National Fuel
Supply Corporation

Post Construction Stormwater Management / Site Restoration Plan

National Fuel Gas Supply Corporation
Tioga Pathway Project

Liberty Township – McKean County
Allegany and Harrison Townships – Potter County
Brookfield, Chatham, Deerfield, Middlebury, and Westfield Townships – Tioga County

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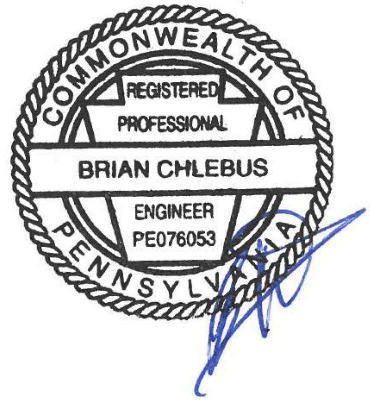

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1.0 PROJECT OVERVIEW

1.1 Introduction

National Fuel Gas Supply Corporation (National Fuel) is proposing construction and operation of the Tioga Pathway Project (Project). The Project is located in Potter, Tioga, and McKean counties, Pennsylvania (PA), and consists of the construction and operation of new pipeline facilities, in addition to the replacement and abandonment of certain existing pipeline facilities. The location of the proposed Project is shown on U.S. Geological Survey (USGS) 7.5-minute quadrangle maps provided in Attachment 1 and a detailed description of the proposed Project is provided in Section 1.2 Project Description.

The purpose of this Post Construction Stormwater Management / Site Restoration (PCSM/SR) Plan is to minimize and/or avoid potential adverse environmental impacts due to the construction, operation, and maintenance activities associated with the Project. The stormwater best management practices (BMPs) proposed within this plan are designed to maximize volume reduction technologies, eliminate or minimize point source discharges to surface waters, preserve the integrity of stream channels, and protect the physical, biological, and chemical qualities of the receiving surface water. This PCSM/SR Plan was prepared in accordance with the following Pennsylvania Department of Environmental Protection (PADEP) documents: *Erosion and Sediment Pollution Control Program Manual* ("E&SPC Manual"), dated March 2012; and the *Pennsylvania Stormwater Best Management Practices Manual*, dated December 2006.

1.2 Project Description

National Fuel is proposing to construct and operate the proposed Tioga Pathway Project and to abandon certain pipeline facilities. The Project is located in Potter and Tioga counties and consists of the construction and operation of the following facilities described in more detail as follows:

- <u>Z20 Replacement Pipeline:</u> Replace approximately 3.84 miles of 12-inch-diameter 1936-vintage bare steel pipeline with new 20-inch-diameter coated steel pipeline in National Fuel's existing right-of-way (ROW) in Potter County;
- <u>YM58 Mainline Pipeline:</u> Install approximately 19.48 miles of new 20-inch-diameter coated steel pipeline beginning at the east end of the 3.84-mile Z20 Pipeline replacement, traversing Potter and Tioga counties, and ending at the NFG Midstream Covington, LLC Lee Hill Interconnect;
- <u>Auxiliary Facilities:</u>
  - <u>McCutcheon Hill OPP Station:</u> Construct a new over-pressure protection (OPP) station at the interconnection between the eastern terminus of the Z20 Replacement Pipeline and the western terminus of the YM59 Mainline Pipeline in Potter County;
  - <u>Measurement equipment at Midstream's Lee Hill Interconnect:</u> Install gas measurement, gas quality, flow control, OPP devices, a pig launcher, and associated appurtenances (Measurement Facilities) at Midstream's Lee Hill Interconnect to connect the proposed YM59 Mainline Pipeline to Midstream's facilities at the east end of the Project in Chatham Township, Tioga County;

- Perform minor modifications at National Fuel's existing Ellisburg Compressor Station (CS) including replacing/installing measurement, OPP devices, flow control, and other associated appurtenances in Potter County;
- Construct one new remote-control valve (RCV) setting at a location along the YM59 Pipeline in Tioga County;
- Perform modifications to an existing valve setting on the Z20 Replacement Pipeline in Potter County; and
- Install a new cathodic protection ground bed at a location along the YM59 Pipeline in Tioga County.[1]

To support construction activities, National Fuel estimates that approximately 3.96 miles of temporary access roads (TARs) and 1.76 miles of permanent access roads (PARs) will be used to support construction and operation of the Project. In addition, three (3) previously used staging areas (Port Allegany Pipe Yard, Harrison Valley Contractor Yard [HV Contractor Yard], and Middlebury Contractor Yard) will be used to store materials and equipment.

The location of the proposed Project is shown on U.S. Geological Survey (USGS) 7.5-minute quadrangle maps provided in Attachment 1.

Construction will involve pipeline installation via open trench excavation and horizontal directional drilling (HDD) methods and the construction of the new OPP Station and cathodic protection ground bed. The existing Z20 Pipeline will be replaced by removal or may be abandoned in place where conditions preclude effective removal. Tree-clearing will be required for the Project and is proposed to occur entirely in the winter, provided all required permits, approvals, land access, and materials have been obtained.

2.0 TOPOGRAPHIC FEATURES

Topography in the Project area consists of rounded hills and broad to narrow valleys, all of which have been modified by glacial erosion and deposition. Streams and wetlands are common throughout the Project area, which reflects the interplay between bedrock of various types, mainly sandstones and siltstones, and glacial erosion and deposition. The more erosion-resistant rocks form the hills, whereas the less erosion-resistant rocks occur in the valleys. Glacial deposits, mainly glacial till or sand and gravel, may occur anywhere, but are found mainly in the valley bottoms. The location maps provided in Attachment 1 are referenced to applicable USGS 7.5-Minute Topographic Quadrangle Maps and depict the existing topographic features throughout the Project area.

1 Two cathodic protection ground bed locations are being considered as potential siting alternatives, but the Project will only require construction of one ground bed.

3.0 SOIL TYPES

3.1 Soil Identification

The Natural Resource Conservation Service (NRCS) soil survey geographic database was accessed to review soil types that exist in the vicinity of the Project. A soils map identifying the principal soil types and locations, and descriptions of the principal soil types that occur in the vicinity of the Project are provided in Attachment 2. Additionally, potential soil limitations and associated resolutions are identified on Table 1.

3.2 Construction Techniques or Special Considerations to Address Limitations

See Table 1 for limitations of Pennsylvania soils pertaining to earth moving projects and for resolutions for soil limitation.

In most situations, typical construction equipment and BMPs will be sufficient to manage potential limitations that may be exhibited by the existing site soil types. At a minimum, surface grubbing and the removal of existing vegetative stabilization will be minimized to the extent necessary to achieve the Project objective. Restoration of soil stabilization will be implemented as soon as practicable following completion of the construction activities. Soil stabilization will be achieved by establishing temporary and/or permanent vegetation through the application of seed and mulch. Furthermore – if wetness in the form of ponding water is encountered during construction – pumps, hoses, and pumped water filter bags will be utilized to dewater the ponding area. The pumped water will be discharged to a well-vegetated area.

4.0 EARTH DISTURBANCE AND LAND USES

4.1 Limits of Disturbance

See Section 1.2 for a description of appurtenances proposed for the Project requiring earth disturbance activity. No earth disturbance may commence without having this PCSM/SR Plan present and implemented. The Project LOD is depicted on the plan drawings provided in Attachment 5. If field changes are necessary, the changes will be implemented as redlines to the on-site PCSM/SR Plan. Any redline changes must be coordinated with the Potter County Conservation District, Tioga County Conservation District, and/or PADEP Regional Permit Coordination Office (RPCO) for approval prior to implementation.

4.2 Proposed Improvements and Land Uses

The Project is located in a rural area a portion of which is located within an existing permanent ROW and a portion location in a proposed permanent ROW. Past and present land use of the Project area includes: maintained ROW for natural gas transmission facilities and existing permanent access roads with adjacent residential parcels, agricultural fields, and woodlands. Future land use of the Project area will be maintained ROW.

5.0 SITE RESTORATION / NET CHANGE IN RUNOFF

Site restoration will include restoring the Project area to pre-construction contour and to a meadow-good condition surface type with the exception of small gravel pad areas for construction of permanent facilities (i.e., OPP station, valve sets, permanent access roads, etc.). Permanent stormwater BMPs shall be implemented at locations of the permanent facilities to mitigate associated increases in stormwater flow rate and volume; therefore, no change in volume and rate of runoff is anticipated as a result of construction of the Project.

The pre-construction contours and drainage patterns throughout the existing pipeline ROW will be maintained to the greatest extent practicable for the post-construction condition. Clearing of vegetation and riparian buffers has been minimized to only that of which is required to achieve the objective of the Project. Additionally, a GEOWEB cellular confinement system will be installed as a PCSM BMP at locations of permanent facilities requiring installation of permanent gravel pad areas, which will mitigate the anticipated rate and volume increase by providing voids for runoff storage and infiltration. Additional information relating to PCSM BMPs is available in Section 7.0. Supporting calculations are provided in Attachment 4.

6.0 LOCATION AND CLASSIFICATION OF SURFACE WATERS

Surface waters in the vicinity of the Project area are depicted on the USGS Topographic Quadrangle Map provided in Attachment 1 and on the plan drawings provided in Attachment 5. Additional information relating to surface waters is available in the Joint Permit documents prepared for the Project.

6.1 Stream Crossings

Field surveys to identify streams were conducted for the Project in October – November 2023 and April May 2024. The Project streams have fishery or water quality classifications designated as cold water fishes (CWF) and warm water fishes (WWF). HQ waters are those surface waters with water quality that exceeds levels necessary to support propagation of fish, shellfish, and wildlife, and recreation in and on the water. CWF waters include maintenance or propagation, or both, of fish species including the family Salmonidae and additional flora and fauna, which are indigenous to a cold water habitat.

The crossing of streams will be necessary as part of construction activities within the LOD for the excavation and mobilization of equipment for the Project. Surface water runoff from the Project area drains to the following named surface waters and/or their unnamed tributaries (“UNTs”):

Marsh Creek	CWF
UNTs to Marsh Creek	CWF
North Branch Cowanesque River	CWF
UNTs to North Branch Cowanesque River	CWF
North Fork Cowanesque River	CWF
UNTs to North Fork Cowanesque River	CWF

California Brook	WWF
UNTs to California Brook	WWF
Cowanesque River	WWF
UNTs to Cowanesque River	WWF
Jemison Creek	WWF
UNTs to Jemison Creek	WWF
Boatman Brook	WWF
UNTs to Boatman Brook	WWF
UNTs to Crooked Creek	WWF
UNTs to Losey Creek	WWF
Rose Lake Run	HQ-CWF

Where applicable, the E&S Plan contains ABACT BMPs to maintain the designated use of the HQ receiving waters. The locations of the receiving waters relative to the Project area are depicted on the plan drawings provided in Attachment 5. All waterbody crossings shall be in accordance with requirements of the Joint Permit obtained for the Project.

6.2 Wetland Crossings

Field surveys to identify wetlands were conducted for the Project in October – November 2023 and April May 2024. Wetland areas that exist within the Project LOD are depicted on the plan drawings provided in Attachment 4. Construction activities within the LOD for the excavation and mobilization of equipment for the Project will cross palustrine emergent (PEM), palustrine scrub-shrub (PSS), and palustrine forested (PFO) wetlands. All waterbody crossings shall be in accordance with requirements of the Chapter 105 permits obtained for the Project.

7.0 BMP DESCRIPTION

Generally, E&S BMPs will be used during construction activities to 1) divert stormwater flows away from exposed areas, 2) convey runoff, 3) prevent sediments from moving off-site, and/or 4) reduce the erosive forces of runoff water – see the E&S Plan prepared for the Project. PCSM/SR BMPs will include structural and non-structural practices. Site restoration in the form of surface stabilization is primarily used for the PCSM/SR Plan. A GEOWEB cellular confinement system will be installed as a PCSM BMP at locations of permanent facilities requiring installation of permanent gravel pad areas. The BMPs incorporated into this PCSM/SR Plan are in accordance with the Pennsylvania Stormwater Best Management Practices Manual.

7.1 Structural Practice

GEOWEB Cellular Confinement System. GEOWEB is a cellular confinement technology consisting of a network of honeycomb-like interconnected cells incorporated into stabilized aggregate surfaces. The GEOWEB cells when filled with clean AASHTO #57 stone provide void space within the cells allowing for collection of surface water runoff, which prevents increases in runoff flow rate while offering a stabilized traversable surface. Furthermore, the GEOWEB cellular confinement system, when placed on a properly prepared subgrade, allows for infiltration thereby mitigating the runoff volume increase typically attributed placement of aggregate. Results of infiltration testing performed for the Project are provided in Attachment 3.

7.2 Non-structural Practices

Permanent Vegetative Stabilization. Disturbed areas will receive topsoil (if needed) and seeding to establish permanent vegetative stabilization. Permanent vegetative stabilization is defined as a uniform 70 percent perennial vegetative cover with a density capable of resisting accelerated erosion. Cut and fill slopes shall be capable of resisting failure due to slumping, sliding, or other movements. Permanent vegetative stabilization shall be in accordance with specification defined within this E&S Plan.

Erosion Control Blankets. A manufactured erosion control blanket will be installed on all slopes 3:1 or steeper and within 50 feet of a surface water or 100 feet of a special protection water. Erosion control blanket shall not be installed in streams or wetlands; and, shall not be installed in agricultural fields or pastures. The blanket will be a biodegradable single mat straw fiber matrix and anchored in place using biodegradable stakes using a stake pattern that is in accordance with the manufacturer's recommendations. Erosion control blanket shall be **North American Green RollMax BioNet SC150BN** or an alternative Owner approved equivalent. Alternatively, hydraulically applied blankets with Flexible Growth Medium may be applied, where allowable, in accordance with guidance defined in the PADEP E&SPC Program Manual.

Waterbars. Waterbars will be installed across the ROW on all slopes greater than 5 percent. Waterbars should be constructed at a slope of 2 percent and will discharge to a well-vegetated area. Spacing of waterbars is in accordance with the guidance defined by PADEP E&SPC Manual.

8.0 SEQUENCE OF BMP INSTALLATION

This construction sequence is intended to provide a general course of action to conform to applicable regulatory agency requirements. The Contractor shall comply with the requirements listed in this section. The Contractor may be required to alter controls based on effectiveness or differing site conditions encountered.

8.1 General Site Restoration Construction Sequence Notes

1. A copy of the E&S Plan, PCSM/SR Plan, and related documents must be available at the Project site at all times.

2. The site restoration construction sequence is consistent with and shall be implemented in conjunction with the E&S construction sequence defined within the E&S Plan prepared for the Project.

3. National Fuel will assign an Environmental Inspector (EI) to the Project. The role of the EI will be to ensure compliance with the construction plans and with the mitigation and construction procedures identified in the PADEP and FERC permits issued for the Project.

The EI will be required to adhere to plans, details, and notes of the PADEP and FERC permits and has stop-work authority, if needed.

8.2 Construction Sequence

1. Proceed with pipeline construction activities in accordance with sequence step 1 through step 11 of the Project E&S Plan.

2. Upon completion of pipeline construction activities, perform trench backfill and final grading to restore contour as close to pre-construction contour as practicable and apply permanent stabilization measures (i.e., seed, mulch). Permanent stabilization measures shall be applied within four (4) days of final grading in non-special protection watersheds – and shall be applied immediately upon completing final grading in special protection watersheds. Soil amendments, seed, and mulch may be applied using broadcast-seeding or hydroseeding techniques that are in accordance with guidance defined in Chapter 11 of the E&SPC Program Manual.
   Note: Use wetland meadow seed mix for wetland areas and riparian buffer seed mix for stream bank and riparian buffer areas. Consult EI for appropriate seed selection for all other areas as work progresses along the right-of-way.

3. Where applicable after application of soil amendments and permanent seeding, install erosion control blanket. Erosion control blanket shall be installed within 50 feet of a surface water – 100 feet of a surface water in HQ/EV watersheds – and on slopes which are 3:1 or steeper. Erosion control blanket shall not be installed on livestock pastures or agricultural fields. Alternatively, hydraulically applied blankets may be applied, where allowable, in accordance with guidance defined in Chapter 11 of the PADEP E&SPC Program Manual.

4. Remove temporary crossings of streams and wetlands once equipment access across associated feature is no longer necessary.

5. Remove temporary access roads in areas where no existing road was present prior to construction. Restoration for these areas shall include: removal of stone aggregate and geotextile underlayment, backfill using stockpiled topsoil, and application of permanent stabilization measures; see sequence step 12 and step 13 procedures.

6. Inspection of E&S BMPs shall continue until aquatic resources are restored to pre-existing conditions or better and the Project area has reached permanent stabilization. Permanent stabilization is defined as a minimum uniform 70% perennial vegetative cover or other non-vegetative cover with a density sufficient to resist accelerated erosion. Cut and fill slopes shall be capable of resisting failure due to slumping, sliding, or other movements.

7. Notify the local county conservation district prior to removal of E&S BMPs. Temporary E&S BMPs may be removed after the entire disturbed area tributary to each BMP reaches permanent stabilization and wetlands/streams are restored to pre-existing conditions or better. Remove all remaining temporary crossings of streams and wetlands; and, remove all

signs and flagging at wetlands, streams, and other locations of special concern. Immediately stabilize any disturbances associated with the removal of the BMPs.

9.0 SUPPORTING CALCULATIONS

Site restoration for the Project primarily consists for restoring disturbed areas to a meadow good condition or better surface condition or to a surface condition equivalent to that of the pre-construction condition with the exception of small gravel pad areas for construction of permanent facilities (i.e., OPP station, valve sets, permanent access roads, etc.). Therefore, a hydrologic analysis has been prepared for the locations of permanent facilities. Technical Release No. 55 (TR-55) methodology within Hydraflow Hydrographs Extension for AutoCAD Civil 3D 2023 was used for runoff flow rate analysis of pre- and post-development hydrologic conditions. TR-55 methodology uses runoff curve number (CN) and time-of-concentration (Tc) to model the conditions of a watershed. Determination of CN and Tc is based on a watersheds soil type, and land cover type and condition. Pre- vs. post-development flow rate and volume calculations are provided in Attachment 4.

10.0 PLAN DRAWINGS

Installation locations, details and notes for BMPs, specifications for soil stabilization methods, and other information applicable to the PCSM/SR Plan are defined on the plan drawings provided in Attachment 5.

11.0 LONG TERM OPERATION AND MAINTENANCE PROGRAM

Until the Project area is stabilized, E&S BMPs must be maintained to ensure they are functioning properly. Preventative and corrective maintenance work, including clean-out, repair, replacement, re-grading, re-seeding, re-mulching, and re-netting must be performed as soon as practical in accordance with the E&S Plan prepared for the Project. If E&S BMPs fail to perform as expected, replacements or modifications to those installed will be required.

Long Term Operation and Maintenance

National Fuel is responsible for maintaining the ROW in accordance with applicable permit conditions/requirements. Long term operation and maintenance of the Project will include periodic (at least twice per year) visual inspections for sufficient vegetative growth and cover. Insufficient vegetative cover is defined as any area not achieving a uniform 70% perennial vegetative cover. Bare spots and areas with insufficient vegetative cover will be re-seeded and re-mulched within 24 hours of discovery. Restoration areas will be inspected for signs of erosion, especially on steep slopes. Corrective measures will be taken, as needed. If there is evidence of trench settling, the area will be re-graded to maintain pre-construction drainage patterns, mulched, and seeded.

The GEOWEB cellular confinement system(s) installed at the locations of permanent facilities shall be inspected and maintained in accordance with the manufacturer recommendations.

Vegetation Maintenance (Ref.: National Fuel Vegetation Maintenance Plan, 4/1/2016)

- Vegetation maintenance of the ROW shall be performed in accordance with FERC Staff's Upland Erosion, Revegetation and Maintenance Plan. A rotating mowing plan shall be utilized so that full ROW mowing will not occur more frequently than every 3 years on any individual section of line; however, to facilitate periodic corrosion/leak surveys, a corridor not exceeding 10 feet in width centered on the pipeline may be cleared at a frequency necessary to maintain the 10-foot corridor in an herbaceous state. No routine mowing, whether of the full ROW or a partial strip such as a survey corridor, shall occur between April 15 and August 1, absent written authorization by the responsible land management agency or the United States Fish and Wildlife Service (USFWS).
- Vegetation maintenance of the ROW in wetland areas shall be performed in accordance with FERC Staff's Wetland and Waterbody Construction Mitigation Procedures. Routine vegetation mowing or clearing shall not be performed over the full width of the ROW; however, to facilitate periodic corrosion/leak surveys, a corridor not exceeding 10 feet in width centered on the pipeline may be cleared at a frequency necessary to maintain the 10-foot corridor in an herbaceous state. In addition, trees within 15 feet of the pipeline with roots that could compromise the integrity of the pipeline coating may be selectively cut and removed from the ROW. No routine vegetation mowing or clearing in wetlands shall be performed between HDD entry and exit points. No herbicides or pesticides shall be used in or within 100 feet of a wetland, except as authorized by the landowner and allowed by the appropriate federal or state agency. No routine mowing shall occur between April 15 and August 1, absent written authorization by the responsible land management agency or the USFWS.

12.0 MATERIAL RECYCLING AND DISPOSAL PROCEDURES

The Contractor shall remove from the site, recycle, or dispose of all building materials and wastes in accordance with the PADEP solid waste management regulations at 25 PA Code 260.1 et seq., 271.1 et seq., and 287.1 et seq. No building materials or wastes shall be buried, dumped, or discharged at the site. Sediment removed from BMPs and excess soil material, if any, shall either be spread on-site and re-vegetated or disposed of off-site. In cases where off-site disposal is necessary, excess soil materials shall be disposed of at a facility with a fully implemented E&S Plan and active permits, if applicable.

13.0 GEOLOGIC FORMATIONS AND SOIL CONDITIONS

No geologic formations with the potential to cause pollution to are known to exist at the Project site. The hazard of erosion relating to easily erodible soil types existing at the Project site is a soil condition with potential to cause pollution in the form of sedimentation; however, BMPs proposed within the E&S Plan will mitigate the potential for pollution caused by this soil condition. Therefore, pollution as a result of soil conditions of the existing soil types is not anticipated. Additional information relating to soils within the Project area is provided in Attachment 2.

14.0 THERMAL IMPACTS TO SURFACE WATERS

Thermal impacts are most commonly associated with urbanization (i.e., increased impervious surfaces) that results in heated stormwater runoff flowing into receiving waters where it mixes, and potentially increases the base temperature of the surface water in streams. However, another contributing factor for stream temperature is solar exposure (radiant energy input) to the surface water. Among the attributes that determine the contribution of solar energy to thermal impacts are the presence of riparian vegetation, as well as stream width and orientation. The amount of heat transferred, and the degree of thermal pollution is of importance for fisheries management and the ecological integrity of receiving waters. However, a singular linear crossing of minimal width and vegetation clearing is not considered a contributing factor to thermal impacts.

By minimizing the clearing of riparian vegetation at stream crossings along the ROW and minimizing the addition/creation of impervious surfaces, the Project does not have thermal impacts. Specifically, thermal impacts will be avoided by implementing the following:

- Siting parallel to and overlapping with existing ROWs, where applicable, to minimize vegetation clearing at stream crossings;
- Reducing the construction ROW width and additional temporary workspaces at stream crossings, where possible;
- No grubbing, grading, or clearing of trees will occur within 50 feet of the top of stream bank until pipeline construction/installation is ready to proceed through that area;
- Restoring (seeding) disturbed areas/ROW as soon as practicable and/or directing runoff to vegetated areas to reduce the temperature of runoff prior to discharge into the streams; and,
- Restoring the stream banks and seeding/planting as soon as practicable to facilitate vegetative growth along the stream channel.

In addition, a combination of non-discharge alternatives and ABACT BMPs will be implemented during construction, where required, to protect and maintain the existing water quality of the receiving waters; specifically, in areas were receiving resources are classified as HQ and EV. Non-discharge alternatives were evaluated to minimize accelerated erosion and sedimentation, and to achieve zero net change in runoff between the pre- and post- construction conditions.

15.0 RIPARIAN BUFFERS

As defined by 25 Pa. Code Chapter 102.14(b), generally, a riparian forest buffer consists of permanent vegetation that is predominantly native trees, shrubs and forbs along a stream that is maintained in a natural state or sustainably managed to protect and enhance water quality, stabilize stream channels and banks, and separate land use activities from surface waters. The riparian width is identified as 100 feet (non-special protection waters) and (special protection waters) 150 feet on both sides of a perennial or intermittent stream.

Chapter 102.14 also states that earth disturbance activities within riparian buffers are subject to specific requirements and criteria (102.14(a) *General requirements for mandatory riparian buffers* and 102.14(b) *Riparian forest buffer criteria*); however, exceptions to subsection (a) and (b) exist for certain conditions and project types (102.14(d) *Exceptions*).

Based on 102.14(d)(2)(ii), an exemption applies for this project since: the Project is a linear pipeline project including maintenance and upgrades to an existing pipeline; and existing riparian buffers will be undisturbed to the extent practicable.

16.0 ANTIDEGRADATION

The Ellisburg Compressor Station (CS) portion of the Project in Potter County is the only location where earth disturbing activities will occur within an HQ watershed; therefore, antidegradation requirements defined in Chapter 102.4(b)(6) and 102.8(h) must be implemented for this portion of the Project. However, although not required, the Project has considered antidegradation alternatives and ABACT BMPs and implemented such practices where practicable throughout the entire Project limit of disturbance in general. As presented below, the Project has been designed such that the requirements of both these sections have been addressed.

Non-discharge alternatives have been evaluated and incorporated into the Project to minimize accelerated erosion and sedimentation, and to achieve zero net change in runoff between the pre- and post- construction conditions. The following provides a summary of the non-discharge alternatives evaluated and/or incorporated into the Project in order to avoid and minimize impacts to the water quality of the HQ waters within designated HQ watersheds.

- The Project has been designed to minimize earth disturbance to the extent practicable; specifically, for the Z20 Replacement Pipeline portion of the Project, the pipeline has been sited parallel to and overlapping with an existing permanent ROW to minimize earth disturbance and vegetation clearing in undisturbed areas.
- The LOD been minimized to the greatest extent practicable while still achieving the project objective to reduce erosion and sedimentation.
- The duration of construction across stream crossings has been reduced:
    - No grubbing or grading will occur within 50 feet of the top of stream bank until construction activity is ready to proceed through that area.
    - Construction across the waterbody will be completed as quickly and efficiently as site conditions allow.

- Duration of construction activity, in general, will be minimized to the extent possible:
  - The duration of earth disturbance will be minimized by stabilizing disturbed areas as soon as practicable after construction in accordance with the E&S Plan and the PCSM/SR Plan.
- Riparian buffers have been avoided to the extent possible.

A combination of non-discharge alternatives and the use of ABACT BMPs will protect and maintain the existing water quality of the receiving waters. The following ABACT BMPs have been incorporated into the Project and will be used onsite during construction activities:

- Street sweeping, an approved alternative to wash racks, will be implemented at construction entrances in HQ watershed and where otherwise necessary as determined by the EI;
- Compost filter socks at dewatering areas and waterbar outlets to provide additional filtration prior to discharge to surface waters;
- Installation of GEOWEB within proposed permanent gravel to promote infiltration and reduce flow rate;
- Implementation of a PPC Plan as necessary to protect water quality;
- Dewatering areas will include the placement of compost filter socks on the down gradient side of the filter bags;
- Erosion control blanket will be applied within 100 feet of receiving waters in HQ watersheds and on slopes 3:1 (H:V) or steeper (except for in agricultural fields and pastures); and,
- Application of permanent seeding for site restoration.

17.0 REFERENCES

Pennsylvania Department of Conservation and Natural Resources, Bureau of Topographic Geologic Survey. 2006. *PAMAP Program LIDAR Processing/ Contour Enhancement Lines of Pennsylvania*. http://www.pasda.psu.edu/default. asp>.

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TABLES

TABLE 1

LIMITATIONS OF PENNSYLVANIA SOILS PERTAINING TO EARTH MOVING PROJECTS Note: Absence of an X does not mean "No Potential Limitation." This is not necessarily an all-inclusive list.																	
Map Symbol	**Soil Name**	**Cutbanks Cave**	**Corrosive to Concrete/Steel**	**Droughty**	**Easily Erodible**	**Flooding**	**Seasonal High Water Table**	**Hydric / Hydric Inclusions**	**Low Strenght / Landslide Prone**	**Slow Percolations**	**Piping**	**Poor Source of Topsoil**	**Frost Action**	**Shrink - Swell**	**Potential Sinkhole**	**Ponding**	**Wetness**
Ab	Alluvial land	X	C/S			X	X	X		X	X	X	X		X		X
BeB	Braceville	X	C/S	X	X		X	X	X	X	X	X	X				X
ChB, ChC, ChD	Chenango	X	C	X		X	X	X		X	X	X	X				
CkA, CkB, CksB	Chippewa	X	C/S	X	X		X	X	X	X	X		X	X		X	
LhD, LhE	Lewbeach **(1)**																
LoB, LoC, LoD, LrF, LsD	Lordstown	X		X	X				X	X	X		X				
MaB, MaC, MaD	Mardin	X	S	X	X		X	X	X	X	X		X				X
MpA	Middlebury	X	S			X	X	X		X	X		X	X			
MqB, MqC, MqD, MqF, MqsC	Mongaup **(1)**																
MoC	Morris	X	C/S	X	X		X	X	X	X		X	X				X
NtB, NtsB	Norchip **(1)**																
OeB, OesD	Onteora **(1)**																
OhB, OhC, OhD	Ontusia **(1)**																
OgB, OgC, OgD, OTF	Oquaga	X	C	X	X			X		X			X				
Ow	Orrville	X	C/S			X	X	X	X	X	X		X				X
Ph	Philo	X	C/S		X	X	X	X	X	X	X	X	X				X
Po	Pope	X	C/S		X	X		X	X	X	X	X	X				
RxA, RxB	Rexford	X	C/S	X		X	X	X	X	X	X	X	X				X
RoE	Rockrift **(1)**																
ToA	Tioga	X	C		X	X	X	X		X							
UdA	Udifluvents / Fluvaquents	X	C/S			X	X	X		X	X		X				
VaD	Valois	X	C					X	X	X		X	X				
VlsF	Vly **(1)**																
VoA, VoB, VoC, VoD, VoE3, VvB, VvC	Volusia	X	C/S	X	X		X	X	X	X	X	X	X				
WeB, WeC, WeD, WesE	Wellsboro	X	C/S	X	X		X	X	X	X	X		X				X
WmB, WmC, WmD, WmE, WmsD	Willdin **(1)**																
WyF	Wyoming	X	C	X				X		X		X					

(1) Information not defined by reference document.

Reference: PADEP E&SPC Program Manual, Table E.1; March 2012

<u>Resolutions for potential soil limitations:</u>

Cutbanks Caves - Cut slopes will be stabilized as soon as possible with seed and mulch or erosion control blankets to prevent sliding. Slopes are designed to not exceed 2H:1V.

Corrosive to Concrete/Steel - Pipes to be used on site shall coated steel.

Droughty - This soil limitation is anticipated to have not impact during construction or long-term operation of the project.

Erodible Soils - E&S BMPs will be in place and functional prior to earth disturbance. Prompt stabilization practices will be implemented.

Flooding - Precautions will be taken during construction to avoid construction activity when heavy precipitation is forecasted.

Seasonal High Water Table - If a high groundwater table be encountered during construction, water will be drained away from disturbed areas to a well vegetated area or a placed compost filter sock prior to being discharged off site. Saturated soils will be dried prior to being used on site.

Hydric / Hydric Inclusions - A wetland delineation has been perfomred to determine the presence of wetlands.

Low Strength - Precautions will be taken to prevent slope failures due to improper construction practices. Soils will be evaluated during construction to determine if additional measures are necessary.

Slow Percolations - infiltration testing will be performed at locations of proposed infiltration BMPs.

Piping - Where necessary, trench plugs will be used to prevent piping.

Poor Source of Topsoil - Soil amendments will be added to site soils to promote vegetative growth.

Frost Action - This soil limitation is anticipated to have not impact during construction or long-term operation of the project.

Shrink - Swell - This soil limitation is anticipated to have not impact during construction or long-term operation of the project.

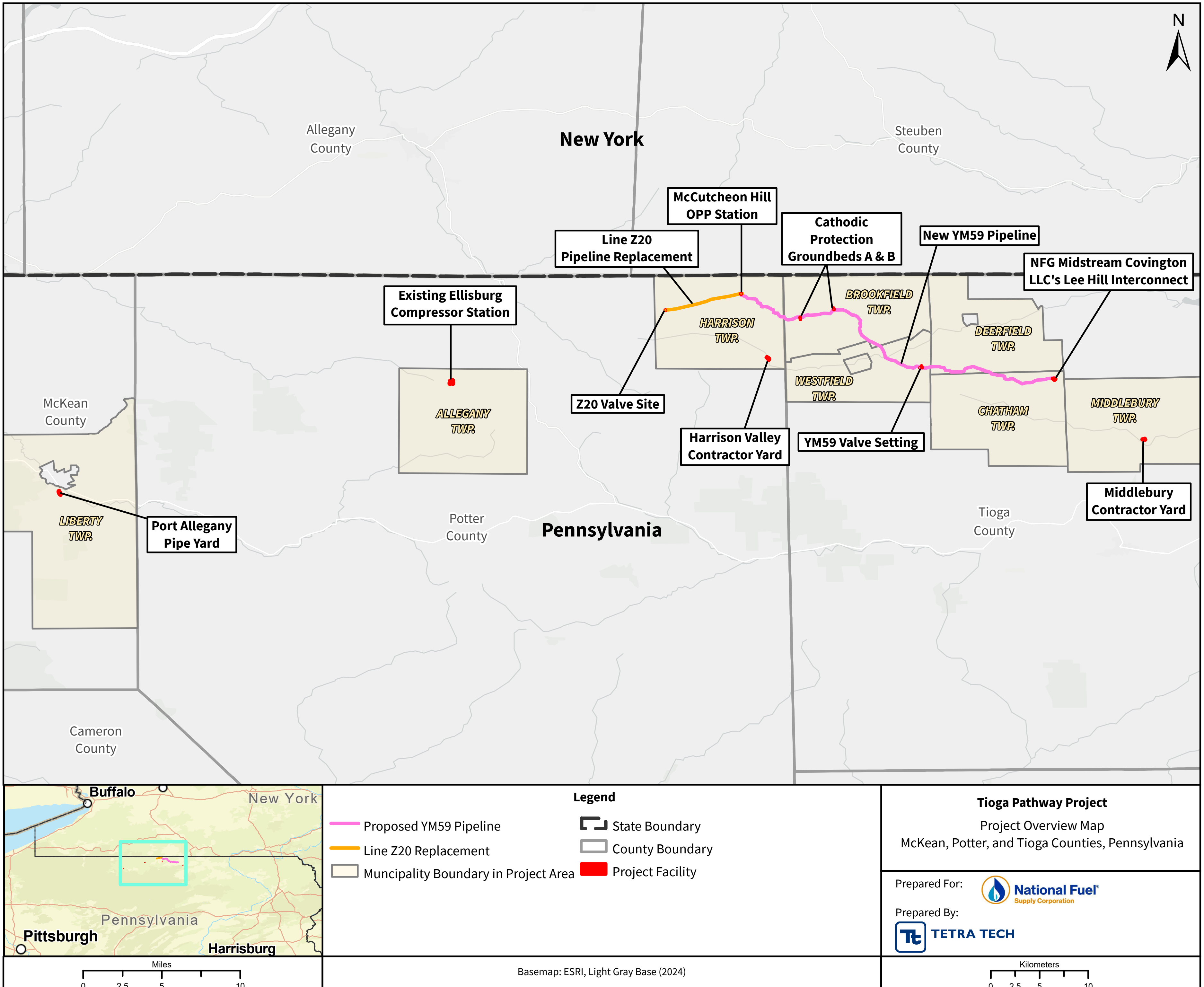
Potential Sinkholes - Should a sinkhole be encountered during construction, repair should be done under the direct observation and supervision of a professional geologis or lincensed geotechnical engineer. Site specific sinkhole repairs should be developed on a case by case basis.

Ponding - If ponding is encountered during construction, water will be drained away from disturbed areas to a well vegetated area or a placed compost filter sock prior to being discharged off site.

Wetness - If wetness is encountered during construction, water will be drained away from disturbed areas to a well vegetated area or a placed compost filter sock prior to being discharged off site. Soils will be evaluated during construction to determine if additional measures are necessary.

ATTACHMENT 1

LOCATION MAP(S)



Cartographer: jen.laslovich

NOT FOR CONSTRUCTION. Preliminary Project Plan – Subject to Change

Date: 8/9/2024 8:46 AM

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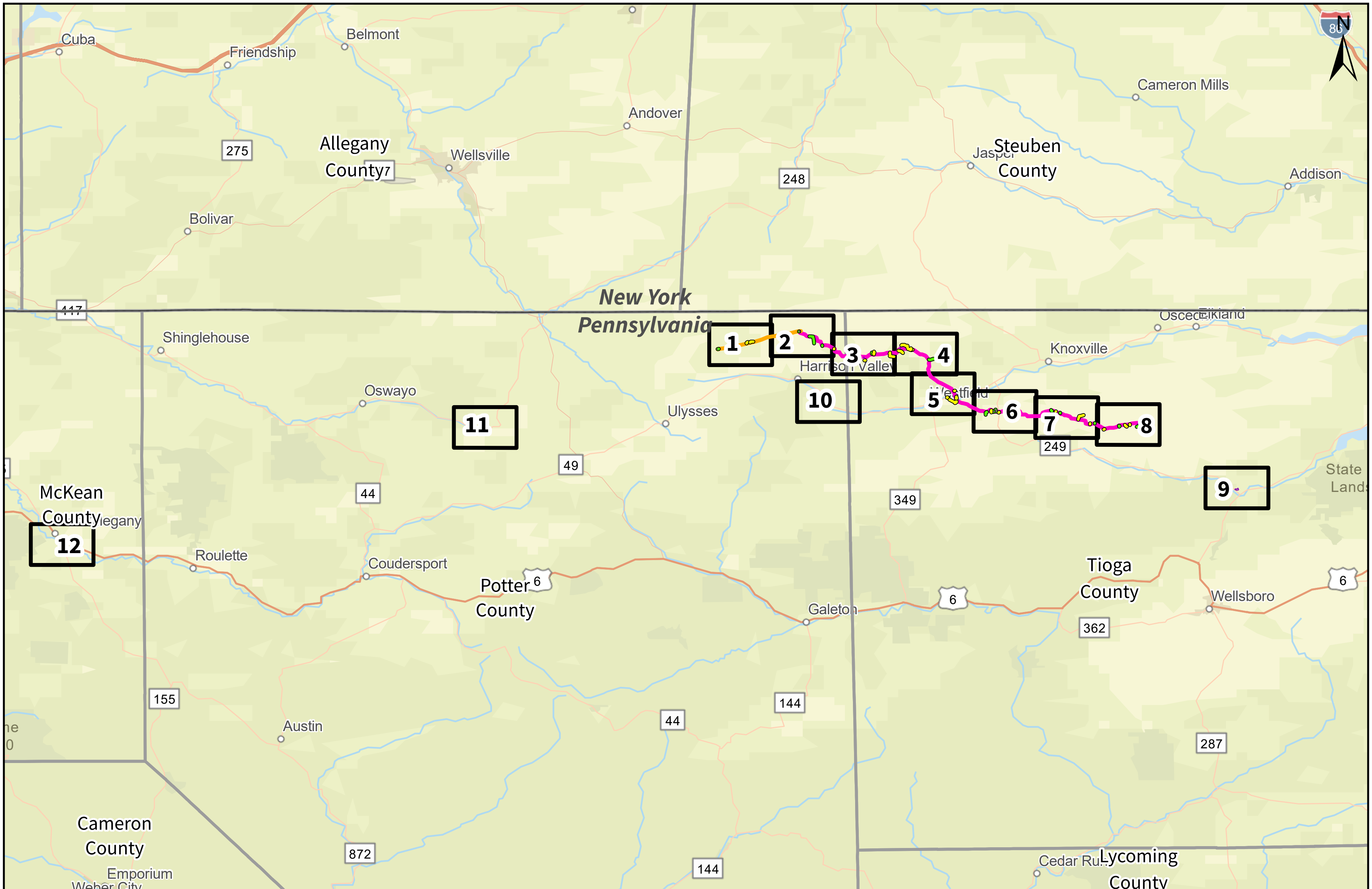

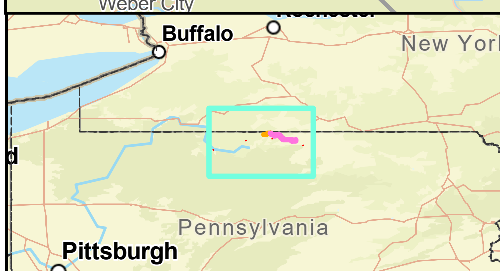

Legend

- Proposed YM59 Pipeline
- Line Z20 Replacement
- Permanent Access Rd (PAR)
- Temporary Access Rd (TAR)
- Project Facility
- Sheet Boundary
- State Boundary
- County Boundary

Tioga Pathway Project
Sheet Key
USGS Project Location Map
McKean, Potter and Tioga Counties, PA

Prepared For: National Fuel Supply Corporation

Prepared By: TETRA TECH

Miles: 0 1.5 3 6 9 12

Basemap: ESRI, Street Map

Kilometers: 0 2.5 5 10

Cartographer: jen.laslovich

NOT FOR CONSTRUCTION

Date: 9/23/2024 1:48 PM

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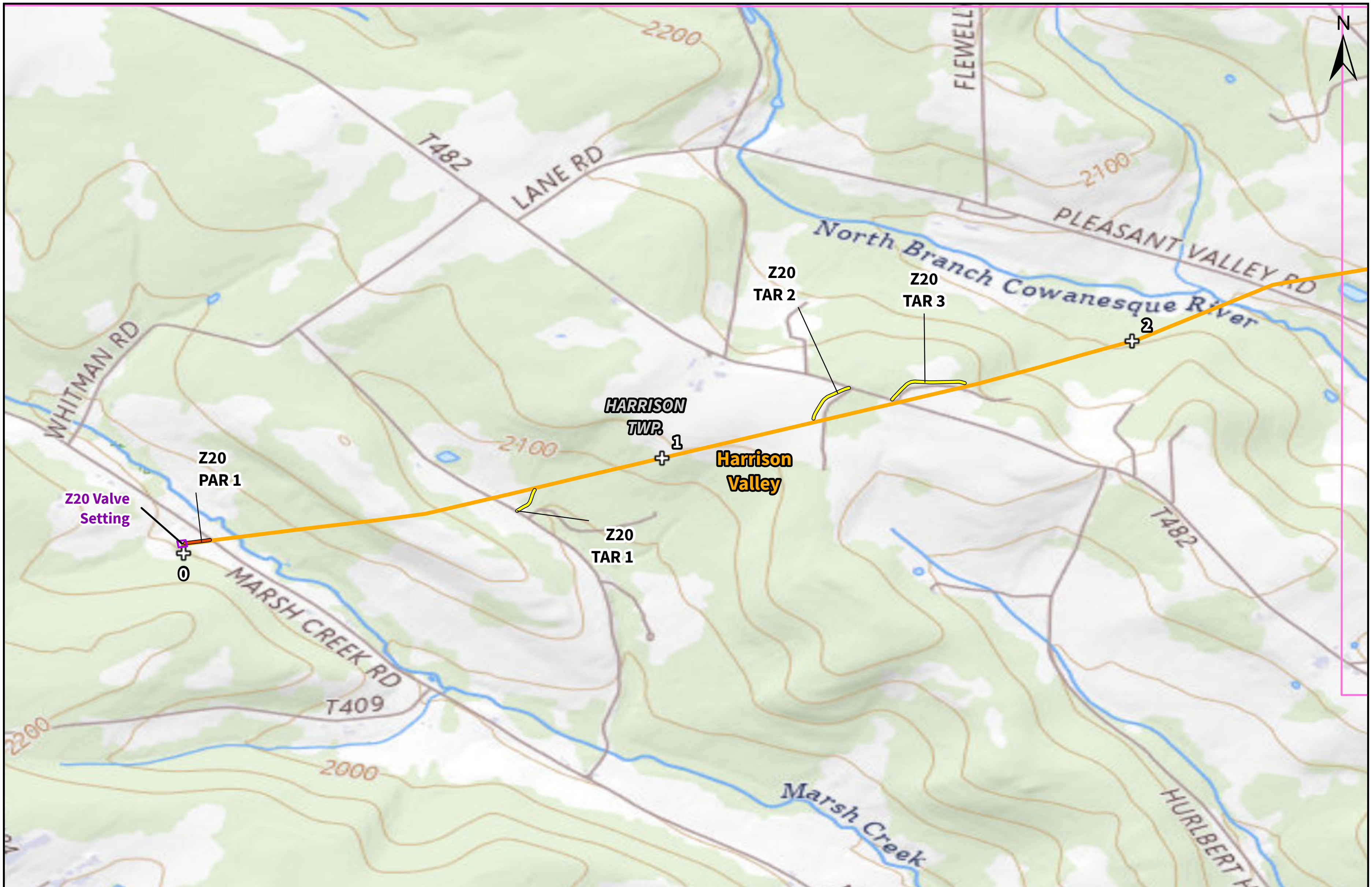

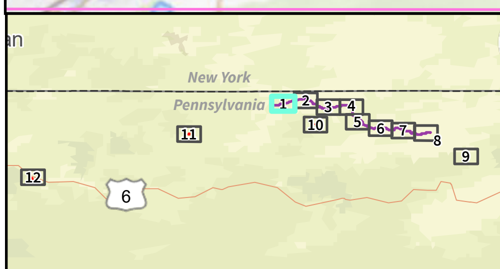

Legend

Sheet 1 of 12

- Line Z20 Replacement
- Permanent Access Rd (PAR)
- Temporary Access Rd (TAR)
- Milepost (MP)
- Project Facility
- Muncipality Boundary
- USGS Topographic Boundary
- Sheet Boundary

Tioga Pathway Project

USGS Project Location Map

Potter County, PA

Prepared For: National Fuel Supply Corporation

Prepared By: TETRA TECH

Feet: 0 1,000 2,000 4,000

Basemap: ESRI, USGS Topographic (2023)

USGS Quad Harrison Valley, PA

Meters: 0 500 1,000

Cartographer: jen.laslovich

NOT FOR CONSTRUCTION

Date: 9/23/2024 1:45 PM

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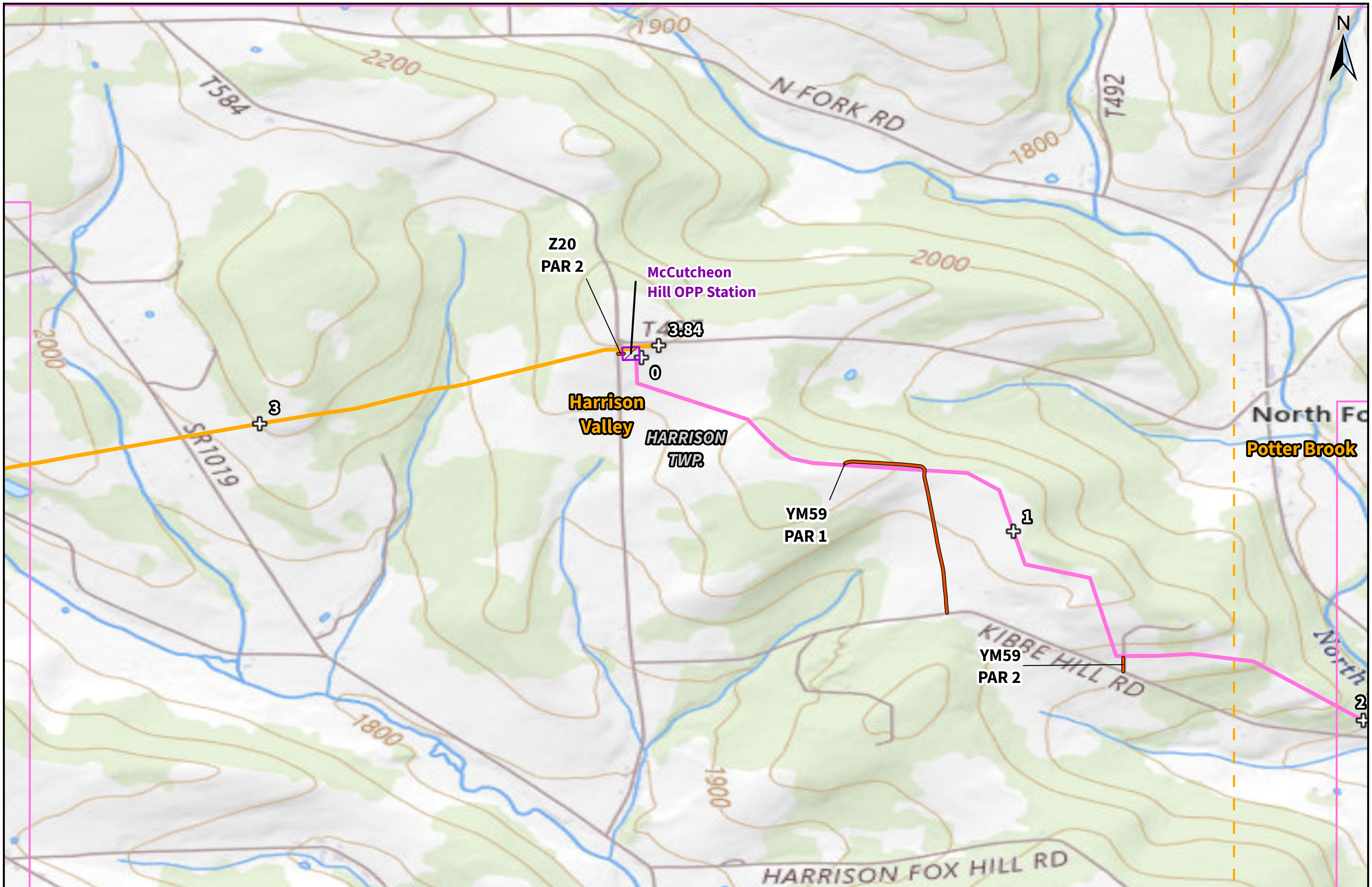

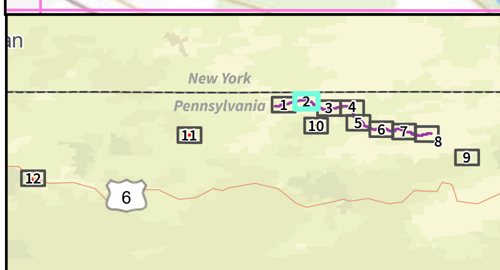

Legend

Sheet 2 of 12

- Proposed YM59 Pipeline
- Line Z20 Replacement
- Permanent Access Rd (PAR)
- Milepost (MP)
- Project Facility
- Muncipality Boundary
- USGS Topographic Boundary
- Sheet Boundary

Tioga Pathway Project

USGS Project Location Map

Potter County, PA

Prepared For: National Fuel Supply Corporation

Prepared By: TETRA TECH

Feet: 0, 1,000, 2,000, 4,000

Basemap: ESRI, USGS Topographic (2023)

USGS Quad Harrison Valley Potter Brook, PA

Meters: 0, 500, 1,000

Cartographer: jen.laslovich

NOT FOR CONSTRUCTION

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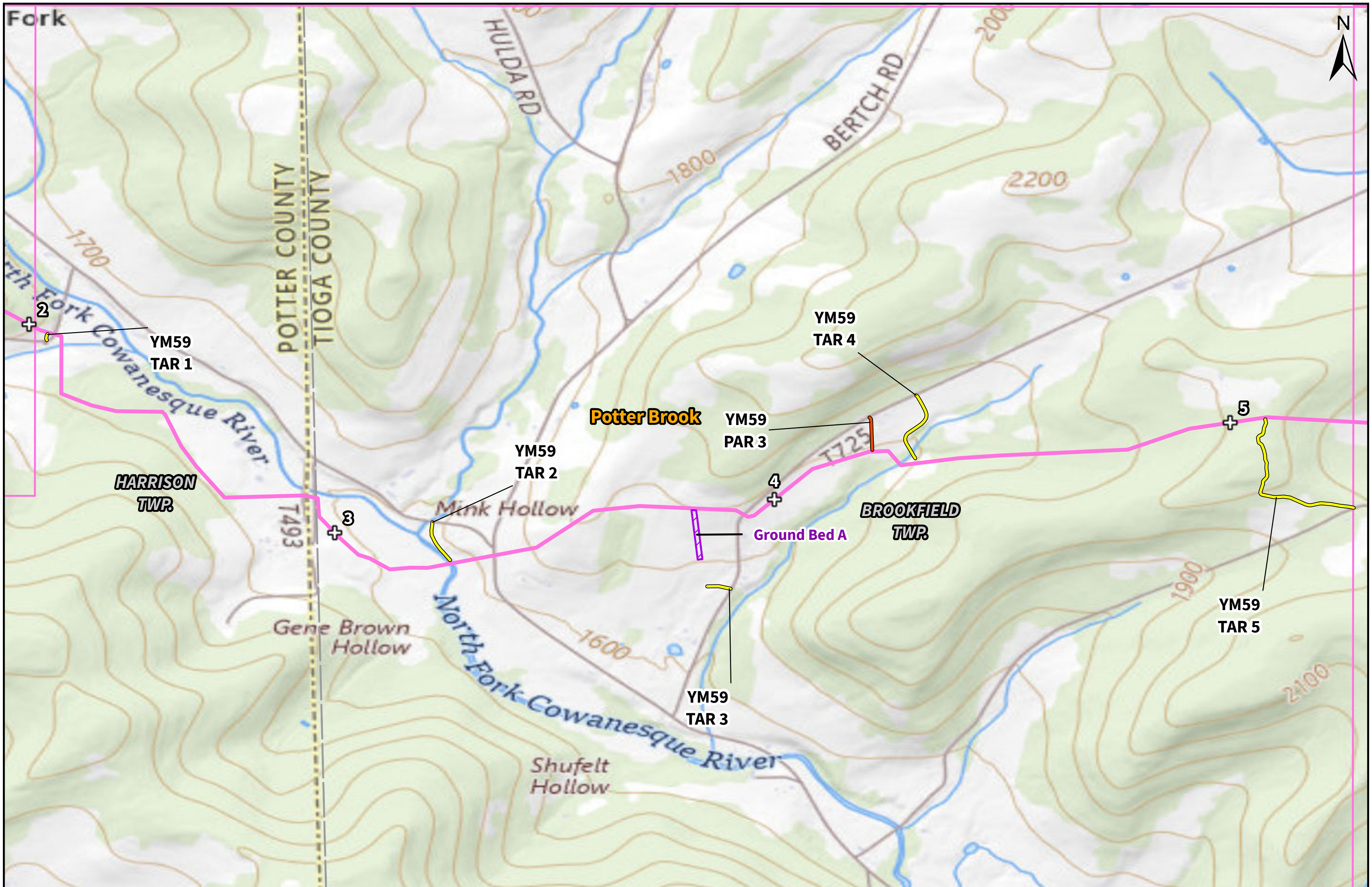

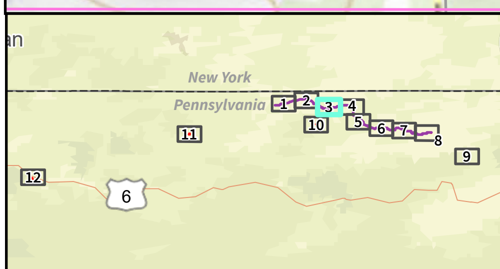

Legend

Sheet 3 of 12

- Proposed YM59 Pipeline
- Permanent Access Rd (PAR)
- Temporary Access Rd (TAR)
- Milepost (MP)
- Project Facility
- Muncipality Boundary
- USGS Topographic Boundary
- Sheet Boundary

Tioga Pathway Project

USGS Project Location Map

Potter and Tioga County, PA

Prepared For: National Fuel Supply Corporation

Prepared By: TETRA TECH

Feet: 0, 1,000, 2,000, 4,000

Basemap: ESRI, USGS Topographic (2023)

USGS Quad Potter Brook, PA

Meters: 0, 500, 1,000

Cartographer: jen.laslovich

NOT FOR CONSTRUCTION

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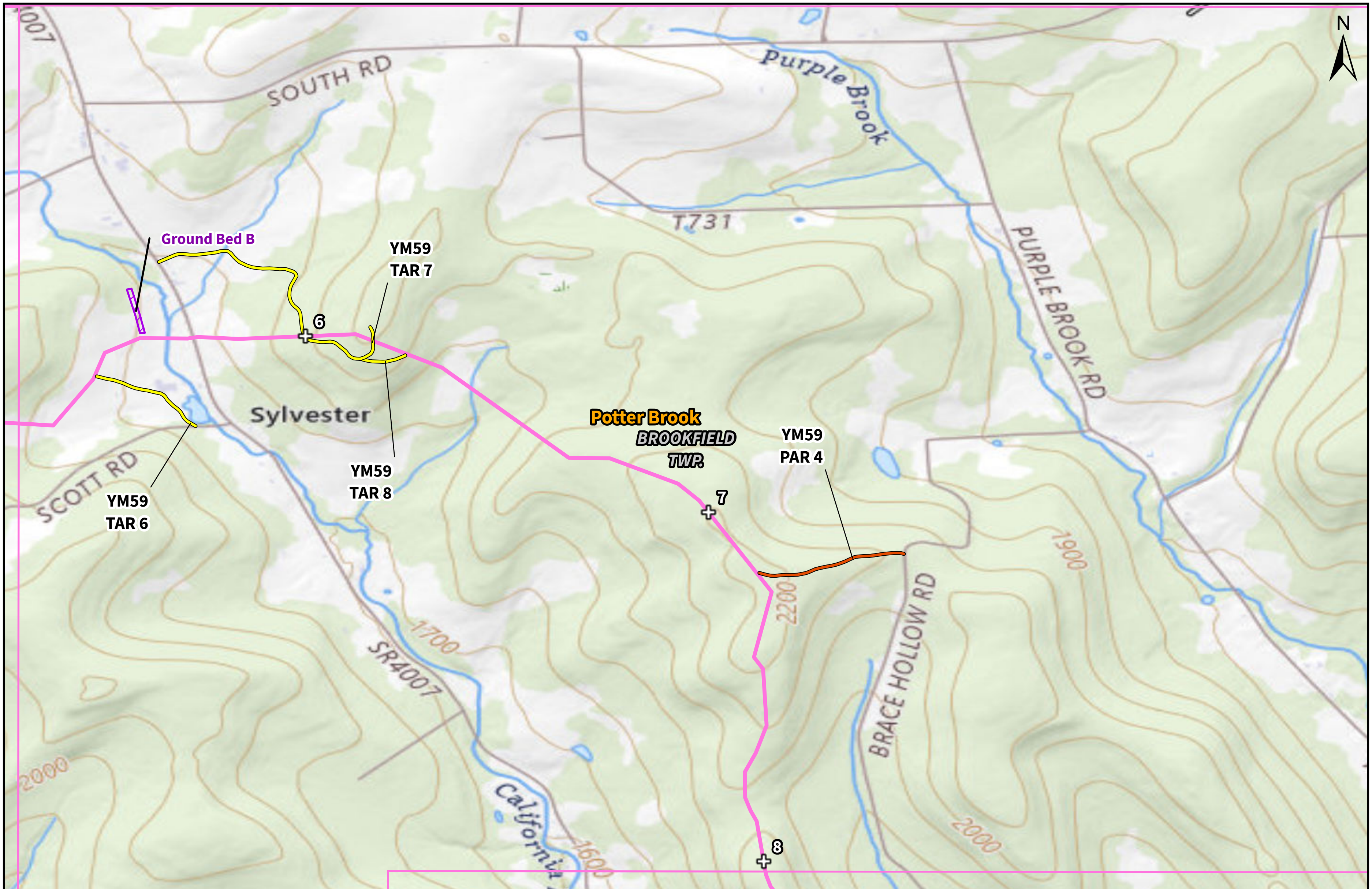

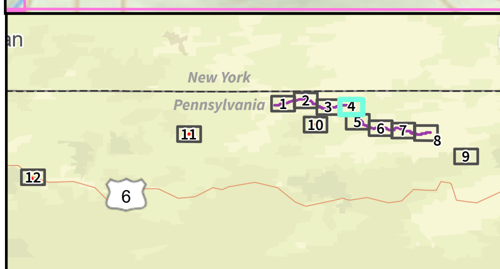

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Sheet 4 of 12

- Proposed YM59 Pipeline
- Permanent Access Rd (PAR)
- Temporary Access Rd (TAR)
- Milepost (MP)
- Project Facility
- Muncipality Boundary
- USGS Topographic Boundary
- Sheet Boundary

Tioga Pathway Project

USGS Project Location Map

Tioga County, PA

Prepared For: National Fuel Supply Corporation

Prepared By: TETRA TECH

Feet

0 1,000 2,000 4,000

Basemap: ESRI, USGS Topographic (2023)

USGS Quad Potter Brook, PA

Meters

0 500 1,000

Cartographer: jen.laslovich

NOT FOR CONSTRUCTION

Date: 9/23/2024 1:45 PM

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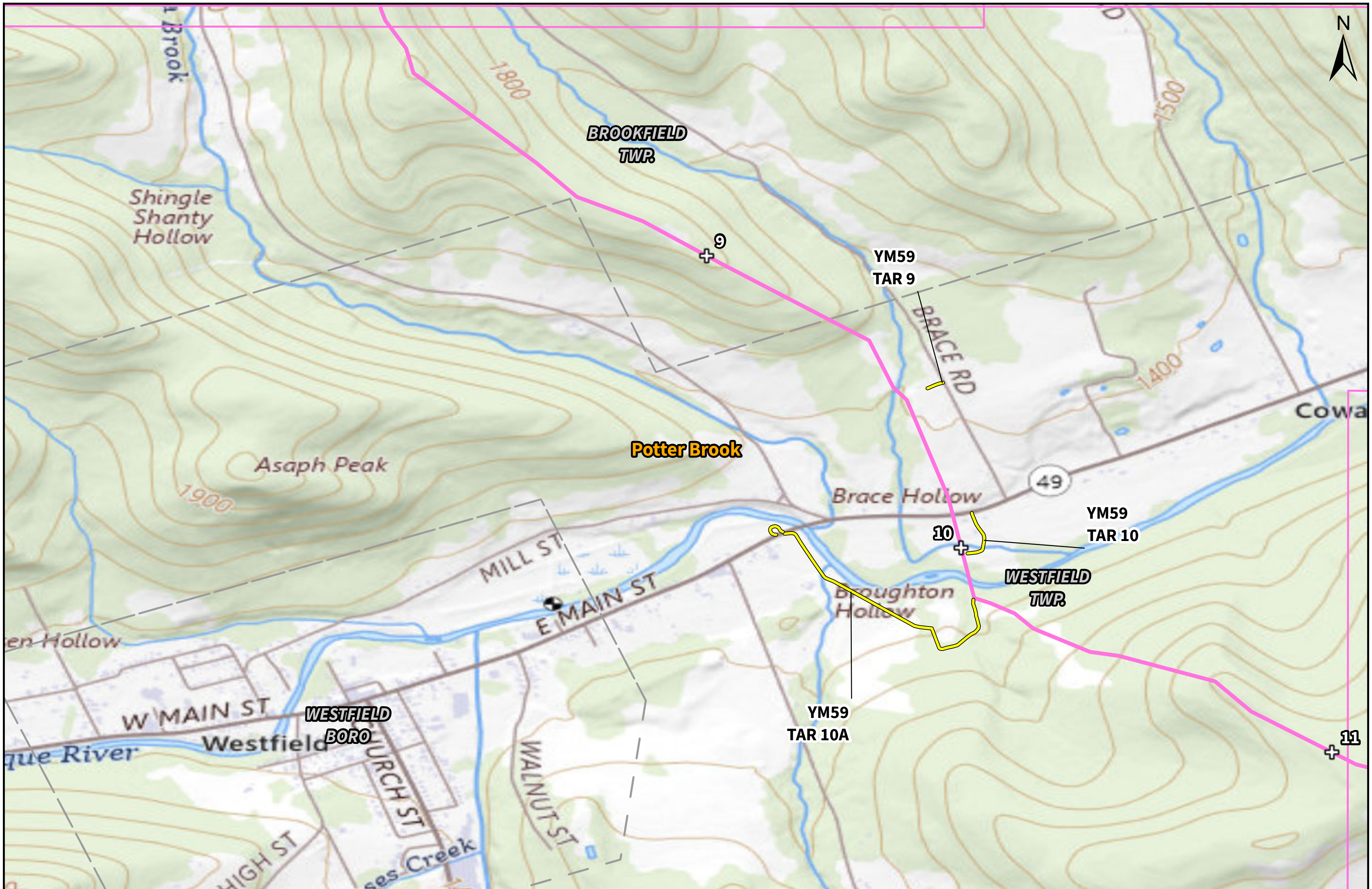

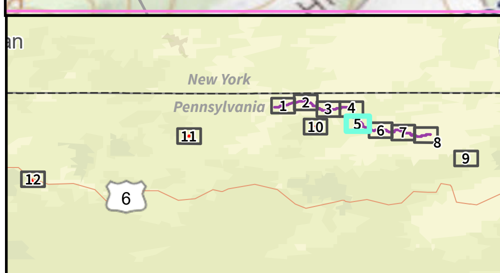

Legend

Sheet 5 of 12

- Proposed YM59 Pipeline
- Temporary Access Rd (TAR)
- Milepost (MP)
- Muncipality Boundary
- USGS Topographic Boundary
- Sheet Boundary

Tioga Pathway Project
USGS Project Location Map
Tioga County, PA

Prepared For: National Fuel Supply Corporation

Prepared By: TETRA TECH

Feet: 0, 1,000, 2,000, 4,000

Basemap: ESRI, USGS Topographic (2023)
USGS Quad Potter Brook, PA

Meters: 0, 500, 1,000

Cartographer: jen.laslovich

NOT FOR CONSTRUCTION

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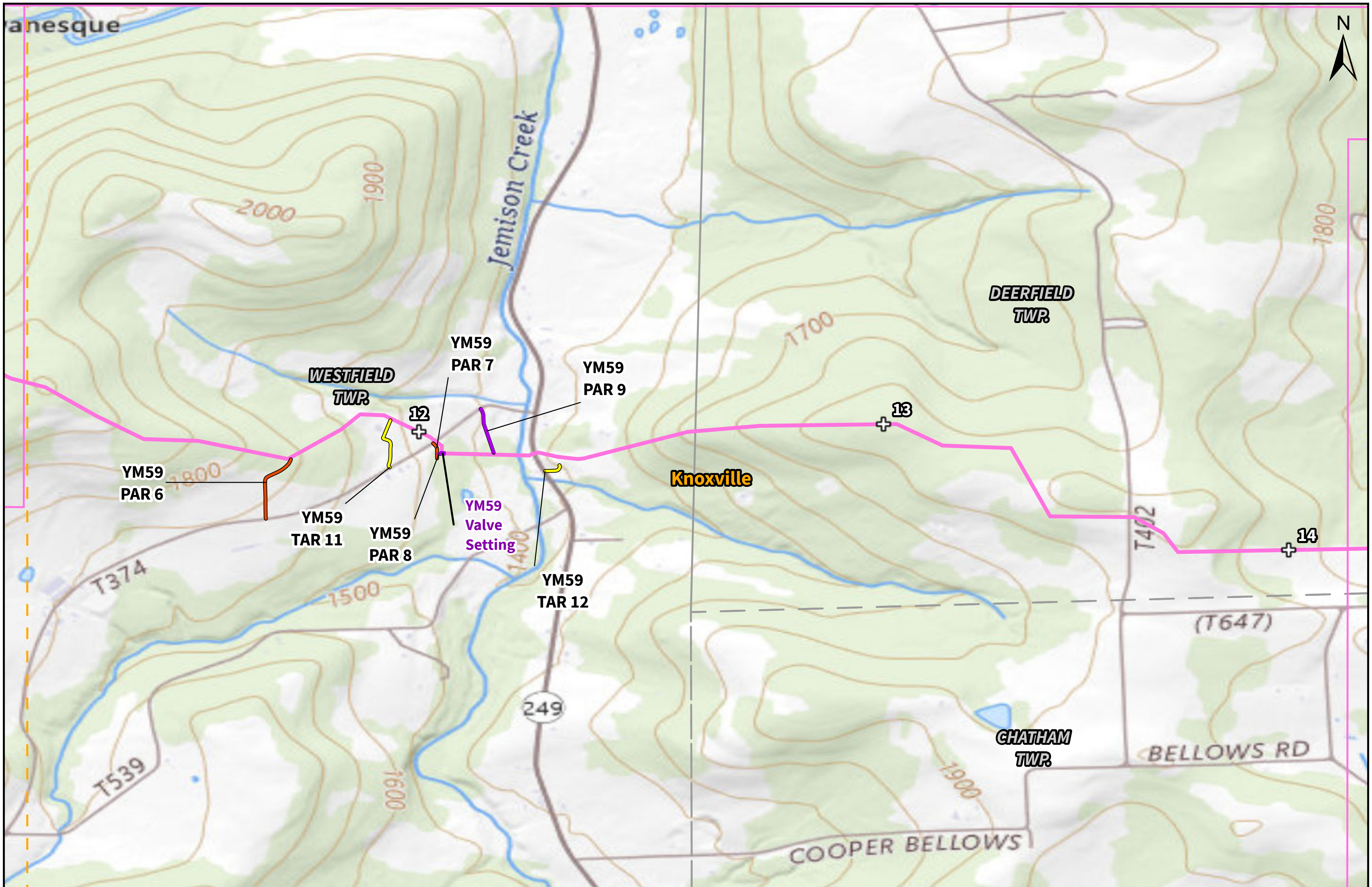

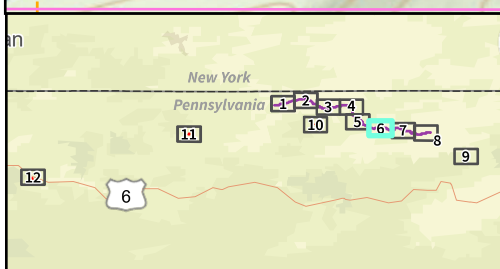

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Sheet 6 of 12

- Proposed YM59 Pipeline
- Permanent Access Rd (PAR)
- Temporary Access Rd (TAR)
- Milepost (MP)
- Project Facility
- Muncipality Boundary
- USGS Topographic Boundary
- Sheet Boundary

Tioga Pathway Project

USGS Project Location Map

Tioga County, PA

Prepared For: National Fuel Supply Corporation

Prepared By: TETRA TECH

Feet: 0 1,000 2,000 4,000

Basemap: ESRI, USGS Topographic (2023)

USGS Quad Potter Brook Knoxville, PA

Meters: 0 500 1,000

Cartographer: jen.laslovich

NOT FOR CONSTRUCTION

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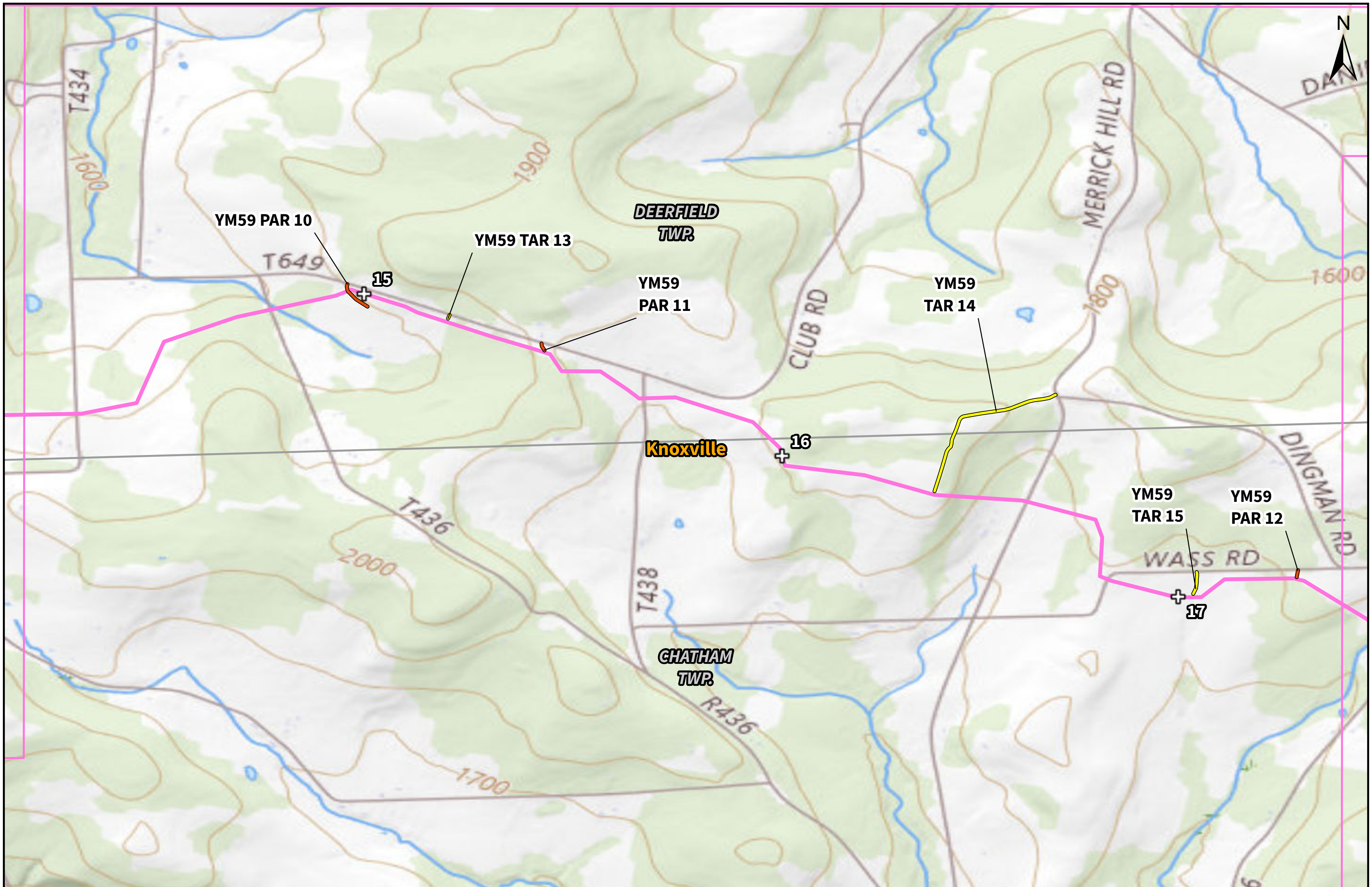

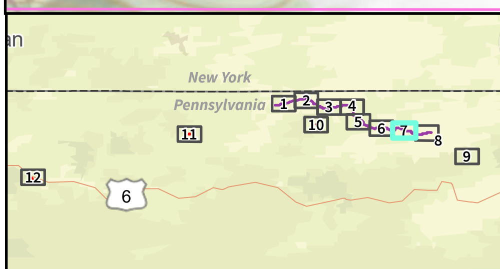

Legend

Sheet 7 of 12

- Proposed YM59 Pipeline
- Permanent Access Rd (PAR)
- Temporary Access Rd (TAR)
- Milepost (MP)
- Muncipality Boundary
- USGS Topographic Boundary
- Sheet Boundary

Tioga Pathway Project
USGS Project Location Map
Tioga County, PA

Prepared For: National Fuel Supply Corporation

Prepared By: TETRA TECH

Feet
0 1,000 2,000 4,000

Basemap: ESRI, USGS Topographic (2023)
USGS Quad Knoxville, PA

Meters
0 500 1,000

Cartographer: jen.laslovich

NOT FOR CONSTRUCTION

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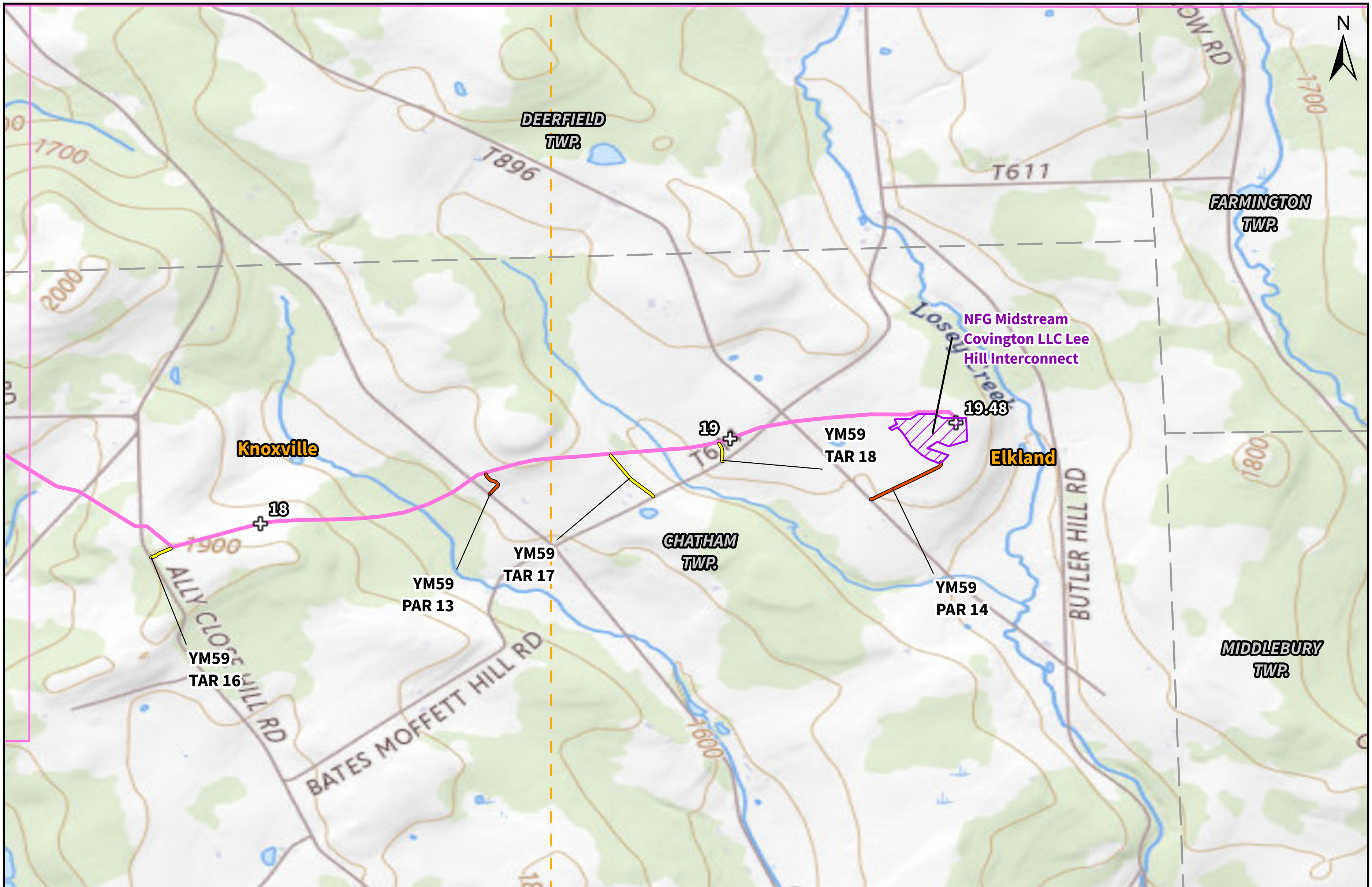

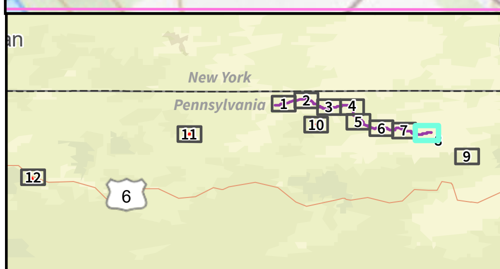

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Sheet 8 of 12

- Proposed YM59 Pipeline
- Permanent Access Rd (PAR)
- Temporary Access Rd (TAR)
- Milepost (MP)
- Project Facility
- Muncipality Boundary
- USGS Topographic Boundary
- Sheet Boundary

Tioga Pathway Project
USGS Project Location Map
Tioga County, PA

Prepared For: National Fuel Supply Corporation

Prepared By: TETRA TECH

Feet: 0, 1,000, 2,000, 4,000

Basemap: ESRI, USGS Topographic (2023)
USGS Quad Knoxville Elkland, PA

Meters: 0, 500, 1,000

Cartographer: jen.laslovich

NOT FOR CONSTRUCTION

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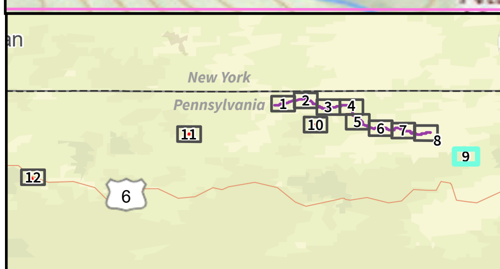

Legend

Sheet 9 of 12

- Project Facility
- Muncipality Boundary
- USGS Topographic Boundary
- Sheet Boundary

Tioga Pathway Project

USGS Project Location Map

Tioga County, PA

Prepared For: National Fuel Supply Corporation

Prepared By: TETRA TECH

Feet: 0, 1,000, 2,000, 4,000

Basemap: ESRI, USGS Topographic (2023)

USGS Quad Keeneyville, PA

Meters: 0, 500, 1,000

Cartographer: jen.laslovich

NOT FOR CONSTRUCTION

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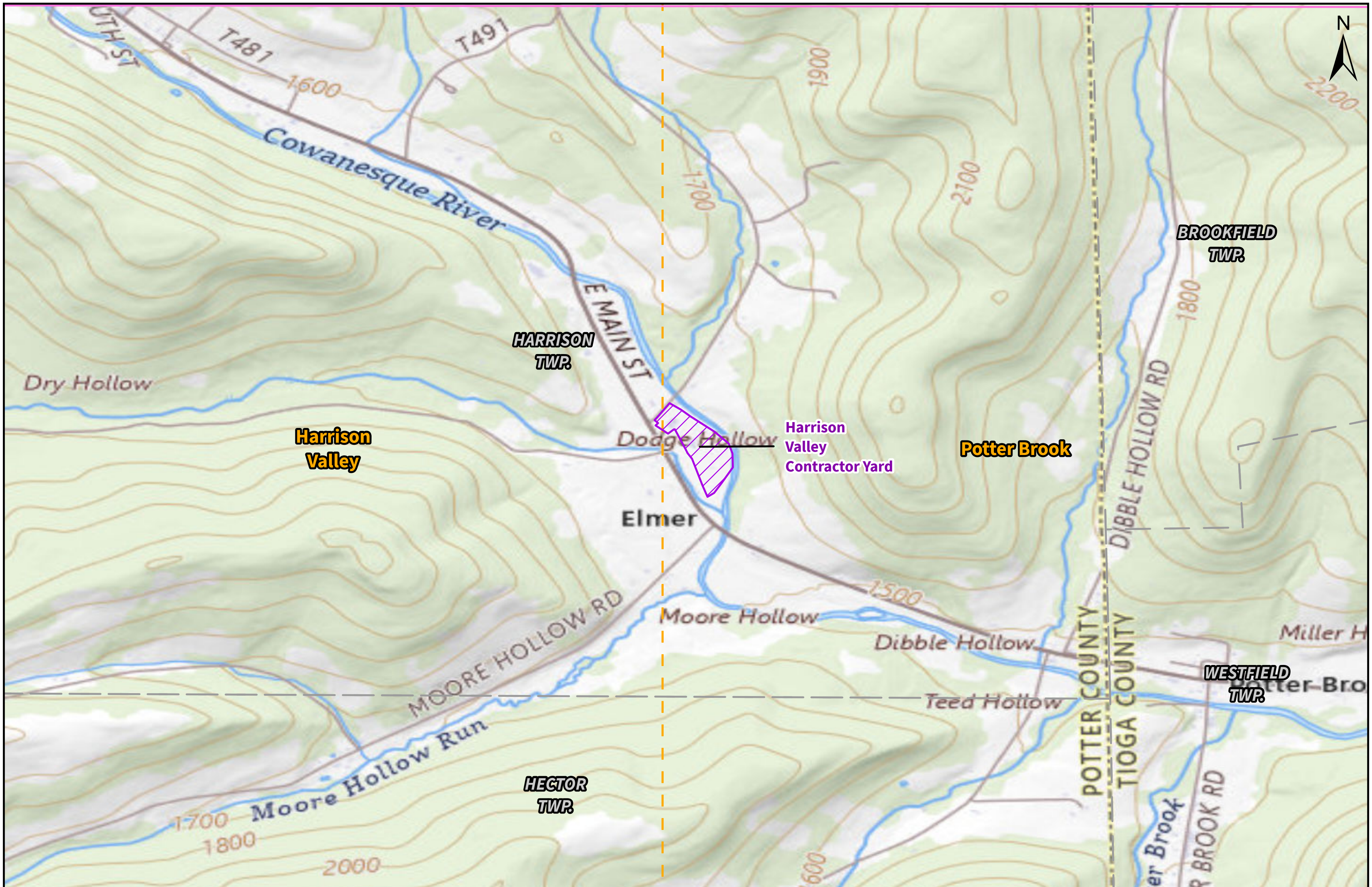

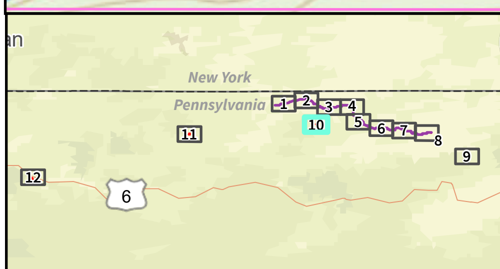

Legend

Sheet 10 of 12

- Project Facility
- Muncipality Boundary
- USGS Topographic Boundary
- Sheet Boundary

Tioga Pathway Project

USGS Project Location Map

Tioga County, PA

Prepared For: National Fuel Supply Corporation

Prepared By: TETRA TECH

Feet: 0 1,000 2,000 4,000

Basemap: ESRI, USGS Topographic (2023)

USGS Quad Harrison Valley Potter Brook, PA

Meters: 0 500 1,000

Cartographer: jen.laslovich

NOT FOR CONSTRUCTION

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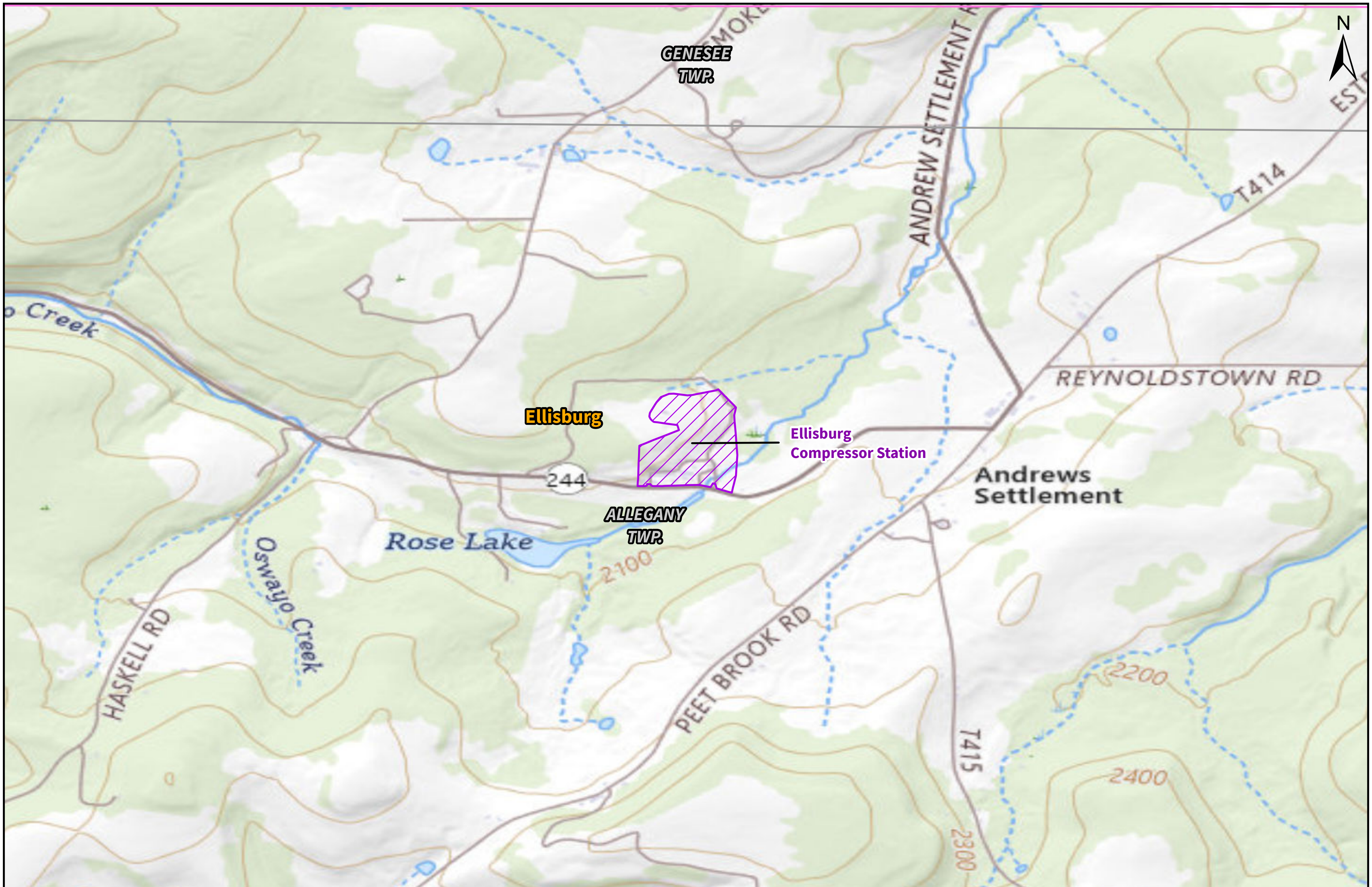

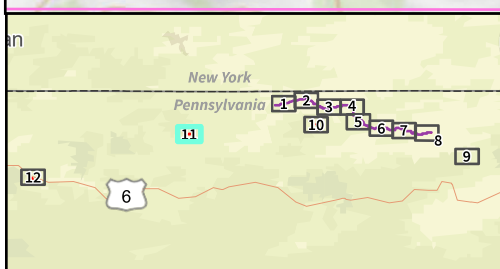

Legend

Sheet 11 of 12

- Project Facility
- Muncipality Boundary
- USGS Topographic Boundary
- Sheet Boundary

Tioga Pathway Project
USGS Project Location Map
Potter County, PA

Prepared For: National Fuel Supply Corporation

Prepared By: TETRA TECH

Feet: 0 | 1,000 | 2,000 | 4,000

Basemap: ESRI, USGS Topographic (2023)
USGS Quad Ellisburg, PA

Meters: 0 | 500 | 1,000

Cartographer: jen.laslovich

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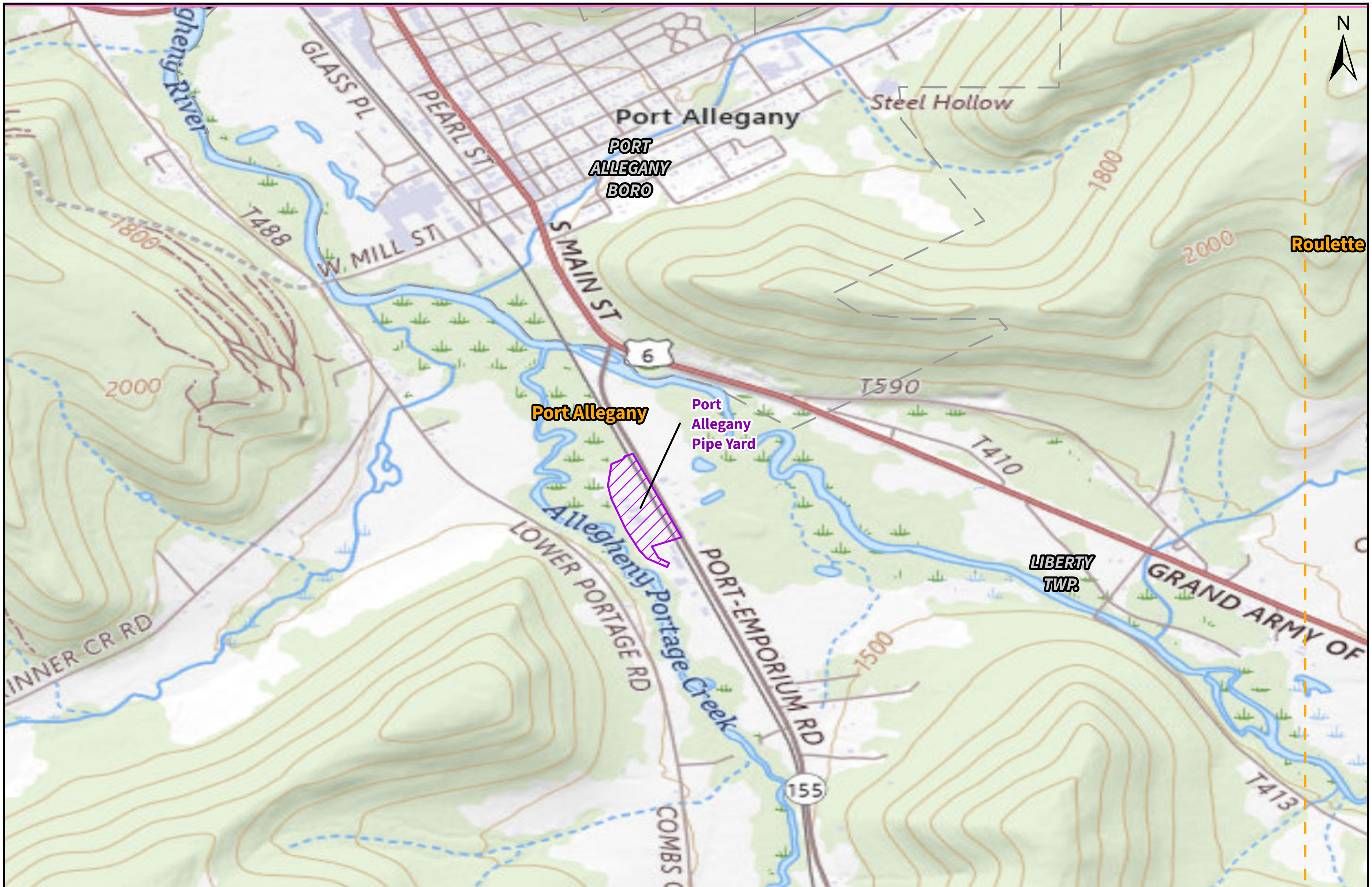

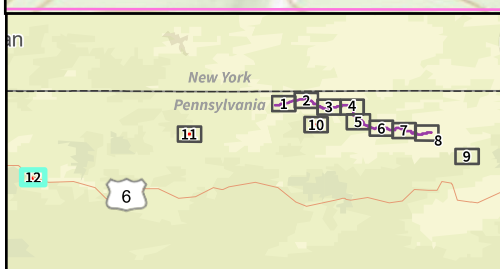

Legend

Sheet 12 of 12

- Project Facility
- Muncipality Boundary
- USGS Topographic Boundary
- Sheet Boundary

Tioga Pathway Project
USGS Project Location Map
McKean County, PA

Prepared For: National Fuel Supply Corporation

Prepared By: TETRA TECH

Feet
0 1,000 2,000 4,000

Basemap: ESRI, USGS Topographic (2023)
USGS Quad Port Allegany Roulette, PA

Meters
0 500 1,000

Cartographer: jen.laslovich

NOT FOR CONSTRUCTION

Date: 9/23/2024 1:45 PM

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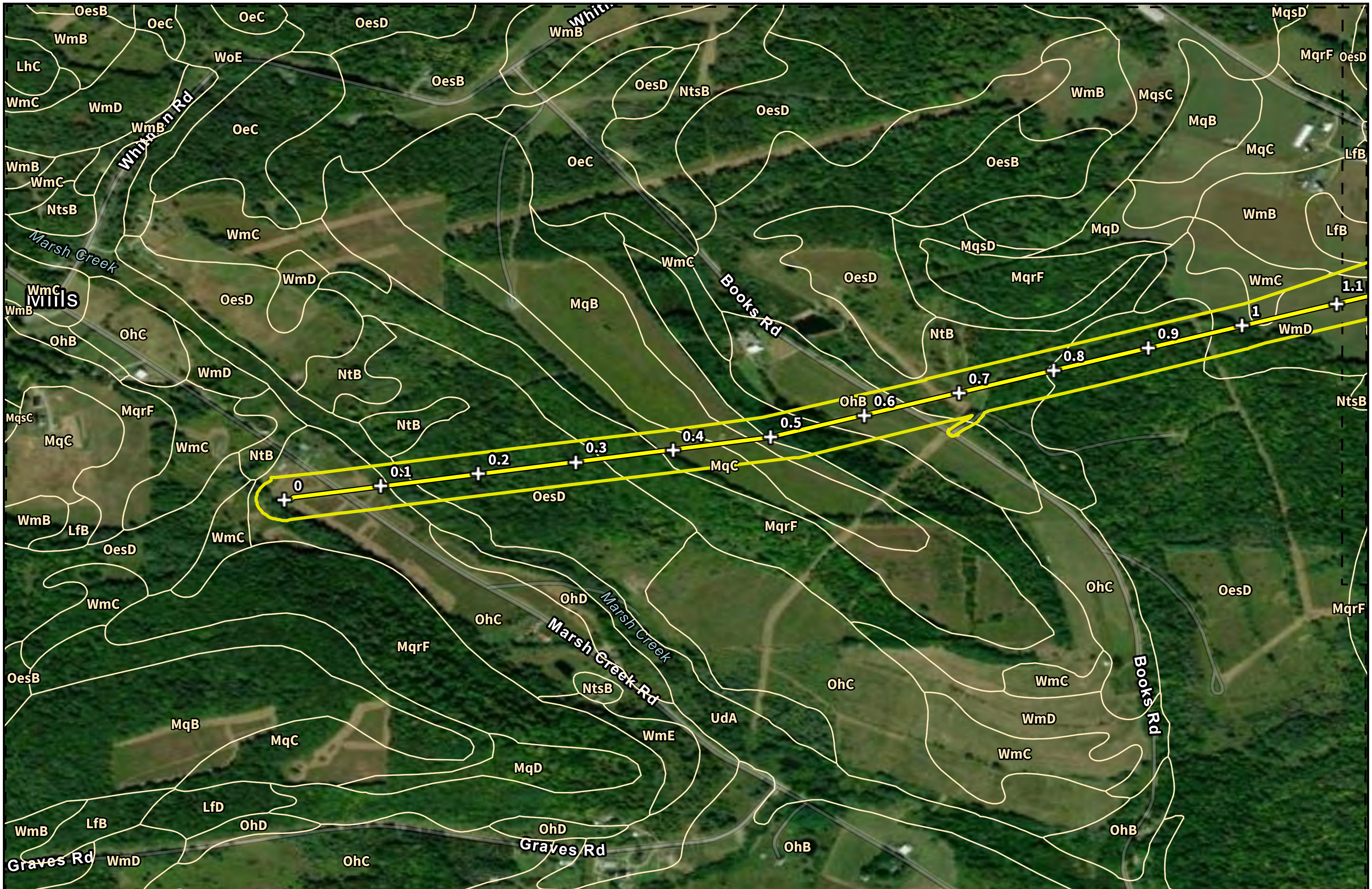
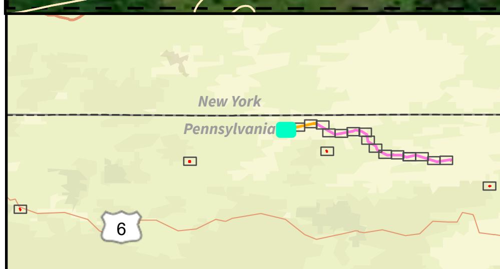
ATTACHMENT 2

SOILS MAP AND SOILS DESCRIPTIONS





Legend

Sheet 1 of 21

- Milepost
- Z20 Pipeline Replacement
- Survey Area
- Soil Unit Boundary (See text/document for translation of soils abbreviations.)
- Sheet Boundary

Tioga Pathway Project

Figure 2

USDA Soils Map

Potter County, PA

Prepared For: NF

National Fuel Supply Corporation

Prepared By:

TETRA TECH

Feet: 0, 500, 1,000, 2,000

Basemap: ESRI, World Imagery (9/21/2020)

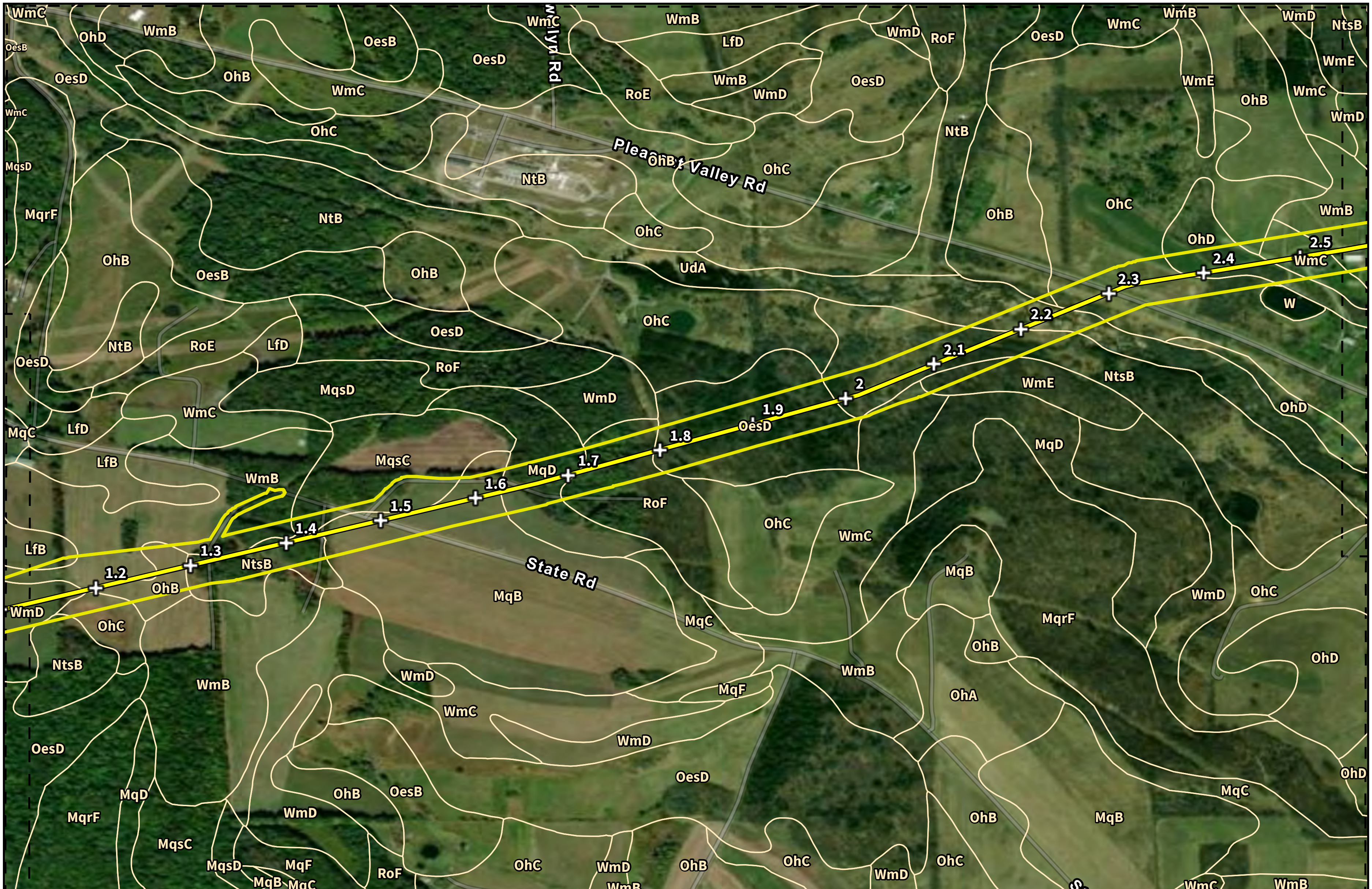
Meters: 0, 150, 300, 600

Cartographer: jen.laslovich

NOT FOR CONSTRUCTION

Date: 6/17/2024 2:17 PM

Document Path: C:\Users\jen.laslovich\Tetra Tech, Inc\My Data Science - Documents\My GIS Project\212C-BF-00493 Tioga Pathway\2_Permitting\USACE\ARR Figure 2.aprx



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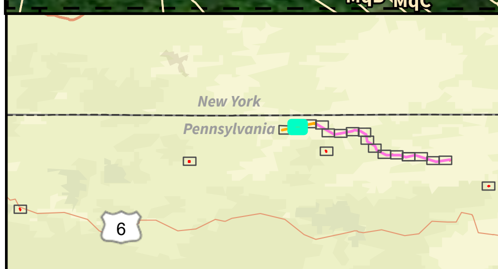
Sheet 2 of 21

- Milepost
- Z20 Pipeline Replacement
- Survey Area
- Soil Unit Boundary (See text/document for translation of soils abbreviations.)
- Sheet Boundary



Tioga Pathway Project

Figure 2

USDA Soils Map

Potter County, PA

Prepared For: NF

National Fuel Supply Corporation

Prepared By:

TETRA TECH

Feet: 0 500 1,000 2,000

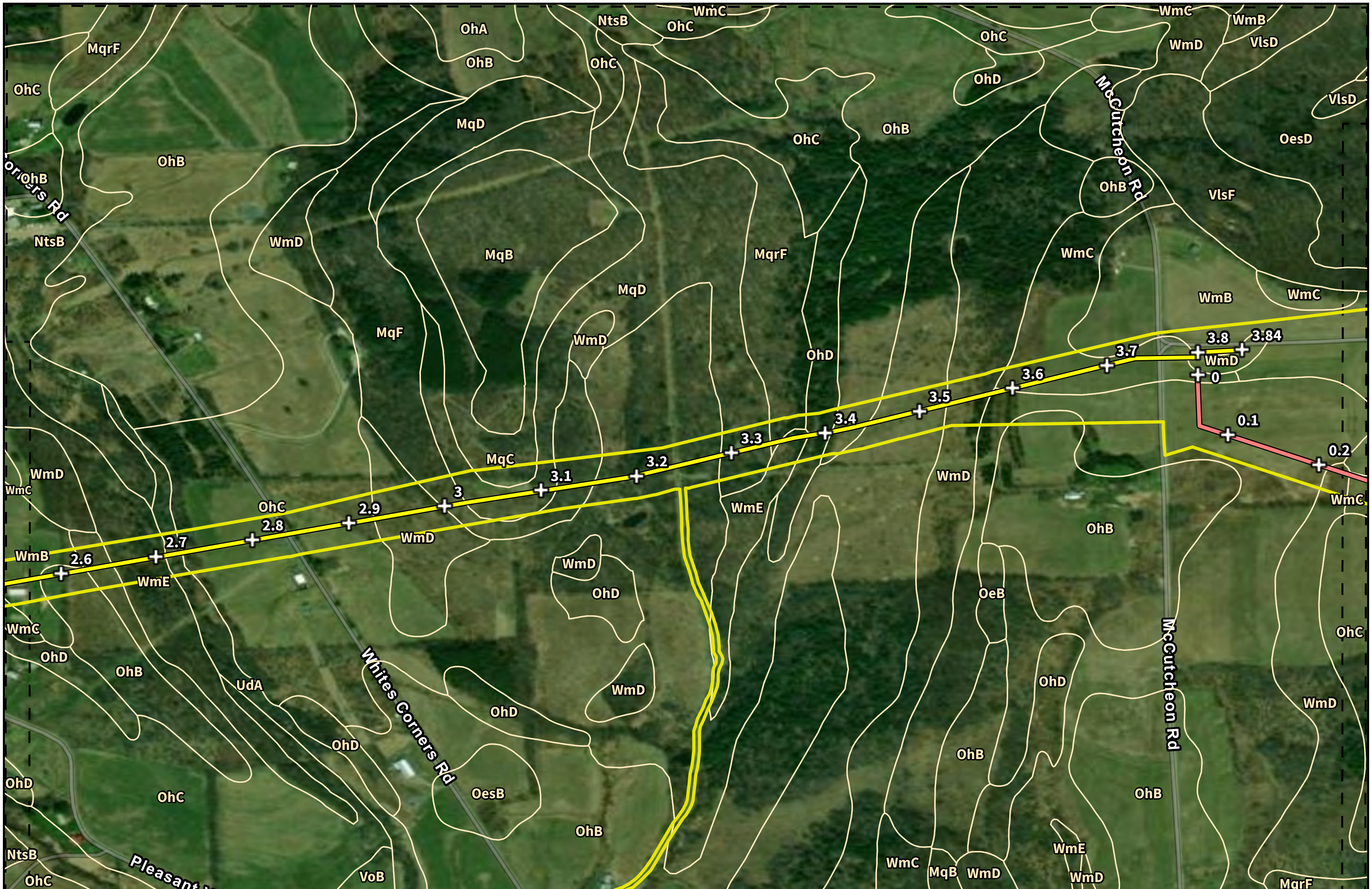
Basemap: ESRI, World Imagery (11/9/2020)

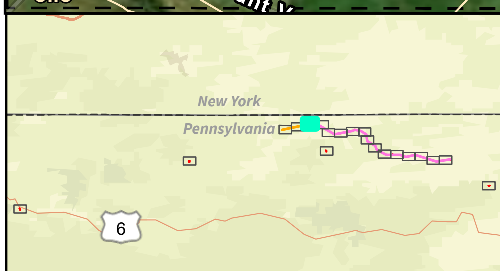
Meters: 0 150 300 600

Cartographer: jen.laslovich

NOT FOR CONSTRUCTION

Date: 6/17/2024 2:17 PM





Legend

Sheet 3 of 21

- Milepost
- Proposed YM59 Pipeline
- Z20 Pipeline Replacement
- Survey Area
- Soil Unit Boundary (See text/document for translation of soils abbreviations.)
- Sheet Boundary

Basemap: ESRI, World Imagery (4/6/2021)

Tioga Pathway Project

Figure 2

USDA Soils Map

Potter County, PA

Prepared For: NF

National Fuel Supply Corporation

Prepared By:

TETRA TECH

Feet: 0, 500, 1,000, 2,000

Meters: 0, 150, 300, 600

Cartographer: jen.laslovich

NOT FOR CONSTRUCTION

Date: 6/17/2024 2:17 PM

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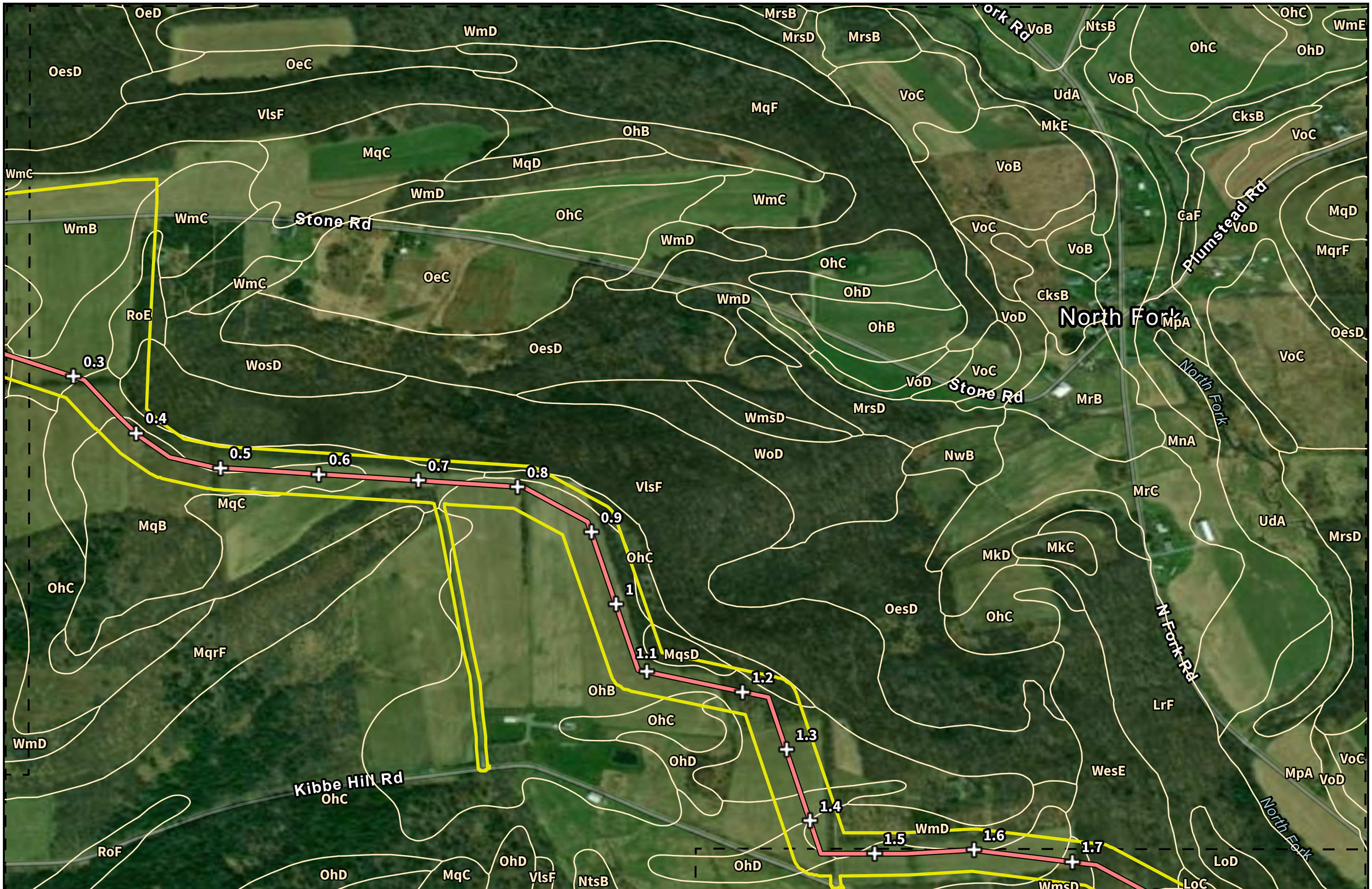
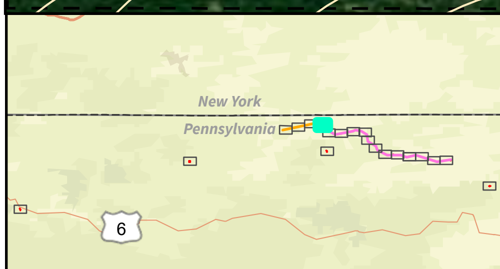




Legend

Sheet 4 of 21

- Milepost
- Proposed YM59 Pipeline
- Survey Area
- Soil Unit Boundary (See text/document for translation of soils abbreviations.)
- Sheet Boundary

Tioga Pathway Project

Figure 2

USDA Soils Map

Potter County, PA

Prepared For:
NF

National Fuel Supply Corporation

Prepared By:

TETRA TECH

Feet: 0, 500, 1,000, 2,000

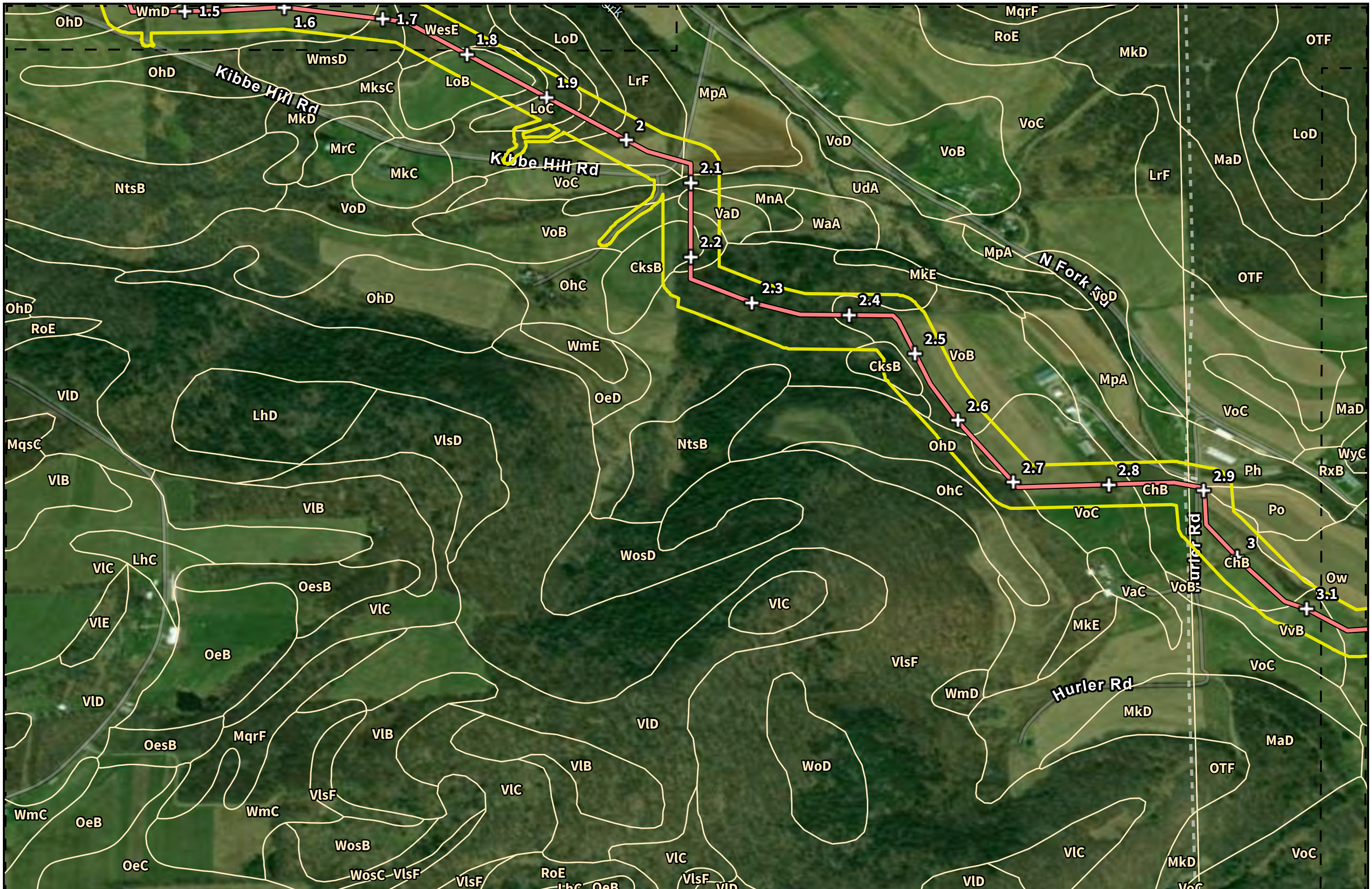
Basemap: ESRI, World Imagery (4/6/2021)

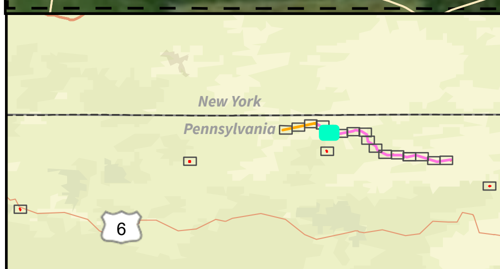
Meters: 0, 150, 300, 600

Cartographer: jen.laslovich

NOT FOR CONSTRUCTION

Date: 6/17/2024 2:17 PM





Legend

Milepost

Proposed YM59 Pipeline

Survey Area

Soil Unit Boundary (See text/document for translation of soils abbreviations.)

Sheet Boundary

Tioga Pathway Project

Figure 2

USDA Soils Map

Potter and Tioga County, PA

Prepared For:
NF

Prepared By:

Feet: 0 | 500 | 1,000 | 2,000

Basemap: ESRI, World Imagery (4/6/2021)

Meters: 0 | 150 | 300 | 600

Cartographer: jen.laslovich

NOT FOR CONSTRUCTION

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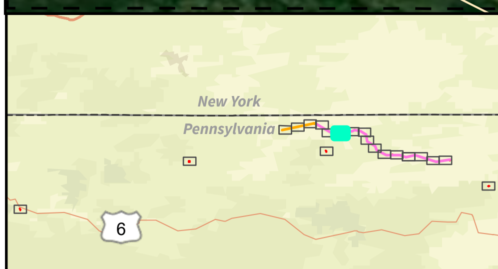

Legend

Sheet 6 of 21

- Milepost
- Proposed YM59 Pipeline
- Survey Area
- Soil Unit Boundary (See text/document for translation of soils abbreviations.)
- Sheet Boundary

Tioga Pathway Project

Figure 2

USDA Soils Map

Tioga County, PA

Prepared For:
NF

National Fuel Supply Corporation

Prepared By:

TETRA TECH

Feet: 0, 500, 1,000, 2,000

Basemap: ESRI, World Imagery (4/6/2021)

Meters: 0, 150, 300, 600

Cartographer: jen.laslovich

NOT FOR CONSTRUCTION

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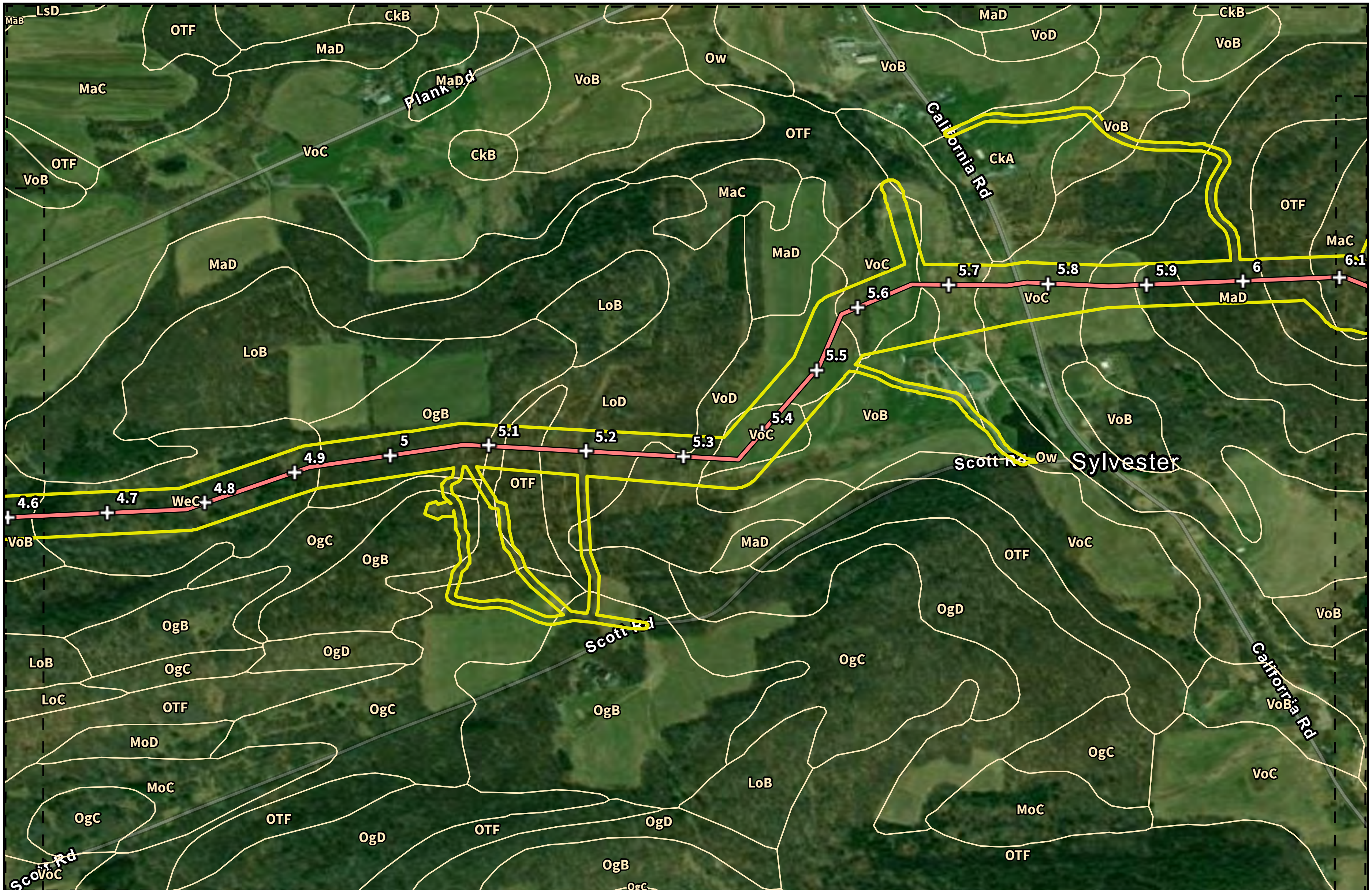

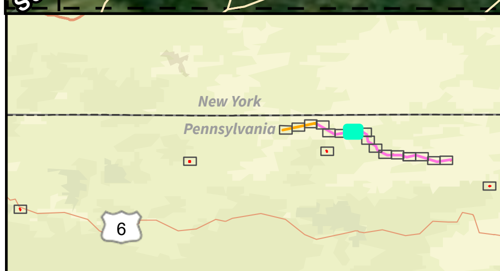

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Milepost

Proposed YM59 Pipeline

Survey Area

Soil Unit Boundary (See text/document for translation of soils abbreviations.)

