CIVIL ENGINEERING
ENVIRONMENTAL
SURVEYING
LANDSCAPE ARCHITECTURE
GEOTECHNICAL

STORMWATER MANAGEMENT REPORT

Clinton Commons
Block 14 Lots 32
Town of Clinton, Hunterdon County, New Jersey

Prepared For:
Clinton Moebus 34, LLC
C/O David Meiskin
9 Kent Place,
Freehold, New Jersey 07728

September 1, 2021

Wayne J. Ingram
Professional Engineer
N.J.P.E. NO. 24GB04258200

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1. INTRODUCTION

Engineering & Land Planning Associates, Inc. has prepared this Stormwater Management Report on behalf of Clinton Moebus 34, LLC, to document the design methodology and the associated calculations for the project's stormwater management system. The project is located on State Highway 31 on Block 14, Lots 32, 32.01 & 32.02 in theTown of Clinton, Hunterdon County, New Jersey. The subject property currently consists of open farm field.. The project proposes to build 3 Retail buildings consists of 30,559 s.f. and 56 townhome units with its associated improvements. The design incorporates stormwater management measures which meet the NJDEP Phase II Stormwater Regulations for stormwater quantity, quality, and groundwater recharge.

2. METHODOLOGY

2.1 Product Description

The existing property totals 28.06 acres and contains farm field. The property is bound to the north by New Jersey State Highway 31, to the west the South branch of Raritan River and wooded area and to the north and east by residential homes. The project consists of the construction of a 56 Townhouses and three pad sites for retail use. The project is considered a major project in accordance with the NJDEP Phase II Stormwater Regulations, as it will include more than 1.0 acre of disturbance and creates more than ¼ acre of new impervious surface. Stormwater management measures have been provided in accordance with NJDEP's Phase II Stormwater regulations.

The conversion of the land cover from farm field to a lawn and impervious surface results in a increase in storm water runoff as a result of the project. The project proposes one storm water infiltration basin that collect the runoff from the proposed roads, driveways and portions of the lawns. The site has Karst formation where infiltration is not advisable. Therefore, have infiltration is confined to the extents of the basin which is located at the most downstream location. The Infiltration Basin outflow discharge to the South branch of Raritan River. The Infiltration basin provides water quality by recharging the water quality storm to ground. The Infiltration basin also provides the required ground water recharge and reduction in the peak runoff from site. These stormwater management measures meet the NJDEP's Phase II regulations for water quantity, quality, and groundwater recharge.

We have also provided the soils map for the property in Appendix A of this report. The report also includes each soil type that is located on site and the respective Hydrologic Soil Group of each soil in description of the soil.

2.2 Stormwater Runoff Quantity

The stormwater quantity runoff analysis has been performed utilizing the Soil Conservation Service (SCS) Technical Release 55 (TR-55) "Urban Hydrology for Small Watersheds," revised June 1986. The site runoff has been calculated for the 2 year, 10 year, and 100 year storm frequencies in accordance with NJDEP's storm water regulations. (N.J.A.C. 7:8-5.4). This project will reduce the site runoff for the calculated storms below that of the existing condition as required during the 2, 10, and 100 year storm events, while maintaining the existing drainage patterns in accordance with N.J.A.C. 7:8-5.4 (3) iii. (see Appendices B, C, and D).

The analysis utilized the SCS Type III-24 hour rainfall distribution. The time of concentration (Tc) calculations were calculated based on the TR-55 methodology. Several potential Tc flow paths were analyzed in order to determine the most appropriate flow path. CN values were calculated for each drainage area utilizing the soil data from Morris County Soil Survey. The summary of results and supporting calculations for the existing and proposed stormwater quantity runoff analysis can be found in Appendices B-E of this report.

2.3 Stormwater Runoff Quality

The storm water runoff quality analysis has been performed in accordance with NJDEP's Storm Water Management Regulations (N.J.A.C. 7:8-5.5). This storm water management plan serves to reduce the post-construction load of Total Suspended Solids (TSS) generated from the water quality design storm by 95 percent, as an annual average. This reduction has been applied to all areas of new development on the site. The water quality design storm consists of 1.25 inches of rain falling in 2 hours with the NJDEP distribution as illustrated in of N.J.A.C. 7:8-5.5 "Table 1 - Water Quality Design Storm Distribution" (refer to Appendix F).

A infiltration basin has been employed to obtain the required 80% TSS removal. In order to achieve 95% TSS removal requirement, we have provided a Up-Flo Filter at the outlet of the infiltration basin, which will provide additional 80% TSS removal. This combined system will provide 96% TSS removal for water quality storm.

2.4 Groundwater Recharge

A groundwater recharge analysis has been performed in accordance with NJDEP's Stormwater Management Rules (N.J.A.C. 7:8-5.4). The New Jersey Groundwater Recharge Spreadsheet (NJGRS) Version 2.0 (updated November 2003) was utilized to determine the groundwater recharge associated with the site. Computations of the pre-development and post-development annual groundwater recharge rate and the annual recharge deficit was prepared based on the New Jersey Geological Survey Report GSR-32 "A Method for Evaluating Ground-Water Recharge Areas in New Jersey", which is incorporated into the NJGSR spreadsheet (Refer to Appendix I of this report).

2.5 Non-Structural Stormwater Management Strategies

As per N.J.A.C. 7:8-5.3 requirements non-structural stormwater strategies have been incorporated into the design to the maximum extent practicable:

The project site is currently an open farm field that is susceptible to erosion and sediment loss due to steep slopes on the property. The proposed improvement will eliminate these susceptible areas since the project area will become maintained lawns, dwellings, driveways, a road is also proposed to break up the over lands flow and contain in underground storm water system. The water quality will benefit because all the impervious surfaces are being recharge using infiltration basin.
The impervious surfaces are minimized on the project site to meet current codes and the runoff over the impervious surfaces flows into a proposed stormwater system.

Natural drainage features and vegetation are maintained and maximized where possible.

The Time of Concentration and flow path is generally maintained from the existing to the proposed condition.

Land disturbance is being minimized and there is minimal clearing needed since the site is currently existing farm field. The land disturbance is generally limited to the existing disturbed area.

Soil compaction will be minimized and any areas of over compaction will be mediated.

Low maintenance trees and native grasses are proposed to encourage retention of all plantings.

The use of natural open channel swales is utilized to convey the stormwater runoff through portions of the site where it is feasible.

The stormwater control system was designed to prevent trash and debris from draining into the existing wetlands located to the south of the project site. This is accomplished through the use of trash racks, grates and stormwater filtration units. The stormwater system will be cleaned and trash/debris will be removed according the Stormwater Management Maintenance Plan.

2.6 Stormwater Conveyance

The storm sewer hydraulics is based upon the Manning Equation as defined in the "Handbook of Hydraulics," by Brater and King, Sixth Edition. Storm sewer capacity is based on full depth gravity flow. The project has designed to convey water via closed pipe systems to the detention

basin. Refer to Appendix E for calculations. The storm system is designed for 25 years storm freq.

3. STORMWATER ANALYSIS

3.1 Stormwater Runoff Quantity

The Existing Drainage Area Plan (Appendix J) located in the site improvement plans illustrates the existing drainage area. The composite curve numbers (CN), time of concentrations (Tc) have been calculated utilizing the TR-55 method for each drainage area. A runoff hydrograph has been calculated for the 2, 10, and 100 year storms. The peak runoff (Q cfs) has been obtained from the runoff hydrograph for each drainage area.

The existing site contains one drainage area (DA#1) which leaves the site in a westerly direction. The DA#1 is consists of 33.69 ac. and contains 0.98 ac of impervious area. Runoff generally sheet flows across the site towards the wetlands and stream located on the westerly portion of the property.

The report also calculates the peak pre-development runoff from area to be disturbed in post-development condition. The Rules requires that the design provide reduction in peak flow from disturbed area from the site. The area to be disturbed is 14.27 ac. as shown on Pre-Development drainage area plan

Refer to Appendices B and C for a summary of the composite curve numbers (CN), pre-development peak discharge rates for the 2, 10, and 100 year storms, and the associated runoff hydrographs.

The proposed site improvements will not result in significant modifications to the overall drainage area layout. The Proposed Drainage Area Plan, located on Appendix M of the site improvement plans illustrates the proposed drainage areas for the post-development condition.

The majority of the stormwater runoff from proposed drainage area PDA#1 will enter the stormwater system via inlets located along the road before ultimately discharging into the wetland areas after in the western area of the property after treating runoff. This Drainage are PDA#1 is consists of 18.29 ac which contains 8.13 ac on impervious area. The PDA#2 includes the runoff from the Gas station pump area and overland flow draining to the Sand filter. The drainage area PDA#2 is consists of 0.62 ac which contains 0.30 ac of impervious area. The remaining areas PDA#3 will flow overland consistent with the existing condition. The PDA#3 is consist of 14.78 ac and contains 0.11 ac impervious area from existing pavement on Route #31. The proposed storm water discharges to levels below that of the existing condition in DA#1 for the 2, 10, and 100 year storms in accordance with NJDEP requirements. This meets the NJDEP Phase II stormwater quantity standards.

3.2 Stormwater Runoff Quality

Runoff quality has achieved the required TSS removal, in accordance with NJDEP standards. The water quality storm hydrographs are contained in Appendix F. Quality treatment has been provided through using Infiltration basin (80% TSS removal rate). The proposed roads, sidewalks and driveways are directed through proposed Infiltration basin resulting in an 80% TSS removal rate in accordance with the NJDEP Phase II standards.

At the outlet from basin, we have provided Up-Flo storm filter structure that is designed to remove 80% TSS removal. The proposed design will attain 96% TSS removal which exceed the requirement of providing 95% TSS removal

The Runoff from the Gas station area could not be recharge in to ground, therefore it is directed toward a sand filter. An outlet structure is provided at the Sand filter which will bypass the runoff from all other storm except water quality storm. The outlet structure is provided with a spillway which will ensure that the water quality runoff is directed towards the sand filter All other larger storm events will bypass the Sand Filter. The sand filter will provide 80% TSS for the runoff from Gas station pump area. The outlet from this sand filter is connected to the outlet structure from the infiltration basin which is directing all outflows to the Storm Filter structure. This design will provide 96% TSS removal for water quality storm which exceeds the requirement..

3.3 Groundwater Recharge

An annual recharge deficit of 465,612 CF is observed in the post-development condition. This is achieved through the permanent conversion of existing farm areas to a lawn surface and impervious surface. The proposed infiltration basin is designed to provide required recharge to mitigate the reduction in the ground water recharge due to proposed development. The analysis has been performed based upon the approved NJDEP Recharge spreadsheet and can be found in Appendix G.

The soil logs information is provided in appendix J of this report. The soil up to depath of about 7.5' has very slow permeability rate. As a result the design proposes to remove the low permeable material and replace it with K3 or better soil. The drain time calculations are performed using average of the permeability results obtained from each soil log. The drain time calculations for the infiltration basin is provided in Appendix F of this report.

3.4 Stormwater Management Maintenance Plan

A recommended Stormwater Management Maintenance Plan has been established for this site in order to maintain the performance and efficiency of the proposed stormwater management basin. The plan is contained in Appendix J of this report.

3.5 Soil Erosion and Sediment Control

Soil Erosion and Sediment Control measures have been designed for the stormwater management system to ensure that water quality is maintained and that the system can safely and adequately control runoff from the property. Design calculations for the conduit outlet protection can be found in Appendix I of this report.

4. CONCLUSIONS

In conclusion, the proposed design includes a proposed storm water management system for the property that meets all of the quantity, quality and recharge requirements outlined in the Storm water Management Rules of N.J.A.C. 7:8. The proposed storm management basin will provides the required 95% TSS removal requirements, it also provides the required recharge and reduce the peak runoff from the site in accordance with quantity requirement.

The summary table provided in this sections shows that the project will meet the peak rate reduction criteria of the storm water rules.

5.1 : Pre-development And Post-development Peak Runoff Results Summary

Pre-Development Peak Runoff

Storm Freq.	To Stream	Total Pre-Dev Flow	Total Pre-Dev Flow From Distrurbed	% Flow Reduction Required From Developed Area	Flow Reduction Required From Developed Area	Max Post- Dev Peak Flow Allowable From Site
(Col #1)	(Col #2)	(Col #3)	(Col #4)	(Col #5)	(Col #6)=#4*#5	(Col #7)=#3-#6
(years)	(c.f.s.)	(c.f.s.)	(c.f.s.)	**(%)**	(c.f.s.)	(c.f.s)
2	14.67	14.67	5.50	50%	2.75	11.92
10	46.85	46.85	18.84	25%	4.71	42.14
100	122.82	122.82	50.73	20%	10.15	112.67

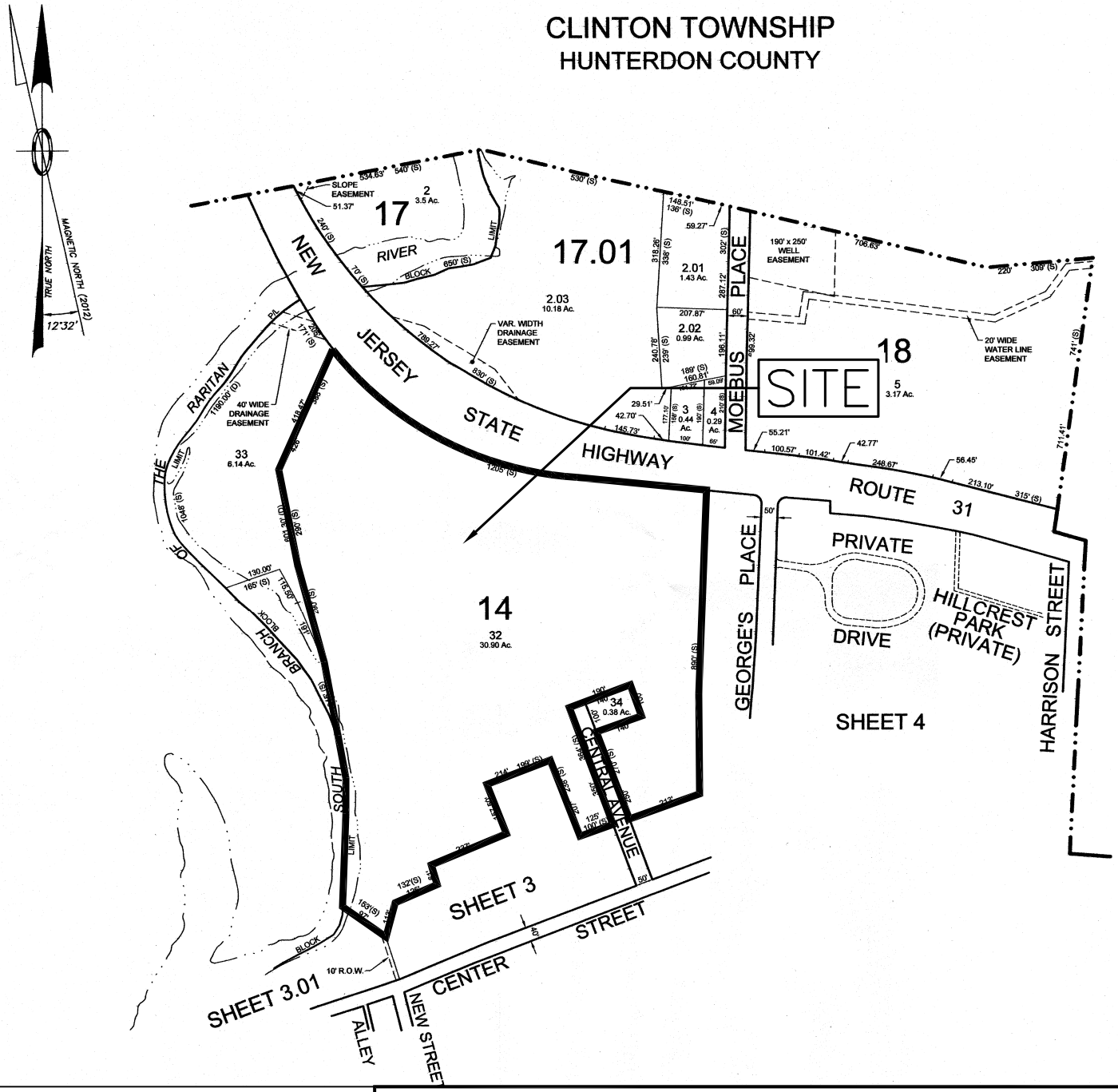
Post-Development Peak Runoff Summary

Storm Freq.	To Stream	Total Post-Dev Peak Runoff	Reduction in Peak Runoff
(Col #8)	(Col #9)	(Col #10)	(Col #11)=#3-#10
(years)	(c.f.s.)	(c.f.s.)	(c.f.s.)
2	9.26	9.26	5.41
10	30.31	30.31	16.54
100	94.15	94.15	28.67

APPENDIX – A:

EXHIBITS

CLINTON TOWNSHIP
HUNTERDON COUNTY



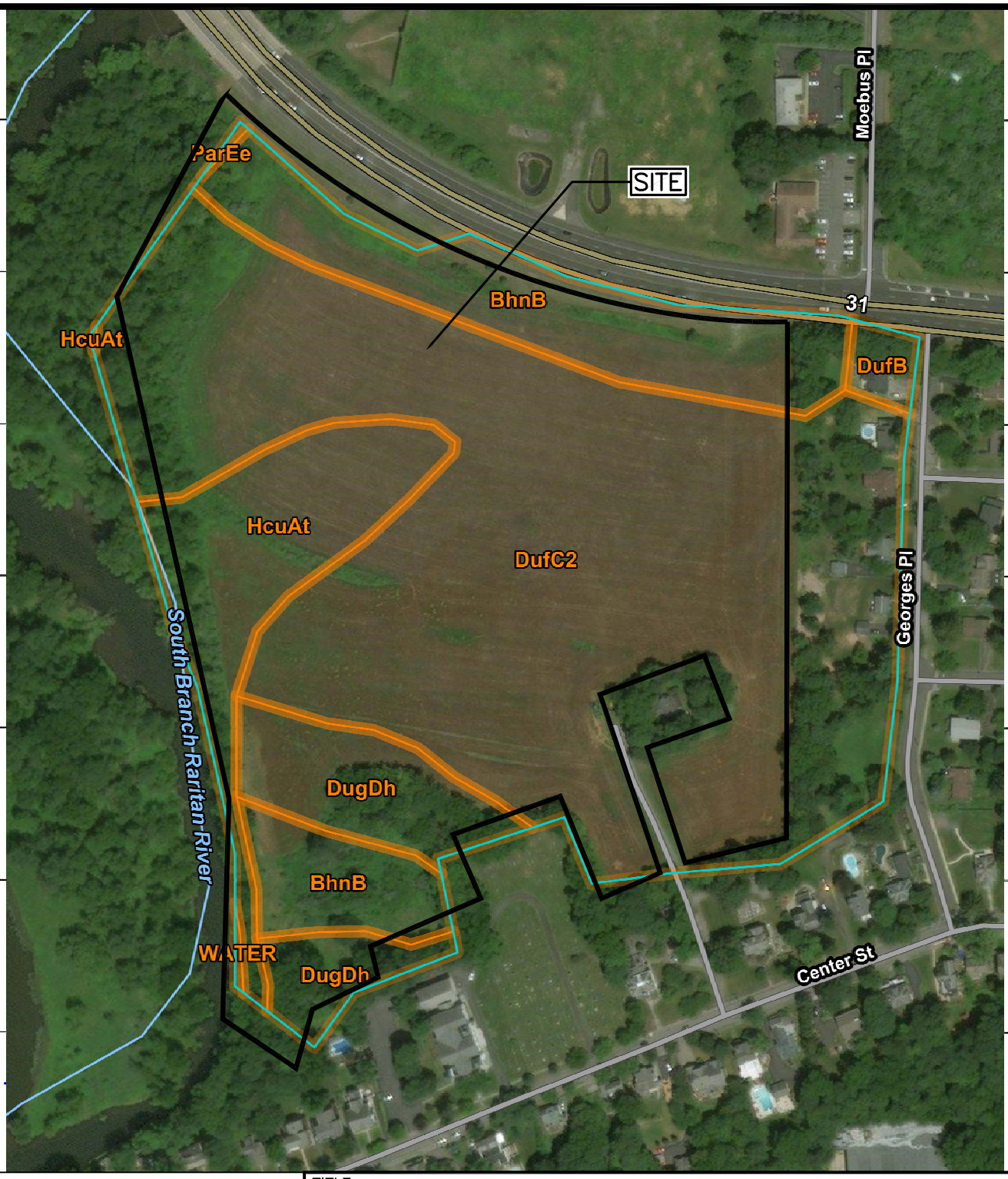
TITLE:

TAX MAP

E&LP

140 WEST MAIN STREET CLINTON TOWNSHIP, NJ 08829
(908) 238-0544 FAX: (908)238-9572
C.O.A. #: 24GA28021500
A PROFESSIONAL ASSOCIATION

LOCATION:		FIGURE:
BLOCK: 14 LOTS: 32 ROUTE #31 TOWN OF CLINTON HUNTERDON COUNTY NEW JERSEY	DATE: 11/18/2020 PROJECT NO.: 8144 FILENAME: 2020-11-18 EXHIBITS	1



TITLE:

SOILS MAP

E&LP
140 WEST MAIN STREET CLINTON TOWNSHIP, NJ 08829
(908) 238-0544 FAX: (908)238-9572
C.O.A. #: 24GA28021500
A PROFESSIONAL ASSOCIATION

LOCATION:
BLOCK: 14
LOTS: 32
ROUTE #31
TOWN OF CLINTON
HUNTERDON COUNTY
NEW JERSEY

DATE: 11/18/2020

PROJECT NO.: 8144

FILENAME: 2020-11-18 EXHIBITS

FIGURE: 2

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Map Unit Polygons

Soil Map Unit Lines

Soil Map Unit Points

Special Point Features

Blowout

Borrow Pit

Clay Spot

Closed Depression

Gravel Pit

Gravelly Spot

Landfill

Lava Flow

Marsh or swamp

Mine or Quarry

Miscellaneous Water

Perennial Water

Rock Outcrop

Saline Spot

Sandy Spot

Severely Eroded Spot

Sinkhole

Slide or Slip

Sodic Spot

Spoil Area

Stony Spot

Very Stony Spot

Wet Spot

Other

Special Line Features

Water Features

Streams and Canals

Transportation

Rails

Interstate Highways

US Routes

Major Roads

Local Roads

Background

Aerial Photography

MAP INFORMATION

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

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: Hunterdon County, New Jersey
Survey Area Data: Version 15, Sep 16, 2019

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

Date(s) aerial images were photographed: Mar 31, 2014—Apr 2, 2017

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

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
BhnB	Birdsboro silt loam, 2 to 6 percent slopes	5.1	15.5%
DufB	Duffield silt loam, 2 to 6 percent slopes	0.3	1.1%
DufC2	Duffield silt loam, 6 to 12 percent slopes, eroded	21.3	65.1%
DugDh	Duffield silt loam, 12 to 18 percent slopes, very rocky	2.6	8.0%
HcuAt	Hatboro-Codorus complex, 0 to 3 percent slopes, frequently flooded	3.3	10.2%
ParEe	Parker cobbly loam, 18 to 40 percent slopes, extremely stony	0.0	0.1%
WATER	Water	0.0	0.1%
Totals for Area of Interest		**32.7**	**100.0%**

Map Unit Descriptions

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

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

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit

descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

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

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

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

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

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

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

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

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

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

Hunterdon County, New Jersey

BhnB—Birdsboro silt loam, 2 to 6 percent slopes

Map Unit Setting

National map unit symbol: ldv5
Elevation: 200 to 1,000 feet
Mean annual precipitation: 30 to 64 inches
Mean annual air temperature: 46 to 79 degrees F
Frost-free period: 131 to 178 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Birdsboro and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Birdsboro

Setting

Landform: Stream terraces
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Old alluvium derived from sandstone and siltstone and/or shale

Typical profile

Ap - 0 to 8 inches: silt loam
BA - 8 to 13 inches: silt loam
Bt - 13 to 29 inches: silt loam
BC - 29 to 40 inches: silt loam
C - 40 to 60 inches: stratified sand to silty clay loam
2C - 60 to 80 inches: stratified sand to fine sand

Properties and qualities

Slope: 2 to 6 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: High (about 10.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: B
Hydric soil rating: No

Minor Components

Bucks

Percent of map unit: 5 percent
Landform: Hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Convex
Hydric soil rating: No

Raritan, rarely flooded

Percent of map unit: 5 percent
Landform: Stream terraces
Landform position (three-dimensional): Rise
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Duffield

Percent of map unit: 5 percent
Landform: Hills
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

DufB—Duffield silt loam, 2 to 6 percent slopes

Map Unit Setting

National map unit symbol: ldvs
Elevation: 300 to 1,000 feet
Mean annual precipitation: 30 to 64 inches
Mean annual air temperature: 46 to 79 degrees F
Frost-free period: 131 to 178 days
Farmland classification: All areas are prime farmland

Map Unit Composition

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

Description of Duffield

Setting

Landform: Hills
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear

Parent material: Fine-loamy residuum weathered from limestone

Typical profile

Ap - 0 to 9 inches: silt loam
BA - 9 to 14 inches: silt loam
Bt1 - 14 to 28 inches: silt loam
Bt2 - 28 to 42 inches: silt loam
C - 42 to 56 inches: loam
R - 56 to 80 inches: unweathered bedrock

Properties and qualities

Slope: 2 to 6 percent
Depth to restrictive feature: 48 to 60 inches to lithic bedrock
Natural drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: High (about 11.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: B
Hydric soil rating: No

Minor Components

Turbotville

Percent of map unit: 5 percent
Landform: Depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: No

Washington

Percent of map unit: 5 percent
Landform: Hills
Landform position (three-dimensional): Interfluve
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

DufC2—Duffield silt loam, 6 to 12 percent slopes, eroded

Map Unit Setting

National map unit symbol: 1lmfh

Elevation: 300 to 1,000 feet
Mean annual precipitation: 30 to 64 inches
Mean annual air temperature: 46 to 79 degrees F
Frost-free period: 131 to 178 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

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

Description of Duffield, Eroded

Setting

Landform: Hills
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Fine-loamy residuum weathered from limestone

Typical profile

Ap - 0 to 9 inches: silt loam
BA - 9 to 14 inches: silt loam
Bt1 - 14 to 28 inches: silt loam
Bt2 - 28 to 42 inches: silt loam
C - 42 to 56 inches: loam
R - 56 to 80 inches: unweathered bedrock

Properties and qualities

Slope: 6 to 12 percent
Depth to restrictive feature: 48 to 60 inches to lithic bedrock
Natural drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: High (about 11.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: B
Hydric soil rating: No

Minor Components

Washington

Percent of map unit: 5 percent
Landform: Hills
Landform position (three-dimensional): Interfluve
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Turbotville

Percent of map unit: 5 percent
Landform: Depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: No

DugDh—Duffield silt loam, 12 to 18 percent slopes, very rocky

Map Unit Setting

National map unit symbol: 1lmfk
Elevation: 300 to 1,300 feet
Mean annual precipitation: 30 to 64 inches
Mean annual air temperature: 46 to 79 degrees F
Frost-free period: 131 to 178 days
Farmland classification: Not prime farmland

Map Unit Composition

Duffield, eroded, very rocky, and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Duffield, Eroded, Very Rocky

Setting

Landform: Hills
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Fine-loamy residuum weathered from limestone

Typical profile

Ap - 0 to 9 inches: silt loam
BA - 9 to 14 inches: silt loam
Bt1 - 14 to 28 inches: silt loam
Bt2 - 28 to 42 inches: silt loam
C - 42 to 56 inches: loam
R - 56 to 80 inches: unweathered bedrock

Properties and qualities

Slope: 12 to 18 percent
Depth to restrictive feature: 48 to 60 inches to lithic bedrock
Natural drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches

Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: High (about 11.1 inches)

Interpretive groups
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: B
Hydric soil rating: No

Minor Components

Klinesville
Percent of map unit: 5 percent
Landform: Hills
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Turbotville
Percent of map unit: 5 percent
Landform: Depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: No

Washington
Percent of map unit: 5 percent
Landform: Hills
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

HcuAt—Hatboro-Codorus complex, 0 to 3 percent slopes, frequently flooded

Map Unit Setting
National map unit symbol: 2w06g
Elevation: 90 to 680 feet
Mean annual precipitation: 47 to 51 inches
Mean annual air temperature: 48 to 57 degrees F
Frost-free period: 180 to 210 days
Farmland classification: Not prime farmland

Map Unit Composition
Hatboro, frequently, and similar soils: 60 percent
Codorus, occasional, and similar soils: 35 percent
Minor components: 5 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Hatboro, Frequently

Setting

Landform: Flood plains
Landform position (two-dimensional): Toeslope, footslope
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Concave
Parent material: Loamy alluvium derived from greenstone and/or phyllite and/or quartzite and/or schist

Typical profile

A - 0 to 11 inches: silt loam
Bg1 - 11 to 18 inches: silt loam
Bg2 - 18 to 29 inches: silt loam
BCg - 29 to 44 inches: silt loam
Cg1 - 44 to 55 inches: silty clay loam
Cg2 - 55 to 80 inches: sandy loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Poorly drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: About 0 to 6 inches
Frequency of flooding: Frequent
Frequency of ponding: Frequent
Available water storage in profile: High (about 9.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: B/D
Hydric soil rating: Yes

Description of Codorus, Occasional

Setting

Landform: Flood plains
Landform position (two-dimensional): Toeslope, footslope
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Concave
Parent material: Loamy alluvium derived from phyllite and/or mica schist and/or greenstone and/or old loamy alluvium derived from phyllite and/or mica schist and/or greenstone

Typical profile

Ap - 0 to 11 inches: silt loam
Bw1 - 11 to 18 inches: silt loam
Bw2 - 18 to 40 inches: gravelly silt loam
2C - 40 to 80 inches: very gravelly silt loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Moderately well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: About 18 to 30 inches
Frequency of flooding: Occasional
Frequency of ponding: None
Available water storage in profile: Moderate (about 7.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: C
Hydric soil rating: No

Minor Components

Delanco

Percent of map unit: 5 percent
Landform: Stream terraces
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Convex
Hydric soil rating: No

ParEe—Parker cobbly loam, 18 to 40 percent slopes, extremely stony

Map Unit Setting

National map unit symbol: 1ls04
Elevation: 250 to 1,200 feet
Mean annual precipitation: 30 to 64 inches
Mean annual air temperature: 46 to 79 degrees F
Frost-free period: 131 to 178 days
Farmland classification: Not prime farmland

Map Unit Composition

Parker, extremely stony, and similar soils: 95 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Parker, Extremely Stony

Setting

Landform: Hills
Landform position (two-dimensional): Shoulder

Landform position (three-dimensional): Nose slope
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Residuum weathered from granite and gneiss

Typical profile

Ap - 0 to 9 inches: cobbly loam
Bw - 9 to 22 inches: cobbly sandy loam
C - 22 to 41 inches: very cobbly sandy loam
R - 41 to 80 inches: unweathered bedrock

Properties and qualities

Slope: 18 to 40 percent
Percent of area covered with surface fragments: 9.0 percent
Depth to restrictive feature: 39 to 60 inches to lithic bedrock
Natural drainage class: Somewhat excessively drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): High (2.00 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Very low (about 2.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: B
Hydric soil rating: No

Minor Components

Gladstone

Percent of map unit: 5 percent
Landform: Hills
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Convex
Hydric soil rating: No

WATER—Water

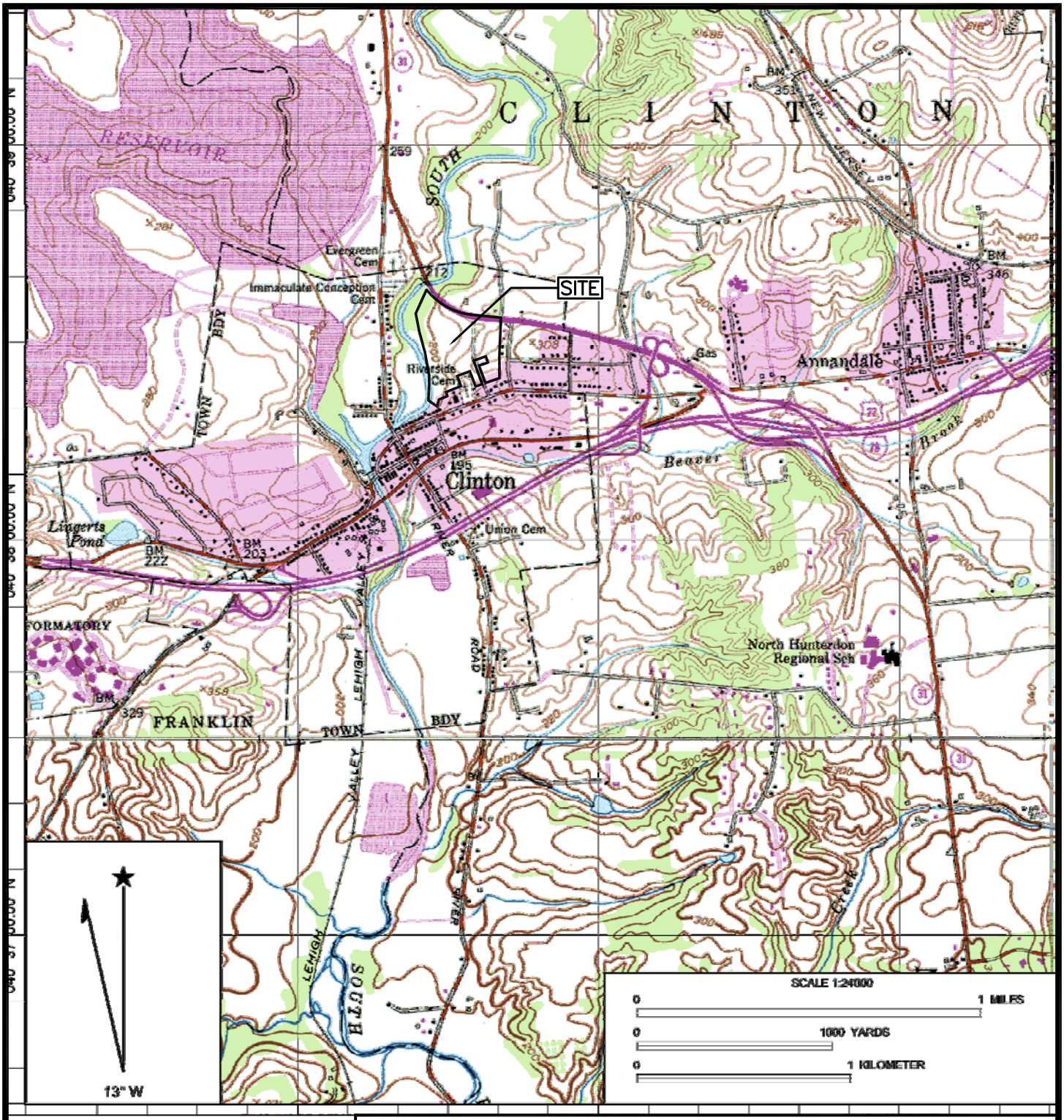
Map Unit Setting

National map unit symbol: ldyj
Mean annual precipitation: 30 to 64 inches
Mean annual air temperature: 46 to 79 degrees F
Frost-free period: 131 to 178 days
Farmland classification: Not prime farmland

Map Unit Composition

Water: 100 percent

Estimates are based on observations, descriptions, and transects of the mapunit.



TITLE:

U.S.G.S. MAP

E&LP
140 WEST MAIN STREET CLINTON TOWNSHIP, NJ 08829
(908) 238-0544 FAX: (908)238-9572
C.O.A. #: 24GA28021500
A PROFESSIONAL ASSOCIATION

LOCATION:
BLOCK: 14
LOTS: 32
ROUTE #31
TOWN OF CLINTON
HUNTERDON COUNTY
NEW JERSEY

DATE:	11/18/2020
PROJECT NO.:	8144
FILENAME:	2020-11-18 EXHIBITS

FIGURE:

3

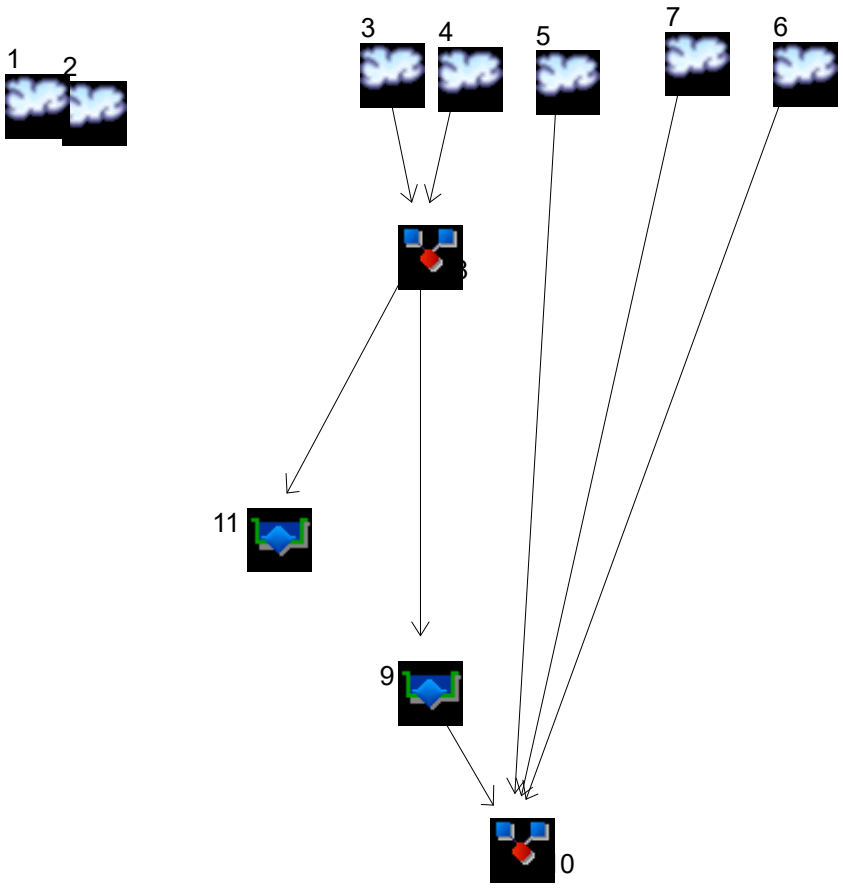
APPENDIX - B:

SUMMARY OF HYDROLOGIC ANALYSIS AND RUNOFF QUANTITY CALCULATIONS

E&LP

Watershed Model Schematic

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066



Legend

Hyd.	Origin	Description
1	SCS Runoff	Pre-Dev To Stream
2	SCS Runoff	Pre-Dev Dist
3	SCS Runoff	Post-Dev Imp To Basin
4	SCS Runoff	Post-Dev Perv. To Basin
5	SCS Runoff	Post-Dev To Stream
6	SCS Runoff	Post-Dev Imp To Outlet Str#2
7	SCS Runoff	Post-Dev To Outlet Str#2
8	Combine	Post-Dev Total To Basin
9	Reservoir	Basin Routing
10	Combine	Post-Dev Total to Stream
11	Reservoir	Spillway Routing

Hydrograph Return Period Recap

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066

Hyd. No.	Hydrograph type (origin)	Inflow Hyd(s)	Peak Outflow (cfs)								Hydrograph description
			1-Yr	2-Yr	3-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr	
1	SCS Runoff	------	-------	14.67	-------	-------	46.85	72.49	-------	122.82	Pre-Dev To Stream
2	SCS Runoff	------	-------	5.503	-------	-------	18.84	29.56	-------	50.73	Pre-Dev Dist
3	SCS Runoff	------	-------	26.23	-------	-------	39.05	47.65	-------	62.94	Post-Dev Imp To Basin
4	SCS Runoff	------	-------	3.376	-------	-------	12.55	19.99	-------	34.79	Post-Dev Perv. To Basin
5	SCS Runoff	------	-------	5.526	-------	-------	18.91	29.68	-------	50.94	Post-Dev To Stream
6	SCS Runoff	------	-------	1.021	-------	-------	1.520	1.854	-------	2.449	Post-Dev Imp To Outlet Str#2
7	SCS Runoff	------	-------	0.136	-------	-------	0.442	0.687	-------	1.169	Post-Dev To Outlet Str#2
8	Combine	3, 4,	-------	28.26	-------	-------	49.53	65.14	-------	94.54	Post-Dev Total To Basin
9	Reservoir	8	-------	4.285	-------	-------	14.94	25.40	-------	46.16	Basin Routing
10	Combine	5, 6, 7, 9	-------	9.260	-------	-------	30.31	51.68	-------	94.15	Post-Dev Total to Stream
11	Reservoir	8	-------	0.000	-------	-------	2.567	13.12	-------	62.40	Spillway Routing

Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph description
1	SCS Runoff	14.67	3	732	69,101	------	------	------	Pre-Dev To Stream
2	SCS Runoff	5.503	3	732	27,372	------	------	------	Pre-Dev Dist
3	SCS Runoff	26.23	3	726	90,814	------	------	------	Post-Dev Imp To Basin
4	SCS Runoff	3.376	3	732	17,970	------	------	------	Post-Dev Perv. To Basin
5	SCS Runoff	5.526	3	732	27,485	------	------	------	Post-Dev To Stream
6	SCS Runoff	1.021	3	726	3,534	------	------	------	Post-Dev Imp To Outlet Str#2
7	SCS Runoff	0.136	3	729	531	------	------	------	Post-Dev To Outlet Str#2
8	Combine	28.26	3	729	108,784	3, 4,	------	------	Post-Dev Total To Basin
9	Reservoir	4.285	3	768	79,378	8	226.82	61,105	Basin Routing
10	Combine	9.260	3	735	110,928	5, 6, 7, 9	------	------	Post-Dev Total to Stream
11	Reservoir	0.000	3	n/a	0	8	228.58	108,784	Spillway Routing

Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph description
1	SCS Runoff	46.85	3	732	177,419	------	------	------	Pre-Dev To Stream
2	SCS Runoff	18.84	3	732	72,112	------	------	------	Pre-Dev Dist
3	SCS Runoff	39.05	3	726	137,458	------	------	------	Post-Dev Imp To Basin
4	SCS Runoff	12.55	3	732	48,645	------	------	------	Post-Dev Perv. To Basin
5	SCS Runoff	18.91	3	732	72,410	------	------	------	Post-Dev To Stream
6	SCS Runoff	1.520	3	726	5,349	------	------	------	Post-Dev Imp To Outlet Str#2
7	SCS Runoff	0.442	3	729	1,398	------	------	------	Post-Dev To Outlet Str#2
8	Combine	49.53	3	729	186,103	3, 4,	------	------	Post-Dev Total To Basin
9	Reservoir	14.94	3	747	156,684	8	227.93	89,025	Basin Routing
10	Combine	30.31	3	735	235,841	5, 6, 7, 9	------	------	Post-Dev Total to Stream
11	Reservoir	2.567	3	870	51,875	8	229.52	138,091	Spillway Routing

Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph description
1	SCS Runoff	72.49	3	732	265,477	------	------	------	Pre-Dev To Stream
2	SCS Runoff	29.56	3	732	108,817	------	------	------	Pre-Dev Dist
3	SCS Runoff	47.65	3	726	168,873	------	------	------	Post-Dev Imp To Basin
4	SCS Runoff	19.99	3	732	74,055	------	------	------	Post-Dev Perv. To Basin
5	SCS Runoff	29.68	3	732	109,267	------	------	------	Post-Dev To Stream
6	SCS Runoff	1.854	3	726	6,572	------	------	------	Post-Dev Imp To Outlet Str#2
7	SCS Runoff	0.687	3	729	2,109	------	------	------	Post-Dev To Outlet Str#2
8	Combine	65.14	3	729	242,928	3, 4,	------	------	Post-Dev Total To Basin
9	Reservoir	25.40	3	741	213,503	8	228.47	105,364	Basin Routing
10	Combine	51.68	3	732	331,451	5, 6, 7, 9	------	------	Post-Dev Total to Stream
11	Reservoir	13.12	3	756	108,700	8	229.71	143,647	Spillway Routing

Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph description
1	SCS Runoff	122.82	3	732	441,546	------	------	------	Pre-Dev To Stream
2	SCS Runoff	50.73	3	732	182,641	------	------	------	Pre-Dev Dist
3	SCS Runoff	62.94	3	726	224,813	------	------	------	Post-Dev Imp To Basin
4	SCS Runoff	34.79	3	732	125,472	------	------	------	Post-Dev Perv. To Basin
5	SCS Runoff	50.94	3	732	183,396	------	------	------	Post-Dev To Stream
6	SCS Runoff	2.449	3	726	8,749	------	------	------	Post-Dev Imp To Outlet Str#2
7	SCS Runoff	1.169	3	729	3,540	------	------	------	Post-Dev To Outlet Str#2
8	Combine	94.54	3	729	350,285	3, 4,	------	------	Post-Dev Total To Basin
9	Reservoir	46.16	3	738	320,851	8	229.33	131,967	Basin Routing
10	Combine	94.15	3	732	516,536	5, 6, 7, 9	------	------	Post-Dev Total to Stream
11	Reservoir	62.40	3	735	216,057	8	230.11	156,801	Spillway Routing

APPENDIX - C:

EXISTING HYDROLOGIC ANALYSIS AND RUNOFF QUANTITY CALCULATIONS

E&LP

Worksheet 2: Runoff Curve Number and Runoff

Project:	Moebus	By:	bh	Date	9/2/2021
Location:	Clinton	Checked:	Enter	Date	Enter
Circle One:	Present	Developed		DA#1	

1. Runoff Curve Number (CN)

Soil Name and hydrologic group (Appendix A)	Cover Description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio	CN* Table 2-2	CN* Table 2-3	CN* Table 2-4	Area X acres / sq. mi. / %	Product of CN X area
B	Open Space	61			29.31	1787.91
B	Wood - Grass Combination	55			3.47	190.85
C	Water	74			0.16	11.84
Any	Impervious Area	98			1.04	101.92
				Totals =	33.98	2092.52

* Use only one CN per line.

