RE: COST SHARE AGREEMENT FOR THE CONSTRUCTION OF A REGIONAL DETENTION BASIN

Background:

In the last meeting in June, City Council authorized the City Administrator to solicit bids for the construction of a new building for the Police Department. Part of the design of the police station included utilizing a regional detention basin for stormwater run-off. This regional detention basin was designed to handle runoff from the new Xtreme Exteriors Headquarters, the new police station, and future development of Mr. Lampe's property. Given that this is a regional detention basin, a cost share was put together in conjunction with Mr. Lampe to aid in the construction of the basin.

Analysis:

Supporting documents are attached below.

This cost share states that the city will reimburse Mr. Lampe for 20% of the cost of the construction of the regional detention basin, up to $30,000. This percentage was determined by the amount of area the Police Station Site contributes to the detention basin, the police station's 5.34 acres to Mr. Lampe's 23.52 acres.

Additionally, the city will reimburse Mr. Lampe for the actual cost of a geosynthetic liner, up to $150,000. This liner is necessary to maintain the stability of an existing sinkhole close to the detention basin which will prevent additional stormwater infiltration and potential expansion of the sinkhole. Without this liner, the sinkhole has the potential to expand onto the police station site which could negatively impact the integrity of the new building and parking lot.

Recommendation:

Staff recommends approval of this Cost Share Agreement.

MEMO SUBMITTED BY:
Justin Orf | Project Facilitator
jorf@nixa.com | 417-725-3785

RESOLUTION NO. 2025-37

A RESOLUTION OF THE COUNCIL OF THE CITY OF NIXA AUTHORIZING THE CITY ADMINISTRATOR TO EXECUTE A COST SHARE AGREEMENT WITH XTREME PROPERTY HOLDINGS, LLC FOR THE CONSTRUCTION OF A REGIONAL DETENTION BASIN.

WHEREAS the City Council desires to authorize the City Administrator to execute a contract with Xtreme Property Holdings LLC for the construction of a regional detention basin.

NOW, THEREFORE, BE IT RESOLVED BY THE COUNCIL OF THE CITY OF NIXA, AS FOLLOWS, THAT:

SECTION 1: The City Council hereby authorizes the City Administrator, or designee, to execute a "Cost Share Agreement for the Construction of a Regional Detention Basin," with Xtreme Property Holdings, LLC. Said Agreement shall be in substantially similar form as "Resolution Exhibit A," which is attached hereto and incorporated herein by this reference as though fully set out herein.

SECTION 2: The City Administrator and the officers of the City are hereby authorized to do all things necessary or convenient to carry out the terms and intent of this Resolution.

SECTION 3: This Resolution shall be in full force and effect from and after its final passage by the City Council and after its approval by the Mayor, subject to the provisions of section 3.11(g) of the City Charter.

ADOPTED BY THE COUNCIL THIS 22nd DAY OF July 2025.

ATTEST:

_____ _____
PRESIDING OFFICER CITY CLERK

APPROVED BY THE MAYOR THIS _____ DAY OF _____ 2025.

ATTEST:

_____ _____
MAYOR CITY CLERK

APPROVED AS TO FORM:

_____
CITY ATTORNEY

RESOLUTION EXHIBIT A

EFFECTIVE DATE: _____

TERMINATION DATE: _____

CONTRACT NUMBER: _____

COST SHARE AGREEMENT FOR THE CONSTRUCTION OF A REGIONAL DETENTION BASIN

THIS COST SHARE AGREEMENT FOR THE CONSTRUCTION OF A REGIONAL DETENTION BASIN ("Contract") is made and entered into upon its execution by the City of Nixa, Missouri, a Constitutional Charter City organized under the laws of the State of Missouri ("City") and Xtreme Property Holdings, LLC, a Missouri Limited Liability Company ("Developer").

WHEREAS the Developer is the owner of the property located at 222 N. Nicholas Rd., Nixa MO 65714; and

WHEREAS the Developer has plans to develop their property as an office building to serve as the headquarters for a construction business; and

WHEREAS the City has begun the preliminary steps of developing the property to the north of the Developer's property, located at 305 N. Leeann Drive, Nixa MO 65714 as a new building to house the City's Police Department; and

WHEREAS to accommodate both developments, it is necessary to construct certain regional detention improvements; and

WHEREAS the City and the Developer desire to collaborate on the construction of the detention improvements; and

WHEREAS the City and Developer have agreed to the terms of this Contract.

NOW, THEREFORE, for the considerations herein expressed, it is mutually agreed by and between the City and the Developer as follows:

1. Project Description. This Contract references the construction of a regional detention basin which is to be designed to manage water runoff for the City's new Police Department building, the Developer's new office building generally located at 222 N. Nicholas Rd,, Nixa MO 65714. Said regional detention basin is detailed in Phase 1 of the "Revised Stormwater Engineering Report – Xtreme Exteriors – Nixa, Missouri – Revised November 2024," which was approved by Olsson Engineering on December 3, 2024, which is incorporated by reference as though fully set forth herein (herein the "Project").

2. City's Responsibilities. Regarding the City's obligations under this Contract, City agrees to perform the following:

2.1. City shall reimburse the Developer 20% of the cost of construction of the regional detention basin. The City's responsibility for this cost shall not exceed **$30,000.00**.

2.2. City shall reimburse the Developer for the actual cost of purchasing and installing an impervious liner for the detention basin. Said liner shall be a 30-million-gallon PVC Geomembrane, or equivalent approved by the City in the City's sole discretion. The City's responsibility for this cost shall not exceed **$150,000.00**. Specifications for the liner are attached hereto, and incorporated herein by this reference, as **Exhibit 1**. Installation of the liner shall

adhere to the requirements of **Exhibit 1**.

2.3. The City shall not be required to make any reimbursement until the City has inspected, at its own expense, the improvements and the improvements meet the City's requirements.

3. Developer's Responsibilities. Regarding the Developer's obligations under this Contract, Developer agrees to perform the following:

3.1. The Developer shall be responsible for any costs of the Project which exceeds the not to exceed amounts applicable to the City's contribution to the Project.

3.2. The Developer shall grant to the City a permanent drainage easement which said easement shall be in substantially similar form as the document attached hereto, and incorporated herein by this reference, as **Exhibit 2**.

3.3. The Developer shall grant to the City a permanent drainage easement which said easement shall be in substantially similar form as the document attached hereto, and incorporated herein by this reference, as **Exhibit 3.**

3.4. The Developer shall be responsible for constructing the Project and any other improvements related to the Project.

4. Term. This Contract shall commence upon its full execution by the Parties and shall continue until the completion of the construction of the Project and the City's approval of the Project.

5. Conflict of Interest. Contractor certifies that no member or officer of its firm or organization is an officer or employee of the City of Nixa, Missouri, or any of its boards or agencies, and further that no officer or employee of the City has any financial interest in this Contract which would violate any applicable federal regulations or the provisions of RSMo. Section 105.450 et seq or the provisions of Nixa City Charter Section 13.1.

6. Assignment. Neither party may assign, transfer, or delegate any or all of its rights or obligations under this Contract, including by operation of law, change of control, or merger, without the prior written consent of the other party. No assignment shall relieve the assigning party of any of its obligations hereunder. Any attempted assignment, transfer, or other conveyance in violation of the foregoing shall be null and void. This Contract shall be binding upon and shall inure to the benefit of the parties hereto and their respective successors and permitted assigns.

7. Liability and Indemnity.

7.1. In no event shall the City be liable to the Developer for special, indirect, or consequential damages, except those caused by the City's gross negligence or willful or wanton misconduct arising out of or in any way connected with a breach of this contract. The maximum liability of the City shall be limited to the amount of money to be paid or received by the Developer under this contract.

7.2. The Developer shall defend, indemnify and save harmless the City, its elected or appointed officials, agents and employees from and against any and all liability, suits, damages, costs (including attorney fees), losses, outlays and expenses from claims in any manner caused by, or allegedly caused by, or arising out of, or connected with, this contract, including, but not

limited to, claims for personal injuries, death, property damage, or for damages arising out of this Contract, notwithstanding any possible negligence, whether sole or concurrent, on the part of the City, its officials, agents and employees.

7.3. The indemnification obligations herein shall not negate, abridge or reduce in any way any additional indemnification rights of the City, its elected or appointed officials, agents and employees, which are otherwise available under statute, or in law or equity.

7.4. The Developer shall indemnify and hold the City harmless for any penalties, fines, fees or costs, including costs of defense, which are charged or assessed by any Federal, state or local agency including, but not limited to, Environmental Protection Agency or Department of Natural Resources.

7.5. The provisions of this Paragraph shall survive the termination or expiration of this Contract.

8. Contract Documents.

8.1. The entire Contract of the parties shall consist of the following documents:

8.1.1. This Contract;

8.1.2. Exhibit 1 (Specification for 30-million-gallon PVC Geomembrane liner);

8.1.3. Exhibit 2 (Permanent Drainage Easement); and

8.1.4. Exhibit 3 (Permanent Drainage Easement).

8.2. The above listed documents are attached hereto and incorporated by their reference herein as though fully set forth herein.

8.3. No modification, amendment, or waiver of any of the provisions of this Contract shall be effective unless in writing specifically referring hereto and signed by both parties.

8.4. In the event of a conflict between terms, the terms of this Contract, exclusive of its Exhibits, Attachments, or Schedules, shall control over the terms of any Exhibit, Attachment, or Schedule.

9. Notices.

9.1. All notices required or permitted hereinunder and required to be in writing may be given by Electronic Mail or by first class mail addressed to City and Contractor at the addresses shown below:

To City:

Name:	City of Nixa, Missouri
Address:	715 W. Mt. Vernon St., PO Box 395, Nixa MO 65714
Phone:	417.725.3785
Email:	jliles@nixa.com
Attn:	Jimmy Liles

Dept: City Administrator

To Developer:

Name: Xtreme Property Holdings, LLC
Address: 130 S. Garden Hill Rd., Nixa, MO 65714
Phone: 417.714.4663
Email: huner@xesiding.com
Attn: Hunter Lampe, Owner

9.2. The date of delivery of any notice given by mail shall be the date falling on the second full day after the day of its mailing. The date of delivery of notice by Electronic Mail transmission shall be deemed to be the date transmission occurs, except where the transmission is not completed by 5:00 p.m. on a regular business day at the terminal of the receiving party, in which case the date of delivery shall be deemed to fall on the next regular business day for the receiving party.

9.3. Notice information may be updated by the respective party upon reasonable notice of such change to the other party.

10. No Third-Party Beneficiaries. This Contract is for the sole benefit of the parties hereto and their respective successors and permitted assigns and nothing herein, express or implied, is intended to or shall confer upon any other person any legal or equitable right, benefit, or remedy of any nature whatsoever, under or by reason of this Contract.

11. Jurisdiction. This Contract and every question arising hereunder shall be construed or determined according to the laws of the State of Missouri, without giving effect to any choice or conflict of law provision or rule which would cause the application of the laws of any jurisdiction other than those of the State of Missouri. Should any part of this Contract be litigated, venue shall be proper only in the Courts of Christian County, Missouri. The provisions of this Paragraph shall survive the termination or expiration of this Contract.

12. Waiver of Jury Trial. Each party irrevocably and unconditional waives any right it may have to a trial by a jury in respect to any legal action arising out of or relating to this Contract or the transaction contemplated thereby. The provisions of this Paragraph shall survive the termination or expiration of this Contract.

13. Severability. If any term or provision of this Contract is held to be invalid, illegal, or unenforceable, such invalidity, illegality, or unenforceability shall not affect any other term or provision of this Contract or invalidate or render unenforceable such term or provision.

14. Headings. The headings in this Contract are for reference only and shall not affect the interpretation of this Contract.

15. Interpretation. This Contract shall be construed without regard to any presumption or rule requiring construction or interpretation against the party drafting an instrument or causing any instrument to be drafted.

[Remainder of page intentionally left blank. Signatures follow on next page.]

IN WITNESS WHEREOF, the parties have set their hands on the day and year herein stated.

CITY

_____
Jimmy Liles, City Administrator

Date: _____

ATTEST:

_____
Rebekka Coffey, City Clerk

Approved as to form:

_____
Nick Woodman, City Attorney

DEVELOPER

_____
Authorized Signer

Date: _____

Hunter Lampe
Printed Name

Owner
Title

Director of Finance Certification:

I certify that this contract is within the purpose of the appropriation to which it is to be charged and that there is an unencumbered balance to the credit of such appropriation sufficient to pay therefore, and that the appropriate accounting entries have been made.

_____
Jennifer Evans, Director of Finance

DEVELOPER VERIFICATION

State of Missouri

County of Christian

On this 16 day of July, 2025, before me personally appeared Hunter Lampe, for Xtreme Property Holdings. LLC, known to me to be the person described in and who executed the above agreement and acknowledged to me that they executed the same as their free act and deed on behalf of said entity.

IN TESTIMONY WHEREOF, I have hereunto set my hand and affixed my official seal in the county and state aforesaid, the day and year first above written.

Sarah Elizabeth Gill
Notary Public

My commission expires: 03-11-2028.

SARAH ELIZABETH GILL
Notary Public, Notary Seal
State of Missouri
Christian County
Commission # 24747548
My Commission Expires 03-11-2028

EXHIBIT 1

Lange Containment Systems Inc.

30 mil PVC Geomembrane Specifications

Certified Properties	ASTM	PVC 30
Thickness	D-5199	30 +1.5 mil .76 + .04 mm
Tensile Properties[3] Strength at Break Elongation Modulus at 100%	D-883[4] Min	 73 lbs/in 12.8 kN/m 380% 32 lbs/in 5.6 kN/m
Tear Strength	D-1004[4] Min	8 lbs 35 N
Dimensional Stability	D-1204[4] Max Chg	3%
Low Temperature Impact	D-1709[4] Pass	-20° F -29° C
Index Properties	**ASTM**	
Specific Gravity	D-792 Typical	1.2 g/cc
Water Extraction Percent Loss (max)	D-1239[4] Max Loss	.15%
Average Plasticizer Molecular Weight	D-2124[4,5]	400
Volatile Loss Percent Loss (max)	D-1203[4] Max Loss	0.7%
Soil Burial: Break Strength Elongation Modulus at 100%	G160[4] Max Chg	5% 20% 20%
Hydrostatic Resistance	D-751[4] Min	100 psi 690 kPa
Seam Strengths	**ASTM**	
Shear Strength[3]	D-882[4] Min	58.4 lbs/in 10 kN/m
Peel Strength[3]	D-882[4] Min	15 lbs/in 2.6 kN/m

Phone: (800) 446-4898 Fax: (303) 446-8798 E-mail: LinerGeeks@langecontainment.com langecontainment.com

Lange CONTAINMENT SYSTEMS INC.

PVC Geomembrane Specifications
FGI 1115 Specifications

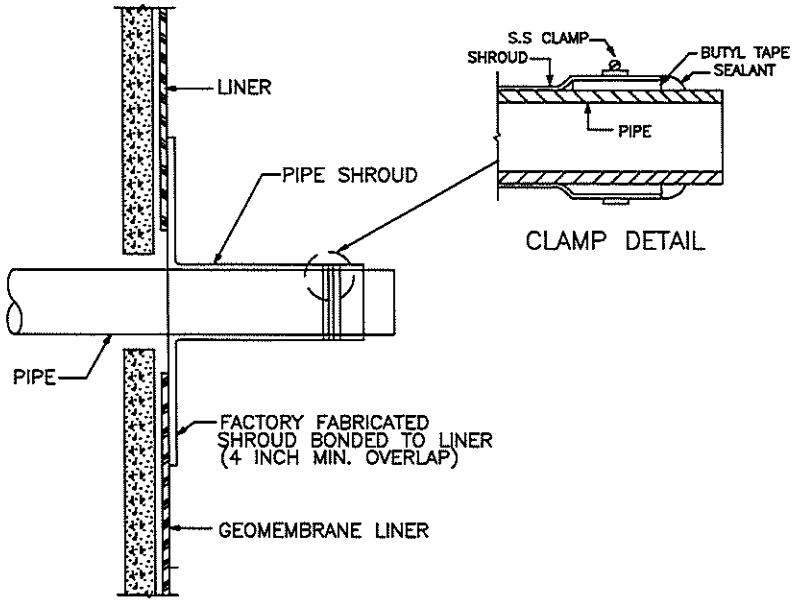
Certified Properties	ASTM	PVC 20	PVC 30	PVC 40	PVC 60
Thickness	D-5199	20 ± 1 mil 0.51 ± .03 mm	30 ± 1.5 mil 0.76 ± .04 mm	40 ± 2 mil 1.02 ± .05 mm	60 ± 3 mil 1.52 ± .08 mm
Tensile Properties[3]					
Strength at Break	D-882[4] Min (MD & TD)	48 lbs./in 8.4 kN./m	73 lbs/in 12.8 kN/m	97 lbs/in 17.0 kN/m	137 lbs/in 24.0 kN/m
Elongation		360%	380%	430%	450%
Modulus at 100%		21 lbs./in 3.7 kN./m	32 lbs/in 5.6 kN/m	40 lbs/in 7.0 kN/m	60 lbs/in 10.5 kN/m
Tear Strength	D-1004[4] Min	6 lbs 27 N	8 lbs 35 N	10 lbs 44 N	15 lbs 67 N
Dimensional Stability	D-1204[4] Max Chg (MD & TD)	4%	3%	3%	3%
Low Temperature Impact	D1790[4,6] Pass	-15°F -26°C	-20°F -29°C	-20°F -29°C	-20°F -29°C
Index Properties	**ASTM**	**PVC 20**	**PVC 30**	**PVC 40**	**PVC 60**
Specific Gravity	D-792 Typical	1.2 g/cc	1.2 g/cc	1.2 g/cc	1.2 g/cc
Water Extraction Percent Loss (max)	D-1239[4] Max Loss	0.15%	0.15%	0.20%	0.20%
Average Plasticizer Molecular Weight	D-2124[4,5,7]	400	400	400	400
Volatile Loss Percent Loss (max)	D-1203[4] Max Loss	0.9%	0.7%	0.5%	0.5%
Soil Burial					
Break Strength	G160[4] Max Chg	5%	5%	5%	5%
Elongation		20%	20%	20%	20%
Modulus at 100%		20%	20%	20%	20%
Hydrostatic Resistance	D-751[4] Min	68 psi 470 kPa	100 psi 690 kPa	120 psi 830 kPa	180 psi 1240 kPa
Seam Strengths	**ASTM**	**PVC 20**	**PVC 30**	**PVC 40**	**PVC 60**
Shear Strength[3]	D-882[4] Min	38.4 lbs/in 6.7 kN/m	58.4 lbs/in 10 kN/m	77.6 lbs/in 14 kN/m	116 lbs/in 20 kN/m
Peel Strength[3]	D-882[4] Min	12.5 lbs/in 2.2 kN/m	15 lbs/in 2.6 kN/m	15 lbs/in 2.6 kN/m	15 lbs/in 2.6 kN/m

Notes:
1. FGI 1115 replaces PGI 1104 Specification effective 1/1/15.
2. Certified properties are tested by lot as specified in PGI 1104 Appendix A.
3. Metric values are converted from US values and are rounded to the available significant digits.
4. Modifications or further details of test are described in PGI 1104 Appendix B.
5. Index properties are tested once per formulation as specified in PGI 1104 Appendix A.
6. For arid climates (sheet temperature of 50°C or 120°F) passing temperatures are -17°C for PVC 20 and -20°C for all other thicknesses.
7. For arid climates use average plasticizer molecular weight of 410.

Made in the U.S.A

Phone: (800) 446-4898 Fax: (303) 446-8798 LinerGeeks@LangeContainment.com www.LangeContainment.com

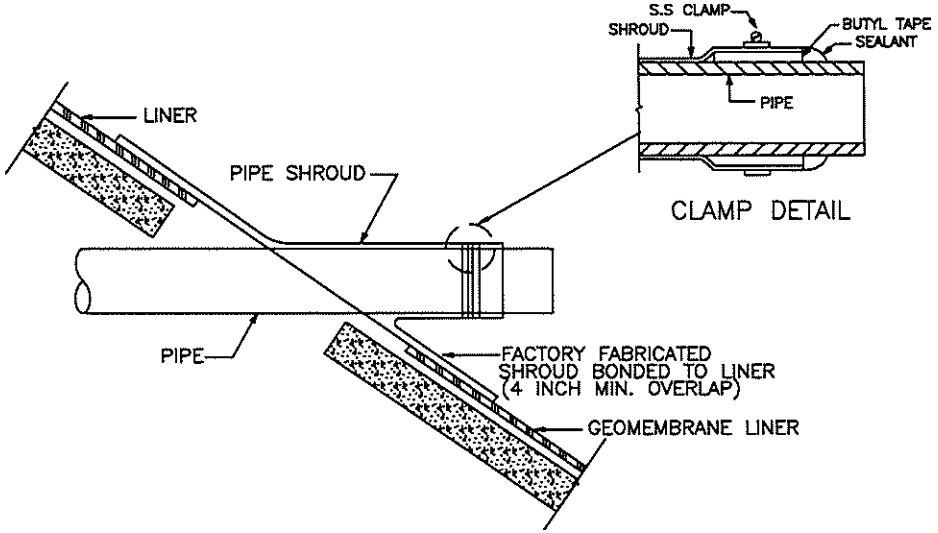
REVISIONS			
REV	DESCRIPTION	DATE	APPROVED



PIPE BOOT DETAIL – 90 DEGREE

REQUIREMENTS FOR FABRICATION:

1. O.D. (OUTSIDE DIAMETER) OF PIPE
2. THE ANGLE PIPE PENETRATES LINER



PIPE BOOT DETAIL – SPECIFIED ANGLE

REQUIREMENTS FOR FABRICATION:

1. O.D. (OUTSIDE DIAMETER) OF PIPE
2. THE ANGLE PIPE PENETRATES LINER

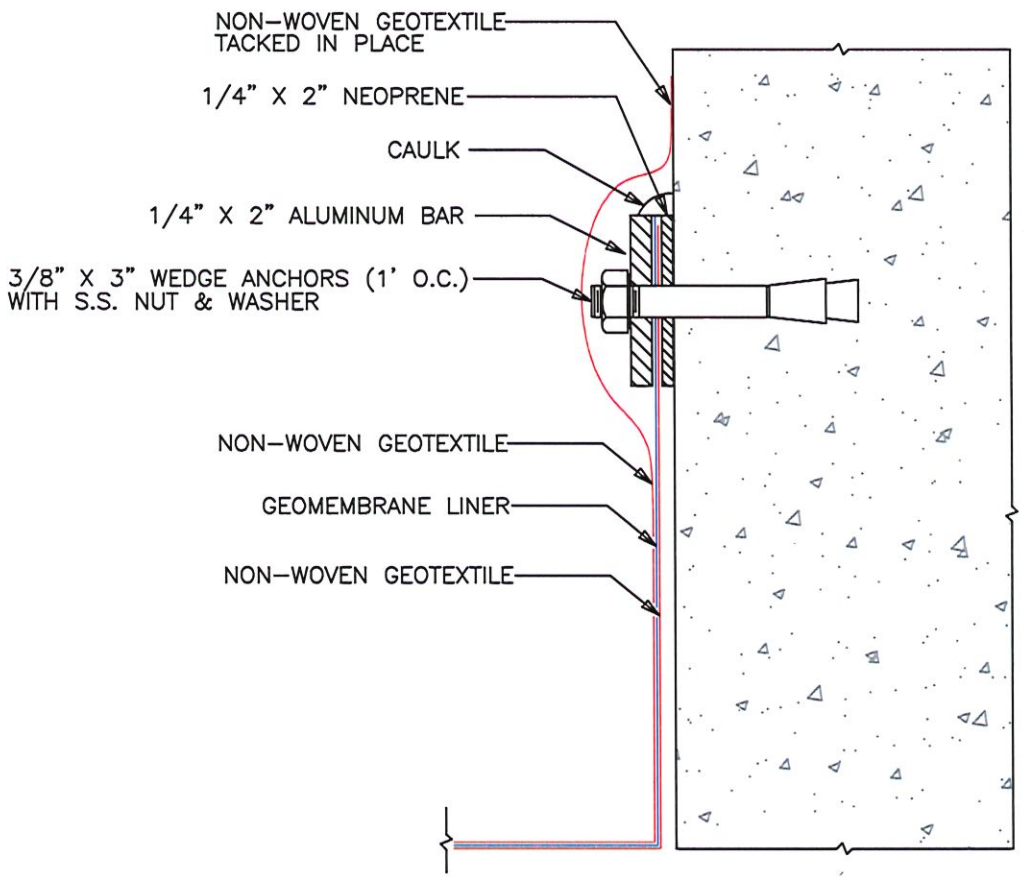
LANGE CONTAINMENT SYSTEMS, INC.
5150 RACE COURT
DENVER, CO 80216
(303) 446-8644 FAX (303) 446-8798

Lange Containment Systems, Inc.

Conceptual Drawing of Typical Pipe Boots

SIZE: A	DRAWN BY: C. Thomas	APPROVED BY: _____	REV: ___
SCALE: 1"= NTS	DWG NO: PIPEBOOT_2A	SHEET: 1 OF 1	DATE: 2/2/04

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED



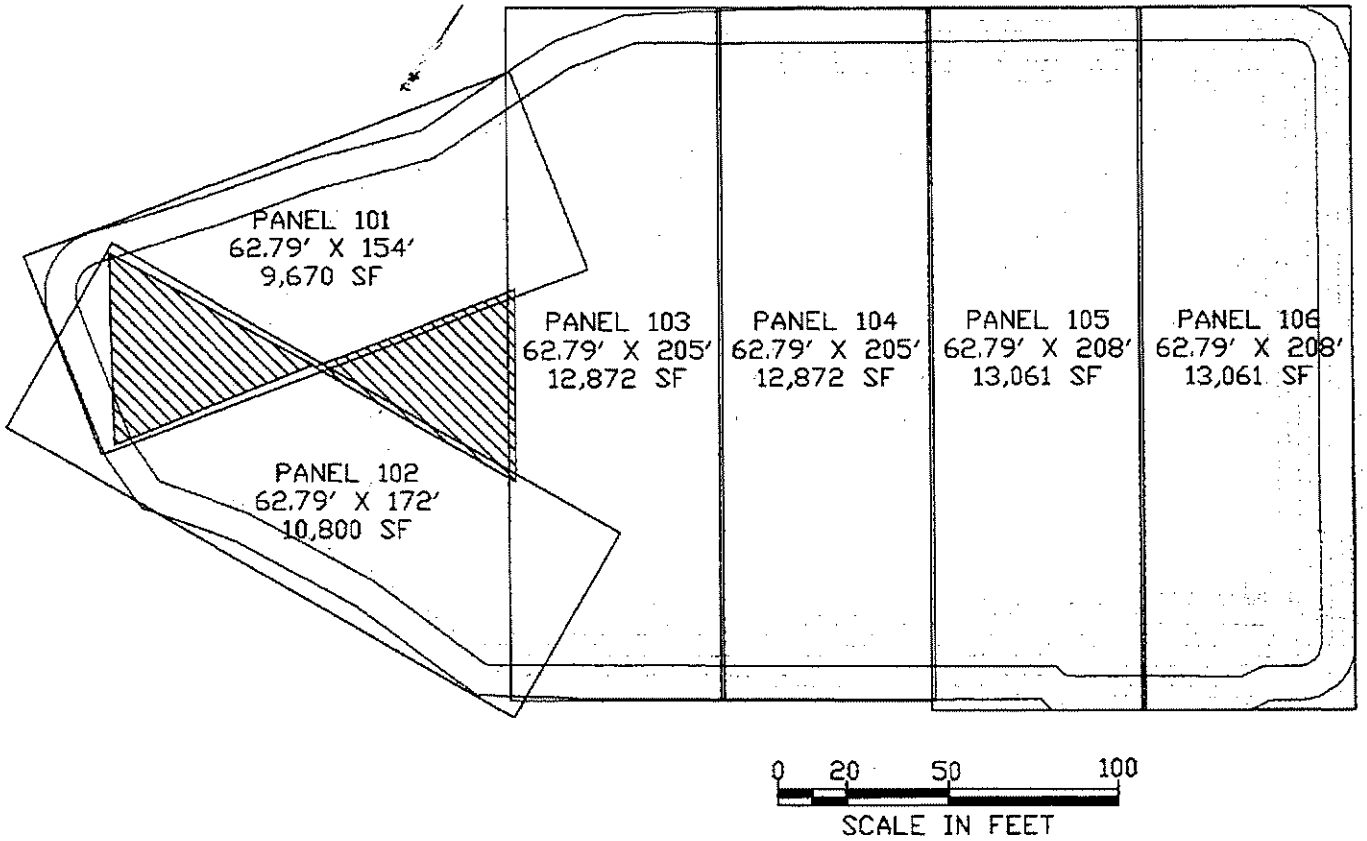
LANGE CONTAINMENT SYSTEMS, INC.
5150 RACE COURT
DENVER, CO 80216
(303) 446-8644 FAX(303) 446-8798

Lange Containment Systems, Inc.

Mechanical Attachment Detail w/ Geotextile Under/Over Liner

SIZE: A	DRAWN BY: C. Thomas	APPROVED BY: _____	REV: ___
SCALE: 1"= NTS	DWG NO: FAST_DblGeo–2	SHEET:	DATE: 3/16/17

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED



OFFSET: 10'
- 3.5' OVER EXCAVATION
- 5' ANCHOR & BENCH
- 1.5' SLOPE CORRECTION

LINER OFFSET @ EL. 1291'

24 LF MECHANICAL ATTACHMENT
4 EA. - OCU 1' STANDARD
2 EA. - 25" BOOT KIT (24" HDPE)

TYPE OF LINER REQUIRED: 30 mil PVC
TOTAL AREA OF LINER REQUIRED: 72,336 SF

NORTH

LANGE CONTAINMENT SYSTEMS, LLC.
5150 RACE COURT
DENVER, CO 80216
(303) 446-8644

WHITECAP

XTREME EXTERIORS DETENTION BASIN LINER

SIZE: A	DRAWN BY: T. PICKETT	APPROVED BY: _____	REV: _____
SCALE: NTS	DWG NO: 125-001		DATE: 1/6/2025

Lange Containment Systems Inc.

LINER FABRICATION QA\QC PROCEDURE

I. FLEXIBLE MEMBRANE LINER (FML)

The finished product shall be supplied as prefabricated panels designed for the project to minimize field seaming. Panel sizes may be as large as 25,000 square feet; however, dimensions will vary for each individual project. A general guideline is prefabricated panels will not exceed 5,000 pounds due to lifting capabilities.

II. INSPECTION

The liner material shall be uniform in color, thickness and surface texture. All roll goods will be visually inspected for pinholes, blisters and manufacturing defects. The FML shall comprise material manufactured of new, top quality products designed and manufactured specifically for the purpose of an impermeable liquid containment as applied to the specific project application.

III. FABRICATION

All factory seams will be fully bonded as required to achieve values as specified. Factory seam widths will be a maximum of 1" wide with a tolerance to .5" wide. If a faulty seam is detected, the area will be repaired by a patch that will extend beyond the defect a minimum of 2 inches in all directions. All finished panels will be given prominent, indelible identifying markings for field deployment.

IV. TESTING

At set - up, the operator will fabricate a test seam to verify seam strength requirements. These samples will be tested in - house in per ASTM procedures for peel and sheer. For PVC, production will not begin until the test values meet or exceed project / ASTM D7408. During production, a test seam will be constructed at the beginning of each panel and or during a shift change.

All factory seams are visually inspected at 3 points during the fabrication process.

V. SHIPPING

The fabricated panels of liner are accordion folded in both directions and banded on a wooden pallet. Prior to shipping, the product is covered with an opaque plastic water repellent stretch wrap. Upon arrival at the jobsite, the material is to be unloaded with a forklift type piece of equipment with a 6,000 pound minimum lifting capacity. Fabricated panels are to be stored in a central location for field deployment. Pallets must not be stacked. In the event of long term outdoor storage, it may be necessary to cover the liners with a heavier opaque waterproof material such as visqueen to protect the product from exposure.

VI. CLOSEOUT

Upon completion of fabrication; all pertinent documentation such as production / testing logs and manufacturer material testing certifications will be available to the Owner.

LINER INSTALLATION
QA \ QC
PROCEDURES

I. LINER STORAGE

The fabricated liner panels are double accordion folded and banded on a wooden pallet. Prior to shipping, the panels are covered with a plastic water repellent stretch wrap. Upon arrival at the project, the product is to be unloaded with a forklift type piece of equipment with a 5,000 pound minimum capacity. The fabricated panels are to be stored in a centrally located area close to the job-site for field deployment. The pallets are not to be stacked as they are unloaded. In the event of long-term storage on-site, it may be necessary to cover the product with an opaque, water-proof material such as visqueon to protect from exposure.

II. LAYOUT

Liner panels will be installed per the approved shop drawing submitted to the Owner. The construction manager will determine the panel lay-out sequence to facilitate and expedite the installation process. Over-all field coordination is the key so our scope of work will not conflict or interfere with other operations and schedules.

III. SEAMING

Prior to the seaming operation, the construction manager will review seaming materials and procedures. Safety equipment will be distributed and discussed. Sample seams will be constructed to verify seam quality. All surfaces that receive geosynthetics must be complete prior to liner placement. The construction manager will maintain a daily log that outlines field conditions, production, etc. Copies of this log will be available to the Owner and General contractor upon completion of the project.

Once the panels are placed, seaming will begin. A general rule of thumb is, only lay out the number of panels that can be seamed together on the same day. However, it must be noted that adverse weather conditions may not allow this on a given day.

Panel installation will be performed only under reasonably calm conditions with ambient temperatures in excess of 40 degrees F. Liner installation is possible in colder climates with the aid of heaters, however production is considerably slower. Liner installation should not be attempted during precipitation.

The liner installation will not commence until the substrate has been inspected and approved by an LCS representative. The G\C and Owner will be notified immediately in the event of a sub-standard condition that may exist. As a general guideline; the installed geomembrane liner is a direct reflection of the sub grade it is placed upon. Surfaces to be lined shall be well compacted, smooth and free of all sharp, angular rocks, vegetation and stubble. It shall be the responsibility of the general contractor to re-prep and maintain the sub grade in the event of rain. Anchor trenching must be complete prior to liner placement.

Sample seams will be made on a daily basis or if on-site conditions change drastically to establish a proper film bond tear. The seaming crews will overlap the material ±6" and construct a minimum (2" wide fully bonded seam if machine welded) without wrinkles or voids. If wrinkles occur (fish-mouths), they will be cut and patched accordingly. The patch will extend beyond the problem area a minimum of 4" in all directions.

IV. TESTING

The field seams will be tested by the air-lance method per ASTM Method D4437. This test consists of directing a flow of pressurized air, regulated at 40 - 50 psi through a 3\16 inch orifice at the field seam interface. The air lance wand shall be held 4" away and perpendicular to the edge of the seam. Where visual or audible signs occur, which indicate unbonded areas, the area will be repaired by our technicians.

V. FINAL INSPECTION

At the conclusion of the project, the superintendent will conduct a final walk through with all parties involved. A certification will be issued stating that all work performed is in accordance with project specifications and in compliance with all industry standards and guidelines.

All trash and debris will be removed at the conclusion of the project.

TITLE OF DOCUMENT: Permanent Drainage Easement

DATE OF DOCUMENT: _____

GRANTOR(S): Xtreme Property Holdings, LLC, a Missouri Limited Liability Company

GRANTEE: City of Nixa, Missouri

MAILING ADDRESS OF GRANTEE: PO BOX 395, Nixa, MO 65714

LEGAL DESCRIPTION: See Exhibit A

REFERENCE BOOK AND PAGE: _____

PERMANENT DRAINAGE EASEMENT

THIS PERMANENT DRAINAGE EASEMENT is made, upon its execution by Grantor, by and between **Xtreme Property Holdings, LLC, a Missouri Limited Liability Company**, (herein "Grantor") and the **CITY OF NIXA, MISSOURI, a Constitutional Charter City**, its successors and assigns (herein "Grantee") with a mailing address of P.O. Box 395, Nixa, Missouri 65714.

WITNESSETH, that Grantor in consideration of the sum of **$1.00** and other valuable consideration, to Grantor, which is in hand paid by Grantee, the receipt of which is hereby acknowledged by Grantor, does by these presents, grant, bargain, sell, convey, and confirm unto Grantee, its successors and assigns, the following described real estate and interest in real estate in the County of Christian, State of Missouri:

> **SEE "EXHIBIT A" WHICH IS ATTACHED HERETO AND INCORPORATED HEREIN BY THIS REFERENCE.** "**Exhibit B**" depicts the general location of the real estate and is for illustrative purposes only.

TO HAVE AND TO HOLD a PERMANENT DRAINAGE EASEMENT, with the right, privilege, and authority to Grantee to lay, locate, construct, reconstruct, repair, maintain, patrol, and replace drainage improvements as deemed necessary by Grantee in, on, through, over, under, and across the property described on **Exhibit A**.

Together with the right, privilege, and authority to remove from said premises any obstructions which interfere with the construction, maintenance, or operation of the easement granted herein. Grantor further does hereby grant, bargain, and convey to Grantee the right of ingress and egress to, from, and over the above-described real estate for doing anything necessary or useful for the enjoyment of the easement herein granted, and together with all rights, privileges, and appurtenances which may be required for full enjoyment of the rights herein.

The Grantors, their tenants, heirs, successors, and assigns shall have the right to use and enjoy the premises fully, except for the rights and privileges herein granted to Grantee, provided however that no building, structure, or improvement shall be erected or placed upon said easement, nor shall the terrain be altered without the prior written consent of Grantee. The use of said premises shall always be subject to such acts and uses by the Grantee as may be necessary for the purposes herein set forth.

Grantor covenants to Grantee that Grantor will forever warrant and defend title to said easement and the quiet enjoyment thereof against all lawful claims and demands of all persons whomsoever. Grantor warrants that they have good title to the described premises and that there are no encumbrances which will limit or interfere with the rights granted herein.

IN WITNESS WHEREOF, Grantor has executed the foregoing on the day and year indicated.

GRANTOR:

Xtreme Property Holdings, LLC, a Missouri Limited Liability Company

By: _____
Hunter E. Lampe, Member

Date: _____

ACCEPTANCE BY GRANTEE:

City of Nixa, Missouri

By: _____
Jimmy Liles, City Administrator

Date: _____

ATTEST:

By: _____
Rebekka Coffey, City Clerk

APPROVED AS TO FORM:

By: _____
Nick Woodman, City Attorney

ACKNOWLEDGMENT OF GRANTOR

State of Missouri)
) ss.
County of Christian)

On this 16 day of July, 2025, before me personally appeared Hunter E. Lampe, to me personally known, who being by me duly sworn did say that they are a member and authorized agent of Xtreme Property Holdings, LLC, a Limited Liability Company of the State of Missouri, and that as such member and authorized agent they have authority to execute the foregoing instrument on behalf of said Limited Liability Company, and acknowledged that they executed the same as their free act and deed and the free act and deed of said Limited Liability Company.

In Testimony Whereof, I have set my hand and affixed my official seal at my office in Nixa, Missouri, the day and year first written.

Notary Public: Sarah Elizabeth Gill

Printed Name: Sarah Elizabeth Gill

My commission expires: 03-11-2028.

SARAH ELIZABETH GILL
Notary Public, Notary Seal
State of Missouri
Christian County
Commission # 24747548
My Commission Expires 03-11-2028

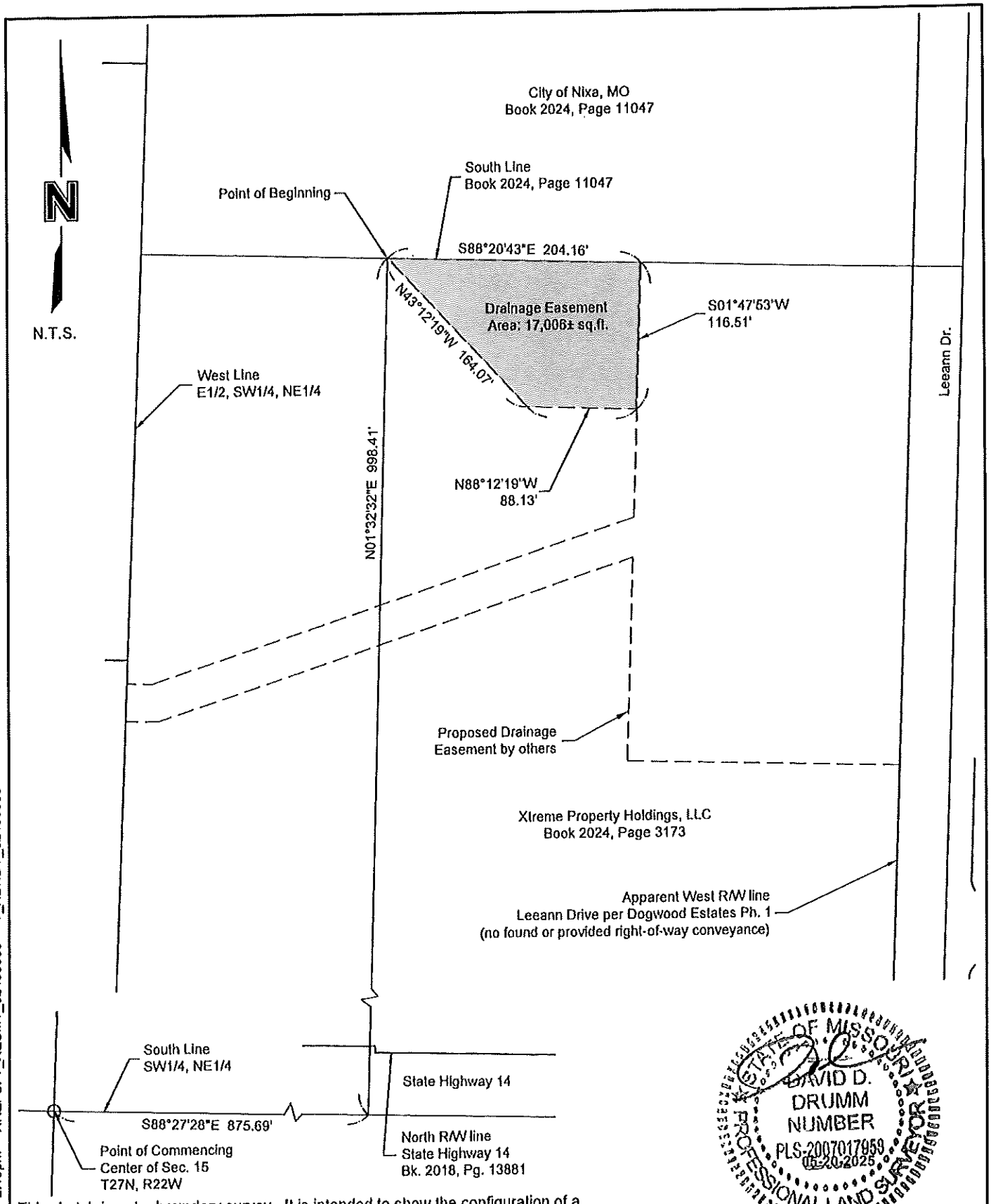
EXHIBIT A

A permanent drainage easement being a part of a tract of land described in Book 2024 at Page 3173 in the Christian County Recorder's office and being a part of the Southwest Quarter (SW1/4) of the Northeast Quarter (NE1/4) in Section 15, Township 27 North, Range 22 West, Christian County, Missouri, more particularly described as follows:

COMMENCING at the center of said Section; thence S88°27'28"E along the South line of said SW1/4 of the NE1/4, a distance of 875.69 feet; thence N01°32'32"E, leaving said South line, a distance of 998.41 feet to the South line of a tract of land described in Book 2024, Page 11047 for a POINT OF BEGINNING; thence S88°20'43"E, along said South line, a distance of 204.16 feet to the NW corner of a proposed drainage easement; thence S01°47'53"W, leaving said South line and along the West line of said proposed drainage easement, a distance of 116.51 feet; thence N88°12'19"W, leaving said West line, a distance of 88.13 feet; thence N43°12'19"W, a distance of 164.07 feet to the POINT OF BEGINNING, containing 17,006 square feet, more or less, subject to right-of-way, easements and restrictions of record.

Prepared by: Olsson, Inc.
Survey MO Certificate of Authority #LC366
550 St. Louis Street, Springfield MO 65806
Tel 417.890.8802
Prepared for: City of Nixa
Project No.: 024-00531

Digitally signed by David D. Drumm
Date: 2025.05.20 14:28:31-05'00'



This sketch is not a boundary survey. It is intended to show the configuration of a permanent drainage easement. It should not be used to locate property lines and does not meet the Standards for Property Boundary Surveys.

STATE OF MISSOURI
DAVID D. DRUMM
NUMBER PLS-2007017959
05-20-2025
PROFESSIONAL LAND SURVEYOR

Digitally Signed by David D. Drumm
Date: 2025.05.20 14:28:17-05'00'

Project no: 024-00531 Drawn by: MRN Date: 05/20/25	DRAINAGE EASEMENT NIXA, MO POLICE STATION	olsson	Olsson Associates, Inc. Survey MO Certificate of Authority #LC366 650 St. Louis Street Springfield, MO 65806 TEL 417.890.8802 FAX 417.890.8805	EXHIBIT B

DWG: F:\2024\00501-01000\024-00583\40-Design\Survey\SRVY\Sheets\V_ESM_PDE_02400583.dwg USER: mnutter
DATE: May 20, 2025 2:19pm XREFS: V_XESMT_02400583 V_XBNDY_02400583

TITLE OF DOCUMENT: Permanent Drainage Easement

DATE OF DOCUMENT: _____

GRANTOR(S): Xtreme Property Holdings, LLC, a Missouri Limited Liability Company

GRANTEE: City of Nixa, Missouri

MAILING ADDRESS OF GRANTEE: PO BOX 395, Nixa, MO 65714

LEGAL DESCRIPTION: See Exhibit A

REFERENCE BOOK AND PAGE: _____

PERMANENT DRAINAGE EASEMENT

THIS PERMANENT DRAINAGE EASEMENT is made, upon its execution by Grantor, by and between **Xtreme Property Holdings, LLC, a Missouri Limited Liability Company**, (herein "Grantor") and the **CITY OF NIXA, MISSOURI, a Constitutional Charter City**, its successors and assigns (herein "Grantee") with a mailing address of P.O. Box 395, Nixa, Missouri 65714.

WITNESSETH, that Grantor in consideration of the sum of **$1.00** and other valuable consideration, to Grantor, which is in hand paid by Grantee, the receipt of which is hereby acknowledged by Grantor, does by these presents, grant, bargain, sell, convey, and confirm unto Grantee, its successors and assigns, the following described real estate and interest in real estate in the County of Christian, State of Missouri:

> **SEE "EXHIBIT A" WHICH IS ATTACHED HERETO AND INCORPORATED HEREIN BY THIS REFERENCE.** "**Exhibit B**" depicts the general location of the real estate and is for illustrative purposes only.

TO HAVE AND TO HOLD a PERMANENT DRAINAGE EASEMENT, with the right, privilege, and authority to Grantee to lay, locate, construct, reconstruct, repair, maintain, patrol, and drainage improvements as deemed necessary by Grantee in, on, through, over, under, and across the property described on **Exhibit A.**

Together with the right, privilege, and authority to remove from said premises any obstructions which interfere with the construction, maintenance, or operation of the easement granted herein. Grantor further does hereby grant, bargain, and convey to Grantee the right of ingress and egress to, from, and over the above-described real estate for doing anything necessary or useful for the enjoyment of the easement herein granted, and together with all rights, privileges, and appurtenances which may be required for full enjoyment of the rights herein.

The Grantors, their tenants, heirs, successors, and assigns shall have the right to use and enjoy the premises fully, except for the rights and privileges herein granted to Grantee, provided however that no building, structure, or improvement shall be erected or placed upon said easement, nor shall the terrain be altered without the prior written consent of Grantee. The use of said premises shall always be subject to such acts and uses by the Grantee as may be necessary for the purposes herein set forth.

Grantor covenants to Grantee that Grantor will forever warrant and defend title to said easement and the quiet enjoyment thereof against all lawful claims and demands of all persons whomsoever. Grantor warrants that they have good title to the described premises and that there are no encumbrances which will limit or interfere with the rights granted herein.

IN WITNESS WHEREOF, Grantor has executed the foregoing on the day and year indicated.

GRANTORS:

Xtreme Property Holdings, LLC, a Missouri Limited Liability Company

By: _____
Hunter E. Lampe, Member

Date: _____

ACCEPTANCE BY GRANTEE:

City of Nixa, Missouri

By: _____
Jimmy Liles, City Administrator

Date: _____

ATTEST:

By: _____
Rebekka Coffey, City Clerk

APPROVED AS TO FORM:

By: _____
Nick Woodman, City Attorney

ACKNOWLEDGMENT OF GRANTOR

State of Missouri)
) ss.
County of Christian)

On this 16 day of July, 2025, before me personally appeared Hunter E. Lampe, to me personally known, who being by me duly sworn did say that they are a member and authorized agent of Xtreme Property Holdings, LLC, a Limited Liability Company of the State of Missouri, and that as such member and authorized agent they have authority to execute the foregoing instrument on behalf of said Limited Liability Company, and acknowledged that they executed the same as their free act and deed and the free act and deed of said Limited Liability Company.

In Testimony Whereof, I have set my hand and affixed my official seal at my office in Nixa, Missouri, the day and year first written.

Notary Public: Sarah Elizabeth Gill

Printed Name: Sarah Elizabeth Gill

My commission expires: 03-11-2028.

SARAH ELIZABETH GILL
Notary Public, Notary Seal
State of Missouri
Christian County
Commission # 24747548
My Commission Expires 03-11-2028

EXHIBIT A

PERPETUAL STORMWATER EASEMENT

A STORMWATER EASEMENT LYING IN PART OF THE SOUTHWEST QUARTER OF THE NORTHEAST QUARTER OF SECTION 15, TOWNSHIP 27 NORTH, RANGE 22 WEST IN THE CITY OF NIXA, CHRISTIAN COUNTY MISSOURI AND SAID EASEMENT BEING MORE PARTICULARLY DESCRIBED AS FOLLOWS:

COMMENCING AT THE NORTHEAST CORNER OF THE SOUTHWEST QUARTER OF THE NORTHEAST QUARTER OF SECTION 15, TOWNSHIP 27 NORTH, RANGE 22 WEST THENCE ALONG THE EAST LINE OF SAID SOUTHWEST QUARTER OF THE NORTHEAST QUARTER SOUTH 01°48'05" WEST, 351.71 FEET TO THE NORTHEAST CORNER OF TRACT 2 OF THE ADMINSTRATIVE MINOR SUBDIVISION RECORDED IN BOOK V, PAGE 5371.A OF THE CHRISTIAN COUNTY RECORDER'S OFFICE; THENCE LEAVING SAID EAST LINE AND ALONG THE NORTH LINE OF SAID TRACT 2 NORTH 88°20'28" WEST, 40.00 FEET TO THE POINT OF BEGINNING, SAID POINT BEING ON THE APPARENT WEST RIGHT-OF-WAY OF LEANN DRIVE AS SHOWN ON SAID ADMINISTRATIVE MINOR SUBDIVISION, THENCE LEAVING SAID NORTH LINE AND ALONG SAID APPARENT RIGHT-OF-WAY SOUTH 01°48'05" WEST, 396.78 FEET; THENCE NORTH 88°20'28" WEST, 220.00 FEET; THENCE NORTH 01°48'05" EAST, 162.23 FEET; THENCE SOUTH 71°49'56" WEST, 403.90 FEET; THENCE NORTH 88°32'44" WEST, 25.80 FEET TO A POINT ON THE WEST LINE OF SAID TRACT 2; THENCE ALONG SAID WEST LINE NORTH 02°07'10" EAST, 30.00 FEET; THENCE LEAVING SAID NORTH LINE SOUTH 88°32'44" EAST, 20.26 FEET; THENCE NORTH 71°49'56" EAST, 409.61 FEET; THENCE NORTH 01°48'05" EAST, 202.63 FEET TO A POINT ON THE AFOREMENTIONED NORTH LINE OF TRACT 2; THENCE ALONG SAID NORTH LINE SOUTH 88°20'28" EAST, 220.00 FEET TO THE POINT OF BEGINNING. CONTAINING 104,902 SQUARE FEET (2.41 ACRES). ALL LYING IN SECTION 15, TOWNSHIP 27 NORTH, RANGE 22 WEST, IN THE CITY OF NIXA, CHRISTIAN COUNTY, MISSOURI.

EXHIBIT "B"

SECTION 15
TWP. 27N, RNG. 22W
CHRISTIAN CO., MISSOURI

STATE OF MISSOURI
KENT R. PETERSON
NUMBER 2659
PROFESSIONAL LAND SURVEYOR

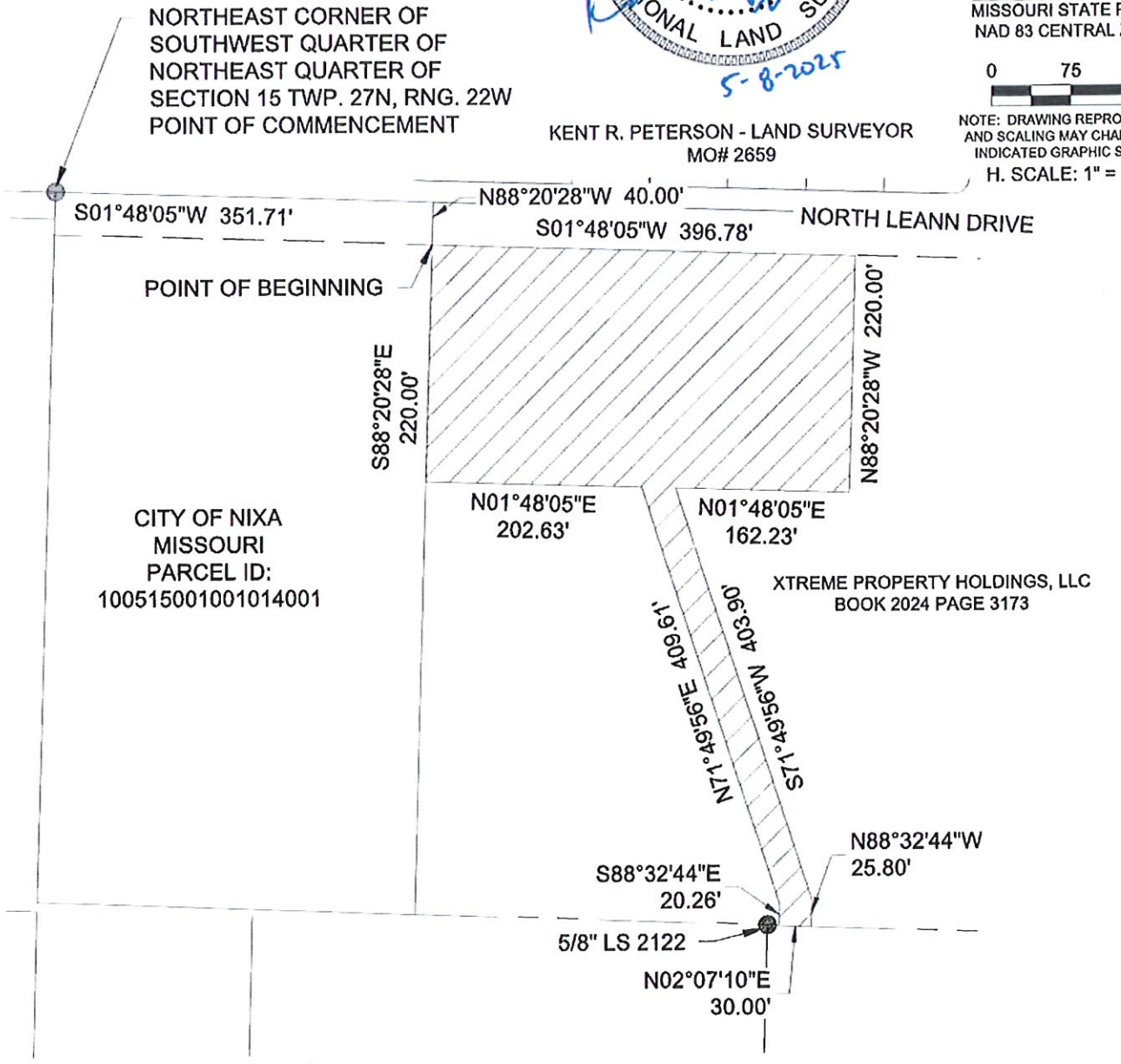
5-8-2025

KENT R. PETERSON - LAND SURVEYOR
MO# 2659

BASIS OF BEARING
MISSOURI STATE PLANE
NAD 83 CENTRAL ZONE

0 75 150

NOTE: DRAWING REPRODUCTION AND SCALING MAY CHANGE THE INDICATED GRAPHIC SCALES
H. SCALE: 1" = 150'



LEGEND

- FOUND MONUMENT AS NOTED
- SECTION LINE
- R/W — RIGHT-OF-WAY LINE
- PERMANENT EASEMENT

EASEMENT AREA

104,902 SQUARE FEET
2.41 ACRES

DATE	REVISION	#
05/08/25	ISSUED FOR REFERENCE	0

TOTH & ASSOCIATES
1550 E. REPUBLIC ROAD
SPRINGFIELD, MO 65804
Ph: 417-888-0645 Fax: 417-888-0657
www.tothassociates.com
CERTIFICATE OF AUTHORITY: MO# LS-2011008797

DRAWN BY: MC
CKD BY: KRP
APPD BY: KRP
DATE: 05/07/25

PROJECT: XTREME EXTERIORS EXHIBITS
LOCATION: NORTH LEEANN DRIVE NIXA, MO 65714
CLIENT: CITY OF NIXA
715 WEST MT. VERNON ST.
NIXA, MO 65714

TITLE: STORMWATER EASEMENT
XTREME EXTERIORS

SHT NO: 1 OF 1

REVISED STORMWATER ENGINEERING REPORT

XTREME EXTERIORS

NIXA, MISSOURI

REVISED NOVEMBER 2024

TOTH & ASSOCIATES
1550 E. REPUBLIC ROAD
SPRINGFIELD, MO 65804
417.888.0645
TOTHASSOCIATES.COM

TABLE OF CONTENTS

REPORT

TOTH & ASSOCIATES

EXHIBITS

APPENDICES

1. INTRODUCTION

This report summarizes the design of a stormwater collection and conveyance system and related water quality and detention improvements to accommodate the construction of Phase 1 and Phase 2 of the proposed Xtreme Exteriors Development, located in Nixa, Missouri. Phase 1 will consist of Xtreme Exteriors Office Building and the City of Nixa Police Station. Phase 2 will be the full buildout of the remainder of the undeveloped land. Phase 2 is currently unplanned and assumed that the development will consist of a 20-acre site that is 85 percent impervious in addition to Phase 1. A site location map is attached as Exhibit 1.

The stormwater computations for the proposed development consist of the design of a regional detention and water quality basin and related storm water collection and conveyance systems. All the proposed stormwater infrastructure has been sized in accordance with the City of Nixa's "Technical Specification Manual".

2. STORMWATER COLLECTION & CONVEYANCE SYSTEM DESIGN CRITERIA

2.1 DESIGN CRITERIA AND RUNOFF DETERMINATIONS

The storm inlets and pipes have been designed and sized in accordance with the following criteria:

1. Closed storm sewers were designed to convey the 25-year storm (major storm).
2. Rip-rap energy dissipaters are located at pipe exits to minimize erosion.
3. Rainfall data was obtained from standard drawings G2 and G3 from the City of Nixa's Technical Specification Manual.

Autodesk Storm and Sanitary Analysis (2023), from now on referred to as SSA, was utilized for the inlet and piping design, as well as open channel flow calculations. All collection and conveyance system design calculations are included in Appendix A of this report.

2.2 DETERMINATION OF STORM SEWER CAPACITY

In order to reflect intercepted flows into the pipes via inlet openings accurately, the capacities of the storm sewer pipes were calculated and modeled using SSA. Flow, based on the inlet's drainage area, is added at each inlet. Then, the size of the main system is increased as needed to accommodate the additional flow. This method of determining storm sewer capacity in conjunction with the calculated flow rates was used to analyze the storm sewer and to size each recommended storm sewer pipe in this report.

The recommended pipe sizes shown in this report are based on installing pipe of the material specified. Other materials may be approved prior to construction, provided they are hydraulically and structurally equivalent, have equal durability, and are listed in Section 96 of the City of Nixa's Technical Specification Manual.

Material *n* values, are as follows:

1. High-Density Polyethylene Pipe (HDPE) *n* = 0.012
2. Reinforced Concrete Pipe (RCP) *n* = 0.013

2.3 DETERMINATION OF INLET CAPACITY

Excess stormwater runoff is rainwater that is not taken by percolation or evaporation, which drains into ditches or street gutters is collected at "suitable" intervals by inlets connecting to the underground storm sewer system. Inlets are located such that they will intercept stormwater flowing in ditches or gutters before the water accumulates.

Curb inlets and grated inlets were utilized for this design. An 8 percent clogging factor was applied to SS curb opening inlets. A 50 percent clogging factor was applied to area inlets located "in sumps" and a 6 percent clogging factor was applied to area inlets located "on grade", per City of Nixa's standards. The clogging factor is added to account for the reduction in efficiency of the inlet due to partial clogging by debris, leaves, etc. Curb inlet and area inlet capacity calculations were performed using SSA.

2.4 DESIGN RESULTS

The stormwater collection and conveyance system for the proposed project consists of an interconnected system of pipes and inlets, as well as an open channel. An SSA summary, as well as other supporting calculations, can be found in Appendix A. The following abbreviations were used in the naming convention: JB – Junction Box, CI – Curb Inlet, AI – Area Inlet, FES – Flared End Section, DS – Downspout, TD – Trench Drain.

A map of the proposed collection and conveyance system is attached as Exhibit 2. Rip-rap energy dissipation has been provided at the discharge ends of the stormwater collection system.

Table 1, below, shows the characteristics of the proposed pipes for Xtreme Exteriors Office Building.

Table 1: Xtreme Exteriors Office Building Conveyance System Characteristics

		Pipe/Channel Characteristics			Flow Characteristics		
Inlet	**Outlet**	**Diameter (in)**	**Material**	**Slope (%)**	**25-year Q (cfs)**	**Depth (in)**	**Peak Velocity (ft/s)**
AI-A1	FES	24	HDPE	0.68	11.63	11.04	8.17
CI-A2	AI-A1	12	HDPE	2.00	2.36	8.76	3.85
CI-A3	CI-A2	12	HDPE	2.00	1.26	4.08	5.33
AI-A4	CI-A3	12	HDPE	1.31	0.24	1.92	2.94
AI-B1	AI-A1	15	HDPE	3.52	4.52	7.80	8.14
AI-B2	AI-B1	15	HDPE	2.00	4.07	7.65	6.55
AI-B3	AI-B2	12	HDPE	1.25	1.33	4.68	4.68
AI-B4	AI-B3	10	HDPE	1.00	0.51	3.96	3.23

The inlet capacity of the inlets for the project was determined utilizing SSA. Provided in Appendix A is an SSA summary report for 25-year and 100-year. Table 2 below shows the characteristics of each inlet. Supporting calculations can be found in Appendix A.

Table 2: Xtreme Exteriors Office Building Collection System Inlet Characteristics

Inlet	Inlet Characteristics			
	Size (O.D.)	**Location**	**100-Year Depth (ft)**	**100-Year Peak Flow (cfs)**
AI-A1	4' x 4'	On Sag	0.54	6.36
CI-A2	4' x 8'	On Sag	0.41	1.61
CI-A3	4' x 8'	On Sag	0.41	1.53
AI-A4	4' x 4'	On Sag	0.16	0.37
AI-B1	4' x 4'	On Sag	0.24	1.02
AI-B2	4' x 4'	On Grade	0.28	2.68
AI-B3	4' x 4'	On Sag	0.26	1.28
AI-B4	3’ x 3’	On Sag	0.22	0.79

The proposed development the Xtreme Exteriors Office Building collection system has an open channel that will be constructed to convey the stormwater from the flared end section, the outfall from the Xtreme Exteriors Office development to the proposed regional detention basin. After the entire development is fully developed, the open channel will no longer be necessary to convey the stormwater, as the land will be developed with a different conveyance system than a channel. Table 3 below shows the characteristics at three corresponding points along the open channel shown in Figure 1. The open channel will be a 424 linear feet long trapezoidal grass-lined open channel. The channel will have a 3 foot wide bottom with side sloped at 3:1 (H:V). The channel is designed to have a 1 foot freeboard over the 100-year water surface elevation. The points of analysis were analyzed for a storm duration of 1-hour with a 100-year

storm event using Hydraflow Express Extension for Autodesk Civil 3D. Results of the channel are shown in Table 3. Supporting calculations can be found in Appendix A.

Figure 1: Xtreme Exteriors Open Channel Points of Analysis

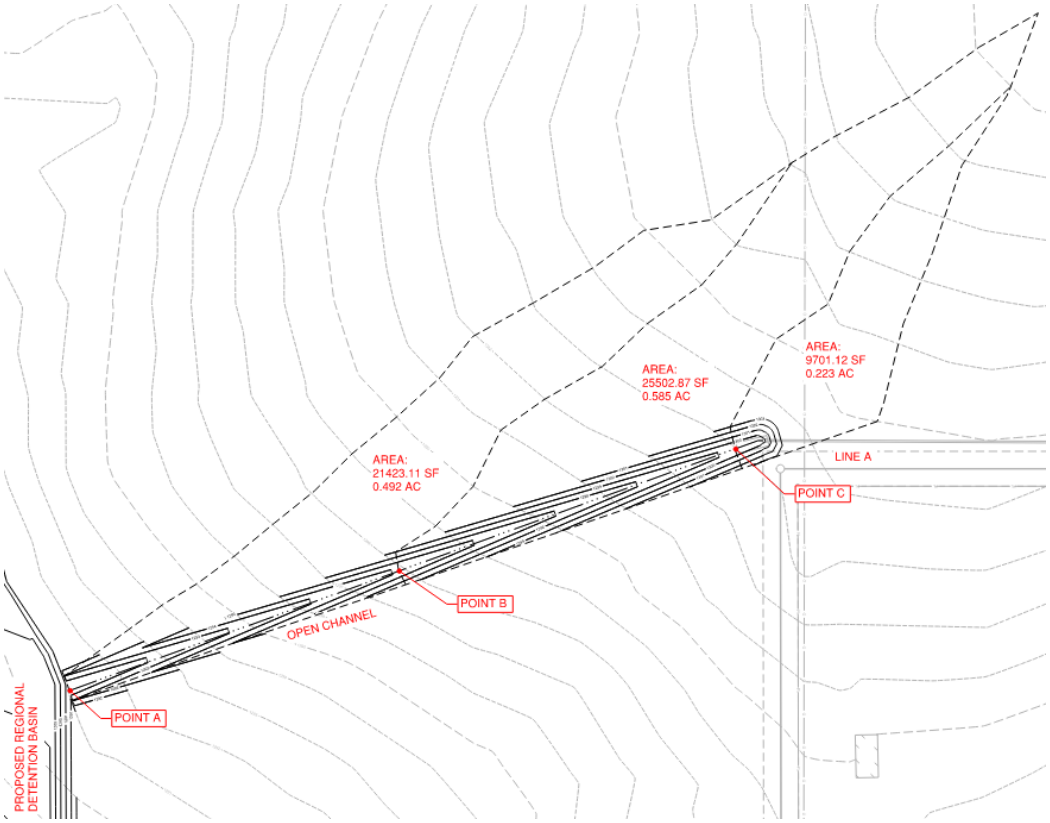


Table 3: Open Channel Points of Analysis

Point of Analysis	Total Area (ac.)	Impervious Area (ac.)	Pervious Area (ac.)	Runoff Coefficient, C	TC (min.)	Intensity (in/hr) 100-yr	Drainage Area Peak Flow (cfs) 100-yr	Xtreme Exterior Line A Flow (cfs) 100-yr	Channel Peak Flow (cfs) 100-yr	Channel Depth (ft) 100-yr
Point A	1.300	0.000	1.300	0.35	5	10.20	4.64	14.13	18.77	0.80
Point B	0.808	0.000	0.808	0.35	5	10.20	2.89		17.00	0.77
Point C	0.223	0.000	0.223	0.35	5	10.20	0.80		14.93	0.72

Upstream of the aforementioned channel, the proposed development the Xtreme Exteriors Office Building collection system has two ditches that will be constructed. The south ditch will convey stormwater to will flow to Area Inlet A1. Table 4 below shows the characteristics and results at four corresponding points along the south ditch shown in Figure 2. The west ditch conveys stormwater runoff to stay in the ditch and ultimately to the church detention basin.

Table 5 below shows the characteristics and results at two corresponding points along the west ditch shown in Figure 3. The ditches will be grass-lined triangular ditches. The ditches will have a maximum side slope of 3:1 (H:V). The ditches are designed to have 1-foot of freeboard over the 100-year water surface elevation. The points of analysis were analyzed for a storm duration of 1-hour with a 100-year storm event using Hydraflow Express Extension for Autodesk Civil 3D. The culverts have been sized as 12" HDPE pipes that will convey the flows, as shown, from the 100-year storm events. Supporting calculations can be found in Appendix A.

Figure 2: Xtreme Exteriors South Ditch Points of Analysis

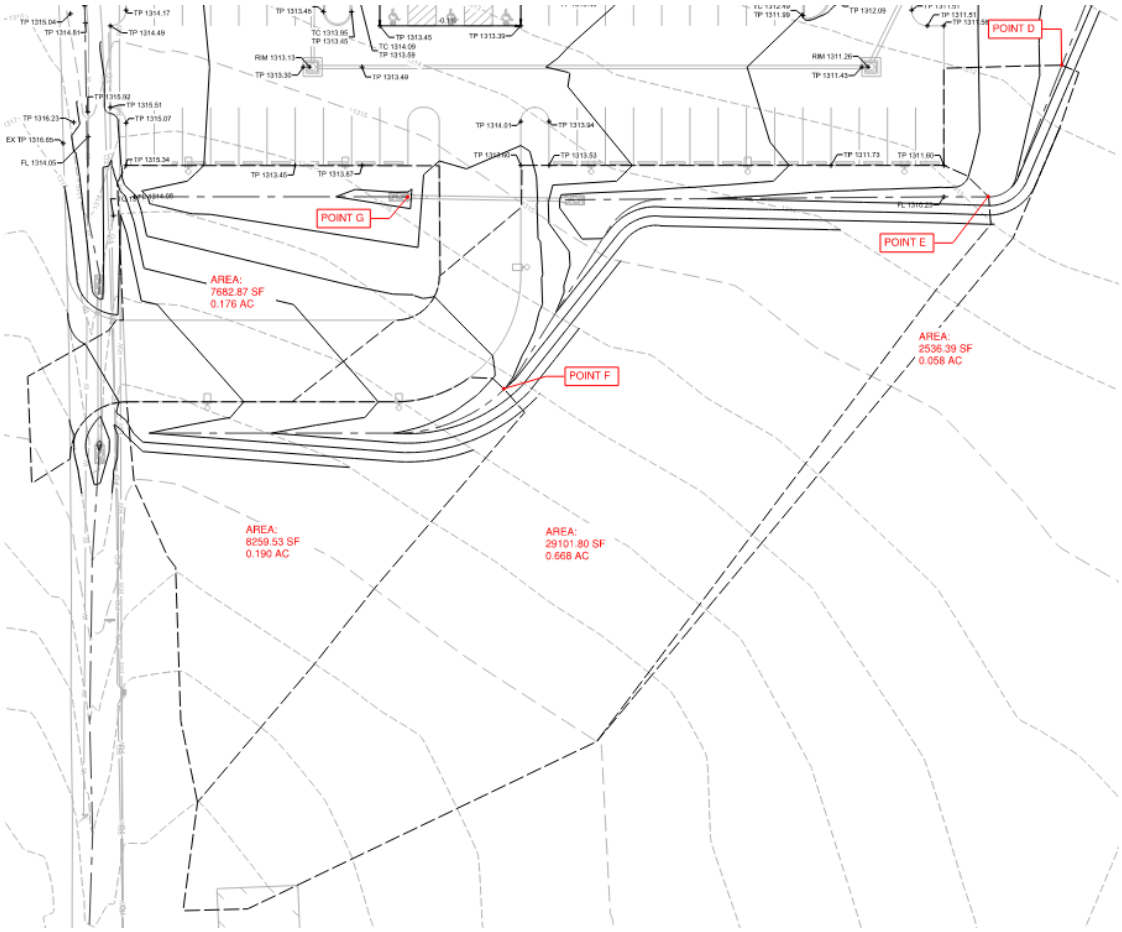


Table 4: South Ditch Points of Analysis

Point of Analysis	Total Area (ac.)	Impervious Area (ac.)	Pervious Area (ac.)	Runoff Coefficient, C	TC (min.)	Intensity (in/hr) 100-yr	Ditch Peak Flow (cfs) 100-yr	Ditch Depth (ft) 100-yr
Point D	0.989	0.104	0.885	0.41	5	10.20	4.16	0.44
Point E	0.930	0.104	0.827	0.42	5	10.20	3.96	0.57
Point F	0.190	0.000	0.190	0.35	5	10.20	0.68	0.24
Point G	0.176	0.062	0.114	0.56	5	10.20	1.01	0.26

Figure 3: Xtreme Exteriors West Ditch Points of Analysis

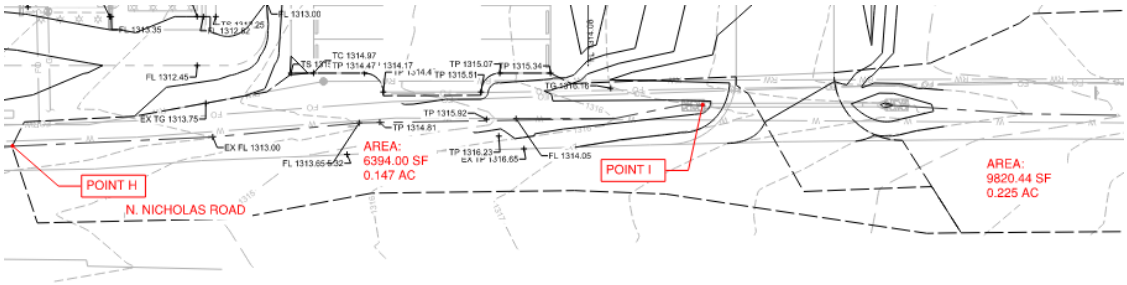


Table 5: West Ditch Points of Analysis

Point of Analysis	Total Area (ac.)	Impervious Area (ac.)	Pervious Area (ac.)	Runoff Coefficient, C	TC (min.)	Intensity (in/hr) 100-yr	Ditch Peak Flow (cfs) 100-yr	Ditch Depth (ft) 100-yr
Point H	0.372	0.171	0.201	0.63	5	10.20	2.38	0.32
Point I	0.225	0.100	0.125	0.62	5	10.20	1.42	0.43

3. STORMWATER DETENTION BASIN

3.1 DESIGN CRITERIA

Stormwater runoff hydrographs were developed using Hydraflow Hydrographs Extension for AutoCAD Civil 3D. The major design assumptions and techniques used to determine the detention volume are as follows:

1. The 1-hour and 24-hour storm durations were modeled using the SCS Type II distribution and Huff's distribution with a controlling storm of 1-hour.
2. Peak flows were analyzed for the 2, 5, 10, 25, and 100-year return frequencies.
3. Time of concentration and curve number computations were computed using the TR-55 method.

The Christian County soils map shows that the general soil associations in the drainage basin are Tonti silt loam and Peridge silt loam. A soils map has been provided as Exhibit 6.

The basin was modeled with rainfall frequency curves from the City of Nixa's Technical Specification Manual. The critical duration analysis in Table 6 shows that the 1-hour storm produced the highest peak flow for the pre and post-development conditions. Basin hydrologic calculations and the Hydraflow results are presented in Appendix B.

Table 6: Critical Duration Analysis

Duration	Pre-Development Peak Flows			Post Development Peak Flows		
	2-year	10-year	100-year	2-year	10-year	100-year
30-minute	14.54	36.44	74.39	23.06	46.10	90.52
1 hour	21.33	42.83	92.45	26.85	52.50	101.93
2 hour	19.81	37.54	84.73	24.90	46.30	89.14

3.2 EXISTING REGIONAL DETENTION BASIN

Pre-project flow includes a regional detention basin upstream of the proposed development. The upstream regional detention basin is on a church's property and collects a portion of the existing Xtreme Exteriors flows prior to any of the proposed development occurring, as shown in Exhibit 3. This regional detention basin was surveyed by Toth & Associates, which provided the geometric characteristics presented in Table 7. In the existing conditions, flow from outlet structure of the church regional detention basin flows overland to a set of connect storm inlets along LeAnn Drive. For post-drainage areas, the existing flow is considered a passthrough and is accounted for in calculations as such.

Table 7: Church Regional Detention Basin Characteristics

Stage (feet)	Surface Area (acres)
1292.58	0.0000
1293.00	0.0484
1294.00	0.6592
1294.55	0.9640
1295.00	1.2046
1296.00	1.4610

The detention basin utilizes a concrete outlet structure.

The outlet structure is as follows:

1. A 12-inch diameter orifice at elevation 1292.62.
2. A 23-foot long overflow weir at elevation 1294.55.

Calculations for the detention basin and outlet structure are presented in Appendix B.

As shown in Exhibit 4, the Xtreme Exteriors development will reroute a portion of the existing flow to the church regional detention basin and route the flow to the proposed regional detention basin. This will decrease the overland flow to the church regional detention basin. As the entire site is fully developed, there will be additional flows that we be rerouted to the proposed regional detention basin, that were previously flowing to the church regional detention basin, as shown in Exhibit 5.

3.3 DESIGN RESULTS

3.3.1 PHASE 1

Pre-project and post-project peak flow rates leaving the site were determined for the 2, 5, 10, 25, and 100-year storm events for the 1-hour storm duration and compared to the pre-project flows. The results of the analysis are presented, below, in Table 8.

Table 8: Detention Basin Phase 1 Peak Flow Rate Summary

Return Frequency (years)	Peak Flows			
	Q_p Pre-Project (cfs)	Q_p Post-Project (cfs)	Q_p Post-Project w/ Detention (cfs)	Peak Stage (feet)
2	21.33	26.85	17.85	1286.11
5	32.33	40.05	21.04	1286.87
10	42.83	52.50	32.52	1287.39
25	58.79	70.78	40.42	1287.90
100	92.45	101.93	50.21	1288.86

A top of berm elevation of 1291.05 feet is proposed for the detention basin. This top of berm elevation provides a minimum of 2.19 feet of freeboard over 100-year peak stage. The computations used to size the detention basin are presented in the attached Appendix B.

3.3.2 PHASE 2

With the addition of Phase 2 flows, pre-project and post-project peak flow rates leaving the site were determined for the 2, 5, 10, 25, and 100-year storm events for the 1-hour storm duration and compared to the pre-project flows. The results of the analysis are presented, below, in Table 9.

Table 9: Detention Basin Phase 2 Peak Flow Rate Summary

Return Frequency (years)	Peak Flows			
	Q_p Pre-Project (cfs)	Qp Post-Project (cfs)	Qp Post-Project w/ Detention (cfs)	Peak Stage (feet)
2	21.33	56.42	19.47	1287.66
5	32.33	76.56	29.42	1288.27
10	42.83	94.75	44.33	1288.65
25	58.79	120.46	51.31	1289.17
100	92.45	162.59	61.54	1290.05

A top of berm elevation of 1291.05 feet is proposed for the detention basin. This top of berm elevation provides a minimum of 1.00 feet of freeboard over 100-year peak stage. The computations used to size the detention basin are presented in the attached Appendix B.

3.4 BASIN AND OUTLET STRUCTURE GEOMETRY

Xtreme Exteriors Development Phase 1 and Phase 2 key geometric characteristics of the detention basin are presented in Table 10.

Table 10: Detention Basin Characteristics

Stage (feet)	Surface Area (acres)
1283.45	0.0000
1284.00	0.0149
1285.00	0.1184
1286.00	0.3185
1287.00	0.5412
1288.00	0.7682
1289.00	0.9824
1290.00	1.1615
1291.00	1.2925
1291.05	1.2959

3.4.1 PHASE 1

The detention basin is to be constructed with a 7-foot x 5-foot (O.D.) concrete outlet structure, with a grate inlet 1-foot below the rim. The structure metal plate perforation elevations are set in order to allow for the required water quality capture volume to drain within the required time. The bottom of the basin will be graded to drain toward the concrete outlet structure, at a slope of 2.00%.

The outlet structure will be as follows:

1. One 36-inch x 41 5/32-inch metal plate, with four (4) 1.00” diameter low flow orifices, drilled at elevations of 1283.45 and 1284.78, which each drain to a 24-inch diameter opening in concrete box at elevation 1283.45. Two rows of four perforations each are proposed.
2. A 24-inch diameter orifice at elevation 1283.45.
3. A 4-foot long x 27.3-inch tall overflow weir on all four sides at elevation 1286.88.

Calculations for the detention basin and outlet structure are presented in Appendix B.

3.4.2 PHASE 2

The detention basin is to utilize the 7-foot x 5-foot (O.D.) Phase 1 concrete outlet structure. The structure metal plate perforation elevations are set in order to allow for the required water quality capture volume to drain within the required time.

The outlet structure will be as follows:

3. One 36-inch x 53 20/32-inch metal plate, with six (6) 1.00" diameter low flow orifices, drilled at elevations of 1283.45, 1284.78, and 1286.12, which each drain to a 21-inch diameter opening in concrete box at elevation 1283.45. Three rows of six perforations each row is proposed.
4. A 21-inch diameter orifice at elevation 1283.45.
5. A 4-foot long x 14.8-inch tall overflow weir on all four sides at elevation 1287.92.

Calculations for the detention basin and outlet structure are presented in Appendix B.

3.5 DETENTION BASIN SUMMARY

Per the City of Nixa's Technical Specification Manual, a minimum freeboard of 1 foot above the 100-year design storm (critical storm) high-water elevation should be provided for when designing the detention basin. This is done by analyzing the 1-hour and 24-hour storm durations to calculate a 100-year stage based on the storage volume of the basin. Stage and freeboard results are presented in Table 11 below. The SCS Type II 24-hr storm requires that a 50 linear foot trapezoidal emergency spillway placed at elevation 1290.05 be constructed, to ensure that the regional detention basin does not overtop.

Table 11: Detention Basin Stage Analysis

Detention Basin		Detention Basin Stage Analysis, 100-year		
		Huff's		SCS Type II
		1-hr	24-hr	24-hr
Phase 1	Stage	1288.86	1287.41	1290.72
	Freeboard (ft)	2.19	3.64	0.33
Phase 2	Stage	1290.05	1288.39	1291.02
	Freeboard (ft)	1.00	2.66	0.03

3.6 DOWNSTREAM OF DETENTION BASIN OUTLET STRUCTURE

The proposed regional detention basin outlet structure is connected to an existing curb inlet structure via two (2) 24-inch pipes. The existing storm sewer was surveyed by Toth & Associates. The results indicate that the existing storm sewer system is able to convey flow from the detention basin outlet, as the flow from the outlet structure is less than the existing flows. This indicates that under proposed conditions, the system is conveying less flow than the existing conditions. An SSA summary, as well as other supporting calculations and map of the existing

storm sewer modeled with a 1-hour critical storm for the 2, 5, 10, 25, and 100-year storm events, can be found in Appendix B. The SSA model provided the results of the tailwater that occurred in the existing curb inlet that is directly downstream of the detention basin outlet structure, based on the depth of water in the existing curb inlet, as presented in Table 12 below.

Table 12: Detention Basin Downstream Tailwater Summary

Return Frequency (years)	Tailwater Elevation (feet)
2	1283.70
5	1283.98
10	1285.33
25	1285.70
100	1285.70

4. STORMWATER QUALITY BASINS

4.1 WATER QUALITY CAPTURE VOLUME AND EXTENDED DRAIN TIME

Required for the design of a dry detention basin, both the *Directly Connected Impervious Area (DCIA)*, as well as the *Runoff Resulting from 1" over 24 hours* (SCS Method) water quality calculations were ran. For Phase 1 and Phase 2, the SCS Method required a larger volume for dry detention. Utilizing the controlling SCS Method, the cumulative water quality capture volume (WQCV) required is equal to 27,548 cubic feet for Phase 1 and 55,951 cubic feet for Phase 2. A weighted curve number based on entire drainage area was used in this calculation. The impervious surface areas were calculated based on known development plans for Phase 1 and an estimated 20 percent of drainage area being impervious surface for Phase 2. Calculations are presented in Appendix C. Individual water quality characteristics and requirements are described below.

