Stormwater Management Narrative

Copart Elk Township

Block 66, Lots 1.01, 1.02 & 1.03
Township of Elk, Gloucester County, New Jersey

Stantec

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Table of Contents

Chapter 1 – DESIGN NOTES

1.1 DESIGN NOTES

1.1.1 BASIN DESIGN

A. Stormwater Runoff: 24-hour, Type III Storm, NRCS TR-55
B. DelMarVa hydrograph with 285 shape factor
C. Time of Concentration: TR-55 Calculation
D. CN Values:
    a. Based on Type 'A' Hydrologic soil group
        i. Impervious = 98
        ii. Lawn (good) = 39
        iii. Woods (good) = 30
    b. Based on Type 'D' Hydrologic soil group
        i. Impervious = 98
        ii. Gravel = 91
        iii. Lawn (good) = 80
        iv. Woods (good) = 77
E. Storm analyzed with rainfall amounts for Gloucester County (NRCS 24 hr Design Storm Rainfall Depths Revised September 2004, 2nd Revision):

Storm Frequency	24 Hr. Rainfall
2 Year	3.3"
10 Year	5.1"
100 Year	8.5"

2.0 Chapter 2 – DESIGN NARRATIVE

2.1 DESIGN OVERVIEW

2.1.1 EXISTING CONDITIONS

The existing site is currently an active automobile storage facility and a vacant wooded area. The site is bounded to the west by Jacob Harris Lane, to the north and east by woods and to the south by residential properties. A majority of the site is densely wooded and contains small areas of wetlands and wetland buffers along the eastern property line.

This project does not propose improvements to the existing storage facility, so the stormwater analysis is limited to the wooded area which is for the proposed expansion of the facility. A large portion of the site drains overland to the east towards wetlands. The Pre-Development Watershed Plan (WS-1) delineates these existing drainage areas as pre-development WS-1.

The pre-development watersheds were evaluated to determine peak flows for the 2, 10 and 100-year storm events using the DelMarVA hydrograph (285 shape factor). The site was evaluated with the characteristics of woods in good condition or impervious coverage. Time of concentration was determined from the TR-55 method and shown on plan WS-1 (calculations included in this report). Soil types have been delineated and listed with relative Hydrologic Soils Groups and CN value.

2.1.2 PROPOSED CONDITIONS

The proposed site is to provide for an expansion of the automobile storage area (approximately 332,459 square feet). All proposed development is to occur to the north of the existing facility.

The proposed site has been divided into two (2) post-development sub watersheds corresponding to the pre-development watershed. Post-development WS-1A provides a drainage path overland to a proposed basin towards the eastern portion of the site. The basin then drains out towards the wetlands. Post-development WS-1B consists any direct runoff from the site. If a storm event occurs that exceeds the 100-year storm event, the overland flow will be directed in a manner similar to existing drainage patterns.

The post-development watersheds were evaluated to determine peak flows for the 2, 10 and 100-year storm events using the DelMarVA hydrograph (285 shape factor). The site was evaluated with the characteristics of the proposed site as impervious, or lawn in good condition. The proposed drainage design has been designed in accordance with the New Jersey Stormwater Regulations in NJAC 7:8.

2.1.3 INFILTRATION BASIN DESIGN

The infiltration basin has been designed in accordance with the New Jersey Stormwater Regulations (NJAC 7:8) and the New Jersey Stormwater Best Management Practices Manual, "Chapter 9.5: Standard for Infiltration Basins" with regards to the following components:

1. Storage Volume, Depth and Duration
   The basin has been designed to provide the required reductions while controlling the outflow through the use of the outlet structure. The basin will provide infiltration through a sand bottom. The basin drains in less than 72 hours. The bottom of each basin is two (2) feet above seasonal high water table.

2. Permeability Rates
   The soil testing analysis has been provided as an appendix in this report. The permeability rate varies with a minimum rate of 1.5 inches per hour. The stormwater design to meet the required reductions was completed using an infiltration rate of 1.5 inches per hour.

3. Bottom Sand Layer
   Infiltration basins are designed with a six (6) inch layer of sand on the bottom of the basin. The sand layer is specified as K5 soil with a maximum of 15% fines and a minimum permeability rate of 20 inches per hour (to be engineer certified).

4. Overflows
   Each infiltration basin provides positive outflow for a storm event that may exceed the basin's capacity. Overflows are conveyed to downstream drainage systems in a safe and stable manner.

5. On-line & Off-line Systems
   The basin is an on-line system that provides treatment for the maximum design storm and convey larger storms through an overflow.

6. Subsurface Infiltration Basins
   All infiltration basins are surface basins.

7. Basis of Design
   Construction of the basin must be done without compacting the basin's subgrade soils and all excavation must be performed from outside the basin.

2.2 DESIGN SUMMARY

The following table summarizes the pre- and post-development flows for watersheds containing proposed development.

PRE- DEVELOPMENT VS. POST-DEVELOPMENT RUNOFF

	2-YEAR	10-YEAR	100-YEAR
PRE-DEVELOPMENT SITE RUNOFF	0.064 cfs	0.335 cfs	7.041 cfs
POST-DEVELOPMENT SITE RUNOFF	0.332 cfs	0.699 cfs	4.335 cfs
PERCENT OF PRE-DEVELOPMENT RUNOFF	-- %	-- %	62 %

The table above shows that the 50 and 75 percent reductions have not been met for the 2- and 10- year storm events, respectively. However, the 80 percent reduction has been met for the 100-year storm event.

The applicant seeks a waiver from adherence to strict compliance with the reductions for the 2- and 10-year storms for the following reasons. For the 2-year storm, the basin is sized with a 2.5-inch orifice, which is the smallest orifice permitted by the regulations. This discharge from the basin for this storm is 0.087 cfs, which is already higher than the pre-development condition. This discharge, accompanied with the direct runoff from the site, which is only the back sides of the basin that have been converted from woods to grass, results in the 0.332 cfs runoff for the site.

In addition, for the 10-year storm, the basin discharge of 0.143 cfs is what flows through the 2.5-inch orifice. Again, the direct runoff for the site, which is only the back sides of the basins that have been converted from woods to grass, results in the overall discharge of 0.699 cfs, which is more that permitted.

In both the 2- and 10-year storms, we believe all reasonable measures have been incorporated into the design to limit the flow from the site. Even with implementing the smallest discharges permitted by the regulations, the reductions cannot be met. We request a waiver from strict compliance with the regulation for the 2- and 10-year storms.

2.3 NEW JERSEY STORMWATER REGULATIONS – N.J.A.C. 7:8

The following stormwater management measures have been considered to meet the requirements of N.J.A.C. 7:8:

1. Erosion control, per the Soil Erosion and Sediment Control Act
2. Groundwater Recharge
3. Stormwater runoff quantity, and
4. Stormwater runoff quality
5. Nonstructural Stormwater Management Strategies Point System
6. Low Impact Development Checklist

The information and calculations enclosed show compliance with the above requirements. To the extent practicable, the requirements have first been met by employing non-structural stormwater management practices, as described in the Low Impact Development Checklist (enclosed). The following stormwater management measures have been addressed for the site:

2.3.1 SOIL EROSION AND SEDIMENT CONTROL

Soil Erosion and Sediment Control Plans have been prepared in accordance with the Soil Erosion and Sediment Control Act and the Gloucester County Soil Conservation District requirements and regulations. Refer to SESC Plans and Details found in Preliminary/Final Site Plans for the Copart – Elk Township prepared by Stantec Consulting, dated December 2020.

2.3.2 ANNUAL GROUNDWATER RECHARGE ANALYSIS

The requirement for post-development recharge equal to the pre-development recharge volume has been met with recharge area of 42,515 SF. The New Jersey Stormwater Best Management Practices Recharge Worksheets attached demonstrate a BMP Effective Depth (dBMP) of 2.0 inches is required in

the basin to provide for the recharge requirements. The minimum depth is 3.5 inches, prior to discharge. Attached is the New Jersey Groundwater Recharge Spreadsheet.

2.3.3 REDUCTION IN STORMWATER RUNOFF

The tables listed in Section 2.2 Design Summary summarize the pre- and post-development flows for each watershed and the reduction of runoff for the proposed development. A waiver from strict compliance with the 2- and 10-year reductions is requested. The reduction for the 100-year storm has been met.

2.3.4 EIGHTY PERCENT (80%) REDUCTION IN TSS

The runoff quality requirement of 80% reduction in Total Suspended Solids (TSS) has been met through sand bottom basin (80% TSS removal rate). This meets the 80% TSS removal rate.

2.3.5 LOW IMPACT DEVELOPMENT CHECKLIST

Attached is the New Jersey Stormwater Best Management Practices Low Impact Development Checklist that identifies non-structural stormwater management practices implemented in the design where possible.

2.3.2 ANNUAL 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
GLOUCESTER CO., WASHINGTON TWP	45.0	1.36

Project Name: Sample Project

Description: This is a test application

Analysis Date: 05/01/19

Pre-Developed Conditions

Land Segment	Area (acres)	TR-55 Land Cover	Soil	Annual Recharge (in)	Annual Recharge (cu.ft)
1	2.89	Woods-grass combination	Berryland Varian	0.0	-
2	9.56	Woods-grass combination	Downer	12.6	438,088
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
Total =	12.5			Total Annual Recharge (in)	Total Annual Recharge (cu-ft)
				9.7	438,088

Post-Developed Conditions

Land Segment	Area (acres)	TR-55 Land Cover	Soil	Annual Recharge (in)	Annual Recharge (cu.ft)
1	7.6	Impervious areas	Downer	0.0	-
2	3.1	Open space	Downer	13.0	146,280
3	1.8	Open space	Berryland Variant	0.0	-
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
Total =	12.5	Warning: make total area equal to Pre-Developed Conditions		Total Annual Recharge (in)	Total Annual Recharge (cu.ft)
				3.2	146,280

Annual Recharge Requirements Calculation ↓

% of Pre-Developed Annual Recharge to Preserve =	100%	Total Impervious Area (sq.ft)
		331,056
Post-Development Annual Recharge Deficit=	*291,808*	(cubic feet)

Recharge Efficiency Parameters Calculations (area averages)

RWC= 1.81	(in)	DRWC= 1.81	(in)
ERWC = 0.58	(in)	EDRWC= 0.58	(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
Sample Project	This is a test application	05/01/19	

Recharge BMP Input Parameters

Parameter	Symbol	Value	Unit
BMP Area	ABMP	42515.0	sq.ft
BMP Effective Depth, this is the design variable	dBMP	2.0	in
Upper level of the BMP surface (negative if above ground)	dBMPu	-29.4	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	0.61	in
ERWC Modified to consider dEXC	EDRWC	0.61	in
Empty Portion of RWC under Infilt. BMP	RERWC	0.48	in

Recharge Design Parameters

Parameter	Symbol	Value	Unit
Inches of Runoff to capture	Qdesign	0.26	in
Inches of Rainfall to capture	Pdesign	0.35	in
Recharge Provided Avg. over Imp. Area		10.6	in
Runoff Captured Avg. over imp. Area		15.4	in

BMP Calculated Size Parameters

ABMP/Aimp	Aratio	0.13	unitless
BMP Volume	VBMP	7,008	cu.ft

Parameters from Annual Recharge Worksheet

Post-D Deficit Recharge (or desired recharge volume)	Vdef	291,808	cu.ft
Post-D Impervious Area (or target Impervious Area)	Aimp	331,056	sq.ft
Root Zone Water Capacity	RWC	1.91	in
RWC Modified to consider dEXC	DRWC	1.91	in
Climatic Factor	C-factor	1.36	no units
Average Annual P	Pavg	45.0	in
Recharge Requirement over Imp. Area	dr	10.6	in

System Performance Calculated Parameters

Annual BMP Recharge Volume		291,808	cu.ft
Avg BMP Recharge Efficiency		68.7%	Represents % Infiltration Recharged
%Rainfall became Runoff		77.8%	%
%Runoff Infiltrated		44.0%	%
%Runoff Recharged		30.2%	%
%Rainfall Recharged		23.5%	%

CALCULATION CHECK MESSAGES

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

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.

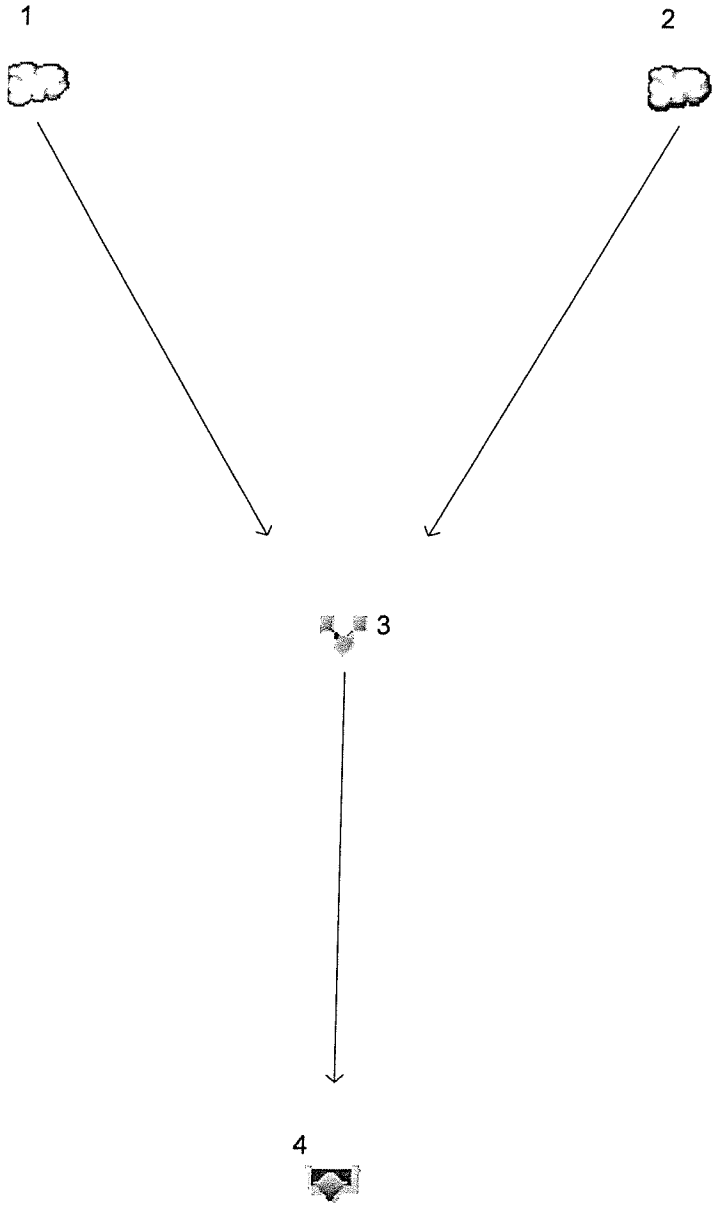
How to solve for different recharge volumes: By default the spreadsheet assigns the values of total deficit recharge volume "Vdef" and total proposed impervious area "Aimp" from the "Annual Recharge" sheet to "Vdef" and "Aimp" on this page. This allows solution for a single BMP to handle the entire recharge 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.

2.3.4 EIGHTY PERCENT REDUCTION IN TSS

NJ Water Quality Storm 1.25 In/Hr

Watershed Model Schematic

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2

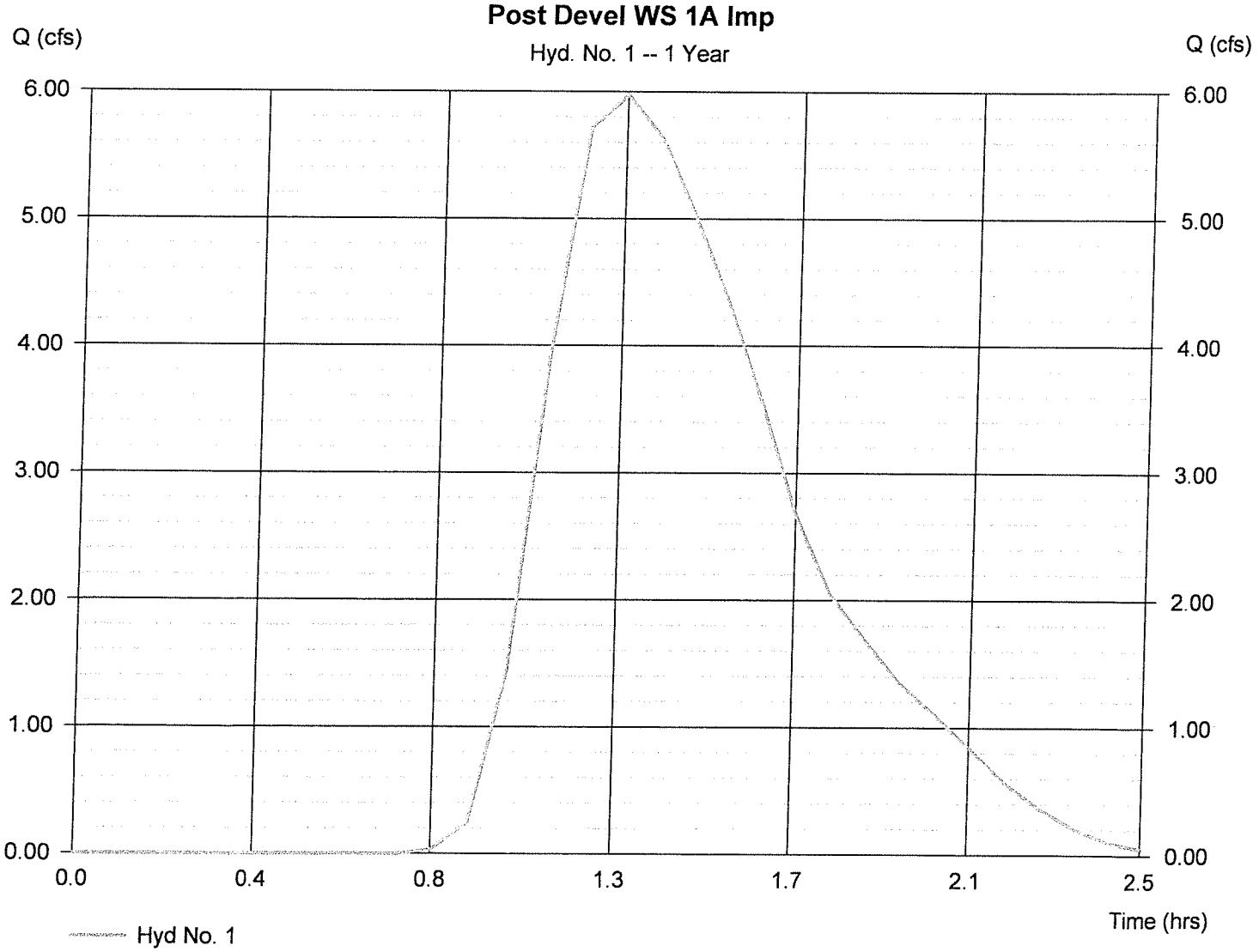
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	5.975	5	75	14,066	------	------	------	Post Devel WS 1A Imp
2	SCS Runoff	0.000	5	n/a	0	------	------	------	Post Devel WS 1A Perv
3	Combine	5.975	5	75	14,066	1, 2	------	------	Post Devel WS 1A
4	Reservoir	0.000	5	n/a	0	3	137.30	14,066	Basin A

Hydrograph Report

Hyd. No. 1

Post Devel WS 1A Imp

Hydrograph type	= SCS Runoff	Peak discharge	= 5.975 cfs
Storm frequency	= 1 yrs	Time to peak	= 1.25 hrs
Time interval	= 5 min	Hyd. volume	= 14,066 cuft
Drainage area	= 7.190 ac	Curve number	= 91
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 10.00 min
Total precip.	= 1.25 in	Distribution	= Custom
Storm duration	= V:\1925\resource\Community-Development\Stormwater\Hydrographs\new jers		



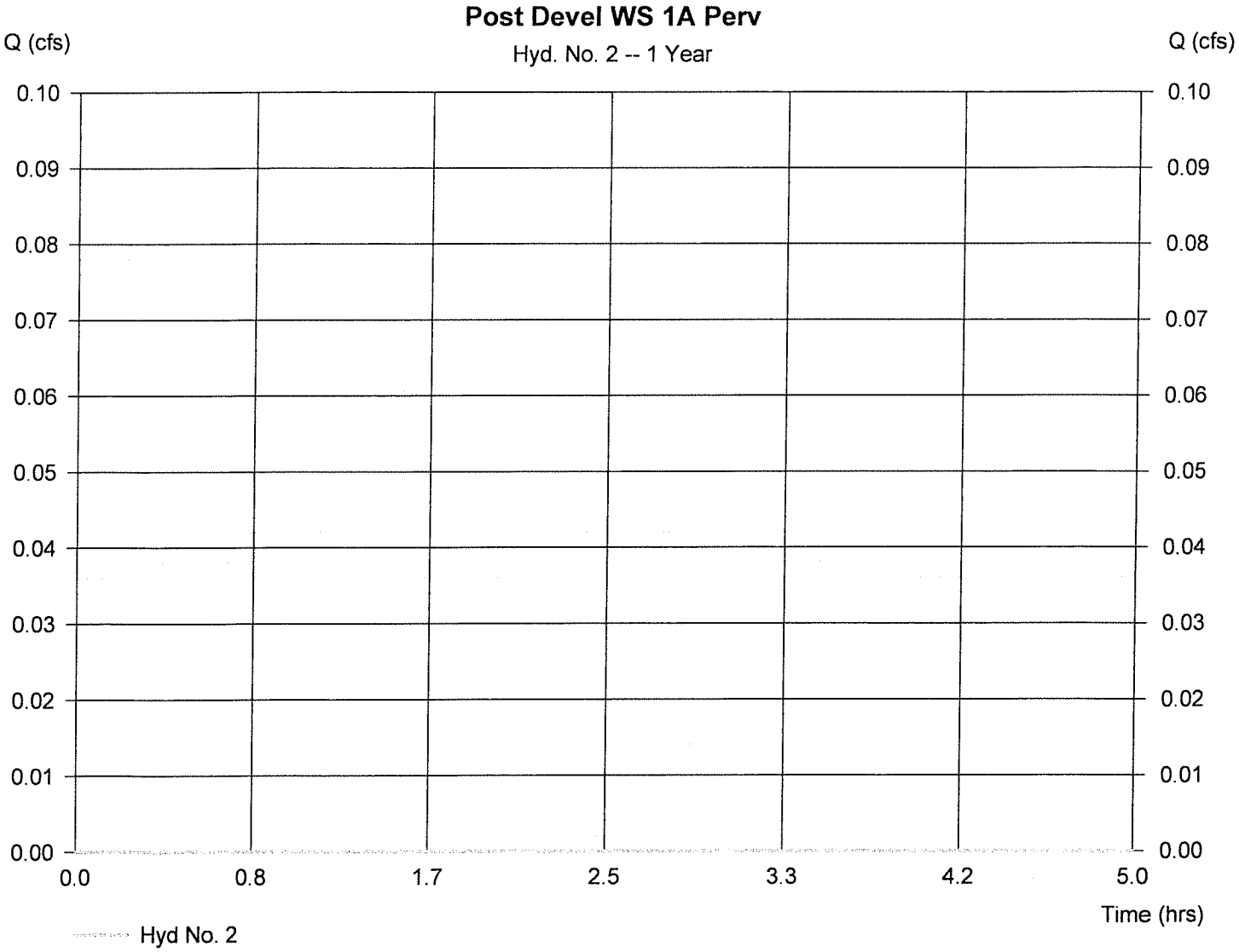
Hydrograph Report

Hyd. No. 2

Post Devel WS 1A Perv

Hydrograph type	= SCS Runoff	Peak discharge	= 0.000 cfs
Storm frequency	= 1 yrs	Time to peak	= n/a
Time interval	= 5 min	Hyd. volume	= 0 cuft
Drainage area	= 2.460 ac	Curve number	= 61*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 10.00 min
Total precip.	= 1.25 in	Distribution	= Custom
Storm duration	= V:\1925\resource\Community-Development\Stormwater\Hydrographs\new jers	Shape factor	= 285

* Composite (Area/CN) = [(1.140 x 39) + (1.320 x 80)] / 2.460



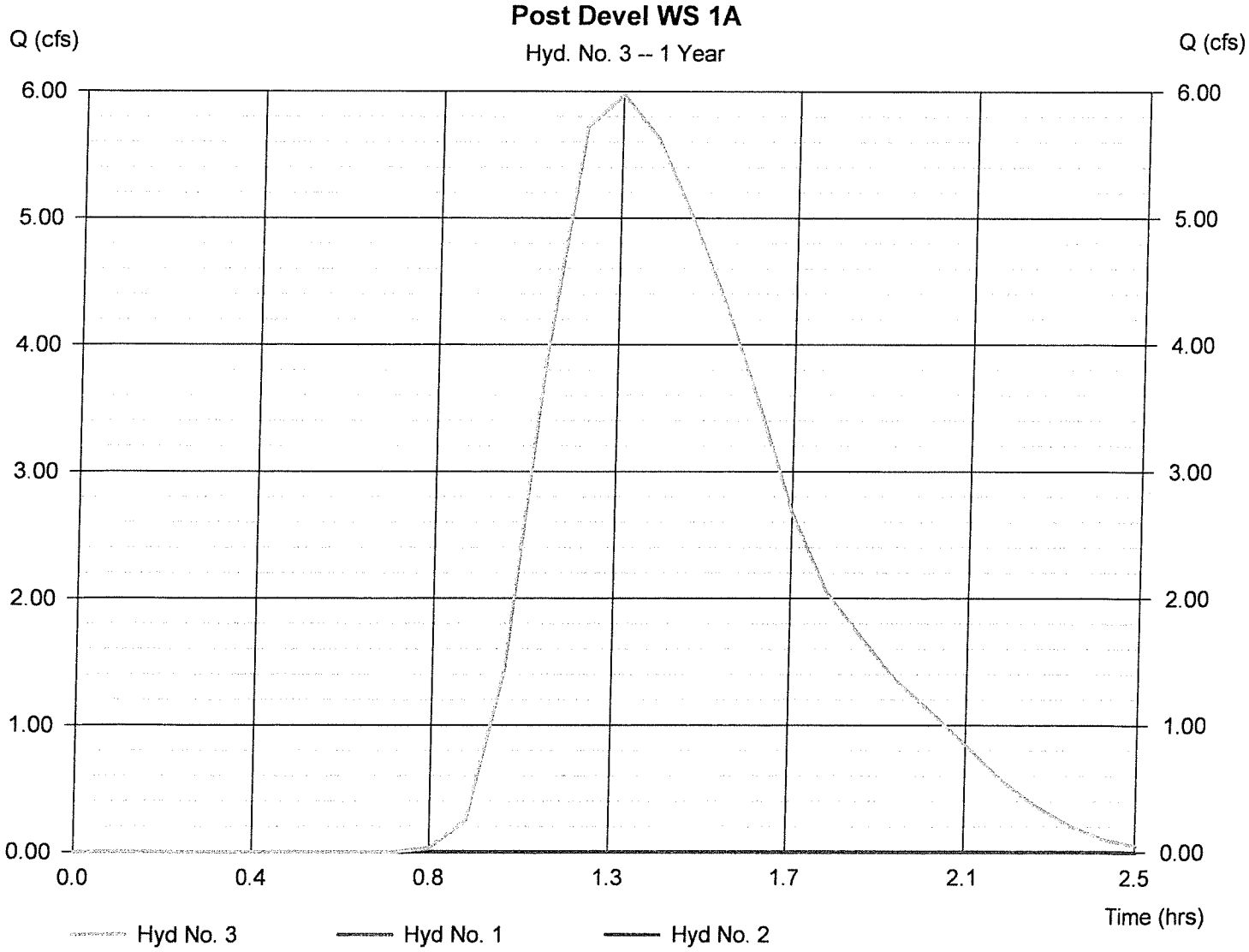
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2 Friday, 12 / 11 / 2020

Hyd. No. 3

Post Devel WS 1A

Hydrograph type	= Combine	Peak discharge	= 5.975 cfs
Storm frequency	= 1 yrs	Time to peak	= 1.25 hrs
Time interval	= 5 min	Hyd. volume	= 14,066 cuft
Inflow hyds.	= 1, 2	Contrib. drain. area	= 9.650 ac



