STORMWATER MANAGEMENT REPORT

Prepared for:

Artis Senior Living, LLC

Proposed Senior Living Facility
Block 71, Lot 37.01
700 Middlesex Avenue (C.R. 501)
Borough of Metuchen
Middlesex County, NJ

Prepared by:

245 Main Street, Suite 110
Chester, NJ 07930
(908) 879-9229

Daniel T. Sehnal, PE
NJ Professional Engineer License #53572

October 2020
DEC# 2621-99-003

TABLE OF CONTENTS

APPENDIX

I. INTRODUCTION

The intent of this study is to analyze the stormwater drainage conditions that will occur as a result of the proposed senior living facility for the site located at 700 Middlesex Avenue in the Borough of Metuchen, Middlesex County, New Jersey and specifically identified as Block 71, Lot 37.01 on the Borough of Metuchen Tax Maps. The site is currently undeveloped consisting of open space; however, it was previously developed as an industrial manufacturing building where the majority of the subject site was developed with associated buildings and other forms of impervious coverage. This buildings and associated improvements were demolished sometime around 2004, and has remained undeveloped since due to environmental remediation activities. As such, and as discussed with and agreed upon with the Borough, the subject site shall be considered previously developed under existing conditions and therefore exempt from water quantity reduction requirements.

Under proposed conditions, Parcel A, consisting of approximately 1.61 acres of the site identified as the Oakite Site Redevelopment Area will be developed to contain one (1) 21,505 SF senior living facility and an associated parking area. It shall be noted, this report and associated stormwater management design is for parcel 'A' and the proposed roadway, as defined above, only. The remainder of the site will be addressed by the overall developer.

II. EXISTING DRAINAGE CONDITIONS

The subject parcel consists approximately 1.61 acres and is currently undeveloped with 100% of the ground cover being pervious. The site was previously developed as an industrial manufacturing building with an associated driveway and parking area, see the historic aerial and past demolition plan of the previous development within the appendix of this report. This development, along with its associated improvements, was removed from the site around 2004. However, due to contamination of the soil from the previous use, remediation of the site delayed any potential redevelopment of the site until this time. As such, we are utilizing the previously developed conditions for our stormwater analysis as the basis for existing conditions.

Based on the Middlesex County Soil Survey, the soil type native to the parcel is:

SOIL TYPE (SYMBOL)	SOIL TYPE (NAME)	HYDROLOGIC SOIL GROUP
UR	Urban Land	D

The site has been evaluated using the TR-55 'Urban Hydrology for Small Watersheds' standards and with the following existing drainage sub-watershed areas as depicted on the Existing Drainage Area Map:

EXISTING DRAINAGE AREA 1:

This study area includes of the entire on-site portion of the proposed Parcel A, previously consisting of a large +/- 180,000 SF industrial building. The stormwater runoff generated from this area was captured by a series of existing roof drains and later conveyed to the existing stormwater system located in the Middlesex Avenue right-of-way. The Runoff Curve Numbers, included within the Appendix of this Report, were chosen to best reflect the existing site conditions as outlined in the USDA's "Urban Hydrology for Small Watersheds: TR-55," including the hydrologic soil group D. A time of concentration of 10 minutes has been used for this analysis.

EXISTING DRAINAGE AREA OFFSITE:

This study area includes of the area proposed to be the Greenwich Parkway Public Roadway which is located within the building footprint of the previously constructed building. As a result, this area is considered entirely impervious. The stormwater runoff generated from this area was captured by a series of roof drains and later conveyed to the existing stormwater system located in the Middlesex Avenue right-of-way. The Runoff Curve Numbers, included within the Appendix of this Report, were chosen to best reflect the existing site conditions as outlined in the USDA's "Urban Hydrology for Small Watersheds: TR-55," including the hydrologic soil group D. A time of concentration of 10 minutes has been used for this analysis.

III. PROPOSED DRAINAGE CONDITIONS

Under proposed conditions, the site will be developed with a 21,505 SF senior living facility consisting of 61 units (64 beds) with associated improvements including; landscaping, parking, outdoor courtyard areas, and a stormwater management system to capture and discharge runoff created by the new development. The proposed site improvements will result in an overall increase in impervious coverage of approximately 46,075 SF (1.06 acres) from current conditions; however when compared to previous developed conditions our development proposes to decrease impervious coverage on site by 26,728 SF (0.61 Ac). The proposed design serves to match the existing drainage patterns to the maximum extent practical. The site has been evaluated using the TR-55 'Urban Hydrology for Small Watersheds' standards and with the following proposed drainage sub-watershed areas as depicted on the Proposed Drainage Area Map:

PROPOSED DRAINAGE AREA 1:

This area consists of the majority of Parcel A including the proposed building, paved parking area, sidewalks and landscaped areas. The stormwater runoff generated by the northeastern portion of this area is collected via proposed onsite inlets and tied into the existing box culvert located just to the northeast of our site within the Lehigh Valley Railroad right-of-way. The stormwater generated from the southwestern portion of the site,

specifically the parking area, is collected by proposed on site inlets and directed to the proposed Up Flo Filter Manufactured Treatment Device to treat the stormwater prior to discharging to the existing box culvert. This runoff is then conveyed from the culvert to the existing stormwater system located within the Durham Avenue right-of-way. The Runoff Curve Numbers, included within the Appendix of this Report, were chosen to best reflect the existing site conditions as outlined in the USDA's "Urban Hydrology for Small Watersheds: TR-55," including the hydrologic soil group D. A time of concentration of 10 minutes has been used for this analysis.

PROPOSED DRAINAGE AREA 1 UNDETAINED:

This area consists of the northeastern portion of Parcel A and includes a portion of the sidewalk and landscaped areas to the rear of the proposed building. The stormwater runoff generated from this area maintains existing drainage patterns and flows undetained off site in a northeasterly direction towards the Lehigh Valley Railroad right-of-way. The amount of stormwater discharged to this area is drastically reduced from existing conditions due to various proposed inlets collecting the majority of stormwater generated on site. As such, drainage conditions in this area are improved, and no negative effects are anticipated due to the discharge of stormwater to this area. The Runoff Curve Numbers, included within the Appendix of this Report, were chosen to best reflect the proposed site conditions as outlined in the USDA's "Urban Hydrology for Small Watersheds: TR-55." The minimum time of concentration of 10 minutes has been utilized for this drainage area.

PROPOSED DRAINAGE AREA 1 OFFSITE:

This study area includes of the area proposed to be the Greenwich Parkway Public Roadway located to the southwest and outside of our proposed development. The stormwater runoff generated from this area is collected by one of the proposed inlets within this roadway where it is then tied into the existing box culvert within the Lehigh Valley Railroad right-of-way. This runoff is then conveyed to the existing stormwater system located within the Durham Avenue right-of-way. The Runoff Curve Numbers, included within the Appendix of this Report, were chosen to best reflect the existing site conditions as outlined in the USDA's "Urban Hydrology for Small Watersheds: TR-55," including the hydrologic soil group D. A time of concentration of 10 minutes has been used for this analysis.

IV. DESIGN METHODOLOGY

The primary design constraints for this project are based on requirements established in the Borough of Metuchen Land Development Ordinance, New Jersey Soil Erosion and Sediment Control Standards, and NJAC 7:8. More specifically, the stormwater management design will serve to maintain existing drainage patterns to the maximum extent practical and reduce proposed runoff rates when compared to pre-development runoff rates for disturbed areas. For the purposes of the drainage design, it is assumed that the project proposes to decrease impervious coverage throughout the site by 26,728 SF (0.61 Ac) when compared

to preexisting conditions. Additionally, the proposed project will disturb over one (1) acre of land. As a result, the project meets the definition of a "major development" as defined NJAC 7:8.

Due to the assumption of the previously developed site, our proposed improvements result in a decrease in impervious coverage. As such, overall runoff flows on site are being decreased, meeting the required water quantity standards through the use of non-structural stormwater management strategies, which are later described within this report. The project is further exempt from groundwater recharge requirements due to the contamination levels of the exiting soils on site. Furthermore, the site is within the PA-1 Metropolitan Planning Area. The proposed development will meet water quality requirements and will provide 80% TSS removal for the parking lot area as per NJAC 7:8 with the use of an approved NJDEP Stormwater Manufactured Treatment Device prior to discharging flows to the Borough's stormwater conveyance network.

In order to prepare the stormwater calculations for the project, extensive initial investigation of the property and topographic survey was performed. On-site review of the tract was performed by Dynamic Engineering Consultants, PC to verify existing site conditions and land cover characteristics. A Boundary, Topographic, and Location Survey of the existing site was conducted by Dynamic Survey, and utilized to create the Drainage Area Maps for the existing and proposed site conditions as defined within this report were established. The Grading Plan within the accompanying engineering drawings was developed for the proposed site improvements with consideration to the existing drainage patterns.

The 2-, 10- and 100-year quantity design storms are based upon the New Jersey 24 Hour Rainfall Frequency Data for Middlesex County as published by the USDA NRCS utilizing a NOAA Type D rainfall distribution. Curve number calculations have been included within the Appendix and are based upon HSG D. Pervious and impervious areas were modeled separately as suggested in the NJDEP Stormwater Management Best Management Practices (BMP) Manual. Finally, the on-site stormwater conveyance system was designed to accommodate the 25-year design storm utilizing the rational method.

V. NON-STRUCTURAL STORMWATER MANAGEMENT STRATEGIES

The site design has been prepared to implement non-structural stormwater management strategies in accordance with N.J.A.C. 7:8-5.3. Some of the strategies implemented at this site location include the following:

Minimize impervious surface coverage: The proposed site design as shown on the accompanying engineering drawings have been designed to decrease impervious coverage when compared to the existing condition.

Provide low maintenance landscaping that encourages retention and planting of native vegetation and minimizes the use of lawn fertilizers and pesticides: The proposed landscaping design has been prepared to provide an aesthetic improvement to the interior and perimeter of the site through the use of native species.

The New Jersey Best Management Practices (BMP) Manual was utilized in preparation of the design of this development.

VI. RUNOFF RATES

The following chart provides the existing and proposed runoff rates for the entire site with a breakdown of the proposed reductions in flows:

EXISTING VS. PROPOSED RUNOFF RATES (CFS)			
Design Storm	**Existing Runoff (Developed - 100% Impervious)**	**Proposed Runoff**	**Reduction**
2-year	5.52	4.78	0.74 (13.4%)
10-year	8.49	7.75	0.74 (8.7%)
100-year	14.36	13.71	0.65 (4.5%)

As indicated above, the peak flows for each point of analysis have been reduced when compared to existing conditions due to the proposed reduction in impervious coverage throughout the site, thus meeting the requirements set forth in the Borough ordinance and N.J.A.C. 7:8. Refer to the Appendix for associated runoff rate calculations.

VII. WATER QUALITY

Although the development is exempt from water quantity reductions, the proposed development does propose more than one-quarter (1/4) acre of impervious coverage from its current conditions and is therefore required to meet the 80% TSS removal rate requirement set forth by the Borough of Metuchen and NJAC 7:8. The proposed roof areas, grassed area, and pedestrian walkways are considered 'clean' runoff in accordance with the NJDEP BMP Manual; therefore, treatment of runoff generated from those areas prior to discharge is not required. Drainage area DA-1 Undetained will remain mostly pervious grass coverage with a small addition of impervious coverage from proposed walkways. Therefore, runoff generated from these areas is exempt from the water quality requirements.

The majority of runoff from DA-1 is collected via various on-site inlets, and routed through the proposed Hydro International Up-Flow Filter, an approved NJDEP Stormwater Manufactured Treatment Device

designed to provide a TSS removal rate of 80%, prior to discharging to the existing stormwater system located within the Durham Avenue right-of-way. Details associated with this device are included in the attached engineering drawings.

VIII. GROUNDWATER RECHARGE

As mentioned above, the project is considered a "major development" under the guidelines set forth by the Borough of Metuchen and NJAC 7:8, and is therefore subject to groundwater recharge requirements set forth in same. However, the subject site is located within the PA-1 Metropolitan Planning Area with contaminated soil while also being a redevelopment project, so therefore exempt from the groundwater recharge requirements.

IX. CONCLUSION

The proposed development has been designed with provisions for the safe and efficient control of stormwater runoff in a manner that will not adversely impact the existing drainage patterns, adjacent roadways, or adjacent parcels.

The stormwater management design reduces peak flow rates through the use of non-structural stormwater measures which reduces runoff rates to be under the curve of the existing hydrographs at all times as required by the Borough of Metuchen and NJAC 7:8.

The water quality TSS removal requirements set forth by the Borough of Metuchen and NJAC 7:8 have been satisfied by use of an NJDEP approved manufactured treatment device, to achieve the 80% TSS required removal rate for the development Ordinance and NJAC 7:8.

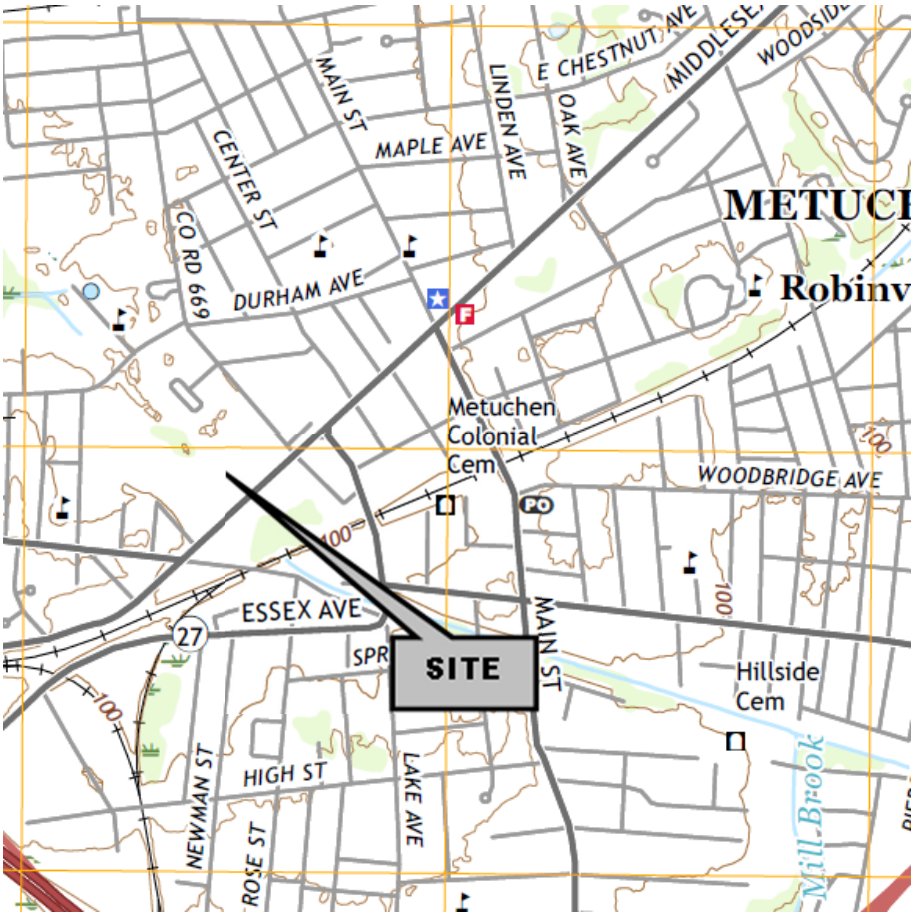
APPENDIX

USGS MAP

DYNAMIC
ENGINEERING EARTH SURVEY TRAFFIC

USGS Map

Perth Amboy Quad



1904 Main Street, Lake Como, NJ 07719 T. 732-974-0198

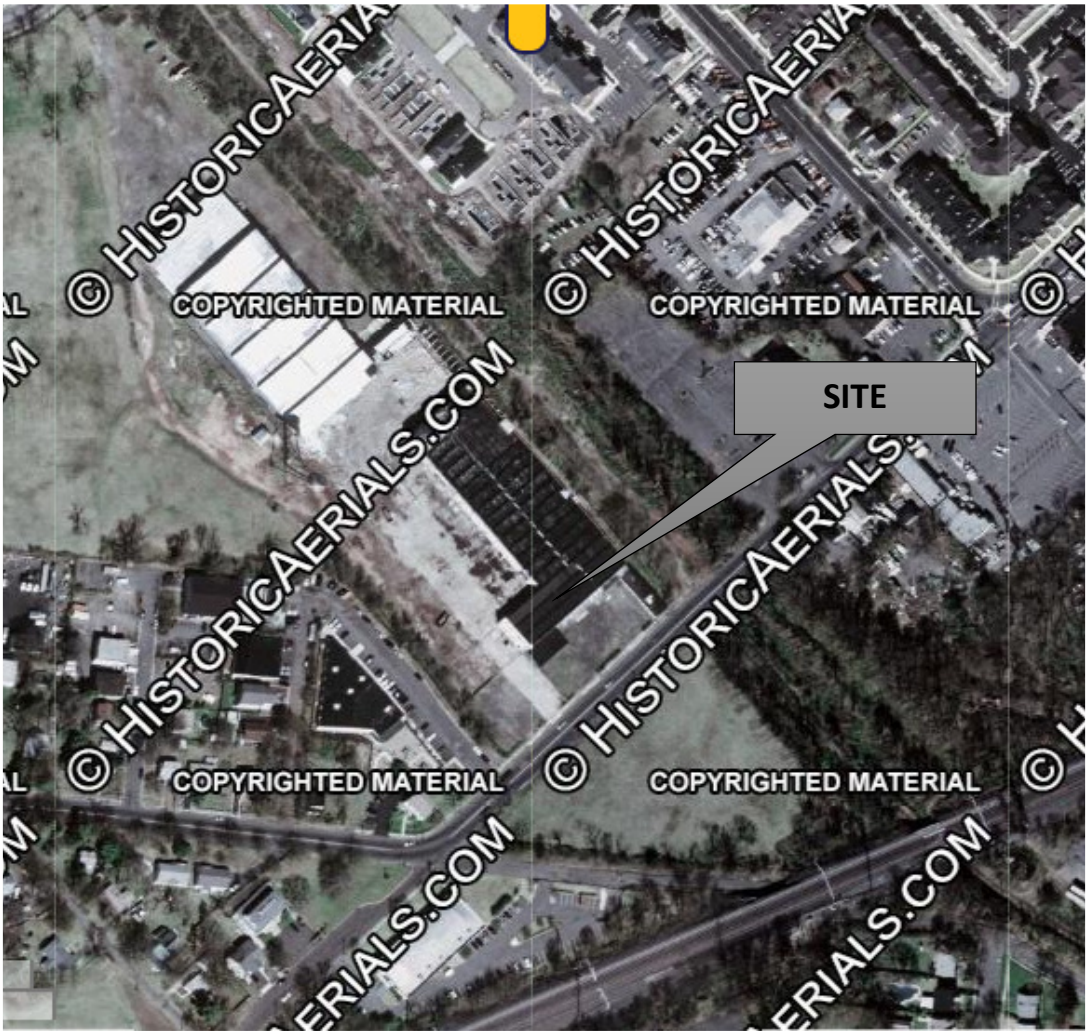
245 Main Street, Suite 110, Chester, NJ 07930 T. 908-879-9229
8 Robbins Street, Suite 102, Toms River, NJ 08753 T. 732-974-0198
790 Newtown Yardley Rd., Suite 425, Newtown, PA 18940 T. 267-685-0276

100 NE 5th Avenue, Suite B2, Delray Beach, FL 33483 T. 561-291-8570
14521 Old Katy Road, Suite 250, Houston, TX 77079 T. 281-789-6400
1301 Central Expressway S., Suite 210, Allen, TX 75013 T. 972-534-2100

HISTORIC AERIAL

DYNAMIC
ENGINEERING EARTH SURVEY TRAFFIC

2002 Historic Aerial Photo Map

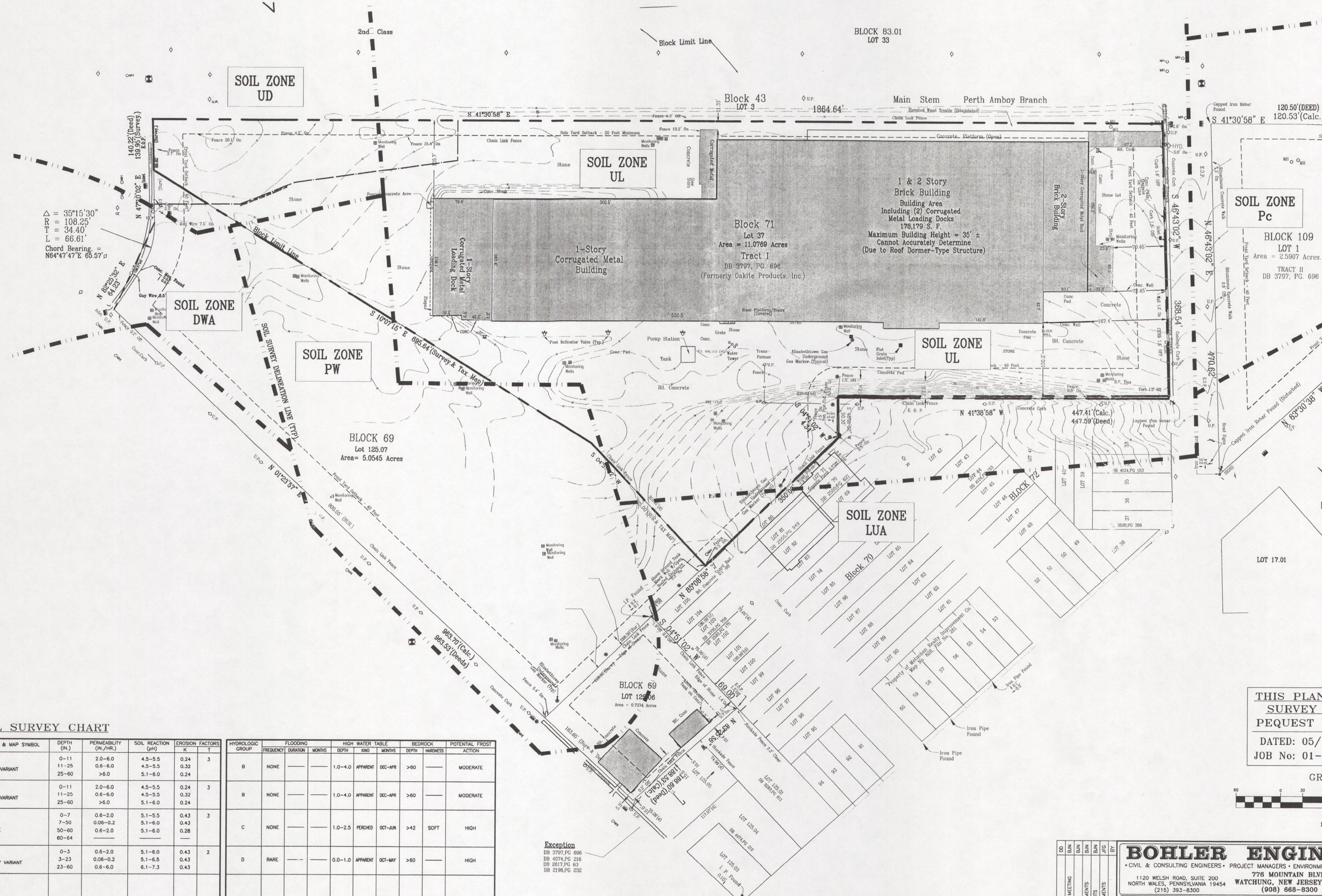


1904 Main Street, Lake Como, NJ 07719 T. 732-974-0198

245 Main Street, Suite 110, Chester, NJ 07930 T. 908-879-9229
8 Robbins Street, Suite 102, Toms River, NJ 08753 T. 732-974-0198
790 Newtown Yardley Rd., Suite 425, Newtown, PA 18940 T. 267-685-0276

100 NE 5th Avenue, Suite B2, Delray Beach, FL 33483 T. 561-291-8570
14521 Old Katy Road, Suite 250, Houston, TX 77079 T. 281-789-6400
1301 Central Expressway S., Suite 210, Allen, TX 75013 T. 972-534-2100

PREVIOUS DEVELOPMENT ENVIRONMENTAL ANALYSIS MAP PREPARED BY BOHLER ENGINEERING



THIS PLAN REFERENCES A SURVEY PREPARED BY: PEQUEST ASSOCIATES, INC.

DATED: 05/18/99

JOB No: 01-41 FILE No: 99-2453

GRAPHIC SCALE

60 0 30 60 120 240

(IN FEET)

1 inch = 60 ft.

NOTE: SOIL TYPE & FIRM BOUNDARY LINES ARE APPROXIMATE

SOIL SURVEY CHART

SOIL NAME & MAP SYMBOL	DEPTH (IN.)	PERMEABILITY (IN./HR.)	SOIL REACTION (pH)	EROSION FACTORS K	EROSION FACTORS T	HYDROLOGIC GROUP	FLOODING FREQUENCY	FLOODING DURATION	FLOODING MONTHS	HIGH WATER TABLE DEPTH	HIGH WATER TABLE KIND	HIGH WATER TABLE MONTHS	BEDROCK DEPTH	BEDROCK HARDNESS	POTENTIAL FROST ACTION
DvA DUNELLEN VARIANT	0-11 11-25 25-60	2.0-6.0 0.6-6.0 >6.0	4.5-5.5 4.5-5.5 5.1-6.0	0.24 0.32 0.24	3	B	NONE	——	——	1.0-4.0	APPARENT	DEC-APR	>60	——	MODERATE
DWA * DUNELLEN VARIANT	0-11 11-25 25-60	2.0-6.0 0.6-6.0 >6.0	4.5-5.5 4.5-5.5 5.1-6.0	0.24 0.32 0.24	3	B	NONE	——	——	1.0-4.0	APPARENT	DEC-APR	>60	——	MODERATE
LUA * LANSDOWNE	0-7 7-50 50-60 60-64	0.6-2.0 0.06-0.2 0.6-2.0 ——	5.1-5.5 5.1-6.0 5.1-6.0 ——	0.43 0.43 0.28 ——	3	C	NONE	——	——	1.0-2.5	PERCHED	OCT-JUN	>42	SOFT	HIGH
Pc PARSIPPANY VARIANT	0-3 3-23 23-60	0.6-2.0 0.06-0.2 0.6-6.0	5.1-6.0 5.1-6.5 6.1-7.3	0.43 0.43 0.43	2	D	RARE	——	——	0.0-1.0	APPARENT	OCT-MAY	>60	——	HIGH
PW * PSAMMENTS															
UD * UDORTHENTS															
UL * URBAN LAND															

* SEE DESCRIPTION OF THE MAP UNIT FOR COMPOSITION AND BEHAVIOUR CHARACTERISTICS OF THE MAP UNIT WITHIN DRAINAGE REPORT.

NOTE: SOIL CHARACTERISTICS TAKEN FROM THE UNITED STATES DEPARTMENT OF AGRICULTURE SOIL SURVEY OF MIDDLESEX COUNTY, NEW JERSEY.

Rev.	Date	Comment	BY
6	09/24/03	REV. PER WATER SERVICE	DD
5	06/27/03	REV. PER CONSTRUCTION MEETING	BJN
4	06/19/03	GENERAL REVISIONS	BJN
3	06/06/03	REV. PER TOWNSHIP COMMENTS	BJN
2	4/11/03	REV. PER CLIENT COMMENTS	BJN
1	2/20/03	REV. PER TOWNSHIP COMMENTS	JFG

BOHLER ENGINEERING, P.C.

• CIVIL & CONSULTING ENGINEERS • PROJECT MANAGERS • ENVIRONMENTAL & SITE PLANNERS • MUNICIPAL ENGINEERS •

1120 WELSH ROAD, SUITE 200
NORTH WALES, PENNSYLVANIA 19454
(215) 393-8300

776 MOUNTAIN BLVD.
WATCHUNG, NEW JERSEY 07069
(908) 668-8300

70 EAST SUNRISE HIGHWAY, SUITE 609
VALLEY STREAM, NEW YORK 11581
(516) 872-2000

PROJECT: METUCHEN I, LLC.
PRELIMINARY/FINAL MAJOR SITE PLAN & MINOR SUBDIVISION
PROPOSED BANK/WAREHOUSE DEVELOPMENT
BLOCK 71-LOT 37, 700 MIDDLESEX AVE.
BOROUGH OF METUCHEN, MIDDLESEX COUNTY, N.J.

