MOTT MACDONALD

PennEast PIPELINE

Mainline Block Valve (MLV) 7 Post Construction Stormwater Management Report

PennEast Pipeline Project

Date: October 2019

PennEast Pipeline Project
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0	12/2018	D. Harzinski	M. Clark	M. Wilcox	Issued for PADEP
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1 Executive Summary

PennEast proposes to construct, install and operate the Project facilities to provide approximately 1.1 million dekatherms per day (MMDth/d) of year-round transportation service from northern Pennsylvania to markets in New Jersey, eastern and southeastern Pennsylvania and surrounding states. The Project is designed to provide a long-term solution to bring the lowest cost natural gas available in the country, produced in the Marcellus Shale region in northern Pennsylvania, to homes and businesses in New Jersey, Pennsylvania and surrounding states.

The Project facilities include a 36-inch diameter, 115-mile mainline pipeline, extending from Luzerne County, Pennsylvania, to Mercer County, New Jersey. The Project will extend from various receipt point interconnections in the eastern Marcellus region, including interconnections with Transcontinental Gas Pipe Line Company, LLC (Transco) and gathering systems operated by Williams Partners L.P., Energy Transfer Partners, L.P. (formerly Regency Energy Partners, LP), and UGI Energy Services, LLC in Luzerne County, Pennsylvania, to various delivery point interconnections in the heart of major northeastern natural gas-consuming markets, including interconnections with UGI Central Penn Gas, Inc., (Blue Mountain) in Carbon County, Pennsylvania, UGI Utilities, Inc. and Columbia Gas Transmission, LLC in Northampton County, Pennsylvania, and Elizabethtown Gas, NRG REMA, LLC, Texas Eastern Transmission, LP (Texas Eastern) and Algonquin Gas Transmission, LLC (Algonquin) in Hunterdon County, New Jersey. The terminus of the proposed PennEast system will be located at a delivery point with Transco in Mercer County, New Jersey.

This report provides an engineering analysis of the stormwater management practices for the MLV-7 site, which is a part of the PennEast Pipeline Project. The methods of analysis included use of the stormwater modeling software Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2019 by Autodesk, Inc., Rational Method Calculations, and the associated PADEP BMP worksheets. The methods of analysis were used to demonstrate the meeting of the proposed requirements for the following facilities:

- Infiltration trench
- Vegetated Swale

The resulting data for the stormwater facilities can be found in Section 4 and in the appendices. The completed model and worksheets show that the post-construction stormwater runoff does not exceed the pre-construction stormwater flows and that the volume requirements are met. The report shows that the proposed stormwater BMPs for the MLV-7 site for the PennEast pipeline will allow the proposed project to comply with the applicable regulatory requirements under Pennsylvania Code Section 102.8, and the applicable Act 167 requirements.

2 Introduction/Overview

The PennEast Pipeline Project was developed in response to market demands in New Jersey and Pennsylvania, and interest from shippers that require transportation capacity to accommodate increased demand and greater reliability of natural gas in the region. The Project will include a new pipeline and above ground facilities that will provide a new source of natural gas supply from the Marcellus Shale producing region to New Jersey and Pennsylvania.

The Mainline Block Valve (MLV) 7 site is located in Upper Nazareth Township in Northampton County, PA. (See Figure 1 for a Location Map and Appendix I for PCSM Plan). The MLV 7 site is being developed as a mainline valve site that will include: the mainline piping (located below grade), the mainline valve (located below grade), the actuator for the mainline valve, two risers with blow off piping, bypass piping between the blow offs, and a RTU panel with communications capabilities. The proposed site will include the block valve and supporting equipment on a gravel pad. Stormwater management facilities are proposed to meet the regulatory requirements for this type of development.

3 Regulatory Compliance

Regulatory jurisdiction over stormwater runoff from the MLV-7 site is the responsibility of the Pennsylvania Department of Environmental Protection (PADEP), under Title 25 – Environmental Protection, Chapter 102 Erosion and Sediment Control, Section 102.8 – Post-Construction Stormwater Requirements. This Post-Construction Stormwater Management Plan fulfills part of the requirements of the Erosion and Sediment Control General Permit (ESCGP-3).

The following paragraphs present each requirement of Pennsylvania Code Section 102.8, incorporating the requirements of Act 167 where applicable, and indicates how they will be addressed. Regulatory requirements are shown in **bold**, and the compliance method is shown in *italics*.

3.1 Post-Construction Stormwater Management Plan General Requirements

(b) General PCSM planning and design. The management of post construction stormwater shall be planned and conducted to the extent practicable in accordance with the following:

This site is subject to the requirements of the Northampton County Act 167 Watershed Management Plan, which imposes stricter requirements than item (g)(2) of Pennsylvania Code Section 102.8. Volume control must be provided as the larger of the difference between the post-development and pre-development 2-year runoff volume, or 1.25 inches of precipitation over the site area based on the rational Method. The post development peak runoff rate must not exceed pre-development peak runoff rate under any storm condition. Volume and peak flow requirements of the Act 167 Plan have been met, with the objective to preserve the integrity of stream channels and the receiving stream. This site is not under the requirements of the Lehigh Valley Planning Commission Act 167 Stormwater Management Plan as it is less than 10,000 SF in disturbance.

(1) Preserve the integrity of stream channels and maintain and protect the physical, biological and chemical qualities of the receiving stream.

One of the objectives in minimizing changes in runoff volume and rate of runoff flow is to preserve the integrity of stream channels and any receiving streams. There are no stream channels within 150 feet of the site. Under existing conditions, offsite stormwater runoff flows overland across the site in the south direction. Under proposed conditions, the site runoff will be conveyed overland to the subsurface infiltration trench within the site. Offsite flow will be directed via a vegetated swale to an inlet and conveyed around the site to an exiting drainage ditch. Onsite stormwater will be attenuated and then discharged over a weir and flow overland to the existing drainage ditch in order to preserve existing drainage patterns and preserve the integrity of the receiving watercourse. An 18" culvert will be constructed to allow for the existing roadside ditch to continue to channelize flow away from the roadway and along its natural path.

The project will eliminate the net change in stormwater volume, rate and quality for stormwater events up to and including the 2-year/24-hour storm. The project will use various structural and non-structural BMPs to meet the water quantity and quality requirements. The peak runoffs will be attenuated with an infiltration trench. The stormwater will be routed through structural and non-structural BMPs and discharged overland towards the stream which is less than 150' away from the site. However, the site is exempt from the creation of a riparian forest buffer management plan according to Chapter 102.14d from the Pennsylvania Code because the site is less than 1 acre of disturbed land. See Section 4 for compliance calculations and descriptions.

(2) Prevent an increase in the rate of stormwater runoff.

Increases in the rate of stormwater runoff are not anticipated. Stormwater management will be provided by a vegetated swale to bypass off-site flows and infiltration trench to attenuate peaks in post-development runoff. See Table 1.

(3) Minimize any increase in stormwater runoff volume.

Increases in stormwater runoff volume up to and including the 2-year storm are not anticipated. Stormwater management will be provided with an infiltration trench to provide storage and infiltration volume of post-development runoff. See Table 2.

(4) Minimize impervious areas.

The site has been designed to minimize the area of disturbance, which minimizes impervious areas. Of the 50' x 50' site area, only a smaller 30' x 30' gravel area is proposed. In addition, in lieu of asphalt, gravel has been chosen to stabilize the pad site. Any areas that are not within the gravel area will be vegetated. Site areas outside of the gravel area and infiltration trench will be maintained as meadow. The 30' x 30' gravel area has been raised above exiting grade so that off-site water is diverted around the pad. Given the limited site traffic (several vehicles a week), and the fact that equipment and concrete barriers will block vehicular access to parts of the pad site, it is anticipated that the gravel will remain pervious. However, for the gravel driveways leading up to the gravel pad and a 10' wide drive isle within the pad has been considered impervious in this analysis for regulatory purposes. The remaining gravel area has been considered pervious as it will not be compacted by vehicular traffic due to the installation of concrete barriers to prevent compaction of the gravel in these areas. The extents of the pad have been restricted to the minimum size necessary for safe and effective operation of the station.

(5) Maximize the protection of existing drainage features and existing vegetation.

Existing drainage features and vegetation have been preserved and protected to the greatest extent practicable, by limiting disturbances and limiting the extents of the project area to the minimum necessary to accomplish the project objectives.

(6) Minimize land clearing and grading.

The site layout has been designed to minimize the area of disturbance, which minimizes land clearing and grading.

(7) Minimize soil compaction.

The site has been designed to minimize the area of disturbance, which minimizes soil compaction. Heavy construction equipment will be restricted to access roads, designated laydown areas and localized work areas. Areas to be used for PCSM BMPs will be clearly identified during construction, and the contractor will be required to prevent compaction of soils in areas that are occupied or to be occupied by PCSM BMPs.

(8) Utilize other structural or nonstructural BMPs that prevent or minimize changes in stormwater runoff.

Gravel is proposed instead of asphalt in order to minimize any increase in the rate or volume of stormwater runoff from the site, and an infiltration trench (BMP) is utilized to minimize any remaining changes in stormwater runoff from pre-development to post-development.

3.1.1 Fifteen Factors of the Post-Construction Stormwater Management Plan

(f) PCSM Plan contents. The PCSM Plan must contain drawings and a narrative consistent with the requirements of this chapter. The PCSM Plan shall be designed to minimize the threat to human health, safety and the environment to the greatest extent practicable. PCSM Plans must contain at a minimum the following:

(1) The existing topographic features of the project site and the immediate surrounding area.

The proposed MLV 7 site is located in Upper Nazareth Township, in Northampton County, Pennsylvania.

The drainage area of the project site is 0.15 acres, with existing slope of approximately 0%-3%. The site generally drains from north to south and eventually discharges to the East Branch of the Monocacy Creek. See Existing Conditions figure in Appendix E for site topographic information.

(2) The types, depth, slope, locations and limitations of the soils and geologic formations.

The MLV 7 site lies within the Jacksonburg Formation, according to the Pennsylvania Department of Conservation and Natural Resources (PADCNR). The "cement rock" upper part of the Jacksonburg Formation is composed of medium- to dark-gray to black, fine-grained, fossiliferous, shaly limestone, with thin pyrite seams. It is about 830 feet thick. The "cement limestone" lower part is a medium- to dark-gray limestone that is coarsely crystalline and fossiliferous and has thin silty layers. It increases in thickness eastward, and its maximum thickness is about 375 feet. The formation is well bedded, with medium to massive beds.

Although the proposed MLV site falls within the approximate outlines of Jacksonburg Formation, it is possible that other formations or rock types could occur in the vicinity of the valve, due to the approximate nature of USGS maps.

Based on the Natural Resources Conservation Service (NRCS) Web Soil Survey, the surficial geology within the area of interest consists heavily of Clarksburg and Comly silt loam. The excerpt in Appendix C from Table E.1 in the PADEP Erosion and Sediment Pollution Control Program Manual lists the limitations of Clarksburg and Comly silt loam.

The Clarksburg silt loam is mapped as roughly 24.8% clay, 54.4% silt, and 20.8% sand. It is moderately well drained and generally consists of slopes ranging from 0%-3%. It is a part of the group C hydrologic soil group. The Comly silt loam consists of 23.7% clay, 46.7% silt, and 29.5% sand. It is moderately well drained and generally has slopes on site ranging from 0%-3%.Comly silt loam is classified as Hydrologic Soil Group C.

These limitations will be addressed through site specific testing for infiltration rates, which will serve as the basis of design for stormwater BMPs.

(3) The characteristics of the project site, including the past, present and proposed land uses and the proposed alteration to the project site.

Aerial images from 1992 depict the MLV 7 site and its surroundings as a wooded forest and as time as went on, the forest was cleared and the site has since been a meadow. There are no known wetlands located within the proposed MLV 7 site. The proposed site location exists presently as farmland and is served by Bath Pike (State Route 248). The runoff rate under the existing conditions was calculated for MLV 7 based on this site land use.

The project proposes to construct a valve access area on approximately 0.04 acres of gravel. The site will drain from north to south. The infiltration trench will be installed to comply with regulatory stormwater requirements.

(4) An identification of the net change in volume and rate of stormwater from preconstruction hydrology to post construction hydrology for the entire project site and each drainage area.

See Section 4 of this report for details on net change in volume and rate of stormwater runoff from pre-construction to post construction.

The summary of these net changes is provided in Tables 1 and 2.

Infiltration volume is provided for up to the 2-year storm, and peak runoff rate does not exceed pre-construction rates (see column 'Maximum Allowable Proposed Peak') under the 2-, 10-, 50-, and 100-year/24-hour storm events.

Table 1: Peak Flow Summary

Recurrence Interval (yrs)	Existing Site Q (cfs)	Maximum Allowable Proposed Peak Flow (cfs)	Pro**posed** Q (cfs)	Proposed Less than Allowable? (Y/N)
1	0.259	0.259	0.228	Yes
2	0.354	0.354	0.303	Yes
5	0.504	0.504	0.421	Yes
10	0.638	0.638	0.526	Yes
25	0.847	0.847	0.689	Yes
50	1.031	1.031	0.832	Yes
100	1.243	1.243	1.071	Yes

Table 2: Total Volume Summary

Recurrence Interval (yrs)	Existing Volume (cf)	Proposed Unmitigated Volume from Model (cf)	Difference between Proposed and Existing (cf)	Proposed Trench Infiltration Capacity (cf)	Adequate Infiltration Volume? (Y/N)
1	152	373	221	299	Yes
2	211	454	244	370	Yes
ACT 167 Rational Volume			156	270	Yes

(5) An identification of the location of surface waters of this Commonwealth, which may receive runoff within or from the project site and their classification under Chapter 93 (relating to water quality standards).

The site drains to East Branch Monocacy Creek, which drains to Monocacy Creek, and then Lehigh River. Chapter 93.9d from the Pennsylvania Code indicates that Monocacy Creek is classified as "HQ-CWF, MF" and there are no exceptions to specific criteria. HQ represents a High Quality Water, and CWF indicates 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. MF (migratory fishes) indicates the passage, maintenance and propagation of anadromous and catadromous fishes and other fishes which move to or from flowing waters to complete their life cycle in other waters.

The project is located within 150 feet of a perennial or intermittent river, stream, or creek, or lake, pond or reservoir in a watershed of Exceptional Value or High Quality. However, the site is exempt from the creation of a riparian forest buffer management plan according to Chapter 102.14d from the Pennsylvania Code because the site is less than 1 acre of disturbed land.

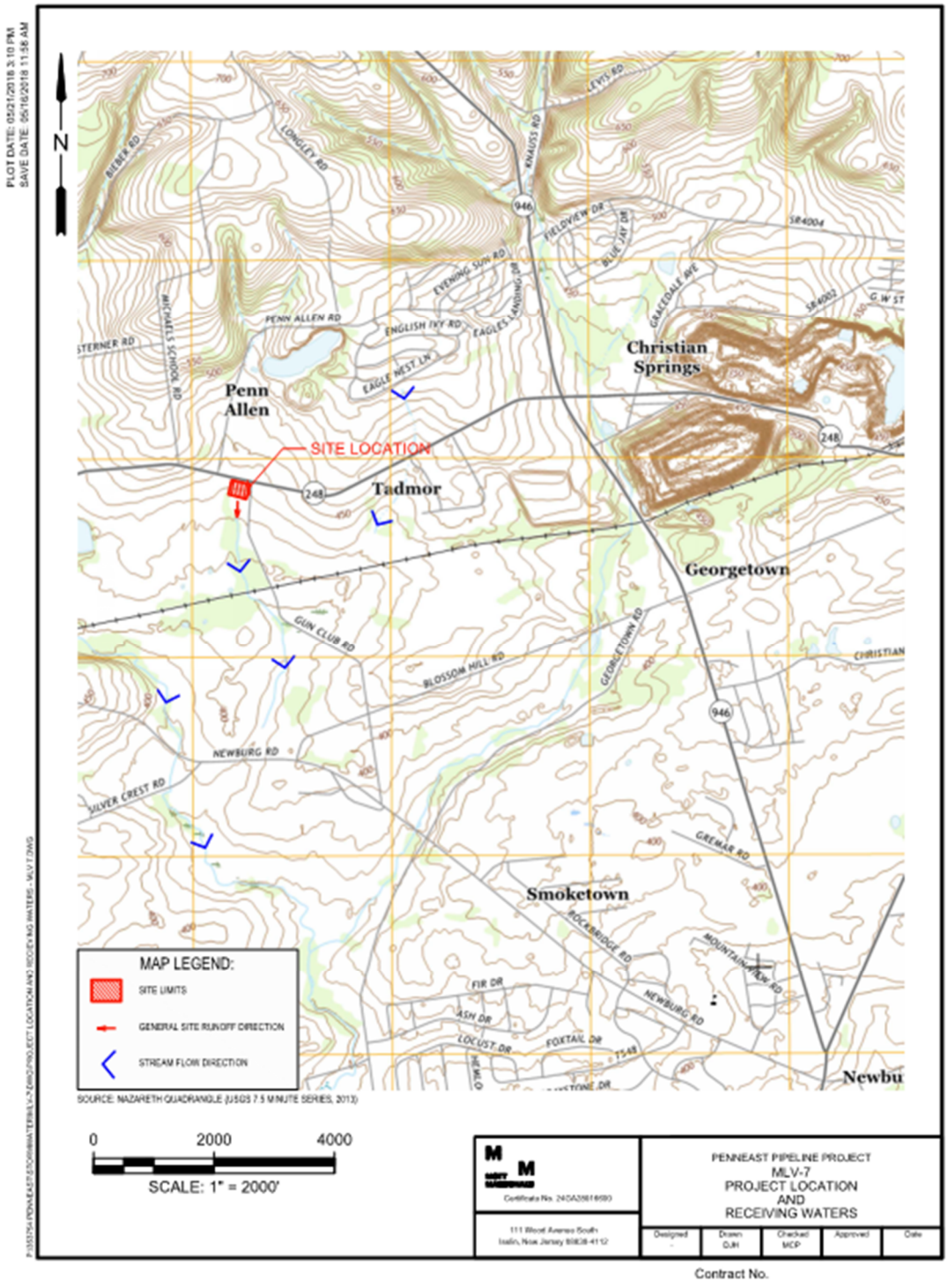

Figure 1: USGS Map showing project site and flow path to receiving waters

(6) A written description of the location and type of PCSM BMPs including construction details for permanent stormwater BMPs including permanent stabilization specifications and locations.

BMPs have been designed according to the recommendations set out in the Pennsylvania Stormwater BMP Manual, as follows:

Infiltration Trench: An infiltration trench will be constructed within the 30' x 30' gravelled pad area of the site, in order to temporarily store and infiltrate stormwater runoff. The trench temporarily stores the runoff to attenuate peak flows. The trench bottom will have an approximate base area of 900 square feet. The trench will consist of a perforated pipe and stone. The infiltration trench will be constructed on uncompacted subgrade.

Vegetated Swale: A swale is designed to collect the runoff from site and offsite areas that drain towards the proposed pad. The swale is designed in accordance with Pennsylvania BMP to divert undisturbed runoff from flowing over the gravel areas within the pad site. The swales will convey the 100-year storm event with a minimum of 6 inches of freeboard.

The recommended guideline in the PA BMP Manual is Impervious Loading Ratio of 5:1 and Total Loading Ratio of 8:1, which are achieved, see Table 3. It is also noted that the hydrologic calculations on Section 4 demonstrate that the trench performance requirements are met. Very little sediment load is anticipated as the site sees minimal vehicular. Properly implemented inspection and maintenance practices will verify the trench's performance.

Table 3: Trench Loading Ratios

ID	FLOOR AREA (ACRES)	TOTAL DRAINAGE AREA (ACRES)	INFLUENT IMPERVIOUS AREA (ACRES)	EFFECTIVE LOADING RATIO BASED ON INFLUENT TOTAL AREA	EFFECTIVE LOADING RATIO BASED ON INFLUENT IMPERVIOUS AREA
TRENCH	0.02	0.04	0.02	2	1
SWALE	0.019	0.101	0.042	5.3	2.2

In addition to structural BMPs, the follow non-structural PCSM BMPs are employed on the site:

- *The site has been designed to minimize the area of disturbance, which minimizes impervious areas, and the extents of the gravel pad have been restricted to be minimum necessary for safe, effective operation of the station. Gravel was selected in lieu of asphalt for the pad area, the extents of the gravel were limited where possible to align with BMPs 5.7 – Reduce Impervious Cover.*
- *Existing drainage features and vegetated areas (forests and open space) have been preserved where possible and protected to the greatest extent practicable. By maintaining natural cover, runoff volume and peak flow increases are mitigated. Grading has been minimized, as previously discussed in accordance with BMP 5.6.1 Minimized Total Disturbed Area – Grading.*
- *In accordance with BMP 5.6.2 – Minimized Soil Compaction in Disturbed Areas, the site has been designed to minimize the area of disturbance, which minimizes soil compaction. Care will be taken to prevent the use of heavy machinery on stormwater BMPs and on areas of the site not being developed; the contractor will be required to prevent compaction of soils in areas that are occupied or to be occupied by PCSM BMPs.*

See the Post-Construction Stormwater Management Plan drawing for location of subsurface infiltration trench on site and construction details of infiltration trench*, vegetated swale, outlet control structure, level spreader, and inlet.*

(7) A sequence of PCSM BMP implementation or installation in relation to earth disturbance activities of the project site and a schedule of inspections for critical stages of PCSM BMP installation.

BMP construction and inspections will be performed based on recommendations from the Pennsylvania Stormwater BMP Manual. The overall sequence of BMP construction is as follows:

1. At least seven (7) days before starting any earth disturbance activities, the owner and/or operator shall notify the PADEP by either telephone or certified mail of the intent to commence earth disturbance activities. Attendance at a pre-construction conference is required upon request of the PADEP.
2. At least three (3) days before starting any earth disturbance activities, contractors involved in those activities shall notify the Pennsylvania One Call system at 1-800-242-1776 to determine the location of existing underground utilities.
3. Install the rock construction entrance.
4. Confirm compost filter sock placement of any proposed disturbed/excavated area and stockpiles.
5. Perform clearing and grubbing to those area described in each stage of work. Remove excess topsoil from the limits of disturbance and stockpile off-site. The contractor is responsible for ensuring that any off-site waste areas have an E&SC plan approved by the local conservation district or PADEP prior to being activated. Snow fencing shall be installed to prevent compaction of infiltration areas.
6. The stone base and sub-surface infiltration facility shall be installed, care shall be taken to prevent sediment laden runoff from entering the stone infiltration base. The Engineer shall inspect the sub-surface infiltration facility prior to backfilling around it.
7. Perform grading activities detailed by proposed grading, notes, and details shown on the plan drawings. Per project specifications, additional temporary placement of compost filter sock may be necessary at the contractor's discretion, should accelerated erosion be observed during grading activities. Install subsurface stormwater infiltration system during bulk filling operations.
8. Construct pad and facilities according to specifications within these plan sheets including stabilization measures. Once the site has been stabilized, grading shall be brought to final elevations.
9. Areas with minor soil compaction shall be ripped to a depth of 8″ and areas of major compaction shall be ripped to a depth of 20″. No ripping shall take place in the vicinity of the mainline piping or other underground utilities.
10. Place topsoil in areas to be vegetated.
11. Apply seed and mulch to disturbed areas as specified and in accordance with this plan.
12. Any temporary measures (such as compost filter sock, collection channel, riprap aprons, etc.) installed by contractor during grading shall remain in place until final stabilization has occurred with a minimum uniform 70% perennial vegetative cover or other permanent non-vegetative cover, with a density sufficient to resist accelerated surface erosion and subsurface characteristics sufficient to resist sliding and other movements. The Engineer shall inspect final stabilization prior to removal of temporary measures.

13. Clean work area of any debris created during the construction sequence.

Vegetated Swales: Vegetated swales will be installed as described in the overall sequence above. This applies to the area east of the pad north of the infiltration trench and existing grade effectively forms a swale. The contractor will be required to prevent the compaction of soils in areas that are occupied or to be occupied by PCSM BMPs. The swales will be rough graded, then fine graded, seeded and vegetated added, and protective lining will be installed. The swales will be inspected after each rainfall between rough grading and fine grading for sediment accumulation, erosion or obstructions. Vegetation will be established as soon as possible to prevent erosion and scour. Once tributary areas are sufficiently stabilized, temporary erosion and sediment controls will be removed. Immediately following site construction, the swales will be inspected to verify that runoff conveyance capacity meets the design capacity. If not, they will be regraded and reseeded and any damaged areas will be fully restored to verify functionality.

Infiltration trench: The infiltration trench will be installed per the overall construction sequence above. Prior to construction, the area of the infiltration trench will be protected from compaction by installing orange safety fencing that will be used to protect the area throughout the project. The infiltration trench will be installed early in the project as the trench invert is approximately at existing grade. As the equipment pad is brought to final grade, the sub-surface infiltration facility will be buried providing protection from compaction. In the event that compaction of the subgrade is unavoidable, see sequence 8. As the equipment pad is brought to final grade, additional stone will be added on top of the infiltration basin to provide protection from compaction.

The infiltration trench will not be put into service until stabilization of disturbed areas is complete to prevent sedimentation and/or damage from construction activity. Erosion and Sediment Control Measures will be installed as required during construction (refer to Mainline specifications).

After completion of construction on site, the trench will be inspected after rainfall events (> 1 inch rainfall depth) to verify that runoff drains within 72 hours. The trench will also be inspected for accumulation of construction sediment, damage to outlet control structures, erosion control measures and signs of water contamination/spills. At this time, accumulated sediment will be removed from the trench if required.

(8) Supporting calculations.

See Appendix B for supporting calculations for hydraulic analysis and BMP design.

(9) Plan drawings.

See Post-Construction Stormwater Management Plan drawing.

(10) A long-term operation and maintenance schedule, which provides for inspection of PCSM BMPs, including the repair, replacement, or other routine maintenance of the PCSM BMPs to ensure proper function and operation. The program must provide for completion of a written report documenting each inspection and all BMP repair and maintenance activities and how access to the PCSM BMPs will be provided.

A maintenance program that provides for routine inspection, as well as repair and replacement as necessary, is essential to effective and efficient operation of the proposed stormwater BMPs. Implementation of the following maintenance plan is a key component in achieving the intent of this PCSM Plan and minimizing negative impacts of stormwater runoff from the proposed facilities. The permittee and any co-permittees shall be responsible for long-term operation and maintenance of the stormwater BMPs unless a different person is identified in the Notice of Termination and has agreed to long-term operation and maintenance of the stormwater BMPs. A formal long-term operation and maintenance plan will be provided in subsequent stages of the undertaking, outlining additional details of maintenance schedules, procedures and reporting requirements.

PennEast will be responsible for the proper construction, stabilization, and maintenance of erosion and sediment controls and post-construction stormwater management facilities which include the vegetated areas. Vegetated areas will be inspected for erosion, distressed vegetation and bare ground. General maintenance will include the regular removal of debris and litter to help prevent possible damage to vegetated areas. Growth of woody vegetation will be controlled by mowing (approximately two times per year) and clearing as appropriate.

Swales:

- *Maintenance activities to be done annually and within 48 hours after every major storm event (> 1 inch rainfall depth).*
- *Inspect and correct erosion problems, damage to vegetation, and sediment and debris accumulation (address when > 3 inches at any spot or covering vegetation).*
- *Inspect vegetation on side slopes for erosion and formation of rills or gullies, correct as needed.*
- *Inspect for pools of standing water; dewater and discharge to an approved location and restore to design grade.*
- *Mow and trim vegetation to verify safety, aesthetics, proper swale operation, or to suppress weeds and invasive vegetation; dispose of cuttings in a local composting facility; mow only when swale is dry to avoid rutting.*
- *Inspect for litter; remove prior to mowing.*
- *Inspect for uniformity in cross-section and longitudinal slope, correct as needed.*
- *Inspect swale inlet (curb cuts, pipes, etc.) and outlet for signs of erosion or blockage, correct as needed.*

Maintenance activities to be done as needed:

- Plant alternative grass species: Standard Upland ROW, Residential, Clover/Food Plot with ROW as listed in the E&S site restoration plans in the event of unsuccessful establishment
- *Reseed bare areas; install appropriate erosion control measures when native soil is exposed or erosion channels are forming.*
- *Rototill and replant swale if draw down time is more than 48 hours.*
- *Inspect and correct check dams when signs of altered water flow (channelization, obstructions, erosion, etc.) are identified.*
- *Water during dry periods, fertilize, and apply pesticide only when absolutely necessary.*

Maintenance under winter conditions:

- *Inspect swale immediately after the spring melt, remove residuals (e.g. sand) and replace damaged vegetation without disturbing remaining vegetation.*
- *If roadside or parking lot runoff is directed to the swale, mulching and/or soil aeration/manipulation may be required in the spring to restore soil structure and moisture capacity and to reduce the impacts of deicing agents.*
- *Use nontoxic, organic deicing agents, applied either as blended, magnesium chloride-based liquid products or as pretreated salt.*
- *Use salt-tolerant vegetation in swales.*

Infiltration trench:

- *Inlet will be inspected and cleaned at least two times per year and after runoff events (> 1 inch rainfall depth).*
- *The trench will be inspected after runoff events to make sure that runoff event (> 1 inch rainfall depth) drains down within 72 hours. The trench will also be inspected for accumulation of*

sediment, damage to outlet control structures, erosion control measures, and signs of water contamination/spills. Accumulated sediment will be removed from the trench as required, and sediment will be properly disposed of. Sediment to be removed by flooding infiltration to allow for particles to float to the top of the system.

(11) Procedures which ensure that the proper measures for recycling or disposal of materials associated with or from the PCSM BMPs are in accordance with Department laws, regulations and requirements.

The responsible party (construction contractor) for earth disturbance activities must verify that proper mechanisms are in place to control waste materials. Construction wastes include, but are not limited to, excess soil materials, damaged netting or matting, sanitary wastes, and general trash that could adversely affect or impact water quality. Measures for housekeeping of the site, materials management, and litter control should be planned and implemented throughout the life of the project. Wherever possible, recycling of excess materials is preferred, rather than disposal.

The contractor/operator will remove, recycle or dispose from the site excess construction materials and wastes in accordance with Pennsylvania's Solid Waste Management Regulations at 25 PA. Code 260.1 et seq., 271.1 et seq. The contractor/operator will not illegally bury, dump, or discharge any building material or wastes at the site.

Sediment removed from erosion control measures or facilities and other soils deemed unsuitable for use as fill shall be stabilized and disposed of offsite at a licensed disposal facility. Offsite disposal must comply with local, county, state and federal rules, regulations, and laws.

(12) An identification of naturally occurring geologic formations or soil conditions that may have the potential to cause pollution after earth disturbance activities are completed and PCSM BMPs are operational and development of a management plan to avoid or minimize potential pollution and its impacts.

Based on NRCS Web Soil Survey, the existing soils have a soil reaction of acidity or alkalinity (pH levels) of approximately 4.4. Upon review of PADCNR's "Geologic Units Containing Potentially Significant Acid-Producing Sulfide Minerals" map, this station site does not lie in a known region containing acid-producing soils.

(13) An identification of potential thermal impacts from post construction stormwater to surface waters of this Commonwealth including BMPs to avoid, minimize or mitigate potential pollution from thermal impacts.

Infiltration of runoff collected in the trench will mitigate thermal impacts from post construction stormwater. Because the infiltration trench is sub-surface it will further mitigate thermal impacts. It is not expected that runoff collected in the trench and discharged overland to the receiving water will be retained in the trench for more than 24 hours, thus providing additional mitigation of potential thermal impacts of discharge from the trench. Existing shade trees are being preserved to the greatest extent possible, and excessive riprapping and concrete channels is being avoided, to minimize the transfer of heat to the runoff.

(14) A riparian forest buffer management plan when required under §102.14 (relating to riparian buffer requirements).

The project is located within 150 feet of a perennial or intermittent river, stream, or creek, or lake, pond or reservoir in a watershed of Exceptional Value or High Quality. However, the site is exempt from the creation of a riparian forest buffer management plan according to Chapter 102.14d from the Pennsylvania Code because the site is less than 1 acre of disturbed land. The project will eliminate the net change in stormwater volume, rate and quality for stormwater events up to and including the 2-year/24-hour storm. The project will use various structural and non-structural BMPs to meet the

water quantity and quality requirements. The peak runoffs will be attenuated with an infiltration trench. The stormwater will be routed through structural and non-structural BMPs and discharged overland towards the area. The project falls into the definition of a non-discharge alternative. See Section 4 for compliance calculations and descriptions. Therefore, a riparian forest buffer management plan is not required.

(15) Additional information requested by the Department.

Additional information requested by the Department will be provided.

3.1.2 Post Construction Stormwater Management Plan Stormwater Analysis

This section addresses the portion of the regulations pertaining to the site-specific stormwater analysis.

(g) PCSM Plan Stormwater analysis. Except for regulated activities that require site restoration or reclamation, and small earth disturbance activities identified in subsection (n), PCSM Plans for proposed activities requiring a permit under this chapter require the following additional information:

(1) Predevelopment site characterization and assessment of soil and geology including appropriate infiltration and geotechnical studies that identify location and depths of test sites and methods used.

The subsurface investigation consisting of two test pits, MLV7-TP1 and MLV7-TP2, were excavated by Craig Test Boring Co., Inc. of Mays Landing, New Jersey on May 16, 2018. Infiltration testing using double-ring infiltrometers was subsequently performed within each test pit.

The test pit elevations are summarized in the table below:

Table 4: Test Pit Summary

Test Pit No.	Existing Grade Elevation (feet)	Proposed BMP Invert (feet)	Infiltration Test Elevation (feet)	Excavation Depth Elevation (feet)	Depth to High Groundwater (feet)
MLV-7 TP-1	432.3	432.5	427.3	5.0	No evidence of high groundwater observed
MLV-7 TP-2	432.6	432.5	427.6	5.0	No evidence of high groundwater observed

Test pit MLV7-TP1 was excavated to 7 feet below existing grade on May 16, 2018. Infiltration testing was performed at 5 feet below existing grade. Two tests were performed at this location.

Test pit MLV7-TP2 was excavated to 7 feet below existing grade on May 16, 2018. Infiltration testing was performed at 5 feet below existing grade. Two tests were performed at this location.

The results of the infiltration tests are summarized as follows:

Table 5: Infiltration Testing Summary

Test Pit	Test #1	Test #2	Final Rate Used
MLV7-TP1	0.5 inch/hr	1.0 inch/hr	0.75 inch/hr
MLV7-TP2	0.0 inch/hr	0.5 inch/hr	0.25 inch/hr
Observed Overall Rate			0.50 inch/hr
Design Rate (Factor of Safety of 2)			0.26 inch/hr

(2) Analysis demonstrating that the PCSM BMPs will meet the volume reduction and water quality requirements specified in an applicable Department approved and current Act 167 stormwater management watershed plan; or manage the net change for storms up to and including the 2-year/24-hour storm event when compared to preconstruction runoff volume and water quality. The analysis for the 2-year/24-hour storm event shall be conducted using the following minimum criteria:

The project site is located in Northampton County, in the Lehigh watershed. Northampton County has an Act 167 Stormwater Management Plan, which states that:

"For all regulated activities that require submission of a formal SWM Site Plan, both the Design Storm Method and the Simplified Method shall be calculated; the larger control volume based on the two calculations shall be controlled.

"Volume must be provided as the larger of the difference between the post-development and pre-development 2-year runoff volume, or 1.25 inches of precipitation over the site area based on the Rational Method.

"The Water Quality Volume (WQv) to be captured and treated will be the larger of the

following:

WQv = c x P x A / 12

Where WQv = water quality volume in acre-feet

c = Rational Method post-development runoff coefficient for the 2year storm

P = 1.25 inches

A = Area in acres of proposed Regulated Activity

OR

WQv = Post-development 2-yr. runoff volume minus Pre-development 2-yr. runoff volume as calculated in Worksheet 4.

EXCEPT that in no case shall the WQv exceed

WQv = 1.25 inches x site area in acres / 12"

The post-development peak runoff rate must not exceed pre-development peak runoff rate under any storm condition.

"The basic goal is no increase in the peak rate of runoff at any point in the watershed...If, through the use of infiltration or other means, an applicant can demonstrate that neither the peak rate nor the volume of runoff are increasing with development, additional controls to meet the release rates are not required."

Please see Section 4 of this report for details on the pre-development and post-development runoff volume and trench drain time calculations with detailed calculations provided in Appendix B.

i. Existing predevelopment non-forested pervious areas must be considered meadow in good condition or its equivalent except for repair, reconstruction or restoration of roadways or rail lines, or construction, repair, reconstruction or restoration of utility infrastructure when the site will be returned to existing condition.

The existing predevelopment site is mainly existing grass land. For the purposes of hydraulic calculations, the existing ground surface was assumed to be meadow.

ii. When the existing project site contains impervious area, 20% of the existing impervious area to be disturbed must be considered meadow in good condition or better, except for repair, reconstruction or restoration of roadways or rail lines, or construction, repair, reconstruction, or restoration of utility infrastructure when the site will be returned to existing condition.

Not Applicable. The existing project site does not contain impervious area.

iii. When the existing site contains impervious area and the existing site conditions have public health, safety or environmental limitations, the applicant may demonstrate to the Department that it is not practicable to satisfy the requirement in subparagraph (ii), but the stormwater volume reduction and water quality treatment will be maximized to the extent practicable to maintain and protect existing water quality and existing and designated uses.

Not applicable. The stormwater volume reduction and water quality treatment requirements are achieved.

iv. Approaches other than that required under paragraph (2) may be proposed by the applicant when the applicant demonstrates to the Department that the alternative will either be more protective than required under paragraph (2) or will maintain and protect existing water quality and existing and designated uses by maintaining the site hydrology, water quality, and erosive impacts of the conditions prior to initiation of any earth disturbance activities.

Not applicable.

(3) Analysis demonstrating that the PCSM BMPs will meet the rate requirements specified in an applicable Department approved and current Act 167 stormwater management watershed plan; or manage the net change in peak rate for the 2, 10, 50, and 100 year/24-hour storm events in a manner not to exceed preconstruction rates.

The project site is located in Northampton County, in the Lehigh watershed. As such, the site is subject to the requirements of the Northampton County Act 167 Watershed Management Plan and Lehigh Valley Planning Commission Act 167 Stormwater Management Plan, which imposes stricter requirements than item (g)(3) of Pennsylvania Code Section 102.8. The Lehigh Valley Planning Commission Act 167 Stormwater Management Plan states that:

"Dual Release Rate Districts – Within these districts, the 2-year post-development peak discharge must be controlled to 30% of the pre-development 2-year runoff peak. Further, the 10-year, 25-year

and 100-year post-development peak runoff must be controlled to the stated percentage of the pre-development peak. Release Rates associated with the 10- through 100-year events vary from 50% to 100% depending upon location in the watershed."

The MLV 7 site is located within a Dual Release Rate District 45 of Map 3 Catasauqua Creek, Monocacy Creek and Nancy Run Act 167 Study Areas however, the total site disturbed area is less than 10,000 square feet. Therefore, the MLV-6 site is exempt from these Dual Release Rate District requirements.

i. ***Hydrologic computations or a routing analysis are required to demonstrate that this requirement has been met****.*

See Section 4 of this report for details on hydrologic computations that demonstrate that runoff rate requirements have been met.

ii. **Exempt from this requirement are Department- approved direct discharges to tidal areas or Department-approved no detention areas.**

Not applicable. Project site does not discharge to tidal areas or no-detention areas.

iii. **Approaches other than that required under paragraph (3) may be proposed by the applicant when the applicant demonstrates to the Department that the alternative will either be more protective than required under paragraph (3) or will maintain and protect existing water quality and existing and designated uses by maintaining the preconstruction site hydrologic impact.**

Not applicable. The requirements of paragraph (3) have been met.

(4) Identification of the methodologies for calculating the total runoff volume and peak rate of runoff and provide supporting documentation and calculations.

See Section 4 of this report for details on the pre-development and post-development peak runoff rate and total runoff volume calculation methodology, which was completed using TR-55 methodology implemented by Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2019. See Appendix B for calculation documentation.

(5) Identification of construction techniques or special considerations to address soil and geologic limitations.

Methods to address potential soil limitations have been provided on the PCSM plans.

(h) PCSM implementation for special protection waters. To satisfy the anti-degradation implementation requirements in §93.4c(b) (relating to implementation of anti-degradation requirements), an earth disturbance activity that requires a permit under this chapter and for which any receiving water that is classified as High Quality or Exceptional Value under Chapter 93, the person proposing the activity shall, in the permit application, do the following:

(1) Evaluate and include non-discharge alternatives in the PCSM Plan unless a person demonstrates that non-discharge alternatives do not exist for the project.

(2) If the person makes the demonstration in paragraph (1) that non-discharge alternatives do not exist for the project, the PCSM Plan must include ABACT, except as provided in §93.4c(b)(1)(iii).

(3) For purposes of this chapter, non-discharge alternatives and ABACT and their design standards are listed in the Pennsylvania Stormwater Best Management Practices Manual Commonwealth of Pennsylvania, Department of Environmental Protection, No. 363-0300-002 (December 2006), as amended and updated.

The project will eliminate the net change in stormwater volume, rate and quality for stormwater events up to and including the 2-year/24-hour storm. The project will use various structural and non-structural BMPs to meet the water quantity and quality requirements. The peak runoffs will be attenuated with an infiltration trench. The stormwater will be routed through a series of structural and non-structural BMPs and discharged overland towards the stream. Therefore, the project falls into the definition of a nondischarge alternative. See Section 4 for compliance calculations and description.

4 Hydrologic and Hydraulic Analysis

This Section outlines the hydrologic calculations that were performed in order to design the stormwater BMPs for the MLV 7 site, and to verify that requirements for stormwater runoff volume and peak rate would be met.

4.1 Existing Conditions

The total drainage area to the point of analysis including site and offsite areas is 0.15 acres of forested and grassed land adjacent to an existing improved road, of which 0.07 acres are the project site itself. In general, the ground slopes to the south. The total drainage area to the swale that is being direct around our site is 0.1 acres of forested and grassed land adjacent to an existing improved road. An area north of the site drains through the site. The onsite soils were identified using the USDA's Web Soil Survey. The project site consists of primarily Clarksburg silt loam, which is Hydrologic Soil Group C. The site also consists of Comly silt loam, which is Hydrologic Soil Group D (see Appendix A for a breakdown of existing condition soils type and curve numbers). Existing condition curve numbers were assigned as per Table 2-2a from USDA's TR-55 "Urban Hydrology for Small Watersheds" (see Appendix B). The time of concentration was calculated using TR-55 methodology, and the routing is shown in the Existing Conditions figure in Appendix E. For times of concentration less than 5 minutes, a minimum time of concentration of 5 minutes was assumed.

Under existing conditions, the land use breakdown is given in Table 6. The drainage area boundaries are shown in the Existing Conditions figure in Appendix E.

Table 6: Existing Conditions Land Use

DA	Cover	Soils	HSG	Area (sq ft)	Area (acres)	CN	CN*A	Weighted CN
Site								
SITE-SWALE	MEAD	CIA	C	1,015	0.0233	71	72,065	71
SITE-TRENCH	MEAD	CIA	C	410	0.0094	71	29,110	71
SITE-TRENCH	MEAD	CIA	C	300	0.0069	71	21,300	71
SITE-TRENCH	MEAD	CIA	C	190	0.0044	71	13,490	71
SITE-TRENCH	MEAD	CIA	C	715	0.0164	71	50,765	71
SITE-BYPASS	MEAD	CIA	C	330	0.0076	71	23,430	71
Total					**0.0680**		**210,160**	**71**
Off-Site								
OFFSITE-SWALE	IMP	CIA	C	1,830	0.0420	98	179,340	98
OFFSITE-SWALE	IMP	CIA	C	1,555	0.0357	71	110,405	71
OFFSITE-BYPASS	IMP	CIA	C	235	0.0054	71	16,685	71
Total					**0.0831**		**306,430**	**85**
Grand Total					**0.15**		**516,590**	**79**

Precipitation data was obtained from NOAA Atlas 14. The rainfall data is summarized in Table 7 and these rainfall depths were applied to the model as a NRCS Type II rainfall.

Table 7: 24-Hour Design Rainfall Depths

Recurrence Interval (years)	Rainfall (inches)
1	2.63
2	3.16
5	3.94
10	4.60
25	5.59
50	6.44
100	7.40

4.2 Proposed Conditions

The proposed site will consist mostly of gravel (compacted crushed stone). The location that will be used for vehicular traffic has been considered to be impervious by PADEP, thus it has been modelled as such in the hydraulic calculations. Gravel areas that will be protected from vehicular traffic will be considered pervious and modelled as such in hydraulic calculations. For design purposes, it was assumed that the entire permanent gravel driveway has been considered compacted and impervious. An infiltration trench was designed to meet the regulatory stormwater requirements. Flow from the site will be directed to the subsurface infiltration trench via sheet flow. The outflow from the trench will be discharged by sheet flow as it overtops the top of stone and will flow along its natural pathways.

Under proposed conditions, the land use breakdown is given in Table 8. The drainage area boundaries are shown in the Proposed Conditions figure in Appendix F.

Table 8: Proposed Condition Land Use

DA	Cover	Soils	HSG	Area (sq ft)	Area (acres)	CN	CN*A	Weighted CN
Site								
SITE-SWALE	MEAD	CIA	C	1,015	0.0233	71	72,065	71
SITE-TRENCH	GRV	CIA	C	410	0.0094	91	37,310	91
SITE-TRENCH	IMP	CIA	C	300	0.0069	98	29,400	98
SITE-TRENCH	GRV	CIA	C	190	0.0044	91	17,290	91
SITE-TRENCH	IMP	CIA	C	715	0.0164	98	70,070	98
SITE-BYPASS	MEAD	CIA	C	330	0.0076	71	23,430	71
Total					**0.0680**		**249,565**	**84**
Off-Site								
OFFSITE-SWALE	IMP	CIA	C	1,830	0.0420	98	179,340	98
OFFSITE-SWALE	IMP	CIA	C	1,555	0.0357	71	110,405	71
OFFSITE-BYPASS	IMP	CIA	C	235	0.0054	71	16,685	71
Total					**0.0831**		**306,430**	**85**
Grand Total					**0.15**		**555,995**	**85**

4.3 Model Development

A model was developed in the Hydraflow Hydrographs extension for AutoCAD Civil 3D v2019 to simulate existing and proposed flow. This model was used to determine the existing and proposed runoff volumes and peak runoff rates. The trench's outlet control structure will be constructed with the lowest opening 1.5' above the trench invert, to drain completely in 72 hours at the design infiltration rate of 0.25 inches/hour, based on the observed rate of 0.5 in/hr with a factor of safety of 2 applied. The proposed flows were routed through the trench and the attenuated flow rates calculated. Model inputs and summary and output reports can be found in Appendix H.

4.4 Stormwater Management Rules Compliance

The project meets the requirements under the Pennsylvania code for Post-Construction Stormwater Management (PCSM) Section 102.8.

4.4.1 Volume Control

A sub-surface stormwater infiltration trench is utilized to provide storage and infiltration to prevent any increases in stormwater runoff volume, up to and including the 2-year/24-hour storm event using the prescribed land use characteristics, thus it meets the PADEP requirements.

The project is subject to two volume controls, the first is the Design Storm Method that requires for storms up to the 2-year storm there be no increase in runoff volume as a result of this project. The second is to remove 1.25" of precipitation over the site area based on the Rational Method.

The Water Quality Volume (WQv) to be captured and treated will be the larger of the following:

WQv = c x P x A / 12

Where WQv = water quality volume in acre-feet

c = Rational Method post-development runoff coefficient for the 2 year storm

c=0.86 for 0.04 acres of gravel

P = 1.25 inches

A = Area in acres of proposed site

WQv = 0.86 x 1.25 x 0.04/12 = 0.00358 acre feet = 156 cf

The larger of the two was used. Because there is no other mechanism such as irrigation or rainwater harvesting, for releasing the required retention volume, infiltration will be employed to remove the required runoff volume.

This was accomplished by providing the required volume below the low outlet of the trench's outlet control structure, as shown in Table 9. Trench drain time is shown in Table 10.

The low orifice in the infiltration trench was placed above the invert, providing the required infiltration volume. As such, regulatory volume control requirements are met. The required volume was achieved as follows:

Table 9: Total Volume Summary

Recurrence Interval (yrs)	Existing Volume (cf)	Proposed Unmitigated Volume from Model (cf)	Difference between Proposed and Existing (cf)	Proposed Trench Infiltration Capacity (cf)	Adequate Infiltration Volume? (Y/N)
1	152	373	221	299	Yes
2	211	454	244	370	Yes
ACT 167 Rational Volume			156	270	Yes

Table 10: Trench Drain Time

Trench Infiltration Depth (ft)	Design Infiltration Rate (in/hr)	Drain Time (hrs)	Allowable Drain Time (hrs)	Drain Time less than allowable
1.5	0.25	45	72	Yes

4.4.2 Peak Flow Control

An infiltration trench is utilized to provide storage attenuation to prevent any increases in the rate of stormwater runoff, thus it meets the PADEP requirements. The model indicates that the trench will result in a peak runoff rate under the 1-, 2-, 10-, 50-, and 100-year/24-hour storm events that does not exceed preconstruction rates. The attenuated flows are summarized in Table 11.

Table 11: Peak Flow Summary

Recurrence Interval (Yrs)	Existing Site Q (cfs)	Maximum Allowable Proposed Peak Flow (cfs)	Proposed Peak Q (cfs)	Proposed Less than Allowable? (Y/N)
1	0.259	0.259	0.228	Yes
2	0.354	0.354	0.303	Yes
5	0.504	0.504	0.421	Yes
10	0.638	0.638	0.526	Yes
25	0.847	0.847	0.689	Yes
50	1.031	1.031	0.832	Yes
100	1.243	1.243	1.071	Yes

4.4.3 Water Quality

The soil classifications were obtained from the USDA Web Soil Survey to estimate if there would be adequate infiltration. The water quality requirements were met through trench infiltration of a minimum of the Post-development 2-yr runoff volume as calculated in Worksheet 4. This was accomplished by providing more than the required volume, below the low outlet of the trench's outlet control structure. compliance with water quality requirements is demonstrated using BMP Worksheet 10 in Appendix C.

BMPs utilized to comply with water quality requirements:

- 5.5.4 Cluster Uses at Each Site; Build on the Smallest Area Possible. The project site footprint minimized to fit within ESCGP-3 boundary. The site footprint was sized to contain all of the necessary pipeline equipment to safely and adequately perform pipeline operations while limiting the total disturbed area. The sites were laid out so that the equipment can be fully accessed and utilized with as little impact on the existing conditions as possible during construction and operations. Because of this, the land disturbed due to the equipment pad and access road is merely a portion of the total area that will be occupied by the pipeline run itself. This was also done to limit the amount of property that was acquired for the project.
- 6.4.8 Vegetated Swale. Vegetated swale will be constructed along the west side to convey the flow from infiltration trench to infiltration berms.
- 6.7.2 Landscape Restoration, disturbed areas outside the proposed gravel pad and access drive will be replanted with native vegetation.
- 6.7.3 Soil Amendment/ Restoration. The top layer of soils will be scarified for site infiltration berm contributory areas.

5 Offsite Discharge Analysis

Attenuated peak flows from the subsurface basin are routed to the vegetated swale and infiltration trench. The dispersed flow will be discharged overland and eventually discharges to Lehigh River as shown in the Off-site Stormwater Discharge Plan (see Appendix J). The point of discharge from the site has been designed to be stable so as not to impact offsite areas, see calculations in Appendix B. Increases in stormwater runoff and volume are not anticipated. Therefore, the project falls into definition of nondischarge alternative. The nondischarge alternative is defined in §102.1 as environmentally sound and cost-effective BMPs that individually or collectively eliminate the net change in stormwater volume, rate and quality for storm events up to and including the 2-year/24-hour storm when compared to the stormwater rate, volume and quality prior to the earth disturbance activities to maintain and protect the existing quality of the receiving surface waters of this Commonwealth.

Because the MLV-7 project falls into definition of nondischarge alternative, no downstream properties are affected by the proposed work and there is no downstream erosion. Proper construction and maintenance requirements are in place to support continued performance of BMPs. The overall peak flow and runoff volume has been reduced while maintaining the overall existing drainage patterns, thus fulfilling PADEP off-site discharge requirements.

6 Conclusion

As demonstrated in the sections above, the design of the proposed stormwater BMPs for the MLV 7 Site for the PennEast pipeline will allow the proposed project to comply with the applicable regulatory requirements under Pennsylvania Code Section 102.8.

Appendices

A. Rainfall Data

NOAA Atlas 14, Volume 2, Version 3
Location name: Nazareth, Pennsylvania, USA*
Latitude: 40.7302°, Longitude: -75.3639°
Elevation: 433.34 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	**0.316** (0.283-0.351)	**0.377** (0.338-0.418)	**0.446** (0.399-0.494)	**0.499** (0.447-0.553)	**0.571** (0.507-0.632)	**0.625** (0.551-0.692)	**0.683** (0.598-0.756)	**0.743** (0.643-0.825)	**0.826** (0.705-0.921)	**0.896** (0.756-1.00)
10-min	**0.503** (0.452-0.559)	**0.602** (0.541-0.669)	**0.713** (0.639-0.791)	**0.798** (0.714-0.885)	**0.906** (0.804-1.00)	**0.991** (0.873-1.10)	**1.08** (0.945-1.20)	**1.17** (1.01-1.30)	**1.30** (1.11-1.45)	**1.40** (1.18-1.58)
15-min	**0.628** (0.564-0.698)	**0.754** (0.677-0.838)	**0.899** (0.806-0.998)	**1.01** (0.900-1.12)	**1.15** (1.02-1.27)	**1.25** (1.10-1.39)	**1.36** (1.19-1.51)	**1.48** (1.28-1.64)	**1.63** (1.40-1.82)	**1.76** (1.48-1.97)
30-min	**0.859** (0.772-0.955)	**1.04** (0.934-1.16)	**1.27** (1.14-1.41)	**1.45** (1.30-1.61)	**1.69** (1.50-1.87)	**1.88** (1.66-2.08)	**2.08** (1.82-2.30)	**2.29** (1.98-2.54)	**2.59** (2.21-2.89)	**2.84** (2.39-3.18)
60-min	**1.07** (0.961-1.19)	**1.30** (1.17-1.45)	**1.63** (1.46-1.81)	**1.89** (1.69-2.10)	**2.25** (2.00-2.49)	**2.54** (2.24-2.81)	**2.86** (2.50-3.17)	**3.20** (2.77-3.56)	**3.70** (3.16-4.13)	**4.13** (3.48-4.63)
2-hr	**1.29** (1.16-1.44)	**1.56** (1.41-1.74)	**1.97** (1.77-2.19)	**2.29** (2.05-2.54)	**2.76** (2.45-3.05)	**3.16** (2.79-3.50)	**3.60** (3.16-3.99)	**4.10** (3.56-4.55)	**4.85** (4.14-5.42)	**5.50** (4.64-6.18)
3-hr	**1.43** (1.29-1.58)	**1.72** (1.56-1.92)	**2.15** (1.94-2.39)	**2.50** (2.24-2.76)	**3.00** (2.67-3.31)	**3.42** (3.03-3.78)	**3.90** (3.42-4.31)	**4.42** (3.84-4.90)	**5.22** (4.47-5.82)	**5.91** (4.99-6.62)
6-hr	**1.82** (1.65-2.02)	**2.18** (1.98-2.42)	**2.69** (2.44-2.99)	**3.13** (2.82-3.46)	**3.77** (3.37-4.16)	**4.33** (3.84-4.78)	**4.96** (4.35-5.47)	**5.67** (4.91-6.27)	**6.76** (5.76-7.51)	**7.73** (6.47-8.60)
12-hr	**2.25** (2.04-2.50)	**2.70** (2.45-3.00)	**3.36** (3.04-3.72)	**3.92** (3.53-4.34)	**4.77** (4.25-5.26)	**5.52** (4.87-6.09)	**6.38** (5.56-7.03)	**7.35** (6.34-8.12)	**8.86** (7.49-9.82)	**10.2** (8.47-11.3)
24-hr	**2.63** (2.44-2.84)	**3.16** (2.94-3.42)	**3.94** (3.65-4.25)	**4.60** (4.26-4.96)	**5.59** (5.14-6.01)	**6.44** (5.89-6.92)	**7.40** (6.70-7.92)	**8.46** (7.61-9.05)	**10.1** (8.95-10.8)	**11.5** (10.1-12.3)
2-day	**3.09** (2.86-3.34)	**3.71** (3.45-4.03)	**4.63** (4.29-5.01)	**5.39** (4.98-5.82)	**6.51** (5.98-7.02)	**7.47** (6.83-8.04)	**8.54** (7.75-9.17)	**9.72** (8.76-10.4)	**11.5** (10.2-12.3)	**13.0** (11.5-14.0)
3-day	**3.25** (3.01-3.52)	**3.91** (3.63-4.23)	**4.86** (4.50-5.25)	**5.65** (5.22-6.10)	**6.81** (6.27-7.34)	**7.81** (7.14-8.40)	**8.91** (8.09-9.56)	**10.1** (9.13-10.9)	**11.9** (10.7-12.8)	**13.5** (11.9-14.5)
4-day	**3.41** (3.17-3.69)	**4.10** (3.81-4.43)	**5.09** (4.72-5.50)	**5.91** (5.46-6.37)	**7.11** (6.55-7.66)	**8.14** (7.46-8.75)	**9.27** (8.44-9.95)	**10.5** (9.51-11.3)	**12.4** (11.1-13.3)	**14.0** (12.4-15.0)
7-day	**4.03** (3.74-4.37)	**4.82** (4.47-5.23)	**5.92** (5.50-6.42)	**6.85** (6.34-7.41)	**8.21** (7.56-8.87)	**9.37** (8.59-10.1)	**10.6** (9.70-11.5)	**12.0** (10.9-13.0)	**14.1** (12.6-15.2)	**15.9** (14.1-17.1)
10-day	**4.65** (4.34-5.01)	**5.55** (5.17-5.98)	**6.73** (6.27-7.24)	**7.70** (7.16-8.28)	**9.10** (8.43-9.77)	**10.3** (9.48-11.0)	**11.5** (10.6-12.3)	**12.9** (11.8-13.8)	**14.9** (13.4-15.9)	**16.5** (14.8-17.7)
20-day	**6.26** (5.89-6.66)	**7.41** (6.97-7.88)	**8.78** (8.26-9.33)	**9.89** (9.28-10.5)	**11.4** (10.7-12.1)	**12.7** (11.8-13.5)	**14.0** (13.0-14.9)	**15.4** (14.2-16.3)	**17.3** (15.9-18.4)	**18.9** (17.3-20.1)
30-day	**7.82** (7.39-8.26)	**9.21** (8.70-9.73)	**10.7** (10.1-11.3)	**11.9** (11.2-12.5)	**13.5** (12.7-14.2)	**14.7** (13.8-15.6)	**16.1** (15.0-16.9)	**17.4** (16.2-18.4)	**19.2** (17.8-20.3)	**20.7** (19.1-21.9)
45-day	**9.92** (9.43-10.4)	**11.6** (11.0-12.2)	**13.3** (12.6-14.0)	**14.6** (13.9-15.4)	**16.3** (15.5-17.2)	**17.6** (16.7-18.6)	**18.9** (17.9-20.0)	**20.2** (19.1-21.4)	**22.0** (20.7-23.2)	**23.3** (21.9-24.7)
60-day	**11.9** (11.3-12.5)	**13.9** (13.2-14.6)	**15.8** (15.0-16.6)	**17.3** (16.4-18.2)	**19.2** (18.2-20.2)	**20.6** (19.5-21.7)	**22.0** (20.8-23.2)	**23.4** (22.1-24.7)	**25.3** (23.8-26.7)	**26.7** (25.1-28.2)

[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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B. Calculation Sheet

EC OFFSITE TO SWALE-Tc CALCULATIONS	
SHEET FLOW	
Manning's n	0.011
Flow length, ft	13.5
2-Yr 24-Hr rainfall, in	3.16
Land slope, %	1.85
Sheet flow time, min	**0.25**
SHEET FLOW	
Manning's n	0.24
Flow length, ft	26
2-Yr 24-Hr rainfall, in	3.16
Land slope, %	6.73
Sheet flow time, min	**3.01**
TIME OF CONC., mins	**3.3**

EC OFFSITE TO SWALE-Tc CALCULATIONS	
SHEET FLOW	
Manning's n	0.011
Flow length, ft	13.5
2-Yr 24-Hr rainfall, in	3.16
Land slope, %	1.85
Sheet flow time, min	**0.25**
SHEET FLOW	
Manning's n	0.24
Flow length, ft	26
2-Yr 24-Hr rainfall, in	3.16
Land slope, %	6.73
Sheet flow time, min	**3.01**
TIME OF CONC., mins	**3.3**

EC SITE TO SWALE-Tc CALCULATIONS	
SHEET FLOW	
Manning's n	0.24
Flow length, ft	18
2-Yr 24-Hr rainfall, in	3.16
Land slope, %	2.78
Sheet flow time, min	**3.19**
TIME OF CONC., mins	**3.2**

This site only has sheet flow.