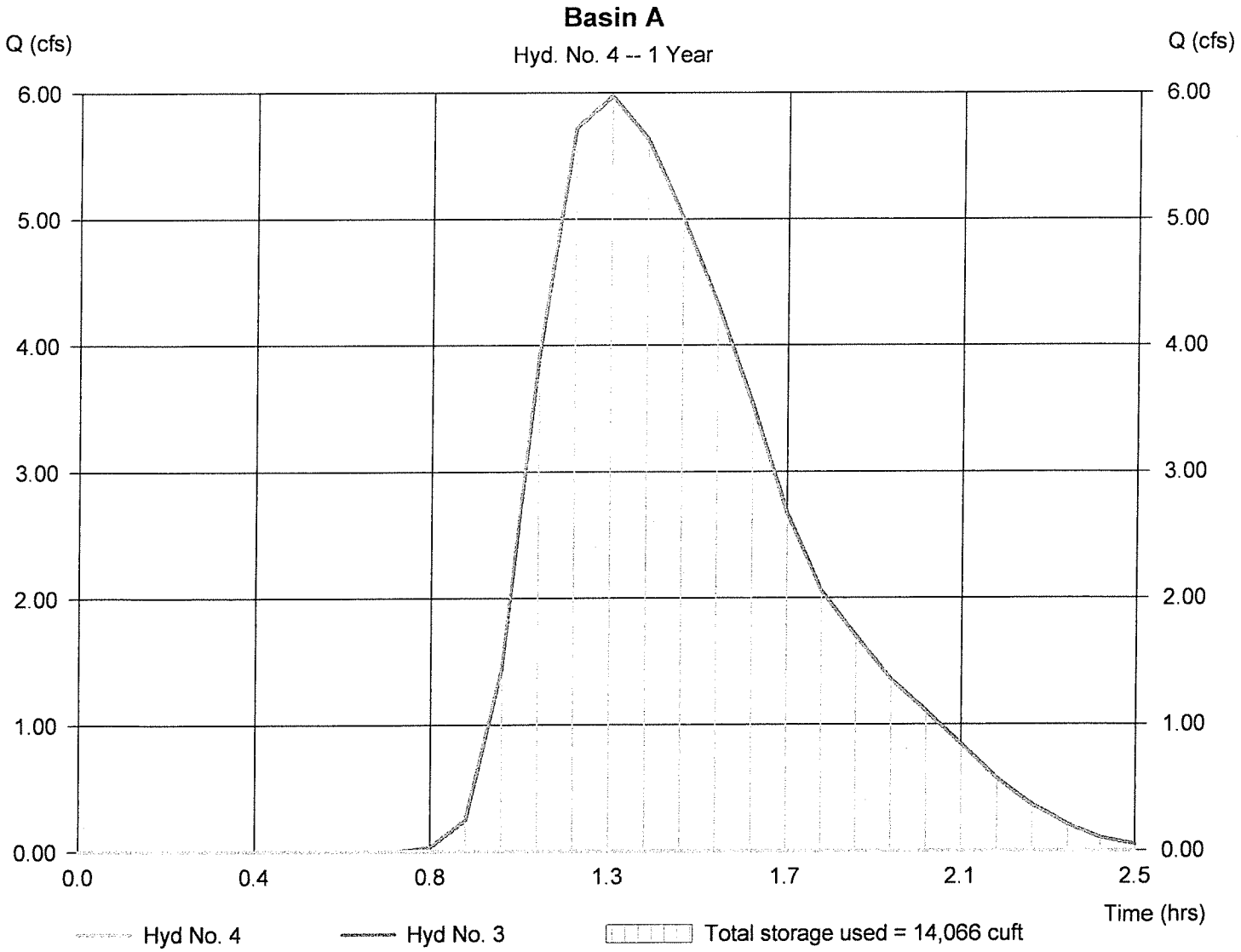
Hydrograph Report

Hyd. No. 4

Basin A

Hydrograph type	= Reservoir	Peak discharge	= 0.000 cfs
Storm frequency	= 1 yrs	Time to peak	= n/a
Time interval	= 5 min	Hyd. volume	= 0 cuft
Inflow hyd. No.	= 3 - Post Devel WS 1A	Max. Elevation	= 137.30 ft
Reservoir name	= Basin	Max. Storage	= 14,066 cuft

Storage Indication method used.



Pond Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2 Friday, 12 / 11 / 2020

Pond No. 1 - Basin

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 137.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	137.00	45,502	0	0
0.50	137.50	46,840	23,082	23,082
1.00	138.00	70,988	29,246	52,328
1.50	138.50	73,311	36,070	88,398
2.00	139.00	75,647	37,234	125,632
2.50	139.50	77,998	38,406	164,038

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 15.00	2.50	0.00	0.00
Span (in)	= 15.00	2.50	0.00	0.00
No. Barrels	= 1	1	0	0
Invert El. (ft)	= 137.00	137.33	0.00	0.00
Length (ft)	= 5.00	1.00	0.00	0.00
Slope (%)	= 0.50	1.00	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	Yes	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 16.00	1.50	0.00	0.00
Crest El. (ft)	= 139.45	138.15	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= 1	Rect	---	---
Multi-Stage	= Yes	Yes	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	137.00	0.00	0.00	---	---	0.00	0.00	---	---	---	---	0.000
0.50	23,082	137.50	0.04 oc	0.04 ic	---	---	0.00	0.00	---	---	---	---	0.042
1.00	52,328	138.00	0.13 oc	0.12 ic	---	---	0.00	0.00	---	---	---	---	0.123
1.50	88,398	138.50	1.14 oc	0.11 ic	---	---	0.00	1.03	---	---	---	---	1.140
2.00	125,632	139.00	3.69 oc	0.12 ic	---	---	0.00	3.57 s	---	---	---	---	3.693
2.50	164,038	139.50	6.77 oc	0.12 ic	---	---	0.60	6.05 s	---	---	---	---	6.765

2.3.5 LOW IMPACT DEVELOPMENT CHECKLIST

New Jersey Stormwater Best Management Practices Manual

February 2004

A P P E N D I X A

Low Impact Development Checklist

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

According to the NJDEP Stormwater Management Rules at N.J.A.C. 7:8, the groundwater recharge, stormwater quality, and stormwater quantity standards established by the Rules for major land development projects must be met by incorporating nine specific nonstructural stormwater management strategies into the project's design to the maximum extent practicable.

To accomplish this, the Rules require an applicant seeking land development approval from a regulatory board or agency to identify those nonstructural strategies that have been incorporated into the project's design. In addition, if an applicant contends that it is not feasible to incorporate any of the specific strategies into the project's design, particularly for engineering, environmental, or safety reasons, the Rules further require that the applicant provide a basis for that contention.

This checklist has been prepared to assist applicants, site designers, and regulatory boards and agencies in ensuring that the nonstructural stormwater management requirements of the Rules are met. It provides an applicant with a means to identify both the nonstructural strategies incorporated into the development's design and the specific low impact development BMPs (LID-BMPs) that have been used to do so. It can also help an applicant explain the engineering, environmental, and/or safety reasons that a specific nonstructural strategy could not be incorporated into the development's design.

The checklist can also assist municipalities and other land development review agencies in the development of specific requirements for both nonstructural strategies and LID-BMPs in zoning and/or land use ordinances and regulations. As such, where requirements consistent with the Rules have been adopted, they may supersede this checklist.

Finally, the checklist can be used during a pre-design meeting between an applicant and pertinent review personnel to discuss local nonstructural strategies and LID-BMPs requirements in order to optimize the development's nonstructural stormwater management design.

Since this checklist is intended to promote the use of nonstructural stormwater management strategies and provide guidance in their incorporation in land development projects, municipalities are permitted to revise it as necessary to meet the goals and objectives of their specific stormwater management program and plan within the limits of N.J.A.C. 7:8.

Low Impact Development Checklist

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

Municipality: Elk Township

County: Gloucester Date: _____

Review board or agency: _____

Proposed land development name: Copart - Elk Township

Lot(s): 1.01, 1.02 & 1.03 Block(s): 66

Project or application number: _____

Applicant's name: Copart of Connecticut

Applicant's address: 14185 Dallas Parkway
Dallas, Texas 75254

Telephone: _____ Fax: _____

Email address: _____

Designer's name: Stantec Consulting Services Inc

Designer's address: 10000 Midlantic Drive, Suite 400 West
Mount Laurel, NJ 08054

Telephone: 856-234-0800 Fax: _____

Email address: clifton.quay@stantec.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.

To the maximum extent possible, existing vegetation has been retained.

Part 2: Review of Local Stormwater Management Regulations

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

Chapter 86, Stormwater Management

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

If yes, briefly describe: 1. Protect areas that provide water quality benefits or areas particularly susceptible to erosion and sediment loss. 2. Minimize impervious surfaces and break up or disconnect the flow of runoff over impervious surfaces. 3. Maximize the protection of natural drainage features and vegetation. 4. Minimize the decrease in the predevelopment time of concentration. 5. Minimize land disturbance including clearing and grading. 6. Minimize soil compaction and all other soil disturbance. 7. Provide low-maintenance landscaping that provides for the retention and planting of native plants and minimizes the use of lawns, fertilizers and pesticides. 8. Provide vegetated open-channel conveyance systems discharging into and through stable vegetated areas. 9. Provide other ~~source controls to prevent or minimize the use or exposure of pollutants at the site in order to prevent or minimize the release of those~~ pollutants into stormwater runoff.

List LID-BMPs prohibited by local regulations: _____

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

Meeting held with: _____

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

Site walk held with: _____

Other agencies with stormwater review jurisdiction:

Name: Gloucester County Soil Conservation District

Required approval: Certification of site plan

Name: _____

Required approval: _____

Name: _____

Required approval: _____

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: x 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: _____

Native ground cover? Yes: _____ No: x If yes, specify % of site: _____

Vegetated buffers? Yes: _____ No: x If yes, specify % of site: _____

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: _____ No: X

If yes, how: _____

_____

Restrict temporary site disturbance during construction? Yes: _____ No: X

If yes, how: _____

_____

Consider soils and slopes in selecting disturbance limits? Yes: _____ No: X

If yes, how: _____

_____

C. Specify percentage of site to be cleared: 28% Regraded: 28%

D. Specify percentage of cleared areas done so for buildings: 0%

For driveways and parking: 71% For roadways: 0%

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

Less parking and storage area for the facility

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

HSG A: 36% HSG B: _____ HSG C: _____ HSG D: 64%

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

HSG A: 64% HSG B: _____ HSG C: _____ HSG D: 7%

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 majority of the soils in the redevelopment area were A soils. Minimizing overall disturbance would decrease the disturbance within greater permeable soil areas.

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

If yes, discuss measures taken to limit Karst impacts:

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: 0.03 ac Proposed: 7.63 ac

B. Specify maximum site impervious coverage allowed by regulations: N/A

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

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		
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: N/A Regulations: _____

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

Proposed: N/A Regulations: _____

F. Specify percentage of total site impervious cover created by buildings: 0%

By driveways and parking: 100% By roadways: _____

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

Reduce the amount of automobile storage areas

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

Total site: 0% Buildings: _____ Driveways and parking: 0% Roads: _____

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

Total site: 0% Buildings: _____ Driveways and parking: 0% Roads: _____

J. Specify percentage of total building roof area that will be vegetated: N/A

K. Specify percentage of total parking area located beneath buildings: N/A

L. Specify percentage of total parking located within multi-level parking deck: N/A

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: _____ Vegetated swale: _____ Natural channel: 100%

Stormwater management facility: _____ 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?

all the water captured in the stormwater basin is overland flow

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 site has been regraded to minimize steep slopes

Increase overland flow roughness: The site is all proposed gravel areas

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 N/A

Specify the number of trash receptacles provided: _____

Specify the spacing between the trash receptacles: _____

Compare trash receptacles proposed with those required by regulations:

Proposed: _____ Regulations: _____

B. Pet Waste Stations N/A

Specify the number of pet waste stations provided: _____

Specify the spacing between the pet waste stations: _____

Compare pet waste stations proposed with those required by regulations:

Proposed: _____ Regulations: _____

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: _____

D. Maintenance N/A

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:

_____

_____

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: N/A

Pollutant: _____ Location: _____

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

Pollutant: _____ Location: _____

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

Pollutant: _____ Location: _____

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

Pollutant: _____ Location: _____

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

Pollutant: _____ 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 proposed redevelopment area is mostly wooded. The site has relatively minimal slopes that lead to a steeper wetlands area in the rear. In order to develop the site, most of the wooded area was removed. The proposed site contains gravel vehicle storage areas and drive aisles. Disconnection of these gravel areas was not possible. The site was graded relatively flat and directs all overland flow into the basin in the rear.

3.0 Chapter 3 – PRE-DEVELOPMENT RUNOFF CALCULATIONS

HYDROGRAPH PLAN VIEW – PRE-DEVELOPMENT CALCULATIONS

HYDROGRAPH SUMMARY REPORT

3.1 PRE-DEVELOPMENT WATERSHED 1

3.1.1 HYDROGRAPH NO. 1, 2 & 3 (2, 10 & 100 YEAR STORM EVENTS)

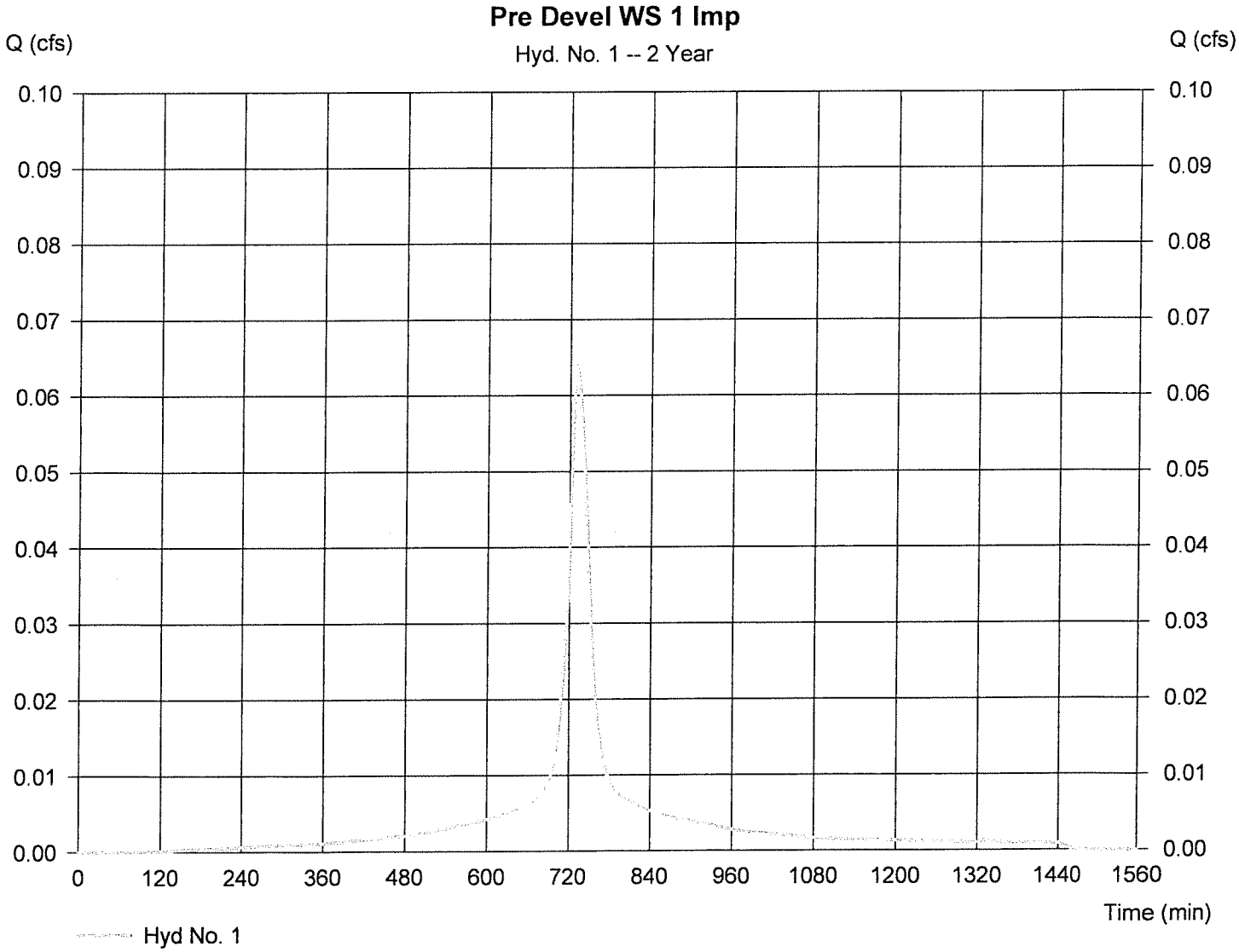
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2 Thursday, 12 / 10 / 2020

Hyd. No. 1

Pre Devel WS 1 Imp

Hydrograph type	= SCS Runoff	Peak discharge	= 0.064 cfs
Storm frequency	= 2 yrs	Time to peak	= 730 min
Time interval	= 2 min	Hyd. volume	= 332 cuft
Drainage area	= 0.030 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 10.00 min
Total precip.	= 3.30 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 285



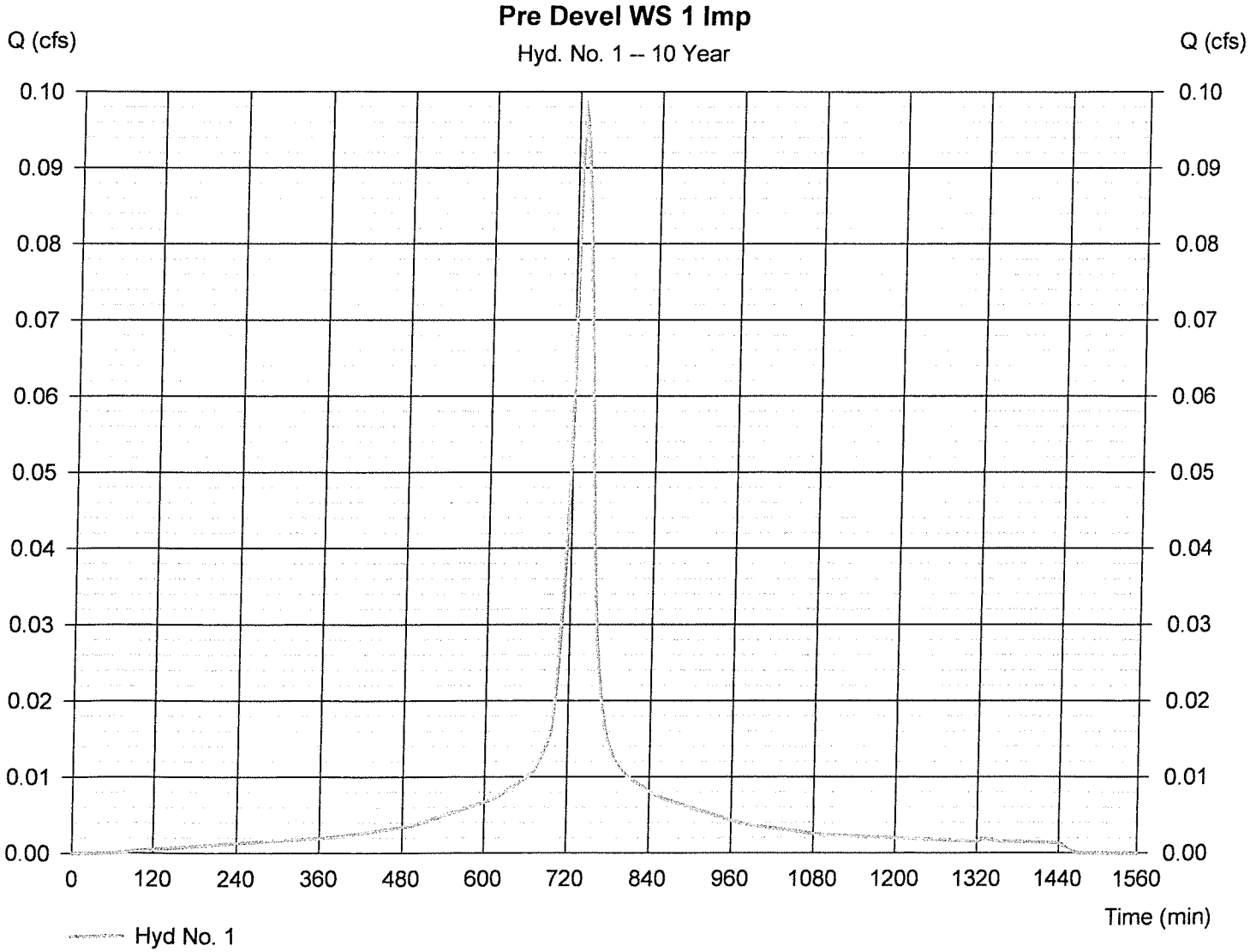
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2 Thursday, 12 / 10 / 2020

Hyd. No. 1

Pre Devel WS 1 Imp

Hydrograph type	= SCS Runoff	Peak discharge	= 0.097 cfs
Storm frequency	= 10 yrs	Time to peak	= 730 min
Time interval	= 2 min	Hyd. volume	= 515 cuft
Drainage area	= 0.030 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 10.00 min
Total precip.	= 5.00 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 285

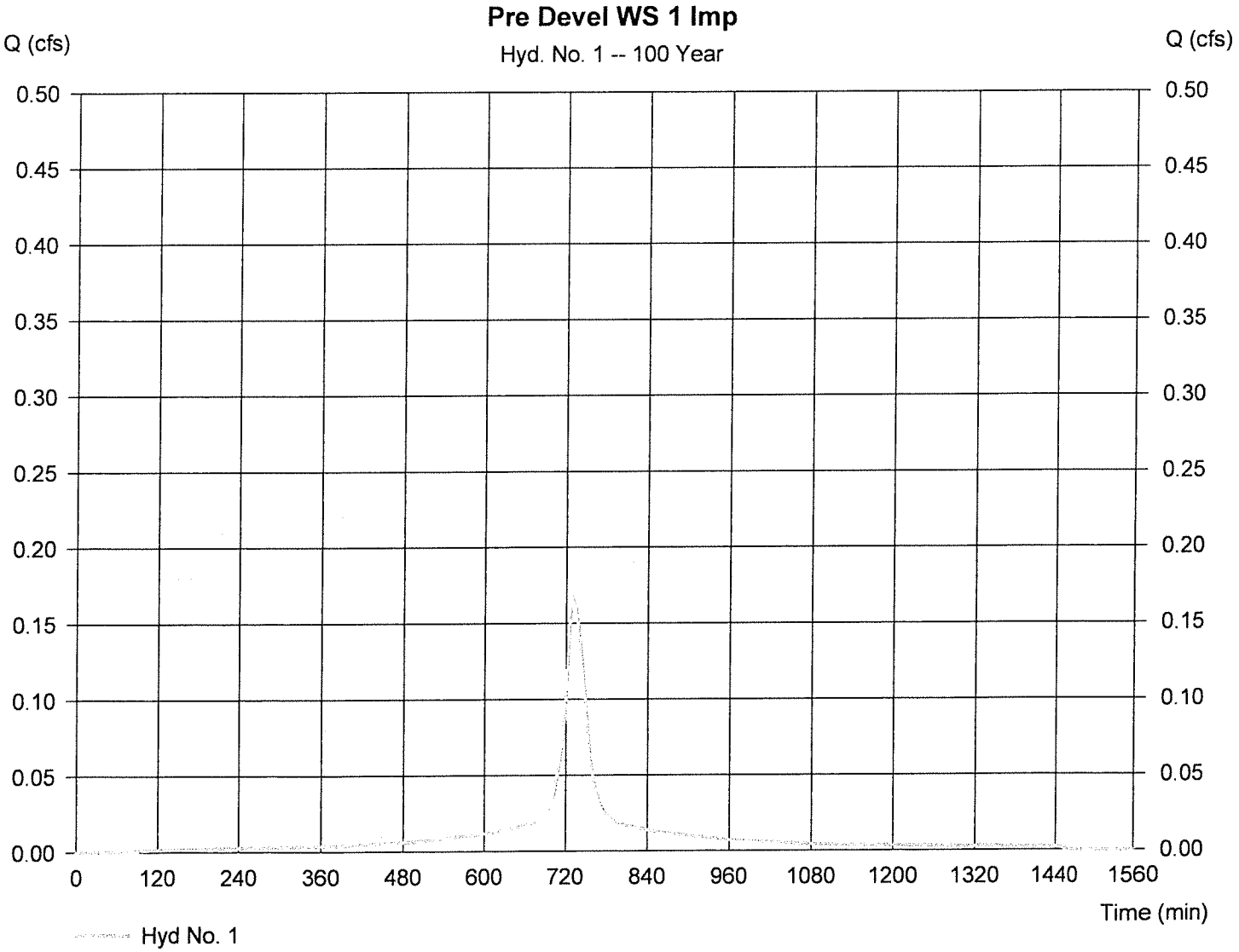


Hydrograph Report

Hyd. No. 1

Pre Devel WS 1 Imp

Hydrograph type	= SCS Runoff	Peak discharge	= 0.166 cfs
Storm frequency	= 100 yrs	Time to peak	= 730 min
Time interval	= 2 min	Hyd. volume	= 894 cuft
Drainage area	= 0.030 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 10.00 min
Total precip.	= 8.50 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 285



Hydrograph Report

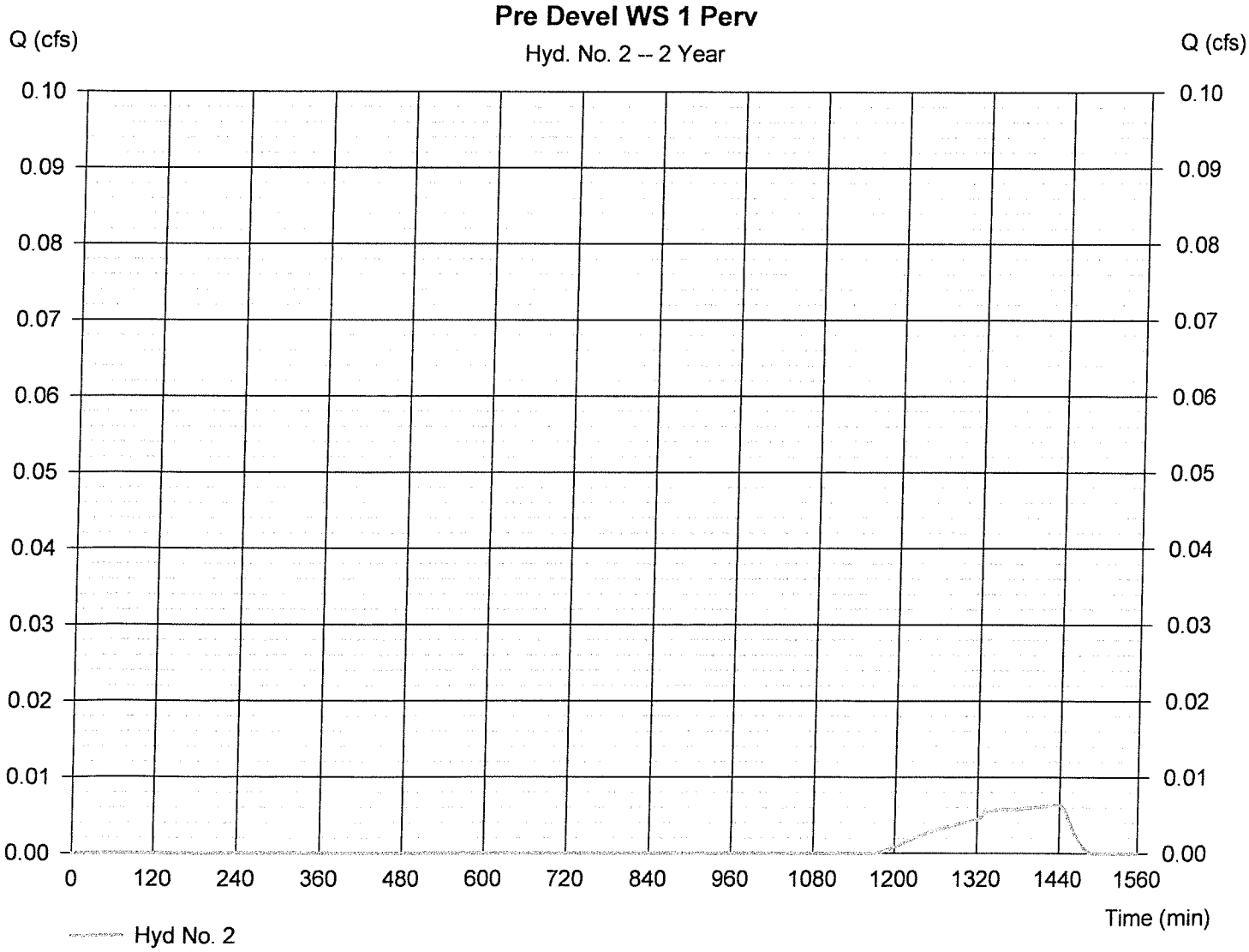
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2 — Thursday, 12 / 10 / 2020