TITLE: ENVIRONMENTAL ANALYSIS MAP

J.G. JAWORSKI
PROFESSIONAL ENGINEER
NEW JERSEY LICENSE No. 36618
PENNSYLVANIA LICENSE No. 47943
NEW YORK LICENSE No. 075707
CONNECTICUT LICENSE No. 20811
MASSACHUSETTS LICENSE No. 40835

K.L. HANEY
PROFESSIONAL ENGINEER
NEW JERSEY LICENSE No. 40371

SCALE: (H) AS (V) NOTED	DATE: 09/13/02
DRAWN BY: BJN	PROJECT No: J011131
CHECKED BY: RAL	CAD I.D. #: J011131-SS -6
CONSTRUCTION CHECK	DATE

SHEET No: 3 OF 21

REV. No. 6

SOIL SURVEY

Map Scale: 1:1,770 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 25 50 100 150

Feet: 0 50 100 200 300

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 18N WGS84

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Rating Polygons

A
A/D
B
B/D
C
C/D
D
Not rated or not available

Soil Rating Lines

A
A/D
B
B/D
C
C/D
D
Not rated or not available

Soil Rating Points

A
A/D
B
B/D
C
C/D
D
Not rated or not available

Water Features

Streams and Canals

Transportation

Rails
Interstate Highways
US Routes
Major Roads
Local Roads

Background

Aerial Photography

MAP INFORMATION

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

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

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

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

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

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

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

Soil Survey Area: Middlesex County, New Jersey
Survey Area Data: Version 14, Sep 15, 2018

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

Date(s) aerial images were photographed: Sep 12, 2014—Sep 26, 2014

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

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
PbtAr	Parsippany very poorly drained variant silt loam, 0 to 3 percent slopes, rarely flooded	D	0.2	3.8%
UR	Urban land		5.3	96.2%
Totals for Area of Interest			**5.5**	**100.0%**

Description

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

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

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

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

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

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

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

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

RUNOFF CURVE NUMBER (CN) CALCULATIONS

DYNAMIC ENGINEERING

Existing Drainage Area Summary and Average Curve Number (CN) Calculations

Project: Artis Senior Living
Job #: 2621-99-003
Location: Metuchen NJ

Computed By: TMT
Checked By: DTS
Date: 8/14/20

Drainage Area	Impervious Area (acre)	Impervious Area (sf)	Curve Number (CN) Used	HSG D - Open Space Area (acre)	HSG D - Open Space Area (sf)	Curve Number (CN) Used	Avg. Perv. Curve Number	Total Pervious Area (acres)	Total Area (acres)	TC (Min.)
DA-1	1.68	39,483	98	0.00	-	80	80	0.00	1.68	10
DA-Offsite	0.41	17,943	98	0.00	-	80	80	0.00	0.41	10
Total	**2.09**	**57426.00**		**0.00**	**0.00**			**0.00**	**2.09**	

Per NRCS Soil Survey -	Ur	HSG	D	Soil	Urban Land

Description	Runoff Curve Number (CN) (HSG D)
Impervious Surface	98
Open Space (lawn) (good)	80

DYNAMIC ENGINEERING

PROPOSED DRAINAGE AREA SUMMARY AND AVERAGE CURVE NUMBER (CN) CALCULATIONS

Project: Artis - Metuchen
Job #: 2621-99-003
Location: 700 Middlesex Ave, Metuchen NJ

Computed By: TMT
Checked By: DTS
Date: 8/14/20

Drainage Area	Impervious Area (acre)	Impervious Area (sf)	Curve Number (CN) Used	HSG D - Open Space Area (acre)	HSG D - Open Space Area (sf)	Curve Number (CN) Used	Avg. Perv. Curve Number	Total Pervious Area (acres)	Total Area (acres)	TC (Min.)
DA-1	1.01	43,969	98	0.48	21,045	80	80	0.48	1.49	10
DA-1 Undetained	0.06	2,404	98	0.13	5,683	80	80	0.13	0.19	10
DA-1 Offsite	0.40	17,469	98	0.01	474	80	80	0.01	0.41	10
Total	**1.47**	**63842.00**		**0.62**	**27202.00**			**0.62**	**2.09**	

Per County Soil Survey -	Ur	HSG	D	Soil	Urban Land

Description	Runoff Curve Number (CN) (HSG D)
Impervious Surface	98
Open Space (lawn) (good)	80

STORMWATER CONVEYANCE CALCULATIONS (PIPE SIZING)

DYNAMIC ENGINEERING

Stormwater Conveyance System Calculations

Project: Artis Senior Living
Job #: 2621-99-003
Location: Metuchen, NJ
Design Storm: 25-Year

Computed By: TMT
Checked By: DTS
Date: 8/25/2020

NOTES:
1) Design method used is Rational Method, unless otherwise noted.
2) Refer to Weighted Runoff Coefficient table for calculation of incremental areas and C values

PIPE SECTION		SUBCATCHMENT AREA	INCREMENTAL		CUMULATIVE	TIME OF CONCENTRATION			I	PEAK RUNOFF		PIPING INPUT			PIPING DATA		
FROM	TO	Area (Acres)	"C"	A x C Ac	A x C (acres)	Tc to Inlet (min)	Tc in Pipe (min.)	Final Tc (min)	(In/Hr)	Q to Inlet (CFS)	Q cum. for Pipe (CFS)	Dia. (In)	Length (Ft)	Man. "n"	Slope (ft/ft)	Pipe Capacity (cfs)	Pipe Velocity (fps)
BA-16	IA-16	0.02	0.98	0.02	0.02	10.00	0.04	10.00	6.80	0.14	0.14	6	25.0	0.010	0.0100	2.19	11.16
IA-16	IA-85	0.05	0.89	0.04	0.06	10.00	0.25	10.04	6.80	0.27	0.41	15	60.0	0.012	0.0050	4.95	4.04
MH-104	MH-102	0.00	0.98	0.00	0.33	10.00	0.57	10.90	6.68	0.00	2.20	15	139.0	0.012	0.0050	4.95	4.04
BA-23	IA-23	0.15	0.98	0.15	0.15	10.00	0.16	10.00	6.80	1.02	1.02	6	70.0	0.010	0.0100	1.46	7.44
IA-23	MH-102	0.09	0.83	0.07	0.22	10.00	0.14	10.16	6.80	0.48	1.50	15	35.0	0.012	0.0050	4.95	4.04
BA-14	IA-14	0.12	0.98	0.12	0.12	10.00	0.09	10.00	6.80	0.82	0.82	10	28.0	0.010	0.0100	2.85	5.23
IA-14	MH-14	0.12	0.93	0.11	0.45	10.00	0.45	10.76	6.68	0.73	3.01	15	110.0	0.012	0.0050	4.95	4.04
MH-14	IA-13	0.00	0.98	0.00	0.45	10.00	0.27	11.21	6.56	0.00	2.95	15	65.0	0.012	0.0050	4.95	4.04
BA-13	IA-13	0.06	0.98	0.06	0.06	10.00	0.06	10.00	6.80	0.41	0.41	6	25.0	0.010	0.0100	1.46	7.44
IA-13	WQ-UNIT	0.20	0.93	0.19	0.70	10.00	0.05	11.48	6.56	1.25	4.59	18	15.0	0.012	0.0050	8.04	4.55
WQ-UNIT	IA-12	0.00	0.98	0.00	0.70	10.00	0.29	11.53	6.44	0.00	4.51	18	76.0	0.012	0.0045	7.63	4.32
IA-12	MH-101	0.03	0.96	0.03	0.73	10.00	0.07	11.82	6.44	0.19	4.70	18	24.0	0.012	0.0075	9.85	5.58
MH-101	IA-7	0.00	0.98	0.00	1.28	10.00	0.13	11.89	6.44	0.00	8.24	24	43.0	0.012	0.0050	17.33	5.52
IA-307	IA-305	0.09	0.98	0.09	0.09	10.00	0.77	10.00	6.80	0.61	0.61	15	186.0	0.012	0.0050	4.95	4.04
IA-306	IA-305	0.06	0.98	0.06	0.06	10.00	0.13	10.00	6.80	0.41	0.41	15	32.0	0.012	0.0050	4.95	4.04
IA-305	IA-304	0.06	0.98	0.06	0.21	10.00	0.69	10.77	6.68	0.40	1.40	15	168.0	0.012	0.0050	4.95	4.04
IA-304	MH-303	0.05	0.98	0.05	0.26	10.00	0.13	11.46	6.56	0.33	1.71	18	36.0	0.012	0.0050	8.04	4.55
MH-303	IA-7	0.00	0.98	0.00	0.26	10.00	0.45	11.59	6.44	0.00	1.67	30	174.0	0.012	0.0050	31.42	6.40
IA-7	MH-DOG	0.29	0.92	0.27	1.81	10.00	0.08	12.04	6.32	1.71	11.44	30	28.0	0.012	0.0041	28.45	5.80

TIME OF CONCENTRATION (Tc) CALCULATIONS

DYNAMIC ENGINEERING
1904 Main Street, Lake Como, NJ 07719
(732) 974-0198

Date: 3/5/2020
Project: Artis Senior Living - Metuchen
Project No: 2621-99-003

Calculated By: NL
Checked By: TMT

Worksheet 3: Time of Concentration (T_c) Calculations

Land Condition: Existing
Drainage Area: Ex DA 1

• Sheet Flow:

		AB	BC			
1.	Surface Description	Short Grass, Prairie	Short Grass, Prairie			
2.	Manning's Roughness Coefficient, n	0.15	0.15			
3.	Flow Length, L { total $L \le 100$ ft }	33.0 ft	38.0 ft			
4.	Two-Year 24-hour Rainfall, p_2 for ... Middlesex County	3.35 in	3.35 in	3.35 in		
5.	Land Slope, s (ft/ft)	0.030 ft/ft	0.026 ft/ft			
6.	Travel Time, $T_t = \frac{0.007\,(n\,L)^{0.8}}{p_2^{0.5}\,s^{0.4}}$	0.056 hr	+ 0.066 hr	+ 0.000 hr	=	0.122 hr

• Shallow Concentrated Flow:

		CD				
7.	Surface Description	Unpaved				
8.	Flow Length, L	134.0 ft				
9.	Watercourse Slope, s	0.037 ft/ft				
10.	Average velocity, V { see Figure 3.1)	3.12 ft/s				
11.	Travel Time, $T_t = \frac{L}{3600\,V}$	0.012 hr	+ 0.000 hr	+ 0.000 hr	=	0.012 hr

• Channel Flow:

12.	Pipe Diameter, D					
13.	Cross-Sectional Flow Area, A					
14.	Wetted Perimeter, p_w					
15.	Hydraulic Radius, $r = A / p_w$					
16.	Channel Slope, s					
17.	Pipe Material					
18.	Manning's Roughness Coefficient, n					
19.	Velocity, $V = \frac{1.49\,r^{2/3}\,s^{1/2}}{n}$					
20.	Flow Length, L					
21.	Travel Time, $T_t = \frac{L}{3600\,V}$	0.000 hr	+ 0.000 hr	+ 0.000 hr	=	0.000 hr
22.	Watershed or subarea Time of Concentration, T_c { add T_t in steps 6, 11 and 21 }					0.134 hr
						8.0 min

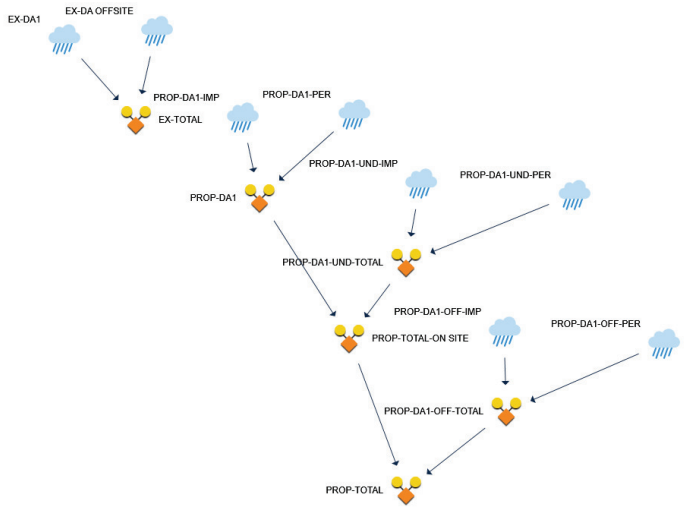
HYDROGRAPH SUMMARY REPORTS – EXISTING VS. PROPOSED CONDITIONS 2-YR, 10-YR, & 100-YR

Basin Model

Project Name:

Hydrology Studio v 3.0.0.16

10-29-2020



Hydrograph by Return Period

Project Name:

Hydrology Studio v 3.0.0.16

10-29-2020

Hyd. No.	Hydrograph Type	Hydrograph Name	Peak Outflow (cfs)							
			1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr
1	NRCS Runoff	EX-DA1		4.436			6.826			11.55
2	NRCS Runoff	EX-DA OFFSITE		1.083			1.666			2.818
4	Junction	EX-TOTAL		5.519			8.491			14.36
7	NRCS Runoff	PROP-DA1-IMP		2.667			4.104			6.941
8	NRCS Runoff	PROP-DA1-PER		0.696			1.378			2.793
9	Junction	PROP-DA1		3.363			5.482			9.734
11	NRCS Runoff	PROP-DA1-UND-IMP		0.158			0.244			0.412
12	NRCS Runoff	PROP-DA1-UND-PER		0.188			0.373			0.756
13	Junction	PROP-DA1-UND-TOTAL		0.347			0.617			1.169
15	Junction	PROP-TOTAL-ON SITE		3.709			6.099			10.90
17	NRCS Runoff	PROP-DA1-OFF-IMP		1.056			1.625			2.749
18	NRCS Runoff	PROP-DA1-OFF-PER		0.014			0.029			0.058
19	Junction	PROP-DA1-OFF-TOTAL		1.071			1.654			2.807
21	Junction	PROP-TOTAL		4.780			7.753			13.71

Hydrograph 2-yr Summary

Project Name:

Hydrology Studio v 3.0.0.16

10-29-2020

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	EX-DA1	4.436	12.17	19,602	---		
2	NRCS Runoff	EX-DA OFFSITE	1.083	12.17	4,784	---		
4	Junction	EX-TOTAL	5.519	12.17	24,386	1, 2		
7	NRCS Runoff	PROP-DA1-IMP	2.667	12.17	11,785	---		
8	NRCS Runoff	PROP-DA1-PER	0.696	12.17	2,728	---		
9	Junction	PROP-DA1	3.363	12.17	14,513	7, 8		
11	NRCS Runoff	PROP-DA1-UND-IMP	0.158	12.17	700	---		
12	NRCS Runoff	PROP-DA1-UND-PER	0.188	12.17	739	---		
13	Junction	PROP-DA1-UND-TOTAL	0.347	12.17	1,439	11, 12		
15	Junction	PROP-TOTAL-ON SITE	3.709	12.17	15,952	9, 13		
17	NRCS Runoff	PROP-DA1-OFF-IMP	1.056	12.17	4,667	---		
18	NRCS Runoff	PROP-DA1-OFF-PER	0.014	12.17	56.8	---		
19	Junction	PROP-DA1-OFF-TOTAL	1.071	12.17	4,724	17, 18		
21	Junction	PROP-TOTAL	4.780	12.17	20,676	15, 19		

Hydrograph Report

Project Name:

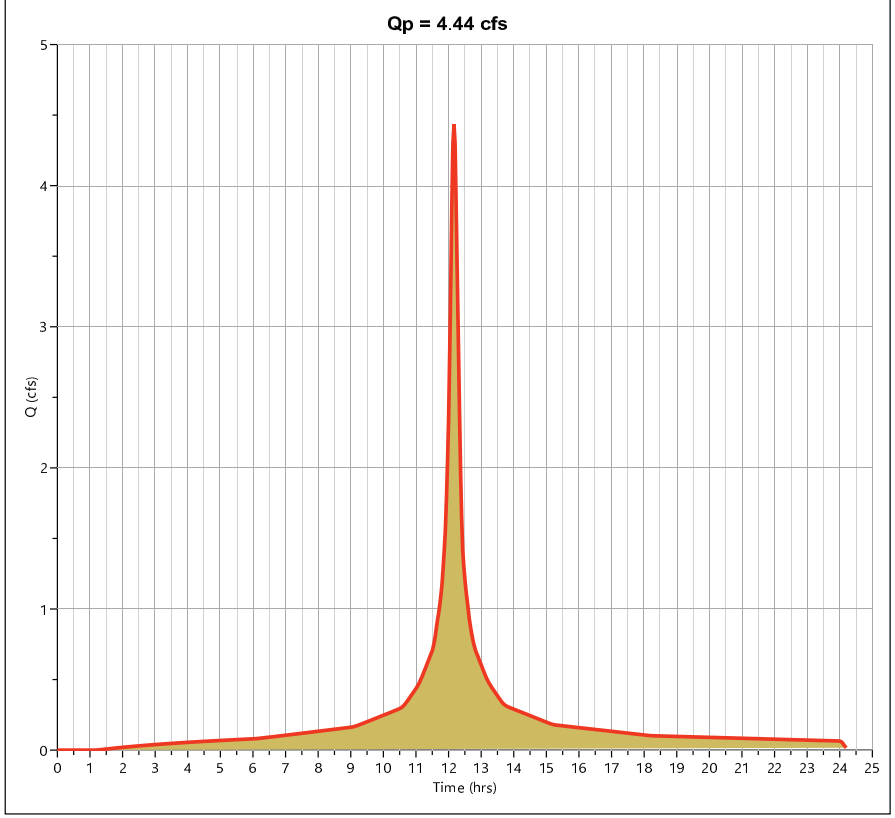
Hydrology Studio v 3.0.0.16

10-29-2020

EX-DA1

Hyd. No. 1

Hydrograph Type	= NRCS Runoff	Peak Flow	= 4.436 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 19,602 cuft
Drainage Area	= 1.68 ac	Curve Number	= 98
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 3.35 in	Design Storm	= NOAA-D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

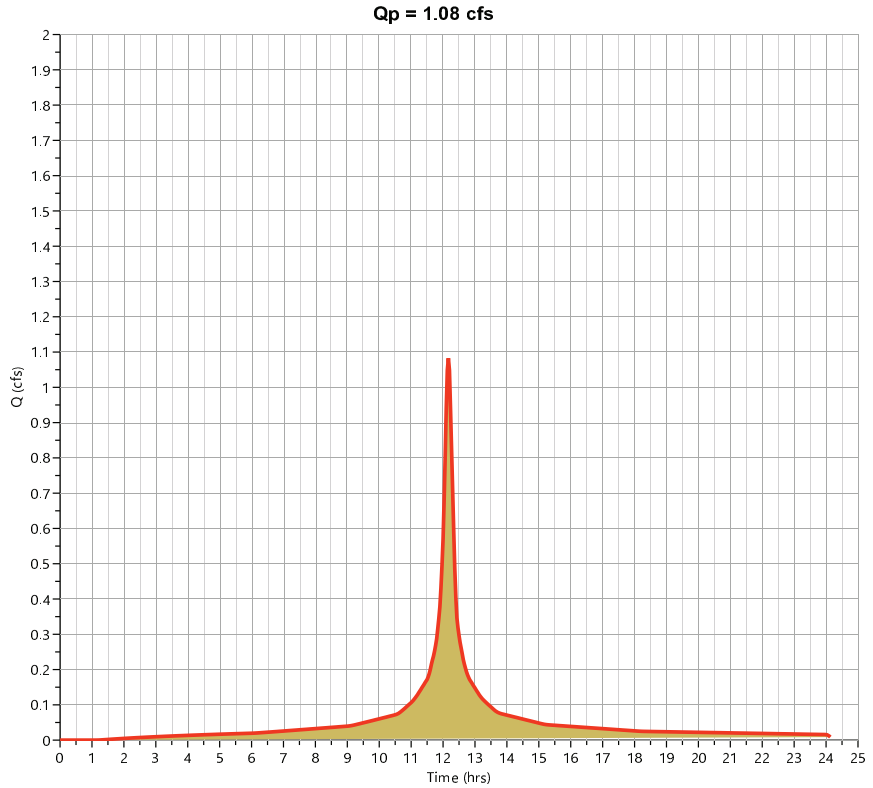
Hydrology Studio v 3.0.0.16

10-29-2020

EX-DA OFFSITE

Hyd. No. 2

Hydrograph Type	= NRCS Runoff	Peak Flow	= 1.083 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 4,784 cuft
Drainage Area	= 0.41 ac	Curve Number	= 98
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 3.35 in	Design Storm	= NOAA-D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

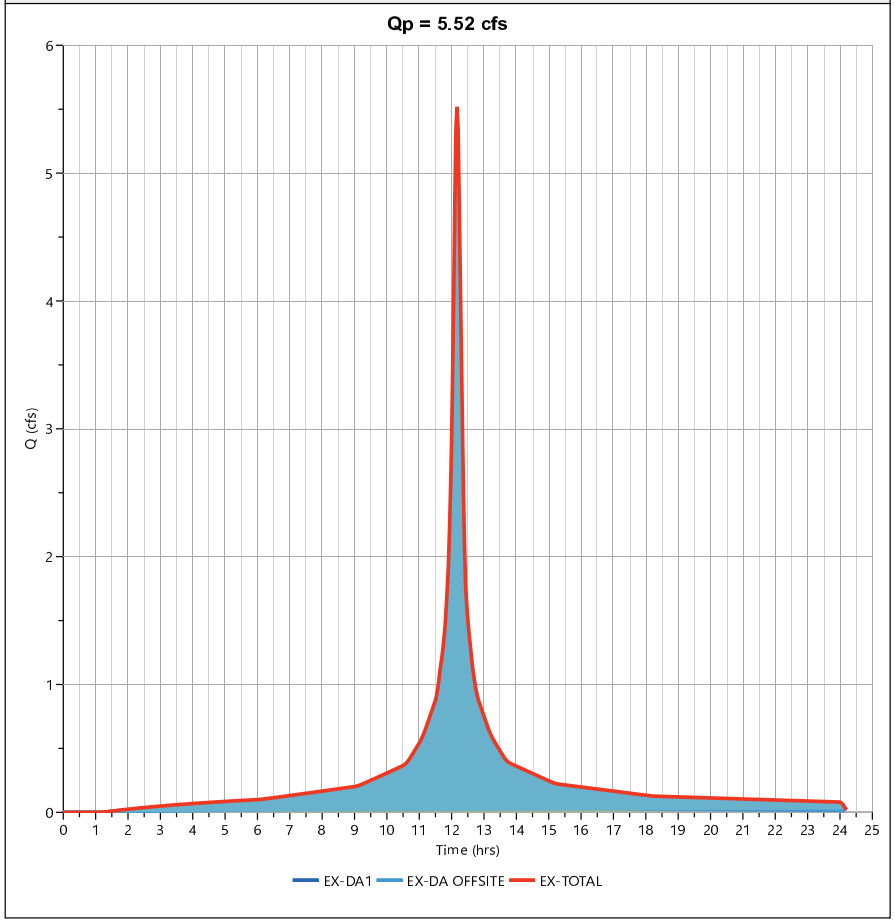
Hydrology Studio v 3.0.0.16

10-29-2020

EX-TOTAL

Hyd. No. 4

Hydrograph Type	= Junction	Peak Flow	= 5.519 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Hydrograph Volume	= 24,386 cuft
Inflow Hydrographs	= 1, 2	Total Contrib. Area	= 2.09 ac



Hydrograph Report

Project Name:

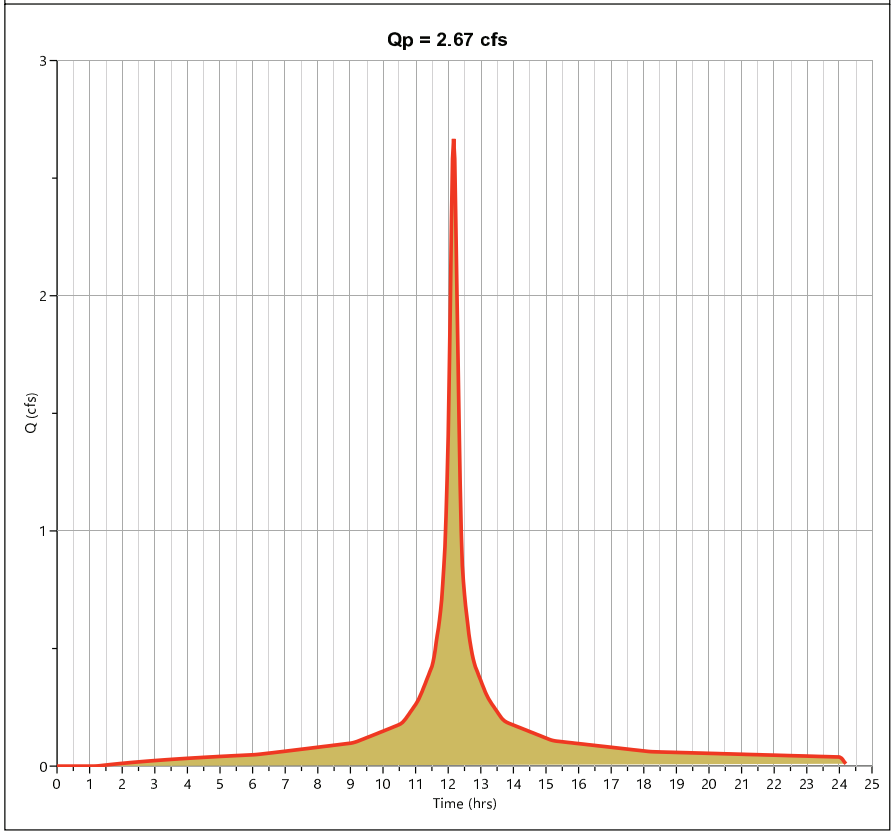
Hydrology Studio v 3.0.0.16

10-29-2020

PROP-DA1-IMP

Hyd. No. 7

Hydrograph Type	= NRCS Runoff	Peak Flow	= 2.667 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 11,785 cuft
Drainage Area	= 1.01 ac	Curve Number	= 98
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 3.35 in	Design Storm	= NOAA-D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

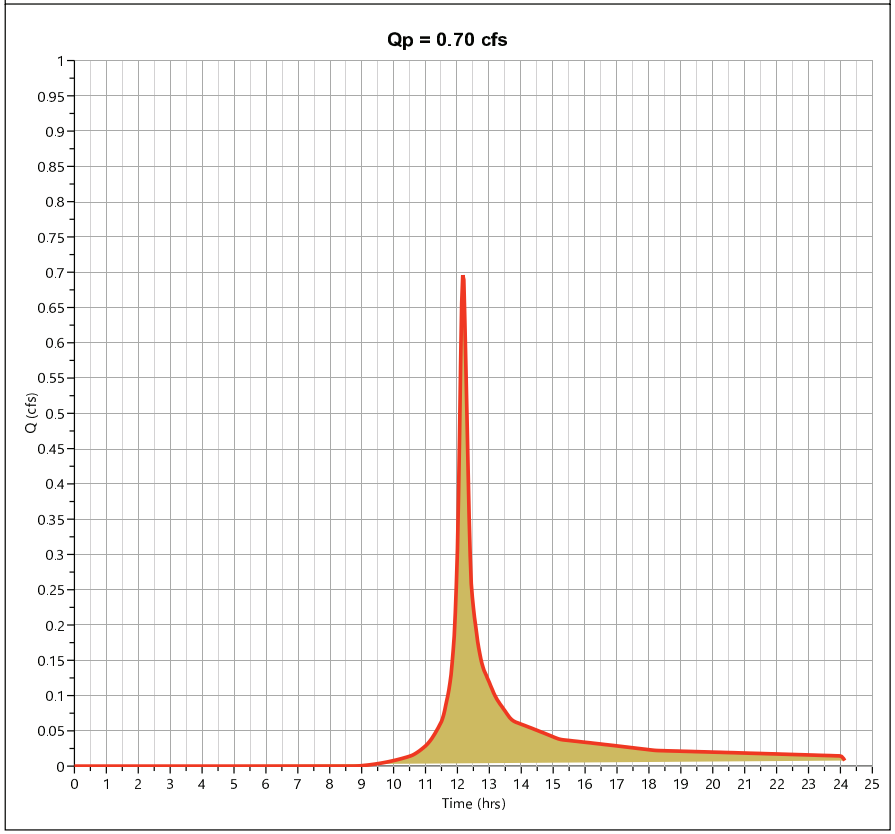
Hydrology Studio v 3.0.0.16

10-29-2020

PROP-DA1-PER

Hyd. No. 8

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.696 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 2,728 cuft
Drainage Area	= 0.48 ac	Curve Number	= 80
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 3.35 in	Design Storm	= NOAA-D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

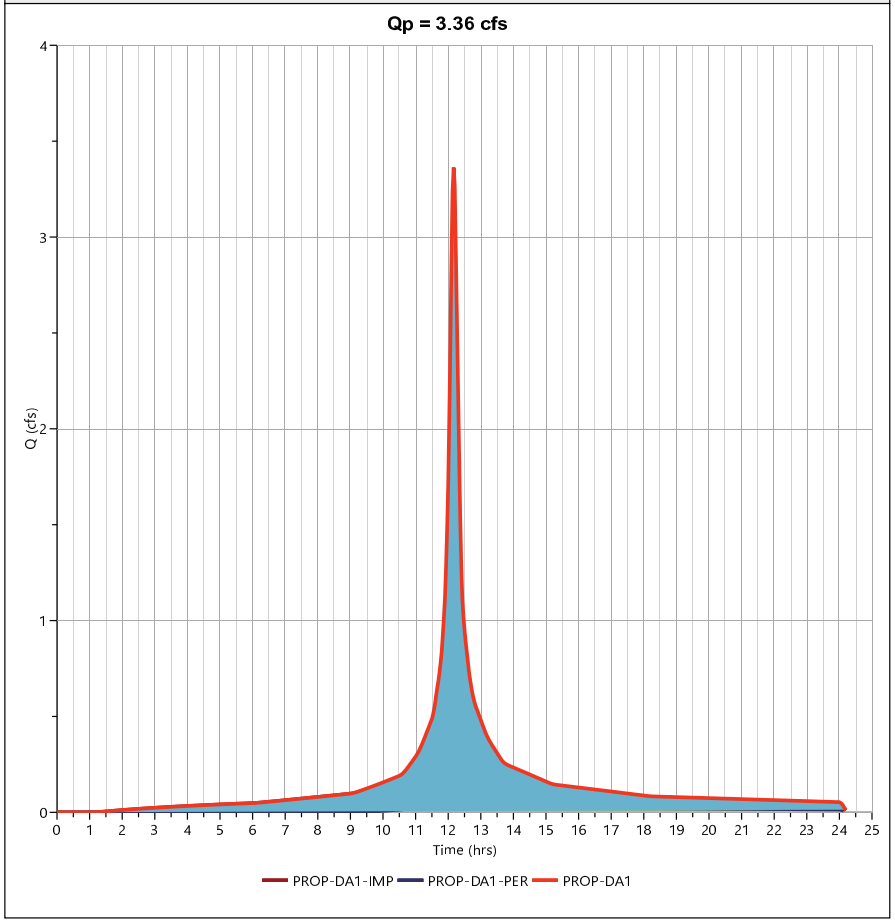
Hydrology Studio v 3.0.0.16

10-29-2020

PROP-DA1

Hyd. No. 9

Hydrograph Type	= Junction	Peak Flow	= 3.363 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Hydrograph Volume	= 14,513 cuft
Inflow Hydrographs	= 7, 8	Total Contrib. Area	= 1.49 ac



Hydrograph Report

Project Name:

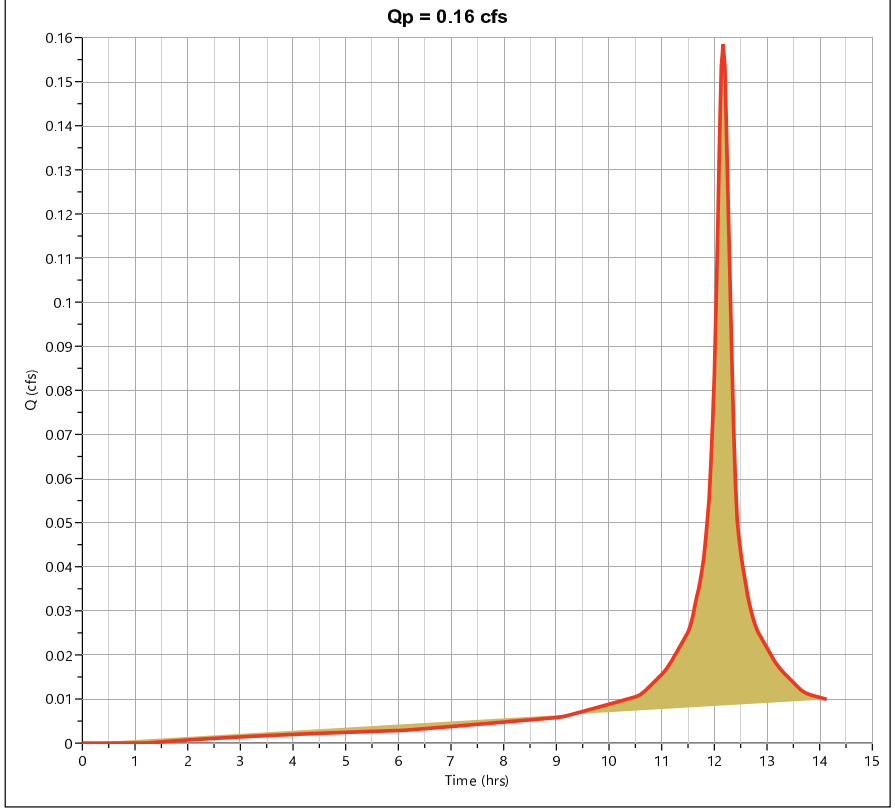
Hydrology Studio v 3.0.0.16

10-29-2020

PROP-DA1-UND-IMP

Hyd. No. 11

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.158 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 700 cuft
Drainage Area	= 0.06 ac	Curve Number	= 98
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 3.35 in	Design Storm	= NOAA-D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