PR SITE TO SWALE-Tc CALCULATIONS	
SHEET FLOW	
Manning's n	0.24
Flow length, ft	10
2-Yr 24-Hr rainfall, in	3.16
Land slope, %	5.00
Sheet flow time, min	**1.58**
TIME OF CONC., mins	**1.6**

This site only has sheet flow.

EC SITE TO TRENCH-Tc CALCULATIONS	
SHEET FLOW	
Manning's n	0.25
Flow length, ft	54
2-Yr 24-Hr rainfall, in	3.16
Land slope, %	2.78
Sheet flow time, min	**7.95**
TIME OF CONC., mins	**7.9**

This site only has sheet flow.

PR SITE TO TRENCH-Tc CALCULATIONS	
SHEET FLOW	
Manning's n	0.011
Flow length, ft	45
2-Yr 24-Hr rainfall, in	3.16
Land slope, %	1.11
Sheet flow time, min	**0.81**
TIME OF CONC., mins	**0.8**

This site only has sheet flow.

PENNEAST- MLV - 7

PROPOSED CONDITIONS RUNOFF COEFFICIENT CALCULATIONS FOR PROPOSED SWALES

***Note: Rational C Coefficients adopted from PA Erosion and Sediment Pollution Control Program Manual, Mar 2012, Table 5.2**

DA	Land Use	Soils	HSG	Area	Area (Acres)	C	C*A	RC
SWALE1	Roadway	CIA	C	1830	0.042	0.86	0.036	0.86
SWALE1	Grass	CIA	C	1555	0.036	0.30	0.011	0.30
SWALE1	grass	CIA	C	1015	0.023	0.28	0.007	0.28
Grand Total					**0.101**		**0.053**	**0.53**

The "RC" value is an area averaged runoff coefficient value (arithmatic mean) calculated as:

$$RC = \frac{\sum_{i=1}^{n} C_i \, x \, Area_i}{\sum_{i=1}^{n} Area_i}$$

RATIONAL METHOD PEAK FLOW CALCULATIONS FOR PROPOSED SWALES

Return Period (Yrs) 10

Min. Time of Concentration (mins) 5 **(Unless otherwise noted below)**

DA	Area (Acres)	RC	Tc (mins)	Rainfall Intensity (in/hr)	Q (cfs)
SWALE1	0.101	0.53	15.00	4.6	0.245

Return Period (Yrs) 100

Min. Time of Concentration (mins) 5 **(Unless otherwise noted below)**

DA	Area (Acres)	RC	Tc (mins)	Rainfall Intensity (in/hr)	Q (cfs)
SWALE1	0.101	0.53	15.00	7.4	0.39

PROJECT NAME:	**SWALE1**	
LOCATION:	**Upper Nazareth Township, Northampton Couty**	
PREPARED BY:	**DATE:**	**5/23/2018**
CHECKED BY:	**DATE:**	**5/25/2018**

CHANNEL OR CHANNEL SECTION		
Temporary or Permanent (T or P)	P	
Required Capacity, Qr (cfs)	0.39	**See attached Rational Peak Flow Calculations**
Left side slope, %	30.00	
Right side slope, %	30.00	
Bottom width, ft	0	
Channel Depth provided, ft	1	
Channel bed slope, %	2.5	
Mannings N	0.07	
Accn. Due to gravity, ft/sec2	32.2	

DESIGN METHOD FOR LINING - SHEAR STRESS

CHECK FOR SHEAR STRESS		
H:V, left	4.00	
H:V, right	4.00	
bed slope, ft/ft	0.025	
Calculated channel flow depth, ft	0.32	
top width at flow depth, ft	2.54	
Bottom Width:Flow Depth Ratio	0.00	**Ratio Ok**
wetted area, sq. ft	0.40	
wetted peri, ft	2.62	
hyd. Radius, ft	0.15	
velocity, ft/s	0.97	
Discharge, cfs	0.39	
Theta, rad	0.025	
Froudes Number	0.30	
Flow type	subcritical	
Shear Stress, Lb/Sq.Ft	0.50	
Protective Lining	**Vegetated**	
Lining required	**TRM-435**	
D_{50}, inches		
Placement Thickness, inches		
Adjusted Mannings N	0.08	
Calculated Critical Slope,Sc ft/ft	0.19	
0.7 Sc, ft/ft	0.14	
1.3 Sc, ft/ft	0.25	
Stable Flow?	Stable	
Calculated Freeboard, ft	0.50	
Freeboard Provided, ft	0.68	**Freeboard Ok, Calculated<Provided**

PENNEAST- MLV - 7

PROPOSED CONDITIONS RUNOFF COEFFICIENT CALCULATIONS FOR PROPOSED INLETS

***Note: Rational C Coefficients adopted from PA Erosion and Sediment Pollution Control Program Manual, Mar 2012, Table 5.2**

DA	Land Use	Soils	HSG	Area	Area (Acres)	C	C*A	RC
INLET1	Roadway	CIA	C	1830	0.042	0.86	0.036	0.86
INLET1	Grass	CIA	C	1555	0.036	0.86	0.031	0.86
INLET1	grass	CIA	C	1015	0.023	0.28	0.007	0.28
INLET1 Total					**0.101**		**0.073**	**0.73**

The "RC" value is an area averaged runoff coefficient value (arithmatic mean) calculated as:

$$RC = \frac{\sum_{i=1}^{n} C_i \, x \, Area_i}{\sum_{i=1}^{n} Area_i}$$

RATIONAL METHOD PEAK FLOW CALCULATIONS FOR PROPOSED INLETS

Return Period (Yrs) 2

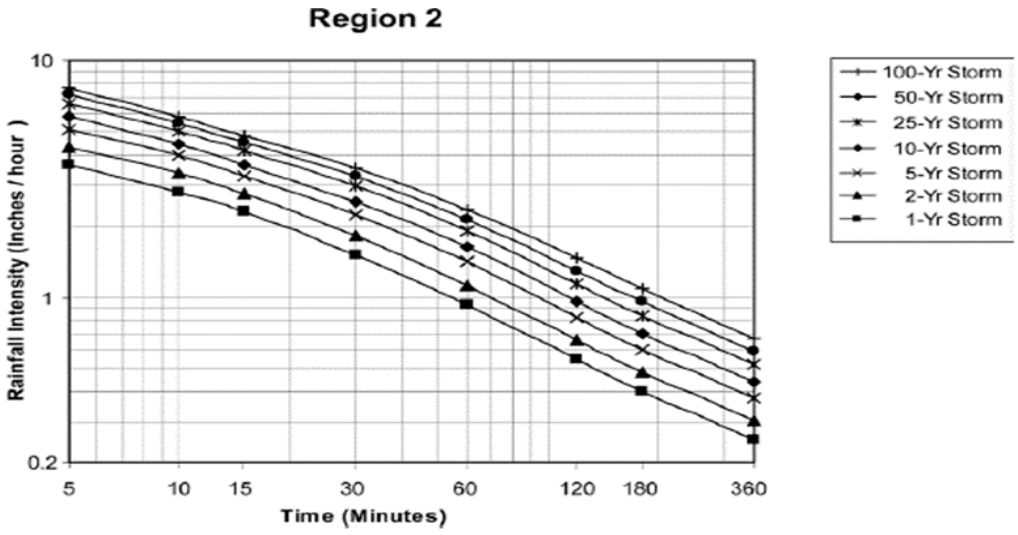
DA	Area (Acres)	RC	Tc (mins)	Rainfall Intensity (in/hr)	Q (cfs)
INLET1	0.101	0.73	5.00	3.2	0.23

Return Period (Yrs) 10

DA	Area (Acres)	RC	Tc (mins)	Rainfall Intensity (in/hr)	Q (cfs)
INLET1	0.101	0.73	5.00	4.6	0.34

Return Period (Yrs) 100

DA	Area (Acres)	RC	Tc (mins)	Rainfall Intensity (in/hr)	Q (cfs)
INLET1	0.101	0.73	5.00	7.4	0.54



MLV-7 INLET CAPACITY CHECK

Inlet ID	Inlet Type	Design Flow, cfs	Grate Open Area, sq ft	Depth of Flow, ft	Inlet Perimeter, ft	Grate Flow Capacity, cfs	Inlet Collection Capacity, cfs
IN#1	Type M Inlet	0.54	4.4	0.56	12.3	15.85	17.01

Pond Report

CALCULATION FOR VOLUME STORAGE
FOR INFILTRATION TRENCH

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v10.514 Thursday, 06 / 28 / 2018

Pond No. 1 - BASIN

Pond Data

Trapezoid -Bottom L x W = 30.0 x 30.0 ft, Side slope = 0.00:1, Bottom elev. = 432.50 ft, Depth = 2.00 ft, Voids = 40.00%

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	432.50	900	0	0
0.20	432.70	900	72	72
0.40	432.90	900	72	144
0.60	433.10	900	72	216
0.80	433.30	900	72	288
1.00	433.50	900	72	360
1.20	433.70	900	72	432
1.40	433.90	900	72	504
1.60	434.10	900	72	576
1.80	434.30	900	72	648
2.00	434.50	900	72	720

Lowest Weir elevation

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	Inactive	0.00	0.00	0.00
Span (in)	= 3.50	0.00	0.00	0.00
No. Barrels	= 1	0	0	0
Invert El. (ft)	= 430.60	0.00	0.00	0.00
Length (ft)	= 0.25	0.00	0.00	0.00
Slope (%)	= 0.00	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	No	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 30.00	0.00	0.00	0.00
Crest El. (ft)	= 434.00	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= Broad	---	---	---
Multi-Stage	= No	No	No	No

Exfil.(in/hr) = 0.000 (by Wet area)
TW Elev. (ft) = 0.00

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

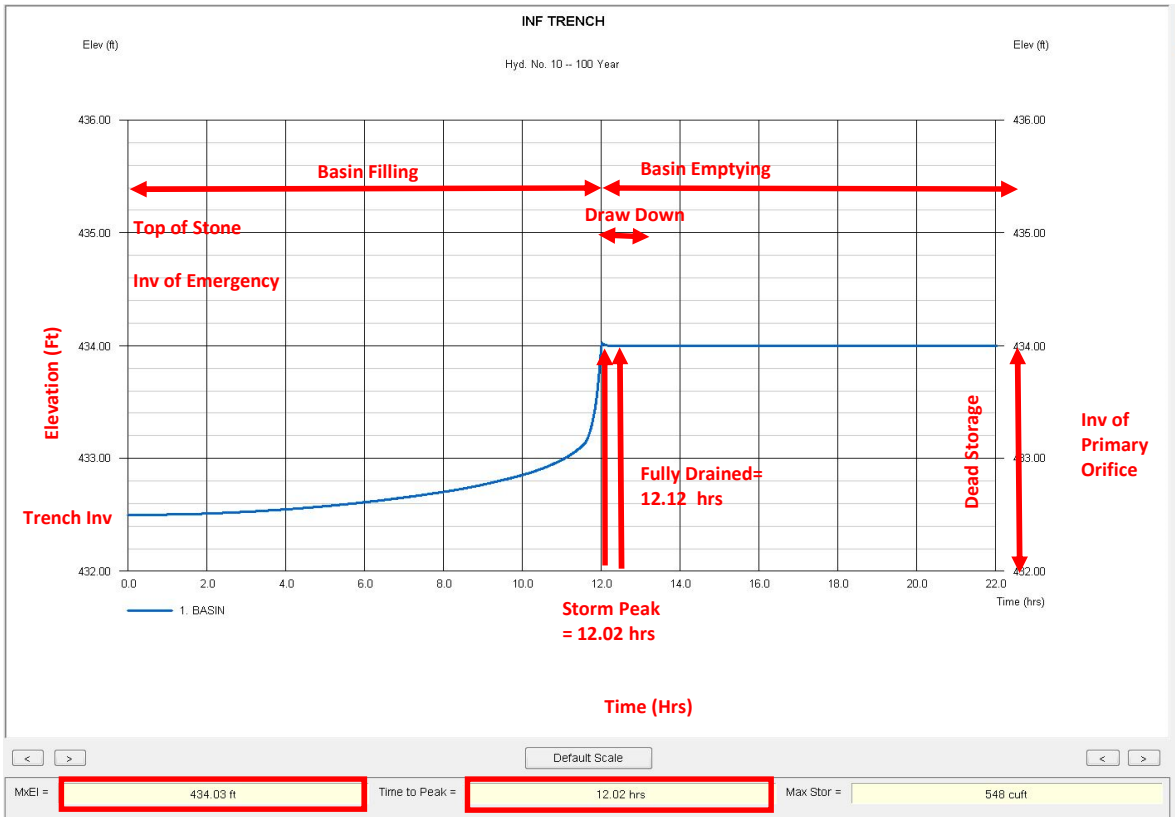
Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
0.00	0	432.50	0.00	---	---	---	0.00	---	---	---	---	---	0.000
0.02	7	432.52	0.00	---	---	---	0.00	---	---	---	---	---	0.000
0.04	14	432.54	0.00	---	---	---	0.00	---	---	---	---	---	0.000
0.06	22	432.56	0.00	---	---	---	0.00	---	---	---	---	---	0.000
0.08	29	432.58	0.00	---	---	---	0.00	---	---	---	---	---	0.000
0.10	36	432.60	0.00	---	---	---	0.00	---	---	---	---	---	0.000
0.12	43	432.62	0.00	---	---	---	0.00	---	---	---	---	---	0.000
0.14	50	432.64	0.00	---	---	---	0.00	---	---	---	---	---	0.000
0.16	58	432.66	0.00	---	---	---	0.00	---	---	---	---	---	0.000
0.18	65	432.68	0.00	---	---	---	0.00	---	---	---	---	---	0.000
0.20	72	432.70	0.00	---	---	---	0.00	---	---	---	---	---	0.000
0.22	79	432.72	0.00	---	---	---	0.00	---	---	---	---	---	0.000
0.24	86	432.74	0.00	---	---	---	0.00	---	---	---	---	---	0.000
0.26	94	432.76	0.00	---	---	---	0.00	---	---	---	---	---	0.000
0.28	101	432.78	0.00	---	---	---	0.00	---	---	---	---	---	0.000
0.30	108	432.80	0.00	---	---	---	0.00	---	---	---	---	---	0.000
0.32	115	432.82	0.00	---	---	---	0.00	---	---	---	---	---	0.000
0.34	122	432.84	0.00	---	---	---	0.00	---	---	---	---	---	0.000
0.36	130	432.86	0.00	---	---	---	0.00	---	---	---	---	---	0.000
0.38	137	432.88	0.00	---	---	---	0.00	---	---	---	---	---	0.000
0.40	144	432.90	0.00	---	---	---	0.00	---	---	---	---	---	0.000
0.42	151	432.92	0.00	---	---	---	0.00	---	---	---	---	---	0.000
0.44	158	432.94	0.00	---	---	---	0.00	---	---	---	---	---	0.000
0.46	166	432.96	0.00	---	---	---	0.00	---	---	---	---	---	0.000
0.48	173	432.98	0.00	---	---	---	0.00	---	---	---	---	---	0.000
0.50	180	433.00	0.00	---	---	---	0.00	---	---	---	---	---	0.000
0.52	187	433.02	0.00	---	---	---	0.00	---	---	---	---	---	0.000
0.54	194	433.04	0.00	---	---	---	0.00	---	---	---	---	---	0.000
0.56	202	433.06	0.00	---	---	---	0.00	---	---	---	---	---	0.000
0.58	209	433.08	0.00	---	---	---	0.00	---	---	---	---	---	0.000
0.60	216	433.10	0.00	---	---	---	0.00	---	---	---	---	---	0.000
0.62	223	433.12	0.00	---	---	---	0.00	---	---	---	---	---	0.000
0.64	230	433.14	0.00	---	---	---	0.00	---	---	---	---	---	0.000

Continues on next page...

BASIN DEWATERING TIME CALCULATIONS

BASIN NAME	UG-BASIN
Design Rate, MLV-7 TP-1, IN/HR	0.38
Design Rate, MLV-7 TP-2, IN/HR	0.13
AVERAGE, IN/HR	0.26
DESIGN RATE, IN/HR	**0.26**
INFILTRATION OF STORAGE VOLUME BELOW PRIMARY ORIFICE	
Bed Bottom Area	900.00
Storage Volume	576.00
DRAIN TIME (1)	**30.12** *DRAIN TIME FOR DEAD STORAGE BELOW PRIMARY ORIFICE*
INFILTRATION OF STORAGE VOLUME ABOVE PRIMARY ORIFICE (THROUGH OUTLET STR)	



Time (hrs)	Elev (ft)
11.93	433.78
11.95	433.85
11.97	433.92
11.98	433.98
12.00	434.03
12.02	<434.02>
12.03	434.02
12.05	434.01
12.07	434.01
12.08	434.01
12.10	434.01
12.12	434.00
12.13	434.00
12.15	434.00
12.17	434.00
12.18	434.00
12.20	434.00
12.22	434.00
12.23	434.00
12.25	434.00
12.27	434.00
12.28	434.00
12.30	434.00
12.32	434.00
12.33	434.00
12.35	434.00
12.37	434.00
12.38	434.00
12.40	434.00
12.42	434.00
12.43	434.00
12.45	434.00
12.47	434.00
12.48	434.00
12.50	434.00
12.52	434.00

DRAIN TIME (2)	**0.10**	*DRAIN TIME FROM 100-YEAR STORM PEAK TO DEAD STORAGE ELEVATION*
TOTAL DRAIN TIME (1+2)	**30.22**	OK

PENNEAST-MLV 7
WEIR DISCHARGE

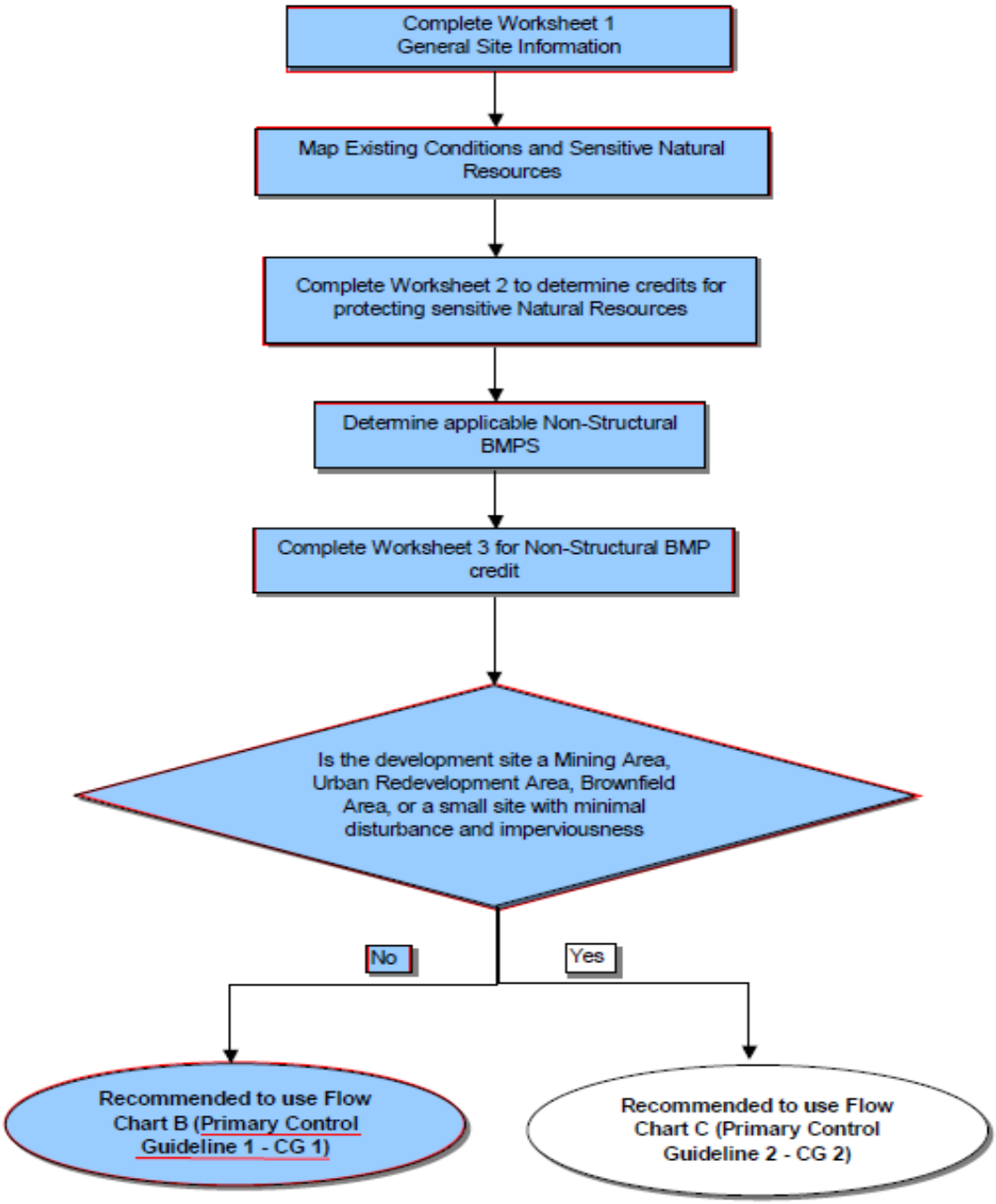
OUTLET ID	IN-1	
Discharge Type	Surface	
10-YR Peak Discharge, cfs	0.02	10-Year Trench Discharge from Model Hydrograph 22
DS Ground Cover	Grass	
Crest Elev.	434	
Design Criteria cfs/lf	13.0	
Calculated Crest Length, ft	0.3	
Design Crest Length, ft	**30**	
Weir Coefficient	3.33	Use sharp crested value to calculate higher velocity
Weir Head (H)	0.00	to be conservative.
Flow Area	0.10	
Velocity	0.00	
Velocity Non-Erosive	YES	

PENNEAST-MLV - 7

PROPOSED DRAINAGE PIPES CAPACITY ANALYSIS

Pipe ID	P-1	
Upstream Str	IN-1	
Downstream Str	OUT	
peak Discharge, cfs	0.40	100-Year Flow
Pipe Diamater, in	15.00	
Manning's N	0.011	
% Slope	1.00	
diameter of pipe, d, ft	1.5	
wetted area, sf =	1.77	
wetted perimeter, P, ft =	4.71	
R =	0.38	
Slope, ft/ft =	0.01	
Full Flow Velocity, ft/s =	**7.04**	
Full Flow Q, cfs =	**12.45**	**Capacity Ok**

C. BMP Worksheets


Complete Worksheet 1
General Site Information
Map Existing Conditions and Sensitive Natural Resources
Complete Worksheet 2 to determine credits for protecting sensitive Natural Resources
Determine applicable Non-Structural BMPS
Complete Worksheet 3 for Non-Structural BMP credit
Is the development site a Mining Area, Urban Redevelopment Area, Brownfield Area, or a small site with minimal disturbance and imperviousness
No
Yes
Recommended to use Flow Chart B (Primary Control Guideline 1 - CG 1)
Recommended to use Flow Chart C (Primary Control Guideline 2 - CG 2)

Worksheet 1. General Site Information

Date: Oct-19

Project Name: PennEast Pipeline - MLV-7

Municipality: Upper Nazareth Township

County: Northampton

Total Area (acres): 0.07

Major River Basin: Delaware River Basin
http://www.dep.state.pa.us/dep/deputate/watermgt/wc/default.htm - newtopics

Watershed: Lehigh River

Sub-Basin: Lehigh

Nearest Surface Water(s) to Receive Runoff: East Branch Monocacy Creek

Chapter 93 - Designated Water Use: HQ-CWF, MF
http://www.pacode.com/secure/data/025/chapter93/chap93toc.html

Impaired according to Chapter 303(d) List ? Yes ☐ No ☑
http://www.dep.state.pa.us/dep/deputate/watermgt/wqp/wqstandards/303d-Report.htm

List Causes of Impairment:

Is project subject to, or part of:

Municipal Separate Storm Sewer System (MS4) Requirements? Yes ☐ No ☑
http://www.dep.state.pa.us/dep/deputate/watermgt/wc/Subjects/StormwaterManagement/GeneralPermits/default.htm

Existing or planned drinking water supply? Yes ☐ No ☑

If yes, distance from proposed discharge (miles):

Approved Act 167 Plan? Yes ☑ No ☐
http://www.dep.state.pa.us/dep/deputate/watermgt/wc/Subjects/StormwaterManagement/Approved_1.html

Existing River Conservation Plan? Yes ☐ No ☑
http://www.dcnr.state.pa.us/brc/rivers/riversconservation/planningprojects/

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	no		
Floodplains	no		
Riparian Areas	no		
Wetlands	no		
Woodlands	no		
Natural Drainage Ways	no		
Steep Slopes, 15%-25%	no		
Steep Slopes, over 25%	no		
Other:	no		
Other:	no		
TOTAL EXISTING:		**0.00**	**0.00**

Worksheet 3. Nonstructural BMP Credits

PROTECTED AREA

1.1 Area of Protected Sensitive/Special Value Features (see WS 2) 0.00 Ac.

1.2 Area of Riparian Forest Buffer Protection 0.00 Ac.

1.3 Area of Minimum Disturbance/Reduced Grading 0.00 Ac.

TOTAL 0.00 Ac.

Site Area	*minus*	Protected Area	=	Stormwater Management Area
0.07	-	0.00	=	0.07

VOLUME CREDITS

3.1 Minimum Soil Compaction

Lawn 0 sq. ft x 1/4" x 1/12 = 0 cubic ft

Meadow 0 sq. ft x 1/3" x 1/12 = 0 cubic ft

3.3 Protect Existing Trees

For Trees within 100 feet of impervious area:

Tree Canopy 0 sq. ft x 1/2" x 1/12 = 0 cubic ft

For Trees within 20 feet of impervious area:

Tree Canopy 0 sq. ft x 1" x 1/12 = 0 cubic ft

5.1 Disconnect Roof Leaders to Vegetated Areas

For runoff directed to areas protected under 5.8.1 and 5.8.2

Roof Area 0 sq. ft x 1/3" x 1/12 = 0 cubic ft

For all other disconnected roof areas

Roof Area 0 sq. ft x 1/4" x 1/12 = 0 cubic ft

5.2 Disconnect Non-Roof Impervious to Vegetated Areas

For runoff directed to areas protected under 5.8.1 and 5.8.2

Impervious Area 0 sq. ft x 1/3" x 1/12 = 0 cubic ft

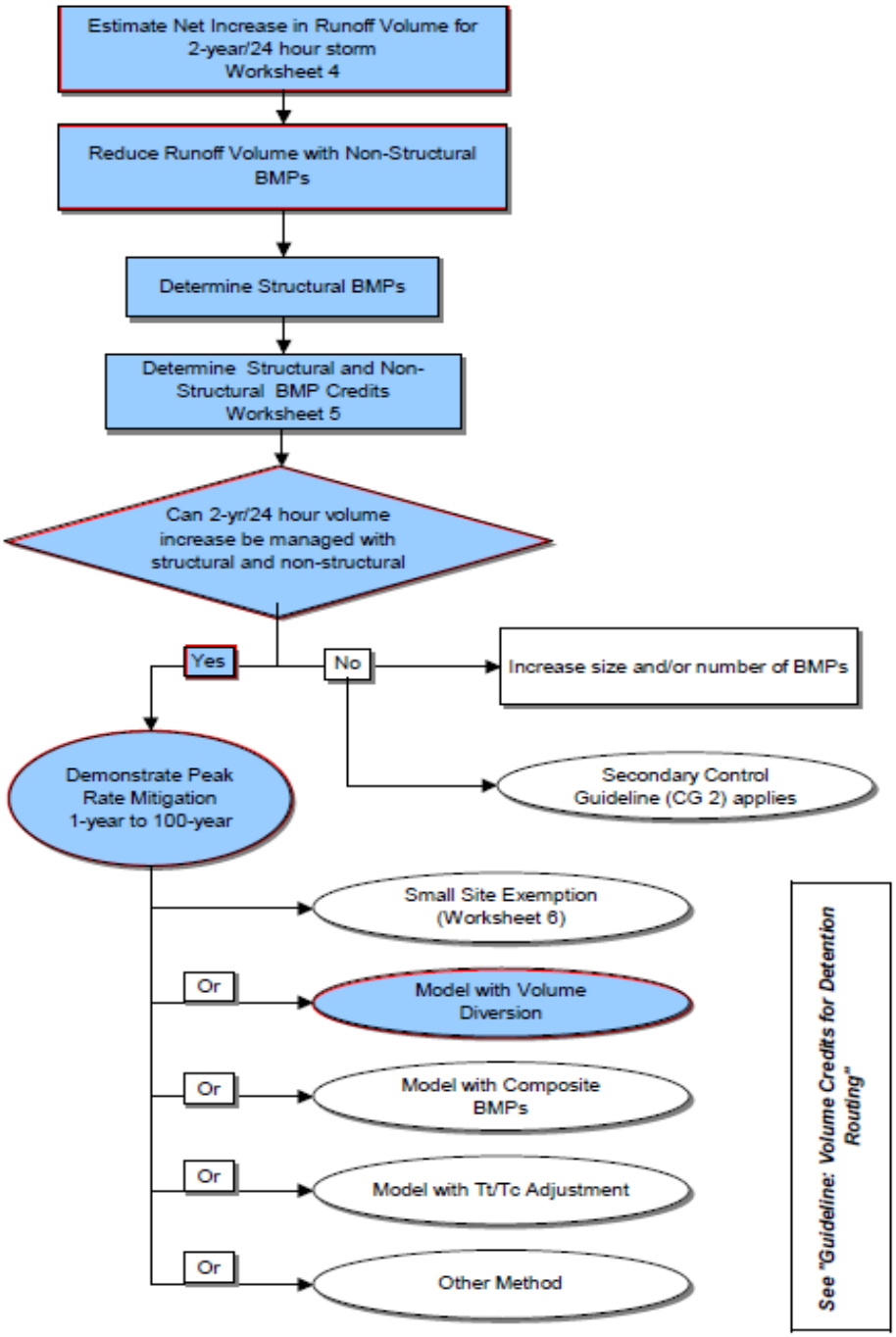
For all other disconnected areas

Impervious Area 0 sq. ft x 1/4" x 1/12 = 0 cubic ft

TOTAL NON-STRUCTURAL VOLUME CREDIT* 0 cubic ft

* For use on Worksheet 5

FLOW CHART B
Control Guideline 1 Process



Worksheet 4A. Change in Runoff Volume for 1-Yr Storm Event

PROJECT: PennEast Pipeline - MLV-7
Drainage Area: 0.15 acres
1-Year Rainfall: 2.74 in

Total Site Area: 0.07 acres
Protected Site Area: 0.00 acres
Managed Area: 0.07 acres

Existing Conditions:

Cover Type/ Condition	Soil Type	Area (sf)	Area (ac)	CN	S	Ia (0.2*S)	Q Runoff (in)	Runoff Volume (cubic ft)
Meadow	CIA	1,015	0.02	71	4.08	0.82	0.62	52
Meadow	CIA	410	0.01	71	4.08	0.82	0.62	21
Meadow	CIA	300	0.01	71	4.08	0.82	0.62	15
Meadow	CIA	190	0.00	71	4.08	0.82	0.62	10
Meadow	CIA	330	0.01	71	4.08	0.82	0.62	17
Meadow	CIA	715	0.02	71	4.08	0.82	0.62	37
TOTAL:		**2,960**	**0.07**				**3.69**	**152**

Developed Conditions:

Cover Type/ Condition	Soil Type	Area (sf)	Area (ac)	CN	S	Ia (0.2*S)	Q Runoff (in)	Runoff Volume (cubic ft)
Meadow	CIA	1,015	0.02	71	4.08	0.82	0.62	52
Gravel	CIA	410	0.01	91	0.99	0.20	1.83	63
Impervious	CIA	300	0.01	98	0.20	0.04	2.51	63
Gravel	CIA	190	0.00	91	0.99	0.20	1.83	29
Meadow	CIA	330	0.01	71	4.08	0.82	0.62	17
Impervious	CIA	715	0.02	98	0.20	0.04	2.51	150
TOTAL:		**2,960**	**0.07**				**9.91**	**373**

1-Year Volume Increase (cubic ft): 221

1-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 (sq. ft)

Note: Runoff Volume must be calculated for EACH land use type/condition and HSG.
The use of a weighted CN value for volume calculations is not acceptable.

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

PROJECT: PennEast Pipeline - MLV-7
Drainage Area: 0.15 acres
2-Year Rainfall: 3.29 in

Total Site Area: 0.07 acres
Protected Site Area: 0.00 acres
Managed Area: 0.07 acres

Existing Conditions:

Cover Type/ Condition	Soil Type	Area (sf)	Area (ac)	CN	S	Ia (0.2*S)	Q Runoff (in)	Runoff Volume (cubic ft)
Meadow	CIA	1,015	0.02	71	4.08	0.82	0.93	79
Meadow	CIA	410	0.01	71	4.08	0.82	0.93	32
Meadow	CIA	300	0.01	71	4.08	0.82	0.93	23
Meadow	CIA	190	0.00	71	4.08	0.82	0.93	15
Meadow	CIA	330	0.01	71	4.08	0.82	0.93	26
Meadow	CIA	715	0.02	71	4.08	0.82	0.93	56
TOTAL:		**2,960**	**0.07**				**5.60**	**230**

Developed Conditions:

Cover Type/ Condition	Soil Type	Area (sf)	Area (ac)	CN	S	Ia (0.2*S)	Q Runoff (in)	Runoff Volume (cubic ft)
Meadow	CIA	1,015	0.02	71	4.08	0.82	0.93	79
Gravel	CIA	410	0.01	91	0.99	0.20	2.34	80
Impervious	CIA	300	0.01	98	0.20	0.04	3.06	76
Gravel	CIA	190	0.00	91	0.99	0.20	2.34	37
Meadow	CIA	330	0.01	71	4.08	0.82	0.93	26
Impervious	CIA	715	0.02	98	0.20	0.04	3.06	182
TOTAL:		**2,960**	**0.07**				**12.67**	**480**

2-Year Volume Increase (cubic ft): 250

1-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 (sq. ft)

Note: Runoff Volume must be calculated for EACH land use type/condition and HSG.
The use of a weighted CN value for volume calculations is not acceptable.

Worksheet 5. Structural BMP Volume Credits

PROJECT: PennEast Pipeline - MLV-7
SUB-BASIN: Lehigh

Required Control Volume (cubic ft) - from Worksheet 4:		250
Non-structural Volume Credit (cubic ft) - from Worksheet 3:	-	0
Structural Volume Requirement (cubic ft) *(Required Control Volume minus Non-structural Credit)*		250

	Proposed BMP	Area (sq. ft)	Storage Volume (cubic ft)
6.4.1	Porous Pavement		
6.4.2	Infiltration Basin		
6.4.3	Infiltration Bed		
6.4.4	Infiltration Trench	900	370
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		
6.6.3	Dry Extended Detention Basin		
6.6.4	Water Quality Filters		
6.7.1	Riparian 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			

Total Structural Volume (cubic ft): 370

Structural Volume Requirement (cubic ft): 250

DIFFERENCE 120 cubic ft

Worksheet 6. Small Site / Small Impervious Area Exception for Peak Rate Mitigation Calculations

The following conditions must be met for exemption from peak rate analysis for small sites under CG-1:

Y The 2-Year Runoff Volume increase must be met in BMPs designed in accordance with Manual Standards.

Y Total Site Impervious Area may not exceed **1 acre.**

Y Maximum Development Area is **5 acres.**

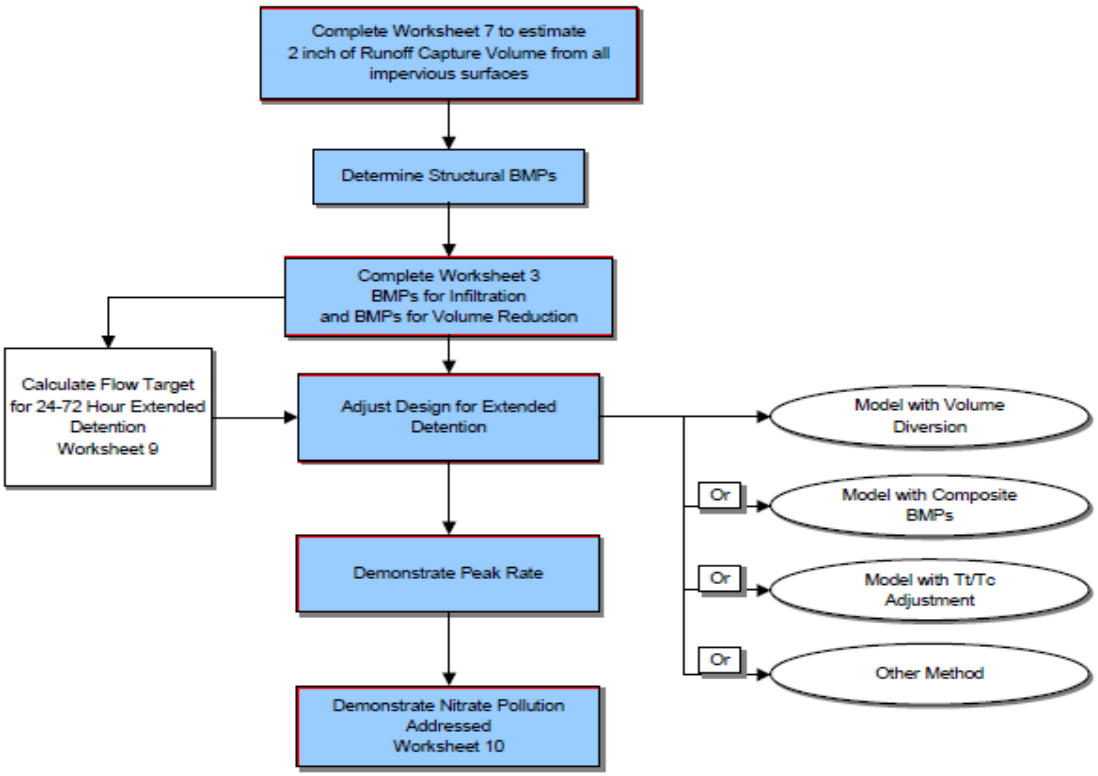
Y Maximum site impervious cover is 50%.

Y No more than 25% Volume Control can be in Non-structural BMPs.

Y Infiltration BMPs must have an infiltration of at least 0.5 in/hr.

Site Area	Percent Impervious	Total Impervious
5 acre	20%	1 acre
2 acre	50%	1 acre
1 acre	50%	0.5 acre
0.5 acre	50%	0.25 acre

FLOW CHART C
Control Guideline 2 Process



Since the Act 167 Plan requires complinace with CG1 and CG2 Flow Chart C and Worksheets 7 and 8 have been included.

Worksheet 7. Calculation of Runoff Volume (PRV and EDV) for CG-2 Only

PROJECT: PennEast Pipeline - MLV-7
DRAINAGE AREA: 0.07

Total Site Area: 0.07 acres
Protected Site Area: 0.00 acres
Managed Area: 0.07 acres
Total Impervious Area: 0.03 acres

2 Inch Runoff - Multiply Total Impervious Area by 2 inc

Cover Type	Area (ac)	Runoff Capture Volume (cubic ft)
Roof	0.00	0
Pavement	0.03	218
Other Impervious	0.00	0
TOTAL:	0.03	218

1 Inch Rainfall ·

Cover Type	Area (square ft)	Area (ac)	Runoff (in)	Runoff Volumes (cubic ft)
Gravel	410	0.01	0.79	27.02
Impervious	300	0.01	0.79	19.77
Gravel	190	0.00	0.79	13
Impervious	715	0.02	0.79	47
TOTAL:	1,615	0.04		106

1. Total Runoff Capture Volume (cu ft) = Total Impervious Area (sq ft x 2 inch x 1/12)

2. PRV (cu ft) = Total Impervious Area (sq ft) x 1 inch x 1/12

3. EDV (cu ft) = Total Area (sq ft) x 1 inch x 1/12

Water quality volume requirements for land areas with existing cover consisting of meadow, brush, wood-grass combination, or woods proposed for conversion to any other non-equivalent type of pervious cover shall be sized for one-half (1/2) the volume required for impervious surfaces as mentioned in this worksheet and calculated in items 1 through 3 above

Worksheet 8. Structural BMP Volume Credits

PROJECT: PennEast Pipeline - MLV-7
SUB-BASIN: Lehigh

Required Control Volume (cubic ft) - *from Worksheet 7:*		218
Non-structural Volume Credit (cubic ft) - *from Worksheet 3:*	-	0
Structural Volume Reqmt (cubic ft) *(Required Control Volume minus Non-structural Credit)*		218

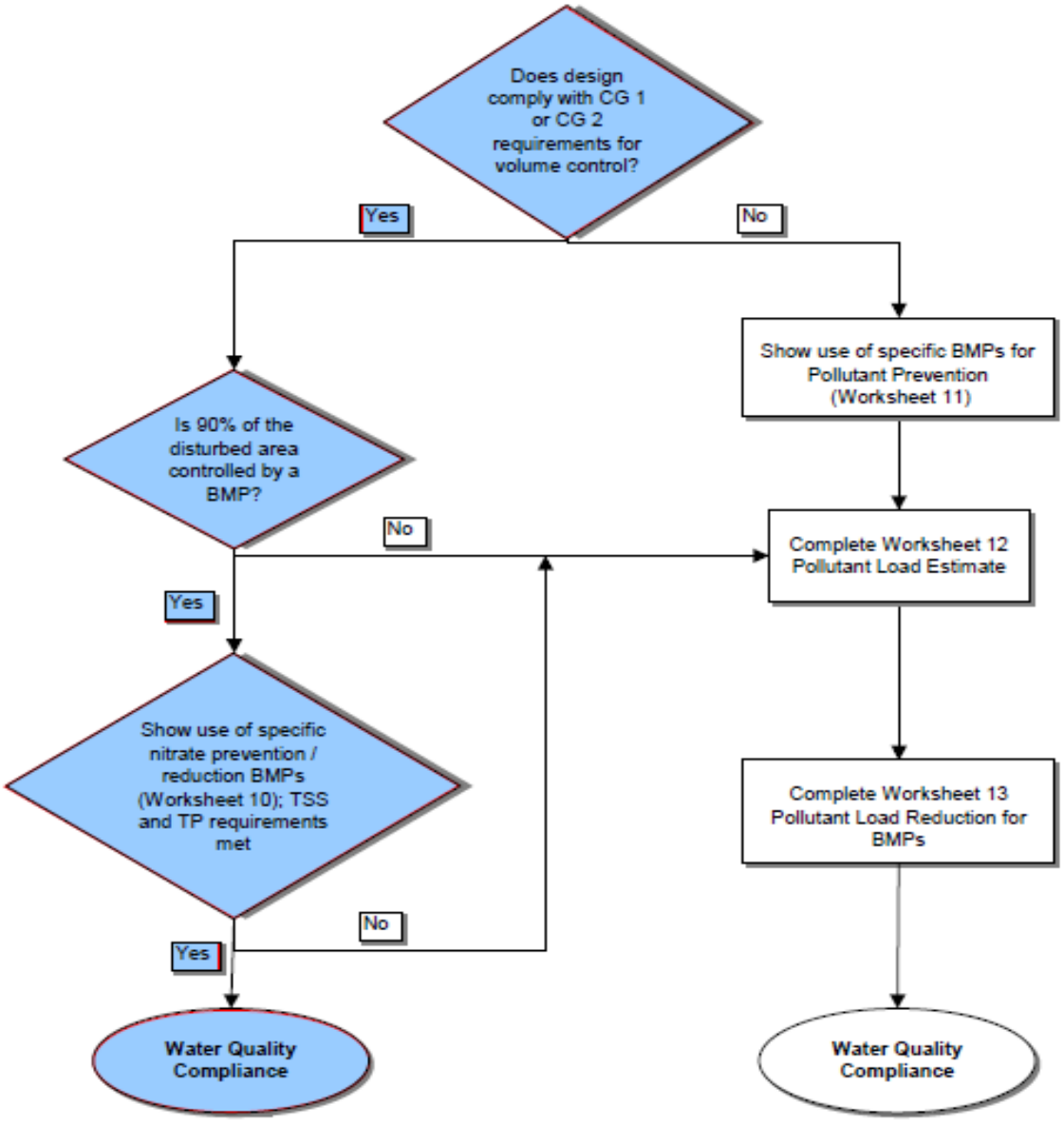
	Proposed BMP*	Area (square ft)	Storage Volume (cubic ft)
6.4.1	Porous Pavement		
6.4.2	Infiltration Basin		
6.4.3	Infiltration Bed		
6.4.4	Infiltration Trench	900	270
6.4.5	Rain Garden / Bioretention		
6.4.6	Dry Well / Seepage Pit		
6.4.7	Constructed Filter		
6.4.8	Vegetated Swale		
6.4.9	Vegetated Filter 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		
6.6.3	Dry Extended Detention Basin		
6.6.4	Water Quality Filters		
6.7.1	Riparian 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			

Total Structural Volume (cubic ft): 270

Structural Volume Requirement (cubic ft): 218

DIFFERENCE 52

Flow Chart D
Water Quality Process



Worksheet 10. Water Quality Compliance for Nitrate

Does the site design incorporate the following BMPs to address nitrate pollution? A summary "yes" rating is achieved if at least 2 Primary BMPs for nitrate are provided across the site or 4 secondary BMPs for nitrate are provided across the site (or 1 primary and 2 secondary).

PRIMARY BMPs FOR NITRATE:

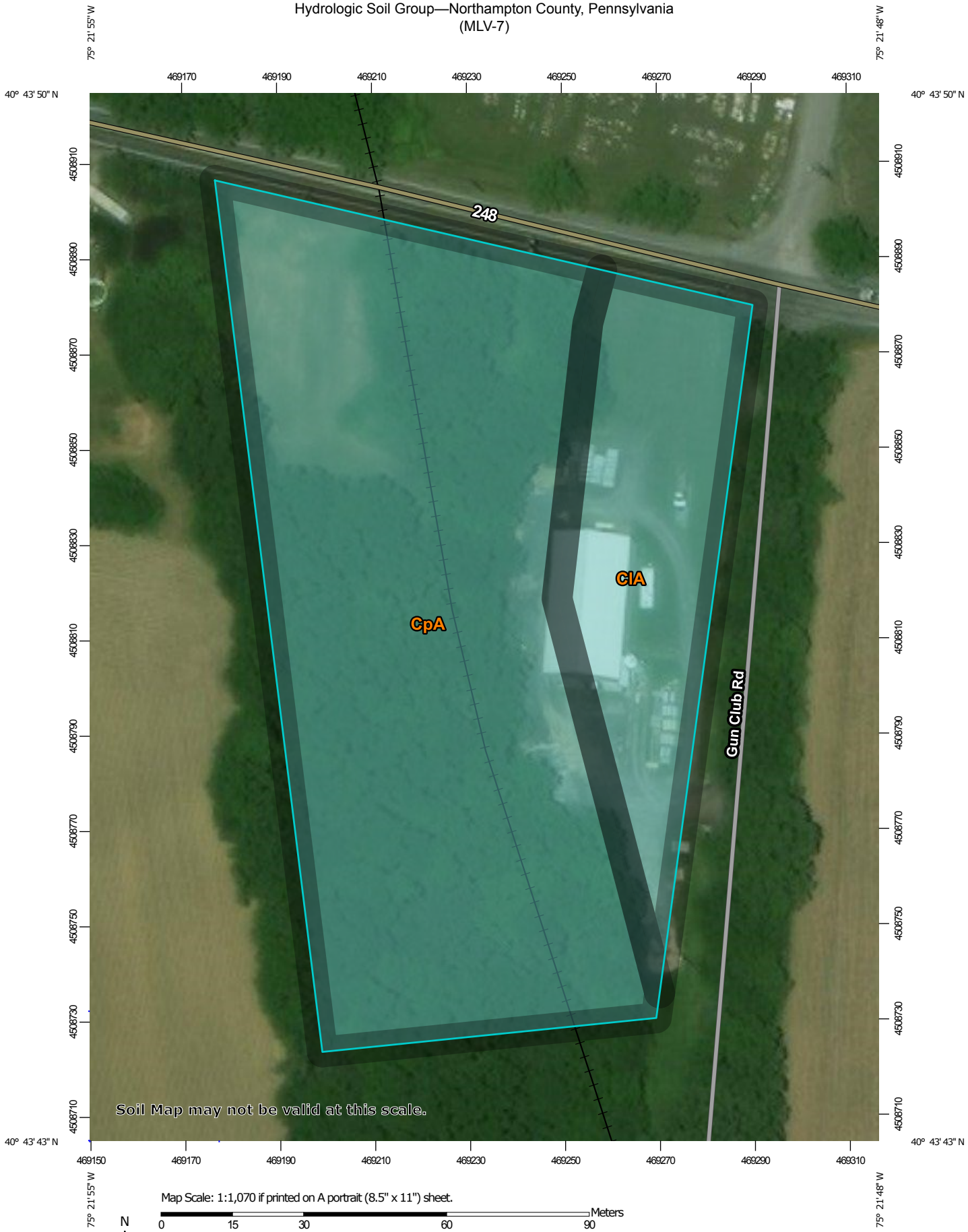
	YES	NO
NS BMP 5.4.2 - Protect / Conserve / Enhance Riparian Buffers		X
NS BMP 5.5.4 - Cluster Uses at Each Site	X	
NS BMP 5.6.1 - Minimize Total Disturbed Area		X
NS BMP 5.6.3 - Re-Vegetate / Re-Forest Disturbed Areas		X
NS BMP 5.9.1 - Street Sweeping / Vacuuming		X
Structural BMP 6.7.1 - Riparian Buffer Restoration		X
Structural BMP 6.7.2 - Landscape Restoration	X	

SECONDARY BMPs FOR NITRATE:

NS BMP 5.4.1 - Protect Sensitive / Special Value Features		X
NS BMP 5.4.3 - Protect / Utilize Natural Drainage Features		X
NS BMP 5.6.2 - Minimize Soil Compaction		X
Structural BMP 6.4.5 - Rain Garden / Bioretention		X
Structural BMP 6.4.8 - Vegetated Swale	X	
Structural BMP 6.4.9 - Vegetated Filter Strip		X
Structural BMP 6.6.1 - Constructed Wetland		X
Structural BMP 6.7.1 - Riparian Buffer Restoration		X
Structural BMP 6.7.2 - Landscape Restoration		X
Structural BMP 6.7.3 - Soils Amendment / Restoration	X	

D. Soil Report

Hydrologic Soil Group—Northampton County, Pennsylvania
(MLV-7)



Map Scale: 1:1,070 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 15 30 60 90

Feet: 0 50 100 200 300

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

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Rating Polygons

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

Soil Rating Lines

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

Soil Rating Points

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

Water Features

Streams and Canals

Transportation

Rails
Interstate Highways
US Routes
Major Roads
Local Roads

Background

Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:12,000.

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

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

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

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

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

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

Soil Survey Area: Northampton County, Pennsylvania
Survey Area Data: Version 9, Oct 4, 2017

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

Date(s) aerial images were photographed: Sep 20, 2010—Aug 28, 2016

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

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
ClA	Clarksburg silt loam, 0 to 3 percent slopes	C	0.9	23.3%
CpA	Comly silt loam, 0 to 3 percent slopes	C	2.9	76.7%
Totals for Area of Interest			**3.8**	**100.0%**

Description

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

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

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

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

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

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

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

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

TABLE E.1 LIMITATIONS OF PENNSYLVANIA SOILS PERTAINING TO EARTHMOVING PROJECTS (Absence of an X does not mean "No Potential Limitation")
NOTE: THIS IS NOT NECESSARILY AN ALL-INCLUSIVE LIST.

SITE	SOIL NAME	CUTBANKS CAVE	CORROSIVE TO CONCRETE\STEEL	DROUGHTY	EASLY ERODIBLE	FLOODING	DEPTH TO SATURATED ZONE/ SEASONAL HIGH WATER TABLE	HYDRIC/ HYDRIC INCLUSIONS	LOW STRENGTH/ LANDSLIDE PRONE	SLOW PERCOLATION	PIPING	POOR SOURCE OF TOPSOIL	FROST ACTION	SHRINK-SWELL	POTENTIAL SINKHOLE	PONDING	WETNESS
MLV-7	Comly	X	C/S	X	X		X	X			X	X	X				

E. Existing Conditons Stormwater Management Map

CpA

UkaB

N/A

NAT_VEG, SWALE

ClA

INF_BAS

INF_BAS

NONE, NAT_VEG

N/A

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

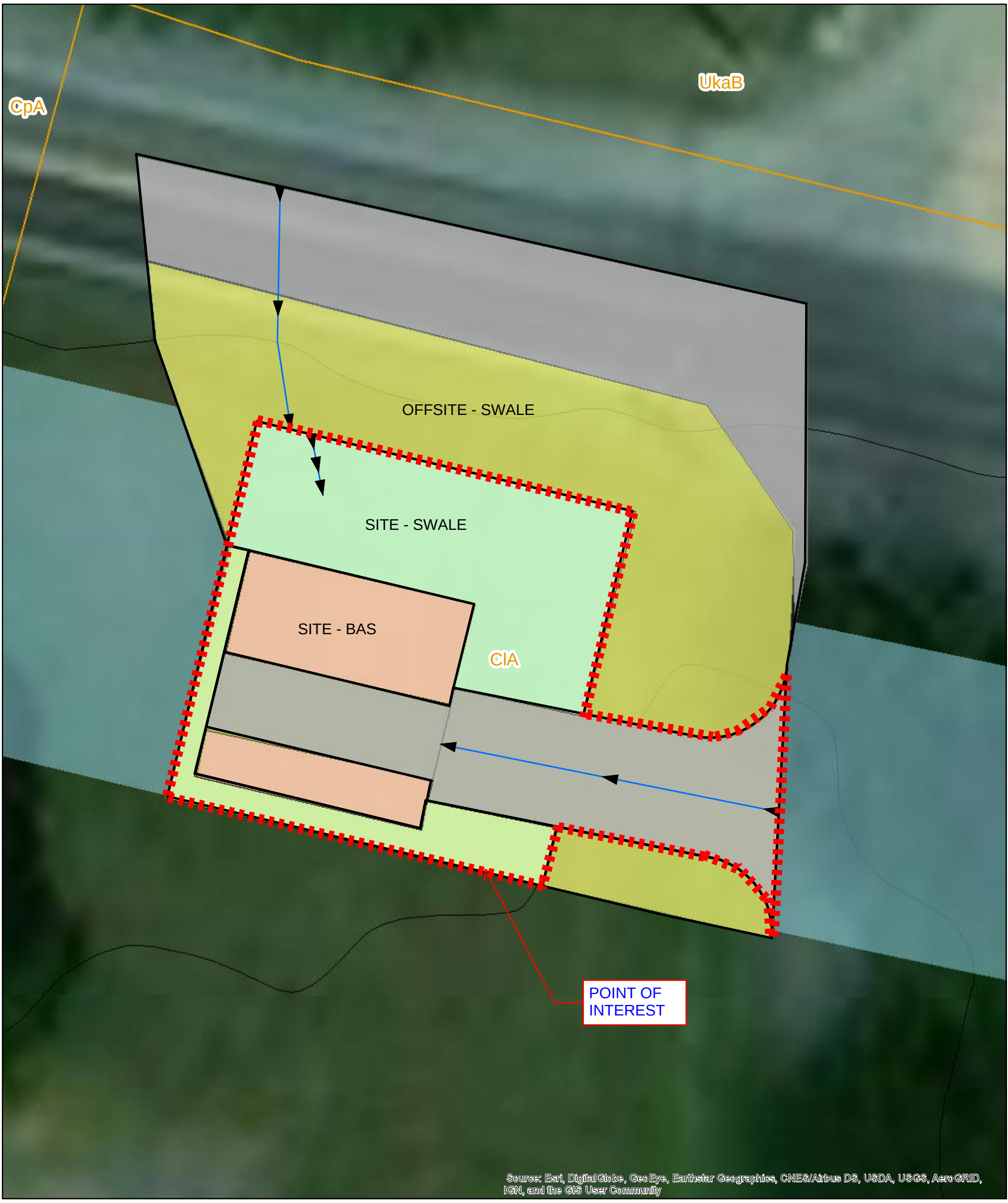
Legend

- Tc Path
- Drainage Area
- LOD
- IMP
- MEAD
- Mainline Easement
- 2ft Contours

0 5 10 20 30 40 Feet

MLV - 7 EXISTING CONDITIONS DRAINAGE AREA MAP

F. Proposed Conditions Stormwater Management Map



Legend

- Tc Path
- Drainage Area
- LOD
- BYPASS
- SWALE
- GRV
- IMP
- MEAD
- Mainline Easement
- 2ft Contours

0 5 10 20 30 40 Feet

MLV - 7 PROPOSED CONDITIONS DRAINAGE AREA MAP

G. Infiltration Memo

MOTT MACDONALD

Technical Note

Project:	PennEast Pipeline Project		
Our reference:	353754-GT-SW-06	**Your reference:**	353754-GT-SW-06
Prepared by:	E. Vigliorolo, EIT	**Date:**	May 24, 2018
Approved by:	V. Shah, PE, PhD	**Checked by:**	E. Pauli, EIT
Subject:	Test Pit and Infiltration Testing – Main Line Valve Site 7		

1 Introduction

This technical note addresses the geotechnical considerations of the suitability of native soils for stormwater design purposes of the Main Line Valve Site 7 located in Nazareth, Northampton County, Pennsylvania (site). The subsurface investigation consisting of two test pits, MLV7-TP1 and MLV7-TP2, were excavated by Craig Test Boring Co., Inc. of Mays Landing, New Jersey on May 16, 2018. Infiltration testing using double-ring infiltrometers was subsequently performed within each test pit. A Locus Map depicting the area of our investigation is provided in Attachment A.