Hyd. No. 2

Pre Devel WS 1 Perv

Hydrograph type	= SCS Runoff	Peak discharge	= 0.006 cfs
Storm frequency	= 2 yrs	Time to peak	= 1440 min
Time interval	= 2 min	Hyd. volume	= 72 cuft
Drainage area	= 10.660 ac	Curve number	= 39*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 18.40 min
Total precip.	= 3.30 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 285

* Composite (Area/CN) = [(8.660 x 30) + (2.000 x 77)] / 10.660



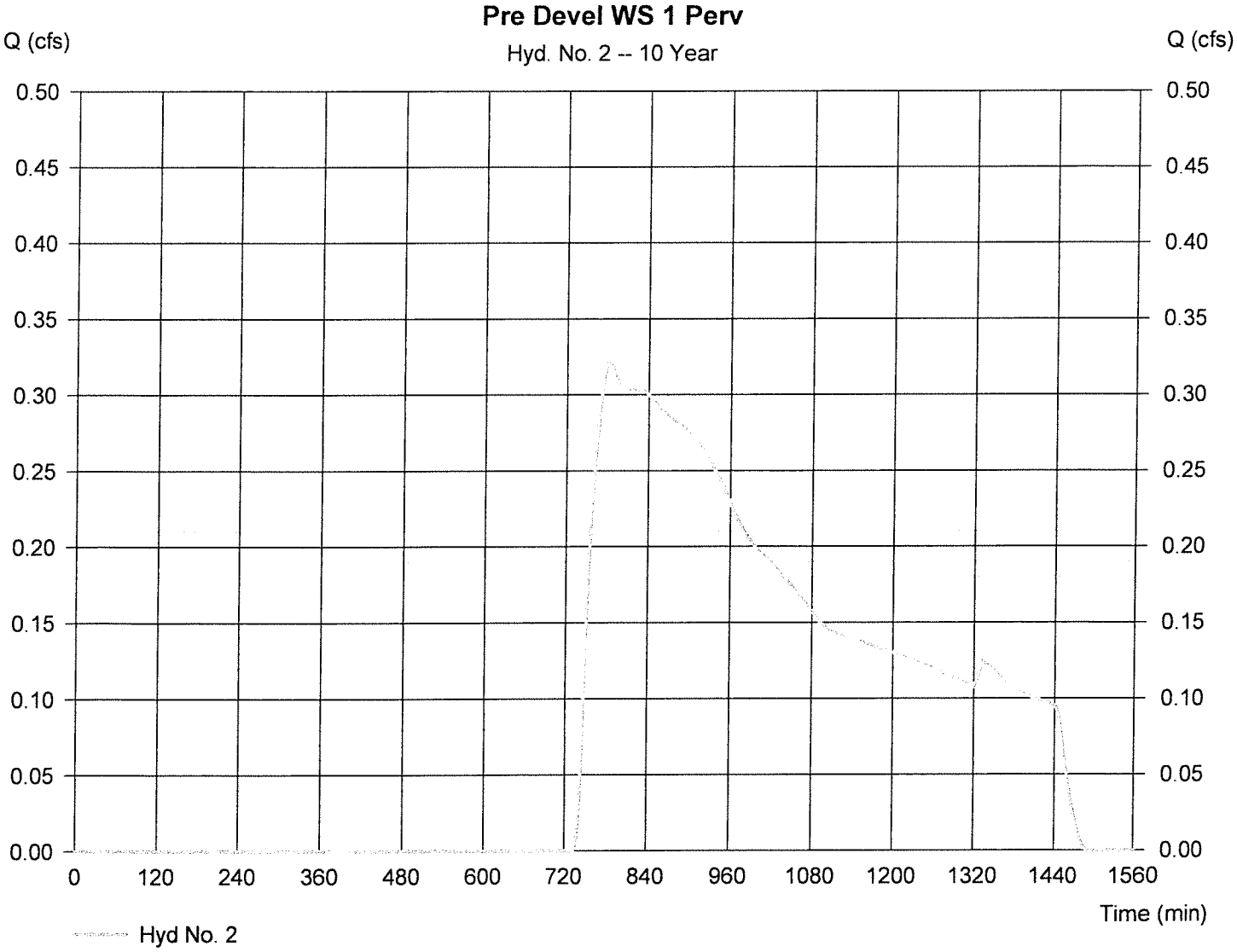
Hydrograph Report

Hyd. No. 2

Pre Devel WS 1 Perv

Hydrograph type	= SCS Runoff	Peak discharge	= 0.321 cfs
Storm frequency	= 10 yrs	Time to peak	= 782 min
Time interval	= 2 min	Hyd. volume	= 7,692 cuft
Drainage area	= 10.660 ac	Curve number	= 39*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 18.40 min
Total precip.	= 5.00 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 285

* Composite (Area/CN) = [(8.660 x 30) + (2.000 x 77)] / 10.660



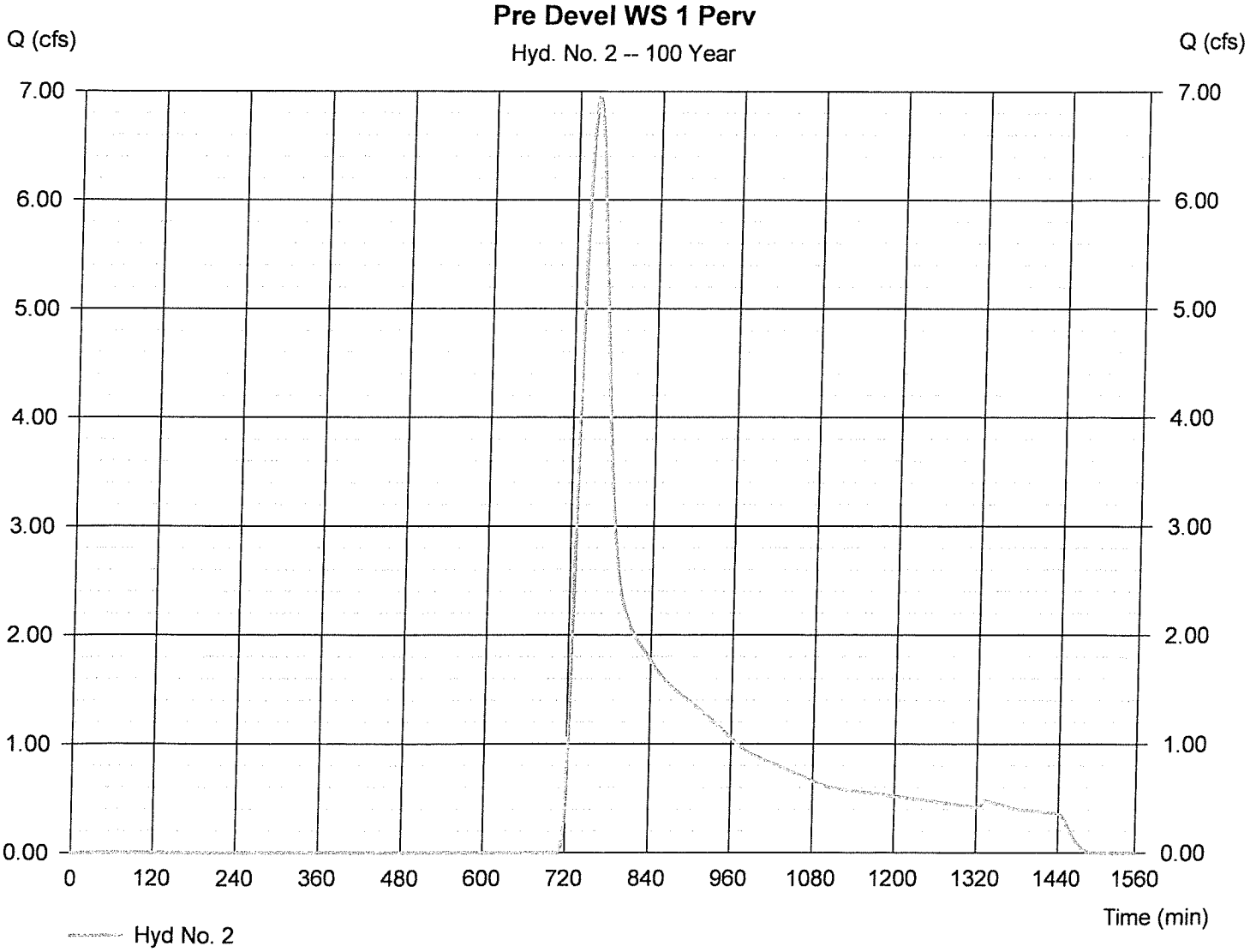
Hydrograph Report

Hyd. No. 2

Pre Devel WS 1 Perv

Hydrograph type	= SCS Runoff	Peak discharge	= 6.939 cfs
Storm frequency	= 100 yrs	Time to peak	= 748 min
Time interval	= 2 min	Hyd. volume	= 52,798 cuft
Drainage area	= 10.660 ac	Curve number	= 39*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 18.40 min
Total precip.	= 8.50 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 285

* Composite (Area/CN) = [(8.660 x 30) + (2.000 x 77)] / 10.660



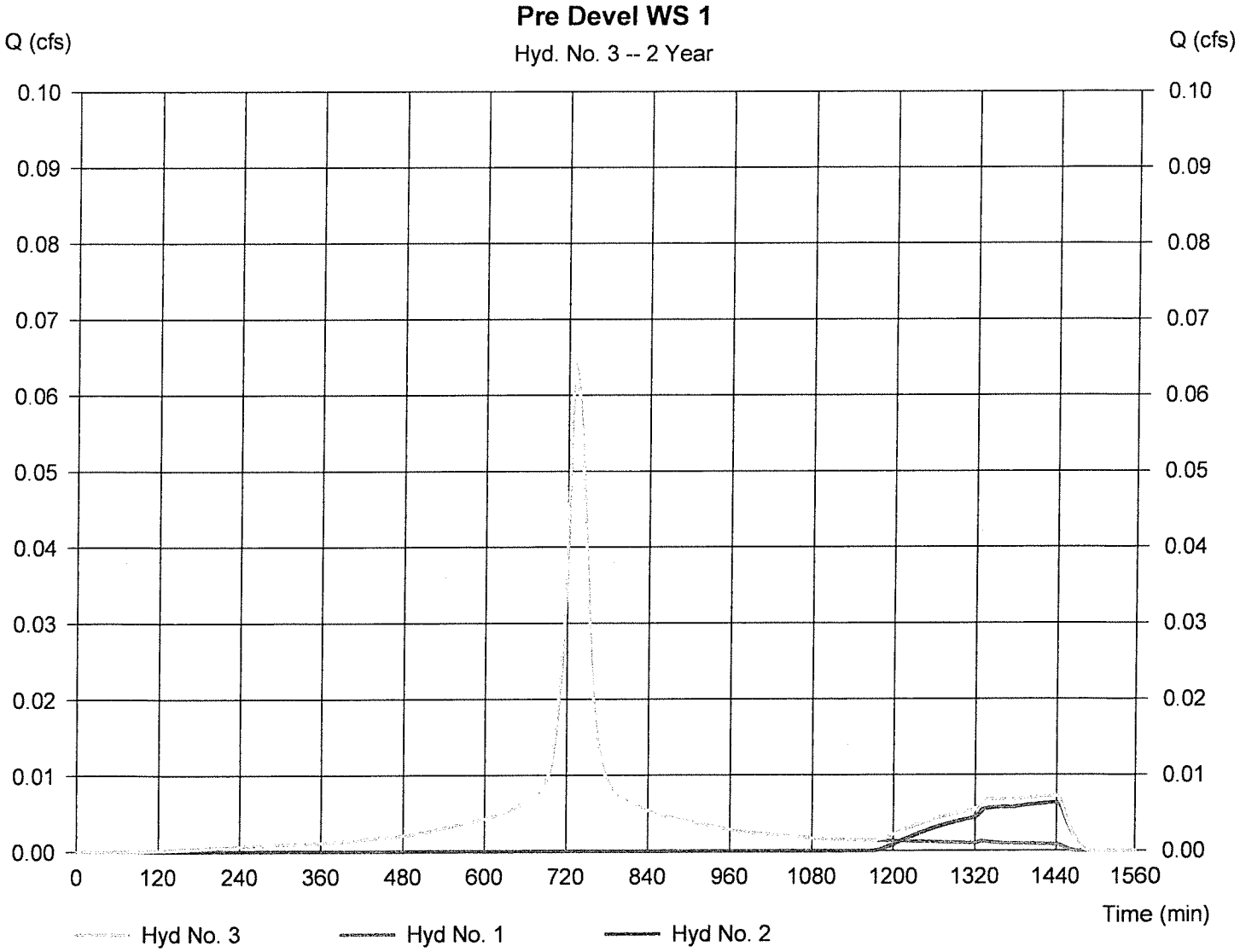
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2 Thursday, 12 / 10 / 2020

Hyd. No. 3

Pre Devel WS 1

Hydrograph type	= Combine	Peak discharge	= 0.064 cfs
Storm frequency	= 2 yrs	Time to peak	= 730 min
Time interval	= 2 min	Hyd. volume	= 404 cuft
Inflow hyds.	= 1, 2	Contrib. drain. area	= 10.690 ac



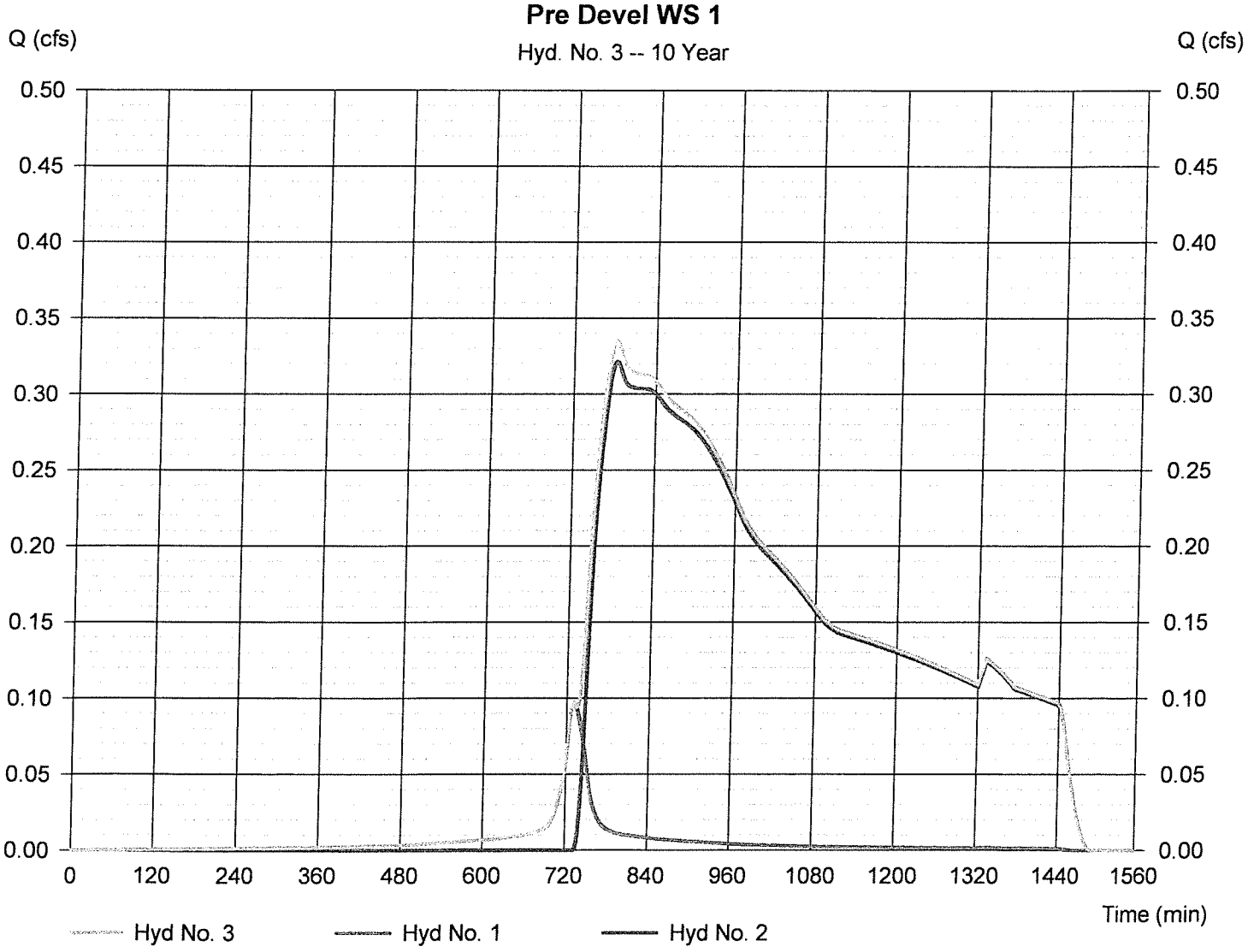
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2 Thursday, 12 / 10 / 2020

Hyd. No. 3

Pre Devel WS 1

Hydrograph type	= Combine	Peak discharge	= 0.335 cfs
Storm frequency	= 10 yrs	Time to peak	= 782 min
Time interval	= 2 min	Hyd. volume	= 8,208 cuft
Inflow hyds.	= 1, 2	Contrib. drain. area	= 10.690 ac



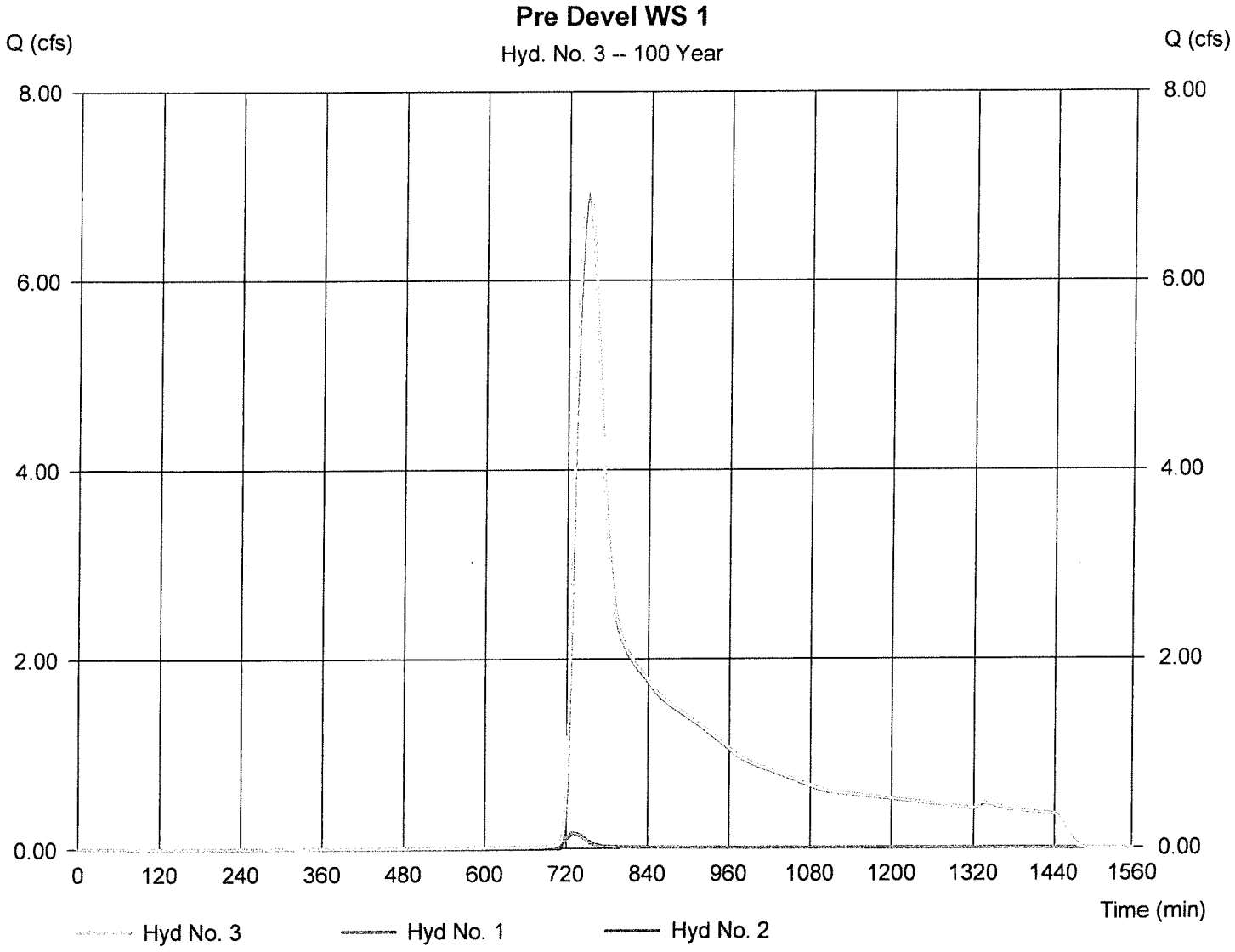
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2 Thursday, 12 / 10 / 2020

Hyd. No. 3

Pre Devel WS 1

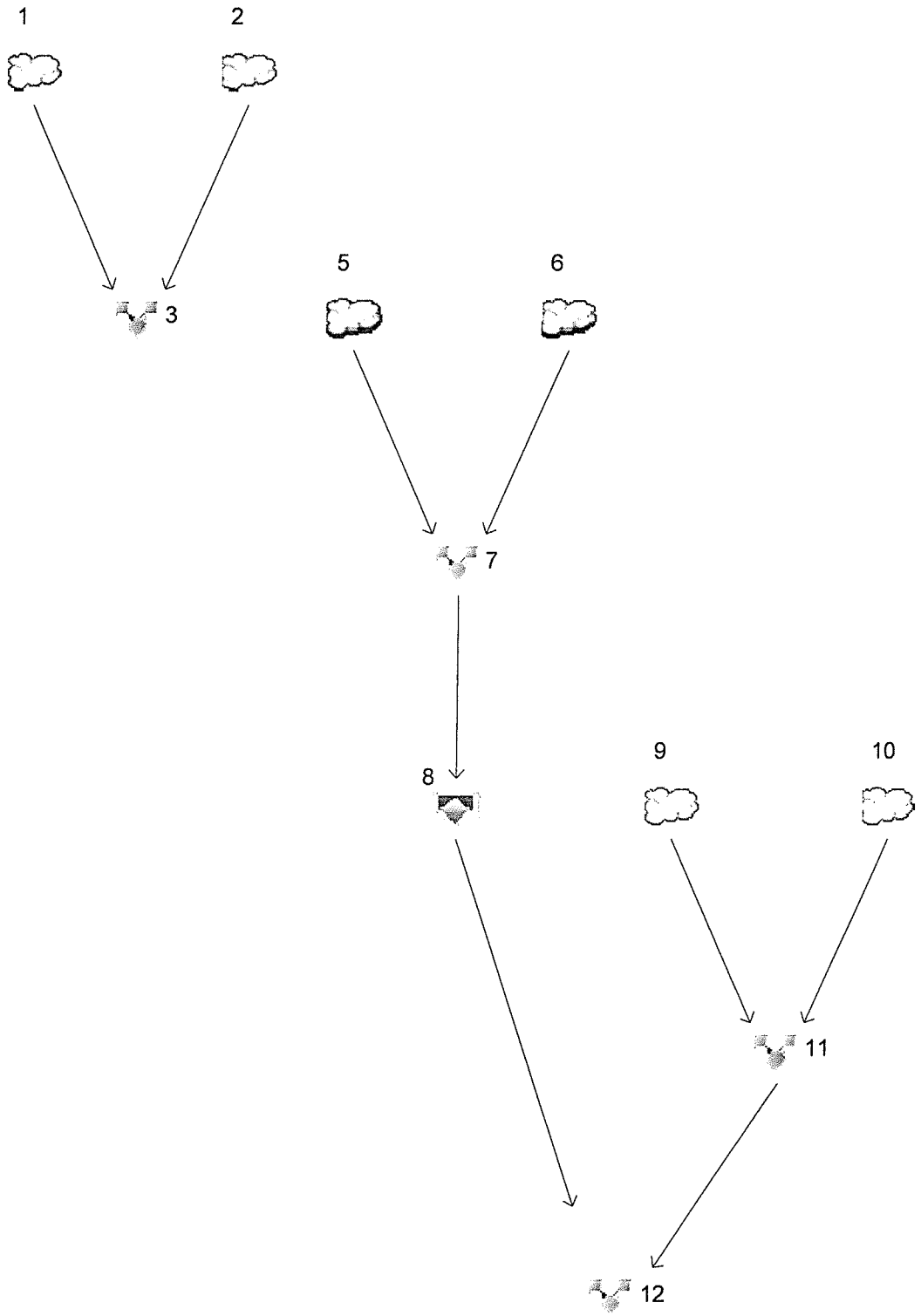
Hydrograph type	= Combine	Peak discharge	= 7.041 cfs
Storm frequency	= 100 yrs	Time to peak	= 748 min
Time interval	= 2 min	Hyd. volume	= 53,692 cuft
Inflow hyds.	= 1, 2	Contrib. drain. area	= 10.690 ac



4.0 Chapter 4 – POST-DEVELOPMENT RUNOFF CALCULATIONS

Watershed Model Schematic

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2

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	0.064	2	730	332	------	------	------	Pre Devel WS 1 Imp
2	SCS Runoff	0.006	2	1440	72	------	------	------	Pre Devel WS 1 Perv
3	Combine	0.064	2	730	404	1, 2	------	------	Pre Devel WS 1
5	SCS Runoff	13.51	2	730	64,738	------	------	------	Post Devel WS 1A Imp
6	SCS Runoff	0.642	2	742	4,291	------	------	------	Post Devel WS 1A Perv
7	Combine	13.99	2	730	69,029	5, 6	------	------	Post Devel WS 1A
8	Reservoir	0.087	2	790	1,450	7	137.68	34,246	Basin A
9	SCS Runoff	0.007	2	730	34	------	------	------	Post Devel WS 1B Imp
10	SCS Runoff	0.283	2	732	1,389	------	------	------	Post Devel WS 1B Perv
11	Combine	0.290	2	732	1,423	9, 10	------	------	Post Devel WS 1B
12	Combine	0.332	2	738	2,873	8, 11	------	------	Post Devel WS 1

Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2

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	0.097	2	730	515	------	------	------	Pre Devel WS 1 Imp
2	SCS Runoff	0.321	2	782	7,692	------	------	------	Pre Devel WS 1 Perv
3	Combine	0.335	2	782	8,208	1, 2	------	------	Pre Devel WS 1
5	SCS Runoff	22.42	2	730	109,594	------	------	------	Post Devel WS 1A Imp
6	SCS Runoff	2.296	2	736	12,099	------	------	------	Post Devel WS 1A Perv
7	Combine	24.60	2	730	121,693	5, 6	------	------	Post Devel WS 1A
8	Reservoir	0.143	2	820	4,366	7	138.16	64,563	Basin A
9	SCS Runoff	0.012	2	730	57	------	------	------	Post Devel WS 1B Imp
10	SCS Runoff	0.596	2	732	2,838	------	------	------	Post Devel WS 1B Perv
11	Combine	0.608	2	732	2,896	9, 10	------	------	Post Devel WS 1B
12	Combine	0.699	2	732	7,262	8, 11	------	------	Post Devel WS 1

Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2

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	0.166	2	730	894	------	------	------	Pre Devel WS 1 Imp
2	SCS Runoff	6.939	2	748	52,798	------	------	------	Pre Devel WS 1 Perv
3	Combine	7.041	2	748	53,692	1, 2	------	------	Pre Devel WS 1
5	SCS Runoff	40.49	2	730	204,168	------	------	------	Post Devel WS 1A Imp
6	SCS Runoff	7.031	2	732	33,848	------	------	------	Post Devel WS 1A Perv
7	Combine	47.44	2	730	238,017	5, 6	------	------	Post Devel WS 1A
8	Reservoir	4.125	2	784	63,234	7	138.97	124,678	Basin A
9	SCS Runoff	0.021	2	730	107	------	------	------	Post Devel WS 1B Imp
10	SCS Runoff	1.301	2	730	6,206	------	------	------	Post Devel WS 1B Perv
11	Combine	1.322	2	730	6,313	9, 10	------	------	Post Devel WS 1B
12	Combine	4.335	2	778	69,546	8, 11	------	------	Post Devel WS 1

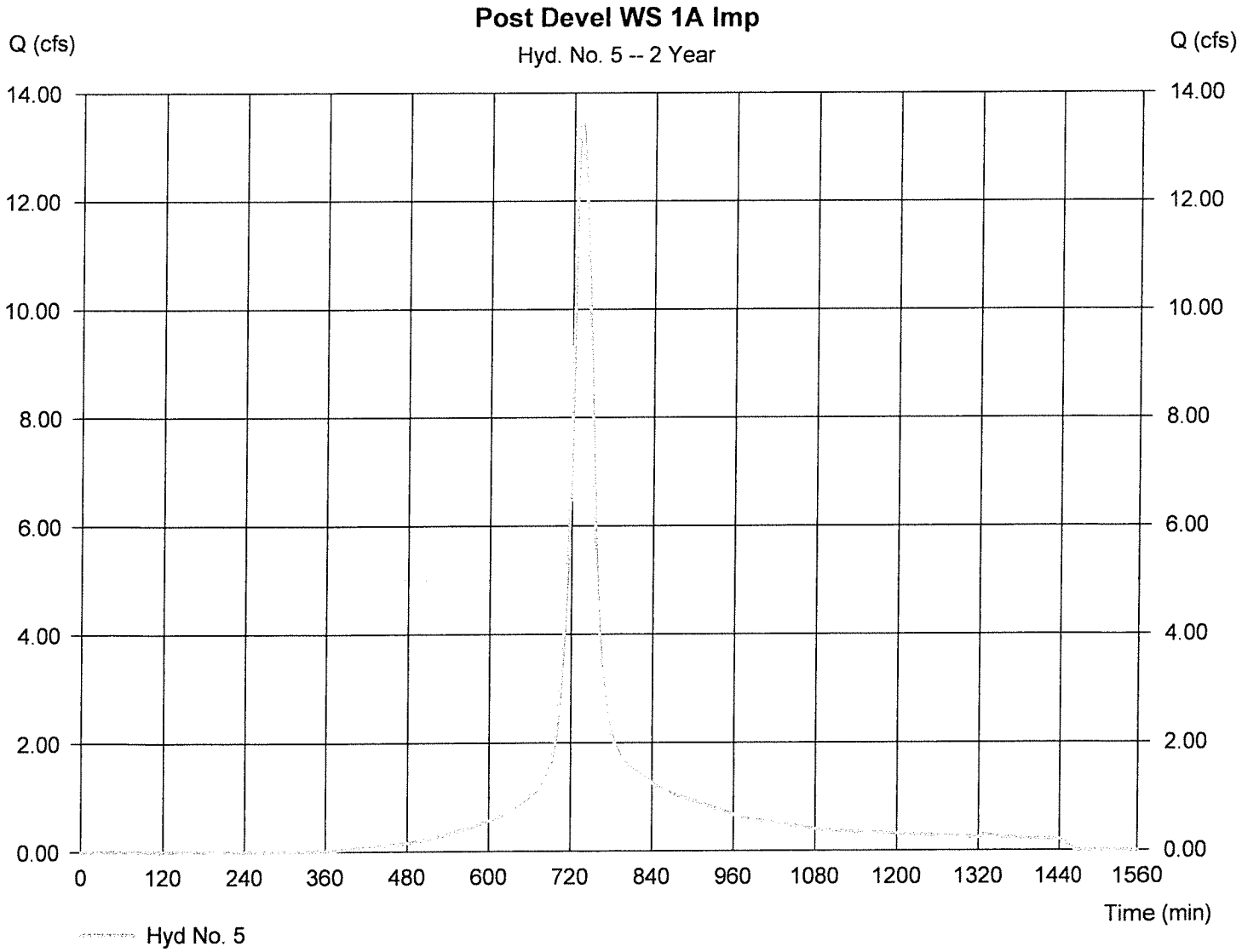
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2 Thursday, 12 / 10 / 2020

Hyd. No. 5

Post Devel WS 1A Imp

Hydrograph type	= SCS Runoff	Peak discharge	= 13.51 cfs
Storm frequency	= 2 yrs	Time to peak	= 730 min
Time interval	= 2 min	Hyd. volume	= 64,738 cuft
Drainage area	= 7.630 ac	Curve number	= 91
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 10.00 min
Total precip.	= 3.30 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 285



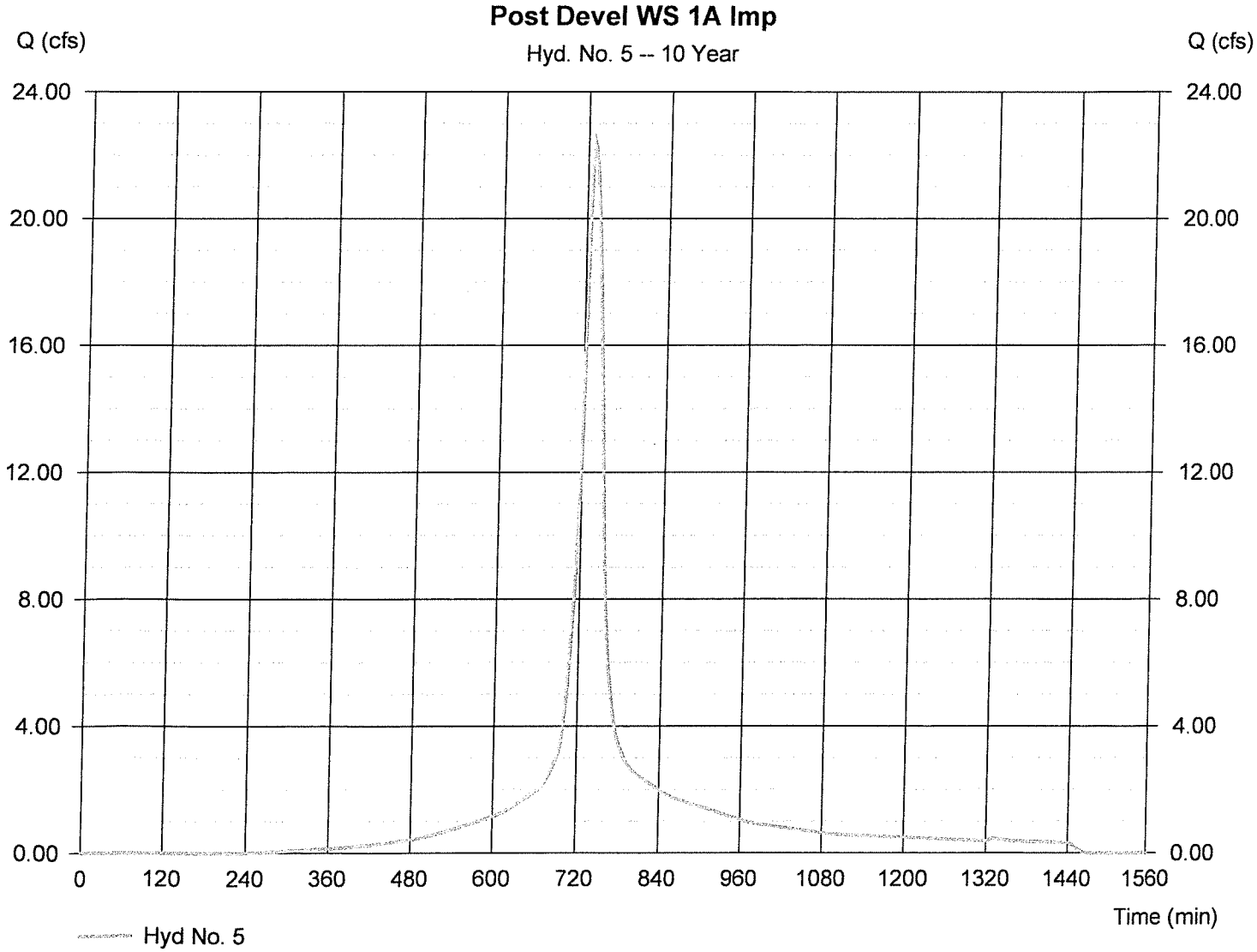
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2 Thursday, 12 / 10 / 2020

Hyd. No. 5

Post Devel WS 1A Imp

Hydrograph type	= SCS Runoff	Peak discharge	= 22.42 cfs
Storm frequency	= 10 yrs	Time to peak	= 730 min
Time interval	= 2 min	Hyd. volume	= 109,594 cuft
Drainage area	= 7.630 ac	Curve number	= 91
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 10.00 min
Total precip.	= 5.00 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 285

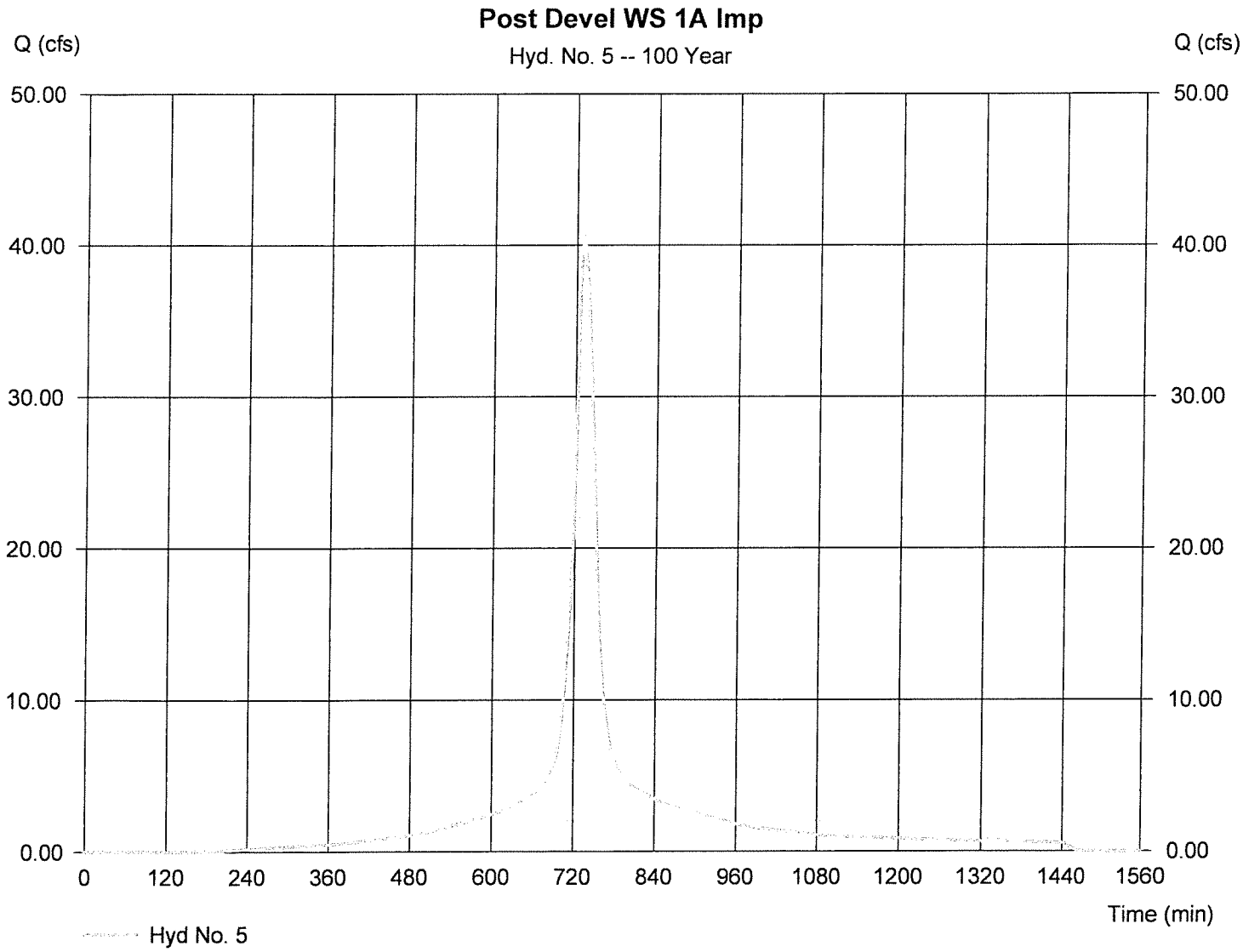


Hydrograph Report

Hyd. No. 5

Post Devel WS 1A Imp

Hydrograph type	= SCS Runoff	Peak discharge	= 40.49 cfs
Storm frequency	= 100 yrs	Time to peak	= 730 min
Time interval	= 2 min	Hyd. volume	= 204,168 cuft
Drainage area	= 7.630 ac	Curve number	= 91
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 10.00 min
Total precip.	= 8.50 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 285



Hydrograph Report

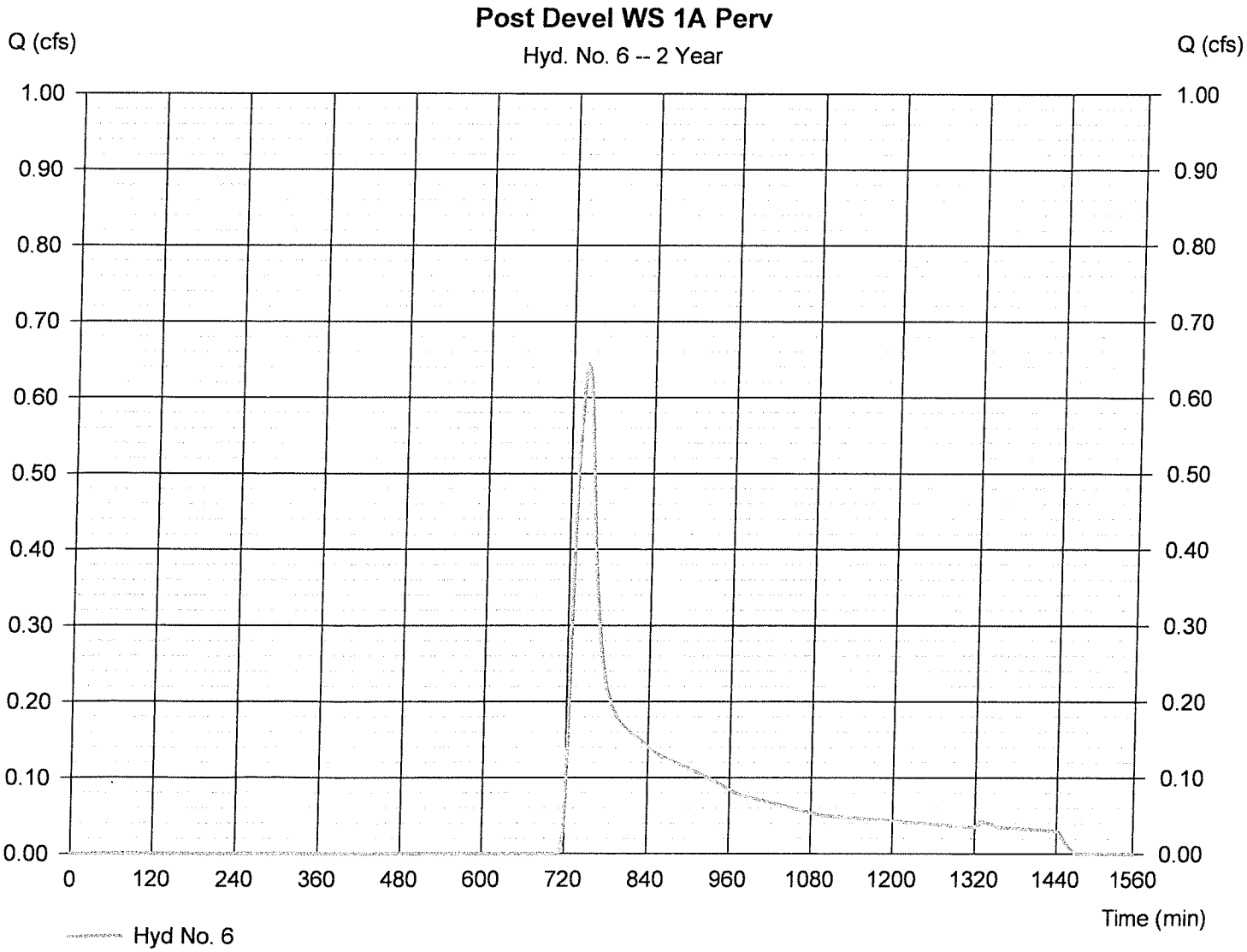
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2 Thursday, 12 / 10 / 2020

Hyd. No. 6

Post Devel WS 1A Perv

Hydrograph type	= SCS Runoff	Peak discharge	= 0.642 cfs
Storm frequency	= 2 yrs	Time to peak	= 742 min
Time interval	= 2 min	Hyd. volume	= 4,291 cuft
Drainage area	= 2.450 ac	Curve number	= 61*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 10.00 min
Total precip.	= 3.30 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 285

* Composite (Area/CN) = [(1.130 x 39) + (1.320 x 80)] / 2.450



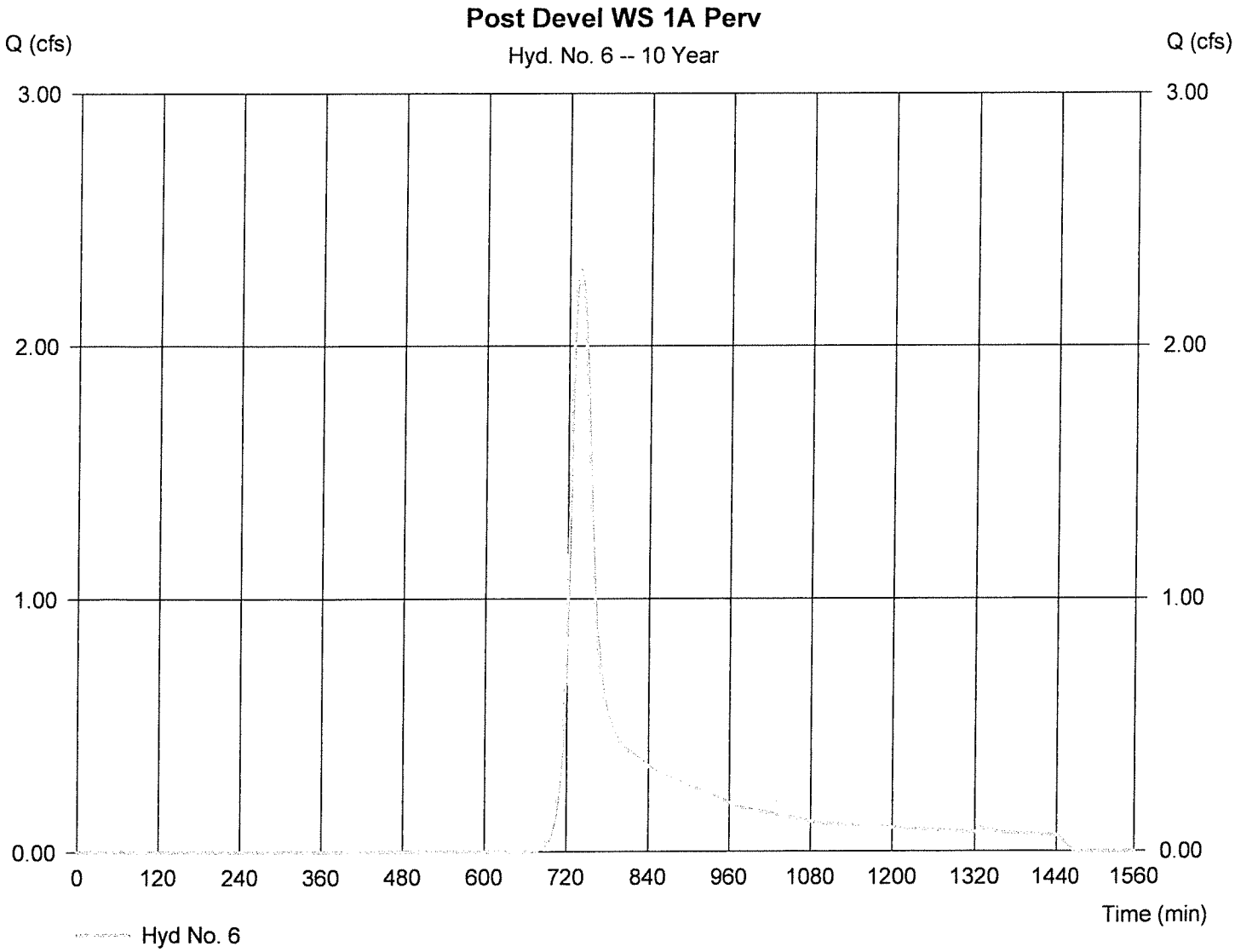
Hydrograph Report

Hyd. No. 6

Post Devel WS 1A Perv

Hydrograph type	= SCS Runoff	Peak discharge	= 2.296 cfs
Storm frequency	= 10 yrs	Time to peak	= 736 min
Time interval	= 2 min	Hyd. volume	= 12,099 cuft
Drainage area	= 2.450 ac	Curve number	= 61*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 10.00 min
Total precip.	= 5.00 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 285

* Composite (Area/CN) = [(1.130 x 39) + (1.320 x 80)] / 2.450



Hydrograph Report

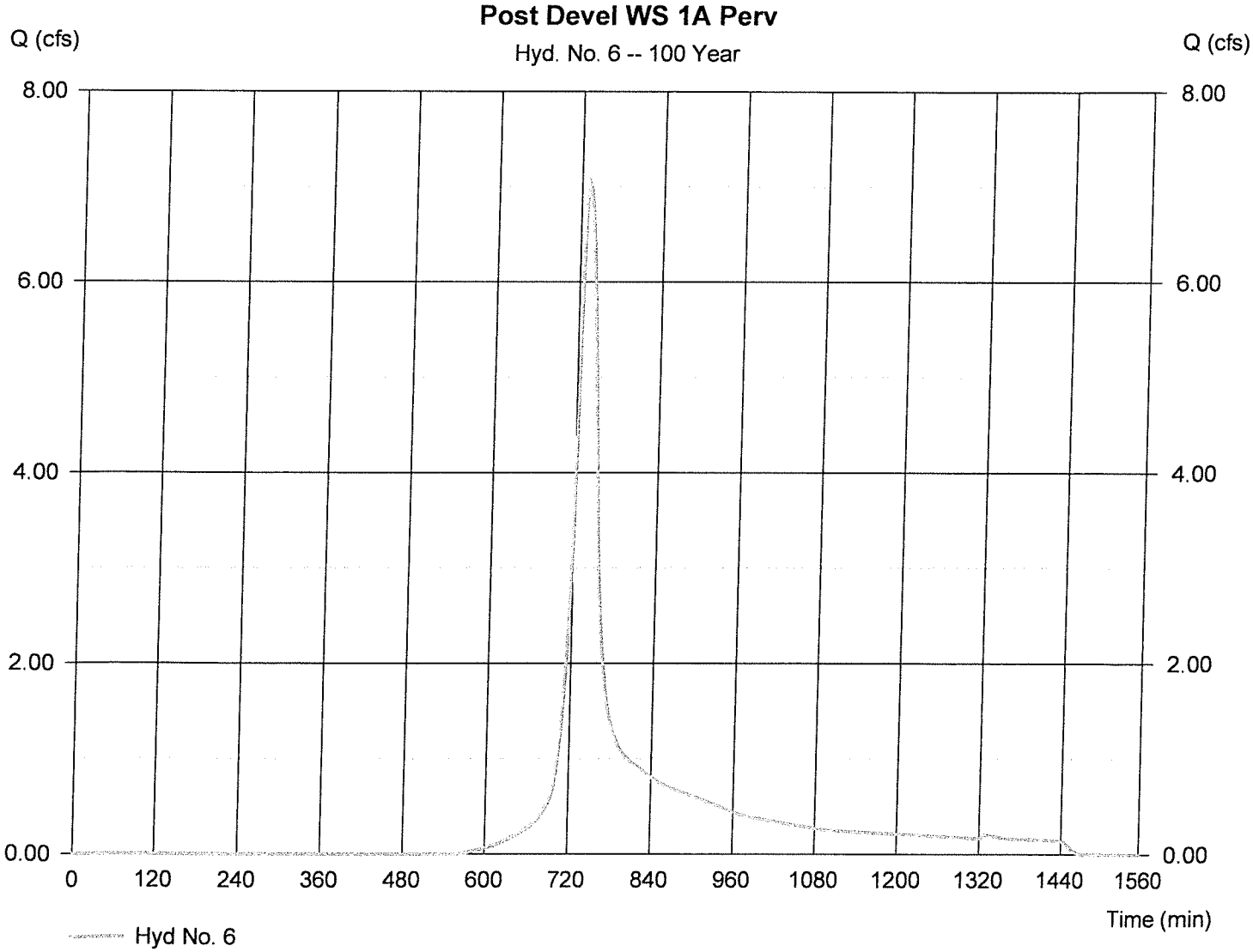
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2 Thursday, 12 / 10 / 2020

Hyd. No. 6

Post Devel WS 1A Perv

Hydrograph type	= SCS Runoff	Peak discharge	= 7.031 cfs
Storm frequency	= 100 yrs	Time to peak	= 732 min
Time interval	= 2 min	Hyd. volume	= 33,848 cuft
Drainage area	= 2.450 ac	Curve number	= 61*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 10.00 min
Total precip.	= 8.50 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 285

