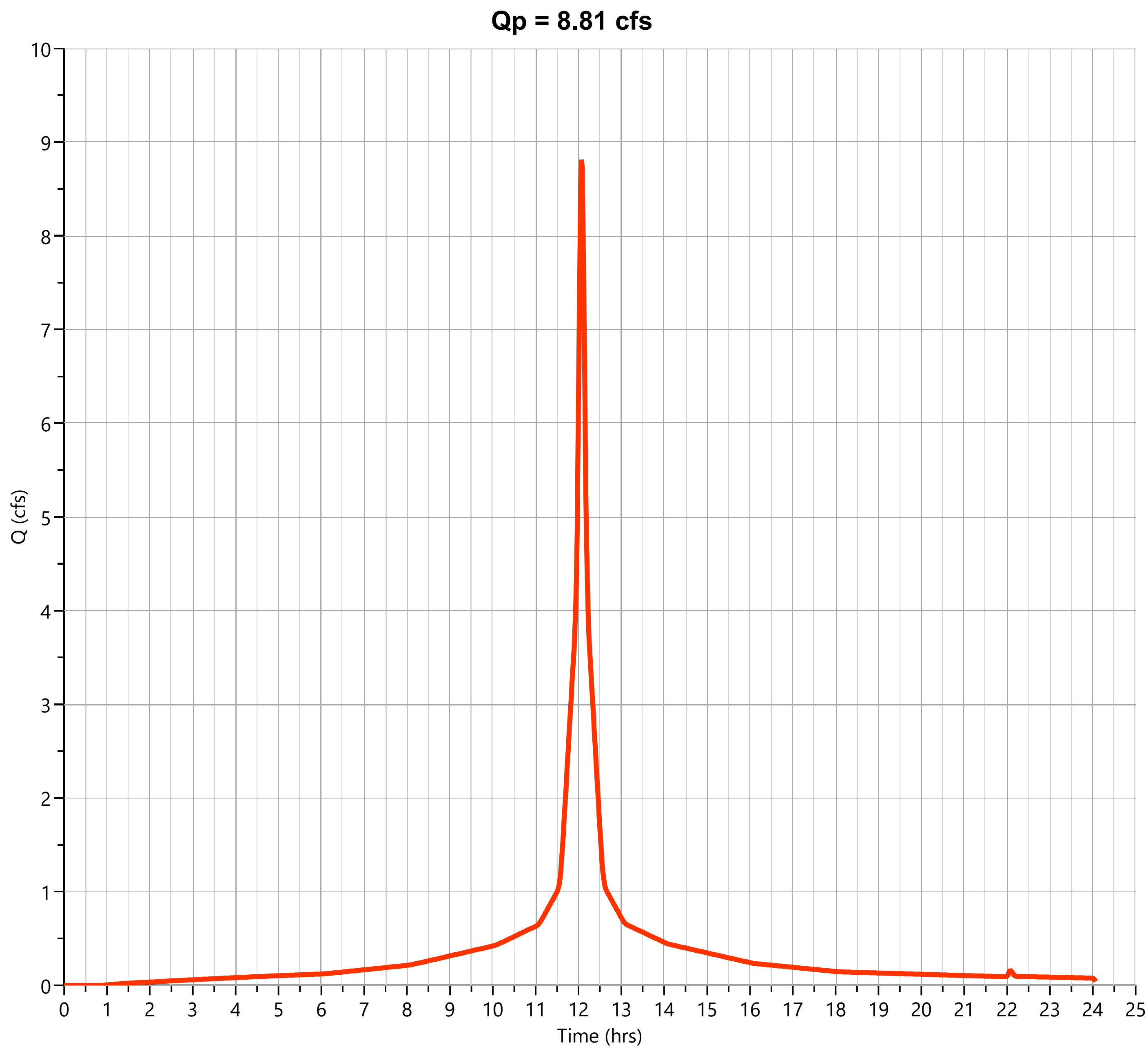
Hyd. No.	Hydrograph Type	Hydrograph Name	Peak Flow (cfs)	Time to Peak (hrs)	Hydrograph Volume (cuft)	Inflow Hyd(s)	Maximum Elevation (ft)	Maximum Storage (cuft)
1	NRCS Runoff	WSHD-A (IMP)	8.812	12.07	31,066	----		
2	NRCS Runoff	WSHD-A (PERV)	1.186	12.07	3,722	----		
3	Junction	WSHD-A	9.998	12.07	34,788	1, 2		
5	NRCS Runoff	WSHD-B (IMP)	9.069	12.07	31,974	----		
6	NRCS Runoff	WSHD-B (PERV)	0.998	12.15	3,807	----		
7	Junction	WSHD-B	9.889	12.07	35,781	5, 6		
9	NRCS Runoff	WSHD-C (IMP)	0.412	12.07	1,453	----		
10	NRCS Runoff	WSHD-C (PERV)	0.466	12.07	1,462	----		
11	Junction	WSHD-C	0.878	12.07	2,916	9, 10		

Hydrograph Report

WSHD-A (IMP)

Hyd. No. 1

Hydrograph Type	= NRCS Runoff	Peak Flow	= 8.812 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.07 hrs
Time Interval	= 1 min	Runoff Volume	= 31,066 cuft
Drainage Area	= 1.71 ac	Curve Number	= 98
Tc Method	= User	Time of Conc. (Tc)	= 6.0 min
Total Rainfall	= 5.09 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484

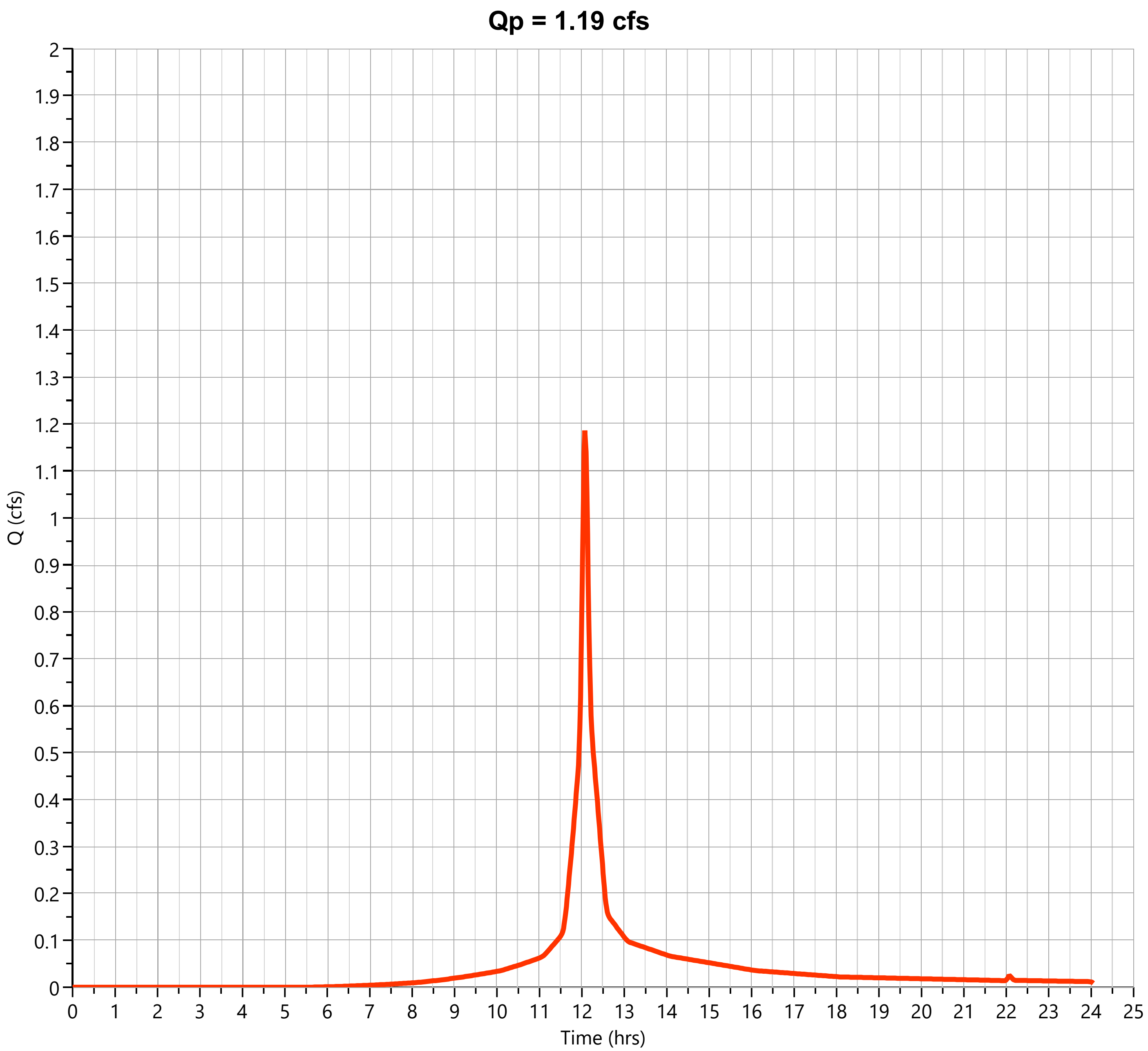


Hydrograph Report

WSHD-A (PERV)

Hyd. No. 2

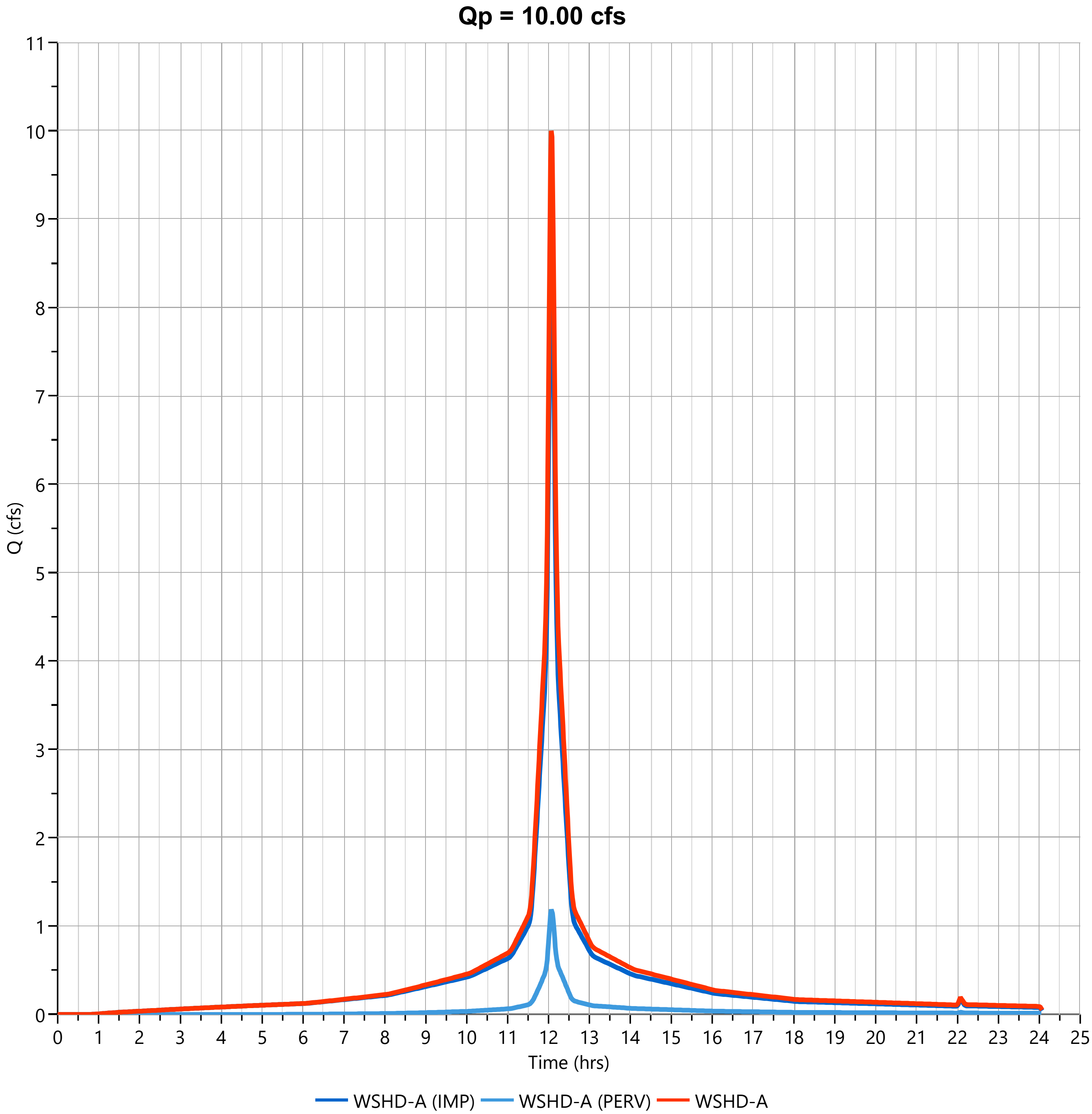
Hydrograph Type	= NRCS Runoff	Peak Flow	= 1.186 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.07 hrs
Time Interval	= 1 min	Runoff Volume	= 3,722 cuft
Drainage Area	= 0.28 ac	Curve Number	= 86
Tc Method	= User	Time of Conc. (Tc)	= 6.0 min
Total Rainfall	= 5.09 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



WSHD-A

Hyd. No. 3

Hydrograph Type	= Junction	Peak Flow	= 9.998 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.07 hrs
Time Interval	= 1 min	Hydrograph Volume	= 34,788 cuft
Inflow Hydrographs	= 1, 2	Total Contrib. Area	= 1.99 ac

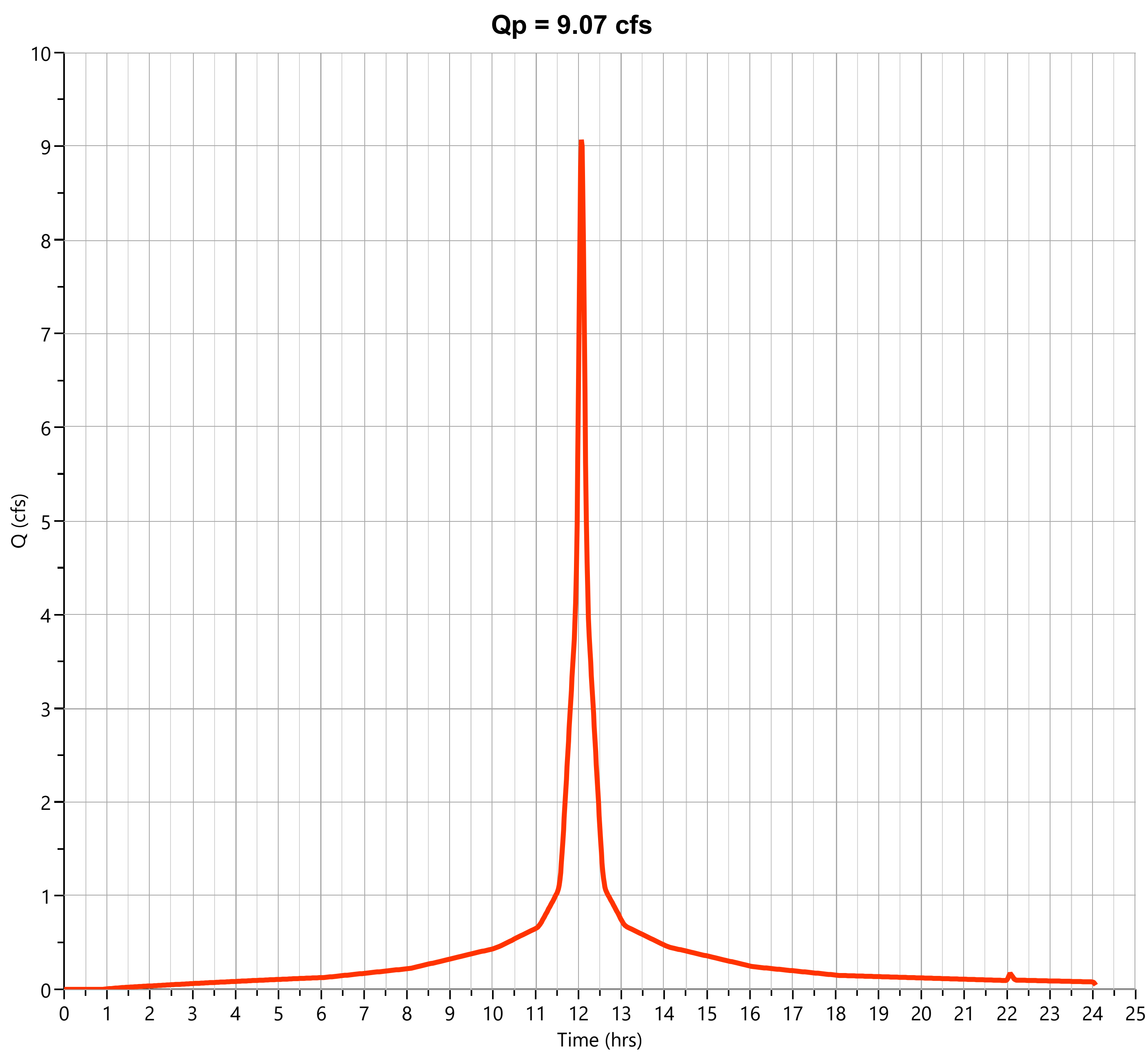


Hydrograph Report

WSHD-B (IMP)

Hyd. No. 5

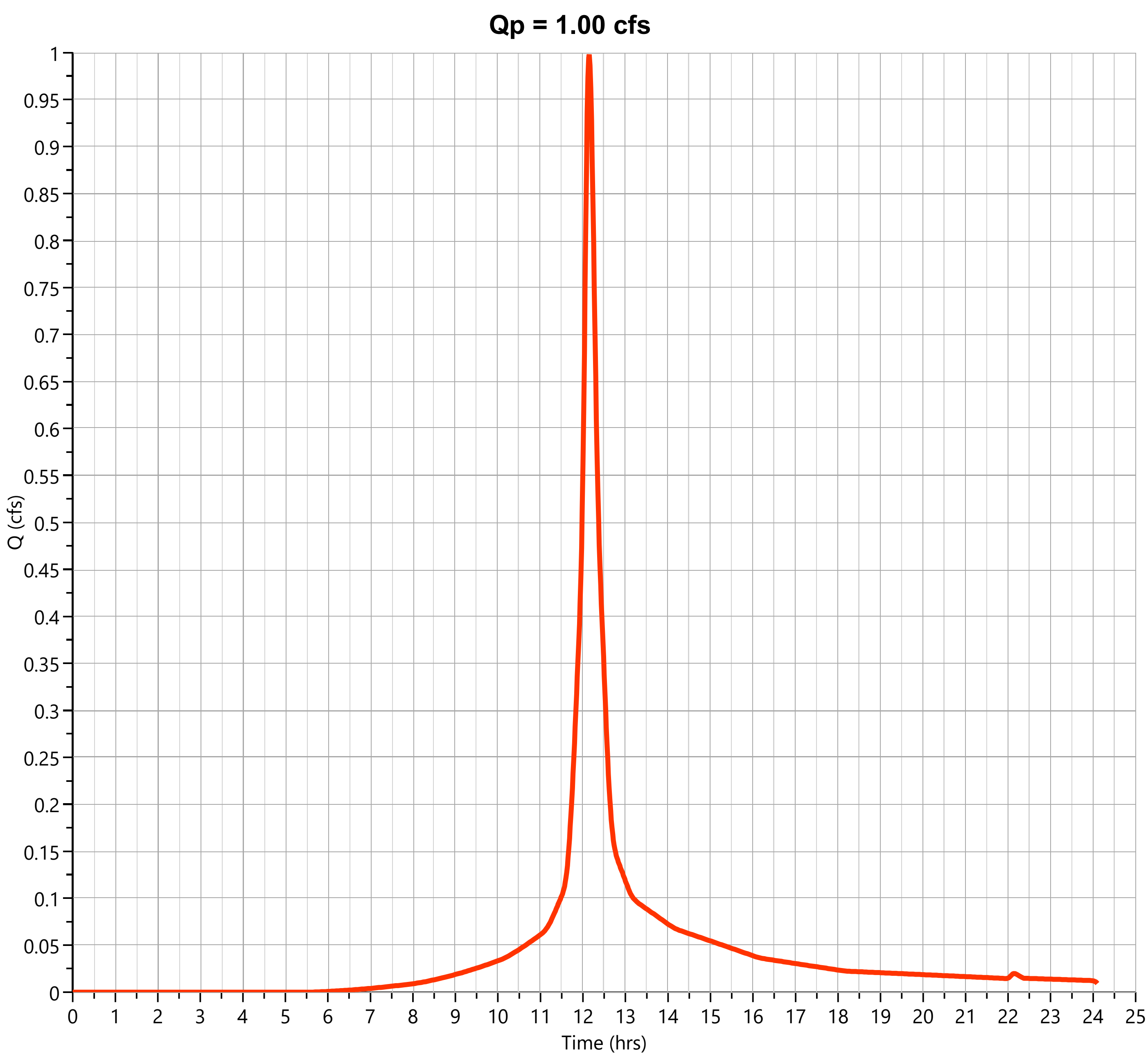
Hydrograph Type	= NRCS Runoff	Peak Flow	= 9.069 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.07 hrs
Time Interval	= 1 min	Runoff Volume	= 31,974 cuft
Drainage Area	= 1.76 ac	Curve Number	= 98
Tc Method	= User	Time of Conc. (Tc)	= 6.0 min
Total Rainfall	= 5.09 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



WSHD-B (PERV)

Hyd. No. 6

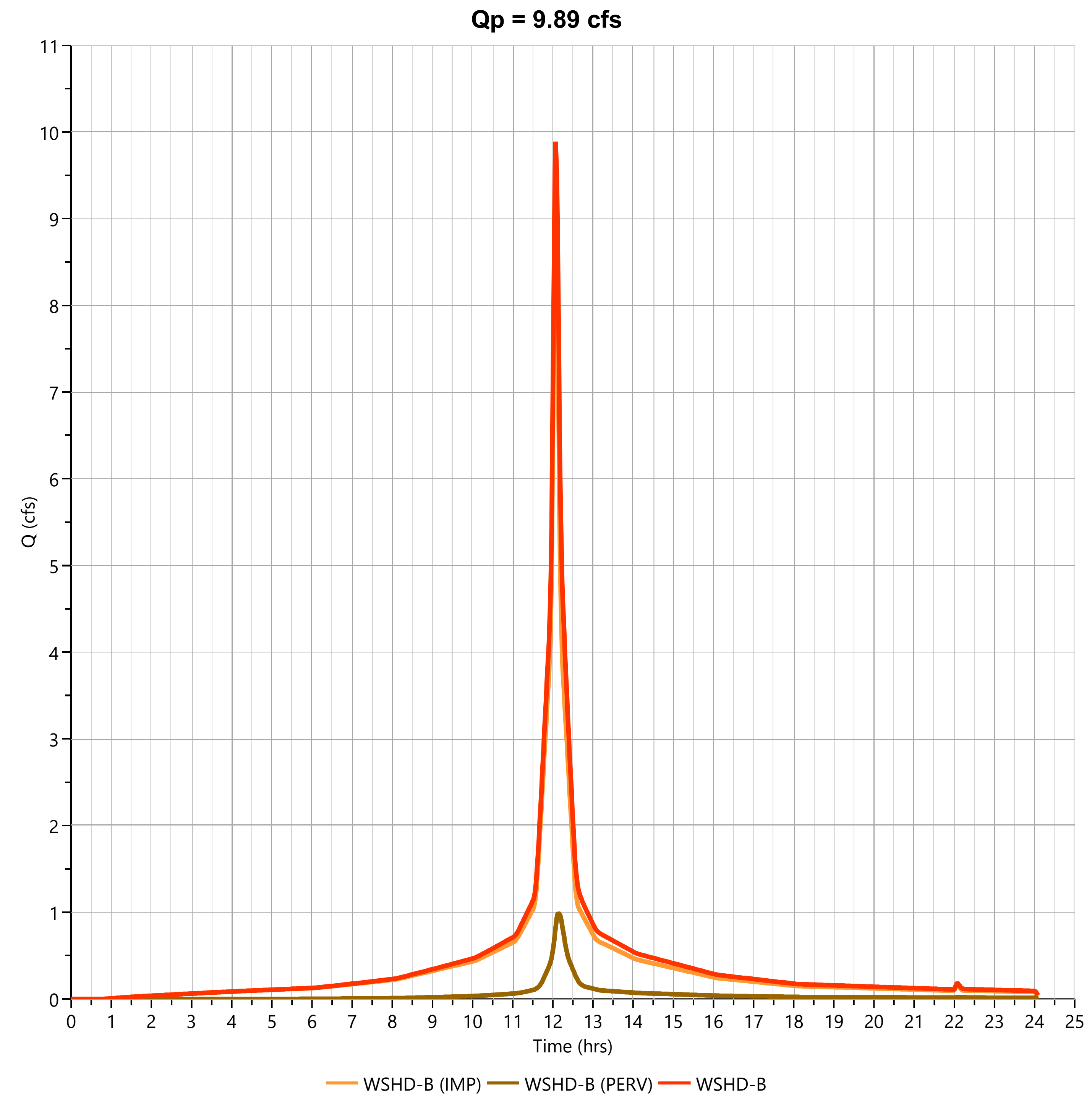
Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.998 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.15 hrs
Time Interval	= 1 min	Runoff Volume	= 3,807 cuft
Drainage Area	= 0.3 ac	Curve Number	= 86
Tc Method	= User	Time of Conc. (Tc)	= 12.0 min
Total Rainfall	= 5.09 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



WSHD-B

Hyd. No. 7

Hydrograph Type	= Junction	Peak Flow	= 9.889 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.07 hrs
Time Interval	= 1 min	Hydrograph Volume	= 35,781 cuft
Inflow Hydrographs	= 5, 6	Total Contrib. Area	= 2.06 ac



Hydrograph Report

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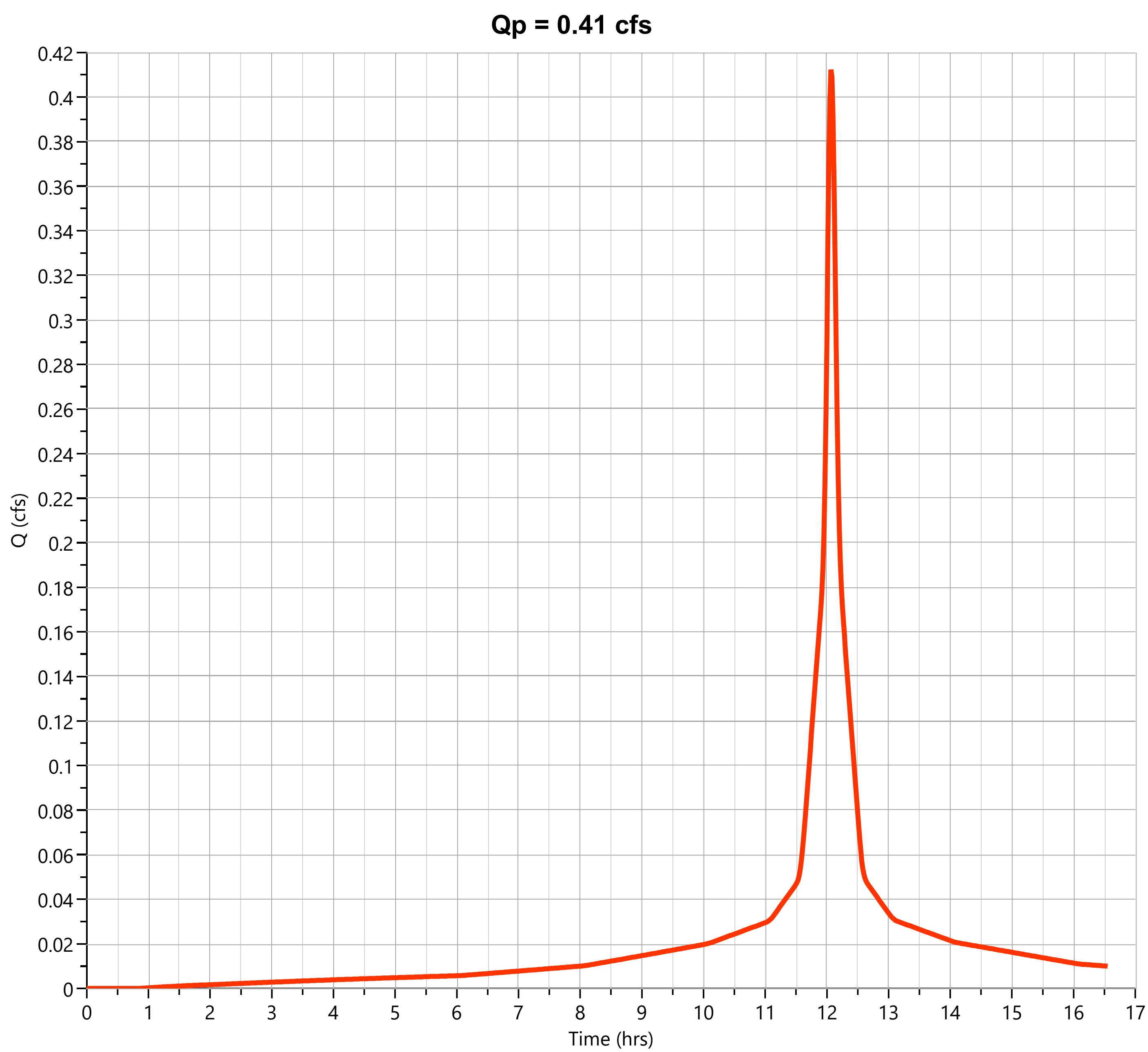
03-17-2020

WSHD-C (IMP)

Hyd. No. 9

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.412 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.07 hrs
Time Interval	= 1 min	Runoff Volume	= 1,453 cuft
Drainage Area	= 0.08 ac	Curve Number	= 98
Tc Method	= User	Time of Conc. (Tc)	= 6.0 min
Total Rainfall	= 5.09 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484

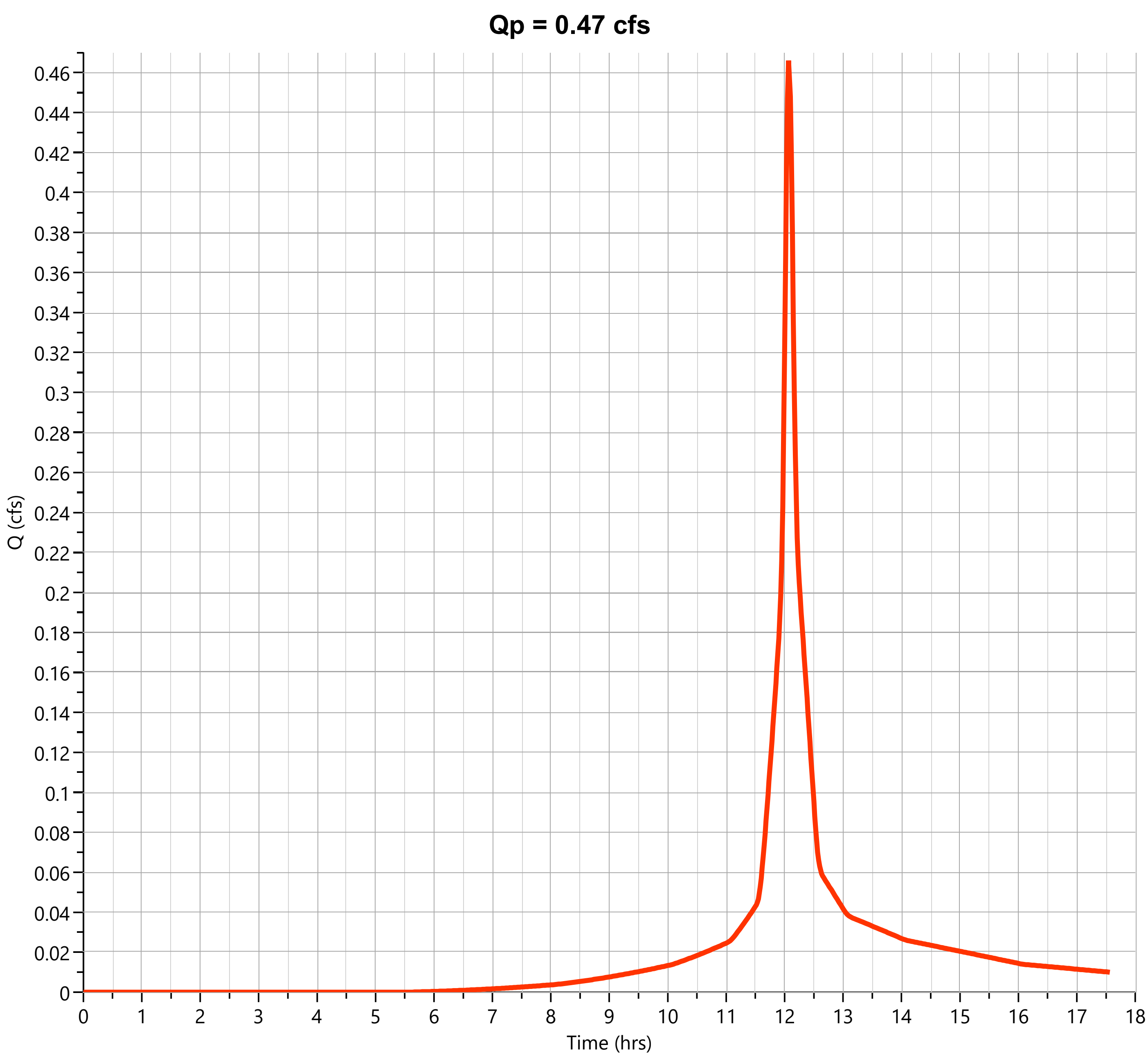


Hydrograph Report

WSHD-C (PERV)

Hyd. No. 10

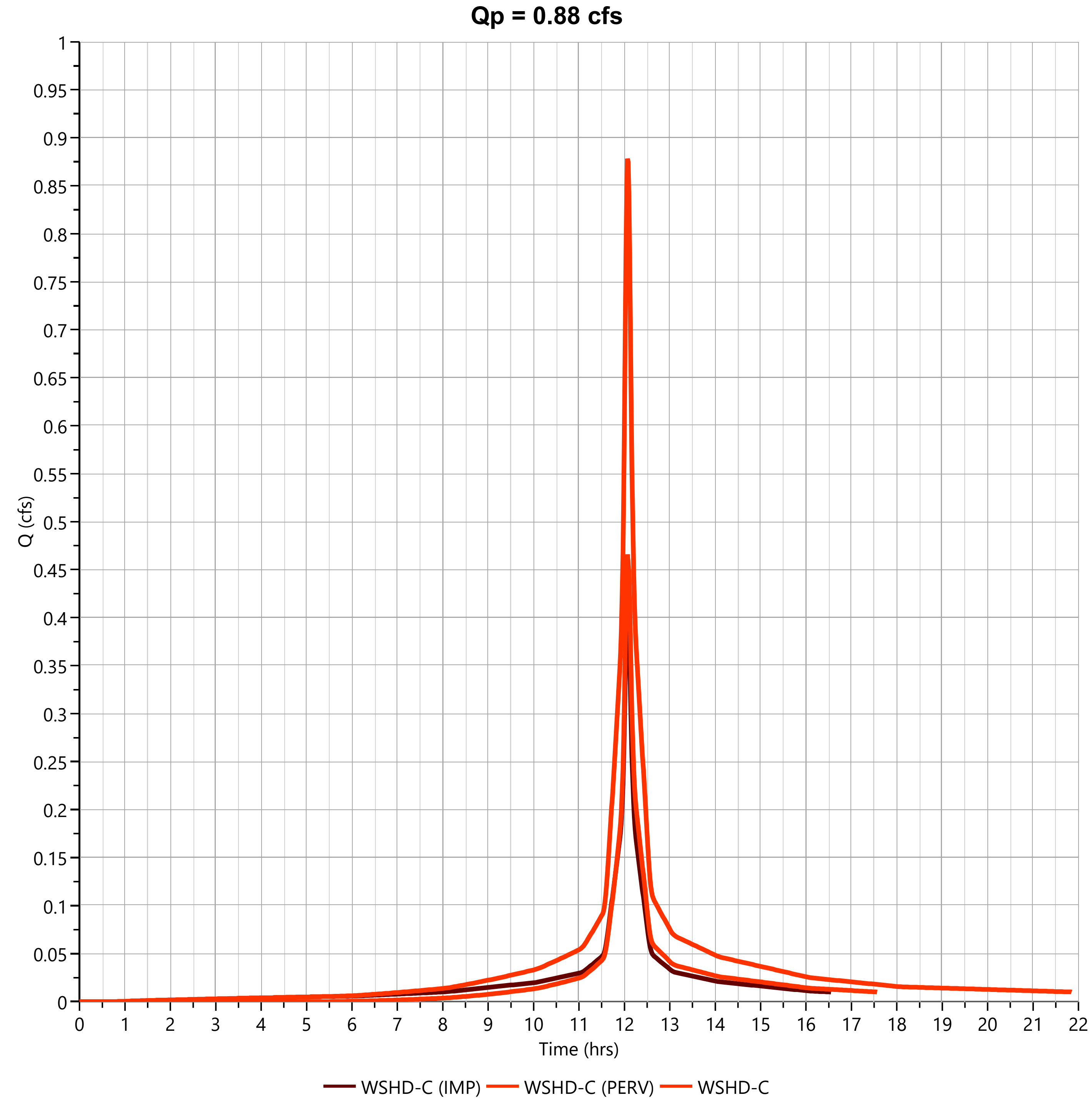
Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.466 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.07 hrs
Time Interval	= 1 min	Runoff Volume	= 1,462 cuft
Drainage Area	= 0.11 ac	Curve Number	= 86
Tc Method	= User	Time of Conc. (Tc)	= 6.0 min
Total Rainfall	= 5.09 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



WSHD-C

Hyd. No. 11

Hydrograph Type	= Junction	Peak Flow	= 0.878 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.07 hrs
Time Interval	= 1 min	Hydrograph Volume	= 2,916 cuft
Inflow Hydrographs	= 9, 10	Total Contrib. Area	= 0.19 ac



Hydrograph 100-yr Summary

Project Name: NYACK HOSPITAL

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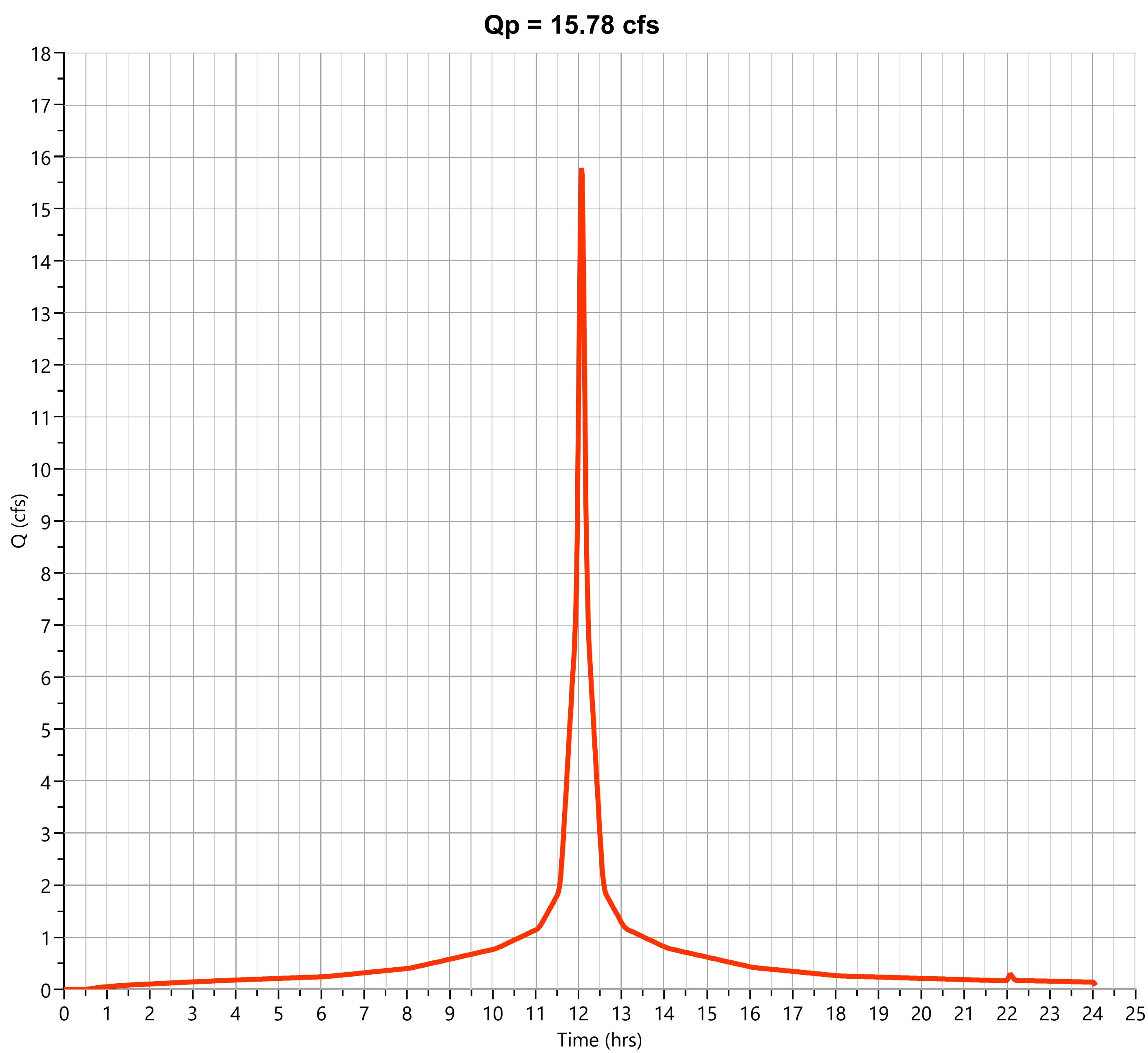
03-17-2020