CN (weighted) $\frac{\text{total product}}{\text{total area}} = \frac{2092.5}{33.98} = 61.581$ Use CN = 62

2. Runoff

	Storm #1	Storm #2	Storm #3
Frequency .....yr.			
Rainfall, P (24 hour).....in.			
Runoff, Q .....in.			

(Use P and CN with Table 2-1, fig. 2-1, or eqs. 2-3 and 2-4)

D-2

Copied from: (210-VI-TR-55, Second Ed., June 1986)

Worksheet 3: Time of Concentration (T_c) or Travel Time (T_t)

Project:	Moebus	By:	bh	Date	9/2/2021
Location:	Clinton	Checked:	Enter	Date	Enter
Circle One:	Present	Developed		DA#1	
Circle One:	Tc	Tt	through subarea		

NOTES: Space for as many as two segments per flow type can be used for each worksheet
Include a map, schematic, or description of flow segments

Sheet flow (applicable to Tc only)	Segment ID		Enter	
1. Surface description (table 3-1).....		Dense Grass		
2. Manning's roughness coeff., (table 3-1).....		0.24		
3. Flow length, L (total L<= 150 ft.).....ft.		100		
4. Two-yr. 24-hr rainfall, P2.....in		3.38		
5. Land Slope, s..... .....ft/ft		0.066		
6. $Tt = \frac{0.007(nL)^{0.8}}{P_2^{0.5}s^{0.4}}$ Compute T_t.....hr.		0.14	0.00	0.14

Shallow Concentrated flow	Segment ID			
7. Surface description (paved or unpaved).....		unpaved		
8. Flow length, L .....ft		1335		
9. Watercourse slope, s .....ft/ft		0.065169		
10. Average velocity, V (figure 3-1).....ft/s		4.1		
11. $T_c = \frac{L}{3600V}$ Compute T_t.....hr		0.09		0.09

Channel flow	Segment ID	Enter	Enter	
12. Cross sectional flow area, a.....ft2				
13. Wetted perimeter, p_w .....ft				
14. Hydraulic radius, $r = a/p_w$ Compute r.....ft				
15. Channel slope, s.....ft/ft				
16. Manning's roughness coeff., n				
17. $V = \frac{1.49}{n}r^{2/3}s^{1/2}$ Compute V.....ft/s				
18. Flow length, L.....ft				
19. $T_t = \frac{L}{3600V}$ Compute T_t.....ft.		0.00	0.00	0.00

20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, and 19)..... 0.23

Min= 14.01

Copied from: (210-VI-TR-55, Second Ed., June 1986)

Worksheet 2: Runoff Curve Number and Runoff

Project:	Moebus	By:	bh	Date	9/2/2021
Location:	Clinton	Checked:	Enter	Date	Enter
Circle One:	Present	Developed		To Stream	

1. Runoff Curve Number (CN)

Soil Name and hydrologic group (Appendix A)	Cover Description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio	CN* Table 2-2	CN* Table 2-3	CN* Table 2-4	Area X acres / sq. mi. / %	Product of CN X area
B	Open Space	61			14.16	863.76
B	Wood - Grass Combination	55			0.20	11.00
C	Water	74			0.00	0.00
Any	Impervious Area	98			0.15	14.70
				Totals =	14.51	889.46

* Use only one CN per line.

CN (weighted) $\frac{\text{total product}}{\text{total area}} = \frac{889.46}{14.51} =$ 61.3 Use CN = 61

2. Runoff

	Storm #1	Storm #2	Storm #3
Frequency .....yr.			
Rainfall, P (24 hour).....in.			
Runoff, Q .....in.			
(Use P and CN with Table 2-1, fig. 2-1, or eqs. 2-3 and 2-4)			

D-2

Copied from: (210-VI-TR-55, Second Ed., June 1986)

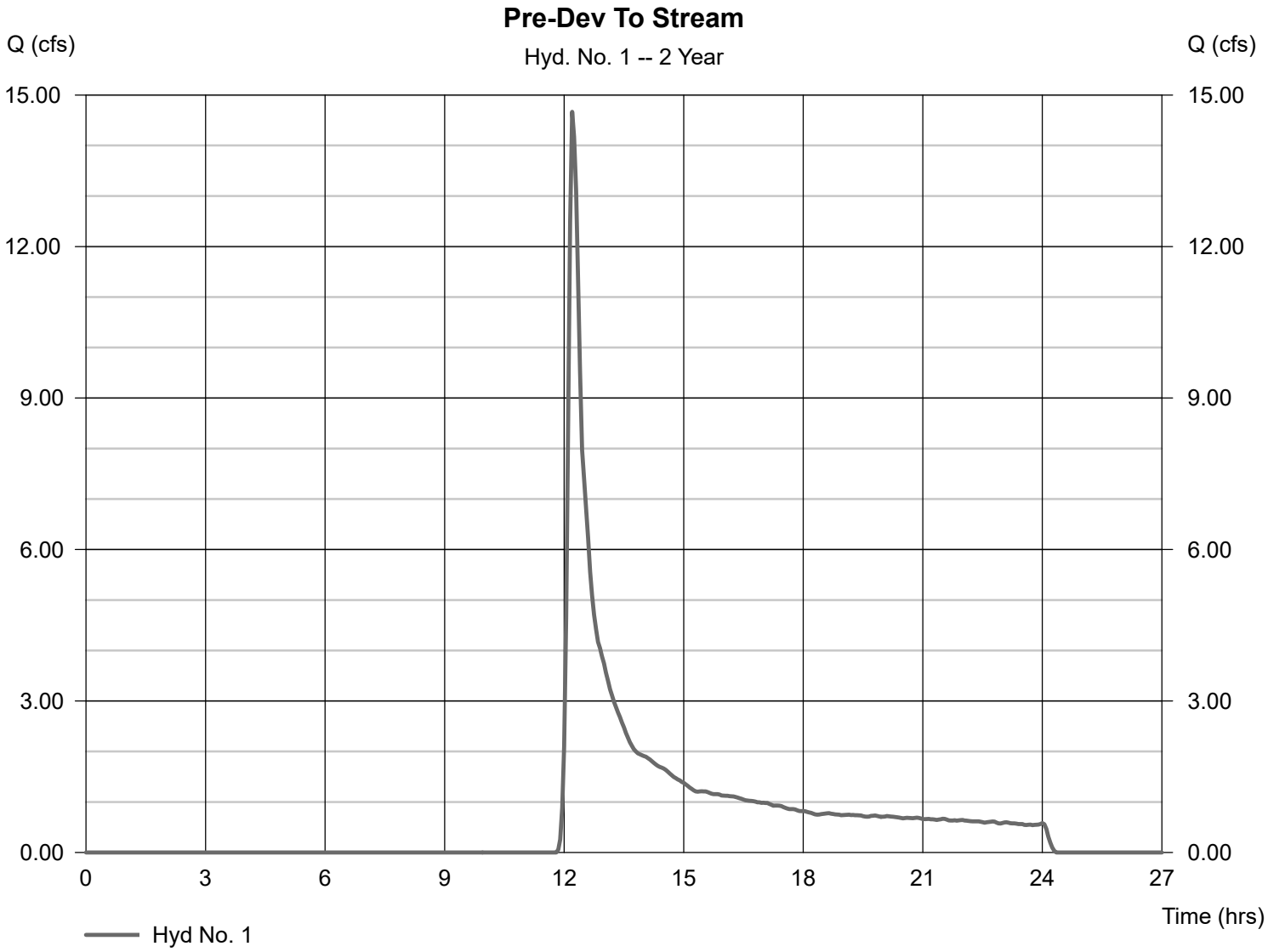
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Thursday, Sep 2, 2021

Hyd. No. 1

Pre-Dev To Stream

Hydrograph type	=	SCS Runoff	Peak discharge	=	14.67 cfs
Storm frequency	=	2 yrs	Time to peak	=	12.20 hrs
Time interval	=	3 min	Hyd. volume	=	69,101 cuft
Drainage area	=	33.980 ac	Curve number	=	62
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	USER	Time of conc. (Tc)	=	14.00 min
Total precip.	=	3.38 in	Distribution	=	Custom
Storm duration	=	NOAA_C_3 min.cds	Shape factor	=	484



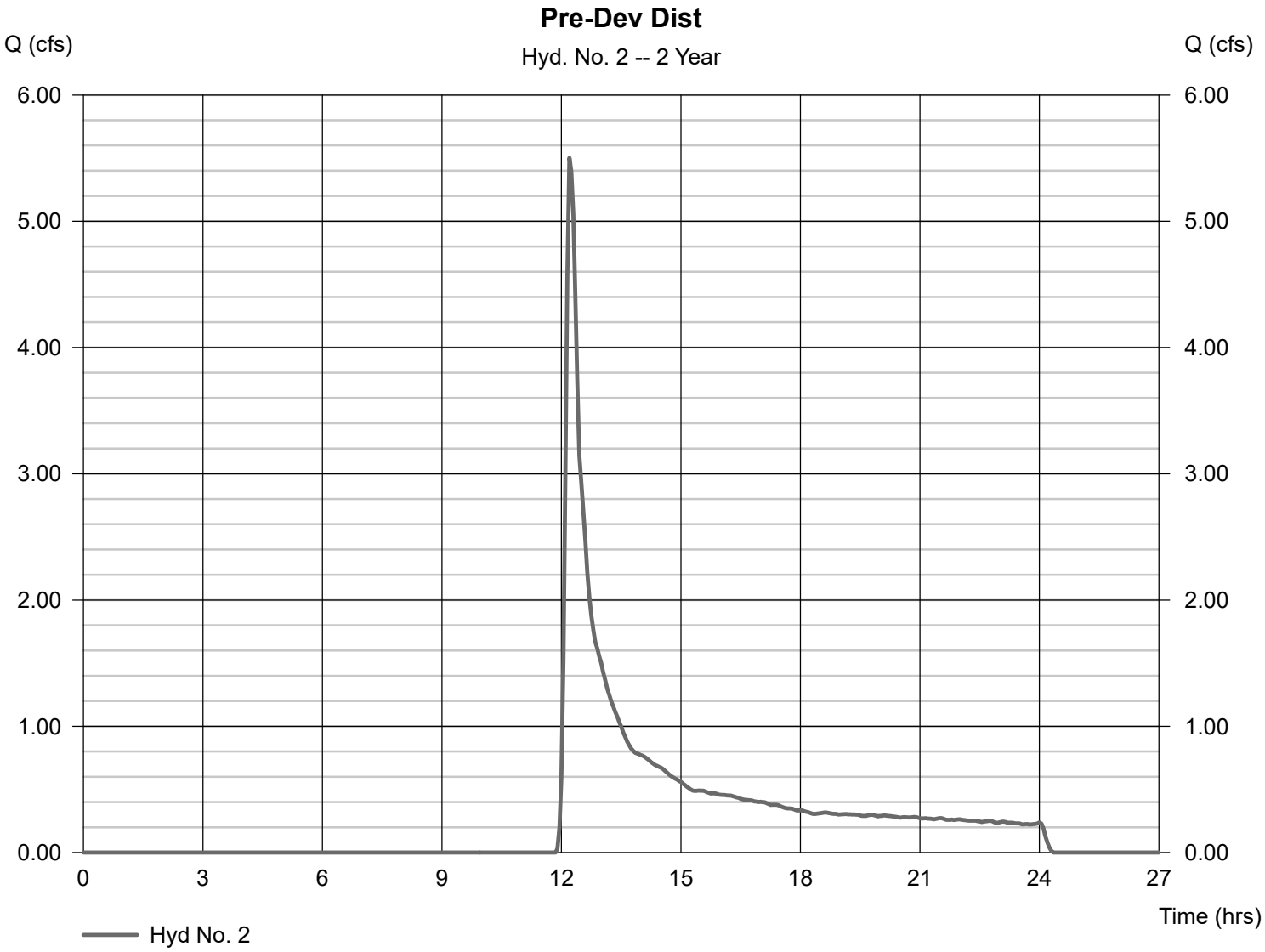
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Thursday, Sep 2, 2021

Hyd. No. 2

Pre-Dev Dist

Hydrograph type	=	SCS Runoff	Peak discharge	=	5.503 cfs
Storm frequency	=	2 yrs	Time to peak	=	12.20 hrs
Time interval	=	3 min	Hyd. volume	=	27,372 cuft
Drainage area	=	14.510 ac	Curve number	=	61
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	USER	Time of conc. (Tc)	=	14.00 min
Total precip.	=	3.38 in	Distribution	=	Custom
Storm duration	=	NOAA_C_3 min.cds	Shape factor	=	484



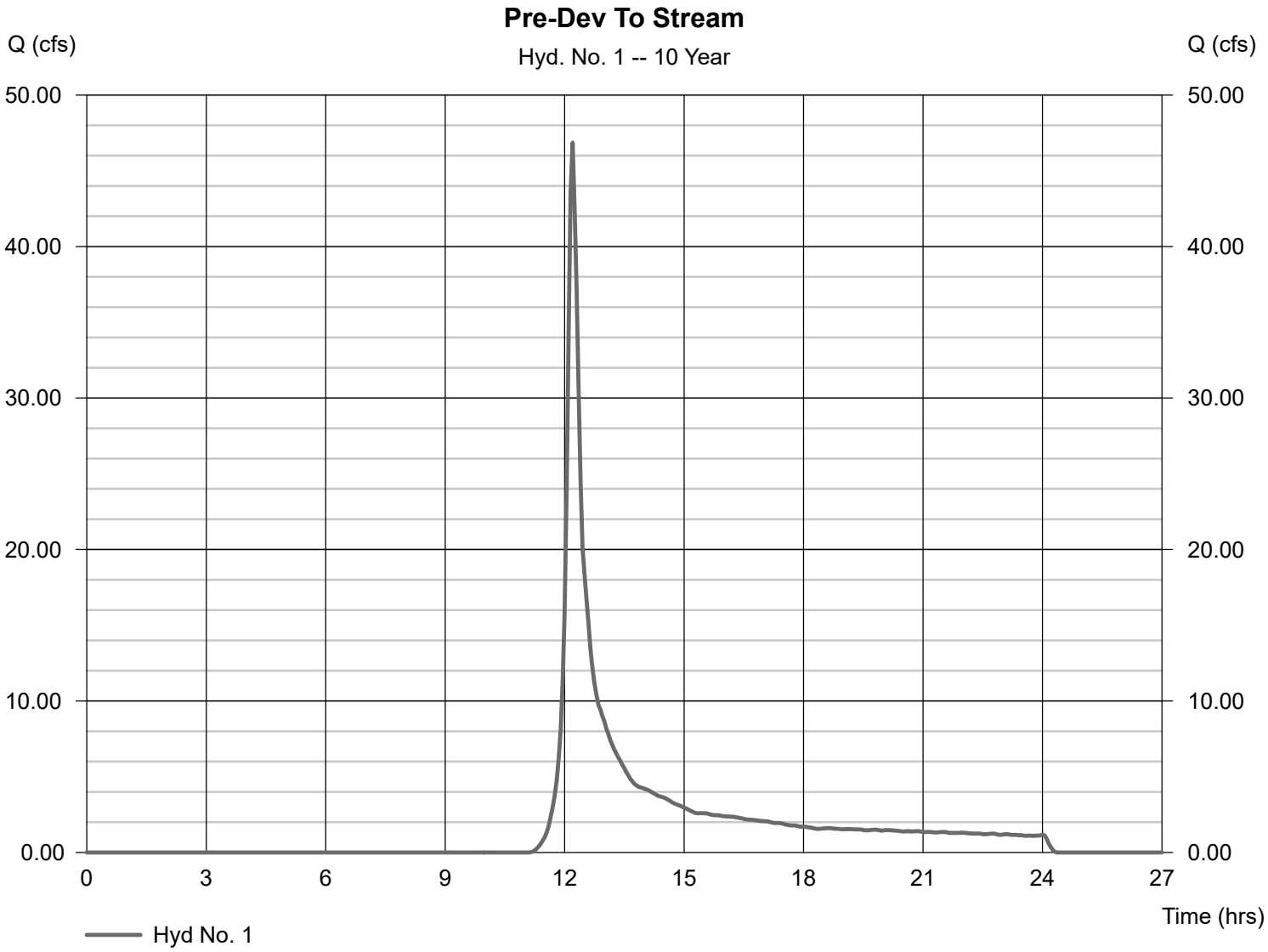
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Thursday, Sep 2, 2021

Hyd. No. 1

Pre-Dev To Stream

Hydrograph type	=	SCS Runoff	Peak discharge	=	46.85 cfs
Storm frequency	=	10 yrs	Time to peak	=	12.20 hrs
Time interval	=	3 min	Hyd. volume	=	177,419 cuft
Drainage area	=	33.980 ac	Curve number	=	62
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	USER	Time of conc. (Tc)	=	14.00 min
Total precip.	=	5.00 in	Distribution	=	Custom
Storm duration	=	NOAA_C_3 min.cds	Shape factor	=	484



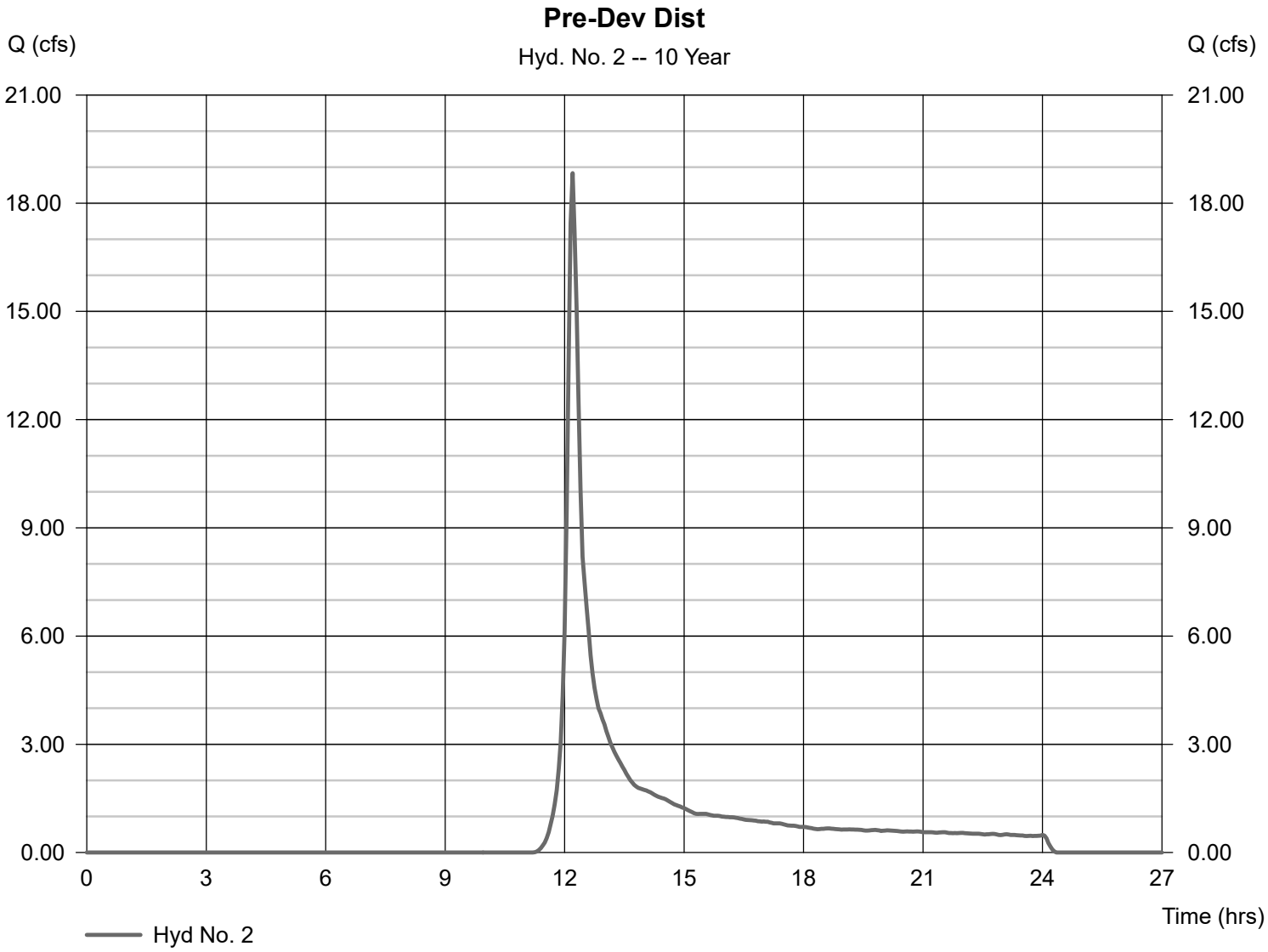
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Thursday, Sep 2, 2021

Hyd. No. 2

Pre-Dev Dist

Hydrograph type	=	SCS Runoff	Peak discharge	=	18.84 cfs
Storm frequency	=	10 yrs	Time to peak	=	12.20 hrs
Time interval	=	3 min	Hyd. volume	=	72,112 cuft
Drainage area	=	14.510 ac	Curve number	=	61
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	USER	Time of conc. (Tc)	=	14.00 min
Total precip.	=	5.00 in	Distribution	=	Custom
Storm duration	=	NOAA_C_3 min.cds	Shape factor	=	484



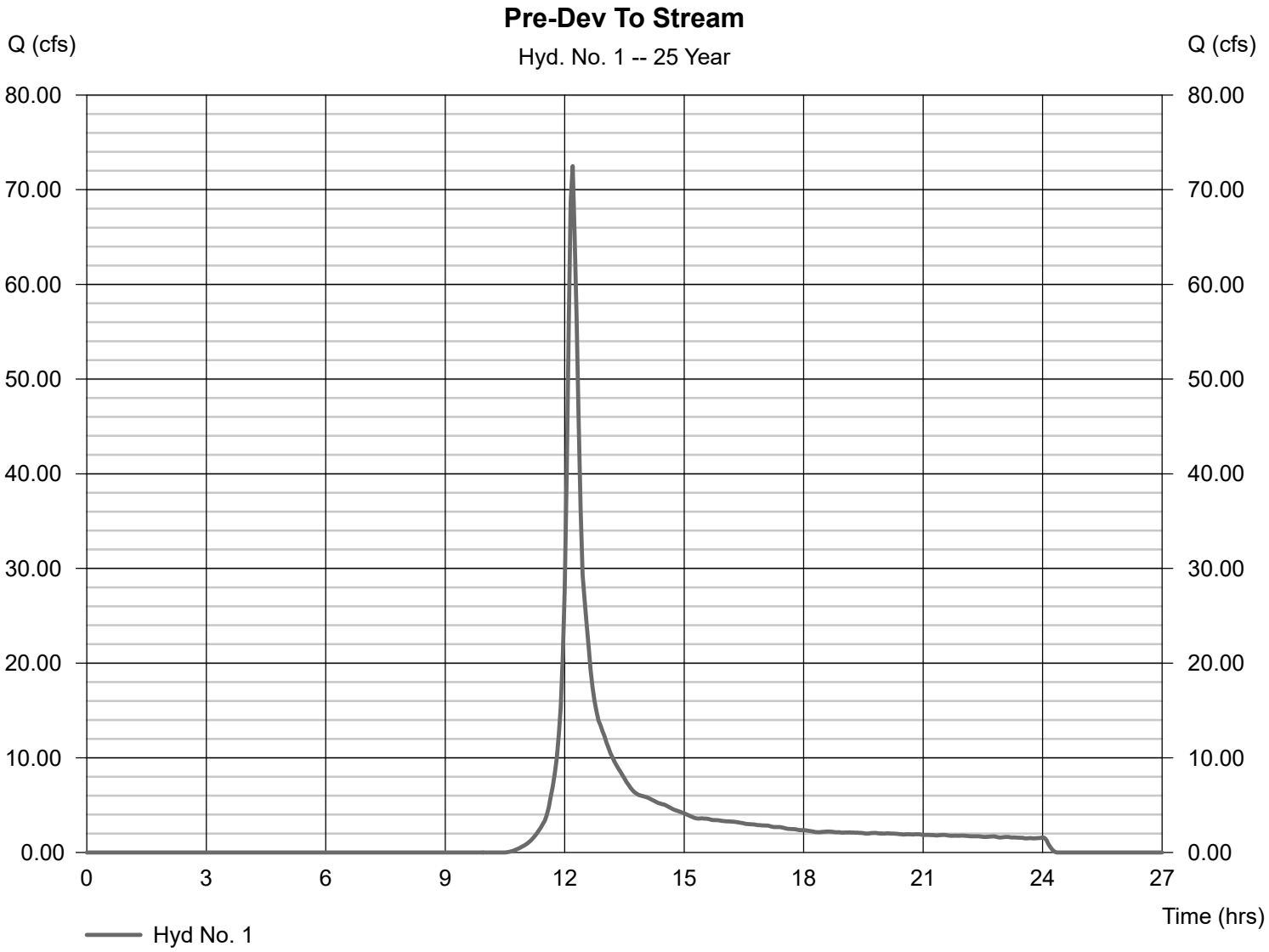
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Thursday, Sep 2, 2021

Hyd. No. 1

Pre-Dev To Stream

Hydrograph type	=	SCS Runoff	Peak discharge	=	72.49 cfs
Storm frequency	=	25 yrs	Time to peak	=	12.20 hrs
Time interval	=	3 min	Hyd. volume	=	265,477 cuft
Drainage area	=	33.980 ac	Curve number	=	62
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	USER	Time of conc. (Tc)	=	14.00 min
Total precip.	=	6.09 in	Distribution	=	Custom
Storm duration	=	NOAA_C_3 min.cds	Shape factor	=	484



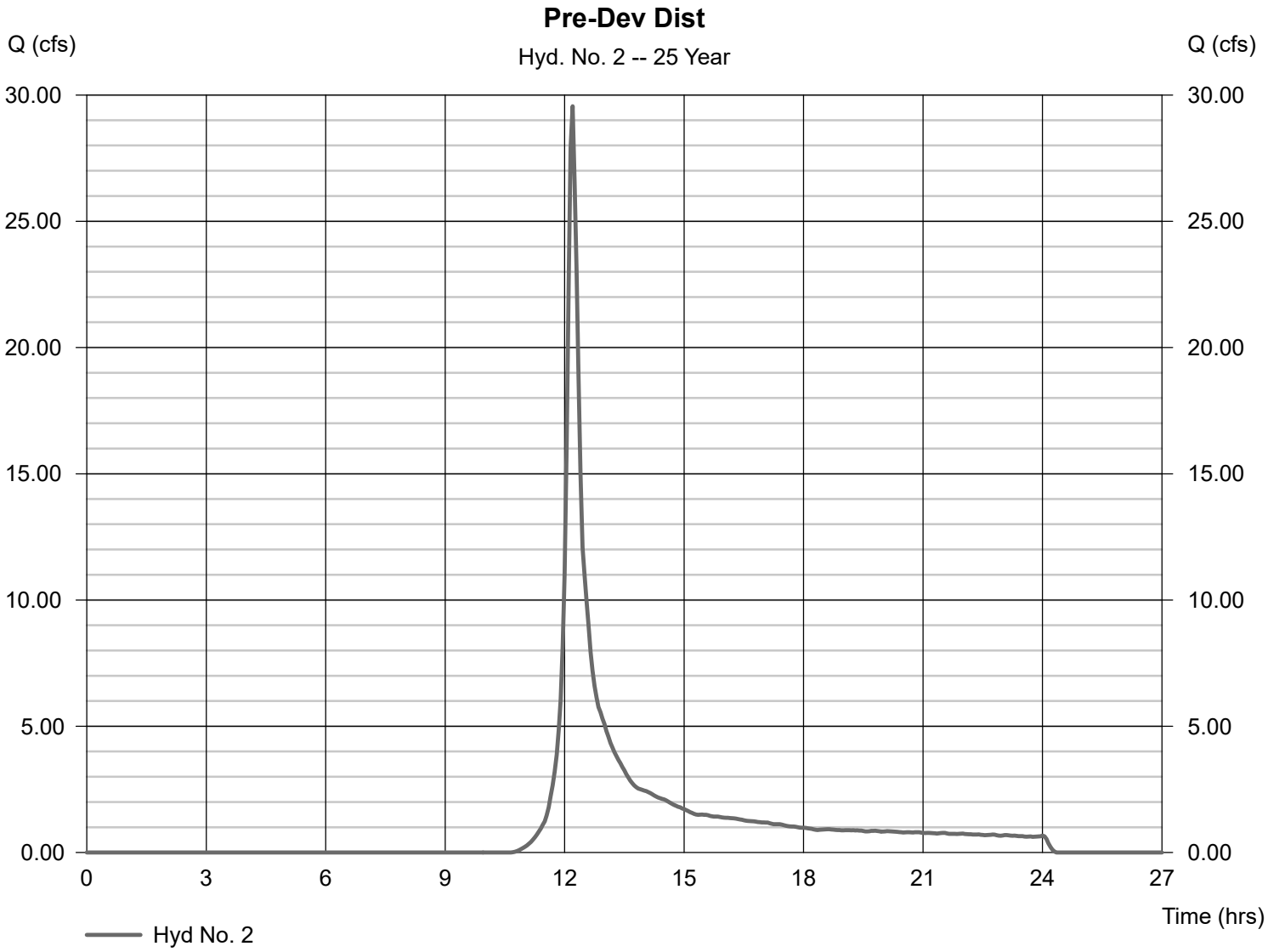
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Thursday, Sep 2, 2021

Hyd. No. 2

Pre-Dev Dist

Hydrograph type	=	SCS Runoff	Peak discharge	=	29.56 cfs
Storm frequency	=	25 yrs	Time to peak	=	12.20 hrs
Time interval	=	3 min	Hyd. volume	=	108,817 cuft
Drainage area	=	14.510 ac	Curve number	=	61
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	USER	Time of conc. (Tc)	=	14.00 min
Total precip.	=	6.09 in	Distribution	=	Custom
Storm duration	=	NOAA_C_3 min.cds	Shape factor	=	484



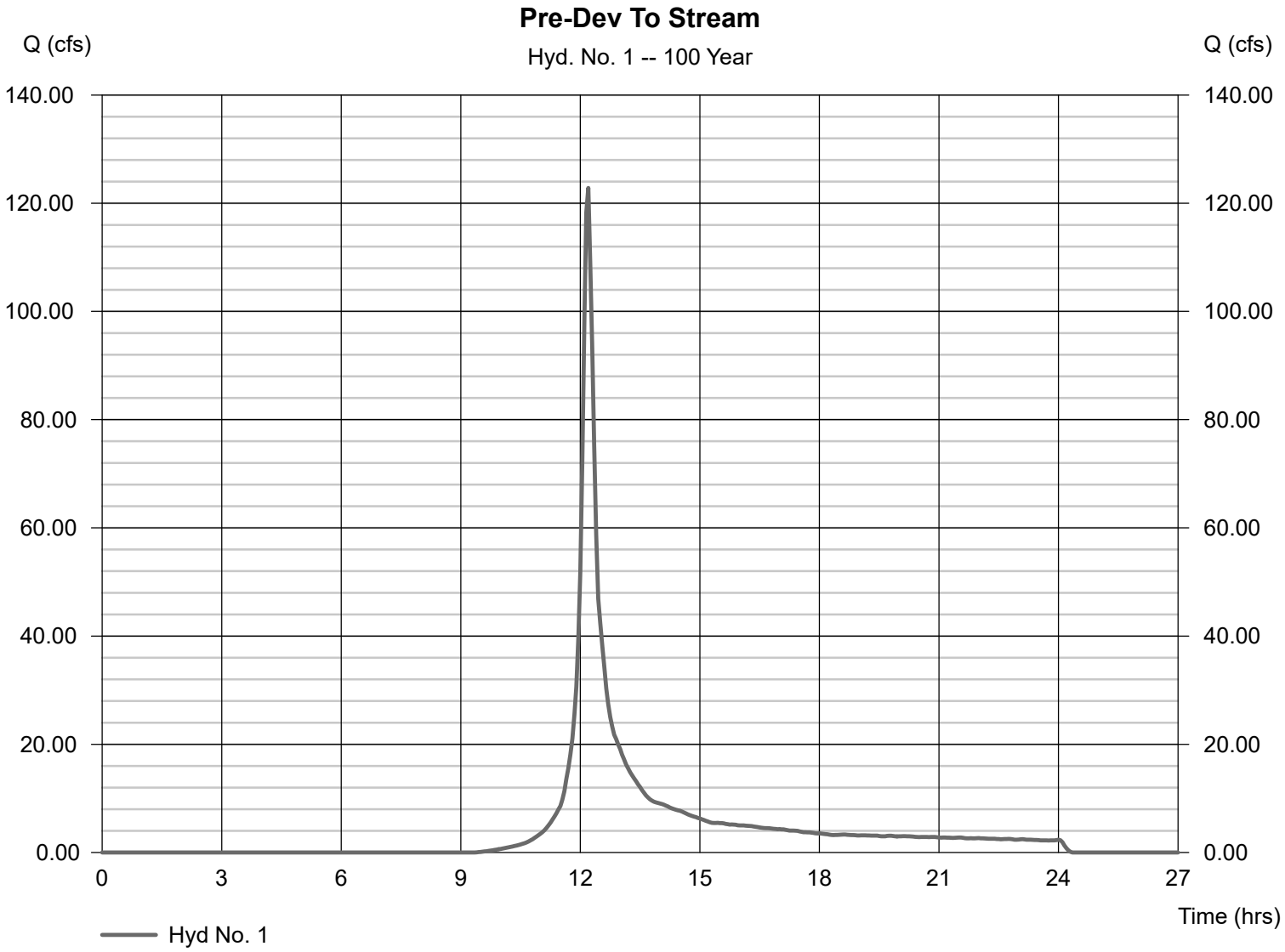
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Thursday, Sep 2, 2021

Hyd. No. 1

Pre-Dev To Stream

Hydrograph type	=	SCS Runoff	Peak discharge	=	122.82 cfs
Storm frequency	=	100 yrs	Time to peak	=	12.20 hrs
Time interval	=	3 min	Hyd. volume	=	441,546 cuft
Drainage area	=	33.980 ac	Curve number	=	62
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	USER	Time of conc. (Tc)	=	14.00 min
Total precip.	=	8.03 in	Distribution	=	Custom
Storm duration	=	NOAA_C_3 min.cds	Shape factor	=	484



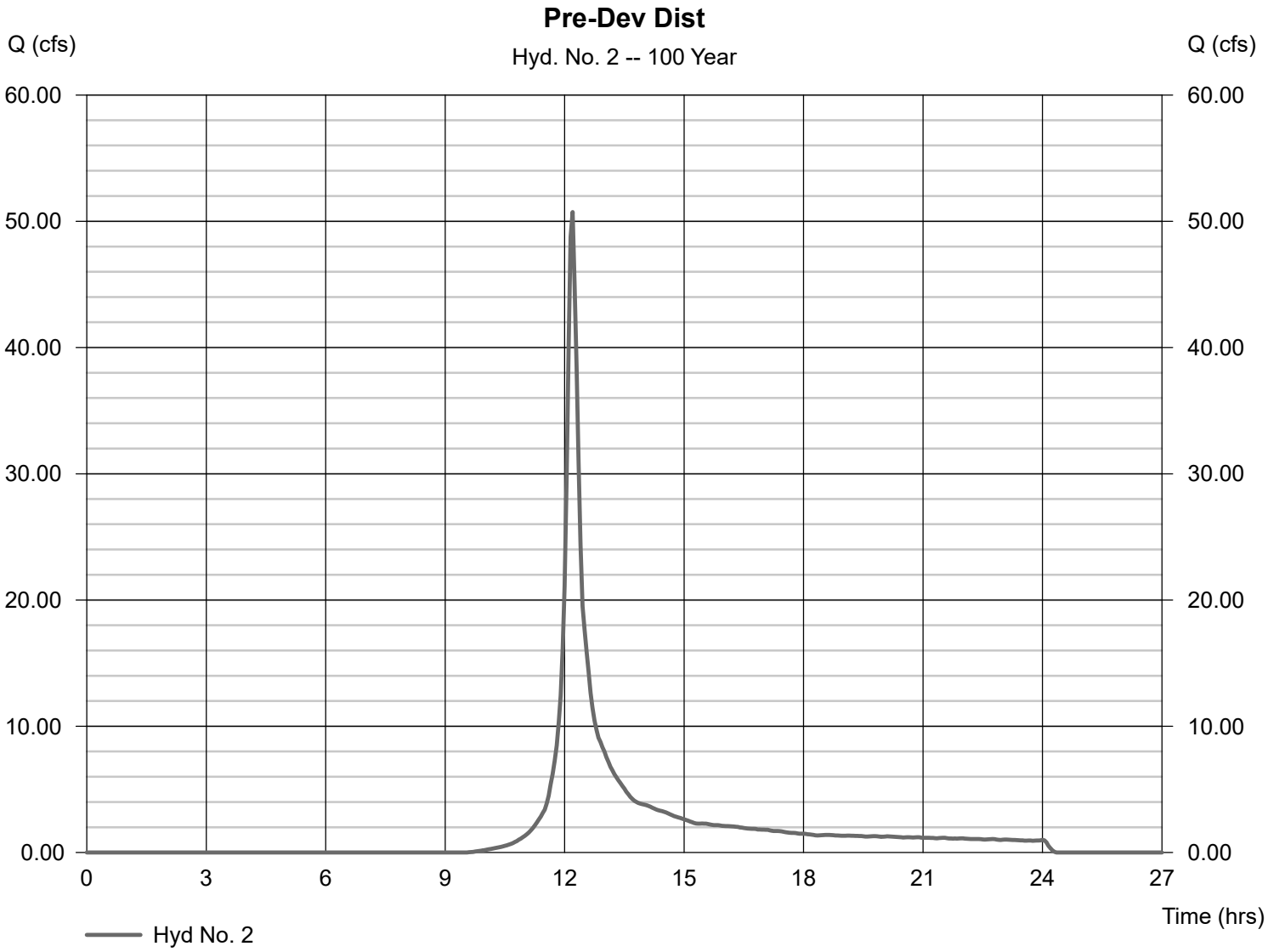
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Thursday, Sep 2, 2021

Hyd. No. 2

Pre-Dev Dist

Hydrograph type	=	SCS Runoff	Peak discharge	=	50.73 cfs
Storm frequency	=	100 yrs	Time to peak	=	12.20 hrs
Time interval	=	3 min	Hyd. volume	=	182,641 cuft
Drainage area	=	14.510 ac	Curve number	=	61
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	USER	Time of conc. (Tc)	=	14.00 min
Total precip.	=	8.03 in	Distribution	=	Custom
Storm duration	=	NOAA_C_3 min.cds	Shape factor	=	484



APPENDIX - D:

PROPOSED HYDROLOGIC ANALYSIS AND RUNOFF QUANTITY CALCULATIONS

E&LP

Worksheet 2: Runoff Curve Number and Runoff

Project:	Moebus	By:	bh	Date	9/2/2021
Location:	Clinton	Checked:	Enter	Date	Enter
Circle One:	Present	Developed		PDA#2-To Stream	

1. Runoff Curve Number (CN)

Soil Name and hydrologic group (Appendix A)	Cover Description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio	CN* Table 2-2	CN* Table 2-3	CN* Table 2-4	Area X acres / sq. mi. / %	Product of CN X area
B	Open Space	61			13.26	808.86
B	Wood - Grass Combination	55			1.01	55.55
C	Water	74			0.16	11.84
Any	Impervious Area	98			0.14	13.72
				Totals =	14.57	889.97

* Use only one CN per line.

CN (weighted) $\frac{\text{total product}}{\text{total area}} = \frac{889.97}{14.57} =$ 61.082 Use CN = 61

2. Runoff

	Storm #1	Storm #2	Storm #3
Frequency .....yr.			
Rainfall, P (24 hour).....in.			
Runoff, Q .....in.			

(Use P and CN with Table 2-1, fig. 2-1, or eqs. 2-3 and 2-4)

D-2

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Worksheet 3: Time of Concentration (T_c) or Travel Time (T_t)

Project:	Moebus	By:	bh	Date	9/2/2021
Location:	Clinton	Checked:	Enter	Date	Enter

Circle One: Present Developed PDA#2-To Stream
Circle One: Tc Tt through subarea

NOTES: Space for as many as two segments per flow type can be used for each worksheet
Include a map, schematic, or description of flow segments

Sheet flow (applicable to Tc only)	Segment ID		Enter	
1. Surface description (table 3-1).....		Dense Grass		
2. Manning's roughness coeff., (table 3-1).....		0.24		
3. Flow length, L (total L<= 150 ft.).....ft.		100		
4. Two-yr. 24-hr rainfall, P2.....in		3.38		
5. Land Slope, s..... .....ft/ft		0.0533		
6. $Tt = \frac{0.007(nL)^{0.8}}{P_2^{0.5}s^{0.4}}$ Compute T_t.....hr.		0.16	0.00	0.16

Shallow Concentrated flow	Segment ID			
7. Surface description (paved or unpaved).....		unpaved		
8. Flow length, L .....ft		600		
9. Watercourse slope, s .....ft/ft		0.063		
10. Average velocity, V (figure 3-1).....ft/s		4.0		
11. $T_c = \frac{L}{3600V}$ Compute T_t.....hr		0.04		0.04

Channel flow	Segment ID	Enter	Enter	
12. Cross sectional flow area, a.....ft2				
13. Wetted perimeter, p_w .....ft				
14. Hydraulic radius, $r = a/p_w$ Compute r.....ft				
15. Channel slope, s.....ft/ft				
16. Manning's roughness coeff., n				
17. $V = \frac{1.49}{n}r^{2/3}s^{1/2}$ Compute V.....ft/s				
18. Flow length, L.....ft				
19. $T_t = \frac{L}{3600V}$ Compute T_t.....ft.		0.00	0.00	0.00

20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, and 19)..... 0.20

Min= 11.85

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Worksheet 2: Runoff Curve Number and Runoff

Project:	Moebus	By:	bh	Date	9/2/2021
Location:	Clinton	Checked:	Enter	Date	Enter
Circle One:	Present	Developed		PDA#1- Perv To Basin	

1. Runoff Curve Number (CN)

Soil Name and hydrologic group (Appendix A)	Cover Description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio	CN* Table 2-2	CN* Table 2-3	CN* Table 2-4	Area X acres / sq. mi. / %	Product of CN X area
B	Open Space	61			8.71	531.31
B	Wood - Grass Combination	55			1.59	87.45
C	Water	74			0.00	0.00
Any	Impervious Area	98			0.00	0.00
				Totals =	10.30	618.76

* Use only one CN per line.

CN (weighted) $\frac{\text{total product}}{\text{total area}} = \frac{618.76}{10.3} = 60.074$ Use CN = 60

2. Runoff

	Storm #1	Storm #2	Storm #3
Frequency .....yr.			
Rainfall, P (24 hour).....in.			
Runoff, Q .....in.			