2 Subsurface Investigation and Infiltration Testing Results

Given the presence of suitable soils and absence of competent bedrock within testing zones, all infiltration tests were performed using a double-ring infiltrometer. The double-ring infiltrometer was placed on level ground within the excavated test pits, and driven a minimum of two inches below existing ground surface. Two 30-minute presoaking periods were conducted prior to start of infiltration testing. Both the outer and inner rings were filled with four inches of water, beginning with the outer ring. The drop in the water level during the second 30-minute presoak period was used to determine the timed intervals to be used during testing. The timed interval between readings was determined based on the following criteria:

- If water level drop is two inches or more, 10-minute intervals were used for recording measurements.
- If water level drop is less than two inches, 30-minute intervals were used for recording measurements.

After each reading, both rings were refilled with water to the four-inch level in an iterative manner. Water level depths were regularly recorded until a minimum of eight readings were completed, or a stabilized rate of drop was obtained, whichever occurred first. A stabilized rate of drop is defined as a maximum difference of a 0.25-inch drop between the highest and lowest reading of four consecutive readings. The drop that occurs in the center ring during the final period or the average stabilized rate is expressed in inches per hour and represents the infiltration rate for that test location. At the completion of the infiltration test, each test pit was excavated an additional two feet to observe the subsurface conditions below the test depth. The test pit and infiltration test results are summarized below:

MLV7-TP1

Test pit MLV7-TP1 was excavated to 7 feet below existing grade on May 16, 2018. Two infiltration tests were performed at 5 feet below existing grade within this test pit. The first test yielded an infiltration rate of 0.5 inches per hour (in/hr), and the second test yielded an infiltration rate of 1.0 in/hr. It is recommended that an average infiltration rate of 0.75 in/hr be considered at this location. No restrictive zones or bedrock were encountered within two feet of the testing depth. In accordance with the Pennsylvania Stormwater Best Management Practices Manual (PA BMP), a minimum factor of safety of 2.0 is recommended for soils encountered at this location. Therefore, the recommended design infiltration rate is 0.38 in/hr.

The general description of the soil profile observed within the excavated test pits are provided below:

- **0 – 6 inches**: Topsoil
- **6 – 14 inches**: Brown Fill with concrete, brick, railroad spikes, cables, and metal fragments, moist
- **14 – 27 inches**: Dark gray Fill, possible railroad ballast encountered, moist
- **27 – 38 inches**: Brown silty Clay with coarse gravel, moist
- **38 – 60 inches**: Light brown gravelly Clay, some silt, moist
- **60 – 84 inches**: Light brown gravelly Clay, some silt, wet

Mottling was not observed and groundwater was not encountered within this test pit.

MLV7-TP2

Test pit MLV7-TP2 was also excavated to 7 feet below existing grade on May 16, 2018. Two infiltration tests were performed at 5 feet below existing grade within this test pit. The first test yielded an infiltration rate of 0.0 in/hr, and the second test yielded an infiltration rate of 0.5 in/hr. It is recommended that an average infiltration rate of 0.25 in/hr be considered at this location. No restrictive zones or bedrock were encountered within two feet of testing depth. In accordance with the PA BMP, a minimum factor of safety of 2.0 is recommended for soils encountered at this location. Therefore, the recommended design infiltration rate is 0.13 in/hr.

The general description of the soil profile observed within the excavated test pits are provided below:

- **0 – 6 inches**: Topsoil
- **6 – 24 inches**: Dark gray Fill, coarse gravel, some medium sand, moist
- **24 – 34 inches**: Brown clayey Sand, some medium gravel, some silt, moist
- **34 – 84 inches**: Brownish yellow gravelly Clay, some medium sand, some silt, wet

Mottling was not observed and groundwater was not encountered within this test pit.

Table 1- Infiltration Test Result

Test Pit No.	Existing Grade El. (feet)	Infiltration Test El. (feet)	Infiltration Test Results (Average) (in/hr)	Recommended Safety Factor	Recommended Design Infiltration Rate (in/hr)
MLV7-TP1	432.3	427.3	0.75	2.0	0.38
MLV7-TP2	432.6	427.6	0.25	2.0	0.13

Infiltration rates observed during our investigation were dependent on the subsurface conditions encountered within each test pit. Test locations which resulted in low infiltration rates consisted of predominately low permeable soils such as silt and clays, and test location which resulted in high infiltration rates contained more permeable soils such as sands, gravel, cobbles, and boulders. The test pit logs and infiltration test forms are provided in Attachment B.

Pennsylvania Stormwater Best Management Practices Manual. Department of Environmental Protection. Bureau of Watershed Management. December 30, 2006 was utilized as reference for this scope of work.

Attachments:

- Attachment A – Locus Map
- Attachment B – Test Pit Logs and Infiltration Test Forms

Appendices

A. Locus Map

NAME	LATITUDE	LONGITUDE	ELEVATION (ft)
MLV7-TP1	14792846	1539617	432.32
MLV7-TP2	14792855	1539549	432.636

NOTES:
1. SCALE IS APPROXIMATE
2. GOOGLE EARTH AERIAL IMAGERY DATED 04/17/2017

100 0 100 200
SCALE IN FEET

MOTT MACDONALD
Certificate No. 24GA28016600
111 Wood Avenue South
Iselin, New Jersey 08830-4112

PENNEAST PIPELINE PROJECT
MAIN LINE VALVE SITE 7
NORTHAMPTON COUNTY, PA

Designed	Drawn	Checked	Approved	Date
EAV	EAV	EWP	TR	05-23-2018

B. Test Pit Logs and Infiltration Test Forms

MOTT MACDONALD

TEST PIT LOG

SITE LOCATION	Main Line Valve 7 (MLV7)	**TEST PIT NUMBER**	**MLV7-TP1**
PROJECT NUMBER	353754	**MOTT MACDONALD REPRESENTATIVE**	B. Kalpouzos
GENERAL LOCATION	Nazareth, PA	**CONTRACTOR**	Craig Test Boring Co. Inc.
TIME OPENED	9:30 AM	**TIME CLOSED**	1:30 PM
DEPTH TO WATER (Feet BGS)	Not Encountered	**EQUIPMENT**	Backhoe excavator
TESTING DEPTH (Feet BGS)	5	**FINAL EXCAVATION DEPTH (Feet BGS)**	7
DATE	5/16/2018		

Note: All classifications and descriptions in this log are solely based on visual field observations. They were developed to generally characterize soils for environmental purposes only. They are not to be relied for any other purpose.

MOTT MACDONALD

TEST PIT LOG

SITE LOCATION	Main Line Valve 7 (MLV7)	**TEST PIT NUMBER**	**MLV7-TP2**
PROJECT NUMBER	353754	**MOTT MACDONALD REPRESENTATIVE**	B. Kalpouzos
GENERAL LOCATION	Nazareth, PA	**CONTRACTOR**	Craig Test Boring Co. Inc.
TIME OPENED	11:30 AM	**TIME CLOSED**	3:30 PM
DEPTH TO WATER (feet BGS)	Not Encountered	**EQUIPMENT**	Backhoe excavator
TESTING DEPTH (feet BGS)	5	**FINAL EXCAVATION DEPTH (feet BGS)**	7
DATE	5/16/2018		

Note: All classifications and descriptions in this log are solely based on visual field observations. They were developed to generally characterize soils for environmental purposes only. They are not to be relied for any other purpose.

MOTT MACDONALD M M

Sheet 1 of 2

Infiltration Test Form

Geotechnical Investigation:

- Project Name: Penneast - MLV Testpits
- Date: 5/16/18
- Job Number: 353754
- Site Location: MLV-7 (NAZARETH, PA)
- Contractor: CTB - Hemmel
- Weather/Temp: 64°F | CLOUDY
- Infiltration Test ID: MLV-7 TP-1
- Report by: B. KALPOUTOS
- Testing Depth: 5 FT
- Infiltration Test Method: Double-Ring Infiltrometer

Infiltration Test Pit Soil Description:

Depth Range (inches)		Description of Soil/Rock Layers
0	6	TOPSOIL, Brown, med. to fine sandy SILT, with roots. moist.
6	14	Brown, FILL, with concrete and bricks, railroad spikes, cables & metal fragments.
14	27	DARK GRAY, FILL, POSSIBLE RAILROAD BALLAST
27	38	Brown, silty CLAY, with coarse gravel, moist.
38	60	light brown, gravelly CLAY, some silt, moist.
60	84	light brown, gravelly CLAY, some silt, wet.

Percolation Test:

Test #1

Time (min.)	30 pre-soak	30 pre-soak	30	30	30	30	30	30	
Test Depth (feet)	Reading No. 1	Reading No. 2	Reading No. 3	Reading No. 4	Reading No. 5	Reading No. 6	Reading No. 7	Reading No. 8	Infil. Rate (in. / hour)
5 FT	2.25	1.5	1.0	3/4	1/4	1/4	1/4	1/4	1/2

Test #2

Time (min.)	30 pre-soak	30 pre-soak	30	30	30	30	30	30	
Test Depth (feet)	Reading No. 1	Reading No. 2	Reading No. 3	Reading No. 4	Reading No. 5	Reading No. 6	Reading No. 7	Reading No. 8	Infil. Rate (in. / hour)
5 FT	2	1.75	1.0	3/4	1/2	1/2	1/2	1/2	1.0

MOTT MACDONALD M M

Sheet 1 of 2

Infiltration Test Form

Geotechnical Investigation:

- Project Name: Pennrest - MLV Testpits
- Date: 5/16/18
- Job Number: 353754
- Site Location: MLV-7 (NAZARETH, PA)
- Contractor: CTB - Hemmel
- Weather/Temp: 64°F / CLOUDY
- Infiltration Test ID: MLV7-TP2
- Report by: B. KALPOUZOS
- Testing Depth: 5 FT
- Infiltration Test Method: Double-Ring Infiltrometer

Infiltration Test Pit Soil Description:

Depth Range (inches)		Description of Soil/Rock Layers
0	6	TOPSOIL, dark brown, med to fine sandy silt, with roots, moist.
6	24	FILL, dark gray, coarse gravel, some med sand, moist.
24	34	Brown, clayey sand, some med. gravel, some silt, moist.
34	60	Brownish yellow, gravelly clay, some med sand, some silt, moist.
60	84	Brownish yellow, gravelly clay, some med. sand, some silt, wet.

Percolation Test:

Test #1

Time (min.)	30 pre-soak	30 pre-soak	30	30	30	30	30	30	
Test Depth (feet)	Reading No. 1	Reading No. 2	Reading No. 3	Reading No. 4	Reading No. 5	Reading No. 6	Reading No. 7	Reading No. 8	Infil. Rate (in. / hour)
5 FT	2.25	1.0	1/2	0	Ø	Ø	Ø	Ø	Ø

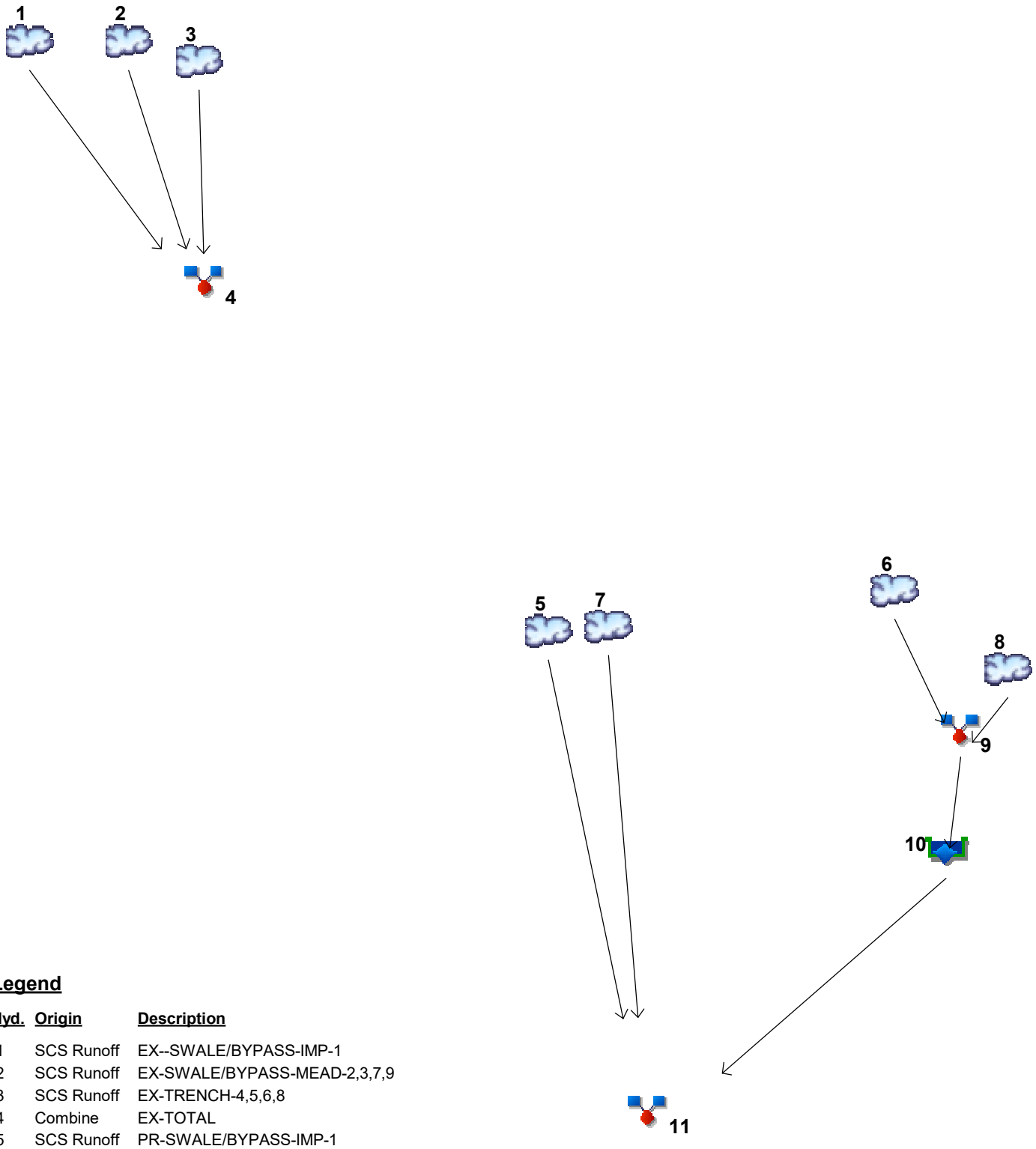
Test #2

Time (min.)	30 pre-soak	30 pre-soak	30	30	30	30	30	30	
Test Depth (feet)	Reading No. 1	Reading No. 2	Reading No. 3	Reading No. 4	Reading No. 5	Reading No. 6	Reading No. 7	Reading No. 8	Infil. Rate (in. / hour)
5 FT.	<2	<2	3/8	3/8	3/8	1/4			1/2

H. Model Input and Output Report

Watershed Model Schematic

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020



Legend

Hyd.	Origin	Description
1	SCS Runoff	EX--SWALE/BYPASS-IMP-1
2	SCS Runoff	EX-SWALE/BYPASS-MEAD-2,3,7,9
3	SCS Runoff	EX-TRENCH-4,5,6,8
4	Combine	EX-TOTAL
5	SCS Runoff	PR-SWALE/BYPASS-IMP-1
6	SCS Runoff	PR-TRENCH-GRV-4,6
7	SCS Runoff	PR-SWALE/BYPASS-MEAD-2,3,7,9
8	SCS Runoff	PR-TRENCH-IMP-5,8
9	Combine	PR-TRENCH
10	Reservoir	INF TRENCH
11	Combine	PR-FINAL

Hydrograph Return Period Recap

Hyd. No.	Hydrograph type (origin)	Inflow hyd(s)	Peak Outflow (cfs)								Hydrograph Description
			1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr	
1	SCS Runoff	------	0.161	0.195	-------	0.244	0.285	0.347	0.401	0.461	EX--SWALE/BYPASS-IMP-1
2	SCS Runoff	------	0.069	0.111	-------	0.181	0.244	0.345	0.434	0.538	EX-SWALE/BYPASS-MEAD-2,3,7,9
3	SCS Runoff	------	0.032	0.052	-------	0.084	0.113	0.160	0.202	0.251	EX-TRENCH-4,5,6,8
4	Combine	1, 2, 3	0.259	0.354	-------	0.504	0.638	0.847	1.031	1.243	EX-TOTAL
5	SCS Runoff	------	0.161	0.195	-------	0.244	0.285	0.347	0.401	0.461	PR-SWALE/BYPASS-IMP-1
6	SCS Runoff	------	0.043	0.054	-------	0.071	0.085	0.107	0.125	0.145	PR-TRENCH-GRV-4,6
7	SCS Runoff	------	0.069	0.111	-------	0.181	0.244	0.345	0.434	0.538	PR-SWALE/BYPASS-MEAD-2,3,7,9
8	SCS Runoff	------	0.089	0.108	-------	0.135	0.158	0.193	0.222	0.256	PR-TRENCH-IMP-5,8
9	Combine	6, 8	0.132	0.162	-------	0.207	0.244	0.299	0.347	0.401	PR-TRENCH
10	Reservoir	9	0.000	0.000	-------	0.000	0.002	0.013	0.043	0.342	INF TRENCH
11	Combine	5, 7, 10	0.228	0.303	-------	0.421	0.526	0.689	0.832	1.071	PR-FINAL

Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

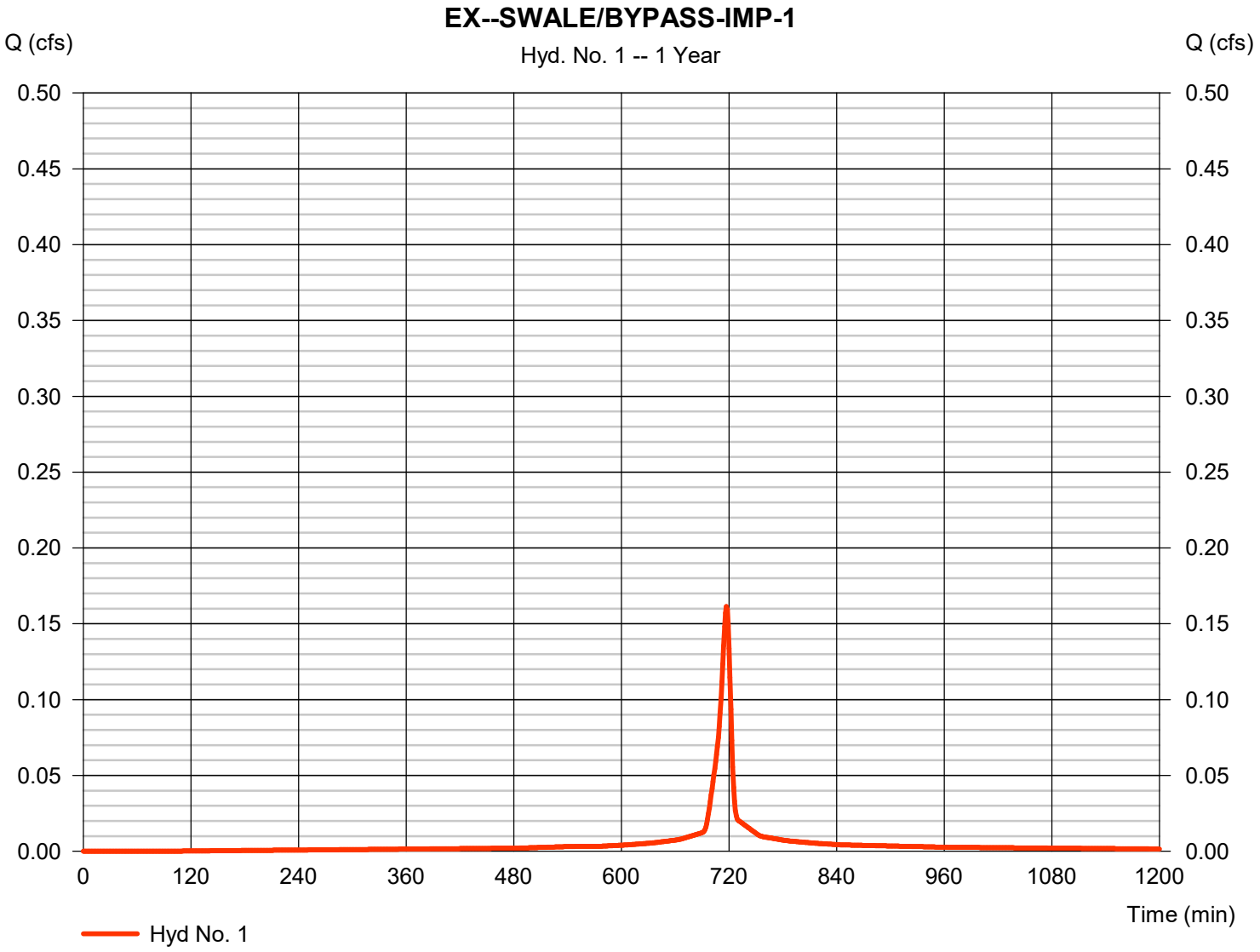
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	0.161	1	717	377	------	------	------	EX--SWALE/BYPASS-IMP-1
2	SCS Runoff	0.069	1	718	150	------	------	------	EX-SWALE/BYPASS-MEAD-2,3,7,9
3	SCS Runoff	0.032	1	719	73	------	------	------	EX-TRENCH-4,5,6,8
4	Combine	0.259	1	718	601	1, 2, 3	------	------	EX-TOTAL
5	SCS Runoff	0.161	1	717	377	------	------	------	PR-SWALE/BYPASS-IMP-1
6	SCS Runoff	0.043	1	717	89	------	------	------	PR-TRENCH-GRV-4,6
7	SCS Runoff	0.069	1	718	150	------	------	------	PR-SWALE/BYPASS-MEAD-2,3,7,9
8	SCS Runoff	0.089	1	717	209	------	------	------	PR-TRENCH-IMP-5,8
9	Combine	0.132	1	717	299	6, 8	------	------	PR-TRENCH
10	Reservoir	0.000	1	n/a	0	9	433.33	299	INF TRENCH
11	Combine	0.228	1	718	528	5, 7, 10	------	------	PR-FINAL

Hydrograph Report

Hyd. No. 1

EX--SWALE/BYPASS-IMP-1

Hydrograph type	= SCS Runoff	Peak discharge	= 0.161 cfs
Storm frequency	= 1 yrs	Time to peak	= 717 min
Time interval	= 1 min	Hyd. volume	= 377 cuft
Drainage area	= 0.042 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 2.63 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

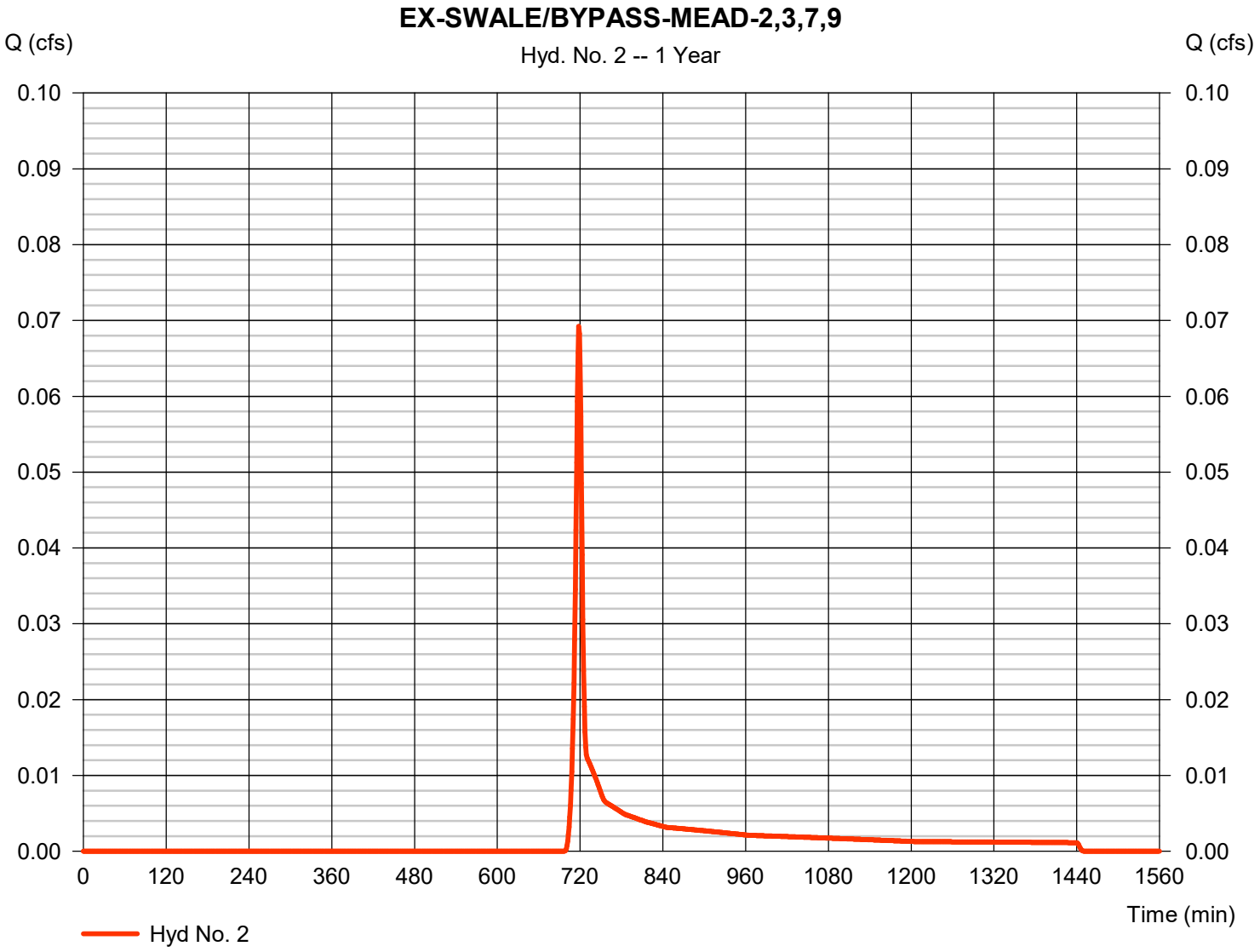


Hydrograph Report

Hyd. No. 2

EX-SWALE/BYPASS-MEAD-2,3,7,9

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.069 cfs
Storm frequency	=	1 yrs	Time to peak	=	718 min
Time interval	=	1 min	Hyd. volume	=	150 cuft
Drainage area	=	0.072 ac	Curve number	=	71
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	2.63 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

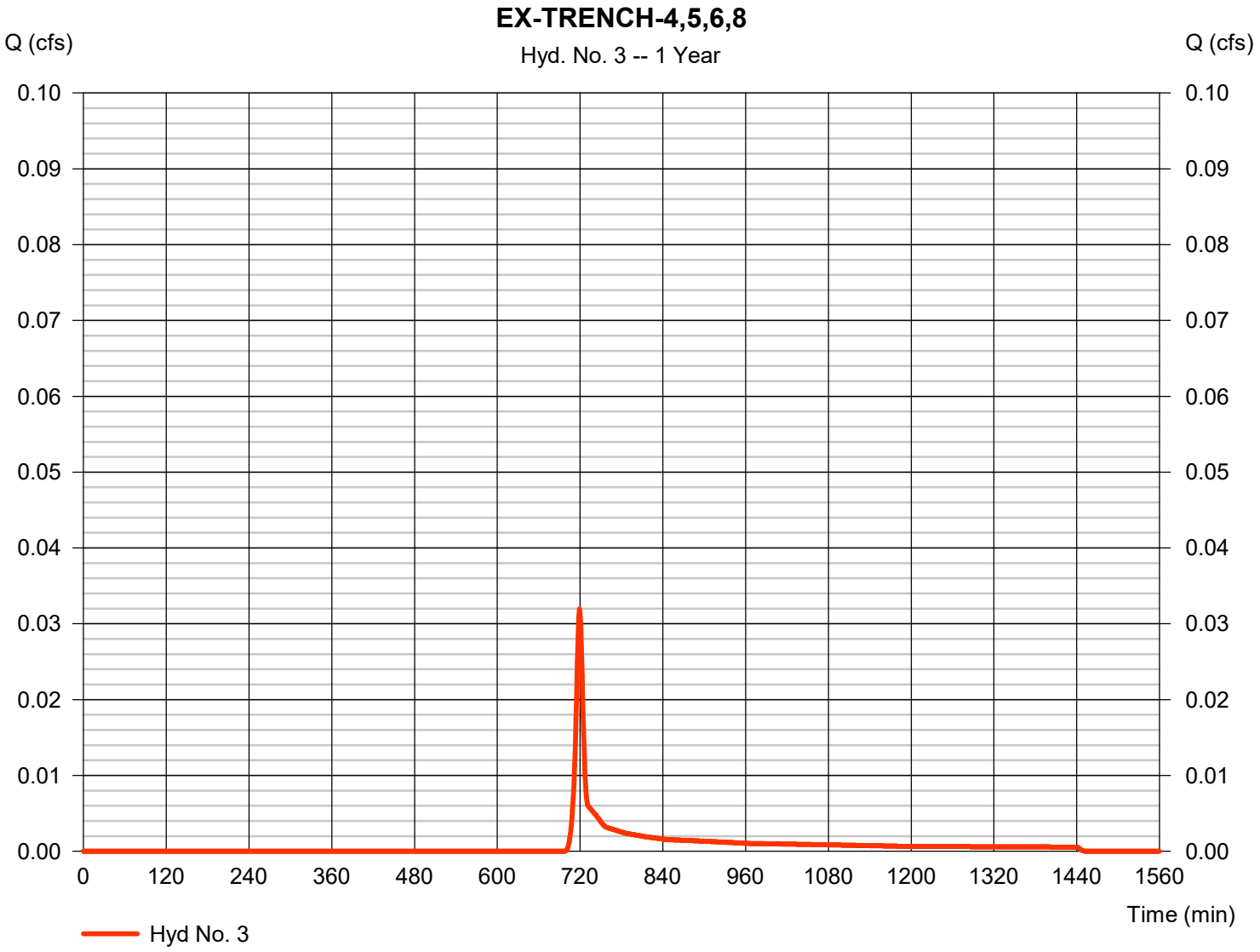


Hydrograph Report

Hyd. No. 3

EX-TRENCH-4,5,6,8

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.032 cfs
Storm frequency	=	1 yrs	Time to peak	=	719 min
Time interval	=	1 min	Hyd. volume	=	73 cuft
Drainage area	=	0.037 ac	Curve number	=	71
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	7.95 min
Total precip.	=	2.63 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

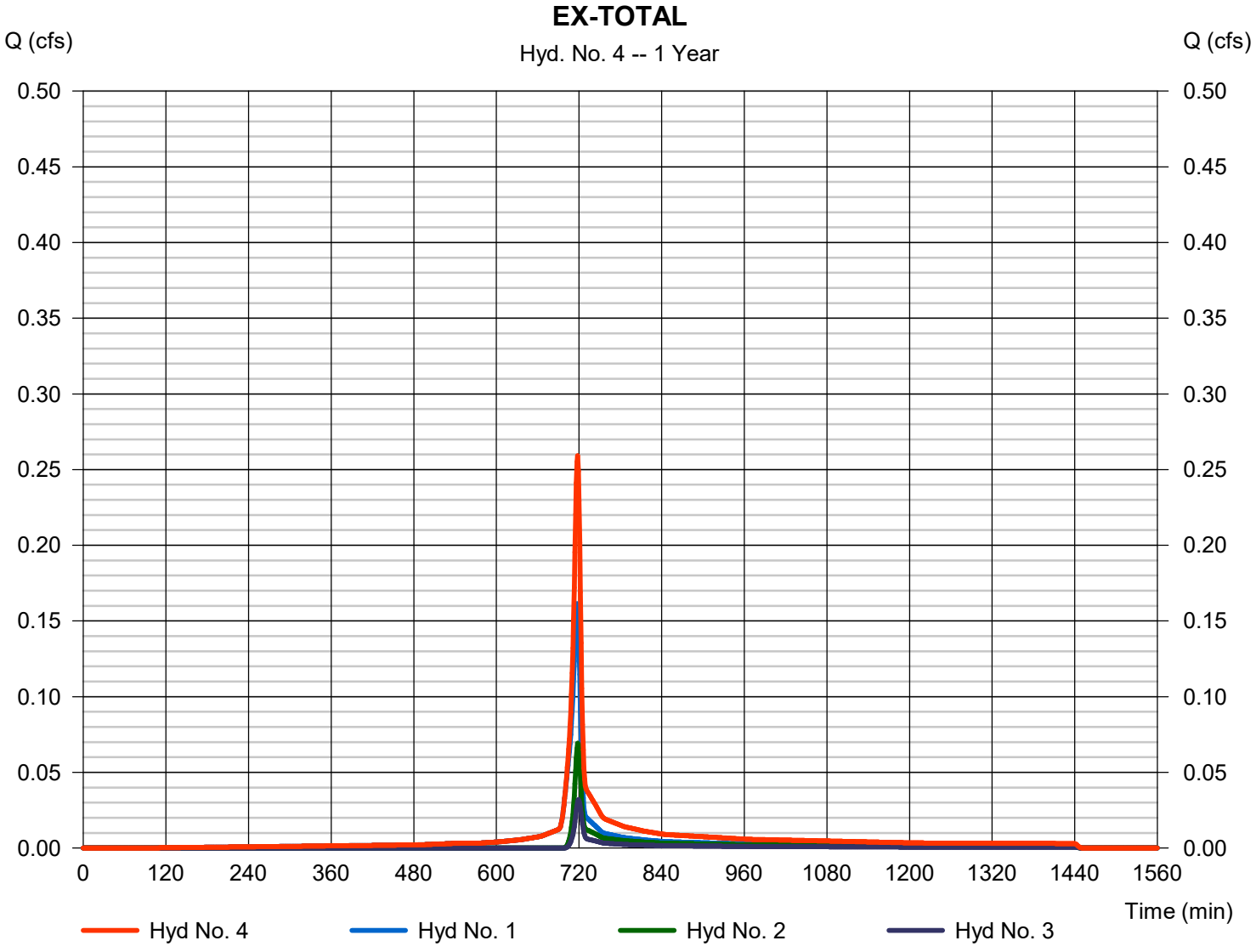


Hydrograph Report

Hyd. No. 4

EX-TOTAL

Hydrograph type	= Combine	Peak discharge	= 0.259 cfs
Storm frequency	= 1 yrs	Time to peak	= 718 min
Time interval	= 1 min	Hyd. volume	= 601 cuft
Inflow hyds.	= 1, 2, 3	Contrib. drain. area	= 0.151 ac

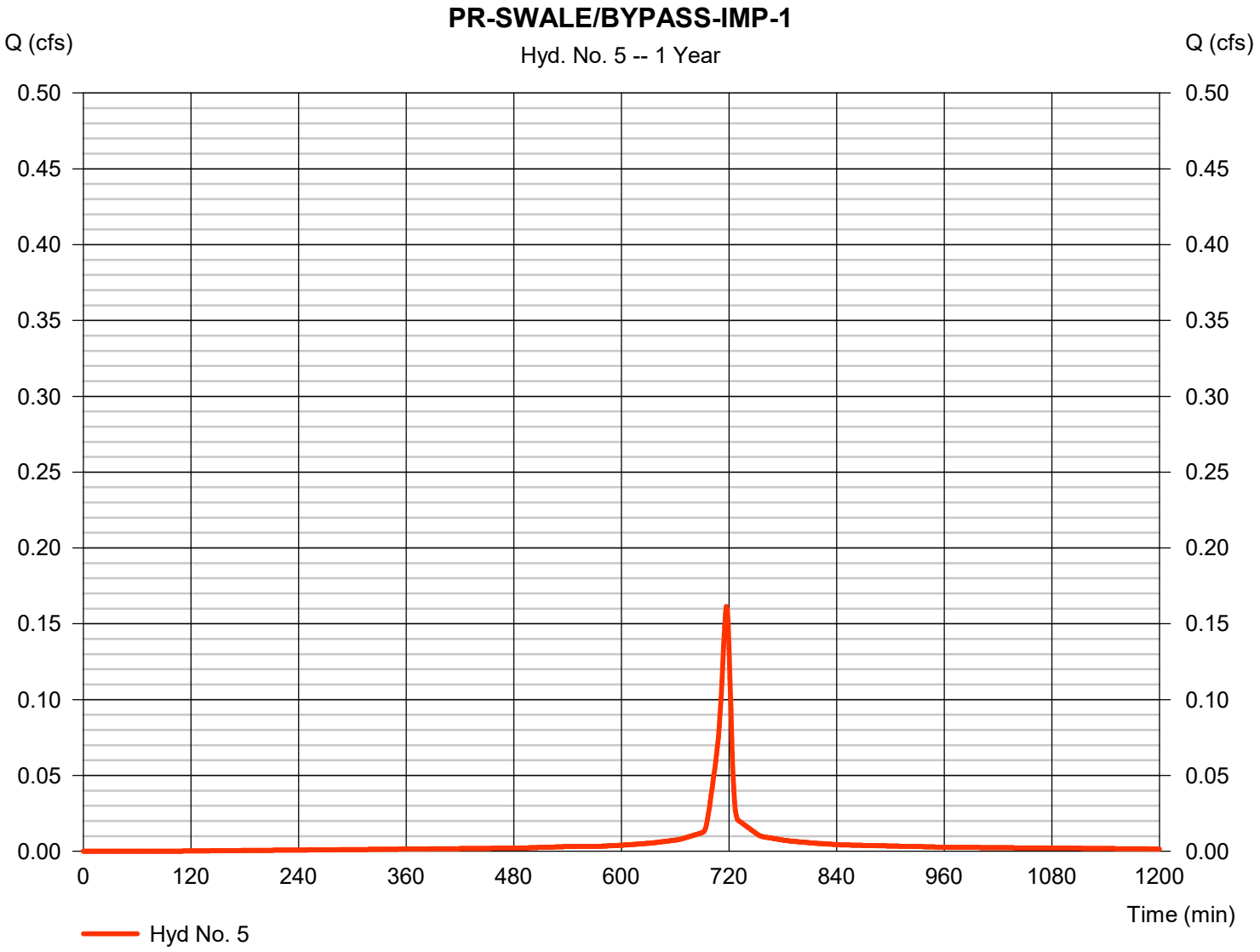


Hydrograph Report

Hyd. No. 5

PR-SWALE/BYPASS-IMP-1

Hydrograph type	= SCS Runoff	Peak discharge	= 0.161 cfs
Storm frequency	= 1 yrs	Time to peak	= 717 min
Time interval	= 1 min	Hyd. volume	= 377 cuft
Drainage area	= 0.042 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 2.63 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

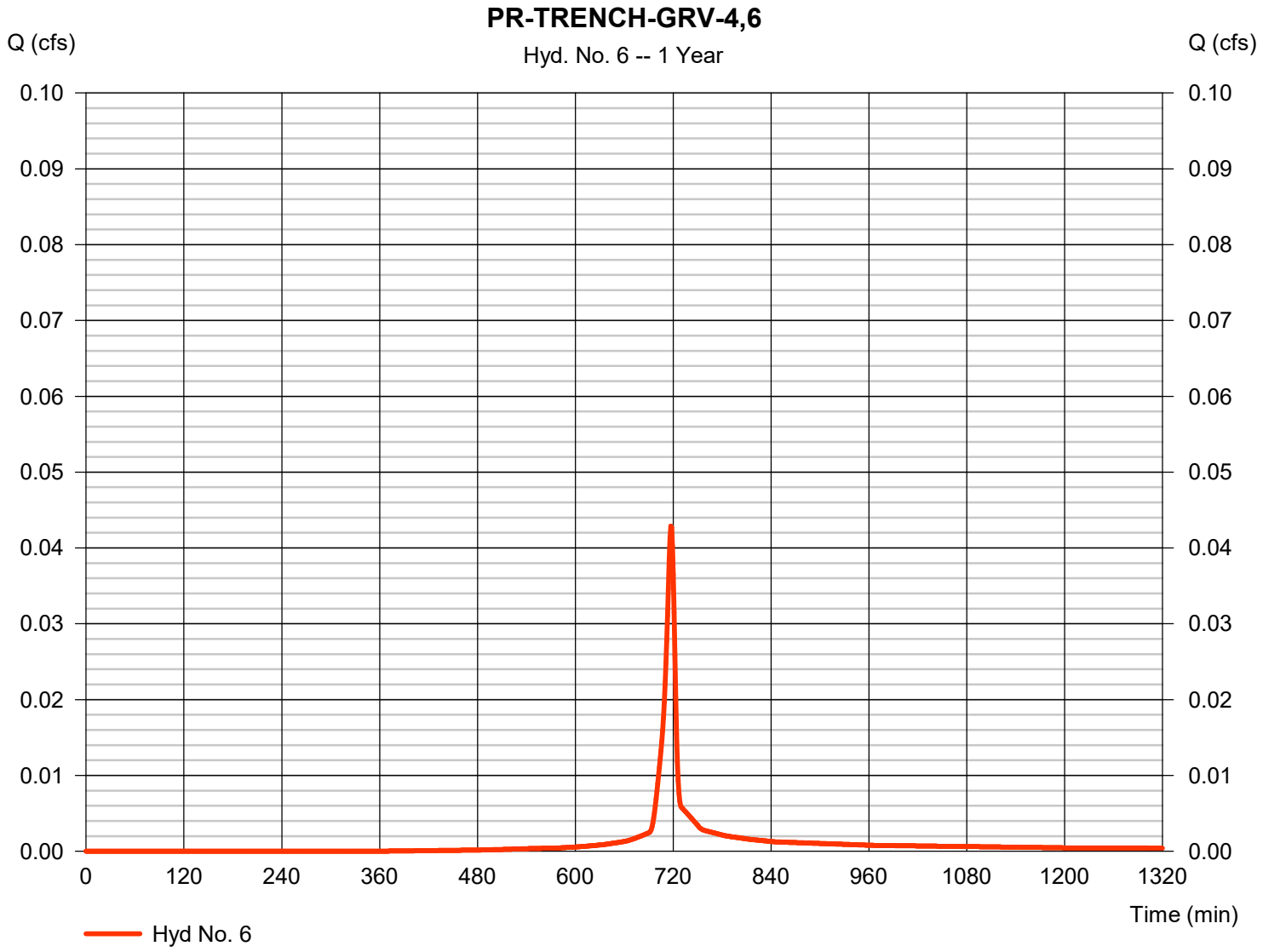


Hydrograph Report

Hyd. No. 6

PR-TRENCH-GRV-4,6

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.043 cfs
Storm frequency	=	1 yrs	Time to peak	=	717 min
Time interval	=	1 min	Hyd. volume	=	89 cuft
Drainage area	=	0.014 ac	Curve number	=	91
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	2.63 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

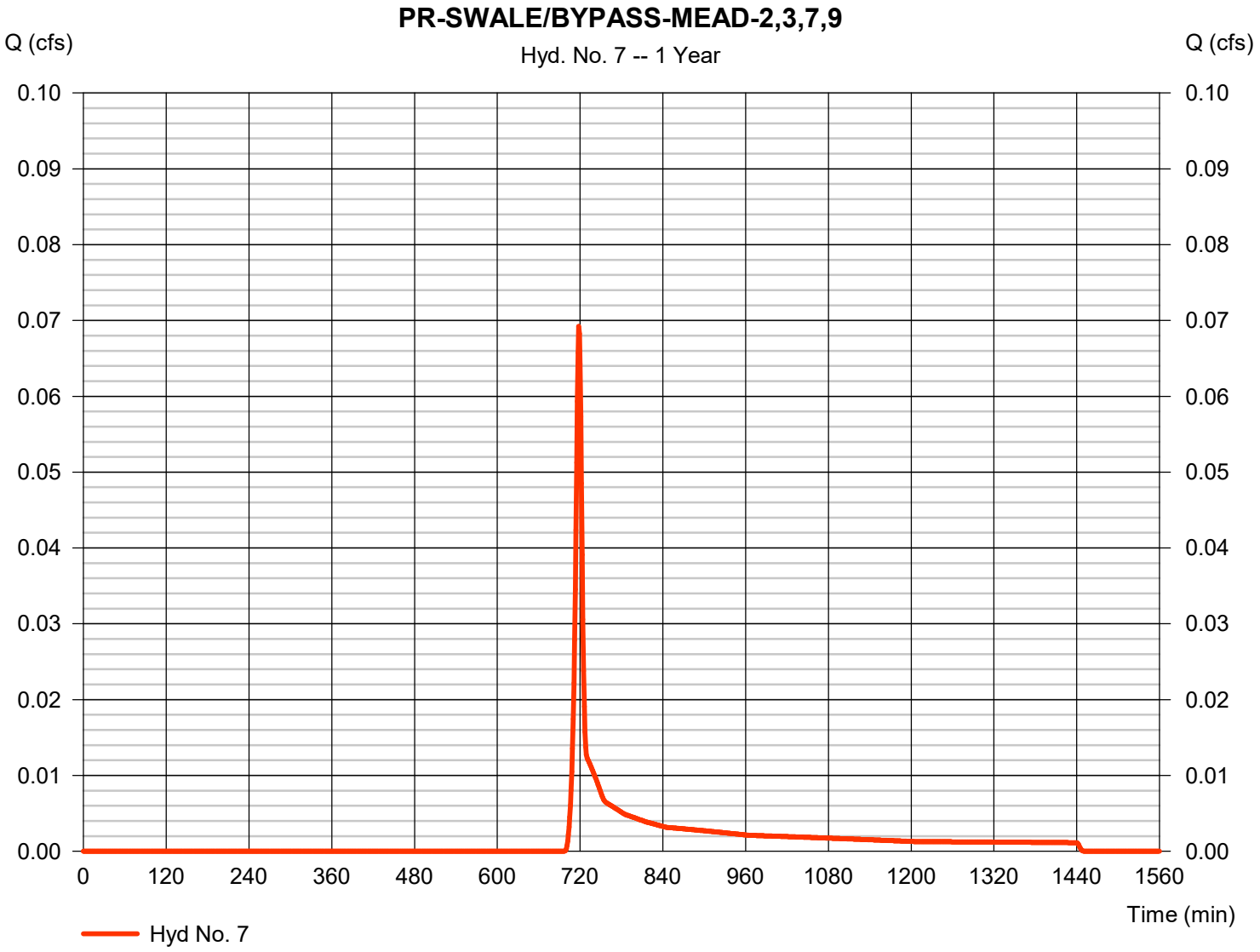


Hydrograph Report

Hyd. No. 7

PR-SWALE/BYPASS-MEAD-2,3,7,9

Hydrograph type	= SCS Runoff	Peak discharge	= 0.069 cfs
Storm frequency	= 1 yrs	Time to peak	= 718 min
Time interval	= 1 min	Hyd. volume	= 150 cuft
Drainage area	= 0.072 ac	Curve number	= 71
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 2.63 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

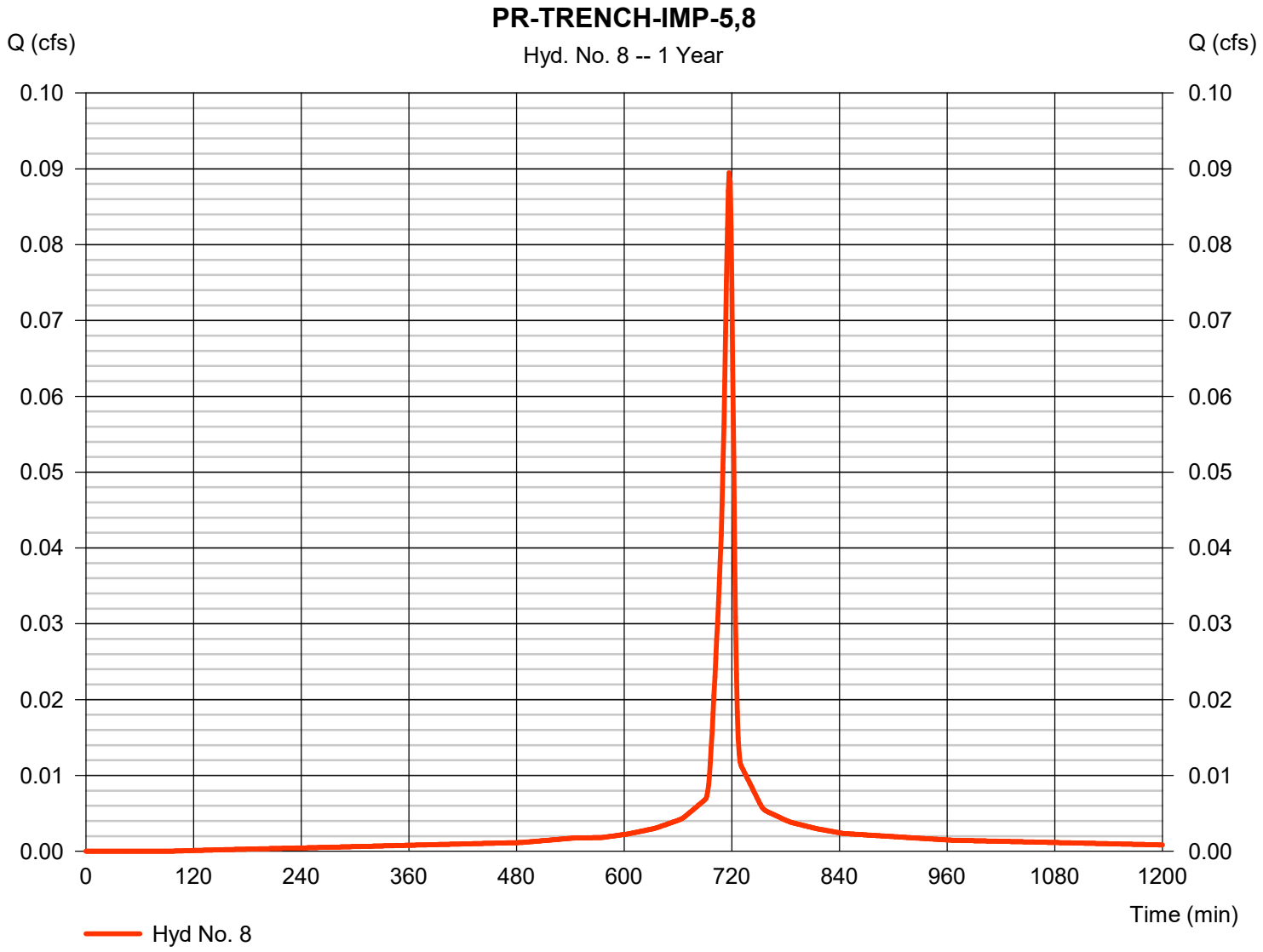


Hydrograph Report

Hyd. No. 8

PR-TRENCH-IMP-5,8

Hydrograph type	= SCS Runoff	Peak discharge	= 0.089 cfs
Storm frequency	= 1 yrs	Time to peak	= 717 min
Time interval	= 1 min	Hyd. volume	= 209 cuft
Drainage area	= 0.023 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 2.63 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

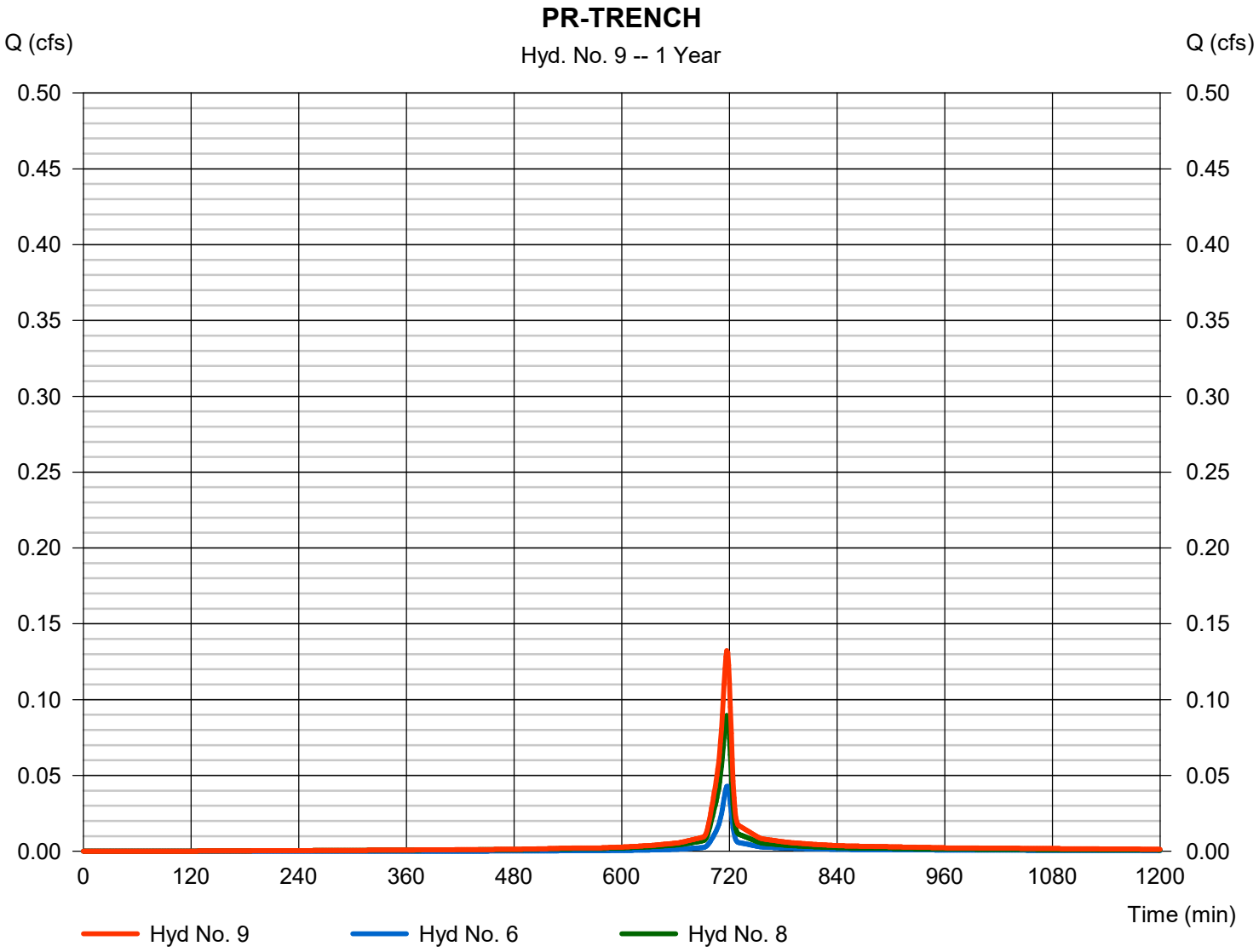


Hydrograph Report

Hyd. No. 9

PR-TRENCH

Hydrograph type	= Combine	Peak discharge	= 0.132 cfs
Storm frequency	= 1 yrs	Time to peak	= 717 min
Time interval	= 1 min	Hyd. volume	= 299 cuft
Inflow hyds.	= 6, 8	Contrib. drain. area	= 0.037 ac



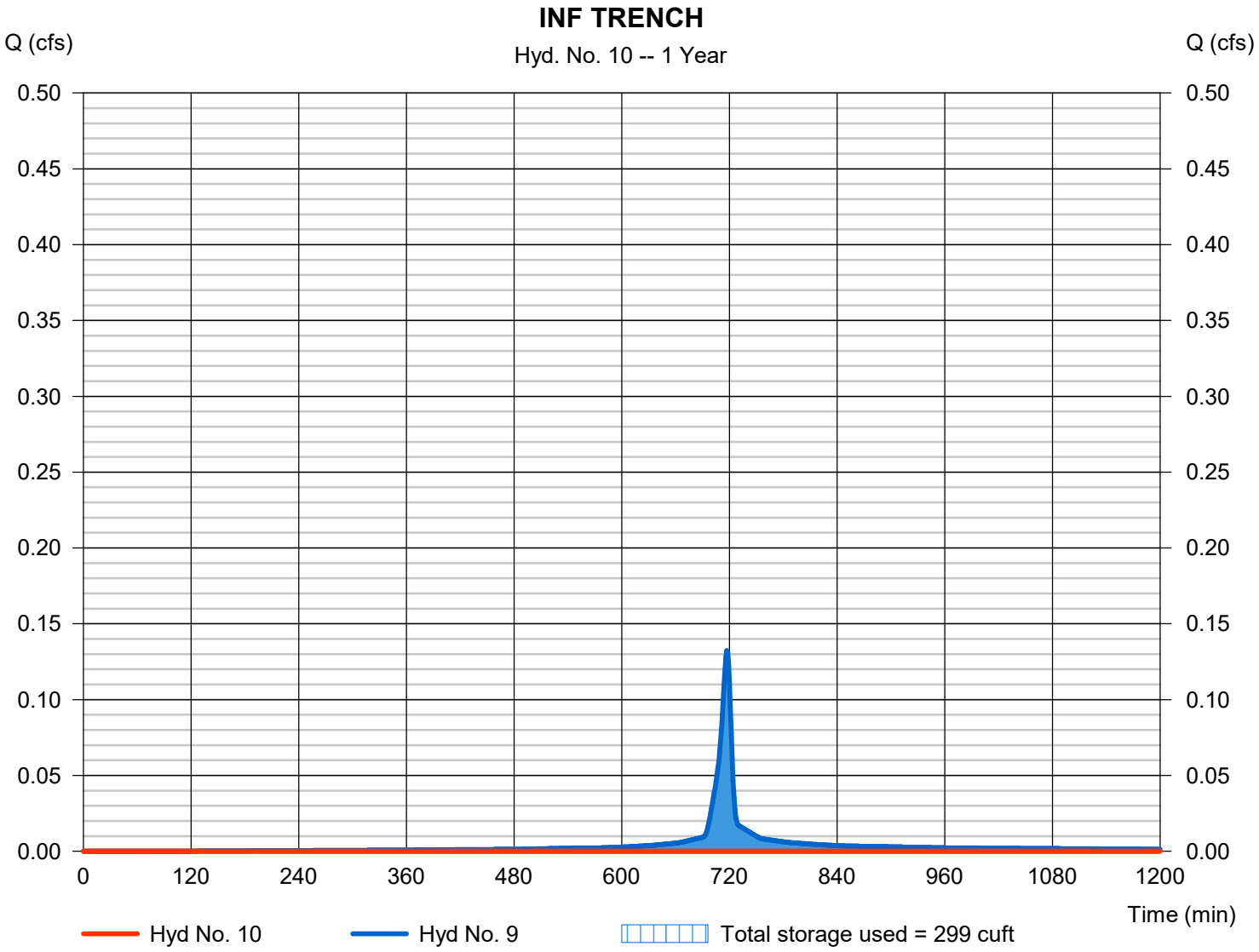
Hydrograph Report

Hyd. No. 10

INF TRENCH

Hydrograph type	=	Reservoir	Peak discharge	=	0.000 cfs
Storm frequency	=	1 yrs	Time to peak	=	n/a
Time interval	=	1 min	Hyd. volume	=	0 cuft
Inflow hyd. No.	=	9 - PR-TRENCH	Max. Elevation	=	433.33 ft
Reservoir name	=	BASIN	Max. Storage	=	299 cuft

Storage Indication method used.