Hyd. No.	Hydrograph Type	Hydrograph Name	Peak Flow (cfs)	Time to Peak (hrs)	Hydrograph Volume (cuft)	Inflow Hyd(s)	Maximum Elevation (ft)	Maximum Storage (cuft)
1	NRCS Runoff	WSHD-A (IMP)	15.78	12.07	56,585	----		
2	NRCS Runoff	WSHD-A (PERV)	2.383	12.07	7,737	----		
3	Junction	WSHD-A	18.16	12.07	64,322	1, 2		
5	NRCS Runoff	WSHD-B (IMP)	16.24	12.07	58,239	----		
6	NRCS Runoff	WSHD-B (PERV)	2.003	12.15	7,913	----		
7	Junction	WSHD-B	17.92	12.07	66,152	5, 6		
9	NRCS Runoff	WSHD-C (IMP)	0.738	12.07	2,647	----		
10	NRCS Runoff	WSHD-C (PERV)	0.936	12.07	3,040	----		
11	Junction	WSHD-C	1.674	12.07	5,687	9, 10		

WSHD-A (IMP)

Hyd. No. 1

Hydrograph Type	= NRCS Runoff	Peak Flow	= 15.78 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.07 hrs
Time Interval	= 1 min	Runoff Volume	= 56,585 cuft
Drainage Area	= 1.71 ac	Curve Number	= 98
Tc Method	= User	Time of Conc. (Tc)	= 6.0 min
Total Rainfall	= 9.08 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484

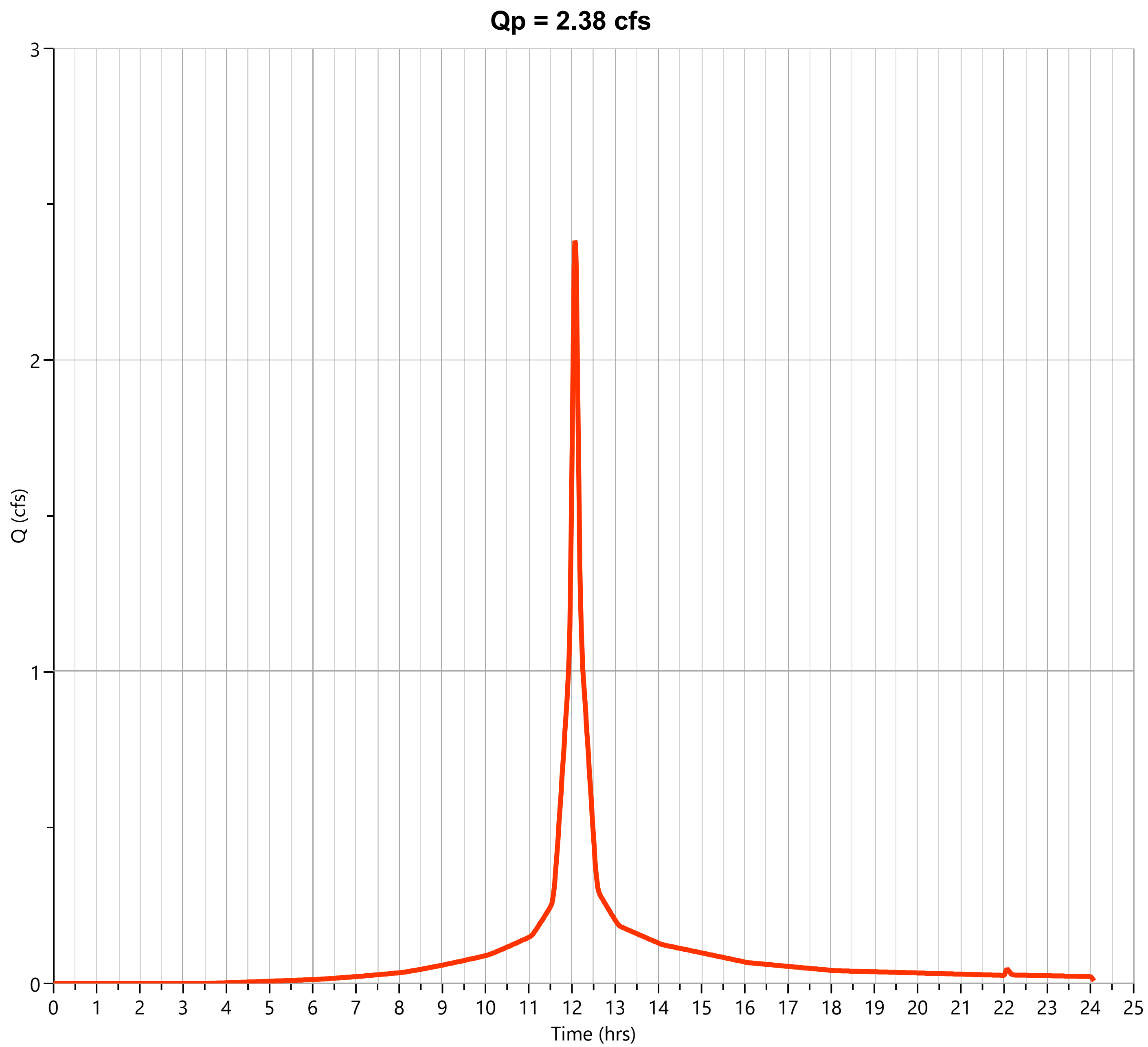


Hydrograph Report

WSHD-A (PERV)

Hyd. No. 2

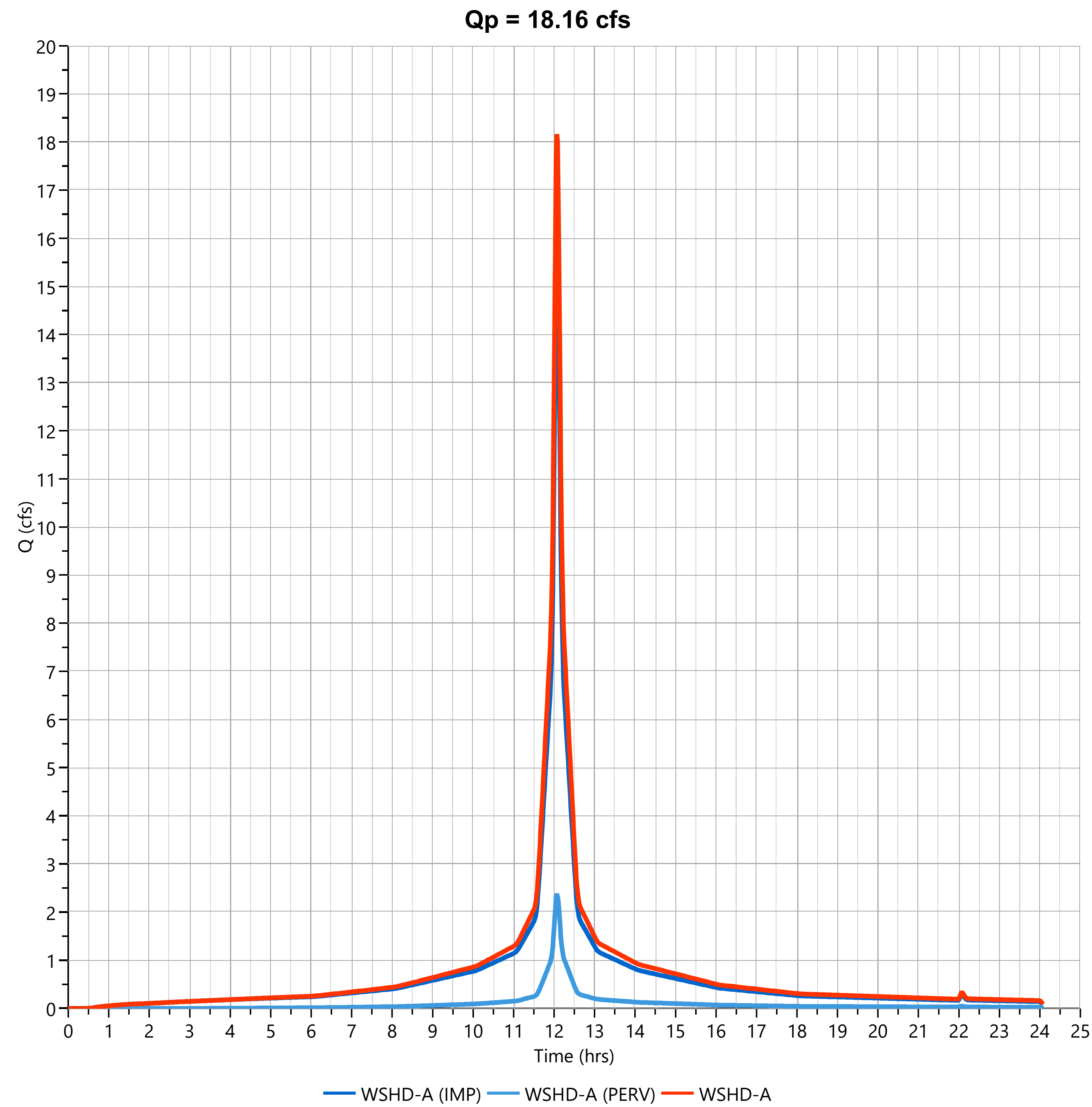
Hydrograph Type	= NRCS Runoff	Peak Flow	= 2.383 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.07 hrs
Time Interval	= 1 min	Runoff Volume	= 7,737 cuft
Drainage Area	= 0.28 ac	Curve Number	= 86
Tc Method	= User	Time of Conc. (Tc)	= 6.0 min
Total Rainfall	= 9.08 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



WSHD-A

Hyd. No. 3

Hydrograph Type	= Junction	Peak Flow	= 18.16 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.07 hrs
Time Interval	= 1 min	Hydrograph Volume	= 64,322 cuft
Inflow Hydrographs	= 1, 2	Total Contrib. Area	= 1.99 ac



Hydrograph Report

Project Name: NYACK HOSPITAL

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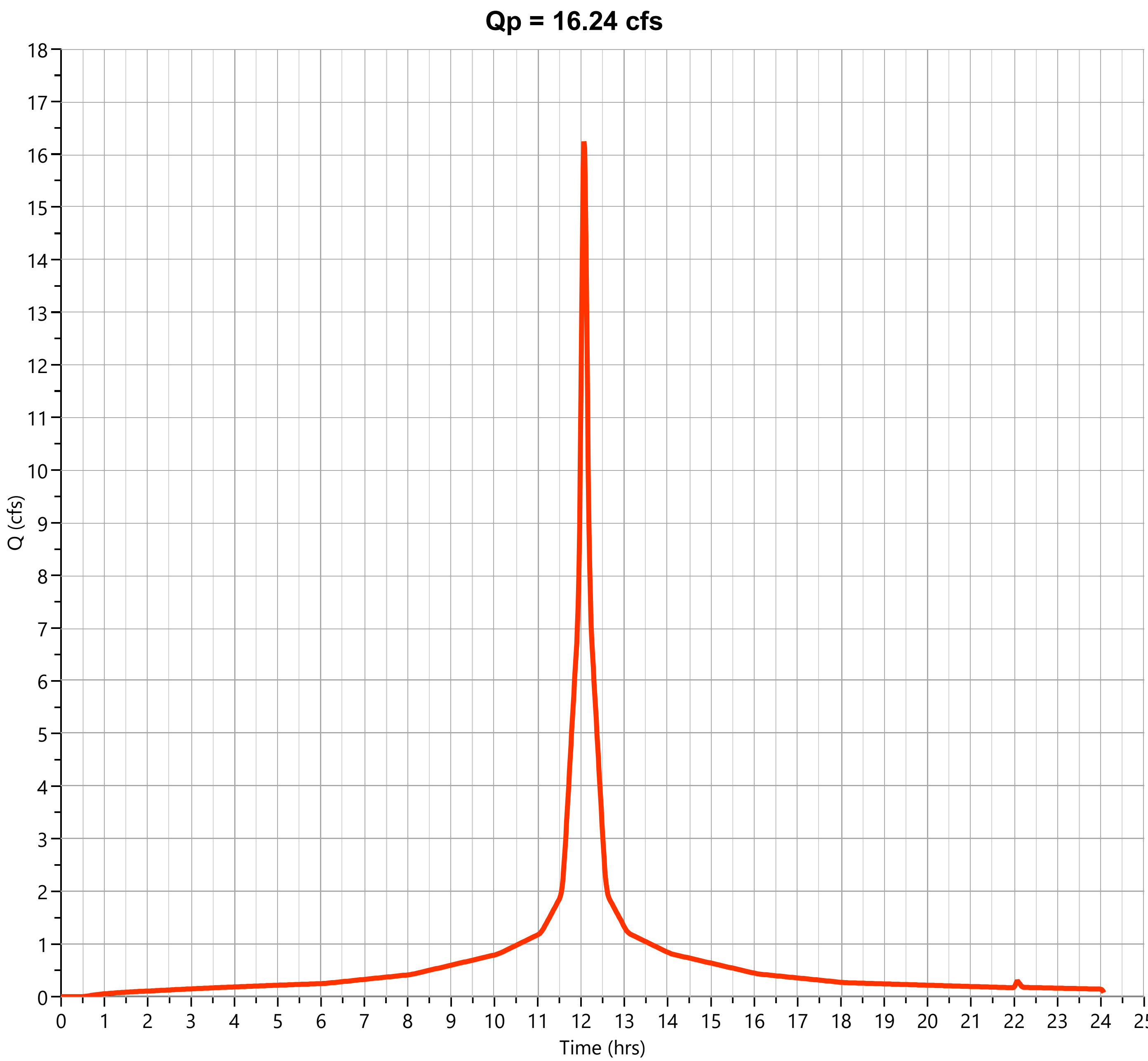
03-17-2020

WSHD-B (IMP)

Hyd. No. 5

Hydrograph Type	= NRCS Runoff	Peak Flow	= 16.24 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.07 hrs
Time Interval	= 1 min	Runoff Volume	= 58,239 cuft
Drainage Area	= 1.76 ac	Curve Number	= 98
Tc Method	= User	Time of Conc. (Tc)	= 6.0 min
Total Rainfall	= 9.08 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484

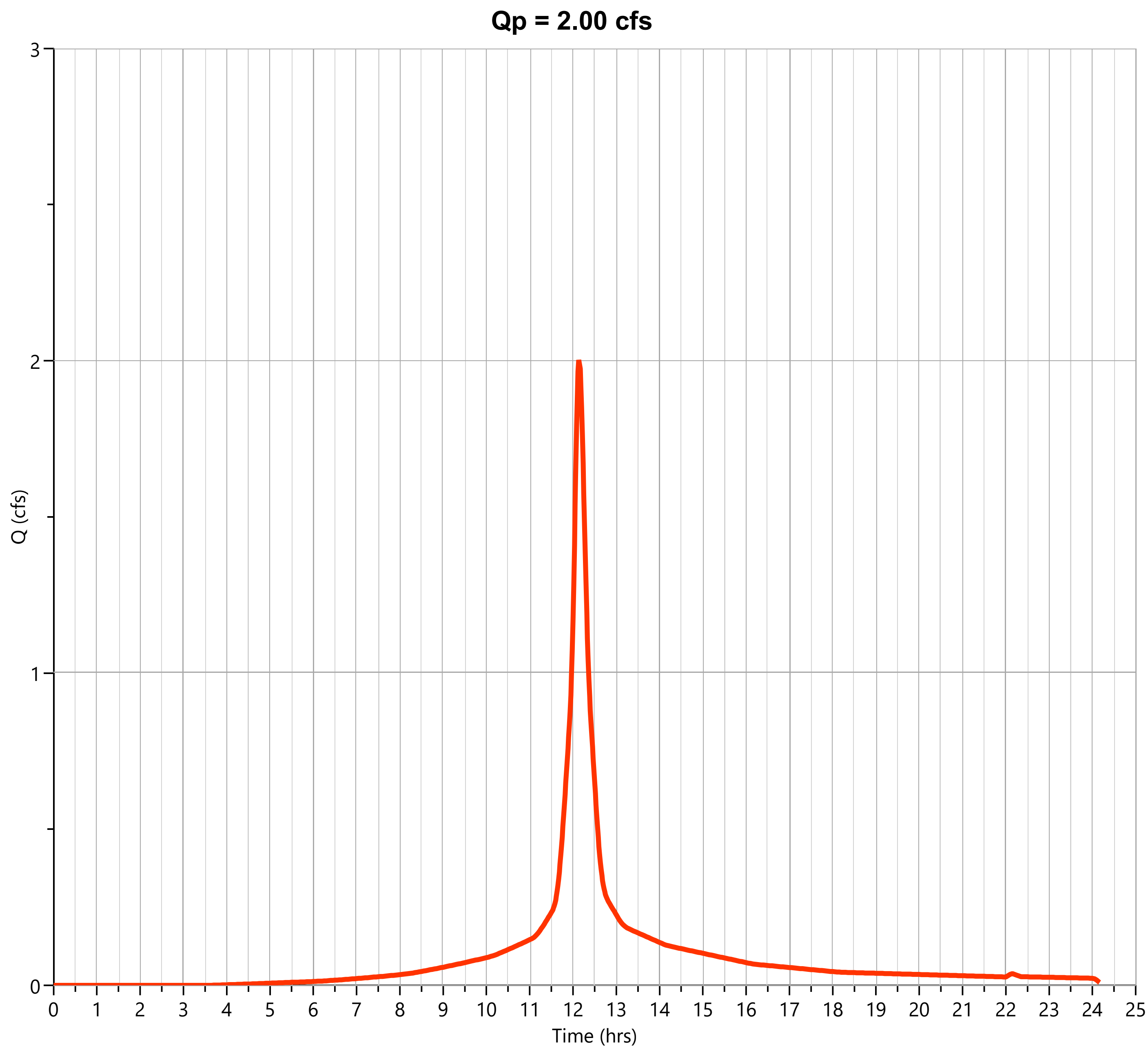


Hydrograph Report

WSHD-B (PERV)

Hyd. No. 6

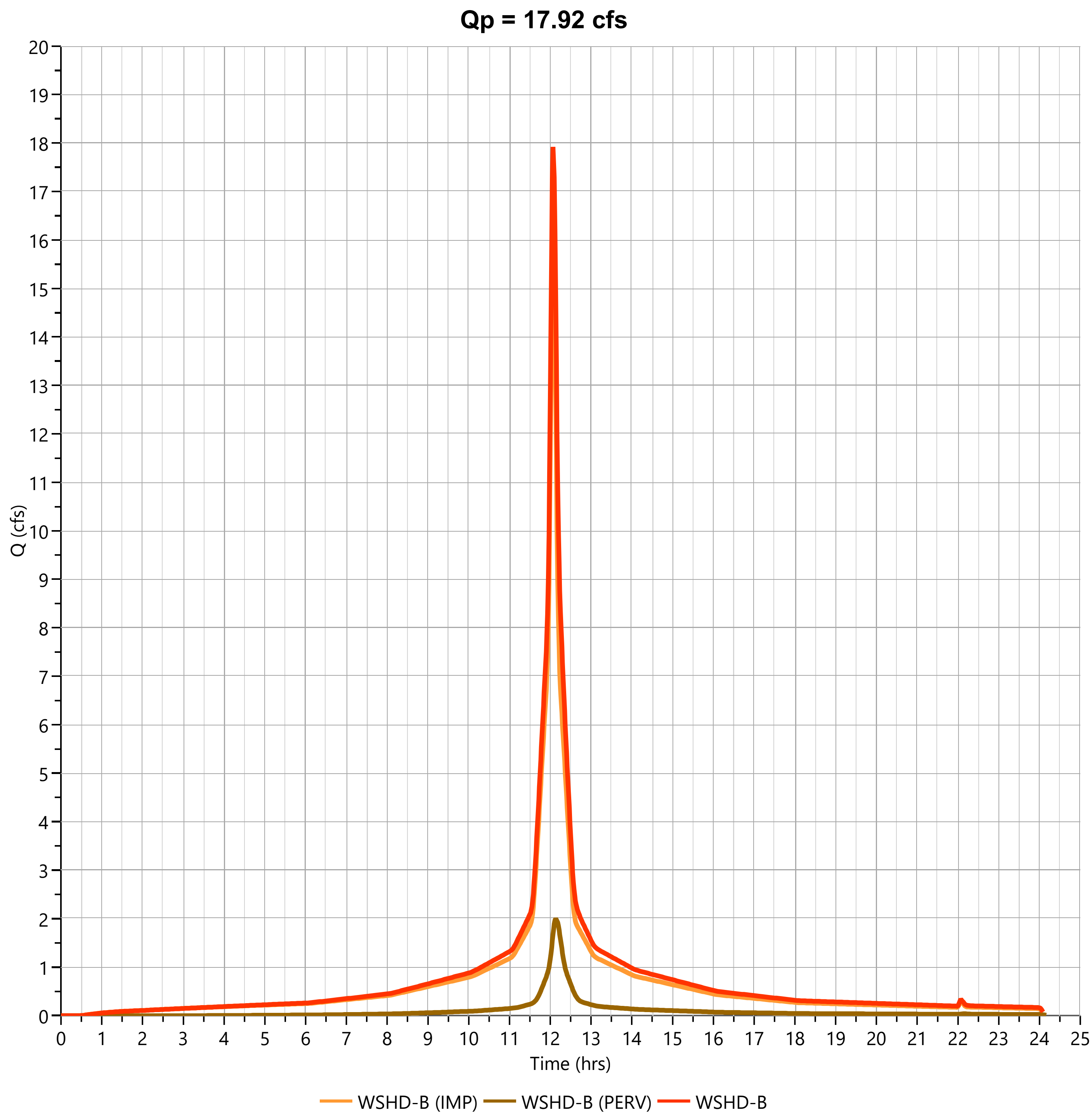
Hydrograph Type	= NRCS Runoff	Peak Flow	= 2.003 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.15 hrs
Time Interval	= 1 min	Runoff Volume	= 7,913 cuft
Drainage Area	= 0.3 ac	Curve Number	= 86
Tc Method	= User	Time of Conc. (Tc)	= 12.0 min
Total Rainfall	= 9.08 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



WSHD-B

Hyd. No. 7

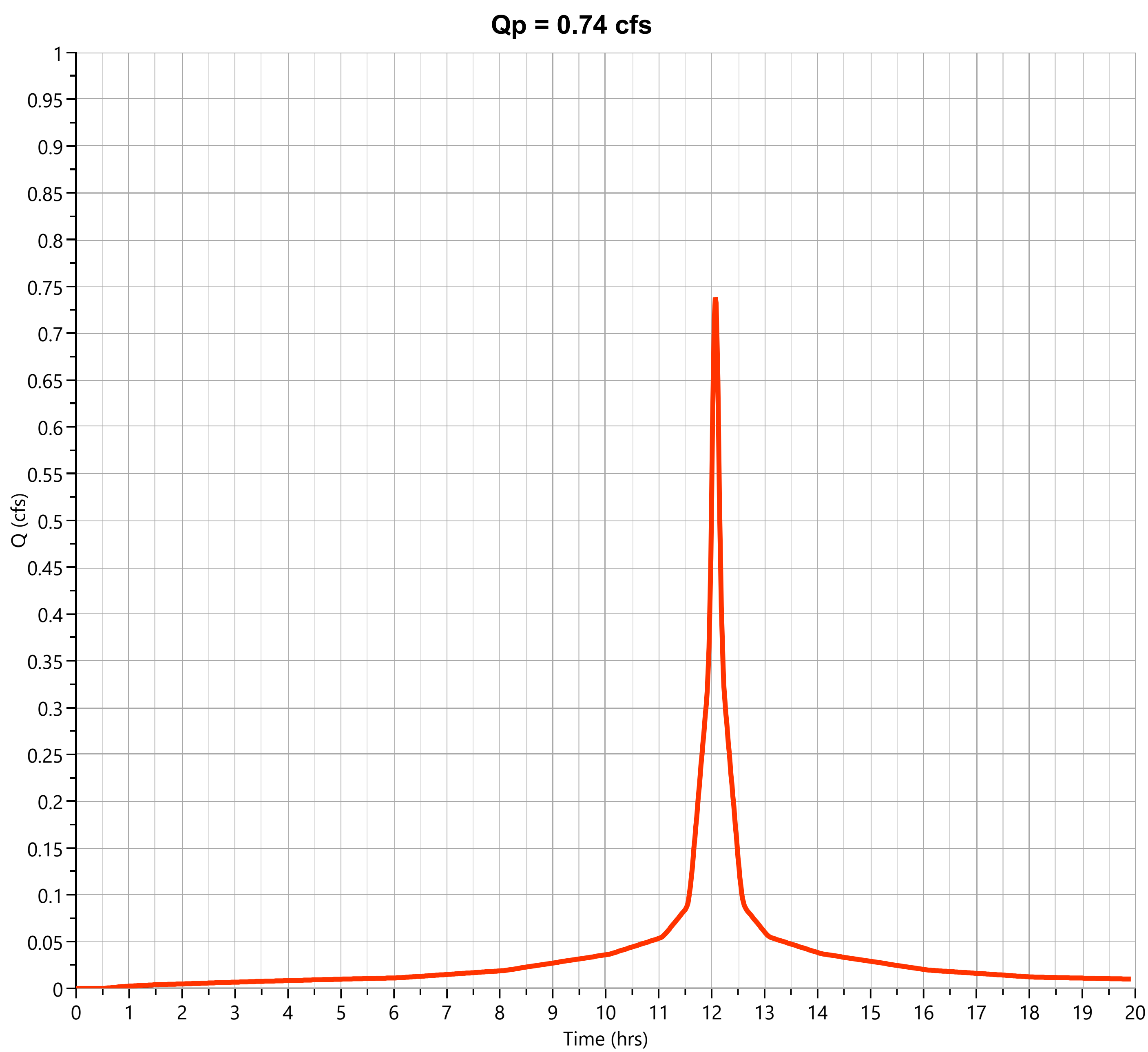
Hydrograph Type	= Junction	Peak Flow	= 17.92 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.07 hrs
Time Interval	= 1 min	Hydrograph Volume	= 66,152 cuft
Inflow Hydrographs	= 5, 6	Total Contrib. Area	= 2.06 ac



WSHD-C (IMP)

Hyd. No. 9

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.738 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.07 hrs
Time Interval	= 1 min	Runoff Volume	= 2,647 cuft
Drainage Area	= 0.08 ac	Curve Number	= 98
Tc Method	= User	Time of Conc. (Tc)	= 6.0 min
Total Rainfall	= 9.08 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name: NYACK HOSPITAL

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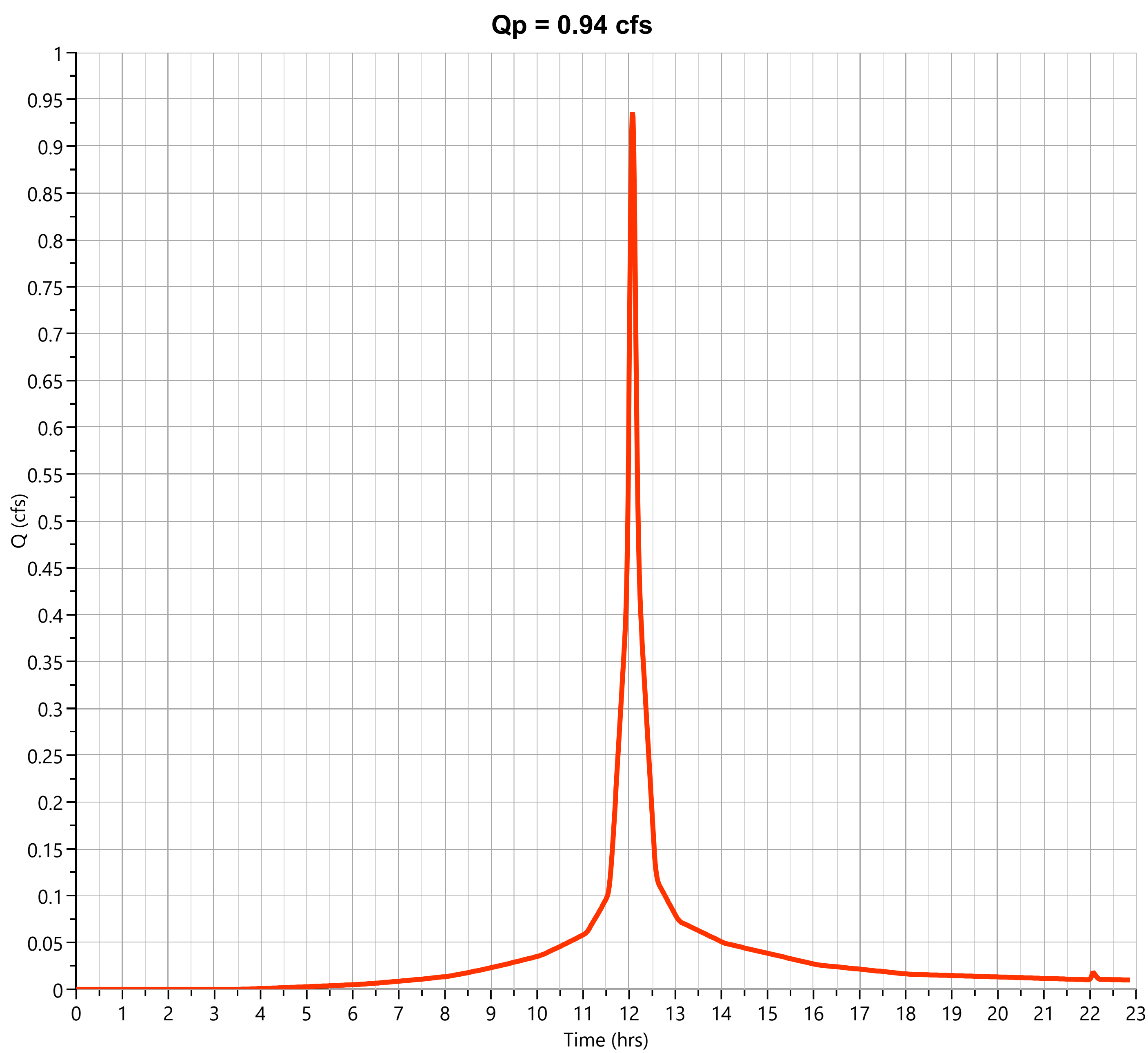
03-17-2020

WSHD-C (PERV)

Hyd. No. 10

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.936 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.07 hrs
Time Interval	= 1 min	Runoff Volume	= 3,040 cuft
Drainage Area	= 0.11 ac	Curve Number	= 86
Tc Method	= User	Time of Conc. (Tc)	= 6.0 min
Total Rainfall	= 9.08 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484

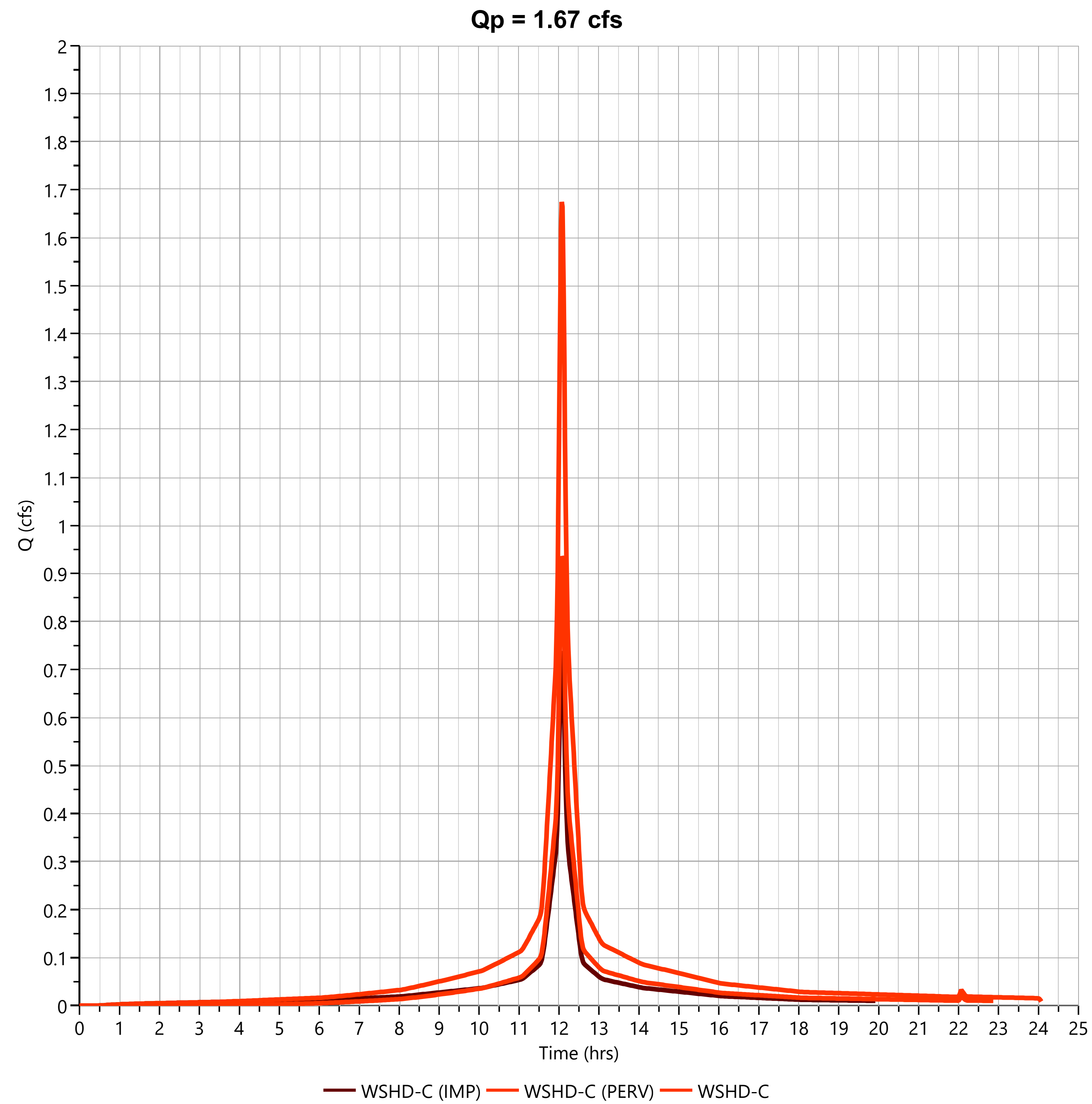


Hydrograph Report

WSHD-C

Hyd. No. 11

Hydrograph Type	= Junction	Peak Flow	= 1.674 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.07 hrs
Time Interval	= 1 min	Hydrograph Volume	= 5,687 cuft
Inflow Hydrographs	= 9, 10	Total Contrib. Area	= 0.19 ac



APPENDIX B

PROPOSED WATERSHED ANALYSIS

CN AND T_c SHEETS

Project **Nyack Hospital - Parking Structure** By **VP** Date **3/17/2020**

Location **Nyack, New York** Checked **LM** Date **3/17/2020**

Circle one: Present (Developed) **Proposed Watershed - A (Impervious)**

1. Runoff Curve Number (CN)

Soil Name and hydrologic group (Appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN [1]			Area [x] acres [ ] mi^2 [ ] %	Product of CN x area
		Table 2-2	Figure 2-3	Figure 2-4		
	Impervious	**98**			**1.67**	**163.66**
				Totals =	**1.67**	**163.66**

1) Use only one CN source per line

CN (weighted) = total product / total area = 163.66 / 1.67 = 98.00 Use CN = **98**

Project	NYACK HOSPITAL - PARKING STRUCTURE	By	VP	Date	3/17/2020
Location	VILLAGE OF NYACK, NY	Checked	LM	Date	3/17/2020

Circle One: Present (Developed) — circled

Circle One: (T_c) — circled T_t through subarea   **WATERSHED A - IMPERVIOUS**

NOTES: Space for as many as two segments per flow type can be used for each worksheet.

Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c Only)

	Units	Segment ID: A-B	Segment 2	Total
1. Surface description (table 3-1)		ASPHALT		
2. Manning's roughness coeff., n (table 3-1)		0.011		
3. Flow Length, L (total L ≤ 150 ft)	ft	100		
4. Two-yr 24-hr rainfall, P_2	in	3.41		
5. Land slope, s	ft/ft	0.065		
6. $T_t = \frac{0.007(nL)^{0.8}}{P_2^{0.5}s^{0.4}}$ Compute T_t	hr	0.012	+	= 0.012

Shallow concentrated flow

	Units	Segment ID	Segment 2	Total
7. Surface description (paved or unpaved)		-		
8. Flow length, L	ft	0		
9. Watercourse slope, s	ft/ft	0		
10. Average velocity, V (figure 3-1)	ft/s	0		
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr	0.000	+	= 0.000

Channel flow

Segment ID	Units	B-C (10" PIPE)	C-D (18" HDPE)	D-E (24" HDPE)	Total
12. Cross sectional flow area, a	ft^2	0.55	1.77	3.41	
13. Wetted perimeter, p_w	ft	2.60	4.71	6.3	
14. Hydraulic radius, r $r = \frac{a}{p_w}$ Compute r	ft	0.21	0.38	0.54	
15. Channel slope, s	ft/ft	0.008	0.012	0.01	
16. Manning's roughness coeff., n		0.011	0.011	0.011	
17. $V = \frac{1.49\ r^{2/3}\ s^{1/2}}{n}$ Compute V	ft/s	4.30	7.73	9.00	
18. Flow length, L	ft	252	409	143	
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr	0.016	+ 0.015	0.004	= 0.035

20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, 19) — hr: **0.048**

Minutes: **2.86**

Say 6 Minutes

Project	**Nyack Hospital - Parking Structure**	By **VP**	Date **3/17/2020**
Location	**Nyack, New York**	Checked **LM**	Date **3/17/2020**
Circle one:	Present (Developed)	**Proposed Watershed - A (Pervious)**	

1. Runoff Curve Number (CN)

Soil Name and hydrologic group (Appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN [1]			Area [x] acres [ ] mi^2 [ ] %	Product of CN x area
		Table 2-2	Figure 2-3	Figure 2-4		
C	**Open Space (good)**	**86**			**0.32**	**27.52**
				Totals =	**0.32**	**27.52**

1) Use only one CN source per line

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{27.52}{0.32}$ = 86.00 Use CN = **86**

Project	NYACK HOSPITAL - PARKING STRUCTURE	By	VP	Date	3/17/2020
Location	VILLAGE OF NYACK, NY	Checked	LM	Date	3/17/2020

Circle One: Present **(Developed)**

Circle One: **(T_c)** T_t through subarea — **WATERSHED A - PERVIOUS**

NOTES: Space for as many as two segments per flow type can be used for each worksheet.

Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c Only)

	Unit	Segment 1	Segment 2	Total
Segment ID		A'-B'		
1. Surface description (table 3-1)		GRASS		
2. Manning's roughness coeff., n (table 3-1)		0.150		
3. Flow Length, L (total L $\leq$ 150 ft)	ft	63		
4. Two-yr 24-hr rainfall, P_2	in	3.41		
5. Land slope, s	ft/ft	0.103		
6. $T_t = \frac{0.007(nL)^{0.8}}{P_2^{0.5} s^{0.4}}$ Compute T_t	hr	0.057	+	= 0.057

Shallow concentrated flow

	Unit	Segment 1	Segment 2	Total
Segment ID				
7. Surface description (paved or unpaved)				
8. Flow length, L	ft			
9. Watercourse slope, s	ft/ft			
10. Average velocity, V (figure 3-1)	ft/s			
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr		+	= 0.000

Channel flow

	Unit	Segment 1	Segment 2	Segment 3	Total
Segment ID		B'-C' (8" CMP)			
12. Cross sectional flow area, a	ft^2	0.35			
13. Wetted perimeter, p_w	ft	2.10			
14. Hydraulic radius, r $r = \frac{a}{p_w}$ Compute r	ft	0.17			
15. Channel slope, s	ft/ft	0.02			
16. Manning's roughness coeff., n		0.024			
17. $V = \frac{1.49\ r^{2/3}\ s^{1/2}}{n}$ Compute V	ft/s	2.66			
18. Flow length, L	ft	605			
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr	0.063	+		= 0.063

	Unit	Value
20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, 19)	hr	0.120
	Minutes	7

Say 7 Minutes

Project **Nyack Hospital - Parking Structure** By **VP** Date **3/17/2020**

Location **Nyack, New York** Checked **LM** Date **3/17/2020**

Circle one: (Present) Developed **Proposed Watershed - B (Impervious)**

1. Runoff Curve Number (CN)

Soil Name and hydrologic group (Appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN [1] Table 2-2	Figure 2-3	Figure 2-4	Area [x] acres [ ] mi^2 [ ] %	Product of CN x area
	Impervious	**98**			**1.75**	**171.50**
				Totals =	**1.75**	**171.50**

1) Use only one CN source per line

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{171.50}{1.75}$ = 98.00 Use CN = **98**

Project	NYACK HOSPITAL - PARKING STRUCTURE	By	VP	Date	3/17/2020
Location	VILLAGE OF NYACK, NY	Checked	LM	Date	3/17/2020

Circle One: Present **(Developed)** [circled]

Circle One: **(T_c)** [circled] T_t through subarea **WATERSHED B - IMPERVIOUS**

NOTES: Space for as many as two segments per flow type can be used for each worksheet.

Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c Only)

	Unit	Segment ID: A-B	Segment ID:		Total
1. Surface description (table 3-1)		ROOF			
2. Manning's roughness coeff., n (table 3-1)		0.011			
3. Flow Length, L (total L ≤ 150 ft)	ft	100			
4. Two-yr 24-hr rainfall, P_2	in	3.41			
5. Land slope, s	ft/ft	0.010			
6. $T_t = \frac{0.007(nL)^{0.8}}{P_2^{0.5} s^{0.4}}$ Compute T_t	hr	0.026	+	=	0.026

Shallow concentrated flow

	Unit	Segment ID: B-C	Segment ID:		Total
7. Surface description (paved or unpaved)		ROOF			
8. Flow length, L	ft	39			
9. Watercourse slope, s	ft/ft	0.01			
10. Average velocity, V (figure 3-1)	ft/s	2			
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr	0.005	+	=	0.005

Channel flow

	Unit	Segment ID: C-D (8" PIPE)	Segment ID: D-E (15" HDPE)			Total
12. Cross sectional flow area, a	ft^2	0.35	1.23			
13. Wetted perimeter, p_w	ft	2.10	3.93			
14. Hydraulic radius, r $r = \frac{a}{p_w}$ Compute r	ft	0.17	0.31			
15. Channel slope, s	ft/ft	0.01	0.01			
16. Manning's roughness coeff., n		0.011	0.011			
17. $V = \frac{1.49\ r^{2/3}\ s^{1/2}}{n}$ Compute V	ft/s	4.10	6.24			
18. Flow length, L	ft	57	392			
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr	0.004 +	0.017		=	0.021

20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, 19) hr **0.053**

Minutes **3.15**

Say 6 Minutes

Project **Nyack Hospital - Parking Structure** By **VP** Date **3/17/2020**

Location **Nyack, New York** Checked **LM** Date **3/17/2020**

Circle one: Present (Developed) **Proposed Watershed - B (Pervious)**

1. Runoff Curve Number (CN)

Soil Name and hydrologic group (Appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN [1] Table 2-2	CN [1] Figure 2-3	CN [1] Figure 2-4	Area [x] acres [ ] mi^2 [ ] %	Product of CN x area
C	**Open Space (good)**	**86**			**0.30**	**25.80**
				Totals =	**0.30**	**25.80**

1) Use only one CN source per line

CN (weighted) = total product / total area = 25.80 / 0.30 = 86.00 Use CN = **86**

Project	NYACK HOSPITAL - PARKING STRUCTURE	By	VP	Date	3/17/2020
Location	VILLAGE OF NYACK, NY	Checked	LM	Date	3/17/2020

Circle One: Present (Developed) — circled: Developed

Circle One: (T_c) T_t through subarea — circled: T_c

WATERSHED B - PERVIOUS

NOTES: Space for as many as two segments per flow type can be used for each worksheet.

Include a map, schematic, or description of flow segments.

	Unit	Segment 1	Segment 2	Segment 3	Total
Sheet flow (Applicable to T_c Only) — Segment ID		A'-B'			
1. Surface description (table 3-1)		GRASS			
2. Manning's roughness coeff., n (table 3-1)		0.150			
3. Flow Length, L (total L ≤ 150 ft)	ft	100			
4. Two-yr 24-hr rainfall, P_2	in	3.41			
5. Land slope, s	ft/ft	0.050			
6. $T_t = \frac{0.007(nL)^{0.8}}{P_2^{0.5} s^{0.4}}$ Compute T_t	hr	0.110	+		= 0.110
Shallow concentrated flow — Segment ID		B'-C'	C'-D'		
7. Surface description (paved or unpaved)		UNPAVED	PAVED		
8. Flow length, L	ft	208	22		
9. Watercourse slope, s	ft/ft	0.037	0.02		
10. Average velocity, V (figure 3-1)	ft/s	3	2.9		
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr	0.019	+ 0.002		= 0.021
Channel flow — Segment ID					
12. Cross sectional flow area, a	ft^2				
13. Wetted perimeter, p_w	ft				
14. Hydraulic radius, r $r = \frac{a}{p_w}$ Compute r	ft				
15. Channel slope, s	ft/ft				
16. Manning's roughness coeff., n					
17. $V = \frac{1.49\ r^{2/3}\ s^{1/2}}{n}$ Compute V	ft/s				
18. Flow length, L	ft				
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr		+		= 0.000
20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, 19)	hr				0.131
	Minutes				8

Say 8 Minutes

Project **Nyack Hospital - Parking Structure** By **VP** Date **3/17/2020**

Location **Nyack, New York** Checked **LM** Date **3/17/2020**

Circle one: Present (Developed) **Proposed Watershed - C (Impervious)**

1. Runoff Curve Number (CN)

Soil Name and hydrologic group (Appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN[1] Table 2-2	CN[1] Figure 2-3	CN[1] Figure 2-4	Area [x] acres [ ] mi^2 [ ] %	Product of CN x area
	Impervious	**98**			**0.08**	**7.84**
				Totals =	**0.08**	**7.84**

1) Use only one CN source per line

$$CN\ (weighted) = \frac{\text{total product}}{\text{total area}} = \frac{7.84}{0.08} = 98.00$$

Use CN = **98**

Project	NYACK HOSPITAL - PARKING STRUCTURE	By	VP	Date	3/17/2020
Location	VILLAGE OF NYACK, NY	Checked	LM	Date	3/17/2020

Circle One: Present (Developed — circled)

Circle One: (T_c — circled) T_t through subarea — **WATERSHED C - IMPERVIOUS**

NOTES: Space for as many as two segments per flow type can be used for each worksheet.

Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c Only)

		Segment 1	Segment 2	Total
Segment ID		A-B		
1. Surface description (table 3-1)		ASPHALT		
2. Manning's roughness coeff., n (table 3-1)		0.011		
3. Flow Length, L (total L ≤ 150 ft)	ft	26		
4. Two-yr 24-hr rainfall, P_2	in	3.41		
5. Land slope, s	ft/ft	0.075		
6. $T_t = \frac{0.007(nL)^{0.8}}{P_2^{0.5}s^{0.4}}$ Compute T_t	hr	0.004	+	= 0.004

Shallow concentrated flow

		Segment 1	Segment 2	Total
Segment ID				
7. Surface description (paved or unpaved)				
8. Flow length, L	ft			
9. Watercourse slope, s	ft/ft			
10. Average velocity, V (figure 3-1)	ft/s			
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr		+	= 0.000

Channel flow

		Segment 1	Segment 2	Segment 3	Total
Segment ID					
12. Cross sectional flow area, a	ft^2				
13. Wetted perimeter, p_w	ft				
14. Hydraulic radius, r $r = \frac{a}{p_w}$ Compute r	ft				
15. Channel slope, s	ft/ft				
16. Manning's roughness coeff., n					
17. $V = \frac{1.49\ r^{2/3}\ s^{1/2}}{n}$ Compute V	ft/s				
18. Flow length, L	ft				
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr		+		= 0.000

20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, 19) — hr **0.004**

Minutes **0.24**

Say 6 Minutes

Project **Nyack Hospital - Parking Structure** By **VP** Date **3/17/2020**

Location **Nyack, New York** Checked **LM** Date **3/17/2020**

Circle one: (Present) Developed **Proposed Watershed - C (Pervious)**

1. Runoff Curve Number (CN)

Soil Name and hydrologic group (Appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN [1]			Area [x] acres [ ] mi^2 [ ] %	Product of CN x area
		Table 2-2	Figure 2-3	Figure 2-4		
C	**Open Space (good)**	**86**			**0.11**	**9.46**
					Totals = **0.11**	**9.46**

1) Use only one CN source per line

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{9.46}{0.11}$ = 86.00 Use CN = **86**

Project	NYACK HOSPITAL - PARKING STRUCTURE	By	VP	Date	3/17/2020
Location	VILLAGE OF NYACK, NY	Checked	LM	Date	3/17/2020

Circle One: Present **(Developed)**

Circle One: **(T_c)** T_t through subarea — **WATERSHED C - PERVIOUS**

NOTES: Space for as many as two segments per flow type can be used for each worksheet.

Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c Only)

	Unit	Segment 1		Segment 2	Total
Segment ID		A'-B'			
1. Surface description (table 3-1)		GRASS			
2. Manning's roughness coeff., n (table 3-1)		0.150			
3. Flow Length, L (total L ≤ 150 ft)	ft	53			
4. Two-yr 24-hr rainfall, P_2	in	3.41			
5. Land slope, s	ft/ft	0.100			
6. $T_t = \frac{0.007(nL)^{0.8}}{P_2^{0.5}s^{0.4}}$ Compute T_t	hr	0.050	+		= 0.050

Shallow concentrated flow

	Unit	Segment 1		Segment 2	Total
Segment ID					
7. Surface description (paved or unpaved)					
8. Flow length, L	ft				
9. Watercourse slope, s	ft/ft				
10. Average velocity, V (figure 3-1)	ft/s				
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr		+		= 0.000

Channel flow

	Unit	Segment 1		Segment 2	Segment 3	Total
Segment ID						
12. Cross sectional flow area, a	ft^2					
13. Wetted perimeter, p_w	ft					
14. Hydraulic radius, r $r = \frac{a}{p_w}$ Compute r	ft					
15. Channel slope, s	ft/ft					
16. Manning's roughness coeff., n						
17. $V = \frac{1.49\ r^{2/3}\ s^{1/2}}{n}$ Compute V	ft/s					
18. Flow length, L	ft					
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr		+			= 0.000

20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, 19) — hr: **0.050**; Minutes: **3**

Say 6 Minutes

PROPOSED RUNOFF HYDROGRAPHS

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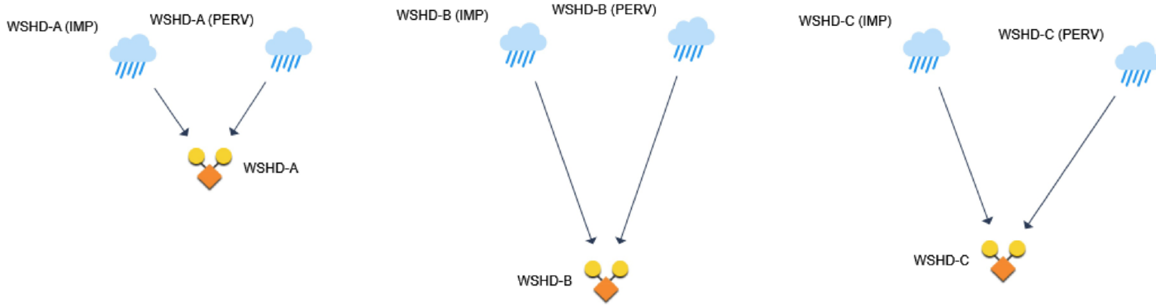
Contents continued...

Basin Model

Hydrology Studio v 3.0.0.14

Project Name:

03-17-2020



Hydrograph 1-yr Summary

Hydrology Studio v 3.0.0.14

Project Name:

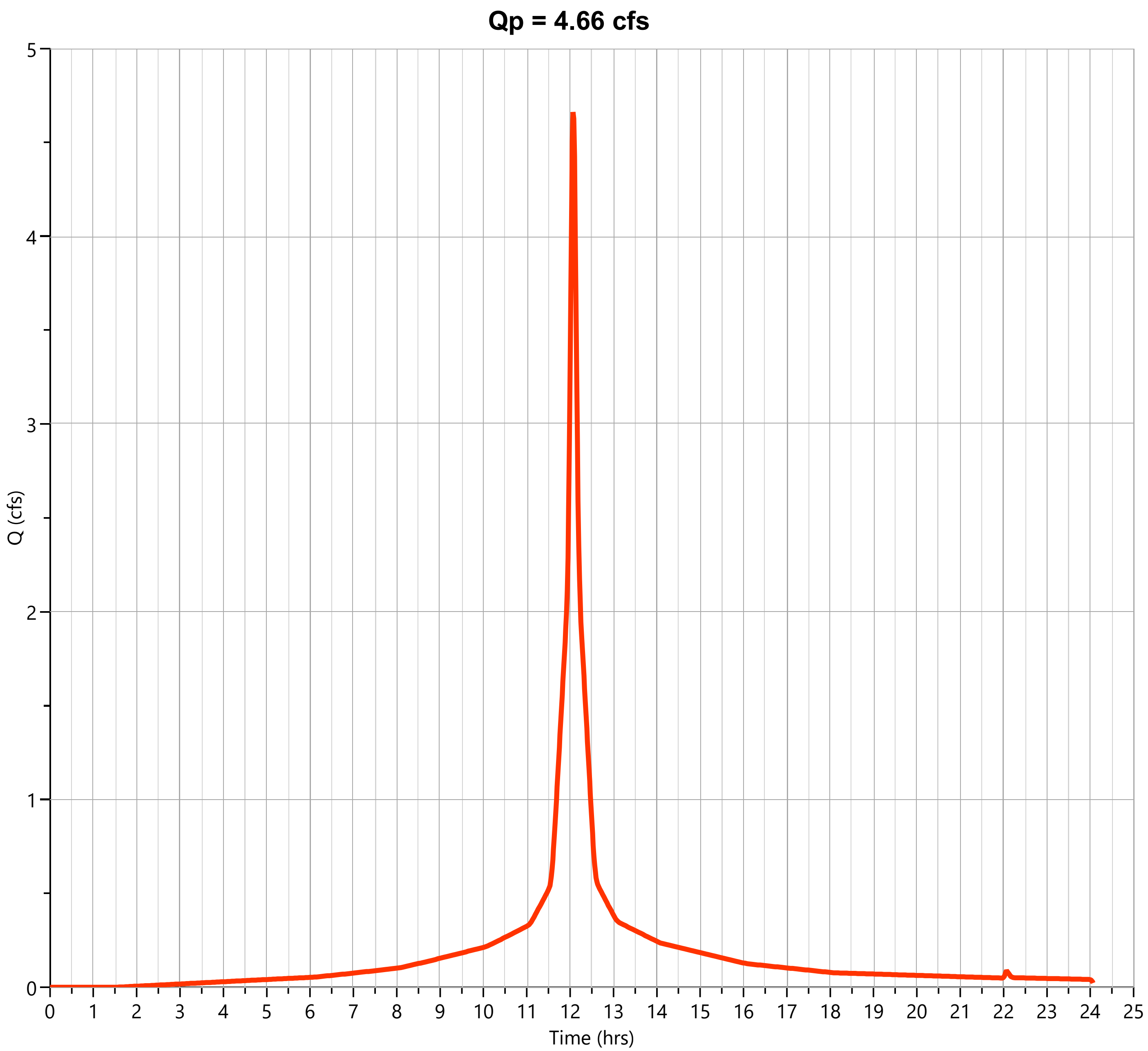
03-17-2020

Hyd. No.	Hydrograph Type	Hydrograph Name	Peak Flow (cfs)	Time to Peak (hrs)	Hydrograph Volume (cuft)	Inflow Hyd(s)	Maximum Elevation (ft)	Maximum Storage (cuft)
1	NRCS Runoff	WSHD-A (IMP)	4.661	12.07	15,999	----		
2	NRCS Runoff	WSHD-A (PERV)	0.577	12.08	1,778	----		
3	Junction	WSHD-A	5.234	12.07	17,777	1, 2		
5	NRCS Runoff	WSHD-B (IMP)	4.884	12.07	16,765	----		
6	NRCS Runoff	WSHD-B (PERV)	0.423	12.15	1,591	----		
7	Junction	WSHD-B	5.220	12.07	18,356	5, 6		
9	NRCS Runoff	WSHD-C (IMP)	0.223	12.07	766	----		
10	NRCS Runoff	WSHD-C (PERV)	0.198	12.08	611	----		
11	Junction	WSHD-C	0.420	12.07	1,378	9, 10		

WSHD-A (IMP)

Hyd. No. 1

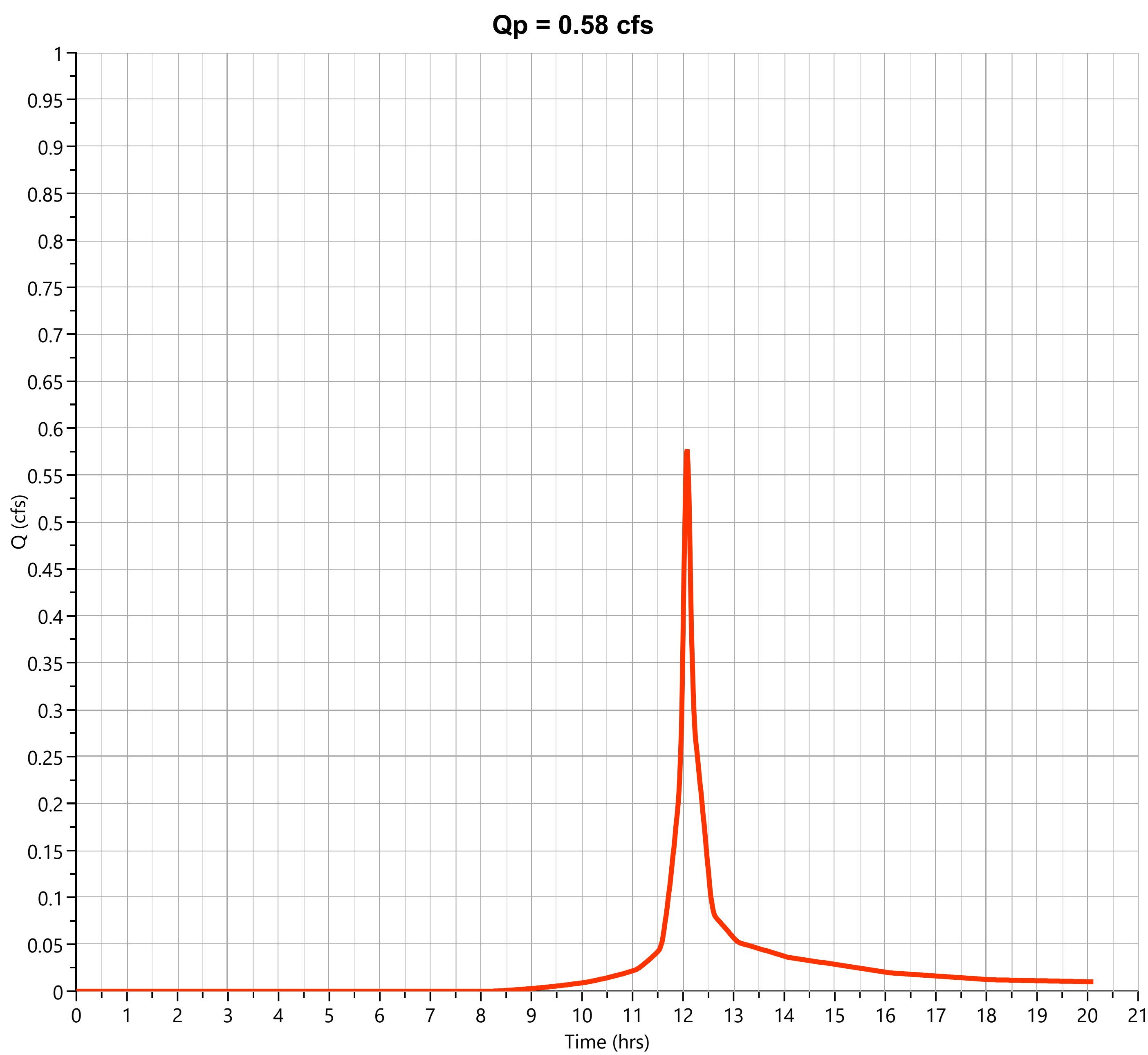
Hydrograph Type	= NRCS Runoff	Peak Flow	= 4.661 cfs
Storm Frequency	= 1-yr	Time to Peak	= 12.07 hrs
Time Interval	= 1 min	Runoff Volume	= 15,999 cuft
Drainage Area	= 1.67 ac	Curve Number	= 98
Tc Method	= User	Time of Conc. (Tc)	= 6.0 min
Total Rainfall	= 2.79 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

WSHD-A (PERV) Hyd. No. 2

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.577 cfs
Storm Frequency	= 1-yr	Time to Peak	= 12.08 hrs
Time Interval	= 1 min	Runoff Volume	= 1,778 cuft
Drainage Area	= 0.32 ac	Curve Number	= 86
Tc Method	= User	Time of Conc. (Tc)	= 6.0 min
Total Rainfall	= 2.79 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



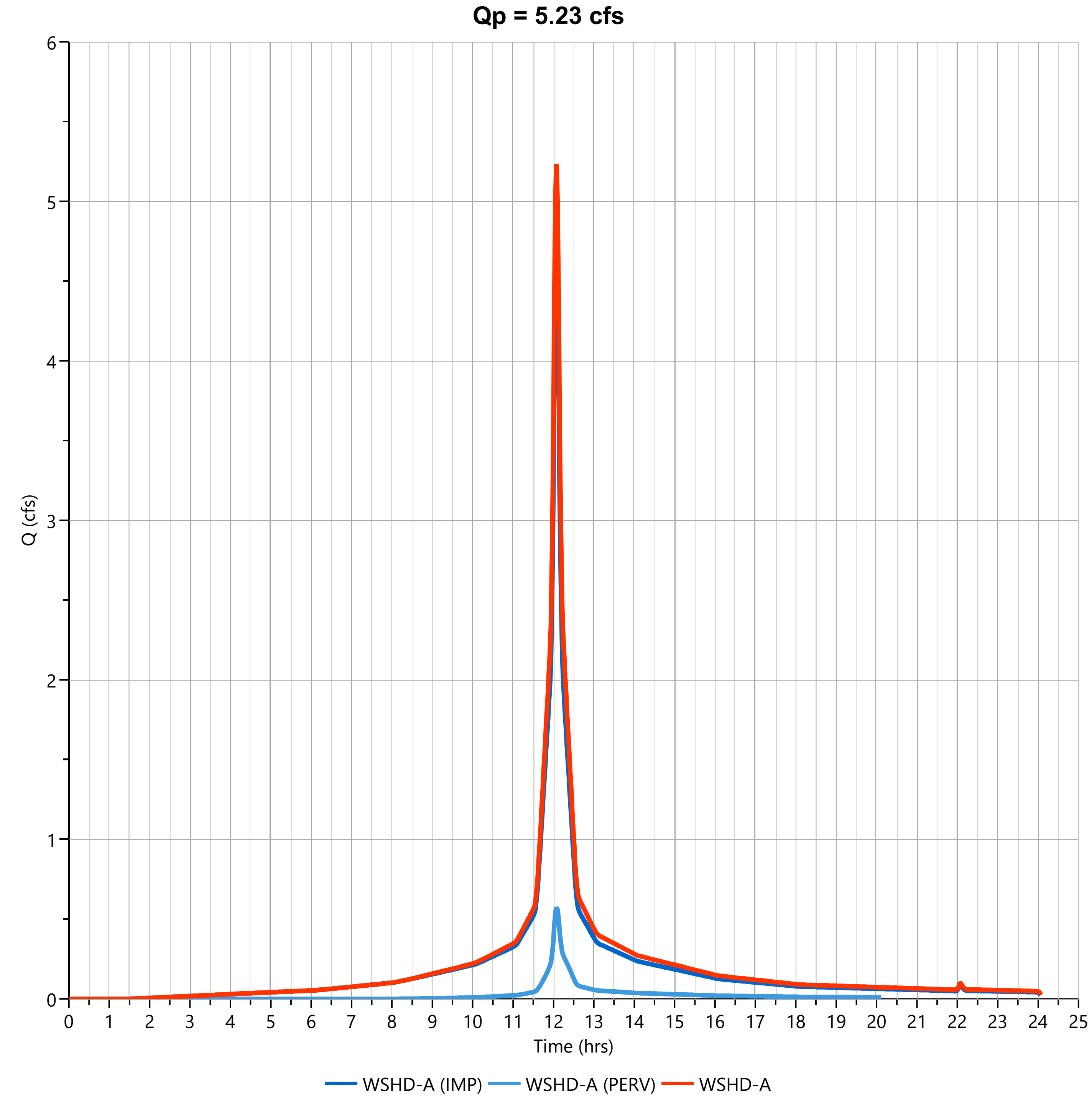
Hydrograph Report

Hydrology Studio v 3.0.0.14 03-17-2020

WSHD-A

Hyd. No. 3

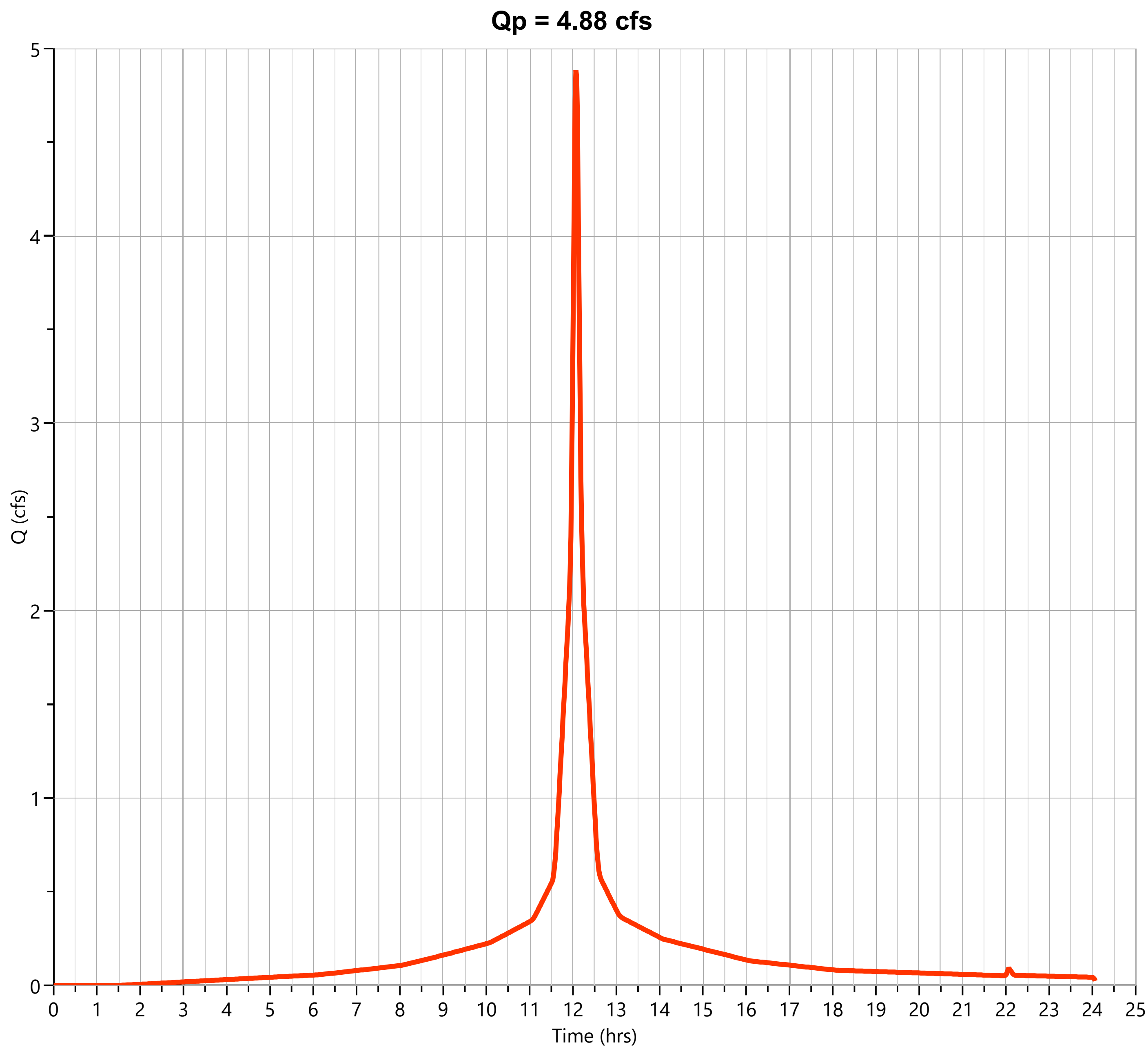
Hydrograph Type	= Junction	Peak Flow	= 5.234 cfs
Storm Frequency	= 1-yr	Time to Peak	= 12.07 hrs
Time Interval	= 1 min	Hydrograph Volume	= 17,777 cuft
Inflow Hydrographs	= 1, 2	Total Contrib. Area	= 1.99 ac



WSHD-B (IMP)

Hyd. No. 5

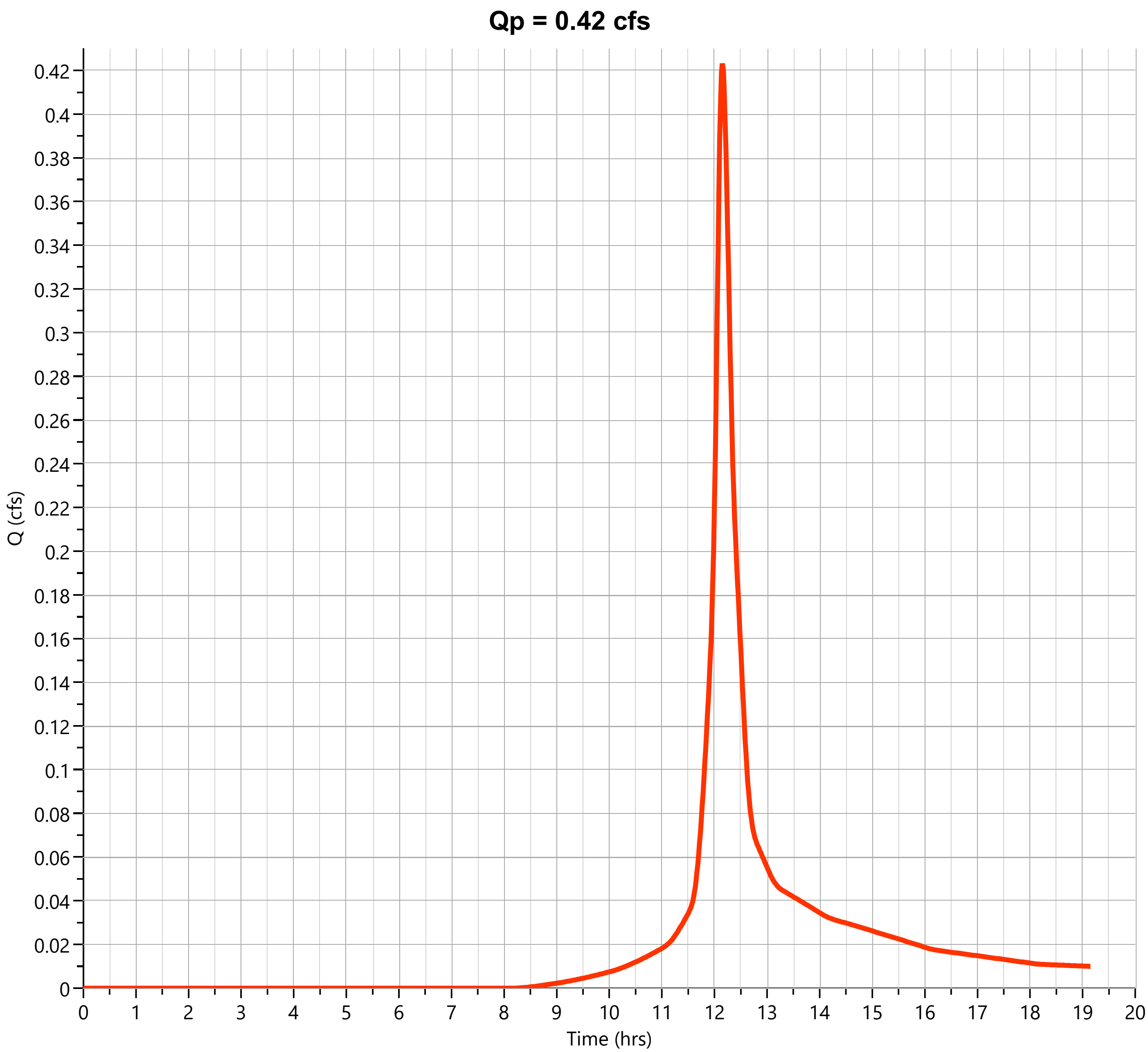
Hydrograph Type	= NRCS Runoff	Peak Flow	= 4.884 cfs
Storm Frequency	= 1-yr	Time to Peak	= 12.07 hrs
Time Interval	= 1 min	Runoff Volume	= 16,765 cuft
Drainage Area	= 1.75 ac	Curve Number	= 98
Tc Method	= User	Time of Conc. (Tc)	= 6.0 min
Total Rainfall	= 2.79 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



WSHD-B (PERV)

Hyd. No. 6

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.423 cfs
Storm Frequency	= 1-yr	Time to Peak	= 12.15 hrs
Time Interval	= 1 min	Runoff Volume	= 1,591 cuft
Drainage Area	= 0.3 ac	Curve Number	= 86
Tc Method	= User	Time of Conc. (Tc)	= 12.0 min
Total Rainfall	= 2.79 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



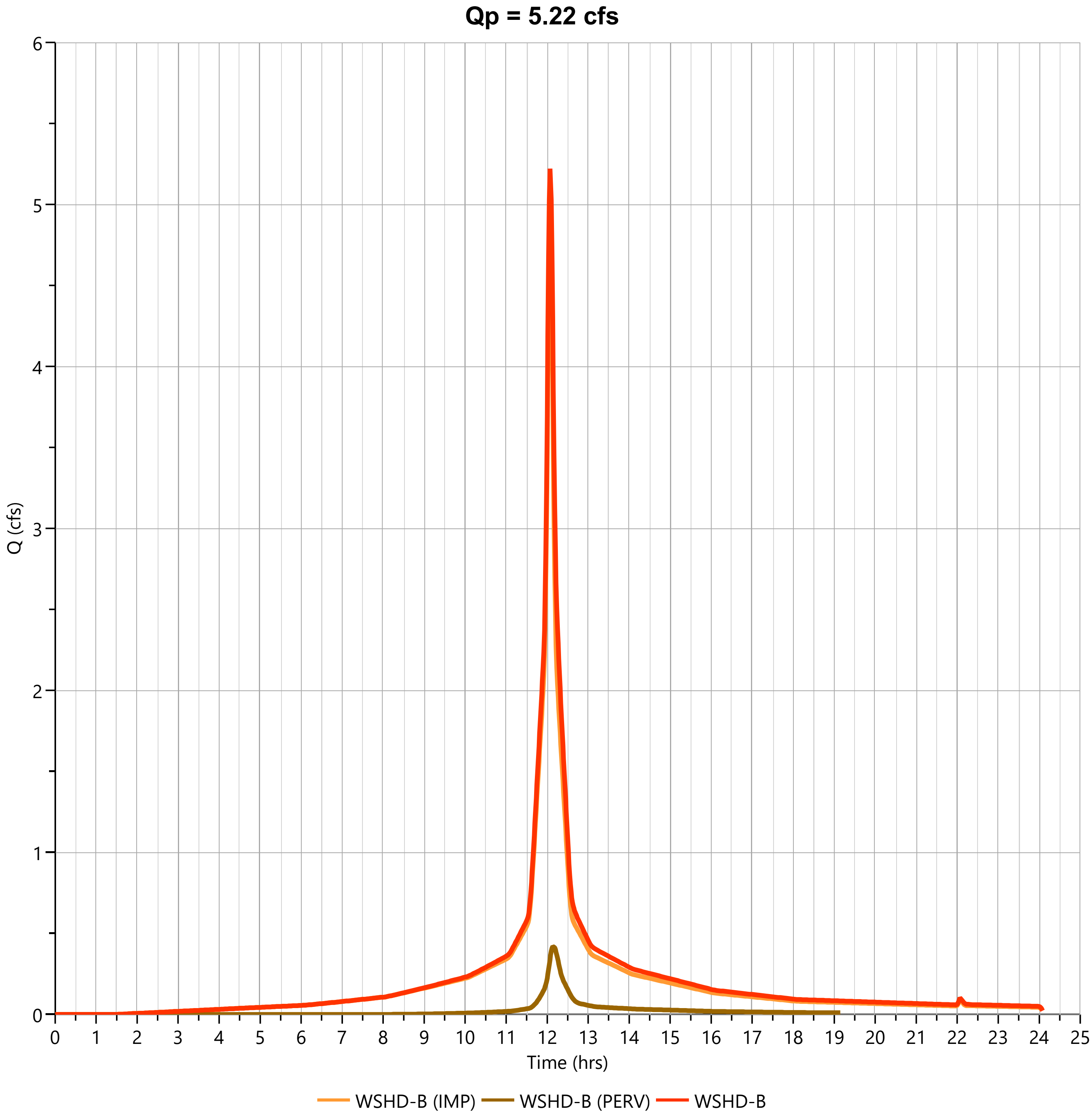
Hydrograph Report

Hydrology Studio v 3.0.0.14 03-17-2020

WSHD-B

Hyd. No. 7

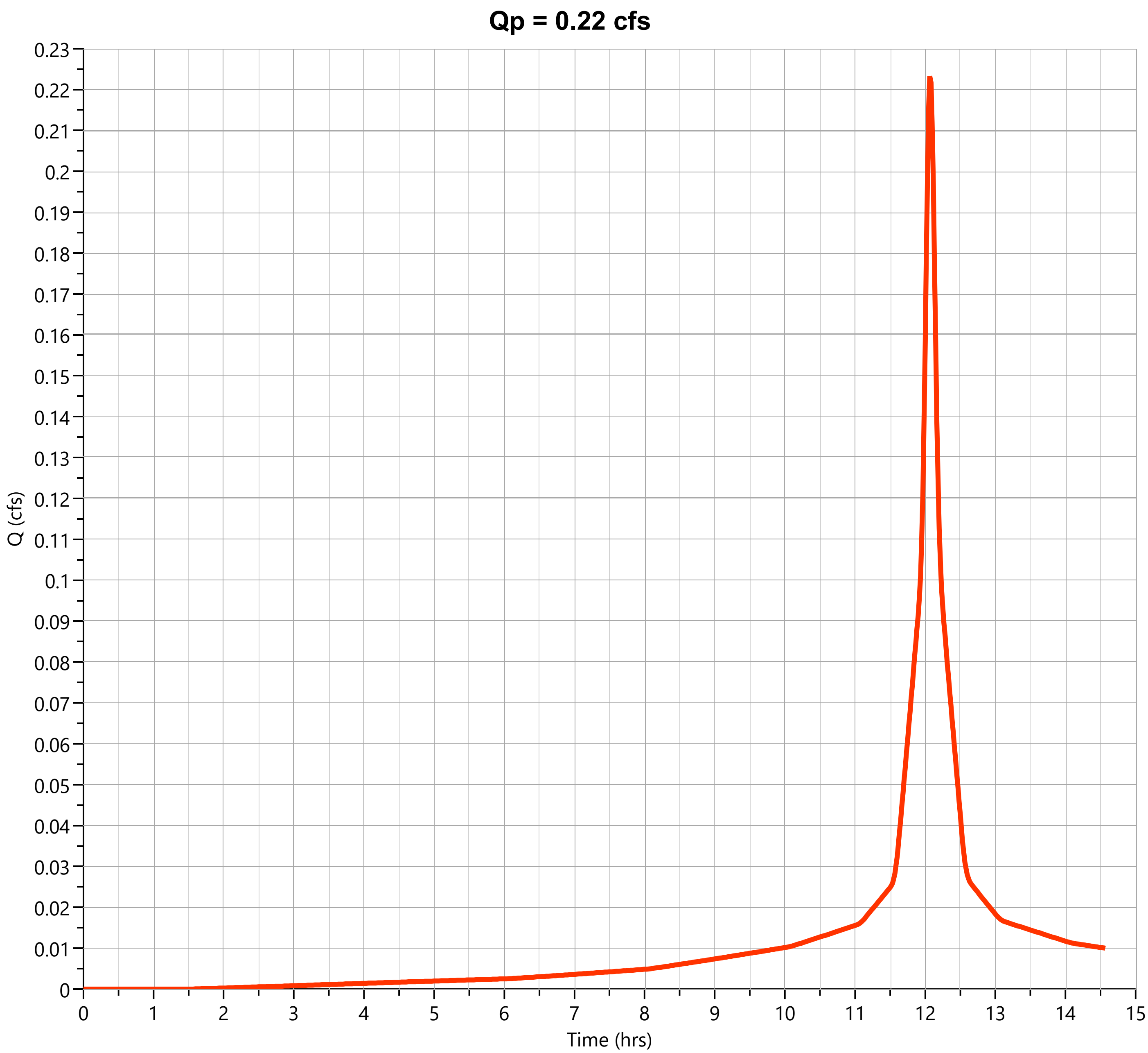
Hydrograph Type	= Junction	Peak Flow	= 5.220 cfs
Storm Frequency	= 1-yr	Time to Peak	= 12.07 hrs
Time Interval	= 1 min	Hydrograph Volume	= 18,356 cuft
Inflow Hydrographs	= 5, 6	Total Contrib. Area	= 2.05 ac