(Use P and CN with Table 2-1, fig. 2-1, or eqs. 2-3 and 2-4)

D-2

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Worksheet 3: Time of Concentration (T_c) or Travel Time (T_t)

Project:	Moebus	By:	bh	Date	9/2/2021
Location:	Clinton	Checked:	Enter	Date	Enter

Circle One: Present — Developed — PDA#1- Perv To Basin
Circle One: Tc — Tt — through subarea

NOTES: Space for as many as two segments per flow type can be used for each worksheet
Include a map, schematic, or description of flow segments

Sheet flow (applicable to Tc only)	Segment ID		Enter	
1. Surface description (table 3-1).....		Dense Grass		
2. Manning's roughness coeff., (table 3-1).....		0.24		
3. Flow length, L (total L<= 150 ft.).....ft.		100		
4. Two-yr. 24-hr rainfall, P2.....in		3.3		
5. Land Slope, s..... .....ft/ft		0.032		
6. $Tt = \frac{0.007(nL)^{0.8}}{P_2^{0.5}s^{0.4}}$ Compute T_t.....hr.		0.19	0.00	0.19

Shallow Concentrated flow	Segment ID			
7. Surface description (paved or unpaved).....		unpaved		
8. Flow length, L .....ft		200		
9. Watercourse slope, s .....ft/ft		0.03		
10. Average velocity, V (figure 3-1).....ft/s		2.8		
11. $T_c = \frac{L}{3600V}$ Compute T_t.....hr		0.02		0.02

Channel flow	Segment ID	Enter	Enter	
12. Cross sectional flow area, a.....ft2				
13. Wetted perimeter, p_w .....ft				
14. Hydraulic radius, $r = a/p_w$ Compute r.....ft				
15. Channel slope, s.....ft/ft				
16. Manning's roughness coeff., n				
17. $V = \frac{1.49}{n}r^{2/3}s^{1/2}$ Compute V.....ft/s				
18. Flow length, L.....ft				
19. $T_t = \frac{L}{3600V}$ Compute T_t.....ft.		0.00	0.00	0.00

20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, and 19)..... 0.21

Min= 12.84

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Worksheet 2: Runoff Curve Number and Runoff

Project:	Moebus	By:	bh	Date	9/2/2021
Location:	Clinton	Checked:	Enter	Date	Enter
Circle One:	Present	Developed		PDA#1-Imp To Basin	

1. Runoff Curve Number (CN)

Soil Name and hydrologic group (Appendix A)	Cover Description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio	CN* Table 2-2	CN* Table 2-3	CN* Table 2-4	Area X acres / sq. mi. / %	Product of CN X area
B	Open Space	61				
B	Wood - Grass Combination	55				
C	Water	74				
Any	Impervious Area	98			8.48	831.04
				Totals =	8.48	831.04

* Use only one CN per line.

CN (weighted) $\frac{\text{total product}}{\text{total area}} = \frac{831.04}{8.48} =$ 98 Use CN = 98

2. Runoff

	Storm #1	Storm #2	Storm #3
Frequency .....yr.			
Rainfall, P (24 hour).....in.			
Runoff, Q .....in.			

(Use P and CN with Table 2-1, fig. 2-1, or eqs. 2-3 and 2-4)

D-2

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Worksheet 2: Runoff Curve Number and Runoff

Project:	Moebus	By:	bh	Date	9/2/2021
Location:	Clinton	Checked:	Enter	Date	Enter
Circle One:	Present	Developed		Imp. To Outlet Str#2	

1. Runoff Curve Number (CN)

Soil Name and hydrologic group (Appendix A)	Cover Description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio	CN* Table 2-2	CN* Table 2-3	CN* Table 2-4	Area X acres / sq. mi. / %	Product of CN X area
B	Open Space	61			0.00	0.00
B	Wood - Grass Combination	55			0.00	0.00
C	Water	74			0.00	0.00
Any	Impervious Area	98			0.33	32.34
				Totals =	0.33	32.34

* Use only one CN per line.

CN (weighted) $\frac{\text{total product}}{\text{total area}} = \frac{32.34}{0.33} =$ 98 Use CN = 98

2. Runoff

	Storm #1	Storm #2	Storm #3
Frequency .....yr.			
Rainfall, P (24 hour).....in.			
Runoff, Q .....in.			

(Use P and CN with Table 2-1, fig. 2-1, or eqs. 2-3 and 2-4)

D-2

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Worksheet 2: Runoff Curve Number and Runoff

Project:	Moebus	By:	bh	Date	9/2/2021
Location:	Clinton	Checked:	Enter	Date	Enter
Circle One:	Present	Developed		Perv. To Outlet Str#2	

1. Runoff Curve Number (CN)

Soil Name and hydrologic group (Appendix A)	Cover Description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio	CN* Table 2-2	CN* Table 2-3	CN* Table 2-4	Area X acres / sq. mi. / %	Product of CN X area
B	Open Space	61			0.30	18.30
B	Wood - Grass Combination	55			0.00	0.00
C	Water	74			0.00	0.00
Any	Impervious Area	98			0.00	0.00
				Totals =	0.30	18.30

* Use only one CN per line.

CN (weighted) $\frac{\text{total product}}{\text{total area}} = \frac{18.3}{0.3} =$ 61 Use CN = 61

2. Runoff

	Storm #1	Storm #2	Storm #3
Frequency .....yr.			
Rainfall, P (24 hour).....in.			
Runoff, Q .....in.			
(Use P and CN with Table 2-1, fig. 2-1, or eqs. 2-3 and 2-4)			

D-2

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Worksheet 3: Time of Concentration (T_c) or Travel Time (T_t)

Project:	Moebus	By:	bh	Date	9/2/2021
Location:	Clinton	Checked:	Enter	Date	Enter

Circle One: Present Developed Perv. To Outlet Str#2
Circle One: Tc Tt through subarea

NOTES: Space for as many as two segments per flow type can be used for each worksheet
Include a map, schematic, or description of flow segments

Sheet flow (applicable to Tc only)	Segment ID		Enter	
1. Surface description (table 3-1).....		Dense Grass		
2. Manning's roughness coeff., (table 3-1).....		0.24		
3. Flow length, L (total L<= 150 ft.).....ft.		100		
4. Two-yr. 24-hr rainfall, P2.....in		3.3		
5. Land Slope, s..... .....ft/ft		0.06		
6. $Tt = \frac{0.007(nL)^{0.8}}{P_2^{0.5}s^{0.4}}$ Compute T_t.....hr.		0.15	0.00	0.15

Shallow Concentrated flow	Segment ID			
7. Surface description (paved or unpaved).....		unpaved		
8. Flow length, L .....ft		50		
9. Watercourse slope, s .....ft/ft		0.06		
10. Average velocity, V (figure 3-1).....ft/s		4.0		
11. $T_c = \frac{L}{3600V}$ Compute T_t.....hr		0.00		0.00

Channel flow	Segment ID	Enter	Enter	
12. Cross sectional flow area, a.....ft2				
13. Wetted perimeter, p_w .....ft				
14. Hydraulic radius, $r = a/p_w$ Compute r.....ft				
15. Channel slope, s.....ft/ft				
16. Manning's roughness coeff., n				
17. $V = \frac{1.49}{n}r^{2/3}s^{1/2}$ Compute V.....ft/s				
18. Flow length, L.....ft				
19. $T_t = \frac{L}{3600V}$ Compute T_t.....ft.		0.00	0.00	0.00

20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, and 19)..... 0.15

Min= 9.27

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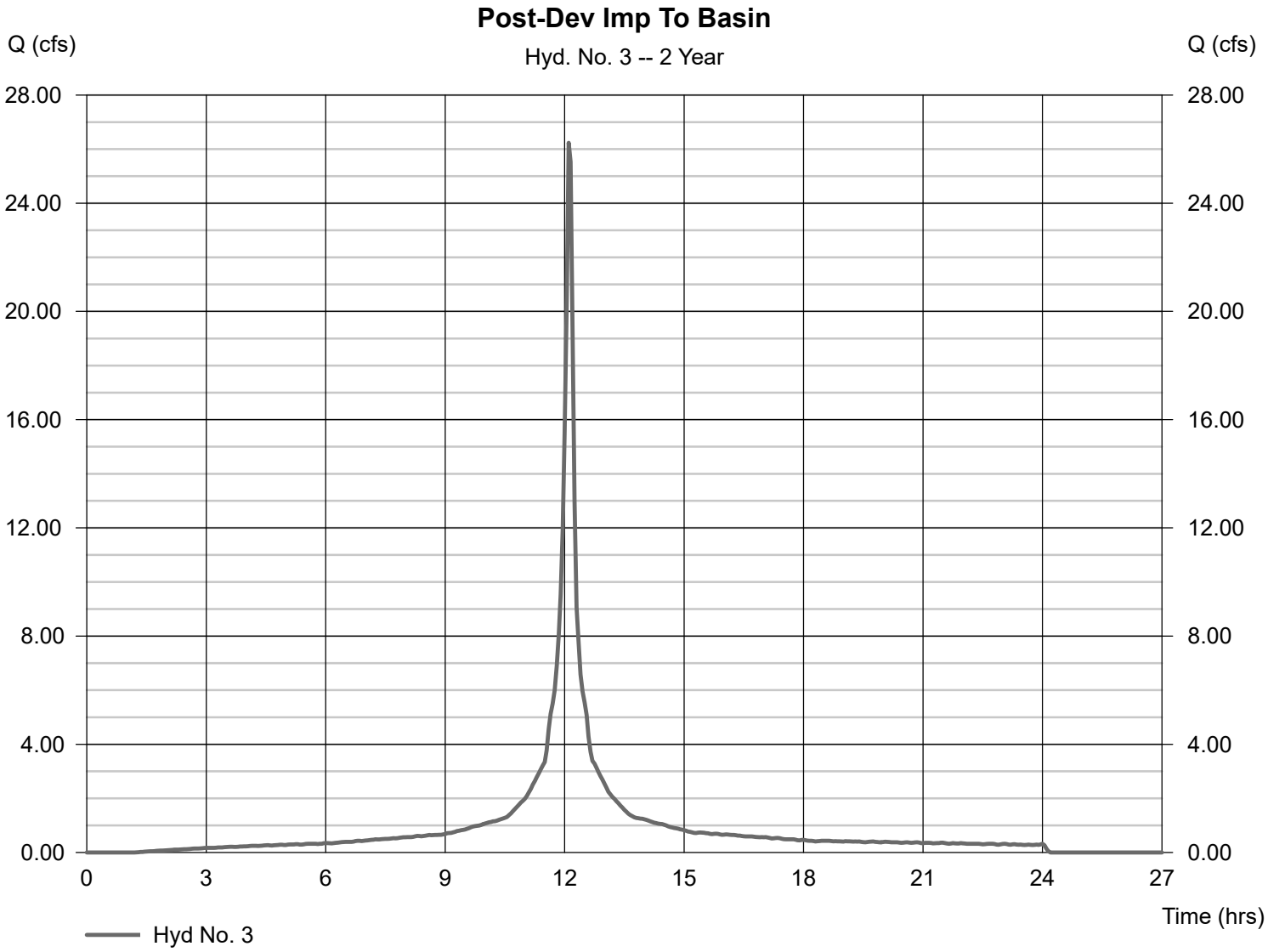
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Thursday, Sep 2, 2021

Hyd. No. 3

Post-Dev Imp To Basin

Hydrograph type	=	SCS Runoff	Peak discharge	=	26.23 cfs
Storm frequency	=	2 yrs	Time to peak	=	12.10 hrs
Time interval	=	3 min	Hyd. volume	=	90,814 cuft
Drainage area	=	8.480 ac	Curve number	=	98
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	USER	Time of conc. (Tc)	=	6.00 min
Total precip.	=	3.38 in	Distribution	=	Custom
Storm duration	=	NOAA_C_3 min.cds	Shape factor	=	484



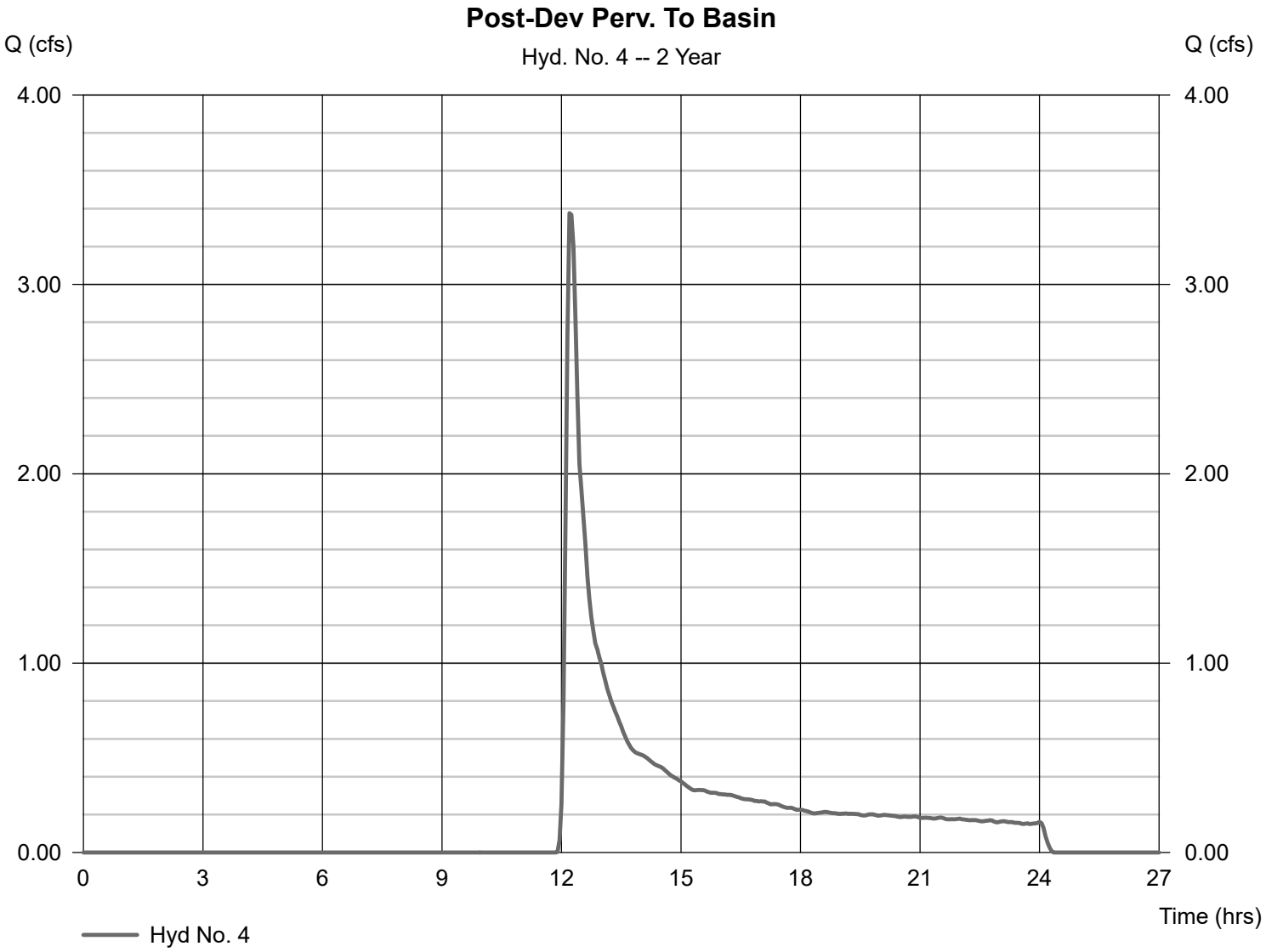
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Thursday, Sep 2, 2021

Hyd. No. 4

Post-Dev Perv. To Basin

Hydrograph type	=	SCS Runoff	Peak discharge	=	3.376 cfs
Storm frequency	=	2 yrs	Time to peak	=	12.20 hrs
Time interval	=	3 min	Hyd. volume	=	17,970 cuft
Drainage area	=	10.300 ac	Curve number	=	60
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	USER	Time of conc. (Tc)	=	12.80 min
Total precip.	=	3.38 in	Distribution	=	Custom
Storm duration	=	NOAA_C_3 min.cds	Shape factor	=	484



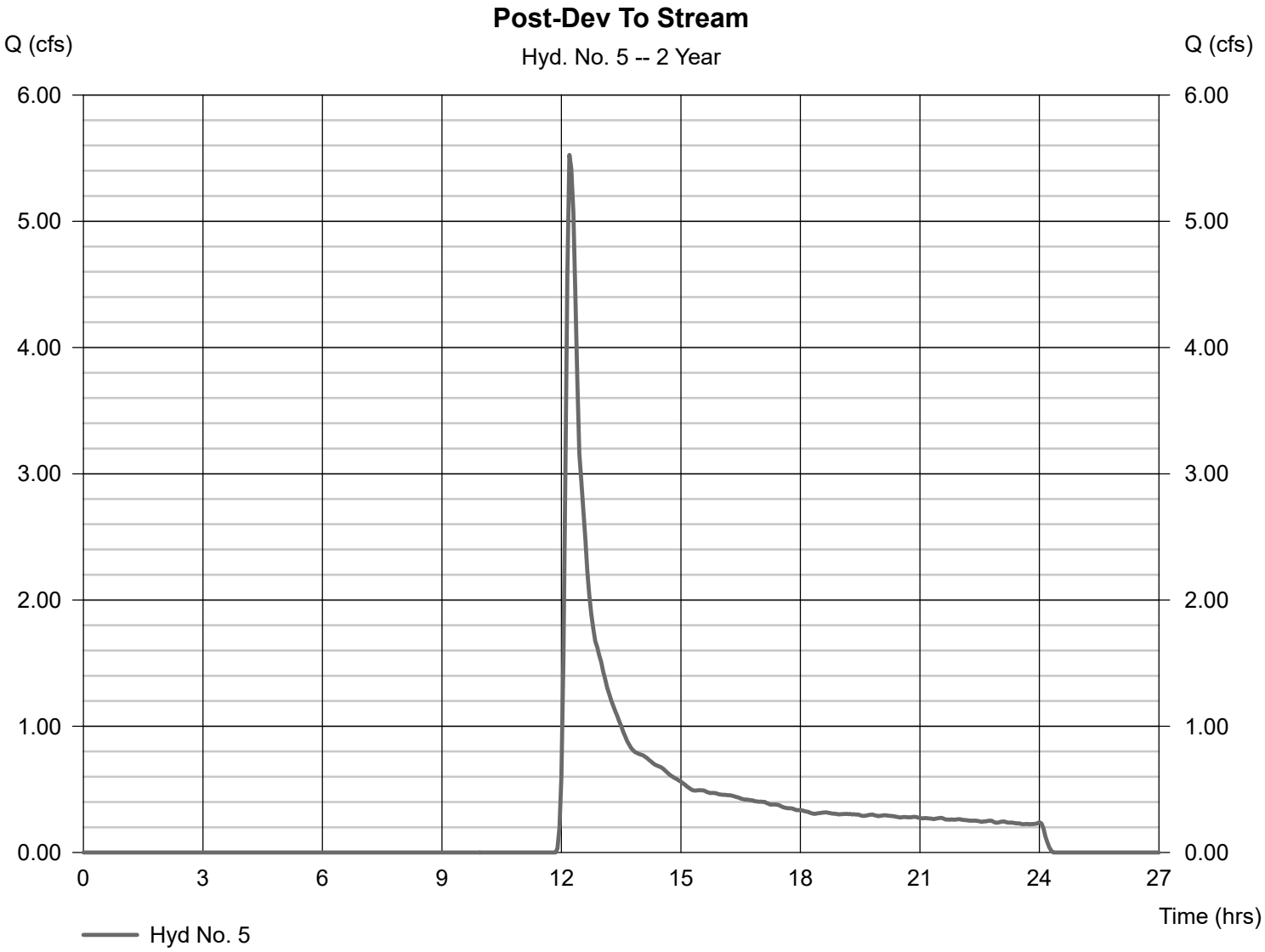
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Thursday, Sep 2, 2021

Hyd. No. 5

Post-Dev To Stream

Hydrograph type	=	SCS Runoff	Peak discharge	=	5.526 cfs
Storm frequency	=	2 yrs	Time to peak	=	12.20 hrs
Time interval	=	3 min	Hyd. volume	=	27,485 cuft
Drainage area	=	14.570 ac	Curve number	=	61
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	USER	Time of conc. (Tc)	=	11.90 min
Total precip.	=	3.38 in	Distribution	=	Custom
Storm duration	=	NOAA_C_3 min.cds	Shape factor	=	484



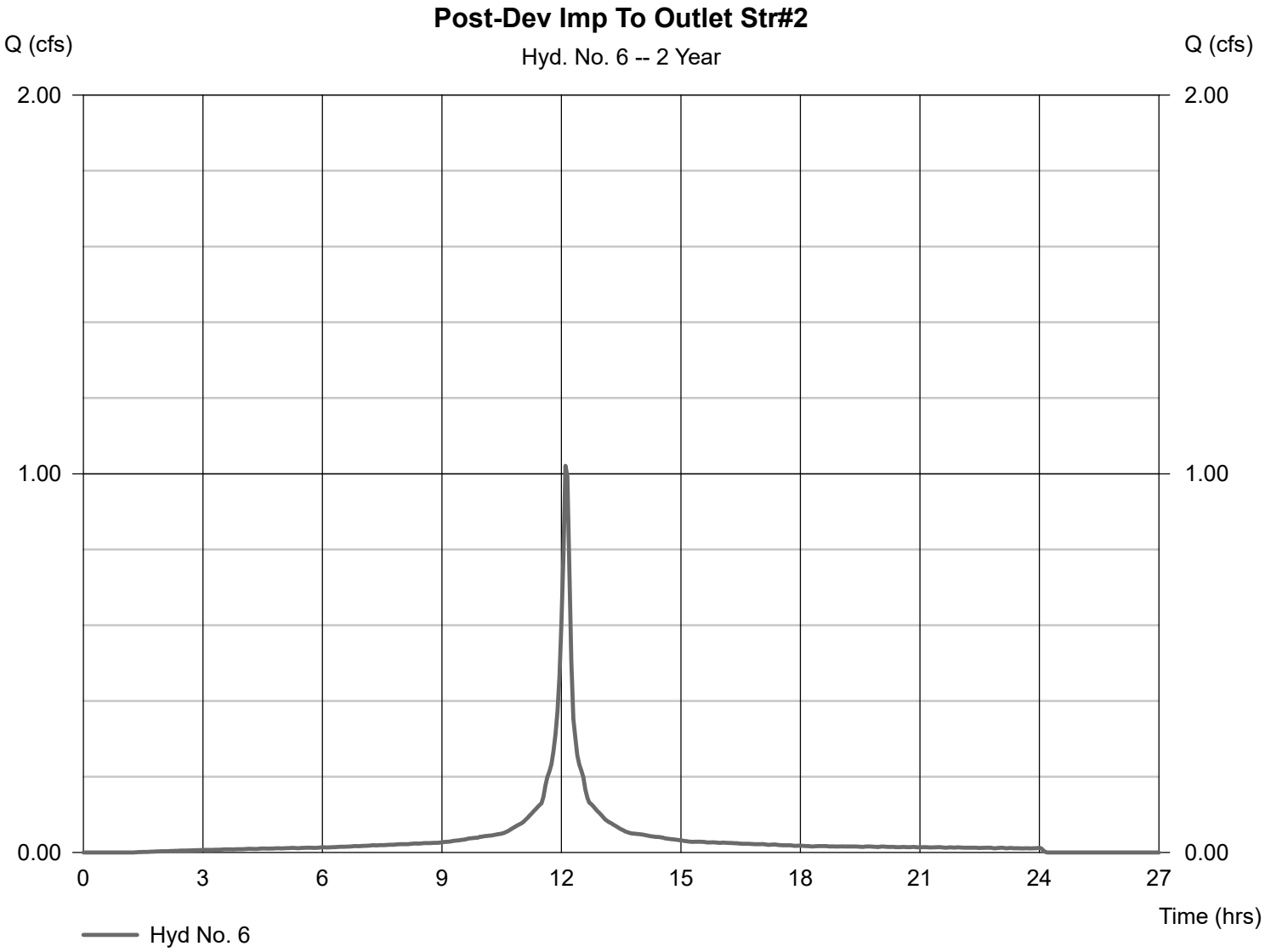
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Thursday, Sep 2, 2021

Hyd. No. 6

Post-Dev Imp To Outlet Str#2

Hydrograph type	=	SCS Runoff	Peak discharge	=	1.021 cfs
Storm frequency	=	2 yrs	Time to peak	=	12.10 hrs
Time interval	=	3 min	Hyd. volume	=	3,534 cuft
Drainage area	=	0.330 ac	Curve number	=	98
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	USER	Time of conc. (Tc)	=	6.00 min
Total precip.	=	3.38 in	Distribution	=	Custom
Storm duration	=	NOAA_C_3 min.cds	Shape factor	=	484



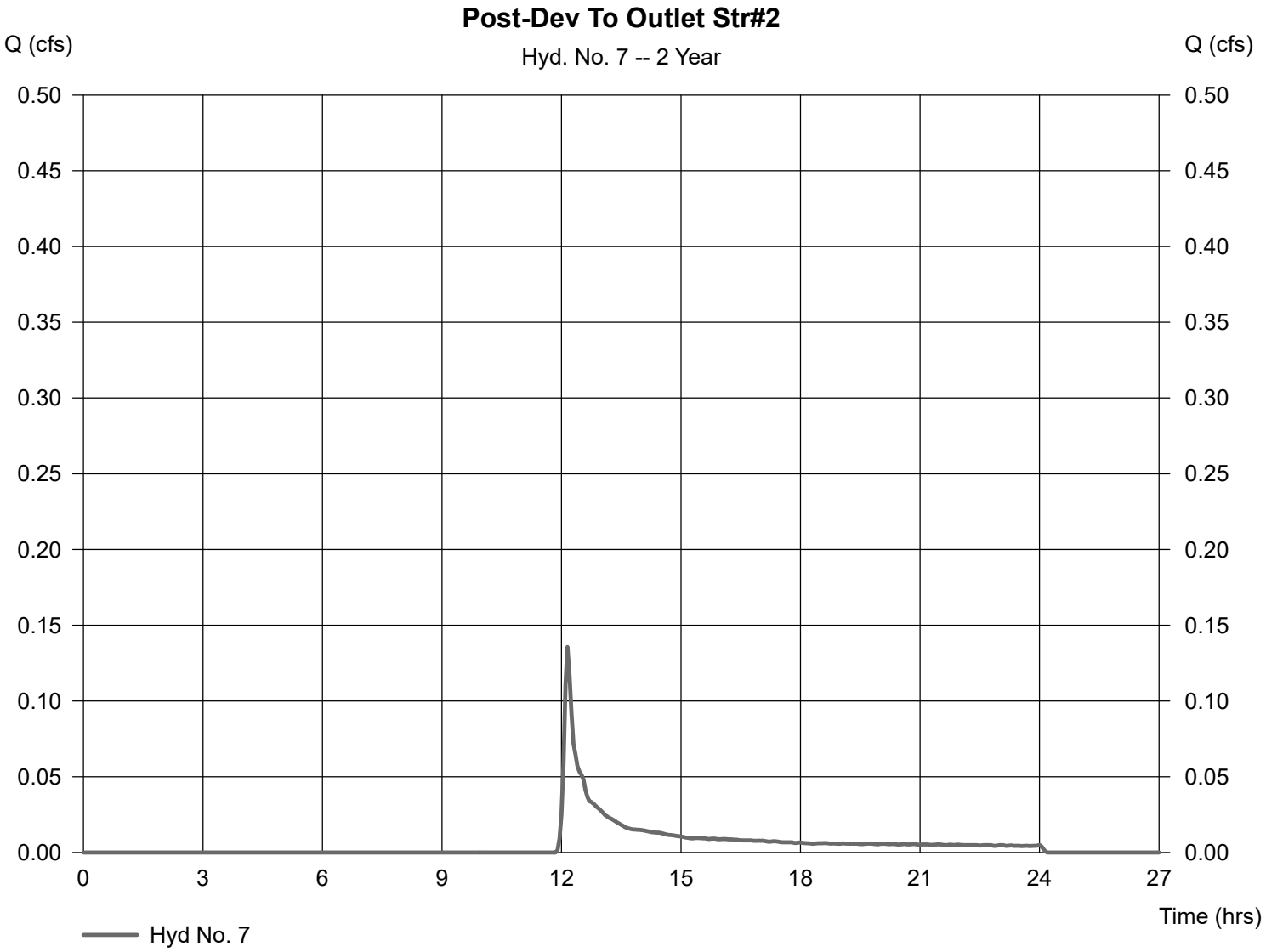
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Thursday, Sep 2, 2021

Hyd. No. 7

Post-Dev To Outlet Str#2

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.136 cfs
Storm frequency	=	2 yrs	Time to peak	=	12.15 hrs
Time interval	=	3 min	Hyd. volume	=	531 cuft
Drainage area	=	0.300 ac	Curve number	=	61
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	USER	Time of conc. (Tc)	=	9.30 min
Total precip.	=	3.38 in	Distribution	=	Custom
Storm duration	=	NOAA_C_3 min.cds	Shape factor	=	484



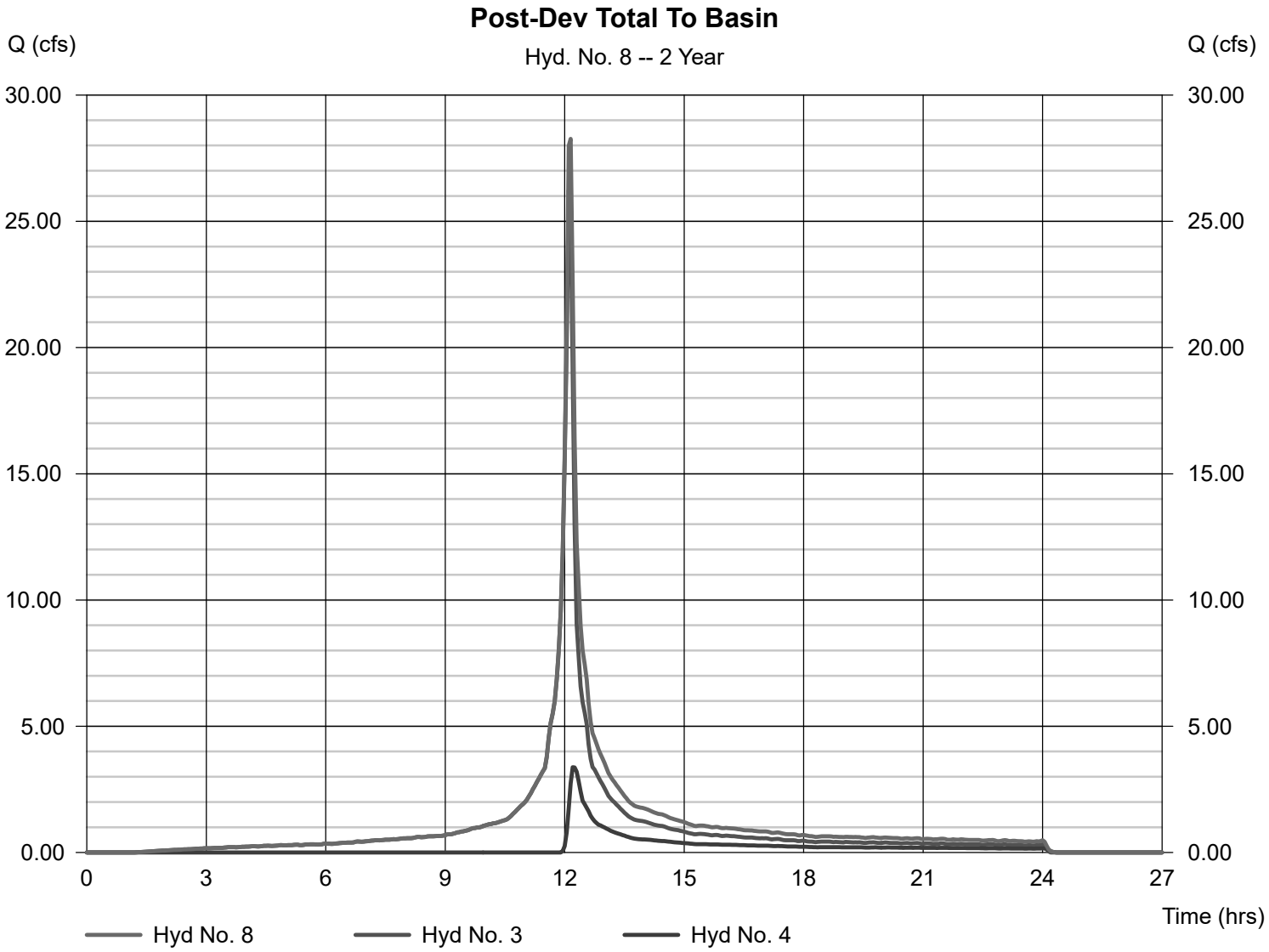
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Thursday, Sep 2, 2021

Hyd. No. 8

Post-Dev Total To Basin

Hydrograph type	= Combine	Peak discharge	= 28.26 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.15 hrs
Time interval	= 3 min	Hyd. volume	= 108,784 cuft
Inflow hyds.	= 3, 4	Contrib. drain. area	= 18.780 ac



Hydrograph Report

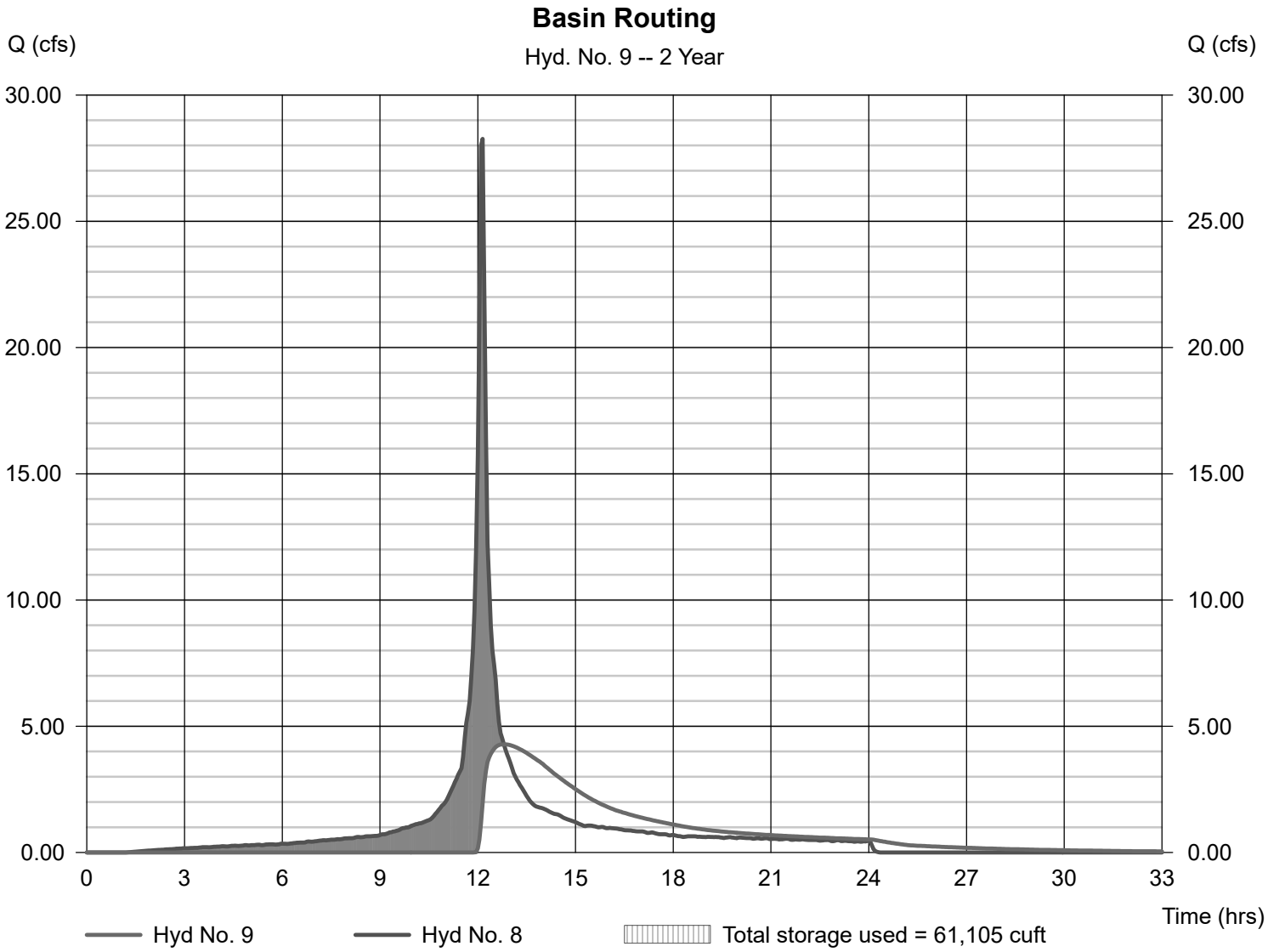
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Thursday, Sep 2, 2021

Hyd. No. 9

Basin Routing

Hydrograph type	=	Reservoir	Peak discharge	=	4.285 cfs
Storm frequency	=	2 yrs	Time to peak	=	12.80 hrs
Time interval	=	3 min	Hyd. volume	=	79,378 cuft
Inflow hyd. No.	=	8 - Post-Dev Total To Basin	Max. Elevation	=	226.82 ft
Reservoir name	=	Infiltration Basin	Max. Storage	=	61,105 cuft

Storage Indication method used.



Pond Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Thursday, Sep 2, 2021

Pond No. 1 - Infiltration Basin

Pond Data

Contours - User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 224.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	224.00	17,618	0	0
2.00	226.00	22,690	40,197	40,197
4.00	228.00	28,130	50,718	90,915
6.00	230.00	33,838	61,874	152,789
8.00	232.00	39,884	73,632	226,421

Culvert / Orifice Structures

		[A]	[B]	[C]	[PrfRsr]
Rise (in)	=	14.00	41.00	0.00	0.00
Span (in)	=	14.00	41.00	0.00	0.00
No. Barrels	=	1	1	0	0
Invert El. (ft)	=	225.55	226.90	0.00	0.00
Length (ft)	=	0.00	0.00	0.00	0.00
Slope (%)	=	0.00	0.00	0.00	n/a
N-Value	=	.013	.013	.013	n/a
Orifice Coeff.	=	0.60	0.60	0.60	0.60
Multi-Stage	=	n/a	No	No	No

Weir Structures

		[A]	[B]	[C]	[D]
Crest Len (ft)	=	50.00	0.00	0.00	0.00
Crest El. (ft)	=	229.50	0.00	0.00	0.00
Weir Coeff.	=	2.60	3.33	3.33	3.33
Weir Type	=	Broad	---	---	---
Multi-Stage	=	No	No	No	No

Exfil.(in/hr) = 0.000 (by Wet area)

TW Elev. (ft) = 0.00

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
0.00	0	224.00	0.00	0.00	---	---	0.00	---	---	---	---	---	0.000
2.00	40,197	226.00	0.87 ic	0.00	---	---	0.00	---	---	---	---	---	0.870
4.00	90,915	228.00	7.03 ic	9.13 ic	---	---	0.00	---	---	---	---	---	16.16
6.00	152,789	230.00	10.12 ic	52.42 ic	---	---	45.96	---	---	---	---	---	108.50
8.00	226,421	232.00	12.47 ic	81.29 ic	---	---	513.87	---	---	---	---	---	607.63

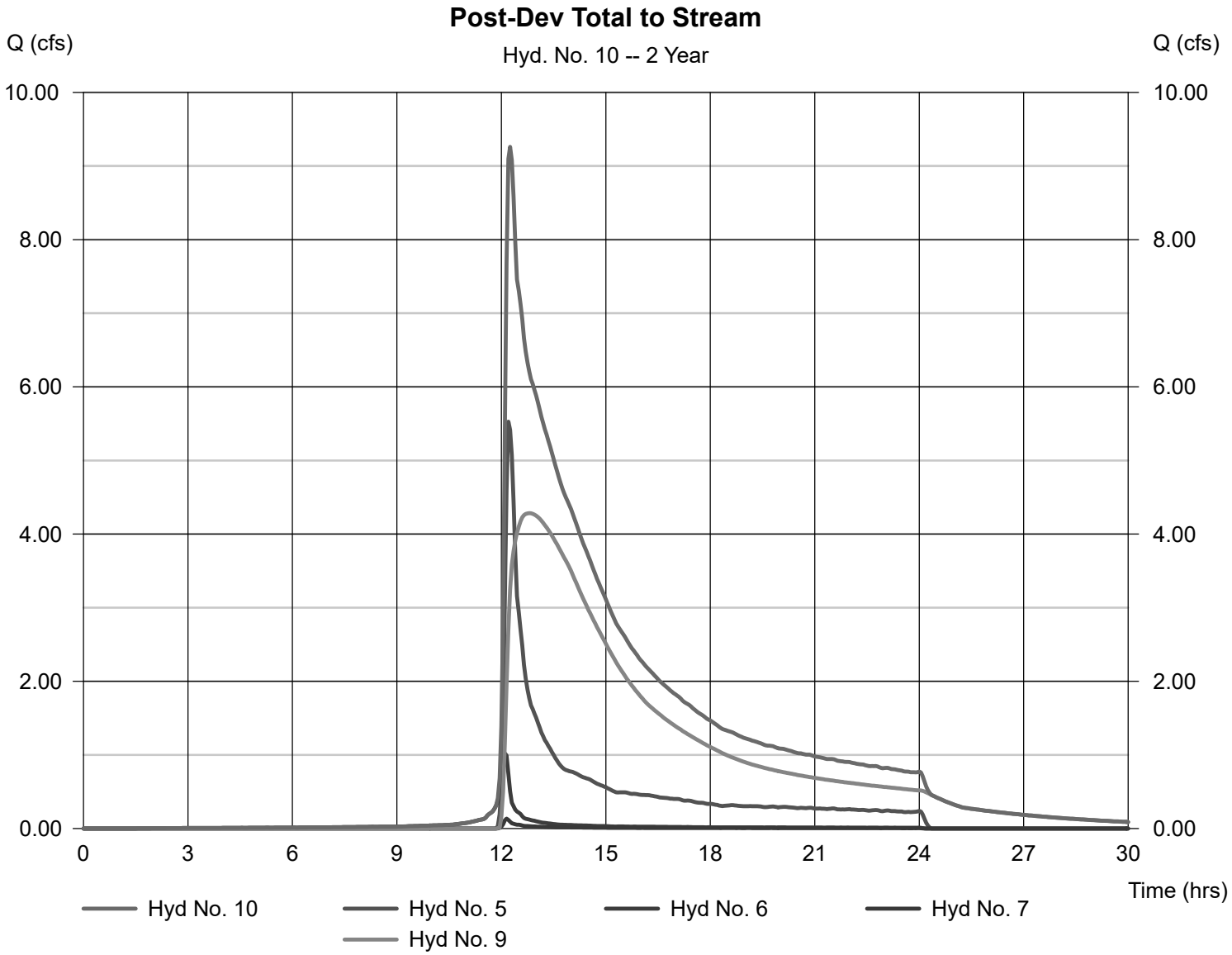
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Thursday, Sep 2, 2021

Hyd. No. 10

Post-Dev Total to Stream

Hydrograph type	= Combine	Peak discharge	= 9.260 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.25 hrs
Time interval	= 3 min	Hyd. volume	= 110,928 cuft
Inflow hyds.	= 5, 6, 7, 9	Contrib. drain. area	= 15.200 ac