Sheet Boundary

Sheet 7 of 21

Tioga Pathway Project

Figure 2

USDA Soils Map

Tioga County, PA

Prepared For:
NF

National Fuel Supply Corporation

Prepared By:

TETRA TECH

Feet: 0, 500, 1,000, 2,000

Basemap: ESRI, World Imagery (4/6/2021)

Meters: 0, 150, 300, 600

Cartographer: jen.laslovich

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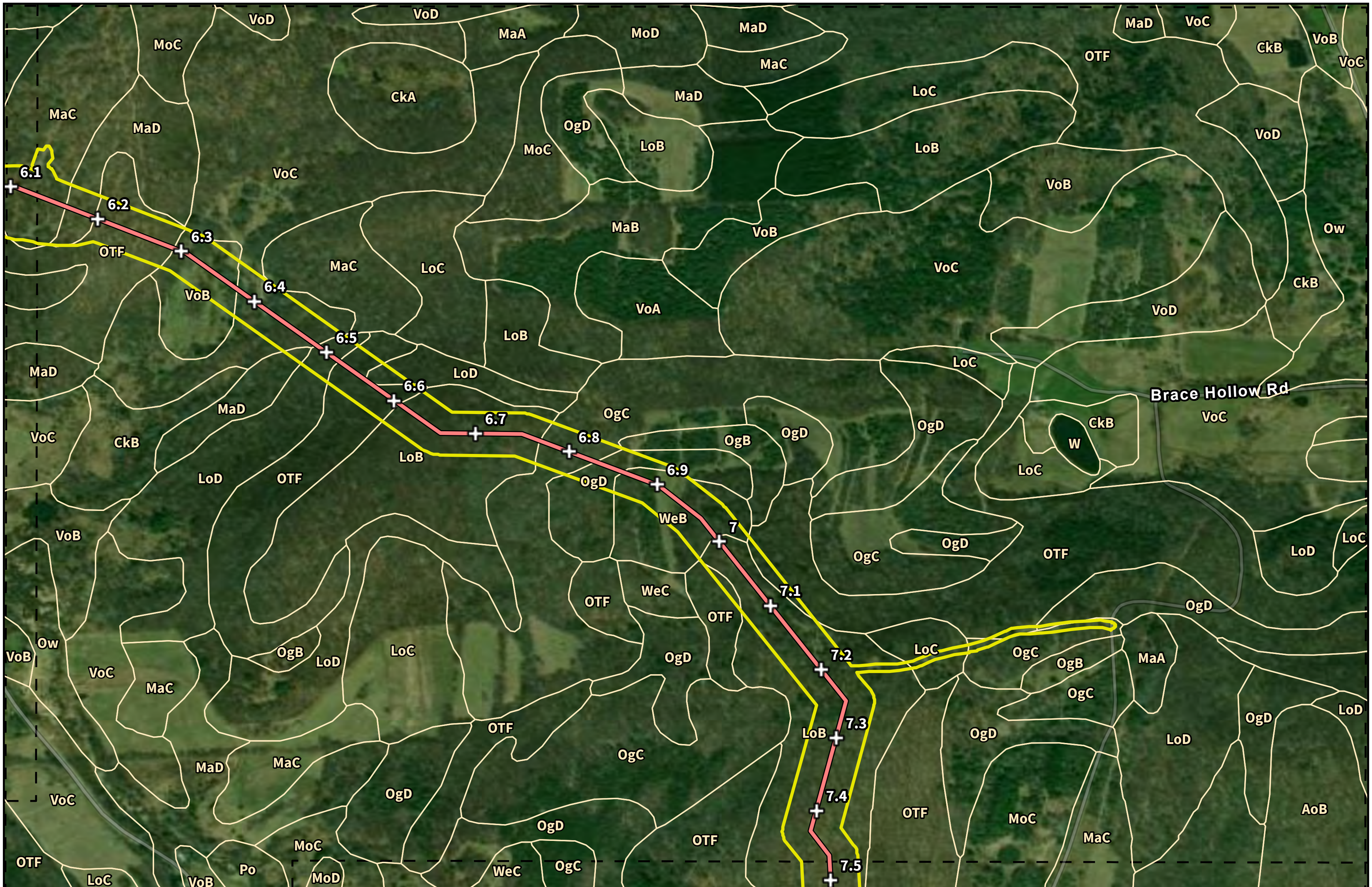

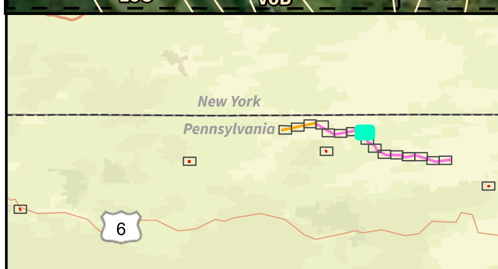

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Milepost

Proposed YM59 Pipeline

Survey Area

Soil Unit Boundary (See text/document for translation of soils abbreviations.)

Sheet Boundary

Sheet 8 of 21

Tioga Pathway Project

Figure 2

USDA Soils Map

Tioga County, PA

Prepared For:
NF

National Fuel
Supply Corporation

Prepared By:

TETRA TECH

Feet

0 500 1,000 2,000

Basemap: ESRI, World Imagery (4/6/2021)

Meters

0 150 300 600

Cartographer: jen.laslovich

NOT FOR CONSTRUCTION

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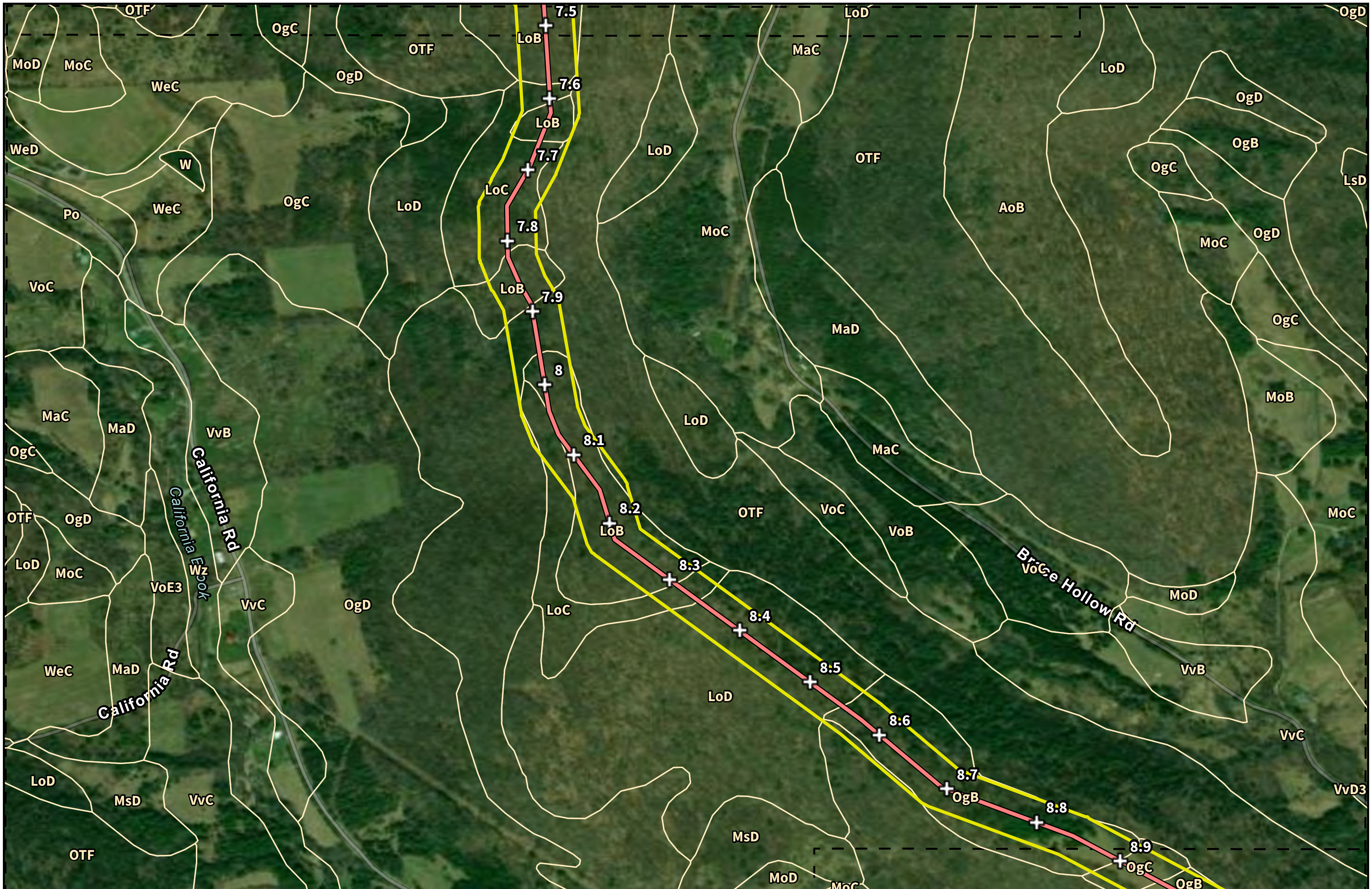

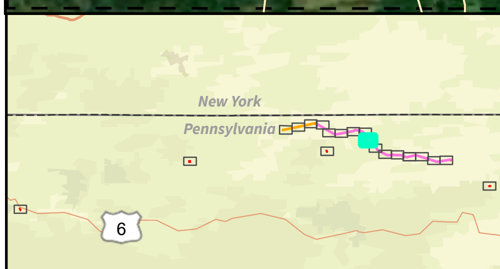

Legend

Sheet 9 of 21

- Milepost
- Proposed YM59 Pipeline
- Survey Area
- Soil Unit Boundary (See text/document for translation of soils abbreviations.)
- Sheet Boundary

Tioga Pathway Project

Figure 2

USDA Soils Map

Tioga County, PA

Prepared For:
NF

National Fuel Supply Corporation

Prepared By:

TETRA TECH

Feet: 0 500 1,000 2,000

Basemap: ESRI, World Imagery (4/6/2021)

Meters: 0 150 300 600

Cartographer: jen.laslovich

NOT FOR CONSTRUCTION

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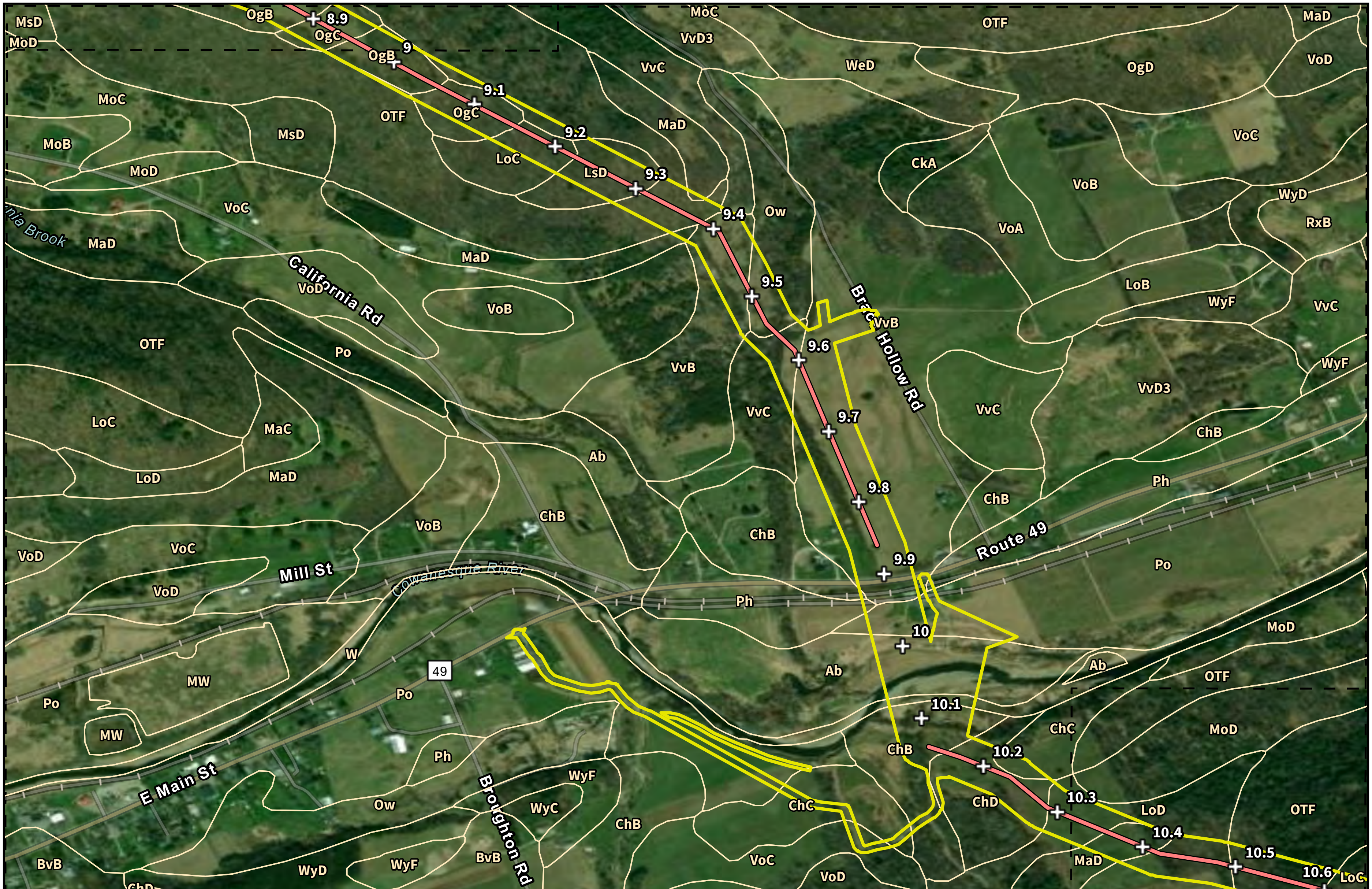

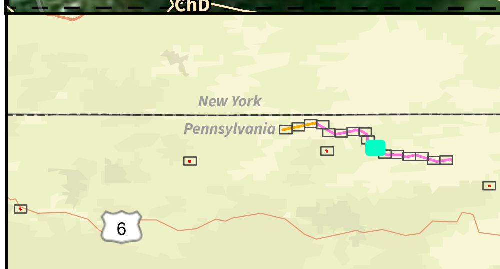

Legend

Sheet 10 of 21

- Milepost
- Proposed YM59 Pipeline
- Survey Area
- Soil Unit Boundary (See text/document for translation of soils abbreviations.)
- Sheet Boundary

Tioga Pathway Project

Figure 2
USDA Soils Map
Tioga County, PA

Prepared For:
NF
National Fuel Supply Corporation
Prepared By:
TETRA TECH

Feet
0 500 1,000 2,000

Basemap: ESRI, World Imagery (4/6/2021)

Meters
0 150 300 600

Cartographer: jen.laslovich

NOT FOR CONSTRUCTION

Date: 6/17/2024 2:18 PM

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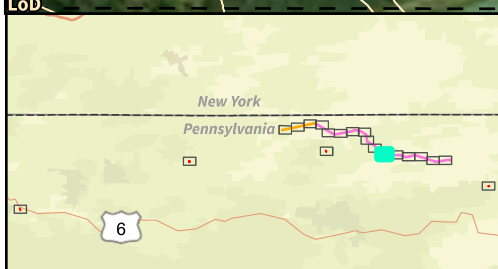

Legend

Milepost

Proposed YM59 Pipeline

Survey Area

Soil Unit Boundary (See text/document for translation of soils abbreviations.)

Sheet Boundary

Sheet 11 of 21

Tioga Pathway Project

Figure 2

USDA Soils Map

Tioga County, PA

Prepared For: NF

National Fuel Supply Corporation

Prepared By:

TETRA TECH

Feet: 0 500 1,000 2,000

Basemap: ESRI, World Imagery (4/6/2021)

Meters: 0 150 300 600

Cartographer: jen.laslovich

NOT FOR CONSTRUCTION

Date: 6/17/2024 2:18 PM

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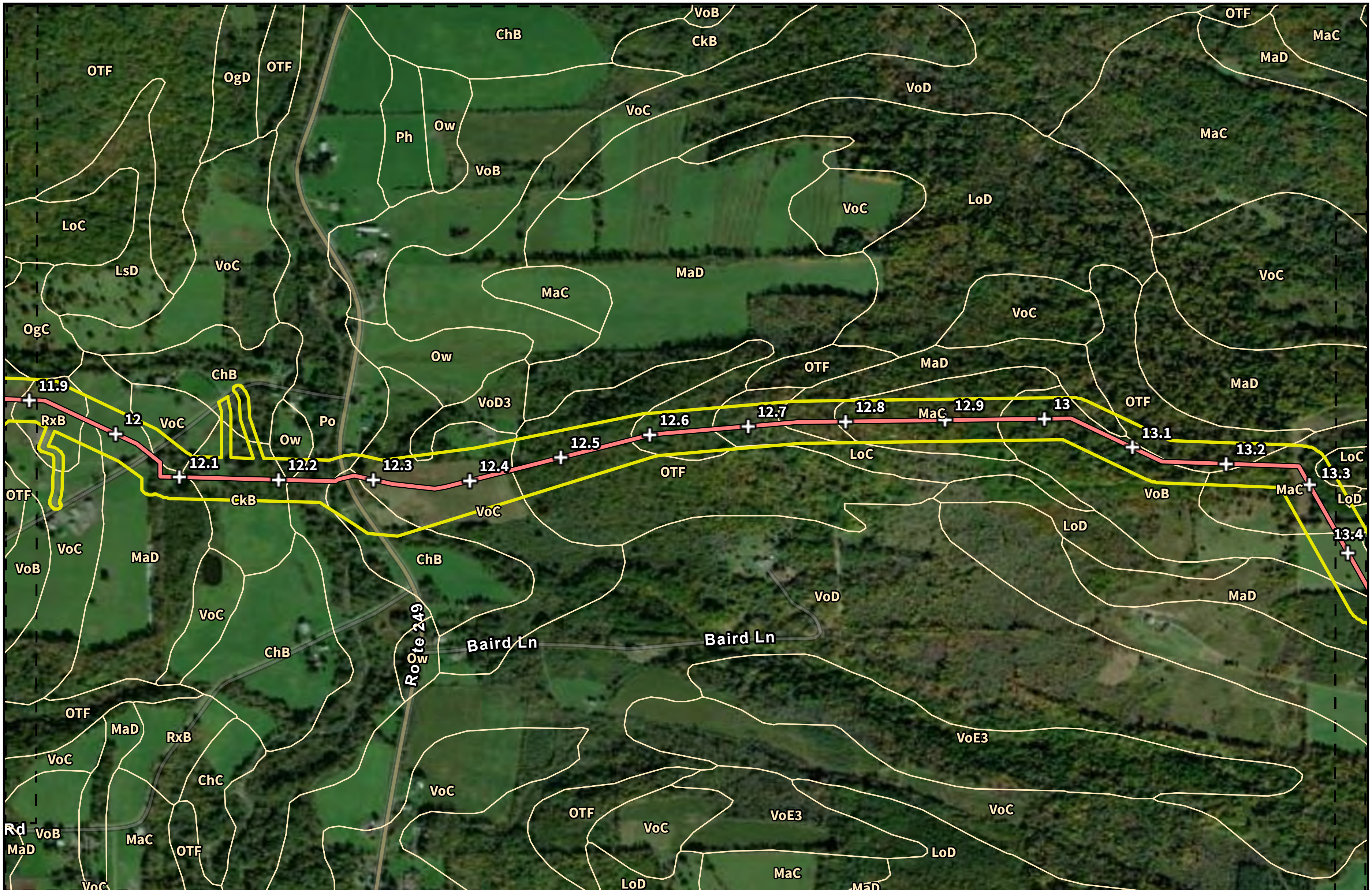

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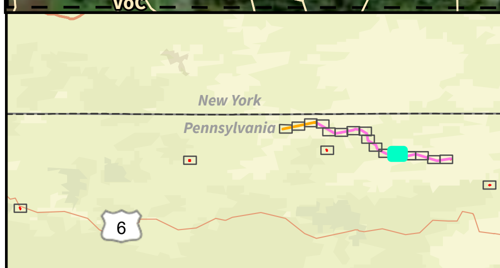
Sheet 12 of 21

- Milepost
- Proposed YM59 Pipeline
- Survey Area
- Soil Unit Boundary (See text/document for translation of soils abbreviations.)
- Sheet Boundary



Tioga Pathway Project

Figure 2

USDA Soils Map

Tioga County, PA

Prepared For:
NF

National Fuel Supply Corporation

Prepared By:

TETRA TECH

Feet: 0 500 1,000 2,000

Basemap: ESRI, World Imagery (10/5/2015)

Meters: 0 150 300 600

Cartographer: jen.laslovich

NOT FOR CONSTRUCTION

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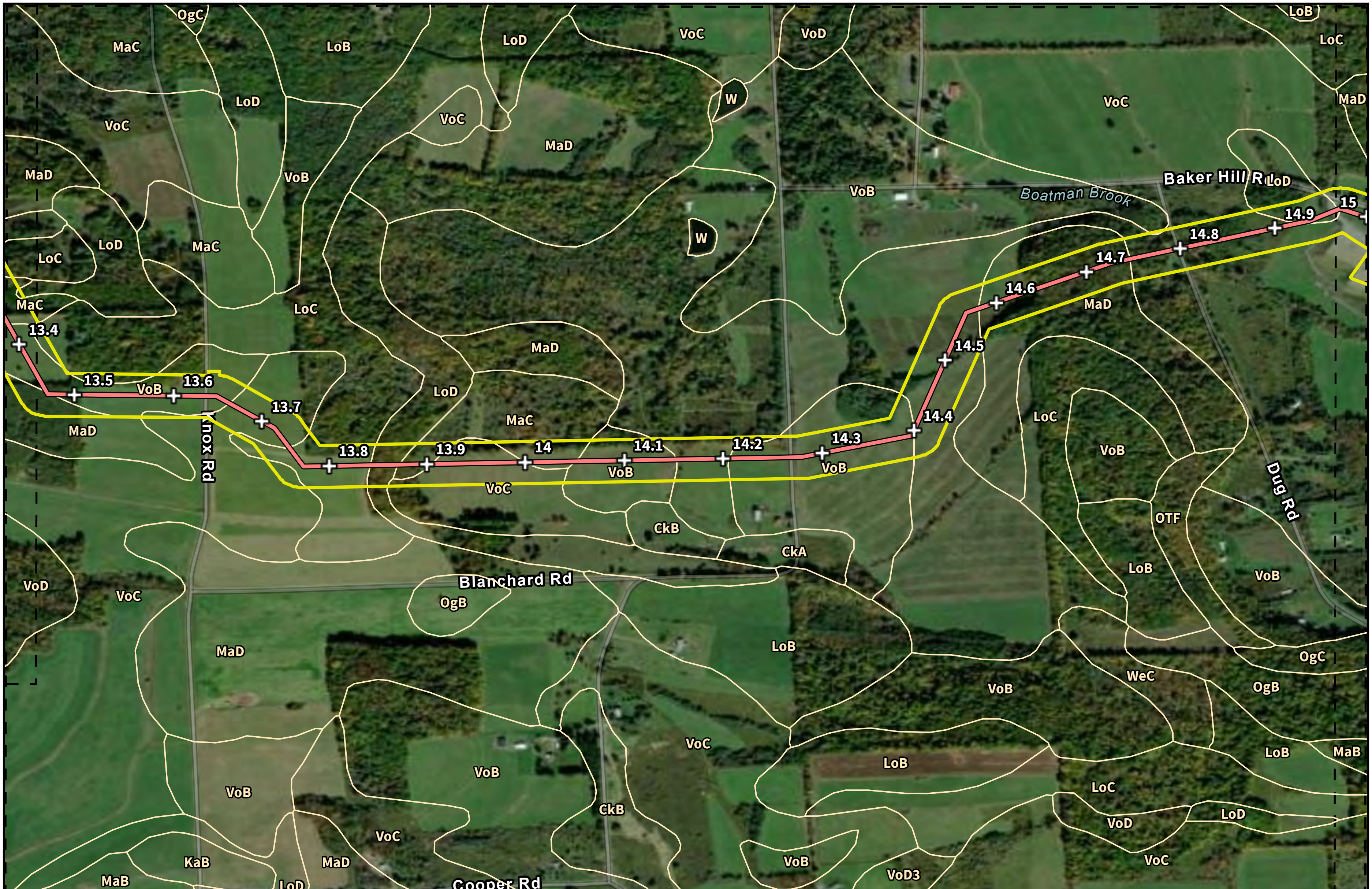

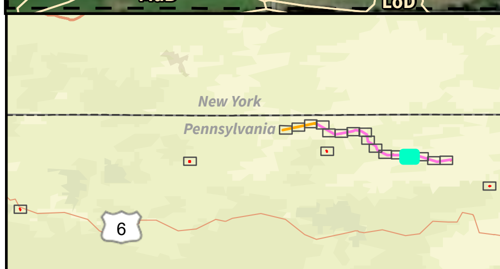

Legend

- Milepost
- Proposed YM59 Pipeline
- Survey Area
- Soil Unit Boundary (See text/document for translation of soils abbreviations.)
- Sheet Boundary

Sheet 13 of 21

Tioga Pathway Project
Figure 2
USDA Soils Map
Tioga County, PA

Prepared For:
NF
National Fuel Supply Corporation
Prepared By:
TETRA TECH

Feet: 0, 500, 1,000, 2,000

Basemap: ESRI, World Imagery (10/5/2015)

Meters: 0, 150, 300, 600

Cartographer: jen.laslovich

NOT FOR CONSTRUCTION

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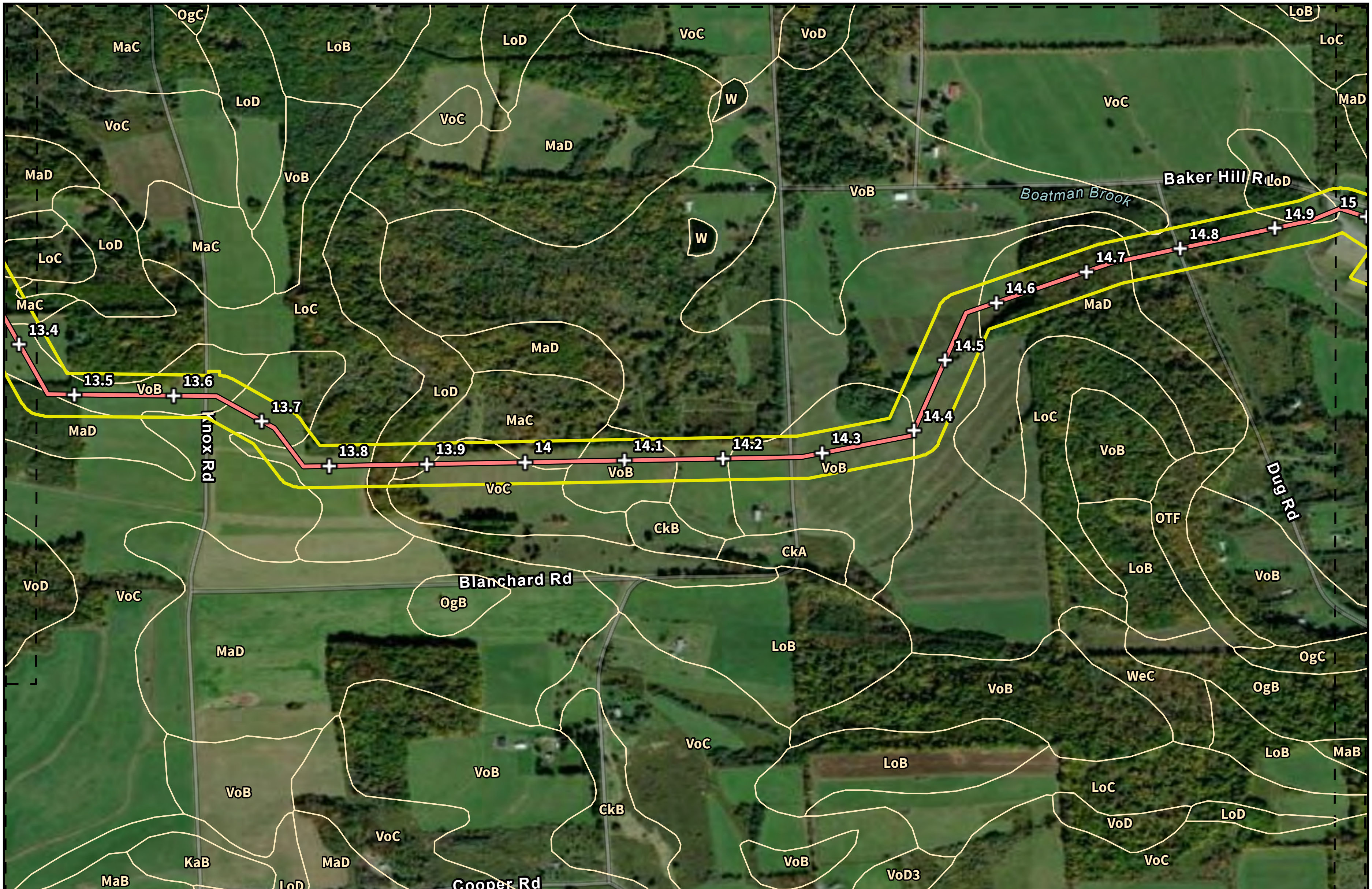

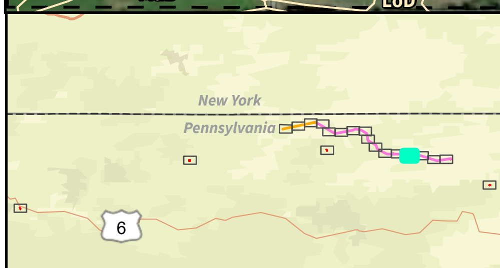

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Milepost

Proposed YM59 Pipeline

Survey Area

Soil Unit Boundary (See text/document for translation of soils abbreviations.)

Sheet Boundary

Sheet 14 of 21

Tioga Pathway Project

Figure 2

USDA Soils Map

Tioga County, PA

Prepared For:
NF

National Fuel Supply Corporation

Prepared By:

TETRA TECH

Feet

0 500 1,000 2,000

Basemap: ESRI, World Imagery (10/5/2015)

Meters

0 150 300 600

Cartographer: jen.laslovich

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Date: 6/17/2024 2:18 PM

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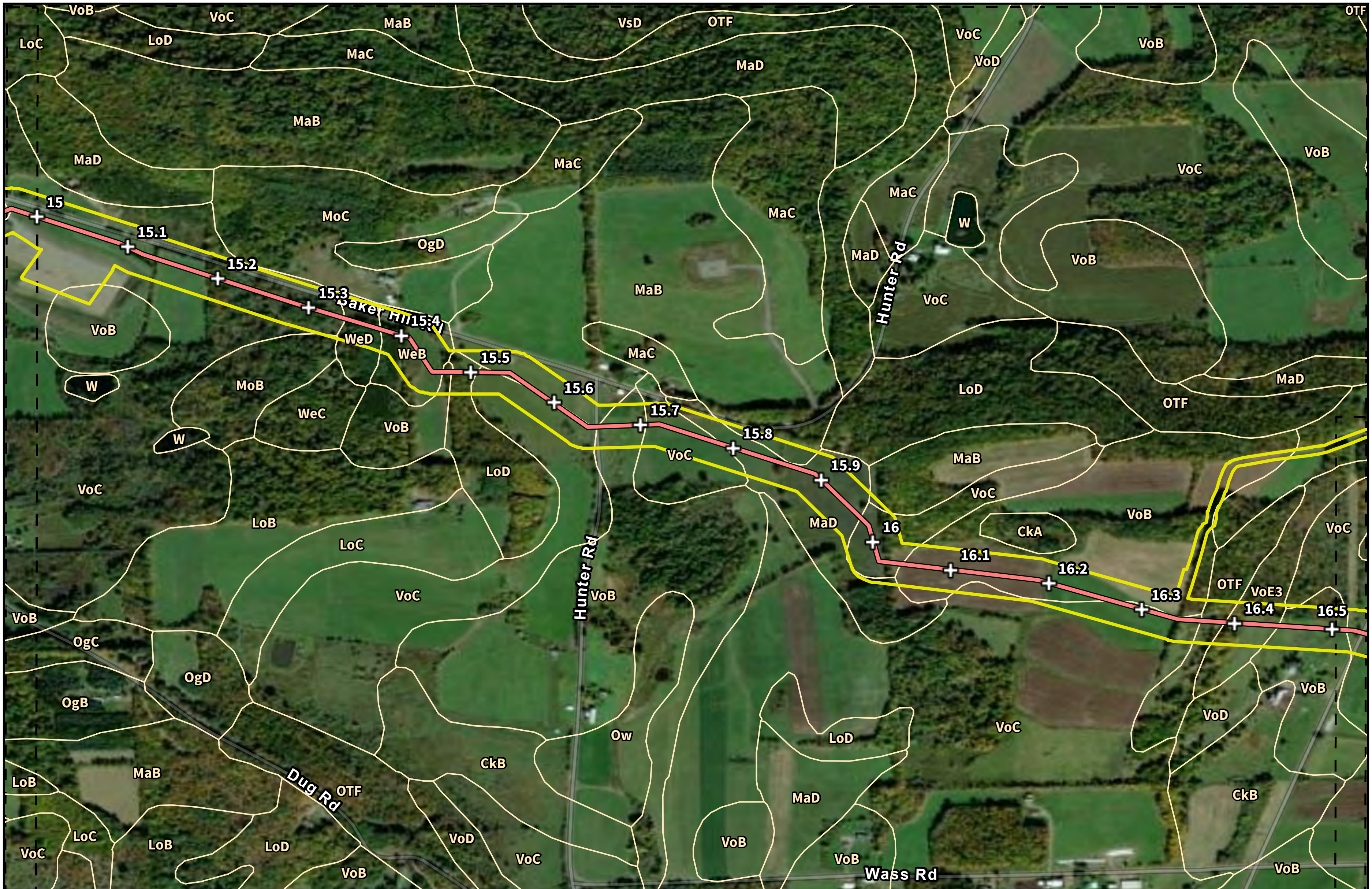

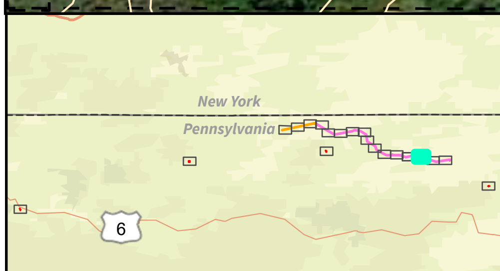

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Milepost

Proposed YM59 Pipeline

Survey Area

Soil Unit Boundary (See text/document for translation of soils abbreviations.)

Sheet Boundary

Sheet 15 of 21

Tioga Pathway Project

Figure 2

USDA Soils Map

Tioga County, PA

Prepared For:
NF

National Fuel Supply Corporation

Prepared By:

TETRA TECH

Feet: 0, 500, 1,000, 2,000

Basemap: ESRI, World Imagery (10/5/2015)

Meters: 0, 150, 300, 600

Cartographer: jen.laslovich

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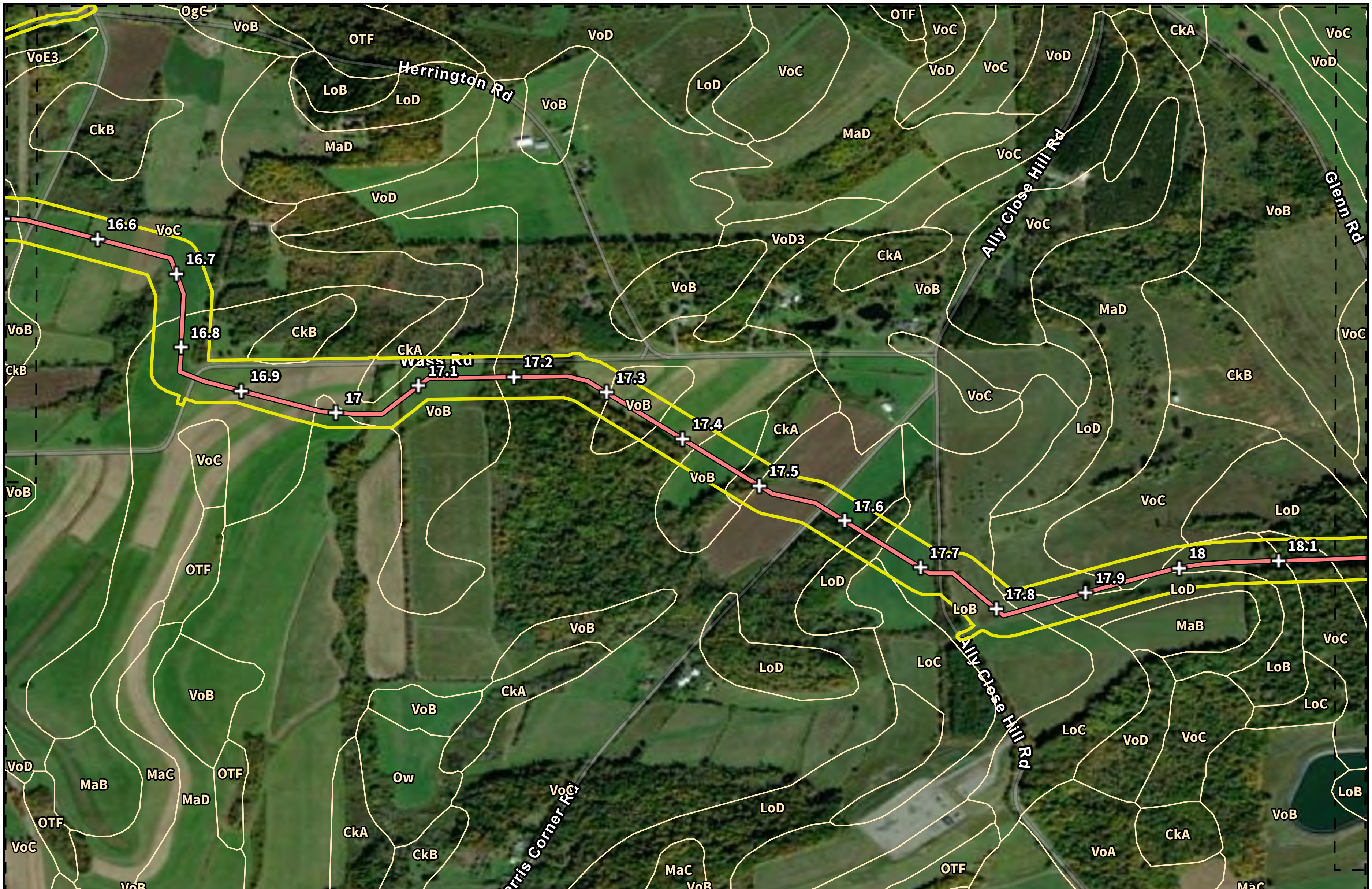
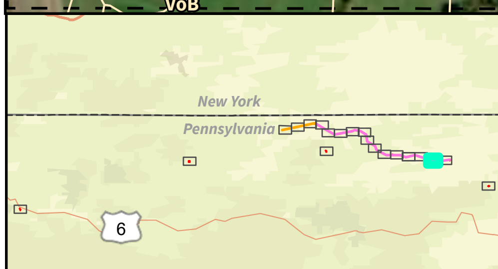




Legend

Milepost

Proposed YM59 Pipeline

Survey Area

Soil Unit Boundary (See text/document for translation of soils abbreviations.)

Sheet Boundary

Sheet 16 of 21

Tioga Pathway Project

Figure 2

USDA Soils Map

Tioga County, PA

Prepared For:
NF

National Fuel Supply Corporation

Prepared By:

TETRA TECH

Feet: 0 500 1,000 2,000

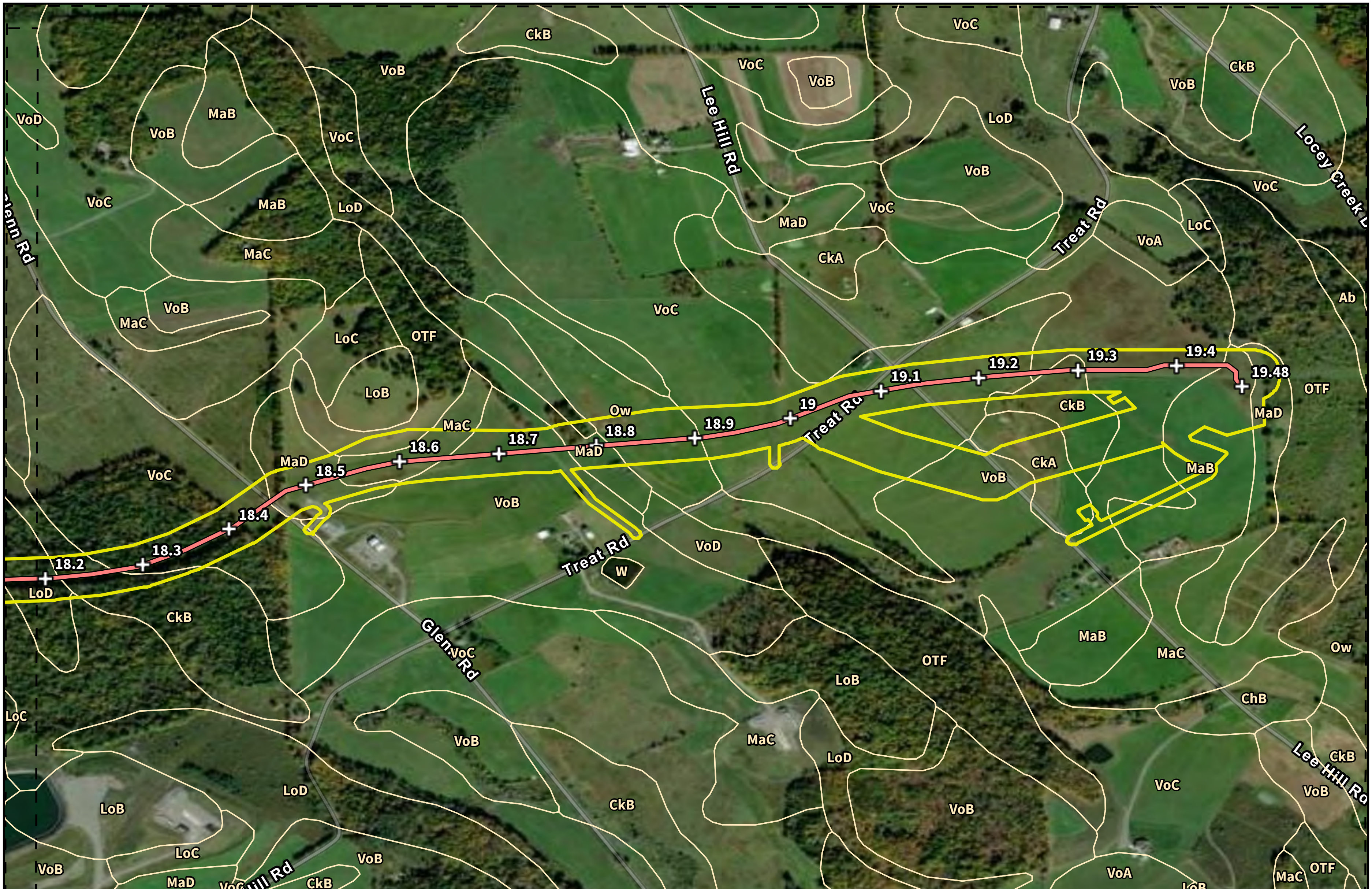
Basemap: ESRI, World Imagery (10/5/2015)

Meters: 0 150 300 600

Cartographer: jen.laslovich

NOT FOR CONSTRUCTION

Date: 6/17/2024 2:19 PM



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Milepost

Proposed YM59 Pipeline

Survey Area

Soil Unit Boundary (See text/document for translation of soils abbreviations.)

Sheet Boundary

Sheet 21 of 21

Tioga Pathway Project

Figure 2

USDA Soils Map

Tioga County, PA

Prepared For:

NF

National Fuel Supply Corporation

Prepared By:

TETRA TECH

Feet: 0 500 1,000 2,000

Basemap: ESRI, World Imagery (10/5/2015)

Meters: 0 150 300 600

Cartographer: jen.laslovich

NOT FOR CONSTRUCTION

Date: 6/17/2024 2:19 PM

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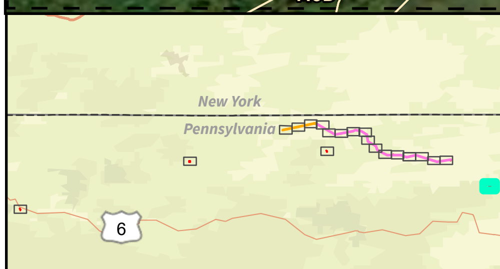

Legend

Survey Area

Soil Unit Boundary (See text/document for translation of soils abbreviations.)

Sheet Boundary

Sheet 18 of 21

Tioga Pathway Project

Figure 2

USDA Soils Map

Tioga County, PA

Prepared For:
NF

National Fuel Supply Corporation

Prepared By:

TETRA TECH

Feet
0 500 1,000 2,000

Basemap: ESRI, World Imagery (10/5/2015)

Meters
0 150 300 600

Cartographer: jen.laslovich

NOT FOR CONSTRUCTION

Date: 6/17/2024 2:19 PM

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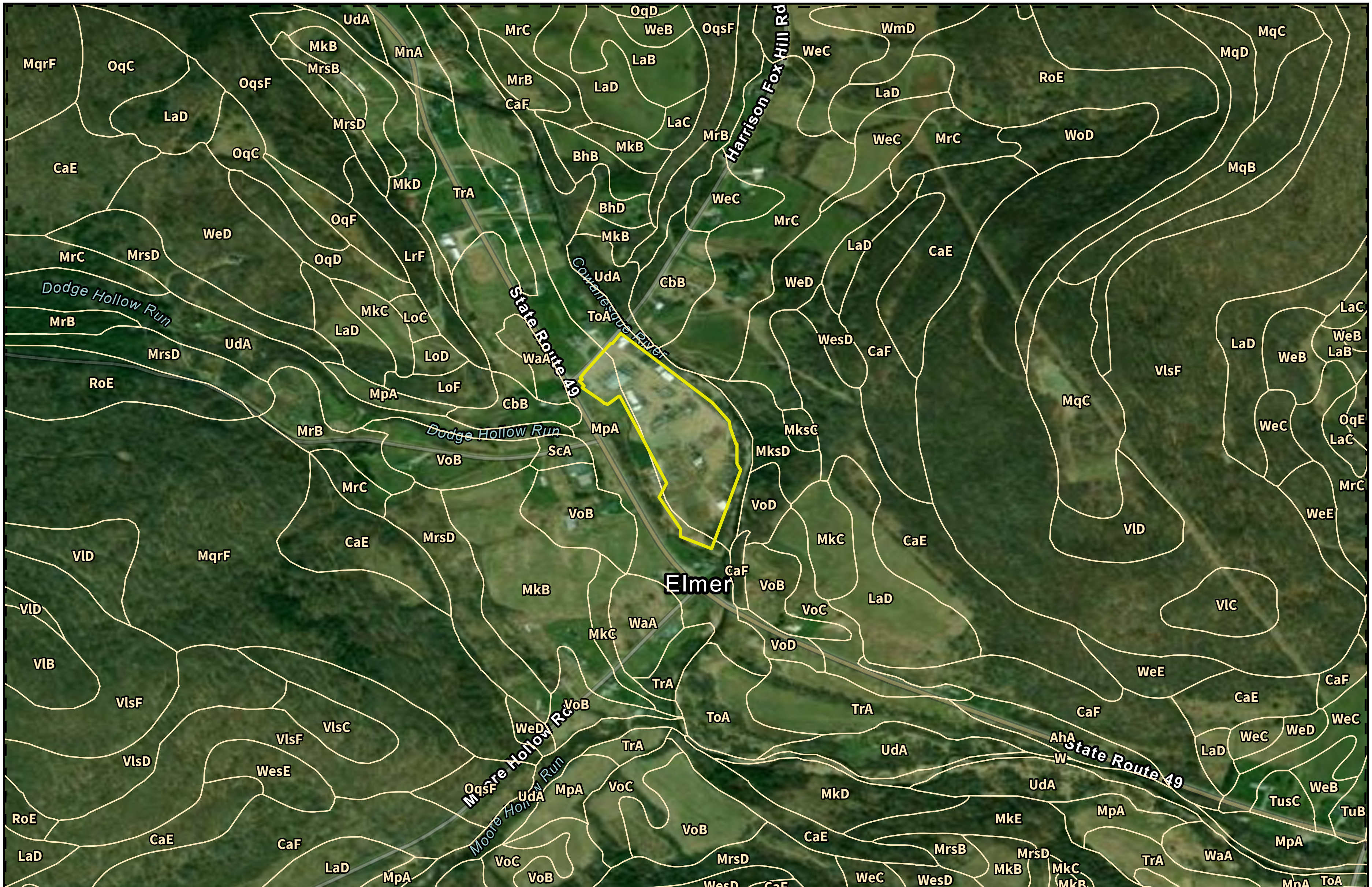

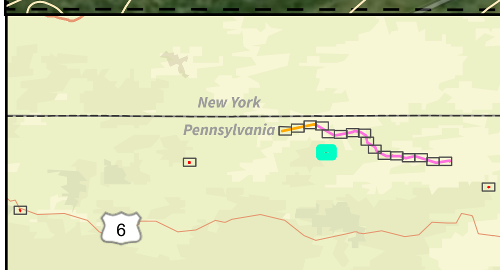

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Survey Area

Soil Unit Boundary (See text/document for translation of soils abbreviations.)

Sheet Boundary

Sheet 19 of 21

Tioga Pathway Project

Figure 2

USDA Soils Map

Tioga County, PA

Prepared For: NF

National Fuel Supply Corporation

Prepared By:

TETRA TECH

Feet: 0, 500, 1,000, 2,000

Basemap: ESRI, World Imagery (4/6/2021)

Meters: 0, 150, 300, 600

Cartographer: jen.laslovich

NOT FOR CONSTRUCTION

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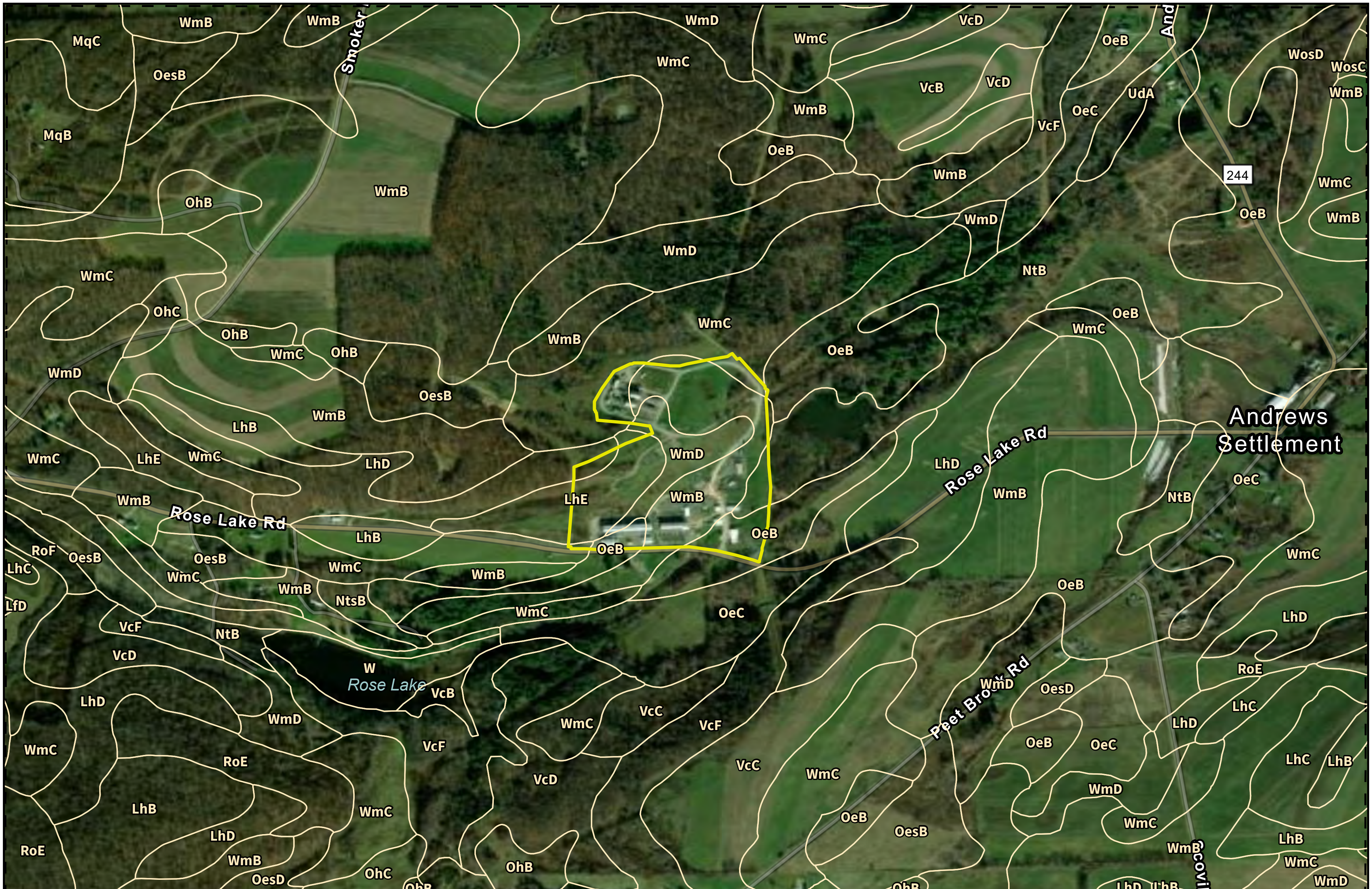

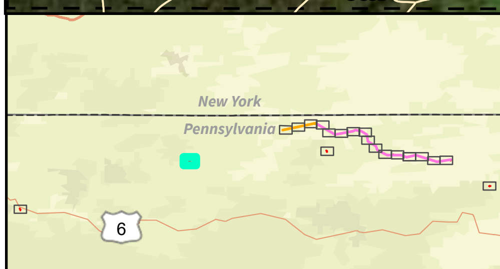

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Survey Area

Soil Unit Boundary (See text/document for translation of soils abbreviations.)

Sheet Boundary

Sheet 20 of 21

Tioga Pathway Project

Figure 2

USDA Soils Map

Tioga County, PA

Prepared For:
NF

Prepared By:

TETRA TECH

Feet: 0, 500, 1,000, 2,000

Basemap: ESRI, World Imagery (11/6/2020)

Meters: 0, 150, 300, 600

Cartographer: jen.laslovich

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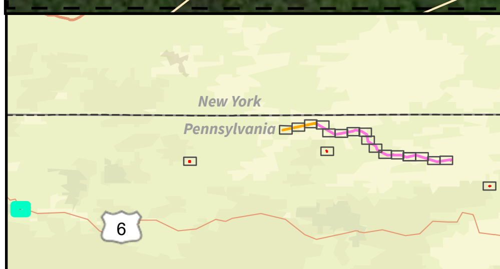

Feet

0 500 1,000 2,000

Legend

Survey Area

Soil Unit Boundary (See text/document for translation of soils abbreviations.)

Sheet Boundary

Sheet 21 of 21

Basemap: ESRI, World Imagery (11/6/2020)

Tioga Pathway Project

Figure 2

USDA Soils Map

Tioga County, PA

Prepared For:
NF

National Fuel Supply Corporation

Prepared By:

TETRA TECH

Meters

0 150 300 600

Cartographer: jen.laslovich

NOT FOR CONSTRUCTION

Date: 6/17/2024 2:19 PM

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MCKEAN COUNTY, PENNSYLVANIA

Map Unit: BeB—Braceville silt loam, 3 to 8 percent slopes

Component: Braceville (85%)

The Braceville component makes up 85 percent of the map unit. Slopes are 3 to 8 percent. This component is on outwash terraces. The parent material consists of coarse-loamy outwash. Depth to a root restrictive layer, fragipan, is 20 to 32 inches. The natural drainage class is moderately well drained. Water movement in the most restrictive layer is moderately low. Available water to a depth of 60 inches (or restricted depth) is very low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 21 inches during January, February, March, November, December. Organic matter content in the surface horizon is about 3 percent. This component is in the F139XY004OH Moist Acidic Slopes ecological site. Nonirrigated land capability classification is 2e. This soil does not meet hydric criteria.

Minor Components: Halsey (5%), Canfield (5%), and Braceville (5%)

Map Unit: ChB—Chenango gravelly loam, 3 to 8 percent slopes

Component: Chenango (90%)

The Chenango component makes up 90 percent of the map unit. Slopes are 3 to 8 percent. This component is on outwash terraces. The parent material consists of gravelly outwash. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 4 percent. This component is in the F140XY021NY Dry Outwash ecological site. Nonirrigated land capability classification is 2e. This soil does not meet hydric criteria.

Minor Components: Braceville (5%) and Rexford, somewhat poorly drained (5%)

Map Unit: Po—Pope loam, 0 to 3 percent slopes, occasionally flooded

Component: Pope (85%)

The Pope component makes up 85 percent of the map unit. Slopes are 0 to 3 percent. This component is on flood plains on dissected plateaus. The parent material consists of acid coarse-loamy alluvium derived from sandstone and shale. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is moderate. Shrink-swell potential is low. This soil is occasionally flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 69 percent. Below this thin organic horizon the organic matter content is about 5 percent. Nonirrigated land capability classification is 2w. This soil does not meet hydric criteria.

Minor Components: Philo (9%) and Atkins (6%)

POTTER COUNTY, PENNSYLVANIA

Map Unit: ChB—Chenango gravelly loam, 0 to 8 percent slopes

Component: Chenango (90%)

The Chenango component makes up 90 percent of the map unit. Slopes are 0 to 8 percent. This component is on valley trains, terraces, outwash plains. The parent material consists of gravelly loamy glaciofluvial deposits over sandy and gravelly glaciofluvial deposits, derived mainly from sandstone, shale, and siltstone. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 5 percent. This component is in the F140XY021NY Dry Outwash ecological site. Nonirrigated land capability classification is 2s. This soil does not meet hydric criteria.

Minor Components: Allard (5%) and Castile (5%)

Map Unit: CksB—Chippewa channery silt loam, 0 to 8 percent slopes, extremely stony

Component: Chippewa, extremely stony (85%)

The Chippewa, extremely stony component makes up 85 percent of the map unit. Slopes are 0 to 8 percent. This component is on depressions on uplands. The parent material consists of loamy till dominated by siltstone, sandstone, and shale fragments. Depth to a root restrictive layer, fragipan, is 8 to 20 inches (depth from the mineral surface is 8 to 17 inches). The natural drainage class is poorly drained. Water movement in the most restrictive layer is low. Available water to a depth of 60 inches (or restricted depth) is very low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 0 inches during January, February, March, April, November, December. Organic matter content in the surface horizon is about 80 percent. Below this thin organic horizon the organic matter content is about 7 percent. This component is in the F140XY016NY Mineral Wetlands ecological site. Nonirrigated land capability classification is 7s. This soil meets hydric criteria.

Minor Components: Volusia, extremely stony (8%) and Chippewa, extremely stony, very poorly drained (7%)

Map Unit: LhD—Lewbeach channery silt loam, 15 to 25 percent slopes

Component: Lewbeach (85%)

The Lewbeach component makes up 85 percent of the map unit. Slopes are 15 to 25 percent. This component is on hills on uplands. The parent material consists of loamy till derived mainly from reddish sandstone, siltstone, and shale. Depth to a root restrictive layer, fragipan, is 17 to 36 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is low. Available water to a depth of 60 inches (or restricted depth) is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 25 inches during January, February, March, November, December. Organic matter content in the surface horizon is about 5 percent. This component is in the F140XY005NY Frigid Steep Well Drained Dense Till ecological site. Nonirrigated land capability classification is 4e. This soil does not meet hydric criteria.

Minor Components: Willowemoc (10%) and Vly (5%)

Map Unit: LhE—Lewbeach channery silt loam, 25 to 35 percent slopes

Component: Lewbeach (85%)

The Lewbeach component makes up 85 percent of the map unit. Slopes are 25 to 35 percent. This component is on hills on uplands. The parent material consists of loamy till derived mainly from reddish sandstone, siltstone, and shale. Depth to a root restrictive layer, fragipan, is 17 to 36 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is low. Available water to a depth of 60 inches (or restricted depth) is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 25 inches during January, February, March, November, December. Organic matter content in the surface horizon is about 10 percent. This component is in the F140XY005NY Frigid Steep Well Drained Dense Till ecological site. Nonirrigated land capability classification is 6e. This soil does not meet hydric criteria.

Minor Components: Willowemoc (5%), Rockrift, very stony (5%), and Vly (5%)

Map Unit: LoB—Lordstown channery silt loam, 3 to 8 percent slopes

Component: Lordstown (90%)

The Lordstown component makes up 90 percent of the map unit. Slopes are 3 to 8 percent. This component is on hills on glaciated uplands. The parent material consists of loamy till derived from sandstone and siltstone. Depth to a root restrictive layer, bedrock, lithic, is 20 to 40 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 5 percent. This component is in the F140XY027NY Well Drained Till Uplands ecological site. Nonirrigated land capability classification is 2e. This soil does not meet hydric criteria.

Minor Components: Arnot (5%) Mardin (5%)

Map Unit: LoC—Lordstown channery silt loam, 8 to 15 percent slopes

Component: Lordstown (90%)

The Lordstown component makes up 90 percent of the map unit. Slopes are 8 to 15 percent. This component is on hills on glaciated uplands. The parent material consists of loamy till derived from sandstone and siltstone. Depth to a root restrictive layer, bedrock, lithic, is 20 to 40 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 5 percent. This component is in the F140XY027NY Well Drained Till Uplands ecological site. Nonirrigated land capability classification is 3e. This soil does not meet hydric criteria.

Minor Components: Arnot (5%) and Mardin (5%)

Map Unit: LoD—Lordstown channery silt loam, 15 to 25 percent slopes

Component: Lordstown (85%)

The Lordstown component makes up 85 percent of the map unit. Slopes are 15 to 25 percent. This component is on hills on glaciated uplands. The parent material consists of loamy till derived from sandstone and siltstone. Depth to a root restrictive layer, bedrock, lithic, is 20 to 40 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 5 percent. This component is in the F140XY027NY Well Drained Till Uplands ecological site. Nonirrigated land capability classification is 4e. This soil does not meet hydric criteria.

Minor Components: Arnot (5%), Mardin (5%), and Cadosia, very stony (5%)

Map Unit: LrF—Lordstown-Cadosia complex, 25 to 60 percent slopes, extremely stony

Component: Lordstown, extremely stony (50%)

The Lordstown, extremely stony component makes up 50 percent of the map unit. Slopes are 25 to 60 percent. This component is on hills on glaciated uplands. The parent material consists of loamy till derived from sandstone and siltstone. Depth to a root restrictive layer, bedrock, lithic, is 20 to 40 inches (depth from the mineral surface is 20 to 38 inches). The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 80 percent. Below this thin organic horizon the organic matter content is about 15 percent. This component is in the F140XY027NY Well Drained Till Uplands ecological site. Nonirrigated land capability classification is 7s. This soil does not meet hydric criteria.

Component: Cadosia, extremely stony (40%)

The Cadosia, extremely stony component makes up 40 percent of the map unit. Slopes are 25 to 60 percent. This component is on glaciated ridges, uplands. The parent material consists of channery loamy local colluvium derived from sedimentary rock and/or channery loamy till derived from sedimentary rock. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 80 percent. Below this thin organic horizon the organic matter content is about 11 percent. This component is in the F140XY027NY Well Drained Till Uplands ecological site. Nonirrigated land capability classification is 7s. This soil does not meet hydric criteria.

Minor Component: Mardin, very stony (10%)

Map Unit: MpA—Middlebury, acid subsoil and Basher soils, 0 to 3 percent slopes, occasionally flooded

Component: Middlebury, acid subsoil, occasionally flooded (45%)

The Middlebury, acid subsoil, occasionally flooded component makes up 45 percent of the map unit. Slopes are 0 to 3 percent. This component is on flood plains, valleys. The parent material consists of loamy alluvium predominantly from areas of shale, sandstone and siltstone. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is moderately well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is high. Shrink-swell potential is low. This soil is occasionally flooded. It is not ponded. A seasonal zone of water saturation is at 22 inches during January, February, March, April, May, November, December. Organic matter content in the surface horizon is about 6 percent. This component is in the F140XY014NY Low Floodplain ecological site. Nonirrigated land capability classification is 2w. This soil does not meet hydric criteria.

Component: Basher, occasionally flooded (40%)

The Basher, occasionally flooded component makes up 40 percent of the map unit. Slopes are 0 to 3 percent. This component is on flood plains, valleys. The parent material consists of coarse-loamy alluvium derived from sedimentary rock. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is moderately well drained. Water movement in the most restrictive layer is moderately high.

Available water to a depth of 60 inches (or restricted depth) is moderate. Shrink-swell potential is low. This soil is occasionally flooded. It is not ponded. A seasonal zone of water saturation is at 21 inches during January, February, March, April, December. Organic matter content in the surface horizon is about 3 percent. This component is in the F140XY014NY Low Floodplain ecological site. Nonirrigated land capability classification is 2w. This soil does not meet hydric criteria.

Minor Components: Barbour (5%), Fluvaquents (5%), and Tioga, acid subsoil, occasionally flooded (5%)

Map Unit: MqB—Mongaup channery silt loam, 3 to 8 percent slopes

Component: Mongaup (90%)

The Mongaup component makes up 90 percent of the map unit. Slopes are 3 to 8 percent. This component is on hills on glaciated uplands. The parent material consists of loamy till derived from sandstone and siltstone. Depth to a root restrictive layer, bedrock, lithic, is 20 to 40 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 5 percent. This component is in the F140XY009NY Frigid Till Uplands ecological site. Nonirrigated land capability classification is 2e. This soil does not meet hydric criteria.

Minor Components: Halcott (5%) and Willdin (5%)

Map Unit: MqC—Mongaup channery silt loam, 8 to 15 percent slopes

Component: Mongaup (90%)

The Mongaup component makes up 90 percent of the map unit. Slopes are 8 to 15 percent. This component is on hills on glaciated uplands. The parent material consists of loamy till derived from sandstone and siltstone. Depth to a root restrictive layer, bedrock, lithic, is 20 to 40 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 5 percent. This component is in the F140XY009NY Frigid Till Uplands ecological site. Nonirrigated land capability classification is 3e. This soil does not meet hydric criteria.

Minor Components: Halcott (5%) and Willdin (5%)

Map Unit: MqD—Mongaup channery silt loam, 15 to 25 percent slopes

Component: Mongaup (85%)

The Mongaup component makes up 85 percent of the map unit. Slopes are 15 to 25 percent. This component is on hills on glaciated uplands. The parent material consists of loamy till derived from sandstone and siltstone. Depth to a root restrictive layer, bedrock, lithic, is 20 to 40 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 5 percent. This component is in the F140XY005NY Frigid Steep Well Drained Dense Till ecological site. Nonirrigated land capability classification is 4e. This soil does not meet hydric criteria.

Minor Components: Halcott (5%), Willdin (5%), Rockrift, very stony (5%)

Map Unit: MqF—Mongaup channery silt loam, 25 to 70 percent slopes

Component: Mongaup (80%)

The Mongaup component makes up 80 percent of the map unit. Slopes are 25 to 70 percent. This component is on hills on glaciated uplands. The parent material consists of loamy till derived from sandstone and siltstone. Depth to a root restrictive layer, bedrock, lithic, is 20 to 40 inches (depth from the mineral surface is 20 to 38 inches). The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 80 percent. Below this thin organic horizon the organic matter content is about 15 percent. This component is in the F140XY005NY Frigid Steep Well Drained Dense Till ecological site. Nonirrigated land capability classification is 7e. This soil does not meet hydric criteria.

Minor Components: Rockrift, very stony (10%), Lewbath (5%), Halcott (5%), and Rock outcrop (<0.01%)

Map Unit: MqrF—Mongaup-Rockrift complex, 25 to 60 percent slopes, extremely stony

Component: Mongaup, extremely stony (50%)

The Mongaup, extremely stony component makes up 50 percent of the map unit. Slopes are 25 to 60 percent. This component is on hills on glaciated uplands. The parent material consists of loamy till derived from sandstone and siltstone. Depth to a root restrictive layer, bedrock, lithic, is 20 to 40 inches (depth from the mineral surface is 20 to 38 inches). The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 80 percent. Below this thin organic horizon the organic matter content is about 15 percent. This component is in the F140XY005NY Frigid Steep Well Drained Dense Till ecological site. Nonirrigated land capability classification is 7s. This soil does not meet hydric criteria.

Component: Rockrift, extremely stony (40%)

The Rockrift, extremely stony component makes up 40 percent of the map unit. Slopes are 25 to 60 percent. This component is on glaciated ridges, uplands. The parent material consists of channery loamy local colluvium derived from sedimentary rock and/or channery loamy till derived from sedimentary rock. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 80 percent. Below this thin organic horizon the organic matter content is about 11 percent. This component is in the F140XY008NY Frigid Steep Till Uplands ecological site. Nonirrigated land capability classification is 7s. This soil does not meet hydric criteria.

Minor Component: Willdin, very stony (10%)

Map Unit: MqsC—Mongaup channery loam, 3 to 15 percent slopes, extremely stony

Component: Mongaup, extremely stony (80%)

The Mongaup, extremely stony component makes up 80 percent of the map unit. Slopes are 3 to 15 percent. This component is on hills on glaciated uplands. The parent material consists of brownish loamy till derived from sandstone and siltstone. Depth to a root restrictive layer, bedrock, lithic, is 20 to 40 inches (depth from the mineral surface is 20 to 38 inches). The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 80 percent. Below this thin organic horizon the organic matter content is about 15 percent. This component is in the F140XY009NY Frigid Till Uplands ecological site. Nonirrigated land capability classification is 7s. This soil does not meet hydric criteria.

Minor Components: Rockrift, extremely stony (10%), Willdin, very stony (5%), Halcott, extremely stony (5%), and Rock outcrop (<0.01%)

Map Unit: NtB—Norchip silt loam, 0 to 8 percent slopes

Component: Norchip (85%)

The Norchip component makes up 85 percent of the map unit. Slopes are 0 to 8 percent. This component is on depressions on uplands. The parent material consists of loamy till dominated by siltstone, sandstone, and shale fragments. Depth to a root restrictive layer, fragipan, is 10 to 20 inches. The natural drainage class is poorly drained. Water movement in the most restrictive layer is low. Available water to a depth of 60 inches (or restricted depth) is very low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 0 inches during January, February, March, April, November, December. Organic matter content in the surface horizon is about 7 percent. This component is in the F140XY001NY Frigid Till Depressions ecological site. Nonirrigated land capability classification is 4w. This soil meets hydric criteria.

Minor Components: Norchip, very poorly drained (10%) and Ontusia (5%)

Map Unit: NtsB—Norchip silt loam, 0 to 8 percent slopes, extremely stony

Component: Norchip, extremely stony (85%)

The Norchip, extremely stony component makes up 85 percent of the map unit. Slopes are 0 to 8 percent. This component is on depressions on uplands. The parent material consists of loamy till dominated by siltstone, sandstone, and shale fragments. Depth to a root restrictive layer, fragipan, is 10 to 20 inches (depth from the mineral surface is 10 to 17 inches). The natural drainage class is poorly drained. Water movement in the most restrictive layer is low. Available water to a depth of 60 inches (or restricted depth) is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 0 inches during January, February, March, April, November, December. Organic matter content in the surface horizon is about 80 percent. Below this thin organic horizon the organic matter content is about 7 percent. This component is in the F140XY001NY Frigid Till Depressions ecological site. Nonirrigated land capability classification is 7s. This soil meets hydric criteria.

Minor Components: Norchip, extremely stony, very poorly drained (10%) and Ontusia, very stony (5%)

Map Unit: OeB—Onteora channery silt loam, 3 to 8 percent slopes

Component: Onteora (90%)

The Onteora component makes up 90 percent of the map unit. Slopes are 3 to 8 percent. This component is on hills on uplands. The parent material consists of loamy till from reddish sandstone, siltstone, and shale. Depth to a root restrictive layer, fragipan, is 10 to 25 inches. The natural drainage class is somewhat poorly drained. Water movement in the most restrictive layer is low. Available water to a depth of 60 inches (or restricted depth) is very low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 10 inches during January, February, March, April, May, November, December. Organic matter content in the surface horizon is about 5 percent. This component is in the F140XY007NY Frigid Moist Dense Till ecological site. Nonirrigated land capability classification is 3w. This soil does not meet hydric criteria.

Minor Components: Norchip (5%) and Willowemoc (5%)

Map Unit: OesD—Onteora and Ontusia soils, 8 to 25 percent slopes, very stony

Component: Onteora, very stony (50%)

The Onteora, very stony component makes up 50 percent of the map unit. Slopes are 8 to 25 percent. This component is on hills on uplands. The parent material consists of loamy till from reddish sandstone, siltstone, and shale. Depth to a root restrictive layer, fragipan, is 10 to 25 inches. The natural drainage class is somewhat poorly drained. Water movement in the most restrictive layer is low. Available water to a depth of 60 inches (or restricted depth) is very low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 10 inches during January, February, March, April, May, November, December. Organic matter content in the surface horizon is about 10 percent. This component is in the F140XY007NY Frigid Moist Dense Till ecological site. Nonirrigated land capability classification is 6s. This soil does not meet hydric criteria.

Component: Ontusia, very stony (30%)

The Ontusia, very stony component makes up 30 percent of the map unit. Slopes are 8 to 25 percent. This component is on hills on uplands. The parent material consists of brownish loamy till derived from interbedded sandstone, siltstone and shale. Depth to a root restrictive layer, fragipan, is 10 to 25 inches. The natural drainage class is somewhat poorly drained. Water movement in the most restrictive layer is low. Available water to a depth of 60 inches (or restricted depth) is very low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 8 inches during January, February, March, April, May, November, December. Organic matter content in the surface horizon is about 10 percent. This component is in the F140XY007NY Frigid Moist Dense Till ecological site. Nonirrigated land capability classification is 6s. This soil does not meet hydric criteria.

Minor Components: Willdin, very stony (5%), Norchip, very stony (5%), Willowemoc, very stony (5%), and Gretor, very stony (5%)

Map Unit: OhB—Ontusia channery silt loam, 3 to 8 percent slopes

Component: Ontusia (90%)

The Ontusia component makes up 90 percent of the map unit. Slopes are 3 to 8 percent. This component is on hills on uplands. The parent material consists of brownish loamy till derived from interbedded sandstone, siltstone and shale. Depth to a root restrictive layer, fragipan, is 10 to 25 inches. The natural drainage class is somewhat poorly drained. Water movement in the most restrictive layer is low. Available water to a depth of 60 inches (or restricted depth) is very low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 8 inches during January, February, March, April, May, November, December. Organic matter content in the surface horizon is about 5 percent. This component is in the F140XY007NY Frigid Moist Dense Till ecological site. Nonirrigated land capability classification is 3w. This soil does not meet hydric criteria.

Minor Components: Norchip (5%) and Willdin (5%)

Map Unit: OhC—Ontusia channery silt loam, 8 to 15 percent slopes

Component: Ontusia (90%)

The Ontusia component makes up 90 percent of the map unit. Slopes are 8 to 15 percent. This component is on hills on uplands. The parent material consists of brownish loamy till derived from interbedded sandstone, siltstone and shale. Depth to a root restrictive layer, fragipan, is 10 to 25 inches. The natural drainage class is somewhat poorly drained. Water movement in the most restrictive layer is low. Available water to a depth of 60 inches (or restricted depth) is very low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 8 inches during January, February, March, April, May, November, December. Organic matter content in the surface horizon is about 5 percent. This component is in the F140XY007NY Frigid Moist Dense Till ecological site. Nonirrigated land capability classification is 3e. This soil does not meet hydric criteria.

Minor Components: Willdin (5%) and Norchip (5%)

Map Unit: OhD—Ontusia channery silt loam, 15 to 25 percent slopes

Component: Ontusia (90%)

The Ontusia component makes up 90 percent of the map unit. Slopes are 15 to 25 percent. This component is on hills on uplands. The parent material consists of brownish loamy till derived from interbedded sandstone, siltstone and shale. Depth to a root restrictive layer, fragipan, is 10 to 25 inches. The natural drainage class is somewhat poorly drained. Water movement in the most restrictive layer is low. Available water to a depth of 60 inches (or restricted depth) is very low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 8 inches during January, February, March, April, May, November, December. Organic matter content in the surface horizon is about 5 percent. This component is in the F140XY007NY Frigid Moist Dense Till ecological site. Nonirrigated land capability classification is 4e. This soil does not meet hydric criteria.

Minor Components: Willdin (7%) and Norchip (3%)

Map Unit: RoF—Rockrift channery silt loam, 35 to 70 percent slopes, very stony

Component: Rockrift, very stony (80%)

The Rockrift, very stony component makes up 80 percent of the map unit. Slopes are 35 to 70 percent. This component is on glaciated ridges, uplands. The parent material consists of channery loamy local colluvium derived from sedimentary rock and/or channery loamy till derived from sedimentary rock. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 80 percent. Below this thin organic horizon the organic matter content is about 11 percent. This component is in the F140XY008NY Frigid Steep Till Uplands ecological site. Nonirrigated land capability classification is 7s. This soil does not meet hydric criteria.

Minor Components: Willdin, very stony (10%) and Mongaup, very stony (10%)

Map Unit: ToA—Tioga, acid subsoil, and Barbour soils, 0 to 3 percent slopes, occasionally flooded

Component: Tioga, acid subsoil, occasionally flooded (45%)

The Tioga, acid subsoil, occasionally flooded component makes up 45 percent of the map unit. Slopes are 0 to 3 percent. This component is on flood plains, valleys. The parent material consists of loamy alluvium. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is high. Shrink-swell potential is low. This soil is occasionally flooded. It is not ponded. A seasonal zone of water saturation is at 60 inches during January, February, March, April, May, November, December. Organic matter content in the surface horizon is about 5 percent. This component is in the F140XY013PA High Floodplain ecological site. Nonirrigated land capability classification is 1. This soil does not meet hydric criteria.

Component: Barbour (40%)

The Barbour component makes up 40 percent of the map unit. Slopes are 0 to 3 percent. This component is on flood plains, valleys. The parent material consists of reddish coarse-loamy alluvium derived from sedimentary rock. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is low. Shrink-swell potential is low. This soil is occasionally flooded. It is not ponded. A seasonal zone of water saturation is at 54 inches during January, February, March, April. Organic matter content in the surface horizon is about 3 percent. This component is in the F140XY013PA High Floodplain ecological site. Nonirrigated land capability classification is 2w. This soil does not meet hydric criteria.

Minor Components: Basher, occasionally flooded (5%), Middlebury, acid subsoil, occasionally flooded (5%), and Udifluvents (5%)

Map Unit: UdA—Udifluvents and Fluvaquents, 0 to 3 percent slopes, frequently flooded

Component: Udifluvents (42%)

The Udifluvents component makes up 42 percent of the map unit. Slopes are 0 to 3 percent. This component is on flood plains, valleys. The parent material consists of alluvium with a wide range of texture. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is moderately well drained. Water movement in the most restrictive layer is moderately low. Available water to a depth of 60 inches (or restricted depth) is moderate. Shrink-swell potential is low. This soil is frequently flooded. It is not ponded. A seasonal zone of water saturation is at 48 inches during January, February, March, April, May, November, December. Organic matter content in the surface horizon is about 2 percent. This component is in the F140XY014NY Low Floodplain ecological site. Nonirrigated land capability classification is 5w. This soil does not meet hydric criteria.

Component: Fluvaquents (35%)

The Fluvaquents component makes up 35 percent of the map unit. Slopes are 0 to 3 percent. This component is on flood plains, valleys. The parent material consists of alluvium with highly variable texture. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is very poorly drained. Water movement in the most restrictive layer is moderately low. Available water to a depth of 60 inches (or restricted depth) is moderate. Shrink-swell potential is low. This soil is frequently flooded. It is not ponded. A seasonal zone of water saturation is at 0 inches during January, February, March, April, May, June, September, October, November, December. Organic matter content in the surface horizon is about 3 percent. This component is in the F140XY015NY Wet Low Floodplain ecological site. Nonirrigated land capability classification is 5w. This soil meets hydric criteria. The calcium carbonate equivalent within 40 inches, typically, does not exceed 8 percent.

Minor Components: Wyalusing (10%), Wayland (5%), Holderton (5%), and Canandaigua, mucky silt loam (3%)

Map Unit: VaD—Valois gravelly silt loam, 15 to 25 percent slopes

Component: Valois (90%)

The Valois component makes up 90 percent of the map unit. Slopes are 15 to 25 percent. This component is on lateral moraines, valley sides, end moraines, valleys. The parent material consists of loamy till derived mainly from sandstone, siltstone, and shale. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 5 percent. This component is in the F140XY027NY Well

Drained Till Uplands ecological site. Nonirrigated land capability classification is 4e. This soil does not meet hydric criteria.

Minor Components: Chenango (5%) and Mardin (5%)

Map Unit: VoB—Volusia channery silt loam, 3 to 8 percent slopes

Component: Volusia (90%)

The Volusia component makes up 90 percent of the map unit. Slopes are 3 to 8 percent. This component is on hills on uplands. The parent material consists of loamy till derived from interbedded sedimentary rock. Depth to a root restrictive layer, fragipan, is 10 to 22 inches. The natural drainage class is somewhat poorly drained. Water movement in the most restrictive layer is low. Available water to a depth of 60 inches (or restricted depth) is very low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 8 inches during January, February, March, April, May, November, December. Organic matter content in the surface horizon is about 5 percent. This component is in the F140XY024NY Moist Dense Till ecological site. Nonirrigated land capability classification is 3w. This soil does not meet hydric criteria.

Minor Components: Chippewa (5%) and Mardin (5%)

Map Unit: VoC—Volusia channery silt loam, 8 to 15 percent slopes

Component: Volusia (90%)

The Volusia component makes up 90 percent of the map unit. Slopes are 8 to 15 percent. This component is on hills on uplands. The parent material consists of loamy till derived from interbedded sedimentary rock. Depth to a root restrictive layer, fragipan, is 10 to 22 inches. The natural drainage class is somewhat poorly drained. Water movement in the most restrictive layer is low. Available water to a depth of 60 inches (or restricted depth) is very low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 8 inches during January, February, March, April, May, November, December. Organic matter content in the surface horizon is about 5 percent. This component is in the F140XY024NY Moist Dense Till ecological site. Nonirrigated land capability classification is 3e. This soil does not meet hydric criteria.

Minor Components: Mardin (6%) and Chippewa (4%)

Map Unit: WesE—Wellsboro channery loam, 25 to 35 percent slopes, very stony

Component: Wellsboro, very stony (85%)

The Wellsboro, very stony component makes up 85 percent of the map unit. Slopes are 25 to 35 percent. This component is on hills on uplands. The parent material consists of loamy till from reddish sandstone, siltstone, and shale. Depth to a root restrictive layer, fragipan, is 14 to 30 inches (depth from the mineral surface is 14 to 27 inches). The natural drainage class is moderately well drained. Water movement in the most restrictive layer is low. Available water to a depth of 60 inches (or restricted depth) is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 18 inches (depth from the mineral surface is 17 inches) during January, February, March, April, November, December. Organic matter content in the surface horizon is about 80 percent. Below this thin organic horizon the organic matter content is about 10 percent. This component is in the F140XY024NY Moist Dense Till ecological site. Nonirrigated land capability classification is 7s. This soil does not meet hydric criteria.

Minor Components: Morris, very stony (5%), Oquaga, extremely stony (5%), and Lackawanna, very stony (5%)

Map Unit: WmB—Willdin channery silt loam, 0 to 8 percent slopes

Component: Willdin (85%)

The Willdin component makes up 85 percent of the map unit. Slopes are 0 to 8 percent. This component is on hills on uplands. The parent material consists of brownish loamy till derived from sandstone and siltstone. Depth to a root restrictive layer, fragipan, is 16 to 26 inches. The natural drainage class is moderately well drained. Water movement in the most restrictive layer is low. Available water to a depth of 60 inches (or restricted depth) is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 17 inches during January, February, March, April, November, December. Organic matter content in the surface horizon is about 5 percent. This component is in the F140XY010NY Frigid Moist Till Uplands ecological site. Nonirrigated land capability classification is 2w. This soil does not meet hydric criteria.

Minor Components: Ontusia (5%), Lewbath (5%), and Middlebrook (5%)

Map Unit: WmC—Willdin channery silt loam, 8 to 15 percent slopes

Component: Willdin (85%)

The Willdin component makes up 85 percent of the map unit. Slopes are 8 to 15 percent. This component is on hills on uplands. The parent material consists of brownish loamy till derived from sandstone and siltstone. Depth to a root restrictive layer, fragipan, is 16 to 26 inches. The natural drainage class is moderately well drained. Water movement in the most restrictive layer is low. Available water to a depth of 60 inches (or restricted depth) is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 17 inches during January, February, March, April, November, December. Organic matter content in the surface horizon is about 5 percent. This component is in the F140XY007NY Frigid Moist Dense Till ecological site. Nonirrigated land capability classification is 3e. This soil does not meet hydric criteria.

Minor Components: Lewbath (6%), Ontusia (6%), and Middlebrook (3%)

Map Unit: WmD—Willdin channery silt loam, 15 to 25 percent slopes

Component: Willdin (80%)

The Willdin component makes up 80 percent of the map unit. Slopes are 15 to 25 percent. This component is on hills on uplands. The parent material consists of brownish loamy till derived from sandstone and siltstone. Depth to a root restrictive layer, fragipan, is 16 to 26 inches. The natural drainage class is moderately well drained. Water movement in the most restrictive layer is low. Available water to a depth of 60 inches (or restricted depth) is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 17 inches during January, February, March, April, November, December. Organic matter content in the surface horizon is about 5 percent. This component is in the F140XY007NY Frigid Moist Dense Till ecological site. Nonirrigated land capability classification is 4e. This soil does not meet hydric criteria.

Minor Components: Lewbath (10%), Mongaup (5%), and Ontusia (5%)

Map Unit: WmE—Willdin channery silt loam, 25 to 35 percent slopes

Component: Willdin (85%)

The Willdin component makes up 85 percent of the map unit. Slopes are 25 to 35 percent. This component is on hills on uplands. The parent material consists of brownish loamy till derived from sandstone and siltstone. Depth to a root restrictive layer, fragipan, is 16 to 26 inches. The natural drainage class is moderately well drained. Water movement in the most restrictive layer is low. Available water to a depth of 60 inches (or restricted depth) is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded.

A seasonal zone of water saturation is at 17 inches during January, February, March, April, November, December. Organic matter content in the surface horizon is about 10 percent. This component is in the F140XY010NY Frigid Moist Till Uplands ecological site. Nonirrigated land capability classification is 6e. This soil does not meet hydric criteria.

Minor Components: Mongaup (5%), Ontusia (5%), and Lewbath (5%)

Map Unit: WmsD—Willdin channery silt loam, 15 to 25 percent slopes, very stony

Component: Willdin, very stony (85%)

The Willdin, very stony component makes up 85 percent of the map unit. Slopes are 15 to 25 percent. This component is on hills on uplands. The parent material consists of brownish loamy till derived from sandstone and siltstone. Depth to a root restrictive layer, fragipan, is 16 to 26 inches. The natural drainage class is moderately well drained. Water movement in the most restrictive layer is low. Available water to a depth of 60 inches (or restricted depth) is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 17 inches during January, February, March, April, November, December. Organic matter content in the surface horizon is about 10 percent. This component is in the F140XY010NY Frigid Moist Till Uplands ecological site. Nonirrigated land capability classification is 6s. This soil does not meet hydric criteria.

Minor Components: Mongaup, extremely stony (5%), Ontusia, very stony (5%), and Lewbath, very stony (5%)

TIOGA COUNTY, PENNSYLVANIA

Map Unit: Ab—Alluvial land

Component: Fluvents, (alluvial land) (65%)

The Fluvents, (alluvial land) component makes up 65 percent of the map unit. Slopes are 0 to 3 percent. The parent material consists of alluvium. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is moderately well drained. Water movement in the most restrictive layer is moderately low. Available water to a depth of 60 inches (or restricted depth) is moderate. Shrink-swell potential is low. This soil is frequently flooded. It is not ponded. A seasonal zone of water saturation is at 39 inches during January, February, March, April, May, November, December. Organic matter content in the surface horizon is about 2 percent. This component is in the F140XY014NY Low Floodplain ecological site. Nonirrigated land capability classification is 5w. This soil does not meet hydric criteria.

Minor Components: Wayland (15%), Orrville (15%), and Pope (5%)

Map Unit: ChB—Chenango gravelly loam, 2 to 12 percent slopes

Component: Chenango (100%)

The Chenango component makes up 100 percent of the map unit. Slopes are 2 to 12 percent. This component is on glacial outwash terraces. The parent material consists of water sorted glacial outwash derived from sedimentary rock. Depth to a root restrictive layer, bedrock, lithic, is 40 to 120 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 4 percent. This component is in the F140XY021NY Dry Outwash ecological site. Nonirrigated land capability classification is 2s. This soil does not meet hydric criteria.

Map Unit: ChC—Chenango gravelly loam, 12 to 20 percent slopes

Component: Chenango (100%)

The Chenango component makes up 100 percent of the map unit. Slopes are 12 to 20 percent. This component is on glacial outwash terraces. The parent material consists of water sorted glacial outwash derived from sedimentary rock. Depth to a root restrictive layer, bedrock, lithic, is 40 to 120 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 4 percent. This component is in the F140XY021NY Dry Outwash ecological site. Nonirrigated land capability classification is 4e. This soil does not meet hydric criteria.

Map Unit: ChD—Chenango gravelly loam, 20 to 30 percent slopes

Component: Chenango (100%)

The Chenango component makes up 100 percent of the map unit. Slopes are 20 to 30 percent. This component is on glacial outwash terraces. The parent material consists of water sorted glacial outwash derived from sedimentary rock. Depth to a root restrictive layer, bedrock, lithic, is 40 to 120 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 4 percent. This component is in the F140XY021NY Dry Outwash ecological site. Nonirrigated land capability classification is 6e. This soil does not meet hydric criteria.

Map Unit: CkA—Chippewa silt loam, 0 to 3 percent slopes

Component: Chippewa (85%)

The Chippewa component makes up 85 percent of the map unit. Slopes are 0 to 3 percent. This component is on depressions on uplands. The parent material consists of loamy till dominated by siltstone, sandstone, and shale fragments. Depth to a root restrictive layer, fragipan, is 8 to 20 inches. The natural drainage class is poorly drained. Water movement in the most restrictive layer is low. Available water to a depth of 60 inches (or restricted depth) is very low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 0 inches during January, February, March, April, November, December. Organic matter content in the surface horizon is about 7 percent. This component is in the F140XY016NY Mineral Wetlands ecological site. Nonirrigated land capability classification is 4w. This soil meets hydric criteria.

Minor Components: Chippewa, very poorly drained (10%) and Volusia (5%)

Map Unit: CkB—Chippewa silt loam, 3 to 8 percent slopes

Component: Chippewa (85%)

The Chippewa component makes up 85 percent of the map unit. Slopes are 3 to 8 percent. This component is on depressions on uplands. The parent material consists of loamy till dominated by siltstone, sandstone, and shale fragments. Depth to a root restrictive layer, fragipan, is 8 to 20 inches. The natural drainage class is poorly drained. Water movement in the most restrictive layer is low. Available water to a depth of 60 inches (or restricted depth) is very low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 0 inches during January, February, March, April, November, December. Organic matter content in the surface horizon is about 7 percent. This component is in the

F140XY016NY Mineral Wetlands ecological site. Nonirrigated land capability classification is 4w. This soil meets hydric criteria.

Minor Components: Volusia (10%) and Chippewa, very poorly drained (5%)

Map Unit: GP—Gravel pit

Component: Pits, gravel (100%). The Pits are miscellaneous areas.

Map Unit: LoB—Lordstown channery loam, 3 to 12 percent slopes

Component: Lordstown (90%)

The Lordstown component makes up 90 percent of the map unit. Slopes are 3 to 12 percent. This component is on hills on glaciated uplands. The parent material consists of loamy till derived from sandstone and siltstone. Depth to a root restrictive layer, bedrock, lithic, is 20 to 40 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 5 percent. This component is in the F140XY027NY Well Drained Till Uplands ecological site. Nonirrigated land capability classification is 2e. This soil does not meet hydric criteria.

Minor Components: Arnot, very stony (5%) and Mardin (5%)

Map Unit: LoC—Lordstown channery loam, 12 to 20 percent slopes

Component: Lordstown (85%)

The Lordstown component makes up 85 percent of the map unit. Slopes are 12 to 20 percent. This component is on hills on glaciated uplands. The parent material consists of loamy till derived from sandstone and siltstone. Depth to a root restrictive layer, bedrock, lithic, is 20 to 40 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 5 percent. This component is in the F140XY027NY Well Drained Till Uplands ecological site. Nonirrigated land capability classification is 3e. This soil does not meet hydric criteria.

Minor Components: Cadosia, very stony (5%), Arnot, very stony (5%), and Mardin (5%)

Map Unit: LoD—Lordstown channery loam, 20 to 30 percent slopes

Component: Lordstown (85%)

The Lordstown component makes up 85 percent of the map unit. Slopes are 20 to 30 percent. This component is on hills on glaciated uplands. The parent material consists of loamy till derived from sandstone and siltstone. Depth to a root restrictive layer, bedrock, lithic, is 20 to 40 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 5 percent. This component is in the F140XY027NY Well Drained Till Uplands ecological site. Nonirrigated land capability classification is 4e. This soil does not meet hydric criteria.

Minor Components: Cadosia, very stony (5%), Bath (5%), and Arnot, extremely stony (5%)

Map Unit: LsD—Lordstown channery loam, 12 to 30 percent slopes, extremely stony

Component: Lordstown, extremely stony (80%)

The Lordstown, extremely stony component makes up 80 percent of the map unit. Slopes are 12 to 30 percent. This component is on hills on glaciated uplands. The parent material consists of brownish loamy till derived from sandstone and siltstone. Depth to a root restrictive layer, bedrock, lithic, is 20 to 40 inches (depth from the mineral surface is 20 to 38 inches). The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 80 percent. Below this thin organic horizon the organic matter content is about 15 percent. This component is in the F140XY027NY Well Drained Till Uplands ecological site. Nonirrigated land capability classification is 7s. This soil does not meet hydric criteria.

Minor Components: Cadosia, extremely stony (10%), Arnot, extremely stony (5%), Mardin, very stony (5%), and Rock outcrop (<0.01%)

Map Unit: MaB—Mardin channery silt loam, 3 to 8 percent slopes

Component: Mardin (85%)

The Mardin component makes up 85 percent of the map unit. Slopes are 3 to 8 percent. This component is on hills on uplands. The parent material consists of loamy till. Depth to a root restrictive layer, fragipan, is 14 to 26 inches. The natural drainage class is moderately well drained. Water movement in the most restrictive layer is low. Available water to a depth of 60 inches (or restricted depth) is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 17 inches during January, February, March, April, November, December. Organic matter content in the surface horizon is about 5 percent. This component is in the F140XY024NY Moist Dense Till ecological site. Nonirrigated land capability classification is 2w. This soil does not meet hydric criteria.

Minor Components: Volusia (5%), Lordstown (5%), and Bath (5%)

Map Unit: MaC—Mardin channery silt loam, 8 to 15 percent slopes

Component: Mardin (88%)

The Mardin component makes up 88 percent of the map unit. Slopes are 8 to 15 percent. This component is on hills on uplands. The parent material consists of loamy till. Depth to a root restrictive layer, fragipan, is 14 to 26 inches. The natural drainage class is moderately well drained. Water movement in the most restrictive layer is low. Available water to a depth of 60 inches (or restricted depth) is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 17 inches during January, February, March, April, November, December. Organic matter content in the surface horizon is about 5 percent. This component is in the F140XY024NY Moist Dense Till ecological site. Nonirrigated land capability classification is 3e. This soil does not meet hydric criteria.

Minor Components: Volusia (5%), Bath (5%), and Lordstown (2%)

Map Unit: MaD—Mardin channery silt loam, 15 to 25 percent slopes

Component: Mardin (85%)

The Mardin component makes up 85 percent of the map unit. Slopes are 15 to 25 percent. This component is on hills on uplands. The parent material consists of loamy till. Depth to a root restrictive layer, fragipan, is 14 to 26 inches. The natural drainage class is moderately well drained. Water movement in the most restrictive layer is low. Available water to a depth of 60 inches (or restricted depth) is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 17 inches during January, February, March, April, November, December. Organic matter content in the surface horizon is about 5 percent. This component is in the F140XY024NY Moist Dense Till ecological site. Nonirrigated land capability classification is 4e. This soil does not meet hydric criteria.

Minor Components: Volusia (5%), Lordstown (5%), and Bath (5%)

Map Unit: OgB—Oquaga channery loam, 3 to 12 percent slopes

Component: Oquaga (90%)

The Oquaga component makes up 90 percent of the map unit. Slopes are 3 to 12 percent. This component is on hills on glaciated uplands. The parent material consists of reddish loamy till derived from sandstone, siltstone, and shale. Depth to a root restrictive layer, bedrock, lithic, is 20 to 40 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 5 percent. This component is in the F140XY027NY Well Drained Till Uplands ecological site. Nonirrigated land capability classification is 2e. This soil does not meet hydric criteria.

Minor Components: Arnot, very stony (5%) and Wellsboro (5%)

Map Unit: OgC—Oquaga channery loam, 12 to 20 percent slopes

Component: Oquaga (85%)

The Oquaga component makes up 85 percent of the map unit. Slopes are 12 to 20 percent. This component is on hills on glaciated uplands. The parent material consists of reddish loamy till derived from sandstone, siltstone, and shale. Depth to a root restrictive layer, bedrock, lithic, is 20 to 40 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 5 percent. This component is in the F140XY027NY Well Drained Till Uplands ecological site. Nonirrigated land capability classification is 3e. This soil does not meet hydric criteria.

Minor Components: Arnot, very stony (5%), Cadosia, very stony (5%), and Wellsboro (5%)

Map Unit: OgD—Oquaga channery loam, 20 to 30 percent slopes

Component: Oquaga (85%)

The Oquaga component makes up 85 percent of the map unit. Slopes are 20 to 30 percent. This component is on hills on glaciated uplands. The parent material consists of reddish loamy till derived from sandstone, siltstone, and shale. Depth to a root restrictive layer, bedrock, lithic, is 20 to 40 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 5 percent. This component is in the F140XY027NY Well Drained Till Uplands ecological site. Nonirrigated land capability classification is 4e. This soil does not meet hydric criteria.

Minor Components: Wellsboro (5%), Arnot, very stony (5%), Cadosia, very stony (5%), and Rock outcrop (<0.01%)

Map Unit: OTF—Oquaga and Lordstown channery loams, 25 to 70 percent slopes, extremely stony

Component: Oquaga, extremely stony (55%)

The Oquaga, extremely stony component makes up 55 percent of the map unit. Slopes are 25 to 70 percent. This component is on hills on glaciated uplands. The parent material consists of reddish loamy till derived from sandstone and shale. Depth to a root restrictive layer, bedrock, lithic, is 20 to 40 inches (depth from the mineral surface is 20 to 38 inches). The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 80 percent. Below this thin organic horizon the organic matter content is about 15 percent. This component is in the F140XY027NY Well Drained Till Uplands ecological site. Nonirrigated land capability classification is 7s. This soil does not meet hydric criteria.

Component: Lordstown, extremely stony (25%)

The Lordstown, extremely stony component makes up 25 percent of the map unit. Slopes are 25 to 70 percent. This component is on hills on glaciated uplands. The parent material consists of brownish loamy till derived from sandstone and siltstone. Depth to a root restrictive layer, bedrock, lithic, is 20 to 40 inches (depth from the mineral surface is 20 to 38 inches). The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 80 percent. Below this thin organic horizon the organic matter content is about 15 percent. This component is in the F140XY027NY Well Drained Till Uplands ecological site. Nonirrigated land capability classification is 7s. This soil does not meet hydric criteria.

Minor Components: Cadosia, extremely stony (10%), Arnot, extremely stony (10%), and Rock outcrop (<0.01%)

Map Unit: Ow—Orrville silt loam

Component: Orrville (80%)

The Orrville component makes up 80 percent of the map unit. Slopes are 0 to 3 percent. This component is on flood plains. The parent material consists of recent loamy alluvium. Depth to a root restrictive layer, bedrock, lithic, is 40 to 70 inches. The natural drainage class is somewhat poorly drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is high. Shrink-swell potential is low. This soil is occasionally flooded. It is not ponded. A seasonal zone of water saturation is at 21 inches during January, February, March, April, May, June, November, December. Organic matter content in the surface horizon is about 3 percent. This component is in the F140XY014NY Low Floodplain ecological site. Nonirrigated land capability classification is 2w. This soil does not meet hydric criteria.

Minor Components: Wayland (15%) and Philo (5%)

Map Unit: Ph—Philo silt loam

Component: Philo (85%)

The Philo component makes up 85 percent of the map unit. Slopes are 0 to 3 percent. This component is on flood plains. The parent material consists of coarse-loamy alluvium derived from sandstone and siltstone. Depth to a root restrictive layer, bedrock, lithic, is 40 to 70 inches. The natural drainage class is moderately well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is moderate. Shrink-swell potential is low. This soil is occasionally flooded. It is not ponded. A seasonal zone of water saturation is at 27 inches during January, February, March, April, December. Organic matter content in the surface horizon is about 3 percent. This component is in the F140XY011NY Rich Organic Wetlands ecological site. Nonirrigated land capability classification is 2w. This soil does not meet hydric criteria.

Minor Components: Pope (10%) and Wayland (5%)

Map Unit: Po—Pope soils

Component: Pope (85%)

The Pope component makes up 85 percent of the map unit. Slopes are 0 to 3 percent. This component is on flood plains. The parent material consists of coarse-loamy alluvium derived from sandstone and siltstone. Depth to a root restrictive layer, bedrock, lithic, is 40 to 70 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is moderate. Shrink-swell potential is low. This soil is frequently flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 3 percent. This component is in the F140XY013PA High Floodplain ecological site. Nonirrigated land capability classification is 2w. This soil does not meet hydric criteria.

Minor Components: Pope (10%) and Wayland (5%)

Map Unit: RxA—Rexford silt loam, 0 to 3 percent slopes

Component: Rexford, somewhat poorly drained (46%)

The Rexford, somewhat poorly drained component makes up 46 percent of the map unit. Slopes are 0 to 3 percent. This component is on outwash terraces. The parent material consists of coarse-loamy outwash derived from sandstone and shale. Depth to a root restrictive layer, fragipan, is 15 to 24 inches. The natural drainage class is somewhat poorly drained. Water movement in the most restrictive layer is moderately low. Available water to a depth of 60 inches (or restricted depth) is very low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 6 inches during March, April. Organic matter content in the surface horizon is about 4 percent. This component is in the F140XY020NY Dense Outwash ecological site. Nonirrigated land capability classification is 3w. This soil does not meet hydric criteria.

Component: Rexford, poorly drained (44%)

The Rexford, poorly drained component makes up 44 percent of the map unit. Slopes are 0 to 3 percent. This component is on depressions. The parent material consists of coarse-loamy outwash derived from sandstone and shale. Depth to a root restrictive layer, fragipan, is 15 to 24 inches. The natural drainage class is poorly drained. Water movement in the most restrictive layer is moderately low. Available water to a depth of 60 inches (or restricted depth) is very low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 4 inches during March, April. Organic matter content in the surface horizon is about 4 percent. This component is in the F140XY016NY Mineral Wetlands ecological site. Nonirrigated land capability classification is 3w. This soil meets hydric criteria.

Minor Component: Braceville (10%)

Map Unit: RxB—Rexford silt loam, 3 to 10 percent slopes

Component: Rexford, somewhat poorly drained (50%)

The Rexford, somewhat poorly drained component makes up 50 percent of the map unit. Slopes are 3 to 10 percent. This component is on outwash terraces. The parent material consists of coarse-loamy outwash derived from sandstone and shale. Depth to a root restrictive layer, fragipan, is 15 to 24 inches. The natural drainage class is somewhat poorly drained. Water movement in the most restrictive layer is moderately low. Available water to a depth of 60 inches (or restricted depth) is very low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 6 inches during March, April. Organic matter content in the surface horizon is about 4 percent. This component is in the F140XY020NY Dense Outwash ecological site. Nonirrigated land capability classification is 3w. This soil does not meet hydric criteria.

Component: Rexford, poorly drained (40%)

The Rexford, poorly drained component makes up 40 percent of the map unit. Slopes are 0 to 3 percent. This component is on depressions. The parent material consists of coarse-loamy outwash derived from sandstone and shale. Depth to a root restrictive layer, fragipan, is 15 to 24 inches. The natural drainage class is poorly drained. Water movement in the most restrictive layer is moderately low. Available water to a depth of 60 inches (or restricted depth) is very low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 4 inches during March, April. Organic matter content in the surface horizon is about 4 percent. This component is in the F140XY016NY Mineral Wetlands ecological site. Nonirrigated land capability classification is 3w. This soil meets hydric criteria.

Minor Component: Braceville (10%)

Map Unit: VoB—Volusia channery silt loam, 3 to 8 percent slopes

Component: Volusia (90%)

The Volusia component makes up 90 percent of the map unit. Slopes are 3 to 8 percent. This component is on hills on uplands. The parent material consists of loamy till derived from interbedded sedimentary rock. Depth to a root restrictive layer, fragipan, is 10 to 22 inches. The natural drainage class is somewhat poorly drained. Water movement in the most restrictive layer is low. Available water to a depth of 60 inches (or restricted depth) is very low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 8 inches during January, February, March, April, May, November, December. Organic matter content in the surface horizon is about 5 percent. This component is in the F140XY024NY Moist Dense Till ecological site. Nonirrigated land capability classification is 3w. This soil does not meet hydric criteria.

Minor Components: Mardin (5%) and Chippewa (5%)

Map Unit: VoC—Volusia channery silt loam, 8 to 15 percent slopes

Component: Volusia (90%)

The Volusia component makes up 90 percent of the map unit. Slopes are 8 to 15 percent. This component is on hills on uplands. The parent material consists of loamy till derived from interbedded sedimentary rock. Depth to a root restrictive layer, fragipan, is 10 to 22 inches. The natural drainage class is somewhat poorly drained. Water movement in the most restrictive layer is low. Available water to a depth of 60 inches (or restricted depth) is very low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 8 inches during January, February, March, April, May, November, December. Organic matter content in the surface horizon is about 5 percent. This component is in the F140XY024NY Moist Dense Till ecological site. Nonirrigated land capability classification is 3e. This soil does not meet hydric criteria.

Minor Components: Mardin (6%) and Chippewa (4%)

Map Unit: VoD—Volusia channery silt loam, 15 to 25 percent slopes

Component: Volusia (90%)

The Volusia component makes up 90 percent of the map unit. Slopes are 15 to 25 percent. This component is on hills on uplands. The parent material consists of loamy till derived from interbedded sedimentary rock. Depth to a root restrictive layer, fragipan, is 10 to 22 inches. The natural drainage class is somewhat poorly drained. Water movement in the most restrictive layer is low. Available water to a depth of 60 inches (or restricted depth) is very low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 8 inches during January, February, March, April, May, November, December. Organic matter content in the surface horizon is about 5 percent. This component is in the F140XY024NY

Moist Dense Till ecological site. Nonirrigated land capability classification is 4e. This soil does not meet hydric criteria.

Minor Components: Mardin (7%) and Chippewa (3%)

Map Unit: VoE3—Volusia channery silt loam, 25 to 35 percent slopes, eroded

Component: Volusia, eroded (82%)

The Volusia, eroded component makes up 82 percent of the map unit. Slopes are 25 to 35 percent. This component is on hills on uplands. The parent material consists of loamy till derived from interbedded sedimentary rock. Depth to a root restrictive layer, fragipan, is 7 to 22 inches. The natural drainage class is somewhat poorly drained. Water movement in the most restrictive layer is low. Available water to a depth of 60 inches (or restricted depth) is very low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 9 inches during January, February, March, April, November, December. Organic matter content in the surface horizon is about 3 percent. This component is in the F140XY024NY Moist Dense Till ecological site. Nonirrigated land capability classification is 7e. This soil does not meet hydric criteria.

Minor Components: Mardin, eroded (15%) and Chippewa (3%)

Map Unit: VvB—Volusia channery silt loam, silty substratum, 3 to 8 percent slopes

Component: Volusia, silty substratum (80%)

The Volusia, silty substratum component makes up 80 percent of the map unit. Slopes are 3 to 8 percent. This component is on valley sides, plateaus. The parent material consists of fine-loamy basal till derived from sandstone and siltstone. Depth to a root restrictive layer, fragipan, is 12 to 20 inches. The natural drainage class is somewhat poorly drained. Water movement in the most restrictive layer is very low. Available water to a depth of 60 inches (or restricted depth) is very low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 6 inches during March, April. Organic matter content in the surface horizon is about 4 percent. This component is in the F140XY024NY Moist Dense Till ecological site. Nonirrigated land capability classification is 3w. This soil does not meet hydric criteria.

Minor Components: Chippewa, silty substratum (15%) and Mardin (5%)

Map Unit: VvC—Volusia channery silt loam, silty substratum, 8 to 15 percent slopes

Component: Volusia, silty substratum (85%)

The Volusia, silty substratum component makes up 85 percent of the map unit. Slopes are 8 to 15 percent. This component is on valley sides, plateaus. The parent material consists of loamy basal till derived from sandstone and siltstone over silty lacustrine deposits. Depth to a root restrictive layer, fragipan, is 12 to 20 inches. The natural drainage class is somewhat poorly drained. Water movement in the most restrictive layer is very low. Available water to a depth of 60 inches (or restricted depth) is very low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 6 inches during March, April. Organic matter content in the surface horizon is about 4 percent. This component is in the F140XY024NY Moist Dense Till ecological site. Nonirrigated land capability classification is 3e. This soil does not meet hydric criteria.

Minor Components: Chippewa, silty substratum (10%) and Mardin (5%)

Map Unit: W—Water

Component: Water (100%). Water is a miscellaneous area.

Map Unit: WeB—Wellsboro channery loam, 3 to 8 percent slopes

Component: Wellsboro (85%)

The Wellsboro component makes up 85 percent of the map unit. Slopes are 3 to 8 percent. This component is on hills on uplands. The parent material consists of loamy till from reddish sandstone, siltstone, and shale. Depth to a root restrictive layer, fragipan, is 14 to 30 inches. The natural drainage class is moderately well drained. Water movement in the most restrictive layer is low. Available water to a depth of 60 inches (or restricted depth) is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 18 inches during January, February, March, April, November, December. Organic matter content in the surface horizon is about 5 percent. This component is in the F140XY024NY Moist Dense Till ecological site. Nonirrigated land capability classification is 2w. This soil does not meet hydric criteria.

Minor Components: Lackawanna (5%), Oquaga (5%), and Morris (5%)

Map Unit: WeC—Wellsboro channery loam, 8 to 15 percent slopes

Component: Wellsboro (90%)

The Wellsboro component makes up 90 percent of the map unit. Slopes are 8 to 15 percent. This component is on hills on uplands. The parent material consists of loamy till from reddish sandstone, siltstone, and shale. Depth to a root restrictive layer, fragipan, is 14 to 30 inches. The natural drainage class is moderately well drained. Water movement in the most restrictive layer is low. Available water to a depth of 60 inches (or restricted depth) is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 18 inches during January, February, March, April, November, December. Organic matter content in the surface horizon is about 5 percent. This component is in the F140XY024NY Moist Dense Till ecological site. Nonirrigated land capability classification is 3e. This soil does not meet hydric criteria.

Minor Components: Morris (5%) and Lackawanna (5%)

Map Unit: WeD—Wellsboro channery loam, 15 to 25 percent slopes

Component: Wellsboro (85%)

The Wellsboro component makes up 85 percent of the map unit. Slopes are 15 to 25 percent. This component is on hills on uplands. The parent material consists of loamy till from reddish sandstone, siltstone, and shale. Depth to a root restrictive layer, fragipan, is 14 to 30 inches. The natural drainage class is moderately well drained. Water movement in the most restrictive layer is low. Available water to a depth of 60 inches (or restricted depth) is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 18 inches during January, February, March, April, November, December. Organic matter content in the surface horizon is about 5 percent. This component is in the F140XY024NY Moist Dense Till ecological site. Nonirrigated land capability classification is 4e. This soil does not meet hydric criteria.

Minor Components: Lackawanna (5%), Oquaga (5%), and Morris (5%)

Map Unit: WyF—Wyoming gravelly sandy loam, 30 to 50 percent slopes

Component: Wyoming (100%)

The Wyoming component makes up 100 percent of the map unit. Slopes are 25 to 45 percent. This component is on terraces. The parent material consists of sandy and gravelly glaciofluvial deposits derived from sandstone and siltstone. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is somewhat excessively drained. Water movement in the most restrictive layer is high. Available water to a depth of 60 inches (or restricted depth) is low. Shrink-swell potential is low. This soil is not flooded.

It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 3 percent. This component is in the F140XY021NY Dry Outwash ecological site. Nonirrigated land capability classification is 7e. This soil does not meet hydric criteria.

ATTACHMENT 3

INFILTRATION TESTING

TRIP REPORT

Date: May 16, 2024

To: National Fuel Gas Supply Corporation

From: Tetra Tech, Inc.

Subject: Summary of Soil Infiltration Tests
Tioga Pathway Project
National Fuel Gas Supply Corporation
Potter and Tioga Counties, Pennsylvania

This trip report provides results of soil infiltration tests that were completed as part of the National Fuel Gas Supply Corporation's proposed Tioga Pathway Project, in Potter and Tioga Counties, Pennsylvania.

1.0 PURPOSE

This report objective is to present the field data and results of double-ring soil infiltration tests, completed on May 6th to 8th, 2024. The goal of the infiltration testing was to characterize onsite soils and their capacity for infiltration to facilitate design of stormwater management best management practices (BMPs).

Six infiltration tests (IT-2-1, IT-2-2, IT-3-1, IT-3-2, IT-4-1, and IT-4-2) were performed. Groundwater and mottled soil were encountered at the test pits for IT-1-1 and IT-1-2; therefore, no infiltration tests were performed at these locations. All tests were conducted 3" below the ground surface. In addition to the six infiltration tests, eight soil lithology tests were conducted, deeming locations to conduct an infiltration test adequate. Test locations are listed numerically in Table 1 and shown on the attached figures.

2.0 FIELD ACTIVIES

The infiltration tests were conducted by Evan Smerdell and Dan Moore of Tetra Tech, Inc., on May 6th through May 8th. The test locations were positioned in the field using a handheld, WAAS-enabled GPS unit. Table 1 provides the coordinates recorded in the field. Infiltration tests were located within the limits of the infiltration surface associated with the proposed infiltration BMPs. Photographs of the testing location are attached to this report.

The infiltration tests were performed in accordance with the procedure specified in the 2006 Pennsylvania Stormwater Best Management Practices (BMP) Manual. The test locations were leveled using hand tools, with care taken to minimize disturbance of the soil surface to be tested. Double-ring infiltrometers were used for testing and consisted of 10-inch and 6-inch diameter sections of steel casing. After digging to the target depth, the test surface was leveled, and any loose soil or fallen vegetation was removed. The rings were driven a minimum of 2 inches into the soil. The infiltration test depths are provided on Table 1.

Test locations were pre-soaked for 1 hour. The tests were then conducted with measurements at 10-minute or 30-minute intervals, based on the observed water level drops during the pre-soak period. Pre-soak and test information was recorded on infiltration test sheets; copies of the test sheets are attached to this report.

During the testing on May 6th through the 8th, the weather was sunny and ambient temperatures were seasonal. Temperatures ranged from 60 to 70 degrees Fahrenheit with no precipitation observed in the area at the time of testing. Less than ½" of rainfall was observed within 24 hours before testing.

In addition to performing the infiltration tests, a hand auger was utilized to characterize the soil, determine the depth to bedrock, if encountered, and inspect for evidence of the seasonal high-water table near the test area. The generated soil logs were identified with the corresponding infiltration test name. This was completed from the ground surface down to two feet below the target infiltration test depth. Descriptions of the soil were documented on field logs, which were based on the form example in the BMP manual. Copies of the soil logs are attached to this report.

3.0 RESULTS

3.1 SOILS DESCRIPTION

Soils were logged in test holes near each testing location (see attached figure for test hole locations). Holes were excavated or hand augured to 2 feet below the respective test depth to log lithology and inspected for evidence of seasonal high-water table and to determine the depth of apparent bedrock if encountered. The soil descriptions were recorded on forms based on the BMP manual, and copies of the field logs are attached to this report.

According to United States Department of Agriculture Natural Resources Conservation Service Web Soil Survey[1] data, all tests consisted of various soil types which are as follows:

- IT-1-1, IT-1-2: Ontusia channery silt loam, 8 to 15 percent slopes, defined as having a drainage class of somewhat poorly drained.
- IT-2-1, IT-2-2: Wildin channery silt loam, 8 to 15 percent slopes, defined as having a drainage class of moderately well drained.
- IT-3-1, IT-3-2: Mardin channery silt loam, 15 to 25 percent slopes, defined as having a drainage class of moderately well drained.
- IT-4-1: Chenango gravelly loam, 2 to 12 percent slopes, defined as having a drainage class of well drained.
- IT-4-2: Chippewa silt loam, 3 to 8 percent slopes, defined as having a drainage class of poorly drained.

[1] http://websoilsurvey.nrcs.usda.gov/. PaGEODE (state.pa.us). Accessed May 9, 2024.

Based on the interactive website PaGEODE, the geology of the sites varies based on the infiltration testing locations. IT-1-1 and IT-1-2, IT-2-1, IT-2-2, IT-3-1, IT-3-2, IT-4-1, and IT-4-2 are underlain by of the Lock Haven Formation, consisting of interbedded light-olive-gray, very fine grained, fossiliferous, thin- and medium-bedded sandstone.

3.2 INFILTRATION TEST RESULTS

Table 1 summarizes the infiltration rates (inches per hour) calculated from the test data. Infiltration rates presented in Table 1 were calculated from the average water level drop of the last four readings measured in the inner ring.

Table 1
Summary of Infiltration Test Results

Test Location (IT-)	Location Data		Test Depth (inches)	Any Restricting Layers Present?	Infiltration Test Result (inches/hour)
	LATITUDE_WGS_84	LONGITUDE_WGS_84			
IT-1-1	41.966944	-77.718055	3	Mottling, 6”	N/A
IT-1-2	41.966944	-77.718333	3	Groundwater, 25”	N/A
IT-2-1	41.981875	-77.648611	3	No	0.59
IT-2-2	41.981667	-77.648611	3	No	5.25
IT-3-1	41.914043	-77.483895	3	No	5.34
IT-3-2	41.913872	-77.483717	3	No	1.13
IT-4-1	41.915281	-77.482261	3	No	0.19
IT-4-2	41.914646	-77.482199	3	No	8.63

SOIL LOGS

TETRA TECH

Soil Log

Tested By: EMS
Project: Tioga IT
Project No.: 212c-BF-00493
Test Pit: IT-1-1
Date: 5/8/24
Elevation:
Equipment Used: Hand
Geology: Catskill Fm
Soil Type: Oquaga-Lordstown
Land Use: Pipeline Valve station
Weather: Sunny 70°

Additional Comments

Horizon	Upper Boundary	Lower Boundary	Soil Textural Class	Type, Size, Coarse Fragments, etc.	Soil Color	Color Patterns	Pores, Roots, Rock Structure	Depth to Bedrock	Depth to Water	Comments
O	0"	3"	sandy silt, some gravel	gravel, v. fine sand	10YR 3/1	Solid	roots/organics	N/A	N/A	damp to wet, heterogeneous, low plastic, alluvium.
A	3"	4"	Sandy silt, some clay	Some C. Sand	10YR 3/2	Solid	some roots, no mottling	N/A	N/A	damp, homogeneous, low plastic, alluvium.
B1	4"	7"	Sandy silt w/ some gravel & cobbles	gravel/cobbles, gap graded/subangular	10YR 3/2	mottled	no roots, mottled	N/A	N/A	damp, heterogeneous, low plastic, alluvium.
B2	7"	27"	Sandy clay w/ gravel & cobbles	gravel/cobbles, gap graded, angular	7.5YR 4/3	mottled	no roots, mottled	N/A	25"	damp, heterogeneous, low plastic, alluvium.

Horizon:	USDA Definition	Soil Textural Class	Boundary	Notes:
O	Organic debris	Use ternary diagram from US Department of Agriculture Soil Conservation Service	Use depth and classification	Mottling encountered. Ground water encountered @ 25". No bedrock encountered. Less than .5" of rain in last 24 hrs.
A	Dark colored, mixed mineral organic matter		Classification as Follows: Abrupt	
B	Maximum accumulation of silicate clay minerals		Clear	
C	Weathered parent material		Gradual	
R	Layer of consolidated rock beneath the soil		Diffuse	

Table based on: Sample soil log located on page 12 of the Pennsylvania Stormwater Best Management Practices Manual
USDA Definitions located from: http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/edu/?cid=nrcs142p2_054308

TETRA TECH

Soil Log

Tested By: EMS **Project:** Tioga IT **Project No.:** 212C-BF-00493

Test Pit: IT-1-2 **Date:** 5/8/24 **Elevation:** **Equipment Used:** Hand

Geology: Catskill Fm **Soil Type:** Oquaga-Lordstown **Land Use:** Pipeline Valve station **Weather:** Sunny 70°

Additional Comments

Horizon	Upper Boundary	Lower Boundary	Soil Textural Class	Type, Size, Coarse Fragments, etc.	Soil Color	Color Patterns	Pores, Roots, Rock Structure	Depth to Bedrock	Depth to Water	Comments
O	0"	2"	sandy silt loam	silt w/ some sand & gravel	10YR 3/2	Solid	roots/ organics	N/A	N/A	damp, heterogeneous, low plastic, alluvium
A	2"	4"	Sandy silt w/ cobbles & gravel	gravel/cobbles gap graded, sub angular	10YR 4/2	Solid	some roots, no mottling	N/A	N/A	damp, homogeneous, low plastic, alluvium
B	4"	27"	sandy clay, some gravel	gravel, fine sand, subangular	7.5YR 5/3	Mottled	no roots, mottled	N/A	25"	damp to wet, heterogeneous, low plastic, alluvium

Horizon:	USDA Definition	Soil Textural Class	Boundary	Notes:
O	Organic debris	Use ternary diagram from	Use depth and classification	No bedrock encountered.
A	Dark colored, mixed mineral organic matter	US Department of Agriculture Soil Conservation Service	Classification as Follows: Abrupt	Mottling encountered in 'B' horizon. Groundwater encountered @ 25".
B	Maximum accumulation of silicate clay minerals		Clear	No testing performed.
C	Weathered parent material		Gradual	Less than .5" of rain in
R	Layer of consolidated rock beneath the soil		Diffuse	last 24 hrs.