WSHD-C (IMP)

Hyd. No. 9

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.223 cfs
Storm Frequency	= 1-yr	Time to Peak	= 12.07 hrs
Time Interval	= 1 min	Runoff Volume	= 766 cuft
Drainage Area	= 0.08 ac	Curve Number	= 98
Tc Method	= User	Time of Conc. (Tc)	= 6.0 min
Total Rainfall	= 2.79 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484

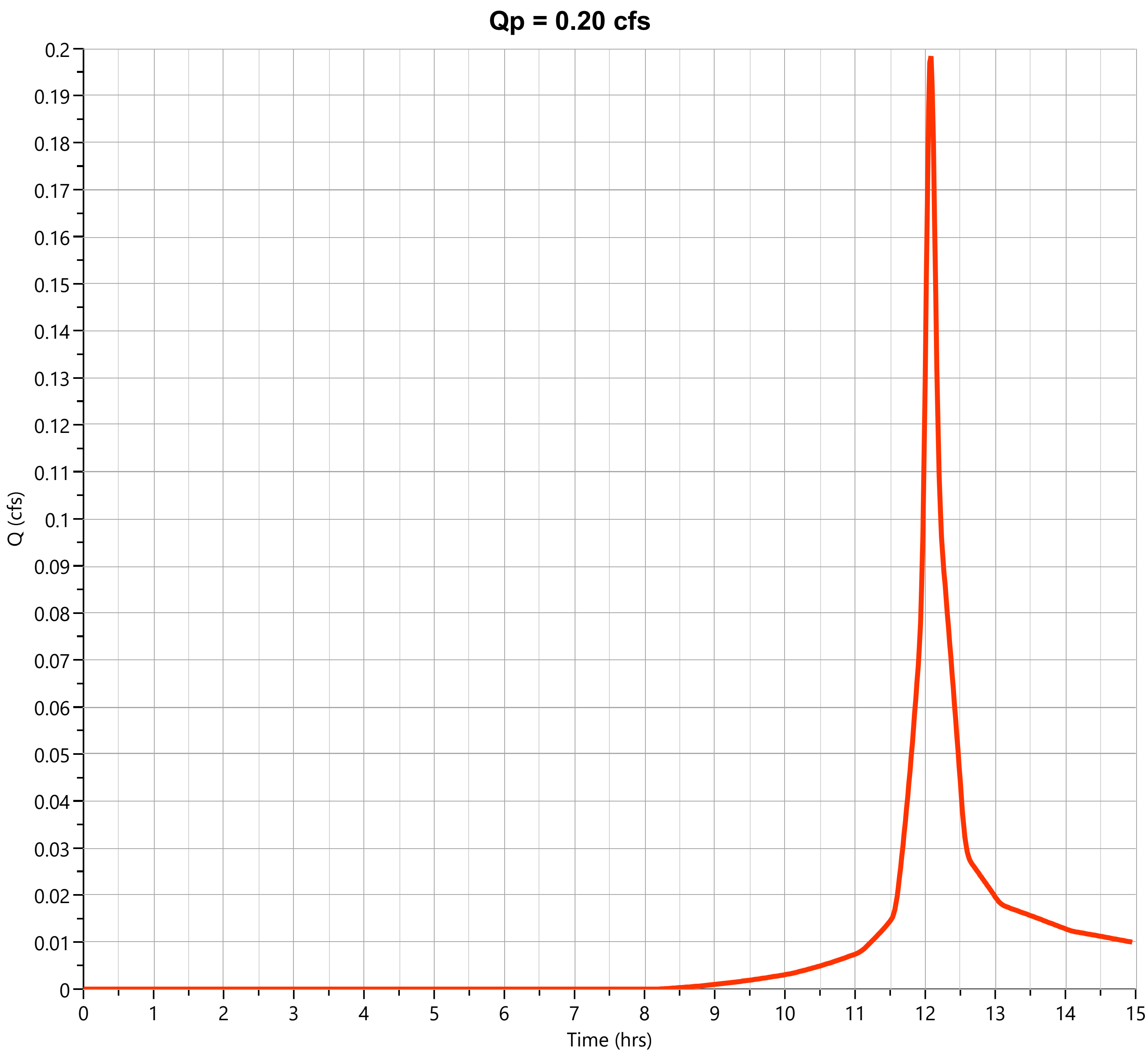


Hydrograph Report

WSHD-C (PERV)

Hyd. No. 10

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.198 cfs
Storm Frequency	= 1-yr	Time to Peak	= 12.08 hrs
Time Interval	= 1 min	Runoff Volume	= 611 cuft
Drainage Area	= 0.11 ac	Curve Number	= 86
Tc Method	= User	Time of Conc. (Tc)	= 6.0 min
Total Rainfall	= 2.79 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

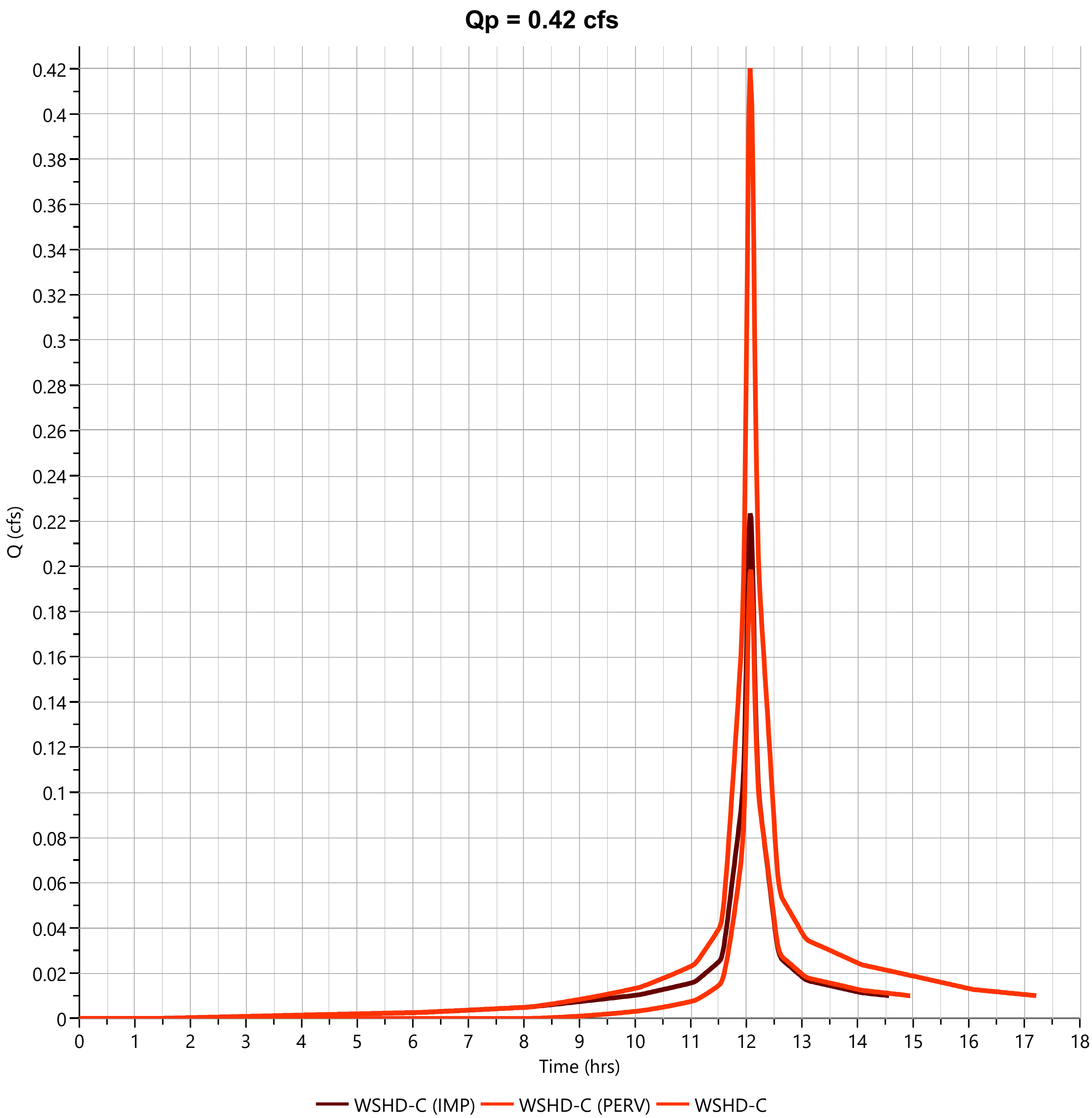
Hydrology Studio v 3.0.0.14

03-17-2020

WSHD-C

Hyd. No. 11

Hydrograph Type	= Junction	Peak Flow	= 0.420 cfs
Storm Frequency	= 1-yr	Time to Peak	= 12.07 hrs
Time Interval	= 1 min	Hydrograph Volume	= 1,378 cuft
Inflow Hydrographs	= 9, 10	Total Contrib. Area	= 0.19 ac



Hydrograph 10-yr Summary

Project Name:

Hydrology Studio v 3.0.0.14

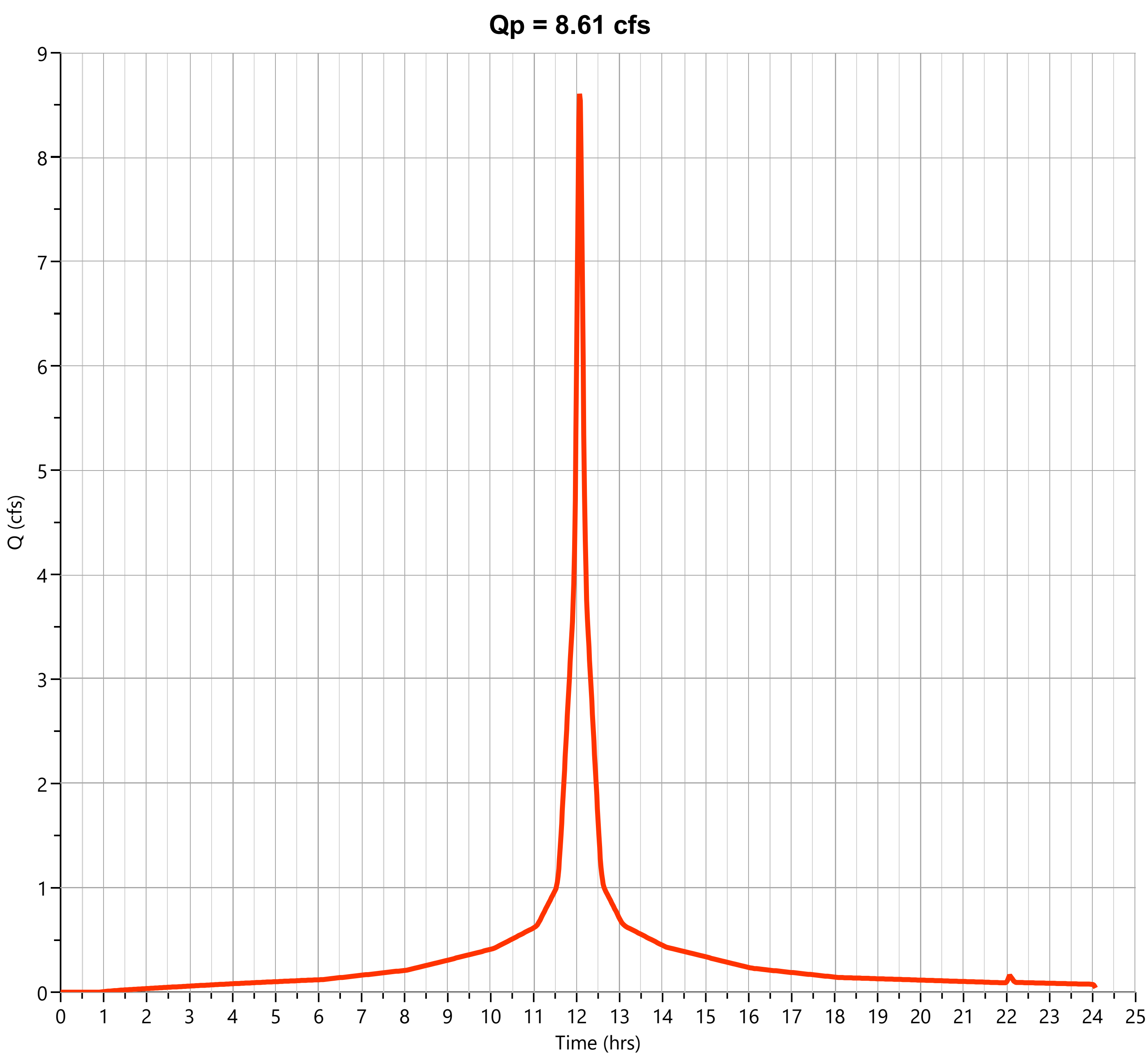
03-17-2020

Hyd. No.	Hydrograph Type	Hydrograph Name	Peak Flow (cfs)	Time to Peak (hrs)	Hydrograph Volume (cuft)	Inflow Hyd(s)	Maximum Elevation (ft)	Maximum Storage (cuft)
1	NRCS Runoff	WSHD-A (IMP)	8.605	12.07	30,339	----		
2	NRCS Runoff	WSHD-A (PERV)	1.356	12.07	4,254	----		
3	Junction	WSHD-A	9.961	12.07	34,593	1, 2		
5	NRCS Runoff	WSHD-B (IMP)	9.018	12.07	31,792	----		
6	NRCS Runoff	WSHD-B (PERV)	0.998	12.15	3,807	----		
7	Junction	WSHD-B	9.838	12.07	35,599	5, 6		
9	NRCS Runoff	WSHD-C (IMP)	0.412	12.07	1,453	----		
10	NRCS Runoff	WSHD-C (PERV)	0.466	12.07	1,462	----		
11	Junction	WSHD-C	0.878	12.07	2,916	9, 10		

WSHD-A (IMP)

Hyd. No. 1

Hydrograph Type	= NRCS Runoff	Peak Flow	= 8.605 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.07 hrs
Time Interval	= 1 min	Runoff Volume	= 30,339 cuft
Drainage Area	= 1.67 ac	Curve Number	= 98
Tc Method	= User	Time of Conc. (Tc)	= 6.0 min
Total Rainfall	= 5.09 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484

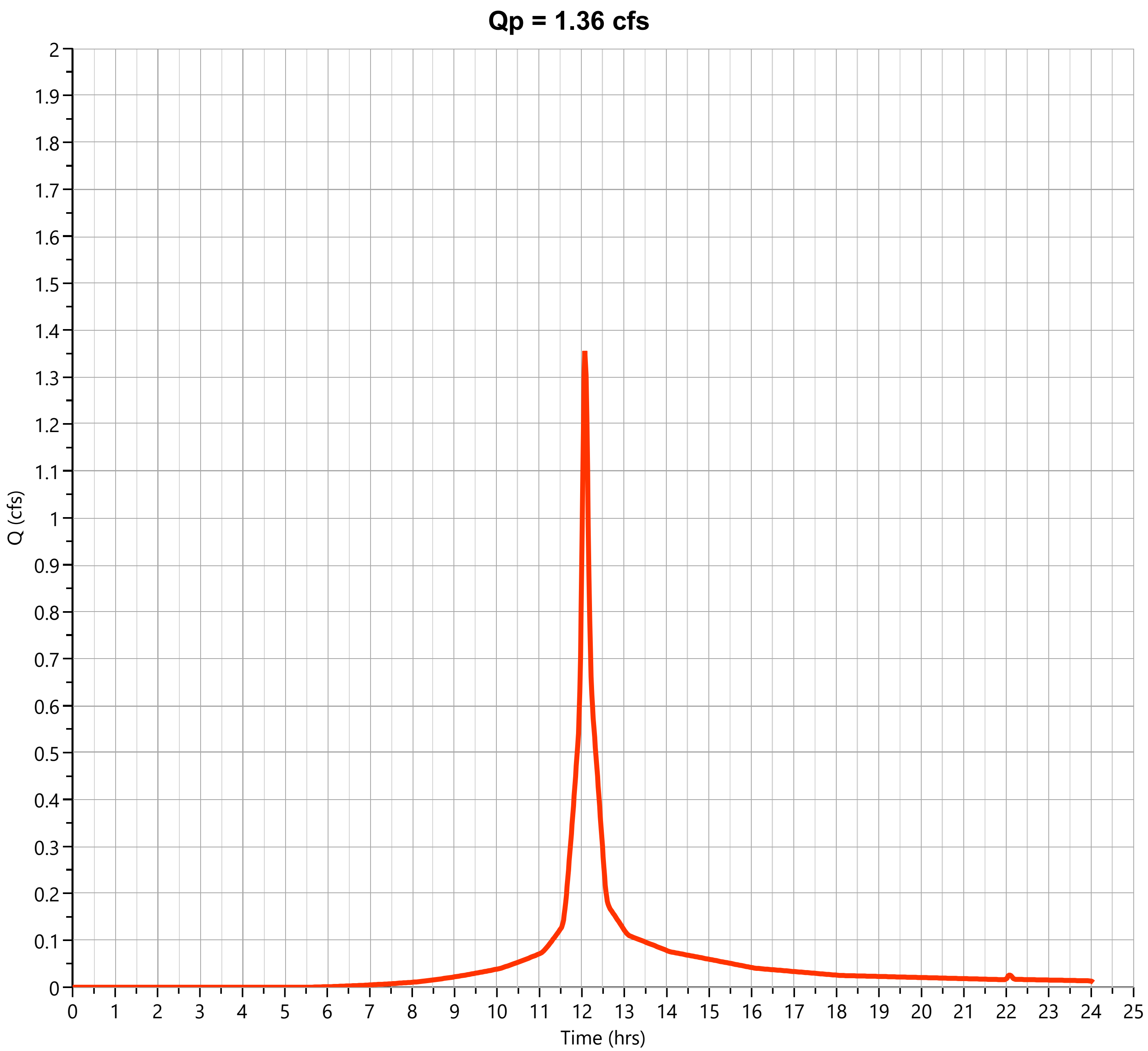


Hydrograph Report

WSHD-A (PERV)

Hyd. No. 2

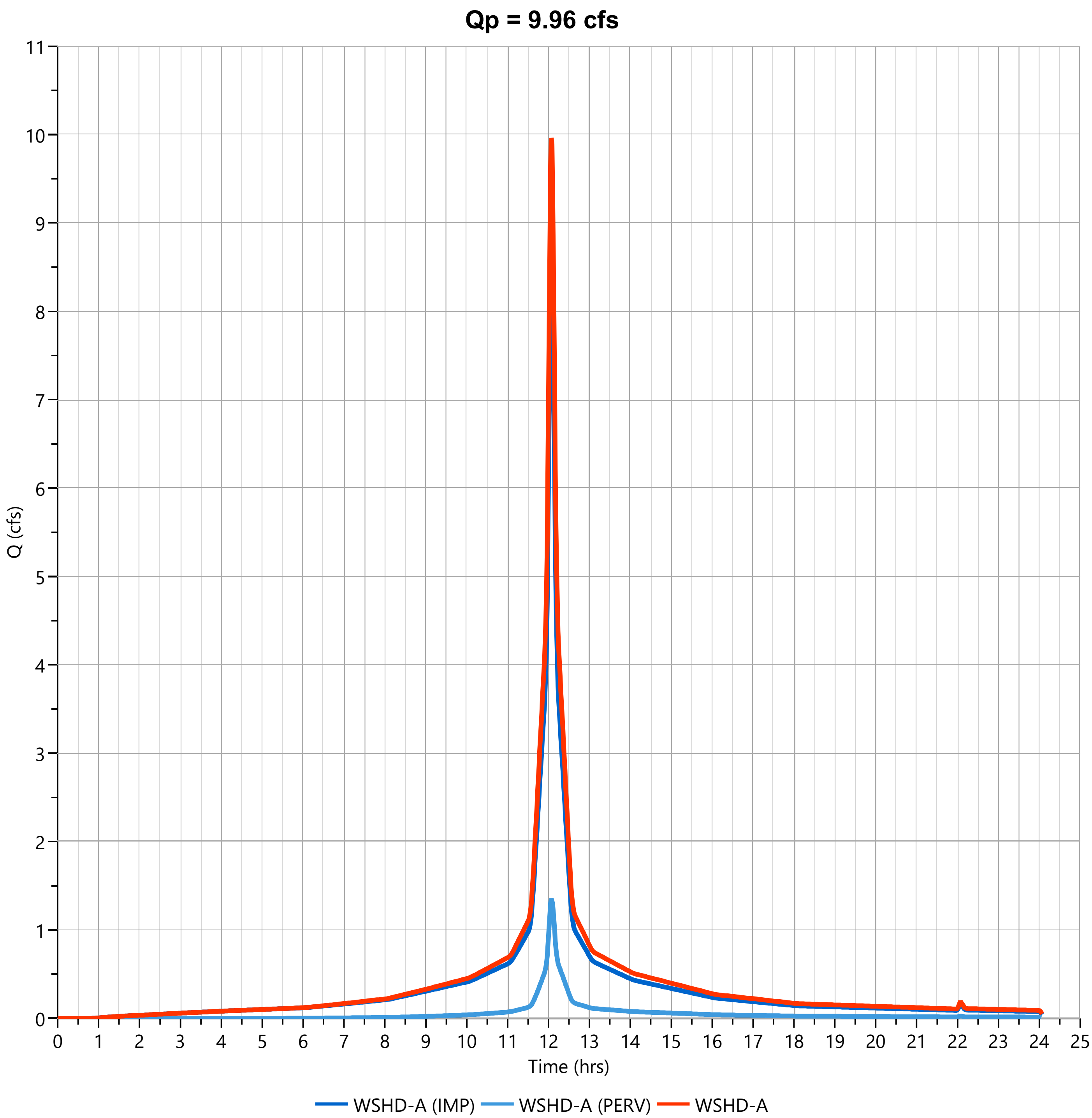
Hydrograph Type	= NRCS Runoff	Peak Flow	= 1.356 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.07 hrs
Time Interval	= 1 min	Runoff Volume	= 4,254 cuft
Drainage Area	= 0.32 ac	Curve Number	= 86
Tc Method	= User	Time of Conc. (Tc)	= 6.0 min
Total Rainfall	= 5.09 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



WSHD-A

Hyd. No. 3

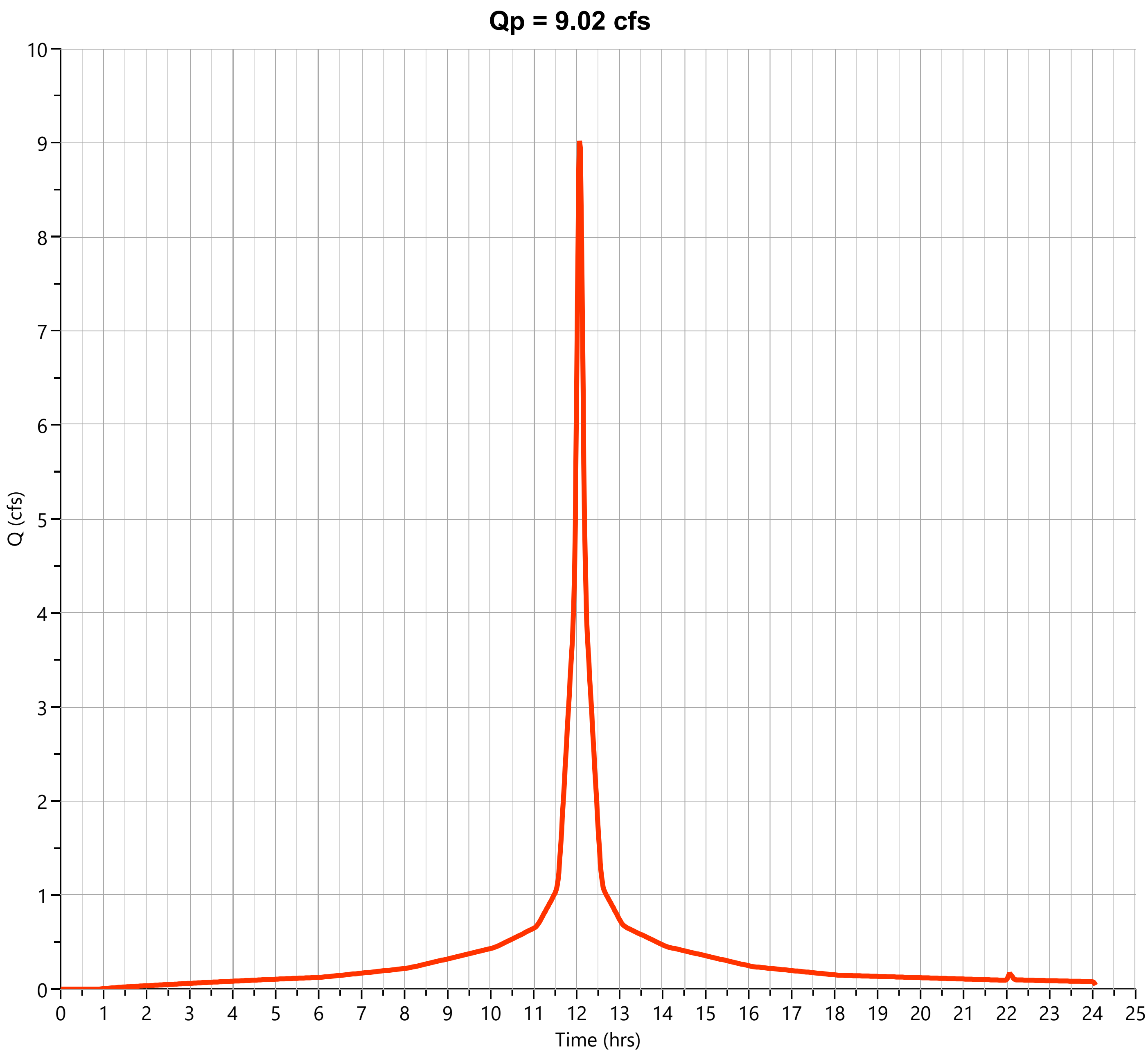
Hydrograph Type	= Junction	Peak Flow	= 9.961 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.07 hrs
Time Interval	= 1 min	Hydrograph Volume	= 34,593 cuft
Inflow Hydrographs	= 1, 2	Total Contrib. Area	= 1.99 ac



WSHD-B (IMP)

Hyd. No. 5

Hydrograph Type	= NRCS Runoff	Peak Flow	= 9.018 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.07 hrs
Time Interval	= 1 min	Runoff Volume	= 31,792 cuft
Drainage Area	= 1.75 ac	Curve Number	= 98
Tc Method	= User	Time of Conc. (Tc)	= 6.0 min
Total Rainfall	= 5.09 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



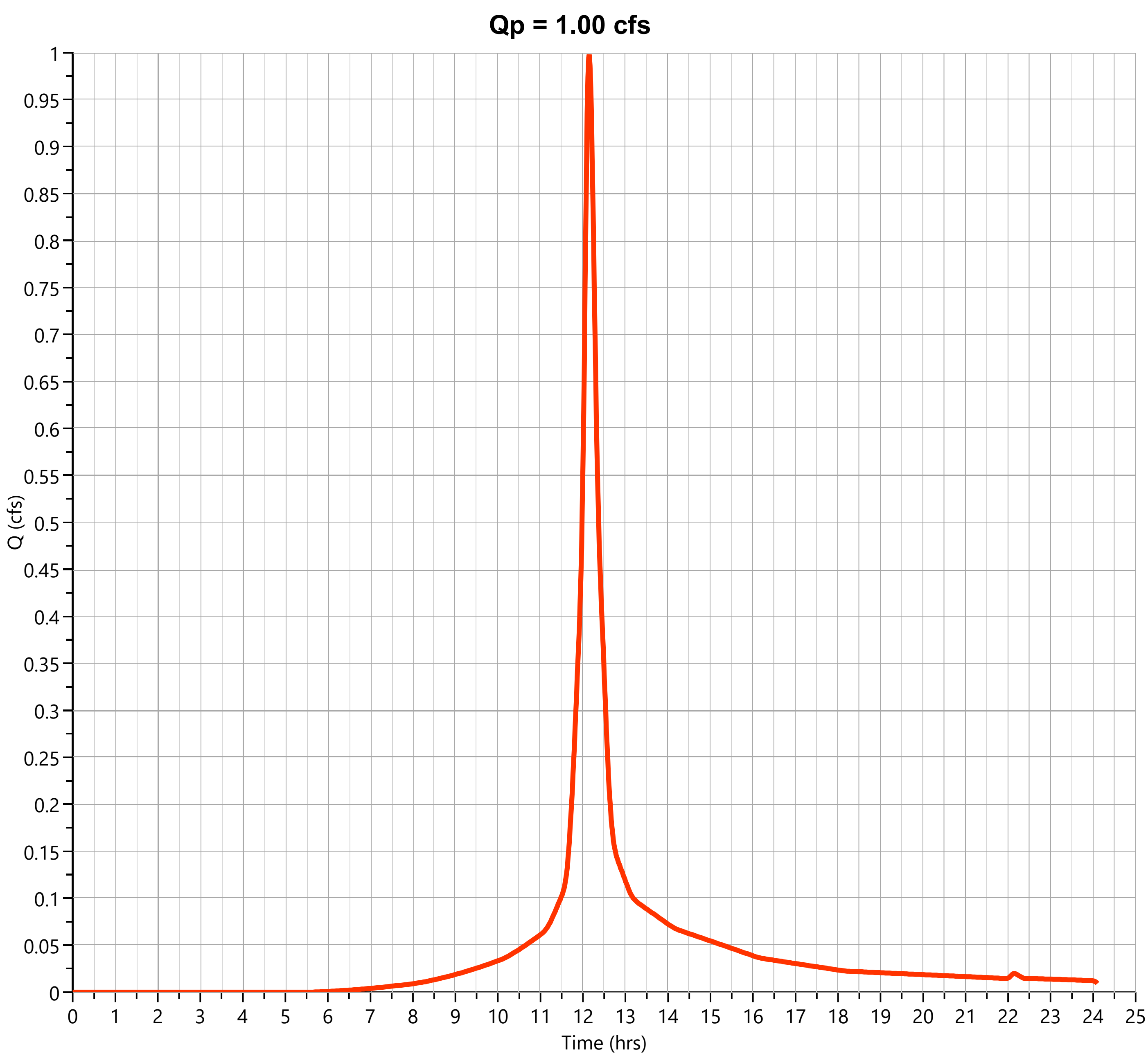
Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.14 03-17-2020

WSHD-B (PERV) Hyd. No. 6

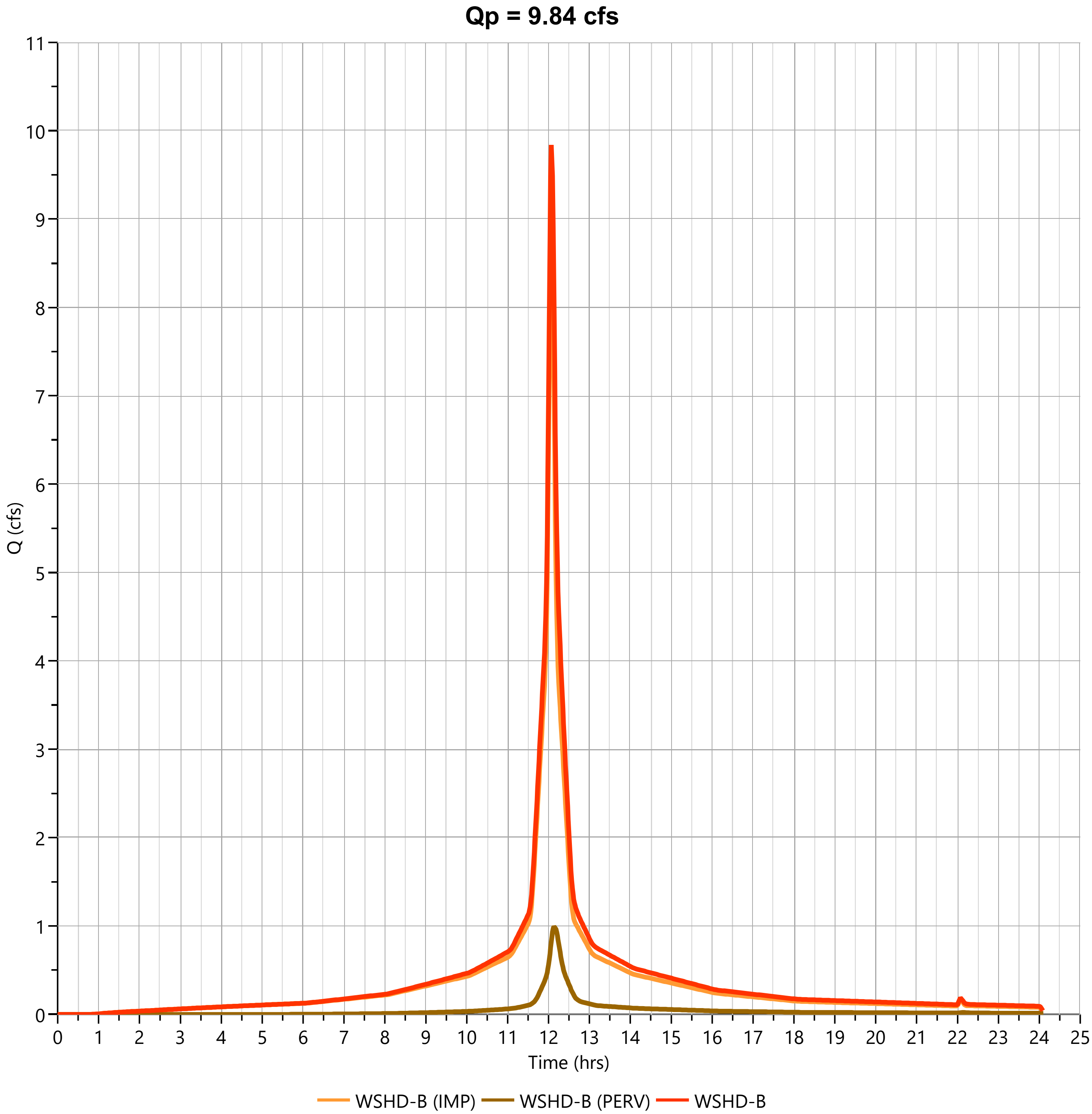
Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.998 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.15 hrs
Time Interval	= 1 min	Runoff Volume	= 3,807 cuft
Drainage Area	= 0.3 ac	Curve Number	= 86
Tc Method	= User	Time of Conc. (Tc)	= 12.0 min
Total Rainfall	= 5.09 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



WSHD-B

Hyd. No. 7

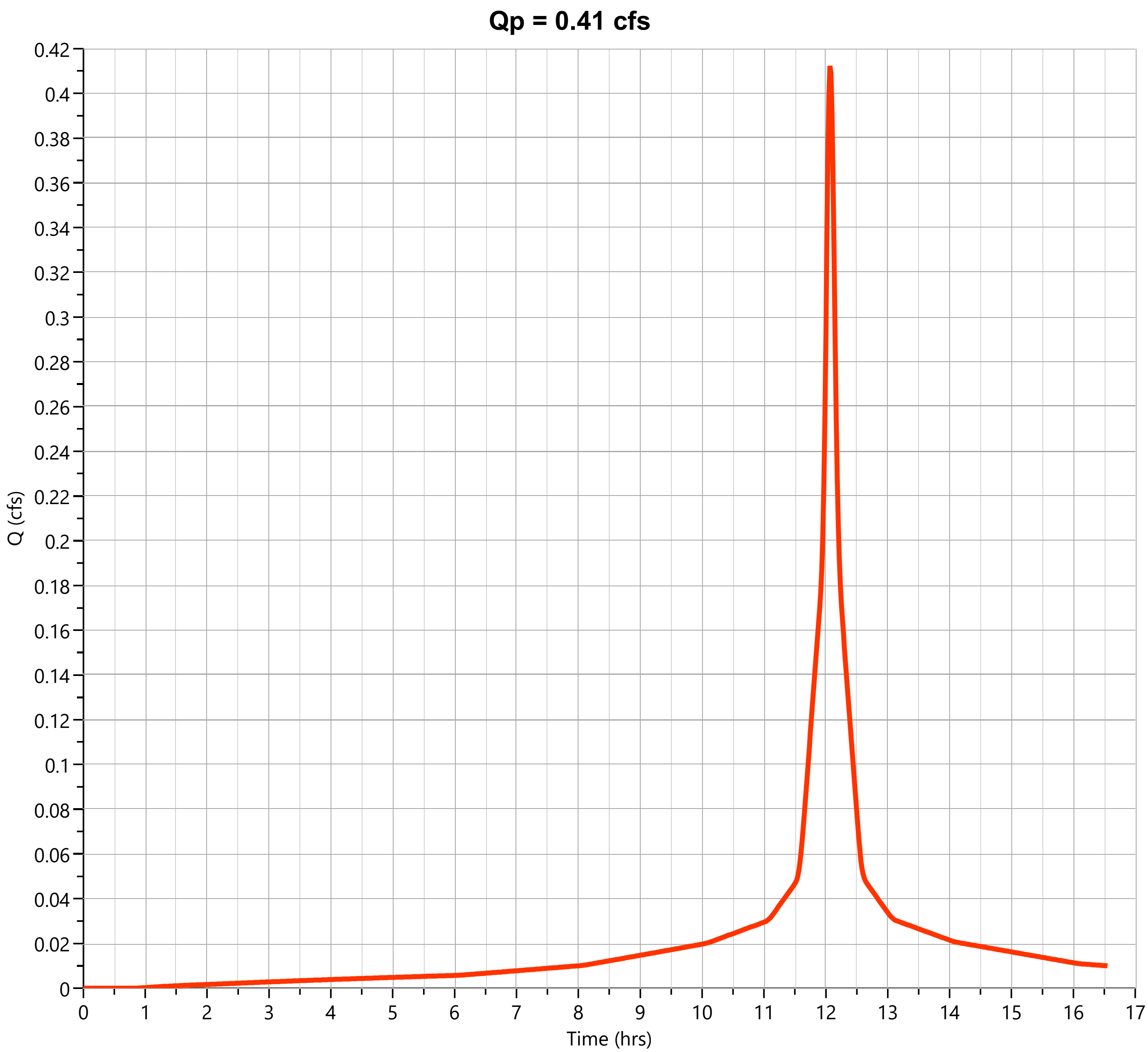
Hydrograph Type	= Junction	Peak Flow	= 9.838 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.07 hrs
Time Interval	= 1 min	Hydrograph Volume	= 35,599 cuft
Inflow Hydrographs	= 5, 6	Total Contrib. Area	= 2.05 ac