* Composite (Area/CN) = [(1.130 x 39) + (1.320 x 80)] / 2.450



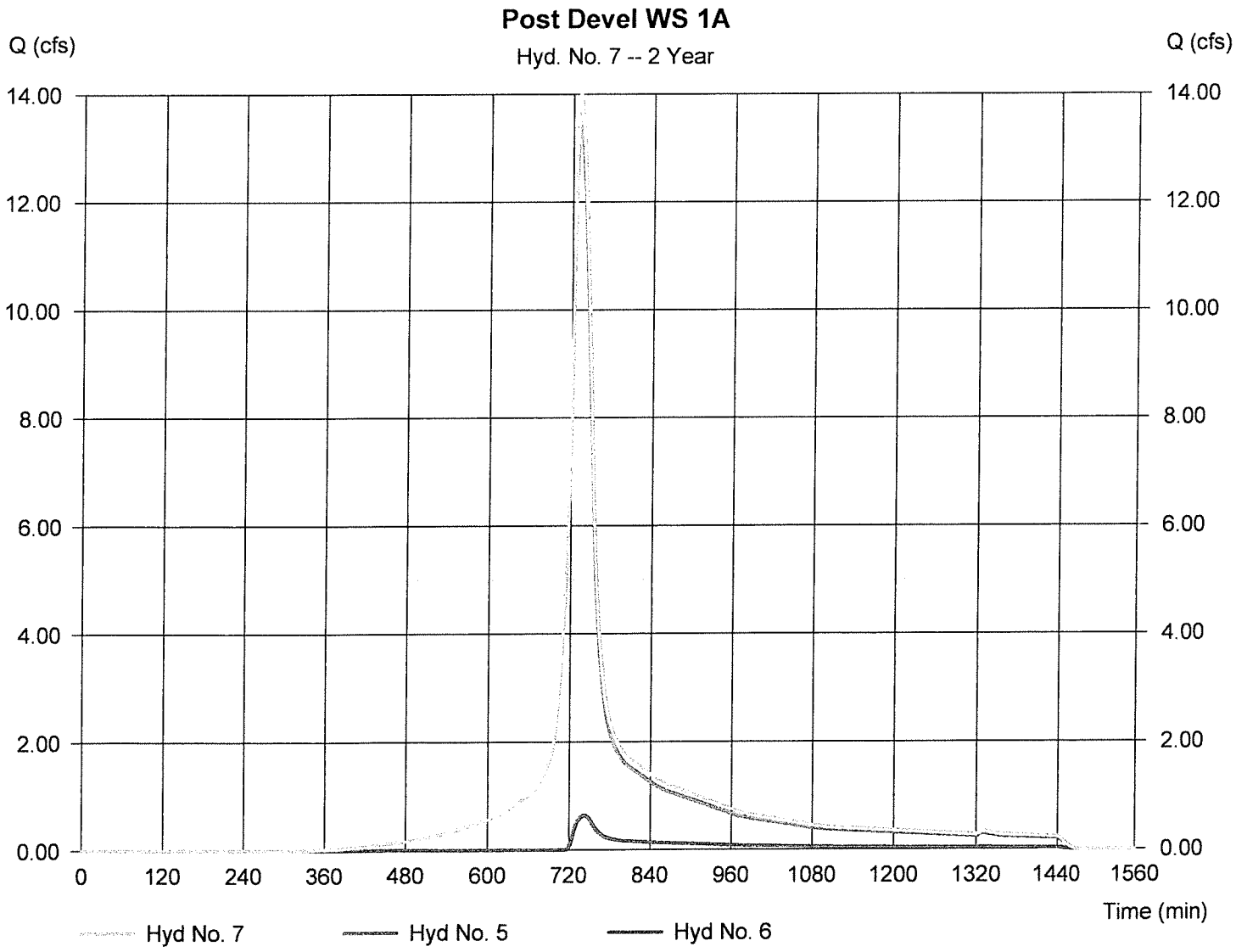
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2 — Thursday, 12 / 10 / 2020

Hyd. No. 7

Post Devel WS 1A

Hydrograph type	= Combine	Peak discharge	= 13.99 cfs
Storm frequency	= 2 yrs	Time to peak	= 730 min
Time interval	= 2 min	Hyd. volume	= 69,029 cuft
Inflow hyds.	= 5, 6	Contrib. drain. area	= 10.080 ac

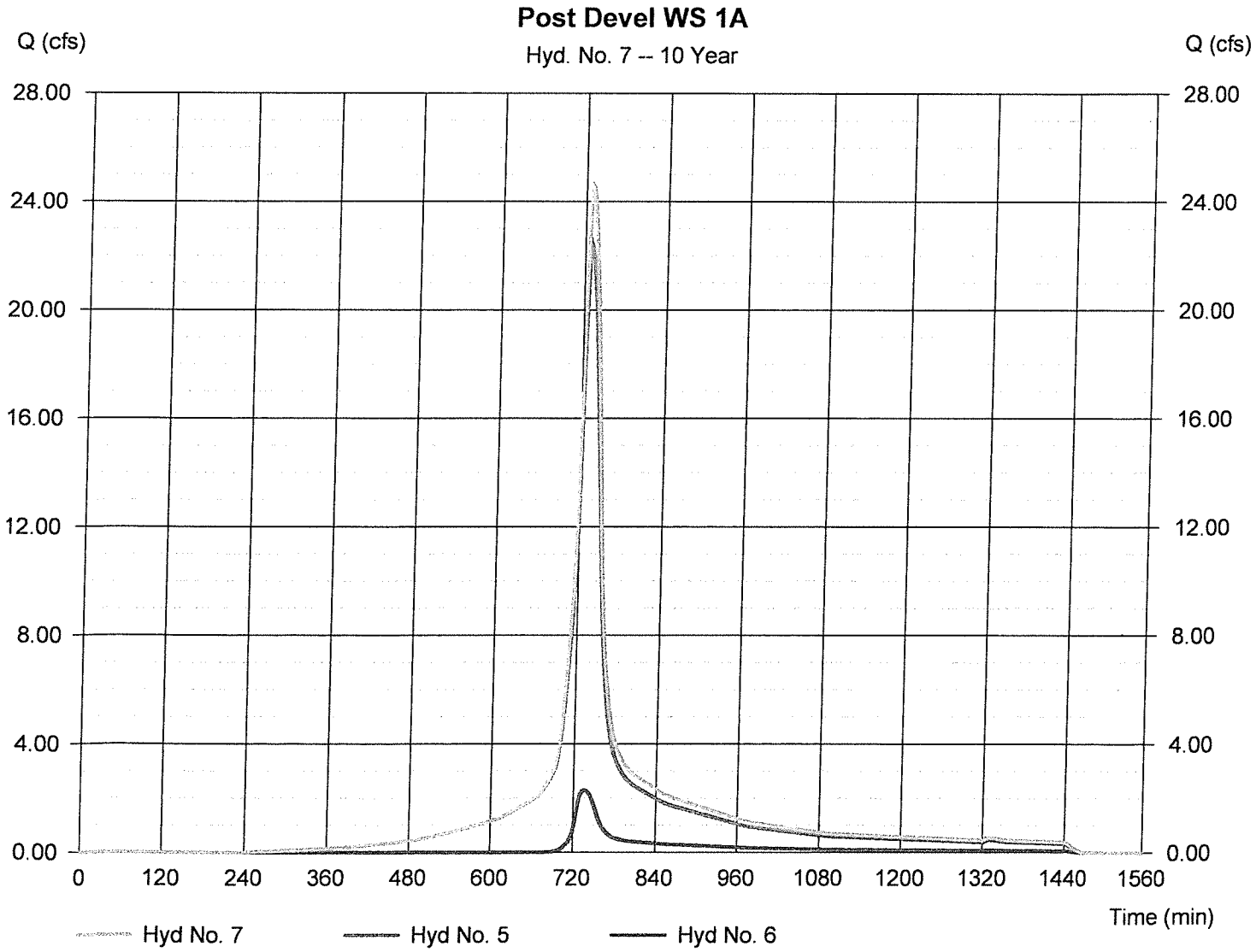


Hydrograph Report

Hyd. No. 7

Post Devel WS 1A

Hydrograph type	= Combine	Peak discharge	= 24.60 cfs
Storm frequency	= 10 yrs	Time to peak	= 730 min
Time interval	= 2 min	Hyd. volume	= 121,693 cuft
Inflow hyds.	= 5, 6	Contrib. drain. area	= 10.080 ac

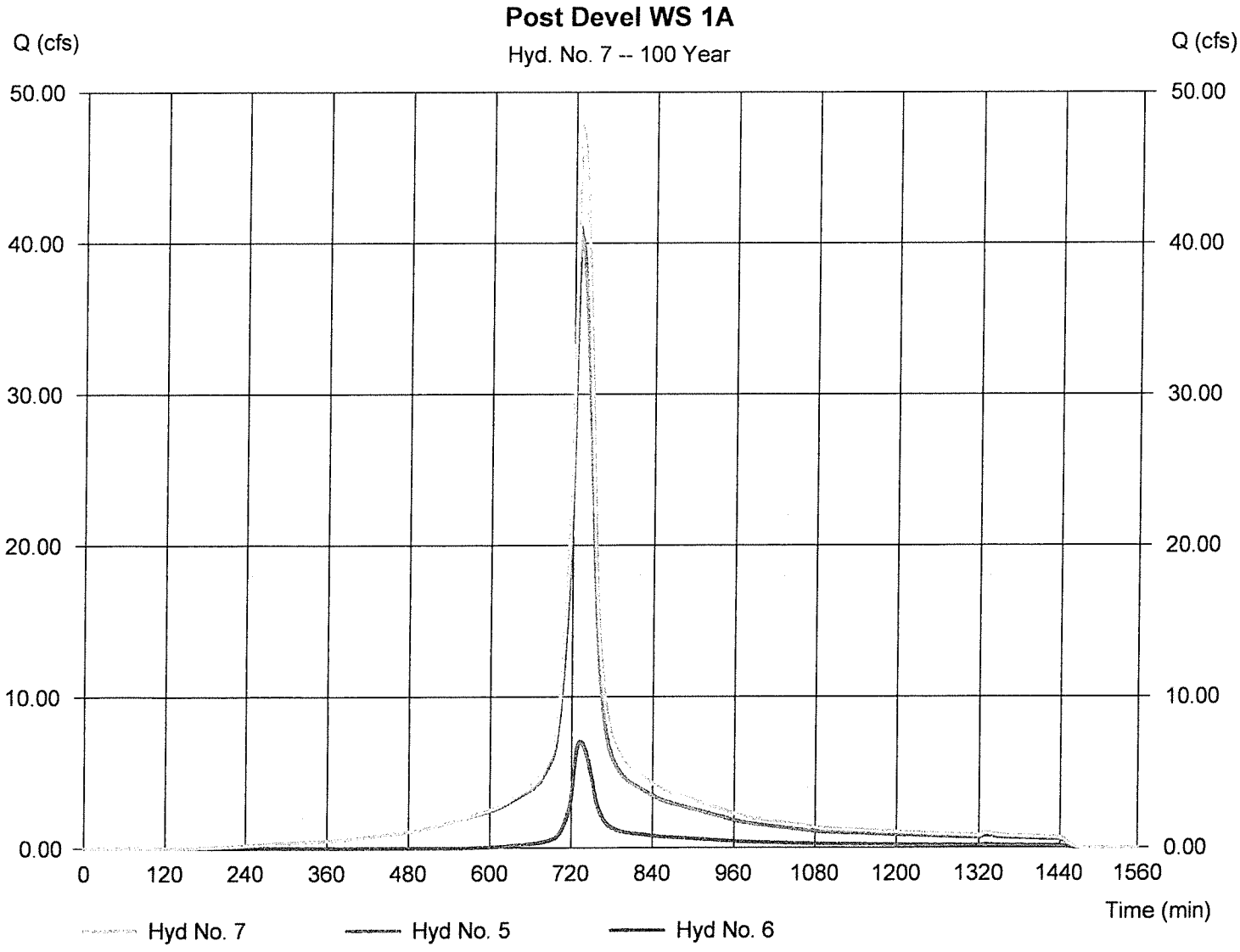


Hydrograph Report

Hyd. No. 7

Post Devel WS 1A

Hydrograph type	= Combine	Peak discharge	= 47.44 cfs
Storm frequency	= 100 yrs	Time to peak	= 730 min
Time interval	= 2 min	Hyd. volume	= 238,017 cuft
Inflow hyds.	= 5, 6	Contrib. drain. area	= 10.080 ac



Hydrograph Report

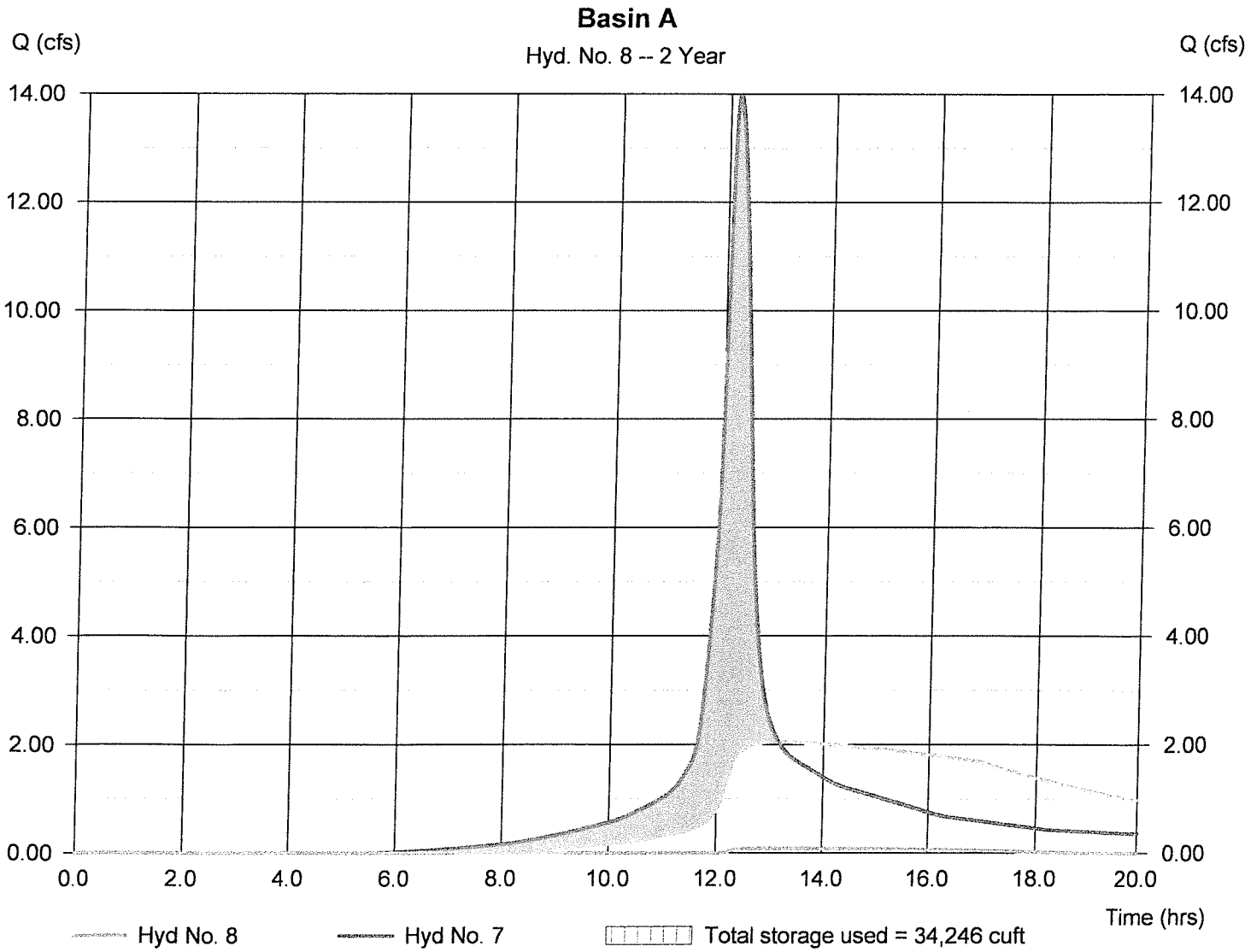
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2 Friday, 12 / 11 / 2020

Hyd. No. 8

Basin A

Hydrograph type	= Reservoir	Peak discharge	= 0.087 cfs
Storm frequency	= 2 yrs	Time to peak	= 13.17 hrs
Time interval	= 2 min	Hyd. volume	= 1,450 cuft
Inflow hyd. No.	= 7 - Post Devel WS 1A	Max. Elevation	= 137.68 ft
Reservoir name	= Basin	Max. Storage	= 34,246 cuft

Storage Indication method used. Exfiltration extracted from Outflow.



Pond Report

Pond No. 1 - Basin

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 137.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	137.00	46,087	0	0
0.50	137.50	47,474	23,387	23,387
1.00	138.00	71,666	29,575	52,962
1.50	138.50	74,031	36,419	89,381
2.00	139.00	76,411	37,605	126,986
2.95	139.95	78,804	73,717	200,703

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 15.00	2.50	0.00	0.00
Span (in)	= 15.00	2.50	0.00	0.00
No. Barrels	= 1	1	0	0
Invert El. (ft)	= 137.00	137.30	0.00	0.00
Length (ft)	= 5.00	1.00	0.00	0.00
Slope (%)	= 0.50	1.00	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	Yes	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 16.00	2.00	20.00	0.00
Crest El. (ft)	= 139.22	138.20	139.45	0.00
Weir Coeff.	= 3.33	3.33	2.60	3.33
Weir Type	= 1	Rect	Broad	---
Multi-Stage	= Yes	Yes	No	No

Exfil.(in/hr) = 1.500 (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	137.00	0.00	0.00	---	---	0.00	0.00	0.00	---	0.000	---	0.000
0.50	23,387	137.50	0.05 oc	0.05 ic	---	---	0.00	0.00	0.00	---	1.648	---	1.700
1.00	52,962	138.00	0.13 oc	0.13 ic	---	---	0.00	0.00	0.00	---	2.488	---	2.615
1.50	89,381	138.50	1.19 oc	0.10 ic	---	---	0.00	1.09	0.00	---	2.571	---	3.762
2.00	126,986	139.00	4.33 oc	0.11 ic	---	---	0.00	4.21 s	0.00	---	2.653	---	6.979
2.95	200,703	139.95	8.99 ic	0.01 ic	---	---	6.72 s	2.23 s	18.38	---	2.736	---	30.08

Hydrograph Report

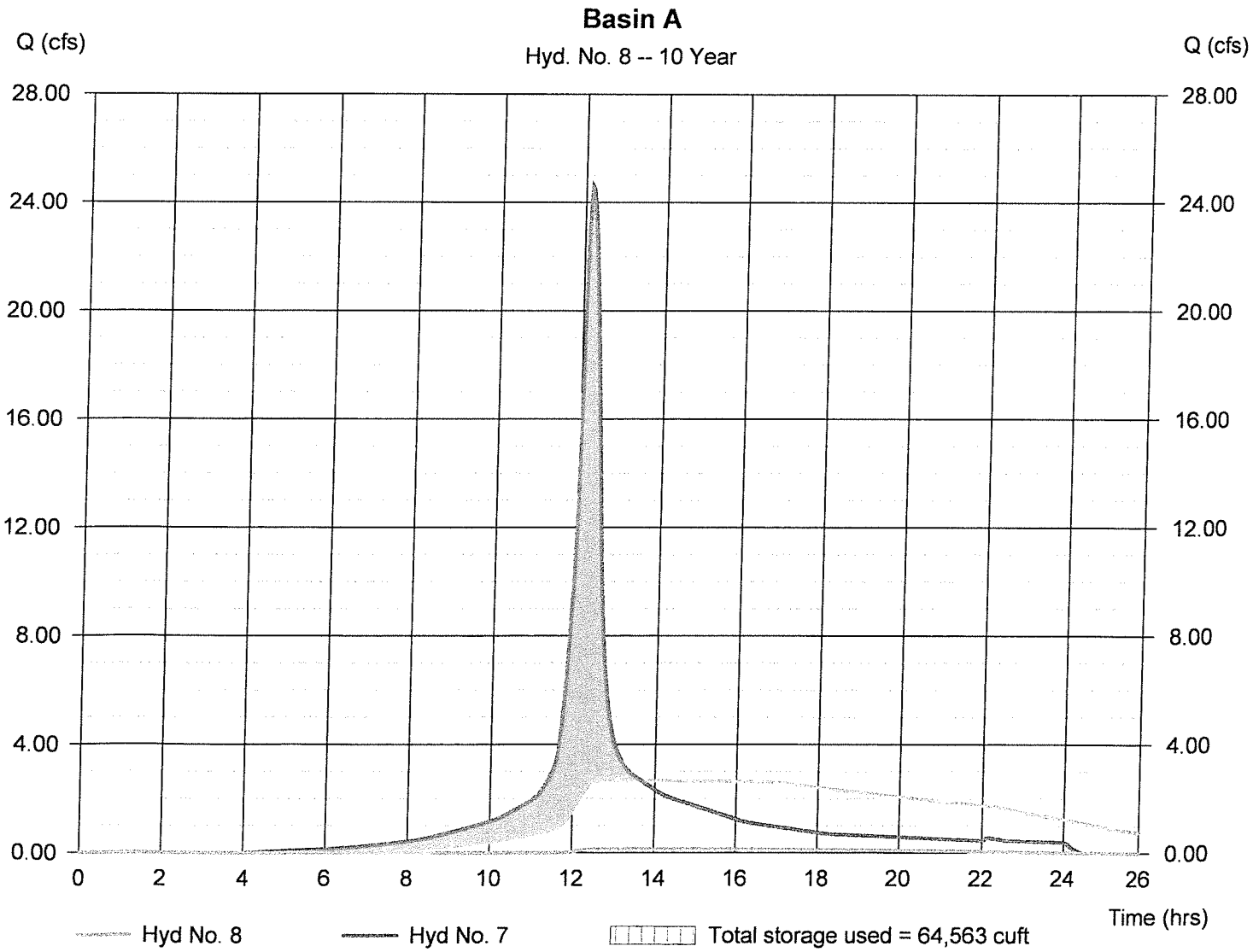
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2 Friday, 12 / 11 / 2020

Hyd. No. 8

Basin A

Hydrograph type	= Reservoir	Peak discharge	= 0.143 cfs
Storm frequency	= 10 yrs	Time to peak	= 13.67 hrs
Time interval	= 2 min	Hyd. volume	= 4,366 cuft
Inflow hyd. No.	= 7 - Post Devel WS 1A	Max. Elevation	= 138.16 ft
Reservoir name	= Basin	Max. Storage	= 64,563 cuft

Storage Indication method used. Exfiltration extracted from Outflow.



Hydrograph Report

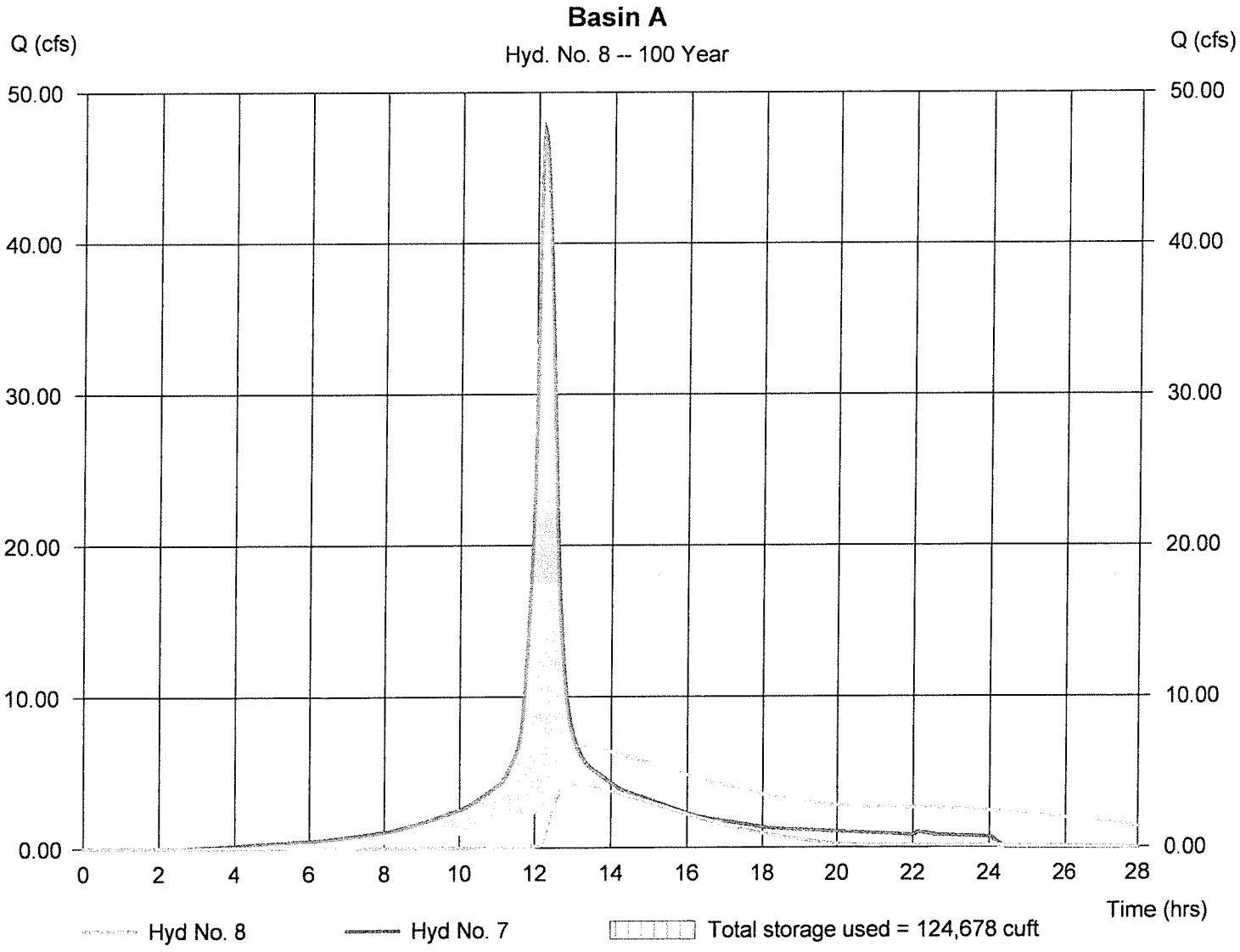
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2 — Friday, 12 / 11 / 2020

Hyd. No. 8

Basin A

Hydrograph type	= Reservoir	Peak discharge	= 4.125 cfs
Storm frequency	= 100 yrs	Time to peak	= 13.07 hrs
Time interval	= 2 min	Hyd. volume	= 63,235 cuft
Inflow hyd. No.	= 7 - Post Devel WS 1A	Max. Elevation	= 138.97 ft
Reservoir name	= Basin	Max. Storage	= 124,678 cuft

Storage Indication method used. Exfiltration extracted from Outflow.