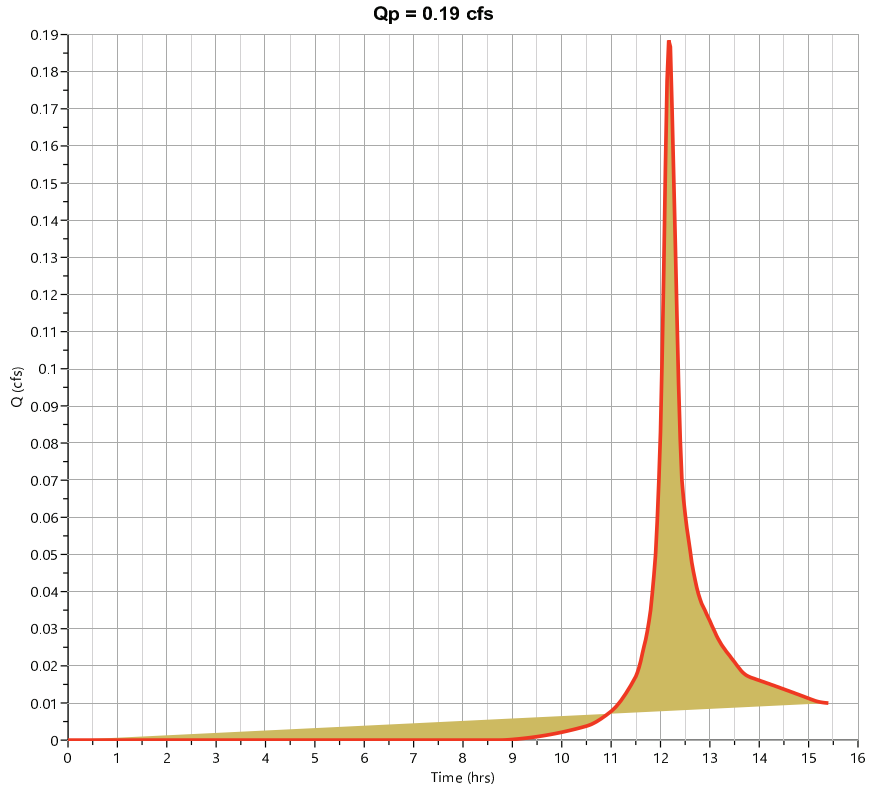
Hydrology Studio v 3.0.0.16

10-29-2020

PROP-DA1-UND-PER

Hyd. No. 12

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.188 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 739 cuft
Drainage Area	= 0.13 ac	Curve Number	= 80
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 3.35 in	Design Storm	= NOAA-D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

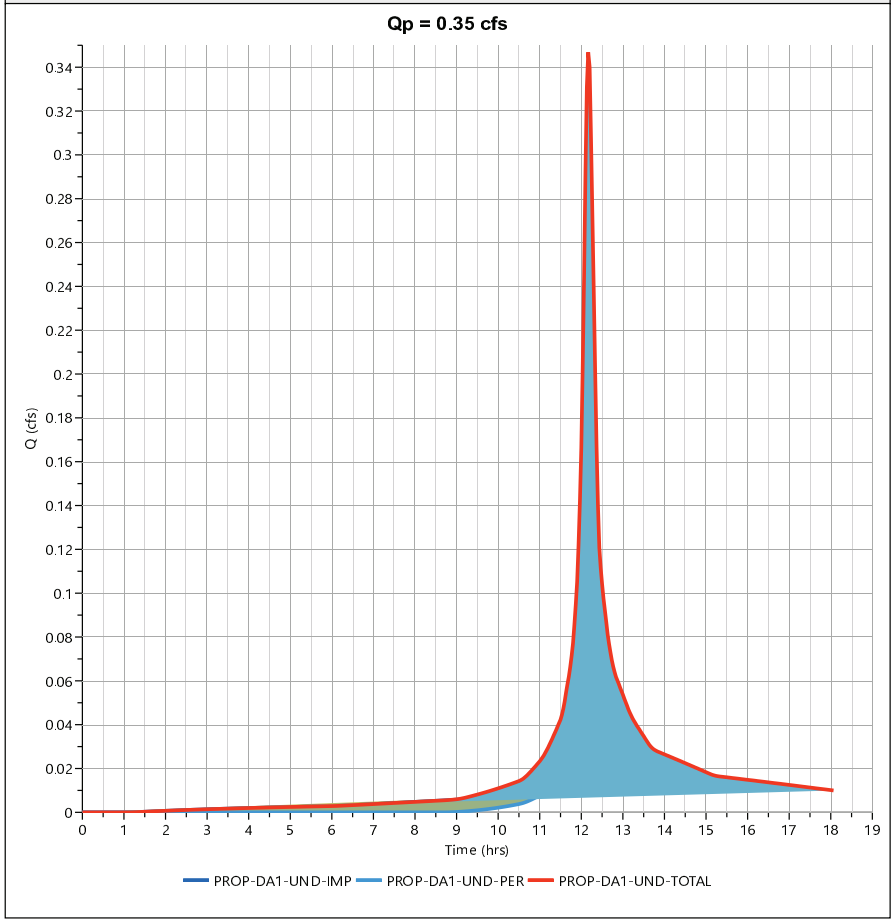
Hydrology Studio v 3.0.0.16

10-29-2020

PROP-DA1-UND-TOTAL

Hyd. No. 13

Hydrograph Type	= Junction	Peak Flow	= 0.347 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Hydrograph Volume	= 1,439 cuft
Inflow Hydrographs	= 11, 12	Total Contrib. Area	= 0.19 ac



Hydrograph Report

Project Name:

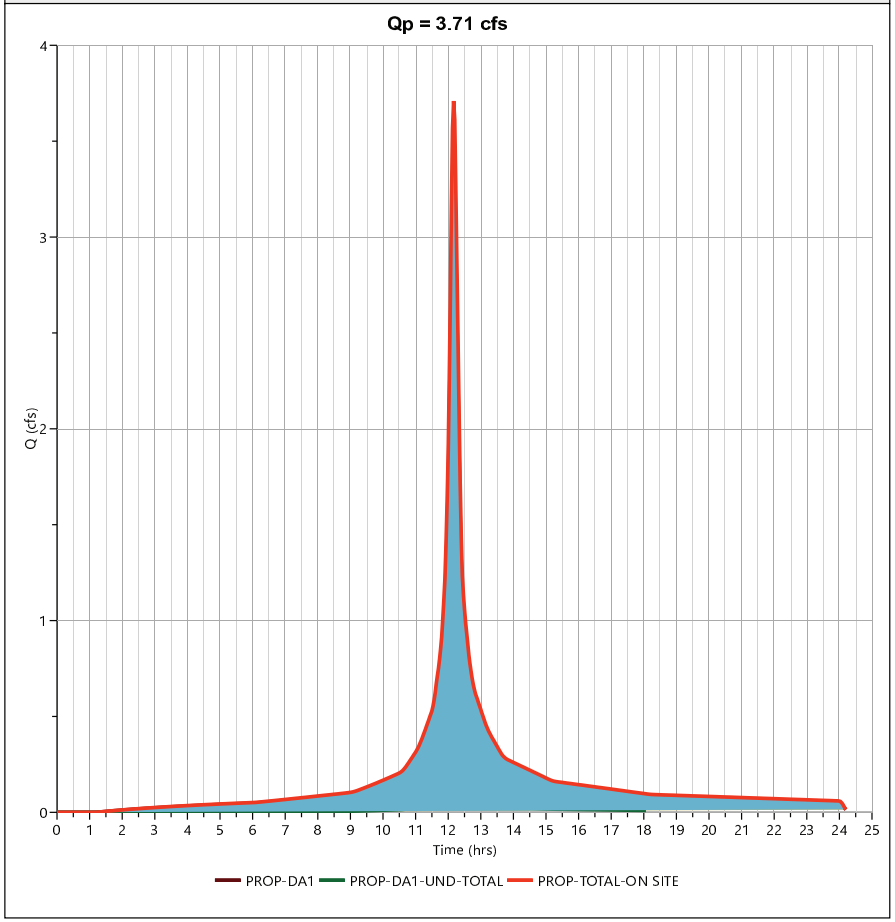
Hydrology Studio v 3.0.0.16

10-29-2020

PROP-TOTAL-ON SITE

Hyd. No. 15

Hydrograph Type	= Junction	Peak Flow	= 3.709 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Hydrograph Volume	= 15,952 cuft
Inflow Hydrographs	= 9, 13	Total Contrib. Area	= 1.68 ac



Hydrograph Report

Project Name:

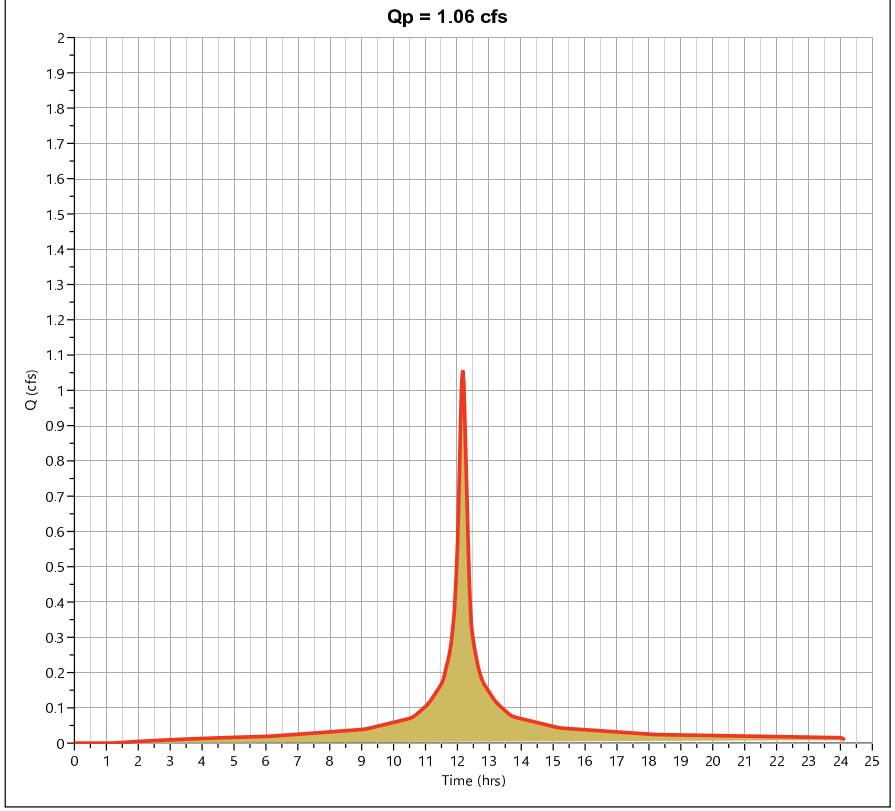
Hydrology Studio v 3.0.0.16

10-29-2020

PROP-DA1-OFF-IMP

Hyd. No. 17

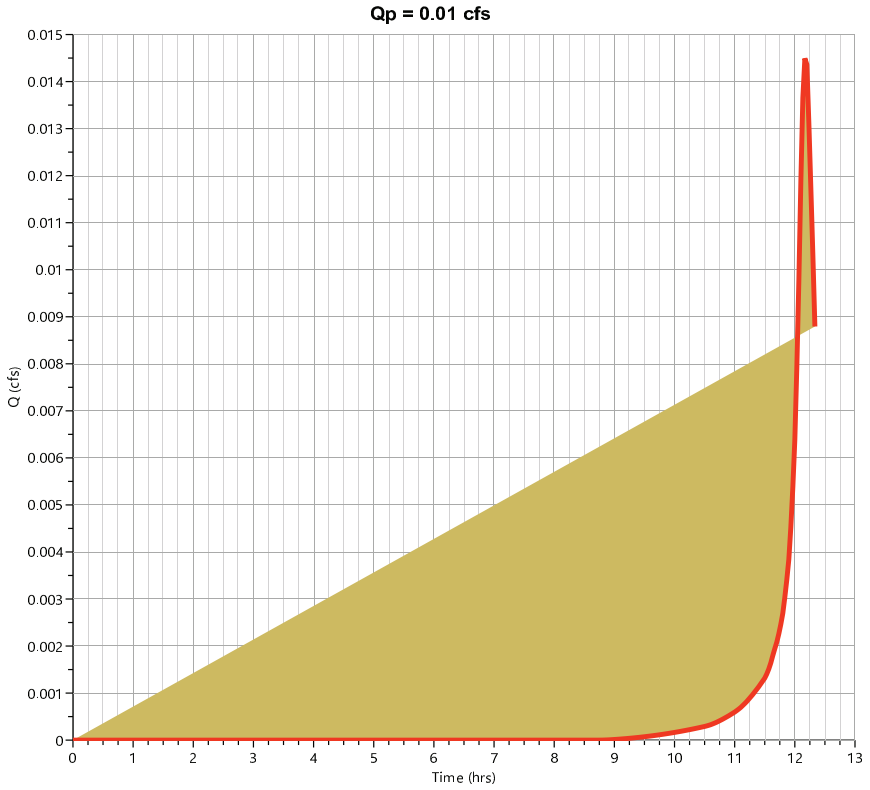
Hydrograph Type	= NRCS Runoff	Peak Flow	= 1.056 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 4,667 cuft
Drainage Area	= 0.4 ac	Curve Number	= 98
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 3.35 in	Design Storm	= NOAA-D
Storm Duration	= 24 hrs	Shape Factor	= 484



PROP-DA1-OFF-PER

Hyd. No. 18

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.014 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 56.8 cuft
Drainage Area	= 0.01 ac	Curve Number	= 80
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 3.35 in	Design Storm	= NOAA-D
Storm Duration	= 24 hrs	Shape Factor	= 484

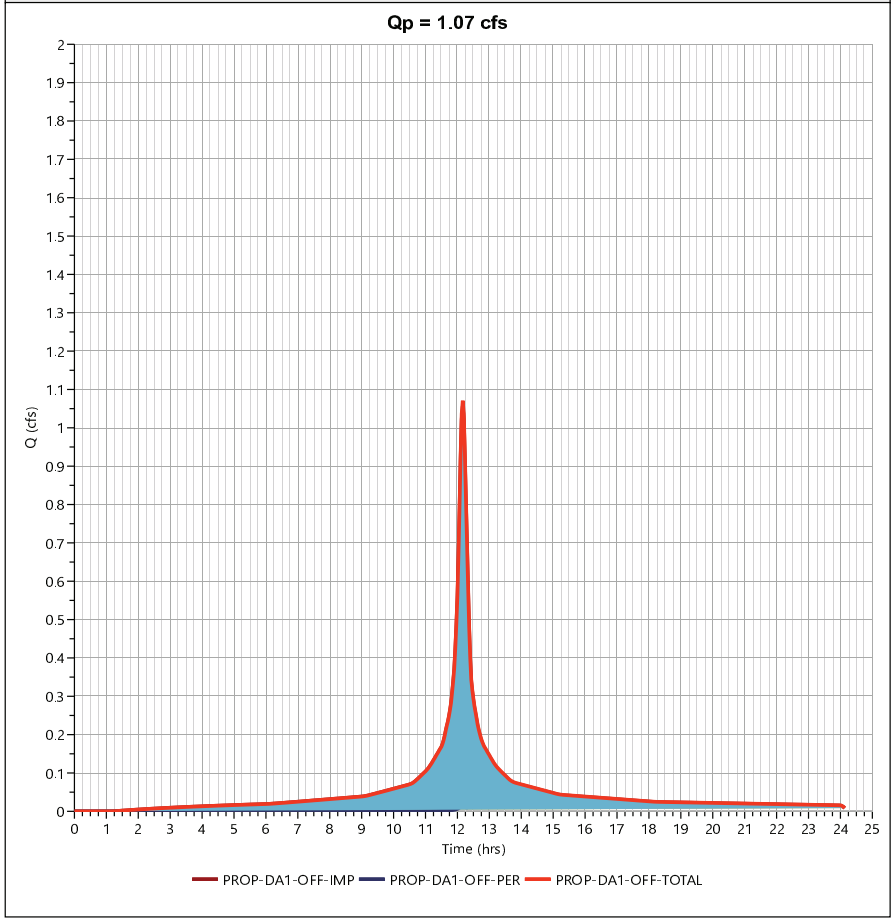


Hydrograph Report
Project Name:
Hydrology Studio v 3.0.0.16
10-29-2020

PROP-DA1-OFF-TOTAL

Hyd. No. 19

Hydrograph Type	= Junction	Peak Flow	= 1.071 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Hydrograph Volume	= 4,724 cuft
Inflow Hydrographs	= 17, 18	Total Contrib. Area	= 0.41 ac



Hydrograph Report

Project Name:

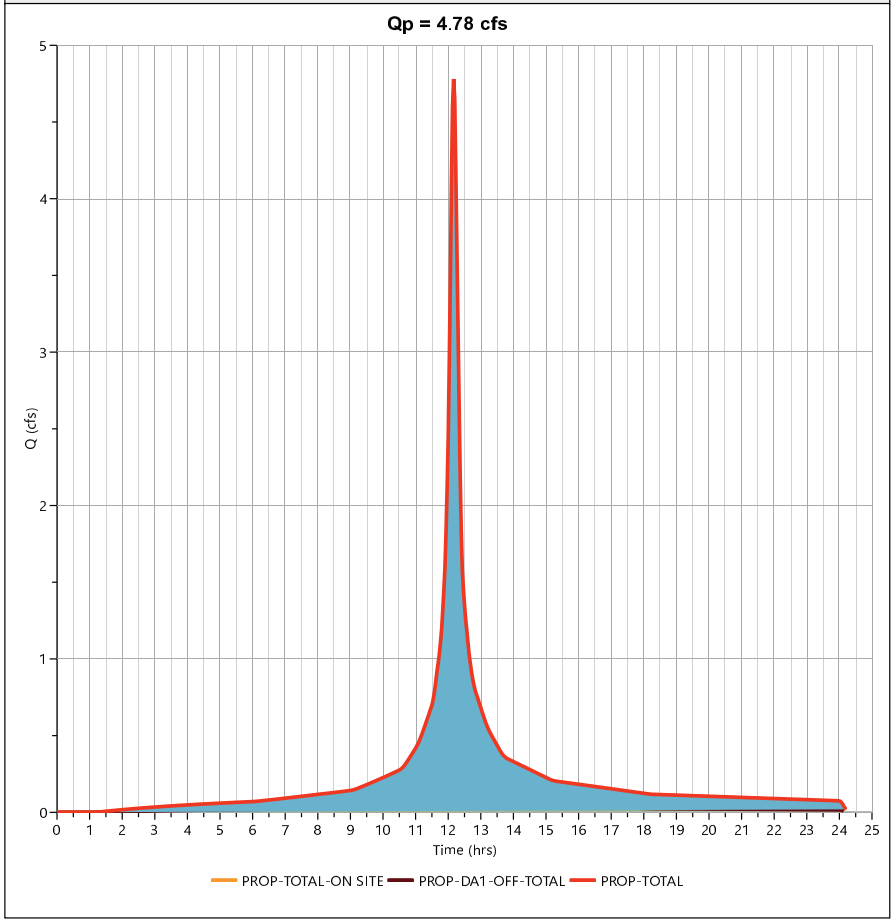
Hydrology Studio v 3.0.0.16

10-29-2020

PROP-TOTAL

Hyd. No. 21

Hydrograph Type	= Junction	Peak Flow	= 4.780 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Hydrograph Volume	= 20,676 cuft
Inflow Hydrographs	= 15, 19	Total Contrib. Area	= 2.09 ac



Design Storm Report

Custom Storm filename: Water Quality Storm.cds

Hydrology Studio v 3.0.0.16

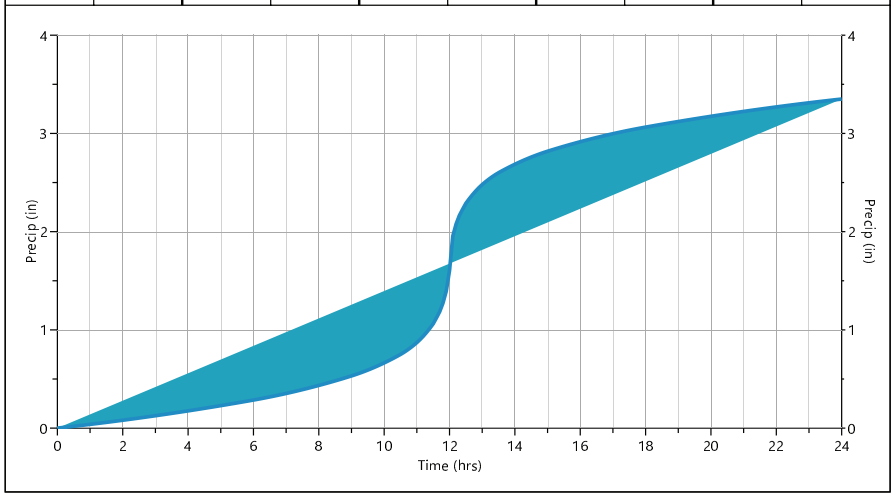
10-29-2020

Storm Distribution: Custom - NOAA-D

Storm Duration	Total Rainfall Volume (in)								
	1-yr	✔ 2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr	
24 hrs	0.00	3.35	0.00	0.00	5.12	0.00	0.00	8.63	

Incremental Rainfall Distribution, 2-yr

Time (hrs)	Precip (in)	Time (hrs)	Precip (in)	Time (hrs)	Precip (in)	Time (hrs)	Precip (in)	Time (hrs)	Precip (in)
11.10	0.010474	11.47	0.015008	11.83	0.040490	12.20	0.040491	12.57	0.015008
11.13	0.011602	11.50	0.015008	11.87	0.040489	12.23	0.029178	12.60	0.015008
11.17	0.011602	11.53	0.020212	11.90	0.040491	12.27	0.029179	12.63	0.013880
11.20	0.011602	11.57	0.020211	11.93	0.069847	12.30	0.029178	12.67	0.013880
11.23	0.012741	11.60	0.020212	11.97	0.069848	12.33	0.021273	12.70	0.013880
11.27	0.012741	11.63	0.021272	12.00	0.069847	12.37	0.021273	12.73	0.012742
11.30	0.012741	11.67	0.021273	12.03	0.116547	12.40	0.021273	12.77	0.012741
11.33	0.013880	11.70	0.021272	12.07	0.116547	12.43	0.020212	12.80	0.012741
11.37	0.013880	11.73	0.029179	**12.10**	**0.116547**	12.47	0.020211	12.83	0.011602
11.40	0.013880	11.77	0.029179	12.13	0.040491	12.50	0.020212	12.87	0.011602
11.43	0.015008	11.80	0.029179	12.17	0.040489	12.53	0.015008	12.90	0.011602



Hydrograph 10-yr Summary

Project Name:

Hydrology Studio v 3.0.0.16

10-29-2020

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	EX-DA1	6.826	12.17	30,709	---		
2	NRCS Runoff	EX-DA OFFSITE	1.666	12.17	7,494	---		
4	Junction	EX-TOTAL	8.491	12.17	38,203	1, 2		
7	NRCS Runoff	PROP-DA1-IMP	4.104	12.17	18,462	---		
8	NRCS Runoff	PROP-DA1-PER	1.378	12.17	5,387	---		
9	Junction	PROP-DA1	5.482	12.17	23,849	7, 8		
11	NRCS Runoff	PROP-DA1-UND-IMP	0.244	12.17	1,097	---		
12	NRCS Runoff	PROP-DA1-UND-PER	0.373	12.17	1,459	---		
13	Junction	PROP-DA1-UND-TOTAL	0.617	12.17	2,556	11, 12		
15	Junction	PROP-TOTAL-ON SITE	6.099	12.17	26,404	9, 13		
17	NRCS Runoff	PROP-DA1-OFF-IMP	1.625	12.17	7,312	---		
18	NRCS Runoff	PROP-DA1-OFF-PER	0.029	12.17	112	---		
19	Junction	PROP-DA1-OFF-TOTAL	1.654	12.17	7,424	17, 18		
21	Junction	PROP-TOTAL	7.753	12.17	33,828	15, 19		

Hydrograph Report

Project Name:

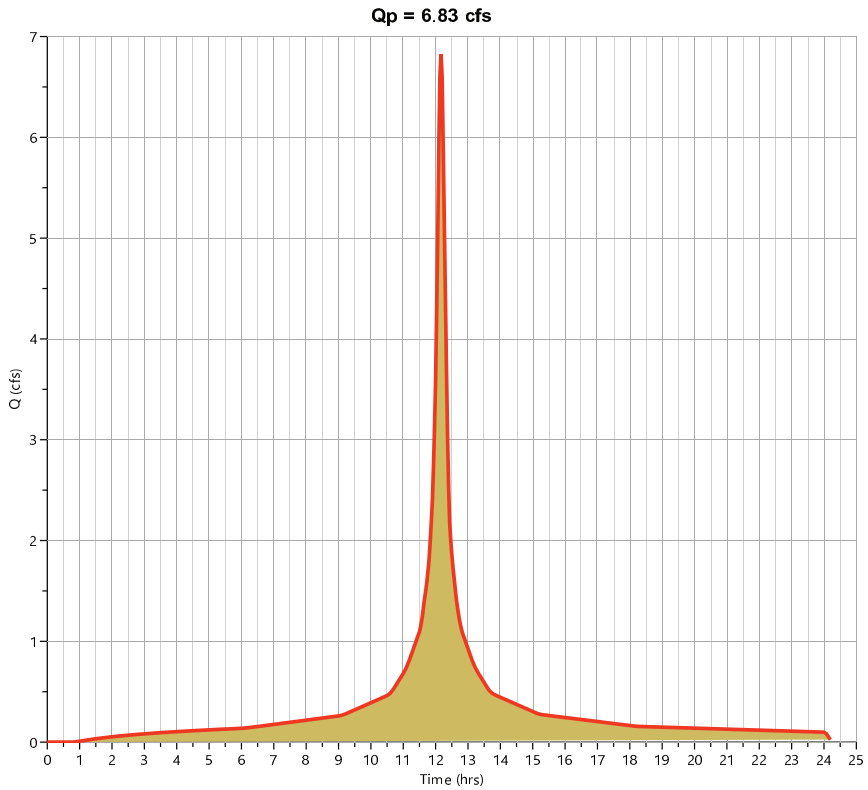
Hydrology Studio v 3.0.0.16

10-29-2020

EX-DA1

Hyd. No. 1

Hydrograph Type	= NRCS Runoff	Peak Flow	= 6.826 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 30,709 cuft
Drainage Area	= 1.68 ac	Curve Number	= 98
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 5.12 in	Design Storm	= NOAA-D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

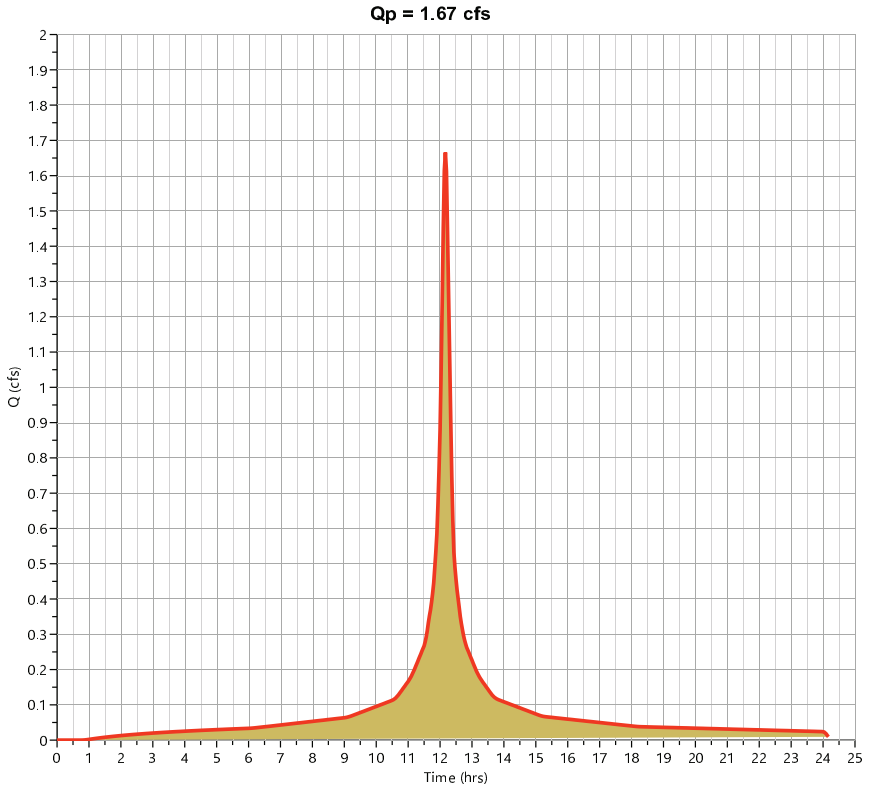
Hydrology Studio v 3.0.0.16

10-29-2020

EX-DA OFFSITE

Hyd. No. 2

Hydrograph Type	= NRCS Runoff	Peak Flow	= 1.666 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 7,494 cuft
Drainage Area	= 0.41 ac	Curve Number	= 98
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 5.12 in	Design Storm	= NOAA-D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

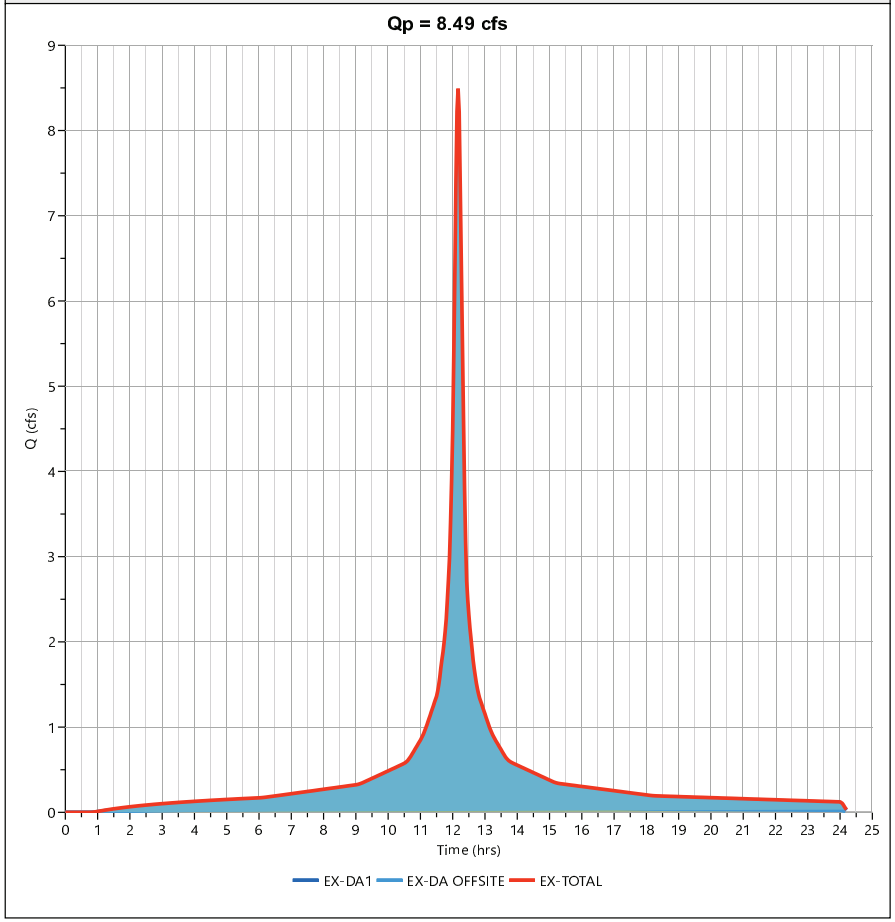
Hydrology Studio v 3.0.0.16

10-29-2020

EX-TOTAL

Hyd. No. 4

Hydrograph Type	= Junction	Peak Flow	= 8.491 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Hydrograph Volume	= 38,203 cuft
Inflow Hydrographs	= 1, 2	Total Contrib. Area	= 2.09 ac



Hydrograph Report

Project Name:

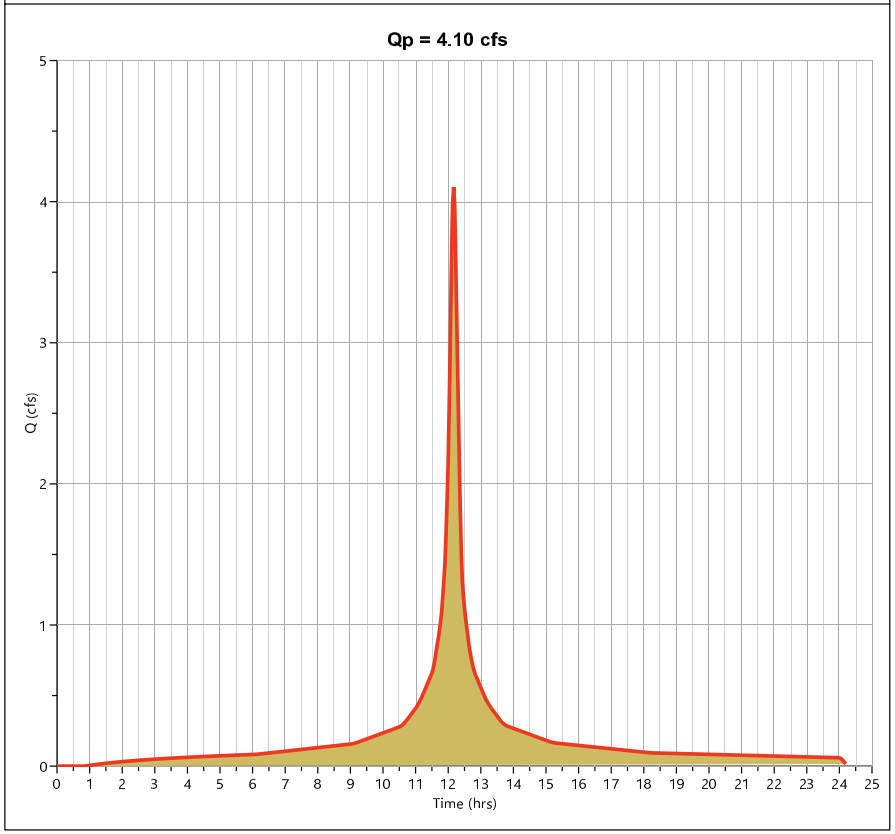
Hydrology Studio v 3.0.0.16

10-29-2020

PROP-DA1-IMP

Hyd. No. 7

Hydrograph Type	= NRCS Runoff	Peak Flow	= 4.104 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 18,462 cuft
Drainage Area	= 1.01 ac	Curve Number	= 98
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 5.12 in	Design Storm	= NOAA-D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

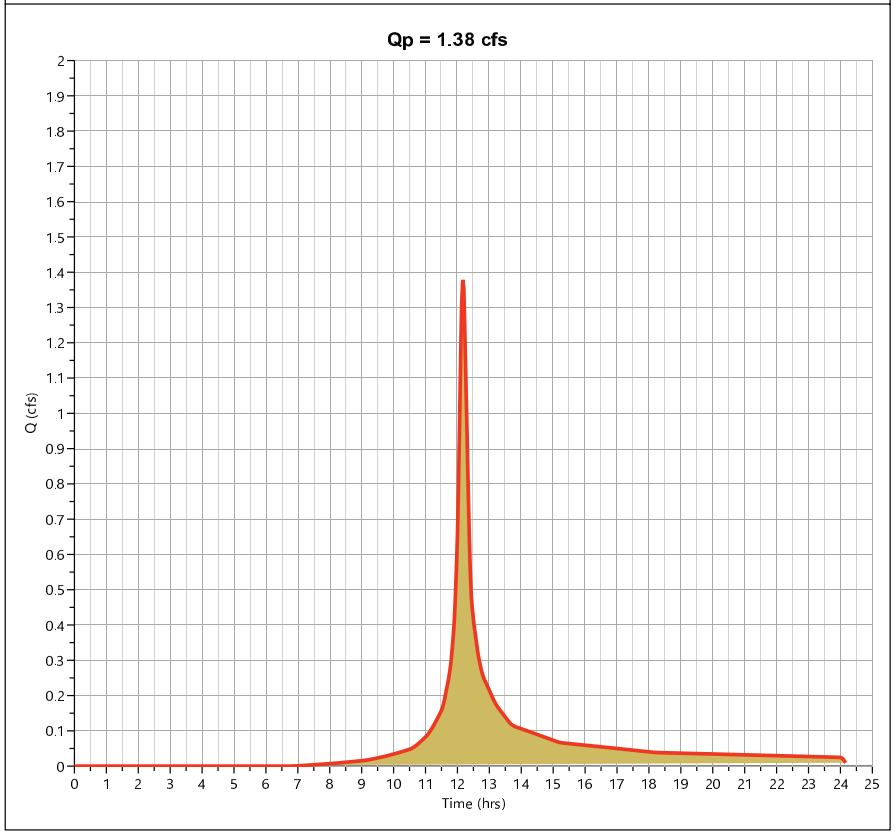
Hydrology Studio v 3.0.0.16

10-29-2020

PROP-DA1-PER

Hyd. No. 8

Hydrograph Type	= NRCS Runoff	Peak Flow	= 1.378 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 5,387 cuft
Drainage Area	= 0.48 ac	Curve Number	= 80
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 5.12 in	Design Storm	= NOAA-D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

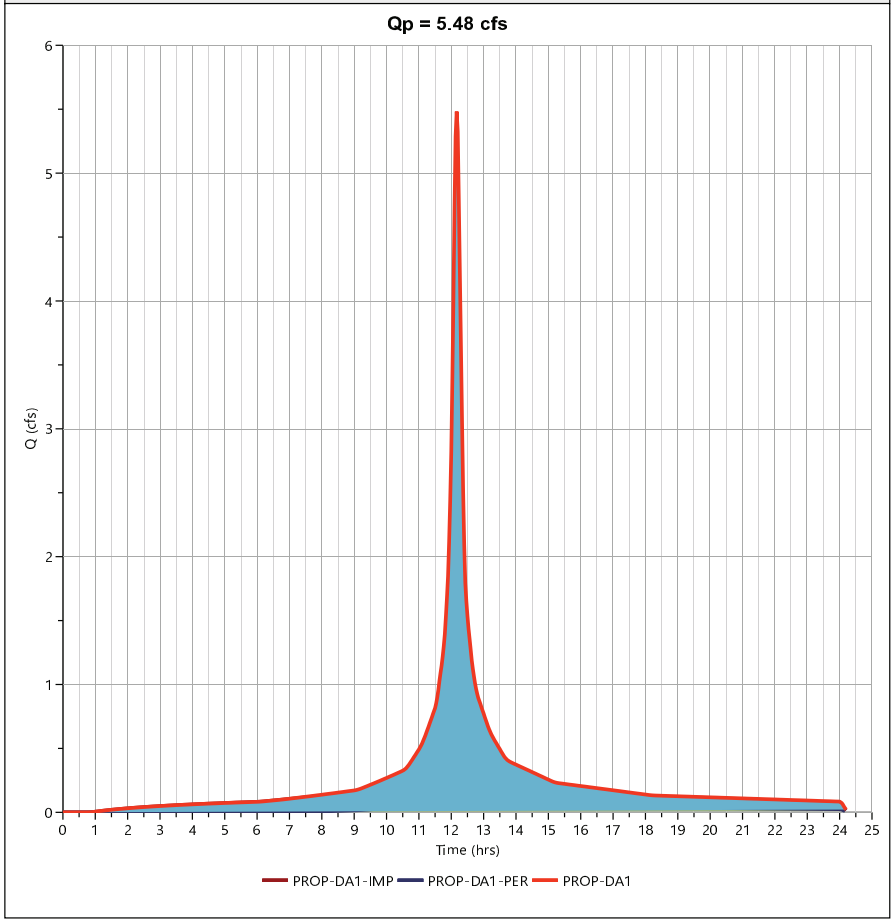
Hydrology Studio v 3.0.0.16

10-29-2020

PROP-DA1

Hyd. No. 9

Hydrograph Type	= Junction	Peak Flow	= 5.482 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Hydrograph Volume	= 23,849 cuft
Inflow Hydrographs	= 7, 8	Total Contrib. Area	= 1.49 ac



Hydrograph Report

Project Name:

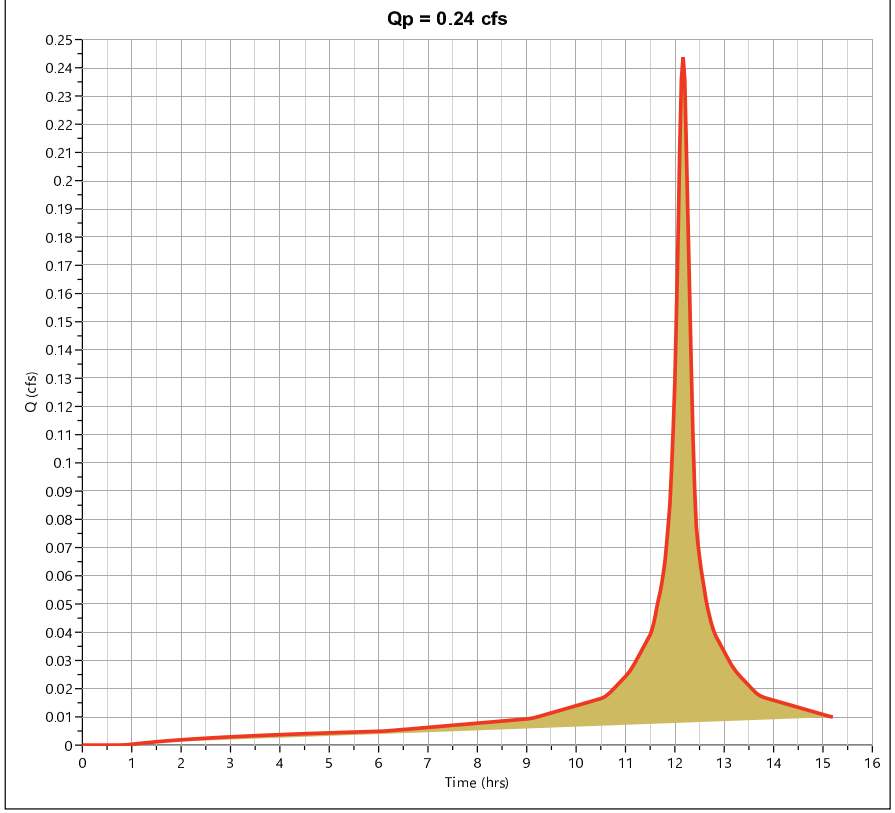
Hydrology Studio v 3.0.0.16

10-29-2020

PROP-DA1-UND-IMP

Hyd. No. 11

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.244 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 1,097 cuft
Drainage Area	= 0.06 ac	Curve Number	= 98
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 5.12 in	Design Storm	= NOAA-D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

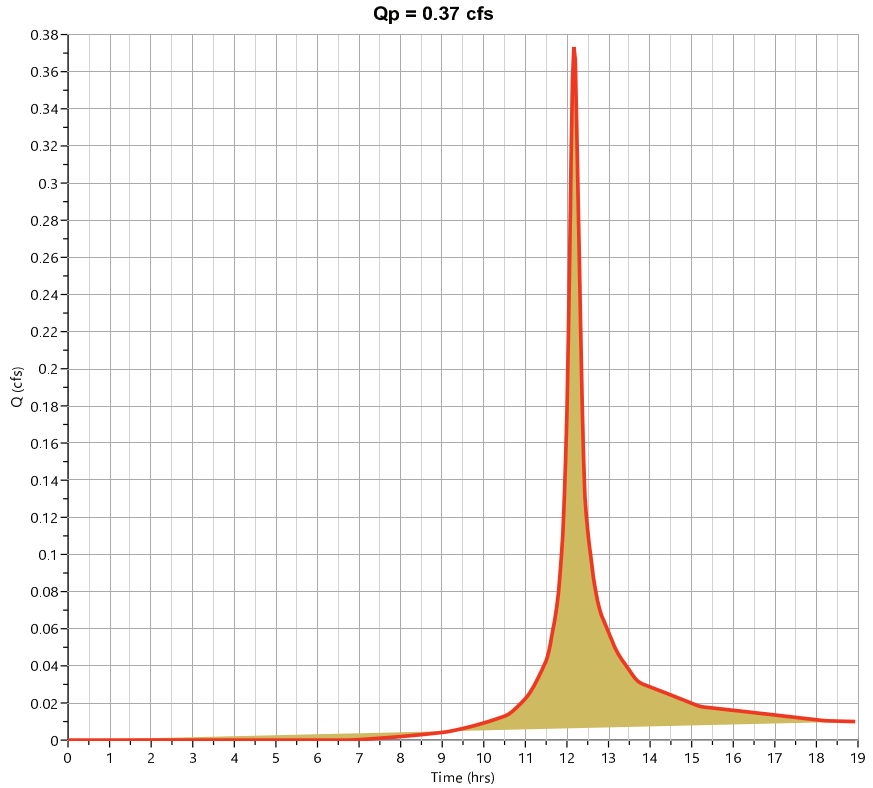
Hydrology Studio v 3.0.0.16

10-29-2020

PROP-DA1-UND-PER

Hyd. No. 12

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.373 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 1,459 cuft
Drainage Area	= 0.13 ac	Curve Number	= 80
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 5.12 in	Design Storm	= NOAA-D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

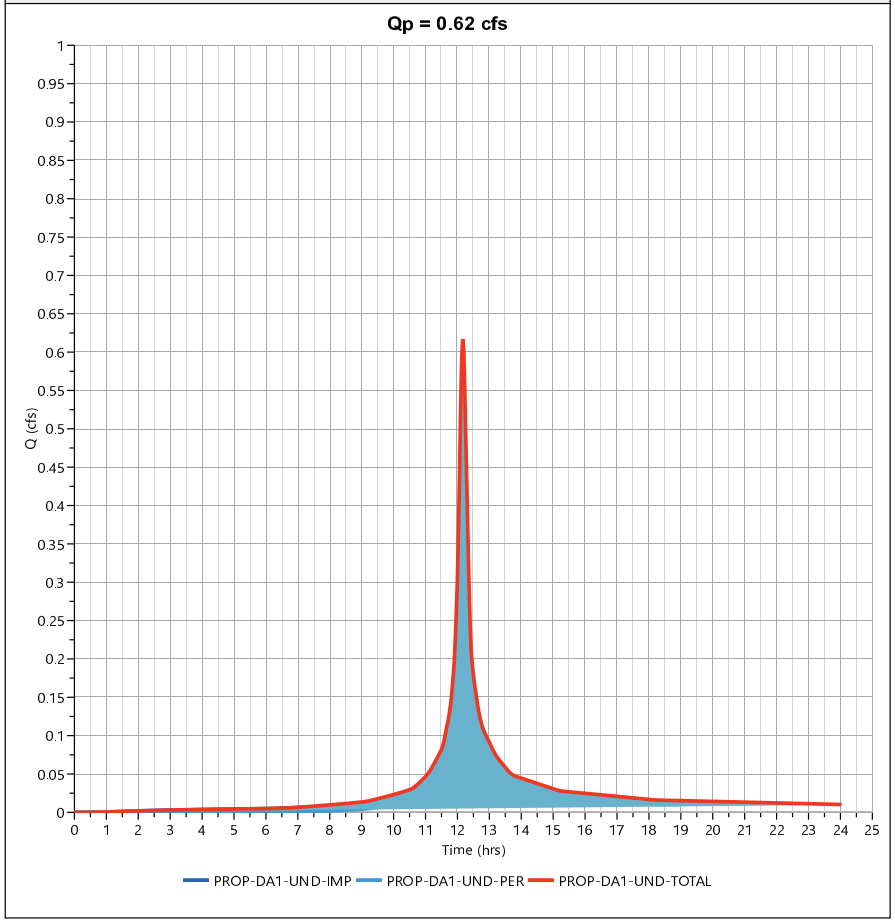
Hydrology Studio v 3.0.0.16

10-29-2020

PROP-DA1-UND-TOTAL

Hyd. No. 13

Hydrograph Type	= Junction	Peak Flow	= 0.617 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Hydrograph Volume	= 2,556 cuft
Inflow Hydrographs	= 11, 12	Total Contrib. Area	= 0.19 ac



Hydrograph Report

Project Name:

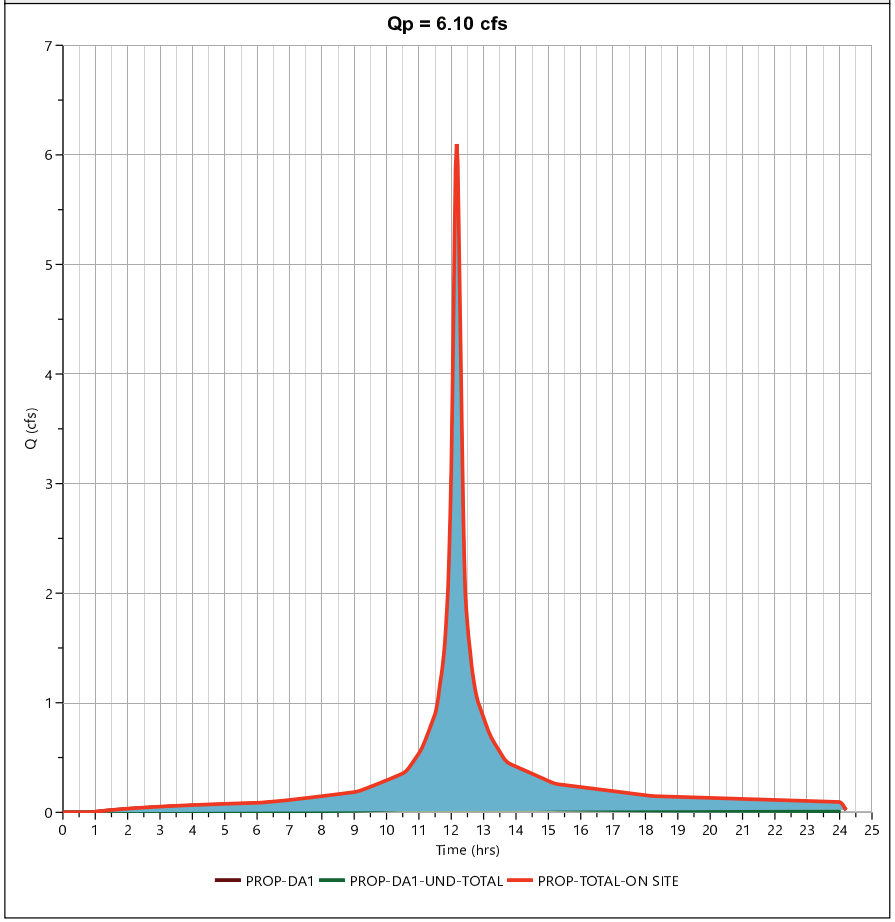
Hydrology Studio v 3.0.0.16

10-29-2020

PROP-TOTAL-ON SITE

Hyd. No. 15

Hydrograph Type	= Junction	Peak Flow	= 6.099 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Hydrograph Volume	= 26,404 cuft
Inflow Hydrographs	= 9, 13	Total Contrib. Area	= 1.68 ac



Hydrograph Report

Project Name:

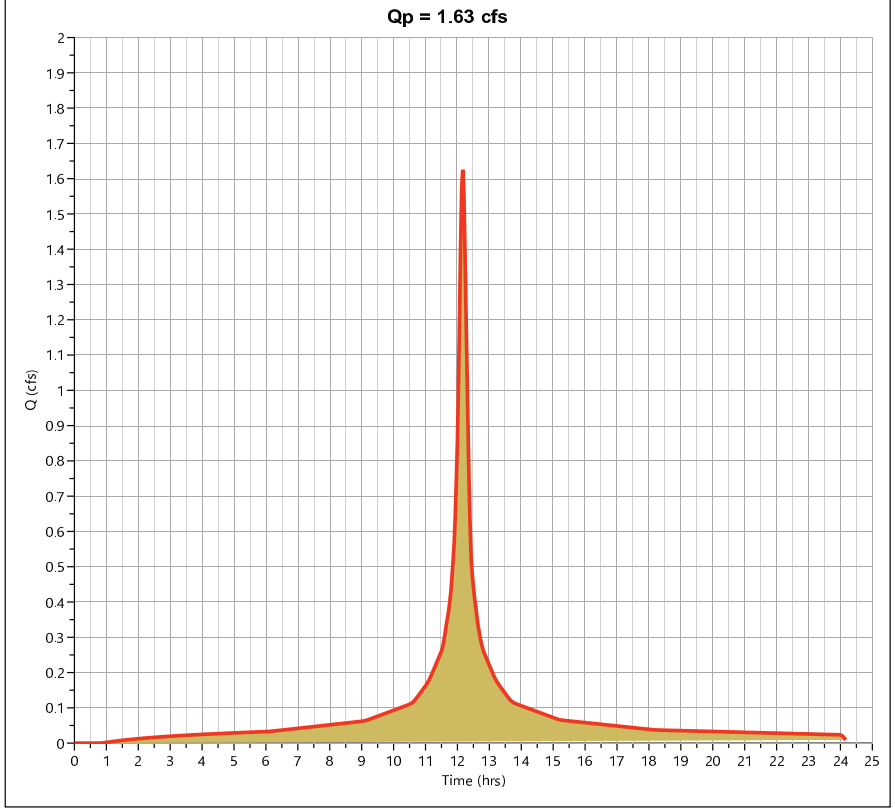
Hydrology Studio v 3.0.0.16

10-29-2020

PROP-DA1-OFF-IMP

Hyd. No. 17

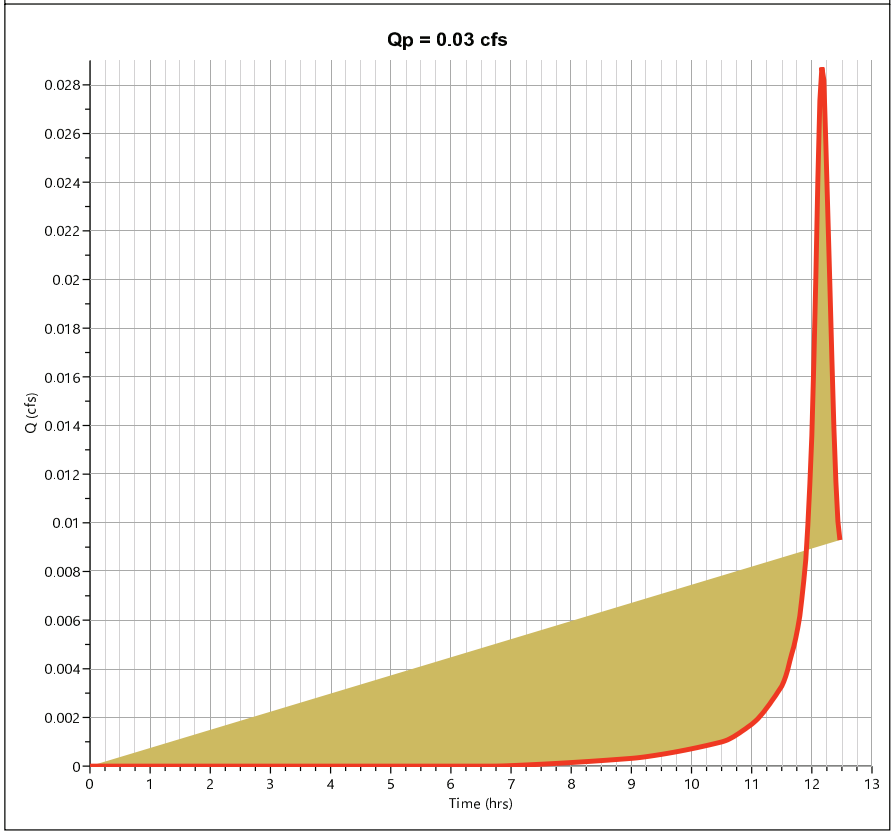
Hydrograph Type	= NRCS Runoff	Peak Flow	= 1.625 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 7,312 cuft
Drainage Area	= 0.4 ac	Curve Number	= 98
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 5.12 in	Design Storm	= NOAA-D
Storm Duration	= 24 hrs	Shape Factor	= 484



PROP-DA1-OFF-PER

Hyd. No. 18

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.029 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 112 cuft
Drainage Area	= 0.01 ac	Curve Number	= 80
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 5.12 in	Design Storm	= NOAA-D
Storm Duration	= 24 hrs	Shape Factor	= 484

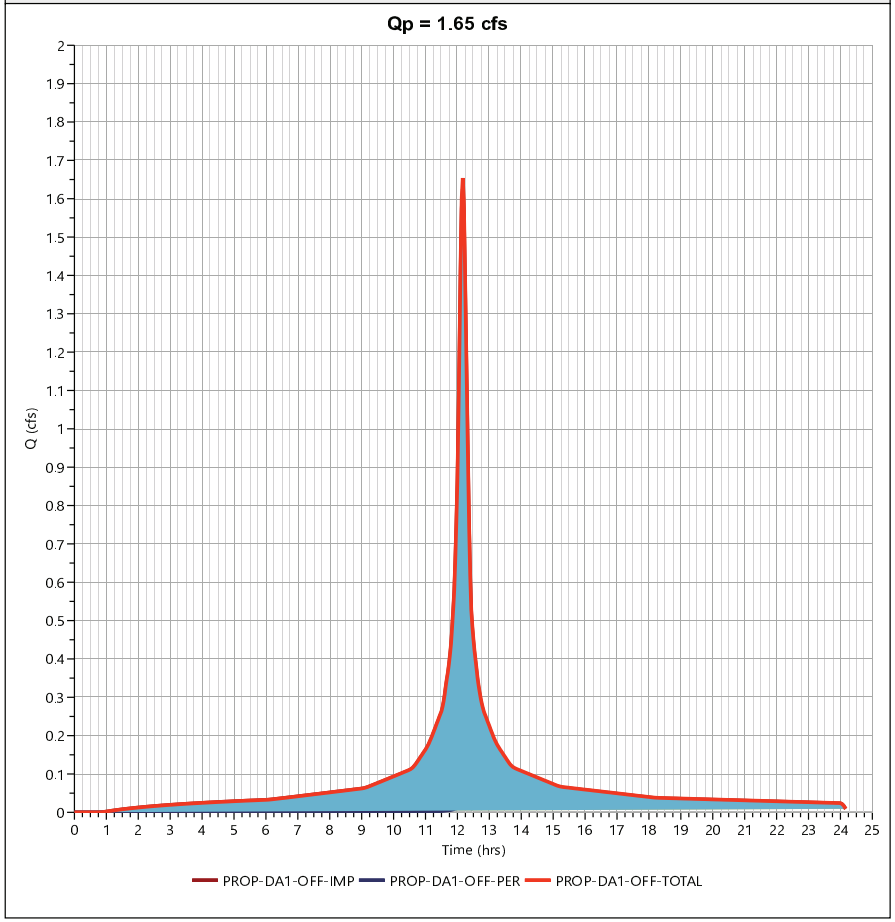


Hydrograph Report
Project Name:
Hydrology Studio v 3.0.0.16
10-29-2020

PROP-DA1-OFF-TOTAL

Hyd. No. 19

Hydrograph Type	= Junction	Peak Flow	= 1.654 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Hydrograph Volume	= 7,424 cuft
Inflow Hydrographs	= 17, 18	Total Contrib. Area	= 0.41 ac



Hydrograph Report

Project Name:

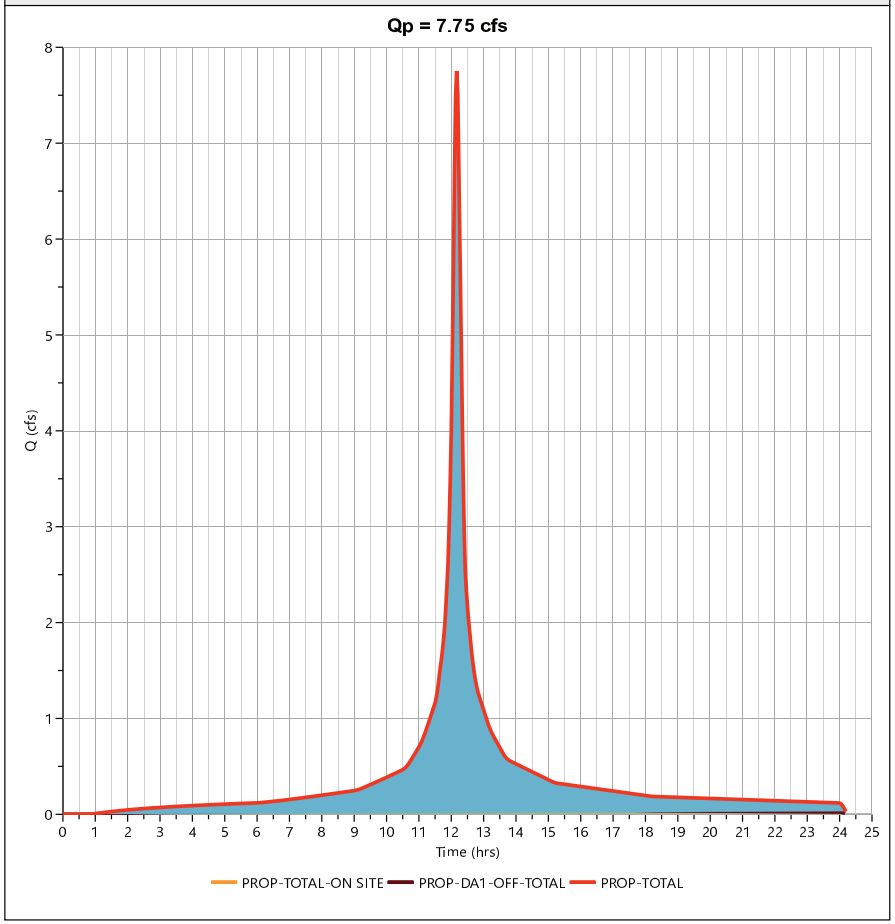
Hydrology Studio v 3.0.0.16

10-29-2020

PROP-TOTAL

Hyd. No. 21

Hydrograph Type	= Junction	Peak Flow	= 7.753 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Hydrograph Volume	= 33,828 cuft
Inflow Hydrographs	= 15, 19	Total Contrib. Area	= 2.09 ac



Design Storm Report

Custom Storm filename: Water Quality Storm.cds

Hydrology Studio v 3.0.0.16

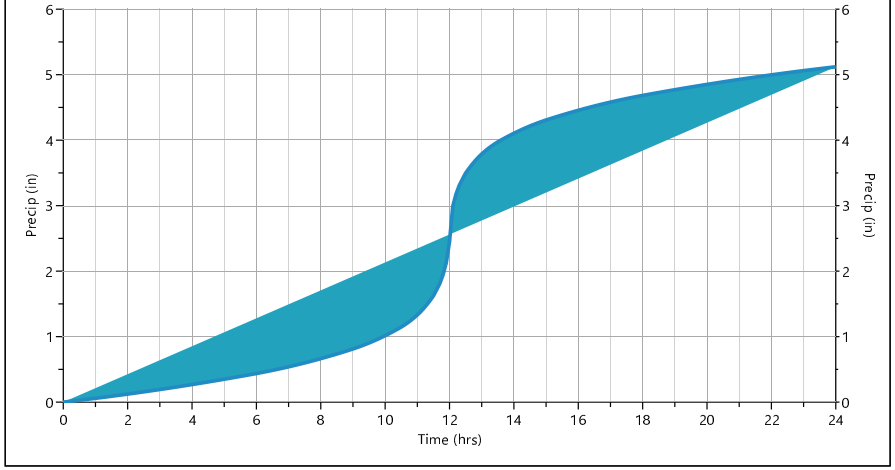
10-29-2020

Storm Distribution: Custom - NOAA-D

Storm Duration	Total Rainfall Volume (in)								
	1-yr	2-yr	3-yr	5-yr	✔ 10-yr	25-yr	50-yr	100-yr	
24 hrs	0.00	3.35	0.00	0.00	5.12	0.00	0.00	8.63	