4.1.1 PHASE 1

The proposed water quality basin has a flowline elevation of 1283.45 at the bottom of the basin and a top of berm elevation of 1291.05. In order to achieve the required WQCV needed, an overflow orifice and perforated metal plate will be installed. The perforated metal plate is designed with eight 1.00" diameter perforations. There are two rows of perforations with four perforations each row. The first row of perforations is set at elevation 1283.45 and the second at 1284.78. The overflow weir is designed to be installed at the elevation 1286.88, resulting in a WQCV of 28,630 cubic feet.

With the proposed water quality improvements in place, the basin functions appropriately for the required storm durations for the 2-year, 5-year, 10-year, 25-year, and 100-year recurrence intervals and provides for over 1 foot of freeboard. The storm events modeled utilize Huff's temporal distribution, paired with the SCS Unit Hydrograph methodology. Additionally, with the improvements in place, the total drain time for the WQCV is equal to approximately 30.9 hours.

4.1.2 PHASE 2

The proposed water quality basin has a flowline elevation of 1283.45 at the bottom of the basin and a top of berm elevation of 1291.05. In order to achieve the required WQCV needed, an overflow weir and perforated metal plate will be installed. The perforated metal plate is designed with eighteen (18) 1.00" diameter perforations. There are three rows of perforations with six perforations each row. The first row of perforations is set at elevation 1283.45, the second at 1284.78, and the third at 1286.12. The overflow weir is designed to be installed at the elevation 1287.92, resulting in a WQCV of 57,256 cubic feet.

With the proposed water quality improvements in place, the basin functions appropriately for the required storm durations for the 2-year, 5-year, 10-year, 25-year, and 100-year recurrence intervals and provides for over 1 foot of freeboard. The storm events modeled utilize Huff's temporal distribution, paired with the SCS Unit Hydrograph methodology. Additionally, with the improvements in place, the total drain time for the WQCV is equal to approximately 29.4 hours.

5. SINKHOLE ANALYSIS AND CONSIDERATION

5.1 OVERVIEW

There are four sinkholes within the footprint of the proposed development. The City requires that an analysis be completed for the consideration of flood hazards and preserving ground water quality. All four sinkholes will be impacted by the development. Sinkholes A and D are the only sinkholes with closed contours, and thus the only sinkholes analyzed in this report.

5.2 ANALYSIS

Analysis of sinkholes has been completed and reported on in the Sinkhole Evaluation by Gredell Engineering Resources dated July 2024 and is attached in Appendix D. This analysis was used as the basis for completing the SCS Type II 6 Hour and 12 Hour storm durations, with results shown in Table 13 and Table 14, respectively. The sinkholes were analyzed using Hydraflow Express Extension for Autodesk Civil 3D. Supporting calculations can be found in Appendix D. Sinkhole A was reported by Gredell Engineering to have a rim and maximum ponding elevation of 1287.50. Sinkhole A is a shallow sinkhole that does not capture the entire stormwater flow from the sinkhole drainage area before the sinkhole reaches the rim. Sinkhole D was found to have a rim and maximum ponding elevation of 1289.50. Sinkhole D is a shallow sinkhole that does not capture the entire stormwater flow from the sinkhole drainage area before the sinkhole reaches the rim. For sinkholes A and D, the amount of flow produced by the drainage area to the sinkhole is almost equal to that of the amount of flow produced after the sinkhole is no longer able to accept additional flow. To be conservative, the analysis of drainage areas in the regional detention basin analysis did not account for stormwater loss via sinkholes.

Table 13: SCS Type II, 6-Hour Sinkhole Flow Analysis

Sinkhole	Sinkhole Stage Analysis, 6-hour (100-year)					
	Peak Flow from Drainage Area (cfs)			Peak flow from Sinkhole Overtopping (cfs)		
	Pre	Post (Phase 1)	Post (Phase 2)	Pre	Post (Phase 1)	Post (Phase 2)
A	3.441	3.441	3.441	3.367	3.367	3.367
D	7.146	4.590	1.359	7.115	4.546	1.059

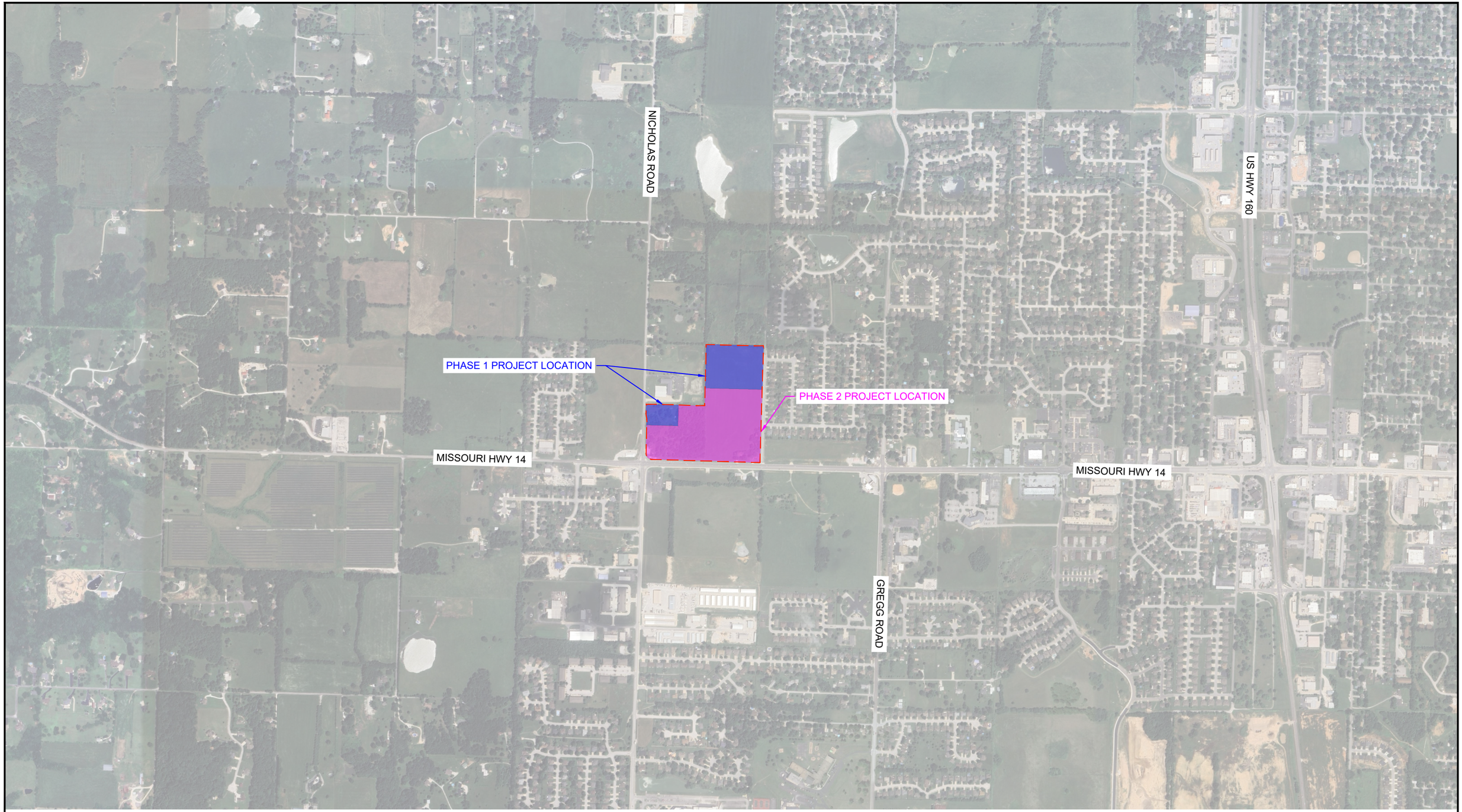
Table 14: SCS Type II, 24-Hour Sinkhole Flow Analysis

Sinkhole	Sinkhole Stage Analysis, 24-hour (100-year)					
	Peak Flow from Drainage Area (cfs)			Peak flow from Sinkhole Overtopping (cfs)		
	Pre	Post (Phase 1)	Post (Phase 2)	Pre	Post (Phase 1)	Post (Phase 2)
A	9.866	9.866	9.866	9.751	9.751	9.751
D	15.88	13.37	4.071	15.72	13.00	3.830

EXHIBITS

1. SITE LOCATION MAP
2. COLLECTION & CONVEYANCE SYSTEM MAP
3. DRAINAGE AREA MAP - STRUCTURES
4. DRAINAGE AREA MAP - PRE
5. DRAINAGE AREA MAP – POST – FULL BUILOUT
6. SOILS MAP AND REPORT

TOTH & ASSOCIATES



SCALE: 1" = 1000'

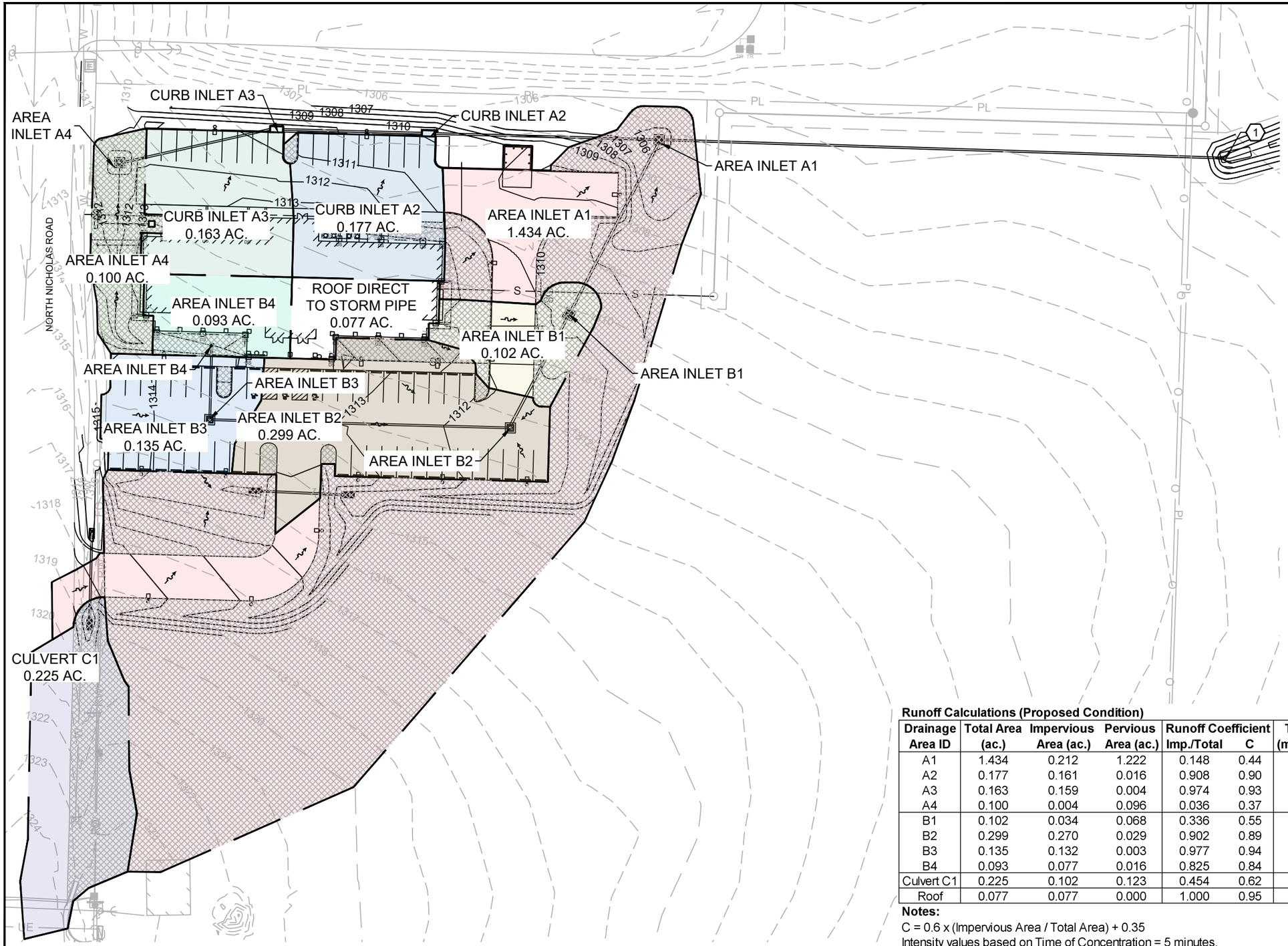
N

EXHIBIT 1: SITE LOCATION MAP

XTREME EXTERIORS DEVELOPMENT
NIXA, MO

JOB NUMBER:	CE-00-393
ISSUED DATE:	11/22/2024

TOTH & ASSOCIATES
1550 E. Republic Rd, Suite A, Springfield MO. 65804
Toth & Associates, Inc.
Missouri State Certificate of Authority #2004004242



HATCH LEGEND:

- = PERVIOUS AREA
- = AREA A1
- = AREA A2
- = AREA A3
- = AREA A4
- = AREA B1
- = AREA B2
- = AREA B3
- = AREA B4
- = AREA C1

SYMBOLS:

DIRECTION OF SHEET FLOW

Runoff Calculations (Proposed Condition)

Drainage Area ID	Total Area (ac.)	Impervious Area (ac.)	Pervious Area (ac.)	Runoff Coefficient Imp./Total	Runoff Coefficient C	TC (min.)	Intensity (in/hr) 2-yr	10-yr	25-yr	100-yr	Peak Flow (cfs) 2-yr	10-yr	25-yr	100-yr
A1	1.434	0.212	1.222	0.148	0.44	5	5.50	7.40	8.40	10.20	3.46	4.66	5.28	6.42
A2	0.177	0.161	0.016	0.908	0.90	5	5.50	7.40	8.40	10.20	0.87	1.17	1.33	1.62
A3	0.163	0.159	0.004	0.974	0.93	5	5.50	7.40	8.40	10.20	0.84	1.13	1.28	1.55
A4	0.100	0.004	0.096	0.036	0.37	5	5.50	7.40	8.40	10.20	0.20	0.28	0.31	0.38
B1	0.102	0.034	0.068	0.336	0.55	5	5.50	7.40	8.40	10.20	0.31	0.42	0.47	0.58
B2	0.299	0.270	0.029	0.902	0.89	5	5.50	7.40	8.40	10.20	1.47	1.97	2.24	2.72
B3	0.135	0.132	0.003	0.977	0.94	5	5.50	7.40	8.40	10.20	0.70	0.94	1.06	1.29
B4	0.093	0.077	0.016	0.825	0.84	5	5.50	7.40	8.40	10.20	0.43	0.58	0.66	0.80
Culvert C1	0.225	0.102	0.123	0.454	0.62	5	5.50	7.40	8.40	10.20	0.77	1.04	1.18	1.43
Roof	0.077	0.077	0.000	1.000	0.95	5	5.50	7.40	8.40	10.20	0.40	0.54	0.62	0.75

Notes:

C = 0.6 x (Impervious Area / Total Area) + 0.35

Intensity values based on Time of Concentration = 5 minutes.

KEY NOTES:

(1) PROPOSED OUTFALL.

SCALE: 1" = 60'

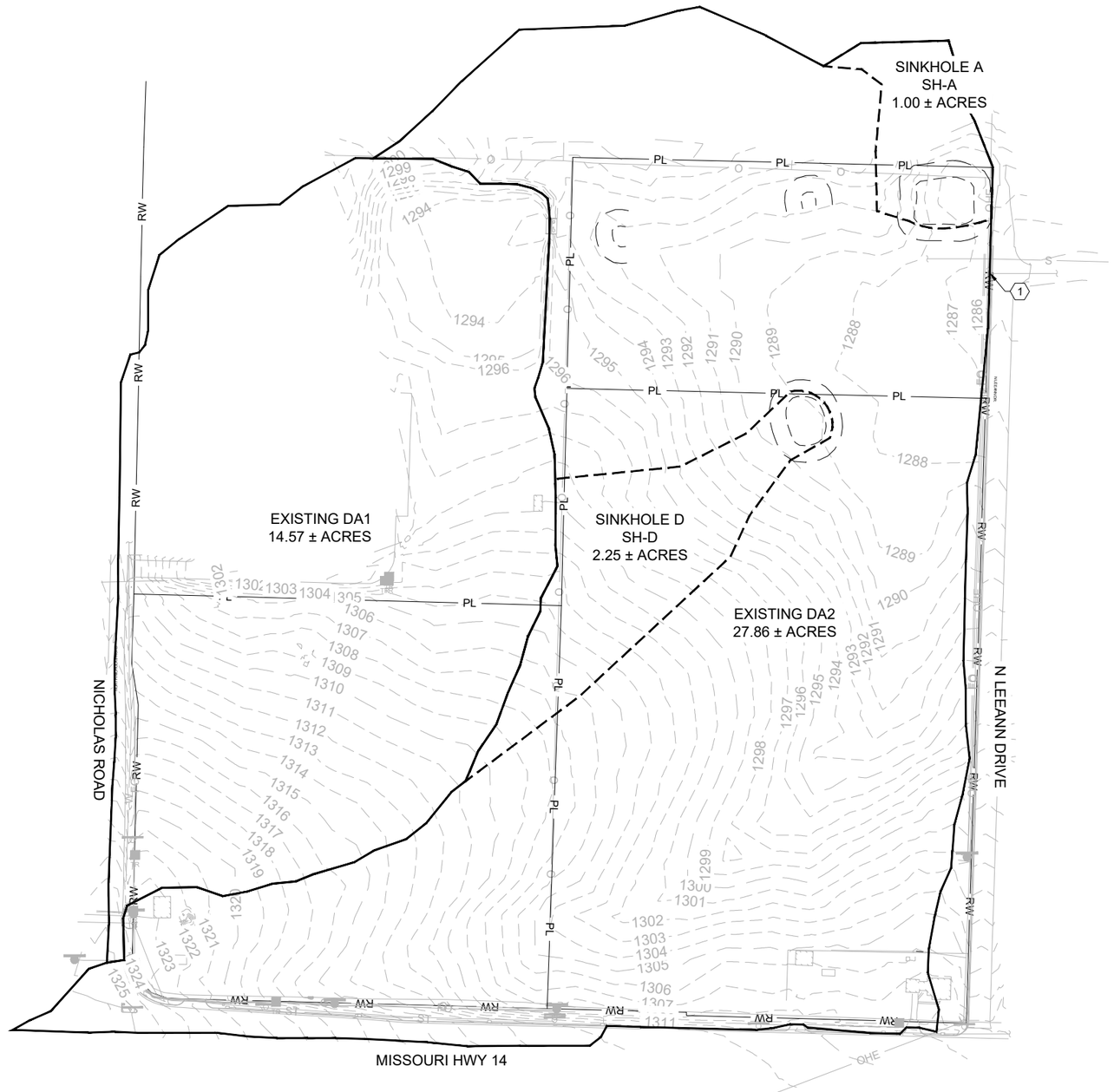
N

EXHIBIT 2: COLLECTION SYSTEM MAP

XTREME EXTERIORS DEVELOPMENT
NIXA, MO

JOB NUMBER: CE-00-393
ISSUED DATE: 10/25/2024

TOTH & ASSOCIATES
1550 E. Republic Rd, Suite A, Springfield MO. 65804
Toth & Associates, Inc.
Missouri State Certificate of Authority #2004004242



KEY NOTES:

(1) EXISTING OUTFALL.

SCALE: 1" = 200'

N

EXHIBIT 3: PRE-DRAINAGE AREA MAP

XTREME EXTERIORS DEVELOPMENT
NIXA, MO

JOB NUMBER: CE-00-393
ISSUED DATE: 11/22/2024

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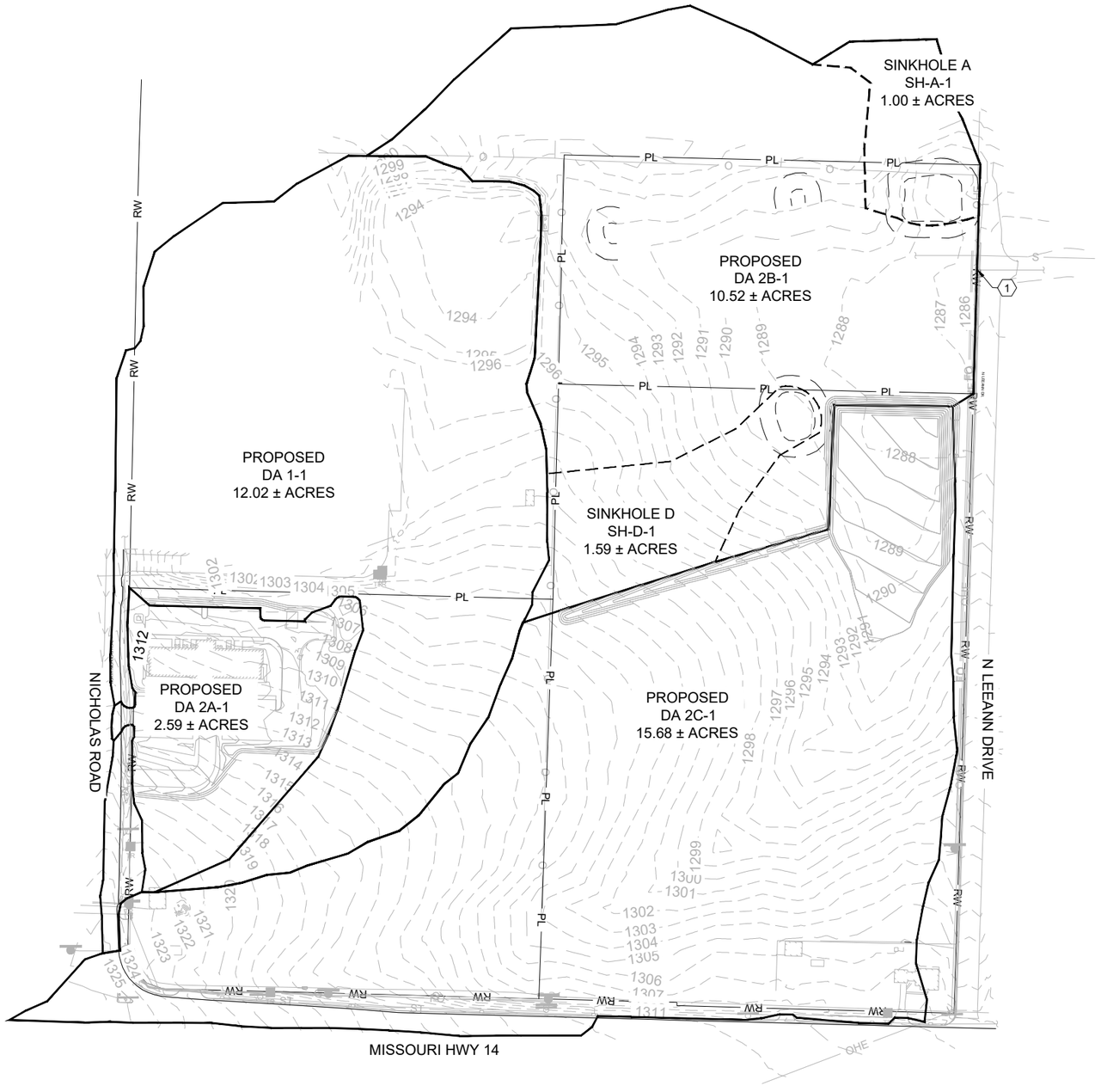

KEY NOTES:

(1) PROPOSED OUTFALL.

SCALE: 1" = 200'

N

EXHIBIT 4: POST-DRAINAGE AREA MAP

XTREME EXTERIORS DEVELOPMENT
NIXA, MO

JOB NUMBER: CE-00-393
ISSUED DATE: 11/22/2024

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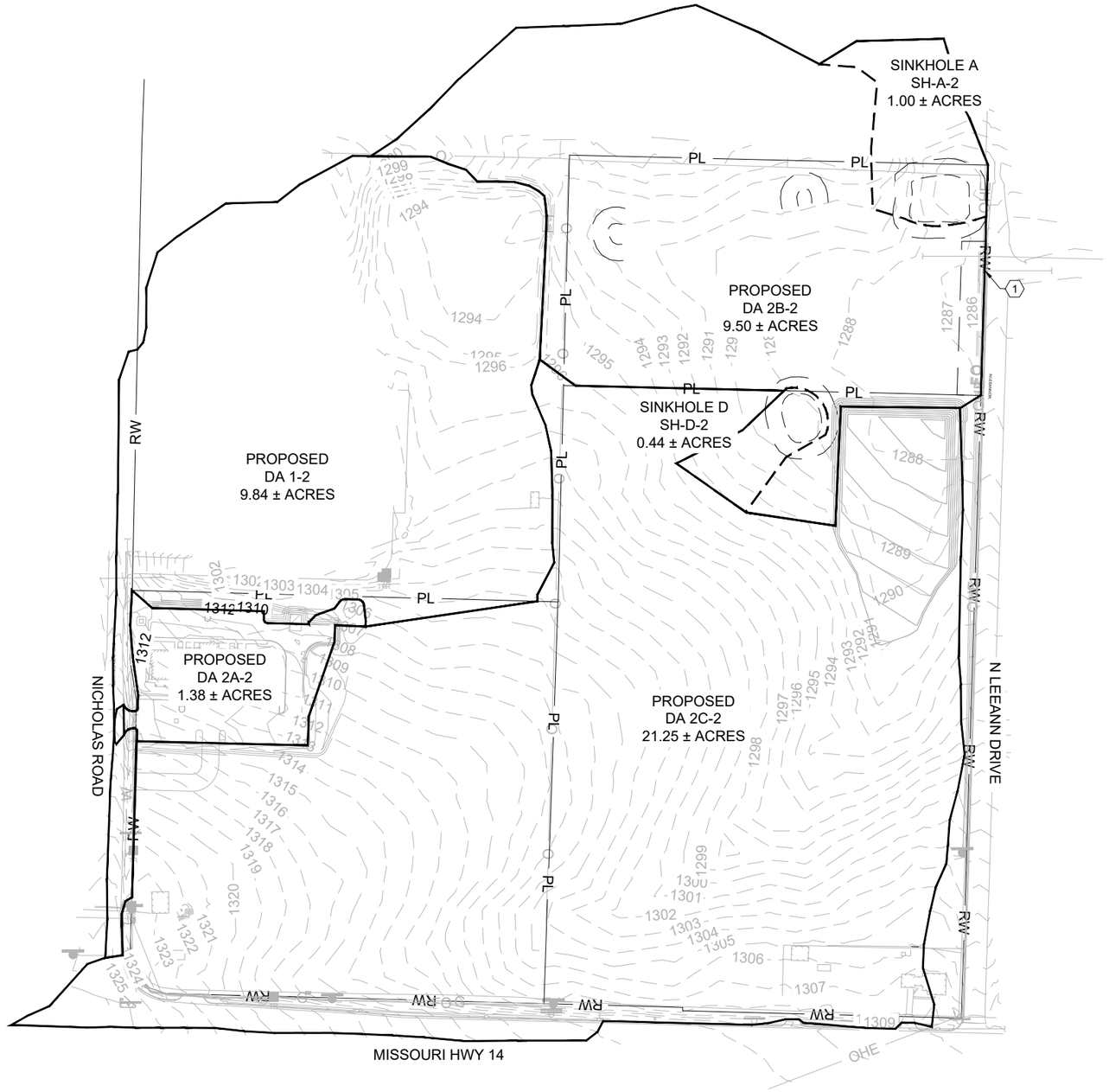


KEY NOTES:

〈1〉 PROPOSED OUTFALL.

SCALE: 1" = 200'

N

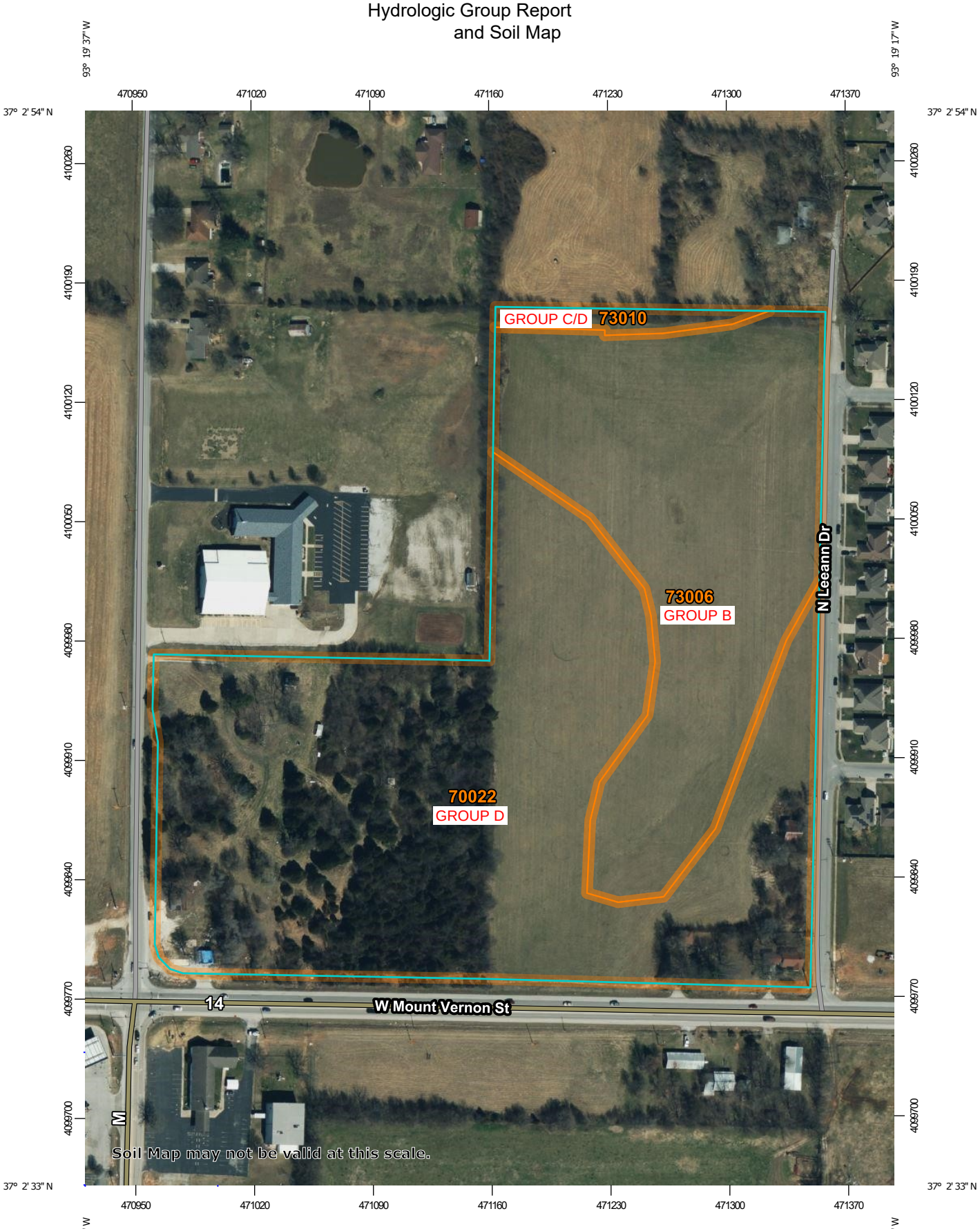
EXHIBIT 5: FULL POST-DRAINAGE AREA MAP

XTREME EXTERIORS DEVELOPMENT
NIXA, MO

JOB NUMBER: CE-00-393
ISSUED DATE: 11/22/2024

TOTH & ASSOCIATES
1550 E. Republic Rd, Suite A, Springfield MO. 65804
Toth & Associates, Inc.
Missouri State Certificate of Authority #2004004242

Hydrologic Group Report and Soil Map



Map Scale: 1:3,070 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 45 90 180 270

Feet: 0 100 200 400 600

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 15N 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: Christian County, Missouri
Survey Area Data: Version 31, Aug 22, 2023

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

Date(s) aerial images were photographed: Mar 5, 2020—Mar 6, 2020

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
70022	Tonti silt loam, 3 to 8 percent slopes	17.9	63.9%
73006	Peridge silt loam, 2 to 5 percent slopes	9.7	34.5%
73010	Wilderness gravelly silt loam, 3 to 8 percent slopes	0.5	1.6%
Totals for Area of Interest		**28.0**	**100.0%**

Map Unit Descriptions

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

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

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or

landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

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

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

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

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

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

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

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

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

Christian County, Missouri

70022—Tonti silt loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2qpbr
Elevation: 600 to 1,500 feet
Mean annual precipitation: 39 to 49 inches
Mean annual air temperature: 54 to 59 degrees F
Frost-free period: 172 to 232 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

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

Description of Tonti

Setting

Landform: Ridges
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Crest
Down-slope shape: Concave
Across-slope shape: Convex
Parent material: Loess over pedisediment over residuum weathered from limestone

Typical profile

Ap - 0 to 8 inches: silt loam
Bt1 - 8 to 20 inches: gravelly silty clay loam
2Btx - 20 to 34 inches: very gravelly silt loam
3Bt2 - 34 to 79 inches: very gravelly clay

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: 13 to 25 inches to fragipan
Drainage class: Moderately well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: About 12 to 24 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 3.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: D
Ecological site: F116BY001MO - Fragipan Upland Woodland
Other vegetative classification: Trees/Timber (Woody Vegetation)
Hydric soil rating: No

Minor Components

Plato

Percent of map unit: 5 percent
Landform: Interfluves
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Crest
Down-slope shape: Convex
Across-slope shape: Convex
Ecological site: F116AY066MO - Fragipan Upland Flatwoods
Other vegetative classification: Trees/Timber (Woody Vegetation)
Hydric soil rating: No

Hogcreek

Percent of map unit: 5 percent
Landform: Ridges
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Crest
Down-slope shape: Convex
Across-slope shape: Convex
Ecological site: F116AY004MO - Fragipan Upland Woodland
Other vegetative classification: Trees/Timber (Woody Vegetation)
Hydric soil rating: No

Bado

Percent of map unit: 3 percent
Landform: Depressions
Landform position (three-dimensional): Interfluve
Down-slope shape: Concave
Across-slope shape: Concave
Ecological site: F116AY066MO - Fragipan Upland Flatwoods
Other vegetative classification: Trees/Timber (Woody Vegetation)
Hydric soil rating: Yes

Lowassie

Percent of map unit: 2 percent
Landform: Sinkholes
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave
Ecological site: R116AY029MO - Ponded Sinkhole Wetland
Other vegetative classification: Trees/Timber (Woody Vegetation)
Hydric soil rating: Yes

73006—Peridge silt loam, 2 to 5 percent slopes

Map Unit Setting

National map unit symbol: 2qpf5
Elevation: 800 to 1,500 feet

Mean annual precipitation: 39 to 49 inches
Mean annual air temperature: 54 to 59 degrees F
Frost-free period: 172 to 232 days
Farmland classification: All areas are prime farmland

Map Unit Composition

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

Description of Peridge

Setting

Landform: Interfluves
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Slope alluvium over residuum weathered from limestone

Typical profile

Ap - 0 to 8 inches: silt loam
Bt - 8 to 19 inches: silt loam
2Bt - 19 to 79 inches: silty clay loam

Properties and qualities

Slope: 2 to 5 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: High (about 11.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: B
Ecological site: F116BY013MO - Loamy Footslope Woodland
Other vegetative classification: Trees/Timber (Woody Vegetation)
Hydric soil rating: No

Minor Components

Needleye

Percent of map unit: 5 percent
Landform: Interfluves
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Crest
Down-slope shape: Linear
Across-slope shape: Concave
Ecological site: F116AY066MO - Fragipan Upland Flatwoods
Other vegetative classification: Trees/Timber (Woody Vegetation)

Hydric soil rating: No

Goss

Percent of map unit: 5 percent
Landform: Ridges
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Crest
Down-slope shape: Convex
Across-slope shape: Convex
Ecological site: F116BY003MO - Chert Upland Woodland
Other vegetative classification: Trees/Timber (Woody Vegetation)
Hydric soil rating: No

73010—Wilderness gravelly silt loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2vxwj
Elevation: 900 to 1,200 feet
Mean annual precipitation: 39 to 49 inches
Mean annual air temperature: 54 to 59 degrees F
Frost-free period: 172 to 232 days
Farmland classification: Not prime farmland

Map Unit Composition

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

Description of Wilderness

Setting

Landform: Ridges
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Crest
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Slope alluvium over pedisediment over residuum weathered from dolomite

Typical profile

A - 0 to 6 inches: gravelly silt loam
E - 6 to 11 inches: gravelly silt loam
Bt1 - 11 to 25 inches: extremely gravelly silt loam
2Btx - 25 to 32 inches: very gravelly silt loam
3Bt2 - 32 to 79 inches: gravelly clay

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: 15 to 29 inches to fragipan
Drainage class: Moderately well drained
Runoff class: Very high

Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 12 to 24 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 3.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: C/D
Ecological site: F116AY012MO - Low-Base Chert Upland Woodland
Other vegetative classification: Trees/Timber (Woody Vegetation)
Hydric soil rating: No

Minor Components

Viraton

Percent of map unit: 3 percent
Landform: Ridges
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Crest
Down-slope shape: Convex
Across-slope shape: Convex
Ecological site: F116AY004MO - Fragipan Upland Woodland
Other vegetative classification: Trees/Timber (Woody Vegetation)
Hydric soil rating: No

Lowassie

Percent of map unit: 2 percent
Landform: Sinkholes
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave
Ecological site: R116AY029MO - Ponded Sinkhole Wetland
Other vegetative classification: Trees/Timber (Woody Vegetation)
Hydric soil rating: Yes

APPENDIX A

COLLECTION & CONVEYANCE SYSTEM DESIGN CALCULATIONS

Xtreme Exteriors - 25-Year SSA Report

Autodesk® Storm and Sanitary Analysis 2016 - Version 13.5.302 (Build 0)

****
Project Description
****
File Name ..... XtremeExteriors_V2.SPF

****
Analysis Options
****
Flow Units ..... cfs
Subbasin Hydrograph Method. Rational
Time of Concentration..... User-Defined
Return Period..... 25 years
Link Routing Method ..... Hydrodynamic
Storage Node Exfiltration.. None
Starting Date NOV-17-2020 00:00:00
Ending Date NOV-17-2020 01:00:00
Report Time Step 00:00:10

****
Element Count
****
Number of subbasins 9
Number of nodes 11
Number of links 11

****
Subbasin Summary
****

Subbasin ID	Total Area acres
A1	1.43
A2	0.18
A3	0.16
A4	0.10
B1	0.10
B2	0.30
B3	0.14
B4	0.09
Roof	0.08

****
Node Summary
****

Node ID	Element Type	Invert Elevation ft	Maximum Elev. ft	Ponded Area ft²	External Inflow
DownspoutPipe	JUNCTION	1307.00	1311.00	0.00	Yes
FES	JUNCTION	1299.54	1305.54	100.00	
Chnl	OUTFALL	1290.99	1293.99	0.00	

****
Inlet Summary
****

Inlet ID	Inlet Manufacturer	Manufacturer Part Number	Inlet Location	Number of Inlets	Catchbasin Invert Elevation ft	Inlet Rim Elevation ft	Ponded Area ft²	Initial Water Elevation ft	Grate Clogging Factor %
AI-A1	FHWA HEC-22 GENERIC	N/A	On Sag	1	1301.83	1305.33	250.00	1301.83	50.00
AI-A4	FHWA HEC-22 GENERIC	N/A	On Sag	1	1308.22	1310.72	250.00		

1308.22	50.00								
AI-B1		FHWA HEC-22 GENERIC	N/A	On Sag	1	1306.33	1309.34	250.00	
1306.33	50.00								
AI-B2		FHWA HEC-22 GENERIC	N/A	On Grade	1	1307.99	1311.26	-	
1307.99	6.00								
AI-B3		FHWA HEC-22 GENERIC	N/A	On Sag	1	1310.38	1313.13	250.00	
1310.38	50.00								
AI-B4		FHWA HEC-22 GENERIC	N/A	On Sag	1	1311.00	1313.00	250.00	
1311.00	50.00								
CI-A2		FHWA HEC-22 GENERIC	N/A	On Sag	1	1304.67	1310.49	250.00	
1304.67	50.00								
CI-A3		FHWA HEC-22 GENERIC	N/A	On Sag	1	1306.53	1311.30	250.00	
1306.53	50.00								

****
Roadway and Gutter Summary
****

Inlet ID	Roadway Longitudinal Slope ft/ft	Roadway Cross Slope ft/ft	Roadway Manning's Roughness	Gutter Cross Slope ft/ft	Gutter Width ft	Gutter Depression in
AI-A1	-	0.0200	0.0160	0.0620	2.00	2.00
AI-A4	-	0.0200	0.0160	0.0620	2.00	2.00
AI-B1	-	0.0200	0.0160	0.0620	2.00	2.00
AI-B2	0.0100	0.0200	0.0160	0.0620	2.00	2.00
AI-B3	-	0.0200	0.0160	0.0620	2.00	2.00
AI-B4	-	0.0200	0.0160	0.0620	2.00	2.00
CI-A2	-	0.0200	0.0160	0.0620	2.00	2.00
CI-A3	-	0.0200	0.0160	0.0620	2.00	2.00

****
Link Summary
****

Link ID	From Node	To Node	Element Type	Length ft	Slope %	Manning's Roughness
A1-A2	CI-A2	AI-A1	CONDUIT	131.8	2.0029	0.0120
A1-B1	AI-B1	AI-A1	CONDUIT	113.6	3.5221	0.0120
A2-A3	CI-A3	CI-A2	CONDUIT	83.0	2.0000	0.0120
A3-A4	AI-A4	CI-A3	CONDUIT	90.3	1.3184	0.0120
B1-B2	AI-B2	DownspoutPipe	CONDUIT	40.1	2.4658	0.0120
B2-B1Bypass	AI-B2	AI-B1	CHANNEL	80.0	2.4000	0.0320
B2-B3	AI-B3	AI-B2	CONDUIT	175.3	1.2494	0.0120
B3-B4	AI-B4	AI-B3	CONDUIT	41.6	1.0086	0.0120
DownspouttoB1	DownspoutPipe	AI-B1	CONDUIT	32.8	2.0439	0.0120
FES-A1	AI-A1	FES	CONDUIT	334.6	0.6843	0.0120
Outfall-FES	FES	Chnl	CHANNEL	424.1	2.0159	0.0320

****
Cross Section Summary
****

Link ID	Shape	Depth/ Diameter ft	Width ft	No. of Barrels	Cross Sectional Area ft²	Full Flow Hydraulic Radius ft	Design Flow Capacity cfs
A1-A2	CIRCULAR	1.00	1.00	1	0.79	0.25	5.46
A1-B1	CIRCULAR	1.25	1.25	1	1.23	0.31	13.13
A2-A3	CIRCULAR	1.00	1.00	1	0.79	0.25	5.46
A3-A4	CIRCULAR	1.00	1.00	1	0.79	0.25	4.43
B1-B2	CIRCULAR	1.25	1.25	1	1.23	0.31	10.99
B2-B1Bypass	IRREGULAR	1.50	1.50	1	1.13	0.22	2.96
B2-B3	CIRCULAR	1.00	1.00	1	0.79	0.25	4.31
B3-B4	CIRCULAR	0.83	0.83	1	0.55	0.21	2.38
DownspouttoB1	CIRCULAR	1.25	1.25	1	1.23	0.31	10.00
FES-A1	CIRCULAR	2.00	2.00	1	3.14	0.50	20.27
Outfall-FES	TRAPEZOIDAL	3.00	21.00	1	36.00	1.64	329.87

****
Transect Summary
****

Transect XS-01
Area:

0.0004	0.0016	0.0036	0.0064	0.0100
0.0144	0.0196	0.0256	0.0324	0.0400
0.0484	0.0576	0.0676	0.0784	0.0900
0.1024	0.1156	0.1296	0.1444	0.1600
0.1764	0.1936	0.2116	0.2304	0.2500
0.2704	0.2916	0.3136	0.3364	0.3600
0.3844	0.4096	0.4356	0.4624	0.4900
0.5184	0.5476	0.5776	0.6084	0.6400
0.6724	0.7056	0.7396	0.7744	0.8100
0.8464	0.8836	0.9216	0.9604	1.0000

Hrad:

0.0200	0.0400	0.0600	0.0800	0.1000
0.1200	0.1400	0.1600	0.1800	0.2000
0.2200	0.2400	0.2600	0.2800	0.3000
0.3200	0.3400	0.3600	0.3800	0.4000
0.4200	0.4400	0.4600	0.4800	0.5000
0.5200	0.5400	0.5600	0.5800	0.6000
0.6200	0.6400	0.6600	0.6800	0.7000
0.7200	0.7400	0.7600	0.7800	0.8000
0.8200	0.8400	0.8600	0.8800	0.9000
0.9200	0.9400	0.9600	0.9800	1.0000

Width:

0.0200	0.0400	0.0600	0.0800	0.1000
0.1200	0.1400	0.1600	0.1800	0.2000
0.2200	0.2400	0.2600	0.2800	0.3000
0.3200	0.3400	0.3600	0.3800	0.4000
0.4200	0.4400	0.4600	0.4800	0.5000
0.5200	0.5400	0.5600	0.5800	0.6000
0.6200	0.6400	0.6600	0.6800	0.7000
0.7200	0.7400	0.7600	0.7800	0.8000
0.8200	0.8400	0.8600	0.8800	0.9000
0.9200	0.9400	0.9600	0.9800	1.0000

Runoff Quantity Continuity	Volume acre-ft	Depth inches
Total Precipitation	0.150	0.700
Continuity Error (%)	0.393	

Flow Routing Continuity	Volume acre-ft	Volume Mgallons
External Inflow	0.051	0.017
External Outflow	0.139	0.045
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.006	0.002
Continuity Error (%)	-0.011	

Runoff Coefficient Computations Report

Subbasin A1

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
-	1.43	-	0.44
Composite Area & Weighted Runoff Coeff.	1.43		0.44

Subbasin A2

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
-	0.18	-	0.90
Composite Area & Weighted Runoff Coeff.	0.18		0.90

Subbasin A3

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.

-	0.16	-	0.93
Composite Area & Weighted Runoff Coeff.	0.16		0.93

Subbasin A4

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
-	0.10	-	0.37
Composite Area & Weighted Runoff Coeff.	0.10		0.37

Subbasin B1

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
-	0.10	-	0.55
Composite Area & Weighted Runoff Coeff.	0.10		0.55

Subbasin B2

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
-	0.30	-	0.89
Composite Area & Weighted Runoff Coeff.	0.30		0.89

Subbasin B3

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
-	0.14	-	0.94
Composite Area & Weighted Runoff Coeff.	0.14		0.94

Subbasin B4

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
-	0.09	-	0.84
Composite Area & Weighted Runoff Coeff.	0.09		0.84

Subbasin Roof

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
-	0.08	-	0.95
Composite Area & Weighted Runoff Coeff.	0.08		0.95

****
Subbasin Runoff Summary
****

Subbasin ID	Accumulated Precip in	Rainfall Intensity in/hr	Total Runoff in	Peak Runoff cfs	Weighted Runoff Coeff	Time of Concentration days	Time of Concentration hh:mm:ss
A1	0.70	8.40	0.31	5.30	0.440	0	00:05:00
A2	0.70	8.40	0.63	1.34	0.900	0	00:05:00
A3	0.70	8.40	0.65	1.27	0.930	0	00:05:00
A4	0.70	8.40	0.26	0.31	0.370	0	00:05:00
B1	0.70	8.40	0.38	0.47	0.550	0	00:05:00
B2	0.70	8.40	0.62	2.24	0.890	0	00:05:00
B3	0.70	8.40	0.66	1.07	0.940	0	00:05:00
B4	0.70	8.40	0.59	0.66	0.840	0	00:05:00
Roof	0.70	8.40	0.66	0.61	0.950	0	00:05:00

****

Node Depth Summary
****

Node ID	Average Depth Attained ft	Maximum Depth Attained ft	Maximum HGL Attained ft	Time of Max Occurrence days	Time of Max Occurrence hh:mm	Total Flooded Volume acre-in	Total Flooded Time minutes	Retention Time hh:mm:ss
DownspoutPipe	0.30	0.74	1307.74	0	00:05	0	0	0:00:00
FES	0.18	0.61	1300.15	0	00:07	0	0	0:00:00
Chnl	0.18	0.60	1291.59	0	00:07	0	0	0:00:00

****
Node Flow Summary
****

Node ID	Element Type	Maximum Lateral Inflow cfs	Peak Inflow cfs	Time of Peak Inflow Occurrence days	Time of Peak Inflow Occurrence hh:mm	Maximum Flooding Overflow cfs	Time of Peak Flooding Occurrence days	Time of Peak Flooding Occurrence hh:mm
DownspoutPipe	JUNCTION	1.23	4.08	0	00:05	0.00		
FES	JUNCTION	0.00	11.63	0	00:06	0.00		
Chnl	OUTFALL	0.00	10.83	0	00:07	0.00		

****
Inlet Depth Summary
****

Inlet ID	Max Gutter Spread during Peak Flow ft	Max Gutter Water Elev during Peak Flow ft	Max Gutter Water Depth during Peak Flow ft	Time of Maximum Depth Occurrence days	Time of Maximum Depth Occurrence hh:mm
AI-A1	19.49	1305.83	0.50	0	00:05
AI-A4	2.43	1310.87	0.15	0	00:06
AI-B1	3.31	1309.51	0.17	0	00:05
AI-B2	9.03	1311.52	0.26	0	00:05
AI-B3	6.98	1313.37	0.24	0	00:06
AI-B4	3.00	1313.17	0.17	0	00:06
CI-A2	7.21	1310.88	0.39	0	00:06
CI-A3	6.97	1311.69	0.39	0	00:06

****
Inlet Flow Summary
****

Inlet ID	Peak Flow cfs	Peak Lateral Flow cfs	Peak Flow Intercepted by Inlet cfs	Peak Flow Bypassing Inlet cfs	Inlet Efficiency during Peak Flow %	Total Flooding acre-in	Total Time Flooded minutes
AI-A1	5.29	5.29	-	-	-	0.000	0
AI-A4	0.31	0.31	-	-	-	0.000	0
AI-B1	0.84	0.47	-	-	-	0.000	0
AI-B2	2.23	2.23	1.85	0.38	82.95	0.000	0
AI-B3	1.06	1.06	-	-	-	0.000	0
AI-B4	0.66	0.66	-	-	-	0.000	0
CI-A2	1.34	1.34	-	-	-	0.000	0
CI-A3	1.27	1.27	-	-	-	0.000	0

****
Outfall Loading Summary
****

Outfall Node ID	Flow Frequency (%)	Average Flow cfs	Peak Inflow cfs

Chnl	98.06	1.71	10.83
System	98.06	1.71	10.83

****
Link Flow Summary
****

Link ID	Element Type	Time of Peak Flow Occurrence days	hh:mm	Maximum Velocity Attained ft/sec	Length Factor	Peak Flow during Analysis cfs	Design Flow Capacity cfs	Ratio of Maximum /Design Flow	Ratio of Maximum Flow Depth	Total Time Surcharged minutes	Reported Condition
A1-A2	CONDUIT	0	00:06	3.85	1.00	2.36	5.46	0.43	0.73	0	Calculated
A1-B1	CONDUIT	0	00:05	8.14	1.00	4.52	13.13	0.34	0.52	0	Calculated
A2-A3	CONDUIT	0	00:06	5.33	1.00	1.26	5.46	0.23	0.34	0	Calculated
A3-A4	CONDUIT	0	00:06	2.94	1.00	0.24	4.43	0.05	0.16	0	Calculated
B1-B2	CONDUIT	0	00:05	4.59	1.00	2.88	10.99	0.26	0.51	0	Calculated
B2-B1Bypass	CHANNEL	0	00:06	3.39	1.00	0.51	2.96	0.17	0.38	0	Calculated
B2-B3	CONDUIT	0	00:06	4.68	1.00	1.33	4.31	0.31	0.39	0	Calculated
B3-B4	CONDUIT	0	00:06	3.23	1.00	0.51	2.38	0.22	0.33	0	Calculated
DownspouttoB1	CONDUIT	0	00:05	6.55	1.00	4.07	10.00	0.41	0.51	0	Calculated
FES-A1	CONDUIT	0	00:06	8.17	1.00	11.63	20.27	0.57	0.46	0	Calculated
Outfall-FES	CHANNEL	0	00:07	3.71	1.00	10.83	329.87	0.03	0.20	0	Calculated

****
Highest Flow Instability Indexes
****
All links are stable.

Analysis began on: Fri Nov 22 07:43:39 2024
Analysis ended on: Fri Nov 22 07:43:39 2024
Total elapsed time: < 1 sec

Xtreme Exteriors - 100-Year SSA Report

Autodesk® Storm and Sanitary Analysis 2016 - Version 13.5.302 (Build 0)

****
Project Description
****
File Name ..... XtremeExteriors_V2.SPF

****
Analysis Options
****
Flow Units ..... cfs
Subbasin Hydrograph Method. Rational
Time of Concentration..... User-Defined
Return Period..... 100 years
Link Routing Method ..... Hydrodynamic
Storage Node Exfiltration.. None
Starting Date NOV-17-2020 00:00:00
Ending Date NOV-17-2020 01:00:00
Report Time Step 00:00:10

****
Element Count
****
Number of subbasins 9
Number of nodes 11
Number of links 11

****
Subbasin Summary
****

Subbasin ID	Total Area acres
A1	1.43
A2	0.18
A3	0.16
A4	0.10
B1	0.10
B2	0.30
B3	0.14
B4	0.09
Roof	0.08

****
Node Summary
****

Node ID	Element Type	Invert Elevation ft	Maximum Elev. ft	Ponded Area ft²	External Inflow
DownspoutPipe	JUNCTION	1307.00	1311.00	0.00	Yes
FES	JUNCTION	1299.54	1305.54	100.00	
Chnl	OUTFALL	1290.99	1293.99	0.00	

****
Inlet Summary
****

Inlet ID	Inlet Manufacturer	Manufacturer Part Number	Inlet Location	Number of Inlets	Catchbasin Invert Elevation ft	Inlet Rim Elevation ft	Ponded Area ft²	Initial Water Elevation ft	Grate Clogging Factor %
AI-A1	FHWA HEC-22 GENERIC	N/A	On Sag	1	1301.83	1305.33	250.00	1301.83	50.00
AI-A4	FHWA HEC-22 GENERIC	N/A	On Sag	1	1308.22	1310.72	250.00		

1308.22	50.00								
AI-B1		FHWA HEC-22 GENERIC	N/A	On Sag	1	1306.33	1309.34	250.00	
1306.33	50.00								
AI-B2		FHWA HEC-22 GENERIC	N/A	On Grade	1	1307.99	1311.26	-	
1307.99	6.00								
AI-B3		FHWA HEC-22 GENERIC	N/A	On Sag	1	1310.38	1313.13	250.00	
1310.38	50.00								
AI-B4		FHWA HEC-22 GENERIC	N/A	On Sag	1	1311.00	1313.00	250.00	
1311.00	50.00								
CI-A2		FHWA HEC-22 GENERIC	N/A	On Sag	1	1304.67	1310.49	250.00	
1304.67	50.00								
CI-A3		FHWA HEC-22 GENERIC	N/A	On Sag	1	1306.53	1311.30	250.00	
1306.53	50.00								

****
Roadway and Gutter Summary
****

Inlet ID	Roadway Longitudinal Slope ft/ft	Roadway Cross Slope ft/ft	Roadway Manning's Roughness	Gutter Cross Slope ft/ft	Gutter Width ft	Gutter Depression in
AI-A1	-	0.0200	0.0160	0.0620	2.00	2.00
AI-A4	-	0.0200	0.0160	0.0620	2.00	2.00
AI-B1	-	0.0200	0.0160	0.0620	2.00	2.00
AI-B2	0.0100	0.0200	0.0160	0.0620	2.00	2.00
AI-B3	-	0.0200	0.0160	0.0620	2.00	2.00
AI-B4	-	0.0200	0.0160	0.0620	2.00	2.00
CI-A2	-	0.0200	0.0160	0.0620	2.00	2.00
CI-A3	-	0.0200	0.0160	0.0620	2.00	2.00

****
Link Summary
****

Link ID	From Node	To Node	Element Type	Length ft	Slope %	Manning's Roughness
A1-A2	CI-A2	AI-A1	CONDUIT	131.8	2.0029	0.0120
A1-B1	AI-B1	AI-A1	CONDUIT	113.6	3.5221	0.0120
A2-A3	CI-A3	CI-A2	CONDUIT	83.0	2.0000	0.0120
A3-A4	AI-A4	CI-A3	CONDUIT	90.3	1.3184	0.0120
B1-B2	AI-B2	DownspoutPipe	CONDUIT	40.1	2.4658	0.0120
B2-B1Bypass	AI-B2	AI-B1	CHANNEL	80.0	2.4000	0.0320
B2-B3	AI-B3	AI-B2	CONDUIT	175.3	1.2494	0.0120
B3-B4	AI-B4	AI-B3	CONDUIT	41.6	1.0086	0.0120
DownspouttoB1	DownspoutPipe	AI-B1	CONDUIT	32.8	2.0439	0.0120
FES-A1	AI-A1	FES	CONDUIT	334.6	0.6843	0.0120
Outfall-FES	FES	Chnl	CHANNEL	424.1	2.0159	0.0320

****
Cross Section Summary
****

Link ID	Shape	Depth/ Diameter ft	Width ft	No. of Barrels	Cross Sectional Area ft²	Full Flow Hydraulic Radius ft	Design Flow Capacity cfs
A1-A2	CIRCULAR	1.00	1.00	1	0.79	0.25	5.46
A1-B1	CIRCULAR	1.25	1.25	1	1.23	0.31	13.13
A2-A3	CIRCULAR	1.00	1.00	1	0.79	0.25	5.46
A3-A4	CIRCULAR	1.00	1.00	1	0.79	0.25	4.43
B1-B2	CIRCULAR	1.25	1.25	1	1.23	0.31	10.99
B2-B1Bypass	IRREGULAR	1.50	1.50	1	1.13	0.22	2.96
B2-B3	CIRCULAR	1.00	1.00	1	0.79	0.25	4.31
B3-B4	CIRCULAR	0.83	0.83	1	0.55	0.21	2.38
DownspouttoB1	CIRCULAR	1.25	1.25	1	1.23	0.31	10.00
FES-A1	CIRCULAR	2.00	2.00	1	3.14	0.50	20.27
Outfall-FES	TRAPEZOIDAL	3.00	21.00	1	36.00	1.64	329.87

****
Transect Summary
****

Transect XS-01
Area:

```
            0.0004     0.0016     0.0036     0.0064     0.0100
            0.0144     0.0196     0.0256     0.0324     0.0400
            0.0484     0.0576     0.0676     0.0784     0.0900
            0.1024     0.1156     0.1296     0.1444     0.1600
            0.1764     0.1936     0.2116     0.2304     0.2500
            0.2704     0.2916     0.3136     0.3364     0.3600
            0.3844     0.4096     0.4356     0.4624     0.4900
            0.5184     0.5476     0.5776     0.6084     0.6400
            0.6724     0.7056     0.7396     0.7744     0.8100
            0.8464     0.8836     0.9216     0.9604     1.0000
Hrad:
            0.0200     0.0400     0.0600     0.0800     0.1000
            0.1200     0.1400     0.1600     0.1800     0.2000
            0.2200     0.2400     0.2600     0.2800     0.3000
            0.3200     0.3400     0.3600     0.3800     0.4000
            0.4200     0.4400     0.4600     0.4800     0.5000
            0.5200     0.5400     0.5600     0.5800     0.6000
            0.6200     0.6400     0.6600     0.6800     0.7000
            0.7200     0.7400     0.7600     0.7800     0.8000
            0.8200     0.8400     0.8600     0.8800     0.9000
            0.9200     0.9400     0.9600     0.9800     1.0000
Width:
            0.0200     0.0400     0.0600     0.0800     0.1000
            0.1200     0.1400     0.1600     0.1800     0.2000
            0.2200     0.2400     0.2600     0.2800     0.3000
            0.3200     0.3400     0.3600     0.3800     0.4000
            0.4200     0.4400     0.4600     0.4800     0.5000
            0.5200     0.5400     0.5600     0.5800     0.6000
            0.6200     0.6400     0.6600     0.6800     0.7000
            0.7200     0.7400     0.7600     0.7800     0.8000
            0.8200     0.8400     0.8600     0.8800     0.9000
            0.9200     0.9400     0.9600     0.9800     1.0000


*************************        Volume         Depth
Runoff Quantity Continuity       acre-ft        inches
*************************     ---------       -------
Total Precipitation ......         0.181         0.842
Continuity Error (%) .....         0.393


*************************        Volume        Volume
Flow Routing Continuity          acre-ft      Mgallons
*************************     ---------     ---------
External Inflow ..........         0.051         0.017
External Outflow .........         0.157         0.051
Initial Stored Volume ....         0.000         0.000
Final Stored Volume ......         0.006         0.002
Continuity Error (%) .....        -0.008


*************************************
Runoff Coefficient Computations Report
*************************************

--------------
Subbasin A1
--------------
                                                    Area          Soil       Runoff
Soil/Surface Description                          (acres)        Group       Coeff.
----------------------------------------------------------------------------------------
-                                                   1.43            -         0.44
Composite Area & Weighted Runoff Coeff.             1.43                      0.44

--------------
Subbasin A2
--------------
                                                    Area          Soil       Runoff
Soil/Surface Description                          (acres)        Group       Coeff.
----------------------------------------------------------------------------------------
-                                                   0.18            -         0.90
Composite Area & Weighted Runoff Coeff.             0.18                      0.90

--------------
Subbasin A3
--------------
                                                    Area          Soil       Runoff
Soil/Surface Description                          (acres)        Group       Coeff.
----------------------------------------------------------------------------------------
```

	Area (acres)	Soil Group	Runoff Coeff.
-	0.16	-	0.93
Composite Area & Weighted Runoff Coeff.	0.16		0.93

Subbasin A4

	Area (acres)	Soil Group	Runoff Coeff.
-	0.10	-	0.37
Composite Area & Weighted Runoff Coeff.	0.10		0.37

Subbasin B1

	Area (acres)	Soil Group	Runoff Coeff.
-	0.10	-	0.55
Composite Area & Weighted Runoff Coeff.	0.10		0.55

Subbasin B2

	Area (acres)	Soil Group	Runoff Coeff.
-	0.30	-	0.89
Composite Area & Weighted Runoff Coeff.	0.30		0.89

Subbasin B3

	Area (acres)	Soil Group	Runoff Coeff.
-	0.14	-	0.94
Composite Area & Weighted Runoff Coeff.	0.14		0.94

Subbasin B4

	Area (acres)	Soil Group	Runoff Coeff.
-	0.09	-	0.84
Composite Area & Weighted Runoff Coeff.	0.09		0.84

Subbasin Roof

	Area (acres)	Soil Group	Runoff Coeff.
-	0.08	-	0.95
Composite Area & Weighted Runoff Coeff.	0.08		0.95

****
Subbasin Runoff Summary
****

Subbasin ID	Accumulated Precip in	Rainfall Intensity in/hr	Total Runoff in	Peak Runoff cfs	Weighted Runoff Coeff	Time of Concentration days	Time of Concentration hh:mm:ss
A1	0.84	10.10	0.37	6.37	0.440	0	00:05:00
A2	0.84	10.10	0.76	1.61	0.900	0	00:05:00
A3	0.84	10.10	0.78	1.53	0.930	0	00:05:00
A4	0.84	10.10	0.31	0.37	0.370	0	00:05:00
B1	0.84	10.10	0.46	0.57	0.550	0	00:05:00
B2	0.84	10.10	0.75	2.69	0.890	0	00:05:00
B3	0.84	10.10	0.79	1.28	0.940	0	00:05:00
B4	0.84	10.10	0.71	0.79	0.840	0	00:05:00
Roof	0.84	10.10	0.80	0.74	0.950	0	00:05:00

****

Node Depth Summary
****

Node ID	Average Depth Attained ft	Maximum Depth Attained ft	Maximum HGL Attained ft	Time of Max Occurrence days	Time of Max Occurrence hh:mm	Total Flooded Volume acre-in	Total Flooded Time minutes	Retention Time hh:mm:ss
DownspoutPipe	0.31	0.82	1307.82	0	00:05	0	0	0:00:00
FES	0.19	0.67	1300.21	0	00:06	0	0	0:00:00
Chnl	0.19	0.67	1291.66	0	00:07	0	0	0:00:00

****
Node Flow Summary
****

Node ID	Element Type	Maximum Lateral Inflow cfs	Peak Inflow cfs	Time of Peak Inflow Occurrence days	Time of Peak Inflow Occurrence hh:mm	Maximum Flooding Overflow cfs	Time of Peak Flooding Occurrence days	Time of Peak Flooding Occurrence hh:mm
DownspoutPipe	JUNCTION	1.36	4.73	0	00:05	0.00		
FES	JUNCTION	0.00	14.13	0	00:06	0.00		
Chnl	OUTFALL	0.00	13.21	0	00:07	0.00		

****
Inlet Depth Summary
****

Inlet ID	Max Gutter Spread during Peak Flow ft	Max Gutter Water Elev during Peak Flow ft	Max Gutter Water Depth during Peak Flow ft	Time of Maximum Depth Occurrence days	Time of Maximum Depth Occurrence hh:mm
AI-A1	21.98	1305.87	0.54	0	00:05
AI-A4	2.55	1310.88	0.16	0	00:06
AI-B1	6.79	1309.58	0.24	0	00:05
AI-B2	9.76	1311.54	0.28	0	00:05
AI-B3	7.84	1313.39	0.26	0	00:06
AI-B4	5.90	1313.22	0.22	0	00:06
CI-A2	8.15	1310.90	0.41	0	00:05
CI-A3	7.88	1311.71	0.41	0	00:05

****
Inlet Flow Summary
****

Inlet ID	Peak Flow cfs	Peak Lateral Flow cfs	Peak Flow Intercepted by Inlet cfs	Peak Flow Bypassing Inlet cfs	Inlet Efficiency during Peak Flow %	Total Flooding acre-in	Total Time Flooded minutes
AI-A1	6.36	6.36	-	-	-	0.000	0
AI-A4	0.37	0.37	-	-	-	0.000	0
AI-B1	1.02	0.57	-	-	-	0.000	0
AI-B2	2.68	2.68	2.14	0.54	79.83	0.000	0
AI-B3	1.28	1.28	-	-	-	0.000	0
AI-B4	0.79	0.79	-	-	-	0.000	0
CI-A2	1.61	1.61	-	-	-	0.000	0
CI-A3	1.53	1.53	-	-	-	0.000	0

****
Outfall Loading Summary
****

Outfall Node ID	Flow Frequency (%)	Average Flow cfs	Peak Inflow cfs

Chnl	98.08	1.93	13.21
System	98.08	1.93	13.21

****
Link Flow Summary
****

Link ID	Element Type	Time of Peak Flow Occurrence days	Time of Peak Flow Occurrence hh:mm	Maximum Velocity Attained ft/sec	Length Factor	Peak Flow during Analysis cfs	Design Flow Capacity cfs	Ratio of Maximum /Design Flow	Ratio of Maximum Flow Depth	Total Time Surcharged minutes	Reported Condition
A1-A2	CONDUIT	0	00:06	4.72	1.00	3.11	5.46	0.57	0.78	0	Calculated
A1-B1	CONDUIT	0	00:05	8.20	1.00	5.27	13.13	0.40	0.61	0	Calculated
A2-A3	CONDUIT	0	00:05	5.70	1.00	1.67	5.46	0.31	0.40	0	Calculated
A3-A4	CONDUIT	0	00:06	3.09	1.00	0.29	4.43	0.07	0.18	0	Calculated
B1-B2	CONDUIT	0	00:05	4.75	1.00	3.44	10.99	0.31	0.57	0	Calculated
B2-B1Bypass	CHANNEL	0	00:06	3.44	1.00	0.59	2.96	0.20	0.40	0	Calculated
B2-B3	CONDUIT	0	00:06	4.91	1.00	1.61	4.31	0.37	0.44	0	Calculated
B3-B4	CONDUIT	0	00:06	3.38	1.00	0.62	2.38	0.26	0.37	0	Calculated
DownspouttoB1	CONDUIT	0	00:05	6.75	1.00	4.73	10.00	0.47	0.56	0	Calculated
FES-A1	CONDUIT	0	00:06	8.45	1.00	14.13	20.27	0.70	0.53	0	Calculated
Outfall-FES	CHANNEL	0	00:07	3.92	1.00	13.21	329.87	0.04	0.22	0	Calculated

****
Highest Flow Instability Indexes
****
All links are stable.

Analysis began on: Fri Nov 22 07:44:53 2024
Analysis ended on: Fri Nov 22 07:44:53 2024
Total elapsed time: < 1 sec

Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Thursday, Nov 21 2024

OPEN CHANNEL - POINT A

Trapezoidal

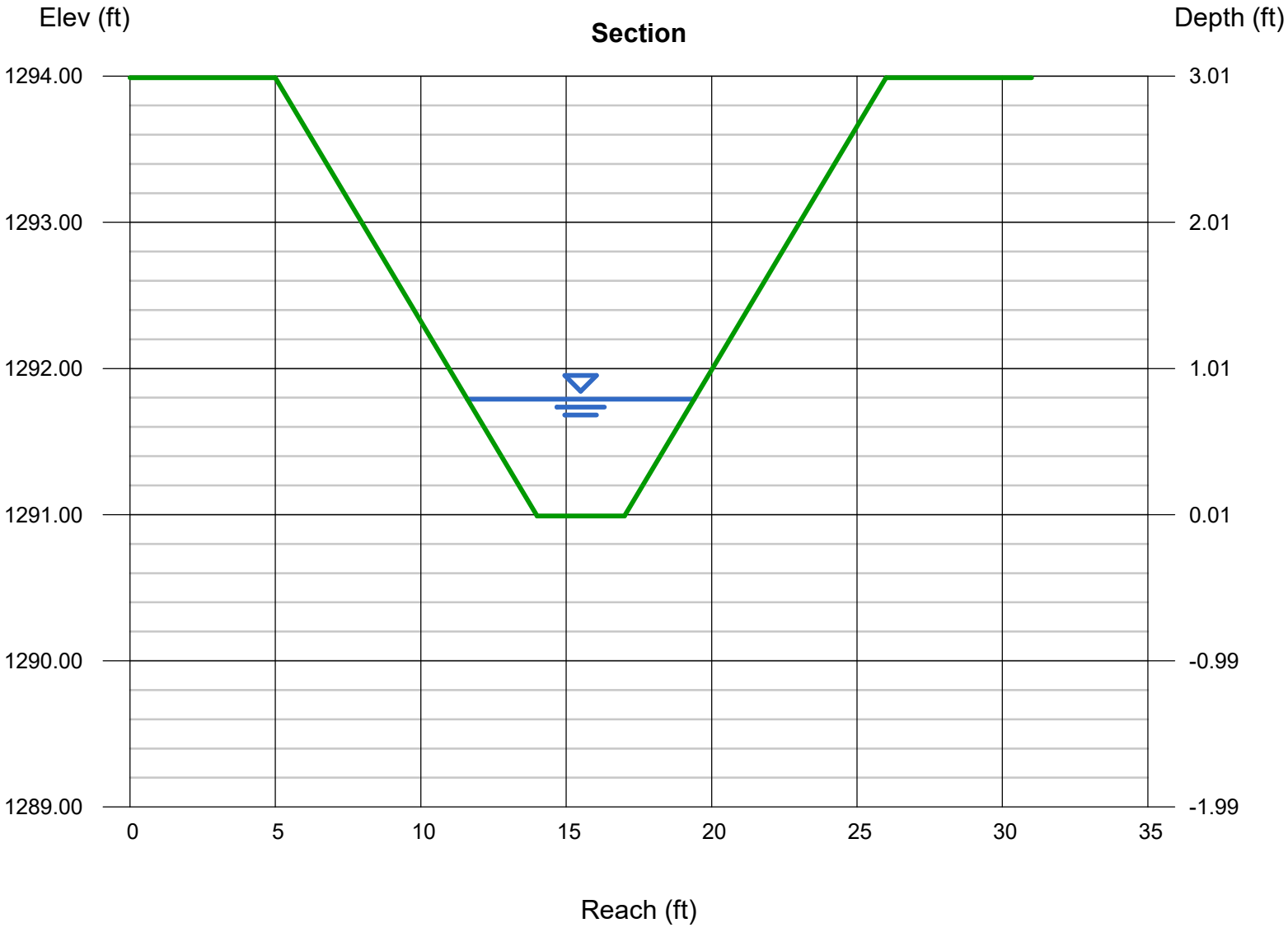
Bottom Width (ft)	= 3.00
Side Slopes (z:1)	= 3.00, 3.00
Total Depth (ft)	= 3.00
Invert Elev (ft)	= 1290.99
Slope (%)	= 2.02
N-Value	= 0.032

Calculations

Compute by:	Known Q
Known Q (cfs)	= 18.77

Highlighted

Depth (ft)	= 0.80
Q (cfs)	= 18.77
Area (sqft)	= 4.32
Velocity (ft/s)	= 4.34
Wetted Perim (ft)	= 8.06
Crit Depth, Yc (ft)	= 0.82
Top Width (ft)	= 7.80
EGL (ft)	= 1.09



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Thursday, Nov 21 2024

OPEN CHANNEL - POINT B

Trapezoidal

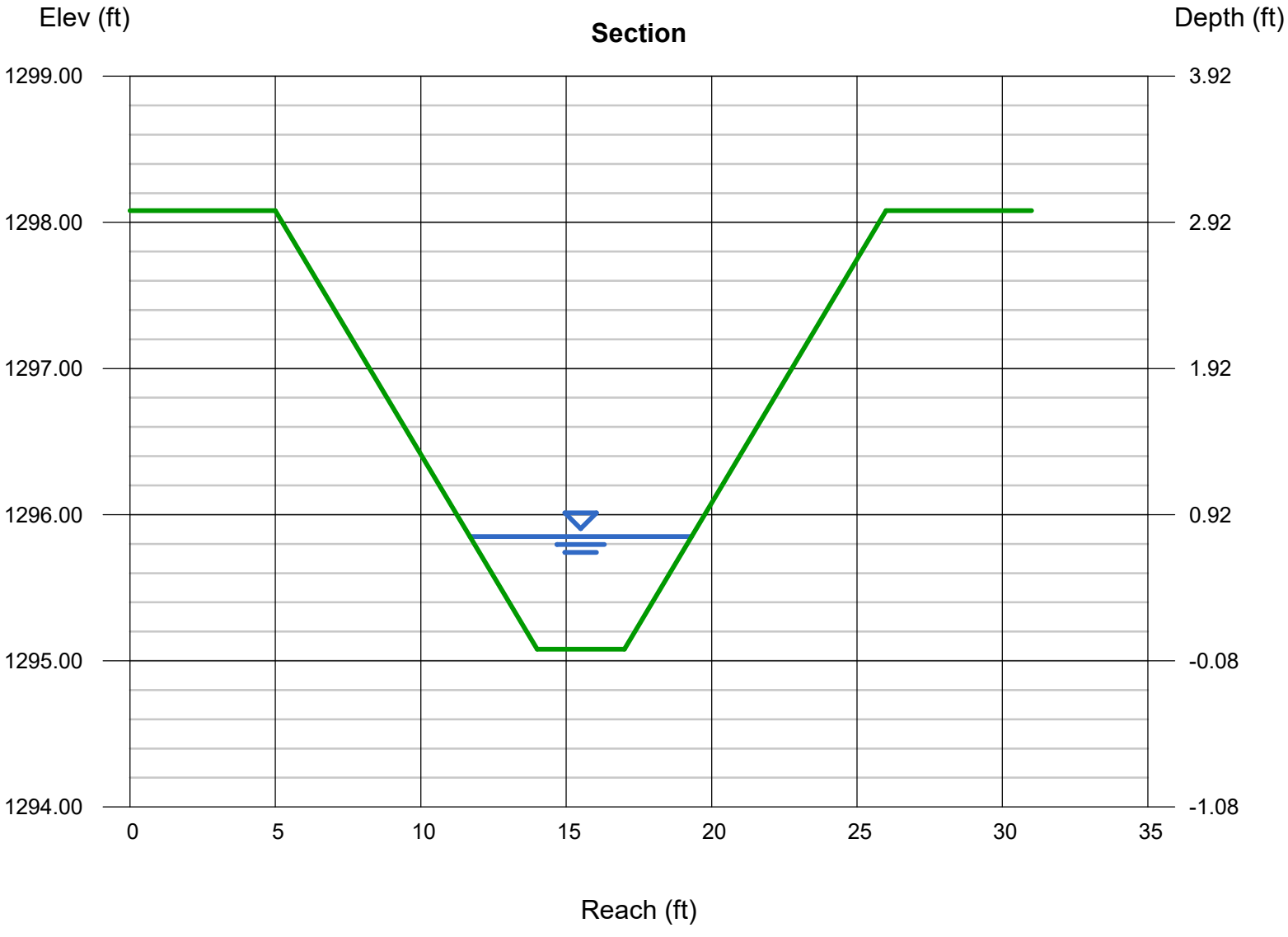
Bottom Width (ft)	= 3.00
Side Slopes (z:1)	= 3.00, 3.00
Total Depth (ft)	= 3.00
Invert Elev (ft)	= 1295.08
Slope (%)	= 2.02
N-Value	= 0.032

Calculations

Compute by:	Known Q
Known Q (cfs)	= 17.02

Highlighted

Depth (ft)	= 0.77
Q (cfs)	= 17.02
Area (sqft)	= 4.09
Velocity (ft/s)	= 4.16
Wetted Perim (ft)	= 7.87
Crit Depth, Yc (ft)	= 0.78
Top Width (ft)	= 7.62
EGL (ft)	= 1.04



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Thursday, Nov 21 2024

OPEN CHANNEL - POINT C

Trapezoidal

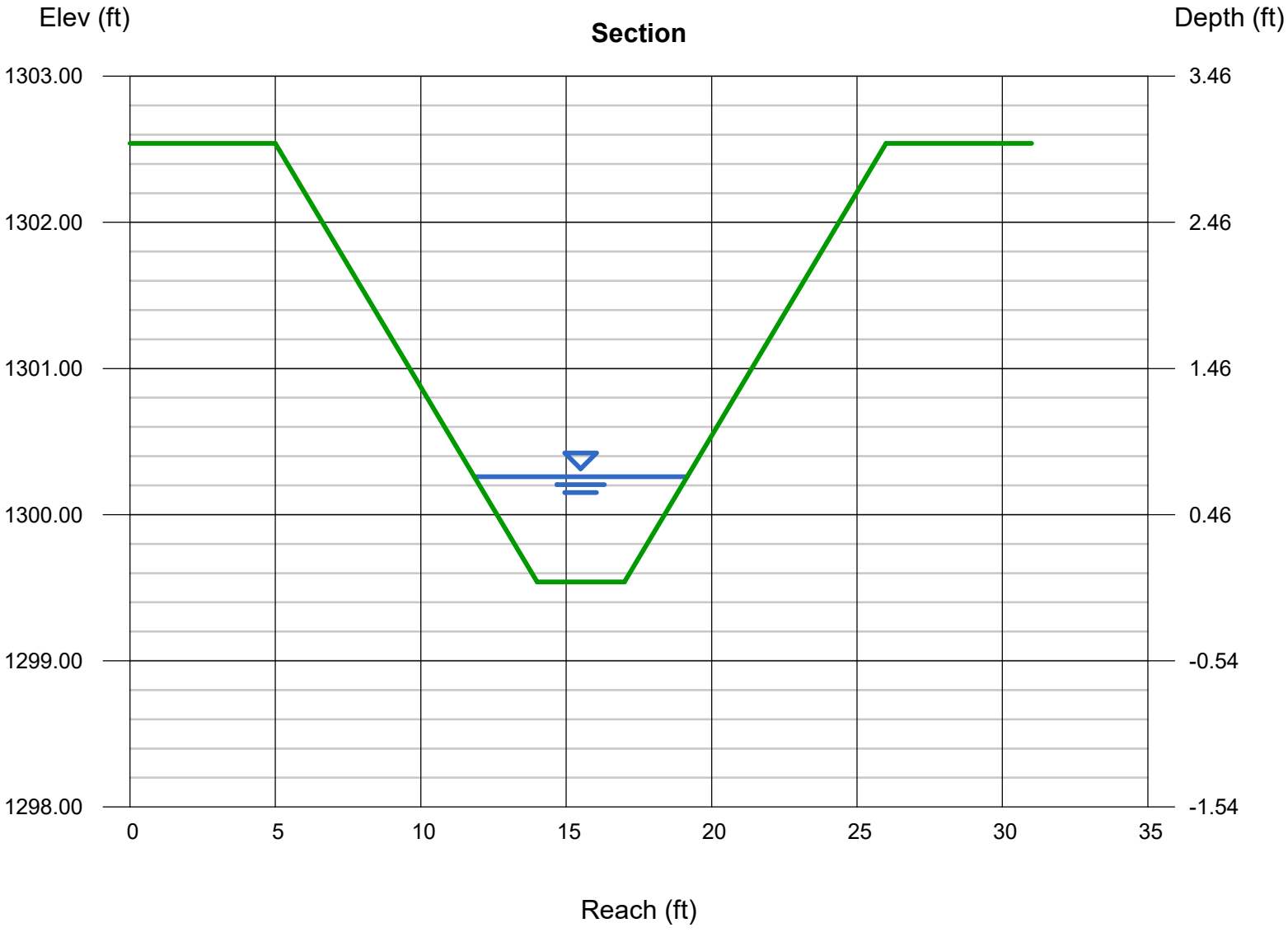
Bottom Width (ft)	= 3.00
Side Slopes (z:1)	= 3.00, 3.00
Total Depth (ft)	= 3.00
Invert Elev (ft)	= 1299.54
Slope (%)	= 2.02
N-Value	= 0.032

Calculations

Compute by:	Known Q
Known Q (cfs)	= 14.93

Highlighted

Depth (ft)	= 0.72
Q (cfs)	= 14.93
Area (sqft)	= 3.72
Velocity (ft/s)	= 4.02
Wetted Perim (ft)	= 7.55
Crit Depth, Yc (ft)	= 0.72
Top Width (ft)	= 7.32
EGL (ft)	= 0.97



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Thursday, Nov 21 2024

POINT D

Triangular

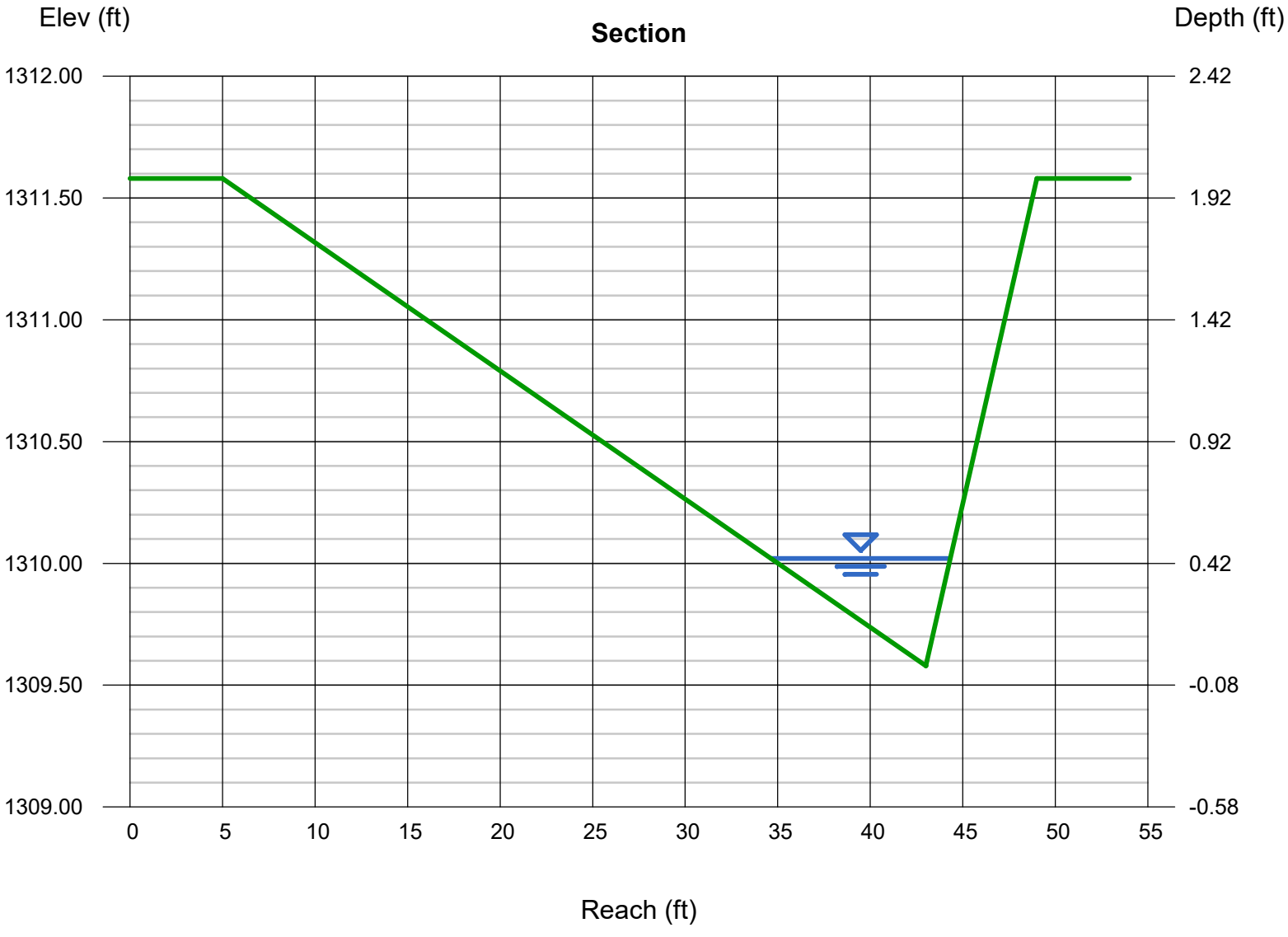
Side Slopes (z:1)	= 19.00, 3.00
Total Depth (ft)	= 2.00
Invert Elev (ft)	= 1309.58
Slope (%)	= 1.50
N-Value	= 0.032