Table based on: Sample soil log located on page 12 of the Pennsylvania Stormwater Best Management Practices Manual
USDA Definitions located from: http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/edu/?cid=nrcs142p2_054308

TETRA TECH

Soil Log

Tested By: E. Smerdell **Project:** Tioga IT **Project No.:**

Test Pit: IT-2-1 **Date:** 5/6/24 **Elevation:** **Equipment Used** Hand

Geology: Lock Haven Fm **Soil Type:** Oquaga-Lordstown **Land Use:** Agriculture **Weather:** Sunny 70°

Additional Comments

Horizon	Upper Boundary	Lower Boundary	Soil Textural Class	Type, Size, Coarse Fragments, etc.	Soil Color	Color Patterns	Pores, Roots, Rock Structure	Depth to Bedrock	Depth to Water	Comments
O	0"	3"	Sandy silt loam	silt, little sand & clay	10YR 3/2	Solid	roots/ organics	N/A	N/A	low plastic, homogeneous, damp, alluvium
A	3"	5"	gravelly sand w/ silt	gravel/cobbles, gap graded, angular	7.5YR 4/1	Solid	Some roots, no mottling	N/A	N/A	nonplastic, heterogeneous, damp, alluvium
B	5"	27"	gravelly sand	gravel/cobbles, gap graded, angular	10YR 4/2	Solid	no roots no mottling	N/A	N/A	non plastic, heterogeneous, moist, alluvium

Horizon:	USDA Definition	Soil Textural Class	Boundary	Notes:
O	Organic debris	Use ternary diagram from	Use depth and classification	No mottling, no groundwater, no bedrock encountered
A	Dark colored, mixed mineral organic matter	US Department of Agriculture Soil Conservation Service	Classification as Follows: Abrupt	less than .5" rainfall in
B	Maximum accumulation of silicate clay minerals		Clear	last 24hrs
C	Weathered parent material		Gradual	
R	Layer of consolidated rock beneath the soil		Diffuse	

Table based on: Sample soil log located on page 12 of the Pennsylvania Stormwater Best Management Practices Manual
USDA Definitions located from: http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/edu/?cid=nrcs142p2_054308

TETRA TECH

Soil Log

Tested By: D. Moore **Project:** Tioga IT **Project No.:**

Test Pit: IT-2-2 **Date:** 5/6/24 **Elevation:** **Equipment Used** Hand

Geology: Lockhaven Fm **Soil Type:** Oquaga - Lordstown **Land Use:** Agriculture **Weather:** Sunny 70°

Additional Comments

Horizon	Upper Boundary	Lower Boundary	Soil Textural Class	Type, Size, Coarse Fragments, etc.	Soil Color	Color Patterns	Pores, Roots, Rock Structure	Depth to Bedrock	Depth to Water	Comments
O	0"	3"	Sandy silt loam	silt, with little sand	7.5 YR 3/3	solid	roots/ organics	N/A	N/A	low plasticity, homogeneous, damp, alluvium
A	3"	7"	gravelly sand	gravel/cobbles gap graded angular	7.5 YR 4/3	solid	some roots No mottling	N/A	N/A	no plasticity, heterogeneous, damp, alluvium
B1	7"	20"	sandy clay	clay, with some sand	10 YR 6/6	solid	no roots No mottling	N/A	N/A	med plasticity, homogeneous, damp, alluvium
B2	20"	27"	gravelly sand	gravel/cobbles gap graded angular	10 YR 5/2	solid	no roots no mottling	N/A	N/A	no plasticity, heterogeneous, damp, alluvium

Horizon:	USDA Definition	Soil Textural Class	Boundary	Notes:
O	Organic debris	Use ternary diagram from US Department of Agriculture Soil Conservation Service	Use depth and classification	No mottling / No Ground water / No bedrock encountered less than .5" rainfall last 24 hours
A	Dark colored, mixed mineral organic matter		Classification as Follows: Abrupt	
B	Maximum accumulation of silicate clay minerals		Clear	
C	Weathered parent material		Gradual	
R	Layer of consolidated rock beneath the soil		Diffuse	

Table based on: Sample soil log located on page 12 of the Pennsylvania Stormwater Best Management Practices Manual
USDA Definitions located from: http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/edu/?cid=nrcs142p2_054308

TETRA TECH

Soil Log

Tested By: E. Smerdell **Project:** Tioga IT **Project No.:**

Test Pit: IT - 3 - 1 **Date:** 5/7/24 **Elevation:** **Equipment Used** Hand

Geology: Lock Haven Fm **Soil Type:** Oquaga -Lordstown **Land Use:** **Weather:** Sunny 70°

Additional Comments

Horizon	Upper Boundary	Lower Boundary	Soil Textural Class	Type, Size, Coarse Fragments, etc.	Soil Color	Color Patterns	Pores, Roots, Rock Structure	Depth to Bedrock	Depth to Water	Comments
O	0"	4"	Sandy silt loam	Silt, little sand	7.5YR 5/4	Solid	Roots / organics	N/A	N/A	low plastic, moist, homogeneous, alluvium
A	4"	8"	Silty Sand	Sand w/ silt, gap graded, subrounded, v.fine	10 YR 5/4	Solid	little roots, no mottling	N/A	N/A	low plastic, dry, homogeneous, alluvium
B	8"	27"	Silty sand, some gravel	gravel, gap graded, angular	10YR 5/5	Solid	no roots, no mottling	N/A	N/A	nonplastic, dry, heterogeneous, alluvium.

Horizon:	USDA Definition	Soil Textural Class	Boundary	Notes:
O	Organic debris	Use ternary diagram from US Department of Agriculture Soil Conservation Service	Use depth and classification	No mottling, no groundwater, no bedrock encountered. Less than .5" of rain in last 24hrs.
A	Dark colored, mixed mineral organic matter		Classification as Follows: Abrupt	
B	Maximum accumulation of silicate clay minerals		Clear	
C	Weathered parent material		Gradual	
R	Layer of consolidated rock beneath the soil		Diffuse	

Table based on: Sample soil log located on page 12 of the Pennsylvania Stormwater Best Management Practices Manual
USDA Definitions located from: http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/edu/?cid=nrcs142p2_054308

TETRA TECH

Soil Log

Tested By: E. Smerdell **Project:** Tioga IT **Project No.:** 212C-BF-00493

Test Pit: TP-3-2 **Date:** 5/7/24 **Elevation:** **Equipment Used** hand auger

Geology: Lock Haven Fm **Soil Type:** Oquaga - Lordstown **Land Use:** agriculture **Weather:** Sunny 70°

Additional Comments

Horizon	Upper Boundary	Lower Boundary	Soil Textural Class	Type, Size, Coarse Fragments, etc.	Soil Color	Color Patterns	Pores, Roots, Rock Structure	Depth to Bedrock	Depth to Water	Comments
O	0"	4"	sandy clay loam	sandy clay, with little cobbles	10 YR 5/3	solid	roots gap graded rounded	NA	NA	damp, hetero, high plasticity, alluvium
A	4"	6"	sandy clay	gravel, cobbles	10 YR 5/3	solid	root gap graded rounded	NA	NA	damp, heterogeneous, medium plasticity alluvium
B	6"	27"	silty, gravelly sand	sand, with some silt, little gravel and cobbles	10 YR 5/4	solid	no roots, gap graded no mottling	NA	NA	damp, heterogeneous no plasticity alluvium

Horizon:	USDA Definition	Soil Textural Class	Boundary	Notes:
O	Organic debris	Use ternary diagram from	Use depth and classification	No mottling, no groundwater, no bedrock encountered.
A	Dark colored, mixed mineral organic matter	US Department of Agriculture Soil Conservation Service	Classification as Follows: Abrupt	Less than .5" rain last 24 hours.
B	Maximum accumulation of silicate clay minerals		Clear	
C	Weathered parent material		Gradual	
R	Layer of consolidated rock beneath the soil		Diffuse	

Table based on: Sample soil log located on page 12 of the Pennsylvania Stormwater Best Management Practices Manual
USDA Definitions located from: http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/edu/?cid=nrcs142p2_054308

TETRA TECH

Soil Log

Tested By:	E Smerdell	**Project:**	Tioga IT	**Project No.:**	
Test Pit:	IT-4-1	**Date:**	5/7/24	**Elevation:**	
Equipment Used	Hand				
Geology:	Lock Haven Fm	**Soil Type:**	Oquaga-Lordstown	**Land Use:**	Wooded / Cleared
Weather:	Partly cloudy, 60°				

Additional Comments

Horizon	Upper Boundary	Lower Boundary	Soil Textural Class	Type, Size, Coarse Fragments, etc.	Soil Color	Color Patterns	Pores, Roots, Rock Structure	Depth to Bedrock	Depth to Water	Comments
O	0"	3"	Sandy silt loam	Silt, little to trace sand	10YR 2/2	Solid	roots, organics	N/A	N/A	low plastic, homogeneous, damp, alluvium
A	3"	6"	Sandy silt w/ cobbles	Cobbles, gap graded, angular	10YR 3/2	Solid	Some roots, no mottling	N/A	N/A	low plastic, heterogeneous, damp alluvium
B	6"	27"	Sandy clay w/ cobbles	cobbles (sandstone), gap graded, angular	10YR 3/3	Solid	no roots, no mottling	N/A	N/A	low plastic, heterogeneous, damp, alluvium

Horizon:	USDA Definition	Soil Textural Class	Boundary
O	Organic debris	Use ternary diagram from US Department of Agriculture Soil Conservation Service	Use depth and classification
A	Dark colored, mixed mineral organic matter		Classification as Follows: Abrupt
B	Maximum accumulation of silicate clay minerals		Clear
C	Weathered parent material		Gradual
R	Layer of consolidated rock beneath the soil		Diffuse

Notes:
No mottling, no groundwater, no bedrock encountered
less than .5" of rain in last 24hrs

Table based on: Sample soil log located on page 12 of the Pennsylvania Stormwater Best Management Practices Manual
USDA Definitions located from: http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/edu/?cid=nrcs142p2_054308

TETRA TECH

Soil Log

Tested By: E. Smerdell **Project:** Tioga IT **Project No.:**

Test Pit: IT-4-2 **Date:** 5/7/24 **Elevation:** **Equipment Used** Hand

Geology: Lock Haven Fm **Soil Type:** Oquaga-Lordstown **Land Use:** Wooded / Cleared **Weather:** Partly Cloudy, 60°

Additional Comments

Horizon	Upper Boundary	Lower Boundary	Soil Textural Class	Type, Size, Coarse Fragments, etc.	Soil Color	Color Patterns	Pores, Roots, Rock Structure	Depth to Bedrock	Depth to Water	Comments
O	0"	1"	Sandy silt loam	Silt, little Sand	10YR 5/5	Solid	roots / organics	N/A	N/A	low plastic, homogeneous, moist to dry, alluvium
A	1"	3"	Silty sand w/gravel & cobbles	gravel/cobbles, gap graded, angular	10YR 5/6	Solid	Some roots, no mottling	N/A	N/A	non plastic, homogeneous, dry, alluvium
B	3"	27"	Sandy clay w/ cobbles & gravel	gravel/cobbles (sandstone), gap graded, angular	7.5YR 5/4	Solid	no roots, no mottling	N/A	N/A	non plastic, heterogeneous, dry, alluvium

Horizon:	USDA Definition	Soil Textural Class	Boundary	Notes:
O	Organic debris	Use ternary diagram from US Department of Agriculture Soil Conservation Service	Use depth and classification	No mottling, no groundwater, no bedrock encountered.
A	Dark colored, mixed mineral organic matter		Classification as Follows: Abrupt	Less than .5" of rain in last 24 hrs.
B	Maximum accumulation of silicate clay minerals		Clear	
C	Weathered parent material		Gradual	
R	Layer of consolidated rock beneath the soil		Diffuse	

Table based on: Sample soil log located on page 12 of the Pennsylvania Stormwater Best Management Practices Manual
USDA Definitions located from: http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/edu/?cid=nrcs142p2_054308

INFILTRATION TEST DATA SHEETS

INFILTRATION TEST DATA SHEET

TETRA TECH

Project Name: Tioga	**Test ID:** IT-2-1
Project Number:	**Date:** 5/6/24
Personnel: EMS, DSM	
Location / Description: Lattitude: 41.981667 N Longitude: 77.648611 W	
Weather: Sunny 70°	**Rainfall within past 24-hours:** .15"

Test Information

Test Method: Double Ring Infiltrometer X Single Ring Infiltrometer _____ Percolation Test _____

Inner Ring Inside Diameter / Height: 6" / 10" Outer Ring Inside Diameter / Height: 10" / 10"

Percolation Hole Diameter: N/A (If performing an open hole perc test)

Distance from bottom of hole to measuring point (minimum water column of 6-8 inches): 7 4/16

Measuring Point: Ring Rim X Indicator Mark _____ **Test Depth (BGS):** 3"

Field Measurements

Time	Reading	Elapsed time since start of test (minutes)	Water level drop, inner ring or perc hole (inches)		Remarks
PRESOAK DATA					
1513	0	0	-----	Refill inner and outer ring after each measurement	16/16" @ 1543
1543	1	30	1 6/16"		~~4/16 @ 1557~~ 6/16 @ 1543
1613	2	60	6/16"		
	3				
	4				
	5				
	6				
TEST DATA					
1613	0	0	-----	Refill inner and outer ring after each measurement	
1643	1	30	5/16"		
1713	2	60	4/16"		
1743	3	90	5/16"		
1813	4	120	5/16"		Stabilized, END TEST
	5				
	6				
	7				
	8				

Additional Comments:

Less than 2" drawdown, 30 min test interval

INFILTRATION TEST DATA SHEET

TETRA TECH

Project Name: Tioga	Test ID: IT-2-2
Project Number:	Date: 5/6/24
Personnel: EMS, DSM	
Location / Description: Lattitude: 41.981667N	Longitude: 77.648611W
Weather: Sunny 70°	Rainfall within past 24-hours: .15"

Test Information

Test Method: Double Ring Infiltrometer X Single Ring Infiltrometer ____ Percolation Test ____

Inner Ring Inside Diameter / Height: 6" / 10" Outer Ring Inside Diameter / Height: 10" / 10"

Percolation Hole Diameter: N/A (If performing an open hole perc test)

Distance from bottom of hole to measuring point (minimum water column of 6-8 inches): 7.5"

Measuring Point: Ring Rim X Indicator Mark ____ **Test Depth (BGS):** 3"

Field Measurements

Time	Reading	Elapsed time since start of test (minutes)	Water level drop, inner ring or perc hole (inches)		Remarks
PRESOAK DATA					
1434	0	0	-----	Refill inner and outer ring after each measurement	
1504	1	30	8 14/16"		3 5/16" @ 1443, 3 4/16" @1457, 2 5/16" @150
1534	2	60	4 12/16"		3 5/16" @ 1516, 1 7/16 @ 1534
	3				
	4				
	5				
	6				
TEST DATA					
1534	0	0	-----	Refill inner and outer ring after each measurement	
1544	1	10	15/16"		
1554	2	20	15/16"		
1604	3	30	13/16"		
1614	4	40	13/16"		Stabilized, END TEST
	5				
	6				
	7				
	8				

Additional Comments:
Greater than 2" drawdown, 10 min test interval

INFILTRATION TEST DATA SHEET

TETRA TECH

Project Name: Tioga IT	**Test ID:** IT-3-1
Project Number:	**Date:** 5/7/24
Personnel: EMS, DSM	
Location / Description: Lattitude: 41.914043 N	Longitude: 77.483895 W
Weather: Sunny 70°	**Rainfall within past 24-hours:** 0"

Test Information

Test Method: Double Ring Infiltrometer X Single Ring Infiltrometer _____ Percolation Test _____

Inner Ring Inside Diameter / Height: 6" / 10" Outer Ring Inside Diameter / Height: 10" / 10"

Percolation Hole Diameter: N/A (If performing an open hole perc test)

Distance from bottom of hole to measuring point (minimum water column of 6-8 inches): 6 11/16"

Measuring Point: Ring Rim X Indicator Mark _____ **Test Depth (BGS):** 3"

Field Measurements

Time	Reading	Elapsed time since start of test (minutes)	Water level drop, inner ring or perc hole (inches)		Remarks
PRESOAK DATA					
1213	0	0	-----	Refill inner and outer ring after each measurement	
1243	1	30	5 9/16"		3 7/16" @ 1234 2 2/16" @ 1243
1313	2	60	4 13/16		3 4/16" @ 1303, 1 9/16 @ 1313
	3				
	4				
	5				
	6				
TEST DATA					
1313	0	0	-----	Refill inner and outer ring after each measurement	
1323	1	10	14/16"		
1333	2	20	13/16"		
1343	3	30	14/16"		
1353	4	40	1"		
	5				
	6				
	7				
	8				

Additional Comments:
Greater than 2" drawdown; 10min test interval.

INFILTRATION TEST DATA SHEET

TETRA TECH

Project Name: Tioga IT	**Test ID:** IT-3-2
Project Number:	**Date:** 5/7/24
Personnel: EMS, DSM	
Location / Description: Lattitude: 41.913872 N	Longitude: 77.483717 W
Weather: Sunny 70°	**Rainfall within past 24-hours:** 0"

Test Information

Test Method: Double Ring Infiltrometer __X__ Single Ring Infiltrometer _____ Percolation Test _____

Inner Ring Inside Diameter / Height: 6" / 10" Outer Ring Inside Diameter / Height: 10" / 10"

Percolation Hole Diameter: N/A (If performing an open hole perc test)

Distance from bottom of hole to measuring point (minimum water column of 6-8 inches): _____________

Measuring Point: Ring Rim __X__ Indicator Mark _____ **Test Depth (BGS):** 3"

Field Measurements

Time	Reading	Elapsed time since start of test (minutes)	Water level drop, inner ring or perc hole (inches)		Remarks
PRESOAK DATA					
1242	0	0	-----	Refill inner and outer ring after each measurement	14/16"@ 1300, 6/16"@ 1312
1312	1	30	1 4/16		
1342	2	60	15/16		
	3				
	4				
	5				
	6				
TEST DATA					
1342	0	0	-----	Refill inner and outer ring after each measurement	
1412	1	30	9/16"		
1442	2	60	8/16"		
1512	3	90	11/16"		
1542	4	120	8/16"		
	5				
	6				
	7				
	8				

Additional Comments:
Less than 2" drawdown; 30 min test interval

TETRA TECH

INFILTRATION TEST DATA SHEET

Project Name: Tioga IT	**Test ID:** IT-4-1
Project Number:	**Date:** 5/7/24
Personnel: EMS, DSM	
Location / Description: Lattitude: 41.915281N Longitude: 77.48226W	
Weather: Partly cloudy, 60°	**Rainfall within past 24-hours:** 0"

Test Information

Test Method: Double Ring Infiltrometer X Single Ring Infiltrometer _____ Percolation Test _____

Inner Ring Inside Diameter / Height: 6" / 10" Outer Ring Inside Diameter / Height: 10" / 10"

Percolation Hole Diameter: N/A (If performing an open hole perc test)

Distance from bottom of hole to measuring point (minimum water column of 6-8 inches): 6 14/16"

Measuring Point: Ring Rim X Indicator Mark _____ **Test Depth (BGS):** 3"

Field Measurements

Time	Reading	Elapsed time since start of test (minutes)	Water level drop, inner ring or perc hole (inches)		Remarks
PRESOAK DATA					
0830	0	0	-----	Refill inner and outer ring after each measurement	
0900	1	30	5/16"		
0930	2	60	3/16"		
	3				
	4				
	5				
	6				
TEST DATA					
0930	0	0	-----	Refill inner and outer ring after each measurement	
1000	1	30	2/16"		
1030	2	60	2/16"		
1100	3	90	1/16"		
1130	4	120	1/16"		
	5				
	6				
	7				
	8				

Additional Comments:

Less than 2" drawdown; 30min test interval

INFILTRATION TEST DATA SHEET

TETRA TECH

Project Name: Tioga IT	**Test ID:** IT-4-2
Project Number:	**Date:** 5/7/24
Personnel: EMS, DSM	
Location / Description: Lattitude: 41.914646N Longitude: 77.482199W	
Weather: Partly cloudy, 60°	**Rainfall within past 24-hours:** 0"

Test Information

Test Method: Double Ring Infiltrometer __X__ Single Ring Infiltrometer _____ Percolation Test _____

Inner Ring Inside Diameter / Height: 6" / 10" Outer Ring Inside Diameter / Height: 10" / 10"

Percolation Hole Diameter: N/A (If performing an open hole perc test)

Distance from bottom of hole to measuring point (minimum water column of 6-8 inches): 7 9/16"

Measuring Point: Ring Rim _X_ Indicator Mark _____ **Test Depth (BGS):** 3"

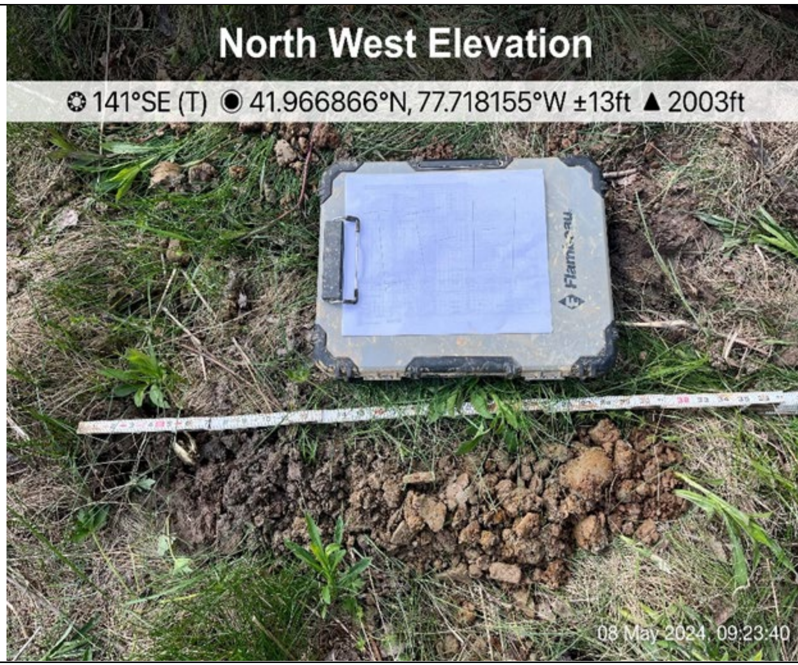
Field Measurements

Time	Reading	Elapsed time since start of test (minutes)	Water level drop, inner ring or perc hole (inches)		Remarks
PRESOAK DATA					
0901	0	0	-----	Refill inner and outer ring after each measurement	2 12/16" @ 0909, 2 12/16" @ 0919, 3 4/16" @ 093
0931	1	30	8 12/16"		1 8/16" @ 0939, 2 7/16 @ 0950, 2 7/16" @ 1001
1001	2	60	6 6/16"		
	3				
	4				
	5				
	6				
TEST DATA					
1001	0	0	-----	Refill inner and outer ring after each measurement	
1011	1	10	1 8/16"		
1021	2	20	1 6/16"		
1031	3	30	1 7/16"		
1041	4	40	1 7/16"		
	5				
	6				
	7				
	8				

Additional Comments:
Greater than 2" drawdown; 10min test interval

PHOTOGRAPHS

INFILTRATION TESTING LOCATION PHOTOGRAPHS
Tioga Pipeline
National Fuel Gas Company
Potter County, PA

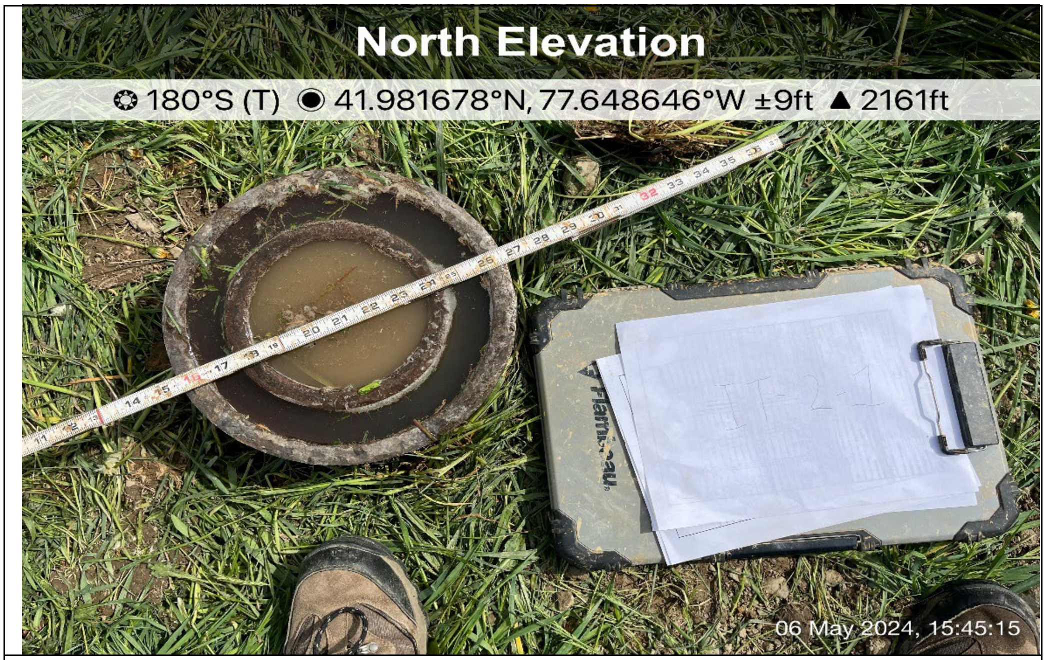


Description: IT-01-01 soil lithology

Date: 5/8/24 **Photograph No.** 1

Description: IT-1-2 soil lithology

Date: 5/8/24 **Photograph No.** 2



Description: IT-2-1 infiltration test

Date: 5/6/24 **Photograph No.** 3

Description: IT-2-1 soil lithology

Date: 5/6/24 **Photograph No.** 4

TETRA TECH

INFILTRATION TESTING LOCATION PHOTOGRAPHS
Tioga Pipeline
National Fuel Gas Company
Potter County, PA

Description: IT-2-2 infiltration test

Date: 5/6/24 **Photograph No.** 5

Description: IT-2-2 soil lithology

Date: 5/6/24 **Photograph No.** 6

INFILTRATION TESTING LOCATION PHOTOGRAPHS
Tioga Pipeline
National Fuel Gas Company
Potter County, PA

Description: IT-3-1 infiltration test

Date: 5/7/24 **Photograph No.** 7

Description: IT-3-1 soil lithology

Date: 5/7/24 **Photograph No.** 8

TETRA TECH

INFILTRATION TESTING LOCATION PHOTOGRAPHS
Tioga Pipeline
National Fuel Gas Company
Potter County, PA

Description: IT-3-2 infiltration test

Date: 5/7/24 **Photograph No.** 9

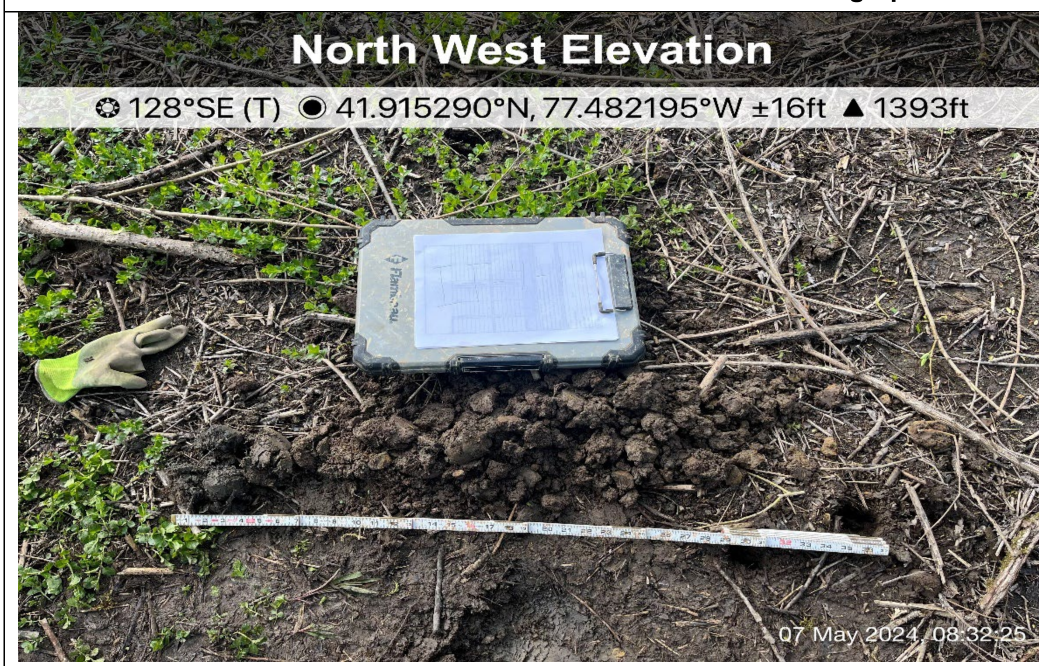
Description: IT-3-2 soil lithology

Date: 5/7/24 **Photograph No.** 10

TETRA TECH

Description: IT-4-1 infiltration test

Date: 5/7/24 **Photograph No.** 11



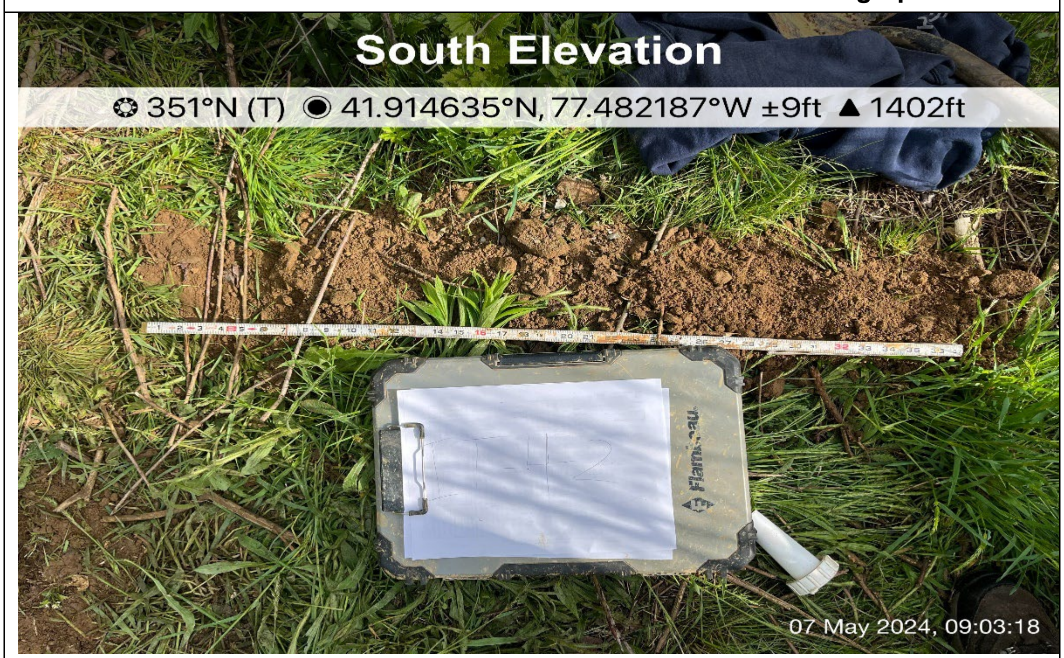
Description: IT-4-1 soil lithology

Date: 5/7/24 **Photograph No.** 12

INFILTRATION TESTING LOCATION PHOTOGRAPHS
Tioga Pipeline
National Fuel Gas Company
Potter County, PA

Description: IT-4-2 infiltration test

Date: 5/7/24 **Photograph No.** 13



Description: IT-4-2 soil lithology

Date: 5/7/24 **Photograph No.** 14

TETRA TECH

ATTACHMENT 4

SUPPORTING CALCULATIONS

HYDROLOGIC CALCULATION METHODOLOGY

Methodology

A hydrologic analysis has been prepared for the project in accordance with standards and specification of PADEP Technical Guidance Number 363-0300-002 and applicable local ordinances. Technical Release No. 55 (TR-55) methodology within Hydraflow Hydrographs Extension for AutoCAD Civil 3D 2023 was used for runoff flow rate analysis of pre- and post-development hydrologic conditions. TR-55 methodology uses runoff curve numbers (CN) and time-of-concentration (Tc) to model the surface conditions of a watershed. Determination of CN and Tc is based on a watersheds soil type, land cover type and condition. The Runoff CN Method as defined in PADEP guidance was used for runoff volume analysis of pre- vs. post-development conditions. Post-development peak flow rate will be controlled to rates less than those of pre-development.

Rainfall

Rainfall data used in the pre- and post-development analysis was obtained from the National Oceanic and Atmospheric Administration (NOAA) National Weather Service Atlas 14, Volume 2, Version 3 Point Precipitation Frequency Estimates. Conditions for each modeled location have been analyzed for the 2-, 10-, 25-, 50-, and 100-year storm events. Rainfall data is summarized as follows:

Rainfall Data Summary

Storm Event (year)	Rainfall Depth (inches)		
	Z20 Valve Site	OPP Station	YM59 Valve Site / PAR-9
2	2.43	2.41	2.38
10	3.48	3.71	3.41
25	4.29	4.52	4.17
50	4.99	5.11	4.87
100	5.85	5.77	5.70

1.3 Land Cover and Soil Type

Soil type and land cover type for each modeled location have been analyzed using the United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) Web Soil Survey, aerial imaging, and site investigation. Soil type and land cover type are summarized as follows:

Soil Type Data Summary

Symbol	Soil Type	HSG
ChB	Chenango gravelly loam (YM59 PAR-9)	D
CkB	Chippewa silt loam (YM59 PAR-9)	A
MaD	Mardin channery loam (YM59 Valve)	D
OhC	Ontusia channery silt loam (Z20 Valve, OPP Station)	D
WmB, WmC, WmD	Willdin channery silt loam (OPP Station)	D

Land Cover Data Summary

Land Cover	CN (HSG D)
Meadow (good condition) – HSG A	30
Impervious (i.e., gravel) – HSG A	76
Meadow (good condition) – HSG D	78
Impervious (i.e., gravel) – HSG D	91

PRE- vs. POST-DEVELOPMENT HYDROLOGY

Stormwater management in Pennsylvania traditionally focuses on flow rate control for large storm events requiring that there be no increase in the rate of runoff from development as compared to the rate of runoff before development for storm events ranging from the 2-year, 24-hour event to the 100-year, 24-hour event. Furthermore, where possible, the *Pennsylvania Stormwater BMP Manual* recommends that stormwater management be expanded to include: rate of flow, volume of flow, groundwater recharge, water quality, and stream channel protection.

For this PCSM Plan, analysis has been developed to identify the overall effect of the proposed gravel areas only and assumes that the outlying areas will not be altered from the pre- to post-development condition. Two separate post-development models were developed for each modeled location; one with no BMPs implemented and one with BMPs implemented. In these models, *Post-dev Tc adjusted* implements a GEOWEB Cellular Confinement System as a BMP for flow rate and volume control – the BMP captures a portion of the drainage area surface water runoff prior to discharge. Tc for the drainage area based on slope and surface with no BMP installed is the 5.0 minute TR-55 minimum; however, this model uses a Tc adjustment that takes into consideration the extended time that will result during filling of the void space of the BMP. The adjusted Tc is determined by calculating the peak rate of the drainage area with no BMP and then, using the calculated peak rate, the time required to fill the void space of the BMP is determined and is added to the 5.0 minute TR-55 minimum.

Z20 VALVE SITE

Pre-Development Hydrology

Pre-development drainage is identified as *Pre-dev* and is 0.51 acres modeled as meadow good condition (CN = 78). The time-of-concentration (Tc) based on slope and surface is less than 5.0 minutes; therefore, a 5.0 minute minimum Tc was applied.

Post-Development Hydrology

Post-dev no BMP: Post-development is two drainage areas identified as *Post-dev undetained* modeled as 0.43 acres meadow good condition (CN = 78) and *Post-dev gravel* modeled as 0.08 acres gravel (CN = 91). Tc based on slope and surface is less than 5.0 minutes; therefore, a 5.0 minute minimum was applied.

Post-dev w/ BMP: This model is similar to the *Post-dev no BMP* model described above, only the gravel portion of the model has been modified to incorporate an adjusted Tc to account for proposed the BMP.

Adjusted Tc

Design Storm	Peak Rate (cfs)	BMP Volume (cf)	Tc (minute)	Adjusted Tc (minute)
2	0.205	252	5 (minimum)	25.6
10	0.326	252	5 (minimum)	17.9
25	0.419	252	5 (minimum)	15.0
50	0.500	252	5 (minimum)	13.4
100	0.597	252	5 (minimum)	12.0

Pre- vs. Post-Development Flow Rate Analysis

Post-development runoff flow rate for the site will not exceed rate calculated for the pre-development condition. Flow rate is controlled through the implementation of a GEOWEB cellular confinement system within the gravel pad of the proposed valve site.

Pre- vs. Post-Development Peak Discharge Summary

POI	Design Storm				
	2-year	**10-year**	**25-year**	**50year**	**100-year**
Pre-Dev Runoff	0.64	1.28	1.82	2.32	2.94
Post-Dev Runoff	0.62	1.27	1.82	2.27	2.93
Net	**-0.02**	**-0.01**	**0.00**	**-0.05**	**-0.01**

Pre- vs. Post-Development Runoff Volume Control

Pre- and post-development runoff volume was determined using the Runoff CN Method as defined in PADEP NPDES guidance. A minimal increase in runoff volume in the post-development site condition is anticipated as a result of the change in surface area from meadow to gravel; however, the associated volume increase is mitigated through use of a GEOWEB Cellular Confinement System, which will detain the volume increase within void space of the gravel pad thereby allowing for infiltration. PADEP Worksheets and supporting calculations are provided.

MCCUTCHEON HILL OPP STATION

Pre-Development Hydrology

Pre-development drainage is identified as *Pre-dev* and is 3.70 acres modeled as meadow good condition (CN = 78). The time-of-concentration (Tc) based on slope and surface is less than 5.0 minutes; therefore, a 5.0 minute minimum Tc was applied.

Post-Development Hydrology

Post-dev no BMP: Post-development is two drainage areas identified as *Post-dev undetained* modeled as 3.16 acres meadow good condition (CN = 78) and *Post-dev gravel* modeled as 0.54 acres gravel (CN = 91). Tc based on slope and surface is less than 5.0 minutes; therefore, a 5.0 minute minimum was applied.

Post-dev w/ BMP: This model is similar to the *Post-dev no BMP* model described above, only the gravel portion of the model has been modified to incorporate an adjusted Tc to account for the proposed BMP.

Adjusted Tc

Design Storm	Peak Rate (cfs)	BMP Volume (cf)	Tc (minute)	Adjusted Tc (minute)
2	1.37	1,680	5 (minimum)	25.4
10	2.38	1,680	5 (minimum)	16.8
25	3.01	1,680	5 (minimum)	14.3
50	3.47	1,680	5 (minimum)	13.4
100	3.97	1,680	5 (minimum)	12.1

Pre- vs. Post-Development Flow Rate Analysis

Post-development runoff flow rate for the site will not exceed rate calculated for the pre-development condition. Flow rate is controlled through the implementation of a GEOWEB cellular confinement system within the gravel pad of the proposed valve site.

Pre- vs. Post-Development Peak Discharge Summary

POI	Design Storm				
	2-year	**10-year**	**25-year**	**50year**	**100-year**
Pre-Dev Runoff	4.57	10.39	14.39	17.43	20.88
Post-Dev Runoff	4.44	10.23	14.26	17.08	20.85
Net	**-0.13**	**-0.16**	**-0.13**	**-0.35**	**-0.03**

Pre- vs. Post-Development Runoff Volume Control

Pre- and post-development runoff volume was determined using the Runoff CN Method as defined in PADEP NPDES guidance. A minimal increase in runoff volume in the post-development site condition is anticipated as a result of the change in surface area from meadow to gravel; however, the associated volume increase is mitigated through use of a GEOWEB Cellular Confinement System, which will detain the volume increase within void space of the gravel pad thereby allowing for infiltration. PADEP Worksheets and supporting calculations are provided.

YM59 VALVE SITE

Pre-Development Hydrology

Pre-development drainage is identified as *Pre-dev* and is 0.25 acres modeled as meadow good condition (CN = 78). The time-of-concentration (Tc) based on slope and surface is less than 5.0 minutes; therefore, a 5.0 minute minimum Tc was applied.

Post-Development Hydrology

Post-dev no BMP: Post-development is two drainage areas identified as *Post-dev undetained* modeled as 0.20 acres meadow good condition (CN = 78) and *Post-dev gravel* modeled as 0.05 acres gravel (CN = 91). Tc based on slope and surface is less than 5.0 minutes; therefore, a 5.0 minute minimum was applied.

Post-dev w/ BMP: This model is similar to the *Post-dev no BMP* model described above, only the gravel portion of the model has been modified to incorporate an adjusted Tc to account for the proposed BMP.

Adjusted Tc

Design Storm	Peak Rate (cfs)	BMP Volume (cf)	Tc (minute)	Adjusted Tc (minute)
2	0.124	151	5 (minimum)	25.3
10	0.199	151	5 (minimum)	17.6
25	0.254	151	5 (minimum)	14.9
50	0.304	151	5 (minimum)	13.4
100	0.363	151	5 (minimum)	11.9

Pre- vs. Post-Development Flow Rate Analysis

Post-development runoff flow rate for the site will not exceed rate calculated for the pre-development condition. Flow rate is controlled through the implementation of a GEOWEB cellular confinement system within the gravel pad of the proposed valve site.

Pre- vs. Post-Development Peak Discharge Summary

POI	Design Storm				
	2-year	10-year	25-year	50year	100-year
Pre-Dev Runoff	0.30	0.61	0.85	1.09	1.39
Post-Dev Runoff	0.29	0.60	0.85	1.07	1.39
Net	**-0.01**	**-0.01**	**0.00**	**-0.02**	**0.00**

Pre- vs. Post-Development Runoff Volume Control

Pre- and post-development runoff volume was determined using the Runoff CN Method as defined in PADEP NPDES guidance. A minimal increase in runoff volume in the post-development site condition is anticipated as a result of the change in surface area from meadow to gravel; however, the associated volume increase is mitigated through use of a GEOWEB Cellular Confinement System, which will detain the volume increase within void space of the gravel pad thereby allowing for infiltration. PADEP Worksheets and supporting calculations are provided.

YM59 PAR-9

Pre-Development Hydrology

Pre-development drainage is identified as *Pre-dev* and is 2.25 acres modeled as meadow good condition (composite CN = 59). The time-of-concentration (Tc) based on slope and surface is less than 5.0 minutes; therefore, a 5.0 minute minimum Tc was applied.

Post-Development Hydrology

Post-dev no BMP: Post-development is two drainage areas identified as *Post-dev undetained* modeled as 2.03 acres meadow good condition (composite CN = 58) and *Post-dev gravel* modeled as 0.22 acres gravel (CN = 85). Tc based on slope and surface is less than 5.0 minutes; therefore, a 5.0 minute minimum was applied.

Post-dev w/ BMP: This model is similar to the Post-dev no BMP model described above, only the gravel portion of the model has been modified to incorporate an adjusted Tc to account the for proposed BMP.

Adjusted Tc

Design Storm	Peak Rate (cfs)	BMP Volume (cf)	Tc (minute)	Adjusted Tc (minute)
2	0.417	2,502	5 (minimum)	100.0
10	0.736	2,502	5 (minimum)	56.7
25	0.991	2,502	5 (minimum)	42.1
50	1.123	2,502	5 (minimum)	37.1
100	1.486	2,502	5 (minimum)	28.1

Pre- vs. Post-Development Flow Rate Analysis

Post-development runoff flow rate for the site will not exceed rate calculated for the pre-development condition. Flow rate is controlled through the implementation of a GEOWEB cellular confinement system within the gravel pad of the proposed valve site.

Pre- vs. Post-Development Peak Discharge Summary

POI	Design Storm				
	2-year	10-year	25-year	50year	100-year
Pre-Dev Runoff	0.13	1.52	3.07	4.59	6.63
Post-Dev Runoff	0.13	1.29	2.75	4.16	6.21
Net	**0.00**	**-0.23**	**-0.32**	**-0.43**	**-0.42**

Pre- vs. Post-Development Runoff Volume Control

Pre- and post-development runoff volume was determined using the Runoff CN Method as defined in PADEP NPDES guidance. A minimal increase in runoff volume in the post-development site condition is anticipated as a result of the change in surface area from meadow to gravel; however, the associated volume increase is mitigated through use of a GEOWEB Cellular Confinement System, which will detain the volume increase within void space of the gravel pad thereby allowing for infiltration. PADEP Worksheets and supporting calculations are provided.

REFERENCES

1. Pennsylvania Department of Environmental Protection. Pennsylvania Stormwater Best Management Practices Manual. Technical Guidance No. 363-0300-002 December 2006.

2. Pennsylvania Department of Environmental Protection. Erosion and Sediment Control Best Management Practice Manual. Technical Guidance No. 363-2134-008. March 2012.

3. United States Department of Agriculture, Natural Resources Conservation Services. Technical Release 55: Urban Hydrology for Small Watersheds. June 1986.

4. United States Department of Agriculture Natural Resources Conservation Services Data Server. http://websoilsurvey.nrcs.usda.gov/app/

NOAA Atlas 14, Volume 2, Version 3
Location name: Mills, Pennsylvania, USA*
Latitude: 41.967°, Longitude: -77.7182°
Elevation: 1992 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

G.M. Bonnin, D. Martin, B. Lin, T. Parzybok, M.Yekta, and D. Riley

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

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

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.276 (0.249-0.308)	0.330 (0.297-0.368)	0.400 (0.360-0.446)	0.457 (0.410-0.507)	0.535 (0.477-0.592)	0.597 (0.529-0.661)	0.663 (0.585-0.733)	0.735 (0.644-0.812)	0.841 (0.728-0.927)	0.927 (0.795-1.02)
10-min	0.428 (0.386-0.478)	0.515 (0.464-0.575)	0.622 (0.560-0.693)	0.706 (0.633-0.783)	0.818 (0.729-0.905)	0.905 (0.803-1.00)	0.999 (0.881-1.10)	1.10 (0.961-1.21)	1.24 (1.07-1.36)	1.35 (1.16-1.49)
15-min	0.525 (0.474-0.586)	0.630 (0.568-0.703)	0.764 (0.687-0.851)	0.868 (0.779-0.963)	1.01 (0.900-1.12)	1.12 (0.994-1.24)	1.24 (1.09-1.37)	1.36 (1.20-1.51)	1.54 (1.34-1.70)	1.69 (1.45-1.86)
30-min	0.695 (0.627-0.776)	0.844 (0.760-0.941)	1.05 (0.941-1.16)	1.21 (1.08-1.34)	1.43 (1.27-1.58)	1.60 (1.42-1.77)	1.79 (1.58-1.98)	1.99 (1.74-2.20)	2.29 (1.98-2.52)	2.53 (2.17-2.79)
60-min	0.848 (0.765-0.947)	1.04 (0.932-1.16)	1.31 (1.18-1.46)	1.53 (1.38-1.70)	1.85 (1.65-2.05)	2.11 (1.87-2.34)	2.40 (2.11-2.65)	2.70 (2.37-2.99)	3.16 (2.74-3.49)	3.55 (3.05-3.92)
2-hr	0.988 (0.898-1.09)	1.20 (1.09-1.33)	1.52 (1.37-1.68)	1.78 (1.60-1.97)	2.18 (1.95-2.40)	2.54 (2.27-2.79)	2.96 (2.62-3.24)	3.44 (3.02-3.77)	4.21 (3.65-4.60)	4.91 (4.22-5.37)
3-hr	1.09 (0.990-1.21)	1.31 (1.19-1.46)	1.65 (1.49-1.83)	1.93 (1.74-2.14)	2.36 (2.12-2.60)	2.76 (2.46-3.02)	3.21 (2.84-3.51)	3.75 (3.29-4.09)	4.60 (3.99-5.01)	5.38 (4.61-5.86)
6-hr	1.38 (1.25-1.52)	1.65 (1.50-1.84)	2.04 (1.85-2.27)	2.38 (2.15-2.64)	2.90 (2.60-3.20)	3.38 (3.01-3.71)	3.92 (3.47-4.30)	4.56 (4.00-5.00)	5.59 (4.84-6.11)	6.52 (5.59-7.14)
12-hr	1.71 (1.56-1.91)	2.05 (1.87-2.30)	2.53 (2.29-2.83)	2.95 (2.66-3.28)	3.60 (3.22-4.00)	4.20 (3.74-4.65)	4.91 (4.32-5.42)	5.73 (5.00-6.31)	7.08 (6.08-7.78)	8.32 (7.05-9.13)
24-hr	2.03 (1.86-2.24)	2.43 (2.23-2.68)	2.99 (2.74-3.30)	3.48 (3.18-3.83)	4.27 (3.86-4.67)	4.99 (4.48-5.46)	5.85 (5.21-6.38)	6.88 (6.05-7.48)	8.54 (7.38-9.28)	10.1 (8.58-10.9)
2-day	2.35 (2.14-2.62)	2.80 (2.55-3.13)	3.44 (3.13-3.83)	4.02 (3.64-4.47)	4.95 (4.44-5.48)	5.82 (5.18-6.43)	6.86 (6.05-7.56)	8.12 (7.06-8.95)	10.2 (8.67-11.2)	12.1 (10.2-13.4)
3-day	2.48 (2.27-2.77)	2.96 (2.70-3.30)	3.63 (3.30-4.04)	4.23 (3.83-4.69)	5.19 (4.66-5.75)	6.10 (5.43-6.74)	7.18 (6.33-7.92)	8.49 (7.38-9.36)	10.6 (9.06-11.7)	12.6 (10.6-13.9)
4-day	2.62 (2.39-2.92)	3.12 (2.85-3.48)	3.81 (3.47-4.25)	4.43 (4.02-4.92)	5.44 (4.88-6.03)	6.38 (5.68-7.05)	7.50 (6.61-8.28)	8.86 (7.69-9.76)	11.1 (9.44-12.2)	13.2 (11.0-14.5)
7-day	3.15 (2.89-3.46)	3.72 (3.42-4.09)	4.44 (4.07-4.88)	5.08 (4.64-5.57)	6.10 (5.55-6.67)	7.04 (6.35-7.68)	8.14 (7.28-8.88)	9.44 (8.36-10.3)	11.5 (10.1-12.6)	13.5 (11.6-14.8)
10-day	3.62 (3.34-3.97)	4.26 (3.94-4.68)	5.04 (4.65-5.53)	5.74 (5.28-6.29)	6.83 (6.24-7.47)	7.83 (7.10-8.55)	9.00 (8.09-9.82)	10.4 (9.23-11.3)	12.6 (11.0-13.7)	14.6 (12.6-15.9)
20-day	5.02 (4.68-5.44)	5.89 (5.48-6.39)	6.82 (6.35-7.40)	7.62 (7.08-8.26)	8.84 (8.18-9.58)	9.92 (9.13-10.7)	11.1 (10.2-12.0)	12.5 (11.4-13.5)	14.6 (13.1-15.8)	16.5 (14.7-17.9)
30-day	6.30 (5.91-6.73)	7.34 (6.91-7.86)	8.37 (7.86-8.95)	9.25 (8.68-9.89)	10.6 (9.88-11.3)	11.7 (10.9-12.5)	13.0 (12.0-13.9)	14.4 (13.2-15.4)	16.5 (15.1-17.7)	18.3 (16.6-19.7)
45-day	8.10 (7.63-8.63)	9.44 (8.90-10.0)	10.6 (10.0-11.3)	11.7 (11.0-12.4)	13.1 (12.3-14.0)	14.4 (13.5-15.3)	15.7 (14.7-16.8)	17.2 (16.0-18.4)	19.3 (17.8-20.7)	21.1 (19.4-22.7)
60-day	9.79 (9.23-10.4)	11.4 (10.7-12.1)	12.7 (12.0-13.5)	13.9 (13.1-14.7)	15.5 (14.6-16.5)	16.9 (15.9-18.0)	18.4 (17.2-19.6)	20.1 (18.7-21.4)	22.4 (20.7-23.9)	24.4 (22.4-26.1)

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

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

Please refer to NOAA Atlas 14 document for more information.

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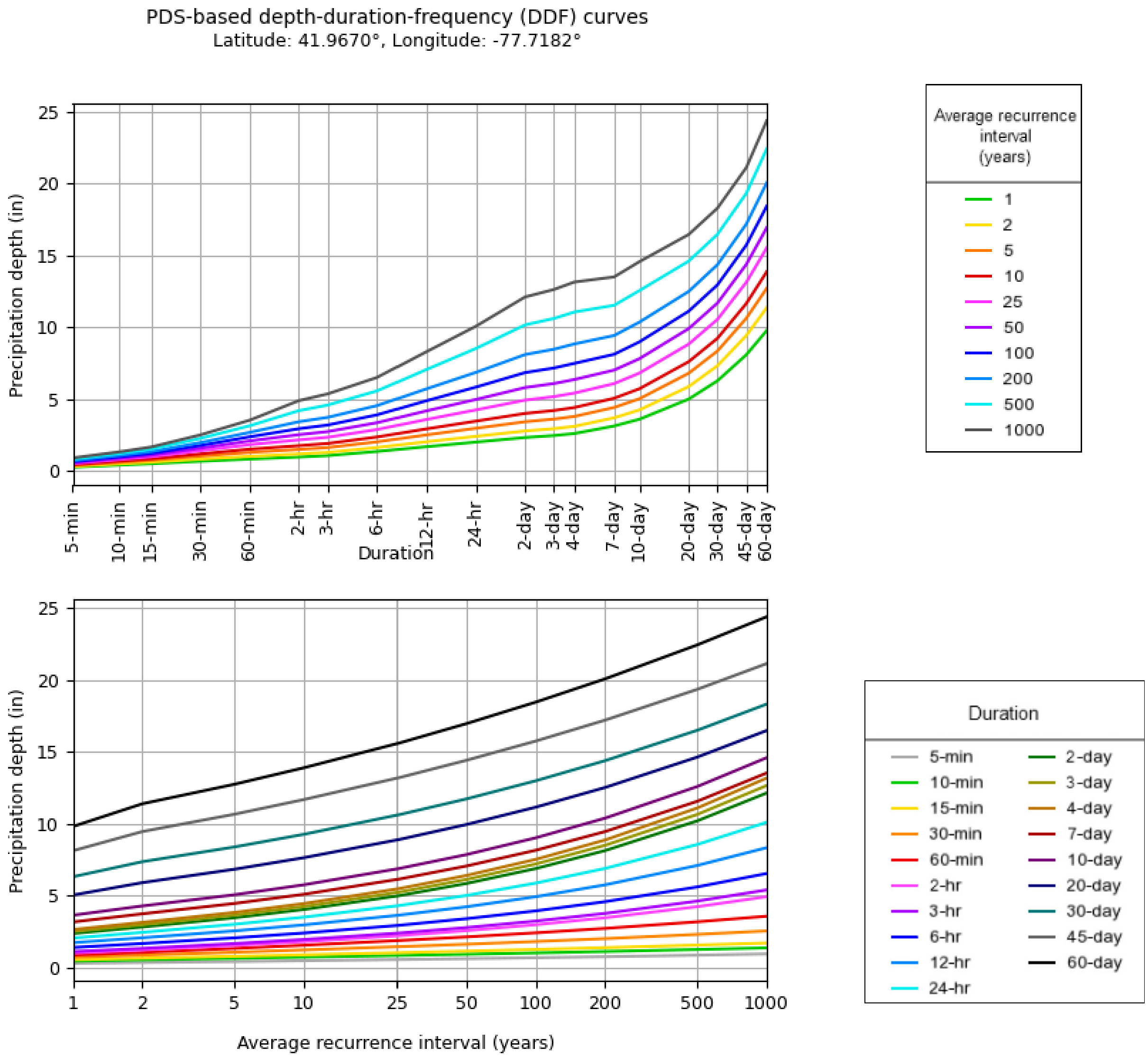
PF graphical



NOAA Atlas 14, Volume 2, Version 3

Created (GMT): Mon Nov 4 13:15:46 2024

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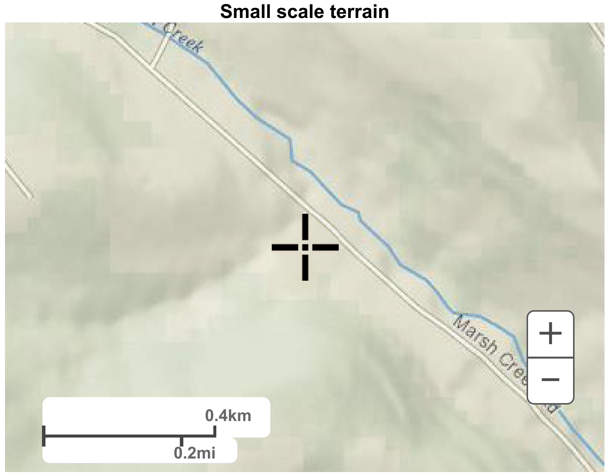
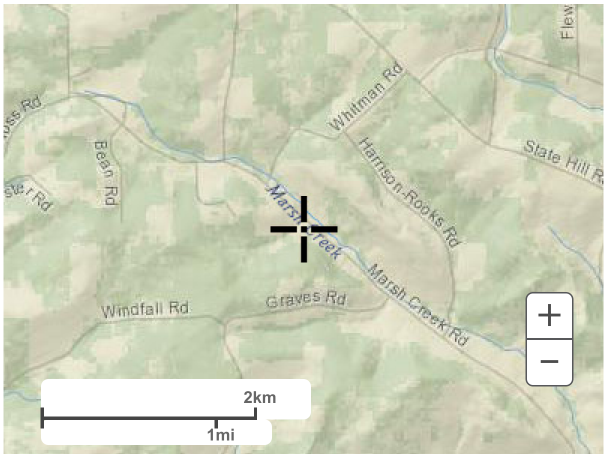
Maps & aerials

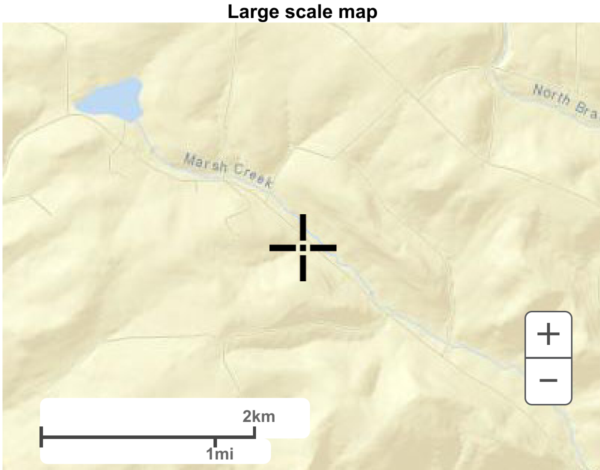
Small scale terrain



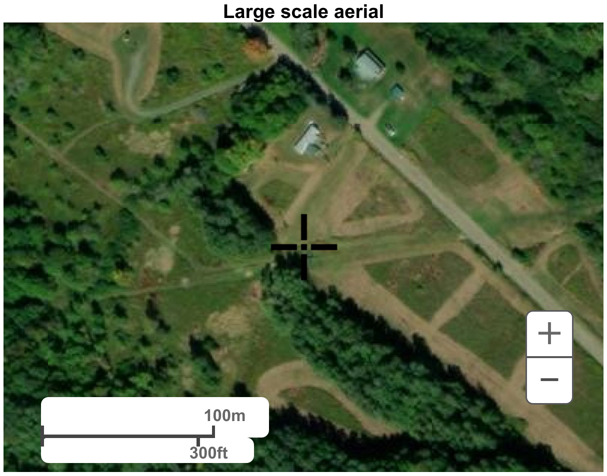
Large scale terrain



Large scale map



Large scale aerial



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NOAA Atlas 14, Volume 10, Version 3
Location name: Westfield, Pennsylvania, USA*
Latitude: 41.9821°, Longitude: -77.6486°
Elevation: 2194 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

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

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

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

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.303 (0.233-0.391)	0.361 (0.277-0.467)	0.456 (0.349-0.592)	0.535 (0.408-0.700)	0.643 (0.475-0.879)	0.725 (0.526-1.01)	0.810 (0.571-1.17)	0.903 (0.607-1.34)	1.03 (0.670-1.60)	1.14 (0.721-1.80)
10-min	0.429 (0.330-0.555)	0.511 (0.393-0.662)	0.646 (0.495-0.840)	0.757 (0.577-0.990)	0.911 (0.674-1.24)	1.03 (0.745-1.43)	1.15 (0.809-1.66)	1.28 (0.859-1.90)	1.46 (0.948-2.26)	1.61 (1.02-2.55)
15-min	0.504 (0.388-0.652)	0.601 (0.462-0.779)	0.759 (0.582-0.987)	0.890 (0.679-1.16)	1.07 (0.792-1.46)	1.21 (0.876-1.69)	1.35 (0.951-1.96)	1.50 (1.01-2.24)	1.72 (1.12-2.66)	1.90 (1.20-3.00)
30-min	0.681 (0.524-0.881)	0.811 (0.624-1.05)	1.02 (0.785-1.33)	1.20 (0.916-1.57)	1.44 (1.07-1.97)	1.63 (1.18-2.27)	1.82 (1.28-2.64)	2.03 (1.36-3.02)	2.32 (1.50-3.59)	2.56 (1.62-4.04)
60-min	0.857 (0.660-1.11)	1.02 (0.786-1.32)	1.29 (0.989-1.68)	1.51 (1.15-1.98)	1.82 (1.34-2.48)	2.05 (1.48-2.86)	2.29 (1.61-3.32)	2.55 (1.71-3.80)	2.92 (1.89-4.51)	3.22 (2.04-5.08)
2-hr	1.04 (0.806-1.34)	1.25 (0.968-1.61)	1.60 (1.23-2.06)	1.88 (1.44-2.44)	2.27 (1.69-3.09)	2.57 (1.87-3.57)	2.88 (2.04-4.15)	3.22 (2.17-4.76)	3.68 (2.39-5.66)	4.06 (2.58-6.38)
3-hr	1.16 (0.901-1.49)	1.40 (1.09-1.80)	1.79 (1.39-2.31)	2.12 (1.63-2.75)	2.57 (1.92-3.48)	2.91 (2.13-4.03)	3.26 (2.32-4.70)	3.65 (2.47-5.40)	4.21 (2.74-6.46)	4.67 (2.97-7.31)
6-hr	1.40 (1.09-1.78)	1.69 (1.32-2.16)	2.17 (1.69-2.78)	2.57 (1.99-3.31)	3.12 (2.35-4.23)	3.53 (2.61-4.90)	3.97 (2.86-5.75)	4.50 (3.05-6.62)	5.29 (3.45-8.08)	5.97 (3.81-9.30)
12-hr	1.68 (1.32-2.12)	2.03 (1.59-2.58)	2.61 (2.04-3.32)	3.09 (2.40-3.96)	3.76 (2.85-5.09)	4.24 (3.16-5.90)	4.78 (3.50-6.99)	5.48 (3.72-8.03)	6.62 (4.33-10.1)	7.64 (4.89-11.8)
24-hr	1.98 (1.56-2.49)	2.41 (1.90-3.04)	3.12 (2.45-3.95)	3.71 (2.90-4.72)	4.52 (3.45-6.11)	5.11 (3.84-7.10)	5.77 (4.27-8.45)	6.67 (4.54-9.73)	8.15 (5.34-12.3)	9.49 (6.09-14.6)
2-day	2.28 (1.81-2.86)	2.82 (2.24-3.53)	3.70 (2.92-4.65)	4.43 (3.48-5.61)	5.44 (4.16-7.29)	6.17 (4.65-8.50)	6.99 (5.16-10.1)	8.05 (5.50-11.7)	9.77 (6.43-14.7)	11.3 (7.28-17.3)
3-day	2.51 (2.00-3.13)	3.10 (2.46-3.87)	4.06 (3.22-5.09)	4.86 (3.83-6.13)	5.96 (4.58-7.96)	6.77 (5.11-9.28)	7.66 (5.66-11.0)	8.81 (6.04-12.7)	10.7 (7.02-16.0)	12.3 (7.92-18.8)
4-day	2.71 (2.16-3.37)	3.33 (2.66-4.15)	4.34 (3.45-5.42)	5.18 (4.09-6.51)	6.34 (4.87-8.43)	7.18 (5.42-9.81)	8.12 (6.00-11.6)	9.31 (6.39-13.4)	11.2 (7.41-16.8)	12.9 (8.33-19.7)
7-day	3.29 (2.64-4.07)	3.95 (3.16-4.89)	5.02 (4.01-6.24)	5.92 (4.69-7.40)	7.14 (5.51-9.43)	8.05 (6.09-10.9)	9.04 (6.68-12.8)	10.3 (7.08-14.7)	12.2 (8.10-18.2)	13.9 (9.01-21.1)
10-day	3.86 (3.10-4.76)	4.54 (3.64-5.60)	5.65 (4.52-7.00)	6.57 (5.22-8.19)	7.83 (6.05-10.3)	8.77 (6.64-11.8)	9.79 (7.22-13.8)	11.0 (7.61-15.7)	12.9 (8.57-19.1)	14.5 (9.42-22.0)
20-day	5.62 (4.54-6.88)	6.35 (5.12-7.79)	7.54 (6.07-9.29)	8.53 (6.82-10.6)	9.90 (7.65-12.8)	10.9 (8.26-14.5)	12.0 (8.78-16.5)	13.2 (9.15-18.7)	14.8 (9.88-21.8)	16.1 (10.5-24.3)
30-day	7.09 (5.75-8.66)	7.87 (6.38-9.62)	9.15 (7.38-11.2)	10.2 (8.19-12.6)	11.7 (9.03-15.0)	12.8 (9.67-16.8)	13.9 (10.1-18.9)	15.1 (10.5-21.2)	16.5 (11.1-24.2)	17.6 (11.5-26.5)
45-day	8.93 (7.26-10.9)	9.79 (7.95-11.9)	11.2 (9.07-13.7)	12.4 (9.95-15.2)	14.0 (10.8-17.8)	15.2 (11.5-19.8)	16.5 (12.0-22.1)	17.6 (12.3-24.7)	19.0 (12.7-27.7)	19.9 (13.0-29.8)
60-day	10.5 (8.54-12.7)	11.4 (9.29-13.9)	12.9 (10.5-15.8)	14.2 (11.5-17.4)	16.0 (12.4-20.3)	17.4 (13.1-22.5)	18.7 (13.6-24.9)	19.8 (13.9-27.8)	21.2 (14.3-30.9)	22.1 (14.5-33.1)

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

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

Please refer to NOAA Atlas 14 document for more information.

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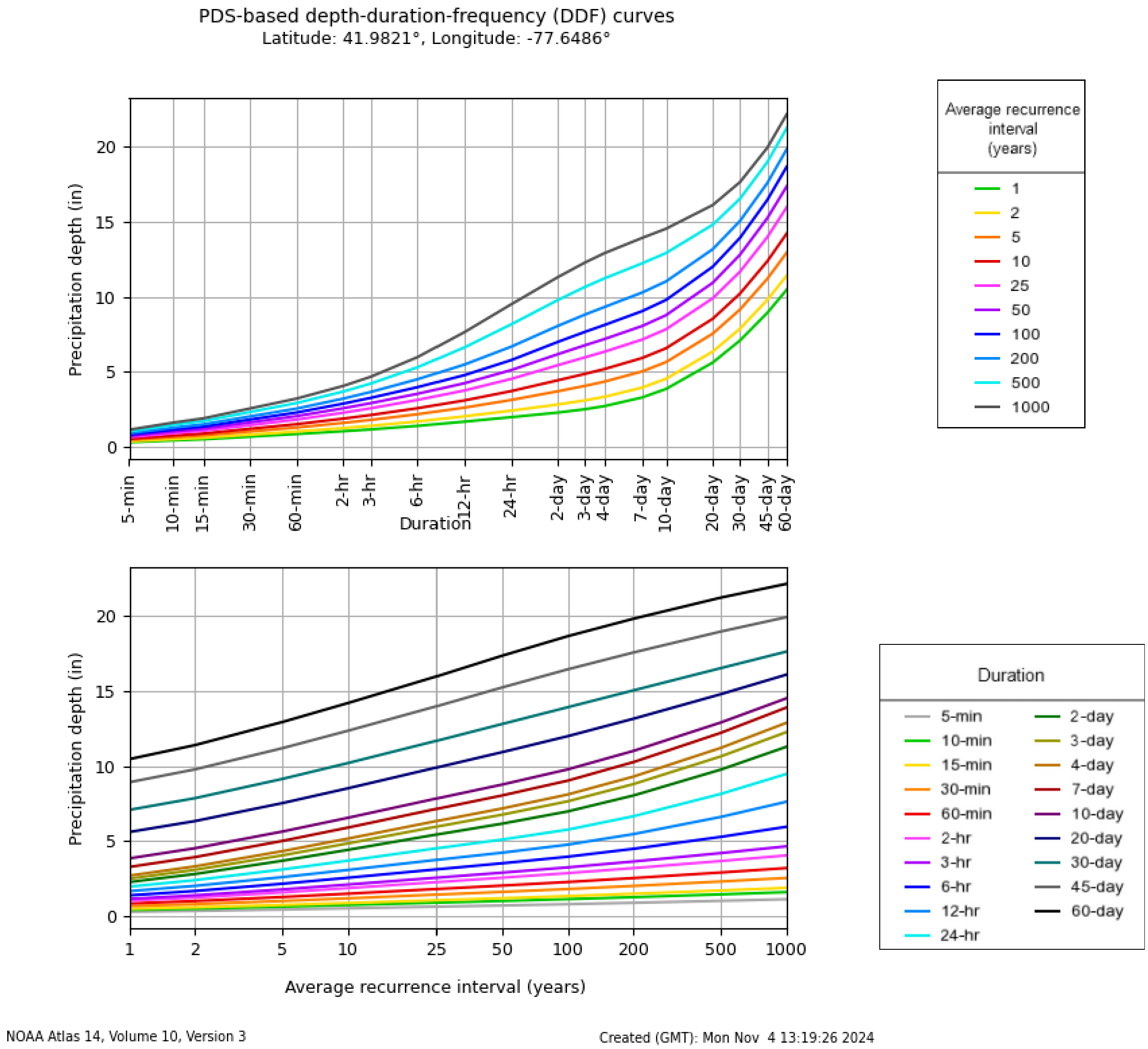
PF graphical



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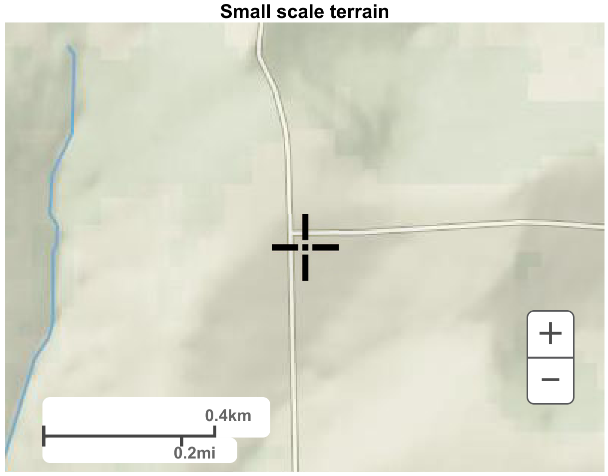
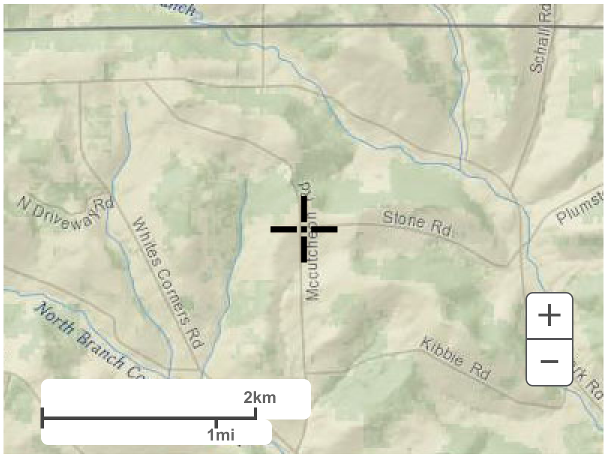
Maps & aerials

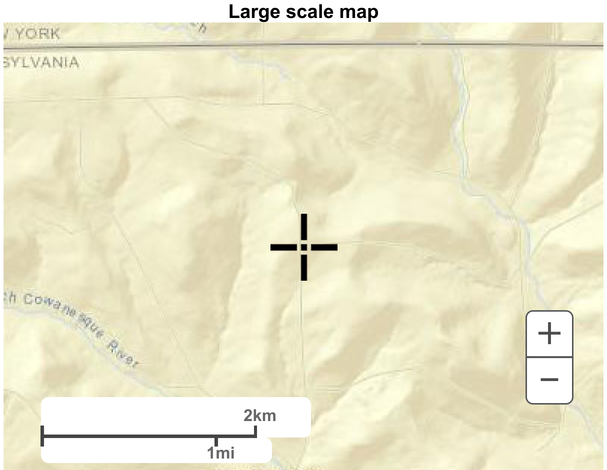
Small scale terrain



Large scale terrain



Large scale map



Large scale aerial

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National Oceanic and Atmospheric Administration
National Weather Service
National Water Center
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

Disclaimer

NOAA Atlas 14, Volume 2, Version 3
Location name: Westfield, Pennsylvania, USA*
Latitude: 41.914°, Longitude: -77.4836°
Elevation: 1443 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

G.M. Bonnin, D. Martin, B. Lin, T. Parzybok, M.Yekta, and D. Riley

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

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

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.272 (0.243-0.307)	0.327 (0.292-0.368)	0.396 (0.353-0.445)	0.452 (0.402-0.507)	0.529 (0.467-0.591)	0.591 (0.520-0.660)	0.656 (0.574-0.733)	0.728 (0.632-0.813)	0.834 (0.715-0.928)	0.920 (0.782-1.02)
10-min	0.423 (0.378-0.478)	0.510 (0.455-0.575)	0.615 (0.548-0.692)	0.697 (0.621-0.782)	0.808 (0.714-0.904)	0.895 (0.788-1.00)	0.988 (0.865-1.10)	1.09 (0.944-1.21)	1.23 (1.05-1.36)	1.34 (1.14-1.49)
15-min	0.519 (0.464-0.586)	0.624 (0.557-0.703)	0.755 (0.673-0.849)	0.858 (0.764-0.962)	0.999 (0.882-1.12)	1.11 (0.975-1.24)	1.23 (1.07-1.37)	1.35 (1.17-1.51)	1.53 (1.31-1.70)	1.67 (1.42-1.86)
30-min	0.686 (0.613-0.775)	0.835 (0.745-0.941)	1.03 (0.921-1.16)	1.19 (1.06-1.34)	1.41 (1.25-1.58)	1.58 (1.39-1.77)	1.77 (1.55-1.98)	1.97 (1.71-2.20)	2.27 (1.94-2.52)	2.51 (2.14-2.79)
60-min	0.838 (0.749-0.946)	1.02 (0.914-1.15)	1.30 (1.16-1.46)	1.52 (1.35-1.70)	1.83 (1.62-2.05)	2.09 (1.84-2.33)	2.37 (2.07-2.65)	2.68 (2.32-2.99)	3.14 (2.69-3.49)	3.52 (3.00-3.92)
2-hr	0.972 (0.877-1.08)	1.18 (1.06-1.32)	1.49 (1.34-1.66)	1.75 (1.57-1.94)	2.14 (1.91-2.38)	2.50 (2.22-2.76)	2.91 (2.57-3.21)	3.39 (2.96-3.73)	4.14 (3.58-4.56)	4.83 (4.14-5.31)
3-hr	1.05 (0.953-1.18)	1.27 (1.14-1.42)	1.59 (1.44-1.78)	1.87 (1.68-2.08)	2.29 (2.04-2.54)	2.67 (2.37-2.95)	3.11 (2.74-3.43)	3.63 (3.17-3.99)	4.45 (3.84-4.88)	5.20 (4.44-5.70)
6-hr	1.33 (1.20-1.48)	1.59 (1.44-1.78)	1.97 (1.78-2.20)	2.30 (2.07-2.56)	2.80 (2.50-3.11)	3.26 (2.90-3.60)	3.79 (3.34-4.17)	4.41 (3.86-4.84)	5.39 (4.66-5.92)	6.29 (5.38-6.90)
12-hr	1.66 (1.50-1.86)	1.99 (1.80-2.23)	2.45 (2.21-2.75)	2.86 (2.57-3.19)	3.49 (3.12-3.89)	4.08 (3.62-4.53)	4.76 (4.18-5.26)	5.56 (4.84-6.13)	6.86 (5.88-7.54)	8.05 (6.82-8.84)
24-hr	1.99 (1.82-2.21)	2.38 (2.17-2.64)	2.92 (2.66-3.24)	3.41 (3.09-3.77)	4.17 (3.75-4.60)	4.87 (4.35-5.36)	5.70 (5.05-6.26)	6.69 (5.86-7.33)	8.28 (7.13-9.05)	9.76 (8.28-10.6)
2-day	2.29 (2.08-2.57)	2.74 (2.48-3.07)	3.37 (3.05-3.77)	3.93 (3.55-4.40)	4.84 (4.32-5.39)	5.69 (5.04-6.32)	6.70 (5.87-7.42)	7.91 (6.84-8.76)	9.89 (8.40-11.0)	11.8 (9.82-13.0)
3-day	2.43 (2.21-2.70)	2.90 (2.64-3.23)	3.55 (3.22-3.94)	4.13 (3.74-4.59)	5.07 (4.55-5.62)	5.96 (5.30-6.58)	7.01 (6.17-7.72)	8.27 (7.18-9.10)	10.3 (8.81-11.4)	12.3 (10.3-13.5)
4-day	2.56 (2.34-2.84)	3.05 (2.79-3.38)	3.72 (3.40-4.12)	4.33 (3.94-4.78)	5.31 (4.78-5.84)	6.23 (5.56-6.83)	7.32 (6.47-8.02)	8.64 (7.53-9.45)	10.8 (9.23-11.8)	12.8 (10.8-14.0)
7-day	3.04 (2.80-3.33)	3.60 (3.32-3.94)	4.29 (3.95-4.69)	4.90 (4.50-5.36)	5.88 (5.37-6.41)	6.79 (6.15-7.38)	7.84 (7.05-8.53)	9.09 (8.08-9.88)	11.1 (9.69-12.1)	13.0 (11.2-14.2)
10-day	3.47 (3.21-3.78)	4.09 (3.79-4.46)	4.83 (4.47-5.26)	5.50 (5.07-5.98)	6.54 (6.00-7.10)	7.49 (6.83-8.13)	8.61 (7.77-9.32)	9.91 (8.86-10.7)	12.0 (10.6-13.0)	13.9 (12.1-15.0)
20-day	4.77 (4.46-5.14)	5.59 (5.22-6.04)	6.48 (6.04-6.99)	7.24 (6.74-7.80)	8.40 (7.79-9.04)	9.42 (8.70-10.1)	10.6 (9.71-11.4)	11.9 (10.8-12.8)	13.8 (12.5-14.9)	15.6 (13.9-16.8)
30-day	5.93 (5.58-6.34)	6.92 (6.52-7.40)	7.88 (7.42-8.41)	8.71 (8.20-9.29)	9.94 (9.33-10.6)	11.0 (10.3-11.7)	12.2 (11.3-13.0)	13.5 (12.5-14.4)	15.5 (14.2-16.6)	17.2 (15.6-18.4)
45-day	7.61 (7.18-8.08)	8.86 (8.37-9.41)	9.98 (9.43-10.6)	10.9 (10.3-11.6)	12.3 (11.6-13.1)	13.5 (12.6-14.3)	14.7 (13.8-15.6)	16.1 (15.0-17.1)	18.0 (16.7-19.2)	19.7 (18.1-21.0)
60-day	9.18 (8.66-9.74)	10.7 (10.1-11.3)	11.9 (11.2-12.6)	13.0 (12.2-13.8)	14.6 (13.7-15.4)	15.9 (14.9-16.8)	17.3 (16.1-18.3)	18.8 (17.5-19.9)	20.9 (19.4-22.3)	22.7 (20.9-24.3)

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

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

Please refer to NOAA Atlas 14 document for more information.

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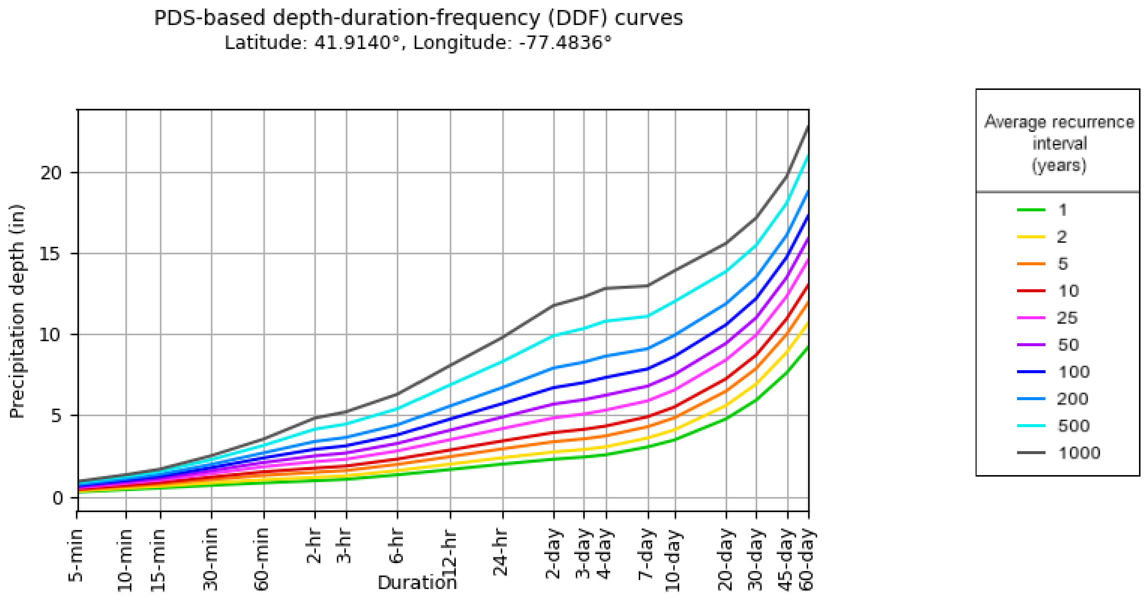
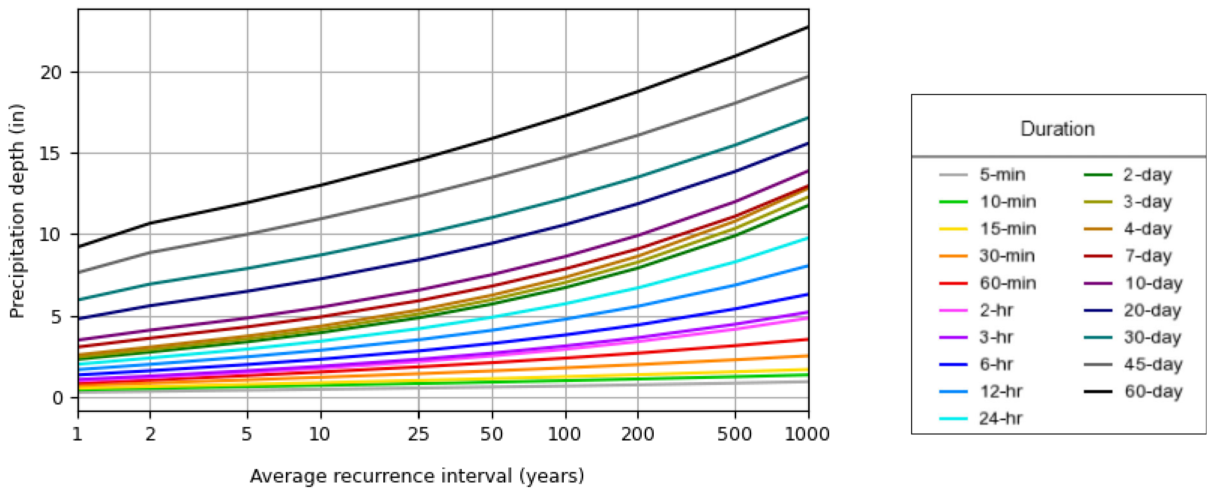
PF graphical





NOAA Atlas 14, Volume 2, Version 3

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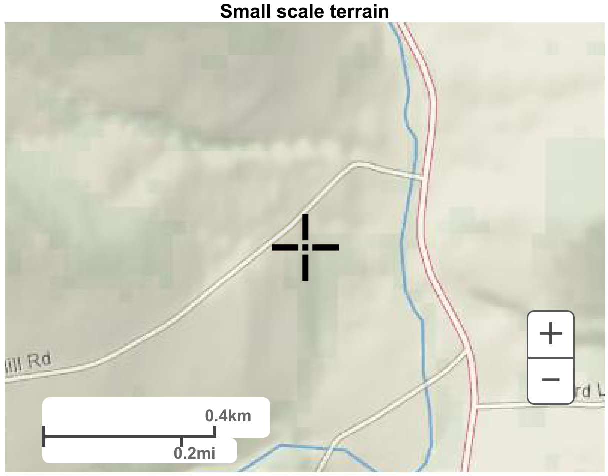
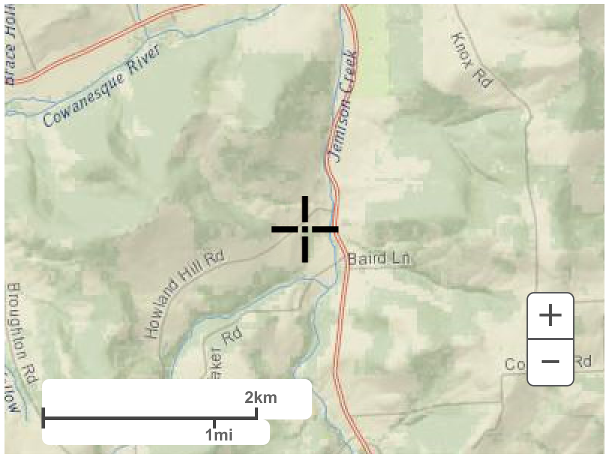
Maps & aerials

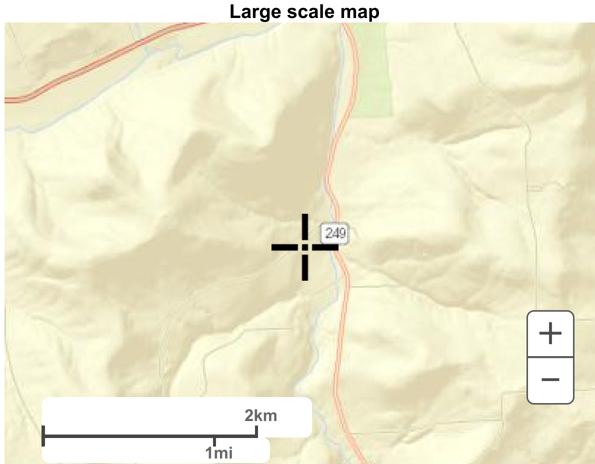
Small scale terrain



Large scale terrain



Large scale map



Large scale aerial

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National Oceanic and Atmospheric Administration
National Weather Service
National Water Center
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

Disclaimer

Worksheet 1. General Site Information

INSTRUCTIONS: Fill out Worksheet 1 for each watershed

Date: November 2024

Project Name: Tioga Pathway Project - Z20 Valve Site

Municipality: Harrison Township

County: Potter

Total Area (acres): 0.08

Major River Basin: Susquehanna River

http://www.pawaterplan.dep.state.pa.us/StateWaterPlan/docroot/default.aspx

Watershed: Tioga-Cowanesque Rivers

Sub-Basin: Upper Susquehanna River

Nearest Surface Water(s) to Receive Runoff: Marsh Creek

Chapter 93 – Designated Water Use: CWF

http://www.pacode.com/secure/data/025/chapter93/chap93toc.html

Impaired according to Category 4 or 5 of the Integrated Water Quality Monitoring and Assessment Report? Yes ☐ No ☑

http://www.portal.state.pa.us/portal/server.pt/community/water_quality_standards/10556/integrated_water_quality_report_-_2010/682562

List Causes of Impairment:

Is there an established TMDL that applies: Yes ☐ No ☑

Total Maximum Daily Loads (TMDLS)

http://www.dep.state.pa.us/watermanagement_apps/tmdl/.

http://www.epa.gov/reg3wapd/tmdl/pa_tmdl/index.htm

Is project subject to, or part of:

Municipal Separate Storm Sewer System (MS4) Requirements? Yes ☐ No ☑

http://www.portal.state.pa.us/portal/server.pt/community/stormwater_management/10628/npdes_ms4%C2%A0information/669119

Existing or planned drinking water supply? Yes ☐ No ☑

If yes, distance from proposed discharge (miles):

Approved Act 167 Plan? Yes ☑ No ☐

http://www.portal.state.pa.us/portal/server.pt?open=514&objID=554325&mode=2

Existing River Conservation Plan? Yes ☐ No ☑

http://www.dcnr.state.pa.us/brc/rivers/riversconservation/registry/

Worksheet 2. Sensitive Natural Resources

INSTRUCTIONS

1. Provide Sensitive Resources Map according to non-structural BMP 5.4.1 in Chapter 5. This map should identify wetlands, woodlands, natural drainage ways, steep slopes, and other sensitive natural areas.

2. Summarize the existing extent of each sensitive resource in the Existing Sensitive Resources Table (below, using Acres). If none present, insert 0.

3. Summarize Total Protected Area as defined under BMPs in Chapter 5.

4. Do not count any area twice. For example, an area that is both a floodplain and a wetland may only be considered once.

EXISTING NATURAL SENSITIVE RESOURCE	MAPPED? Yes/no/n/a	TOTAL AREA (Ac.)	PROTECTED AREA (Ac.)
Waterbodies	n/a	0	0
Floodplains	n/a	0	0
Riparian Areas	n/a	0	0
Wetlands	n/a	0	0
Woodlands	n/a	0	0
Natural Drainage Ways	n/a	0	0
Steep Slopes, 15% - 25%	n/a	0	0
Steep Slopes, over 25%	n/a	0	0
Other:			
Other:			
TOTAL EXISTING:		**0**	**0**

Worksheet 3. Nonstructural BMP Credits

PROTECTED AREA

1.1 Area of Protected Sensitive/Special Value Features (see WS 2)	0	**Ac.**
1.2 Area of Riparian Forest Buffer Protection	0	**Ac.**
3.1 Area of Minimum Disturbance/Reduced Grading	0	**Ac**
TOTAL	**0**	**Ac**

Site Area	Minus	Protected Area	=	Stormwater Management Area
0.08	-	0.00	=	0.08

This is the area that requires stormwater management

VOLUME CREDITS

3.1 Minimum Soil Compaction (See Chapter 8, page 22 – SW BMP Manual)

Lawn	____ ft^2	x 1/4" x 1/12	=	0	ft^3
Meadow	____ ft^2	x 1/3" x 1/12	=	0	ft^3

3.3 Protect Existing Trees (See Chapter 8, page 23 – SW BMP Manual)

For Trees within 100 feet of impervious area:

Tree Canopy	____ ft^2	x 1/2" x 1/12	=	0	ft^3

5.1 Disconnect Roof Leaders to Vegetated Areas (See Chapter 8 page 25 – SW BMP Manual)

For runoff directed to areas protected under 5.8.1 and 5.8.2

Roof Area	____ ft^2	x 1/3" x 1/12	=	0	ft^3

For all other disconnected roof areas

Roof Area	____ ft^2	x 1/4" x 1/12	=	0	ft^3

5.2 Disconnect Non-Roof impervious to Vegetated Areas (See Chapter 8, page 26 – SW BMP Manual)

For Runoff directed to areas protected under 5.8.1 and 5.8.2

Impervious Area	____ ft^2	x 1/3" x 1/12	=	0	ft^3

For all other disconnected roof areas

Impervious Area	____ ft^2	x 1/4" x 1/12	=	0	ft^3

TOTAL NON-STRUCTURAL VOLUME CREDIT* **0** ft

**For use on Worksheet 5*

Worksheet 4. Change in Runoff Volume for 2-YR Storm Event

PROJECT: Tioga Pathway Project - Z20 Valve Site
Drainage Area: 0.08 acres
2-Year Rainfall: 2.43 (in)

Total Site Area: 0.08 acres
Protected Site Area: 0 acres
Managed Area: 0.08 acres

Existing Conditions:

Cover Type / Condition	Soil Type	Area (sf)	Area (ac)	CN	S	Ia (0.2*S)	Q Runoff[1] (in)	Runoff Volume[2] (ft^3)
Meadow (good condition)	D	3,600	0.08	78	2.82	0.56	0.74	223
TOTAL (PRE):		3,600	0.08					223

Developed Conditions:

Cover Type / Condition	Soil Type	Area (sf)	Area (ac)	CN	S	Ia (0.2*S)	Q Runoff[1] (in)	Runoff Volume[2] (ft^3)
Meadow (good condition)	D	0	0.00	78	2.82	0.56	0.74	0
Impervious (i.e., gravel)	D	3,600	0.08	91	0.99	0.20	1.55	464
TOTAL (POST):		3,600	0.08					464

2-Year Volume Increase (ft^3):	**464 - 223 = 241**

2-Year Volume Increase = Developed Conditions Runoff Volume - Existing Conditions Runoff Volume

1. Runoff (in) = $Q = (P - 0.2S)^2 / (P + 0.8S)$ where
   P = 2-Year Rainfall (in)
   S = (1000 / CN) - 10

2. Runoff Volume (CF) = Q x Area x 1/12
   Q = Runoff (in)
   Area = Land use area (ft^2)

Worksheet 5. Structural BMP Volume Credits

PROJECT: Tioga Pathway Project - Z20 Valve Site
SUB-BASIN: Upper Susquehanna River

Required Control Volume (ft^3) – *from Worksheet 4*: 241

Non-structural Volume Credit (ft^3) – *from Worksheet 3*: - 0
(maximum is 25% of required volume)

Structural Volume Reqmt (ft^3) 241

(Required Control Volume minus Non-structural Credit)

Proposed BMP		Area (ft^2)	Volume Reduction Permanently Removed (ft^3)
6.4.1	Porous Pavement		
6.4.2	Infiltration Basin		
6.4.3	Infiltration Bed		
6.4.4	Infiltration Trench		
6.4.5	Rain Garden/Bioretention		
6.4.6	Dry Well / Seepage Pit		
6.4.7	Constructed Filter		
6.4.8	Vegetated Swale		
6.4.9	Vegetated Filter Strip		
6.4.10	Berm		
6.5.1	Vegetated Roof		
6.5.2	Capture and Re-use		
6.6.1	Constructed Wetlands		
6.6.2	Wet Pond / Retention Basin		
6.7.1	Riparian Buffer/Riparian Forest Buffer Restoration		
6.7.2	Landscape Restoration / Reforestation		
6.7.3	Soil Amendment		
6.8.1	Level Spreader		
6.8.2	Special Storage Areas		
Other		(GEOWEB) 1260	252

Total Structural Volume (ft^3): 252
Structural Volume Requirement (ft^3): 241
DIFFERENCE **11**

Worksheet 1. General Site Information

INSTRUCTIONS: Fill out Worksheet 1 for each watershed

Date: November 2024

Project Name: Tioga Pathway Project - McCutcheon Hill OPP Sta.

Municipality: Harrison Township

County: Potter

Total Area (acres): 0.54

Major River Basin: Susquehanna River

http://www.pawaterplan.dep.state.pa.us/StateWaterPlan/docroot/default.aspx

Watershed: Tioga-Cowanesque Rivers

Sub-Basin: Upper Susquehanna River

Nearest Surface Water(s) to Receive Runoff: UNT to North Branch Cowanesque River

Chapter 93 – Designated Water Use: CWF

http://www.pacode.com/secure/data/025/chapter93/chap93toc.html

Impaired according to Category 4 or 5 of the Integrated Water Quality Monitoring and Assessment Report? Yes ☐ No ☑

http://www.portal.state.pa.us/portal/server.pt/community/water_quality_standards/10556/integrated_water_quality_report_-_2010/682562

List Causes of Impairment:

Is there an established TMDL that applies: Yes ☐ No ☑

Total Maximum Daily Loads (TMDLS)

http://www.dep.state.pa.us/watermanagement_apps/tmdl/.

http://www.epa.gov/reg3wapd/tmdl/pa_tmdl/index.htm

Is project subject to, or part of:

Municipal Separate Storm Sewer System (MS4) Requirements? Yes ☐ No ☑

http://www.portal.state.pa.us/portal/server.pt/community/stormwater_management/10628/npdes_ms4%C2%A0information/669119

Existing or planned drinking water supply? Yes ☐ No ☑

If yes, distance from proposed discharge (miles):

Approved Act 167 Plan? Yes ☑ No ☐

http://www.portal.state.pa.us/portal/server.pt?open=514&objID=554325&mode=2

Existing River Conservation Plan? Yes ☐ No ☑

http://www.dcnr.state.pa.us/brc/rivers/riversconservation/registry/

Worksheet 2. Sensitive Natural Resources

INSTRUCTIONS

1. Provide Sensitive Resources Map according to non-structural BMP 5.4.1 in Chapter 5. This map should identify wetlands, woodlands, natural drainage ways, steep slopes, and other sensitive natural areas.

2. Summarize the existing extent of each sensitive resource in the Existing Sensitive Resources Table (below, using Acres). If none present, insert 0.

3. Summarize Total Protected Area as defined under BMPs in Chapter 5.

4. Do not count any area twice. For example, an area that is both a floodplain and a wetland may only be considered once.

EXISTING NATURAL SENSITIVE RESOURCE	MAPPED? Yes/no/n/a	TOTAL AREA (Ac.)	PROTECTED AREA (Ac.)
Waterbodies	n/a	0	0
Floodplains	n/a	0	0
Riparian Areas	n/a	0	0
Wetlands	n/a	0	0
Woodlands	n/a	0	0
Natural Drainage Ways	n/a	0	0
Steep Slopes, 15% - 25%	n/a	0	0
Steep Slopes, over 25%	n/a	0	0
Other:			
Other:			
TOTAL EXISTING:		**0**	**0**

Worksheet 3. Nonstructural BMP Credits

PROTECTED AREA

1.1 Area of Protected Sensitive/Special Value Features (see WS 2)	0 **Ac.**
1.2 Area of Riparian Forest Buffer Protection	0 **Ac.**
3.1 Area of Minimum Disturbance/Reduced Grading	0 **Ac**
TOTAL	**0** **Ac**

Site Area	Minus	Protected Area	=	Stormwater Management Area
0.54	-	0.00	=	0.54

This is the area that requires stormwater management

VOLUME CREDITS

3.1 Minimum Soil Compaction (See Chapter 8, page 22 – SW BMP Manual)

Lawn	____ ft^2	x 1/4" x 1/12	=	0 ft^3
Meadow	____ ft^2	x 1/3" x 1/12	=	0 ft^3

3.3 Protect Existing Trees (See Chapter 8, page 23 – SW BMP Manual)

For Trees within 100 feet of impervious area:

Tree Canopy	____ ft^2	x 1/2" x 1/12	=	0 ft^3

5.1 Disconnect Roof Leaders to Vegetated Areas (See Chapter 8 page 25 – SW BMP Manual)

For runoff directed to areas protected under 5.8.1 and 5.8.2

Roof Area	____ ft^2	x 1/3" x 1/12	=	0 ft^3

For all other disconnected roof areas

Roof Area	____ ft^2	x 1/4" x 1/12	=	0 ft^3

5.2 Disconnect Non-Roof impervious to Vegetated Areas (See Chapter 8, page 26 – SW BMP Manual)

For Runoff directed to areas protected under 5.8.1 and 5.8.2

Impervious Area	____ ft^2	x 1/3" x 1/12	=	0 ft^3

For all other disconnected roof areas

Impervious Area	____ ft^2	x 1/4" x 1/12	=	0 ft^3

TOTAL NON-STRUCTURAL VOLUME CREDIT* **0** ft

**For use on Worksheet 5*

Worksheet 4. Change in Runoff Volume for 2-YR Storm Event

PROJECT: Tioga Pathway Project - McCutcheon Hill OPP Sta.
Drainage Area: 0.54 acres
2-Year Rainfall: 2.41 (in)

Total Site Area: 0.54 acres
Protected Site Area: 0 acres
Managed Area: 0.54 acres

Existing Conditions:

Cover Type / Condition	Soil Type	Area (sf)	Area (ac)	CN	S	Ia (0.2*S)	Q Runoff[1] (in)	Runoff Volume[2] (ft^3)
Meadow (good condition)	D	23,695	0.54	78	2.82	0.56	0.73	1,442
TOTAL (PRE):		23,695	0.54					1,442

Developed Conditions:

Cover Type / Condition	Soil Type	Area (sf)	Area (ac)	CN	S	Ia (0.2*S)	Q Runoff[1] (in)	Runoff Volume[2] (ft^3)
Meadow (good condition)	D	0	0.00	78	2.82	0.56	0.73	0
Impervious (i.e., gravel)	D	23,695	0.54	91	0.99	0.20	1.53	3,019
TOTAL (POST):		23,695	0.54					3,019

2-Year Volume Increase (ft^3):	**3019 - 1442 = 1577**

2-Year Volume Increase = Developed Conditions Runoff Volume - Existing Conditions Runoff Volume

1. Runoff (in) = $Q = (P - 0.2S)^2 / (P + 0.8S)$ where
   P = 2-Year Rainfall (in)
   S = (1000 / CN) - 10

2. Runoff Volume (CF) = Q x Area x 1/12
   Q = Runoff (in)
   Area = Land use area (ft^2)

Worksheet 5. Structural BMP Volume Credits

PROJECT: Tioga Pathway Project - McCutcheon Hill OPP Sta.
SUB-BASIN: Upper Susquehanna River

Required Control Volume (ft^3) – *from Worksheet 4*: 1577

Non-structural Volume Credit (ft^3) – *from Worksheet 3*: - 0
(maximum is 25% of required volume)

Structural Volume Reqmt (ft^3) 1577

(Required Control Volume minus Non-structural Credit)

	Proposed BMP	Area (ft^2)	Volume Reduction Permanently Removed (ft^3)
6.4.1	Porous Pavement		
6.4.2	Infiltration Basin		
6.4.3	Infiltration Bed		
6.4.4	Infiltration Trench		
6.4.5	Rain Garden/Bioretention		
6.4.6	Dry Well / Seepage Pit		
6.4.7	Constructed Filter		
6.4.8	Vegetated Swale		
6.4.9	Vegetated Filter Strip		
6.4.10	Berm		
6.5.1	Vegetated Roof		
6.5.2	Capture and Re-use		
6.6.1	Constructed Wetlands		
6.6.2	Wet Pond / Retention Basin		
6.7.1	Riparian Buffer/Riparian Forest Buffer Restoration		
6.7.2	Landscape Restoration / Reforestation		
6.7.3	Soil Amendment		
6.8.1	Level Spreader		
6.8.2	Special Storage Areas		
Other		(GEOWEB) 8400	1680

Total Structural Volume (ft^3): 1680
Structural Volume Requirement (ft^3): 1577
DIFFERENCE **103**

Worksheet 1. General Site Information

INSTRUCTIONS: Fill out Worksheet 1 for each watershed

Date: November 2024

Project Name: Tioga Pathway Project - YM59 Valve Site

Municipality: Westfield Township

County: Tioga

Total Area (acres): 0.05

Major River Basin: Susquehanna River

http://www.pawaterplan.dep.state.pa.us/StateWaterPlan/docroot/default.aspx

Watershed: Tioga-Cowanesque Rivers

Sub-Basin: Upper Susquehanna River

Nearest Surface Water(s) to Receive Runoff: Jemison Creek

Chapter 93 – Designated Water Use: WWF

http://www.pacode.com/secure/data/025/chapter93/chap93toc.html

Impaired according to Category 4 or 5 of the Integrated Water Quality Monitoring and Assessment Report? Yes ☐ No ☑

http://www.portal.state.pa.us/portal/server.pt/community/water_quality_standards/10556/integrated_water_quality_report_-_2010/682562

List Causes of Impairment:

Is there an established TMDL that applies: Yes ☐ No ☑

Total Maximum Daily Loads (TMDLS)

http://www.dep.state.pa.us/watermanagement_apps/tmdl/.

http://www.epa.gov/reg3wapd/tmdl/pa_tmdl/index.htm

Is project subject to, or part of:

Municipal Separate Storm Sewer System (MS4) Requirements? Yes ☐ No ☑

http://www.portal.state.pa.us/portal/server.pt/community/stormwater_management/10628/npdes_ms4%C2%A0information/669119

Existing or planned drinking water supply? Yes ☐ No ☑

If yes, distance from proposed discharge (miles):

Approved Act 167 Plan? Yes ☑ No ☐

http://www.portal.state.pa.us/portal/server.pt?open=514&objID=554325&mode=2

Existing River Conservation Plan? Yes ☐ No ☑

http://www.dcnr.state.pa.us/brc/rivers/riversconservation/registry/

Worksheet 2. Sensitive Natural Resources

INSTRUCTIONS

1. Provide Sensitive Resources Map according to non-structural BMP 5.4.1 in Chapter 5. This map should identify wetlands, woodlands, natural drainage ways, steep slopes, and other sensitive natural areas.

2. Summarize the existing extent of each sensitive resource in the Existing Sensitive Resources Table (below, using Acres). If none present, insert 0.

3. Summarize Total Protected Area as defined under BMPs in Chapter 5.

4. Do not count any area twice. For example, an area that is both a floodplain and a wetland may only be considered once.

EXISTING NATURAL SENSITIVE RESOURCE	MAPPED? Yes/no/n/a	TOTAL AREA (Ac.)	PROTECTED AREA (Ac.)
Waterbodies	n/a	0	0
Floodplains	n/a	0	0
Riparian Areas	n/a	0	0
Wetlands	n/a	0	0
Woodlands	n/a	0	0
Natural Drainage Ways	n/a	0	0
Steep Slopes, 15% - 25%	n/a	0	0
Steep Slopes, over 25%	n/a	0	0
Other:			
Other:			
TOTAL EXISTING:		**0**	**0**

Worksheet 3. Nonstructural BMP Credits

PROTECTED AREA

1.1 Area of Protected Sensitive/Special Value Features (see WS 2)	0 **Ac.**
1.2 Area of Riparian Forest Buffer Protection	0 **Ac.**
3.1 Area of Minimum Disturbance/Reduced Grading	0 **Ac**
TOTAL	**0** **Ac**

Site Area	Minus	Protected Area	=	Stormwater Management Area
0.05	-	0.00	=	0.05

This is the area that requires stormwater management

VOLUME CREDITS

3.1 Minimum Soil Compaction (See Chapter 8, page 22 – SW BMP Manual)

Lawn	_____ ft^2	x 1/4" x 1/12	=	0 ft^3
Meadow	_____ ft^2	x 1/3" x 1/12	=	0 ft^3

3.3 Protect Existing Trees (See Chapter 8, page 23 – SW BMP Manual)

For Trees within 100 feet of impervious area:

Tree Canopy	_____ ft^2	x 1/2" x 1/12	=	0 ft^3

5.1 Disconnect Roof Leaders to Vegetated Areas (See Chapter 8 page 25 – SW BMP Manual)

For runoff directed to areas protected under 5.8.1 and 5.8.2

Roof Area	_____ ft^2	x 1/3" x 1/12	=	0 ft^3

For all other disconnected roof areas

Roof Area	_____ ft^2	x 1/4" x 1/12	=	0 ft^3

5.2 Disconnect Non-Roof impervious to Vegetated Areas (See Chapter 8, page 26 – SW BMP Manual)

For Runoff directed to areas protected under 5.8.1 and 5.8.2

Impervious Area	_____ ft^2	x 1/3" x 1/12	=	0 ft^3

For all other disconnected roof areas

Impervious Area	_____ ft^2	x 1/4" x 1/12	=	0 ft^3

TOTAL NON-STRUCTURAL VOLUME CREDIT* **0** ft

**For use on Worksheet 5*

Worksheet 4. Change in Runoff Volume for 2-YR Storm Event

PROJECT: Tioga Pathway Project - YM59 Valve Site
Drainage Area: 0.05 acres
2-Year Rainfall: 2.38 (in)

Total Site Area: 0.05 acres
Protected Site Area: 0 acres
Managed Area: 0.05 acres

Existing Conditions:

Cover Type / Condition	Soil Type	Area (sf)	Area (ac)	CN	S	Ia (0.2*S)	Q Runoff[1] (in)	Runoff Volume[2] (ft^3)
Meadow (good condition)	D	1,985	0.05	78	2.82	0.56	0.71	118
TOTAL (PRE):		1,985	0.05					118

Developed Conditions:

Cover Type / Condition	Soil Type	Area (sf)	Area (ac)	CN	S	Ia (0.2*S)	Q Runoff[1] (in)	Runoff Volume[2] (ft^3)
Meadow (good condition)	D	0	0.00	78	2.82	0.56	0.71	0
Impervious (i.e., gravel)	D	1,985	0.05	91	0.99	0.20	1.50	248
TOTAL (POST):		1,985	0.05					248

2-Year Volume Increase (ft^3):	**248 - 118 = 131**

2-Year Volume Increase = Developed Conditions Runoff Volume - Existing Conditions Runoff Volume

1. Runoff (in) = Q = $(P - 0.2S)^2 / (P + 0.8S)$ where
   P = 2-Year Rainfall (in)
   S = (1000 / CN) - 10

2. Runoff Volume (CF) = Q x Area x 1/12
   Q = Runoff (in)
   Area = Land use area (ft^2)

Worksheet 5. Structural BMP Volume Credits

PROJECT: Tioga Pathway Project - YM59 Valve Site
SUB-BASIN: Upper Susquehanna River

Required Control Volume (ft^3) – *from Worksheet 4*: 131

Non-structural Volume Credit (ft^3) – *from Worksheet 3*: - 0
(maximum is 25% of required volume)

Structural Volume Reqmt (ft^3) 131

(Required Control Volume minus Non-structural Credit)

Proposed BMP		Area (ft^2)	Volume Reduction Permanently Removed (ft^3)
6.4.1	Porous Pavement		
6.4.2	Infiltration Basin		
6.4.3	Infiltration Bed		
6.4.4	Infiltration Trench		
6.4.5	Rain Garden/Bioretention		
6.4.6	Dry Well / Seepage Pit		
6.4.7	Constructed Filter		
6.4.8	Vegetated Swale		
6.4.9	Vegetated Filter Strip		
6.4.10	Berm		
6.5.1	Vegetated Roof		
6.5.2	Capture and Re-use		
6.6.1	Constructed Wetlands		
6.6.2	Wet Pond / Retention Basin		
6.7.1	Riparian Buffer/Riparian Forest Buffer Restoration		
6.7.2	Landscape Restoration / Reforestation		
6.7.3	Soil Amendment		
6.8.1	Level Spreader		
6.8.2	Special Storage Areas		
Other		(GEOWEB) 735	151

Total Structural Volume (ft^3): 147
Structural Volume Requirement (ft^3): 131
DIFFERENCE **9**

Worksheet 1. General Site Information

INSTRUCTIONS: Fill out Worksheet 1 for each watershed

Date: November 2024

Project Name: Tioga Pathway Project - YM59 PAR-9

Municipality: Westfield Township

County: Tioga

Total Area (acres): 0.22

Major River Basin: Susquehanna River

http://www.pawaterplan.dep.state.pa.us/StateWaterPlan/docroot/default.aspx

Watershed: Tioga-Cowanesque Rivers

Sub-Basin: Upper Susquehanna River

Nearest Surface Water(s) to Receive Runoff: Jemison Creek

Chapter 93 – Designated Water Use: WWF

http://www.pacode.com/secure/data/025/chapter93/chap93toc.html

Impaired according to Category 4 or 5 of the Integrated Water Quality Monitoring and Assessment Report? Yes ☐ No ☑

http://www.portal.state.pa.us/portal/server.pt/community/water_quality_standards/10556/integrated_water_quality_report_-_2010/682562

List Causes of Impairment:

Is there an established TMDL that applies: Yes ☐ No ☑

Total Maximum Daily Loads (TMDLS)

http://www.dep.state.pa.us/watermanagement_apps/tmdl/.

http://www.epa.gov/reg3wapd/tmdl/pa_tmdl/index.htm

Is project subject to, or part of:

Municipal Separate Storm Sewer System (MS4) Requirements? Yes ☐ No ☑

http://www.portal.state.pa.us/portal/server.pt/community/stormwater_management/10628/npdes_ms4%C2%A0information/669119

Existing or planned drinking water supply? Yes ☐ No ☑

If yes, distance from proposed discharge (miles):

Approved Act 167 Plan? Yes ☑ No ☐

http://www.portal.state.pa.us/portal/server.pt?open=514&objID=554325&mode=2

Existing River Conservation Plan? Yes ☐ No ☑

http://www.dcnr.state.pa.us/brc/rivers/riversconservation/registry/

Worksheet 2. Sensitive Natural Resources

INSTRUCTIONS

1. Provide Sensitive Resources Map according to non-structural BMP 5.4.1 in Chapter 5. This map should identify wetlands, woodlands, natural drainage ways, steep slopes, and other sensitive natural areas.

2. Summarize the existing extent of each sensitive resource in the Existing Sensitive Resources Table (below, using Acres). If none present, insert 0.

3. Summarize Total Protected Area as defined under BMPs in Chapter 5.

4. Do not count any area twice. For example, an area that is both a floodplain and a wetland may only be considered once.