WSHD-C (IMP)

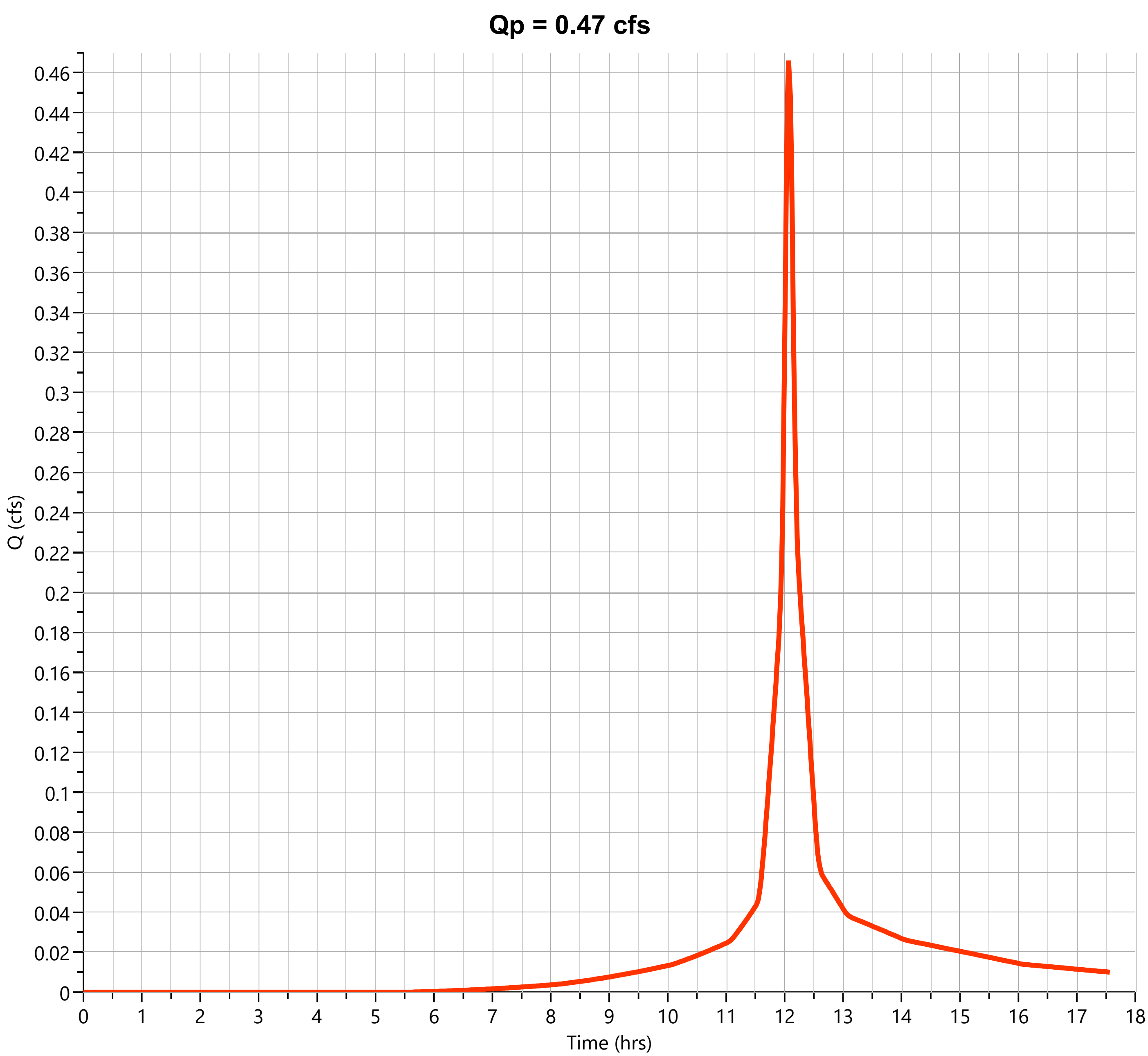
Hyd. No. 9

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.412 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.07 hrs
Time Interval	= 1 min	Runoff Volume	= 1,453 cuft
Drainage Area	= 0.08 ac	Curve Number	= 98
Tc Method	= User	Time of Conc. (Tc)	= 6.0 min
Total Rainfall	= 5.09 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



WSHD-C (PERV) Hyd. No. 10

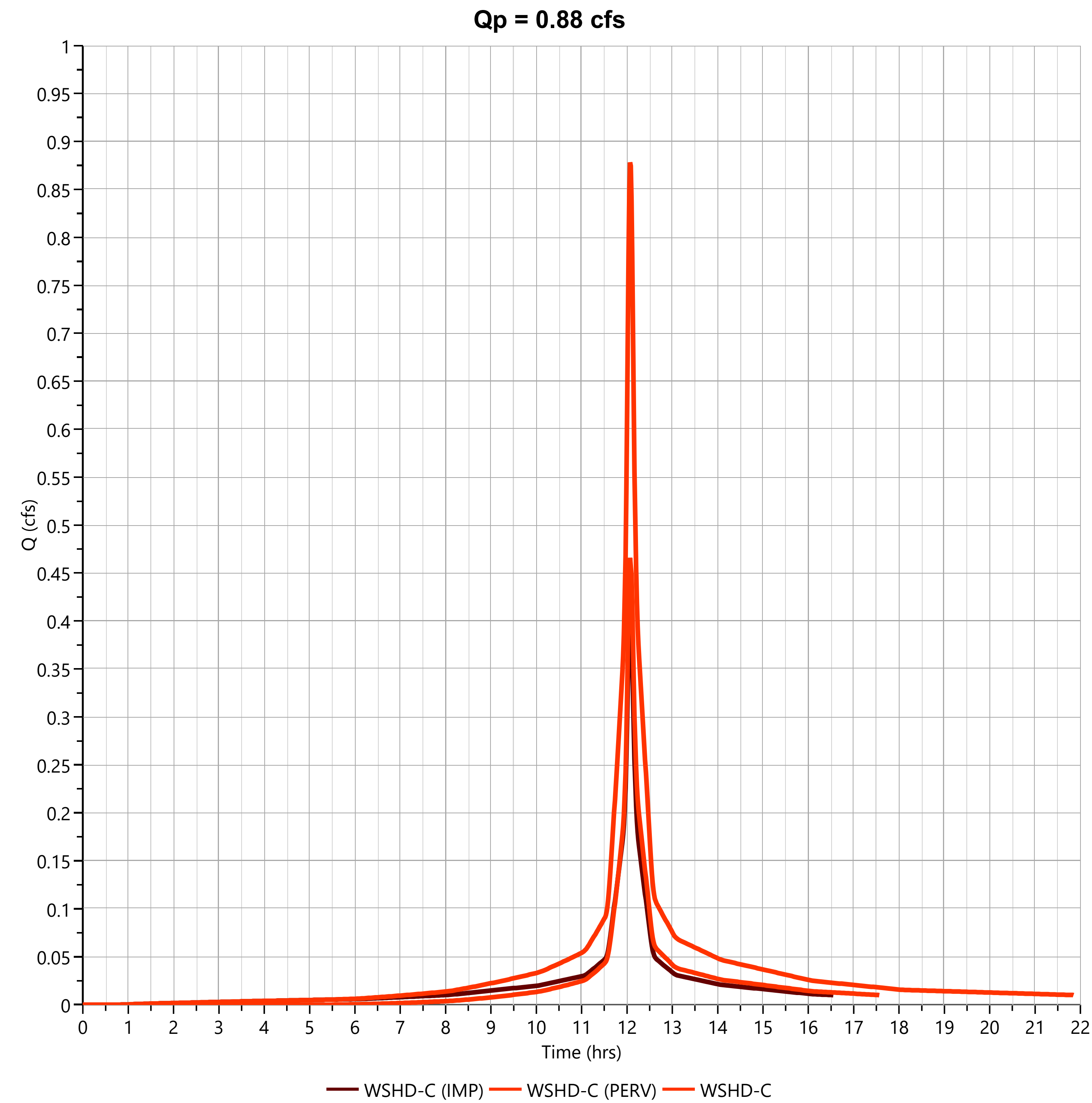
Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.466 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.07 hrs
Time Interval	= 1 min	Runoff Volume	= 1,462 cuft
Drainage Area	= 0.11 ac	Curve Number	= 86
Tc Method	= User	Time of Conc. (Tc)	= 6.0 min
Total Rainfall	= 5.09 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



WSHD-C

Hyd. No. 11

Hydrograph Type	= Junction	Peak Flow	= 0.878 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.07 hrs
Time Interval	= 1 min	Hydrograph Volume	= 2,916 cuft
Inflow Hydrographs	= 9, 10	Total Contrib. Area	= 0.19 ac



Hydrograph 100-yr Summary

Project Name:

Hydrology Studio v 3.0.0.14

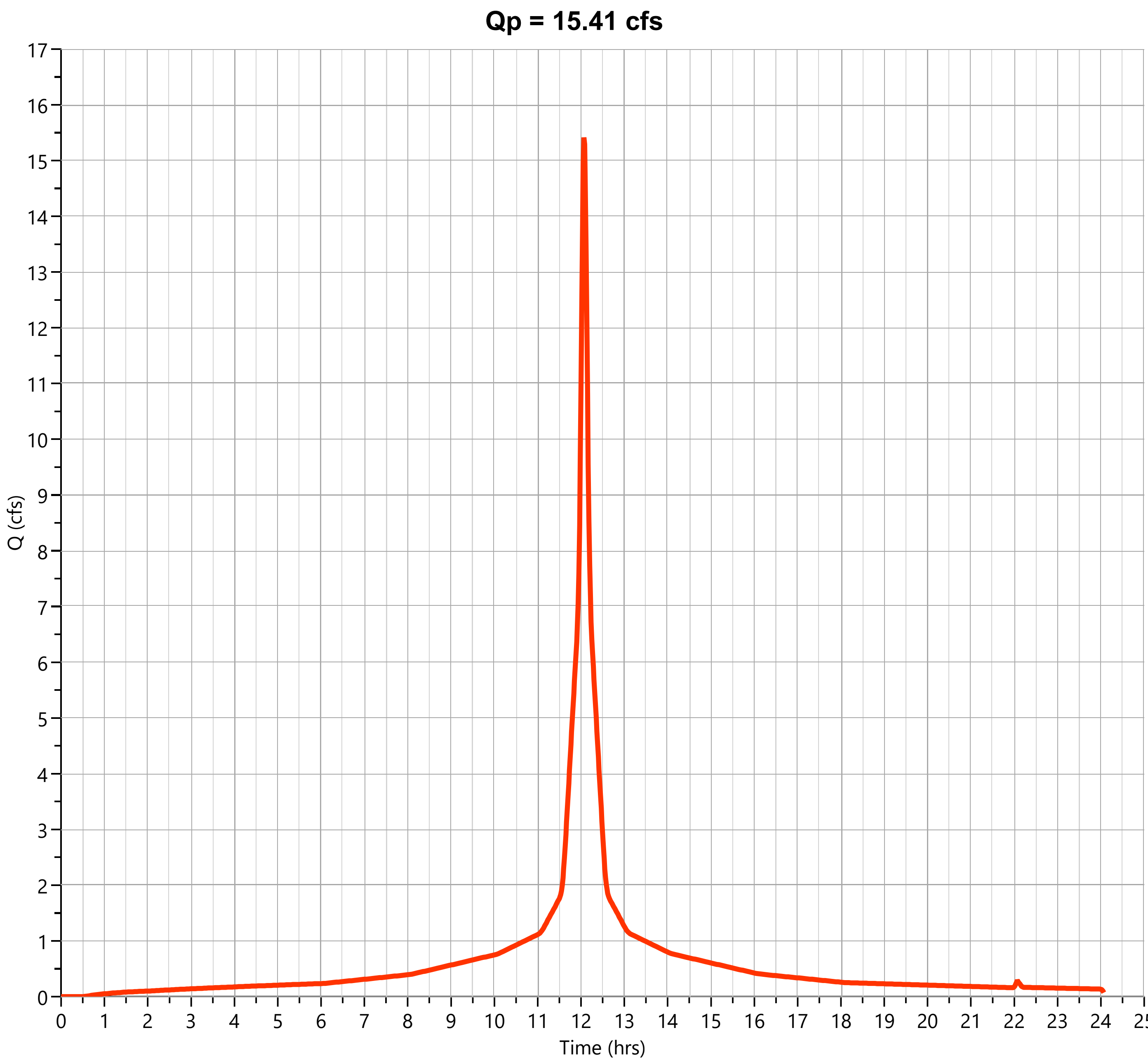
03-17-2020

Hyd. No.	Hydrograph Type	Hydrograph Name	Peak Flow (cfs)	Time to Peak (hrs)	Hydrograph Volume (cuft)	Inflow Hyd(s)	Maximum Elevation (ft)	Maximum Storage (cuft)
1	NRCS Runoff	WSHD-A (IMP)	15.41	12.07	55,261	----		
2	NRCS Runoff	WSHD-A (PERV)	2.723	12.07	8,843	----		
3	Junction	WSHD-A	18.14	12.07	64,104	1, 2		
5	NRCS Runoff	WSHD-B (IMP)	16.15	12.07	57,908	----		
6	NRCS Runoff	WSHD-B (PERV)	2.003	12.15	7,913	----		
7	Junction	WSHD-B	17.82	12.07	65,822	5, 6		
9	NRCS Runoff	WSHD-C (IMP)	0.738	12.07	2,647	----		
10	NRCS Runoff	WSHD-C (PERV)	0.936	12.07	3,040	----		
11	Junction	WSHD-C	1.674	12.07	5,687	9, 10		

Hydrograph Report

WSHD-A (IMP) Hyd. No. 1

Hydrograph Type	= NRCS Runoff	Peak Flow	= 15.41 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.07 hrs
Time Interval	= 1 min	Runoff Volume	= 55,261 cuft
Drainage Area	= 1.67 ac	Curve Number	= 98
Tc Method	= User	Time of Conc. (Tc)	= 6.0 min
Total Rainfall	= 9.08 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484

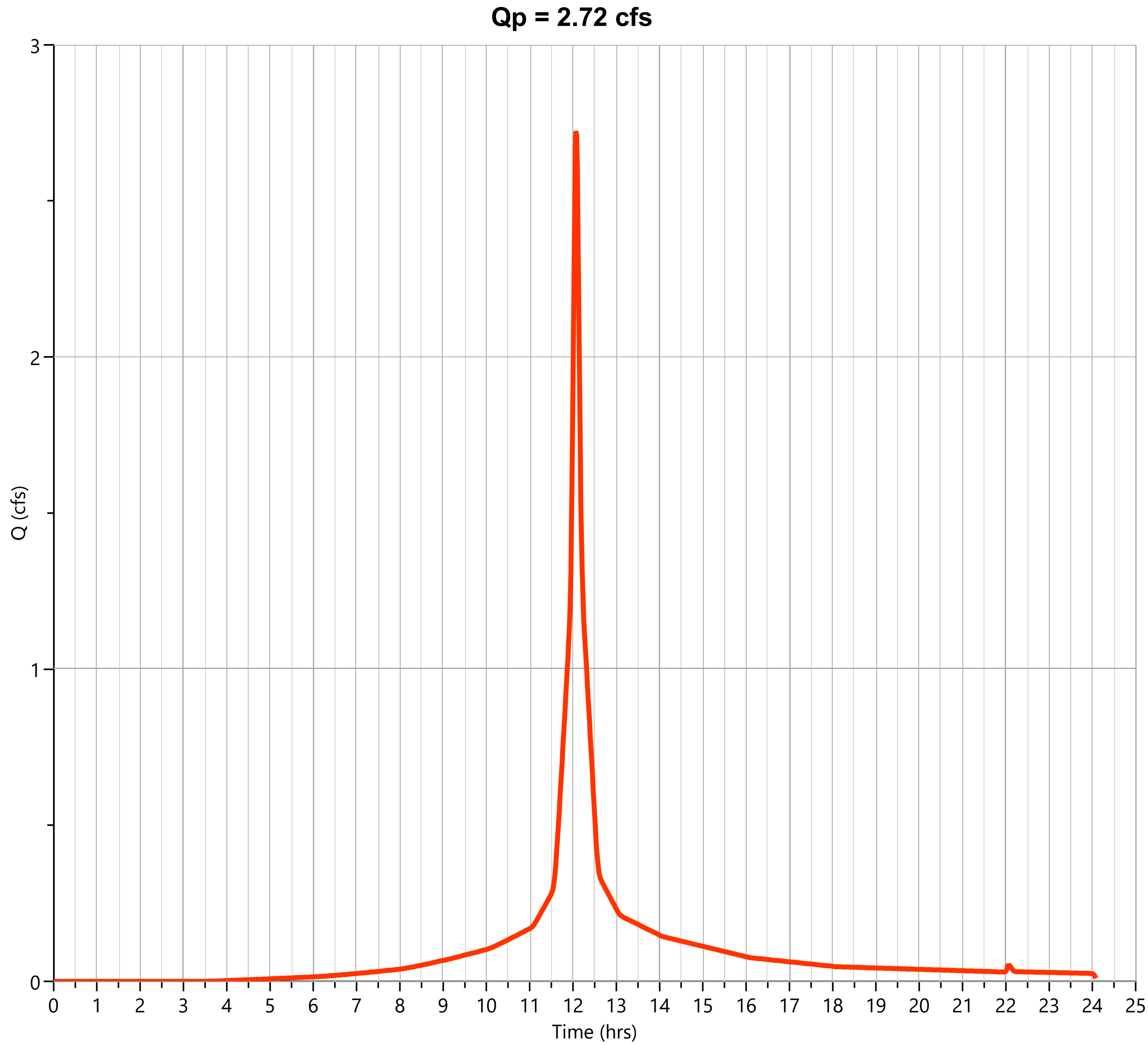


Hydrograph Report

Hydrology Studio v 3.0.0.14 03-17-2020

WSHD-A (PERV) Hyd. No. 2

Hydrograph Type	= NRCS Runoff	Peak Flow	= 2.723 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.07 hrs
Time Interval	= 1 min	Runoff Volume	= 8,843 cuft
Drainage Area	= 0.32 ac	Curve Number	= 86
Tc Method	= User	Time of Conc. (Tc)	= 6.0 min
Total Rainfall	= 9.08 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484

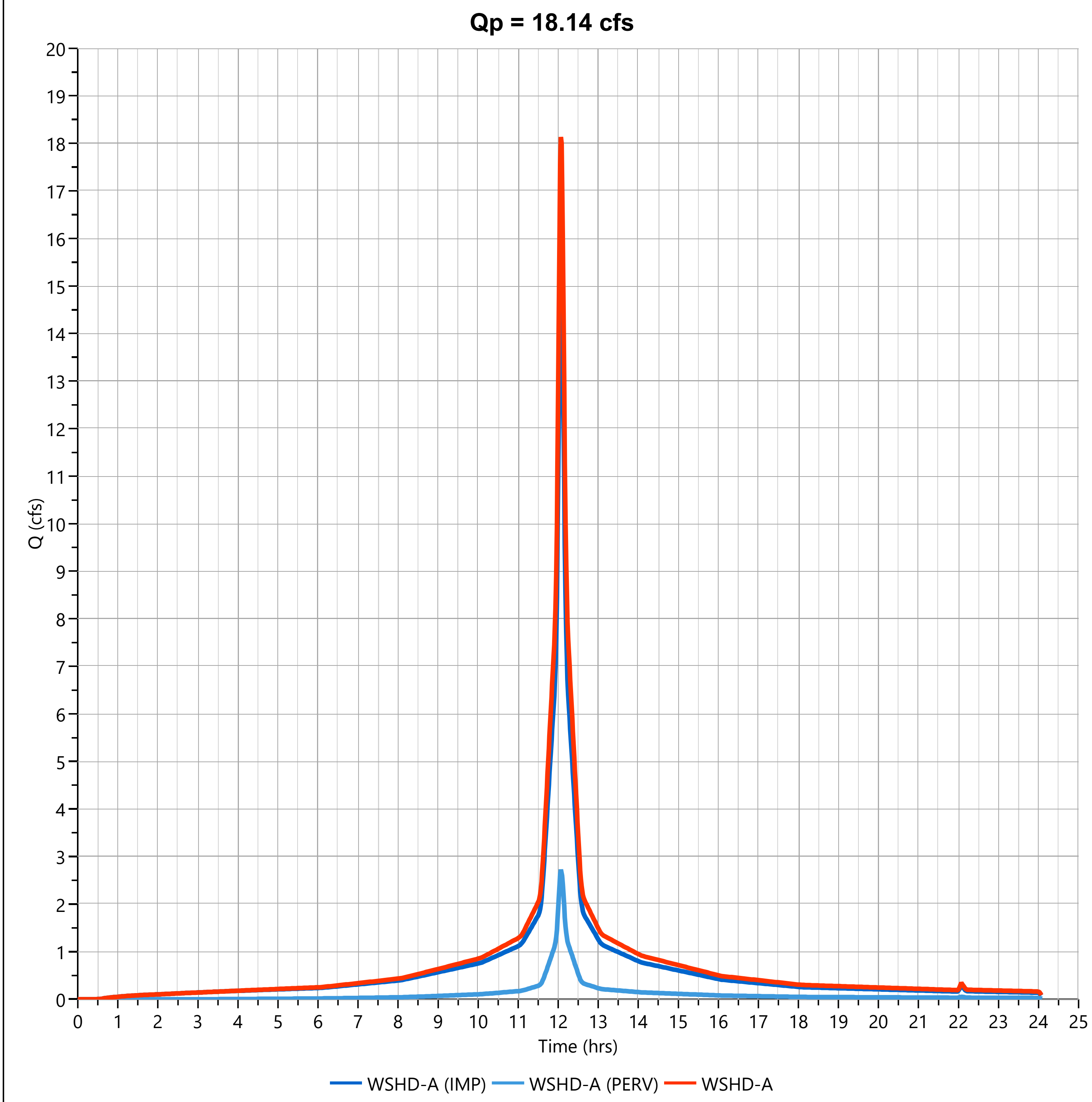


Hydrograph Report

WSHD-A

Hyd. No. 3

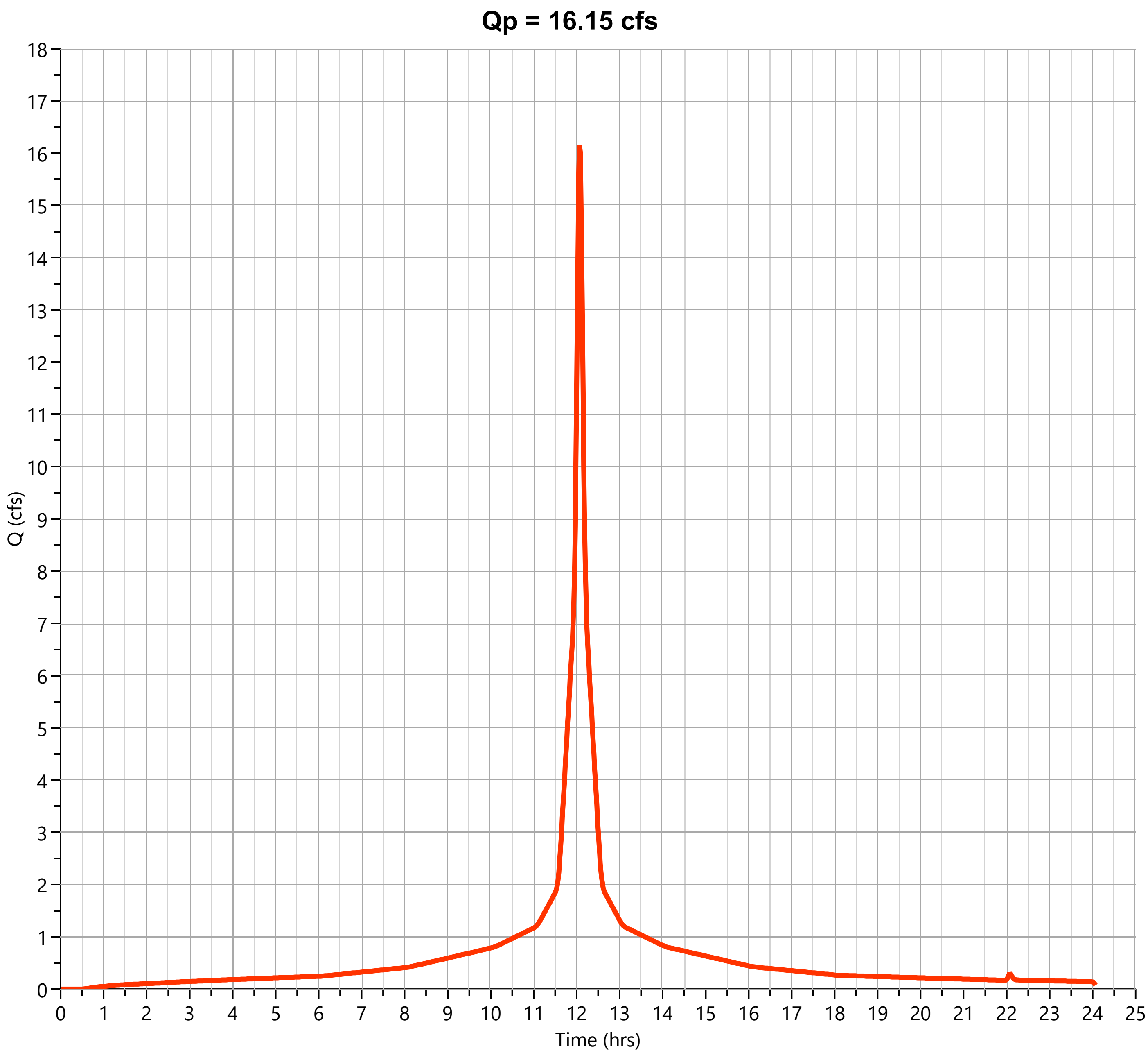
Hydrograph Type	= Junction	Peak Flow	= 18.14 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.07 hrs
Time Interval	= 1 min	Hydrograph Volume	= 64,104 cuft
Inflow Hydrographs	= 1, 2	Total Contrib. Area	= 1.99 ac



WSHD-B (IMP)

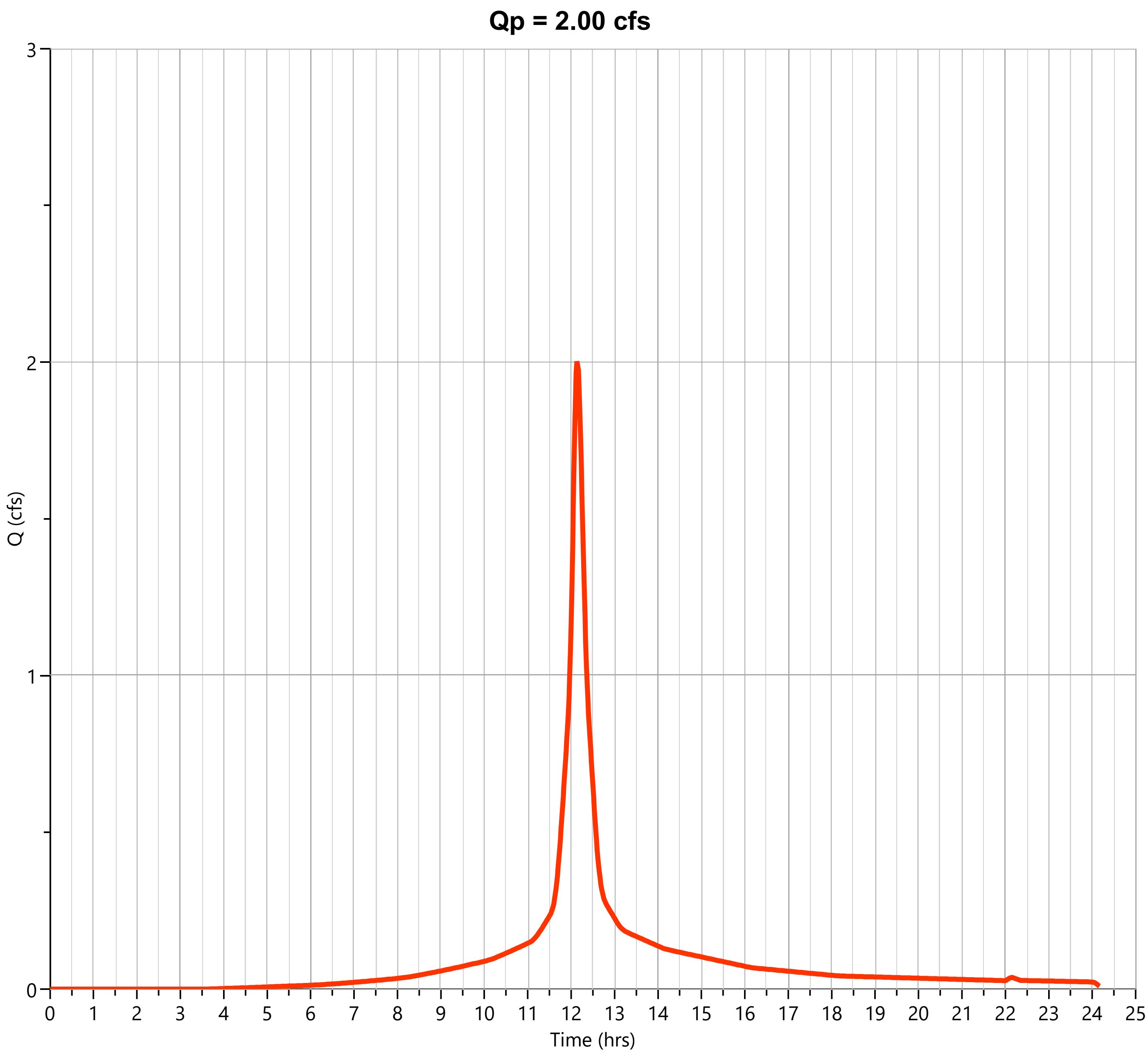
Hyd. No. 5

Hydrograph Type	= NRCS Runoff	Peak Flow	= 16.15 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.07 hrs
Time Interval	= 1 min	Runoff Volume	= 57,908 cuft
Drainage Area	= 1.75 ac	Curve Number	= 98
Tc Method	= User	Time of Conc. (Tc)	= 6.0 min
Total Rainfall	= 9.08 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



WSHD-B (PERV) Hyd. No. 6

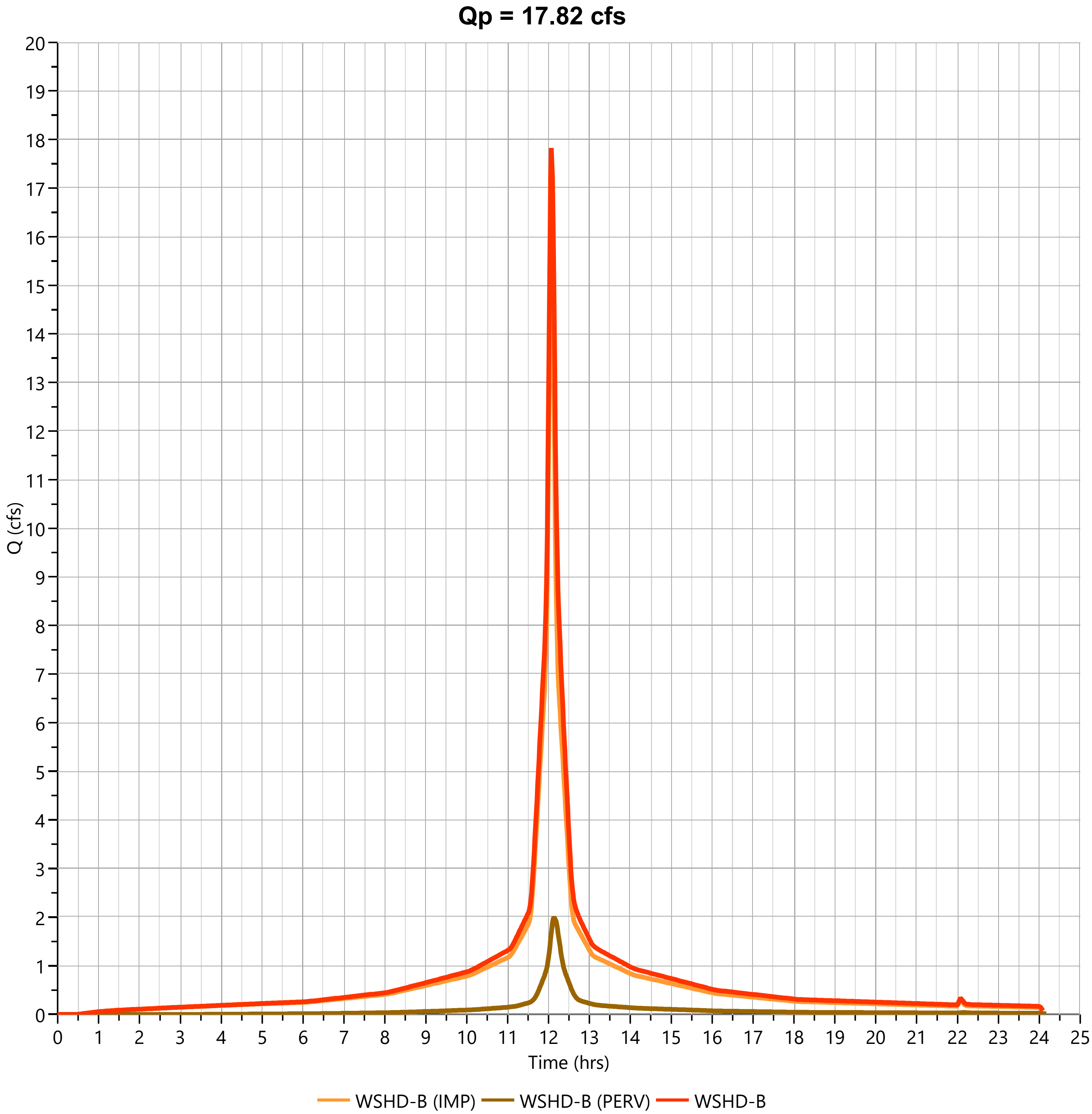
Hydrograph Type	= NRCS Runoff	Peak Flow	= 2.003 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.15 hrs
Time Interval	= 1 min	Runoff Volume	= 7,913 cuft
Drainage Area	= 0.3 ac	Curve Number	= 86
Tc Method	= User	Time of Conc. (Tc)	= 12.0 min
Total Rainfall	= 9.08 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



WSHD-B

Hyd. No. 7

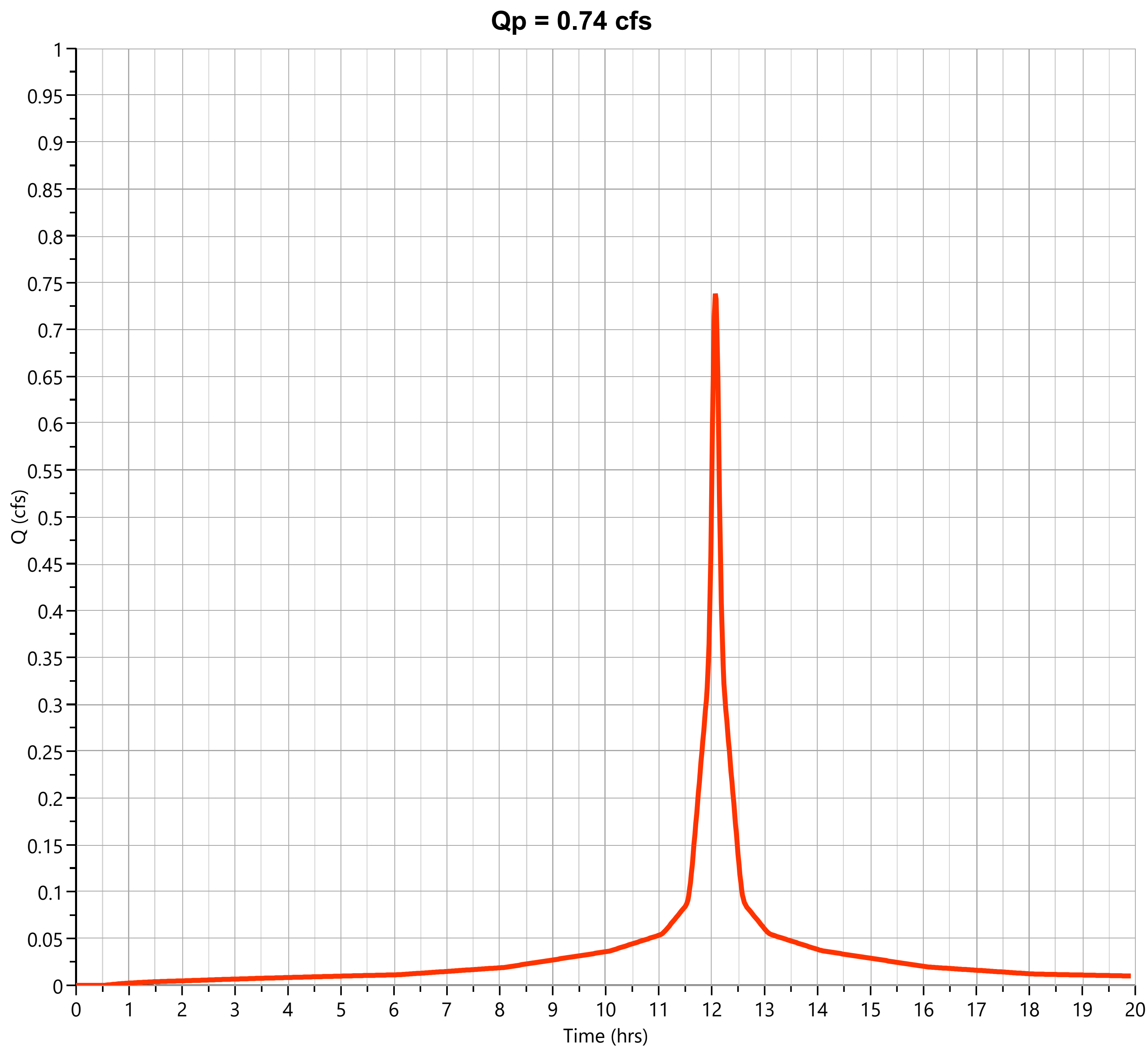
Hydrograph Type	= Junction	Peak Flow	= 17.82 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.07 hrs
Time Interval	= 1 min	Hydrograph Volume	= 65,822 cuft
Inflow Hydrographs	= 5, 6	Total Contrib. Area	= 2.05 ac



WSHD-C (IMP)