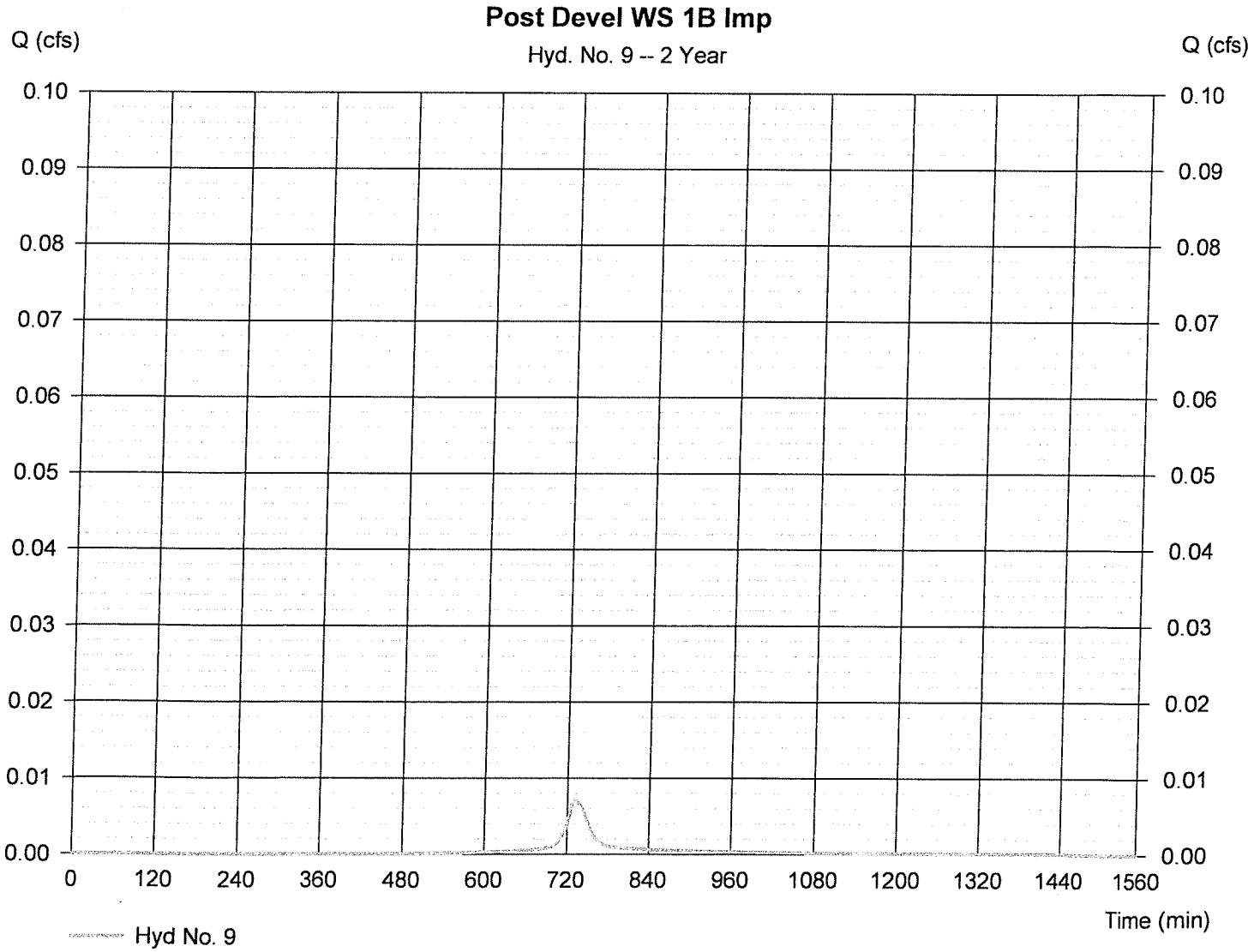
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2 Thursday, 12 / 10 / 2020

Hyd. No. 9

Post Devel WS 1B Imp

Hydrograph type	= SCS Runoff	Peak discharge	= 0.007 cfs
Storm frequency	= 2 yrs	Time to peak	= 730 min
Time interval	= 2 min	Hyd. volume	= 34 cuft
Drainage area	= 0.004 ac	Curve number	= 91
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 10.00 min
Total precip.	= 3.30 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 285

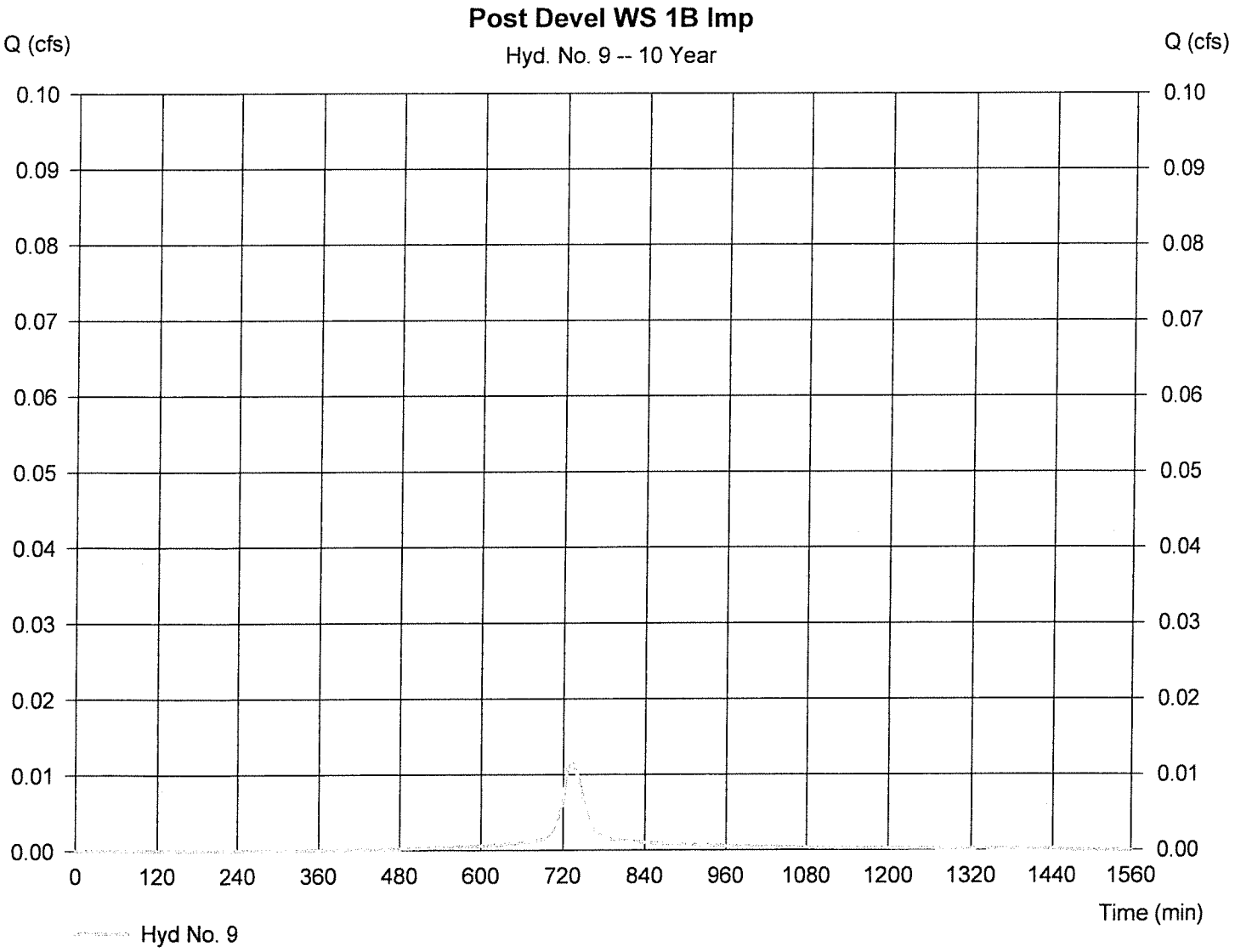


Hydrograph Report

Hyd. No. 9

Post Devel WS 1B Imp

Hydrograph type	= SCS Runoff	Peak discharge	= 0.012 cfs
Storm frequency	= 10 yrs	Time to peak	= 730 min
Time interval	= 2 min	Hyd. volume	= 57 cuft
Drainage area	= 0.004 ac	Curve number	= 91
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 10.00 min
Total precip.	= 5.00 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 285

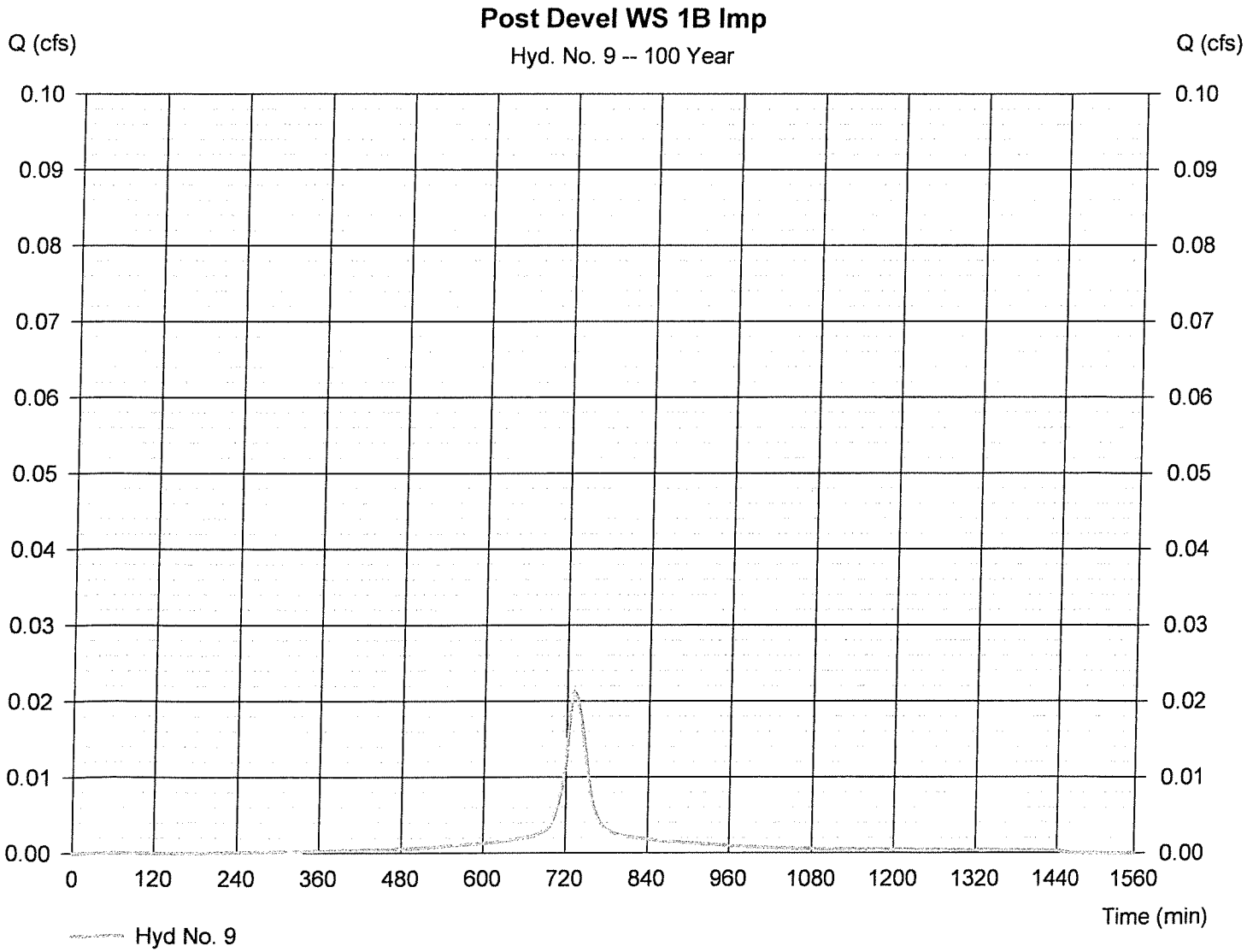


Hydrograph Report

Hyd. No. 9

Post Devel WS 1B Imp

Hydrograph type	= SCS Runoff	Peak discharge	= 0.021 cfs
Storm frequency	= 100 yrs	Time to peak	= 730 min
Time interval	= 2 min	Hyd. volume	= 107 cuft
Drainage area	= 0.004 ac	Curve number	= 91
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 10.00 min
Total precip.	= 8.50 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 285



Hydrograph Report

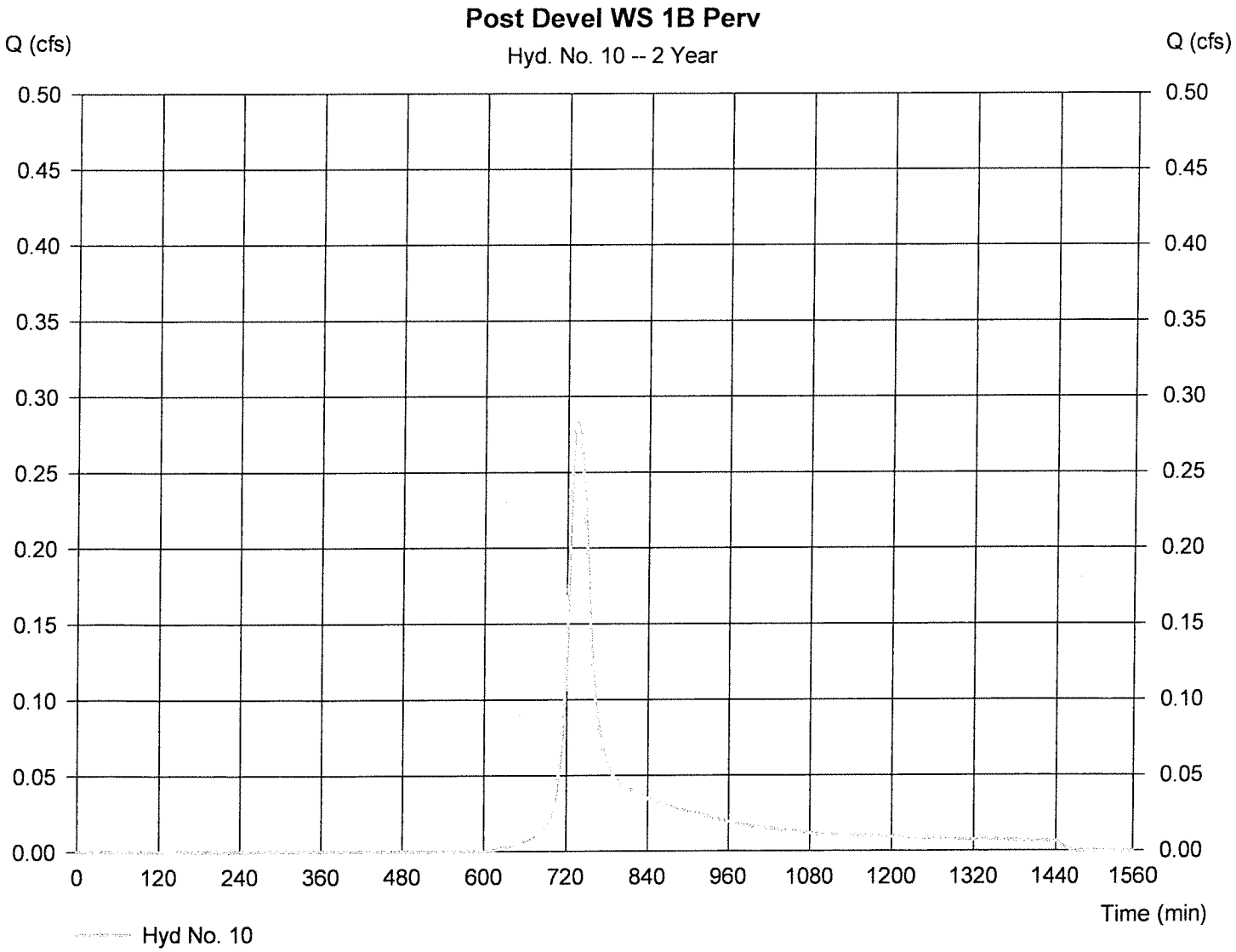
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2 — Thursday, 12 / 10 / 2020

Hyd. No. 10

Post Devel WS 1B Perv

Hydrograph type	= SCS Runoff	Peak discharge	= 0.283 cfs
Storm frequency	= 2 yrs	Time to peak	= 732 min
Time interval	= 2 min	Hyd. volume	= 1,389 cuft
Drainage area	= 0.300 ac	Curve number	= 77*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 10.00 min
Total precip.	= 3.30 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 285

* Composite (Area/CN) = [(0.020 x 39) + (0.280 x 80)] / 0.300



Hydrograph Report

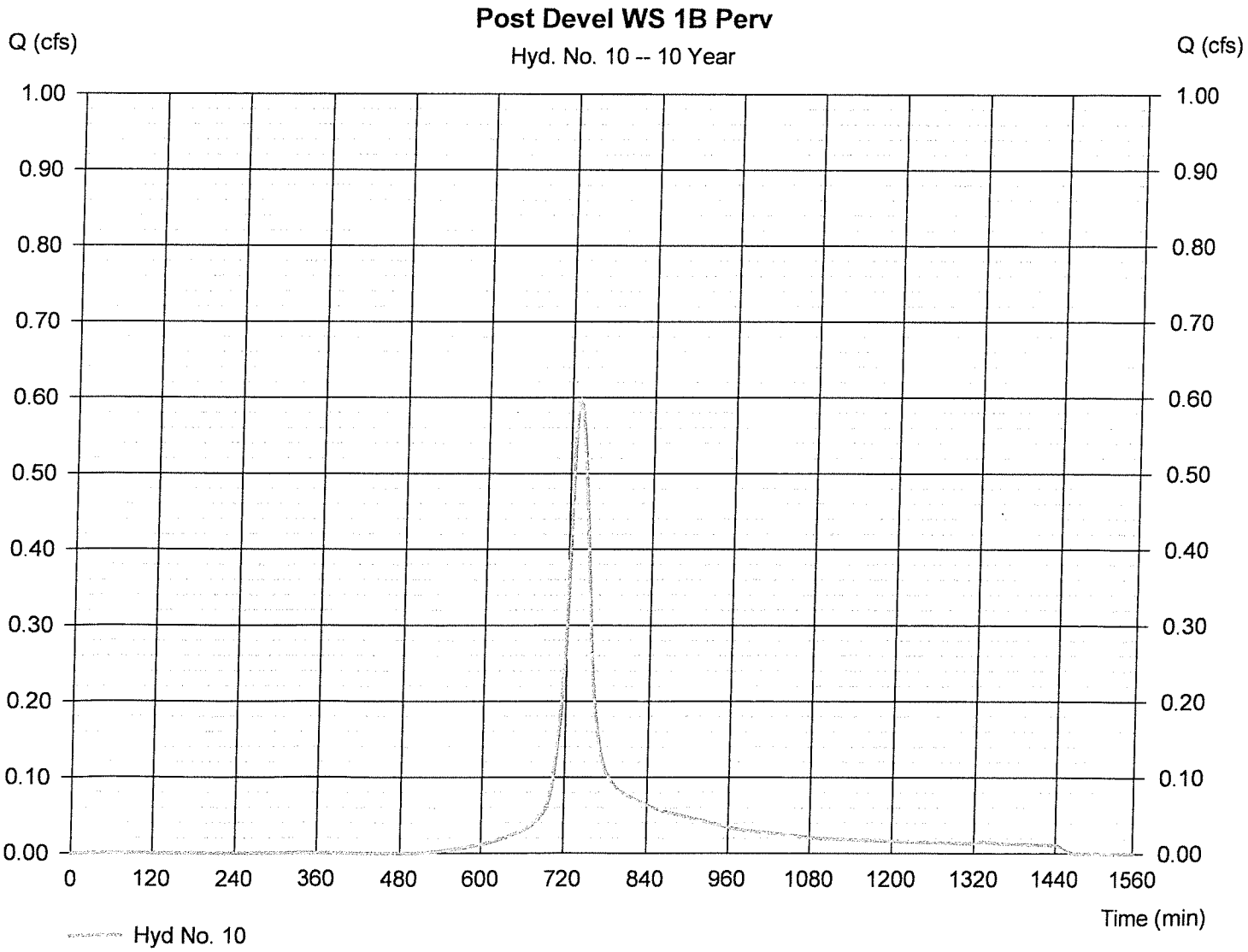
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2 Thursday, 12 / 10 / 2020

Hyd. No. 10

Post Devel WS 1B Perv

Hydrograph type	= SCS Runoff	Peak discharge	= 0.596 cfs
Storm frequency	= 10 yrs	Time to peak	= 732 min
Time interval	= 2 min	Hyd. volume	= 2,838 cuft
Drainage area	= 0.300 ac	Curve number	= 77*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 10.00 min
Total precip.	= 5.00 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 285

* Composite (Area/CN) = [(0.020 x 39) + (0.280 x 80)] / 0.300



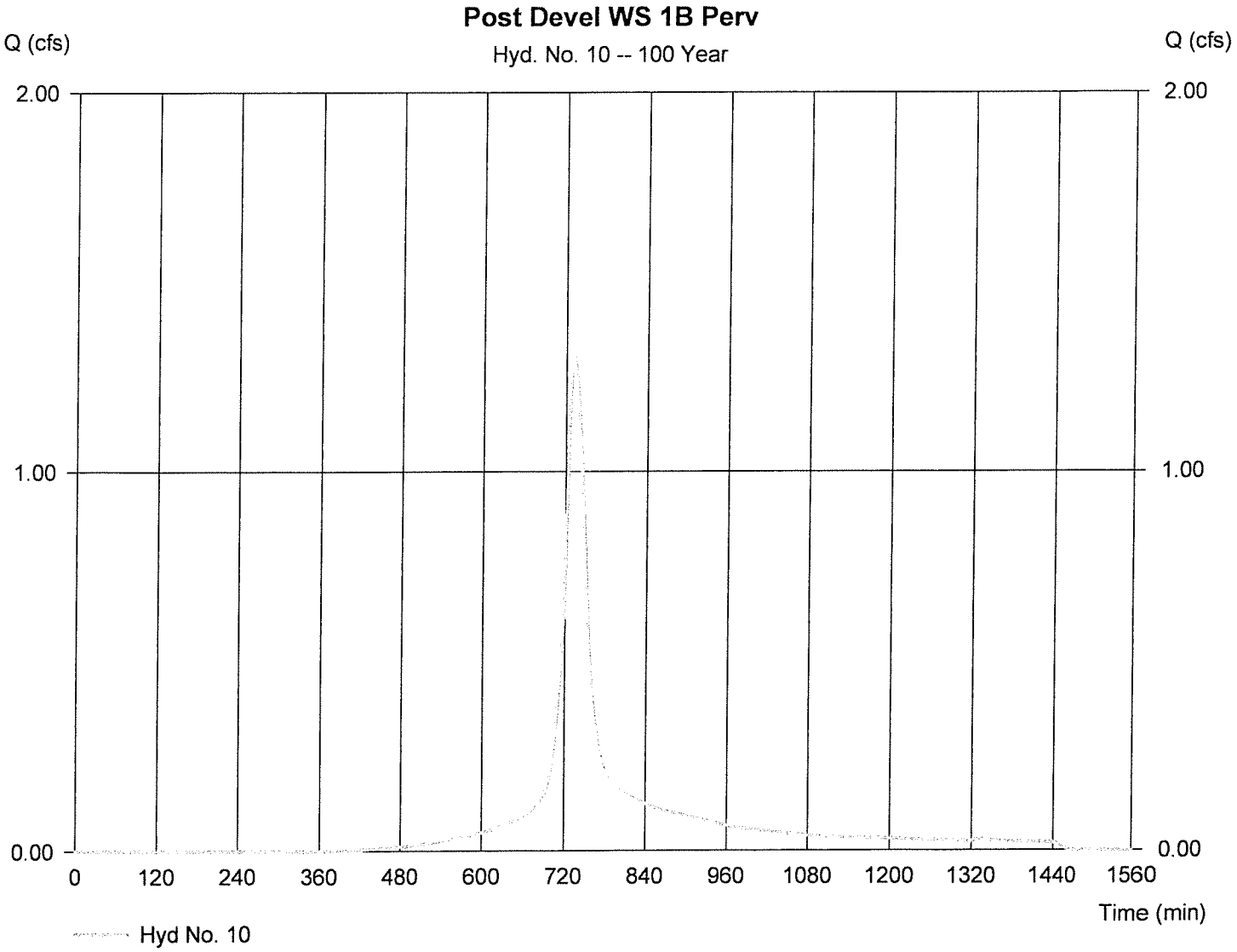
Hydrograph Report

Hyd. No. 10

Post Devel WS 1B Perv

Hydrograph type	= SCS Runoff	Peak discharge	= 1.301 cfs
Storm frequency	= 100 yrs	Time to peak	= 730 min
Time interval	= 2 min	Hyd. volume	= 6,206 cuft
Drainage area	= 0.300 ac	Curve number	= 77*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 10.00 min
Total precip.	= 8.50 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 285

* Composite (Area/CN) = [(0.020 x 39) + (0.280 x 80)] / 0.300



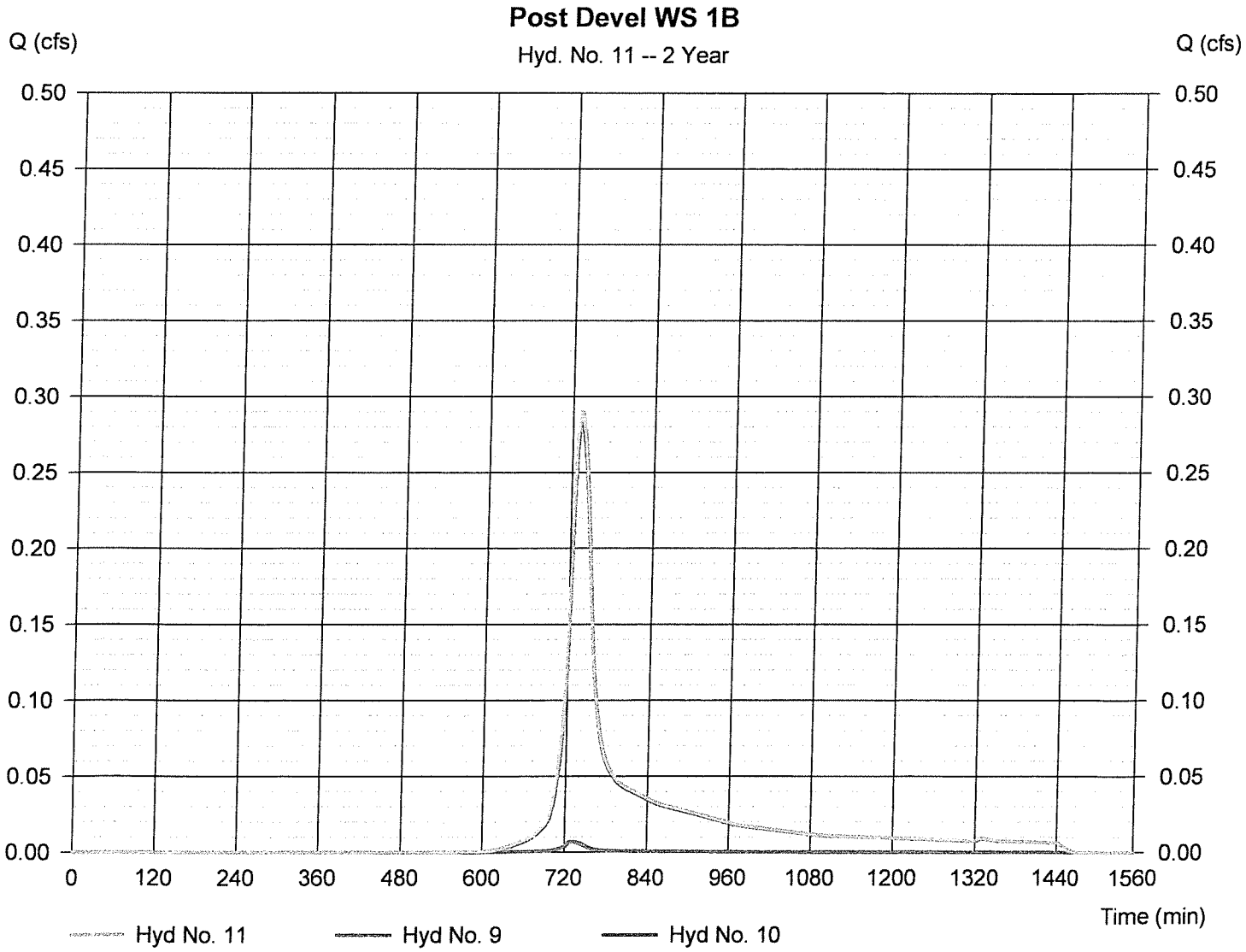
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2 Thursday, 12 / 10 / 2020

Hyd. No. 11

Post Devel WS 1B

Hydrograph type	= Combine	Peak discharge	= 0.290 cfs
Storm frequency	= 2 yrs	Time to peak	= 732 min
Time interval	= 2 min	Hyd. volume	= 1,423 cuft
Inflow hyds.	= 9, 10	Contrib. drain. area	= 0.304 ac