EXISTING NATURAL SENSITIVE RESOURCE	MAPPED? Yes/no/n/a	TOTAL AREA (Ac.)	PROTECTED AREA (Ac.)
Waterbodies	n/a	0	0
Floodplains	n/a	0	0
Riparian Areas	n/a	0	0
Wetlands	n/a	0	0
Woodlands	n/a	0	0
Natural Drainage Ways	n/a	0	0
Steep Slopes, 15% - 25%	n/a	0	0
Steep Slopes, over 25%	n/a	0	0
Other:			
Other:			
TOTAL EXISTING:		**0**	**0**

Worksheet 3. Nonstructural BMP Credits

PROTECTED AREA

1.1 Area of Protected Sensitive/Special Value Features (see WS 2)	0 **Ac.**
1.2 Area of Riparian Forest Buffer Protection	0 **Ac.**
3.1 Area of Minimum Disturbance/Reduced Grading	0 **Ac**
TOTAL	**0** **Ac**

Site Area	Minus	Protected Area	=	Stormwater Management Area
0.22	-	0.00	=	0.22

This is the area that requires stormwater management

VOLUME CREDITS

3.1 Minimum Soil Compaction (See Chapter 8, page 22 – SW BMP Manual)

Lawn	______ ft^2	x 1/4" x 1/12	=	0 ft^3
Meadow	______ ft^2	x 1/3" x 1/12	=	0 ft^3

3.3 Protect Existing Trees (See Chapter 8, page 23 – SW BMP Manual)

For Trees within 100 feet of impervious area:

Tree Canopy	______ ft^2	x 1/2" x 1/12	=	0 ft^3

5.1 Disconnect Roof Leaders to Vegetated Areas (See Chapter 8 page 25 – SW BMP Manual)

For runoff directed to areas protected under 5.8.1 and 5.8.2

Roof Area	______ ft^2	x 1/3" x 1/12	=	0 ft^3

For all other disconnected roof areas

Roof Area	______ ft^2	x 1/4" x 1/12	=	0 ft^3

5.2 Disconnect Non-Roof impervious to Vegetated Areas (See Chapter 8, page 26 – SW BMP Manual)

For Runoff directed to areas protected under 5.8.1 and 5.8.2

Impervious Area	______ ft^2	x 1/3" x 1/12	=	0 ft^3

For all other disconnected roof areas

Impervious Area	______ ft^2	x 1/4" x 1/12	=	0 ft^3

TOTAL NON-STRUCTURAL VOLUME CREDIT* **0** ft

**For use on Worksheet 5*

Worksheet 4. Change in Runoff Volume for 2-YR Storm Event

PROJECT: Tioga Pathway Project - YM59 PAR-9
Drainage Area: 0.22 acres
2-Year Rainfall: 2.38 (in)

Total Site Area: 0.22 acres
Protected Site Area: 0 acres
Managed Area: 0.22 acres

Existing Conditions:

Cover Type / Condition	Soil Type	Area (sf)	Area (ac)	CN	S	Ia (0.2*S)	Q Runoff[1] (in)	Runoff Volume[2] (ft^3)
Meadow (good condition)	A	5,882	0.14	30	23.33	4.67	0.25	122
Meadow (good condition)	D	3,814	0.09	78	2.82	0.56	0.71	226
TOTAL (PRE):		9,696	0.22					348

Developed Conditions:

Cover Type / Condition	Soil Type	Area (sf)	Area (ac)	CN	S	Ia (0.2*S)	Q Runoff[1] (in)	Runoff Volume[2] (ft^3)
Impervious (i.e., gravel)	A	5,882	0.14	76	3.16	0.63	0.62	305
Impervious (i.e., gravel)	D	3,814	0.09	91	0.99	0.20	1.50	477
TOTAL (POST):		9,696	0.22					783

2-Year Volume Increase (ft^3):	**783 - 348 = 435**

2-Year Volume Increase = Developed Conditions Runoff Volume - Existing Conditions Runoff Volume

1. Runoff (in) = Q = $(P - 0.2S)^2 / (P + 0.8S)$ where
   P = 2-Year Rainfall (in)
   S = (1000 / CN) - 10

2. Runoff Volume (CF) = Q x Area x 1/12
   Q = Runoff (in)
   Area = Land use area (ft^2)

Worksheet 5. Structural BMP Volume Credits

PROJECT: Tioga Pathway Project - YM59 PAR-9
SUB-BASIN: Upper Susquehanna River

Required Control Volume (ft^3) – *from Worksheet 4*: 435

Non-structural Volume Credit (ft^3) – *from Worksheet 3*: - 0
(maximum is 25% of required volume)

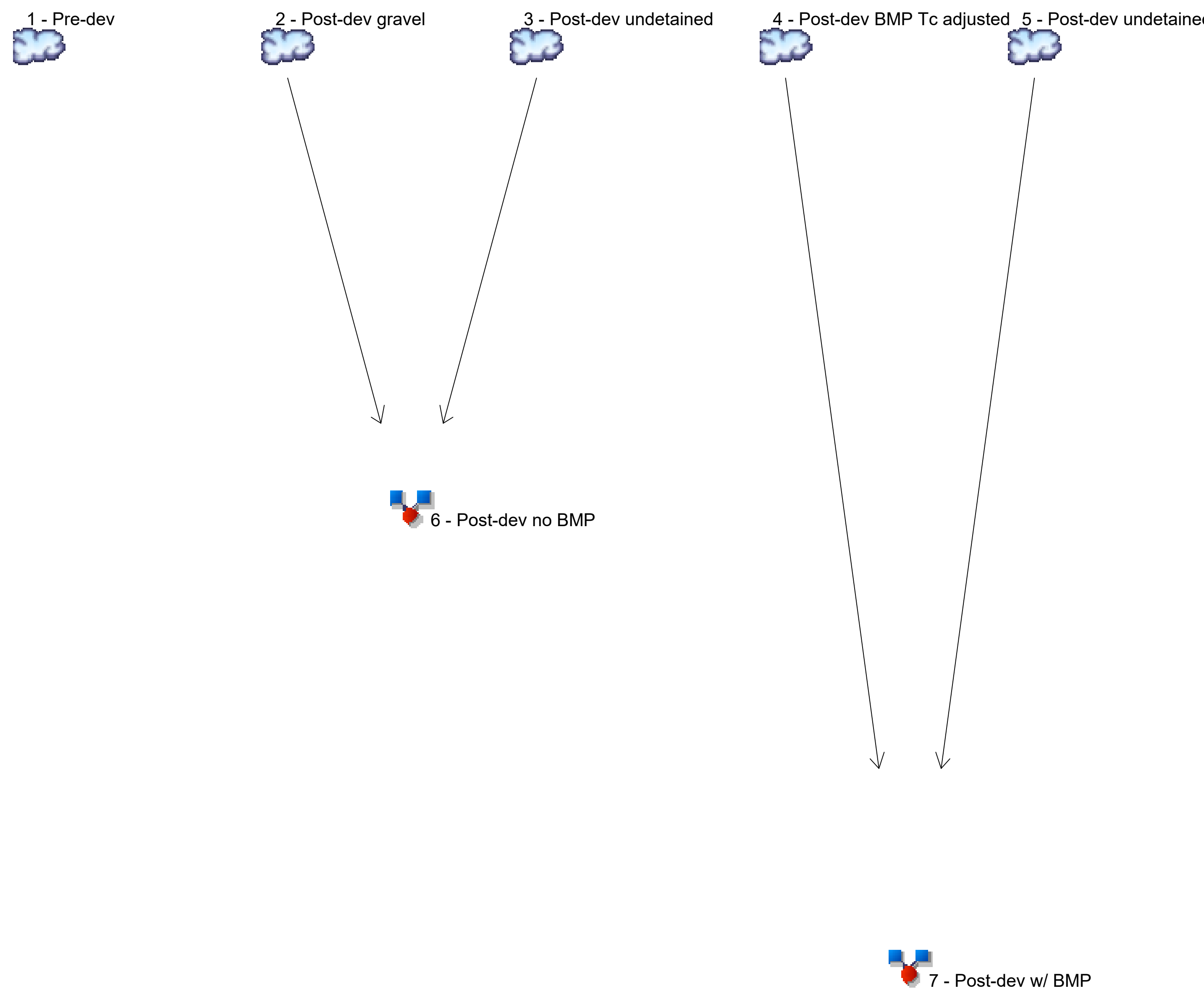
Structural Volume Reqmt (ft^3) 435

(Required Control Volume minus Non-structural Credit)

Proposed BMP		Area (ft^2)	Volume Reduction Permanently Removed (ft^3)
6.4.1	Porous Pavement		
6.4.2	Infiltration Basin		
6.4.3	Infiltration Bed		
6.4.4	Infiltration Trench		
6.4.5	Rain Garden/Bioretention		
6.4.6	Dry Well / Seepage Pit		
6.4.7	Constructed Filter		
6.4.8	Vegetated Swale		
6.4.9	Vegetated Filter Strip		
6.4.10	Berm		
6.5.1	Vegetated Roof		
6.5.2	Capture and Re-use		
6.6.1	Constructed Wetlands		
6.6.2	Wet Pond / Retention Basin		
6.7.1	Riparian Buffer/Riparian Forest Buffer Restoration		
6.7.2	Landscape Restoration / Reforestation		
6.7.3	Soil Amendment		
6.8.1	Level Spreader		
6.8.2	Special Storage Areas		
Other		(GEOWEB) 9360	2502

Total Structural Volume (ft^3): 2502
Structural Volume Requirement (ft^3): 435
DIFFERENCE **2067**

Watershed Model Schematic



Project: Z20 valve site.gpw	Thursday, 11 / 7 / 2024

Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023

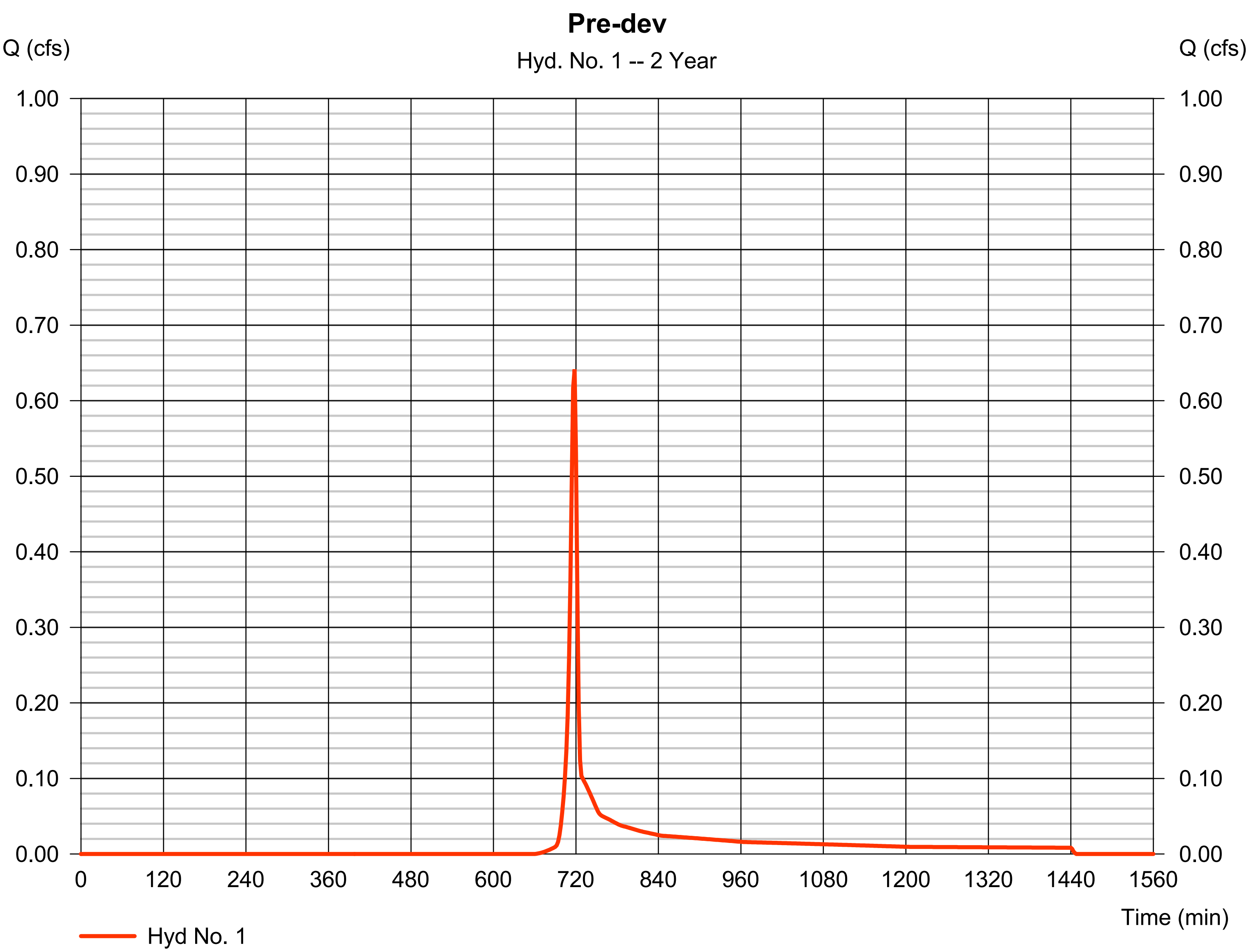
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	0.642	2	718	1,289	------	------	------	Pre-dev
2	SCS Runoff	0.205	2	716	421	------	------	------	Post-dev gravel
3	SCS Runoff	0.541	2	718	1,087	------	------	------	Post-dev undetained
4	SCS Runoff	0.120	2	728	442	------	------	------	Post-dev BMP Tc adjusted
5	SCS Runoff	0.541	2	718	1,087	------	------	------	Post-dev undetained
6	Combine	0.741	2	718	1,508	2, 3,	------	------	Post-dev no BMP
7	Combine	0.620	2	718	1,529	4, 5,	------	------	Post-dev w/ BMP

Hydrograph Report

Hyd. No. 1

Pre-dev

Hydrograph type	= SCS Runoff	Peak discharge	= 0.642 cfs
Storm frequency	= 2 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 1,289 cuft
Drainage area	= 0.510 ac	Curve number	= 78
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 2.43 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



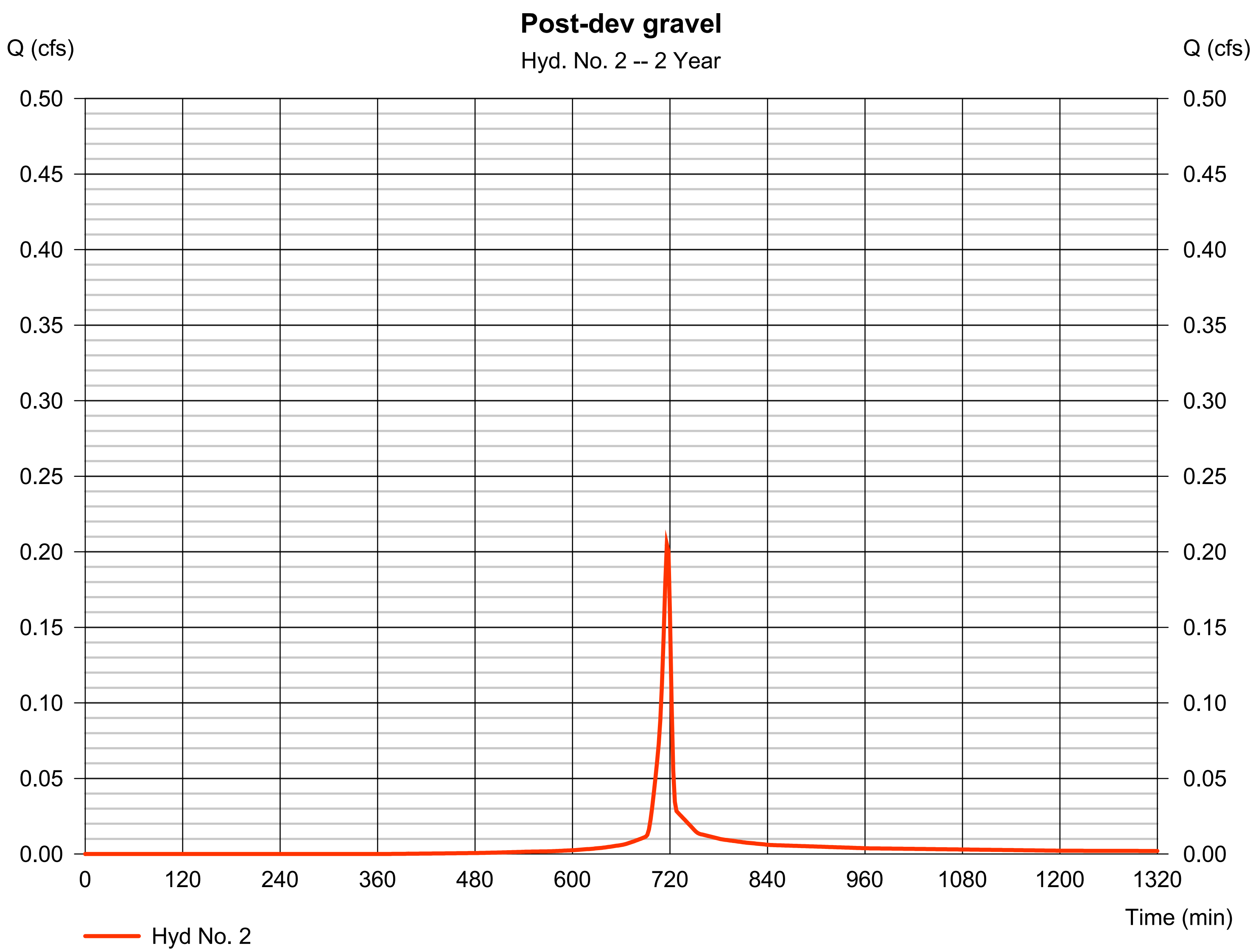
Hydrograph Report

Hyd. No. 2

Post-dev gravel

Hydrograph type	= SCS Runoff	Peak discharge	= 0.205 cfs
Storm frequency	= 2 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 421 cuft
Drainage area	= 0.080 ac	Curve number	= 91*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 2.43 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.430 x 78) + (0.080 x 91)] / 0.080

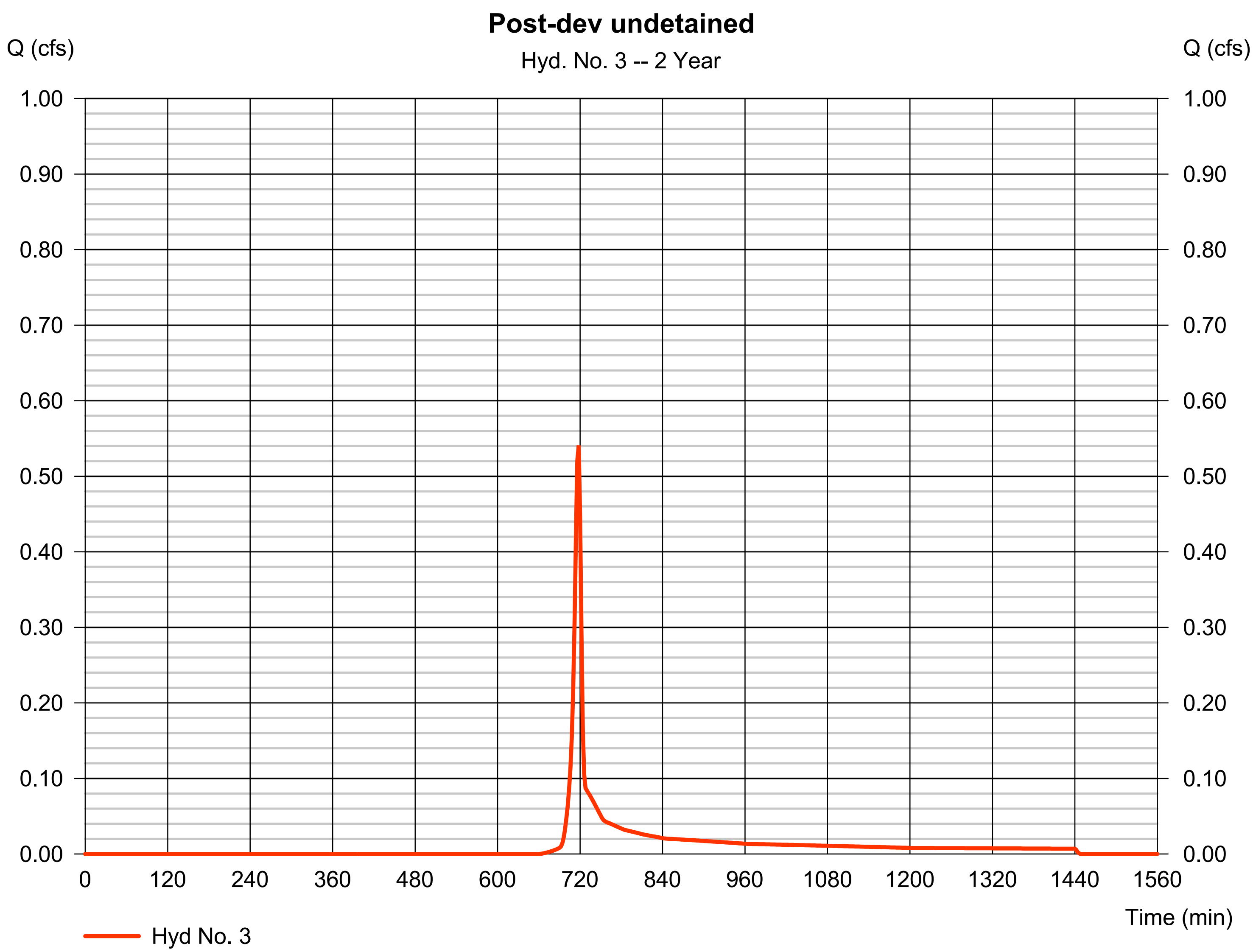


Hydrograph Report

Hyd. No. 3

Post-dev undetained

Hydrograph type	= SCS Runoff	Peak discharge	= 0.541 cfs
Storm frequency	= 2 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 1,087 cuft
Drainage area	= 0.430 ac	Curve number	= 78
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 2.43 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

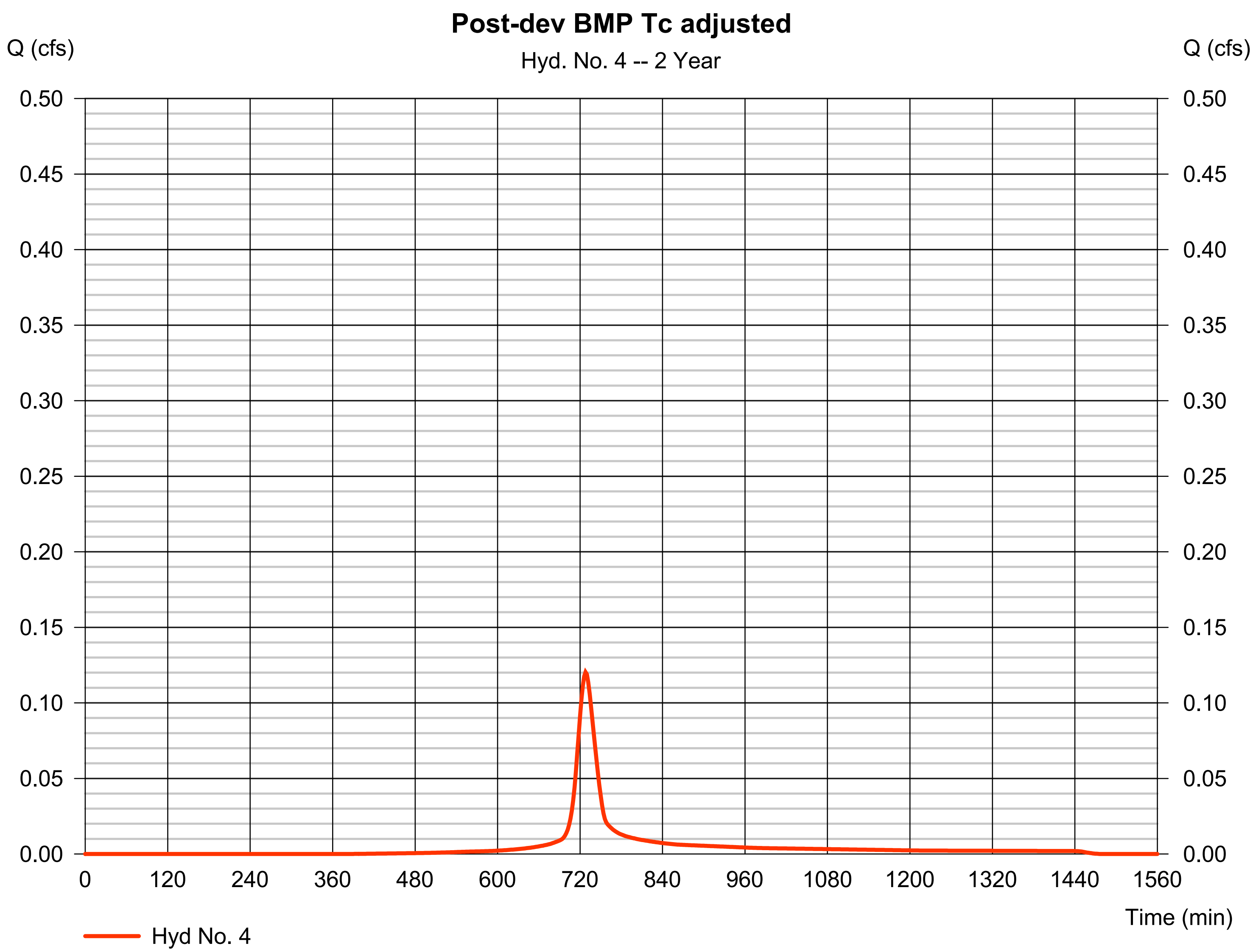


Hydrograph Report

Hyd. No. 4

Post-dev BMP Tc adjusted

Hydrograph type	= SCS Runoff	Peak discharge	= 0.120 cfs
Storm frequency	= 2 yrs	Time to peak	= 728 min
Time interval	= 2 min	Hyd. volume	= 442 cuft
Drainage area	= 0.080 ac	Curve number	= 91
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 25.20 min
Total precip.	= 2.43 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

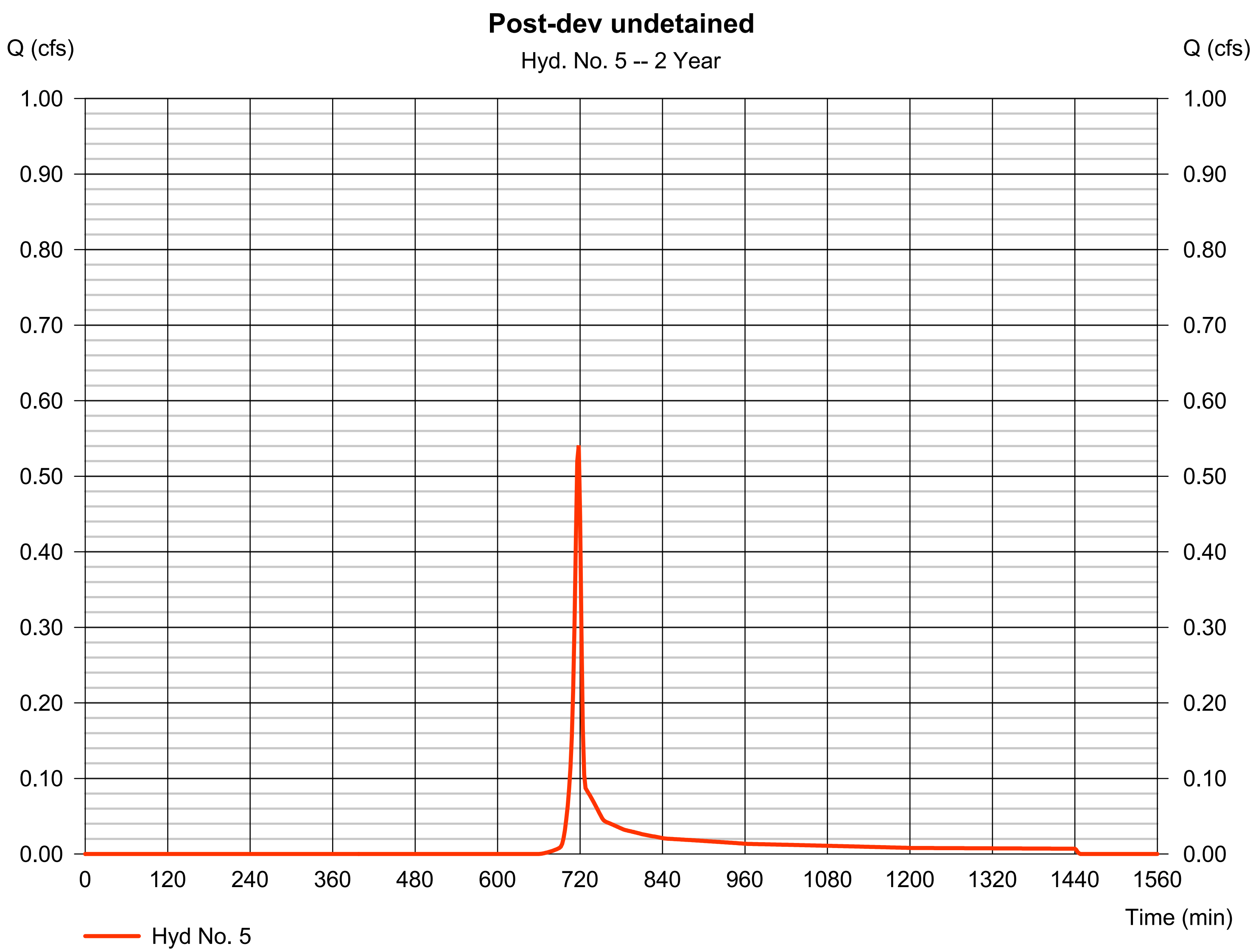


Hydrograph Report

Hyd. No. 5

Post-dev undetained

Hydrograph type	= SCS Runoff	Peak discharge	= 0.541 cfs
Storm frequency	= 2 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 1,087 cuft
Drainage area	= 0.430 ac	Curve number	= 78
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 2.43 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

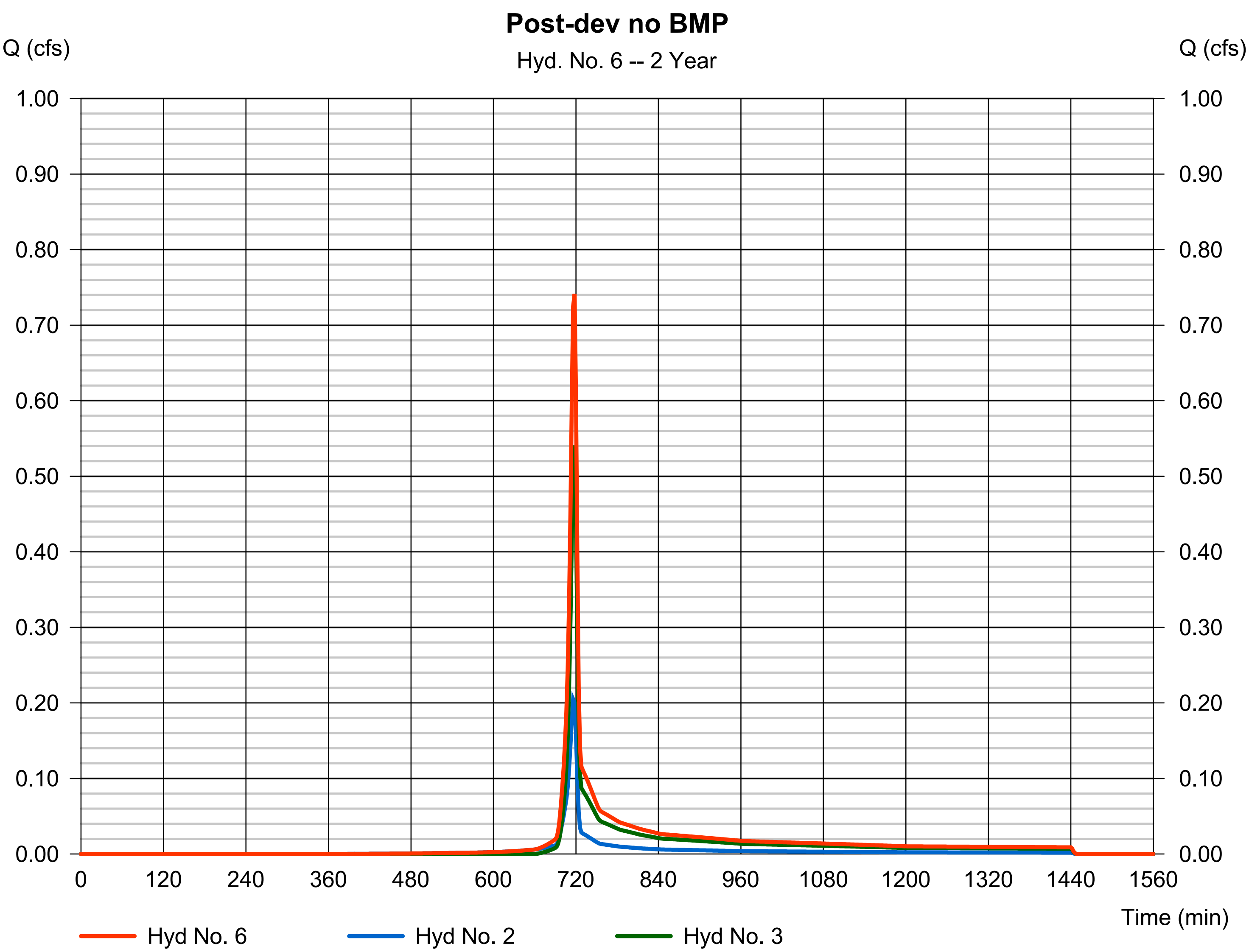


Hydrograph Report

Hyd. No. 6

Post-dev no BMP

Hydrograph type	= Combine	Peak discharge	= 0.741 cfs
Storm frequency	= 2 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 1,508 cuft
Inflow hyds.	= 2, 3	Contrib. drain. area	= 0.510 ac

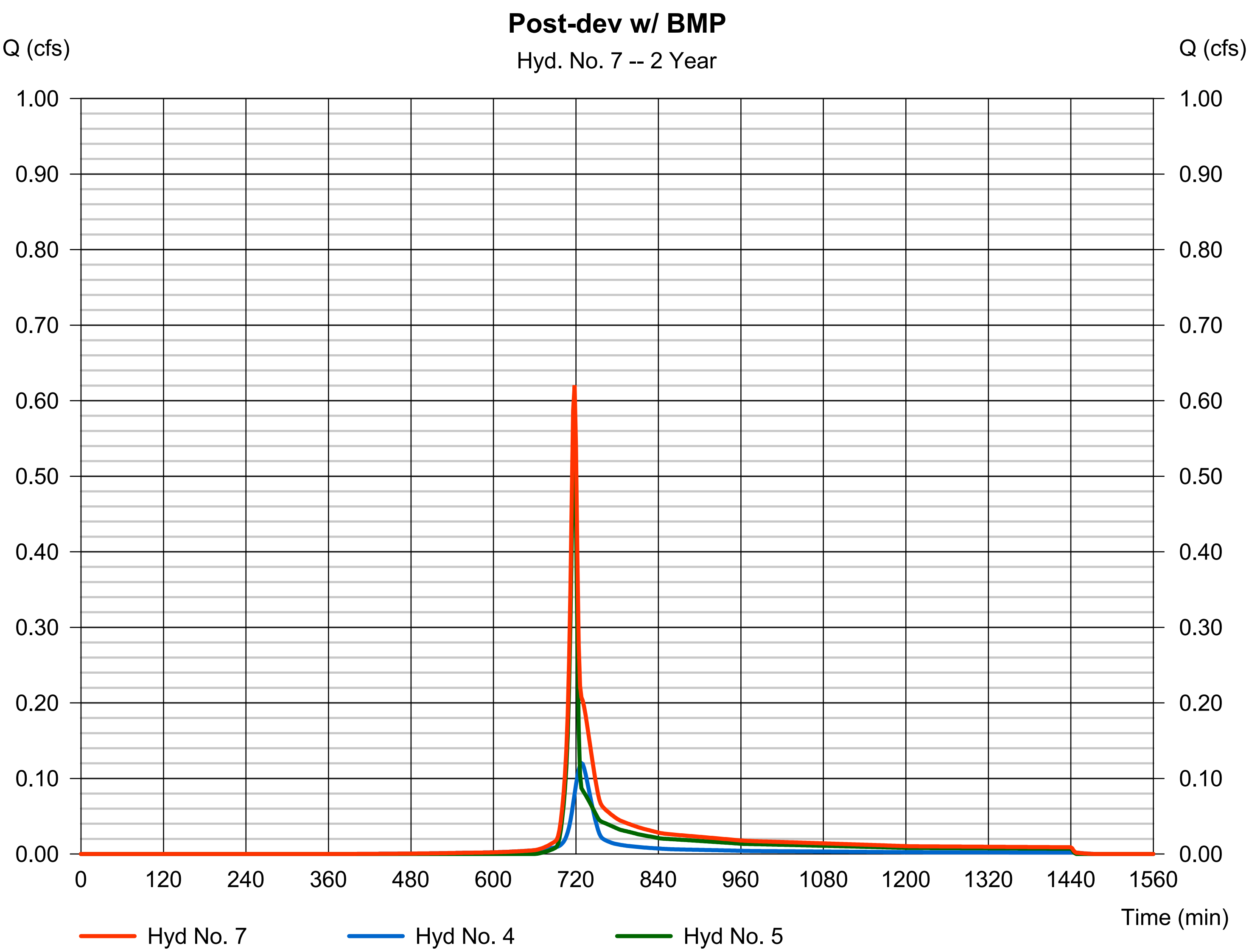


Hydrograph Report

Hyd. No. 7

Post-dev w/ BMP

Hydrograph type	= Combine	Peak discharge	= 0.620 cfs
Storm frequency	= 2 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 1,529 cuft
Inflow hyds.	= 4, 5	Contrib. drain. area	= 0.510 ac



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023

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	1.282	2	718	2,572	------	------	------	Pre-dev
2	SCS Runoff	0.326	2	716	687	------	------	------	Post-dev gravel
3	SCS Runoff	1.081	2	718	2,169	------	------	------	Post-dev undetained
4	SCS Runoff	0.230	2	724	732	------	------	------	Post-dev BMP Tc adjusted
5	SCS Runoff	1.081	2	718	2,169	------	------	------	Post-dev undetained
6	Combine	1.398	2	716	2,856	2, 3,	------	------	Post-dev no BMP
7	Combine	1.267	2	718	2,901	4, 5,	------	------	Post-dev w/ BMP

Z20 valve site.gpw	Return Period: 10 Year	Thursday, 11 / 7 / 2024

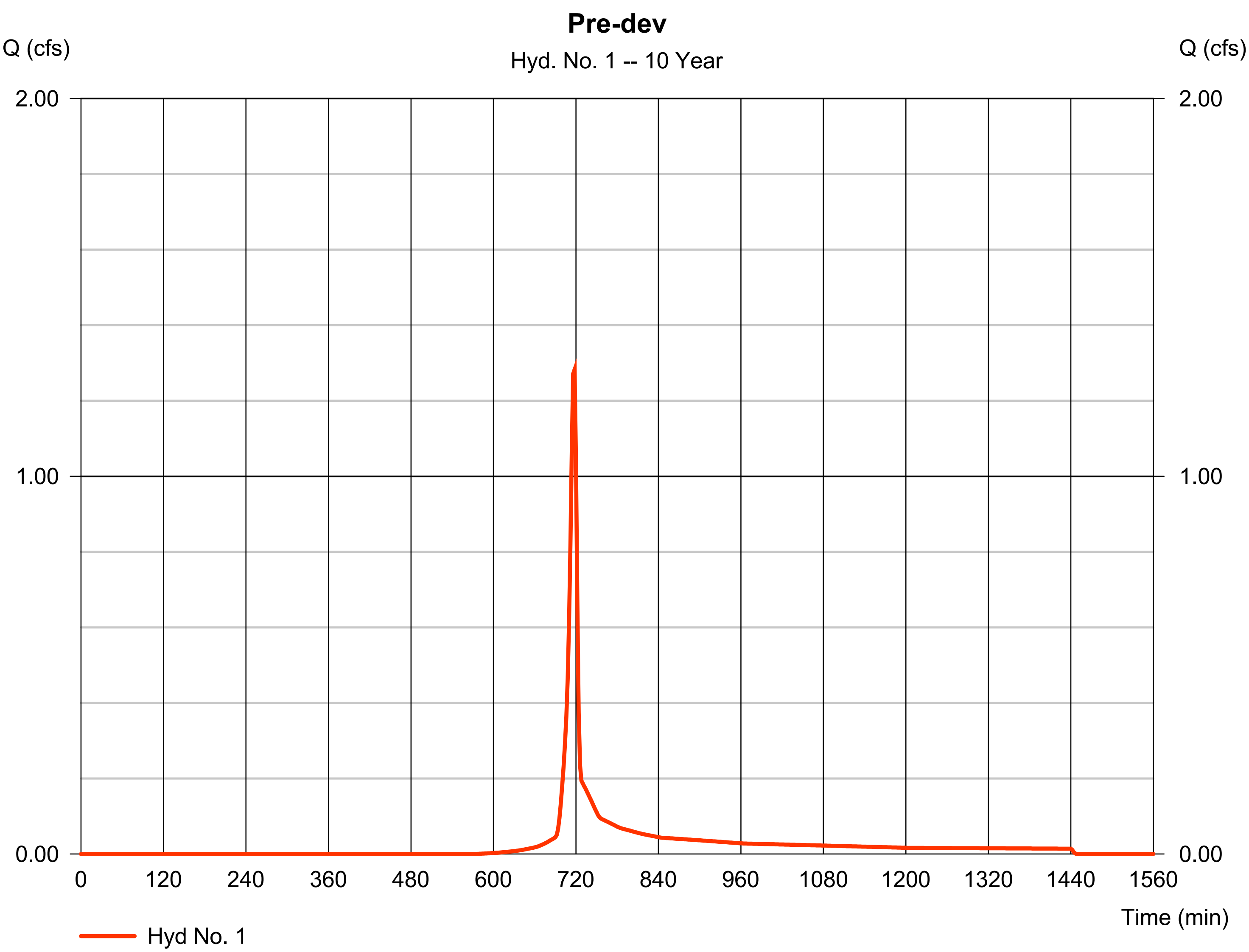
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023 Thursday, 11 / 7 / 2024

Hyd. No. 1

Pre-dev

Hydrograph type	= SCS Runoff	Peak discharge	= 1.282 cfs
Storm frequency	= 10 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 2,572 cuft
Drainage area	= 0.510 ac	Curve number	= 78
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 3.48 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



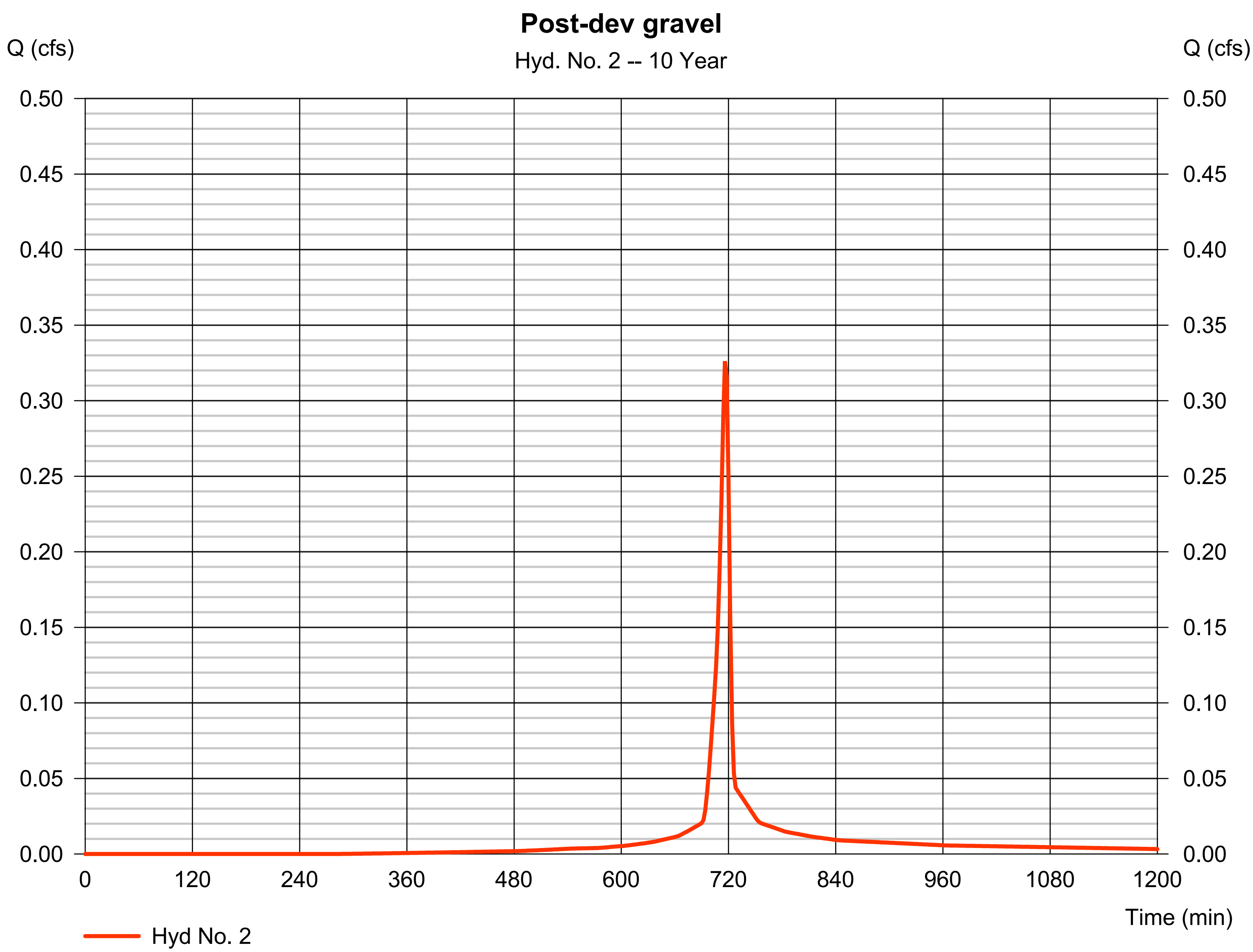
Hydrograph Report

Hyd. No. 2

Post-dev gravel

Hydrograph type	= SCS Runoff	Peak discharge	= 0.326 cfs
Storm frequency	= 10 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 687 cuft
Drainage area	= 0.080 ac	Curve number	= 91*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 3.48 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.430 x 78) + (0.080 x 91)] / 0.080

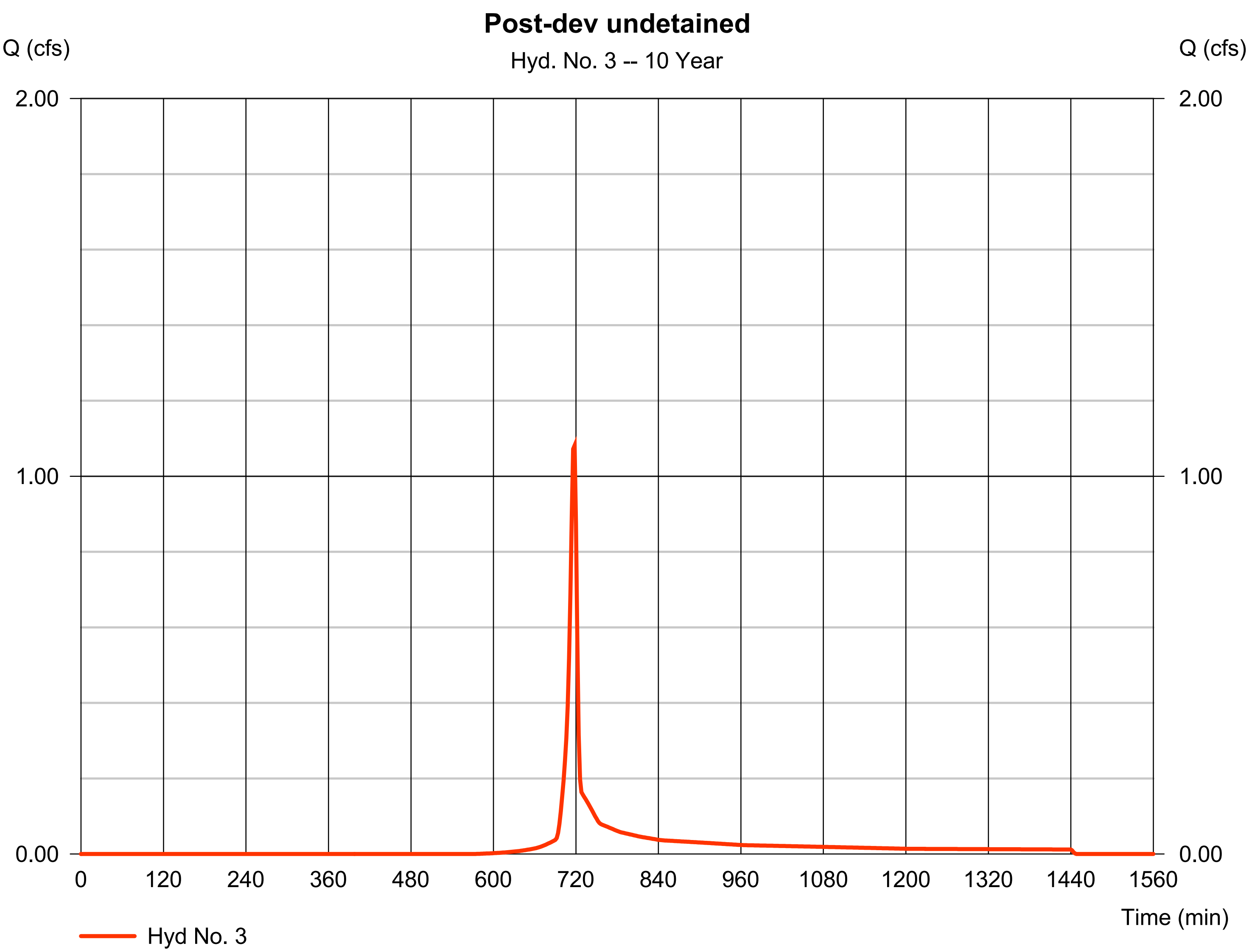


Hydrograph Report

Hyd. No. 3

Post-dev undetained

Hydrograph type	= SCS Runoff	Peak discharge	= 1.081 cfs
Storm frequency	= 10 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 2,169 cuft
Drainage area	= 0.430 ac	Curve number	= 78
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 3.48 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

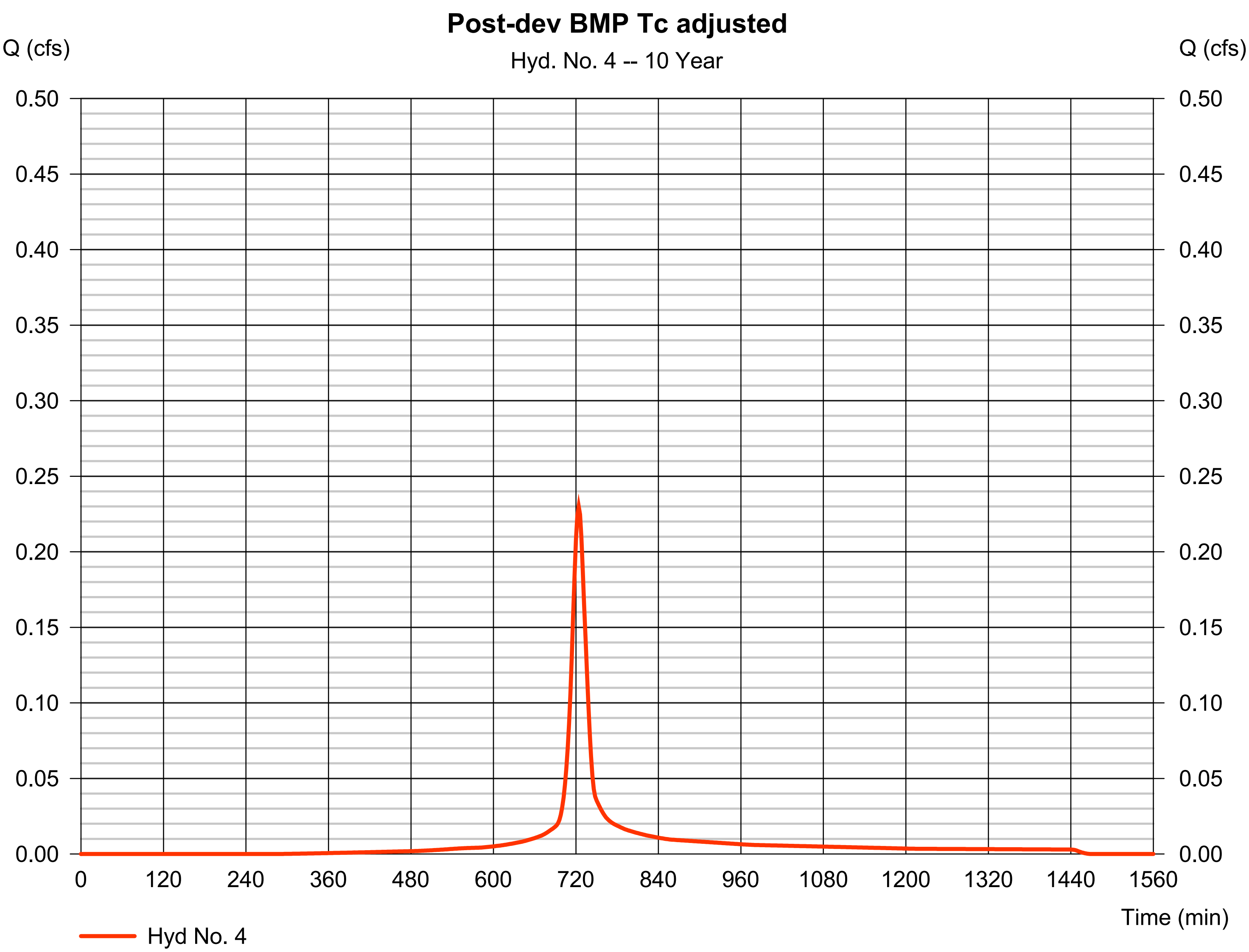


Hydrograph Report

Hyd. No. 4

Post-dev BMP Tc adjusted

Hydrograph type	= SCS Runoff	Peak discharge	= 0.230 cfs
Storm frequency	= 10 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 732 cuft
Drainage area	= 0.080 ac	Curve number	= 91
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 17.90 min
Total precip.	= 3.48 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

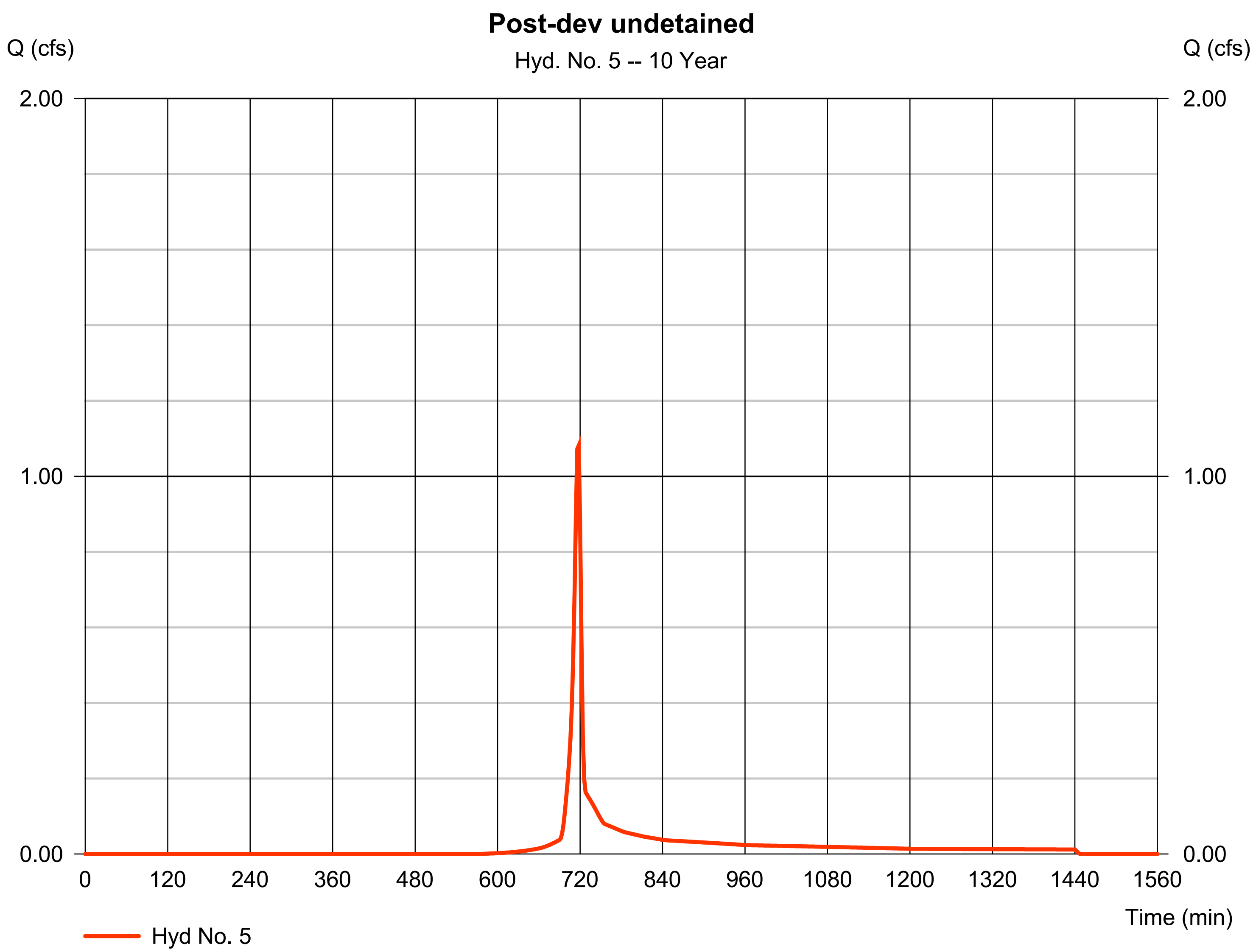


Hydrograph Report

Hyd. No. 5

Post-dev undetained

Hydrograph type	= SCS Runoff	Peak discharge	= 1.081 cfs
Storm frequency	= 10 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 2,169 cuft
Drainage area	= 0.430 ac	Curve number	= 78
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 3.48 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

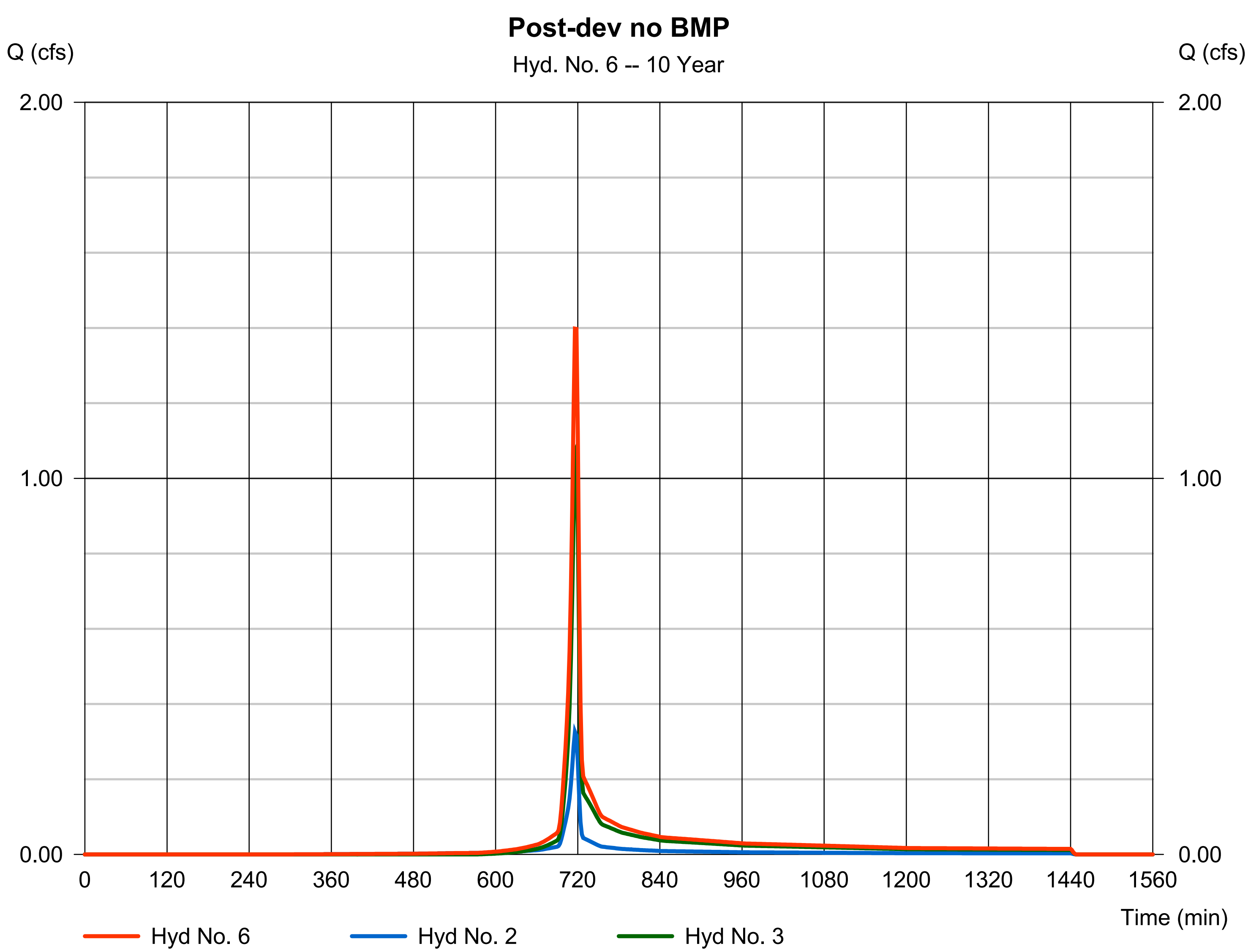


Hydrograph Report

Hyd. No. 6

Post-dev no BMP

Hydrograph type	= Combine	Peak discharge	= 1.398 cfs
Storm frequency	= 10 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 2,856 cuft
Inflow hyds.	= 2, 3	Contrib. drain. area	= 0.510 ac

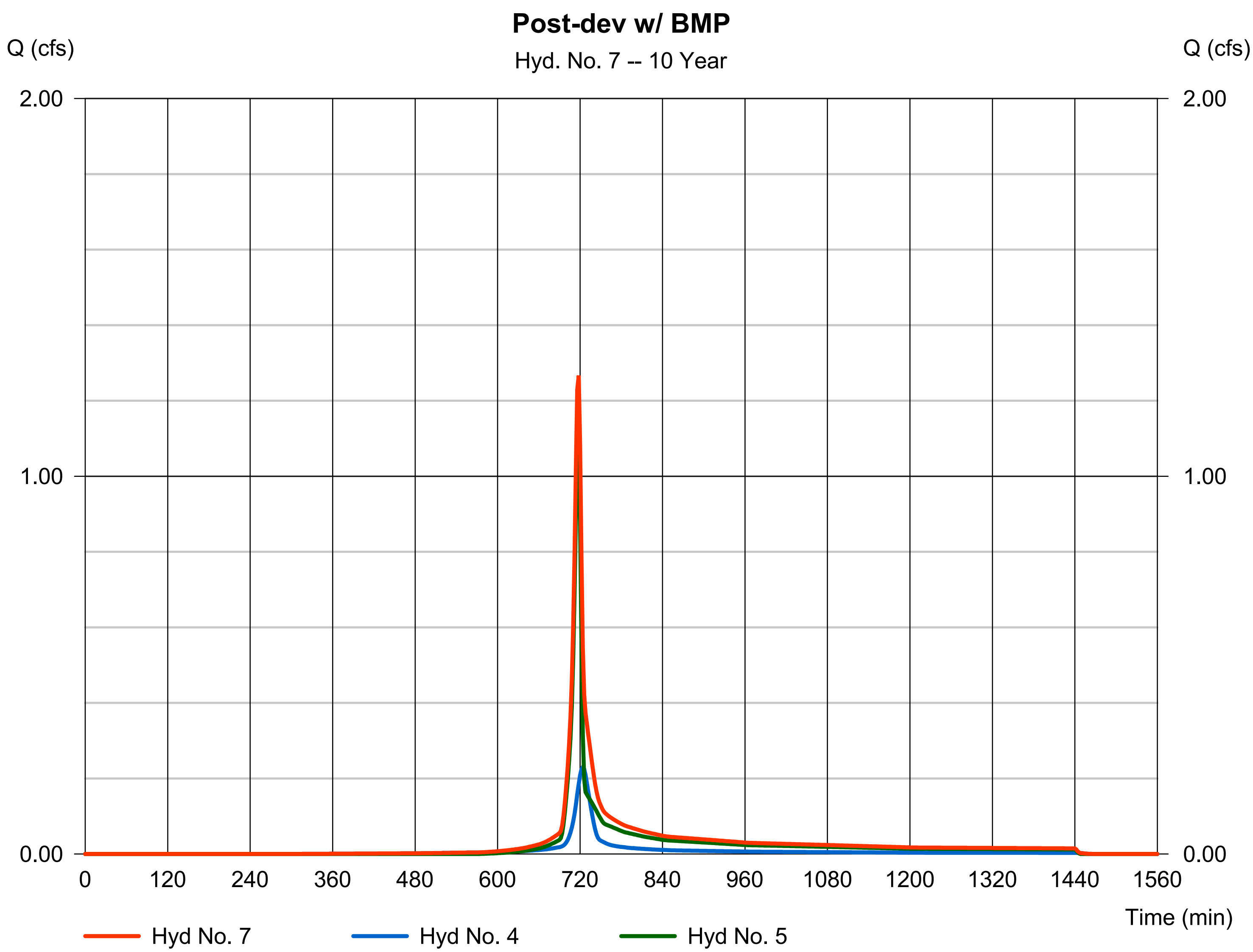


Hydrograph Report

Hyd. No. 7

Post-dev w/ BMP

Hydrograph type	= Combine	Peak discharge	= 1.267 cfs
Storm frequency	= 10 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 2,901 cuft
Inflow hyds.	= 4, 5	Contrib. drain. area	= 0.510 ac



Hydrograph Summary Report

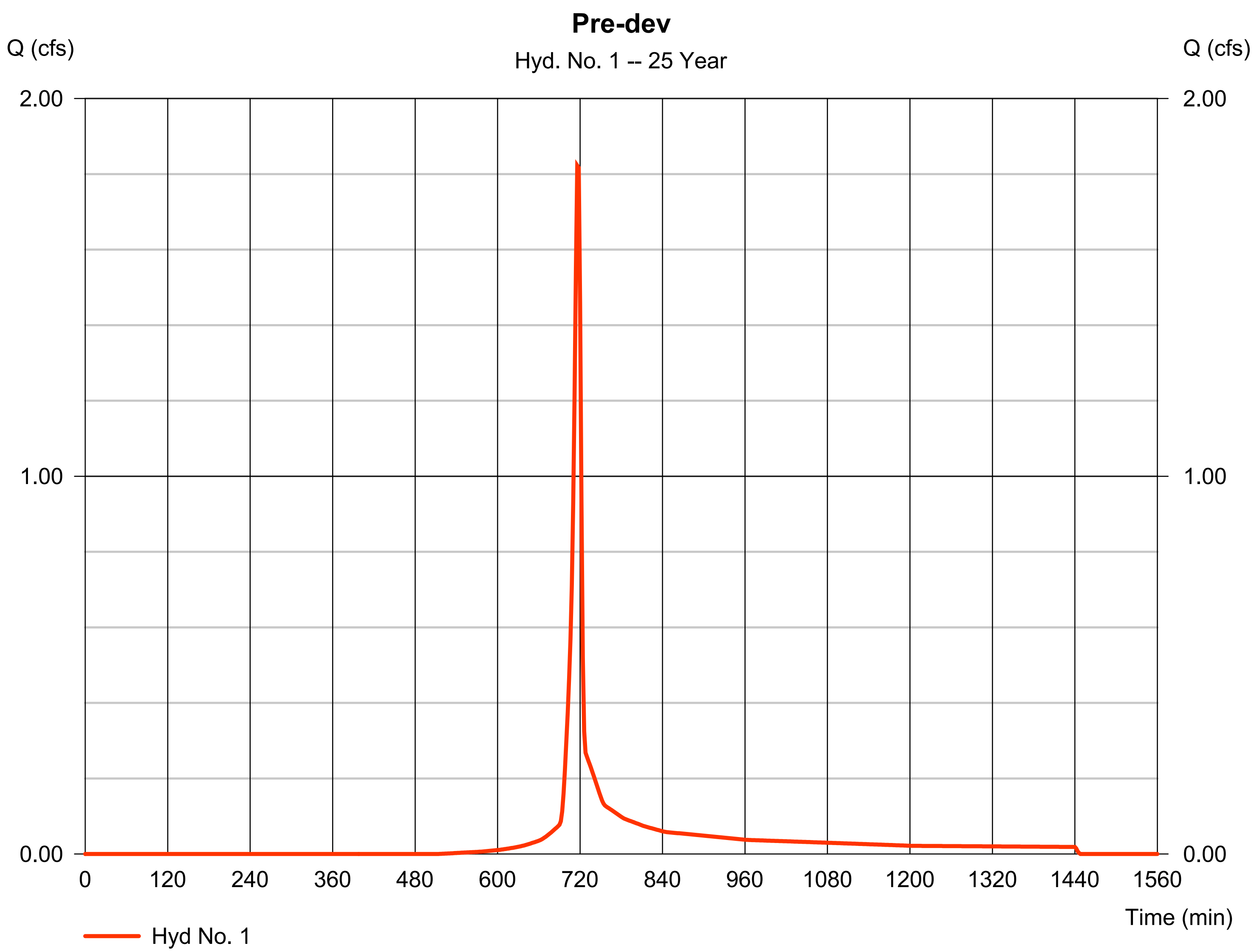
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	1.823	2	716	3,680	------	------	------	Pre-dev
2	SCS Runoff	0.419	2	716	897	------	------	------	Post-dev gravel
3	SCS Runoff	1.537	2	716	3,103	------	------	------	Post-dev undetained
4	SCS Runoff	0.321	2	722	933	------	------	------	Post-dev BMP Tc adjusted
5	SCS Runoff	1.537	2	716	3,103	------	------	------	Post-dev undetained
6	Combine	1.956	2	716	4,000	2, 3,	------	------	Post-dev no BMP
7	Combine	1.816	2	718	4,036	4, 5,	------	------	Post-dev w/ BMP

Hydrograph Report

Hyd. No. 1

Pre-dev

Hydrograph type	= SCS Runoff	Peak discharge	= 1.823 cfs
Storm frequency	= 25 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 3,680 cuft
Drainage area	= 0.510 ac	Curve number	= 78
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 4.29 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



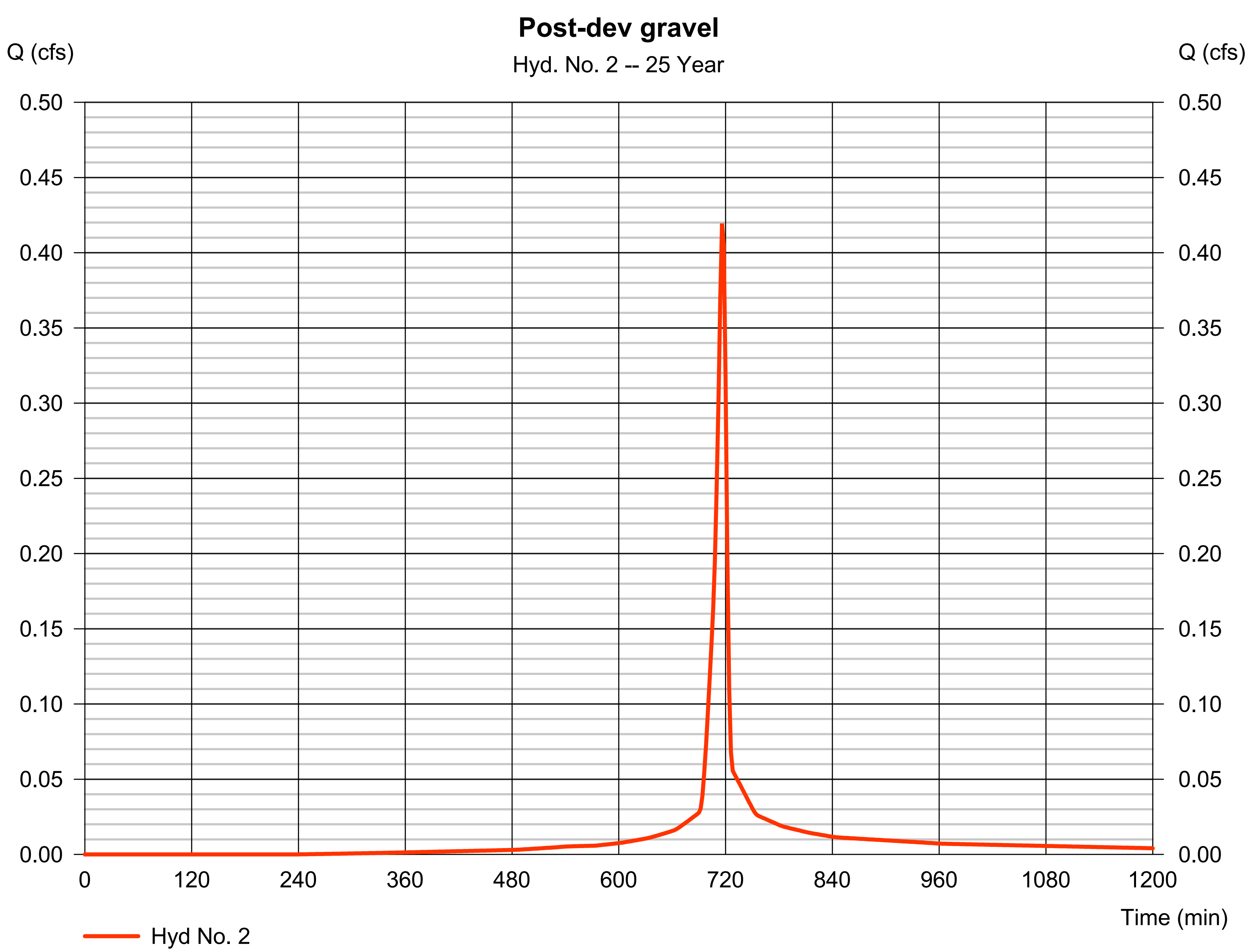
Hydrograph Report

Hyd. No. 2

Post-dev gravel

Hydrograph type	= SCS Runoff	Peak discharge	= 0.419 cfs
Storm frequency	= 25 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 897 cuft
Drainage area	= 0.080 ac	Curve number	= 91*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 4.29 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.430 x 78) + (0.080 x 91)] / 0.080

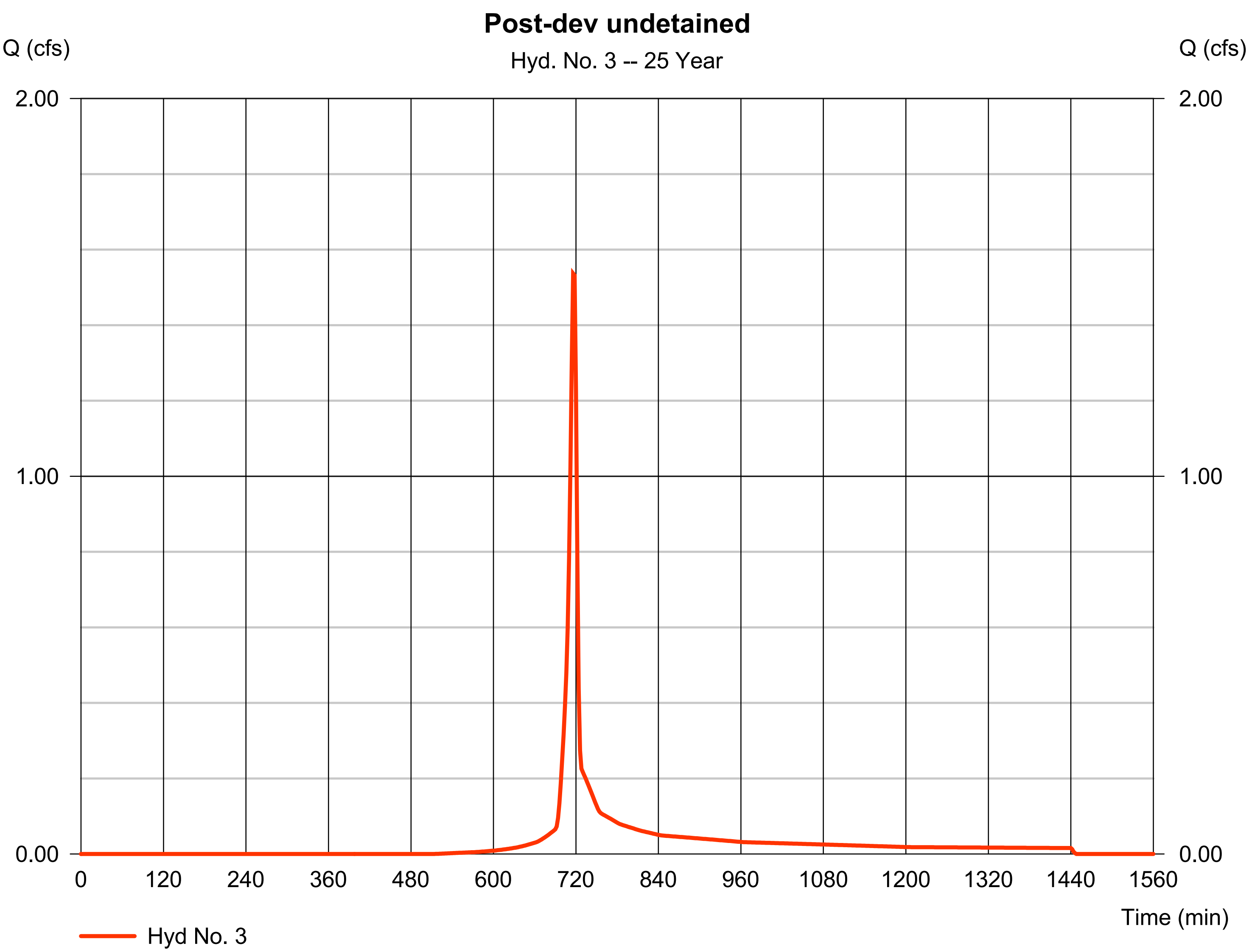


Hydrograph Report

Hyd. No. 3

Post-dev undetained

Hydrograph type	= SCS Runoff	Peak discharge	= 1.537 cfs
Storm frequency	= 25 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 3,103 cuft
Drainage area	= 0.430 ac	Curve number	= 78
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 4.29 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

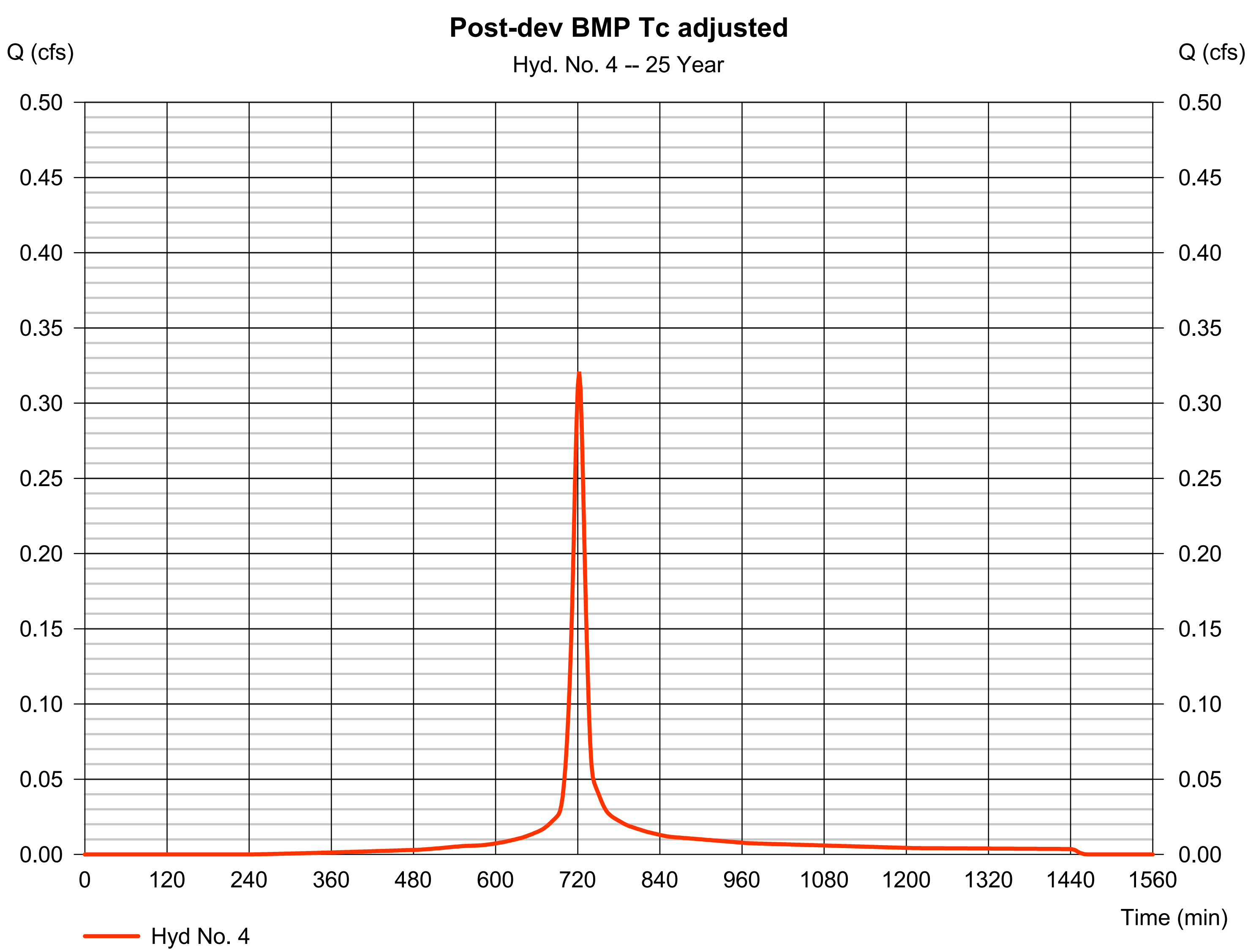


Hydrograph Report

Hyd. No. 4

Post-dev BMP Tc adjusted

Hydrograph type	= SCS Runoff	Peak discharge	= 0.321 cfs
Storm frequency	= 25 yrs	Time to peak	= 722 min
Time interval	= 2 min	Hyd. volume	= 933 cuft
Drainage area	= 0.080 ac	Curve number	= 91
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 15.00 min
Total precip.	= 4.29 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

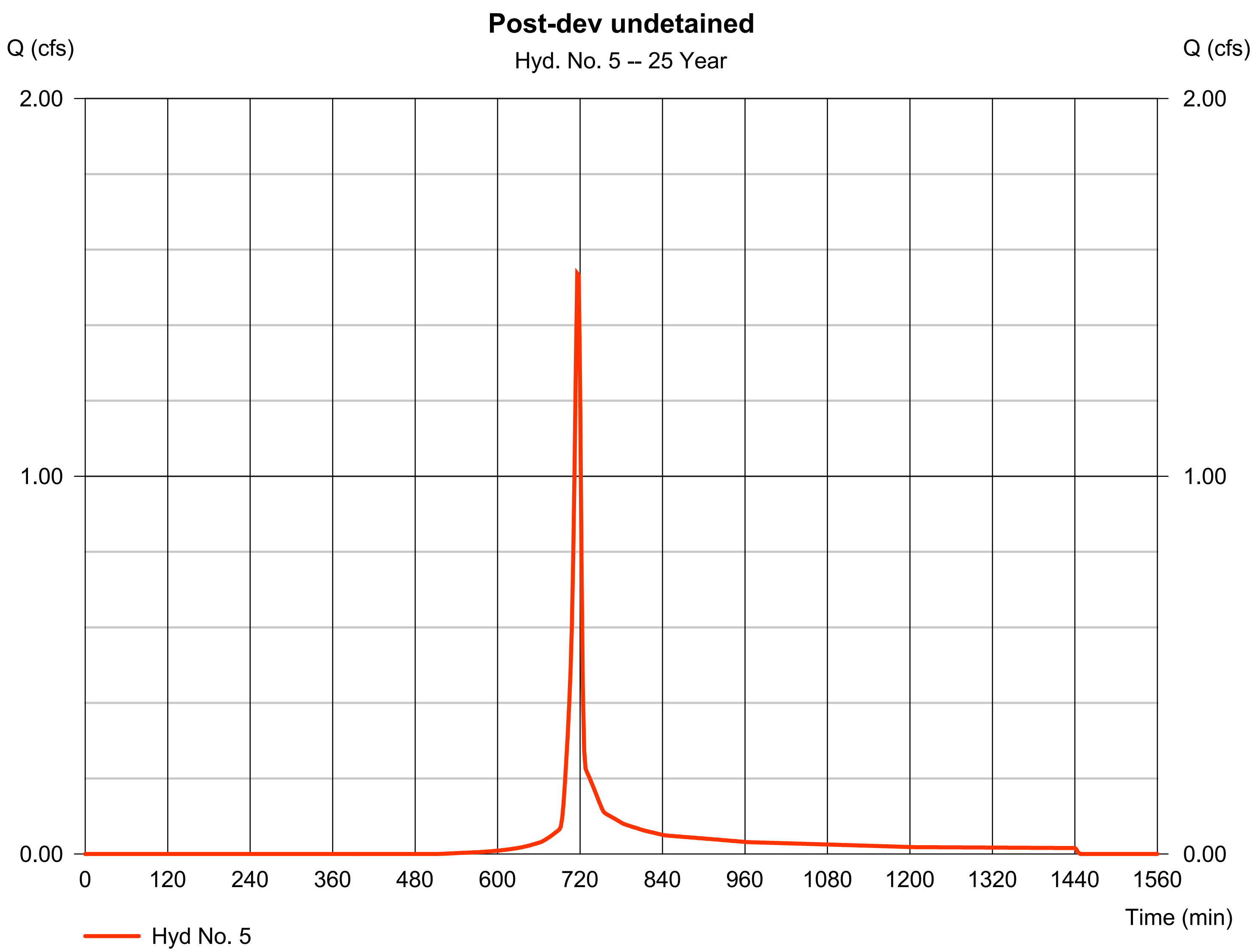


Hydrograph Report

Hyd. No. 5

Post-dev undetained

Hydrograph type	= SCS Runoff	Peak discharge	= 1.537 cfs
Storm frequency	= 25 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 3,103 cuft
Drainage area	= 0.430 ac	Curve number	= 78
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 4.29 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

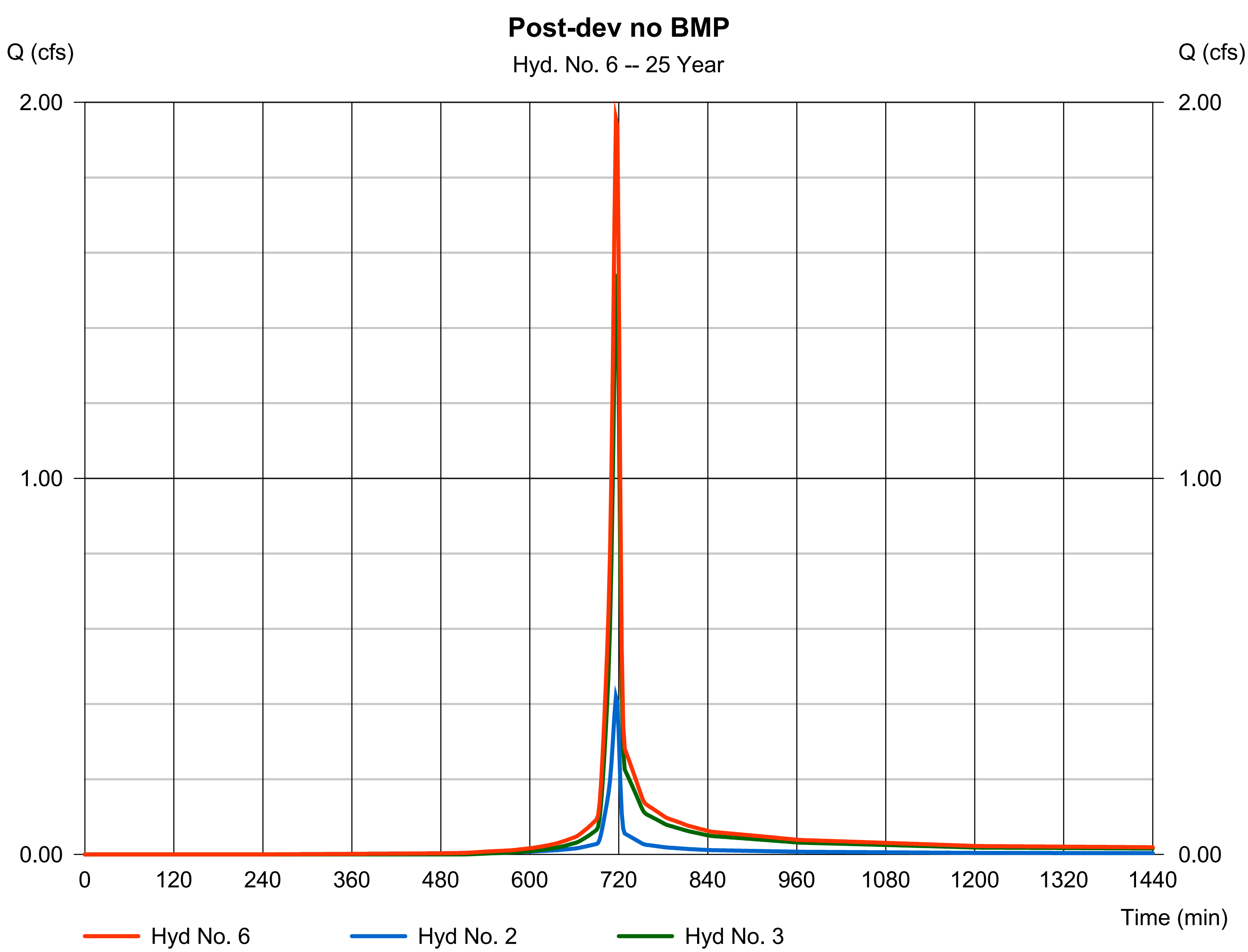


Hydrograph Report

Hyd. No. 6

Post-dev no BMP

Hydrograph type	= Combine	Peak discharge	= 1.956 cfs
Storm frequency	= 25 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 4,000 cuft
Inflow hyds.	= 2, 3	Contrib. drain. area	= 0.510 ac

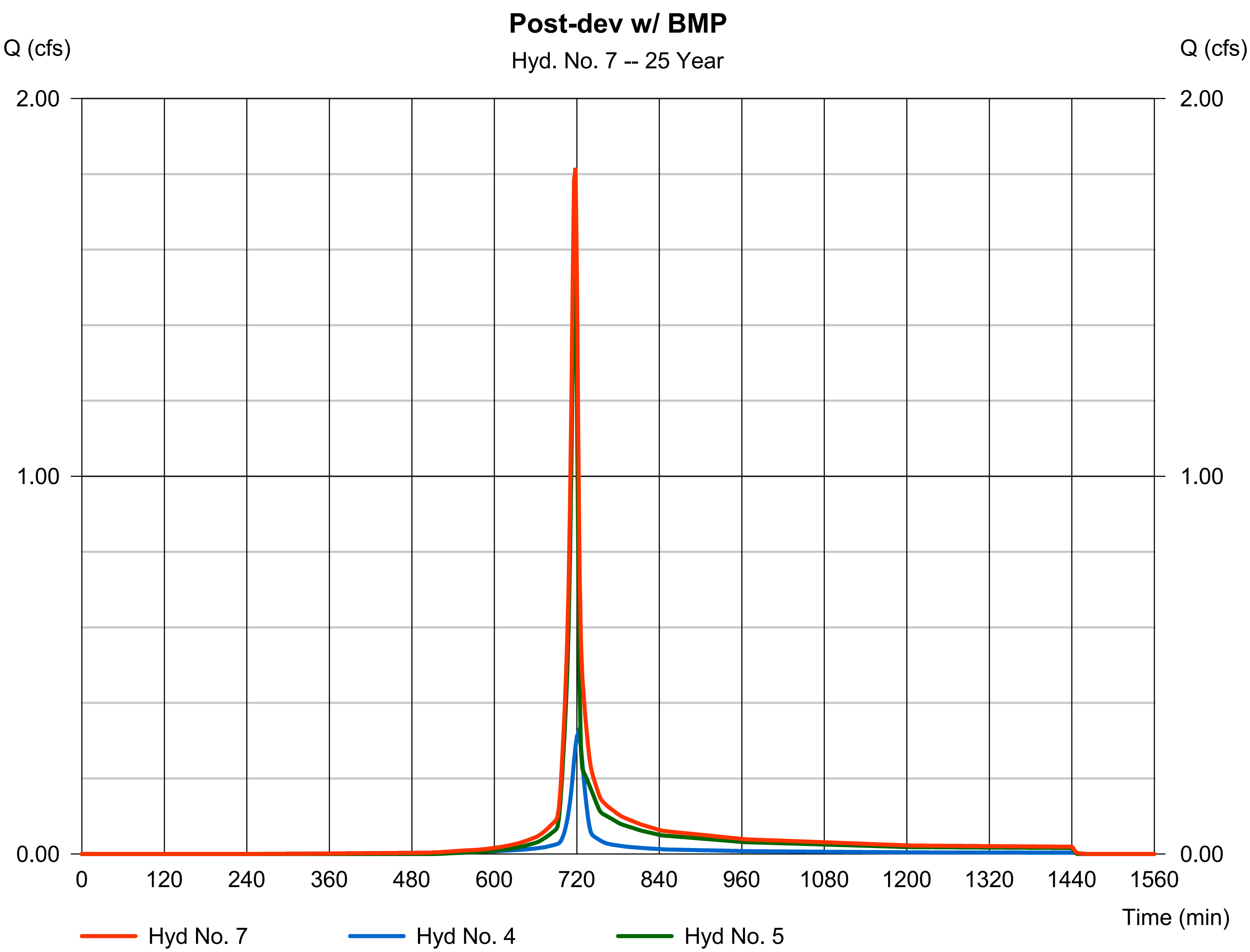


Hydrograph Report

Hyd. No. 7

Post-dev w/ BMP

Hydrograph type	= Combine	Peak discharge	= 1.816 cfs
Storm frequency	= 25 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 4,036 cuft
Inflow hyds.	= 4, 5	Contrib. drain. area	= 0.510 ac



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023

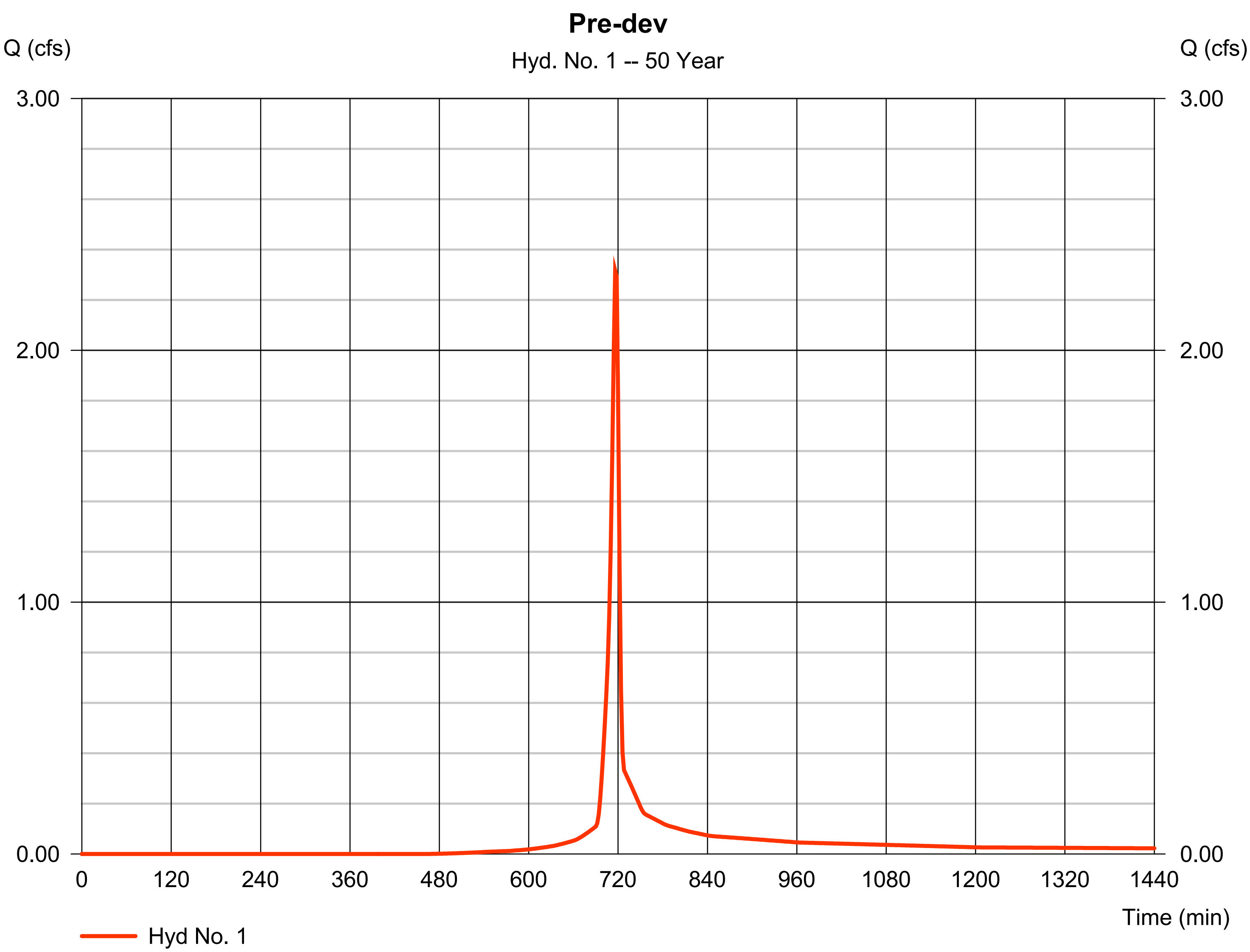
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	2.317	2	716	4,692	------	------	------	Pre-dev
2	SCS Runoff	0.500	2	716	1,081	------	------	------	Post-dev gravel
3	SCS Runoff	1.953	2	716	3,956	------	------	------	Post-dev undetained
4	SCS Runoff	0.383	2	722	1,125	------	------	------	Post-dev BMP Tc adjusted
5	SCS Runoff	1.953	2	716	3,956	------	------	------	Post-dev undetained
6	Combine	2.453	2	716	5,037	2, 3,	------	------	Post-dev no BMP
7	Combine	2.274	2	718	5,080	4, 5,	------	------	Post-dev w/ BMP

Hydrograph Report

Hyd. No. 1

Pre-dev

Hydrograph type	= SCS Runoff	Peak discharge	= 2.317 cfs
Storm frequency	= 50 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 4,692 cuft
Drainage area	= 0.510 ac	Curve number	= 78
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 4.99 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Report

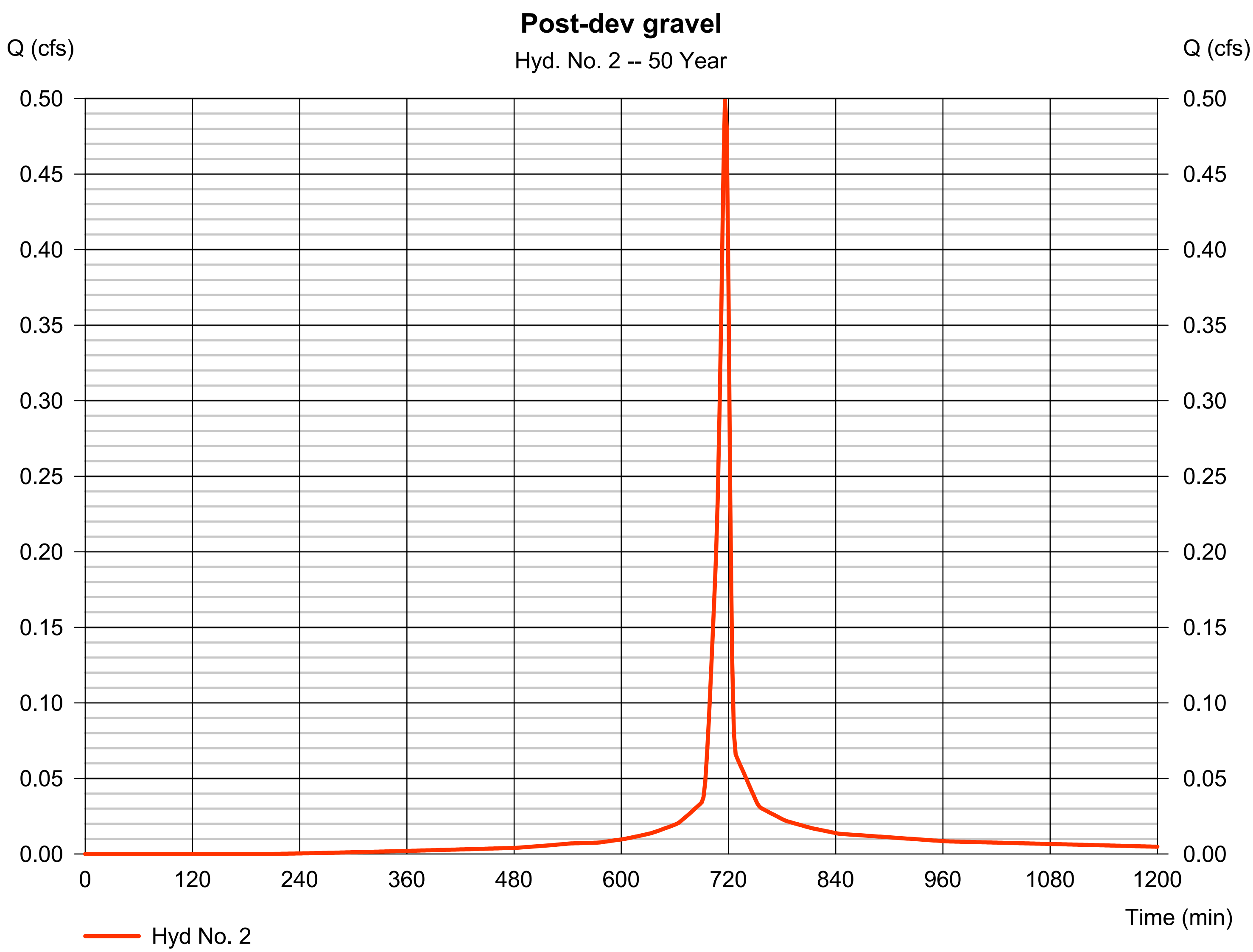
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023 — Thursday, 11 / 7 / 2024

Hyd. No. 2

Post-dev gravel

Hydrograph type	= SCS Runoff	Peak discharge	= 0.500 cfs
Storm frequency	= 50 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 1,081 cuft
Drainage area	= 0.080 ac	Curve number	= 91*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 4.99 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.430 x 78) + (0.080 x 91)] / 0.080

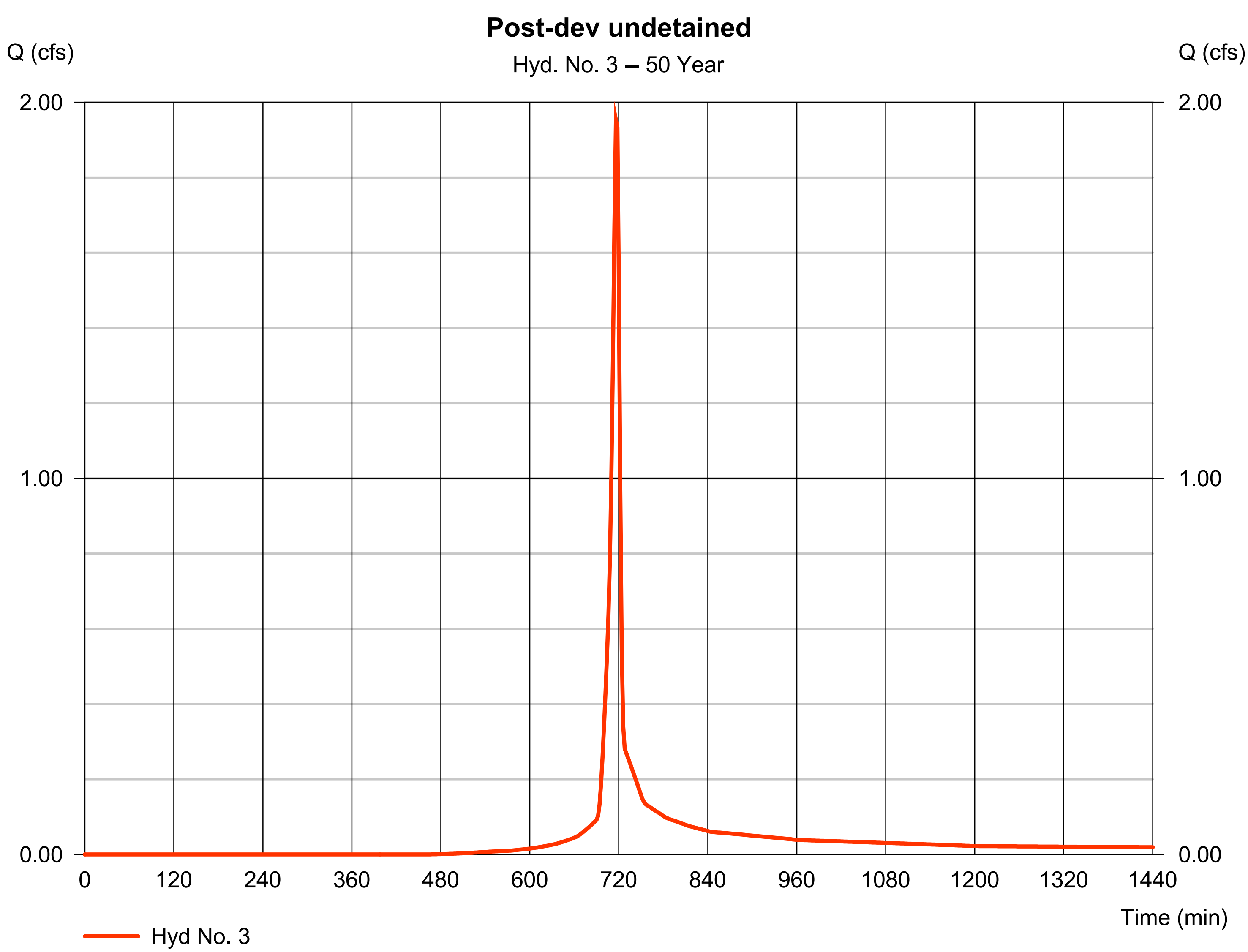


Hydrograph Report

Hyd. No. 3

Post-dev undetained

Hydrograph type	= SCS Runoff	Peak discharge	= 1.953 cfs
Storm frequency	= 50 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 3,956 cuft
Drainage area	= 0.430 ac	Curve number	= 78
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 4.99 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

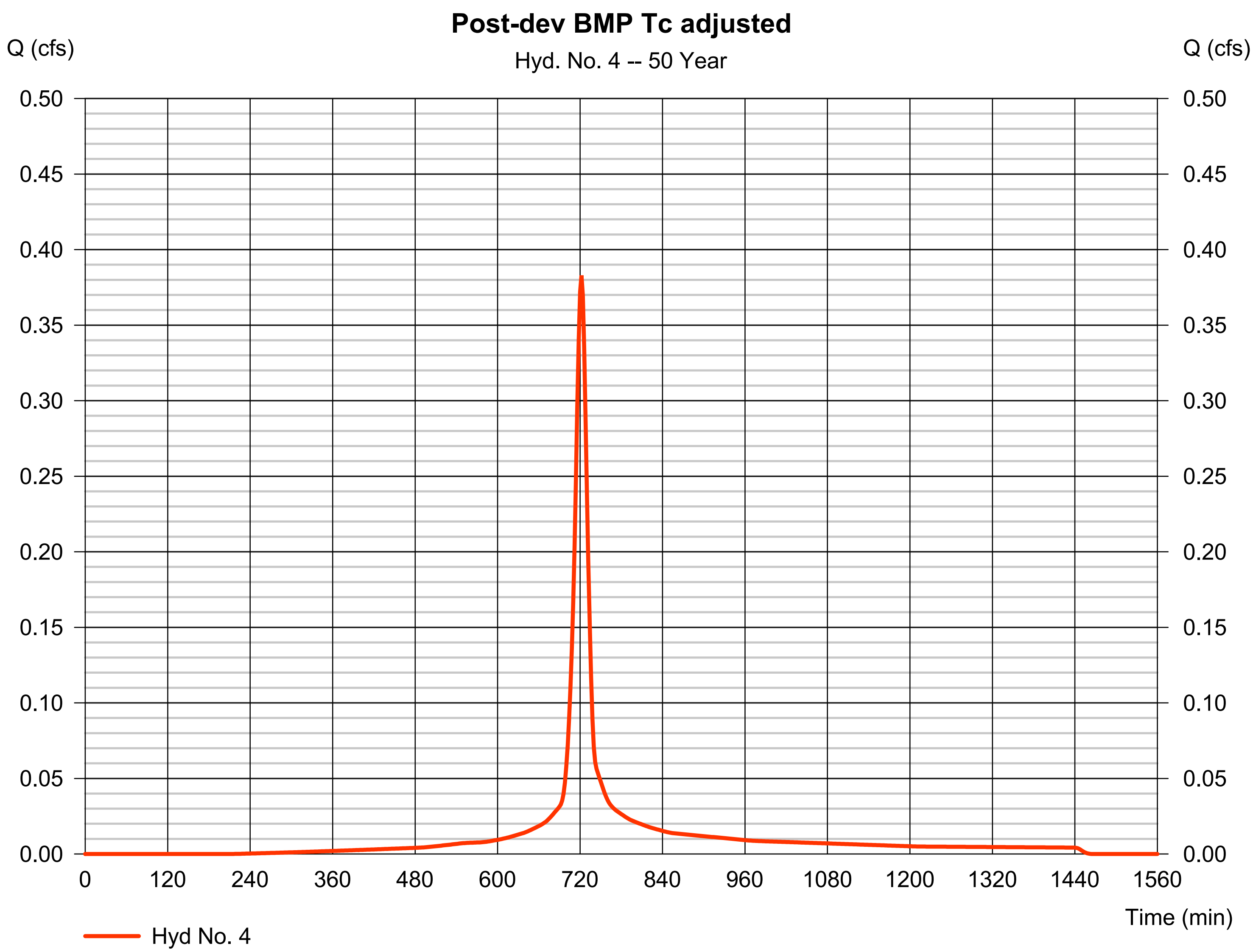


Hydrograph Report

Hyd. No. 4

Post-dev BMP Tc adjusted

Hydrograph type	= SCS Runoff	Peak discharge	= 0.383 cfs
Storm frequency	= 50 yrs	Time to peak	= 722 min
Time interval	= 2 min	Hyd. volume	= 1,125 cuft
Drainage area	= 0.080 ac	Curve number	= 91
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 13.40 min
Total precip.	= 4.99 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

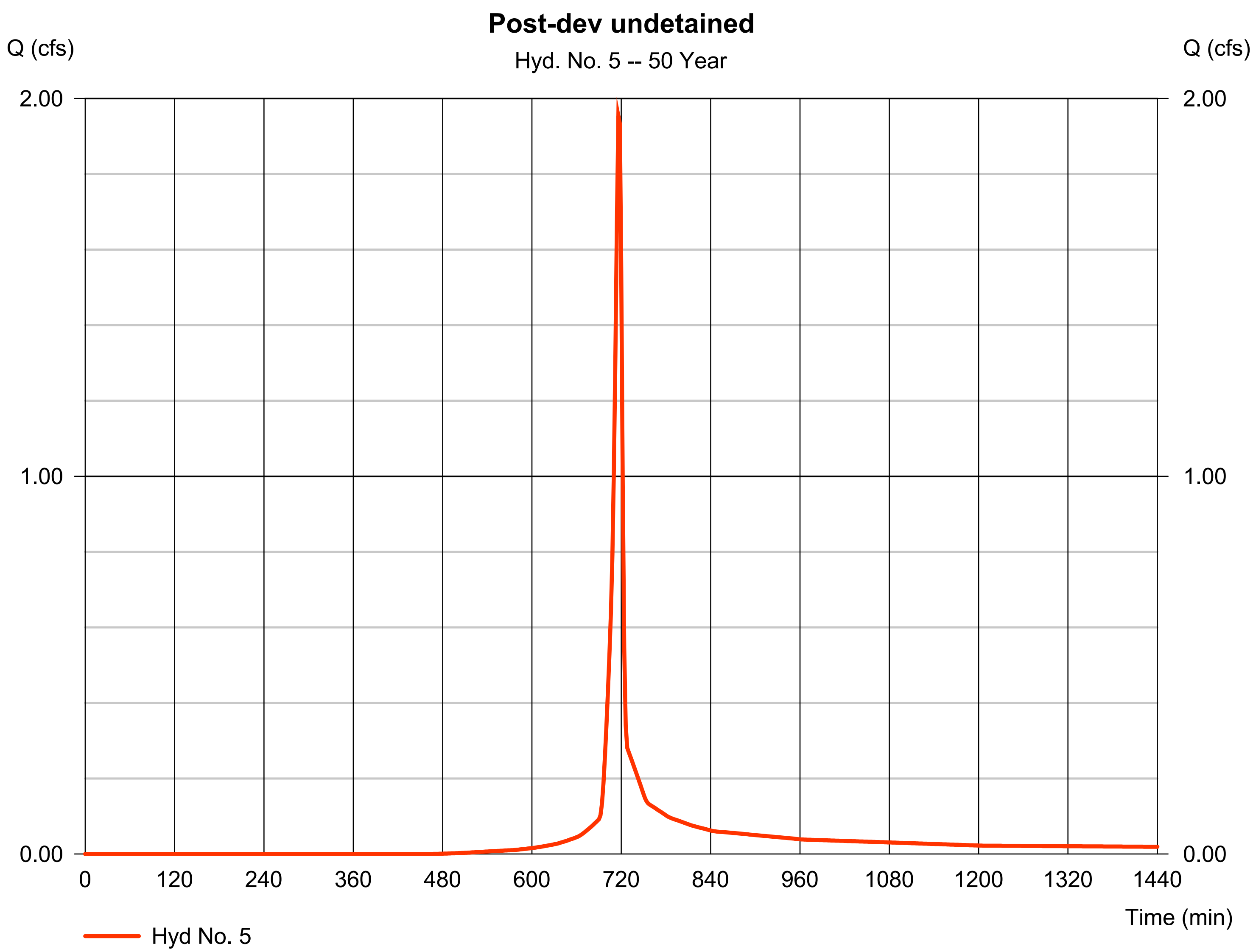


Hydrograph Report

Hyd. No. 5

Post-dev undetained

Hydrograph type	= SCS Runoff	Peak discharge	= 1.953 cfs
Storm frequency	= 50 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 3,956 cuft
Drainage area	= 0.430 ac	Curve number	= 78
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 4.99 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

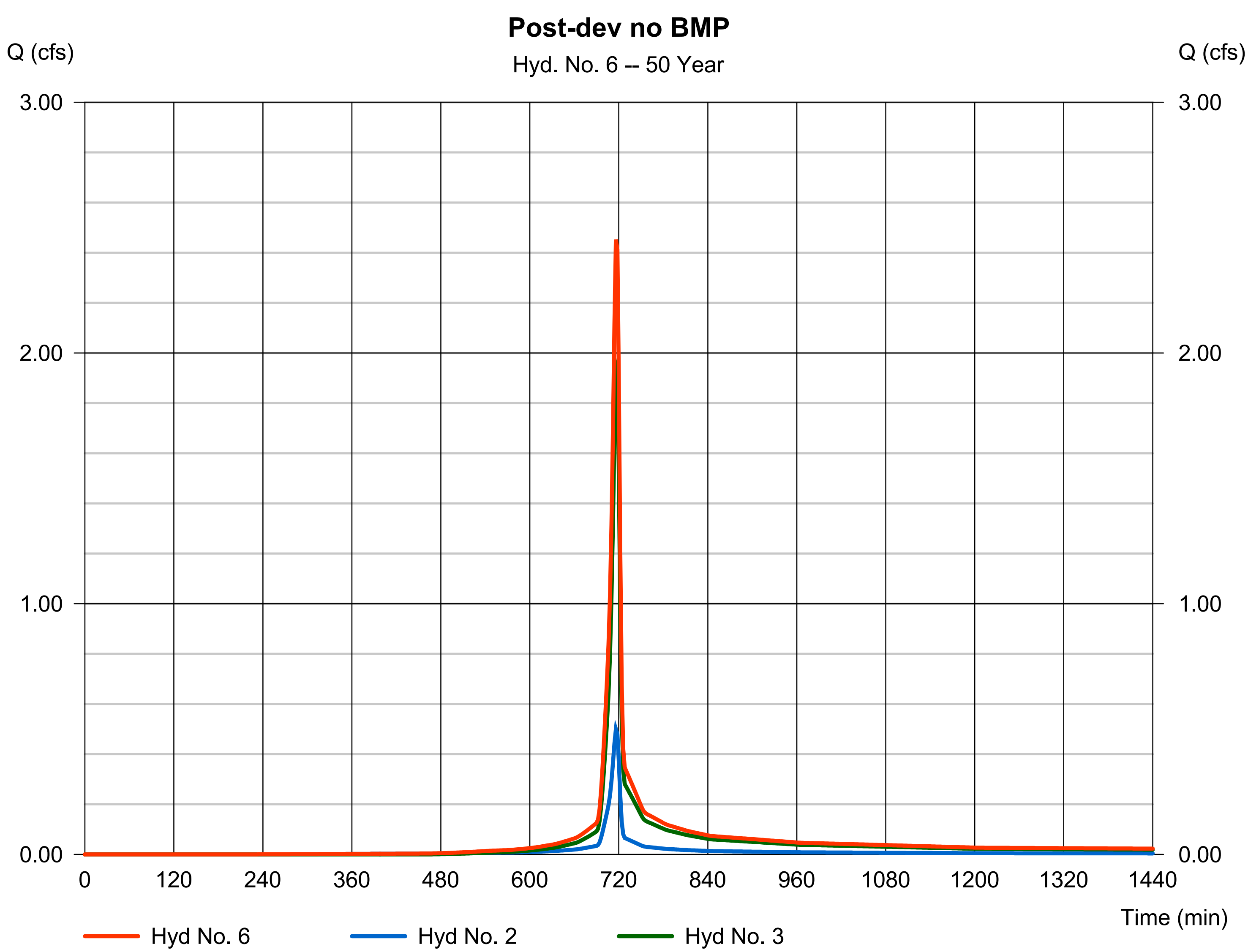


Hydrograph Report

Hyd. No. 6

Post-dev no BMP

Hydrograph type	= Combine	Peak discharge	= 2.453 cfs
Storm frequency	= 50 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 5,037 cuft
Inflow hyds.	= 2, 3	Contrib. drain. area	= 0.510 ac

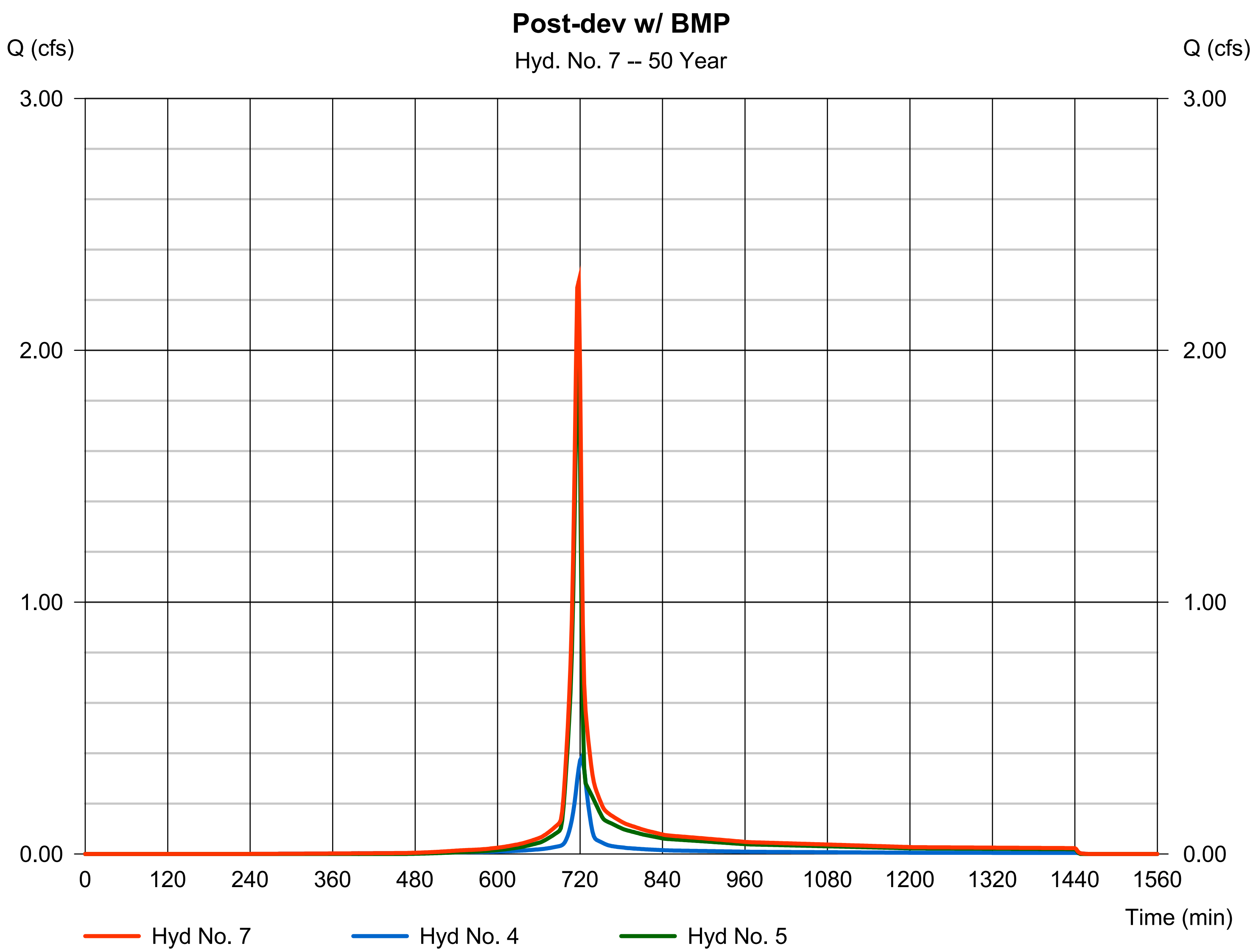


Hydrograph Report

Hyd. No. 7

Post-dev w/ BMP

Hydrograph type	= Combine	Peak discharge	= 2.274 cfs
Storm frequency	= 50 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 5,080 cuft
Inflow hyds.	= 4, 5	Contrib. drain. area	= 0.510 ac



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023

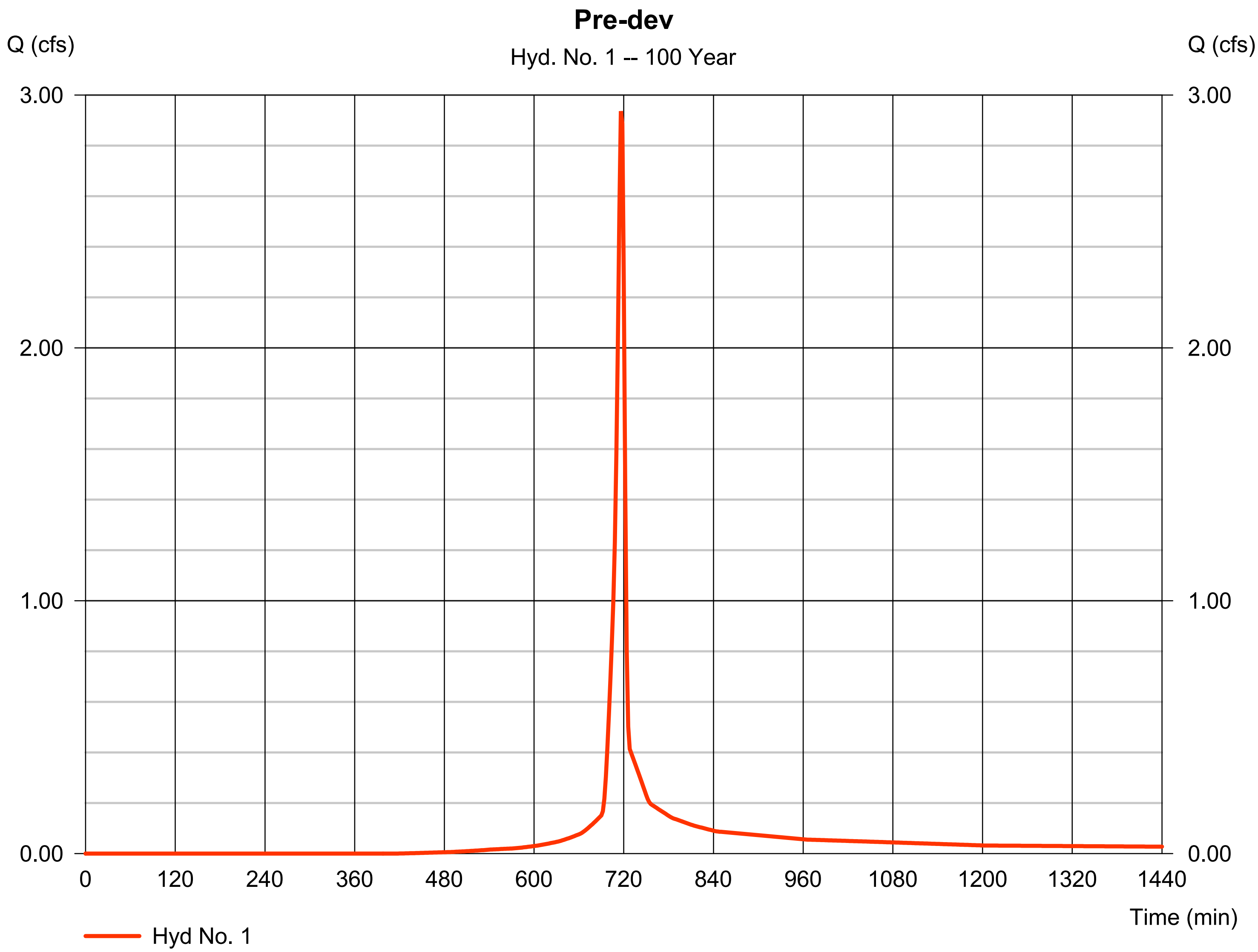
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	2.936	2	716	5,982	------	------	------	Pre-dev
2	SCS Runoff	0.597	2	716	1,310	------	------	------	Post-dev gravel
3	SCS Runoff	2.476	2	716	5,044	------	------	------	Post-dev undetained
4	SCS Runoff	0.523	2	720	1,441	------	------	------	Post-dev BMP Tc adjusted
5	SCS Runoff	2.476	2	716	5,044	------	------	------	Post-dev undetained
6	Combine	3.073	2	716	6,353	2, 3,	------	------	Post-dev no BMP
7	Combine	2.932	2	718	6,484	4, 5,	------	------	Post-dev w/ BMP

Hydrograph Report

Hyd. No. 1

Pre-dev

Hydrograph type	= SCS Runoff	Peak discharge	= 2.936 cfs
Storm frequency	= 100 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 5,982 cuft
Drainage area	= 0.510 ac	Curve number	= 78
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 5.85 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



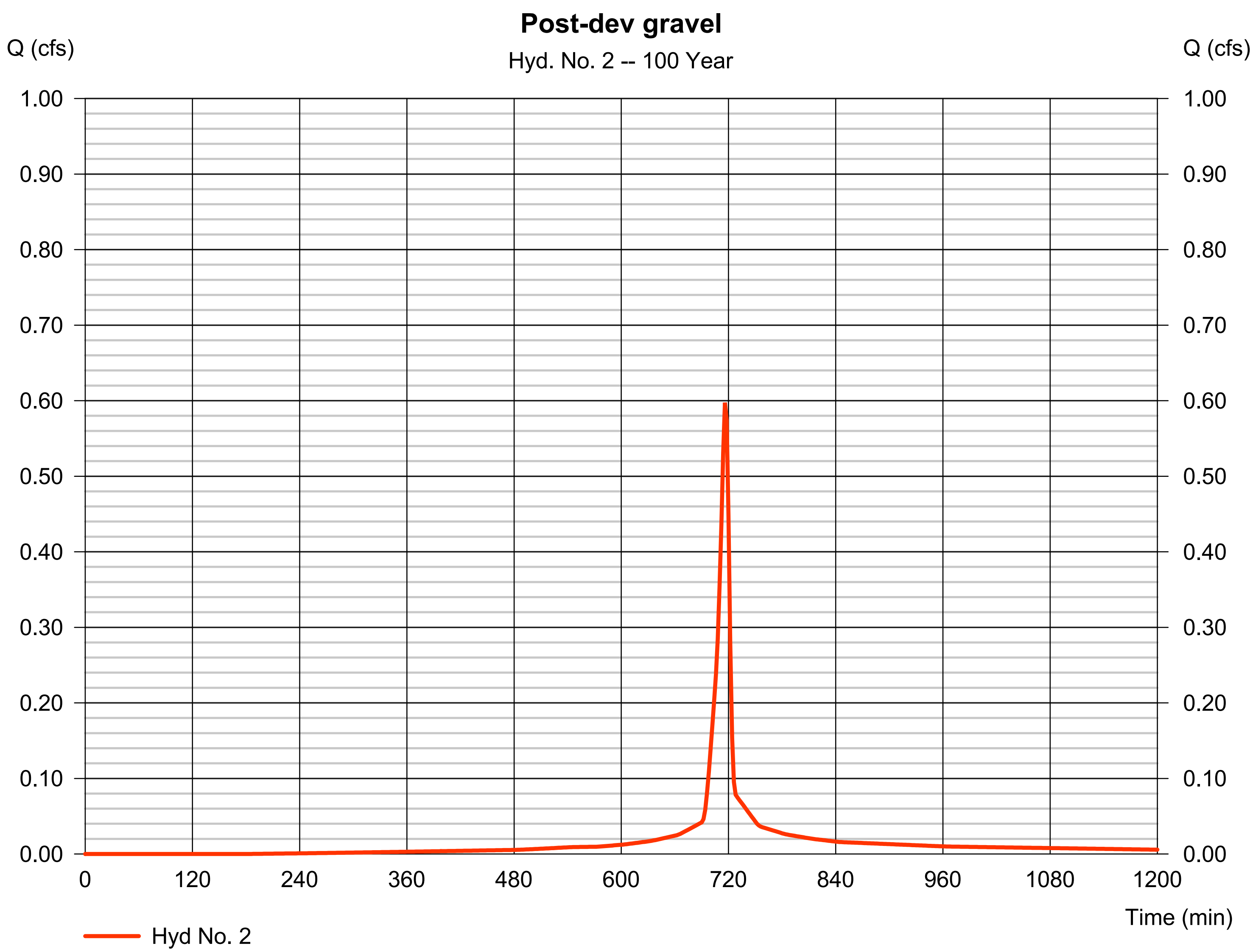
Hydrograph Report

Hyd. No. 2

Post-dev gravel

Hydrograph type	= SCS Runoff	Peak discharge	= 0.597 cfs
Storm frequency	= 100 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 1,310 cuft
Drainage area	= 0.080 ac	Curve number	= 91*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 5.85 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.430 x 78) + (0.080 x 91)] / 0.080

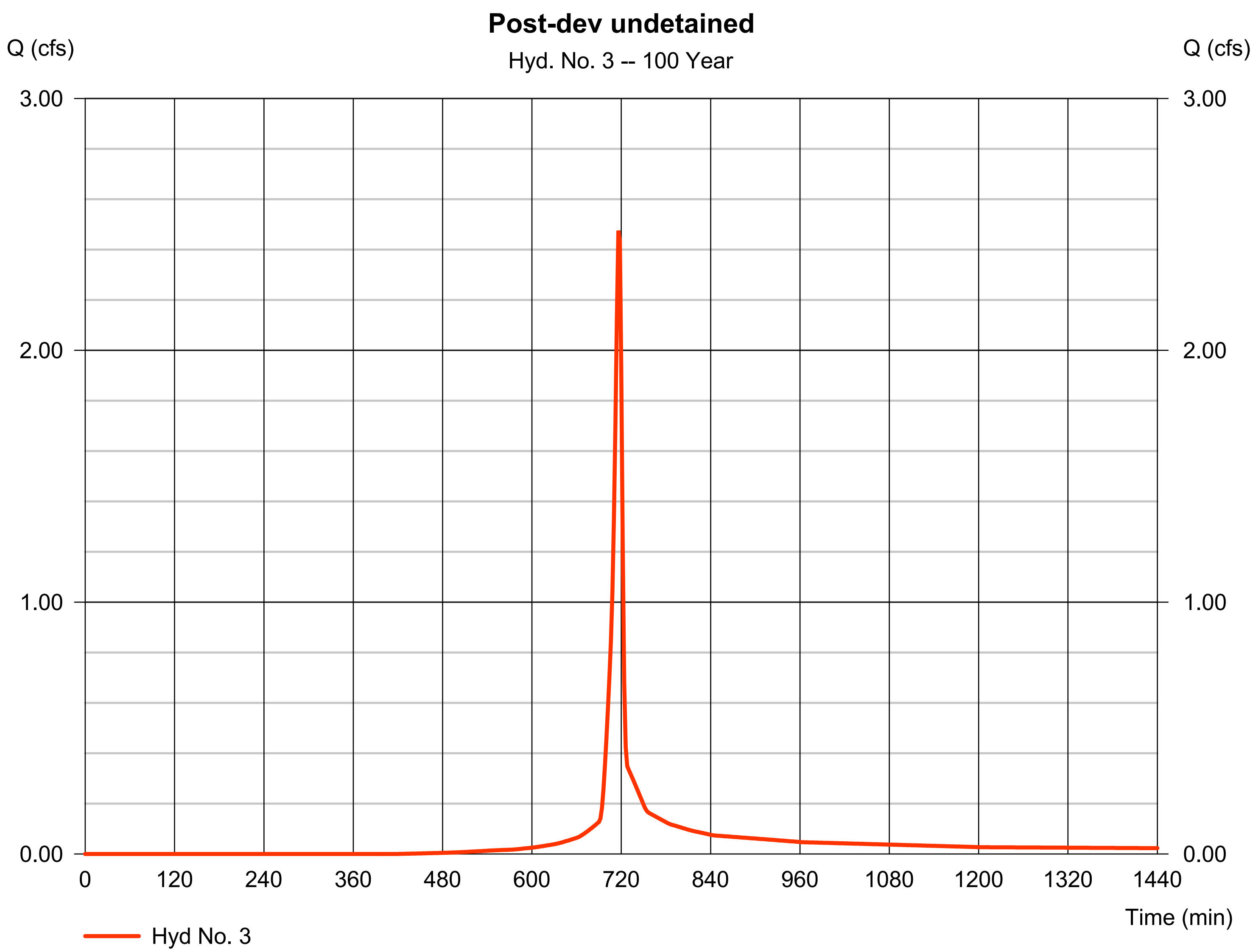


Hydrograph Report

Hyd. No. 3

Post-dev undetained

Hydrograph type	= SCS Runoff	Peak discharge	= 2.476 cfs
Storm frequency	= 100 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 5,044 cuft
Drainage area	= 0.430 ac	Curve number	= 78
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 5.85 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

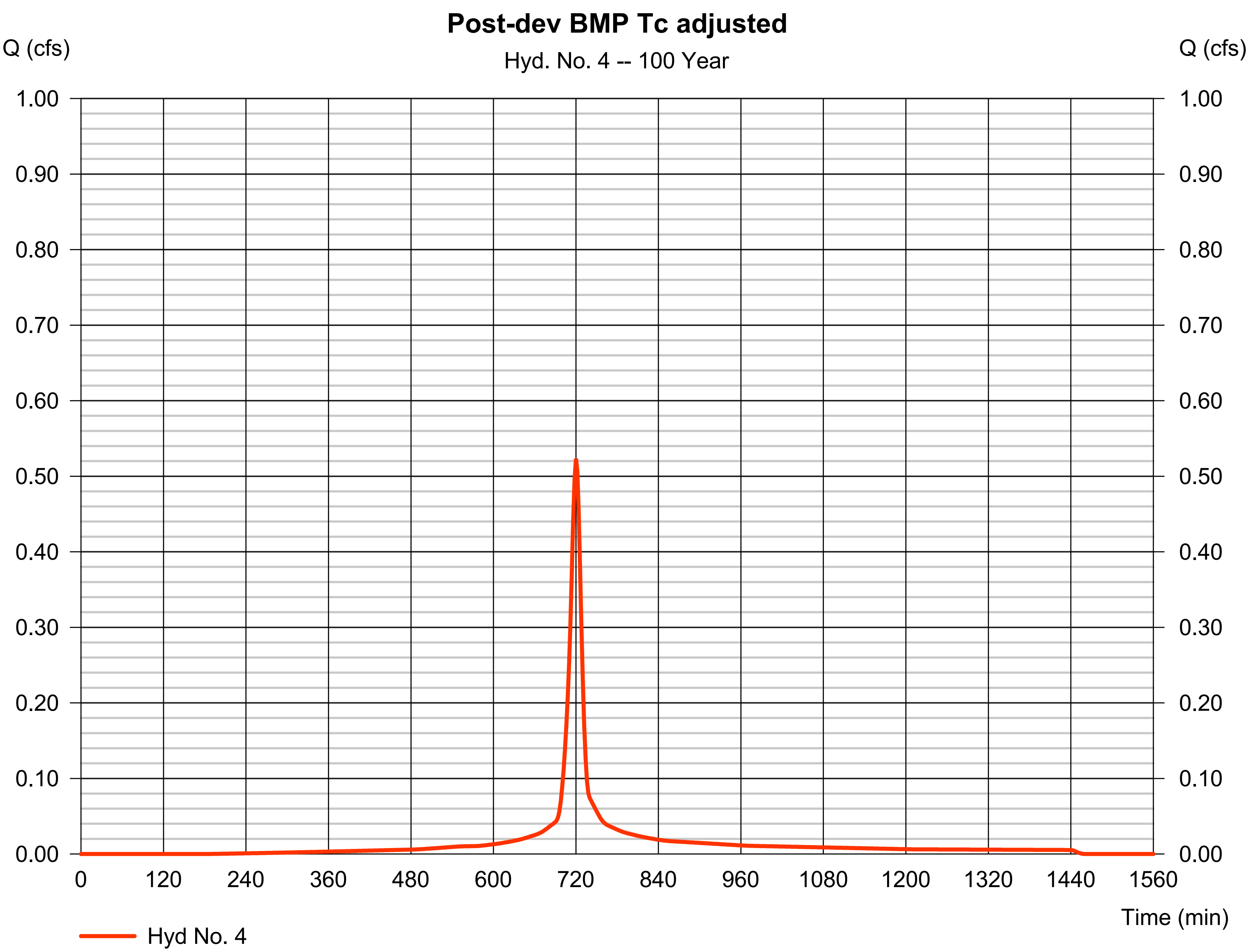


Hydrograph Report

Hyd. No. 4

Post-dev BMP Tc adjusted

Hydrograph type	= SCS Runoff	Peak discharge	= 0.523 cfs
Storm frequency	= 100 yrs	Time to peak	= 720 min
Time interval	= 2 min	Hyd. volume	= 1,441 cuft
Drainage area	= 0.080 ac	Curve number	= 91
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 12.00 min
Total precip.	= 5.85 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

