PRELIMINARY GRADING AND DRAINAGE ENGINEERING DESIGN REPORT

PREPARED IN ACCORDANCE WITH MDEQ'S CIRCULAR DEQ-8 AND
CITY OF MISSOULA SUBDIVISION REGULATIONS

for

Sapphire Place Subdivision

Located at:
3285 Flynn Lane
Parcel 2A of COS 6689
Section 7, T13N, R19W
City of Missoula, Montana

March 2023

Prepared For:
Cathcart Group
200 Reserve Blvd #300
Charlottesville, VA 22901

Prepared By:
IMEG Corp.
1817 South Ave W, Suite A
Missoula, MT 59806

1.0 GENERAL

Cathcart Group is proposing to develop the above-described property with 39 lots. Within these lots are multi-family buildings as well as proposed open space and a clubhouse. Additionally, an existing historical building will remain on-site. In addition to the proposed buildings the project will include sidewalks, roads, parking areas and dedicated open space/parks. The analyzed drainage area including road right-of-way consists of 19.88 acres of which the owner has used approximately 8.5 acres for farmland leases predominantly for fallow crop production and the remaining acreage not used for farmland consists of historic development including the unoccupied ranch house and various other outbuildings. The difference in acreage reported for the project and acreage analyzed for drainage comes from streets proposed outside of the project property lines. The project is adjacent to Flynn Lane to the east. As this property is located within the Sx^{w}tpqyen Master Plan Area, this report will follow the rules laid out in the Form Based Code (FBC) which call for light imprint stormwater infrastructure. Refer to Section 4.1 of this report for a breakdown of light imprint infrastructure proposed for the development.

As laid out in the FBC, 2- and 10-year storm mitigation will be provided on-site as close to the source of the stormwater as possible by a combination of drywell sumps, storm ponds and rain gardens. Some basins will mitigate the 100-year storm within the basin, however, some basins will have the 100-year storm routed to central storm pond located along the western property line. The drywell sump locations shown on the plan are preliminary and subject to change with final designs.

The Storm Water Site Evaluation Form provided by the City of Missoula (attached in Appendix C) determined that this site is of medium priority, with 22 points. This is primarily due to the proposed development being a subdivision and over 0.5 acres in size as well as the proximity to groundwater. This report will address the Post-Development Runoff Control Requirements,

meet Water Quality Control Requirements, and include a Stormwater Management Site Plan (See Civil Construction Plan Set). Refer to Section 5.0 for information regarding SWPPP on site.

2.0 DRAINAGE DESIGN CRITERIA AND METHODS USED

Per correspondence with Missoula City Public Works and Mobility, Hydraflow Hydrographs was used to calculate stormwater volumes and peak flowrates for this development. Within this program, the TR-55 model was used, based on the principles of the SCS runoff equation, to estimate runoff requirements. The flows from the 2-, 10-, and 100-year, 24-hour storm event were analyzed, and calculations have been provided for all storms. Additionally, The Hydraflow Hydrographs program was used to calculate stormwater peak flows and volumes after being routed through stormwater ponds. The stormwater runoff from basins which show a discharge during the 100-year storm will be routed to a regional 100-year stormwater pond.

3.0 EXTENT OF STORM DRAINAGE

The following information pertains to on- and off-site flows that may affect the proposed development as well as conveyance for stormwater flow rates that will be increased due to the development. Detailed information on the existing and proposed drainage patterns is provided in the Drainage Basin Exhibit in Appendix A.

3.1 DELINIATION OF DRAINAGE AREAS WITHIN SUBDIVISION

3.1A EXISTING BASIN

The project site analyzed for drainage purposes is comprised of approximately 19.88 acres consisting of some development and farmland which is currently harvested for hay. As some of the buildings on-site will remain after the development, we have incorporated it into our existing drainage calculations. The existing property has been analyzed as three existing basins, with three different discharge locations. There are no obvious drainageways on the property, so basins were delineated based on topographic information. The general slope of the existing site is 1%, sloping from east to west. There does exist an irrigation ditch on-site, however, this acts as a drainage basin boundary as the topographic information's shows stormwater flowing away from the ditch on both sides. The site is bounded to the east by Flynn Lane, to the south by the proposed West End Homes Subdivision, and to the north by the Summit Beverage building and west by undeveloped property. As this area is within the Master Plan, we expect all surrounding undeveloped property to be developed in the future. The total area of each existing basin can be seen in the below table.

The entire property is in the Zone X floodplain designation. Ground cover of the unimproved site is grass with fair coverage. A study conducted by NewFields indicates that the groundwater depth to existing grade around the property was from 14 to >20 feet. We utilized Figure 4-2 of the study "2-Year Creek Event, 2-Year Storm Discharge – Full Buildout, Excluding Flynn-Lowney Ditch" as per the City of Missoula's recommendation. The west end of the property has the shallowest groundwater throughout the site although it is still deep enough to allow standard depth drywell sumps without any distance to groundwater issues. There are no existing waterways or wetlands located on the subject property.

Existing Basin	Total Area (acres)
Basin A	8.81
Basin B	4.11
Basin C	6.96

Table 1: Basin Areas

3.1B DEVELOPED BASINS

The developed on-site basins were delineated based on the proposed site grading. Within these basins we have proposed some shallow rain gardens, storm ponds and drywell sumps to mitigate the post-development 2- and 10-year storms in all basins as well a regional storm pond along the western property boundary to mitigate the post-development 100-year storm for some basins. Some basins will have infrastructure to fully retain up to the 100-year storm. Refer to Section 4.3 for stormwater runoff mitigation design details.

Proposed Basin	Total Area (acres)
Basin A	1.54
Basin B	1.21
Basin C	5.68
Basin D	2.74
Basin E	4.72
Road Basin 1	1.07
Road Basin 2	0.80
Road Basin 3	0.89
Road Basin 4	0.58
Trail Street	0.64

Table 2: Proposed Basin Areas

3.2 DELINEATION OF DRAINAGE AREAS OUTSIDE OF SUBDIVISION

Flynn Lane which is located to the east is elevated from the surrounding properties (both east and west), and our preliminary road plans have been designed to limit any runoff from Flynn Lane to be conveyed onto the property. Additionally, Flynn Lane will have proposed curb and gutter with this development plan on the west side of the road. Drywell sumps will be proposed along Flynn Lane at one sump per 5,000 SF of impervious coverage. No other stormwater from neighboring areas should be discharged onto the property.

~~3.3 MODELED OFF-SITE FLOWS~~

3.4 PROVISIONS TO PASS OFF-SITE STORMWATER FLOWS

IMEG does not anticipate any above ground stormwater runoff from off-site to cross the subject property. This is mainly due to the topography of the surrounding area sloping from east to west, and the location of Flynn Lane to the east of the property. See the description of Flynn Lane in Section 3.2. The property to the north is developed, ensuring no stormwater runoff goes to the south. Therefore, no specific design is required for this project for off-site flow conveyance. However, we do believe that there will be capacity within the curb lines of the road to handle additional stormwater, although there will not be any infiltrative capacity in the proposed drywells to infiltrate off-site flows. Any off-site flows which may pass through the site will be routed through the curb lines of the development and be discharged along with the water generated on-site.

4.0 PROVISIONS TO MITIGATE ON-SITE STORMWATER FLOWS

With the increase in impervious coverage in every basin, there will be increased runoff. The general stormwater mitigation plan for the Sapphire Place Subdivision is as follows: drywell sumps, storm ponds and rain gardens throughout the site will be proposed to retain the entirety of the post-development 100-year storm. Refer to Section 4.3 for a detailed description of the stormwater runoff mitigation plan for each drainage basin.

See Section 4.2F for more information on pre- and post-development site variables. Below in Sections 4.1A-4.1C, the general plan for stormwater mitigation is laid out on the lot, corridor and neighborhood level. We will be working closely with the City of Missoula going forward to ensure that this plan will meet all the requirements of the Sx^{w}tpqyen Master Plan as well as those of the Public Works Department.

As half street improvements are being proposed for Flynn Lane, we will be proposing stormwater mitigation facilities to mitigate the difference between the pre- and post-development 100-year storm. Keeping in line with our recommendations for the project site based on our infiltration testing completed, we will be proposing one sump per 5,000 SF of impervious coverage at a minimum. A sump will be installed at every low point in the road to ensure that stormwater does not inundate the road during the 10-year storm.

4.1 STORMWATER QUALITY CONTROL AND LIGHT IMPRINT COMPLIANCE

Stormwater quality has been addressed by mitigating runoff from storm as close to the source as possible. By routing stormwater runoff to rain gardens, we ensure that the first 0.5" of rainfall on impervious surfaces will be treated, which will cut down on pollutants. Refer to the table in Section 4.3 for a breakdown of total stormwater volume detained per basin.

The Sx^{w}tpqyen Master Plan has laid out that at least one piece of light imprint stormwater mitigation infrastructure be implemented in the lot, corridor, and neighborhood level of the subdivision. Refer to the sections below for a narrative on how the light imprint infrastructure is being implemented throughout this development.

4.1A LOT LEVEL STORMWATER MITIGATION

The proposed subdivision includes three different transects as laid out in the Sx^{w}tpqyen Master Plan. The acreage is split with half being T4 and the other half split between T3 and T5. Refer to the Master Site Plan provided in the Subdivision Application to reference the lot sizes in relation to what is being proposed on each lot. Rain Gardens are being proposed to treat stormwater runoff from the lots, which meets the Master Plan Requirement for Light-Imprint Stormwater.

4.1B CORRIDOR LEVEL STORMWATER MITIGATION

Any initial stormwater runoff which is discharged into or generated by the roads will be mitigated by drywell sumps and rain gardens within the road corridor. These rain gardens meet the requirement for light-imprint stormwater.

4.1C NEIGHBORHOOD LEVEL STORMWATER MITIGATION

All stormwater mitigation will occur on a lot level for the 10-year storm. Some limited stormwater from basins will reach the 100-year storm pond A. Any overflow will be routed through the road corridors to be discharged from the site at pre-development rates for the 100-year storm.

4.2 CALCULATONS & DESIGN

Calculations for this report are based on the SCS Type II Rainfall Distribution and the TR-55 module within the Hydraflow Hydrographs modeling program. Calculations were made using curve numbers, basins, and time of concentration to ensure proper routing and that any proposed infrastructure is not inundated. For any variables, values, equations, or calculations not explicitly shown below in this report, refer to the attached Hydrographs Summary Report in Appendix B.

Additionally, the Hydraflow Hydrographs modeling program was used to route each drainage basin through a conceptual pond with the proposed storage volume. We calculated the peak flow and discharge volume from each basin during the 2-, 10- and 100-year storm after all the stormwater detention areas have been inundated. For the basis of calculations, basins with multiple storm ponds have been modeled as having one pond of equal storage volume. This is possible as we are not proposing any controlled discharge of any pond and instead, we have proposed each pond to overflow once fully inundated. The results of this were then used to calculate the total discharge of stormwater from the site.

For basins showing a discharge during the 100-year storm, this stormwater runoff will be routed through pipe networks to a regional stormwater pond located along the western boundary of the property.

To comply with the Post Development Runoff Control Requirements, stormwater from the project shall be retained for the entirety of the post-development 100-year storm.

4.2A HYDROLOGIC SOIL GROUP

The NRCS Soils Data was obtained from the Web Soil Survey website (located at: http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx) found in Appendix C. The NRCS Soils Data for this site shows it to be Desmet Loam, which is Soil Group B.

4.2B CURVE NUMBERS & LAND USE DATA

As explained above, the existing on-site soil is Hydrologic Soil Group B, and is primarily grass and weeds in fair condition. The corresponding weighted Curve Number (CN) of 69 (Grass) was used for every pre-development basin in the TR-55 module. In the post-development condition, all proposed impervious infrastructure (i.e. buildings, asphalt, concrete, etc.) was accounted for in each basin. All pervious ground in the post-development condition has been determined to be primarily grass in good condition; therefore, the corresponding weighted Curve Numbers (CN) of 61 (Grass) and 98 (Impervious) were utilized for the post-development condition in the TR-55 module. See Appendix B for the data used for this site.

Curve numbers assigned for post-development drainage basins are based on total impervious coverage (buildings and asphalt/concrete) within each basin and not on composite assigned curve numbers.

4.2C BASINS AND AREAS

The site was analyzed as ten (10) basins for the post-development condition, as described in Section 3.1B above. Basins were delineated based on the post-development grading plan.

4.2D TIME OF CONCENTRATION

Time of concentration was determined by the TR-55 module in Hydraflow Hydrographs and is calculated based on the longest flow path and watercourse slope of the pre-development and post-development conditions for the site and individual basins. It is important to note that, as per Chapter 6 of the Missoula City Public Works Standards and Specifications Manual, if the TR-55-calculated time of concentration was less than 5 minutes, the minimum time of concentration of 5 minutes was used in the calculations for that basin.

4.2E STORM DATA

The SCS Method uses 24-hour storm depths provided by Chapter 6 of the Missoula City Public Works Standards and Specifications Manual for each design recurrence interval. In this case, the 2-year, 10-year, and 100-year storm event were analyzed.

4.2F SUMMARY OF SITE VARIABLES

See the Hydrograph Reports Included in Appendix B for both the Pre- and Post-Development site conditions. In general, the curve number for all pre-development basins was 69 (Fair Condition Vegetation). For the Post-Development basins, Composite Curve Numbers were anywhere from 72 to 95, with an average of 86 for the on-site basins and roads.

Storage is being calculated to retain and infiltrate the entirety of the post-development 100-year storm.

4.3 RUNOFF MITIGATION

As mentioned above, the entirety of the post-development 100-year storm will be stored and infiltrated on-site. Only the trail street to the north will discharge stormwater during the 10- and 100-year storm. The trail street will discharge at discharge point A and will be less than the historical discharge location. A spreadsheet which summarizes the total storage provided by rain gardens, drywell sumps and stormwater ponds for each basin has been included in Appendix B. For this drainage report, we have assumed that all drywell sumps installed in areas with a depth to groundwater of 16’ or greater will have 12’ depth drywells.

For the proposed road corridors, we have proposed bio-retention ponds within some landscaping areas as well as drywell sumps. These drainage facilities will retain and store the entirety of the 2- and 10-year storms. Overflow stormwater from the 100-year storm will be routed to the 100-year storm pond proposed in the along the western property boundary.

For the on-site drainage basins, we have proposed drywell sumps and bio-retention ponds to retain and store the entirety of the 10-year storm for all basins. Drainage Basins B and C will retain the entirety of the 100-year storm within the basin, with all others discharging to the Regional 100-Year Pond A located along the western property boundary. See below for a table which shows the quantity of stormwater from each basin being discharged to the regional 100-year pond for the 100-year storm.

Discharge to Regional Storm Pond	Basin A	Basin B	Basin C	Basin D	Basin E	RB1	RB2	RB3	RB4	Total Stormwater Discharge to Pond
10-Year Volume (CF)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
100-Year Volume (CF)	1,885	N/A	N/A	3,525	3,714	1,836	1,530	1,699	981	15,170

Table 3: Stormwater Discharge to 100-Year Storm Pond

The 100-year storm will pond up to a depth of 4-feet and will infiltrate within 36 hours after the 100-year storm. No stormwater will be discharged to this pond during the 10-year or smaller storm events.

As discussed in Section 4.3B, we will be running additional infiltration tests throughout the development to get more realistic results. Although these are within the maximum drain time of 48 hours, we expect these infiltration times to decrease as we get more realistic infiltration rates

4.3A RUNOFF RATES & VOLUME

The Storm Drainage Summary Table is included within Appendix B. Additionally, a pond calculation table has been included in Appendix B that outlines the storage provided for each basin and regional stormwater pond. The table breaks down the peak flow, and volume of the pre- and post-development storm as well as the peak discharge rate of the post-development 100-year storm after it has been mitigated.

Drainage Basins	2-Year Peak Flow (CFS)	2-Year Volume (CF)	10-Year Peak Flow (CFS)	10-Year Volume (CF)	100-Year Peak Flow (CFS)	100-Year Volume (CF)
Pre-Development Discharge Point A	0.02	620	0.28	3,691	1.35	10,333
Post-Development Discharge Point A	**N/A**	**N/A**	**0.04**	**416**	**0.80**	**1,227**
Pre-Development Discharge Point B	0.01	311	0.18	1,851	0.98	5,183
Post-Development Discharge Point B	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**
Pre-Development Discharge Point C	0.01	376	0.21	2,673	1.28	7,901
Post-Development Discharge Point C	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**

Table 3: Stormwater Discharge to 100-Year Storm Pond

The only stormwater to be discharged from the site will be from the trail street to the north, which is far less than both the 10- and 100-year pre-development flow. All storm piping within the project site will be sized adequately to convey the peak flow for the post-development 100-year storm from each basin being conveyed to the regional 100-year storm pond.

4.3B INFILTRATION

Tetra Tech was contracted to perform 7 infiltration tests throughout the subject property. Each drywell sump is within the 300’ radius to each bore hole with a few exceptions. In some instances, a proposed drywell sump was located outside the 300’ radius; in these instances, the closest conservative infiltration rate was used. Additionally, the most conservative infiltration rate was used when a sump was in multiple infiltration rate zones. The findings from these infiltration tests can be found within the Percolation Test Results located in Appendix D. For preliminary designs, we have taken the conservative approach of assuming a safety factor of 3 for each sump. The final storm drainage reports for each phase will utilize a safety factor of 2 for sumps with pre-treatment. A total surface area of 61.23 sf (Per Chapter 6 of the City of Missoula

Public Works Manual) was used with the infiltration rate to calculate the flow rates shown in the table below:

Bore Hole	Infiltration Flow Rate (CFS)
1	0.008
2	0.042
3	.012
4	.025
5	0.056
6	.019
7	0.031

Table 4: Infiltration Flow Rate Summary

To abate concerns from the City of Missoula, we have provided enough storage in each basin and a regional stormwater pond to store the entirety of the post-development 100-year storm without counting any infiltration. The infiltration rates have been utilized to ensure that all stormwater drains within 48 hours after the storm.

The neighboring properties to both the north and south (Summit Beverage and West End Homes) both have much faster infiltration rates than were measured for the site. We believe that the original tests run had not hit gravel layers and that the act of boring may have skewed the infiltration data to be very slow. We will be setting up additional infiltration tests utilizing profile holes as opposed to bore holes. It is their experience that sometimes the sides of the bore hole can become smeared with soil high in silt. Profile holes can sometimes provide more accurate infiltration rates. Additionally, Tetra Tech has been instructed to excavate down to the gravel layer as we will be utilizing 12-ft sumps on the site where it is permitted.

Should we get faster infiltration rates for these additional tests, we will be utilizing the infiltration rates to mitigate the peak flow and stormwater volume from the design storm. In this case, we will remove stormwater storage/additional sumps for future iterations of the stormwater plan.

4.3C 100-YEAR RUNOFF MITIGATION AND STORAGE

Basins B & C will retain all of the 100-year storm on-site utilizing proposed rain gardens and drywell sumps. For the 100-year storms, Drainage Basins A, D, & E and Road Basin 1, 2, 3 & 4 will be routed to Pond A.

The proposed 100-year storm pond has been sized as conservatively as possible as we did not take any credit for stormwater infiltration. Should we get faster infiltration rates, we will reduce the size of the regional 100-year pond.

4.3D INUNDATION

The stormwater for the project site is proposed to be fully retained within the site, with only 0.80 CFS and 1,227 CF being discharged from the Trail Street. We have provided some emergency overflow locations for the 100-year reginal pond should they overflow due to a storm larger than 100-year or should some drainage facilities fail. It should be noted that we do not expect stormwater to ever be discharged from these locations.

Pond A will overflow to the south and run within swales along the proposed trail where will be outlet to the west. We will work with the Icon Apartment Project to ensure that stormwater will have a place to run once it gets developed.

4.4 DOWN-GRADIENT ANALYSIS

The stormwater discharge from the trail street will be conveyed within the Icon Apartment project. Final designs will incorporate the runoff peak flowrate in curb capacity and storm network calculations.

As we do not have a quantified stormwater peak flow or volume for the emergency overflows, we will ensure that no buildings are inundated should stormwater overflow.

5.0 EROSION CONTROL & STORMWATER POLLUTION PREVENTION PLAN

A Stormwater Pollution Prevention Plan (SWPPP) will be required through the Montana Department of Environmental Quality (MDEQ), it will be the responsibility of the Contractor (or owner if previously agreed upon) to prepare, obtain, and administrate a SWPPP and any other erosion control permits required by City of Missoula. Erosion and sediment control in the form of BMP's or stabilized surface throughout the project area will minimize the potential for pollutants to leave the site.
Throughout the project site during construction, all stormwater inlets will be protected as per City Standard 651 to ensure that no sediment is discharged into the drywell sumps. Additionally, Perimeter Control will be installed as per City Standard 652 along the downstream property boundary. In this case, the western property boundary will have perimeter control installed. Any other areas where sediment may be discharged from the site along perimeter boundaries will have perimeter control installed. Temporary Gravel Construction Accesses shall be installed off Flynn Lane as per City Standard 650. See the Road Plans for the SWPPP Sheet for the site.

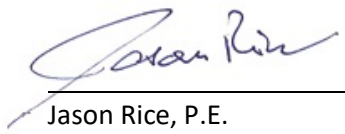
6.0 CONCLUSIONS

This drainage report has been prepared in accordance with Chapter 6 of the Missoula City Public Works Standards and Specifications Manual. This report shows that a stormwater design to mitigate the post-development 100-year storm is possible on-site. The proposed drywell sumps will ensure that the roads are not inundated during the 10-year storm and no buildings will be inundated during the 100-year storm. Other existing drainage patterns in non-disturbed or off-site areas will be maintained. All construction will be in accordance with the Construction Plans, Montana Public Works Standard Specifications (MPWSS), and City of Missoula requirements.

Prepared by:
IMEG Corp.,

Mike Mayen, E.I.

Reviewed by:
IMEG Corp.,



Jason Rice, P.E.

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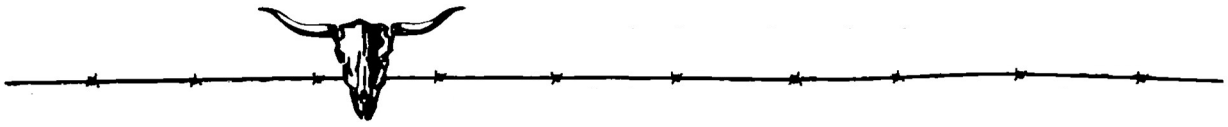
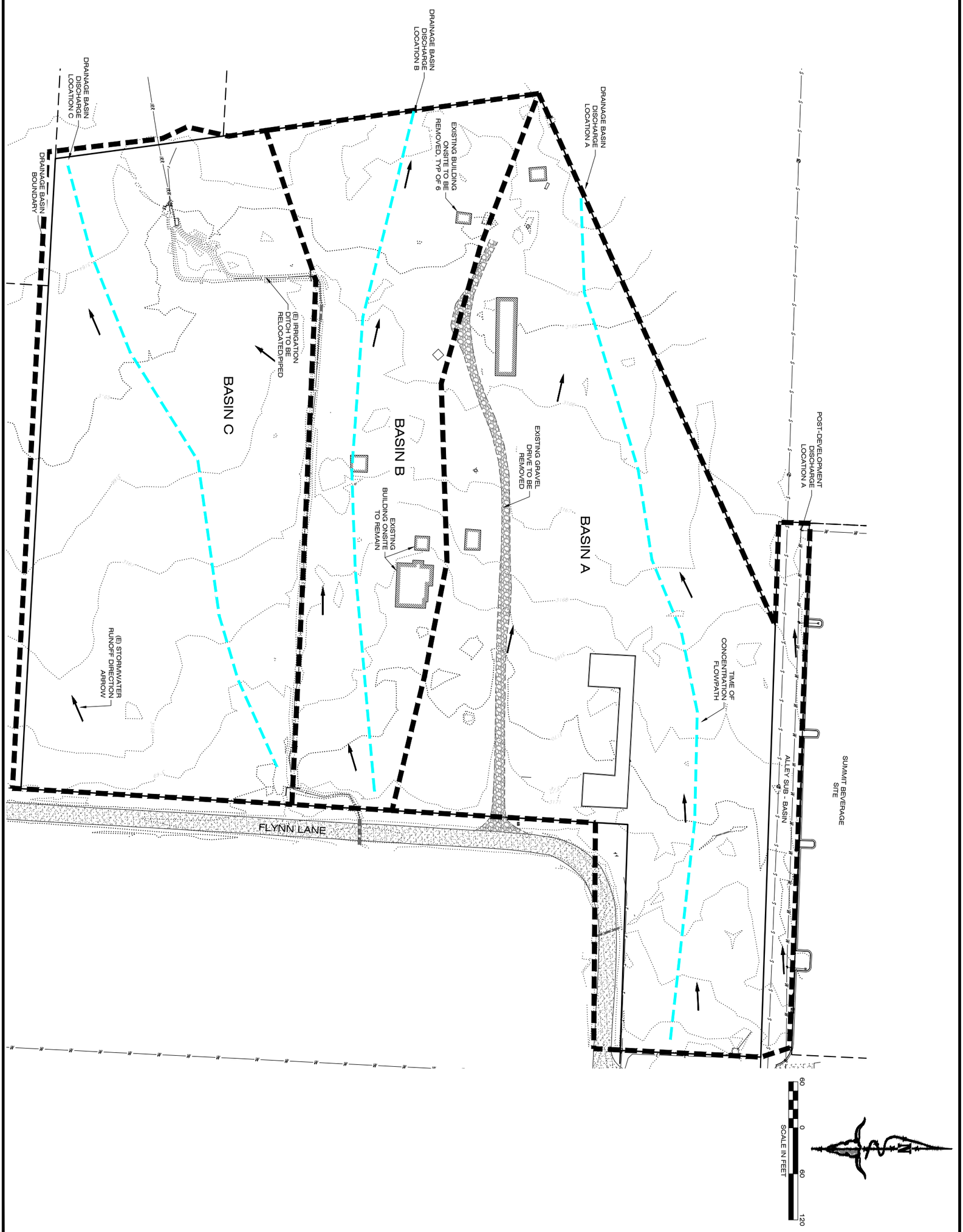


Appendix A:

Existing Drainage Basin Exhibit
Proposed Drainage Basin Exhibit
Groundwater Depth Exhibit
Drywell Sump Infiltration Rate Exhibit



PRELIMINARY

PROJECT NO.	21001343
PROJECT NAME	SAPPHIRE PLACE MAJOR SUB AND MASTER SITE PLAN
SHEET:	1 OF 4
SHEET TITLE:	EXISTING DRAINAGE BASIN EXHIBIT
LOCATION:	3285 FLYNN LANE PARCEL 2A OF COS 6689 SECTION 07, T13N, R19W, P.M.M. MISSOULA COUNTY
PREPARED FOR:	CATHCART GROUP
DESIGNED:	MM
DRAFTED:	MM
CHECKED:	JR
DATE:	FEB 2023

REVISIONS	DATE

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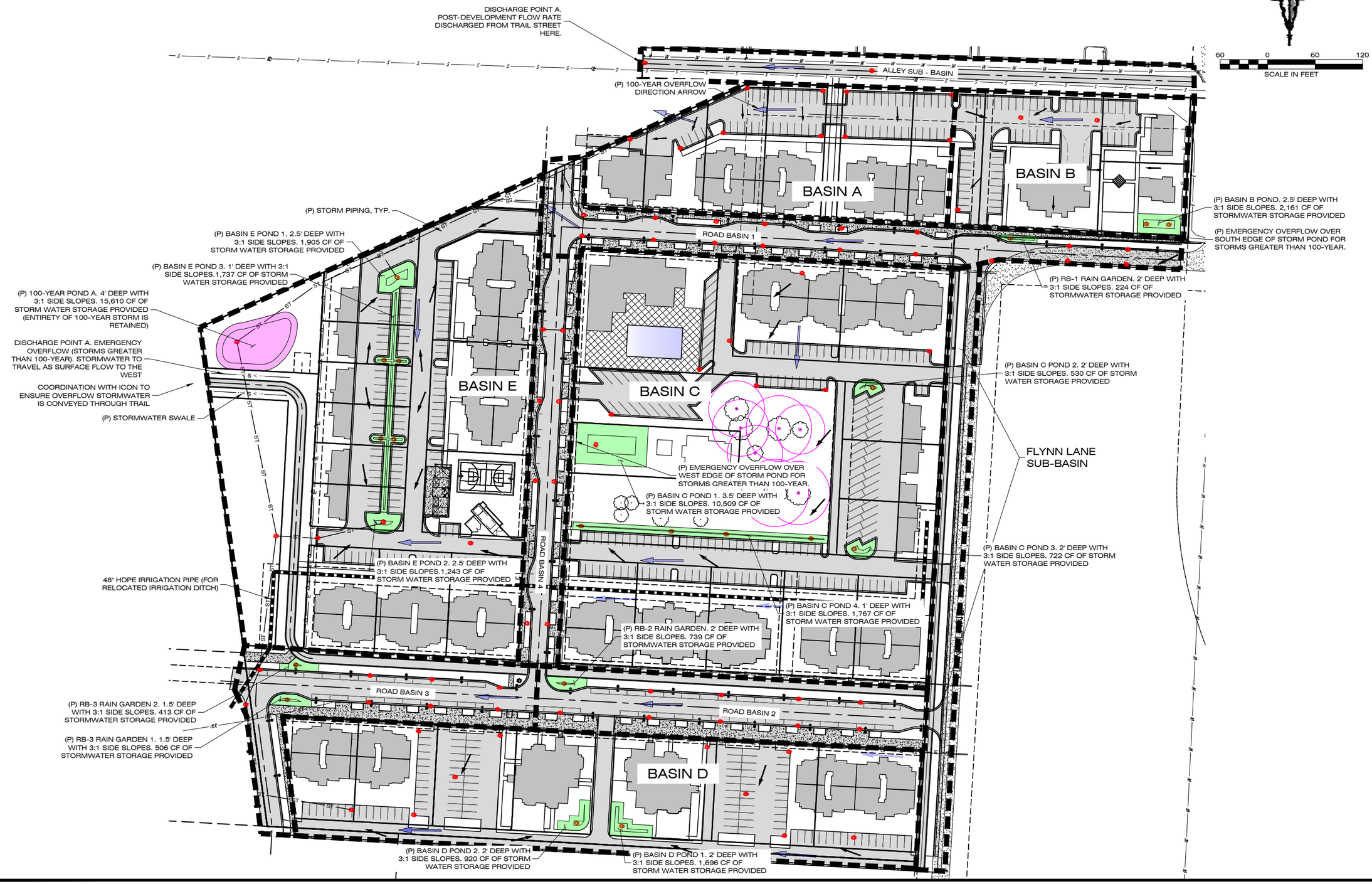
LEGEND

- PROPOSED FLOW DIRECTION
- PROPOSED 100-YEAR OVERFLOW DIRECTION



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PLOT DATE: 3/23/2023 9:45 AM

DATE
REVISIONS

DESIGNED: MM
DRAFTED: MM
CHECKED: JR
DATE: FEB 2023

LOCATION: 3285 FLYNN LANE
PARCEL 2A OF COS 6689
SECTION 07, T13N, R19W, P.M.M.
MISSOULA COUNTY

PREPARED FOR: CATHCART GROUP

PROJECT NAME: SAPPHIRE PLACE
MAJOR SUB AND MASTER SITE PLAN

SHEET TITLE: PROPOSED DRAINAGE BASIN EXHIBIT

PROJECT NO. 21001343

SHEET: 2 OF 4

PRELIMINARY

DWG LOCATION: G:\2021\21001343\DESIGN\CIVIL\3_SWM PKGS_DRAWINGS\AUTOCAD\EXHIBITS\21001343-DRAINAGE BASINS-M.DWG

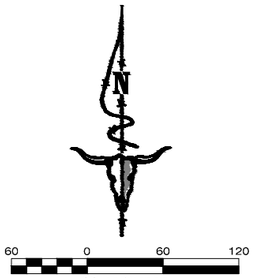
GROUNDWATER DEPTH OF 14-16 FEET BELOW EXISTING GRADE.

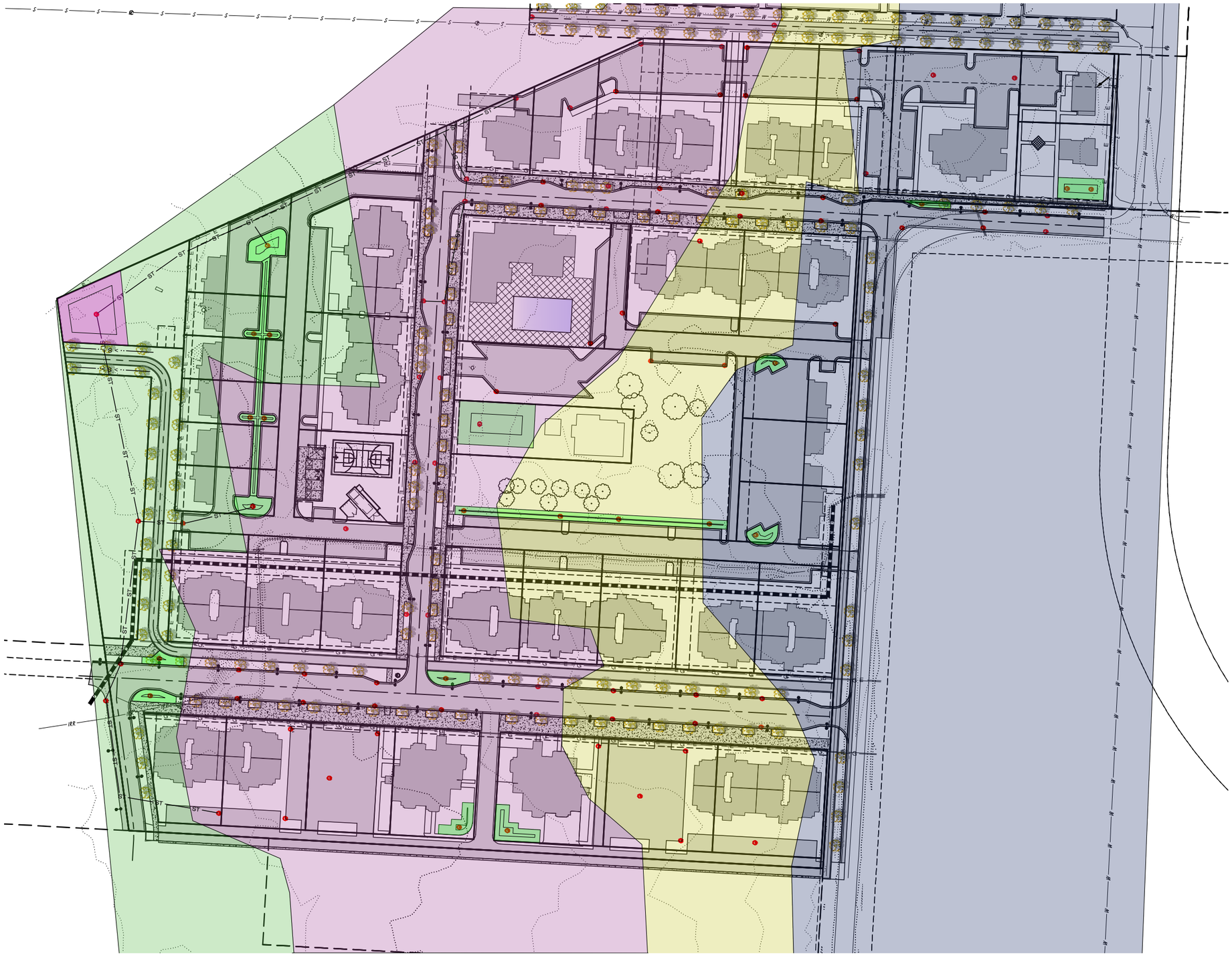
GROUNDWATER DEPTH OF 16-18 FEET BELOW EXISTING GRADE.

GROUNDWATER DEPTH OF 18-20 FEET BELOW EXISTING GRADE.

GROUNDWATER DEPTH OF >20 FEET BELOW EXISTING GRADE.

DATA USED BASED ON FIGURE 4-9 "SIMULATED DEPTH TO GROUNDWATER: 2-YEAR CREEK EVENT, 2-YEAR STORM DISCHARGE - FULL BUILDOUT SUMPS, EXCLUDING FLYNN-LOWRY DITCH"





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REVISIONS | DATE

DESIGNED: MM
DRAFTED: MM
CHECKED: JR
DATE: FEB 2023

LOCATION:
3285 FLYNN LANE
PARCEL 2A OF COS 6689
SECTION 07, T13N, R19W, P.M.M.
MISSOULA COUNTY

PREPARED FOR:
CATHCART GROUP

PROJECT NAME:
SAPPHIRE PLACE
MAJOR SUB AND MASTER SITE PLAN

SHEET TITLE:
GROUNDWATER DEPTH EXHIBIT

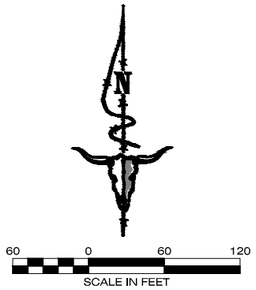
PROJECT NO.
21001343

SHEET:
3 OF 4

PRELIMINARY

PLOT DATE: 3/21/2023 1:30 PM

ENG LOCATION: I:\PROJECTS\PROJECTS\2021\21001343.000\ENGINEERING\DWG_SHEETSET\21001343-ENGINEERING.DWG



.003 CFS INFILTRATION RATE (SAFETY FACTOR 3)
.005 INFILTRATION RATE (PRE-TREATMENT)

.01 CFS INFILTRATION RATE (SAFETY FACTOR 3)
.02 CFS INFILTRATION RATE (PRE-TREATMENT)

.02 CFS INFILTRATION RATE (SAFETY FACTOR 3)
.03 CFS INFILTRATION RATE (PRE-TREATMENT)

NOTE: INFILTRATION RATES BASED ON 61.23 SF OF BOTTOM AREA FOR A DRYWELL SUMP AND A SAFETY FACTOR OF 3 (CHAPTER 6 OF CITY OF MISSOULA PUBLIC WORKS MANUAL). PRE-TREATMENT INFILTRATION RATES PROVIDED USE A SAFETY FACTOR OF 2 (CHAPTER 6 OF CITY OF MISSOULA PUBLIC WORKS MANUAL).

IMEG
1817 SOUTH AVE W, STE. A
MISSOULA, MT
59801
PH: 406.721.0142
FAX: 406.721.5224
www.imegcorp.com

PLOT DATE: 3/21/2023 1:36 PM

REVISIONS | DATE

DESIGNED: MM
DRAFTED: MM
CHECKED: JR
DATE: FEB 2023

LOCATION: 3285 FLYNN LANE
PARCEL 2A OF COS 6689
SECTION 07, T13N, R19W, P.M.M.
MISSOULA COUNTY

PREPARED FOR: CATHCART GROUP

PROJECT NAME: SAPPHIRE PLACE
MAJOR SUB AND MASTER SITE PLAN

SHEET TITLE: DRYWELL SUMP INFILTRATION RATE EXHIBIT

PROJECT NO: 21001343

SHEET: 4 OF 4

PRELIMINARY

DWG LOCATION: N:\JOBS\ACTIVE\PROJECTS\2021\21001343\DESIGN\CIVIL\SHEETS\21001343-DRAINAGE-DRYWELL.DWG

Appendix B:

Hydraflow Hydrographs Summary Report
Hydraflow Hydrographs Pond Routing Summary Report
Storm Drainage Summary
Pond Volume Calculations

Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021

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	0.020	2	932	687	------	------	------	Existing Drainage Basin A
2	SCS Runoff	0.009	2	920	313	------	------	------	Existing Drainage Basin B
3	SCS Runoff	0.011	2	1068	391	------	------	------	Existing Drainage Basin C

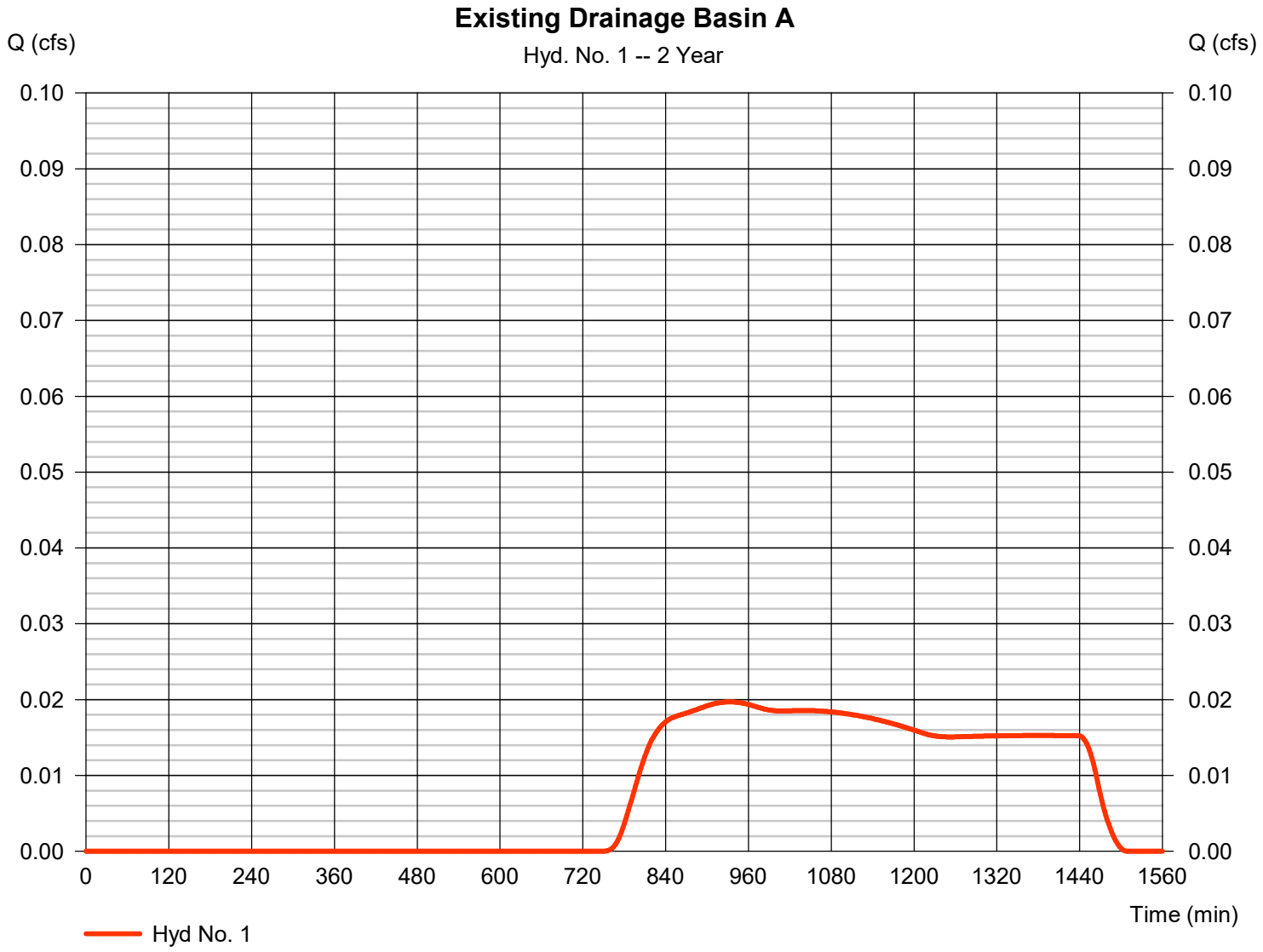
Hydrograph Report

Hyd. No. 1

Existing Drainage Basin A

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.020 cfs
Storm frequency	=	2 yrs	Time to peak	=	932 min
Time interval	=	2 min	Hyd. volume	=	687 cuft
Drainage area	=	8.810 ac	Curve number	=	70*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	43.70 min
Total precip.	=	1.17 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(7.690 x 69) + (0.260 x 98)] / 8.810



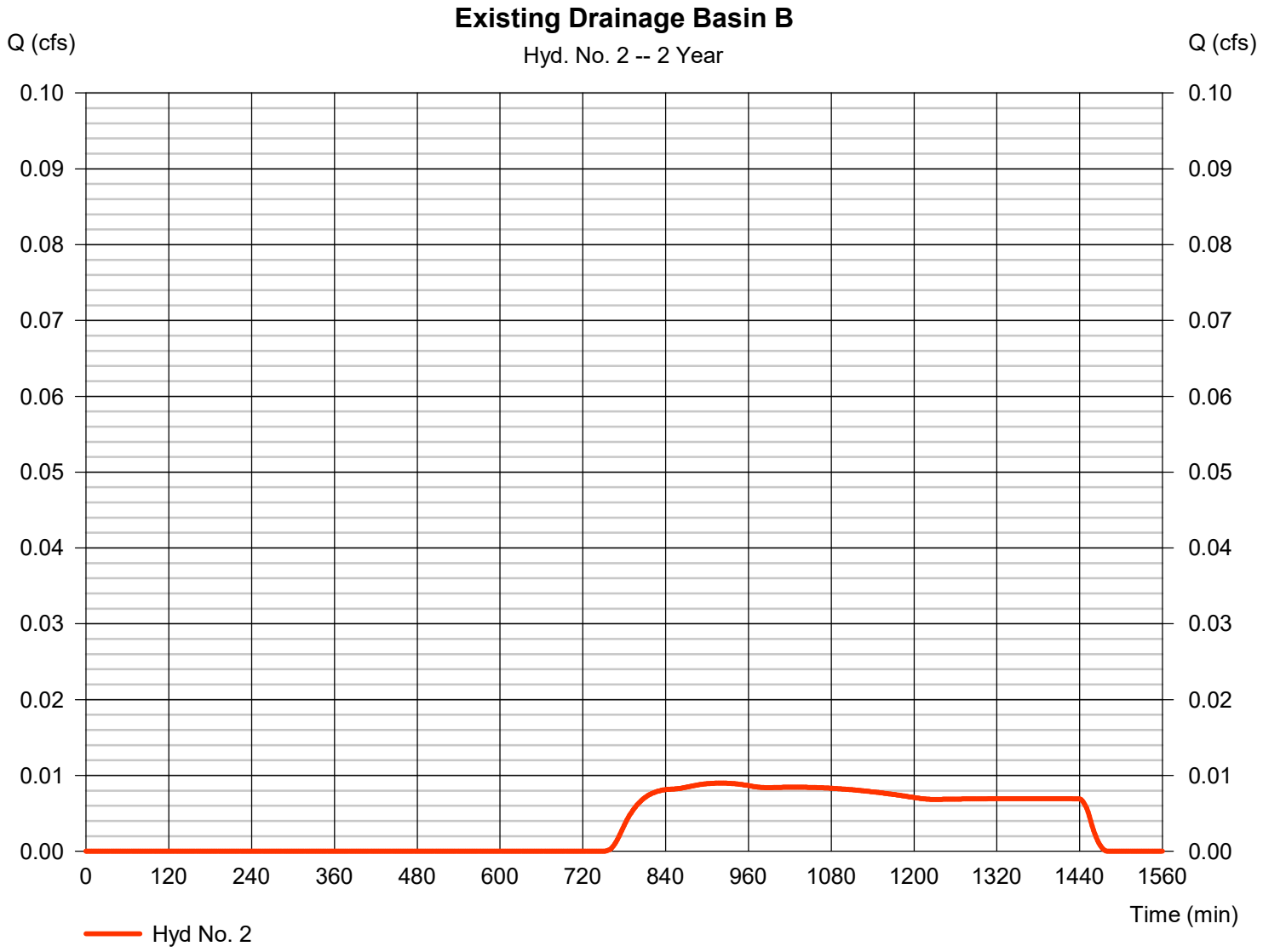
Hydrograph Report

Hyd. No. 2

Existing Drainage Basin B

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.009 cfs
Storm frequency	=	2 yrs	Time to peak	=	920 min
Time interval	=	2 min	Hyd. volume	=	313 cuft
Drainage area	=	4.110 ac	Curve number	=	70*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	26.40 min
Total precip.	=	1.17 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(4.010 x 69) + (0.080 x 98)] / 4.110



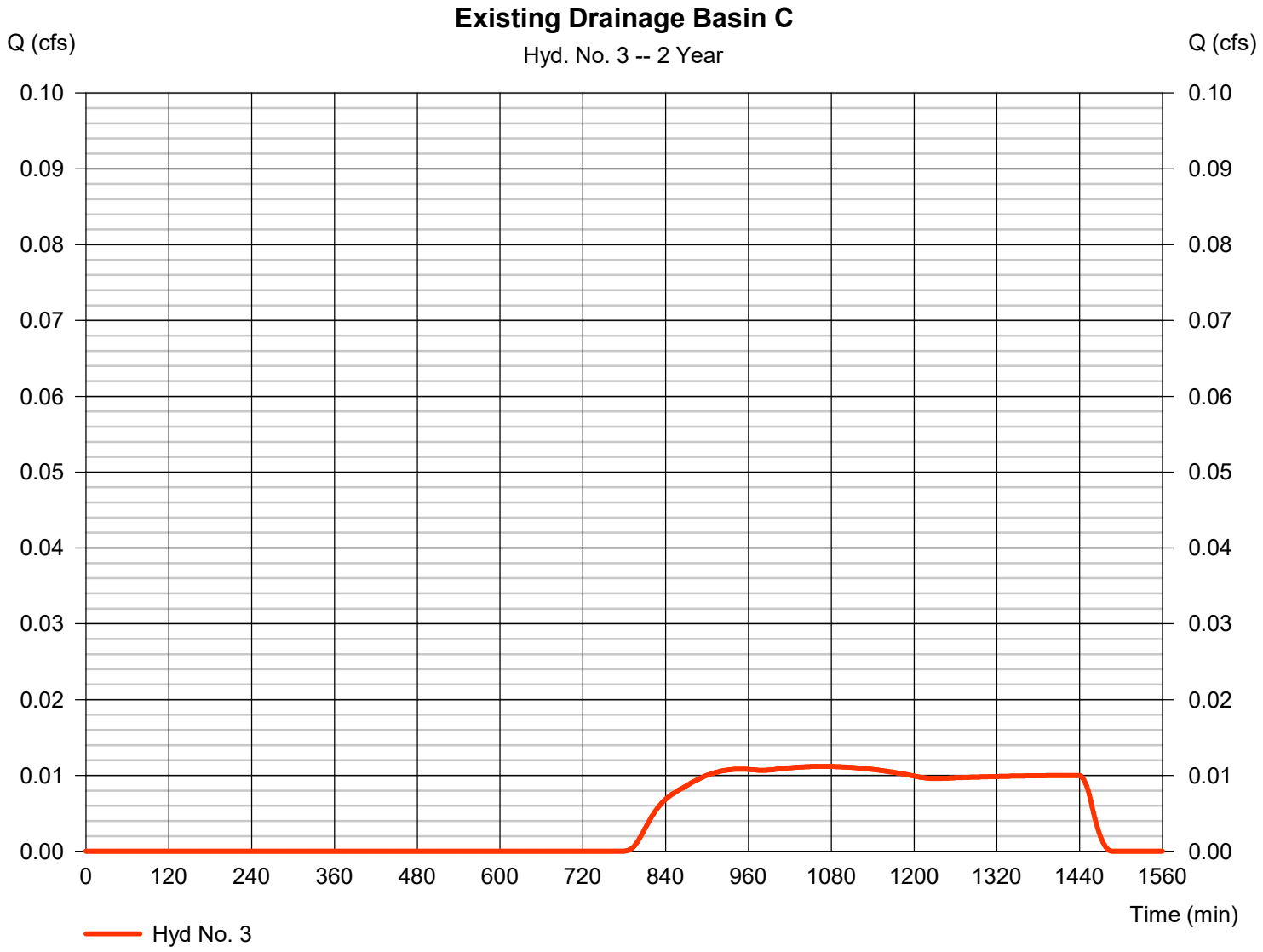
Hydrograph Report

Hyd. No. 3

Existing Drainage Basin C

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.011 cfs
Storm frequency	=	2 yrs	Time to peak	=	1068 min
Time interval	=	2 min	Hyd. volume	=	391 cuft
Drainage area	=	6.960 ac	Curve number	=	69*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	29.00 min
Total precip.	=	1.17 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(6.700 x 69)] / 6.960