Pond No. 1 - BASIN

Pond Data

Trapezoid -Bottom L x W = 30.0 x 30.0 ft, Side slope = 0.00:1, Bottom elev. = 432.50 ft, Depth = 2.00 ft, Voids = 40.00%

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	432.50	900	0	0
0.20	432.70	900	72	72
0.40	432.90	900	72	144
0.60	433.10	900	72	216
0.80	433.30	900	72	288
1.00	433.50	900	72	360
1.20	433.70	900	72	432
1.40	433.90	900	72	504
1.60	434.10	900	72	576
1.80	434.30	900	72	648
2.00	434.50	900	72	720

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	Inactive	0.00	0.00	0.00
Span (in)	= 3.50	0.00	0.00	0.00
No. Barrels	= 1	0	0	0
Invert El. (ft)	= 430.60	0.00	0.00	0.00
Length (ft)	= 0.25	0.00	0.00	0.00
Slope (%)	= 0.00	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	No	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 30.00	0.00	0.00	0.00
Crest El. (ft)	= 434.00	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= Broad	---	---	---
Multi-Stage	= No	No	No	No

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

TW Elev. (ft) = 0.00

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

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
0.00	0	432.50	0.00	---	---	---	0.00	---	---	---	---	---	0.000
0.02	7	432.52	0.00	---	---	---	0.00	---	---	---	---	---	0.000
0.04	14	432.54	0.00	---	---	---	0.00	---	---	---	---	---	0.000
0.06	22	432.56	0.00	---	---	---	0.00	---	---	---	---	---	0.000
0.08	29	432.58	0.00	---	---	---	0.00	---	---	---	---	---	0.000
0.10	36	432.60	0.00	---	---	---	0.00	---	---	---	---	---	0.000
0.12	43	432.62	0.00	---	---	---	0.00	---	---	---	---	---	0.000
0.14	50	432.64	0.00	---	---	---	0.00	---	---	---	---	---	0.000
0.16	58	432.66	0.00	---	---	---	0.00	---	---	---	---	---	0.000
0.18	65	432.68	0.00	---	---	---	0.00	---	---	---	---	---	0.000
0.20	72	432.70	0.00	---	---	---	0.00	---	---	---	---	---	0.000
0.22	79	432.72	0.00	---	---	---	0.00	---	---	---	---	---	0.000
0.24	86	432.74	0.00	---	---	---	0.00	---	---	---	---	---	0.000
0.26	94	432.76	0.00	---	---	---	0.00	---	---	---	---	---	0.000
0.28	101	432.78	0.00	---	---	---	0.00	---	---	---	---	---	0.000
0.30	108	432.80	0.00	---	---	---	0.00	---	---	---	---	---	0.000
0.32	115	432.82	0.00	---	---	---	0.00	---	---	---	---	---	0.000
0.34	122	432.84	0.00	---	---	---	0.00	---	---	---	---	---	0.000
0.36	130	432.86	0.00	---	---	---	0.00	---	---	---	---	---	0.000
0.38	137	432.88	0.00	---	---	---	0.00	---	---	---	---	---	0.000
0.40	144	432.90	0.00	---	---	---	0.00	---	---	---	---	---	0.000
0.42	151	432.92	0.00	---	---	---	0.00	---	---	---	---	---	0.000
0.44	158	432.94	0.00	---	---	---	0.00	---	---	---	---	---	0.000
0.46	166	432.96	0.00	---	---	---	0.00	---	---	---	---	---	0.000
0.48	173	432.98	0.00	---	---	---	0.00	---	---	---	---	---	0.000
0.50	180	433.00	0.00	---	---	---	0.00	---	---	---	---	---	0.000
0.52	187	433.02	0.00	---	---	---	0.00	---	---	---	---	---	0.000
0.54	194	433.04	0.00	---	---	---	0.00	---	---	---	---	---	0.000
0.56	202	433.06	0.00	---	---	---	0.00	---	---	---	---	---	0.000
0.58	209	433.08	0.00	---	---	---	0.00	---	---	---	---	---	0.000
0.60	216	433.10	0.00	---	---	---	0.00	---	---	---	---	---	0.000
0.62	223	433.12	0.00	---	---	---	0.00	---	---	---	---	---	0.000
0.64	230	433.14	0.00	---	---	---	0.00	---	---	---	---	---	0.000

Continues on next page...

BASIN

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
0.66	238	433.16	0.00	---	---	---	0.00	---	---	---	---	---	0.000
0.68	245	433.18	0.00	---	---	---	0.00	---	---	---	---	---	0.000
0.70	252	433.20	0.00	---	---	---	0.00	---	---	---	---	---	0.000
0.72	259	433.22	0.00	---	---	---	0.00	---	---	---	---	---	0.000
0.74	266	433.24	0.00	---	---	---	0.00	---	---	---	---	---	0.000
0.76	274	433.26	0.00	---	---	---	0.00	---	---	---	---	---	0.000
0.78	281	433.28	0.00	---	---	---	0.00	---	---	---	---	---	0.000
0.80	288	433.30	0.00	---	---	---	0.00	---	---	---	---	---	0.000
0.82	295	433.32	0.00	---	---	---	0.00	---	---	---	---	---	0.000
0.84	302	433.34	0.00	---	---	---	0.00	---	---	---	---	---	0.000
0.86	310	433.36	0.00	---	---	---	0.00	---	---	---	---	---	0.000
0.88	317	433.38	0.00	---	---	---	0.00	---	---	---	---	---	0.000
0.90	324	433.40	0.00	---	---	---	0.00	---	---	---	---	---	0.000
0.92	331	433.42	0.00	---	---	---	0.00	---	---	---	---	---	0.000
0.94	338	433.44	0.00	---	---	---	0.00	---	---	---	---	---	0.000
0.96	346	433.46	0.00	---	---	---	0.00	---	---	---	---	---	0.000
0.98	353	433.48	0.00	---	---	---	0.00	---	---	---	---	---	0.000
1.00	360	433.50	0.00	---	---	---	0.00	---	---	---	---	---	0.000
1.02	367	433.52	0.00	---	---	---	0.00	---	---	---	---	---	0.000
1.04	374	433.54	0.00	---	---	---	0.00	---	---	---	---	---	0.000
1.06	382	433.56	0.00	---	---	---	0.00	---	---	---	---	---	0.000
1.08	389	433.58	0.00	---	---	---	0.00	---	---	---	---	---	0.000
1.10	396	433.60	0.00	---	---	---	0.00	---	---	---	---	---	0.000
1.12	403	433.62	0.00	---	---	---	0.00	---	---	---	---	---	0.000
1.14	410	433.64	0.00	---	---	---	0.00	---	---	---	---	---	0.000
1.16	418	433.66	0.00	---	---	---	0.00	---	---	---	---	---	0.000
1.18	425	433.68	0.00	---	---	---	0.00	---	---	---	---	---	0.000
1.20	432	433.70	0.00	---	---	---	0.00	---	---	---	---	---	0.000
1.22	439	433.72	0.00	---	---	---	0.00	---	---	---	---	---	0.000
1.24	446	433.74	0.00	---	---	---	0.00	---	---	---	---	---	0.000
1.26	454	433.76	0.00	---	---	---	0.00	---	---	---	---	---	0.000
1.28	461	433.78	0.00	---	---	---	0.00	---	---	---	---	---	0.000
1.30	468	433.80	0.00	---	---	---	0.00	---	---	---	---	---	0.000
1.32	475	433.82	0.00	---	---	---	0.00	---	---	---	---	---	0.000
1.34	482	433.84	0.00	---	---	---	0.00	---	---	---	---	---	0.000
1.36	490	433.86	0.00	---	---	---	0.00	---	---	---	---	---	0.000
1.38	497	433.88	0.00	---	---	---	0.00	---	---	---	---	---	0.000
1.40	504	433.90	0.00	---	---	---	0.00	---	---	---	---	---	0.000
1.42	511	433.92	0.00	---	---	---	0.00	---	---	---	---	---	0.000
1.44	518	433.94	0.00	---	---	---	0.00	---	---	---	---	---	0.000
1.46	526	433.96	0.00	---	---	---	0.00	---	---	---	---	---	0.000
1.48	533	433.98	0.00	---	---	---	0.00	---	---	---	---	---	0.000
1.50	540	434.00	0.00	---	---	---	0.00	---	---	---	---	---	0.000
1.52	547	434.02	0.00	---	---	---	0.28	---	---	---	---	---	0.281
1.54	554	434.04	0.00	---	---	---	0.80	---	---	---	---	---	0.797
1.56	562	434.06	0.00	---	---	---	1.46	---	---	---	---	---	1.465
1.58	569	434.08	0.00	---	---	---	2.26	---	---	---	---	---	2.256
1.60	576	434.10	0.00	---	---	---	3.16	---	---	---	---	---	3.159
1.62	583	434.12	0.00	---	---	---	4.15	---	---	---	---	---	4.153
1.64	590	434.14	0.00	---	---	---	5.23	---	---	---	---	---	5.232
1.66	598	434.16	0.00	---	---	---	6.39	---	---	---	---	---	6.392
1.68	605	434.18	0.00	---	---	---	7.63	---	---	---	---	---	7.627
1.70	612	434.20	0.00	---	---	---	8.93	---	---	---	---	---	8.932
1.72	619	434.22	0.00	---	---	---	10.30	---	---	---	---	---	10.30
1.74	626	434.24	0.00	---	---	---	11.74	---	---	---	---	---	11.74
1.76	634	434.26	0.00	---	---	---	13.24	---	---	---	---	---	13.24
1.78	641	434.28	0.00	---	---	---	14.79	---	---	---	---	---	14.79
1.80	648	434.30	0.00	---	---	---	16.41	---	---	---	---	---	16.41
1.82	655	434.32	0.00	---	---	---	18.08	---	---	---	---	---	18.08
1.84	662	434.34	0.00	---	---	---	19.80	---	---	---	---	---	19.80
1.86	670	434.36	0.00	---	---	---	21.57	---	---	---	---	---	21.57
1.88	677	434.38	0.00	---	---	---	23.40	---	---	---	---	---	23.40
1.90	684	434.40	0.00	---	---	---	25.27	---	---	---	---	---	25.27
1.92	691	434.42	0.00	---	---	---	27.18	---	---	---	---	---	27.18
1.94	698	434.44	0.00	---	---	---	29.15	---	---	---	---	---	29.15
1.96	706	434.46	0.00	---	---	---	31.16	---	---	---	---	---	31.16
1.98	713	434.48	0.00	---	---	---	33.21	---	---	---	---	---	33.21
2.00	720	434.50	0.00	---	---	---	35.32	---	---	---	---	---	35.32

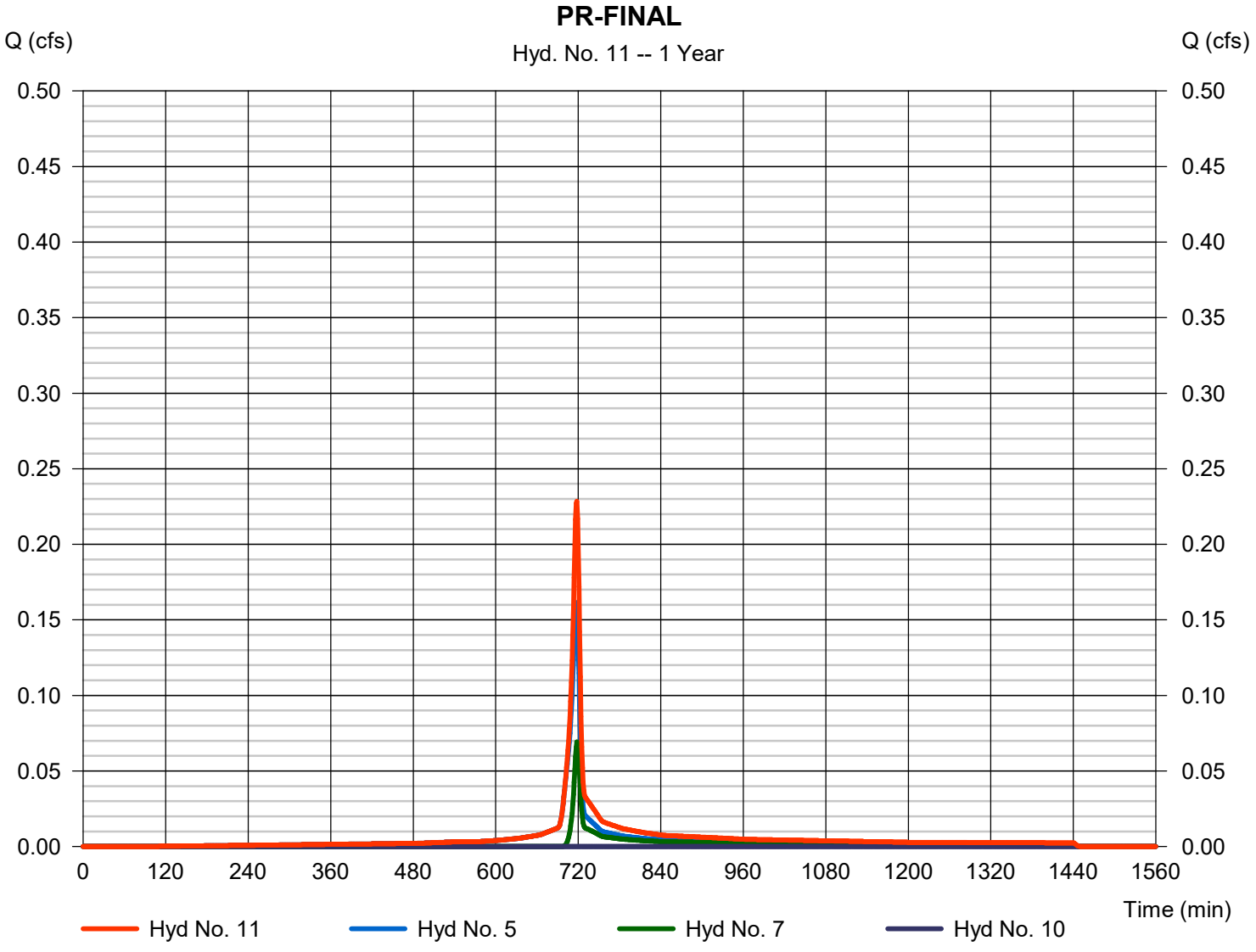
...End

Hydrograph Report

Hyd. No. 11

PR-FINAL

Hydrograph type	= Combine	Peak discharge	= 0.228 cfs
Storm frequency	= 1 yrs	Time to peak	= 718 min
Time interval	= 1 min	Hyd. volume	= 528 cuft
Inflow hyds.	= 5, 7, 10	Contrib. drain. area	= 0.114 ac



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

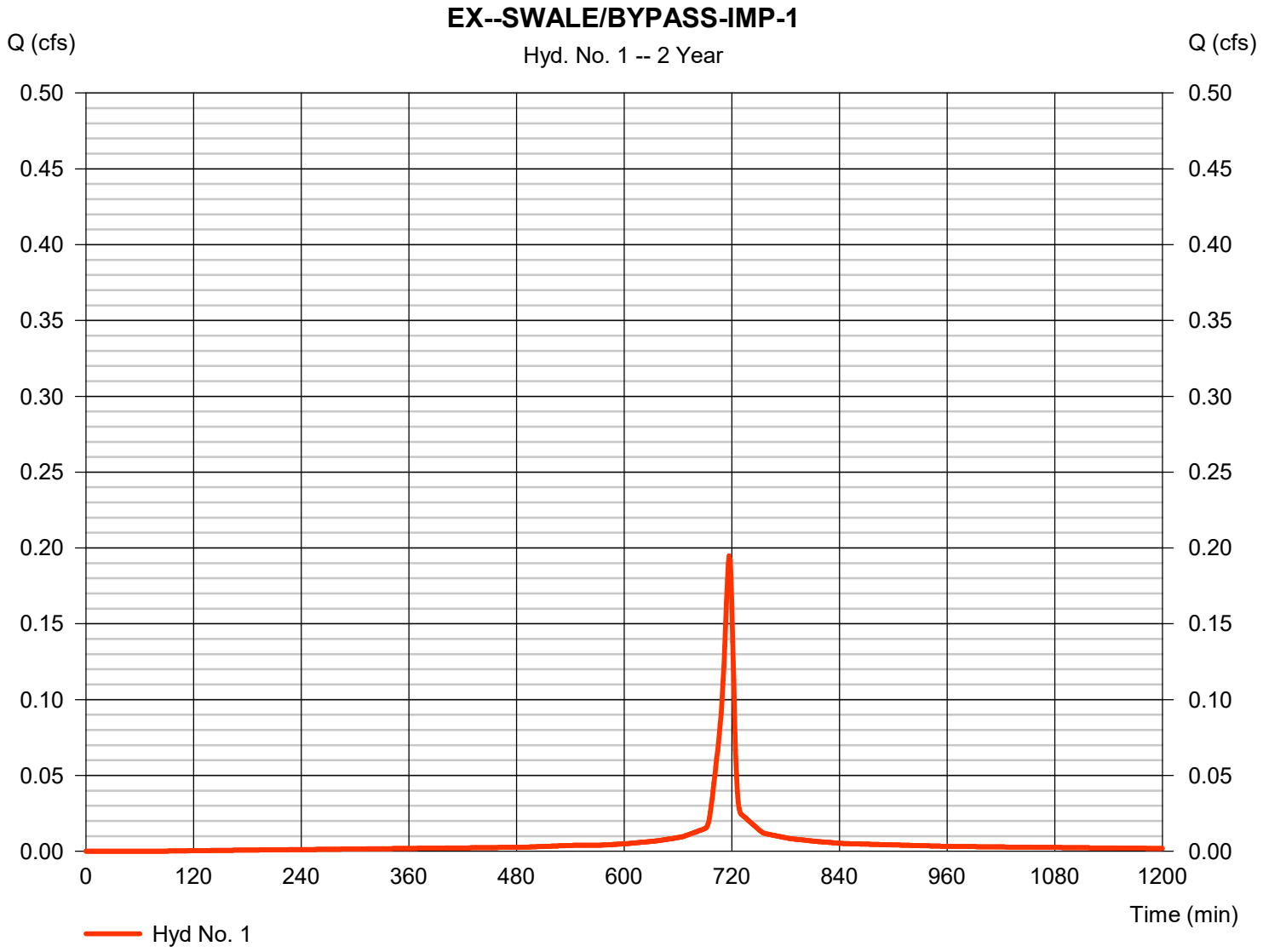
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	0.195	1	717	460	------	------	------	EX--SWALE/BYPASS-IMP-1
2	SCS Runoff	0.111	1	718	230	------	------	------	EX-SWALE/BYPASS-MEAD-2,3,7,9
3	SCS Runoff	0.052	1	719	112	------	------	------	EX-TRENCH-4,5,6,8
4	Combine	0.354	1	718	803	1, 2, 3	------	------	EX-TOTAL
5	SCS Runoff	0.195	1	717	460	------	------	------	PR-SWALE/BYPASS-IMP-1
6	SCS Runoff	0.054	1	717	115	------	------	------	PR-TRENCH-GRV-4,6
7	SCS Runoff	0.111	1	718	230	------	------	------	PR-SWALE/BYPASS-MEAD-2,3,7,9
8	SCS Runoff	0.108	1	717	255	------	------	------	PR-TRENCH-IMP-5,8
9	Combine	0.162	1	717	370	6, 8	------	------	PR-TRENCH
10	Reservoir	0.000	1	n/a	0	9	433.53	370	INF TRENCH
11	Combine	0.303	1	718	691	5, 7, 10	------	------	PR-FINAL

Hydrograph Report

Hyd. No. 1

EX--SWALE/BYPASS-IMP-1

Hydrograph type	= SCS Runoff	Peak discharge	= 0.195 cfs
Storm frequency	= 2 yrs	Time to peak	= 717 min
Time interval	= 1 min	Hyd. volume	= 460 cuft
Drainage area	= 0.042 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 3.16 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

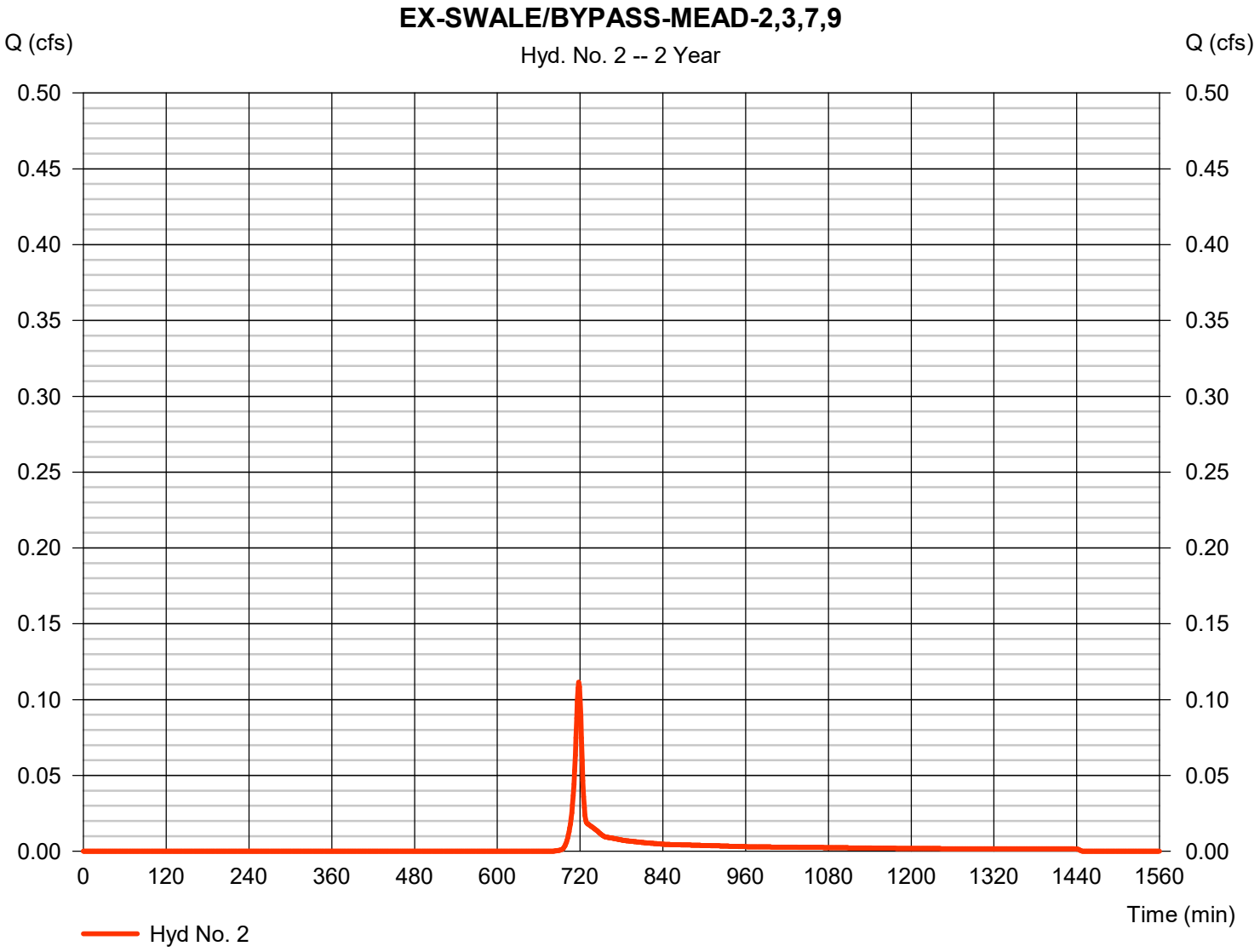


Hydrograph Report

Hyd. No. 2

EX-SWALE/BYPASS-MEAD-2,3,7,9

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.111 cfs
Storm frequency	=	2 yrs	Time to peak	=	718 min
Time interval	=	1 min	Hyd. volume	=	230 cuft
Drainage area	=	0.072 ac	Curve number	=	71
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	3.16 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

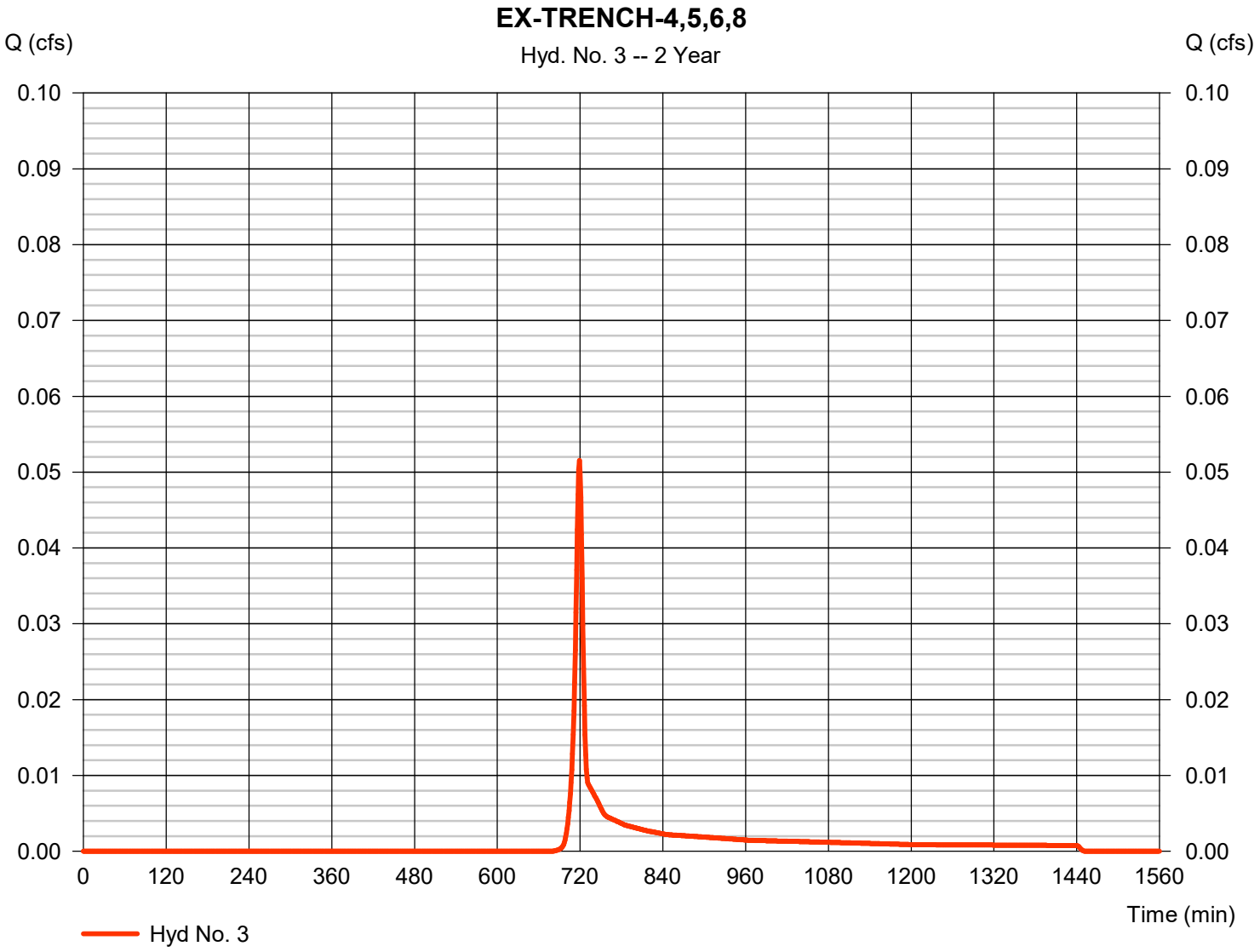


Hydrograph Report

Hyd. No. 3

EX-TRENCH-4,5,6,8

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.052 cfs
Storm frequency	=	2 yrs	Time to peak	=	719 min
Time interval	=	1 min	Hyd. volume	=	112 cuft
Drainage area	=	0.037 ac	Curve number	=	71
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	7.95 min
Total precip.	=	3.16 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

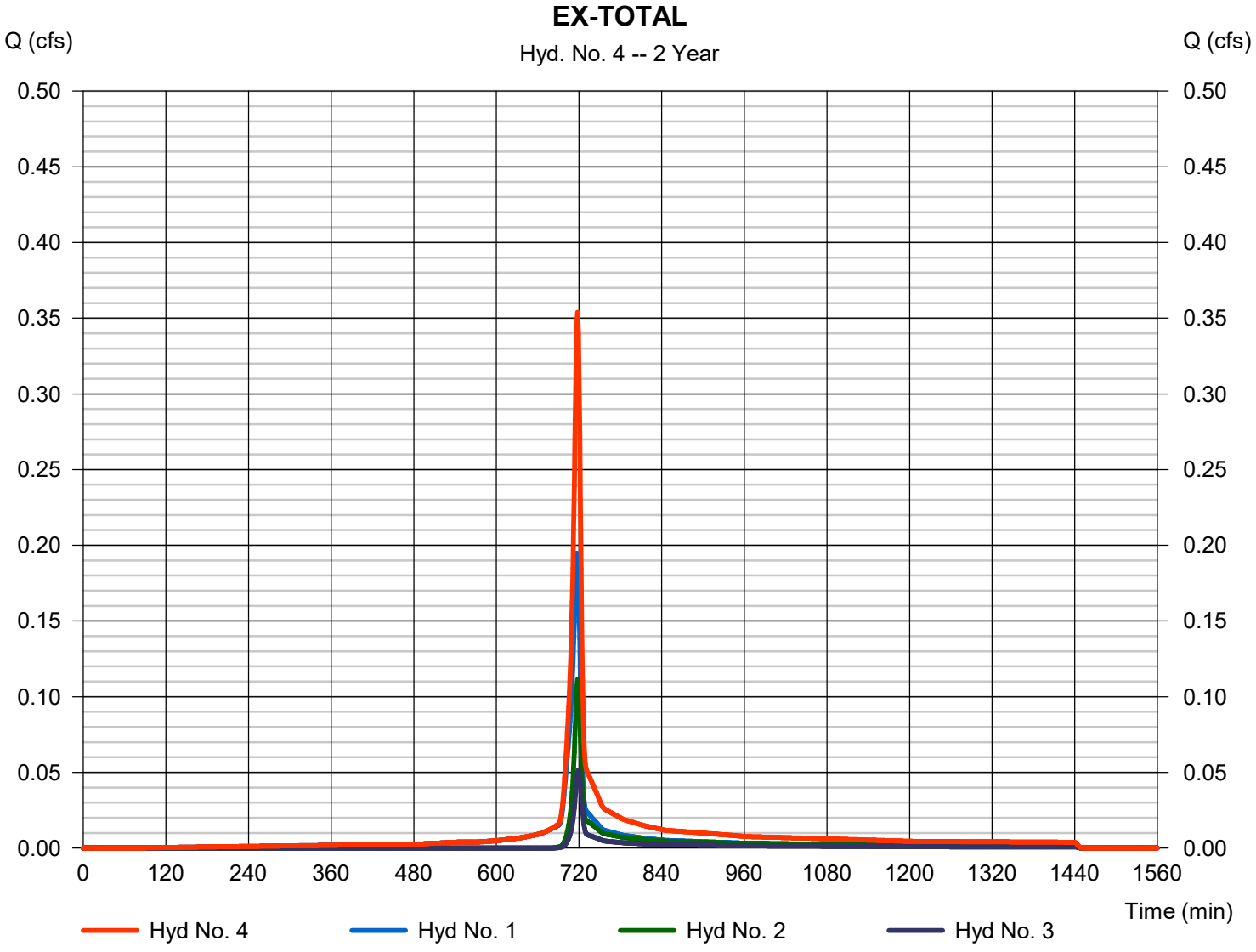


Hydrograph Report

Hyd. No. 4

EX-TOTAL

Hydrograph type	= Combine	Peak discharge	= 0.354 cfs
Storm frequency	= 2 yrs	Time to peak	= 718 min
Time interval	= 1 min	Hyd. volume	= 803 cuft
Inflow hyds.	= 1, 2, 3	Contrib. drain. area	= 0.151 ac

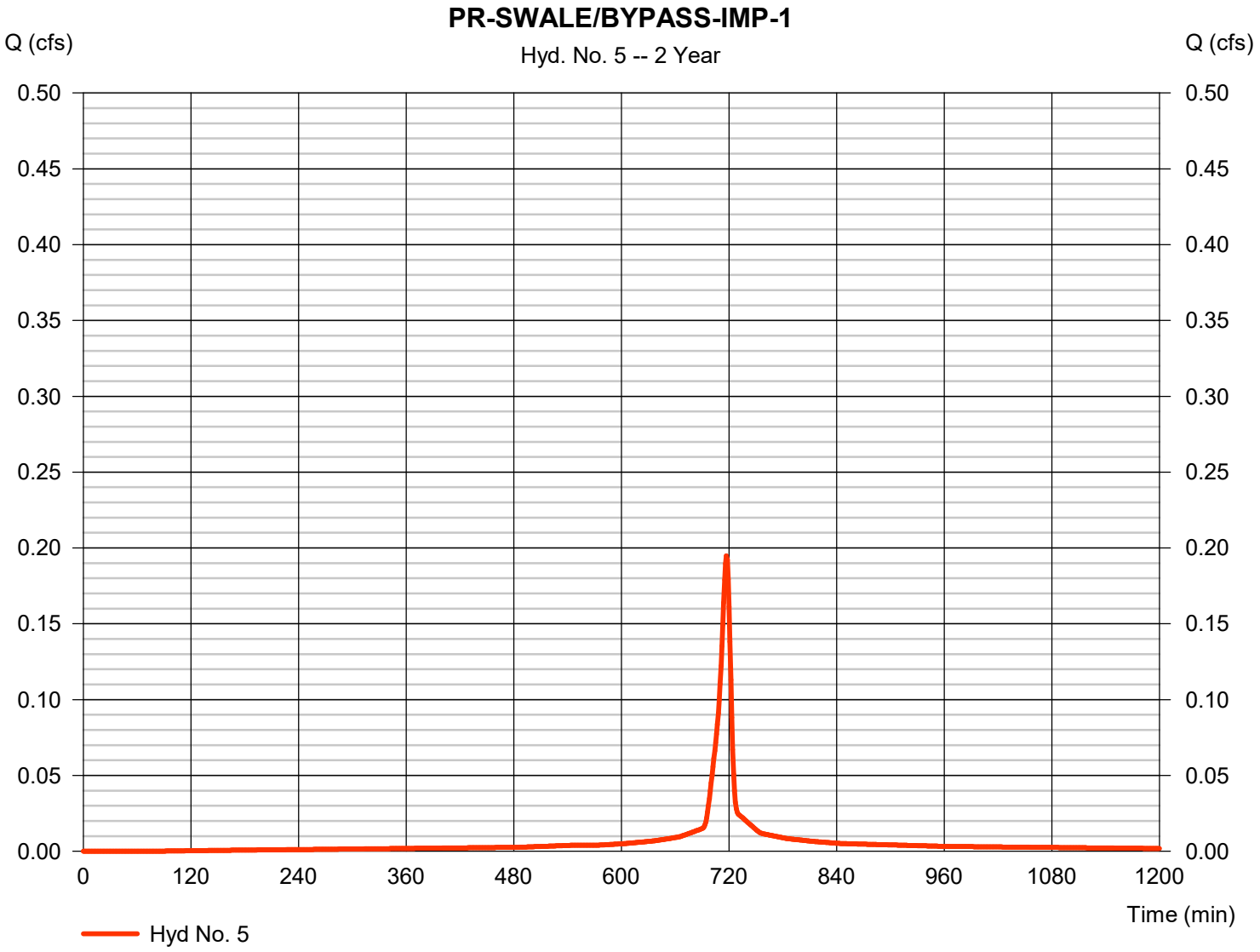


Hydrograph Report

Hyd. No. 5

PR-SWALE/BYPASS-IMP-1

Hydrograph type	= SCS Runoff	Peak discharge	= 0.195 cfs
Storm frequency	= 2 yrs	Time to peak	= 717 min
Time interval	= 1 min	Hyd. volume	= 460 cuft
Drainage area	= 0.042 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 3.16 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

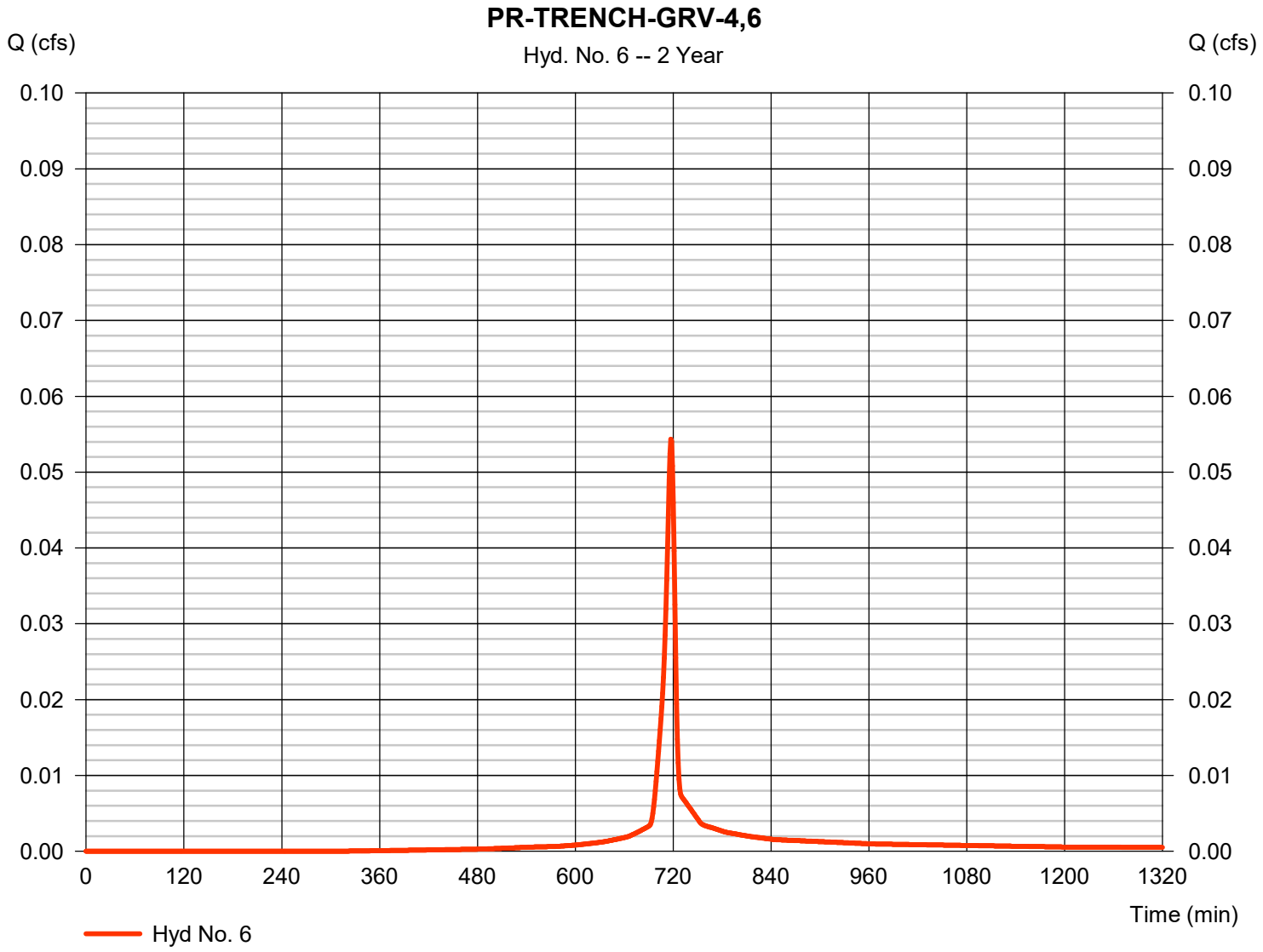


Hydrograph Report

Hyd. No. 6

PR-TRENCH-GRV-4,6

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.054 cfs
Storm frequency	=	2 yrs	Time to peak	=	717 min
Time interval	=	1 min	Hyd. volume	=	115 cuft
Drainage area	=	0.014 ac	Curve number	=	91
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	3.16 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

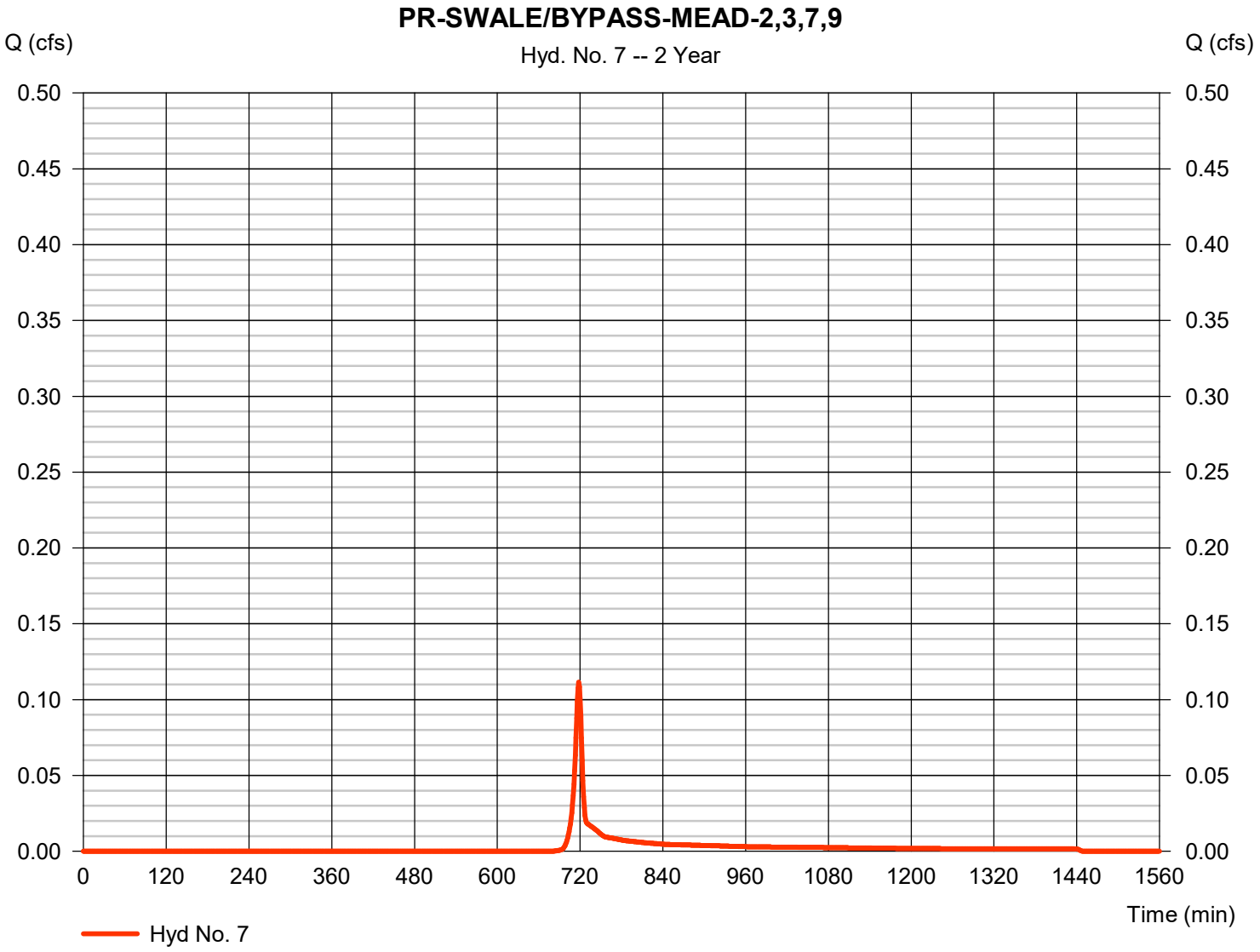


Hydrograph Report

Hyd. No. 7

PR-SWALE/BYPASS-MEAD-2,3,7,9

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.111 cfs
Storm frequency	=	2 yrs	Time to peak	=	718 min
Time interval	=	1 min	Hyd. volume	=	230 cuft
Drainage area	=	0.072 ac	Curve number	=	71
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	3.16 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

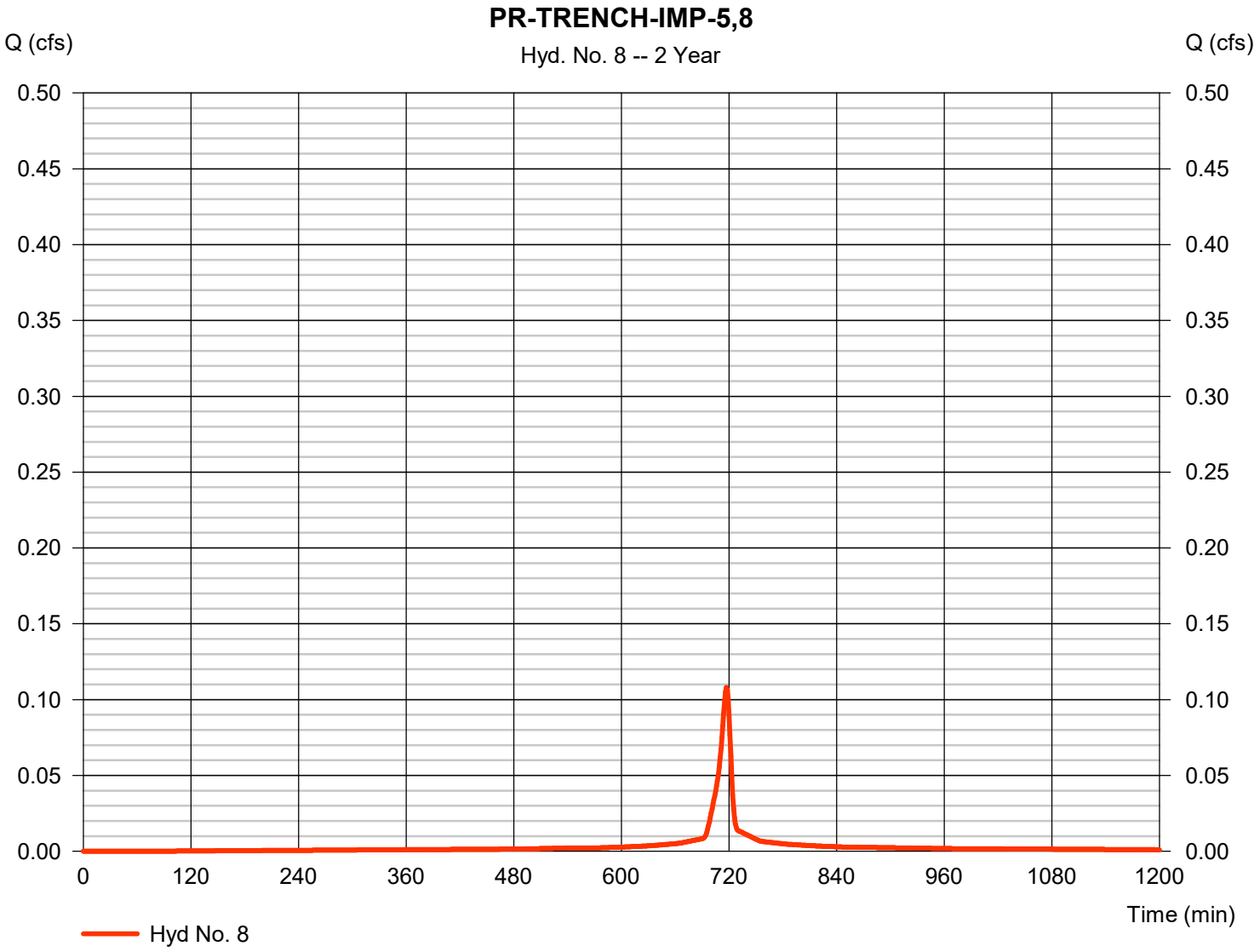


Hydrograph Report

Hyd. No. 8

PR-TRENCH-IMP-5,8

Hydrograph type	= SCS Runoff	Peak discharge	= 0.108 cfs
Storm frequency	= 2 yrs	Time to peak	= 717 min
Time interval	= 1 min	Hyd. volume	= 255 cuft
Drainage area	= 0.023 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 3.16 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

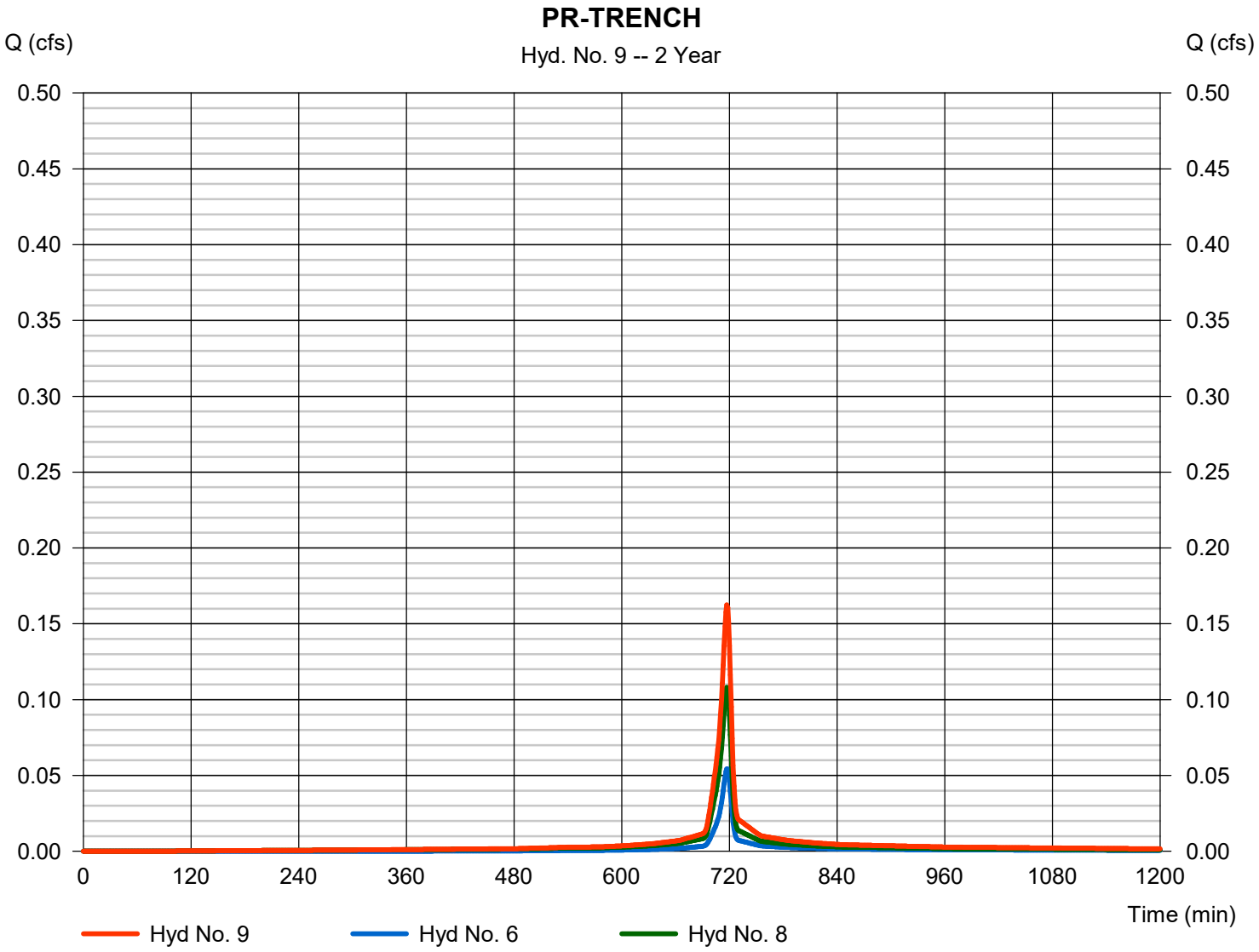


Hydrograph Report

Hyd. No. 9

PR-TRENCH

Hydrograph type	= Combine	Peak discharge	= 0.162 cfs
Storm frequency	= 2 yrs	Time to peak	= 717 min
Time interval	= 1 min	Hyd. volume	= 370 cuft
Inflow hyds.	= 6, 8	Contrib. drain. area	= 0.037 ac



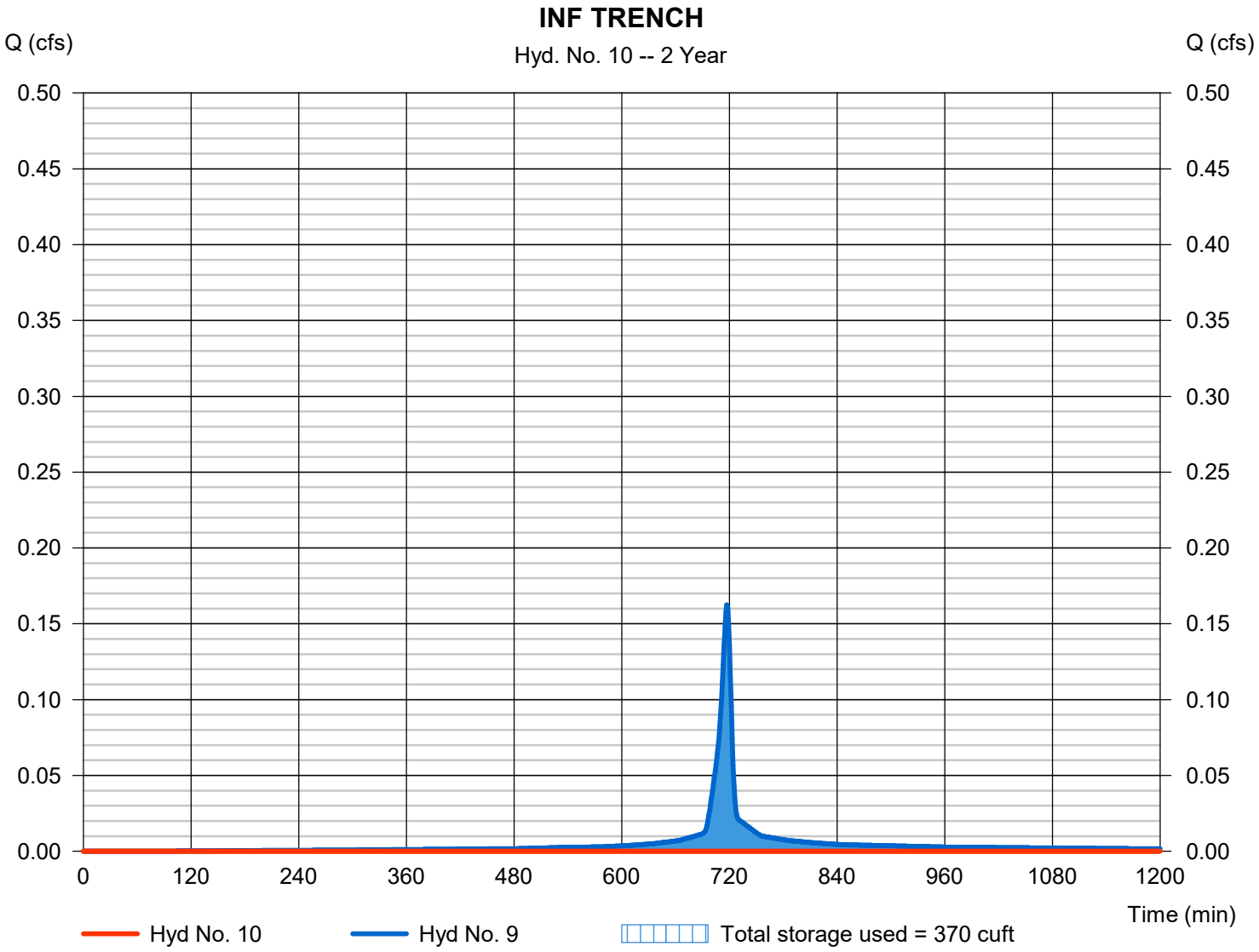
Hydrograph Report

Hyd. No. 10

INF TRENCH

Hydrograph type	=	Reservoir	Peak discharge	=	0.000 cfs
Storm frequency	=	2 yrs	Time to peak	=	n/a
Time interval	=	1 min	Hyd. volume	=	0 cuft
Inflow hyd. No.	=	9 - PR-TRENCH	Max. Elevation	=	433.53 ft
Reservoir name	=	BASIN	Max. Storage	=	370 cuft

Storage Indication method used.