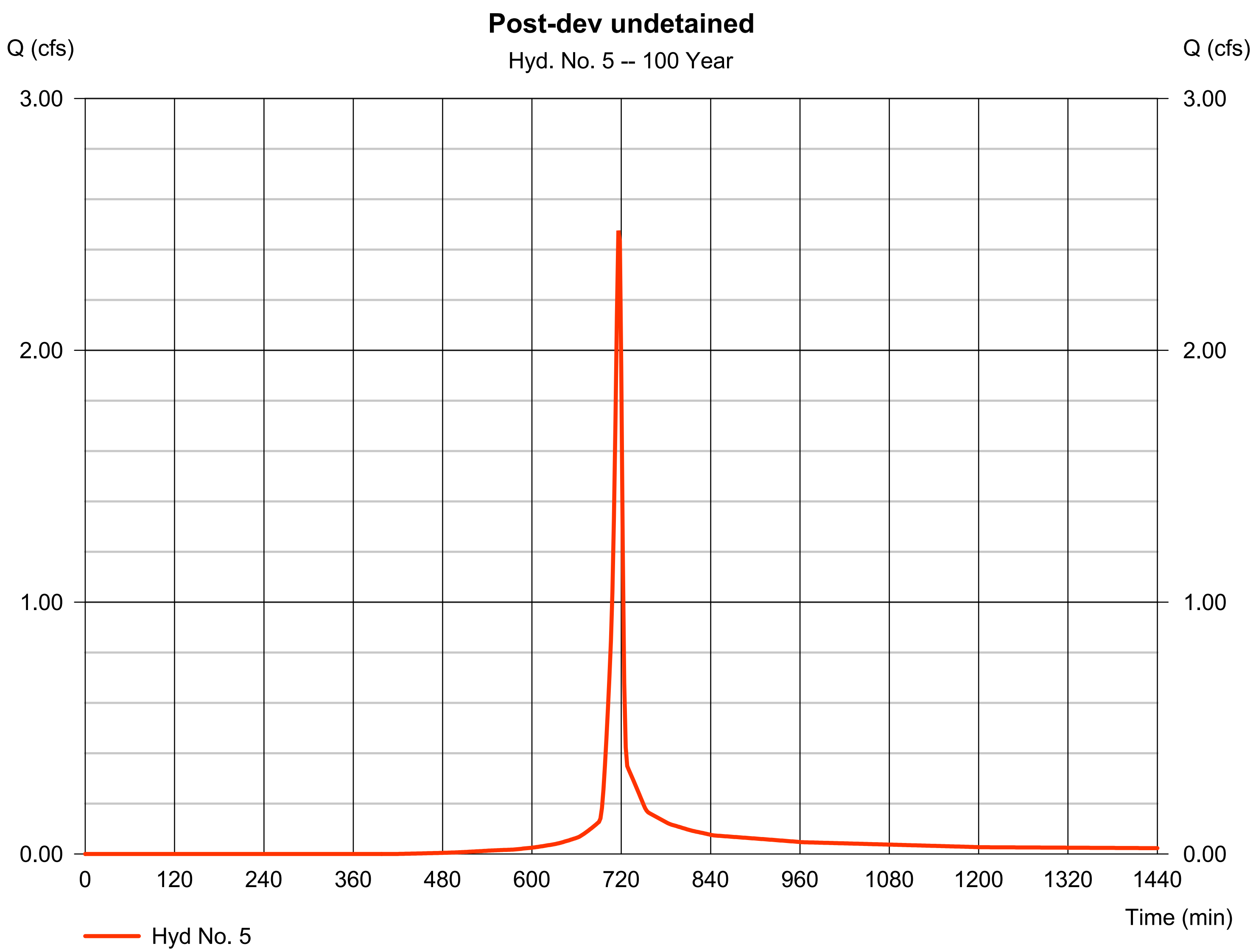


Hydrograph Report

Hyd. No. 5

Post-dev undetained

Hydrograph type	= SCS Runoff	Peak discharge	= 2.476 cfs
Storm frequency	= 100 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 5,044 cuft
Drainage area	= 0.430 ac	Curve number	= 78
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 5.85 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

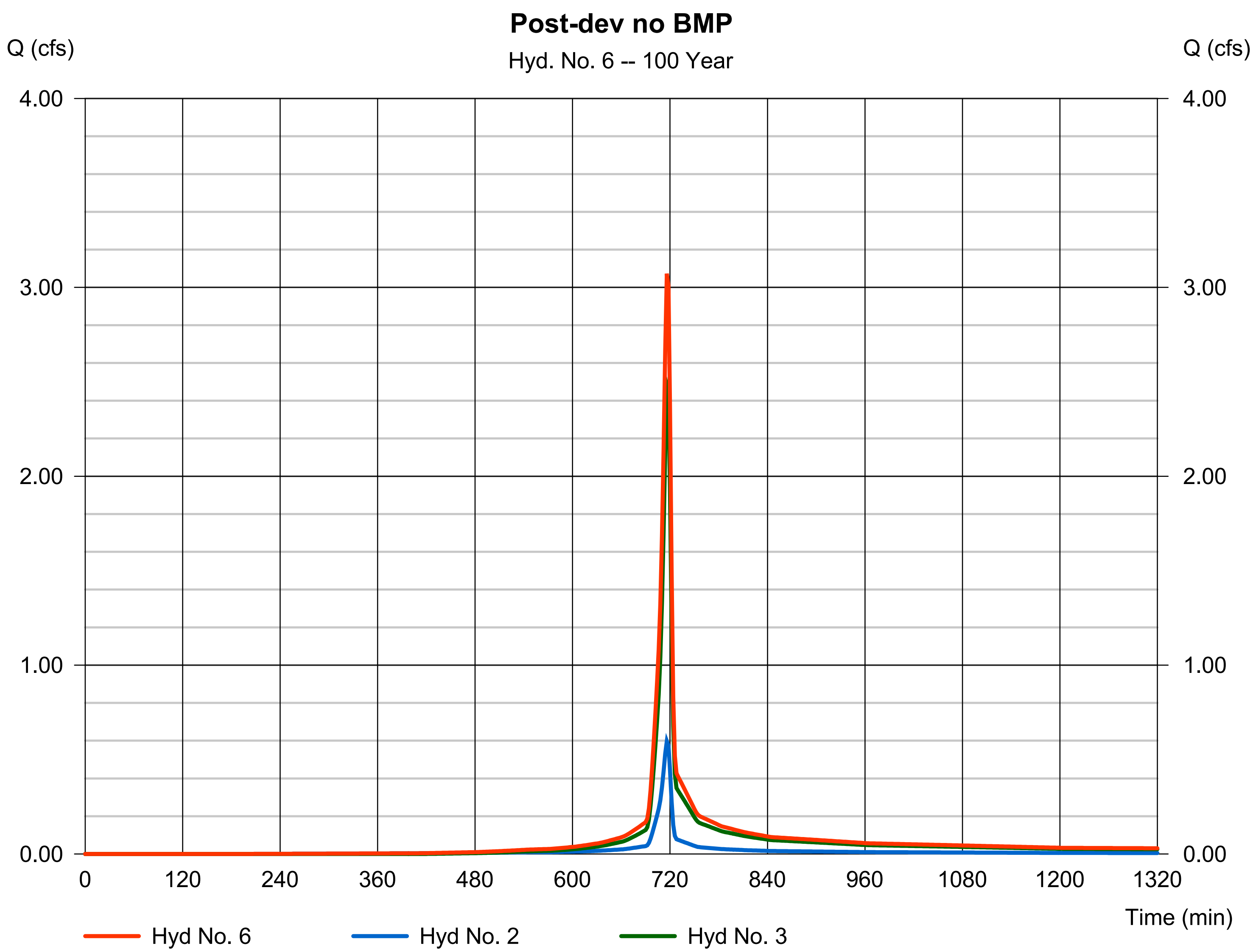


Hydrograph Report

Hyd. No. 6

Post-dev no BMP

Hydrograph type	= Combine	Peak discharge	= 3.073 cfs
Storm frequency	= 100 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 6,353 cuft
Inflow hyds.	= 2, 3	Contrib. drain. area	= 0.510 ac

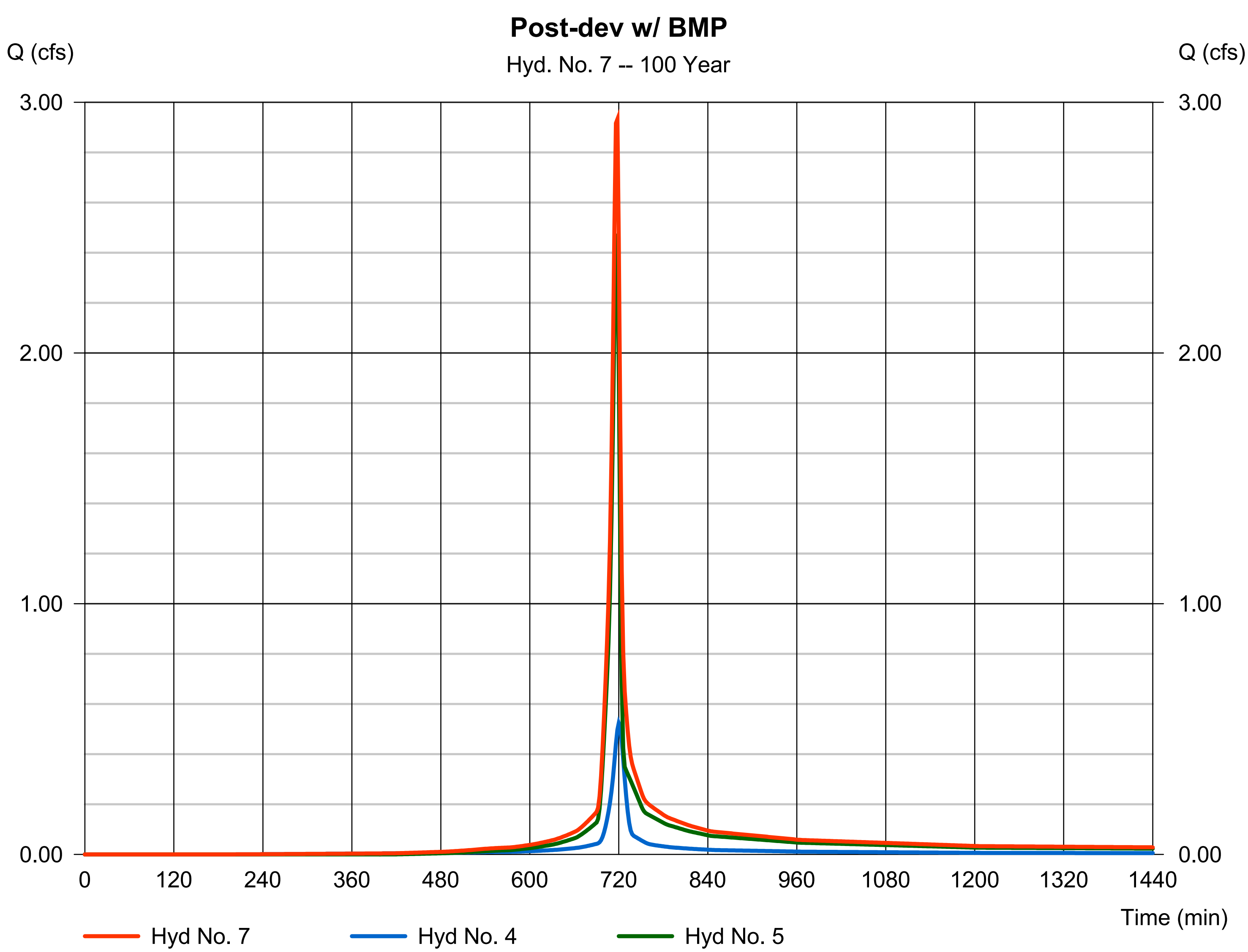


Hydrograph Report

Hyd. No. 7

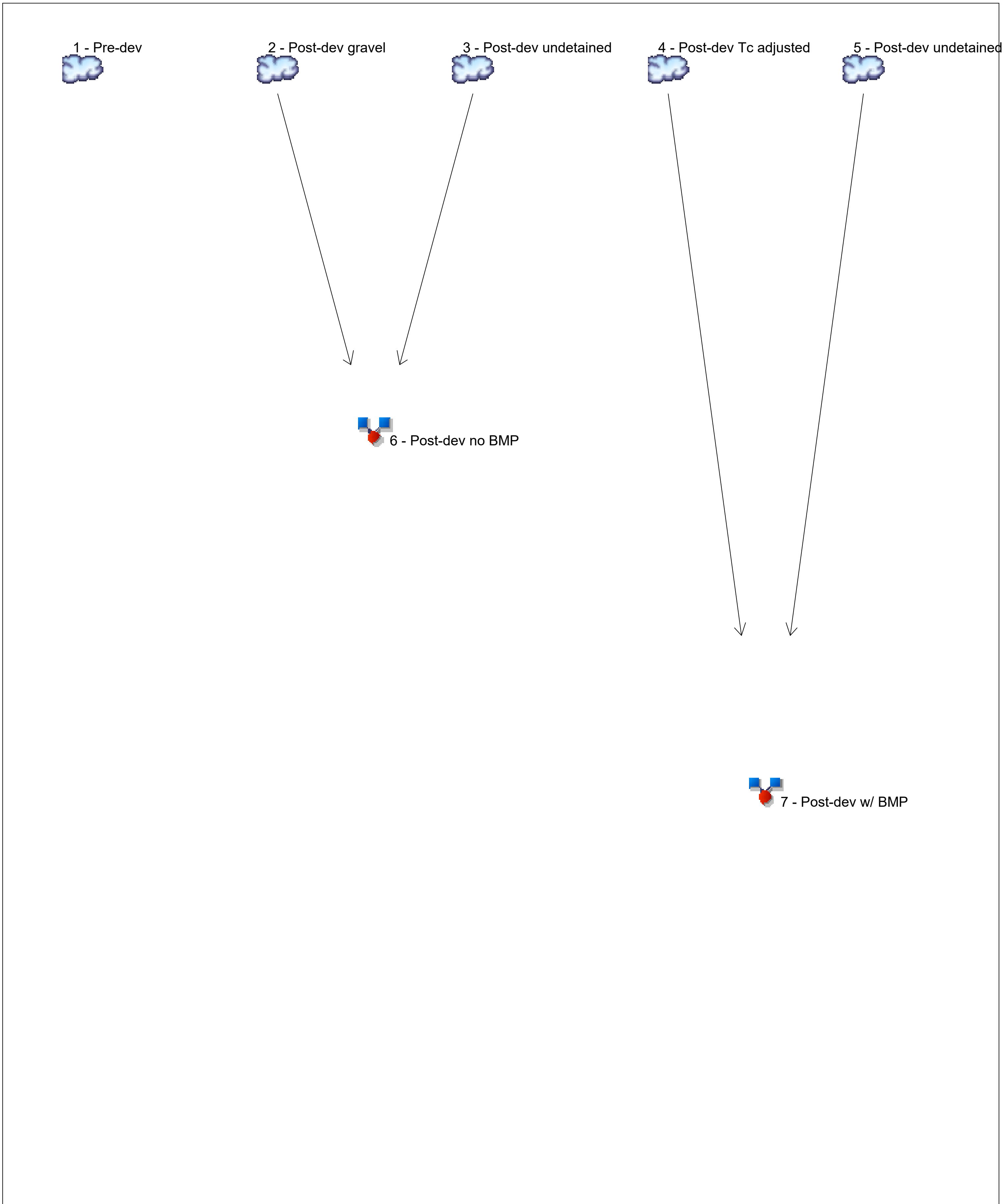
Post-dev w/ BMP

Hydrograph type	= Combine	Peak discharge	= 2.932 cfs
Storm frequency	= 100 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 6,484 cuft
Inflow hyds.	= 4, 5	Contrib. drain. area	= 0.510 ac



Watershed Model Schematic

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023



Project: OPP station.gpw

Friday, 11 / 8 / 2024

Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023

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	4.572	2	718	9,194	------	------	------	Pre-dev
2	SCS Runoff	1.368	2	716	2,809	------	------	------	Post-dev gravel
3	SCS Runoff	3.905	2	718	7,852	------	------	------	Post-dev undetained
4	SCS Runoff	0.803	2	728	2,950	------	------	------	Post-dev Tc adjusted
5	SCS Runoff	3.905	2	718	7,852	------	------	------	Post-dev undetained
6	Combine	5.243	2	718	10,662	2, 3,	------	------	Post-dev no BMP
7	Combine	4.435	2	718	10,802	4, 5,	------	------	Post-dev w/ BMP

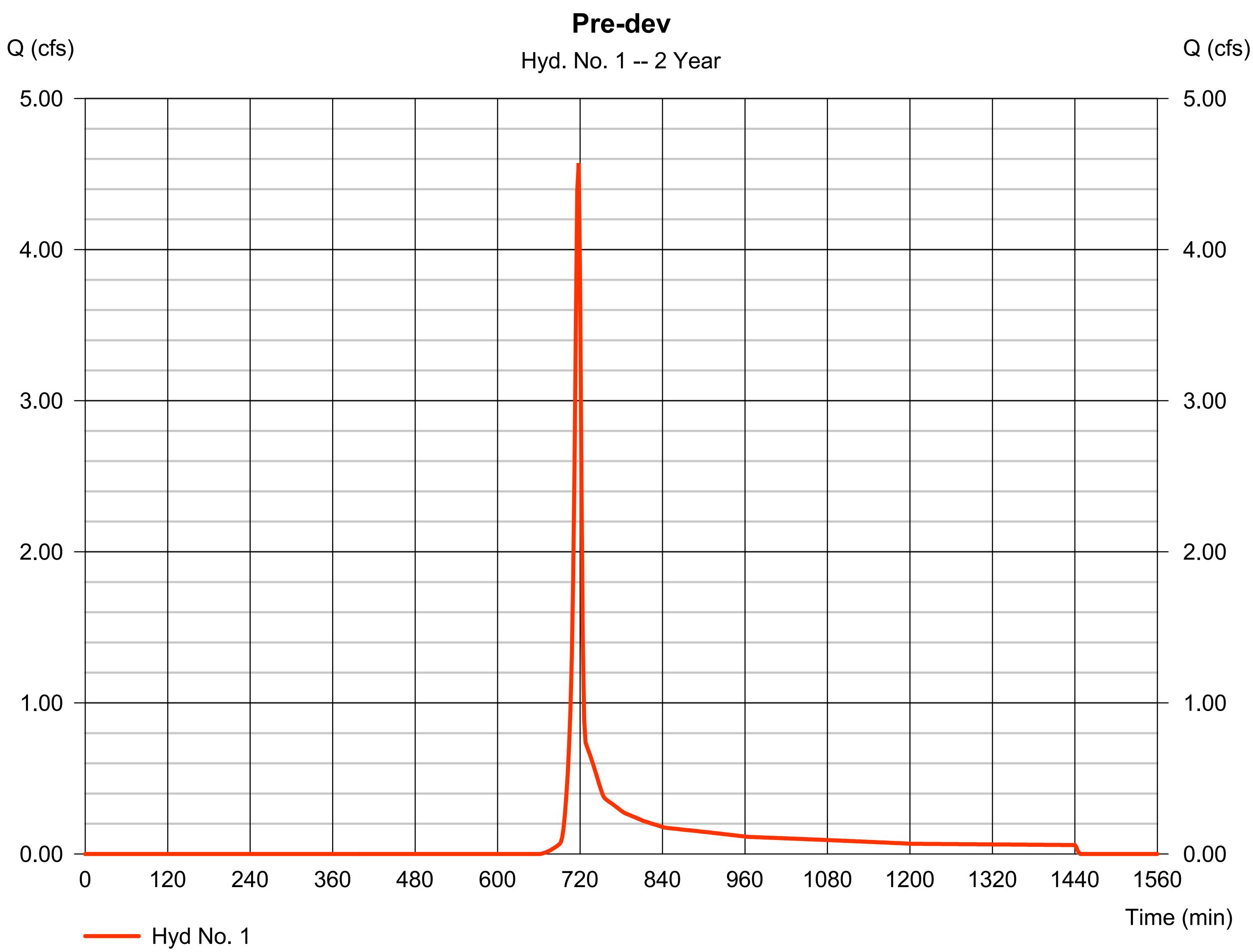
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023 — Friday, 11 / 8 / 2024

Hyd. No. 1

Pre-dev

Hydrograph type	= SCS Runoff	Peak discharge	= 4.572 cfs
Storm frequency	= 2 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 9,194 cuft
Drainage area	= 3.700 ac	Curve number	= 78
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 2.41 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Report

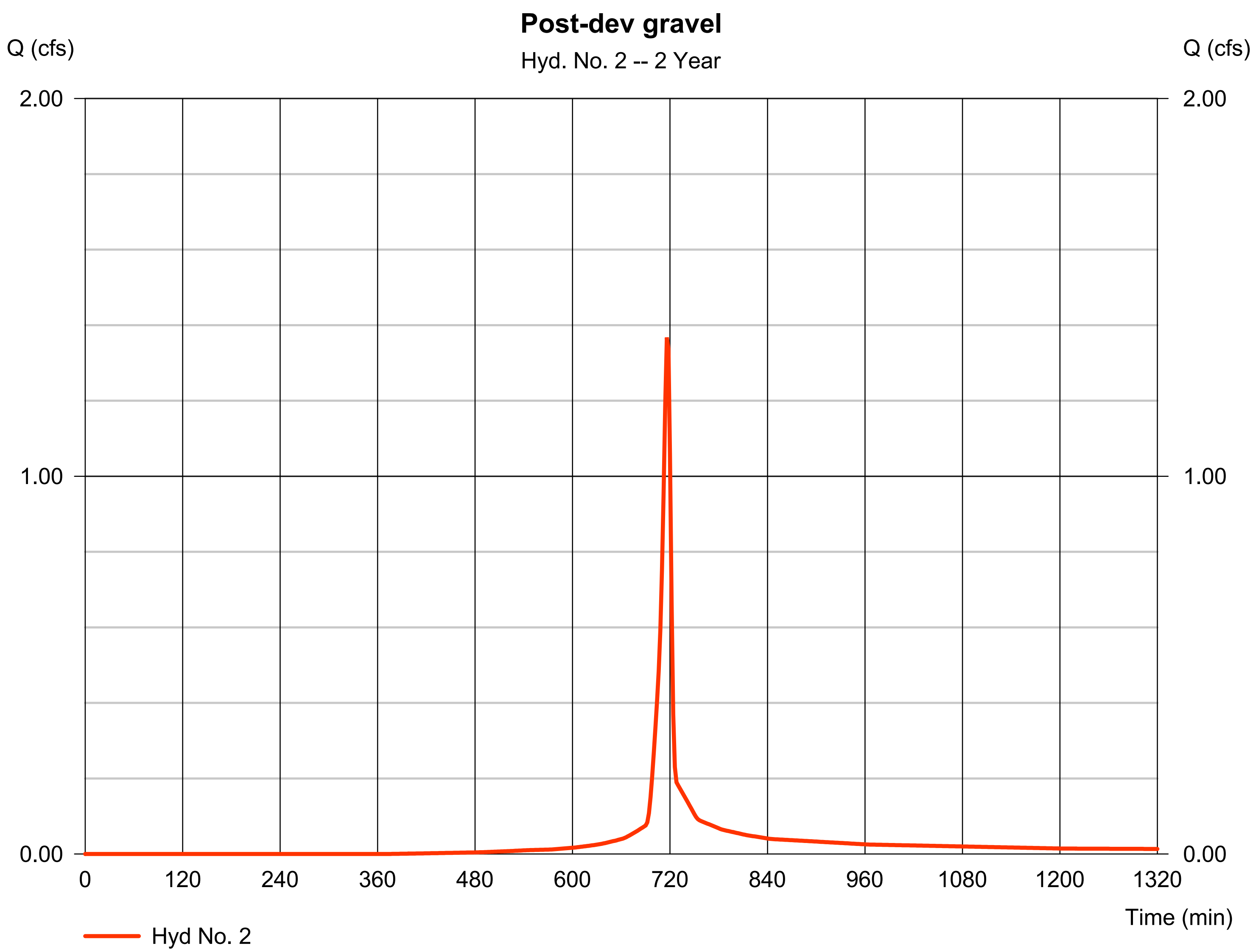
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023 | Friday, 11 / 8 / 2024

Hyd. No. 2

Post-dev gravel

Hydrograph type	= SCS Runoff	Peak discharge	= 1.368 cfs
Storm frequency	= 2 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 2,809 cuft
Drainage area	= 0.540 ac	Curve number	= 91*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 2.41 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.430 x 78) + (0.080 x 91)] / 0.540



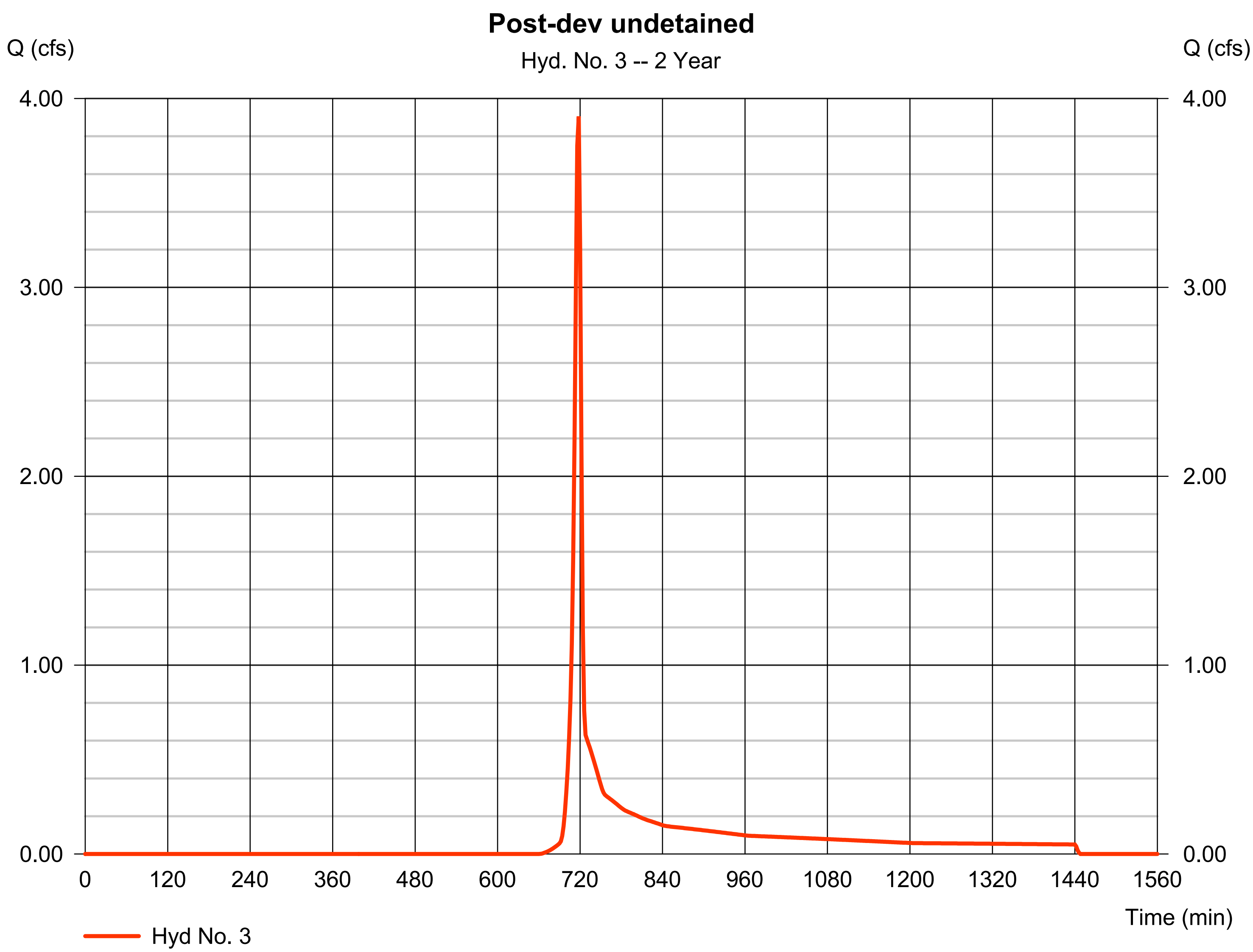
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023 Friday, 11 / 8 / 2024

Hyd. No. 3

Post-dev undetained

Hydrograph type	= SCS Runoff	Peak discharge	= 3.905 cfs
Storm frequency	= 2 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 7,852 cuft
Drainage area	= 3.160 ac	Curve number	= 78
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 2.41 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

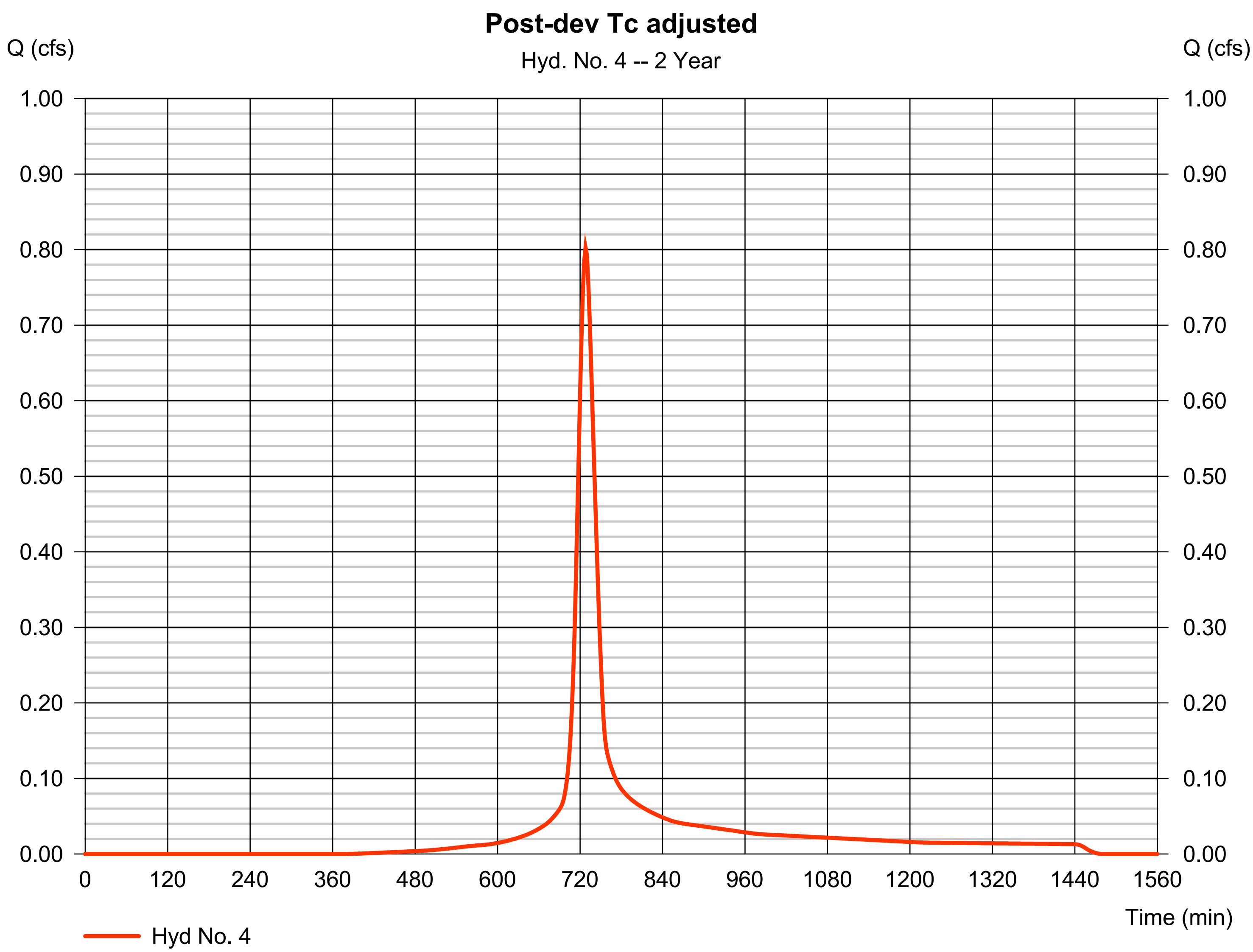


Hydrograph Report

Hyd. No. 4

Post-dev Tc adjusted

Hydrograph type	= SCS Runoff	Peak discharge	= 0.803 cfs
Storm frequency	= 2 yrs	Time to peak	= 728 min
Time interval	= 2 min	Hyd. volume	= 2,950 cuft
Drainage area	= 0.540 ac	Curve number	= 91
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 25.40 min
Total precip.	= 2.41 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

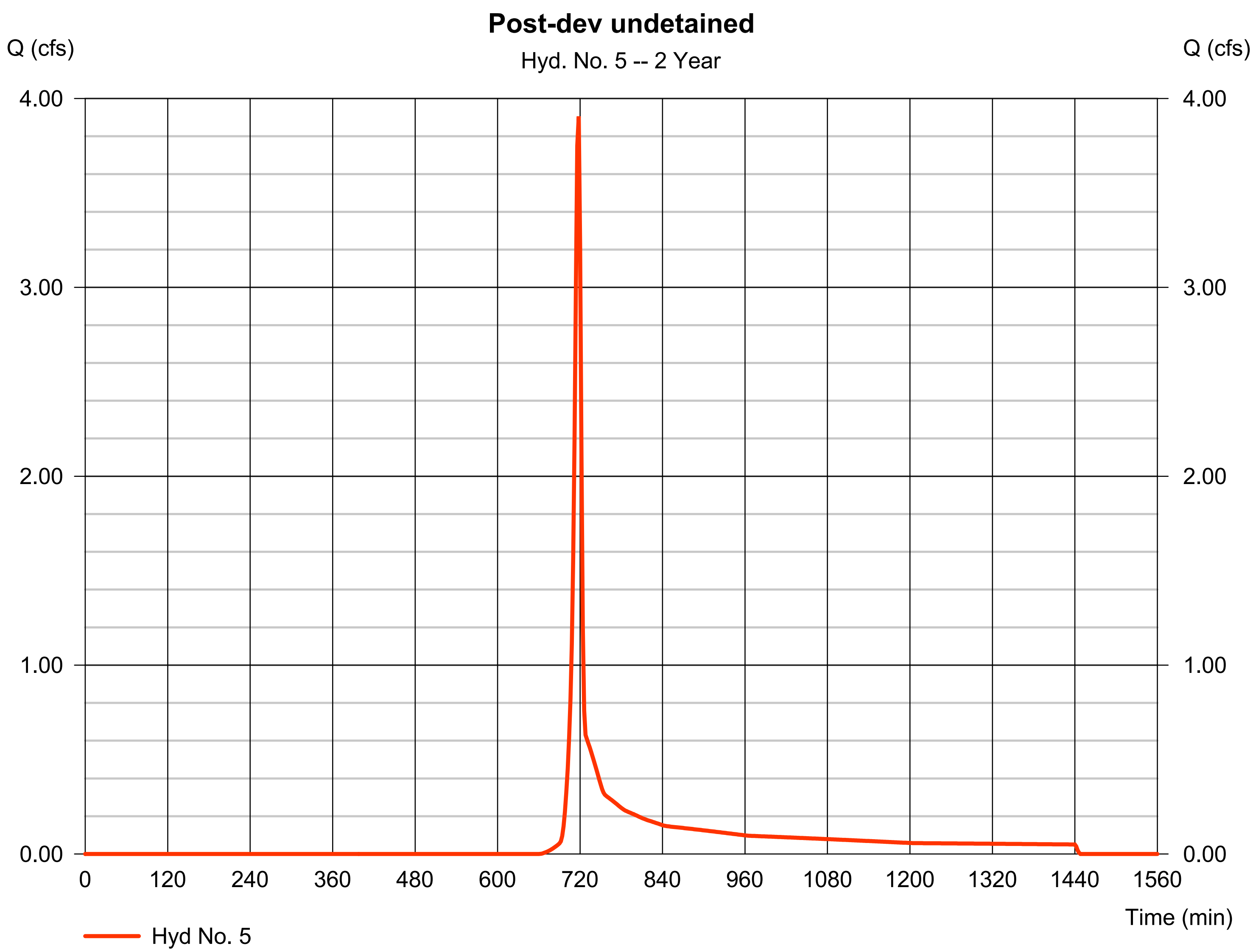


Hydrograph Report

Hyd. No. 5

Post-dev undetained

Hydrograph type	= SCS Runoff	Peak discharge	= 3.905 cfs
Storm frequency	= 2 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 7,852 cuft
Drainage area	= 3.160 ac	Curve number	= 78
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 2.41 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



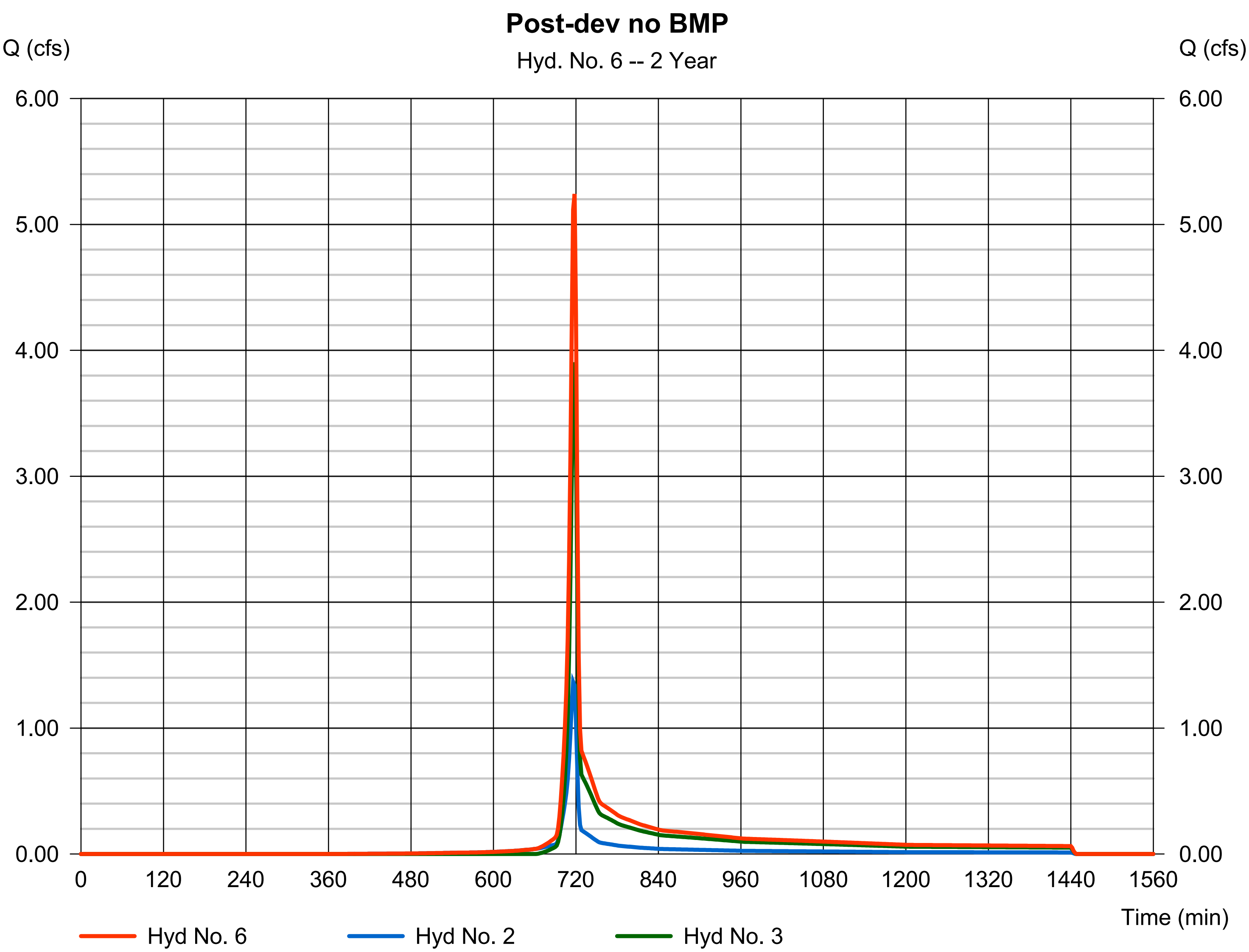
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023 — Friday, 11 / 8 / 2024

Hyd. No. 6

Post-dev no BMP

Hydrograph type	= Combine	Peak discharge	= 5.243 cfs
Storm frequency	= 2 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 10,662 cuft
Inflow hyds.	= 2, 3	Contrib. drain. area	= 3.700 ac



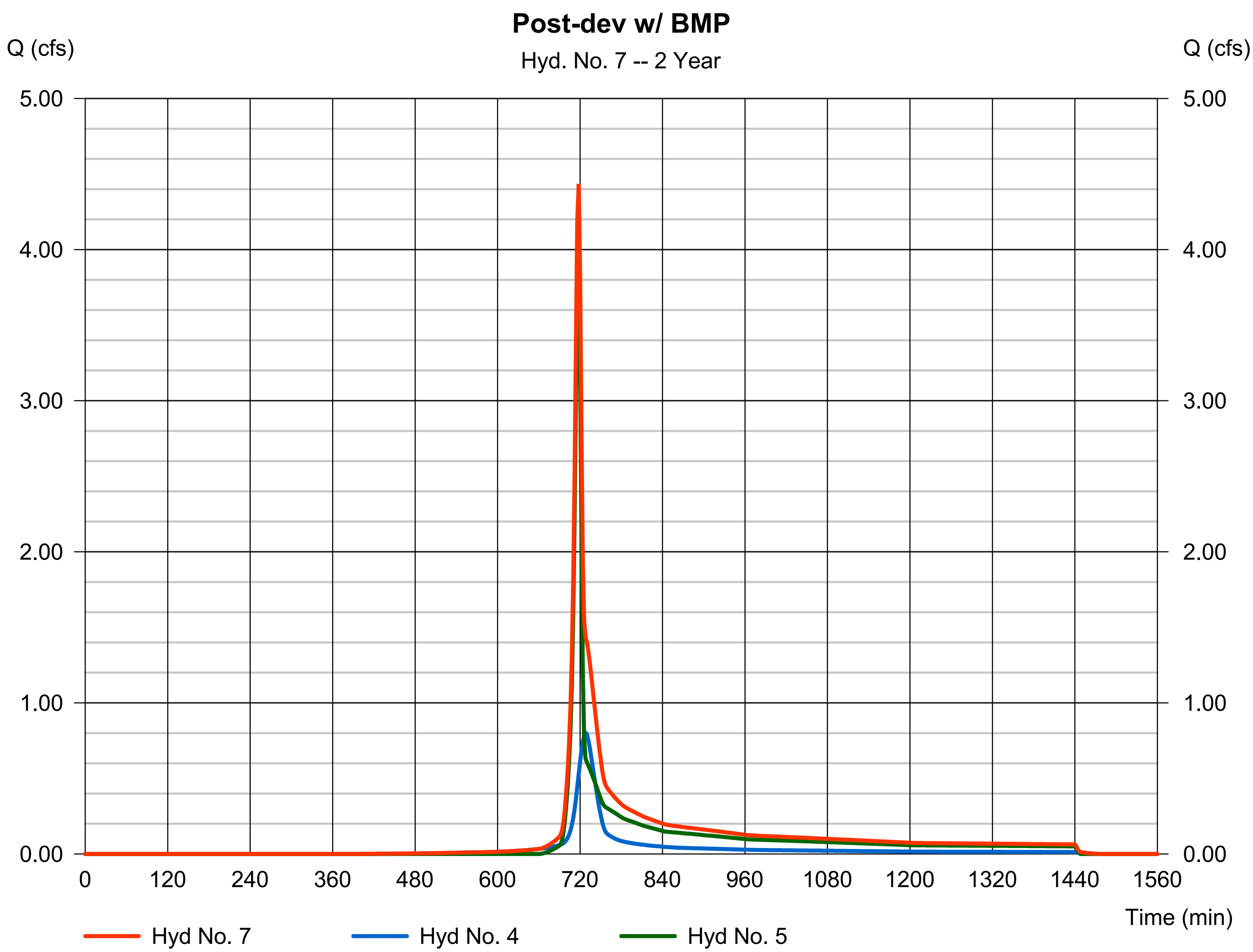
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023 Friday, 11 / 8 / 2024

Hyd. No. 7

Post-dev w/ BMP

Hydrograph type	= Combine	Peak discharge	= 4.435 cfs
Storm frequency	= 2 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 10,802 cuft
Inflow hyds.	= 4, 5	Contrib. drain. area	= 3.700 ac



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023

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	10.39	2	718	20,886	------	------	------	Pre-dev
2	SCS Runoff	2.381	2	716	5,036	------	------	------	Post-dev gravel
3	SCS Runoff	8.871	2	718	17,838	------	------	------	Post-dev undetained
4	SCS Runoff	1.681	2	724	5,372	------	------	------	Post-dev Tc adjusted
5	SCS Runoff	8.871	2	718	17,838	------	------	------	Post-dev undetained
6	Combine	11.21	2	716	22,874	2, 3,	------	------	Post-dev no BMP
7	Combine	10.23	2	718	23,210	4, 5,	------	------	Post-dev w/ BMP

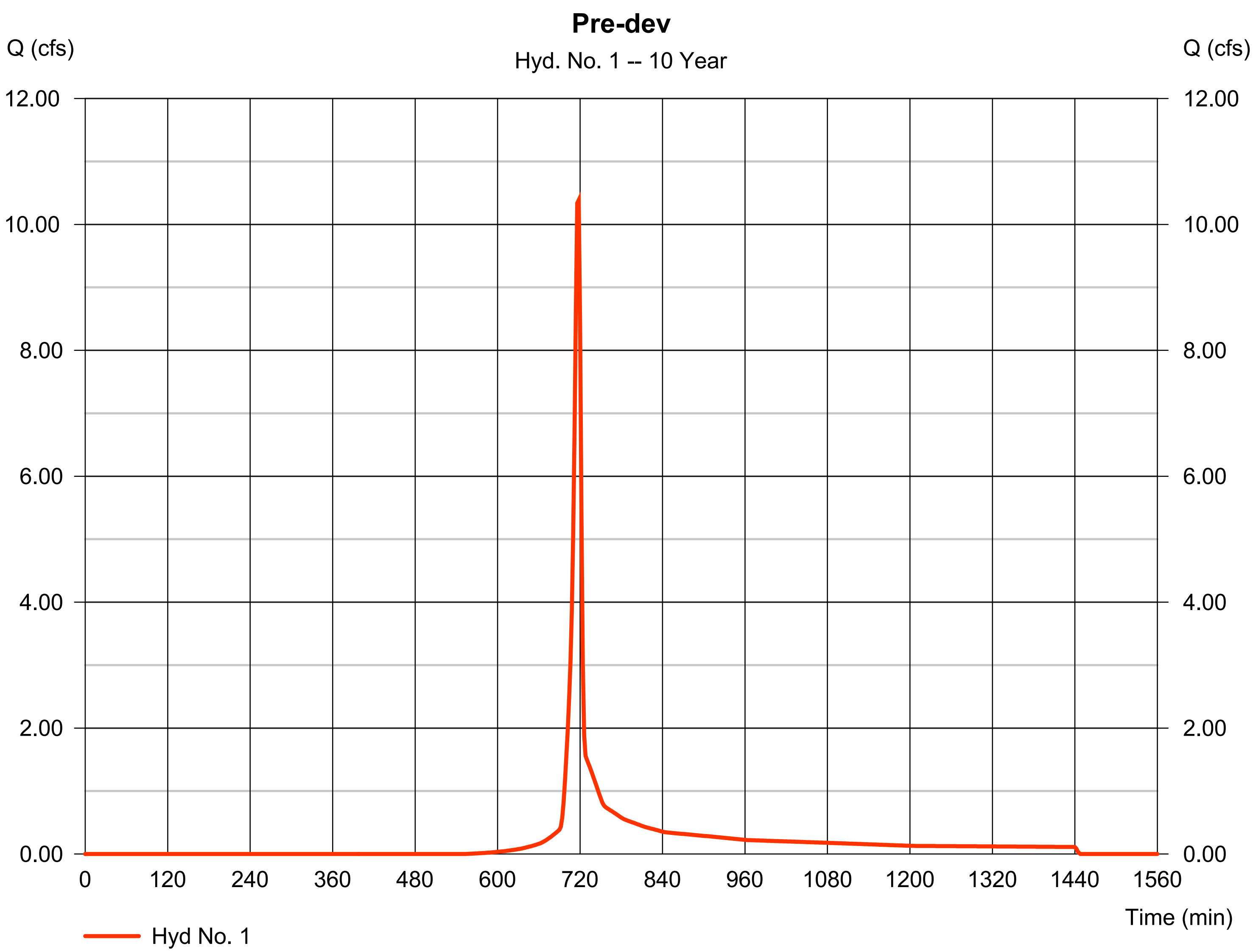
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023 Friday, 11 / 8 / 2024

Hyd. No. 1

Pre-dev

Hydrograph type	= SCS Runoff	Peak discharge	= 10.39 cfs
Storm frequency	= 10 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 20,886 cuft
Drainage area	= 3.700 ac	Curve number	= 78
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 3.71 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Report

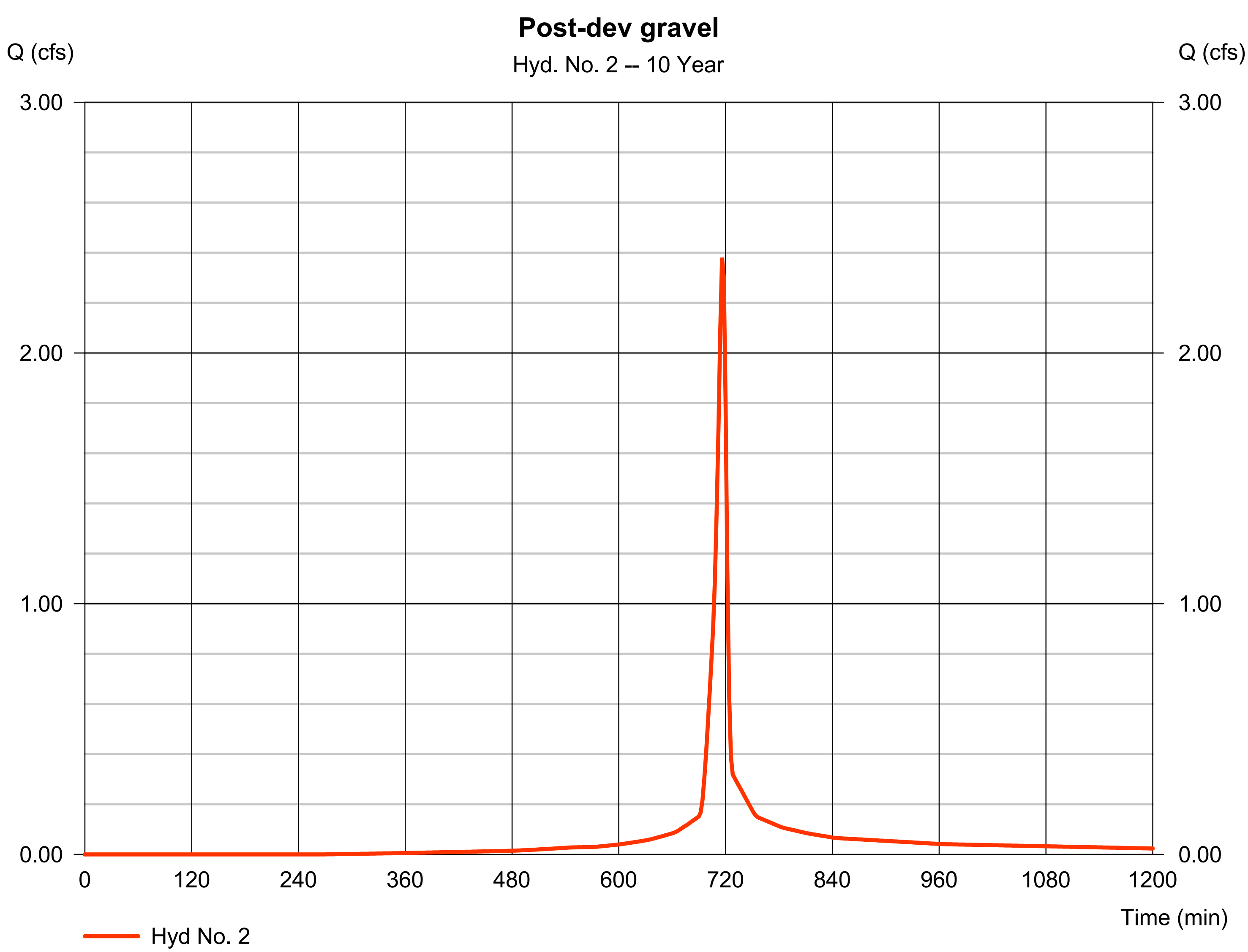
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023 Friday, 11 / 8 / 2024

Hyd. No. 2

Post-dev gravel

Hydrograph type	= SCS Runoff	Peak discharge	= 2.381 cfs
Storm frequency	= 10 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 5,036 cuft
Drainage area	= 0.540 ac	Curve number	= 91*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 3.71 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.430 x 78) + (0.080 x 91)] / 0.540



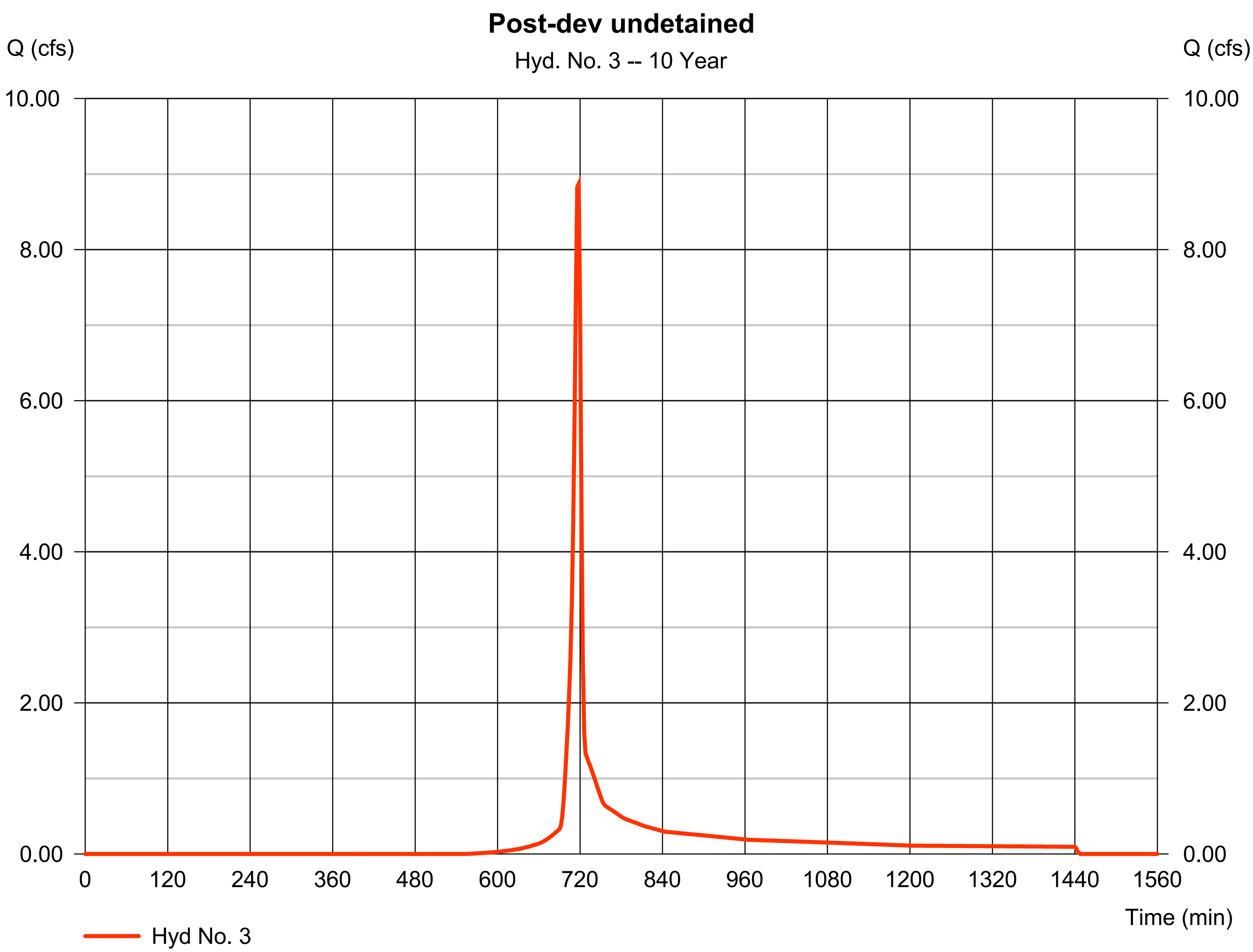
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023 Friday, 11 / 8 / 2024

Hyd. No. 3

Post-dev undetained

Hydrograph type	= SCS Runoff	Peak discharge	= 8.871 cfs
Storm frequency	= 10 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 17,838 cuft
Drainage area	= 3.160 ac	Curve number	= 78
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 3.71 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



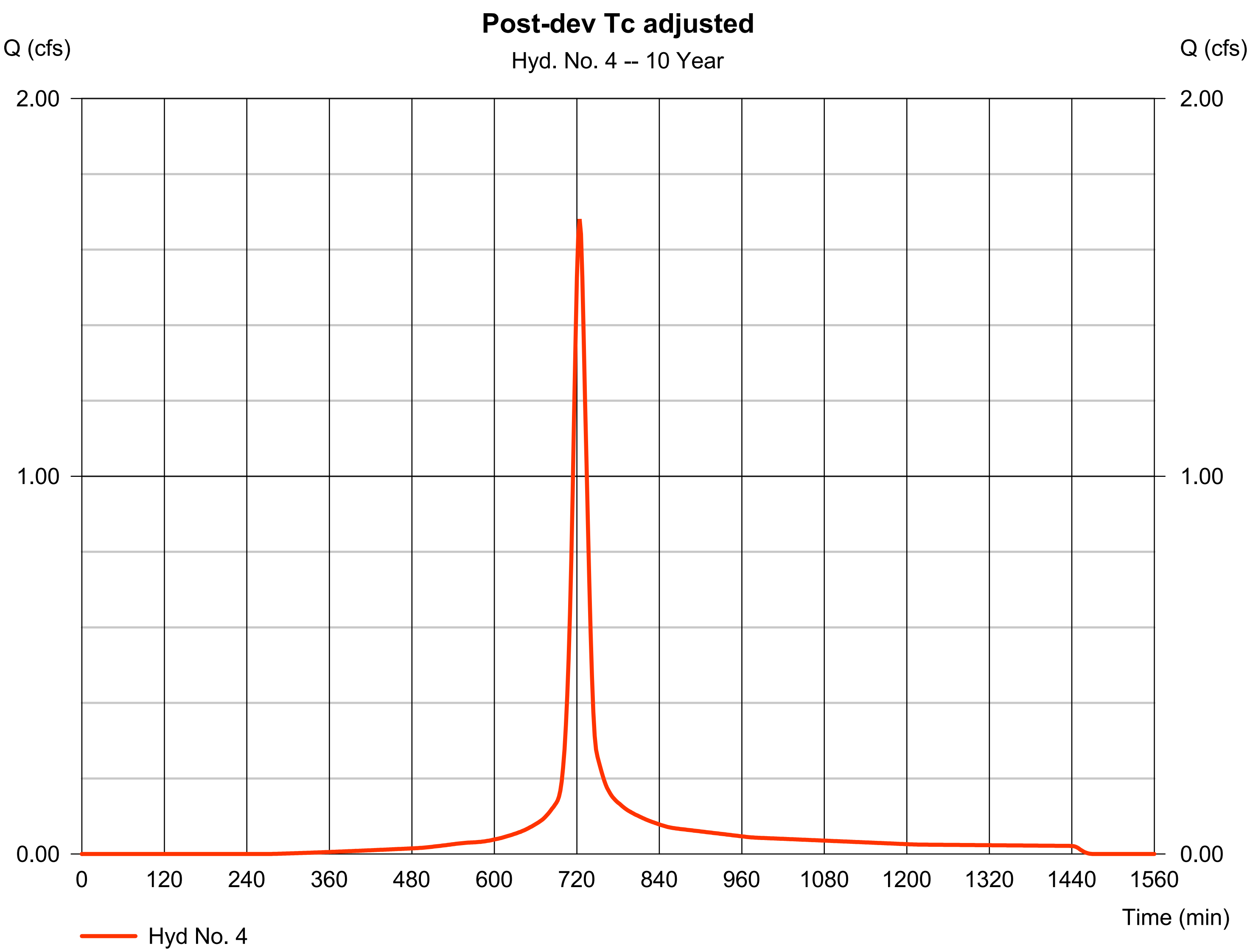
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023 | Friday, 11 / 8 / 2024

Hyd. No. 4

Post-dev Tc adjusted

Hydrograph type	= SCS Runoff	Peak discharge	= 1.681 cfs
Storm frequency	= 10 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 5,372 cuft
Drainage area	= 0.540 ac	Curve number	= 91
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 16.80 min
Total precip.	= 3.71 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

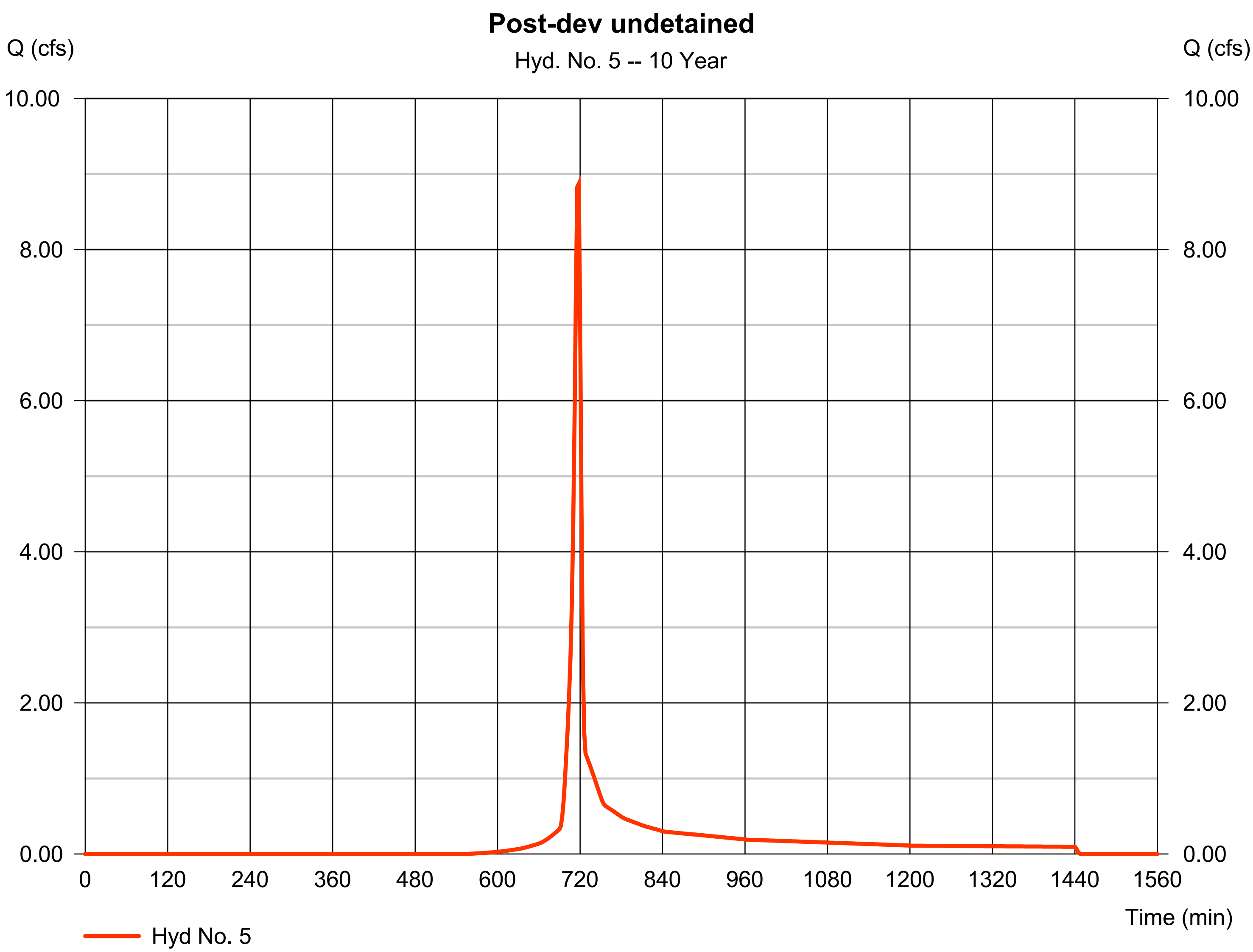


Hydrograph Report

Hyd. No. 5

Post-dev undetained

Hydrograph type	= SCS Runoff	Peak discharge	= 8.871 cfs
Storm frequency	= 10 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 17,838 cuft
Drainage area	= 3.160 ac	Curve number	= 78
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 3.71 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



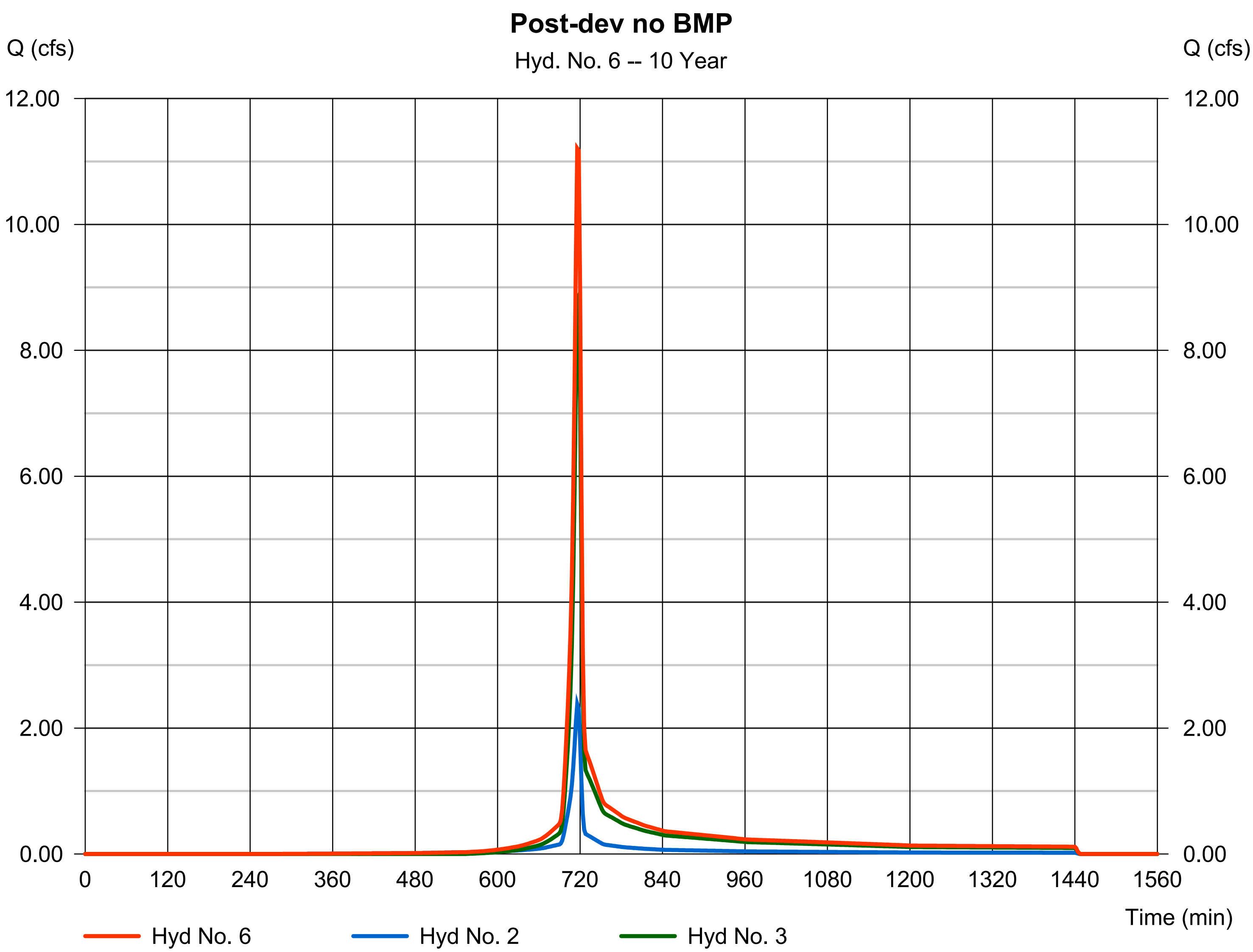
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023 Friday, 11 / 8 / 2024

Hyd. No. 6

Post-dev no BMP

Hydrograph type	= Combine	Peak discharge	= 11.21 cfs
Storm frequency	= 10 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 22,874 cuft
Inflow hyds.	= 2, 3	Contrib. drain. area	= 3.700 ac



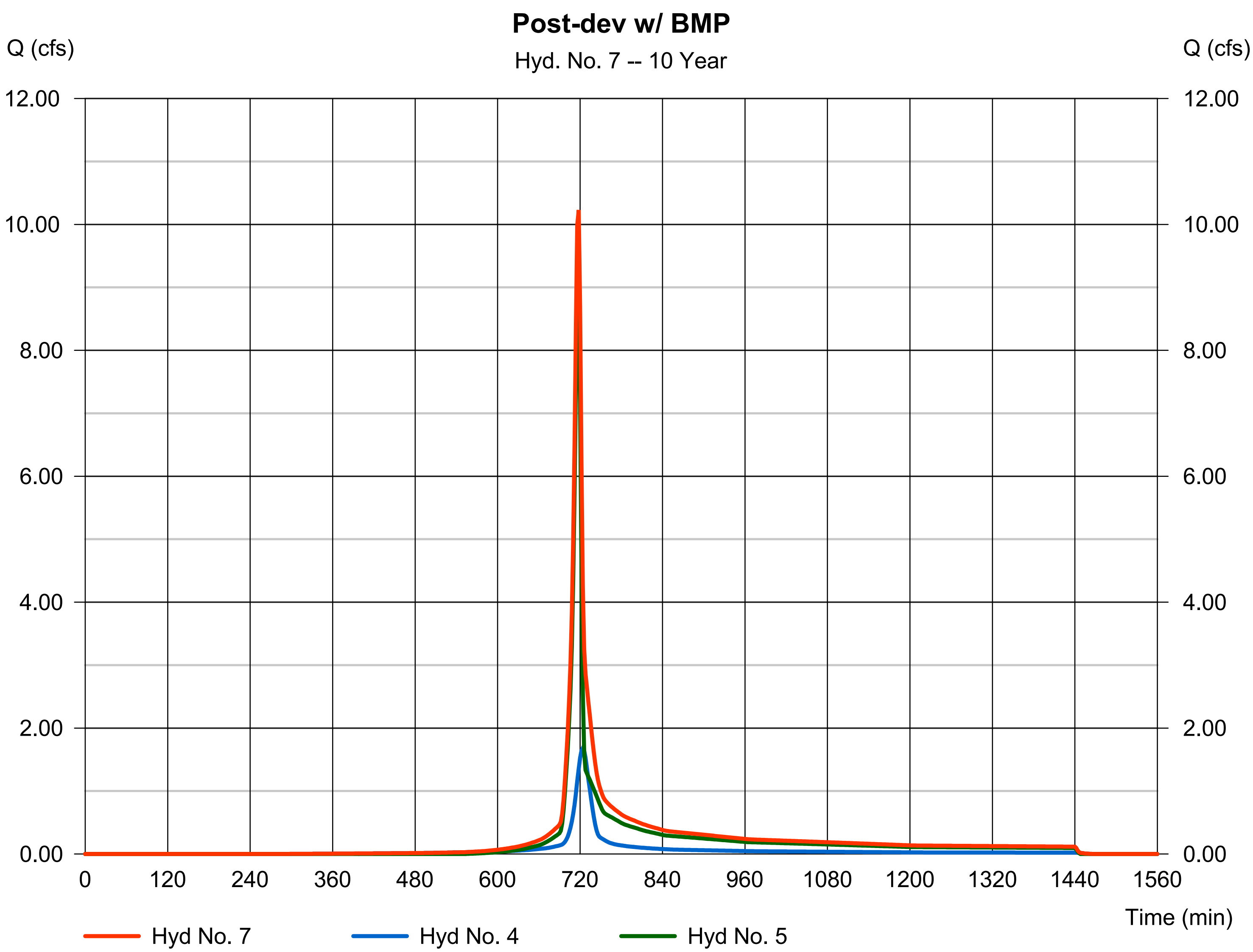
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023 Friday, 11 / 8 / 2024

Hyd. No. 7

Post-dev w/ BMP

Hydrograph type	= Combine	Peak discharge	= 10.23 cfs
Storm frequency	= 10 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 23,210 cuft
Inflow hyds.	= 4, 5	Contrib. drain. area	= 3.700 ac



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023

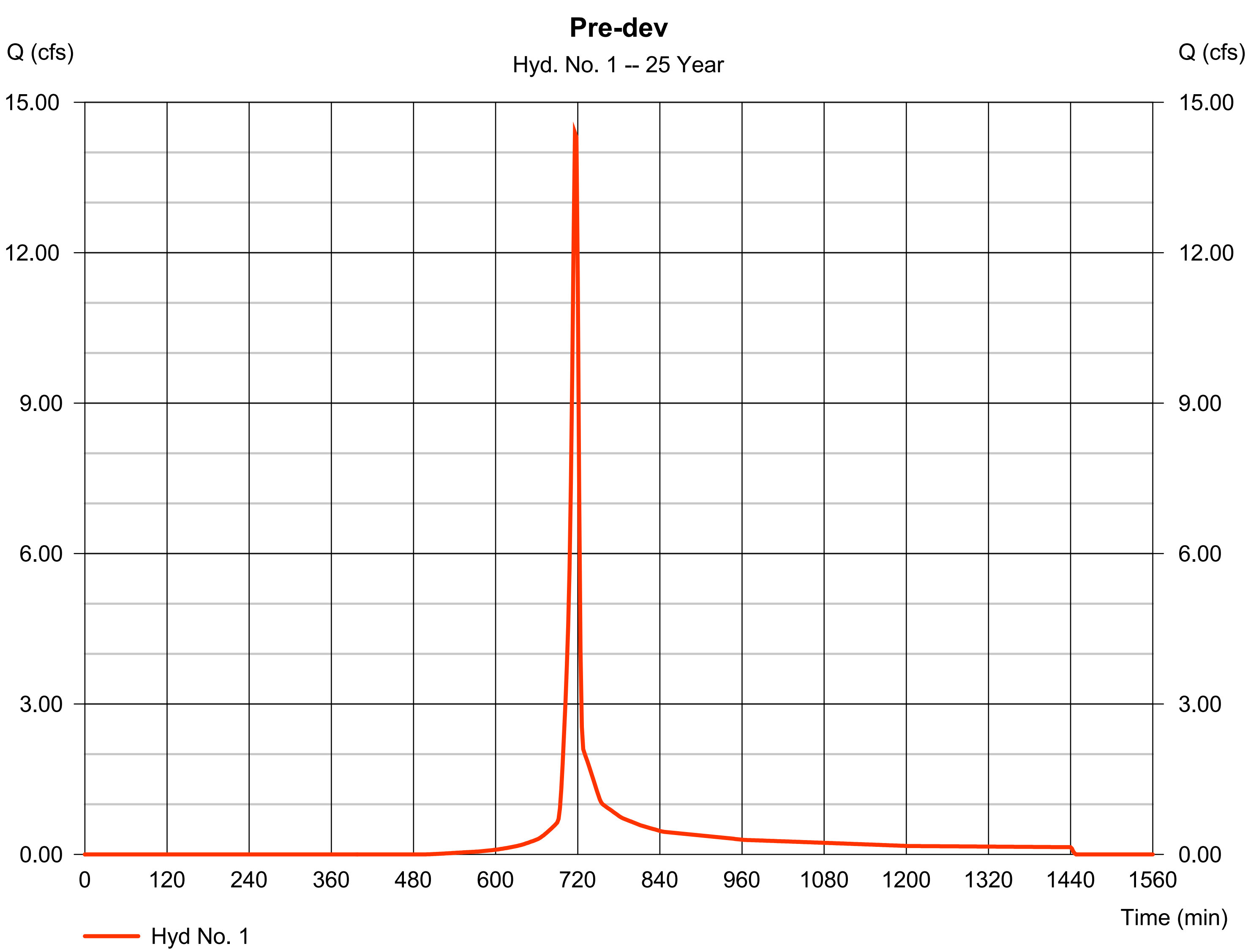
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	14.39	2	716	29,078	------	------	------	Pre-dev
2	SCS Runoff	3.009	2	716	6,464	------	------	------	Post-dev gravel
3	SCS Runoff	12.29	2	716	24,834	------	------	------	Post-dev undetained
4	SCS Runoff	2.304	2	722	6,722	------	------	------	Post-dev Tc adjusted
5	SCS Runoff	12.29	2	716	24,834	------	------	------	Post-dev undetained
6	Combine	15.30	2	716	31,298	2, 3,	------	------	Post-dev no BMP
7	Combine	14.26	2	718	31,557	4, 5,	------	------	Post-dev w/ BMP

Hydrograph Report

Hyd. No. 1

Pre-dev

Hydrograph type	= SCS Runoff	Peak discharge	= 14.39 cfs
Storm frequency	= 25 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 29,078 cuft
Drainage area	= 3.700 ac	Curve number	= 78
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 4.52 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Report

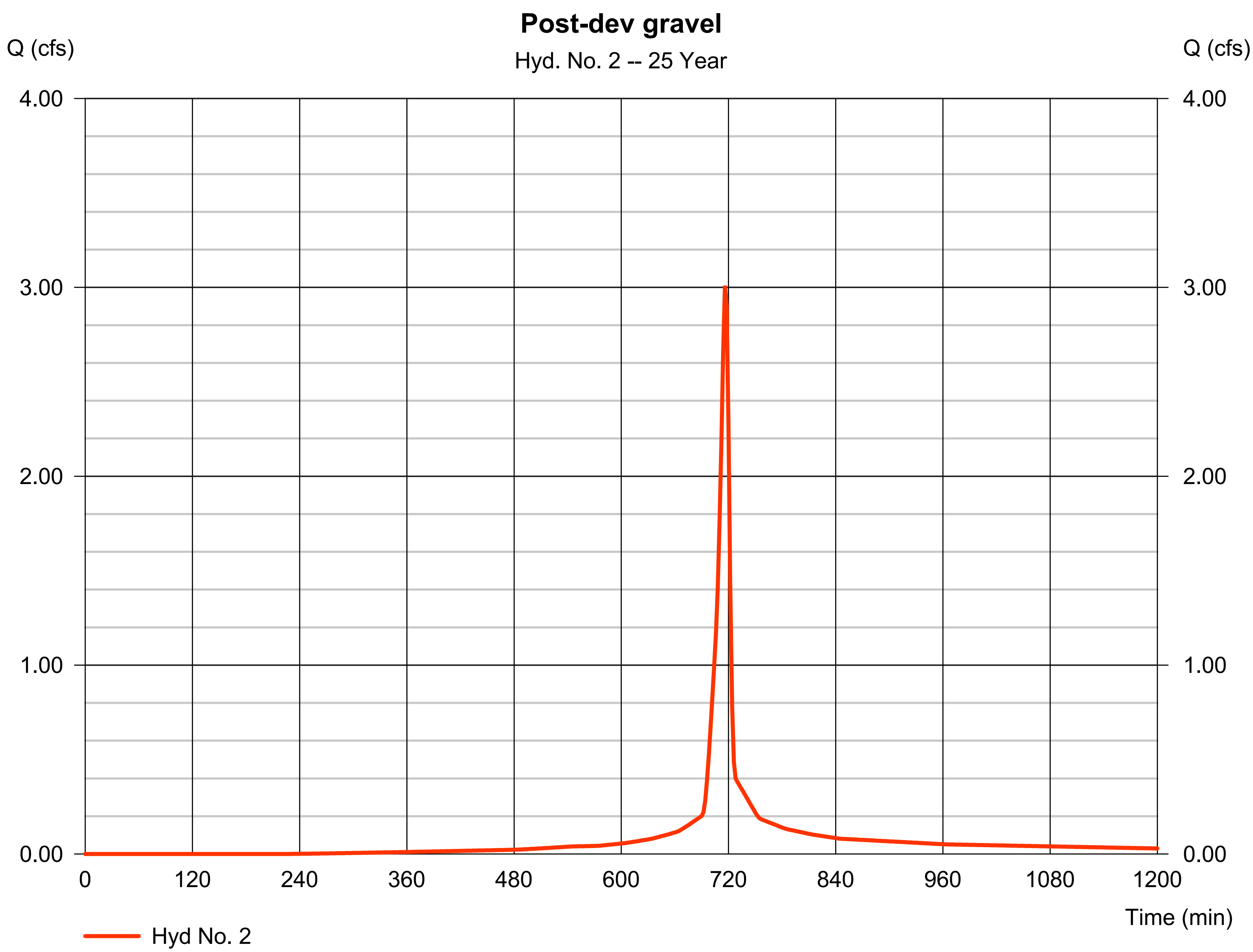
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023 Friday, 11 / 8 / 2024

Hyd. No. 2

Post-dev gravel

Hydrograph type	= SCS Runoff	Peak discharge	= 3.009 cfs
Storm frequency	= 25 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 6,464 cuft
Drainage area	= 0.540 ac	Curve number	= 91*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 4.52 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.430 x 78) + (0.080 x 91)] / 0.540

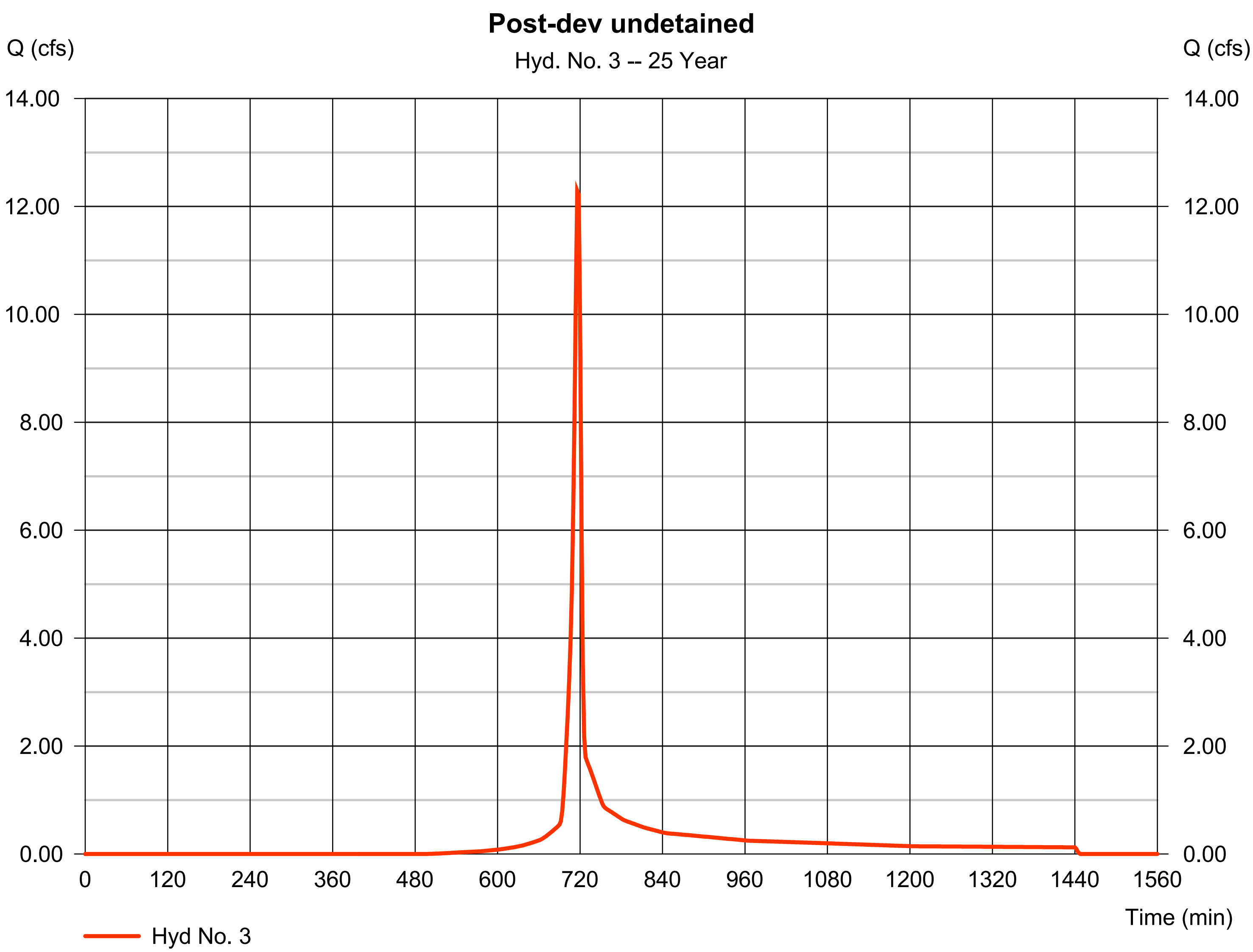


Hydrograph Report

Hyd. No. 3

Post-dev undetained

Hydrograph type	= SCS Runoff	Peak discharge	= 12.29 cfs
Storm frequency	= 25 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 24,834 cuft
Drainage area	= 3.160 ac	Curve number	= 78
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 4.52 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



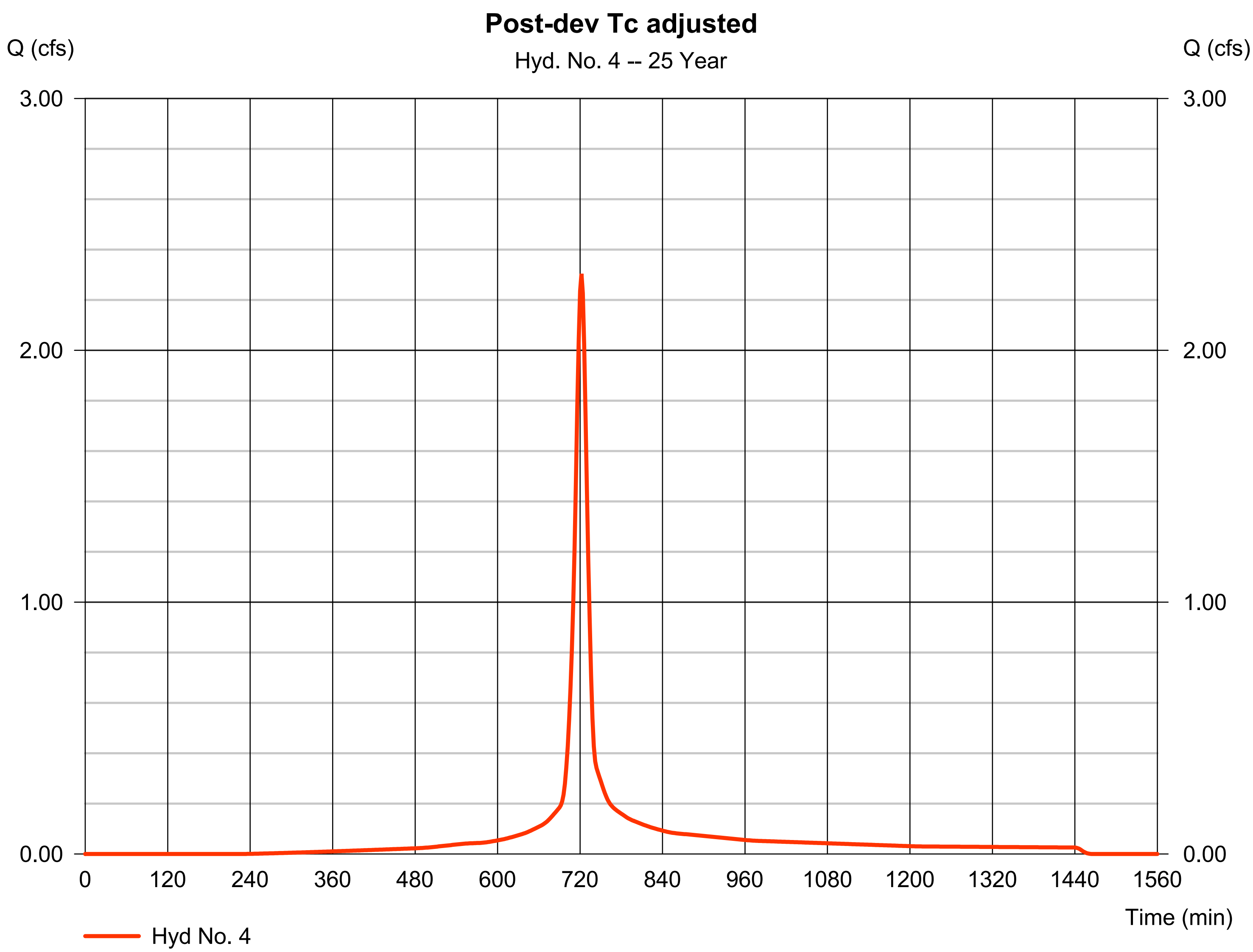
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023 Friday, 11 / 8 / 2024

Hyd. No. 4

Post-dev Tc adjusted

Hydrograph type	= SCS Runoff	Peak discharge	= 2.304 cfs
Storm frequency	= 25 yrs	Time to peak	= 722 min
Time interval	= 2 min	Hyd. volume	= 6,722 cuft
Drainage area	= 0.540 ac	Curve number	= 91
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 14.30 min
Total precip.	= 4.52 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

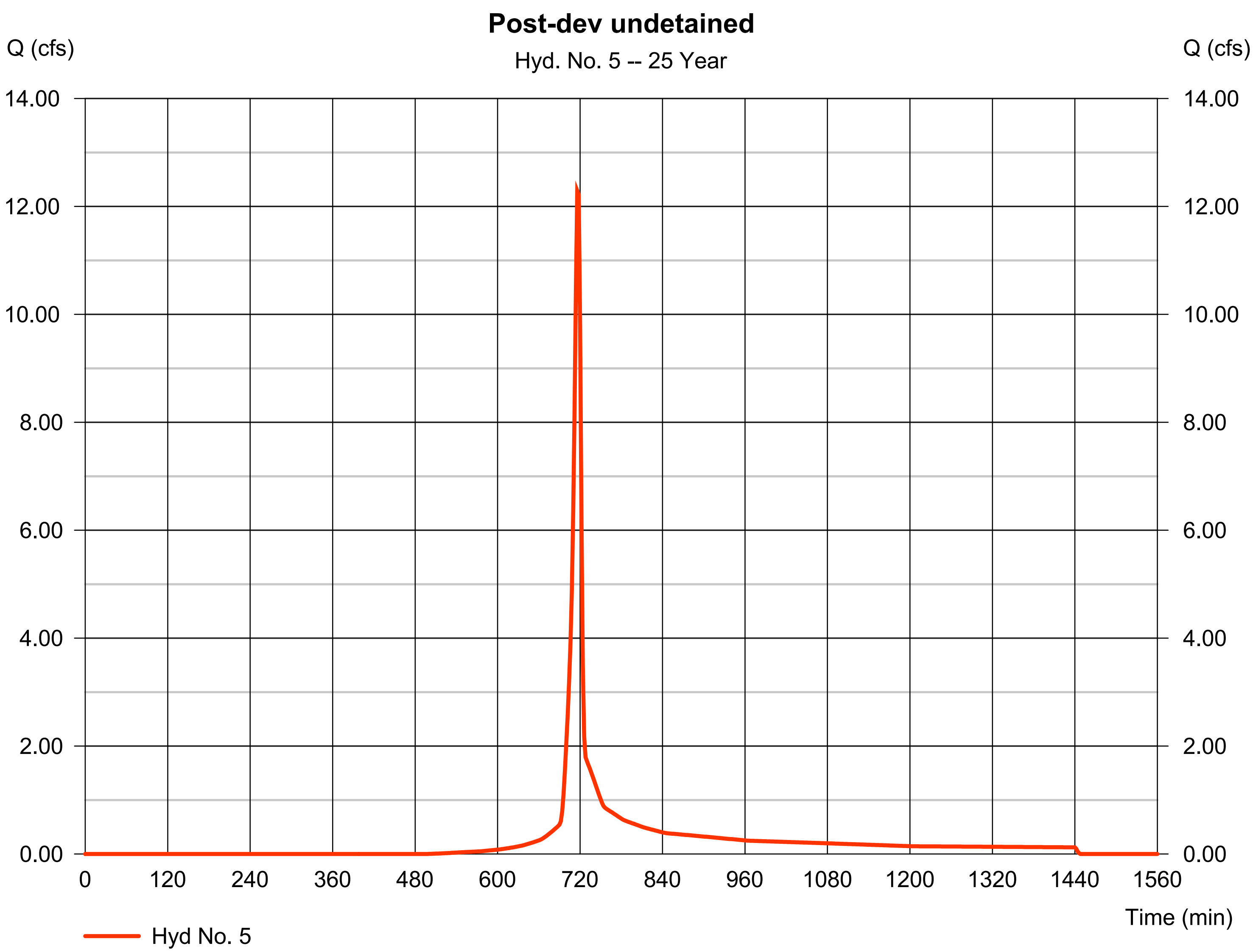


Hydrograph Report

Hyd. No. 5

Post-dev undetained

Hydrograph type	= SCS Runoff	Peak discharge	= 12.29 cfs
Storm frequency	= 25 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 24,834 cuft
Drainage area	= 3.160 ac	Curve number	= 78
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 4.52 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



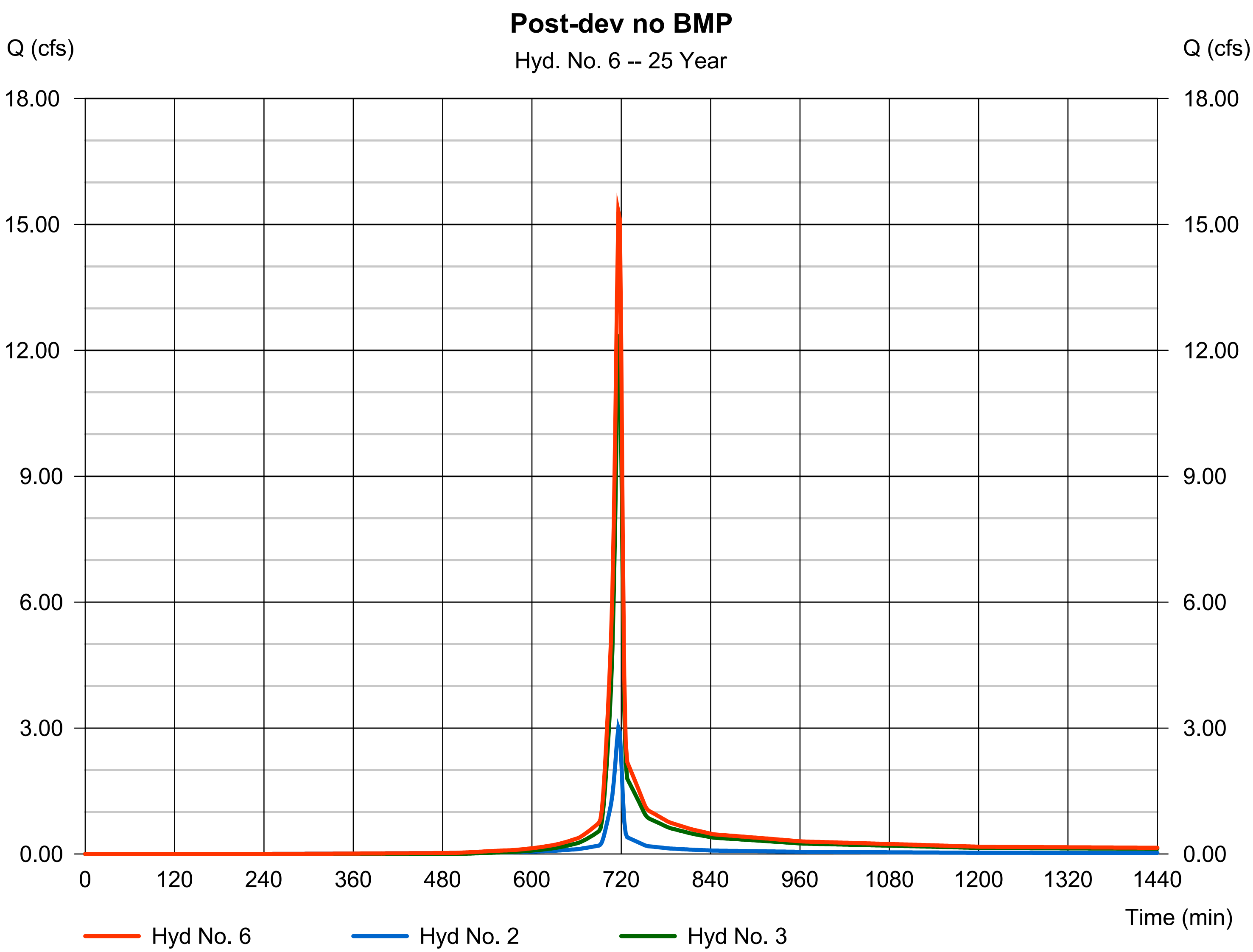
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023 Friday, 11 / 8 / 2024

Hyd. No. 6

Post-dev no BMP

Hydrograph type	= Combine	Peak discharge	= 15.30 cfs
Storm frequency	= 25 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 31,298 cuft
Inflow hyds.	= 2, 3	Contrib. drain. area	= 3.700 ac



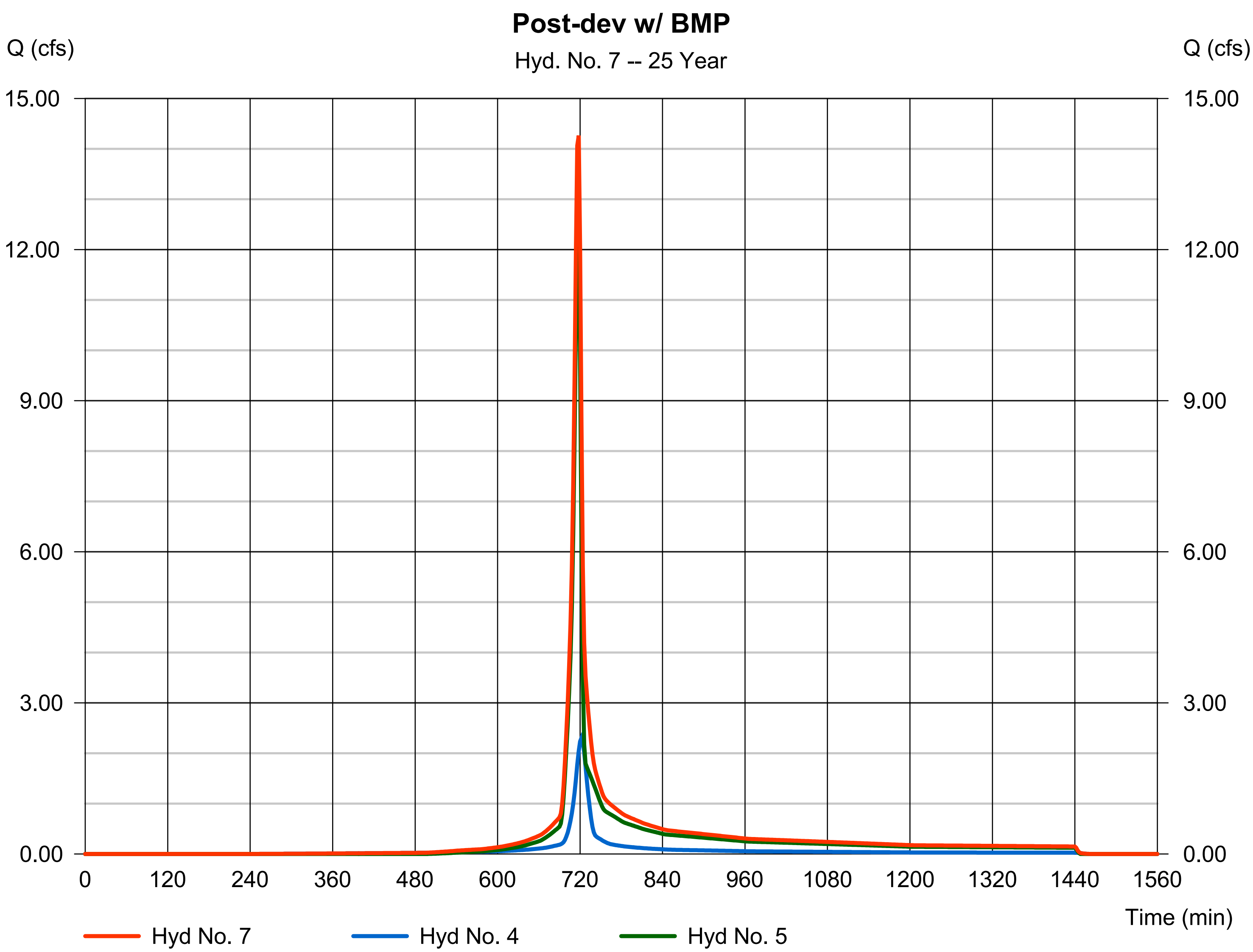
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023 Friday, 11 / 8 / 2024

Hyd. No. 7

Post-dev w/ BMP

Hydrograph type	= Combine	Peak discharge	= 14.26 cfs
Storm frequency	= 25 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 31,557 cuft
Inflow hyds.	= 4, 5	Contrib. drain. area	= 3.700 ac



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023

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	17.43	2	716	35,323	------	------	------	Pre-dev
2	SCS Runoff	3.465	2	716	7,514	------	------	------	Post-dev gravel
3	SCS Runoff	14.88	2	716	30,168	------	------	------	Post-dev undetained
4	SCS Runoff	2.657	2	722	7,815	------	------	------	Post-dev Tc adjusted
5	SCS Runoff	14.88	2	716	30,168	------	------	------	Post-dev undetained
6	Combine	18.35	2	716	37,682	2, 3,	------	------	Post-dev no BMP
7	Combine	17.08	2	718	37,983	4, 5,	------	------	Post-dev w/ BMP

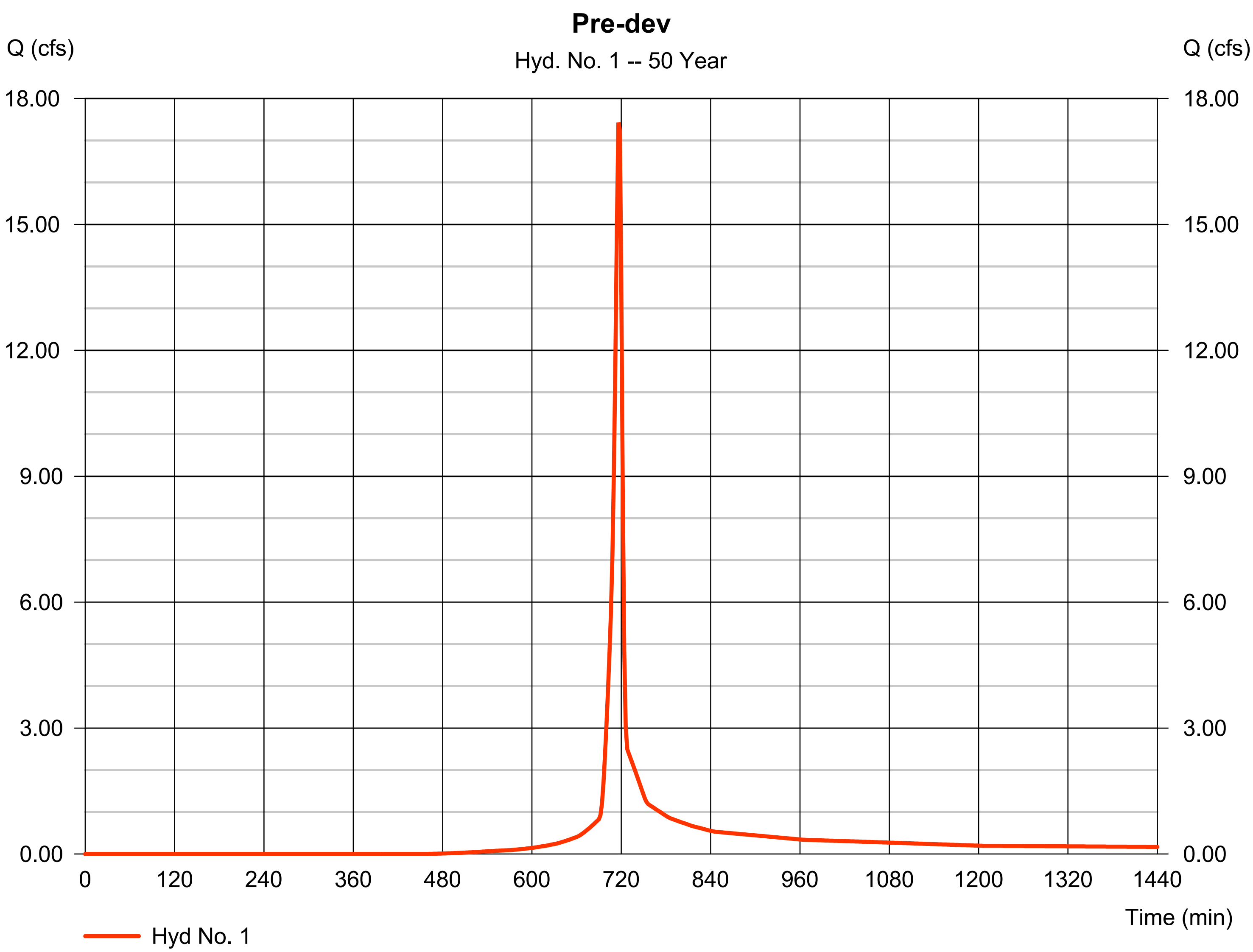
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023 Friday, 11 / 8 / 2024

Hyd. No. 1

Pre-dev

Hydrograph type	= SCS Runoff	Peak discharge	= 17.43 cfs
Storm frequency	= 50 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 35,323 cuft
Drainage area	= 3.700 ac	Curve number	= 78
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 5.11 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Report

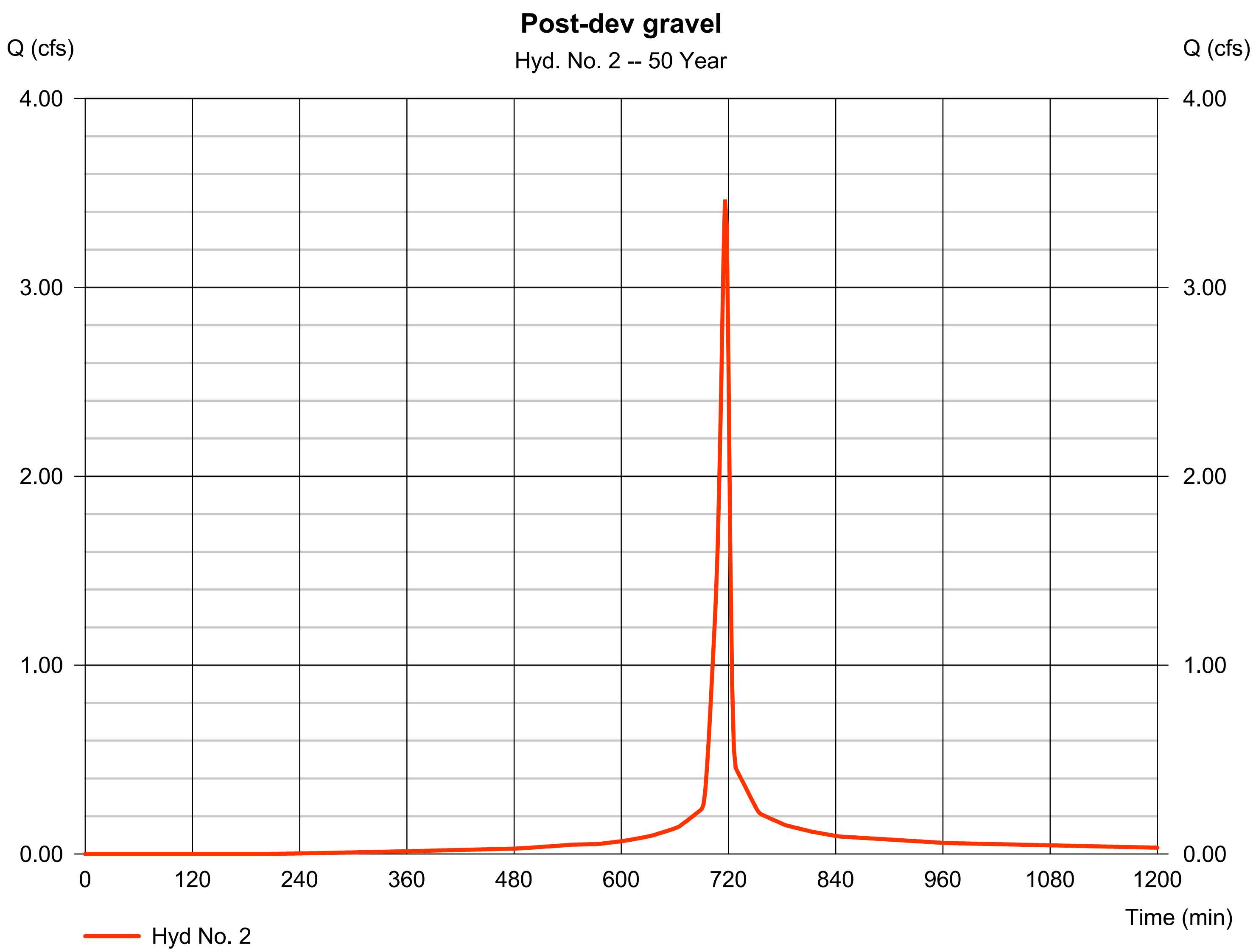
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023 Friday, 11 / 8 / 2024

Hyd. No. 2

Post-dev gravel

Hydrograph type	= SCS Runoff	Peak discharge	= 3.465 cfs
Storm frequency	= 50 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 7,514 cuft
Drainage area	= 0.540 ac	Curve number	= 91*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 5.11 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.430 x 78) + (0.080 x 91)] / 0.540



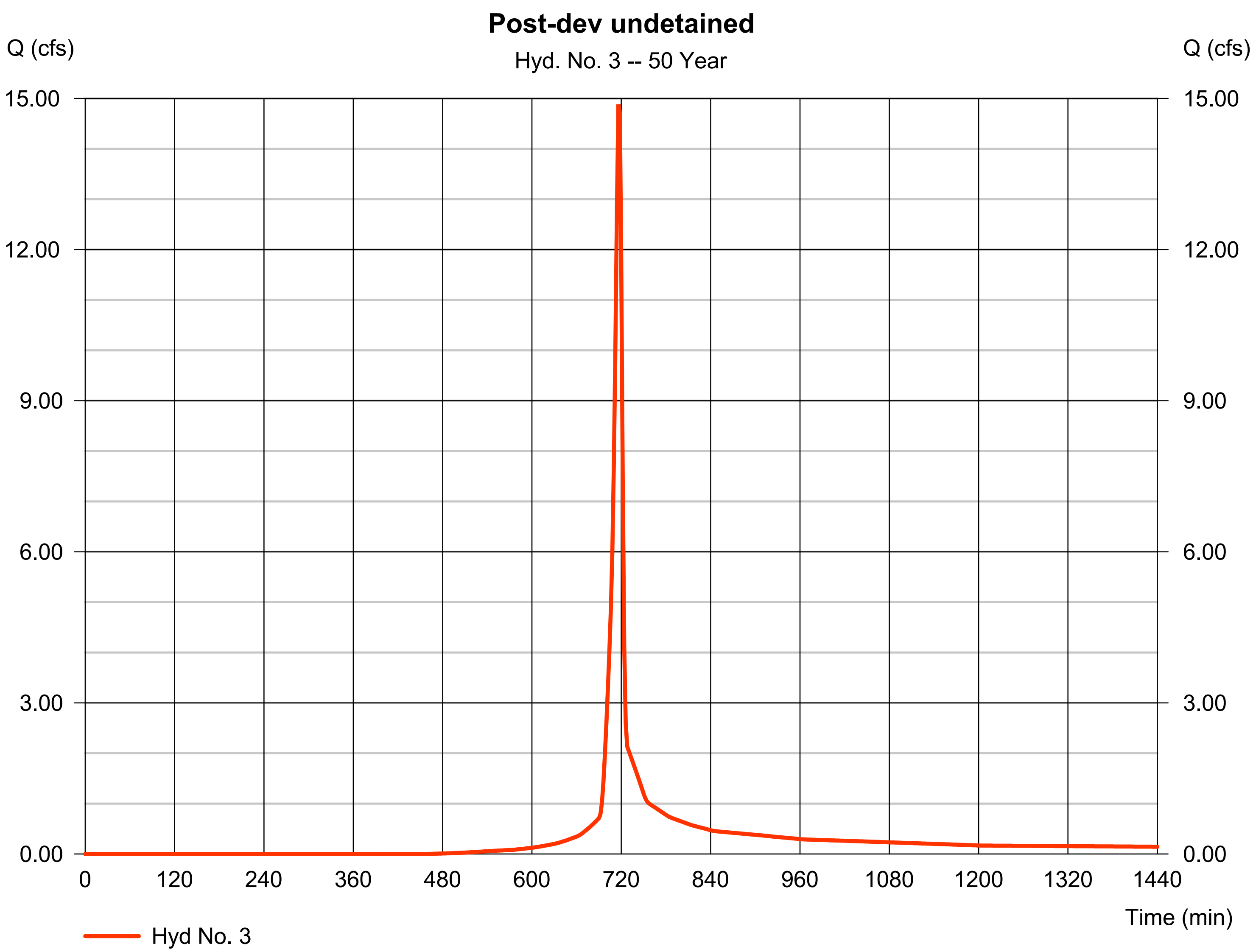
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023 Friday, 11 / 8 / 2024

Hyd. No. 3

Post-dev undetained

Hydrograph type	= SCS Runoff	Peak discharge	= 14.88 cfs
Storm frequency	= 50 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 30,168 cuft
Drainage area	= 3.160 ac	Curve number	= 78
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 5.11 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



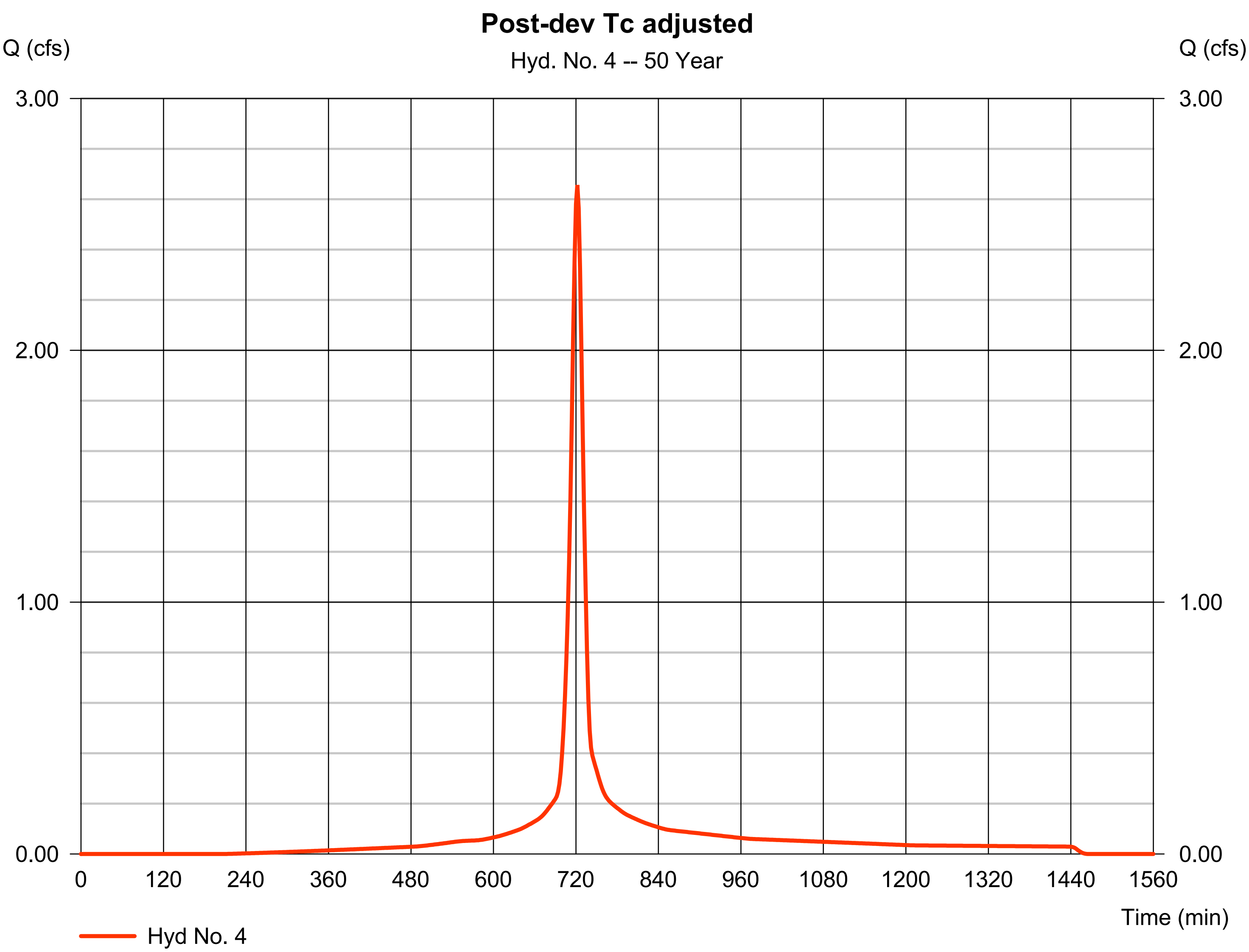
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023 Friday, 11 / 8 / 2024

Hyd. No. 4

Post-dev Tc adjusted

Hydrograph type	= SCS Runoff	Peak discharge	= 2.657 cfs
Storm frequency	= 50 yrs	Time to peak	= 722 min
Time interval	= 2 min	Hyd. volume	= 7,815 cuft
Drainage area	= 0.540 ac	Curve number	= 91
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 13.40 min
Total precip.	= 5.11 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



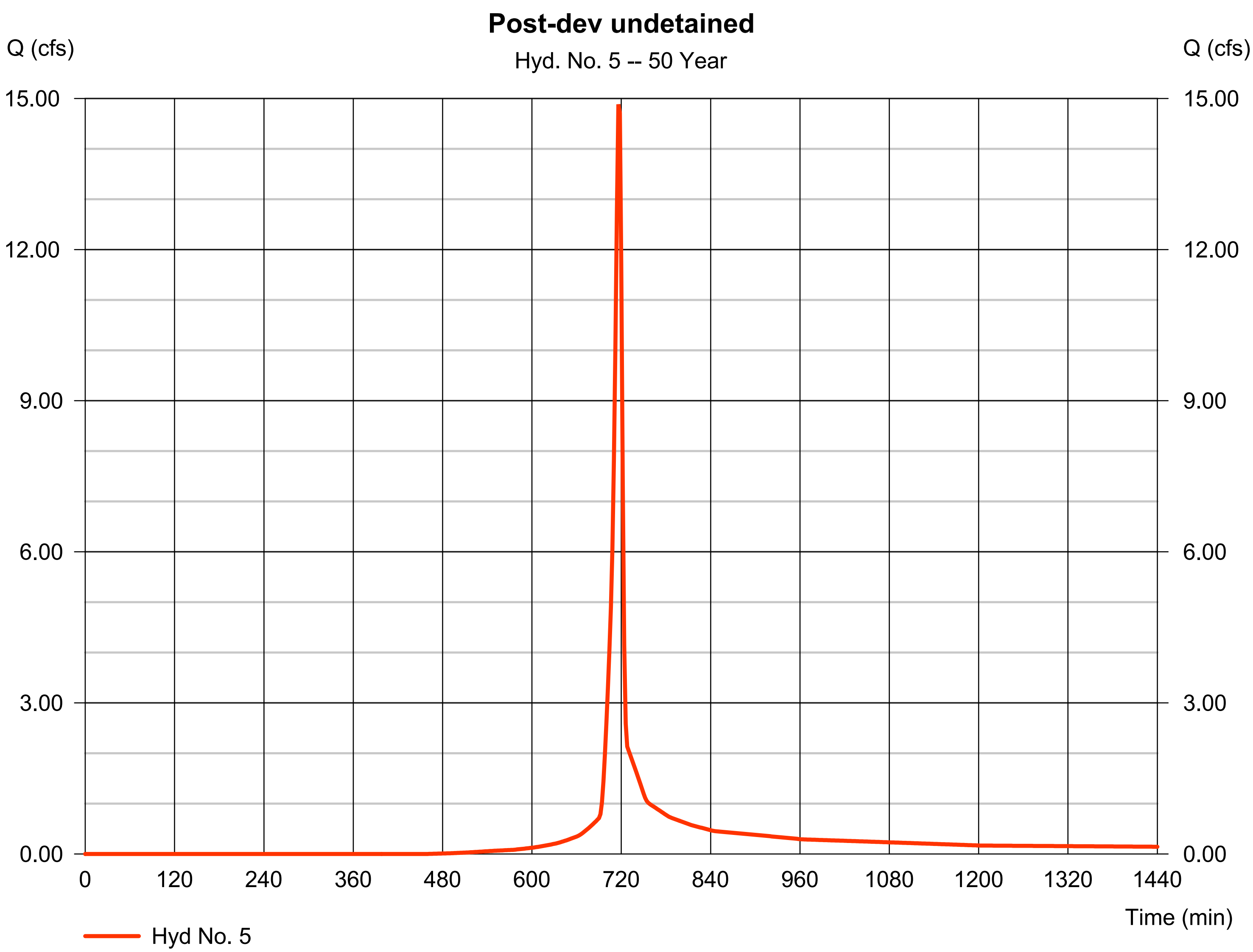
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023 — Friday, 11 / 8 / 2024

Hyd. No. 5

Post-dev undetained

Hydrograph type	= SCS Runoff	Peak discharge	= 14.88 cfs
Storm frequency	= 50 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 30,168 cuft
Drainage area	= 3.160 ac	Curve number	= 78
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 5.11 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



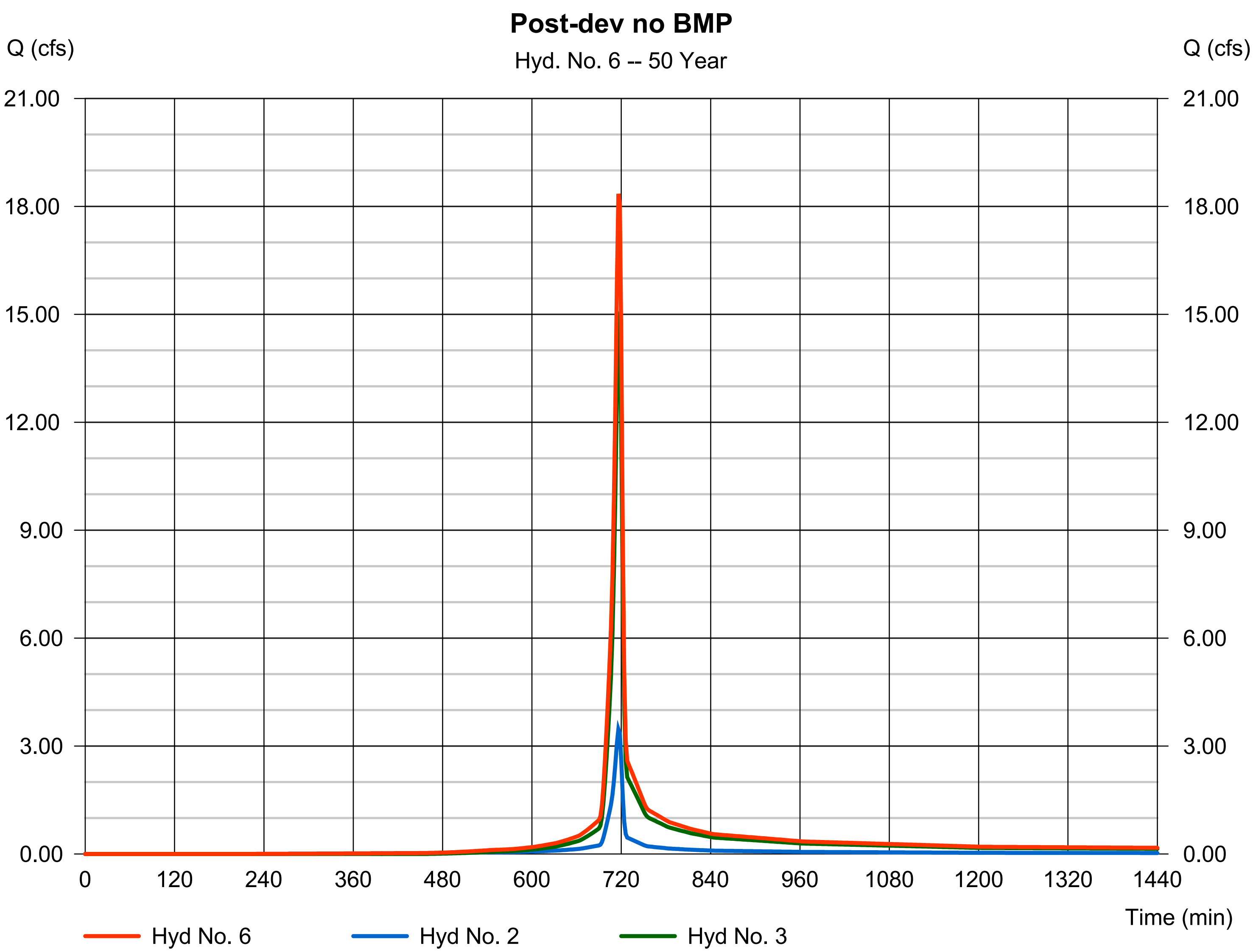
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023 Friday, 11 / 8 / 2024