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021

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	0.314	2	756	4,090	------	------	------	Existing Drainage Basin A
2	SCS Runoff	0.184	2	738	1,860	------	------	------	Existing Drainage Basin B
3	SCS Runoff	0.219	2	746	2,777	------	------	------	Existing Drainage Basin C

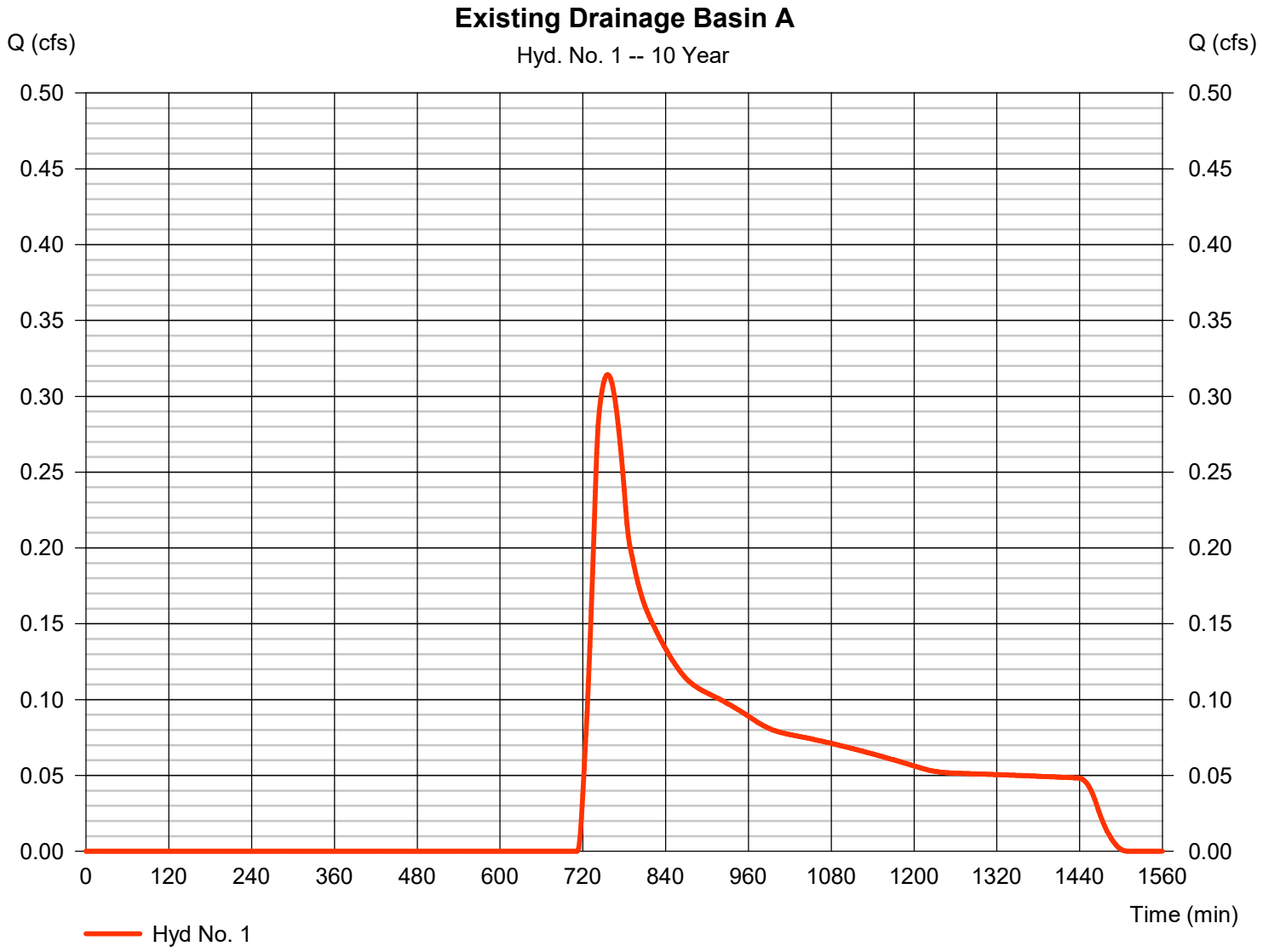
Hydrograph Report

Hyd. No. 1

Existing Drainage Basin A

Hydrograph type	= SCS Runoff	Peak discharge	= 0.314 cfs
Storm frequency	= 10 yrs	Time to peak	= 756 min
Time interval	= 2 min	Hyd. volume	= 4,090 cuft
Drainage area	= 8.810 ac	Curve number	= 70*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 43.70 min
Total precip.	= 1.66 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(7.690 x 69) + (0.260 x 98)] / 8.810



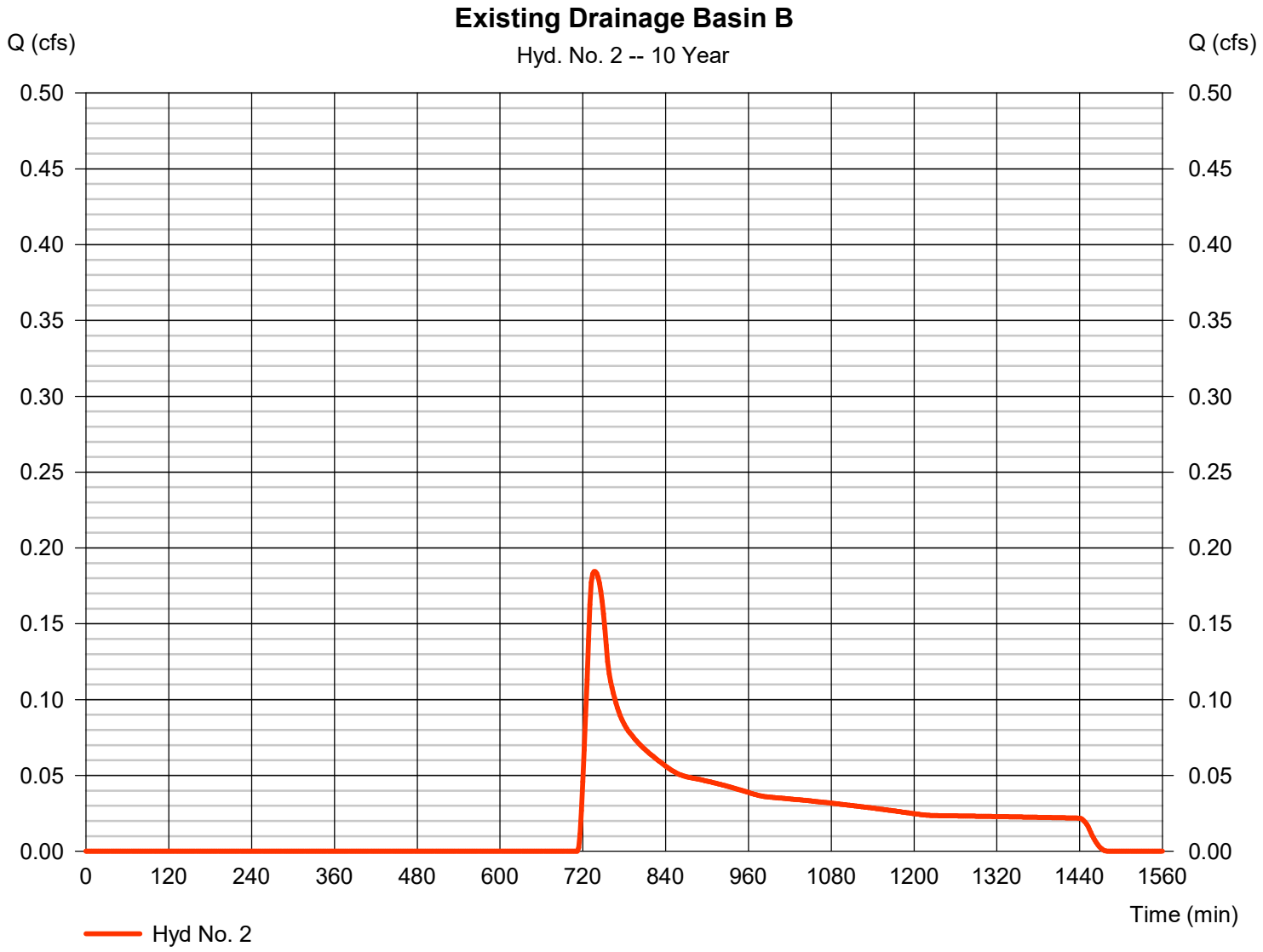
Hydrograph Report

Hyd. No. 2

Existing Drainage Basin B

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.184 cfs
Storm frequency	=	10 yrs	Time to peak	=	738 min
Time interval	=	2 min	Hyd. volume	=	1,860 cuft
Drainage area	=	4.110 ac	Curve number	=	70*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	26.40 min
Total precip.	=	1.66 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(4.010 x 69) + (0.080 x 98)] / 4.110



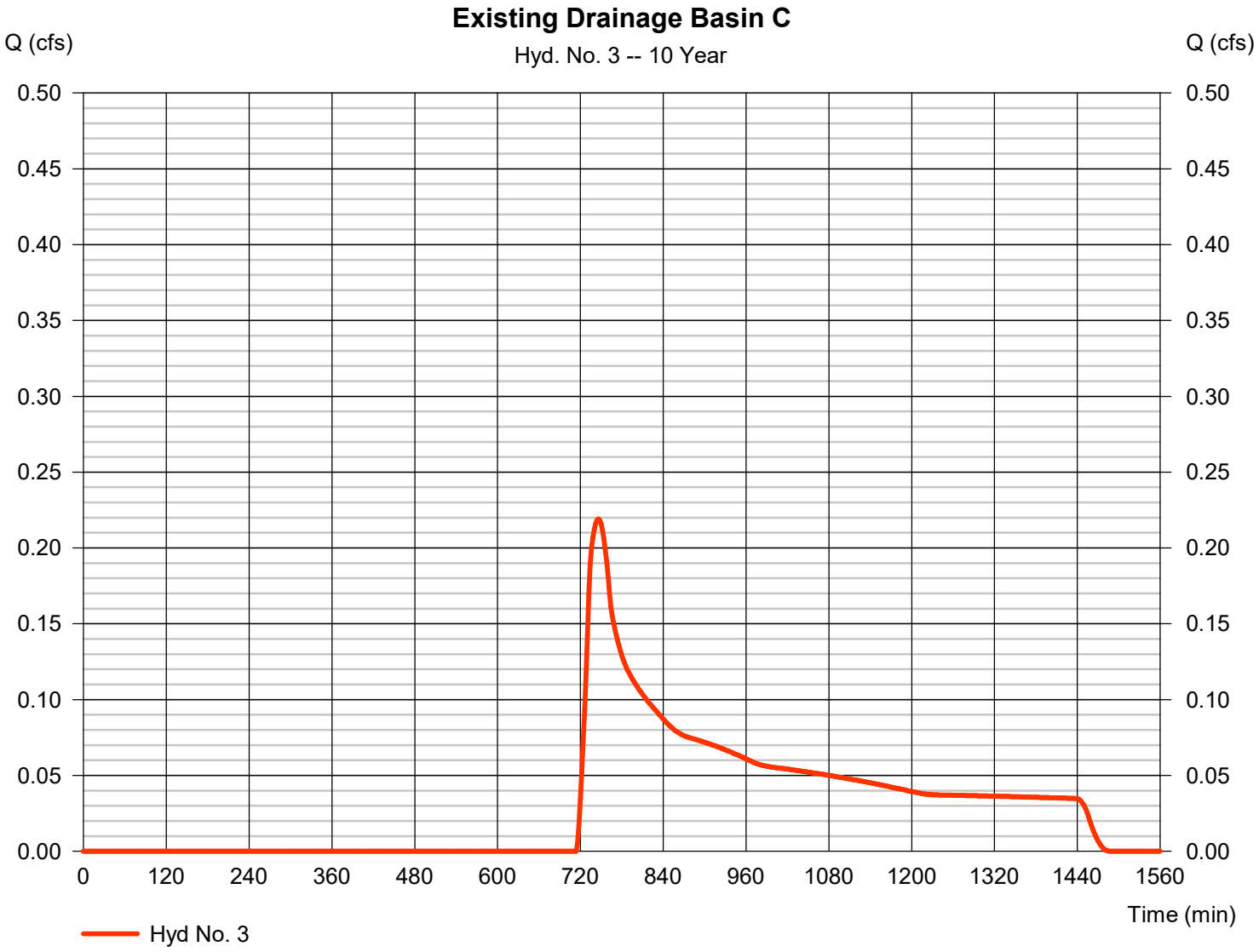
Hydrograph Report

Hyd. No. 3

Existing Drainage Basin C

Hydrograph type	= SCS Runoff	Peak discharge	= 0.219 cfs
Storm frequency	= 10 yrs	Time to peak	= 746 min
Time interval	= 2 min	Hyd. volume	= 2,777 cuft
Drainage area	= 6.960 ac	Curve number	= 69*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 29.00 min
Total precip.	= 1.66 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(6.700 x 69)] / 6.960



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	1.493	2	744	11,451	------	------	------	Existing Drainage Basin A
2	SCS Runoff	0.984	2	732	5,208	------	------	------	Existing Drainage Basin B
3	SCS Runoff	1.329	2	734	8,207	------	------	------	Existing Drainage Basin C

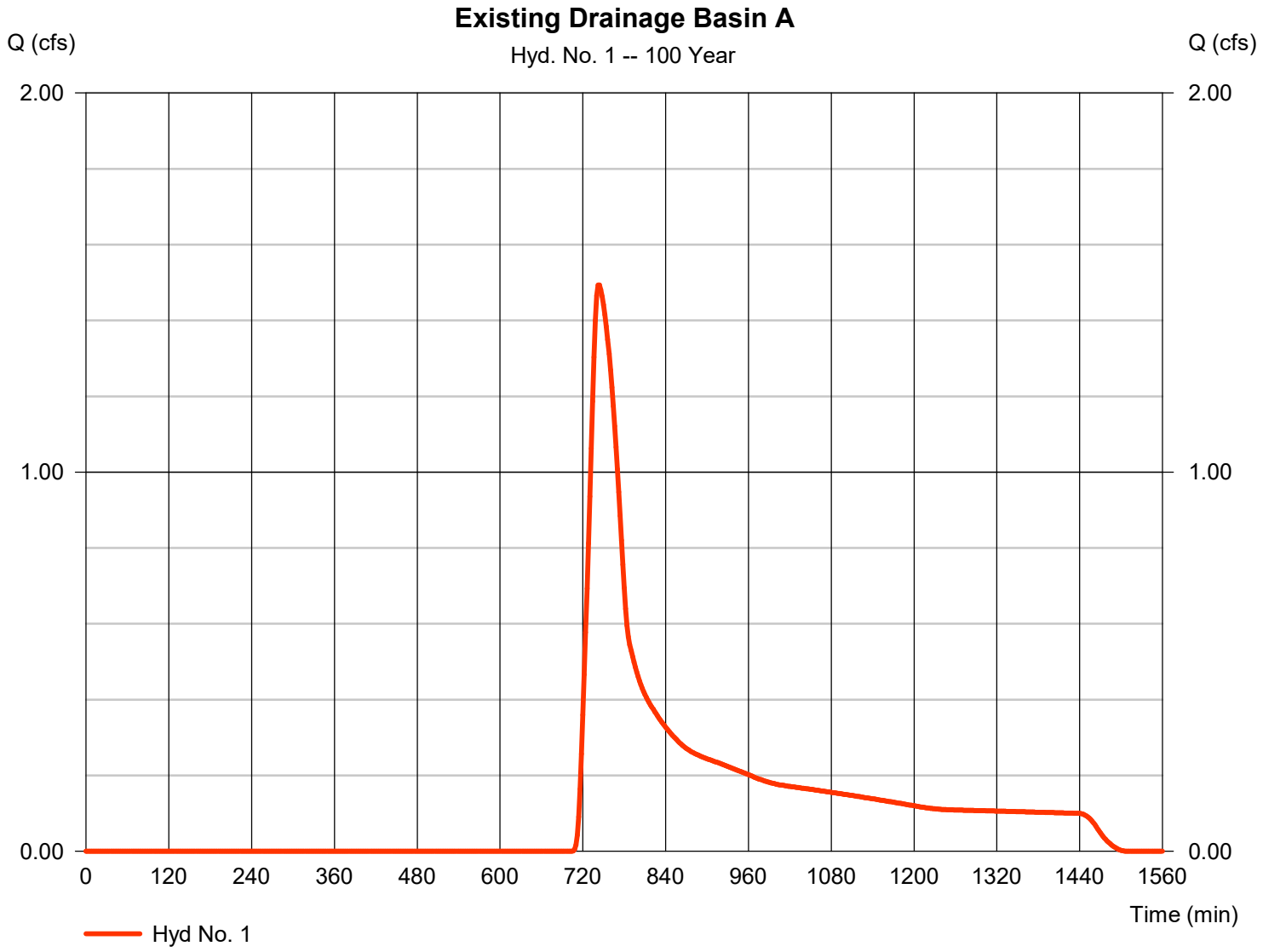
Hydrograph Report

Hyd. No. 1

Existing Drainage Basin A

Hydrograph type	=	SCS Runoff	Peak discharge	=	1.493 cfs
Storm frequency	=	100 yrs	Time to peak	=	744 min
Time interval	=	2 min	Hyd. volume	=	11,451 cuft
Drainage area	=	8.810 ac	Curve number	=	70*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	43.70 min
Total precip.	=	2.28 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(7.690 x 69) + (0.260 x 98)] / 8.810



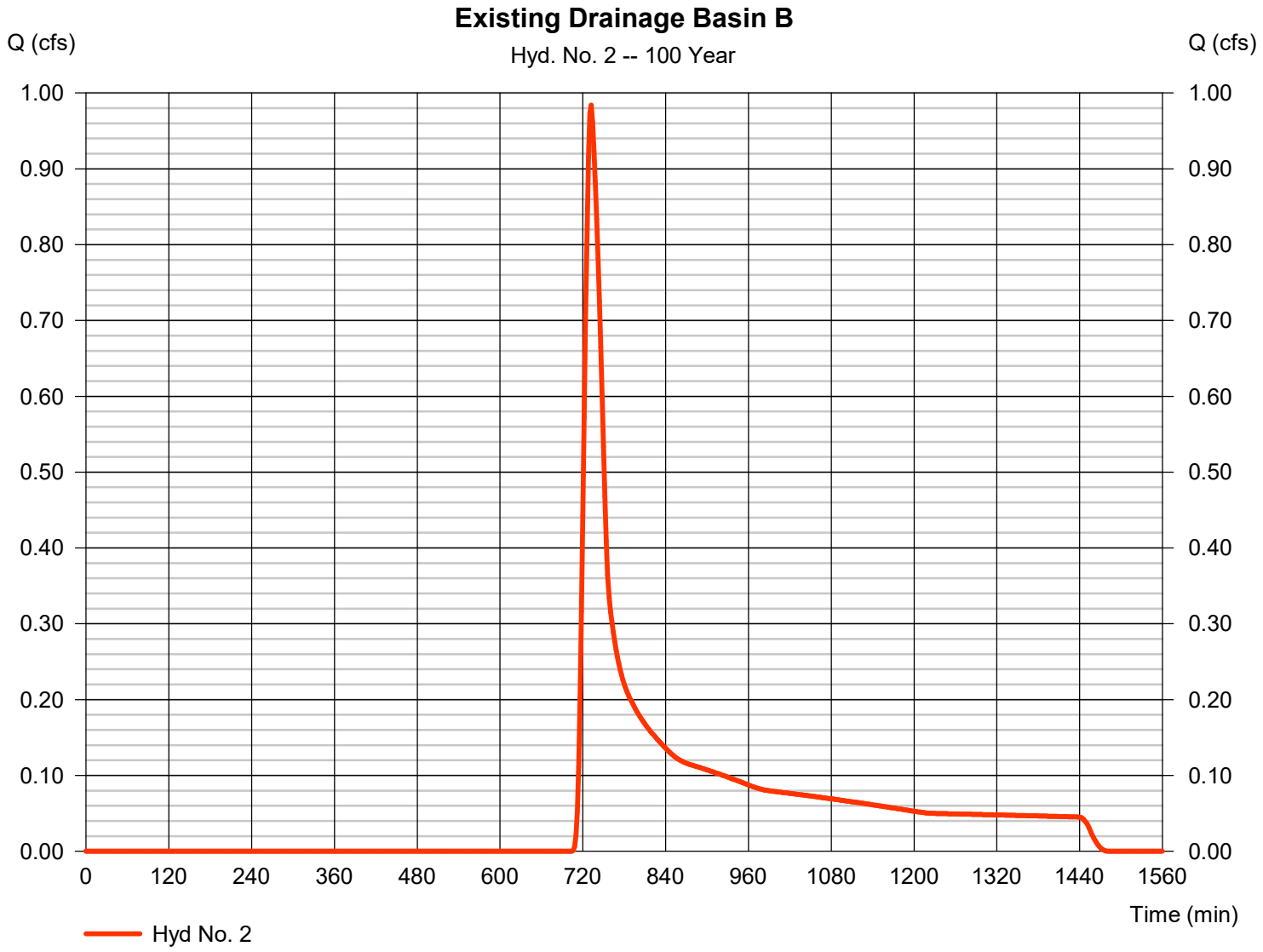
Hydrograph Report

Hyd. No. 2

Existing Drainage Basin B

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.984 cfs
Storm frequency	=	100 yrs	Time to peak	=	732 min
Time interval	=	2 min	Hyd. volume	=	5,208 cuft
Drainage area	=	4.110 ac	Curve number	=	70*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	26.40 min
Total precip.	=	2.28 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(4.010 x 69) + (0.080 x 98)] / 4.110



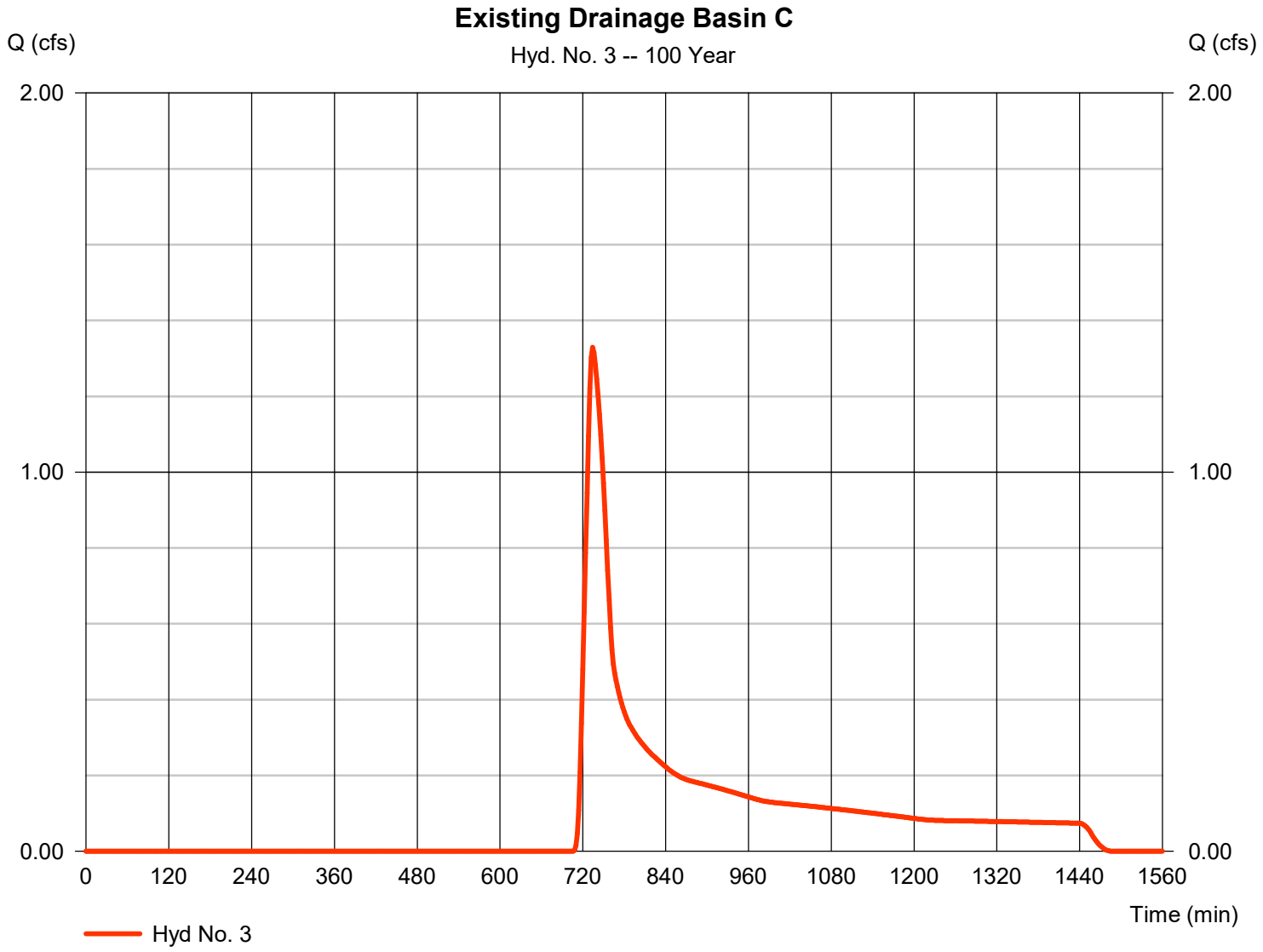
Hydrograph Report

Hyd. No. 3

Existing Drainage Basin C

Hydrograph type	=	SCS Runoff	Peak discharge	=	1.329 cfs
Storm frequency	=	100 yrs	Time to peak	=	734 min
Time interval	=	2 min	Hyd. volume	=	8,207 cuft
Drainage area	=	6.960 ac	Curve number	=	69*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	29.00 min
Total precip.	=	2.28 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(6.700 x 69)] / 6.960



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021

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	0.346	2	718	845	------	------	------	Post-Development Basin A
2	SCS Runoff	0.272	2	718	664	------	------	------	Post-Development Basin B
3	SCS Runoff	1.533	2	718	3,530	------	------	------	Post-Development Basin C
4	SCS Runoff	1.009	2	718	2,155	------	------	------	Post-Development Basin D
5	SCS Runoff	0.511	2	720	1,720	------	------	------	Post-Development Basin E
6	SCS Runoff	1.041	3	717	2,354	------	------	------	Post-Development Road Basin 1
7	SCS Runoff	0.868	2	716	1,760	------	------	------	Post-Development Road Basin 2
8	SCS Runoff	0.966	2	716	1,958	------	------	------	Post-Development Road Basin 3
9	SCS Runoff	0.688	2	716	1,406	------	------	------	Post-Development Road Basin 4
10	SCS Runoff	0.116	2	718	308	------	------	------	Trail Street Sub Basin
11	Reservoir	0.000	2	n/a	0	1	100.75	845	Pond A Routing
12	Reservoir	0.000	2	n/a	0	2	100.38	664	Pond B Routing
13	Reservoir	0.000	2	n/a	0	3	100.40	3,530	Pond C Routing
14	Reservoir	0.000	2	n/a	0	4	100.95	2,155	Pond D Routing
15	Reservoir	0.000	2	n/a	0	5	100.49	1,720	Pond E Routing
16	Reservoir	0.000	3	n/a	0	6	101.12	2,354	RB-1 Sump Routing
17	Reservoir	0.000	2	n/a	0	7	101.17	1,760	RB-2 Sump Routing
18	Reservoir	0.000	2	n/a	0	8	101.16	1,958	RB-3 Sump Routing
19	Reservoir	0.000	2	n/a	0	9	101.16	1,406	RB-4 Sump Routing
20	Reservoir	0.000	2	n/a	0	10	101.64	308	Trail Street Sump Rout

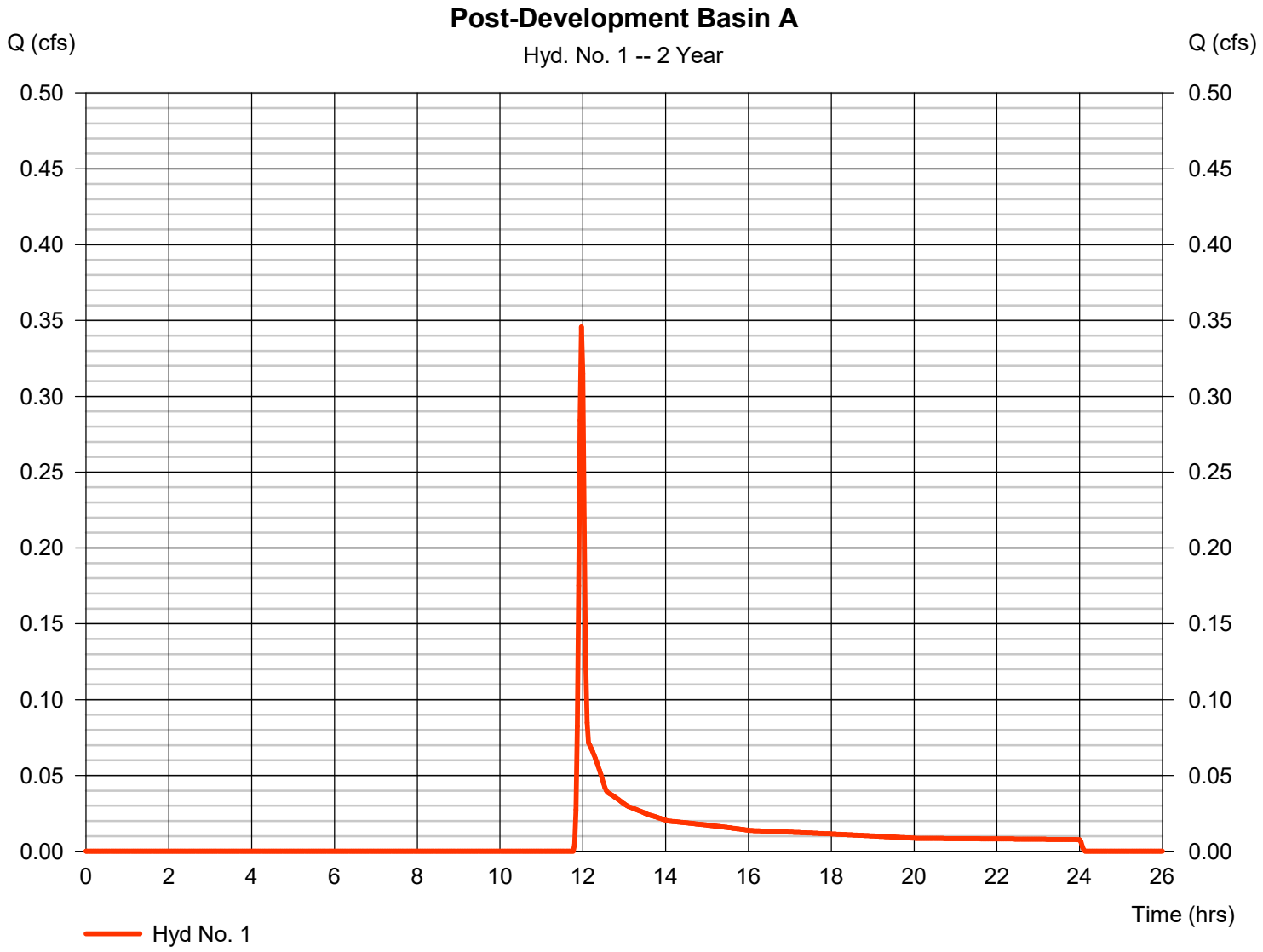
Hydrograph Report

Hyd. No. 1

Post-Development Basin A

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.346 cfs
Storm frequency	=	2 yrs	Time to peak	=	11.97 hrs
Time interval	=	2 min	Hyd. volume	=	845 cuft
Drainage area	=	1.540 ac	Curve number	=	81*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	1.17 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.940 x 98) + (0.780 x 61)] / 1.540



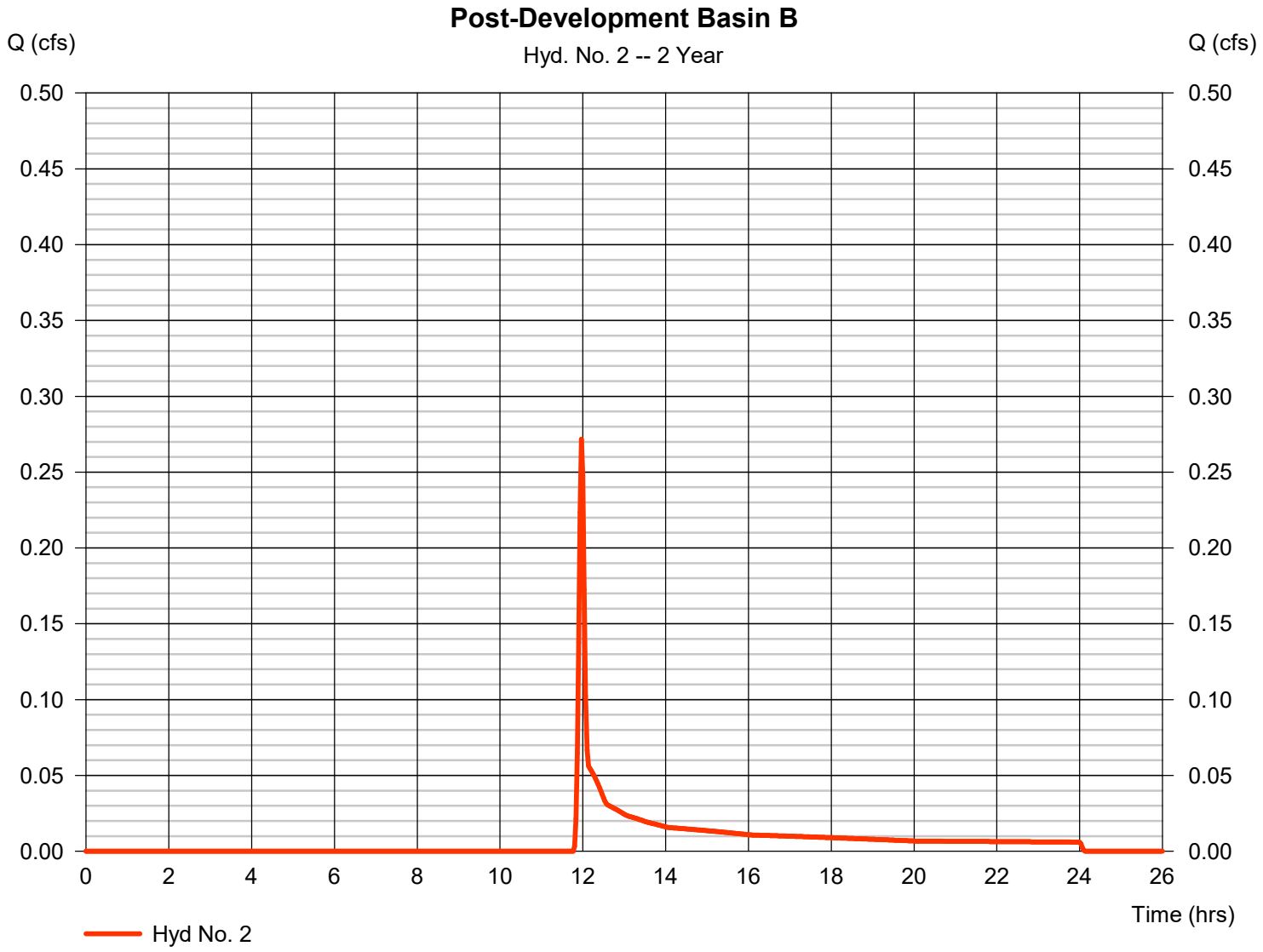
Hydrograph Report

Hyd. No. 2

Post-Development Basin B

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.272 cfs
Storm frequency	=	2 yrs	Time to peak	=	11.97 hrs
Time interval	=	2 min	Hyd. volume	=	664 cuft
Drainage area	=	1.210 ac	Curve number	=	81*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	1.17 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.660 x 98) + (0.550 x 61)] / 1.210



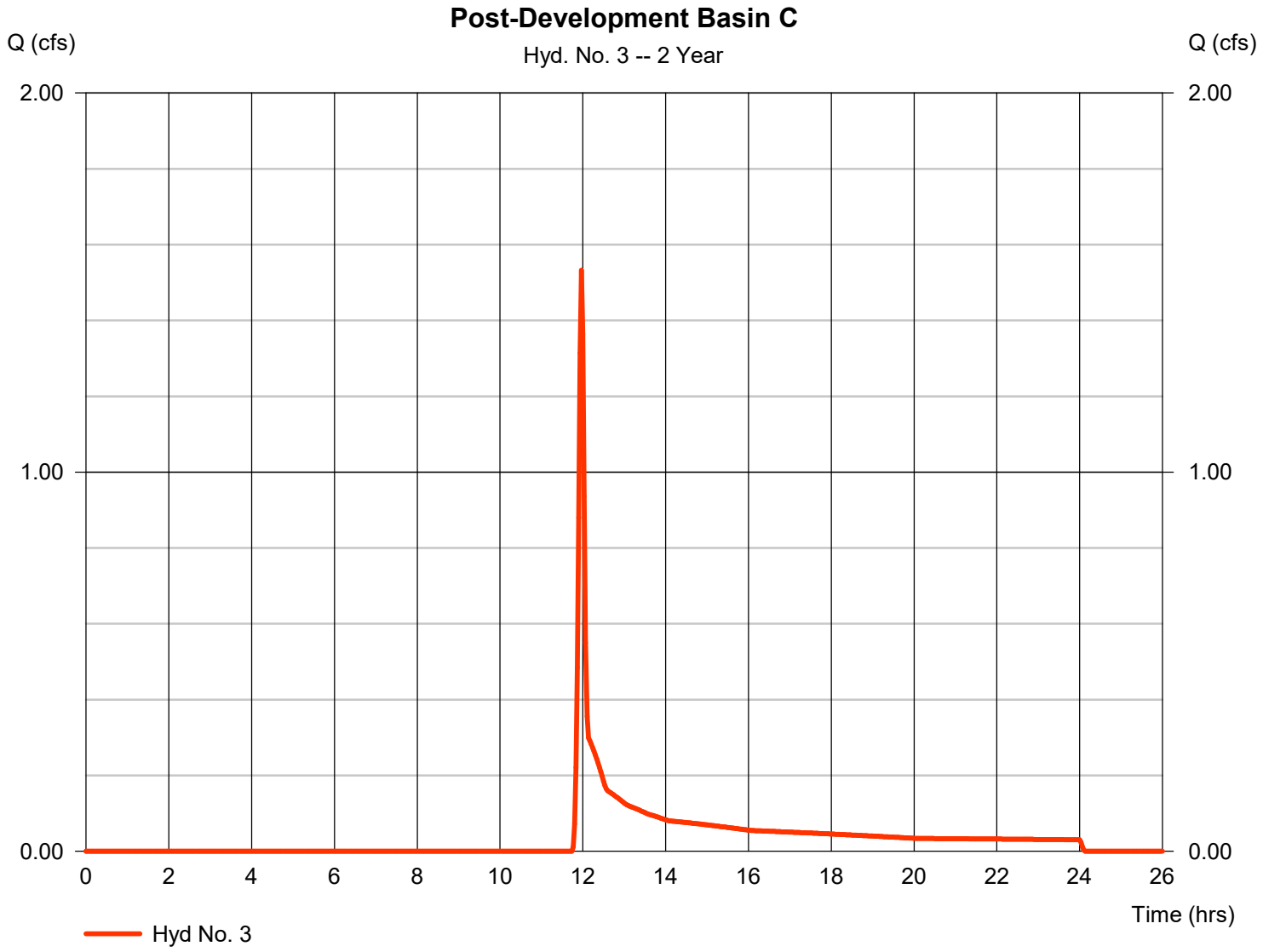
Hydrograph Report

Hyd. No. 3

Post-Development Basin C

Hydrograph type	=	SCS Runoff	Peak discharge	=	1.533 cfs
Storm frequency	=	2 yrs	Time to peak	=	11.97 hrs
Time interval	=	2 min	Hyd. volume	=	3,530 cuft
Drainage area	=	5.680 ac	Curve number	=	82*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	1.17 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(2.630 x 98) + (3.050 x 61)] / 5.680



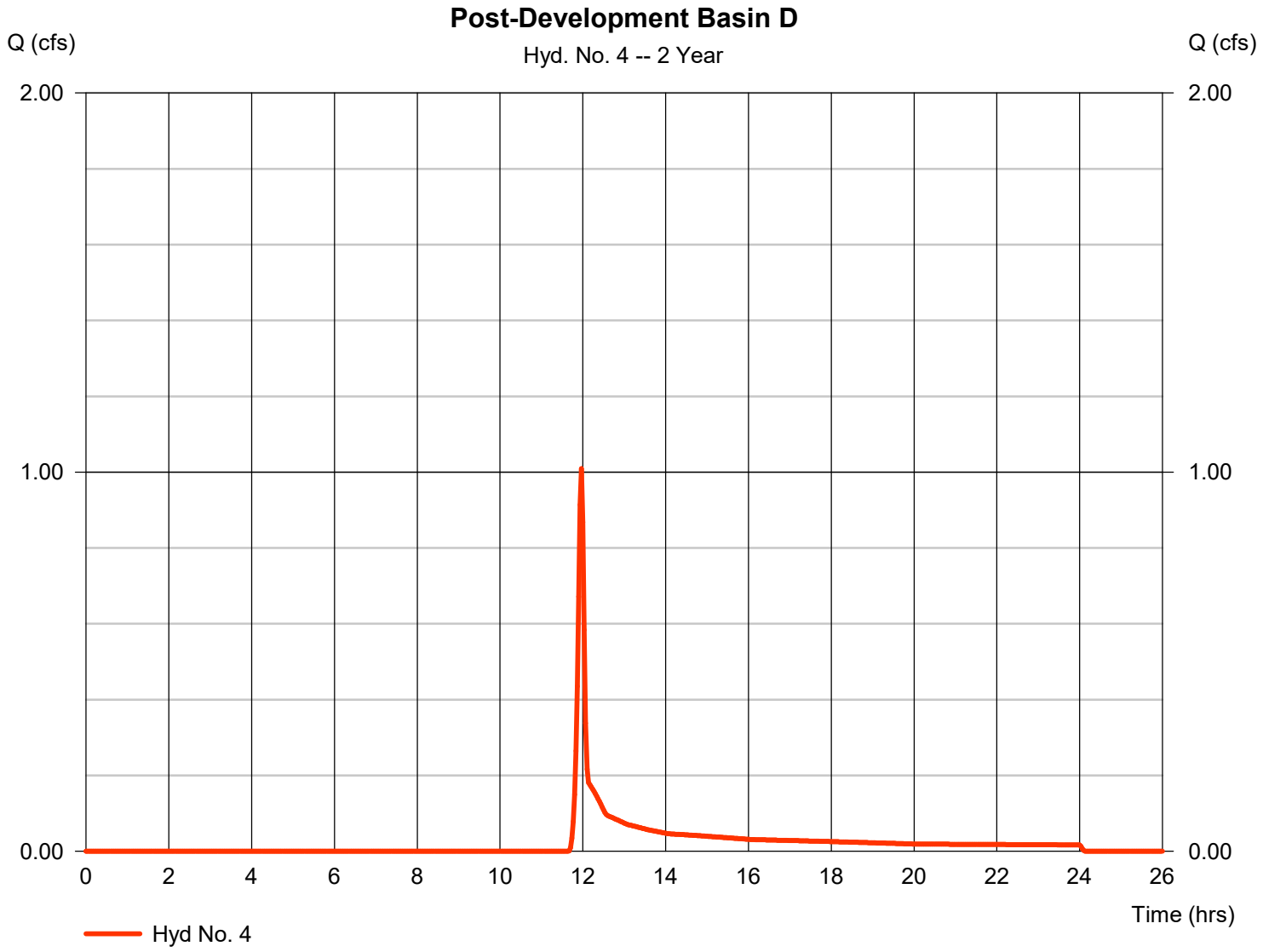
Hydrograph Report

Hyd. No. 4

Post-Development Basin D

Hydrograph type	=	SCS Runoff	Peak discharge	=	1.009 cfs
Storm frequency	=	2 yrs	Time to peak	=	11.97 hrs
Time interval	=	2 min	Hyd. volume	=	2,155 cuft
Drainage area	=	2.740 ac	Curve number	=	84*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	1.17 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(1.790 x 98) + (1.150 x 61)] / 2.740



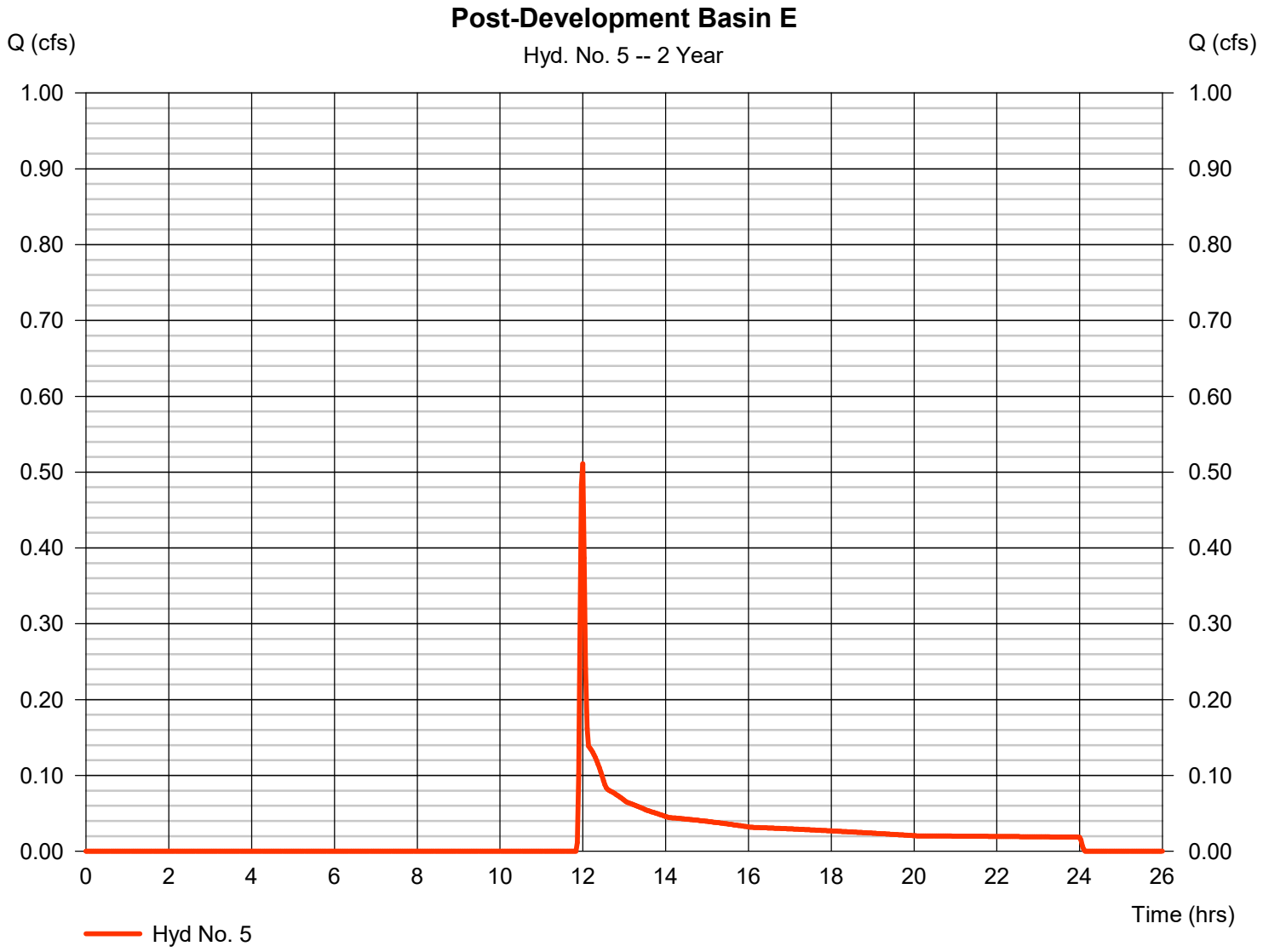
Hydrograph Report

Hyd. No. 5

Post-Development Basin E

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.511 cfs
Storm frequency	=	2 yrs	Time to peak	=	12.00 hrs
Time interval	=	2 min	Hyd. volume	=	1,720 cuft
Drainage area	=	4.720 ac	Curve number	=	78*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	1.17 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(2.170 x 98) + (2.550 x 61)] / 4.720