Calculations

Compute by:	Known Q
Known Q (cfs)	= 4.16

Highlighted

Depth (ft)	= 0.44
Q (cfs)	= 4.160
Area (sqft)	= 2.13
Velocity (ft/s)	= 1.95
Wetted Perim (ft)	= 9.76
Crit Depth, Yc (ft)	= 0.39
Top Width (ft)	= 9.68
EGL (ft)	= 0.50



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Thursday, Nov 21 2024

POINT E

Triangular

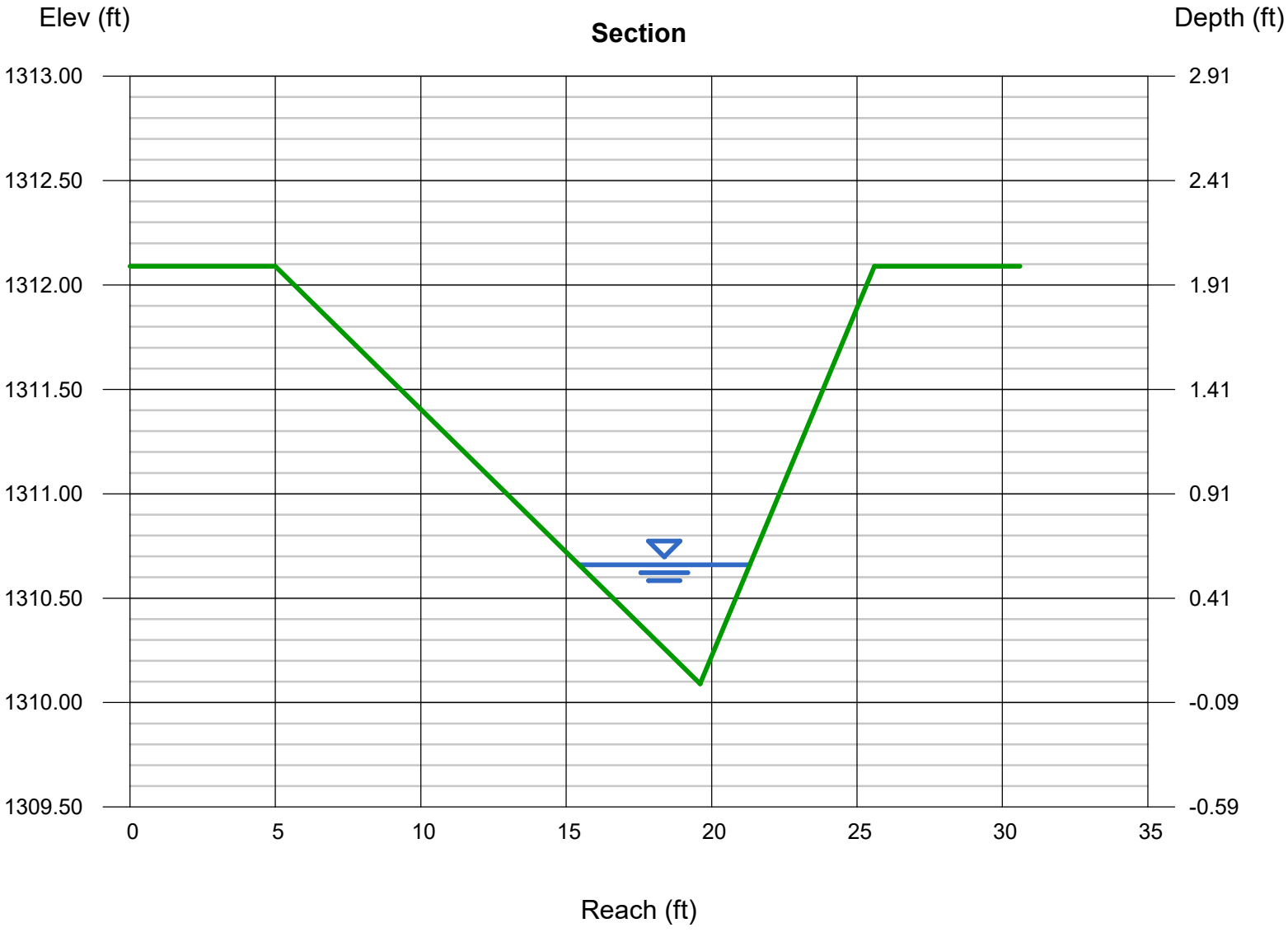
Side Slopes (z:1)	= 7.30, 3.00
Total Depth (ft)	= 2.00
Invert Elev (ft)	= 1310.09
Slope (%)	= 1.50
N-Value	= 0.032

Calculations

Compute by:	Known Q
Known Q (cfs)	= 3.96

Highlighted

Depth (ft)	= 0.57
Q (cfs)	= 3.960
Area (sqft)	= 1.67
Velocity (ft/s)	= 2.37
Wetted Perim (ft)	= 6.00
Crit Depth, Yc (ft)	= 0.52
Top Width (ft)	= 5.87
EGL (ft)	= 0.66



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Thursday, Nov 21 2024

POINT F

Triangular

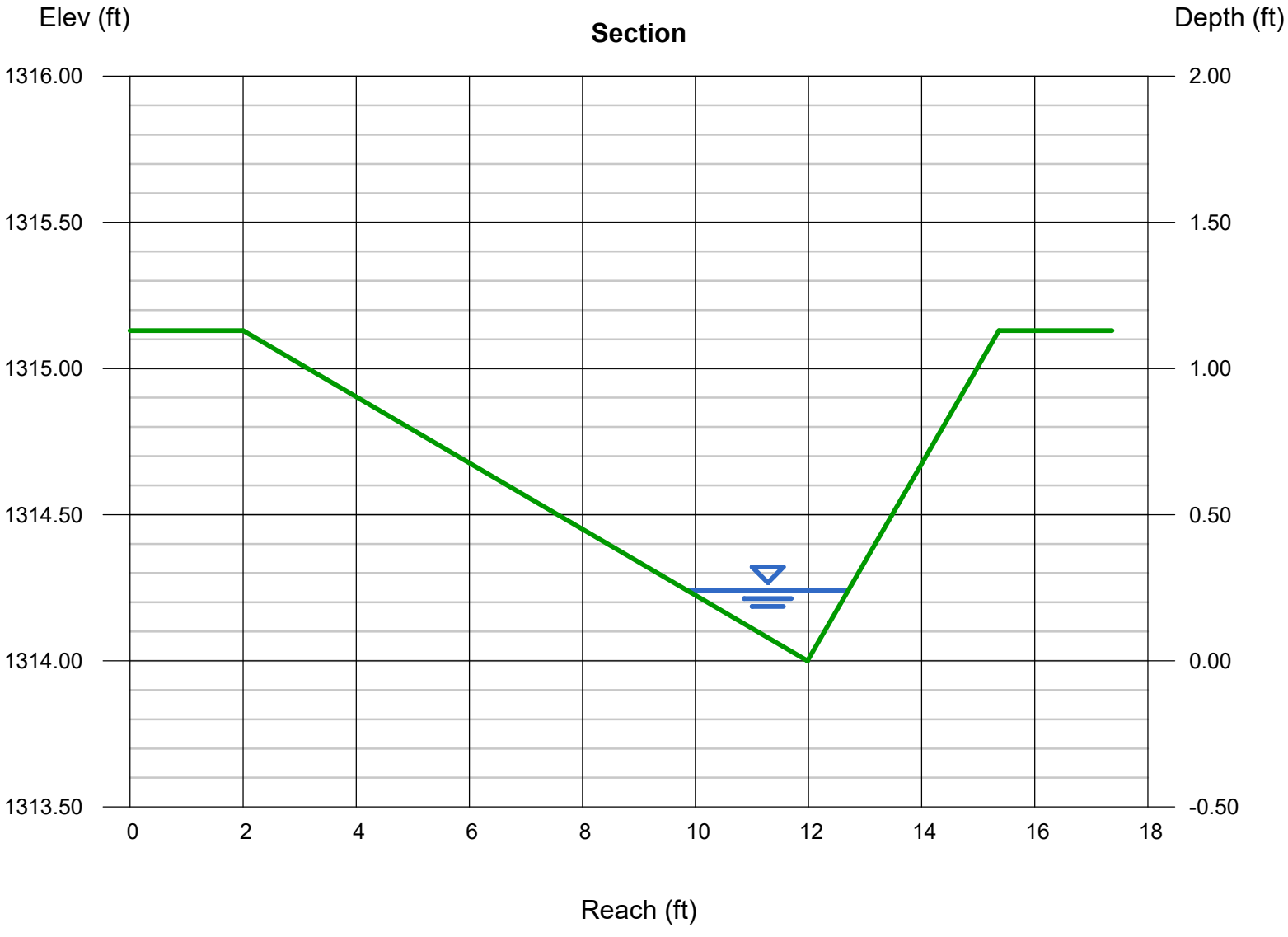
Side Slopes (z:1)	= 8.83, 3.00
Total Depth (ft)	= 1.13
Invert Elev (ft)	= 1314.00
Slope (%)	= 3.56
N-Value	= 0.032

Calculations

Compute by:	Known Q
Known Q (cfs)	= 0.68

Highlighted

Depth (ft)	= 0.24
Q (cfs)	= 0.680
Area (sqft)	= 0.34
Velocity (ft/s)	= 2.00
Wetted Perim (ft)	= 2.89
Crit Depth, Yc (ft)	= 0.25
Top Width (ft)	= 2.84
EGL (ft)	= 0.30



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Thursday, Nov 21 2024

POINT G

Triangular

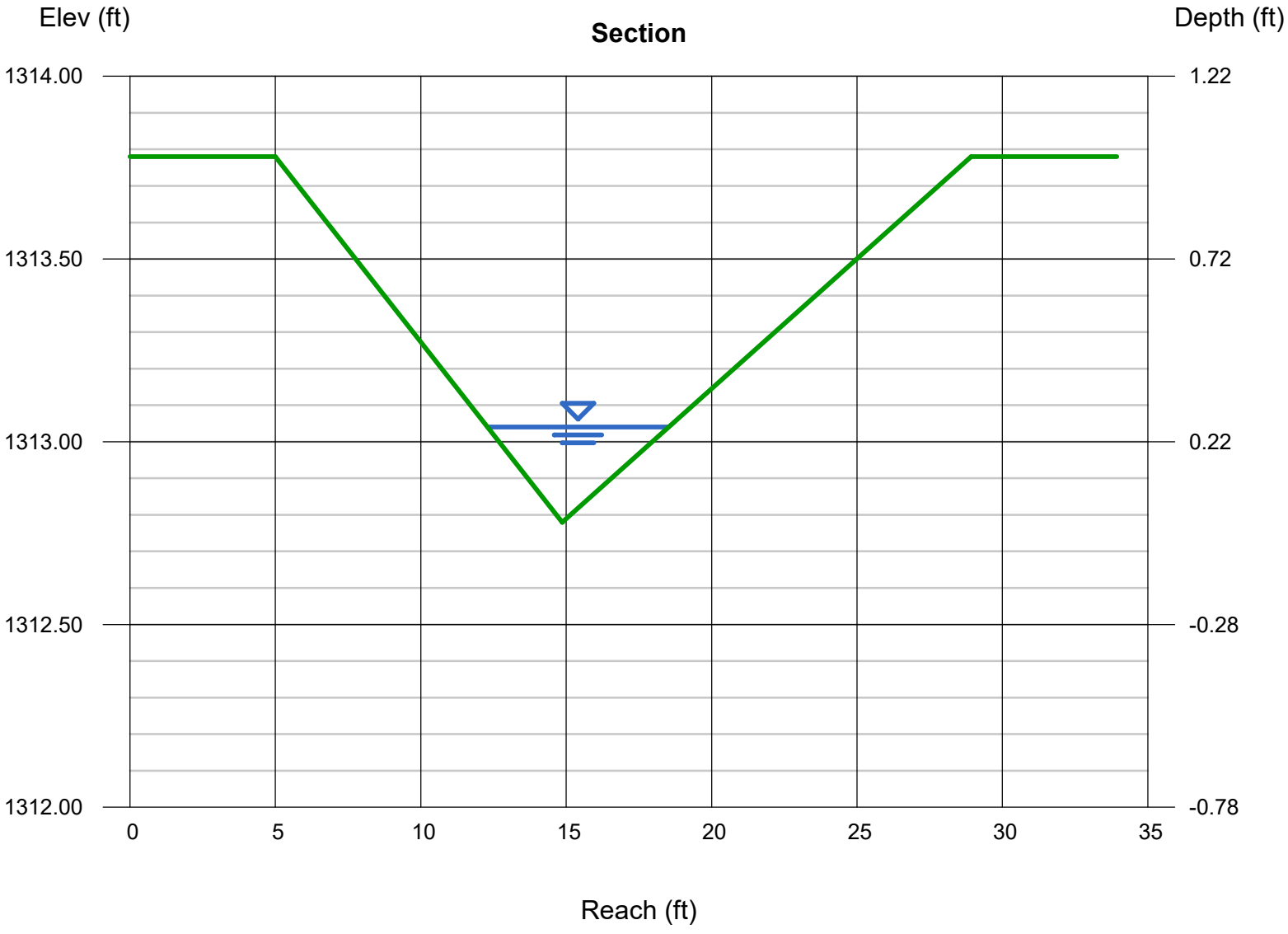
Side Slopes (z:1)	= 9.86, 14.07
Total Depth (ft)	= 1.00
Invert Elev (ft)	= 1312.78
Slope (%)	= 1.33
N-Value	= 0.032

Calculations

Compute by:	Known Q
Known Q (cfs)	= 1.01

Highlighted

Depth (ft)	= 0.26
Q (cfs)	= 1.010
Area (sqft)	= 0.81
Velocity (ft/s)	= 1.25
Wetted Perim (ft)	= 6.24
Crit Depth, Yc (ft)	= 0.22
Top Width (ft)	= 6.22
EGL (ft)	= 0.28



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Thursday, Nov 21 2024

POINT H

Triangular

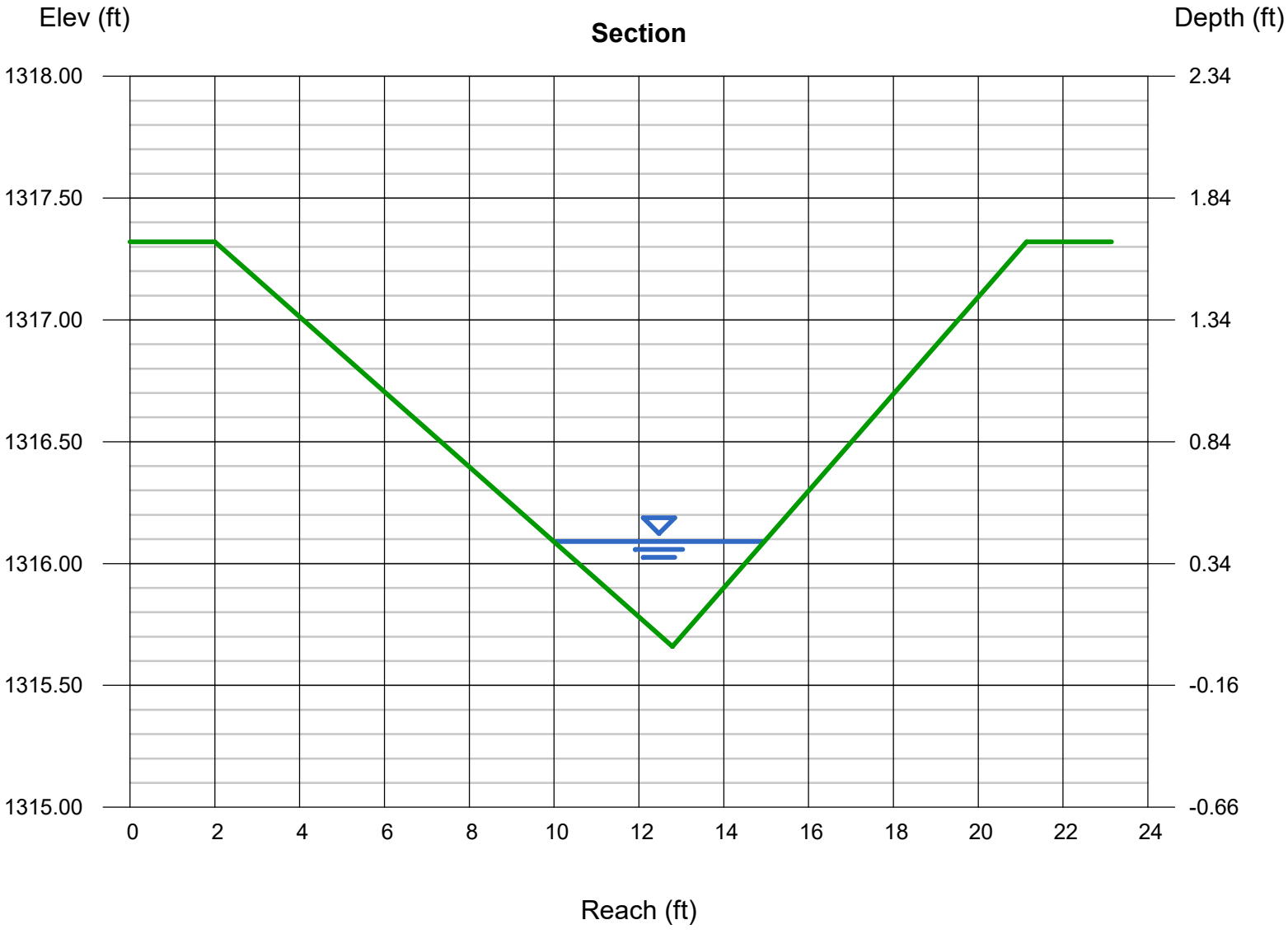
Side Slopes (z:1)	= 6.50, 5.03
Total Depth (ft)	= 1.66
Invert Elev (ft)	= 1315.66
Slope (%)	= 1.00
N-Value	= 0.032

Calculations

Compute by:	Known Q
Known Q (cfs)	= 1.72

Highlighted

Depth (ft)	= 0.43
Q (cfs)	= 1.720
Area (sqft)	= 1.07
Velocity (ft/s)	= 1.61
Wetted Perim (ft)	= 5.03
Crit Depth, Yc (ft)	= 0.36
Top Width (ft)	= 4.96
EGL (ft)	= 0.47



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Thursday, Nov 21 2024

POINT I

Triangular

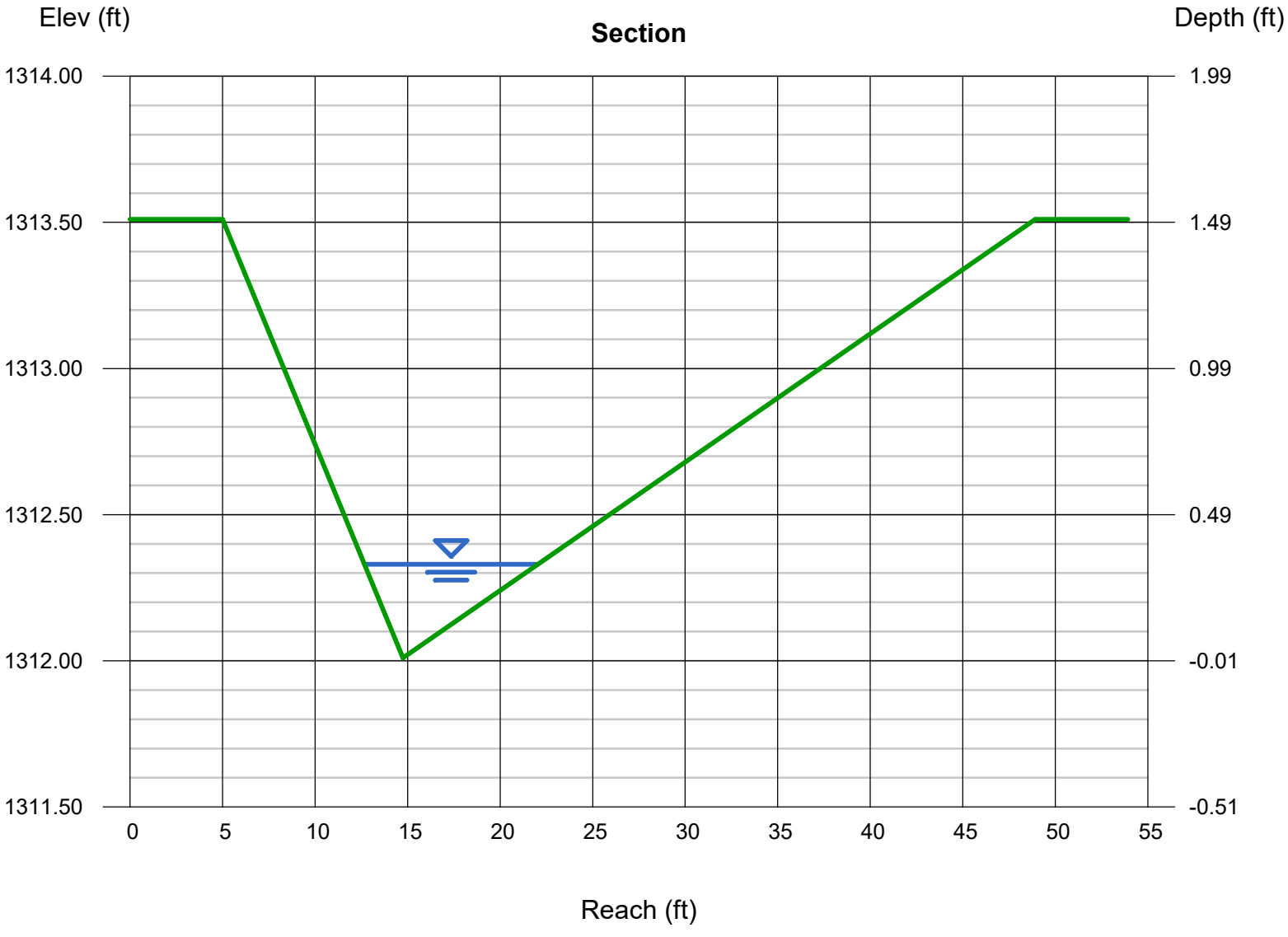
Side Slopes (z:1)	= 6.50, 22.78
Total Depth (ft)	= 1.50
Invert Elev (ft)	= 1312.01
Slope (%)	= 1.79
N-Value	= 0.032

Calculations

Compute by:	Known Q
Known Q (cfs)	= 2.68

Highlighted

Depth (ft)	= 0.32
Q (cfs)	= 2.680
Area (sqft)	= 1.50
Velocity (ft/s)	= 1.79
Wetted Perim (ft)	= 9.40
Crit Depth, Yc (ft)	= 0.30
Top Width (ft)	= 9.37
EGL (ft)	= 0.37



Culvert Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Monday, Nov 25 2024

Entrance Culvert in ROW

Invert Elev Dn (ft)	=	1315.66
Pipe Length (ft)	=	48.00
Slope (%)	=	2.44
Invert Elev Up (ft)	=	1316.83
Rise (in)	=	12.0
Shape	=	Circular
Span (in)	=	12.0
No. Barrels	=	1
n-Value	=	0.012
Culvert Type	=	Circular Concrete
Culvert Entrance	=	Square edge w/headwall (C)
Coeff. K,M,c,Y,k	=	0.0098, 2, 0.0398, 0.67, 0.5

Embankment

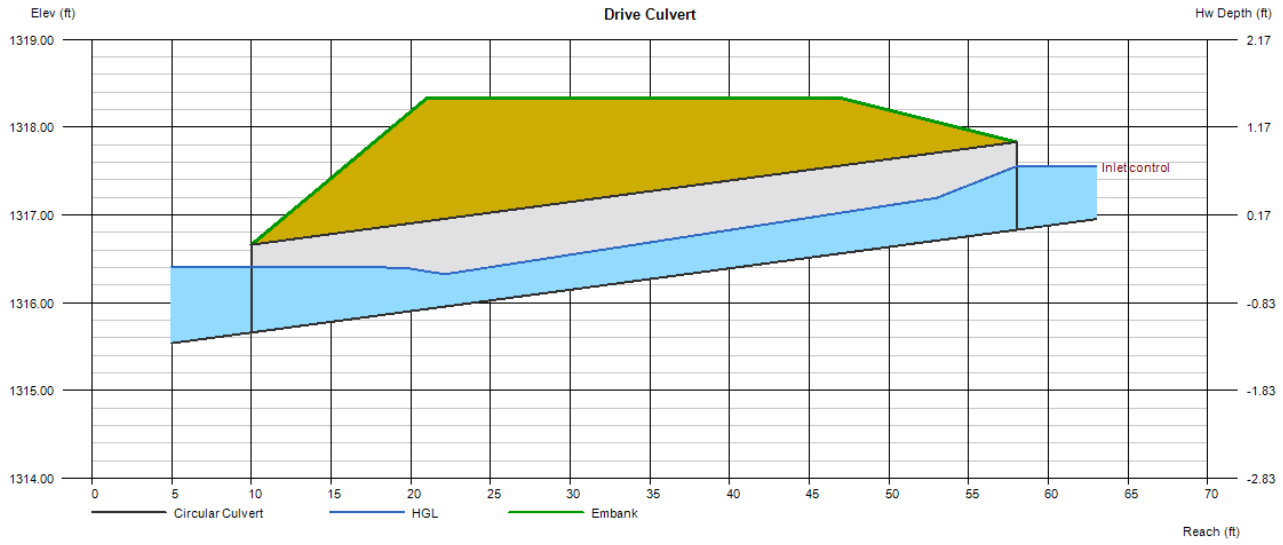
Top Elevation (ft)	=	1318.33
Top Width (ft)	=	26.00
Crest Width (ft)	=	15.00

Calculations

Qmin (cfs)	=	1.42
Qmax (cfs)	=	1.42
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	1.42
Qpipe (cfs)	=	1.42
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	2.24
Veloc Up (ft/s)	=	3.58
HGL Dn (ft)	=	1316.41
HGL Up (ft)	=	1317.33
Hw Elev (ft)	=	1317.55
Hw/D (ft)	=	0.72
Flow Regime	=	Inlet Control



Culvert Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Monday, Nov 25 2024

Drive Culvert

Invert Elev Dn (ft)	=	1311.46
Pipe Length (ft)	=	50.00
Slope (%)	=	2.46
Invert Elev Up (ft)	=	1312.69
Rise (in)	=	12.0
Shape	=	Circular
Span (in)	=	12.0
No. Barrels	=	1
n-Value	=	0.012
Culvert Type	=	Circular Concrete
Culvert Entrance	=	Square edge w/headwall (C)
Coeff. K,M,c,Y,k	=	0.0098, 2, 0.0398, 0.67, 0.5

Embankment

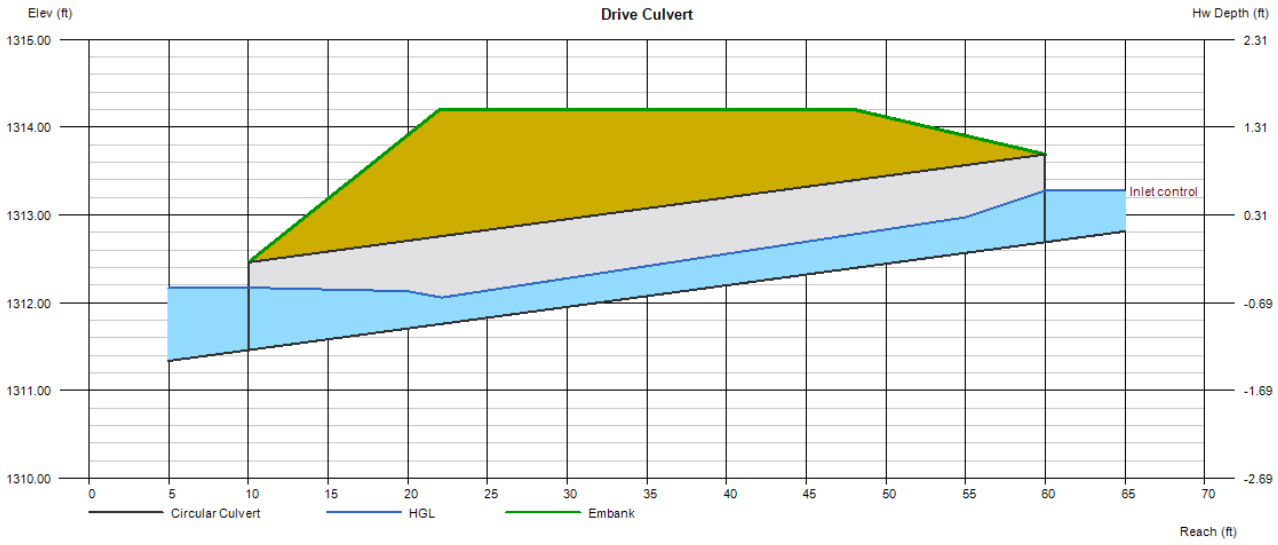
Top Elevation (ft)	=	1314.20
Top Width (ft)	=	26.00
Crest Width (ft)	=	25.00

Calculations

Qmin (cfs)	=	1.01
Qmax (cfs)	=	1.01
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

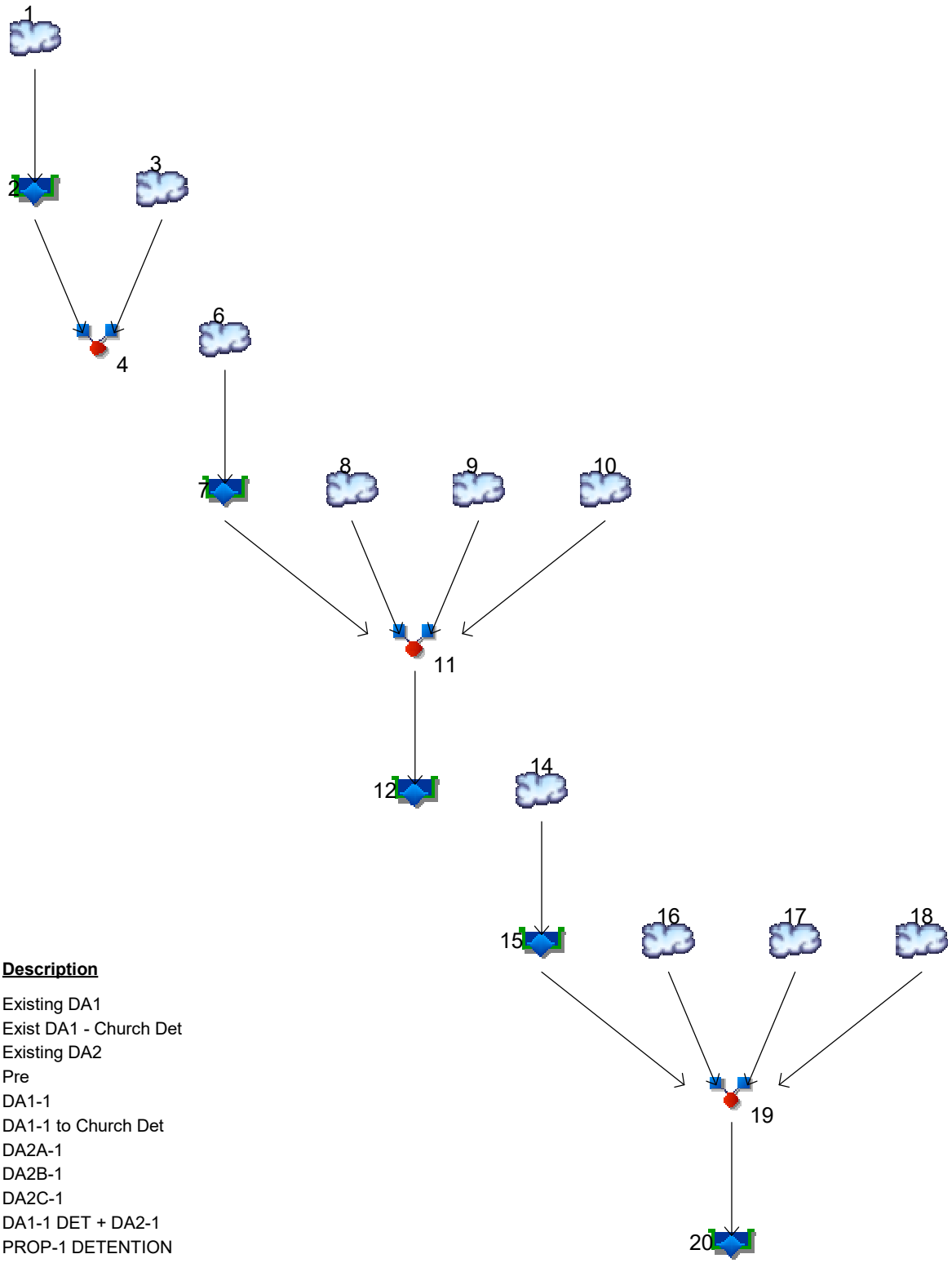
Qtotal (cfs)	=	1.01
Qpipe (cfs)	=	1.01
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	1.69
Veloc Up (ft/s)	=	3.21
HGL Dn (ft)	=	1312.17
HGL Up (ft)	=	1313.11
Hw Elev (ft)	=	1313.28
Hw/D (ft)	=	0.59
Flow Regime	=	Inlet Control



APPENDIX B

DETENTION BASIN DESIGN CALCULATIONS

Watershed Model Schematic



Legend

Hyd.	Origin	Description
1	SCS Runoff	Existing DA1
2	Reservoir	Exist DA1 - Church Det
3	SCS Runoff	Existing DA2
4	Combine	Pre
6	SCS Runoff	DA1-1
7	Reservoir	DA1-1 to Church Det
8	SCS Runoff	DA2A-1
9	SCS Runoff	DA2B-1
10	SCS Runoff	DA2C-1
11	Combine	DA1-1 DET + DA2-1
12	Reservoir	PROP-1 DETENTION
14	SCS Runoff	DA1-2
15	Reservoir	DA1-2 to Church Det
16	SCS Runoff	DA2A-2
17	SCS Runoff	DA2B-2
18	SCS Runoff	DA2C-2
19	Combine	DA1-2 DET + DA2-2
20	Reservoir	PROP 2 - FULL DEV DET

Hydraflow Table of Contents

Hydrograph Summary Report

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

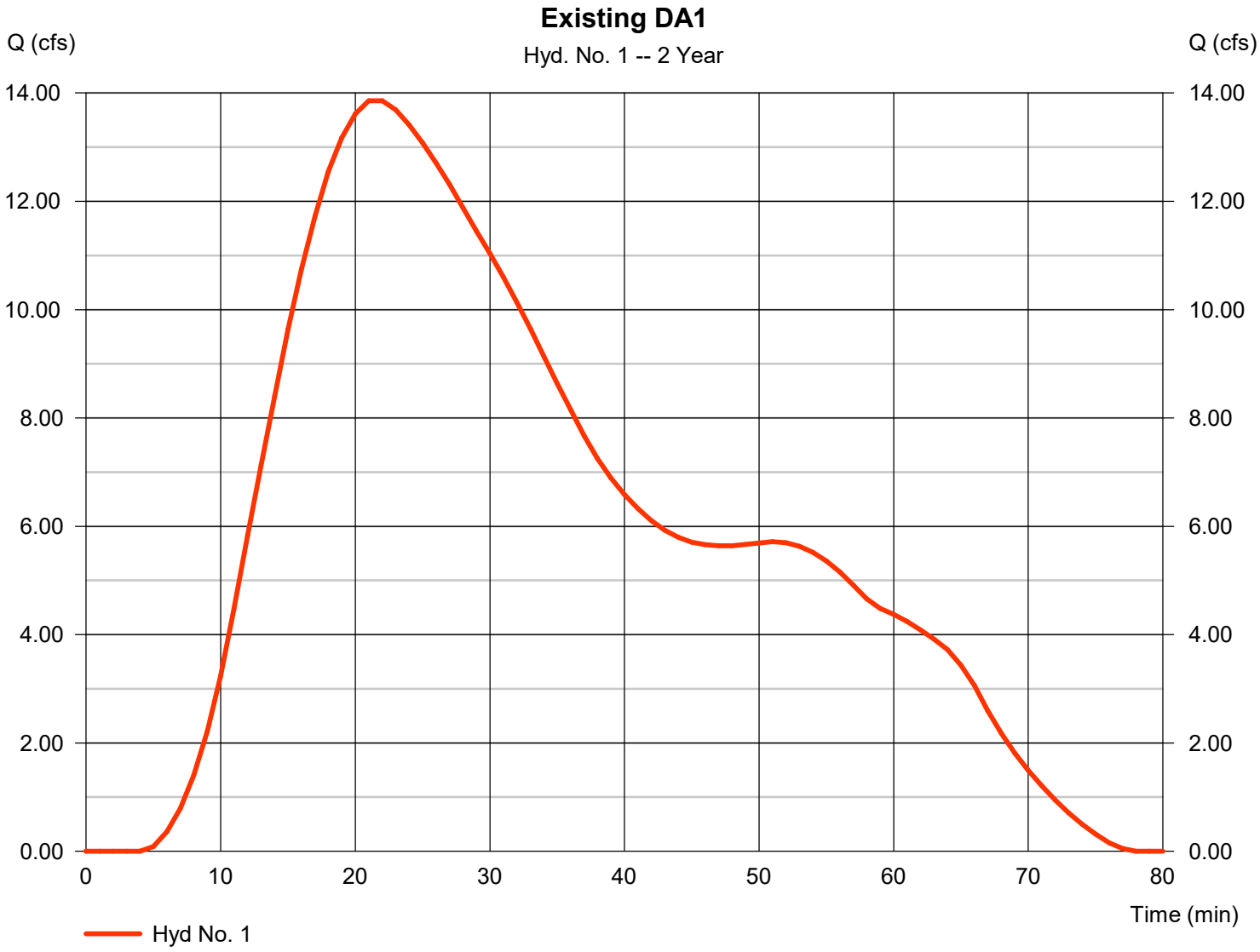
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	13.86	1	21	27,689	------	------	------	Existing DA1
2	Reservoir	3.746	1	64	27,656	1	1294.10	16,732	Exist DA1 - Church Det
3	SCS Runoff	18.34	1	27	40,041	------	------	------	Existing DA2
4	Combine	21.33	1	28	67,697	2, 3	------	------	Pre
6	SCS Runoff	11.43	1	21	22,843	------	------	------	DA1-1
7	Reservoir	3.522	1	61	22,810	6	1293.99	13,010	DA1-1 to Church Det
8	SCS Runoff	2.808	1	27	6,134	------	------	------	DA2A-1
9	SCS Runoff	13.21	1	16	23,944	------	------	------	DA2B-1
10	SCS Runoff	11.58	1	24	24,222	------	------	------	DA2C-1
11	Combine	26.85	1	22	77,110	7, 8, 9, 10	------	------	DA1-1 DET + DA2-1
12	Reservoir	17.85	1	37	77,062	11	1286.11	13,954	PROP-1 DETENTION
14	SCS Runoff	9.280	1	27	20,205	------	------	------	DA1-2
15	Reservoir	3.203	1	63	20,172	14	1293.84	11,086	DA1-2 to Church Det
16	SCS Runoff	2.275	1	23	4,608	------	------	------	DA2A-2
17	SCS Runoff	13.11	1	15	23,467	------	------	------	DA2B-2
18	SCS Runoff	41.08	1	19	74,786	------	------	------	DA2C-2
19	Combine	56.42	1	19	123,033	15, 16, 17, 18	------	------	DA1-2 DET + DA2-2
20	Reservoir	19.47	1	52	122,986	19	1287.66	49,060	PROP 2 - FULL DEV DET

Hydrograph Report

Hyd. No. 1

Existing DA1

Hydrograph type	=	SCS Runoff	Peak discharge	=	13.86 cfs
Storm frequency	=	2 yrs	Time to peak	=	21 min
Time interval	=	1 min	Hyd. volume	=	27,689 cuft
Drainage area	=	14.570 ac	Curve number	=	87
Basin Slope	=	2.0 %	Hydraulic length	=	2185 ft
Tc method	=	User	Time of conc. (Tc)	=	10.10 min
Total precip.	=	1.47 in	Distribution	=	Huff-1st
Storm duration	=	1.00 hrs	Shape factor	=	484



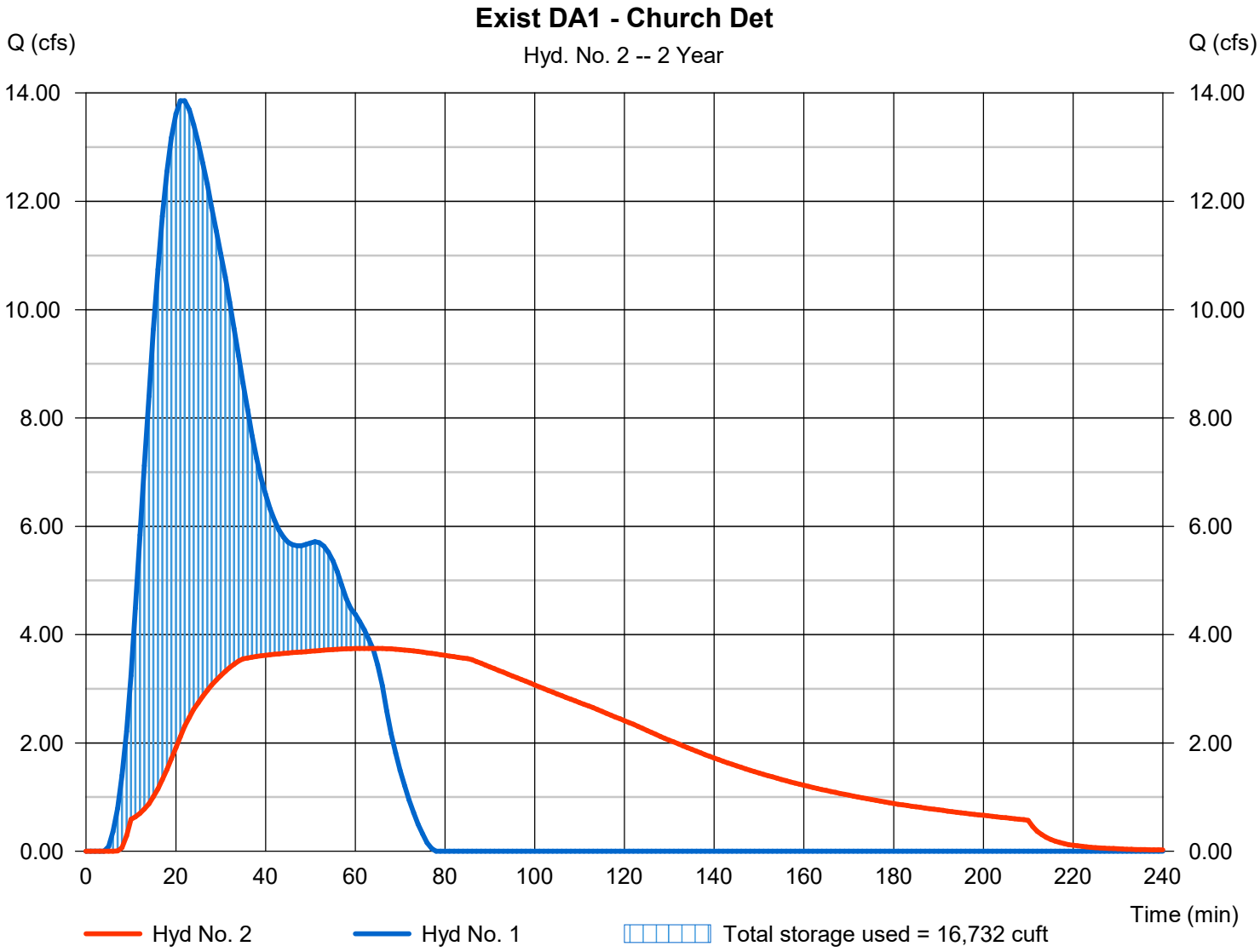
Hydrograph Report

Hyd. No. 2

Exist DA1 - Church Det

Hydrograph type	=	Reservoir	Peak discharge	=	3.746 cfs
Storm frequency	=	2 yrs	Time to peak	=	64 min
Time interval	=	1 min	Hyd. volume	=	27,656 cuft
Inflow hyd. No.	=	1 - Existing DA1	Max. Elevation	=	1294.10 ft
Reservoir name	=	Church Detention	Max. Storage	=	16,732 cuft

Storage Indication method used.



Pond Report

Pond No. 1 - Church Detention

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 1292.58 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	1292.58	00	0	0
0.42	1293.00	2,109	295	295
1.42	1294.00	28,716	12,868	13,163
1.97	1294.55	41,993	19,331	32,494
2.42	1295.00	52,471	21,204	53,698
3.42	1296.00	63,643	57,961	111,660

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 12.00	0.00	0.00	0.00
Span (in)	= 12.00	0.00	0.00	0.00
No. Barrels	= 1	0	0	0
Invert El. (ft)	= 1292.62	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

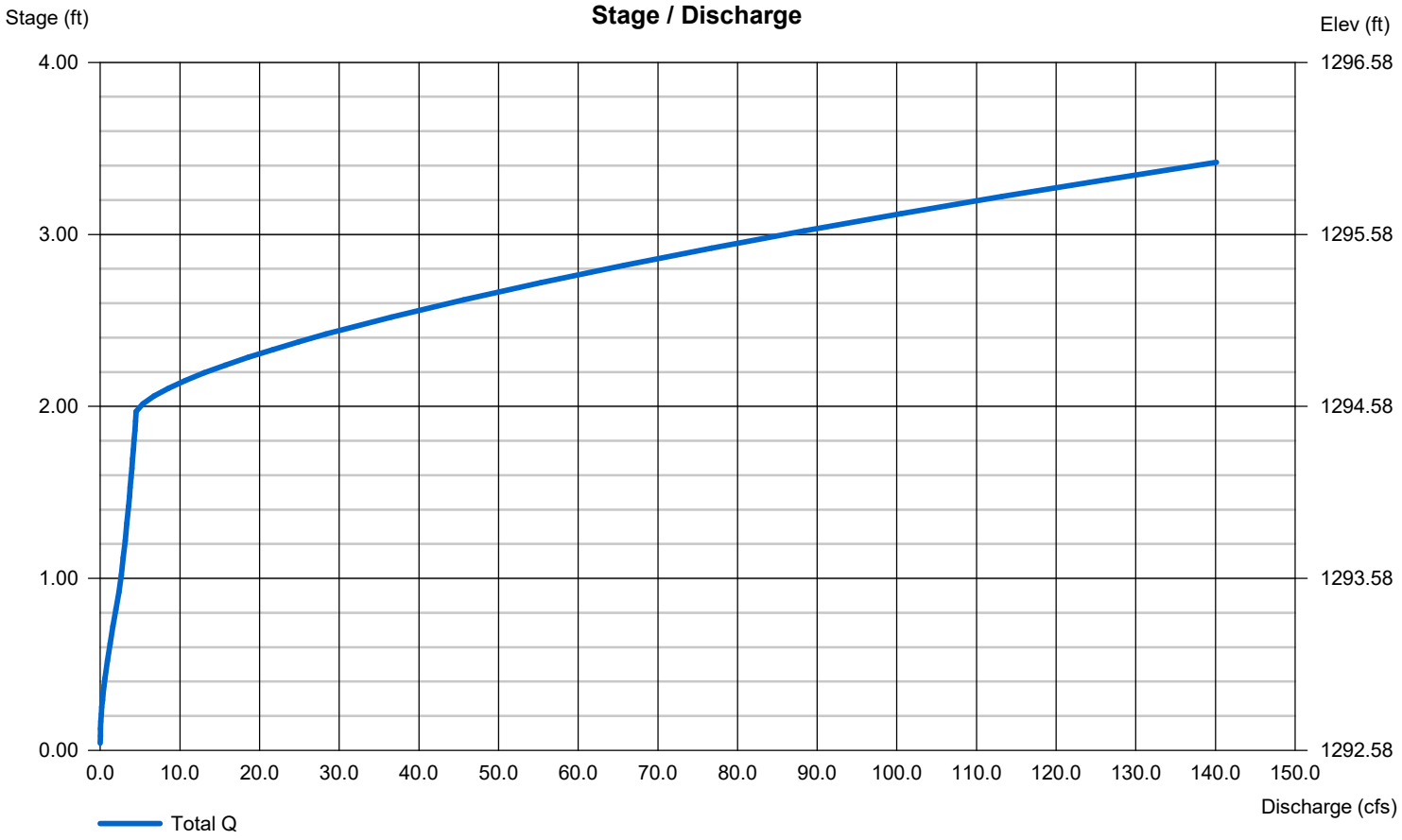
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 23.00	0.00	0.00	0.00
Crest El. (ft)	= 1294.55	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= Ciplti	Rect	---	---
Multi-Stage	= No	No	No	No

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

TW Elev. (ft) = 0.00

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

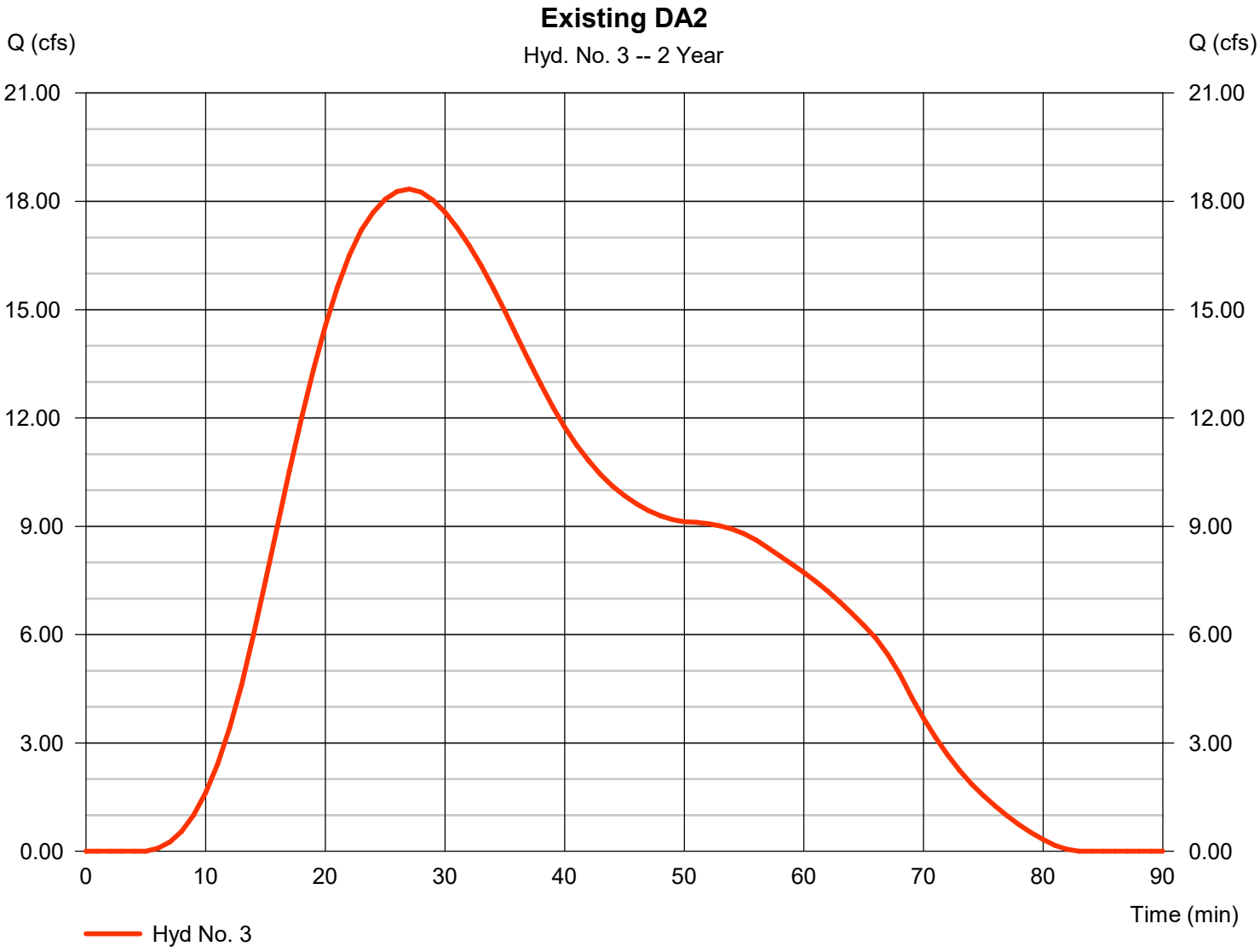


Hydrograph Report

Hyd. No. 3

Existing DA2

Hydrograph type	=	SCS Runoff	Peak discharge	=	18.34 cfs
Storm frequency	=	2 yrs	Time to peak	=	27 min
Time interval	=	1 min	Hyd. volume	=	40,041 cuft
Drainage area	=	27.860 ac	Curve number	=	84
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	13.90 min
Total precip.	=	1.47 in	Distribution	=	Huff-1st
Storm duration	=	1.00 hrs	Shape factor	=	484

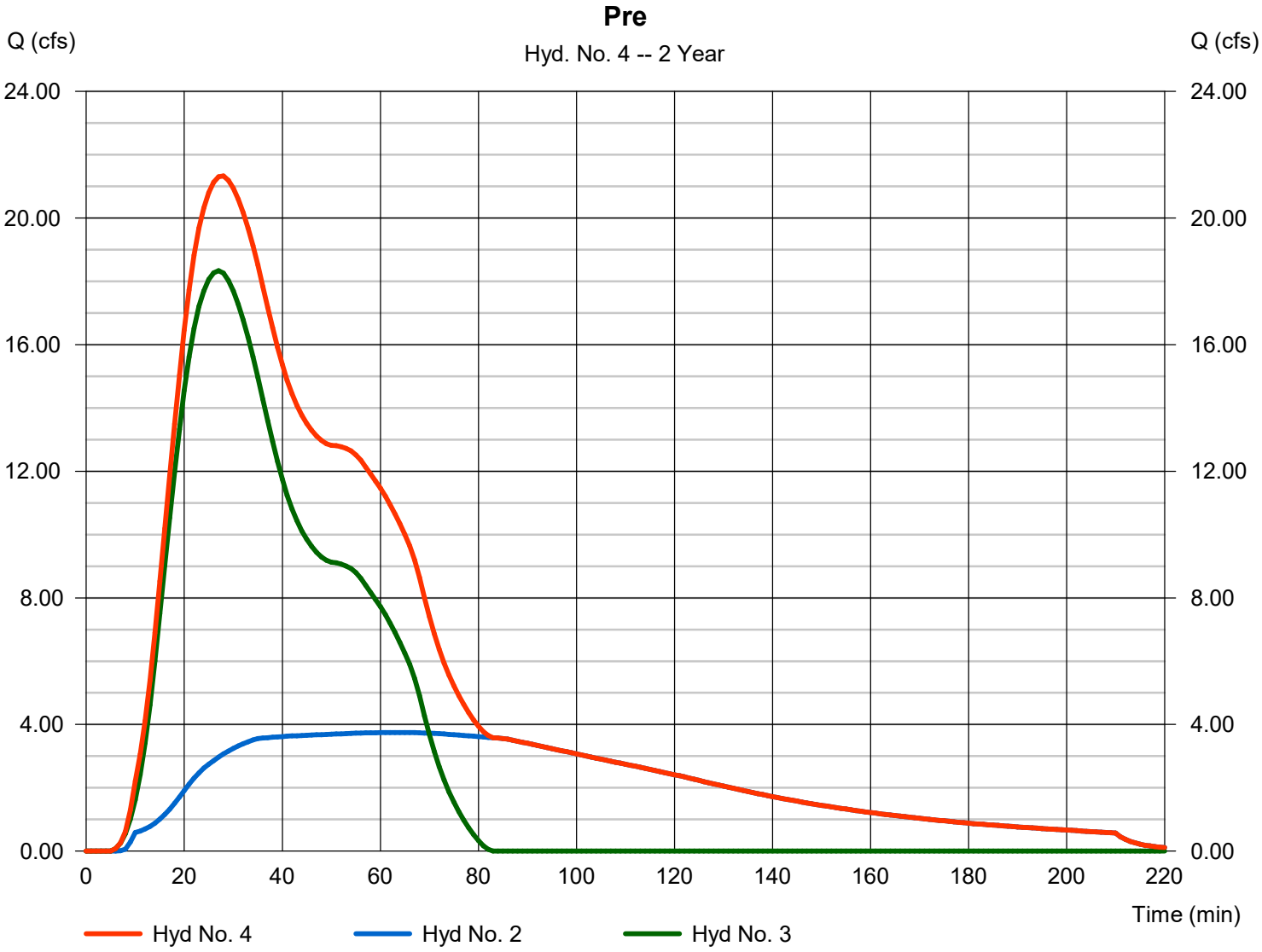


Hydrograph Report

Hyd. No. 4

Pre

Hydrograph type	=	Combine	Peak discharge	=	21.33 cfs
Storm frequency	=	2 yrs	Time to peak	=	28 min
Time interval	=	1 min	Hyd. volume	=	67,697 cuft
Inflow hyds.	=	2, 3	Contrib. drain. area	=	27.860 ac



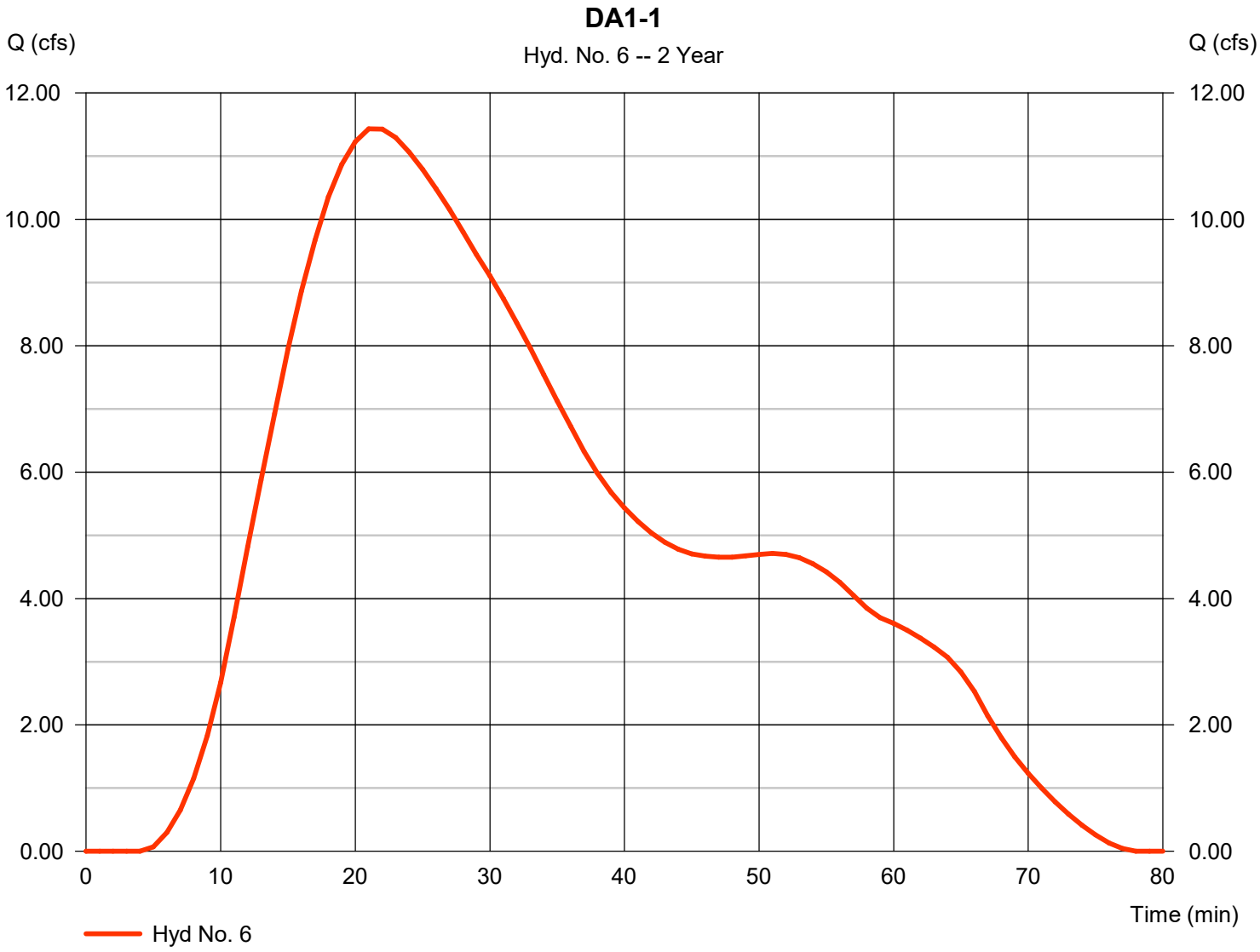
Hydrograph Report

Hyd. No. 6

DA1-1

Hydrograph type	=	SCS Runoff	Peak discharge	=	11.43 cfs
Storm frequency	=	2 yrs	Time to peak	=	21 min
Time interval	=	1 min	Hyd. volume	=	22,843 cuft
Drainage area	=	12.020 ac	Curve number	=	87*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	10.08 min
Total precip.	=	1.47 in	Distribution	=	Huff-1st
Storm duration	=	1.00 hrs	Shape factor	=	484

* Composite (Area/CN) = [(4.755 x 90) + (1.295 x 75)] / 12.020



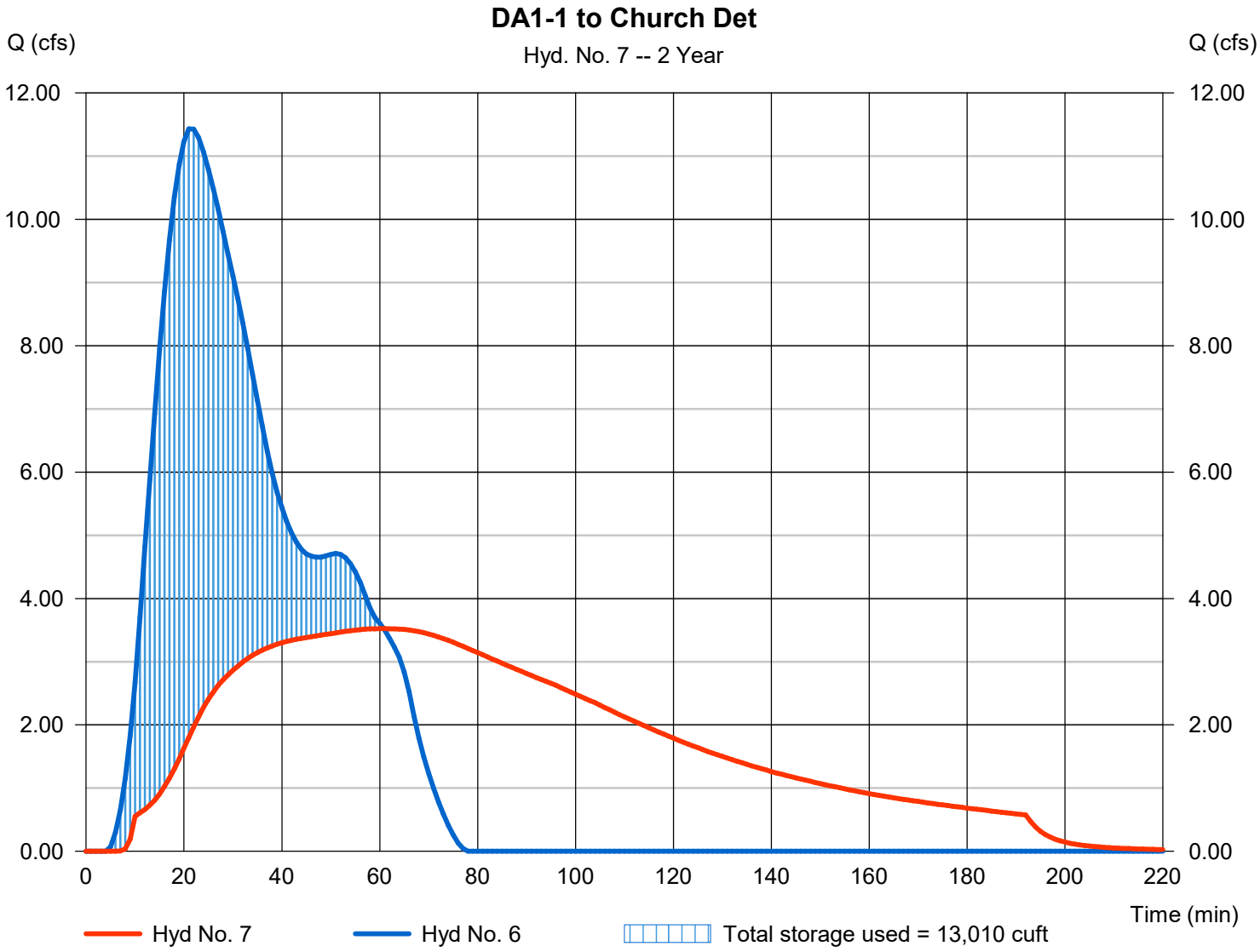
Hydrograph Report

Hyd. No. 7

DA1-1 to Church Det

Hydrograph type	=	Reservoir	Peak discharge	=	3.522 cfs
Storm frequency	=	2 yrs	Time to peak	=	61 min
Time interval	=	1 min	Hyd. volume	=	22,810 cuft
Inflow hyd. No.	=	6 - DA1-1	Max. Elevation	=	1293.99 ft
Reservoir name	=	Church Detention	Max. Storage	=	13,010 cuft

Storage Indication method used.



Pond Report

Pond No. 1 - Church Detention

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 1292.58 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	1292.58	00	0	0
0.42	1293.00	2,109	295	295
1.42	1294.00	28,716	12,868	13,163
1.97	1294.55	41,993	19,331	32,494
2.42	1295.00	52,471	21,204	53,698
3.42	1296.00	63,643	57,961	111,660

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 12.00	0.00	0.00	0.00
Span (in)	= 12.00	0.00	0.00	0.00
No. Barrels	= 1	0	0	0
Invert El. (ft)	= 1292.62	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

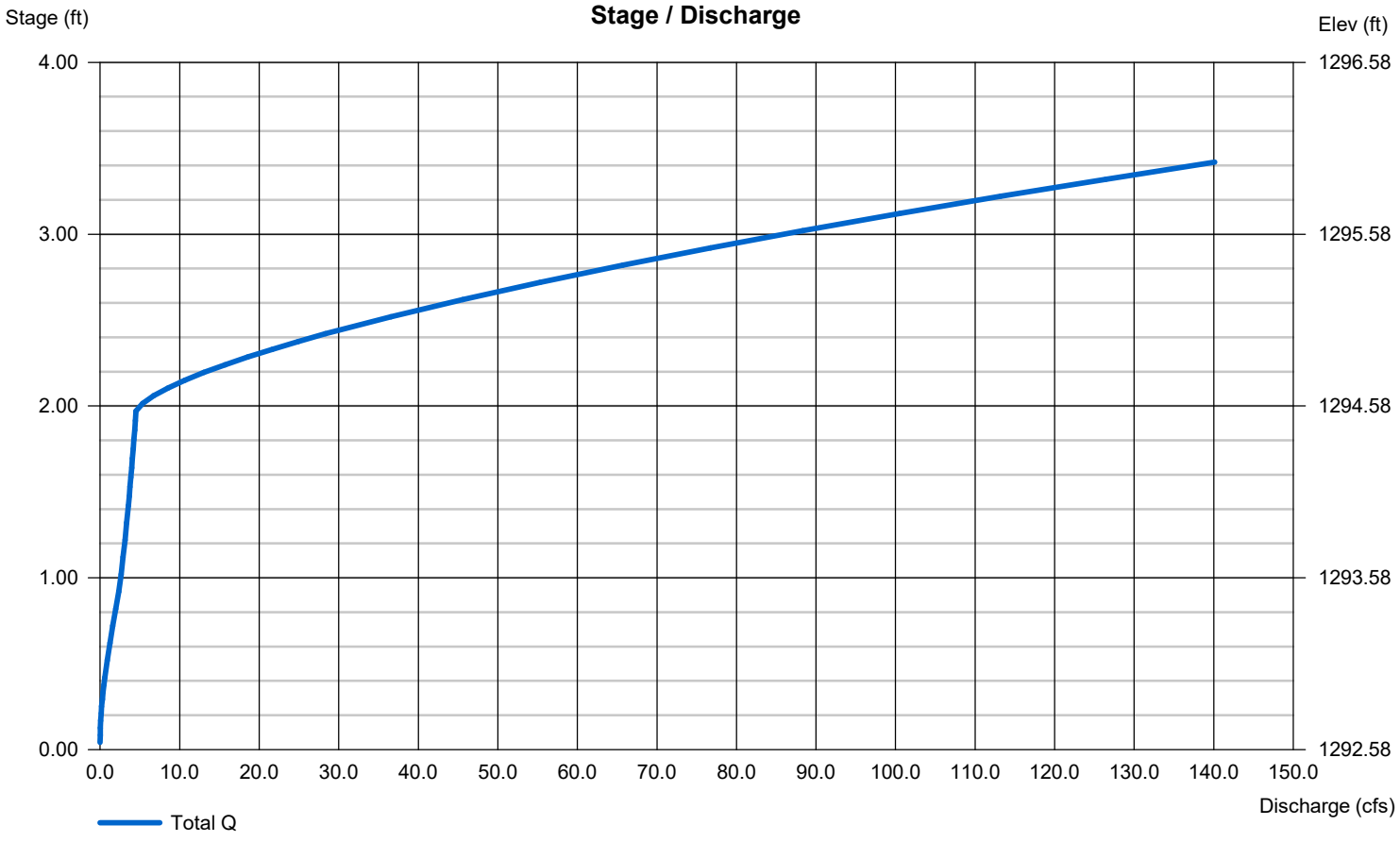
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 23.00	0.00	0.00	0.00
Crest El. (ft)	= 1294.55	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= Ciplti	Rect	---	---
Multi-Stage	= No	No	No	No

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

TW Elev. (ft) = 0.00

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



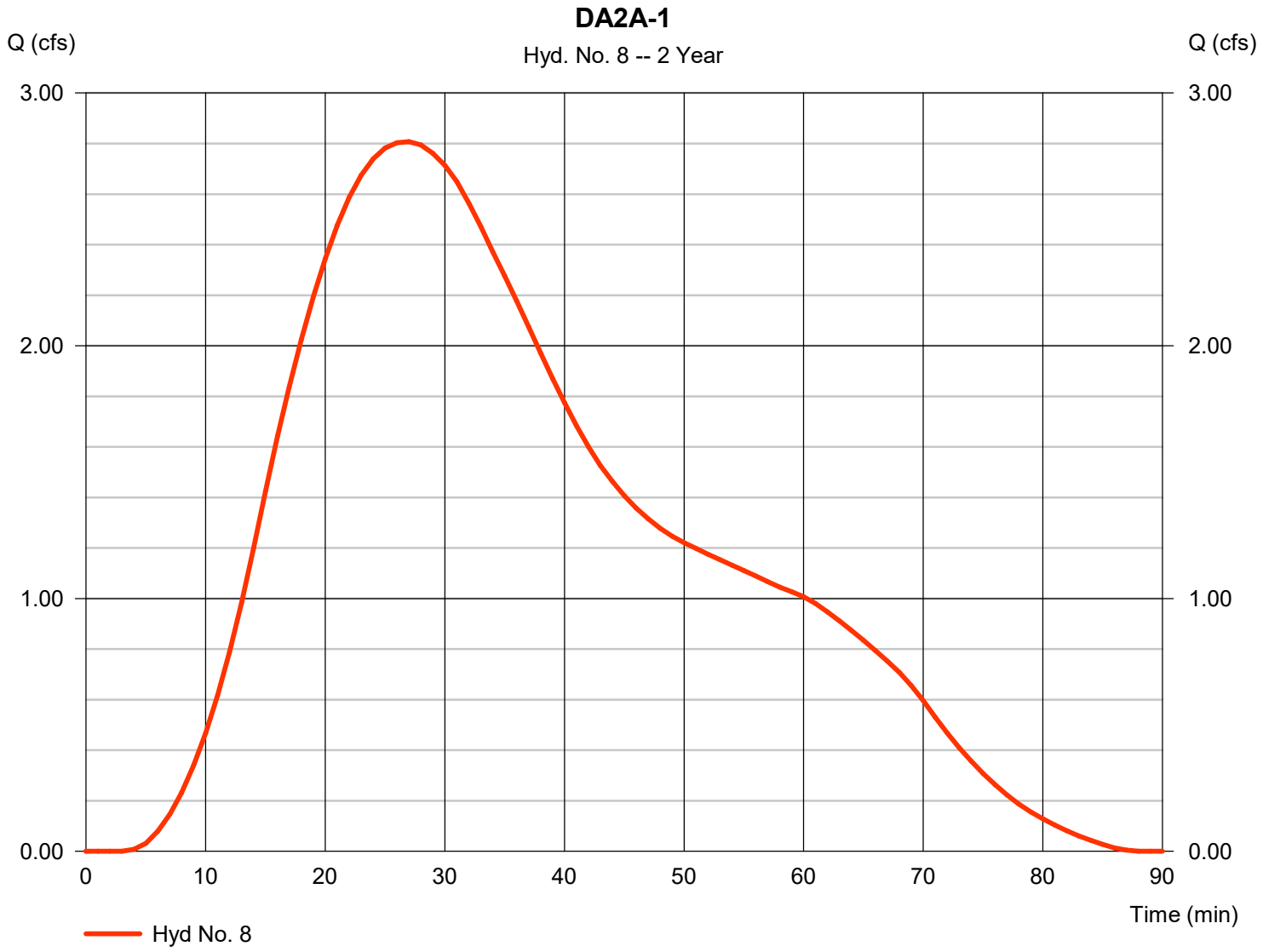
Hydrograph Report

Hyd. No. 8

DA2A-1

Hydrograph type	=	SCS Runoff	Peak discharge	=	2.808 cfs
Storm frequency	=	2 yrs	Time to peak	=	27 min
Time interval	=	1 min	Hyd. volume	=	6,134 cuft
Drainage area	=	2.590 ac	Curve number	=	90*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	18.10 min
Total precip.	=	1.47 in	Distribution	=	Huff-1st
Storm duration	=	1.00 hrs	Shape factor	=	484

* Composite (Area/CN) = [(4.880 x 90) + (2.170 x 75)] / 2.590



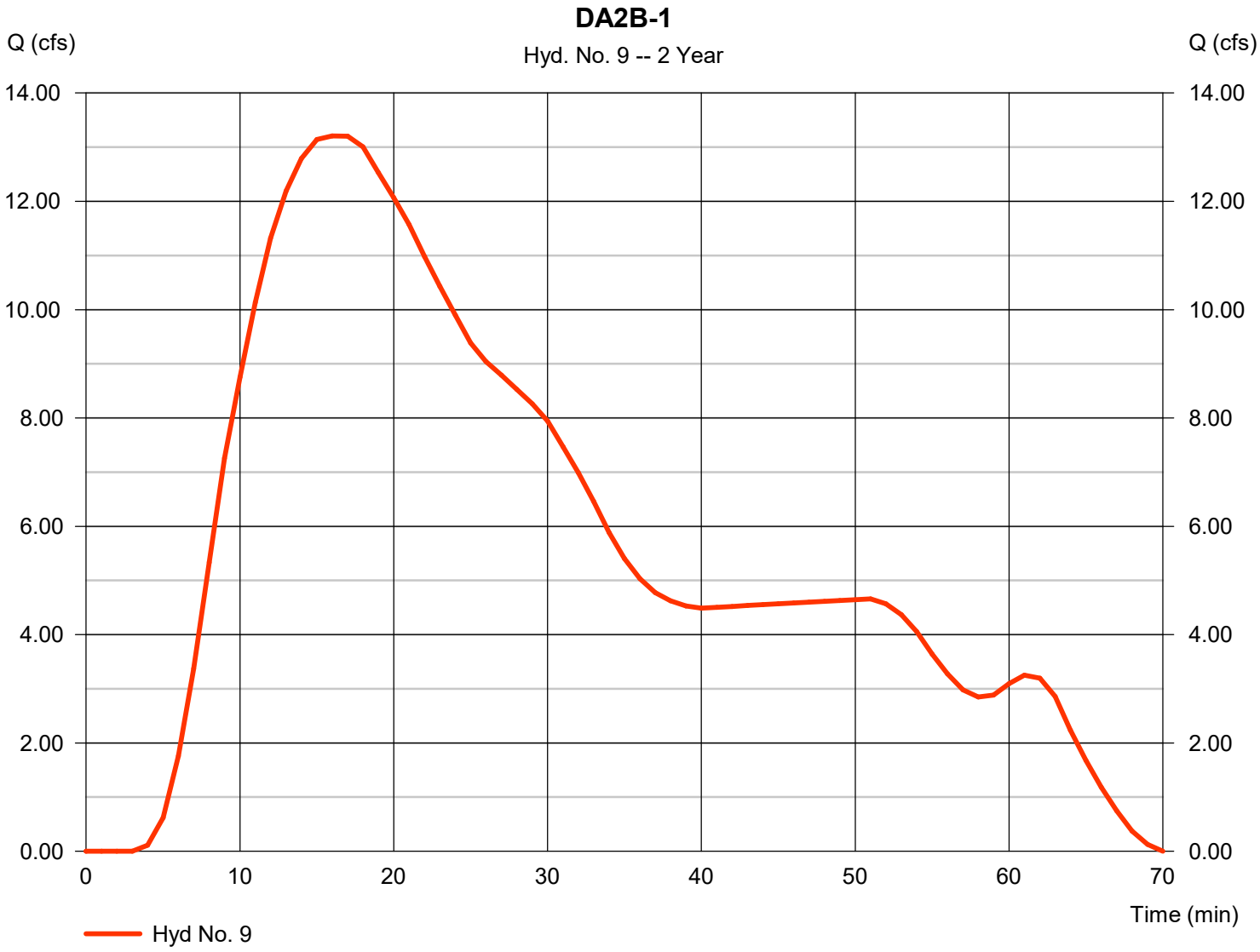
Hydrograph Report

Hyd. No. 9

DA2B-1

Hydrograph type	=	SCS Runoff	Peak discharge	=	13.21 cfs
Storm frequency	=	2 yrs	Time to peak	=	16 min
Time interval	=	1 min	Hyd. volume	=	23,944 cuft
Drainage area	=	10.520 ac	Curve number	=	89*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	1.47 in	Distribution	=	Huff-1st
Storm duration	=	1.00 hrs	Shape factor	=	484

* Composite (Area/CN) = [(4.880 x 90) + (2.170 x 75)] / 10.520



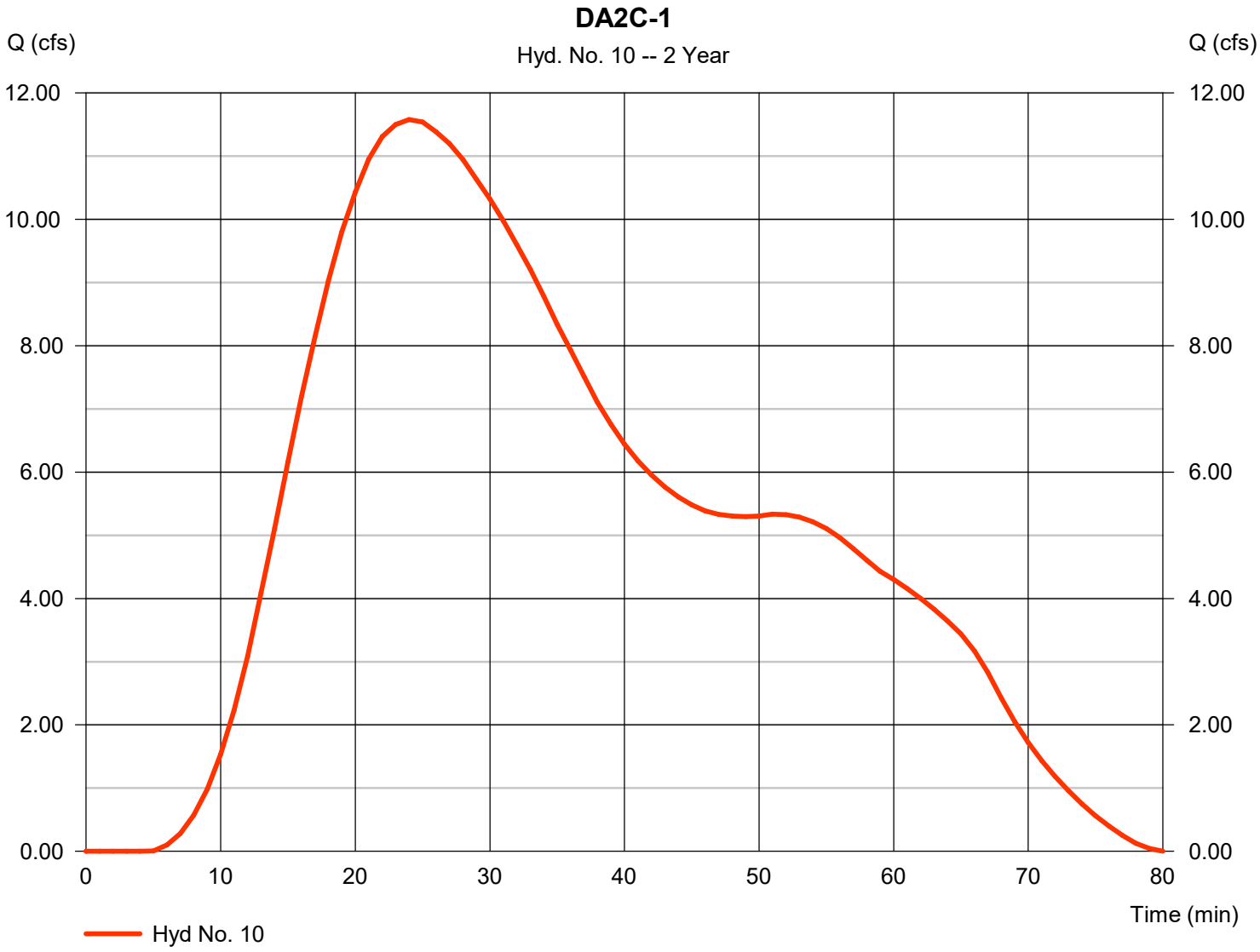
Hydrograph Report

Hyd. No. 10

DA2C-1

Hydrograph type	=	SCS Runoff	Peak discharge	=	11.58 cfs
Storm frequency	=	2 yrs	Time to peak	=	24 min
Time interval	=	1 min	Hyd. volume	=	24,222 cuft
Drainage area	=	15.680 ac	Curve number	=	85*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	11.90 min
Total precip.	=	1.47 in	Distribution	=	Huff-1st
Storm duration	=	1.00 hrs	Shape factor	=	484

* Composite (Area/CN) = [(4.880 x 90) + (2.170 x 75)] / 15.680

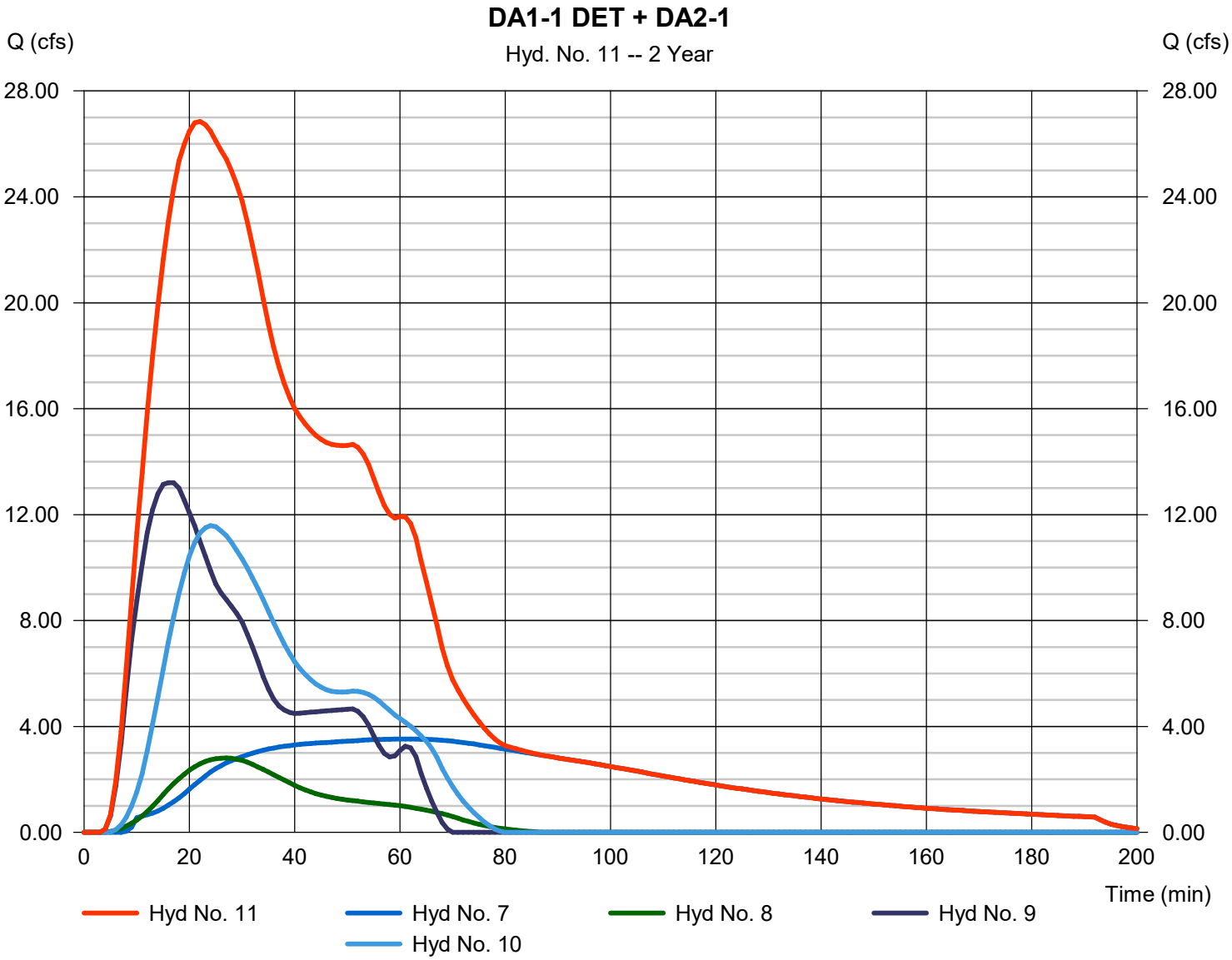


Hydrograph Report

Hyd. No. 11

DA1-1 DET + DA2-1

Hydrograph type	= Combine	Peak discharge	= 26.85 cfs
Storm frequency	= 2 yrs	Time to peak	= 22 min
Time interval	= 1 min	Hyd. volume	= 77,110 cuft
Inflow hyds.	= 7, 8, 9, 10	Contrib. drain. area	= 28.790 ac



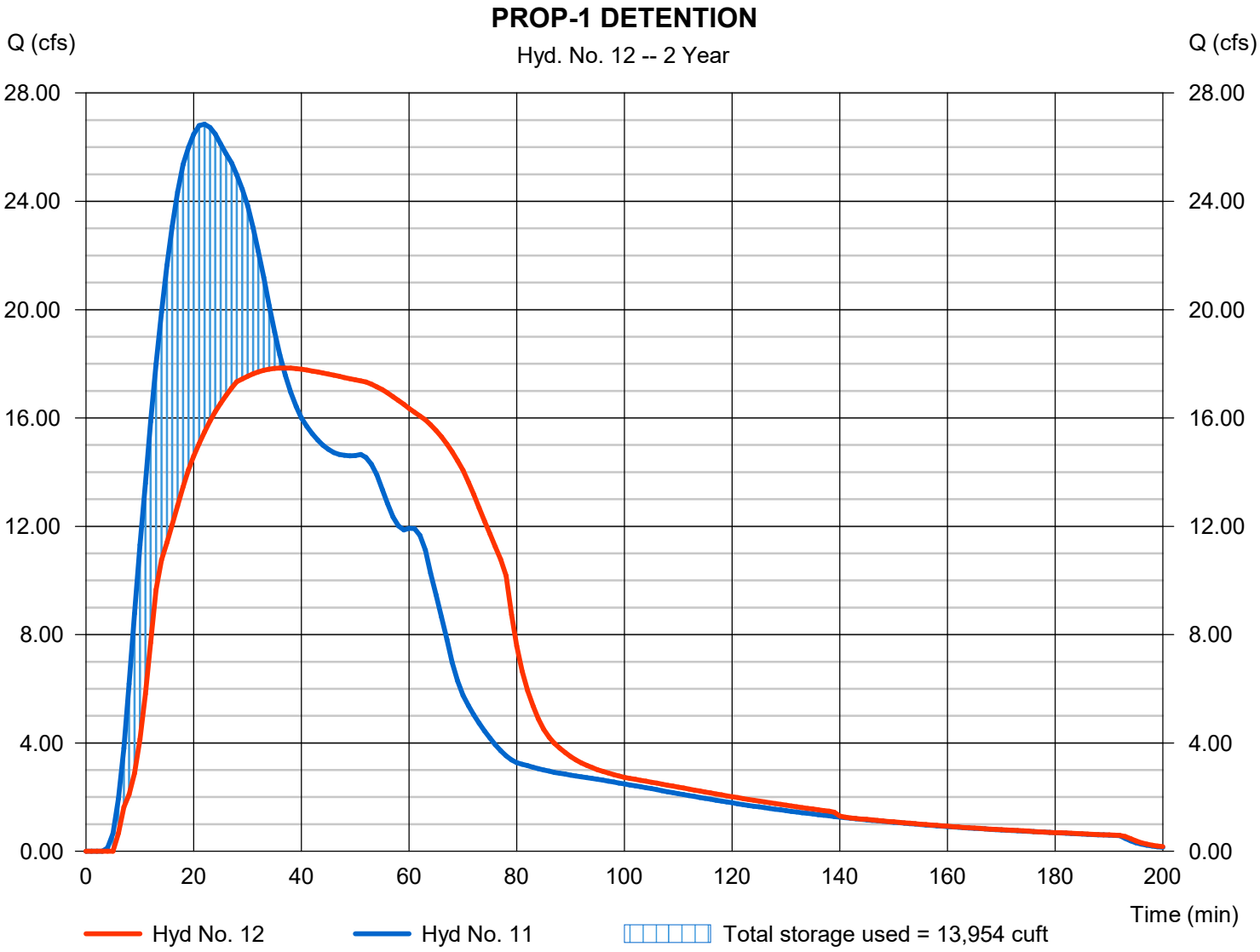
Hydrograph Report

Hyd. No. 12

PROP-1 DETENTION

Hydrograph type	=	Reservoir	Peak discharge	=	17.85 cfs
Storm frequency	=	2 yrs	Time to peak	=	37 min
Time interval	=	1 min	Hyd. volume	=	77,062 cuft
Inflow hyd. No.	=	11 - DA1-1 DET + DA2-1	Max. Elevation	=	1286.11 ft
Reservoir name	=	Phase 1	Max. Storage	=	13,954 cuft

Storage Indication method used.