Hyd. No. 9

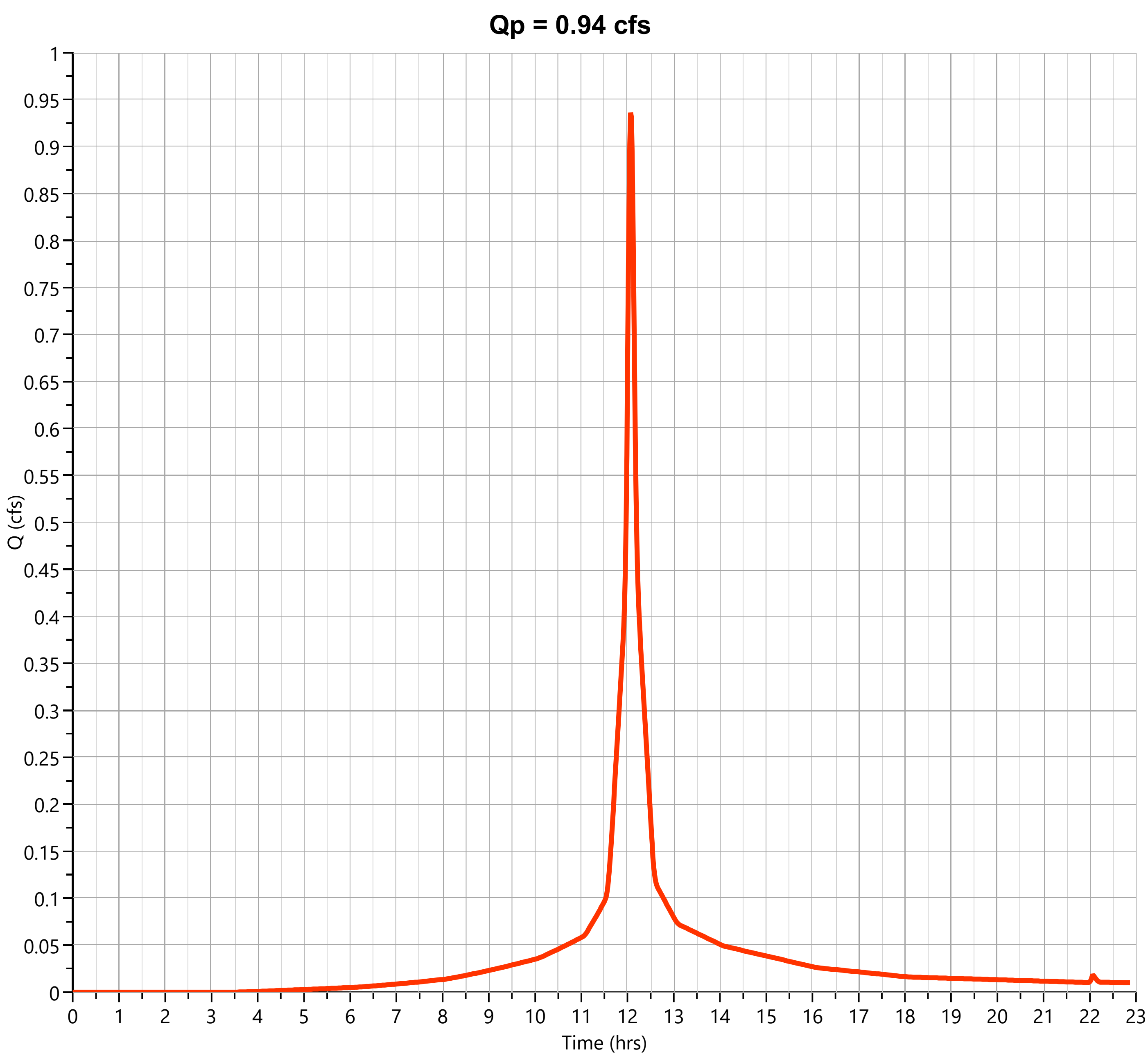
Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.738 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.07 hrs
Time Interval	= 1 min	Runoff Volume	= 2,647 cuft
Drainage Area	= 0.08 ac	Curve Number	= 98
Tc Method	= User	Time of Conc. (Tc)	= 6.0 min
Total Rainfall	= 9.08 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



WSHD-C (PERV)

Hyd. No. 10

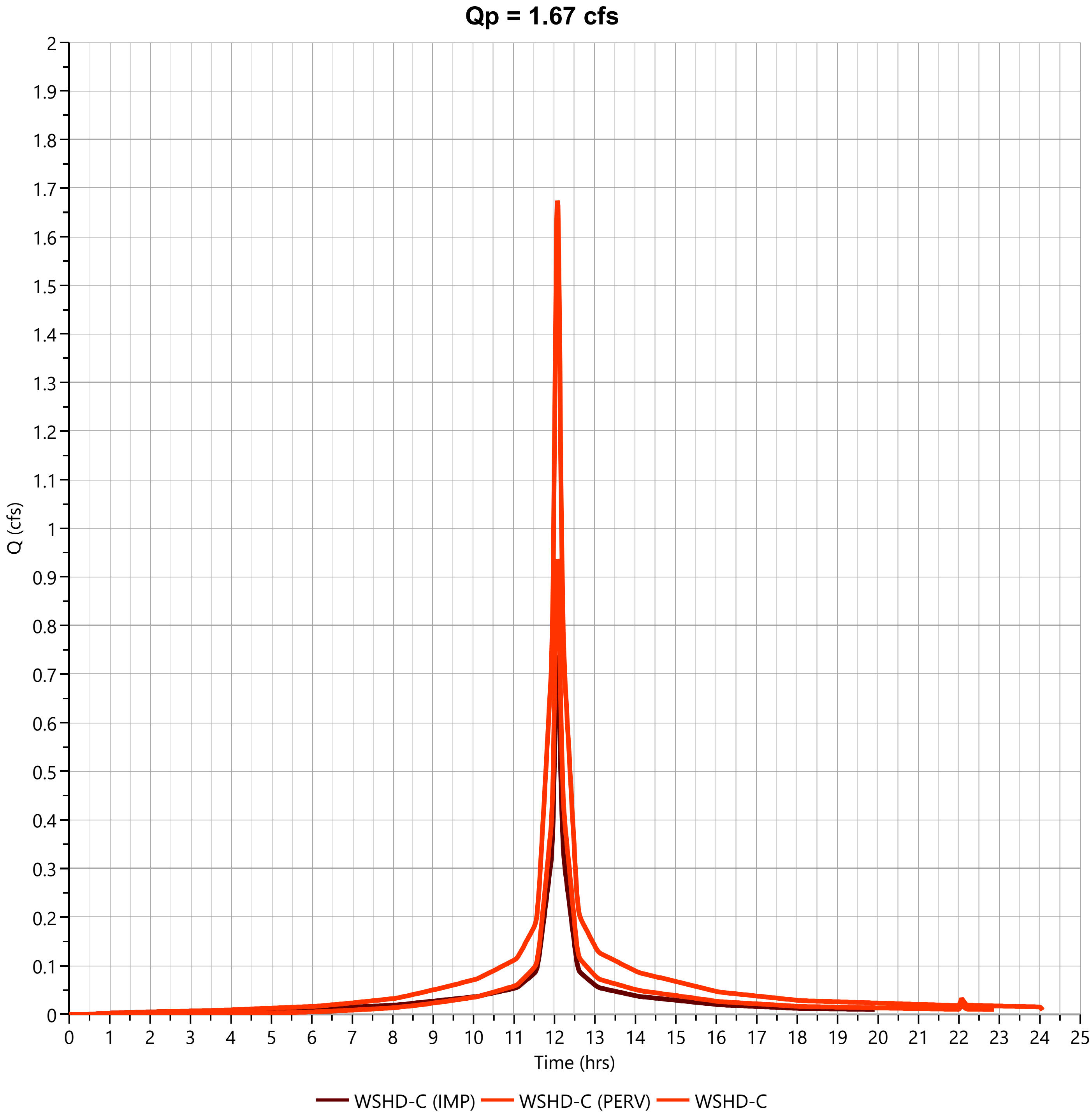
Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.936 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.07 hrs
Time Interval	= 1 min	Runoff Volume	= 3,040 cuft
Drainage Area	= 0.11 ac	Curve Number	= 86
Tc Method	= User	Time of Conc. (Tc)	= 6.0 min
Total Rainfall	= 9.08 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



WSHD-C

Hyd. No. 11

Hydrograph Type	= Junction	Peak Flow	= 1.674 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.07 hrs
Time Interval	= 1 min	Hydrograph Volume	= 5,687 cuft
Inflow Hydrographs	= 9, 10	Total Contrib. Area	= 0.19 ac



APPENDIX C

WATER QUALITY VOLUME AND
WATER QUALITY PEAK FLOW RATE CALCULATIONS

WATER QUALITY CALCULATIONS, WQv:

EXISTING

Water Quality Volume Calculation, WQv:

$$WQv = \frac{P \times Rv \times A}{12}$$

Where: P = 90% Rainfall Event Number (See Figure 7 in this report) = 1.5
I = Impervious Cover (Percent)
Rv = 0.05 + 0.009 (I) ; Min Rv = 0.2
A = Site Area in acres (redevelopment area)

I = 86.7 %
Rv = 0.8303
A = 2.17 ac

See Figure 3 in this report for impervious coverage and redevelopment area

WQv = 0.23 acre-feet or 9,811 cubic feet

PROPOSED

Water Quality Volume Calculation, WQv:

$$WQv = \frac{P \times Rv \times A}{12}$$

Where: P = 90% Rainfall Event Number (See Figure 7 in this report) = 1.5
I = Impervious Cover (Percent)
Rv = 0.05 + 0.009 (I) ; Min Rv = 0.2
A = Site Area in acres (disturbed area)

I = 85.5 %
Rv = 0.8195
A = 2.17 ac

See Figure 4 in this report for impervious coverage and disturbed area

WQv = 0.22 acre-feet or 9,683 cubic feet

This redevelopment project will meet the required water quality treatment by using a combination of impervious coverage (IC) reduction, treating runoff with standard practices and the use of alternative practices using the following calculation:

%WQv by Alternative Practice = (25 - (% IC + %WQv treatment by Standard Practice + % runoff reduction)) x 3

%IC = 1.50 % (see Figures 3 and 4 in this report)
% WQv by Standard Practices = 9.00 %
% runoff reduction = 1.30 %

%WQv by Alternative Practice = 39.60 % or
%WQv by Alternative Practice = 0.088 cubic feet or 3,834 acre-feet

Water Quality Peak Flow Calculation, Qp for Alternative Practice:

$$CN = \frac{1000}{[10 + 5P + 10Q - 10(Q^2 + 1.25\,QP)^{1/2}]}$$

Where: P = 90% Rainfall Event Number (See Figure 7) = 1.5
Q = runoff volume, in inches = 0.49

CN = 85.87
Use CN = 86
Tc = 0.1 hr.

Ia = 0.326 in. (Initial Abstraction - see Table 4-1 from the TR-55 Manual included at then end of this Appendix)
Ia/P = 0.217
q_u = 625 cms/in (Unit Peak Discharge - see Exhibit 4-III from the TR-55 Manual included at the end of this Appendix)

Qp = q_u * A * WQv

Where: WQv = Water Quality Volume in inches - also referred to as Q
A = drainage area in square miles

Qp = 1.03 cfs

Chapter 4 Graphical Peak Discharge Method

This chapter presents the Graphical Peak Discharge method for computing peak discharge from rural and urban areas. The Graphical method was developed from hydrograph analyses using TR-20, “Computer Program for Project Formulation—Hydrology” (SCS 1983). The peak discharge equation used is:

$$q_p = q_u A_m Q F_p \qquad \text{[eq. 4-1]}$$

where:

- q_p = peak discharge (cfs)
- q_u = unit peak discharge (csm/in)
- A_m = drainage area (mi^2)
- Q = runoff (in)
- F_p = pond and swamp adjustment factor

The input requirements for the Graphical method are as follows: (1) T_c (hr), (2) drainage area (mi^2), (3) appropriate rainfall distribution (I, IA, II, or III), (4) 24-hour rainfall (in), and (5) CN. If pond and swamp areas are spread throughout the watershed and are not considered in the T_c computation, an adjustment for pond and swamp areas is also needed.

Peak discharge computation

For a selected rainfall frequency, the 24-hour rainfall (P) is obtained from appendix B or more detailed local precipitation maps. CN and total runoff (Q) for the watershed are computed according to the methods outlined in chapter 2. The CN is used to determine the initial abstraction (I_a) from table 4-1. I_a / P is then computed.

If the computed I_a / P ratio is outside the range in exhibit 4 (4-I, 4-IA, 4-II, and 4-III) for the rainfall distribution of interest, then the limiting value should be used. If the ratio falls between the limiting values, use linear interpolation. Figure 4-1 illustrates the sensitivity of I_a / P to CN and P.

Peak discharge per square mile per inch of runoff (q_u) is obtained from exhibit 4-I, 4-IA, 4-II, or 4-III by using T_c (chapter 3), rainfall distribution type, and I_a / P ratio. The pond and swamp adjustment factor is obtained from table 4-2 (rounded to the nearest table value). Use worksheet 4 in appendix D to aid in computing the peak discharge using the Graphical method.

Figure 4-1 Variation of I_a / P for P and CN

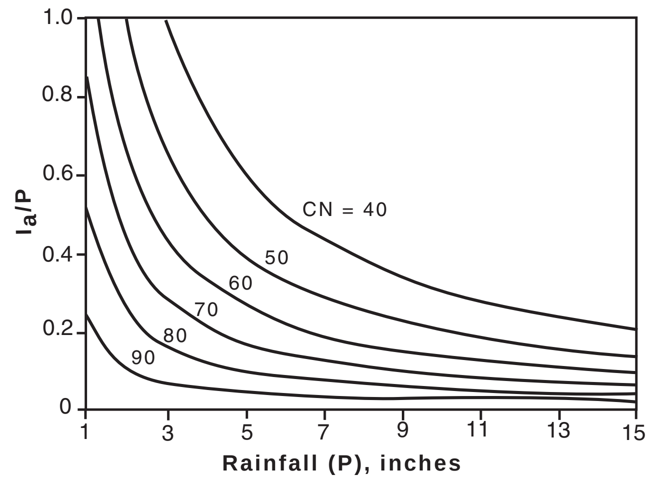
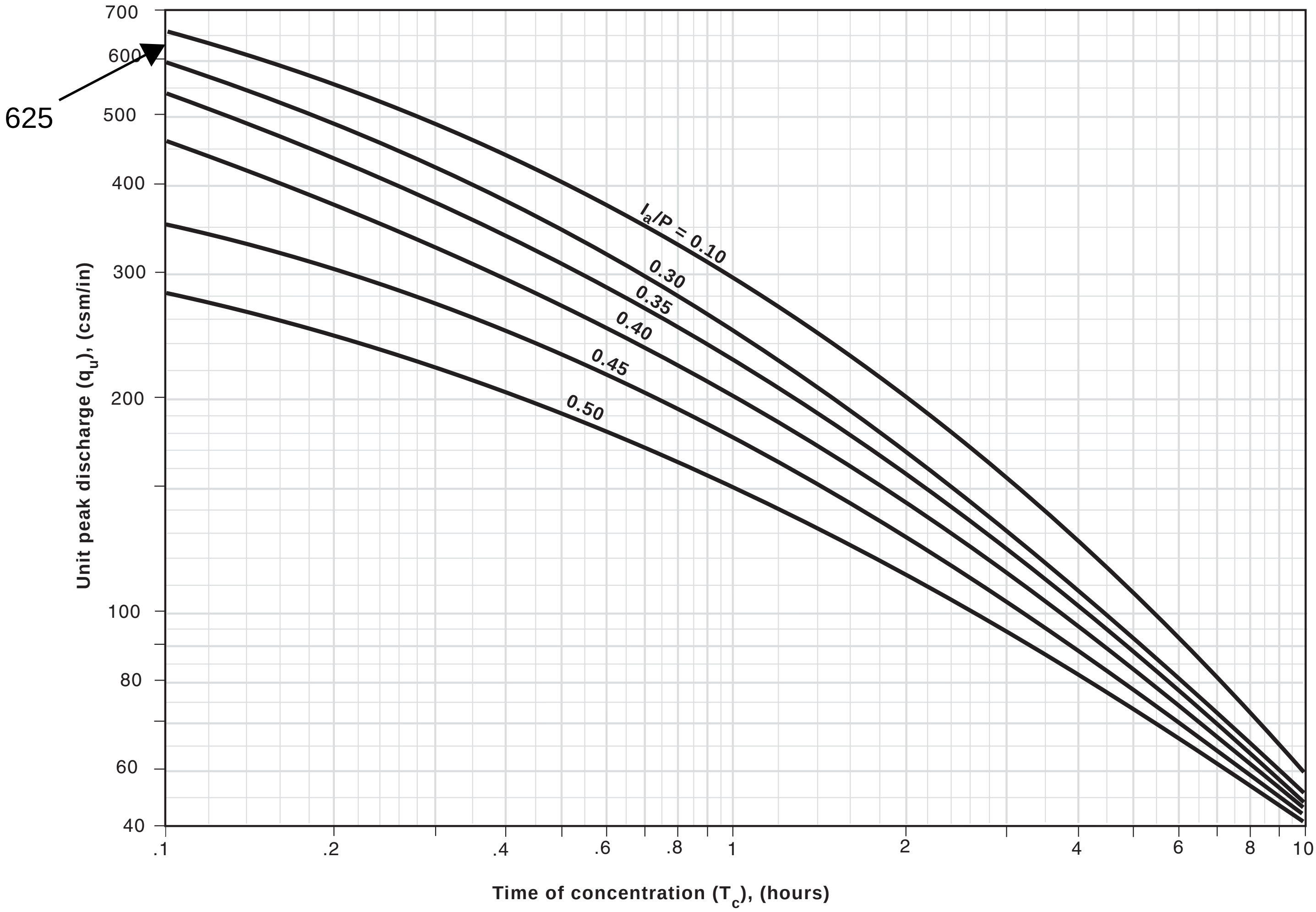


Table 4-1 I_a values for runoff curve numbers

Curve number	I_a (in)	Curve number	I_a (in)
40	3.000	70	0.857
41	2.878	71	0.817
42	2.762	72	0.778
43	2.651	73	0.740
44	2.545	74	0.703
45	2.444	75	0.667
46	2.348	76	0.632
47	2.255	77	0.597
48	2.167	78	0.564
49	2.082	79	0.532
50	2.000	80	0.500
51	1.922	81	0.469
52	1.846	82	0.439
53	1.774	83	0.410
54	1.704	84	0.381
55	1.636	85	0.353
56	1.571	86	0.326
57	1.509	87	0.299
58	1.448	88	0.273
59	1.390	89	0.247
60	1.333	90	0.222
61	1.279	91	0.198
62	1.226	92	0.174
63	1.175	93	0.151
64	1.125	94	0.128
65	1.077	95	0.105
66	1.030	96	0.083
67	0.985	97	0.062
68	0.941	98	0.041
69	0.899		

Exhibit 4-III Unit peal discharge (q_u) for NRCS (SCS) type III rainfall distribution



APPENDIX D

CDS SIZING CALCULATIONS AND DOCUMENTATION

State of New Jersey
DEPARTMENT OF ENVIRONMENTAL PROTECTION
Bureau of Nonpoint Pollution Control
Division of Water Quality
401-02B
Post Office Box 420
Trenton, New Jersey 08625-0420
609-633-7021 Fax: 609-777-0432
http://www.state.nj.us/dep/dwq/bnpc_home.htm

CHRIS CHRISTIE
Governor

KIM GUADAGNO
Lt. Governor

BOB MARTIN
Commissioner

March 21, 2017

Derek M. Berg
Contech Engineered Solutions, LLC
71 US Route 1, Suite F
Scarborough, ME 04074

Re: Revised MTD Lab Certification
Continuous Deflective Separator (CDS®) Stormwater Treatment Device by Contech Engineered Solutions, LLC
On-line Installation

TSS Removal Rate 50%

Dear Mr. Berg:

This revised certification letter supersedes the Department's prior certification dated January 9, 2015. This revision was completed to reflect the updated Manufactured Treatment Device (MTD) scaling methodology as agreed upon by the manufacturers' working group on September 19, 2016. In part, the updated scaling for hydrodynamic MTDs is based on the depth of the reference (tested) MTD from the top of the false floor utilized during removal efficiency testing, not from the physical bottom of the unit. Based on the above decision, Table A-2 of the NJCAT Technology Verification report located at http://www.njcat.org/uploads/newDocs/CDSVerificationReportFinal1.pdf has been revised, and Table 1 noted below has been added.

The Stormwater Management rules under N.J.A.C. 7:8-5.5(b) and 5.7 (c) allow the use of manufactured treatment devices (MTDs) for compliance with the design and performance standards at N.J.A.C. 7:8-5 if the pollutant removal rates have been verified by the New Jersey Corporation for Advanced Technology (NJCAT) and have been certified by the New Jersey Department of Environmental Protection (NJDEP). Contech Engineered Solutions, LLC has requested an MTD Laboratory Certification for the CDS® Stormwater Treatment Device.

The verification is subject to the "Procedure for Obtaining Verification of a Stormwater Manufactured Treatment Device from New Jersey Corporation for Advance Technology" dated January 25, 2013. The applicable protocol is the "New Jersey Laboratory Testing Protocol to Assess Total Suspended Solids Removal by a Hydrodynamic Sedimentation Manufactured Treatment Device" dated January 25, 2013.

NJCAT verification documents submitted to the NJDEP indicate that the requirements of the aforementioned protocol have been met or exceeded. The NJCAT letter also included a recommended certification TSS removal rate and the required maintenance plan. The NJCAT Verification Report with the Verification

Appendix dated September 2014 (Revised January 2017) for this device is published online at http://www.njcat.org/verification-process/technology-verification-database.html.

The NJDEP certifies the use of the CDS® Stormwater Treatment Device by Contech Engineered Solutions, LLC at a TSS removal rate of 50% when designed, operated, and maintained in accordance with the information provided in the Verification Appendix and the following conditions:

1. The maximum treatment flow rate (MTFR) for the manufactured treatment device (MTD) is calculated using the New Jersey Water Quality Design Storm (1.25 inches in 2 hrs) in N.J.A.C. 7:8-5.5.

2. The CDS® Stormwater Treatment Device shall be installed using the same configuration reviewed by NJCAT and shall be sized in accordance with the criteria specified in item 6 below.

3. This CDS® Stormwater Treatment Device cannot be used in series with another MTD or a media filter (such as a sand filter) to achieve an enhanced removal rate for total suspended solids (TSS) removal under N.J.A.C. 7:8-5.5.

4. Additional design criteria for MTDs can be found in Chapter 9.6 of the New Jersey Stormwater Best Management Practices (NJ Stormwater BMP) Manual which can be found on-line at www.njstormwater.org.

5. The maintenance plan for a site using this device shall incorporate, at a minimum, the maintenance requirements for the CDS® Stormwater Treatment Device. A copy of the maintenance plan is attached to this certification. However, it is recommended to review the maintenance website at http://www.conteches.com/products/stormwater-management/treatment/cds.aspx#1822141-technical-info for any changes to the maintenance requirements.

6. Sizing Requirements:

   The example below demonstrates the sizing procedure for the CDS®:

   Example: A 0.25-acre impervious site is to be treated to 50% TSS removal using a CDS®. The impervious site runoff (Q) based on the New Jersey Water Quality Design Storm was determined to be 0.79 cfs.

   Maximum Treatment Flow Rate (MTFR) Evaluation:

   The site runoff (Q) was based on the following:
   time of concentration = 10 minutes
   i=3.2 in/hr (page 5-8, Fig. 5-3 of the NJ Stormwater BMP Manual)
   c=0.99 (runoff coefficient for impervious)
   Q=ciA=0.99x3.2x0.25=0.79 cfs

   Given the site runoff is 0.79 cfs and based on Table 1 below, the CDS® Model CDS-4 with an MTFR of 0.93 cfs would be the smallest model approved that could be used for this site that could remove 50% of the TSS from the impervious area without exceeding the MTFR.

The sizing table corresponding to the available system models is noted below. Additional specifications regarding each model can be found in the Verification Appendix under Table A-1 and A-2.

Table 1 CDS Models

CDS Model	Manhole Diameter (ft.)	Treatment Chamber Depth (ft.)	MTFR (cfs)
CDS-3	3	3.50	0.52
CDS-4	4	3.50	0.93
CDS-5	5	3.75	1.5
CDS-6	6	4.50	2.1
CDS-7	7	5.25	2.8
CDS-8	8	6.00	3.7
CDS-10	10	7.50	5.8
CDS-12	12	9.00	8.4

1.03 CFS Treatment Flow from Appendix C

- Treatment Chamber Depth is defined as the depth below the invert to the top of the false floor installed at 50% sediment depth.

A detailed maintenance plan is mandatory for any project with a Stormwater BMP subject to the Stormwater Management Rules, N.J.A.C. 7:8. The plan must include all of the items identified in the Stormwater Management Rules, N.J.A.C. 7:8-5.8. Such items include, but are not limited to, the list of inspection and maintenance equipment and tools, specific corrective and preventative maintenance tasks, indication of problems in the system, and training of maintenance personnel. Additional information can be found in Chapter 8: Maintenance and Retrofit of Stormwater Management Measures.

If you have any questions regarding the above information, please contact Mr. Shashi Nayak of my office at (609) 633-7021.

Sincerely,

James J. Murphy, Chief
Bureau of Nonpoint Pollution Control

Attachment: Maintenance Plan

c: Chron File
Richard Magee, NJCAT
Vince Mazzei, NJDEP - DLUR
Ravi Patraju, NJDEP - BES
Gabriel Mahon, NJDEP - BNPC
Shashi Nayak, NJDEP – BNPC

CONTECH®
ENGINEERED SOLUTIONS

CDS® Inspection and Maintenance Guide – New Jersey

CDS TECHNOLOGIES

Maintenance

The CDS system should be inspected at regular intervals and maintained when necessary to ensure optimum performance. The rate at which the system collects pollutants will depend more heavily on site activities than the size of the unit. For example, unstable soils or heavy winter sanding will cause the grit chamber to fill more quickly but regular sweeping of paved surfaces will slow accumulation.

Inspection

Inspection is the key to effective maintenance and is easily performed. Pollutant transport and deposition may vary from year to year and regular inspections will help ensure that the system is cleaned out at the appropriate time. At a minimum, inspections should be performed twice per year (e.g. spring and fall) however more frequent inspections may be necessary in climates where winter sanding operations may lead to rapid accumulations, or in equipment washdown areas. Installations should also be inspected more frequently where excessive amounts of trash are expected.

The visual inspection should ascertain that the system components are in working order and that there are no blockages or obstructions in the inlet and separation screen. The inspection should also quantify the accumulation of hydrocarbons, trash, and sediment in the system. Measuring pollutant accumulation can be done with a calibrated dipstick, tape measure or other measuring instrument. If absorbent material is used for enhanced removal of hydrocarbons, the level of discoloration of the sorbent material should also be identified during inspection. It is useful and often required as part of an operating permit to keep a record of each inspection. A simple form for doing so is provided.

Access to the CDS unit is typically achieved through two manhole access covers. One opening allows for inspection and cleanout of the separation chamber (cylinder and screen) and isolated sump. The other allows for inspection and cleanout of sediment captured and retained outside the screen. For deep units, a single manhole access point allows both sump cleanout and access outside the screen.

The CDS system should be cleaned when the level of sediment has reached 75% of capacity in the isolated sump or when an appreciable level of hydrocarbons and trash has accumulated. If absorbent material is used, it should be replaced when significant discoloration has occurred. Performance will not be impacted until 100% of the sump capacity is exceeded however it is recommended that the system be cleaned prior to that for easier removal of sediment. The level of sediment is easily determined by measuring from finished grade down to the top of the sediment pile. To avoid underestimating the level of sediment in the chamber, the measuring device must be lowered to the top of the sediment pile carefully. Particles at the top of the pile typically offer less resistance to the end of the rod than consolidated particles toward the bottom of the pile. Once this measurement is recorded, it should be compared to the as-built drawing for the unit to determine weather the height of the sediment pile off the bottom of the sump floor exceeds 75% of the total height of isolated sump. Refer to Table 1 for depth from water surface to top of sediment pile for each model size indicating that maintenance is required.

Cleaning

Cleaning of a CDS systems should be done during dry weather conditions when no flow is entering the system. The use of a vacuum truck is generally the most effective and convenient method of removing pollutants from the system. Simply remove the manhole covers and insert the vacuum hose into the sump. The system should be completely drained down and the sump fully evacuated of sediment. The area outside the screen should also be cleaned out if pollutant build-up exists in this area.

In installations where the risk of petroleum spills is small, liquid contaminants may not accumulate as quickly as sediment. However, the system should be cleaned out immediately in the event of an oil or gasoline spill should be cleaned out immediately. Motor oil and other hydrocarbons that accumulate on a more routine basis should be removed when an appreciable layer has been captured. To remove these pollutants, it may be preferable to use absorbent pads since they are usually less expensive to dispose than the oil/water emulsion that may be created by vacuuming the oily layer. Trash and debris can be netted out to separate it from the other pollutants. The screen should be power washed to ensure it is free of trash and debris.

Manhole covers should be securely seated following cleaning activities to prevent leakage of runoff into the system from above and also to ensure that proper safety precautions have been followed. Confined space entry procedures need to be followed if physical access is required. Disposal of all material removed from the CDS system should be done in accordance with local regulations. In many jurisdictions, disposal of the sediments may be handled in the same manner as the disposal of sediments removed from catch basins or deep sump manholes.

CDS Model	Diameter		Distance from Water Surface to Top of Sediment Pile[1]		Sediment Storage Capacity	
	ft	m	ft	m	yd^3	m^3
CDS-3	3	0.9	3.0	0.9	0.5	0.4
CDS-4	4	1.2	3.0	0.9	0.9	0.7
CDS-5	5	1.5	3.25	1.0	1.5	1.1
CDS-6	6	1.8	4.0	1.2	2.1	1.6
CDS-7	7	2.1	4.75	1.4	2.9	2.2
CDS-8	8	2.4	5.5	1.7	3.7	2.8
CDS-10	10	3.0	7.0	2.1	5.8	4.4
CDS-12	12	3.4	8.5	2.6	8.4	6.4

Table 1: CDS Maintenance Indicators and Sediment Storage Capacities

[1] Distances from water surface to top of sediment pile are based on 75% of sump capacity being occupied.

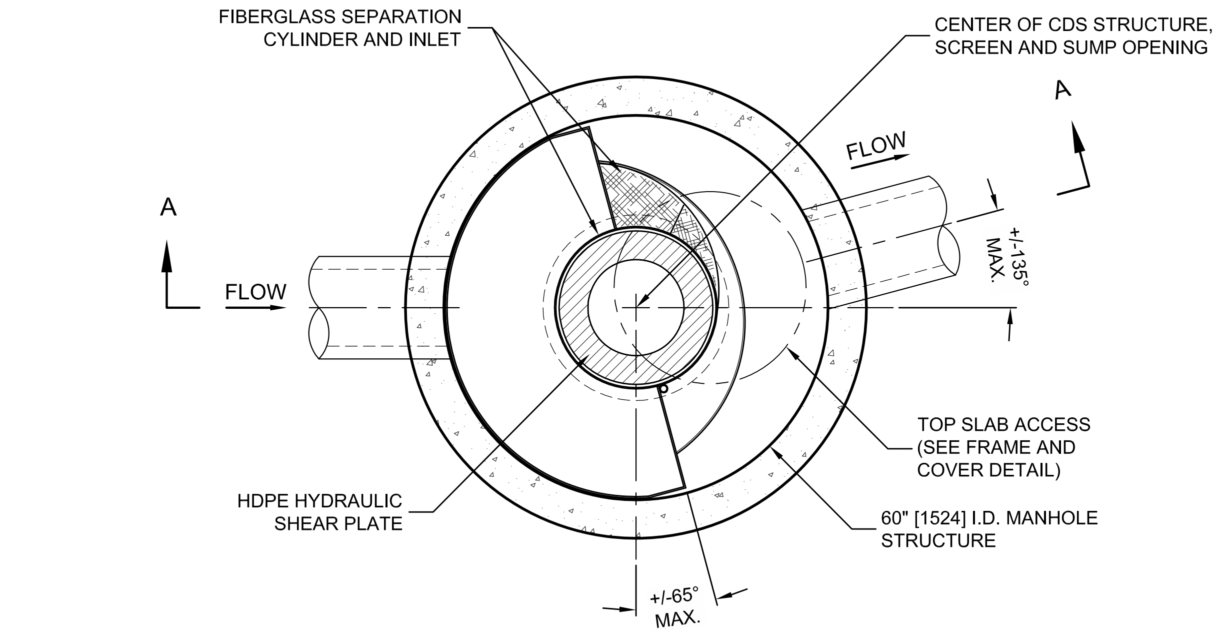
CDS Inspection & Maintenance Log

CDS Model: ______________________ Location: ______________________

Date	Water depth to sediment[1]	Floatable Layer Thickness[2]	Describe Maintenance Performed	Maintenance Personnel	Comments

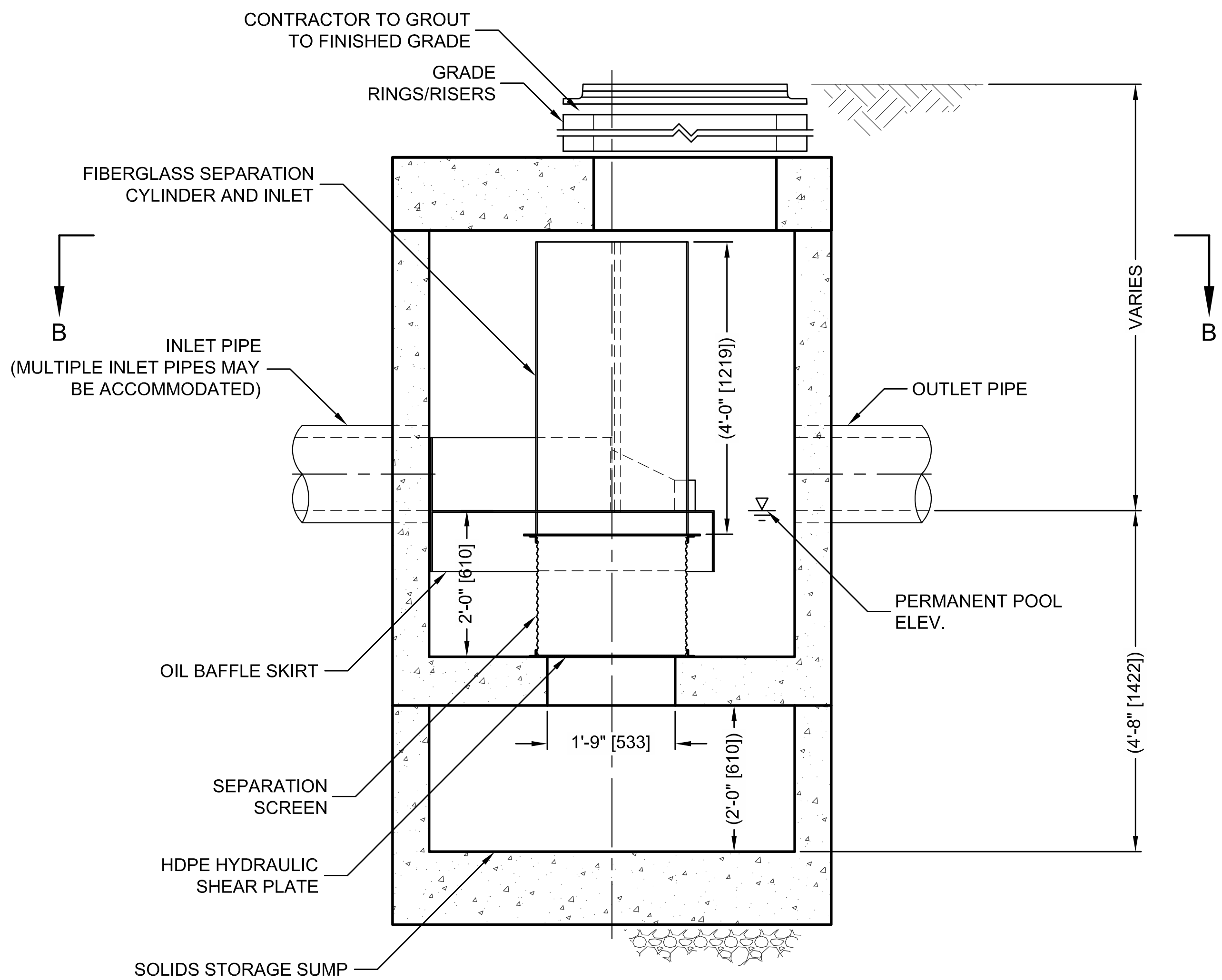
1. The water depth to sediment is determined by taking two measurements with a stadia rod: one measurement from the manhole opening to the top of the sediment pile and the other from the manhole opening to the water surface. If the difference between these measurements is less than the values listed in table 1 the system should be cleaned out. **Note: to avoid underestimating the volume of sediment in the chamber, the measuring device must be carefully lowered to the top of the sediment pile.**

2. For optimum performance, the system should be cleaned out when the floating hydrocarbon layer accumulates to an appreciable thickness. In the event of an oil spill, the system should be cleaned immediately.



PLAN VIEW B-B

N.T.S.



ELEVATION A-A

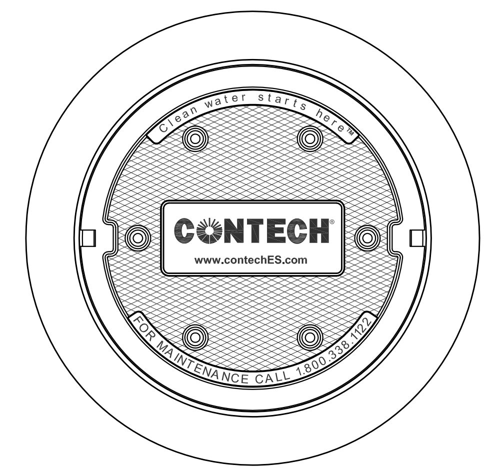
N.T.S.

CDS2015-5-C DESIGN NOTES

THE STANDARD CDS2015-5-C CONFIGURATION IS SHOWN. ALTERNATE CONFIGURATIONS ARE AVAILABLE AND ARE LISTED BELOW. SOME CONFIGURATIONS MAY BE COMBINED TO SUIT SITE REQUIREMENTS.

CONFIGURATION DESCRIPTION
GRATED INLET ONLY (NO INLET PIPE)
GRATED INLET WITH INLET PIPE OR PIPES
CURB INLET ONLY (NO INLET PIPE)
CURB INLET WITH INLET PIPE OR PIPES
SEPARATE OIL BAFFLE (SINGLE INLET PIPE REQUIRED FOR THIS CONFIGURATION)
SEDIMENT WEIR FOR NJDEP / NJCAT CONFORMING UNITS

TYPICAL DETAIL - SHOP DRAWINGS FOR CDS WATER QUALITY UNIT MUST BE SUBMITTED TO THE DESIGN ENGINEER FOR REVIEW PRIOR TO ORDERING UNIT



FRAME AND COVER

(DIAMETER VARIES)

N.T.S.

SITE SPECIFIC DATA REQUIREMENTS

STRUCTURE ID			
WATER QUALITY FLOW RATE (CFS OR L/s)			*
PEAK FLOW RATE (CFS OR L/s)			*
RETURN PERIOD OF PEAK FLOW (YRS)			*
SCREEN APERTURE (2400 OR 4700)			*
PIPE DATA:	I.E.	MATERIAL	DIAMETER
INLET PIPE 1	*	*	*
INLET PIPE 2	*	*	*
OUTLET PIPE	*	*	*
RIM ELEVATION			*
ANTI-FLOTATION BALLAST		WIDTH	HEIGHT
		*	*

NOTES/SPECIAL REQUIREMENTS:

* PER ENGINEER OF RECORD

GENERAL NOTES

1. CONTECH TO PROVIDE ALL MATERIALS UNLESS NOTED OTHERWISE.
2. DIMENSIONS MARKED WITH ( ) ARE REFERENCE DIMENSIONS. ACTUAL DIMENSIONS MAY VARY.
3. FOR FABRICATION DRAWINGS WITH DETAILED STRUCTURE DIMENSIONS AND WEIGHTS, PLEASE CONTACT YOUR CONTECH ENGINEERED SOLUTIONS LLC REPRESENTATIVE. www.contechES.com
4. CDS WATER QUALITY STRUCTURE SHALL BE IN ACCORDANCE WITH ALL DESIGN DATA AND INFORMATION CONTAINED IN THIS DRAWING.
5. STRUCTURE SHALL MEET AASHTO HS20 AND CASTINGS SHALL MEET HS20 (AASHTO M 306) LOAD RATING, ASSUMING GROUNDWATER ELEVATION AT, OR BELOW, THE OUTLET PIPE INVERT ELEVATION. ENGINEER OF RECORD TO CONFIRM ACTUAL GROUNDWATER ELEVATION.
6. PVC HYDRAULIC SHEAR PLATE IS PLACED ON SHELF AT BOTTOM OF SCREEN CYLINDER. REMOVE AND REPLACE AS NECESSARY DURING MAINTENANCE CLEANING.