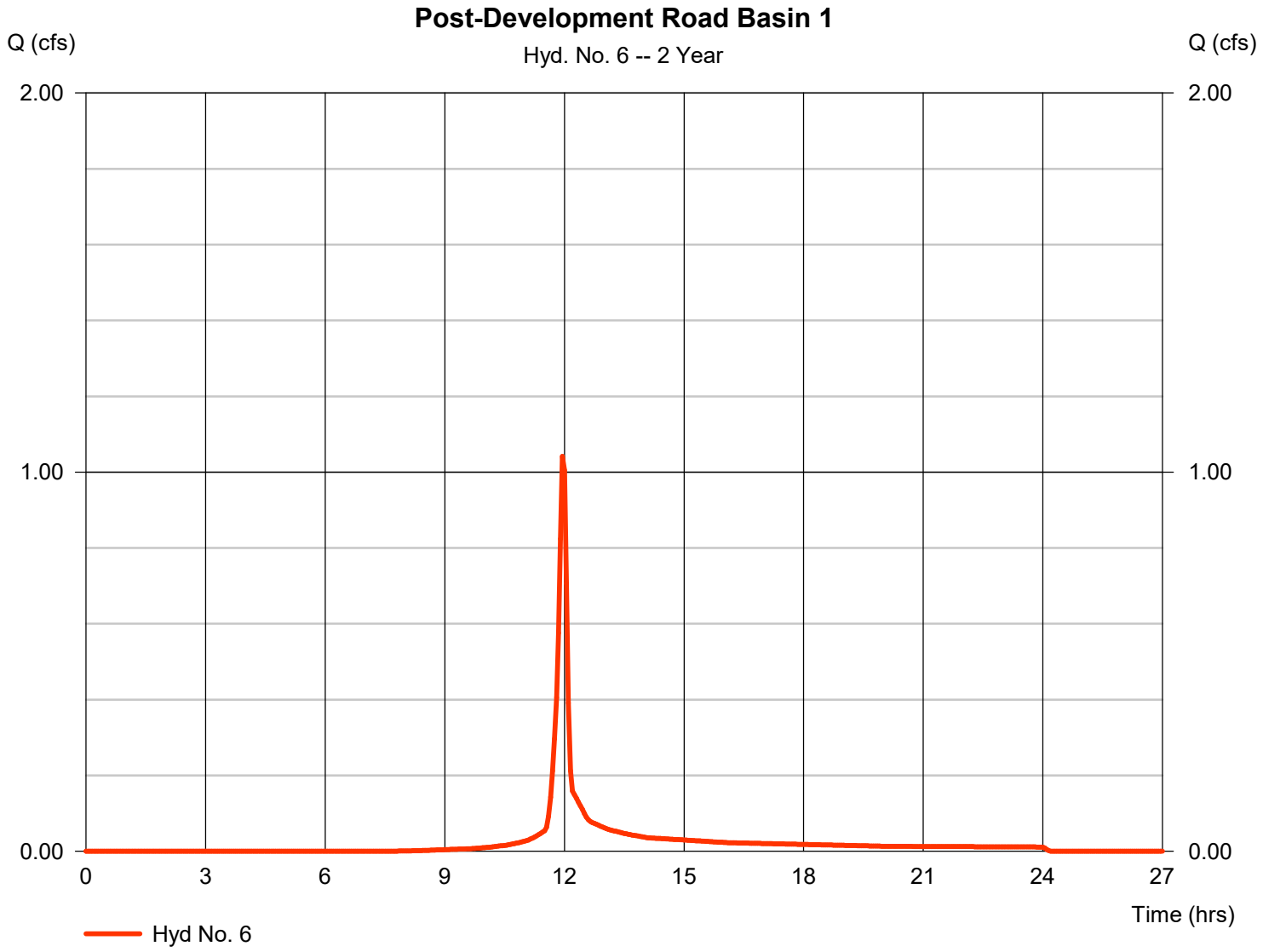
Hydrograph Report

Hyd. No. 6

Post-Development Road Basin 1

Hydrograph type	=	SCS Runoff	Peak discharge	=	1.041 cfs
Storm frequency	=	2 yrs	Time to peak	=	11.95 hrs
Time interval	=	3 min	Hyd. volume	=	2,354 cuft
Drainage area	=	1.070 ac	Curve number	=	94*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	1.17 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.880 x 98) + (0.190 x 61)] / 1.070



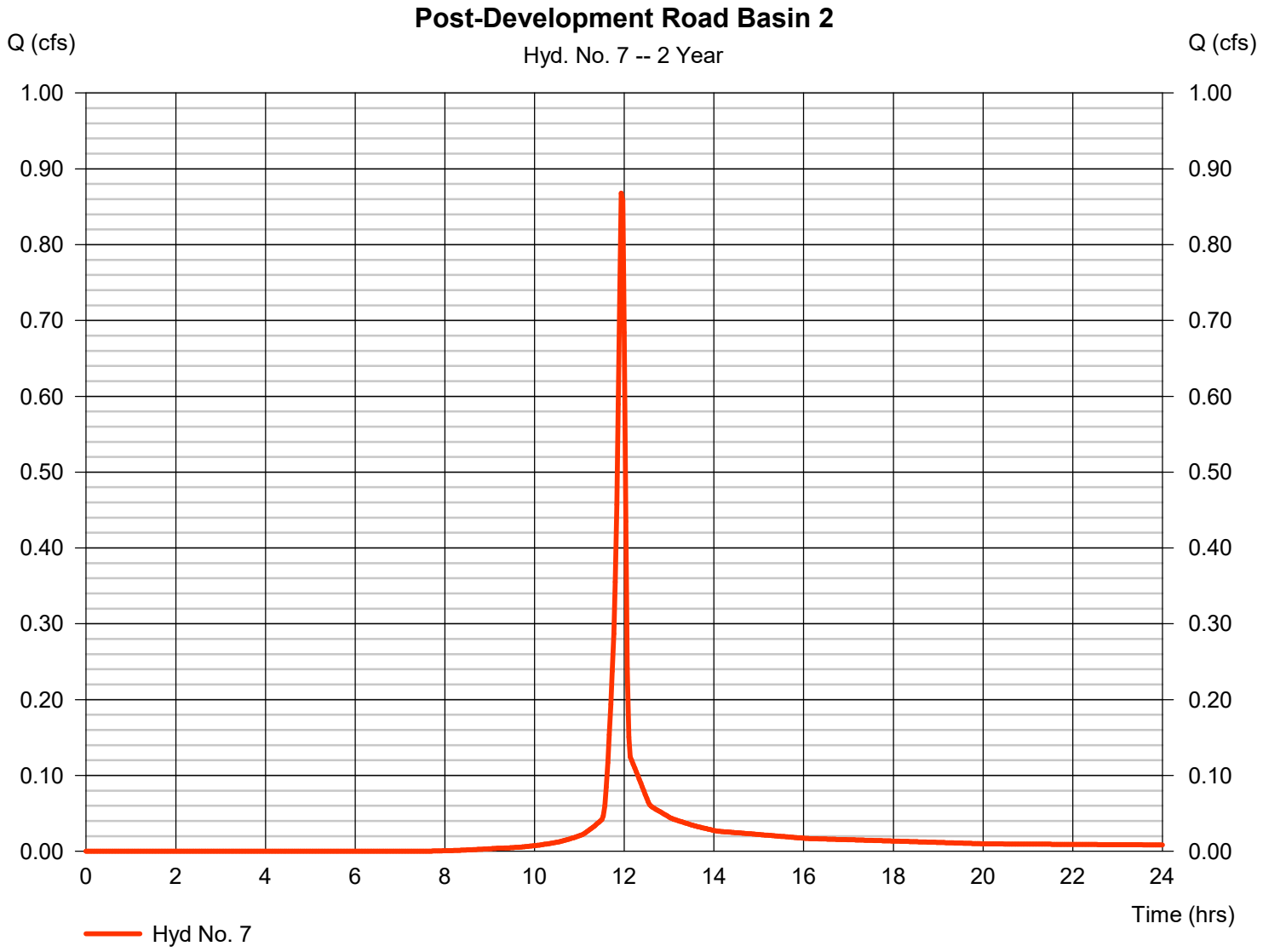
Hydrograph Report

Hyd. No. 7

Post-Development Road Basin 2

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.868 cfs
Storm frequency	=	2 yrs	Time to peak	=	11.93 hrs
Time interval	=	2 min	Hyd. volume	=	1,760 cuft
Drainage area	=	0.800 ac	Curve number	=	94*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	1.17 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.090 x 61) + (0.710 x 98)] / 0.800



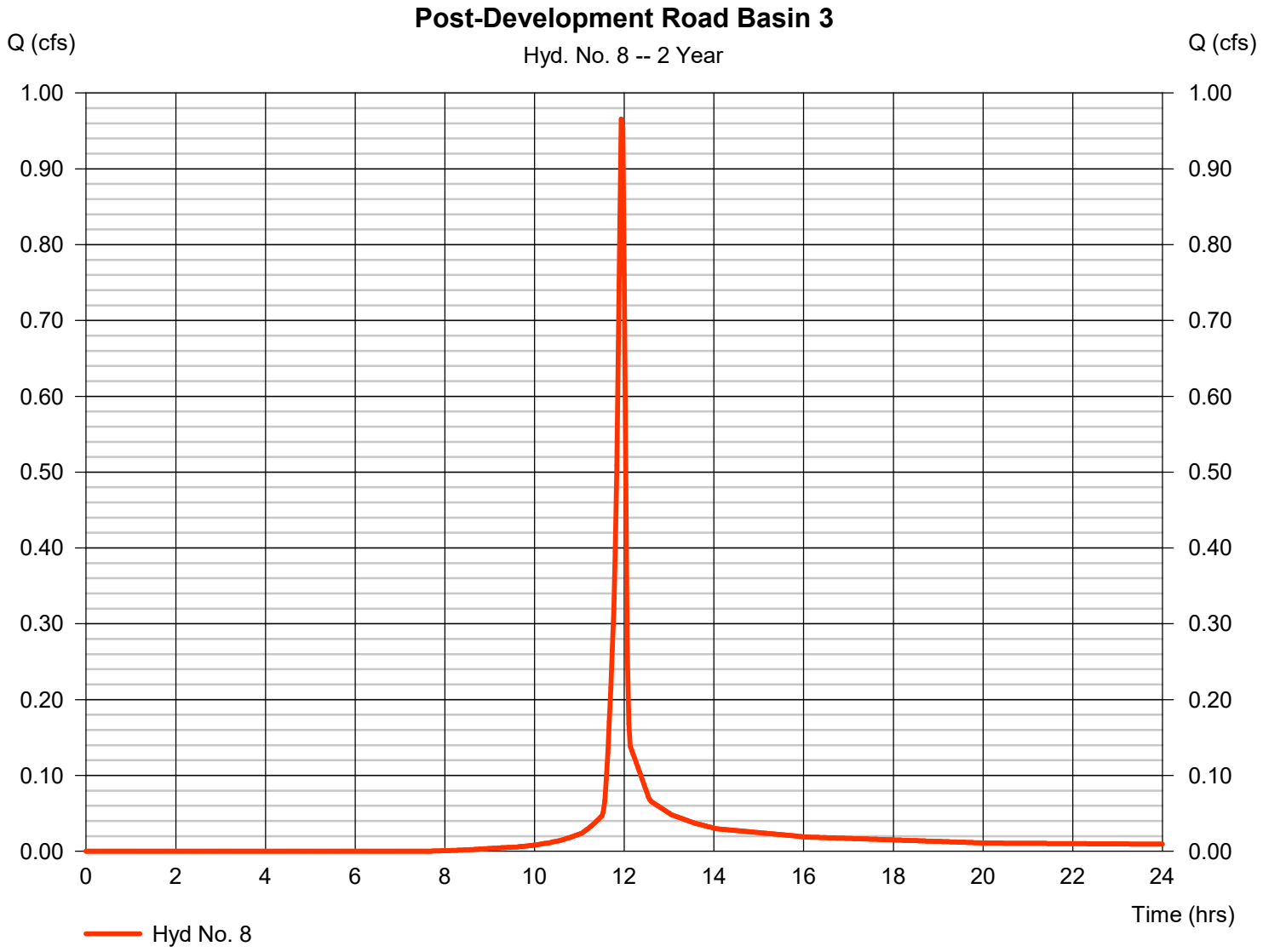
Hydrograph Report

Hyd. No. 8

Post-Development Road Basin 3

Hydrograph type	= SCS Runoff	Peak discharge	= 0.966 cfs
Storm frequency	= 2 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 1,958 cuft
Drainage area	= 0.890 ac	Curve number	= 94*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 1.17 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.790 x 98) + (0.100 x 61)] / 0.890



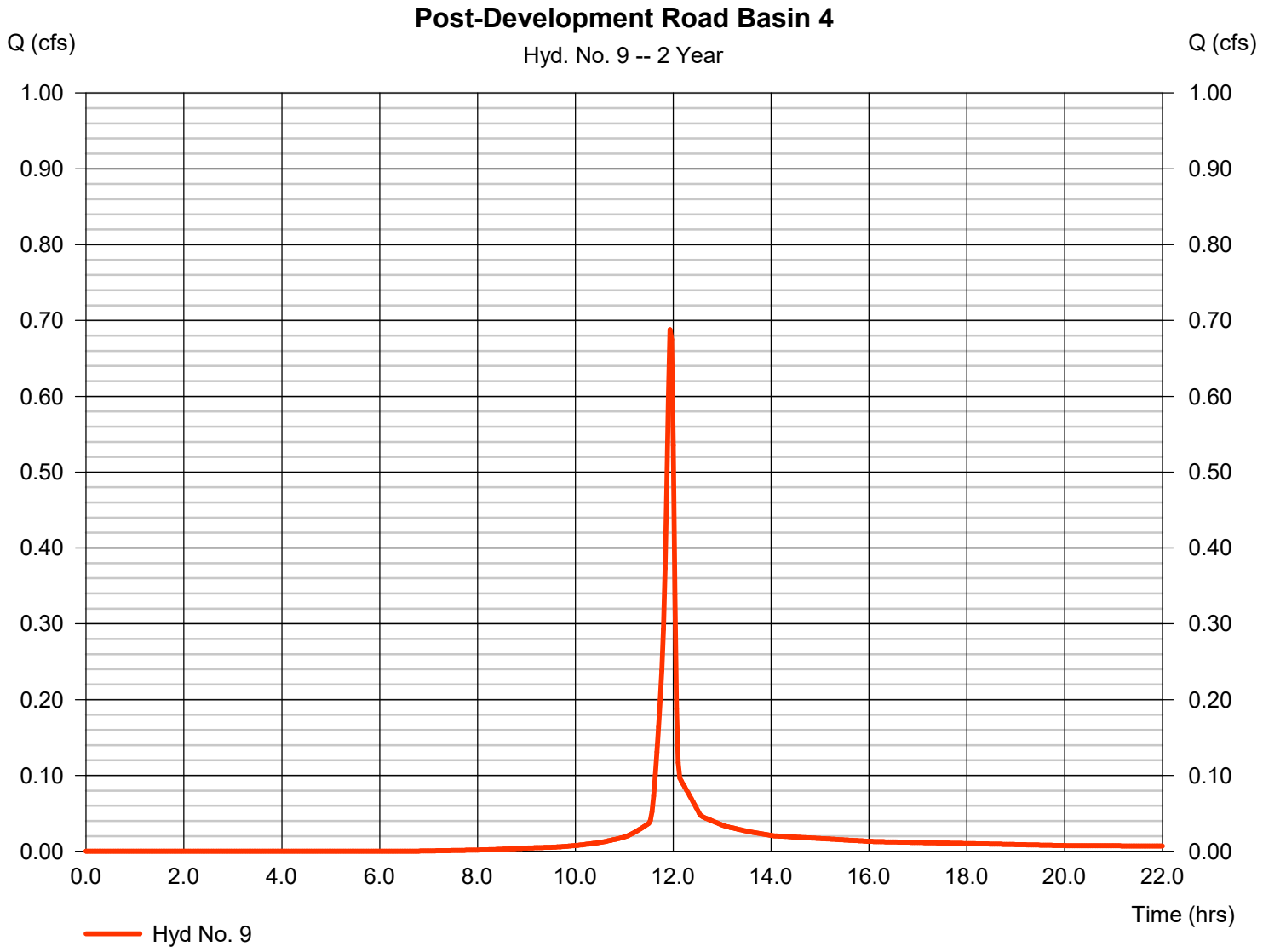
Hydrograph Report

Hyd. No. 9

Post-Development Road Basin 4

Hydrograph type	= SCS Runoff	Peak discharge	= 0.688 cfs
Storm frequency	= 2 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 1,406 cuft
Drainage area	= 0.580 ac	Curve number	= 95*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 1.17 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.530 x 98) + (0.050 x 61)] / 0.580



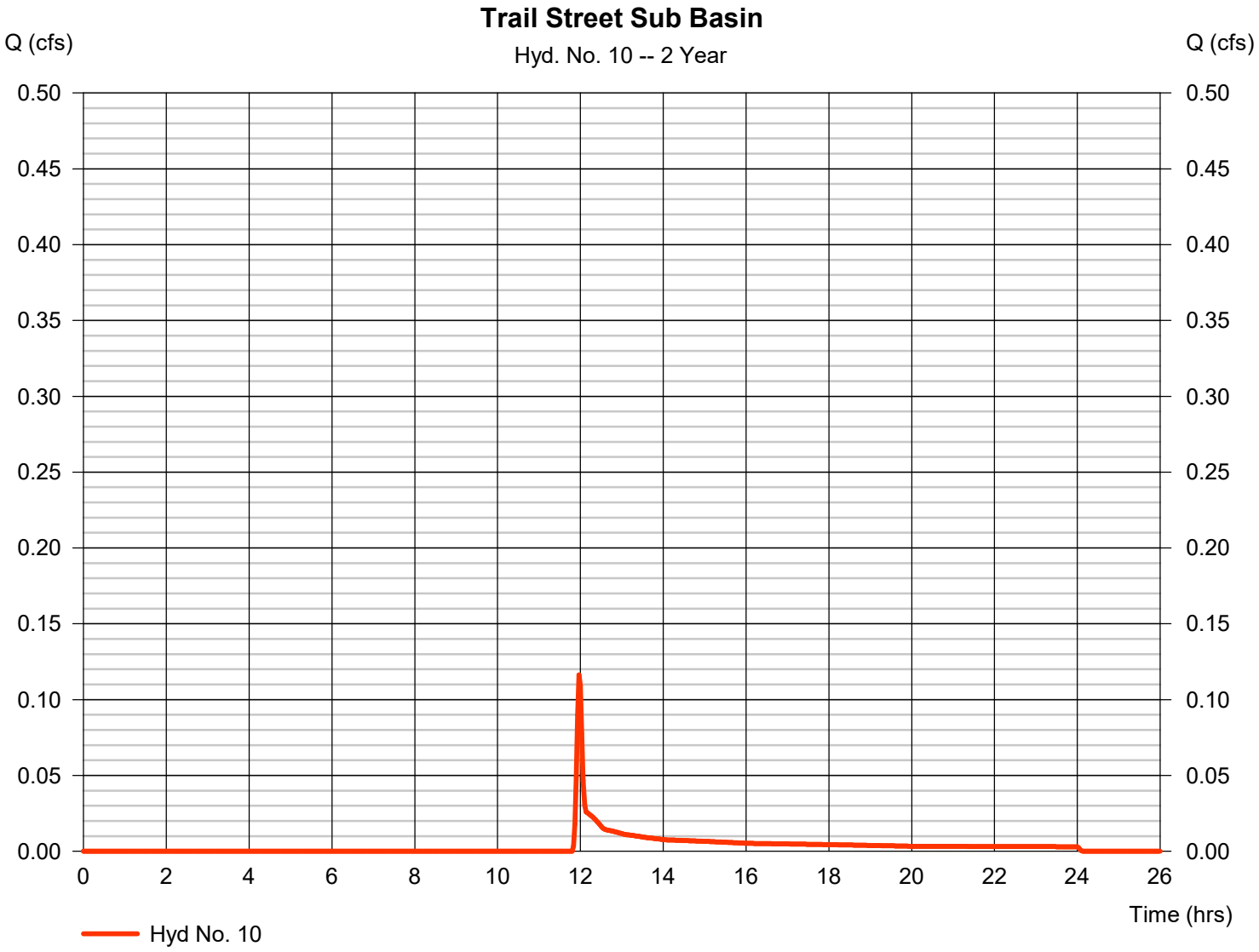
Hydrograph Report

Hyd. No. 10

Trail Street Sub Basin

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.116 cfs
Storm frequency	=	2 yrs	Time to peak	=	11.97 hrs
Time interval	=	2 min	Hyd. volume	=	308 cuft
Drainage area	=	0.640 ac	Curve number	=	80*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	1.17 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.330 x 98) + (0.310 x 61)] / 0.640



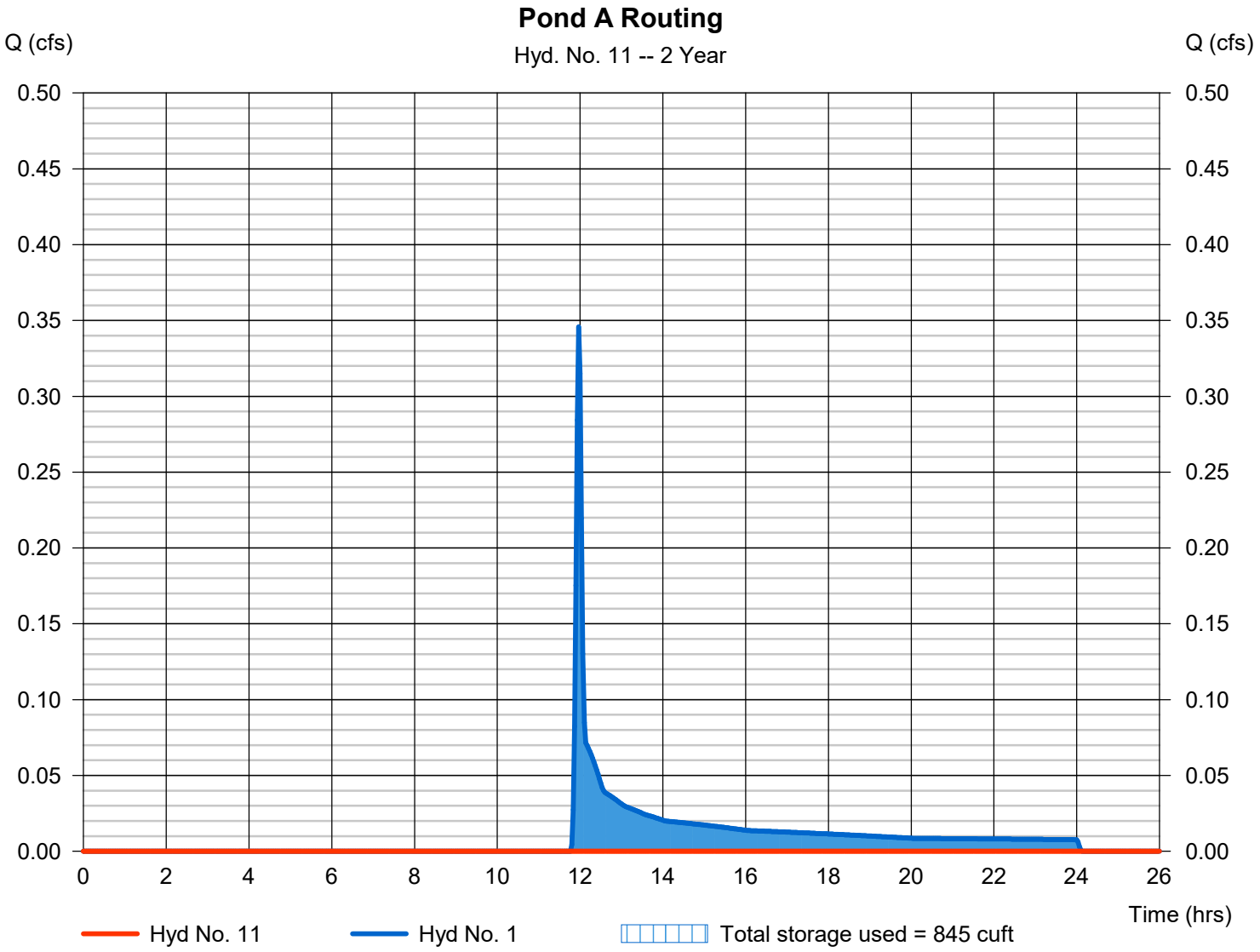
Hydrograph Report

Hyd. No. 11

Pond A Routing

Hydrograph type	=	Reservoir	Peak discharge	=	0.000 cfs
Storm frequency	=	2 yrs	Time to peak	=	n/a
Time interval	=	2 min	Hyd. volume	=	0 cuft
Inflow hyd. No.	=	1 - Post-Development Basin A	Max. Elevation	=	100.75 ft
Reservoir name	=	Basin A Pond	Max. Storage	=	845 cuft

Storage Indication method used.



Pond Report

Pond No. 1 - Basin A Pond

Pond Data

Pond storage is based on user-defined values.

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	100.00	n/a	0	0
1.00	101.00	n/a	1,125	1,125
2.00	102.00	n/a	1,125	2,250
2.10	102.10	n/a	5	2,255

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	Inactive	Inactive	0.00	0.00
Span (in)	= 12.00	4.00	0.00	0.00
No. Barrels	= 1	1	0	0
Invert El. (ft)	= 100.00	101.00	0.00	0.00
Length (ft)	= 20.00	20.00	0.00	0.00
Slope (%)	= 1.00	1.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	Yes	No	No

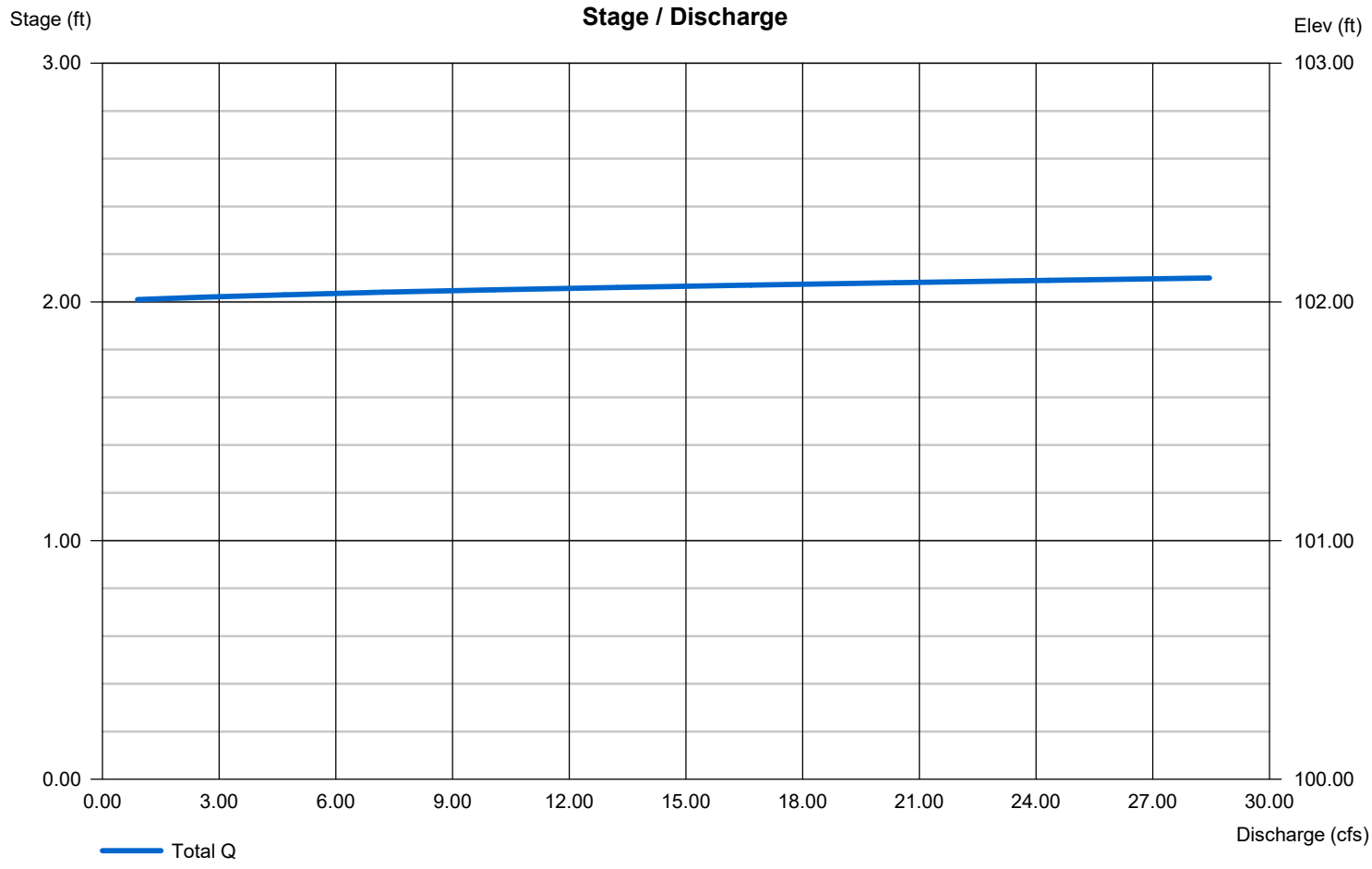
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 10.00	0.00	0.00	0.00
Crest El. (ft)	= 102.00	0.00	0.00	0.00
Weir Coeff.	= 90.00	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).



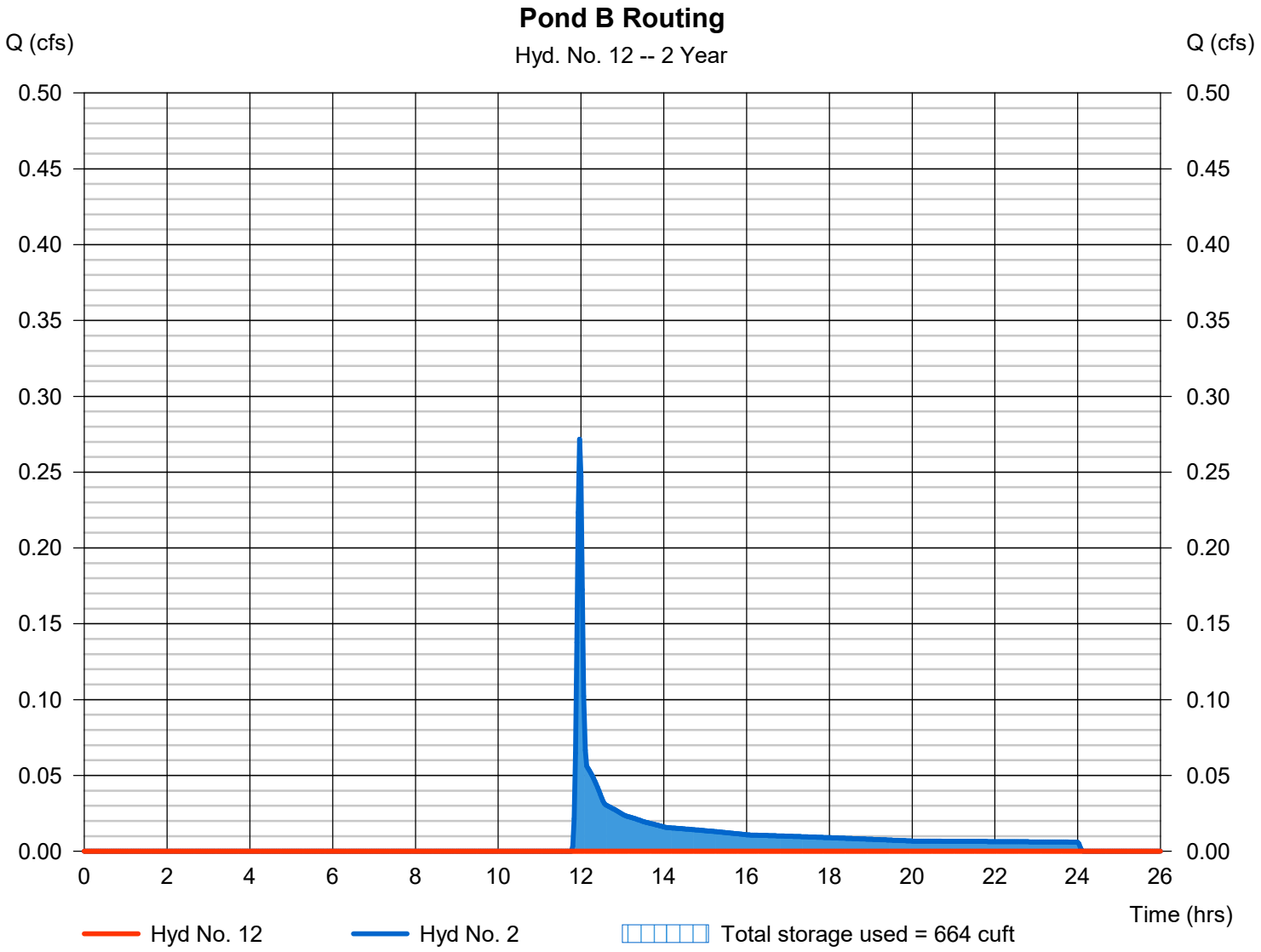
Hydrograph Report

Hyd. No. 12

Pond B Routing

Hydrograph type	=	Reservoir	Peak discharge	=	0.000 cfs
Storm frequency	=	2 yrs	Time to peak	=	n/a
Time interval	=	2 min	Hyd. volume	=	0 cuft
Inflow hyd. No.	=	2 - Post-Development Basin B	Max. Elevation	=	100.38 ft
Reservoir name	=	Basin B Pond	Max. Storage	=	664 cuft

Storage Indication method used.



Pond Report

Pond No. 2 - Basin B Pond

Pond Data

Pond storage is based on user-defined values.

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	100.00	n/a	0	0
1.00	101.00	n/a	1,750	1,750
2.00	102.00	n/a	1,710	3,460
2.10	103.00	n/a	5	3,465

Culvert / Orifice Structures

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

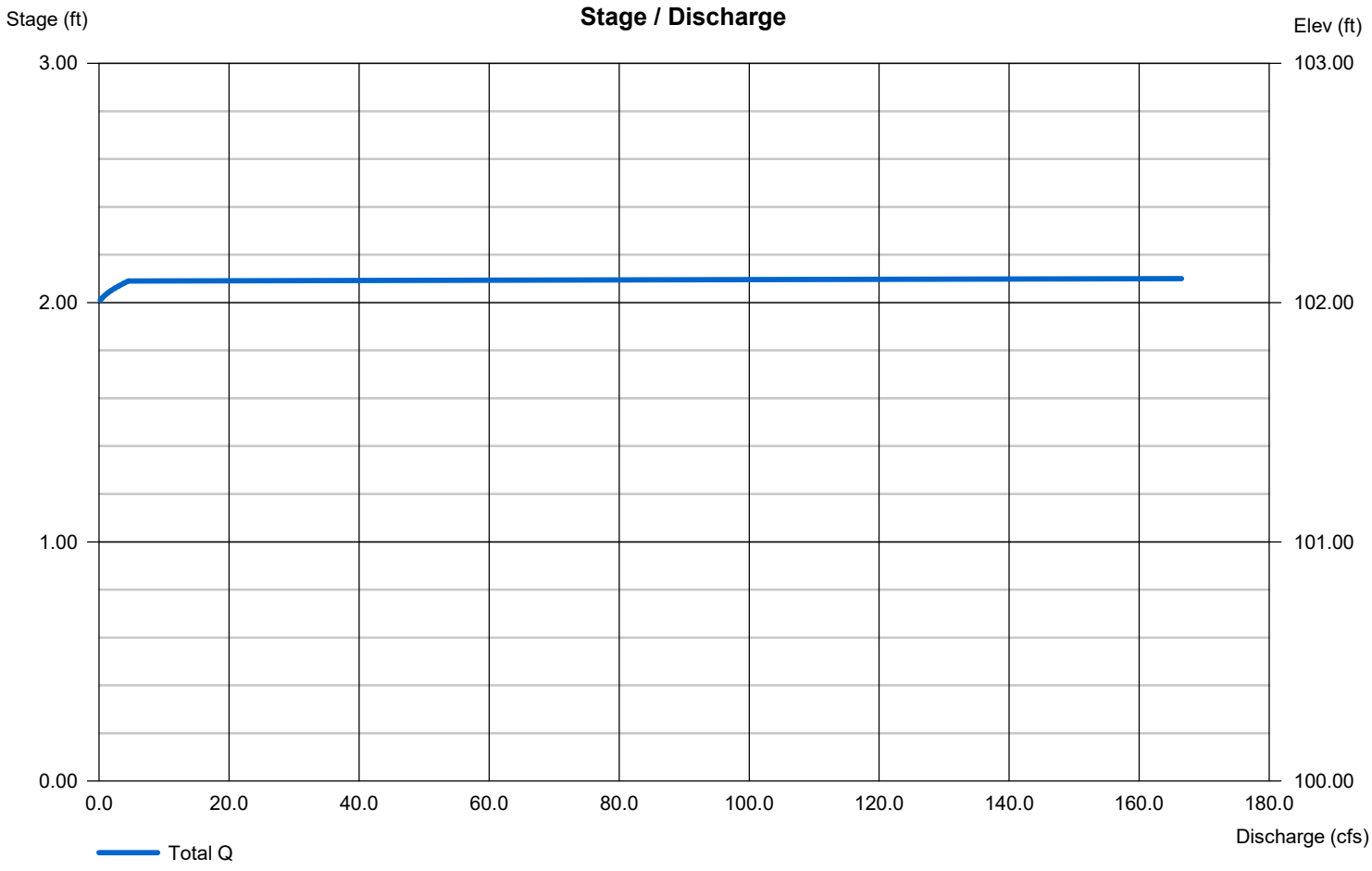
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 50.00	0.00	0.00	0.00
Crest El. (ft)	= 102.00	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= Rect	---	---	---
Multi-Stage	= No	No	No	No

Exfil.(in/hr) = 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).



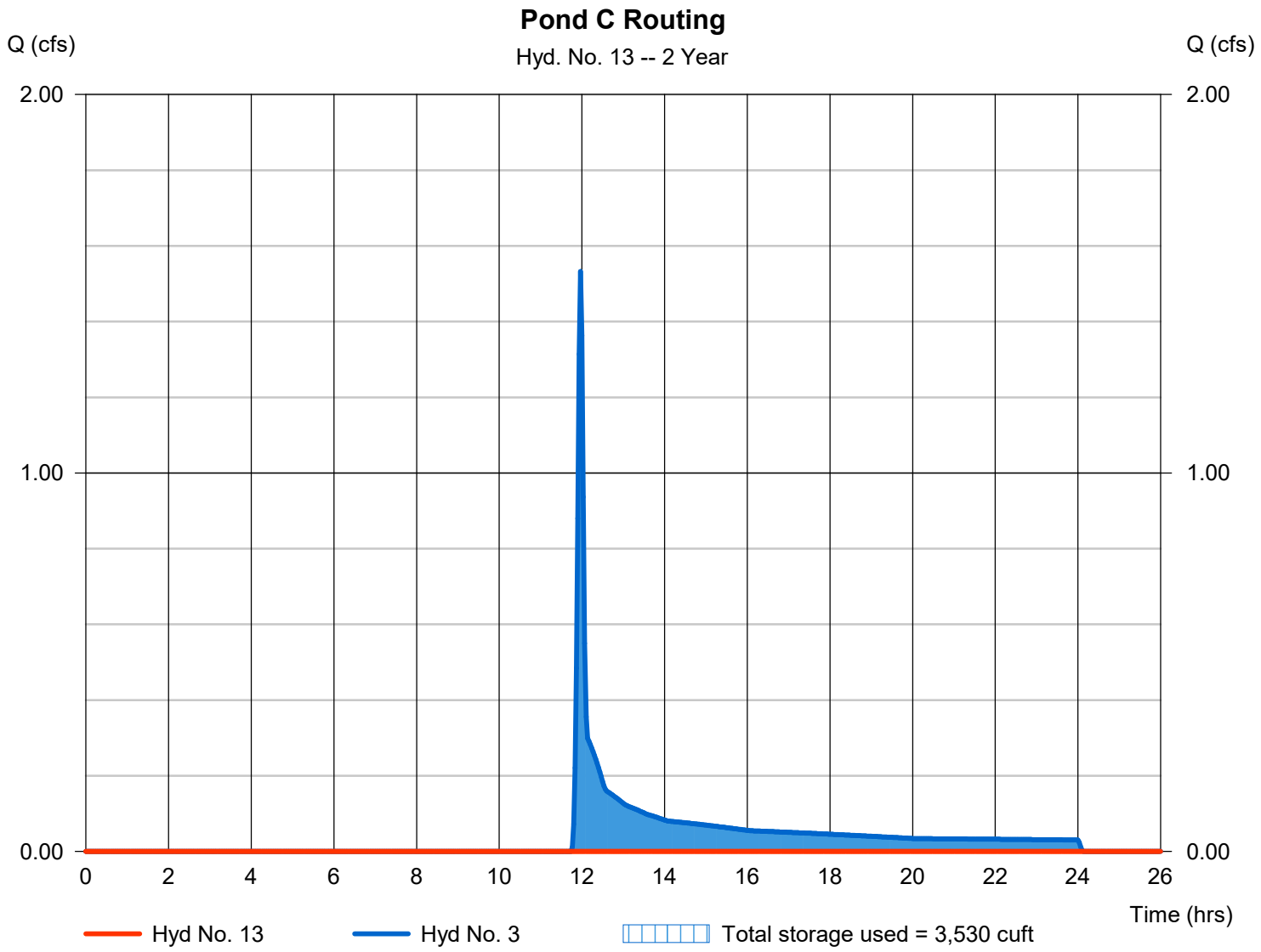
Hydrograph Report

Hyd. No. 13

Pond C Routing

Hydrograph type	=	Reservoir	Peak discharge	=	0.000 cfs
Storm frequency	=	2 yrs	Time to peak	=	n/a
Time interval	=	2 min	Hyd. volume	=	0 cuft
Inflow hyd. No.	=	3 - Post-Development Basin C	Max. Elevation	=	100.40 ft
Reservoir name	=	Basin C Pond	Max. Storage	=	3,530 cuft

Storage Indication method used.



Pond Report

Pond No. 3 - Basin C Pond

Pond Data

Pond storage is based on user-defined values.

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	100.00	n/a	0	0
1.00	101.00	n/a	8,792	8,792
2.00	102.00	n/a	7,472	16,264
2.10	103.00	n/a	86	16,350

Culvert / Orifice Structures

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

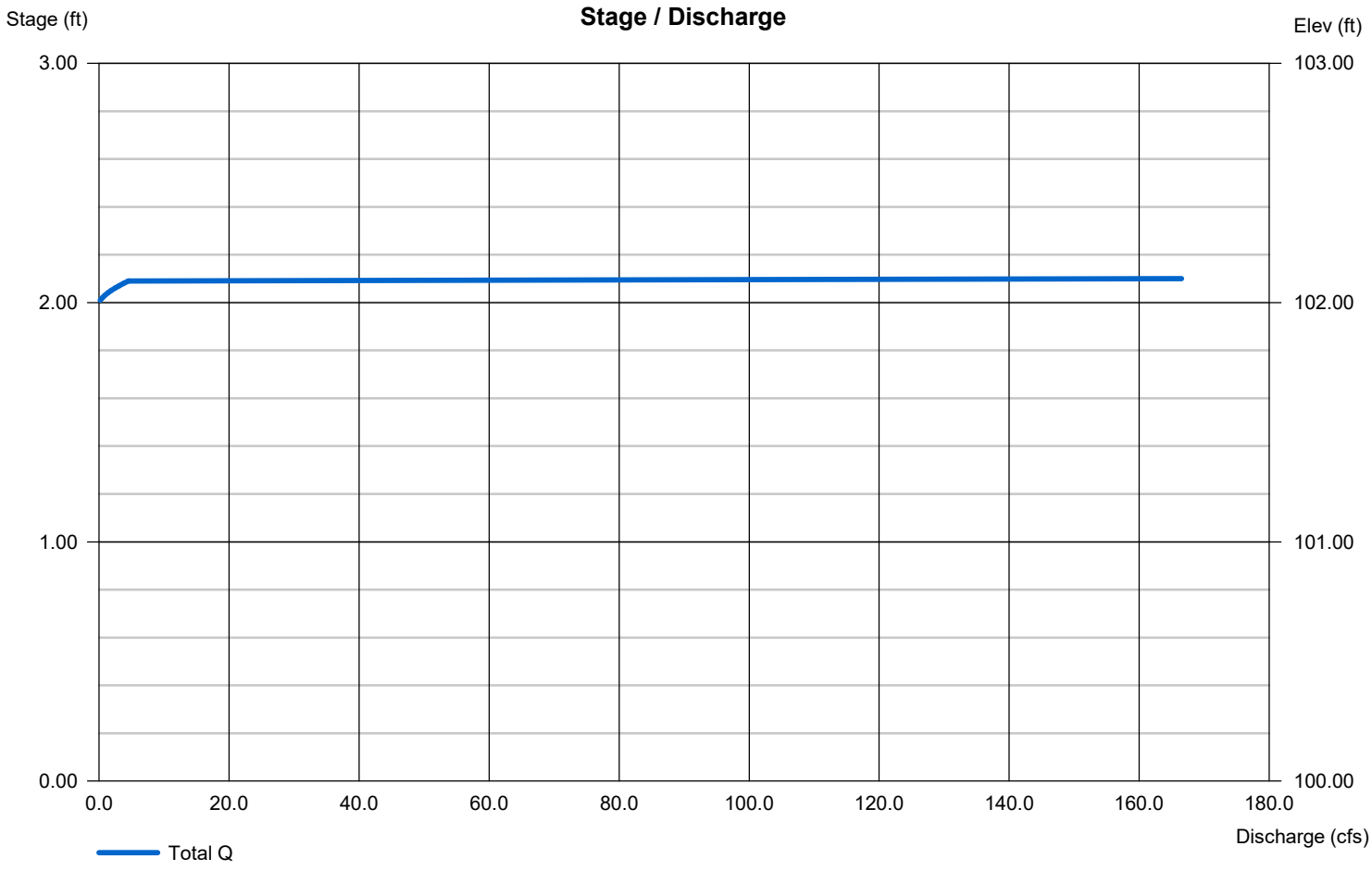
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 50.00	0.00	0.00	0.00
Crest El. (ft)	= 102.00	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= Rect	---	---	---
Multi-Stage	= No	No	No	No

Exfil.(in/hr) = 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).



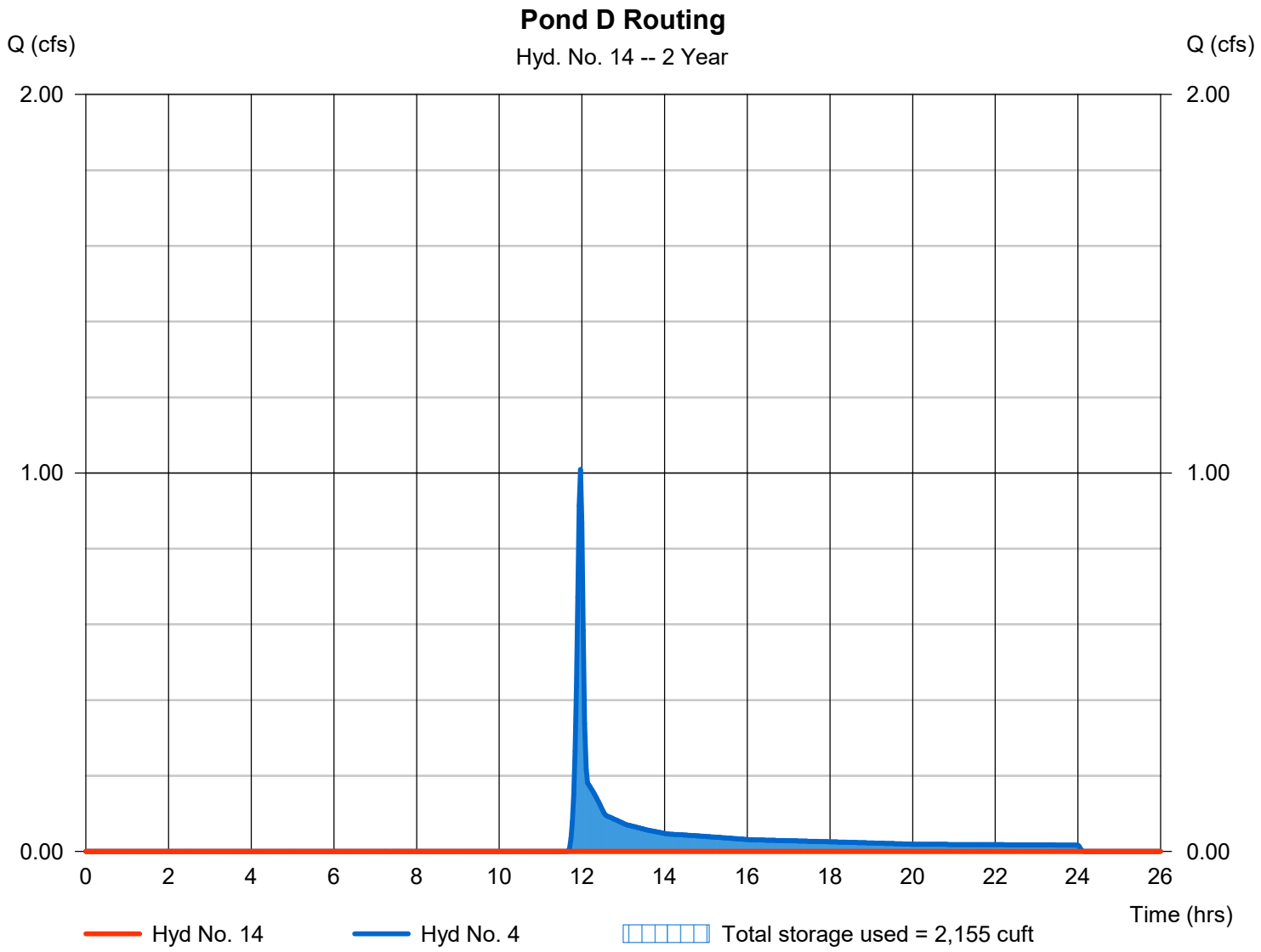
Hydrograph Report

Hyd. No. 14

Pond D Routing

Hydrograph type	=	Reservoir	Peak discharge	=	0.000 cfs
Storm frequency	=	2 yrs	Time to peak	=	n/a
Time interval	=	2 min	Hyd. volume	=	0 cuft
Inflow hyd. No.	=	4 - Post-Development Basin D	Max. Elevation	=	100.95 ft
Reservoir name	=	Basin D Pond	Max. Storage	=	2,155 cuft

Storage Indication method used.