Hyd. No. 6

Post-dev no BMP

Hydrograph type	= Combine	Peak discharge	= 18.35 cfs
Storm frequency	= 50 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 37,682 cuft
Inflow hyds.	= 2, 3	Contrib. drain. area	= 3.700 ac



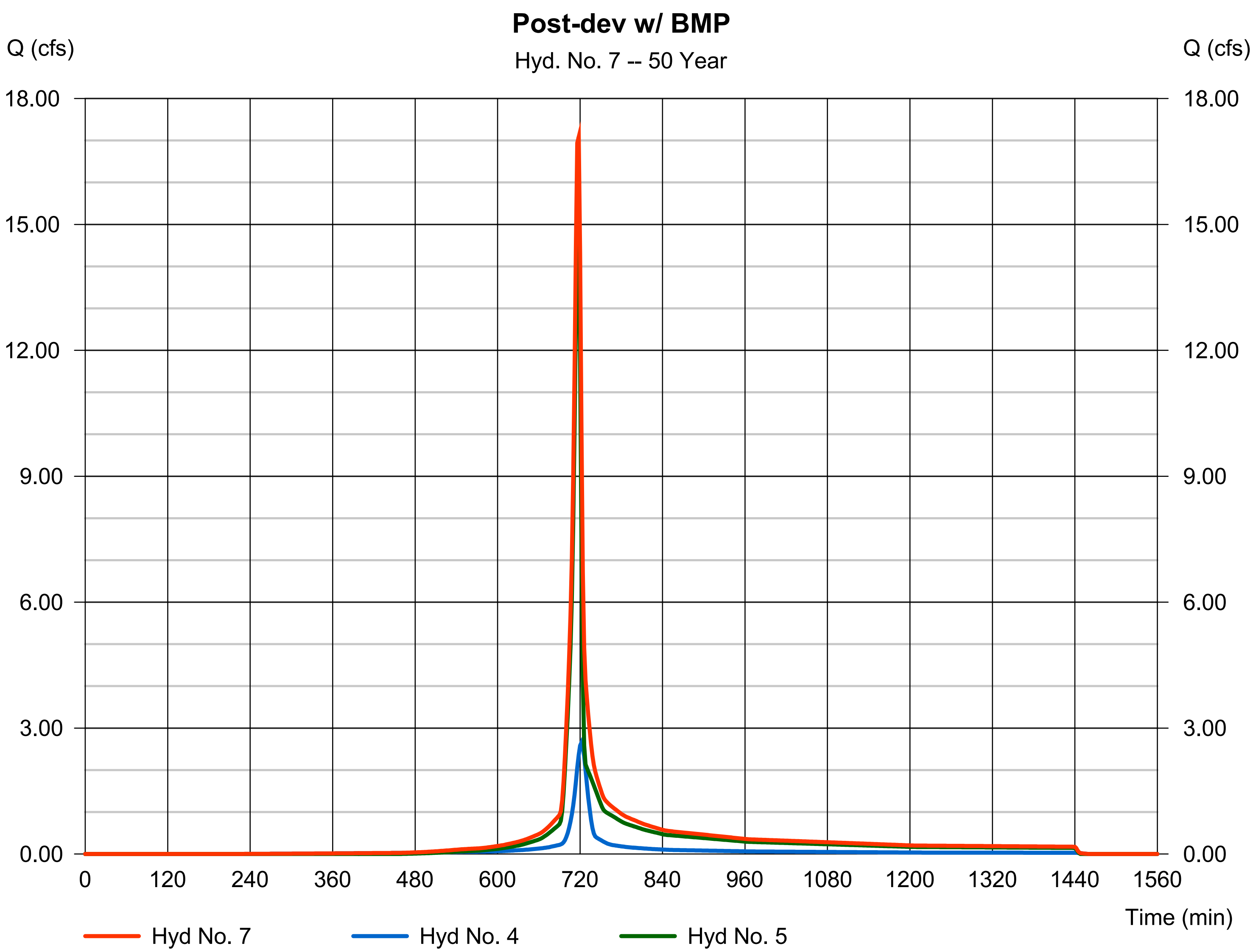
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023 Friday, 11 / 8 / 2024

Hyd. No. 7

Post-dev w/ BMP

Hydrograph type	= Combine	Peak discharge	= 17.08 cfs
Storm frequency	= 50 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 37,983 cuft
Inflow hyds.	= 4, 5	Contrib. drain. area	= 3.700 ac



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023

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	20.88	2	716	42,516	------	------	------	Pre-dev
2	SCS Runoff	3.972	2	716	8,696	------	------	------	Post-dev gravel
3	SCS Runoff	17.83	2	716	36,311	------	------	------	Post-dev undetained
4	SCS Runoff	3.478	2	720	9,566	------	------	------	Post-dev Tc adjusted
5	SCS Runoff	17.83	2	716	36,311	------	------	------	Post-dev undetained
6	Combine	21.81	2	716	45,007	2, 3,	------	------	Post-dev no BMP
7	Combine	20.85	2	718	45,877	4, 5,	------	------	Post-dev w/ BMP

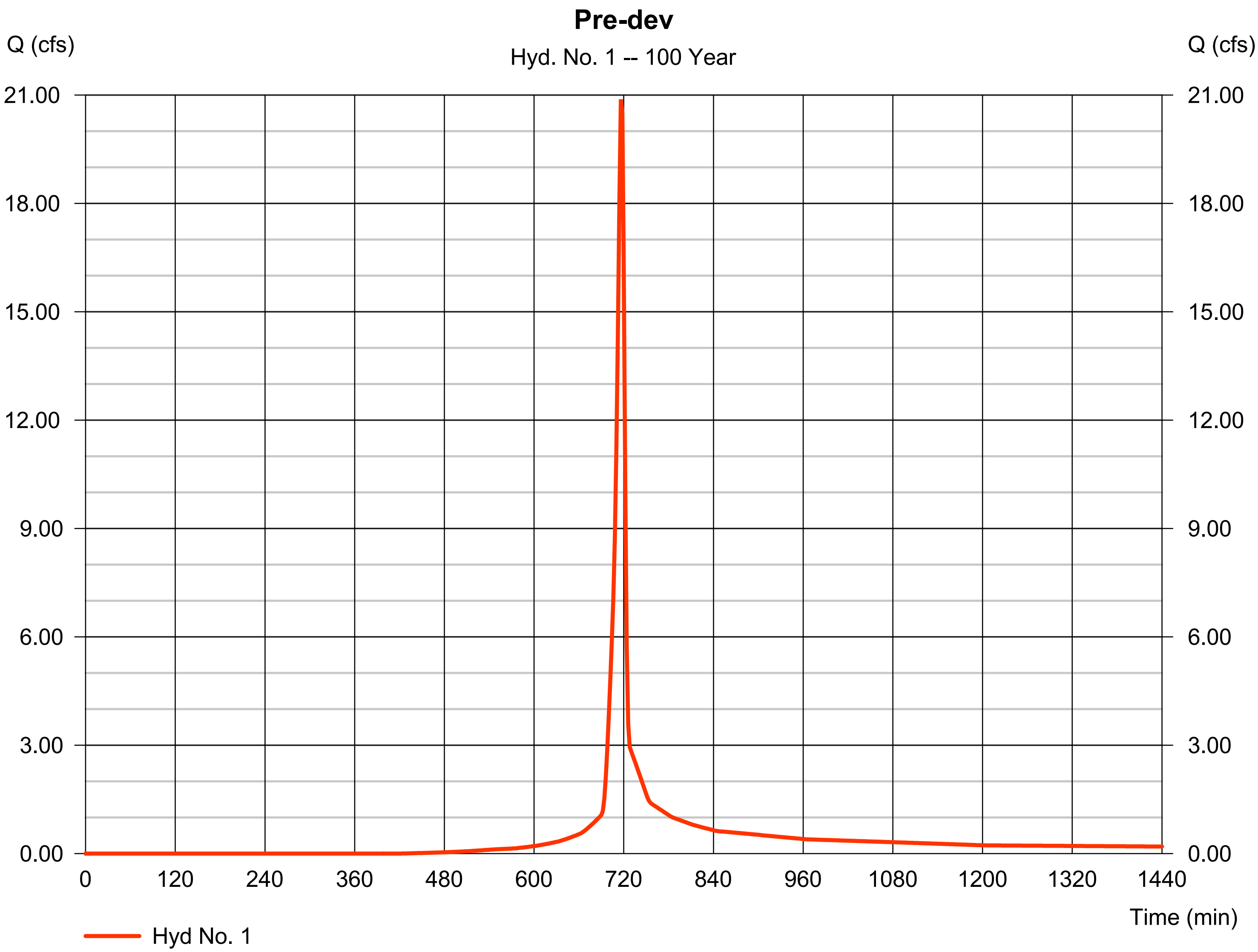
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023 — Friday, 11 / 8 / 2024

Hyd. No. 1

Pre-dev

Hydrograph type	= SCS Runoff	Peak discharge	= 20.88 cfs
Storm frequency	= 100 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 42,516 cuft
Drainage area	= 3.700 ac	Curve number	= 78
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 5.77 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Report

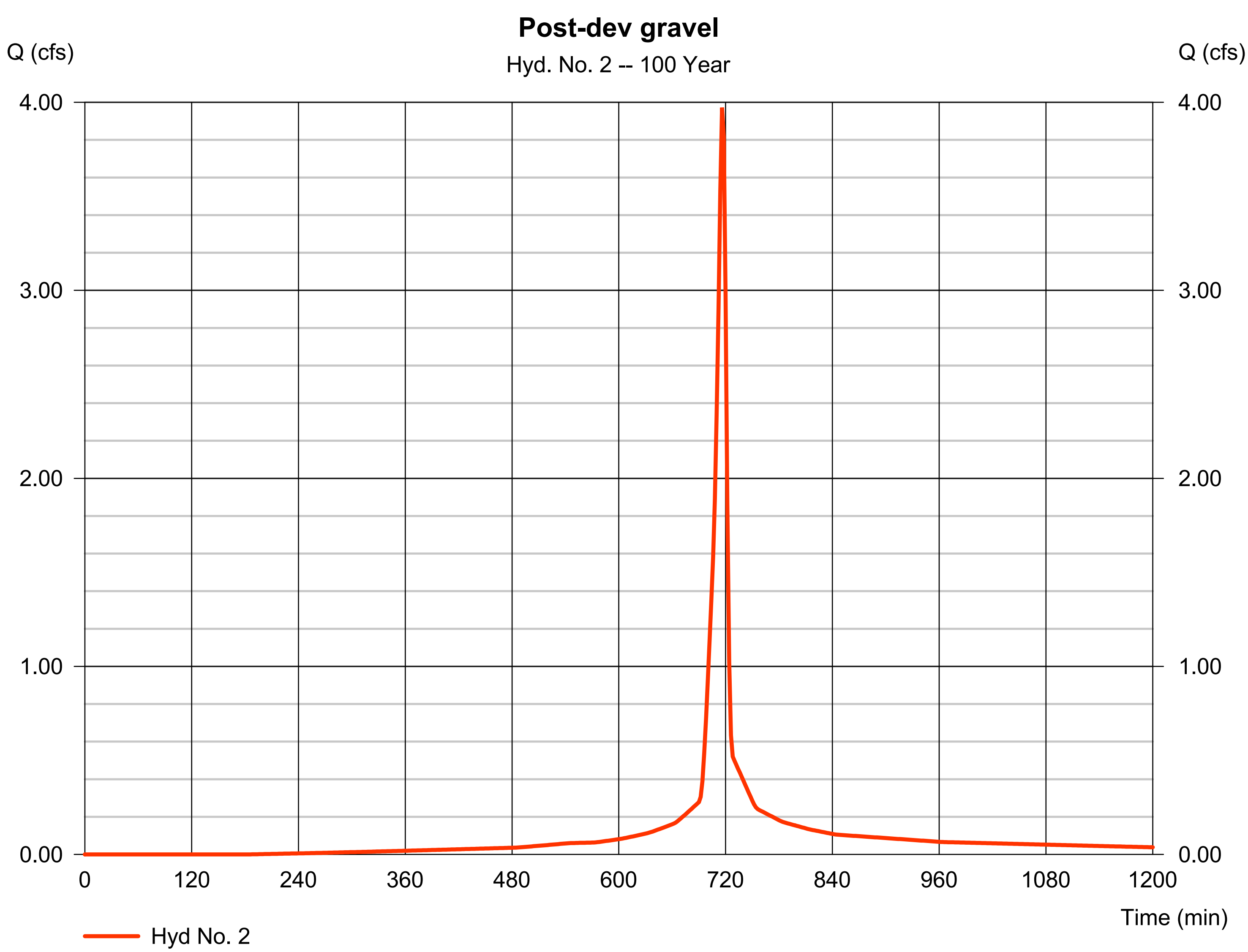
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023 Friday, 11 / 8 / 2024

Hyd. No. 2

Post-dev gravel

Hydrograph type	= SCS Runoff	Peak discharge	= 3.972 cfs
Storm frequency	= 100 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 8,696 cuft
Drainage area	= 0.540 ac	Curve number	= 91*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 5.77 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.430 x 78) + (0.080 x 91)] / 0.540



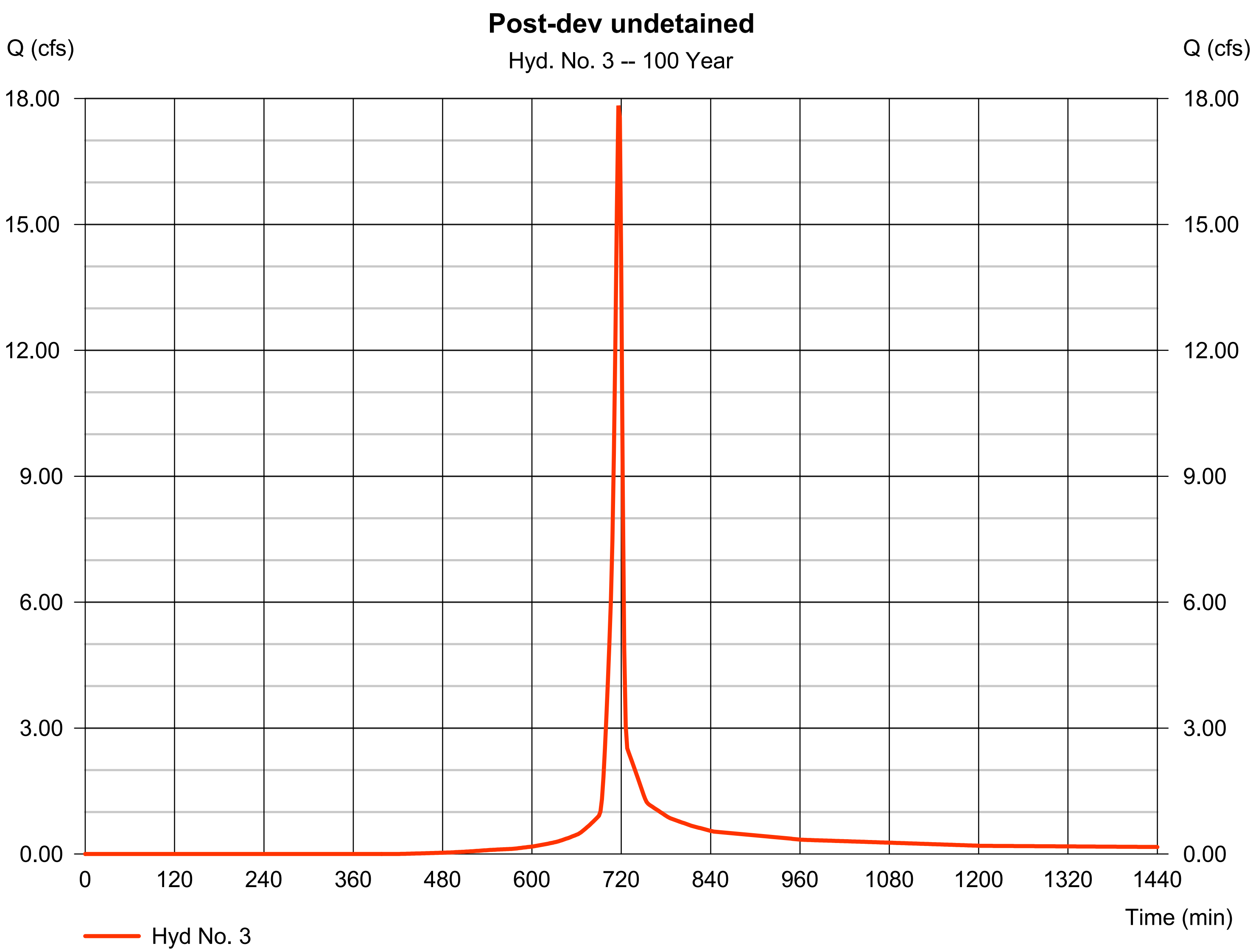
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023 Friday, 11 / 8 / 2024

Hyd. No. 3

Post-dev undetained

Hydrograph type	= SCS Runoff	Peak discharge	= 17.83 cfs
Storm frequency	= 100 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 36,311 cuft
Drainage area	= 3.160 ac	Curve number	= 78
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 5.77 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



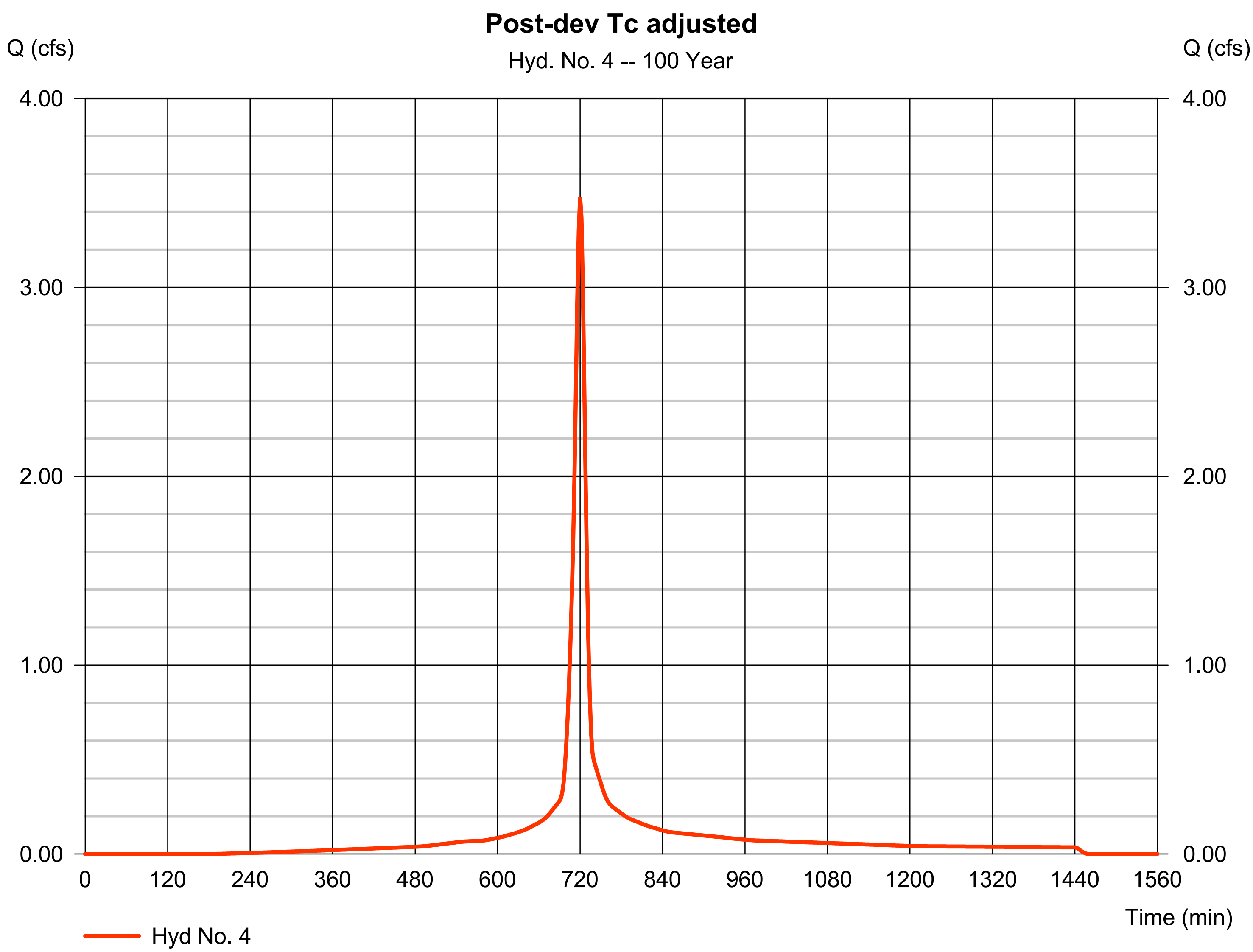
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023 Friday, 11 / 8 / 2024

Hyd. No. 4

Post-dev Tc adjusted

Hydrograph type	= SCS Runoff	Peak discharge	= 3.478 cfs
Storm frequency	= 100 yrs	Time to peak	= 720 min
Time interval	= 2 min	Hyd. volume	= 9,566 cuft
Drainage area	= 0.540 ac	Curve number	= 91
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 12.10 min
Total precip.	= 5.77 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

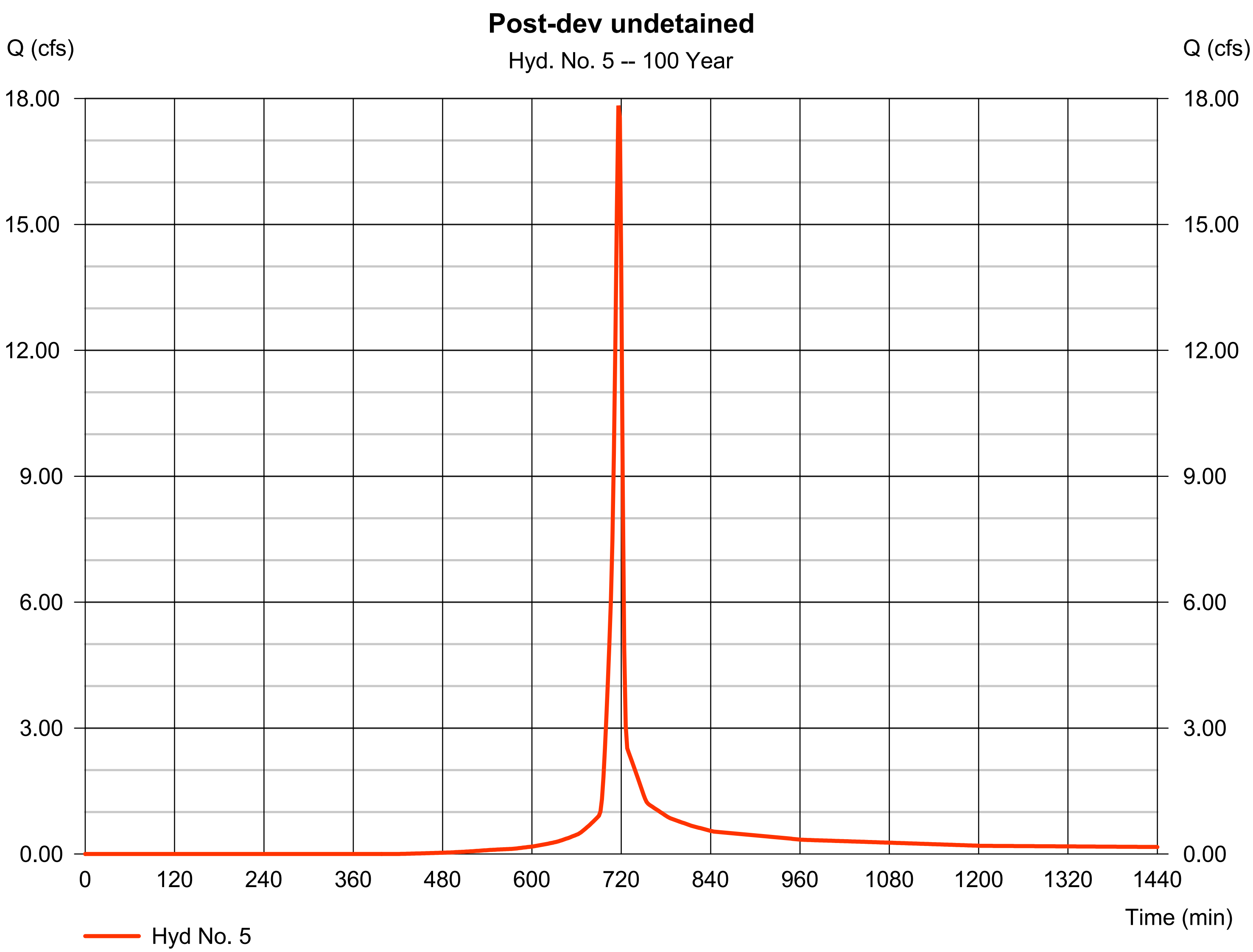


Hydrograph Report

Hyd. No. 5

Post-dev undetained

Hydrograph type	= SCS Runoff	Peak discharge	= 17.83 cfs
Storm frequency	= 100 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 36,311 cuft
Drainage area	= 3.160 ac	Curve number	= 78
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 5.77 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



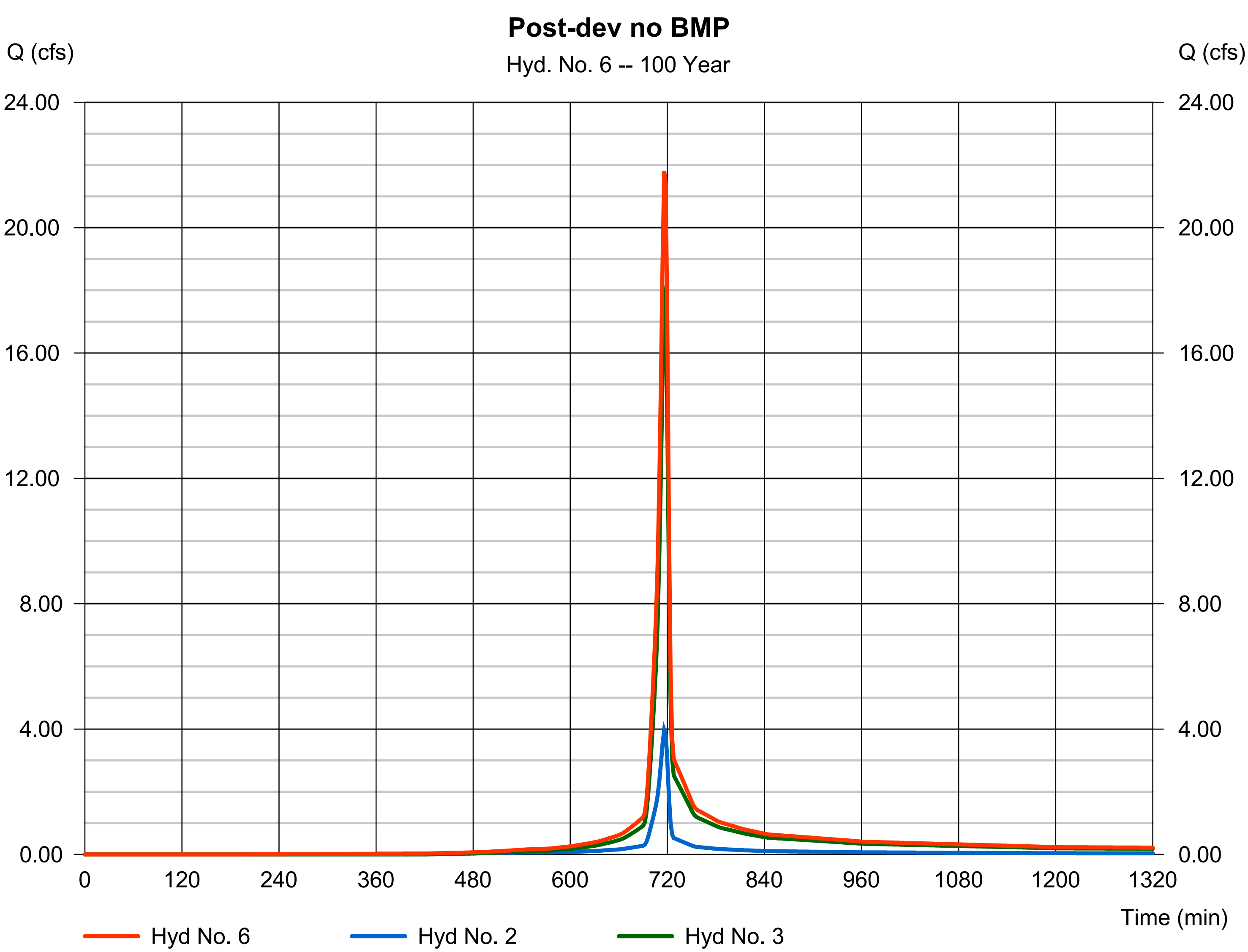
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023 Friday, 11 / 8 / 2024

Hyd. No. 6

Post-dev no BMP

Hydrograph type	= Combine	Peak discharge	= 21.81 cfs
Storm frequency	= 100 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 45,007 cuft
Inflow hyds.	= 2, 3	Contrib. drain. area	= 3.700 ac



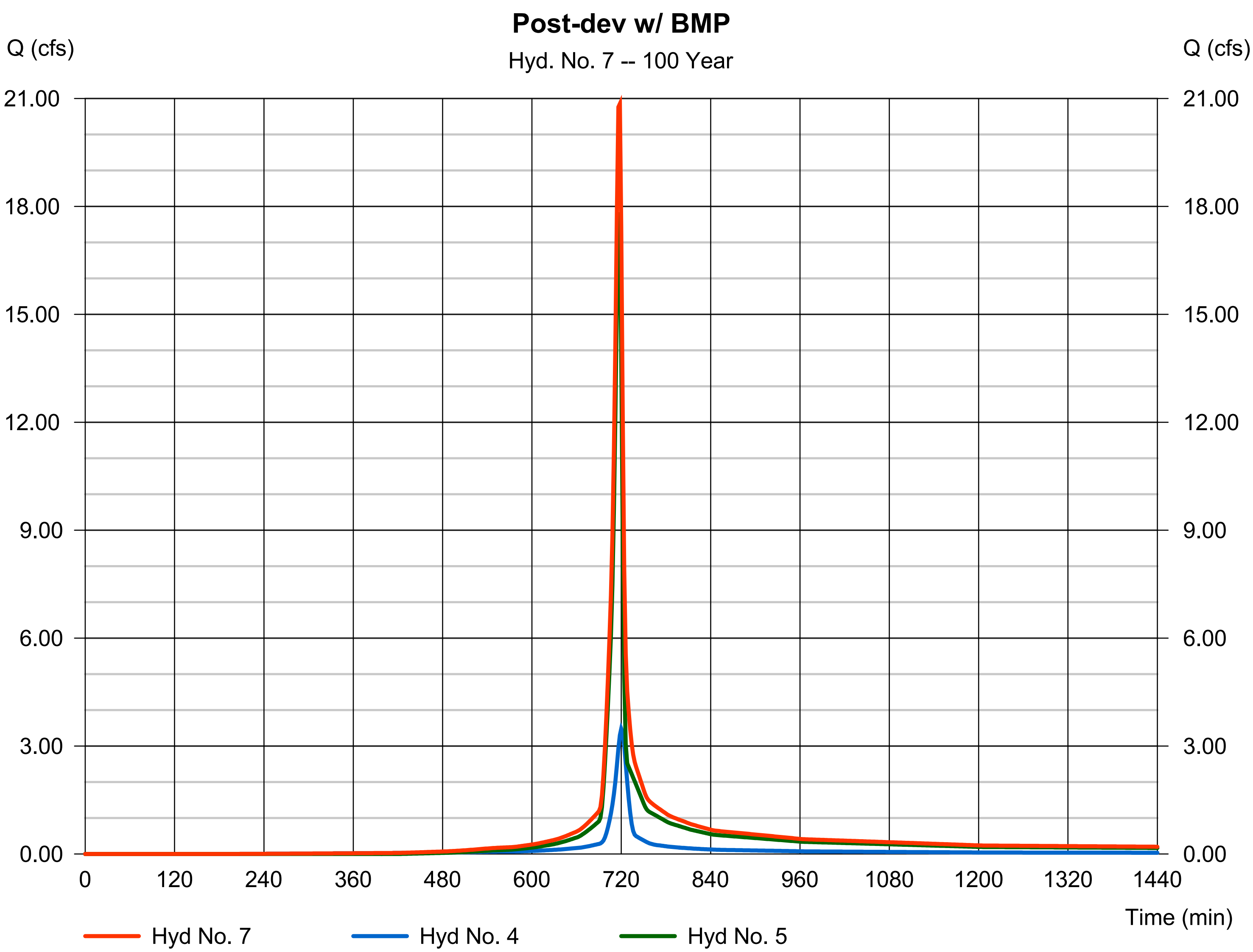
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023 Friday, 11 / 8 / 2024

Hyd. No. 7

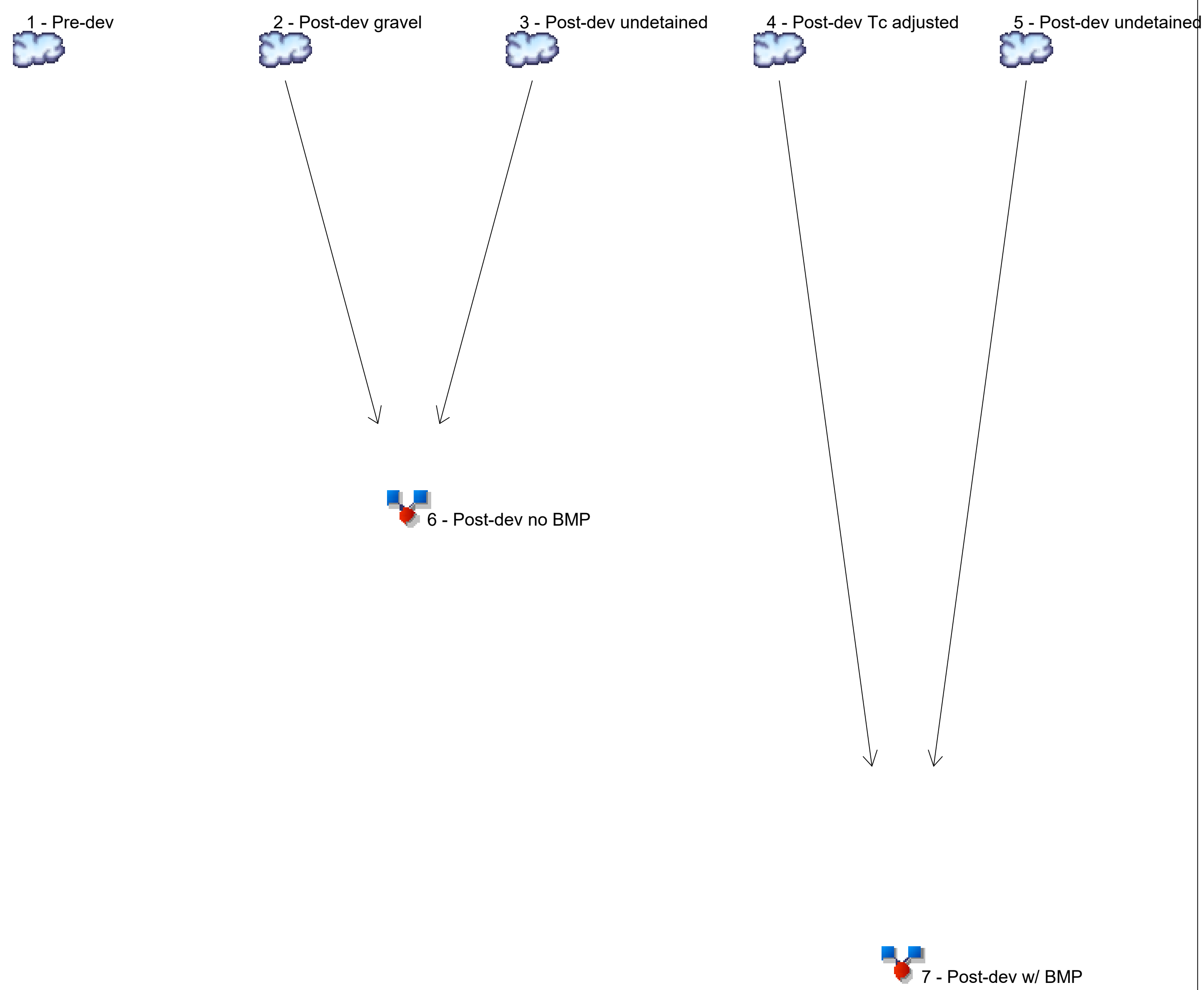
Post-dev w/ BMP

Hydrograph type	= Combine	Peak discharge	= 20.85 cfs
Storm frequency	= 100 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 45,877 cuft
Inflow hyds.	= 4, 5	Contrib. drain. area	= 3.700 ac



Watershed Model Schematic

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023



Project: YM59 valve site.gpw	Friday, 11 / 8 / 2024

Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023

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	0.301	2	718	605	------	------	------	Pre-dev
2	SCS Runoff	0.124	2	716	256	------	------	------	Post-dev gravel
3	SCS Runoff	0.241	2	718	484	------	------	------	Post-dev undetained
4	SCS Runoff	0.073	2	728	268	------	------	------	Post-dev Tc adjusted
5	SCS Runoff	0.241	2	718	484	------	------	------	Post-dev undetained
6	Combine	0.362	2	718	740	2, 3,	------	------	Post-dev no BMP
7	Combine	0.289	2	718	752	4, 5,	------	------	Post-dev w/ BMP

YM59 valve site.gpw	Return Period: 2 Year	Friday, 11 / 8 / 2024

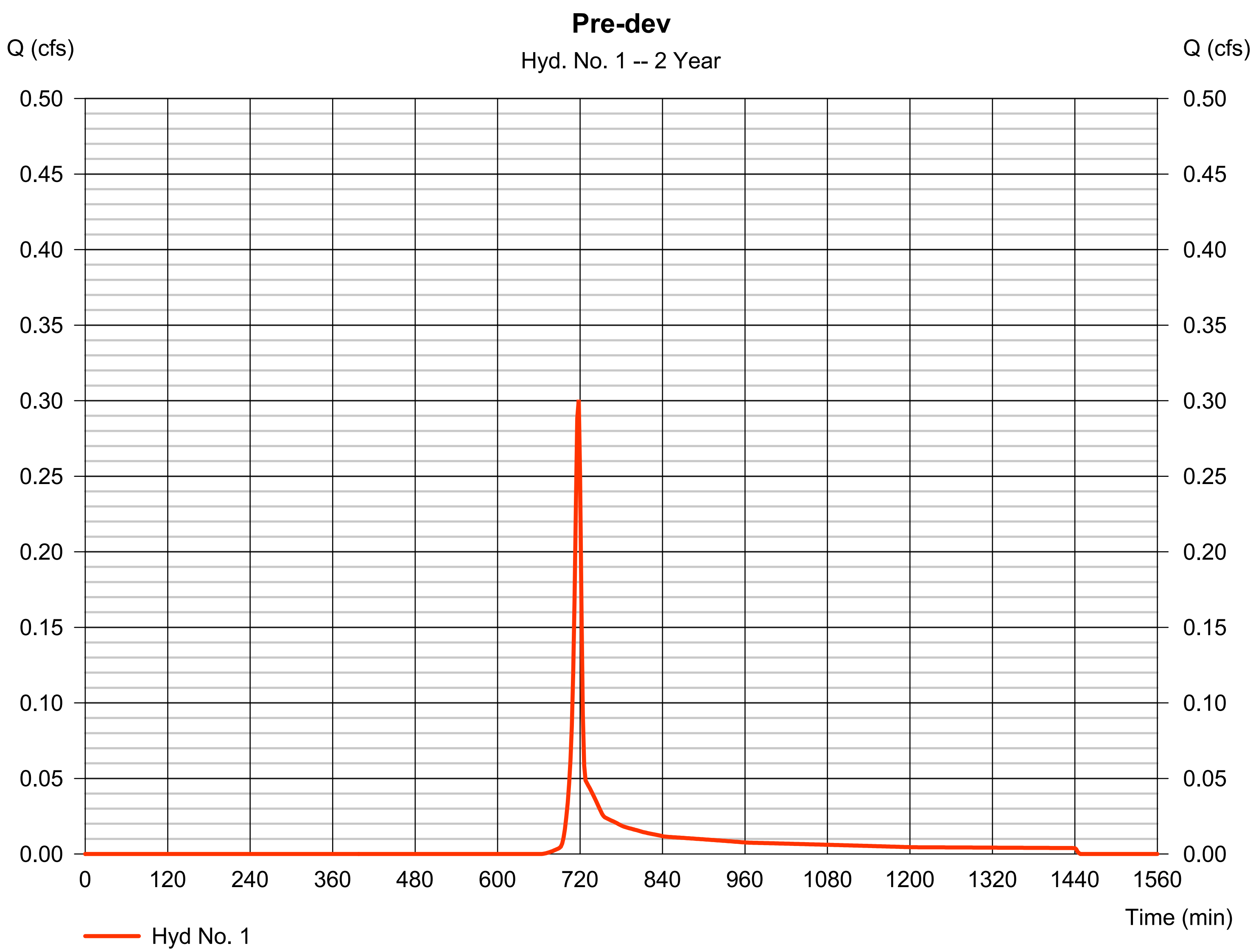
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023 Friday, 11 / 8 / 2024

Hyd. No. 1

Pre-dev

Hydrograph type	= SCS Runoff	Peak discharge	= 0.301 cfs
Storm frequency	= 2 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 605 cuft
Drainage area	= 0.250 ac	Curve number	= 78
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 2.38 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Report

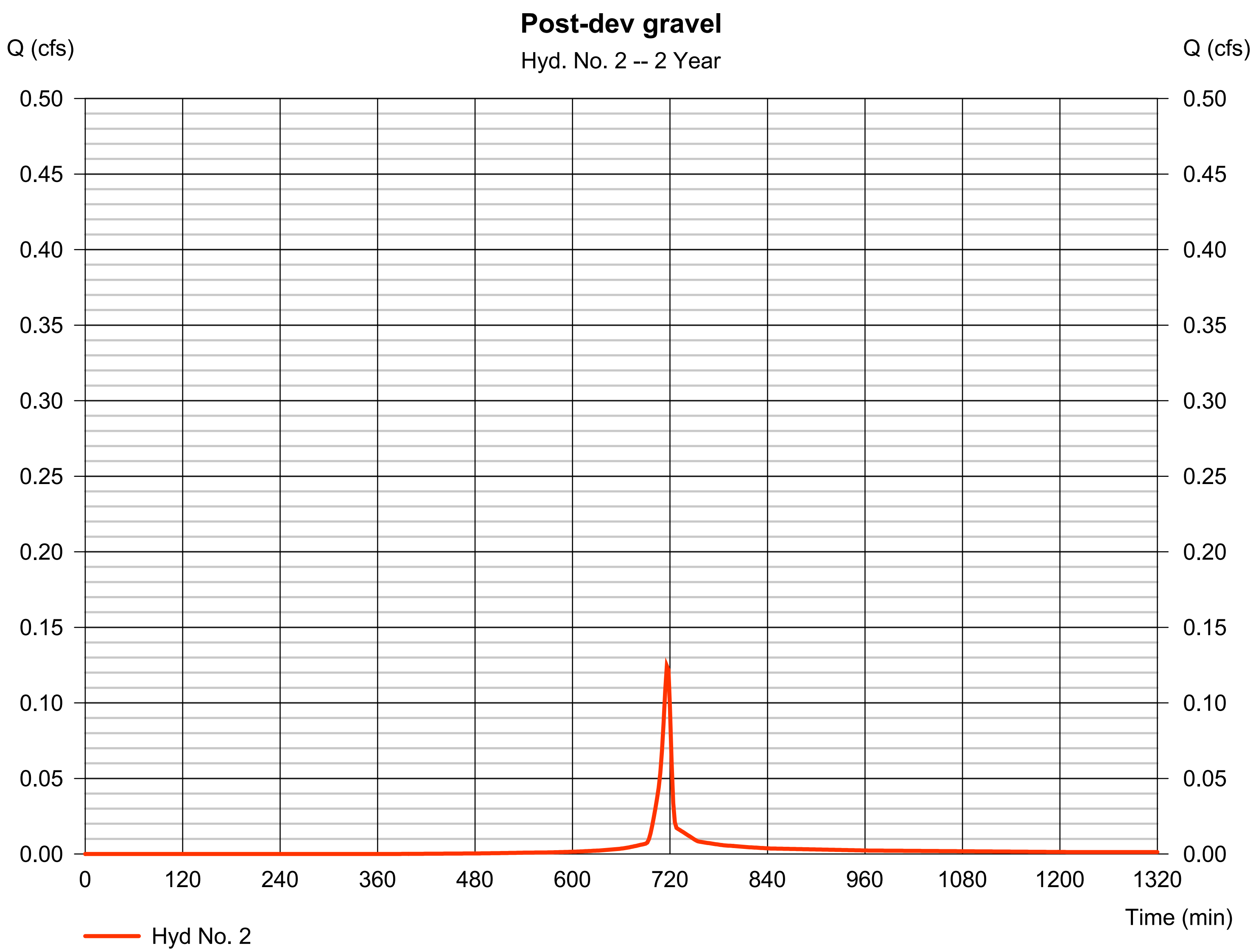
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023 Friday, 11 / 8 / 2024

Hyd. No. 2

Post-dev gravel

Hydrograph type	= SCS Runoff	Peak discharge	= 0.124 cfs
Storm frequency	= 2 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 256 cuft
Drainage area	= 0.050 ac	Curve number	= 91*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 2.38 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.430 x 78) + (0.080 x 91)] / 0.050



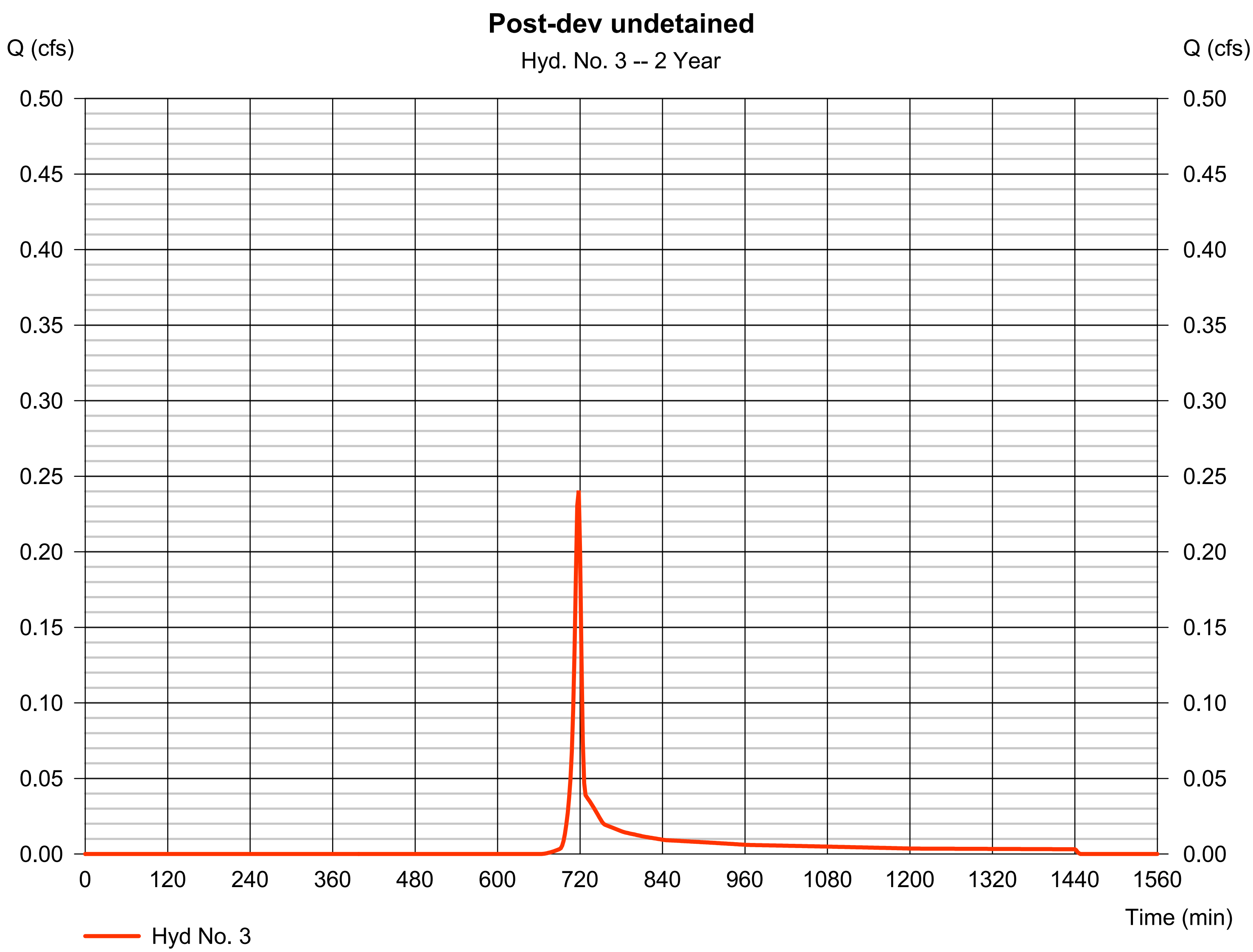
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023 Friday, 11 / 8 / 2024

Hyd. No. 3

Post-dev undetained

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.241 cfs
Storm frequency	=	2 yrs	Time to peak	=	718 min
Time interval	=	2 min	Hyd. volume	=	484 cuft
Drainage area	=	0.200 ac	Curve number	=	78
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	2.38 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484



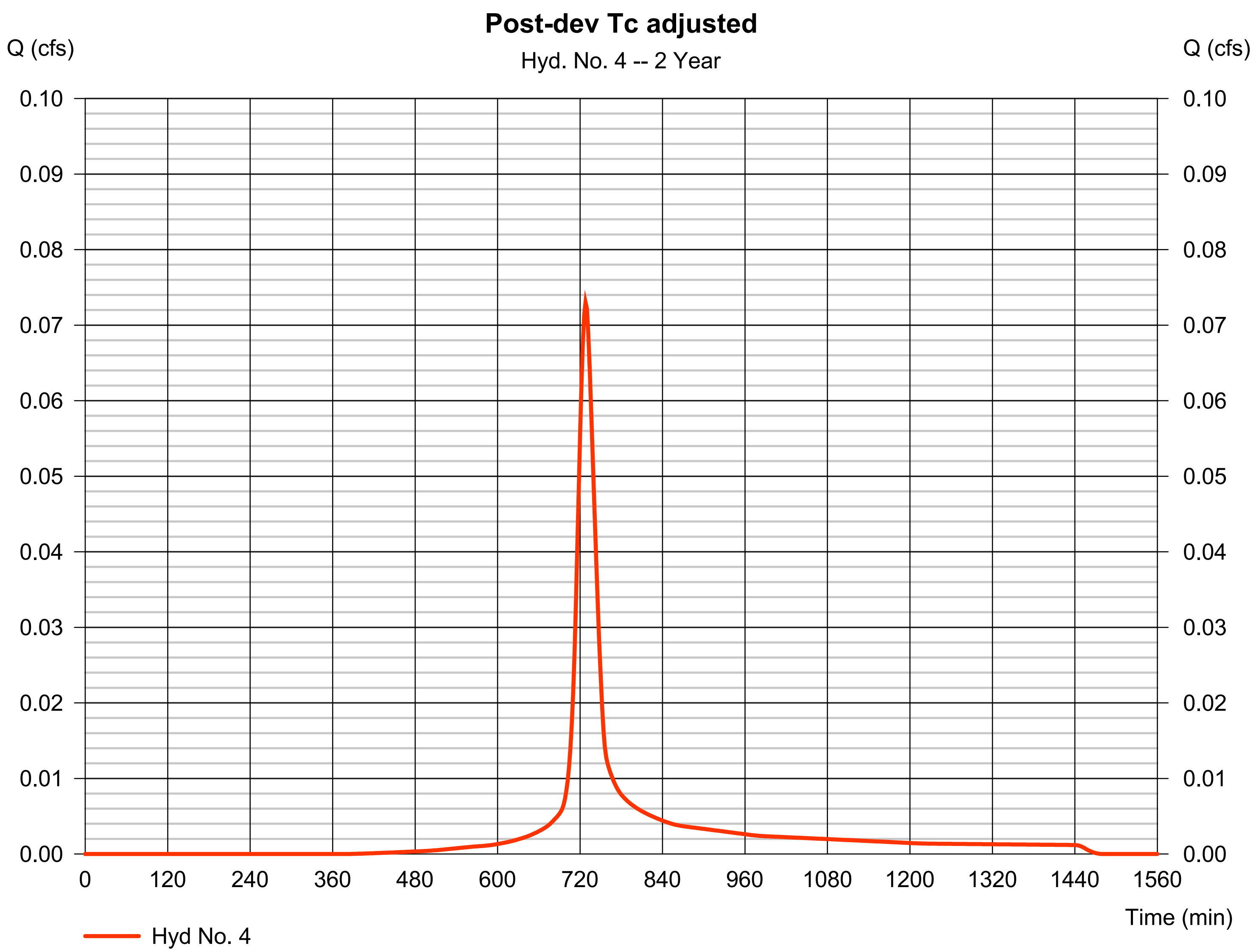
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023 Friday, 11 / 8 / 2024

Hyd. No. 4

Post-dev Tc adjusted

Hydrograph type	= SCS Runoff	Peak discharge	= 0.073 cfs
Storm frequency	= 2 yrs	Time to peak	= 728 min
Time interval	= 2 min	Hyd. volume	= 268 cuft
Drainage area	= 0.050 ac	Curve number	= 91
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 25.30 min
Total precip.	= 2.38 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

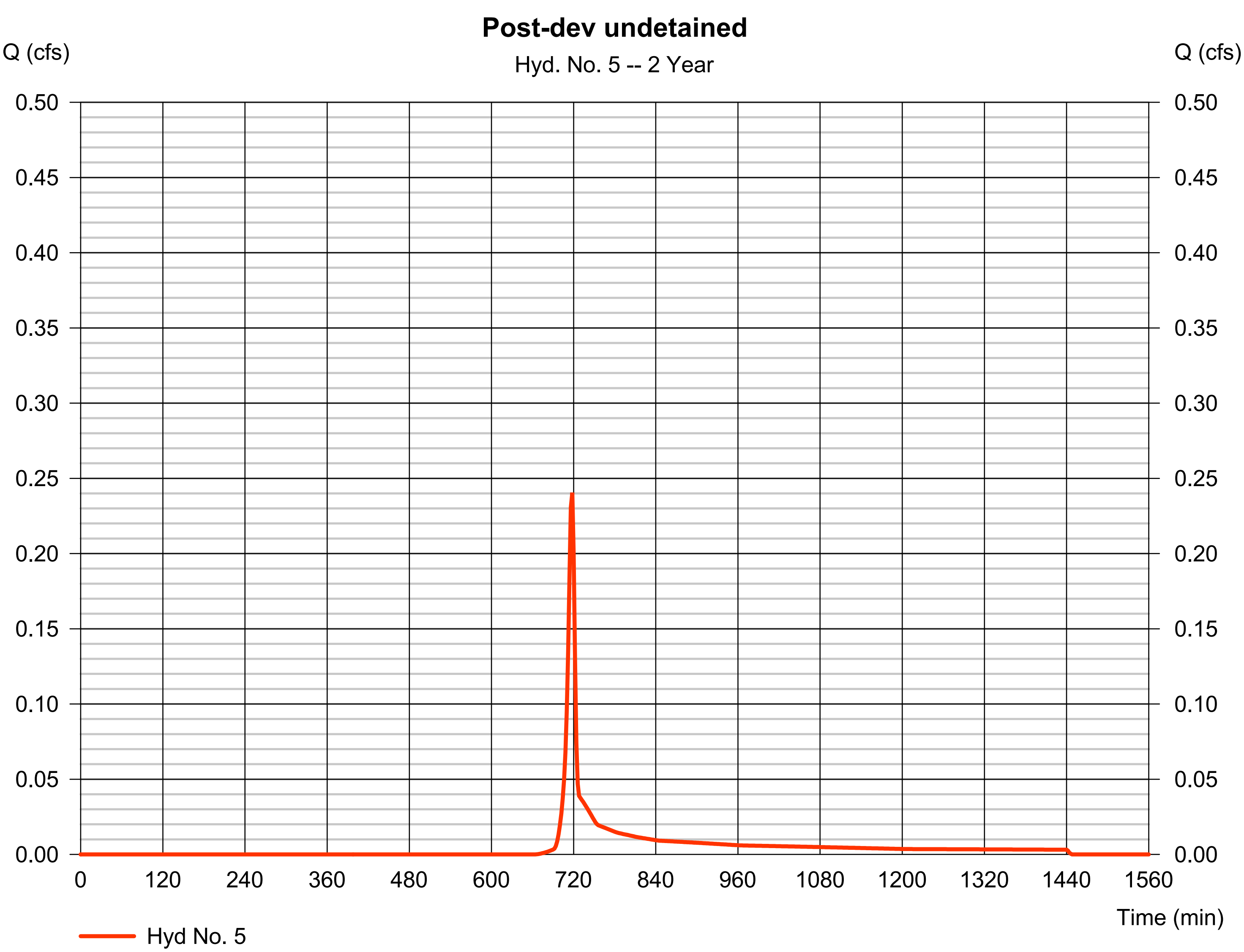


Hydrograph Report

Hyd. No. 5

Post-dev undetained

Hydrograph type	= SCS Runoff	Peak discharge	= 0.241 cfs
Storm frequency	= 2 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 484 cuft
Drainage area	= 0.200 ac	Curve number	= 78
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 2.38 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



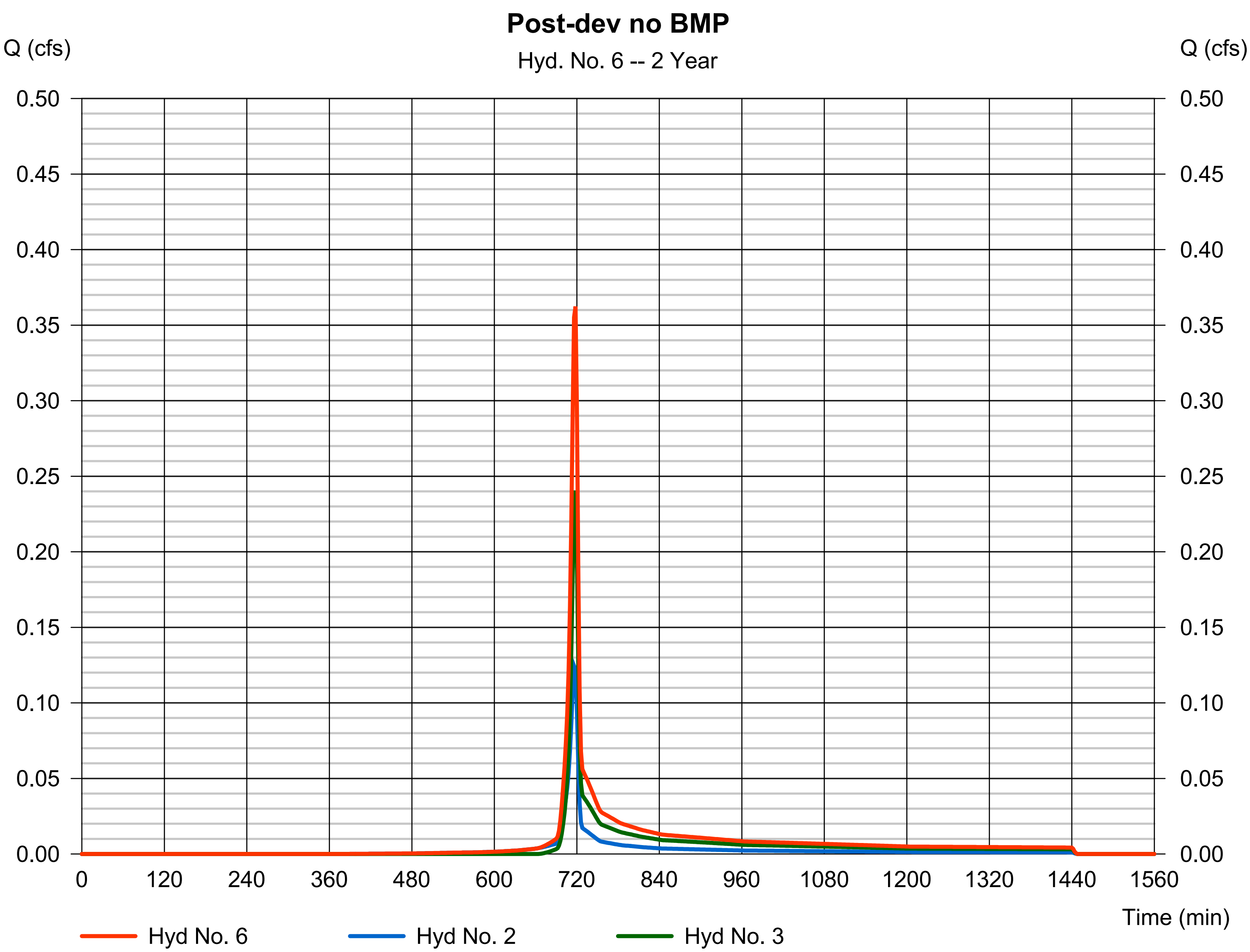
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023 Friday, 11 / 8 / 2024

Hyd. No. 6

Post-dev no BMP

Hydrograph type	= Combine	Peak discharge	= 0.362 cfs
Storm frequency	= 2 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 740 cuft
Inflow hyds.	= 2, 3	Contrib. drain. area	= 0.250 ac



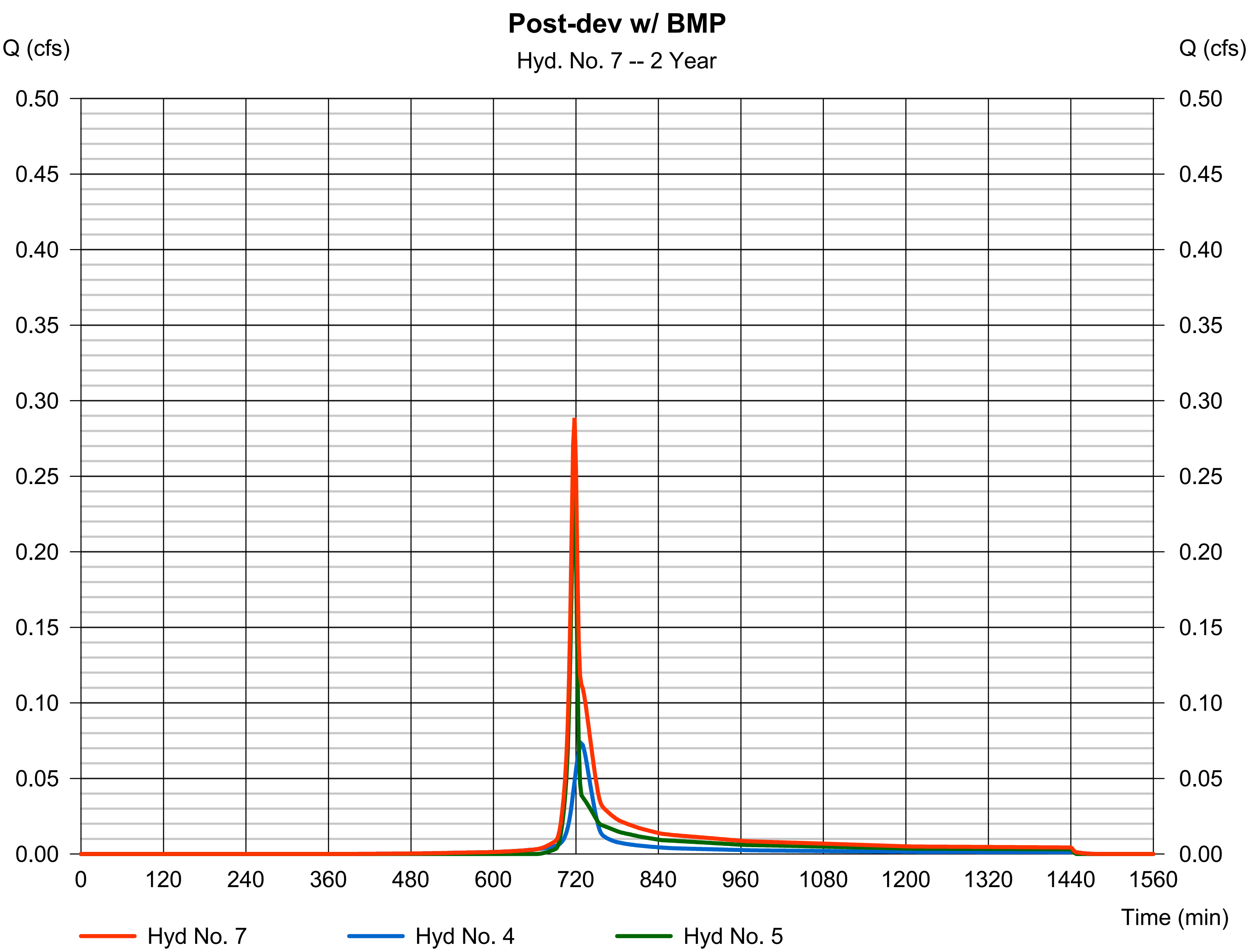
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023 Friday, 11 / 8 / 2024

Hyd. No. 7

Post-dev w/ BMP

Hydrograph type	= Combine	Peak discharge	= 0.289 cfs
Storm frequency	= 2 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 752 cuft
Inflow hyds.	= 4, 5	Contrib. drain. area	= 0.250 ac



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023

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	0.607	2	718	1,216	------	------	------	Pre-dev
2	SCS Runoff	0.199	2	716	418	------	------	------	Post-dev gravel
3	SCS Runoff	0.485	2	718	973	------	------	------	Post-dev undetained
4	SCS Runoff	0.140	2	724	446	------	------	------	Post-dev Tc adjusted
5	SCS Runoff	0.485	2	718	973	------	------	------	Post-dev undetained
6	Combine	0.679	2	716	1,391	2, 3,	------	------	Post-dev no BMP
7	Combine	0.598	2	718	1,419	4, 5,	------	------	Post-dev w/ BMP

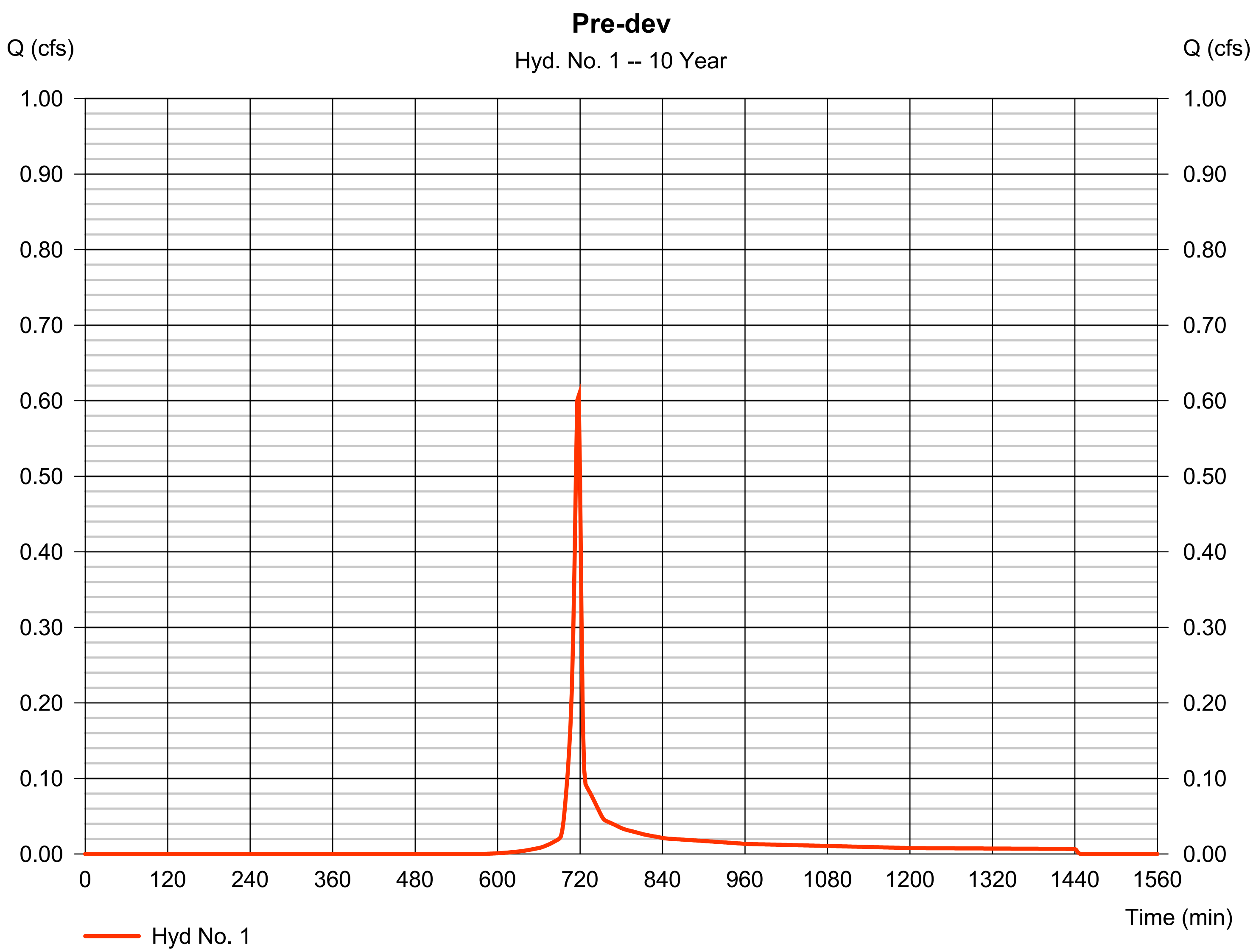
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023 Friday, 11 / 8 / 2024

Hyd. No. 1

Pre-dev

Hydrograph type	= SCS Runoff	Peak discharge	= 0.607 cfs
Storm frequency	= 10 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 1,216 cuft
Drainage area	= 0.250 ac	Curve number	= 78
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 3.41 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Report

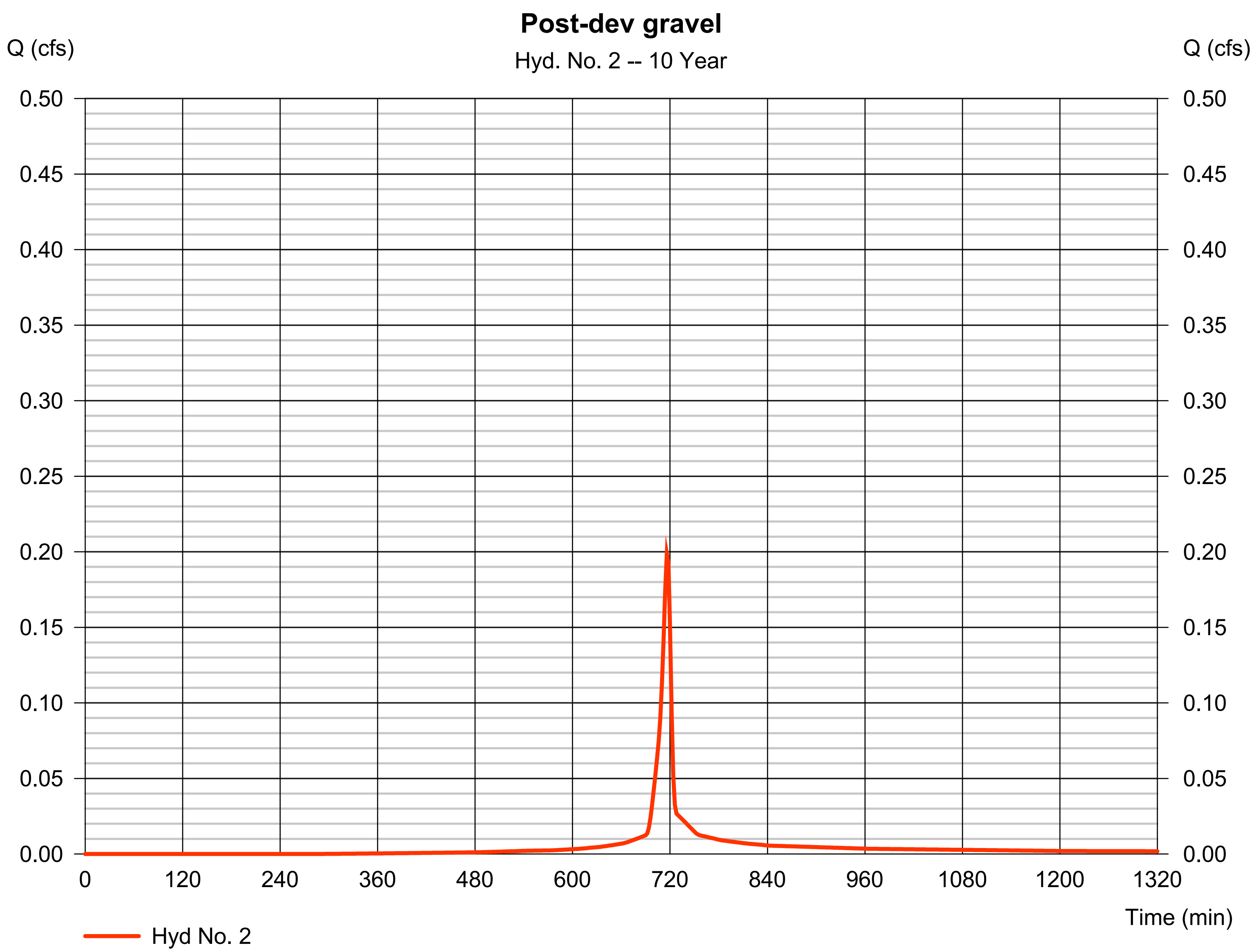
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023 Friday, 11 / 8 / 2024

Hyd. No. 2

Post-dev gravel

Hydrograph type	= SCS Runoff	Peak discharge	= 0.199 cfs
Storm frequency	= 10 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 418 cuft
Drainage area	= 0.050 ac	Curve number	= 91*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 3.41 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.430 x 78) + (0.080 x 91)] / 0.050



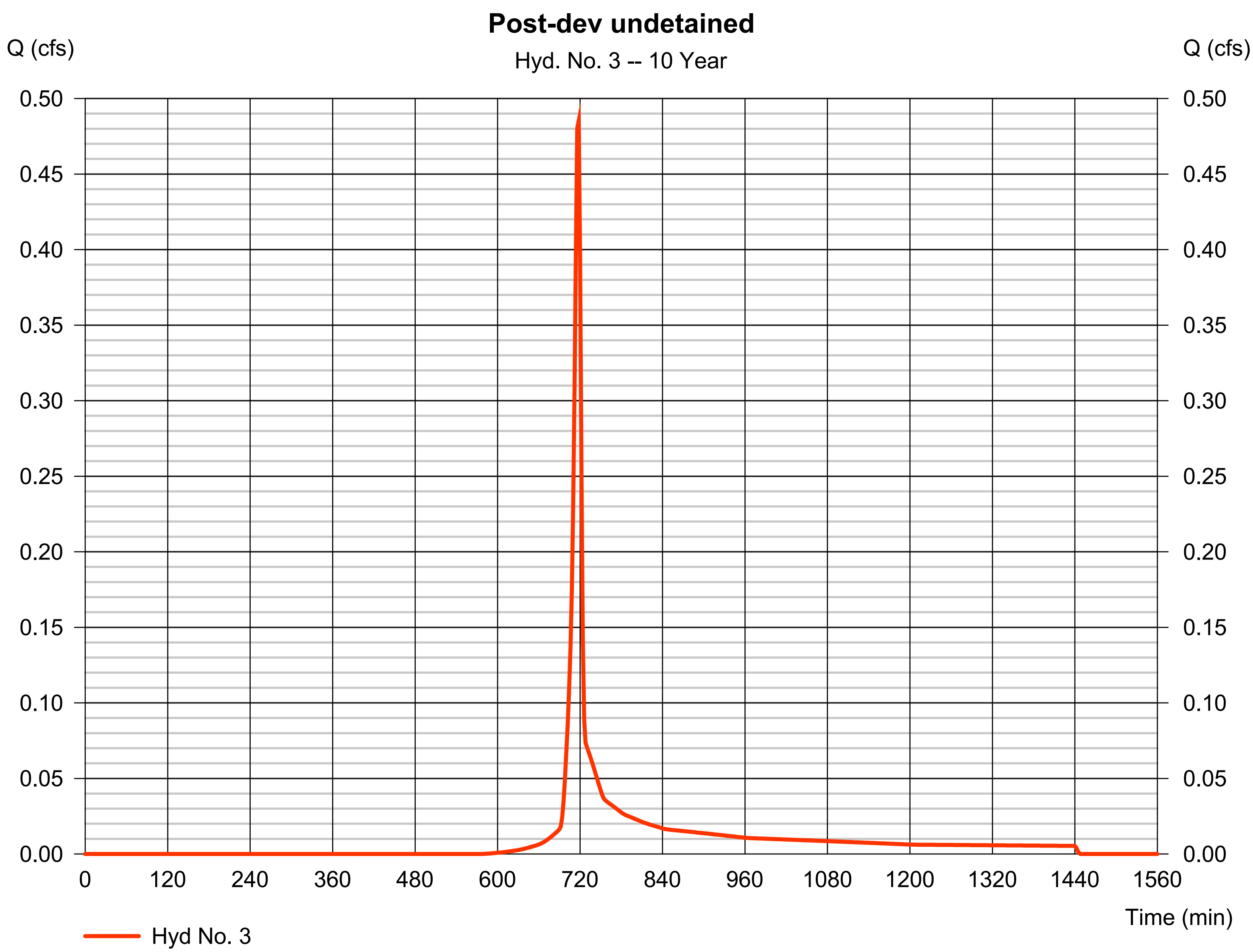
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023 — Friday, 11 / 8 / 2024

Hyd. No. 3

Post-dev undetained

Hydrograph type	= SCS Runoff	Peak discharge	= 0.485 cfs
Storm frequency	= 10 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 973 cuft
Drainage area	= 0.200 ac	Curve number	= 78
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 3.41 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



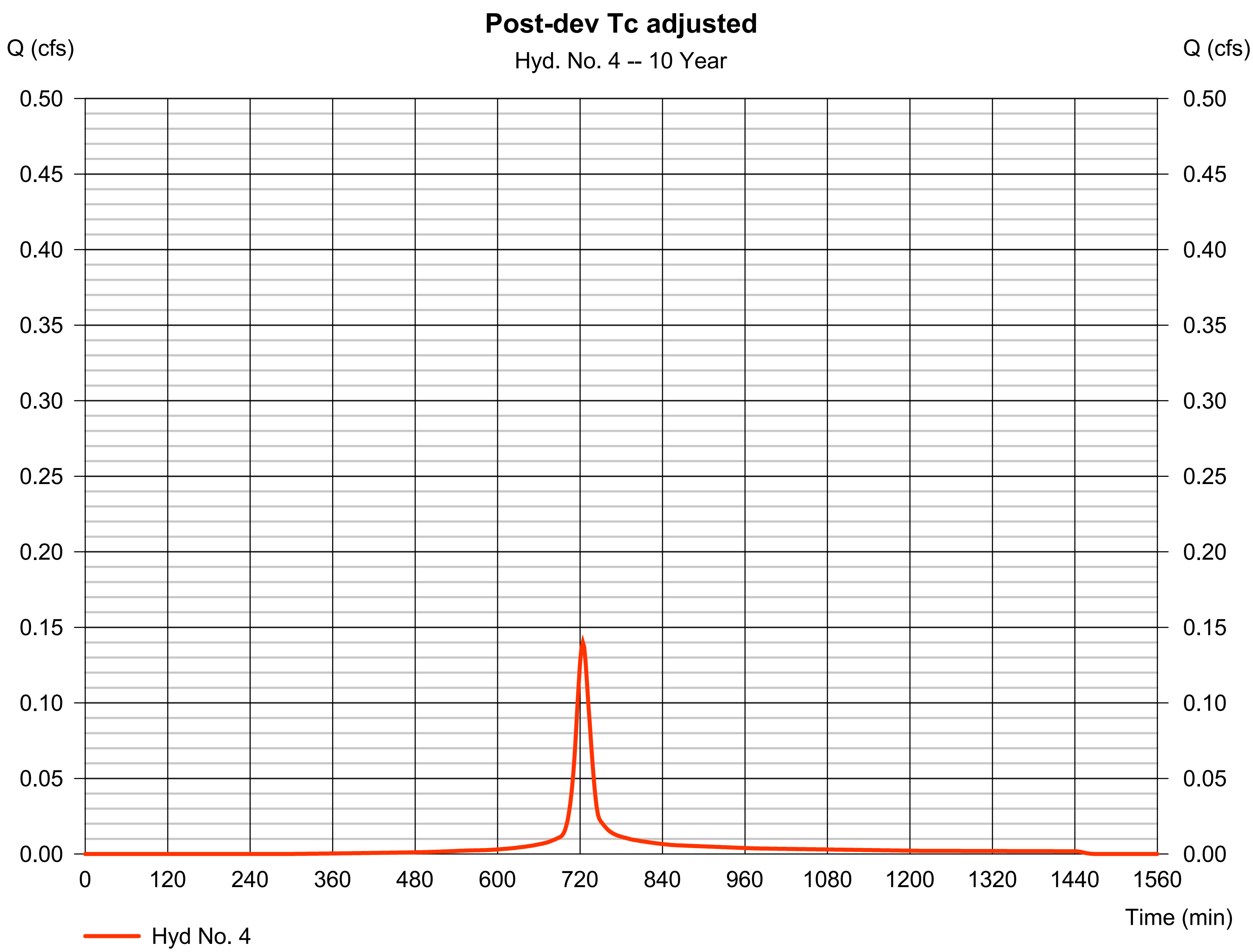
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023 Friday, 11 / 8 / 2024

Hyd. No. 4

Post-dev Tc adjusted

Hydrograph type	= SCS Runoff	Peak discharge	= 0.140 cfs
Storm frequency	= 10 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 446 cuft
Drainage area	= 0.050 ac	Curve number	= 91
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 17.60 min
Total precip.	= 3.41 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



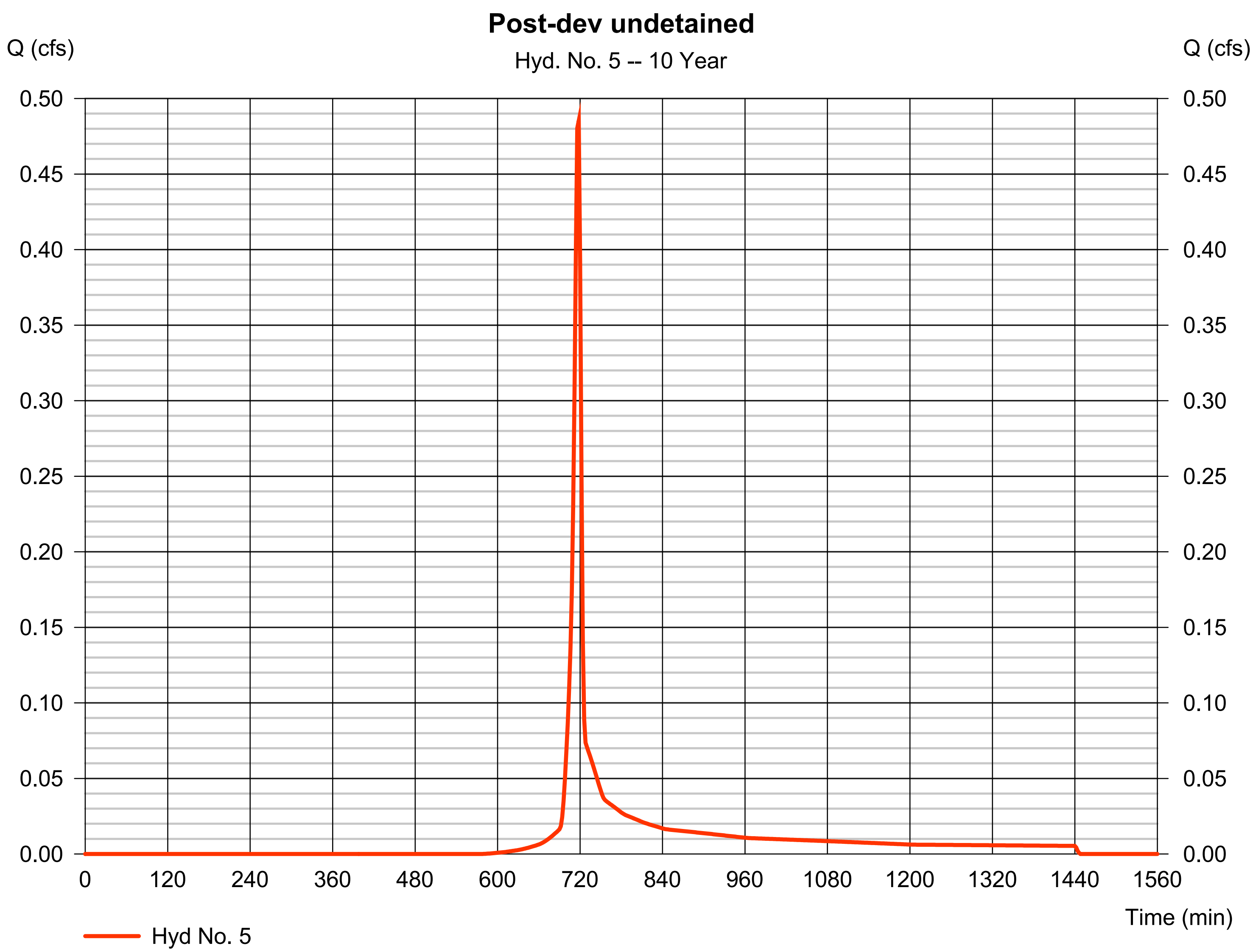
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023 Friday, 11 / 8 / 2024

Hyd. No. 5

Post-dev undetained

Hydrograph type	= SCS Runoff	Peak discharge	= 0.485 cfs
Storm frequency	= 10 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 973 cuft
Drainage area	= 0.200 ac	Curve number	= 78
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 3.41 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



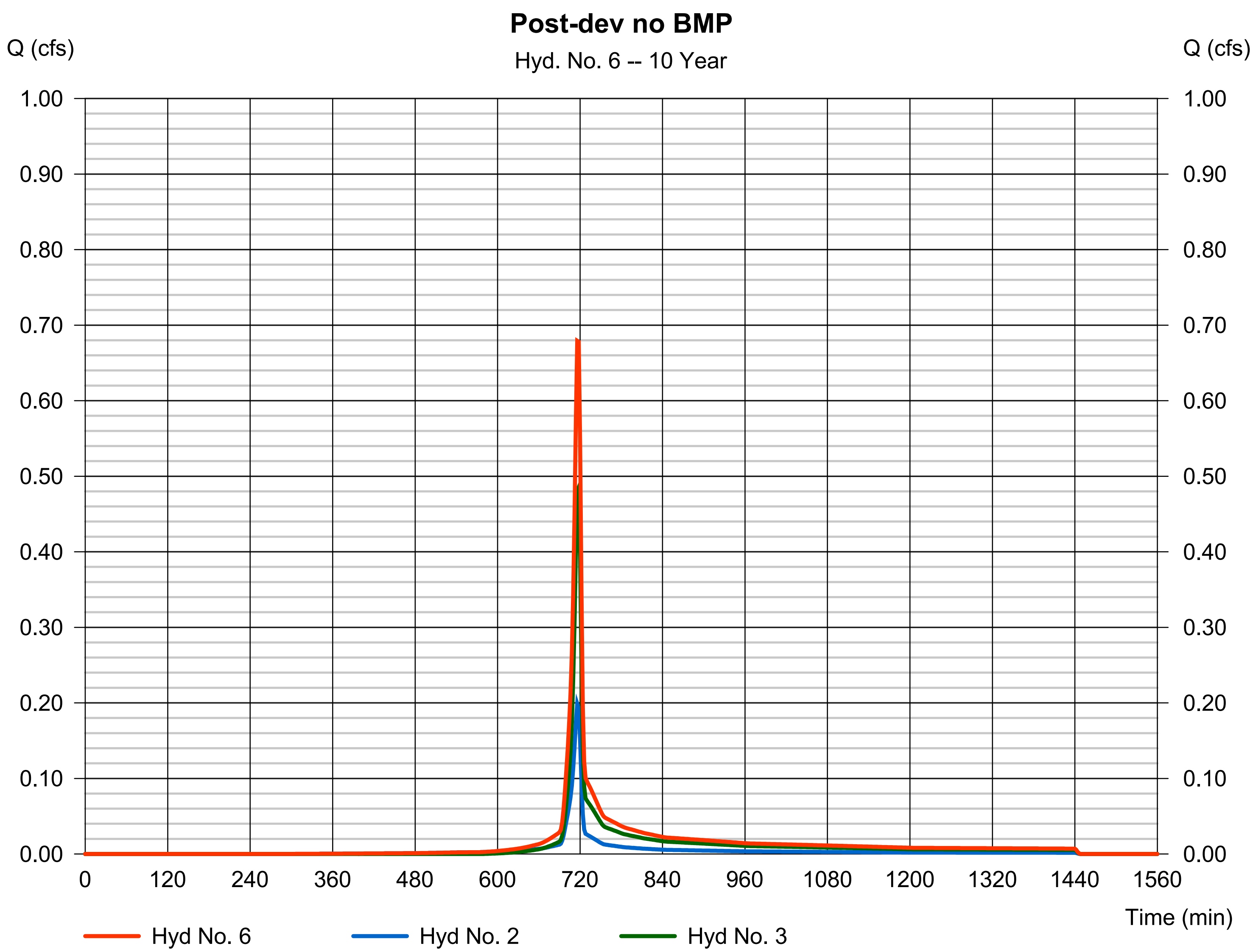
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023 Friday, 11 / 8 / 2024

Hyd. No. 6

Post-dev no BMP

Hydrograph type	= Combine	Peak discharge	= 0.679 cfs
Storm frequency	= 10 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 1,391 cuft
Inflow hyds.	= 2, 3	Contrib. drain. area	= 0.250 ac



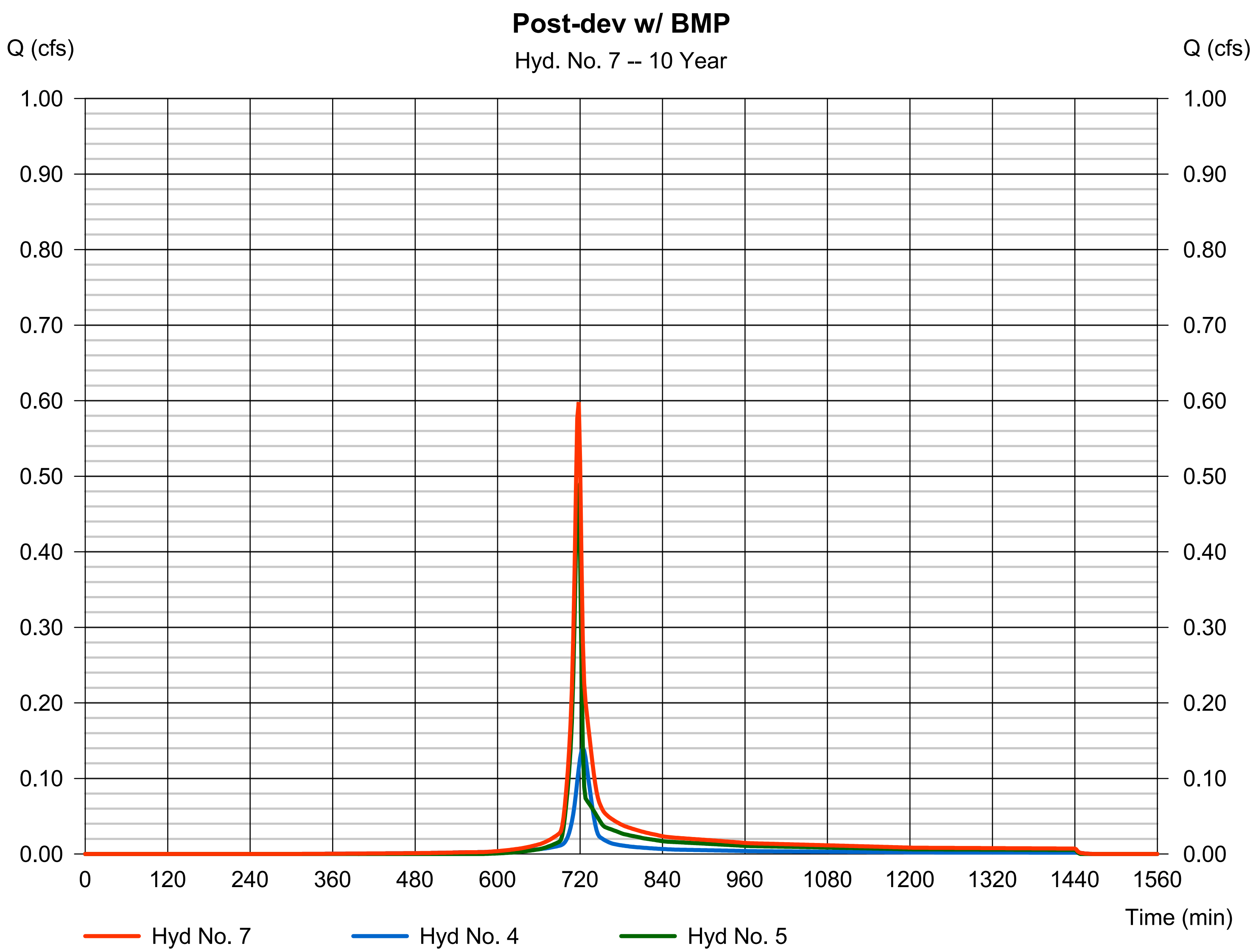
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023 Friday, 11 / 8 / 2024

Hyd. No. 7

Post-dev w/ BMP

Hydrograph type	= Combine	Peak discharge	= 0.598 cfs
Storm frequency	= 10 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 1,419 cuft
Inflow hyds.	= 4, 5	Contrib. drain. area	= 0.250 ac



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023

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	0.853	2	716	1,721	------	------	------	Pre-dev
2	SCS Runoff	0.254	2	716	541	------	------	------	Post-dev gravel
3	SCS Runoff	0.682	2	716	1,377	------	------	------	Post-dev undetained
4	SCS Runoff	0.194	2	722	563	------	------	------	Post-dev Tc adjusted
5	SCS Runoff	0.682	2	716	1,377	------	------	------	Post-dev undetained
6	Combine	0.936	2	716	1,918	2, 3,	------	------	Post-dev no BMP
7	Combine	0.853	2	718	1,940	4, 5,	------	------	Post-dev w/ BMP

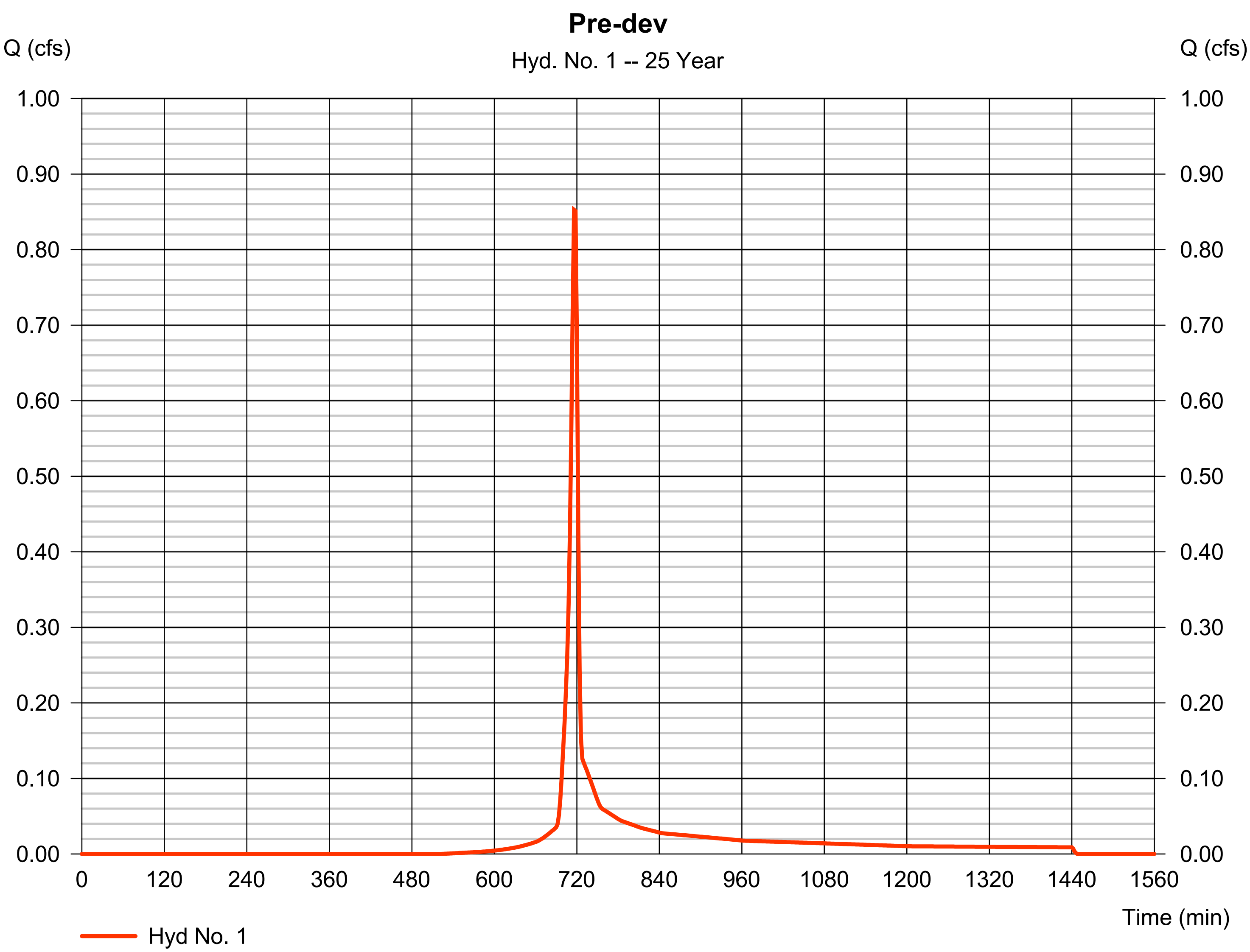
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023 — Friday, 11 / 8 / 2024

Hyd. No. 1

Pre-dev

Hydrograph type	= SCS Runoff	Peak discharge	= 0.853 cfs
Storm frequency	= 25 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 1,721 cuft
Drainage area	= 0.250 ac	Curve number	= 78
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 4.17 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Report

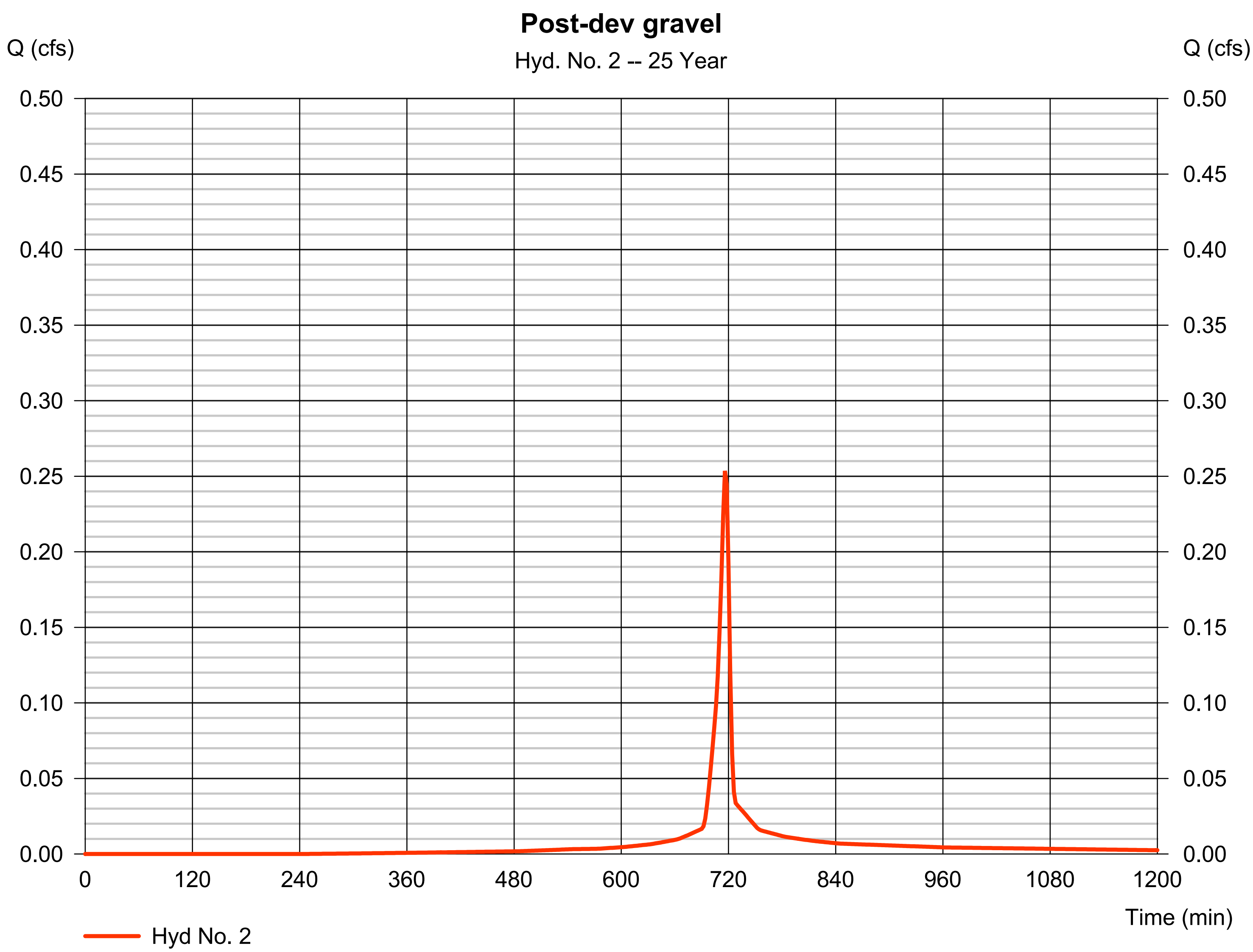
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023 — Friday, 11 / 8 / 2024

Hyd. No. 2

Post-dev gravel

Hydrograph type	= SCS Runoff	Peak discharge	= 0.254 cfs
Storm frequency	= 25 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 541 cuft
Drainage area	= 0.050 ac	Curve number	= 91*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 4.17 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.430 x 78) + (0.080 x 91)] / 0.050



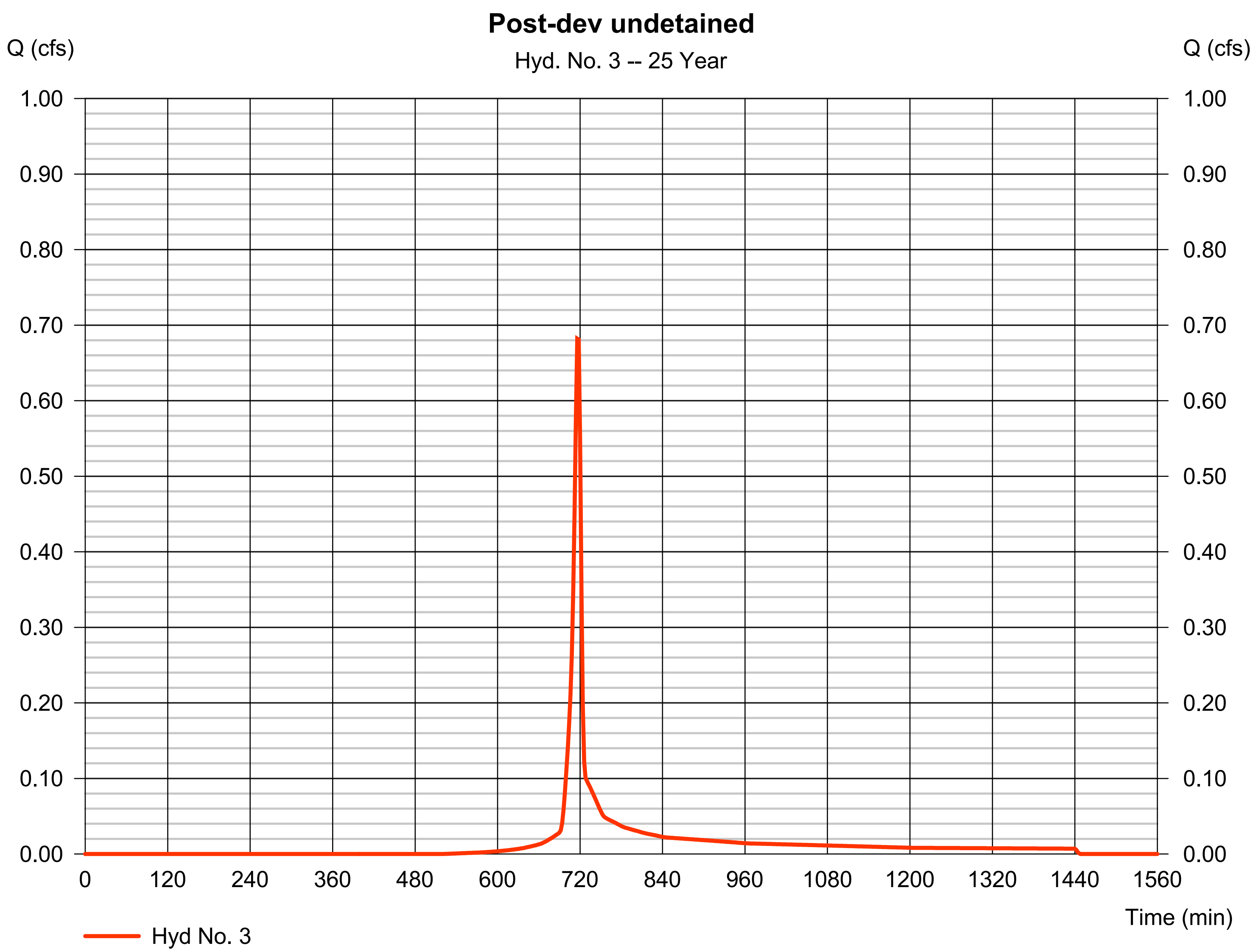
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023 — Friday, 11 / 8 / 2024

Hyd. No. 3

Post-dev undetained

Hydrograph type	= SCS Runoff	Peak discharge	= 0.682 cfs
Storm frequency	= 25 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 1,377 cuft
Drainage area	= 0.200 ac	Curve number	= 78
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 4.17 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

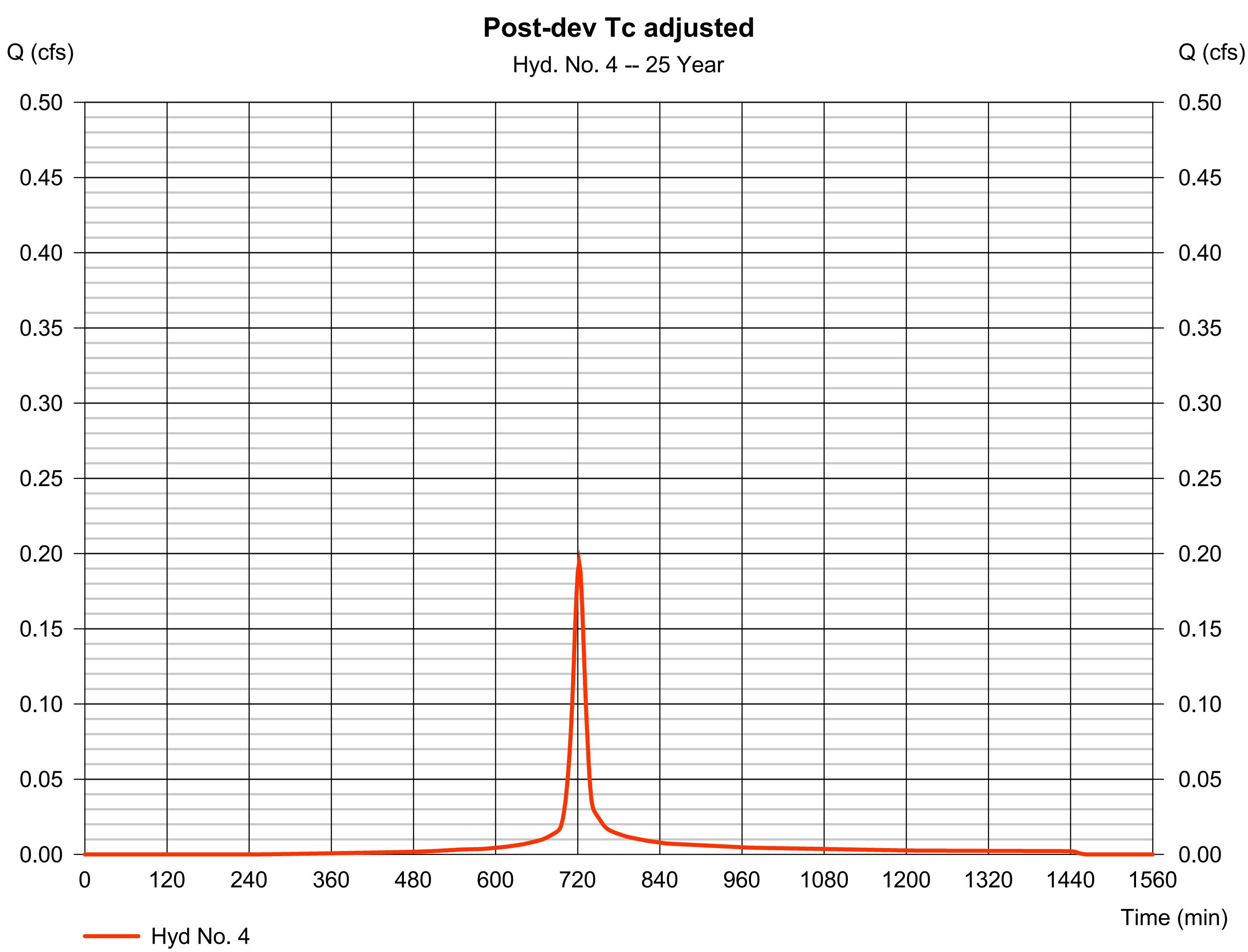


Hydrograph Report

Hyd. No. 4

Post-dev Tc adjusted

Hydrograph type	= SCS Runoff	Peak discharge	= 0.194 cfs
Storm frequency	= 25 yrs	Time to peak	= 722 min
Time interval	= 2 min	Hyd. volume	= 563 cuft
Drainage area	= 0.050 ac	Curve number	= 91
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 14.90 min
Total precip.	= 4.17 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



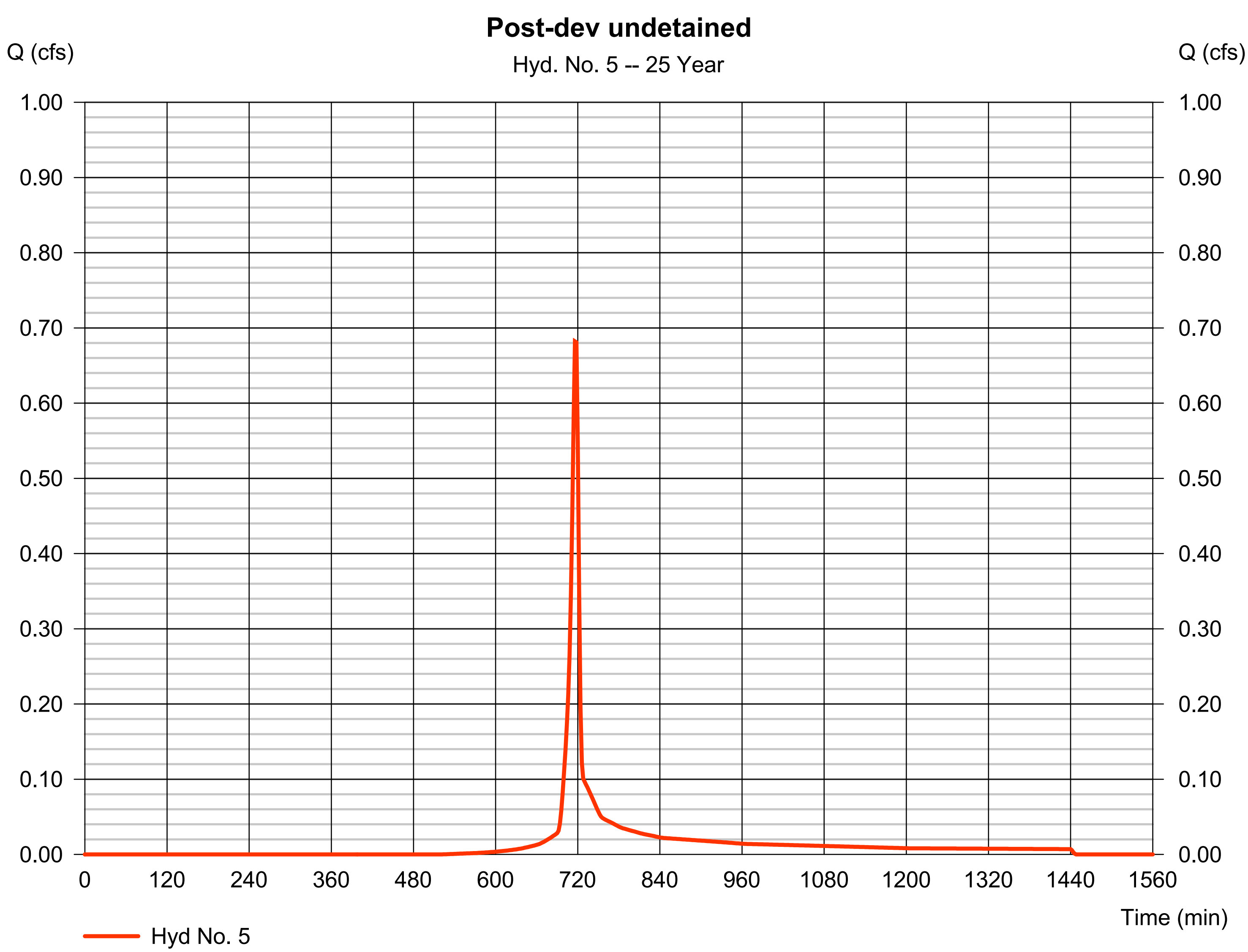
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023 Friday, 11 / 8 / 2024

Hyd. No. 5

Post-dev undetained

Hydrograph type	= SCS Runoff	Peak discharge	= 0.682 cfs
Storm frequency	= 25 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 1,377 cuft
Drainage area	= 0.200 ac	Curve number	= 78
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 4.17 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



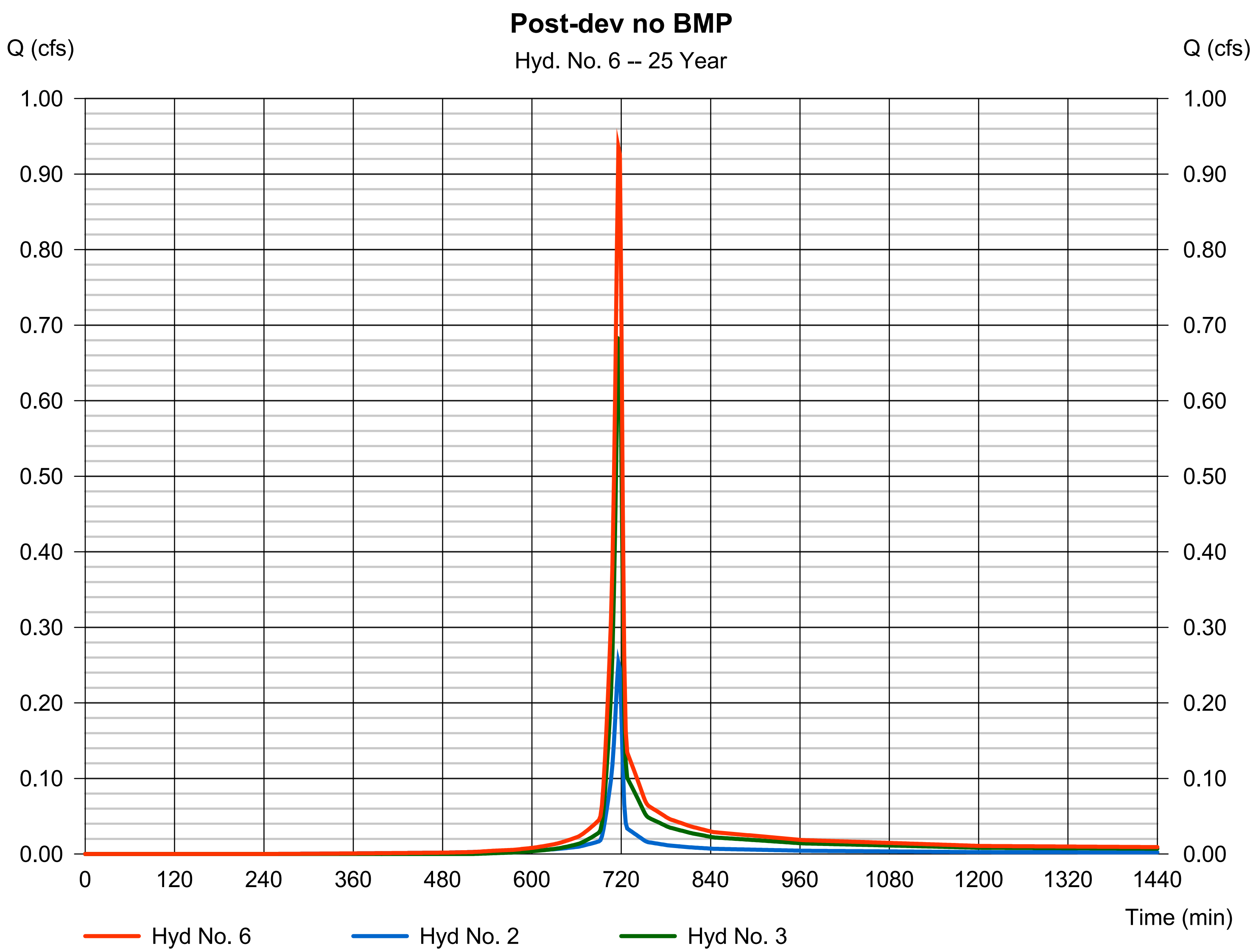
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023 Friday, 11 / 8 / 2024

Hyd. No. 6

Post-dev no BMP

Hydrograph type	= Combine	Peak discharge	= 0.936 cfs
Storm frequency	= 25 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 1,918 cuft
Inflow hyds.	= 2, 3	Contrib. drain. area	= 0.250 ac



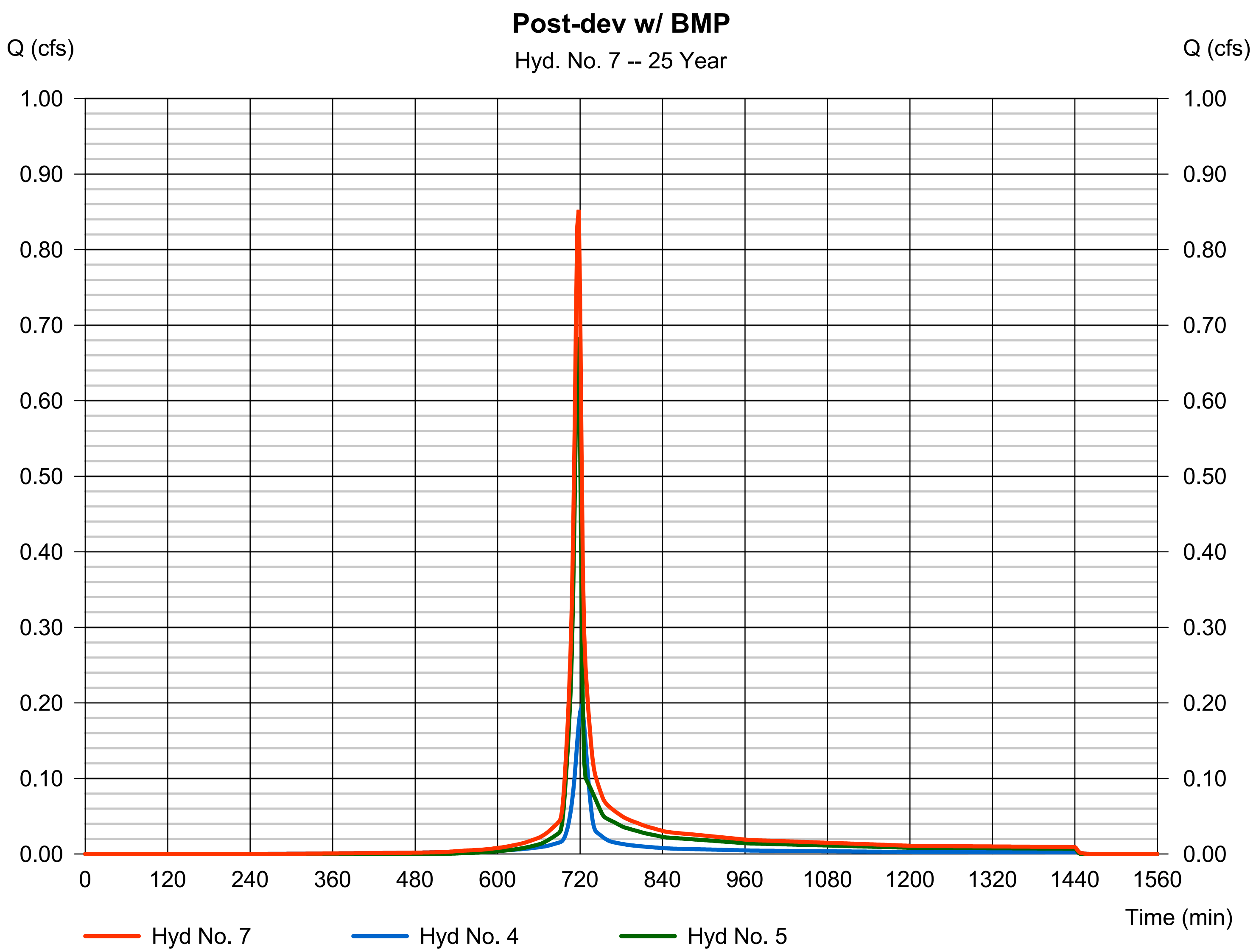
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023 — Friday, 11 / 8 / 2024

Hyd. No. 7

Post-dev w/ BMP

Hydrograph type	= Combine	Peak discharge	= 0.853 cfs
Storm frequency	= 25 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 1,940 cuft
Inflow hyds.	= 4, 5	Contrib. drain. area	= 0.250 ac



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023

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	1.094	2	716	2,213	------	------	------	Pre-dev
2	SCS Runoff	0.304	2	716	656	------	------	------	Post-dev gravel
3	SCS Runoff	0.875	2	716	1,771	------	------	------	Post-dev undetained
4	SCS Runoff	0.233	2	722	682	------	------	------	Post-dev Tc adjusted
5	SCS Runoff	0.875	2	716	1,771	------	------	------	Post-dev undetained
6	Combine	1.179	2	716	2,427	2, 3,	------	------	Post-dev no BMP
7	Combine	1.074	2	718	2,453	4, 5,	------	------	Post-dev w/ BMP