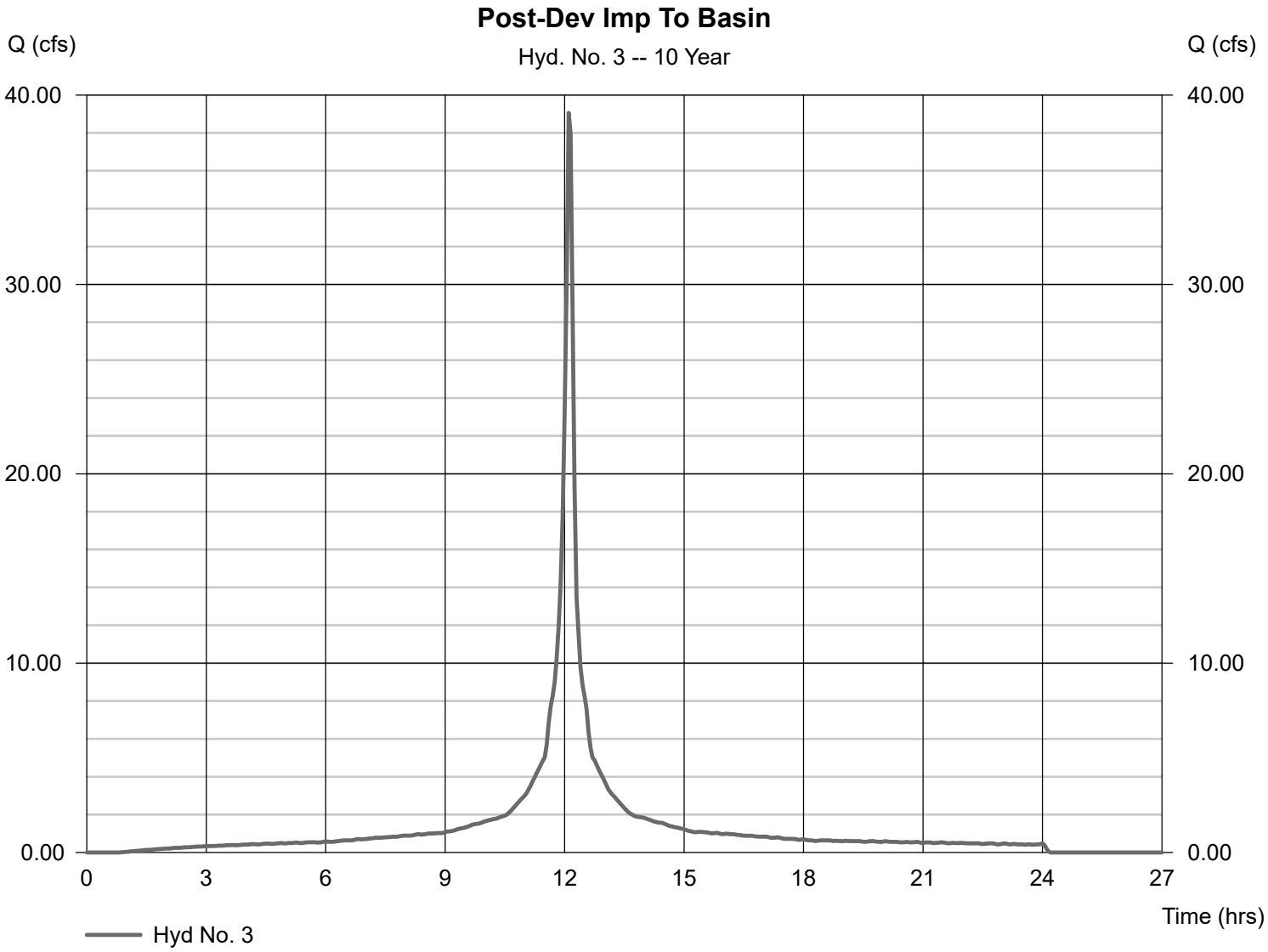
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Thursday, Sep 2, 2021

Hyd. No. 3

Post-Dev Imp To Basin

Hydrograph type	=	SCS Runoff	Peak discharge	=	39.05 cfs
Storm frequency	=	10 yrs	Time to peak	=	12.10 hrs
Time interval	=	3 min	Hyd. volume	=	137,458 cuft
Drainage area	=	8.480 ac	Curve number	=	98
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	USER	Time of conc. (Tc)	=	6.00 min
Total precip.	=	5.00 in	Distribution	=	Custom
Storm duration	=	NOAA_C_3 min.cds	Shape factor	=	484



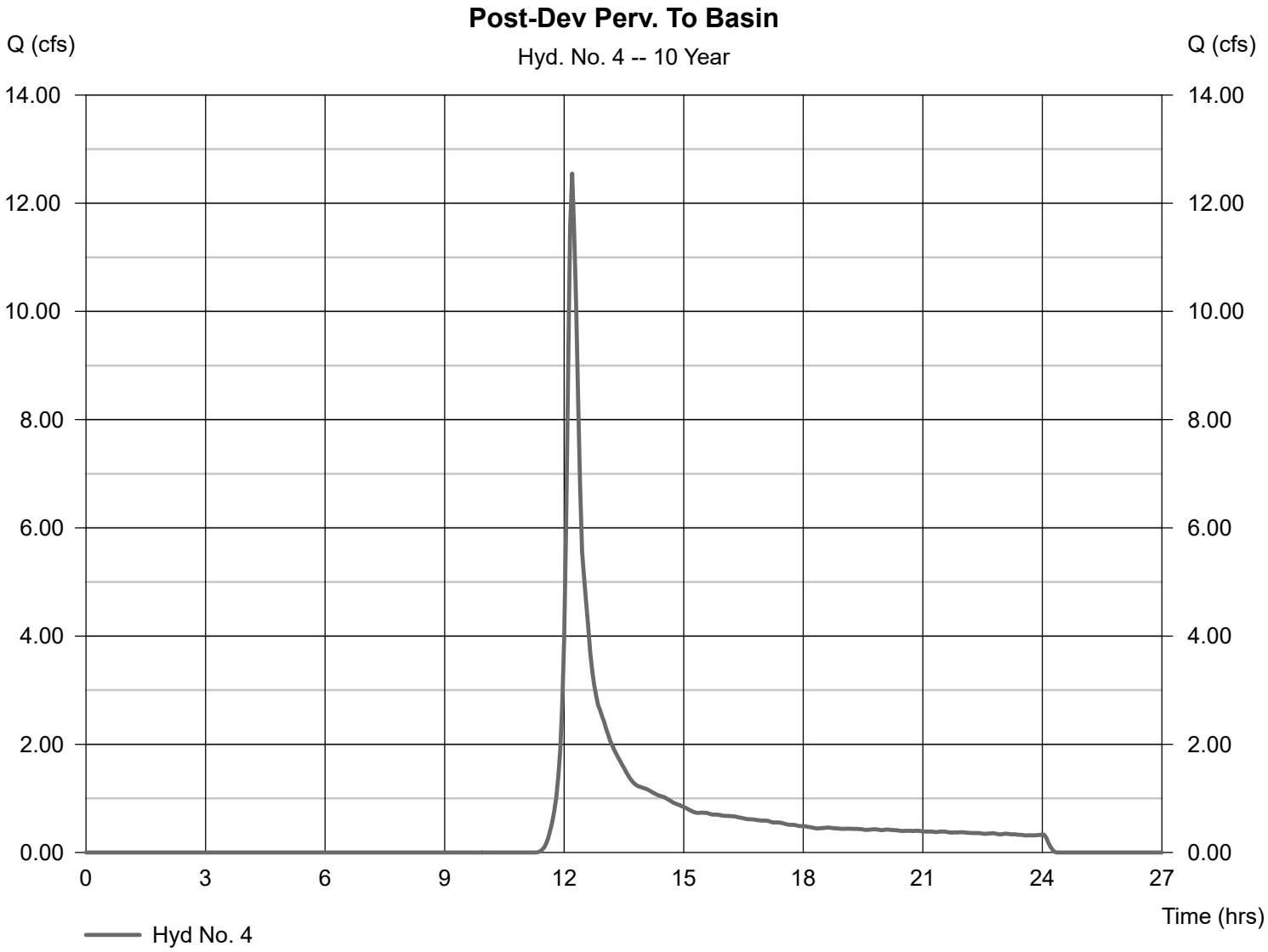
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Thursday, Sep 2, 2021

Hyd. No. 4

Post-Dev Perv. To Basin

Hydrograph type	=	SCS Runoff	Peak discharge	=	12.55 cfs
Storm frequency	=	10 yrs	Time to peak	=	12.20 hrs
Time interval	=	3 min	Hyd. volume	=	48,645 cuft
Drainage area	=	10.300 ac	Curve number	=	60
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	USER	Time of conc. (Tc)	=	12.80 min
Total precip.	=	5.00 in	Distribution	=	Custom
Storm duration	=	NOAA_C_3 min.cds	Shape factor	=	484



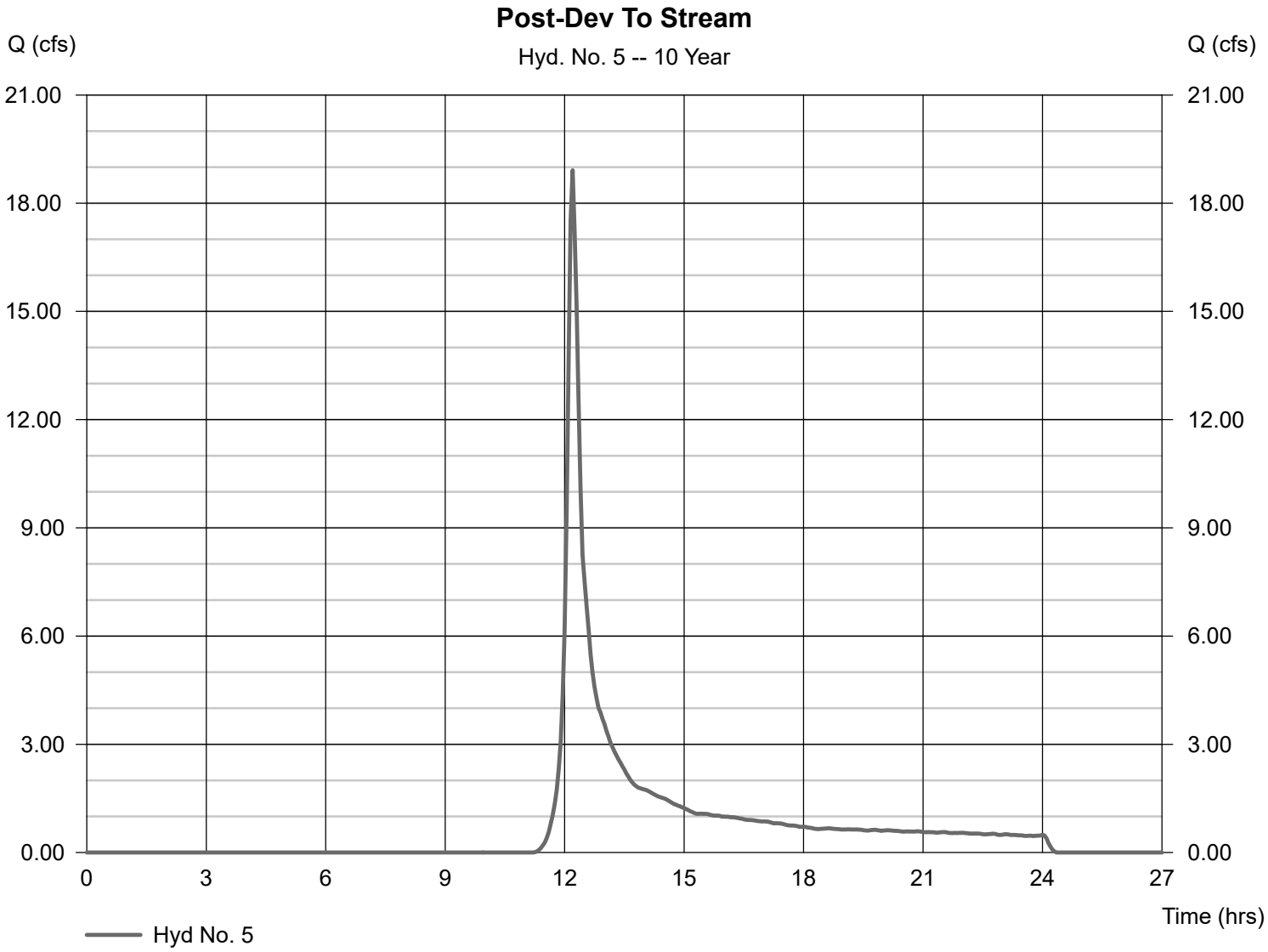
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Thursday, Sep 2, 2021

Hyd. No. 5

Post-Dev To Stream

Hydrograph type	=	SCS Runoff	Peak discharge	=	18.91 cfs
Storm frequency	=	10 yrs	Time to peak	=	12.20 hrs
Time interval	=	3 min	Hyd. volume	=	72,410 cuft
Drainage area	=	14.570 ac	Curve number	=	61
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	USER	Time of conc. (Tc)	=	11.90 min
Total precip.	=	5.00 in	Distribution	=	Custom
Storm duration	=	NOAA_C_3 min.cds	Shape factor	=	484



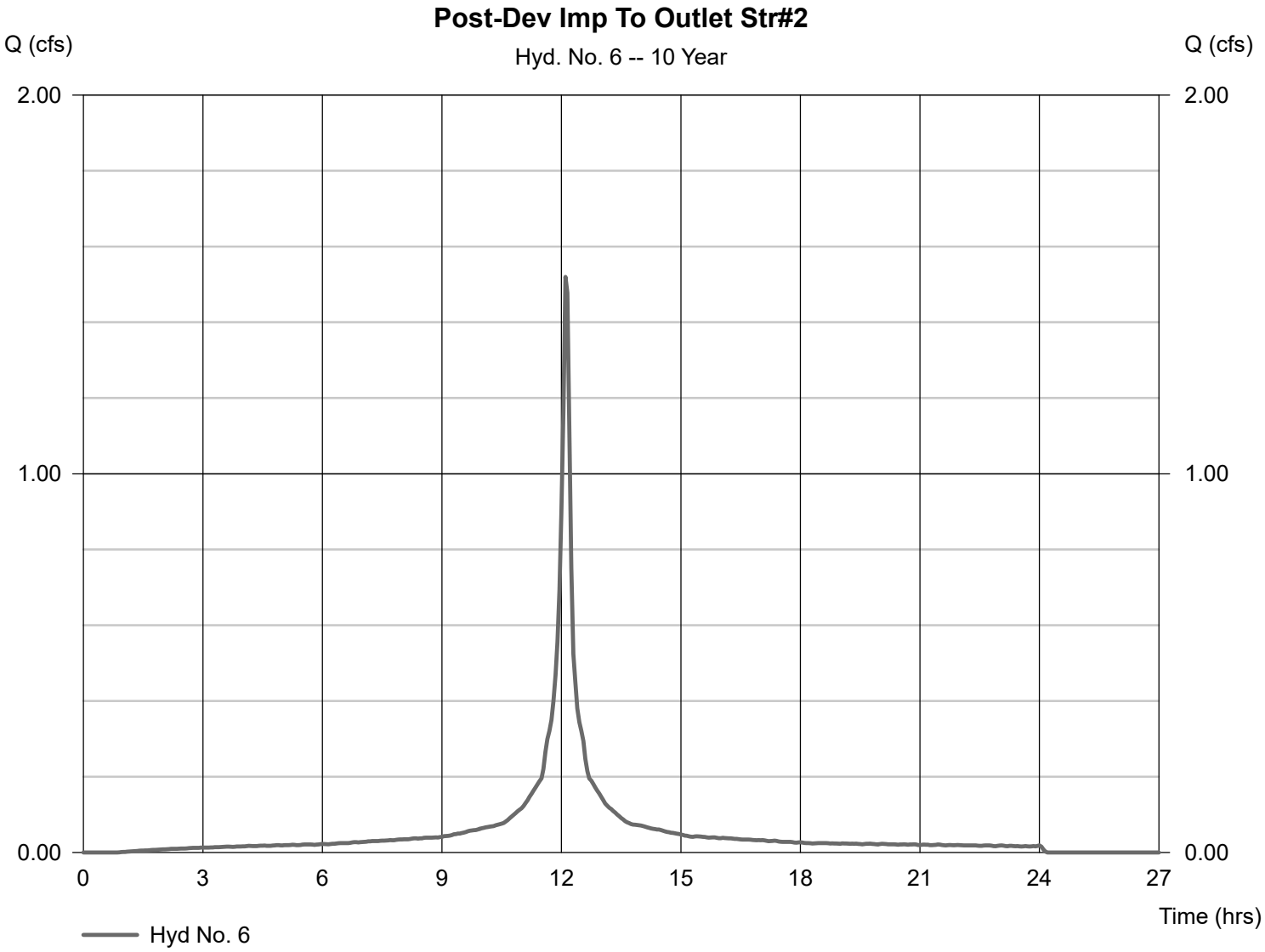
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Thursday, Sep 2, 2021

Hyd. No. 6

Post-Dev Imp To Outlet Str#2

Hydrograph type	=	SCS Runoff	Peak discharge	=	1.520 cfs
Storm frequency	=	10 yrs	Time to peak	=	12.10 hrs
Time interval	=	3 min	Hyd. volume	=	5,349 cuft
Drainage area	=	0.330 ac	Curve number	=	98
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	USER	Time of conc. (Tc)	=	6.00 min
Total precip.	=	5.00 in	Distribution	=	Custom
Storm duration	=	NOAA_C_3 min.cds	Shape factor	=	484



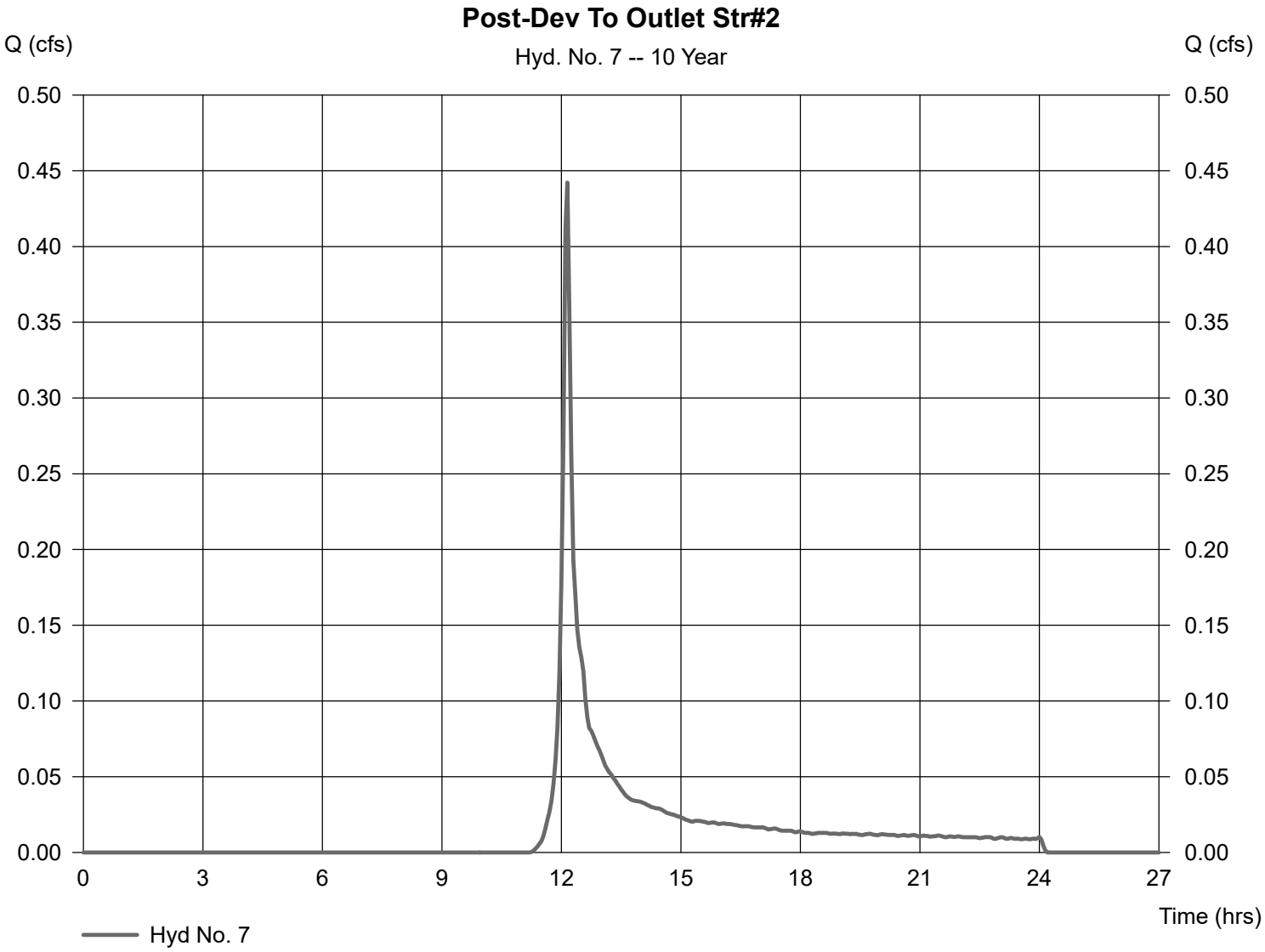
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Thursday, Sep 2, 2021

Hyd. No. 7

Post-Dev To Outlet Str#2

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.442 cfs
Storm frequency	=	10 yrs	Time to peak	=	12.15 hrs
Time interval	=	3 min	Hyd. volume	=	1,398 cuft
Drainage area	=	0.300 ac	Curve number	=	61
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	USER	Time of conc. (Tc)	=	9.30 min
Total precip.	=	5.00 in	Distribution	=	Custom
Storm duration	=	NOAA_C_3 min.cds	Shape factor	=	484



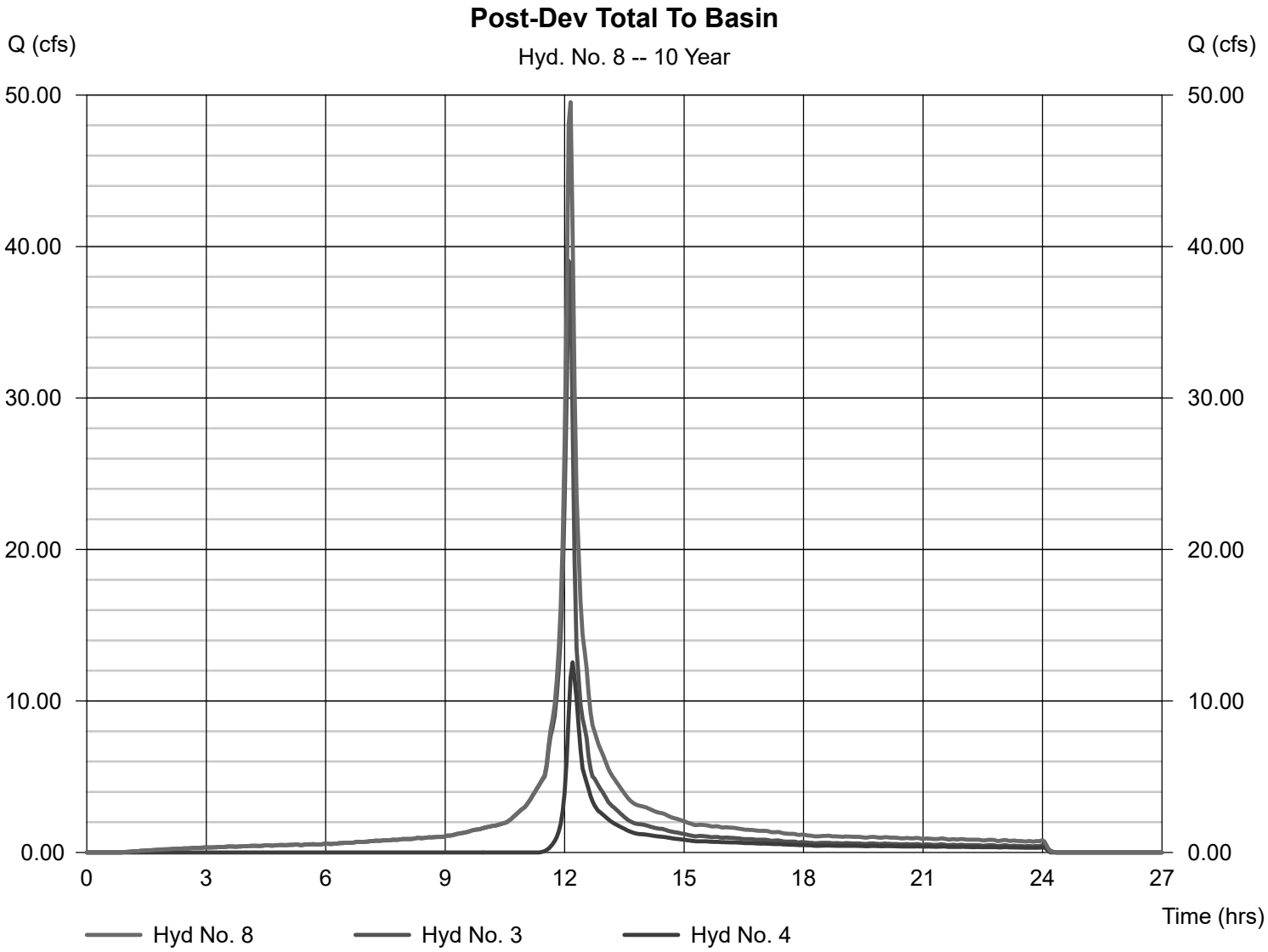
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Thursday, Sep 2, 2021

Hyd. No. 8

Post-Dev Total To Basin

Hydrograph type	= Combine	Peak discharge	= 49.53 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.15 hrs
Time interval	= 3 min	Hyd. volume	= 186,103 cuft
Inflow hyds.	= 3, 4	Contrib. drain. area	= 18.780 ac



Hydrograph Report

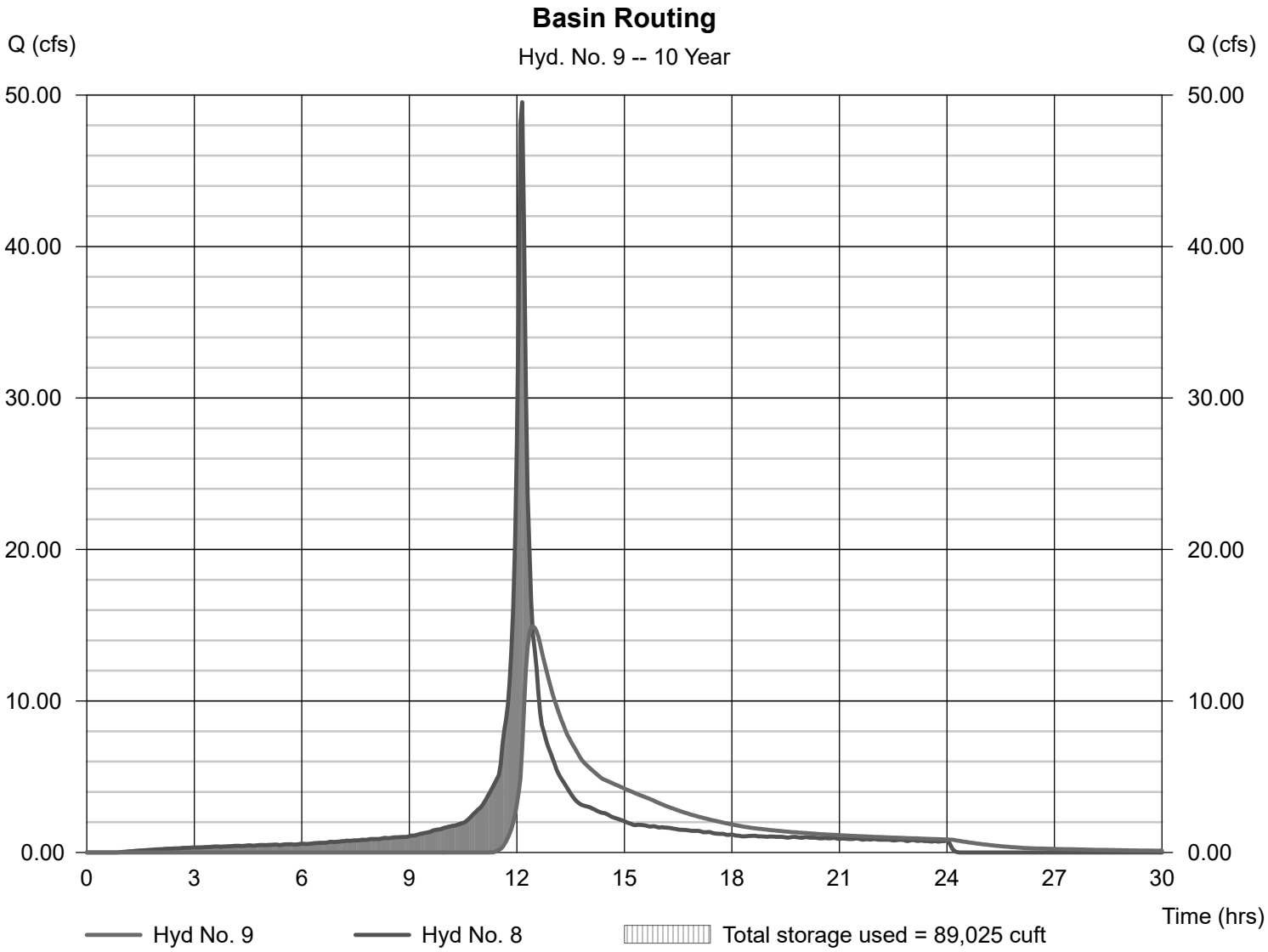
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Thursday, Sep 2, 2021

Hyd. No. 9

Basin Routing

Hydrograph type	=	Reservoir	Peak discharge	=	14.94 cfs
Storm frequency	=	10 yrs	Time to peak	=	12.45 hrs
Time interval	=	3 min	Hyd. volume	=	156,684 cuft
Inflow hyd. No.	=	8 - Post-Dev Total To Basin	Max. Elevation	=	227.93 ft
Reservoir name	=	Infiltration Basin	Max. Storage	=	89,025 cuft

Storage Indication method used.



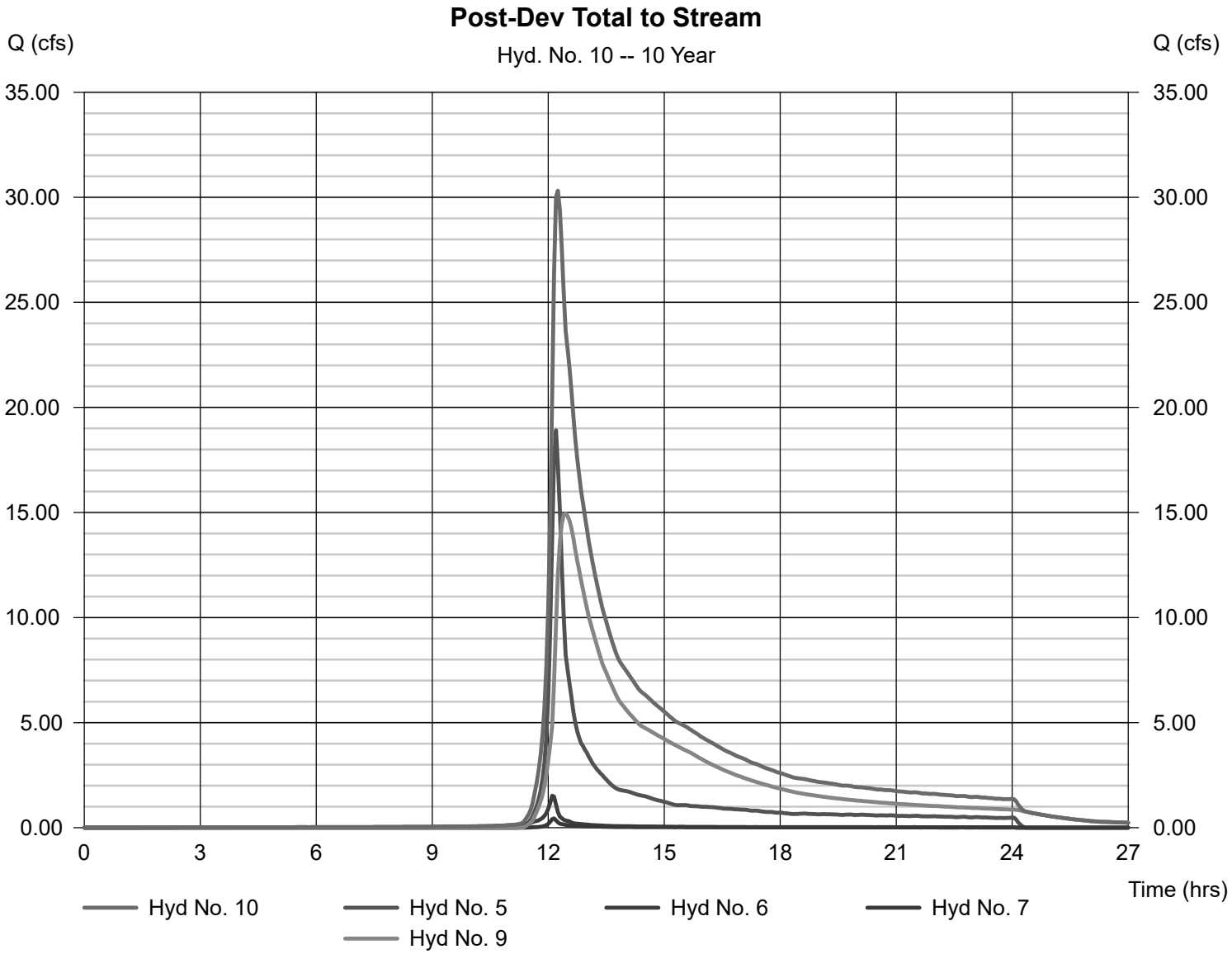
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Thursday, Sep 2, 2021

Hyd. No. 10

Post-Dev Total to Stream

Hydrograph type	= Combine	Peak discharge	= 30.31 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.25 hrs
Time interval	= 3 min	Hyd. volume	= 235,841 cuft
Inflow hyds.	= 5, 6, 7, 9	Contrib. drain. area	= 15.200 ac



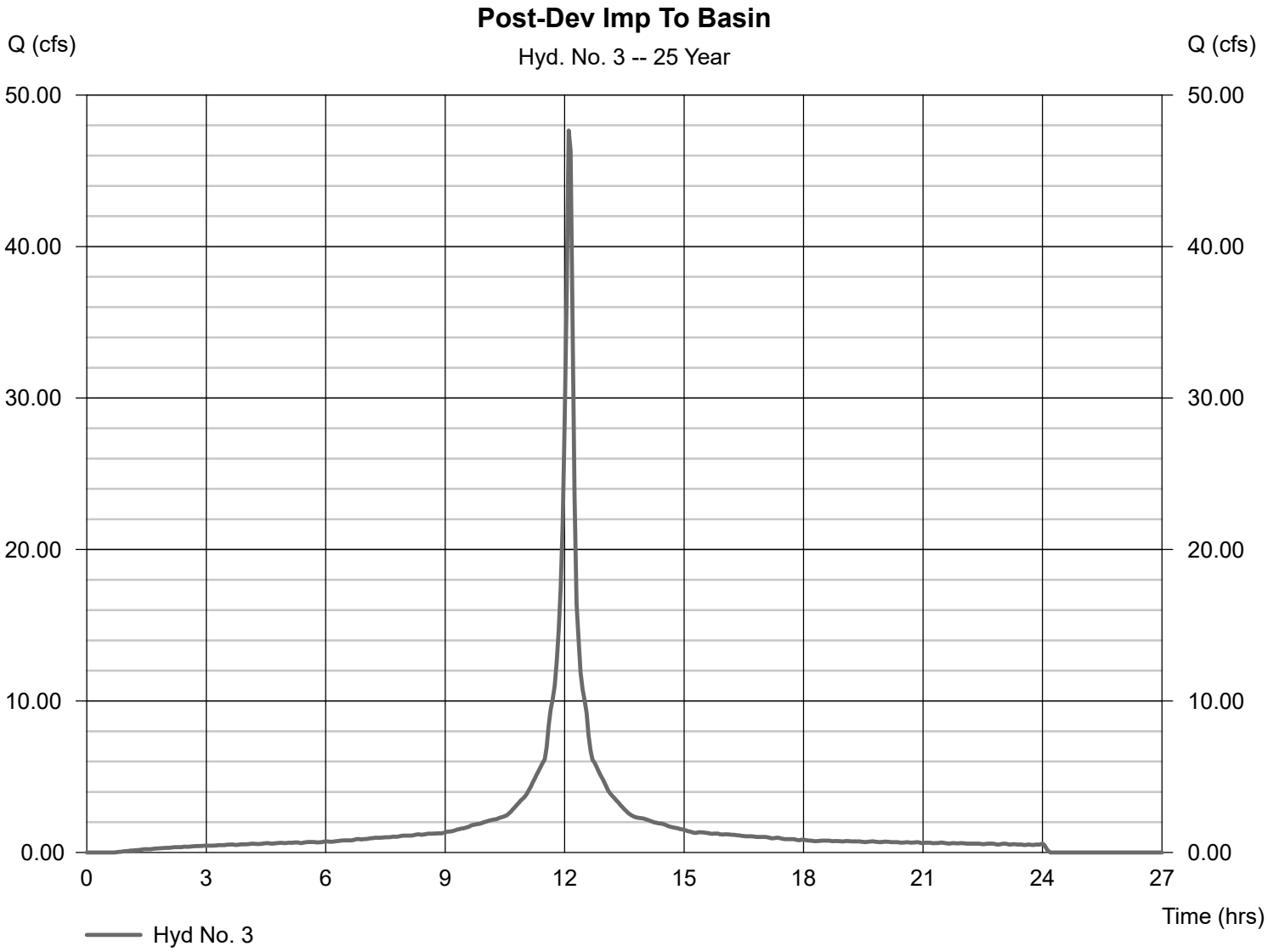
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Thursday, Sep 2, 2021

Hyd. No. 3

Post-Dev Imp To Basin

Hydrograph type	=	SCS Runoff	Peak discharge	=	47.65 cfs
Storm frequency	=	25 yrs	Time to peak	=	12.10 hrs
Time interval	=	3 min	Hyd. volume	=	168,873 cuft
Drainage area	=	8.480 ac	Curve number	=	98
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	USER	Time of conc. (Tc)	=	6.00 min
Total precip.	=	6.09 in	Distribution	=	Custom
Storm duration	=	NOAA_C_3 min.cds	Shape factor	=	484



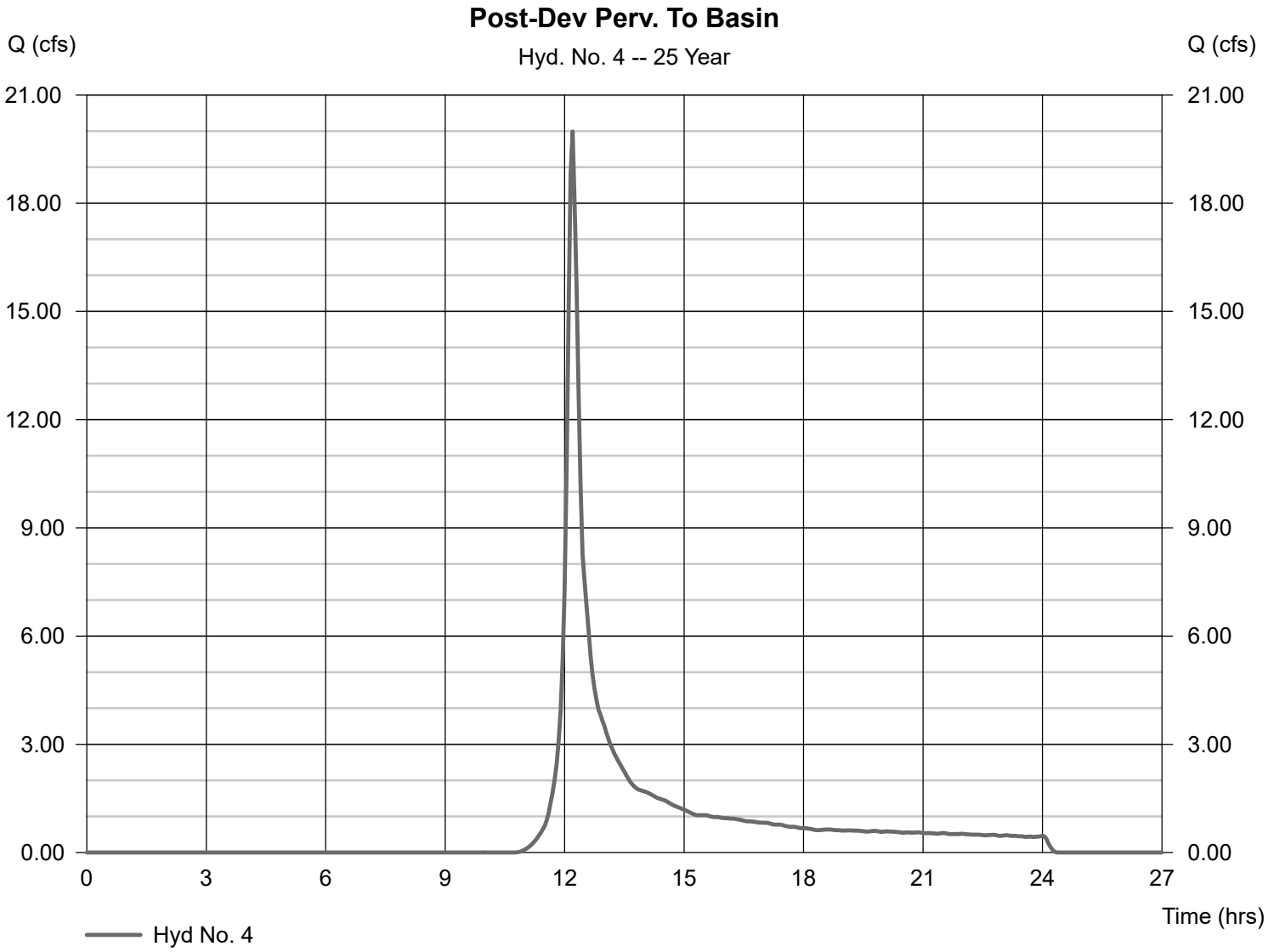
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Thursday, Sep 2, 2021

Hyd. No. 4

Post-Dev Perv. To Basin

Hydrograph type	=	SCS Runoff	Peak discharge	=	19.99 cfs
Storm frequency	=	25 yrs	Time to peak	=	12.20 hrs
Time interval	=	3 min	Hyd. volume	=	74,055 cuft
Drainage area	=	10.300 ac	Curve number	=	60
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	USER	Time of conc. (Tc)	=	12.80 min
Total precip.	=	6.09 in	Distribution	=	Custom
Storm duration	=	NOAA_C_3 min.cds	Shape factor	=	484



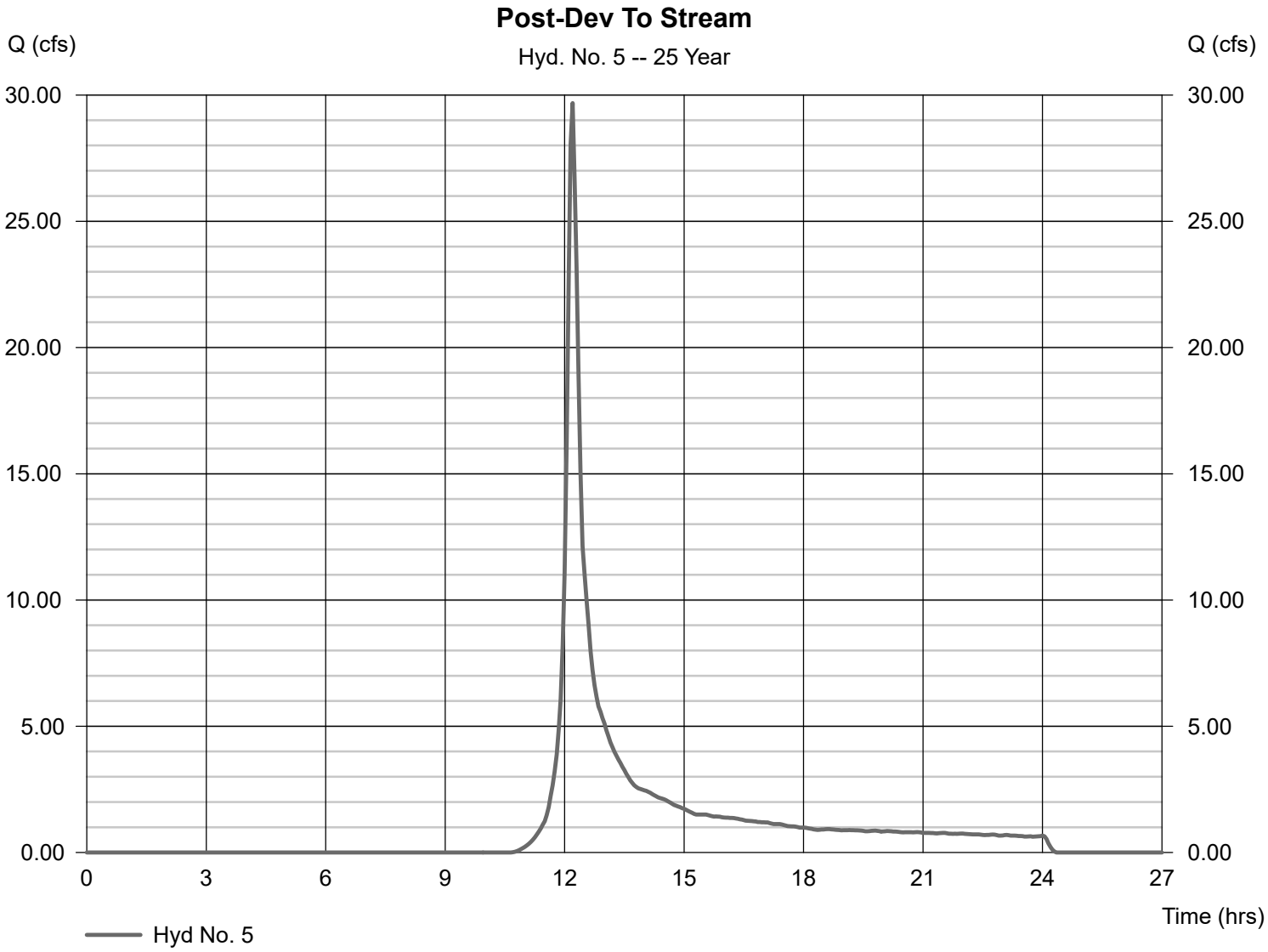
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Thursday, Sep 2, 2021