Pond Report

Pond No. 4 - Basin D Pond

Pond Data

Pond storage is based on user-defined values.

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	100.00	n/a	0	0
1.00	101.00	n/a	2,268	2,268
2.00	102.00	n/a	3,048	5,316
2.10	102.10	n/a	4	5,320

Culvert / Orifice Structures

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

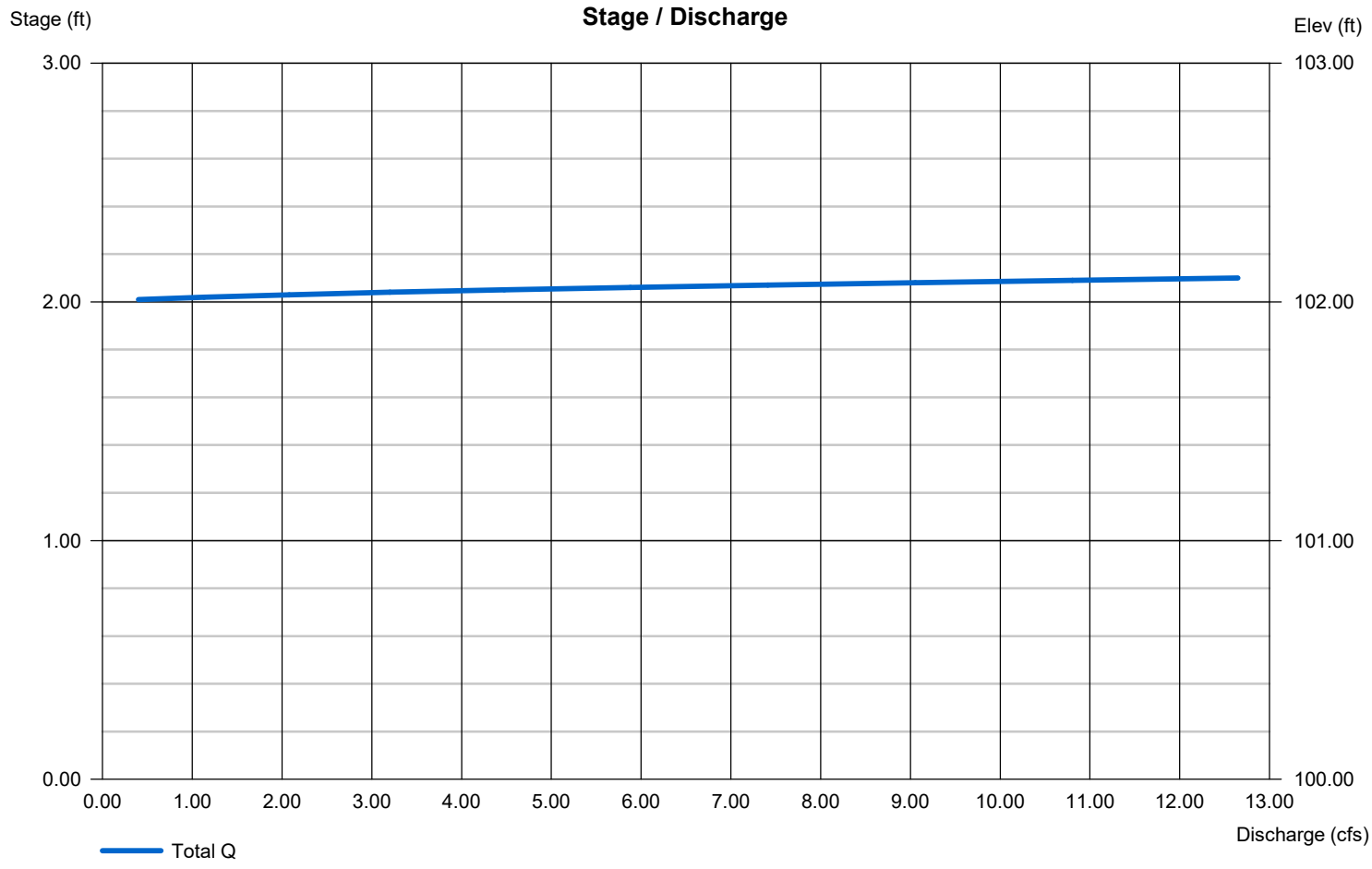
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 50.00	0.00	0.00	0.00
Crest El. (ft)	= 102.00	0.00	0.00	0.00
Weir Coeff.	= 8.00	3.33	3.33	3.33
Weir Type	= Rect	---	---	---
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).



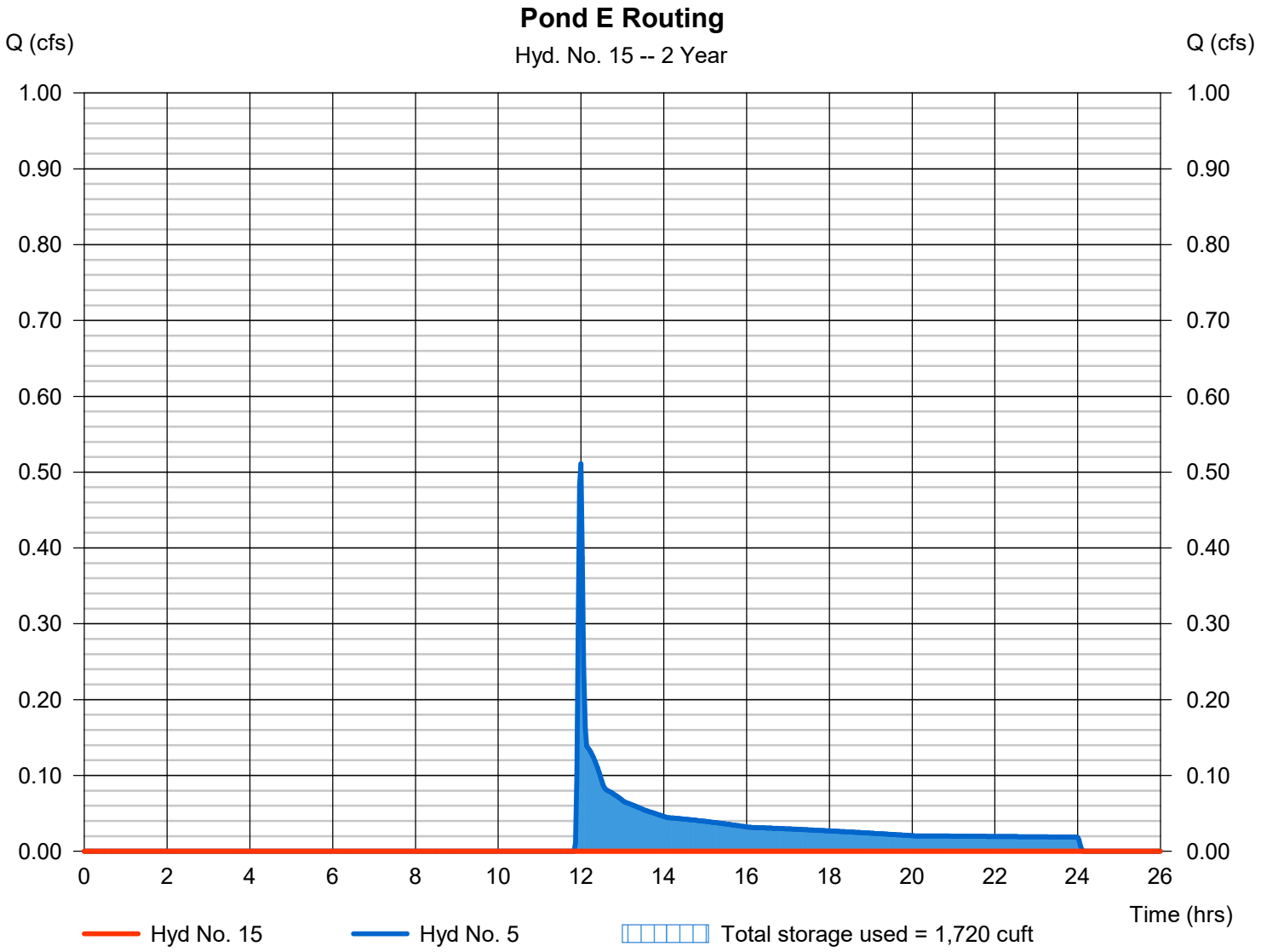
Hydrograph Report

Hyd. No. 15

Pond E Routing

Hydrograph type	=	Reservoir	Peak discharge	=	0.000 cfs
Storm frequency	=	2 yrs	Time to peak	=	n/a
Time interval	=	2 min	Hyd. volume	=	0 cuft
Inflow hyd. No.	=	5 - Post-Development Basin E	Max. Elevation	=	100.49 ft
Reservoir name	=	Basin E Pond	Max. Storage	=	1,720 cuft

Storage Indication method used.



Pond Report

Pond No. 5 - Basin E Pond

Pond Data

Pond storage is based on user-defined values.

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	100.00	n/a	0	0
1.00	101.00	n/a	3,500	3,500
2.00	102.00	n/a	3,184	6,684
2.10	102.10	n/a	6	6,690

Culvert / Orifice Structures

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

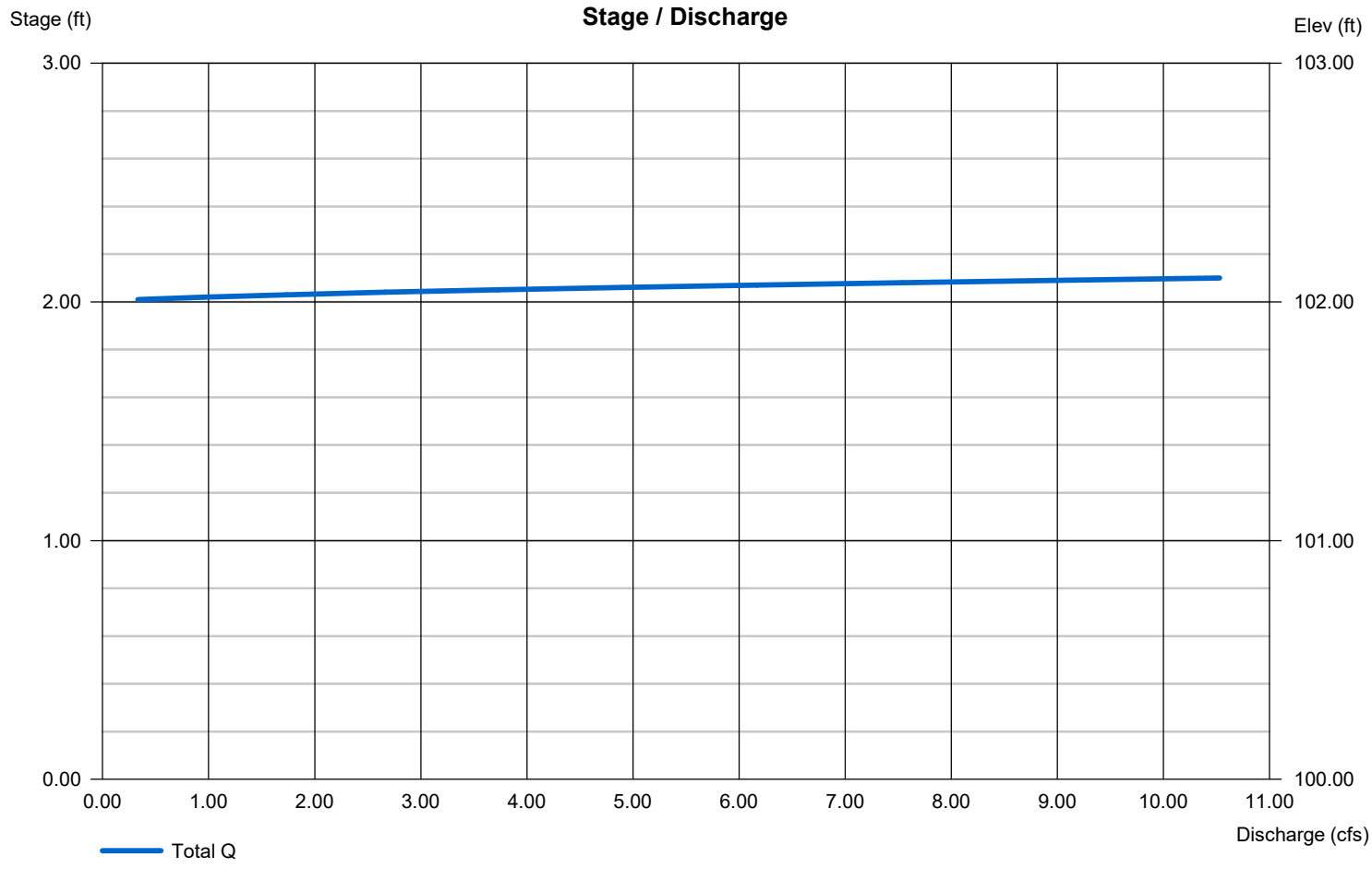
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 100.00	0.00	0.00	0.00
Crest El. (ft)	= 102.00	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= Rect	---	---	---
Multi-Stage	= No	No	No	No

Exfil.(in/hr) = 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).



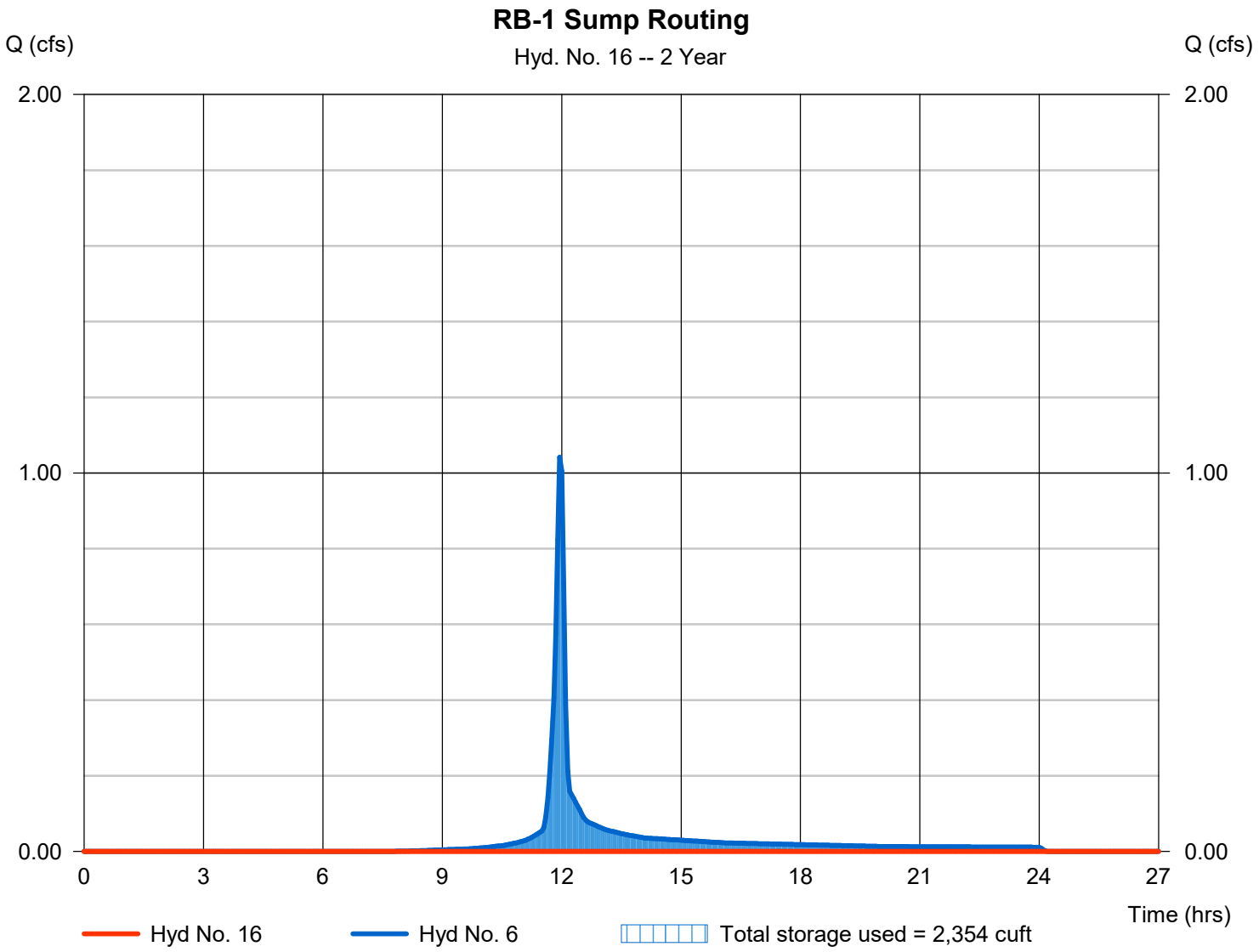
Hydrograph Report

Hyd. No. 16

RB-1 Sump Routing

Hydrograph type	=	Reservoir	Peak discharge	=	0.000 cfs
Storm frequency	=	2 yrs	Time to peak	=	n/a
Time interval	=	3 min	Hyd. volume	=	0 cuft
Inflow hyd. No.	=	6 - Post-Development Road Basin 1	Max. Elevation	=	101.12 ft
Reservoir name	=	RB-1 Pond	Max. Storage	=	2,354 cuft

Storage Indication method used.



Pond No. 6 - RB-1 Pond

Pond Data

Pond storage is based on user-defined values.

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	100.00	n/a	0	0
1.00	101.00	n/a	2,100	2,100
2.00	102.00	n/a	2,109	4,209
2.10	102.10	n/a	6	4,215

Culvert / Orifice Structures

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

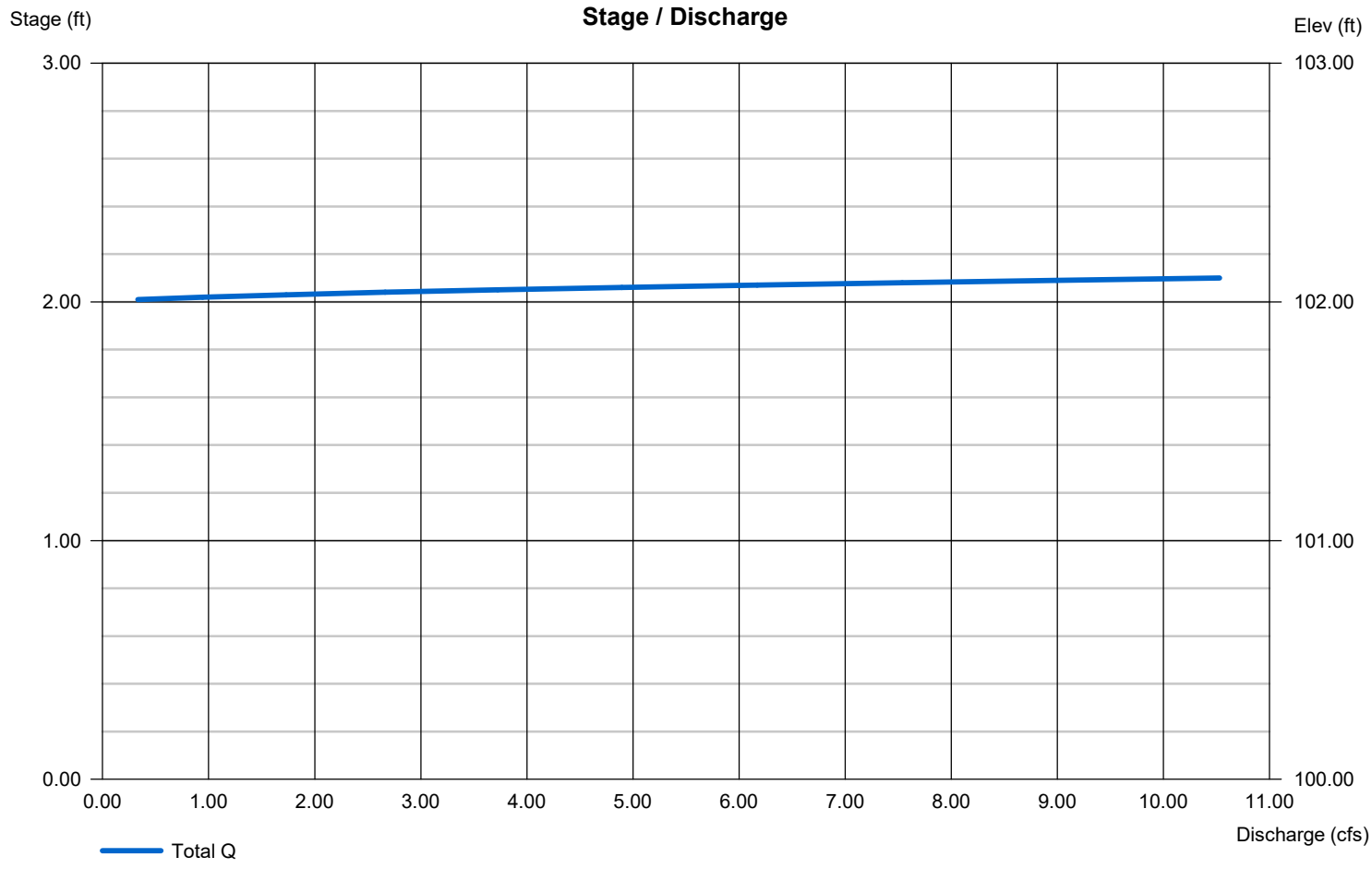
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 100.00	0.00	0.00	0.00
Crest El. (ft)	= 102.00	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= Rect	---	---	---
Multi-Stage	= No	No	No	No

Exfil.(in/hr) = 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).



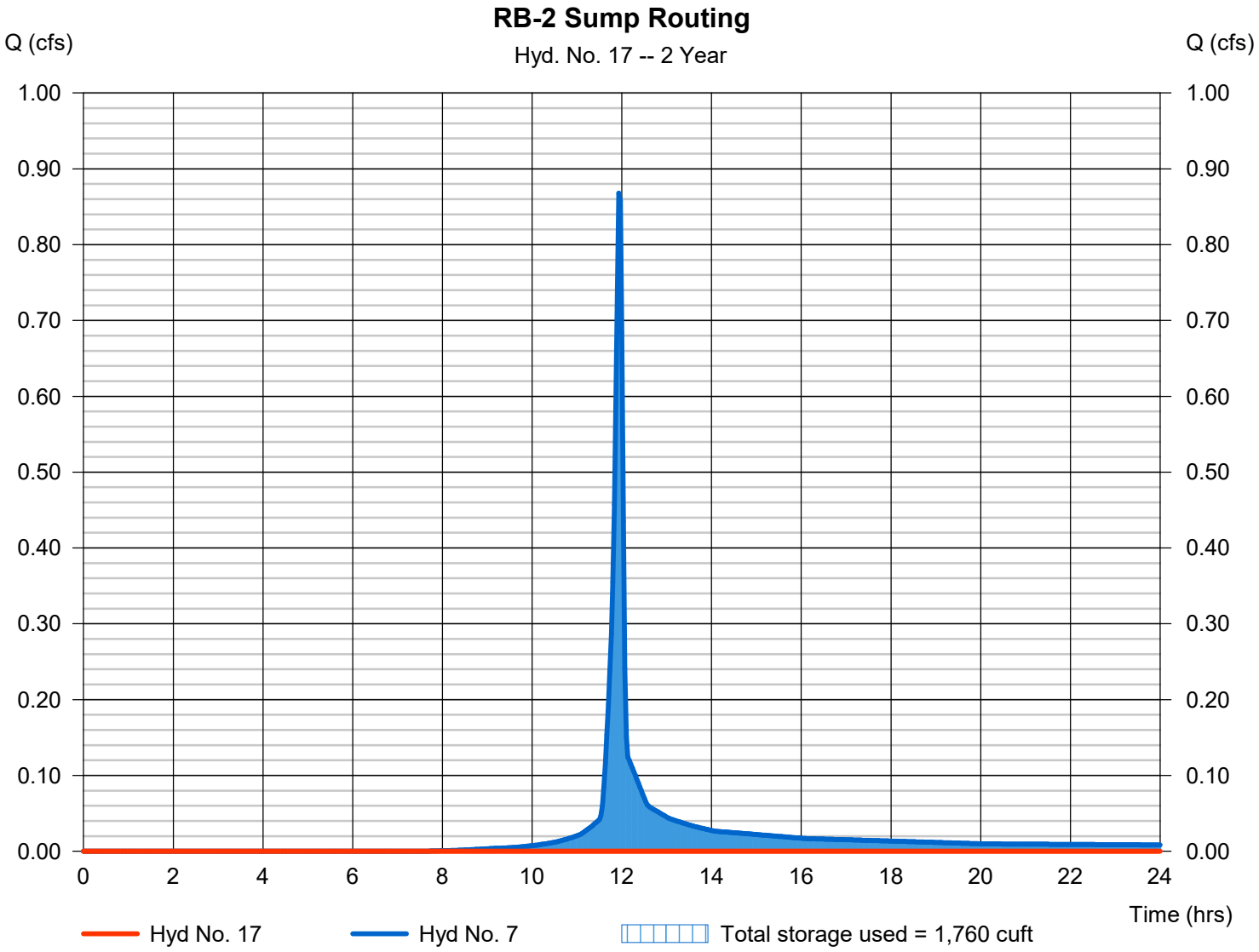
Hydrograph Report

Hyd. No. 17

RB-2 Sump Routing

Hydrograph type	=	Reservoir	Peak discharge	=	0.000 cfs
Storm frequency	=	2 yrs	Time to peak	=	n/a
Time interval	=	2 min	Hyd. volume	=	0 cuft
Inflow hyd. No.	=	7 - Post-Development Road Basin	Max. Elevation	=	101.17 ft
Reservoir name	=	RB-2 sumps	Max. Storage	=	1,760 cuft

Storage Indication method used.



Pond Report

Pond No. 7 - RB-2 sumps

Pond Data

Pond storage is based on user-defined values.

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	100.00	n/a	0	0
1.00	101.00	n/a	1,500	1,500
2.00	102.00	n/a	1,489	2,989
2.10	102.10	n/a	11	3,000

Culvert / Orifice Structures

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

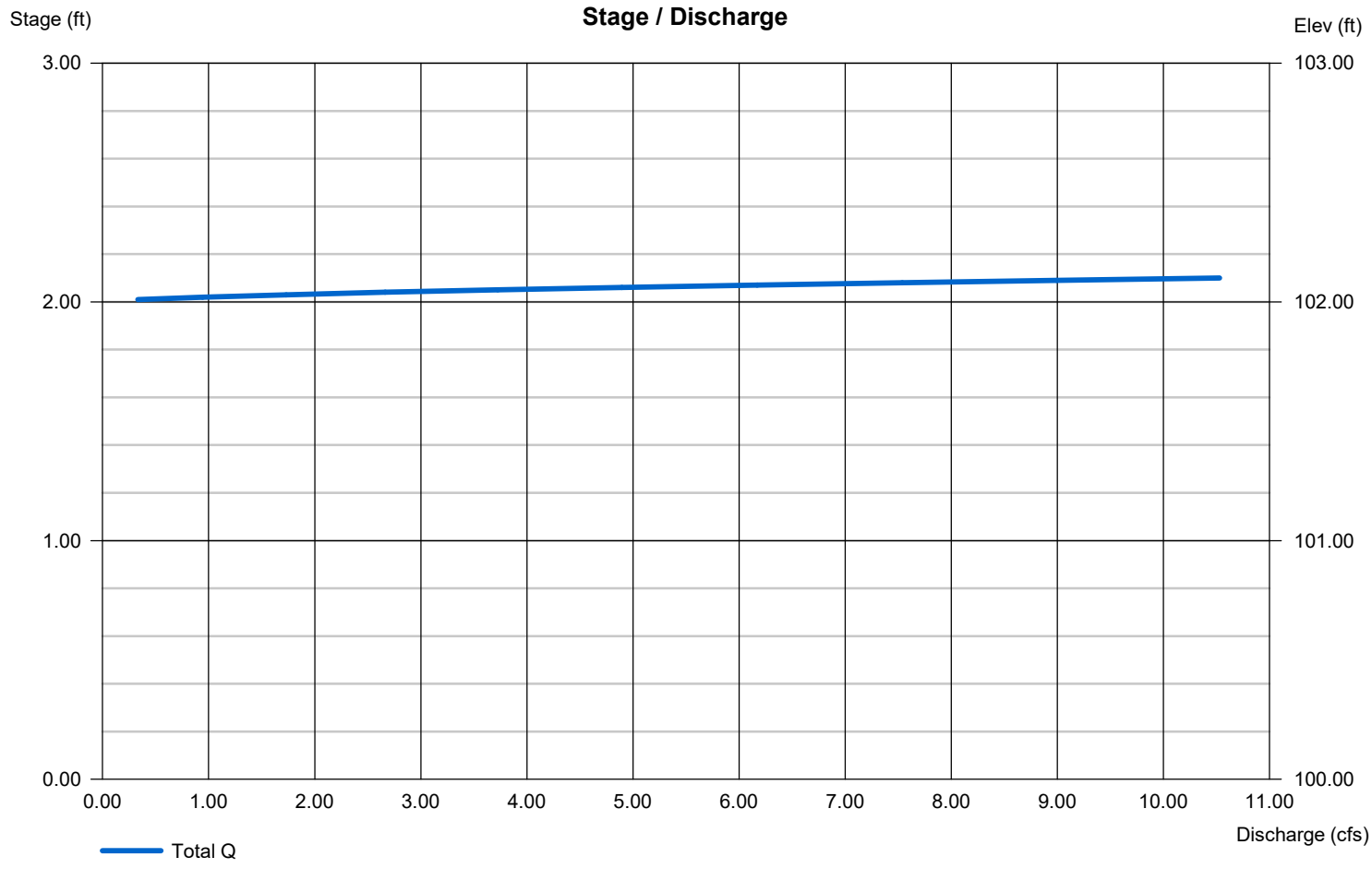
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 100.00	0.00	0.00	0.00
Crest El. (ft)	= 102.00	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= Rect	---	---	---
Multi-Stage	= No	No	No	No

Exfil.(in/hr) = 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).



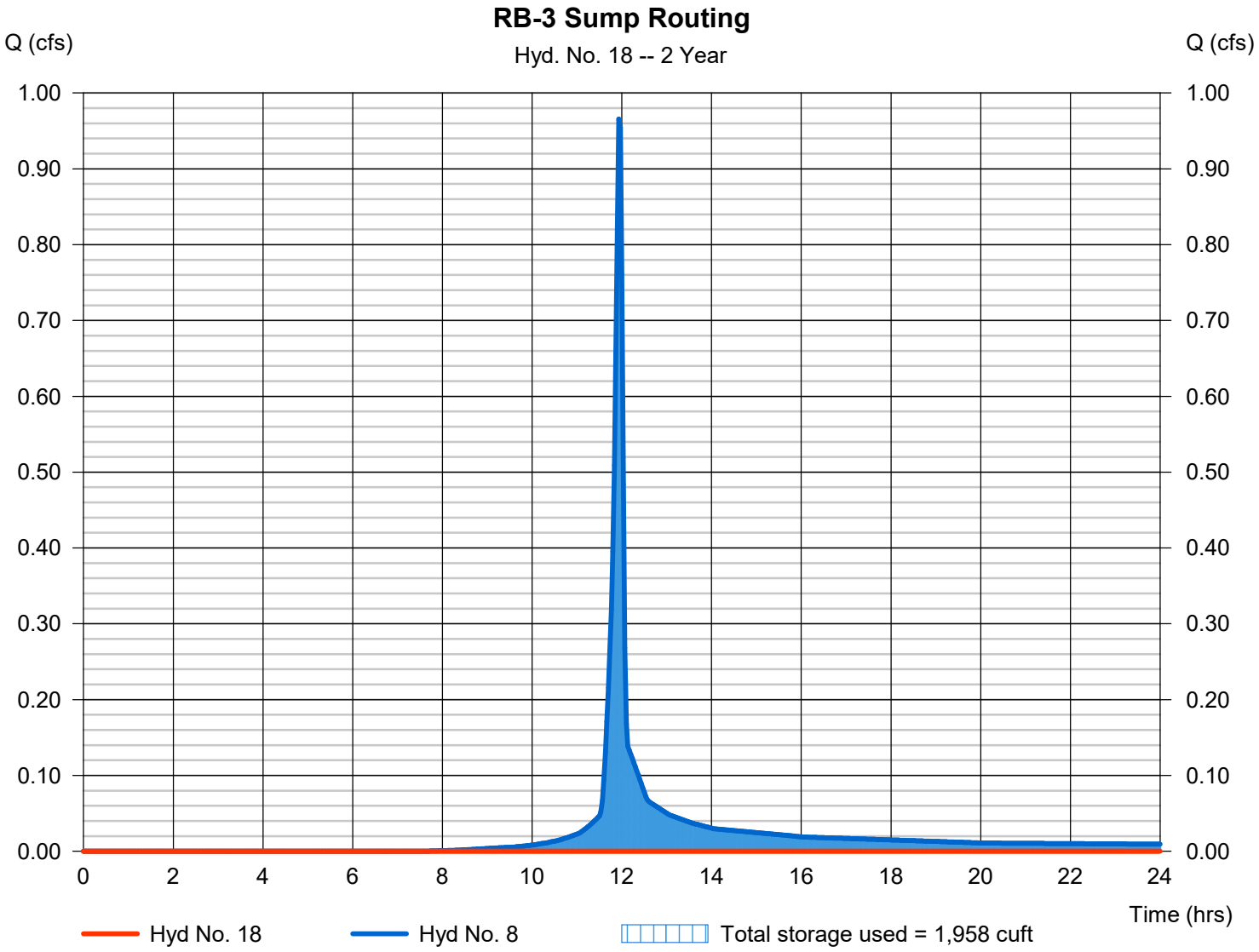
Hydrograph Report

Hyd. No. 18

RB-3 Sump Routing

Hydrograph type	=	Reservoir	Peak discharge	=	0.000 cfs
Storm frequency	=	2 yrs	Time to peak	=	n/a
Time interval	=	2 min	Hyd. volume	=	0 cuft
Inflow hyd. No.	=	8 - Post-Development Road Basin	Max. Elevation	=	101.16 ft
Reservoir name	=	RB-3 Sumps	Max. Storage	=	1,958 cuft

Storage Indication method used.



Pond Report

Pond No. 8 - RB-3 Sumps

Pond Data

Pond storage is based on user-defined values.

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	100.00	n/a	0	0
1.00	101.00	n/a	1,700	1,700
2.00	102.00	n/a	1,629	3,329
2.10	102.10	n/a	6	3,335

Culvert / Orifice Structures

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

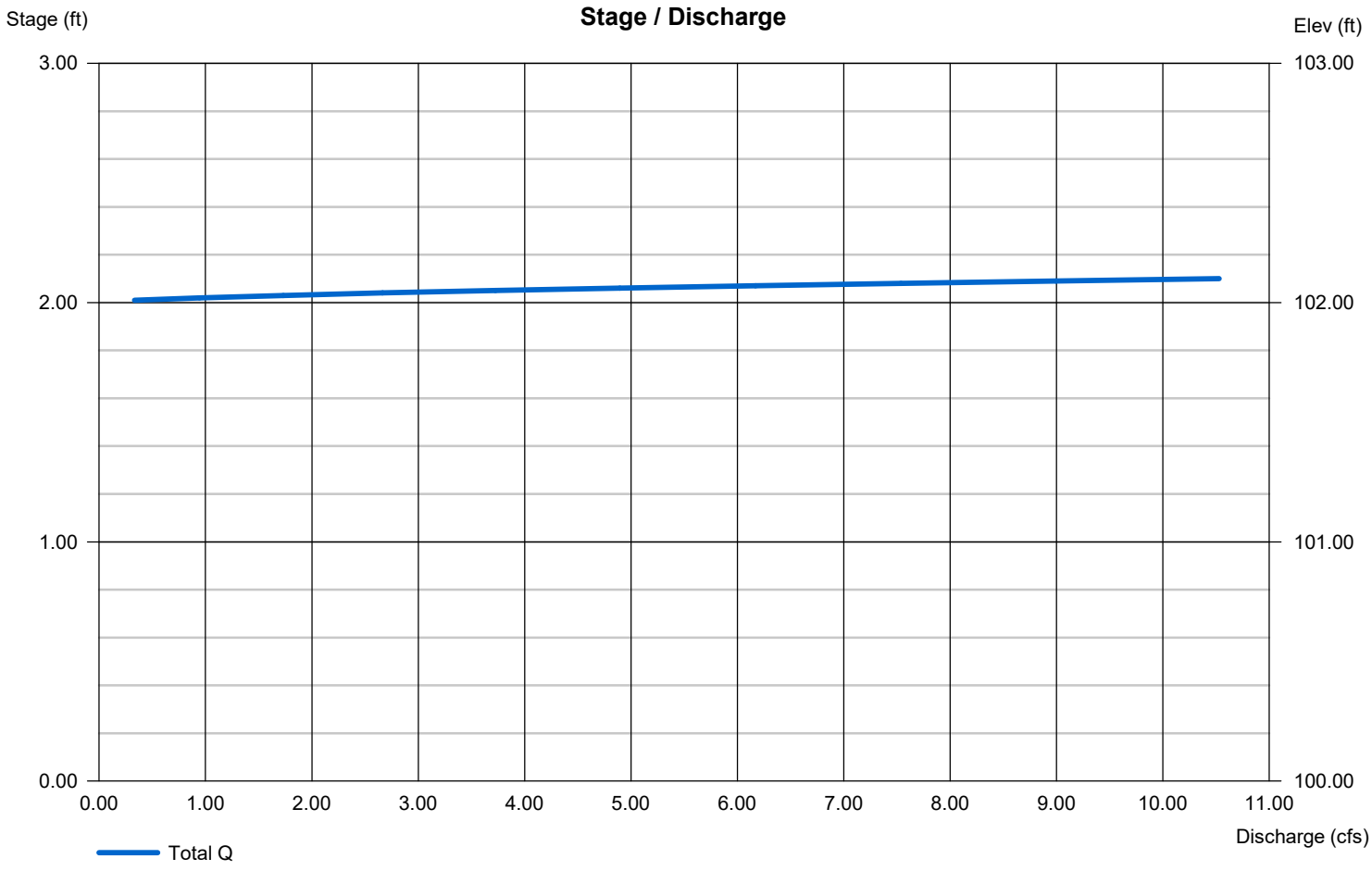
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 100.00	0.00	0.00	0.00
Crest El. (ft)	= 102.00	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= Rect	---	---	---
Multi-Stage	= No	No	No	No

Exfil.(in/hr) = 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).



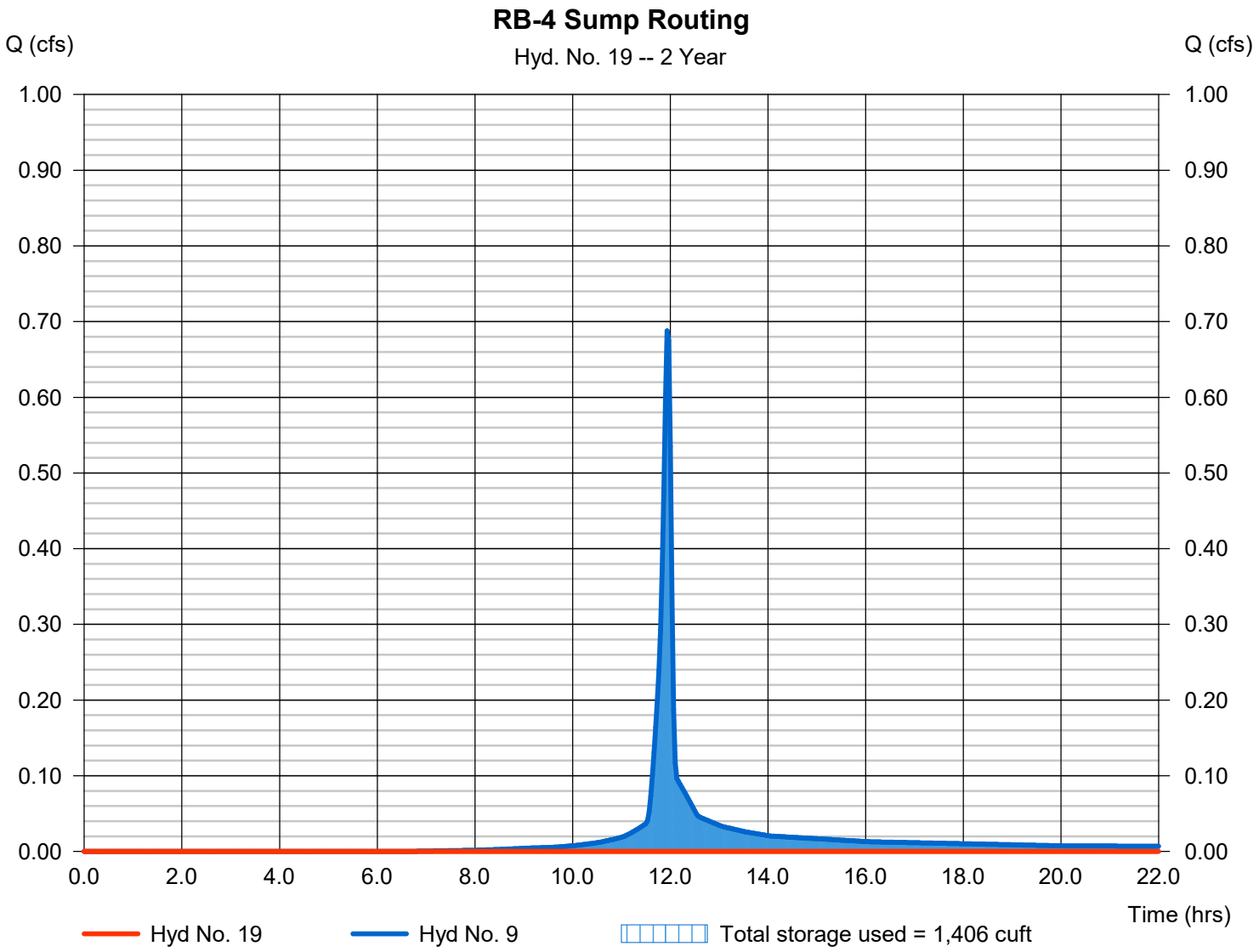
Hydrograph Report

Hyd. No. 19

RB-4 Sump Routing

Hydrograph type	=	Reservoir	Peak discharge	=	0.000 cfs
Storm frequency	=	2 yrs	Time to peak	=	n/a
Time interval	=	2 min	Hyd. volume	=	0 cuft
Inflow hyd. No.	=	9 - Post-Development Road Basin 4	Max. Elevation	=	101.16 ft
Reservoir name	=	RB-4 Sumps	Max. Storage	=	1,406 cuft

Storage Indication method used.



Pond Report

Pond No. 9 - RB-4 Sumps

Pond Data

Pond storage is based on user-defined values.

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	100.00	n/a	0	0
1.00	101.00	n/a	1,200	1,200
2.00	102.00	n/a	1,275	2,475
2.10	102.10	n/a	5	2,480

Culvert / Orifice Structures

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

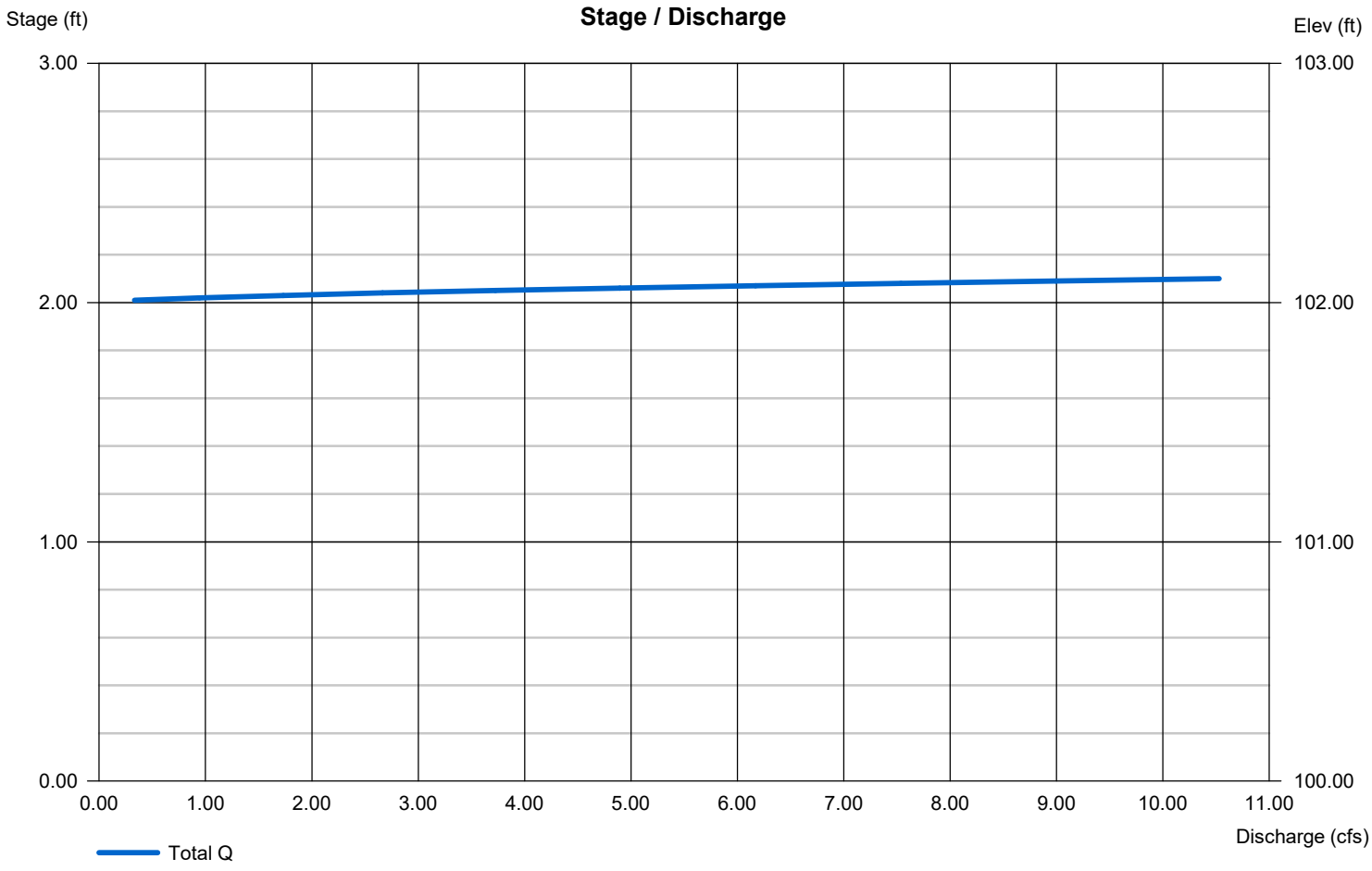
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 100.00	0.00	0.00	0.00
Crest El. (ft)	= 102.00	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= Rect	---	---	---
Multi-Stage	= No	No	No	No

Exfil.(in/hr) = 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).



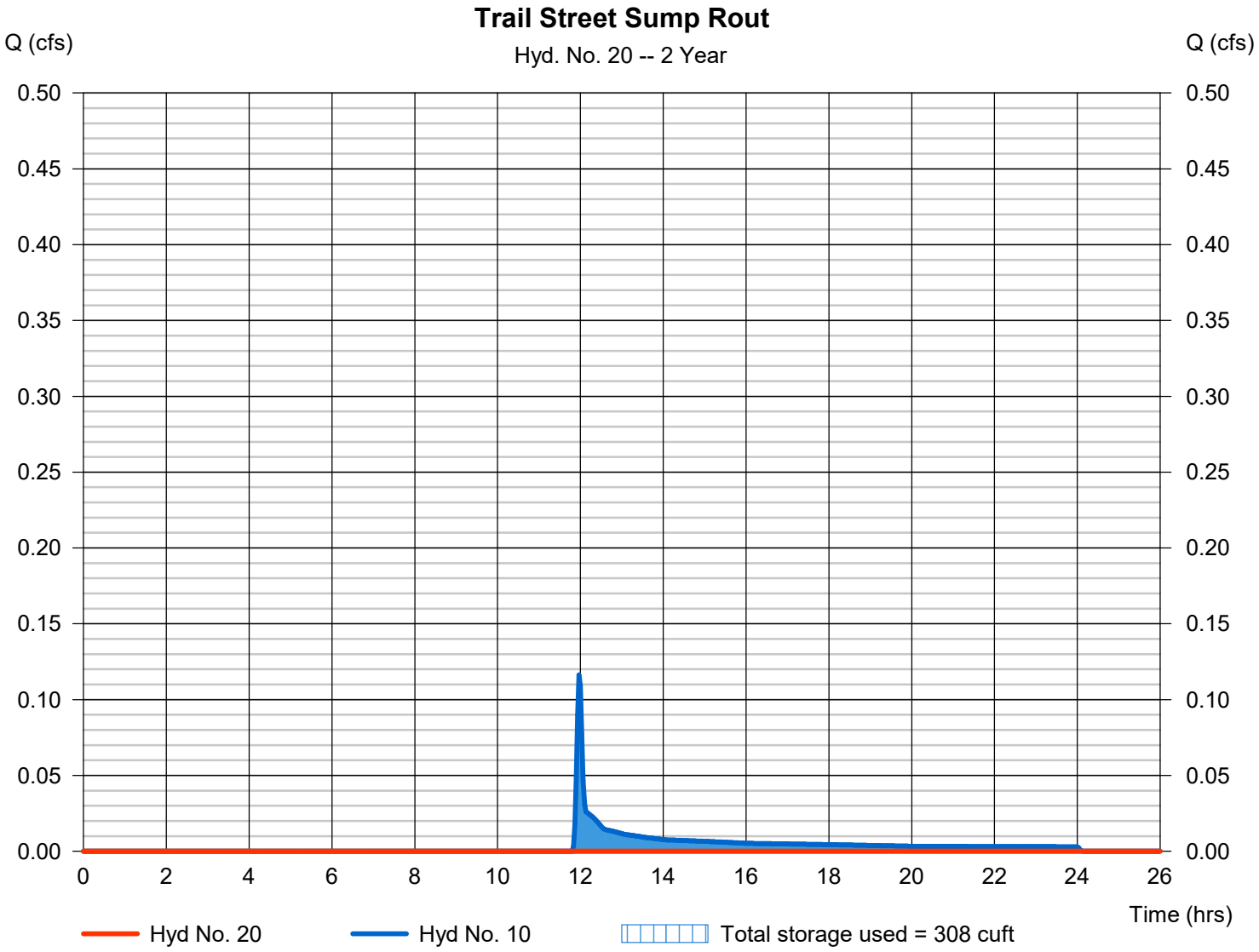
Hydrograph Report

Hyd. No. 20

Trail Street Sump Rout

Hydrograph type	=	Reservoir	Peak discharge	=	0.000 cfs
Storm frequency	=	2 yrs	Time to peak	=	n/a
Time interval	=	2 min	Hyd. volume	=	0 cuft
Inflow hyd. No.	=	10 - Trail Street Sub Basin	Max. Elevation	=	101.64 ft
Reservoir name	=	Trail Street Sumps	Max. Storage	=	308 cuft

Storage Indication method used.