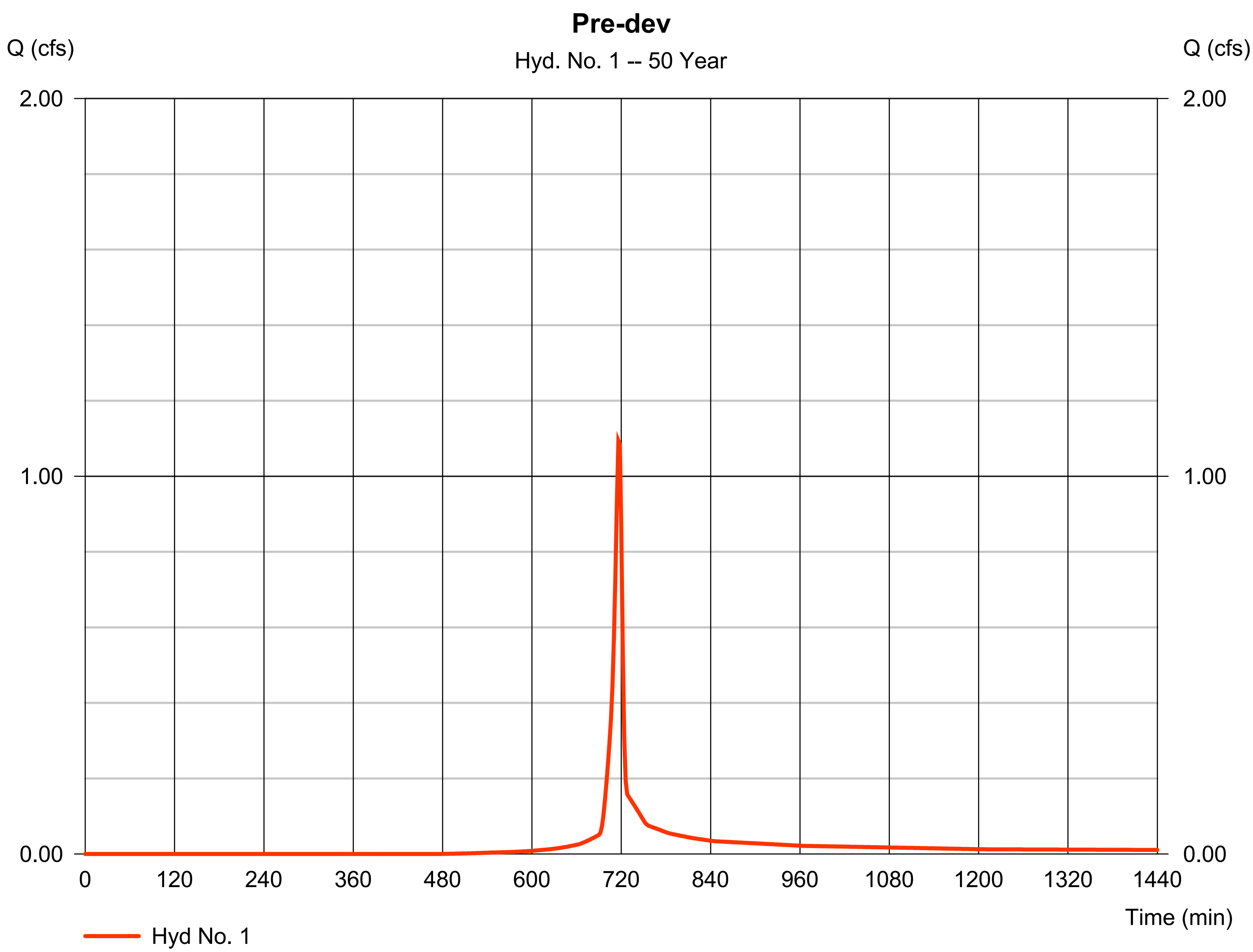
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023 | Friday, 11 / 8 / 2024

Hyd. No. 1

Pre-dev

Hydrograph type	= SCS Runoff	Peak discharge	= 1.094 cfs
Storm frequency	= 50 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 2,213 cuft
Drainage area	= 0.250 ac	Curve number	= 78
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 4.87 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Report

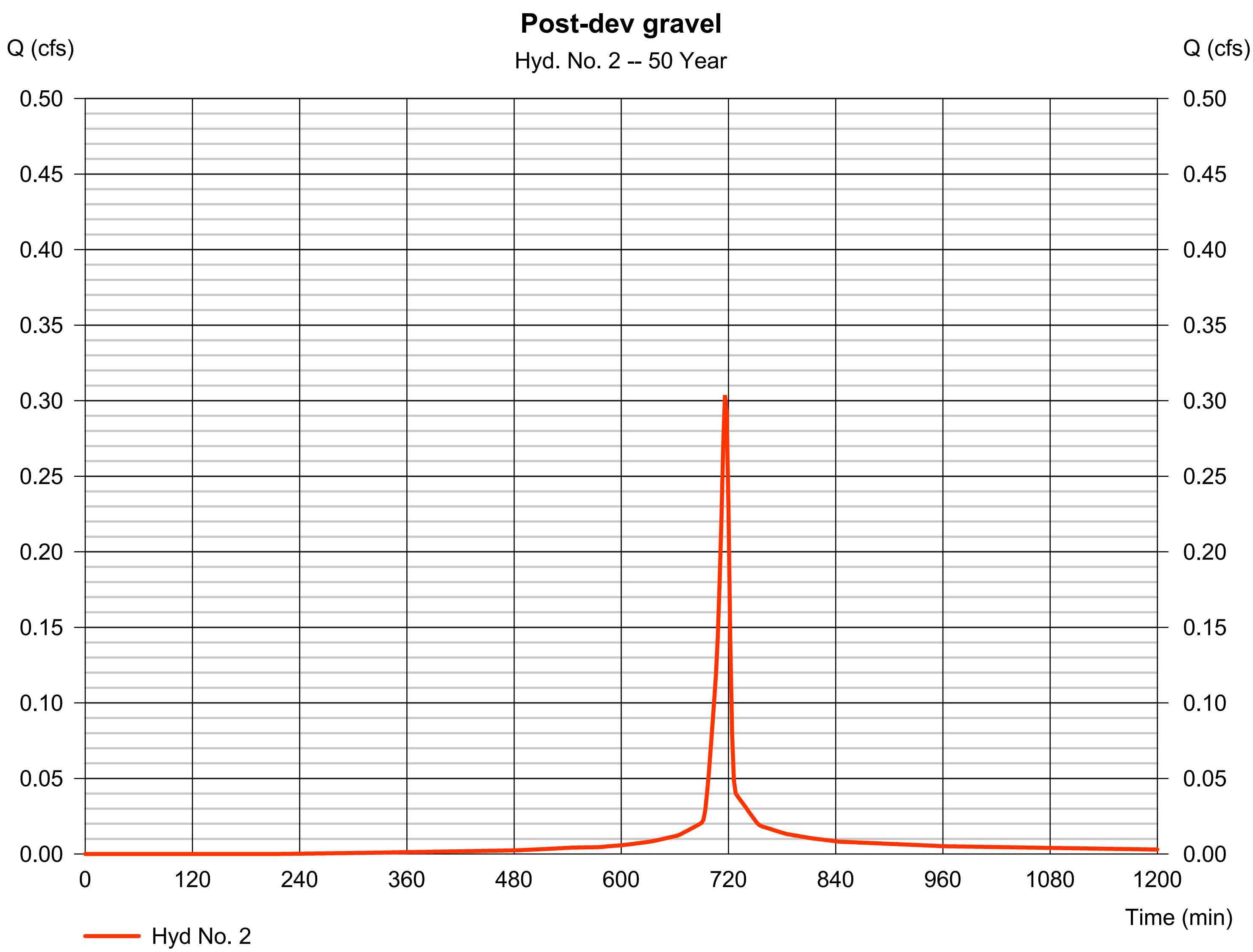
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023 Friday, 11 / 8 / 2024

Hyd. No. 2

Post-dev gravel

Hydrograph type	= SCS Runoff	Peak discharge	= 0.304 cfs
Storm frequency	= 50 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 656 cuft
Drainage area	= 0.050 ac	Curve number	= 91*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 4.87 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.430 x 78) + (0.080 x 91)] / 0.050



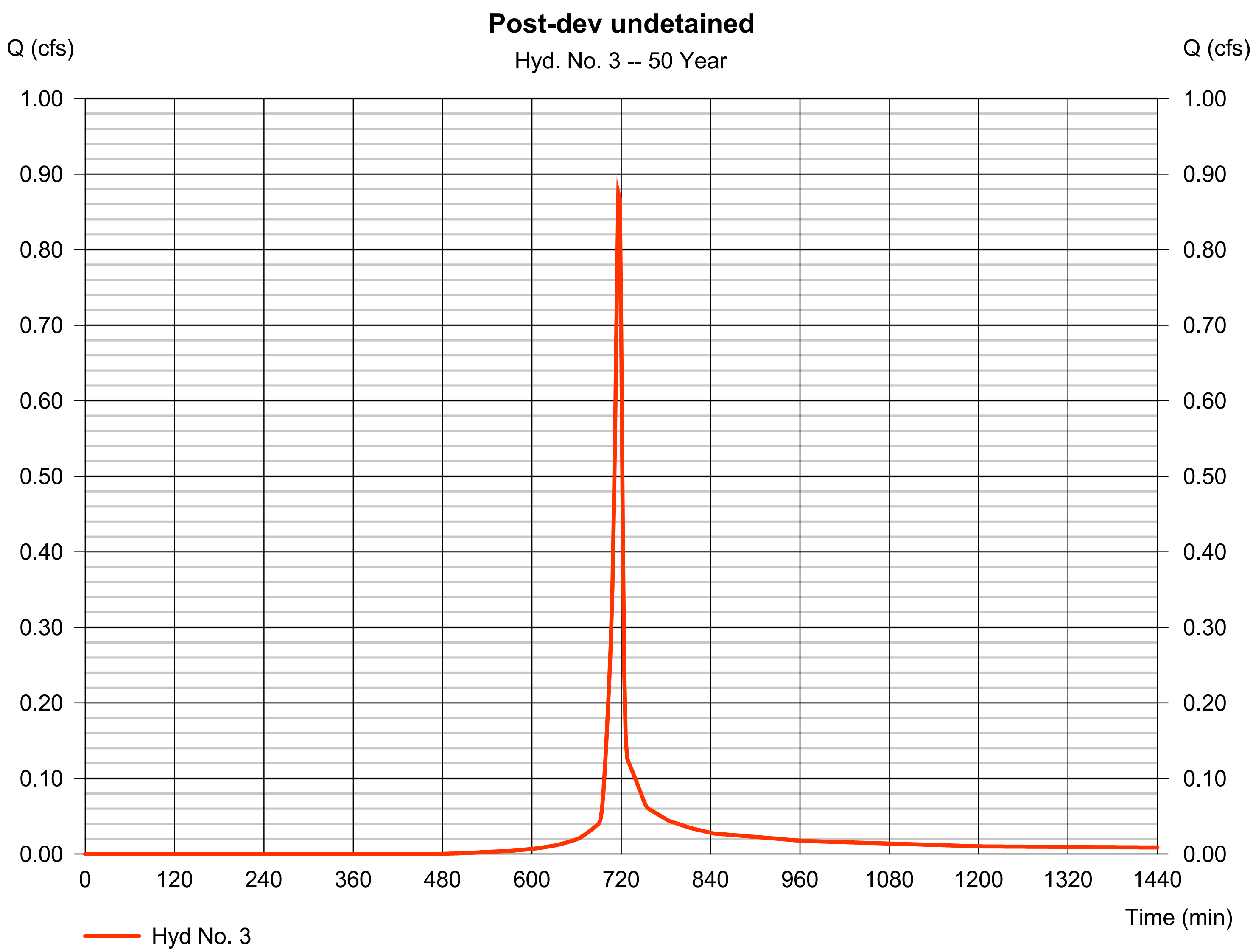
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023 | Friday, 11 / 8 / 2024

Hyd. No. 3

Post-dev undetained

Hydrograph type	= SCS Runoff	Peak discharge	= 0.875 cfs
Storm frequency	= 50 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 1,771 cuft
Drainage area	= 0.200 ac	Curve number	= 78
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 4.87 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



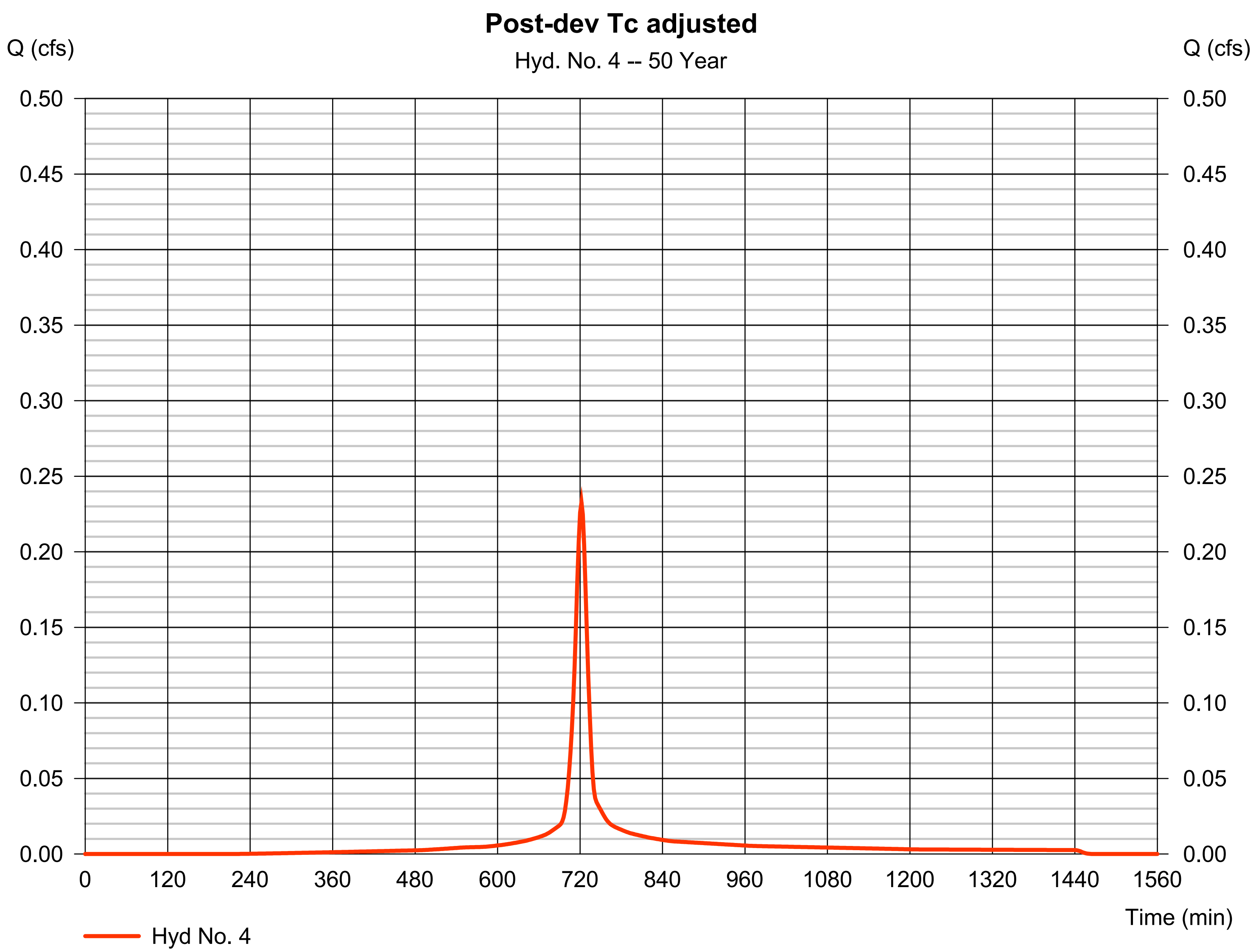
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023 Friday, 11 / 8 / 2024

Hyd. No. 4

Post-dev Tc adjusted

Hydrograph type	= SCS Runoff	Peak discharge	= 0.233 cfs
Storm frequency	= 50 yrs	Time to peak	= 722 min
Time interval	= 2 min	Hyd. volume	= 682 cuft
Drainage area	= 0.050 ac	Curve number	= 91
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 13.40 min
Total precip.	= 4.87 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



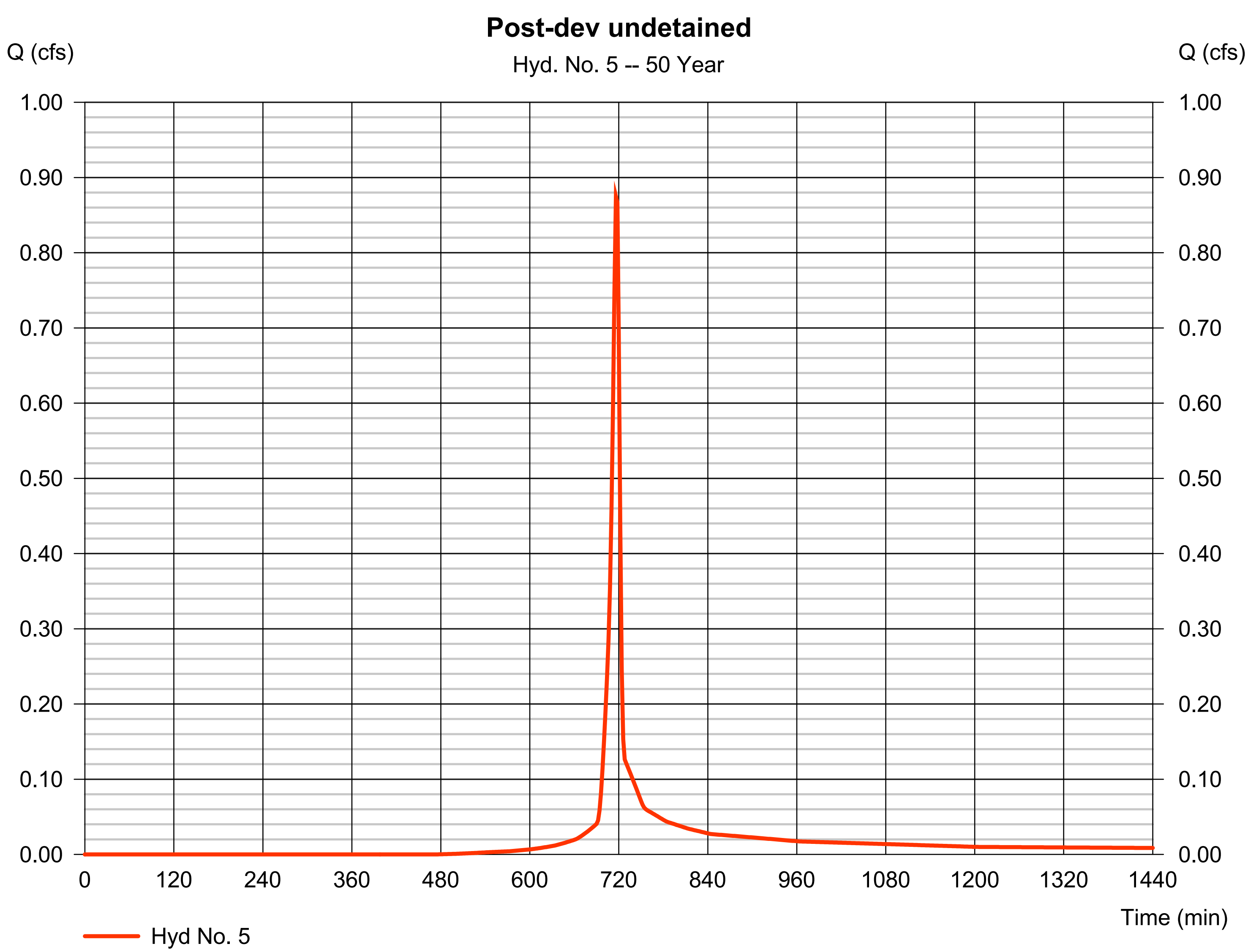
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023 Friday, 11 / 8 / 2024

Hyd. No. 5

Post-dev undetained

Hydrograph type	= SCS Runoff	Peak discharge	= 0.875 cfs
Storm frequency	= 50 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 1,771 cuft
Drainage area	= 0.200 ac	Curve number	= 78
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 4.87 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



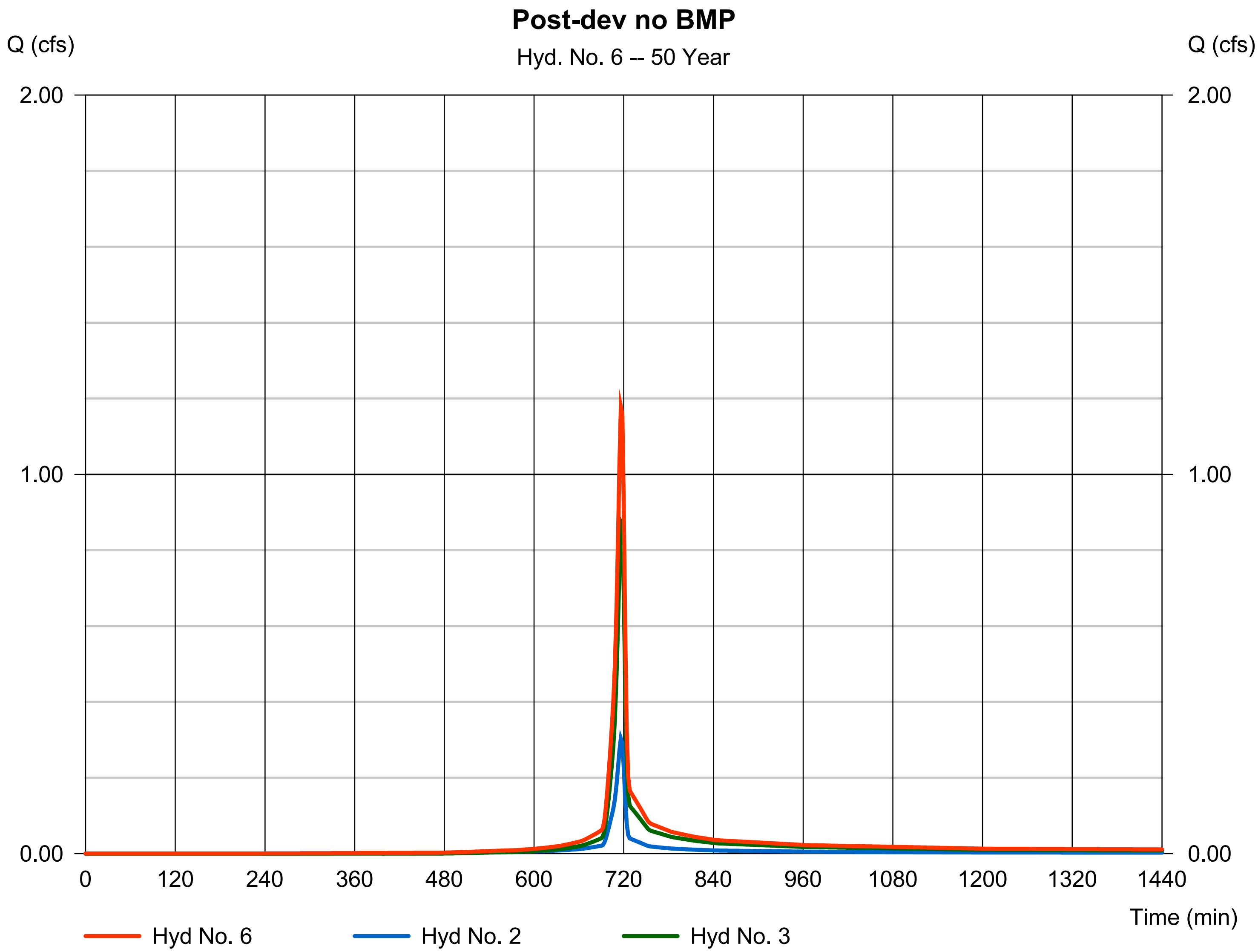
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023 Friday, 11 / 8 / 2024

Hyd. No. 6

Post-dev no BMP

Hydrograph type	= Combine	Peak discharge	= 1.179 cfs
Storm frequency	= 50 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 2,427 cuft
Inflow hyds.	= 2, 3	Contrib. drain. area	= 0.250 ac



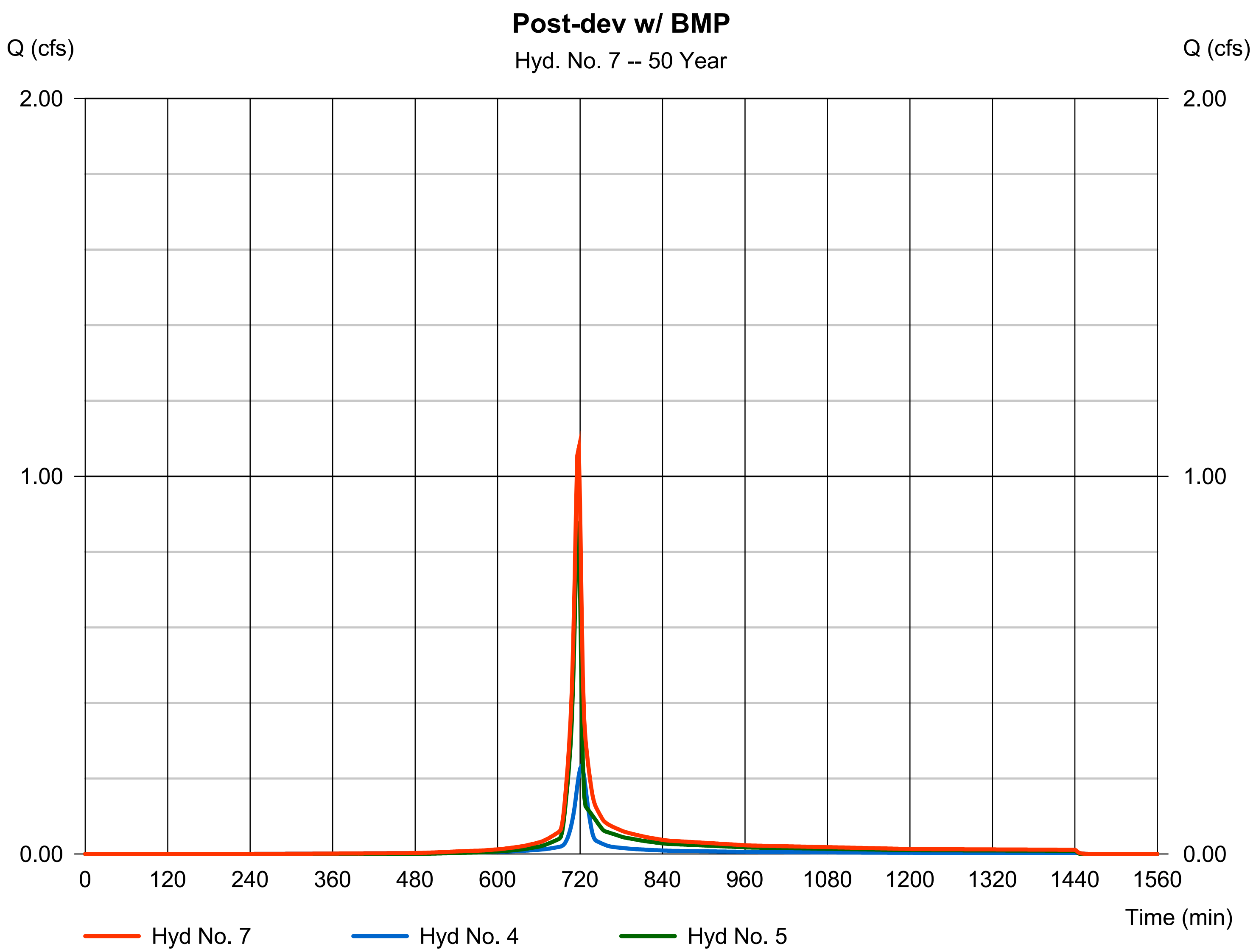
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023 — Friday, 11 / 8 / 2024

Hyd. No. 7

Post-dev w/ BMP

Hydrograph type	= Combine	Peak discharge	= 1.074 cfs
Storm frequency	= 50 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 2,453 cuft
Inflow hyds.	= 4, 5	Contrib. drain. area	= 0.250 ac



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023

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	1.386	2	716	2,821	------	------	------	Pre-dev
2	SCS Runoff	0.363	2	716	794	------	------	------	Post-dev gravel
3	SCS Runoff	1.109	2	716	2,256	------	------	------	Post-dev undetained
4	SCS Runoff	0.318	2	720	873	------	------	------	Post-dev Tc adjusted
5	SCS Runoff	1.109	2	716	2,256	------	------	------	Post-dev undetained
6	Combine	1.472	2	716	3,050	2, 3,	------	------	Post-dev no BMP
7	Combine	1.393	2	718	3,129	4, 5,	------	------	Post-dev w/ BMP

YM59 valve site.gpw	Return Period: 100 Year	Friday, 11 / 8 / 2024

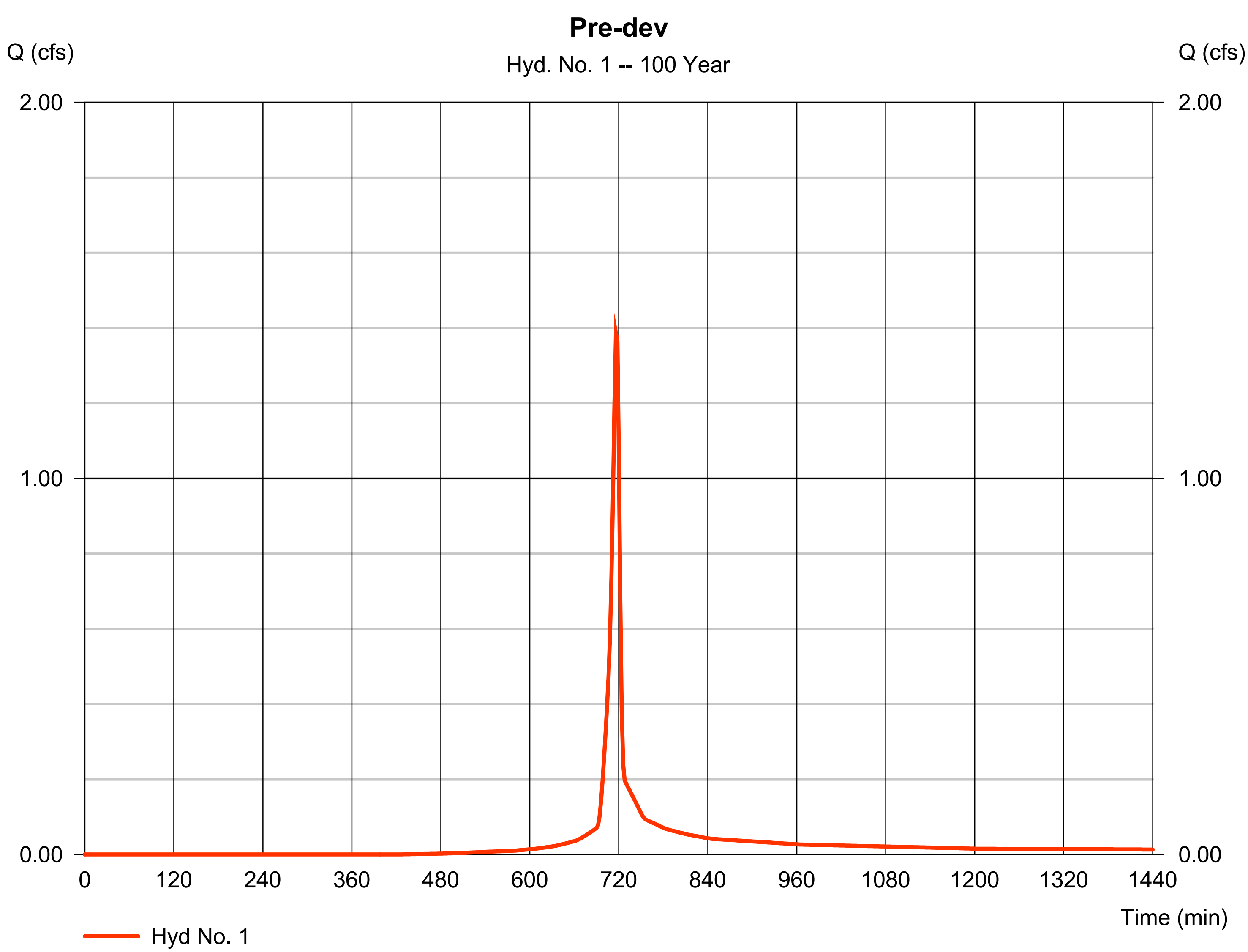
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023 Friday, 11 / 8 / 2024

Hyd. No. 1

Pre-dev

Hydrograph type	= SCS Runoff	Peak discharge	= 1.386 cfs
Storm frequency	= 100 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 2,821 cuft
Drainage area	= 0.250 ac	Curve number	= 78
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 5.70 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Report

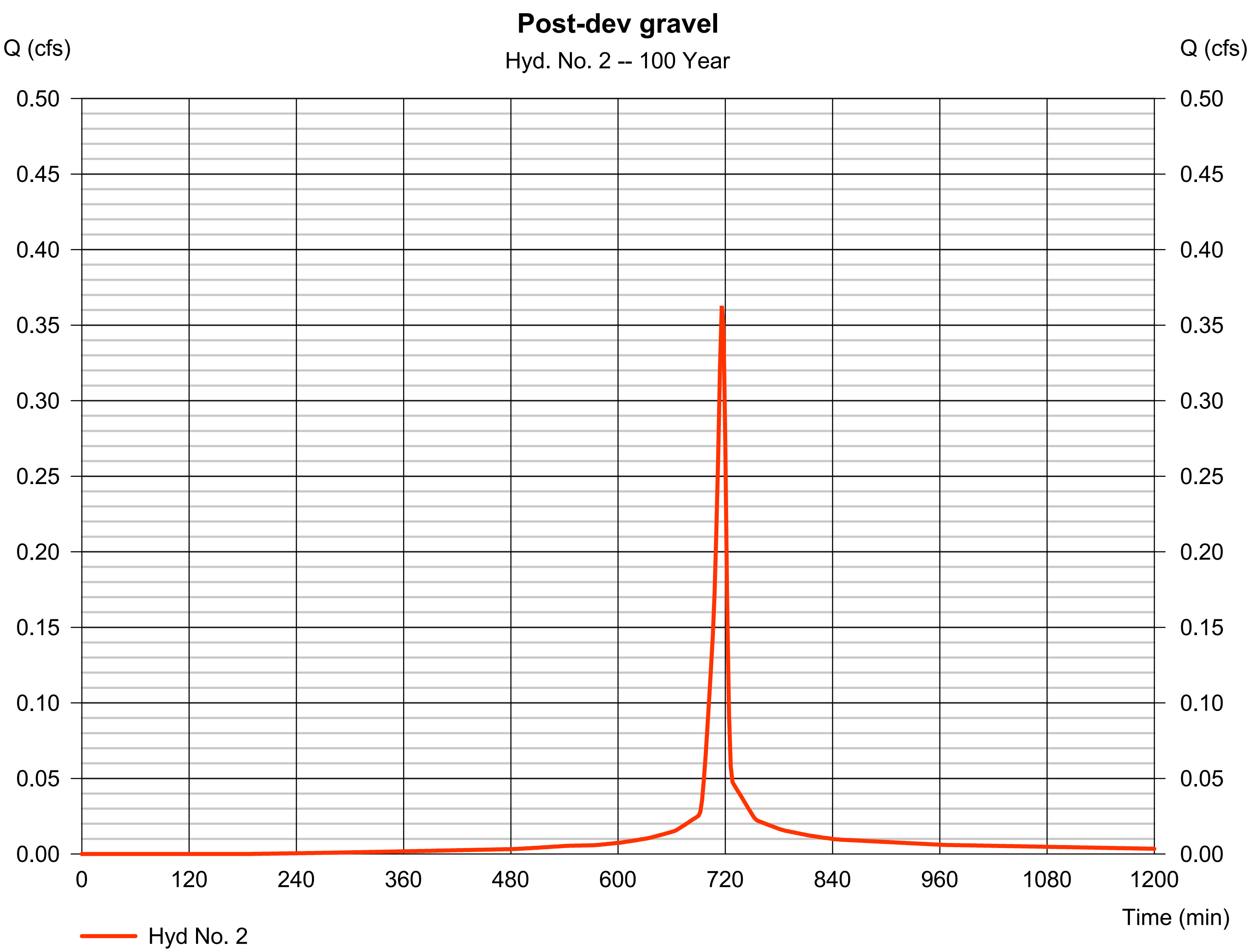
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023 Friday, 11 / 8 / 2024

Hyd. No. 2

Post-dev gravel

Hydrograph type	= SCS Runoff	Peak discharge	= 0.363 cfs
Storm frequency	= 100 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 794 cuft
Drainage area	= 0.050 ac	Curve number	= 91*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 5.70 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.430 x 78) + (0.080 x 91)] / 0.050

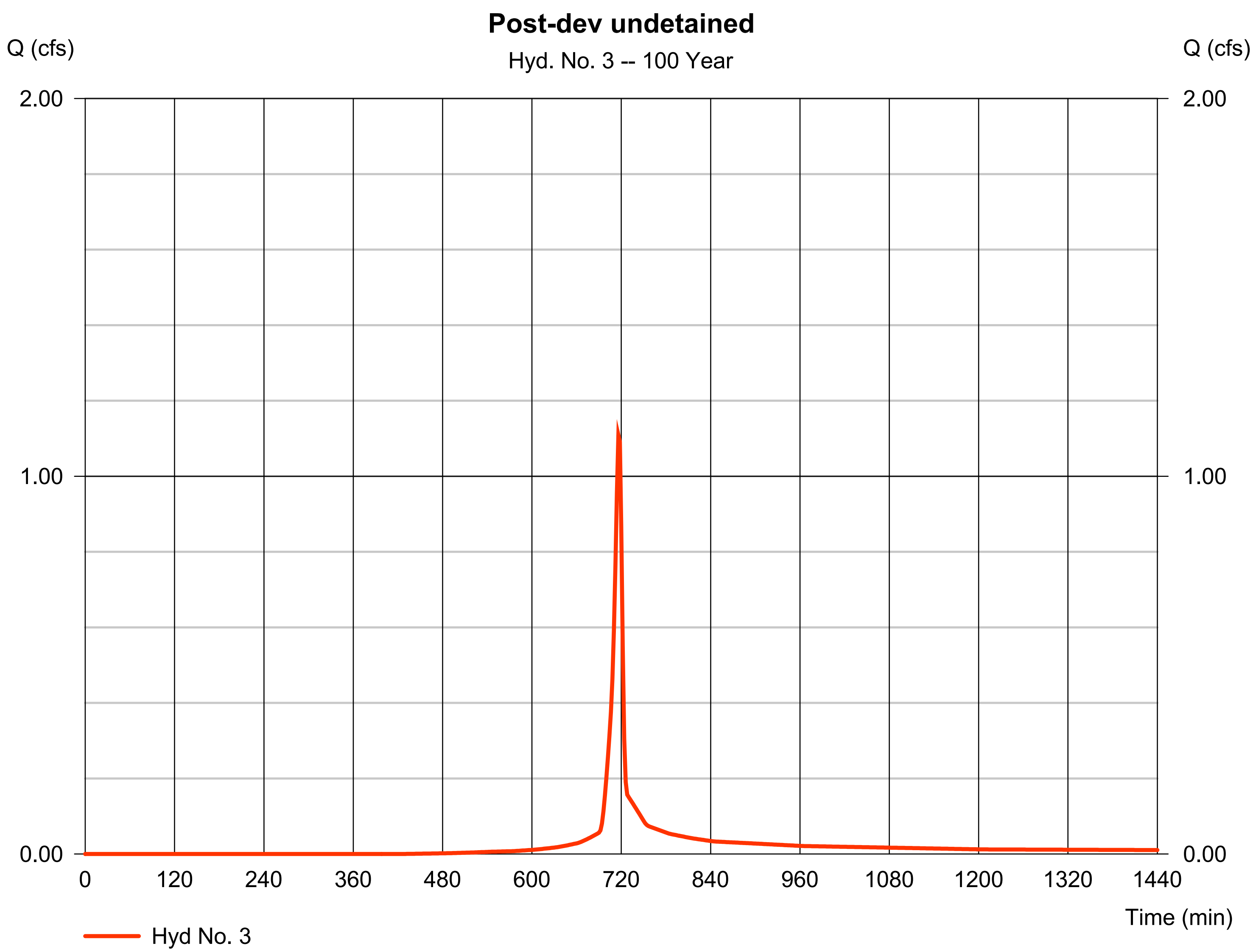


Hydrograph Report

Hyd. No. 3

Post-dev undetained

Hydrograph type	= SCS Runoff	Peak discharge	= 1.109 cfs
Storm frequency	= 100 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 2,256 cuft
Drainage area	= 0.200 ac	Curve number	= 78
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 5.70 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



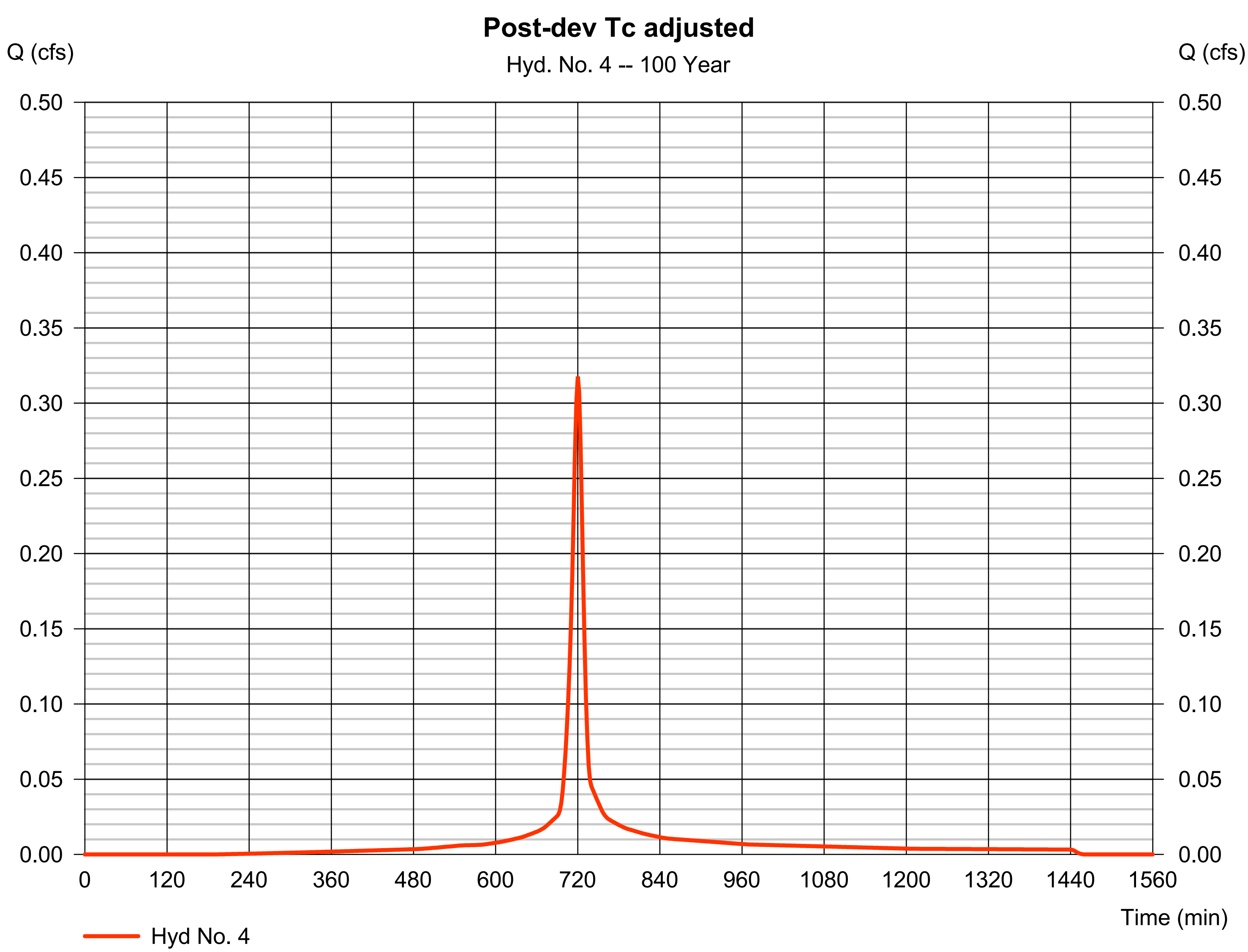
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023 | Friday, 11 / 8 / 2024

Hyd. No. 4

Post-dev Tc adjusted

Hydrograph type	= SCS Runoff	Peak discharge	= 0.318 cfs
Storm frequency	= 100 yrs	Time to peak	= 720 min
Time interval	= 2 min	Hyd. volume	= 873 cuft
Drainage area	= 0.050 ac	Curve number	= 91
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 11.90 min
Total precip.	= 5.70 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



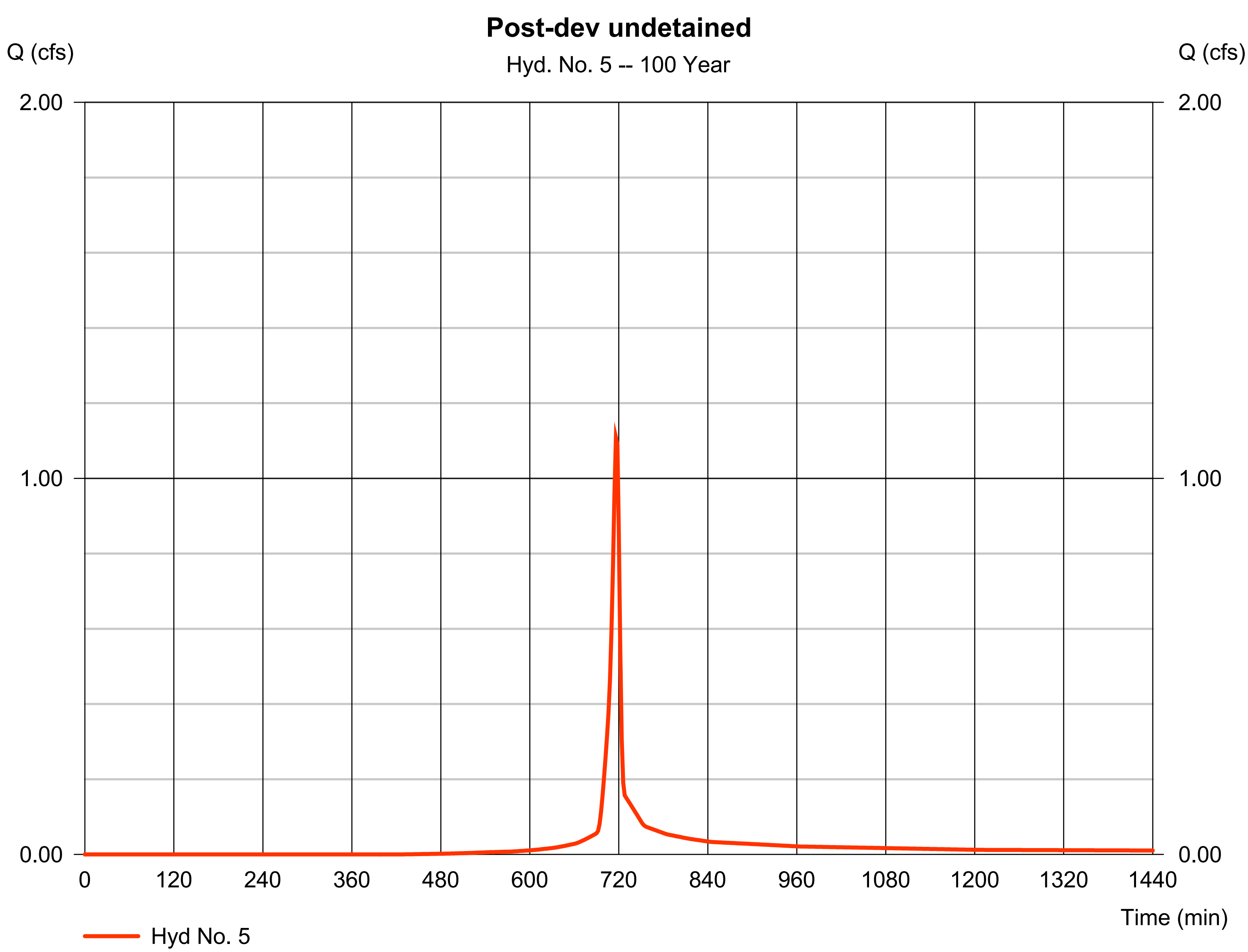
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023 — Friday, 11 / 8 / 2024

Hyd. No. 5

Post-dev undetained

Hydrograph type	= SCS Runoff	Peak discharge	= 1.109 cfs
Storm frequency	= 100 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 2,256 cuft
Drainage area	= 0.200 ac	Curve number	= 78
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 5.70 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



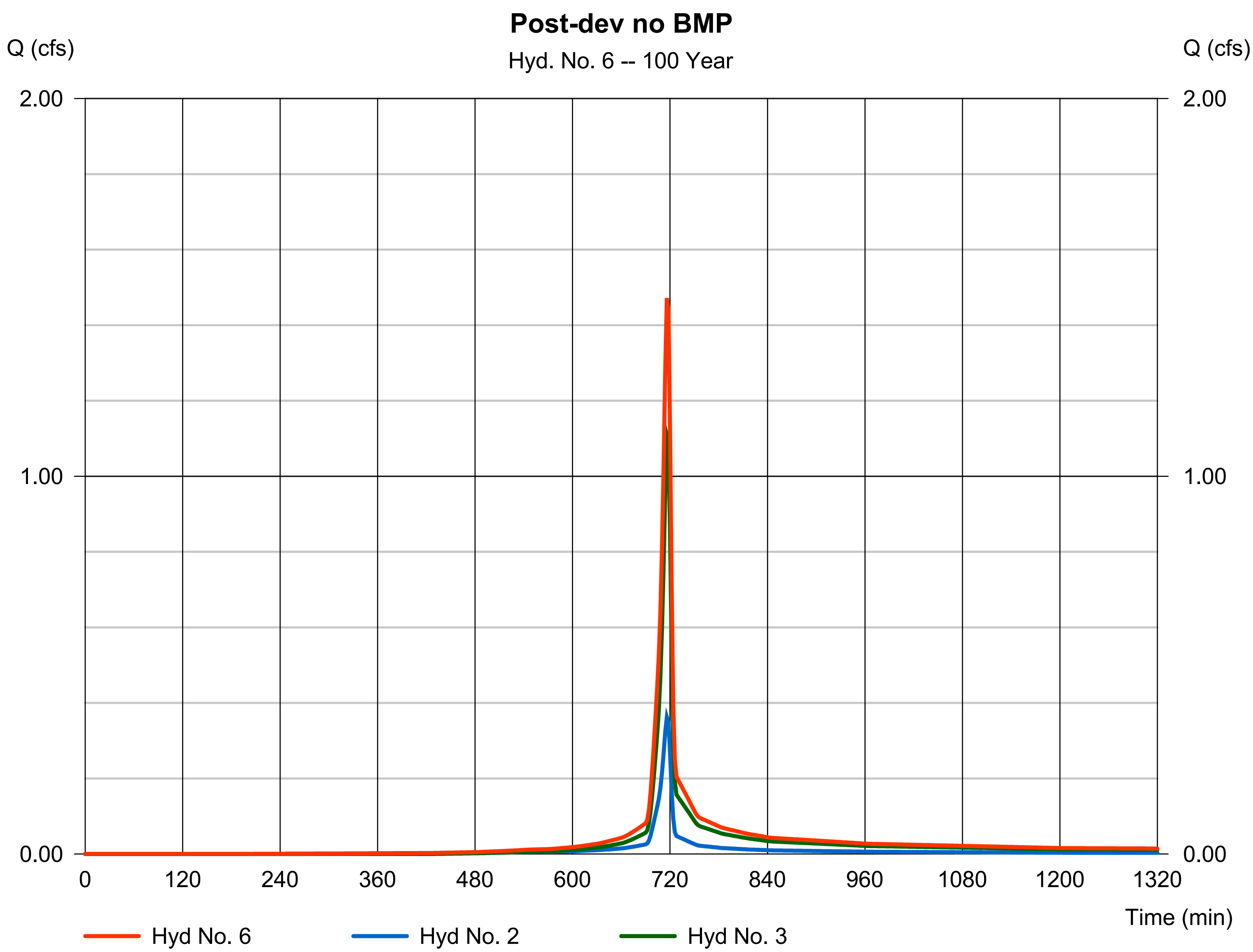
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023 Friday, 11 / 8 / 2024

Hyd. No. 6

Post-dev no BMP

Hydrograph type	= Combine	Peak discharge	= 1.472 cfs
Storm frequency	= 100 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 3,050 cuft
Inflow hyds.	= 2, 3	Contrib. drain. area	= 0.250 ac



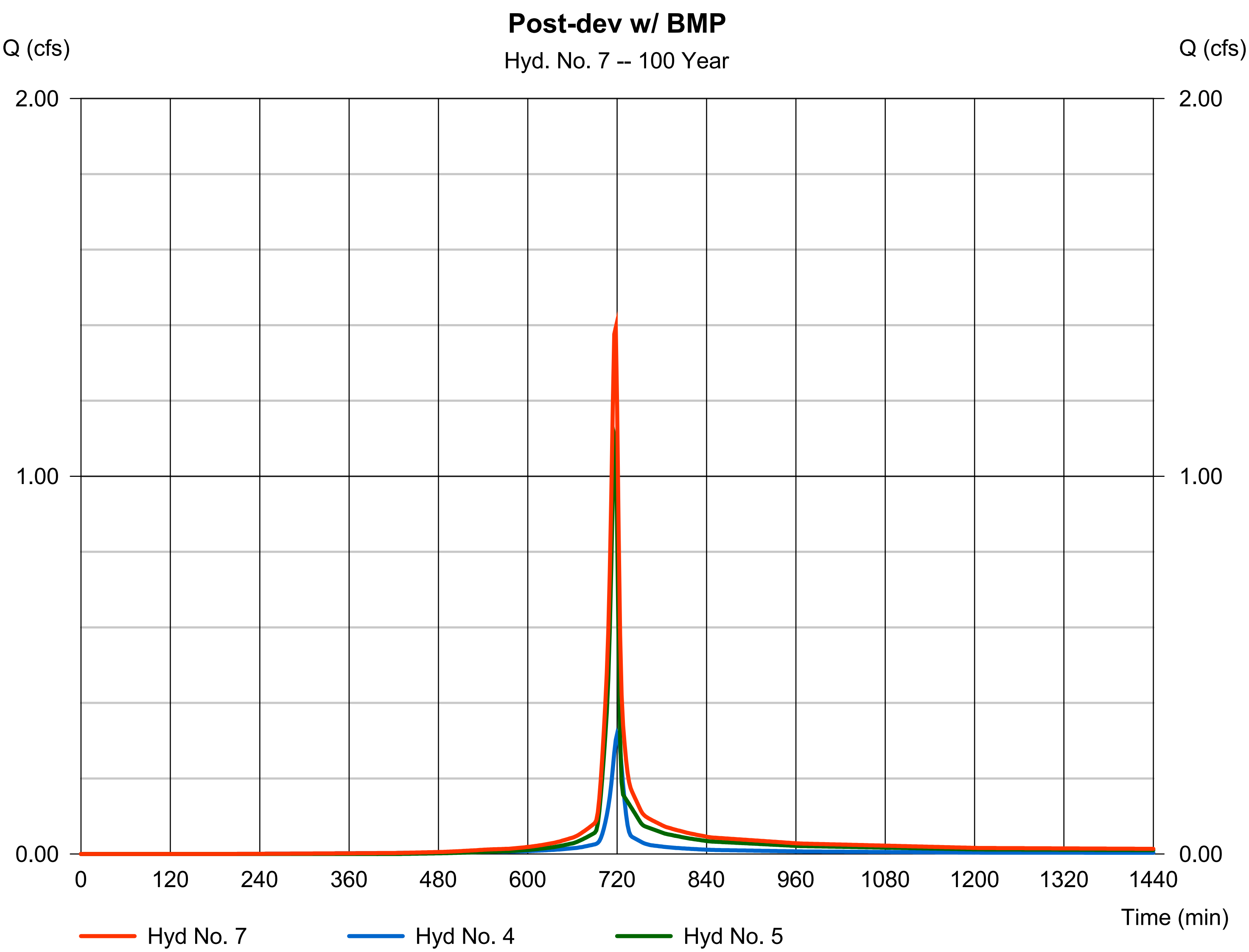
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023 Friday, 11 / 8 / 2024

Hyd. No. 7

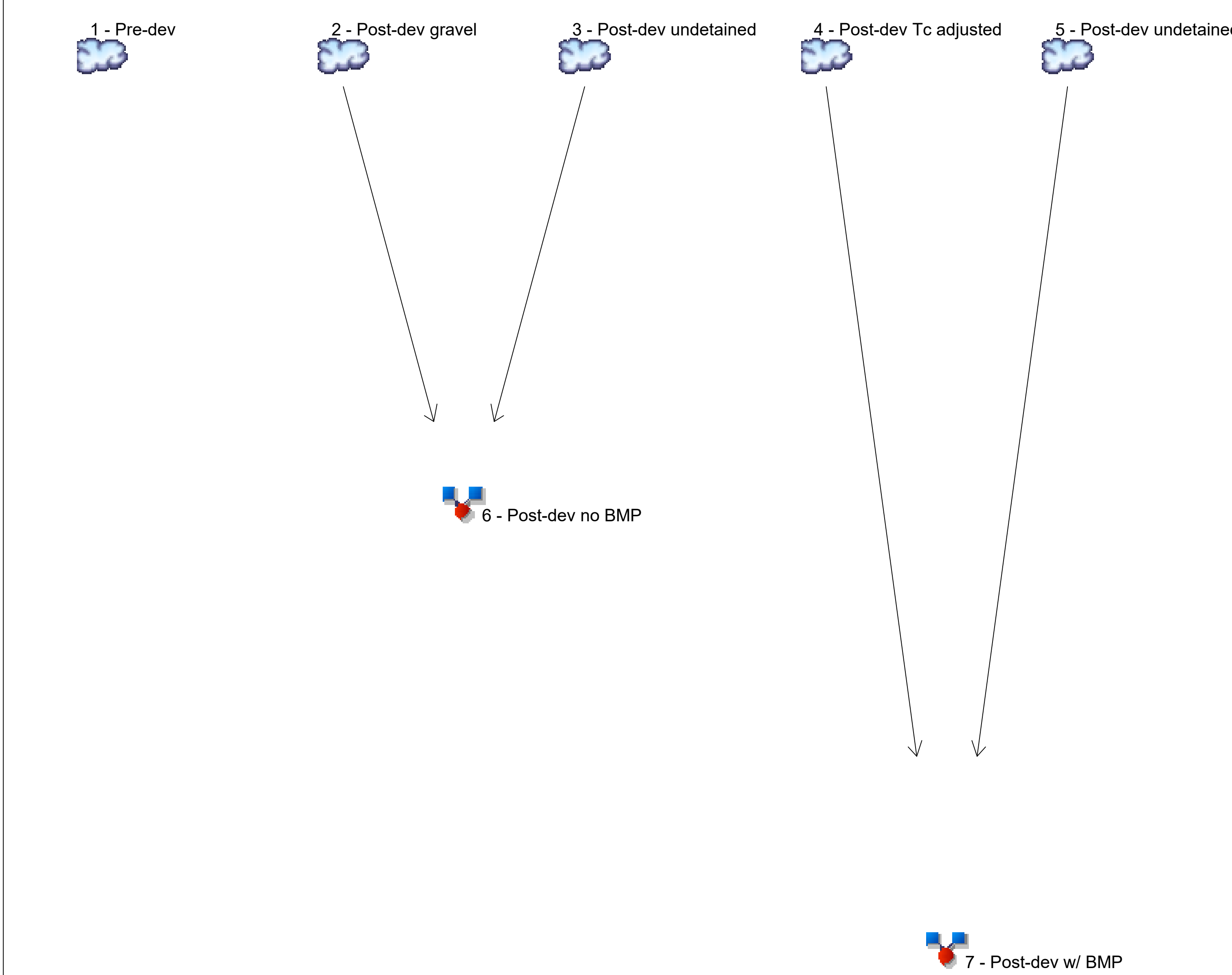
Post-dev w/ BMP

Hydrograph type	= Combine	Peak discharge	= 1.393 cfs
Storm frequency	= 100 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 3,129 cuft
Inflow hyds.	= 4, 5	Contrib. drain. area	= 0.250 ac



Watershed Model Schematic

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023



Project: YM59 PAR9.gpw	Friday, 11 / 8 / 2024

Hydrograph Summary Report

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	0.134	2	720	1,037	------	------	------	Pre-dev
2	SCS Runoff	0.417	2	718	841	------	------	------	Post-dev gravel
3	SCS Runoff	0.069	2	722	807	------	------	------	Post-dev undetained
4	SCS Runoff	0.093	2	774	897	------	------	------	Post-dev Tc adjusted
5	SCS Runoff	0.069	2	722	807	------	------	------	Post-dev undetained
6	Combine	0.438	2	718	1,648	2, 3,	------	------	Post-dev no BMP
7	Combine	0.126	2	774	1,704	4, 5,	------	------	Post-dev w/ BMP

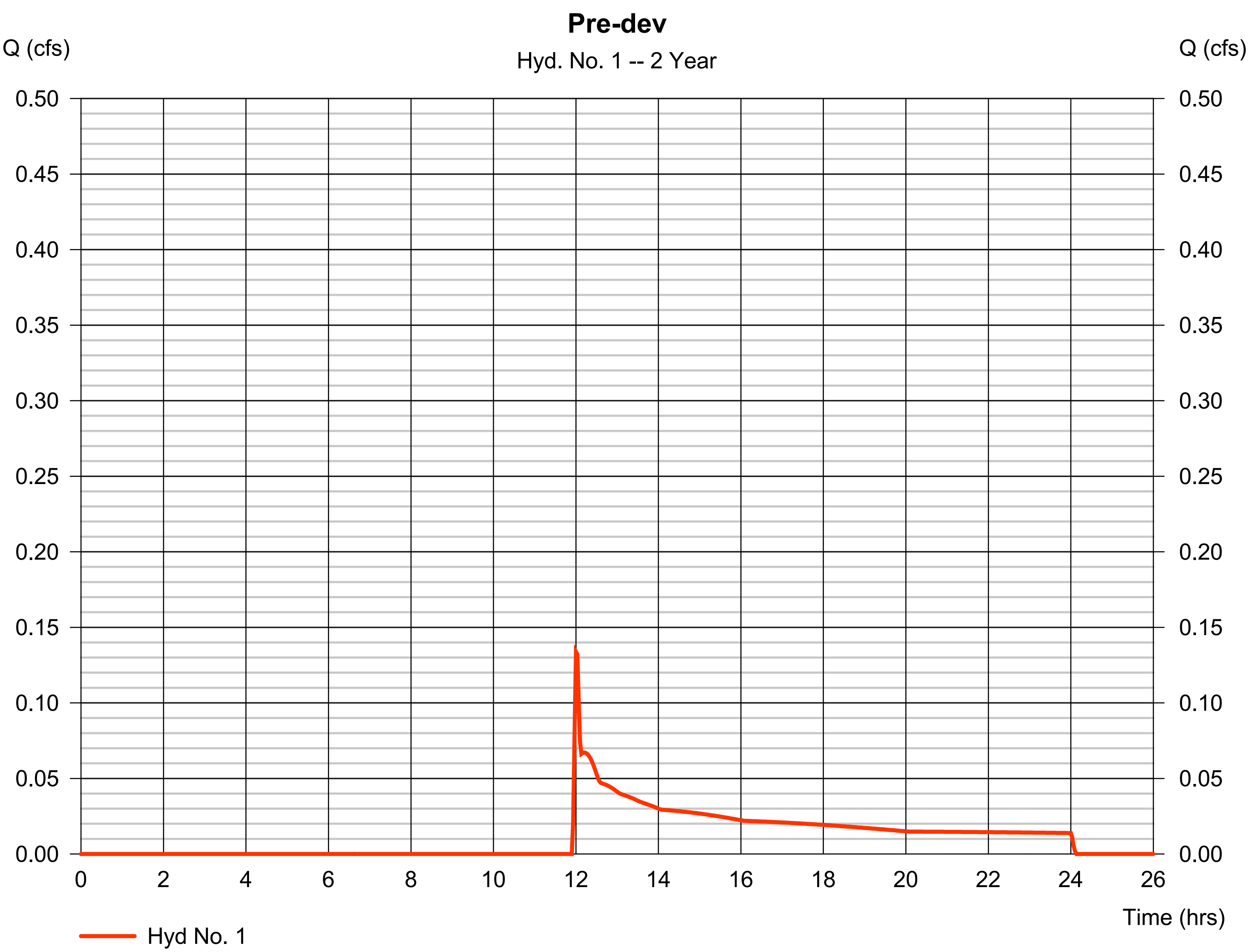
Hydrograph Report

Hyd. No. 1

Pre-dev

Hydrograph type	= SCS Runoff	Peak discharge	= 0.134 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.00 hrs
Time interval	= 2 min	Hyd. volume	= 1,037 cuft
Drainage area	= 2.250 ac	Curve number	= 59*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 2.43 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(1.380 x 78) + (0.870 x 30)] / 2.250



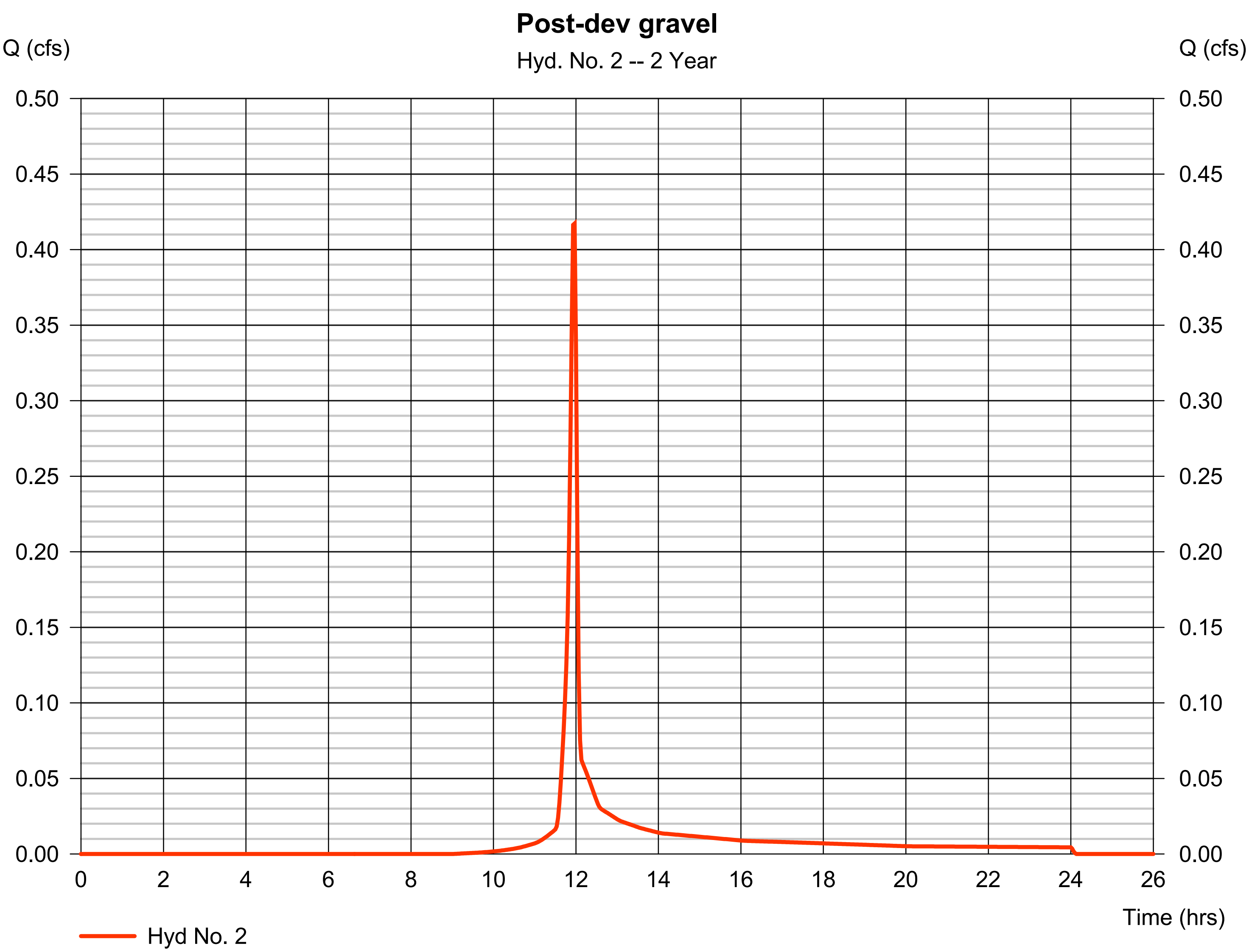
Hydrograph Report

Hyd. No. 2

Post-dev gravel

Hydrograph type	= SCS Runoff	Peak discharge	= 0.417 cfs
Storm frequency	= 2 yrs	Time to peak	= 11.97 hrs
Time interval	= 2 min	Hyd. volume	= 841 cuft
Drainage area	= 0.220 ac	Curve number	= 85*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 2.43 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.130 x 91) + (0.090 x 76)] / 0.220



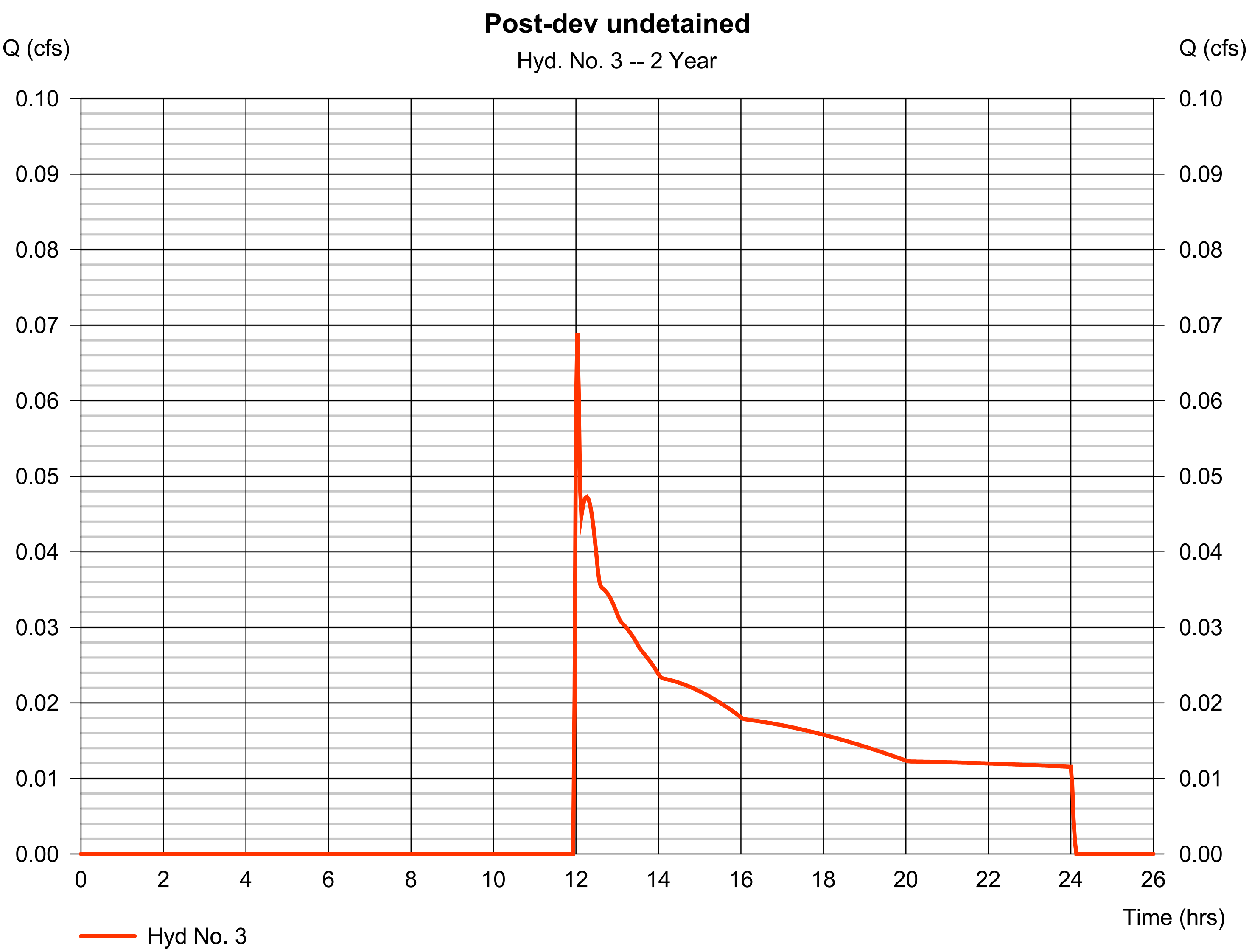
Hydrograph Report

Hyd. No. 3

Post-dev undetained

Hydrograph type	= SCS Runoff	Peak discharge	= 0.069 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.03 hrs
Time interval	= 2 min	Hyd. volume	= 807 cuft
Drainage area	= 2.030 ac	Curve number	= 58*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 2.43 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(1.250 x 76) + (0.780 x 30)] / 2.030



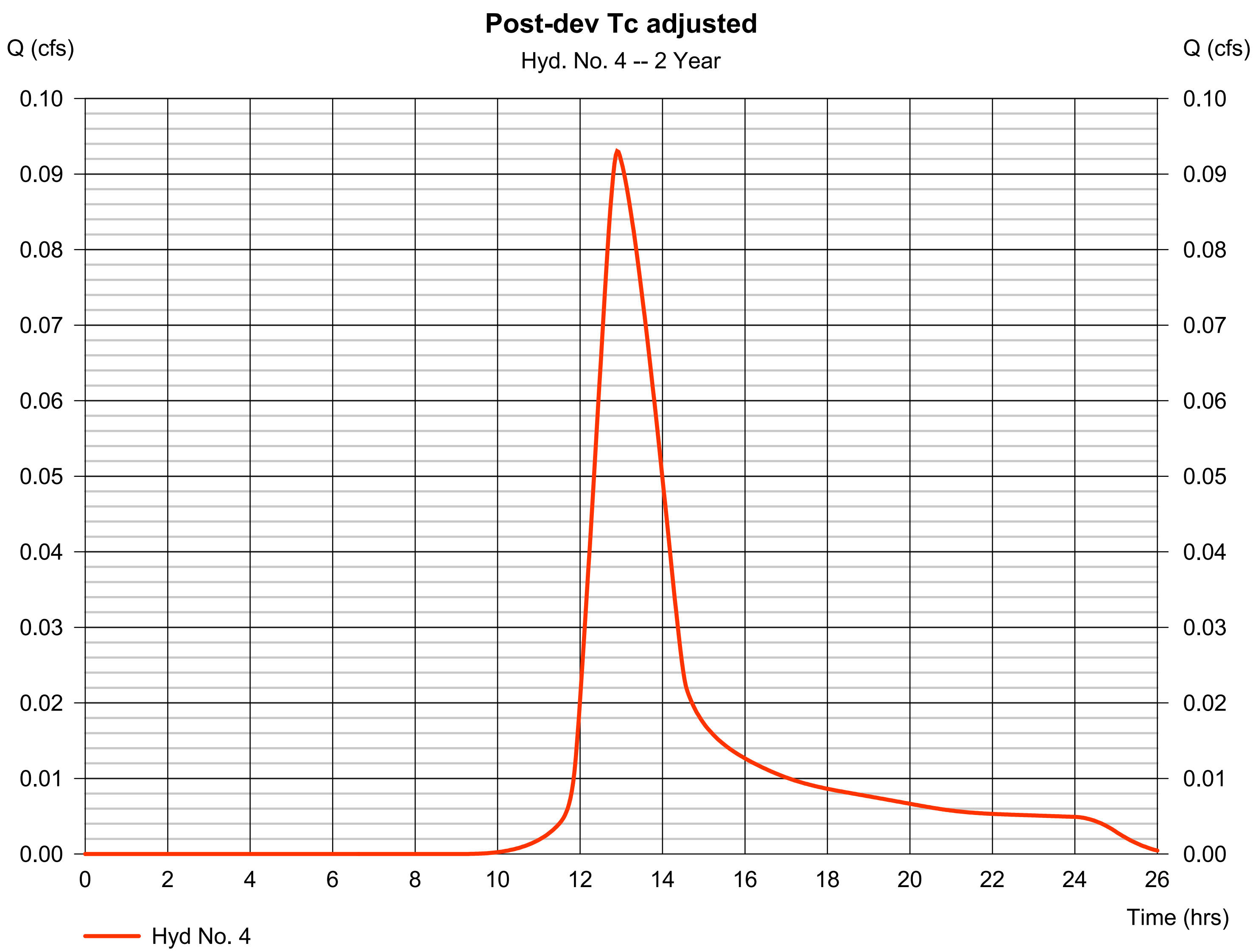
Hydrograph Report

Hyd. No. 4

Post-dev Tc adjusted

Hydrograph type	= SCS Runoff	Peak discharge	= 0.093 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.90 hrs
Time interval	= 2 min	Hyd. volume	= 897 cuft
Drainage area	= 0.220 ac	Curve number	= 85*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 100.00 min
Total precip.	= 2.43 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.130 x 91) + (0.090 x 76)] / 0.220



Hydrograph Report

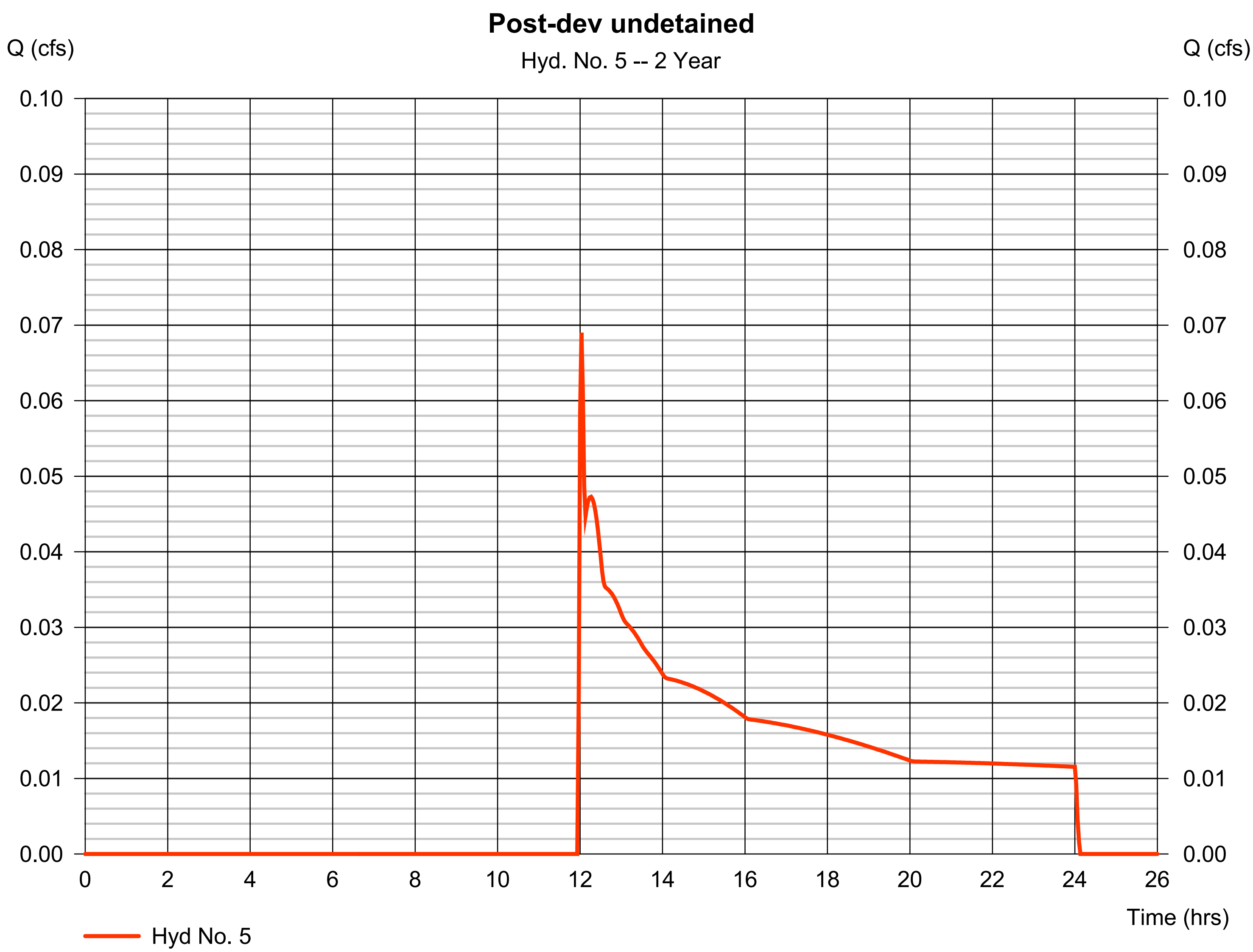
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023 — Friday, 11 / 8 / 2024

Hyd. No. 5

Post-dev undetained

Hydrograph type	= SCS Runoff	Peak discharge	= 0.069 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.03 hrs
Time interval	= 2 min	Hyd. volume	= 807 cuft
Drainage area	= 2.030 ac	Curve number	= 58*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 2.43 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(1.250 x 76) + (0.780 x 30)] / 2.030

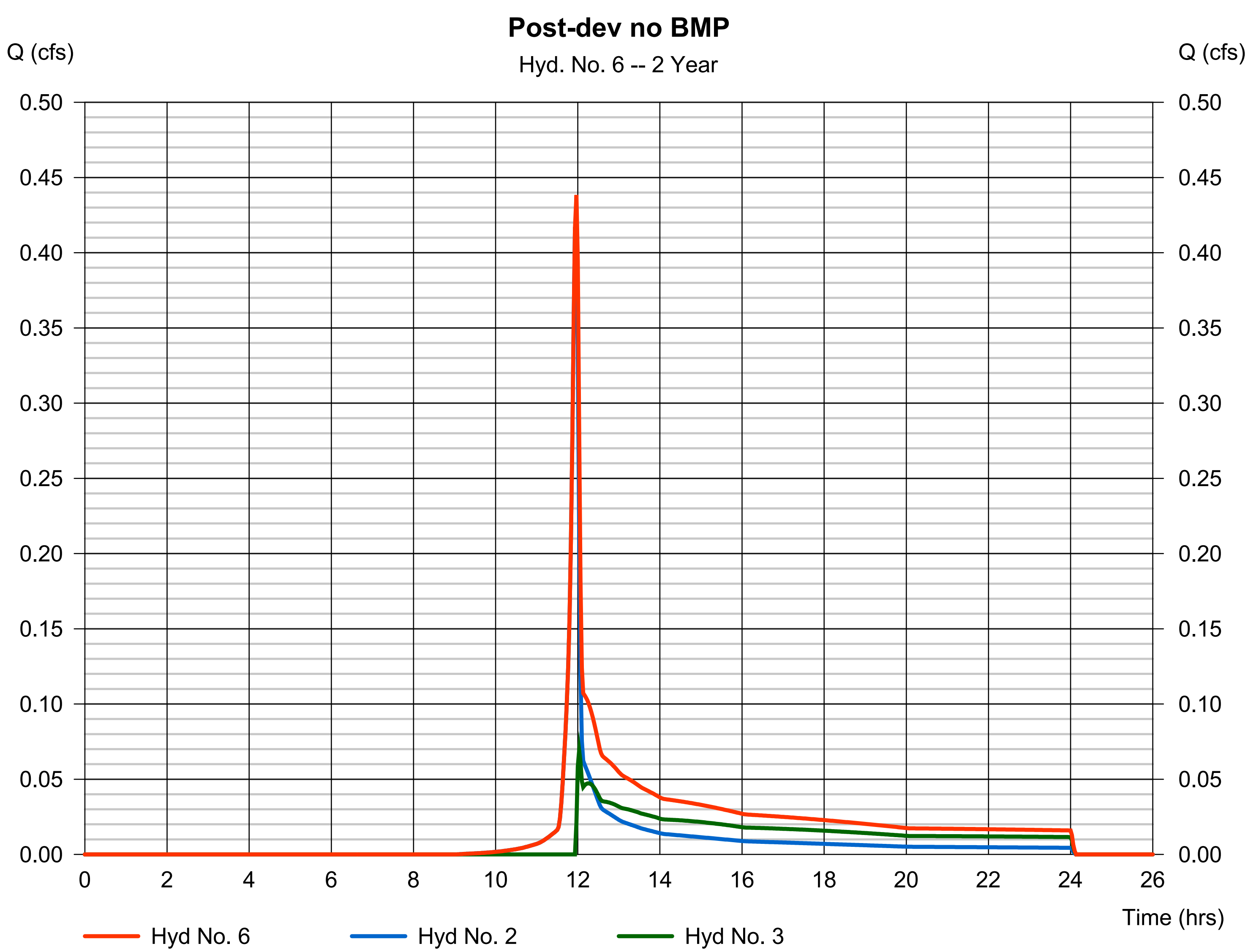


Hydrograph Report

Hyd. No. 6

Post-dev no BMP

Hydrograph type	= Combine	Peak discharge	= 0.438 cfs
Storm frequency	= 2 yrs	Time to peak	= 11.97 hrs
Time interval	= 2 min	Hyd. volume	= 1,648 cuft
Inflow hyds.	= 2, 3	Contrib. drain. area	= 2.250 ac

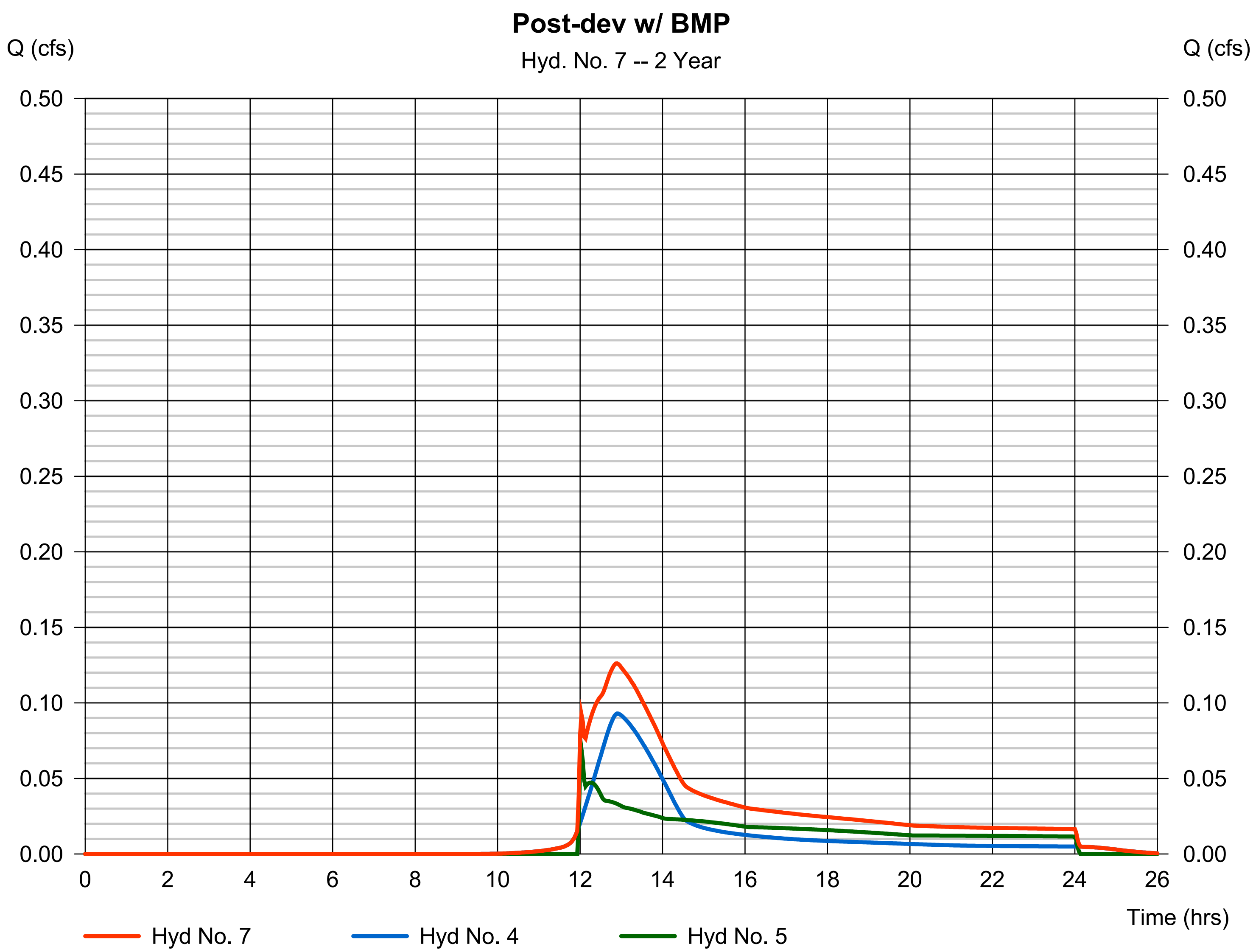


Hydrograph Report

Hyd. No. 7

Post-dev w/ BMP

Hydrograph type	= Combine	Peak discharge	= 0.126 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.90 hrs
Time interval	= 2 min	Hyd. volume	= 1,704 cuft
Inflow hyds.	= 4, 5	Contrib. drain. area	= 2.250 ac



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023

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	1.521	2	718	3,701	------	------	------	Pre-dev
2	SCS Runoff	0.736	2	716	1,497	------	------	------	Post-dev gravel
3	SCS Runoff	1.204	2	718	3,073	------	------	------	Post-dev undetained
4	SCS Runoff	0.257	2	748	1,585	------	------	------	Post-dev Tc adjusted
5	SCS Runoff	1.204	2	718	3,073	------	------	------	Post-dev undetained
6	Combine	1.930	2	718	4,569	2, 3,	------	------	Post-dev no BMP
7	Combine	1.294	2	718	4,657	4, 5,	------	------	Post-dev w/ BMP

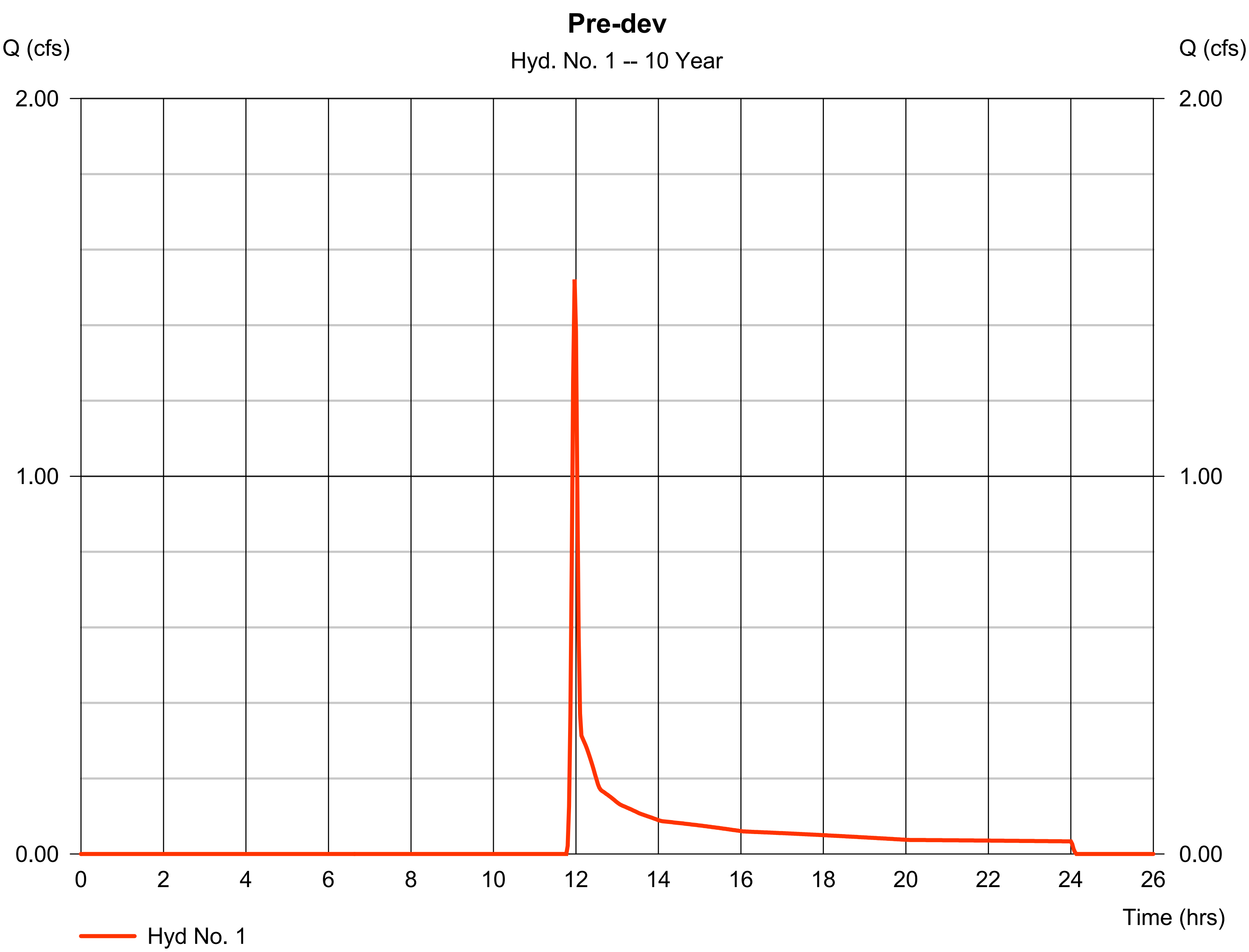
Hydrograph Report

Hyd. No. 1

Pre-dev

Hydrograph type	= SCS Runoff	Peak discharge	= 1.521 cfs
Storm frequency	= 10 yrs	Time to peak	= 11.97 hrs
Time interval	= 2 min	Hyd. volume	= 3,701 cuft
Drainage area	= 2.250 ac	Curve number	= 59*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 3.48 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(1.380 x 78) + (0.870 x 30)] / 2.250



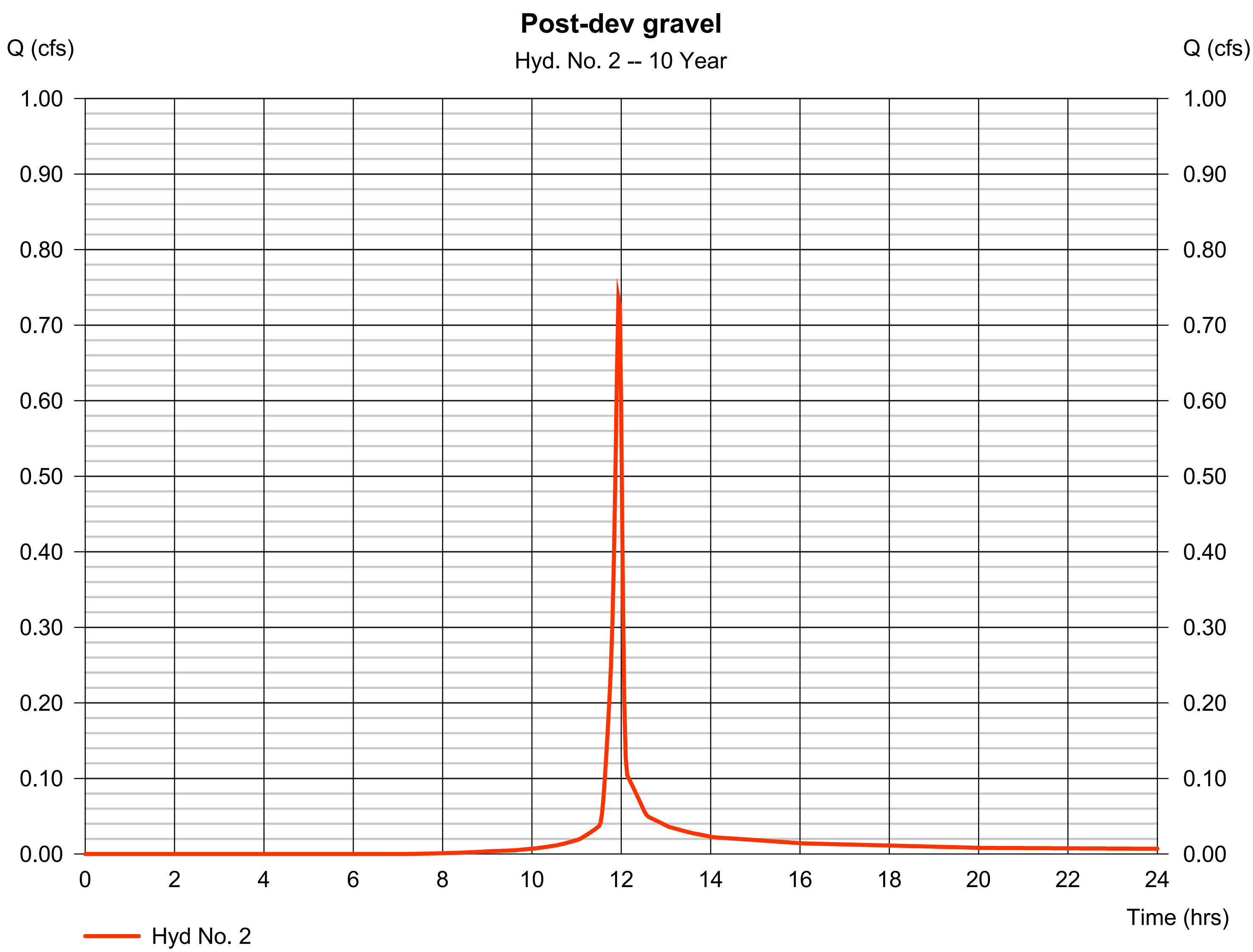
Hydrograph Report

Hyd. No. 2

Post-dev gravel

Hydrograph type	= SCS Runoff	Peak discharge	= 0.736 cfs
Storm frequency	= 10 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 1,497 cuft
Drainage area	= 0.220 ac	Curve number	= 85*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 3.48 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.130 x 91) + (0.090 x 76)] / 0.220



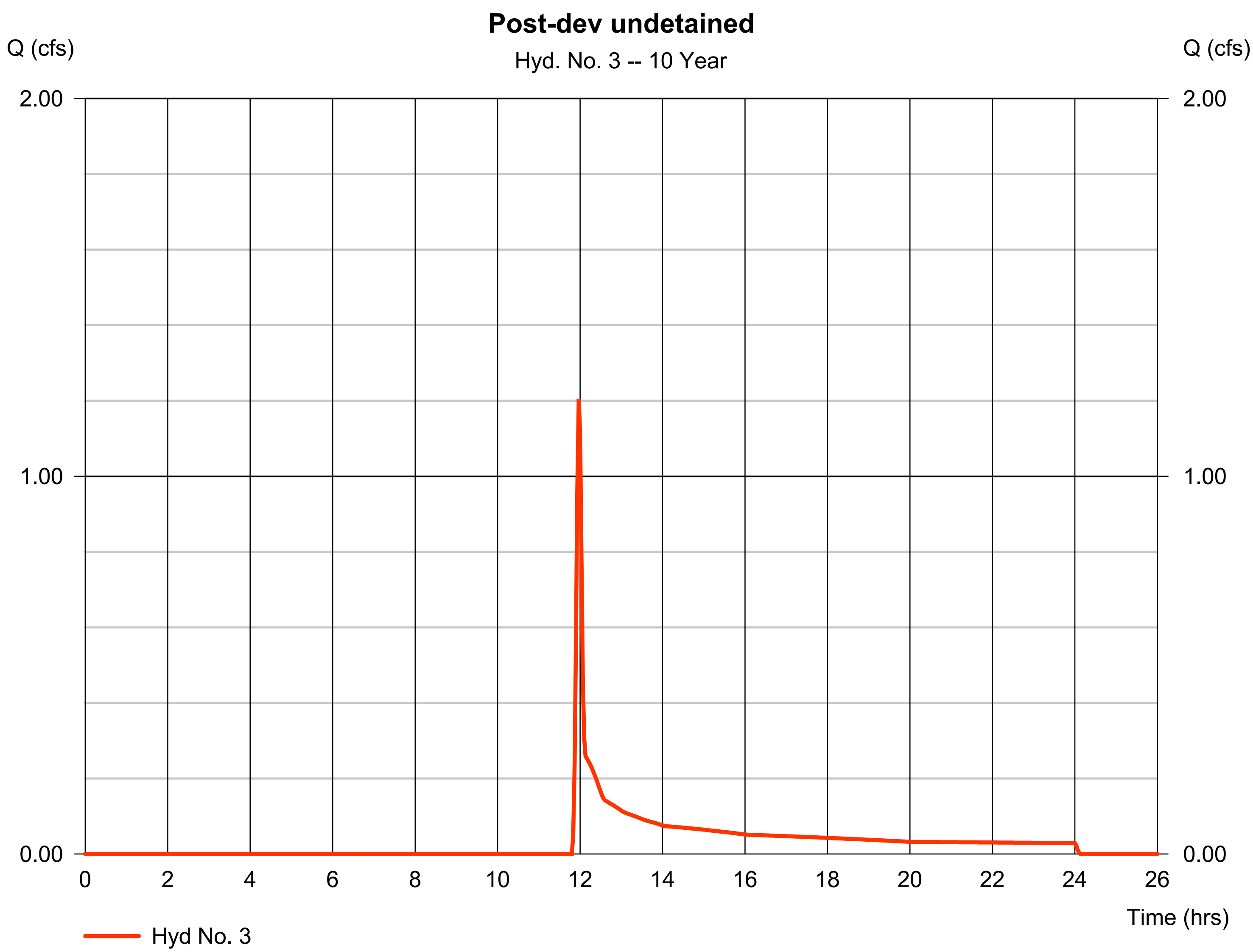
Hydrograph Report

Hyd. No. 3

Post-dev undetained

Hydrograph type	= SCS Runoff	Peak discharge	= 1.204 cfs
Storm frequency	= 10 yrs	Time to peak	= 11.97 hrs
Time interval	= 2 min	Hyd. volume	= 3,073 cuft
Drainage area	= 2.030 ac	Curve number	= 58*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 3.48 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(1.250 x 76) + (0.780 x 30)] / 2.030



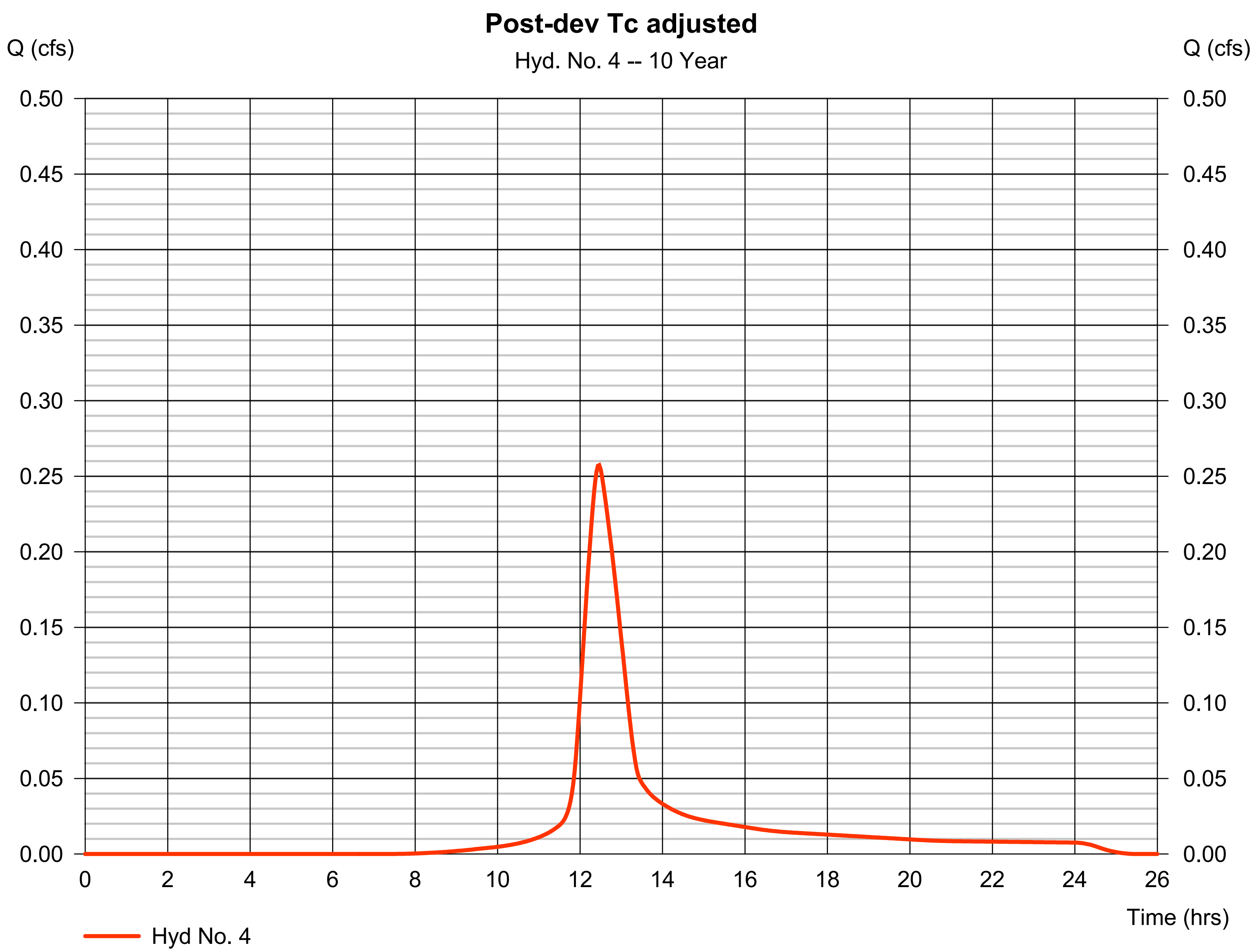
Hydrograph Report

Hyd. No. 4

Post-dev Tc adjusted

Hydrograph type	= SCS Runoff	Peak discharge	= 0.257 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.47 hrs
Time interval	= 2 min	Hyd. volume	= 1,585 cuft
Drainage area	= 0.220 ac	Curve number	= 85*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 56.70 min
Total precip.	= 3.48 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.130 x 91) + (0.090 x 76)] / 0.220



Hydrograph Report

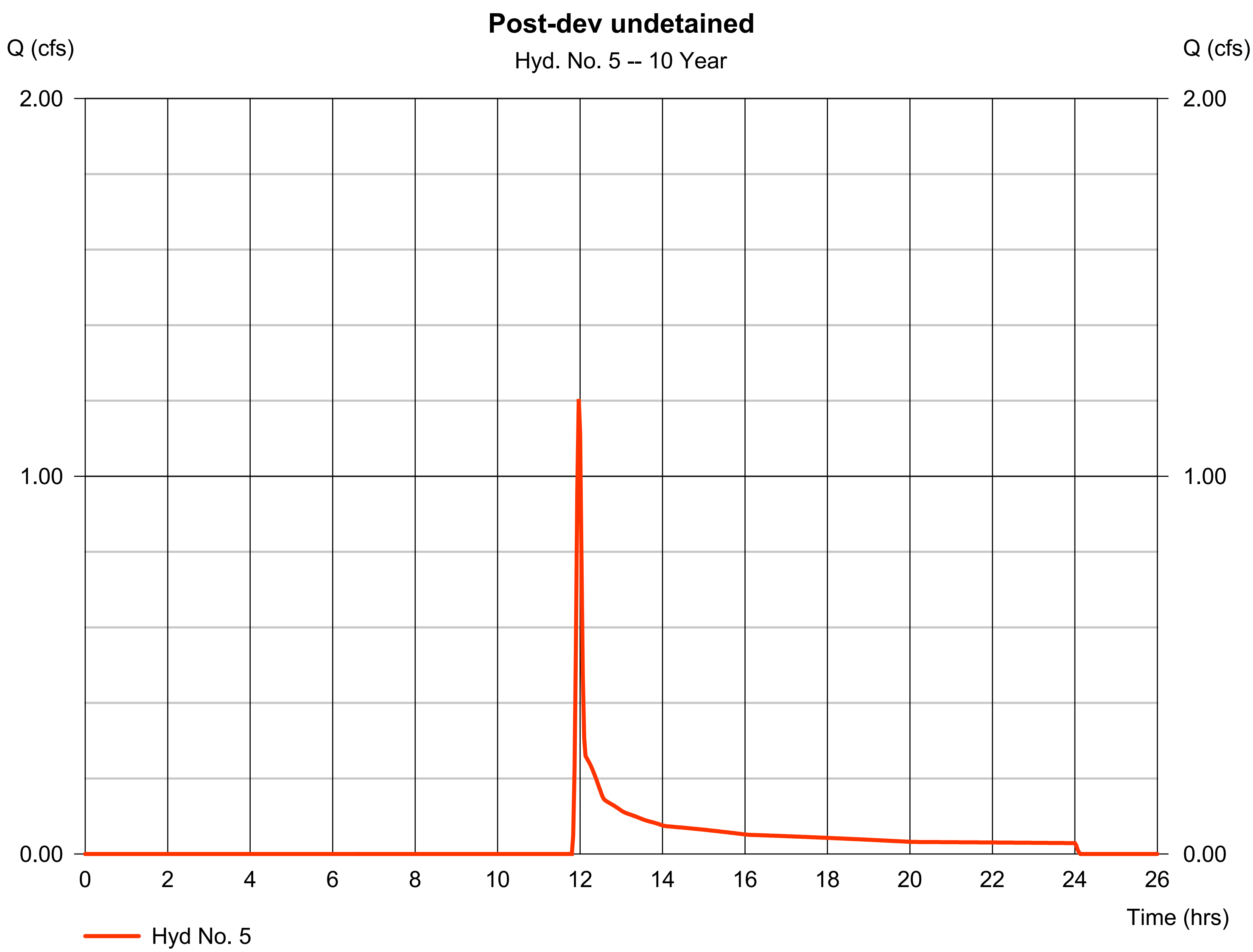
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023 — Thursday, 11 / 7 / 2024

Hyd. No. 5

Post-dev undetained

Hydrograph type	= SCS Runoff	Peak discharge	= 1.204 cfs
Storm frequency	= 10 yrs	Time to peak	= 11.97 hrs
Time interval	= 2 min	Hyd. volume	= 3,073 cuft
Drainage area	= 2.030 ac	Curve number	= 58*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 3.48 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(1.250 x 76) + (0.780 x 30)] / 2.030

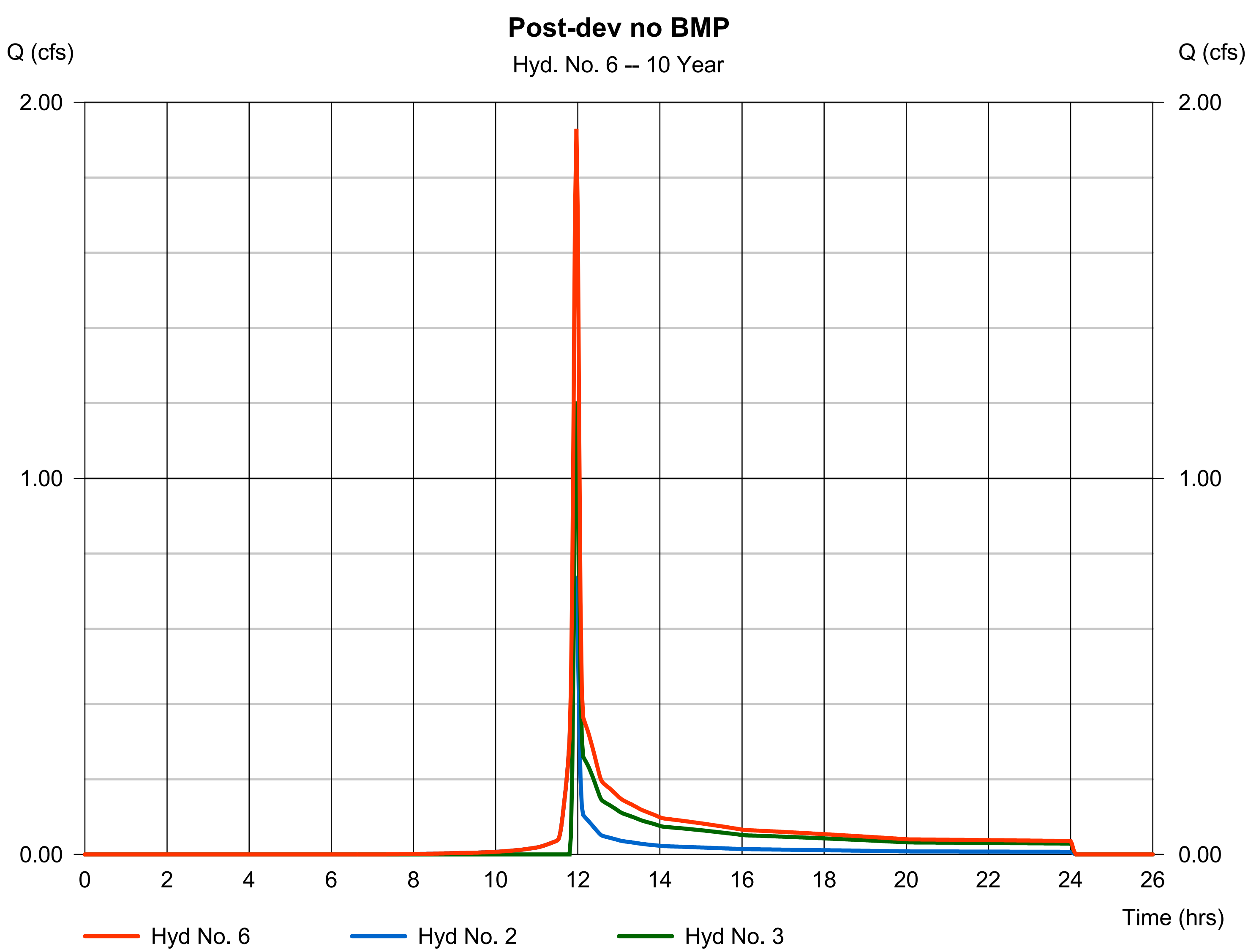


Hydrograph Report

Hyd. No. 6

Post-dev no BMP

Hydrograph type	= Combine	Peak discharge	= 1.930 cfs
Storm frequency	= 10 yrs	Time to peak	= 11.97 hrs
Time interval	= 2 min	Hyd. volume	= 4,569 cuft
Inflow hyds.	= 2, 3	Contrib. drain. area	= 2.250 ac

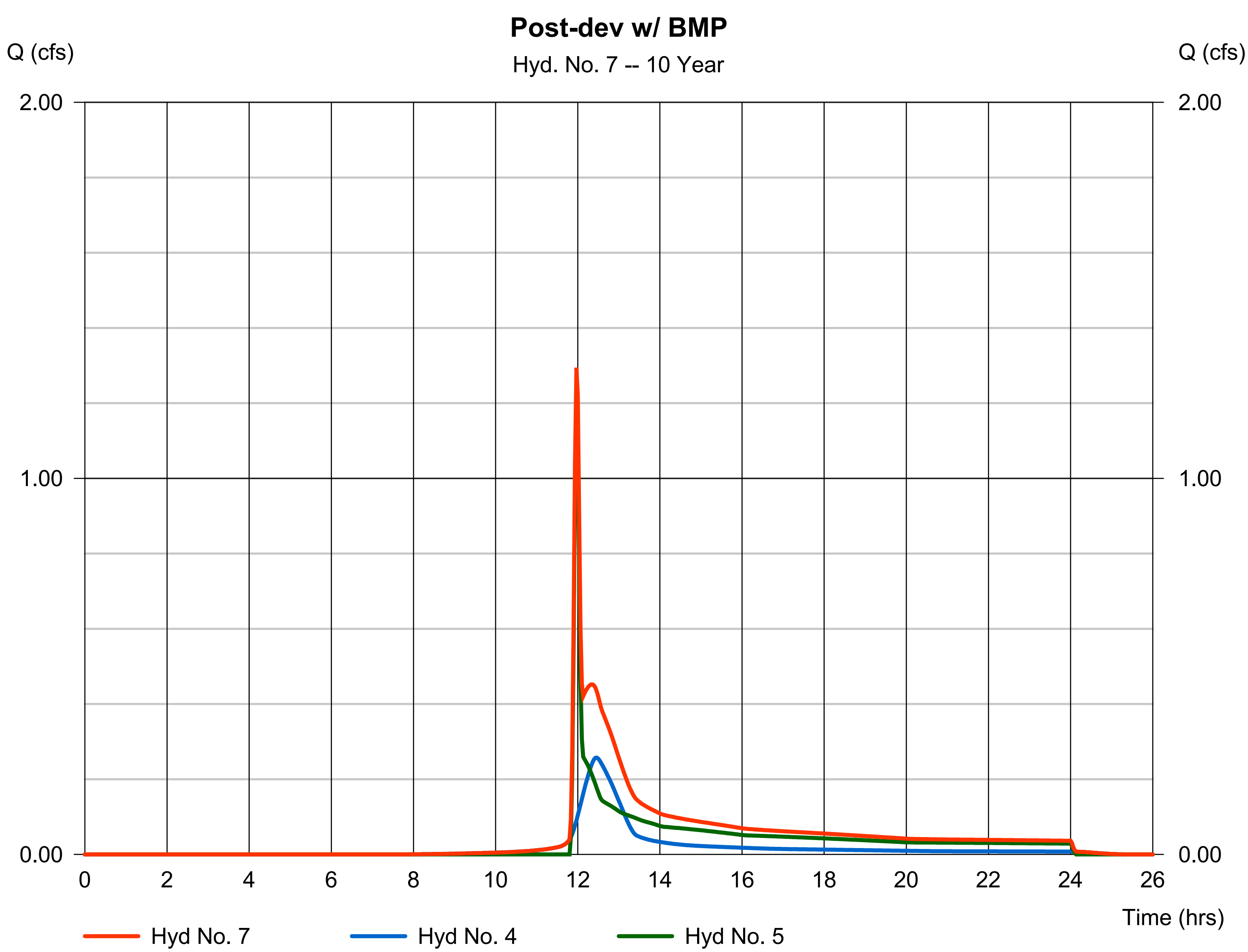


Hydrograph Report

Hyd. No. 7

Post-dev w/ BMP

Hydrograph type	= Combine	Peak discharge	= 1.294 cfs
Storm frequency	= 10 yrs	Time to peak	= 11.97 hrs
Time interval	= 2 min	Hyd. volume	= 4,657 cuft
Inflow hyds.	= 4, 5	Contrib. drain. area	= 2.250 ac



Hydrograph Summary Report

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	3.067	2	718	6,539	------	------	------	Pre-dev
2	SCS Runoff	0.991	2	716	2,035	------	------	------	Post-dev gravel
3	SCS Runoff	2.553	2	718	5,533	------	------	------	Post-dev undetained
4	SCS Runoff	0.425	2	738	2,192	------	------	------	Post-dev Tc adjusted
5	SCS Runoff	2.553	2	718	5,533	------	------	------	Post-dev undetained
6	Combine	3.522	2	718	7,568	2, 3,	------	------	Post-dev no BMP
7	Combine	2.745	2	718	7,725	4, 5,	------	------	Post-dev w/ BMP

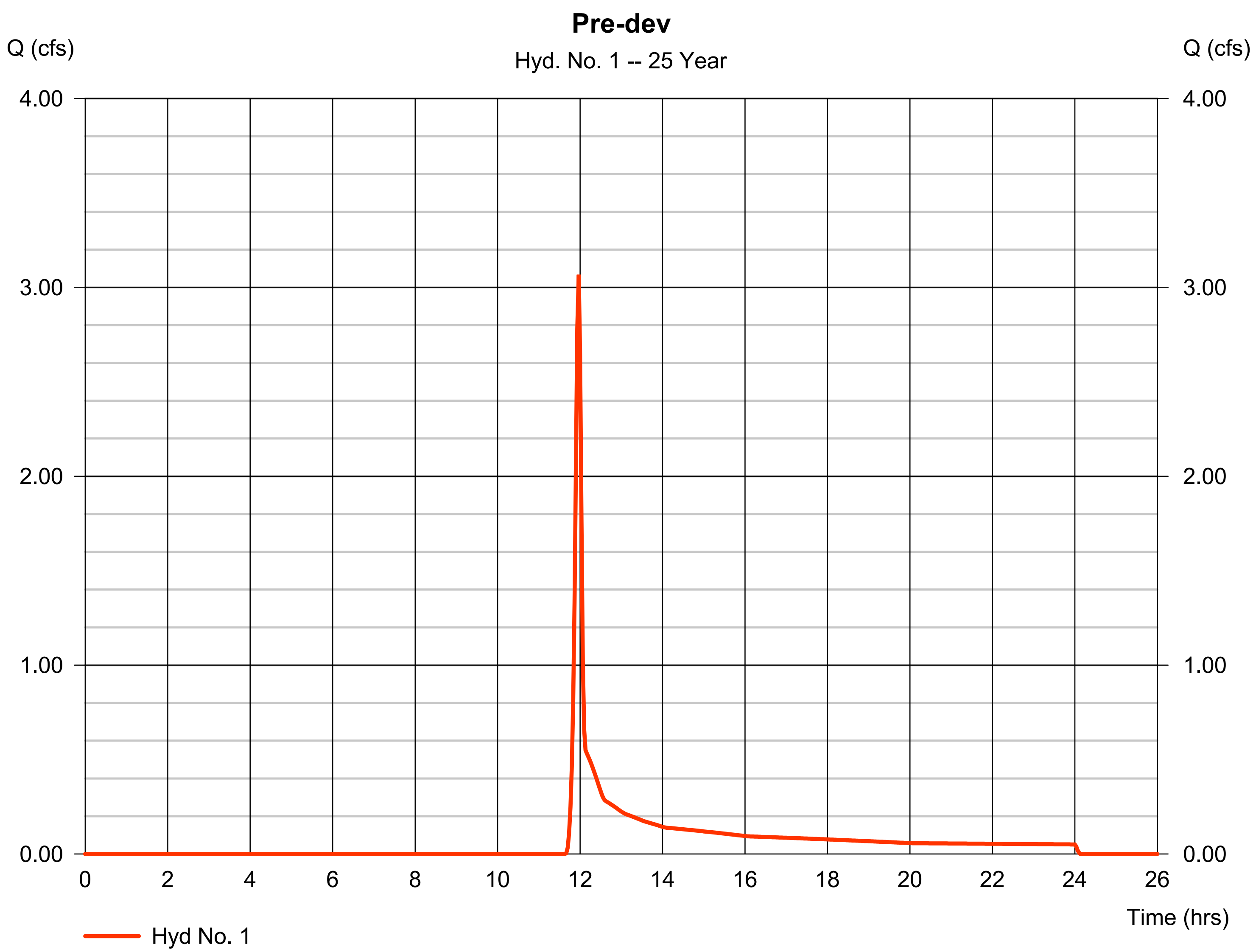
Hydrograph Report

Hyd. No. 1

Pre-dev

Hydrograph type	= SCS Runoff	Peak discharge	= 3.067 cfs
Storm frequency	= 25 yrs	Time to peak	= 11.97 hrs
Time interval	= 2 min	Hyd. volume	= 6,539 cuft
Drainage area	= 2.250 ac	Curve number	= 59*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 4.29 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(1.380 x 78) + (0.870 x 30)] / 2.250