Hyd. No. 5

Post-Dev To Stream

Hydrograph type	=	SCS Runoff	Peak discharge	=	29.68 cfs
Storm frequency	=	25 yrs	Time to peak	=	12.20 hrs
Time interval	=	3 min	Hyd. volume	=	109,267 cuft
Drainage area	=	14.570 ac	Curve number	=	61
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	USER	Time of conc. (Tc)	=	11.90 min
Total precip.	=	6.09 in	Distribution	=	Custom
Storm duration	=	NOAA_C_3 min.cds	Shape factor	=	484



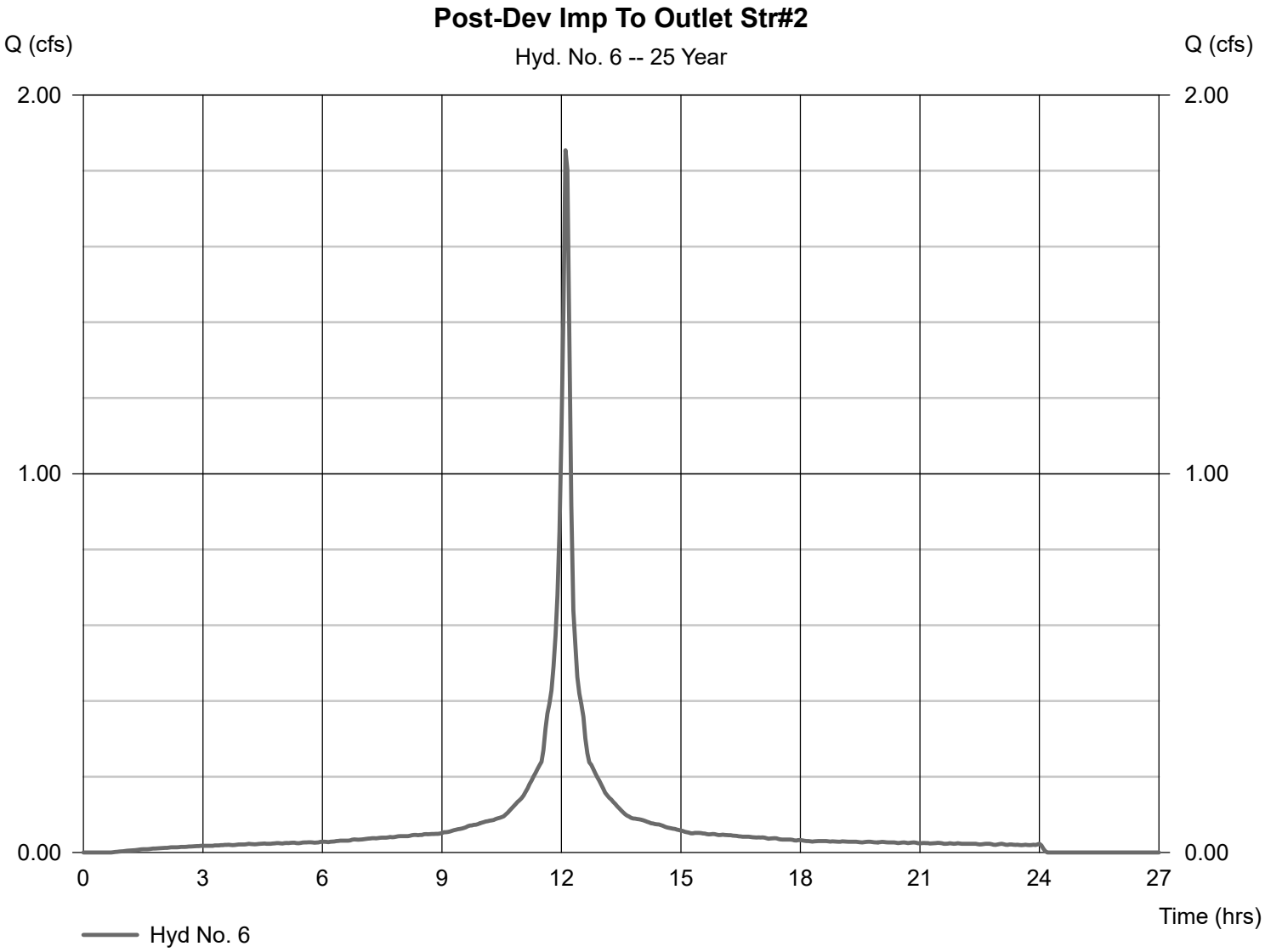
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Thursday, Sep 2, 2021

Hyd. No. 6

Post-Dev Imp To Outlet Str#2

Hydrograph type	=	SCS Runoff	Peak discharge	=	1.854 cfs
Storm frequency	=	25 yrs	Time to peak	=	12.10 hrs
Time interval	=	3 min	Hyd. volume	=	6,572 cuft
Drainage area	=	0.330 ac	Curve number	=	98
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	USER	Time of conc. (Tc)	=	6.00 min
Total precip.	=	6.09 in	Distribution	=	Custom
Storm duration	=	NOAA_C_3 min.cds	Shape factor	=	484



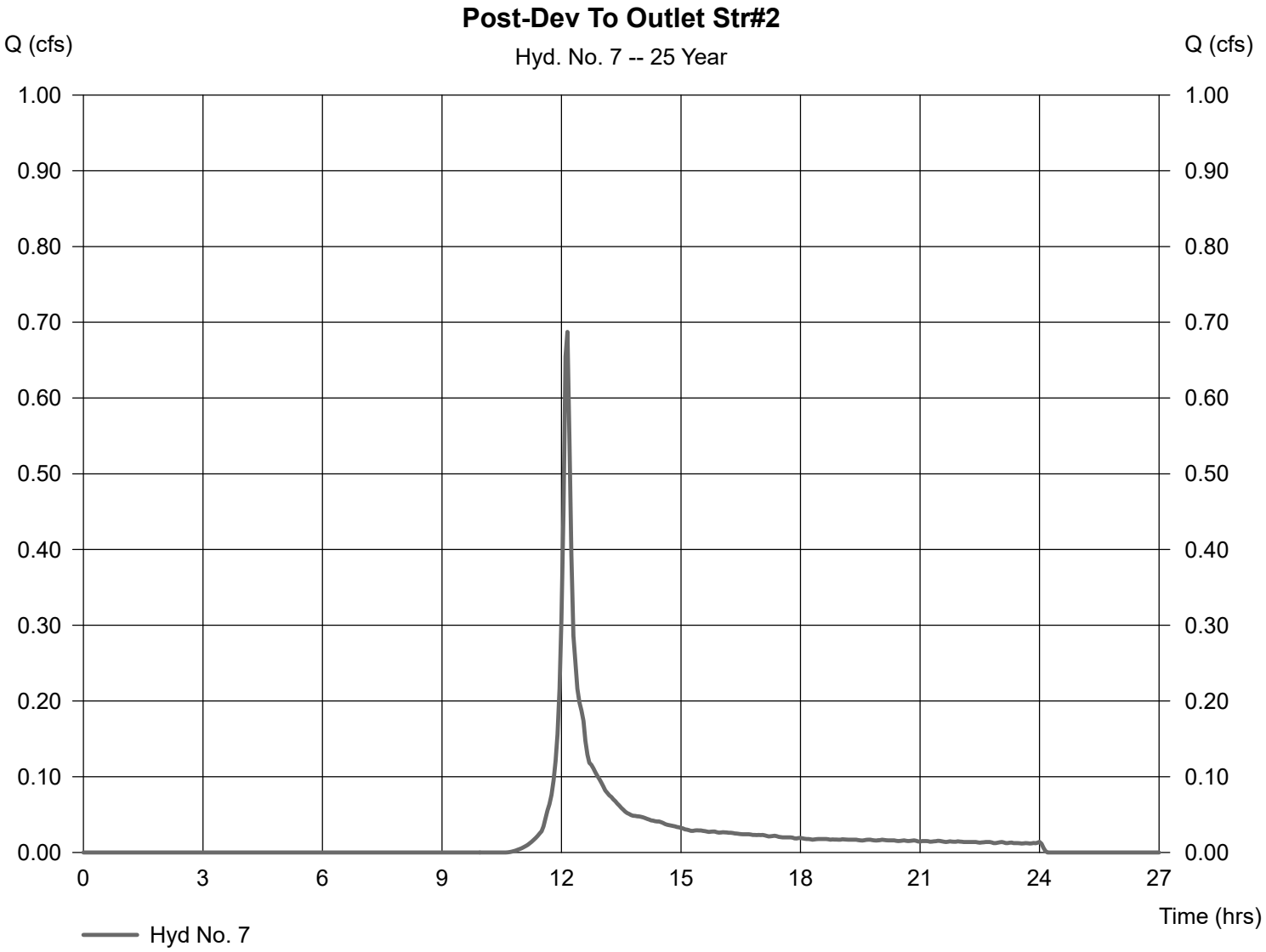
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Thursday, Sep 2, 2021

Hyd. No. 7

Post-Dev To Outlet Str#2

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.687 cfs
Storm frequency	=	25 yrs	Time to peak	=	12.15 hrs
Time interval	=	3 min	Hyd. volume	=	2,109 cuft
Drainage area	=	0.300 ac	Curve number	=	61
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	USER	Time of conc. (Tc)	=	9.30 min
Total precip.	=	6.09 in	Distribution	=	Custom
Storm duration	=	NOAA_C_3 min.cds	Shape factor	=	484



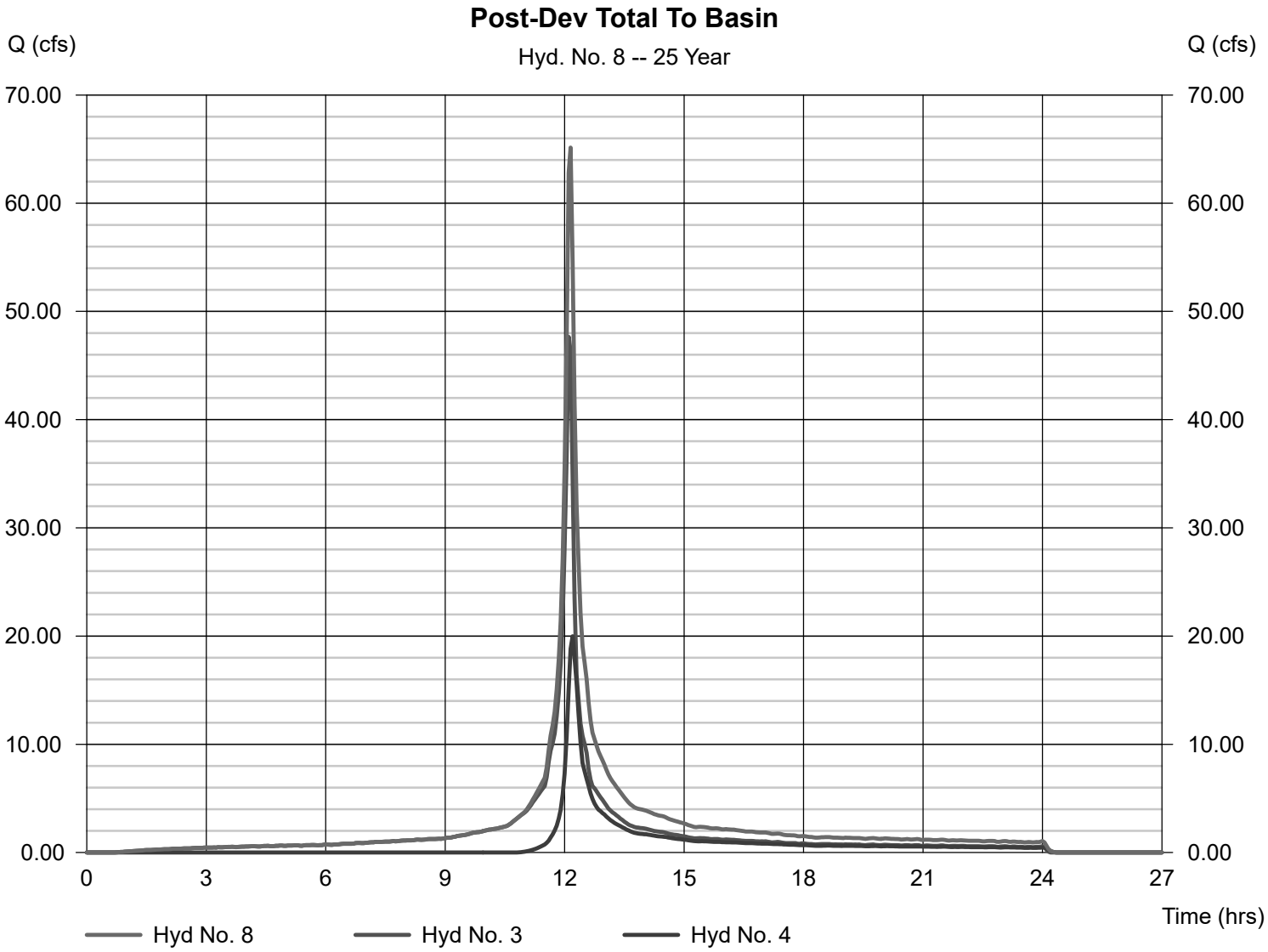
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Thursday, Sep 2, 2021

Hyd. No. 8

Post-Dev Total To Basin

Hydrograph type	= Combine	Peak discharge	= 65.14 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.15 hrs
Time interval	= 3 min	Hyd. volume	= 242,928 cuft
Inflow hyds.	= 3, 4	Contrib. drain. area	= 18.780 ac



Hydrograph Report

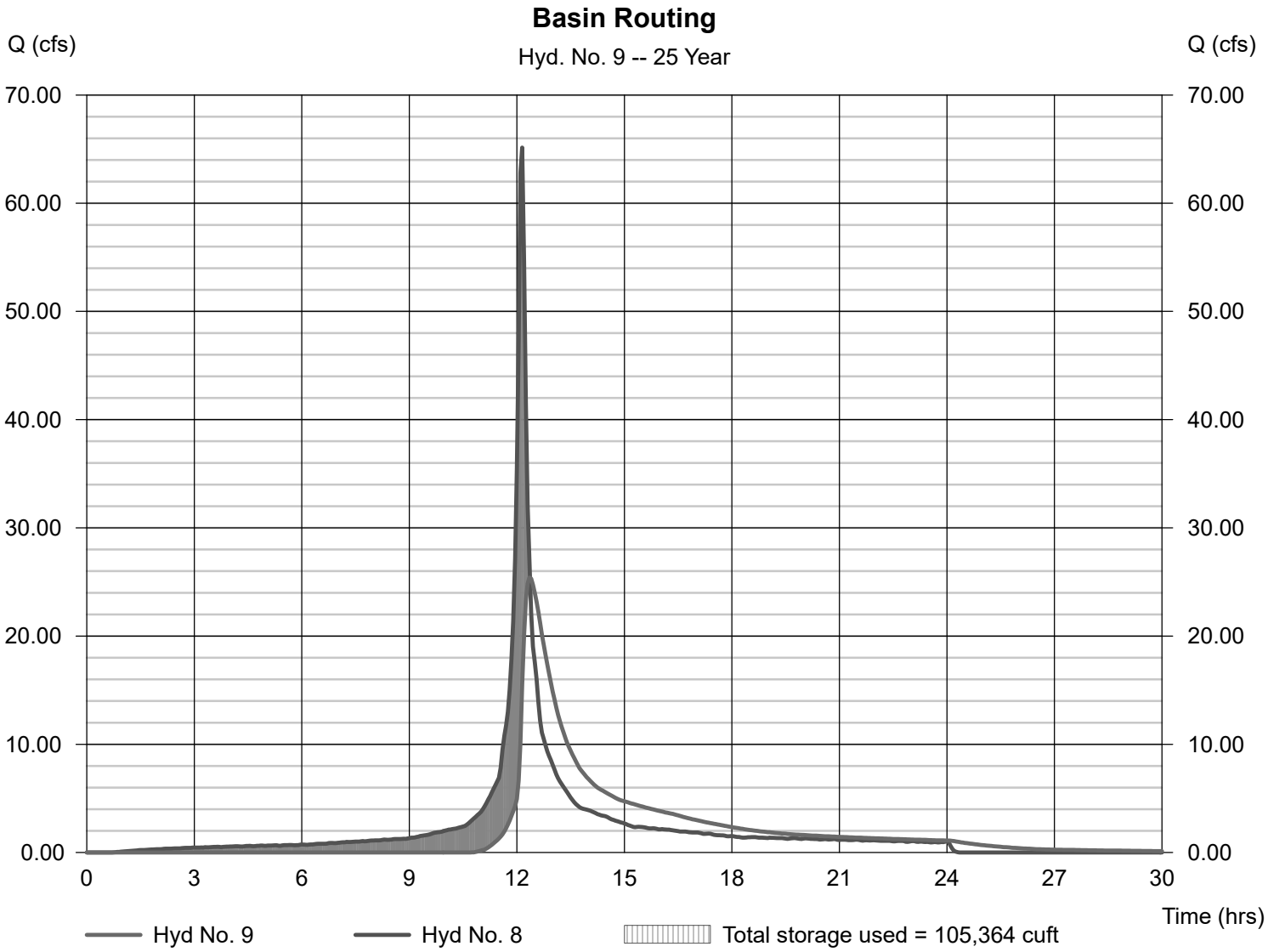
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Thursday, Sep 2, 2021

Hyd. No. 9

Basin Routing

Hydrograph type	=	Reservoir	Peak discharge	=	25.40 cfs
Storm frequency	=	25 yrs	Time to peak	=	12.35 hrs
Time interval	=	3 min	Hyd. volume	=	213,503 cuft
Inflow hyd. No.	=	8 - Post-Dev Total To Basin	Max. Elevation	=	228.47 ft
Reservoir name	=	Infiltration Basin	Max. Storage	=	105,364 cuft

Storage Indication method used.



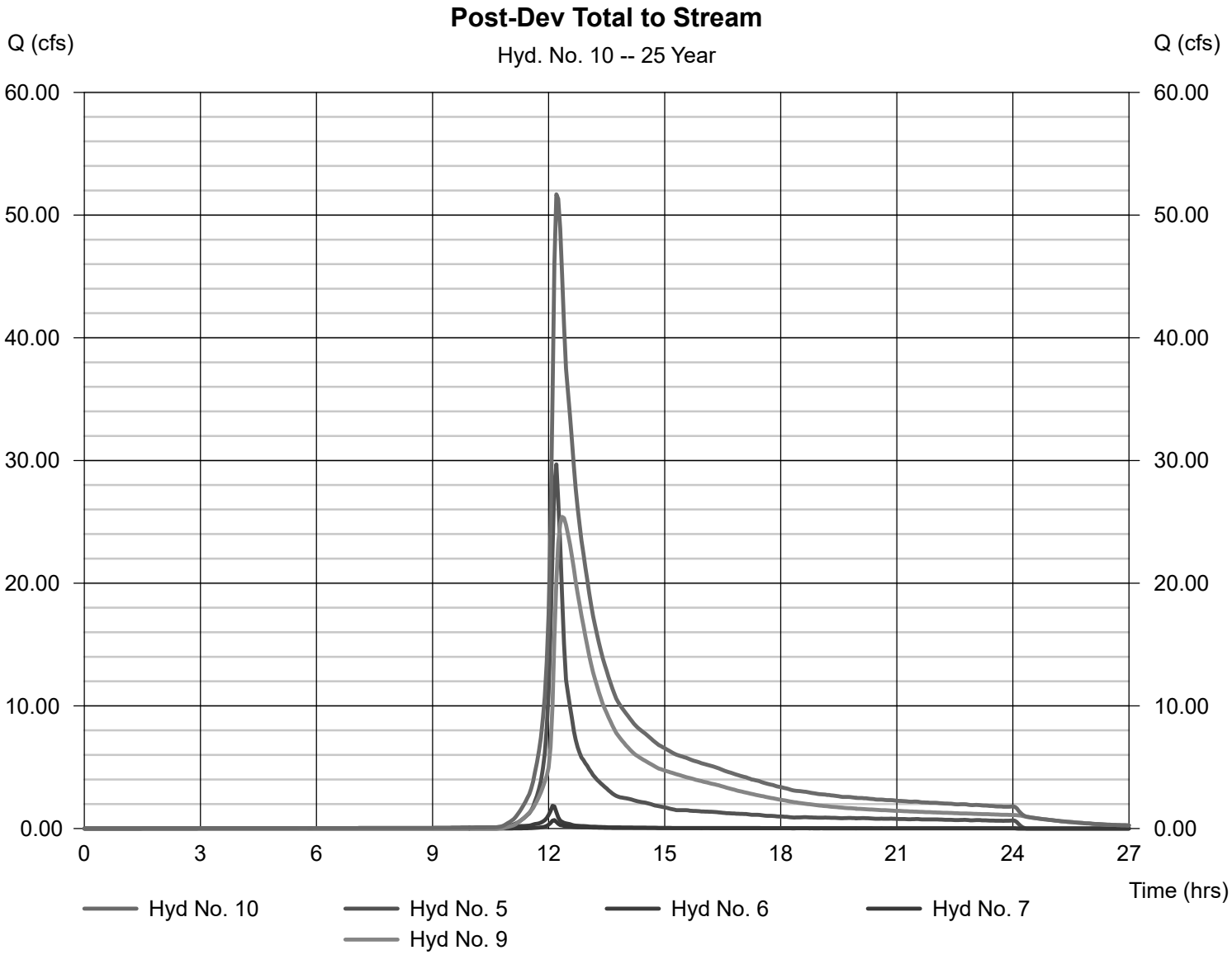
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Thursday, Sep 2, 2021

Hyd. No. 10

Post-Dev Total to Stream

Hydrograph type	= Combine	Peak discharge	= 51.68 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.20 hrs
Time interval	= 3 min	Hyd. volume	= 331,451 cuft
Inflow hyds.	= 5, 6, 7, 9	Contrib. drain. area	= 15.200 ac



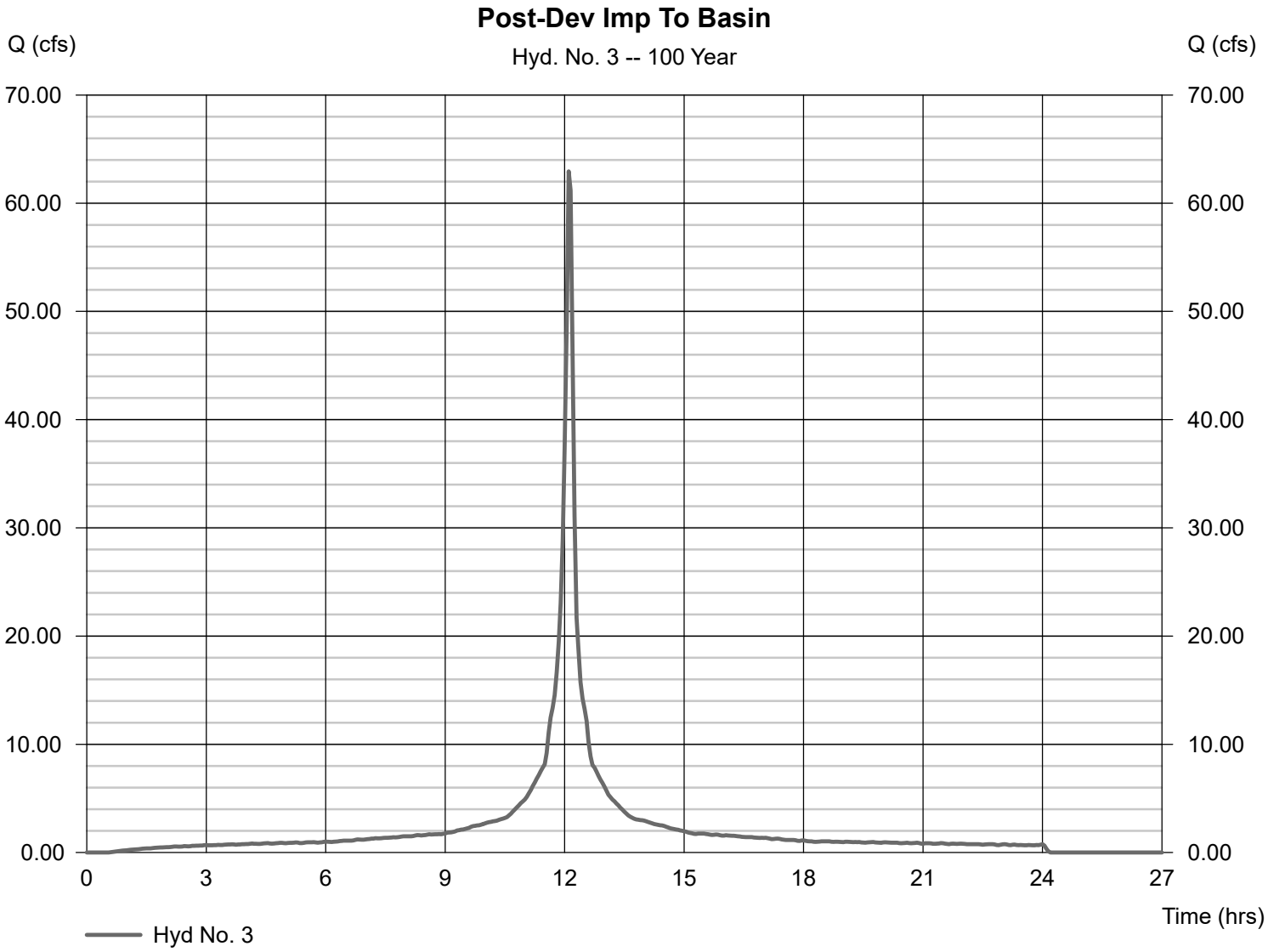
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Thursday, Sep 2, 2021

Hyd. No. 3

Post-Dev Imp To Basin

Hydrograph type	=	SCS Runoff	Peak discharge	=	62.94 cfs
Storm frequency	=	100 yrs	Time to peak	=	12.10 hrs
Time interval	=	3 min	Hyd. volume	=	224,813 cuft
Drainage area	=	8.480 ac	Curve number	=	98
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	USER	Time of conc. (Tc)	=	6.00 min
Total precip.	=	8.03 in	Distribution	=	Custom
Storm duration	=	NOAA_C_3 min.cds	Shape factor	=	484



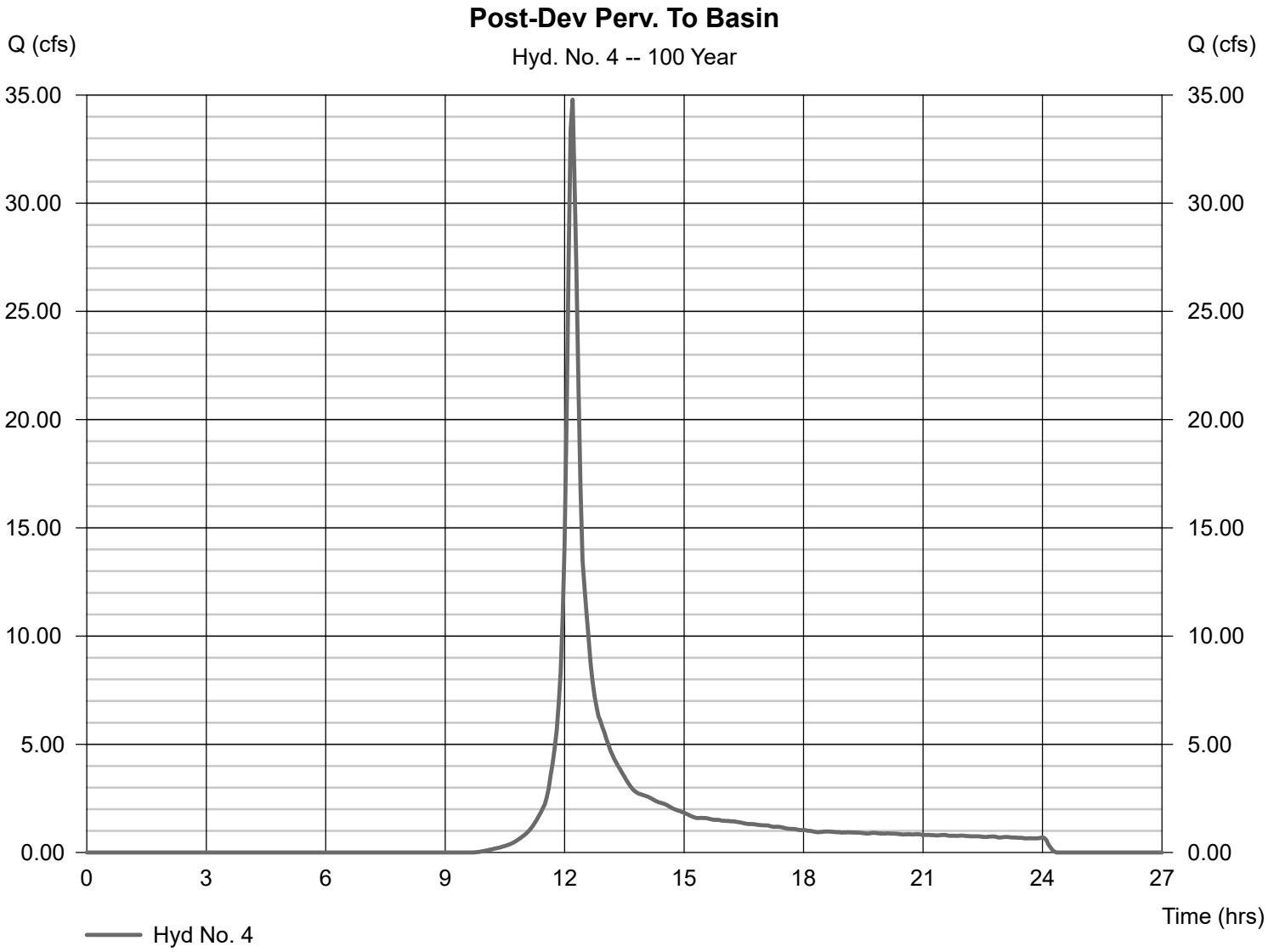
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Thursday, Sep 2, 2021

Hyd. No. 4

Post-Dev Perv. To Basin

Hydrograph type	=	SCS Runoff	Peak discharge	=	34.79 cfs
Storm frequency	=	100 yrs	Time to peak	=	12.20 hrs
Time interval	=	3 min	Hyd. volume	=	125,472 cuft
Drainage area	=	10.300 ac	Curve number	=	60
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	USER	Time of conc. (Tc)	=	12.80 min
Total precip.	=	8.03 in	Distribution	=	Custom
Storm duration	=	NOAA_C_3 min.cds	Shape factor	=	484



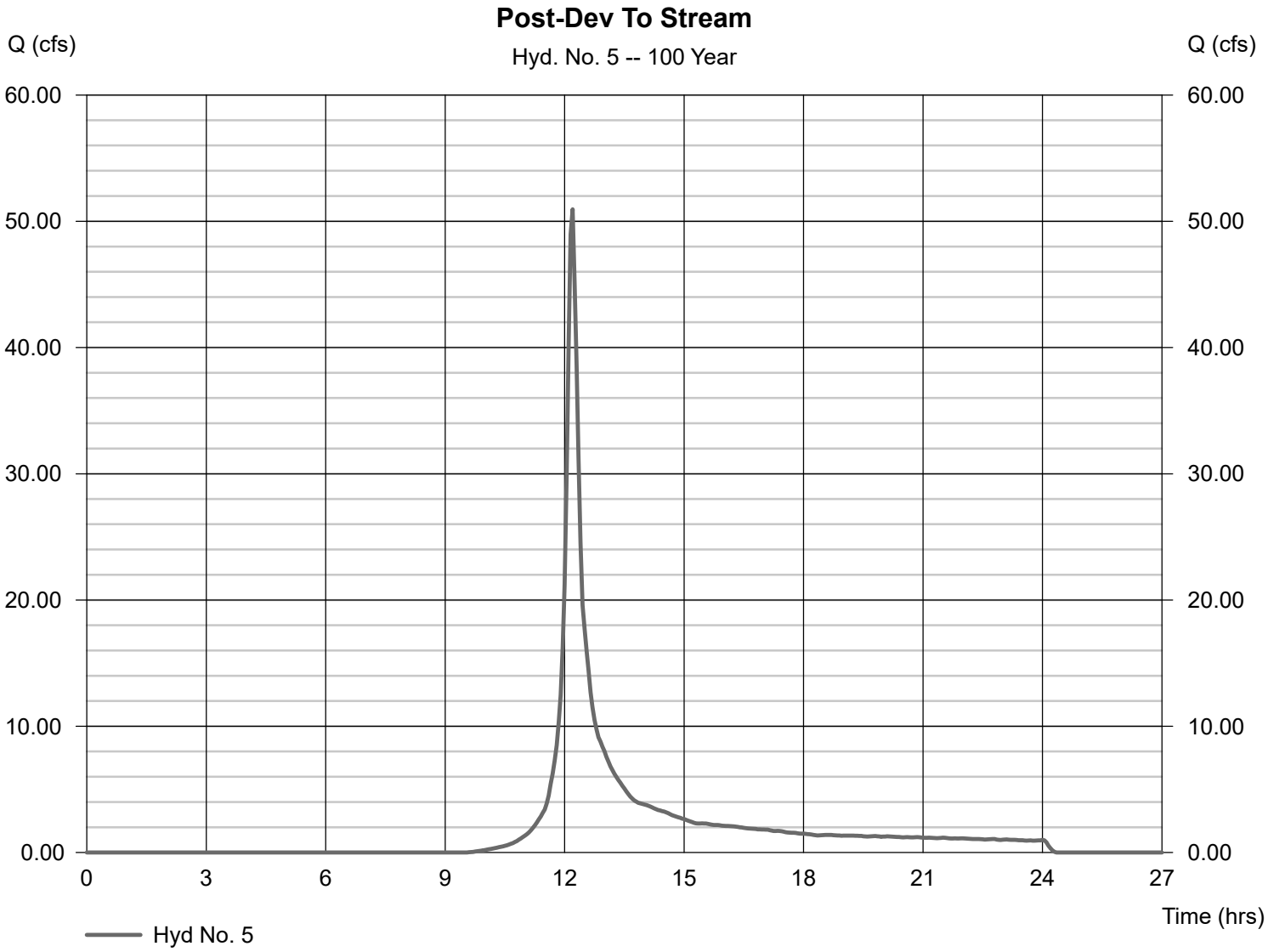
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Thursday, Sep 2, 2021

Hyd. No. 5

Post-Dev To Stream

Hydrograph type	=	SCS Runoff	Peak discharge	=	50.94 cfs
Storm frequency	=	100 yrs	Time to peak	=	12.20 hrs
Time interval	=	3 min	Hyd. volume	=	183,396 cuft
Drainage area	=	14.570 ac	Curve number	=	61
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	USER	Time of conc. (Tc)	=	11.90 min
Total precip.	=	8.03 in	Distribution	=	Custom
Storm duration	=	NOAA_C_3 min.cds	Shape factor	=	484



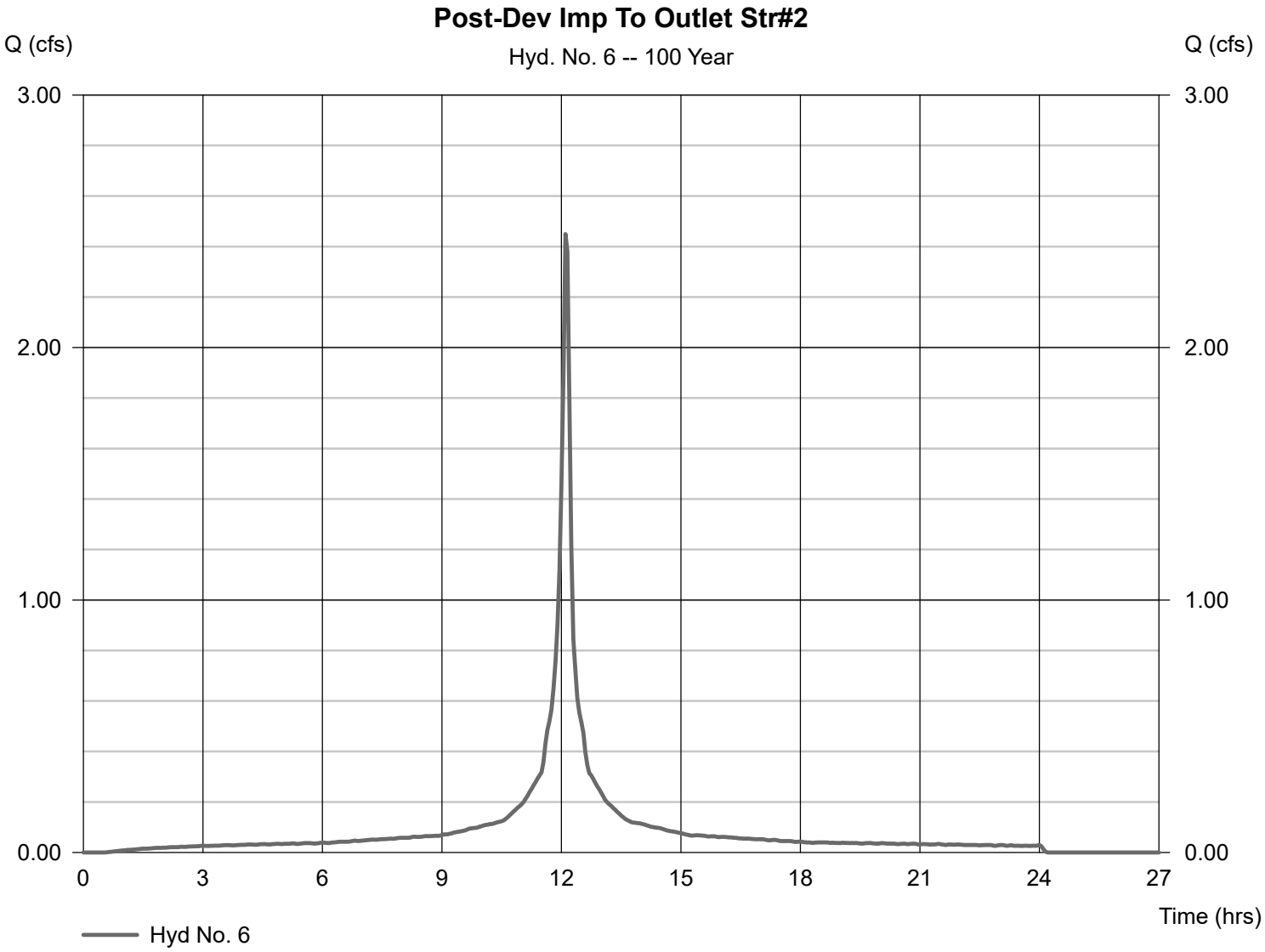
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Thursday, Sep 2, 2021

Hyd. No. 6

Post-Dev Imp To Outlet Str#2

Hydrograph type	=	SCS Runoff	Peak discharge	=	2.449 cfs
Storm frequency	=	100 yrs	Time to peak	=	12.10 hrs
Time interval	=	3 min	Hyd. volume	=	8,749 cuft
Drainage area	=	0.330 ac	Curve number	=	98
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	USER	Time of conc. (Tc)	=	6.00 min
Total precip.	=	8.03 in	Distribution	=	Custom
Storm duration	=	NOAA_C_3 min.cds	Shape factor	=	484



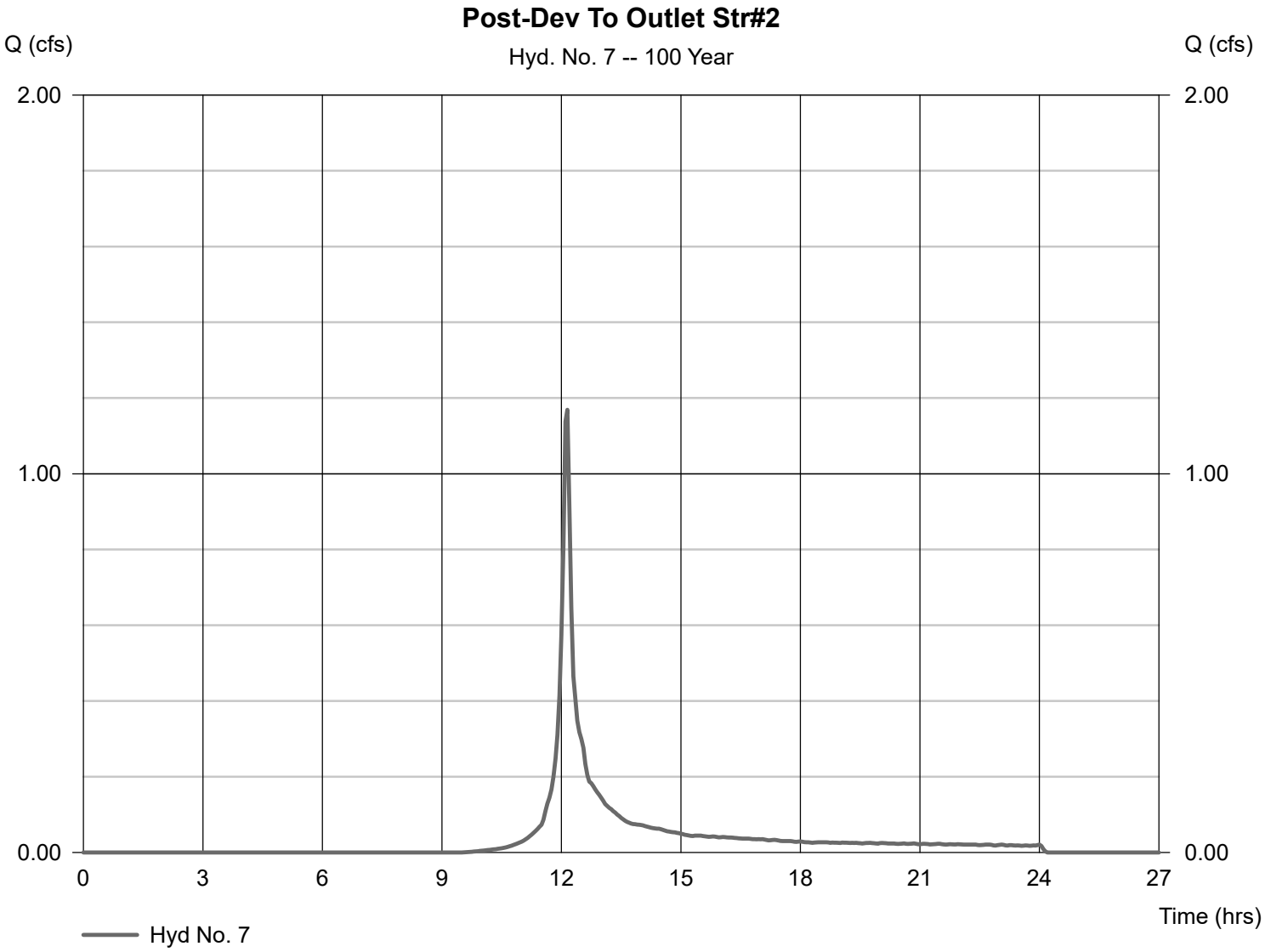
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Thursday, Sep 2, 2021

Hyd. No. 7

Post-Dev To Outlet Str#2

Hydrograph type	=	SCS Runoff	Peak discharge	=	1.169 cfs
Storm frequency	=	100 yrs	Time to peak	=	12.15 hrs
Time interval	=	3 min	Hyd. volume	=	3,540 cuft
Drainage area	=	0.300 ac	Curve number	=	61
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	USER	Time of conc. (Tc)	=	9.30 min
Total precip.	=	8.03 in	Distribution	=	Custom
Storm duration	=	NOAA_C_3 min.cds	Shape factor	=	484