Pond Report

Pond No. 10 - Trail Street Sumps

Pond Data

Pond storage is based on user-defined values.

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	100.00	n/a	0	0
1.00	101.00	n/a	170	170
2.00	102.00	n/a	215	385
2.10	102.10	n/a	5	390

Culvert / Orifice Structures

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

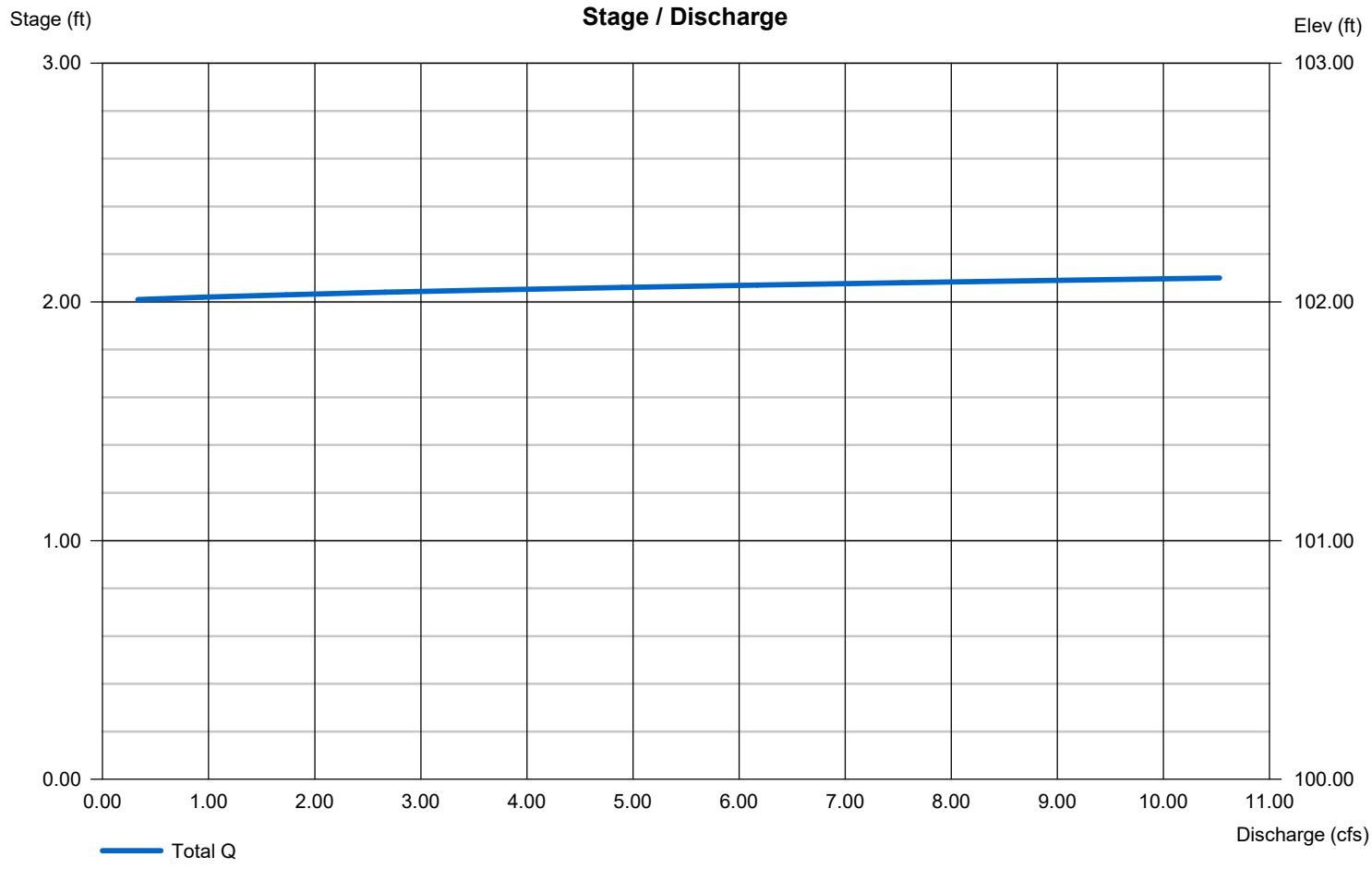
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 100.00	0.00	0.00	0.00
Crest El. (ft)	= 102.00	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= Rect	---	---	---
Multi-Stage	= No	No	No	No

Exfil.(in/hr) = 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).



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	1.022	2	718	2,102	------	------	------	Post-Development Basin A
2	SCS Runoff	0.803	2	718	1,651	------	------	------	Post-Development Basin B
3	SCS Runoff	4.146	2	718	8,435	------	------	------	Post-Development Basin C
4	SCS Runoff	2.385	2	718	4,791	------	------	------	Post-Development Basin D
5	SCS Runoff	2.266	2	718	4,925	------	------	------	Post-Development Basin E
6	SCS Runoff	1.722	3	717	3,939	------	------	------	Post-Development Road Basin 1
7	SCS Runoff	1.428	2	716	2,945	------	------	------	Post-Development Road Basin 2
8	SCS Runoff	1.589	2	716	3,276	------	------	------	Post-Development Road Basin 3
9	SCS Runoff	1.098	2	716	2,293	------	------	------	Post-Development Road Basin 4
10	SCS Runoff	0.384	2	718	801	------	------	------	Trail Street Sub Basin
11	Reservoir	0.000	2	n/a	0	1	101.87	2,102	Pond A Routing
12	Reservoir	0.000	2	n/a	0	2	100.94	1,651	Pond B Routing
13	Reservoir	0.000	2	n/a	0	3	100.96	8,435	Pond C Routing
14	Reservoir	0.000	2	n/a	0	4	101.83	4,791	Pond D Routing
15	Reservoir	0.000	2	n/a	0	5	101.45	4,925	Pond E Routing
16	Reservoir	0.000	3	n/a	0	6	101.87	3,939	RB-1 Sump Routing
17	Reservoir	0.000	2	n/a	0	7	101.97	2,945	RB-2 Sump Routing
18	Reservoir	0.000	2	n/a	0	8	101.97	3,276	RB-3 Sump Routing
19	Reservoir	0.000	2	n/a	0	9	101.86	2,293	RB-4 Sump Routing
20	Reservoir	0.042	2	774	416	10	102.00	385	Trail Street Sump Rout

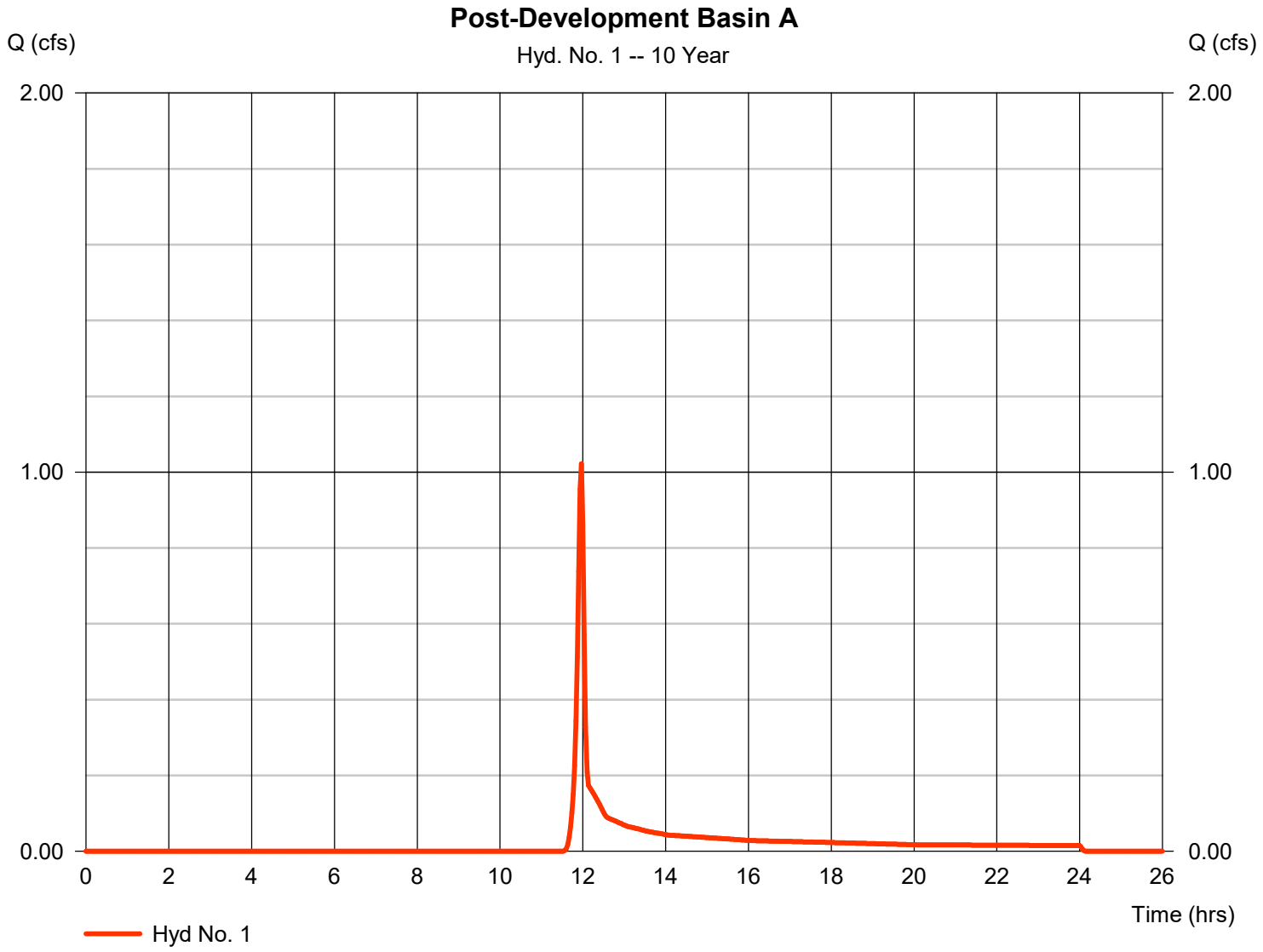
Hydrograph Report

Hyd. No. 1

Post-Development Basin A

Hydrograph type	=	SCS Runoff	Peak discharge	=	1.022 cfs
Storm frequency	=	10 yrs	Time to peak	=	11.97 hrs
Time interval	=	2 min	Hyd. volume	=	2,102 cuft
Drainage area	=	1.540 ac	Curve number	=	81*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	1.66 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.940 x 98) + (0.780 x 61)] / 1.540



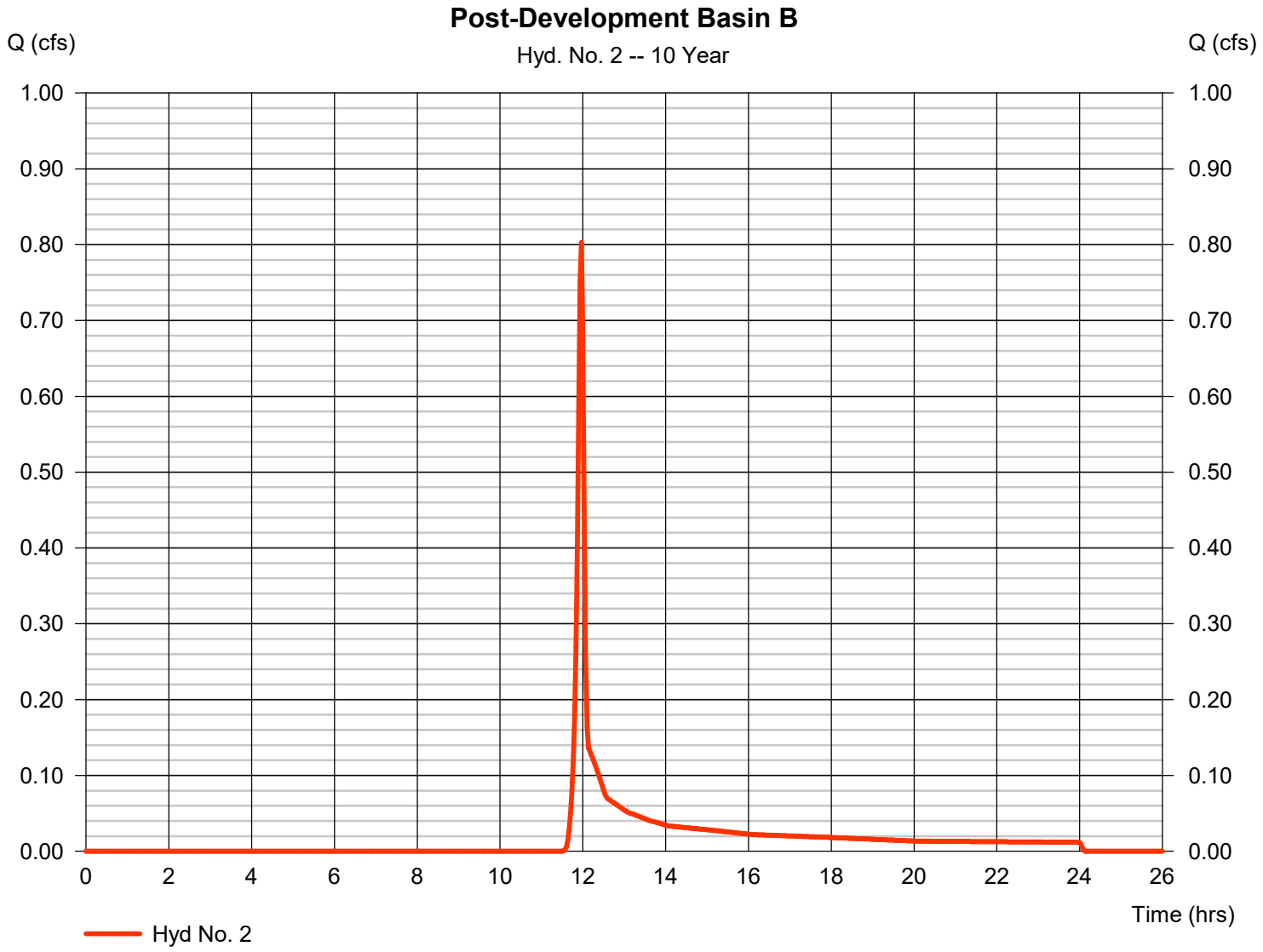
Hydrograph Report

Hyd. No. 2

Post-Development Basin B

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.803 cfs
Storm frequency	=	10 yrs	Time to peak	=	11.97 hrs
Time interval	=	2 min	Hyd. volume	=	1,651 cuft
Drainage area	=	1.210 ac	Curve number	=	81*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	1.66 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.660 x 98) + (0.550 x 61)] / 1.210



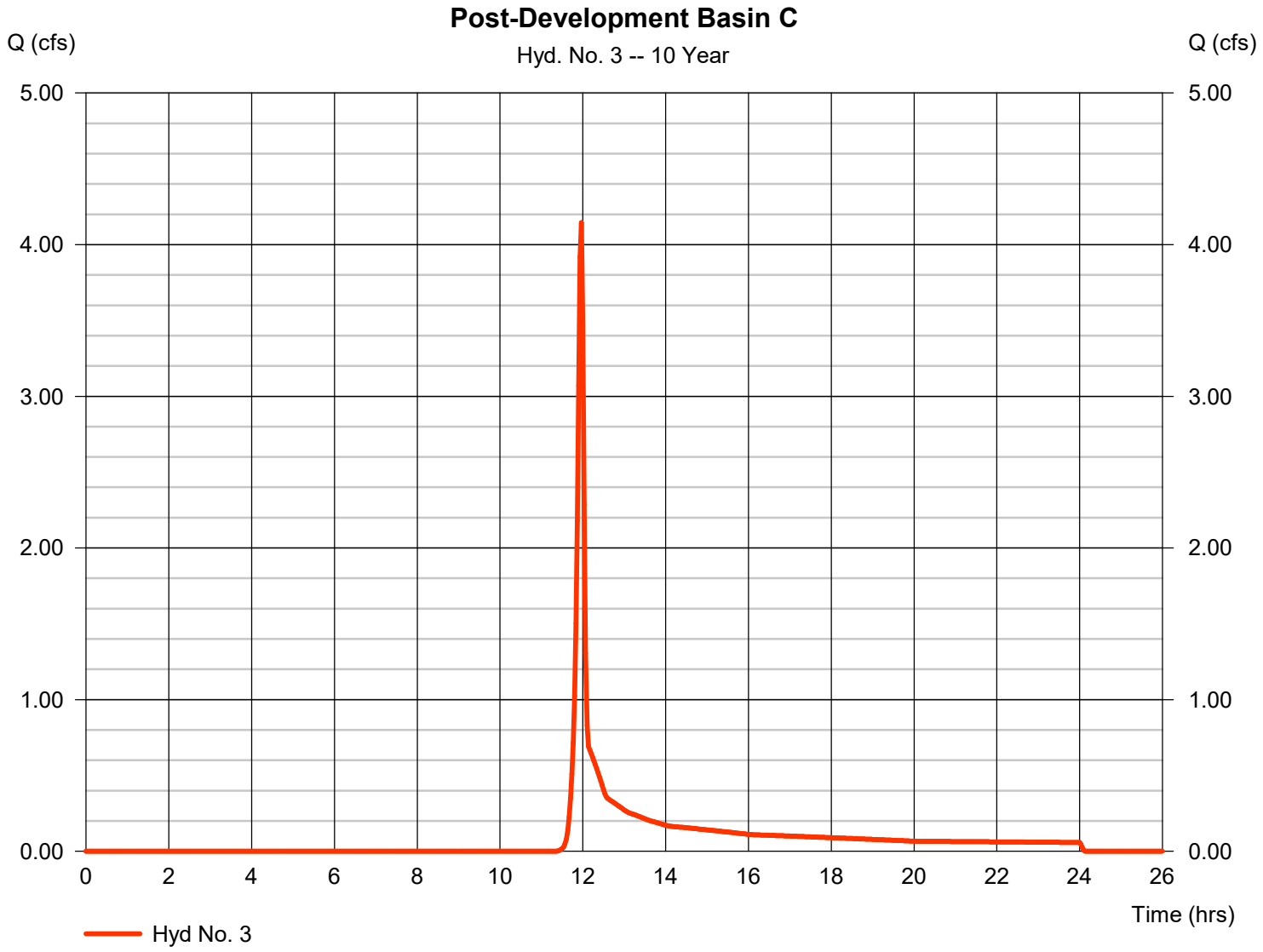
Hydrograph Report

Hyd. No. 3

Post-Development Basin C

Hydrograph type	=	SCS Runoff	Peak discharge	=	4.146 cfs
Storm frequency	=	10 yrs	Time to peak	=	11.97 hrs
Time interval	=	2 min	Hyd. volume	=	8,435 cuft
Drainage area	=	5.680 ac	Curve number	=	82*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	1.66 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(2.630 x 98) + (3.050 x 61)] / 5.680



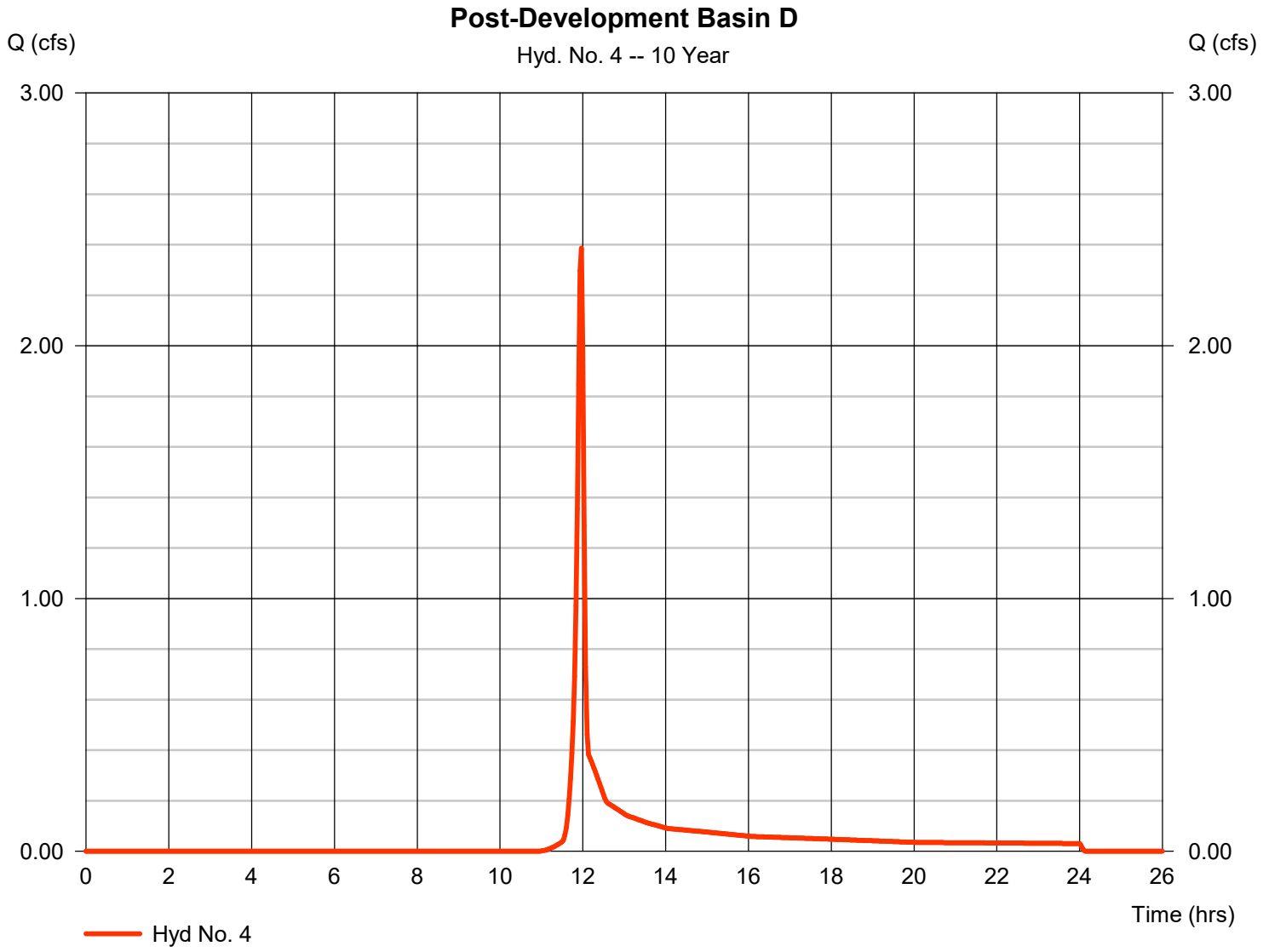
Hydrograph Report

Hyd. No. 4

Post-Development Basin D

Hydrograph type	=	SCS Runoff	Peak discharge	=	2.385 cfs
Storm frequency	=	10 yrs	Time to peak	=	11.97 hrs
Time interval	=	2 min	Hyd. volume	=	4,791 cuft
Drainage area	=	2.740 ac	Curve number	=	84*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	1.66 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(1.790 x 98) + (1.150 x 61)] / 2.740



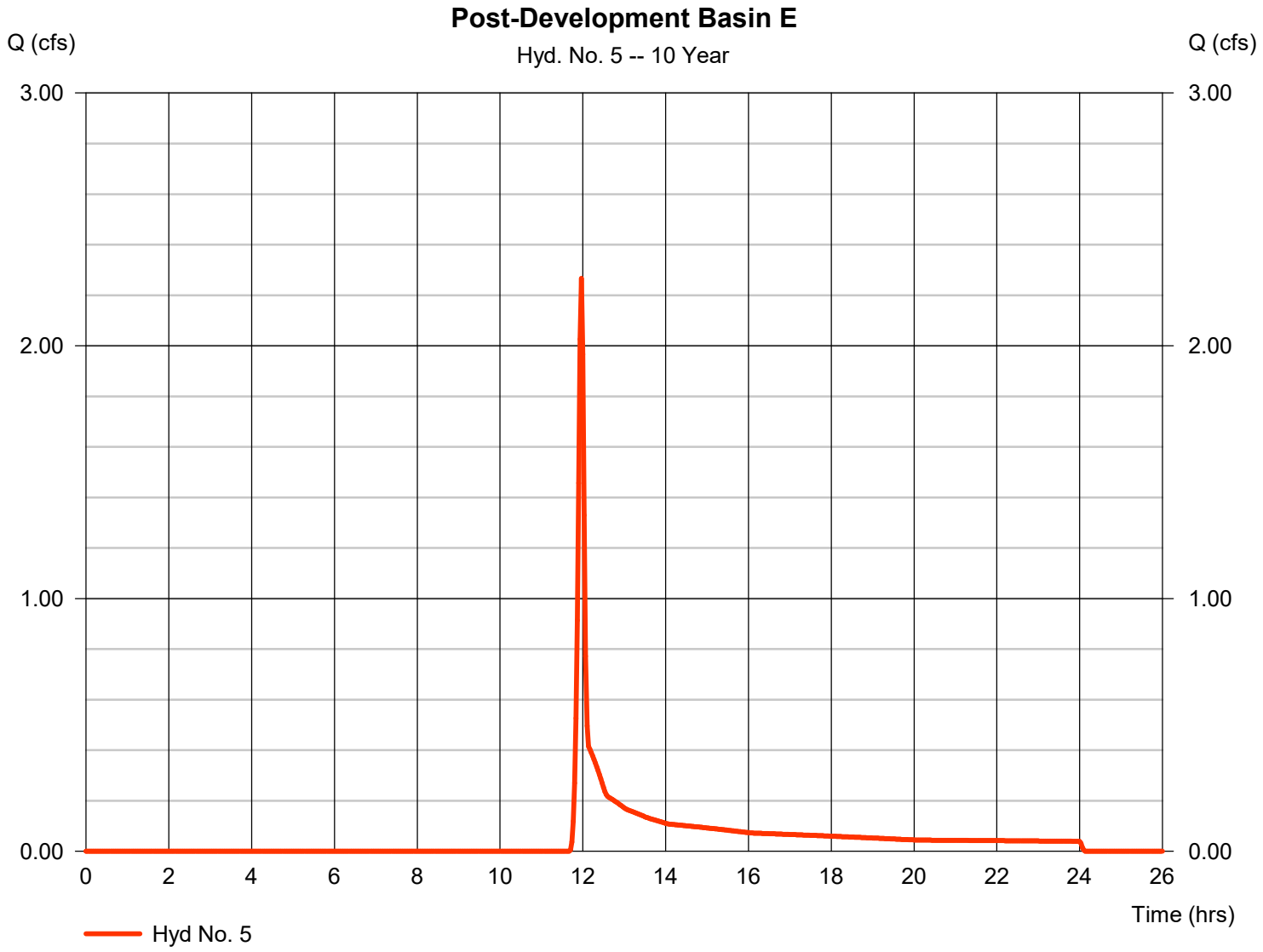
Hydrograph Report

Hyd. No. 5

Post-Development Basin E

Hydrograph type	=	SCS Runoff	Peak discharge	=	2.266 cfs
Storm frequency	=	10 yrs	Time to peak	=	11.97 hrs
Time interval	=	2 min	Hyd. volume	=	4,925 cuft
Drainage area	=	4.720 ac	Curve number	=	78*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	1.66 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(2.170 x 98) + (2.550 x 61)] / 4.720



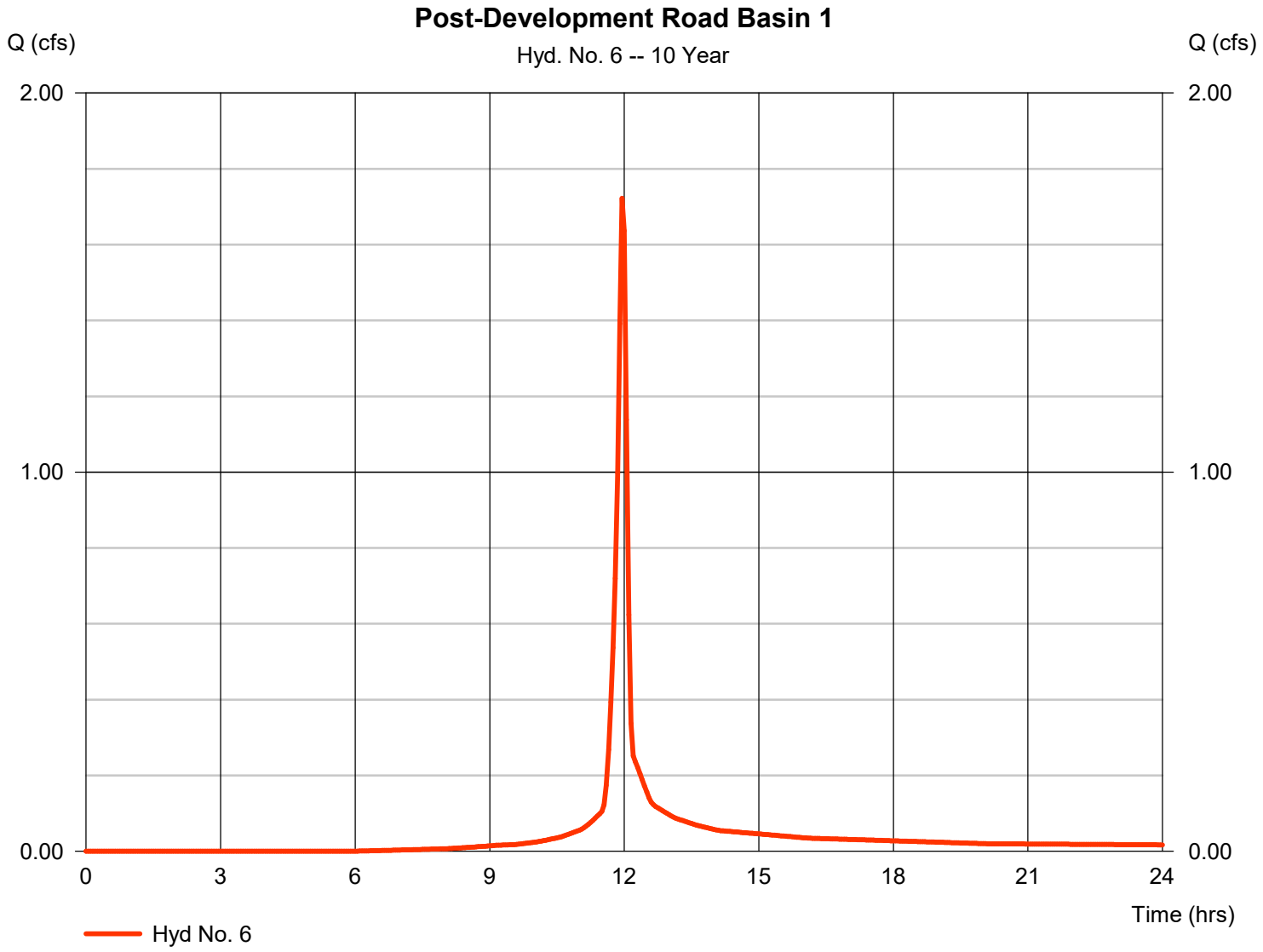
Hydrograph Report

Hyd. No. 6

Post-Development Road Basin 1

Hydrograph type	=	SCS Runoff	Peak discharge	=	1.722 cfs
Storm frequency	=	10 yrs	Time to peak	=	11.95 hrs
Time interval	=	3 min	Hyd. volume	=	3,939 cuft
Drainage area	=	1.070 ac	Curve number	=	94*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	1.66 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.880 x 98) + (0.190 x 61)] / 1.070



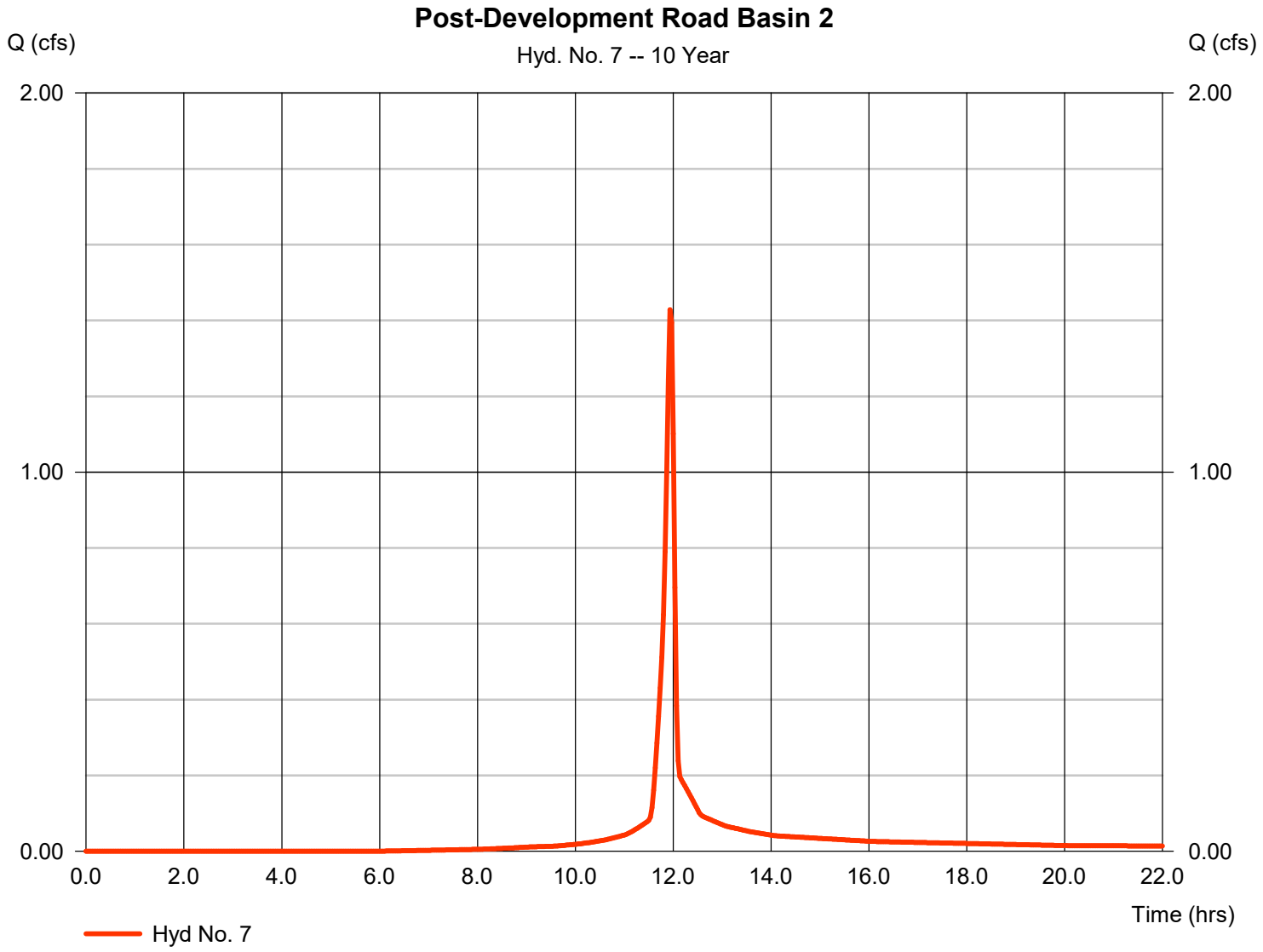
Hydrograph Report

Hyd. No. 7

Post-Development Road Basin 2

Hydrograph type	=	SCS Runoff	Peak discharge	=	1.428 cfs
Storm frequency	=	10 yrs	Time to peak	=	11.93 hrs
Time interval	=	2 min	Hyd. volume	=	2,945 cuft
Drainage area	=	0.800 ac	Curve number	=	94*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	1.66 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.090 x 61) + (0.710 x 98)] / 0.800



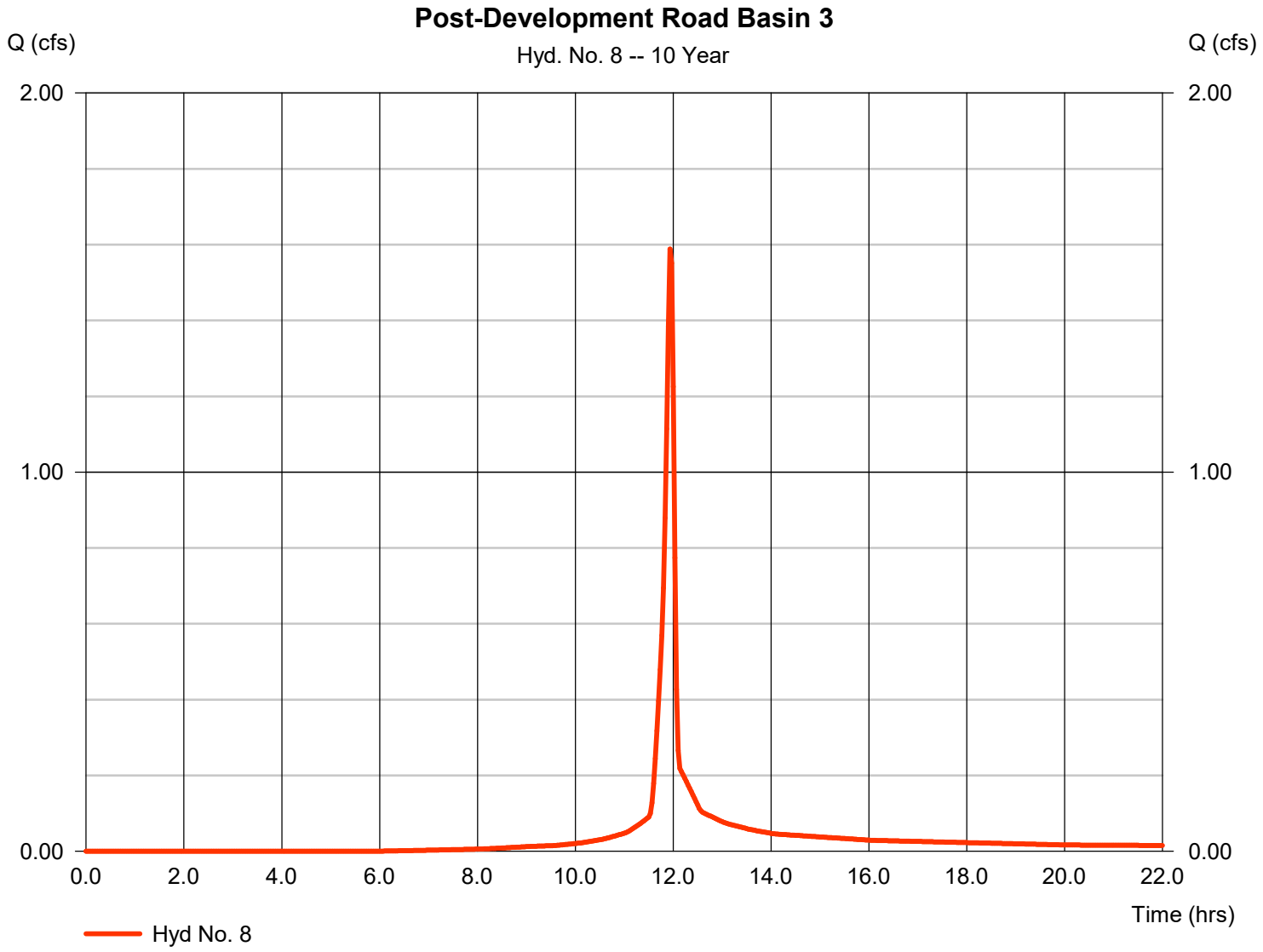
Hydrograph Report

Hyd. No. 8

Post-Development Road Basin 3

Hydrograph type	= SCS Runoff	Peak discharge	= 1.589 cfs
Storm frequency	= 10 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 3,276 cuft
Drainage area	= 0.890 ac	Curve number	= 94*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 1.66 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.790 x 98) + (0.100 x 61)] / 0.890



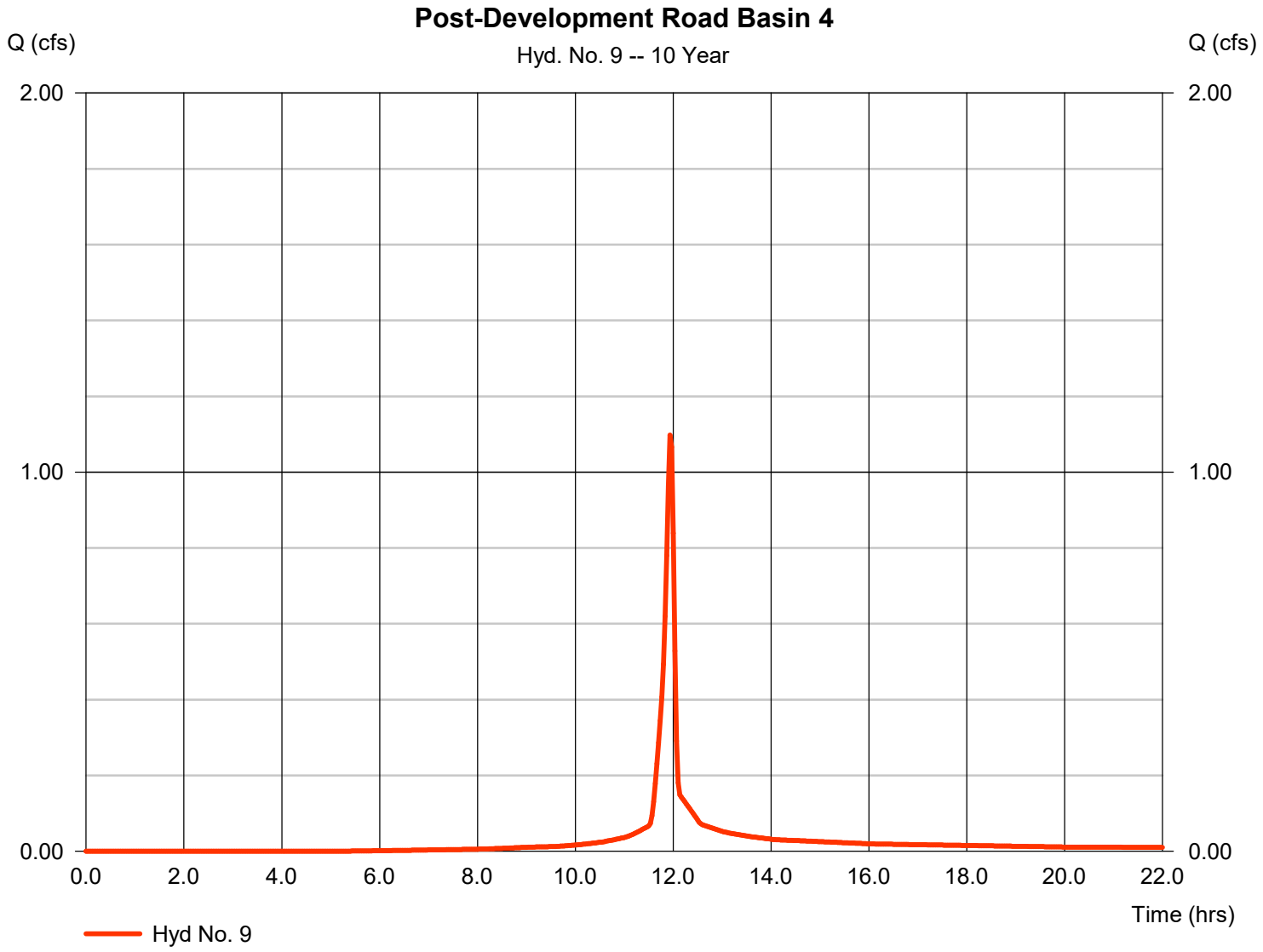
Hydrograph Report

Hyd. No. 9

Post-Development Road Basin 4

Hydrograph type	=	SCS Runoff	Peak discharge	=	1.098 cfs
Storm frequency	=	10 yrs	Time to peak	=	11.93 hrs
Time interval	=	2 min	Hyd. volume	=	2,293 cuft
Drainage area	=	0.580 ac	Curve number	=	95*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	1.66 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.530 x 98) + (0.050 x 61)] / 0.580



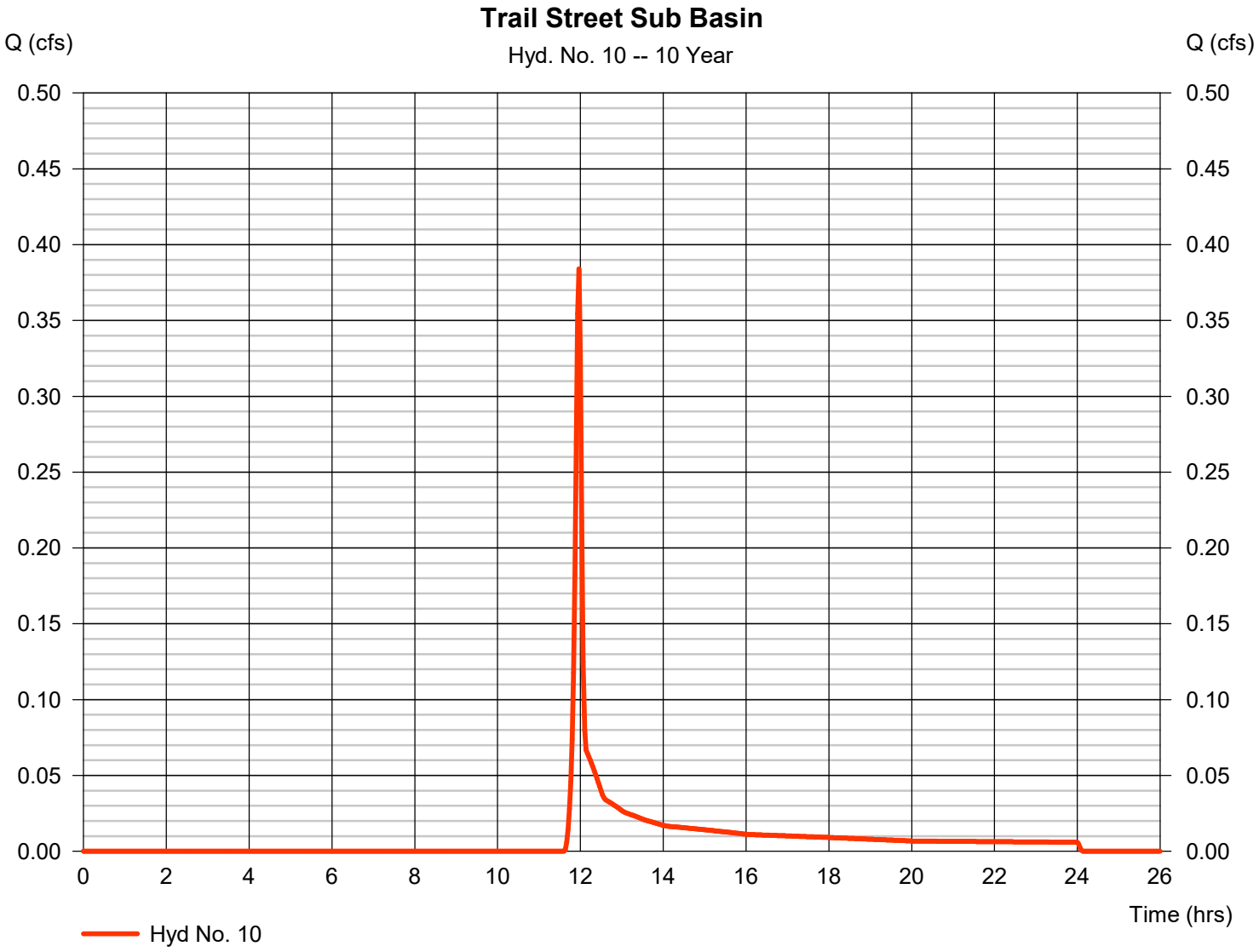
Hydrograph Report

Hyd. No. 10

Trail Street Sub Basin

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.384 cfs
Storm frequency	=	10 yrs	Time to peak	=	11.97 hrs
Time interval	=	2 min	Hyd. volume	=	801 cuft
Drainage area	=	0.640 ac	Curve number	=	80*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	1.66 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.330 x 98) + (0.310 x 61)] / 0.640



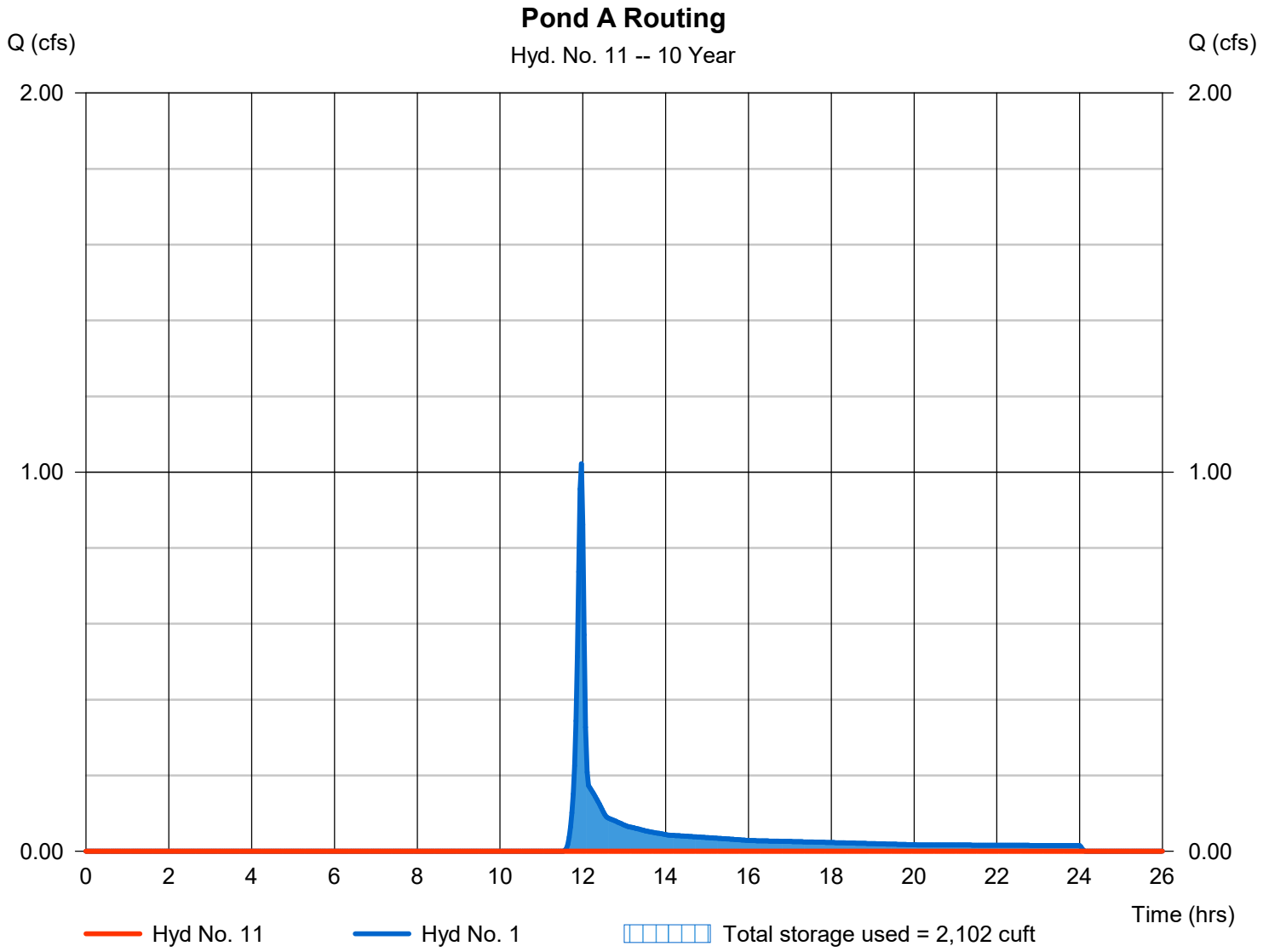
Hydrograph Report

Hyd. No. 11

Pond A Routing

Hydrograph type	=	Reservoir	Peak discharge	=	0.000 cfs
Storm frequency	=	10 yrs	Time to peak	=	n/a
Time interval	=	2 min	Hyd. volume	=	0 cuft
Inflow hyd. No.	=	1 - Post-Development Basin A	Max. Elevation	=	101.87 ft
Reservoir name	=	Basin A Pond	Max. Storage	=	2,102 cuft

Storage Indication method used.