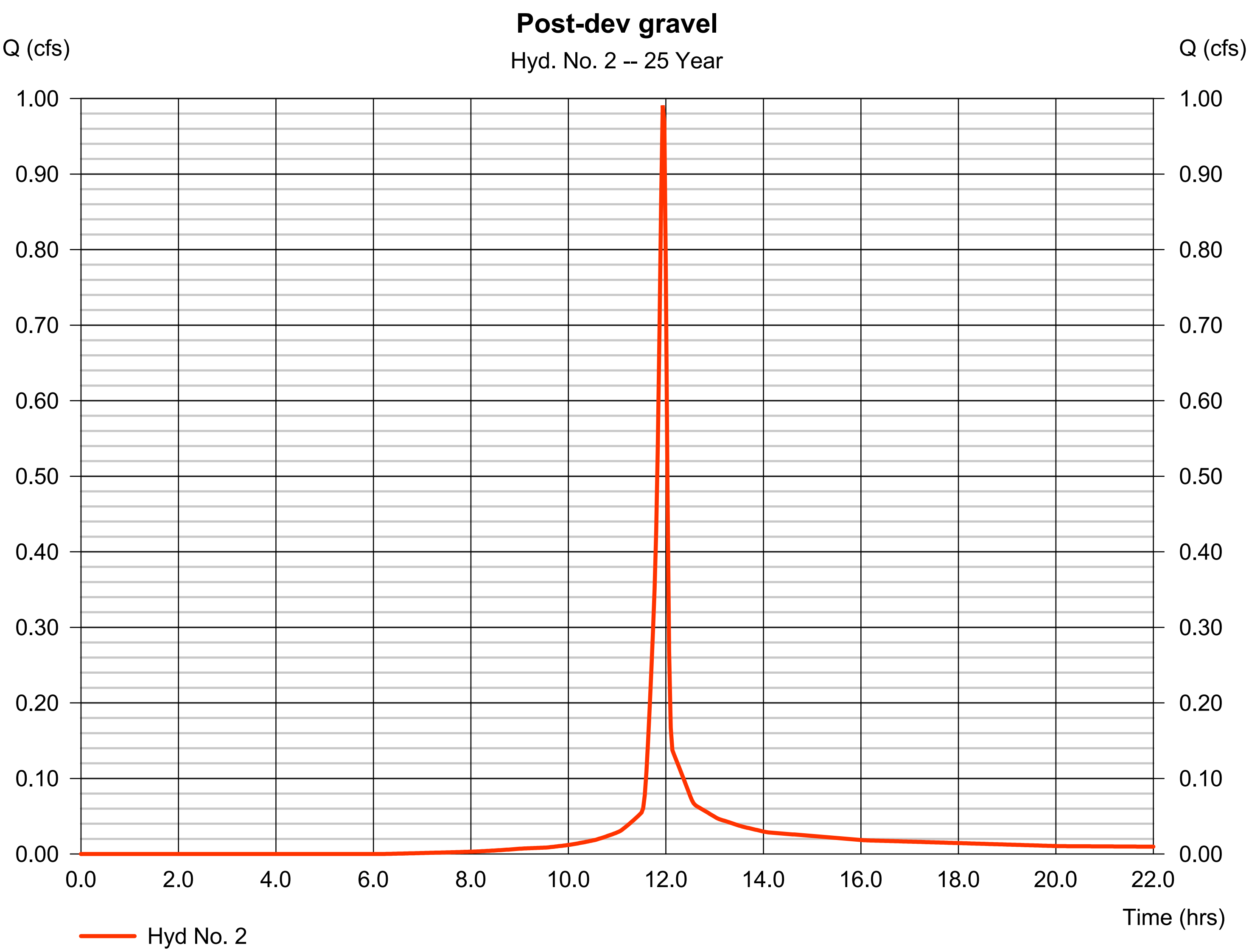
Hydrograph Report

Hyd. No. 2

Post-dev gravel

Hydrograph type	= SCS Runoff	Peak discharge	= 0.991 cfs
Storm frequency	= 25 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 2,035 cuft
Drainage area	= 0.220 ac	Curve number	= 85*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 4.29 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.130 x 91) + (0.090 x 76)] / 0.220



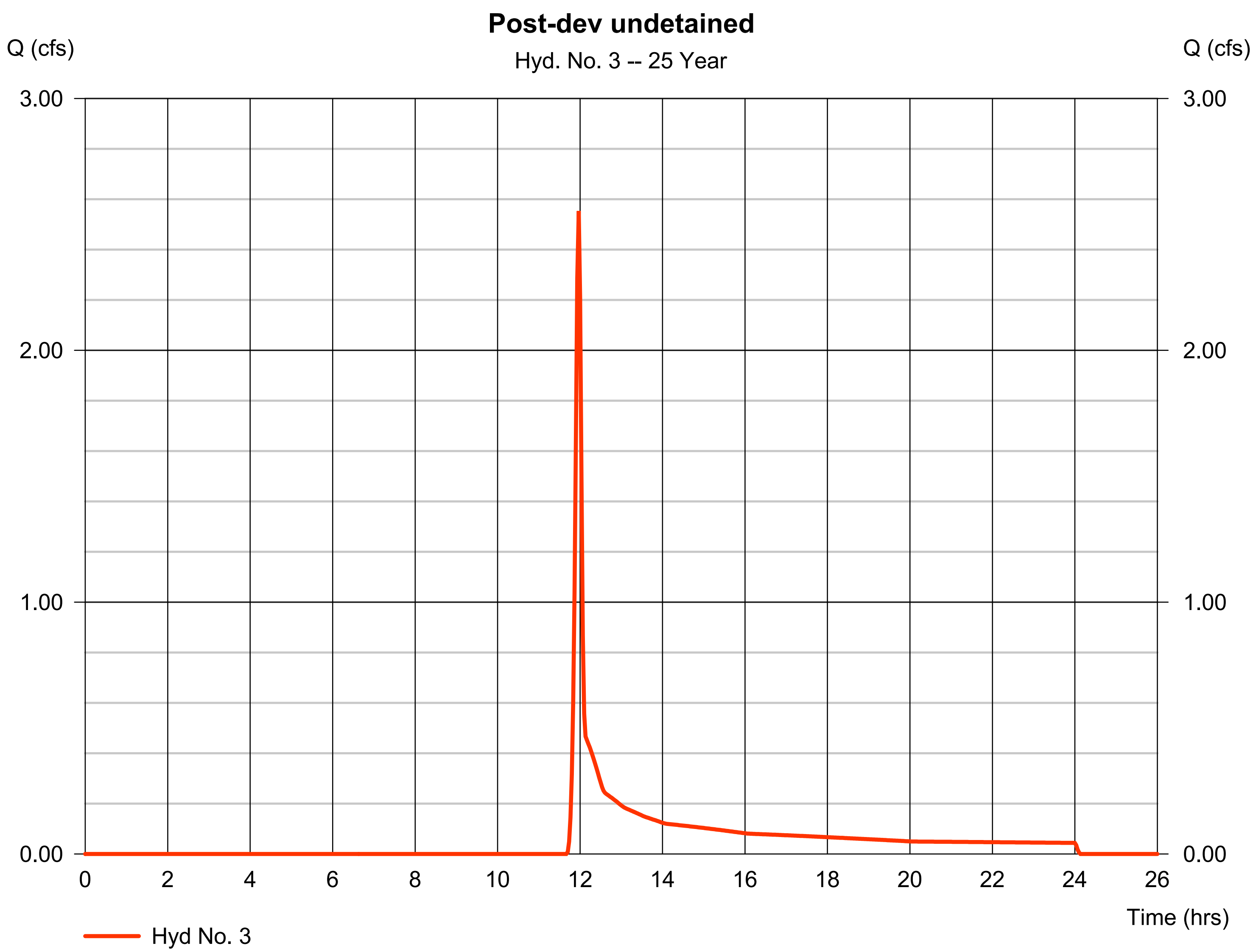
Hydrograph Report

Hyd. No. 3

Post-dev undetained

Hydrograph type	= SCS Runoff	Peak discharge	= 2.553 cfs
Storm frequency	= 25 yrs	Time to peak	= 11.97 hrs
Time interval	= 2 min	Hyd. volume	= 5,533 cuft
Drainage area	= 2.030 ac	Curve number	= 58*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 4.29 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(1.250 x 76) + (0.780 x 30)] / 2.030



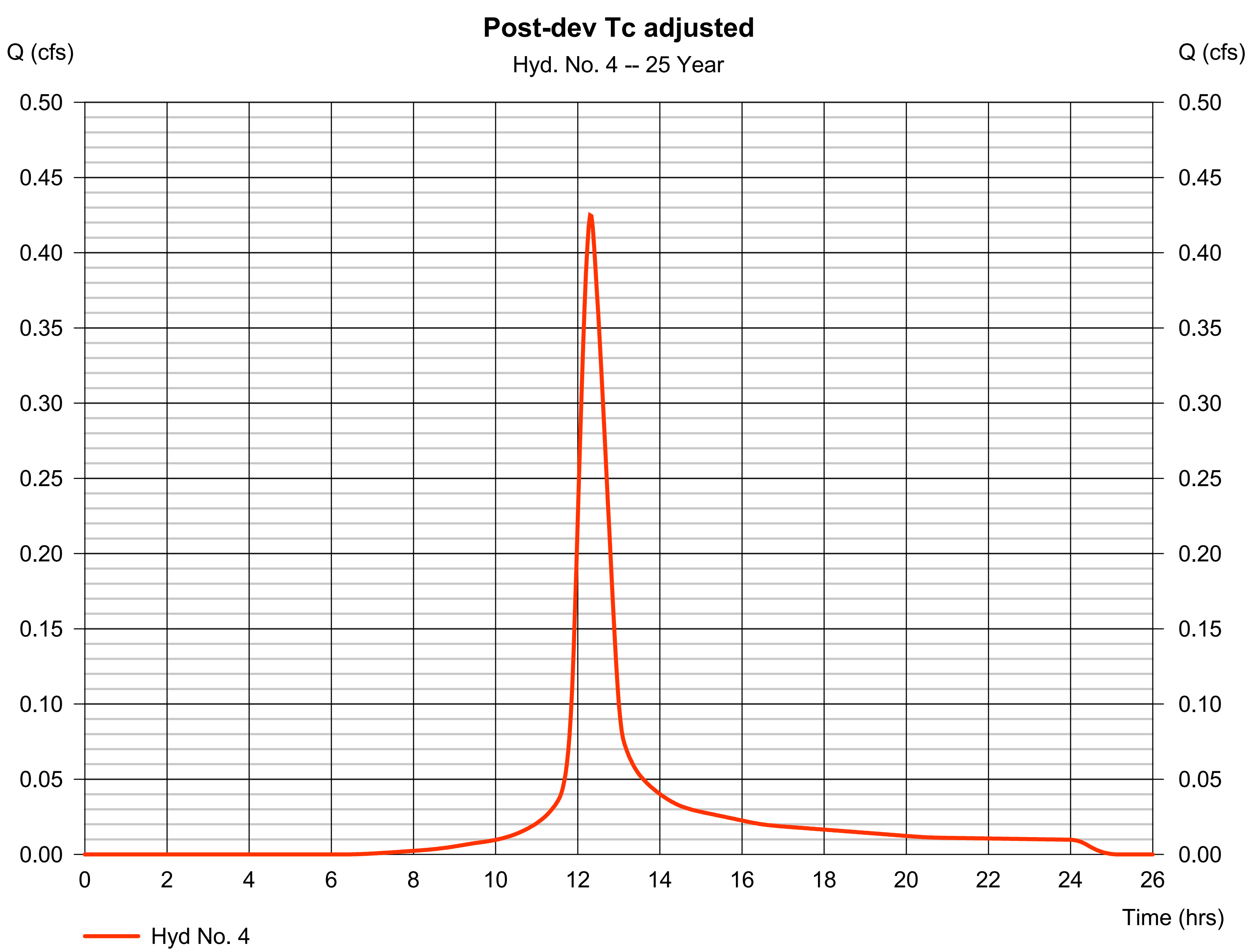
Hydrograph Report

Hyd. No. 4

Post-dev Tc adjusted

Hydrograph type	= SCS Runoff	Peak discharge	= 0.425 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.30 hrs
Time interval	= 2 min	Hyd. volume	= 2,192 cuft
Drainage area	= 0.220 ac	Curve number	= 85*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 42.10 min
Total precip.	= 4.29 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.130 x 91) + (0.090 x 76)] / 0.220



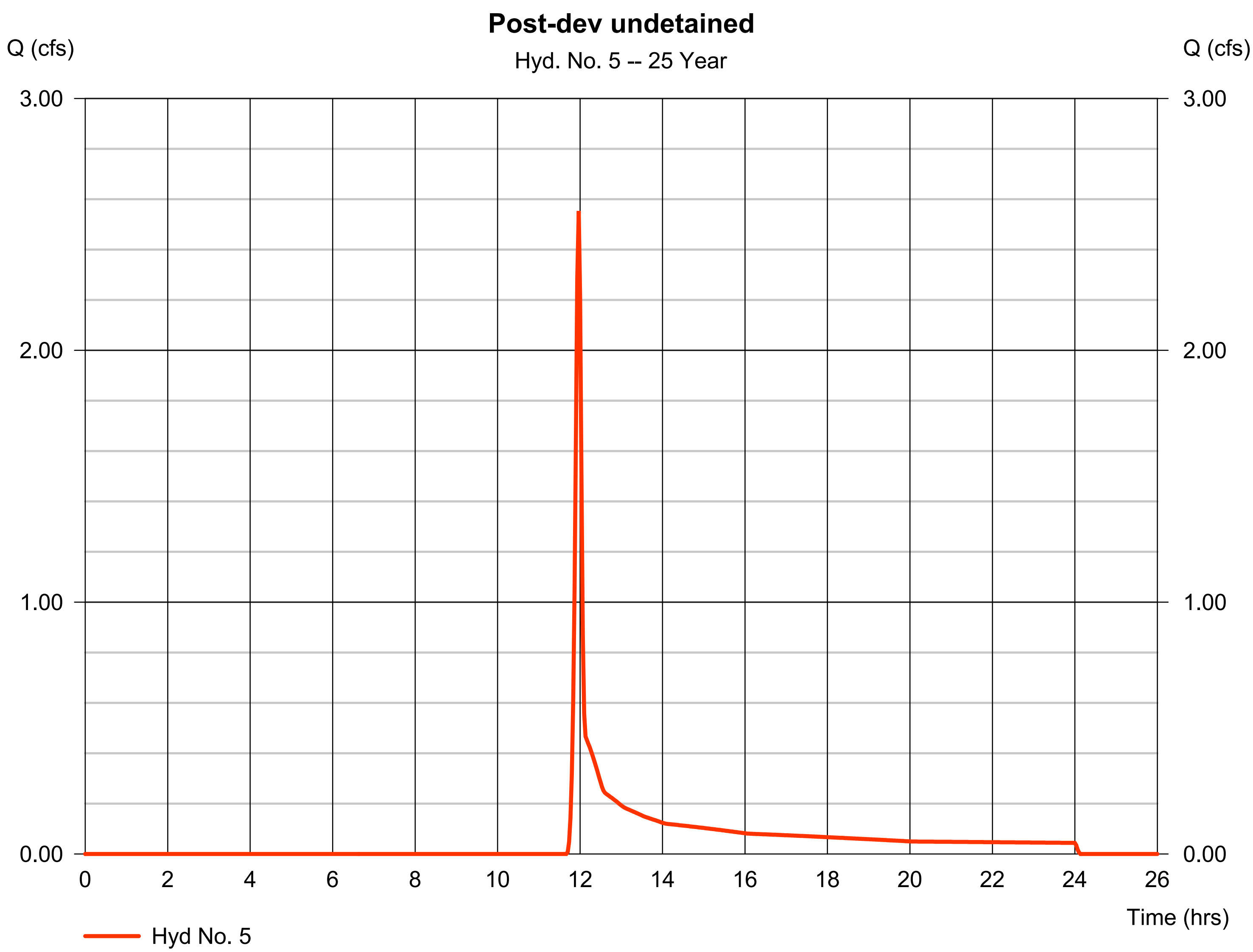
Hydrograph Report

Hyd. No. 5

Post-dev undetained

Hydrograph type	= SCS Runoff	Peak discharge	= 2.553 cfs
Storm frequency	= 25 yrs	Time to peak	= 11.97 hrs
Time interval	= 2 min	Hyd. volume	= 5,533 cuft
Drainage area	= 2.030 ac	Curve number	= 58*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 4.29 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(1.250 x 76) + (0.780 x 30)] / 2.030



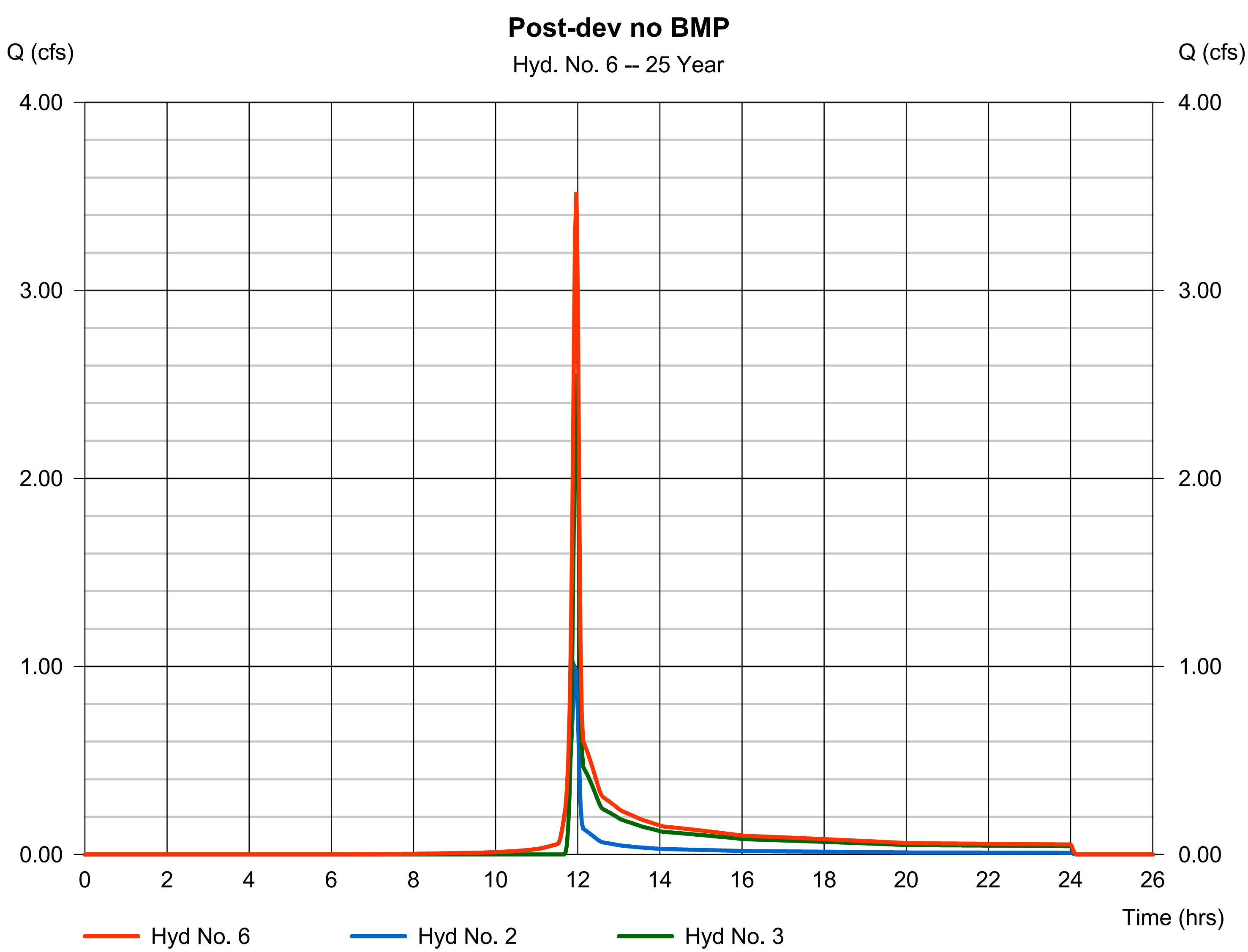
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023 Thursday, 11 / 7 / 2024

Hyd. No. 6

Post-dev no BMP

Hydrograph type	= Combine	Peak discharge	= 3.522 cfs
Storm frequency	= 25 yrs	Time to peak	= 11.97 hrs
Time interval	= 2 min	Hyd. volume	= 7,568 cuft
Inflow hyds.	= 2, 3	Contrib. drain. area	= 2.250 ac



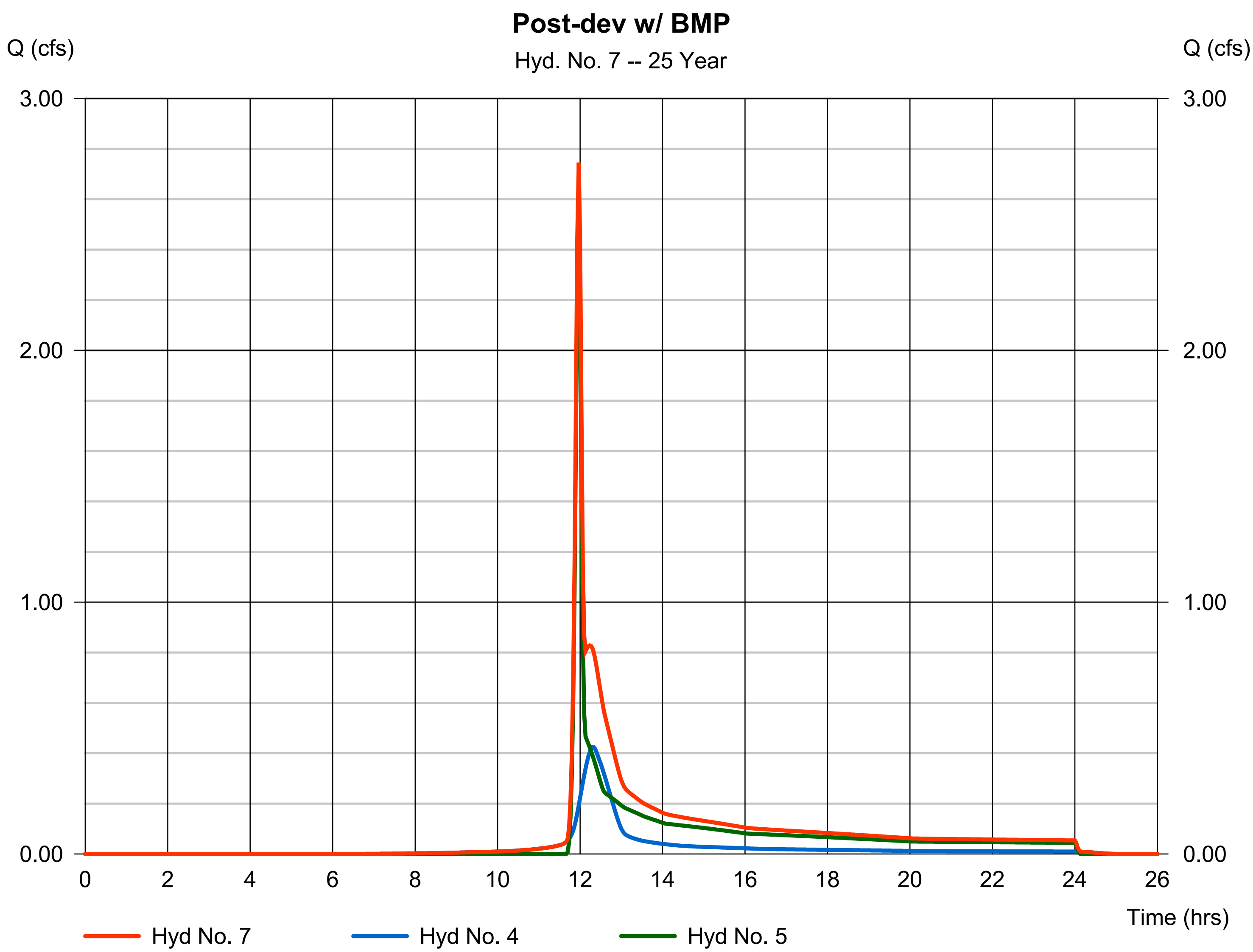
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023 Thursday, 11 / 7 / 2024

Hyd. No. 7

Post-dev w/ BMP

Hydrograph type	= Combine	Peak discharge	= 2.745 cfs
Storm frequency	= 25 yrs	Time to peak	= 11.97 hrs
Time interval	= 2 min	Hyd. volume	= 7,725 cuft
Inflow hyds.	= 4, 5	Contrib. drain. area	= 2.250 ac



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023

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	4.587	2	718	9,408	------	------	------	Pre-dev
2	SCS Runoff	1.213	2	716	2,515	------	------	------	Post-dev gravel
3	SCS Runoff	3.888	2	718	8,036	------	------	------	Post-dev undetained
4	SCS Runoff	0.552	2	736	2,682	------	------	------	Post-dev Tc adjusted
5	SCS Runoff	3.888	2	718	8,036	------	------	------	Post-dev undetained
6	Combine	5.069	2	718	10,551	2, 3,	------	------	Post-dev no BMP
7	Combine	4.160	2	718	10,719	4, 5,	------	------	Post-dev w/ BMP

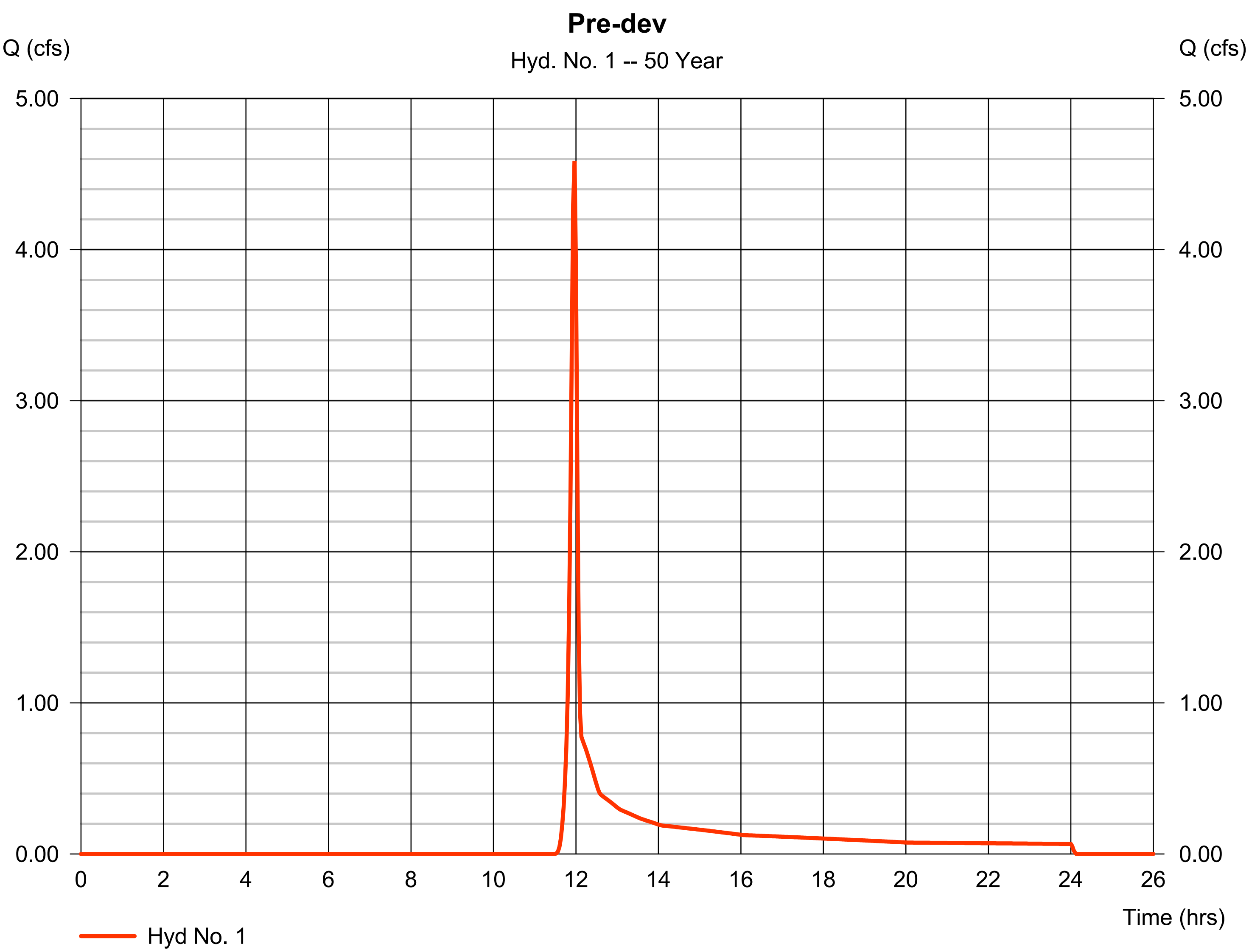
Hydrograph Report

Hyd. No. 1

Pre-dev

Hydrograph type	= SCS Runoff	Peak discharge	= 4.587 cfs
Storm frequency	= 50 yrs	Time to peak	= 11.97 hrs
Time interval	= 2 min	Hyd. volume	= 9,408 cuft
Drainage area	= 2.250 ac	Curve number	= 59*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 4.99 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(1.380 x 78) + (0.870 x 30)] / 2.250



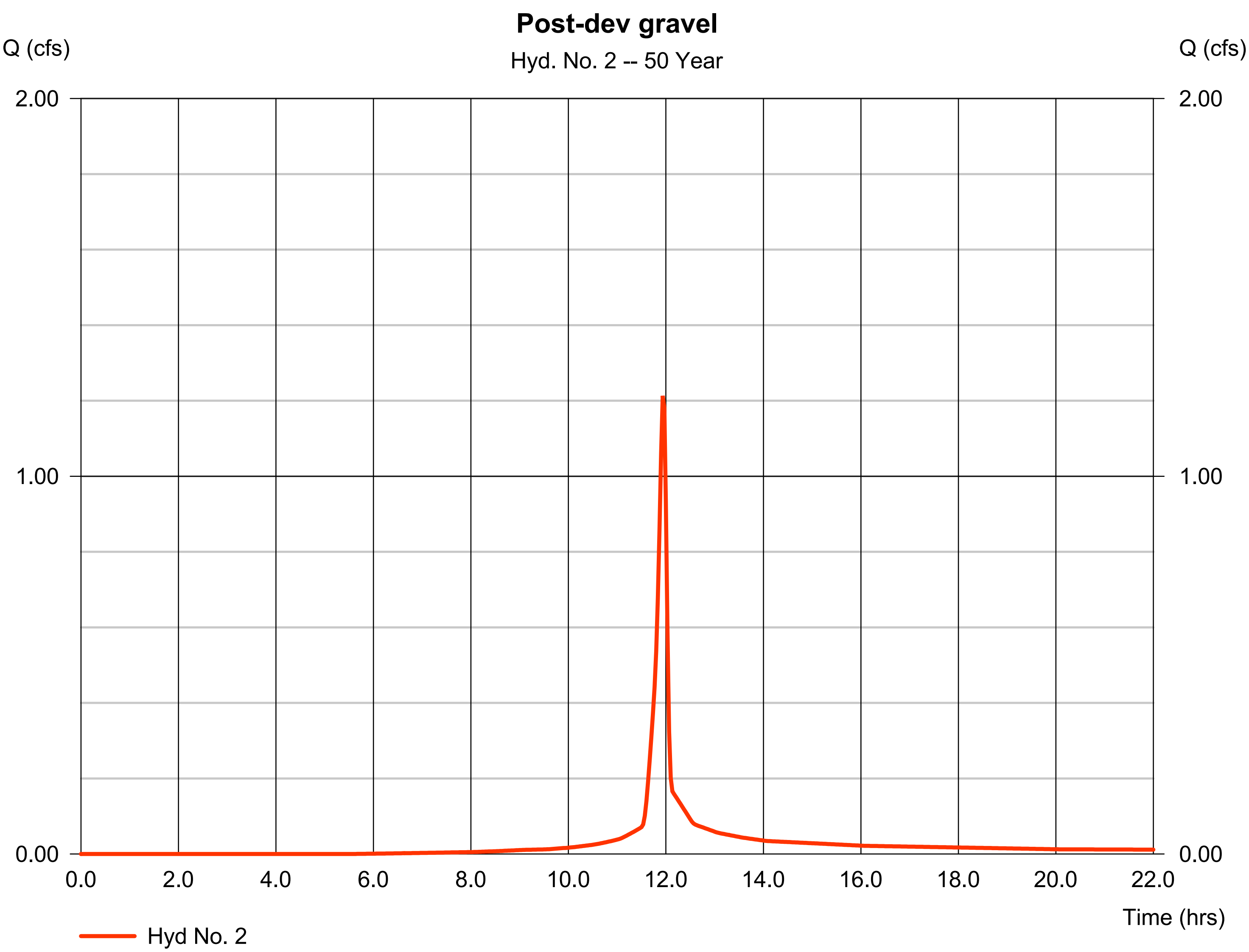
Hydrograph Report

Hyd. No. 2

Post-dev gravel

Hydrograph type	= SCS Runoff	Peak discharge	= 1.213 cfs
Storm frequency	= 50 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 2,515 cuft
Drainage area	= 0.220 ac	Curve number	= 85*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 4.99 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.130 x 91) + (0.090 x 76)] / 0.220



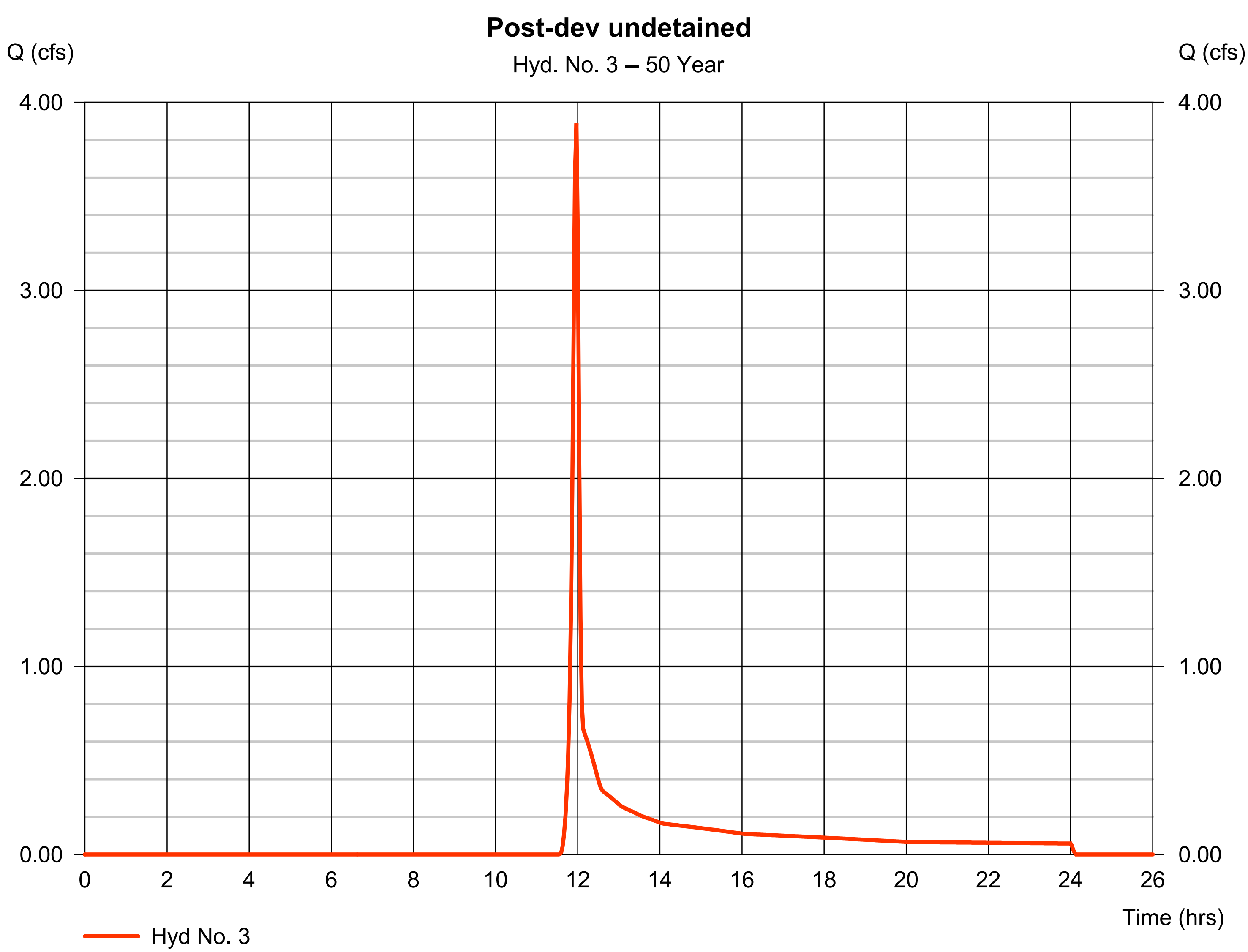
Hydrograph Report

Hyd. No. 3

Post-dev undetained

Hydrograph type	= SCS Runoff	Peak discharge	= 3.888 cfs
Storm frequency	= 50 yrs	Time to peak	= 11.97 hrs
Time interval	= 2 min	Hyd. volume	= 8,036 cuft
Drainage area	= 2.030 ac	Curve number	= 58*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 4.99 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(1.250 x 76) + (0.780 x 30)] / 2.030



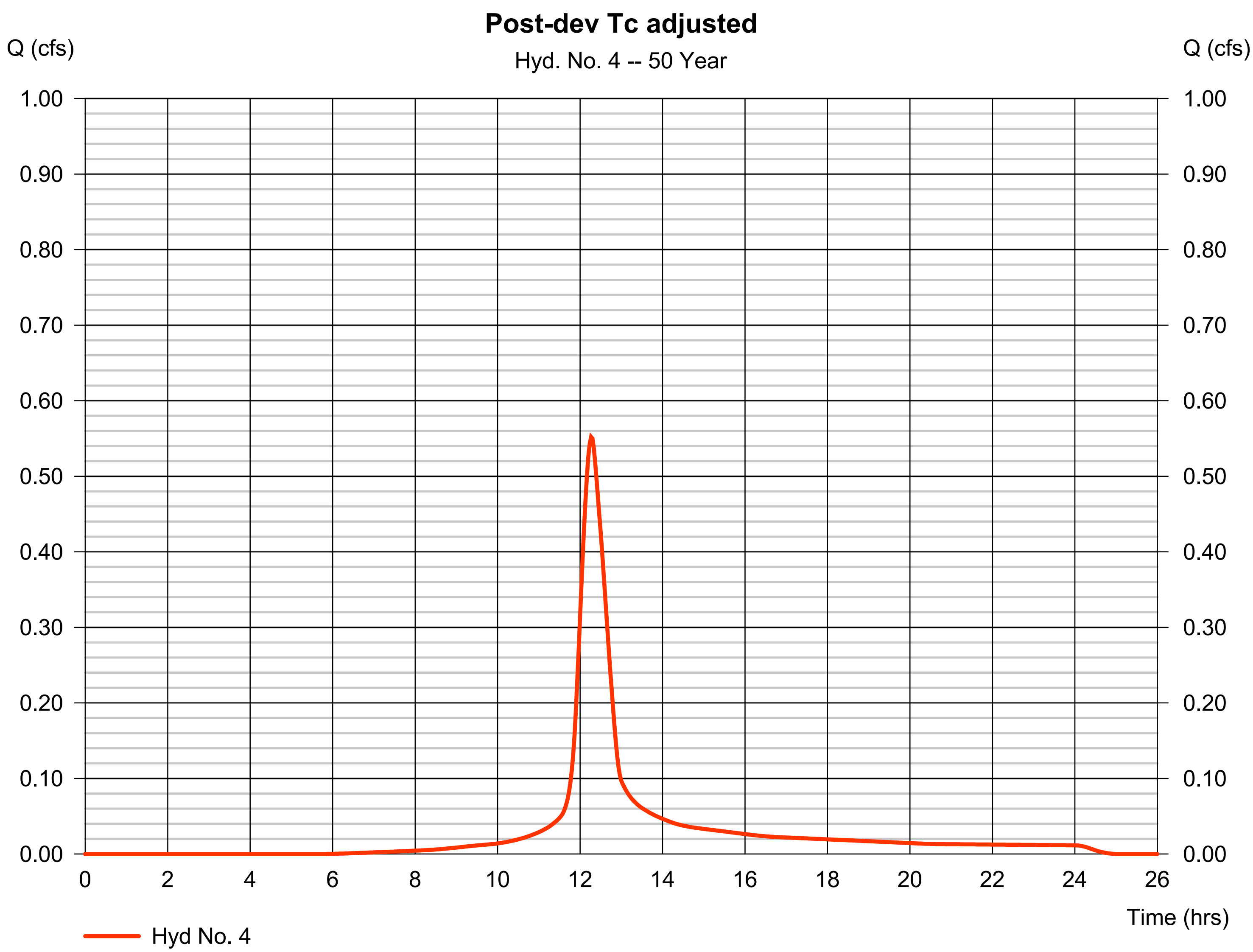
Hydrograph Report

Hyd. No. 4

Post-dev Tc adjusted

Hydrograph type	= SCS Runoff	Peak discharge	= 0.552 cfs
Storm frequency	= 50 yrs	Time to peak	= 12.27 hrs
Time interval	= 2 min	Hyd. volume	= 2,682 cuft
Drainage area	= 0.220 ac	Curve number	= 85*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 37.10 min
Total precip.	= 4.99 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.130 x 91) + (0.090 x 76)] / 0.220



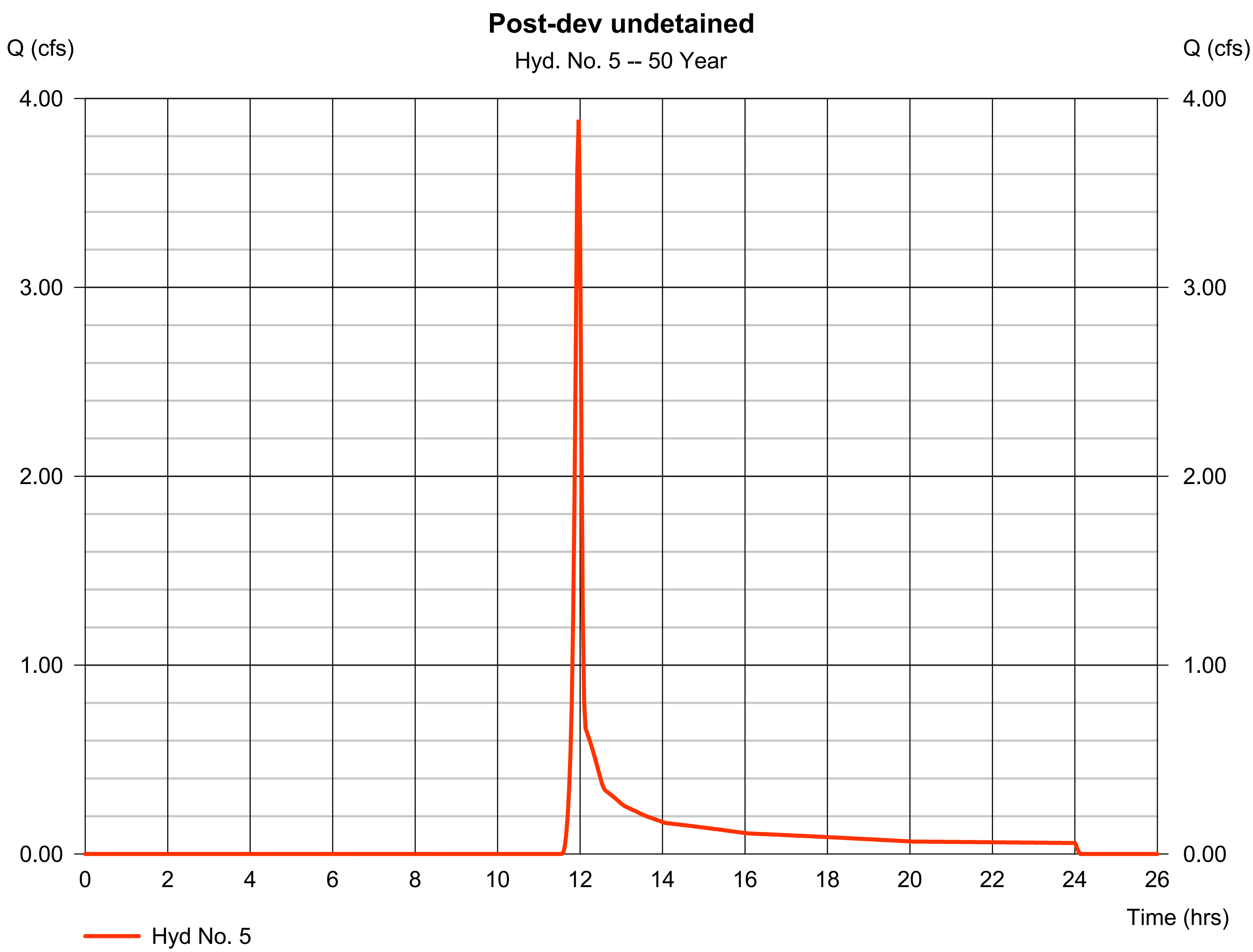
Hydrograph Report

Hyd. No. 5

Post-dev undetained

Hydrograph type	= SCS Runoff	Peak discharge	= 3.888 cfs
Storm frequency	= 50 yrs	Time to peak	= 11.97 hrs
Time interval	= 2 min	Hyd. volume	= 8,036 cuft
Drainage area	= 2.030 ac	Curve number	= 58*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 4.99 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(1.250 x 76) + (0.780 x 30)] / 2.030

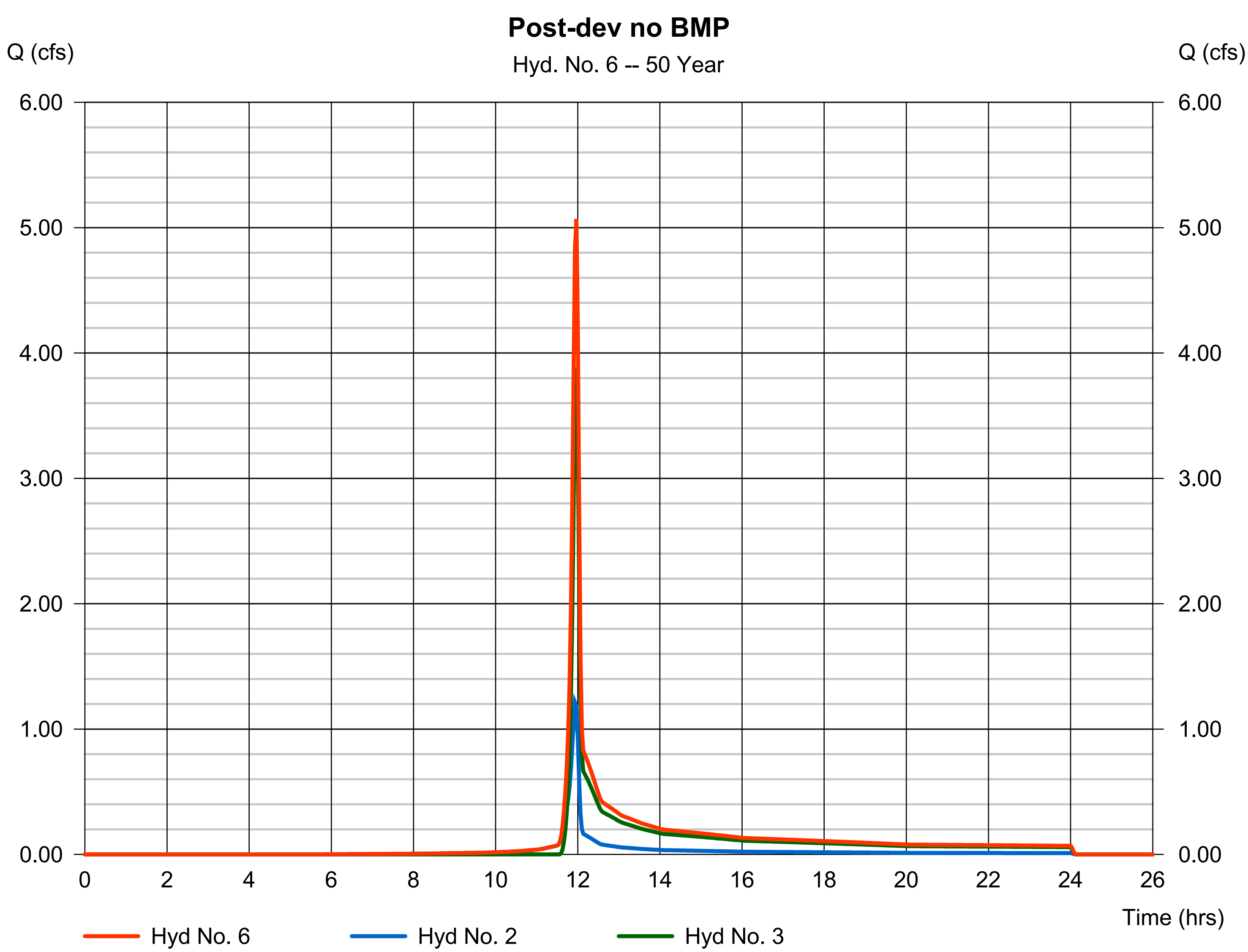


Hydrograph Report

Hyd. No. 6

Post-dev no BMP

Hydrograph type	= Combine	Peak discharge	= 5.069 cfs
Storm frequency	= 50 yrs	Time to peak	= 11.97 hrs
Time interval	= 2 min	Hyd. volume	= 10,551 cuft
Inflow hyds.	= 2, 3	Contrib. drain. area	= 2.250 ac

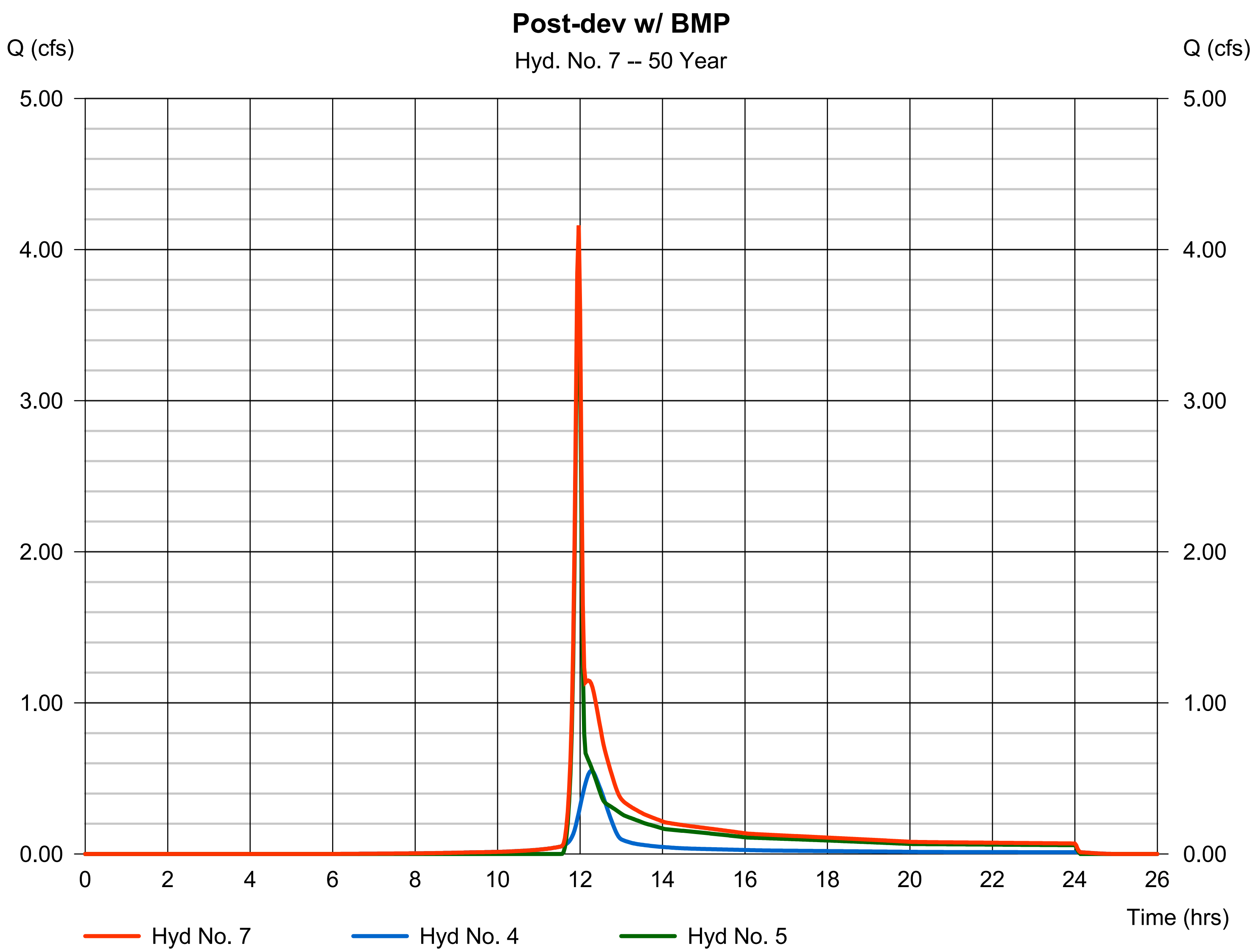


Hydrograph Report

Hyd. No. 7

Post-dev w/ BMP

Hydrograph type	= Combine	Peak discharge	= 4.160 cfs
Storm frequency	= 50 yrs	Time to peak	= 11.97 hrs
Time interval	= 2 min	Hyd. volume	= 10,719 cuft
Inflow hyds.	= 4, 5	Contrib. drain. area	= 2.250 ac



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023

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	6.632	2	718	13,351	------	------	------	Pre-dev
2	SCS Runoff	1.486	2	716	3,115	------	------	------	Post-dev gravel
3	SCS Runoff	5.692	2	718	11,496	------	------	------	Post-dev undetained
4	SCS Runoff	0.824	2	730	3,323	------	------	------	Post-dev Tc adjusted
5	SCS Runoff	5.692	2	718	11,496	------	------	------	Post-dev undetained
6	Combine	7.134	2	718	14,612	2, 3,	------	------	Post-dev no BMP
7	Combine	6.205	2	718	14,819	4, 5,	------	------	Post-dev w/ BMP

YM59 PAR9.gpw	Return Period: 100 Year	Friday, 11 / 8 / 2024

Hydrograph Report

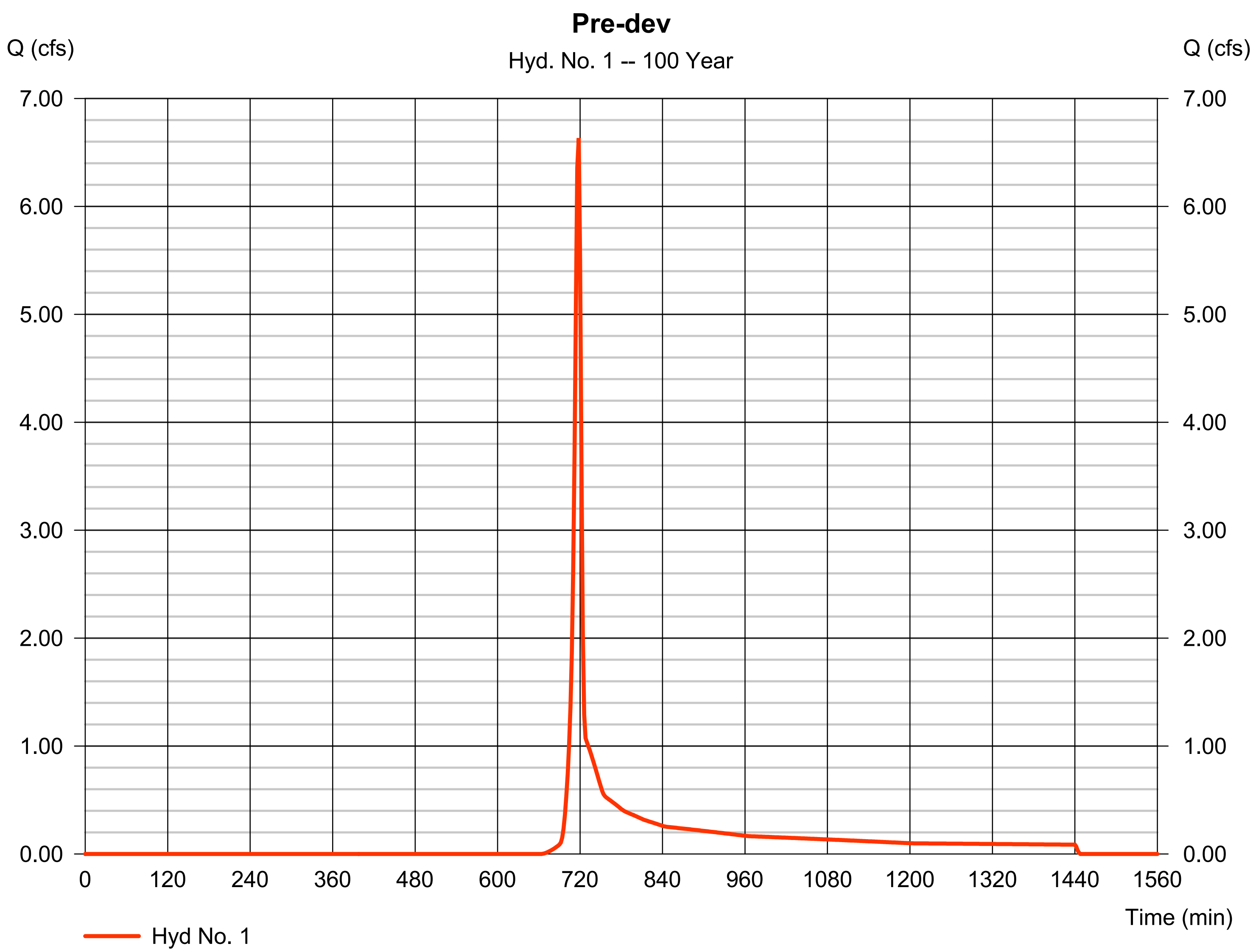
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023 Friday, 11 / 8 / 2024

Hyd. No. 1

Pre-dev

Hydrograph type	= SCS Runoff	Peak discharge	= 6.632 cfs
Storm frequency	= 100 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 13,351 cuft
Drainage area	= 2.250 ac	Curve number	= 59*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 5.85 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(1.380 x 78) + (0.870 x 30)] / 2.250



Hydrograph Report

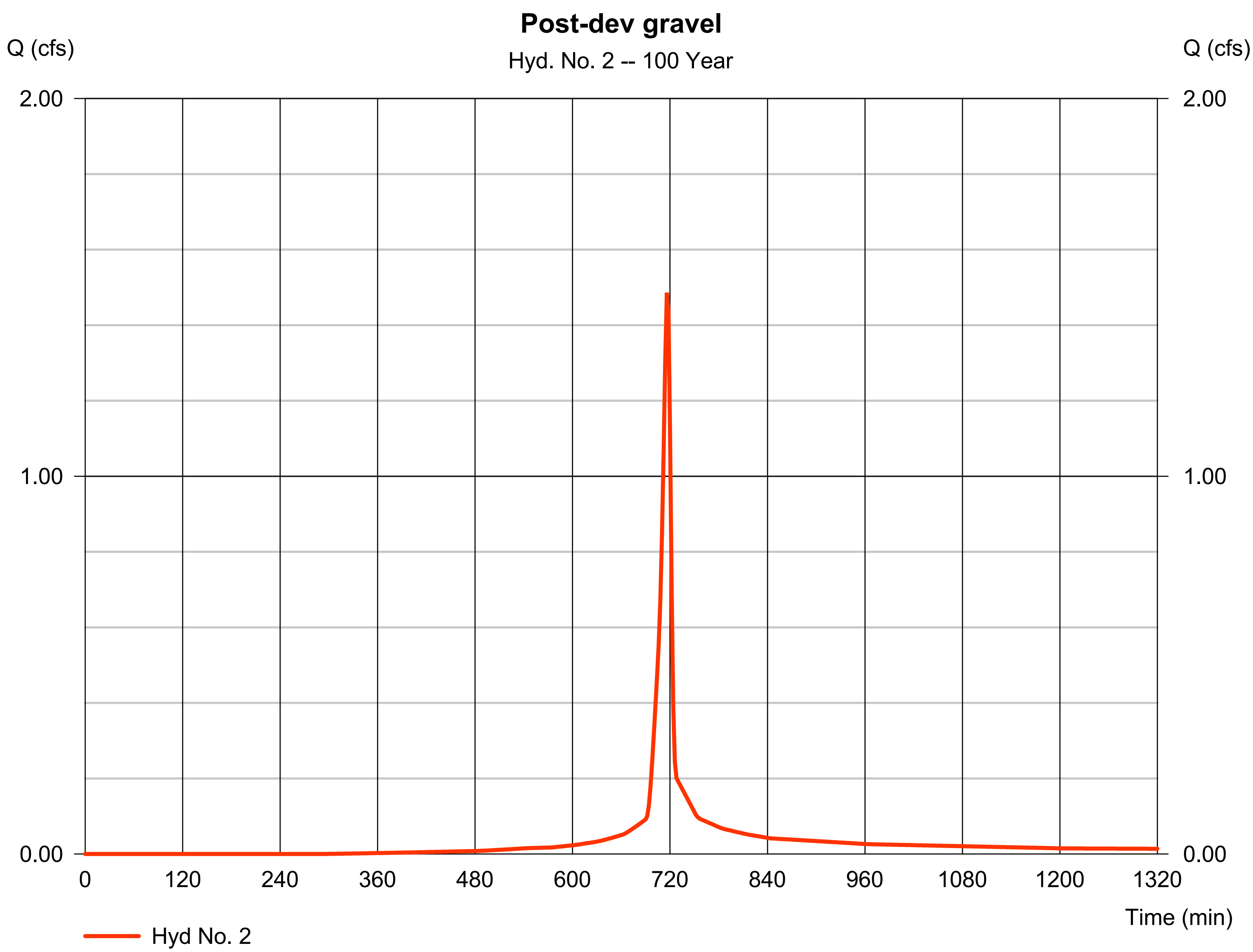
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023 | Friday, 11 / 8 / 2024

Hyd. No. 2

Post-dev gravel

Hydrograph type	= SCS Runoff	Peak discharge	= 1.486 cfs
Storm frequency	= 100 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 3,115 cuft
Drainage area	= 0.220 ac	Curve number	= 85*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 5.85 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.130 x 91) + (0.090 x 76)] / 0.220



Hydrograph Report

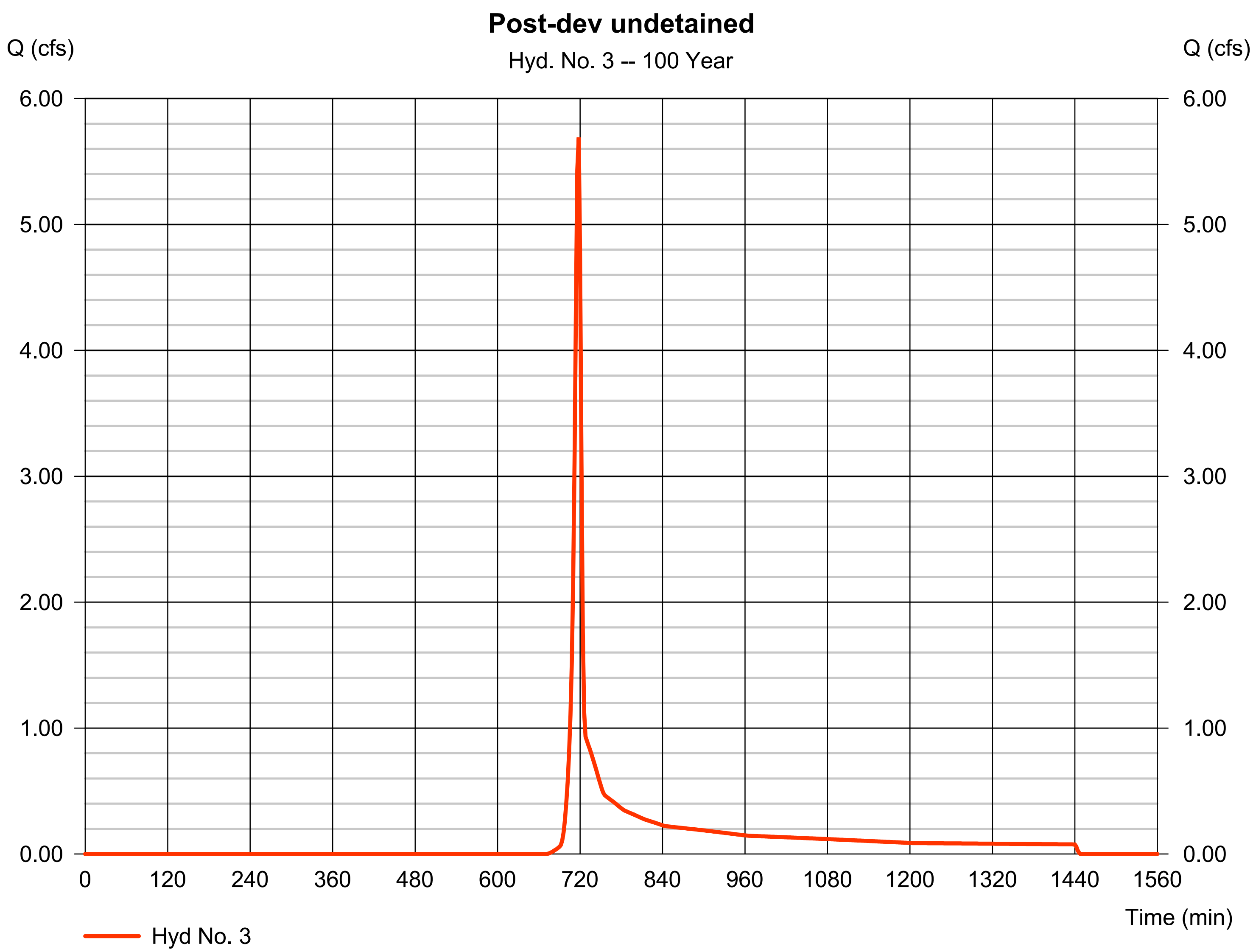
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023 | Friday, 11 / 8 / 2024

Hyd. No. 3

Post-dev undetained

Hydrograph type	= SCS Runoff	Peak discharge	= 5.692 cfs
Storm frequency	= 100 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 11,496 cuft
Drainage area	= 2.030 ac	Curve number	= 58*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 5.85 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(1.250 x 76) + (0.780 x 30)] / 2.030



Hydrograph Report

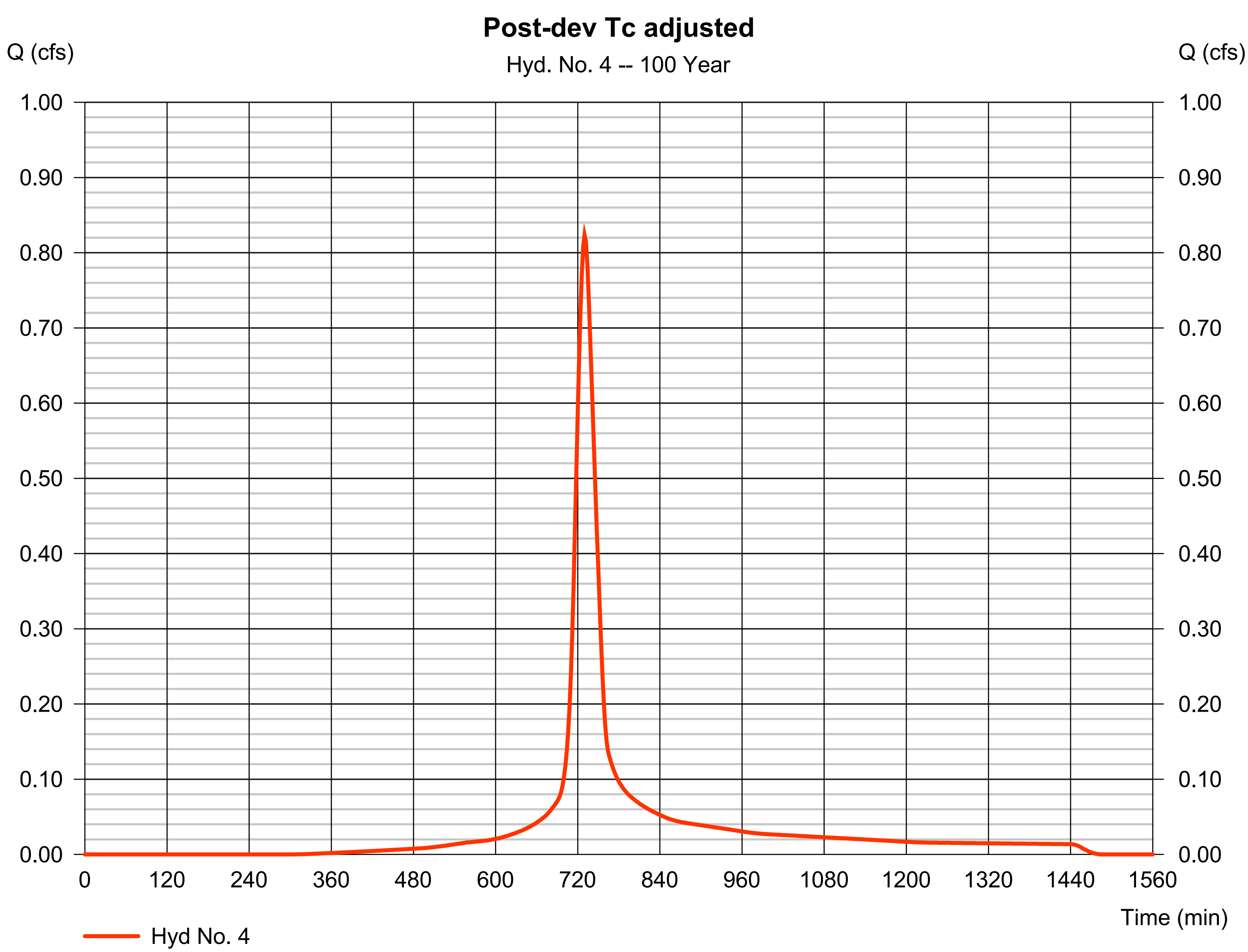
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023 Friday, 11 / 8 / 2024

Hyd. No. 4

Post-dev Tc adjusted

Hydrograph type	= SCS Runoff	Peak discharge	= 0.824 cfs
Storm frequency	= 100 yrs	Time to peak	= 730 min
Time interval	= 2 min	Hyd. volume	= 3,323 cuft
Drainage area	= 0.220 ac	Curve number	= 85*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 28.10 min
Total precip.	= 5.85 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.130 x 91) + (0.090 x 76)] / 0.220



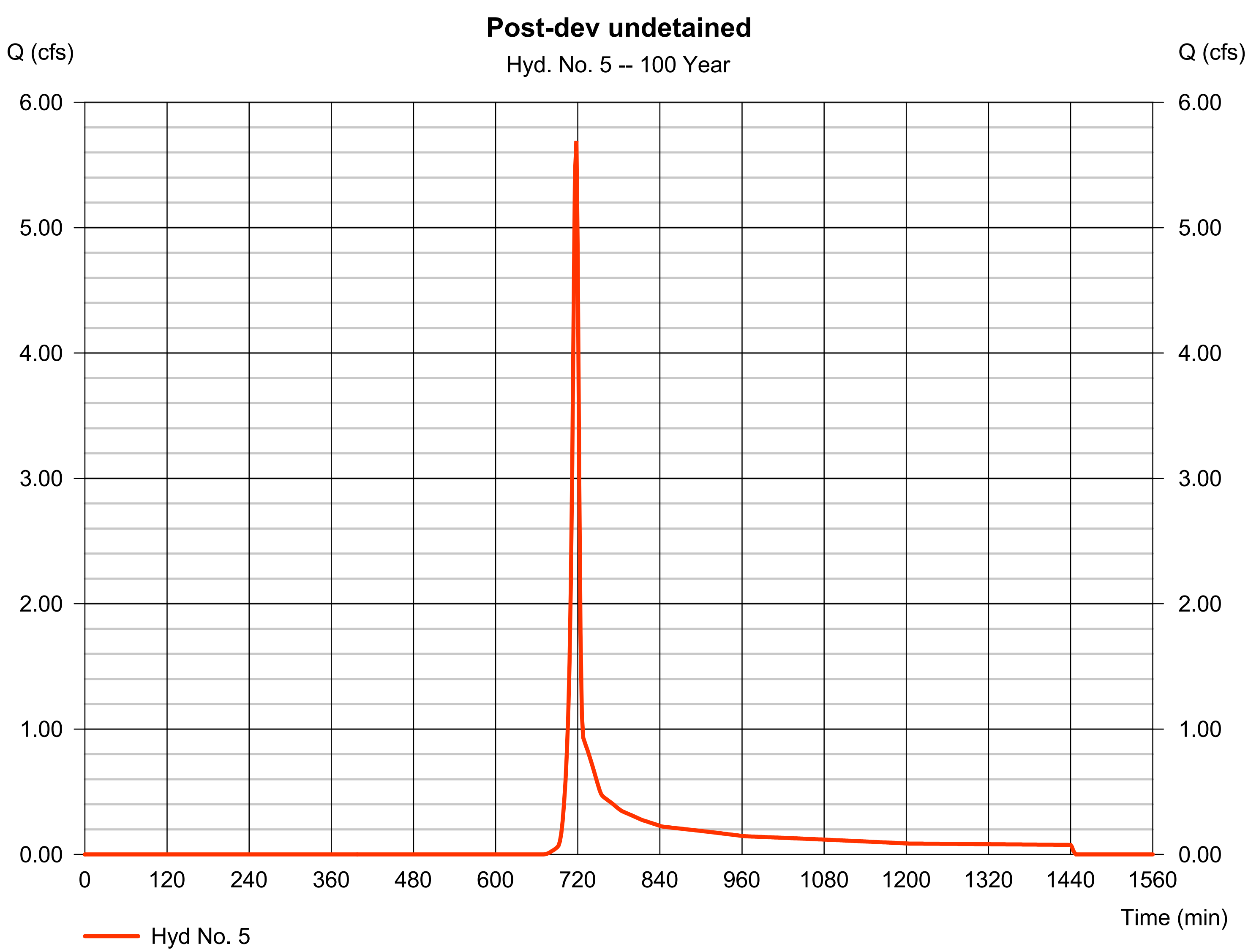
Hydrograph Report

Hyd. No. 5

Post-dev undetained

Hydrograph type	= SCS Runoff	Peak discharge	= 5.692 cfs
Storm frequency	= 100 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 11,496 cuft
Drainage area	= 2.030 ac	Curve number	= 58*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 5.85 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(1.250 x 76) + (0.780 x 30)] / 2.030



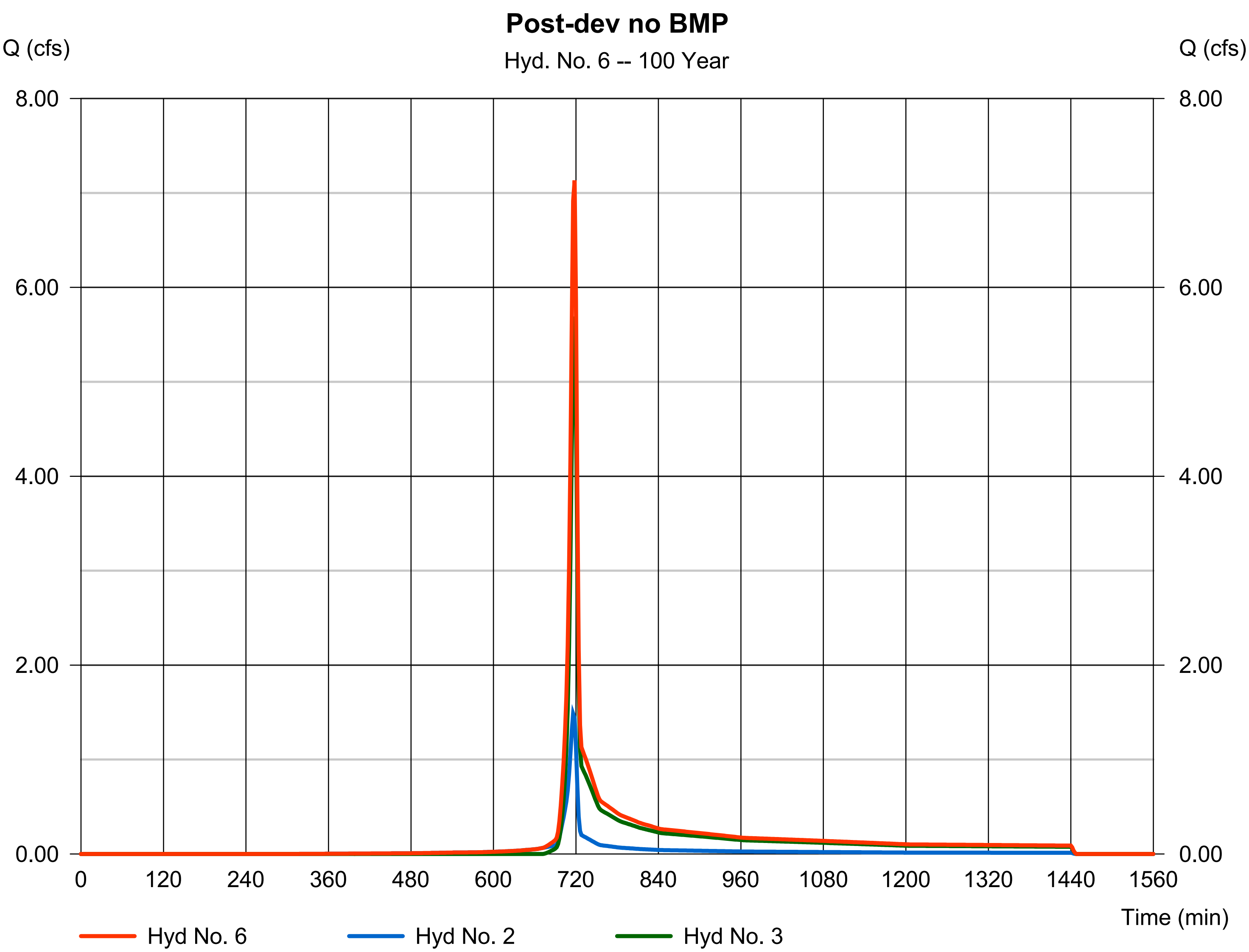
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023 Friday, 11 / 8 / 2024

Hyd. No. 6

Post-dev no BMP

Hydrograph type	= Combine	Peak discharge	= 7.134 cfs
Storm frequency	= 100 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 14,612 cuft
Inflow hyds.	= 2, 3	Contrib. drain. area	= 2.250 ac



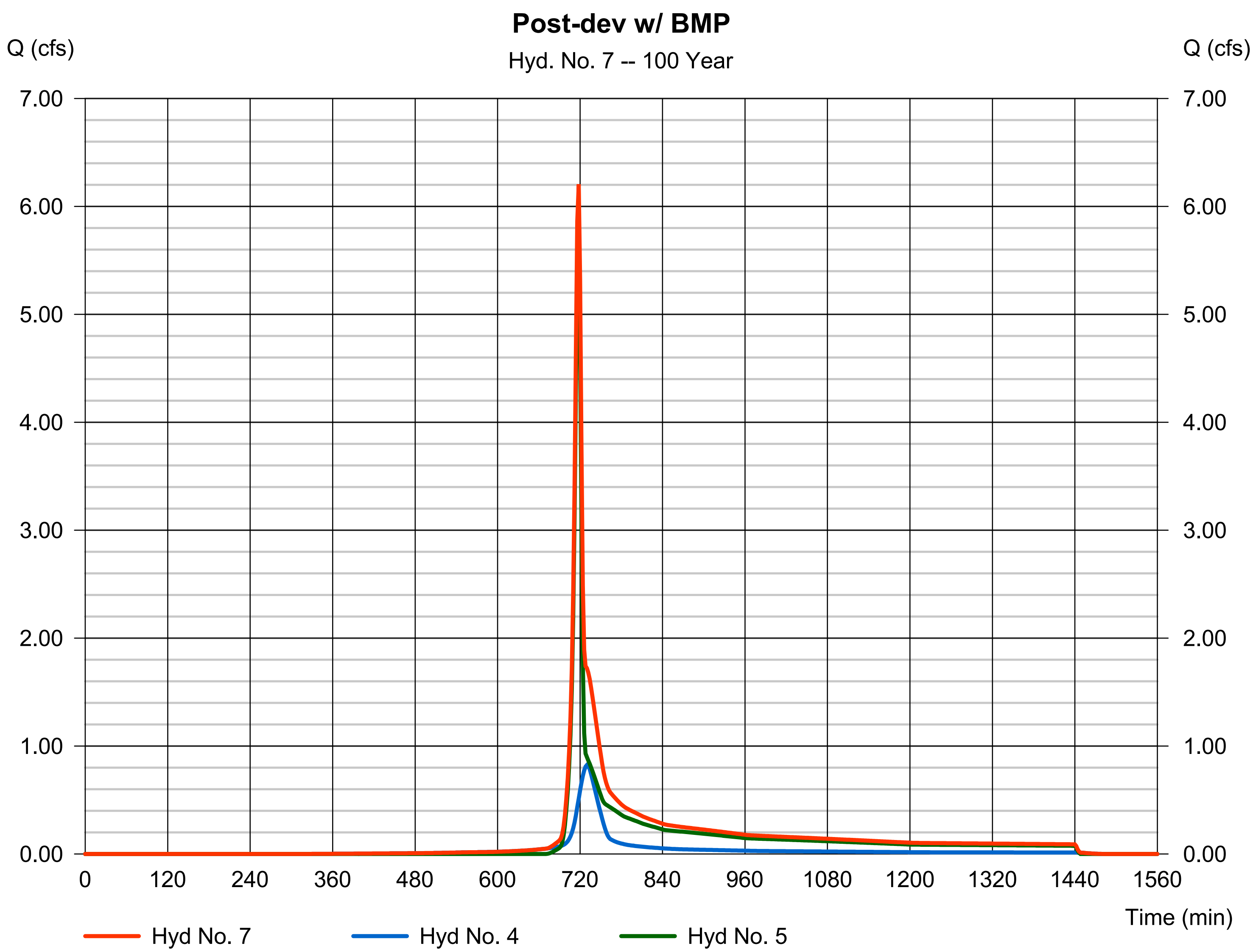
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023 — Friday, 11 / 8 / 2024

Hyd. No. 7

Post-dev w/ BMP

Hydrograph type	= Combine	Peak discharge	= 6.205 cfs
Storm frequency	= 100 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 14,819 cuft
Inflow hyds.	= 4, 5	Contrib. drain. area	= 2.250 ac



PRODUCT SPECIFICATION (CSI-FORMAT)

SECTION 31 32 00
SOIL STABILIZATION SYSTEM

PART 1 GENERAL

1.1 SUMMARY

A. Work Included: This section includes providing all material, labor, tools and equipment for installation of geocell system as shown in the Contract Documents and as specified in this section.

B. The geocell shall be used for load support application.

1.2 RELATED SECTIONS AND DIVISIONS

A. The applicable provisions of the General Conditions shall govern the work in this Section.

B. Section 013300 – Submittal Procedures

C. Section 311000 – Site Clearing

D. Section 312000 – Earth Moving.

E. Section 312500 – Erosion and Sedimentation Control.

F. Section 313219 – Geosynthetic Stabilization and Separation Layer.

G. Section 323000 - Site Improvements.

H. Section 329200 –Turfs and Grasses.

I. Section 334600 – Subdrainage.

1.3 REFERENCES

A. American Association of State Highway and Transportation Officials (AASHTO)

1. AASHTO M288 – Geotextile Specification for Highway Applications.

B. American Society of Testing and Materials (ASTM)

1. ASTM D1505 – Density of Plastics by the Density-Gradient Technique.
2. ASTM D1603 – Standard Test for Carbon Black in Olefin Plastics.
3. ASTM D1693 – Environmental Stress-Cracking of Ethylene Plastics.
4. ASTM D5199 – Measuring Nominal Thickness of Geotextiles and Geomembranes.
5. ASTM D5394 – Standard Test Method for Environmental Stress-Cracking of Ethylene Plastics.
6. ASTM D5596 – Standard Test Method for Microscopic Evaluation of the Dispersion of Carbon Black in Polyolefin Geosynthetics.
7. ASTM D 5721 – Standard Practice for Air-Oven Aging of Polyolefin Geomembranes.
8. ASTM D 5885 – Standard Test Method for Oxidative Induction Time of Polyolefin Geosynthetics by High-Pressure Differential Scanning Calorimetry.

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9. ASTM D 6693 (Type IV) – Standard Test Method for Determining Tensile Properties of Nonreinforced Polyethylene and Nonreinforced Flexible Polypropylene Geomembranes.
10. ASTM D 7328 – Standard Test Method for Effect of Exposure of Unreinforced Polyolefin Geomembrane Using Fluorescent UV Condensation Apparatus
11. ASTM E 41 – Terminology Relating to Conditioning.

C. US Army Corps of Engineers (USACE)

1. Technical Report GL-86-19, Appendix A.

D. International Organization for Standardization (European Union) (EN-ISO)

1. ISO 6721 – Plastics – Determination of Dynamic Mechanical Properties
2. EN ISO 10319 – Geosynthetics – Wide-Width Tensile Test
3. EN 12224 – Geotextiles and Geotextile-Related Products – Determination of the Resistance to Weathering
4. EN ISO 13426 – Geotextiles and Geotextile-Related Products – Strength of Internal Structural Junctions – Part 1: Geocells
5. EN ISO 13438 – Screening Test Method for Determining the Resistance of Geotextiles and Geotextile-Related Products to Oxidation

1.4 SUBMITTALS

A. Submit manufacturer's shop drawings in accordance with Section 001300, Submittals including Manufacturer’s product data, calculations, drawings and field representative qualifications.

B. Manufacturer Calculations. Provide a complete set of project calculations to determine the load support requirements.

1. The calculations shall be submitted at the time of bid. The calculation shall be included in an evaluation containing a written summary, plan view, cross section, calculations, stress distribution graph, number of passes graph and research and testing documentation. The evaluation shall be based on site specific project conditions. No standard tables or graphs are acceptable.
2. The calculation method shall be based on computer software developed through research and testing at an accredited university or research facility based specifically on the product being submitted. Provide third party research summary for the calculation method specific to the manufacturer’s material values and panel connectors.
3. The load support calculations shall be based on wheel loading, tire pressure, number of passes, bearing capacity coefficient and include the following:
   a. The minimum allowable stress factor of safety shall be 1.40.
   b. Provide geocell size and depth.
   c. Provide hoop stress (psi/kPa) and hoop tension (lb/kg) values.
   d. Perforated cell wall factor of safety for rupture.
   e. Internal junction (seams) factor of safety for peel, shear and separation.
   f. Mechanical junction (panel connection) factor of safety for peel, shear and separation.
   g. Vertical stress distribution graph showing stress reduction vs. depth below surface.

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h. Number of passes graph showing cross section requirement vs. number of passes.

4. Provide third party testing on panel connection device showing minimum pull through resistance of 275 lbs.

5. If required, provide a description of the recommended enhanced woven geotextile separation layer and include in the calculations.

6. The stability calculations shall be in Microsoft Excel converted to Adobe PDF format.

7. Cross section drawings shall be in AutoCAD converted to Adobe PDF format.

C. Manufacturer's Certificate of Analysis: Manufacturer shall supply certificate of analysis containing the following test results for the geocell material used for project: Base Resin Lot Number(s), Resin Density per ASTM-1505, Production Lot Number(s), Material Thickness, Short Term Seam Peel Strength, and percentage of Carbon Black. Submit qualifications certifying the installer is experienced in the installation of the specified products.

D. Submit qualifications of Manufacturer's field representative certifying the field representative is experienced in the installation of the specified products.

E. Submit certificate of compliance that all materials and resins used to produce the specified materials are 100% made by plants located in the United States per public law Build America, Buy America (BABA) included in the Infrastructure Investment and Jobs Act under Title IX, Subtitle A, Part 1.

F. No material will be considered as an equivalent to the geocell material specified herein unless it meets all requirements of this specification, without exception. Alternates must be submitted prior to bid. Manufacturers seeking to supply what they represent as equivalent material must submit records, data, independent test results, samples, certifications, and documentation deemed necessary by the Engineer to prove equivalency. The Engineer shall approve or disapprove other Manufacturers' materials in accordance with the General Conditions after all information is submitted and reviewed. Any substitute materials submitted shall be subject to independent lab testing at the contractor's expense.

1.5 QUALITY ASSURANCE AND CONTROL

A. The geocell material shall be provided from a single Manufacturer for the entire project.

B. The Manufacturer's Quality Management System shall be certified and in accordance with ISO 9001:2015 and CE certification. Any substitute materials submitted shall provide a certification that their geocell manufacturing process is part of an ISO program and a certification will be required specifically stating that their testing facility is certified and in accordance with ISO. An ISO certification for the substitute material will not be acceptable unless it is proven it pertains specifically to the geocell manufacturing operations.

C. The Manufacturer shall provide certification of compliance to all applicable testing procedures and related specifications upon the customer's written request. Request for certification shall be submitted no later than the date of order placement. The Manufacturer shall have a minimum of 20 years' experience producing geocells and accessories.

D. Certified Installer Training Course

1. At a minimum, the certified installer training course shall be taken by the contractor's project manager and on-site project manager.

2. The certified training course is free of charge and consists of reviewing the Construction Resource Package. The training course is 2 hours in length.

3. The contractor shall take the certified training course addressing best practices for base preparation, geotextile installation, engineered base composition and installation, unit installation and orientation

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and unit fill.

E. Pre-Construction Meeting: Prior to construction, conduct a virtual or on-site meeting to review all the requirements and expectations to complete the work. The pre-construction meeting shall be attended by all parties involved in the installation of the geocell system.

1. Manufacturer shall provide a recommended list of all necessary tools and equipment required for installation. Installation videos and techniques shall be reviewed.

2. Discuss any special features and requirements for the installation of the geocell system to prevent any delays and conflicts in completing the work.

F. Pre-Installation Meeting: Prior to installation of any materials, conduct a pre-installation meeting to discuss the scope of work and review installation requirements. The pre-installation meeting shall be attended by all parties involved in the installation of the geocell.

G. Manufacturer's Field Representative Qualifications:

1. Manufacturer shall provide a qualified field representative on site at the start of construction to ensure the system is installed in accordance with the Contract Documents.

2. Manufacturer's field representative shall have a minimum 10 years' installation experience with the specified products in the specified application.

3. Manufacturer of any substitute materials to be used shall certify that a representative can meet the above criteria and will be on site for initial construction start up. Manufacturers other than Presto will be required to provide proof the representative meets these qualifications.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to site in Manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and Manufacturer.

B. The materials shall be stored in accordance with Manufacturer's instructions. The materials shall be protected from damage and away from direct sunlight.

C. The materials shall be delivered, unloaded and installed in a manner to prevent and minimize damage.

1.7 WARRANTY

A. The Manufacturer shall warrant each section that it ships to be free from defects in materials and workmanship at the time of manufacture. The Manufacturer's exclusive liability under this warranty or otherwise will be to furnish without charge to the original f.o.b. point a replacement for any section which proves to be defective under normal use and service during the 10-year period which begins on the date of shipment. The Manufacturer reserves the right to inspect any allegedly defective section in order to verify the defect and ascertain its cause.

B. This warranty shall not cover defects attributable to causes or occurrences beyond the Manufacturer's control and unrelated to the manufacturing process, including, but not limited to, abuse, misuse, mishandling, neglect, improper storage, improper installation, improper alteration or improper application.

C. In no event shall the Manufacturer be liable for any special, indirect, incidental or consequential damages for the breach of any express or implied warranty or for any other reason, including negligence, in connection with the geocell.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURER

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A. Presto Geosystems, PO Box 2399, Appleton, Wisconsin 54912-2399.

Phone: (920) 738-1328. Email: info@prestogeo.com. Website: www.prestogeo.com.

2.2 GEOWEB® GEOCELL

A. Manufacturing Certification

1. The Manufacturer shall have earned a certificate of registration, which demonstrates that its quality-management system for its geocell is currently registered to the ISO 9001:2015 and CE quality standards.

B. Base Materials

1. Polyethylene Stabilized with Carbon Black

a. Density shall be 58.4 to 60.2 pound/ft^3 (0.935 to 0.965 g/cm^3) in accordance with ASTM D1505.

b. Environmental Stress Crack Resistance (ESCR) shall be 5000 hours in accordance with ASTM D1693.

c. Resistance to Oxidation shall be minimum of 100 years in accordance with EN ISO 13438.

d. 100% of original strip tensile strength shall be retained following exposure to accelerated weathering in in accordance with EN 12224.

e. The Flexural Storage Modulus shall be a minimum of 800 MPa in accordance with ISO 6721.

f. Ultra-Violet light stabilization with carbon black.

g. Carbon Black content shall be 1.5 to 2 percent by weight, through addition of a carrier with certified carbon black content.

h. Carbon black shall be homogeneously distributed throughout material.

i. The manufacturer must have an in-place quality control to prevent irregularities in strip material.

C. Cell Properties

1. Individual cells shall be uniform in shape and size when expanded.

2. Individual cell dimensions (nominal) shall be dimensions ± 10%.

3. GW30V Cell

a. Length shall be 11.3 inches (287 mm).

b. Width shall be 12.6 inches (320 mm).

c. Nominal area shall be 71.3 in^2 (460 cm^2) plus or minus 1%.

d. Nominal depth shall be 6 inches (150 mm).

D. Strip Properties and Assembly

1. Perforated Textured Strip/Cell

a. Strip sheet thickness shall be 50 mil (1.27 mm), minus 5 percent, plus 10 percent in accordance with ASTM D5199. Determine thickness flat, before surface disruption.

b. Polyethylene strips shall be textured surface with a multitude of rhomboidal (diamond shape) indentations.

c. Textured sheet thickness shall be 60 mil plus or minus 6 mil (1.52 mm plus or minus 0.15 mm).

d. Indentation surface density shall be 140 to 200 per in^2 (22 to 31 per cm^2).

e. Perforated with horizontal rows of 0.4-inch (10 mm) diameter holes.

f. Perforations within each row shall be 0.75 inches (19 mm) on-center.

g. Horizontal rows shall be staggered and separated 0.50 inches (12 mm) relative to hole centers.

h. Edge of strip to nearest edge of perforation shall be a minimum of 0.3 inches (8 mm).

i. Centerline of spot weld to nearest edge of perforation shall be a minimum of 0.7 inches (18 mm).

j. A slot with a dimension of 3/8 inch x 1-3/8 inch (10 mm x 35 mm) is standard in the center of the non-perforated areas and at the center of each weld.

2. Assembly of Cell Sections

a. Fabricate using strips of sheet polyethylene each with a length of 142 inches (3.61 m) and a width equal to cell depth.

b. Connect strips using full depth ultrasonic spot-welds aligned perpendicular to the longitudinal axis of strip.

c. Ultrasonic weld melt-pool width shall be 1.0-inch (25 mm) maximum.

d. Weld spacing for GW30V cell sections shall be 17.5 inches plus or minus 0.10 inch (445 mm plus or minus 2.5 mm).

E. Cell Seam Strength Tests

1. Minimum seam strengths are required by design and shall be reported in test results. Materials submitted with average or typical values will not be accepted. Written certification of minimum strengths must be supplied to the engineer at the time of submittals.

2. Short-Term Seam Peel-Strength Test

a. Cell seam strength shall be uniform over full depth of cell.

b. Minimum seam peel strength shall be 480 lbf (2,130 N) for 6-inch (150 mm) deep panels.

3. Long-Term Seam Peel-Strength Test

a. Conditions: Minimum of 7 days in a temperature-controlled environment that undergoes change on a 1-hour cycle from room temperature to 130 °F (54 °C).

b. Room temperature shall be in accordance with ASTM E41.

c. Test samples shall consist of two, four-inch (100 mm) wide strips welded together.

d. Test sample consisting of two carbon black stabilized strips shall support a 160-pound (72.5 kg) load for test period.

4. Internal Junction Efficiency

a. Internal junction efficiency (seams) shall be determined as a ratio of junction performance to perforated strip performance, as determined by EN ISO 10319 and EN ISO 13426.

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b. Internal junction efficiency (factor of safety) shall be calculated for peel, shear and separation.

c. Minimum internal junction efficiency shall be ≥ 100 percent.

5. Mechanical Junction Efficiency

a. Mechanical junction efficiency (panel to panel connection) shall be determined as a ratio of junction performance to perforated strip performance, as determined by EN ISO 10319 and EN ISO 13426.

b. Mechanical junction efficiency (factor of safety) shall be calculated for peel, shear and separation.

c. Minimum mechanical junction efficiency shall be ≥ 100 percent.

d. Panel connection device shall be with integral components as designed by the Manufacturer.

6. 10,000-hour Seam Peel Strength Certification

a. Provide data showing that the high-density polyethylene resin used to produce the geocell sections has been tested using an appropriate number of seam samples and varying loads to generate data indicating that the seam peel strength shall survive a loading of at least 209 lbf (95 kg) for a minimum of 10,000 hours.

2.3 INTEGRAL COMPONENTS

A. ATRA® Stake Clip

1. The stake clip is a molded, high-strength polyethylene device available in standard (0.5 inch) and metric (10–12 mm) versions.

2. Stake clips shall be installed as an end cap on No. 4 (0.5 inch) and metric (10–12 mm) steel rebar to form ATRA® Anchors.

B. ATRA® Key

1. The keys shall be constructed of polyethylene and provide a high strength connection with minimum pull-through resistance of 275 lbs (125 kg).

2. Keys shall be used to connect sections together at each interleaf and end-to-end connection.

3. The keys include a structurally reinforced handle and frictional barbs to enhance interlock with the textured wall surface to prevent mechanical joint failure including peel, shear and separation.

4. Metal staples, zip ties, and two-piece connectors are not an acceptable panel connection method.

2.4 STAKE ANCHORAGE

A. ATRA® Anchors

1. Anchors shall consist of No. 4 (0.5 inch) or metric (10–12 mm) steel reinforcing rod with a stake clip attached as an end cap.

2. Anchors shall be assembled by inserting the stake clip onto the rebar so that the end is flush with the top of the stake clip. Prior to attaching the stake clip, the rebar shall be beveled and free from all burrs.

3. The anchor length and placement shall be as shown in the Contract Documents.

2.5 INFILL MATERIALS

A. Infill material shall be crushed aggregate with a maximum particle size of one-third cell depth.

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B. Infill material shall be free of any foreign material.

C. Clays and silts are not acceptable infill material.

D. Infill material shall be free-flowing and not frozen when placed in the sections.

2.6 ADDITIONAL COMPONENTS

A. Geotextile

1. The enhanced woven geotextile separation layer shall be as specified in the Contract Documents.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify site conditions are as indicated on the drawings. Notify the Engineer if site conditions are not acceptable. Do not begin preparation or installation until unacceptable conditions have been corrected.

B. Verify layout of structure is as indicated on the drawings. Notify the Engineer if layout of structure is not acceptable. Do not begin preparation or installation until unacceptable conditions have been corrected.

3.2 INSTALLATION

A. Prepare subgrade and install load support system in accordance with Contract Documents and manufacturer's installation guidelines.

B. On-site time for installation assistance by the Manufacturer’s field representative shall be a minimum of a 1 day with one trip. All travel and expense costs for field representative installation observation shall be included in the base bid price.

C. Subgrade Preparation

1. Excavate and shape sub grade in accordance with the Contract Documents.
2. Ensure foundation soil meets minimum strength requirements through proof rolling or other conventional method and is approved by the Engineer. If unacceptable foundation soils are encountered, excavate and replace with suitable quality material as directed by the Engineer.
3. Install geotextile separation layer in accordance with the Contract Documents and manufacturer’s recommendations including overlaps based on sub grade CBR.

D. Subbase Preparation and Installation

1. Ensure that the subgrade soil meets the minimum strength requirements for installation of the subbase.
2. Place additional subbase materials to the required depth as specified in the Contract Documents.
3. Compact to a minimum 95 percent Standard Proctor.
4. Install geotextile separation layer on top of subbase ensuring required overlaps are maintained and outer edges of the geotextile are buried in accordance with the Manufacturer’s recommendations.

E. Section Anchorage and Connection

1. Anchorage requirements shall be as shown on the Contract Documents.
2. Anchorage shall be provided by ATRA anchors.
3. After the sections are expanded, drive anchors so the arm of the stake clip engages with the top of the cell wall.

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4. Connect the sections with keys at each interleaf and end-to-end connection. Insert the key through the cell wall I-slot before inserting through the adjacent cell. Turn the key 90 degrees to lock the sections together.
5. Anchorage pattern and stake length shall be as specified in the Contract Documents.

F. Aggregate Infill Placement

1. Place infill in expanded cells with suitable material handling equipment.
2. Infill material shall be free-flowing and not frozen when placed into the sections.
3. Overfill cells and compact to provide a minimum 2-inch wear surface. Maintain the wear surface over the sections to prevent damage to the cell walls.
4. Limit the drop height to prevent panel distortion.
5. Compact as specified in the Contract Documents.
6. Surface protection shall be provided and installed in accordance with the Contract Documents.

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Appendix A

Short-Term Seam Strength Test Procedure

Frequency of Test

The short-term seam peel strength test (referred to as the 'test' in this section) shall be performed on a geocell section randomly taken directly from the production line each two hours.

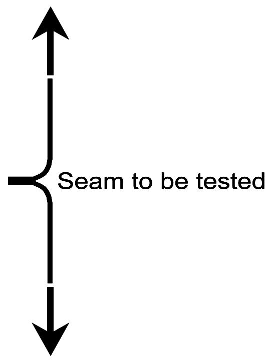

Figure A1

Test Sample Preparation

Randomly choose 10 welds within the selected section and cut those welds from the section such that 10 cm (4 in) of material exist on each side of the weld. The test sample shall have a general appearance as illustrated in Figure A1. Prior to testing, the test samples shall have air cool for a minimum of 30 minutes from the time the selected geocell section was manufactured.

Short-term Seam Peel Strength Test

The apparatus used for testing the short-term seam peel strength shall be of such configuration that the jaws of the clamp shall not over stress the sample during the test period. Load shall be applied at a rate of 12 in (300 mm) per minute and be applied for adequate time to determine the maximum load. The date, time and load shall be recorded.

Short-term seam peel strength shall be defined as the maximum load applied to the test sample. Minimum required short-term seam peel strength shall be:

- 640 lbf (2840 N) for the 8 in (200 mm) depth cell
- 480 lbf (2130 N) for the 6 in (150 mm) depth cell
- 320 lbf (1420 N) for the 4 in (100 mm) depth cell
- 240 lbf (1060 N) for the 3 in (75 mm) depth cell.

Definition of Pass / Failure

Two methods shall be used to determine acceptability of the manufactured geocell sections. The successful passing of the short-term seam peel test shall not be used to determine acceptable of the polyethylene for use in manufacturing of the geocell sections. Acceptability of the polyethylene shall be determined through tests conducted in Appendix B.

The Tested Value

If more than one of the tested seam samples fails to meet the minimum peel strength, all sections manufactured after the previously successful test shall be rejected.

If all tested seam samples meet the minimum peel strength, all geocell sections manufactured since the last successful test shall be considered to have passed the test.

When one of the tested seam samples fails to meet the minimum peel strength, another 10 samples shall be randomly selected and cut from the previously selected section. If more than one of these samples fails, all sections manufactured after the previously successful test shall be rejected. Otherwise, all geocell sections manufactured since the last successful test shall be considered to have passed the test.

Visual Failure Mode

After each sample is tested, the seam shall be examined to determine the failure mode. Two failure modes are possible.

- Material failure within and adjacent to the weld indicated by material strain and
- Weld failure resulting in complete separation of the seam and shows little or no material strain.

Upon examination, when the failure mode results in complete separation of the seam and indicates little or no material strain, product manufactured shall be rejected.

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Appendix B
Long-Term Seam-Strength Test Procedure

Frequency of Test

The long-term seam peel strength test (referred to as the 'test' in this section) shall be performed:

1. On each new resin lot number if the geocell manufacturer extrudes the sheet or strip used to produce the geocell material.

2. On each new order of sheet and/or strip if the geocell manufacturer does not extrude the sheet and/or strip used to produce the geocell material.

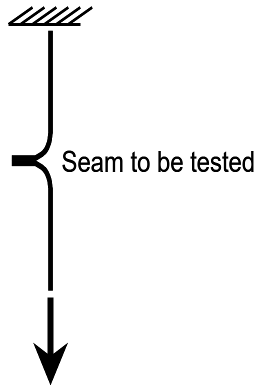

Figure B1

Test Sample Preparation

A test sample shall be made using two sets of two strips meeting all aspects of the material portion of this specification. Testing shall be done on non-perforated samples to obtain the true seam strength of the bond. One set of two strips are to be welded in welder position "A" and the other set of two strips are to be welded in welder position "B" producing two 1-cell long sections of geocell product. Welding should be done using a warm welder. The welded samples shall be labeled "A" and "B" and the weld seams of each sample shall be numbered consecutively from left to right starting with the number 1 (one) and corresponding to the welding head number.

The samples shall air cool for a minimum of 30 minutes. Randomly choose 10 welds from samples "A" and "B" and cut those welds from the geocell samples such that 4 in (10 cm) of material exist on each side of the weld. These samples shall be cut to a width of 4 in (10 cm). Properly identify each weld using the sample letter and weld seam number.

These samples are now ready to be tested.

Long-term Seam Peel Strength Test

The long-term seam peel strength test shall take place within an environmentally controlled chamber that undergoes temperature change on a 1-hour cycle from room temperature to 130°F (54°C). Room temperature shall be defined per ASTM E41.

Within the environmentally controlled chamber, one of the ends of the samples (10 samples in total) shall be secured to a stationary upper clamp. The jaws of the clamp shall be of such configuration that the grip does not over stress the sample during the test period. The sample shall be secured so that its axis is vertical and the welds being tested are horizontal as the sample hangs within the environmentally controlled chamber.

A weight of 160 lb (72.5 kg) shall be lifted via a hoist or lift platform and attached to the free lower end, of the sample. The weight shall be lowered in a way so that no impact load occurs on the sample being tested. The weight shall be sufficient distance from the floor of the chamber so that the weight will not touch the floor of the chamber as the sample undergoes creep during the test period. The date and hour the weight is applied shall be recorded.

The temperature cycle shall commence immediately within the environmentally controlled chamber. The test period for the applied load shall be 168 hours.

Definition of Pass / Failure

If any of the 10 seams fail prior to the end of the 168-hour (7-day) period, the date and hour of the failure shall be recorded and the polyethylene resin and strip material shall be considered unsuitable for geocell manufacturing.

END OF SECTION

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October 23, 2024

Brian Chlebus
TETRA TECH, INC
6715 Tippecanoe Rd, Suite C201
Canfield, OH 44406

RE: PR24626 TIOGA PATHWAY
Load Support System

Dear Brian:

Presto Geosystems has completed the evaluation for the Tioga Pathway Load Support System project. Our recommendations are provided and detailed in the attached cross section and calculation. The evaluation is copyrighted and based on the unique engineering properties of GEOWEB® system. Any use of this evaluation for any product other than that manufactured by Reynolds Presto Products, Inc. makes this evaluation invalid.

The objective of this evaluation is to propose a GEOWEB geocell system for stabilization of the base.

As the originator and leader in geocell technology, Presto Geosystems offers the following advantages:

- Manufacturer Certificate of Analysis. Presto Geosystems manufactures GEOWEB, ATRA® keys and ATRA Stake Clips in accordance with stringent ISO and CE quality standards. Our quality management system allows Presto Geosystems to provide Certificates of Compliance (COC) and Certificates of Analysis (COA) that allow traceability on all materials produced and supplied for this project. We do not provide geocell materials through private label manufacturers, which is often the case with our competitors. The ability for the Owner to receive COC and COA for geocell is critical to the integrity of the project.

- Manufacturer Calculations. The attached calculations are based specifically on GEOWEB material characteristics, research/testing and accessories. Our calculations are based on the site-specific characteristics and information contained in the request for project evaluation. The recommendations are based on GEOWEB panels, ATRA key connection device and ATRA stake clips. The anchorage recommendations are specific to our product and DO NOT apply to any other geocell manufacturers.

- ATRA Key connection device. ATRA keys provide a permanent and stronger panel connection compared to metal staples or zip ties. ATRA keys are made of high-density polyethylene and are the strongest method available for panel connection. ATRA keys will not corrode or degrade and provide a permanent connection. ATRA keys were used to determine the anchorage recommendations. If a different connection device is proposed, the Presto Geosystems recommendation does not apply. ATRA keys allow multiple panels to be installed concurrently decreasing installation time and preventing panel separation during installation and compaction. Panel separation may occur with metal staples or zip ties during installation, which can lead to long-term maintenance issues.

- Installation Assistance. Representatives of Presto Geosystems, or the local distributor, are available to be on-site at the beginning of construction to ensure that the GEOWEB panels and accessories are installed as intended. We are committed to train the Contractor based on our in-depth product knowledge and installation experience. Our past project success will minimize installation time and issues. As with any material, there are advantageous techniques of installation, which we can offer during our visit.

Assumptions and Materials

It is our understanding that the relevant dimensions of the area, for the purpose of this analysis, are as follows:

Parameters:

CBR, %	3.0
Type of Sub Grade	Native
Vehicle	
Type	Construction Vehicles
Wheel Loading, lbs	20,000
Tire Pressure, psi	125
Infill Friction Angle ϕ, degree	30
Infill Type	Crushed Aggregate
Infill Weight γ, lbs/ft^3	120

Based on the evaluation, the following materials are recommended for the GEOWEB application at the site.

1. Prepare sub grade to a minimum CBR of 3.0%.
2. Provide a Mirafi HP270 enhanced woven geotextile separation layer on top of the sub grade and install in accordance with Manufacturer instructions including overlaps based on sub grade CBR.
3. Provide GEOWEB GW30V6 (6-inch) panels filled with suitable material.
4. Pre-shape the GEOWEB panels before infill placement.
5. Connect the GEOWEB sections with ATRA Keys at each interleaf and end-to-end connection.
6. The GEOWEB infill and wear surface can be washed #57 limestone.
7. Limit the drop of infill into the GEOWEB panels to prevent distortion.
8. Overfill GEOWEB panels and compact to provide a minimum 2-inch wear surface.
9. Refer to the GEOWEB Load Support Installation Guide for installation procedures.

For additional Load Support Resources, click here:
Load Support Engineering Resource Package
GEOWEB Load Support Installation Guide

If you have any questions or need any additional information, please call.

Sincerely,

Sam Justice

Sam Justice, P.E.
Civil Engineer
Presto Geosystems

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Product Specification - GEOWEB® GW30V6 Geocell

GENERAL

The GEOWEB A1geocell product is manufactured from textured, perforated strips of high density polyethylene that are bonded together to create a network of interconnected cells. The cells can be filled with topsoil, aggregate, concrete, recycled materials, or other infill material for geotechnical applications such as: 1) load support for unpaved and paved roads, railways, ports, heavy-duty pavements, container yard, and pads; 2) gravity and reinforced walls, reinforced slopes and fascia walls; and, 3) slope, channel, and geomembrane protection.

DIMENSIONS

Parameter	Units	Value
Cell Depth	Inches (mm)	6 (150)
Cell Size (Length x Width +/- 10%)	Inches (mm)	11.3 x 12.6 (287 x 320)
Expanded Section Width	Cells	8
	Feet (m)	Varies: 7.7 to 9.2 (2.3 to 2.8)
Expanded Section Length	Cells	18, 21, 25, 29, or 34
	Feet (m)	Varies: 15.4 to 35.1 (4.7 to 10.7)

STRUCTURAL INTEGRITY AND SYSTEM PERFORMANCE

Parameter	Units	Value
Minimum Short-Term Seam Peel Strength	lb (N)	480 (2,130)
Long-Term Seam Peel Strength (standard 4-inch sample width)[1]	lb (N)	160 (710)
Internal Junction Efficiency[2]	%	≥ 100
Mechanical Junction Efficiency (ATRA Key Connection)[2]	%	≥ 100
Peak Friction Angle Ratio (δ/Ø)[3]	Unitless	0.95

MATERIAL PROPERTIES

Parameter	Test Method	Units	Value
Polymer Density	ASTM D1505 or D792	lbs/ft^3 (g/cm^3)	58.4 - 60.2 (0.935 - 0.965)
Flexural Storage Modulus	ISO 6721	Mpa	≥ 800
Carbon Black Content[4]	ASTM D1603	%	1.5 - 2.0
Sheet Thickness Prior to Texture	ASTM D5199	mil (mm)	50 (1.27), -5% +10%
Sheet Thickness After Texture	ASTM D5199	mil (mm)	60 (1.52), -5% +10%
Texture Surface Density	--	per/in2 (per/m^2)	140 - 200 (22 - 31)

DURABILITY

Parameter	Test Method	Units	Value
Environmental Stress Crack Resistance	ASTM D1693	hrs	> 5,000
Environmental Stress Crack Resistance (Accelerated Test)	ASTM D5397	hrs	≥ 400
Resistance to Oxidation[5]	EN ISO 13438	yrs	≥ 100
Resistance to Weathering[6]	EN 12224	%	100

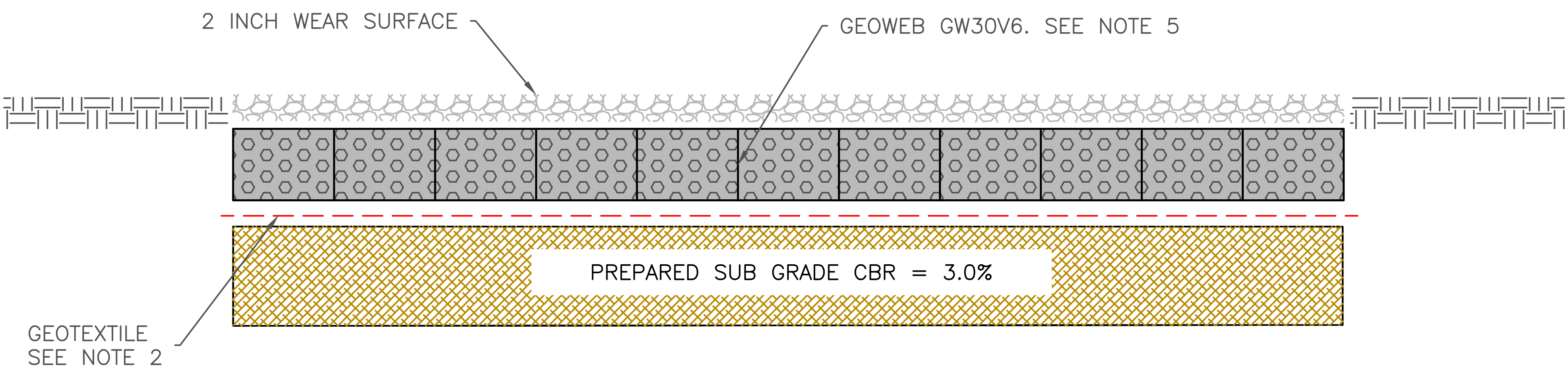
Notes:

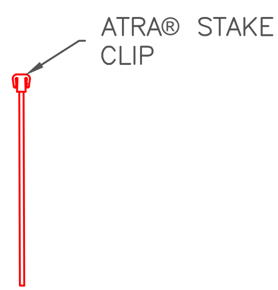
1) A 4 in. (100-mm) wide seam sample shall support a 160 lb (72.5 kg) load for a period of 7 days minimum in a temperature-controlled environment undergoing a temperature change on a 10 hour cycle from ambient room to 130° F (54°). Ambient room temperature is per ASTM E 41.
2) Junction efficiency determined as a percentage of junction performance (EN ISO 13426-1) to perforated strip performance (EN ISO 10319).
3) Typical design value for granular infill material. Consult with manufacturer to confirm value for other types of infill materials.
4) Standard black HDPE strips. For tan/green GEOWEB, hindered amine light stabilizer (HALS) content will be 2.0% by weight of carrier.
5) Predicted to be durable for a minimum of 100 years in natural soil with a pH between 4 and 9 and at a soil temperature ≤ 25°C.
6) 100% of original tensile strength retained following exposure to 370 hours of ultraviolet light and accelerated weathering in accordance with EN 12224.

CE 2895 | 23 UK CA 0338 | 23
ISO 9001:2015 Certified

Notes:

1. This evaluation is copyrighted and is based on the use of GEOWEB® manufactured by Reynolds Presto Products, Inc. All rights reserved. Any use of this evaluation for any geocell product other than that manufactured by Reynolds Presto Products, Inc is strictly prohibited and makes this evaluation invalid.
2. Provide a Mirafi HP270 enhanced woven geotextile separation layer and install per Manufacturer recommendations including overlaps based on sub grade CBR.
3. The Geoweb panels shall be connected with ATRA® keys at each interleaf and end to end connection.
4. Provide ATRA Anchors to keep panels open for infill as required.
5. Geoweb infill shall be washed #57 limestone. Overfill the GEOWEB panels and compact to provide a minimum 2-inch wear surface.
6. Limit the drop of infill to prevent panel distortion.
7. Refer to the Geoweb Load Support Installation Guide for installation procedures.





ATRA ANCHOR

ATRA KEY

REYNOLDS PRESTO PRODUCTS, INC
670 NORTH PERKINS STREET
APPLETON, WI 54914
920-738-1342
WWW.PRESTOGEO.COM

PR24626 TIOGA PATHWAY
GEOWEB LOAD SUPPORT

DATE	OCTOBER 23, 2024	FILE NAME	SHEET 1
SCALE	NTS	SHEET	1 OF 1

STRESS REDUCTION USING THE GEOWEB SYSTEM

PROJECT	PR24626 TIOGA PATHWAY	DATE 10/23/24

					The Geoweb System Benefit			
Layer Type	Layer Thickness (in)	Depth from Surface (in)	Radius of Loaded Area (in)	Stress at Bottom of Layer (psi)	Vertical Stress (psi)	Horizontal Stress (psi)	Stress Reduction (psi)	New Stress under Geoweb (psi)
Surface		0.00	7.14	125.00				
Wear Surface	2.00	2.00		122.54				
Geoweb Layer	6.00	8.00		73.06	97.80	32.60	22.36	50.70
Aggregate	0.00	8.00		50.70				
2nd Geoweb Layer	0.00	8.00		50.70	50.70	16.90	0.00	50.70
Aggregate	0.00	8.00		50.70				
Geotextile		8.00		50.70				

Geoweb	Cell Size	Diameter, in	Depth (in)
	GW30	9.50	6.00

Geoweb Infill	Type	Unit Weight (lb/ft^3)	Friction Angle	Added Stress (psi)
Properties	Gravel	120	30	0.56

Below Geoweb	Depth (in)	Unit Weight (lb/ft^3)	Shear Strength (psi)	Reduced Stress (psi)	Other Properties: CBR	Other Properties: R Value	K Value, psi/in
Excavation	8.00	0					
Subgrade			13.02	0.00	3.0%	6.03	100

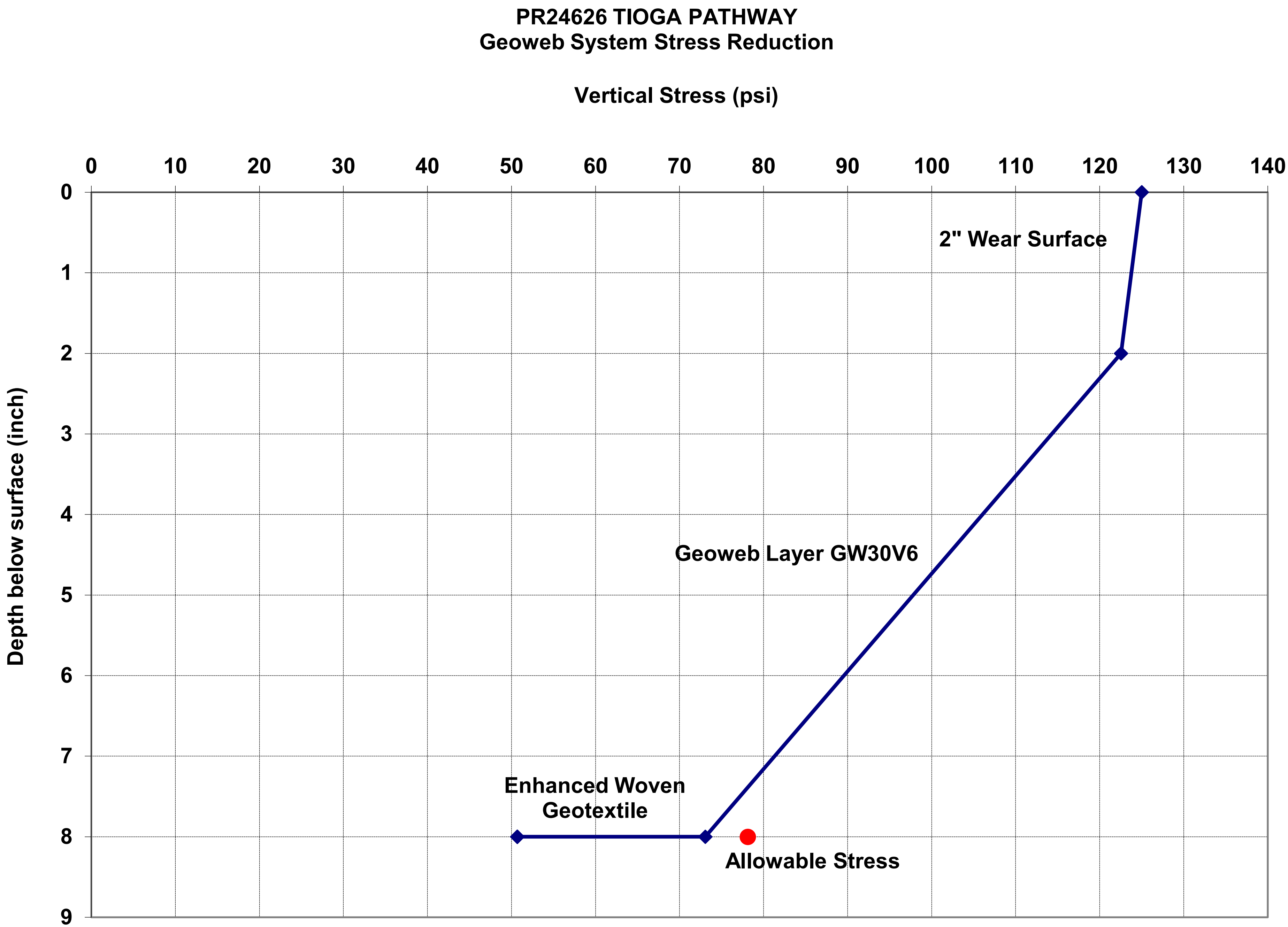
Required Calculation Data					
Wheel Load (lbf)	20,000	AASHTO H/HS25 Loading			
Tire Pressure (psi)	125				
Distribution Angle	45.00	H = 0	V = 0	OR	Angle = 45
% Frictional Interaction	95.0%				
Geotextile Type	Enhanced Woven				
Bearing Capacity Coefficient (N_c)	6.00				
Factor of Safety	1.30				

Calculation Results		
Distributed Stress on Subgrade per Calculation, $Q_{distributed}$ (psi)	51.25	
Allowable Subgrade Stress, $Q_{allowable}$ (psi)	78.12	
Calculated Factor of Safety	1.52	Acceptable

Hoop Stress Check (Genuine Geoweb® Mechanical Properties)

Perforated Cell Wall:	9.50	FoS, Cell Wall Rupture	✓		
Internal Junctions (Seams):	12.92	FoS, Resistance to Peel	✓	Hoop Stress (psi):	103.23
	19.37	FoS, Resistance to Shear	✓	Hoop Tension (lb):	37.16
	15.34	FoS, Resistance to Separation	✓		
Mechanical Junctions (ATRA Key):	3.82	FoS, Resistance to Peel	✓		
	6.86	FoS, Resistance to Shear	✓		
	5.19	FoS, Resistance to Separation	✓		
Results:	System Components Meet Project Requirements				

Limitation of Use:



PR24626 TIOGA PATHWAY
Geoweb System Stress Reduction
Vertical Stress (psi)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
Depth below surface (inch)
0
1
2
3
4
5
6
7
8
9
2" Wear Surface
Geoweb Layer GW30V6
Enhanced Woven Geotextile
Allowable Stress

Justice, Sam M.

From: projectevaluation@info.prestogeo.com
Sent: Tuesday, October 22, 2024 4:00 PM
To: Wedin, Bryan S.; Schneider, Cory S.; Bouchard, Katie L.; Armstrong, Lauren P.; Beyer, Ashley J.; Vander Linden, Jennifer A.; George, Jp P.; Justice, Sam M.; Petersmark, Lisa E.
Subject: New submission from Free Project Evaluation :

Contact Name
Brian Chlebus

Company Name
Tetra Tech, Inc.

Email
brian.chlebus@tetratech.com

Phone Number
330-406-6118

Street Address
6715 Tippecanoe Road, Suite C201

City
Canfield

State or Province
Ohio

Zip or Postal Code
44406

Country
USA

Relationship with Project
- Consulting Engineer

Did you speak with a Presto Distributor/Rep about your project?
- No

Project Name
Tioga Pathway

Project City
Westfield

Project State or Province
PA

Project Country
USA

Estimated GEOWEB Area
35000 ft2 (max.)

Units of Measure for GEOWEB Area

Standard

Describe problem to be solved by the GEOWEB system

GEOWEB will be installed within the gravel paving section of three (3) separate valve sites and a gravel access road proposed for construction as part of a pipeline project. Assuming GEOWEB GW30V6 geocell. Purpose of the GEOWEB is reinforcement of the gravel paving section and stormwater management. Specifically, the GEOWEB backfill will be a clean No 57 limestone aggregate with void space that will retain a specific runoff volume for infiltration. The sample valve site provided will be the only location requiring earthwork - the other locations are, generally, at existing grade with minimal grading needed.

Project Evaluation Needed By

November 1, 2024, or as soon as possible

Projected Bid Date

TBD

Planned Construction Startup

2026

Units of measure for this section

Standard

For what is the load support structure used?

Construction Access

What is the final wearing surface of the Load Support System?

Aggregate Surface

Description

channery silt loam

What is the subgrade soil strength? (Enter at least one value.)

- California Bearing Ratio (CBR) Value (%)

Please enter value(s) of chosen method(s)

3

Unit Density

89 lb/ft3

Angle of Internal Friction

38

What is the planned underlayment?

- Non-Woven Geotextile

Type

permeable

Upload Files (Max 3 files, 3 mb each. File types pdf, doc, docx, dwg, jpg)

- sample-valve-site.JPG

Check the box to accept our privacy agreement.

Yes, I agree to the terms and conditions.

ATTACHMENT 5

PCSM/SR PLAN DRAWINGS