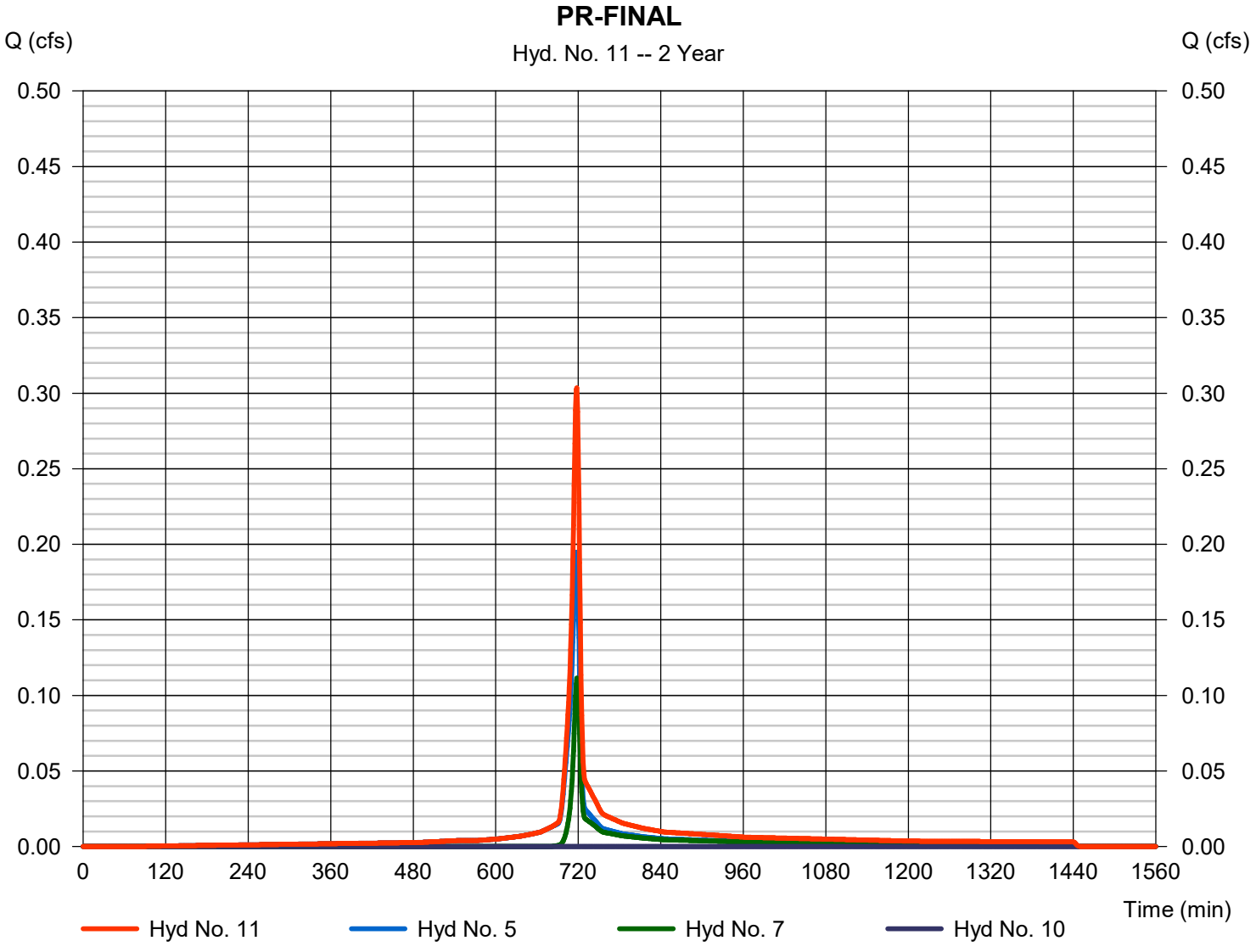


Hydrograph Report

Hyd. No. 11

PR-FINAL

Hydrograph type	= Combine	Peak discharge	= 0.303 cfs
Storm frequency	= 2 yrs	Time to peak	= 718 min
Time interval	= 1 min	Hyd. volume	= 691 cuft
Inflow hyds.	= 5, 7, 10	Contrib. drain. area	= 0.114 ac



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

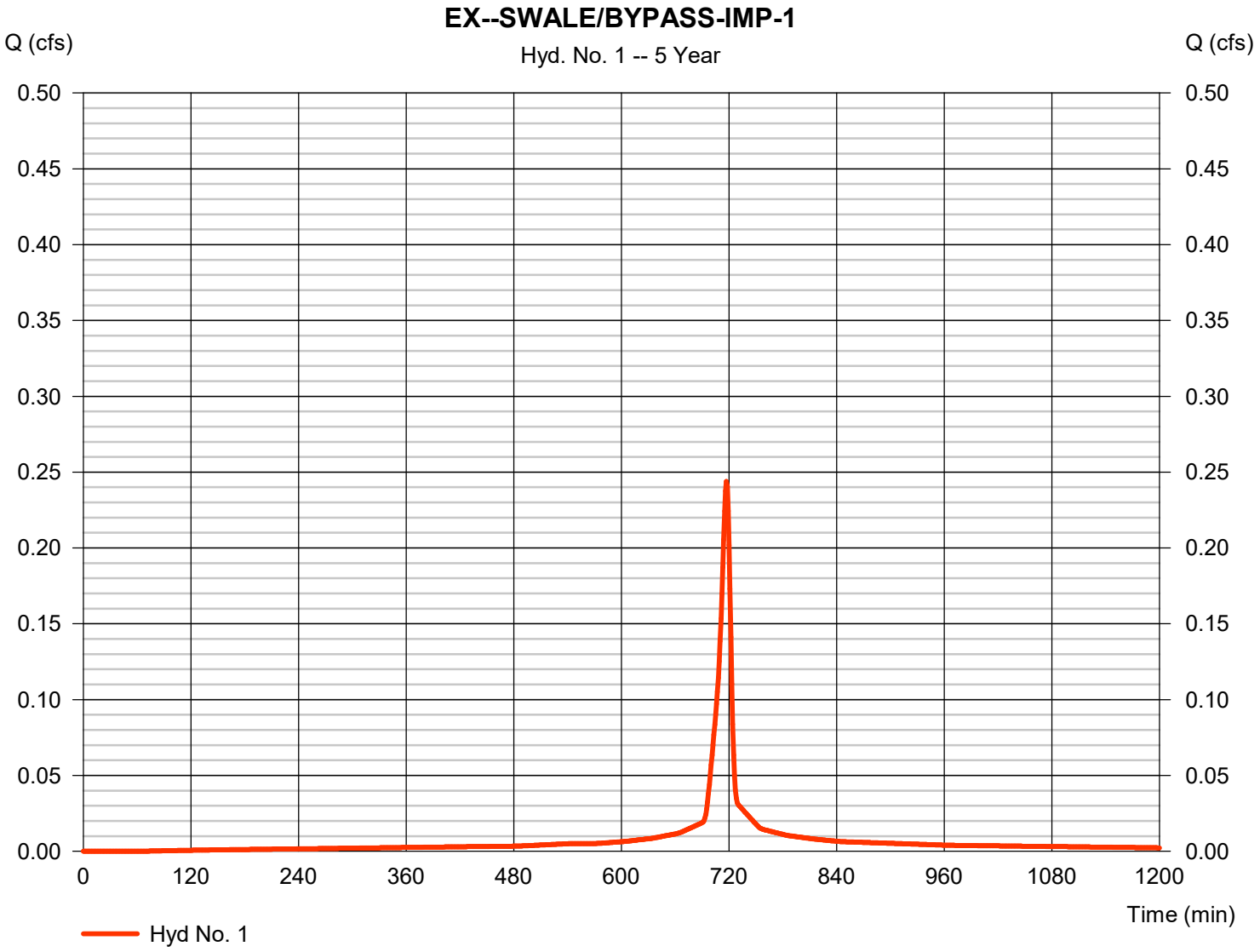
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	0.244	1	717	583	------	------	------	EX--SWALE/BYPASS-IMP-1
2	SCS Runoff	0.181	1	718	365	------	------	------	EX-SWALE/BYPASS-MEAD-2,3,7,9
3	SCS Runoff	0.084	1	719	178	------	------	------	EX-TRENCH-4,5,6,8
4	Combine	0.504	1	718	1,125	1, 2, 3	------	------	EX-TOTAL
5	SCS Runoff	0.244	1	717	583	------	------	------	PR-SWALE/BYPASS-IMP-1
6	SCS Runoff	0.071	1	717	153	------	------	------	PR-TRENCH-GRV-4,6
7	SCS Runoff	0.181	1	718	365	------	------	------	PR-SWALE/BYPASS-MEAD-2,3,7,9
8	SCS Runoff	0.135	1	717	323	------	------	------	PR-TRENCH-IMP-5,8
9	Combine	0.207	1	717	476	6, 8	------	------	PR-TRENCH
10	Reservoir	0.000	1	n/a	0	9	433.82	476	INF TRENCH
11	Combine	0.421	1	718	947	5, 7, 10	------	------	PR-FINAL

Hydrograph Report

Hyd. No. 1

EX--SWALE/BYPASS-IMP-1

Hydrograph type	= SCS Runoff	Peak discharge	= 0.244 cfs
Storm frequency	= 5 yrs	Time to peak	= 717 min
Time interval	= 1 min	Hyd. volume	= 583 cuft
Drainage area	= 0.042 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 3.94 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

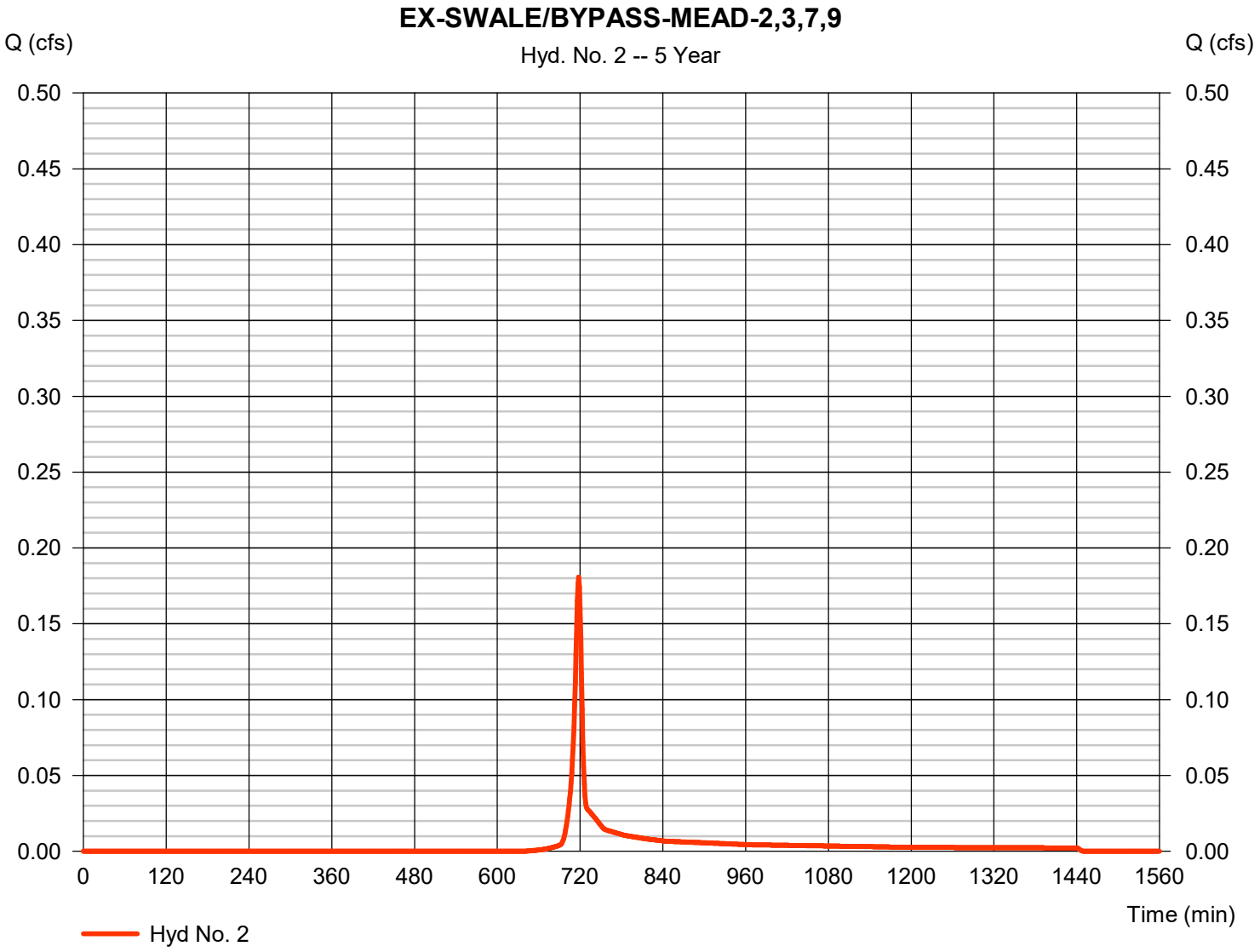


Hydrograph Report

Hyd. No. 2

EX-SWALE/BYPASS-MEAD-2,3,7,9

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.181 cfs
Storm frequency	=	5 yrs	Time to peak	=	718 min
Time interval	=	1 min	Hyd. volume	=	365 cuft
Drainage area	=	0.072 ac	Curve number	=	71
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	3.94 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

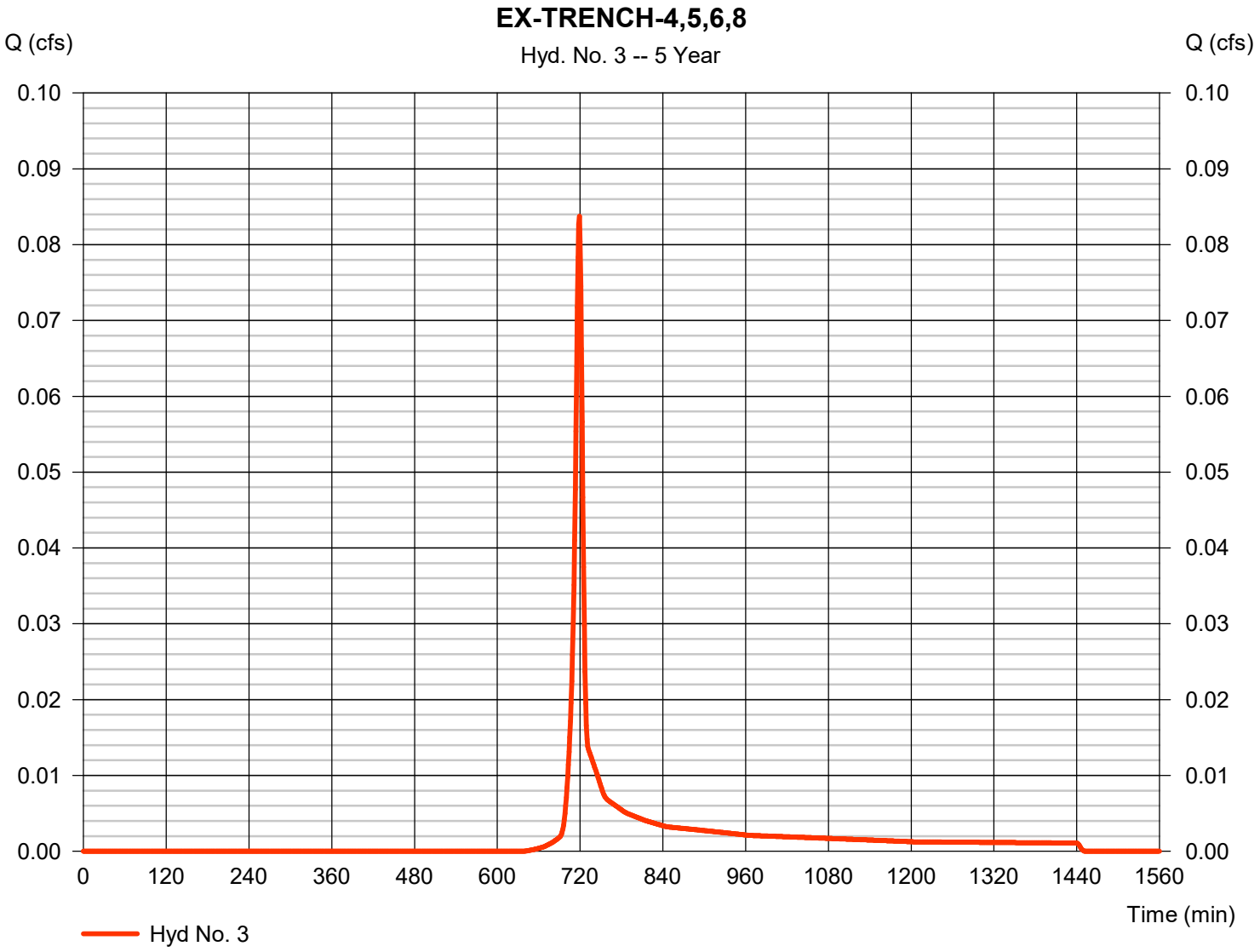


Hydrograph Report

Hyd. No. 3

EX-TRENCH-4,5,6,8

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.084 cfs
Storm frequency	=	5 yrs	Time to peak	=	719 min
Time interval	=	1 min	Hyd. volume	=	178 cuft
Drainage area	=	0.037 ac	Curve number	=	71
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	7.95 min
Total precip.	=	3.94 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

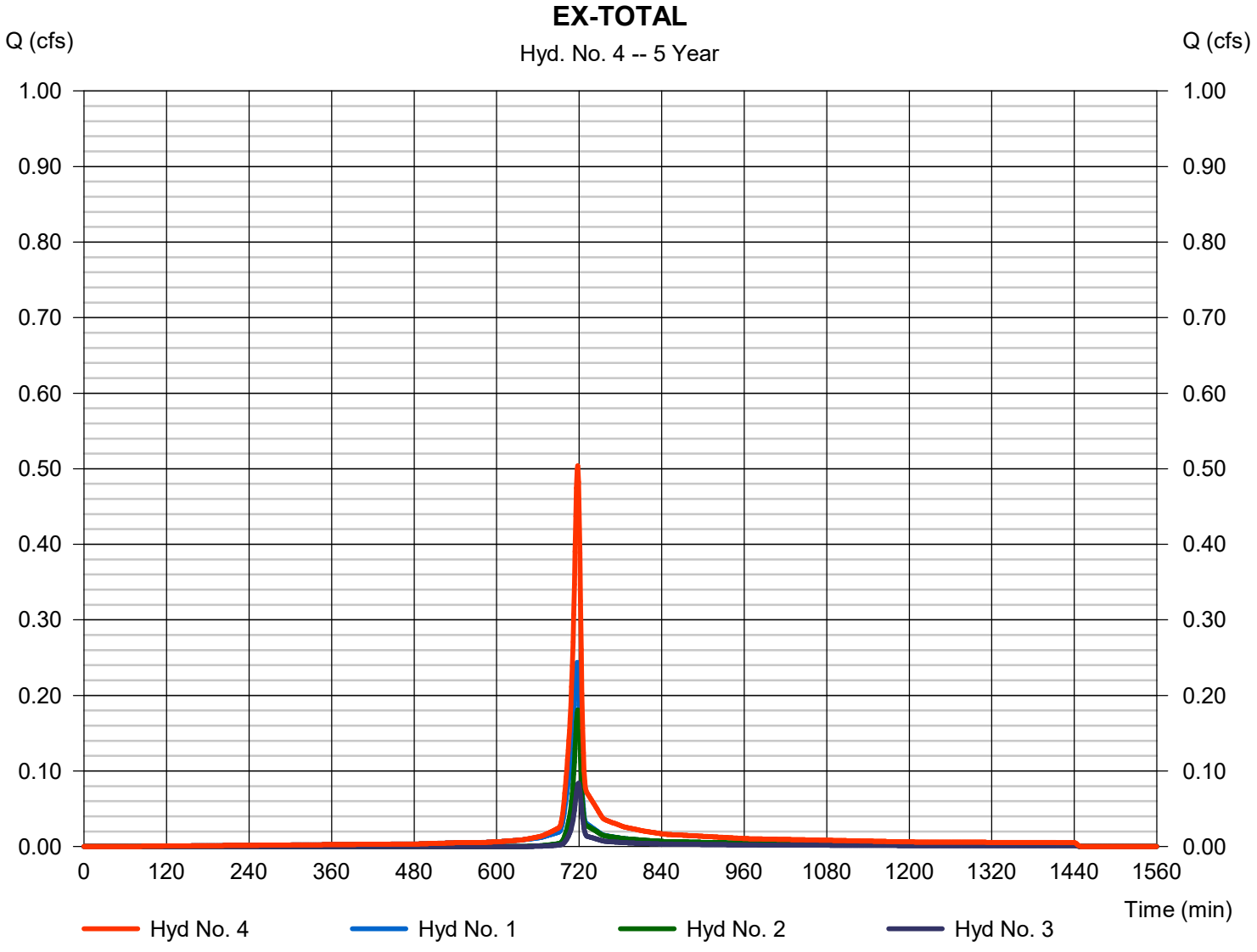


Hydrograph Report

Hyd. No. 4

EX-TOTAL

Hydrograph type	=	Combine	Peak discharge	=	0.504 cfs
Storm frequency	=	5 yrs	Time to peak	=	718 min
Time interval	=	1 min	Hyd. volume	=	1,125 cuft
Inflow hyds.	=	1, 2, 3	Contrib. drain. area	=	0.151 ac

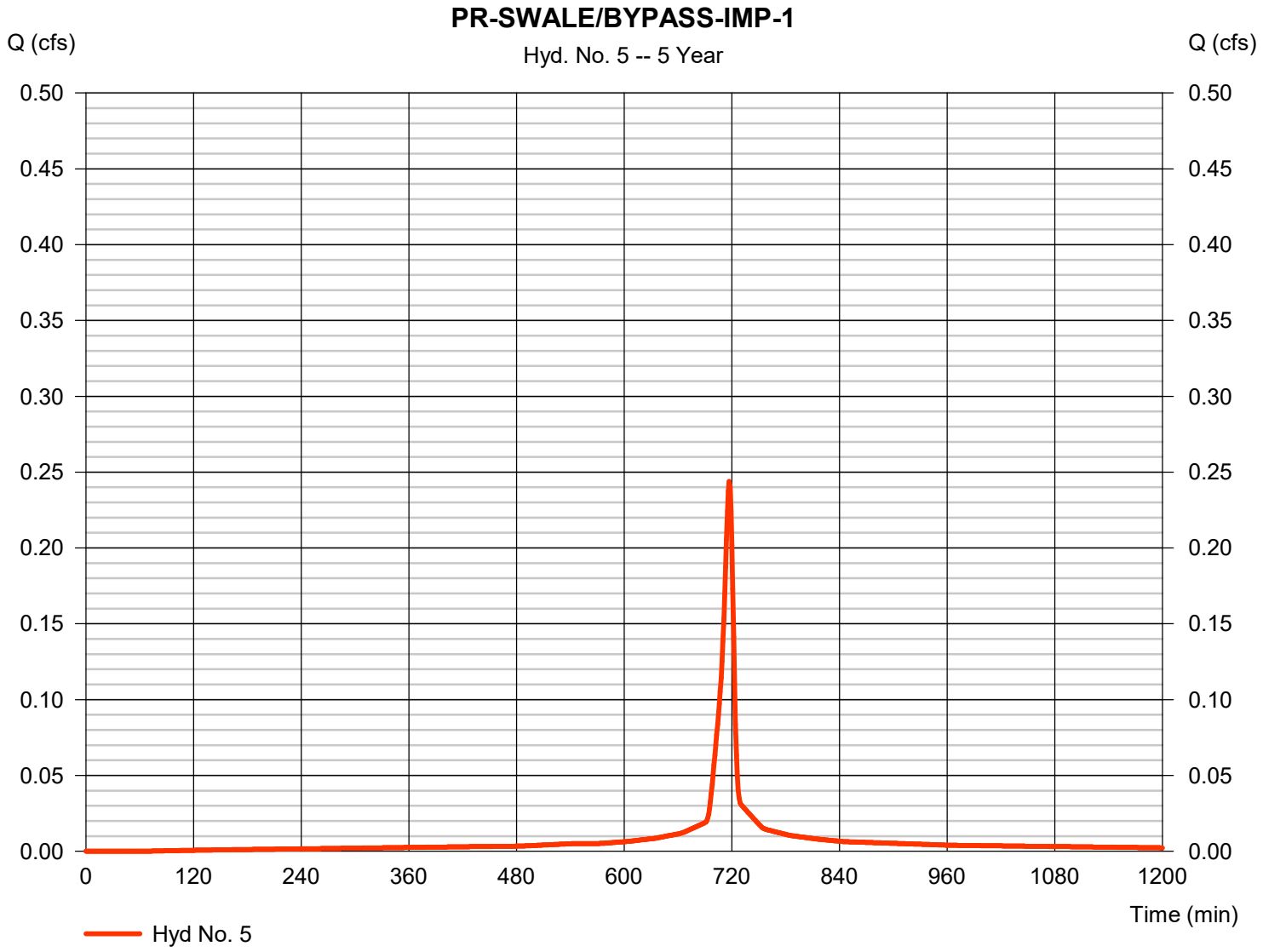


Hydrograph Report

Hyd. No. 5

PR-SWALE/BYPASS-IMP-1

Hydrograph type	= SCS Runoff	Peak discharge	= 0.244 cfs
Storm frequency	= 5 yrs	Time to peak	= 717 min
Time interval	= 1 min	Hyd. volume	= 583 cuft
Drainage area	= 0.042 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 3.94 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

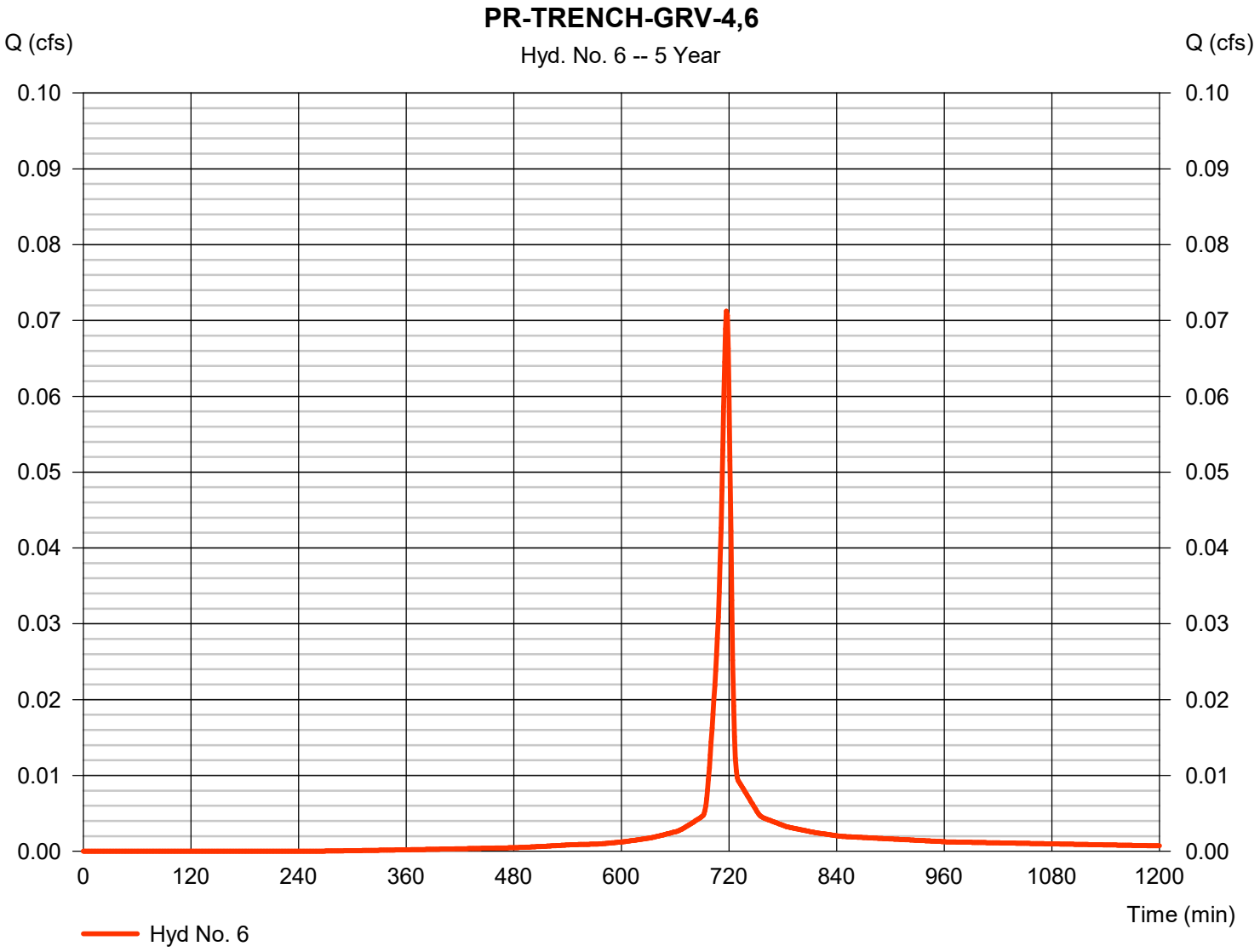


Hydrograph Report

Hyd. No. 6

PR-TRENCH-GRV-4,6

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.071 cfs
Storm frequency	=	5 yrs	Time to peak	=	717 min
Time interval	=	1 min	Hyd. volume	=	153 cuft
Drainage area	=	0.014 ac	Curve number	=	91
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	3.94 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

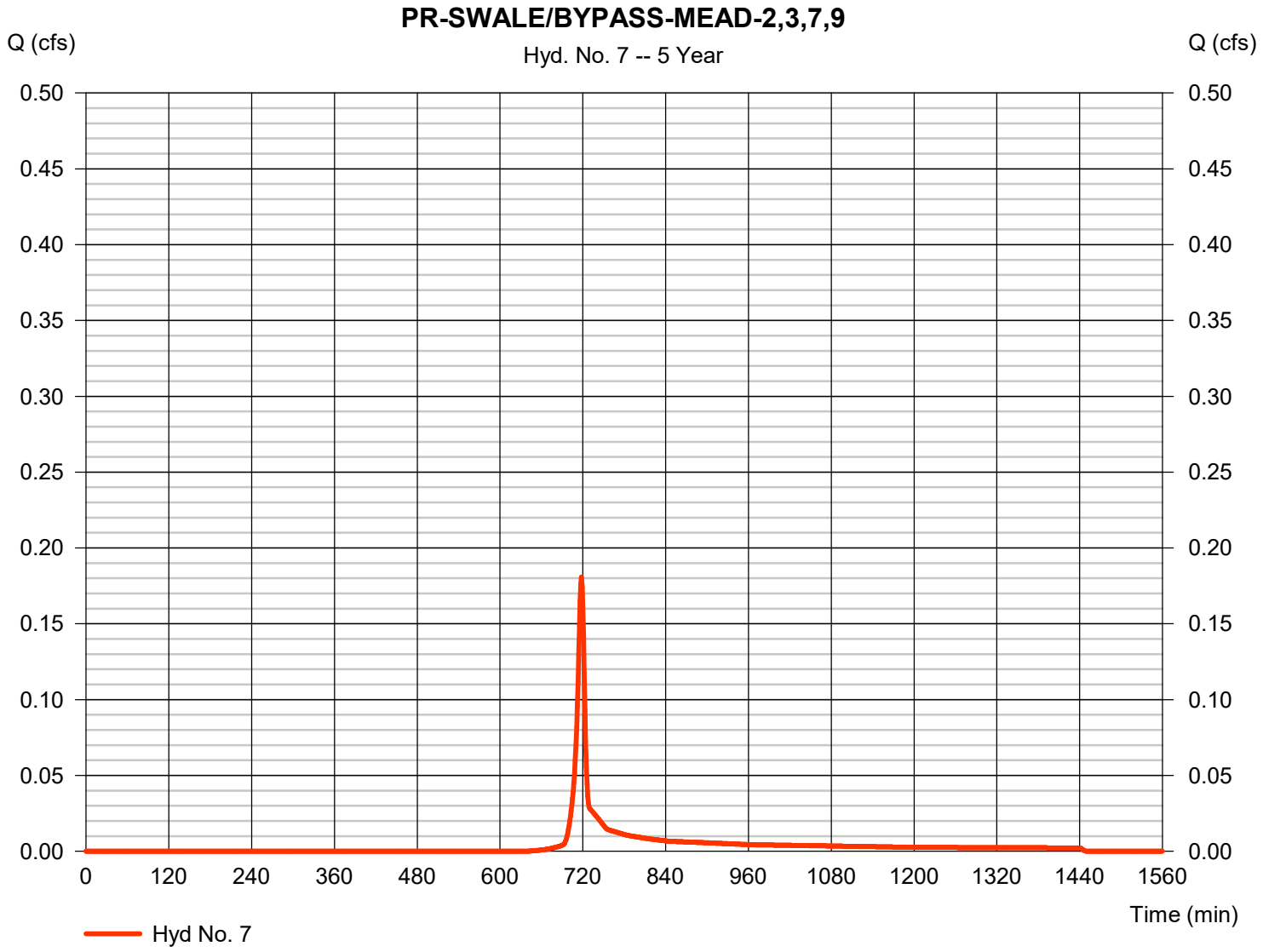


Hydrograph Report

Hyd. No. 7

PR-SWALE/BYPASS-MEAD-2,3,7,9

Hydrograph type	= SCS Runoff	Peak discharge	= 0.181 cfs
Storm frequency	= 5 yrs	Time to peak	= 718 min
Time interval	= 1 min	Hyd. volume	= 365 cuft
Drainage area	= 0.072 ac	Curve number	= 71
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 3.94 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

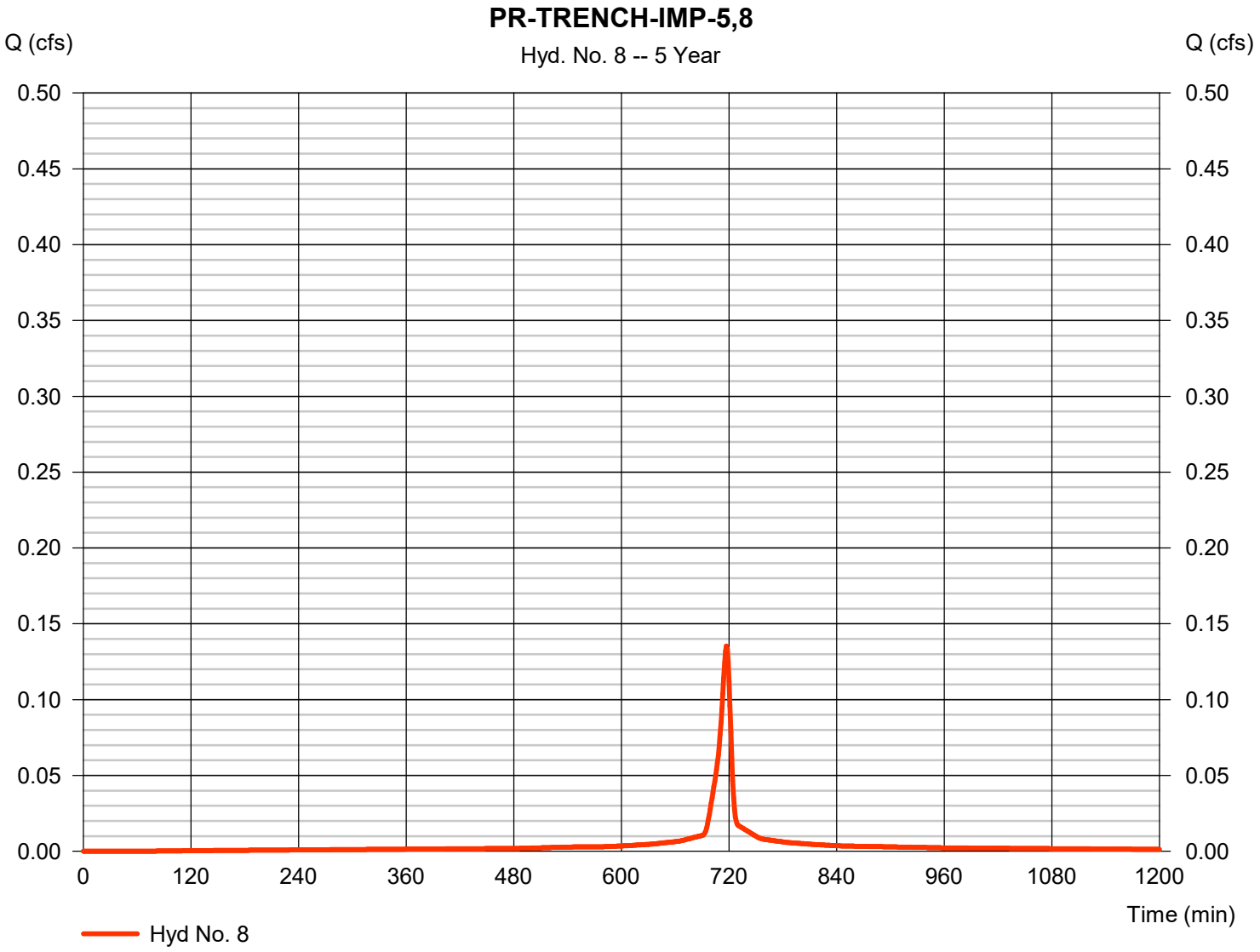


Hydrograph Report

Hyd. No. 8

PR-TRENCH-IMP-5,8

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.135 cfs
Storm frequency	=	5 yrs	Time to peak	=	717 min
Time interval	=	1 min	Hyd. volume	=	323 cuft
Drainage area	=	0.023 ac	Curve number	=	98
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	3.94 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

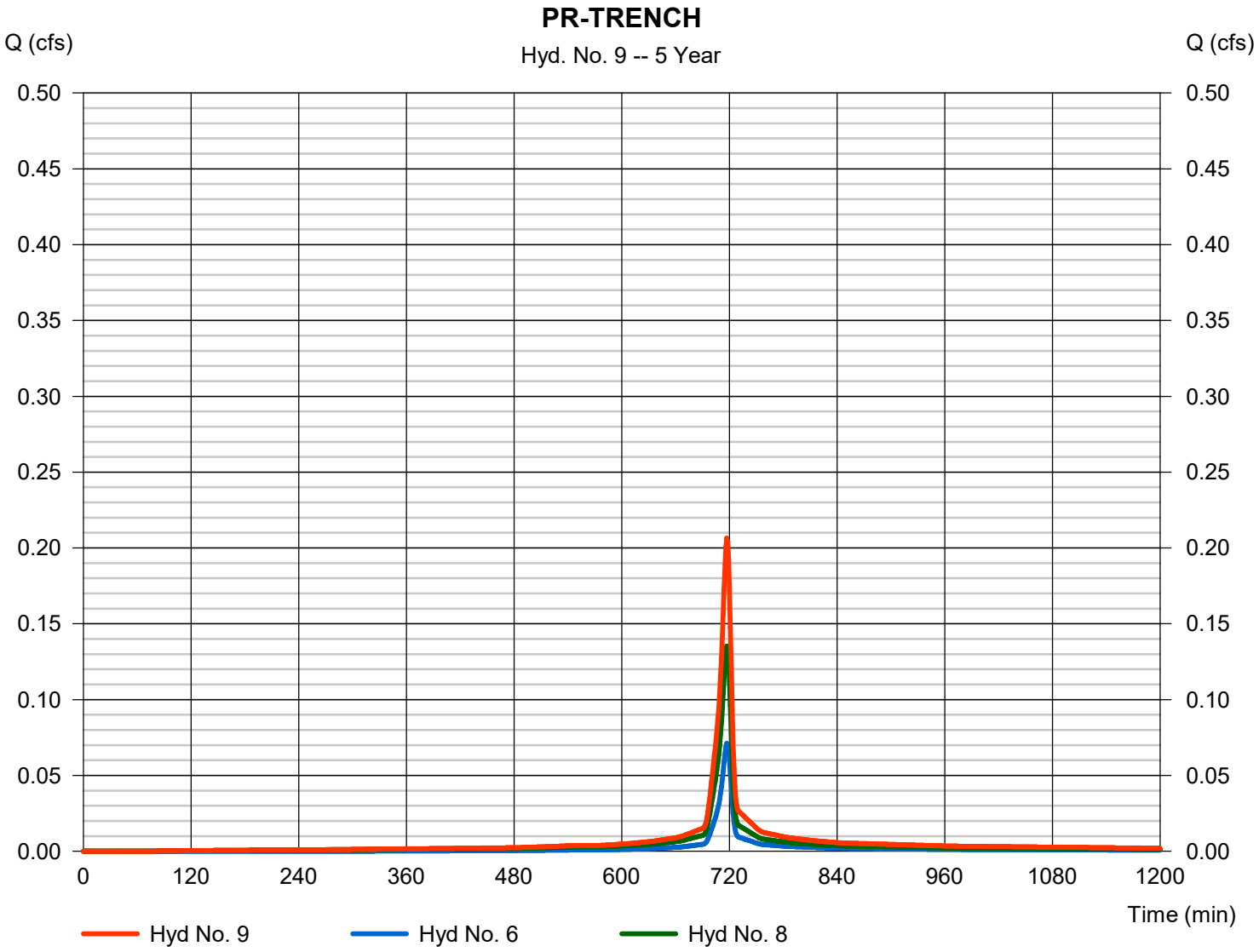


Hydrograph Report

Hyd. No. 9

PR-TRENCH

Hydrograph type	=	Combine	Peak discharge	=	0.207 cfs
Storm frequency	=	5 yrs	Time to peak	=	717 min
Time interval	=	1 min	Hyd. volume	=	476 cuft
Inflow hyds.	=	6, 8	Contrib. drain. area	=	0.037 ac



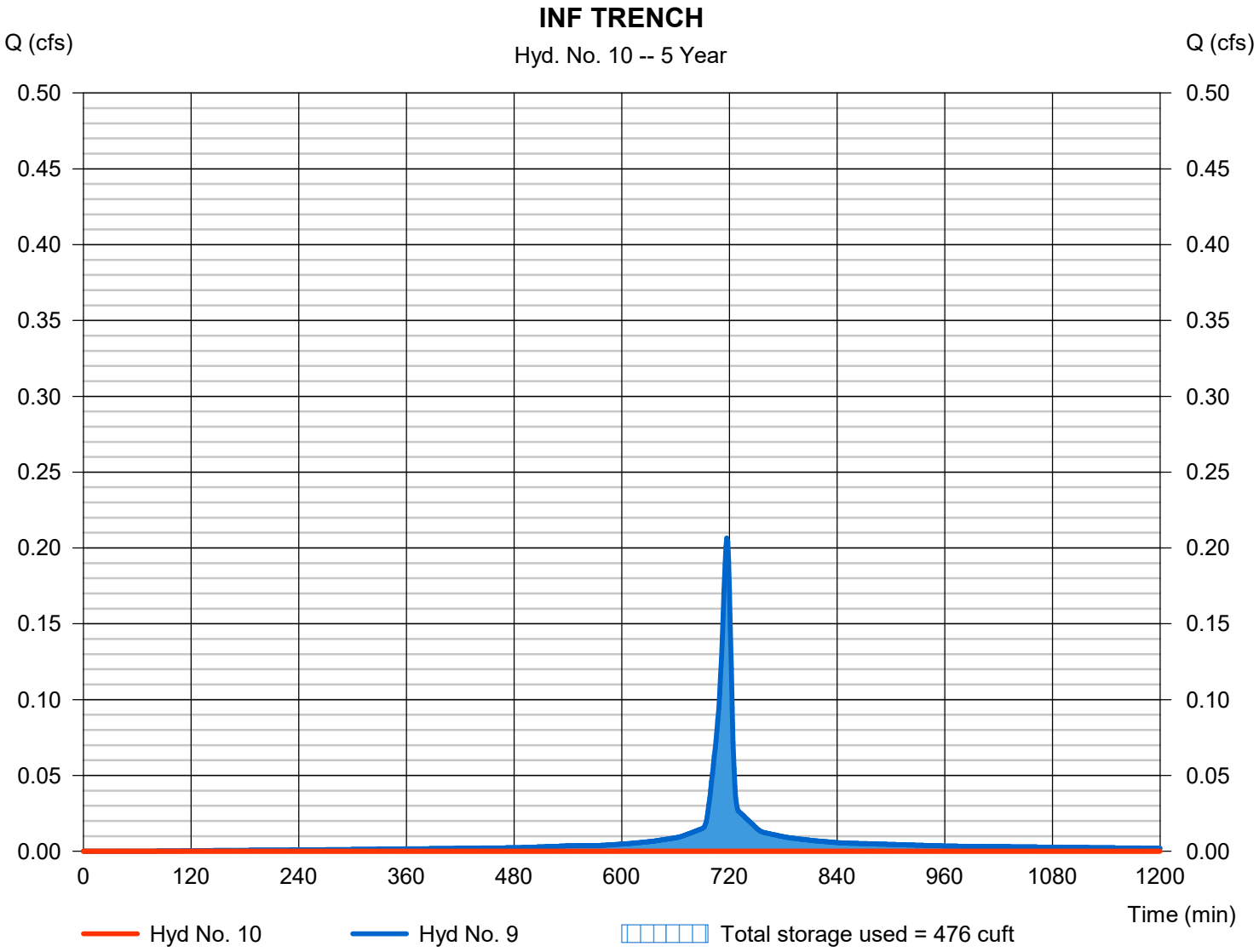
Hydrograph Report

Hyd. No. 10

INF TRENCH

Hydrograph type	=	Reservoir	Peak discharge	=	0.000 cfs
Storm frequency	=	5 yrs	Time to peak	=	n/a
Time interval	=	1 min	Hyd. volume	=	0 cuft
Inflow hyd. No.	=	9 - PR-TRENCH	Max. Elevation	=	433.82 ft
Reservoir name	=	BASIN	Max. Storage	=	476 cuft

Storage Indication method used.

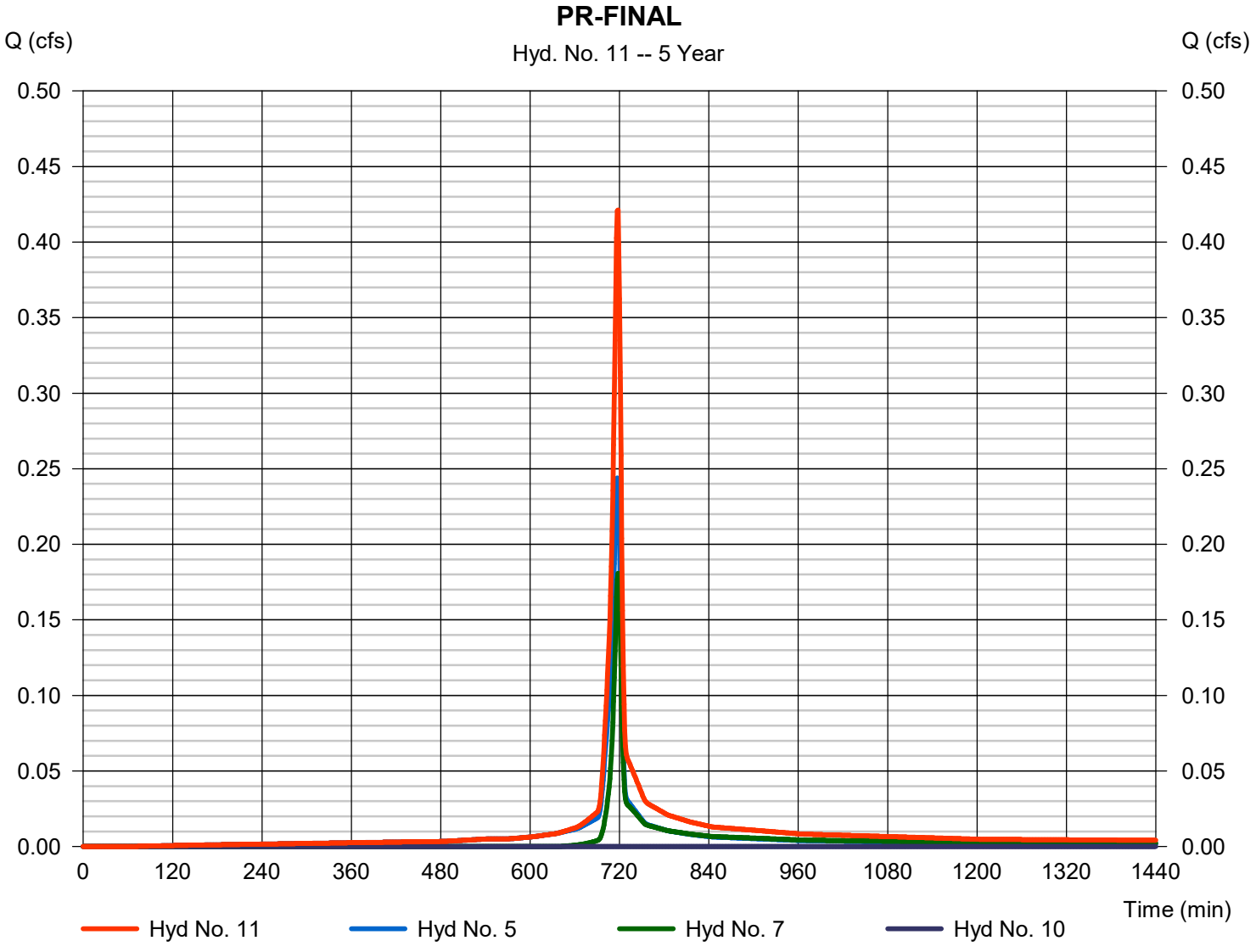


Hydrograph Report

Hyd. No. 11

PR-FINAL

Hydrograph type	= Combine	Peak discharge	= 0.421 cfs
Storm frequency	= 5 yrs	Time to peak	= 718 min
Time interval	= 1 min	Hyd. volume	= 947 cuft
Inflow hyds.	= 5, 7, 10	Contrib. drain. area	= 0.114 ac



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

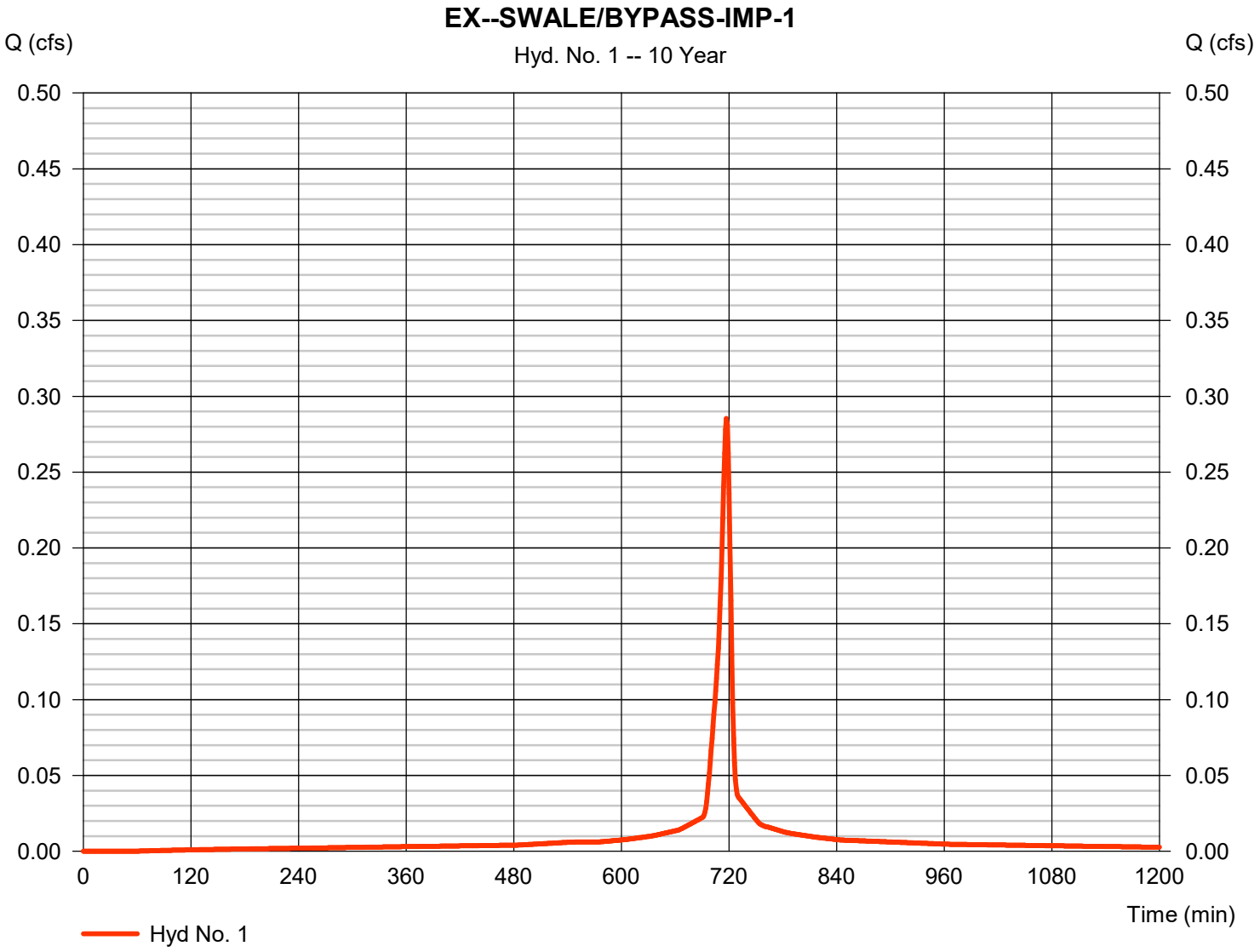
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	0.285	1	717	686	------	------	------	EX--SWALE/BYPASS-IMP-1
2	SCS Runoff	0.244	1	718	490	------	------	------	EX-SWALE/BYPASS-MEAD-2,3,7,9
3	SCS Runoff	0.113	1	719	239	------	------	------	EX-TRENCH-4,5,6,8
4	Combine	0.638	1	718	1,415	1, 2, 3	------	------	EX-TOTAL
5	SCS Runoff	0.285	1	717	686	------	------	------	PR-SWALE/BYPASS-IMP-1
6	SCS Runoff	0.085	1	717	186	------	------	------	PR-TRENCH-GRV-4,6
7	SCS Runoff	0.244	1	718	490	------	------	------	PR-SWALE/BYPASS-MEAD-2,3,7,9
8	SCS Runoff	0.158	1	717	381	------	------	------	PR-TRENCH-IMP-5,8
9	Combine	0.244	1	717	566	6, 8	------	------	PR-TRENCH
10	Reservoir	0.002	1	1235	26	9	434.00	540	INF TRENCH
11	Combine	0.526	1	717	1,203	5, 7, 10	------	------	PR-FINAL

Hydrograph Report

Hyd. No. 1

EX--SWALE/BYPASS-IMP-1

Hydrograph type	= SCS Runoff	Peak discharge	= 0.285 cfs
Storm frequency	= 10 yrs	Time to peak	= 717 min
Time interval	= 1 min	Hyd. volume	= 686 cuft
Drainage area	= 0.042 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 4.60 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

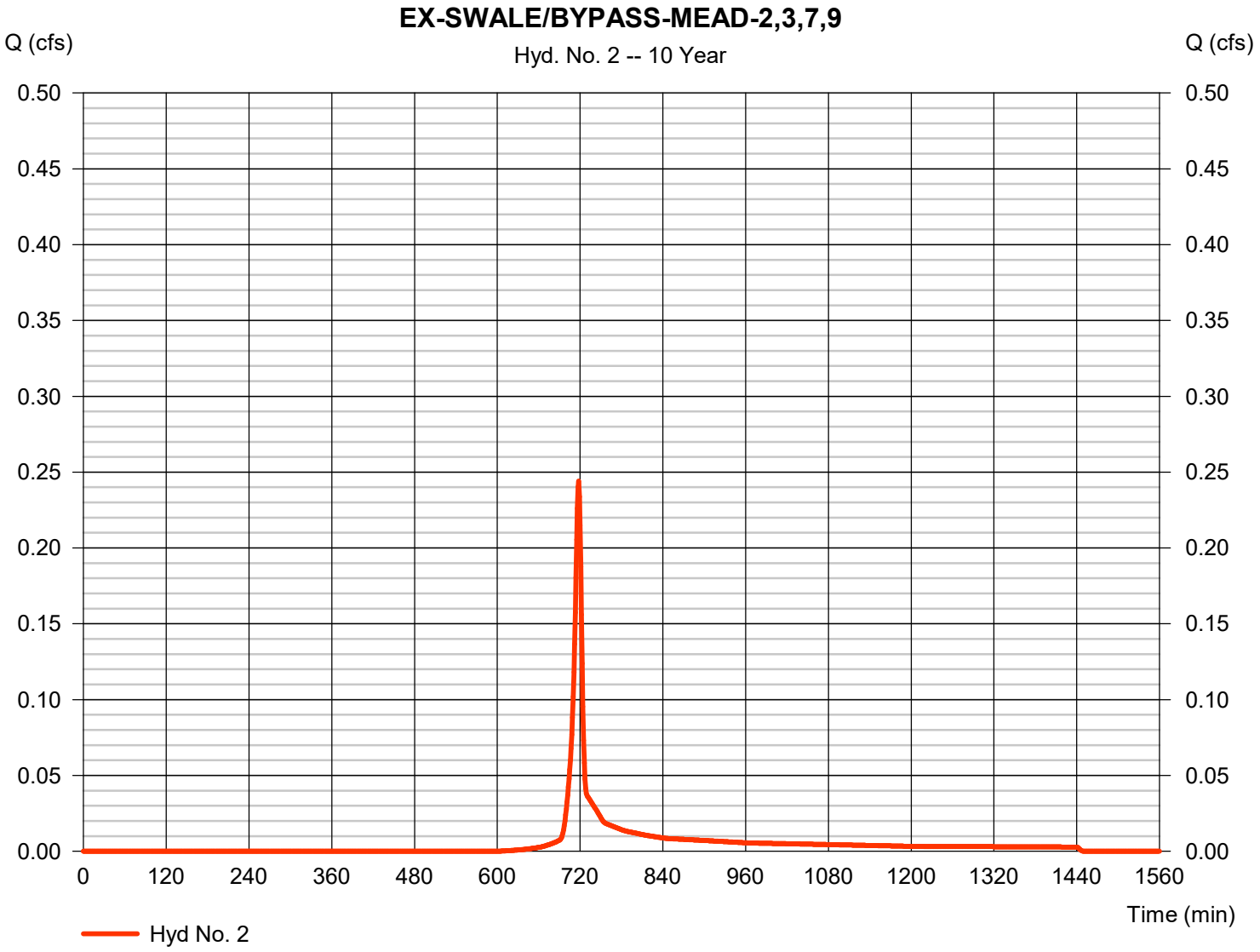


Hydrograph Report

Hyd. No. 2

EX-SWALE/BYPASS-MEAD-2,3,7,9

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.244 cfs
Storm frequency	=	10 yrs	Time to peak	=	718 min
Time interval	=	1 min	Hyd. volume	=	490 cuft
Drainage area	=	0.072 ac	Curve number	=	71
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	4.60 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