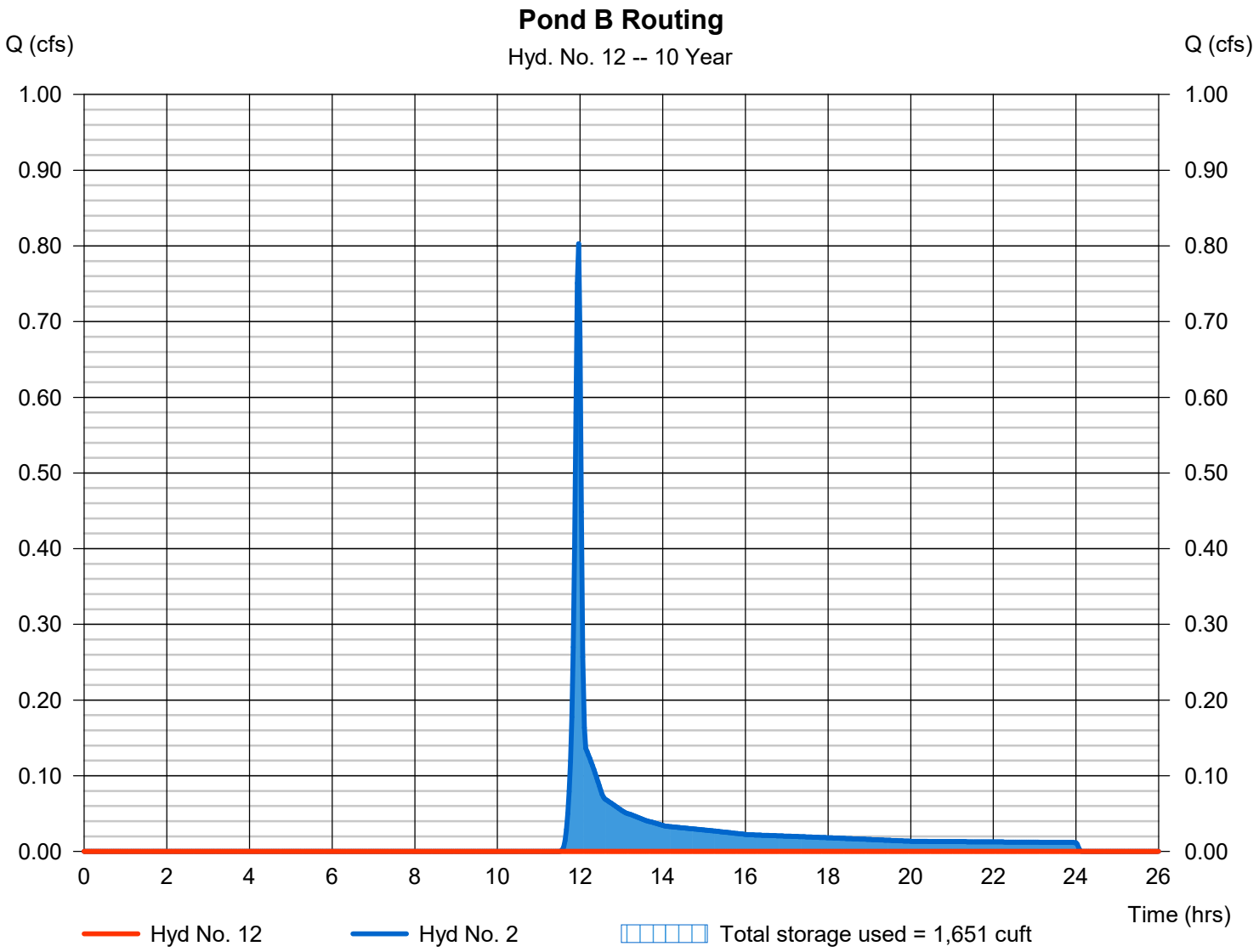
Hydrograph Report

Hyd. No. 12

Pond B Routing

Hydrograph type	=	Reservoir	Peak discharge	=	0.000 cfs
Storm frequency	=	10 yrs	Time to peak	=	n/a
Time interval	=	2 min	Hyd. volume	=	0 cuft
Inflow hyd. No.	=	2 - Post-Development Basin B	Max. Elevation	=	100.94 ft
Reservoir name	=	Basin B Pond	Max. Storage	=	1,651 cuft

Storage Indication method used.



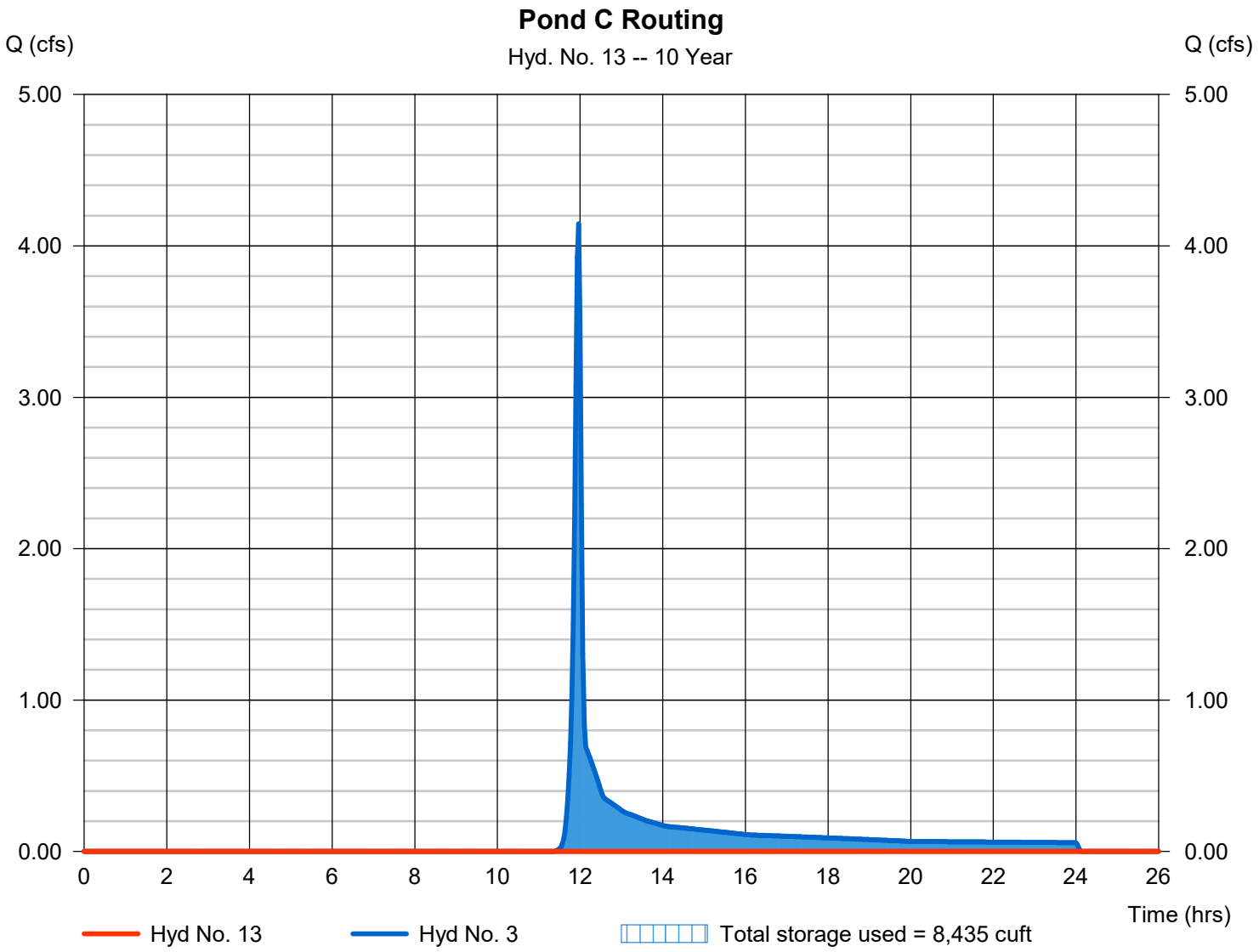
Hydrograph Report

Hyd. No. 13

Pond C Routing

Hydrograph type	=	Reservoir	Peak discharge	=	0.000 cfs
Storm frequency	=	10 yrs	Time to peak	=	n/a
Time interval	=	2 min	Hyd. volume	=	0 cuft
Inflow hyd. No.	=	3 - Post-Development Basin C	Max. Elevation	=	100.96 ft
Reservoir name	=	Basin C Pond	Max. Storage	=	8,435 cuft

Storage Indication method used.



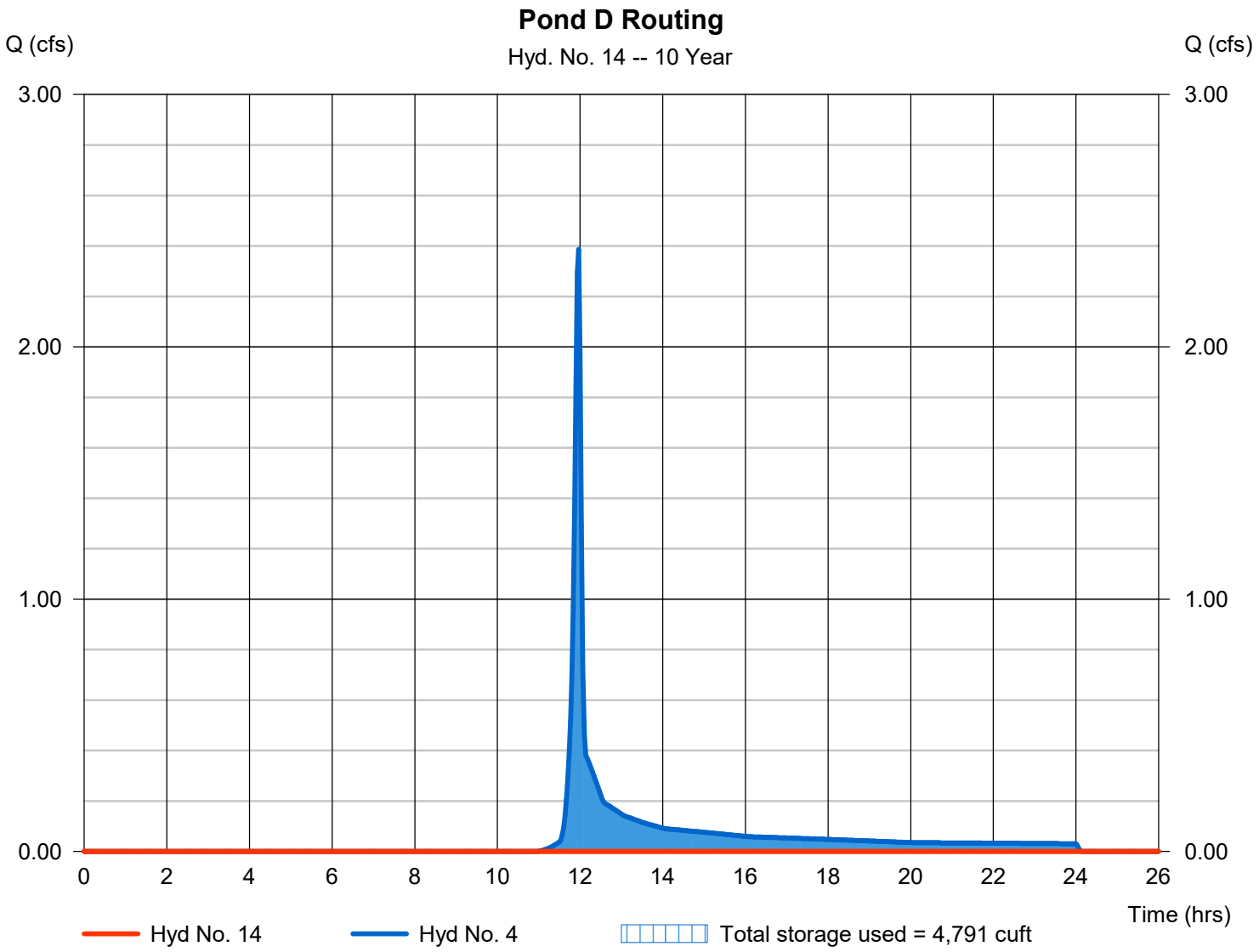
Hydrograph Report

Hyd. No. 14

Pond D Routing

Hydrograph type	=	Reservoir	Peak discharge	=	0.000 cfs
Storm frequency	=	10 yrs	Time to peak	=	n/a
Time interval	=	2 min	Hyd. volume	=	0 cuft
Inflow hyd. No.	=	4 - Post-Development Basin D	Max. Elevation	=	101.83 ft
Reservoir name	=	Basin D Pond	Max. Storage	=	4,791 cuft

Storage Indication method used.



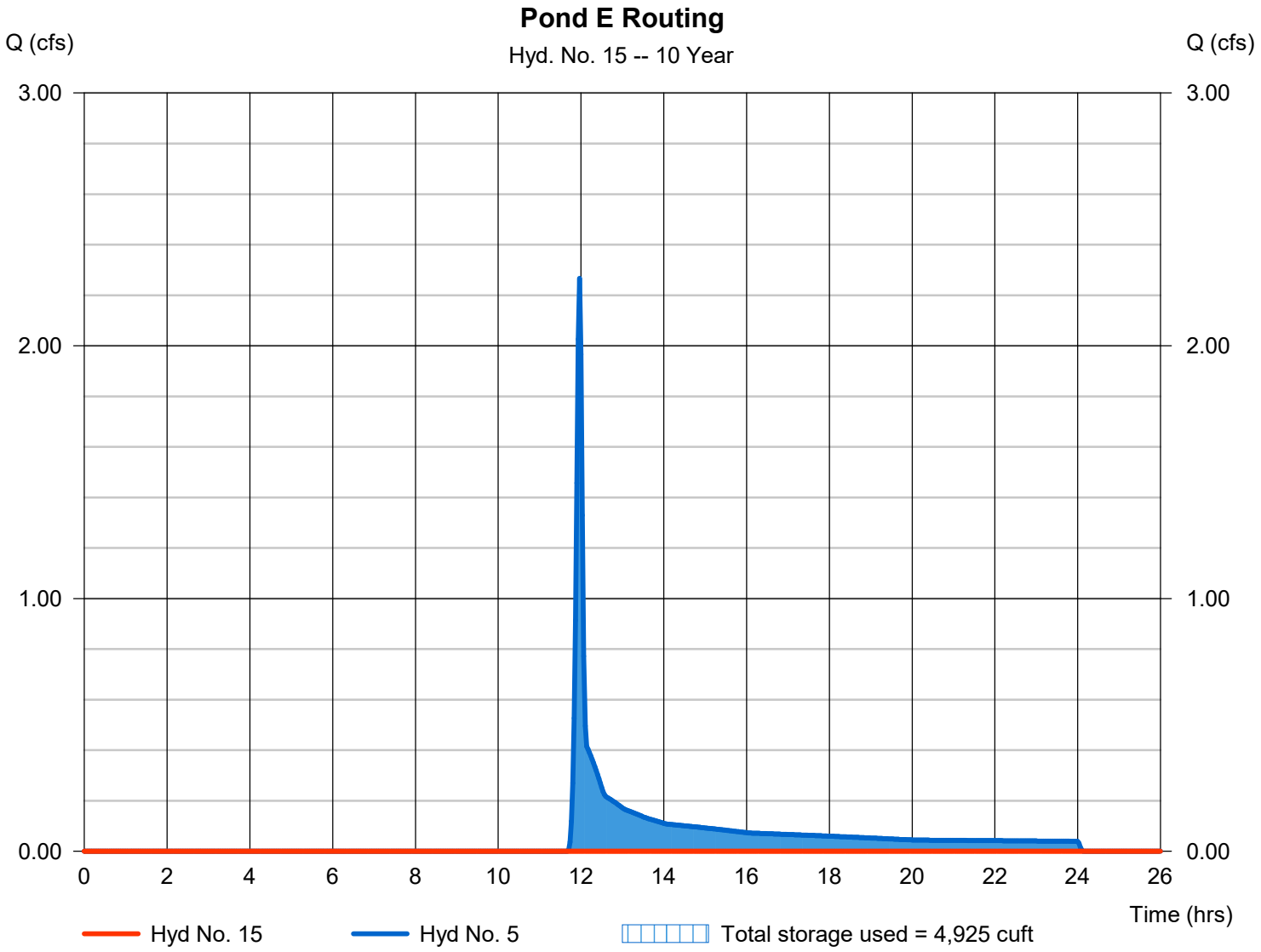
Hydrograph Report

Hyd. No. 15

Pond E Routing

Hydrograph type	=	Reservoir	Peak discharge	=	0.000 cfs
Storm frequency	=	10 yrs	Time to peak	=	n/a
Time interval	=	2 min	Hyd. volume	=	0 cuft
Inflow hyd. No.	=	5 - Post-Development Basin E	Max. Elevation	=	101.45 ft
Reservoir name	=	Basin E Pond	Max. Storage	=	4,925 cuft

Storage Indication method used.



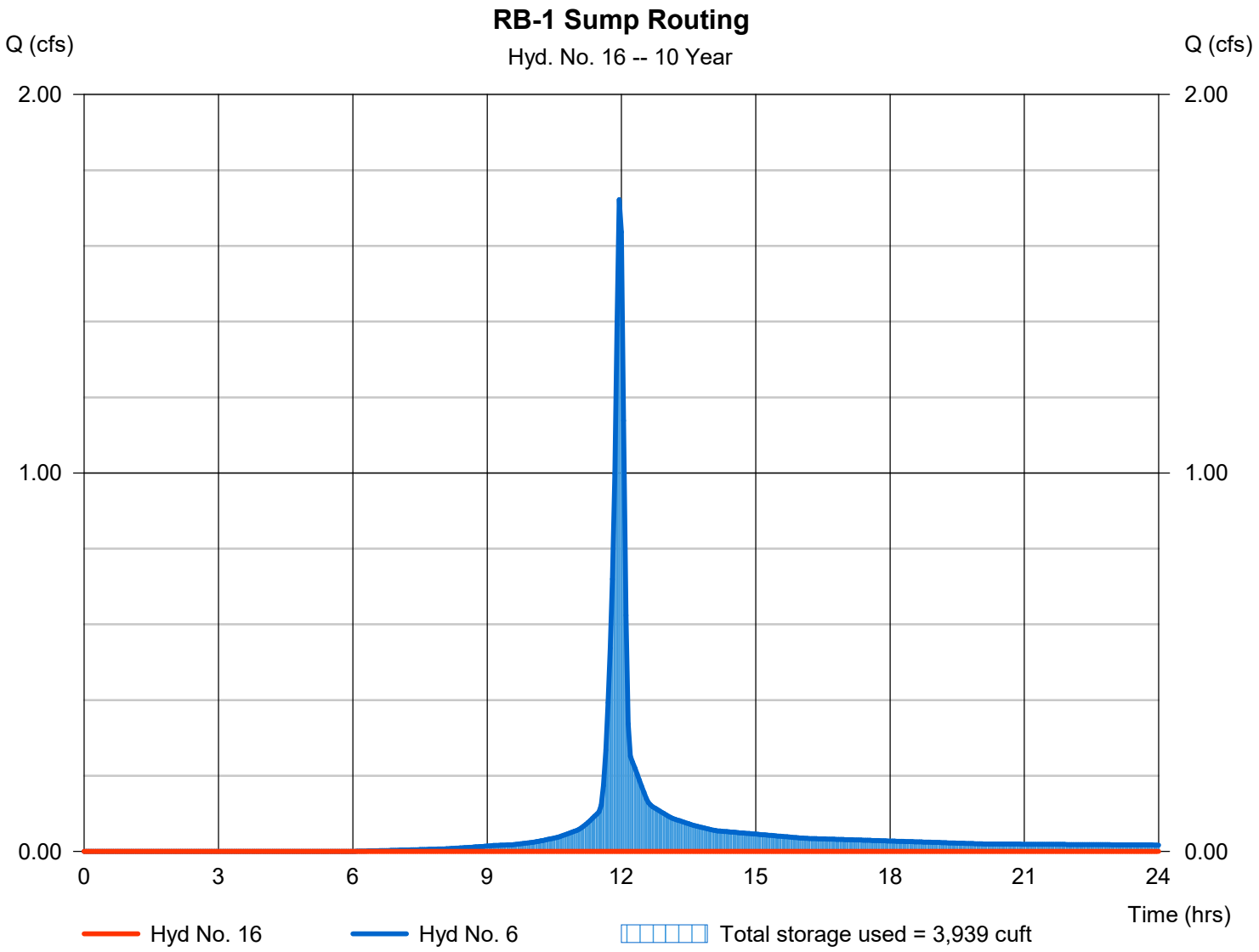
Hydrograph Report

Hyd. No. 16

RB-1 Sump Routing

Hydrograph type	=	Reservoir	Peak discharge	=	0.000 cfs
Storm frequency	=	10 yrs	Time to peak	=	n/a
Time interval	=	3 min	Hyd. volume	=	0 cuft
Inflow hyd. No.	=	6 - Post-Development Road Basin 1	Max. Elevation	=	101.87 ft
Reservoir name	=	RB-1 Pond	Max. Storage	=	3,939 cuft

Storage Indication method used.



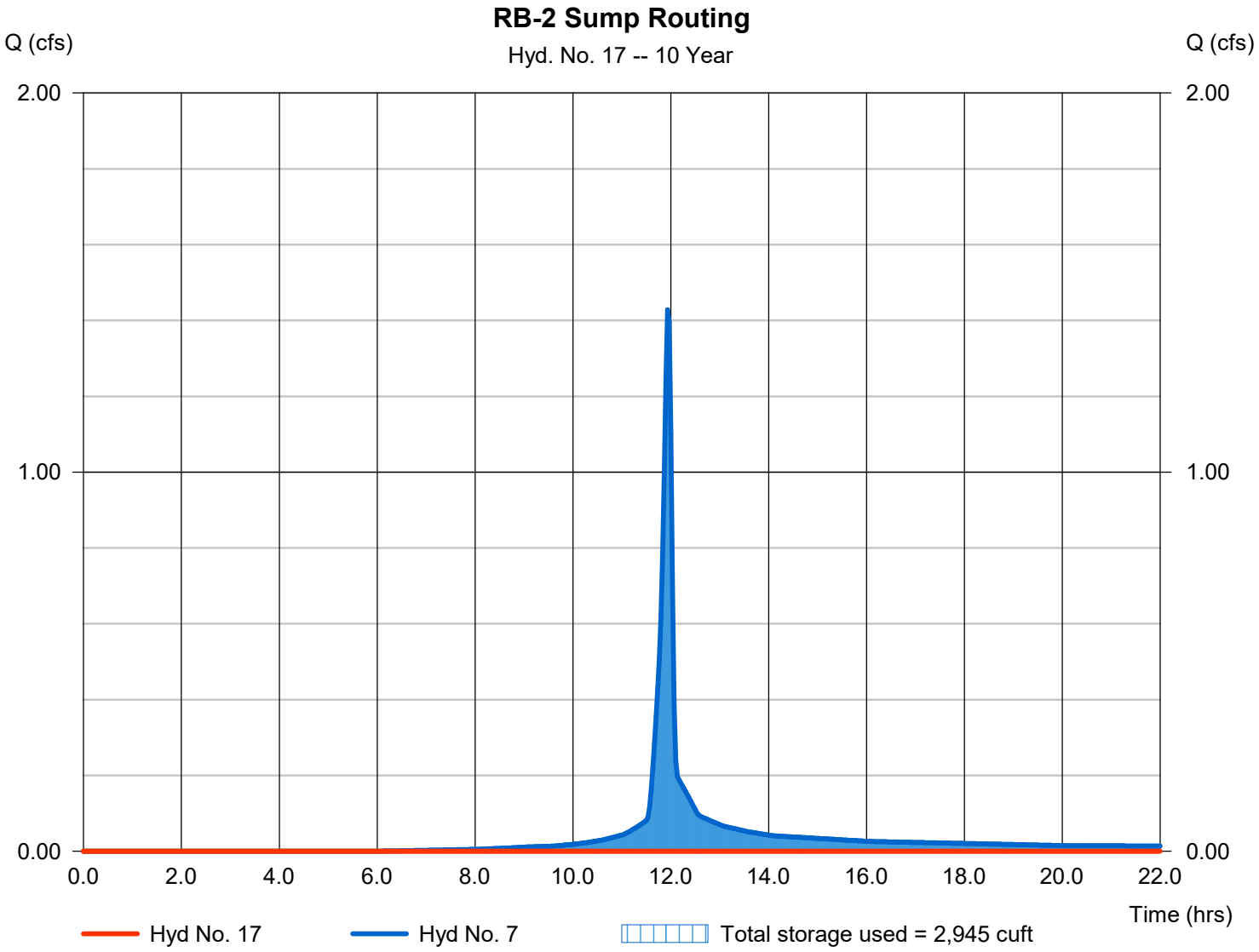
Hydrograph Report

Hyd. No. 17

RB-2 Sump Routing

Hydrograph type	=	Reservoir	Peak discharge	=	0.000 cfs
Storm frequency	=	10 yrs	Time to peak	=	n/a
Time interval	=	2 min	Hyd. volume	=	0 cuft
Inflow hyd. No.	=	7 - Post-Development Road Basin	Max. Elevation	=	101.97 ft
Reservoir name	=	RB-2 sumps	Max. Storage	=	2,945 cuft

Storage Indication method used.



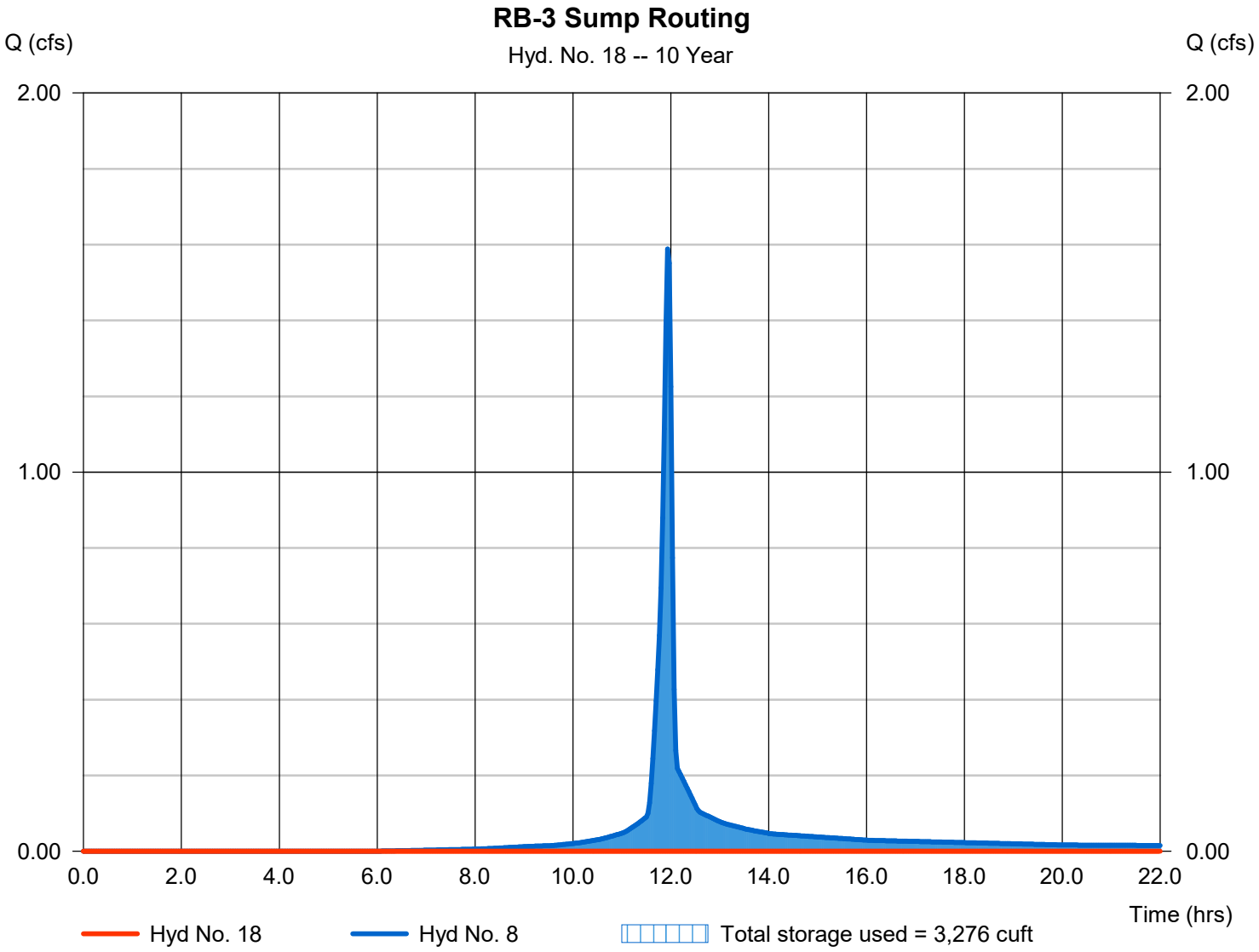
Hydrograph Report

Hyd. No. 18

RB-3 Sump Routing

Hydrograph type	=	Reservoir	Peak discharge	=	0.000 cfs
Storm frequency	=	10 yrs	Time to peak	=	n/a
Time interval	=	2 min	Hyd. volume	=	0 cuft
Inflow hyd. No.	=	8 - Post-Development Road Basin	Max. Elevation	=	101.97 ft
Reservoir name	=	RB-3 Sumps	Max. Storage	=	3,276 cuft

Storage Indication method used.



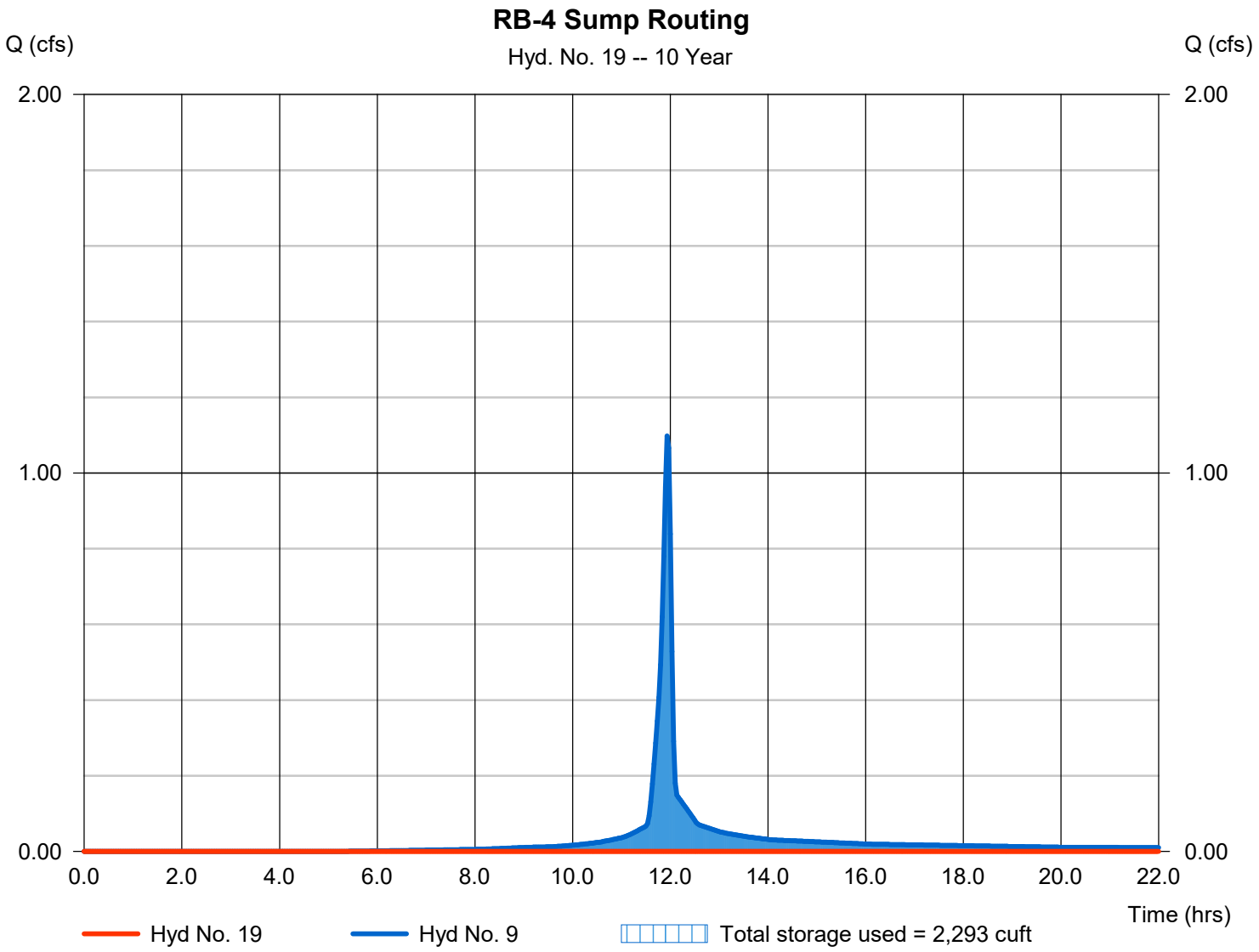
Hydrograph Report

Hyd. No. 19

RB-4 Sump Routing

Hydrograph type	=	Reservoir	Peak discharge	=	0.000 cfs
Storm frequency	=	10 yrs	Time to peak	=	n/a
Time interval	=	2 min	Hyd. volume	=	0 cuft
Inflow hyd. No.	=	9 - Post-Development Road Basin 4	Max. Elevation	=	101.86 ft
Reservoir name	=	RB-4 Sumps	Max. Storage	=	2,293 cuft

Storage Indication method used.



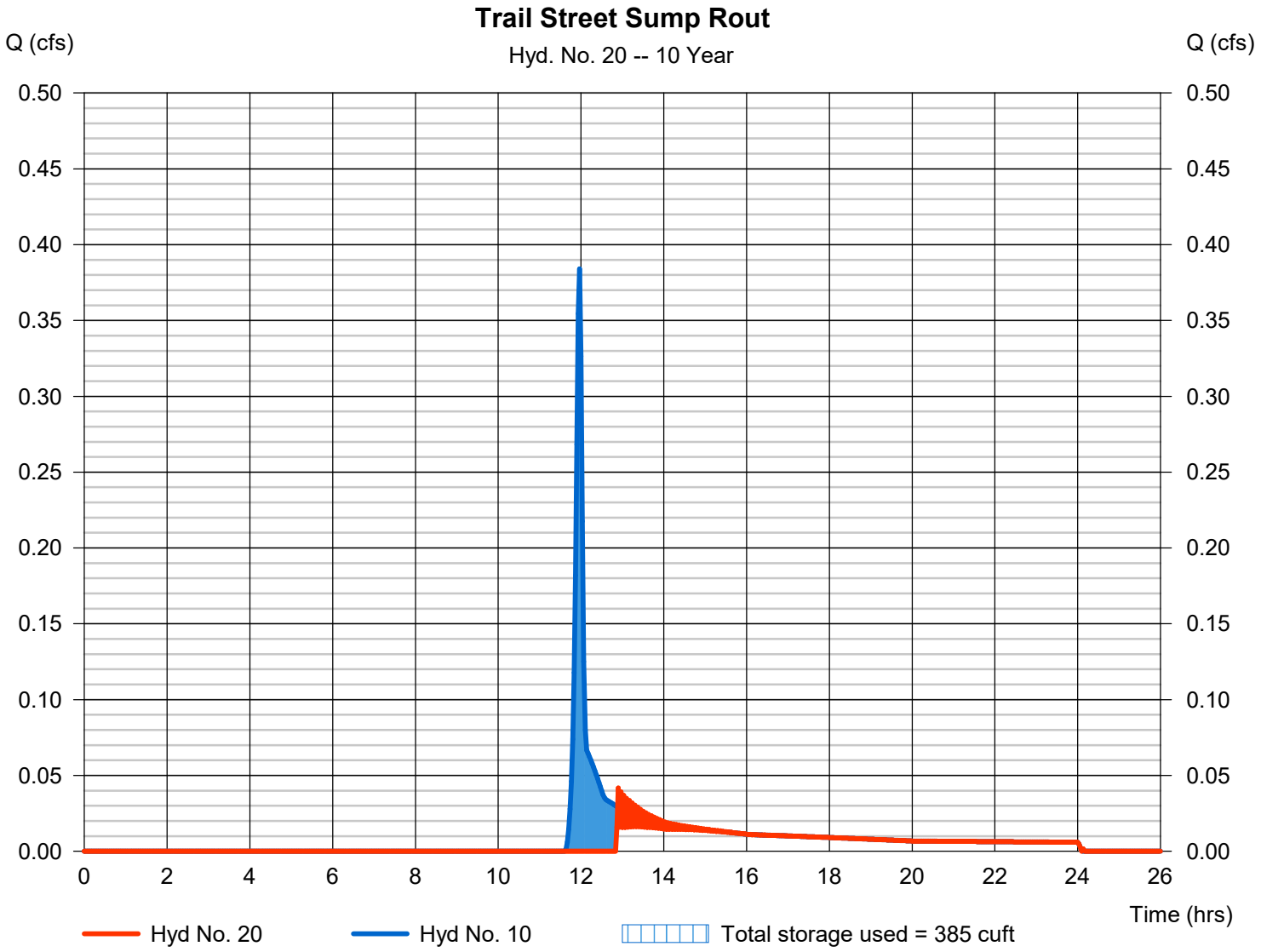
Hydrograph Report

Hyd. No. 20

Trail Street Sump Rout

Hydrograph type	=	Reservoir	Peak discharge	=	0.042 cfs
Storm frequency	=	10 yrs	Time to peak	=	12.90 hrs
Time interval	=	2 min	Hyd. volume	=	416 cuft
Inflow hyd. No.	=	10 - Trail Street Sub Basin	Max. Elevation	=	102.00 ft
Reservoir name	=	Trail Street Sumps	Max. Storage	=	385 cuft

Storage Indication method used.



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	2.067	2	718	4,135	------	------	------	Post-Development Basin A
2	SCS Runoff	1.624	2	718	3,249	------	------	------	Post-Development Basin B
3	SCS Runoff	8.117	2	718	16,232	------	------	------	Post-Development Basin C
4	SCS Runoff	4.411	2	718	8,841	------	------	------	Post-Development Basin D
5	SCS Runoff	5.162	2	718	10,425	------	------	------	Post-Development Basin E
6	SCS Runoff	2.594	3	717	6,045	------	------	------	Post-Development Road Basin 1
7	SCS Runoff	2.144	2	716	4,519	------	------	------	Post-Development Road Basin 2
8	SCS Runoff	2.385	2	716	5,028	------	------	------	Post-Development Road Basin 3
9	SCS Runoff	1.616	2	716	3,456	------	------	------	Post-Development Road Basin 4
10	SCS Runoff	0.804	2	718	1,612	------	------	------	Trail Street Sub Basin
11	Reservoir	0.197	2	766	1,885	1	102.00	2,250	Pond A Routing
12	Reservoir	0.000	2	n/a	0	2	101.88	3,249	Pond B Routing
13	Reservoir	0.000	2	n/a	0	3	102.00	16,232	Pond C Routing
14	Reservoir	0.494	2	780	3,525	4	102.01	5,316	Pond D Routing
15	Reservoir	0.342	2	850	3,741	5	102.01	6,685	Pond E Routing
16	Reservoir	0.213	3	780	1,836	6	102.01	4,209	RB-1 Sump Routing
17	Reservoir	0.223	2	756	1,530	7	102.01	2,990	RB-2 Sump Routing
18	Reservoir	0.194	2	756	1,699	8	102.01	3,329	RB-3 Sump Routing
19	Reservoir	0.075	2	784	981	9	102.00	2,475	RB-4 Sump Routing
20	Reservoir	0.798	2	718	1,227	10	102.02	386	Trail Street Sump Rout

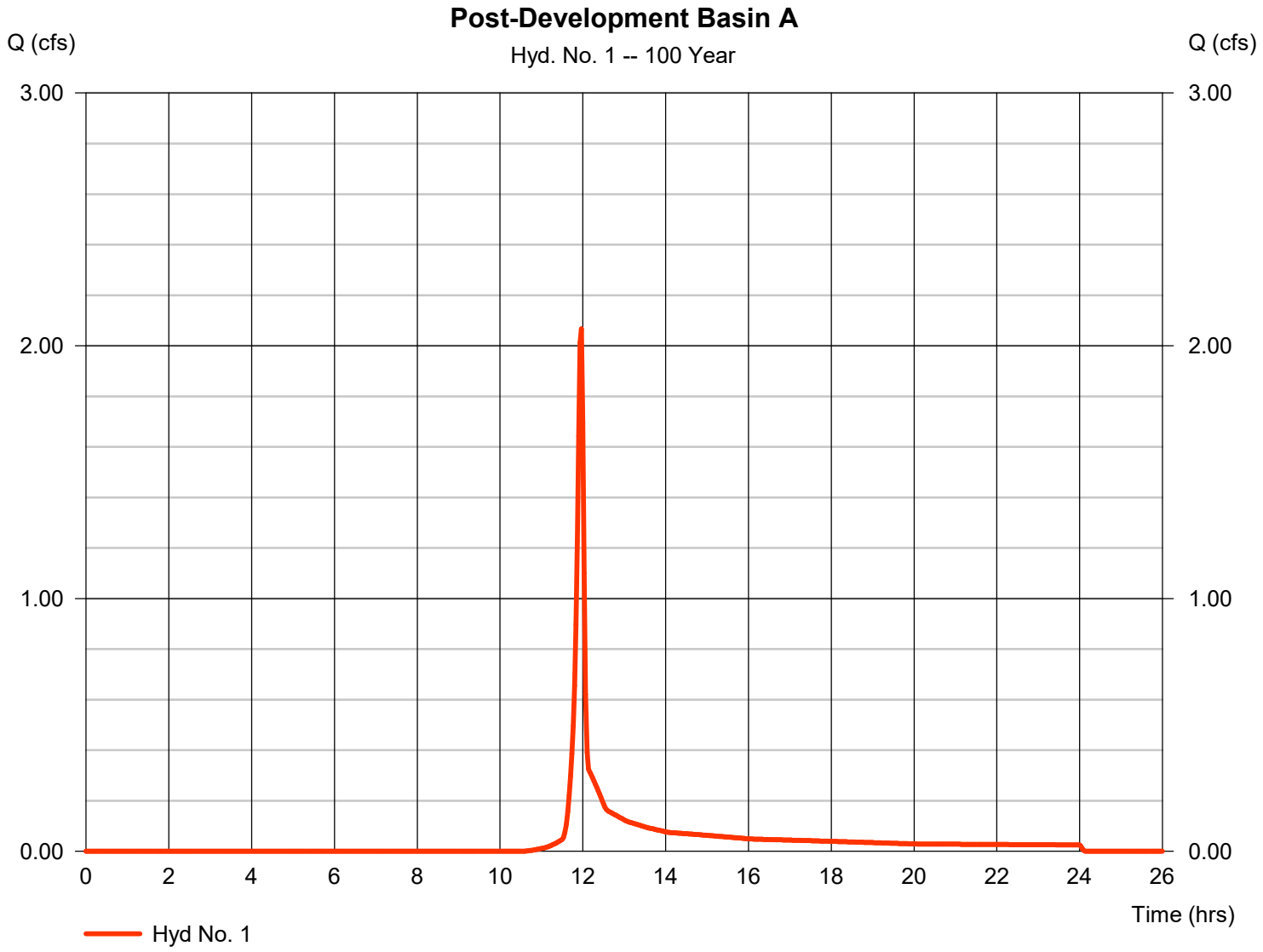
Hydrograph Report

Hyd. No. 1

Post-Development Basin A

Hydrograph type	=	SCS Runoff	Peak discharge	=	2.067 cfs
Storm frequency	=	100 yrs	Time to peak	=	11.97 hrs
Time interval	=	2 min	Hyd. volume	=	4,135 cuft
Drainage area	=	1.540 ac	Curve number	=	81*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	2.28 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.940 x 98) + (0.780 x 61)] / 1.540



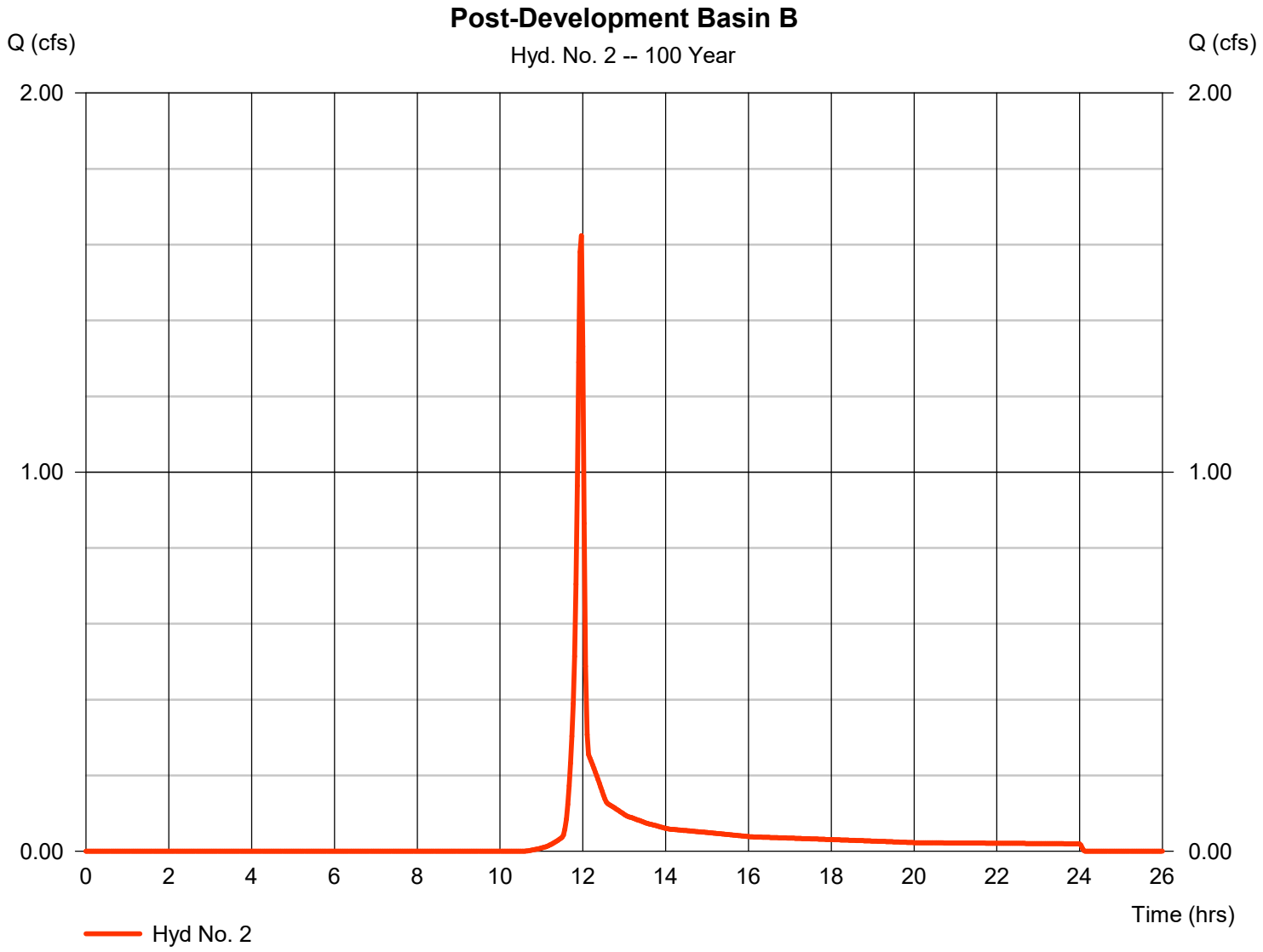
Hydrograph Report

Hyd. No. 2

Post-Development Basin B

Hydrograph type	=	SCS Runoff	Peak discharge	=	1.624 cfs
Storm frequency	=	100 yrs	Time to peak	=	11.97 hrs
Time interval	=	2 min	Hyd. volume	=	3,249 cuft
Drainage area	=	1.210 ac	Curve number	=	81*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	2.28 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.660 x 98) + (0.550 x 61)] / 1.210