Pond Report

Pond No. 3 - Phase 1

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 1283.45 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	1283.45	00	0	0
0.55	1284.00	650	119	119
1.55	1285.00	5,157	2,546	2,665
2.55	1286.00	13,875	9,163	11,828
3.55	1287.00	23,575	18,510	30,338
4.55	1288.00	33,464	28,373	58,710
5.55	1289.00	42,792	38,029	96,739
6.55	1290.00	50,595	46,634	143,374
7.55	1291.00	56,302	53,418	196,791
7.60	1291.05	56,448	2,816	199,607

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 24.00	24.00	0.00	0.00
Span (in)	= 24.00	24.00	0.00	0.00
No. Barrels	= 2	1	0	0
Invert El. (ft)	= 1283.35	1283.45	0.00	0.00
Length (ft)	= 153.83	0.00	0.00	0.00
Slope (%)	= 0.42	0.00	0.00	n/a
N-Value	= .012	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	Yes	No	No

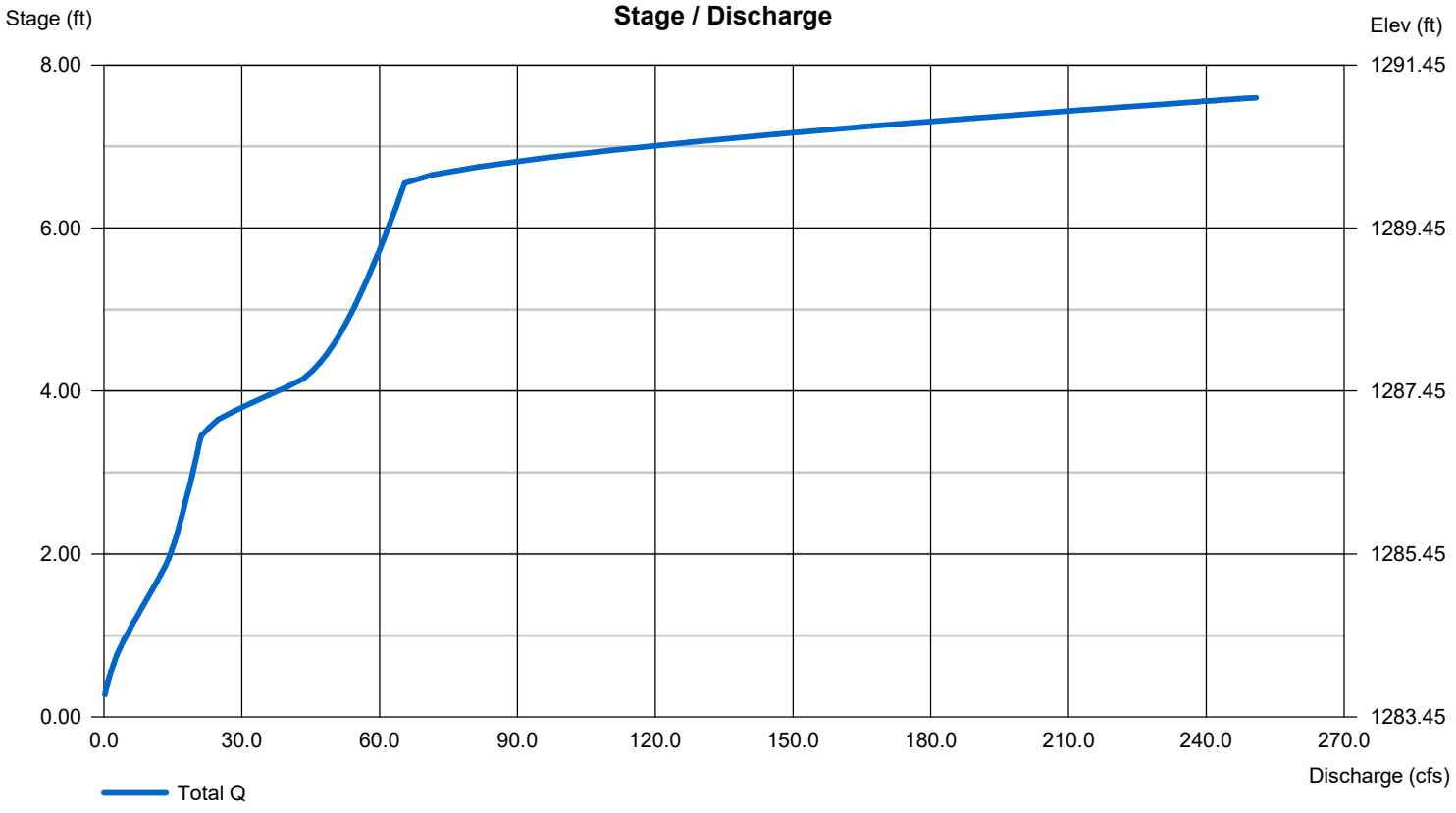
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 16.00	50.00	Inactive	0.00
Crest El. (ft)	= 1286.88	1290.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= Rect	Ciplti	---	---
Multi-Stage	= Yes	No	No	No

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

TW Elev. (ft) = 1283.70

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

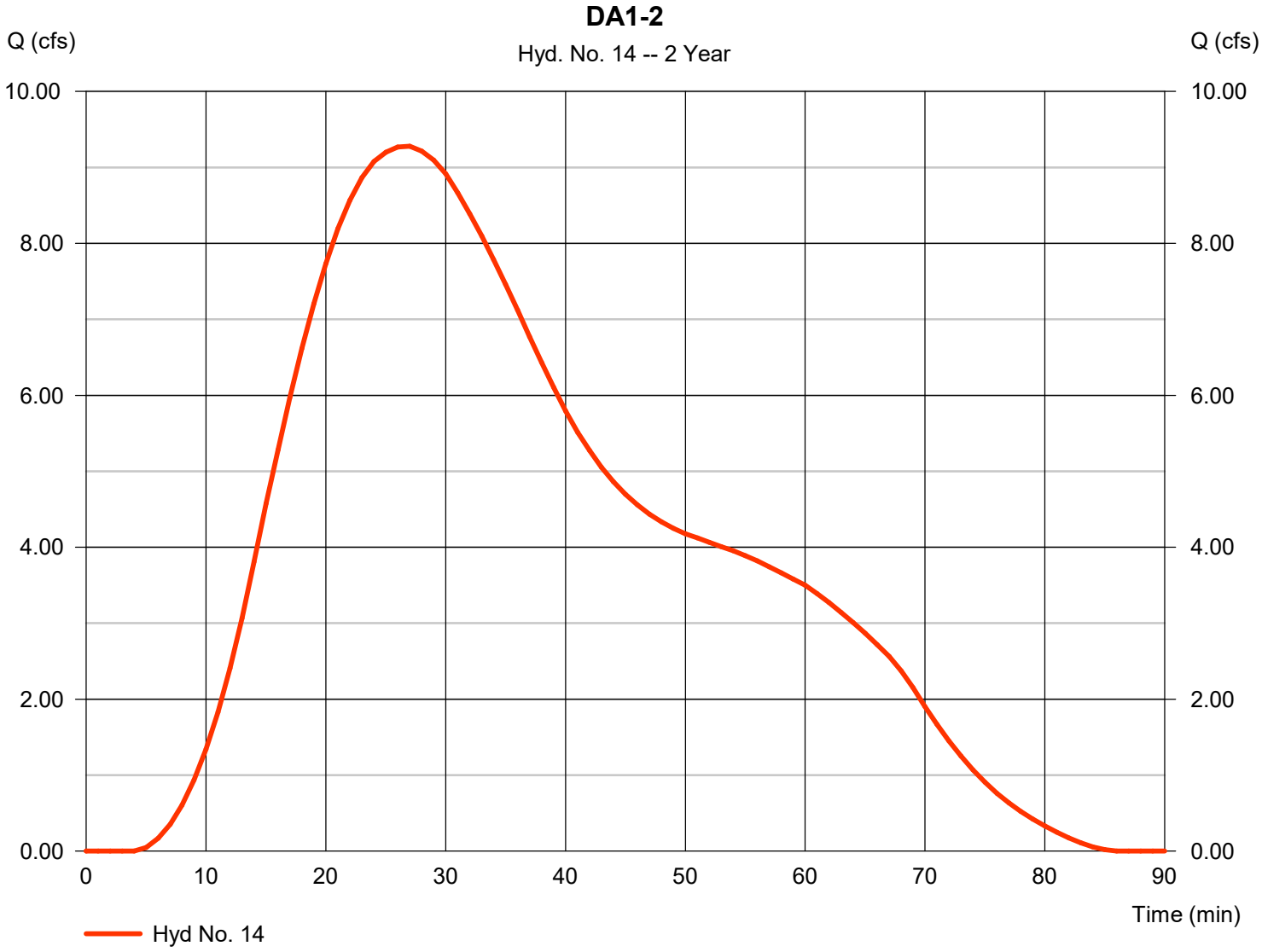


Hydrograph Report

Hyd. No. 14

DA1-2

Hydrograph type	=	SCS Runoff	Peak discharge	=	9.280 cfs
Storm frequency	=	2 yrs	Time to peak	=	27 min
Time interval	=	1 min	Hyd. volume	=	20,205 cuft
Drainage area	=	9.840 ac	Curve number	=	88
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	15.36 min
Total precip.	=	1.47 in	Distribution	=	Huff-1st
Storm duration	=	1.00 hrs	Shape factor	=	484



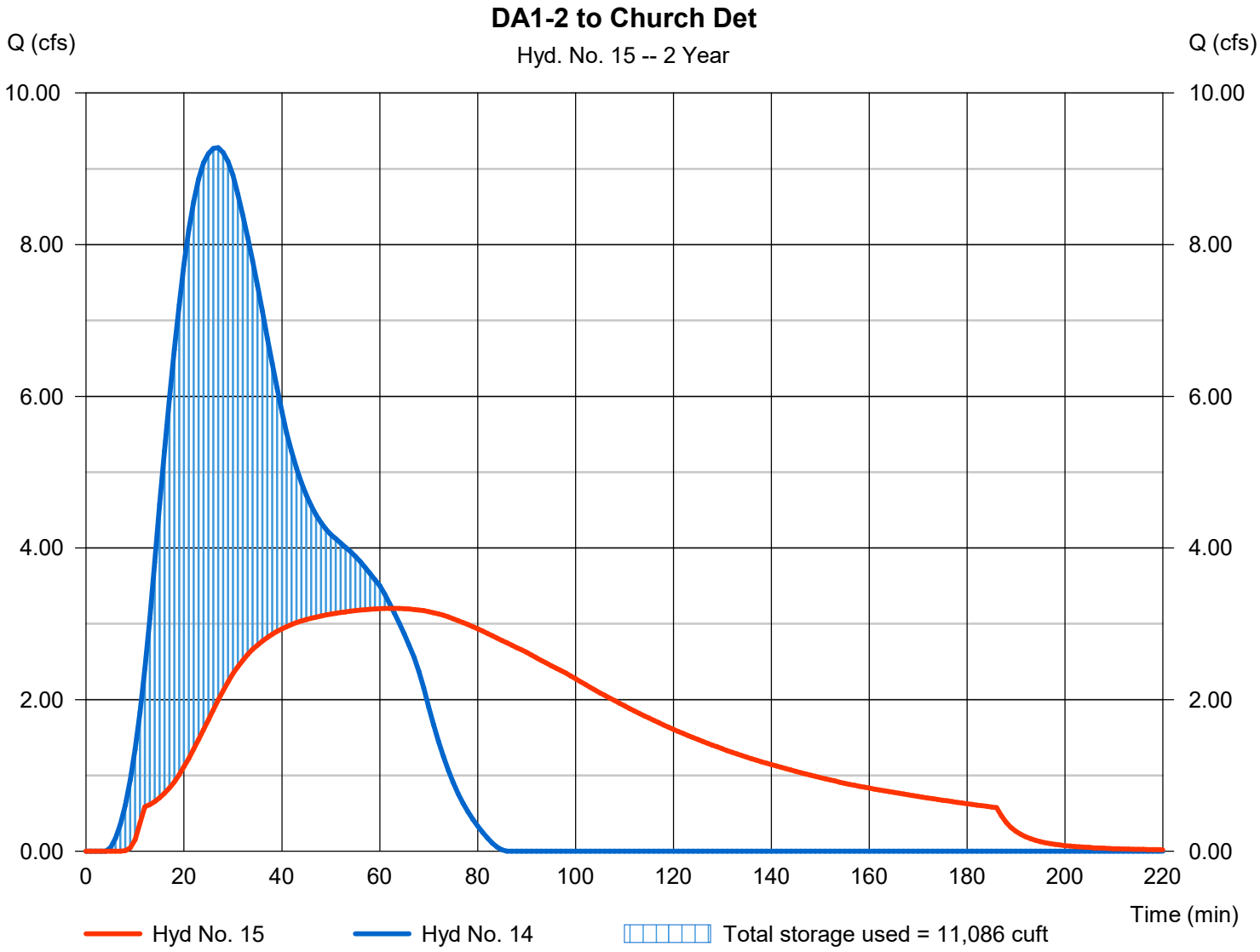
Hydrograph Report

Hyd. No. 15

DA1-2 to Church Det

Hydrograph type	=	Reservoir	Peak discharge	=	3.203 cfs
Storm frequency	=	2 yrs	Time to peak	=	63 min
Time interval	=	1 min	Hyd. volume	=	20,172 cuft
Inflow hyd. No.	=	14 - DA1-2	Max. Elevation	=	1293.84 ft
Reservoir name	=	Church Detention	Max. Storage	=	11,086 cuft

Storage Indication method used.



Pond Report

Pond No. 1 - Church Detention

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 1292.58 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	1292.58	00	0	0
0.42	1293.00	2,109	295	295
1.42	1294.00	28,716	12,868	13,163
1.97	1294.55	41,993	19,331	32,494
2.42	1295.00	52,471	21,204	53,698
3.42	1296.00	63,643	57,961	111,660

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 12.00	0.00	0.00	0.00
Span (in)	= 12.00	0.00	0.00	0.00
No. Barrels	= 1	0	0	0
Invert El. (ft)	= 1292.62	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

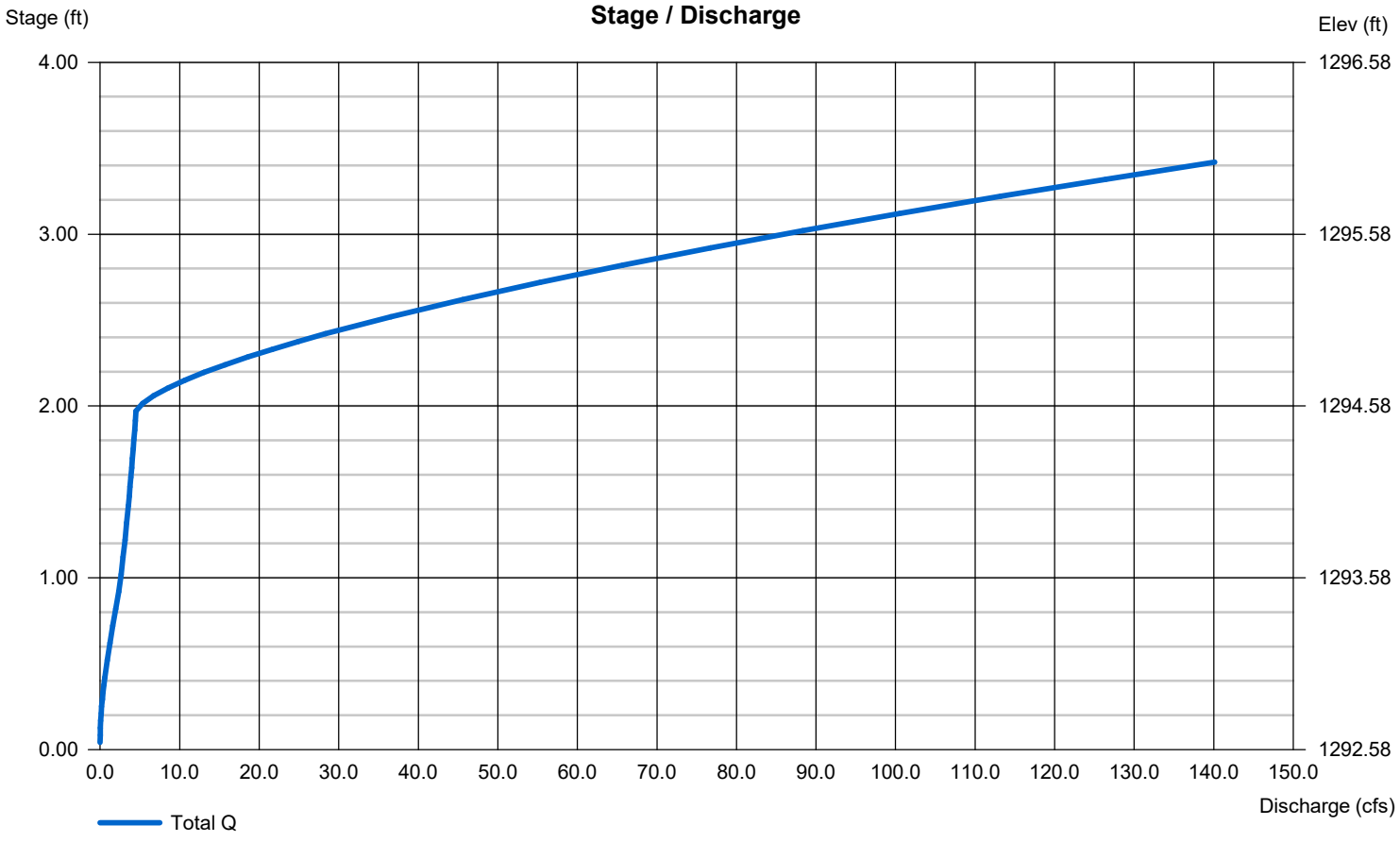
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 23.00	0.00	0.00	0.00
Crest El. (ft)	= 1294.55	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= Ciplti	Rect	---	---
Multi-Stage	= No	No	No	No

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

TW Elev. (ft) = 0.00

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

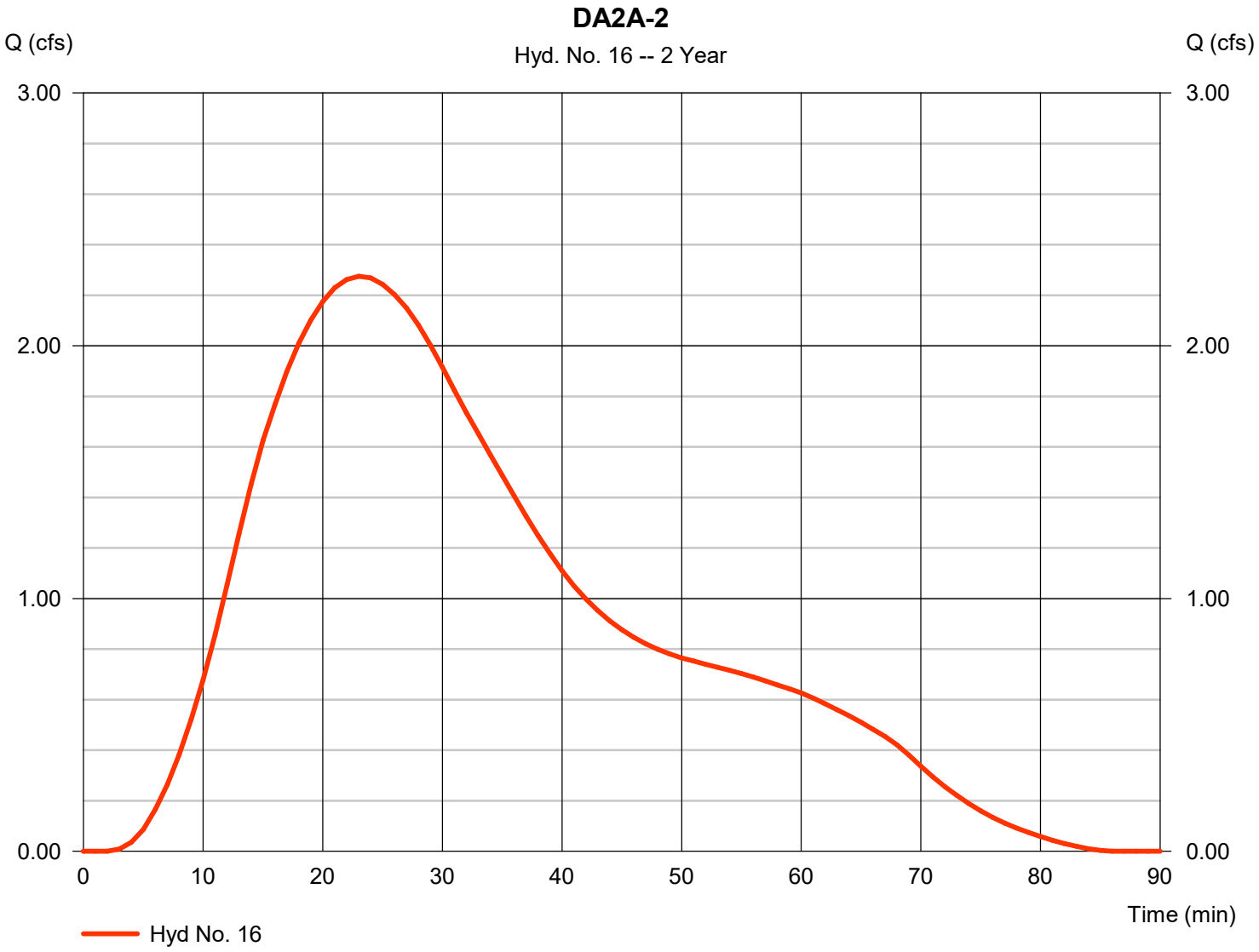


Hydrograph Report

Hyd. No. 16

DA2A-2

Hydrograph type	=	SCS Runoff	Peak discharge	=	2.275 cfs
Storm frequency	=	2 yrs	Time to peak	=	23 min
Time interval	=	1 min	Hyd. volume	=	4,608 cuft
Drainage area	=	1.380 ac	Curve number	=	94
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	16.00 min
Total precip.	=	1.47 in	Distribution	=	Huff-1st
Storm duration	=	1.00 hrs	Shape factor	=	484

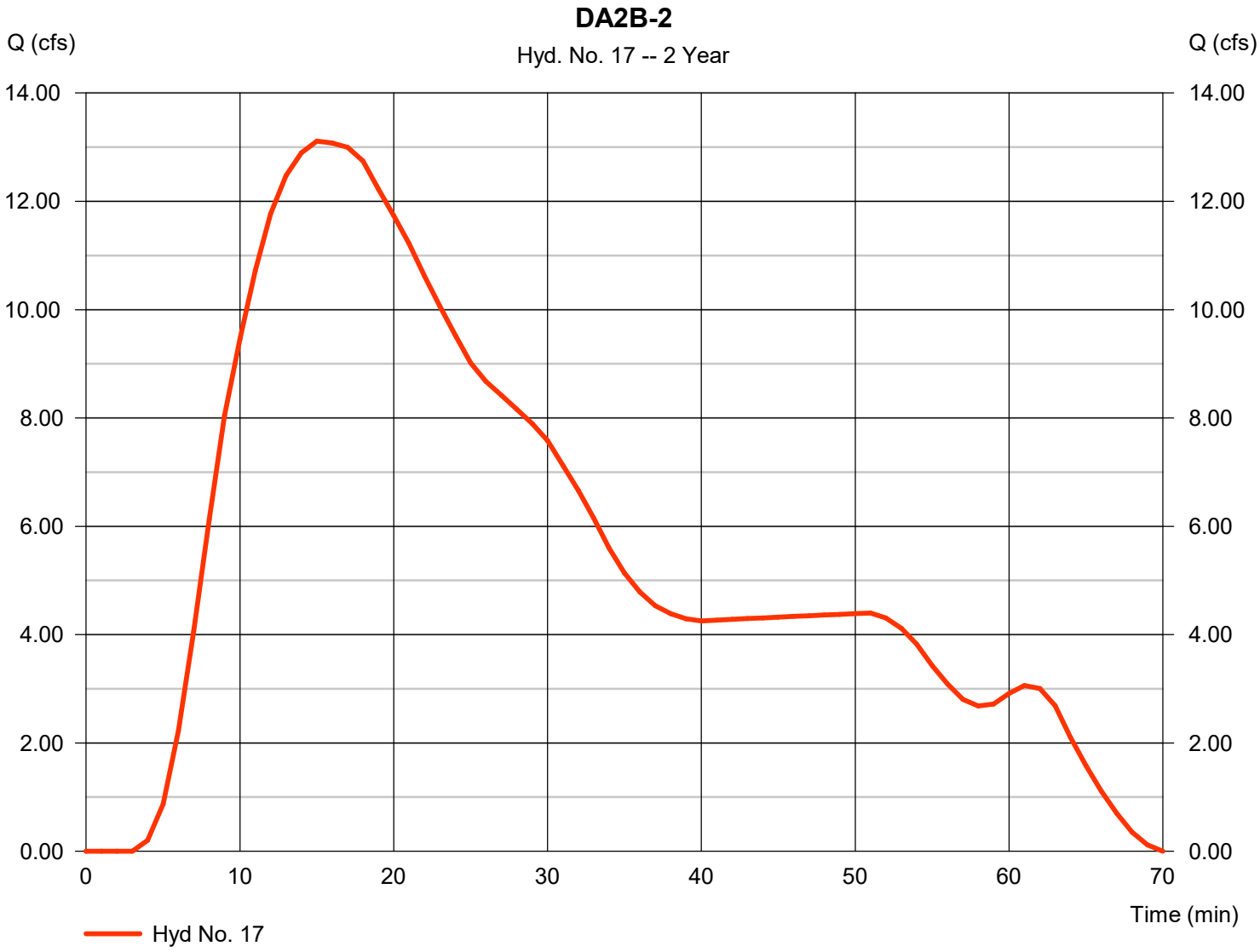


Hydrograph Report

Hyd. No. 17

DA2B-2

Hydrograph type	=	SCS Runoff	Peak discharge	=	13.11 cfs
Storm frequency	=	2 yrs	Time to peak	=	15 min
Time interval	=	1 min	Hyd. volume	=	23,467 cuft
Drainage area	=	9.500 ac	Curve number	=	90
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	1.47 in	Distribution	=	Huff-1st
Storm duration	=	1.00 hrs	Shape factor	=	484

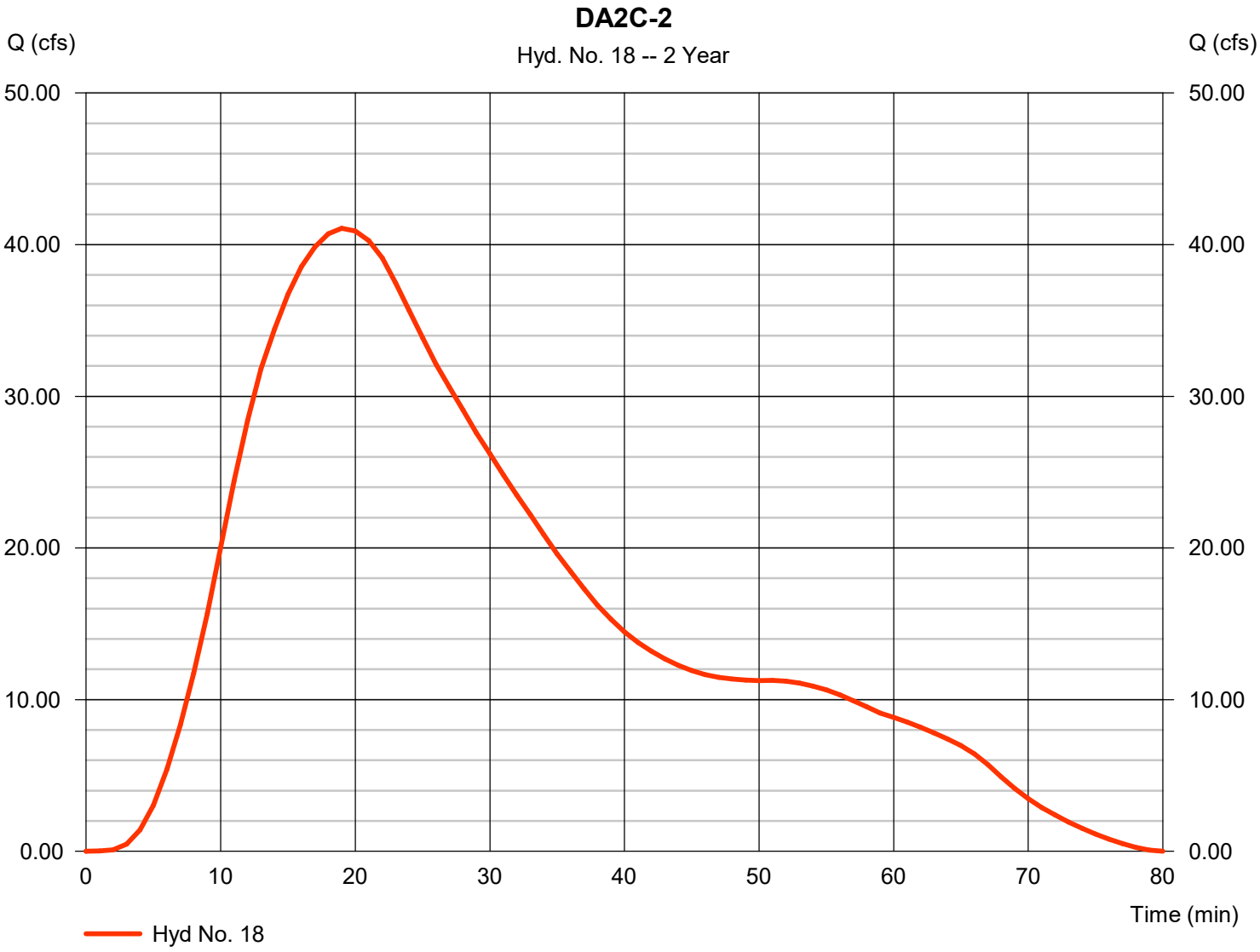


Hydrograph Report

Hyd. No. 18

DA2C-2

Hydrograph type	=	SCS Runoff	Peak discharge	=	41.08 cfs
Storm frequency	=	2 yrs	Time to peak	=	19 min
Time interval	=	1 min	Hyd. volume	=	74,786 cuft
Drainage area	=	21.250 ac	Curve number	=	95
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	11.90 min
Total precip.	=	1.47 in	Distribution	=	Huff-1st
Storm duration	=	1.00 hrs	Shape factor	=	484

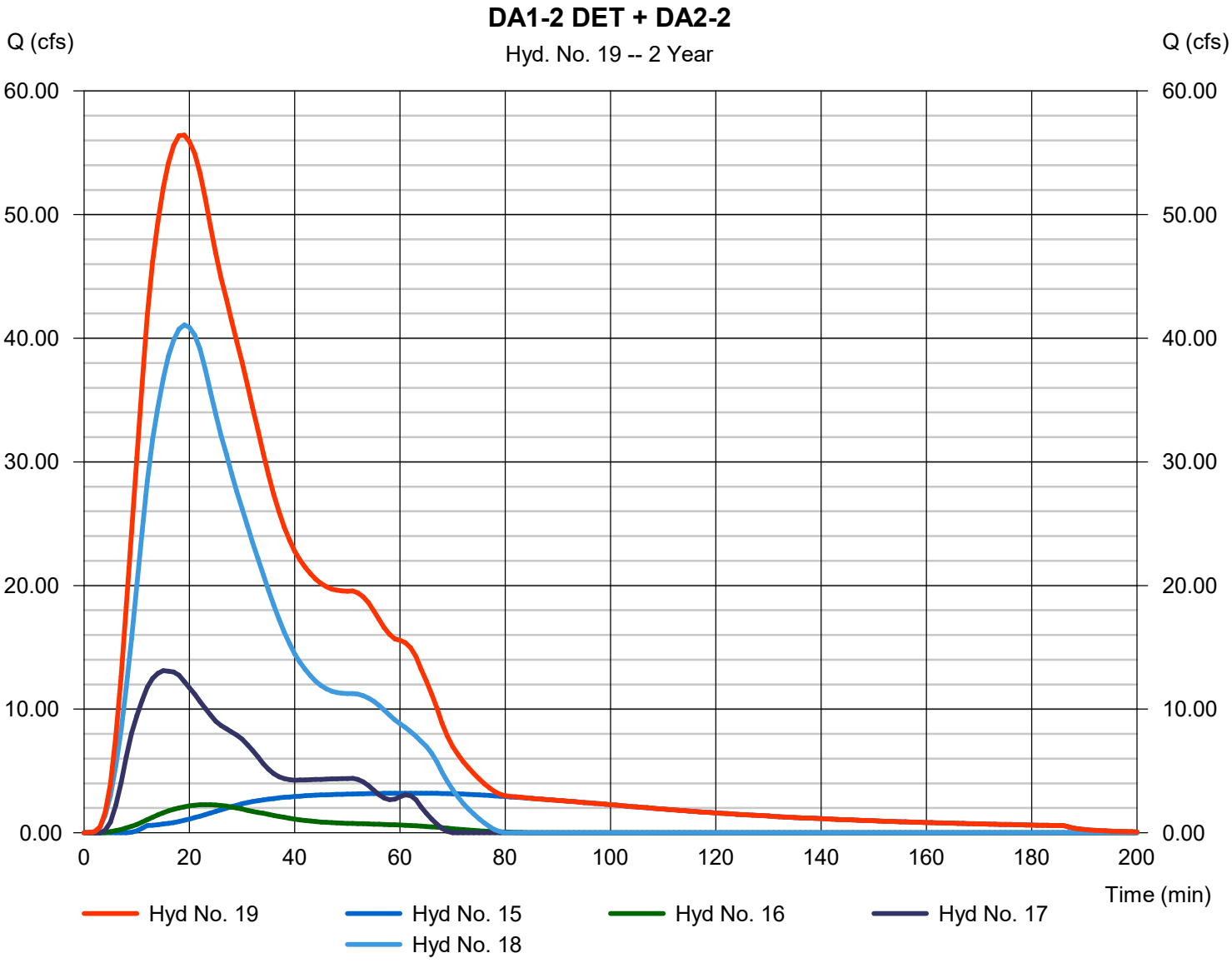


Hydrograph Report

Hyd. No. 19

DA1-2 DET + DA2-2

Hydrograph type	=	Combine	Peak discharge	=	56.42 cfs
Storm frequency	=	2 yrs	Time to peak	=	19 min
Time interval	=	1 min	Hyd. volume	=	123,033 cuft
Inflow hyds.	=	15, 16, 17, 18	Contrib. drain. area	=	32.130 ac



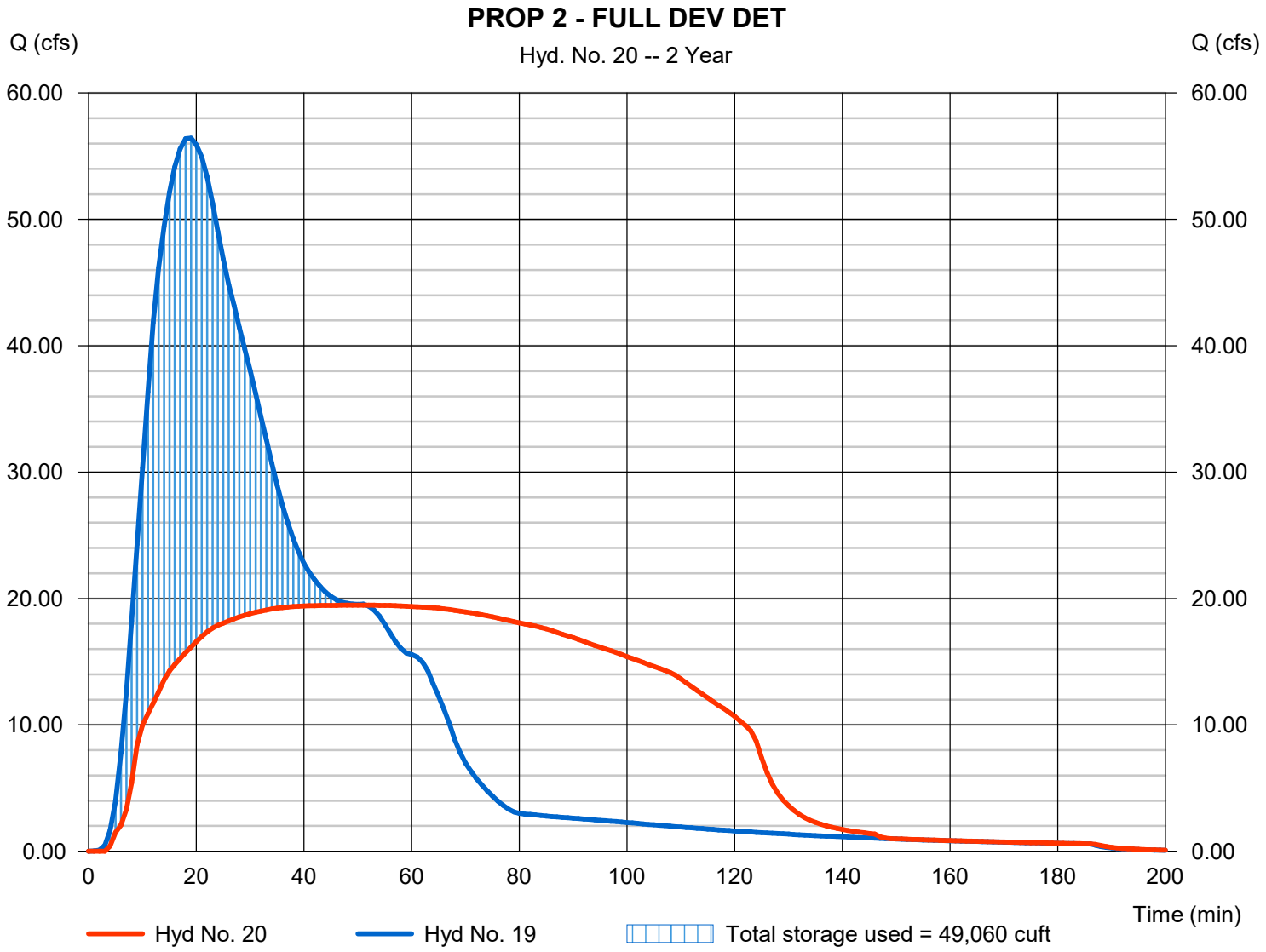
Hydrograph Report

Hyd. No. 20

PROP 2 - FULL DEV DET

Hydrograph type	=	Reservoir	Peak discharge	=	19.47 cfs
Storm frequency	=	2 yrs	Time to peak	=	52 min
Time interval	=	1 min	Hyd. volume	=	122,986 cuft
Inflow hyd. No.	=	19 - DA1-2 DET + DA2-2	Max. Elevation	=	1287.66 ft
Reservoir name	=	Phase 2	Max. Storage	=	49,060 cuft

Storage Indication method used.



Pond Report

Pond No. 2 - Phase 2

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 1283.45 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	1283.45	00	0	0
0.55	1284.00	650	119	119
1.55	1285.00	5,157	2,546	2,665
2.55	1286.00	13,875	9,163	11,828
3.55	1287.00	23,575	18,510	30,338
4.55	1288.00	33,464	28,373	58,710
5.55	1289.00	42,792	38,029	96,739
6.55	1290.00	50,595	46,634	143,374
7.55	1291.00	56,302	53,418	196,791
7.60	1291.05	56,448	2,816	199,607

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 24.00	21.00	0.00	0.00
Span (in)	= 24.00	21.00	0.00	0.00
No. Barrels	= 2	1	0	0
Invert El. (ft)	= 1283.35	1283.45	0.00	0.00
Length (ft)	= 153.83	0.00	0.00	0.00
Slope (%)	= 0.42	0.00	0.00	n/a
N-Value	= .012	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	Yes	No	No

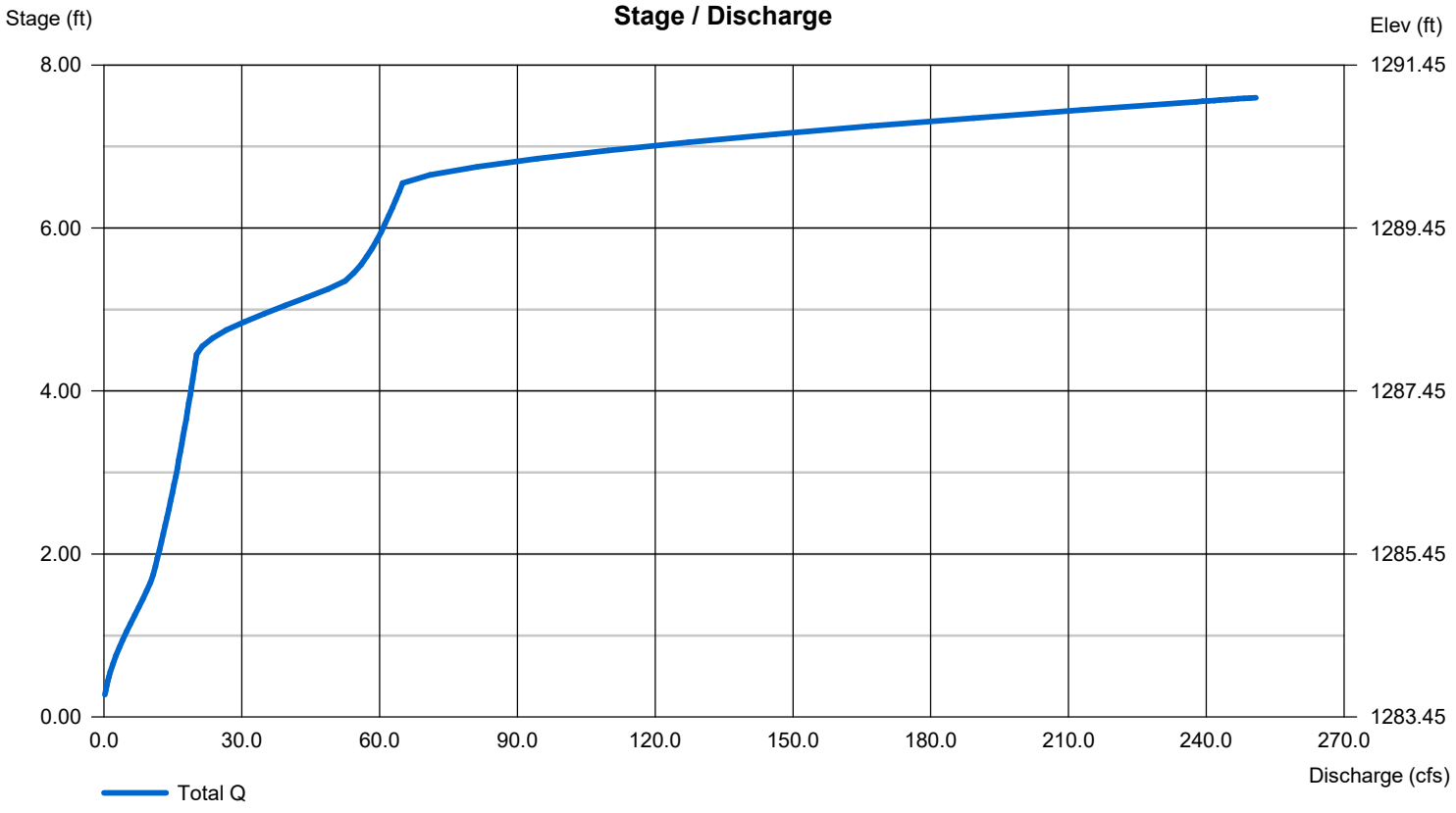
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 16.00	50.00	Inactive	0.00
Crest El. (ft)	= 1287.92	1290.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= Rect	Ciplti	Rect	---
Multi-Stage	= Yes	No	No	No

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

TW Elev. (ft) = 1283.70

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



Hydraflow Table of Contents

Extreme_Nixa-Detention.gpw

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

Friday, 11 / 22 / 2024

Hydrograph Summary Report

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

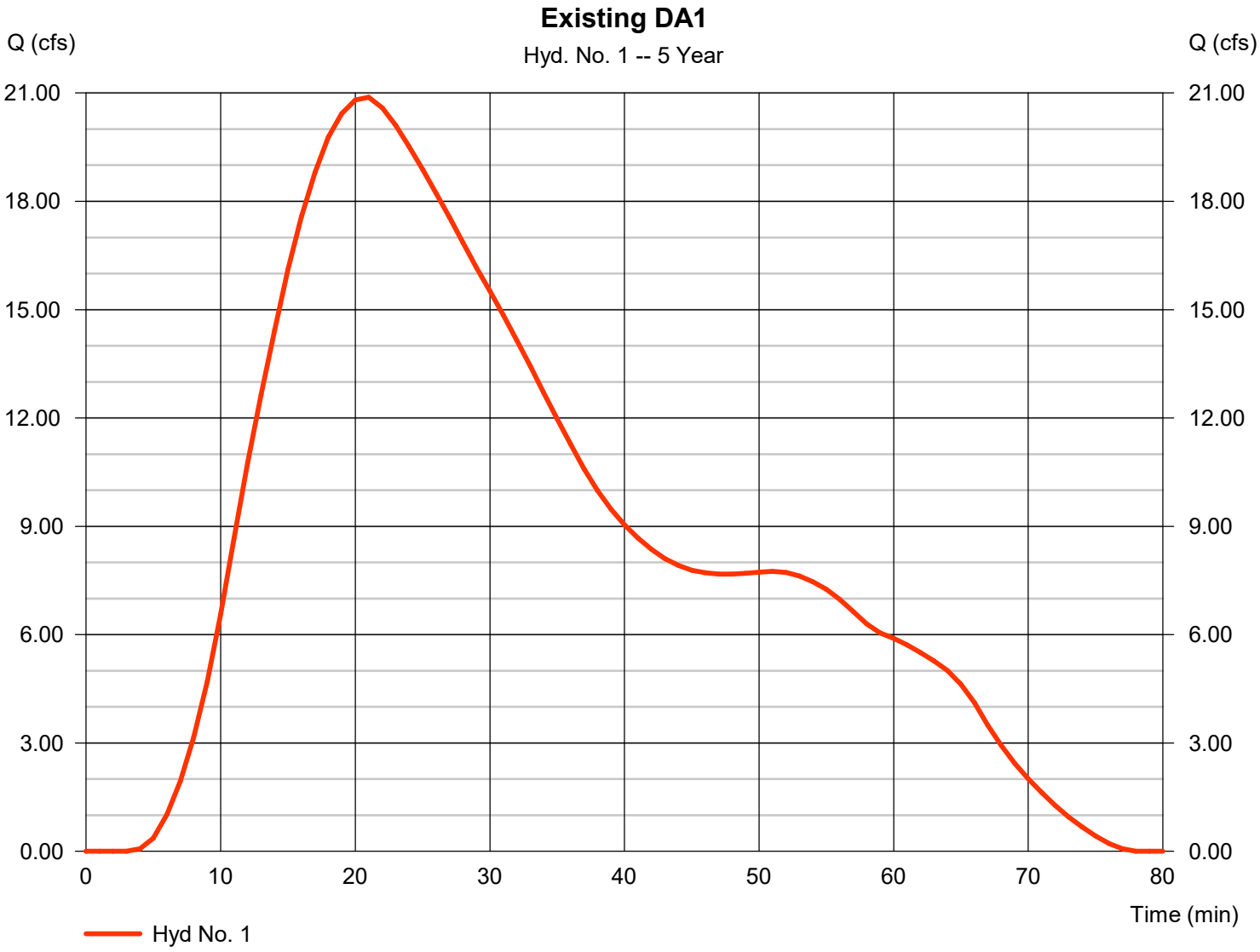
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	20.88	1	21	40,495	------	------	------	Existing DA1
2	Reservoir	4.282	1	66	40,462	1	1294.40	27,306	Exist DA1 - Church Det
3	SCS Runoff	28.70	1	25	61,265	------	------	------	Existing DA2
4	Combine	32.33	1	26	101,727	2, 3	------	------	Pre
6	SCS Runoff	17.23	1	21	33,408	------	------	------	DA1-1
7	Reservoir	3.986	1	64	33,375	6	1294.23	21,290	DA1-1 to Church Det
8	SCS Runoff	4.008	1	26	8,597	------	------	------	DA2A-1
9	SCS Runoff	19.25	1	15	33,998	------	------	------	DA2B-1
10	SCS Runoff	17.95	1	23	36,487	------	------	------	DA2C-1
11	Combine	40.05	1	21	112,457	7, 8, 9, 10	------	------	DA1-1 DET + DA2-1
12	Reservoir	21.04	1	41	112,350	11	1286.87	27,902	PROP-1 DETENTION
14	SCS Runoff	13.66	1	25	29,175	------	------	------	DA1-2
15	Reservoir	3.790	1	65	29,142	14	1294.12	17,547	DA1-2 to Church Det
16	SCS Runoff	3.074	1	23	6,139	------	------	------	DA2A-2
17	SCS Runoff	18.81	1	15	32,894	------	------	------	DA2B-2
18	SCS Runoff	54.81	1	19	98,191	------	------	------	DA2C-2
19	Combine	76.56	1	18	166,366	15, 16, 17, 18	------	------	DA1-2 DET + DA2-2
20	Reservoir	29.42	1	40	166,258	19	1288.27	68,983	PROP 2 - FULL DEV DET

Hydrograph Report

Hyd. No. 1

Existing DA1

Hydrograph type	=	SCS Runoff	Peak discharge	=	20.88 cfs
Storm frequency	=	5 yrs	Time to peak	=	21 min
Time interval	=	1 min	Hyd. volume	=	40,495 cuft
Drainage area	=	14.570 ac	Curve number	=	87
Basin Slope	=	2.0 %	Hydraulic length	=	2185 ft
Tc method	=	User	Time of conc. (Tc)	=	10.10 min
Total precip.	=	1.80 in	Distribution	=	Huff-1st
Storm duration	=	1.00 hrs	Shape factor	=	484



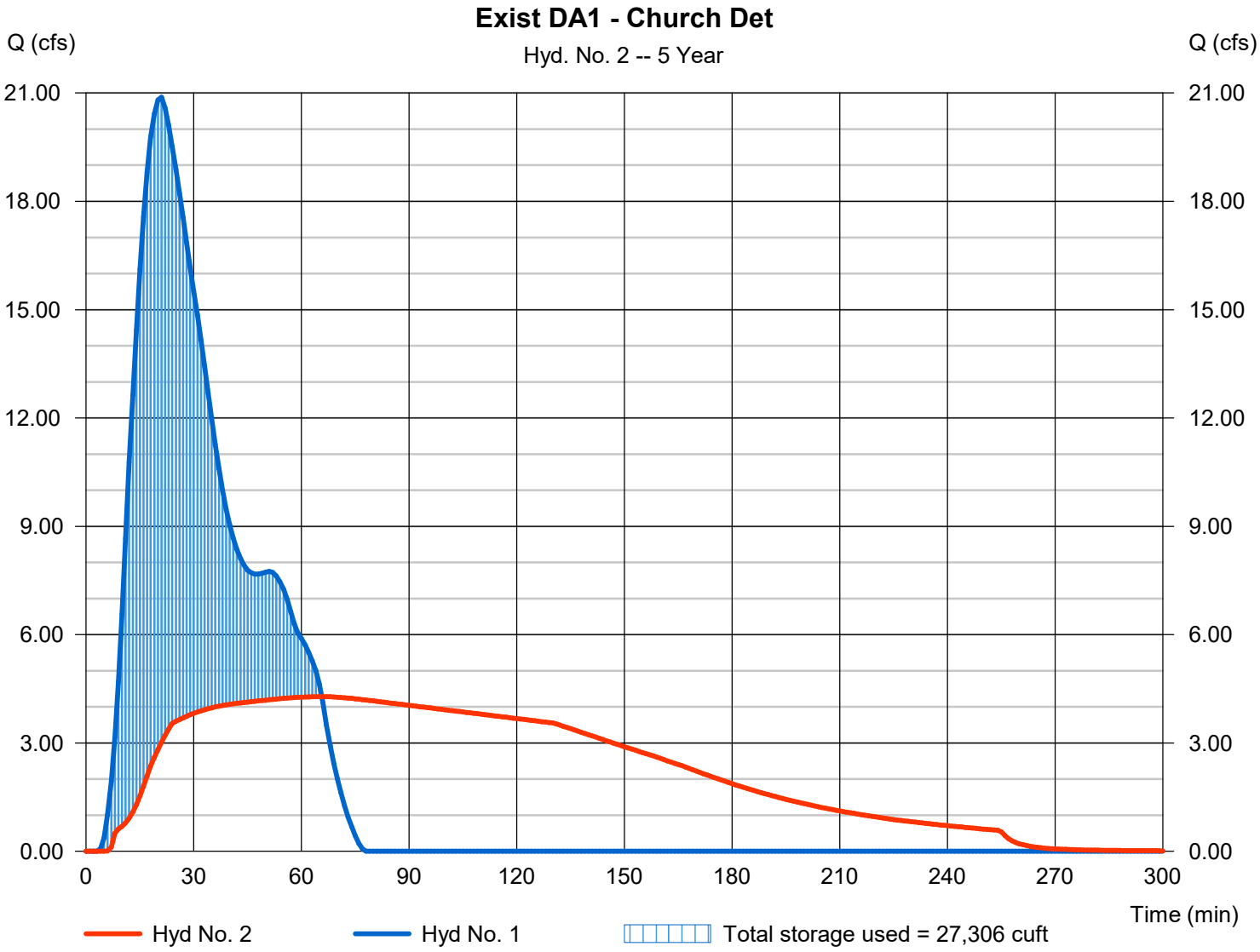
Hydrograph Report

Hyd. No. 2

Exist DA1 - Church Det

Hydrograph type	=	Reservoir	Peak discharge	=	4.282 cfs
Storm frequency	=	5 yrs	Time to peak	=	66 min
Time interval	=	1 min	Hyd. volume	=	40,462 cuft
Inflow hyd. No.	=	1 - Existing DA1	Max. Elevation	=	1294.40 ft
Reservoir name	=	Church Detention	Max. Storage	=	27,306 cuft

Storage Indication method used.



Pond Report

Pond No. 1 - Church Detention

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 1292.58 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	1292.58	00	0	0
0.42	1293.00	2,109	295	295
1.42	1294.00	28,716	12,868	13,163
1.97	1294.55	41,993	19,331	32,494
2.42	1295.00	52,471	21,204	53,698
3.42	1296.00	63,643	57,961	111,660

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 12.00	0.00	0.00	0.00
Span (in)	= 12.00	0.00	0.00	0.00
No. Barrels	= 1	0	0	0
Invert El. (ft)	= 1292.62	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

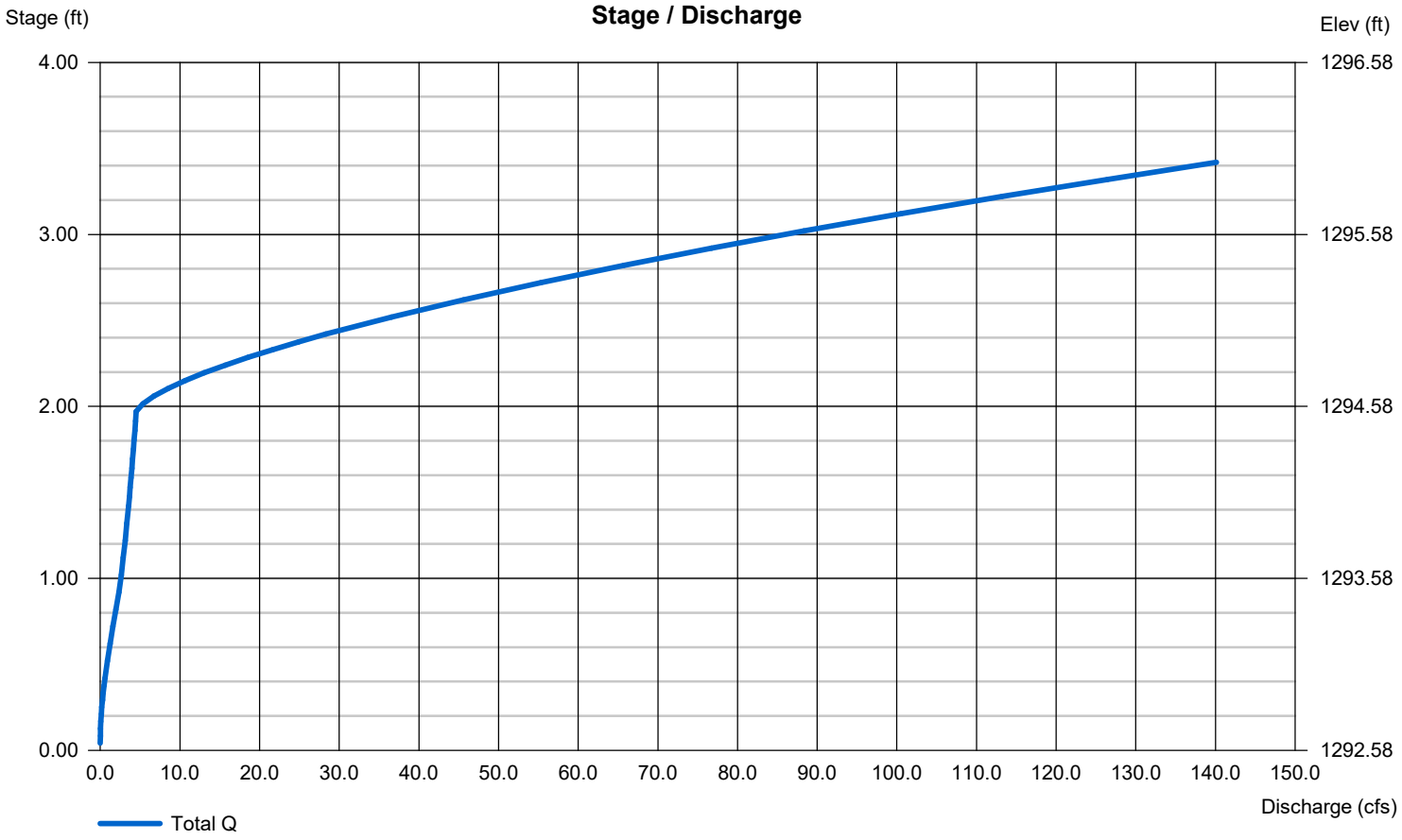
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 23.00	0.00	0.00	0.00
Crest El. (ft)	= 1294.55	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= Ciplti	Rect	---	---
Multi-Stage	= No	No	No	No

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

TW Elev. (ft) = 0.00

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

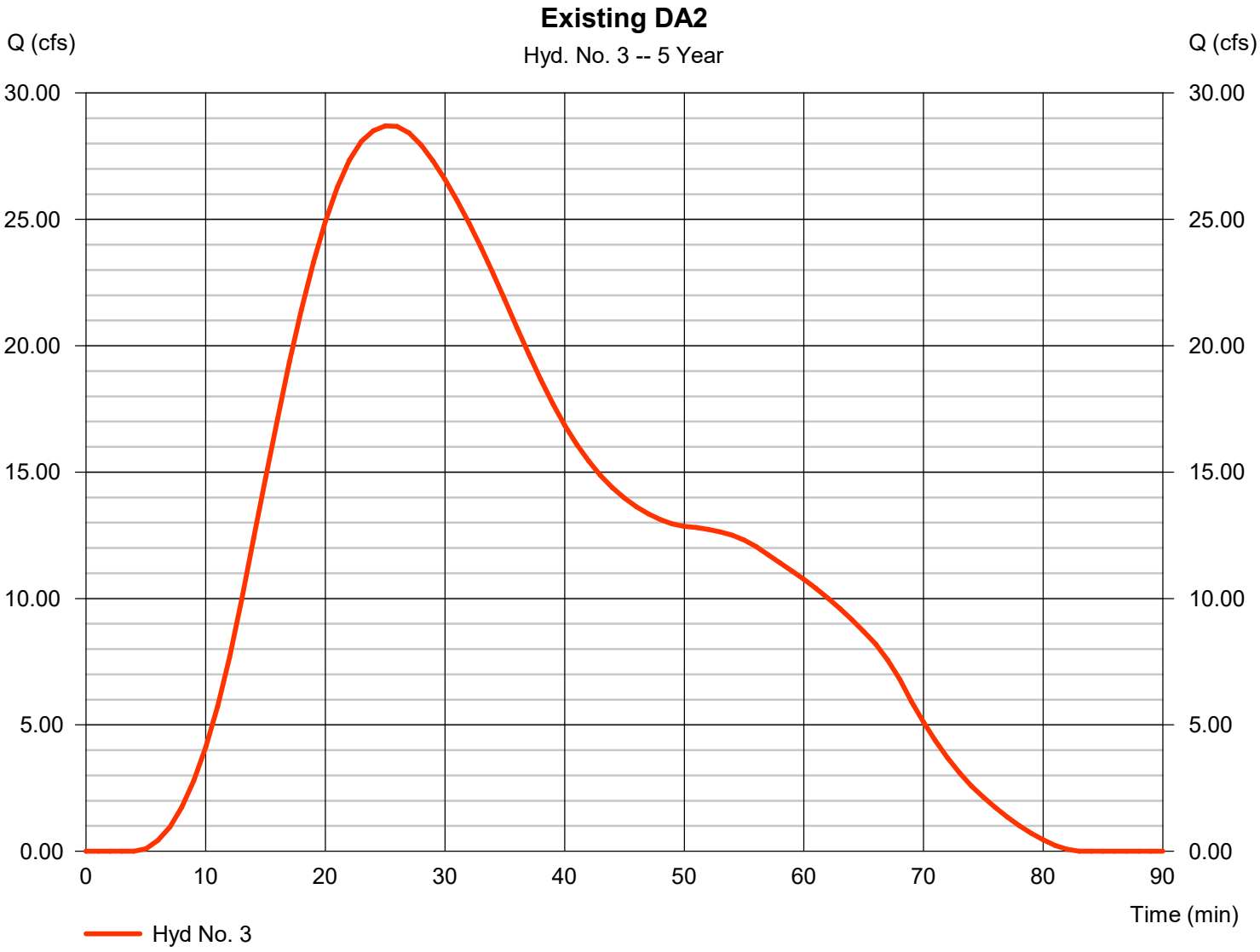


Hydrograph Report

Hyd. No. 3

Existing DA2

Hydrograph type	=	SCS Runoff	Peak discharge	=	28.70 cfs
Storm frequency	=	5 yrs	Time to peak	=	25 min
Time interval	=	1 min	Hyd. volume	=	61,265 cuft
Drainage area	=	27.860 ac	Curve number	=	84
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	13.90 min
Total precip.	=	1.80 in	Distribution	=	Huff-1st
Storm duration	=	1.00 hrs	Shape factor	=	484

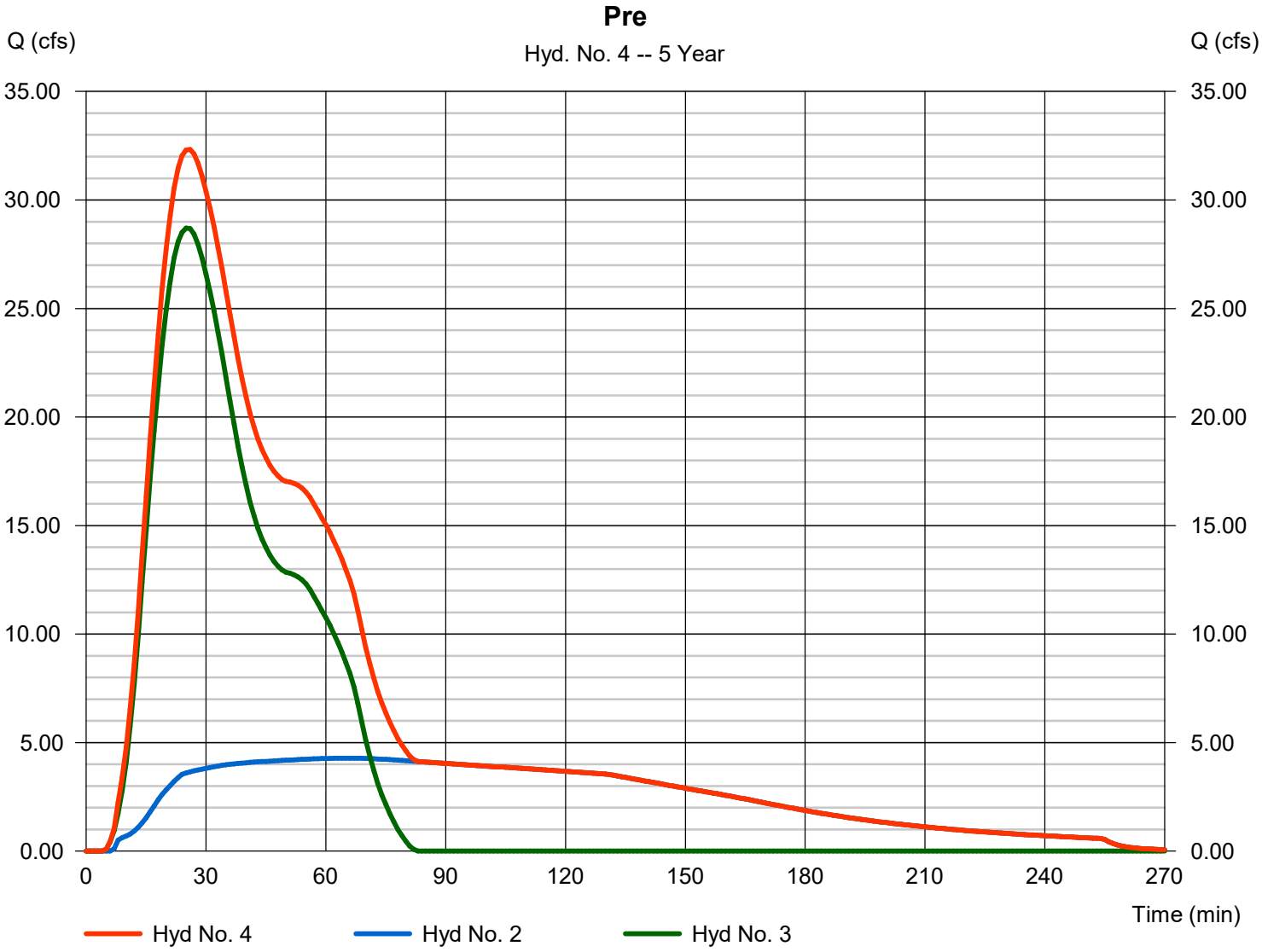


Hydrograph Report

Hyd. No. 4

Pre

Hydrograph type	=	Combine	Peak discharge	=	32.33 cfs
Storm frequency	=	5 yrs	Time to peak	=	26 min
Time interval	=	1 min	Hyd. volume	=	101,727 cuft
Inflow hyds.	=	2, 3	Contrib. drain. area	=	27.860 ac



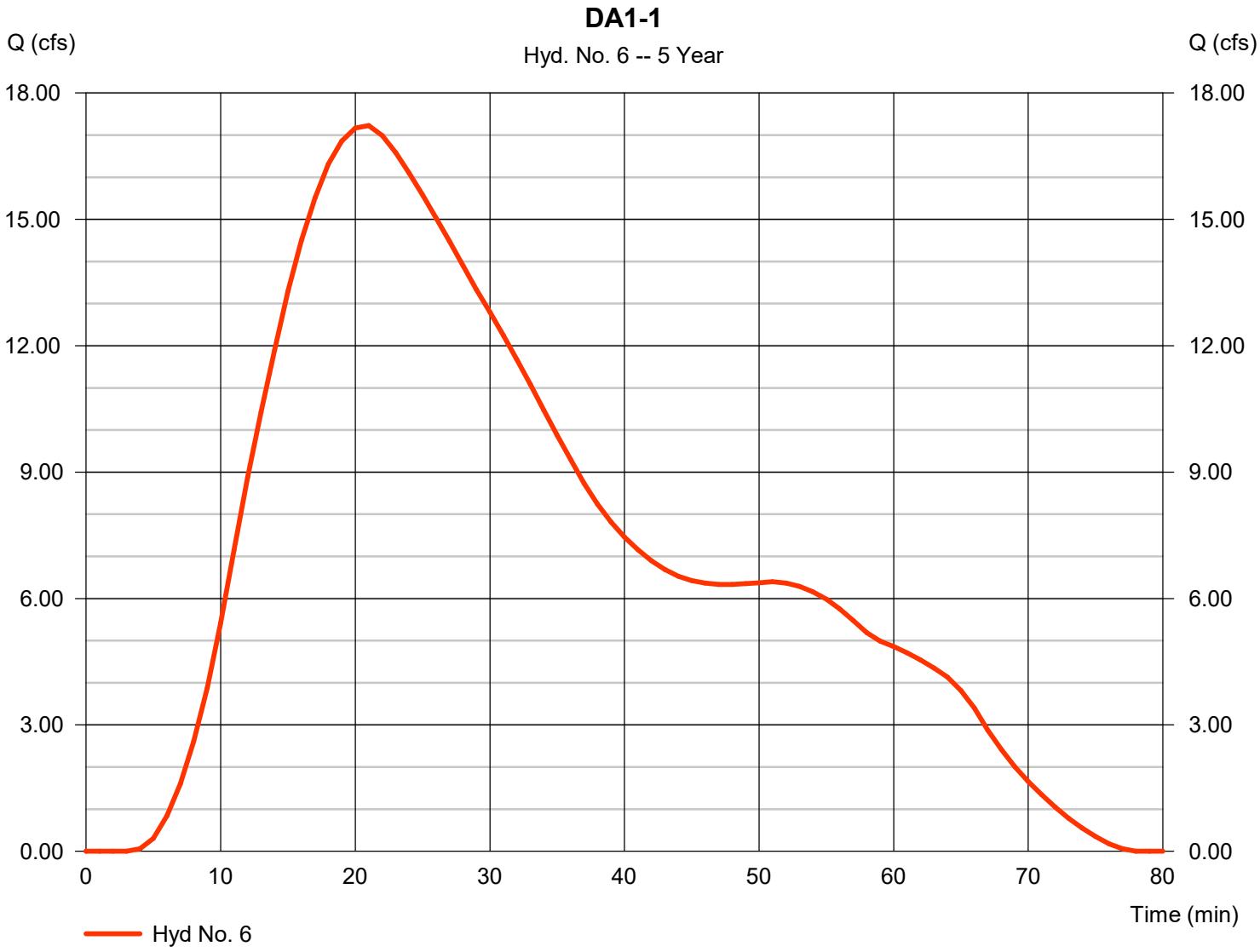
Hydrograph Report

Hyd. No. 6

DA1-1

Hydrograph type	=	SCS Runoff	Peak discharge	=	17.23 cfs
Storm frequency	=	5 yrs	Time to peak	=	21 min
Time interval	=	1 min	Hyd. volume	=	33,408 cuft
Drainage area	=	12.020 ac	Curve number	=	87*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	10.08 min
Total precip.	=	1.80 in	Distribution	=	Huff-1st
Storm duration	=	1.00 hrs	Shape factor	=	484

* Composite (Area/CN) = [(4.755 x 90) + (1.295 x 75)] / 12.020



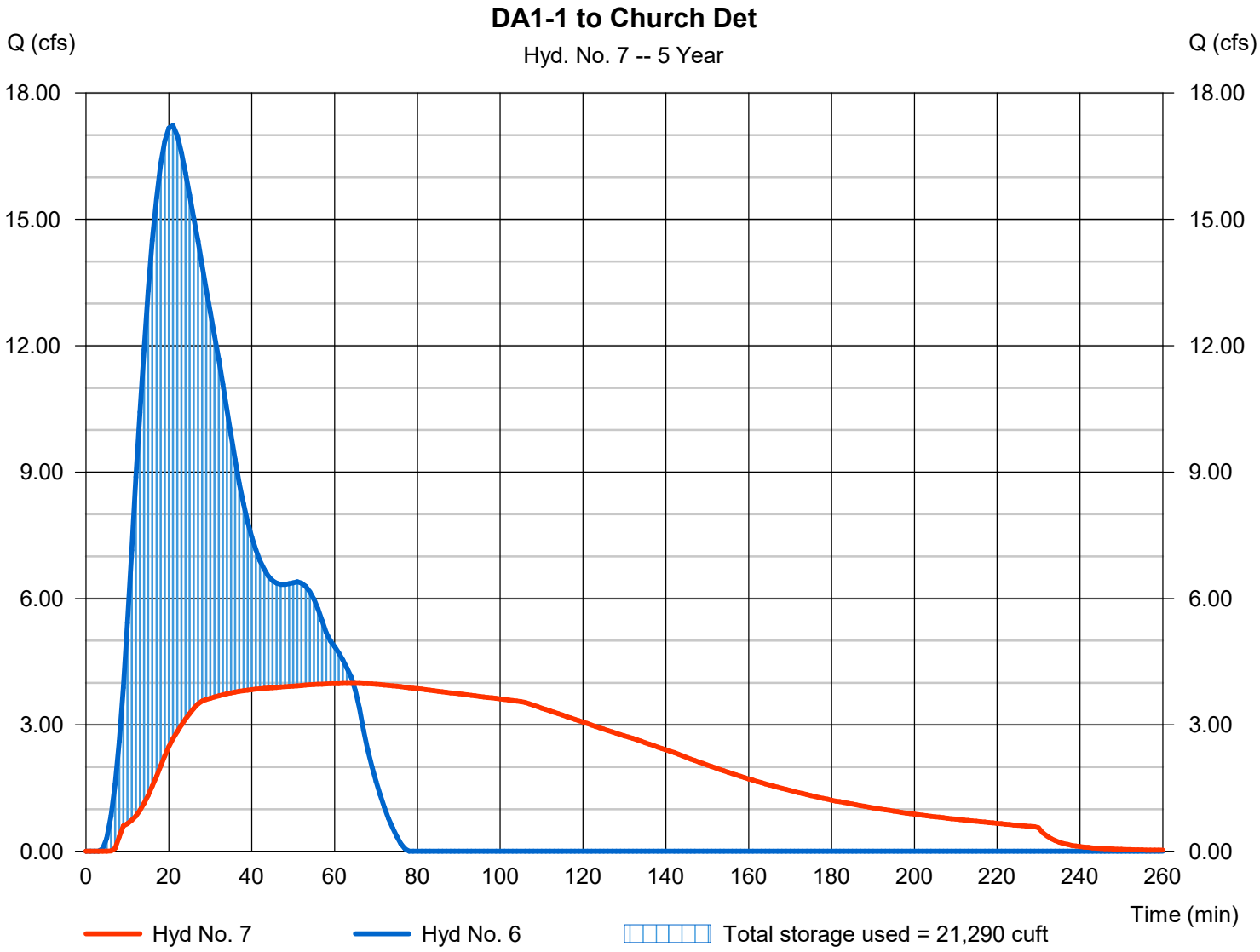
Hydrograph Report

Hyd. No. 7

DA1-1 to Church Det

Hydrograph type	=	Reservoir	Peak discharge	=	3.986 cfs
Storm frequency	=	5 yrs	Time to peak	=	64 min
Time interval	=	1 min	Hyd. volume	=	33,375 cuft
Inflow hyd. No.	=	6 - DA1-1	Max. Elevation	=	1294.23 ft
Reservoir name	=	Church Detention	Max. Storage	=	21,290 cuft

Storage Indication method used.