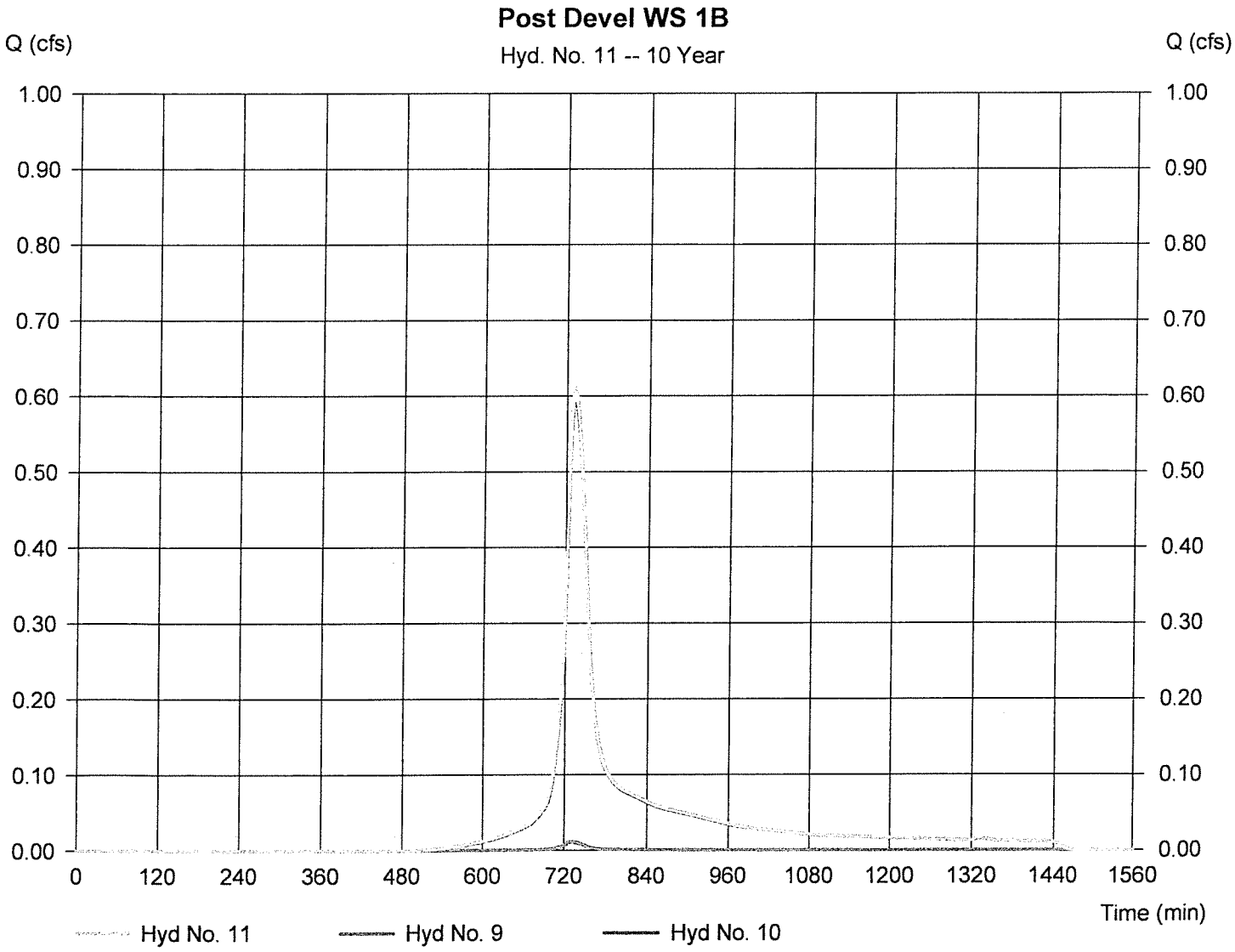


Hydrograph Report

Hyd. No. 11

Post Devel WS 1B

Hydrograph type	= Combine	Peak discharge	= 0.608 cfs
Storm frequency	= 10 yrs	Time to peak	= 732 min
Time interval	= 2 min	Hyd. volume	= 2,896 cuft
Inflow hyds.	= 9, 10	Contrib. drain. area	= 0.304 ac

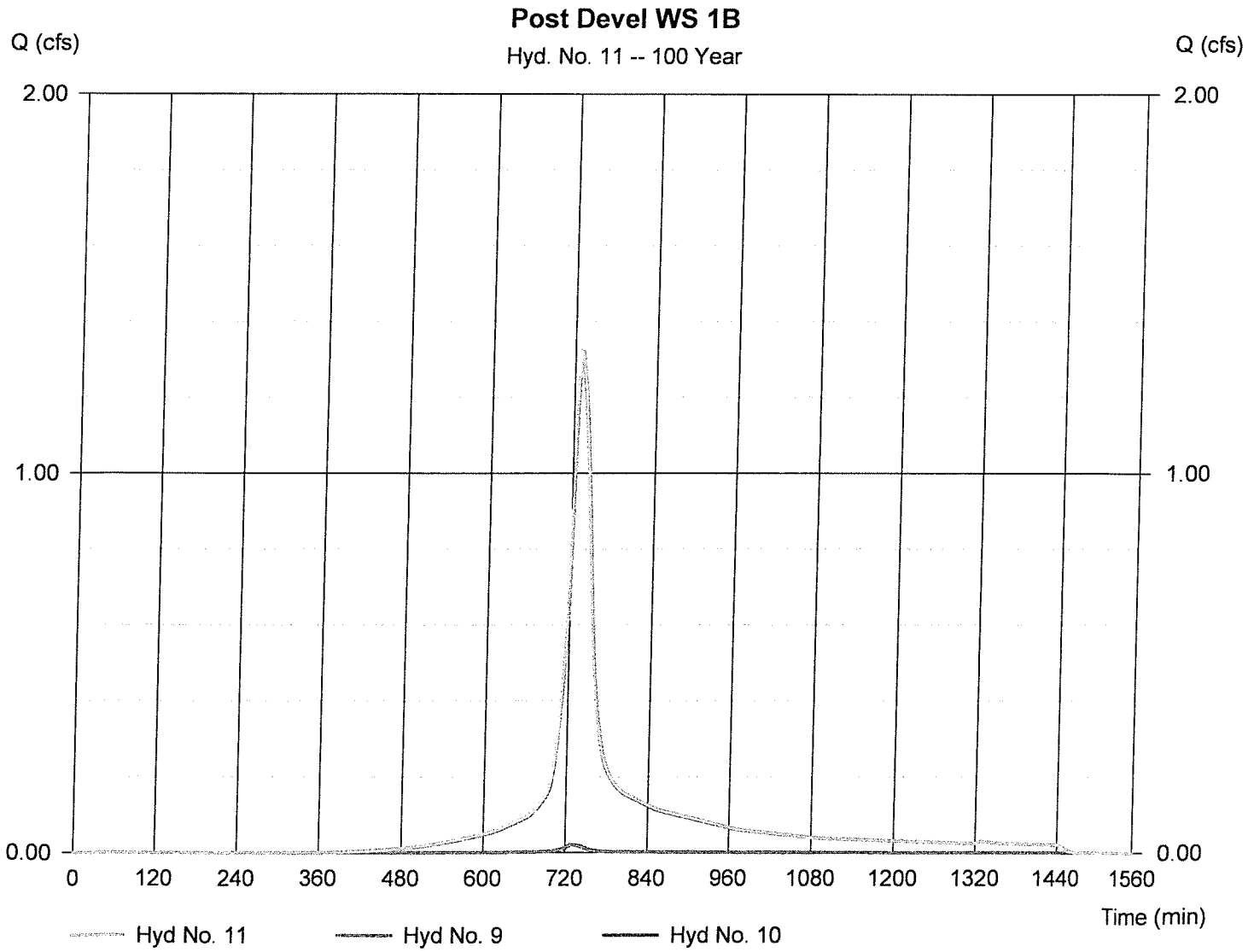


Hydrograph Report

Hyd. No. 11

Post Devel WS 1B

Hydrograph type	= Combine	Peak discharge	= 1.322 cfs
Storm frequency	= 100 yrs	Time to peak	= 730 min
Time interval	= 2 min	Hyd. volume	= 6,313 cuft
Inflow hyds.	= 9, 10	Contrib. drain. area	= 0.304 ac



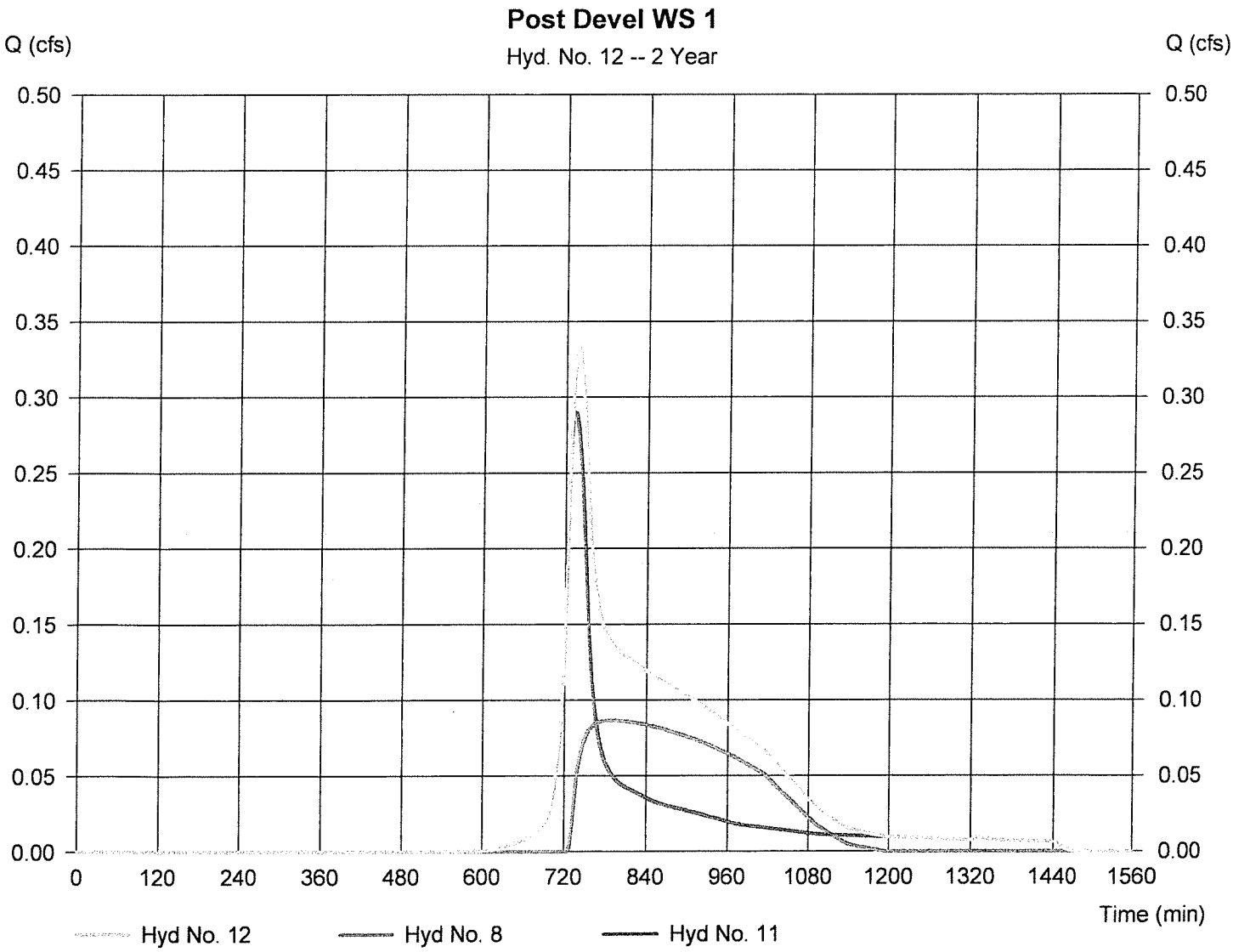
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2 Friday, 12 / 11 / 2020

Hyd. No. 12

Post Devel WS 1

Hydrograph type	= Combine	Peak discharge	= 0.332 cfs
Storm frequency	= 2 yrs	Time to peak	= 738 min
Time interval	= 2 min	Hyd. volume	= 2,873 cuft
Inflow hyds.	= 8, 11	Contrib. drain. area	= 0.000 ac



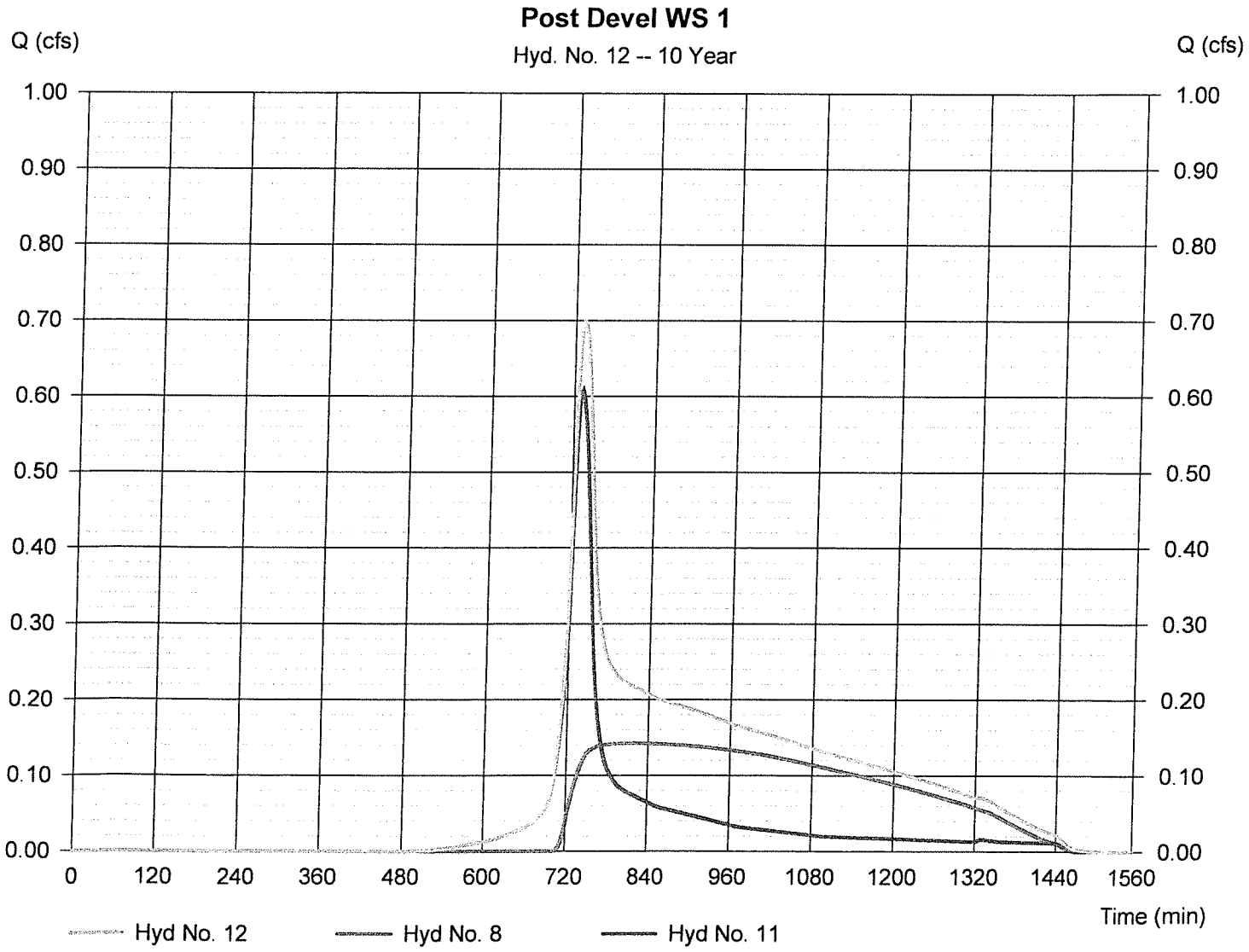
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2 Friday, 12 / 11 / 2020

Hyd. No. 12

Post Devel WS 1

Hydrograph type	= Combine	Peak discharge	= 0.699 cfs
Storm frequency	= 10 yrs	Time to peak	= 732 min
Time interval	= 2 min	Hyd. volume	= 7,262 cuft
Inflow hyds.	= 8, 11	Contrib. drain. area	= 0.000 ac

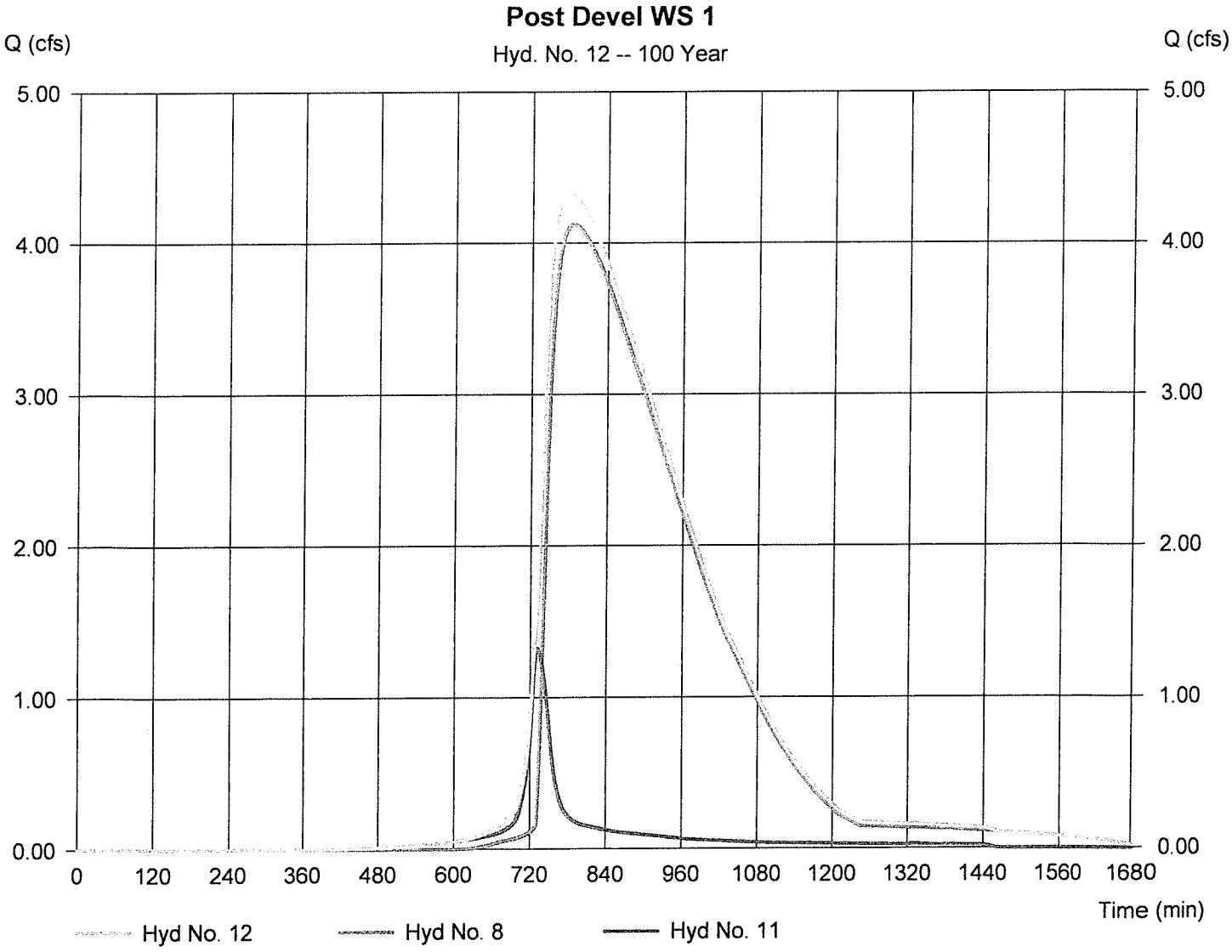


Hydrograph Report

Hyd. No. 12

Post Devel WS 1

Hydrograph type	= Combine	Peak discharge	= 4.335 cfs
Storm frequency	= 100 yrs	Time to peak	= 778 min
Time interval	= 2 min	Hyd. volume	= 69,546 cuft
Inflow hyds.	= 8, 11	Contrib. drain. area	= 0.000 ac



6.0 Chapter 6 – EMERGENCY SPILLWAY CALCULATIONS

EMERGENCY SPILLWAY CALCULATIONS

Stantec Consulting Services Inc.
10000 Midlantic Drive Suite 300W
Mount Laurel NJ 08054
Tel: (856) 234-0800
Fax: (856) 234-5928

COPART - ELK TOWNHIP
BLOCK 66, LOTS 1.01, 1.02 & 1.03
TOWNSHIP OF ELK, GLOUCESTER COUNTY, NJ

Emergency Spillway | Basin

A. Stone Size Calculations for 100 year storm [1]

Q=	4.125	cfs
S=	0.0100	ft/ft
Side Slope =	3	:1
Spillway Elv.=	139.45	
100-year Storm Elv.=	139.61	
Depth (d)=	1.92	inches (depth of water for 100-year storm)
Length (b)=	20	feet

$d_{50} = 12(118\ Q\ S^{13/6}\ R_h/P)^{2/3}$ (Median Riprap Diamteter for Straight Trapezoidal Channels)

Wetted Perimeter (P)=	20.96	feet
Wetted Area (A)=	3.28	square feet
Hydraulic Radius (R_h)=	0.156	feet
Velocity=	1.26	feet per second
Froude Number (F) =	0.55	sub-critical flow

Design Velocity is less than 2 cfs. The Spillway can be stabilized with turf.

[1]Standards for Soil Erosion and Sediment Control in New Jersey, "Standard for Grassed Waterway", 18-1

7.0 Chapter 7 – SOIL CONSERVATION

7.1 RIP RAP CALCULATIONS

7.2 BASIN DATA SUMMARY SHEETS

7.1 RIP RAP CALCULATIONS

CONDUIT OUTLET PROTECTION CALCULATIONS

COPART - ELK TOWNHIP
BLOCK 66, LOTS 1.01, 1.02 & 1.03
TOWNSHIP OF ELK, GLOUCESTER COUNTY, NJ

STANTEC NO.192520356

Horizontal Riprap Apron[1]

A. Apron Dimensions

1. The length of the apron, L_a, shall be determined from the formula:

$$L_a = \left(1.8\frac{q}{D_o^{\frac{1}{2}}}\right) + 7D_o$$

TW < 1/2 D_o

Q =	1.004	cfs			
Wo =	15	inches	= 1.25	ft	
q =	0.8032	cfs per foot			
D_o =	1.25	ft			
L_a =	10.04	ft			
Use length of apron,			L_a =	10	feet

Where D_o is the maximum inside culvert height in feet, W_o is the maximum inside culvert width in feet, q is the unit discharge, = Q/W_o in cfs per foot for the conduit design storm or the 25 year storm, which ever is greater.

2. Where there is no well-defined channel immediately downstream of the apron, the width W, of the outlet end of the apron shall be as follows:

For tailwater elevation less than the elevation of the center of the pipe,

$$W = 3W_o + L_a$$

W_o =	1.25	ft
W =	13.79	ft
Use width of apron,	W =	14 feet

Where L_a is the length of the apron determined from the formula and W_o is the culvert width. The width of the apron at the culvert outlet shall be at least 3 times the culvert width.

B. Riprap

1. The median stone diameter, D_{50} in feet, shall be determined from the formula:

For Horizontal Apron:

$$D_{50} = \frac{0.016}{T_w} q^{1.33}$$

where $q=Q/D_o$

T_w =	0.250	ft		
q =	0.8032	cfs per foot		
d_{50} =	0.05	ft =	0.57	in
Use stone diameter,	d_{50} =	1	inches	

For areas where T_w cannot be computed, use $T_w = 0.2\ D_o$
Where q and Do are as defined under apron dimensions and Tw is tailwater depth above the invert of culvert in feet.

[1]Standards for Soil Erosion and Sediment Control in New Jersey, "Conduit Outlet Protection", 12-3

7.2 BASIN DATA SUMMARY SHEET

New Jersey Department of Agriculture

Hydrologic Modeling Database – Data Entry Form

Project Site Details

Chpt. 251 Application Number: _____

Start Date (if known): _____

County: Gloucester County

Street Address: 718 Jacob Harris Avenue

Municipality: Elk Township

Block: 66

Lot: 1.01, 1.02 & 1.03

NJDEP Anderson Landuse Code (4 digits):

Landuse description: automobile storage facility

Site Centroid Location (NJ State Plane Feet): [1]

Northing: 312198.9975 Easting: 314406.5644

Project Contact Details

Applicant: Copart of Connecticut

Address: 14185 Dallas Parkway, Dallas, Texas 75254

Phone: _____

Email: _____

Post Construction Operation & Maintenance:[2]

Party Name: _____

Address: _____

Phone: _____

Email: _____

Party type: _____

New Jersey Department of Agriculture

Hydrologic Modeling Database – Data Entry Form

Basin Details:[3]

Basin Centroid (NJ State Plane Feet):[4]

Northing: 313133.9277 Easting: 3142588.9349

Basin Type: infiltration

Construction: ☒excavated ☐embankment ☐ sub-surface (check one)

Status phase:[5] Design ☒ As-built ☐

Dam Height: (ft) 2.95 top width: (ft) 212

Dam Classification: _____

Drainage Area(s) to Basin [note- include any bypass areas][6]

Drainage Area Name	Drainage Area (acres)	Post-Development CN#	Percent Impervious	Time of Concentration (min)
WS 1A	10.07	84	75.8	10

Basin Outlet Structure(s)[7]

ID:

End of Pipe Location:[8] Northing: 313003.8648 Easting: 314413.2080

Discharge Type[9] (weir, orifice, etc)	Dimensions (diameter, length)	Elevation (USGS)	Discharge Coefficient[10]	Equation Used[11]
orifice	2.5"	137.30	0.6	
weir	2' x 1.25'	138.20	3.33	
broad crested	20'	139.45	2.60	

New Jersey Department of Agriculture

Hydrologic Modeling Database – Data Entry Form

Basin Outlet Structure(s)

ID:

End of Pipe Location: Northing: Easting:

Discharge Type (weir, orifice, etc)	Dimensions (diameter, length)	Elevation (USGS)	Discharge Coefficient	Equation Used

Basin Stage-Discharge Rating Table[12]

Elevation (USGS Feet)	Storage (Acre-Ft)	Total Outlet Structure Discharge (cfs)
137.0	0	0.000
137.5	0.5369	1.700
138.0	1.2158	2.615
138.5	2.0519	3.762
139.0	2.9152	6.979
139.95	4.6075	30.08

NJDEP BMP Water Quality Structures[13]

Type (rain garden, green roof, seepage pit etc)	Size	Size Units (cu ft, sq ft etc)	Northing (SPF)	Easting (SPF)
sand bottom	42515	sf	313001.1371	314296.2707

New Jersey Department of Agriculture

Hydrologic Modeling Database – Data Entry Form

Explanatory Notes-

---

[1] Approximate location of center of site, coordinates in state plane feet
[2] Indicate who will be responsible for permanent operation and maintenance
[3] Additional Basin Detail Pages can be used for more than one basin in a project.
[4] Approximate location of center of basin, coordinates in state plane feet
[5] Indicate "design" for basins not yet constructed
[6] Drainage areas which are modified by construction, but not directed to the basin should still be listed and described
[7] "Outlet structure" means the control box, outlet headwall, FES etc. This does not refer to an individual control on the structure such as a weir or orifice. There are two tables for more than one outlet structure
[8] Approximate location of terminal discharge end of basin outfall, coordinates instate plane feet
[9] Indicate the type of outlet – weir, orifice, hydro brake, etc.
[10] Discharge Coefficient specific to the type of outlet control i.e., 0.6 for circular orifice
[11] List the discharge equation for each outlet (weir, orifice etc) used
[12] For basins with dead storage below the primary outlet, indicate 0 cfs discharge until the lowest outlet is reached. Routing table should begin at the lowest basin elevation.
[13] Describe NJDEP BMP Manual water quality devices such as seepage pits, rain gardens etc. Size is appropriate for device – cubic feet, square feet or linear feet. Location of device using state plane feet coordinates.