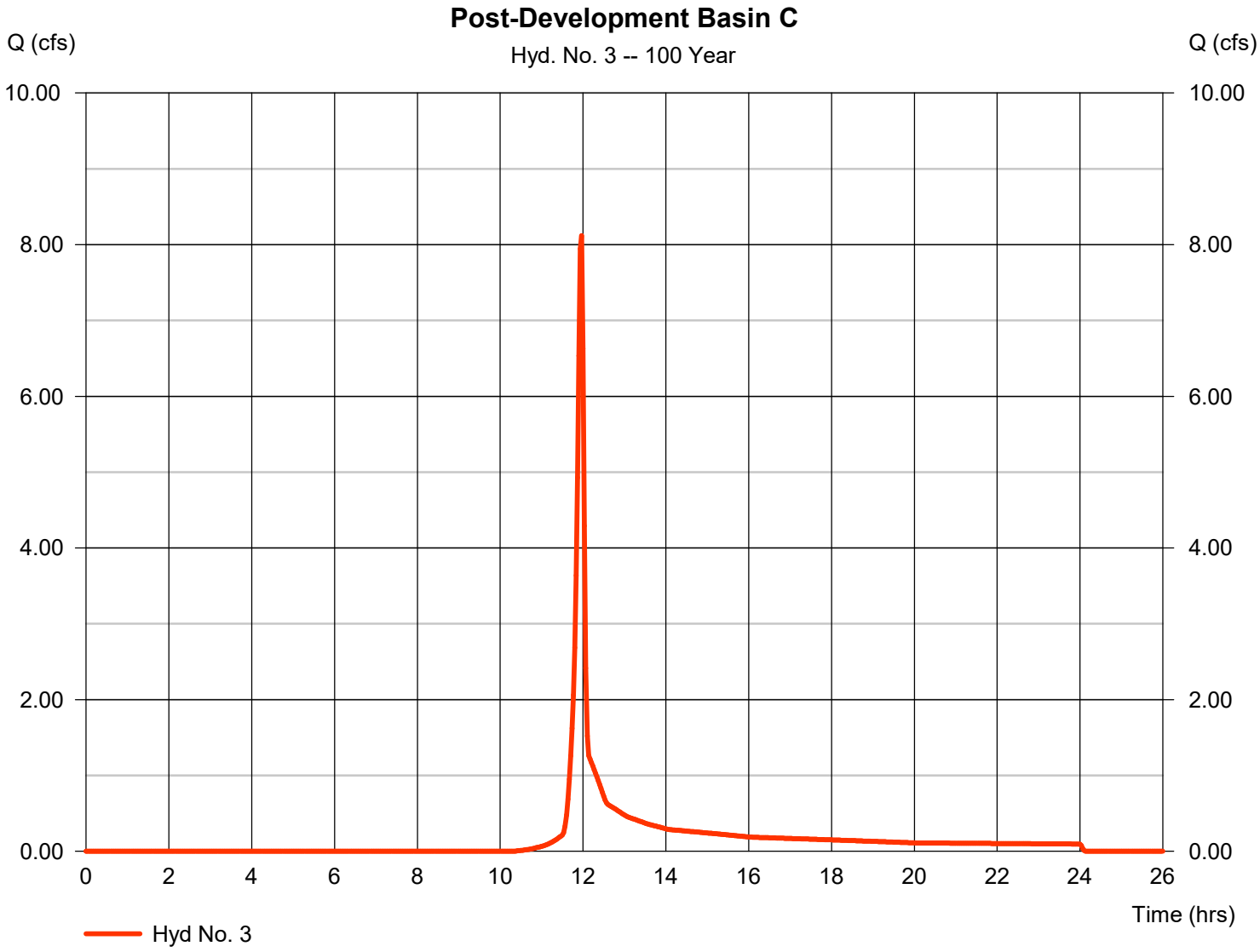
Hydrograph Report

Hyd. No. 3

Post-Development Basin C

Hydrograph type	=	SCS Runoff	Peak discharge	=	8.117 cfs
Storm frequency	=	100 yrs	Time to peak	=	11.97 hrs
Time interval	=	2 min	Hyd. volume	=	16,232 cuft
Drainage area	=	5.680 ac	Curve number	=	82*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	2.28 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(2.630 x 98) + (3.050 x 61)] / 5.680



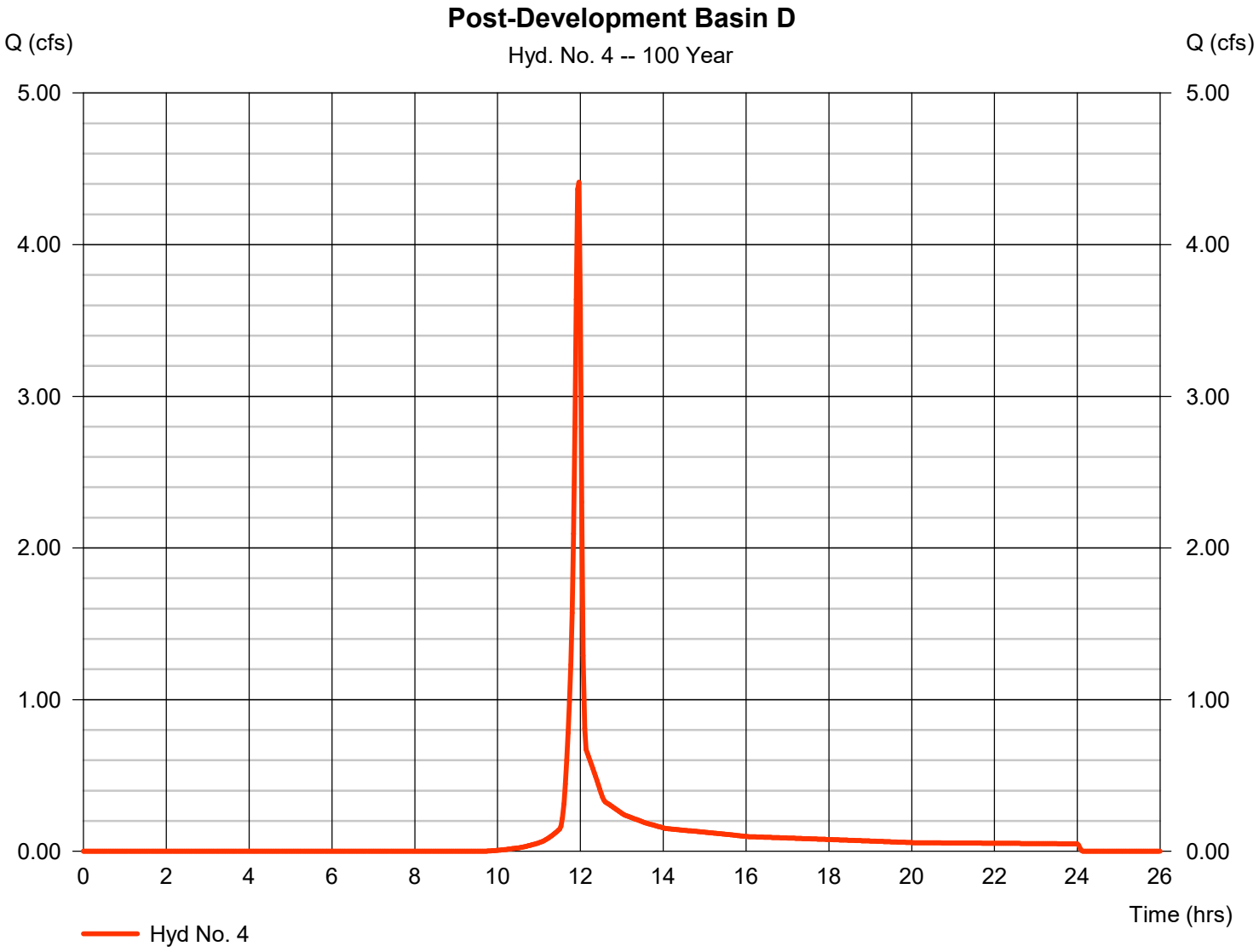
Hydrograph Report

Hyd. No. 4

Post-Development Basin D

Hydrograph type	=	SCS Runoff	Peak discharge	=	4.411 cfs
Storm frequency	=	100 yrs	Time to peak	=	11.97 hrs
Time interval	=	2 min	Hyd. volume	=	8,841 cuft
Drainage area	=	2.740 ac	Curve number	=	84*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	2.28 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(1.790 x 98) + (1.150 x 61)] / 2.740



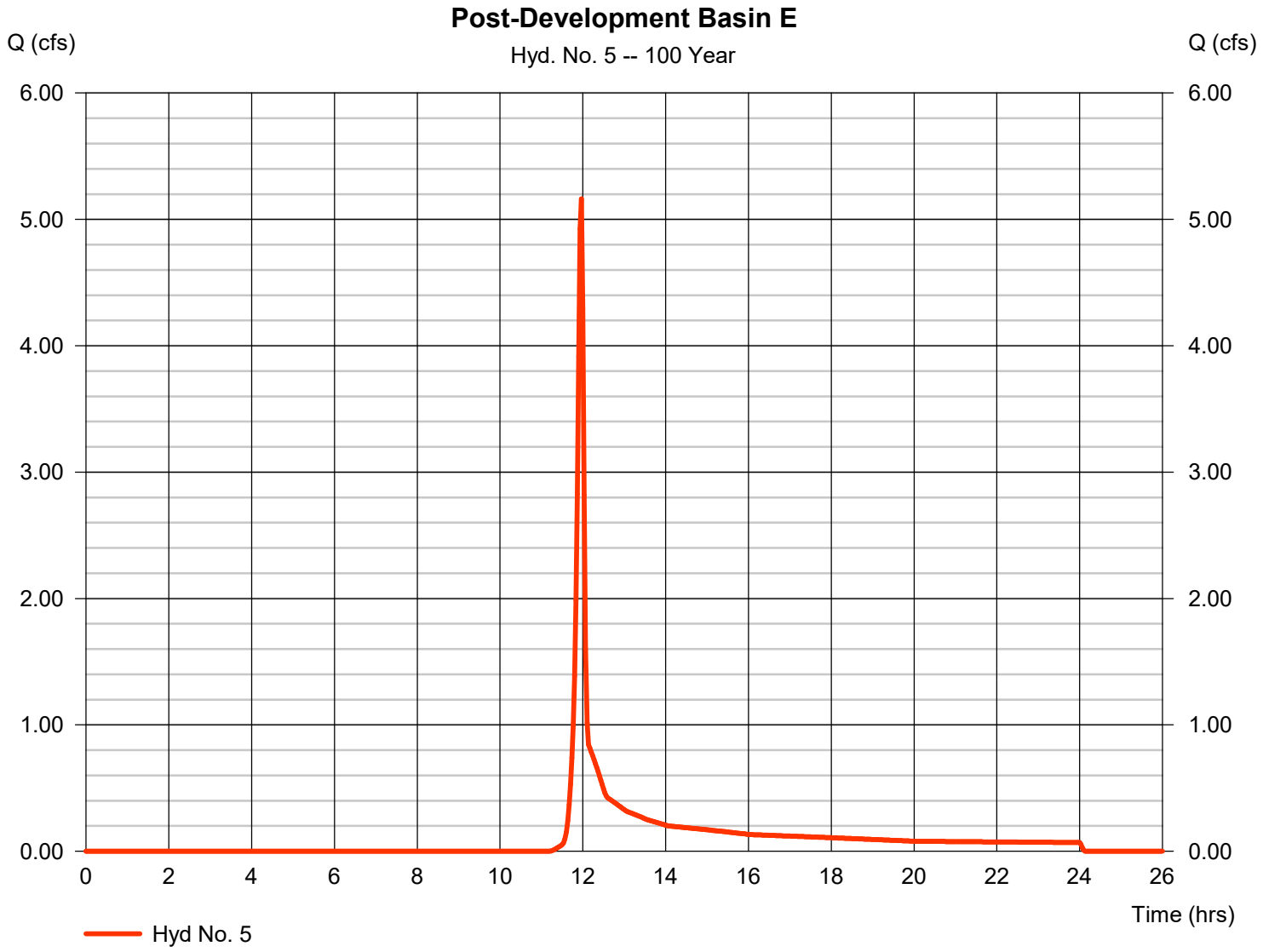
Hydrograph Report

Hyd. No. 5

Post-Development Basin E

Hydrograph type	=	SCS Runoff	Peak discharge	=	5.162 cfs
Storm frequency	=	100 yrs	Time to peak	=	11.97 hrs
Time interval	=	2 min	Hyd. volume	=	10,425 cuft
Drainage area	=	4.720 ac	Curve number	=	78*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	2.28 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(2.170 x 98) + (2.550 x 61)] / 4.720



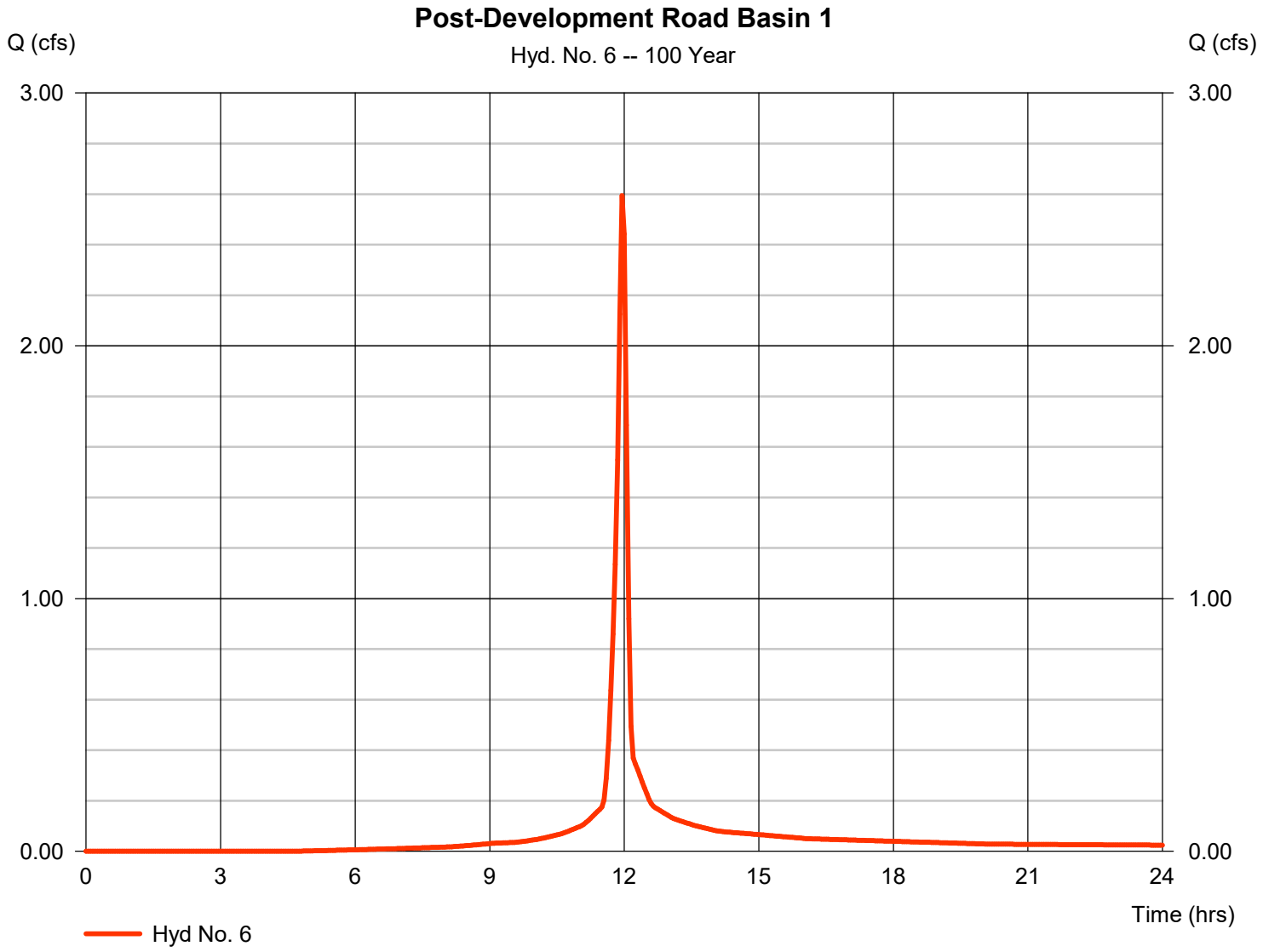
Hydrograph Report

Hyd. No. 6

Post-Development Road Basin 1

Hydrograph type	=	SCS Runoff	Peak discharge	=	2.594 cfs
Storm frequency	=	100 yrs	Time to peak	=	11.95 hrs
Time interval	=	3 min	Hyd. volume	=	6,045 cuft
Drainage area	=	1.070 ac	Curve number	=	94*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	2.28 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.880 x 98) + (0.190 x 61)] / 1.070



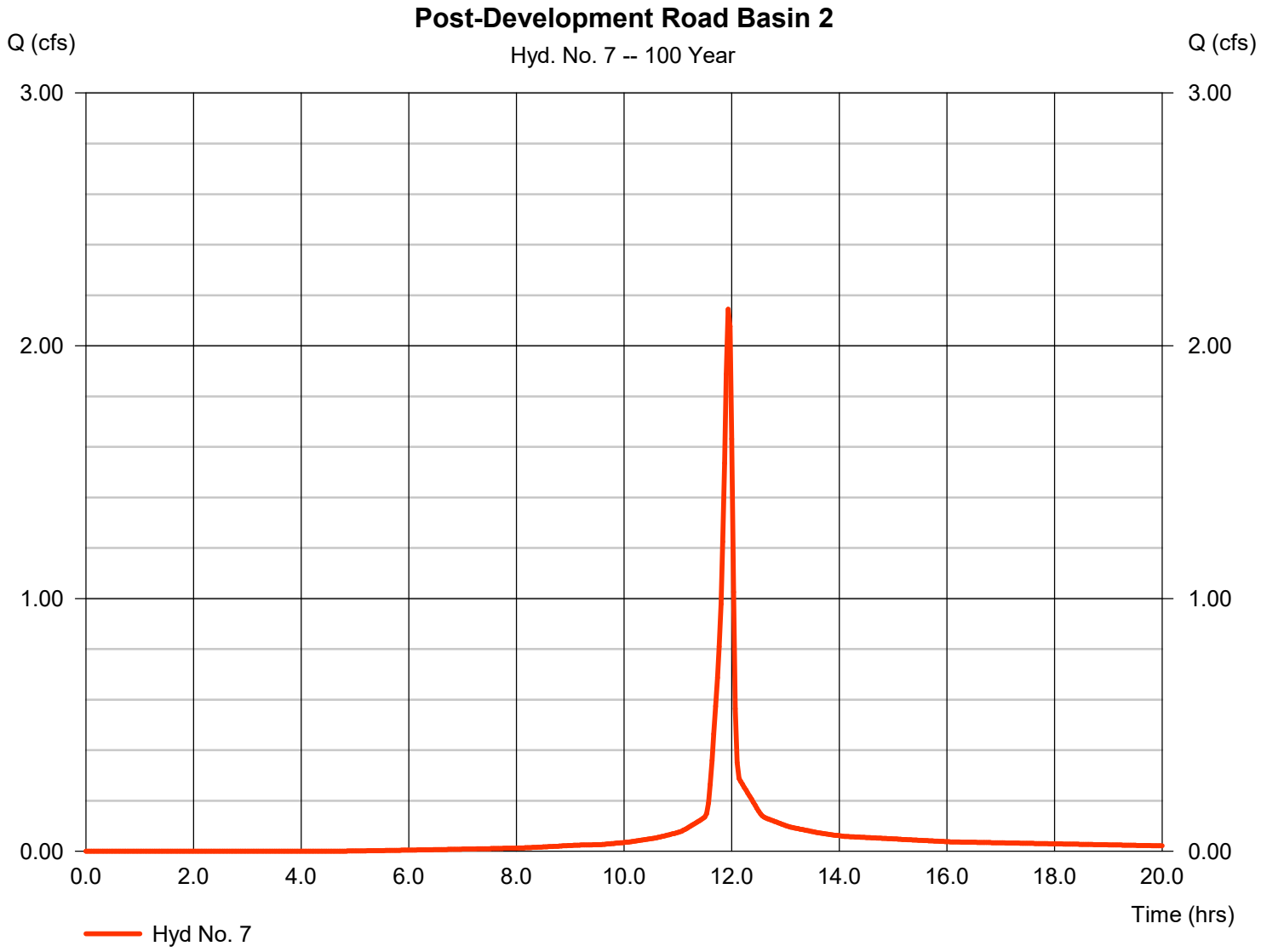
Hydrograph Report

Hyd. No. 7

Post-Development Road Basin 2

Hydrograph type	= SCS Runoff	Peak discharge	= 2.144 cfs
Storm frequency	= 100 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 4,519 cuft
Drainage area	= 0.800 ac	Curve number	= 94*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 2.28 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.090 x 61) + (0.710 x 98)] / 0.800



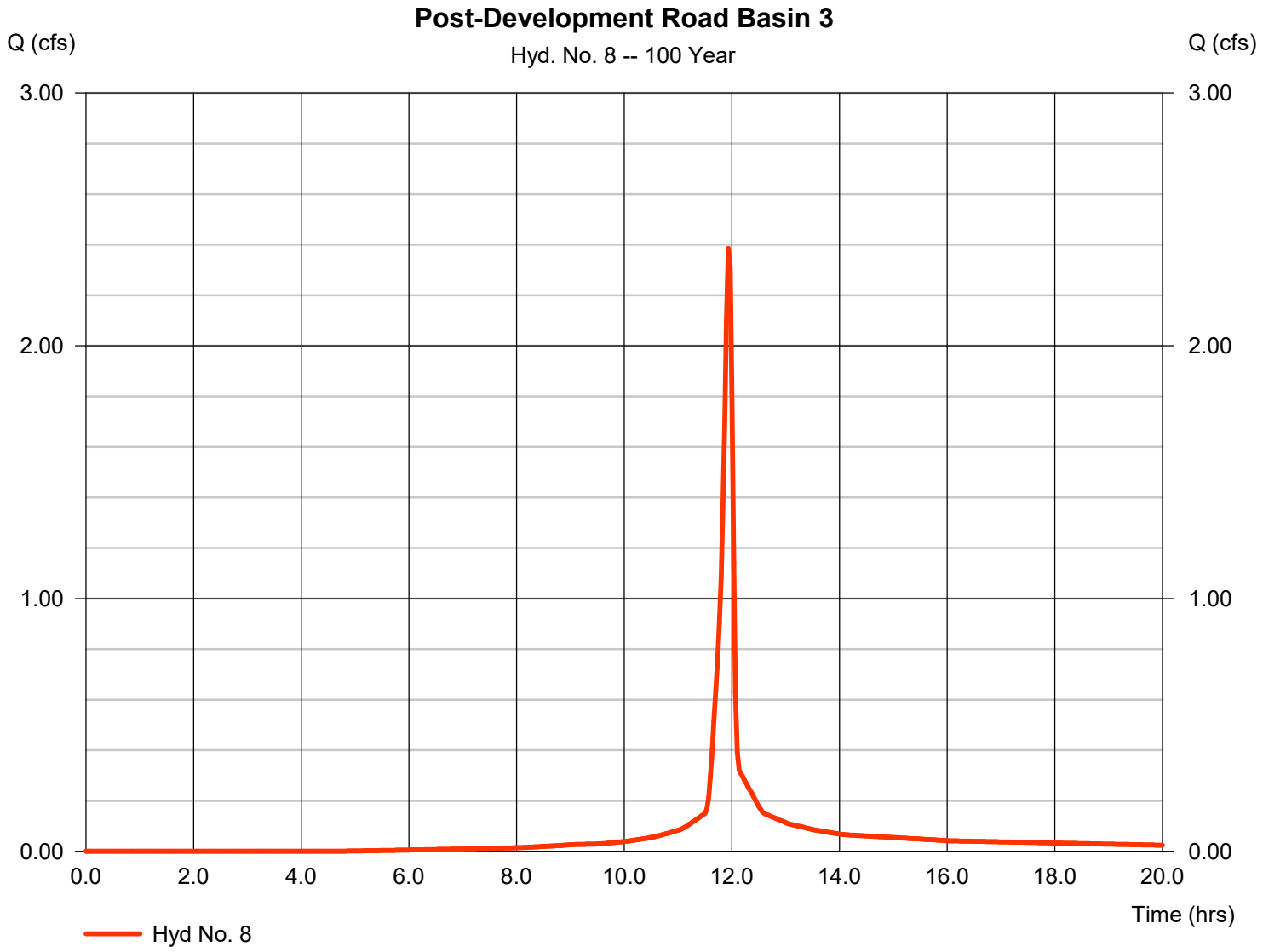
Hydrograph Report

Hyd. No. 8

Post-Development Road Basin 3

Hydrograph type	=	SCS Runoff	Peak discharge	=	2.385 cfs
Storm frequency	=	100 yrs	Time to peak	=	11.93 hrs
Time interval	=	2 min	Hyd. volume	=	5,028 cuft
Drainage area	=	0.890 ac	Curve number	=	94*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	2.28 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.790 x 98) + (0.100 x 61)] / 0.890



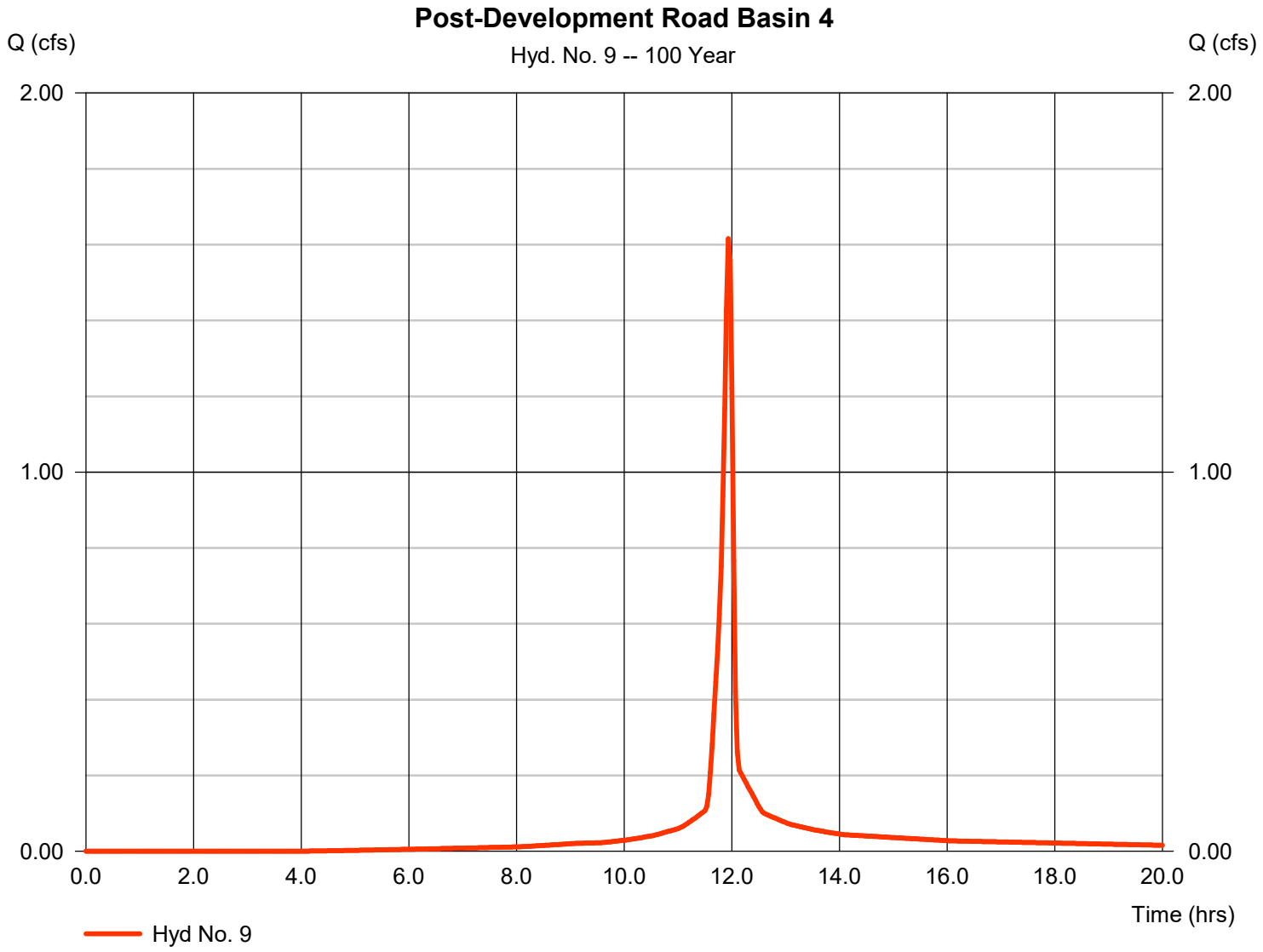
Hydrograph Report

Hyd. No. 9

Post-Development Road Basin 4

Hydrograph type	=	SCS Runoff	Peak discharge	=	1.616 cfs
Storm frequency	=	100 yrs	Time to peak	=	11.93 hrs
Time interval	=	2 min	Hyd. volume	=	3,456 cuft
Drainage area	=	0.580 ac	Curve number	=	95*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	2.28 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.530 x 98) + (0.050 x 61)] / 0.580



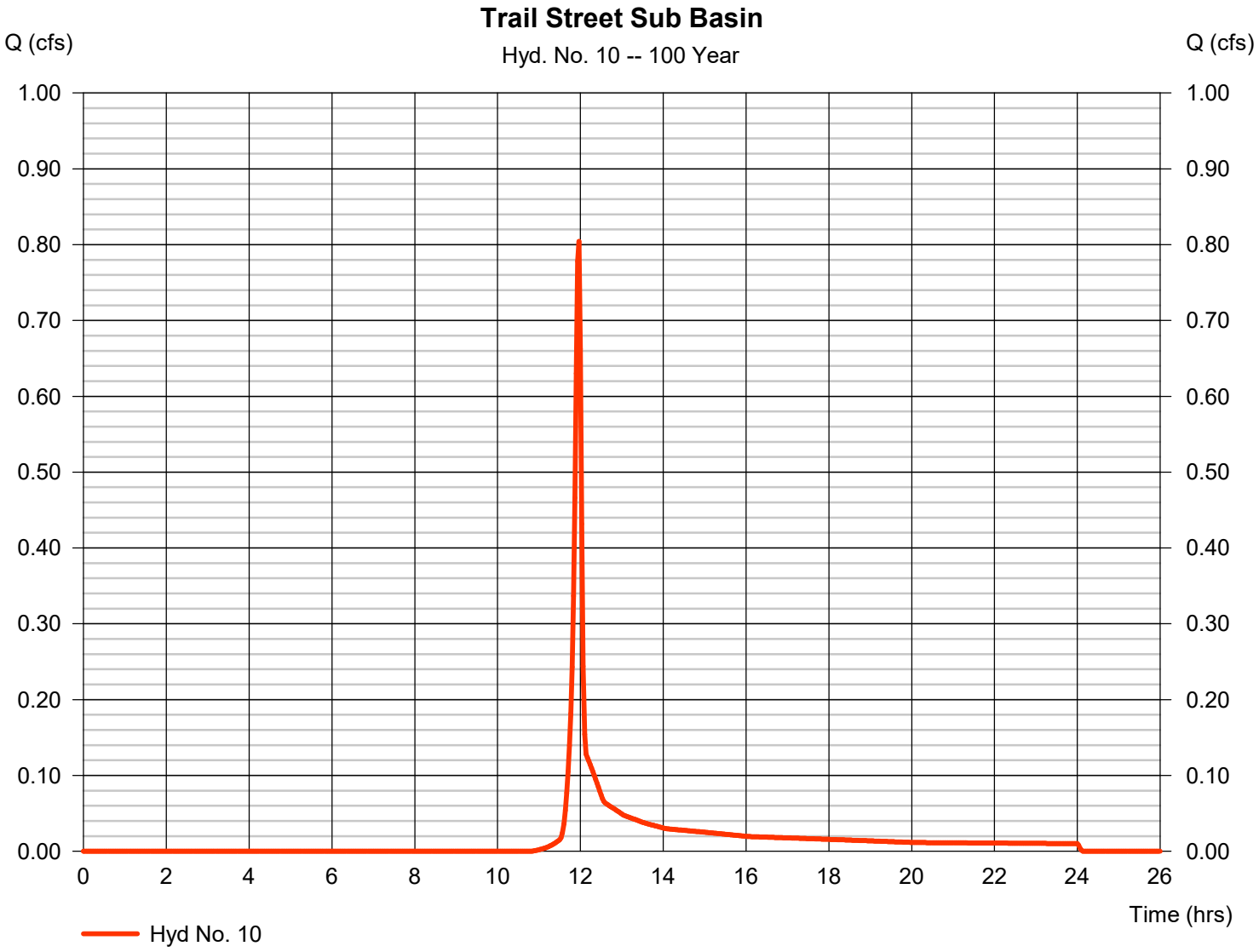
Hydrograph Report

Hyd. No. 10

Trail Street Sub Basin

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.804 cfs
Storm frequency	=	100 yrs	Time to peak	=	11.97 hrs
Time interval	=	2 min	Hyd. volume	=	1,612 cuft
Drainage area	=	0.640 ac	Curve number	=	80*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	2.28 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.330 x 98) + (0.310 x 61)] / 0.640



Hydrograph Report

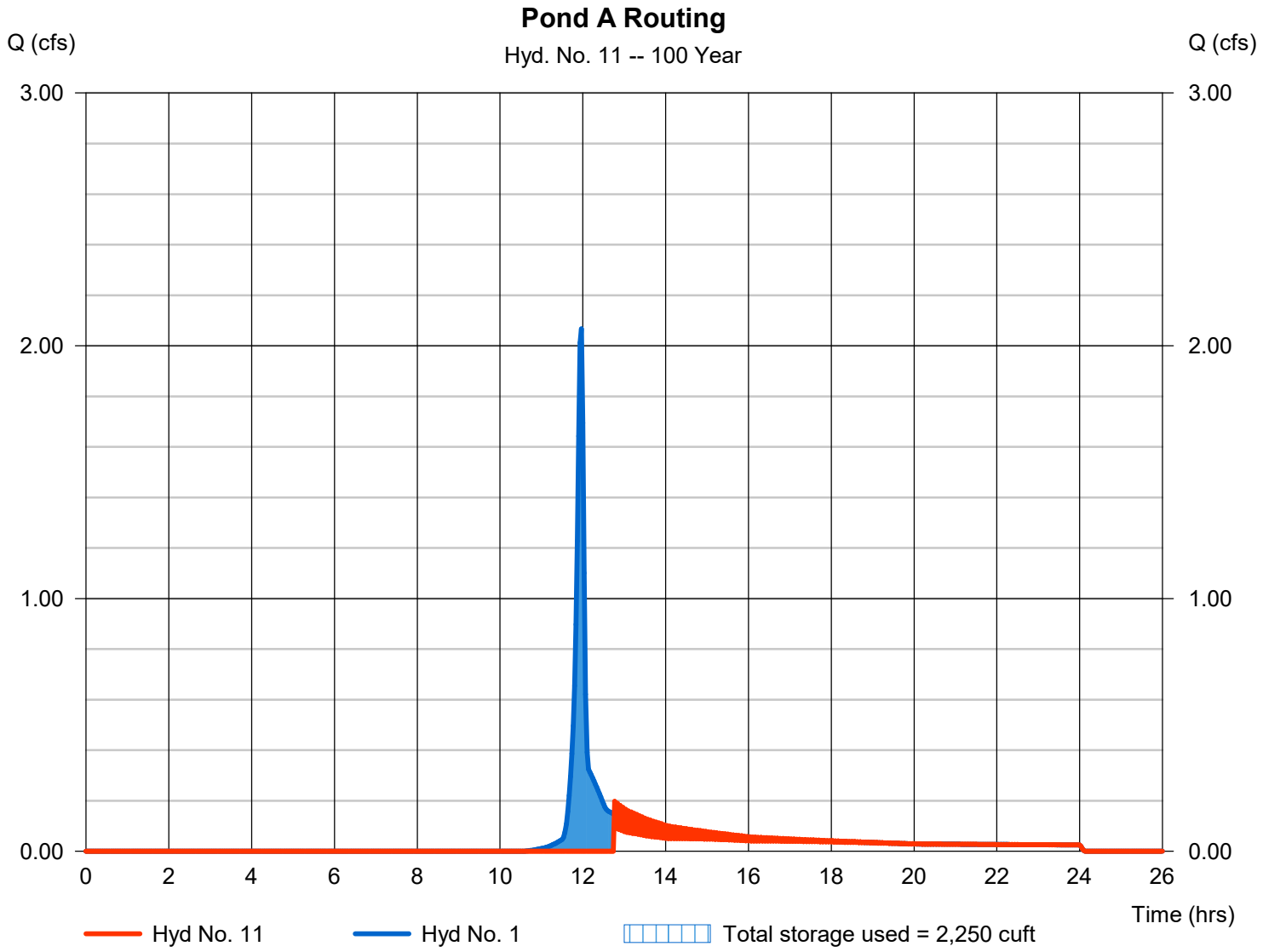
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021 Monday, 02 / 27 / 2023

Hyd. No. 11

Pond A Routing

Hydrograph type	=	Reservoir	Peak discharge	=	0.197 cfs
Storm frequency	=	100 yrs	Time to peak	=	12.77 hrs
Time interval	=	2 min	Hyd. volume	=	1,885 cuft
Inflow hyd. No.	=	1 - Post-Development Basin A	Max. Elevation	=	102.00 ft
Reservoir name	=	Basin A Pond	Max. Storage	=	2,250 cuft

Storage Indication method used.



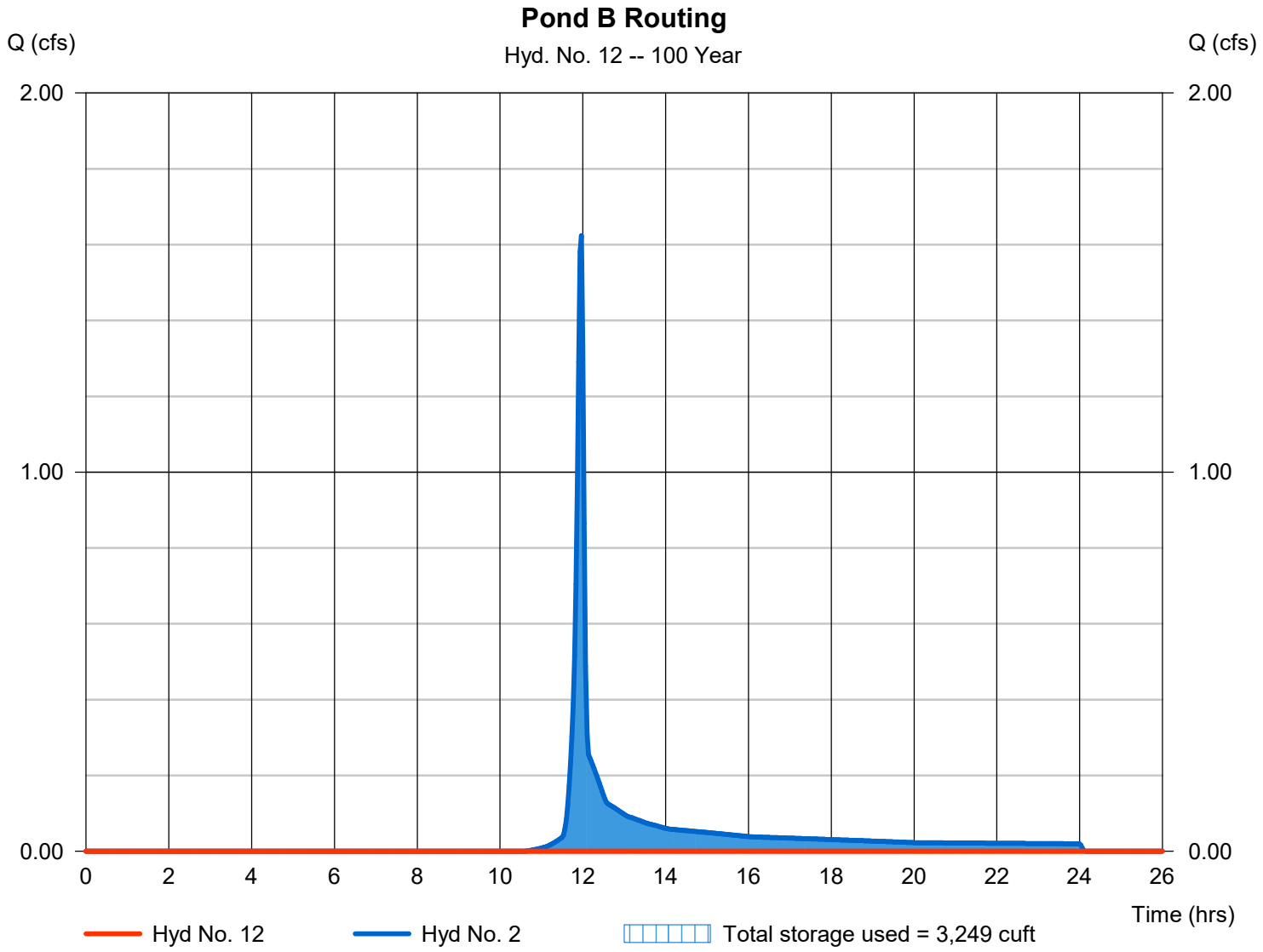
Hydrograph Report

Hyd. No. 12

Pond B Routing

Hydrograph type	=	Reservoir	Peak discharge	=	0.000 cfs
Storm frequency	=	100 yrs	Time to peak	=	n/a
Time interval	=	2 min	Hyd. volume	=	0 cuft
Inflow hyd. No.	=	2 - Post-Development Basin B	Max. Elevation	=	101.88 ft
Reservoir name	=	Basin B Pond	Max. Storage	=	3,249 cuft

Storage Indication method used.



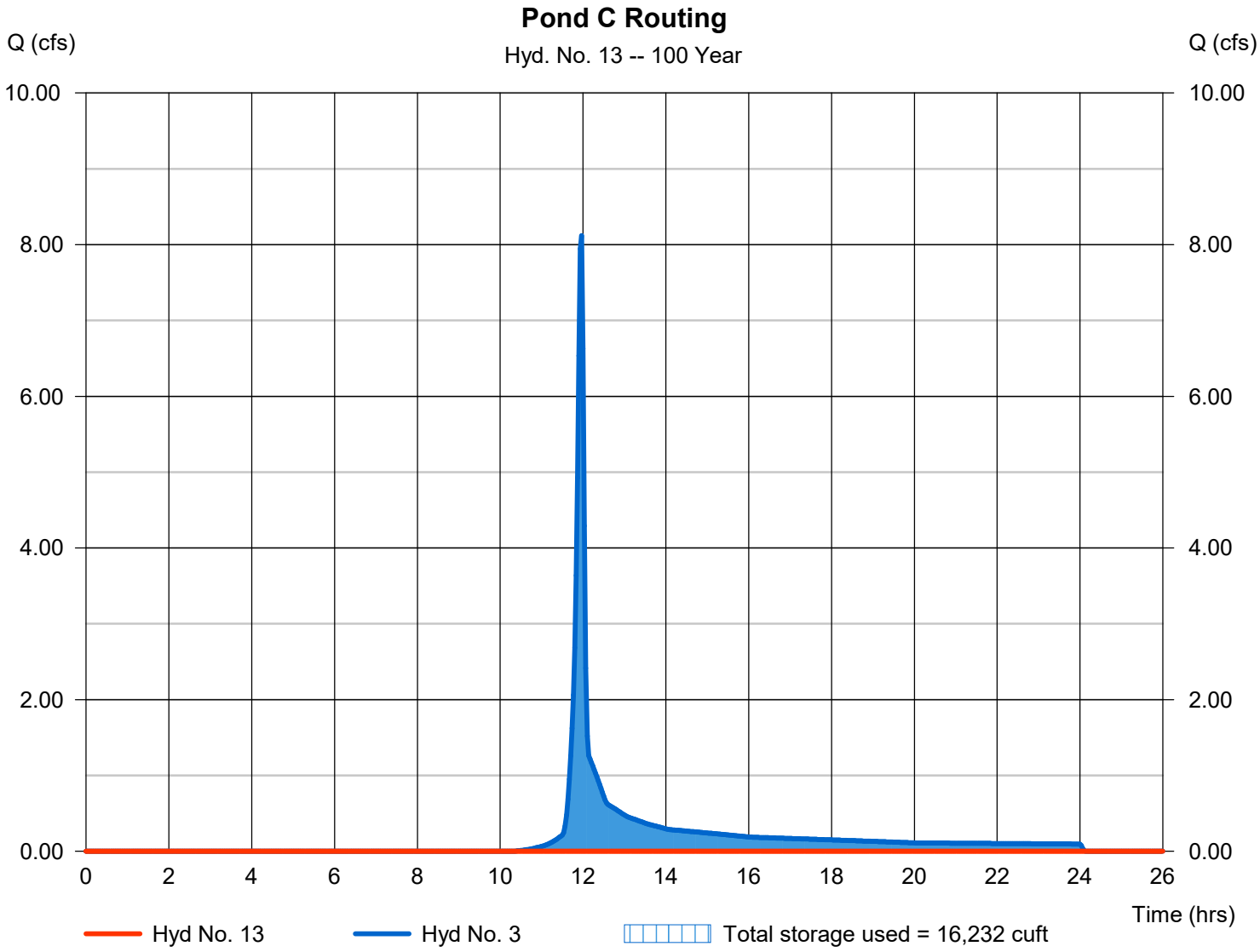
Hydrograph Report

Hyd. No. 13

Pond C Routing

Hydrograph type	=	Reservoir	Peak discharge	=	0.000 cfs
Storm frequency	=	100 yrs	Time to peak	=	n/a
Time interval	=	2 min	Hyd. volume	=	0 cuft
Inflow hyd. No.	=	3 - Post-Development Basin C	Max. Elevation	=	102.00 ft
Reservoir name	=	Basin C Pond	Max. Storage	=	16,232 cuft

Storage Indication method used.



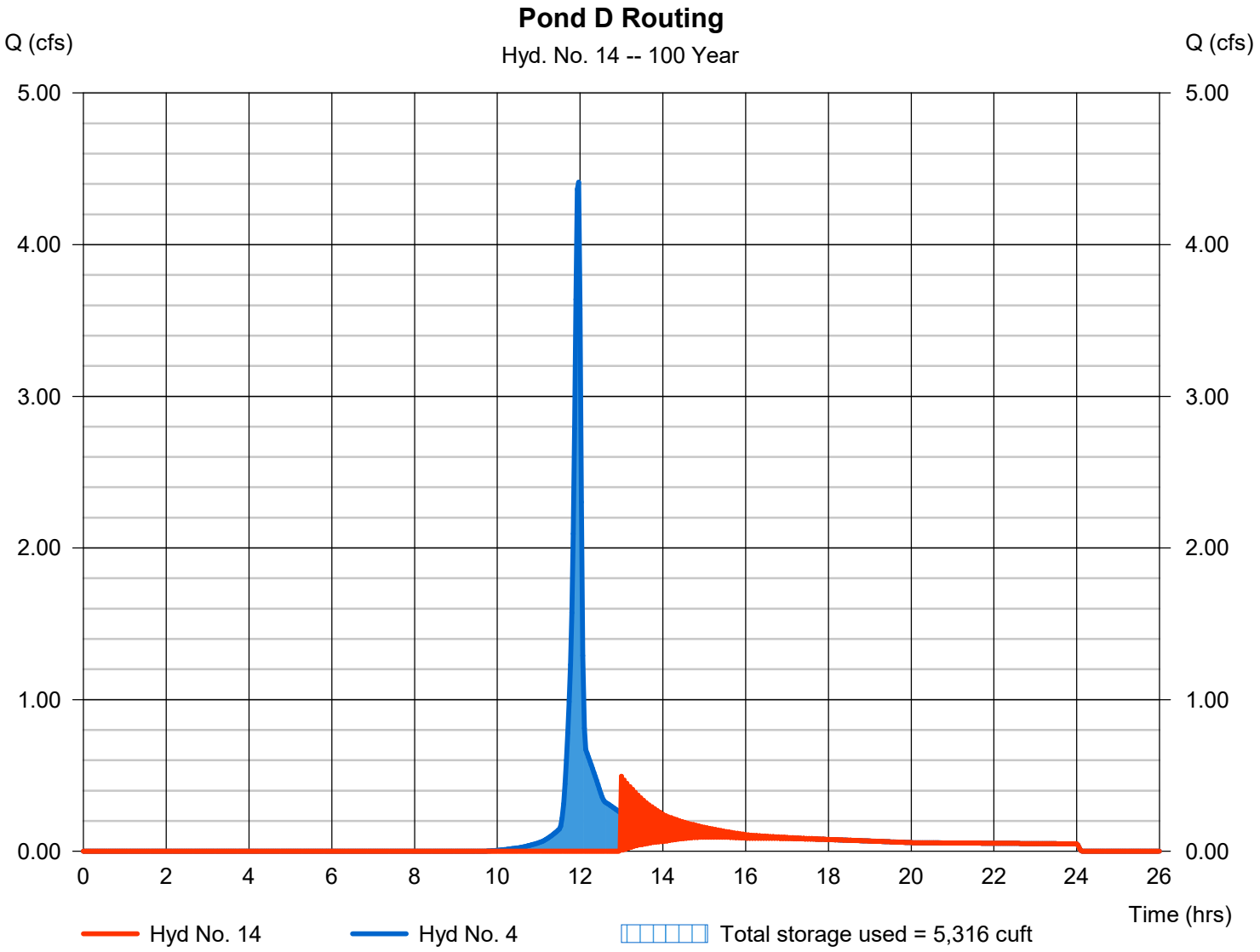
Hydrograph Report

Hyd. No. 14

Pond D Routing

Hydrograph type	=	Reservoir	Peak discharge	=	0.494 cfs
Storm frequency	=	100 yrs	Time to peak	=	13.00 hrs
Time interval	=	2 min	Hyd. volume	=	3,525 cuft
Inflow hyd. No.	=	4 - Post-Development Basin D	Max. Elevation	=	102.01 ft
Reservoir name	=	Basin D Pond	Max. Storage	=	5,316 cuft

Storage Indication method used.