Pond Report

Pond No. 1 - Church Detention

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 1292.58 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	1292.58	00	0	0
0.42	1293.00	2,109	295	295
1.42	1294.00	28,716	12,868	13,163
1.97	1294.55	41,993	19,331	32,494
2.42	1295.00	52,471	21,204	53,698
3.42	1296.00	63,643	57,961	111,660

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 12.00	0.00	0.00	0.00
Span (in)	= 12.00	0.00	0.00	0.00
No. Barrels	= 1	0	0	0
Invert El. (ft)	= 1292.62	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

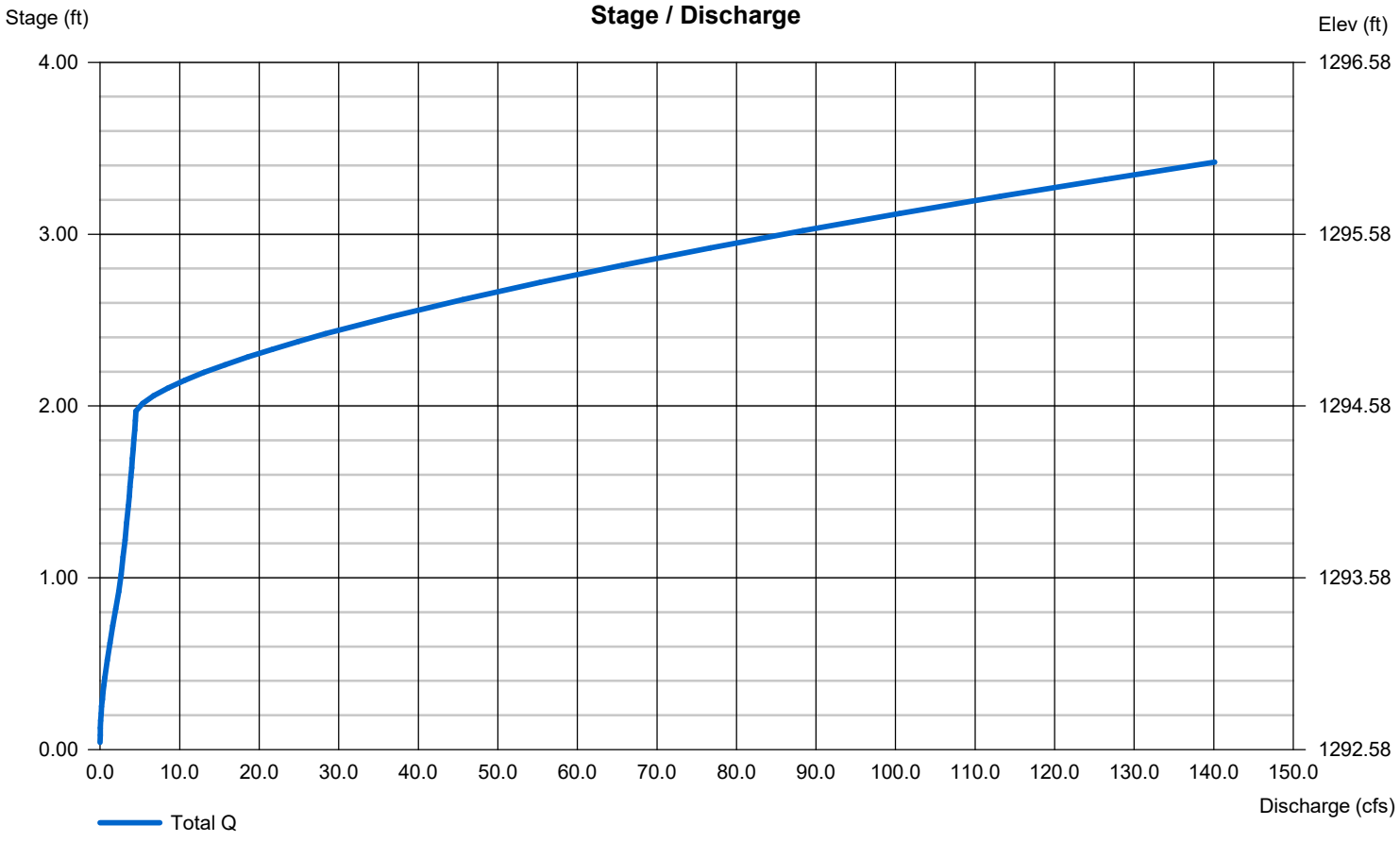
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 23.00	0.00	0.00	0.00
Crest El. (ft)	= 1294.55	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= Ciplti	Rect	---	---
Multi-Stage	= No	No	No	No

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

TW Elev. (ft) = 0.00

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



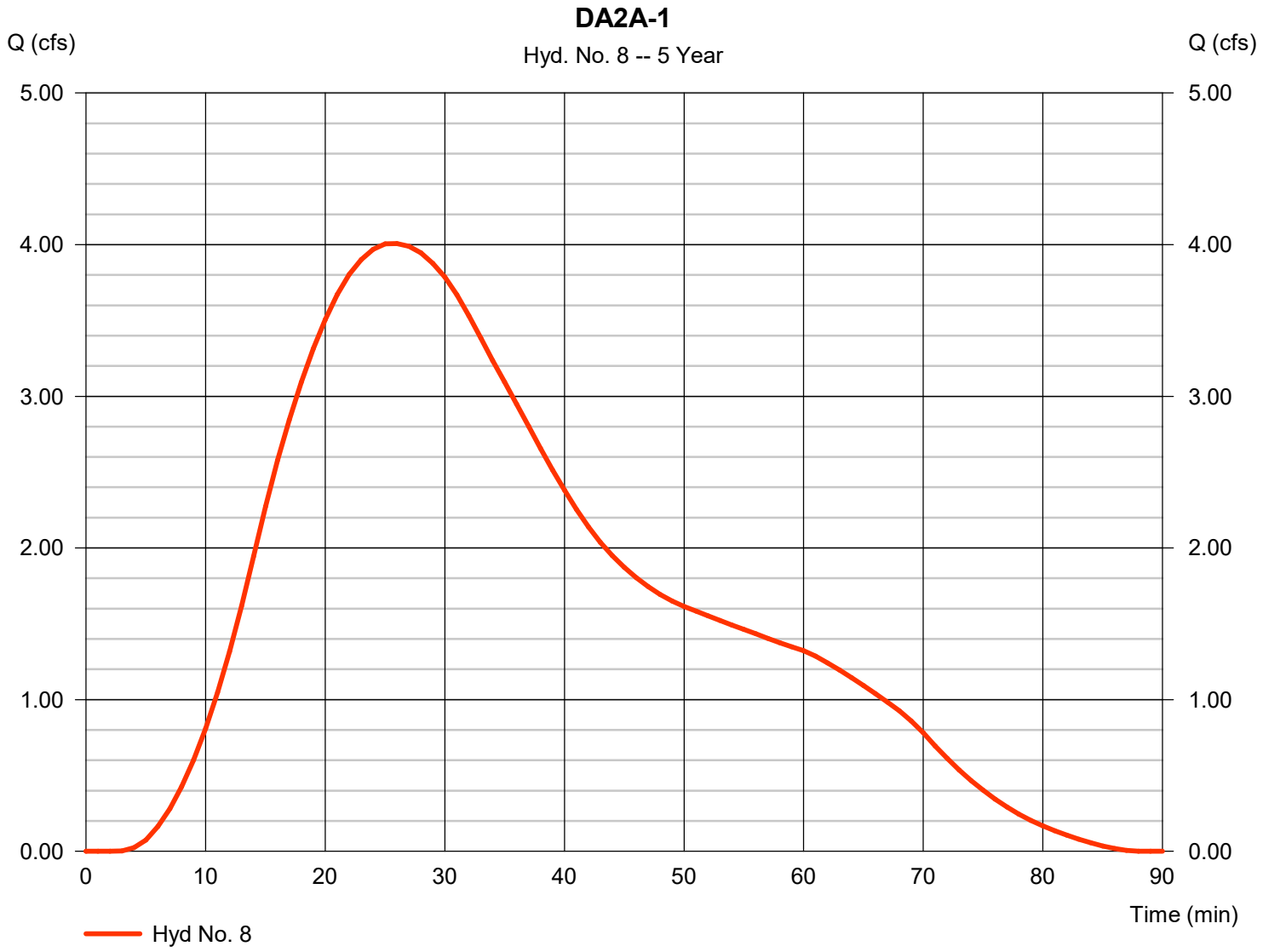
Hydrograph Report

Hyd. No. 8

DA2A-1

Hydrograph type	=	SCS Runoff	Peak discharge	=	4.008 cfs
Storm frequency	=	5 yrs	Time to peak	=	26 min
Time interval	=	1 min	Hyd. volume	=	8,597 cuft
Drainage area	=	2.590 ac	Curve number	=	90*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	18.10 min
Total precip.	=	1.80 in	Distribution	=	Huff-1st
Storm duration	=	1.00 hrs	Shape factor	=	484

* Composite (Area/CN) = [(4.880 x 90) + (2.170 x 75)] / 2.590



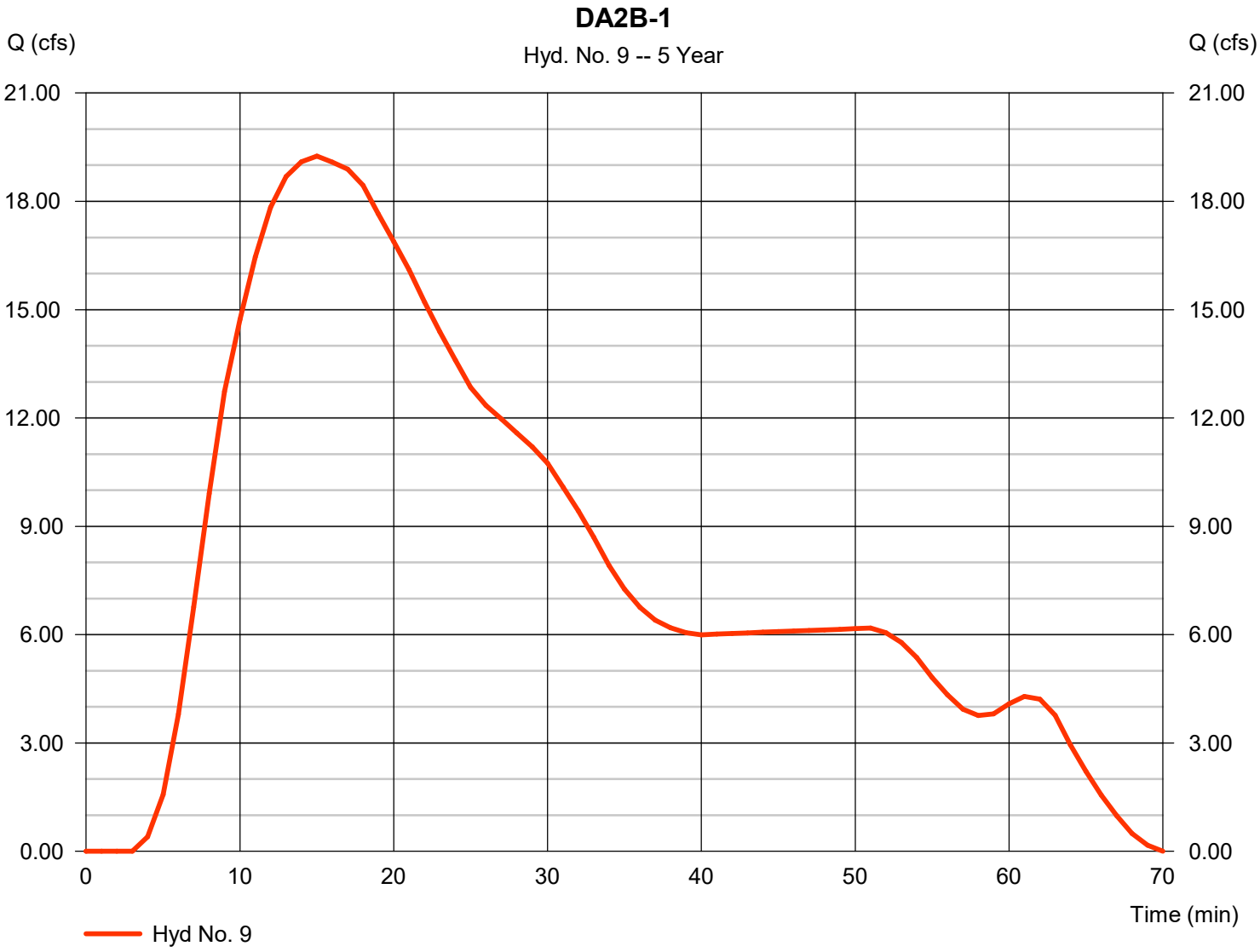
Hydrograph Report

Hyd. No. 9

DA2B-1

Hydrograph type	=	SCS Runoff	Peak discharge	=	19.25 cfs
Storm frequency	=	5 yrs	Time to peak	=	15 min
Time interval	=	1 min	Hyd. volume	=	33,998 cuft
Drainage area	=	10.520 ac	Curve number	=	89*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	1.80 in	Distribution	=	Huff-1st
Storm duration	=	1.00 hrs	Shape factor	=	484

* Composite (Area/CN) = [(4.880 x 90) + (2.170 x 75)] / 10.520



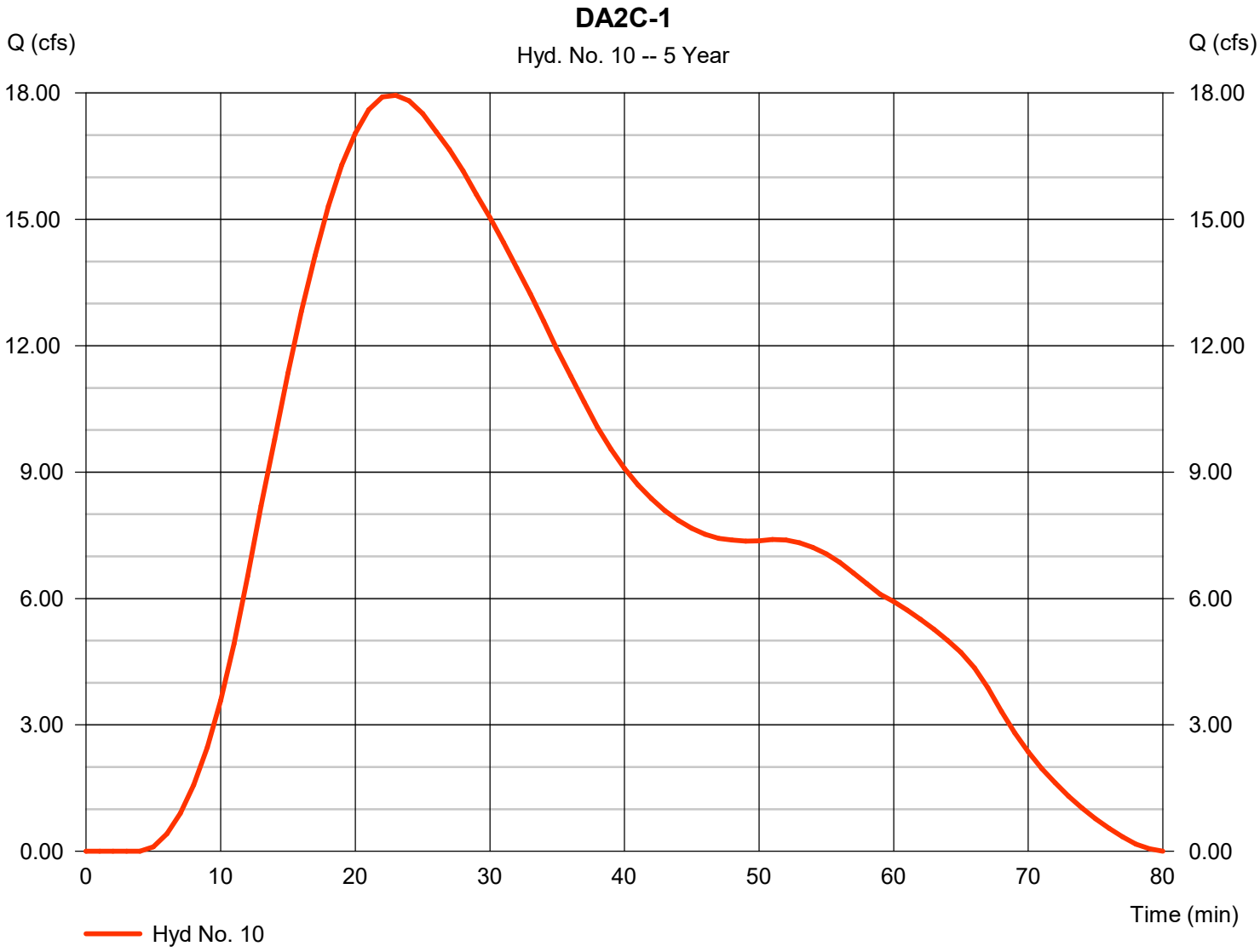
Hydrograph Report

Hyd. No. 10

DA2C-1

Hydrograph type	=	SCS Runoff	Peak discharge	=	17.95 cfs
Storm frequency	=	5 yrs	Time to peak	=	23 min
Time interval	=	1 min	Hyd. volume	=	36,487 cuft
Drainage area	=	15.680 ac	Curve number	=	85*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	11.90 min
Total precip.	=	1.80 in	Distribution	=	Huff-1st
Storm duration	=	1.00 hrs	Shape factor	=	484

* Composite (Area/CN) = [(4.880 x 90) + (2.170 x 75)] / 15.680

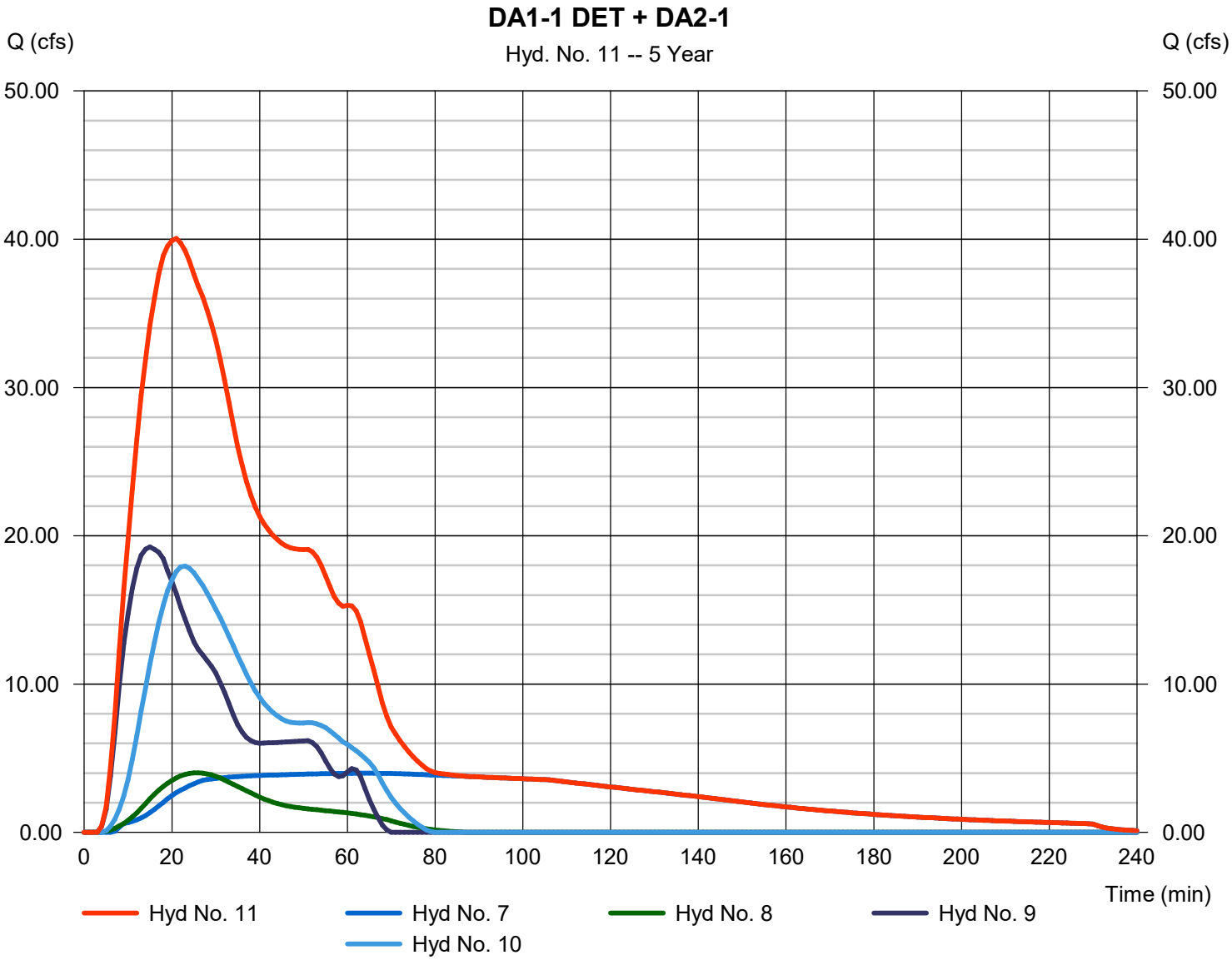


Hydrograph Report

Hyd. No. 11

DA1-1 DET + DA2-1

Hydrograph type	=	Combine	Peak discharge	=	40.05 cfs
Storm frequency	=	5 yrs	Time to peak	=	21 min
Time interval	=	1 min	Hyd. volume	=	112,457 cuft
Inflow hyds.	=	7, 8, 9, 10	Contrib. drain. area	=	28.790 ac



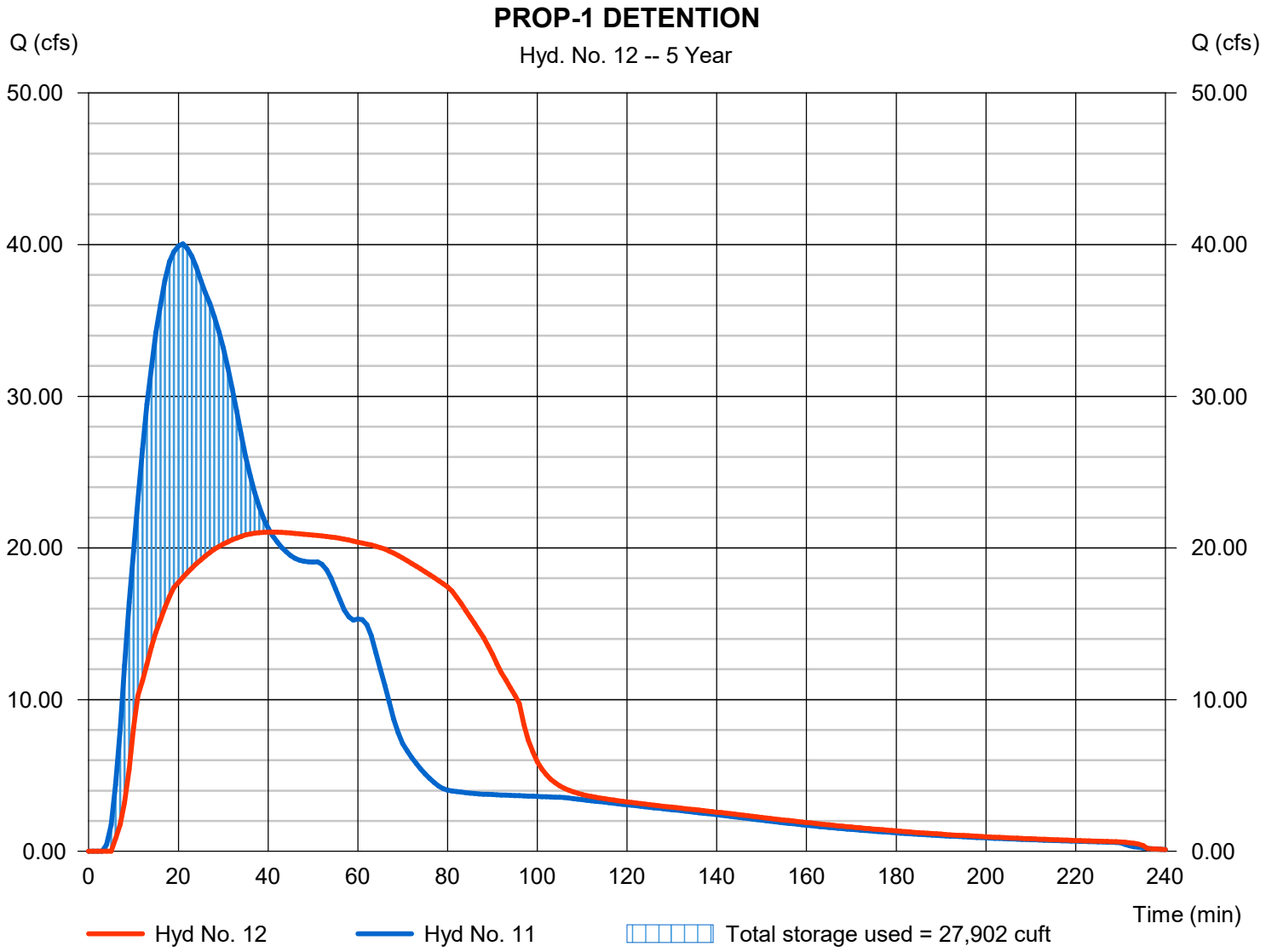
Hydrograph Report

Hyd. No. 12

PROP-1 DETENTION

Hydrograph type	=	Reservoir	Peak discharge	=	21.04 cfs
Storm frequency	=	5 yrs	Time to peak	=	41 min
Time interval	=	1 min	Hyd. volume	=	112,350 cuft
Inflow hyd. No.	=	11 - DA1-1 DET + DA2-1	Max. Elevation	=	1286.87 ft
Reservoir name	=	Phase 1	Max. Storage	=	27,902 cuft

Storage Indication method used.



Pond Report

Pond No. 3 - Phase 1

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 1283.45 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	1283.45	00	0	0
0.55	1284.00	650	119	119
1.55	1285.00	5,157	2,546	2,665
2.55	1286.00	13,875	9,163	11,828
3.55	1287.00	23,575	18,510	30,338
4.55	1288.00	33,464	28,373	58,710
5.55	1289.00	42,792	38,029	96,739
6.55	1290.00	50,595	46,634	143,374
7.55	1291.00	56,302	53,418	196,791
7.60	1291.05	56,448	2,816	199,607

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 24.00	24.00	0.00	0.00
Span (in)	= 24.00	24.00	0.00	0.00
No. Barrels	= 2	1	0	0
Invert El. (ft)	= 1283.35	1283.45	0.00	0.00
Length (ft)	= 153.83	0.00	0.00	0.00
Slope (%)	= 0.42	0.00	0.00	n/a
N-Value	= .012	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	Yes	No	No

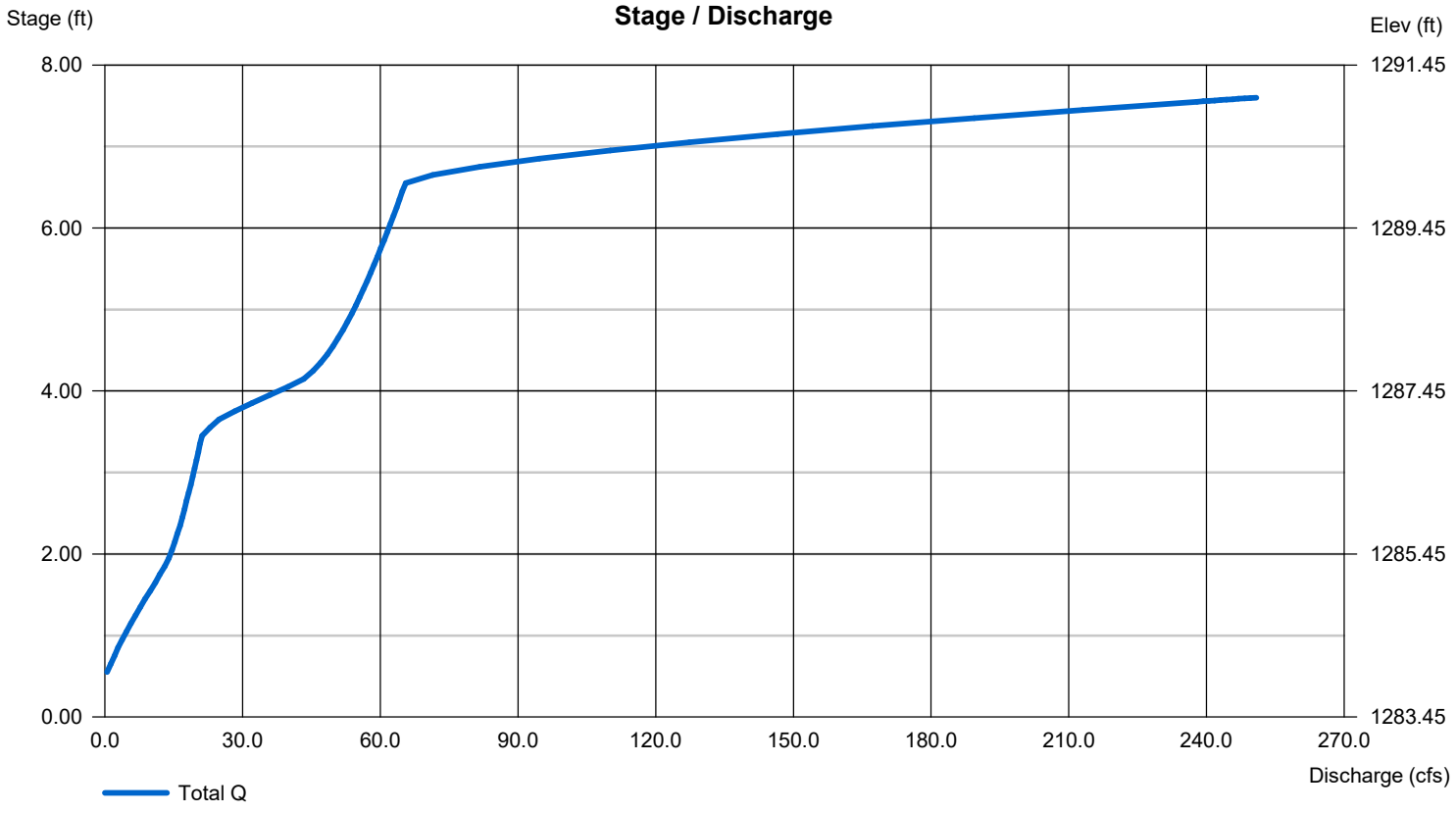
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 16.00	50.00	Inactive	0.00
Crest El. (ft)	= 1286.88	1290.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= Rect	Ciplti	---	---
Multi-Stage	= Yes	No	No	No

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

TW Elev. (ft) = 1283.98

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

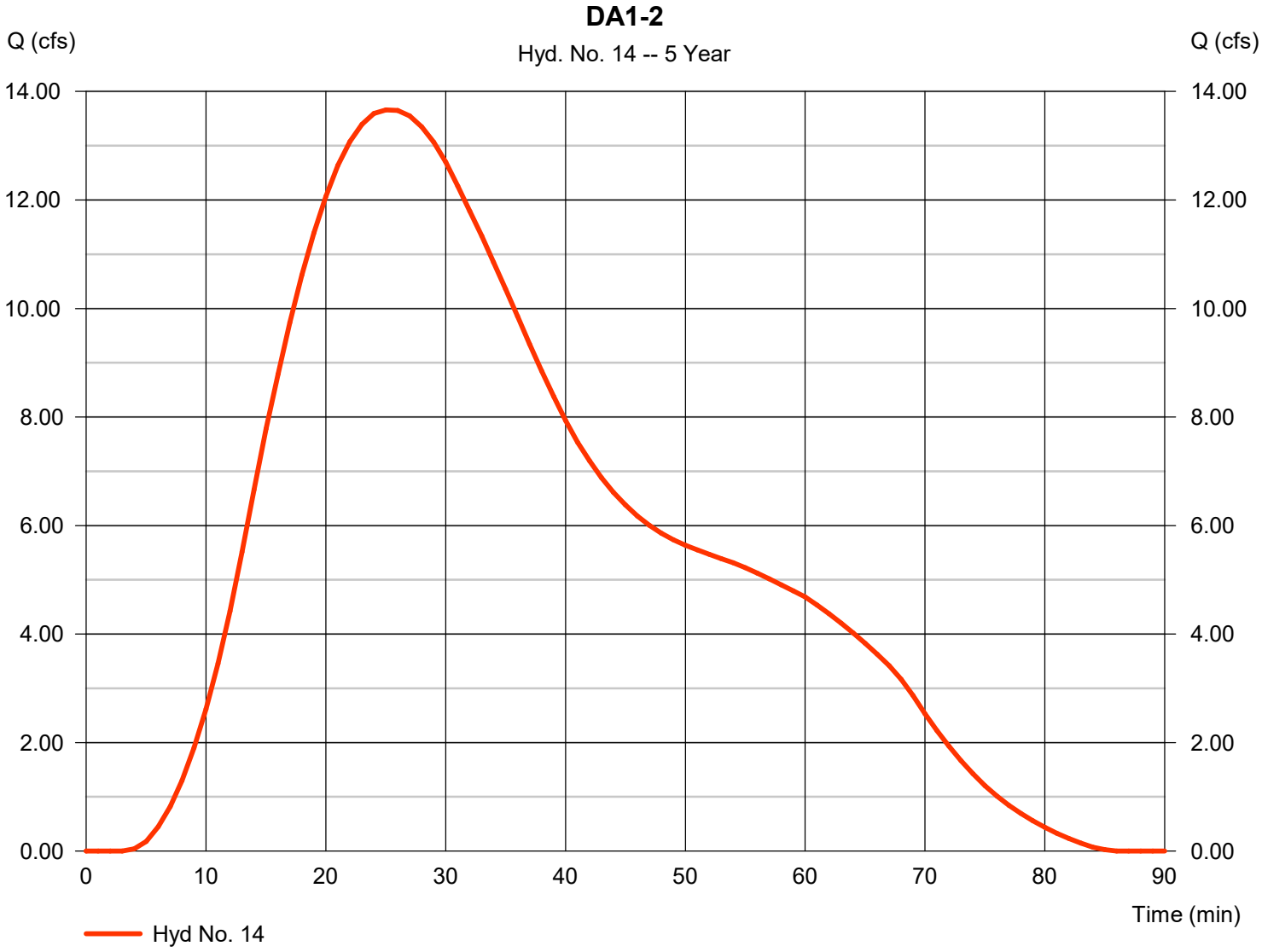


Hydrograph Report

Hyd. No. 14

DA1-2

Hydrograph type	=	SCS Runoff	Peak discharge	=	13.66 cfs
Storm frequency	=	5 yrs	Time to peak	=	25 min
Time interval	=	1 min	Hyd. volume	=	29,175 cuft
Drainage area	=	9.840 ac	Curve number	=	88
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	15.36 min
Total precip.	=	1.80 in	Distribution	=	Huff-1st
Storm duration	=	1.00 hrs	Shape factor	=	484



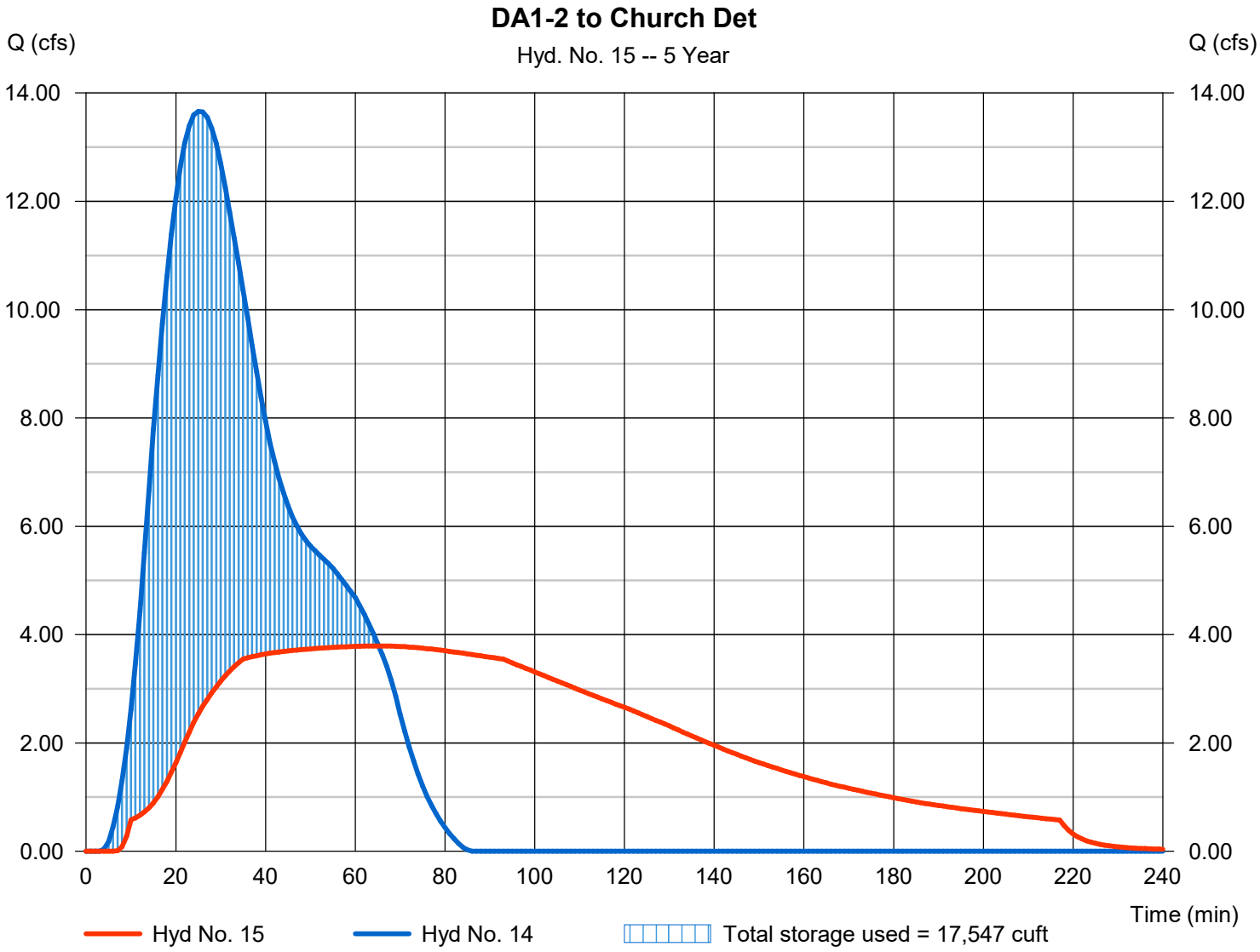
Hydrograph Report

Hyd. No. 15

DA1-2 to Church Det

Hydrograph type	=	Reservoir	Peak discharge	=	3.790 cfs
Storm frequency	=	5 yrs	Time to peak	=	65 min
Time interval	=	1 min	Hyd. volume	=	29,142 cuft
Inflow hyd. No.	=	14 - DA1-2	Max. Elevation	=	1294.12 ft
Reservoir name	=	Church Detention	Max. Storage	=	17,547 cuft

Storage Indication method used.



Pond Report

Pond No. 1 - Church Detention

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 1292.58 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	1292.58	00	0	0
0.42	1293.00	2,109	295	295
1.42	1294.00	28,716	12,868	13,163
1.97	1294.55	41,993	19,331	32,494
2.42	1295.00	52,471	21,204	53,698
3.42	1296.00	63,643	57,961	111,660

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 12.00	0.00	0.00	0.00
Span (in)	= 12.00	0.00	0.00	0.00
No. Barrels	= 1	0	0	0
Invert El. (ft)	= 1292.62	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

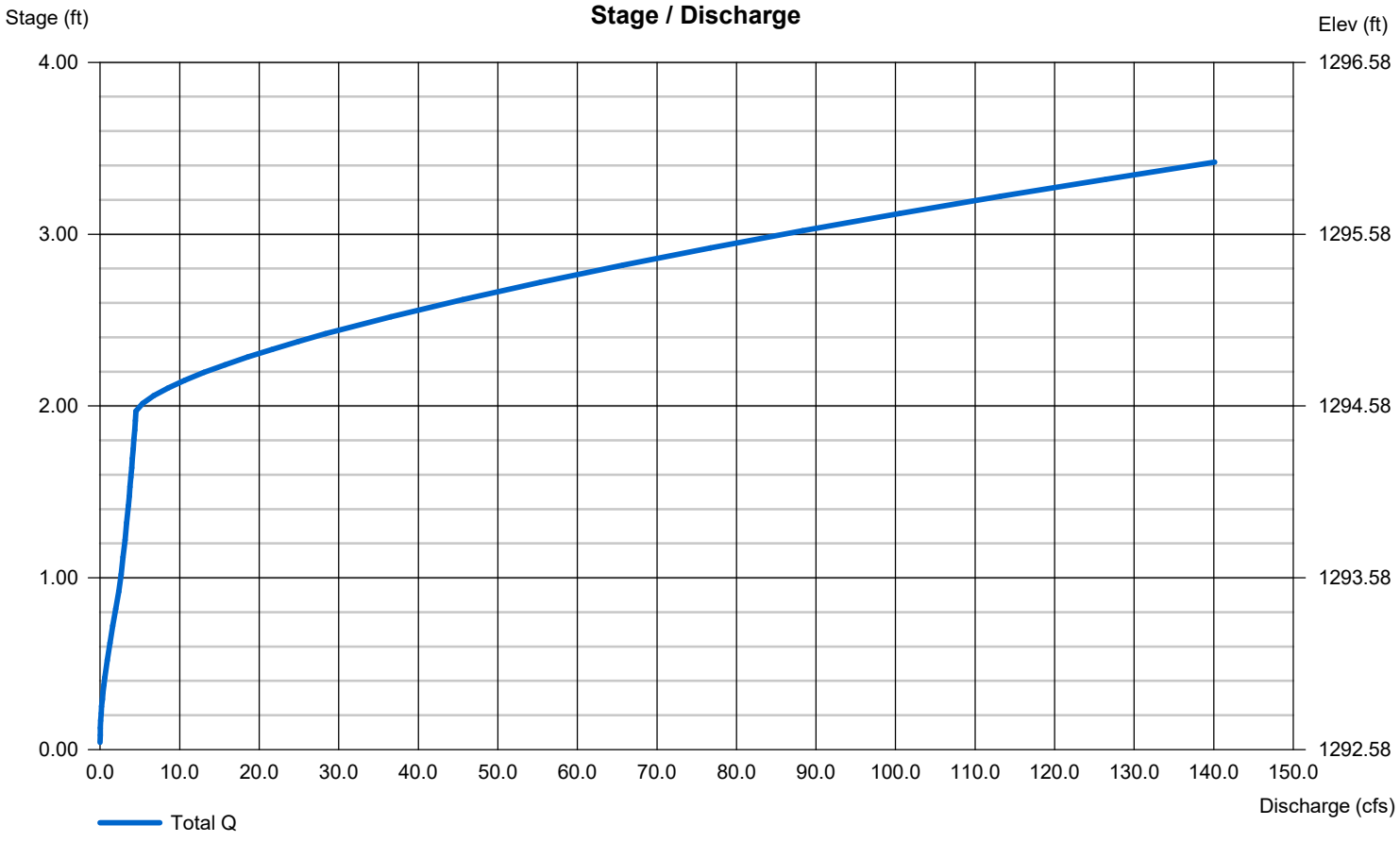
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 23.00	0.00	0.00	0.00
Crest El. (ft)	= 1294.55	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= Ciplti	Rect	---	---
Multi-Stage	= No	No	No	No

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

TW Elev. (ft) = 0.00

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

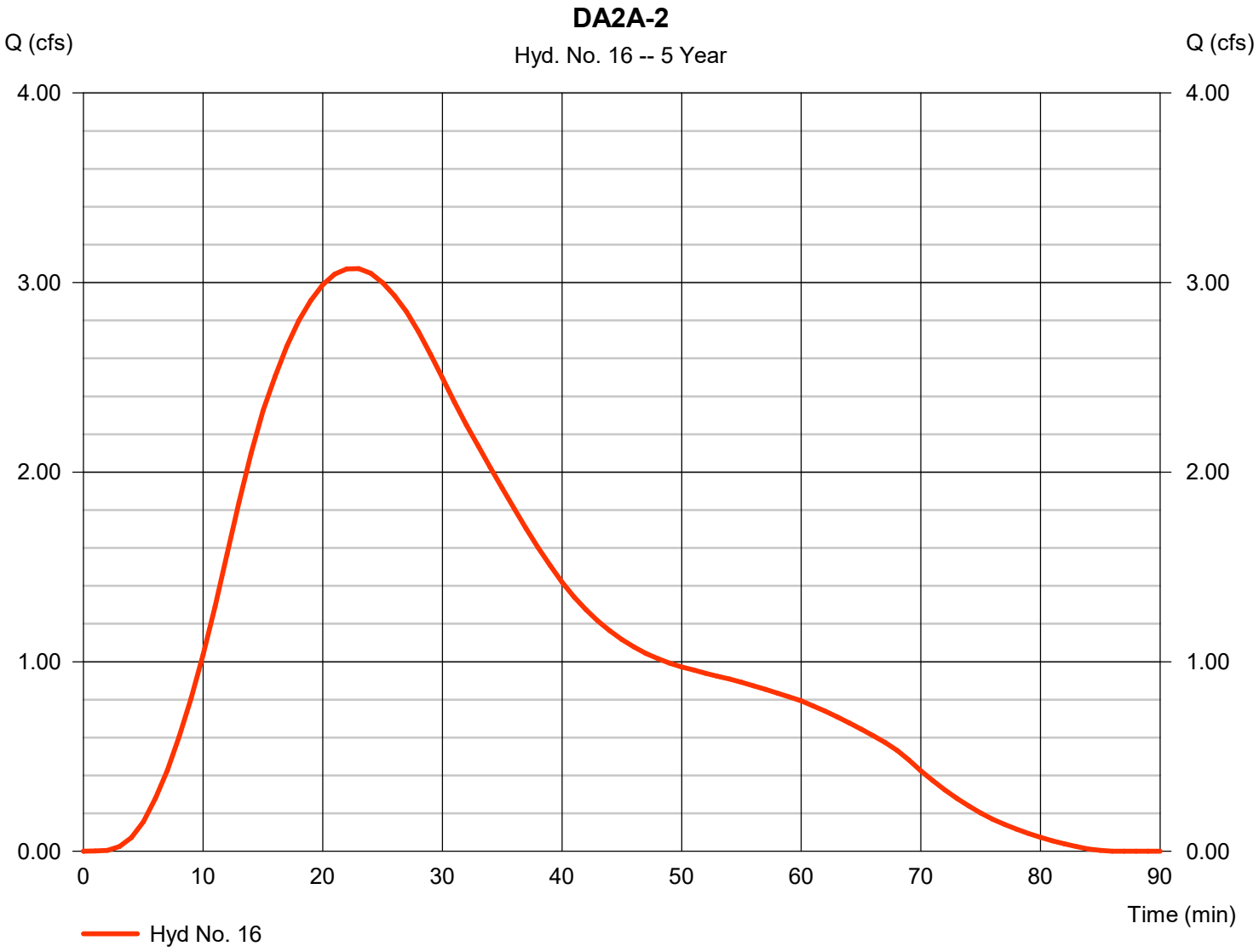


Hydrograph Report

Hyd. No. 16

DA2A-2

Hydrograph type	=	SCS Runoff	Peak discharge	=	3.074 cfs
Storm frequency	=	5 yrs	Time to peak	=	23 min
Time interval	=	1 min	Hyd. volume	=	6,139 cuft
Drainage area	=	1.380 ac	Curve number	=	94
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	16.00 min
Total precip.	=	1.80 in	Distribution	=	Huff-1st
Storm duration	=	1.00 hrs	Shape factor	=	484

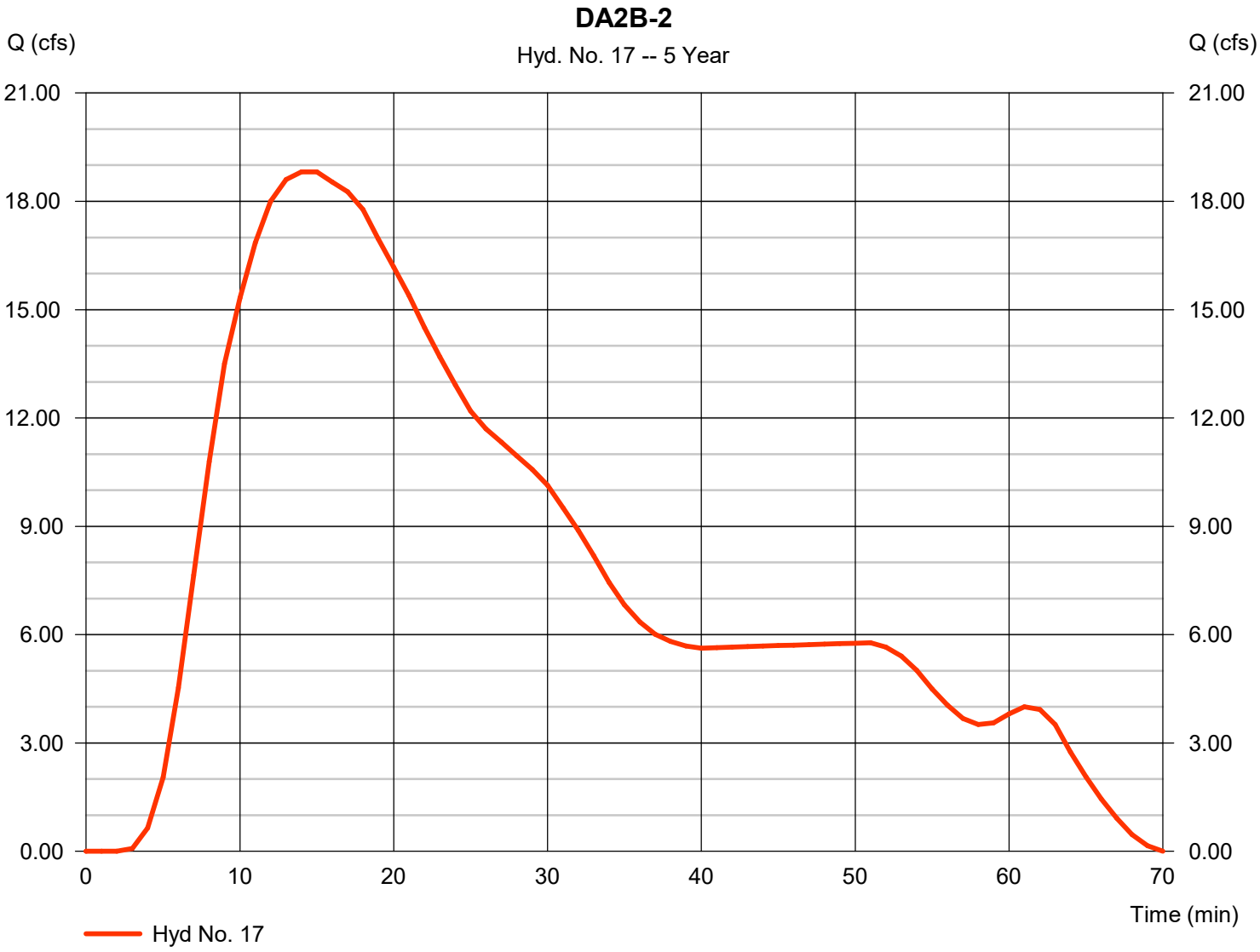


Hydrograph Report

Hyd. No. 17

DA2B-2

Hydrograph type	=	SCS Runoff	Peak discharge	=	18.81 cfs
Storm frequency	=	5 yrs	Time to peak	=	15 min
Time interval	=	1 min	Hyd. volume	=	32,894 cuft
Drainage area	=	9.500 ac	Curve number	=	90
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	1.80 in	Distribution	=	Huff-1st
Storm duration	=	1.00 hrs	Shape factor	=	484

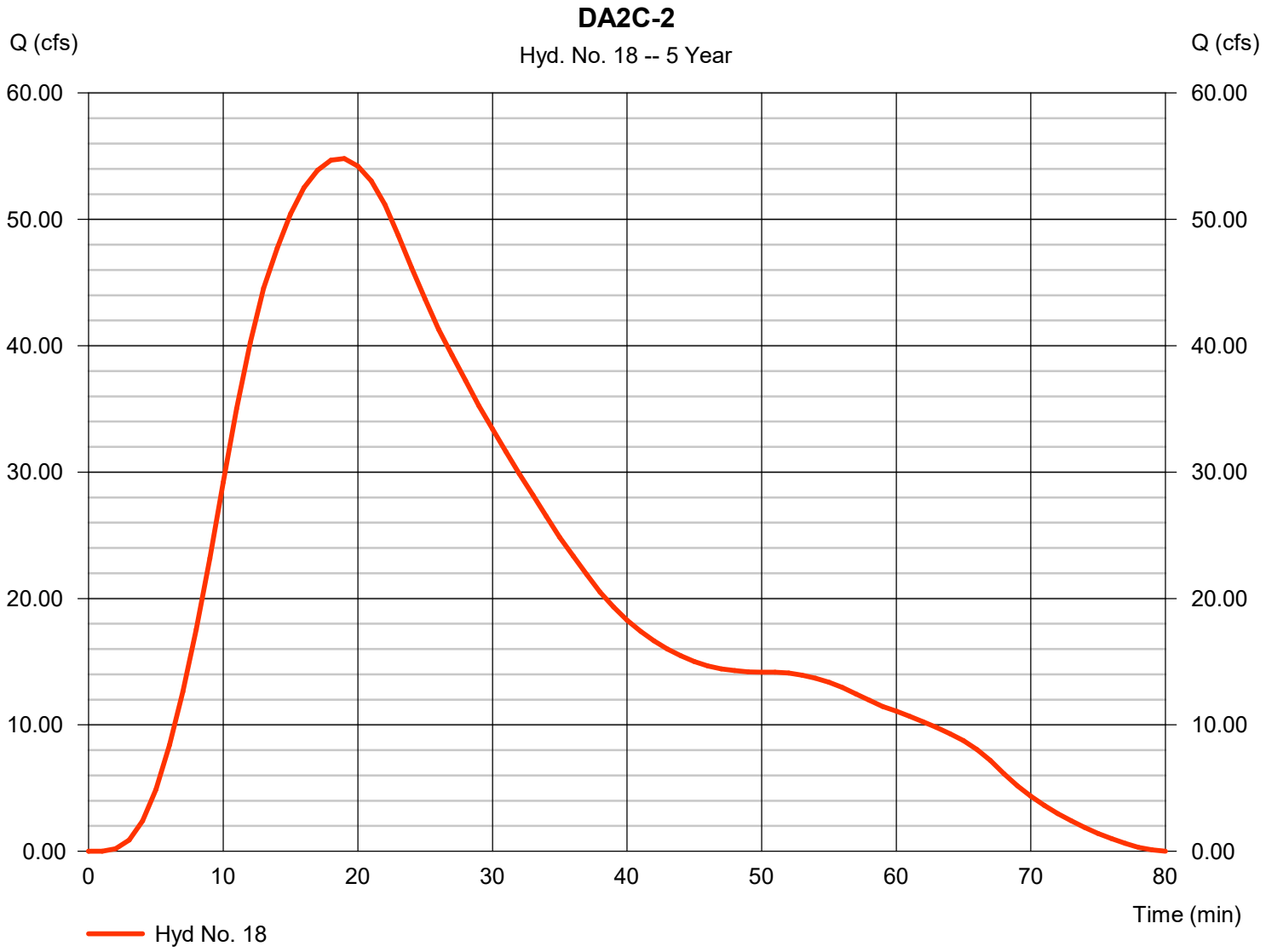


Hydrograph Report

Hyd. No. 18

DA2C-2

Hydrograph type	=	SCS Runoff	Peak discharge	=	54.81 cfs
Storm frequency	=	5 yrs	Time to peak	=	19 min
Time interval	=	1 min	Hyd. volume	=	98,191 cuft
Drainage area	=	21.250 ac	Curve number	=	95
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	11.90 min
Total precip.	=	1.80 in	Distribution	=	Huff-1st
Storm duration	=	1.00 hrs	Shape factor	=	484

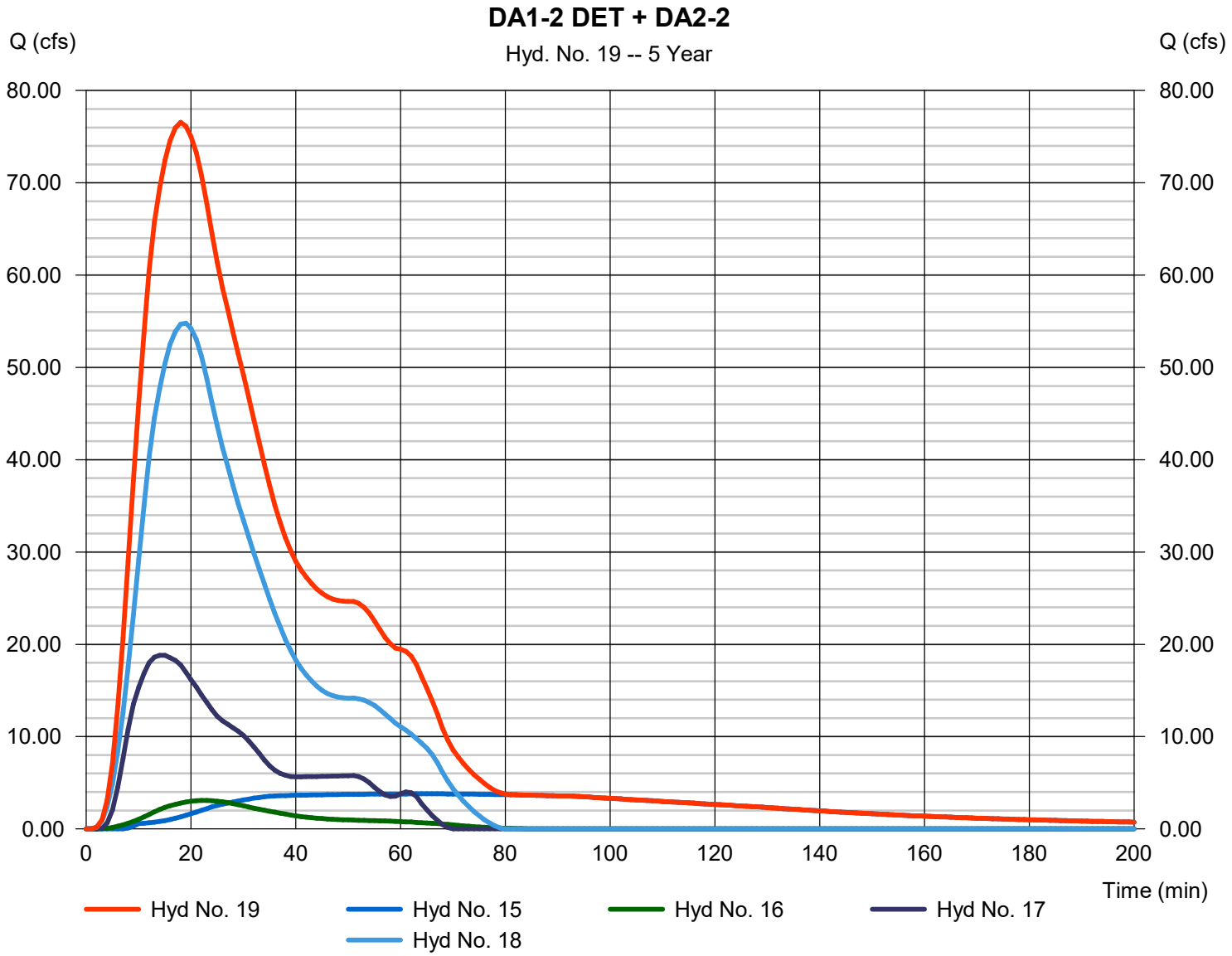


Hydrograph Report

Hyd. No. 19

DA1-2 DET + DA2-2

Hydrograph type	= Combine	Peak discharge	= 76.56 cfs
Storm frequency	= 5 yrs	Time to peak	= 18 min
Time interval	= 1 min	Hyd. volume	= 166,366 cuft
Inflow hyds.	= 15, 16, 17, 18	Contrib. drain. area	= 32.130 ac



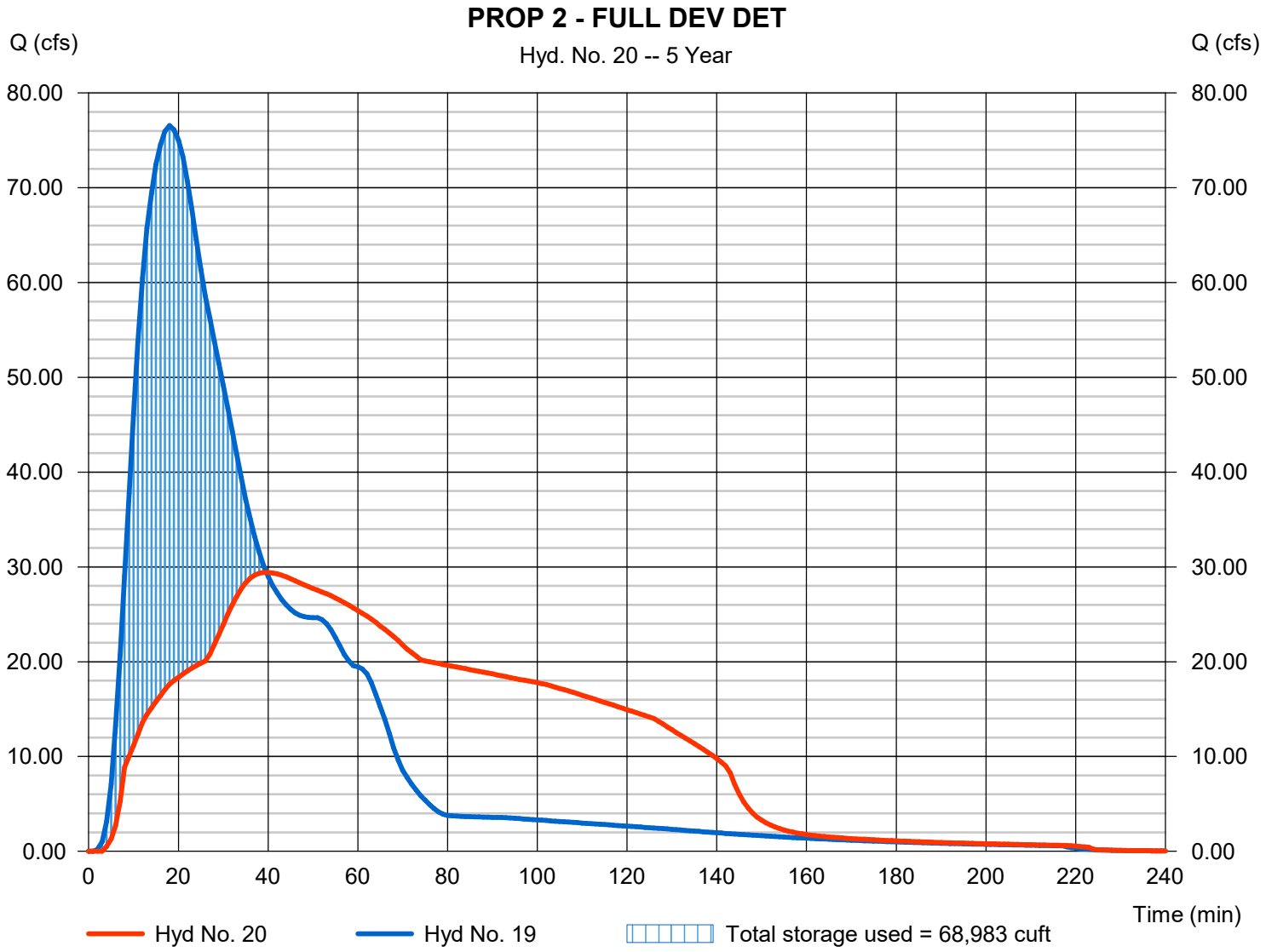
Hydrograph Report

Hyd. No. 20

PROP 2 - FULL DEV DET

Hydrograph type	= Reservoir	Peak discharge	= 29.42 cfs
Storm frequency	= 5 yrs	Time to peak	= 40 min
Time interval	= 1 min	Hyd. volume	= 166,258 cuft
Inflow hyd. No.	= 19 - DA1-2 DET + DA2-2	Max. Elevation	= 1288.27 ft
Reservoir name	= Phase 2	Max. Storage	= 68,983 cuft

Storage Indication method used.



Pond Report

Pond No. 2 - Phase 2

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 1283.45 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	1283.45	00	0	0
0.55	1284.00	650	119	119
1.55	1285.00	5,157	2,546	2,665
2.55	1286.00	13,875	9,163	11,828
3.55	1287.00	23,575	18,510	30,338
4.55	1288.00	33,464	28,373	58,710
5.55	1289.00	42,792	38,029	96,739
6.55	1290.00	50,595	46,634	143,374
7.55	1291.00	56,302	53,418	196,791
7.60	1291.05	56,448	2,816	199,607

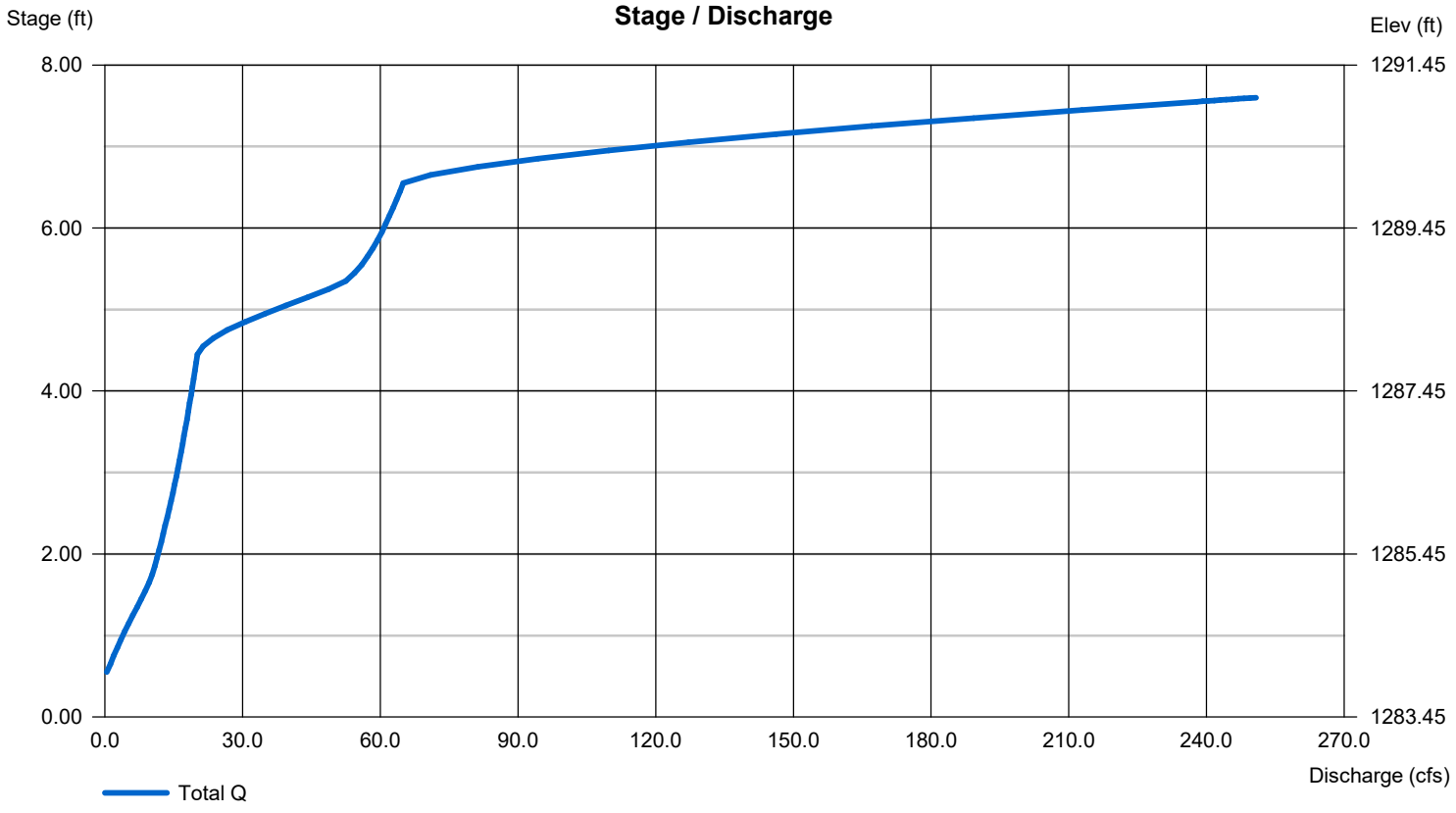
Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 24.00	21.00	0.00	0.00
Span (in)	= 24.00	21.00	0.00	0.00
No. Barrels	= 2	1	0	0
Invert El. (ft)	= 1283.35	1283.45	0.00	0.00
Length (ft)	= 153.83	0.00	0.00	0.00
Slope (%)	= 0.42	0.00	0.00	n/a
N-Value	= .012	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	Yes	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 16.00	50.00	Inactive	0.00
Crest El. (ft)	= 1287.92	1290.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= Rect	Ciplti	Rect	---
Multi-Stage	= Yes	No	No	No
Exfil.(in/hr)	= 0.000 (by Wet area)			
TW Elev. (ft)	= 1283.98			

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



Hydraflow Table of Contents

Hydrograph Summary Report

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

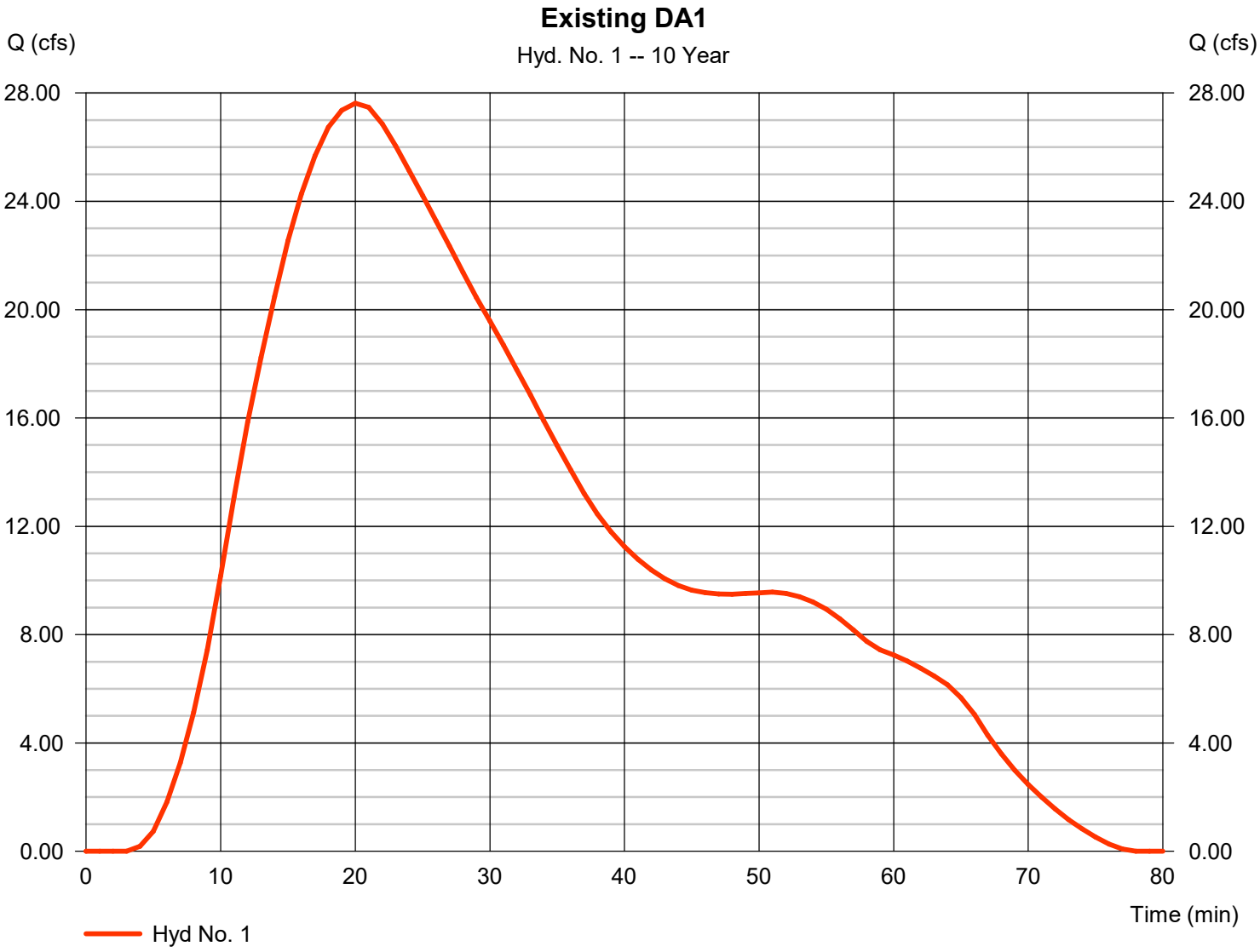
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	27.62	1	20	52,524	------	------	------	Existing DA1
2	Reservoir	6.401	1	63	52,491	1	1294.63	36,235	Exist DA1 - Church Det
3	SCS Runoff	38.95	1	24	81,621	------	------	------	Existing DA2
4	Combine	42.83	1	25	134,113	2, 3	------	------	Pre
6	SCS Runoff	22.78	1	20	43,332	------	------	------	DA1-1
7	Reservoir	4.392	1	66	43,299	6	1294.47	29,633	DA1-1 to Church Det
8	SCS Runoff	5.145	1	25	10,885	------	------	------	DA2A-1
9	SCS Runoff	24.98	1	14	43,419	------	------	------	DA2B-1
10	SCS Runoff	24.25	1	22	48,268	------	------	------	DA2C-1
11	Combine	52.50	1	20	145,871	7, 8, 9, 10	------	------	DA1-1 DET + DA2-1
12	Reservoir	32.52	1	35	140,457	11	1287.39	41,359	PROP-1 DETENTION
14	SCS Runoff	17.82	1	25	37,480	------	------	------	DA1-2
15	Reservoir	4.137	1	67	37,447	14	1294.32	24,302	DA1-2 to Church Det
16	SCS Runoff	3.802	1	22	7,510	------	------	------	DA2A-2
17	SCS Runoff	24.32	1	13	41,648	------	------	------	DA2B-2
18	SCS Runoff	67.22	1	18	119,118	------	------	------	DA2C-2
19	Combine	94.75	1	18	205,722	15, 16, 17, 18	------	------	DA1-2 DET + DA2-2
20	Reservoir	44.33	1	35	200,308	19	1288.65	83,536	PROP 2 - FULL DEV DET

Hydrograph Report

Hyd. No. 1

Existing DA1

Hydrograph type	=	SCS Runoff	Peak discharge	=	27.62 cfs
Storm frequency	=	10 yrs	Time to peak	=	20 min
Time interval	=	1 min	Hyd. volume	=	52,524 cuft
Drainage area	=	14.570 ac	Curve number	=	87
Basin Slope	=	2.0 %	Hydraulic length	=	2185 ft
Tc method	=	User	Time of conc. (Tc)	=	10.10 min
Total precip.	=	2.09 in	Distribution	=	Huff-1st
Storm duration	=	1.00 hrs	Shape factor	=	484



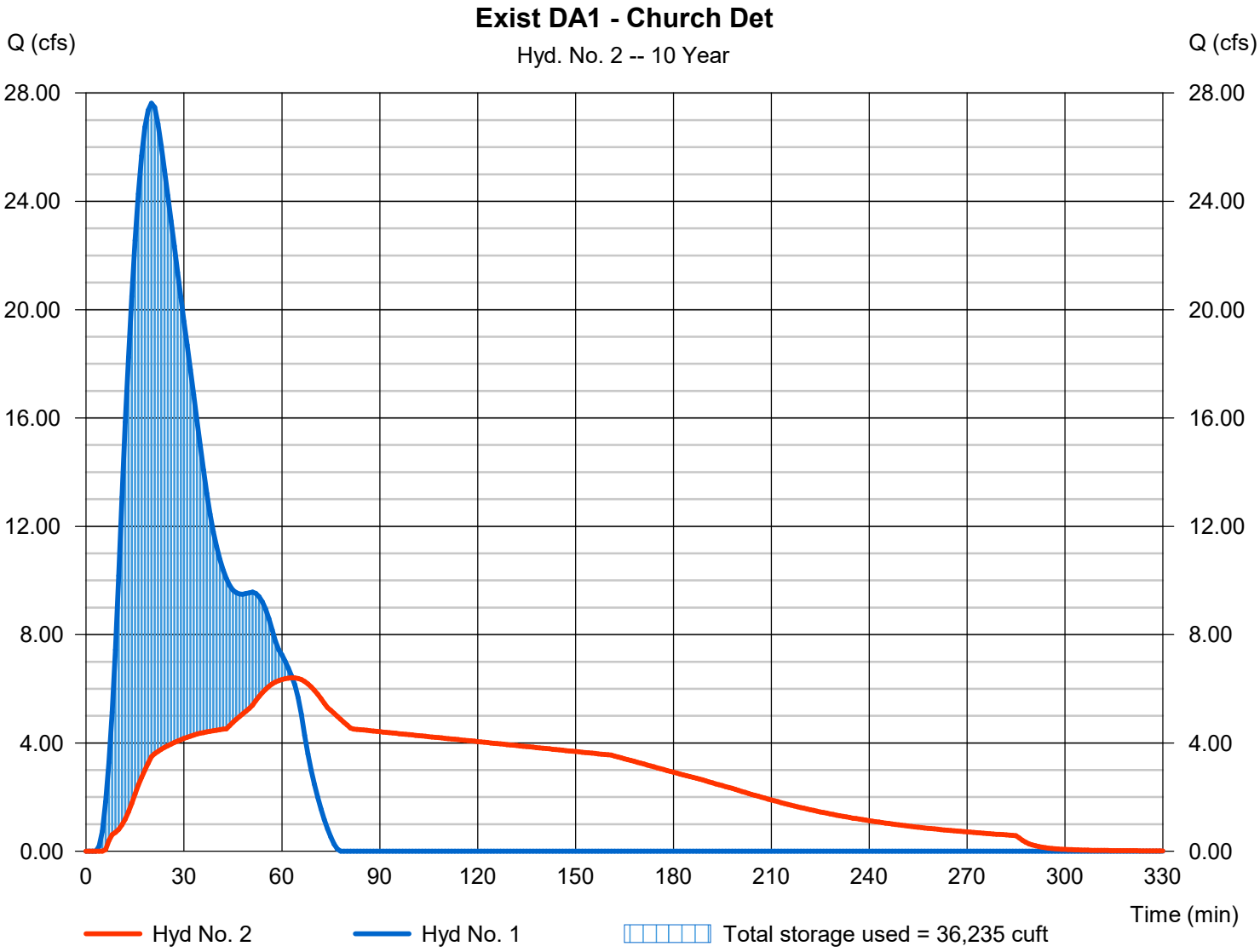
Hydrograph Report

Hyd. No. 2

Exist DA1 - Church Det

Hydrograph type	=	Reservoir	Peak discharge	=	6.401 cfs
Storm frequency	=	10 yrs	Time to peak	=	63 min
Time interval	=	1 min	Hyd. volume	=	52,491 cuft
Inflow hyd. No.	=	1 - Existing DA1	Max. Elevation	=	1294.63 ft
Reservoir name	=	Church Detention	Max. Storage	=	36,235 cuft

Storage Indication method used.