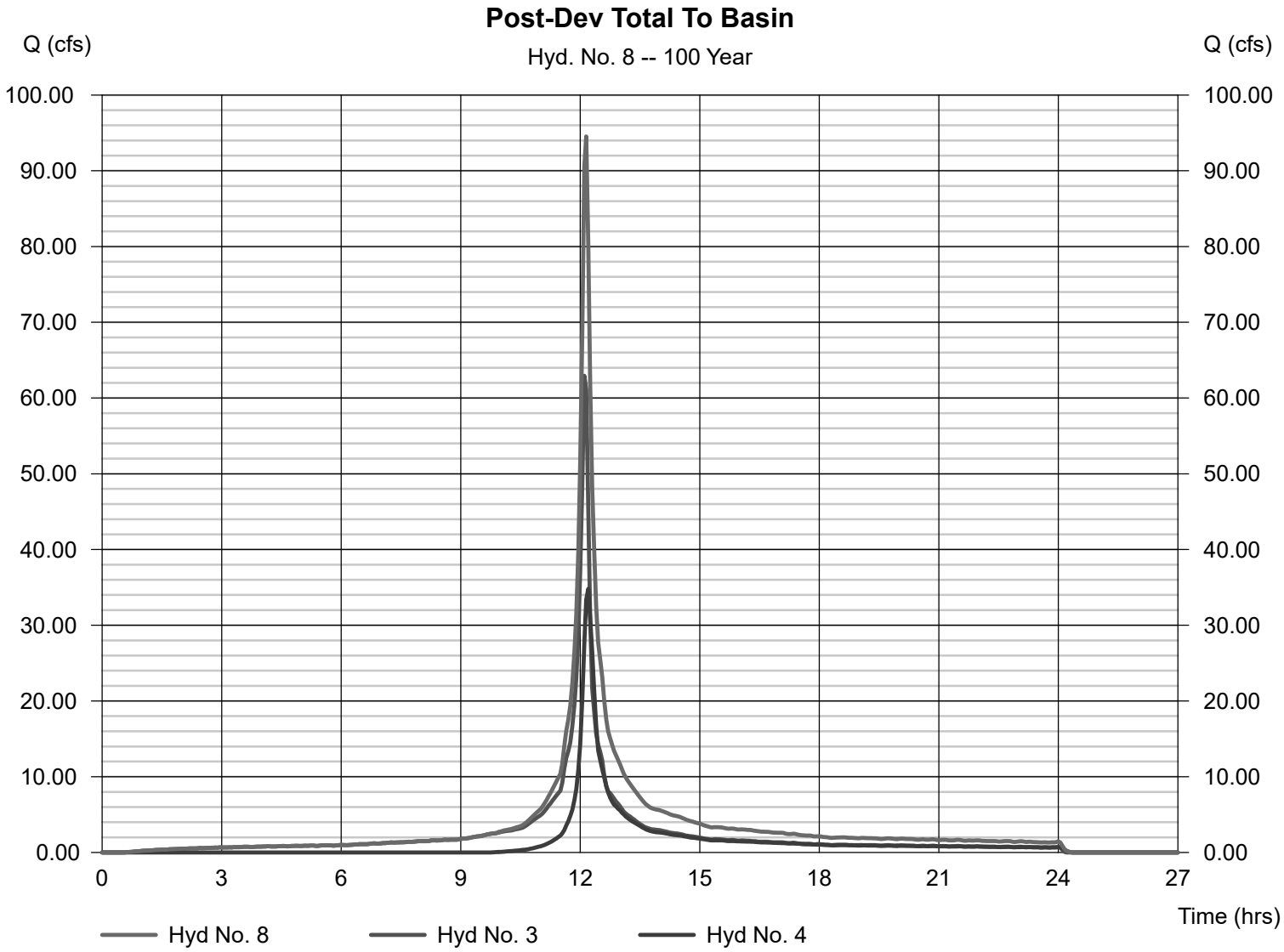
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Thursday, Sep 2, 2021

Hyd. No. 8

Post-Dev Total To Basin

Hydrograph type	= Combine	Peak discharge	= 94.54 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.15 hrs
Time interval	= 3 min	Hyd. volume	= 350,285 cuft
Inflow hyds.	= 3, 4	Contrib. drain. area	= 18.780 ac



Hydrograph Report

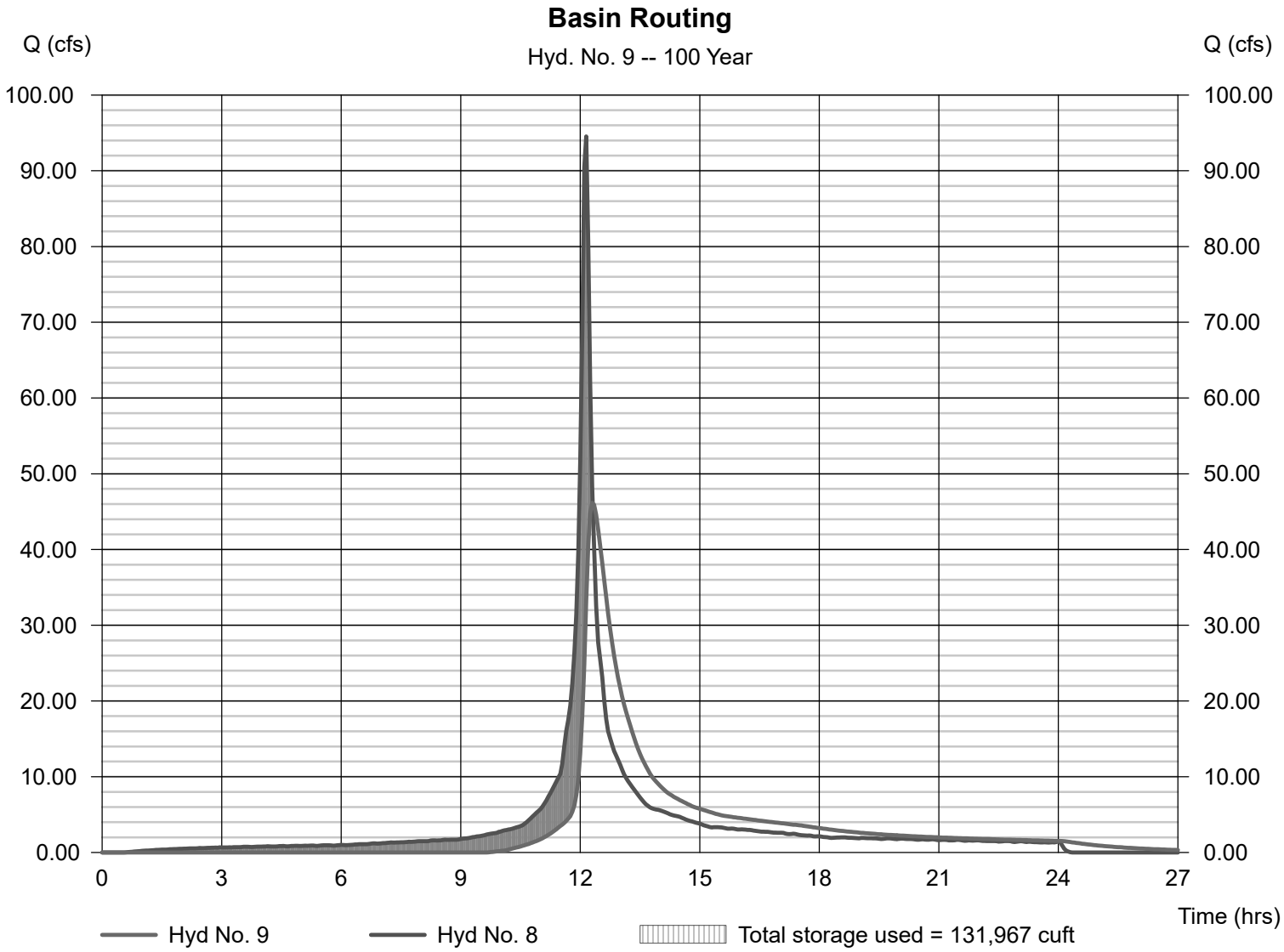
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Thursday, Sep 2, 2021

Hyd. No. 9

Basin Routing

Hydrograph type	= Reservoir	Peak discharge	= 46.16 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.30 hrs
Time interval	= 3 min	Hyd. volume	= 320,851 cuft
Inflow hyd. No.	= 8 - Post-Dev Total To Basin	Max. Elevation	= 229.33 ft
Reservoir name	= Infiltration Basin	Max. Storage	= 131,967 cuft

Storage Indication method used.



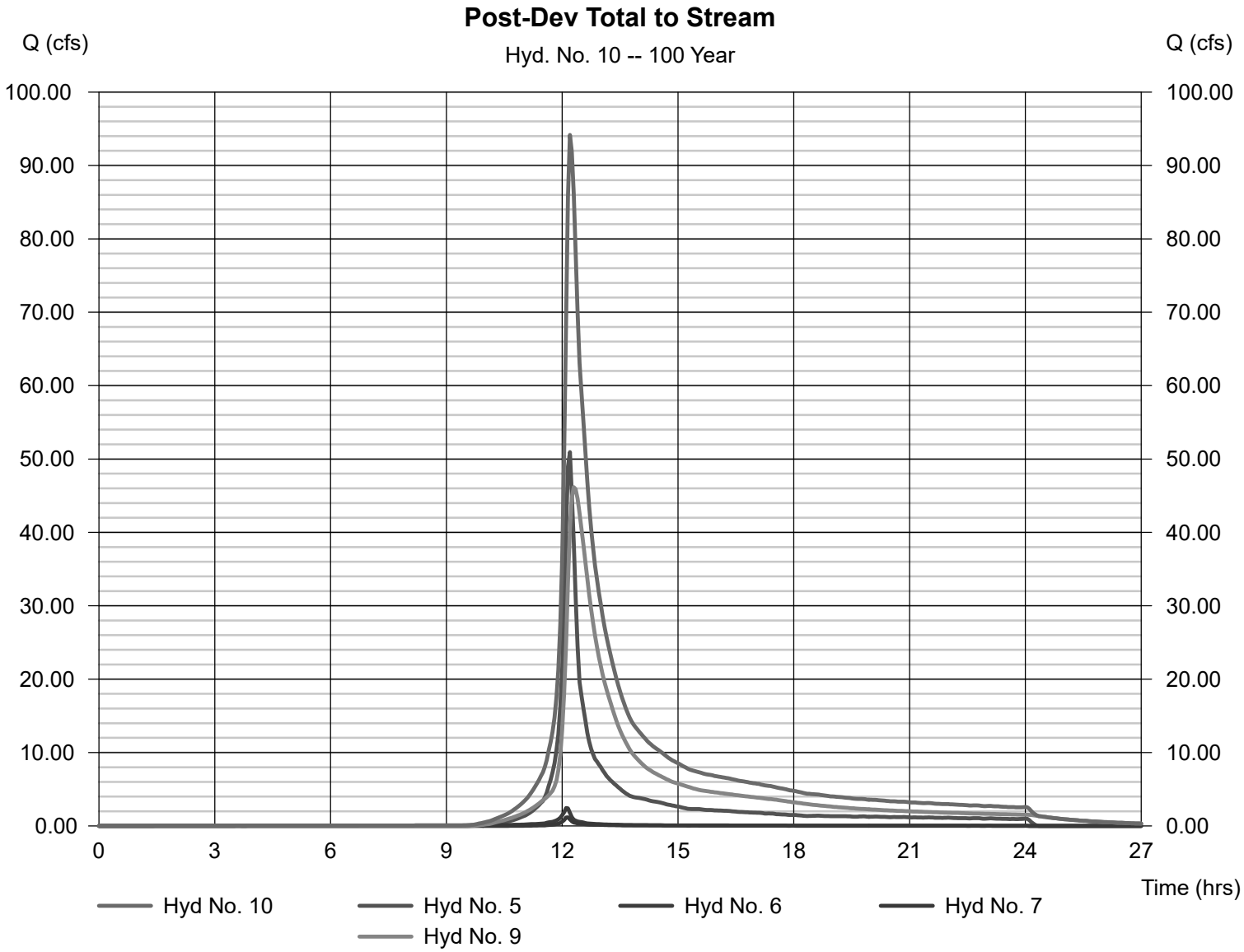
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Thursday, Sep 2, 2021

Hyd. No. 10

Post-Dev Total to Stream

Hydrograph type	= Combine	Peak discharge	= 94.15 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.20 hrs
Time interval	= 3 min	Hyd. volume	= 516,536 cuft
Inflow hyds.	= 5, 6, 7, 9	Contrib. drain. area	= 15.200 ac



APPENDIX - E:

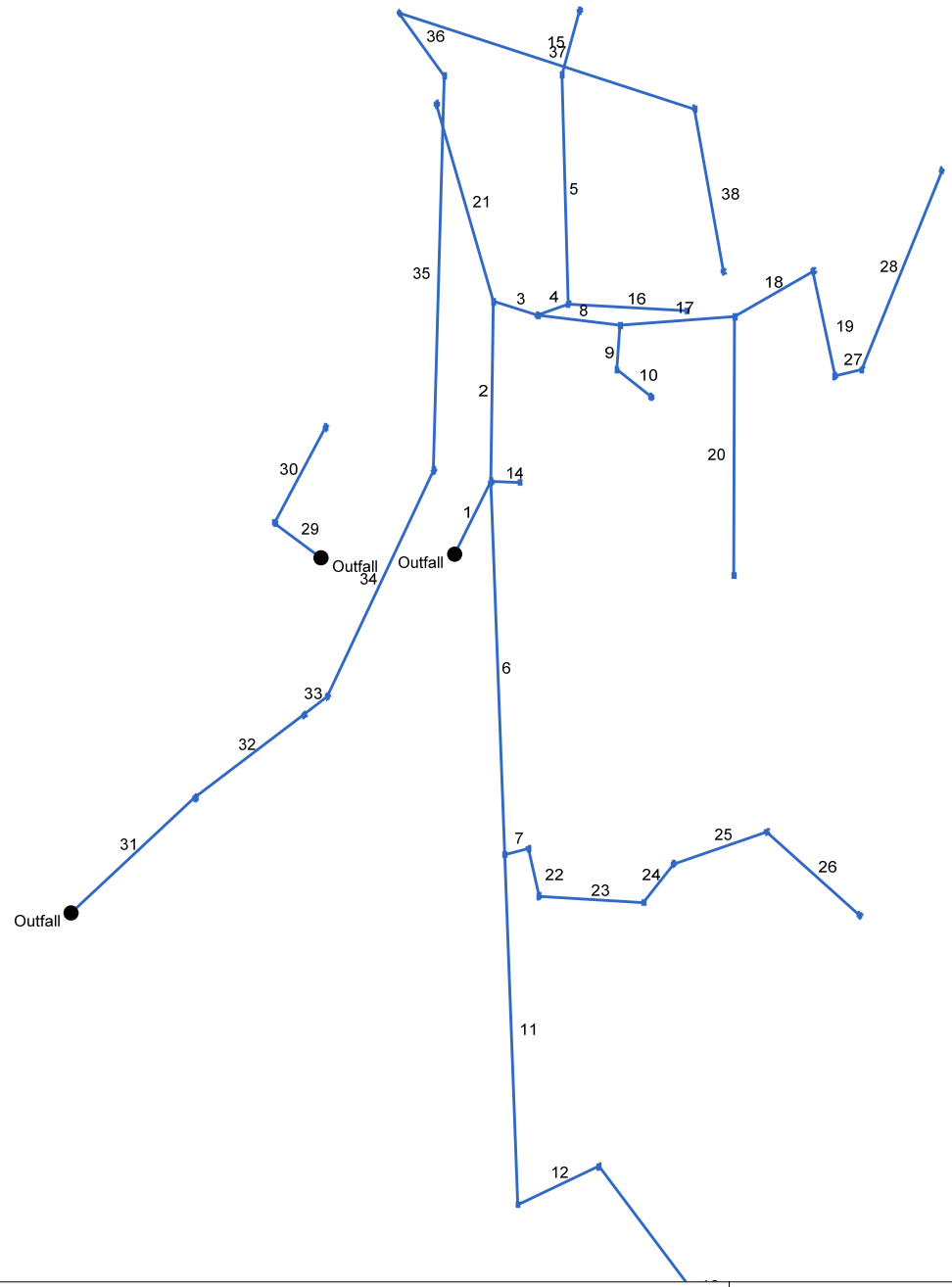
STORM SEWER SIZING CALCULATIONS

Weighted "C" (2)

Structure Number	Weighted "C"	Drainage Area (ac.)	Tc	Impervious Area (ac.)	Pervious Area (ac.)
Inlet#1	0.45	2.71	22.00	0.74	1.97
Inlet#2	0.84	0.39	10.00	0.31	0.08
Inlet#3	0.83	0.33	10.00	0.26	0.07
Inlet#4	0.75	0.28	9.00	0.19	0.09
Inlet#5	0.66	0.36	12.00	0.20	0.16
Inlet#6	0.69	0.05	6.00	0.03	0.02
Inlet#7	0.71	1.08	15.00	0.67	0.41
Inlet#8	0.90	0.40	6.00	0.35	0.05
Inlet#9	0.82	0.13	6.00	0.10	0.03
Inlet#10	0.66	0.80	18.00	0.44	0.36
Inlet#11	1.27	0.08	6.00	0.11	-0.03
Inlet#12	0.99	0.27	6.00	0.27	0.00
Inlet#13	0.96	0.26	6.00	0.25	0.01
Inlet#14	0.68	0.47	9.00	0.27	0.20
Inlet#15	0.81	0.61	6.00	0.46	0.15
Inlet#16	0.89	0.22	6.00	0.19	0.03
Inlet#17	0.72	0.66	12.00	0.42	0.24
Inlet#18	0.85	0.26	8.00	0.21	0.05
Inlet#19	0.99	0.13	6.00	0.13	0.00
Inlet#20	0.71	0.08	6.00	0.05	0.03
Inlet#21	0.45	0.34	10.00	0.09	0.25
Inlet#22	0.89	0.23	6.00	0.20	0.03
Inlet#23	0.90	0.16	14.00	0.14	0.02
Inlet#24	0.29	4.40	22.00	0.22	4.18
Inlet#25	0.39	0.62	14.00	0.12	0.50
Inlet#26	0.89	0.43	8.00	0.37	0.06
Inlet#27	0.95	0.20	6.00	0.19	0.01
Inlet#28	0.80	0.31	6.00	0.23	0.08
Inlet#29	0.92	0.33	6.00	0.30	0.03
Inlet#30	0.99	0.78	6.00	0.78	0.00
Basin	0.35	1.41	12.00	0.19	1.22
	SubTotal=	**18.78**		**8.48**	**10.30**
Trench Dra	0.99	0.33	6.00	0.33	0.00
Sand Filter	0.25	0.30	12.00	0.00	0.30
	SubTotal=	**0.63**		**0.33**	**0.30**
	Total On Site=	**19.41**		**8.81**	**10.60**
Inlet #31	0.83	0.18	6.00	0.14	0.04
To Stream		14.39			
Total		33.98			

Runoff Co-efficient for impervious area=	0.99
Runoff Co-efficient for pervious area=	0.25
Adjustment Factor For Runoff Coefficient=	1

Hydraflow Storm Sewers Extension for Autodesk® Civil 3D® Plan



Project File: 32606-2021-08-27.stm	Number of lines: 39	Date: 9/1/2021

Storm Sewers v2020.00

Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line	(ft)	Incr (ac)	Total (ac)	(C)	Incr	Total	Inlet (min)	Syst (min)	(in/hr)	(cfs)	(cfs)	(ft/s)	Size (in)	Slope (%)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	
39	End	155.779	0.18	0.18	0.83	0.15	0.15	6.0	6.0	7.8	1.17	14.75	3.96	18	1.68	246.43	249.05	246.72	249.45	249.33	254.55	31-EX
38	37	117.985	0.33	0.33	0.99	0.33	0.33	6.0	6.0	7.8	2.55	6.08	4.12	15	0.75	251.50	252.39	252.12	253.03	256.25	255.64	TR-MH1
37	36	346.722	0.00	0.33	0.00	0.00	0.33	0.0	6.9	7.4	2.42	13.23	6.08	15	3.58	239.10	251.50	239.46	252.12	240.20	256.25	MH1-OUT2
36	35	68.517	0.30	0.63	0.25	0.08	0.40	12.0	12.0	5.9	2.35	7.32	4.62	15	1.09	234.25	235.00	234.74	235.61	243.15	240.20	OUT2-MH2
35	34	274.956	0.00	0.63	0.00	0.00	0.40	0.0	12.6	5.7	2.30	6.27	4.31	15	0.80	228.94	231.15	229.46	231.76	238.69	243.15	MH2-MH3
34	33	198.785	0.00	0.63	0.00	0.00	0.40	0.0	15.0	5.3	2.11	9.48	5.01	15	1.84	219.10	222.75	219.50	223.33	232.00	238.69	MH3-OUT1
33	32	29.890	0.00	0.63	0.00	0.00	0.40	0.0	16.9	5.0	49.00	91.59	10.41	30	4.25	214.73	216.00	217.02	218.29	232.20	232.00	OUT1-FIL
32	31	137.953	0.00	0.63	0.00	0.00	0.40	0.0	16.9	5.0	48.99	94.72	14.93	30	4.55	208.46	214.73	209.74	217.02	213.09	232.20	FIL-MH4
31	End	163.378	0.00	0.63	0.00	0.00	0.40	0.0	17.2	4.9	48.98	98.31	15.18	30	4.90	191.00	199.00	192.25	201.29	1.96	213.09	MH4-HW3
30	29	88.900	0.33	0.33	0.92	0.30	0.30	6.0	6.0	7.8	2.37	5.14	4.02	15	0.54	230.55	231.03	231.15	231.65	235.16	234.28	29-30
29	End	58.648	0.78	1.11	0.99	0.77	1.08	6.0	6.8	7.5	8.04	14.90	7.49	15	4.54	224.00	226.66	224.95	227.78	1.38	235.16	30-HW2
28	27	166.227	2.71	2.71	0.45	1.22	1.22	22.0	22.0	4.3	5.30	6.53	5.14	15	0.87	255.70	257.15	256.73	258.08	264.15	260.40	1-2
27	19	31.069	0.39	3.10	0.84	0.33	1.55	10.0	22.6	4.3	6.63	8.96	5.94	15	1.64	255.19	255.70	256.29	256.73	263.74	264.15	2-3
26	25	121.447	0.26	0.26	0.85	0.22	0.22	8.0	8.0	7.0	1.54	11.28	4.94	15	2.60	262.02	265.18	262.33	265.67	265.27	268.43	18-19
25	24	109.199	0.13	0.39	0.99	0.13	0.35	6.0	9.6	6.5	2.26	16.25	6.60	15	5.39	254.73	260.62	255.05	261.22	257.98	265.27	19-20
24	23	44.019	0.08	0.47	0.71	0.06	0.41	6.0	10.6	6.2	2.52	15.57	3.66	15	4.95	252.15	254.33	252.90	254.97	255.40	257.98	20-21
23	22	119.898	0.34	0.81	0.45	0.15	0.56	10.0	10.9	6.1	3.42	14.94	4.13	15	4.56	246.68	252.15	247.54	252.90	249.93	255.40	21-22
22	7	35.444	0.23	1.04	0.89	0.20	0.76	6.0	11.6	5.9	4.55	12.27	4.83	15	3.08	245.59	246.68	246.52	247.54	248.84	249.93	22-23
21	2	151.608	0.61	0.61	0.81	0.49	0.49	6.0	6.0	7.8	3.86	4.36	3.91	15	0.39	234.21	234.80	235.18	235.70	241.40	237.55	15-16
20	17	180.336	0.36	0.36	0.66	0.24	0.24	6.0	6.0	7.8	1.86	7.86	3.56	18	0.48	250.02	250.88	250.52	251.39	256.02	254.38	5-6
19	18	76.975	0.33	3.43	0.83	0.27	1.82	10.0	22.7	4.3	7.78	9.73	6.70	15	1.94	253.70	255.19	254.84	256.29	259.55	263.74	3-4
18	17	95.401	0.28	3.71	0.75	0.21	2.03	9.0	22.9	4.3	8.64	10.20	8.34	15	2.13	251.67	253.70	252.55	254.84	256.02	259.55	4-6

Project File: 32606-2021-08-27.stm | Number of lines: 39 | Run Date: 9/1/2021

NOTES:Intensity = 31.22 / (Inlet time + 3.80) ^ 0.61; Return period =Yrs. 25 ; c = cir e = ellip b = box

Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line	(ft)	Incr (ac)	Total (ac)	(C)	Incr	Total	Inlet (min)	Syst (min)	(in/hr)	(cfs)	(cfs)	(ft/s)	Size (in)	Slope (%)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	
17	8	131.966	0.05	4.12	0.69	0.03	2.30	6.0	23.2	4.2	9.75	13.09	9.91	15	3.50	244.25	248.87	245.05	250.05	247.50	256.02	6-9
16	4	136.626	0.27	0.27	0.99	0.27	0.27	6.0	6.0	7.8	2.09	6.04	4.13	15	0.75	248.75	249.77	249.26	250.35	252.30	253.02	12-13
15	5	48.778	0.80	0.80	0.66	0.53	0.53	18.0	18.0	4.8	2.54	6.26	3.87	15	0.80	248.02	248.41	248.70	249.05	251.77	251.36	10-11
14	1	33.663	0.66	0.66	0.72	0.48	0.48	12.0	12.0	5.9	2.78	8.27	5.12	15	1.40	235.28	235.75	235.78	236.42	238.13	238.61	17-28
13	12	278.132	4.40	4.40	0.29	1.28	1.28	22.0	22.0	4.3	5.55	7.31	3.67	18	0.41	238.77	239.92	240.29	240.97	249.36	243.22	24-25
12	11	97.073	0.62	5.02	0.39	0.24	1.52	12.0	23.5	4.2	6.38	8.25	4.93	18	0.53	238.26	238.77	239.35	239.75	247.01	249.36	25-26
11	6	243.896	0.43	5.45	0.89	0.38	1.90	8.0	23.9	4.2	7.91	9.91	5.28	18	0.76	236.41	238.26	237.73	239.35	248.61	247.01	26-27
10	9	43.631	1.08	1.08	0.71	0.77	0.77	15.0	15.0	5.3	4.04	15.09	4.35	15	4.65	244.81	246.84	245.79	247.65	248.06	250.09	7-8
9	8	31.005	0.40	1.48	0.90	0.36	1.13	6.0	15.2	5.2	5.89	9.40	6.90	15	1.81	244.25	244.81	244.97	245.79	247.50	248.06	8-9
8	3	95.254	0.13	5.73	0.82	0.11	3.54	6.0	23.5	4.2	14.87	22.84	9.51	18	4.03	237.66	241.50	238.80	242.90	241.16	247.50	9-14
7	6	27.605	0.16	1.20	0.90	0.14	0.91	12.0	12.0	5.9	5.32	9.69	6.74	15	1.92	245.06	245.59	245.72	246.52	248.61	248.84	23-27
6	1	260.071	0.20	6.85	0.95	0.19	3.00	6.0	24.8	4.1	12.24	14.93	8.42	18	1.72	231.93	236.41	232.96	237.73	238.13	248.61	27-28
5	4	159.832	0.08	0.88	0.99	0.08	0.61	6.0	18.4	4.8	2.89	6.59	4.71	15	0.89	246.60	248.02	247.18	248.70	252.30	251.77	11-13
4	3	36.375	0.26	1.41	0.96	0.25	1.12	6.0	19.5	4.6	5.20	15.08	5.47	15	4.65	237.91	239.60	238.80	240.52	241.16	252.30	13-14
3	2	51.591	0.47	7.61	0.68	0.32	4.98	9.0	23.6	4.2	20.85	26.42	8.45	24	1.16	236.56	237.16	237.90	238.80	241.40	241.16	14-16
2	1	125.403	0.22	8.44	0.89	0.20	5.67	6.0	23.8	4.2	23.67	28.94	9.24	24	1.40	231.71	233.46	233.09	235.18	238.13	241.40	16-18
1	End	65.471	0.31	16.26	0.80	0.25	9.39	8.0	25.5	4.0	37.82	59.65	9.59	30	1.80	224.00	225.18	225.72	227.26	228.38	238.13	28-HW1

Project File: 32606-2021-08-27.stm | Number of lines: 39 | Run Date: 9/1/2021

NOTES:Intensity = 31.22 / (Inlet time + 3.80) ^ 0.61; Return period =Yrs. 25 ; c = cir e = ellip b = box

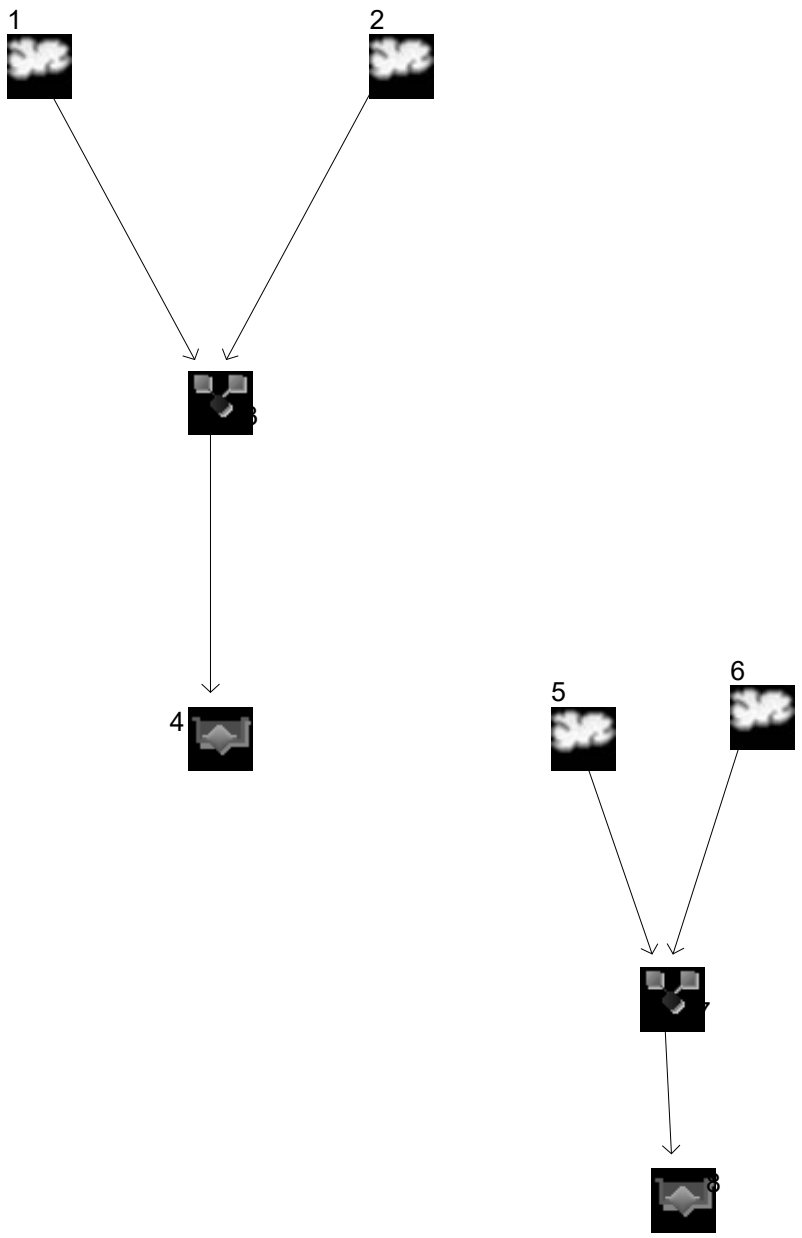
APPENDIX - F:

QUALITY STORM HYDROLOGIC ANALYSIS AND RUNOFF QUANTITY CALCULATIONS

E&LP

Watershed Model Schematic

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066



Legend

Hyd.	Origin	Description
1	SCS Runoff	Post-Dev Imp To Basin-WQ
2	SCS Runoff	Post-Dev Per To Basin
3	Combine	Post-Dev Total To Basin-WQ
4	Reservoir	Pond Routing
5	SCS Runoff	Post-Dev Imp To Sand Filter
6	SCS Runoff	Post-Dev Per to Sand Filter
7	Combine	Post-Dev Total To Sand Filter
8	Reservoir	Sand Filter Routing

Hydrograph Return Period Recap

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066

Hyd. No.	Hydrograph type (origin)	Inflow Hyd(s)	Peak Outflow (cfs)								Hydrograph description
			1-Yr	2-Yr	3-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr	
1	SCS Runoff	------	23.92	-------	-------	-------	-------	-------	-------	-------	Post-Dev Imp To Basin-WQ
2	SCS Runoff	------	0.000	-------	-------	-------	-------	-------	-------	-------	Post-Dev Per To Basin
3	Combine	1, 2	23.92	-------	-------	-------	-------	-------	-------	-------	Post-Dev Total To Basin-WQ
4	Reservoir	3	0.000	-------	-------	-------	-------	-------	-------	-------	Pond Routing
5	SCS Runoff	------	0.931	-------	-------	-------	-------	-------	-------	-------	Post-Dev Imp To Sand Filter
6	SCS Runoff	------	0.084	-------	-------	-------	-------	-------	-------	-------	Post-Dev Per to Sand Filter
7	Combine	5, 6	0.931	-------	-------	-------	-------	-------	-------	-------	Post-Dev Total To Sand Filter
8	Reservoir	7	0.037	-------	-------	-------	-------	-------	-------	-------	Sand Filter Routing

Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph description
1	SCS Runoff	23.92	2	64	29,856	------	------	------	Post-Dev Imp To Basin-WQ
2	SCS Runoff	0.000	2	n/a	0	------	------	------	Post-Dev Per To Basin
3	Combine	23.92	2	64	29,856	1, 2	------	------	Post-Dev Total To Basin-WQ
4	Reservoir	0.000	2	n/a	0	3	225.49	29,856	Pond Routing
5	SCS Runoff	0.931	2	64	1,162	------	------	------	Post-Dev Imp To Sand Filter
6	SCS Runoff	0.084	2	722	318	------	------	------	Post-Dev Per to Sand Filter
7	Combine	0.931	2	64	1,480	5, 6	------	------	Post-Dev Total To Sand Filter
8	Reservoir	0.037	2	106	37	7	239.22	976	Sand Filter Routing

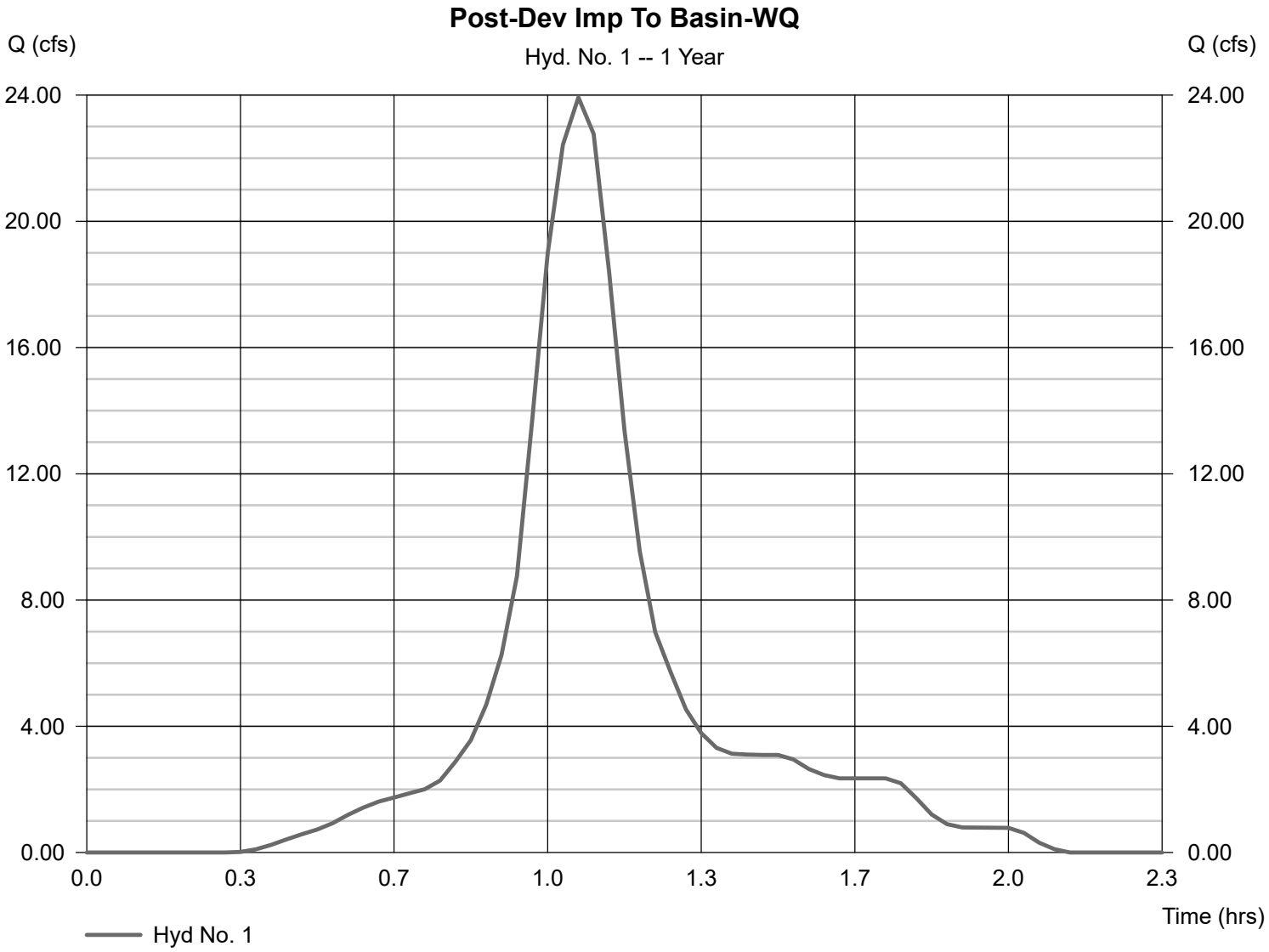
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Thursday, Sep 2, 2021

Hyd. No. 1

Post-Dev Imp To Basin-WQ

Hydrograph type	=	SCS Runoff	Peak discharge	=	23.92 cfs
Storm frequency	=	1 yrs	Time to peak	=	1.07 hrs
Time interval	=	2 min	Hyd. volume	=	29,856 cuft
Drainage area	=	8.480 ac	Curve number	=	98
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	USER	Time of conc. (Tc)	=	6.00 min
Total precip.	=	1.25 in	Distribution	=	Custom
Storm duration	=	NJ-WQ.cds	Shape factor	=	484



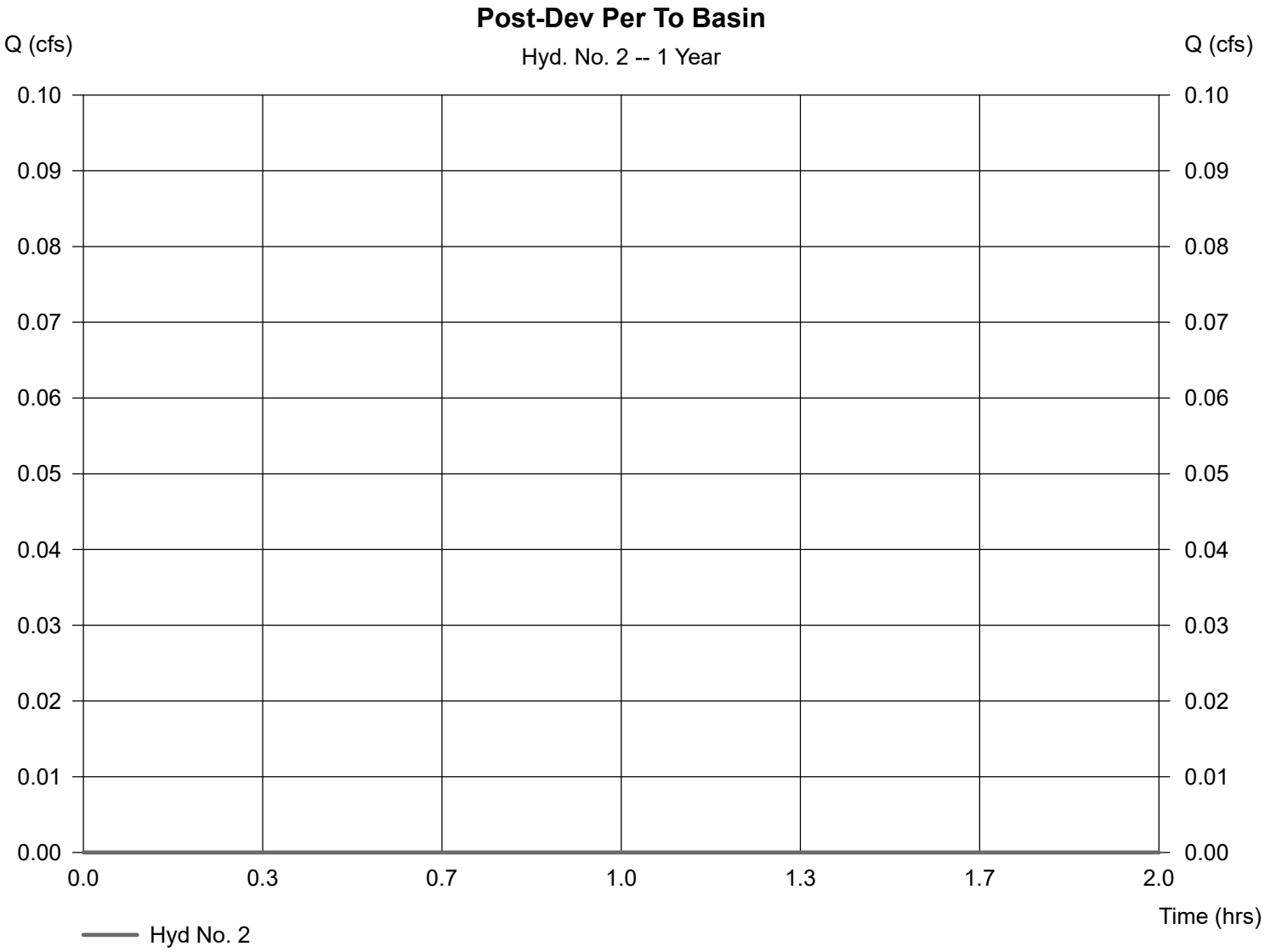
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Thursday, Sep 2, 2021

Hyd. No. 2

Post-Dev Per To Basin

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.000 cfs
Storm frequency	=	1 yrs	Time to peak	=	n/a
Time interval	=	2 min	Hyd. volume	=	0 cuft
Drainage area	=	10.300 ac	Curve number	=	60
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	USER	Time of conc. (Tc)	=	12.80 min
Total precip.	=	1.25 in	Distribution	=	Custom
Storm duration	=	NJ-WQ.cds	Shape factor	=	484



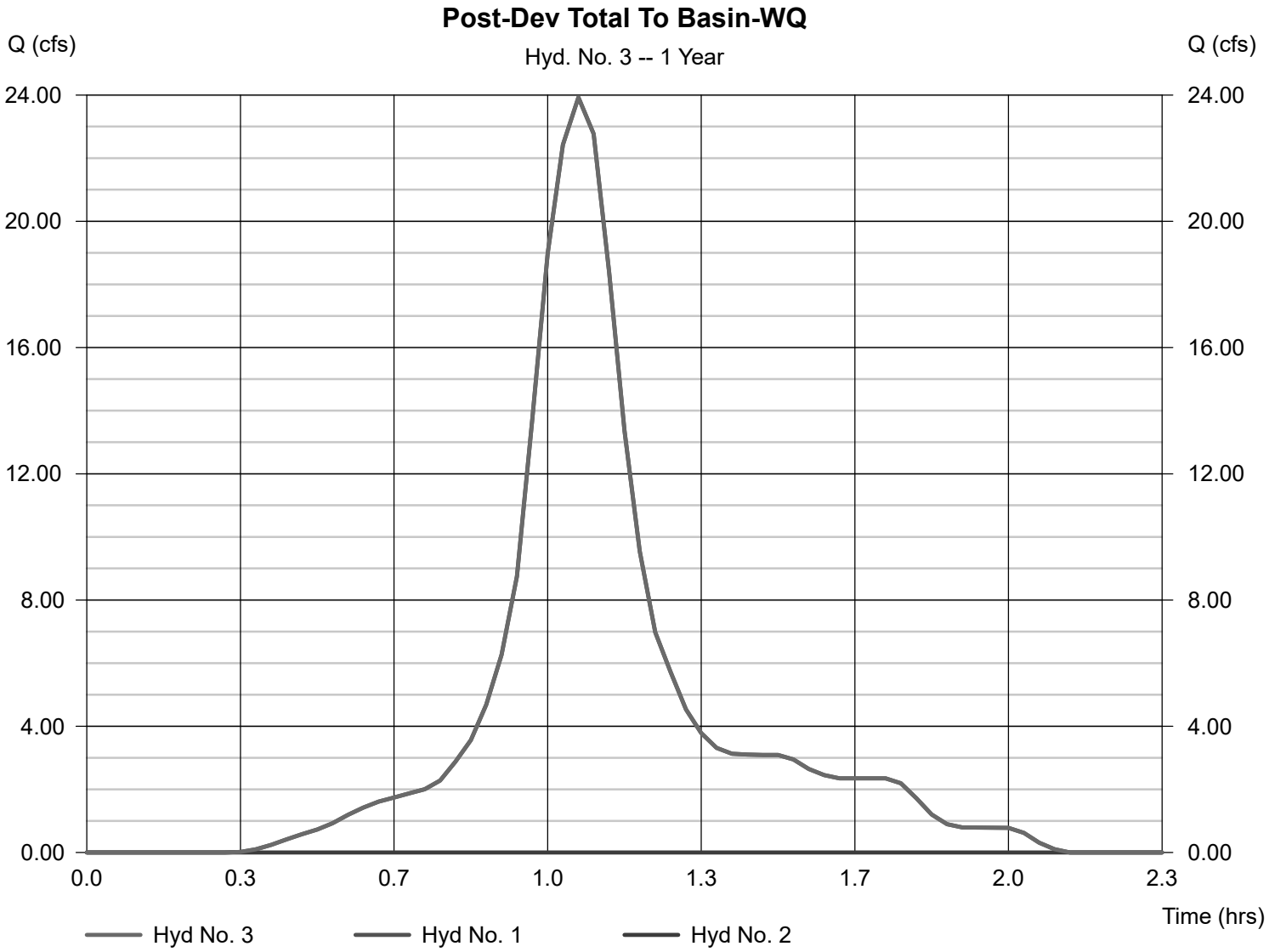
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Thursday, Sep 2, 2021

Hyd. No. 3

Post-Dev Total To Basin-WQ

Hydrograph type	= Combine	Peak discharge	= 23.92 cfs
Storm frequency	= 1 yrs	Time to peak	= 1.07 hrs
Time interval	= 2 min	Hyd. volume	= 29,856 cuft
Inflow hyds.	= 1, 2	Contrib. drain. area	= 18.780 ac



Hydrograph Report

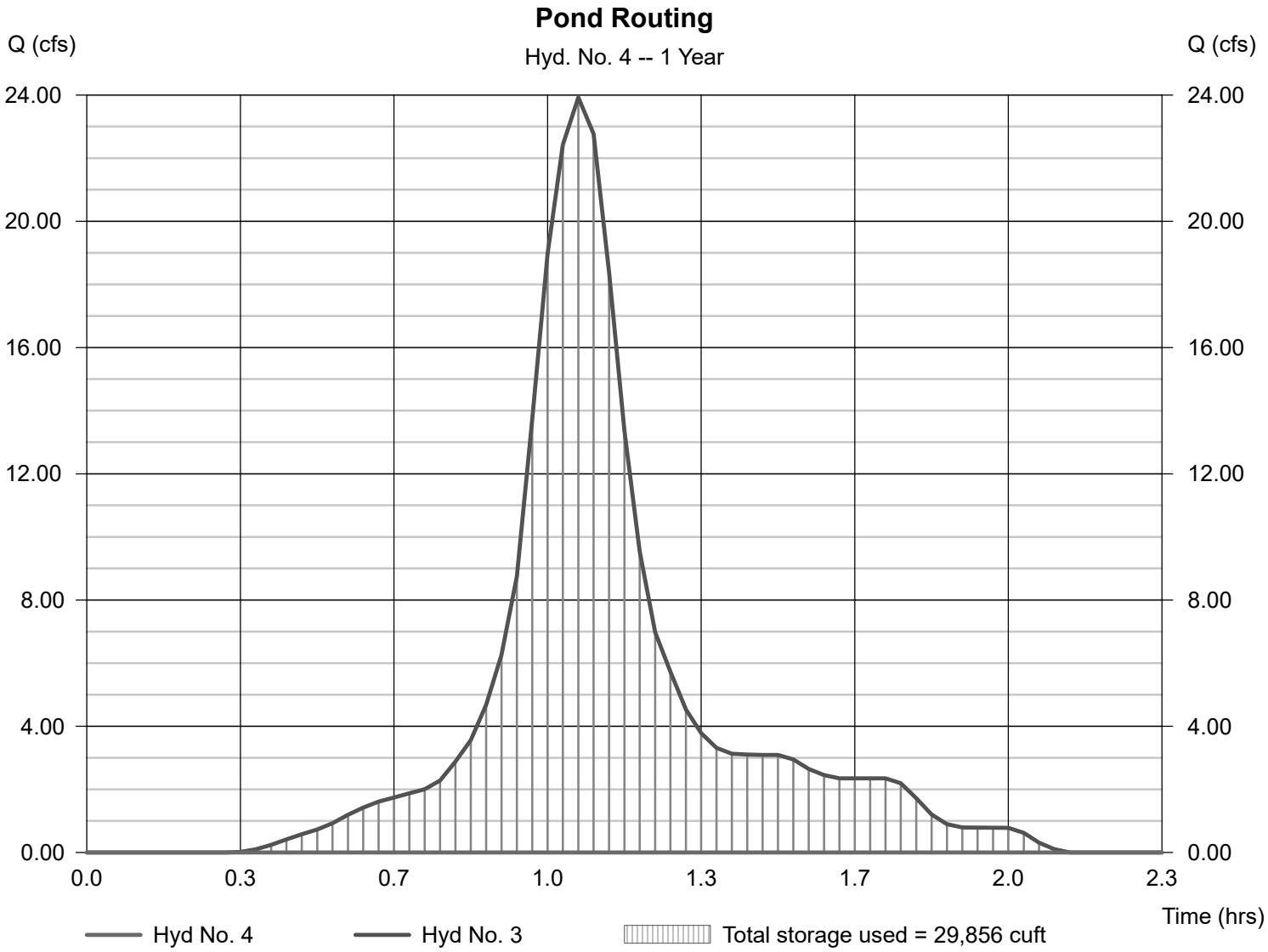
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Thursday, Sep 2, 2021

Hyd. No. 4

Pond Routing

Hydrograph type	= Reservoir	Peak discharge	= 0.000 cfs
Storm frequency	= 1 yrs	Time to peak	= n/a
Time interval	= 2 min	Hyd. volume	= 0 cuft
Inflow hyd. No.	= 3 - Post-Dev Total To Basin-WQ	Max. Elevation	= 225.49 ft
Reservoir name	= Infiltration Basin	Max. Storage	= 29,856 cuft

Storage Indication method used.