Incremental Rainfall Distribution, 10-yr

Time (hrs)	Precip (in)	Time (hrs)	Precip (in)	Time (hrs)	Precip (in)	Time (hrs)	Precip (in)	Time (hrs)	Precip (in)
11.10	0.016009	11.47	0.022938	11.83	0.061884	12.20	0.061884	12.57	0.022938
11.13	0.017732	11.50	0.022938	11.87	0.061882	12.23	0.044595	12.60	0.022938
11.17	0.017732	11.53	0.030891	11.90	0.061884	12.27	0.044595	12.63	0.021214
11.20	0.017733	11.57	0.030890	11.93	0.106752	12.30	0.044595	12.67	0.021214
11.23	0.019473	11.60	0.030891	11.97	0.106752	12.33	0.032512	12.70	0.021214
11.27	0.019473	11.63	0.032512	12.00	0.106751	12.37	0.032512	12.73	0.019473
11.30	0.019473	11.67	0.032512	12.03	0.178125	12.40	0.032512	12.77	0.019472
11.33	0.021214	11.70	0.032512	12.07	0.178125	12.43	0.030891	12.80	0.019473
11.37	0.021214	11.73	0.044595	**12.10**	**0.178126**	12.47	0.030890	12.83	0.017732
11.40	0.021214	11.77	0.044595	12.13	0.061884	12.50	0.030891	12.87	0.017732
11.43	0.022938	11.80	0.044597	12.17	0.061882	12.53	0.022937	12.90	0.017732



Hydrograph 100-yr Summary

Project Name:

Hydrology Studio v 3.0.0.16

10-29-2020

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	EX-DA1	11.55	12.17	52,763	---		
2	NRCS Runoff	EX-DA OFFSITE	2.818	12.17	12,877	---		
4	Junction	EX-TOTAL	14.36	12.17	65,640	1, 2		
7	NRCS Runoff	PROP-DA1-IMP	6.941	12.17	31,721	---		
8	NRCS Runoff	PROP-DA1-PER	2.793	12.17	11,173	---		
9	Junction	PROP-DA1	9.734	12.17	42,894	7, 8		
11	NRCS Runoff	PROP-DA1-UND-IMP	0.412	12.17	1,884	---		
12	NRCS Runoff	PROP-DA1-UND-PER	0.756	12.17	3,026	---		
13	Junction	PROP-DA1-UND-TOTAL	1.169	12.17	4,910	11, 12		
15	Junction	PROP-TOTAL-ON SITE	10.90	12.17	47,804	9, 13		
17	NRCS Runoff	PROP-DA1-OFF-IMP	2.749	12.17	12,563	---		
18	NRCS Runoff	PROP-DA1-OFF-PER	0.058	12.17	233	---		
19	Junction	PROP-DA1-OFF-TOTAL	2.807	12.17	12,796	17, 18		
21	Junction	PROP-TOTAL	13.71	12.17	60,599	15, 19		

Hydrograph Report

Project Name:

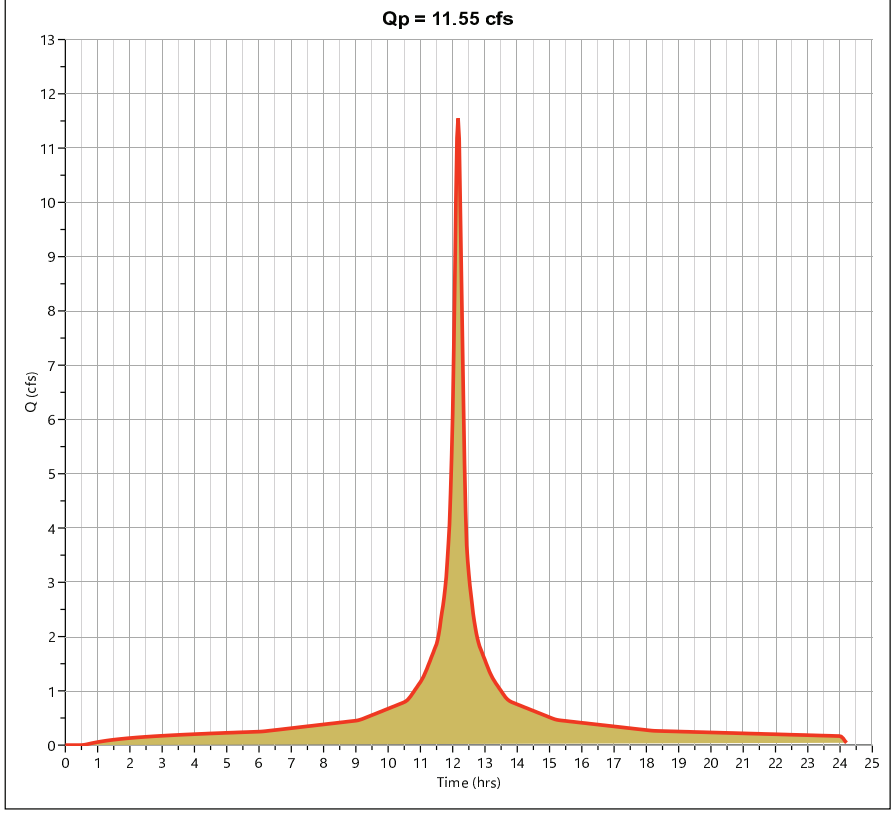
Hydrology Studio v 3.0.0.16

10-29-2020

EX-DA1

Hyd. No. 1

Hydrograph Type	= NRCS Runoff	Peak Flow	= 11.55 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 52,763 cuft
Drainage Area	= 1.68 ac	Curve Number	= 98
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 8.63 in	Design Storm	= NOAA-D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

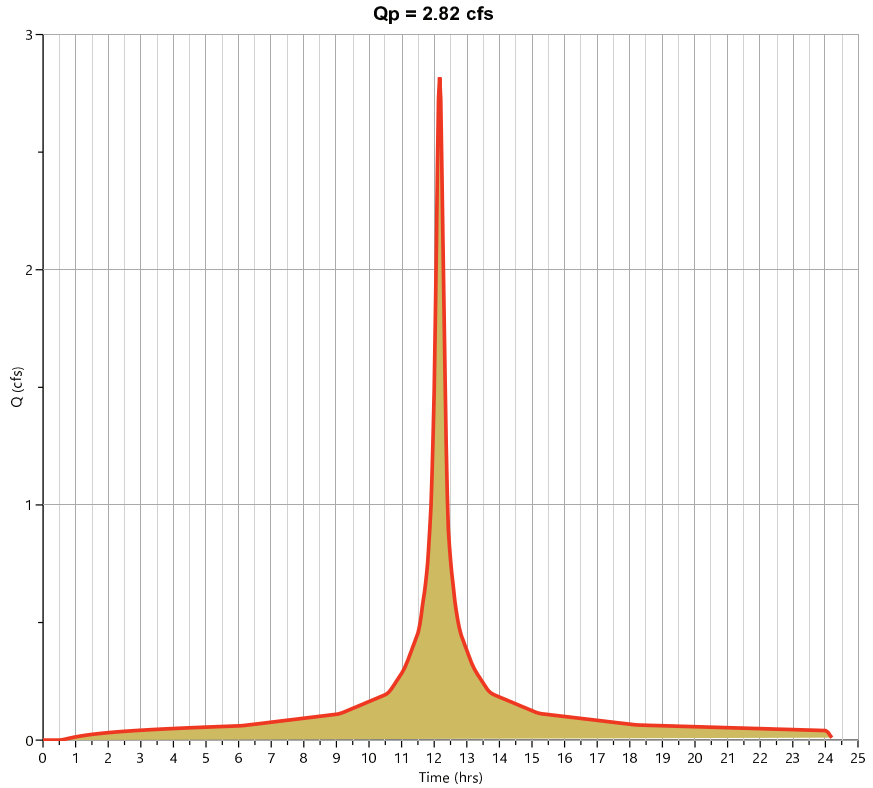
Hydrology Studio v 3.0.0.16

10-29-2020

EX-DA OFFSITE

Hyd. No. 2

Hydrograph Type	= NRCS Runoff	Peak Flow	= 2.818 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 12,877 cuft
Drainage Area	= 0.41 ac	Curve Number	= 98
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 8.63 in	Design Storm	= NOAA-D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

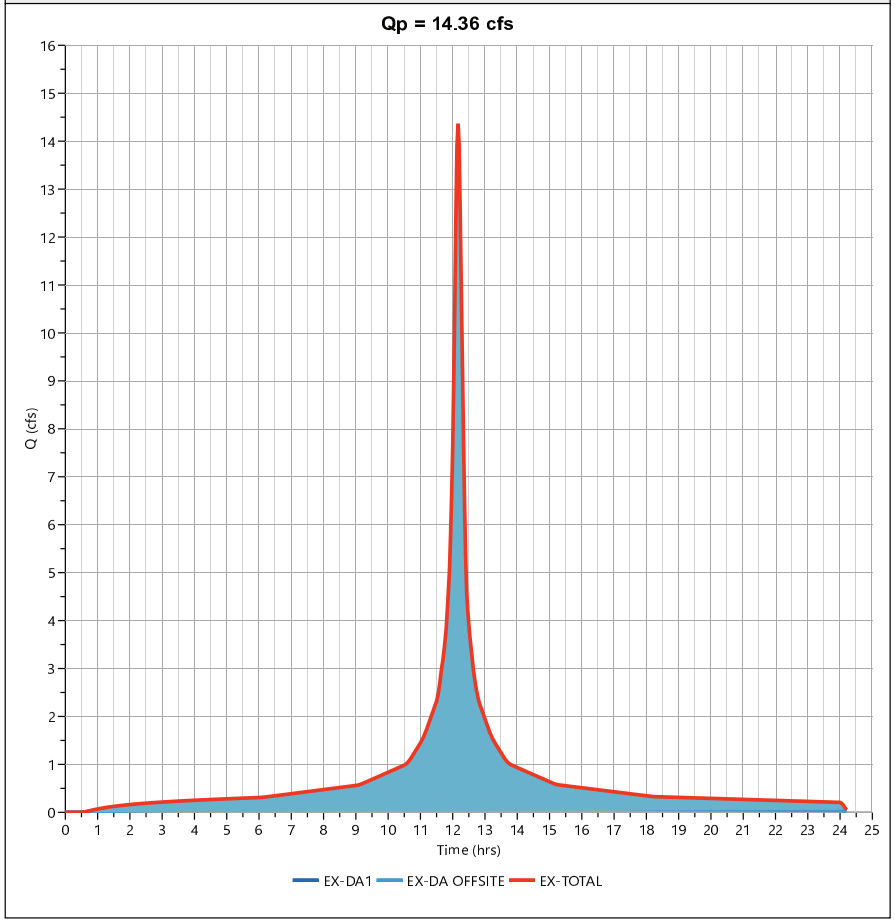
Hydrology Studio v 3.0.0.16

10-29-2020

EX-TOTAL

Hyd. No. 4

Hydrograph Type	= Junction	Peak Flow	= 14.36 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Hydrograph Volume	= 65,640 cuft
Inflow Hydrographs	= 1, 2	Total Contrib. Area	= 2.09 ac



Hydrograph Report

Project Name:

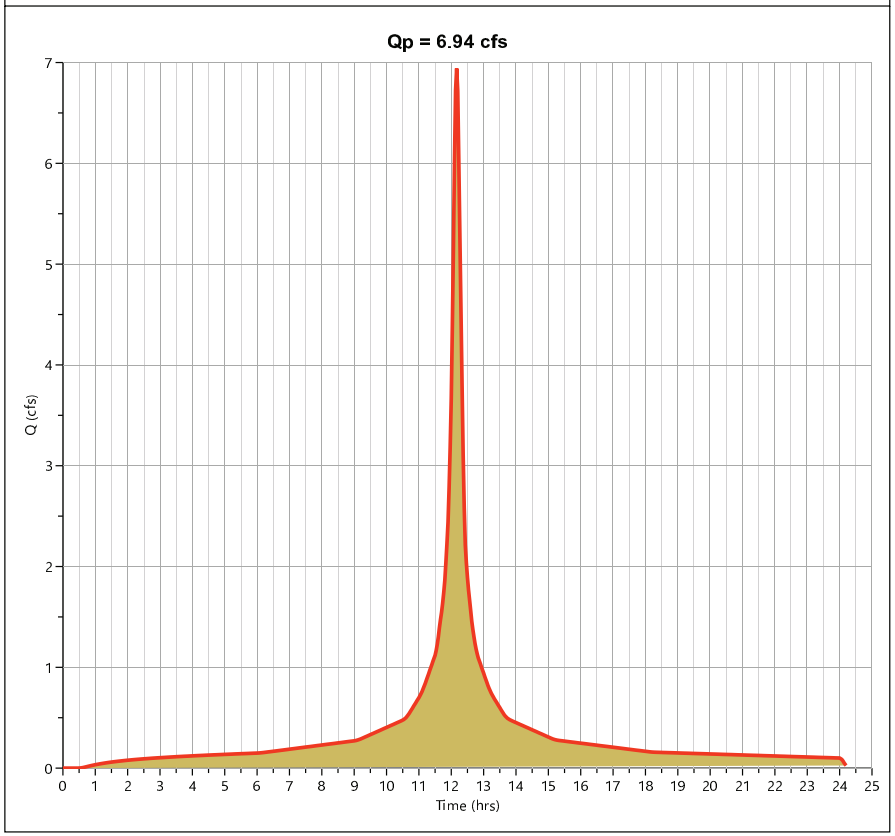
Hydrology Studio v 3.0.0.16

10-29-2020

PROP-DA1-IMP

Hyd. No. 7

Hydrograph Type	= NRCS Runoff	Peak Flow	= 6.941 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 31,721 cuft
Drainage Area	= 1.01 ac	Curve Number	= 98
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 8.63 in	Design Storm	= NOAA-D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

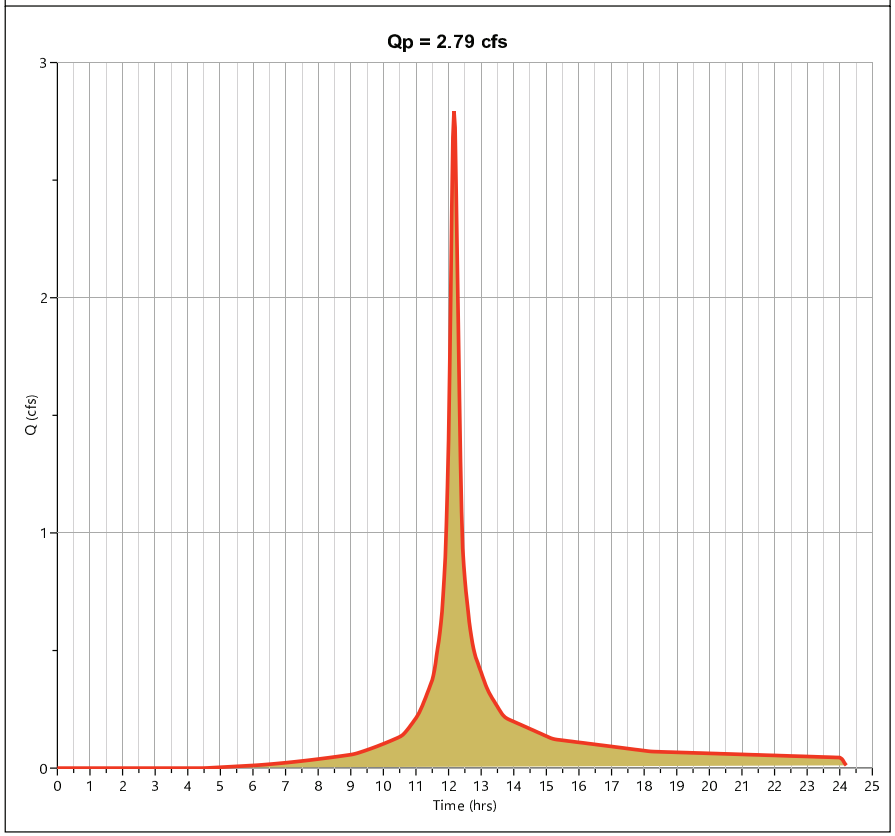
Hydrology Studio v 3.0.0.16

10-29-2020

PROP-DA1-PER

Hyd. No. 8

Hydrograph Type	= NRCS Runoff	Peak Flow	= 2.793 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 11,173 cuft
Drainage Area	= 0.48 ac	Curve Number	= 80
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 8.63 in	Design Storm	= NOAA-D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

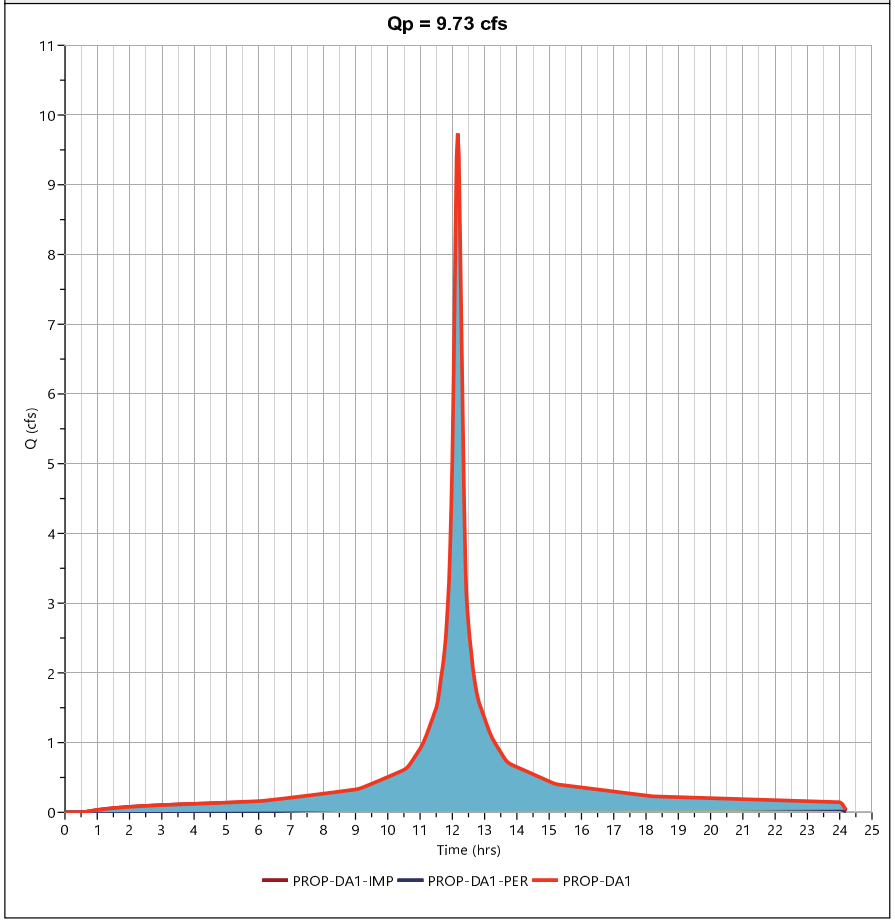
Hydrology Studio v 3.0.0.16

10-29-2020

PROP-DA1

Hyd. No. 9

Hydrograph Type	= Junction	Peak Flow	= 9.734 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Hydrograph Volume	= 42,894 cuft
Inflow Hydrographs	= 7, 8	Total Contrib. Area	= 1.49 ac



Hydrograph Report

Project Name:

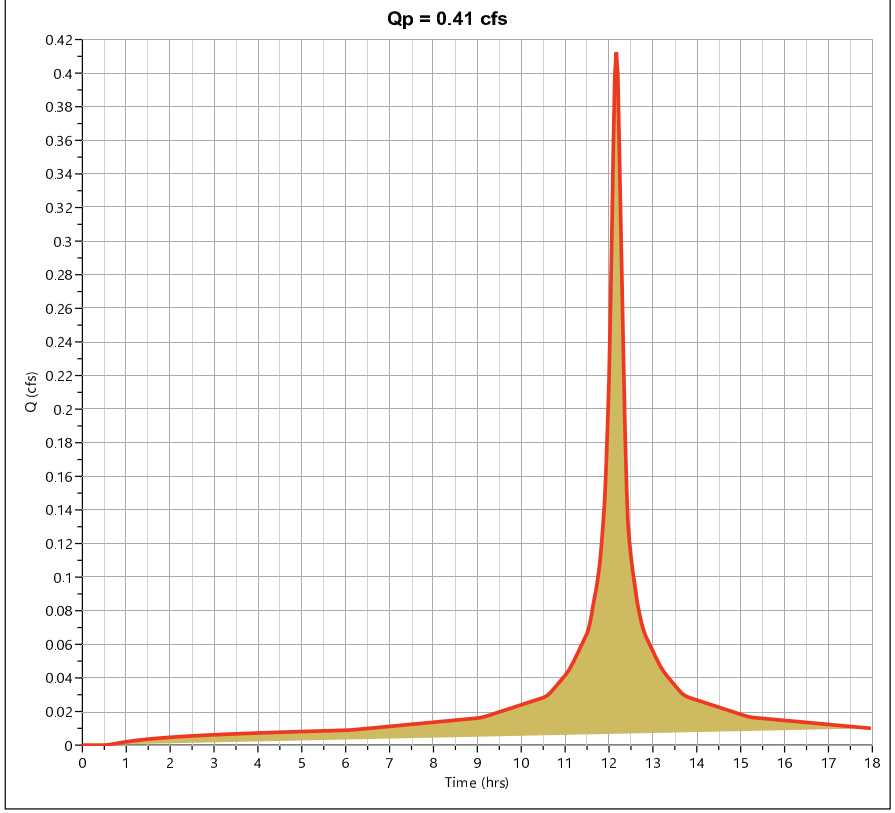
Hydrology Studio v 3.0.0.16

10-29-2020

PROP-DA1-UND-IMP

Hyd. No. 11

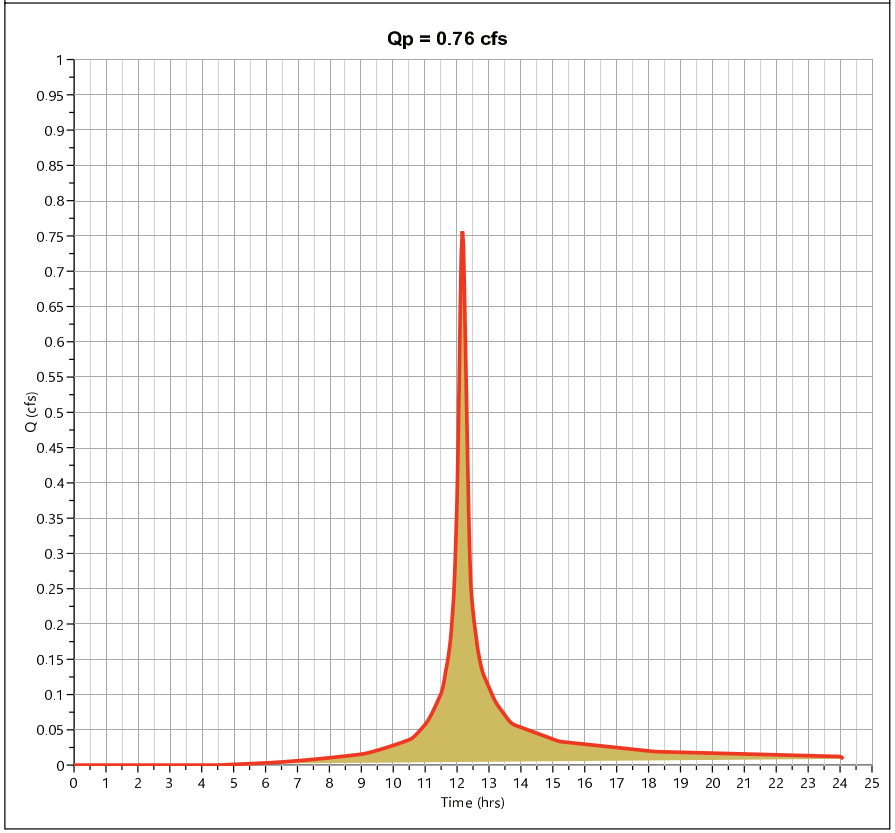
Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.412 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 1,884 cuft
Drainage Area	= 0.06 ac	Curve Number	= 98
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 8.63 in	Design Storm	= NOAA-D
Storm Duration	= 24 hrs	Shape Factor	= 484



PROP-DA1-UND-PER

Hyd. No. 12

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.756 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 3,026 cuft
Drainage Area	= 0.13 ac	Curve Number	= 80
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 8.63 in	Design Storm	= NOAA-D
Storm Duration	= 24 hrs	Shape Factor	= 484

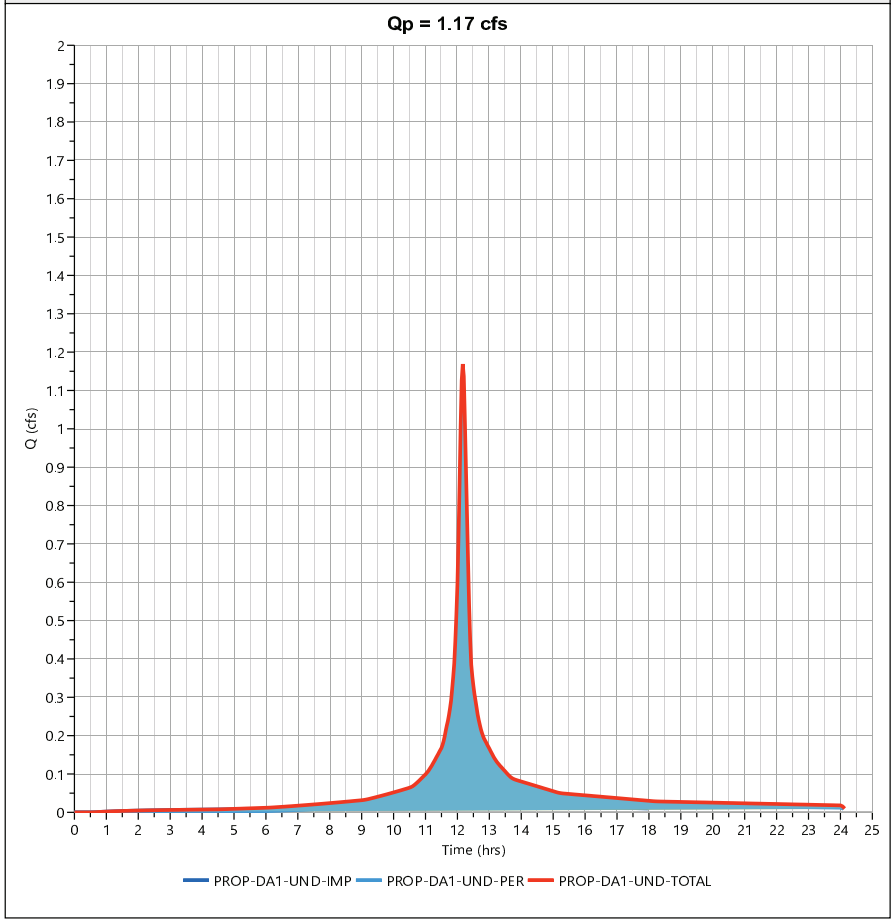


Hydrograph Report
Project Name:
Hydrology Studio v 3.0.0.16
10-29-2020

PROP-DA1-UND-TOTAL

Hyd. No. 13

Hydrograph Type	= Junction	Peak Flow	= 1.169 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Hydrograph Volume	= 4,910 cuft
Inflow Hydrographs	= 11, 12	Total Contrib. Area	= 0.19 ac



Hydrograph Report

Project Name:

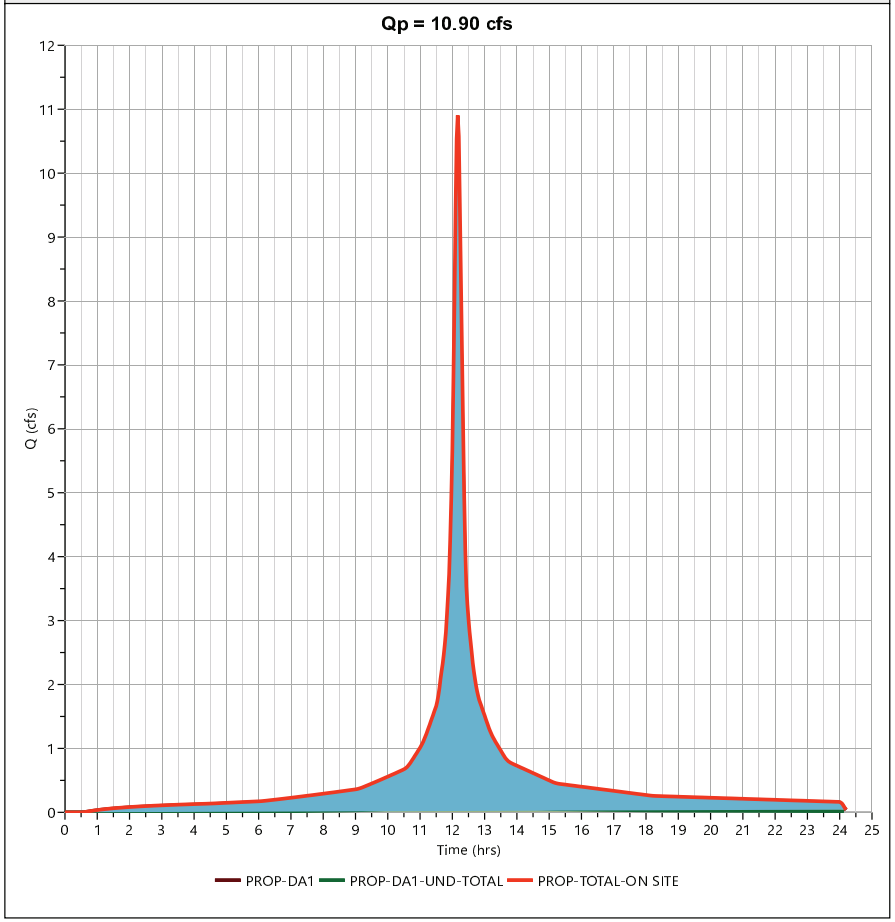
Hydrology Studio v 3.0.0.16

10-29-2020

PROP-TOTAL-ON SITE

Hyd. No. 15

Hydrograph Type	= Junction	Peak Flow	= 10.90 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Hydrograph Volume	= 47,804 cuft
Inflow Hydrographs	= 9, 13	Total Contrib. Area	= 1.68 ac



Hydrograph Report

Project Name:

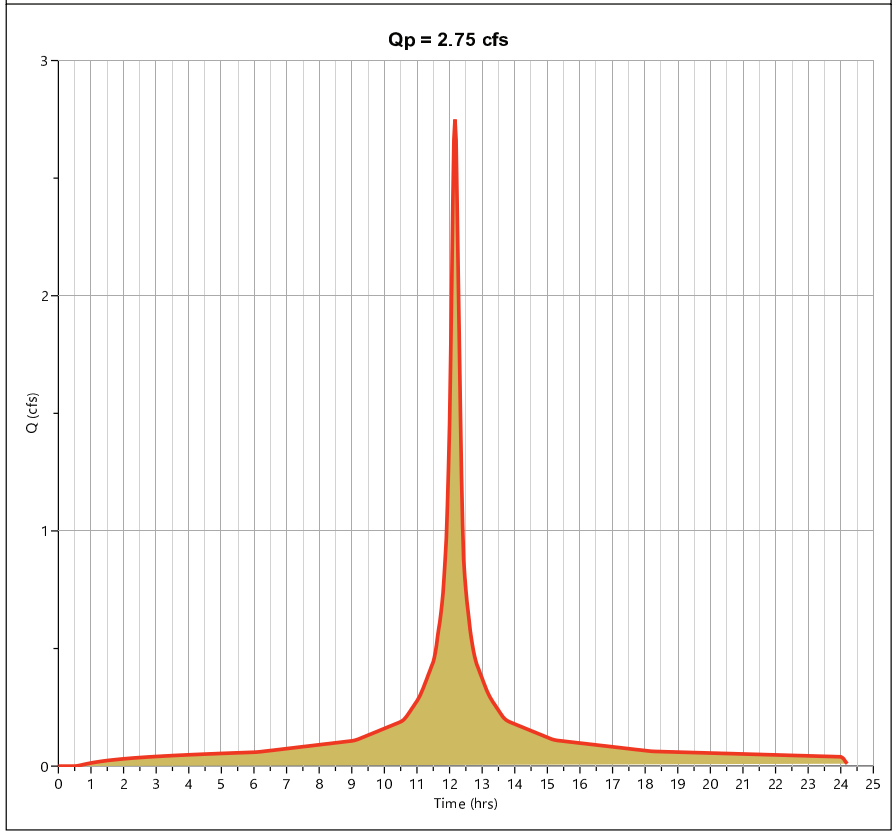
Hydrology Studio v 3.0.0.16

10-29-2020

PROP-DA1-OFF-IMP

Hyd. No. 17

Hydrograph Type	= NRCS Runoff	Peak Flow	= 2.749 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 12,563 cuft
Drainage Area	= 0.4 ac	Curve Number	= 98
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 8.63 in	Design Storm	= NOAA-D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

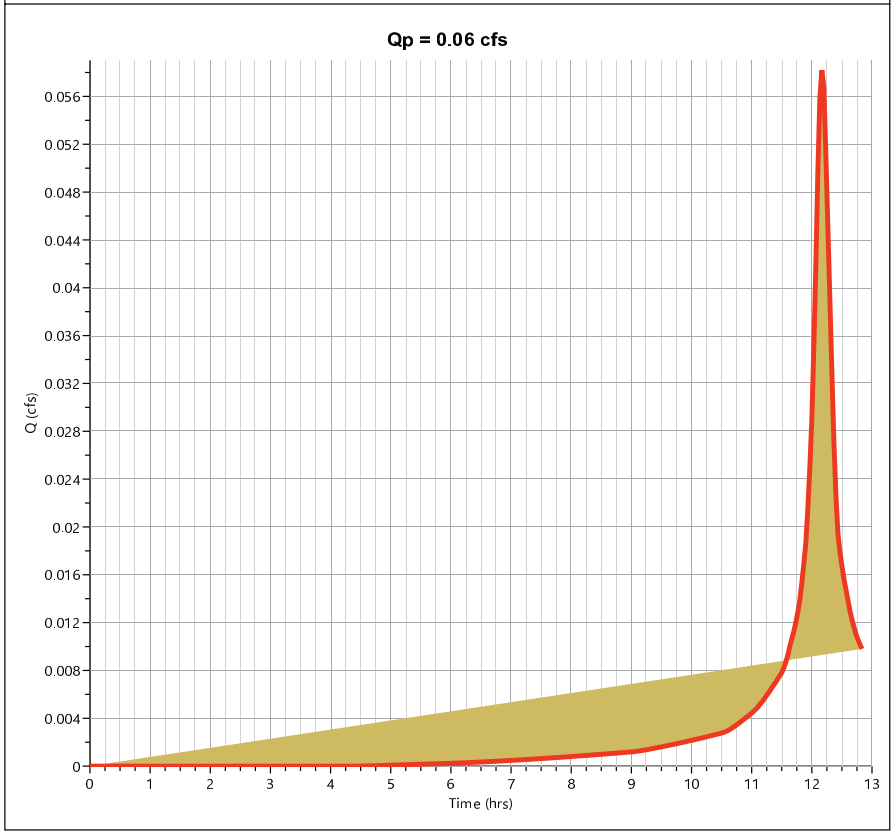
Hydrology Studio v 3.0.0.16

10-29-2020

PROP-DA1-OFF-PER

Hyd. No. 18

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.058 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 233 cuft
Drainage Area	= 0.01 ac	Curve Number	= 80
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 8.63 in	Design Storm	= NOAA-D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

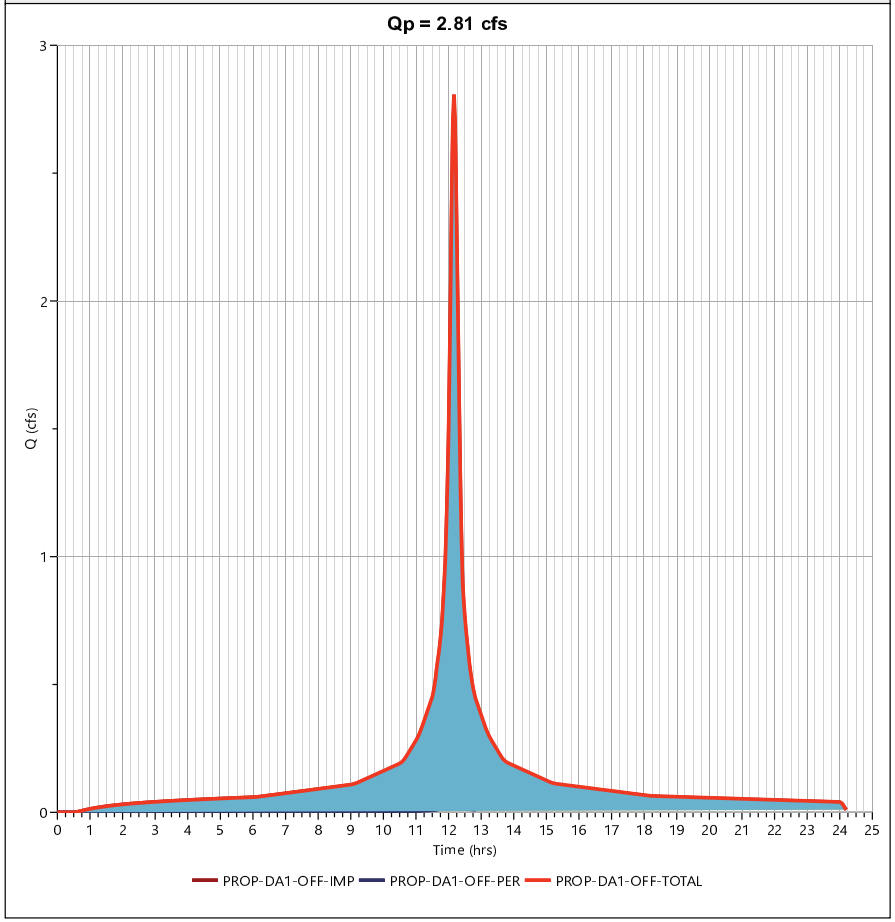
Hydrology Studio v 3.0.0.16

10-29-2020

PROP-DA1-OFF-TOTAL

Hyd. No. 19

Hydrograph Type	= Junction	Peak Flow	= 2.807 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Hydrograph Volume	= 12,796 cuft
Inflow Hydrographs	= 17, 18	Total Contrib. Area	= 0.41 ac



Hydrograph Report

Project Name:

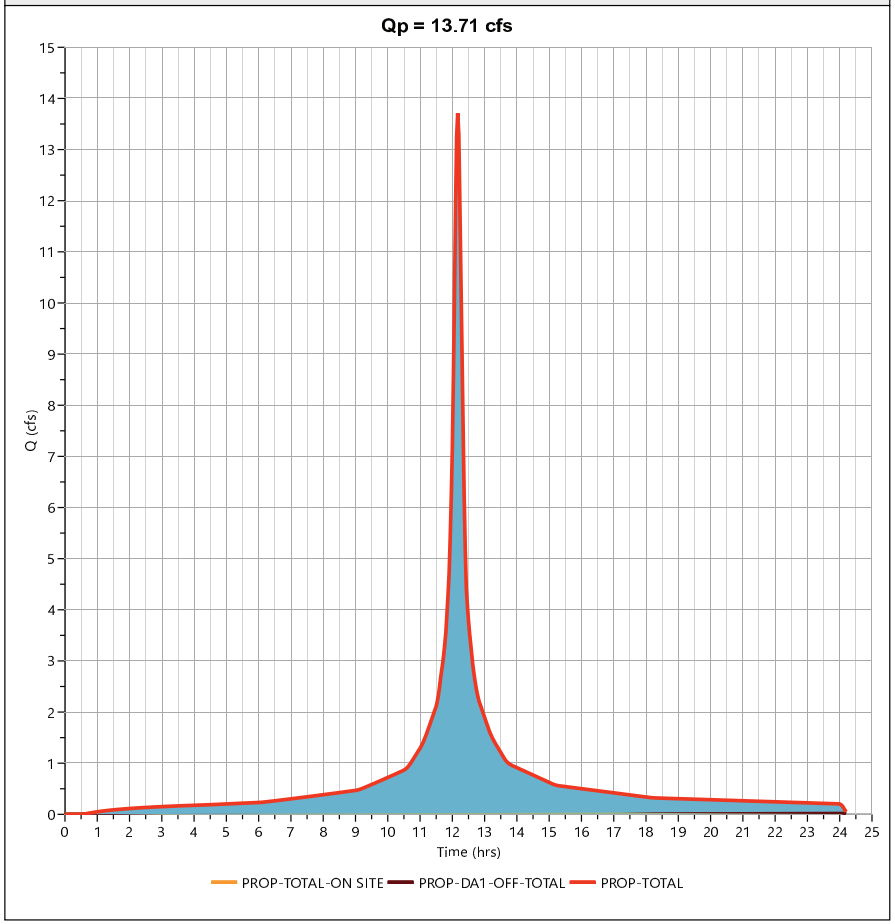
Hydrology Studio v 3.0.0.16

10-29-2020

PROP-TOTAL

Hyd. No. 21

Hydrograph Type	= Junction	Peak Flow	= 13.71 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Hydrograph Volume	= 60,599 cuft
Inflow Hydrographs	= 15, 19	Total Contrib. Area	= 2.09 ac



Design Storm Report

Custom Storm filename: Water Quality Storm.cds

Hydrology Studio v 3.0.0.16

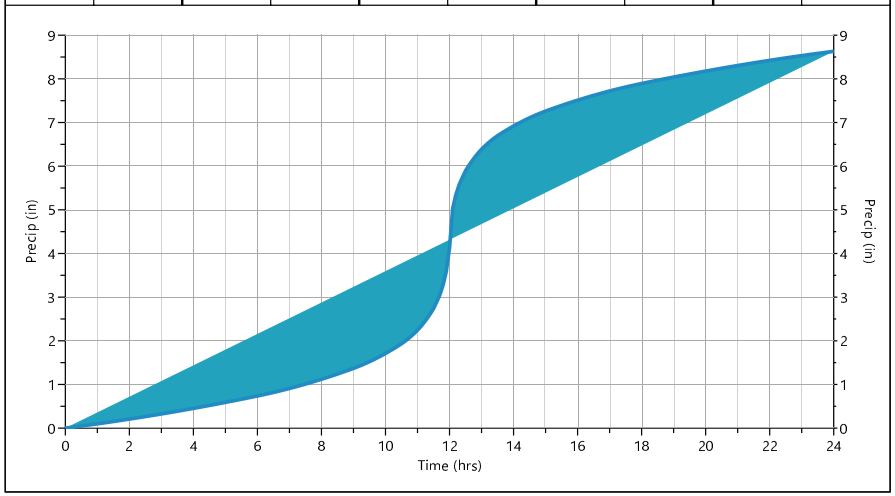
10-29-2020

Storm Distribution: Custom - NOAA-D

Storm Duration	Total Rainfall Volume (in)								
	1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	✔ 100-yr	
24 hrs	0.00	3.35	0.00	0.00	5.12	0.00	0.00	8.63	

Incremental Rainfall Distribution, 100-yr

Time (hrs)	Precip (in)	Time (hrs)	Precip (in)	Time (hrs)	Precip (in)	Time (hrs)	Precip (in)	Time (hrs)	Precip (in)
11.10	0.026983	11.47	0.038663	11.83	0.104308	12.20	0.104308	12.57	0.038662
11.13	0.029889	11.50	0.038664	11.87	0.104305	12.23	0.075167	12.60	0.038662
11.17	0.029889	11.53	0.052068	11.90	0.104308	12.27	0.075167	12.63	0.035757
11.20	0.029889	11.57	0.052066	11.93	0.179935	12.30	0.075167	12.67	0.035757
11.23	0.032823	11.60	0.052068	11.97	0.179936	12.33	0.054801	12.70	0.035758
11.27	0.032822	11.63	0.054801	12.00	0.179935	12.37	0.054801	12.73	0.032824
11.30	0.032823	11.67	0.054801	12.03	0.300239	12.40	0.054801	12.77	0.032821
11.33	0.035757	11.70	0.054801	12.07	0.300239	12.43	0.052068	12.80	0.032823
11.37	0.035757	11.73	0.075167	**12.10**	**0.300239**	12.47	0.052066	12.83	0.029889
11.40	0.035757	11.77	0.075167	12.13	0.104308	12.50	0.052068	12.87	0.029889
11.43	0.038662	11.80	0.075170	12.17	0.104306	12.53	0.038661	12.90	0.029888



IDF Report

IDF filename: SampleIDF.idf

Hydrology Studio v 3.0.0.16

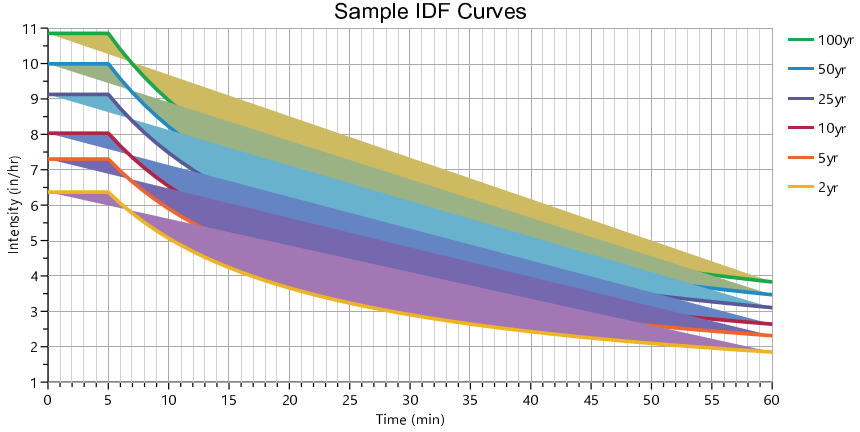
10-29-2020

Equation Coefficients	Intensity = B / (Tc + D)^E (in/hr)								
	1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr	
B	0.0000	58.1215	0.0000	57.1446	58.8780	63.5498	67.7965	72.2003	
D	0.0000	10.3000	0.0000	10.3000	10.3000	10.4000	10.5000	10.6000	
E	0.0000	0.8106	0.0000	0.7542	0.7303	0.7097	0.6986	0.6898	

Minimum Tc = 5 minutes

Tc (min)	Intensity Values (in/hr)								
	1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr	
Cf	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
5	0	6.37	0	7.30	8.03	9.13	9.99	10.85	
10	0	5.06	0	5.90	6.53	7.48	8.22	8.96	
15	0	4.24	0	5.00	5.56	6.40	7.06	7.71	
20	0	3.66	0	4.36	4.88	5.63	6.23	6.82	
25	0	3.23	0	3.89	4.36	5.06	5.60	6.14	
30	0	2.90	0	3.52	3.96	4.60	5.11	5.61	
35	0	2.64	0	3.22	3.64	4.24	4.71	5.18	
40	0	2.43	0	2.98	3.37	3.94	4.38	4.82	
45	0	2.25	0	2.77	3.14	3.68	4.10	4.52	
50	0	2.10	0	2.60	2.95	3.46	3.86	4.26	
55	0	1.96	0	2.44	2.78	3.27	3.65	4.03	
60	0	1.85	0	2.31	2.64	3.10	3.47	3.83	

Cf = Correction Factor applied to Rational Method runoff coefficient.



Precipitation Report

Precipitation filename: Morris County NRCS.pcp

Hydrology Studio v 3.0.0.16 (Rainfall totals in Inches)

10-29-2020

	Active	1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr
Active			✔			✔			✔
SCS Storms	**> SCS Dimensionless Storms**								
SCS 6hr		0	0	0	0	0	0	0	0
Type I, 24-hr		0	0	0	0	0	0	0	0
Type IA, 24-hr		0	0	0	0	0	0	0	0
Type II, 24-hr		0	0	0	0	0	0	0	0
Type II FL, 24-hr		0	0	0	0	0	0	0	0
Type III, 24-hr		2.94	3.54	0	4.47	5.24	6.37	7.32	8.35
Synthetic Storms	**> IDF-Based Synthetic Storms**								
1-hr		0	1.85	0	2.31	2.64	3.10	3.47	3.83
2-hr		0	2.24	0	2.90	3.36	4.01	4.51	5.01
3-hr		0	2.48	0	3.27	3.82	4.60	5.20	5.79
6-hr		0	2.89	0	3.96	4.70	5.73	6.53	7.32
12-hr		0	3.33	0	4.75	5.73	7.08	8.13	9.17
24-hr		0	3.82	0	5.66	6.94	8.70	10.07	11.42
Huff Distribution	**> 1st Quartile (0 to 6 hrs)**								
1-hr		0.76	0.98	0	1.33	1.61	2.01	2.34	2.69
2-hr		0.89	1.14	0	1.50	1.80	2.24	2.60	2.99
3-hr		0.98	1.24	0	1.59	1.90	2.33	2.68	3.07
6-hr		1.20	1.50	0	1.86	2.18	2.64	3.01	3.41
Huff Distribution	**> 2nd Quartile (>6 to 12 hrs)**								
8-hr		0	0	0	0	0	0	0	0
12-hr		0	0	0	0	0	0	0	0
Huff Distribution	**> 3rd Quartile (>12 to 24 hrs)**								
18-hr		0	0	0	0	0	0	0	0
24-hr		0	0	0	0	0	0	0	0
Custom Storms	**> Custom Storm Distributions**								
NJ Water Quality		1.25	0	0	0	0	0	0	0
My Custom Storm 2		0	0	0	0	0	0	0	0
My Custom Storm 3		0	0	0	0	0	0	0	0
My Custom Storm 4		0	0	0	0	0	0	0	0
My Custom Storm 5		0	0	0	0	0	0	0	0
My Custom Storm 6		0	0	0	0	0	0	0	0
My Custom Storm 7		0	0	0	0	0	0	0	0
My Custom Storm 8		0	0	0	0	0	0	0	0
My Custom Storm 9		0	0	0	0	0	0	0	0
My Custom Storm 10		0	0	0	0	0	0	0	0

Precipitation Report Cont'd

Precipitation filename: Morris County NRCS.pcp

Rainfall totals in Inches

10-29-2020

	Active	1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr
Active			✔			✔			✔
Huff Indiana	**> Indianapolis**								
30-min		0	0	0	0	0	0	0	0
1-hr		0	0	0	0	0	0	0	0
2-hr		0	0	0	0	0	0	0	0
3-hr		0	0	0	0	0	0	0	0
6-hr		0	0	0	0	0	0	0	0
12-hr		0	0	0	0	0	0	0	0
24-hr		0	0	0	0	0	0	0	0
Huff Indiana	**> Evansville**								
30-min		0	0	0	0	0	0	0	0
1-hr		0	0	0	0	0	0	0	0
2-hr		0	0	0	0	0	0	0	0
3-hr		0	0	0	0	0	0	0	0
6-hr		0	0	0	0	0	0	0	0
12-hr		0	0	0	0	0	0	0	0
24-hr		0	0	0	0	0	0	0	0
Huff Indiana	**> Fort Wayne**								
30-min		0	0	0	0	0	0	0	0
1-hr		0	0	0	0	0	0	0	0
2-hr		0	0	0	0	0	0	0	0
3-hr		0	0	0	0	0	0	0	0
6-hr		0	0	0	0	0	0	0	0
12-hr		0	0	0	0	0	0	0	0
24-hr		0	0	0	0	0	0	0	0
Huff Indiana	**> South Bend**								
30-min		0	0	0	0	0	0	0	0
1-hr		0	0	0	0	0	0	0	0
2-hr		0	0	0	0	0	0	0	0
3-hr		0	0	0	0	0	0	0	0
6-hr		0	0	0	0	0	0	0	0
12-hr		0	0	0	0	0	0	0	0
24-hr		0	0	0	0	0	0	0	0

Precipitation Report Cont'd

Precipitation filename: Morris County NRCS.pcp

Rainfall totals in Inches

10-29-2020

	Active	1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr
Active			✔			✔			✔
NRCS Storms	**> NRCS Dimensionless Storms**								
NRCS MSE1, 24-hr		0	0	0	0	0	0	0	0
NRCS MSE2, 24-hr		0	0	0	0	0	0	0	0
NRCS MSE3, 24-hr		0	0	0	0	0	0	0	0
NRCS MSE4, 24-hr		0	0	0	0	0	0	0	0
NRCS MSE5, 24-hr		0	0	0	0	0	0	0	0
NRCS MSE6, 24-hr		0	0	0	0	0	0	0	0
NOAA-A, 24-hr		0	0	0	0	0	0	0	0
NOAA-B, 24-hr		0	0	0	0	0	0	0	0
NOAA-C, 24-hr		0	0	0	0	0	0	0	0
NOAA-D, 24-hr	✔	0	3.35	0	0	5.12	0	0	8.63
NRCC-A, 24-hr		0	0	0	0	0	0	0	0
NRCC-B, 24-hr		0	0	0	0	0	0	0	0
NRCC-C, 24-hr		0	0	0	0	0	0	0	0
NRCC-D, 24-hr		0	0	0	0	0	0	0	0
CA-1, 24-hr		0	0	0	0	0	0	0	0
CA-2, 24-hr		0	0	0	0	0	0	0	0
CA-3, 24-hr		0	0	0	0	0	0	0	0
CA-4, 24-hr		0	0	0	0	0	0	0	0
CA-5, 24-hr		0	0	0	0	0	0	0	0
CA-6, 24-hr		0	0	0	0	0	0	0	0

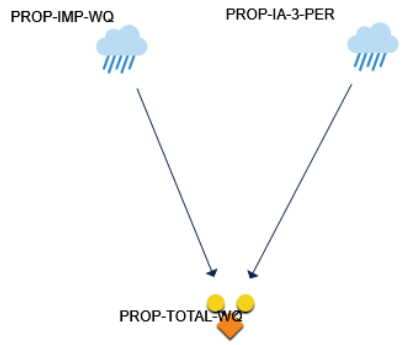
HYDROGRAPH SUMMARY REPORTS – WATER QUALITY DESIGN STORM

Basin Model

Project Name:

Hydrology Studio v 3.0.0.16

10-26-2020



Hydrograph by Return Period

Project Name:

Hydrology Studio v 3.0.0.16

10-26-2020

Hyd. No.	Hydrograph Type	Hydrograph Name	Peak Outflow (cfs)							
			1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr
1	NRCS Runoff	PROP-IMP-WQ	1.482							
2	NRCS Runoff	PROP-PER-WQ	0.048							
3	Junction	PROP-TOTAL-WQ	1.524							

Hydrograph 1-yr Summary

Project Name:

Hydrology Studio v 3.0.0.16

10-26-2020

Hyd. No.	Hydrograph Type	Hydrograph Name	Peak Flow (cfs)	Time to Peak (min)	Hydrograph Volume (cuft)	Inflow Hyd(s)	Maximum Elevation (ft)	Maximum Storage (cuft)
1	NRCS Runoff	PROP-IMP-WQ	1.482	68	2,324	----		
2	NRCS Runoff	PROP-PER-WQ	0.048	74	84.2	----		
3	Junction	PROP-TOTAL-WQ	1.524	70	2,408	1, 2		

Hydrograph Report

Project Name:

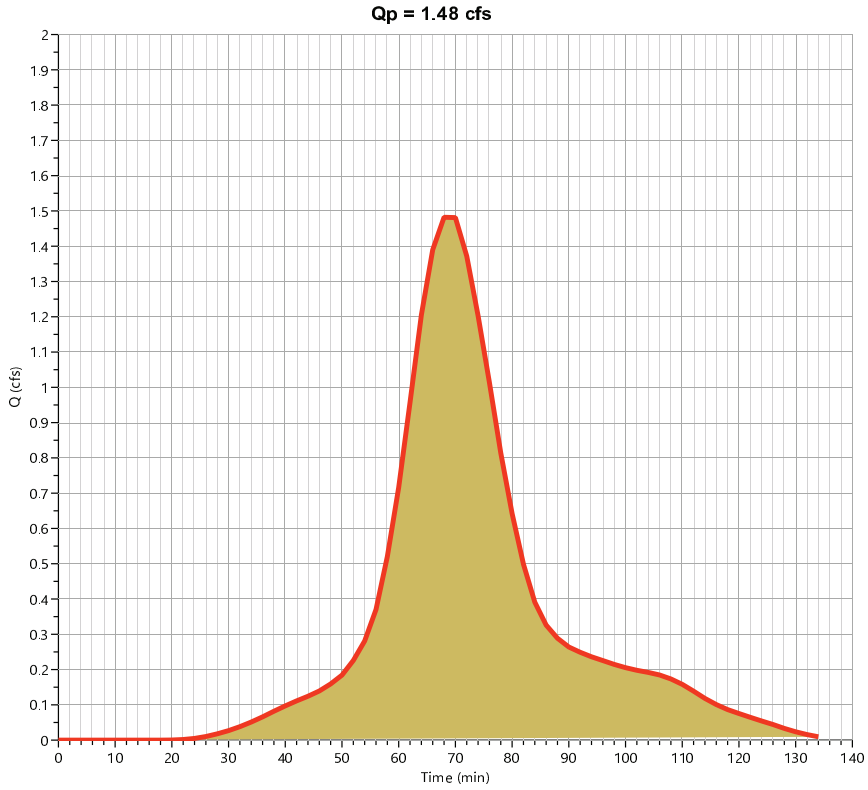
Hydrology Studio v 3.0.0.16

10-26-2020

PROP-IMP-WQ

Hyd. No. 1

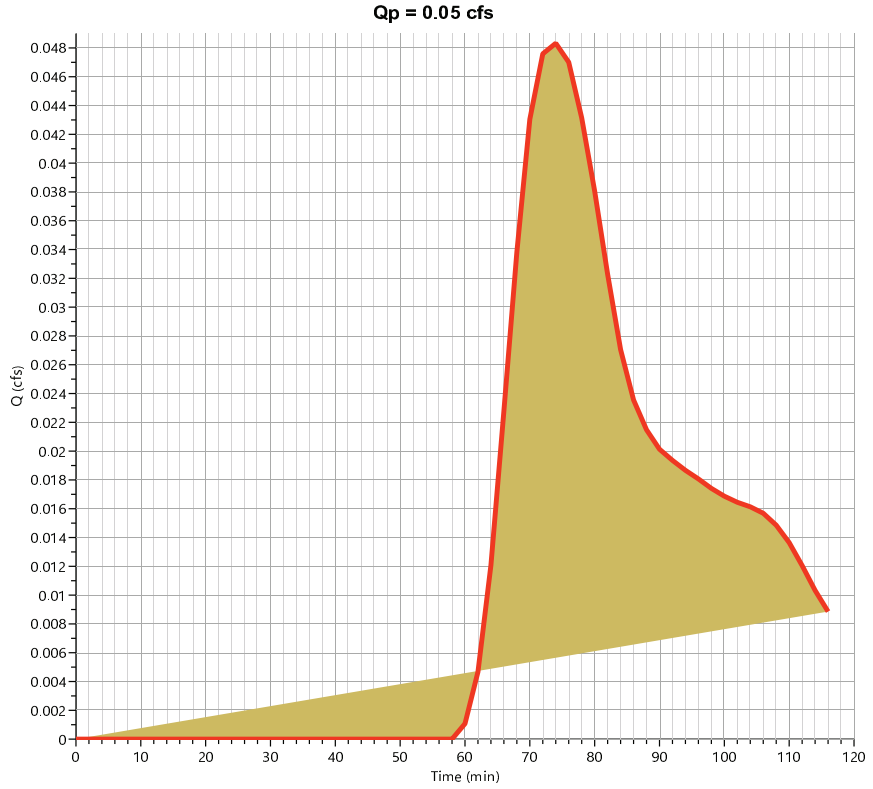
Hydrograph Type	= NRCS Runoff	Peak Flow	= 1.482 cfs
Storm Frequency	= 1-yr	Time to Peak	= 68 min
Time Interval	= 2 min	Runoff Volume	= 2,324 cuft
Drainage Area	= 0.6 ac	Curve Number	= 98
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 1.25 in	Design Storm	= NJ WQ Storm
Storm Duration	= 2 hrs	Shape Factor	= 484



PROP-PER-WQ

Hyd. No. 2

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.048 cfs
Storm Frequency	= 1-yr	Time to Peak	= 74 min
Time Interval	= 2 min	Runoff Volume	= 84.2 cuft
Drainage Area	= 0.13 ac	Curve Number	= 80
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 1.25 in	Design Storm	= NJ WQ Storm
Storm Duration	= 2 hrs	Shape Factor	= 484

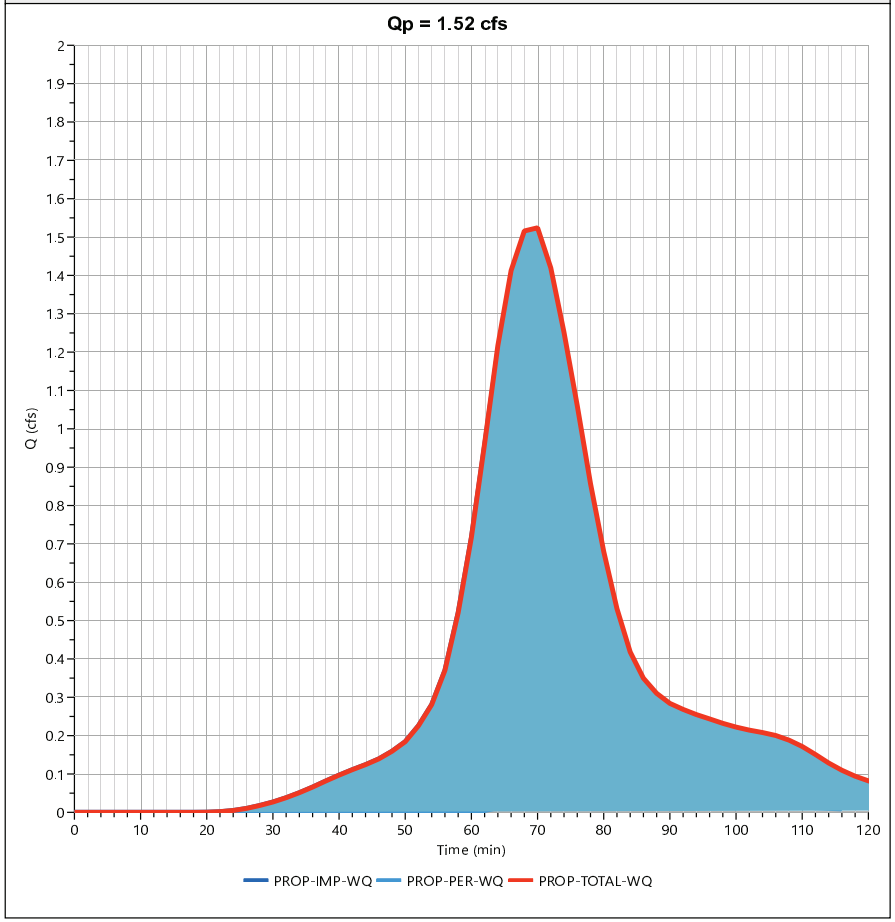


Hydrograph Report
Project Name:
Hydrology Studio v 3.0.0.16
10-26-2020

PROP-TOTAL-WQ

Hyd. No. 3

Hydrograph Type	= Junction	Peak Flow	= 1.524 cfs
Storm Frequency	= 1-yr	Time to Peak	= 70 min
Time Interval	= 2 min	Hydrograph Volume	= 2,408 cuft
Inflow Hydrographs	= 1, 2	Total Contrib. Area	= 0.73 ac