INSTALLATION NOTES

A. ANY SUB-BASE, BACKFILL DEPTH, AND/OR ANTI-FLOTATION PROVISIONS ARE SITE-SPECIFIC DESIGN CONSIDERATIONS AND SHALL BE SPECIFIED BY ENGINEER OF RECORD.
B. CONTRACTOR TO PROVIDE EQUIPMENT WITH SUFFICIENT LIFTING AND REACH CAPACITY TO LIFT AND SET THE CDS MANHOLE STRUCTURE (LIFTING CLUTCHES PROVIDED).
C. CONTRACTOR TO ADD JOINT SEALANT BETWEEN ALL STRUCTURE SECTIONS, AND ASSEMBLE STRUCTURE.
D. CONTRACTOR TO PROVIDE, INSTALL, AND GROUT PIPES. MATCH PIPE INVERTS WITH ELEVATIONS SHOWN.
E. CONTRACTOR TO TAKE APPROPRIATE MEASURES TO ASSURE UNIT IS WATER TIGHT, HOLDING WATER TO FLOWLINE INVERT MINIMUM. IT IS SUGGESTED THAT ALL JOINTS BELOW PIPE INVERTS ARE GROUTED.

CONTECH ENGINEERED SOLUTIONS LLC
www.contechES.com
9025 Centre Pointe Dr., Suite 400, West Chester, OH 45069
800-338-1122 513-645-7000 513-645-7993 FAX

CDS2015-5-C
INLINE CDS
STANDARD DETAIL

CONTECH®
ENGINEERED SOLUTIONS

CDS®
Hydrodynamic Separator

The experts you need to solve your stormwater management challenges

Your Contech Team

Contech is the leader in stormwater management solutions, helping engineers, contractors and owners with infrastructure and land development projects throughout North America.

With our responsive team of stormwater experts, local regulatory expertise and flexible solutions, Contech is the trusted partner you can count on for stormwater management solutions.

STORMWATER CONSULTANT

It's my job to recommend the best solution to meet permitting requirements.

STORMWATER DESIGN ENGINEER

I work with consultants to design the best approved solution to meet your project's needs.

REGULATORY MANAGER

I understand the local stormwater regulations and what solutions will be approved.

SALES ENGINEER

I make sure our solutions meet the needs of the contractor during construction.

Contech is your partner in stormwater management solutions

Unique screening technology for stormwater runoff – CDS®

The CDS hydrodynamic separator uses swirl concentration and continuous deflective separation to screen, separate and trap trash, debris, sediment, and hydrocarbons from stormwater runoff.

At the heart of the CDS system is a unique screening technology used to capture and retain trash and debris. The screen face is louvered so that it is smooth in the downstream direction. The effect created is called "Continuous Deflective Separation." The power of the incoming flow is harnessed to continually shear debris off the screen and to direct trash and sediment toward the center of the separation cylinder. This results in a screen that is self-cleaning and provides 100% removal of floatables and neutrally buoyant material debris 4.7 mm or larger, without blinding.

CDS is used to meet trash Total Maximum Daily Load (TMDL) requirements, for stormwater quality control, inlet and outlet pollution control, and as pretreatment for filtration, detention/infiltration, bioretention, rainwater harvesting systems, and a variety of green infrastructure practices.

CDS® Features and Benefits

FEATURE	BENEFIT
Captures and retains 100% of floatables and neutrally buoyant debris 4.7mm or larger	Superior pollutant removal
Self-cleaning screen	Ease of maintenance
Isolated storage sump eliminates scour potential	Excellent pollutant retention
Internal bypass	Eliminates the need for additional structures
Multiple pipe inlets and 90-180º angles	Design flexibility
Clear access to sump and stored pollutants	Fast, easy maintenance

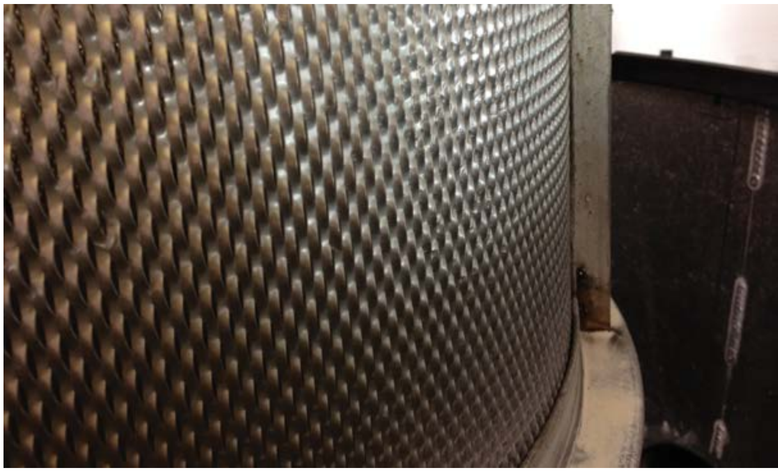
APPLICATION TIPS

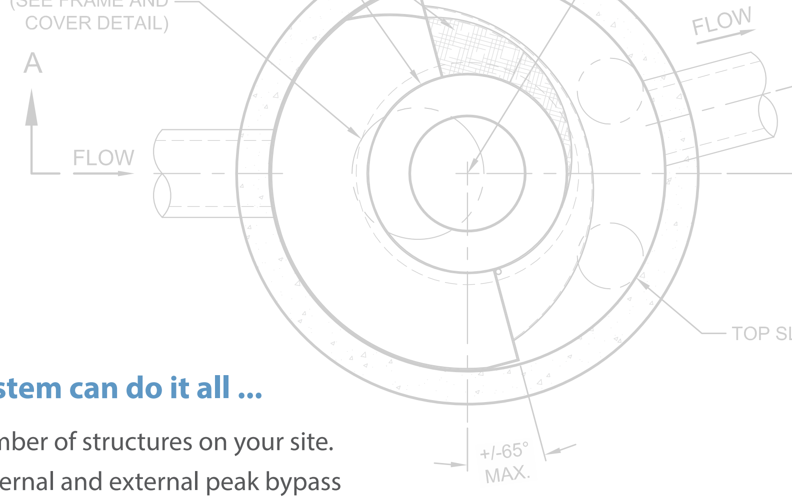
- Because of its internal peak bypass weirs, CDS systems can provide cost savings by eliminating the need for additional structures.
- Pretreating detention, infiltration, and green infrastructure practices with CDS can protect downstream structures and provide for easy maintenance.
- The CDS an ideal solution for retrofit applications due to its compact footprint and configuration flexibility.

The CDS® Screen

A fundamentally different approach to trash control …

Traditional approaches to trash control typically involve "direct screening" that can easily become clogged, as trash is pinned to the screen as water passes through. Clogged screens can lead to flooding as water backs up. The design of the CDS screen is fundamentally different. Flow is introduced to the screen face which is louvered so that it is smooth in the downstream direction. The effect created is called "Continuous Deflective Separation." The power of the incoming flow is harnessed to continually shear debris off the screen and to direct trash and sediment toward the center of the separation cylinder.

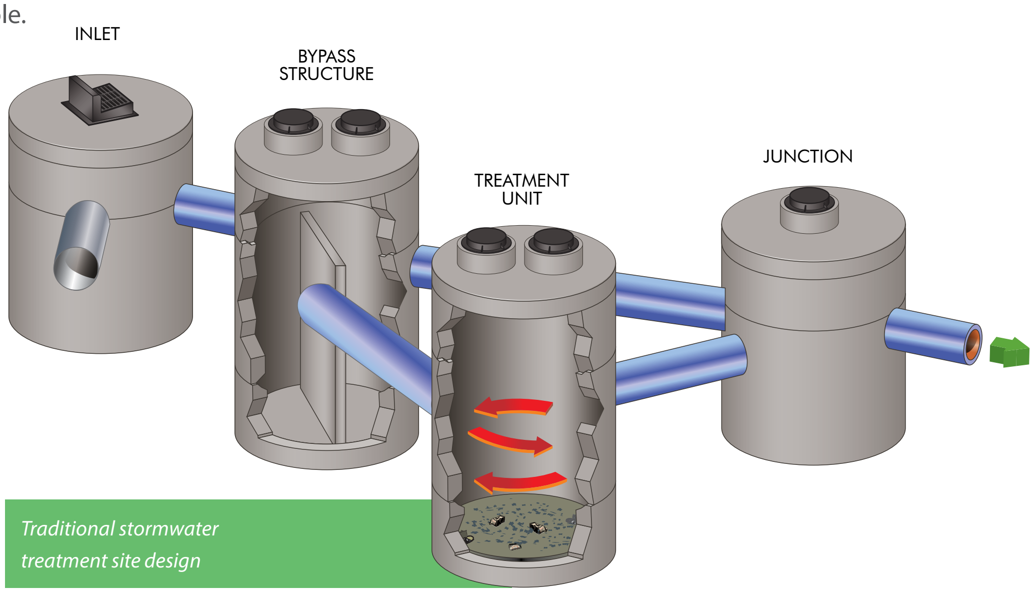




CDS® Design Configuration

Why use traditional stormwater design when ONE system can do it all ...

The CDS effectively treats stormwater runoff while reducing the number of structures on your site. Inline, offline, grate inlet, and drop inlet configurations available. Internal and external peak bypass options also available.

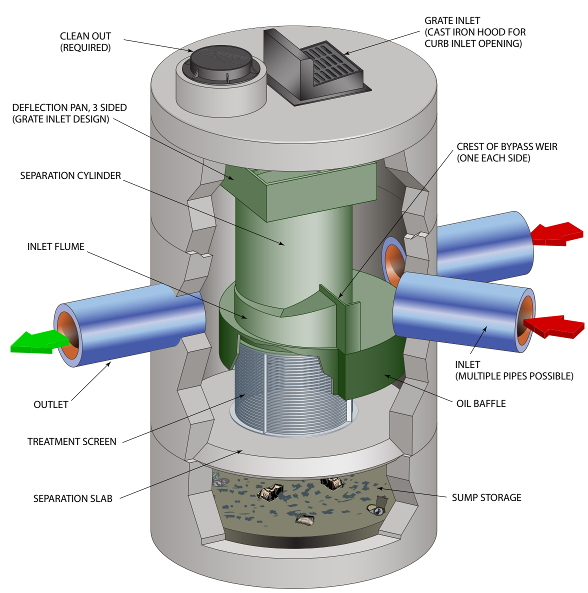


Traditional stormwater treatment site design

A Traditional Stormwater Treatment Site Design would require several structures on your site. With CDS, one system can do it all!

CDS® Advantages

- Grate inlet option available
- Internal bypass weir
- Accepts multiple inlets at a variety of angles
- Advanced hydrodynamic separator
- Captures and retains 100% of floatables and neutrally buoyant debris 4.7 mm or larger
- Indirect screening capability keeps screen from clogging
- Retention of all captured pollutants, even at high flows
- Performance verified by NJCAT, WA Ecology, and ETV Canada



Learn More:

www.ContechES.com/cds

CDS® Applications

CDS is commonly used in the following stormwater applications:

- Stormwater quality control – trash, debris, sediment, and hydrocarbon removal
- Urban retrofit and redevelopment
- Inlet and outlet protection
- Pretreatment for filtration, detention/infiltration, bioretention, rainwater harvesting systems, and Low Impact Development designs

CDS® provides trash control

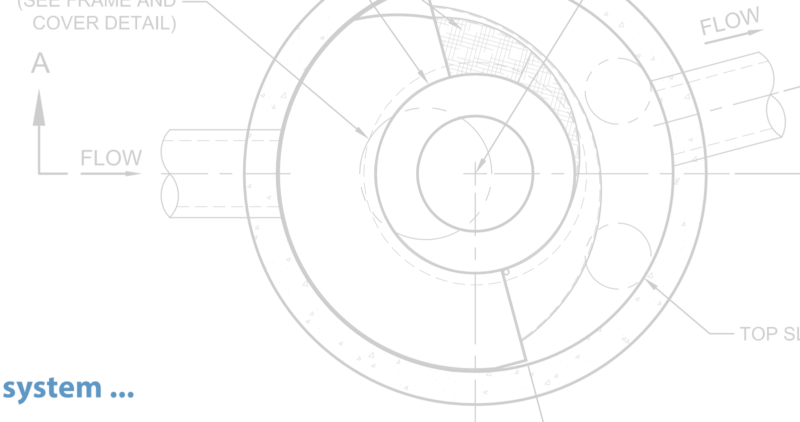
CDS® pretreats a bioswale

Select CDS® Certifications and Verifications

CDS has been verified by some of the most stringent stormwater technology evaluation organizations in North America, including:

- Washington State Department of Ecology (GULD) - Pretreatment
- New Jersey Department of Environmental Protection (NJDEP)
- Canadian Environmental Technology Verification (ETV)
- California Statewide Trash Amendments Full Capture System Certified*

**The CDS System has been certified by the California State Water Resources Control Board as a Full Capture System provided that it is sized to treat the peak flow rate from the region specific 1-year, 1-hour design storm, or the peak flow capacity of the corresponding storm drain, whichever is less.*



CDS® Maintenance

Select a cost-effective and easy-to-access treatment system ...

Systems vary in their maintenance needs, and the selection of a cost-effective and easy-to-access treatment system can mean a huge difference in maintenance expenses for years to come.

A CDS unit is designed to minimize maintenance and make it as easy and inexpensive as possible to keep our systems working properly.

Most CDS® units can easily be cleaned within thirty minutes.

INSPECTION

Inspection is the key to effective maintenance. Pollutant deposition and transport may vary from year to year and site to site. Semi-annual inspections will help ensure that the system is cleaned out at the appropriate time. Inspections should be performed more frequently where site conditions may cause rapid accumulation of pollutants.

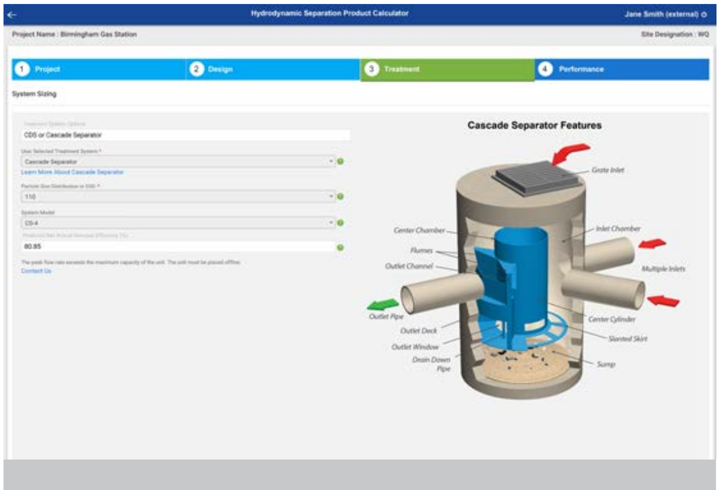
RECOMMENDATIONS FOR CDS MAINTENANCE

The recommended cleanout of solids within the CDS unit's sump should occur at 75% of the sump capacity. Access to the CDS unit is typically achieved through two manhole access covers – one allows inspection and cleanout of the separation chamber and sump, and another allows inspection and cleanout of sediment captured and retained behind the screen. A vacuum truck is recommended for cleanout of the CDS unit and can be easily accomplished in less than 30 minutes for most installations.

Design Your Own Hydrodynamic Separator (DYOHDS™)

Quickly prepare designs for estimates and project meetings ...

- Multiple sizing methods available.
- Site-specific questions ensure the selected unit will comply with site constraints.
- Multiple treatment options may be available based on regulations and site parameters.
- Follow up reports contain a site-specific design, sizing summary, standard detail, and specification.



Learn More:
www.ContechES.com/dyohds

A partner you can rely on

STORMWATER SOLUTIONS

PIPE SOLUTIONS

STRUCTURES SOLUTIONS

Few companies offer the wide range of high-quality stormwater resources you can find with us — state-of-the-art products, decades of expertise, and all the maintenance support you need to operate your system cost-effectively.

THE CONTECH WAY

Contech® Engineered Solutions provides innovative, cost-effective site solutions to engineers, contractors, and developers on projects across North America. Our portfolio includes bridges, drainage, erosion control, retaining wall, sanitary sewer and stormwater management products.

TAKE THE NEXT STEP

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CONTECH® ENGINEERED SOLUTIONS

CDS Guide
Operation, Design, Performance and Maintenance

CDS®

Using patented continuous deflective separation technology, the CDS system screens, separates and traps debris, sediment, and oil and grease from stormwater runoff. The indirect screening capability of the system allows for 100% removal of floatables and neutrally buoyant material without blinding. Flow and screening controls physically separate captured solids, and minimize the re-suspension and release of previously trapped pollutants. Inline units can treat up to 6 cfs, and internally bypass flows in excess of 50 cfs (1416 L/s). Available precast or cast-in-place, offline units can treat flows from 1 to 300 cfs (28.3 to 8495 L/s). The pollutant removal capacity of the CDS system has been proven in lab and field testing.

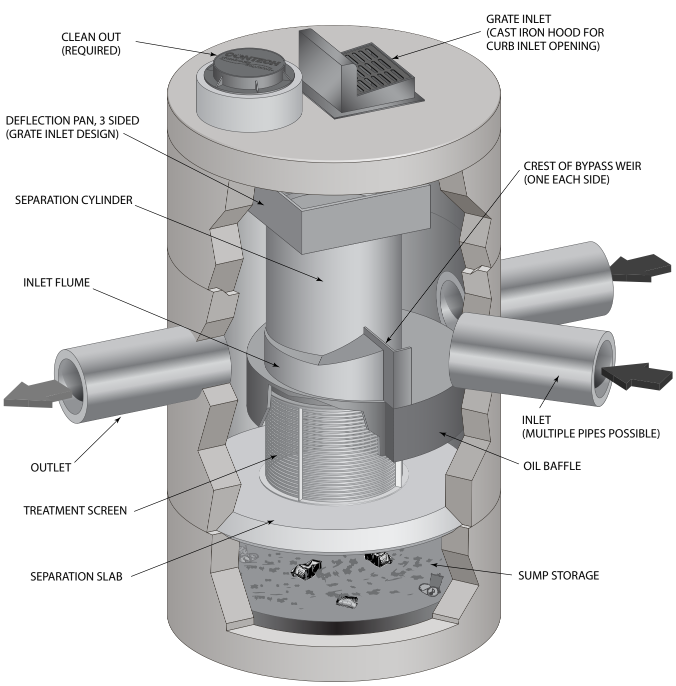
Operation Overview

Stormwater enters the diversion chamber where the diversion weir guides the flow into the unit's separation chamber and pollutants are removed from the flow. All flows up to the system's treatment design capacity enter the separation chamber and are treated.

Swirl concentration and screen deflection force floatables and solids to the center of the separation chamber where 100% of floatables and neutrally buoyant debris larger than the screen apertures are trapped.

Stormwater then moves through the separation screen, under the oil baffle and exits the system. The separation screen remains clog free due to continuous deflection.

During the flow events exceeding the treatment design capacity, the diversion weir bypasses excessive flows around the separation chamber, so captured pollutants are retained in the separation cylinder.



Design Basics

There are three primary methods of sizing a CDS system. The Water Quality Flow Rate Method determines which model size provides the desired removal efficiency at a given flow rate for a defined particle size. The Rational Rainfall Method™ or the and Probabilistic Method is used when a specific removal efficiency of the net annual sediment load is required.

Typically in the Unites States, CDS systems are designed to achieve an 80% annual solids load reduction based on lab generated performance curves for a gradation with an average particle size (d50) of 125 microns (μm). For some regulatory environments, CDS systems can also be designed to achieve an 80% annual solids load reduction based on an average particle size (d50) of 75 microns (μm) or 50 microns (μm).

Water Quality Flow Rate Method

In some cases, regulations require that a specific treatment rate, often referred to as the water quality design flow (WQQ), be treated. This WQQ represents the peak flow rate from either an event with a specific recurrence interval, e.g. the six-month storm, or a water quality depth, e.g. 1/2-inch (13 mm) of rainfall.

The CDS is designed to treat all flows up to the WQQ. At influent rates higher than the WQQ, the diversion weir will direct most flow exceeding the WQQ around the separation chamber. This allows removal efficiency to remain relatively constant in the separation chamber and eliminates the risk of washout during bypass flows regardless of influent flow rates.

Treatment flow rates are defined as the rate at which the CDS will remove a specific gradation of sediment at a specific removal efficiency. Therefore the treatment flow rate is variable, based on the gradation and removal efficiency specified by the design engineer.

Rational Rainfall Method™

Differences in local climate, topography and scale make every site hydraulically unique. It is important to take these factors into consideration when estimating the long-term performance of any stormwater treatment system. The Rational Rainfall Method combines site-specific information with laboratory generated performance data, and local historical precipitation records to estimate removal efficiencies as accurately as possible.

Short duration rain gauge records from across the United States and Canada were analyzed to determine the percent of the total annual rainfall that fell at a range of intensities. US stations' depths were totaled every 15 minutes, or hourly, and recorded in 0.01-inch increments. Depths were recorded hourly with 1-mm resolution at Canadian stations. One trend was consistent at all sites; the vast majority of precipitation fell at low intensities and high intensity storms contributed relatively little to the total annual depth.

These intensities, along with the total drainage area and runoff coefficient for each specific site, are translated into flow rates using the Rational Rainfall Method. Since most sites are relatively small and highly impervious, the Rational Rainfall Method is appropriate. Based on the runoff flow rates calculated for each intensity, operating rates within a proposed CDS system are determined. Performance efficiency curve determined from full scale laboratory tests on defined sediment PSDs is applied to calculate solids removal efficiency. The relative removal efficiency at each operating rate is added to produce a net annual pollutant removal efficiency estimate.

Probabilistic Rational Method

The Probabilistic Rational Method is a sizing program Contech developed to estimate a net annual sediment load reduction for a particular CDS model based on site size, site runoff coefficient, regional rainfall intensity distribution, and anticipated pollutant characteristics.

The Probabilistic Method is an extension of the Rational Method used to estimate peak discharge rates generated by storm events of varying statistical return frequencies (e.g. 2-year storm event). Under the Rational Method, an adjustment factor is used to adjust the runoff coefficient estimated for the 10-year event, correlating a known hydrologic parameter with the target storm event. The rainfall intensities vary depending on the return frequency of the storm event under consideration. In general, these two frequency dependent parameters (rainfall intensity and runoff coefficient) increase as the return frequency increases while the drainage area remains constant.

These intensities, along with the total drainage area and runoff coefficient for each specific site, are translated into flow rates using the Rational Method. Since most sites are relatively small and highly impervious, the Rational Method is appropriate. Based on the runoff flow rates calculated for each intensity, operating rates within a proposed CDS are determined. Performance efficiency curve on defined sediment PSDs is applied to calculate solids removal efficiency. The relative removal efficiency at each operating rate is added to produce a net annual pollutant removal efficiency estimate.

Treatment Flow Rate

The inlet throat area is sized to ensure that the WQQ passes through the separation chamber at a water surface elevation equal to the crest of the diversion weir. The diversion weir bypasses excessive flows around the separation chamber, thus preventing re-suspension or re-entrainment of previously captured particles.

Hydraulic Capacity

The hydraulic capacity of a CDS system is determined by the length and height of the diversion weir and by the maximum allowable head in the system. Typical configurations allow hydraulic capacities of up to ten times the treatment flow rate. The crest of the diversion weir may be lowered and the inlet throat may be widened to increase the capacity of the system at a given water surface elevation. The unit is designed to meet project specific hydraulic requirements.

Performance

Full-Scale Laboratory Test Results

A full-scale CDS system (Model CDS2020-5B) was tested at the facility of University of Florida, Gainesville, FL. This CDS unit was evaluated under controlled laboratory conditions of influent flow rate and addition of sediment.

Two different gradations of silica sand material (UF Sediment & OK-110) were used in the CDS performance evaluation. The particle size distributions (PSDs) of the test materials were analyzed using standard method "Gradation ASTM D-422 "Standard Test Method for Particle-Size Analysis of Soils" by a certified laboratory.

UF Sediment is a mixture of three different products produced by the U.S. Silica Company: "Sil-Co-Sil 106", "#1 DRY" and "20/40 Oil Frac". Particle size distribution analysis shows that the UF Sediment has a very fine gradation (d50 = 20 to 30 μm) covering a wide size range (Coefficient of Uniformity, C averaged at 10.6). In comparison with the hypothetical TSS gradation specified in the NJDEP (New Jersey Department of Environmental Protection) and NJCAT (New Jersey Corporation for Advanced Technology) protocol for lab testing, the UF Sediment covers a similar range of particle size but with a finer d50 (d50 for NJDEP is approximately 50 μm) (NJDEP, 2003).

The OK-110 silica sand is a commercial product of U.S. Silica Sand. The particle size distribution analysis of this material, also included in Figure 1, shows that 99.9% of the OK-110 sand is finer than 250 microns, with a mean particle size (d50) of 106 microns. The PSDs for the test material are shown in Figure 1.

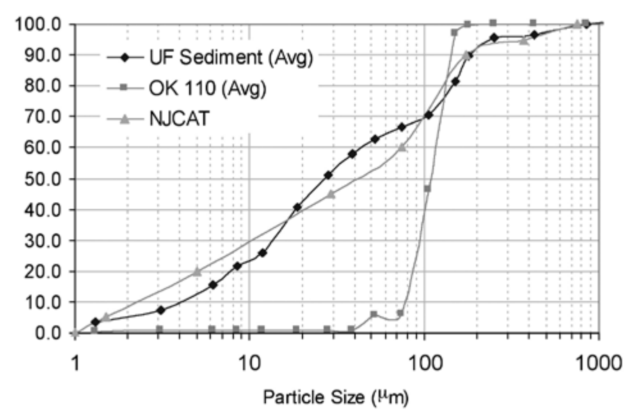


Figure 1. Particle size distributions

Tests were conducted to quantify the performance of a specific CDS unit (1.1 cfs (31.3-L/s) design capacity) at various flow rates, ranging from 1% up to 125% of the treatment design capacity of the unit, using the 2400 micron screen. All tests were conducted with controlled influent concentrations of approximately 200 mg/L. Effluent samples were taken at equal time intervals across the entire duration of each test run. These samples were then processed with a Dekaport Cone sample splitter to obtain representative sub-samples for Suspended Sediment Concentration (SSC) testing using ASTM D3977-97 "Standard Test Methods for Determining Sediment Concentration in Water Samples", and particle size distribution analysis.

Results and Modeling

Based on the data from the University of Florida, a performance model was developed for the CDS system. A regression analysis was used to develop a fitting curve representative of the scattered data points at various design flow rates. This model, which demonstrated good agreement with the laboratory data, can then be used to predict CDS system performance with respect to SSC removal for any particle size gradation, assuming the particles are inorganic sandy-silt. Figure 2 shows CDS predictive performance for two typical particle size gradations (NJCAT gradation and OK-110 sand) as a function of operating rate.

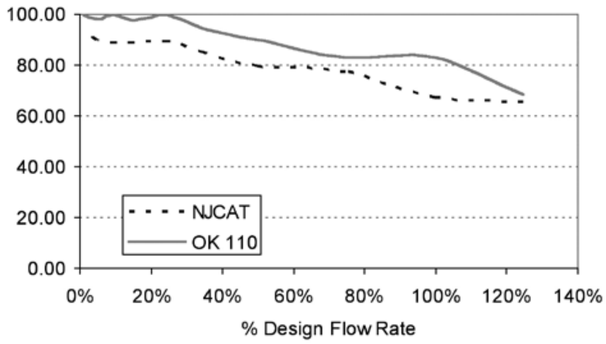


Figure 2. CDS stormwater treatment predictive performance for various particle gradations as a function of operating rate.

Many regulatory jurisdictions set a performance standard for hydrodynamic devices by stating that the devices shall be capable of achieving an 80% removal efficiency for particles having a mean particle size (d50) of 125 microns (e.g. Washington State Department of Ecology — WASDOE - 2008). The model can be used to calculate the expected performance of such a PSD (shown in Figure 3). The model indicates (Figure 4) that the CDS system with 2400 micron screen achieves approximately 80% removal at the design (100%) flow rate, for this particle size distribution (d50 = 125 μm).

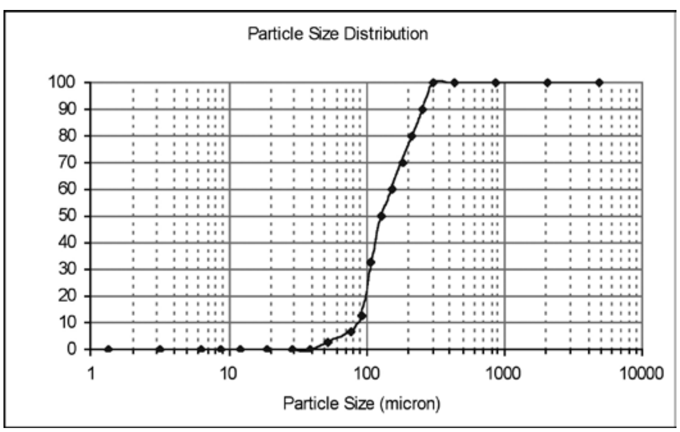


Figure 3. WASDOE PSD

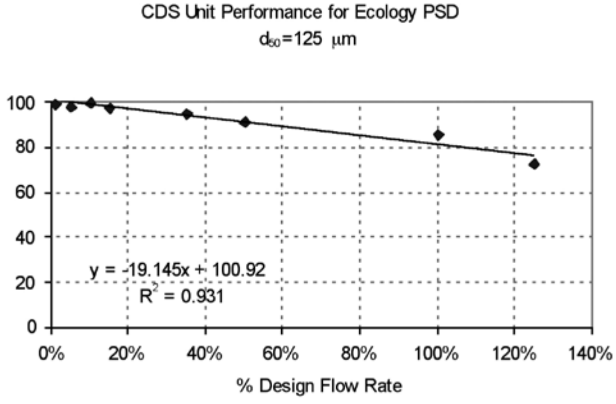


Figure 4. Modeled performance for WASDOE PSD.

Maintenance

The CDS system should be inspected at regular intervals and maintained when necessary to ensure optimum performance. The rate at which the system collects pollutants will depend more heavily on site activities than the size of the unit. For example, unstable soils or heavy winter sanding will cause the grit chamber to fill more quickly but regular sweeping of paved surfaces will slow accumulation.

Inspection

Inspection is the key to effective maintenance and is easily performed. Pollutant transport and deposition may vary from year to year and regular inspections will help ensure that the system is cleaned out at the appropriate time. At a minimum, inspections should be performed twice per year (e.g. spring and fall) however more frequent inspections may be necessary in climates where winter sanding operations may lead to rapid accumulations, or in equipment washdown areas. Installations should also be inspected more frequently where excessive amounts of trash are expected.

The visual inspection should ascertain that the system components are in working order and that there are no blockages or obstructions in the inlet and separation screen. The inspection should also quantify the accumulation of hydrocarbons, trash, and sediment in the system. Measuring pollutant accumulation can be done with a calibrated dipstick, tape measure or other measuring instrument. If absorbent material is used for enhanced removal of hydrocarbons, the level of discoloration of the sorbent material should also be identified

during inspection. It is useful and often required as part of an operating permit to keep a record of each inspection. A simple form for doing so is provided.

Access to the CDS unit is typically achieved through two manhole access covers. One opening allows for inspection and cleanout of the separation chamber (cylinder and screen) and isolated sump. The other allows for inspection and cleanout of sediment captured and retained outside the screen. For deep units, a single manhole access point would allows both sump cleanout and access outside the screen.

The CDS system should be cleaned when the level of sediment has reached 75% of capacity in the isolated sump or when an appreciable level of hydrocarbons and trash has accumulated. If absorbent material is used, it should be replaced when significant discoloration has occurred. Performance will not be impacted until 100% of the sump capacity is exceeded however it is recommended that the system be cleaned prior to that for easier removal of sediment. The level of sediment is easily determined by measuring from finished grade down to the top of the sediment pile. To avoid underestimating the level of sediment in the chamber, the measuring device must be lowered to the top of the sediment pile carefully. Particles at the top of the pile typically offer less resistance to the end of the rod than consolidated particles toward the bottom of the pile. Once this measurement is recorded, it should be compared to the as-built drawing for the unit to determine weather the height of the sediment pile off the bottom of the sump floor exceeds 75% of the total height of isolated sump.

Cleaning

Cleaning of a CDS systems should be done during dry weather conditions when no flow is entering the system. The use of a vacuum truck is generally the most effective and convenient method of removing pollutants from the system. Simply remove the manhole covers and insert the vacuum hose into the sump. The system should be completely drained down and the sump fully evacuated of sediment. The area outside the screen should also be cleaned out if pollutant build-up exists in this area.

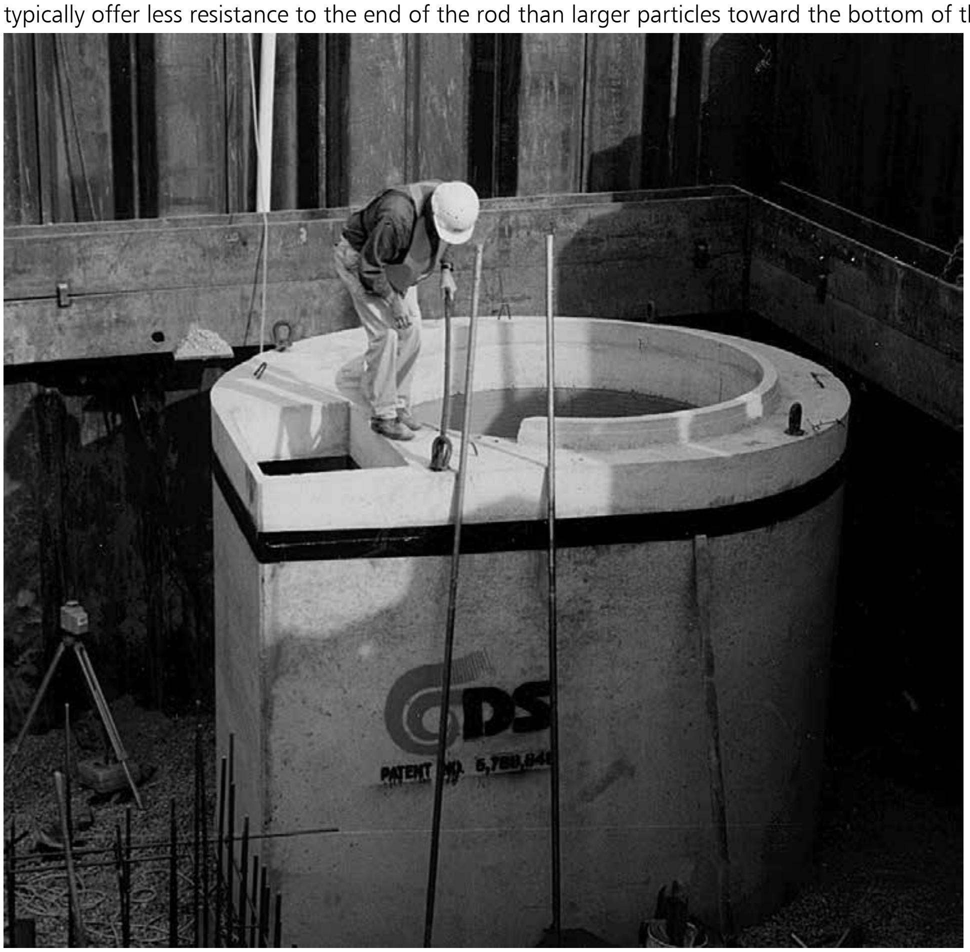
In installations where the risk of petroleum spills is small, liquid contaminants may not accumulate as quickly as sediment. However, the system should be cleaned out immediately in the event of an oil or gasoline spill. Motor oil and other hydrocarbons that accumulate on a more routine basis should be removed when an appreciable layer has been captured. To remove these pollutants, it may be preferable to use absorbent pads since they are usually less expensive to dispose than the oil/water emulsion that may be created by vacuuming the oily layer. Trash and debris can be netted out to separate it from the other pollutants. The screen should be cleaned to ensure it is free of trash and debris.

Manhole covers should be securely seated following cleaning activities to prevent leakage of runoff into the system from above and also to ensure that proper safety precautions have been followed. Confined space entry procedures need to be followed if physical access is required. Disposal of all material removed from the CDS system should be done in accordance with local regulations. In many jurisdictions, disposal of the sediments may be handled in the same manner as the disposal of sediments removed from catch basins or deep sump manholes. Check your local regulations for specific requirements on disposal.

CDS Model	Diameter		Distance from Water Surface to Top of Sediment Pile		Sediment Storage Capacity	
	ft	m	ft	m	y^3	m^3
CDS1515	3	0.9	3.0	0.9	0.5	0.4
CDS2015	4	1.2	3.0	0.9	0.9	0.7
CDS2015	5	1.5	3.0	0.9	1.3	1.0
CDS2020	5	1.5	3.5	1.1	1.3	1.0
CDS2025	5	1.5	4.0	1.2	1.3	1.0
CDS3020	6	1.8	4.0	1.2	2.1	1.6
CDS3025	6	1.8	4.0	1.2	2.1	1.6
CDS3030	6	1.8	4.6	1.4	2.1	1.6
CDS3035	6	1.8	5.0	1.5	2.1	1.6
CDS4030	8	2.4	4.6	1.4	5.6	4.3
CDS4040	8	2.4	5.7	1.7	5.6	4.3
CDS4045	8	2.4	6.2	1.9	5.6	4.3
CDS5640	10	3.0	6.3	1.9	8.7	6.7
CDS5653	10	3.0	7.7	2.3	8.7	6.7
CDS5668	10	3.0	9.3	2.8	8.7	6.7
CDS5678	10	3.0	10.3	3.1	8.7	6.7

Table 1: CDS Maintenance Indicators and Sediment Storage Capacities

Note: To avoid underestimating the volume of sediment in the chamber, carefully lower the measuring device to the top of the sediment pile. Finer silty particles at the top of the pile may be more difficult to feel with a measuring stick. These finer particles typically offer less resistance to the end of the rod than larger particles toward the bottom of the pile.



CDS Inspection & Maintenance Log

CDS Model: ______________________________ Location: ______________________________

Date	Water depth to sediment[1]	Floatable Layer Thickness[2]	Describe Maintenance Performed	Maintenance Personnel	Comments

1. The water depth to sediment is determined by taking two measurements with a stadia rod: one measurement from the manhole opening to the top of the sediment pile and the other from the manhole opening to the water surface. If the difference between these measurements is less than the values listed in table 1 the system should be cleaned out. **Note: to avoid underestimating the volume of sediment in the chamber, the measuring device must be carefully lowered to the top of the sediment pile**.

2. For optimum performance, the system should be cleaned out when the floating hydrocarbon layer accumulates to an appreciable thickness. In the event of an oil spill, the system should be cleaned immediately.

SUPPORT

- Drawings and specifications are available at www.ContechES.com.
- Site-specific design support is available from our engineers.