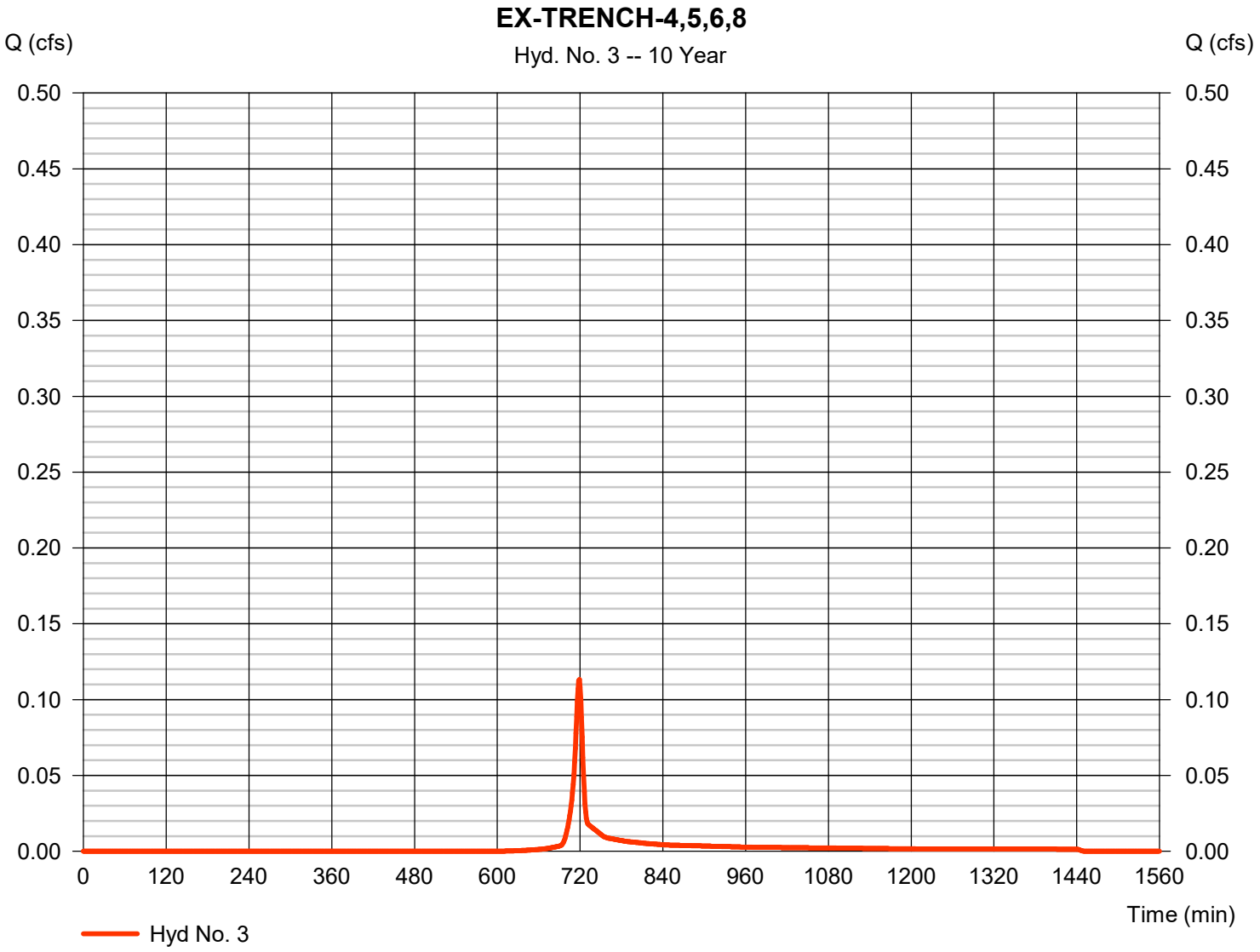


Hydrograph Report

Hyd. No. 3

EX-TRENCH-4,5,6,8

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.113 cfs
Storm frequency	=	10 yrs	Time to peak	=	719 min
Time interval	=	1 min	Hyd. volume	=	239 cuft
Drainage area	=	0.037 ac	Curve number	=	71
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	7.95 min
Total precip.	=	4.60 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

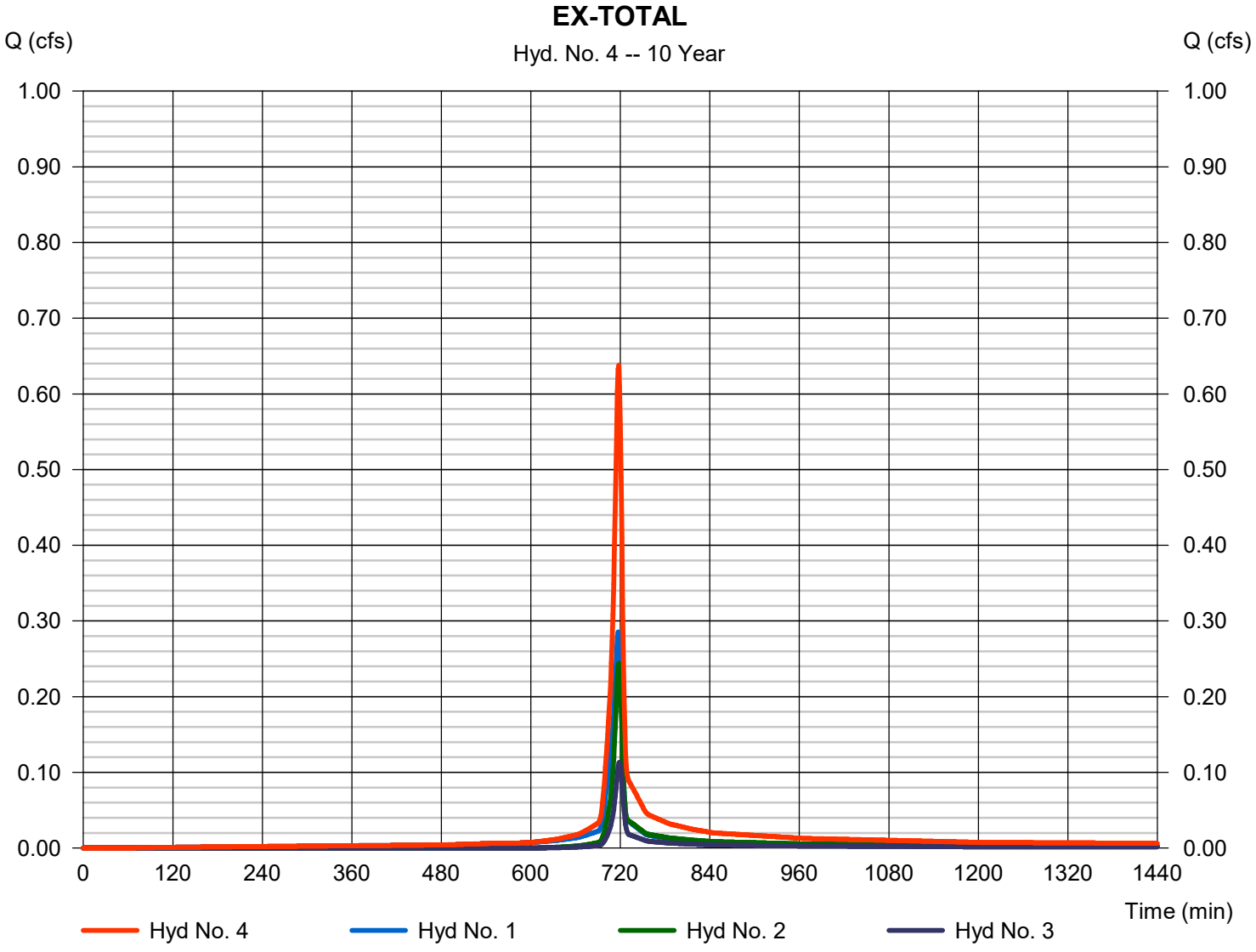


Hydrograph Report

Hyd. No. 4

EX-TOTAL

Hydrograph type	= Combine	Peak discharge	= 0.638 cfs
Storm frequency	= 10 yrs	Time to peak	= 718 min
Time interval	= 1 min	Hyd. volume	= 1,415 cuft
Inflow hyds.	= 1, 2, 3	Contrib. drain. area	= 0.151 ac

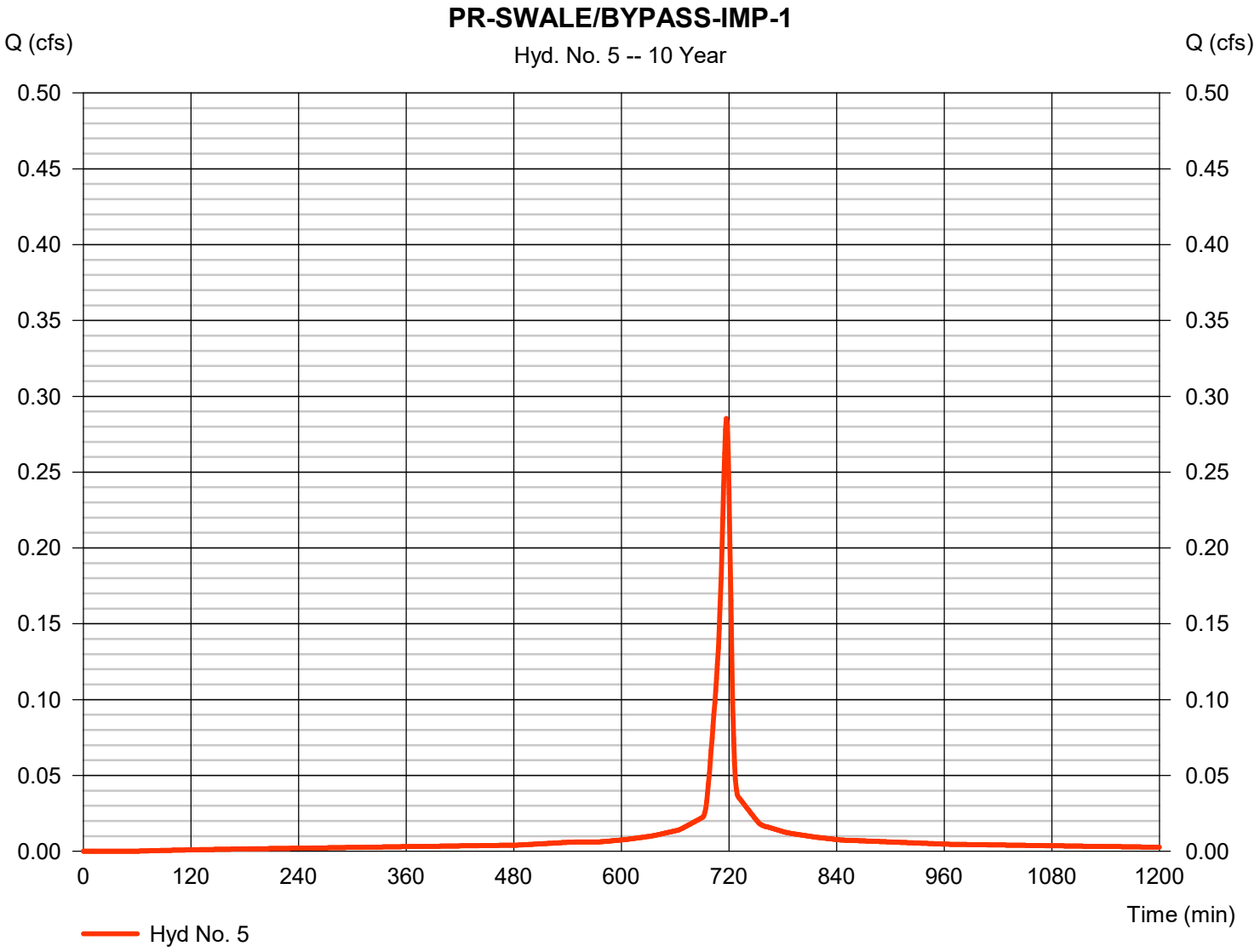


Hydrograph Report

Hyd. No. 5

PR-SWALE/BYPASS-IMP-1

Hydrograph type	= SCS Runoff	Peak discharge	= 0.285 cfs
Storm frequency	= 10 yrs	Time to peak	= 717 min
Time interval	= 1 min	Hyd. volume	= 686 cuft
Drainage area	= 0.042 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 4.60 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

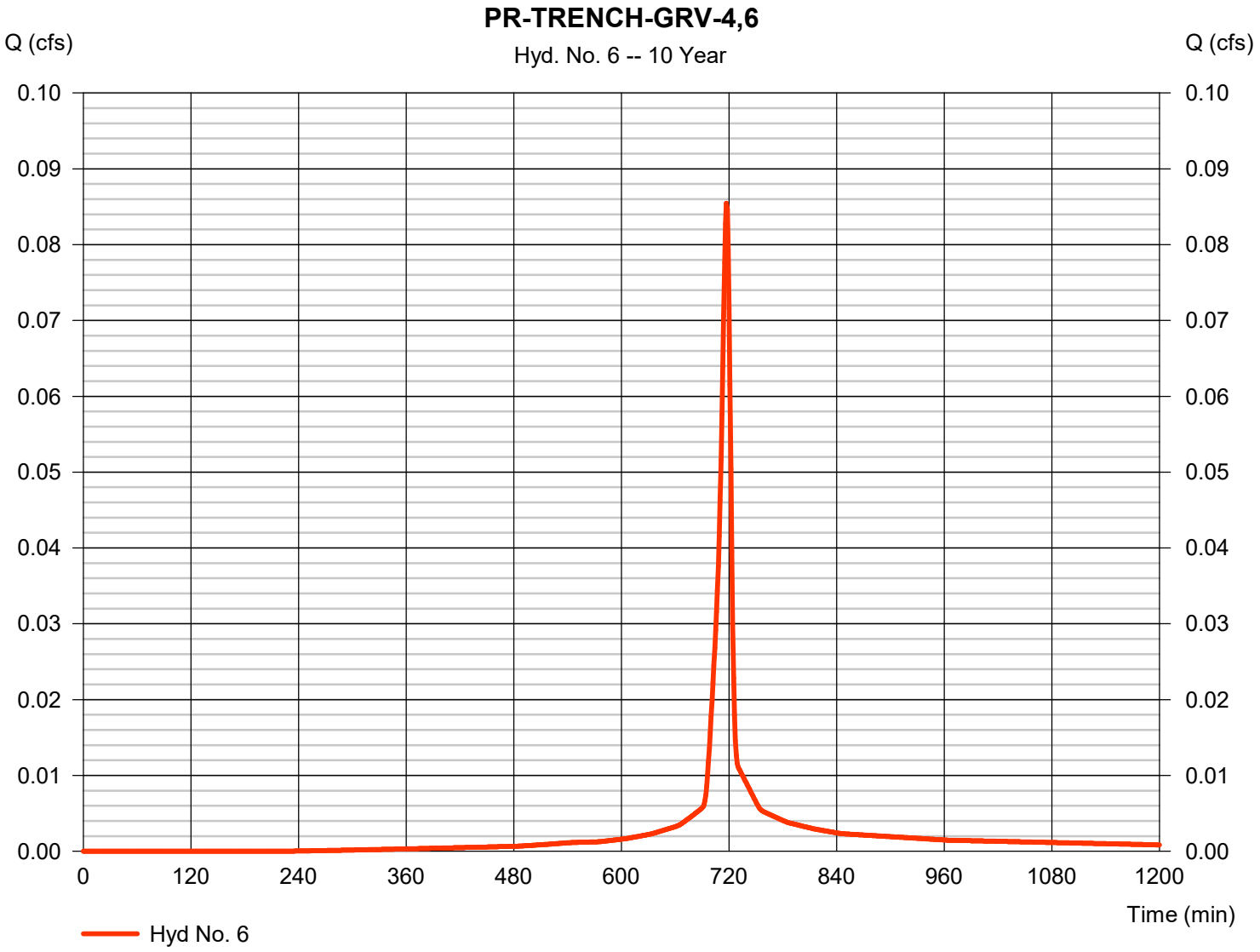


Hydrograph Report

Hyd. No. 6

PR-TRENCH-GRV-4,6

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.085 cfs
Storm frequency	=	10 yrs	Time to peak	=	717 min
Time interval	=	1 min	Hyd. volume	=	186 cuft
Drainage area	=	0.014 ac	Curve number	=	91
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	4.60 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

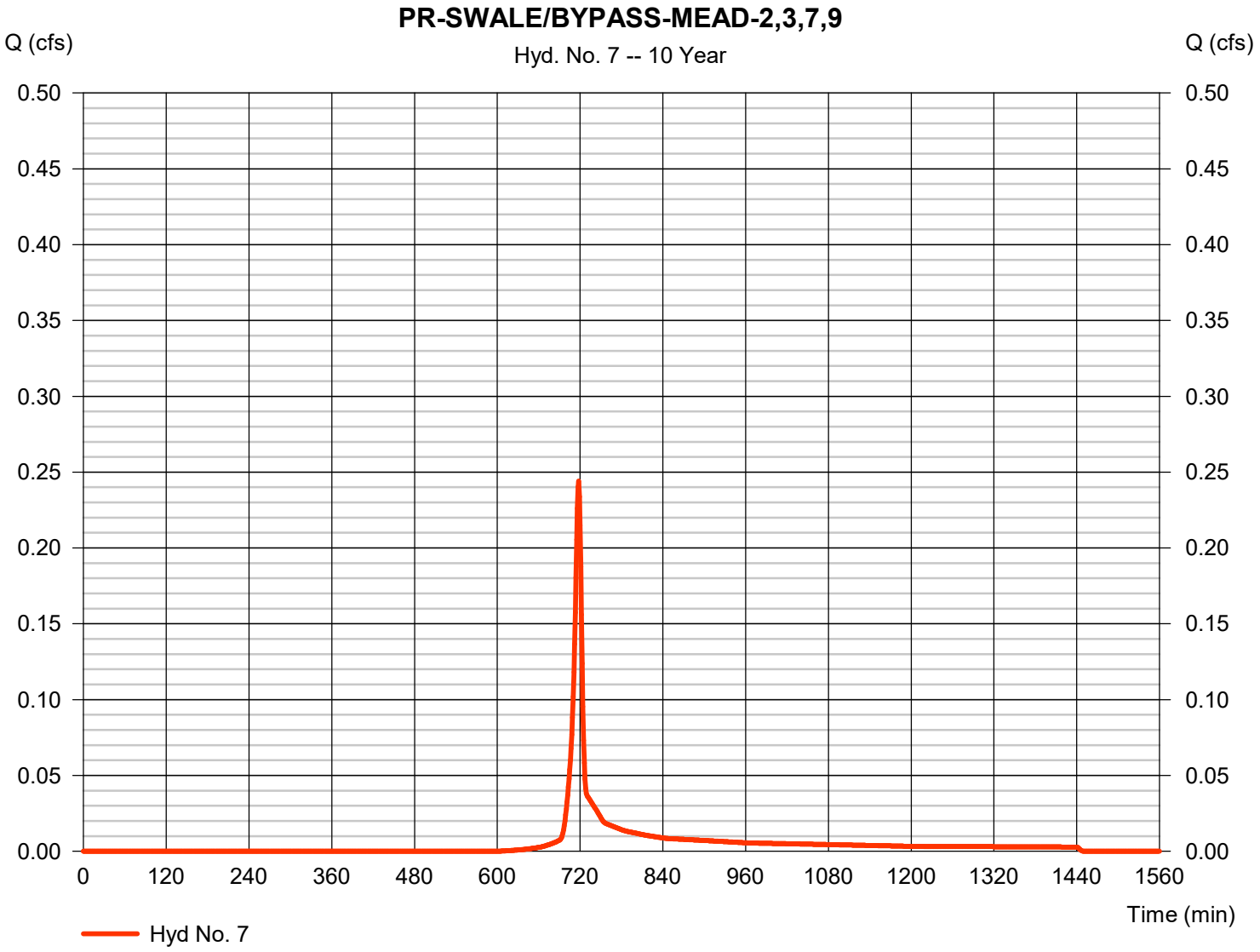


Hydrograph Report

Hyd. No. 7

PR-SWALE/BYPASS-MEAD-2,3,7,9

Hydrograph type	= SCS Runoff	Peak discharge	= 0.244 cfs
Storm frequency	= 10 yrs	Time to peak	= 718 min
Time interval	= 1 min	Hyd. volume	= 490 cuft
Drainage area	= 0.072 ac	Curve number	= 71
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 4.60 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

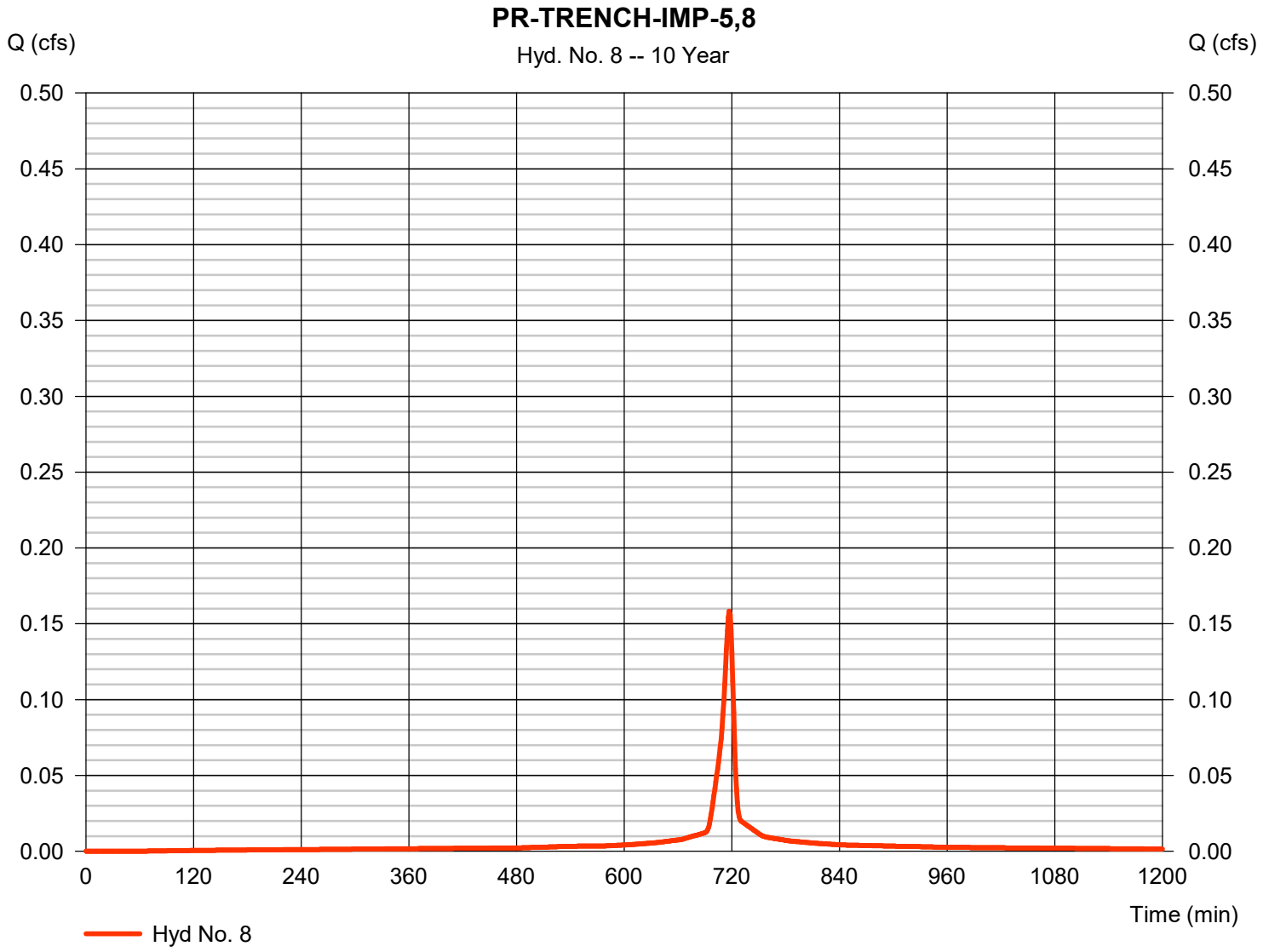


Hydrograph Report

Hyd. No. 8

PR-TRENCH-IMP-5,8

Hydrograph type	= SCS Runoff	Peak discharge	= 0.158 cfs
Storm frequency	= 10 yrs	Time to peak	= 717 min
Time interval	= 1 min	Hyd. volume	= 381 cuft
Drainage area	= 0.023 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 4.60 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

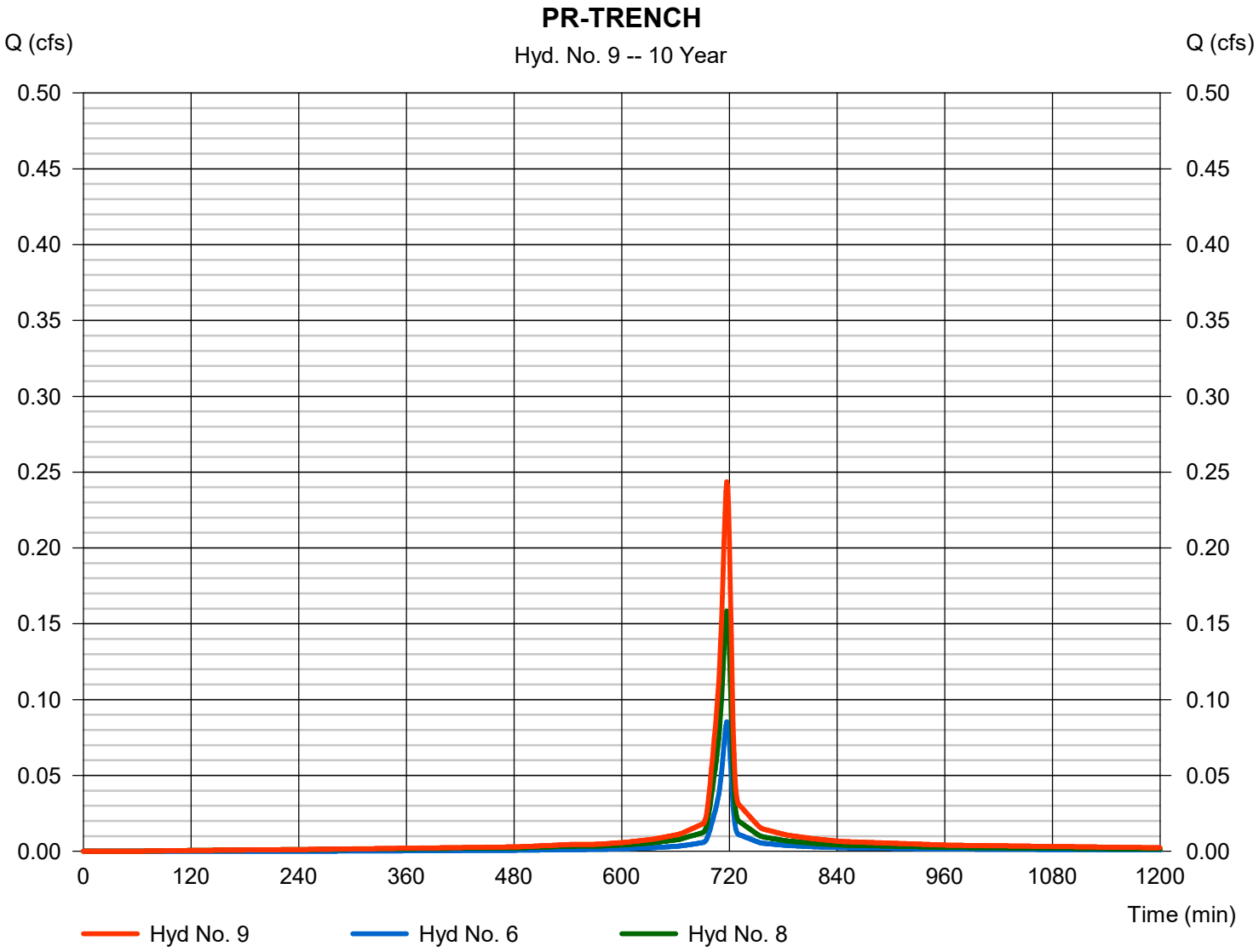


Hydrograph Report

Hyd. No. 9

PR-TRENCH

Hydrograph type	= Combine	Peak discharge	= 0.244 cfs
Storm frequency	= 10 yrs	Time to peak	= 717 min
Time interval	= 1 min	Hyd. volume	= 566 cuft
Inflow hyds.	= 6, 8	Contrib. drain. area	= 0.037 ac



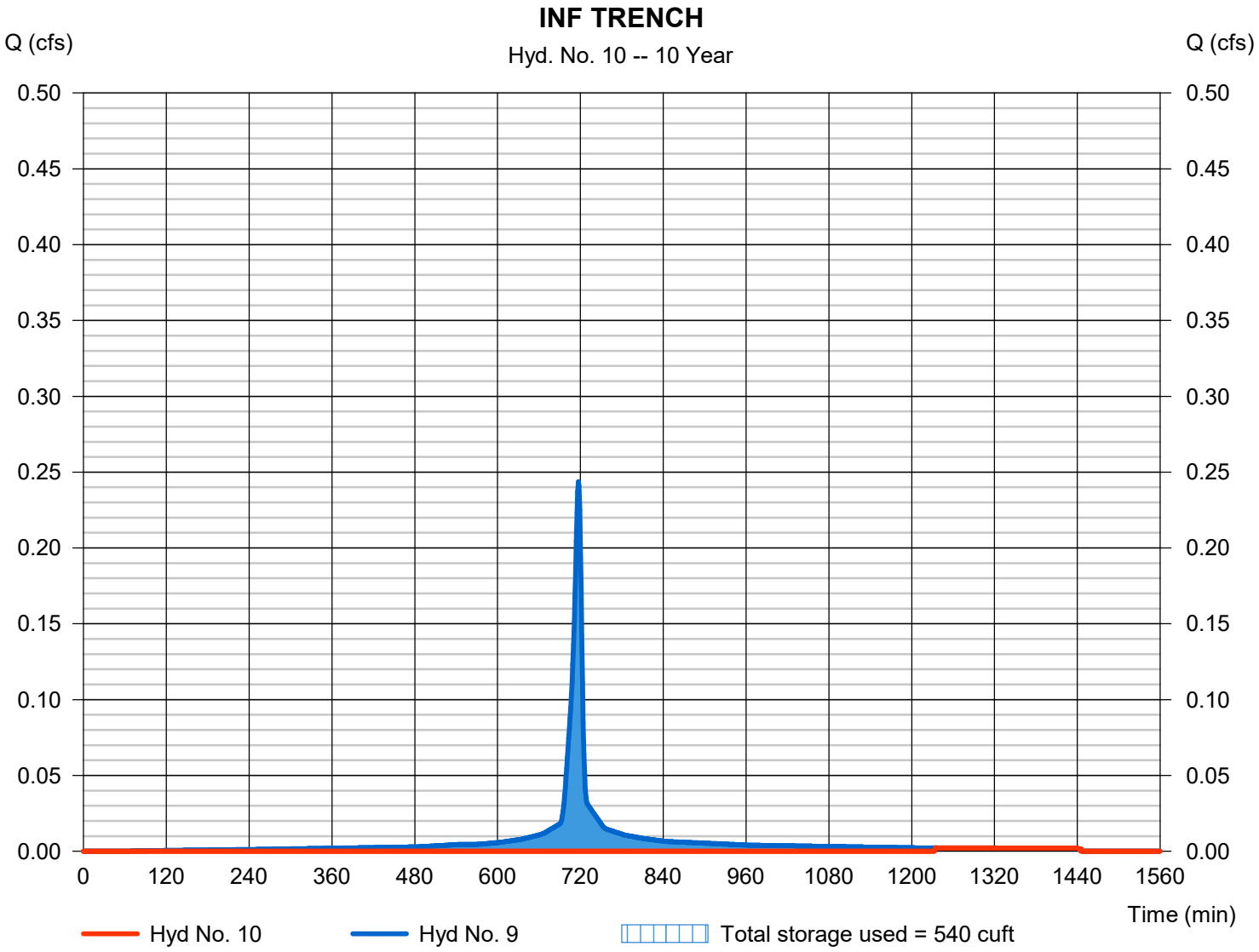
Hydrograph Report

Hyd. No. 10

INF TRENCH

Hydrograph type	=	Reservoir	Peak discharge	=	0.002 cfs
Storm frequency	=	10 yrs	Time to peak	=	1235 min
Time interval	=	1 min	Hyd. volume	=	26 cuft
Inflow hyd. No.	=	9 - PR-TRENCH	Max. Elevation	=	434.00 ft
Reservoir name	=	BASIN	Max. Storage	=	540 cuft

Storage Indication method used.

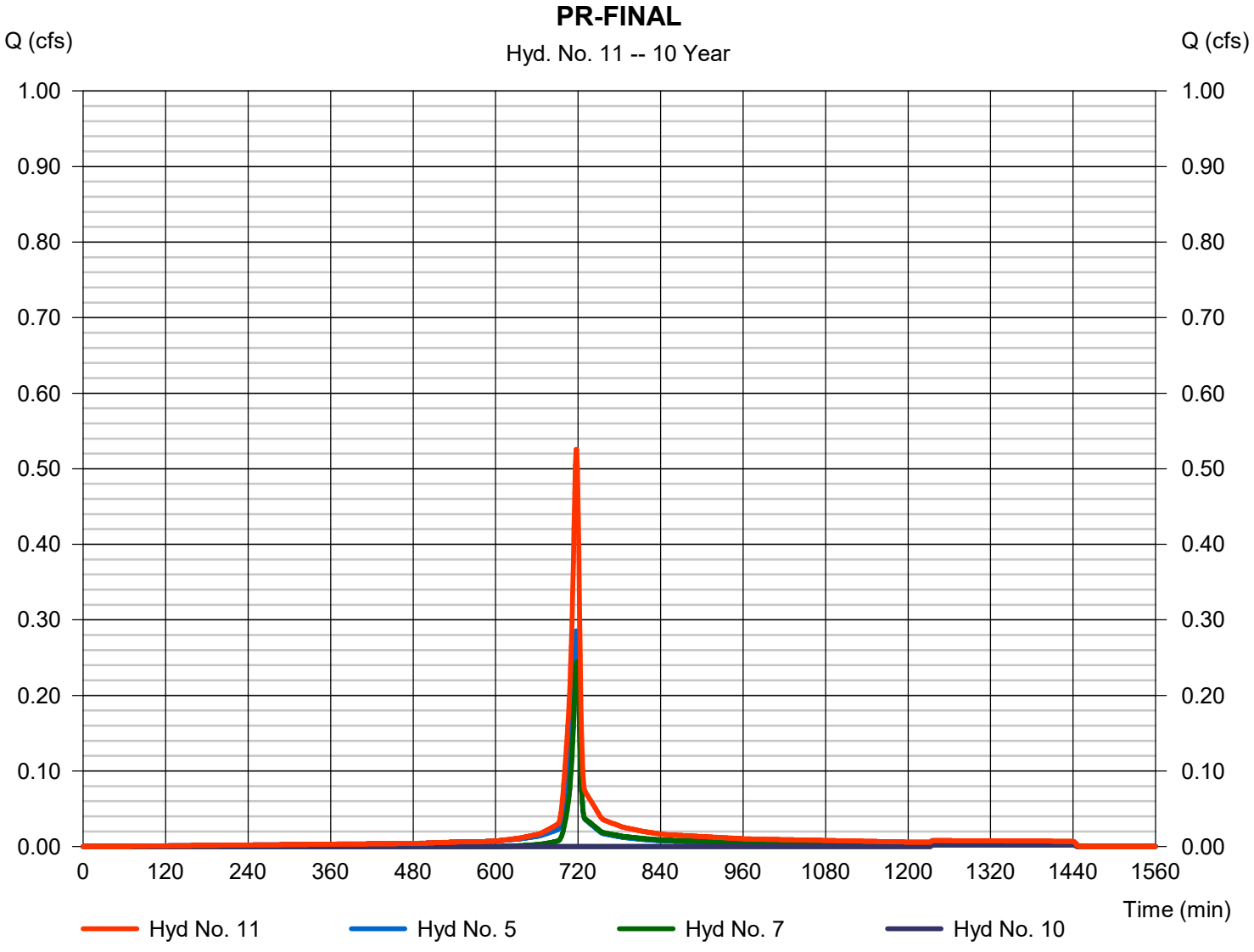


Hydrograph Report

Hyd. No. 11

PR-FINAL

Hydrograph type	= Combine	Peak discharge	= 0.526 cfs
Storm frequency	= 10 yrs	Time to peak	= 717 min
Time interval	= 1 min	Hyd. volume	= 1,203 cuft
Inflow hyds.	= 5, 7, 10	Contrib. drain. area	= 0.114 ac



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

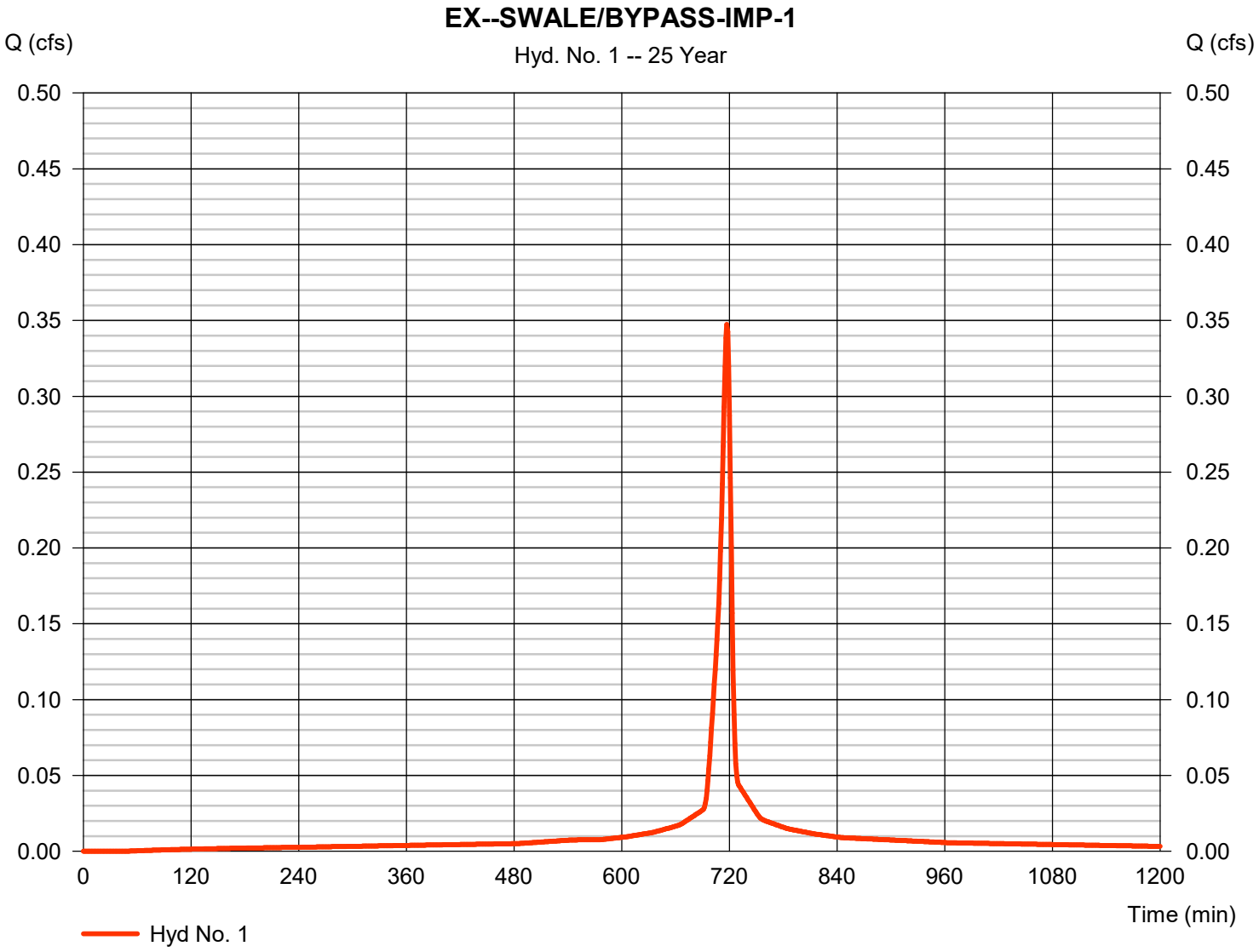
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	0.347	1	717	842	------	------	------	EX--SWALE/BYPASS-IMP-1
2	SCS Runoff	0.345	1	718	693	------	------	------	EX-SWALE/BYPASS-MEAD-2,3,7,9
3	SCS Runoff	0.160	1	719	338	------	------	------	EX-TRENCH-4,5,6,8
4	Combine	0.847	1	718	1,872	1, 2, 3	------	------	EX-TOTAL
5	SCS Runoff	0.347	1	717	842	------	------	------	PR-SWALE/BYPASS-IMP-1
6	SCS Runoff	0.107	1	717	235	------	------	------	PR-TRENCH-GRV-4,6
7	SCS Runoff	0.345	1	718	693	------	------	------	PR-SWALE/BYPASS-MEAD-2,3,7,9
8	SCS Runoff	0.193	1	717	467	------	------	------	PR-TRENCH-IMP-5,8
9	Combine	0.299	1	717	702	6, 8	------	------	PR-TRENCH
10	Reservoir	0.013	1	803	162	9	434.00	540	INF TRENCH
11	Combine	0.689	1	717	1,697	5, 7, 10	------	------	PR-FINAL

Hydrograph Report

Hyd. No. 1

EX--SWALE/BYPASS-IMP-1

Hydrograph type	= SCS Runoff	Peak discharge	= 0.347 cfs
Storm frequency	= 25 yrs	Time to peak	= 717 min
Time interval	= 1 min	Hyd. volume	= 842 cuft
Drainage area	= 0.042 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 5.59 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

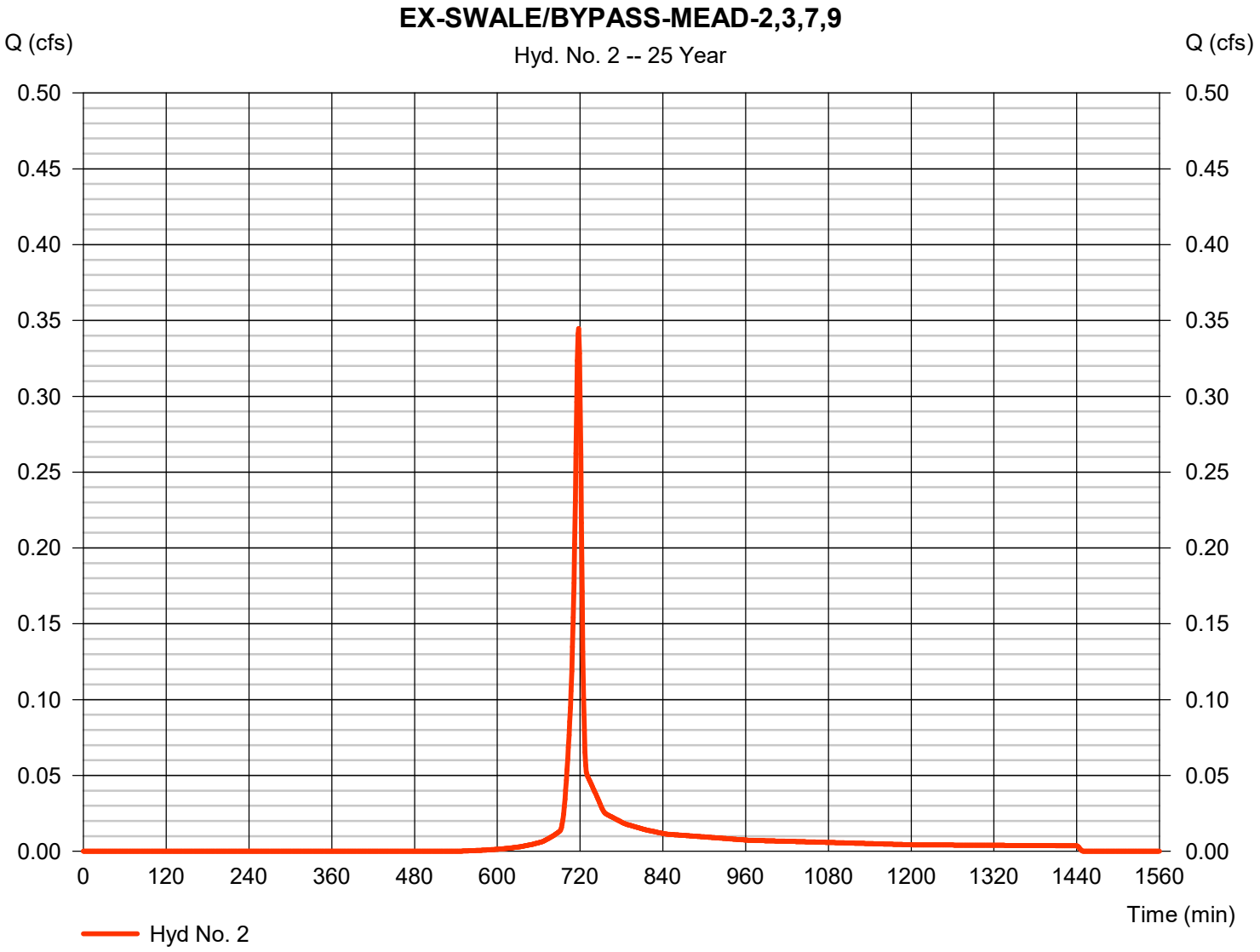


Hydrograph Report

Hyd. No. 2

EX-SWALE/BYPASS-MEAD-2,3,7,9

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.345 cfs
Storm frequency	=	25 yrs	Time to peak	=	718 min
Time interval	=	1 min	Hyd. volume	=	693 cuft
Drainage area	=	0.072 ac	Curve number	=	71
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	5.59 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

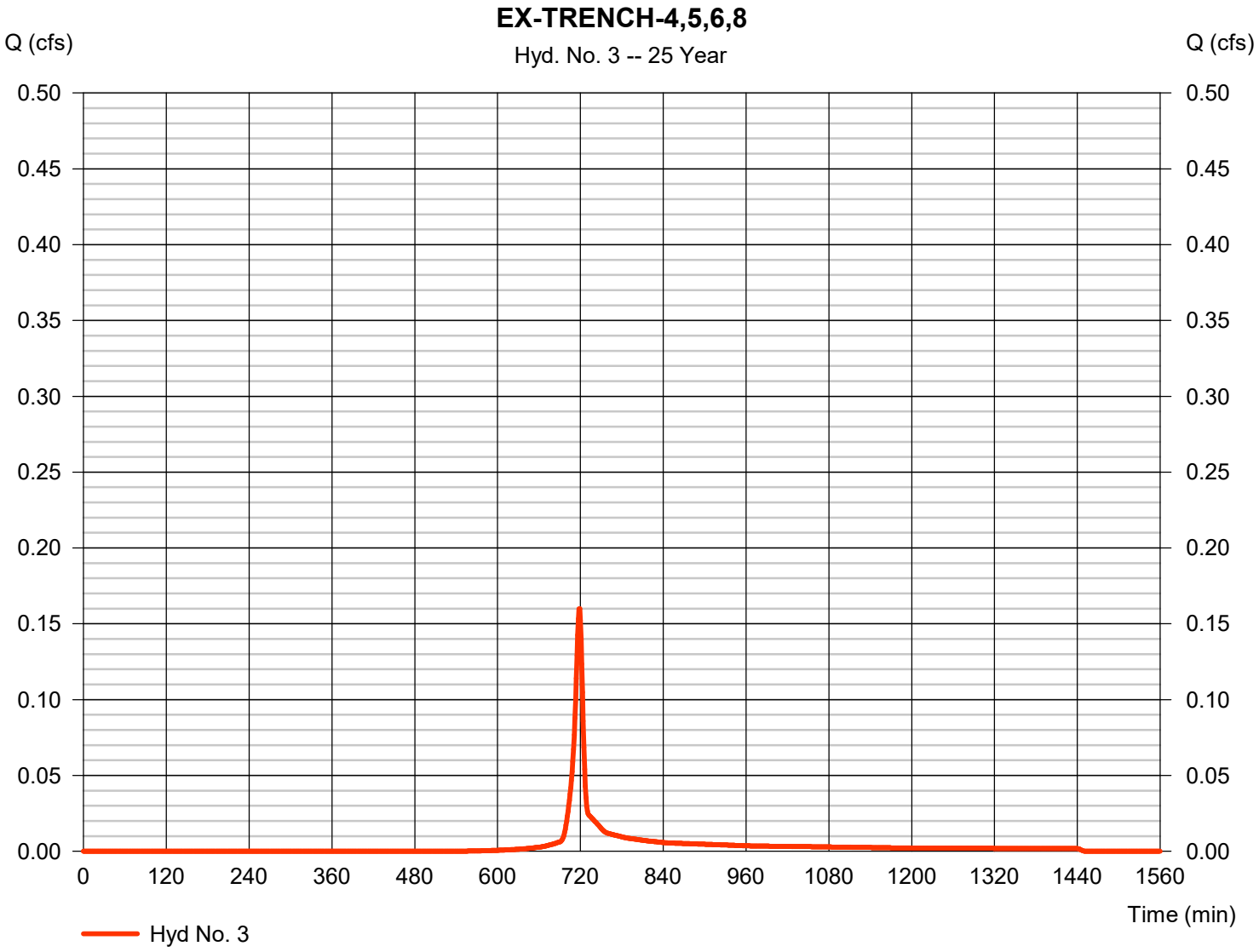


Hydrograph Report

Hyd. No. 3

EX-TRENCH-4,5,6,8

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.160 cfs
Storm frequency	=	25 yrs	Time to peak	=	719 min
Time interval	=	1 min	Hyd. volume	=	338 cuft
Drainage area	=	0.037 ac	Curve number	=	71
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	7.95 min
Total precip.	=	5.59 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

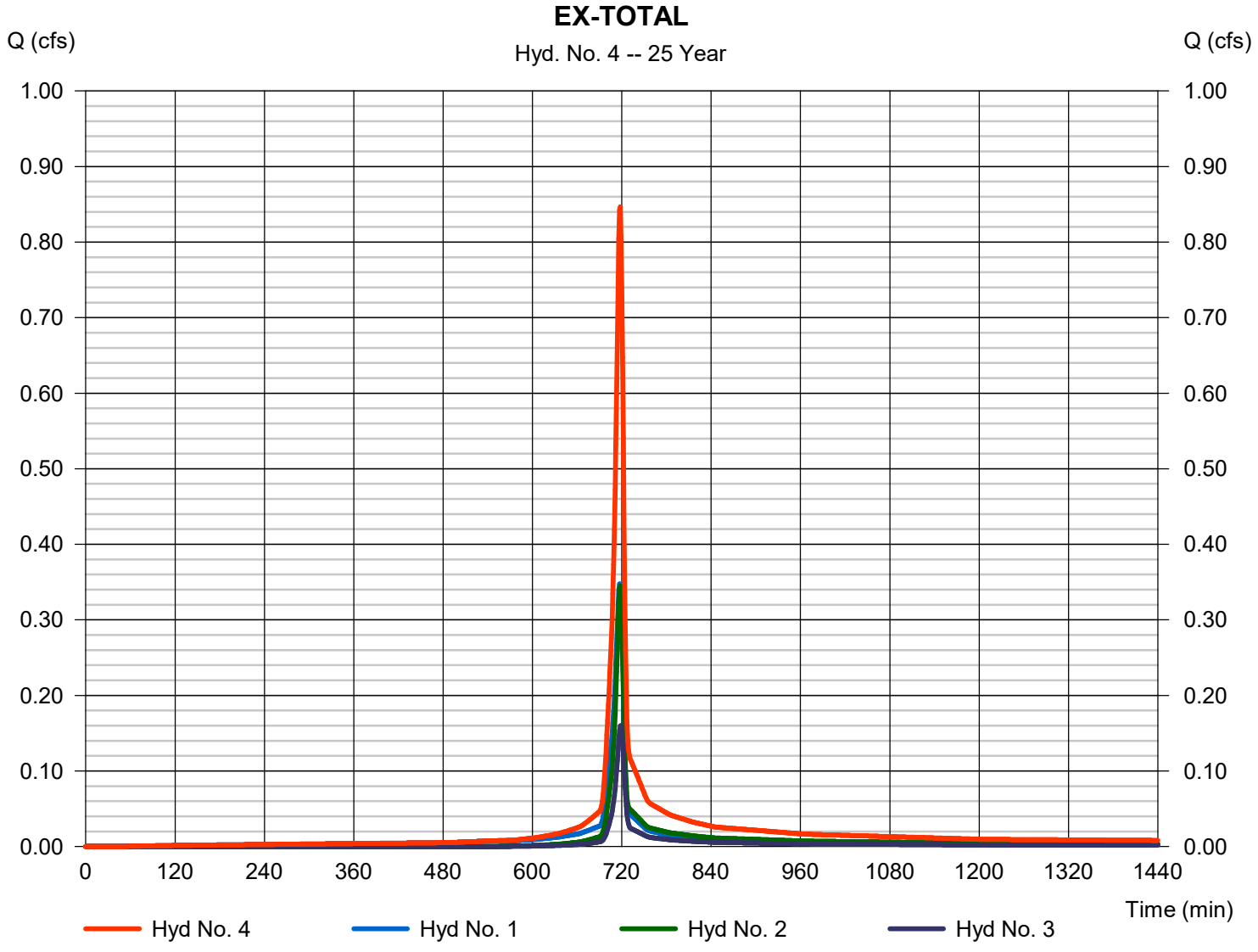


Hydrograph Report

Hyd. No. 4

EX-TOTAL

Hydrograph type	=	Combine	Peak discharge	=	0.847 cfs
Storm frequency	=	25 yrs	Time to peak	=	718 min
Time interval	=	1 min	Hyd. volume	=	1,872 cuft
Inflow hyds.	=	1, 2, 3	Contrib. drain. area	=	0.151 ac

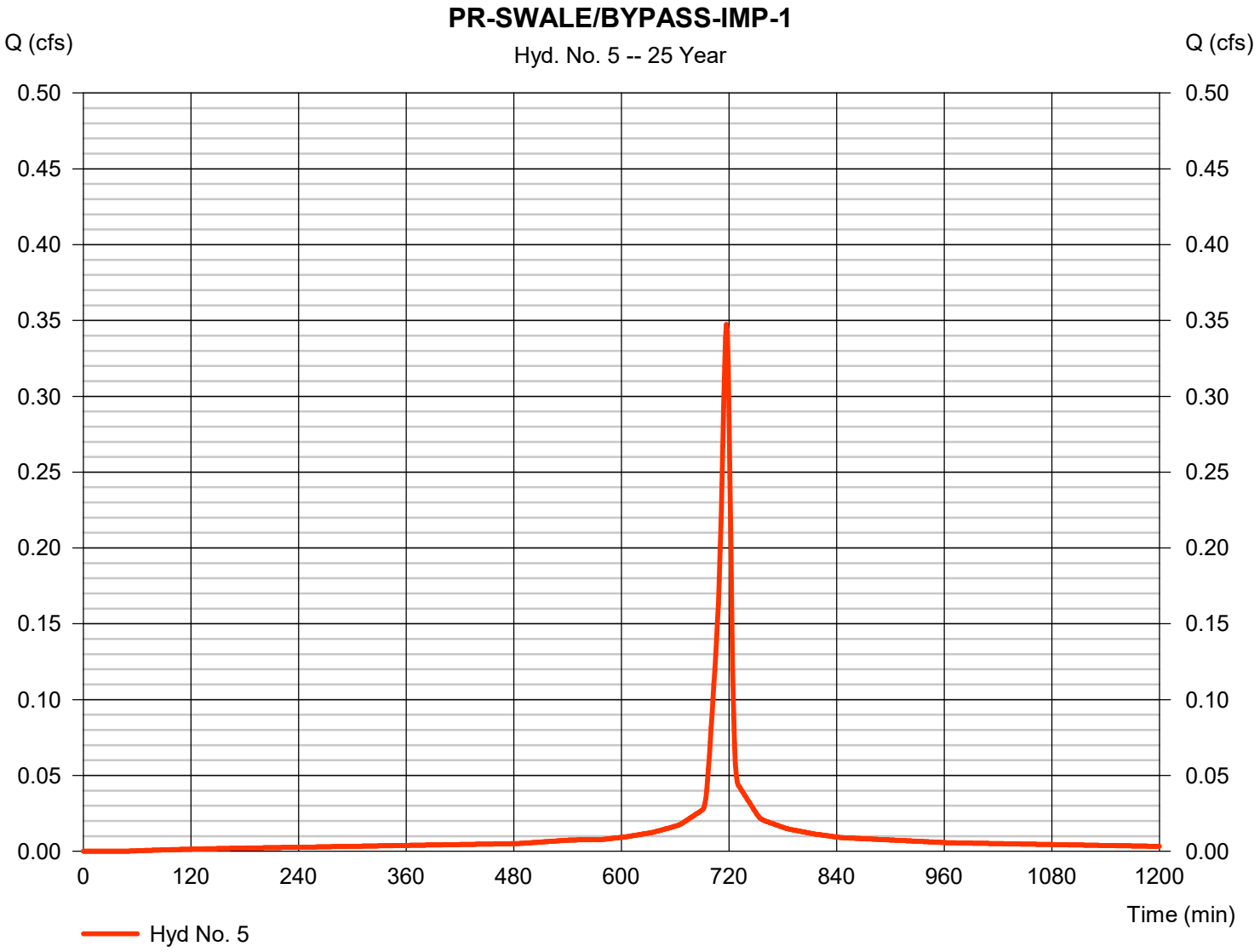


Hydrograph Report

Hyd. No. 5

PR-SWALE/BYPASS-IMP-1

Hydrograph type	= SCS Runoff	Peak discharge	= 0.347 cfs
Storm frequency	= 25 yrs	Time to peak	= 717 min
Time interval	= 1 min	Hyd. volume	= 842 cuft
Drainage area	= 0.042 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 5.59 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