Design Storm Report

Custom Storm filename: Water Quality Storm.cds

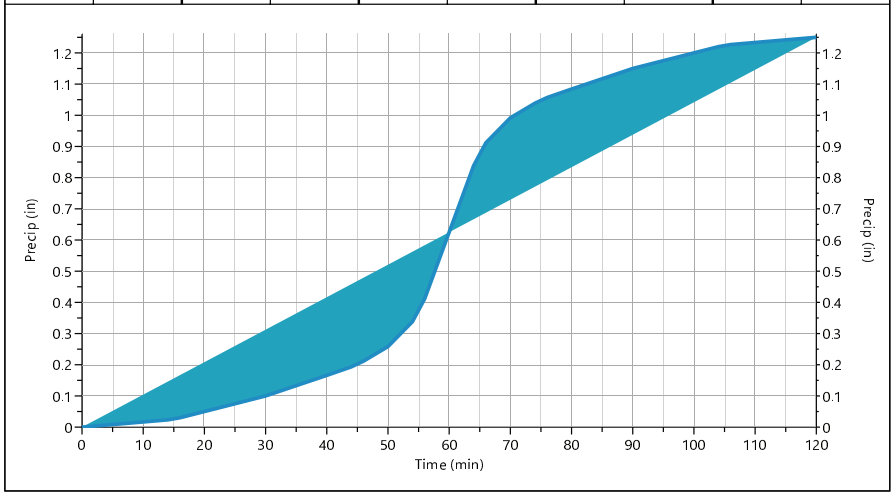
Hydrology Studio v 3.0.0.16

10-26-2020

Storm Distribution: Custom - NJDEP WQ Storm

Storm Duration	Total Rainfall Volume (in)								
	✔ 1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr	
2 hrs	1.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	

Incremental Rainfall Distribution, 1-yr									
Time (min)	Precip (in)	Time (min)	Precip (in)	Time (min)	Precip (in)	Time (min)	Precip (in)	Time (min)	Precip (in)
2	0.003300	24	0.010000	46	0.018450	68	0.040000	90	0.013200
4	0.003300	26	0.010000	48	0.023300	70	0.040001	92	0.010000
6	0.003325	28	0.010000	50	0.023302	72	0.023300	94	0.010000
8	0.003350	30	0.010000	52	0.040000	74	0.023300	96	0.010000
10	0.003350	32	0.013200	54	0.040000	76	0.018450	98	0.010000
12	0.003350	34	0.013200	56	0.073350	78	0.013600	100	0.010002
14	0.003350	36	0.013200	58	0.106700	80	0.013600	102	0.010000
16	0.006675	38	0.013200	60	0.106700	82	0.013200	104	0.010000
18	0.010000	40	0.013200	62	0.106698	84	0.013200	106	0.006673
20	0.010000	42	0.013600	64	0.106700	86	0.013200	108	0.003350
22	0.010000	44	0.013600	66	0.073349	88	0.013200	110	0.003350



IDF Report

IDF filename: SampleIDF.idf

Hydrology Studio v 3.0.0.16

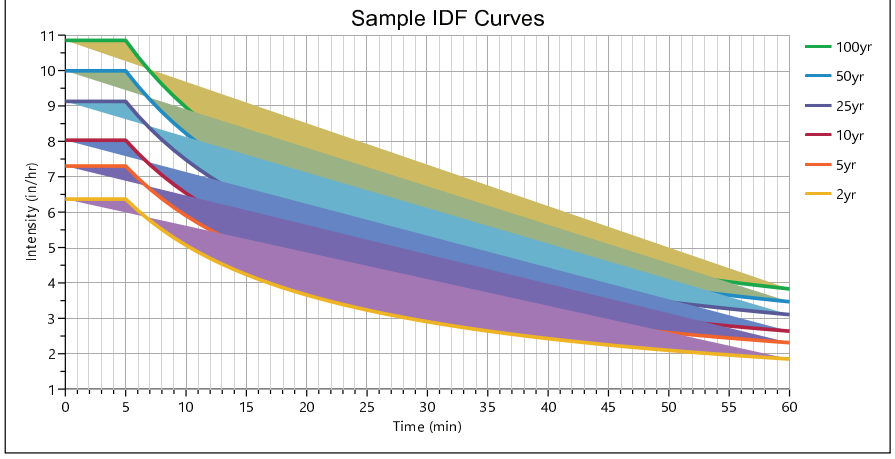
10-26-2020

Equation Coefficients	Intensity = B / (Tc + D)^E (in/hr)								
	1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr	
B	0.0000	58.1215	0.0000	57.1446	58.8780	63.5498	67.7965	72.2003	
D	0.0000	10.3000	0.0000	10.3000	10.3000	10.4000	10.5000	10.6000	
E	0.0000	0.8106	0.0000	0.7542	0.7303	0.7097	0.6986	0.6898	

Minimum Tc = 5 minutes

Tc (min)	Intensity Values (in/hr)								
	1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr	
Cf	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
5	0	6.37	0	7.30	8.03	9.13	9.99	10.85	
10	0	5.06	0	5.90	6.53	7.48	8.22	8.96	
15	0	4.24	0	5.00	5.56	6.40	7.06	7.71	
20	0	3.66	0	4.36	4.88	5.63	6.23	6.82	
25	0	3.23	0	3.89	4.36	5.06	5.60	6.14	
30	0	2.90	0	3.52	3.96	4.60	5.11	5.61	
35	0	2.64	0	3.22	3.64	4.24	4.71	5.18	
40	0	2.43	0	2.98	3.37	3.94	4.38	4.82	
45	0	2.25	0	2.77	3.14	3.68	4.10	4.52	
50	0	2.10	0	2.60	2.95	3.46	3.86	4.26	
55	0	1.96	0	2.44	2.78	3.27	3.65	4.03	
60	0	1.85	0	2.31	2.64	3.10	3.47	3.83	

Cf = Correction Factor applied to Rational Method runoff coefficient.



Precipitation Report

Precipitation filename: Middlesex County.pcp

Hydrology Studio v 3.0.0.16 (Rainfall totals in Inches)

10-26-2020

	Active	1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr
Active		✔							
SCS Storms	**> SCS Dimensionless Storms**								
SCS 6hr		0	0	0	0	0	0	0	0
Type I, 24-hr		0	0	0	0	0	0	0	0
Type IA, 24-hr		0	0	0	0	0	0	0	0
Type II, 24-hr		0	0	0	0	0	0	0	0
Type II FL, 24-hr		0	0	0	0	0	0	0	0
Type III, 24-hr		2.76	3.35	0	4.30	5.12	6.36	7.43	8.63
Synthetic Storms	**> IDF-Based Synthetic Storms**								
1-hr		0	1.85	0	2.31	2.64	3.10	3.47	3.83
2-hr		0	2.24	0	2.90	3.36	4.01	4.51	5.01
3-hr		0	2.48	0	3.27	3.82	4.60	5.20	5.79
6-hr		0	2.89	0	3.96	4.70	5.73	6.53	7.32
12-hr		0	3.33	0	4.75	5.73	7.08	8.13	9.17
24-hr		0	3.82	0	5.66	6.94	8.70	10.07	11.42
Huff Distribution	**> 1st Quartile (0 to 6 hrs)**								
1-hr		0.76	0.98	0	1.33	1.61	2.01	2.34	2.69
2-hr		0.89	1.14	0	1.50	1.80	2.24	2.60	2.99
3-hr		0.98	1.24	0	1.59	1.90	2.33	2.68	3.07
6-hr		1.20	1.50	0	1.86	2.18	2.64	3.01	3.41
Huff Distribution	**> 2nd Quartile (>6 to 12 hrs)**								
8-hr		0	0	0	0	0	0	0	0
12-hr		0	0	0	0	0	0	0	0
Huff Distribution	**> 3rd Quartile (>12 to 24 hrs)**								
18-hr		0	0	0	0	0	0	0	0
24-hr		0	0	0	0	0	0	0	0
Custom Storms	**> Custom Storm Distributions**								
NJ Water Quality		1.25	0	0	0	0	0	0	0
My Custom Storm 2		0	0	0	0	0	0	0	0
My Custom Storm 3		0	0	0	0	0	0	0	0
My Custom Storm 4		0	0	0	0	0	0	0	0
My Custom Storm 5		0	0	0	0	0	0	0	0
My Custom Storm 6		0	0	0	0	0	0	0	0
My Custom Storm 7		0	0	0	0	0	0	0	0
My Custom Storm 8		0	0	0	0	0	0	0	0
My Custom Storm 9		0	0	0	0	0	0	0	0
My Custom Storm 10		0	0	0	0	0	0	0	0

Precipitation Report Cont'd

Precipitation filename: Middlesex County.pcp

Rainfall totals in Inches

10-26-2020

	Active	1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr
Active		✔							
Huff Indiana	**> Indianapolis**								
30-min		0	0	0	0	0	0	0	0
1-hr		0	0	0	0	0	0	0	0
2-hr		0	0	0	0	0	0	0	0
3-hr		0	0	0	0	0	0	0	0
6-hr		0	0	0	0	0	0	0	0
12-hr		0	0	0	0	0	0	0	0
24-hr		0	0	0	0	0	0	0	0
Huff Indiana	**> Evansville**								
30-min		0	0	0	0	0	0	0	0
1-hr		0	0	0	0	0	0	0	0
2-hr		0	0	0	0	0	0	0	0
3-hr		0	0	0	0	0	0	0	0
6-hr		0	0	0	0	0	0	0	0
12-hr		0	0	0	0	0	0	0	0
24-hr		0	0	0	0	0	0	0	0
Huff Indiana	**> Fort Wayne**								
30-min		0	0	0	0	0	0	0	0
1-hr		0	0	0	0	0	0	0	0
2-hr		0	0	0	0	0	0	0	0
3-hr		0	0	0	0	0	0	0	0
6-hr		0	0	0	0	0	0	0	0
12-hr		0	0	0	0	0	0	0	0
24-hr		0	0	0	0	0	0	0	0
Huff Indiana	**> South Bend**								
30-min		0	0	0	0	0	0	0	0
1-hr		0	0	0	0	0	0	0	0
2-hr		0	0	0	0	0	0	0	0
3-hr		0	0	0	0	0	0	0	0
6-hr		0	0	0	0	0	0	0	0
12-hr		0	0	0	0	0	0	0	0
24-hr		0	0	0	0	0	0	0	0

Precipitation Report Cont'd

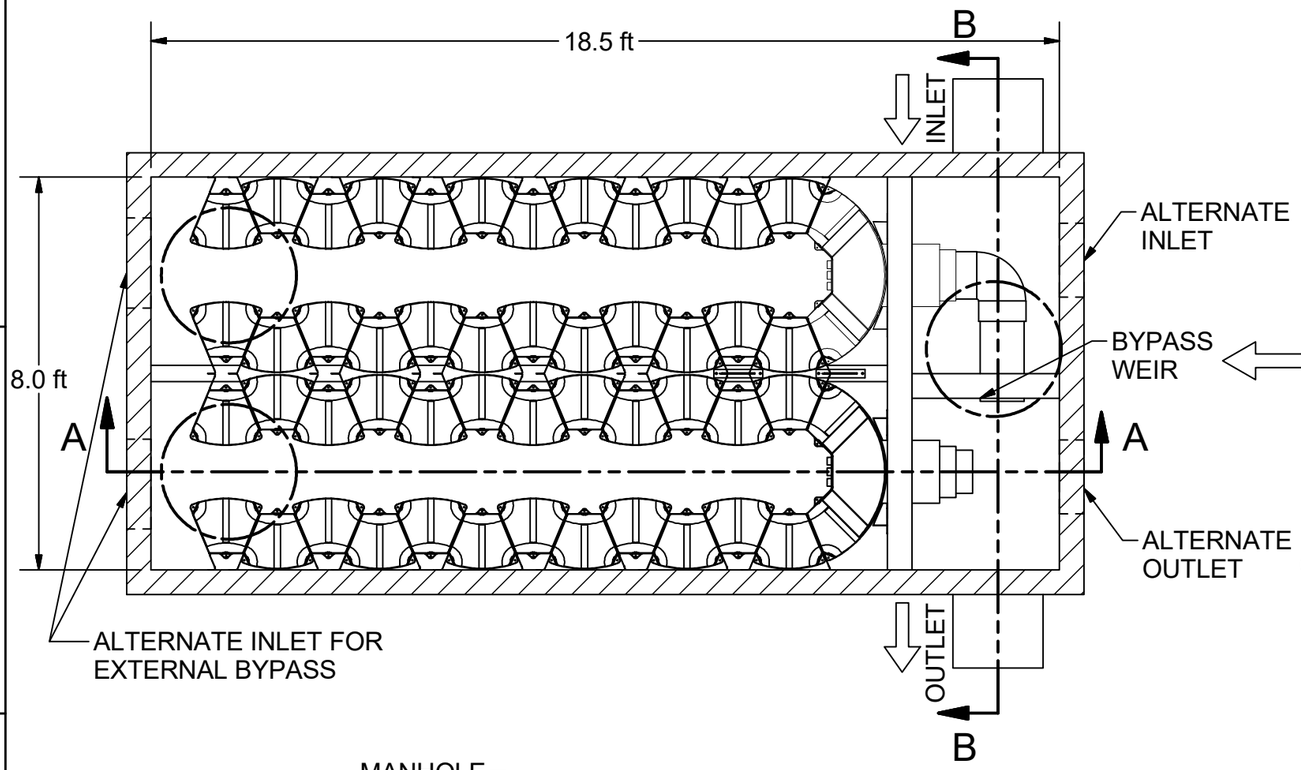
Precipitation filename: Middlesex County.pcp

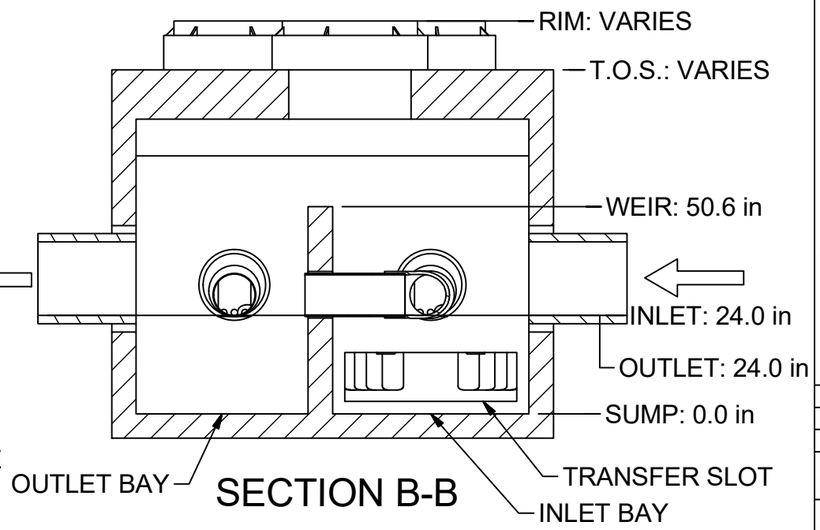
Rainfall totals in Inches

10-26-2020

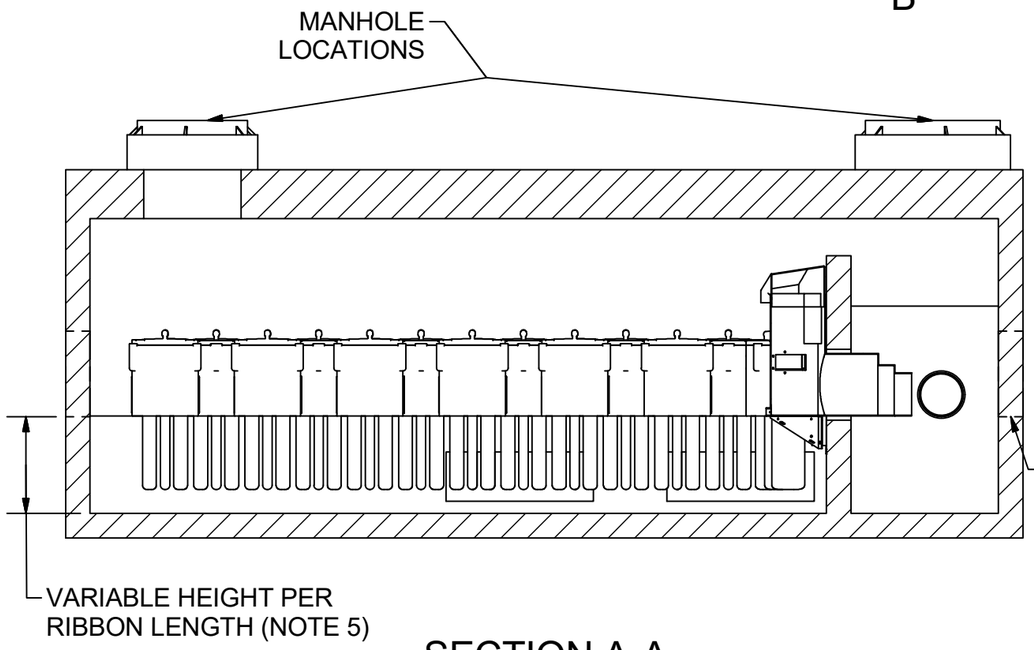
	Active	1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr
Active		✔							
NRCS Storms	**> NRCS Dimensionless Storms**								
NRCS MSE3, 24-hr		0	0	0	0	0	0	0	0
NRCS MSE4, 24-hr		0	0	0	0	0	0	0	0
NRCS MSE3, 24-hr		0	0	0	0	0	0	0	0
NRCS MSE4, 24-hr		0	0	0	0	0	0	0	0
NRCS MSE5, 24-hr		0	0	0	0	0	0	0	0
NRCS MSE6, 24-hr		0	0	0	0	0	0	0	0
NOAA-A, 24-hr		0	0	0	0	0	0	0	0
NOAA-B, 24-hr		0	0	0	0	0	0	0	0
NOAA-C, 24-hr		0	0	0	0	0	0	0	0
NOAA-D, 24-hr		0	0	0	0	0	0	0	0
NRCC-A, 24-hr		0	0	0	0	0	0	0	0
NRCC-B, 24-hr		0	0	0	0	0	0	0	0
NRCC-C, 24-hr		0	0	0	0	0	0	0	0
NRCC-D, 24-hr		0	0	0	0	0	0	0	0
CA-1, 24-hr		0	0	0	0	0	0	0	0
CA-2, 24-hr		0	0	0	0	0	0	0	0
CA-3, 24-hr		0	0	0	0	0	0	0	0
CA-4, 24-hr		0	0	0	0	0	0	0	0
CA-5, 24-hr		0	0	0	0	0	0	0	0
CA-6, 24-hr		0	0	0	0	0	0	0	0

HYDRO INTERNATIONAL UP-FLOW FILTER DETAIL, CERTIFICATION, AND OPERATIONS AND MAINTENANCE MANUAL





SECTION B-B



SECTION A-A

CAPACITIES:

- Minimum performance: 80% removal. NJDEP - NJDEP Blend; NJCAT, Sil-Co-Sil 106 (d50 = 22 microns) at the peak treatment flow.
- NJDEP peak treatment flow:
  - .033 CFS (15 GPM) per module (Ribbons)
  - .056 CFS (25 GPM) per module (CPZ)
- Maximum number of modules per outlet module: 36

ADDITIONAL DESIGN INFORMATION:

- Normal operating W.S.E. is 26" above the outlet invert
- Media Types Available: Ribbons, CPZ

DO NOT SCALE DRAWING

UNLESS OTHERWISE SPECIFIED, DIMENSIONS ARE IN INCHES.

TOLERENCES ARE:
FRACTIONS ± 1/16
DECIMALS:
X.X ± .06
X.XX ± .03
X.XXX ± .015
ANGLES: ± .5°

PROJECTION

COMMENTS:

1. STRUCTURE WALL AND SLAB THICKNESSES ARE NOT TO SCALE
2. CONTACT HYDRO INTERNATIONAL FOR A BOTTOM OF STRUCTURE ELEVATION PRIOR TO SETTING THE STRUCTURE
3. NOT FOR CONSTURCION CONTACT HYDRO FOR SITE SPECIFIC DRAWING
4. NOT ALL SIZES AVAILABLE IN ALL AREAS
5. SUMP DEPTH AVAILABLE IN 24" AND 36" DEPTHS

REVISION HISTORY

REV	BY	DESCRIPTION	DATE
-		FIRST RELEASE	6/4/18

DATE: 6/4/2018
SCALE: 1:35
DRAWN BY: CV
CHECKED BY: JMC
APPROVED BY: KO

Title
UP-FLO FILTER
8 ft x 18.5ft

41-52 MODULES

Hydro International
94 Hutchins Drive
Portland, ME 04102
Tel: +1 (207) 756-6200
Fax: +1 (207) 756-6212
hydro-int.com

WEIGHT: N/A
MATERIAL:
NEXT ASSEMBLY: UP-FLOW FILTER-
DRAWING NO.: UP-FLOW FILTER-8X18.5 GA
SHEET SIZE: B
SHEET: 1 OF 1
Rev: -

State of New Jersey
DEPARTMENT OF ENVIRONMENTAL PROTECTION
Bureau of Nonpoint Pollution Control
Division of Water Quality
Mail Code 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

January 11, 2017

David Scott, CPSWQ
General Manager
Hydro International
94 Hutchins Drive
Portland, ME 04102

Re: MTD Laboratory Certification
Up-Flo® Filter by Hydro International
Off-line Installation

TSS Removal Rate 80%

Dear Mr. Scott:

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). Hydro International has requested a Laboratory Certification for the Up-Flo® Filter System.

This project falls under the "Procedure for Obtaining Verification of a Stormwater Manufactured Treatment Device from New Jersey Corporation for Advanced Technology" dated January 25, 2013. The applicable protocol is the "New Jersey Department of Environmental Protection Laboratory Protocol to Assess Total Suspended Solids Removal by a Filtration Manufactured Treatment Device" dated January 25, 2013.

NJCAT verification documents submitted to the NJDEP indicate that the requirements of the afore-mentioned 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 for this device is published online at http://www.njcat.org/verification-process/technology-verification-database.html.

The NJDEP certifies the use of the Up-Flo® Filter by Hydro International at a TSS removal rate of 80%, when designed, operated and maintained in accordance with the information provided in the Verification Appendix and subject to 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. The MTFR is calculated based on a verified loading rate of 1.264 gpm/sf of effective filtration treatment area.

2. The Up-Flo® Filter shall be installed using the same configuration as the unit verified by NJCAT, and sized in accordance with the criteria specified in item 6 below.

3. This 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 Up-Flo® Filter, which is attached to this document. However, it is recommended to review the maintenance website at http://www.hydro-int.com/sites/default/files/nj_uff_inspection_and_maintnenance.pdf for any changes to the maintenance requirements.

6. Sizing Requirements:

   The example below demonstrates the sizing procedure for an Up-Flo® Filter.

   Example: A 0.25-acre impervious site is to be treated to 80% TSS removal using an Up-Flo® Filter. The impervious site runoff (Q) based on the New Jersey Water Quality Design Storm was determined to be 0.79 cfs or 354.58 gpm.

   The selection of configuration for use in the Up-Flo® Filter is based upon both the MTFR and the maximum inflow drainage area. It is necessary to select the configuration using both methods and to rely on the method that results in the larger configuration determined by the two methods.

   Inflow Drainage Area Evaluation:

   The drainage area to the Up-Flo® Filter in this example is 0.25 acres. Based upon the information in Table 1 below, the following minimum configuration is required in an Up-Flo® Filter to treat the impervious area without exceeding the maximum drainage area:

Model Size UFF-ZV-19-285R with MTFR of 285 gpm and Maximum Allowable Inflow Drainage Area of 0.264 acre

Maximum Treatment Flow Rate (MTFR) Evaluation:

The site runoff (Q) was determined 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=0.79x448.83 gpm=354.58 gpm

Based on a flow rate of 354.58 gpm, the following minimum configurations are required in an Up-Flo® Filter System to treat the impervious area without exceeding the MTFR:

Model Size UFF-ZV-38-285R with MTFR of 570 gpm and Maximum Allowable Inflow Drainage Area of 0.528 acre

The MTFR Evaluation results will be used since that method results in the higher minimum configuration determined by the two methods.

The sizing table corresponding to the available system models are noted below:

Table 1 Up-Flo® Filter Configurations and NJDEP Sizing Table

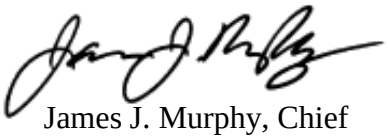
Configuration	Model Size	Number of Filter Modules	Max. Filtration Rate[1] (gpm)	Minimum Sedimentation Area [1,2] (sq.ft.)	Minimum Wet Volume [1,2] (cu.ft.)	Total Filtration Area [1] (sq.ft.)	Total Mass Capture [1] (lbs)	Maximum Allowable Inflow Area [1] (Acres)
Manhole	UFF-MH-285R	6	90	12.57	31.30	71.22	50.0	0.083
Vault	UFF-ZV-19-285R	19	285	39.79	99.12	225.5	158	0.264
Vault	UFF-ZV-38-285R	38	570	79.59	198.2	451.1	317	0.528
Vault	UF-ZV-57-285R	57	855	119.4	297.4	676.6	475	0.792

[1] Refer to Table A-1 of NJCAT Verification Report dated December 2016: UFF Design Specifications for the design parameters
[2] The precast structure housing the filter modules shall have at least the "Min. Sedimentation Area"

Be advised 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 Stormwater Management Rules, N.J.A.C. 7:8-5.8. Such items include, but are not limited to, the list of 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 Shashi Nayak of my office at (609) 633-7021.

Sincerely,

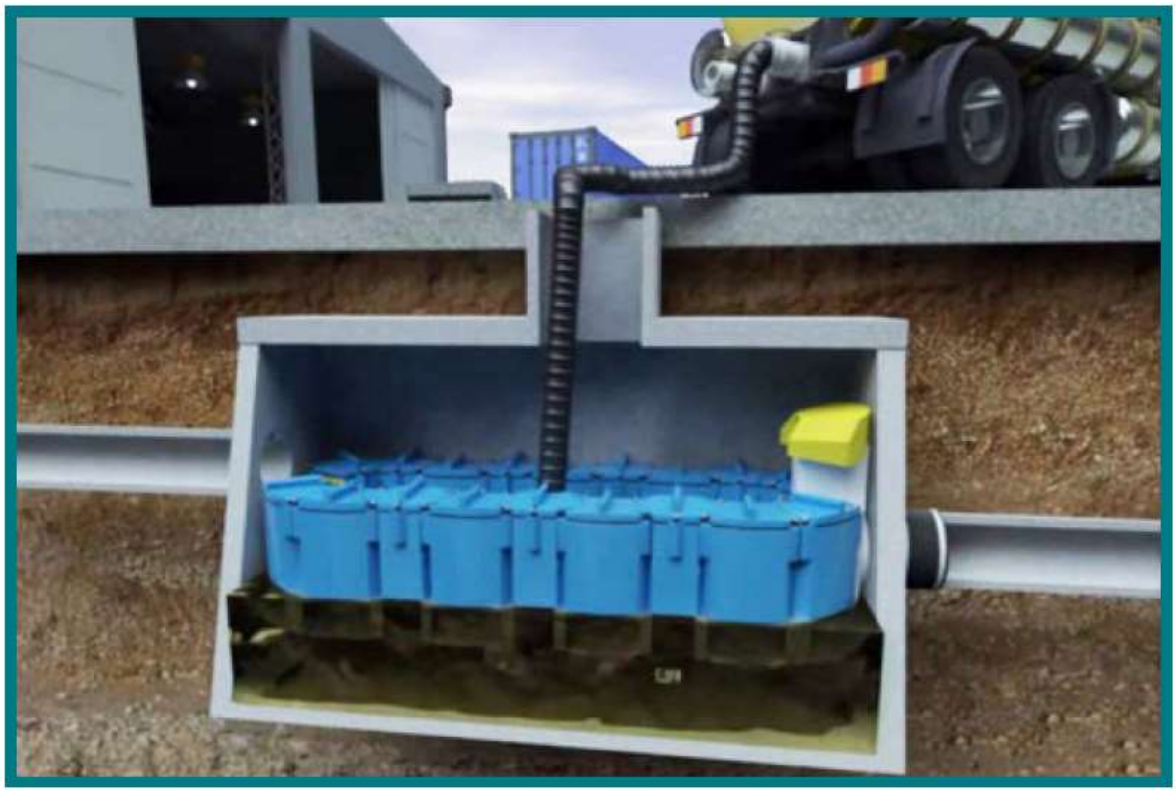


James J. Murphy, Chief
Bureau of Nonpoint Pollution Control

Attachment: Maintenance Plan

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

Hydro International



Operation and Maintenance Manual

Up-Flo® Filter

Filtration System for Stormwater Treatment

Stormwater Solutions

94 Hutchins Drive
Portland, ME 04102

Tel: (207) 756-6200
Fax: (207) 756-6212
stormwaterinquiry@hydro-int.com

www.hydro-int.com

Overview & Product Description

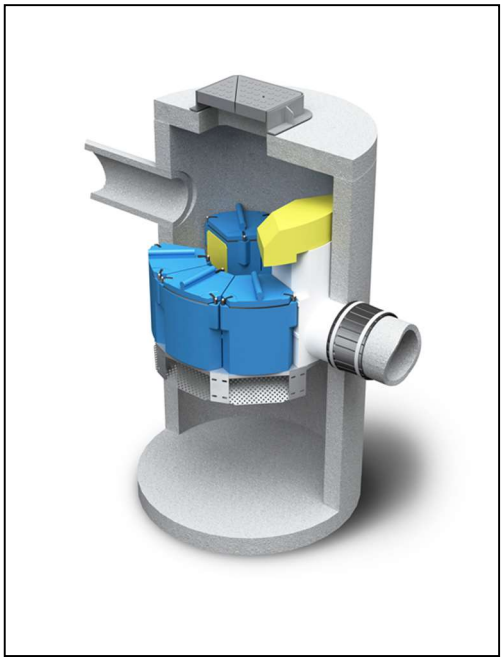
DON'T WANT TO GO IT ALONE? CALL HYDRO AND WE'LL TAKE CARE OF INSPECTION, REPLACEMENT MEDIA AND CLEANOUT.