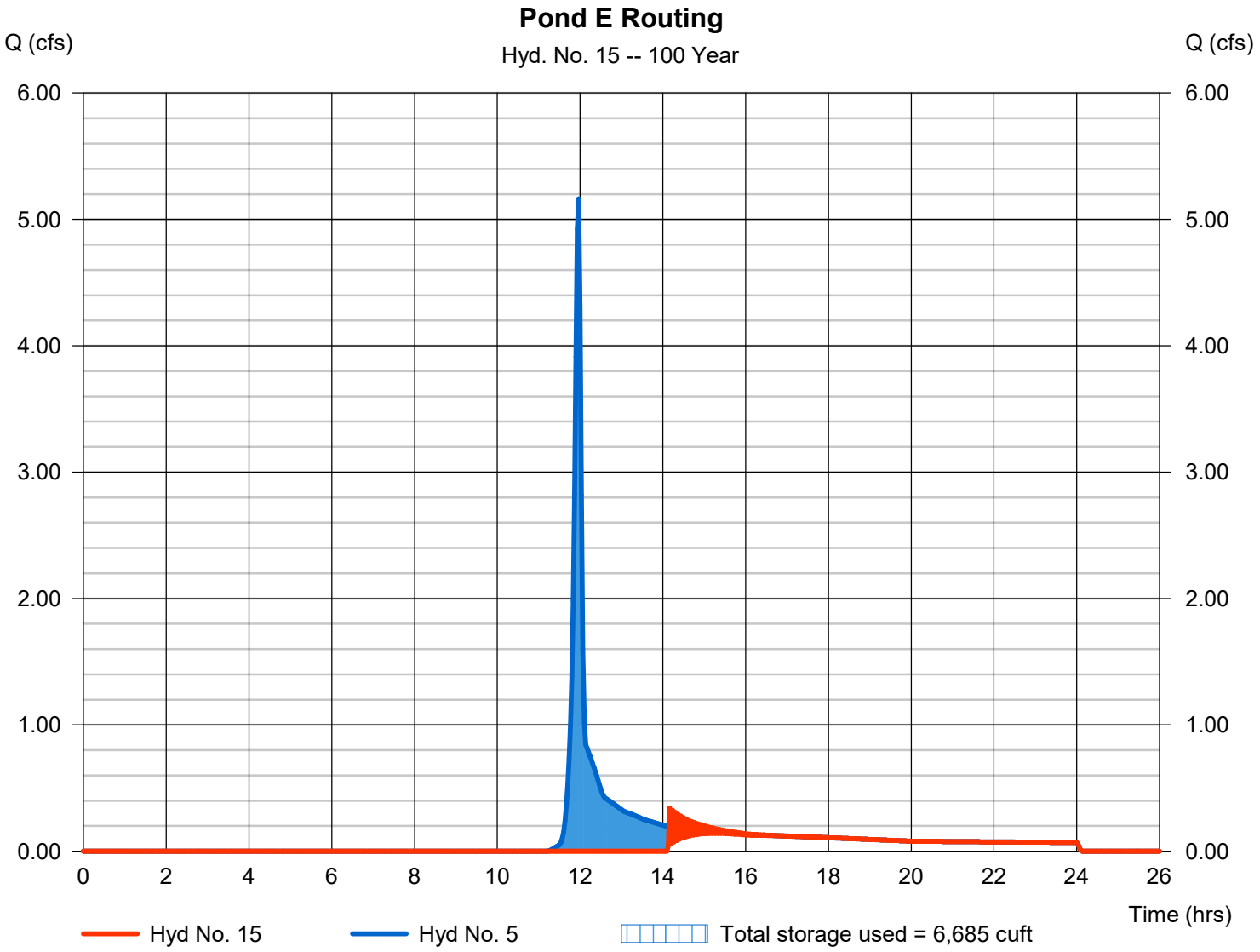
Hydrograph Report

Hyd. No. 15

Pond E Routing

Hydrograph type	=	Reservoir	Peak discharge	=	0.342 cfs
Storm frequency	=	100 yrs	Time to peak	=	14.17 hrs
Time interval	=	2 min	Hyd. volume	=	3,741 cuft
Inflow hyd. No.	=	5 - Post-Development Basin E	Max. Elevation	=	102.01 ft
Reservoir name	=	Basin E Pond	Max. Storage	=	6,685 cuft

Storage Indication method used.



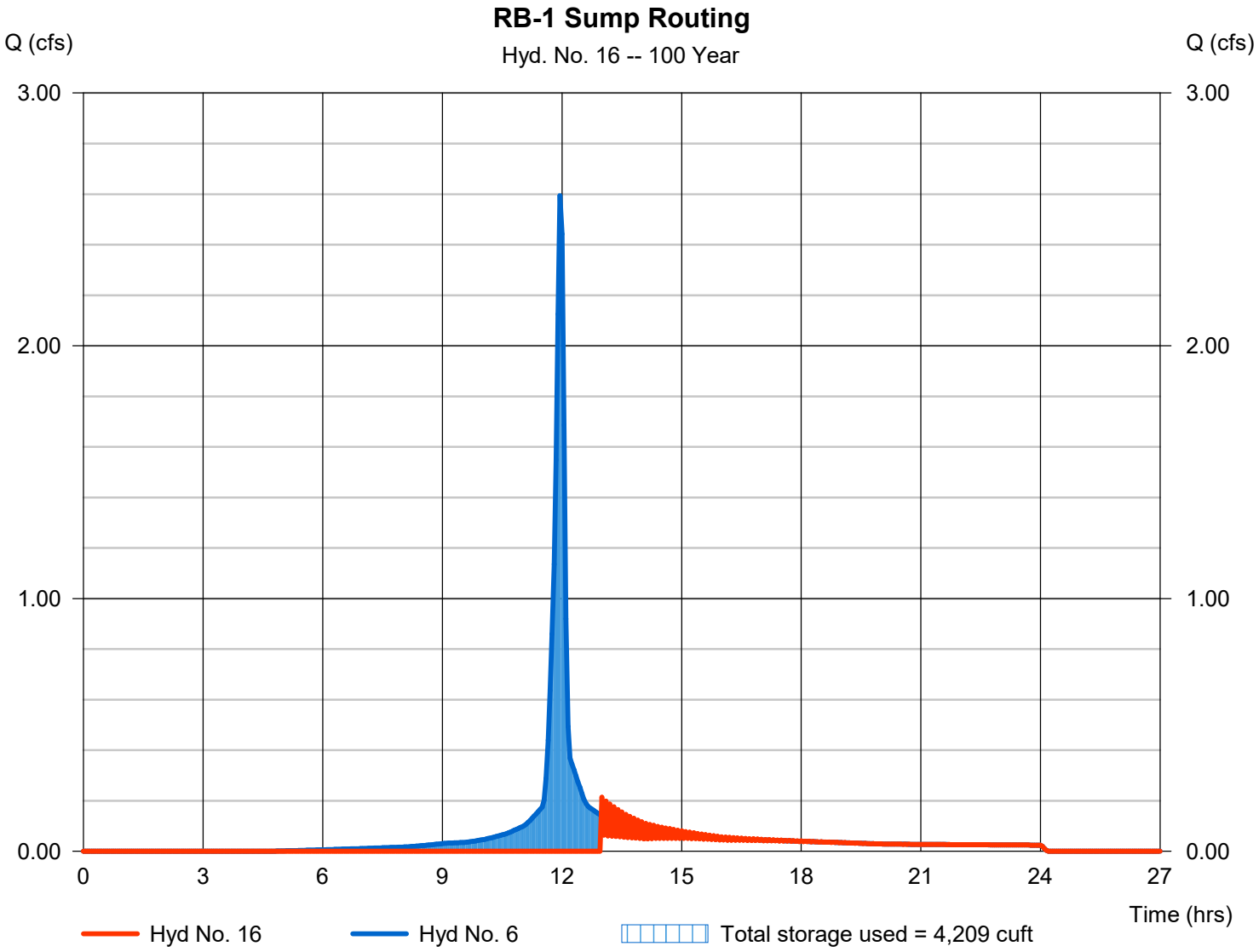
Hydrograph Report

Hyd. No. 16

RB-1 Sump Routing

Hydrograph type	=	Reservoir	Peak discharge	=	0.213 cfs
Storm frequency	=	100 yrs	Time to peak	=	13.00 hrs
Time interval	=	3 min	Hyd. volume	=	1,836 cuft
Inflow hyd. No.	=	6 - Post-Development Road Basin 1	Max. Elevation	=	102.01 ft
Reservoir name	=	RB-1 Pond	Max. Storage	=	4,209 cuft

Storage Indication method used.



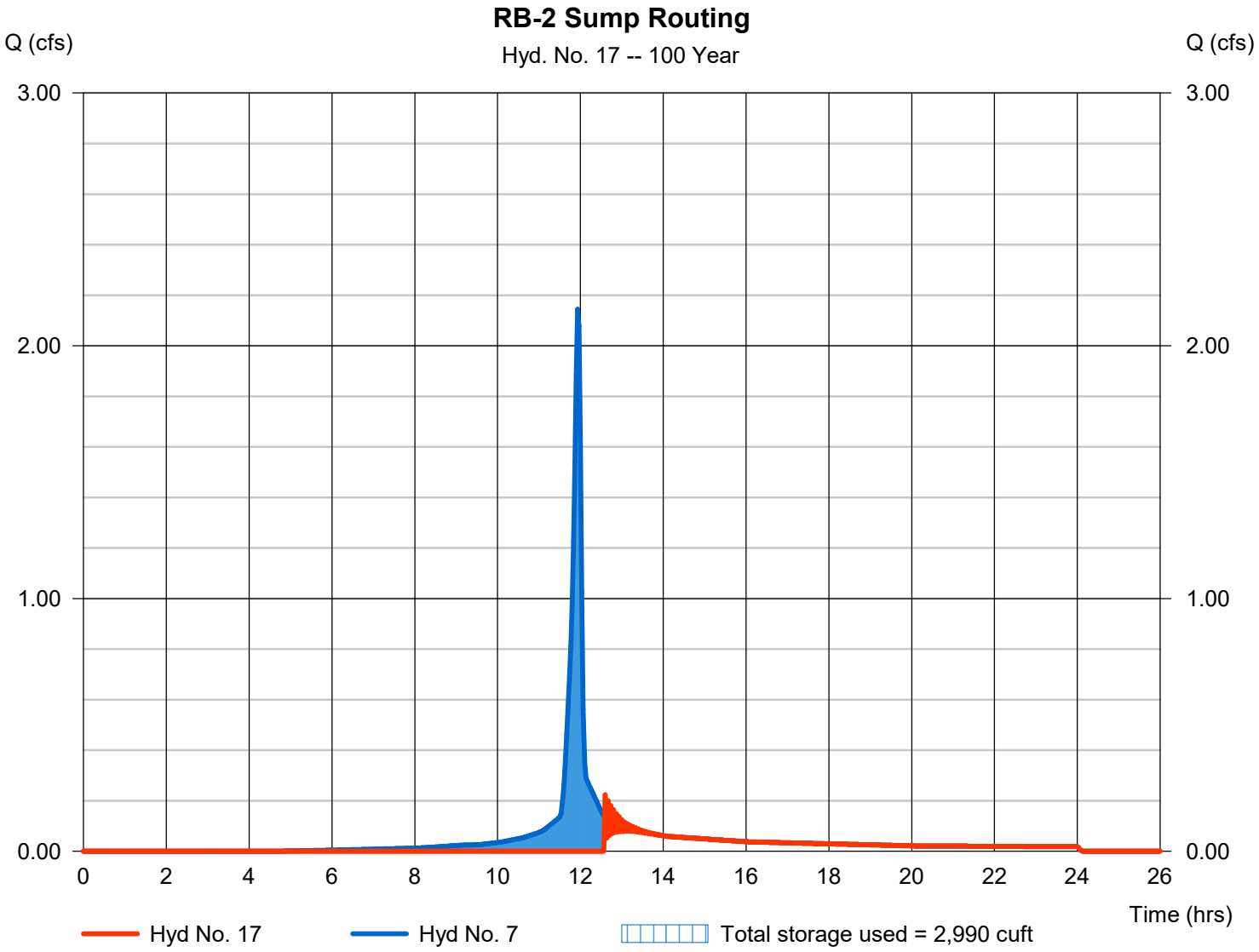
Hydrograph Report

Hyd. No. 17

RB-2 Sump Routing

Hydrograph type	=	Reservoir	Peak discharge	=	0.223 cfs
Storm frequency	=	100 yrs	Time to peak	=	12.60 hrs
Time interval	=	2 min	Hyd. volume	=	1,530 cuft
Inflow hyd. No.	=	7 - Post-Development Road Basin	Max. Elevation	=	102.01 ft
Reservoir name	=	RB-2 sumps	Max. Storage	=	2,990 cuft

Storage Indication method used.



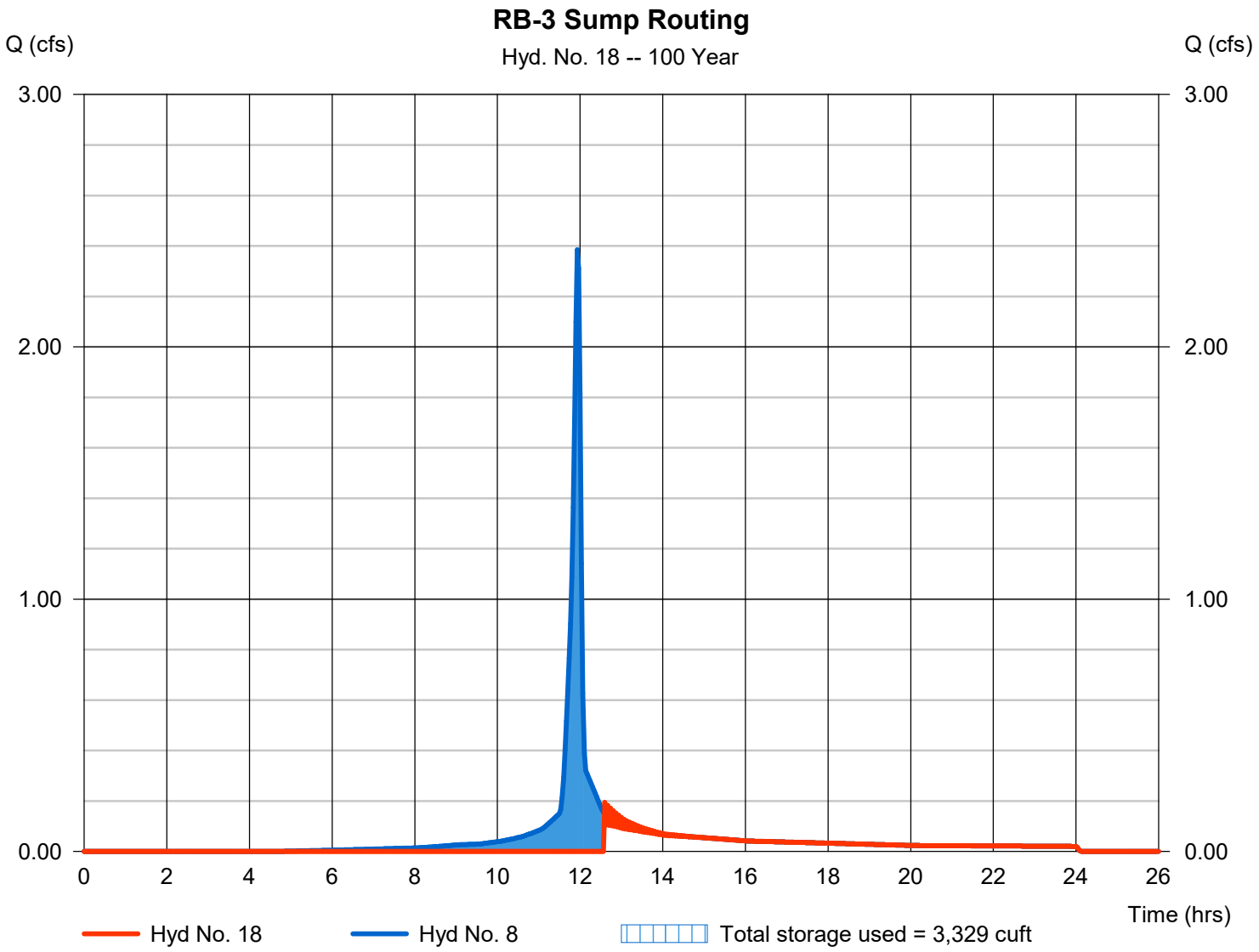
Hydrograph Report

Hyd. No. 18

RB-3 Sump Routing

Hydrograph type	=	Reservoir	Peak discharge	=	0.194 cfs
Storm frequency	=	100 yrs	Time to peak	=	12.60 hrs
Time interval	=	2 min	Hyd. volume	=	1,699 cuft
Inflow hyd. No.	=	8 - Post-Development Road Basin	Max. Elevation	=	102.01 ft
Reservoir name	=	RB-3 Sumps	Max. Storage	=	3,329 cuft

Storage Indication method used.



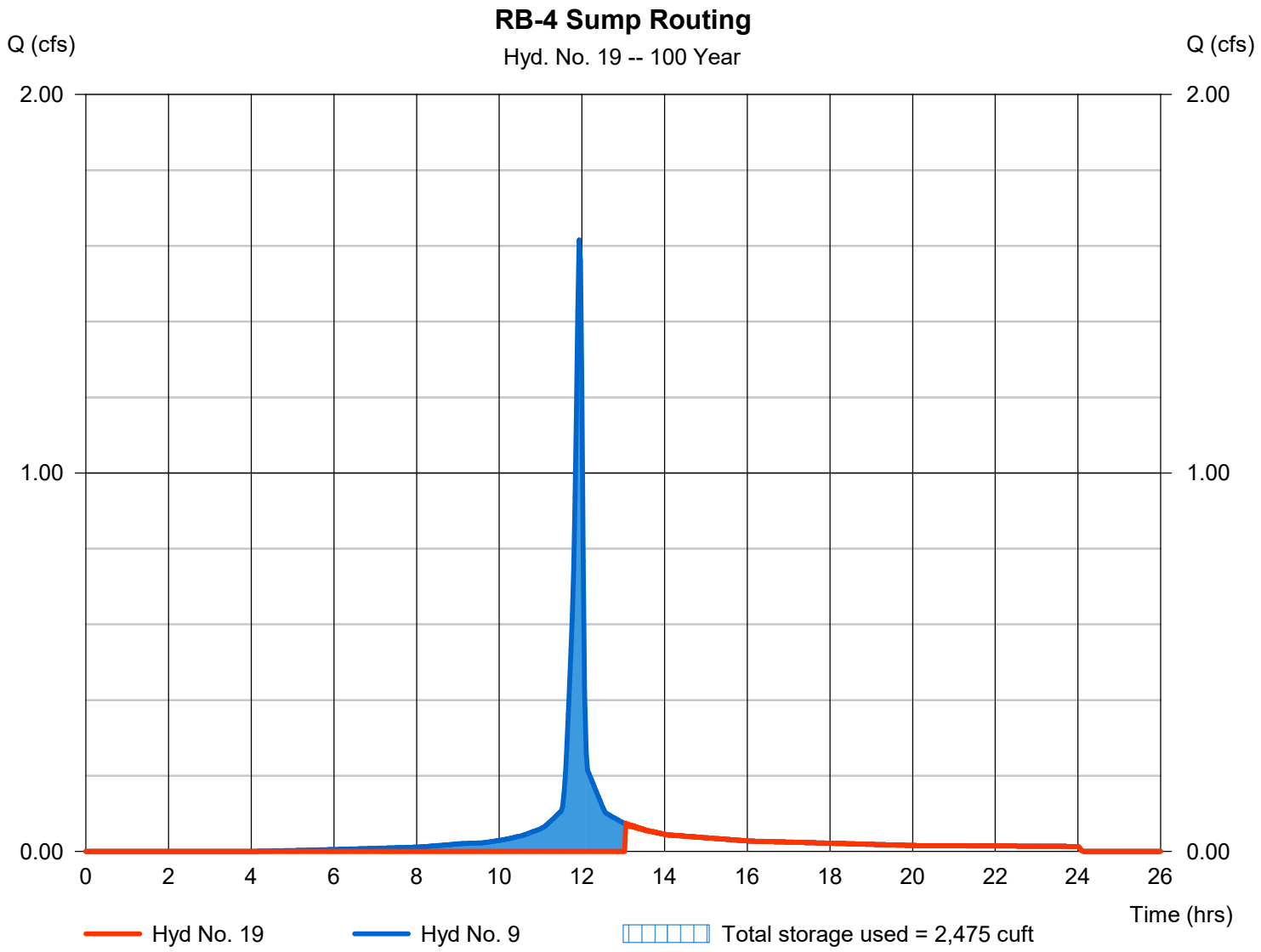
Hydrograph Report

Hyd. No. 19

RB-4 Sump Routing

Hydrograph type	=	Reservoir	Peak discharge	=	0.075 cfs
Storm frequency	=	100 yrs	Time to peak	=	13.07 hrs
Time interval	=	2 min	Hyd. volume	=	981 cuft
Inflow hyd. No.	=	9 - Post-Development Road Basin 4	Max. Elevation	=	102.00 ft
Reservoir name	=	RB-4 Sumps	Max. Storage	=	2,475 cuft

Storage Indication method used.



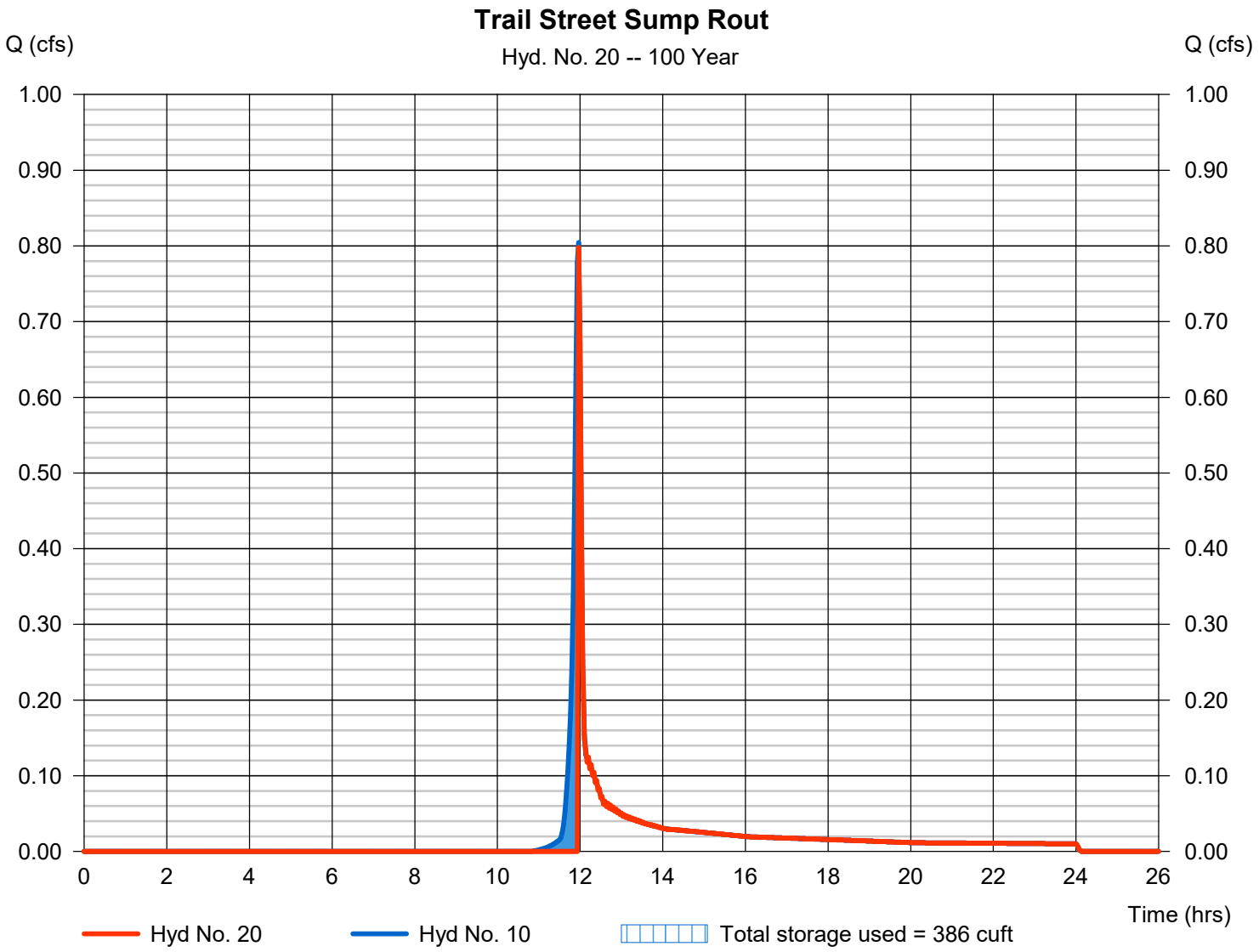
Hydrograph Report

Hyd. No. 20

Trail Street Sump Rout

Hydrograph type	=	Reservoir	Peak discharge	=	0.798 cfs
Storm frequency	=	100 yrs	Time to peak	=	11.97 hrs
Time interval	=	2 min	Hyd. volume	=	1,227 cuft
Inflow hyd. No.	=	10 - Trail Street Sub Basin	Max. Elevation	=	102.02 ft
Reservoir name	=	Trail Street Sumps	Max. Storage	=	386 cuft

Storage Indication method used.



Drainage Basins	Total Area (acres)	2-Year Runoff Peak Flow (CFS)	2-Year Runoff Volume (CF)	10-Year Runoff Peak Flow (CFS)	10-Year Runoff Volume (CF)	100-Year Runoff Peak Flow Rate (CFS)	100-Year Runoff Volume (CF)
Basin A	1.54	0.35	845	1.02	2102	2.07	4135
Basin B	1.21	0.27	664	0.8	1651	1.62	3249
Basin C	5.68	1.53	3530	4.15	8435	8.12	16232
Basin D	2.74	1.01	2455	2.39	4791	4.41	8841
Basin E	4.72	0.51	1720	2.67	4925	5.16	10425
Road Basin 1	1.07	1.04	2354	1.72	3939	2.59	6045
Road Basin 2	0.8	0.87	1760	1.43	2945	2.14	4519
Road Basin 3	0.89	0.97	1958	1.59	3276	2.39	5028
Road Basin 4	0.58	0.69	1406	1.1	2293	1.62	3456
Trail Street	0.64	0.12	308	0.38	801	0.8	1612

IMEG Corp.
(406) 721-0142

P.O. Box 3851
Missoula, MT 59806

Project Name: Sapphire Place Subdivision
Project # : 21001343
Date: 3/20/2023

Storage Calculations -2- and 10-Year Storm

Rain Garden Pond Sizing Calculations and Storage Provided

	Basin A	Basin B	Basin C Pond 1	Basin C Pond 2	Basin C Pond 3	Basin C Pond 4	Basin D Pond 1	Basin D Pond 2	Basin E Pond 1	Basin E Pond 2	Basin E Pond 3	RB1	RB2	RB3 Pond 1	RB3 Pond 2	RB4	Trail Street
Area of Top of Pond (SF):	-	1,346	4,632	500	637	3,220	1,356	834	1,271	890	2,786	376	713	620	537	-	-
Area of Bottom of Pond (SF):	-	383	1,373	30	122	313	340	86	253	104	687	72	26	54	14	-	-
Average Area (SF):	-	865	3,003	265	380	1,767	848	460	762	497	1,737	224	370	337	276	-	-
Depth of Pond (FT):	-	2.50	3.50	2.00	2.00	1.00	2.00	2.00	2.50	2.50	1.00	1.00	2.00	1.50	1.50	-	-
Pond Storage Provided (CF):	**-**	**2,161**	**10,509**	**530**	**759**	**1,767**	**1,696**	**920**	**1,905**	**1,243**	**1,737**	**224**	**739**	**506**	**413**	**-**	**-**
8' Sumps Provided:	-	-	-			-	-	-	-			1	-	-	1	-	1
12' Sumps Provided:	10	5	-			12	-	12	-		8	17	10	-	10	11	1
Sump Storage Provided:	2250	1125	-			2700	-	2700	-		1800	3985	2250	-	2410	2475	385
Total Storage Provided (CF):	**2250**	**3,286**	**-**			**16,264**	**-**	**5,316**	**-**		**6,684**	**4,209**	**2,989**	**-**	**3,329**	**2,475**	**385**

Storage Calculations -100-Year Storm

	Pond A
Area of Top of Pond (SF):	5,420
Area of Bottom of Pond (SF):	2,385
Average Area (SF):	3,903
Depth of Pond (FT):	4.00
Pond Storage Provided (CF):	**15,610**
8' Sumps Provided:	1
12' Sumps Provided:	-
Sump Storage Provided:	160
Total Storage Provided (CF):	**15,770**

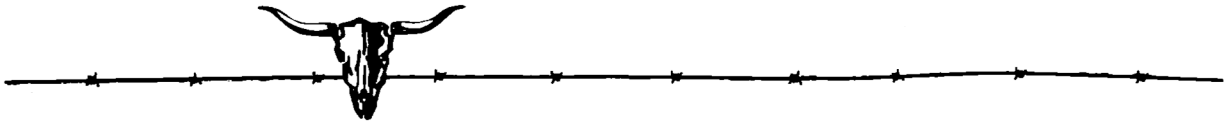
Stormwater Storage Summary

Total Storage Provided: 62,572 CF **(Pond A + Total Storage from Each On-site Basin, Not Including Trail Street)**

Post-Development 100-Year Storm Volume: 61,930 CF ***Not Including Trail Street**

Post-Development 100-Year Storm Volume To Regional Ponds: 15,170 CF ***Not Including Trail Street**

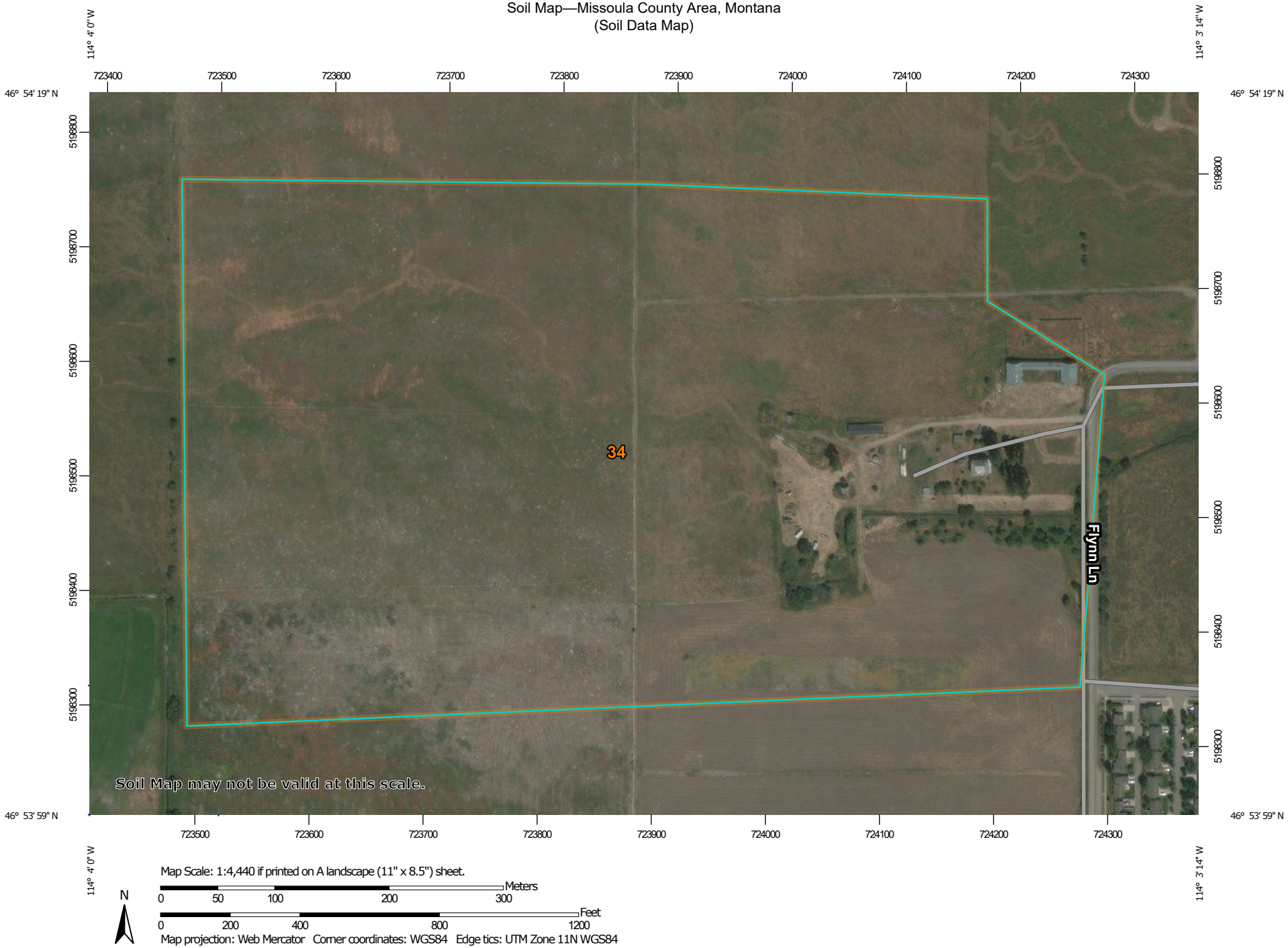
Regional Pond Storage Provided 15,770 CF



Appendix C:

USDA NRCS Soil Data Map & Information
Firmette Map
Neighboring Well Log
Stormwater Evaluation Form

Soil Map—Missoula County Area, Montana
(Soil Data Map)



Map Scale: 1:4,440 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 50 100 200 300

Feet
0 200 400 800 1200

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 11N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

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

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

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

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

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

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

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

Soil Survey Area: Missoula County Area, Montana
Survey Area Data: Version 19, Sep 2, 2021

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

Date(s) aerial images were photographed: Aug 6, 2014—Nov 2, 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.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
34	Desmet loam, 0 to 2 percent slopes	86.8	100.0%
Totals for Area of Interest		**86.8**	**100.0%**

Missoula County Area, Montana

34—Desmet loam, 0 to 2 percent slopes

Map Unit Setting

National map unit symbol: 4wbz
Elevation: 2,700 to 5,200 feet
Mean annual precipitation: 10 to 19 inches
Mean annual air temperature: 39 to 45 degrees F
Frost-free period: 90 to 120 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

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

Description of Desmet

Setting

Landform: Stream terraces
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium

Typical profile

Ap - 0 to 7 inches: loam
A - 7 to 15 inches: loam
Bk - 15 to 24 inches: loam
BC1 - 24 to 39 inches: very fine sandy loam
BC2 - 39 to 60 inches: very fine sandy loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 15 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: High (about 9.2 inches)

Interpretive groups

Land capability classification (irrigated): 2c
Land capability classification (nonirrigated): 3c
Hydrologic Soil Group: B
Ecological site: R043BP818MT - Upland Grassland

Hydric soil rating: No

Minor Components

Alberton

Percent of map unit: 5 percent
Landform: Stream terraces
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R044AB110MT - Sandy (Sy) LRU 44A-B
Hydric soil rating: No

Grantsdale

Percent of map unit: 4 percent
Landform: Stream terraces
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R044AB032MT - Loamy (Lo) LRU 44A-B
Hydric soil rating: No

Moiese

Percent of map unit: 4 percent
Landform: Stream terraces
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R044BA134MT - Shallow to Gravel (SwGr) LRU 44B-A
Hydric soil rating: No

Somewhat poorly drained soils

Percent of map unit: 2 percent
Ecological site: R044AP806MT - SUBIRRIGATED GRASSLAND ESG 44A LRU P
Hydric soil rating: No

Data Source Information

Soil Survey Area: Missoula County Area, Montana
Survey Area Data: Version 19, Sep 2, 2021

National Flood Hazard Layer FIRMette

FEMA

114°3'42"W 46°54'22"N

114°3'5"W 46°53'58"N

Feet 1:6,000

0 250 500 1,000 1,500 2,000

Basemap: USGS National Map: Orthoimagery: Data refreshed October, 2020

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- 20.2 Cross Sections with 1% Annual Chance
- 17.5 Water Surface Elevation
- Coastal Transect
- 513 Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

N

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 6/29/2022 at 6:01 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

MONTANA WELL LOG REPORT

This well log reports the activities of a licensed Montana well driller, serves as the official record of work done within the borehole and casing, and describes the amount of water encountered. This report is compiled electronically from the contents of the Ground Water Information Center (GWIC) database for this site. Acquiring water rights is the well owner's responsibility and is NOT accomplished by the filing of this report.

Other Options

Go to GWIC website
Plot this site in State Library Digital Atlas
Plot this site in Google Maps

Site Name: DOUGHERTY JOHN
GWIC Id: 706331

Section 1: Well Owner(s)

Section 2: Location

Township	Range	Section	Quarter Sections
13N	19W	7	SW¼ NW¼

County MISSOULA

Geocode

Latitude	Longitude	Geomethod	Datum
46.9016	-114.0563	MAP	NAD27

Ground Surface Altitude	Ground Surface Method	Datum	Date
3161			

Addition **Block** **Lot**

Section 3: Proposed Use of Water

IRRIGATION (1)

Section 4: Type of Work

Drilling Method: DUG
Status: NEW WELL

Section 5: Well Completion Date

Date well completed: Friday, January 1, 1965

Section 6: Well Construction Details

There are no borehole dimensions assigned to this well.

Casing

From	To	Diameter	Wall Thickness	Pressure Rating	Joint	Type
0	36	60				

There are no completion records assigned to this well.

Annular Space (Seal/Grout/Packer)

There are no annular space records assigned to this well.

Section 7: Well Test Data

Total Depth: 36
Static Water Level:
Water Temperature:

Unknown Test Method *

Yield _ gpm.
Pumping water level _ feet.
Time of recovery _ hours.
Recovery water level _ feet.

* *During the well test the discharge rate shall be as uniform as possible. This rate may or may not be the sustainable yield of the well. Sustainable yield does not include the reservoir of the well casing.*

Section 8: Remarks

Section 9: Well Log

Geologic Source

111ALVM - ALLUVIUM (HOLOCENE)

Lithology Data

There are no lithologic details assigned to this well.

Driller Certification

All work performed and reported in this well log is in compliance with the Montana well construction standards. This report is true to the best of my knowledge.

Name:
Company:
License No: -
Date Completed: 1/1/1965

MISSOULA
PUBLIC WORKS & MOBILITY DEPARTMENT—Storm Water Division
1345 W. Broadway • Missoula, Montana 59802 • (406) 552-6744

rev. May 7, 2021

Storm Water Site Evaluation Form

This form is used for the Construction Site Inspection Frequency Determination and is completed by the applicant/owner.

Date: _____

Project Name: _____ **Permit No.:** _____

Address: _____ **Zip Code:** _____

Project Area (acres): _____ **Disturbance Area (acres):** _____

Applicant/Owner Representative: _____ **Phone number:** _____

Owner Name: _____ **Phone Number:** _____

Owner Address: _____

In compliance with the Clean Water Act and the National Pollutant Discharge and Elimination System permit program—administered by the Montana Department of Environmental Quality as authorized by the U.S. Environmental Protection Agency—the City of Missoula must inspect construction sites based upon their priority ranking.

Site Priority Determination

Check the appropriate Project Priority box based on the worksheet total on page 2.

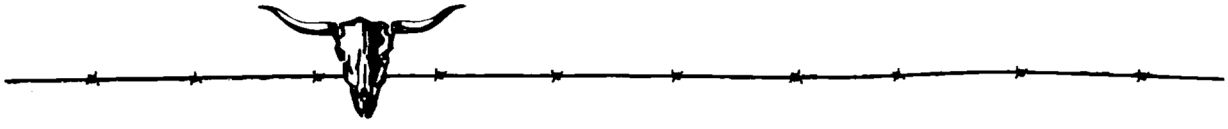
Score	Priority	Inspection Frequency	Project Priority
6 to 11	Low	1. Once at commencement of construction after BMPs have been implemented	
12 to 30	Medium	1. Once at commencement of construction after BMPs have been implemented	
		2. Once at the conclusion of the project prior to finalization	
31 to 67	High	1. Once at commencement of construction after BMPs have been implemented	
		2. Once within 48 hours, after one rain event of 0.25 inches or greater	
		3. Once within 48 hours, after runoff from snowmelt due to thawing conditions that cause visible surface erosion at the project site	
		4. Once at the conclusion of the project prior to finalization	

rev. May 7, 2021

Site Priority Ranking Worksheet

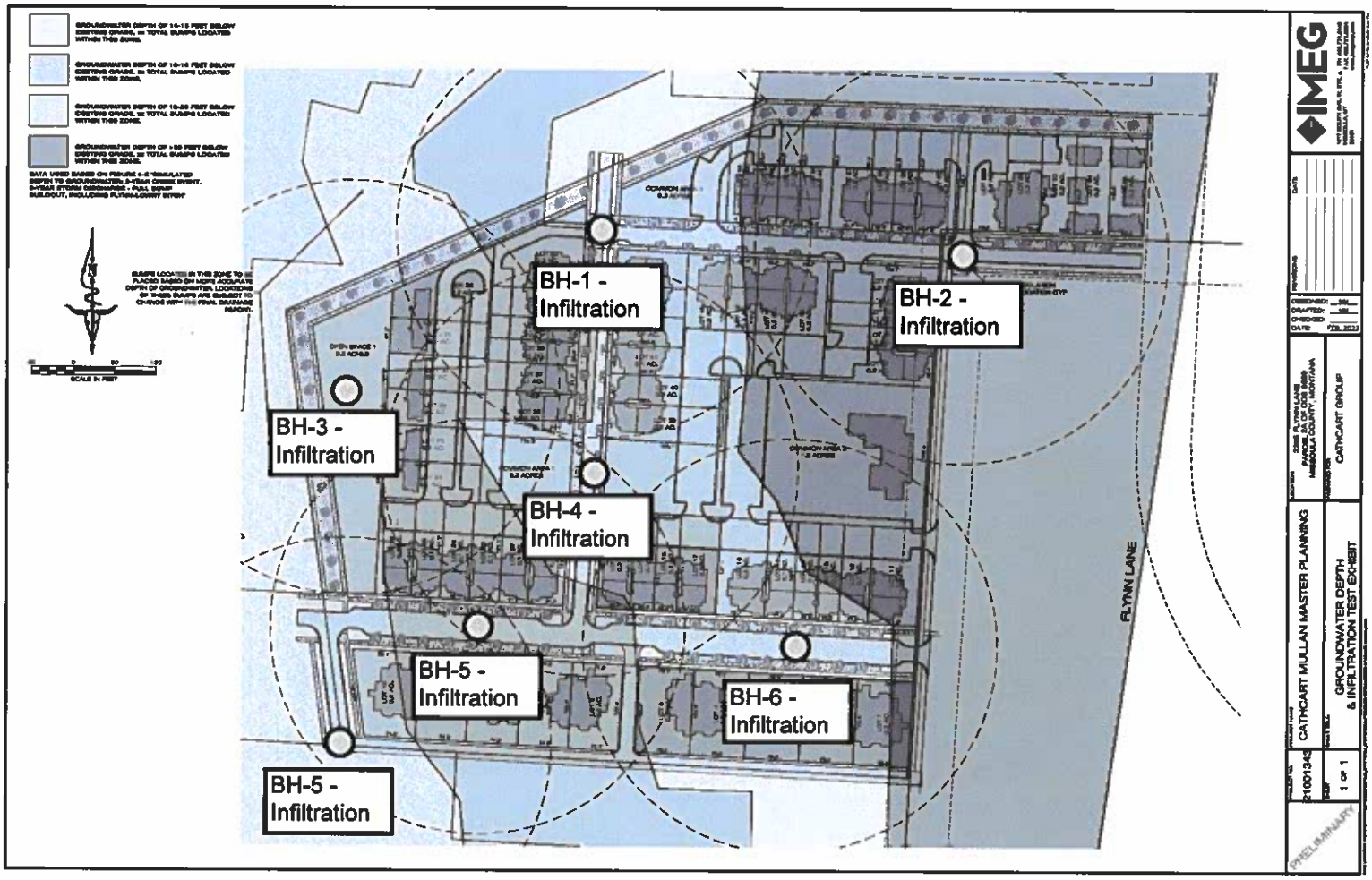
Criteria	Rating System	Rating Value	Site Rating
Project type	Subdivision with 5 or more units	7	
	TED with 5 or more units	7	
	Commercial site ≥ 0.5 acres	7	
	None of the above	0	
Proximity to waterbody (surface or dry well/groundwater)	≥ 1,500 feet	1	
	200 to 1,499 feet	5	
	< 200 feet	7	
	Discharge to waterbody	10	
Depth to groundwater	> 20 feet	1	
	≤ 20 feet	10	
Discharge to an impaired waterbody	No (dry well/groundwater, Butler Creek, LaValle Creek, Pattee Creek, or Rattlesnake Creek)	1	
	Yes (Bitterroot River, Clark Fork River, Grant Creek, or Miller Creek)	10	
Maximum proposed slope	Slopes < 20:1 (H:V) Slopes < 5%	1	
	20:1 ≤ Slopes < 10:1 (H:V) 5% ≤ Slopes < 10%	5	
	Slopes ≥10:1 (H:V) Slopes ≥ 10%	10	
History of non-compliance (applicant and/or owner)	No history of non-compliance	1	
	1 time non-compliant	5	
	2+ times non-compliant	10	
Risk of hazardous material spills/leaks	No hazardous materials stored on site	1	
	Non-liquid hazardous materials stored on site	5	
	Liquid hazardous materials stored on site	10	
		Total Score	
6 to 11 = Low	12 to 30 = Medium	31 to 67 = High	

Permittees found to be habitually non-compliant may be subject to one or more disciplinary actions: compliance through the Missoula Valley Water Quality District Enforcement Response Plan; increased inspection frequency; formal Notice of Violation (NOV), including stop work order; fine(s); and/or suspension/revocation of City Business License.



Appendix D:

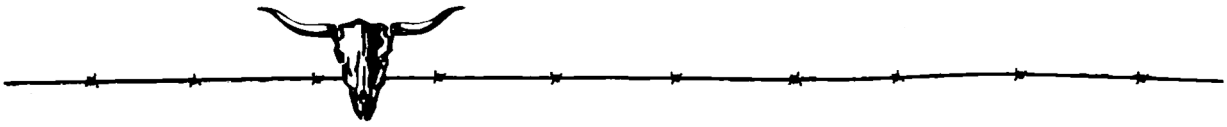
Tetra Tech Percolation Test Results


BH-1 - Infiltration
BH-2 - Infiltration
BH-3 - Infiltration
BH-4 - Infiltration
BH-5 - Infiltration
BH-6 - Infiltration
BH-5 - Infiltration
FLYNN LANE
IMEG
CATHCART MULLAN MASTER PLANNING
GROUNDWATER DEPTH & INFILTRATION TEST EXHIBIT
CATHCART GROUP
21001345
1 OF 1
PRELIMINARY

Tetra Tech performed three (3) infiltration tests following procedures outlined in Appendix 6-F (Test Pit Infiltration Method) of the Missoula Public Works Manual, Tetra Tech installed a 4-inch solid PVC pipe (with the bottom 1 foot being perforated) through hollow stem augers to depths of approximately 10.0 feet over 4 to 5 inches of pea gravel. Pea gravel was also placed around the PVC pipe extending upward above the slotted section of pipe. Following installation of the PVC pipe and pea gravel, the auger was removed from the borehole and the remaining annulus was backfilled with auger cuttings.

Table 1. Cathcart Infiltration Test Results

Test Location	Soil Type (USCS)	Infiltration Rate (in/hr)
BH-1	CL	5.5
BH-2	CL	28.5
BH-3	SP	12.0
BH-4	SP	20.0
BH-5	SP	40.2
BH-6	SP	17.0
BH-7	SP	23.3



Grading and Drainage Plans (attached separately)

INCLUDED BY REFERENCE

Montana Public Works and Specifications *(latest edition)*
Montana Department of Environmental Quality Circular 8 *(2018 Edition)*
Chapter 6 of the City of Missoula Public Works Manual (*2021 Edition*)