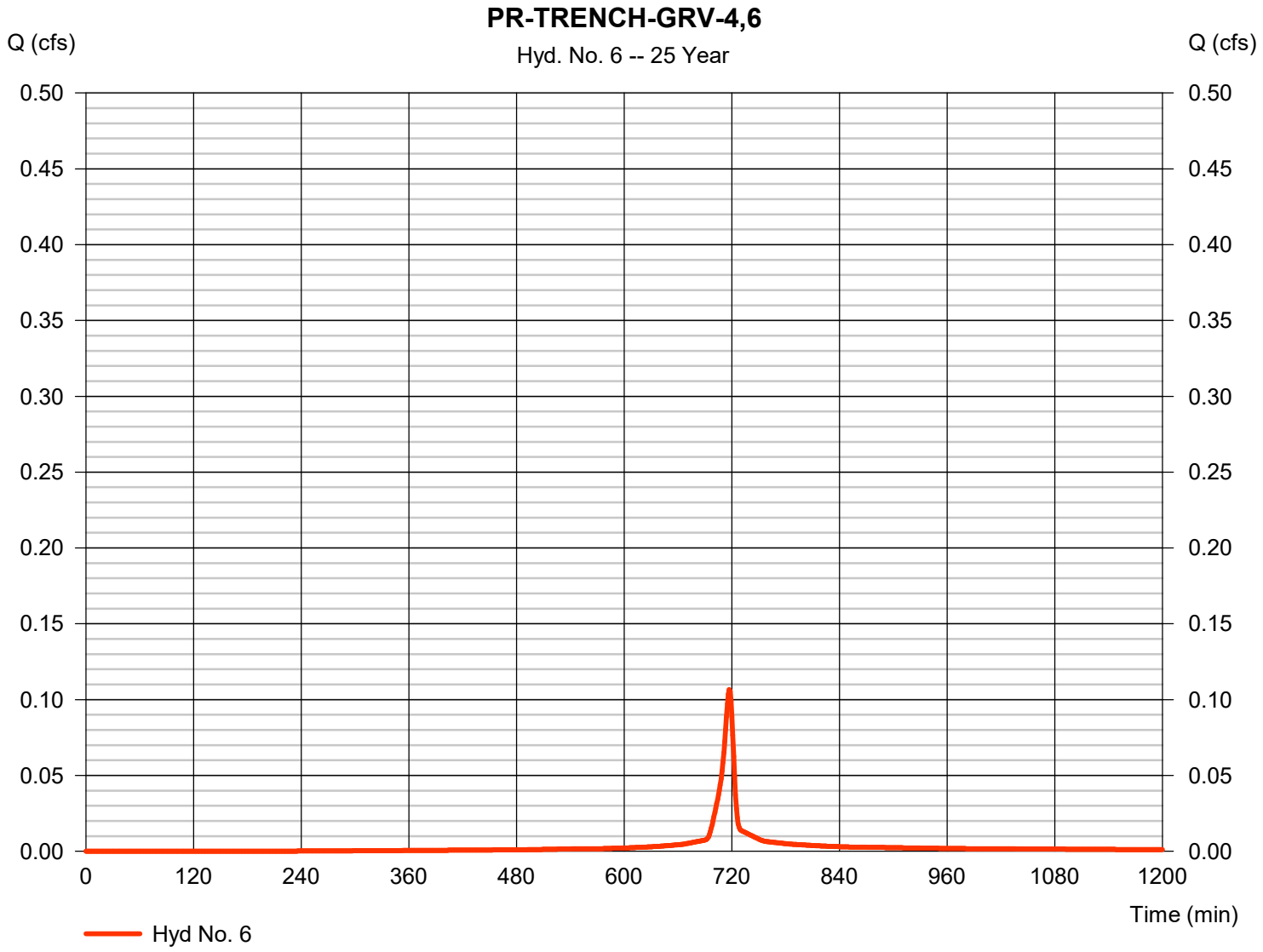


Hydrograph Report

Hyd. No. 6

PR-TRENCH-GRV-4,6

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.107 cfs
Storm frequency	=	25 yrs	Time to peak	=	717 min
Time interval	=	1 min	Hyd. volume	=	235 cuft
Drainage area	=	0.014 ac	Curve number	=	91
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	5.59 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

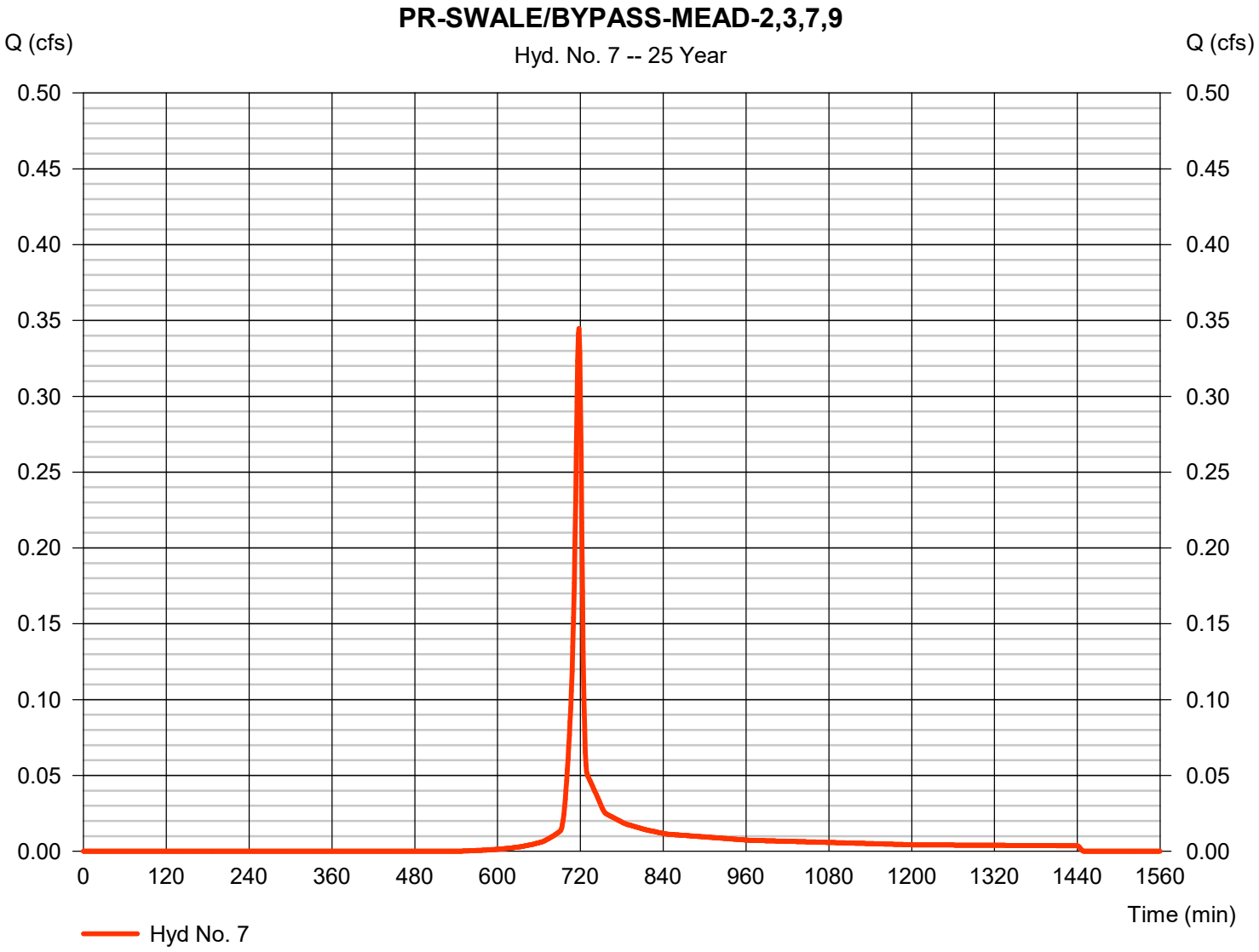


Hydrograph Report

Hyd. No. 7

PR-SWALE/BYPASS-MEAD-2,3,7,9

Hydrograph type	= SCS Runoff	Peak discharge	= 0.345 cfs
Storm frequency	= 25 yrs	Time to peak	= 718 min
Time interval	= 1 min	Hyd. volume	= 693 cuft
Drainage area	= 0.072 ac	Curve number	= 71
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 5.59 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

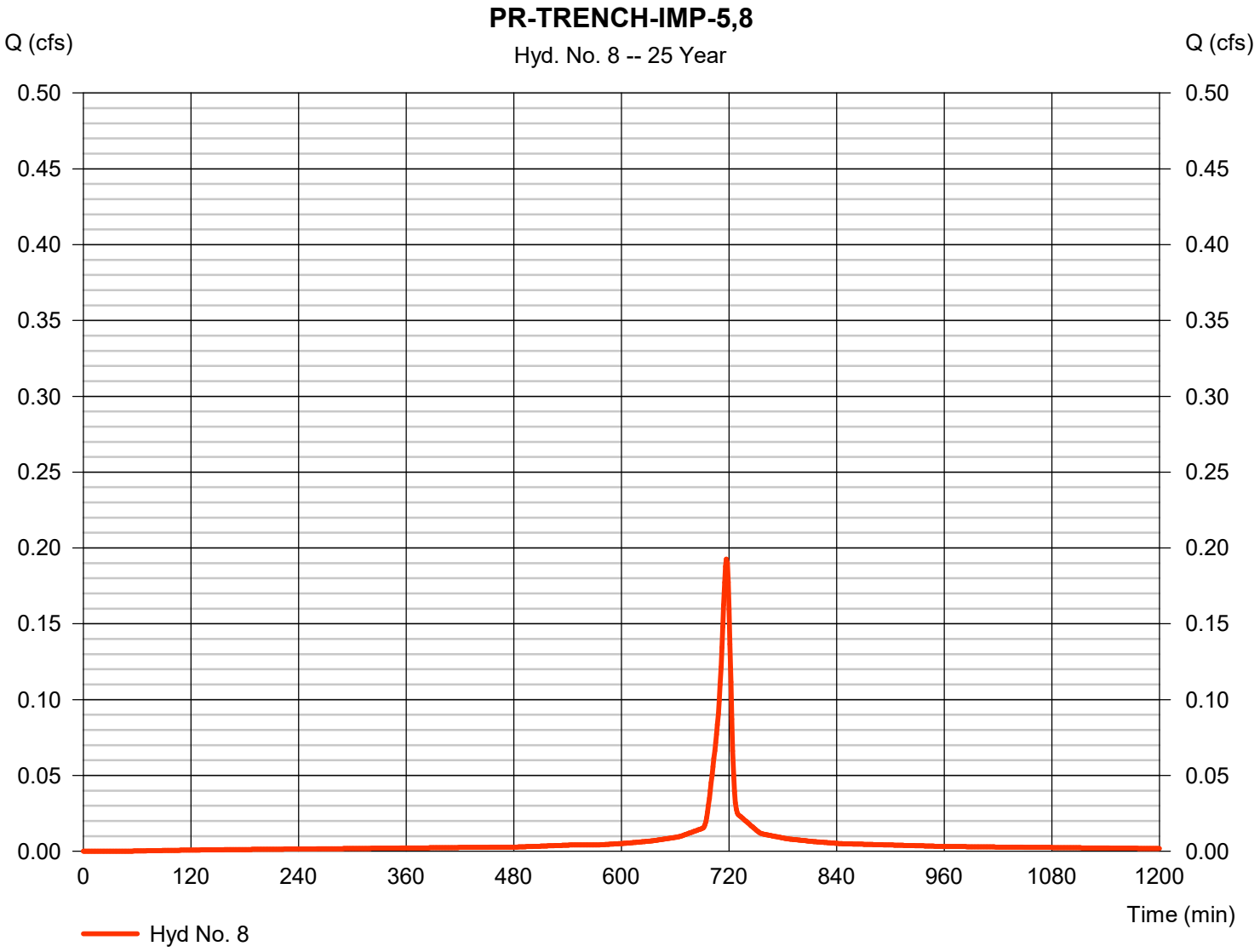


Hydrograph Report

Hyd. No. 8

PR-TRENCH-IMP-5,8

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.193 cfs
Storm frequency	=	25 yrs	Time to peak	=	717 min
Time interval	=	1 min	Hyd. volume	=	467 cuft
Drainage area	=	0.023 ac	Curve number	=	98
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	5.59 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

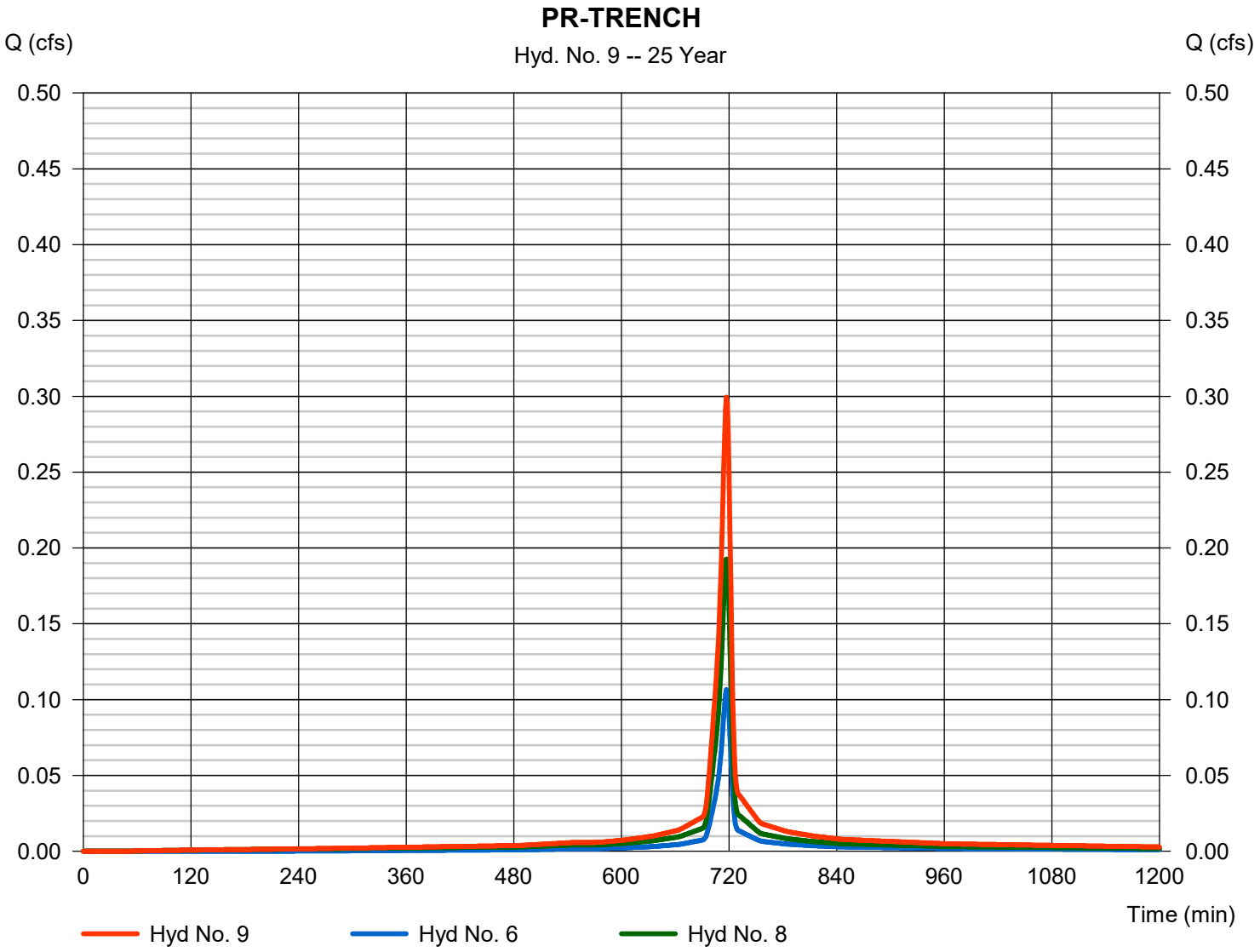


Hydrograph Report

Hyd. No. 9

PR-TRENCH

Hydrograph type	=	Combine	Peak discharge	=	0.299 cfs
Storm frequency	=	25 yrs	Time to peak	=	717 min
Time interval	=	1 min	Hyd. volume	=	702 cuft
Inflow hyds.	=	6, 8	Contrib. drain. area	=	0.037 ac



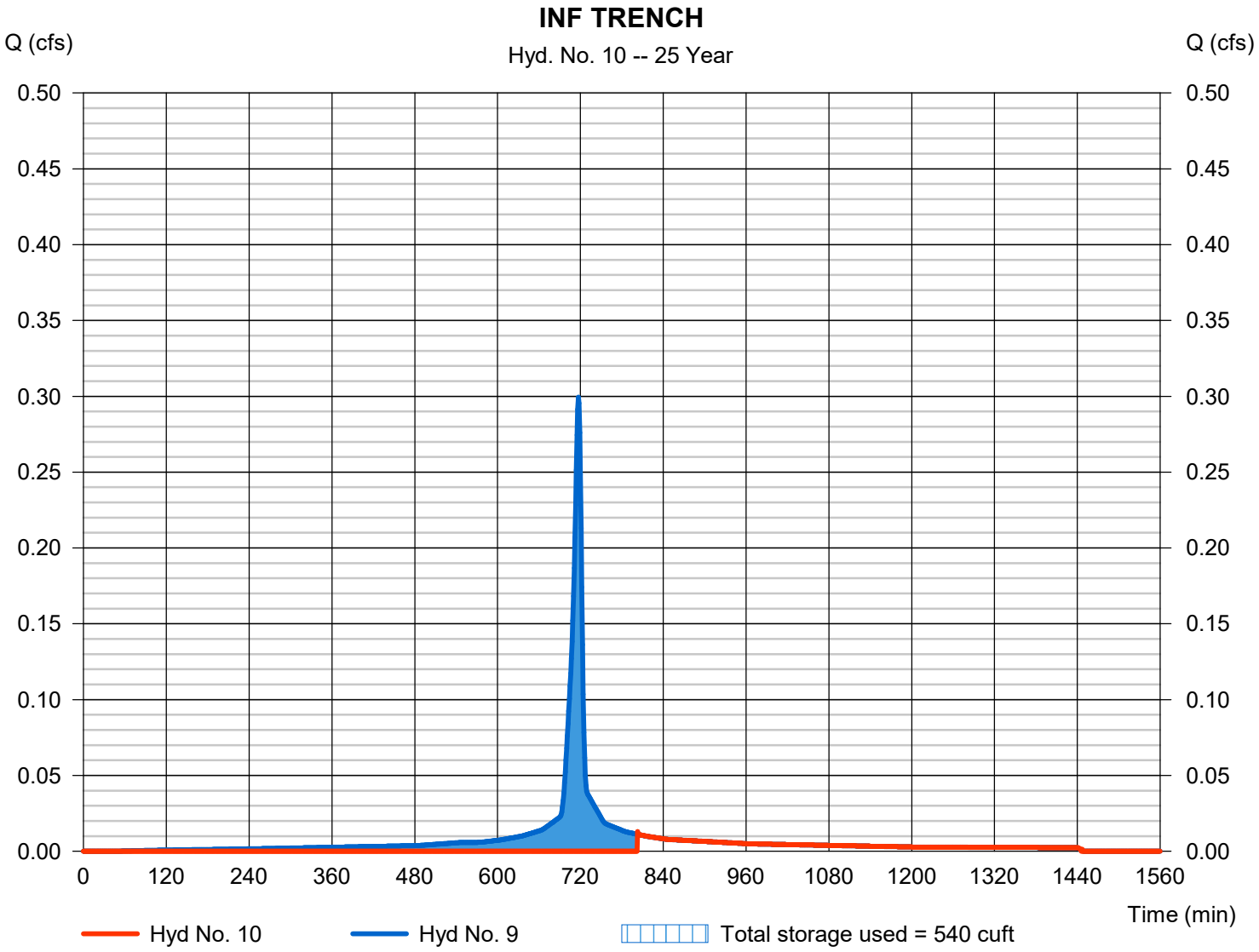
Hydrograph Report

Hyd. No. 10

INF TRENCH

Hydrograph type	=	Reservoir	Peak discharge	=	0.013 cfs
Storm frequency	=	25 yrs	Time to peak	=	803 min
Time interval	=	1 min	Hyd. volume	=	162 cuft
Inflow hyd. No.	=	9 - PR-TRENCH	Max. Elevation	=	434.00 ft
Reservoir name	=	BASIN	Max. Storage	=	540 cuft

Storage Indication method used.

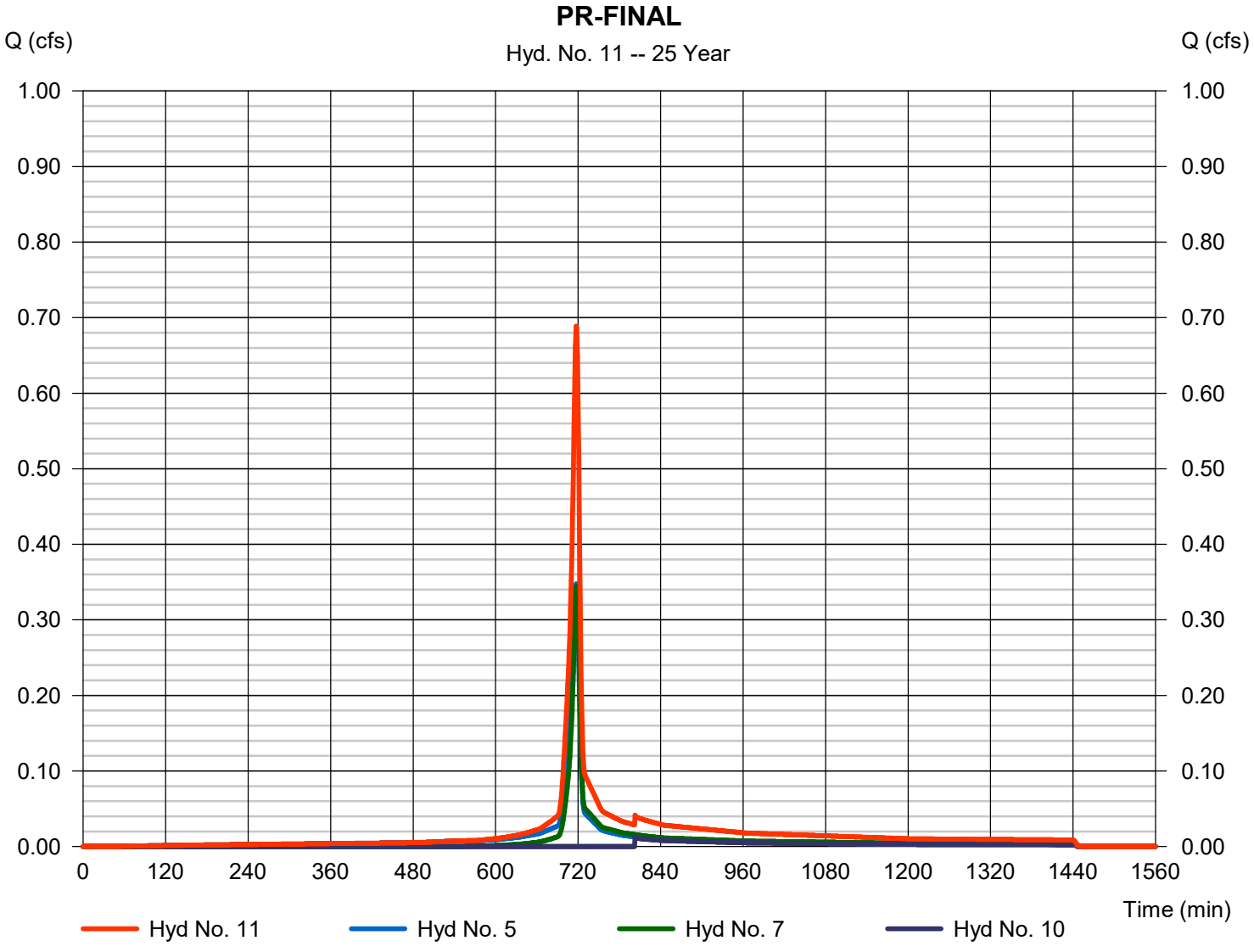


Hydrograph Report

Hyd. No. 11

PR-FINAL

Hydrograph type	=	Combine	Peak discharge	=	0.689 cfs
Storm frequency	=	25 yrs	Time to peak	=	717 min
Time interval	=	1 min	Hyd. volume	=	1,697 cuft
Inflow hyds.	=	5, 7, 10	Contrib. drain. area	=	0.114 ac



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

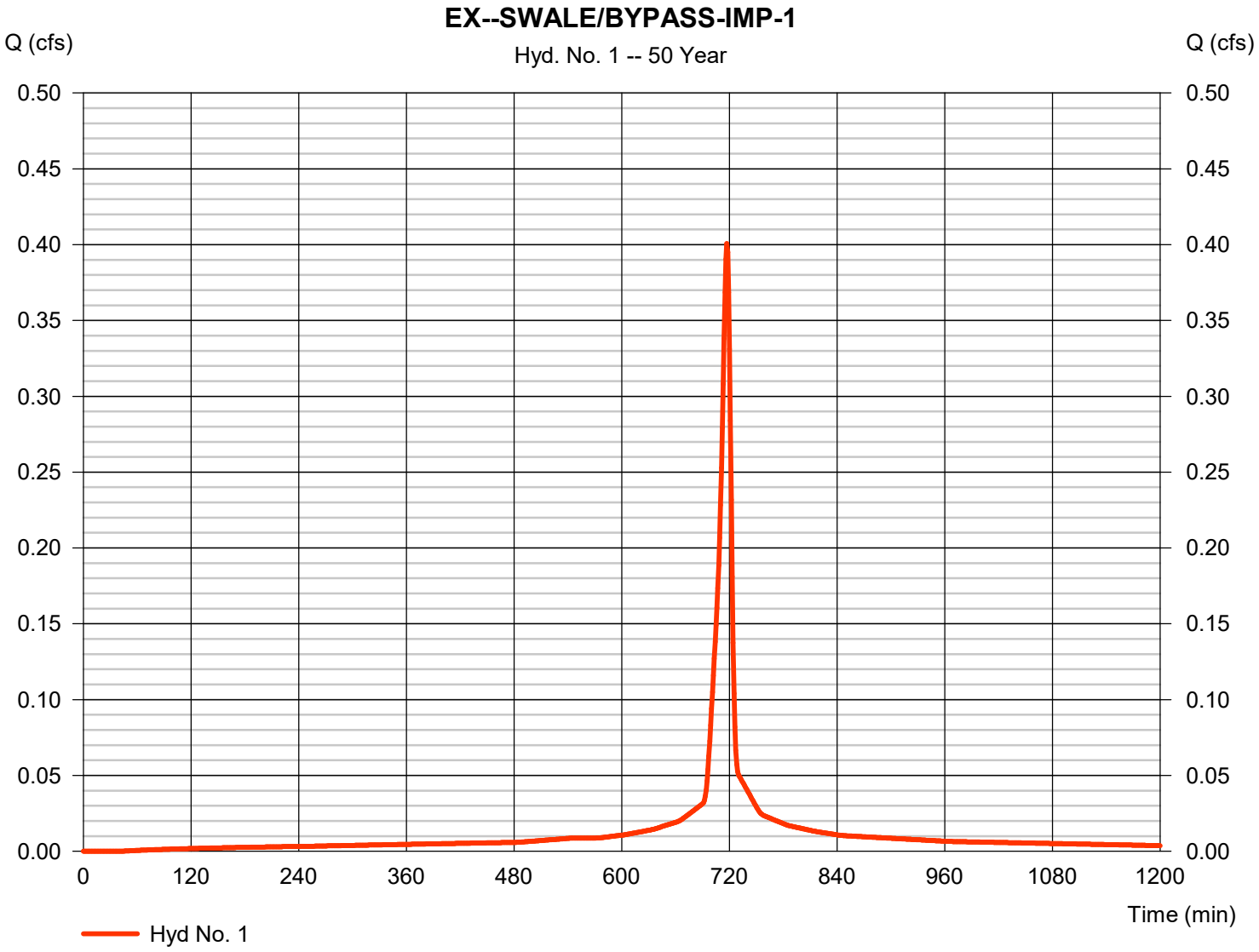
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	0.401	1	717	975	------	------	------	EX--SWALE/BYPASS-IMP-1
2	SCS Runoff	0.434	1	718	878	------	------	------	EX-SWALE/BYPASS-MEAD-2,3,7,9
3	SCS Runoff	0.202	1	718	428	------	------	------	EX-TRENCH-4,5,6,8
4	Combine	1.031	1	718	2,281	1, 2, 3	------	------	EX-TOTAL
5	SCS Runoff	0.401	1	717	975	------	------	------	PR-SWALE/BYPASS-IMP-1
6	SCS Runoff	0.125	1	717	278	------	------	------	PR-TRENCH-GRV-4,6
7	SCS Runoff	0.434	1	718	878	------	------	------	PR-SWALE/BYPASS-MEAD-2,3,7,9
8	SCS Runoff	0.222	1	717	541	------	------	------	PR-TRENCH-IMP-5,8
9	Combine	0.347	1	717	819	6, 8	------	------	PR-TRENCH
10	Reservoir	0.043	1	733	279	9	434.00	541	INF TRENCH
11	Combine	0.832	1	717	2,132	5, 7, 10	------	------	PR-FINAL

Hydrograph Report

Hyd. No. 1

EX--SWALE/BYPASS-IMP-1

Hydrograph type	= SCS Runoff	Peak discharge	= 0.401 cfs
Storm frequency	= 50 yrs	Time to peak	= 717 min
Time interval	= 1 min	Hyd. volume	= 975 cuft
Drainage area	= 0.042 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 6.44 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



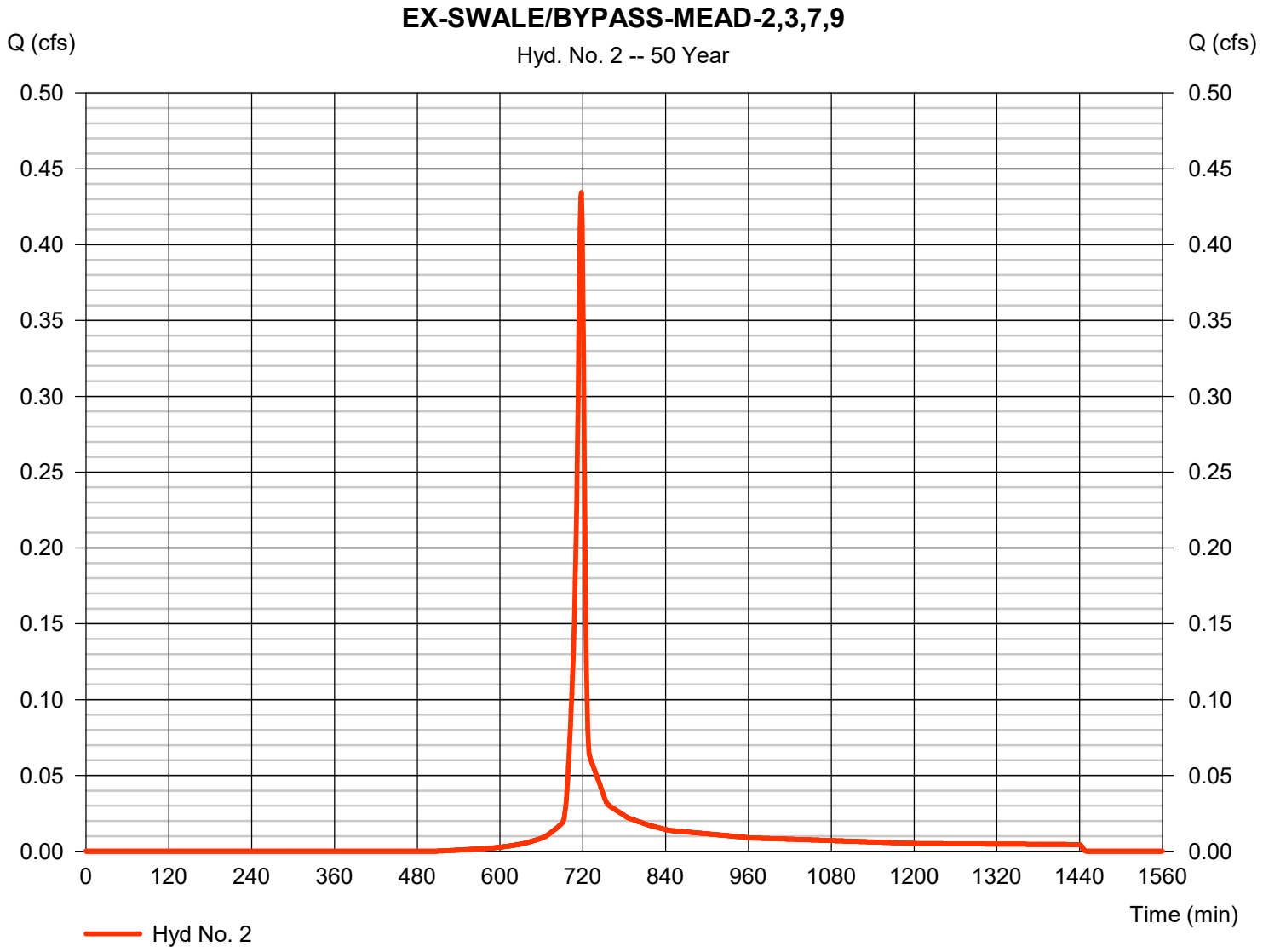
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Wednesday, 08 / 14 / 2019

Hyd. No. 2

EX-SWALE/BYPASS-MEAD-2,3,7,9

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.434 cfs
Storm frequency	=	50 yrs	Time to peak	=	718 min
Time interval	=	1 min	Hyd. volume	=	878 cuft
Drainage area	=	0.072 ac	Curve number	=	71
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	6.44 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

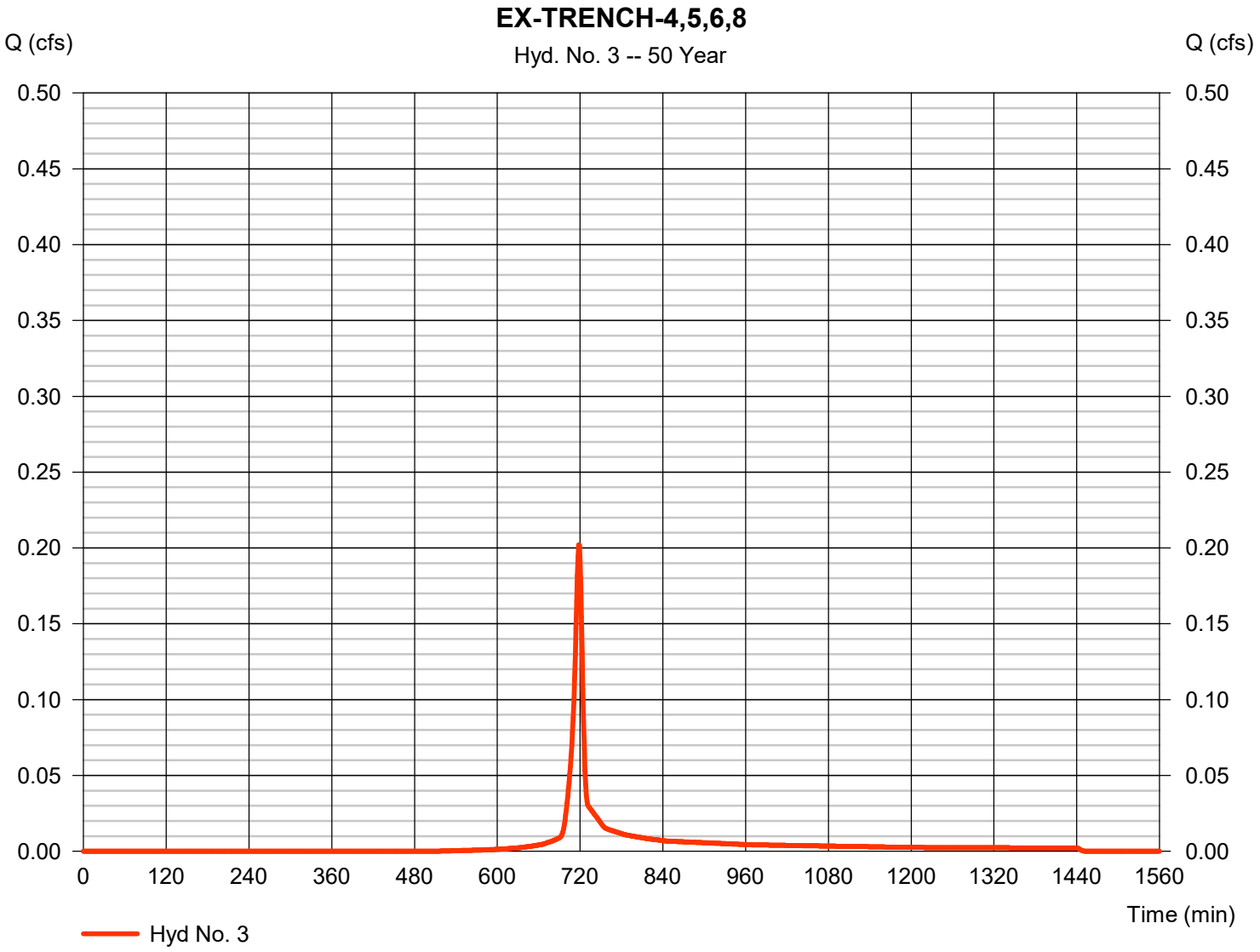


Hydrograph Report

Hyd. No. 3

EX-TRENCH-4,5,6,8

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.202 cfs
Storm frequency	=	50 yrs	Time to peak	=	718 min
Time interval	=	1 min	Hyd. volume	=	428 cuft
Drainage area	=	0.037 ac	Curve number	=	71
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	7.95 min
Total precip.	=	6.44 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

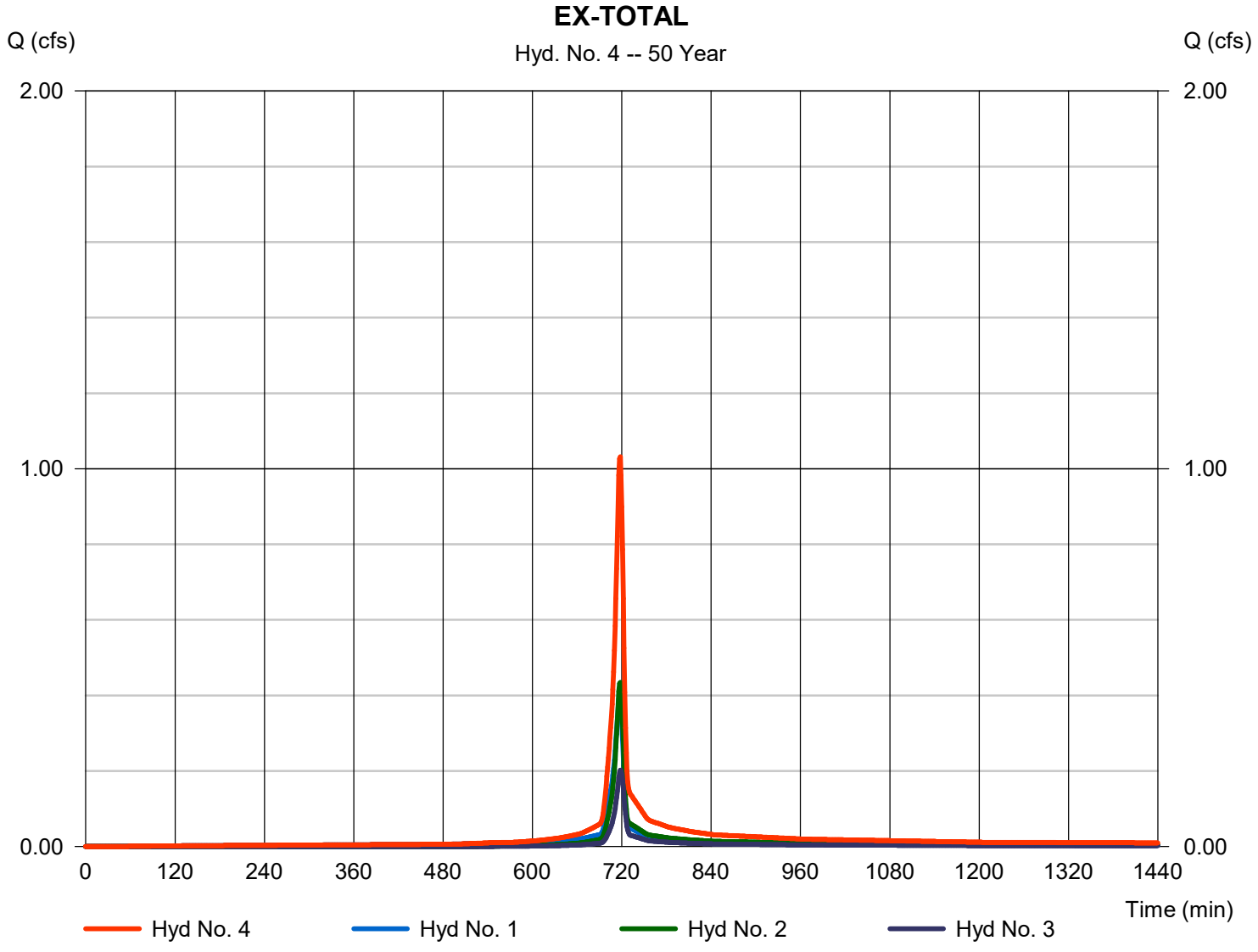


Hydrograph Report

Hyd. No. 4

EX-TOTAL

Hydrograph type	=	Combine	Peak discharge	=	1.031 cfs
Storm frequency	=	50 yrs	Time to peak	=	718 min
Time interval	=	1 min	Hyd. volume	=	2,281 cuft
Inflow hyds.	=	1, 2, 3	Contrib. drain. area	=	0.151 ac

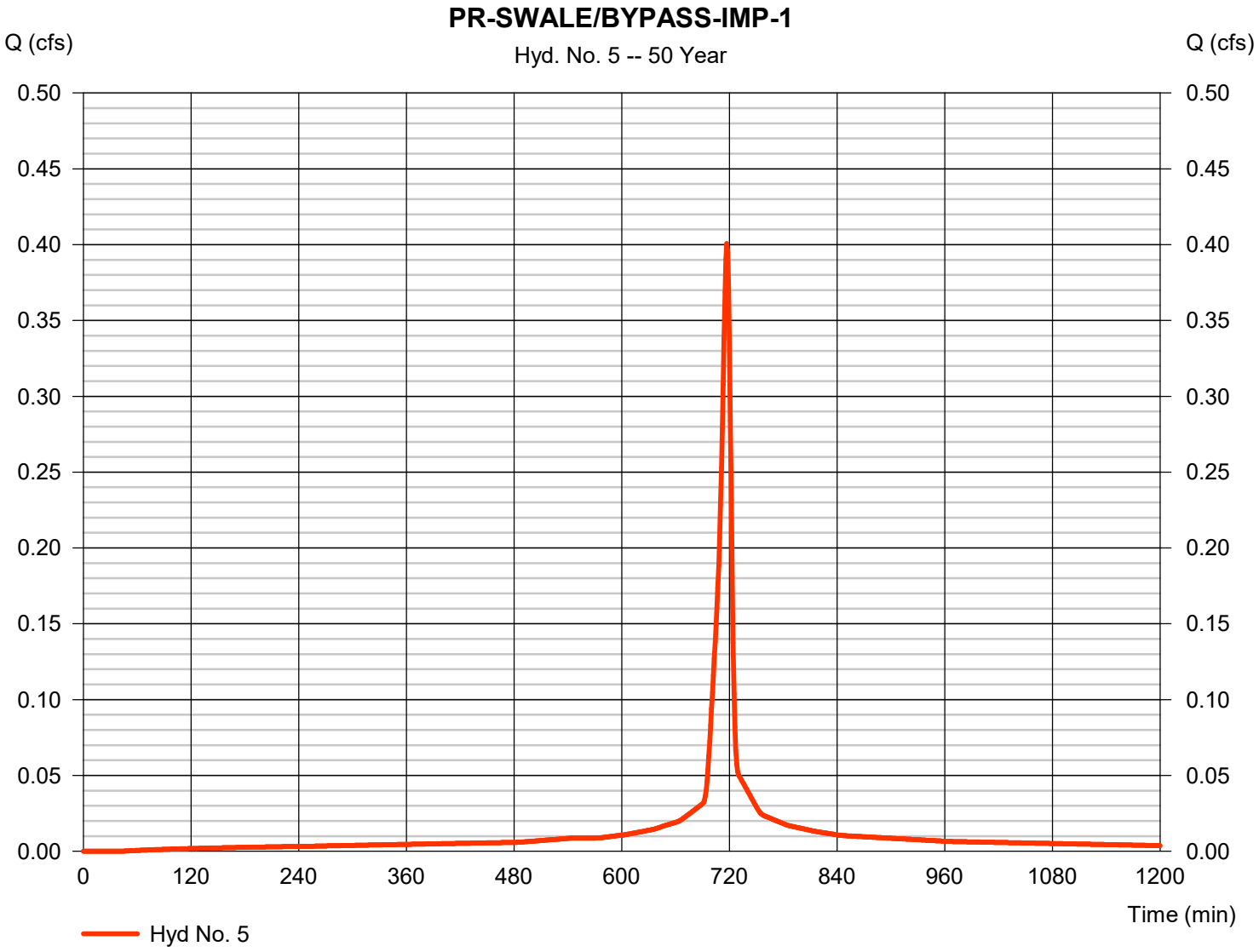


Hydrograph Report

Hyd. No. 5

PR-SWALE/BYPASS-IMP-1

Hydrograph type	= SCS Runoff	Peak discharge	= 0.401 cfs
Storm frequency	= 50 yrs	Time to peak	= 717 min
Time interval	= 1 min	Hyd. volume	= 975 cuft
Drainage area	= 0.042 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 6.44 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

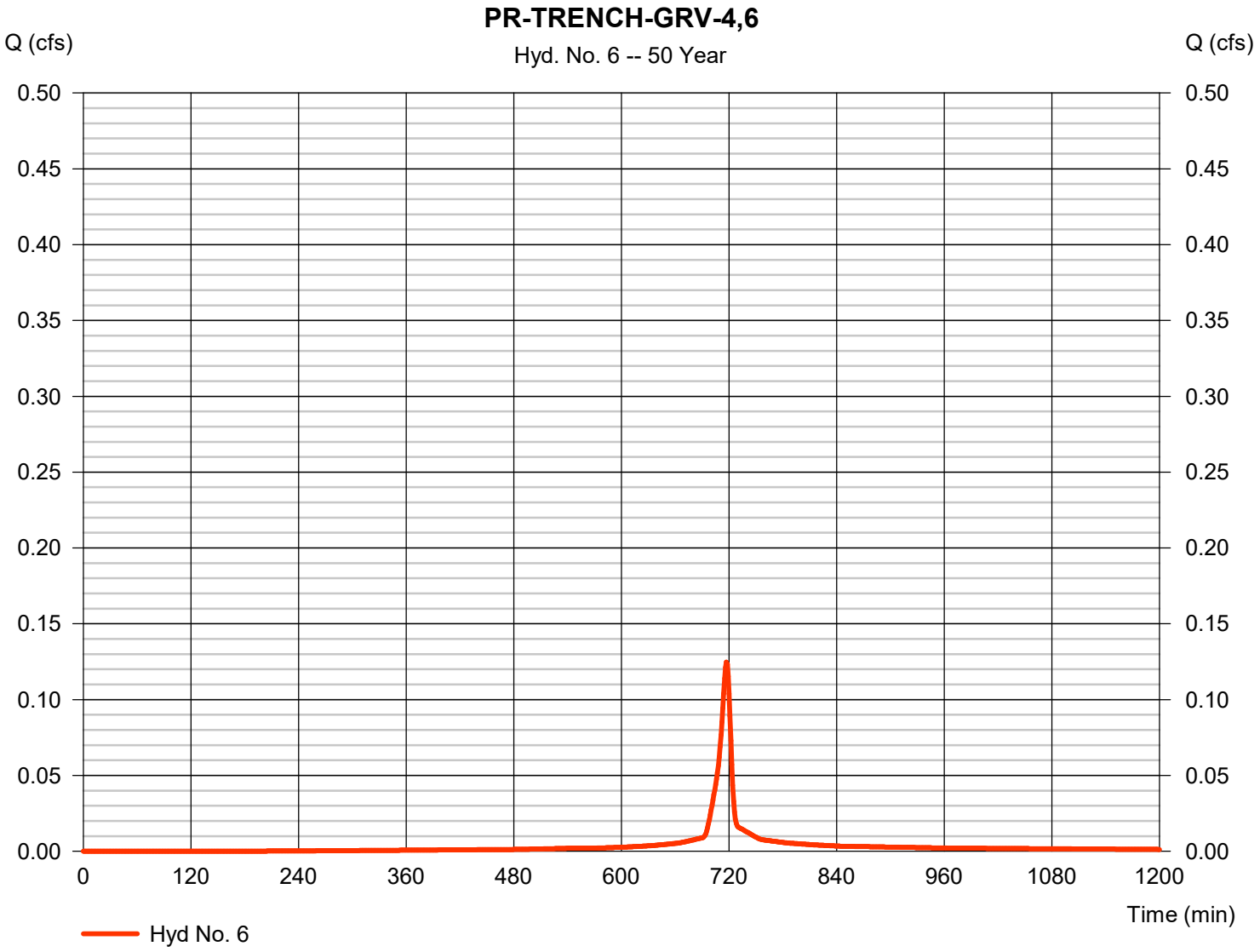


Hydrograph Report

Hyd. No. 6

PR-TRENCH-GRV-4,6

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.125 cfs
Storm frequency	=	50 yrs	Time to peak	=	717 min
Time interval	=	1 min	Hyd. volume	=	278 cuft
Drainage area	=	0.014 ac	Curve number	=	91
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	6.44 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

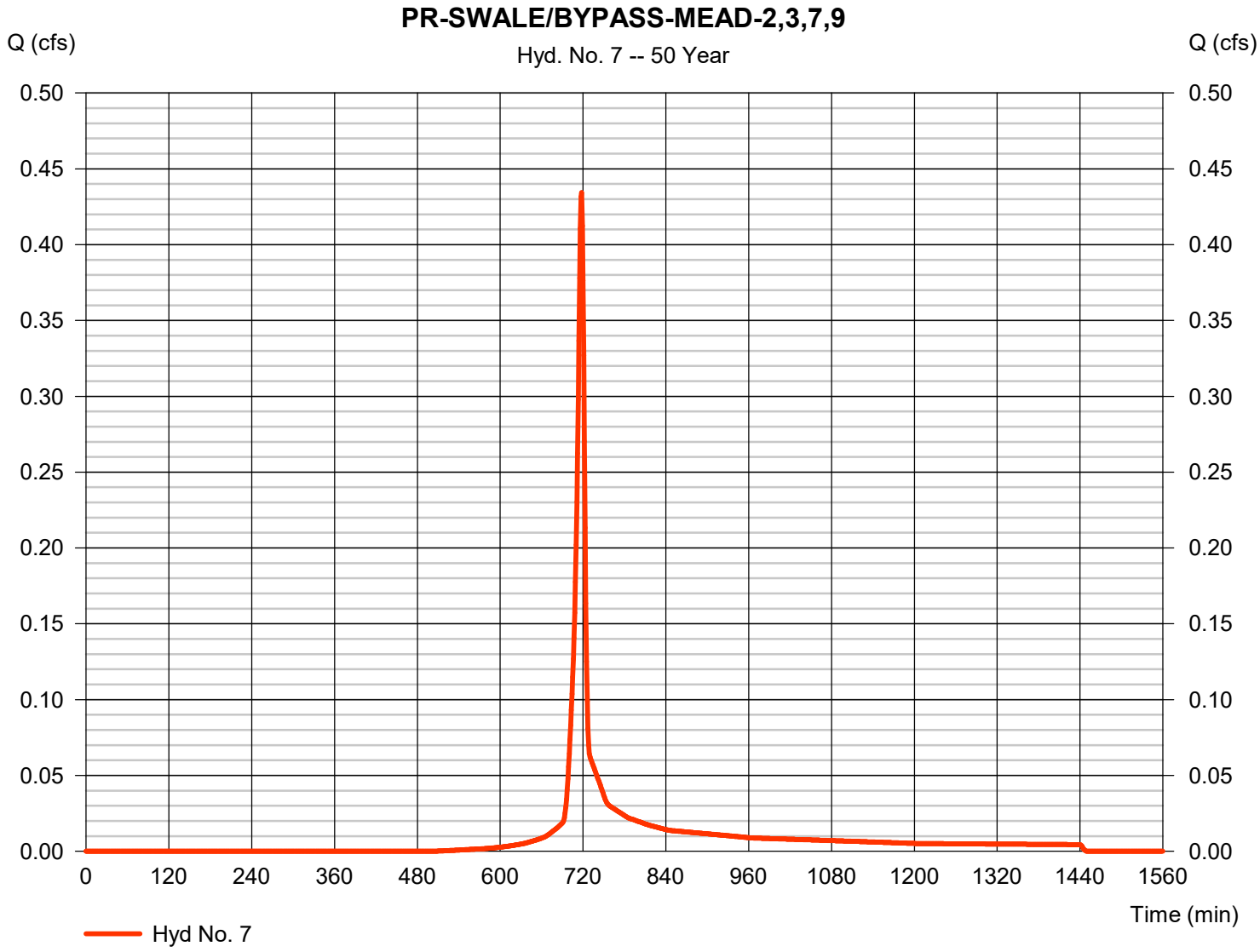


Hydrograph Report

Hyd. No. 7

PR-SWALE/BYPASS-MEAD-2,3,7,9

Hydrograph type	= SCS Runoff	Peak discharge	= 0.434 cfs
Storm frequency	= 50 yrs	Time to peak	= 718 min
Time interval	= 1 min	Hyd. volume	= 878 cuft
Drainage area	= 0.072 ac	Curve number	= 71
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 6.44 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

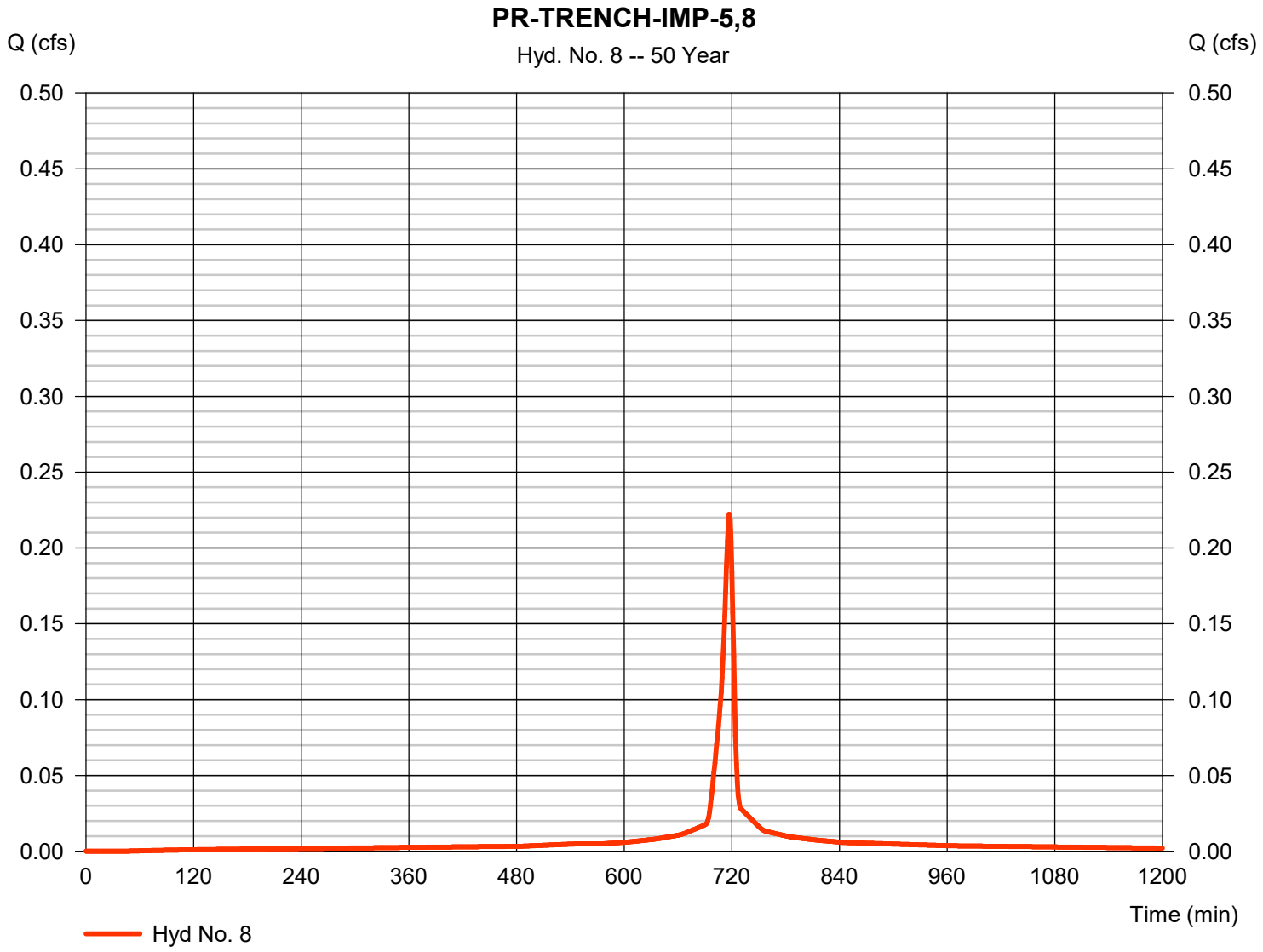


Hydrograph Report

Hyd. No. 8

PR-TRENCH-IMP-5,8

Hydrograph type	= SCS Runoff	Peak discharge	= 0.222 cfs
Storm frequency	= 50 yrs	Time to peak	= 717 min
Time interval	= 1 min	Hyd. volume	= 541 cuft
Drainage area	= 0.023 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 6.44 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

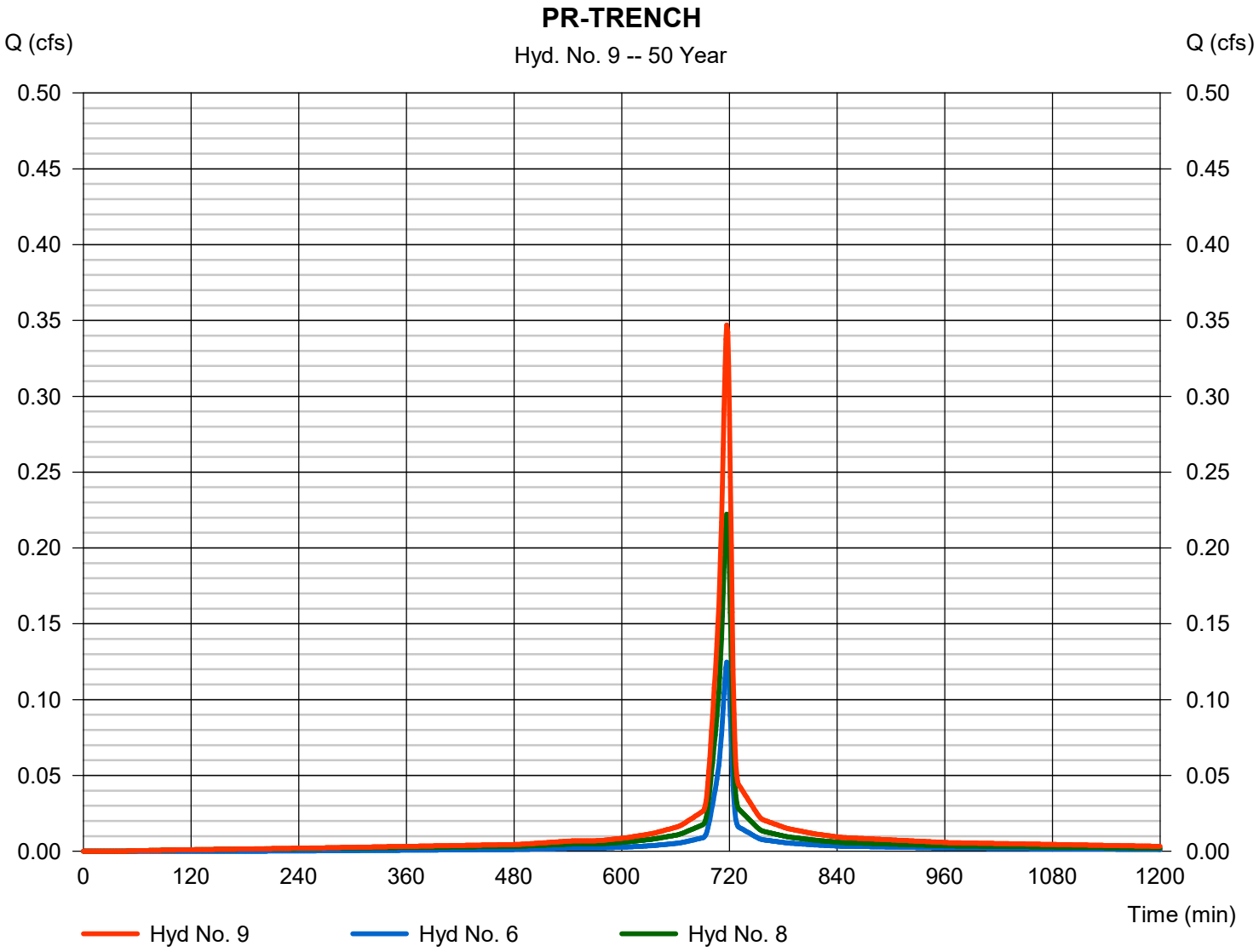


Hydrograph Report

Hyd. No. 9

PR-TRENCH

Hydrograph type	=	Combine	Peak discharge	=	0.347 cfs
Storm frequency	=	50 yrs	Time to peak	=	717 min
Time interval	=	1 min	Hyd. volume	=	819 cuft
Inflow hyds.	=	6, 8	Contrib. drain. area	=	0.037 ac



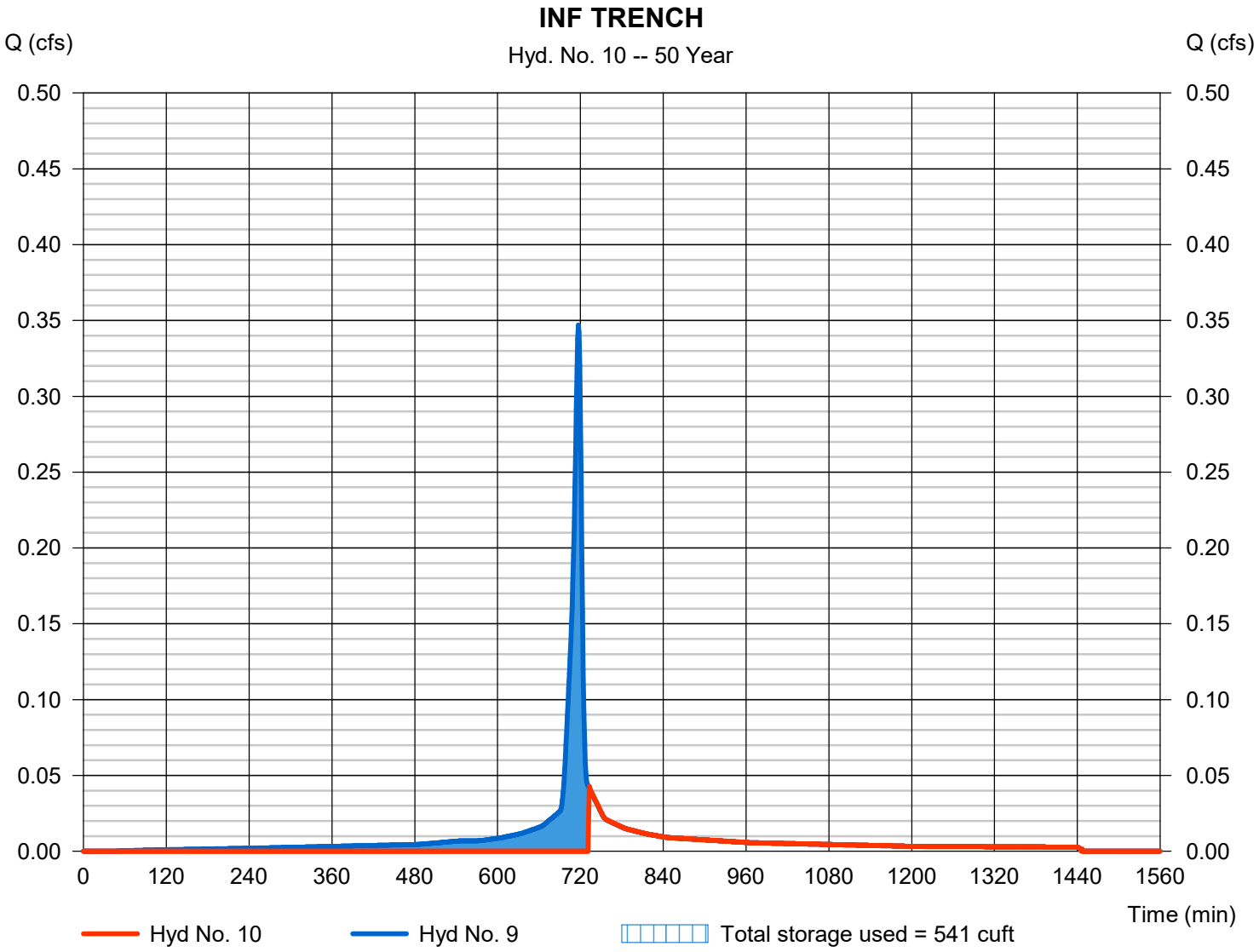
Hydrograph Report

Hyd. No. 10

INF TRENCH

Hydrograph type	=	Reservoir	Peak discharge	=	0.043 cfs
Storm frequency	=	50 yrs	Time to peak	=	733 min
Time interval	=	1 min	Hyd. volume	=	279 cuft
Inflow hyd. No.	=	9 - PR-TRENCH	Max. Elevation	=	434.00 ft
Reservoir name	=	BASIN	Max. Storage	=	541 cuft

Storage Indication method used.