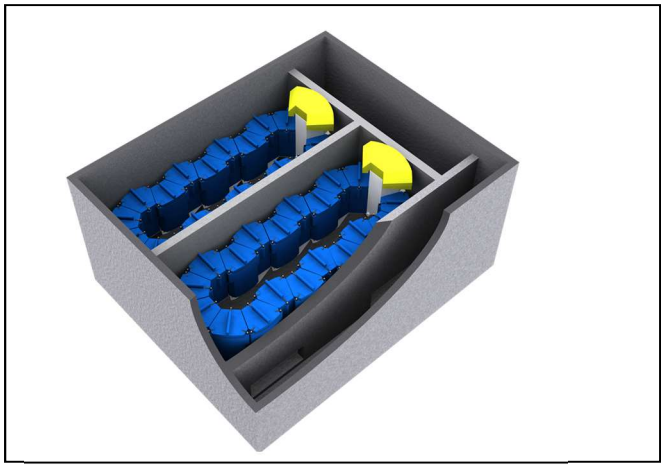
CALL 1 (888) 382-7808 FOR A QUOTE

The Up-Flo® Filter is a modular high-rate stormwater filtration device designed to capture trash, oil, sediment and remove fine pollutants such as dissolved and particulate metals and nutrients from stormwater runoff. In general, a minimum of two inspections are required per year to monitor sediment and gross pollutant accumulations.

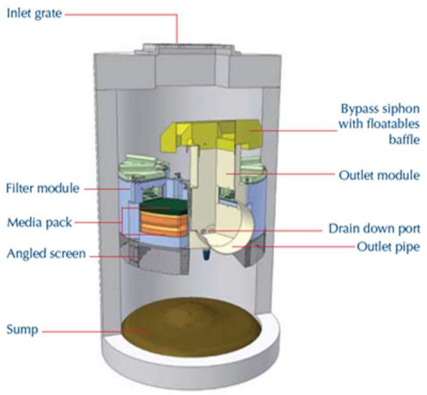
In order to sustain expected flow and removal rates for the Up-Flo® Filter, annual replacement of the Media Pack and removal of accumulated sediment from the sump is required. Depending on site use and pollutant characteristics, annual rainfall, design and functionality of the stormdrain conveyance system, annual replacement and clean out may be more or less often.

The Up-Flo Filter has modular components that connect together to form a ring of 1-6 Filter Modules or linearly to fit into rectangular precast structures with filter bays. Each filter bay can house 1-19 Filter Modules and precast structures can be constructed with multiple filter bays. Each Filter Module will have either a filtration Media Pack or filtration Ribbons.

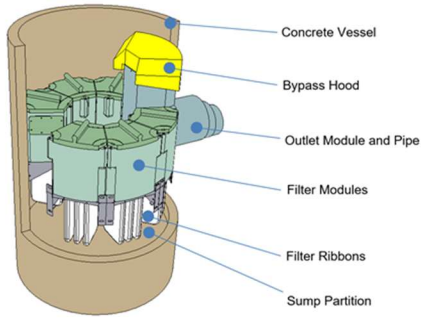




It does not matter what type of media is used, the Filter Modules house the filtration medium and the precast structure is used to suspend the Filter Modules to provide a sedimentation sump. Stainless steel support frames are used to support the Filter Modules and attach them to the precast structure. An Outlet Module (with hood) is used to connect the Filter Modules to a discharge pipe and convey filtered water away from the treatment area. A Draindown Filter and screen are provided when filtration media is used but not with filtration Ribbons.



Up-Flo with Filtration Media



Up-Flo with Filtration Ribbons

Maintenance activities can be categorized by those that can be performed from outside the Up-Flo® vessel and those that are performed inside the vessel. Maintenance performed from outside the vessel includes removal of floatables and oils that have accumulated on the water surface and removal of sediment from the sump. Maintenance performed inside the vessel includes removal and replacement of Media Packs (Filter Bags, flow Distribution Media and Draindown) or filtration Ribbons. A vactor truck is required for removal of oils, water, sediment, and to enter the vessel for performing inside maintenance. OSHA Confined Space Entry procedures need to be followed when entering the Up-Flo® vessel.

Inspection

The frequency of inspection and maintenance can be determined in the field after installation. Based on site characteristics such as contributing area, types of surfaces (e.g., paved and/or landscaped), site activities (e.g., short-term or long-term parking), and site maintenance (e.g., sanding and sweeping), inspection and maintenance should be conducted at intervals of no more than six months during the first year of operation. Typically, maintenance is recommended once per year thereafter.

By removing the manhole cover during a storm and monitoring the water level in the manhole or vault, site personnel can determine whether the filter is in bypass. A properly-sized filter that is in bypass during a storm that is producing runoff at, or below, the filter's design filtration rate needs maintenance. Otherwise, scheduled inspections will determine when one or more of the following maintenance thresholds have been reached:

- Sediment depth at sump storage capacity. Minimum 8" should separate the Draindown filter inlet from stored sediment in the sump or 6" should separate the bottom of the filtration Ribbons and sump floor. A simple probe, such as the Sludge-Judge®, can be used to determine the depth of the solids in the sump.
- Clogging of the Media Bags. Minimum filtration rate is generally reached when the Media Bags have accumulated approximately 20 lbs of sediment or when filtration Ribbons from one module have accumulated approximately 8 lbs. Determining the amount of accumulated sediment will be accomplished by removing both of the Media Bags from one of the Media Packs and weighing the bags separately or removing the filter Ribbon assembly as weighing. A spent Media Bag weighs approximately 50 lbs wet and a filter Ribbon assembly from one module weighs approximately 15 lbs spent .
- Draindown filter clogged. With modules supplied with filtration media, the Drain Down Filter is designed to lower the water level in the Up-Flo® vessel to an elevation below the bottom of the Filter Modules between storm events. If inspection one to two days after a storm event indicates otherwise, the Drain Down Filter has likely become clogged with sediment.
- Slime and debris covering the flow distribution media, angled screens or filtration Ribbons. After removal of the Media Bags or filtration Ribbons, the bottom flow distribution media should be removed and inspected to determine if it is coated with slime or debris. Similarly, the angled screen should be inspected for blockages and ragging.
- Oil forming a measureable thickness on the surface of the water. Since water in the Up-Flo® vessel drains down to an elevation below the bottom of the Filter Modules when the system is idle, the amount of accumulated oils must be minimized so that oils are not entrained into the Media Pack when stormwater begins to fill the vessel at the start of a storm event.
- Floatables completely covering the surface of the water. Similar to oils, the amount of accumulated floatables must be minimized to prevent trash and loose debris from becoming trapped on the angled screens when stormwater begins to fill the Up-Flo® vessel at the start of a storm event.

The site-specific solids loading rate in the sump and in the Media Packs will be determined during the first year of Up-Flo® Filter operation. Starting with a clean sump, the solids loading rate in the sump will be calculated by measuring the sediment depth in the sump and dividing the depth by the correlating interval of time since it was cleaned. Similarly, starting with fresh Media Bags or Ribbons, the solids loading rate in the Media Packs and Ribbons will be calculated by weighing the Media Bags or Ribbons and dividing the weights by the respective time interval since they were installed. The wet weight of the heaviest bag or Ribbon assembly from a single module will be used to determine the loading rate.

After completion of the first year of operation, the inspection and maintenance intervals for cleaning the sump and replacing Media Bags or Ribbons will be established to keep the solids loading within the respective limits of the sump and filter medium. Replacement of the Draindown Filter, replacement of flow Distribution Media, and removal of oils and floatables will occur at the same frequency unless the first year of operation indicates otherwise. Keeping to the established maintenance intervals will keep treatment flow rates at, or above, the design flow rate.

Maintenance

The access port located at the top of the manhole or vault provides access to the Up-Flo® vessel for maintenance personnel to enter the vessel and comfortably remove and replace Media Packs or Ribbon assemblies. The same access would be used for maintenance personnel working from the surface to net or skim debris and floatables or to vactor out sediment, oil, and water. Unless the Up-Flo® Filter has been installed in a very shallow unit, it is necessary to have personnel with OSHA-confined space entry performing the maintenance that occurs inside the vessel.

Maintenance activities include inspection, floatables removal, oil removal, sediment removal, Media Pack and Ribbon assembly replacement, and Draindown Filter replacement. Filtration medium housed in the Filter Modules is easily accessed by loosening three latches used to secure the Filter Module Lid. Maintenance intervals are determined from monitoring the Up-Flo® Filter during its first year of operation. Depending on the site, some maintenance activities may have to be performed on a more frequent basis than others. In the case of floatables removal, a vactor truck is not required. Otherwise, a vactor truck is normally required for oil removal, removal of sediment from the sump, and to dewater the vessel for replacement of the Media Packs and Draindown Filter. All inspection and maintenance activities would be recorded in an Inspection and Maintenance Log.

Good housekeeping practices upstream of the Up-Flo® Filter can significantly extend Media Bag life. For example, sweeping paved surfaces, collecting leaves and grass trimmings, and protecting bare ground from the elements will reduce loading to the system. Media Packs should not be installed in the Filter Modules until construction activities are complete and site stabilization is effective.

Up-Flo Filter Inspection & Maintenance Logs

SITE REFERENCE NAME OR NUMBER FOR THIS UP-FLO® FILTER LOCATION:	
SITE NAME:	
SITE LOCATION:	
OWNER:	SITE CONTRACTOR:
CONTACT NAME:	CONTACT NAME:
COMPANY NAME:	COMPANY NAME:
ADDRESS:	ADDRESS:
TELEPHONE:	TELEPHONE:
FAX:	FAX:

INSTALLATION DATE: / /

CONFIGURATION (CIRCLE ONE): MANHOLE VAULT SYSTEM

TOTAL NUMBER OF UP-FLO® FILTER MODULES: _____

Hydro International

Up-Flo® Filter Inspection Log

Site Name: _____ Owner Change since last inspection? Y N

Location: _____

Owner Name: _____

Address: _____ Phone Number: _____

Site Status: _____

Date: _____ Time: _____ Site conditions*: _____

**(Stable, Under Construction, Needing Maintenance, etc.)*

Inspection Frequency Key: A=annual; M=monthly; S=after major storms

Inspection Items	Inspection Frequency	Inspected? (Yes/No)	Maintenance Needed? (Yes/No)	Comments/Description
Debris Removal				
Adjacent area free of debris?	M			
Inlets and Outlets free of debris?	M			
Facility (internally) free of debris?	M			
Vegetation				
Surrounding area fully stabilized? (no evidence of eroding material into Up-Flo® Filter)	A			
Grass mowed?	M			
Water retention where required				
Water holding chamber(s) at normal pool?	A			
Evidence of erosion?	A			
Sediment Deposition				
Filtration Chamber free of sediments?	A			
Sedimentation sump not more than 50% full?	A			
Structural Components				
Any evidence of structural deterioration?	A			
Grates in good condition?	A			
Spalling or cracking of structural parts?	A			
Outlet/Overflow Spillway	A			
Other				
Noticeable odors?	A			
Any evidence of filter(s) clogging?	M			
Evidence of flow bypassing facility?	A			

Inspector Comments: _____

_____

_____

_____

Overall Condition of Up-Flo® Filter**: ☐ Acceptable ☐ Unacceptable

***"Acceptable" would mean properly functioning; "unacceptable" would mean damaged or required further maintenance.*

If any of the above Inspection Items are checked "Yes" for "Maintenance Needed", list Maintenance actions and their completion dates below or on the Maintenance Log provided on page 15 of the Up-Flo® Filter Operation & Maintenance Manual:

Maintenance Action Needed	Due Date

The next routine inspection is schedule for approximately: (date) _____

Inspected by: (signature) _____

Inspected by: (printed) _____

Hydro International

Up-Flo® Filter Maintenance Log

Site Name: _____ Owner Change since last inspection? Y N

Location: _____

Owner Name: _____

Address: _____ Phone Number: _____

Site Status: _____

Date: _____ Time: _____ Site conditions: _____
**(Stable, Under Construction, Needing Maintenance, etc.)*

Estimated volume of oil/floatable trash removed: _____

Sediment depth measured in sump prior to removal: _____

Number of Filter Modules fitted with new media packs: _____

Inspector Comments: _____

_____

_____

_____

Overall Condition of Up-Flo® Filter: ☐ Acceptable ☐ Unacceptable
***"Acceptable" would mean properly functioning; "unacceptable" would mean damaged or required further maintenance.*

Maintained by: (signature) _____

Maintained by: (printed) _____

Do it Right the First Time

Learn more at hydro-int.com/service

CALL **1 (888) 382-7808** TO SCHEDULE AN INSPECTION

Stormwater Solutions

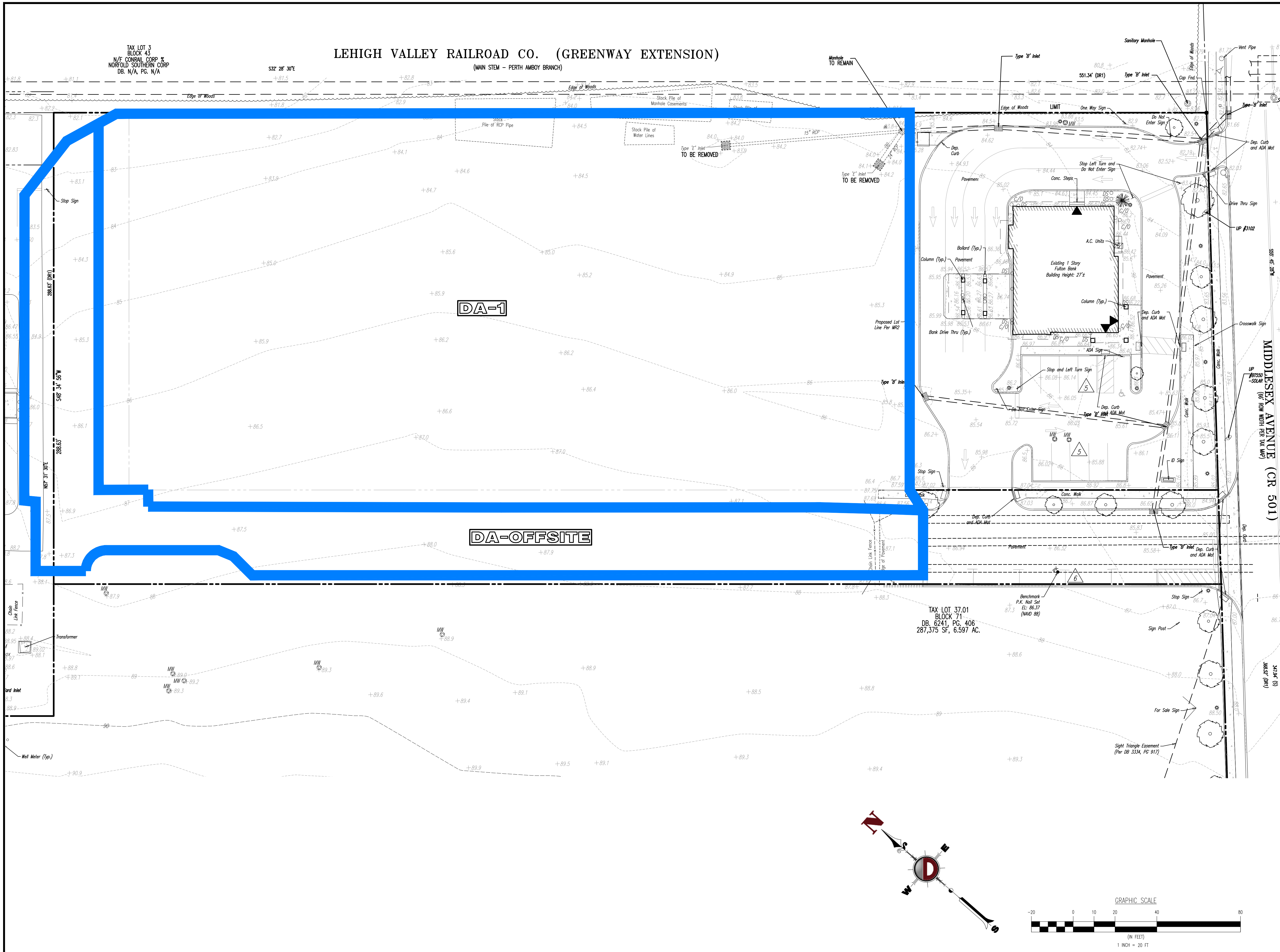
94 Hutchins Drive
Portland, ME 04102

Tel: (207) 756-6200
Fax: (207) 756-6212
stormwaterinquiry@hydro-int.com

www.hydro-int.com

Turning Water Around...®

DRAINAGE AREA MAPS



Plotted: 10/27/20 – 11:14 AM, By: russell
File: P:\DEC\PC PROJECTS\2621 Artis Senior Living, LLC\99-003 Metuchen\Dwg\DA Maps\262199003EDAM1.dwg, ---> 01 EXISTING DRAINAGE AREA MAPS

REV.	DATE	COMMENTS	BY

COMMENTS: THIS PLAN SET IS FOR PERMITTING PURPOSES ONLY AND MAY NOT BE USED FOR CONSTRUCTION

CONSTRUCTION CHECK — DATE —

CONSTRUCTION CHECK — DATE —

PROJECT: PRELIMINARY AND FINAL SITE AND SUBDIVISION PLAN
ARTIS SENIOR LIVING, LLC
PROPOSED 61 UNIT SENIOR LIVING FACILITY
BLOCK 71, LOT 37.01
700 MIDDLESEX AVENUE (CR 501)
BOROUGH OF METUCHEN, MIDDLESEX COUNTY, NEW JERSEY

811 Know what's below. Call before you dig.
PROTECT YOURSELF
ALL STATES REQUIRE NOTIFICATION OF EXCAVATORS, DESIGNERS, OR ANY PERSON PREPARING TO DISTURB THE EARTH'S SURFACE ANYWHERE IN ANY STATE
FOR STATE SPECIFIC DIRECT PHONE NUMBERS VISIT: WWW.CALL811.COM

DYNAMIC ENGINEERING
LAND DEVELOPMENT CONSULTING • PERMITTING
GEOTECHNICAL • ENVIRONMENTAL
TRAFFIC • SURVEY • PLANNING & ZONING
245 Main Street, Suite 110
Chester, NJ 07930
T: 908.879.9229 | F: 908.879.0222
Additional offices conveniently located at:
Lake Como, New Jersey • T: 732.974.0198
Toms River, New Jersey • T: 732.974.0198
Newtown, Pennsylvania • T: 267.685.0276
Allen, Texas • T: 972.534.2100
Houston, Texas • T: 281.789.6400
Austin, Texas • T: 512.646.2646
Delray Beach, Florida • T: 561.921.8570
www.dynamicec.com

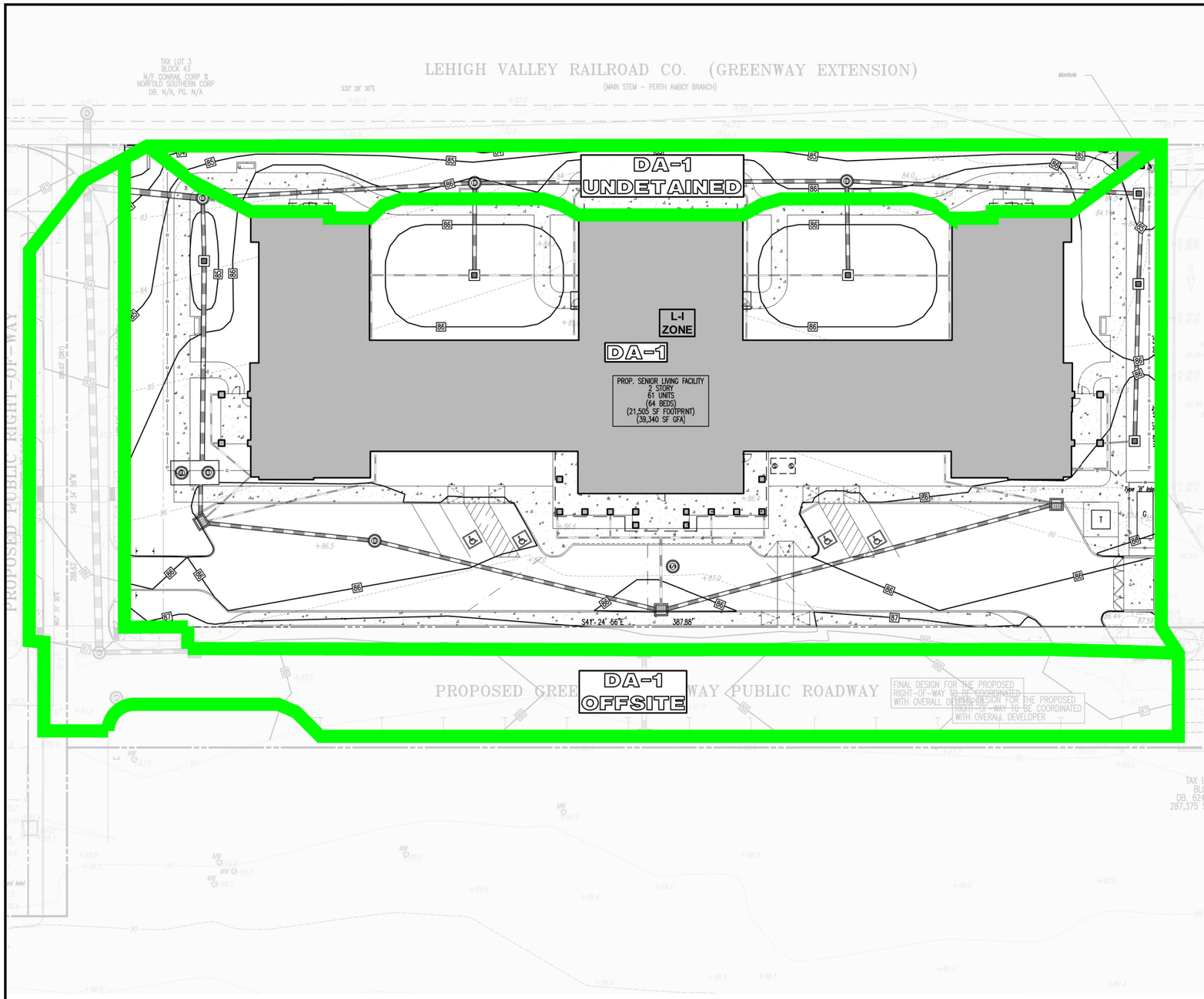
DANIEL T. SEHNAL
PROFESSIONAL ENGINEER
NEW JERSEY LICENSE No. 53572

JOSEPH G. JAWORSKI
PROFESSIONAL ENGINEER
NEW JERSEY LICENSE No. 36618

TITLE: EXISTING DRAINAGE AREA MAPS

SCALE:	DATE:	DRAWN BY:	DESIGNED BY:
(H) 1"=20' (V)	11/26/2019	LZ/RRR	DTS
PROJECT No: 2621-99-003			CHECKED BY: JGJ

SHEET No: 1 OF 3 — Rev. #: 0



Plotted: 08/14/20 – 2:21 PM By: sloverich
File: P:\DEC\PC PROJECTS\2621 Artis Senior Living, LLC\99-003 Metuchen\Dwg\DA Maps\02621990003PDAM1.dwg, ---> 02 PROPOSED DRAINAGE AREA MAPS

DYNAMIC
• ENGINEERING • EARTH
• SURVEY • TRAFFIC

NO.	DATE	COMMENTS	BY

COMMENTS: THIS PLAN SET IS FOR PERMITTING PURPOSES ONLY AND MAY NOT BE USED FOR CONSTRUCTION

CONSTRUCTION CHECK – DATE

CONSTRUCTION CHECK – DATE

PROJECT: **PRELIMINARY AND FINAL SITE AND SUBDIVISION PLAN**
ARTIS SENIOR LIVING, LLC
PROPOSED 61 UNIT SENIOR LIVING FACILITY
BLOCK 71, LOT 37.01
700 MIDDLESEX AVENUE (CR 501)
BOROUGH OF METUCHEN, MIDDLESEX COUNTY, NEW JERSEY

811 Know what's below. Call before you dig.
PROTECT YOURSELF
ALL STATES REQUIRE NOTIFICATION OF EXCAVATORS, DESIGNERS, OR ANY PERSON PREPARING TO DISTURB THE EARTH'S SURFACE ANYWHERE IN ANY STATE
FOR STATE SPECIFIC DIRECT PHONE NUMBERS VISIT: WWW.CALL811.COM

DYNAMIC ENGINEERING
LAND DEVELOPMENT CONSULTING • PERMITTING
GEOTECHNICAL • ENVIRONMENTAL
TRAFFIC • SURVEY • PLANNING & ZONING
245 Main Street, Suite 110
Chester, NJ 07930
T: 908.879.9229 | F: 908.879.0222
Additional offices conveniently located at:
Lake Como, New Jersey • T: 732.974.0198
Toms River, New Jersey • T: 732.974.0198
Newtown, Pennsylvania • T: 267.685.0076
Allen, Texas • T: 972.534.2100
Houston, Texas • T: 281.799.4400
Austin, Texas • T: 512.646.2446
Delray Beach, Florida • T: 561.921.8570
www.dynamicec.com

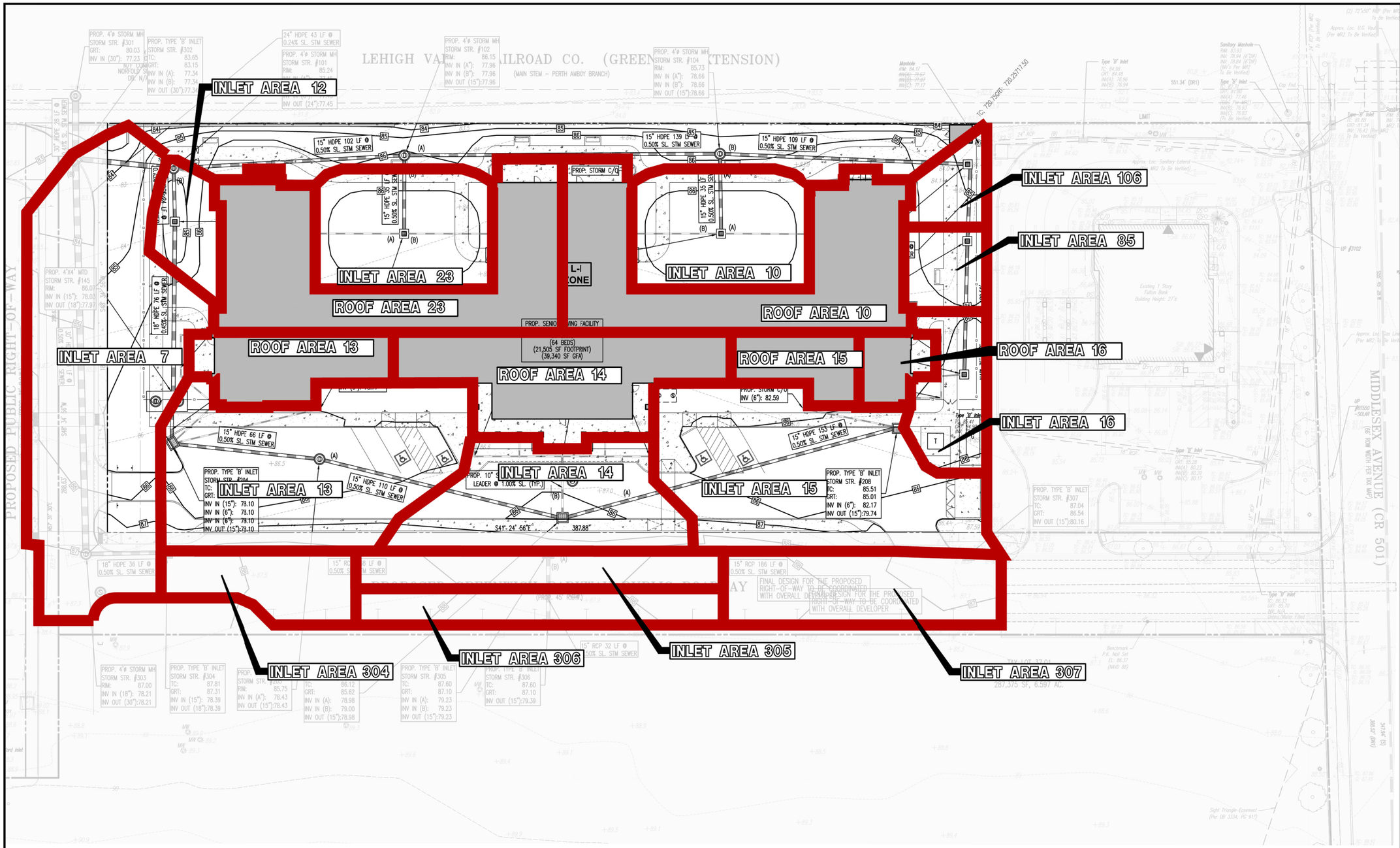
DANIEL T. SEHNAL
PROFESSIONAL ENGINEER
NEW JERSEY LICENSE No. 53572

JOSEPH G. JAWORSKI
PROFESSIONAL ENGINEER
NEW JERSEY LICENSE No. 36618

TITLE: **PROPOSED DRAINAGE AREA MAPS**

SCALE: (H) 1"=20' (V)	DATE: 11/26/2019	DRAWN BY: LZ/RRR	DESIGNED BY: DTS
PROJECT No: 2621-99-003			CHECKED BY: JGJ

SHEET No: 2 OF 3
Rev. #: 0



DYNAMIC
• ENGINEERING • EARTH • SURVEY • TRAFFIC

NO.	DATE	COMMENTS	BY

COMMENTS: THIS PLAN SET IS FOR PERMITTING PURPOSES ONLY AND MAY NOT BE USED FOR CONSTRUCTION

CONSTRUCTION CHECK — DATE

CONSTRUCTION CHECK — DATE

PROJECT: **PRELIMINARY AND FINAL SITE AND SUBDIVISION PLAN**
ARTIS SENIOR LIVING, LLC
PROPOSED 61 UNIT SENIOR LIVING FACILITY
700 MIDDLESEX AVENUE (CR 501)
BLOCK 71, LOT 37.01
BOROUGH OF METUCHEN, MIDDLESEX COUNTY, NEW JERSEY

811 Know what's below. Call before you dig.
PROTECT YOURSELF
ALL STATES REQUIRE NOTIFICATION OF EXCAVATORS, DESIGNERS, OR ANY PERSON PREPARING TO DISTURB THE EARTH'S SURFACE ANYWHERE IN ANY STATE
FOR STATE SPECIFIC DIRECT PHONE NUMBERS VISIT: WWW.CALL811.COM

DYNAMIC ENGINEERING
LAND DEVELOPMENT CONSULTING • PERMITTING
GEOTECHNICAL • ENVIRONMENTAL
TRAFFIC • SURVEY • PLANNING & ZONING
245 Main Street, Suite 110
Chester, NJ 07930
T: 908.879.9229 | F: 908.879.0222
Additional offices conveniently located at:
Lake Como, New Jersey • T: 732.974.0198
Toms River, New Jersey • T: 732.974.0198
Newtown, Pennsylvania • T: 267.685.0076
Allen, Texas • T: 972.534.2100
Houston, Texas • T: 281.799.4400
Austin, Texas • T: 512.646.2446
Delray Beach, Florida • T: 561.921.8570
www.dynamicec.com

DANIEL T. SEHNAL
PROFESSIONAL ENGINEER
NEW JERSEY LICENSE No. 53572

JOSEPH G. JAWORSKI
PROFESSIONAL ENGINEER
NEW JERSEY LICENSE No. 36618

TITLE:
INLET DRAINAGE AREA MAPS

SCALE: (H) 1"=20' (V)	DATE: 11/26/2019	DRAWN BY: LZ/RRR	DESIGNED BY: DTS
PROJECT No: 2621-99-003			CHECKED BY: JGJ

SHEET No: 3 OF 3 — Rev. #: 0

Plotted: 08/14/20 – 2:21 PM By: slovenich
File: P:\DEC\PC PROJECTS\2621 Artis Senior Living, LLC\99-003 Metuchen\Dwg\DA Maps\02621990003DAM1.dwg, ----> 03 INLET DRAINAGE AREA MAPS