Pond Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Thursday, Sep 2, 2021

Pond No. 1 - Infiltration Basin

Pond Data

Contours - User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 224.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	224.00	15,533	0	0
1.00	225.00	21,794	18,574	18,574
2.00	226.00	24,200	22,984	41,558
4.00	228.00	29,480	53,588	95,146
6.00	230.00	34,992	64,387	159,533
8.00	232.00	40,998	75,903	235,436

Culvert / Orifice Structures

		[A]	[B]	[C]	[PrfRsr]
Rise (in)	=	14.00	41.00	0.00	0.00
Span (in)	=	14.00	41.00	0.00	0.00
No. Barrels	=	1	1	0	0
Invert El. (ft)	=	225.80	226.90	0.00	0.00
Length (ft)	=	0.00	0.00	0.00	0.00
Slope (%)	=	0.00	0.00	0.00	n/a
N-Value	=	.013	.013	.013	n/a
Orifice Coeff.	=	0.60	0.60	0.60	0.60
Multi-Stage	=	n/a	No	No	No

Weir Structures

		[A]	[B]	[C]	[D]
Crest Len (ft)	=	50.00	0.00	0.00	0.00
Crest El. (ft)	=	229.50	0.00	0.00	0.00
Weir Coeff.	=	2.60	3.33	3.33	3.33
Weir Type	=	Broad	---	---	---
Multi-Stage	=	No	No	No	No

Exfil.(in/hr) = 0.000 (by Contour)

TW Elev. (ft) = 0.00

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
0.00	0	224.00	0.00	0.00	---	---	0.00	---	---	---	---	---	0.000
1.00	18,574	225.00	0.00	0.00	---	---	0.00	---	---	---	---	---	0.000
2.00	41,558	226.00	0.19 ic	0.00	---	---	0.00	---	---	---	---	---	0.186
4.00	95,146	228.00	6.54 ic	9.13 ic	---	---	0.00	---	---	---	---	---	15.67
6.00	159,533	230.00	9.79 ic	52.42 ic	---	---	45.96	---	---	---	---	---	108.17
8.00	235,436	232.00	12.20 ic	81.29 ic	---	---	513.87	---	---	---	---	---	607.36

Drain Time Calculations

Total Volume to Recharge =	29856	c.ft.	
Area of Recharge =	15533	s.f.	
Permeability Rate =	1.78	in/hr	(=2.73+0.0.83)/2
Factor of Safety =	2		
Design Permeability Rate =	0.89	in/hr	

Duration of Infitration period t(hr) = $\frac{\text{Volume of Runoff to recharge (cf) x 12 (in/ft)}}{\text{Infiltration Area (sf) x Recharge Rate (in/hr)}}$

25.92

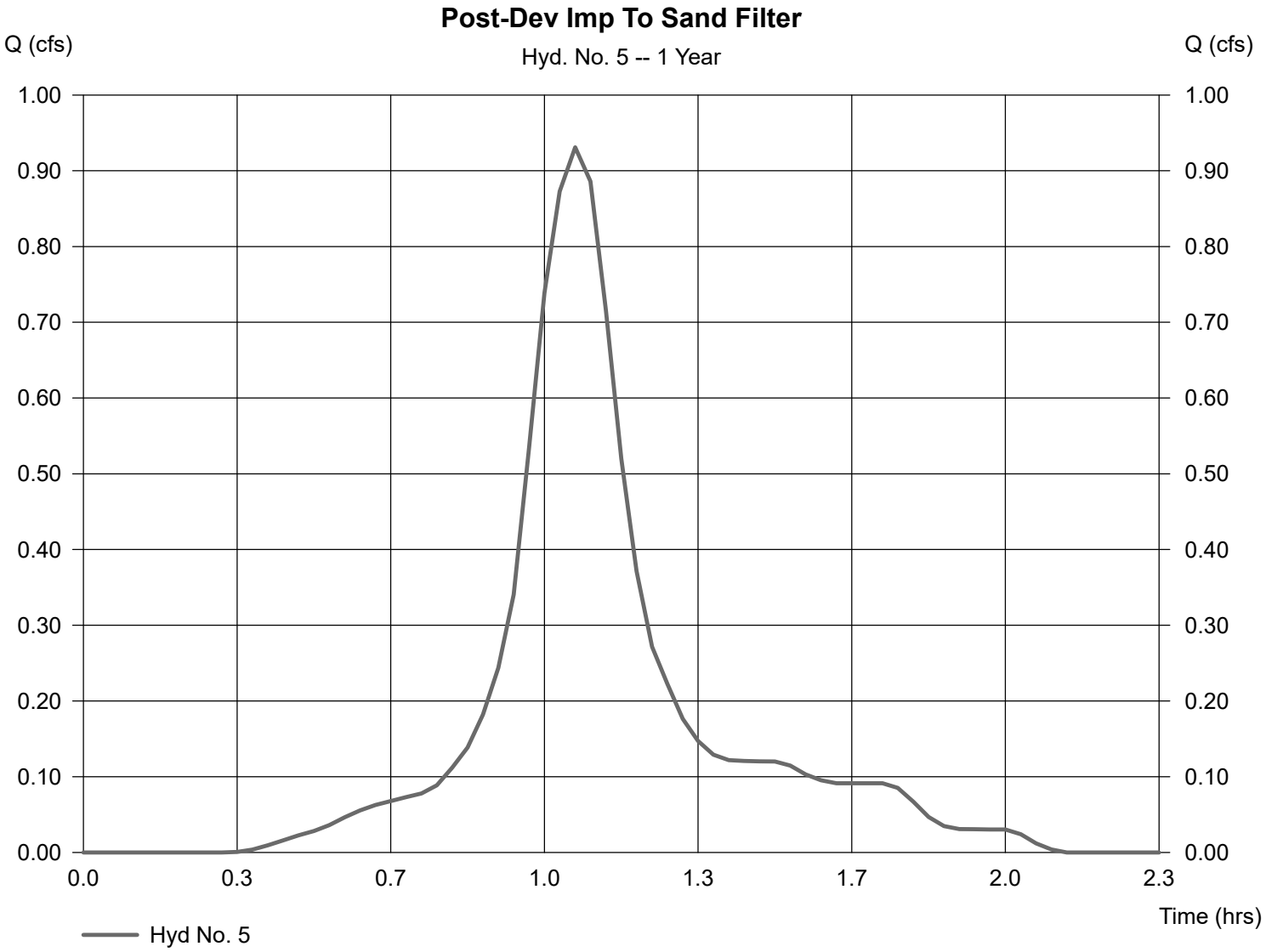
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Thursday, Sep 2, 2021

Hyd. No. 5

Post-Dev Imp To Sand Filter

Hydrograph type	= SCS Runoff	Peak discharge	= 0.931 cfs
Storm frequency	= 1 yrs	Time to peak	= 1.07 hrs
Time interval	= 2 min	Hyd. volume	= 1,162 cuft
Drainage area	= 0.330 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 6.00 min
Total precip.	= 1.25 in	Distribution	= Custom
Storm duration	= NJ-WQ.cds	Shape factor	= 484



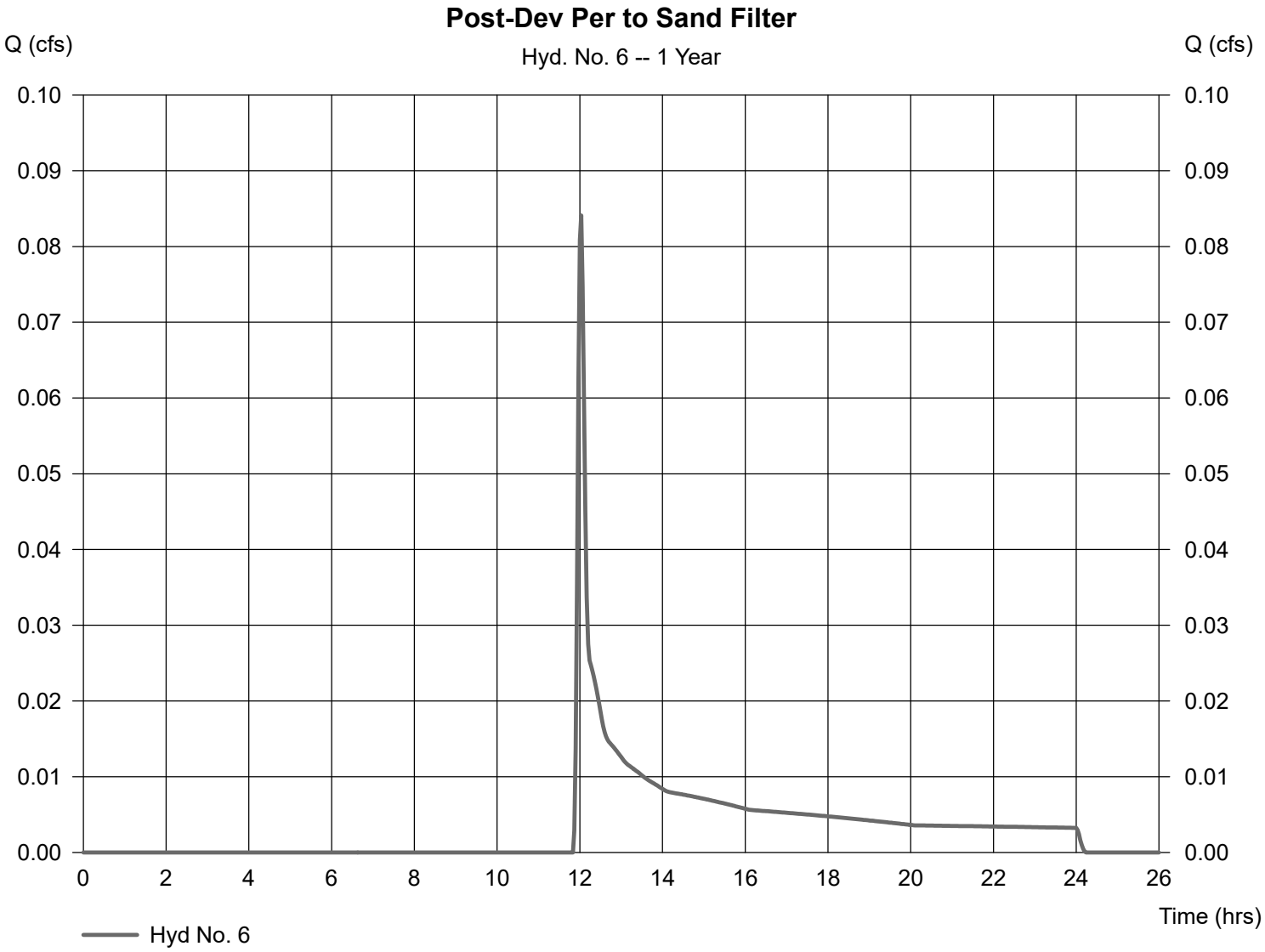
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Thursday, Sep 2, 2021

Hyd. No. 6

Post-Dev Per to Sand Filter

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.084 cfs
Storm frequency	=	1 yrs	Time to peak	=	12.03 hrs
Time interval	=	2 min	Hyd. volume	=	318 cuft
Drainage area	=	0.300 ac	Curve number	=	61
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	USER	Time of conc. (Tc)	=	9.30 min
Total precip.	=	2.80 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484



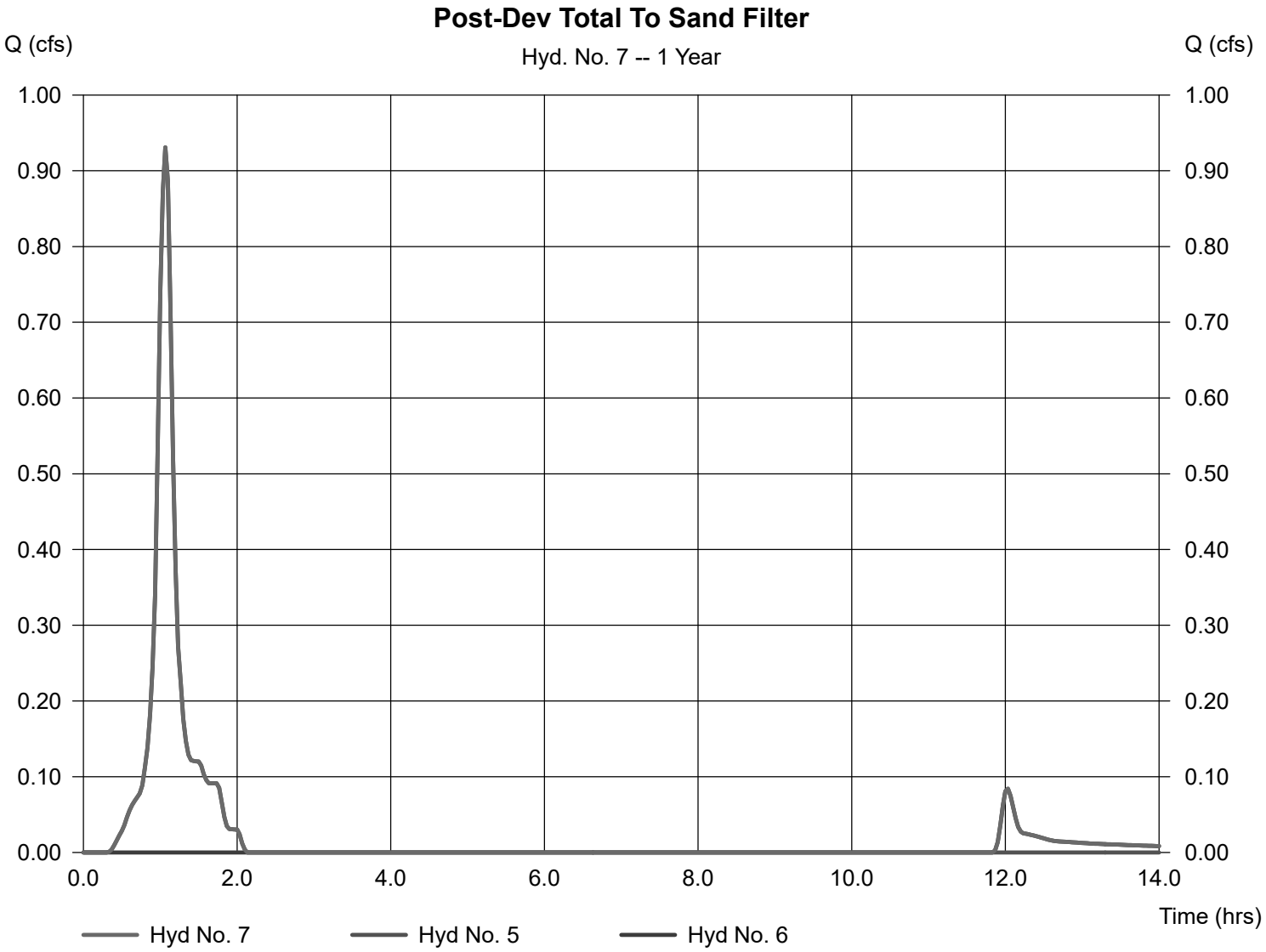
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Thursday, Sep 2, 2021

Hyd. No. 7

Post-Dev Total To Sand Filter

Hydrograph type	= Combine	Peak discharge	= 0.931 cfs
Storm frequency	= 1 yrs	Time to peak	= 1.07 hrs
Time interval	= 2 min	Hyd. volume	= 1,480 cuft
Inflow hyds.	= 5, 6	Contrib. drain. area	= 0.630 ac



Hydrograph Report

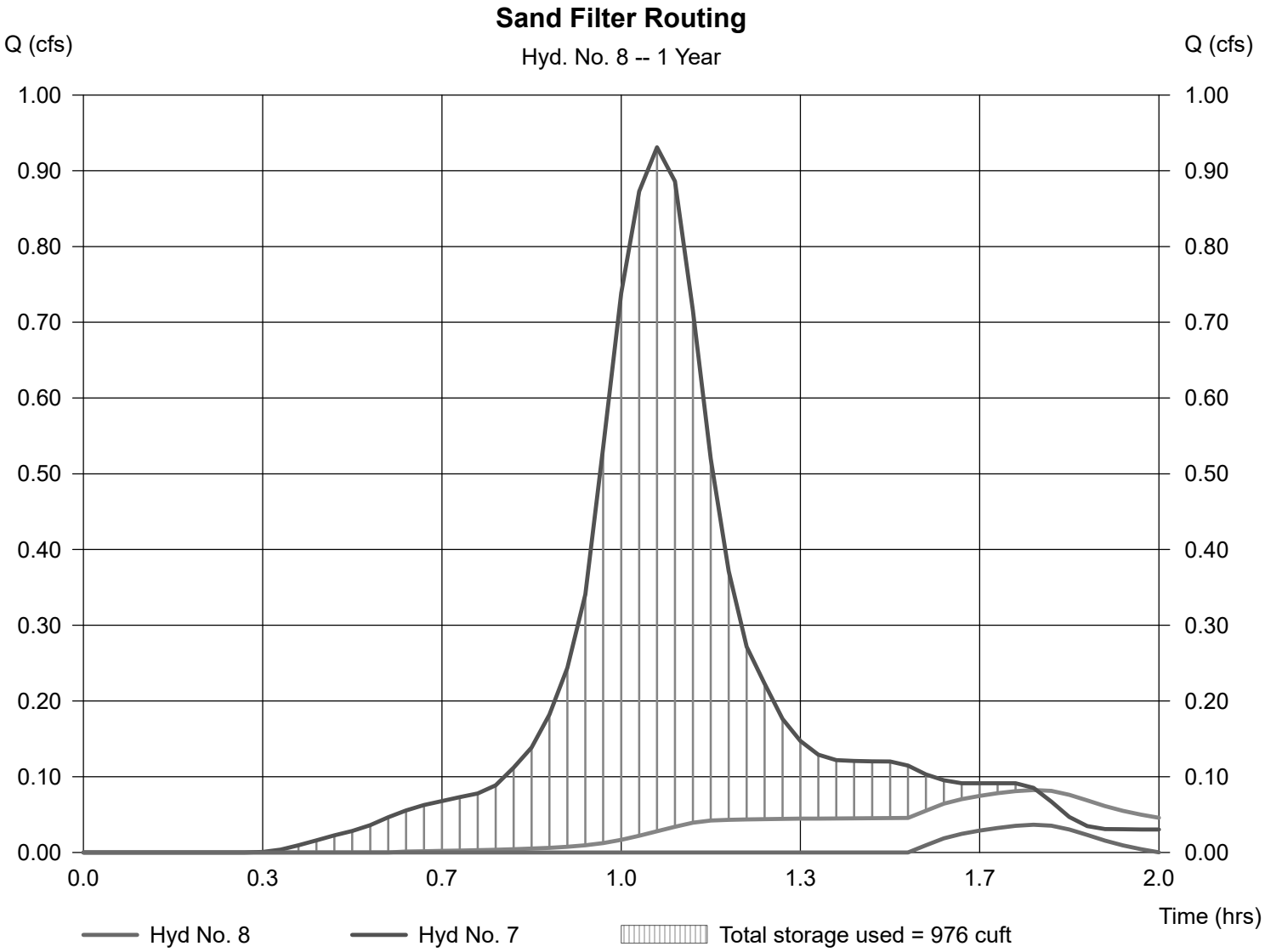
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Thursday, Sep 2, 2021

Hyd. No. 8

Sand Filter Routing

Hydrograph type	= Reservoir	Peak discharge	= 0.037 cfs
Storm frequency	= 1 yrs	Time to peak	= 1.77 hrs
Time interval	= 2 min	Hyd. volume	= 37 cuft
Inflow hyd. No.	= 7 - Post-Dev Total To Sand Filter	Max. Elevation	= 239.22 ft
Reservoir name	= Sand Filter	Max. Storage	= 976 cuft

Storage Indication method used. Exfiltration extracted from Outflow.



Pond Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Thursday, Sep 2, 2021

Pond No. 3 - Sand Filter

Pond Data

Contours - User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 238.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	238.00	581	0	0
1.00	239.00	907	738	738
2.00	240.00	1,291	1,093	1,831

Culvert / Orifice Structures

		[A]	[B]	[C]	[PrfRsr]
Rise (in)	=	0.00	0.00	0.00	0.00
Span (in)	=	0.00	0.00	0.00	0.00
No. Barrels	=	1	0	0	0
Invert El. (ft)	=	0.00	0.00	0.00	0.00
Length (ft)	=	0.00	0.00	0.00	0.00
Slope (%)	=	0.00	0.00	0.00	n/a
N-Value	=	.013	.013	.013	n/a
Orifice Coeff.	=	0.60	0.60	0.60	0.60
Multi-Stage	=	n/a	No	No	No

Weir Structures

		[A]	[B]	[C]	[D]
Crest Len (ft)	=	2.00	0.00	0.00	0.00
Crest El. (ft)	=	239.20	0.00	0.00	0.00
Weir Coeff.	=	3.33	3.33	3.33	3.33
Weir Type	=	Rect	---	---	---
Multi-Stage	=	No	No	No	No

Exfil.(in/hr)	=	2.000 (by Contour)
TW Elev. (ft)	=	0.00

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
0.00	0	238.00	---	---	---	---	0.00	---	---	---	0.000	---	0.000
1.00	738	239.00	---	---	---	---	0.00	---	---	---	0.042	---	0.042
2.00	1,831	240.00	---	---	---	---	4.77	---	---	---	0.060	---	4.825

State of New Jersey

PHILIP D. MURPHY
Governor

SHEILA Y. OLIVER
Lt. Governor

Division of Water Quality
Bureau of Nonpoint Pollution Control
401 East State Street
P.O. Box 420 Mail Code 401-02B
Trenton, New Jersey 08625-0420
Phone: 609-633-7021 / Fax: 609-777-0432
http://www.state.nj.us/dep/dwq/bnpc_home.htm

CATHERINE R. McCABE
Commissioner

February 10, 2020

Jeremy Fink, P.E.
Principal Product Development Engineer
Hydro International
94 Hutchins Drive
Portland, ME 04102

Re: MTD Laboratory Certification
Up-Flo® Filter EMC (Extended Maintenance Cartridge)
Off-line Installation

TSS Removal Rate 80%

Dear Mr. Fink:

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 EMC.

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 (dated January 2020) for this device is published online at http://www.njcat.org/uploads/newDocs/NJCATUPFLOFILTERwithEXTMAINTCARTFINAL.pdf.

The NJDEP certifies the use of the Up-Flo® Filter EMC 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 0.96 gpm/sf of effective filtration treatment area.

2. The Up-Flo® Filter EMC 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 EMC, which is attached to this document. However, it is recommended to review the maintenance website at https://www.hydro-int.com/sites/default/files/up-flo_filter_emc_operation_maintenance_manual.pdf for any changes to the maintenance requirements.

6. Sizing Requirements:

   The example below demonstrates the sizing procedure for an Up-Flo® Filter EMC. After determining the number of filter modules necessary, the corresponding model selection must be appropriate to hold at least that minimum number of filters.

   Example: A 0.25-acre impervious site is to be treated to 80% TSS removal using an Up-Flo® Filter EMC. 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 EMC 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 EMC in this example is 0.25 acres. Based upon the information in Tables 1 and 2 below, the following minimum

configuration is required for an Up-Flo® Filter EMC to treat the impervious area without exceeding the maximum drainage area:

Using Table 2, all vault sizes for the 18", 27", 36" and 48" cartridges would be able to treat runoff without exceeding the maximum allowable drainage area. A minimum of 5, 4, 3, or 2 cartridges for the 18", 27", 36", or 48" cartridge sizes, respectively, would be required to avoid exceeding the maximum allowable drainage area.

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 = 0.99 x 3.2x 0.25=0.79 cfs = 0.79 x 448.83 gpm/cfs = 354.58 gpm

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

For 18" cartridge: 8 x 18.5 ft. vault size with 66 cartridges
For 27" cartridge: 8 x 10 ft. or 6 x 14 ft. vault size with 40 cartridges
For 36" cartridge: 8 x 8 ft. or 6 x 10 ft. vault size with 29 cartridges
For 48" cartridge: 6 x 8 ft. vault size with 21 cartridges

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 in the Design Specifications and Vault Arrangements noted below.

Table 1: Up-Flo® Filter EMC Cartridge Design Specifications

Individual Cartridge Height (inches)	MTFR (gpm)	MTFR (cfs)	Max Drainage Area Per Cartridge (acre)
18	5.40	0.012	0.05
27	8.90	0.020	0.08
36	12.4	0.028	0.12
48	17.0	0.038	0.16

Table 2: Up-Flo® Filter EMC Typical Vault Arrangements*

			18-inch Cartridge			27-inch Cartridge			36-inch Cartridge			48-inch Cartridge		
Vault Size (ft.)	Width (ft.)	Vault Length (ft.)	Max. No. Carts.	MTFR (cfs)	Max Drain Area (ac)	Max. No. Carts.	MTFR (cfs)	Max Drain Area (ac)	No. Carts.	MTFR (cfs)	Max Drain Area (ac)	Max. No. Carts.	MTFR (cfs)	Max Drain Area (ac)
4x4	4	4	6	0.071	0.31	6	0.118	0.51	6	0.165	0.71	6	0.227	0.97
4x6	4	6	11	0.134	0.57	11	0.218	0.93	11	0.303	1.29	11	0.417	1.78
4x8	4	8	15	0.180	0.77	15	0.296	1.27	15	0.412	1.76	15	0.568	2.43
6x6	6	6	17	0.205	0.87	17	0.336	1.44	17	0.468	2.00	15	0.568	2.43
6x8	6	8	24	0.290	1.23	24	0.475	2.03	23	0.633	2.70	23	0.871	3.72
6x10	6	10	31	0.374	1.59	30	0.595	2.54	30	0.827	3.53	28	1.061	4.53
6x12	6	12	38	0.459	1.95	37	0.733	3.13	35	0.965	4.12	34	1.288	5.50
6x14	6	14	45	0.541	2.31	44	0.871	3.72	41	1.130	4.82	39	1.477	6.31
8x8	8	8	32	0.385	1.65	31	0.613	2.62	30	0.827	3.53	29	1.098	4.69
8x10	8	10	41	0.495	2.11	40	0.791	3.38	38	1.047	4.47	36	1.364	5.82
8x13	8	13	55	0.664	2.83	49	0.970	4.14	50	1.377	5.88	46	1.742	7.44
8x14	8	14	59	0.711	3.03	57	1.130	4.82	53	1.459	6.23	49	1.856	7.92
8x15	8	15	63	0.760	3.24	61	1.208	5.15	57	1.571	6.70	53	2.007	8.57
8x18.5	8	18.5	80	0.965	4.12	75	1.484	6.34	70	1.927	8.23	64	2.424	10.35
8x24	8	24	102	1.230	5.25	96	1.900	8.11	87	2.397	10.23	79	2.992	12.77

*-Vault sizes are noted with the maximum number of cartridges.

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 Anthony Robalik or Minesh Patel of my office at (609) 633-7021.

Sincerely,

Gabriel Mahon, Chief
Bureau of Nonpoint Pollution Control

Attachment: Maintenance Plan

cc: Chron File
Richard Magee, NJCAT
Vince Mazzei, NJDEP - DLUR
James Murphy, NJDEP - BNPC
Anthony Robalik NJDEP – BNPC
Minesh Patel NJDEP – BNPC

APPENDIX - G:

GROUNDWATER RECHARGE ANALYSIS

New Jersey Groundwater Recharge Spreadsheet
Version 2.0
November 2003

Annual Groundwater Recharge Analysis (based on GSR-32)

Select Township ↓	Average Annual P (in)	Climatic Factor
HUNTERDON CO., CLINTON TOWN	46.8	1.54

Project Name:	Moebus
Description:	
Analysis Date:	11/05/19

Pre-Developed Conditions

Land Segment	Area (acres)	TR-55 Land Cover	Soil	Annual Recharge (in)	Annual Recharge (cu.ft)
1	23.24	Open space	Duffield	15.3	1,288,533
2	2.46	Woods-grass combination	Duffield	15.7	140,005
3	3	Open space	Birdsboro	15.3	166,197
4	0.2	Woods-grass combination	Birdsboro	15.8	11,455
5	2.94	Open space	Haledon	12.9	137,471
6	0.44	Woods-grass combination	Haledon	13.9	22,225
7	0.16	Open space	Udorthents	0.0	-
8	0.64	Impervious areas	Duffield	0.0	-
9					
10					
11					
12					
13					
14	0				
15	0				
Total =	33.1			Total Annual Recharge (in)	Total Annual Recharge (cu-ft)
				14.7	1,765,885

Post-Developed Conditions

Land Segment	Area (acres)	TR-55 Land Cover	Soil	Annual Recharge (in)	Annual Recharge (cu.ft)
1	17.18	Open space	Duffield	15.3	952,539
2	2.14	Woods-grass combination	Duffield	15.7	121,793
3	2.05	Open space	Birdsboro	15.3	113,568
4	0.2	Woods-grass combination	Birdsboro	15.8	11,455
5	2.43	Open space	Haledon	12.9	113,624
6	0.44	Woods-grass combination	Haledon	13.9	22,225
7	0.16	Open space	Udorthents	0.0	-
8	8.48	Impervious areas	Duffield	0.0	-
9					
10					
11					
12					
13					
14	0				
15	0				
Total =	33.1			Total Annual Recharge (in)	Total Annual Recharge (cu.ft)
				11.1	1,335,203

Annual Recharge Requirements Calculation ↓

% of Pre-Developed Annual Recharge to Preserve =	100%	Total Impervious Area (sq.ft)	369,389
Post-Development Annual Recharge Deficit=	***430,682***	(cubic feet)	

Recharge Efficiency Parameters Calculations (area averages)

RWC=	5.41	(in)	DRWC=	5.41	(in)
ERWC =	1.24	(in)	EDRWC=	1.24	(in)

Procedure to fill the Pre-Development and Post-Development Conditions Tables

For each land segment, first enter the area, then select TR-55 Land Cover, then select Soil. Start from the top of the table and proceed downward. Don't leave blank rows (with A=0) in between your segment entries. Rows with A=0 will not be displayed or used in calculations. For impervious areas outside of standard lots select "Impervious Areas" as the Land Cover. Soil type for impervious areas are only required if an infiltration facility will be built within these areas.

Project Name	Description	Analysis Date	BMP or LID Type
Moebus	0	11/05/19	

Recharge BMP Input Parameters

Parameter	Symbol	Value	Unit
BMP Area	ABMP	5714.2	sq.ft
BMP Effective Depth, this is the design variable	dBMP	16.0	in
Upper level of the BMP surface (negative if above ground)	dBMPu	-16.0	in
Depth of lower surface of BMP, must be>=dBMPu	dEXC	0.0	in
Post-development Land Segment Location of BMP , Input Zero if Location is distributed or undetermined	SegBMP	1	unitless

Root Zone Water capacity Calculated Parameters

Parameter	Symbol	Value	Unit
Empty Portion of RWC under Post-D Natural Recharge	ERWC	1.42	in
ERWC Modified to consider dEXC	EDRWC	1.42	in
Empty Portion of RWC under Infilt. BMP	RERWC	1.11	in

Recharge Design Parameters

Parameter	Symbol	Value	Unit
Inches of Runoff to capture	Qdesign	0.25	in
Inches of Rainfall to capture	Pdesign	0.34	in
Recharge Provided Avg. over Imp. Area		14.0	in
Runoff Captured Avg. over imp. Area		15.4	in

BMP Calculated Size Parameters

ABMP/Aimp	Aratio	0.02	unitless
BMP Volume	VBMP	7,619	cu.ft

CALCULATION CHECK MESSAGES

Volume Balance-> **OK**
dBMP Check---> **OK**
dEXC Check---> **OK**
BMP Location---> **OK**

Parameters from Annual Recharge Worksheet

Post-D Deficit Recharge (or desired recharge volume)	Vdef	430,682	cu.ft
Post-D Impervious Area (or target Impervious Area)	Aimp	369,389	sq.ft
Root Zone Water Capacity	RWC	6.18	in
RWC Modified to consider dEXC	DRWC	6.18	in
Climatic Factor	C-factor	1.54	no units
Average Annual P	Pavg	46.8	in
Recharge Requirement over Imp. Area	dr	14.0	in

System Performance Calculated Parameters

Annual BMP Recharge Volume		430,682	cu.ft
Avg BMP Recharge Efficiency		91.1%	Represents % Infiltration Recharged
%Rainfall became Runoff		78.1%	%
%Runoff Infiltrated		42.0%	%
%Runoff Recharged		38.3%	%
%Rainfall Recharged		29.9%	%

OTHER NOTES

Pdesign is accurate only after BMP dimensions are updated to make rech volume= deficit volume. The portion of BMP infiltration prior to filling and the area occupied by BMP are ignored in these calculations. Results are sensetive to dBMP, make sure dBMP selected is small enough for BMP to empty in less than 3 days. For land Segment Location of BMP if you select "impervious areas" RWC will be minimal but not zero as determined by the soil type and a shallow root zone for this Land Cover allowing consideration of lateral flow and other losses.

How to solve for different recharge volumes: By default the spreadsheet assigns the values of total deficit recharge volume "Vdef" and total proposed impervious area "Aimp" from the "Annual Recharge" sheet to "Vdef" and "Aimp" on this page. This allows solution for a single BMP to handle the entire recharge requirement assuming the runoff from entire impervious area is available to the BMP.
To solve for a smaller BMP or a LID-IMP to recharge only part of the recharge requirement, set Vdef to your target value and Aimp to impervious area directly connected to your infiltration facility and then solve for ABMP or dBMP. To go back to the default configuration clik the "Default Vdef & Aimp" button.

APPENDIX - H:

SOIL EROSION MEASURES

Concept Engineering Consultants, P.A.

227 Route #33 East, Bldg #2, Unit #7
Manalapan, NJ 07726

Date: 9/25/2020
Project: Clinton
Project No: 032606

Calculated By: BH
Checked By:

Conduit Outlet Protection Calculations

Scour Hole # 1

Design Parameters:

Design Storm Flow for 25 Year, Q	35.00	cfs
Vertical Dimension of Outlet Pipe, D_o	30	in
Horizontal Dimension of Outlet Pipe, W_o	30	in
Tailwater Depth, TW[1]	2.00	ft
Scour Hole Depth, y (1/2 D_o or D_o)	15	in

Apron Dimension Calculations:

Minimum Bottom Width, $W_1 = 2W_o$	W_1 =	5.00 ft
Minimum Bottom Length, $L_1 = 3D_o$	L_1 =	7.50 ft
Minimum Top Width *(max side slope of 3:1)*, W_2	W_2 =	12.50 ft
Minimum Top Length *(max side slope of 3:1)*, L_2	L_2 =	15.00 ft

Rip Rap Stone Size Calculations:

Unit Dicharge, $q = Q/D_o$ = 14.00 cfs per foot

- **Case I: $y = 1/2\ D_o$**

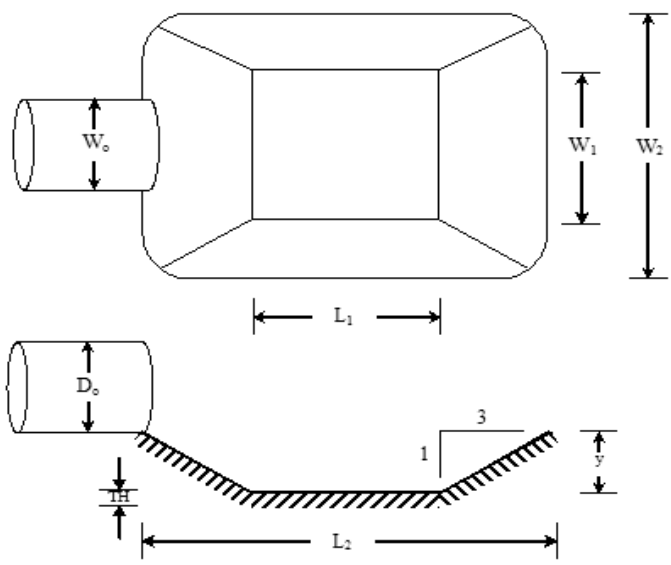
  Median Stone, $d_{50} = \dfrac{0.0125\ q^{1.33}}{TW}$ = 2.51 in Therefore, use ***d50* = 6 in**

  Apron Thickness, $TH = 2 \times d_{50}$ with filter fabric . . . . . ***TH* = 12 in**

- **Case II: $y = D_o$**

  Median Stone, $d_{50} = \dfrac{0.0082\ q^{1.33}}{TW}$ =

  Apron Thickness, $TH = 2 \times d_{50}$ with filter fabric . . . . . .



Notes:

1. The side slopes shall be 3:1 or flatter.
2. The bottom grade shall be 0.0% (level).
3. There shall be no overfall at the end of the apron or at the end of the culvert.
4. Fifty (50) percent by weight of the rip-rap mixture shall be smaller than the median size stone designated as d_{50}. The largest stone size in the mixture shall be 1.5 times the d_{50} size. The rip-rap shall be reasonably well graded.
5. The thickness of the rip-rap apron may be two (2) times the median stone diameter provided that the apron is constructed on a bedding of four (4) inches of 3/4 inch clean stone on approved filter fabric material.
6. Rip-rap and filter fabric shall meet the standards of the governing Soil Conservation District as well as the requirements of the local municipality.
7. Where the scour hole is to be placed within an existing or proposed waterway:
   a. The scour hole sidewalls should be eliminated to maintain a smooth hydraulic line along the waterway bottom to avoid inviting turbulent flow from a sudden depression in the waterway.
   b. If the flow in the waterway is greater than the flow from the proposed outlet, the rip-rap used to construct the scour hole should be sized based on the greater flow value according to the standard rip-rap.

Footnote:

1. Tailwater depth shall be the 2 year storm if discharging into a detention basin. For areas where tailwater cannot be computed, use $TW = 0.2D_o$.

Concept Engineering Consultants, P.A.