Pond Report

Pond No. 1 - Church Detention

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 1292.58 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	1292.58	00	0	0
0.42	1293.00	2,109	295	295
1.42	1294.00	28,716	12,868	13,163
1.97	1294.55	41,993	19,331	32,494
2.42	1295.00	52,471	21,204	53,698
3.42	1296.00	63,643	57,961	111,660

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 12.00	0.00	0.00	0.00
Span (in)	= 12.00	0.00	0.00	0.00
No. Barrels	= 1	0	0	0
Invert El. (ft)	= 1292.62	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

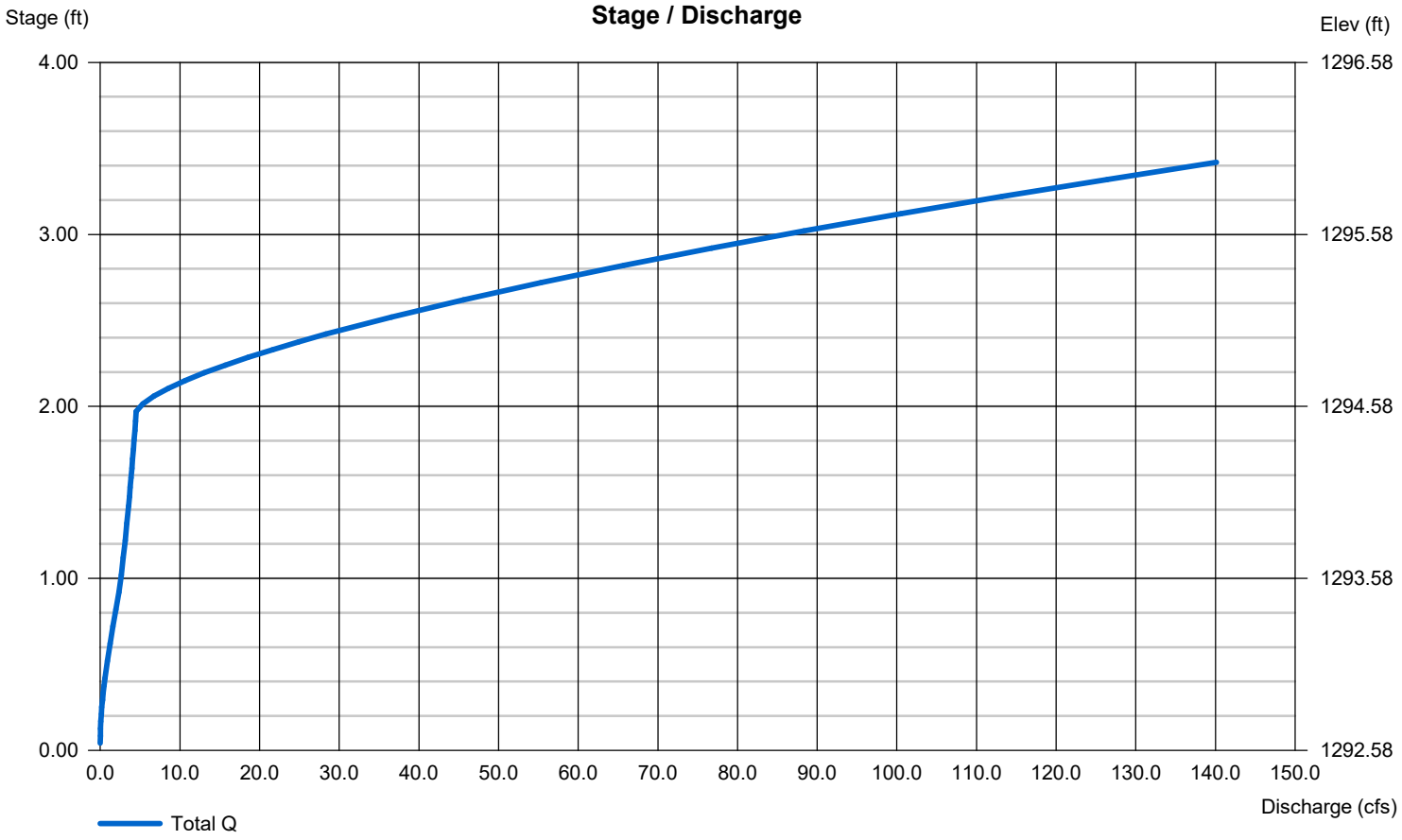
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 23.00	0.00	0.00	0.00
Crest El. (ft)	= 1294.55	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= Ciplti	Rect	---	---
Multi-Stage	= No	No	No	No

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

TW Elev. (ft) = 0.00

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

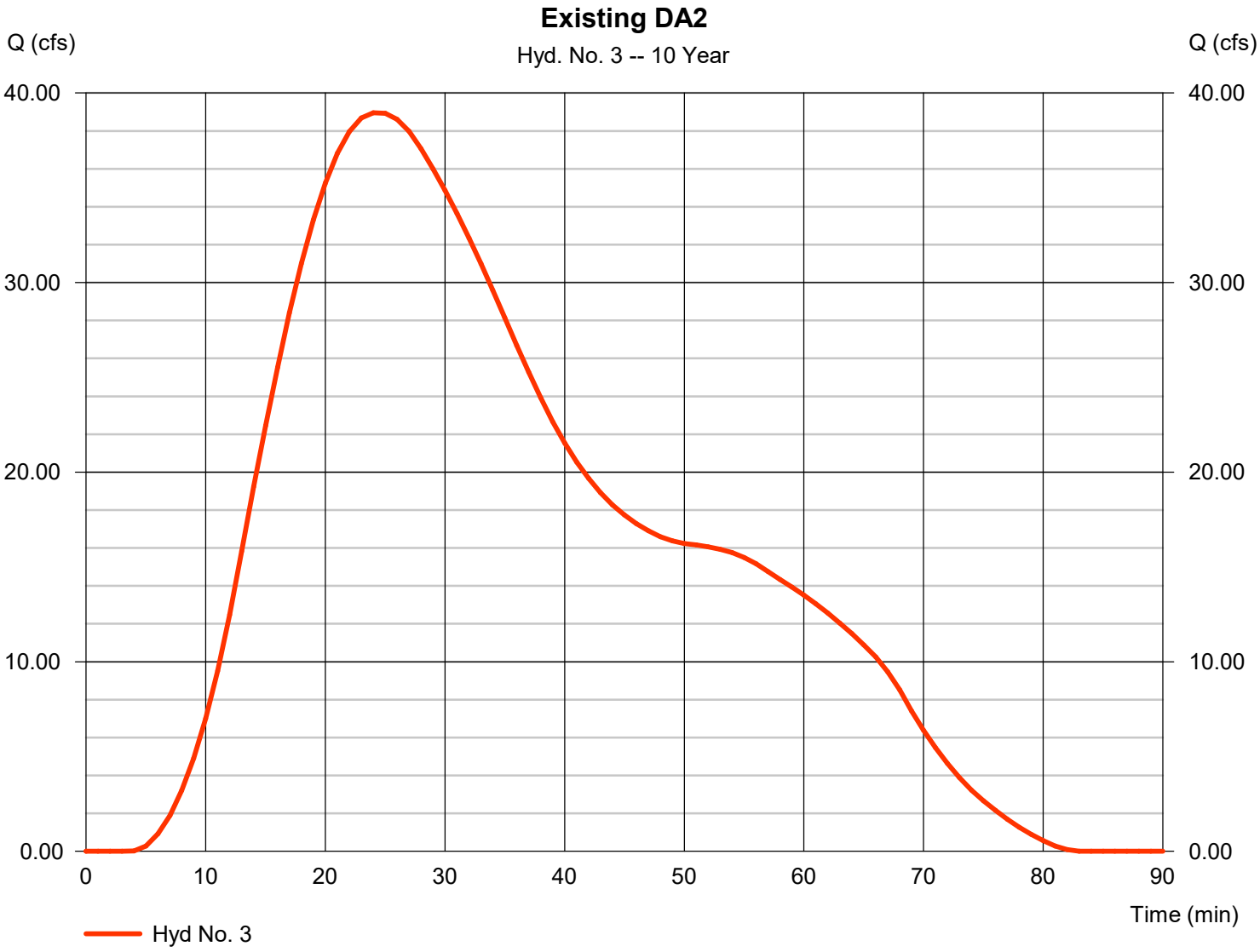


Hydrograph Report

Hyd. No. 3

Existing DA2

Hydrograph type	=	SCS Runoff	Peak discharge	=	38.95 cfs
Storm frequency	=	10 yrs	Time to peak	=	24 min
Time interval	=	1 min	Hyd. volume	=	81,621 cuft
Drainage area	=	27.860 ac	Curve number	=	84
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	13.90 min
Total precip.	=	2.09 in	Distribution	=	Huff-1st
Storm duration	=	1.00 hrs	Shape factor	=	484

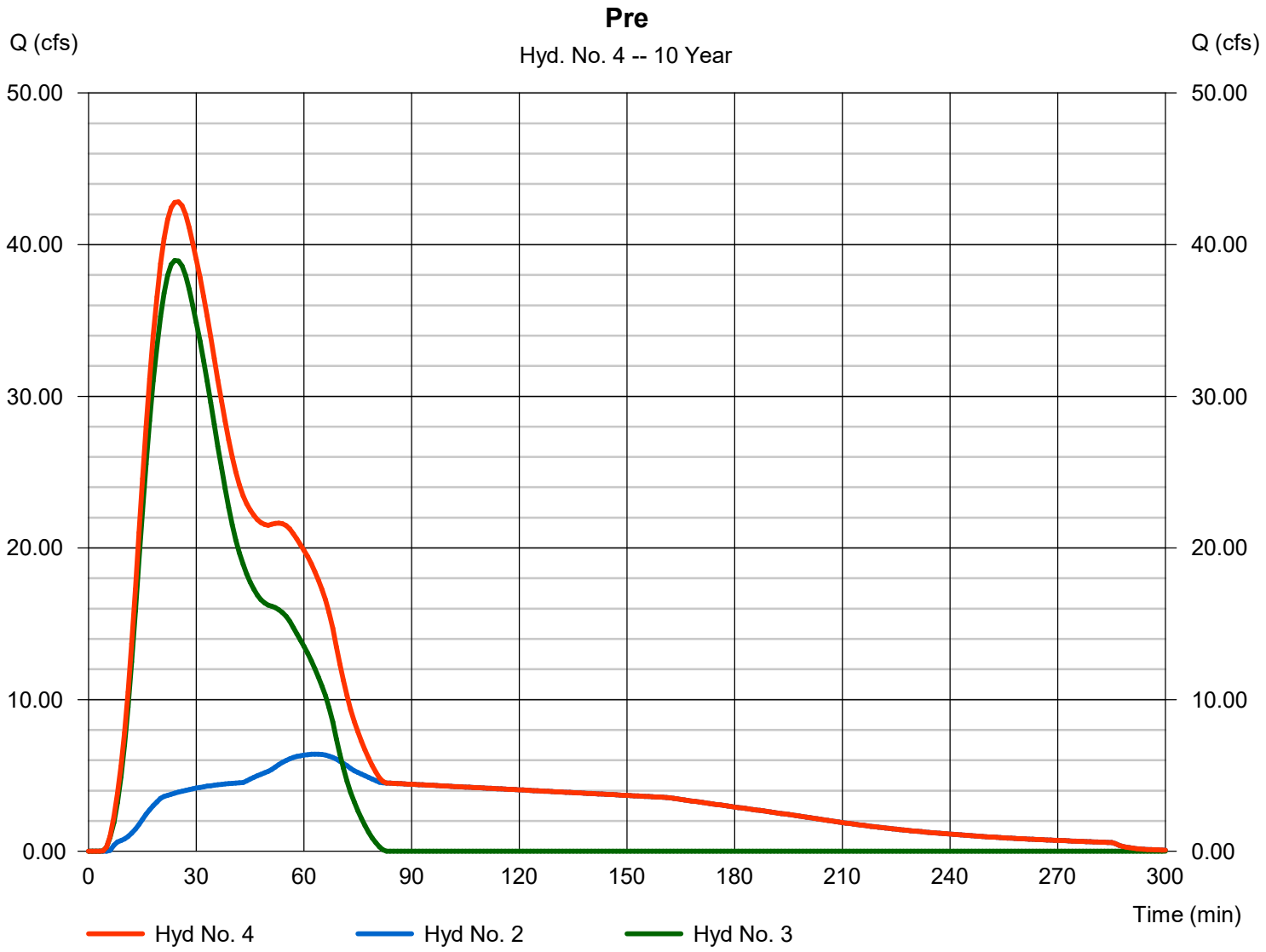


Hydrograph Report

Hyd. No. 4

Pre

Hydrograph type	= Combine	Peak discharge	= 42.83 cfs
Storm frequency	= 10 yrs	Time to peak	= 25 min
Time interval	= 1 min	Hyd. volume	= 134,113 cuft
Inflow hyds.	= 2, 3	Contrib. drain. area	= 27.860 ac



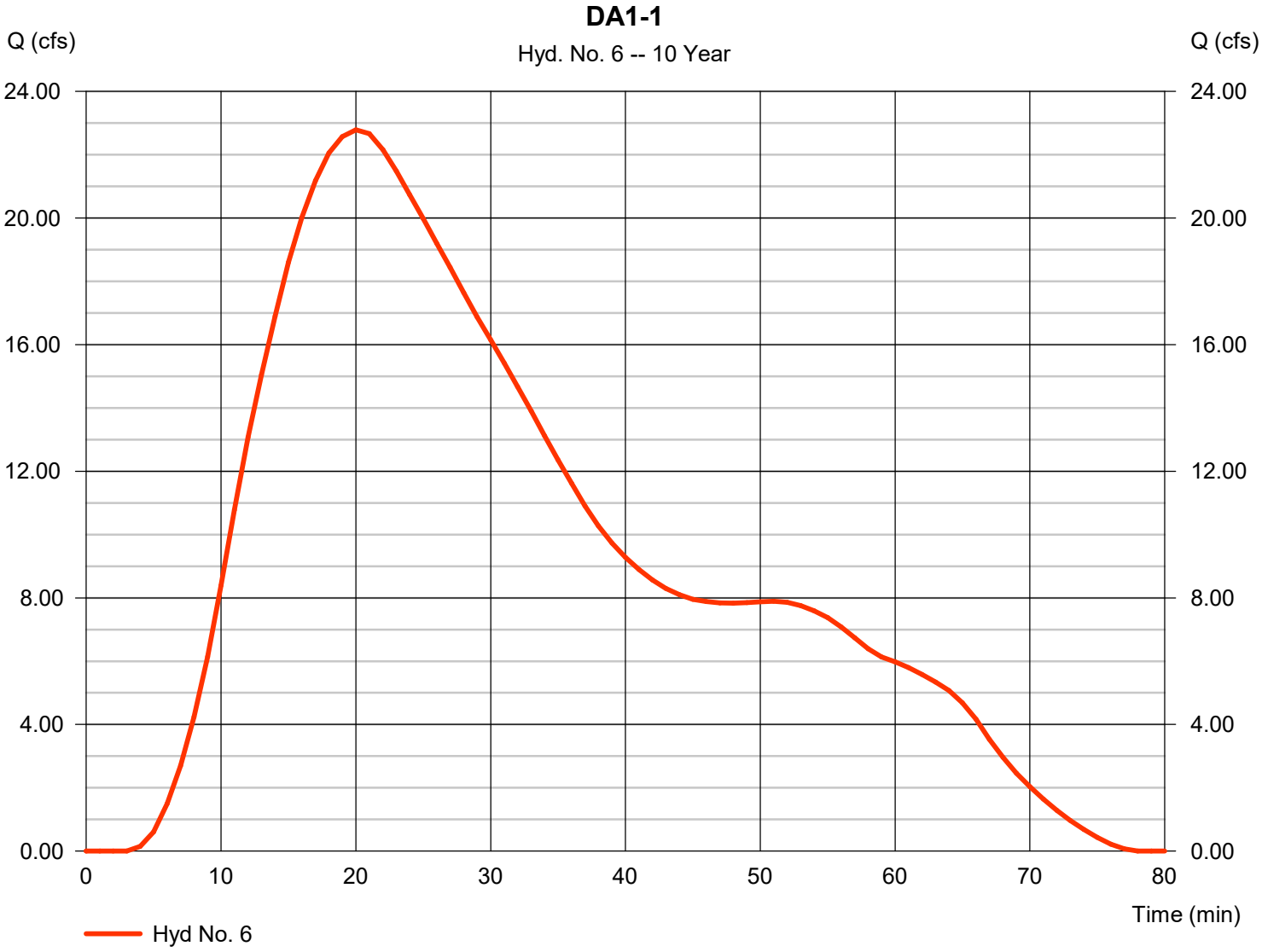
Hydrograph Report

Hyd. No. 6

DA1-1

Hydrograph type	=	SCS Runoff	Peak discharge	=	22.78 cfs
Storm frequency	=	10 yrs	Time to peak	=	20 min
Time interval	=	1 min	Hyd. volume	=	43,332 cuft
Drainage area	=	12.020 ac	Curve number	=	87*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	10.08 min
Total precip.	=	2.09 in	Distribution	=	Huff-1st
Storm duration	=	1.00 hrs	Shape factor	=	484

* Composite (Area/CN) = [(4.755 x 90) + (1.295 x 75)] / 12.020



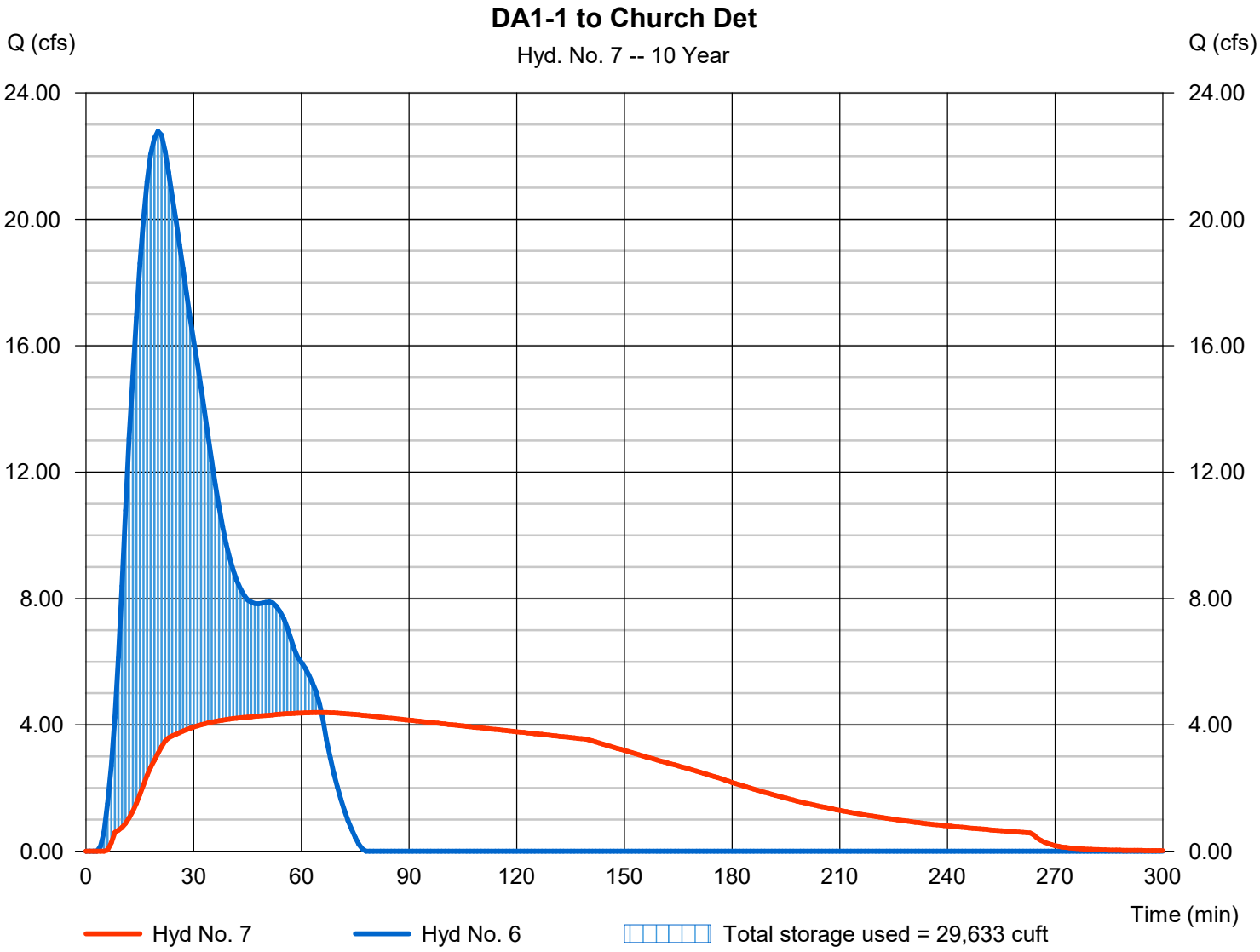
Hydrograph Report

Hyd. No. 7

DA1-1 to Church Det

Hydrograph type	=	Reservoir	Peak discharge	=	4.392 cfs
Storm frequency	=	10 yrs	Time to peak	=	66 min
Time interval	=	1 min	Hyd. volume	=	43,299 cuft
Inflow hyd. No.	=	6 - DA1-1	Max. Elevation	=	1294.47 ft
Reservoir name	=	Church Detention	Max. Storage	=	29,633 cuft

Storage Indication method used.



Pond Report

Pond No. 1 - Church Detention

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 1292.58 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	1292.58	00	0	0
0.42	1293.00	2,109	295	295
1.42	1294.00	28,716	12,868	13,163
1.97	1294.55	41,993	19,331	32,494
2.42	1295.00	52,471	21,204	53,698
3.42	1296.00	63,643	57,961	111,660

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 12.00	0.00	0.00	0.00
Span (in)	= 12.00	0.00	0.00	0.00
No. Barrels	= 1	0	0	0
Invert El. (ft)	= 1292.62	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

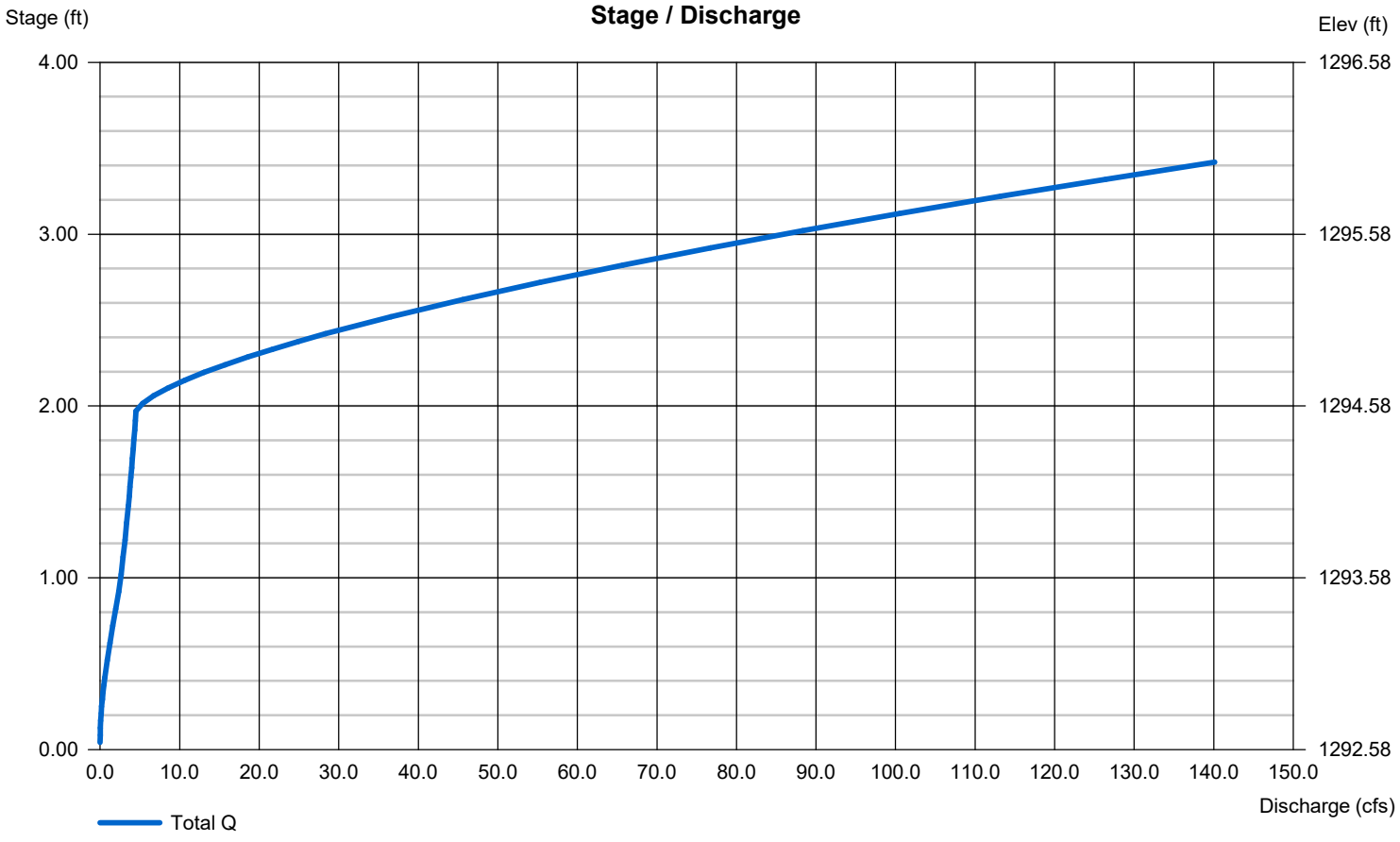
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 23.00	0.00	0.00	0.00
Crest El. (ft)	= 1294.55	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= Ciplti	Rect	---	---
Multi-Stage	= No	No	No	No

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

TW Elev. (ft) = 0.00

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



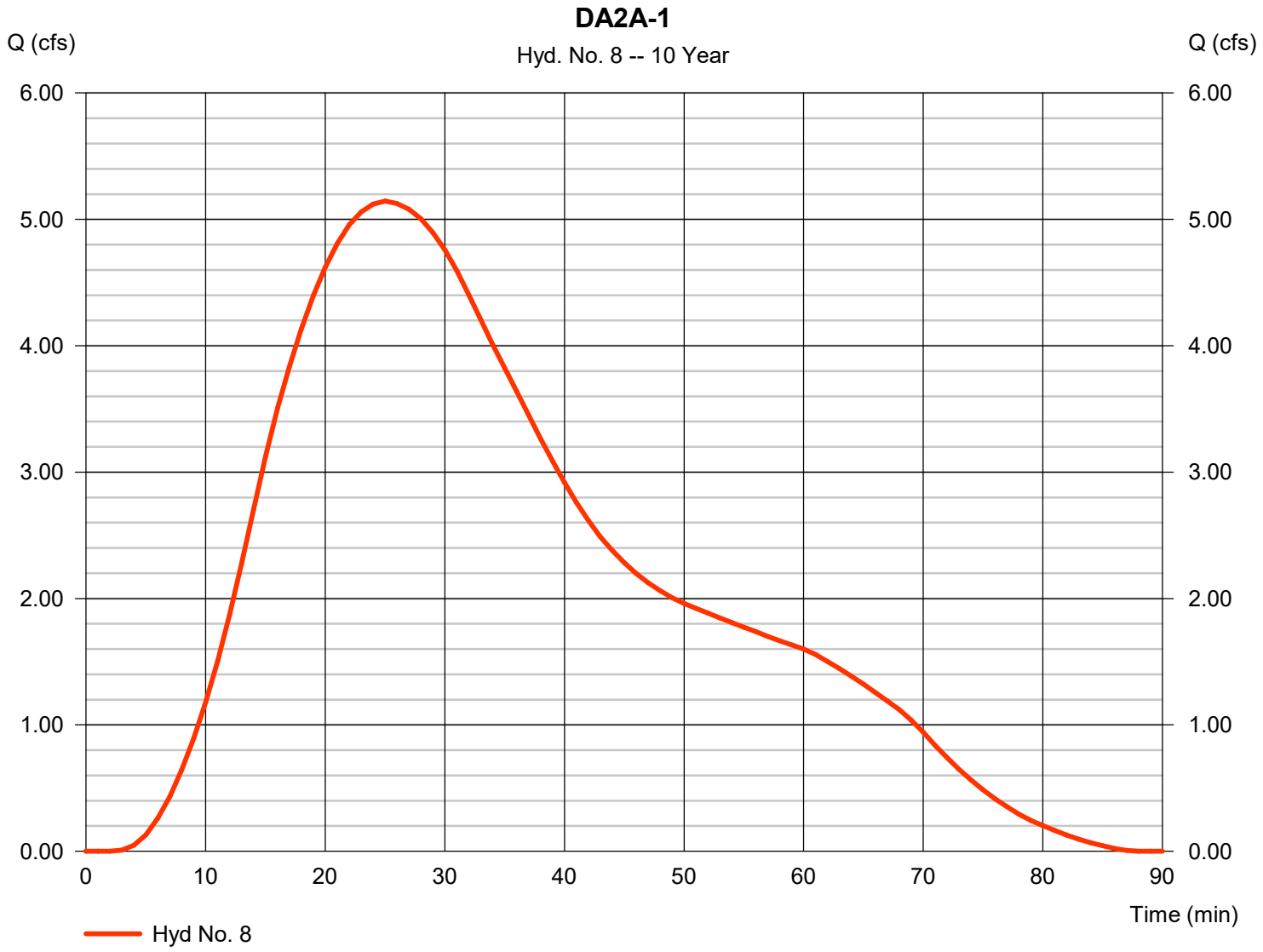
Hydrograph Report

Hyd. No. 8

DA2A-1

Hydrograph type	=	SCS Runoff	Peak discharge	=	5.145 cfs
Storm frequency	=	10 yrs	Time to peak	=	25 min
Time interval	=	1 min	Hyd. volume	=	10,885 cuft
Drainage area	=	2.590 ac	Curve number	=	90*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	18.10 min
Total precip.	=	2.09 in	Distribution	=	Huff-1st
Storm duration	=	1.00 hrs	Shape factor	=	484

* Composite (Area/CN) = [(4.880 x 90) + (2.170 x 75)] / 2.590



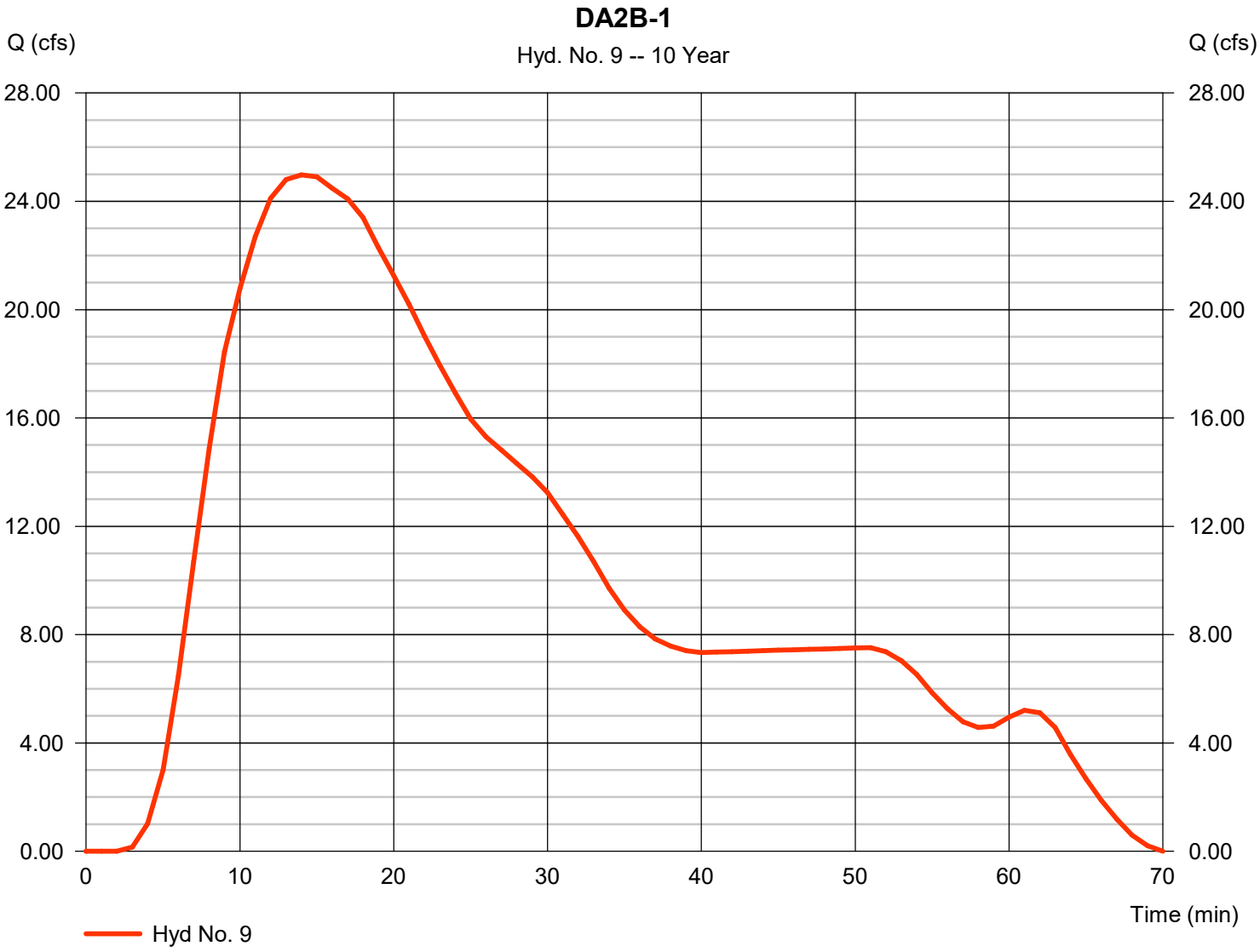
Hydrograph Report

Hyd. No. 9

DA2B-1

Hydrograph type	=	SCS Runoff	Peak discharge	=	24.98 cfs
Storm frequency	=	10 yrs	Time to peak	=	14 min
Time interval	=	1 min	Hyd. volume	=	43,419 cuft
Drainage area	=	10.520 ac	Curve number	=	89*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	2.09 in	Distribution	=	Huff-1st
Storm duration	=	1.00 hrs	Shape factor	=	484

* Composite (Area/CN) = [(4.880 x 90) + (2.170 x 75)] / 10.520



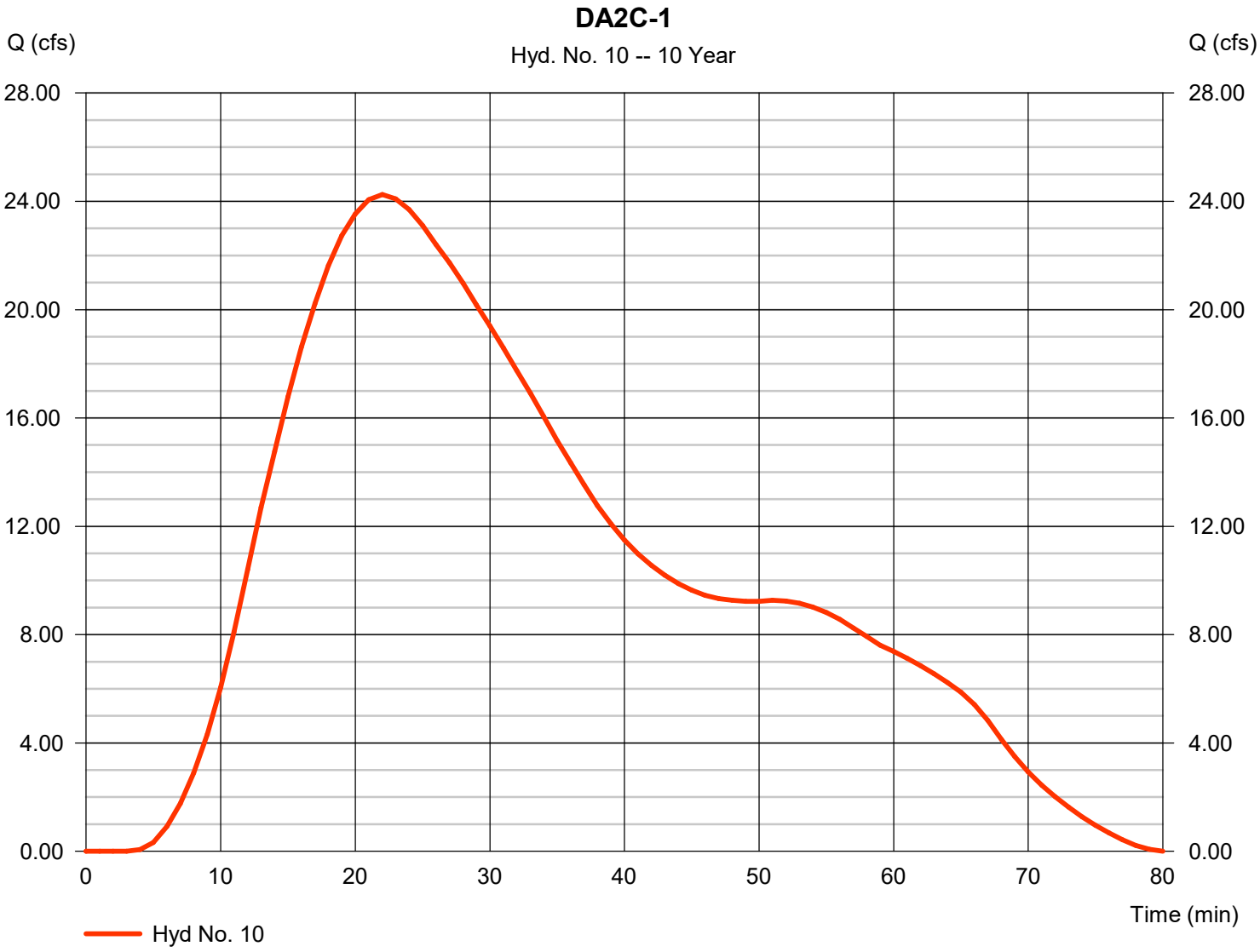
Hydrograph Report

Hyd. No. 10

DA2C-1

Hydrograph type	=	SCS Runoff	Peak discharge	=	24.25 cfs
Storm frequency	=	10 yrs	Time to peak	=	22 min
Time interval	=	1 min	Hyd. volume	=	48,268 cuft
Drainage area	=	15.680 ac	Curve number	=	85*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	11.90 min
Total precip.	=	2.09 in	Distribution	=	Huff-1st
Storm duration	=	1.00 hrs	Shape factor	=	484

* Composite (Area/CN) = [(4.880 x 90) + (2.170 x 75)] / 15.680

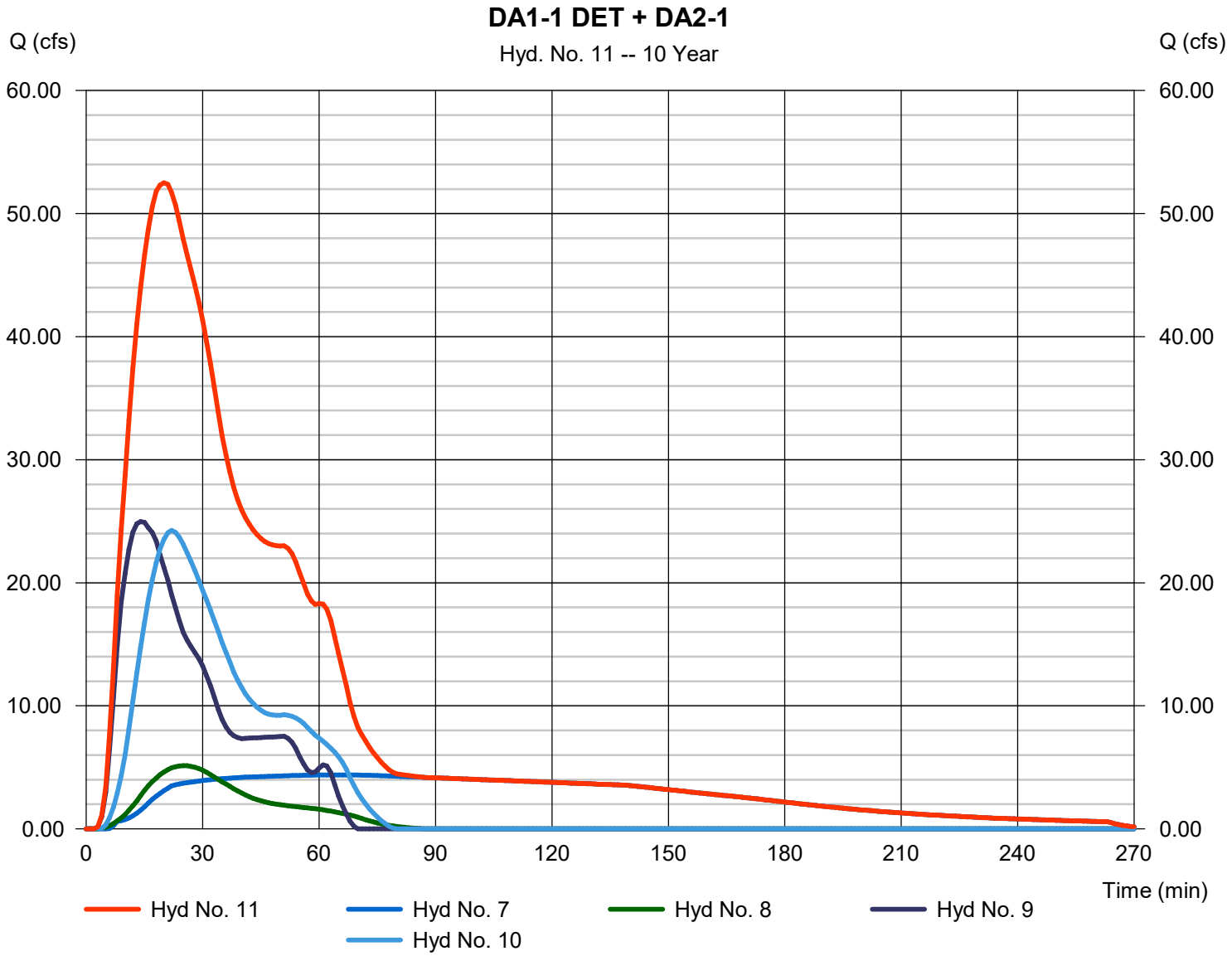


Hydrograph Report

Hyd. No. 11

DA1-1 DET + DA2-1

Hydrograph type	= Combine	Peak discharge	= 52.50 cfs
Storm frequency	= 10 yrs	Time to peak	= 20 min
Time interval	= 1 min	Hyd. volume	= 145,871 cuft
Inflow hyds.	= 7, 8, 9, 10	Contrib. drain. area	= 28.790 ac



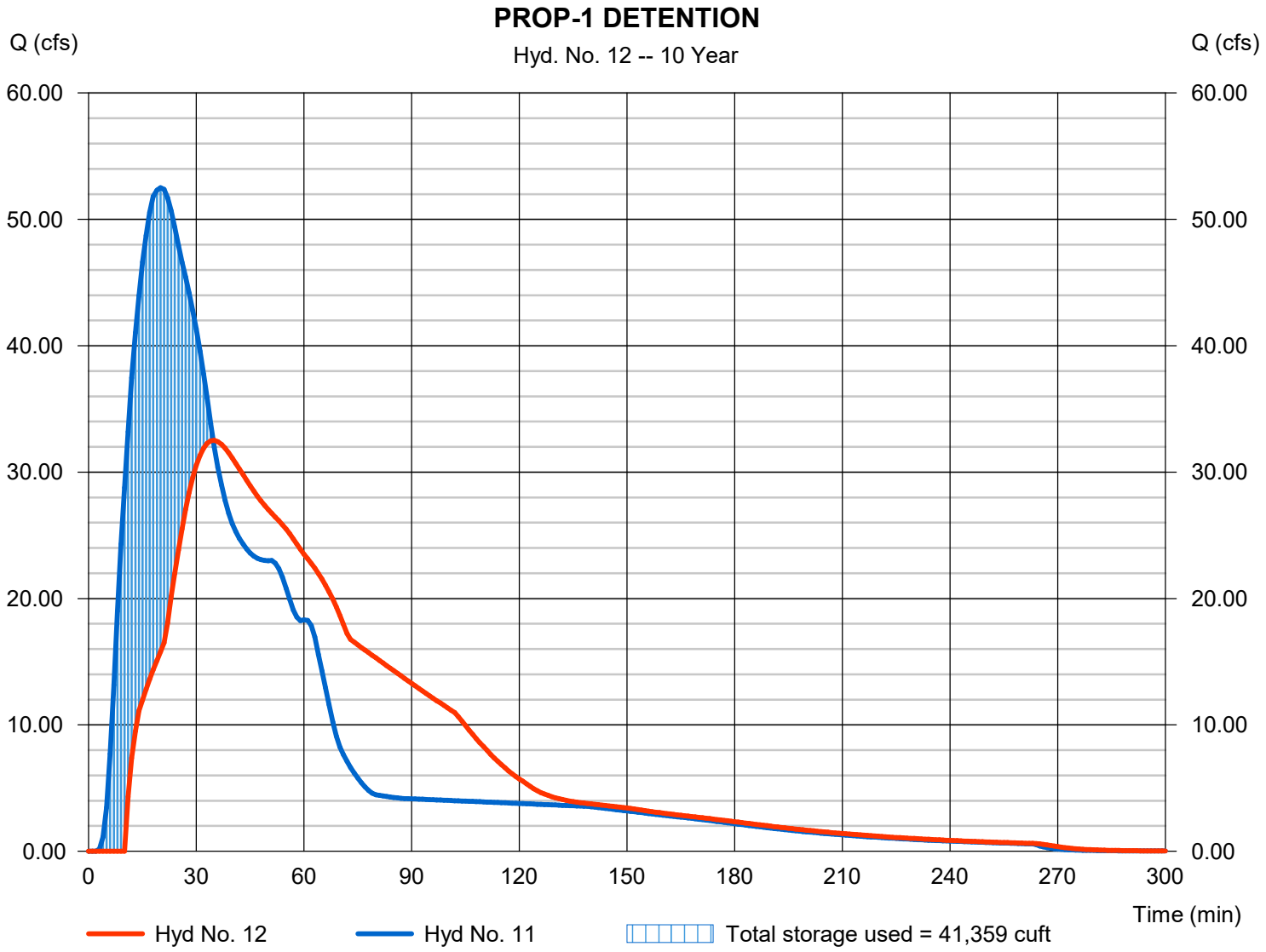
Hydrograph Report

Hyd. No. 12

PROP-1 DETENTION

Hydrograph type	=	Reservoir	Peak discharge	=	32.52 cfs
Storm frequency	=	10 yrs	Time to peak	=	35 min
Time interval	=	1 min	Hyd. volume	=	140,457 cuft
Inflow hyd. No.	=	11 - DA1-1 DET + DA2-1	Max. Elevation	=	1287.39 ft
Reservoir name	=	Phase 1	Max. Storage	=	41,359 cuft

Storage Indication method used.



Pond Report

Pond No. 3 - Phase 1

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 1283.45 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	1283.45	00	0	0
0.55	1284.00	650	119	119
1.55	1285.00	5,157	2,546	2,665
2.55	1286.00	13,875	9,163	11,828
3.55	1287.00	23,575	18,510	30,338
4.55	1288.00	33,464	28,373	58,710
5.55	1289.00	42,792	38,029	96,739
6.55	1290.00	50,595	46,634	143,374
7.55	1291.00	56,302	53,418	196,791
7.60	1291.05	56,448	2,816	199,607

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 24.00	24.00	0.00	0.00
Span (in)	= 24.00	24.00	0.00	0.00
No. Barrels	= 2	1	0	0
Invert El. (ft)	= 1283.35	1283.45	0.00	0.00
Length (ft)	= 153.83	0.00	0.00	0.00
Slope (%)	= 0.42	0.00	0.00	n/a
N-Value	= .012	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	Yes	No	No

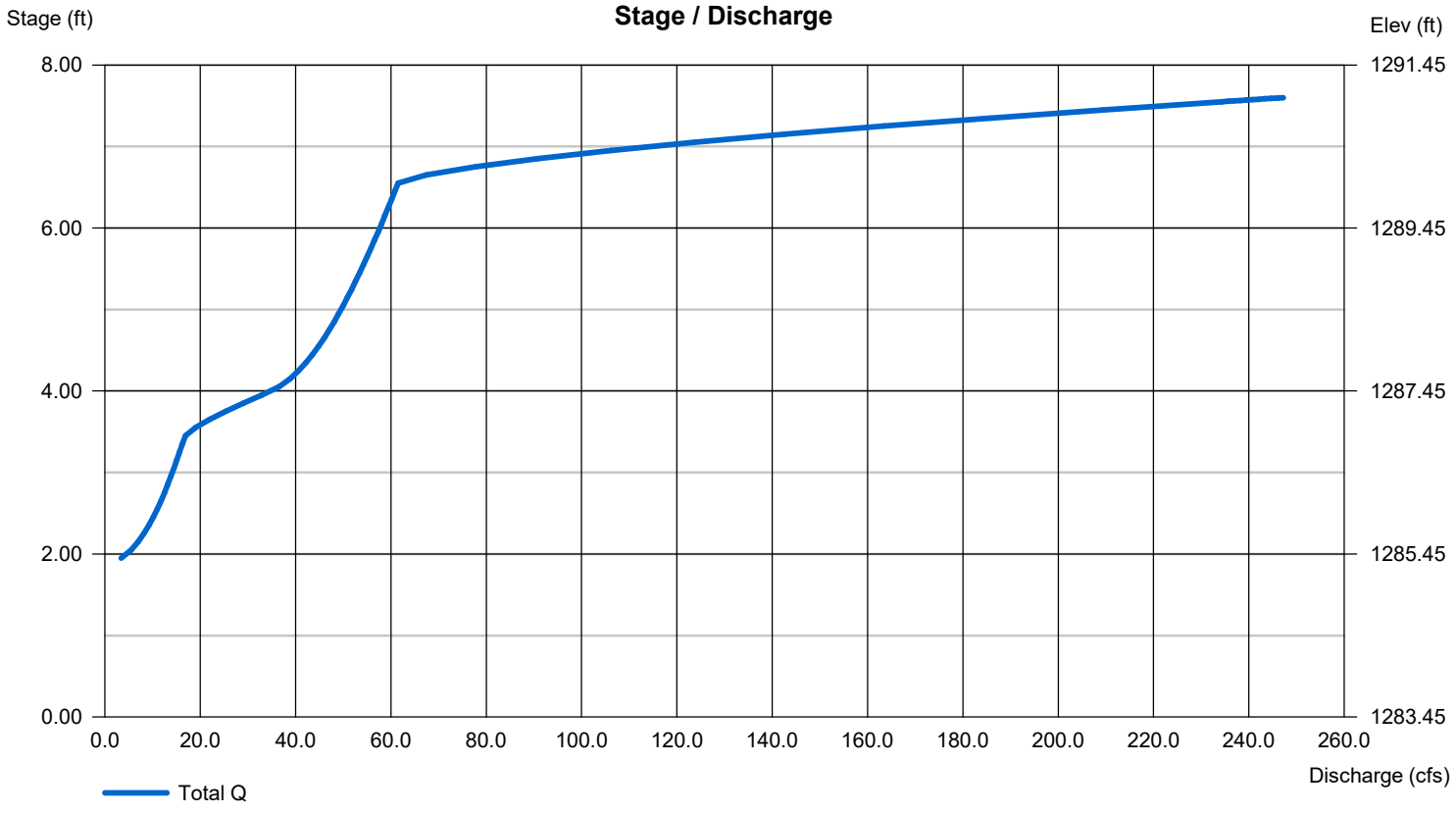
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 16.00	50.00	Inactive	0.00
Crest El. (ft)	= 1286.88	1290.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= Rect	Ciplti	---	---
Multi-Stage	= Yes	No	No	No

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

TW Elev. (ft) = 1285.33

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

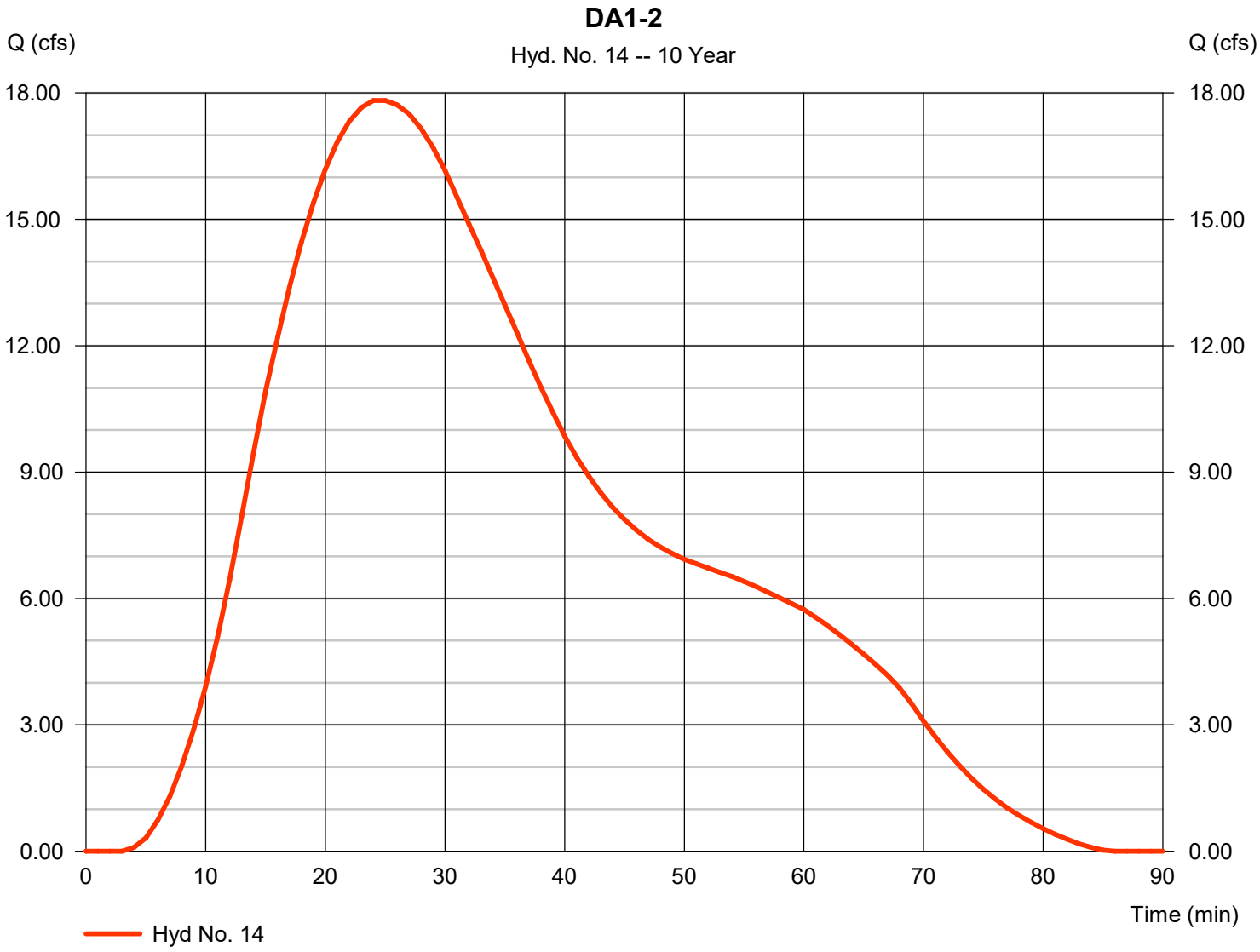


Hydrograph Report

Hyd. No. 14

DA1-2

Hydrograph type	=	SCS Runoff	Peak discharge	=	17.82 cfs
Storm frequency	=	10 yrs	Time to peak	=	25 min
Time interval	=	1 min	Hyd. volume	=	37,480 cuft
Drainage area	=	9.840 ac	Curve number	=	88
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	15.36 min
Total precip.	=	2.09 in	Distribution	=	Huff-1st
Storm duration	=	1.00 hrs	Shape factor	=	484



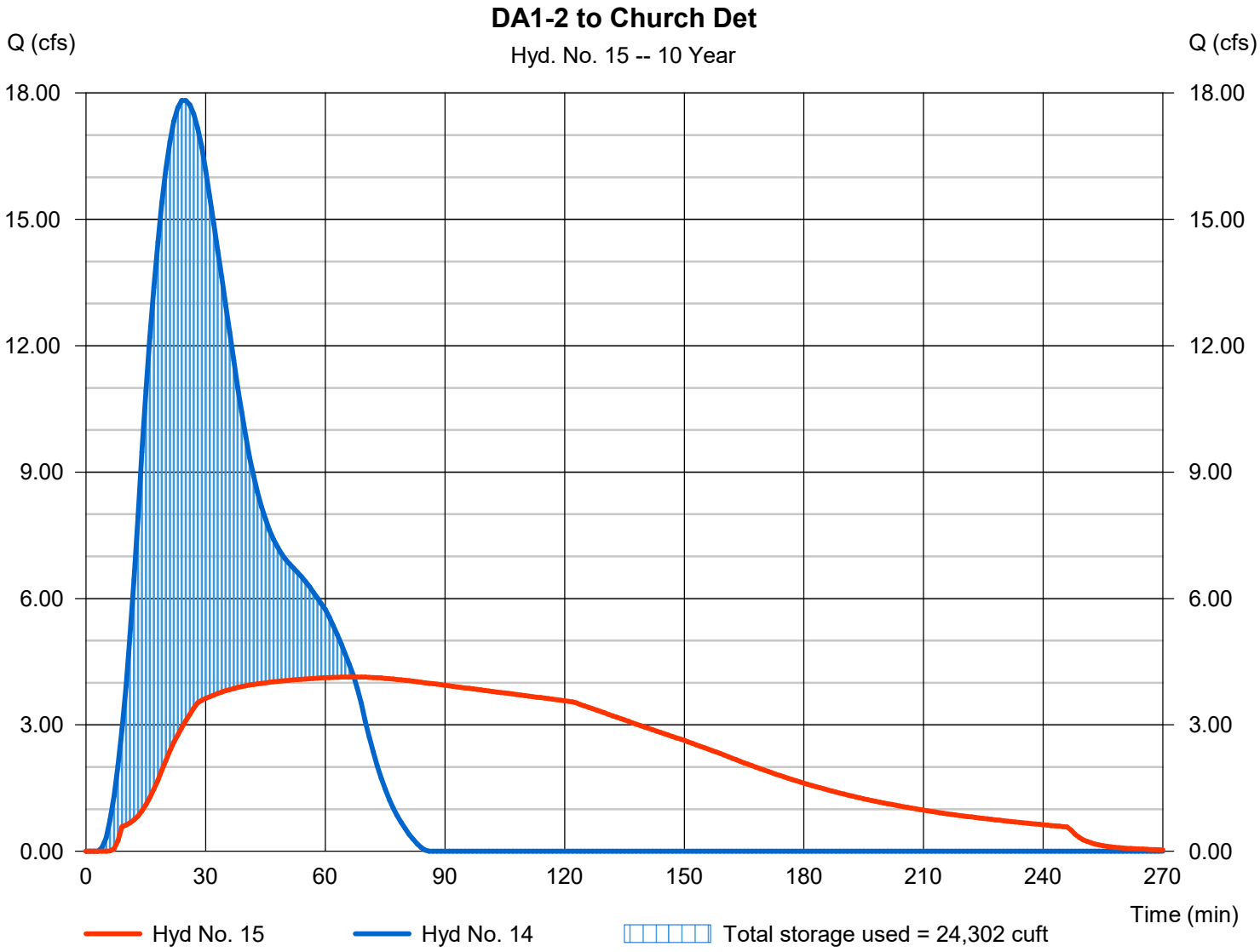
Hydrograph Report

Hyd. No. 15

DA1-2 to Church Det

Hydrograph type	=	Reservoir	Peak discharge	=	4.137 cfs
Storm frequency	=	10 yrs	Time to peak	=	67 min
Time interval	=	1 min	Hyd. volume	=	37,447 cuft
Inflow hyd. No.	=	14 - DA1-2	Max. Elevation	=	1294.32 ft
Reservoir name	=	Church Detention	Max. Storage	=	24,302 cuft

Storage Indication method used.



Pond Report

Pond No. 1 - Church Detention

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 1292.58 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	1292.58	00	0	0
0.42	1293.00	2,109	295	295
1.42	1294.00	28,716	12,868	13,163
1.97	1294.55	41,993	19,331	32,494
2.42	1295.00	52,471	21,204	53,698
3.42	1296.00	63,643	57,961	111,660

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 12.00	0.00	0.00	0.00
Span (in)	= 12.00	0.00	0.00	0.00
No. Barrels	= 1	0	0	0
Invert El. (ft)	= 1292.62	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

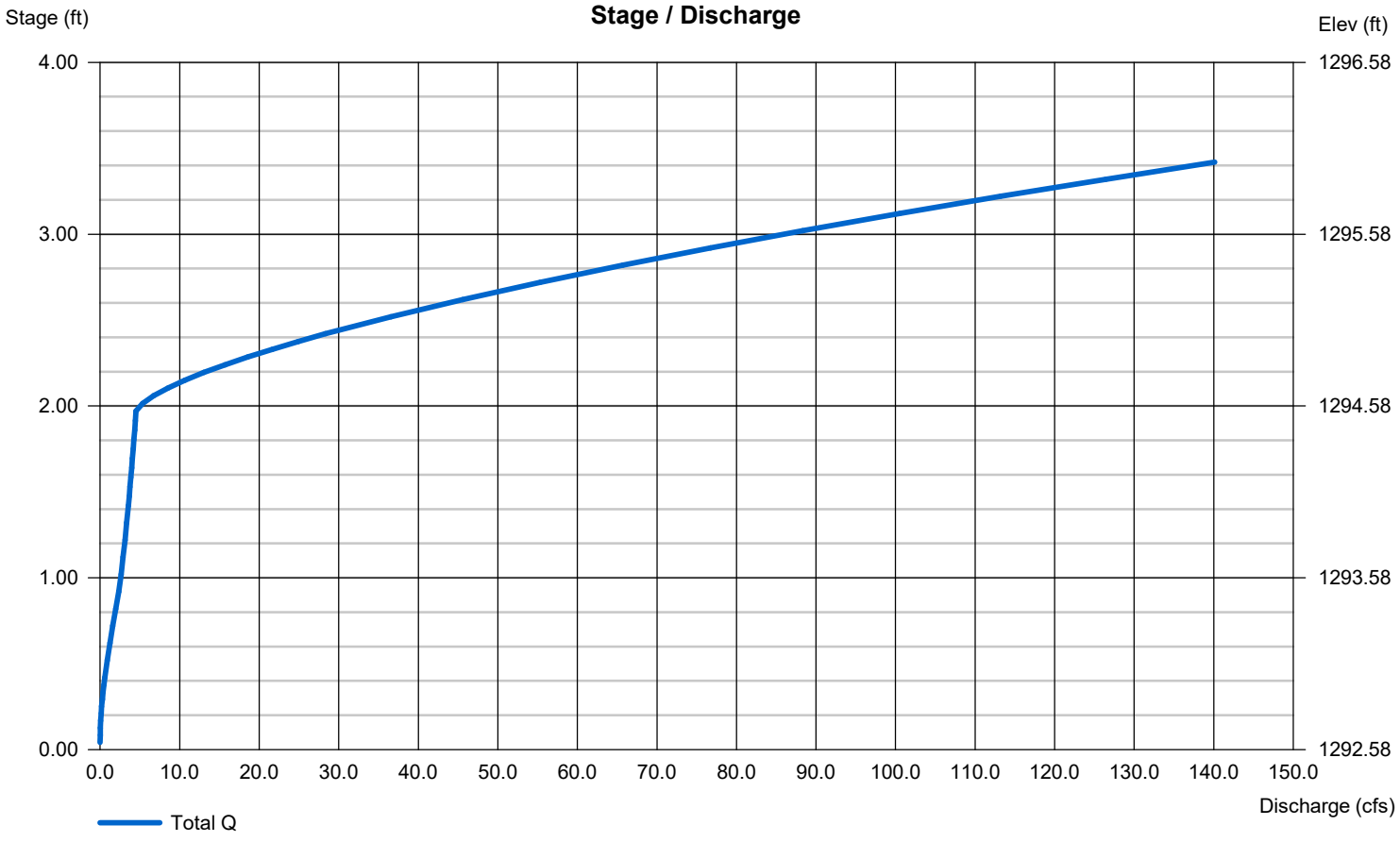
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 23.00	0.00	0.00	0.00
Crest El. (ft)	= 1294.55	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= Ciplti	Rect	---	---
Multi-Stage	= No	No	No	No

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

TW Elev. (ft) = 0.00

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

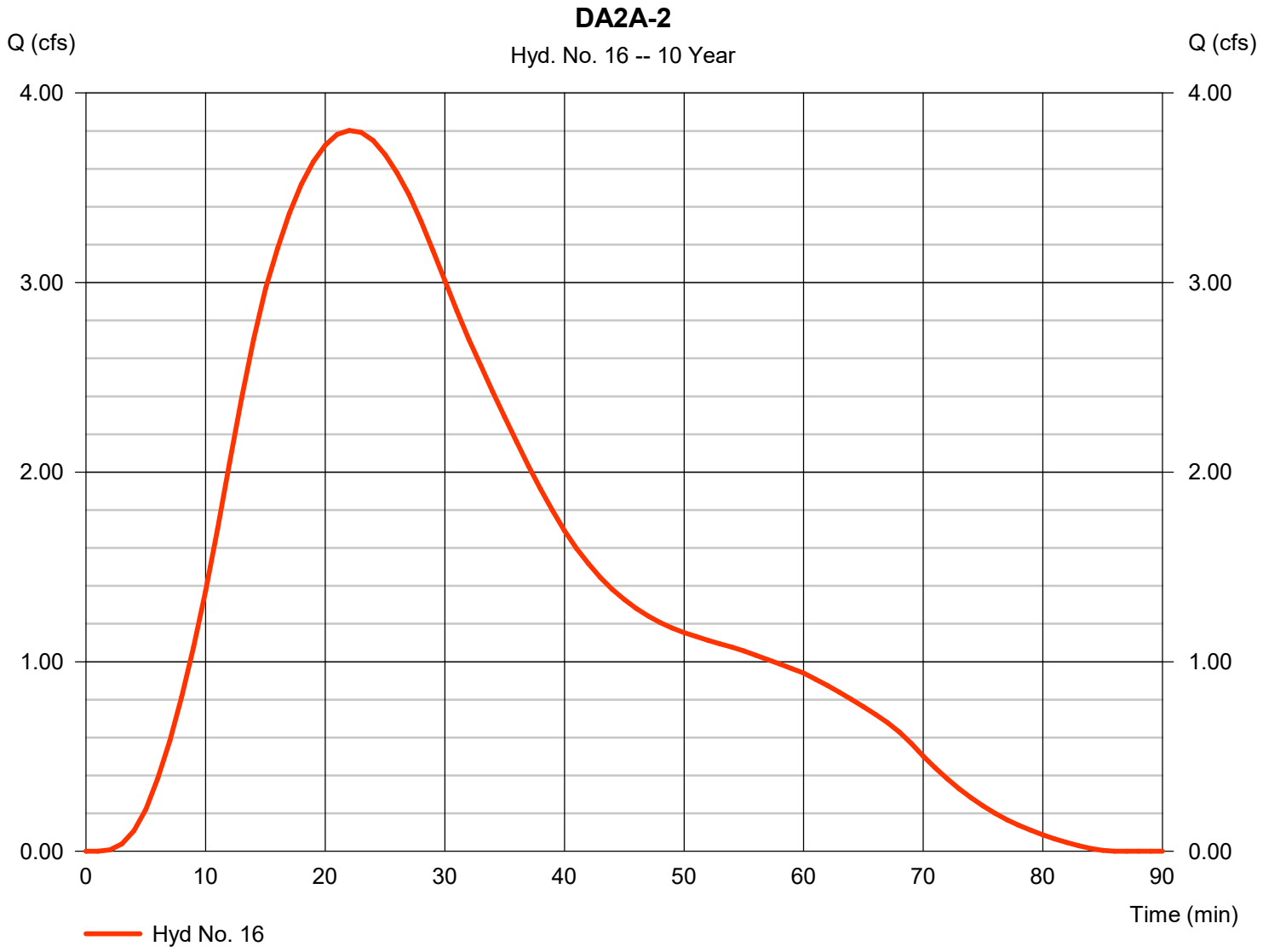


Hydrograph Report

Hyd. No. 16

DA2A-2

Hydrograph type	=	SCS Runoff	Peak discharge	=	3.802 cfs
Storm frequency	=	10 yrs	Time to peak	=	22 min
Time interval	=	1 min	Hyd. volume	=	7,510 cuft
Drainage area	=	1.380 ac	Curve number	=	94
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	16.00 min
Total precip.	=	2.09 in	Distribution	=	Huff-1st
Storm duration	=	1.00 hrs	Shape factor	=	484

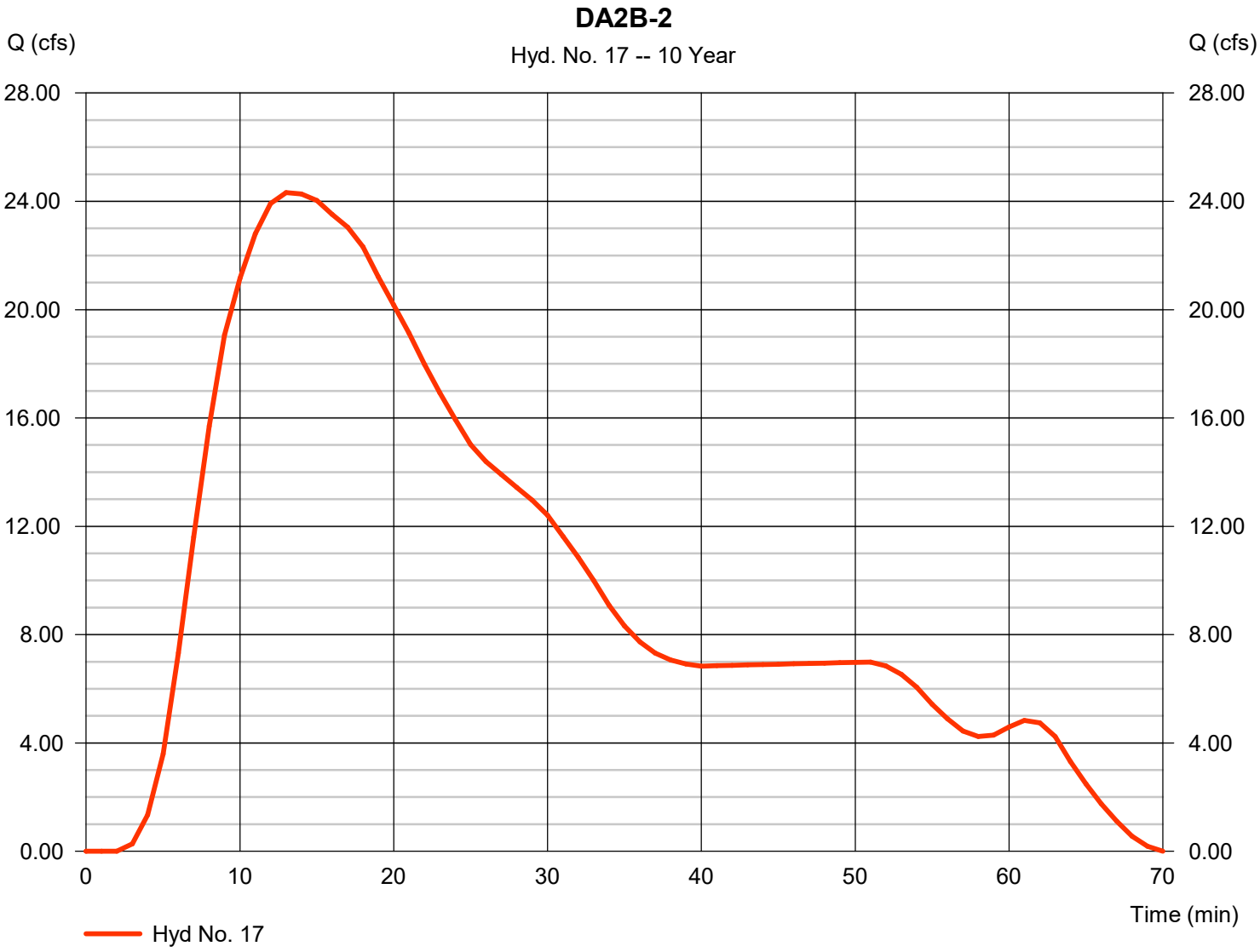


Hydrograph Report

Hyd. No. 17

DA2B-2

Hydrograph type	=	SCS Runoff	Peak discharge	=	24.32 cfs
Storm frequency	=	10 yrs	Time to peak	=	13 min
Time interval	=	1 min	Hyd. volume	=	41,648 cuft
Drainage area	=	9.500 ac	Curve number	=	90
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	2.09 in	Distribution	=	Huff-1st
Storm duration	=	1.00 hrs	Shape factor	=	484

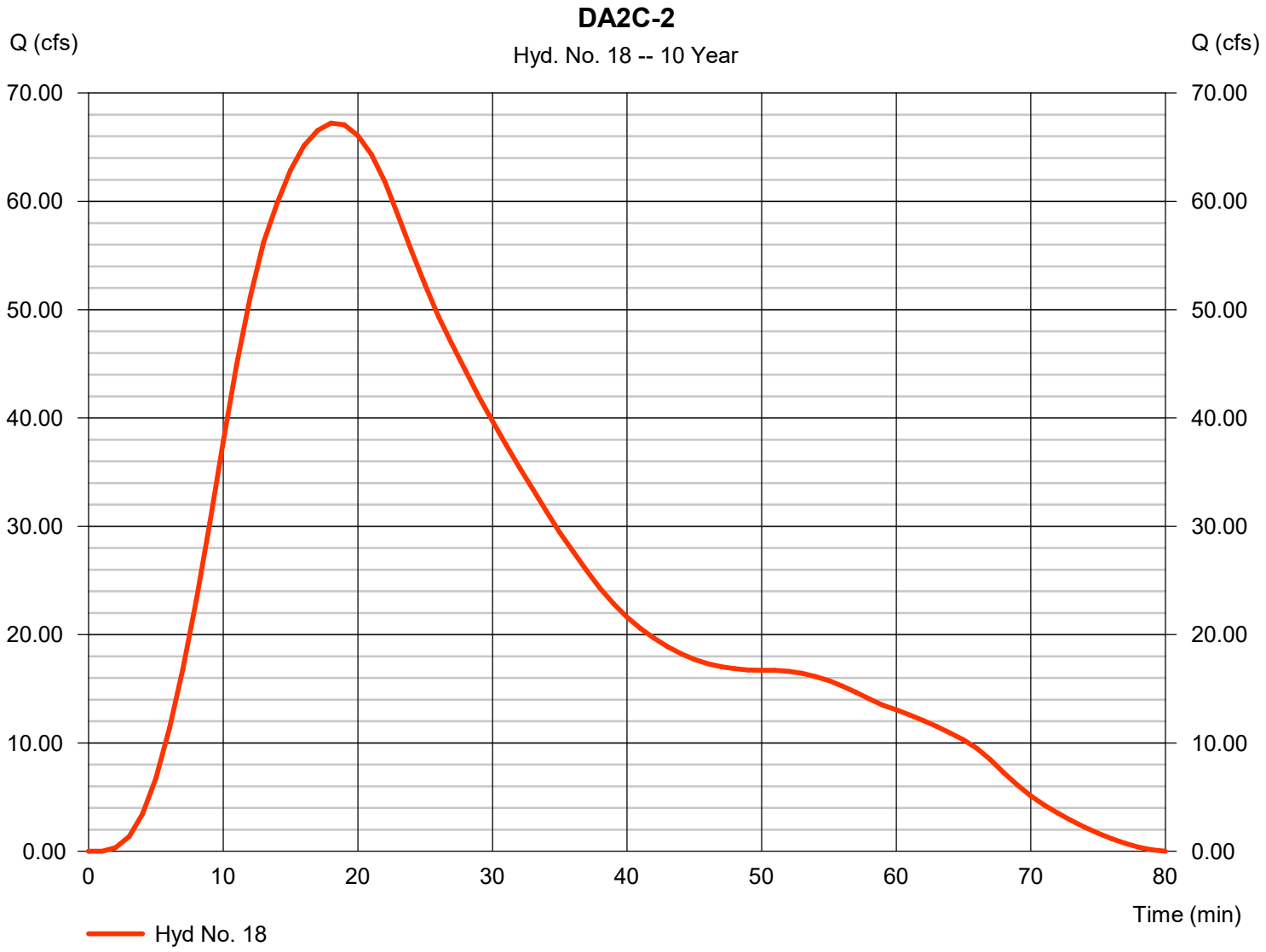


Hydrograph Report

Hyd. No. 18

DA2C-2

Hydrograph type	=	SCS Runoff	Peak discharge	=	67.22 cfs
Storm frequency	=	10 yrs	Time to peak	=	18 min
Time interval	=	1 min	Hyd. volume	=	119,118 cuft
Drainage area	=	21.250 ac	Curve number	=	95
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	11.90 min
Total precip.	=	2.09 in	Distribution	=	Huff-1st
Storm duration	=	1.00 hrs	Shape factor	=	484

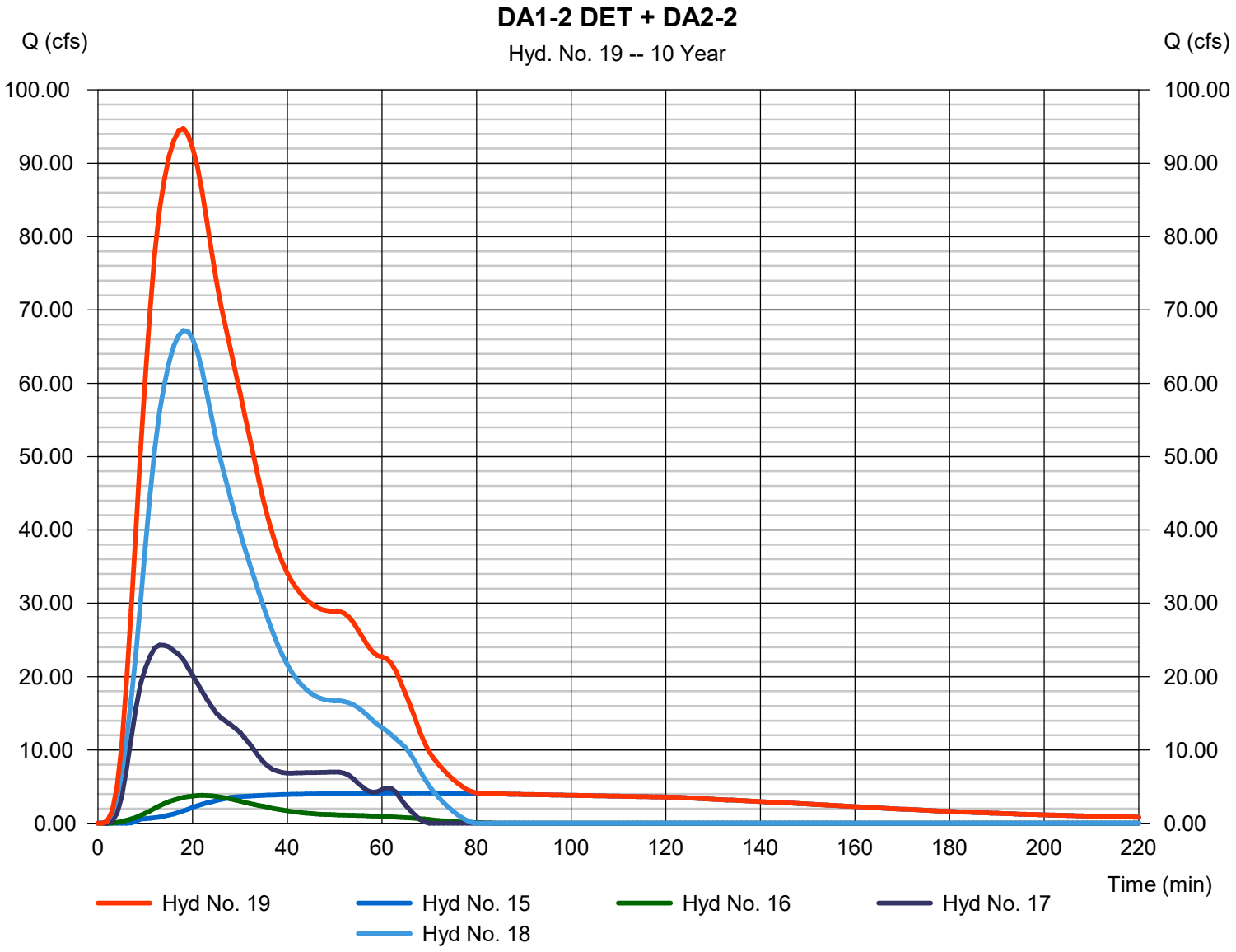


Hydrograph Report

Hyd. No. 19

DA1-2 DET + DA2-2

Hydrograph type	=	Combine	Peak discharge	=	94.75 cfs
Storm frequency	=	10 yrs	Time to peak	=	18 min
Time interval	=	1 min	Hyd. volume	=	205,722 cuft
Inflow hyds.	=	15, 16, 17, 18	Contrib. drain. area	=	32.130 ac



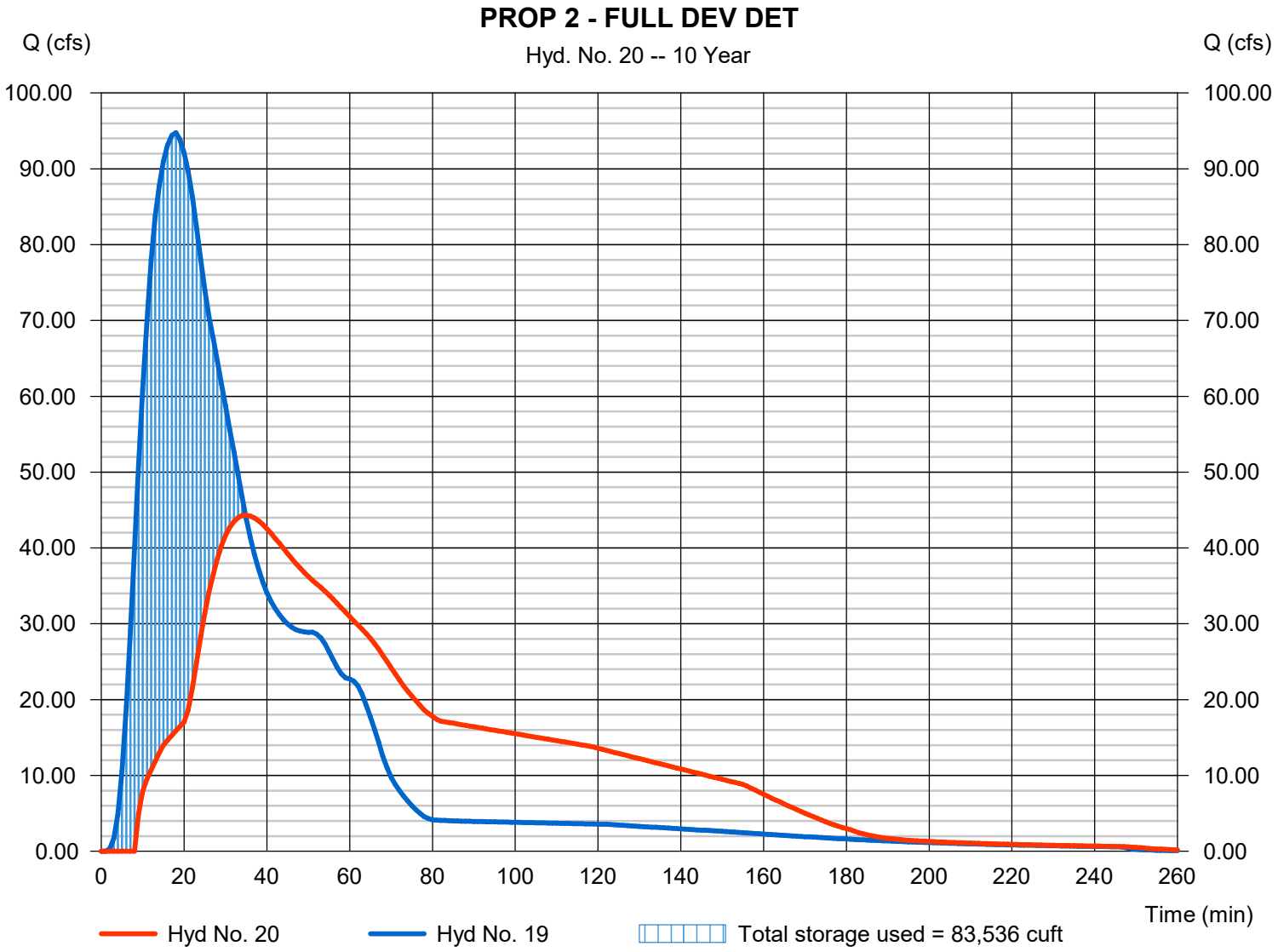
Hydrograph Report

Hyd. No. 20

PROP 2 - FULL DEV DET

Hydrograph type	= Reservoir	Peak discharge	= 44.33 cfs
Storm frequency	= 10 yrs	Time to peak	= 35 min
Time interval	= 1 min	Hyd. volume	= 200,308 cuft
Inflow hyd. No.	= 19 - DA1-2 DET + DA2-2	Max. Elevation	= 1288.65 ft
Reservoir name	= Phase 2	Max. Storage	= 83,536 cuft

Storage Indication method used.