8.0 Chapter 8 – WATERSHED AREA MAPS

8.1 PRE-DEVELOPMENT WATERSHEDS

8.1.1 PRE-DEVELOPMENT WATERSHED AREA MAP

8.1.2 PRE-DEVELOPMENT WATERSHED AREA CALCULATIONS

8.2 POST-DEVELOPMENT WATERSHEDS

8.2.1 POST-DEVELOPMENT WATERSHED AREA MAP

8.2.2 POST-DEVELOPMENT WATERSHED AREA CALCULATIONS

8.1 PRE-DEVELOPMENT WATERSHEDS

PRE-DEVELOPMENT WATERSHED 1

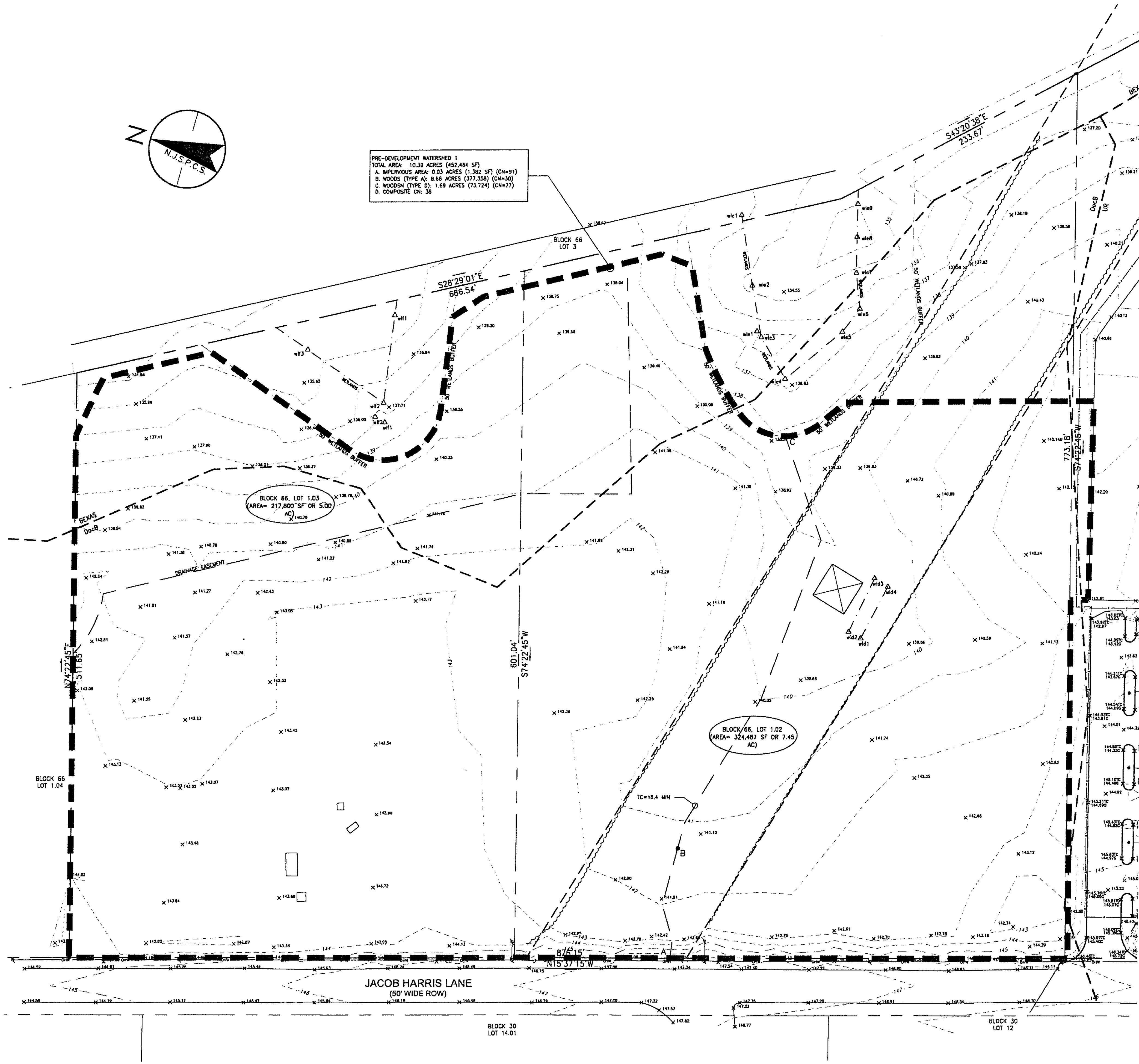
COPART - ELK TOWNHIP
BLOCK 66, LOTS 1.01, 1.02 & 1.03
TOWNSHIP OF ELK, GLOUCESTER COUNTY, NJ

STANTEC NO.192520356

PRE-DEVEL. WS 1

	SOIL	AREA		AREA		CN
TOTAL AREA		452464	SF	10.39	ACRES	
IMPERVIOUS		1382	SF	0.03	ACRES	98
WOODS	Type A	377358	SF	8.66	ACRES	30
	Type D	73724	SF	1.69	ACRES	77

COMPOSITE CN = 38



Stantec
10000 Midlantic Drive, Suite 300 W Tel. 856.234.0800
Mount Laurel, NJ 08054-1740 Fax. 856.234.5928
www.stantec.com

Revision	By	Appd.	MM.DD.YY

Project
COPART - ELK TOWNSHIP
BLOCK 66, LOTS 1.01, 1.02, 1.03
TOWNSHIP OF ELK, GLOUCESTER COUNTY, NEW JERSEY

Client
COPART OF CONNECTICUT

Title
PREDEVELOPMENT WATERSHED PLAN

Permit-Seal

CLIFTON W. QUAY
PROFESSIONAL ENGINEER, PROFESSIONAL PLANNER
N.J.P.E. LICENSE #42670, N.J.P.P. LICENSE #LI05653

DATE

Project Number: 192520356

LPD	CWQ	JRO	12-10-2020
Dwn.	Chkd.	Dsgn.	MM.DD.YY

Scale: 1"=40'

Drawing No. C-601

Revision 0 | Sheet 1 of 1

8.2 POST-DEVELOPMENT WATERSHEDS

POST-DEVELOPMENT WATERSHED 1

COPART - ELK TOWNHIP
BLOCK 66, LOTS 1.01, 1.02 & 1.03
TOWNSHIP OF ELK, GLOUCESTER COUNTY, NJ

STANTEC NO.192520356

POST-DEVEL. WS 1

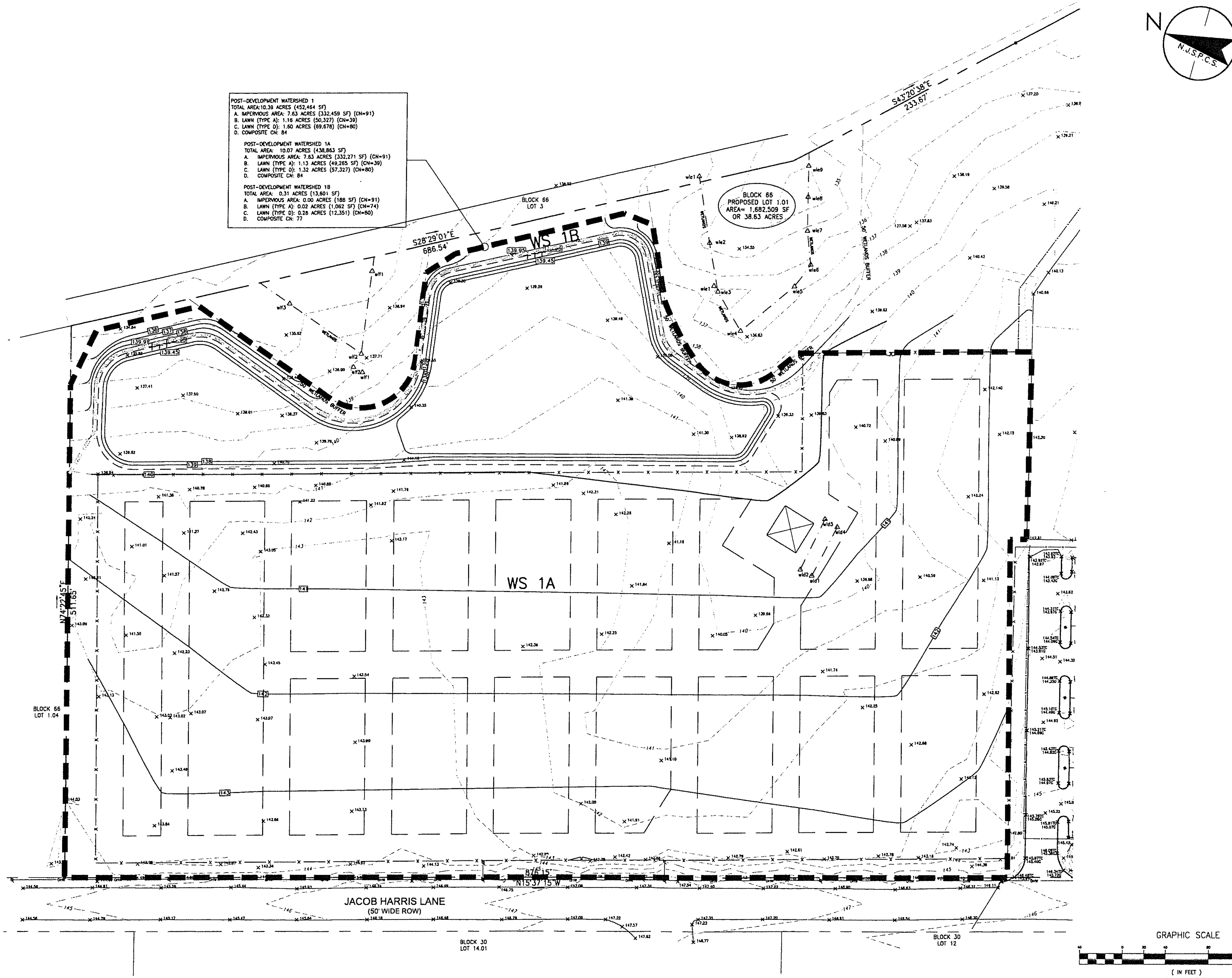
	SOIL	AREA	AREA		CN
TOTAL AREA		452464 SF	10.39	ACRES	
IMPERVIOUS		332459 SF	7.63	ACRES	91
LAWN (good)	Type A	50327 SF	1.16	ACRES	39
	Type D	69678 SF	1.60	ACRES	80
COMPOSITE CN =	71				

POST-DEVEL. WS 1A BASIN A

		SOIL	AREA	AREA		CN
TOTAL AREA			438863 SF	10.07	ACRES	
	IMPERVIOUS		332271 SF	7.63	ACRES	91
	LAWN (good)	Type A	49265 SF	1.13	ACRES	39
		Type D	57327 SF	1.32	ACRES	80
COMPOSITE CN =		84				

POST-DEVEL. WS 1B runoff

		SOIL	AREA	AREA		CN
TOTAL AREA			13601 SF	0.31	ACRES	
	IMPERVIOUS		188 SF	0.004	ACRES	91
	LAWN (good)	Type A	1062 SF	0.02	ACRES	39
		Type D	12351 SF	0.28	ACRES	80
COMPOSITE CN =		77				



Stantec

10000 Midlantic Drive, Suite 300 W Tel. 856.234.0800
Mount Laurel, NJ 08054-1740 Fax. 856.234.5928
www.stantec.com

Revision	By	Appd.	MM.DD.YY

Project
COPART - ELK TOWNSHIP
BLOCK 66, LOTS 1.01, 1.02, 1.03
TOWNSHIP OF ELK, GLOUCESTER COUNTY, NEW JERSEY

Client
COPART OF CONNECTICUT

Title
POSTDEVELOPMENT WATERSHED PLAN

Permit-Seal

CLIFTON W. QUAY
PROFESSIONAL ENGINEER, PROFESSIONAL PLANNER
N.J.P.E. LICENSE #42670, N.J.P.P. LICENSE #L05653

DATE

Project Number: 192520356

LPD	CWQ	JRO	12-10-2020
Dwn.	Chkd.	Dsgn.	MM.DD.YY

Scale: 1"=40'

Drawing No. C-602

Revision 0 Sheet 1 of 1

9.0 Geotechnical Report

EARTH ENGINEERING INCORPORATED
Geotechnical Engineers & Geologists

December 8, 2020
EEI Project No. **33279.J0**

Joseph Odenheimer, P.E.
Senior Project Manager
Stantec
10000 Midlantic Drive
Suite 300W
Mount Laurel NJ 08054-1520

Re: Infiltration Testing
COPART – Elk Township
Block 66, Lots 1.01, 1.02, & 1.03
Jacob Harris Lane
Township of Elk, Gloucester County, NJ

Dear Mr. Odenheimer:

Earth Engineering Incorporated (EEI) has completed Infiltration Testing to provide data for the design of the proposed stormwater management system at the above-referenced project site. The objective of this project has been to obtain infiltration rates of the subgrade soils for the proposed stormwater management basin at test areas designated by Stantec. The scope of work was completed in general accordance with EEI proposal WB-7771, Revision 1, dated December 7, 2020.

The scope of work for this project included test pits and the performance of in-situ infiltration testing. This letter presents the results of our work.

I. SITE AND PROJECT DESCRIPTION

The project site is situated on Jacob Harris Lane in Elk Township, Gloucester County, New Jersey. Jacob Harris Lane borders the site to the west and a powerline easement borders the site to the south. Undeveloped wooded lots border the site to the north and east. Ellis Street is located beyond the wooded lot to the north

The area investigated is currently a wooded lot. A surficial stormwater management basin is proposed for construction as part of the planned site development.

II. FIELD INVESTIGATION AND DISCUSSION

As part of the field test investigation, two (2) test pits were performed to complete the proposed scope of work. The test pits were excavated on December 2, 2020 by Advantage Sitework, LLC of Little Egg Harbor, New Jersey utilizing a John Deere 310SG back-hoe. The test pits were terminated at a depth of 9.5 feet below the existing ground surface upon encountering repeated excavation sidewall collapse. The test pit locations are shown on the Testing Location Plan, EEI Drawing No. 33279.J0-A-101, attached to this letter.

Soil description logs providing the depth, thickness, and description of the materials encountered in the test pits are enclosed with this letter. The purpose of the test pits was to investigate for potential limiting zones below proposed testing depths. A limiting zone is defined as a horizon or condition of the soil or underlying strata which includes:

A. Seasonal high water table, weather-perched or regional, determined by direct observation of the water table or soil mottling.

B. Rock with open joints, fractures or solution channels, masses of loose rock fragments including gravel, with insufficient fine soil to fill the voids between the fragments.

C. Rock formation, other stratum, or soil condition which is so slowly permeable that it effectively limits the downward passage of effluent.

The bedrock surface, which can represent a limiting zone, was not encountered to the depths achieved within the test pits.

Groundwater was encountered in test pits TP-1 and TP-2 at depths of 3.0' and 7.0', respectively. Soil mottling, which may be an indication of seasonal high groundwater, was also observed in test pits TP-1 and TP-2 at depths of 2.5' and 4.5', respectively. The depths to soil mottling correlate to possible seasonal high groundwater elevations ranging from approximately 134.9' to 135.5'.

The soils encountered within the test pits were visually classified and documented in the field during the investigation by a representative of EEI. A generalized soil profile consisting of loamy sand was encountered in test pits performed. Fined grained soil typical of a limiting zone was not encountered in the test pits to the depths achieved.

The following table summarizes the type and depth of limiting zones encountered in test pits. Additional details regarding the soils and limiting zones is provided on the Soil Description Logs included in the Appendix.

TABLE I – COMPARISON OF INFILTRATION DEPTHS AND LIMITING ZONES

Test Pit Number	(1) Ground Surface Elevation (ft.)	Limiting Zone (ft.)	Limiting Zone Depth (ft.)	Limiting Zone Elevation (ft.)	Infiltration Test Depth (ft.)	Infiltration Test Elevation (ft.)
TP-1	138.0	Soil Mottling	2.5	135.5	0.5	137.5
		Groundwater	3.0	135.0		
TP-2	139.4	Soil Mottling	4.5	134.9	2.5	136.9
		Groundwater	7.0	132.4		

(1) Ground surface elevations were provided by Stantec.

III. INFILTRATION TEST RESULTS

Following completion of the exploratory test pits, two (2) double ring infiltration tests were performed adjacent to each test pit by EEI to determine infiltration rates for the on-site soils. The double ring infiltration tests were performed at depths of 0.5 and 2.5 feet below the existing ground surface and at least 2.0 feet above the depth seasonal high groundwater, as indicated by soil mottling. The in-situ infiltration testing was performed in general accordance with Appendix E of the New Jersey Stormwater Best Management Practices Manual (NJ BMP Manual). The following table summarizes the infiltration data for each test location. Detailed field information is shown on Table IA - Double Ring Infiltrometer Test Results, attached to this letter.

TABLE II - Double Ring Infiltrometer Test Results

Test Hole Number	Ground Surface Elevation (feet)	Infiltration Depth (feet)	Infiltration Elevation (feet)	Test Interval (minutes)	Final Drop in Water Level (inches)	Infiltration Rate (inches/hour)
DRI-1A	138.0	0.5	137.5	10	1.000	6.00
DRI-1B	138.0	0.5	137.5	10	1.125	6.75
DRI-2A	139.4	2.5	136.9	10	3.125	18.75
DRI-2B	139.4	2.5	136.9	10	3.250	19.50

As shown in the Table II, above, the measured infiltration rates ranged from 6.00 to 19.50 inches per hour. Based on these results, stormwater infiltration generally appears to be feasible in the areas investigated at this site. The determination of the appropriate design value for the stormwater management basin including application of the appropriate factors of safety is the responsibility of the project civil engineer. A minimum factor of safety of 2.0 is recommended for most cases.

EEI recommends performing in-situ infiltration testing following excavations to achieve the basin design elevations. This testing will serve to confirm design infiltration rates of the soils at the basin bottom elevation and can be used to delineate areas, if any, that require over-excavation of low or non-permeable soils.

IV. LIMITATIONS

The information contained in this letter is based upon the subsurface data collected and on details stated in this letter. Should conditions arise which differ from those specifically stated herein, our office should be notified immediately so that our conclusions can be reviewed and revised, if necessary.

The scope of work for this project was limited to providing infiltration test results for the proposed stormwater infiltration facilities, as discussed herein. This report offers no facts or opinions related to potential impacts resulting from infiltrating stormwater at this location on surrounding areas or proposed structures. No conclusions or recommendations related to geotechnical conditions at the site are discussed or inferred herein.

It is emphasized that this infiltration testing investigation was conducted for the proposed stormwater management feature to be constructed at the proposed Copart facility to be located on Jacob Harris Lane in Elk Township, Gloucester County, New Jersey. Earth Engineering Incorporated does not assume any responsibility in using this report for drainage system consideration or design other than at the specific site addressed.

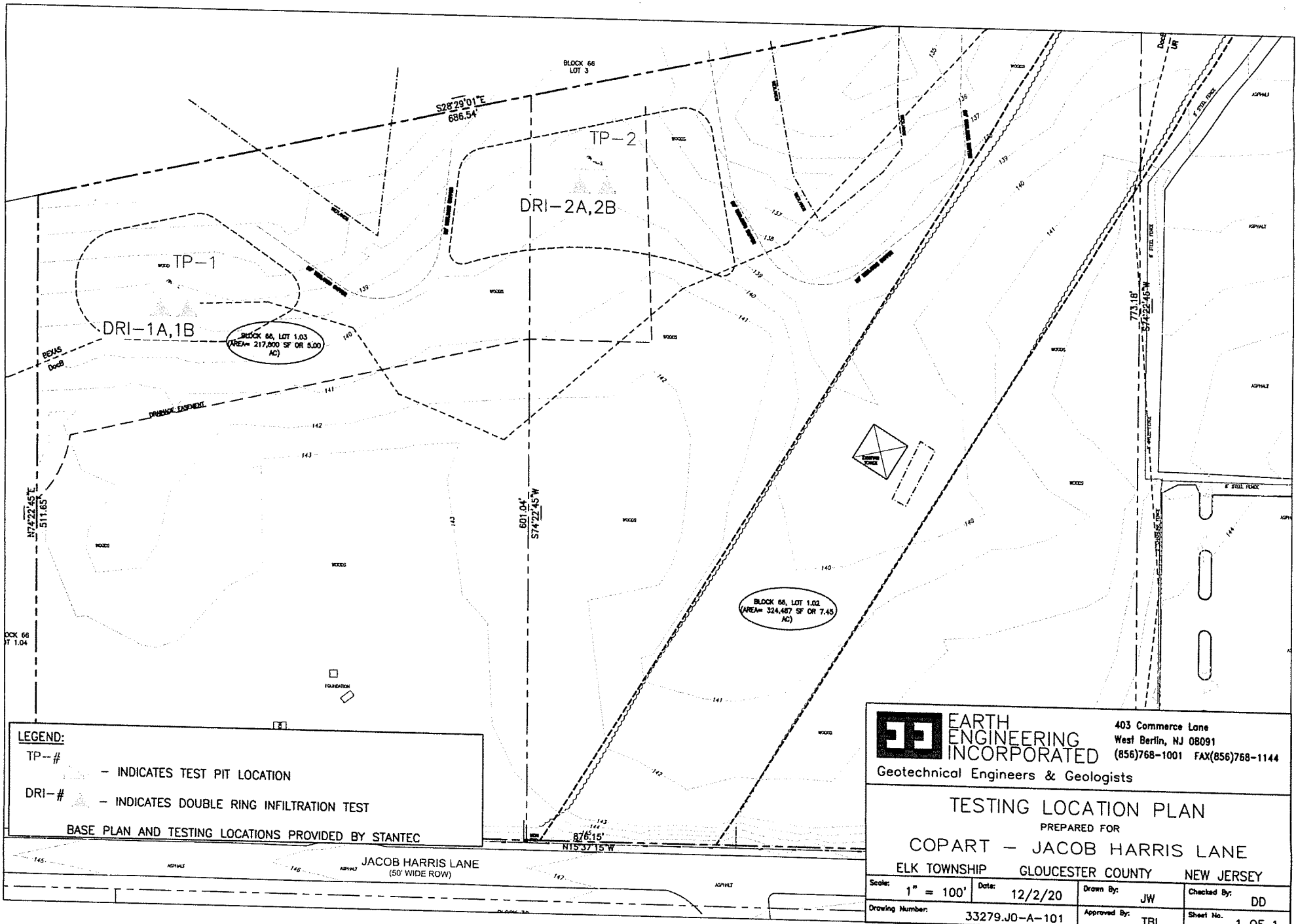
EEI appreciates the opportunity to be of service to Stantec with this project. If additional information is required or there are questions regarding the contents discussed herein, please contact the undersigned.

Respectfully submitted,
Earth Engineering Incorporated

Jim Ward, P.G.
Assistant Director - South Jersey Division

Thomas B. Louis, P.E.
Director - South Jersey Division
New Jersey Professional Engineer
License Number GE 40918

Attachments: Testing Location Plan
Soil Description Logs
Table IA – Double Ring Infiltrometer Test Results Log



LEGEND:

TP--# – INDICATES TEST PIT LOCATION

DRI-# – INDICATES DOUBLE RING INFILTRATION TEST

BASE PLAN AND TESTING LOCATIONS PROVIDED BY STANTEC

EARTH ENGINEERING INCORPORATED
403 Commerce Lane
West Berlin, NJ 08091
(856)768-1001 FAX(856)768-1144
Geotechnical Engineers & Geologists

TESTING LOCATION PLAN

PREPARED FOR

COPART – JACOB HARRIS LANE

ELK TOWNSHIP GLOUCESTER COUNTY NEW JERSEY

Scale: 1" = 100'	Date: 12/2/20	Drawn By: JW	Checked By: DD
Drawing Number: 33279.J0-A-101		Approved By: TBL	Sheet No. 1 OF 1

Soil Description Log

Test Pit Location: TP-1
Surface Elevation: 138.0'
Equipment Used: *Deere 310 SG Backhoe*
Excavating Company: Advantage Site Work
Total Depth: 9.5'

Ground Cover / Land Use: Wooded
Limiting Zone: Soil mottling at 2.5', Groundwater at 3.0'
Initial Water Depth: 3.0' **Time:** 1/4 hr. **Date:** 12/2/2020
Subsequent Water Depth: -- **Time:** -- **Date:** --
Additional Notes: Infiltration test at 0.5'

Profile Description

	Depth (ft.)	Boundary	Matrix Color	Redox Mottles	Mottle Color	Texture	Structure	Consistence	Remarks
1	0.0 - 0.5	clear smooth	10YR 3/2 very dark grayish brown	--	--	loamy sand	subangular blocky	very friable	topsoil, abundant roots
2	0.5 - 2.5	clear smooth	10YR 6/4 light yellowish brown	--	--	loamy sand	subangular blocky	very friable	moist, trace roots
3	2.5 - 9.5	--	2.5Y 7/1 light gray	many coarse prominent	7.5YR 8/6 reddish yellow	loamy sand	subangular blocky	very friable	moist/wet, 5% gravel
4									Repeated Collapse at 9.5'
5									
6									
7									
8									

EARTH ENGINEERING INCORPORATED
Geotechnical Engineers & Geologists
403 Commerce Lane, West Berlin, NJ 08091
PHONE 856-768-1001 FAX 856-778-1144

Project Name: Jacob Harris Lane, Elk Township, Gloucester County, NJ
Project Number: 33279.J0
Date of Testing: 12/2/2020
EEI Representative: A. Baer
Compiled by: A. Baer
Date Compiled: 12/2/2020
Sheet Number: 1 of 1

Soil Description Log

Test Pit Location: TP-2
Surface Elevation: 139.4'
Equipment Used: Deere 310 SG Backhoe
Excavating Company: Advantage Site Work
Total Depth: 9.5'

Ground Cover / Land Use: Wooded
Limiting Zone: Soil mottling at 4.5', Groundwater at 7.0'
Initial Water Depth: 7.0' **Time:** 1/4 hr. **Date:** 12/2/2020
Subsequent Water Depth: -- **Time:** -- **Date:** --
Additional Notes: Infiltration test at 2.5'

Profile Description

	Depth (ft.)	Boundary	Matrix Color	Redox Mottles	Mottle Color	Texture	Structure	Consistence	Remarks
1	0.0 - 0.5	clear smooth	10YR 3/2 very dark grayish brown	--	--	loamy sand	subangular blocky	very friable	topsoil, abundant roots
2	0.5 - 4.5	clear smooth	10YR 6/4 light yellowish brown	--	--	loamy sand	subangular blocky	very friable	moist, trace roots, 5% gravel
3	4.5 - 9.5	--	2.5Y 7/1 light gray	many coarse prominent	7.5YR 8/6 reddish yellow	loamy sand	subangular blocky	very friable	moist/wet, trace roots, 5% gravel
4									Repeated collapse at 9.5'
5									
6									
7									
8									

EARTH ENGINEERING INCORPORATED
Geotechnical Engineers & Geologists
403 Commerce Lane, West Berlin, NJ 08091
PHONE 856-768-1001 FAX 856-778-1144

Project Name: Jacob Harris Lane, Elk Township, Gloucester County, NJ
Project Number: 33279.J0
Date of Testing: 12/2/2020
EEI Representative: A. Baer
Compiled by: A. Baer
Date Compiled: 12/2/2020
Sheet Number: 1 of 1

TABLE 1A - Double Ring Infiltrometer Test Results Log

Test Hole Number	Surface Elevation (ft.)	*Infiltration Depth (ft.)	Drop in Water during Presoak Period (in.)		Drop in Water at Time (in.)								Infiltration Rate
			30 min.	60 min.	10 Min.	20 Min.	30 Min.	40 Min.	50 Min.	60 Min.			Inches/Hour
DRI-1A	138.0	**0.5	5.000	3.750	1.125	1.000	1.000	1.000	1.000	1.000			6.00
DRI-1B	138.0	**0.5	5.000	3.750	1.250	1.125	1.125	1.125	1.125	1.125			6.75

* Infiltration depths were measured from existing site grades at the time of the investigation.

** Infiltration test depth field adjusted based on depth to limiting zone.

Test Hole Number	Surface Elevation (ft.)	*Infiltration Depth (ft.)	Drop in Water during Presoak Period (in.)		Drop in Water at Time (in.)								Infiltration Rate
			30 min.	60 min.	10 Min.	20 Min.	30 Min.	40 Min.	50 Min.	60 Min.			Inches/Hour
DRI-2A	139.4	**2.5	6.000	6.000	3.500	3.250	3.125	3.125	3.125	3.125			18.75
DRI-2B	139.4	**2.5	6.000	6.000	3.750	3.500	3.250	3.250	3.250	3.250			19.50

Indicates the final reading that was used to determine the infiltration rate at the corresponding location.

EARTH ENGINEERING INCORPORATED

Geotechnical Engineers & Geologists

403 Commerce Lane West Berlin, NJ 08091

PHONE 856-768-1001 FAX 856-768-1144

INFILTRATION TESTING LOG

Project Name: Jacob Harris Lane, Elk Township, NJ
Project Number: 33279.J0
Date of Testing: 12/2/20
EEI Representative: A. Baer
Drawn/ Compiled by: A. Baer
Date Compiled: 12/2/20