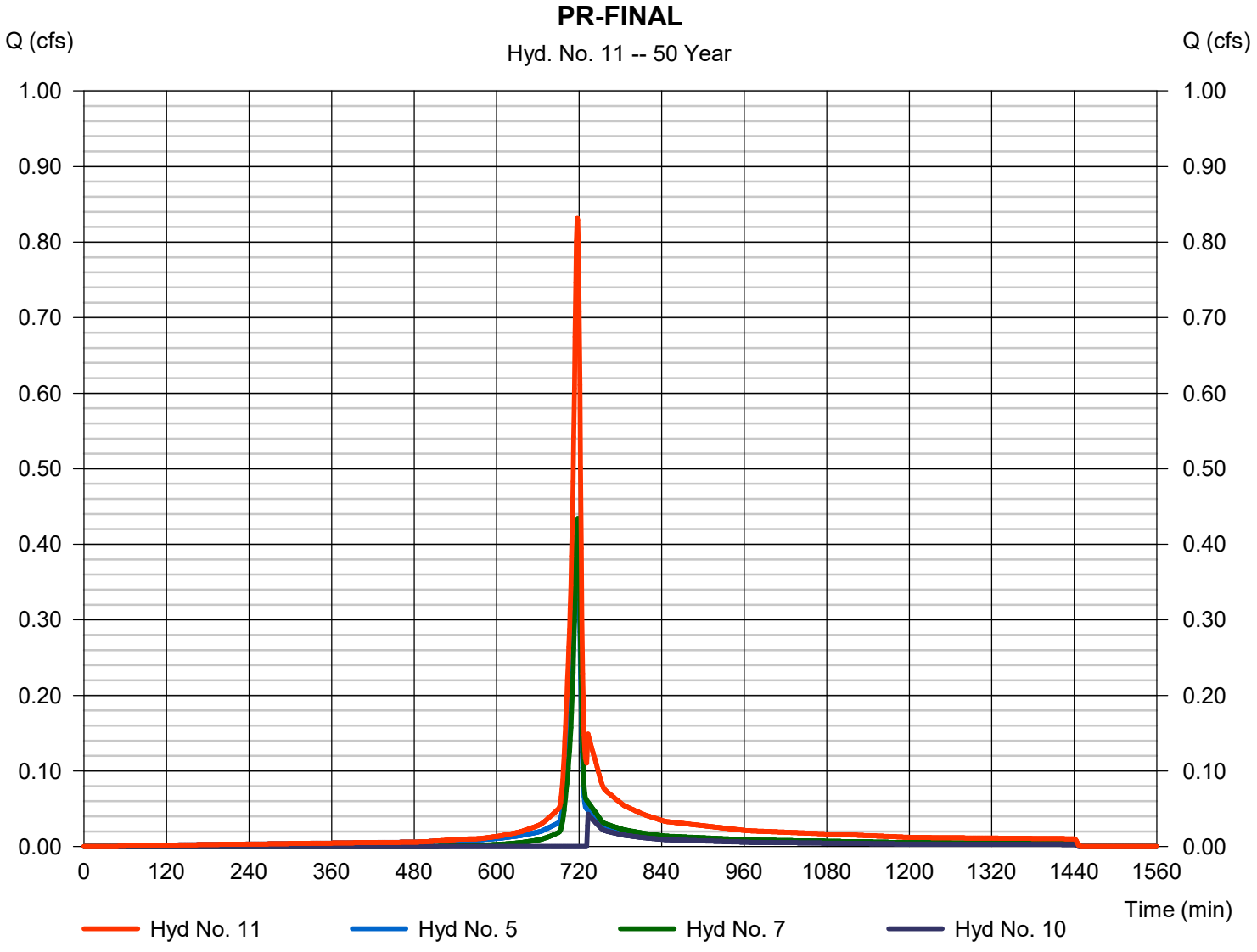


Hydrograph Report

Hyd. No. 11

PR-FINAL

Hydrograph type	=	Combine	Peak discharge	=	0.832 cfs
Storm frequency	=	50 yrs	Time to peak	=	717 min
Time interval	=	1 min	Hyd. volume	=	2,132 cuft
Inflow hyds.	=	5, 7, 10	Contrib. drain. area	=	0.114 ac



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

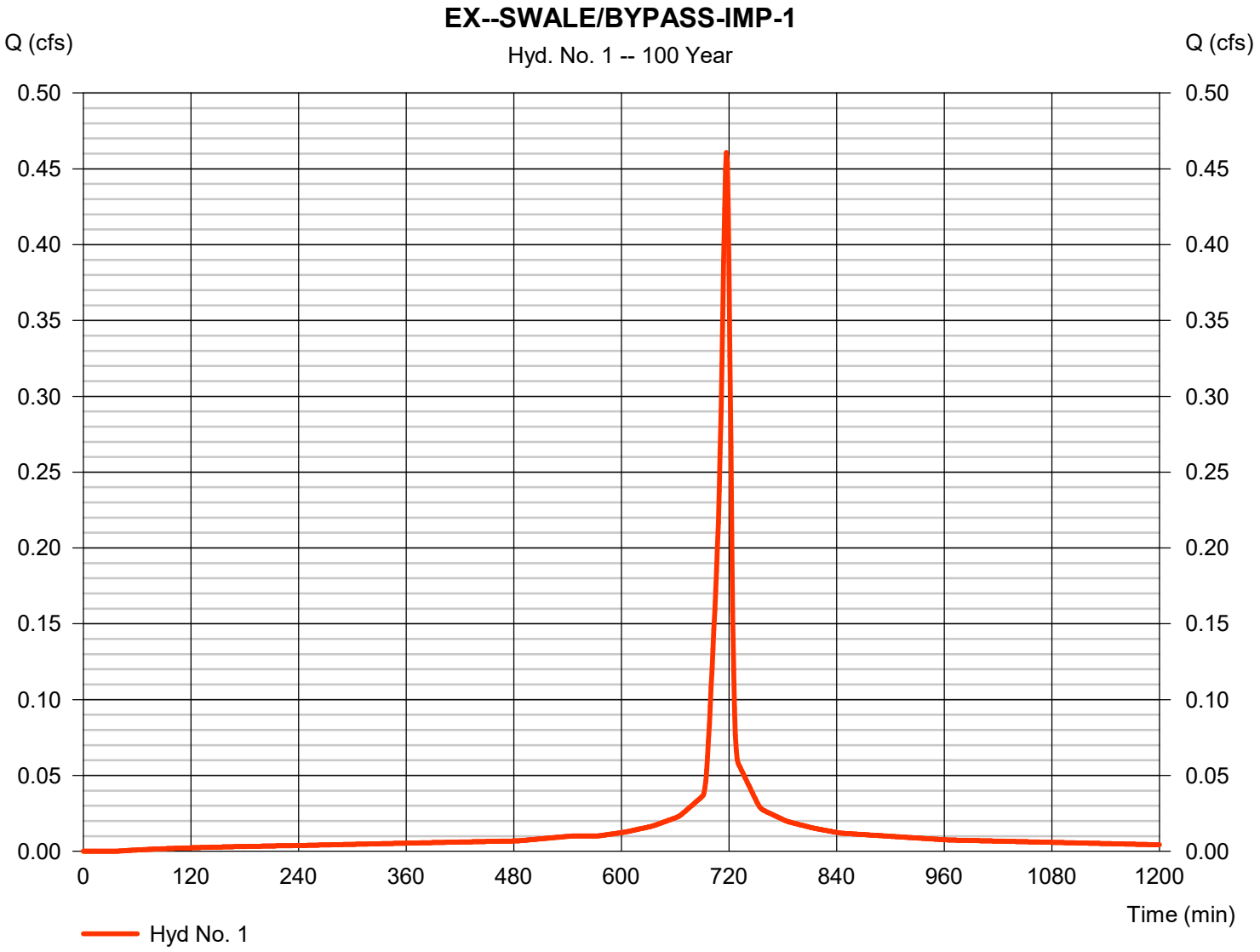
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	0.461	1	717	1,126	------	------	------	EX--SWALE/BYPASS-IMP-1
2	SCS Runoff	0.538	1	718	1,095	------	------	------	EX-SWALE/BYPASS-MEAD-2,3,7,9
3	SCS Runoff	0.251	1	718	533	------	------	------	EX-TRENCH-4,5,6,8
4	Combine	1.243	1	718	2,754	1, 2, 3	------	------	EX-TOTAL
5	SCS Runoff	0.461	1	717	1,126	------	------	------	PR-SWALE/BYPASS-IMP-1
6	SCS Runoff	0.145	1	717	327	------	------	------	PR-TRENCH-GRV-4,6
7	SCS Runoff	0.538	1	718	1,095	------	------	------	PR-SWALE/BYPASS-MEAD-2,3,7,9
8	SCS Runoff	0.256	1	717	625	------	------	------	PR-TRENCH-IMP-5,8
9	Combine	0.401	1	717	952	6, 8	------	------	PR-TRENCH
10	Reservoir	0.342	1	721	412	9	434.03	548	INF TRENCH
11	Combine	1.071	1	721	2,632	5, 7, 10	------	------	PR-FINAL

Hydrograph Report

Hyd. No. 1

EX--SWALE/BYPASS-IMP-1

Hydrograph type	= SCS Runoff	Peak discharge	= 0.461 cfs
Storm frequency	= 100 yrs	Time to peak	= 717 min
Time interval	= 1 min	Hyd. volume	= 1,126 cuft
Drainage area	= 0.042 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 7.40 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

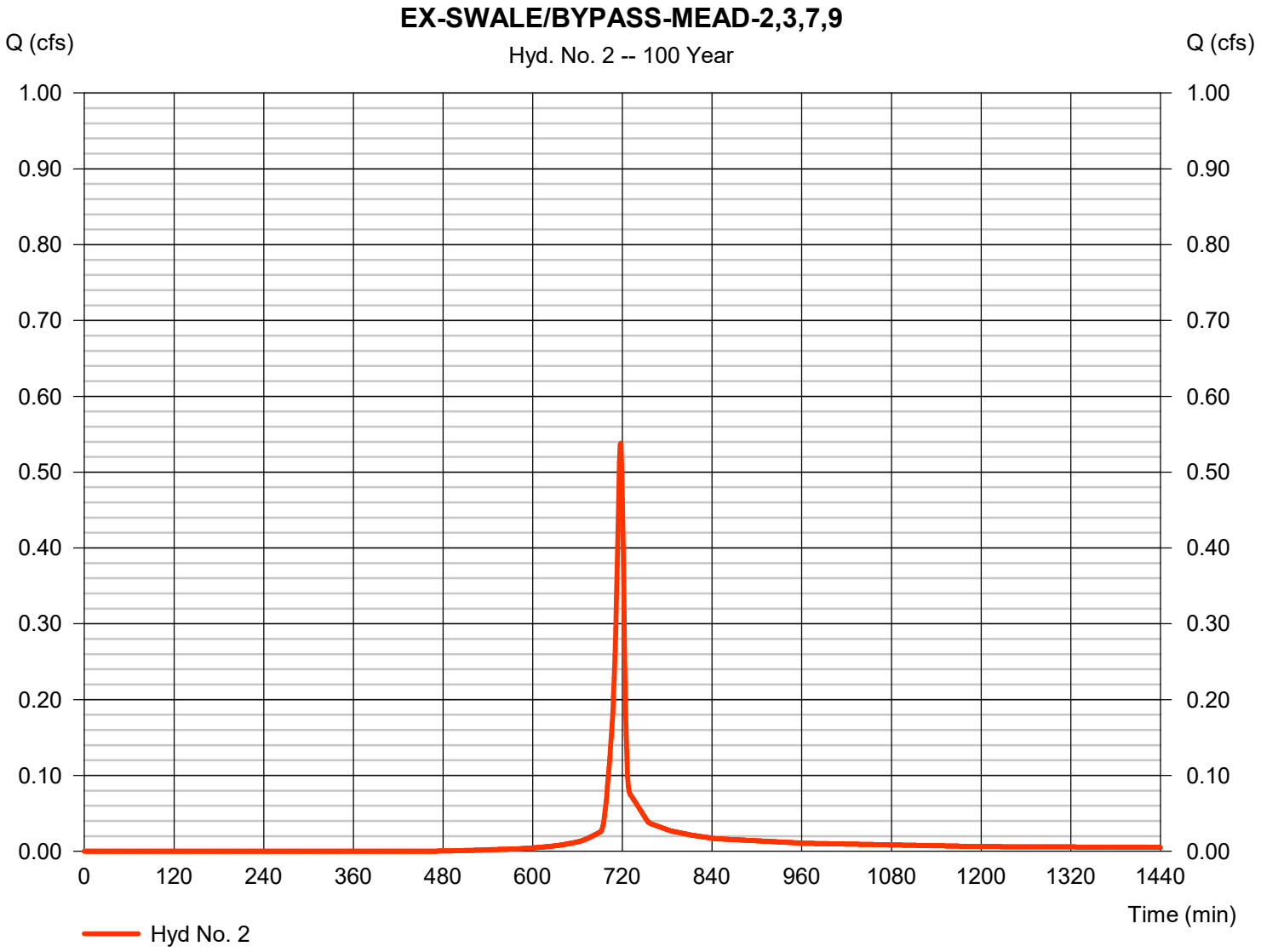


Hydrograph Report

Hyd. No. 2

EX-SWALE/BYPASS-MEAD-2,3,7,9

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.538 cfs
Storm frequency	=	100 yrs	Time to peak	=	718 min
Time interval	=	1 min	Hyd. volume	=	1,095 cuft
Drainage area	=	0.072 ac	Curve number	=	71
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	7.40 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

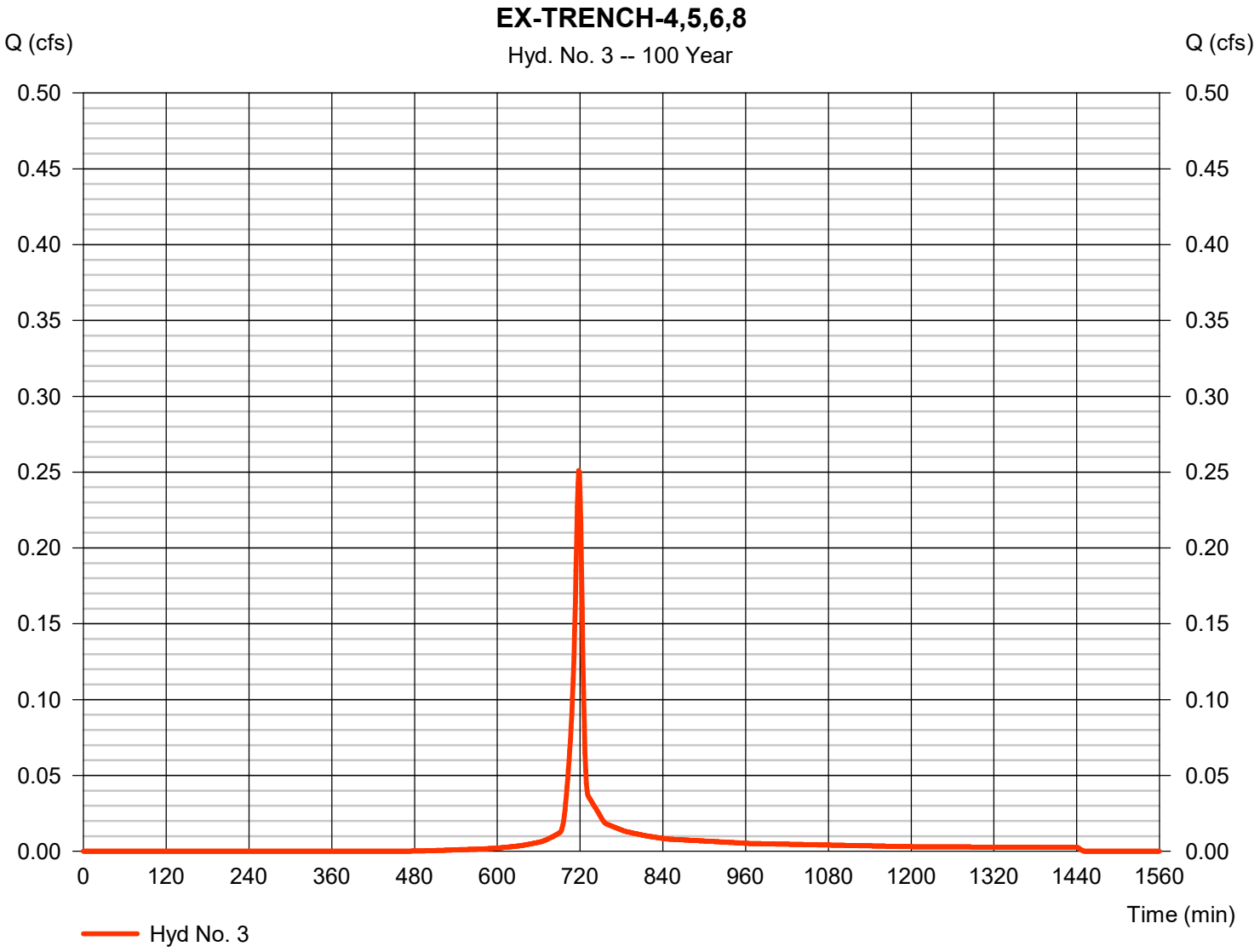


Hydrograph Report

Hyd. No. 3

EX-TRENCH-4,5,6,8

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.251 cfs
Storm frequency	=	100 yrs	Time to peak	=	718 min
Time interval	=	1 min	Hyd. volume	=	533 cuft
Drainage area	=	0.037 ac	Curve number	=	71
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	7.95 min
Total precip.	=	7.40 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

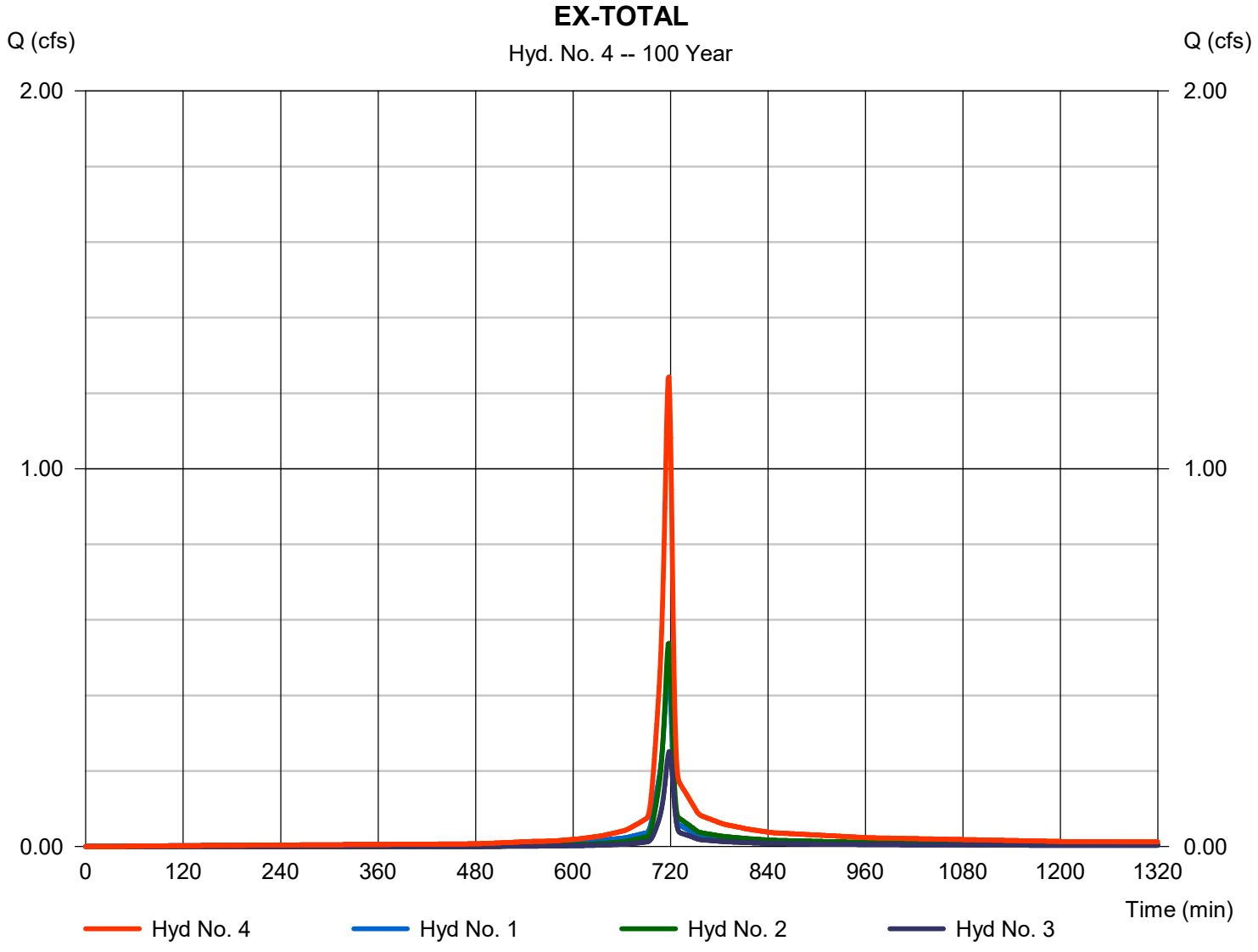


Hydrograph Report

Hyd. No. 4

EX-TOTAL

Hydrograph type	= Combine	Peak discharge	= 1.243 cfs
Storm frequency	= 100 yrs	Time to peak	= 718 min
Time interval	= 1 min	Hyd. volume	= 2,754 cuft
Inflow hyds.	= 1, 2, 3	Contrib. drain. area	= 0.151 ac

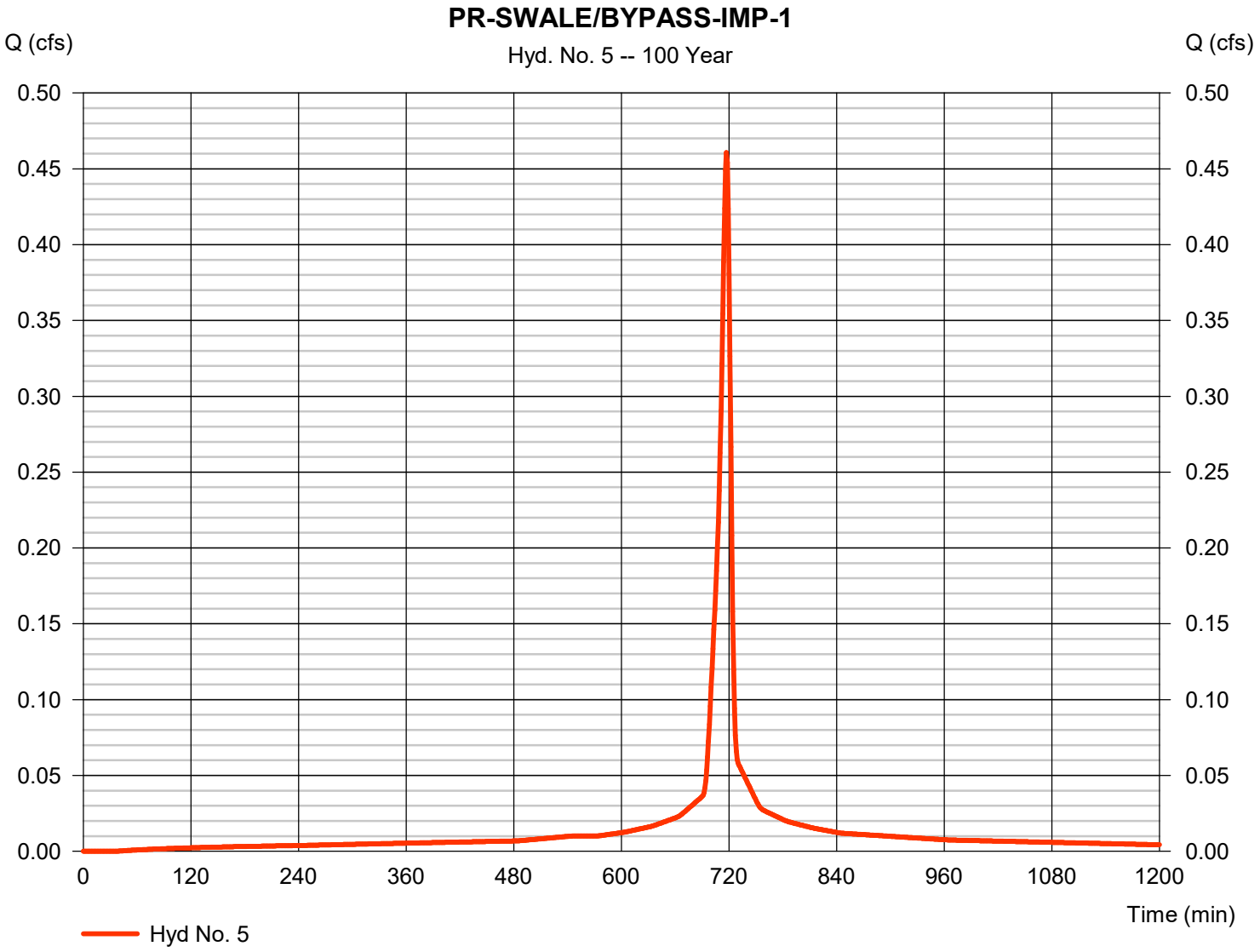


Hydrograph Report

Hyd. No. 5

PR-SWALE/BYPASS-IMP-1

Hydrograph type	= SCS Runoff	Peak discharge	= 0.461 cfs
Storm frequency	= 100 yrs	Time to peak	= 717 min
Time interval	= 1 min	Hyd. volume	= 1,126 cuft
Drainage area	= 0.042 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 7.40 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

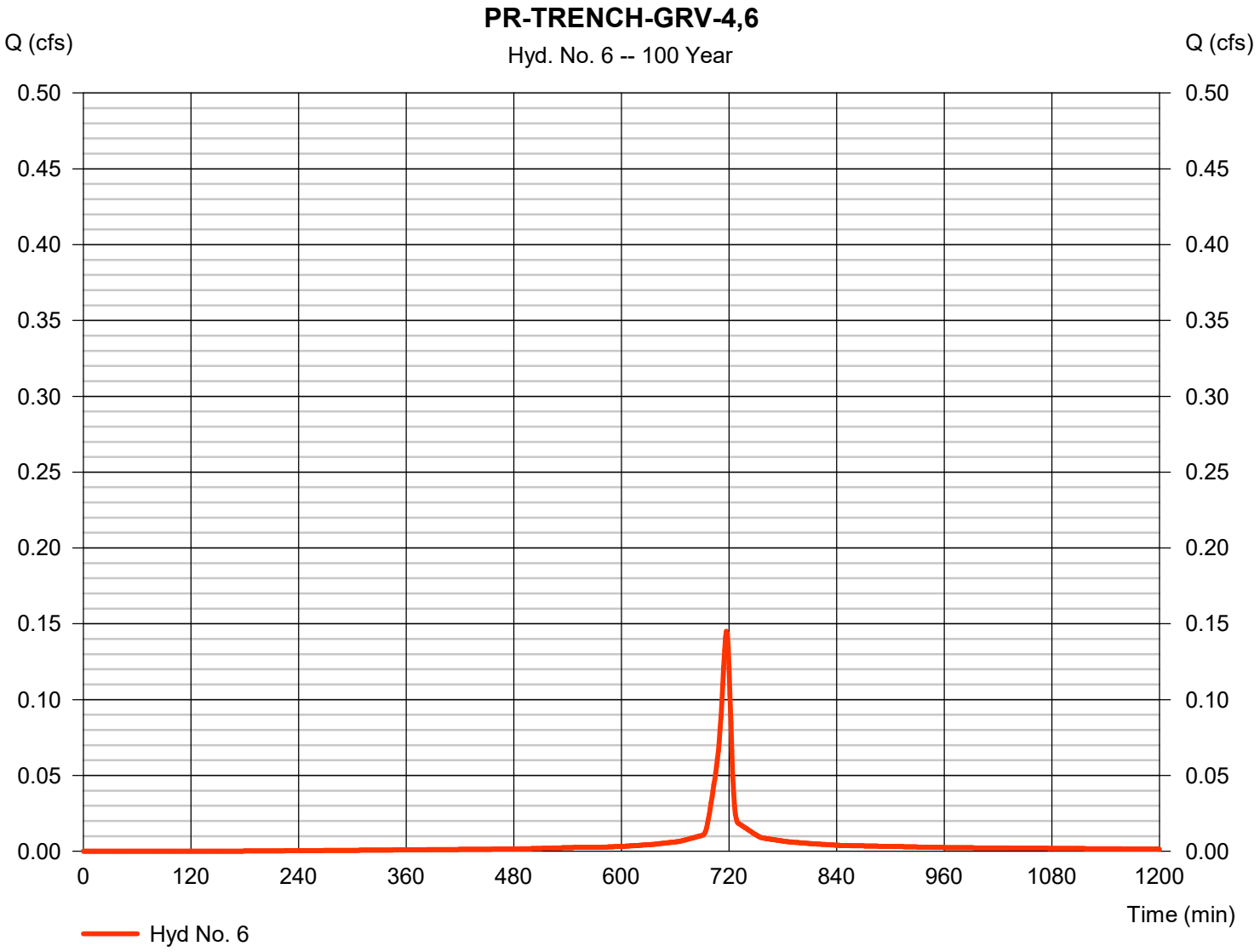


Hydrograph Report

Hyd. No. 6

PR-TRENCH-GRV-4,6

Hydrograph type	= SCS Runoff	Peak discharge	= 0.145 cfs
Storm frequency	= 100 yrs	Time to peak	= 717 min
Time interval	= 1 min	Hyd. volume	= 327 cuft
Drainage area	= 0.014 ac	Curve number	= 91
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 7.40 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

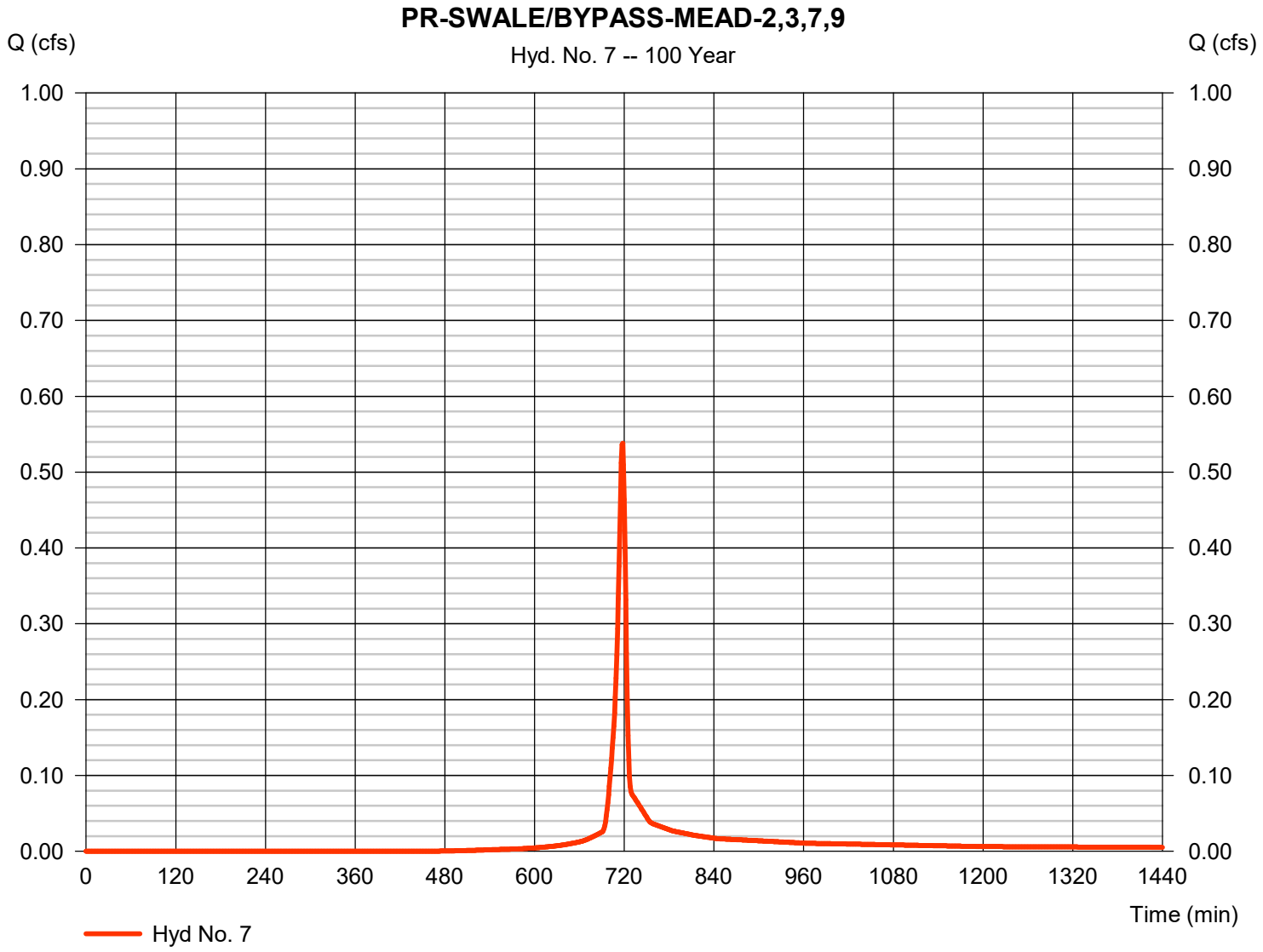


Hydrograph Report

Hyd. No. 7

PR-SWALE/BYPASS-MEAD-2,3,7,9

Hydrograph type	= SCS Runoff	Peak discharge	= 0.538 cfs
Storm frequency	= 100 yrs	Time to peak	= 718 min
Time interval	= 1 min	Hyd. volume	= 1,095 cuft
Drainage area	= 0.072 ac	Curve number	= 71
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 7.40 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

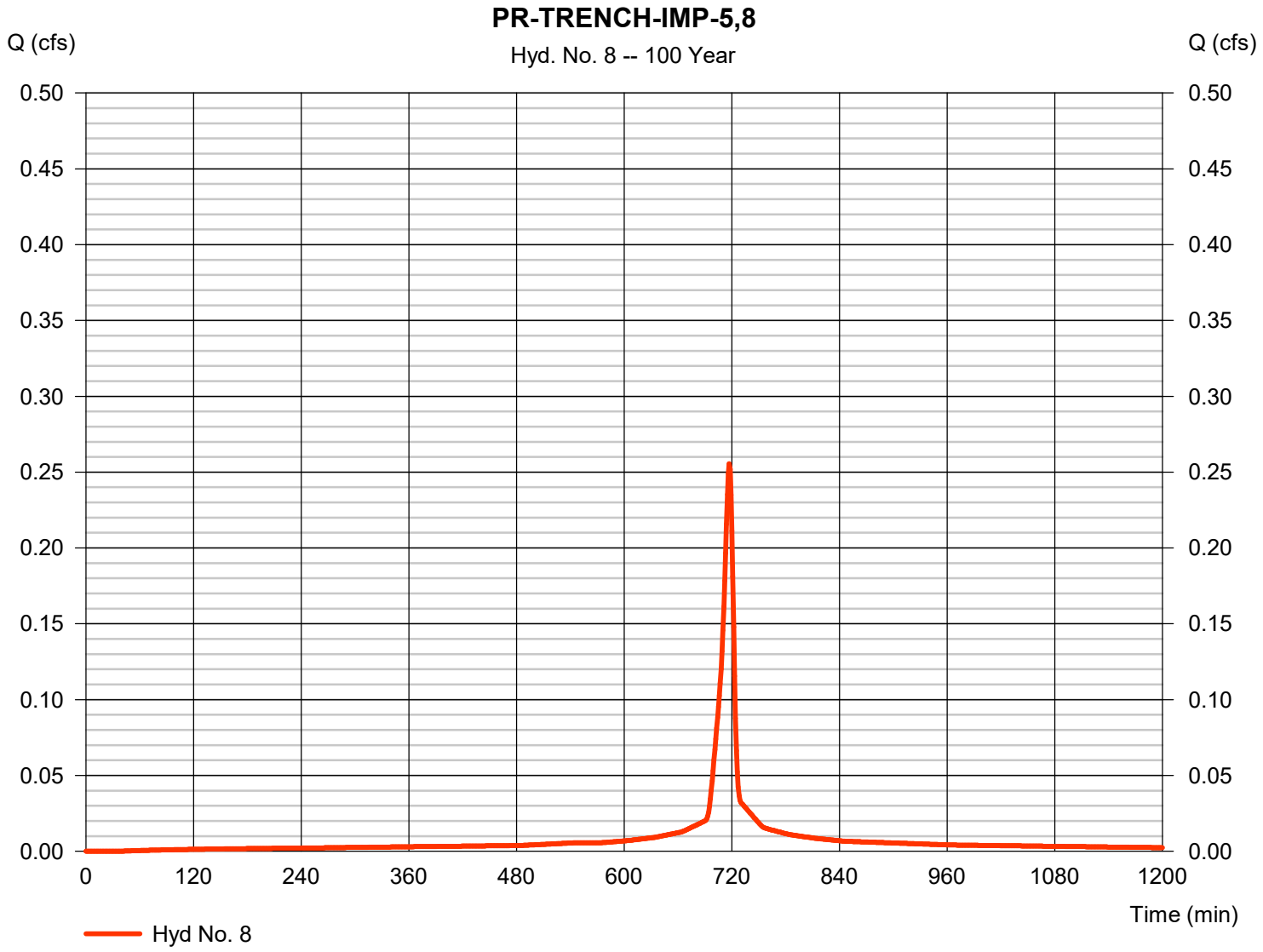


Hydrograph Report

Hyd. No. 8

PR-TRENCH-IMP-5,8

Hydrograph type	= SCS Runoff	Peak discharge	= 0.256 cfs
Storm frequency	= 100 yrs	Time to peak	= 717 min
Time interval	= 1 min	Hyd. volume	= 625 cuft
Drainage area	= 0.023 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 7.40 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

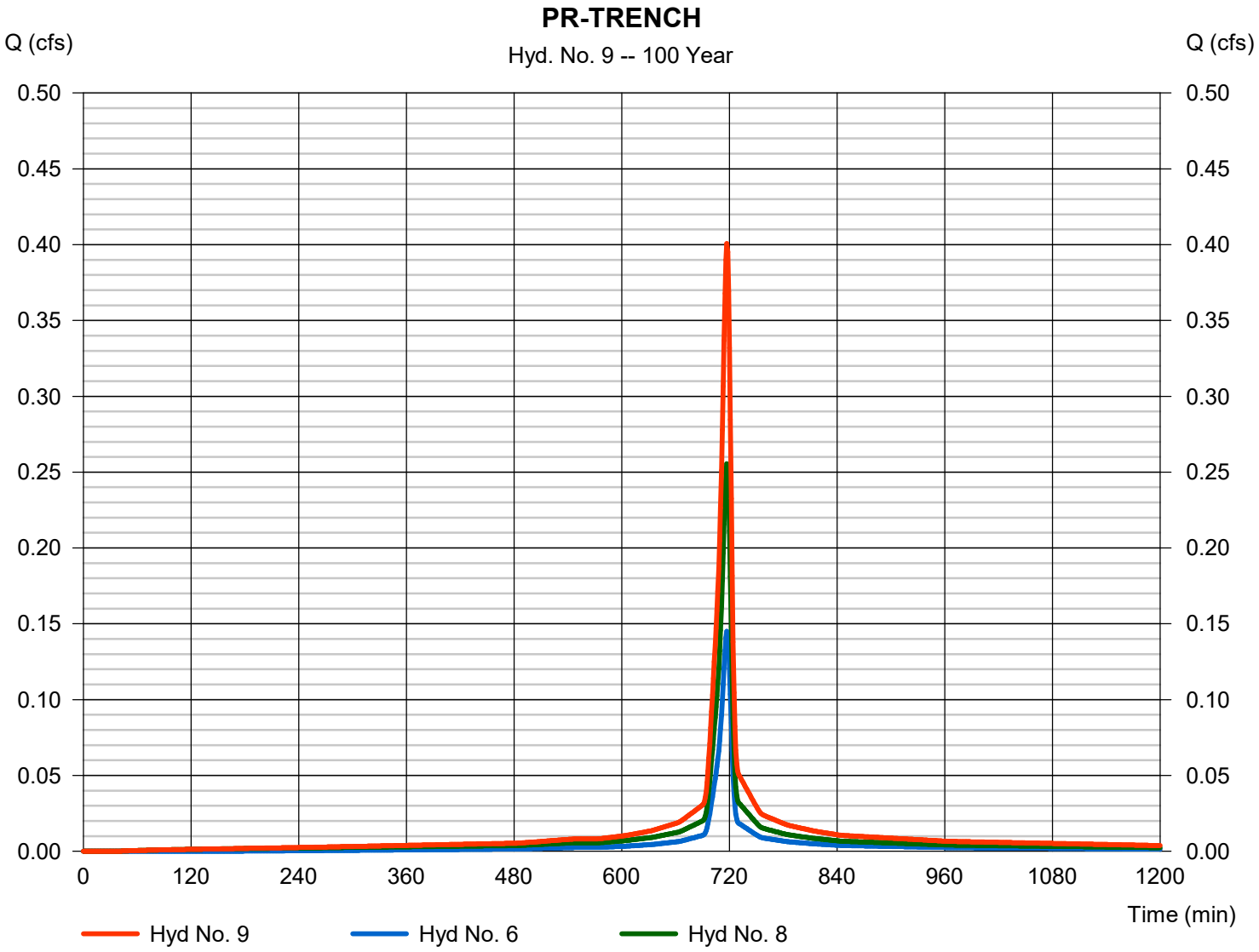


Hydrograph Report

Hyd. No. 9

PR-TRENCH

Hydrograph type	=	Combine	Peak discharge	=	0.401 cfs
Storm frequency	=	100 yrs	Time to peak	=	717 min
Time interval	=	1 min	Hyd. volume	=	952 cuft
Inflow hyds.	=	6, 8	Contrib. drain. area	=	0.037 ac



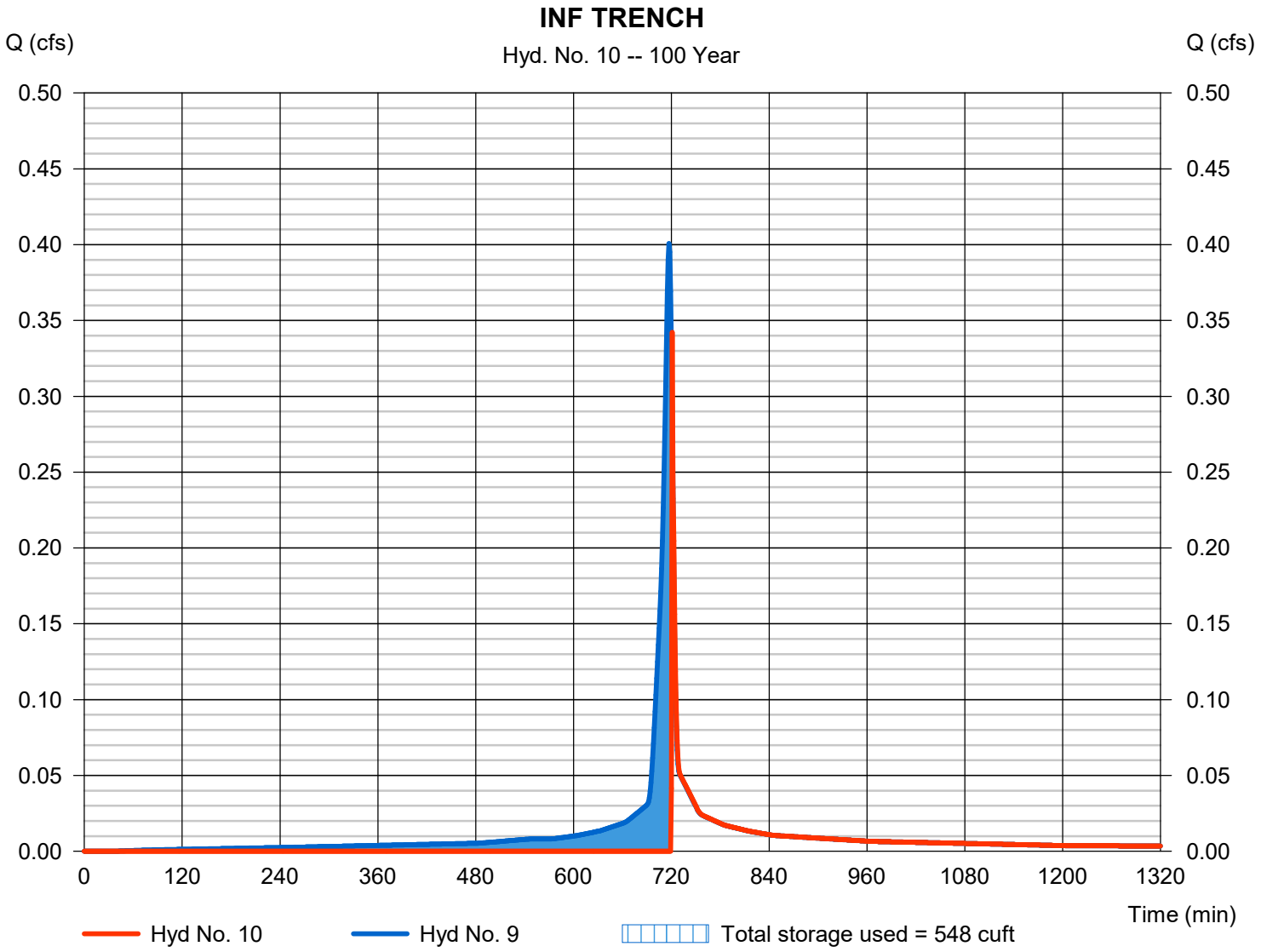
Hydrograph Report

Hyd. No. 10

INF TRENCH

Hydrograph type	=	Reservoir	Peak discharge	=	0.342 cfs
Storm frequency	=	100 yrs	Time to peak	=	721 min
Time interval	=	1 min	Hyd. volume	=	412 cuft
Inflow hyd. No.	=	9 - PR-TRENCH	Max. Elevation	=	434.03 ft
Reservoir name	=	BASIN	Max. Storage	=	548 cuft

Storage Indication method used.

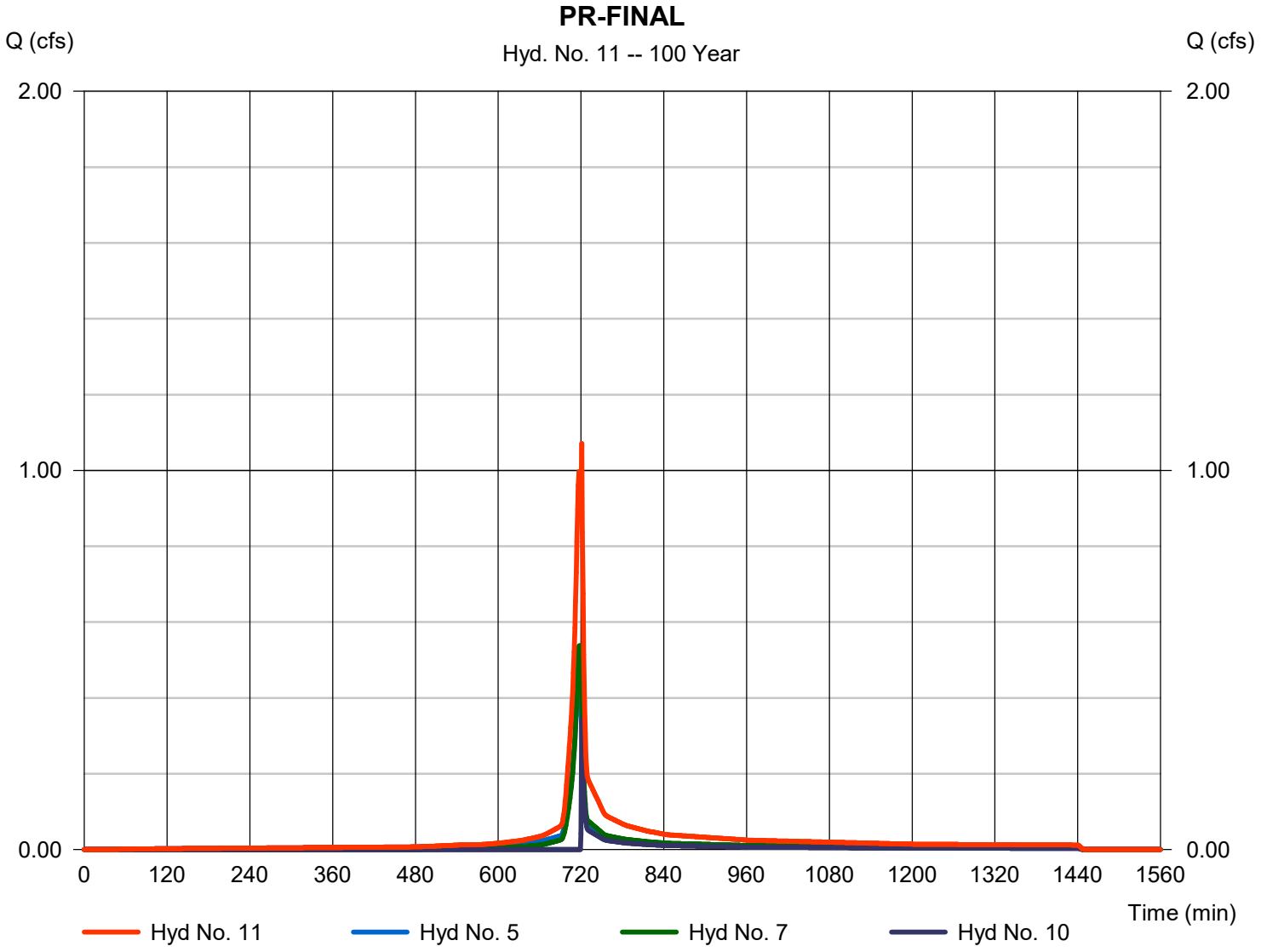


Hydrograph Report

Hyd. No. 11

PR-FINAL

Hydrograph type	= Combine	Peak discharge	= 1.071 cfs
Storm frequency	= 100 yrs	Time to peak	= 721 min
Time interval	= 1 min	Hyd. volume	= 2,632 cuft
Inflow hyds.	= 5, 7, 10	Contrib. drain. area	= 0.114 ac



Hydraflow Rainfall Report

Return Period (Yrs)	Intensity-Duration-Frequency Equation Coefficients (FHA)			
	B	D	E	(N/A)
1	36.9738	16.1000	0.7641	--------
2	94.4784	24.8001	0.9391	--------
3	0.0000	0.0000	0.0000	--------
5	176.2795	30.1001	1.0248	--------
10	317.8354	35.8000	1.1154	--------
25	309.7854	36.4000	1.0685	--------
50	1324.7950	53.7998	1.3207	--------
100	68.0213	20.7000	0.7186	--------

File name: Irvington.IDF

Intensity = B / (Tc + D)^E

Return Period (Yrs)	Intensity Values (in/hr)											
	5 min	10	15	20	25	30	35	40	45	50	55	60
1	3.60	3.06	2.67	2.39	2.16	1.98	1.83	1.70	1.60	1.50	1.42	1.35
2	3.90	3.37	2.97	2.66	2.41	2.20	2.03	1.88	1.75	1.64	1.55	1.46
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	4.60	4.01	3.56	3.19	2.90	2.65	2.44	2.26	2.11	1.97	1.86	1.75
10	5.08	4.46	3.98	3.58	3.25	2.98	2.75	2.54	2.37	2.22	2.08	1.96
25	5.80	5.13	4.60	4.17	3.81	3.50	3.24	3.01	2.82	2.64	2.49	2.35
50	6.10	5.48	4.96	4.52	4.14	3.82	3.54	3.29	3.07	2.88	2.71	2.55
100	6.60	5.81	5.21	4.74	4.36	4.05	3.79	3.56	3.36	3.19	3.04	2.90

Tc = time in minutes. Values may exceed 60.

Precip. file name: P:\353754 PennEast\Stormwater\Site 10 - Transco\SW Model\Site10.pcp

Storm Distribution	Rainfall Precipitation Table (in)							
	1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr
SCS 24-hour	2.63	3.16	0.00	3.94	4.60	5.59	6.44	7.40
SCS 6-Hr	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-1st	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-2nd	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-3rd	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-4th	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-Indy	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Custom	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Hydraflow Table of Contents

I. PCSM Drawings (Attached)

J. Offsite Stormwater Discharge Plan (Attached)