Pond Report

Pond No. 2 - Phase 2

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 1283.45 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	1283.45	00	0	0
0.55	1284.00	650	119	119
1.55	1285.00	5,157	2,546	2,665
2.55	1286.00	13,875	9,163	11,828
3.55	1287.00	23,575	18,510	30,338
4.55	1288.00	33,464	28,373	58,710
5.55	1289.00	42,792	38,029	96,739
6.55	1290.00	50,595	46,634	143,374
7.55	1291.00	56,302	53,418	196,791
7.60	1291.05	56,448	2,816	199,607

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 24.00	21.00	0.00	0.00
Span (in)	= 24.00	21.00	0.00	0.00
No. Barrels	= 2	1	0	0
Invert El. (ft)	= 1283.35	1283.45	0.00	0.00
Length (ft)	= 153.83	0.00	0.00	0.00
Slope (%)	= 0.42	0.00	0.00	n/a
N-Value	= .012	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	Yes	No	No

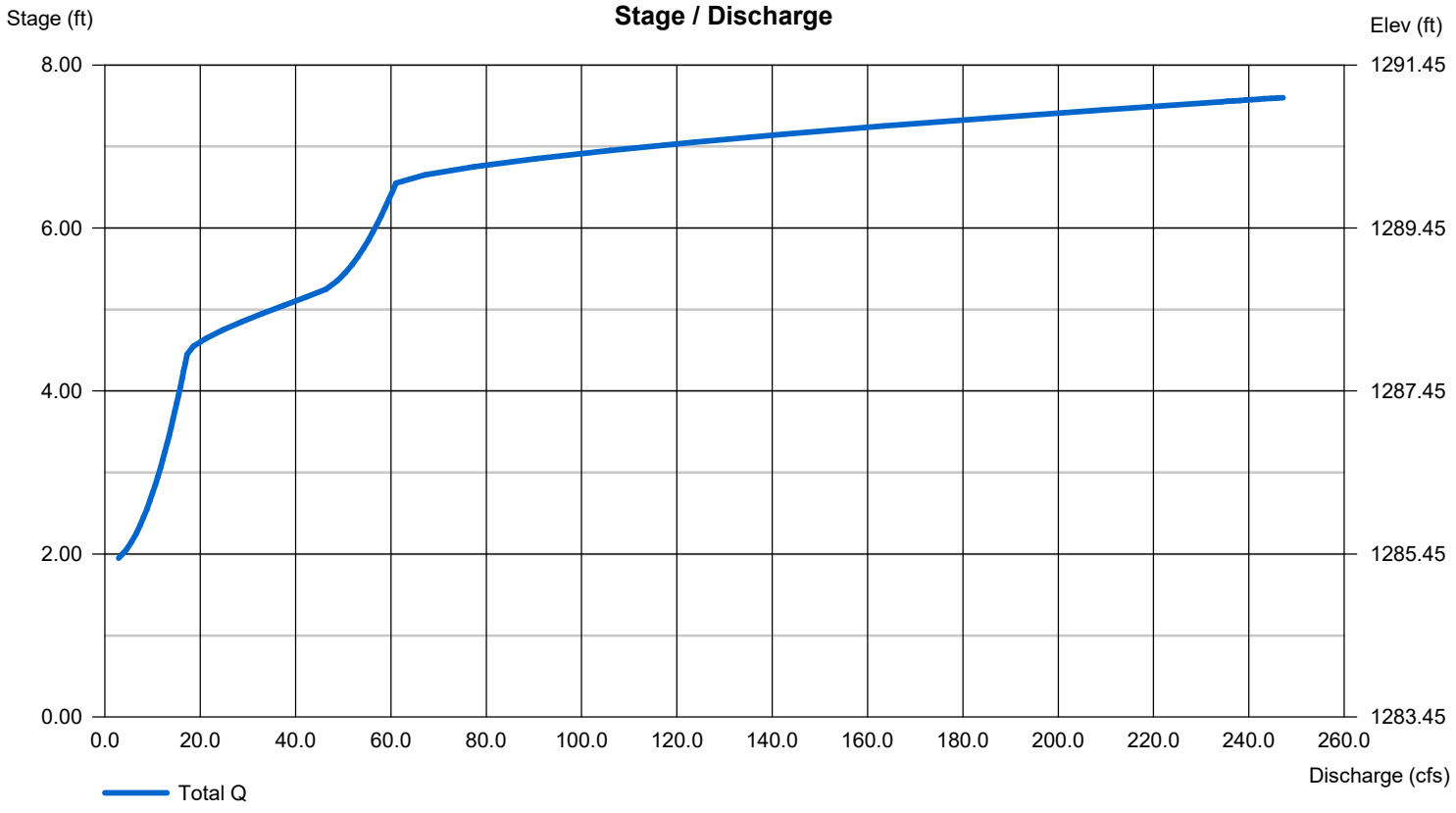
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 16.00	50.00	Inactive	0.00
Crest El. (ft)	= 1287.92	1290.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= Rect	Ciplti	Rect	---
Multi-Stage	= Yes	No	No	No

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

TW Elev. (ft) = 1285.33

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



Hydraflow Table of Contents

Hydrograph Summary Report

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

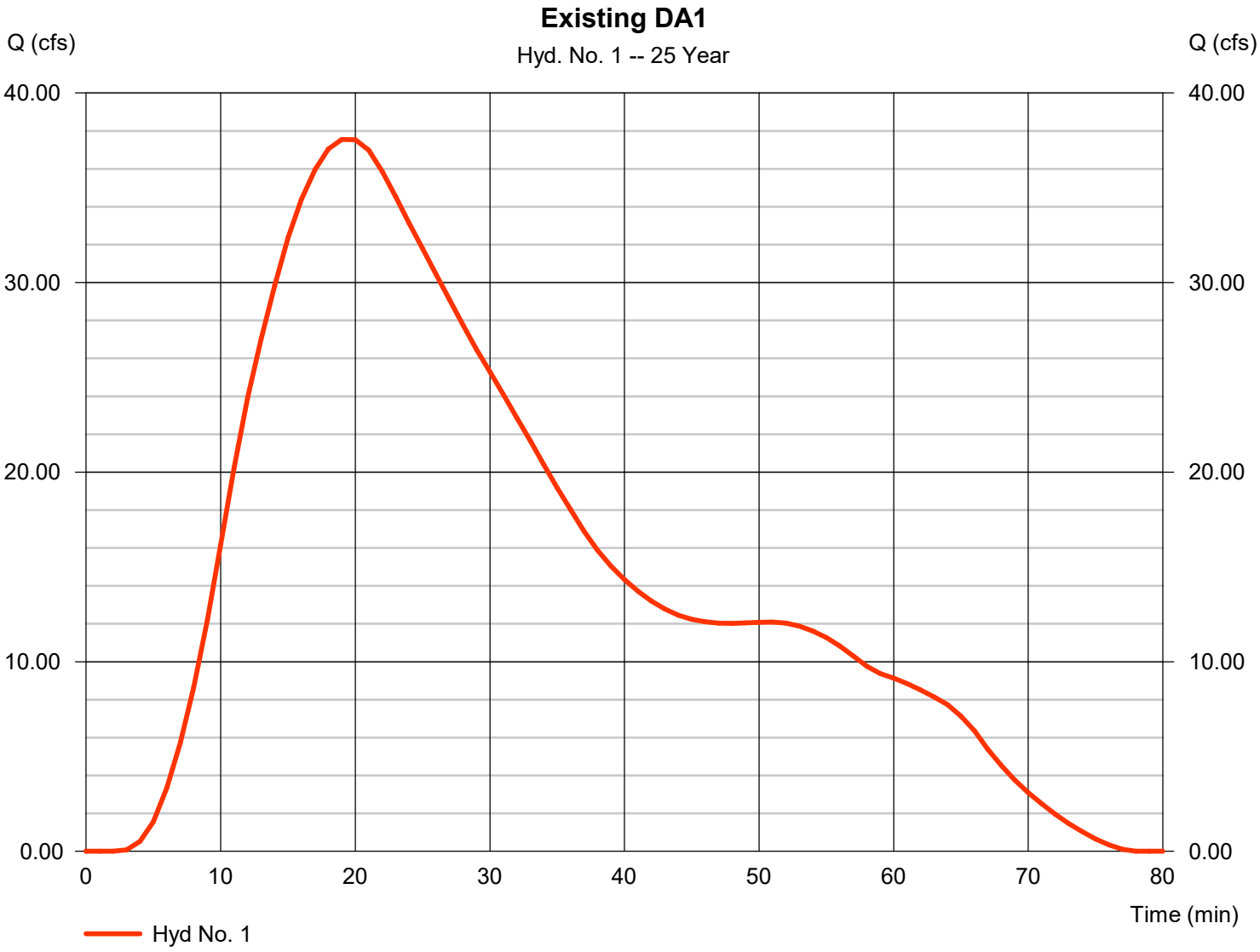
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	37.54	1	19	70,091	------	------	------	Existing DA1
2	Reservoir	11.89	1	53	70,058	1	1294.75	42,065	Exist DA1 - Church Det
3	SCS Runoff	54.62	1	23	112,058	------	------	------	Existing DA2
4	Combine	58.79	1	24	182,115	2, 3	------	------	Pre
6	SCS Runoff	30.97	1	19	57,824	------	------	------	DA1-1
7	Reservoir	8.091	1	58	57,791	6	1294.67	38,333	DA1-1 to Church Det
8	SCS Runoff	6.770	1	25	14,132	------	------	------	DA2A-1
9	SCS Runoff	33.66	1	13	56,933	------	------	------	DA2B-1
10	SCS Runoff	33.62	1	21	65,518	------	------	------	DA2C-1
11	Combine	70.78	1	19	194,374	7, 8, 9, 10	------	------	DA1-1 DET + DA2-1
12	Reservoir	40.42	1	35	185,295	11	1287.90	55,959	PROP-1 DETENTION
14	SCS Runoff	24.03	1	24	49,651	------	------	------	DA1-2
15	Reservoir	5.172	1	67	49,618	14	1294.59	34,212	DA1-2 to Church Det
16	SCS Runoff	4.827	1	22	9,433	------	------	------	DA2A-2
17	SCS Runoff	32.52	1	13	54,070	------	------	------	DA2B-2
18	SCS Runoff	84.73	1	18	148,340	------	------	------	DA2C-2
19	Combine	120.46	1	17	261,461	15, 16, 17, 18	------	------	DA1-2 DET + DA2-2
20	Reservoir	51.31	1	36	252,382	19	1289.17	104,793	PROP 2 - FULL DEV DET

Hydrograph Report

Hyd. No. 1

Existing DA1

Hydrograph type	=	SCS Runoff	Peak discharge	=	37.54 cfs
Storm frequency	=	25 yrs	Time to peak	=	19 min
Time interval	=	1 min	Hyd. volume	=	70,091 cuft
Drainage area	=	14.570 ac	Curve number	=	87
Basin Slope	=	2.0 %	Hydraulic length	=	2185 ft
Tc method	=	User	Time of conc. (Tc)	=	10.10 min
Total precip.	=	2.49 in	Distribution	=	Huff-1st
Storm duration	=	1.00 hrs	Shape factor	=	484



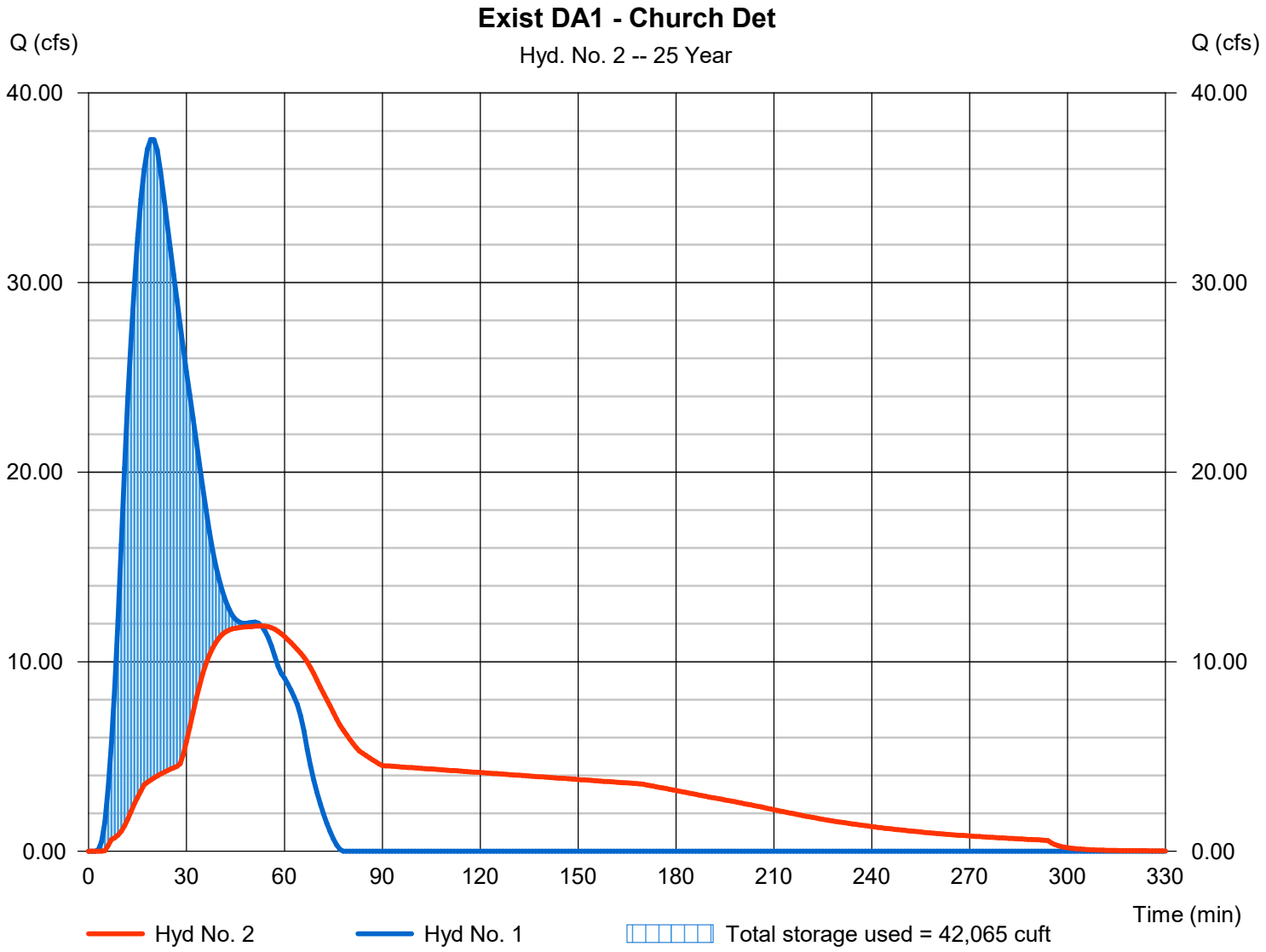
Hydrograph Report

Hyd. No. 2

Exist DA1 - Church Det

Hydrograph type	=	Reservoir	Peak discharge	=	11.89 cfs
Storm frequency	=	25 yrs	Time to peak	=	53 min
Time interval	=	1 min	Hyd. volume	=	70,058 cuft
Inflow hyd. No.	=	1 - Existing DA1	Max. Elevation	=	1294.75 ft
Reservoir name	=	Church Detention	Max. Storage	=	42,065 cuft

Storage Indication method used.



Pond Report

Pond No. 1 - Church Detention

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 1292.58 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	1292.58	00	0	0
0.42	1293.00	2,109	295	295
1.42	1294.00	28,716	12,868	13,163
1.97	1294.55	41,993	19,331	32,494
2.42	1295.00	52,471	21,204	53,698
3.42	1296.00	63,643	57,961	111,660

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 12.00	0.00	0.00	0.00
Span (in)	= 12.00	0.00	0.00	0.00
No. Barrels	= 1	0	0	0
Invert El. (ft)	= 1292.62	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

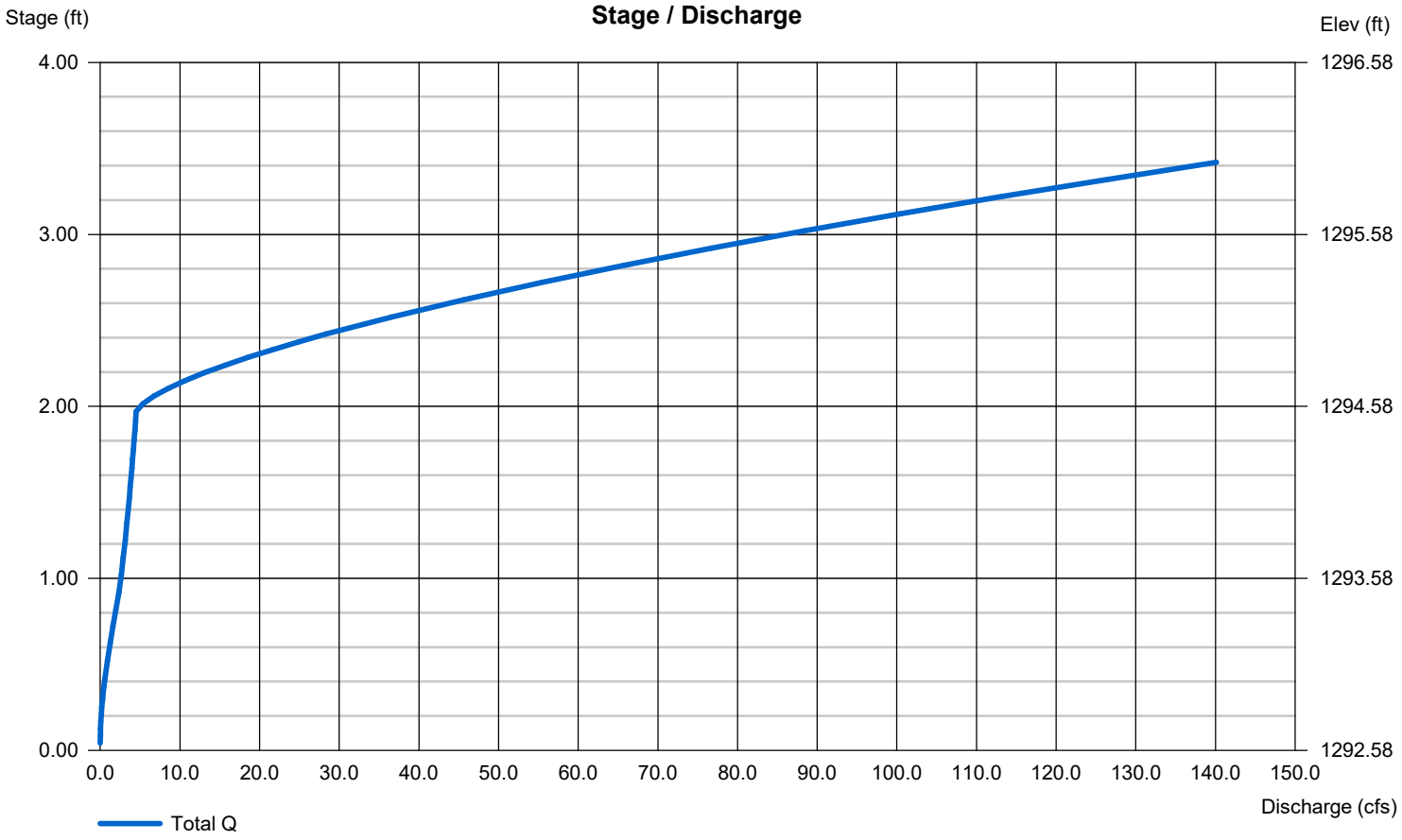
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 23.00	0.00	0.00	0.00
Crest El. (ft)	= 1294.55	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= Ciplti	Rect	---	---
Multi-Stage	= No	No	No	No

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

TW Elev. (ft) = 0.00

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

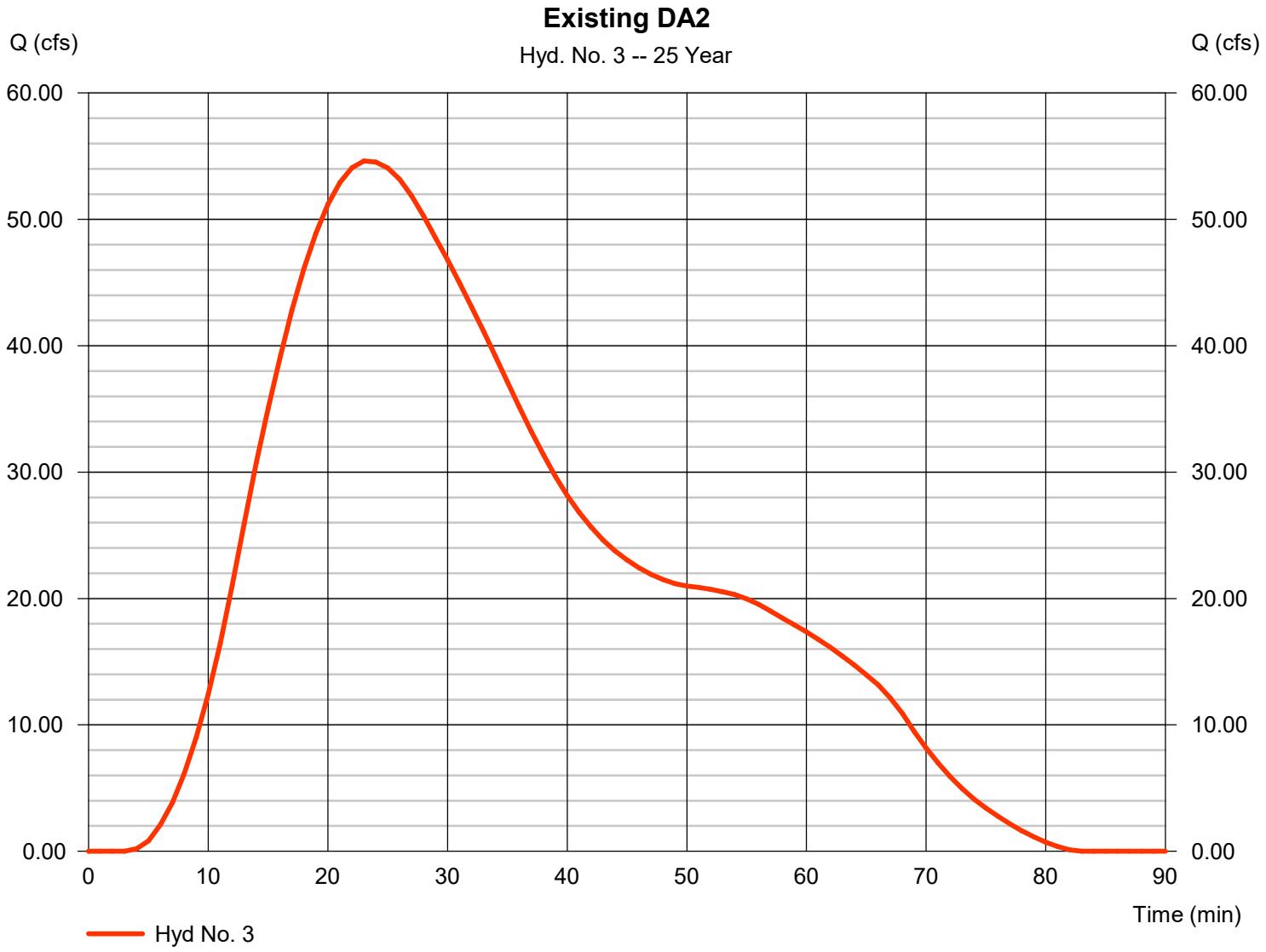


Hydrograph Report

Hyd. No. 3

Existing DA2

Hydrograph type	=	SCS Runoff	Peak discharge	=	54.62 cfs
Storm frequency	=	25 yrs	Time to peak	=	23 min
Time interval	=	1 min	Hyd. volume	=	112,058 cuft
Drainage area	=	27.860 ac	Curve number	=	84
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	13.90 min
Total precip.	=	2.49 in	Distribution	=	Huff-1st
Storm duration	=	1.00 hrs	Shape factor	=	484

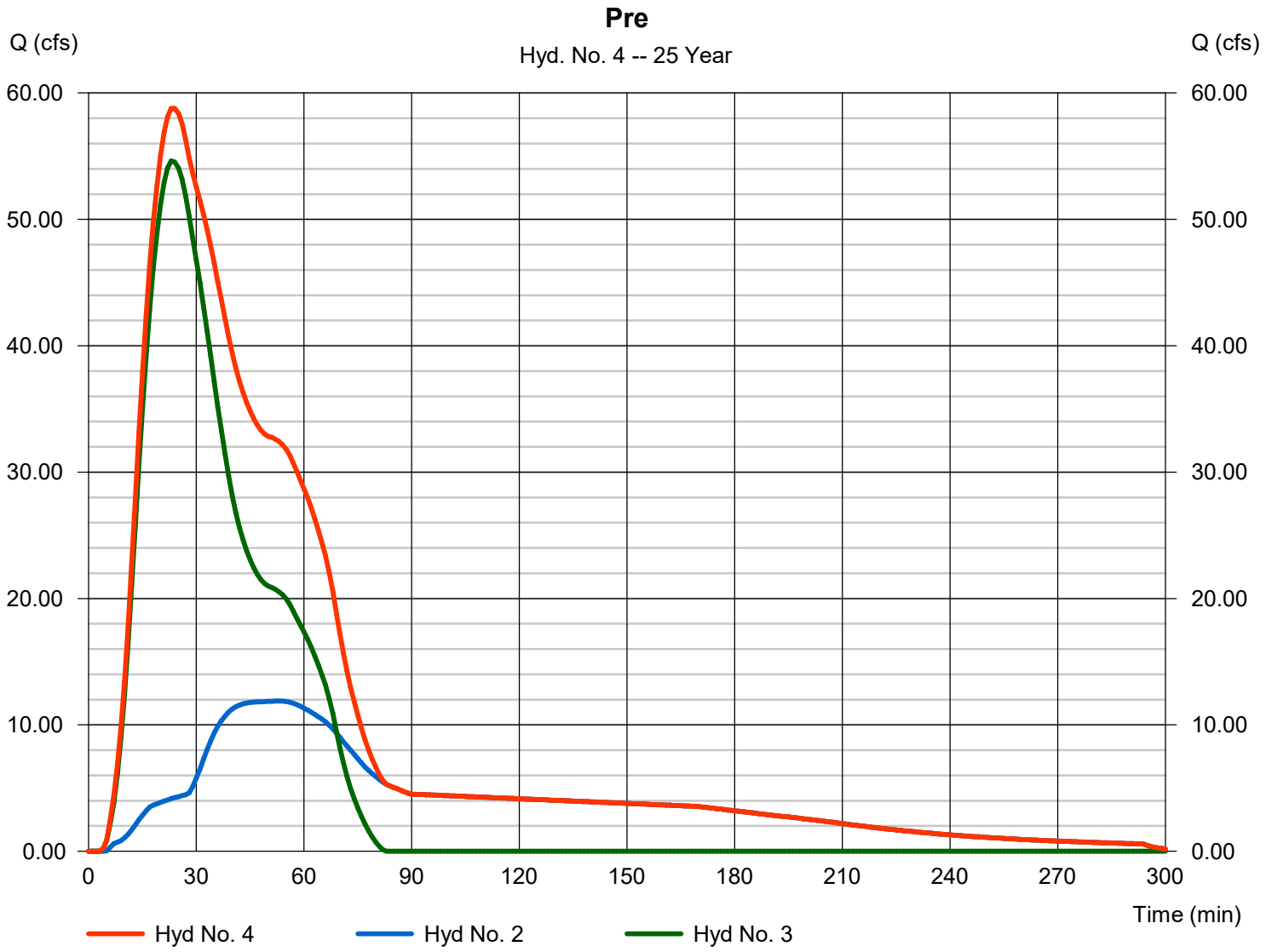


Hydrograph Report

Hyd. No. 4

Pre

Hydrograph type	=	Combine	Peak discharge	=	58.79 cfs
Storm frequency	=	25 yrs	Time to peak	=	24 min
Time interval	=	1 min	Hyd. volume	=	182,115 cuft
Inflow hyds.	=	2, 3	Contrib. drain. area	=	27.860 ac



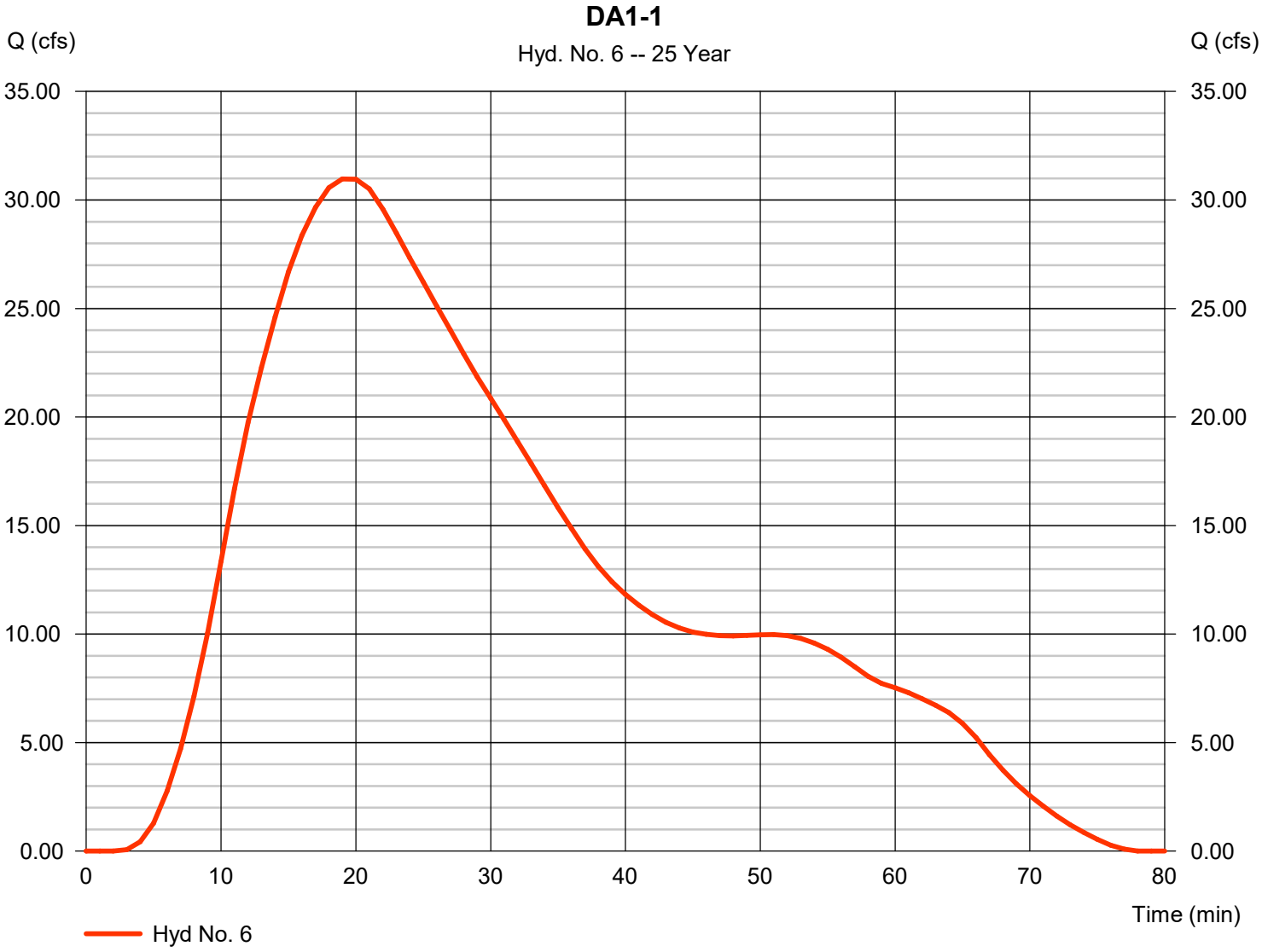
Hydrograph Report

Hyd. No. 6

DA1-1

Hydrograph type	=	SCS Runoff	Peak discharge	=	30.97 cfs
Storm frequency	=	25 yrs	Time to peak	=	19 min
Time interval	=	1 min	Hyd. volume	=	57,824 cuft
Drainage area	=	12.020 ac	Curve number	=	87*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	10.08 min
Total precip.	=	2.49 in	Distribution	=	Huff-1st
Storm duration	=	1.00 hrs	Shape factor	=	484

* Composite (Area/CN) = [(4.755 x 90) + (1.295 x 75)] / 12.020



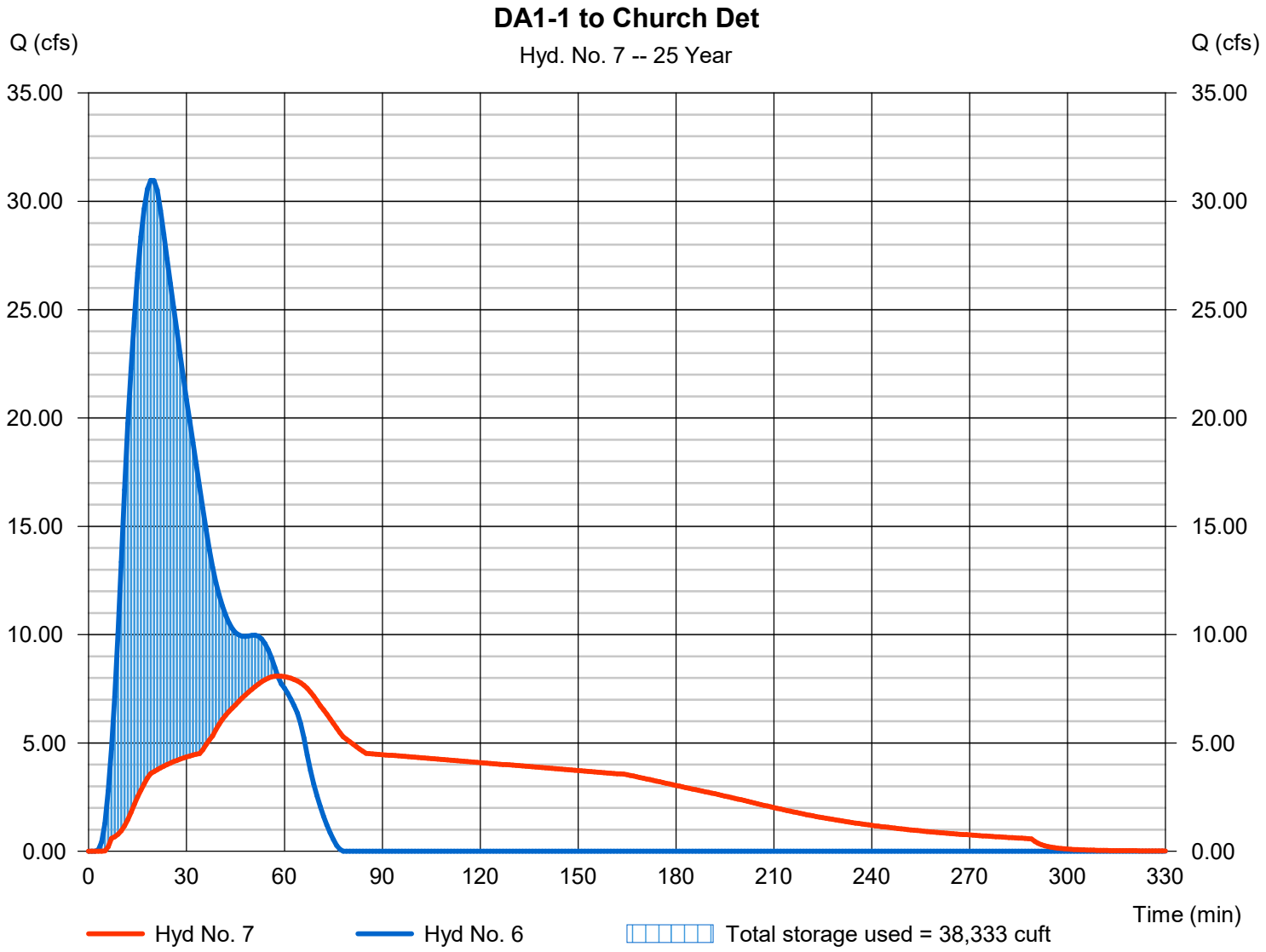
Hydrograph Report

Hyd. No. 7

DA1-1 to Church Det

Hydrograph type	=	Reservoir	Peak discharge	=	8.091 cfs
Storm frequency	=	25 yrs	Time to peak	=	58 min
Time interval	=	1 min	Hyd. volume	=	57,791 cuft
Inflow hyd. No.	=	6 - DA1-1	Max. Elevation	=	1294.67 ft
Reservoir name	=	Church Detention	Max. Storage	=	38,333 cuft

Storage Indication method used.



Pond Report

Pond No. 1 - Church Detention

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 1292.58 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	1292.58	00	0	0
0.42	1293.00	2,109	295	295
1.42	1294.00	28,716	12,868	13,163
1.97	1294.55	41,993	19,331	32,494
2.42	1295.00	52,471	21,204	53,698
3.42	1296.00	63,643	57,961	111,660

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 12.00	0.00	0.00	0.00
Span (in)	= 12.00	0.00	0.00	0.00
No. Barrels	= 1	0	0	0
Invert El. (ft)	= 1292.62	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

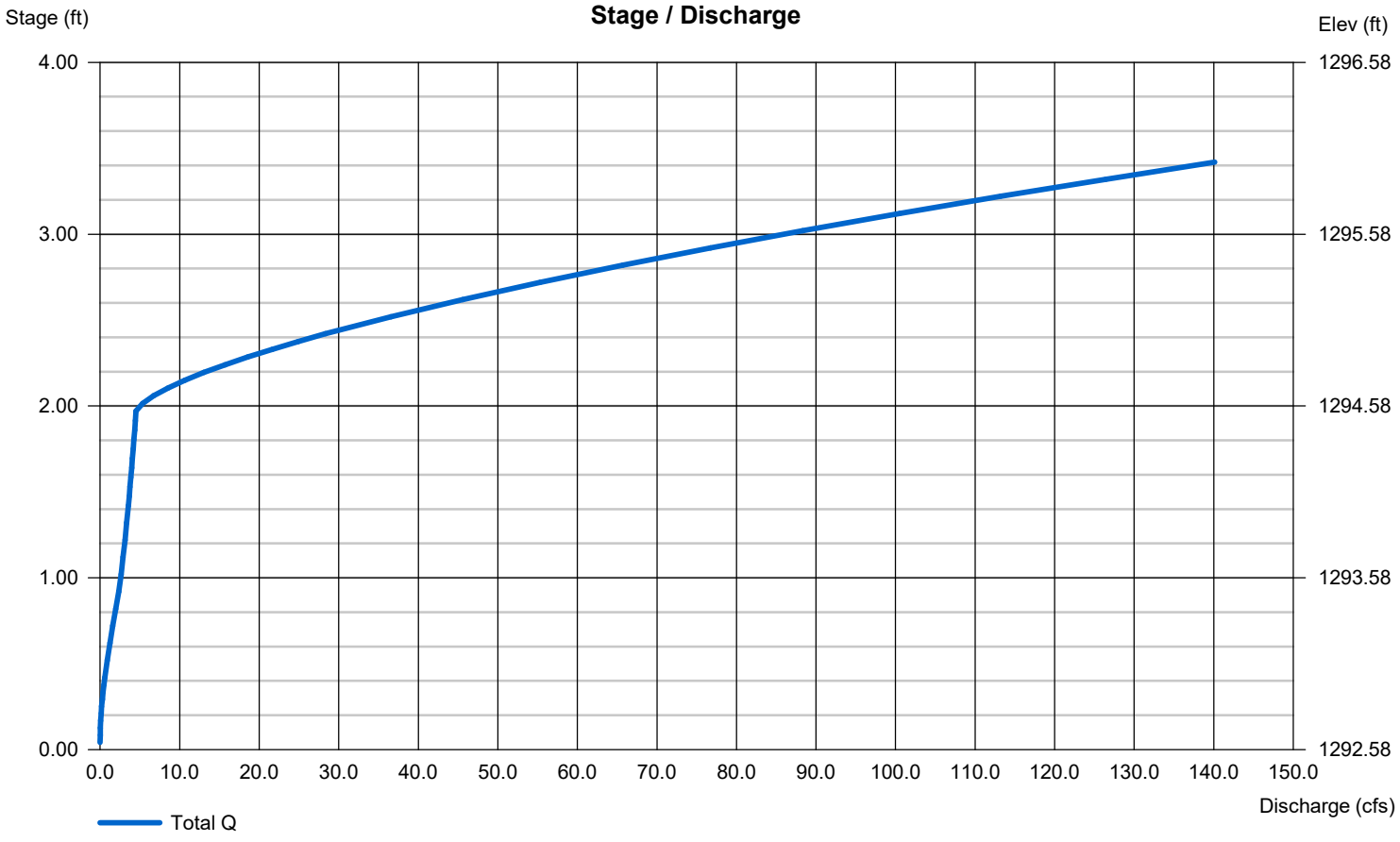
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 23.00	0.00	0.00	0.00
Crest El. (ft)	= 1294.55	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= Ciplti	Rect	---	---
Multi-Stage	= No	No	No	No

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

TW Elev. (ft) = 0.00

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



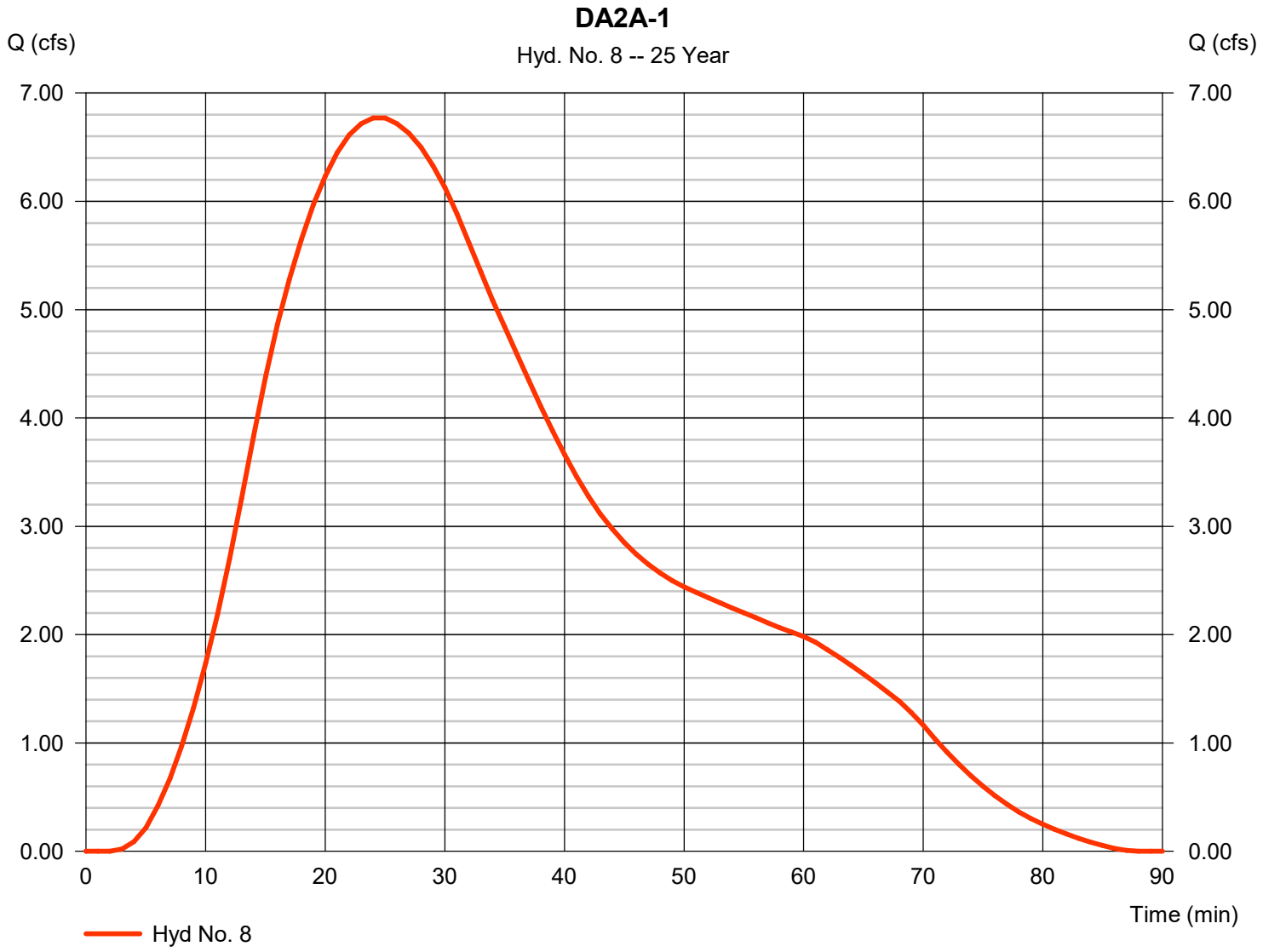
Hydrograph Report

Hyd. No. 8

DA2A-1

Hydrograph type	=	SCS Runoff	Peak discharge	=	6.770 cfs
Storm frequency	=	25 yrs	Time to peak	=	25 min
Time interval	=	1 min	Hyd. volume	=	14,132 cuft
Drainage area	=	2.590 ac	Curve number	=	90*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	18.10 min
Total precip.	=	2.49 in	Distribution	=	Huff-1st
Storm duration	=	1.00 hrs	Shape factor	=	484

* Composite (Area/CN) = [(4.880 x 90) + (2.170 x 75)] / 2.590



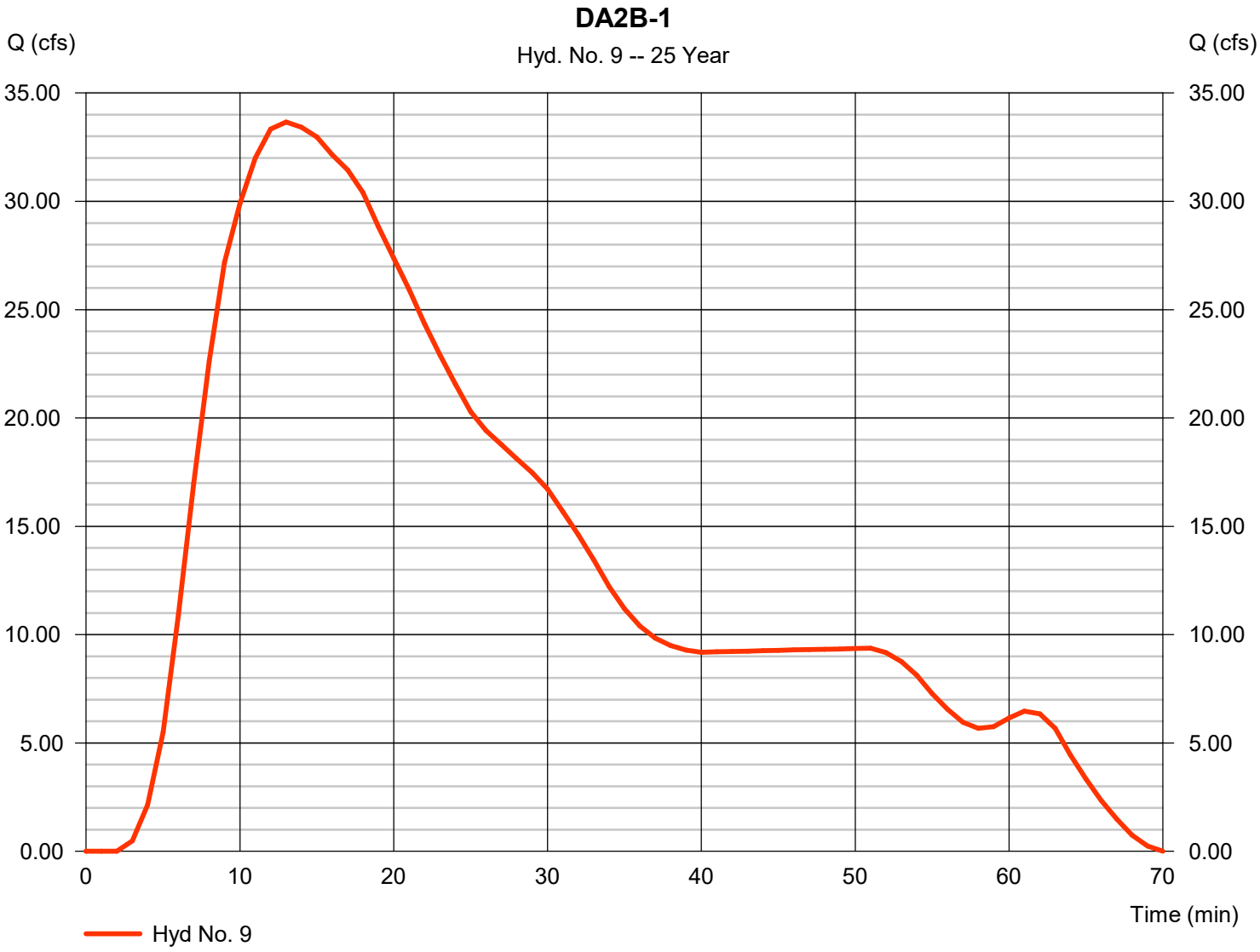
Hydrograph Report

Hyd. No. 9

DA2B-1

Hydrograph type	=	SCS Runoff	Peak discharge	=	33.66 cfs
Storm frequency	=	25 yrs	Time to peak	=	13 min
Time interval	=	1 min	Hyd. volume	=	56,933 cuft
Drainage area	=	10.520 ac	Curve number	=	89*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	2.49 in	Distribution	=	Huff-1st
Storm duration	=	1.00 hrs	Shape factor	=	484

* Composite (Area/CN) = [(4.880 x 90) + (2.170 x 75)] / 10.520



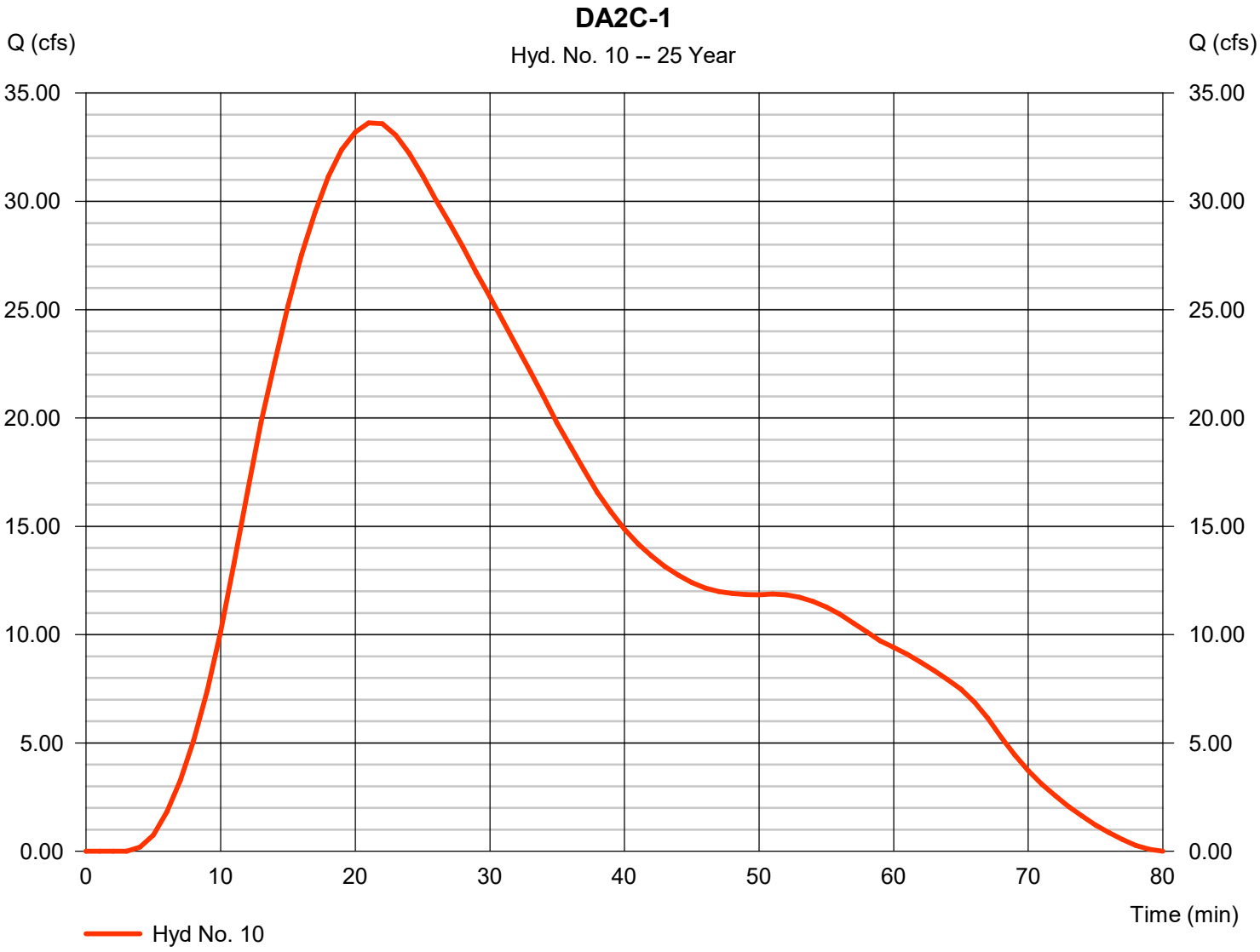
Hydrograph Report

Hyd. No. 10

DA2C-1

Hydrograph type	=	SCS Runoff	Peak discharge	=	33.62 cfs
Storm frequency	=	25 yrs	Time to peak	=	21 min
Time interval	=	1 min	Hyd. volume	=	65,518 cuft
Drainage area	=	15.680 ac	Curve number	=	85*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	11.90 min
Total precip.	=	2.49 in	Distribution	=	Huff-1st
Storm duration	=	1.00 hrs	Shape factor	=	484

* Composite (Area/CN) = [(4.880 x 90) + (2.170 x 75)] / 15.680

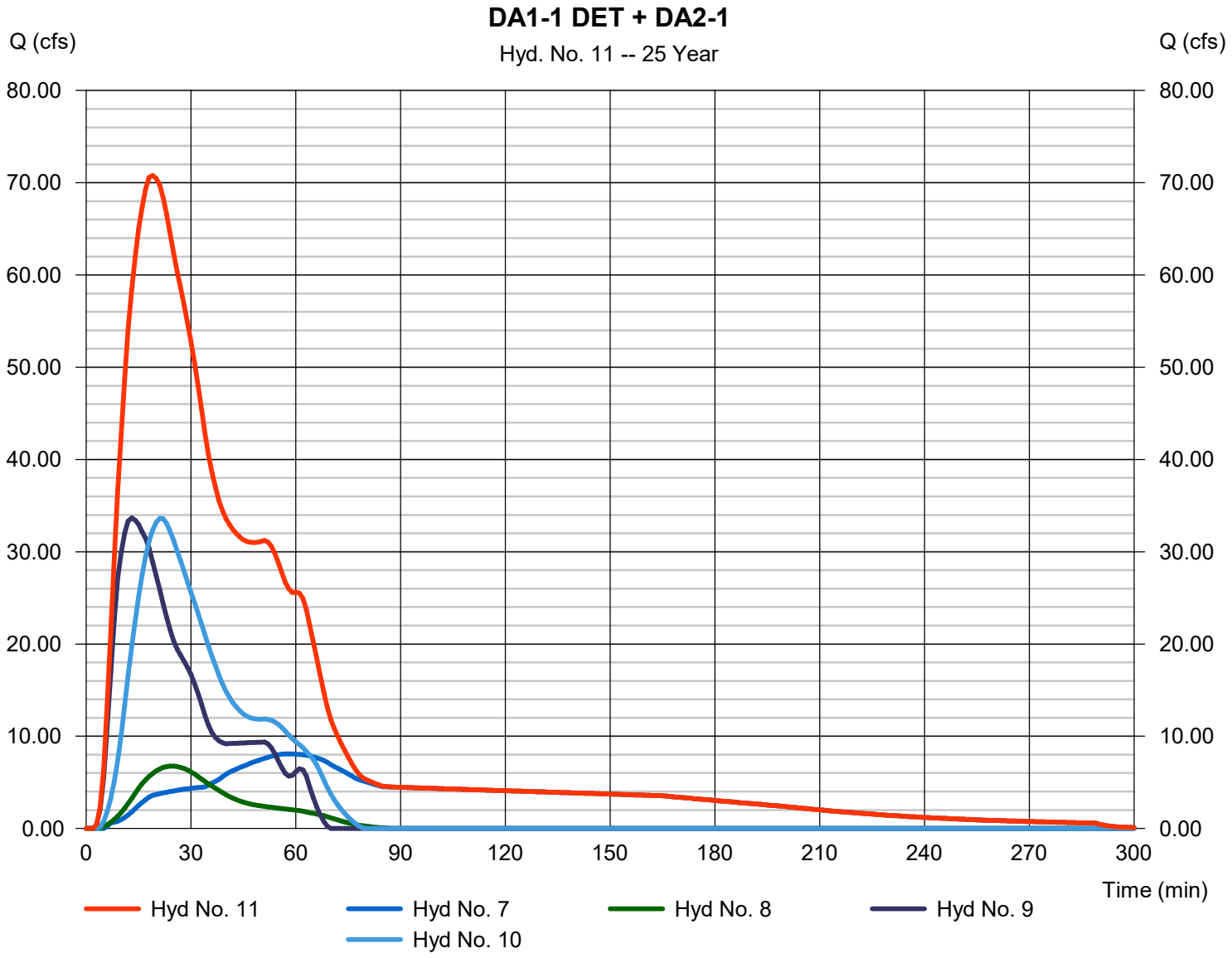


Hydrograph Report

Hyd. No. 11

DA1-1 DET + DA2-1

Hydrograph type	= Combine	Peak discharge	= 70.78 cfs
Storm frequency	= 25 yrs	Time to peak	= 19 min
Time interval	= 1 min	Hyd. volume	= 194,374 cuft
Inflow hyds.	= 7, 8, 9, 10	Contrib. drain. area	= 28.790 ac



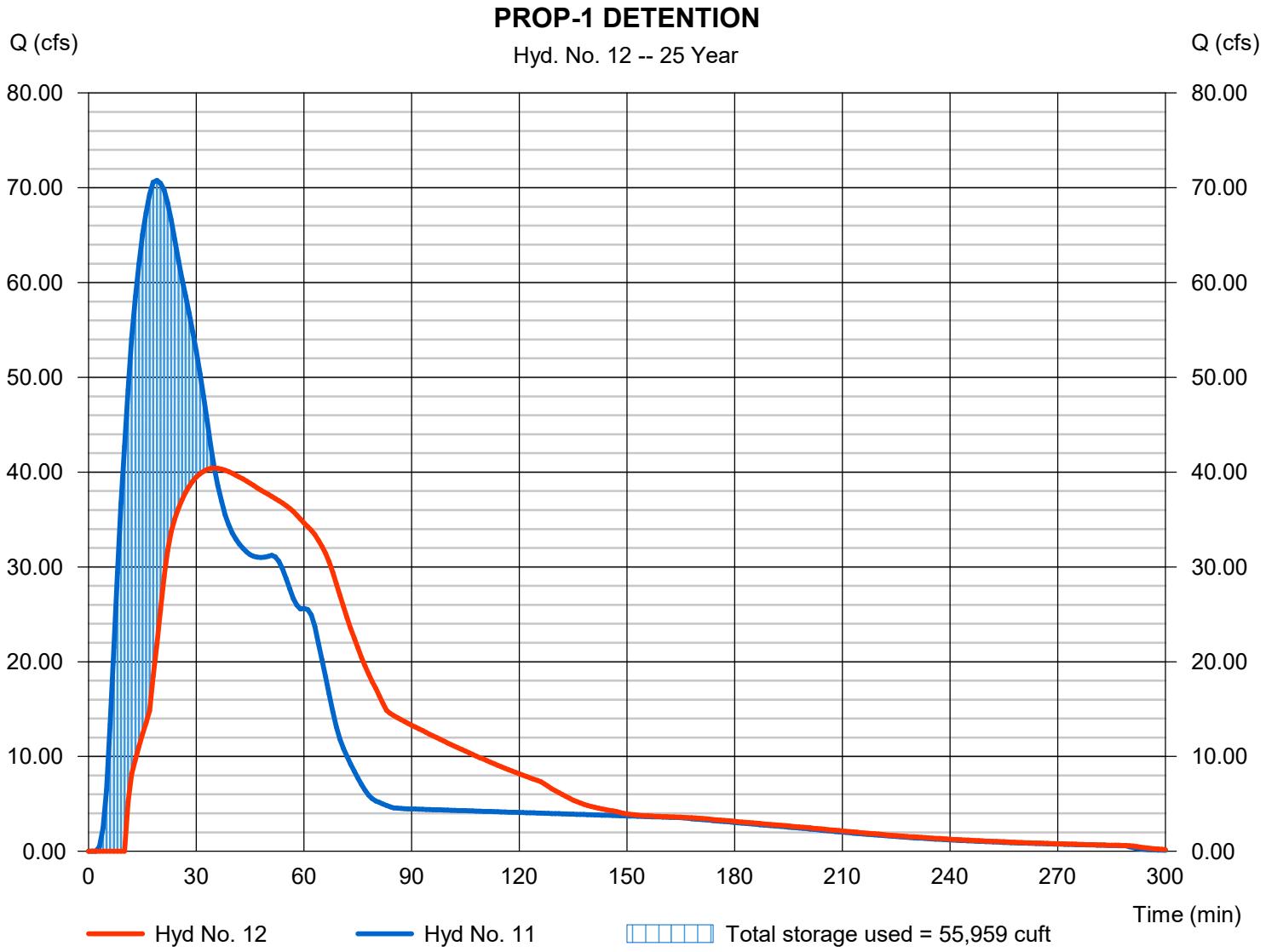
Hydrograph Report

Hyd. No. 12

PROP-1 DETENTION

Hydrograph type	=	Reservoir	Peak discharge	=	40.42 cfs
Storm frequency	=	25 yrs	Time to peak	=	35 min
Time interval	=	1 min	Hyd. volume	=	185,295 cuft
Inflow hyd. No.	=	11 - DA1-1 DET + DA2-1	Max. Elevation	=	1287.90 ft
Reservoir name	=	Phase 1	Max. Storage	=	55,959 cuft

Storage Indication method used.



Pond Report

Pond No. 3 - Phase 1

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 1283.45 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	1283.45	00	0	0
0.55	1284.00	650	119	119
1.55	1285.00	5,157	2,546	2,665
2.55	1286.00	13,875	9,163	11,828
3.55	1287.00	23,575	18,510	30,338
4.55	1288.00	33,464	28,373	58,710
5.55	1289.00	42,792	38,029	96,739
6.55	1290.00	50,595	46,634	143,374
7.55	1291.00	56,302	53,418	196,791
7.60	1291.05	56,448	2,816	199,607

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 24.00	24.00	0.00	0.00
Span (in)	= 24.00	24.00	0.00	0.00
No. Barrels	= 2	1	0	0
Invert El. (ft)	= 1283.35	1283.45	0.00	0.00
Length (ft)	= 153.83	0.00	0.00	0.00
Slope (%)	= 0.42	0.00	0.00	n/a
N-Value	= .012	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	Yes	No	No

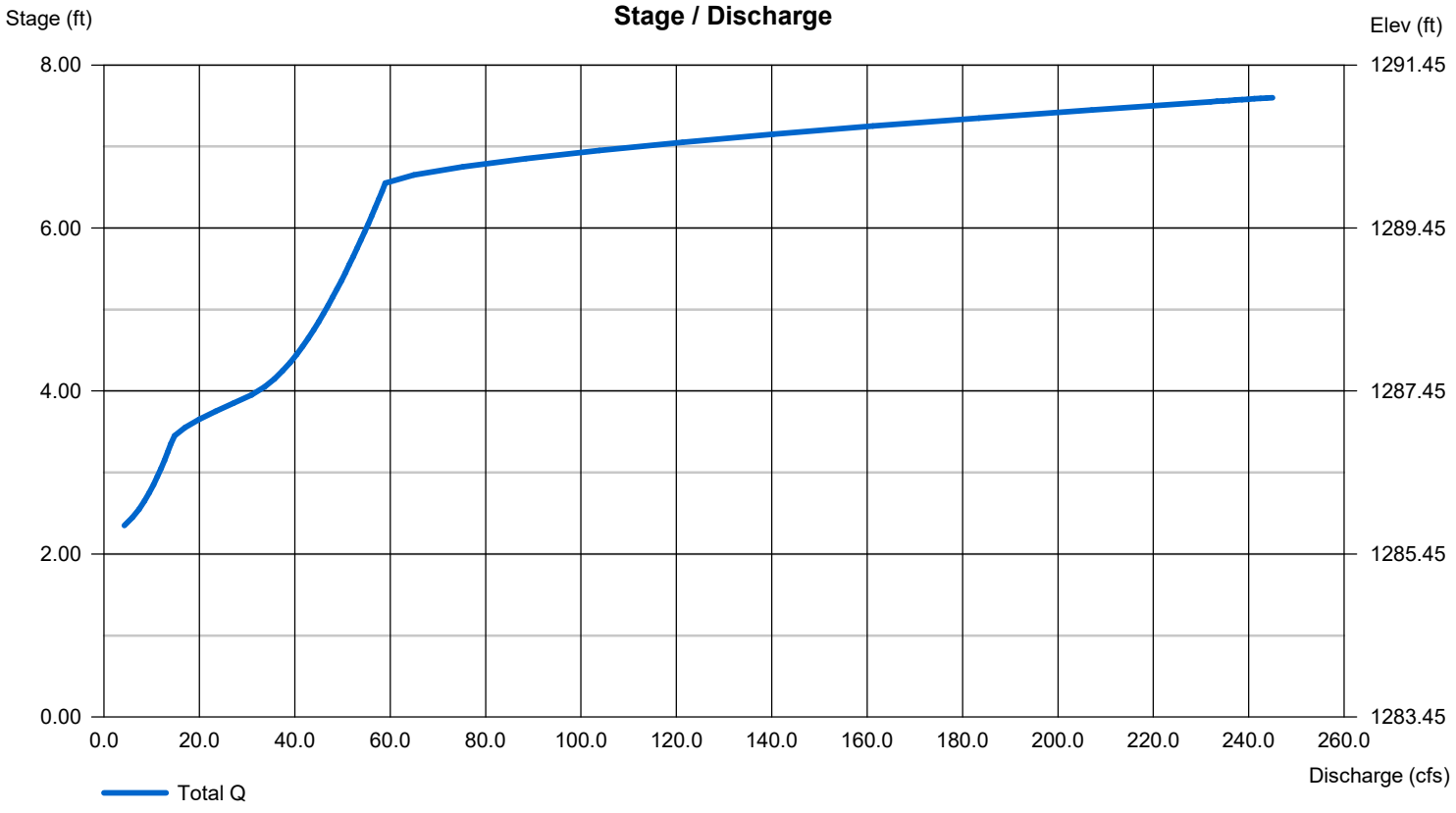
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 16.00	50.00	Inactive	0.00
Crest El. (ft)	= 1286.88	1290.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= Rect	Ciplti	---	---
Multi-Stage	= Yes	No	No	No

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

TW Elev. (ft) = 1285.70

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

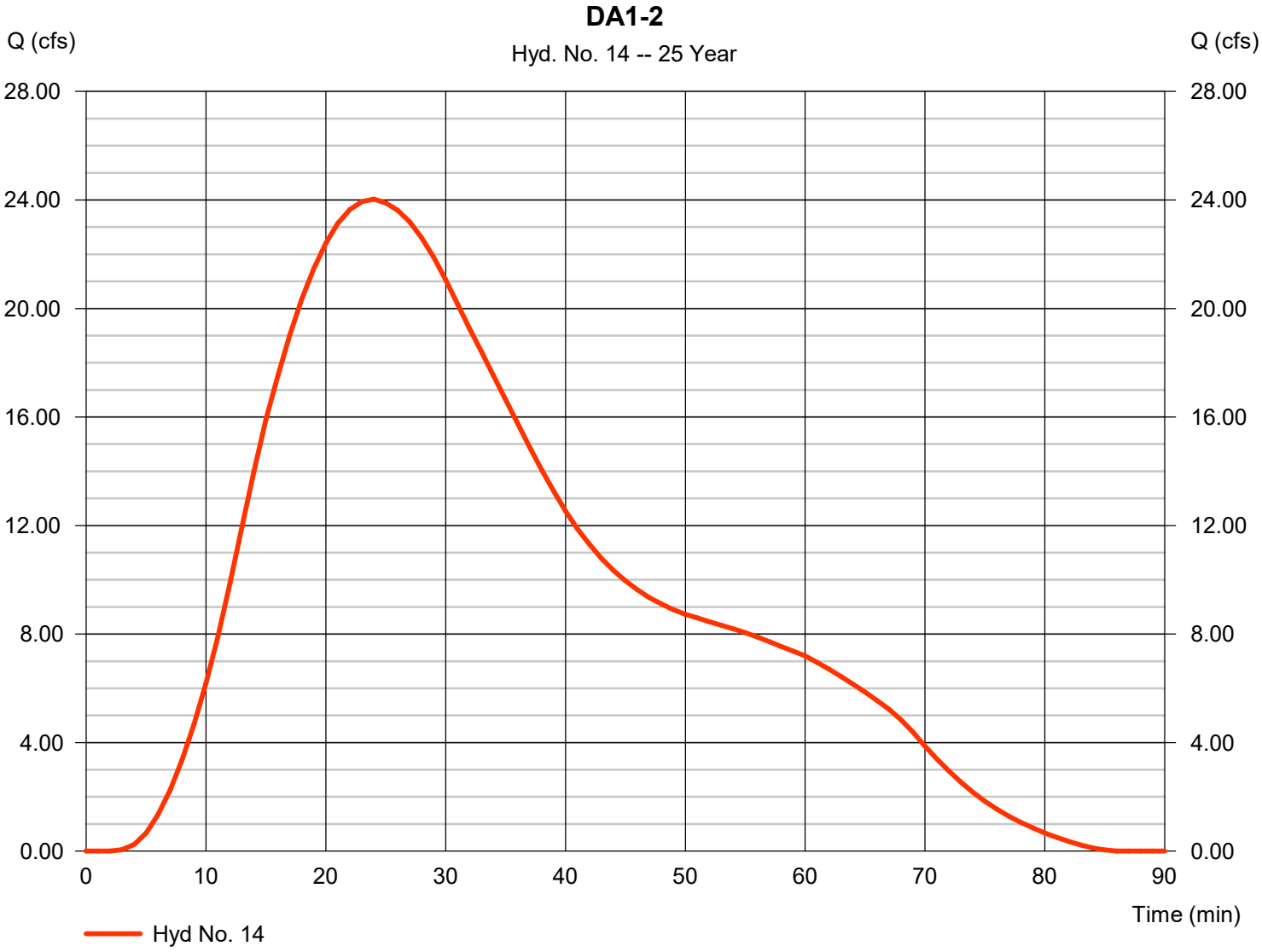


Hydrograph Report

Hyd. No. 14

DA1-2

Hydrograph type	=	SCS Runoff	Peak discharge	=	24.03 cfs
Storm frequency	=	25 yrs	Time to peak	=	24 min
Time interval	=	1 min	Hyd. volume	=	49,651 cuft
Drainage area	=	9.840 ac	Curve number	=	88
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	15.36 min
Total precip.	=	2.49 in	Distribution	=	Huff-1st
Storm duration	=	1.00 hrs	Shape factor	=	484



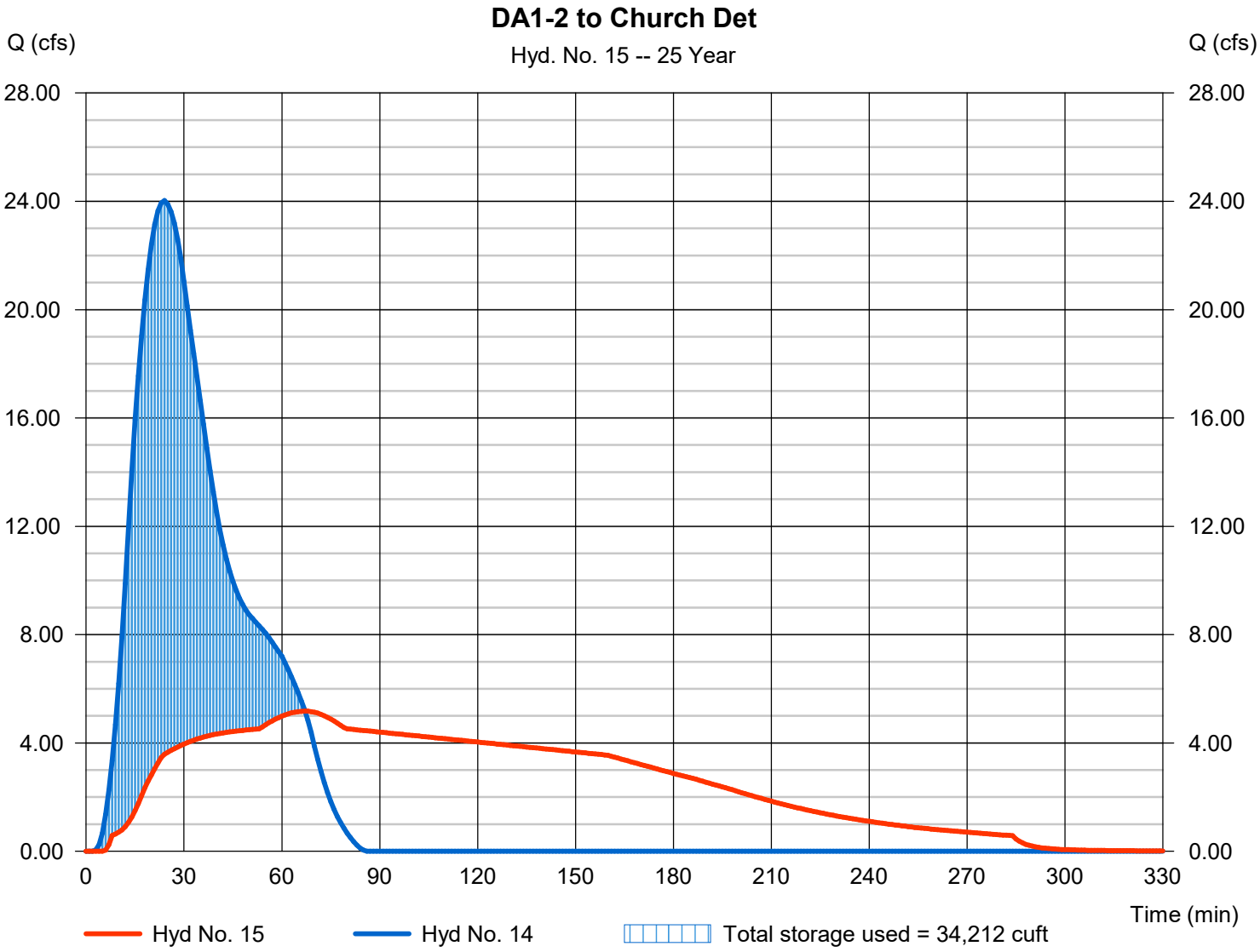
Hydrograph Report

Hyd. No. 15

DA1-2 to Church Det

Hydrograph type	=	Reservoir	Peak discharge	=	5.172 cfs
Storm frequency	=	25 yrs	Time to peak	=	67 min
Time interval	=	1 min	Hyd. volume	=	49,618 cuft
Inflow hyd. No.	=	14 - DA1-2	Max. Elevation	=	1294.59 ft
Reservoir name	=	Church Detention	Max. Storage	=	34,212 cuft

Storage Indication method used.



Pond Report

Pond No. 1 - Church Detention

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 1292.58 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	1292.58	00	0	0
0.42	1293.00	2,109	295	295
1.42	1294.00	28,716	12,868	13,163
1.97	1294.55	41,993	19,331	32,494
2.42	1295.00	52,471	21,204	53,698
3.42	1296.00	63,643	57,961	111,660

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 12.00	0.00	0.00	0.00
Span (in)	= 12.00	0.00	0.00	0.00
No. Barrels	= 1	0	0	0
Invert El. (ft)	= 1292.62	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

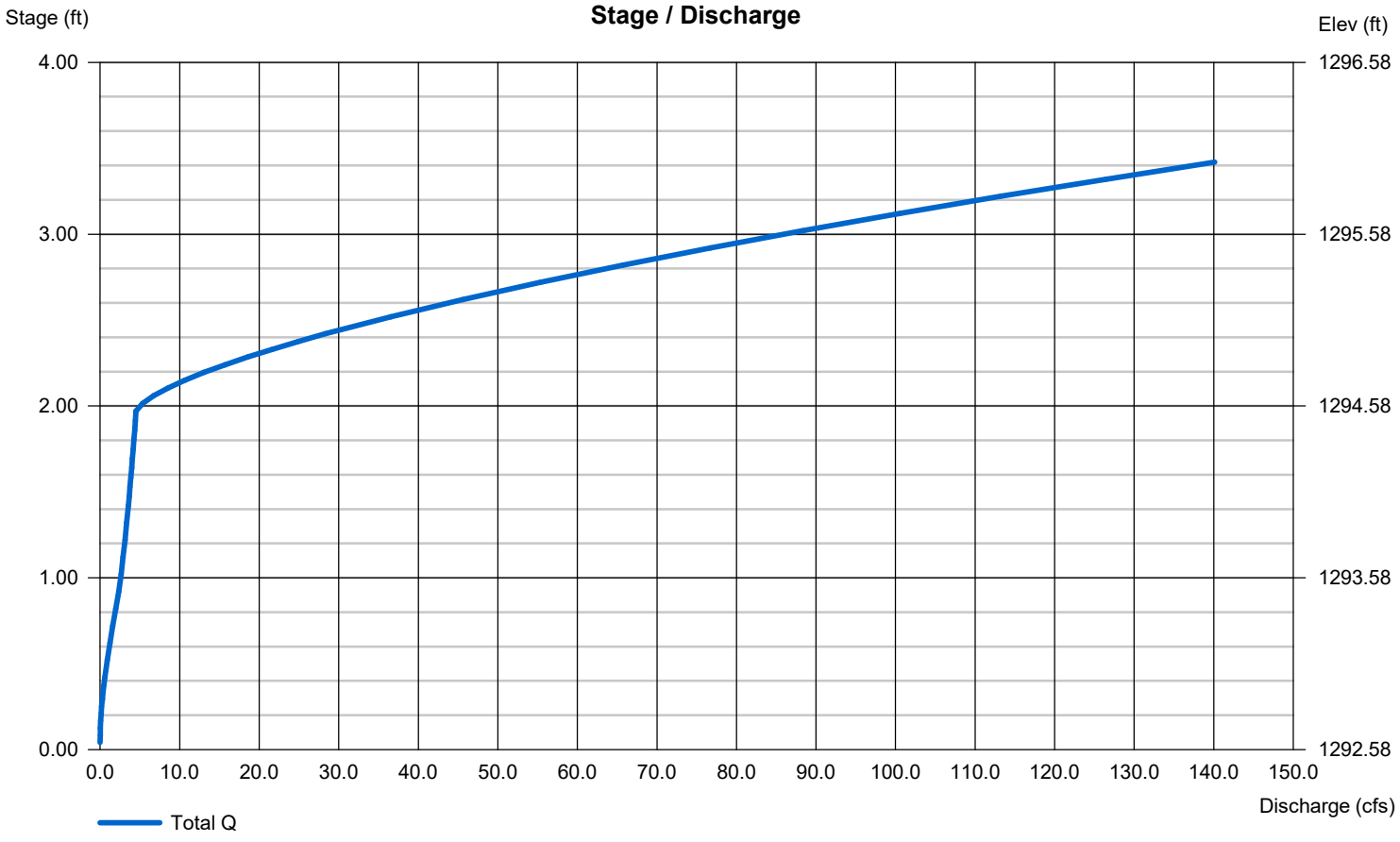
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 23.00	0.00	0.00	0.00
Crest El. (ft)	= 1294.55	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= Ciplti	Rect	---	---
Multi-Stage	= No	No	No	No

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

TW Elev. (ft) = 0.00

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

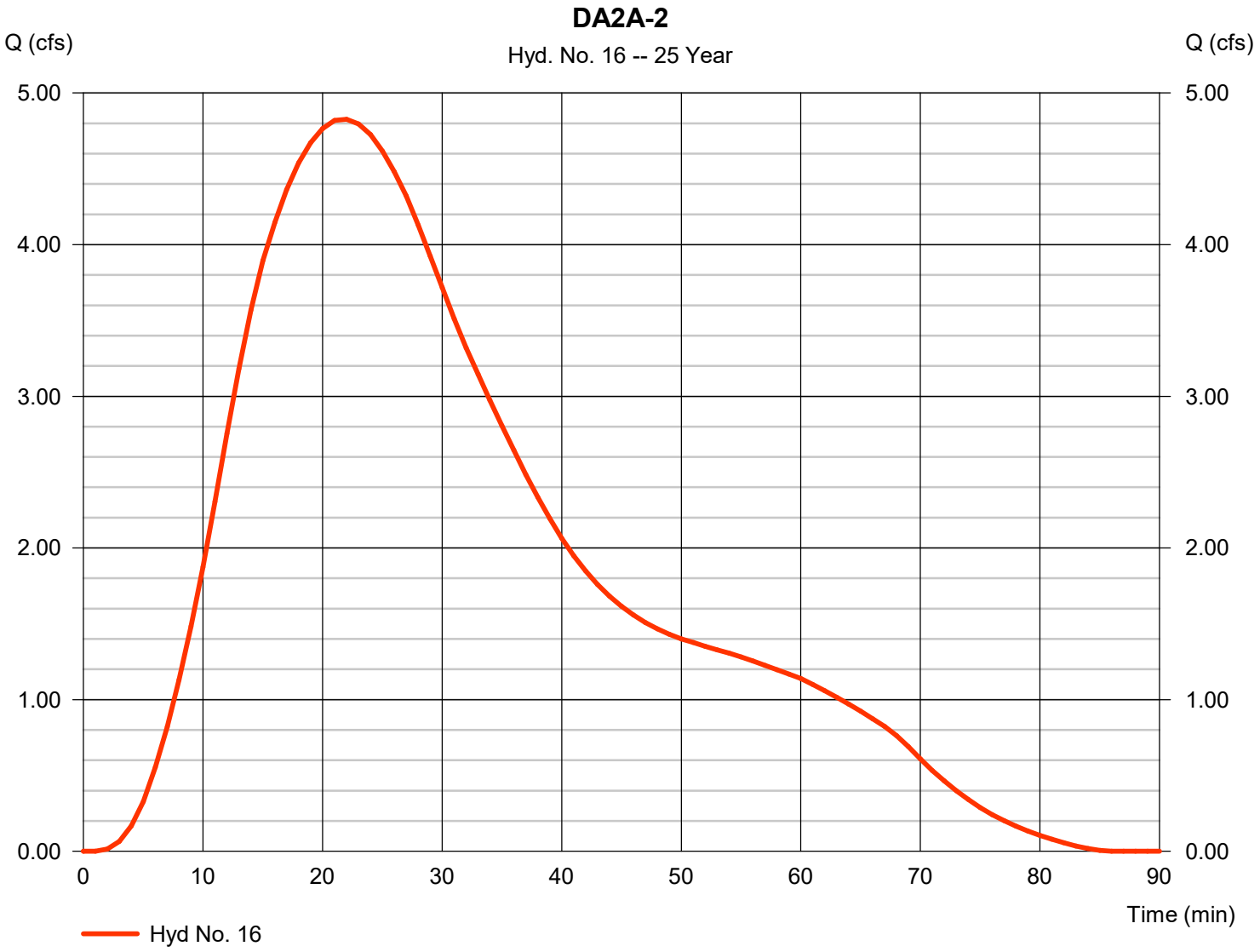


Hydrograph Report

Hyd. No. 16

DA2A-2

Hydrograph type	=	SCS Runoff	Peak discharge	=	4.827 cfs
Storm frequency	=	25 yrs	Time to peak	=	22 min
Time interval	=	1 min	Hyd. volume	=	9,433 cuft
Drainage area	=	1.380 ac	Curve number	=	94
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	16.00 min
Total precip.	=	2.49 in	Distribution	=	Huff-1st
Storm duration	=	1.00 hrs	Shape factor	=	484

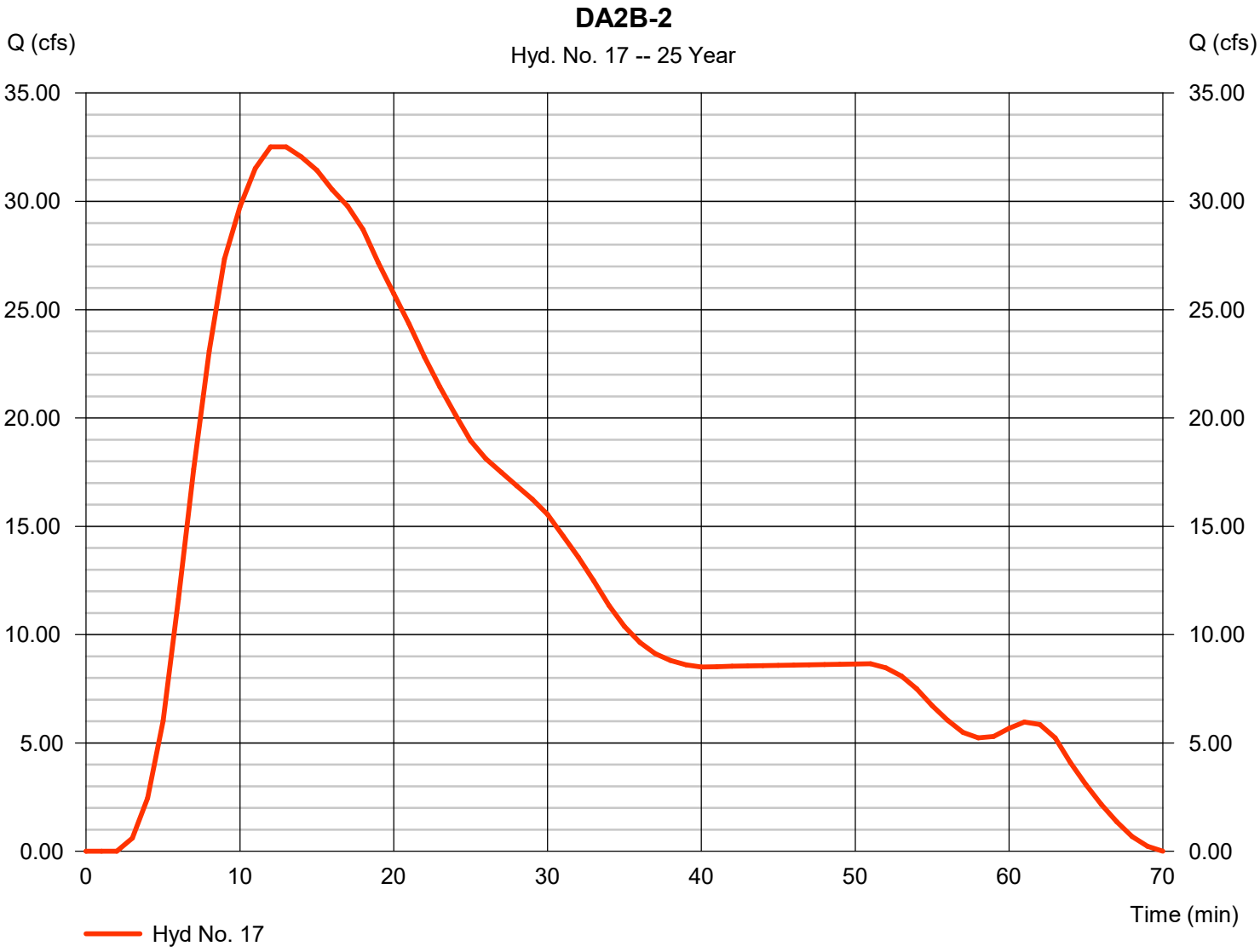


Hydrograph Report

Hyd. No. 17

DA2B-2

Hydrograph type	=	SCS Runoff	Peak discharge	=	32.52 cfs
Storm frequency	=	25 yrs	Time to peak	=	13 min
Time interval	=	1 min	Hyd. volume	=	54,070 cuft
Drainage area	=	9.500 ac	Curve number	=	90
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	2.49 in	Distribution	=	Huff-1st
Storm duration	=	1.00 hrs	Shape factor	=	484