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cds_manual 3/17 PDF

APPENDIX E

RAIN GARDEN DESIGN CALCULATIONS

WATER QUALITY CALCULATIONS, WQv:

RG-1 (See Figure 9 in the Figures section of this report)
Water Quality Volume Calculation, WQv:

$$WQv = \frac{P \times Rv \times A}{12}$$

Where: P = 90% Rainfall Event Number (See Figure 7 in this report) = 1.5
I = Impervious Cover (Percent)
Rv = 0.05 + 0.009 (I) ; Min Rv = 0.2
A = Site Area in acres (redevelopment area)

I = 73.3 %
Rv = 0.7097
A = 0.080 ac

WQv = 0.01 acre-feet or 309 cubic feet

RG-2 (See Figure 9 in the Figures section of this report)
Water Quality Volume Calculation, WQv:

$$WQv = \frac{P \times Rv \times A}{12}$$

Where: P = 90% Rainfall Event Number (See Figure 7 in this report) = 1.5
I = Impervious Cover (Percent)
Rv = 0.05 + 0.009 (I) ; Min Rv = 0.2
A = Site Area in acres (redevelopment area)

I = 53.3 %
Rv = 0.5297
A = 0.150 ac

WQv = 0.01 acre-feet or 433 cubic feet

RG-3 (See Figure 9 in the Figures section of this report)
Water Quality Volume Calculation, WQv:

$$WQv = \frac{P \times Rv \times A}{12}$$

Where: P = 90% Rainfall Event Number (See Figure 7 in this report) = 1.5
I = Impervious Cover (Percent)
Rv = 0.05 + 0.009 (I) ; Min Rv = 0.2
A = Site Area in acres (redevelopment area)

I = 59.7 %
Rv = 0.5873
A = 0.041 ac

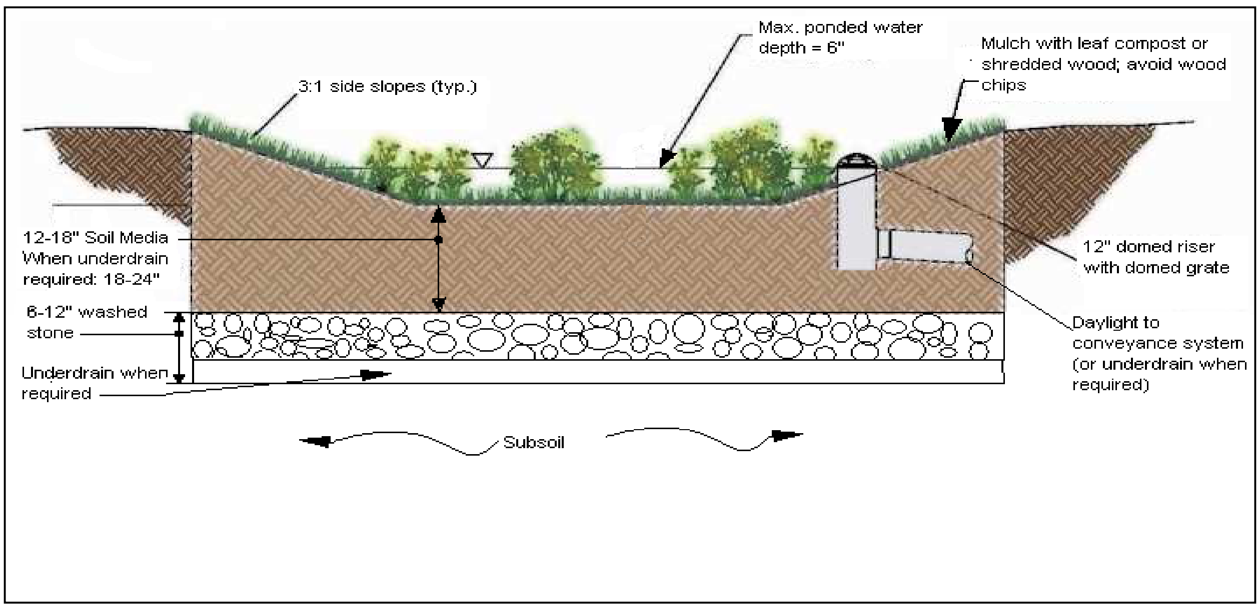
WQv = 0.00 acre-feet or 131 cubic feet

	Surface Area	Vsm 24" Soil Media	Vdl 12" Washed Stone	Ponding Depth (6")	Ponding Area	Vponding	WQv
RG-1	228	91	36	0.5	376	188	315
RG-2	329	132	53	0.5	487	244	428
RG-3	91	36	15	0.5	158	79	130
Porosity (soil) = 0.20						**Proposed WQv**	**873**
Porosity (stone) = 0.40						**Required WQv**	**9,683**
						% Treatment	**9.0**

5.3.7 Rain Gardens

Description: The rain garden is a stormwater management practice intended to manage and treat small volumes of stormwater runoff from impervious surfaces using a conditioned planting soil bed and planting materials to filter runoff stored within a shallow depression. This practice is most commonly used in residential land use settings. The method is a variation on bioretention and combines physical filtering and adsorption with bio-geochemical processes to remove pollutants. Rain gardens are a simplified version of bioretention and are designed as a passive filter system without an underdrain connected to the storm drain system. A gravel drainage layer is typically used for dispersed infiltration. Rainwater is directed into the garden from residential roof drains, driveways and other hard surfaces. The runoff temporarily ponds in the garden and seeps into the soil over one to two days. The system consists of an inflow component, a shallow ponding area over a planted soil bed, mulch layer, gravel filter chamber, attractive shrubs, grasses and flowers, and an overflow mechanism to convey larger rain events to the storm drain system or receiving waters (see Figures 5.42 and 5.43).

Figure 5.41 Profile of a typical rain garden



APPENDIX F

STORM PIPE CONVEYANCE CALCULATIONS

RUNOFF COEFFICIENT CALCULATIONS

Nyack Hospital - Parking Structure
Village of Nyack, NY
DATE: 03/17/2020

RUNOFF COEFFICIENT TABLE- ONSITE								
100-SERIES								
DRAINAGE AREA	**TOTAL AREA (SF)**	**TOTAL AREA (AC)**	**PERVIOUS AREA (SF)**	**GRASS AREA (AC)**	**IMPERVIOUS AREA (AC)**	**GRASS (0.30)**	**IMPERVIOUS (0.99)**	**C VALUE**
EX CB-101	16,317	**0.37**	6,125	0.14	0.23	0.04	0.23	**0.73**
CB-101	980	**0.02**	180	0.00	0.02	0.00	0.02	**0.86**
CB-102	6,326	**0.15**	1,146	0.03	0.12	0.01	0.12	**0.87**
CB-103	6,906	**0.16**	216	0.00	0.15	0.00	0.15	**0.97**
CB-104	3,206	**0.07**	418	0.01	0.06	0.00	0.06	**0.90**
CB-105	10,095	**0.23**	1,895	0.04	0.19	0.01	0.19	**0.86**
WQ-101	6,569	**0.15**	1,021	0.02	0.13	0.01	0.13	**0.88**
CB-106	7,578	**0.17**	1,281	0.03	0.14	0.01	0.14	**0.87**
YD-101	487	**0.01**	59	0.00	0.01	0.00	0.01	**0.91**
ROOF-101	15,063	**0.35**	0	0.00	0.35	0.00	0.34	**0.99**
ROOF-102	14,275	**0.33**	0	0.00	0.33	0.00	0.32	**0.99**
200-SERIES								
EX MH-201	44,143	**1.01**	5,685	0.13	0.88	0.04	0.87	**0.90**
EX MH-202	12,650	**0.29**	885	0.02	0.27	0.01	0.27	**0.94**
CB-201	14,011	**0.32**	2,722	0.06	0.26	0.02	0.26	**0.86**
CB-202	2,557	**0.06**	51	0.00	0.06	0.00	0.06	**0.98**
CB-203	6,198	**0.14**	427	0.01	0.13	0.00	0.13	**0.94**
CB-204	1,442	**0.03**	250	0.01	0.03	0.00	0.03	**0.87**
CB-205	1,853	**0.04**	913	0.02	0.02	0.01	0.02	**0.65**
CB-206	2,047	**0.05**	649	0.01	0.03	0.00	0.03	**0.77**

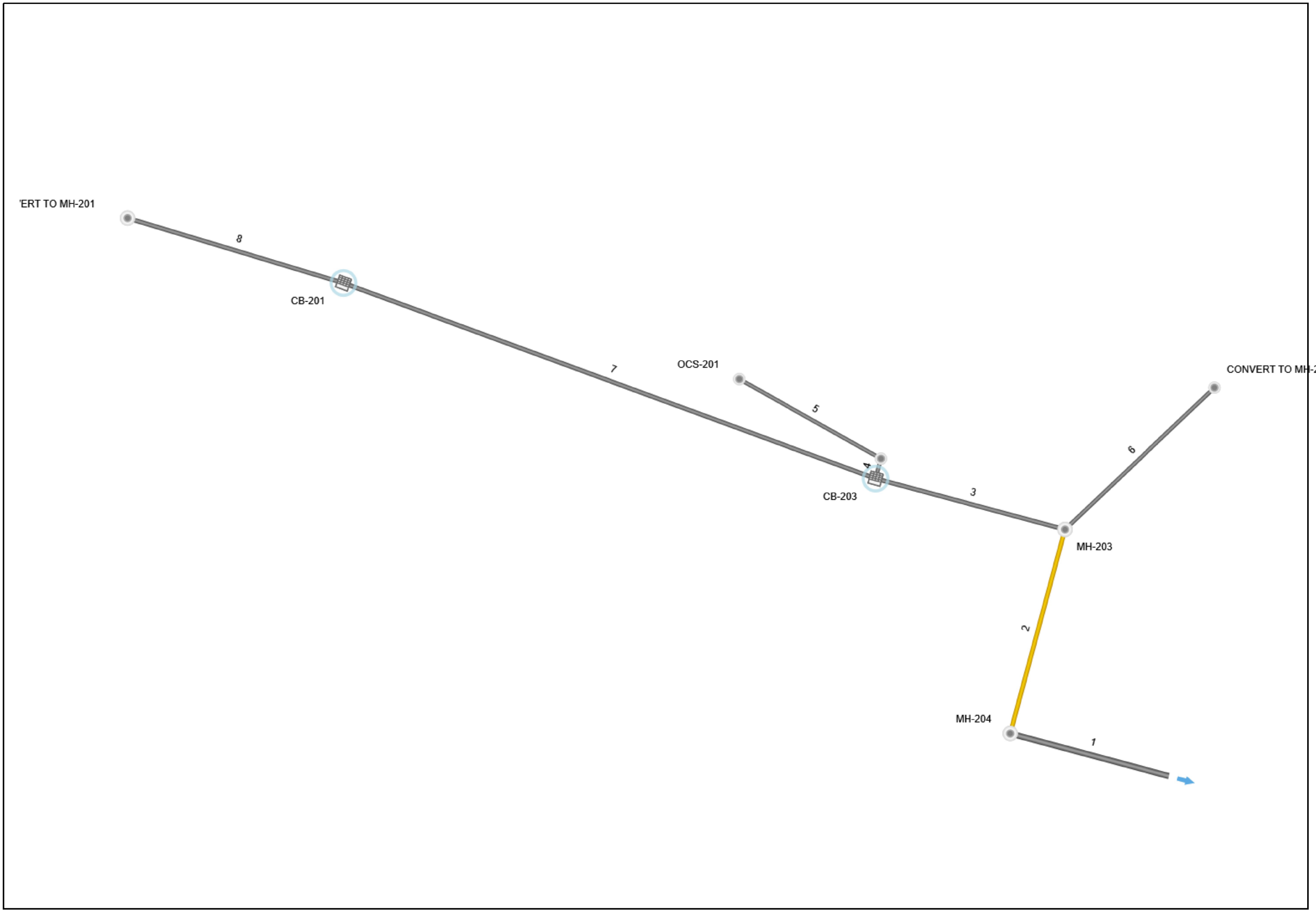
25-YEAR STORM
CONVEYANCE ANALYSIS

Plan View

Stormwater Studio 2019 v 3.0.0.3

Project Name: Nyack Hospital - Parking Structure WSHD A

03-17-2020



Project File: Nyack Hospital - Parking Structure WSHD A.sws

Storm Sewer Tabulation

Stormwater Studio 2019 v 3.0.0.3

Project Name: Nyack Hospital - Parking Structure WSHD A

03-17-2020

Line ID	Length	Drng Area		Rational	C x A		Tc		Intensity	Total Q	Capacity	Velocity	Line		Invert Elev		HGL Elev		Surface Elev		Line No
		Incr	Total		Incr	Total	Inlet	Syst					Size	Slope	Dn	Up	Dn	Up	Dn	Up	
	(ft)	(ac)	(ac)	(C)			(min)	(min)	(in/hr)	(cfs)	(cfs)	(ft/s)	(in)	(%)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	
MH-203 - EX CB-203	53.29	0.00	1.76	0.00	0.00	1.59	0.0	7.23	7.52	11.95	21.23	4.04	24	0.75	187.88	188.28	189.88	189.95	190.55	191.95	1
MH-202 - MH-203	68.42	0.00	1.76	0.00	0.00	1.59	0.0	7.06	7.61	12.09	11.38	6.84	18	1.00	188.31	188.99	190.03	190.81	191.95	194.96	2
CB-203 - MH-202	63.61	0.14	1.47	0.94	0.13	1.32	6.0	6.86	7.71	10.14	11.38	5.74	18	1.00	188.99	189.63	191.77	192.27	194.96	197.57	3
CO-201 - CB-203	6.69	0.00	0.00	0.00	0.00	0.00	0.0	0.29	15.35	0.00	2.37	0.00	10	1.00	193.32	193.39	193.32	193.39	197.57	197.80	4
OCS-201 - CO-201	52.70	0.00	0.00	0.00	0.00	0.00	0.0	0.00	16.20	0.00	2.37	0.00	10	1.00	193.39	193.92	193.39	193.92	197.80	198.75	5
CONVERT TO MH-201 - MH-202	66.82	0.29	0.29	0.94	0.27	0.27	6.0	6.00	8.19	2.23	7.00	4.28	15	1.00	192.18	192.85	192.69	193.45	194.96	195.88	6
CB-201 - CB-203	183.87	0.32	1.33	0.86	0.28	1.18	6.0	6.29	8.02	9.49	11.38	5.37	18	1.00	189.63	191.47	192.65	193.93	197.57	200.49	7
EX CB-201 - CB-201	73.12	1.01	1.01	0.90	0.91	0.91	6.0	6.00	8.19	7.44	11.38	4.21	18	1.00	191.47	192.20	194.39	194.71	200.49	202.33	8

Notes: IDF File = Nyack.IDF, Return Period = 25-yrs.

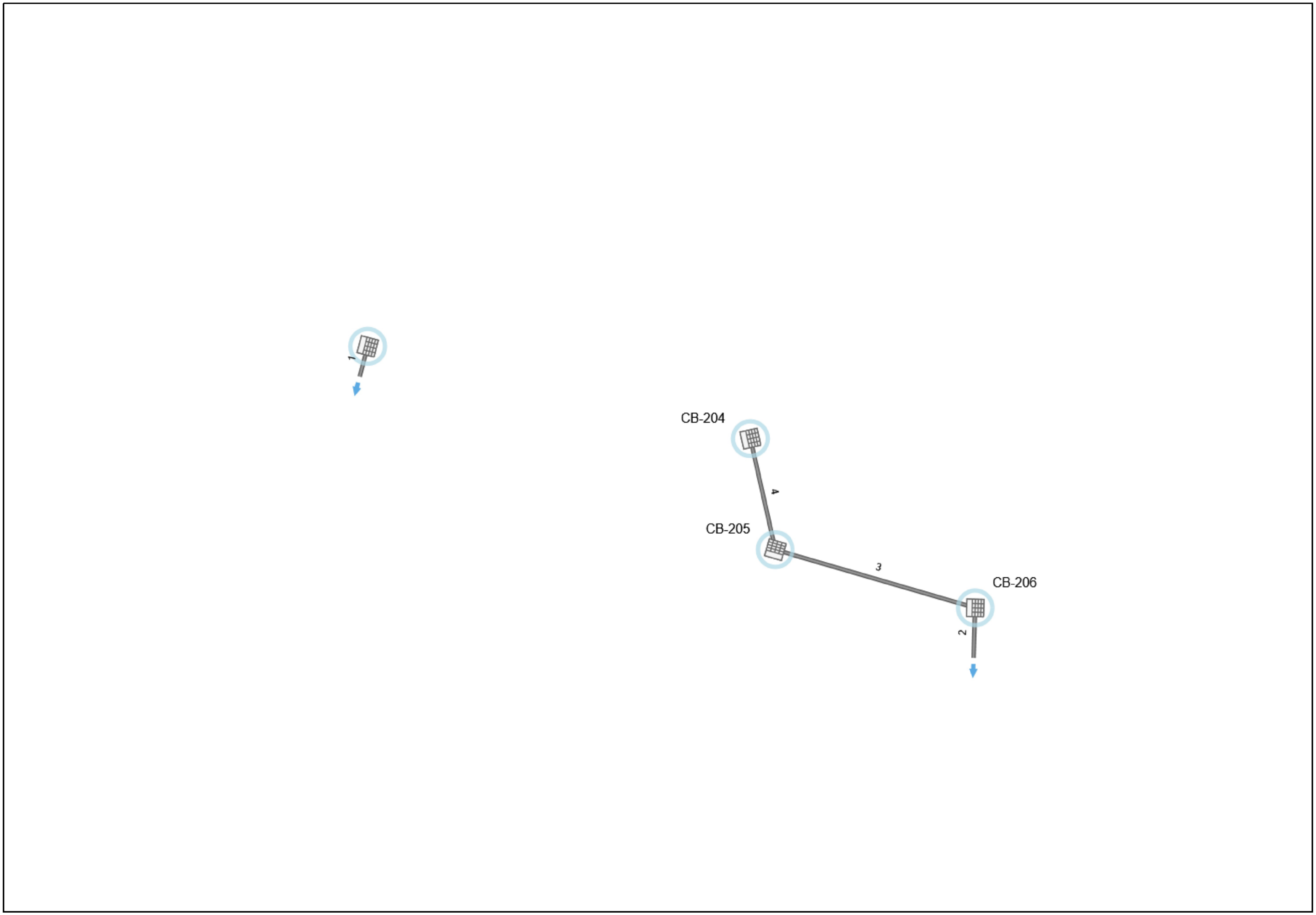
Project File: Nyack Hospital - Parking Structure WSHD A.sws

Plan View

Stormwater Studio 2019 v 3.0.0.3

Project Name: Nyack Hospital - Parking Structure Rain Garden Inflow

03-17-2020



Project File: Nyack Hospital - Parking Structure WSHD A - Raingarden Inflow.sws

Storm Sewer Tabulation

Stormwater Studio 2019 v 3.0.0.3

Project Name: Nyack Hospital - Parking Structure Rain Garden Inflow

03-17-2020

Line ID	Length (ft)	Drng Area Incr (ac)	Drng Area Total (ac)	Rational (C)	C x A Incr	C x A Total	Tc Inlet (min)	Tc Syst (min)	Intensity (in/hr)	Total Q (cfs)	Capacity (cfs)	Velocity (ft/s)	Line Size (in)	Line Slope (%)	Invert Elev Dn (ft)	Invert Elev Up (ft)	HGL Elev Dn (ft)	HGL Elev Up (ft)	Surface Elev Dn (ft)	Surface Elev Up (ft)	Line No
CB-202 - END-SECTION-201	7.20	0.06	0.06	0.98	0.06	0.06	6.0	6.00	8.19	0.48	3.86	0.62	12	1.00	198.75	198.82	199.75	199.75	199.86	200.53	1
CB-206 - END-SECTION-202	11.50	0.05	0.12	0.77	0.04	0.09	6.0	8.48	6.97	0.63	2.73	0.81	12	0.50	190.80	190.86	191.80	191.80	191.91	193.23	2
CB-205 - CB-206	48.02	0.04	0.07	0.65	0.03	0.05	6.0	7.11	7.58	0.39	2.73	0.58	12	0.50	190.86	191.10	191.81	191.82	193.23	196.22	3
CB-204 - CB-205	26.18	0.03	0.03	0.87	0.03	0.03	6.0	6.00	8.19	0.21	2.73	0.39	12	0.50	191.10	191.23	191.83	191.83	196.22	197.25	4

Notes: IDF File = Nyack.IDF, Return Period = 25-yrs.

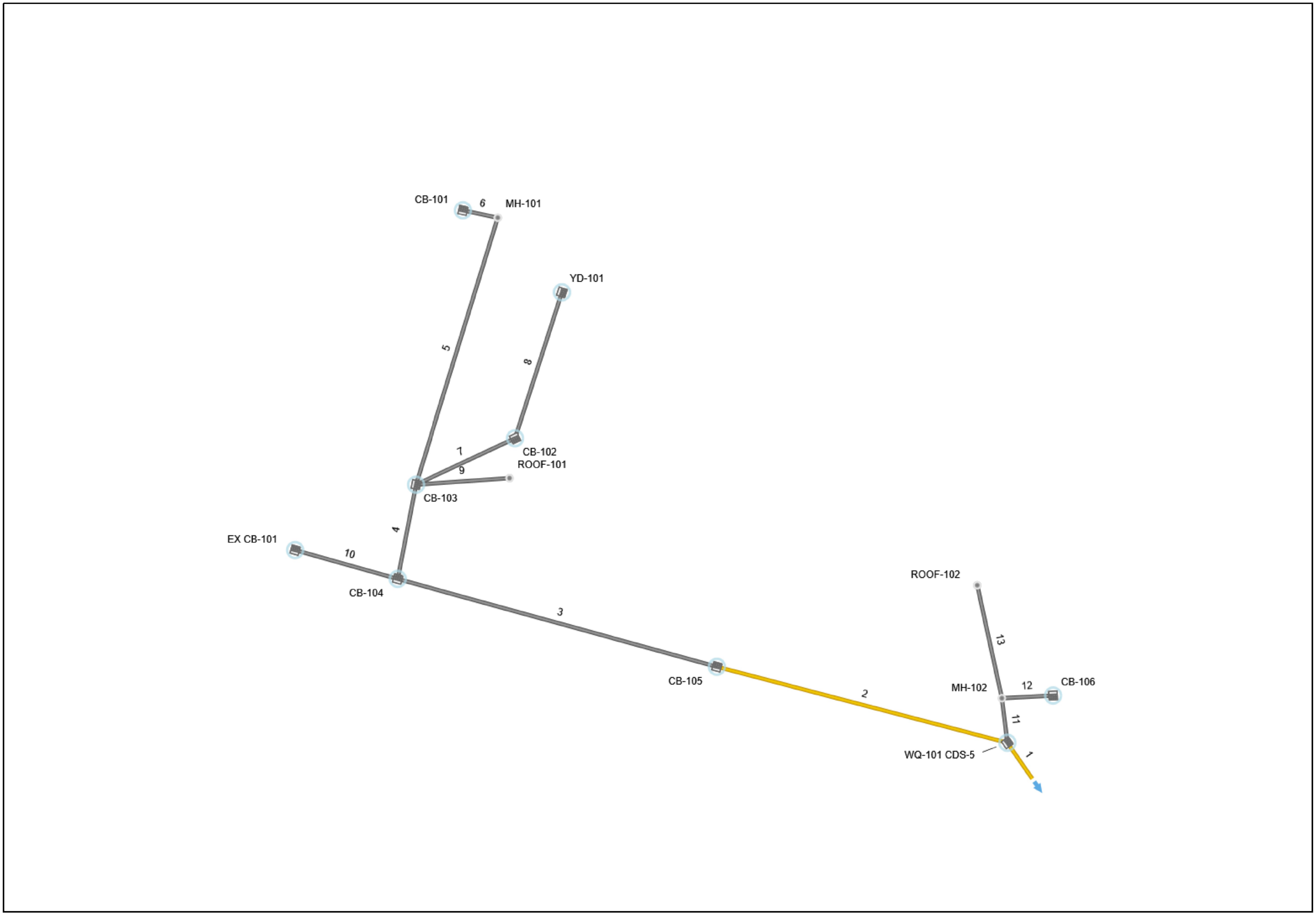
Project File: Nyack Hospital - Parking Structure WSHD A - Raingarden Inflow.sws

Plan View

Stormwater Studio 2019 v 3.0.0.3

Project Name: Nyack Hospital - Parking Structure (WSHD B)

03-17-2020



Project File: Nyack Hospital - Parking Structure WSHD B.sws

Storm Sewer Tabulation

Stormwater Studio 2019 v 3.0.0.3

Project Name: Nyack Hospital - Parking Structure (WSHD B)

03-17-2020

Line ID	Length	Drng Area		Rational	C x A		Tc		Intensity	Total Q	Capacity	Velocity	Line		Invert Elev		HGL Elev		Surface Elev		Line No
		Incr	Total		Incr	Total	Inlet	Syst					Size	Slope	Dn	Up	Dn	Up	Dn	Up	
	(ft)	(ac)	(ac)	(C)			(min)	(min)	(in/hr)	(cfs)	(cfs)	(ft/s)	(in)	(%)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	
WQ-101 CDS-5 - EX CB-102	21.94	0.15	2.01	0.88	0.13	1.80	6.0	9.47	6.59	11.84	8.32	9.65	15	1.41	182.34	182.65	183.59	184.22	185.12	187.10	1
CB-105 - WQ-101 CDS-5	150.69	0.23	1.36	0.86	0.20	1.19	6.0	9.07	6.74	8.01	7.00	6.53	15	1.00	182.65	184.16	185.58	187.56	187.10	191.27	2
CB-104 - CB-105	166.12	0.07	1.13	0.90	0.06	0.99	6.0	8.56	6.94	6.88	7.00	5.60	15	1.00	184.17	185.83	188.13	189.73	191.27	195.81	3
CB-103 - CB-104	48.12	0.16	0.69	0.97	0.16	0.66	6.0	8.40	7.00	4.61	7.00	5.13	15	1.00	190.93	191.41	191.79	192.27	195.81	196.68	4
MH-101 - CB-103	139.94	0.00	0.02	0.00	0.00	0.02	0.0	6.17	8.09	0.14	3.86	2.02	12	1.00	193.00	194.40	193.13	194.56	196.68	201.35	5
CB-101 - MH-101	17.81	0.02	0.02	0.86	0.02	0.02	6.0	6.00	8.19	0.14	3.86	1.75	12	1.00	198.77	198.95	198.93	199.11	201.35	201.95	6
CB-102 - CB-103	54.89	0.15	0.16	0.87	0.13	0.14	6.0	7.77	7.27	1.01	3.86	1.47	12	1.00	191.41	191.96	192.66	192.69	196.68	196.45	7
YD-101 - CB-102	76.79	0.01	0.01	0.91	0.01	0.01	6.0	6.00	8.19	0.07	3.86	0.68	12	1.00	191.96	192.73	192.77	192.86	196.45	196.36	8
ROOF-101 - CB-103	47.07	0.35	0.35	0.99	0.35	0.35	6.0	6.00	8.19	2.84	3.86	4.16	12	1.00	191.53	192.00	192.56	192.72	196.68	196.42	9
EX CB-101 - CB-104	53.39	0.37	0.37	0.73	0.27	0.27	6.0	6.00	8.19	2.21	7.00	1.80	15	1.00	185.83	186.36	190.32	190.37	195.81	197.36	10
MH-102 - WQ-101 CDS-5	22.50	0.00	0.50	0.00	0.00	0.47	0.0	6.43	7.94	3.77	7.00	3.07	15	1.00	183.88	184.10	185.89	185.96	187.10	188.31	11
CB-107 - MH-102	25.67	0.17	0.17	0.87	0.15	0.15	6.0	6.00	8.19	1.21	7.00	0.99	15	1.00	184.10	184.36	186.16	186.17	188.31	187.36	12
ROOF-102 - MH-102	57.93	0.33	0.33	0.99	0.33	0.33	6.0	6.00	8.19	2.67	3.86	3.41	12	1.00	184.10	184.68	186.06	186.34	188.31	190.97	13

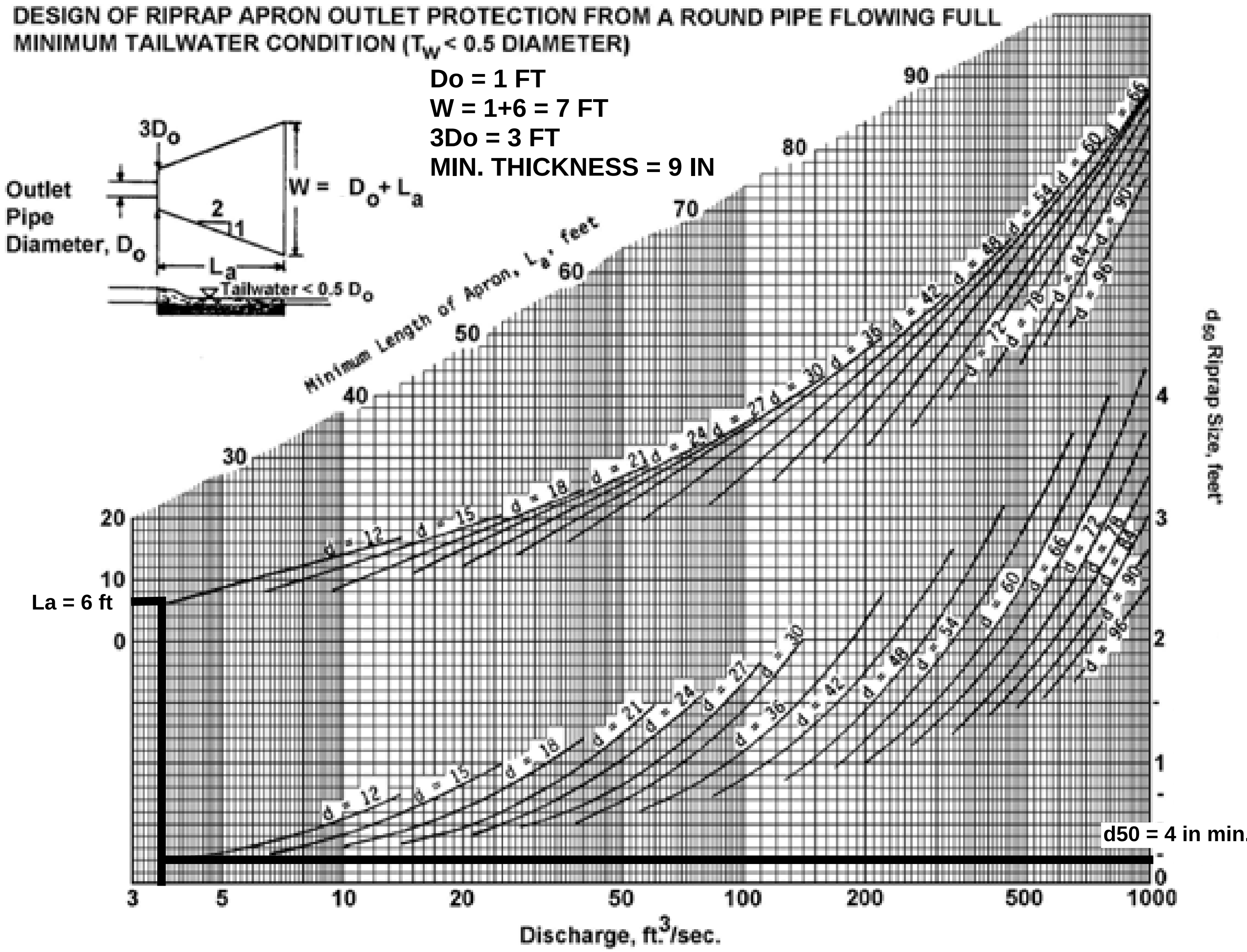
Notes: IDF File = Nyack.IDF, Return Period = 25-yrs.

Project File: Nyack Hospital - Parking Structure WSHD B.sws

APPENDIX G

RIP-RAP PROTECTION CALCULATIONS

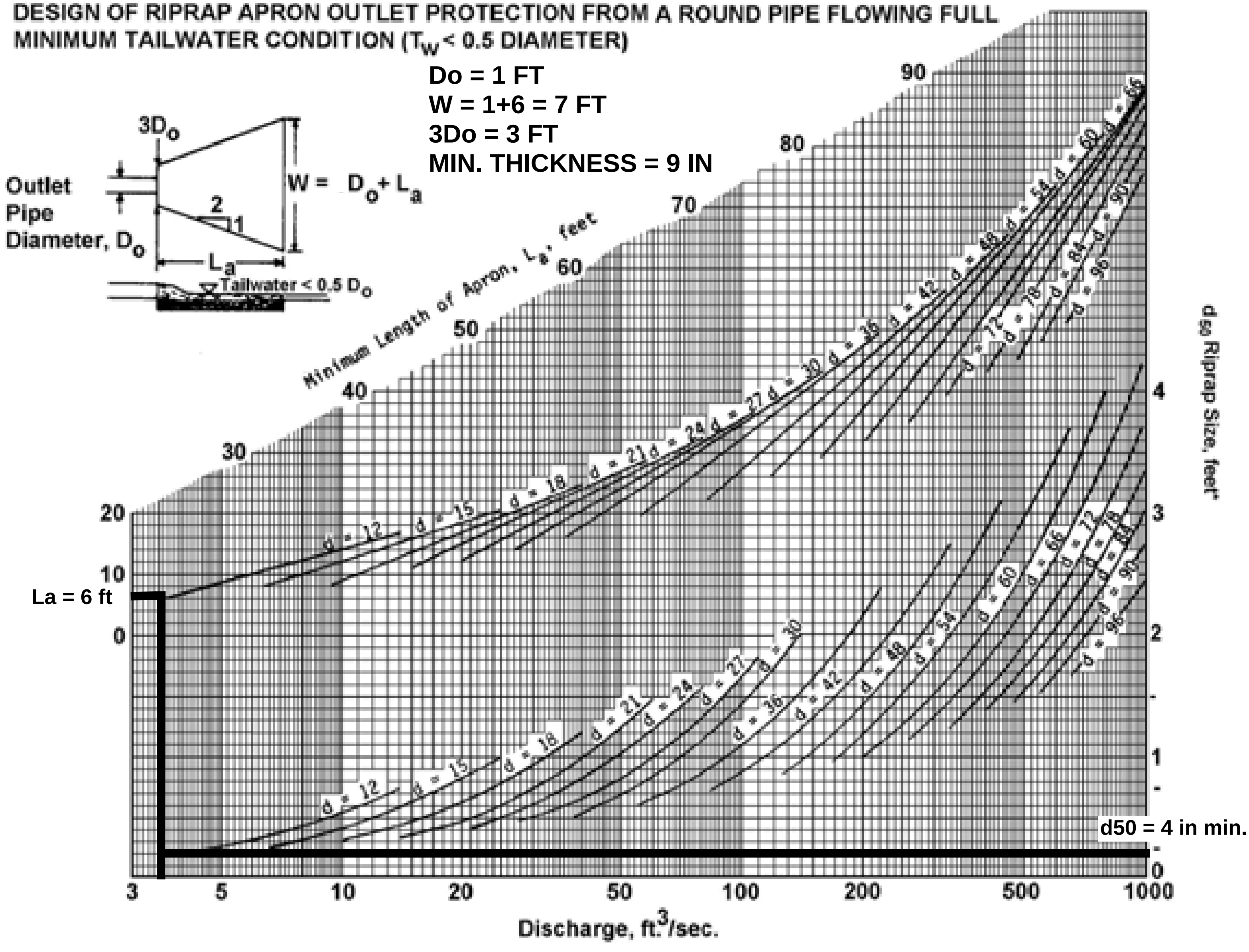
Figure 3.16
Outlet Protection Design—Minimum Tailwater Condition Chart
(Design of Outlet Protection from a Round Pipe Flowing Full, Minimum Tailwater Condition: $T_w < 0.5D_o$) (USDA - NRCS)



* For discharge velocities exceeding Maximum Allowable for Riprap indicated, increase d_{50} stone size and/or provide velocity reduction device.

RG-1 DISCHARGE (d=12")
25-YEAR STORM = 0.48 CFS
USE MIN. ON CURVE

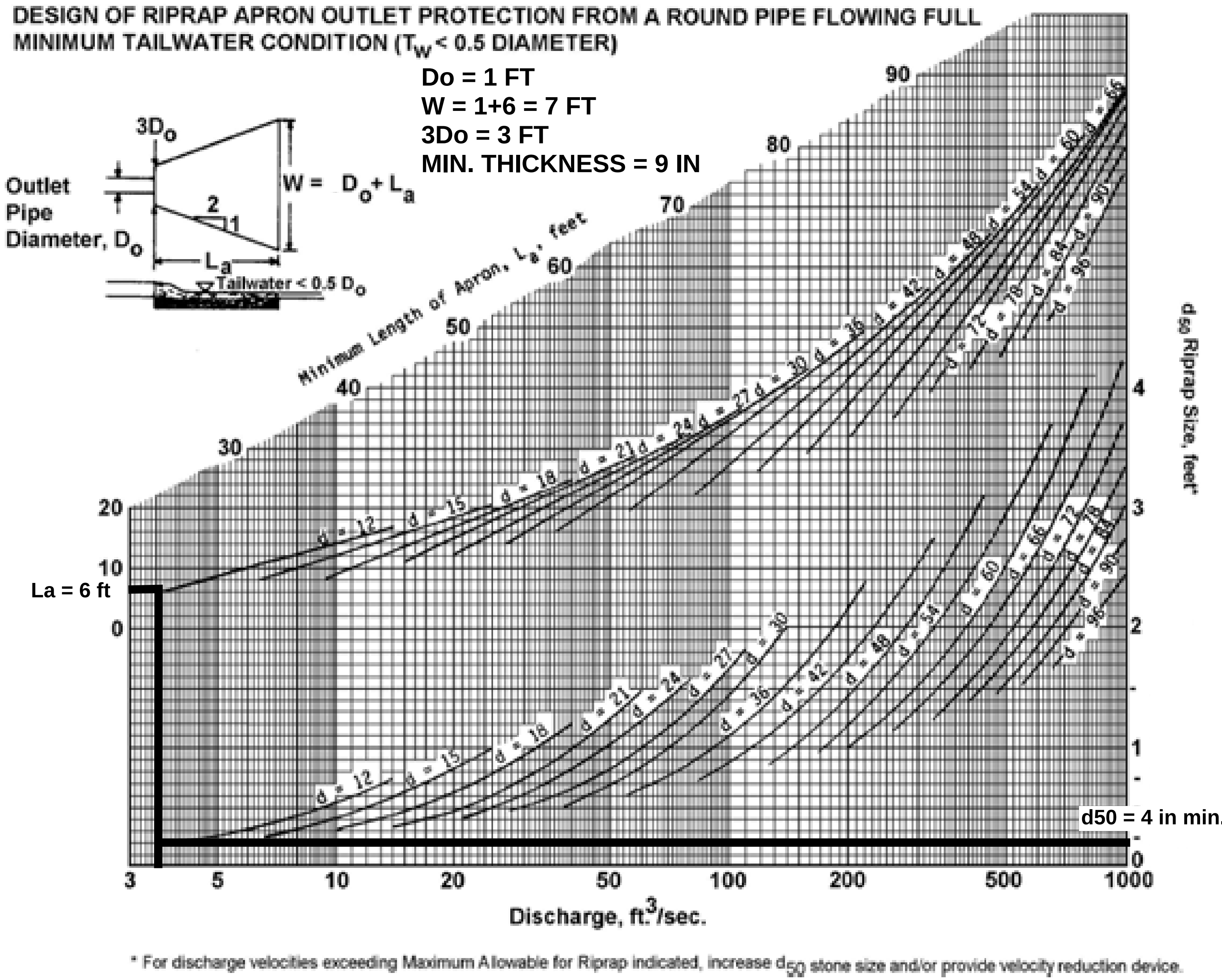
Figure 3.16
Outlet Protection Design—Minimum Tailwater Condition Chart (Design of Outlet Protection from a Round Pipe Flowing Full, Minimum Tailwater Condition: $T_w < 0.5D_o$) (USDA - NRCS)



* For discharge velocities exceeding Maximum Allowable for Riprap indicated, increase d_{50} stone size and/or provide velocity reduction device.

RG-2 DISCHARGE (d=12")
25-YEAR STORM = 0.63 CFS
USE MIN. ON CURVE

Figure 3.16
Outlet Protection Design—Minimum Tailwater Condition Chart (Design of Outlet Protection from a Round Pipe Flowing Full, Minimum Tailwater Condition: $T_w < 0.5D_o$) (USDA - NRCS)



* For discharge velocities exceeding Maximum Allowable for Riprap indicated, increase d_{50} stone size and/or provide velocity reduction device.

RG-3 DISCHARGE (Curb Cut=12")
25-YEAR STORM = (0.99)(8.86)(0.041) = 0.36 CFS
USE MIN. ON CURVE