227 Route #33 East, Bldg #2, Unit #7
Manalapan, NJ 07726

Date: 9/25/2020
Project: Clinton
Project No: 032606

Calculated By: BH
Checked By:

Conduit Outlet Protection Calculations

Scour Hole # 2

Design Parameters:

Design Storm Flow for 25 Year, Q	11.00	cfs
Vertical Dimension of Outlet Pipe, D_o	15	in
Horizontal Dimension of Outlet Pipe, W_o	15	in
Tailwater Depth, TW[1]	2.00	ft
Scour Hole Depth, y (1/2 D_o or D_o)	8	in

Apron Dimension Calculations:

Minimum Bottom Width, $W_1 = 2W_o$	W_1 = **2.50 ft**
Minimum Bottom Length, $L_1 = 3D_o$	L_1 = **3.75 ft**
Minimum Top Width *(max side slope of 3:1)*, W_2	W_2 = **6.25 ft**
Minimum Top Length *(max side slope of 3:1)*, L_2	L_2 = **7.50 ft**

Rip Rap Stone Size Calculations:

Unit Dicharge, $q = Q/D_o$ = 8.80 cfs per foot

- **Case I: $y = 1/2\ D_o$**

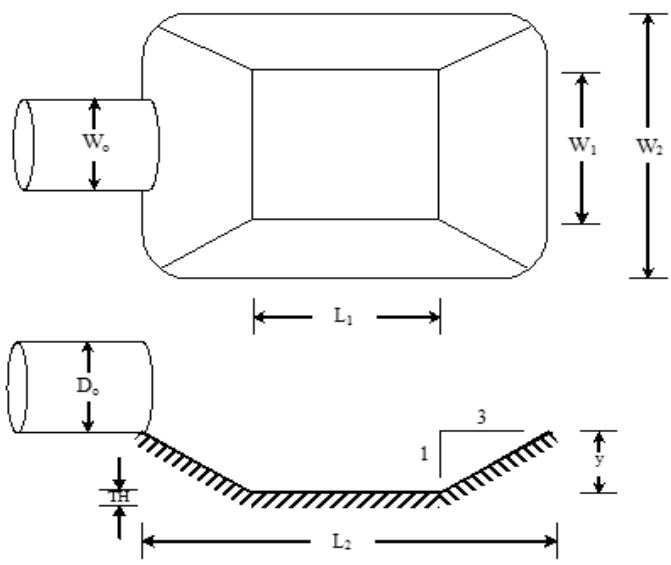
  Median Stone, $d_{50} = \dfrac{0.0125\ q^{1.33}}{TW}$ = 1.35 in Therefore, use ***d50* = 6 in**

  Apron Thickness, $TH = 2 \times d_{50}$ with filter fabric . . . . . ***TH* = 12 in**

- **Case II: $y = D_o$**

  Median Stone, $d_{50} = \dfrac{0.0082\ q^{1.33}}{TW}$ =

  Apron Thickness, $TH = 2 \times d_{50}$ with filter fabric . . . . . .



Notes:

1. The side slopes shall be 3:1 or flatter.
2. The bottom grade shall be 0.0% (level).
3. There shall be no overfall at the end of the apron or at the end of the culvert.
4. Fifty (50) percent by weight of the rip-rap mixture shall be smaller than the median size stone designated as d_{50}. The largest stone size in the mixture shall be 1.5 times the d_{50} size. The rip-rap shall be reasonably well graded.
5. The thickness of the rip-rap apron may be two (2) times the median stone diameter provided that the apron is constructed on a bedding of four (4) inches of 3/4 inch clean stone on approved filter fabric material.
6. Rip-rap and filter fabric shall meet the standards of the governing Soil Conservation District as well as the requirements of the local municipality.
7. Where the scour hole is to be placed within an existing or proposed waterway:
   a. The scour hole sidewalls should be eliminated to maintain a smooth hydraulic line along the waterway bottom to avoid inviting turbulent flow from a sudden depression in the waterway.
   b. If the flow in the waterway is greater than the flow from the proposed outlet, the rip-rap used to construct the scour hole should be sized based on the greater flow value according to the standard rip-rap.

Footnote:

1. Tailwater depth shall be the 2 year storm if discharging into a detention basin. For areas where tailwater cannot be computed, use $TW = 0.2D_o$.

Concept Engineering Consultants, P.A.

227 Route #33 East, Bldg #2, Unit #7
Manalapan, NJ 07726

Date: 8/10/2020
Project: Clinton,nj
Project No: 032606

Calculated By: BH
Checked By:

Conduit Outlet Protection Calculations

Scour Hole # 3

Design Parameters:

Design Storm Flow for 25 Year, Q	28.50	cfs
Vertical Dimension of Outlet Pipe, D_o	30	in
Horizontal Dimension of Outlet Pipe, W_o	30	in
Tailwater Depth, TW[1]	1.00	ft
Scour Hole Depth, y (1/2 D_o or D_o)	15	in

Apron Dimension Calculations:

Minimum Bottom Width, $W_1 = 2W_o$	W_1 =	5.00 ft
Minimum Bottom Length, $L_1 = 3D_o$	L_1 =	7.50 ft
Minimum Top Width *(max side slope of 3:1)*, W_2	W_2 =	12.50 ft
Minimum Top Length *(max side slope of 3:1)*, L_2	L_2 =	15.00 ft

Rip Rap Stone Size Calculations:

Unit Dicharge, $q = Q/D_o$ = 11.40 cfs per foot

- **Case I: $y = 1/2\ D_o$**

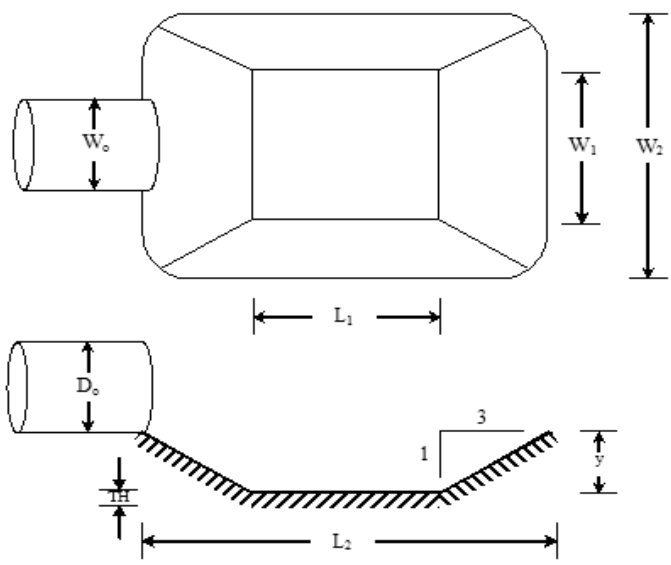
  Median Stone, $d_{50} = \dfrac{0.0125\ q^{1.33}}{TW}$ = 3.82 in Therefore, use ***d50* = 6 in**

  Apron Thickness, $TH = 2 \times d_{50}$ with filter fabric . . . . . ***TH* = 12 in**

- **Case II: $y = D_o$**

  Median Stone, $d_{50} = \dfrac{0.0082\ q^{1.33}}{TW}$ =

  Apron Thickness, $TH = 2 \times d_{50}$ with filter fabric . . . . . .



Notes:

1. The side slopes shall be 3:1 or flatter.
2. The bottom grade shall be 0.0% (level).
3. There shall be no overfall at the end of the apron or at the end of the culvert.
4. Fifty (50) percent by weight of the rip-rap mixture shall be smaller than the median size stone designated as d_{50}. The largest stone size in the mixture shall be 1.5 times the d_{50} size. The rip-rap shall be reasonably well graded.
5. The thickness of the rip-rap apron may be two (2) times the median stone diameter provided that the apron is constructed on a bedding of four (4) inches of 3/4 inch clean stone on approved filter fabric material.
6. Rip-rap and filter fabric shall meet the standards of the governing Soil Conservation District as well as the requirements of the local municipality.
7. Where the scour hole is to be placed within an existing or proposed waterway:
   a. The scour hole sidewalls should be eliminated to maintain a smooth hydraulic line along the waterway bottom to avoid inviting turbulent flow from a sudden depression in the waterway.
   b. If the flow in the waterway is greater than the flow from the proposed outlet, the rip-rap used to construct the scour hole should be sized based on the greater flow value according to the standard rip-rap.

Footnote:

1. Tailwater depth shall be the 2 year storm if discharging into a detention basin. For areas where tailwater cannot be computed, use $TW = 0.2D_o$.

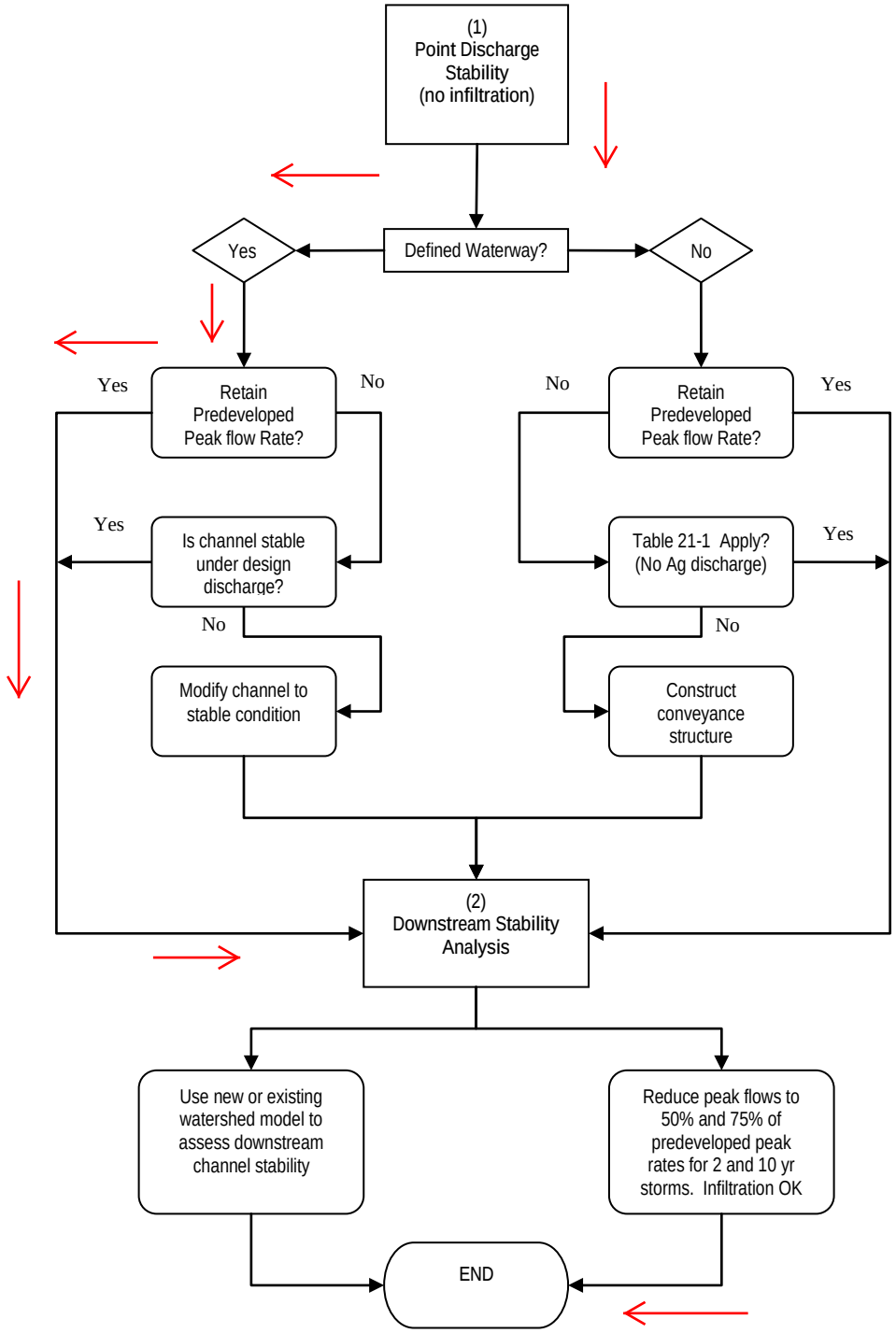
Offsite Stability Compliance.

The flow chart Figure 21-1 is provided in this appendix. The Project discharges the runoff to Well Defined waterway.

The project is designed to reduce the peak rate of flow from site for 2, 10 and 100 year storm as required by NJDEP storm water standards.

Based on above, the project meets the offsite stability standards.

Figure 21–1
Point Discharge and Downstream Stability Analysis Procedure



Return to TOC

APPENDIX - I:

STORMWATER MANAGEMENT MAINTENANCE PLAN (ATTACHED SEPARATELY)

APPENDIX - J:

SOIL LOG

SOIL LOG

Project Name:	Clinton Moebus 34, LLC	Boring #:	SL-2
Client Project #:		E&LP Project #:	8144
Location:	Town of Clinton, Hunterdon County	Total Depth:	
Date Drilled:	2/17/2020	Static Groundwater Level:	
Drilling Contractor:		Ground Surface Elevation:	Not Surveyed
Drilling Method:		Sampling Equipment:	--
Drilling Equipment:		Casing Equipment:	--
Drilling Angle:		Logged by:	MP

Depth Below Surface (Feet)	Blow Count 6"-6"-6"-6"	Recovery (in)	Sample Interval	Sample ID#	Lithologic Description	Comments	Depth Below Surface (Feet)
0.0					12" Topsoil;	No mottling or evidence of groundwater	0.0
0.5							0.5
1.0							1.0
1.5					Silty Clay; 10 YR 4/6; Subang Blocky; Dry; Friable Sample A @ 4'-5'	No mottling or evidence of groundwater	1.5
2.0							2.0
2.5							2.5
3.0							3.0
3.5							3.5
4.0							4.0
4.5							4.5
5.0							5.0
5.5							5.5
6.0							6.0
6.5					Silty Clay; 10 YR 6/6; 10% Gravel, 10% Cobble Subang Blocky; Moist; Friable Sample B @ 7'-7.5'	No mottling or evidence of groundwater	6.5
7.0							7.0
7.5							7.5
8.0							8.0
8.5					Silty Clay;10 YR 5/3; 10% Gravel, 10% Cobble Subang Blocky; Moist; Friable Sample C @ 9'-9.5'	Many signs of mottling (20%<) Distinct, Coarse (>15mm) Depth to 95"	8.5
9.0							9.0
9.5							9.5
10.0							10.0
10.5							10.5
11.0							11.0
11.5							11.5
12.0							12.0
12.5							12.5
13.0							13.0
13.5							13.5
14.0							14.0
14.5							14.5
15.0							15.0
15.5							15.5
16.0							16.0
16.5							16.5
17.0							17.0
17.5							17.5
18.0							18.0
18.5							18.5
19.0							19.0
19.5							19.5
20.0							20.0
20.5							20.5
21.0							21.0
21.5							21.5
22.0							22.0
22.5							22.5
23.0							23.0
23.5							23.5
24.0							24.0
24.5							24.5
25.0							25.0

SOIL LOG

Project Name:	Clinton Moebus 34, LLC	Boring #:	SL-3
Client Project #:		E&LP Project #:	8144
Location:	Town of Clinton, Hunterdon County	Total Depth:	
Date Drilled:	2/17/2020	Static Groundwater Level:	
Drilling Contractor:		Ground Surface Elevation:	Not Surveyed
Drilling Method:		Sampling Equipment:	--
Drilling Equipment:		Casing Equipment:	--
Drilling Angle:		Logged by:	MP

Depth Below Surface (Feet)	Blow Count 6"-6"-6"-6"	Recovery (in)	Sample Interval	Sample ID#	Lithologic Description	Comments	Depth Below Surface (Feet)
0.0					15" Topsoil;	No mottling or evidence of groundwater	0.0
0.5							0.5
1.0							1.0
1.5							1.5
2.0					Silty Clay; 10 YR 4/6; Subang Blocky; Moist; Friable Sample A @ 4'-5.5'	No mottling or evidence of groundwater	2.0
2.5							2.5
3.0							3.0
3.5							3.5
4.0							4.0
4.5							4.5
5.0							5.0
5.5							5.5
6.0							6.0
6.5					Silty Clay; 10 YR 6/6; Subang Blocky; Moist; Friable Sample B @ 7'-7.5'	No mottling. Evidence of seepage @ 127"	6.5
7.0							7.0
7.5							7.5
8.0							8.0
8.5							8.5
9.0							9.0
9.5							9.5
10.0							10.0
10.5							10.5
11.0							11.0
11.5							11.5
12.0							12.0
12.5							12.5
13.0							13.0
13.5							13.5
14.0							14.0
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15.0							15.0
15.5							15.5
16.0							16.0
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22.5							22.5
23.0							23.0
23.5							23.5
24.0							24.0
24.5							24.5
25.0							25.0

SOIL LOG

Project Name:	Clinton Moebus 34, LLC	Boring #:	SL-13
Client Project #:		E&LP Project #:	8144
Location:	Town of Clinton, Hunterdon County	Total Depth:	
Date Drilled:	2/17/2020	Static Groundwater Level:	
Drilling Contractor:		Ground Surface Elevation:	Not Surveyed
Drilling Method:		Sampling Equipment:	--
Drilling Equipment:		Casing Equipment:	--
Drilling Angle:		Logged by:	MP

Depth Below Surface (Feet)	Blow Count 6"-6"-6"-6"	Recovery (in)	Sample Interval	Sample ID#	Lithologic Description	Comments	Depth Below Surface (Feet)
0.0							0.0
0.5					10" Topsoil;	No mottling or evidence of groundwater	0.5
1.0							1.0
1.5							1.5
2.0						No mottling or evidence of groundwater	2.0
2.5							2.5
3.0					Silty Clay; 10 YR 5/8; Subang Blocky; Dry; Friable		3.0
3.5						Side of depressed land is more than 50% rock @ 4FT	3.5
4.0							4.0
4.5							4.5
5.0							5.0
5.5							5.5
6.0					Silty Clay; 10 YR 4/6; 10% Gravel, 30% Cobble, 30% Stone Subang Blocky; Dry; Friable	No mottling or evidence of groundwater.	6.0
6.5							6.5
7.0							7.0
7.5							7.5
8.0					**Refusal @ 96"**		8.0
8.5							8.5
9.0							9.0
9.5							9.5
10.0							10.0
10.5							10.5
11.0							11.0
11.5							11.5
12.0							12.0
12.5							12.5
13.0							13.0
13.5							13.5
14.0							14.0
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19.0							19.0
19.5							19.5
20.0							20.0
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21.0							21.0
21.5							21.5
22.0							22.0
22.5							22.5
23.0							23.0
23.5							23.5
24.0							24.0
24.5							24.5
25.0							25.0

Engineering & Land Planning Associates

Project:	Moebus	Date:	2/26/2020
Location:	Clinton Township	Sample:	IN PLACE
Test By:	Annika Asplund		SL-2 @ C (9'-9.5')

				Disturbed	
L=	6.000	T1=	635	Tube Weight	700
H1=	7.500	T2=	1339	Gross Weight	1,558
H2=	6.000	T3=	1389	Net Weight	858
r=	1.125	T4=	1722		
R=	1.125	T5=	1761	Sample Vol. (in^3)	23.844375
		T(sec.)=	1761	(cm^3)	390.8093063
		T(min.)=	29.35		
				Bulk Density	2.195444137
					min. 1.2 gr/cm^3

Soil Permeability: 2.74

Soil Class: K3

Engineering & Land Planning Associates

Project:	Moebus	Date:	2/27/2020
Location:	Clinton Township	Sample:	IN PLACE
Test By:	Annika Asplund		SL-3 @ B (7'-7.5')

L=	6.000	T1=	5613
H1=	7.500	T2=	6170
H2=	6.000	T3=	5298
r=	1.125	T4=	5979
R=	1.125	T5=	5799
		T(sec.)=	5799
		T(min.)=	96.65

Soil Permeability: 0.83

Soil Class: K2

Disturbed	
Tube Weight	700
Gross Weight	1,171
Net Weight	471
Sample Vol. (in^3)	23.844375
(cm^3)	390.8093063
Bulk Density	1.205191362
	min. 1.2 gr/cm^3

APPENDIX K:

GROUNDWATER MOUNDING ANALYSIS

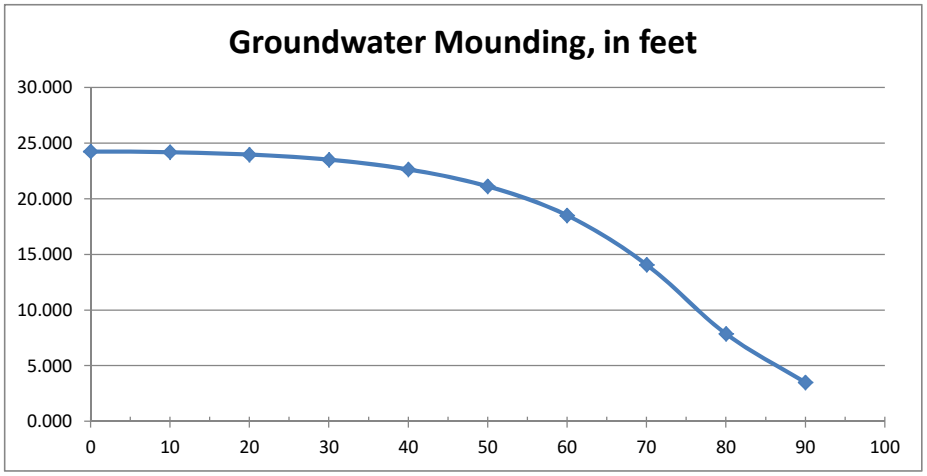
Input Values

1.78	R	Recharge rate (permeability rate) (in/hr)
0.150	Sy	Specific yield, Sy (dimensionless) default value is 0.15; max value is 0.2 provided that a lab test data is submitted
1.78	Kh	Horizontal hydraulic conductivity (in/hr) Kh = 5xRecharge Rate (R) in the costal plan; Kh=R outside the coastal plan
72.500	x	1/2 length of basin (x direction, in feet)
50.000	y	1/2 width of basin (y direction, in feet)
25.92	t	Duration of infiltration period (hours)
10.00	hi(0)	Initial thickness of saturated zone (feet)

34.246	h(max)	Maximum thickness of saturated zone (beneath center of basin at end of infiltration period)
24.246	Δh(max)	Maximum groundwater mounding (beneath center of basin at end of infiltration period)

Ground-water Mounding, in feet	Distance from center of basin in x direction, in feet
24.246	0
24.183	10
23.966	20
23.504	30
22.638	40
21.110	50
18.511	60
14.076	70
7.858	80
3.496	90

Re-Calculate Now



Disclaimer

This spreadsheet solving the Hantush (1967) equation for ground-water mounding beneath an infiltration basin is made available to the general public as a convenience for those wishing to replicate values documented in the USGS Scientific Investigations Report 2010-5102 "Groundwater mounding beneath hypothetical stormwater infiltration basins" or to calculate values based on user-specified site conditions. Any changes made to the spreadsheet (other than values identified as user-specified) after transmission from the USGS could have unintended, undesirable consequences. These consequences could include, but may not be limited to: erroneous output, numerical instabilities, and violations of underlying assumptions that are inherent in results presented in the accompanying USGS published report. The USGS assumes no responsibility for the consequences of any changes made to the spreadsheet. If changes are made to the spreadsheet, the user is responsible for documenting the changes and justifying the results and conclusions.

APPENDIX - L:

LOW IMPACT CHECKLIST.

Low Impact Development Checklist

A checklist for identifying nonstructural stormwater management strategies incorporated into proposed land development

Municipality: Town Of Clinton

County: Hunterdon Date: 12-09-20

Review board or agency: Town of Clinton Planning Board

Proposed land development name: Clinton Commons

Lot(s): 32 Block(s): 14

Project or application number: 1337-18-006.1 (LOI Application #)

Applicant's name: Clinton Moebus 34, LLC

Applicant's address: 123 Route #33 East, Suite 204, Manalapan, NJ 07726

Telephone: 732-792-2750 Fax: 732-792-2740

Email address: brhalari@gmail.com

Designer's name: Engineering and Planning Associates, Inc

Designer's address: 140 West Main St, High Bridge, NJ 08829

Telephone: 908-238-0544 Fax: 908-238-9572

Email address: aranger@elp-inc.com

Part 1: Description of Nonstructural Approach to Site Design

In narrative form, provide an overall description of the nonstructural stormwater management approach and strategies incorporated into the proposed site's design. Attach additional pages as necessary. Details of each nonstructural strategy are provided in Part 3 below.

The subject property is located on Highway #31 in Town of Clinton, Hunterdon County, NJ. The property is consists of 28.06 ac and is currently being farmed. There is some wooded area located along the stream located along westerly property line.

The proposed design was arrived thru numerous meeting with township professionals. As a part of development, Applicant has proposed to dedicate 11.98 ac of land to Town of Clinton as open space. Additionally, the design also preserve 1.51 ac. of land as open space to the north of Central Ave.

The site has steep grades from east to west towards the stream. By eliminating the farm field and providing year around dense grass and storm water management, the project will reduce the soil erosion. Also, the proposed development will has less use of pesticide then a normal farm field.

We have also provided some grass swale behind the proposed residential development to slow down the flow and provide better water quality.

The site has Karst formation which limits many recharging opportunities.

Part 2: Review of Local Stormwater Management Regulations

Title and date of stormwater management regulations used in development design:

N.J.A.C. 7:8 – Current rules

Do regulations include nonstructural requirements? Yes: X No: _____

If yes, briefly describe: The storm water regulations has been adopted by Town.

List LID-BMPs prohibited by local regulations: None

Pre-design meeting held? Yes:_____ Date:_____ No: X

Meeting held with: _____

Pre-design site walk held? Yes:_____ Date:_____ No: X

Site walk held with: _____

Other agencies with stormwater review jurisdiction:

Name: Town of Clinton

Required approval: Preliminary and Final Site plan and subdivision approval

Name: Hunterdon County Soil Erosion district

Required approval: Certification of Plans

Name: NJDEP Freshwater wetlands and Flood Hazard area Rule, Highlands Municipal Referral Application

Required approval: G.P. #11 & FHA IP

Part 3: Nonstructural Strategies and LID-BMPs in Design

3.1 Vegetation and Landscaping

Effective management of both existing and proposed site vegetation can reduce a development's adverse impacts on groundwater recharges and runoff quality and quantity. This section of the checklist helps identify the vegetation and landscaping strategies and nonstructural LID-BMPs that have been incorporated into the proposed development's design to help maintain existing recharge rates and/or minimize or prevent increases in runoff quantity and pollutant loading.

A. Has an inventory of existing site vegetation been performed? Yes: X__No: _____

If yes, was this inventory a factor in the site's layout and design? Yes:___No: _____

B. Does the site design utilize any of the following nonstructural LID-BMPs?

Preservation of natural areas? Yes: X_____No:_____If yes, specify % of site: 94%(wooded area)_____

Native ground cover? Yes: X_____No:_____If yes, specify % of site: 50%__

Vegetated buffers? Yes: X_____No:_____If yes, specify % of site: 3%___

C. Do the land development regulations require these nonstructural LID-BMPs?

Preservation of natural areas? Yes:_____No: X_____If yes, specify % of site: _____

Native ground cover? Yes:_____No: X_____If yes, specify % of site: _____

Vegetated buffers? Yes:_____No: X_____If yes, specify % of site: _____

D. If vegetated filter strips or buffers are utilized, specify their functions: N/A

Reduce runoff volume increases through lower runoff coefficient: Yes:_____No: __

Reduce runoff pollutant loads through runoff treatment: Yes:_____No: _____

Maintain groundwater recharge by preserving natural areas: Yes:_____No: __

3.2 Minimize Land Disturbance

Minimizing land disturbance is a nonstructural LID-BMP that can be applied during both the development's construction and post-construction phases. This section of the checklist helps identify those land disturbance strategies and nonstructural LID-BMPs that have been incorporated into the proposed development's design to minimize land disturbance and the resultant change in the site's hydrologic character.

A. Have inventories of existing site soils and slopes been performed? Yes: X_____No: _

If yes, were these inventories factors in the site's layout and design? Yes: X_____No: _

B. Does the development's design utilize any of the following nonstructural LID-BMPs?

Restrict permanent site disturbance by land owners? Yes: X_____No: _____

If yes, how: Significant portion of the site is dedicated as open space (47.8% of the site)

Restrict temporary site disturbance during construction? Yes: X_____No: _____

If yes, how: By providing a silt fence defining the limit of disturbance clear during construction activities.

Consider soils and slopes in selecting disturbance limits? Yes: X_____No: _____

If yes, how: The development is located in the flat area of site away from stream

C. Specify percentage of site to be cleared: 50%_____Regraded: 50%

D. Specify percentage of cleared areas done so for buildings: 9.5%

For driveways and parking: 13.7%_____For roadways: 6.4%

E. What design criteria and/or site changes would be required to reduce the percentages in C and D above?

We have designed a multifamily and commercial project in a continuous uplands area. The rules allows to disturb much more.

F. Specify site's hydrologic soil group (HSG) percentages:

HSG A:_____ HSG B: 99.4% HSG C:_____ HSG D: 0.6%

G. Specify percentage of each HSG that will be permanently disturbed:

HSG A:_____ HSG B: 50% HSG C:_____ HSG D: 0%

H. Locating site disturbance within areas with less permeable soils (HSG C and D) and minimizing disturbance within areas with greater permeable soils (HSG A and B) can help maintain groundwater recharge rates and reduce runoff volume increases. In light of the HSG percentages in F and G above, what other practical measures if any can be taken to achieve this?

The site has only one type of the soil except for wetlands area. All development is located away from wetlands area.

I. Does the site include Karst topography? Yes: X_____ No: _____

If yes, discuss measures taken to limit Karst impacts:

All the recharge area are proposed in the proposed infiltration basin which is located at the down stream side of the project .

The ADS storm drainage piping system is proposed which will be installed water tight..

3.3 Impervious Area Management

New impervious surfaces at a development site can have the greatest adverse effect on groundwater recharge and stormwater quality and quantity. This section of the checklist helps identify those nonstructural strategies and LID-BMPs that have been incorporated into a proposed development's design to comprehensively manage the extent and impacts of new impervious surfaces.

A. Specify impervious cover at site: Existing: 0%_____Proposed: 31%_____

B. Specify maximum site impervious coverage allowed by regulations: 43.7%_____

C. Compare proposed street cartway widths with those required by regulations:

Type of Street	Proposed Cartway Width (feet)	Required Cartway Width (feet)
Residential access – low intensity		
Residential access – medium intensity		
Residential access – high intensity with parking	24	25
Residential access – high intensity without parking		
Neighborhood		
Minor collector – low intensity without parking		
Minor collector – with one parking lane		
Minor collector – with two parking lanes		
Minor collector – without parking		
Major collector		

D. Compare proposed parking space dimensions with those required by regulations:

Proposed: 9'x 18'& 10'x18'_____Regulations: 9'x18'_____

E. Compare proposed number of parking spaces with those required by regulations:

Proposed: 480_____Regulations: 306_____

F. Specify percentage of total site impervious cover created by buildings: 9.5%

By driveways and parking: 13.7%_____By roadways: 6.4%_____

G. What design criteria and/or site changes would be required to reduce the percentages in F above?

The commercial portion of the project is designed based on the need on each use. The users requires more parking

Then Town requirements. The townhomes are provided with two car garage which requires wide driveway.

As a result the residential use has more parking then required. We had to provide some parking for guest

And some parking for playground area.

H. Specify percentage of total impervious area that will be unconnected:

Total site: 7%__Buildings:70%_____Driveways and parking: 0%_____Roads: 0%_____

I. Specify percentage of total impervious area that will be porous:

Total site: 0%__Buildings:_____Driveways and parking:_____Roads: _____

J. Specify percentage of total building roof area that will be vegetated: 0%_____

K. Specify percentage of total parking area located beneath buildings: 23.3%_____

L. Specify percentage of total parking located within multi-level parking deck: 0%_____

3.4 Time of Concentration Modifications

Decreasing a site's time of concentration (Tc) can lead directly to increased site runoff rates which, in turn, can create new and/or aggravate existing erosion and flooding problems downstream. This section of the checklist helps identify those nonstructural strategies and LID-BMPs that have been incorporated into the proposed development's design to effectively minimize such Tc decreases.

When reviewing Tc modification strategies, it is important to remember that a drainage area's Tc should reflect the general conditions throughout the area. As a result, Tc modifications must generally be applied throughout a drainage area, not just along a specific Tc route.

A. Specify percentage of site's total stormwater conveyance system length that will be:

Storm sewer: 4029 Vegetated swale: 805 Natural channel: _____

Stormwater management facility: One Infiltration Basin
_____ Other: _____

Note: the total length of the stormwater conveyance system should be measured from the site's downstream property line to the downstream limit of sheet flow at the system's headwaters.

B. What design criteria and/or site changes would be required to reduce the storm sewer percentages and increase the vegetated swale and natural channel percentages in A above?

The project is designed with swale as much as possible. Due to type of the development, (Commercial andHigh density residential) it is hard to incorporate more swales.

C. In conveyance system subareas that have overland or sheet flow over impervious surfaces or turf grass, what practical and effective site changes can be made to:

Decrease overland flow slope: The proposed design already have reduced the slopes of overlands flows.

Increase overland flow roughness: We have change the part of the ground cover from farm filed to dense grass

3.5 Preventative Source Controls

The most effective way to address water quality concerns is by pollution prevention. This section of the checklist helps identify those nonstructural strategies and LID-BMPs that have been incorporated into the proposed development's design to reduce the exposure of pollutants to prevent their release into the stormwater runoff.

A. Trash Receptacles

Specify the number of trash receptacles provided: 2

Specify the spacing between the trash receptacles: _____

Compare trash receptacles proposed with those required by

regulations: Proposed:2 Regulations: none

B. Pet Waste Stations

Specify the number of pet waste stations provided: n/a

Specify the spacing between the pet waste stations: _____

Compare pet waste stations proposed with those required by

regulations: Proposed: None Regulations: None

C. Inlets, Trash Racks, and Other Devices that Prevent Discharge of Large Trash and Debris

Specify percentage of total inlets that comply with the NJPDES storm drain inlet criteria: 100%

D. Maintenance

Specify the frequency of the following maintenance activities:

Street sweeping: Proposed: _____ Regulations: _____

Litter collection: Proposed: _____ Regulations: _____

Identify other stormwater management measures on the site that prevent discharge of large trash and debris:

Outlet structure is provided with trash rack which will prevent large trash and debris going to stream

E. Prevention and Containment of Spills

Identify locations where pollutants are located on the site, and the features that prevent these pollutants from being exposed to stormwater runoff:

Pollutant: N/A_____Location: _____

Feature utilized to prevent pollutant exposure, harmful accumulation, or contain spills:

Pollutant: N/A_____Location: _____

Feature utilized to prevent pollutant exposure, harmful accumulation, or contain spills:

Pollutant: N/A_____Location: _____

Feature utilized to prevent pollutant exposure, harmful accumulation, or contain spills:

Pollutant: N/A_____Location: _____

Feature utilized to prevent pollutant exposure, harmful accumulation, or contain spills:

Pollutant: N/A_____Location: _____

Part 4: Compliance with Nonstructural Requirements of NJDEP Stormwater Management Rules

1. Based upon the checklist responses above, indicate which nonstructural strategies have been incorporated into the proposed development's design in accordance with N.J.A.C. 7:8-5.3(b):

No.	Nonstructural Strategy	Yes	No
1.	Protect areas that provide water quality benefits or areas particularly susceptible to erosion and sediment loss.	X	
2.	Minimize impervious surfaces and break up or disconnect the flow of runoff over impervious surfaces.	X	
3.	Maximize the protection of natural drainage features and vegetation.	X	
4.	Minimize the decrease in the pre-construction time of concentration.	X	
5.	Minimize land disturbance including clearing and grading.	X	
6.	Minimize soil compaction.	X	
7.	Provide low maintenance landscaping that encourages retention and planting of native vegetation and minimizes the use of lawns, fertilizers, and pesticides	X	
8.	Provide vegetated open-channel conveyance systems discharge into and through stable vegetated areas.		X
9.	Provide preventative source controls.	X	

2. For those strategies that have not been incorporated into the proposed development's design, provide engineering, environmental, and/or safety reasons. Attached additional pages as necessary.

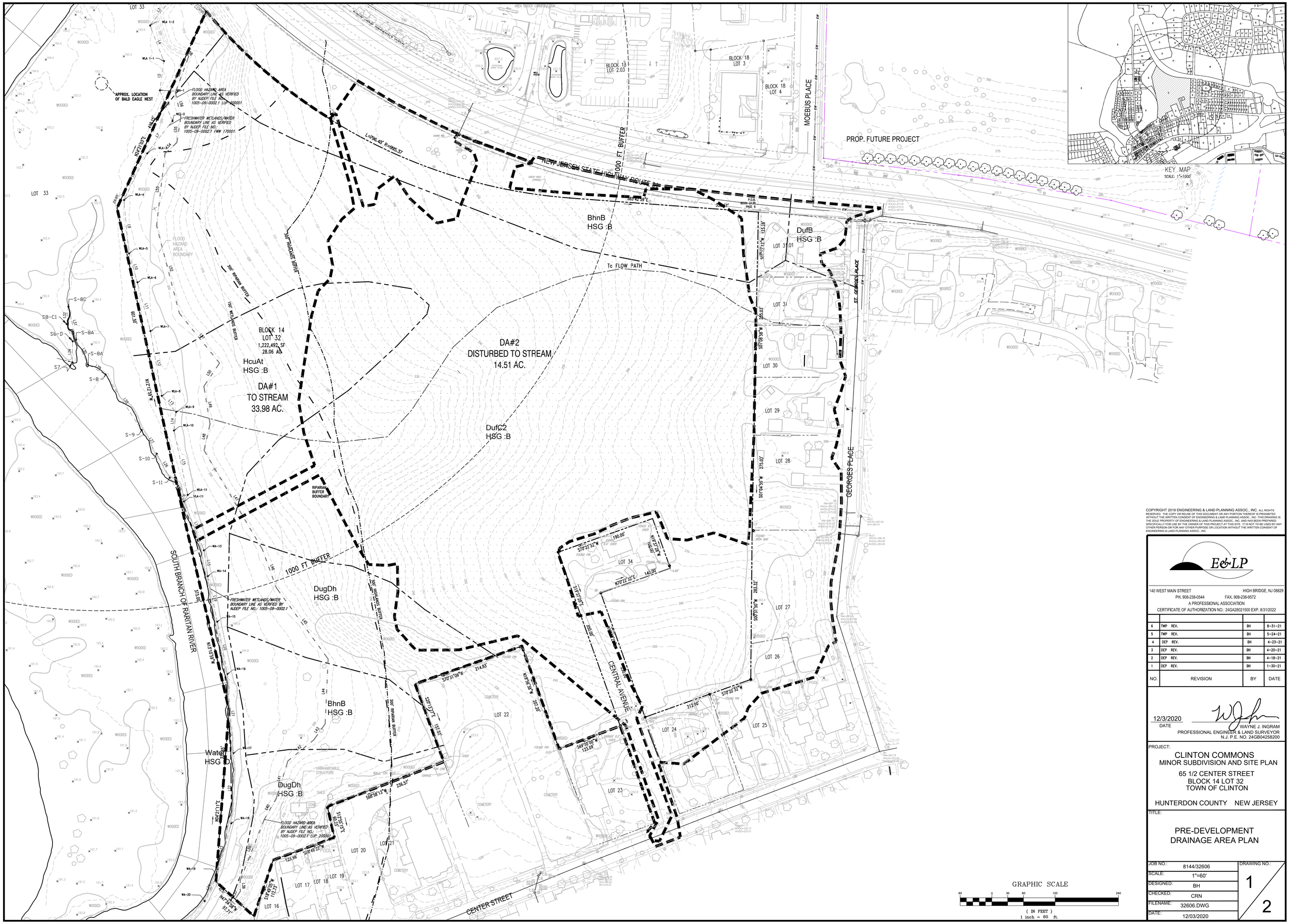
The site has steel slopes along the stream. This makes construction of large open channel conveyance system difficult.

The construction of open channel will disturb significant more stream corridor and Highlands buffer.

APPENDIX - M:

PRE-DEVELOPMENT AND POST-DEVELOPMENT DRAINAGE AREA PLANS.

E&LP



E&LP
140 WEST MAIN STREET HIGH BRIDGE, NJ 08829
PH. 908-238-0544 FAX. 908-238-9572
A PROFESSIONAL ASSOCIATION
CERTIFICATE OF AUTHORIZATION NO.: 24GA28021500 EXP. 8/31/2022

NO.	REVISION	BY	DATE
6	TWP REV.	BH	8-31-21
5	TWP REV.	BH	5-24-21
4	DEP REV.	BH	4-23-21
3	DEP REV.	BH	4-20-21
2	DEP REV.	BH	4-18-21
1	DEP REV.	BH	1-30-21

12/3/2020
DATE

WAYNE J. INGRAM
PROFESSIONAL ENGINEER & LAND SURVEYOR
N.J. P.E. NO. 24GB04258200

PROJECT:

CLINTON COMMONS
MINOR SUBDIVISION AND SITE PLAN

65 1/2 CENTER STREET
BLOCK 14 LOT 32
TOWN OF CLINTON

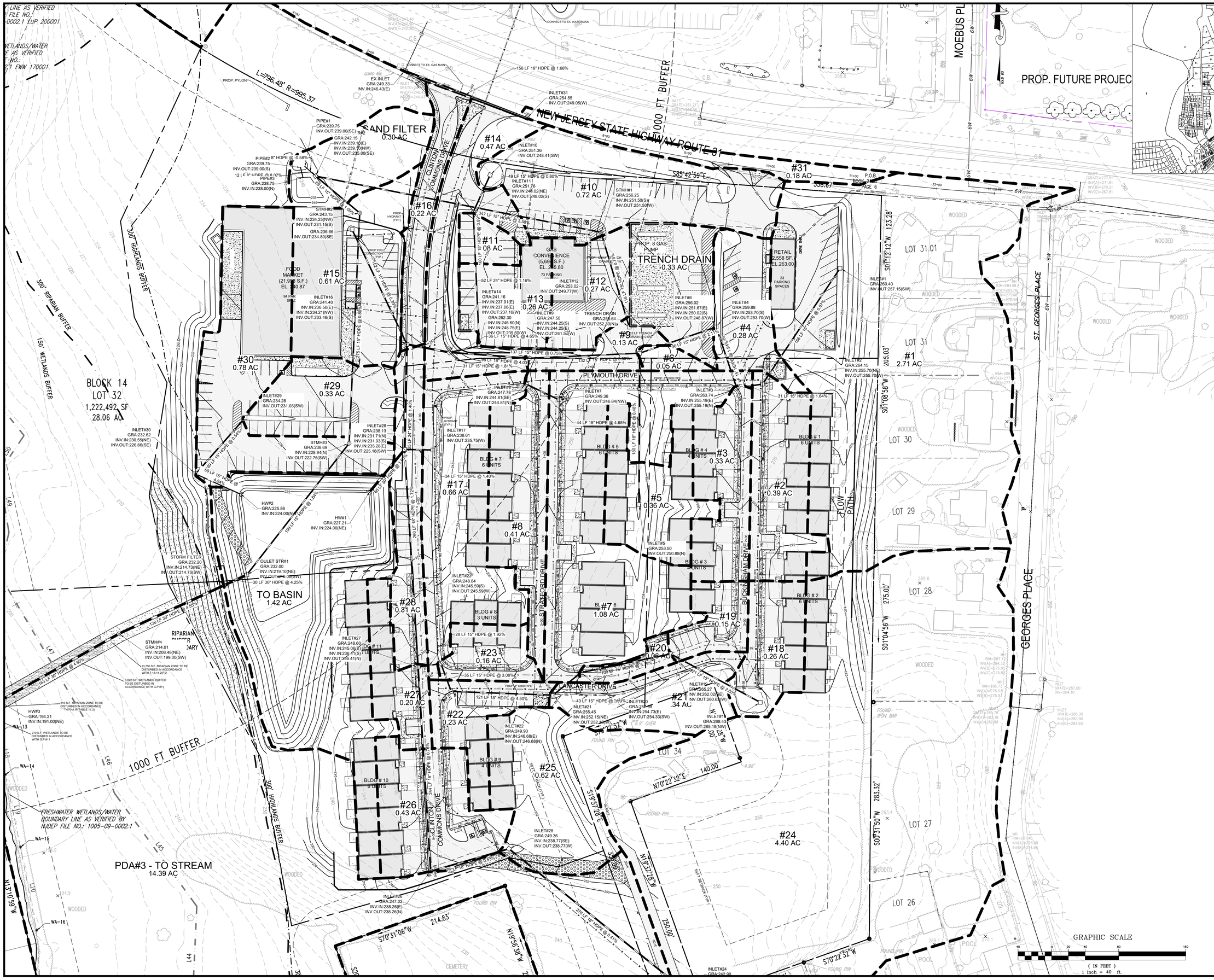
HUNTERDON COUNTY NEW JERSEY

TITLE:

PRE-DEVELOPMENT
DRAINAGE AREA PLAN

JOB NO.:	8144/32606
SCALE:	1"=60'
DESIGNED:	BH
CHECKED:	CRN
FILENAME:	32606.DWG
DATE:	12/03/2020

DRAWING NO.: 1 / 2



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2	DEP REV.	BH	4-18-21
1	DEP REV.	BH	1-30-21

12/3/2020
DATE

WAYNE J. INGRAM
PROFESSIONAL ENGINEER & LAND SURVEYOR
N.J. P.E. NO. 24GB04258200

PROJECT:
CLINTON COMMONS
MINOR SUBDIVISION AND SITE PLAN
65 1/2 CENTER STREET
BLOCK 14 LOT 32
TOWN OF CLINTON
HUNTERDON COUNTY NEW JERSEY

TITLE:
POST-DEVELOPMENT
DRAINAGE AREA PLAN

JOB NO.:	8144/32606
SCALE:	1"=40'
DESIGNED:	BH
CHECKED:	CRN
FILENAME:	32606.DWG
DATE:	12/03/2020

DRAWING NO.: 2 / 2