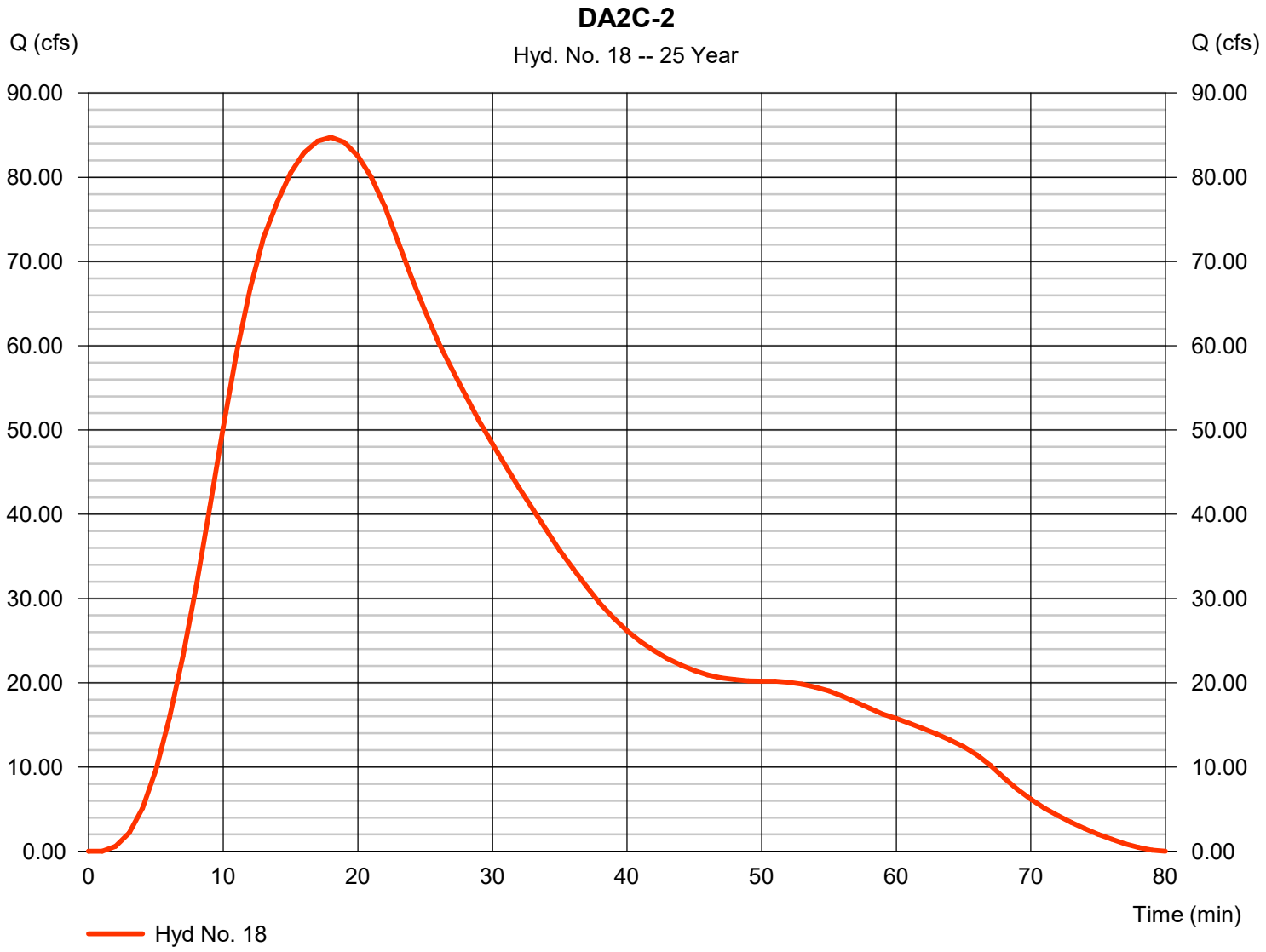


Hydrograph Report

Hyd. No. 18

DA2C-2

Hydrograph type	=	SCS Runoff	Peak discharge	=	84.73 cfs
Storm frequency	=	25 yrs	Time to peak	=	18 min
Time interval	=	1 min	Hyd. volume	=	148,340 cuft
Drainage area	=	21.250 ac	Curve number	=	95
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	11.90 min
Total precip.	=	2.49 in	Distribution	=	Huff-1st
Storm duration	=	1.00 hrs	Shape factor	=	484

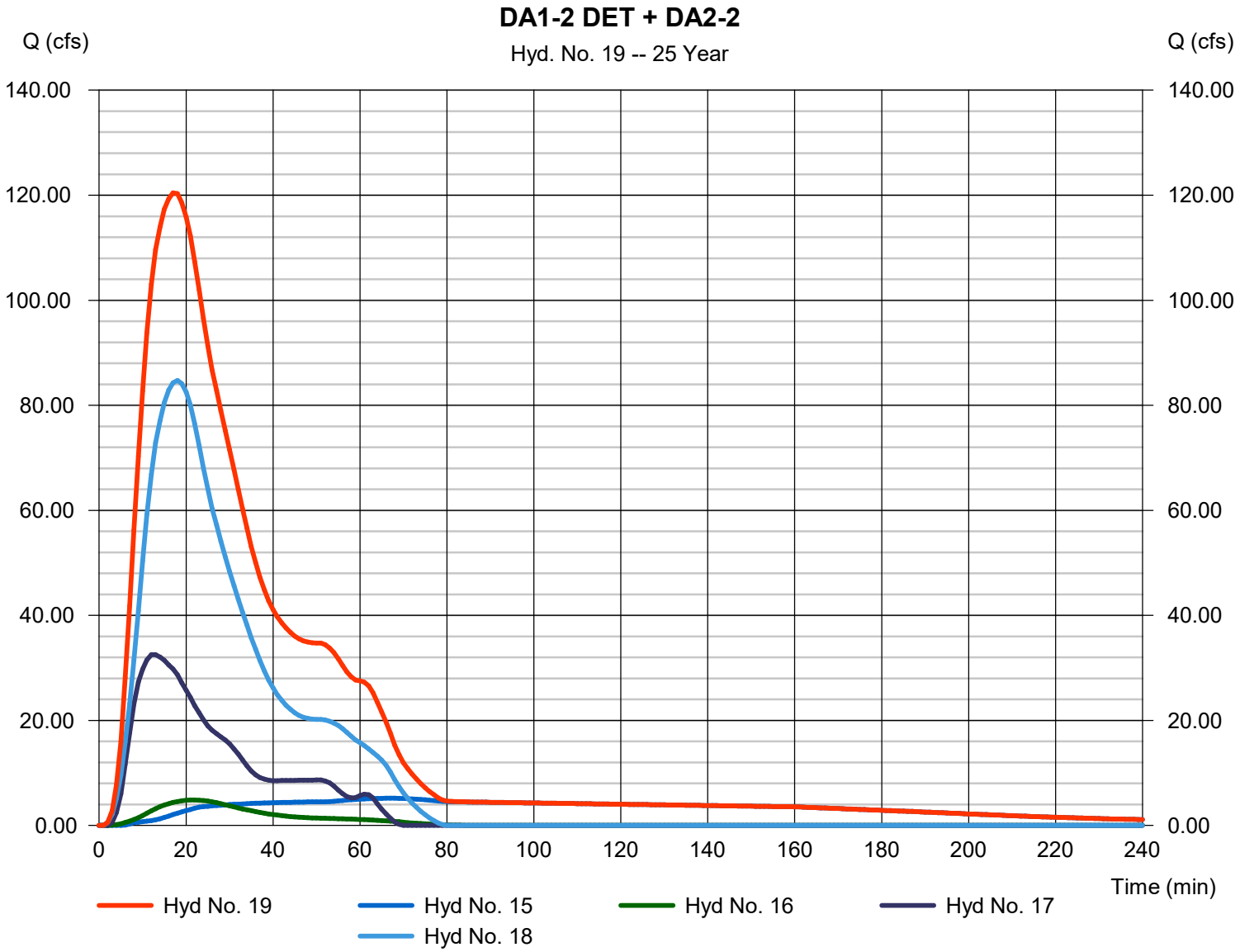


Hydrograph Report

Hyd. No. 19

DA1-2 DET + DA2-2

Hydrograph type	=	Combine	Peak discharge	=	120.46 cfs
Storm frequency	=	25 yrs	Time to peak	=	17 min
Time interval	=	1 min	Hyd. volume	=	261,461 cuft
Inflow hyds.	=	15, 16, 17, 18	Contrib. drain. area	=	32.130 ac



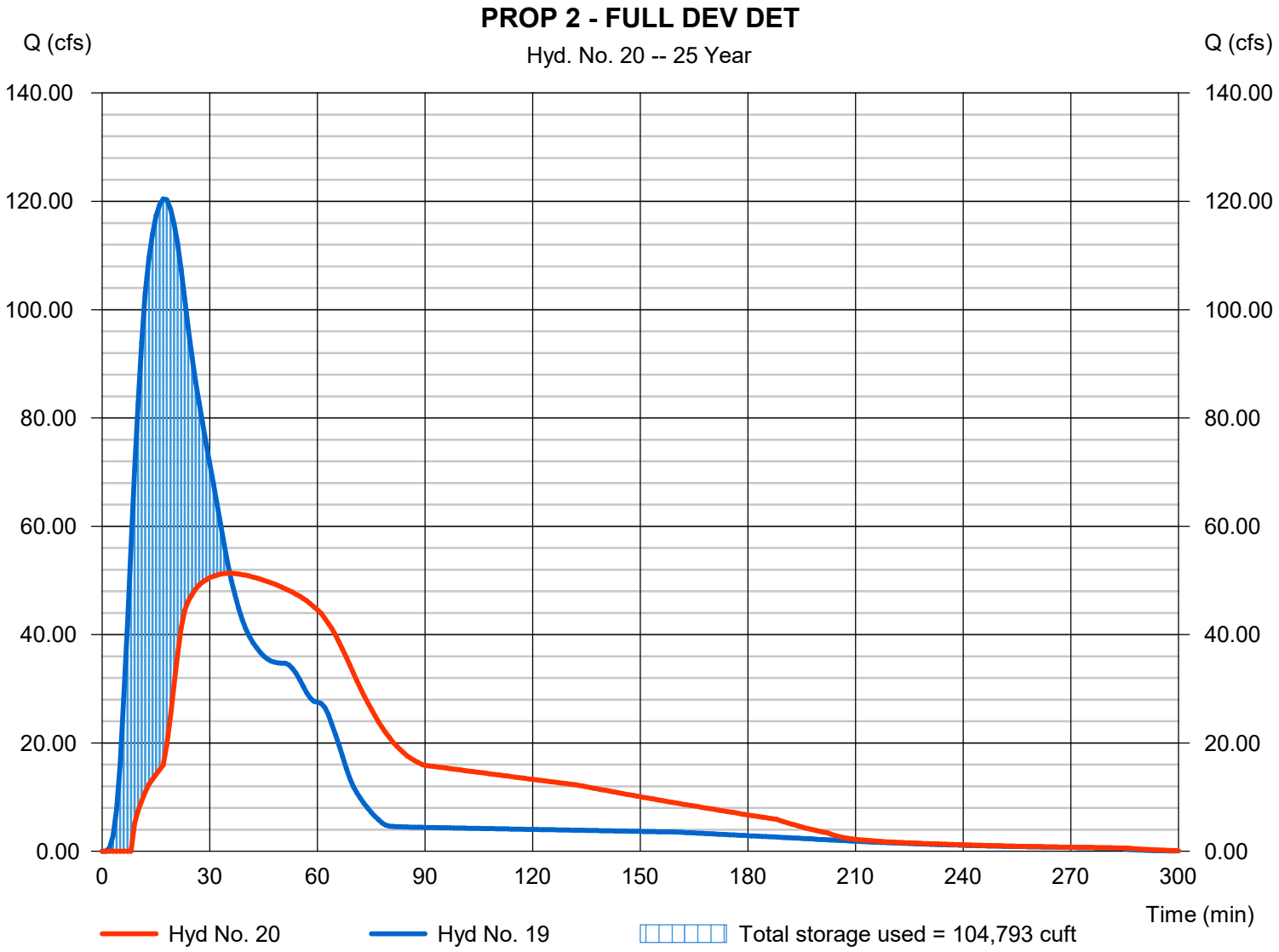
Hydrograph Report

Hyd. No. 20

PROP 2 - FULL DEV DET

Hydrograph type	=	Reservoir	Peak discharge	=	51.31 cfs
Storm frequency	=	25 yrs	Time to peak	=	36 min
Time interval	=	1 min	Hyd. volume	=	252,382 cuft
Inflow hyd. No.	=	19 - DA1-2 DET + DA2-2	Max. Elevation	=	1289.17 ft
Reservoir name	=	Phase 2	Max. Storage	=	104,793 cuft

Storage Indication method used.



Pond Report

Pond No. 2 - Phase 2

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 1283.45 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	1283.45	00	0	0
0.55	1284.00	650	119	119
1.55	1285.00	5,157	2,546	2,665
2.55	1286.00	13,875	9,163	11,828
3.55	1287.00	23,575	18,510	30,338
4.55	1288.00	33,464	28,373	58,710
5.55	1289.00	42,792	38,029	96,739
6.55	1290.00	50,595	46,634	143,374
7.55	1291.00	56,302	53,418	196,791
7.60	1291.05	56,448	2,816	199,607

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 24.00	21.00	0.00	0.00
Span (in)	= 24.00	21.00	0.00	0.00
No. Barrels	= 2	1	0	0
Invert El. (ft)	= 1283.35	1283.45	0.00	0.00
Length (ft)	= 153.83	0.00	0.00	0.00
Slope (%)	= 0.42	0.00	0.00	n/a
N-Value	= .012	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	Yes	No	No

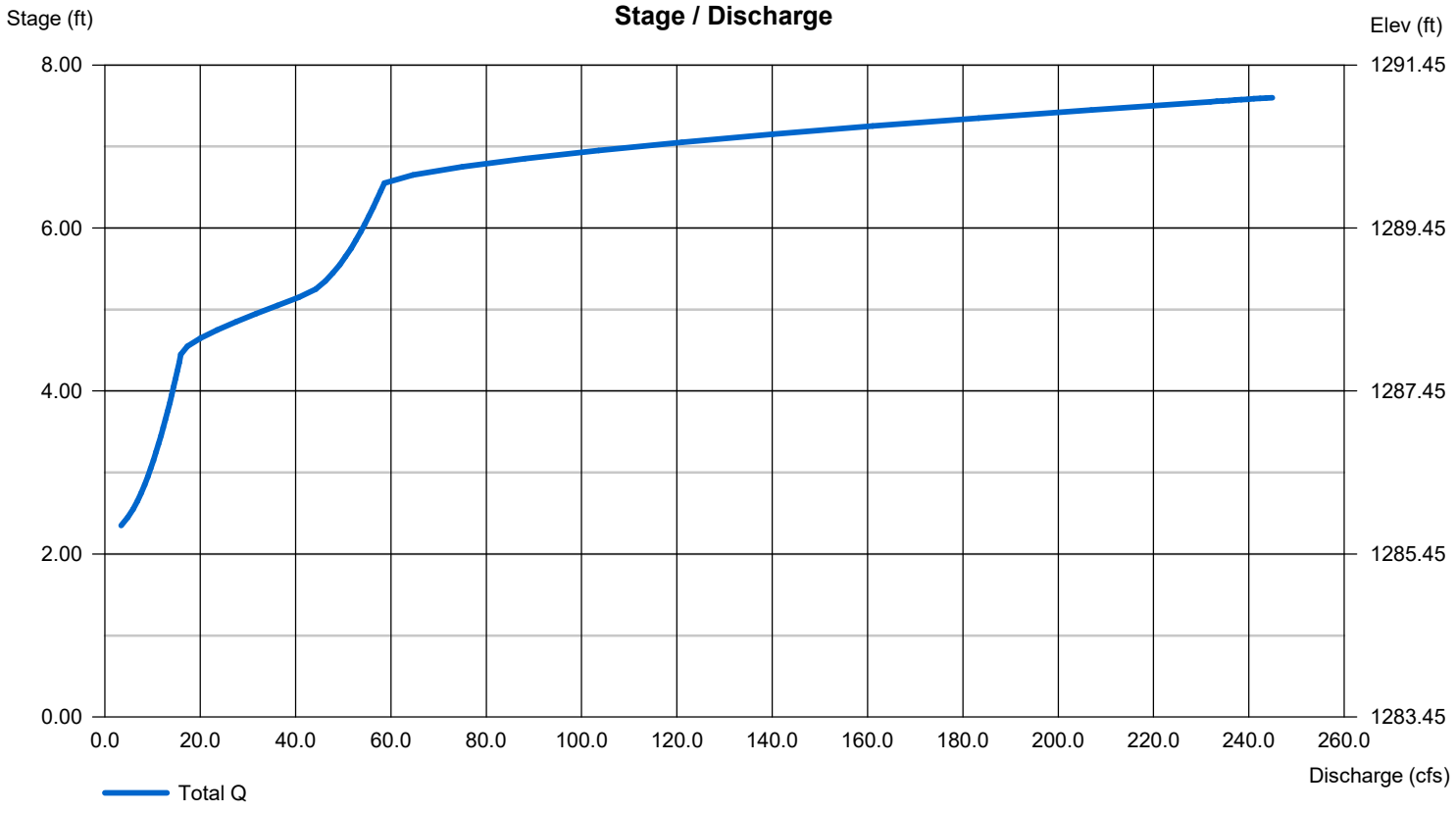
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 16.00	50.00	Inactive	0.00
Crest El. (ft)	= 1287.92	1290.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= Rect	Ciplti	Rect	---
Multi-Stage	= Yes	No	No	No

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

TW Elev. (ft) = 1285.70

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



Hydraflow Table of Contents

Hydrograph Summary Report

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

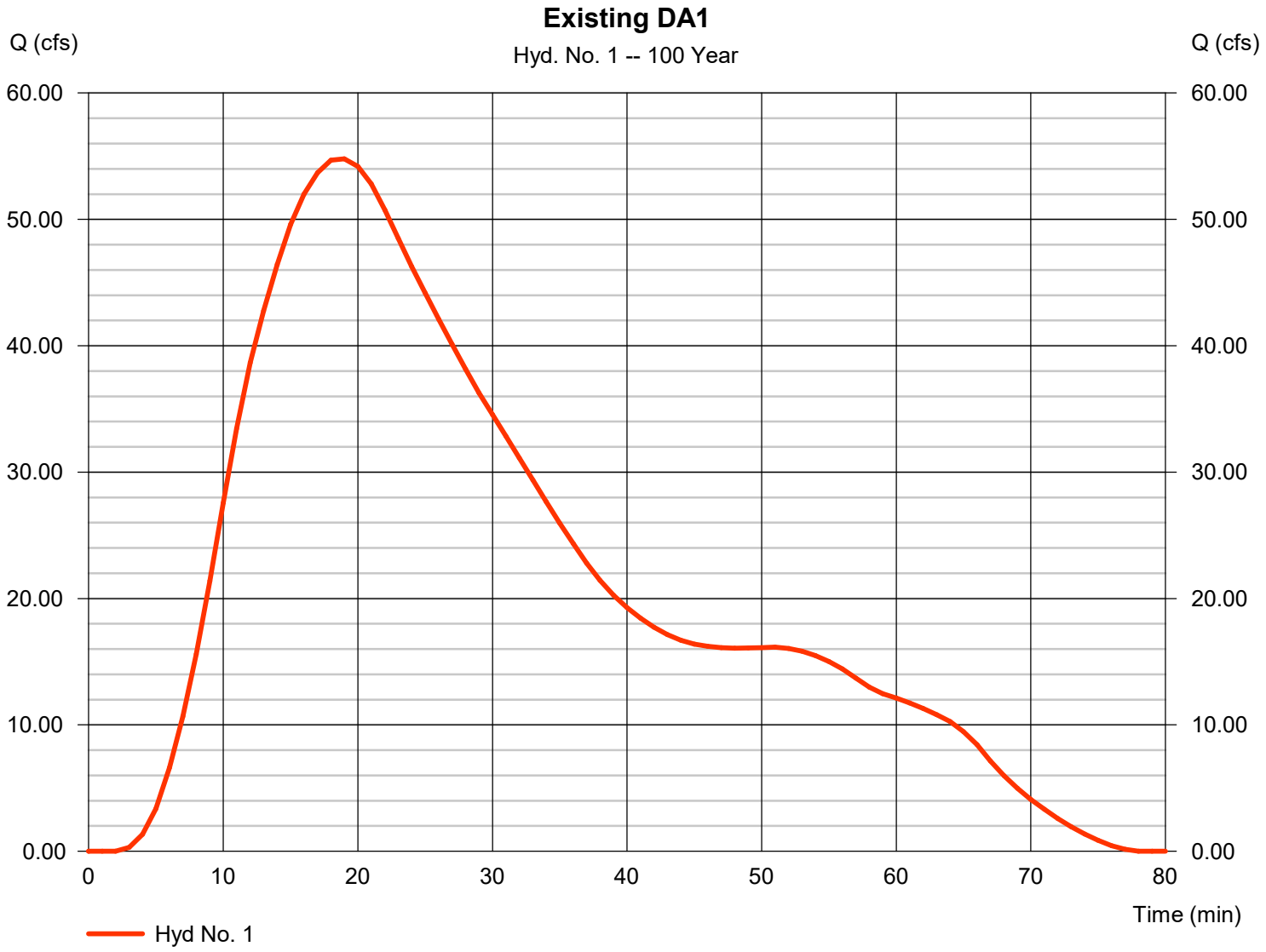
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	54.80	1	19	99,716	------	------	------	Existing DA1
2	Reservoir	24.53	1	36	99,683	1	1294.95	51,344	Exist DA1 - Church Det
3	SCS Runoff	82.05	1	23	164,106	------	------	------	Existing DA2
4	Combine	92.45	1	26	263,789	2, 3	------	------	Pre
6	SCS Runoff	45.21	1	19	82,264	------	------	------	DA1-1
7	Reservoir	16.89	1	39	82,231	6	1294.84	46,103	DA1-1 to Church Det
8	SCS Runoff	9.527	1	24	19,555	------	------	------	DA2A-1
9	SCS Runoff	48.93	1	12	79,245	------	------	------	DA2B-1
10	SCS Runoff	50.03	1	21	95,127	------	------	------	DA2C-1
11	Combine	101.93	1	18	276,159	7, 8, 9, 10	------	------	DA1-1 DET + DA2-1
12	Reservoir	50.21	1	43	267,079	11	1288.86	91,323	PROP-1 DETENTION
14	SCS Runoff	34.48	1	23	69,856	------	------	------	DA1-2
15	Reservoir	11.83	1	49	69,823	14	1294.75	42,013	DA1-2 to Church Det
16	SCS Runoff	6.509	1	21	12,558	------	------	------	DA2A-2
17	SCS Runoff	46.91	1	12	74,819	------	------	------	DA2B-2
18	SCS Runoff	113.05	1	17	195,634	------	------	------	DA2C-2
19	Combine	162.59	1	17	352,834	15, 16, 17, 18	------	------	DA1-2 DET + DA2-2
20	Reservoir	61.54	1	38	343,755	19	1290.05	145,989	PROP 2 - FULL DEV DET

Hydrograph Report

Hyd. No. 1

Existing DA1

Hydrograph type	=	SCS Runoff	Peak discharge	=	54.80 cfs
Storm frequency	=	100 yrs	Time to peak	=	19 min
Time interval	=	1 min	Hyd. volume	=	99,716 cuft
Drainage area	=	14.570 ac	Curve number	=	87
Basin Slope	=	2.0 %	Hydraulic length	=	2185 ft
Tc method	=	User	Time of conc. (Tc)	=	10.10 min
Total precip.	=	3.13 in	Distribution	=	Huff-1st
Storm duration	=	1.00 hrs	Shape factor	=	484



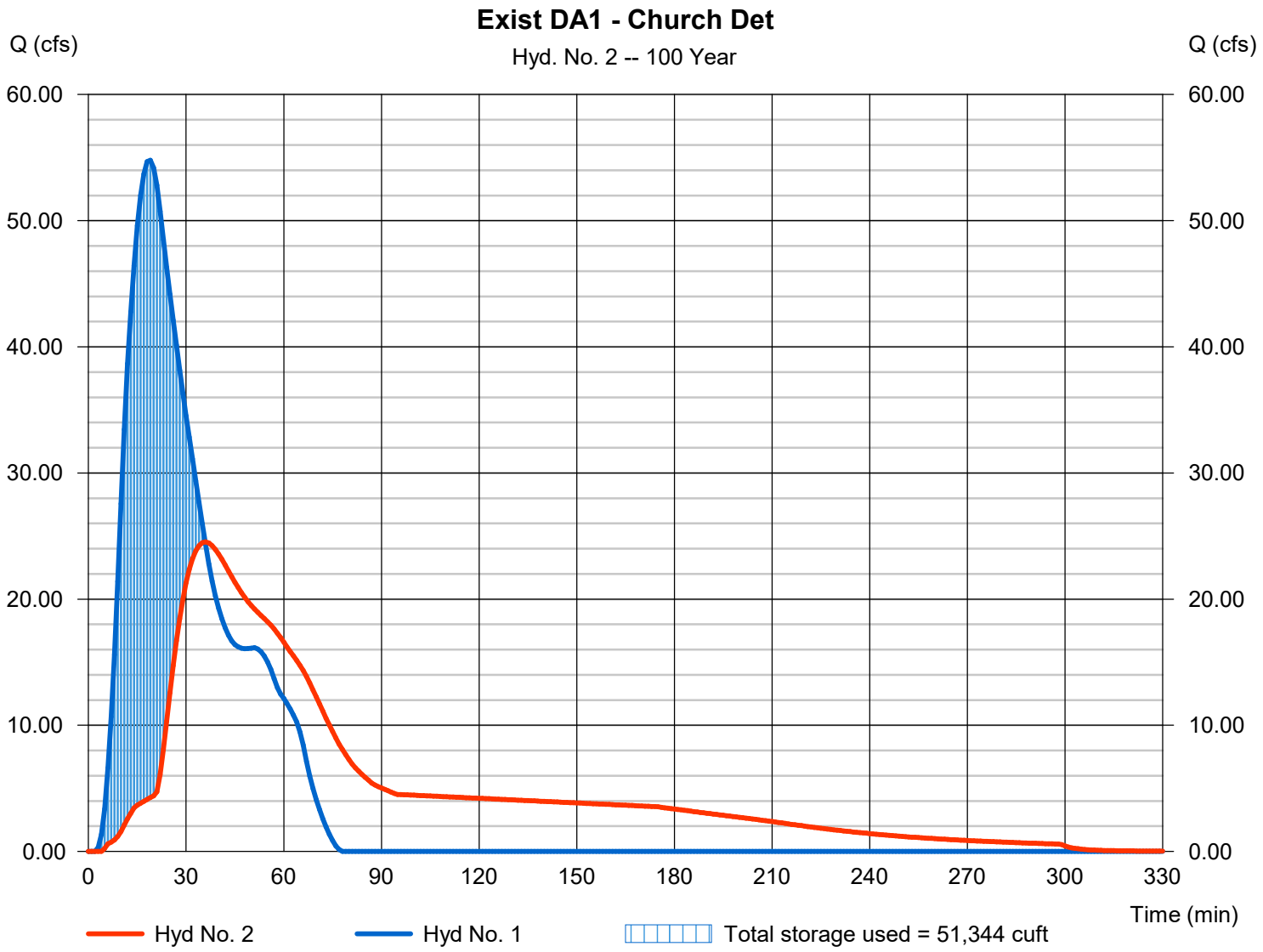
Hydrograph Report

Hyd. No. 2

Exist DA1 - Church Det

Hydrograph type	=	Reservoir	Peak discharge	=	24.53 cfs
Storm frequency	=	100 yrs	Time to peak	=	36 min
Time interval	=	1 min	Hyd. volume	=	99,683 cuft
Inflow hyd. No.	=	1 - Existing DA1	Max. Elevation	=	1294.95 ft
Reservoir name	=	Church Detention	Max. Storage	=	51,344 cuft

Storage Indication method used.



Pond Report

Pond No. 1 - Church Detention

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 1292.58 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	1292.58	00	0	0
0.42	1293.00	2,109	295	295
1.42	1294.00	28,716	12,868	13,163
1.97	1294.55	41,993	19,331	32,494
2.42	1295.00	52,471	21,204	53,698
3.42	1296.00	63,643	57,961	111,660

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 12.00	0.00	0.00	0.00
Span (in)	= 12.00	0.00	0.00	0.00
No. Barrels	= 1	0	0	0
Invert El. (ft)	= 1292.62	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

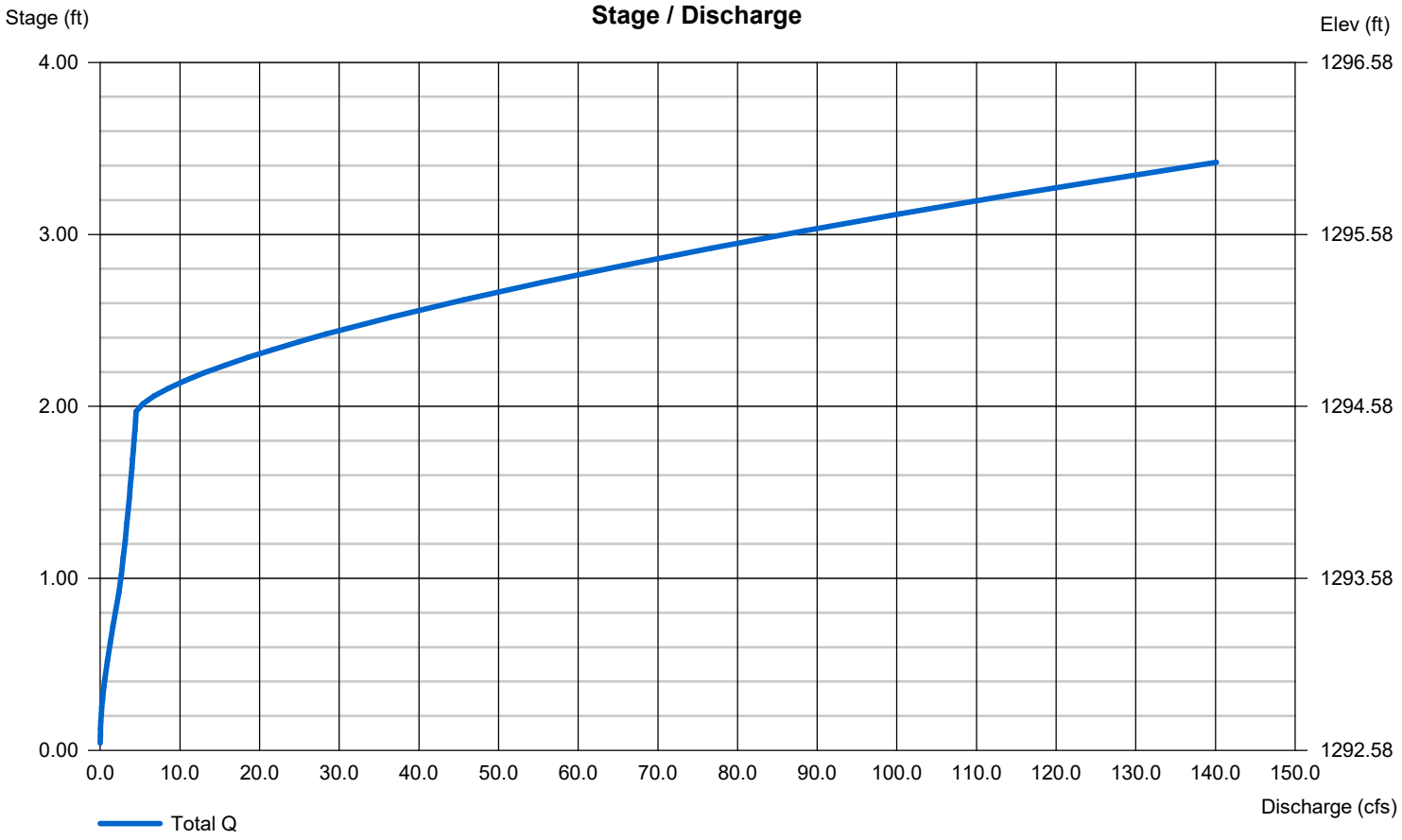
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 23.00	0.00	0.00	0.00
Crest El. (ft)	= 1294.55	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= Ciplti	Rect	---	---
Multi-Stage	= No	No	No	No

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

TW Elev. (ft) = 0.00

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

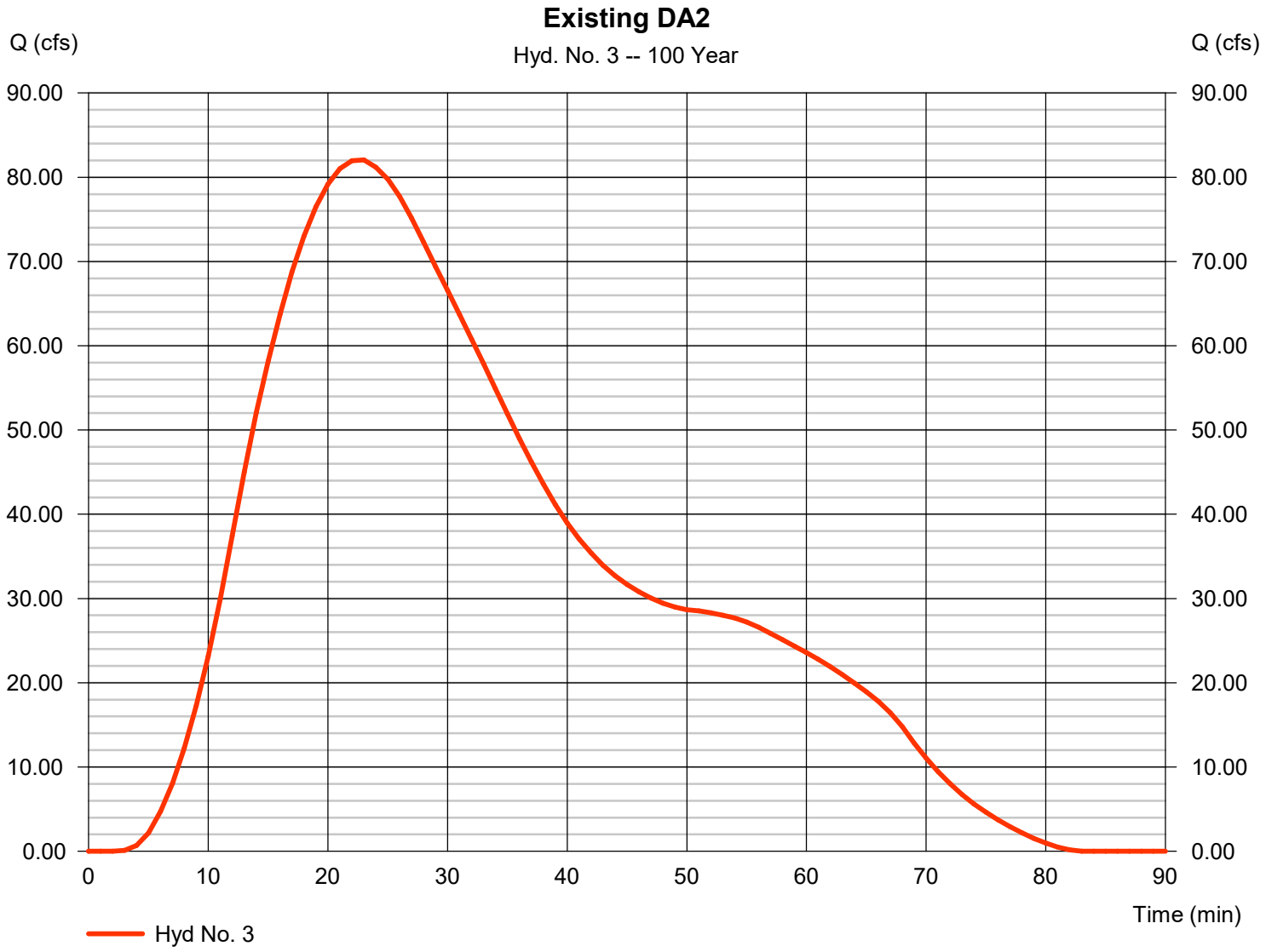


Hydrograph Report

Hyd. No. 3

Existing DA2

Hydrograph type	=	SCS Runoff	Peak discharge	=	82.05 cfs
Storm frequency	=	100 yrs	Time to peak	=	23 min
Time interval	=	1 min	Hyd. volume	=	164,106 cuft
Drainage area	=	27.860 ac	Curve number	=	84
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	13.90 min
Total precip.	=	3.13 in	Distribution	=	Huff-1st
Storm duration	=	1.00 hrs	Shape factor	=	484

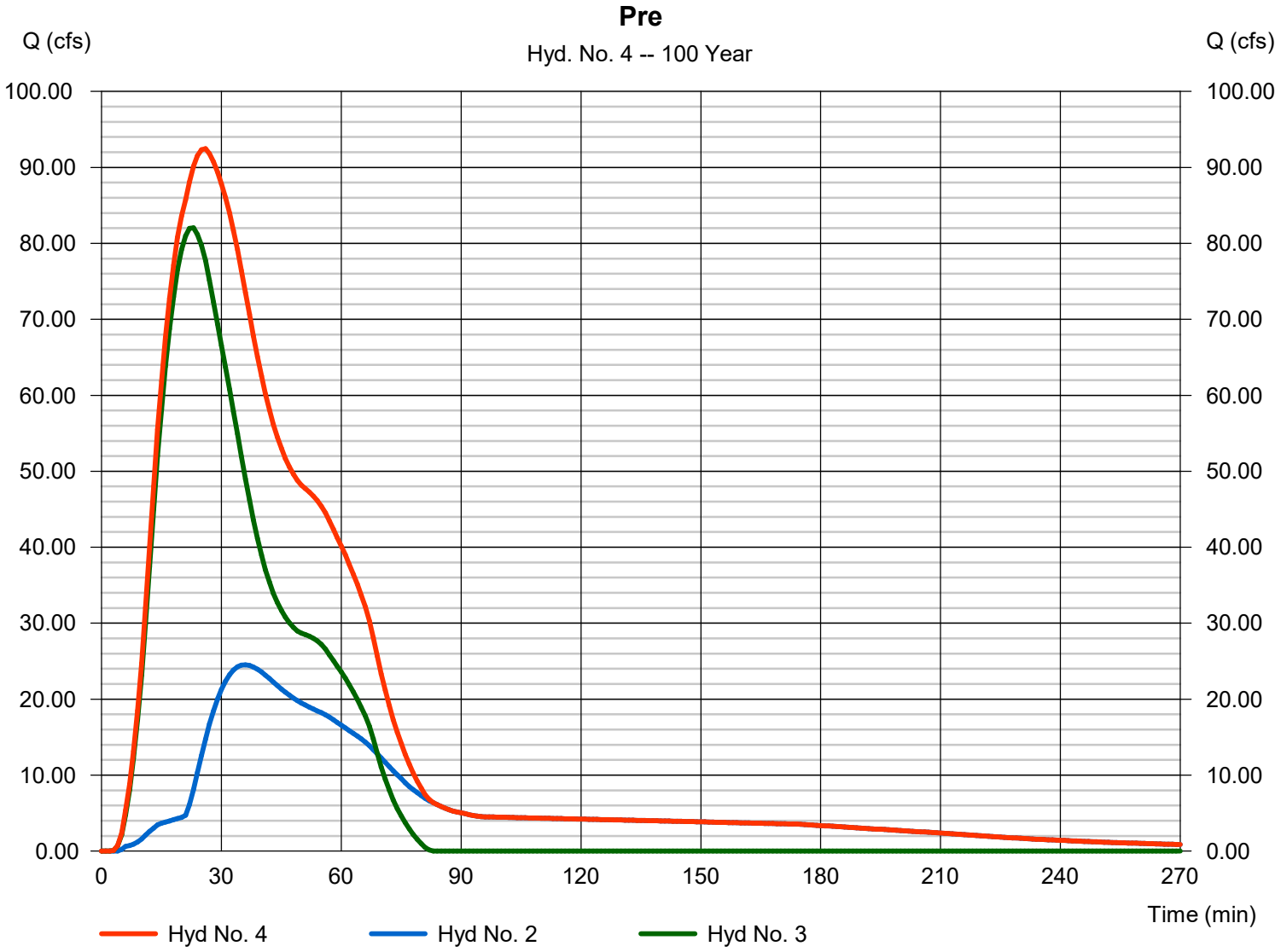


Hydrograph Report

Hyd. No. 4

Pre

Hydrograph type	= Combine	Peak discharge	= 92.45 cfs
Storm frequency	= 100 yrs	Time to peak	= 26 min
Time interval	= 1 min	Hyd. volume	= 263,789 cuft
Inflow hyds.	= 2, 3	Contrib. drain. area	= 27.860 ac



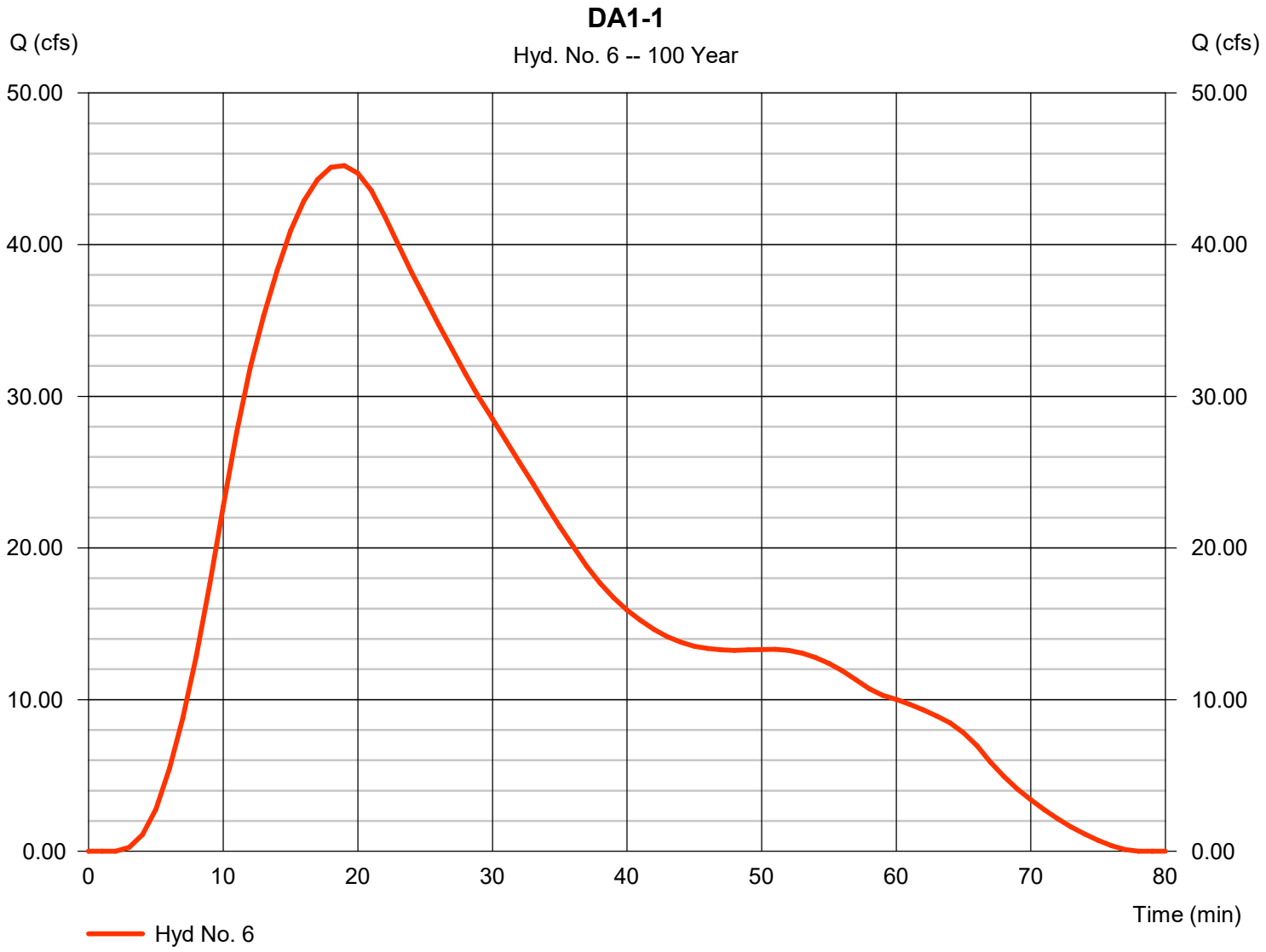
Hydrograph Report

Hyd. No. 6

DA1-1

Hydrograph type	=	SCS Runoff	Peak discharge	=	45.21 cfs
Storm frequency	=	100 yrs	Time to peak	=	19 min
Time interval	=	1 min	Hyd. volume	=	82,264 cuft
Drainage area	=	12.020 ac	Curve number	=	87*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	10.08 min
Total precip.	=	3.13 in	Distribution	=	Huff-1st
Storm duration	=	1.00 hrs	Shape factor	=	484

* Composite (Area/CN) = [(4.755 x 90) + (1.295 x 75)] / 12.020



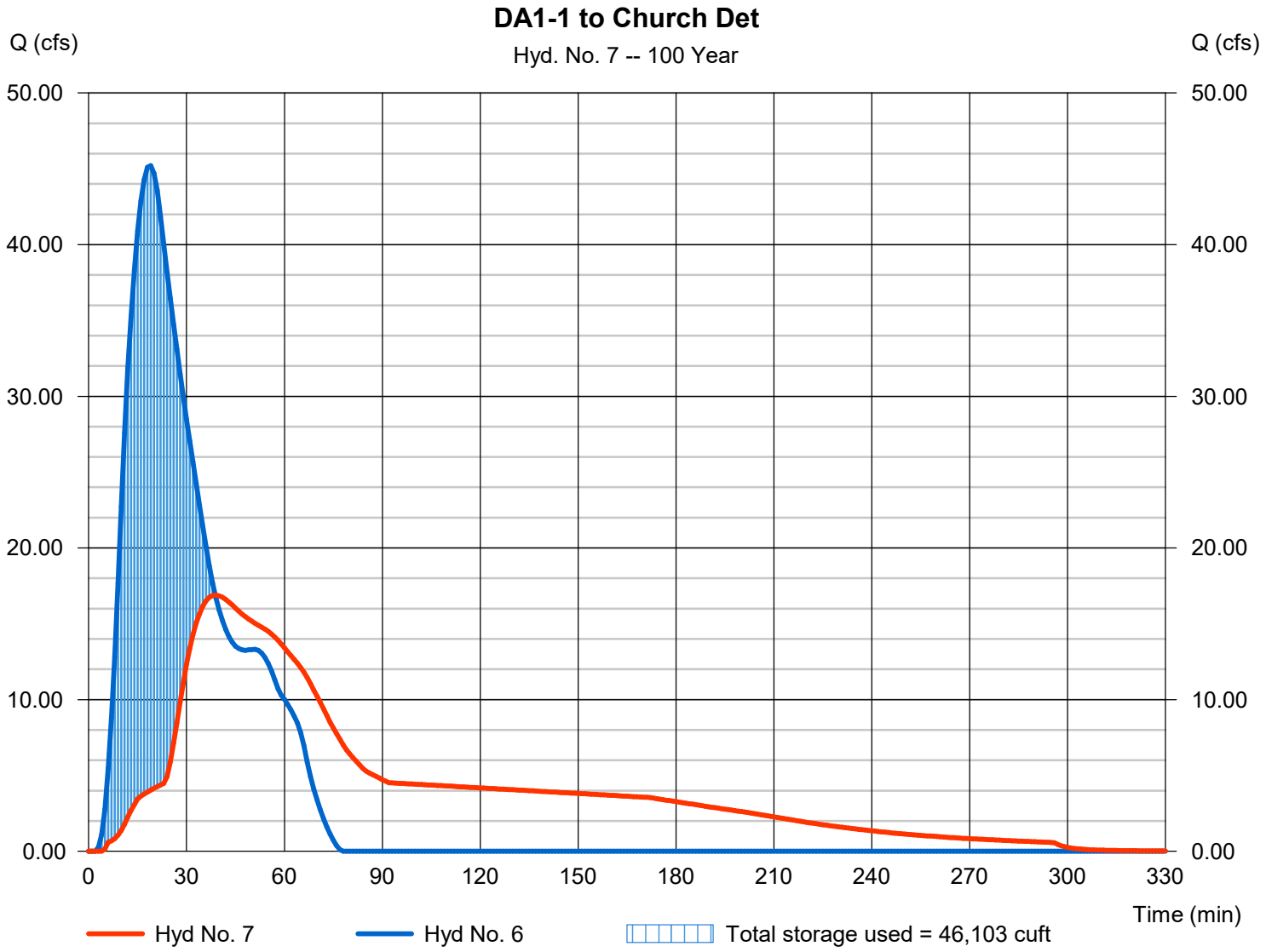
Hydrograph Report

Hyd. No. 7

DA1-1 to Church Det

Hydrograph type	=	Reservoir	Peak discharge	=	16.89 cfs
Storm frequency	=	100 yrs	Time to peak	=	39 min
Time interval	=	1 min	Hyd. volume	=	82,231 cuft
Inflow hyd. No.	=	6 - DA1-1	Max. Elevation	=	1294.84 ft
Reservoir name	=	Church Detention	Max. Storage	=	46,103 cuft

Storage Indication method used.



Pond Report

Pond No. 1 - Church Detention

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 1292.58 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	1292.58	00	0	0
0.42	1293.00	2,109	295	295
1.42	1294.00	28,716	12,868	13,163
1.97	1294.55	41,993	19,331	32,494
2.42	1295.00	52,471	21,204	53,698
3.42	1296.00	63,643	57,961	111,660

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 12.00	0.00	0.00	0.00
Span (in)	= 12.00	0.00	0.00	0.00
No. Barrels	= 1	0	0	0
Invert El. (ft)	= 1292.62	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

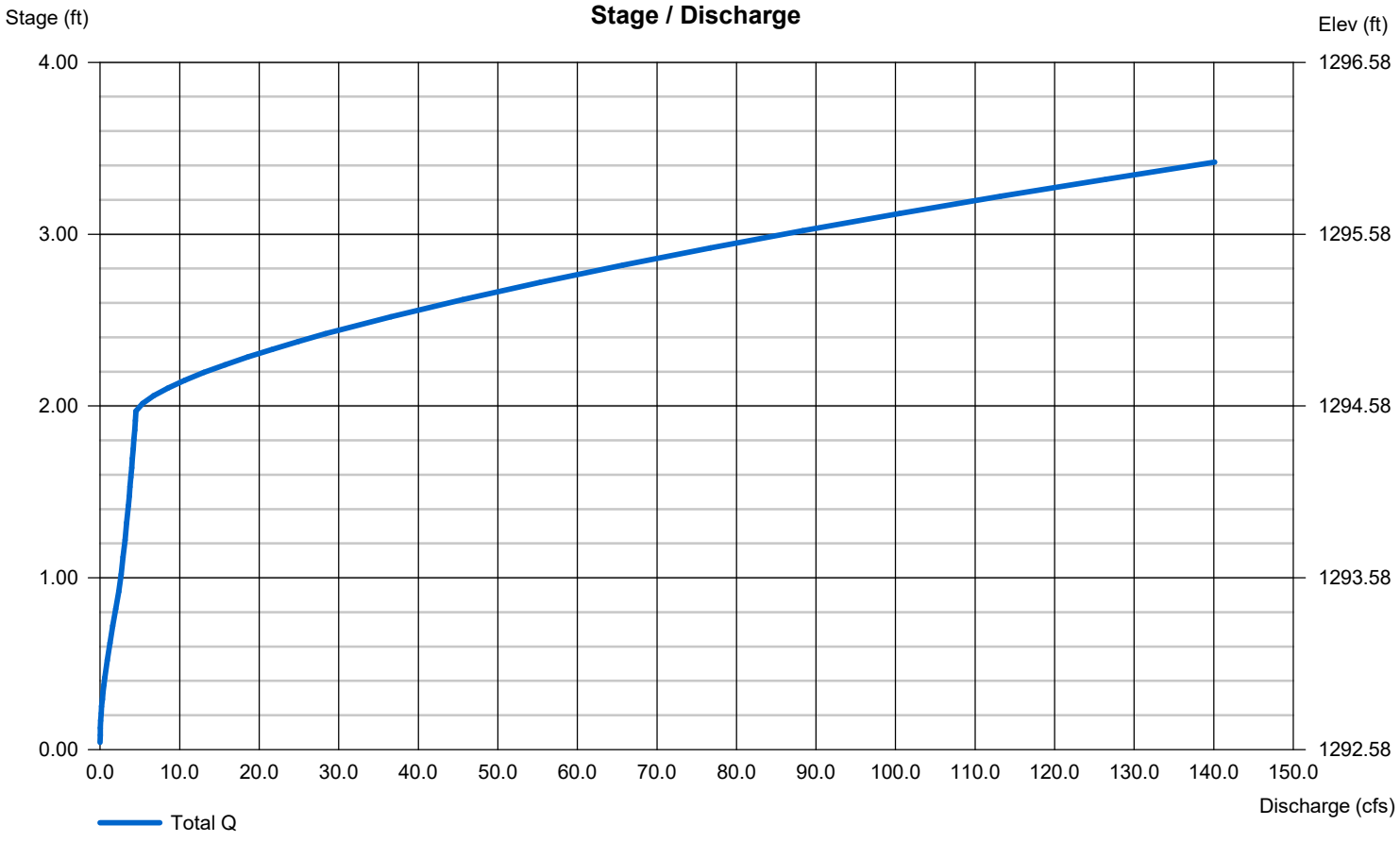
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 23.00	0.00	0.00	0.00
Crest El. (ft)	= 1294.55	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= Ciplti	Rect	---	---
Multi-Stage	= No	No	No	No

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

TW Elev. (ft) = 0.00

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



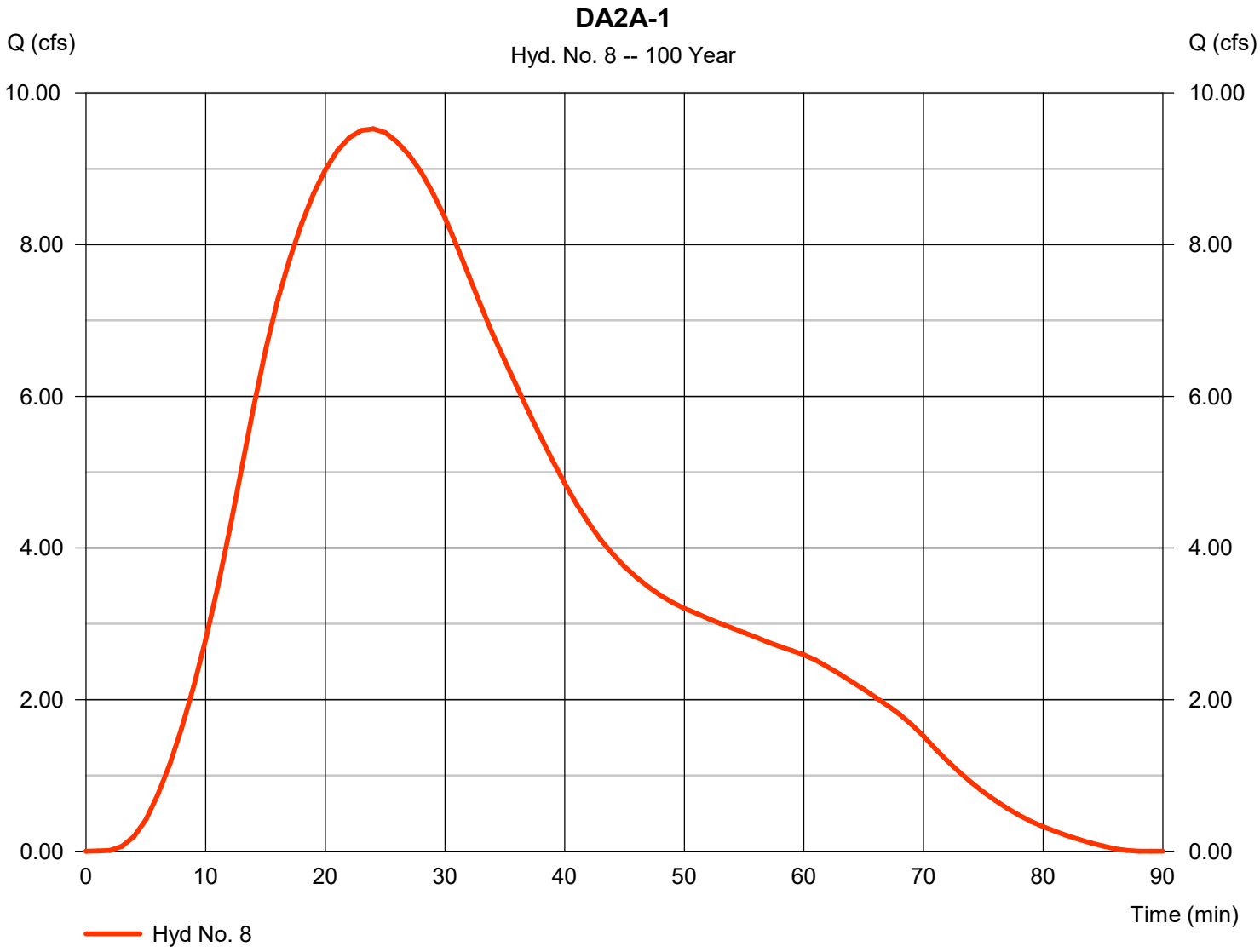
Hydrograph Report

Hyd. No. 8

DA2A-1

Hydrograph type	=	SCS Runoff	Peak discharge	=	9.527 cfs
Storm frequency	=	100 yrs	Time to peak	=	24 min
Time interval	=	1 min	Hyd. volume	=	19,555 cuft
Drainage area	=	2.590 ac	Curve number	=	90*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	18.10 min
Total precip.	=	3.13 in	Distribution	=	Huff-1st
Storm duration	=	1.00 hrs	Shape factor	=	484

* Composite (Area/CN) = [(4.880 x 90) + (2.170 x 75)] / 2.590



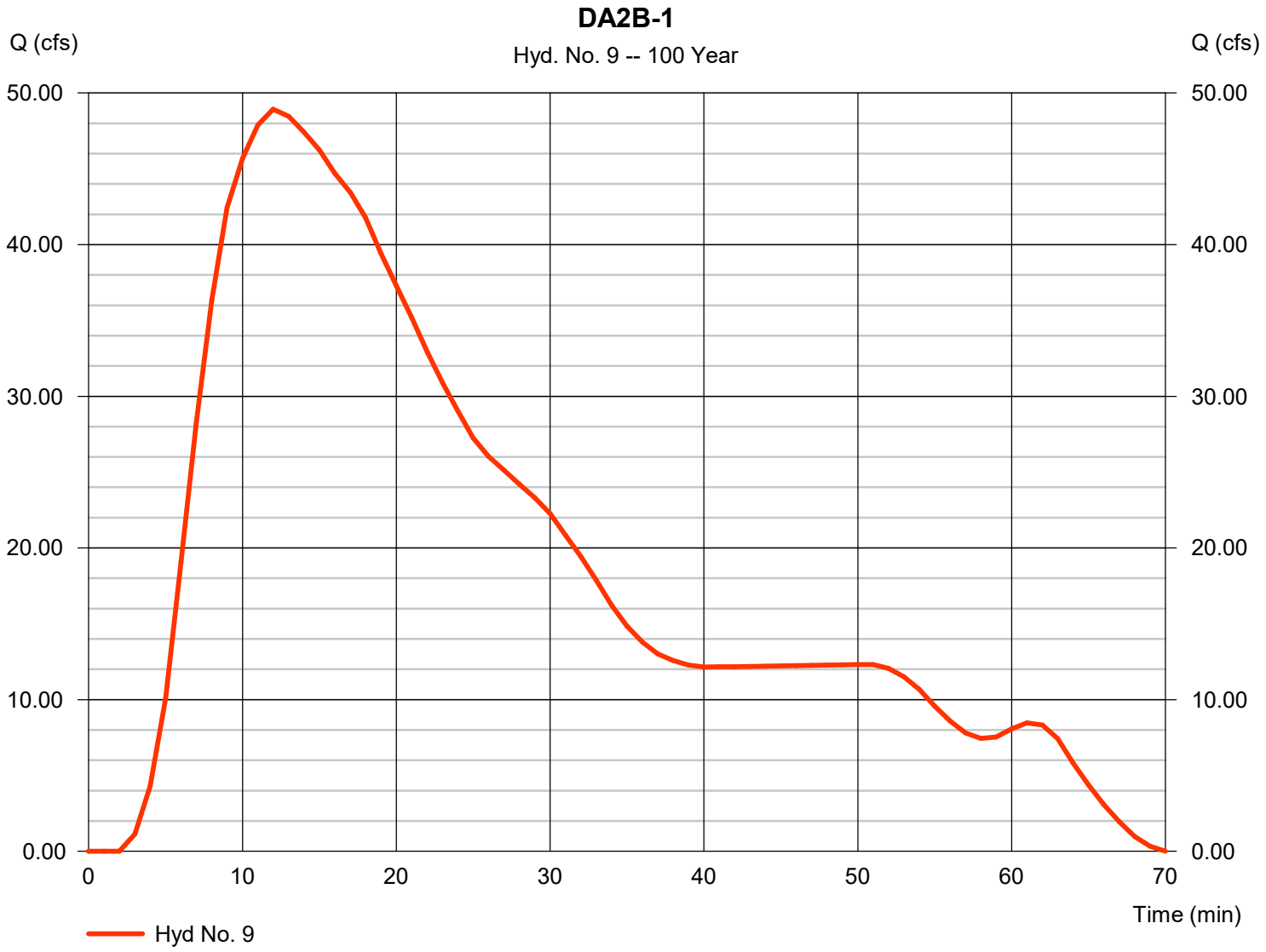
Hydrograph Report

Hyd. No. 9

DA2B-1

Hydrograph type	=	SCS Runoff	Peak discharge	=	48.93 cfs
Storm frequency	=	100 yrs	Time to peak	=	12 min
Time interval	=	1 min	Hyd. volume	=	79,245 cuft
Drainage area	=	10.520 ac	Curve number	=	89*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	3.13 in	Distribution	=	Huff-1st
Storm duration	=	1.00 hrs	Shape factor	=	484

* Composite (Area/CN) = [(4.880 x 90) + (2.170 x 75)] / 10.520



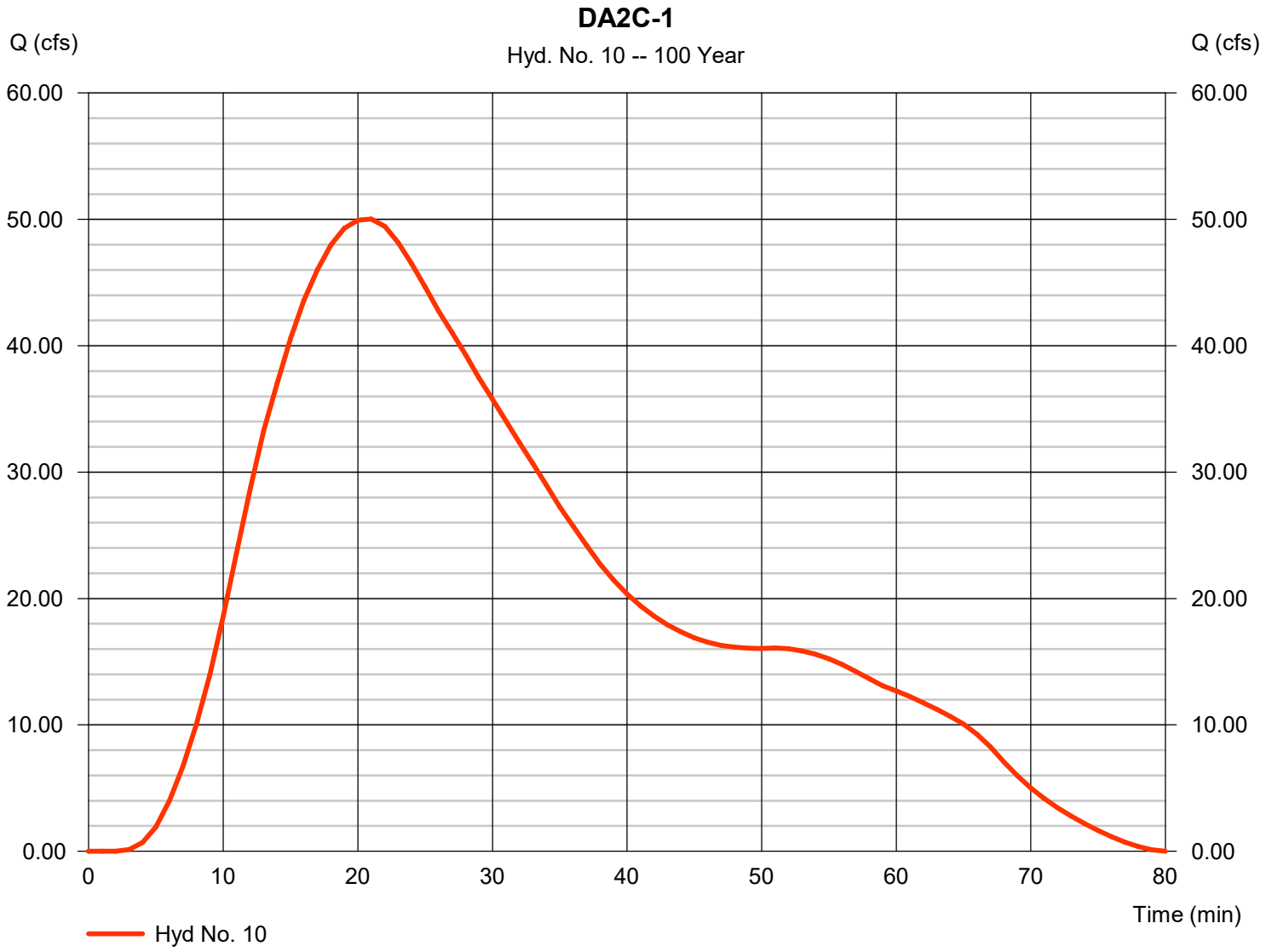
Hydrograph Report

Hyd. No. 10

DA2C-1

Hydrograph type	=	SCS Runoff	Peak discharge	=	50.03 cfs
Storm frequency	=	100 yrs	Time to peak	=	21 min
Time interval	=	1 min	Hyd. volume	=	95,127 cuft
Drainage area	=	15.680 ac	Curve number	=	85*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	11.90 min
Total precip.	=	3.13 in	Distribution	=	Huff-1st
Storm duration	=	1.00 hrs	Shape factor	=	484

* Composite (Area/CN) = [(4.880 x 90) + (2.170 x 75)] / 15.680

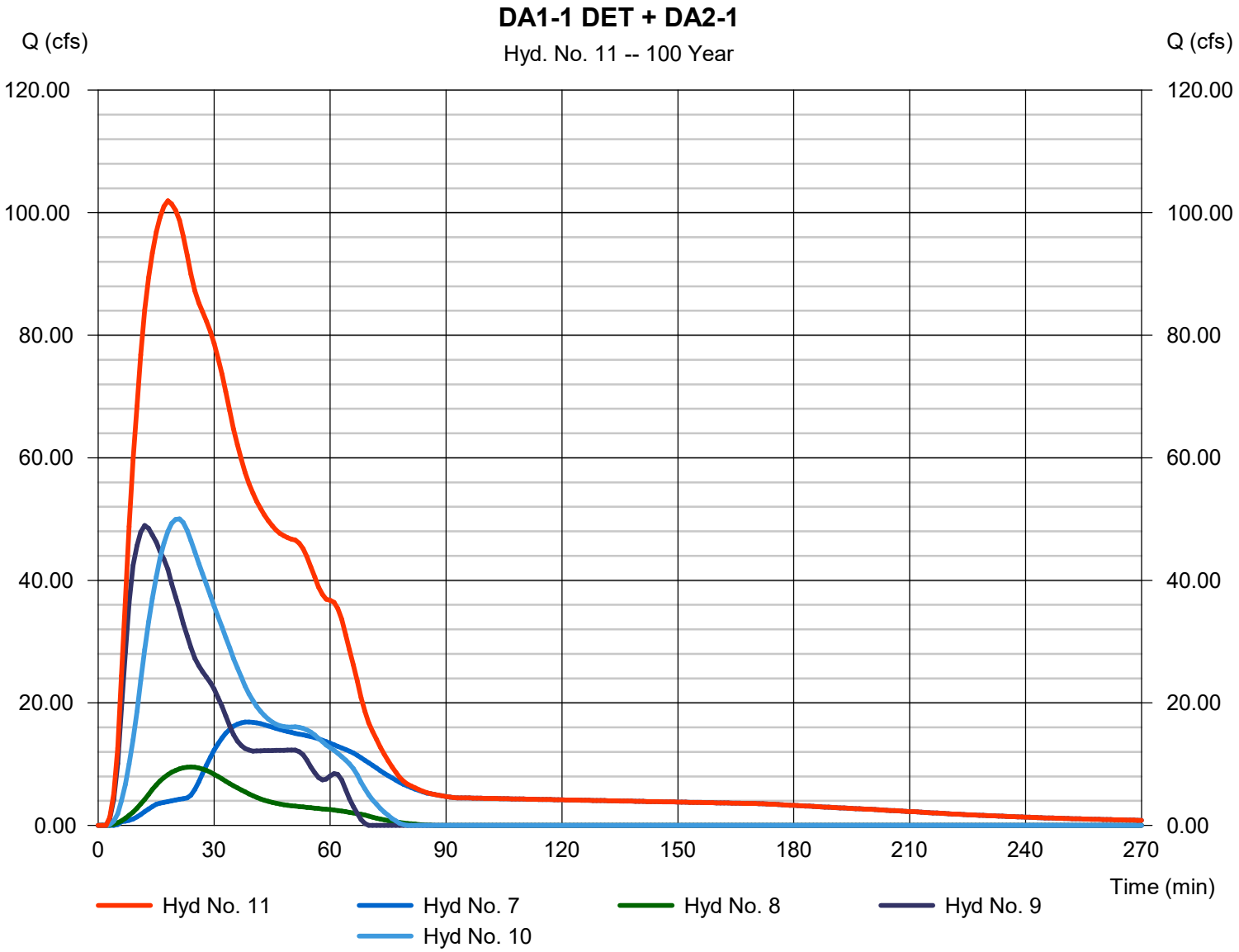


Hydrograph Report

Hyd. No. 11

DA1-1 DET + DA2-1

Hydrograph type	= Combine	Peak discharge	= 101.93 cfs
Storm frequency	= 100 yrs	Time to peak	= 18 min
Time interval	= 1 min	Hyd. volume	= 276,159 cuft
Inflow hyds.	= 7, 8, 9, 10	Contrib. drain. area	= 28.790 ac



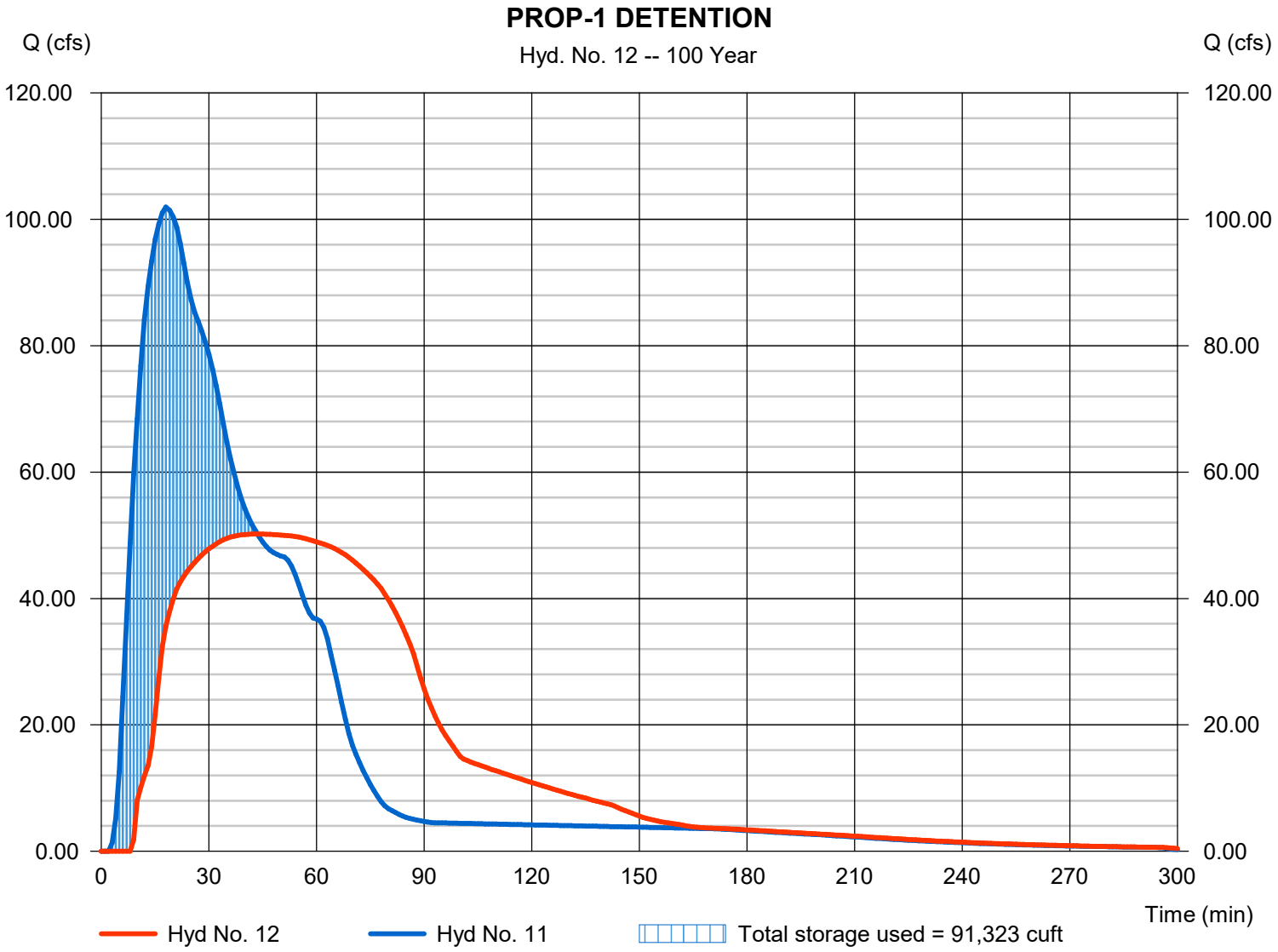
Hydrograph Report

Hyd. No. 12

PROP-1 DETENTION

Hydrograph type	=	Reservoir	Peak discharge	=	50.21 cfs
Storm frequency	=	100 yrs	Time to peak	=	43 min
Time interval	=	1 min	Hyd. volume	=	267,079 cuft
Inflow hyd. No.	=	11 - DA1-1 DET + DA2-1	Max. Elevation	=	1288.86 ft
Reservoir name	=	Phase 1	Max. Storage	=	91,323 cuft

Storage Indication method used.



Pond Report

Pond No. 3 - Phase 1

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 1283.45 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	1283.45	00	0	0
0.55	1284.00	650	119	119
1.55	1285.00	5,157	2,546	2,665
2.55	1286.00	13,875	9,163	11,828
3.55	1287.00	23,575	18,510	30,338
4.55	1288.00	33,464	28,373	58,710
5.55	1289.00	42,792	38,029	96,739
6.55	1290.00	50,595	46,634	143,374
7.55	1291.00	56,302	53,418	196,791
7.60	1291.05	56,448	2,816	199,607

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 24.00	24.00	0.00	0.00
Span (in)	= 24.00	24.00	0.00	0.00
No. Barrels	= 2	1	0	0
Invert El. (ft)	= 1283.35	1283.45	0.00	0.00
Length (ft)	= 153.83	0.00	0.00	0.00
Slope (%)	= 0.42	0.00	0.00	n/a
N-Value	= .012	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	Yes	No	No

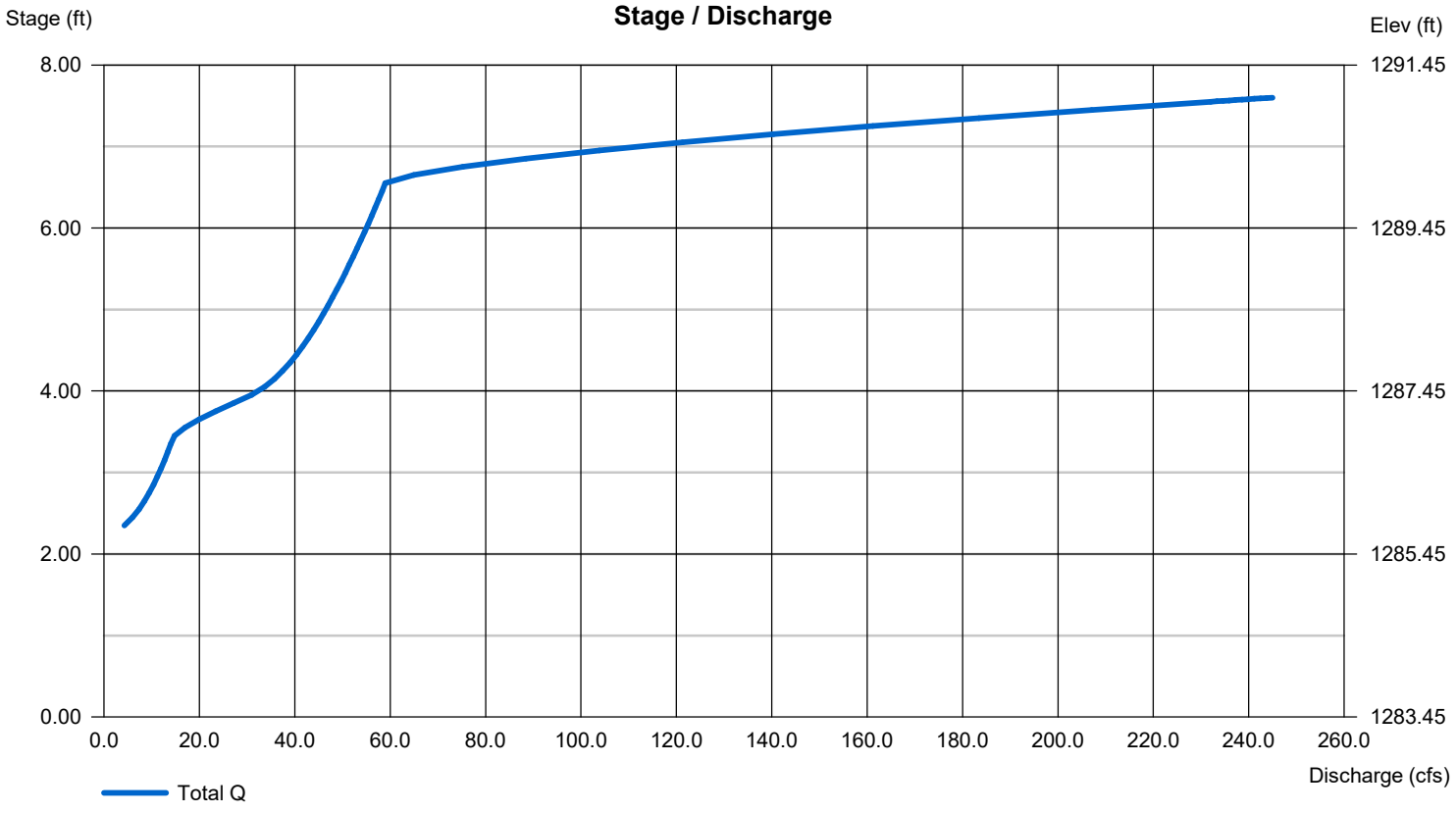
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 16.00	50.00	Inactive	0.00
Crest El. (ft)	= 1286.88	1290.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= Rect	Ciplti	---	---
Multi-Stage	= Yes	No	No	No

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

TW Elev. (ft) = 1285.70

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

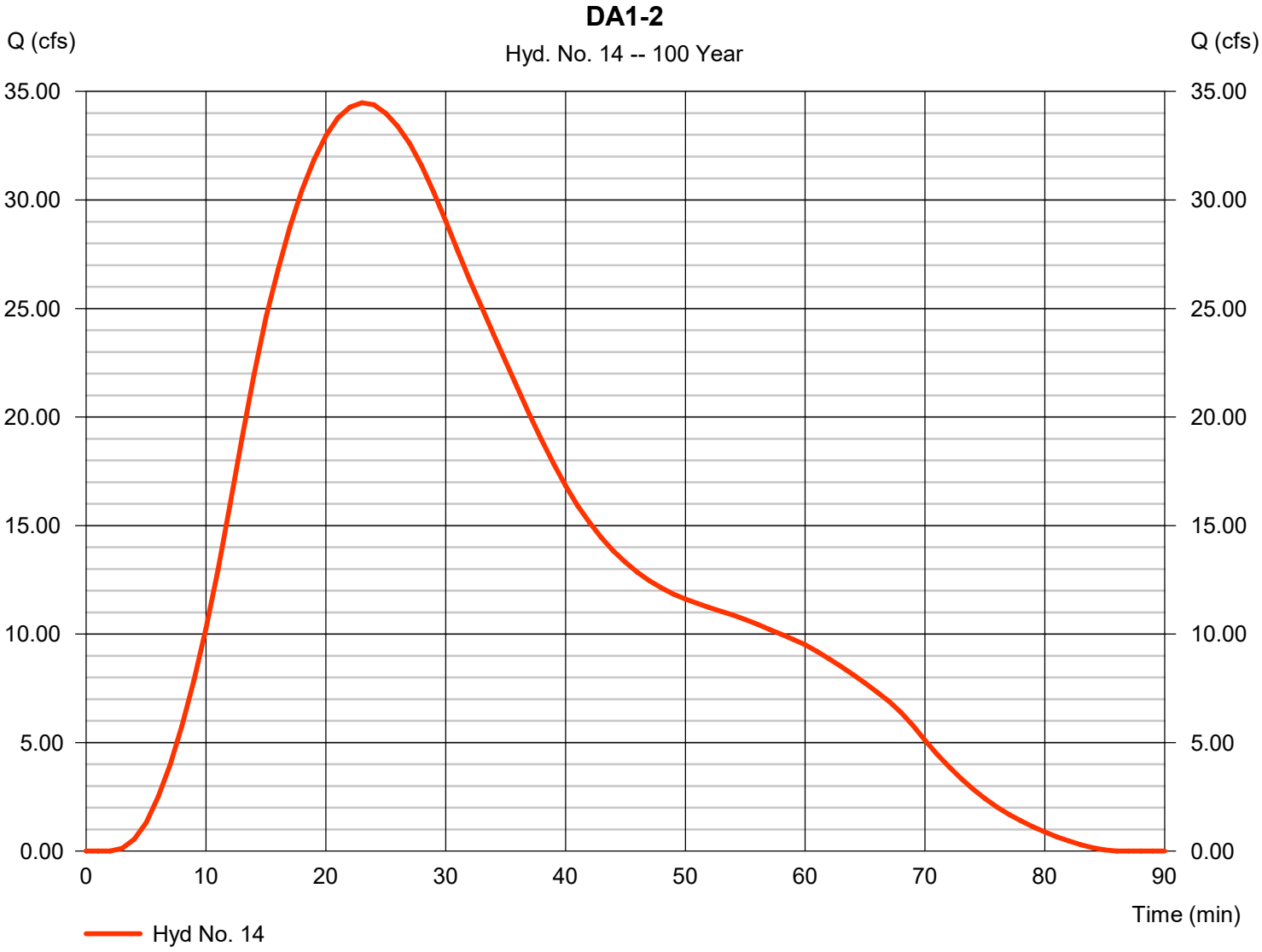


Hydrograph Report

Hyd. No. 14

DA1-2

Hydrograph type	=	SCS Runoff	Peak discharge	=	34.48 cfs
Storm frequency	=	100 yrs	Time to peak	=	23 min
Time interval	=	1 min	Hyd. volume	=	69,856 cuft
Drainage area	=	9.840 ac	Curve number	=	88
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	15.36 min
Total precip.	=	3.13 in	Distribution	=	Huff-1st
Storm duration	=	1.00 hrs	Shape factor	=	484



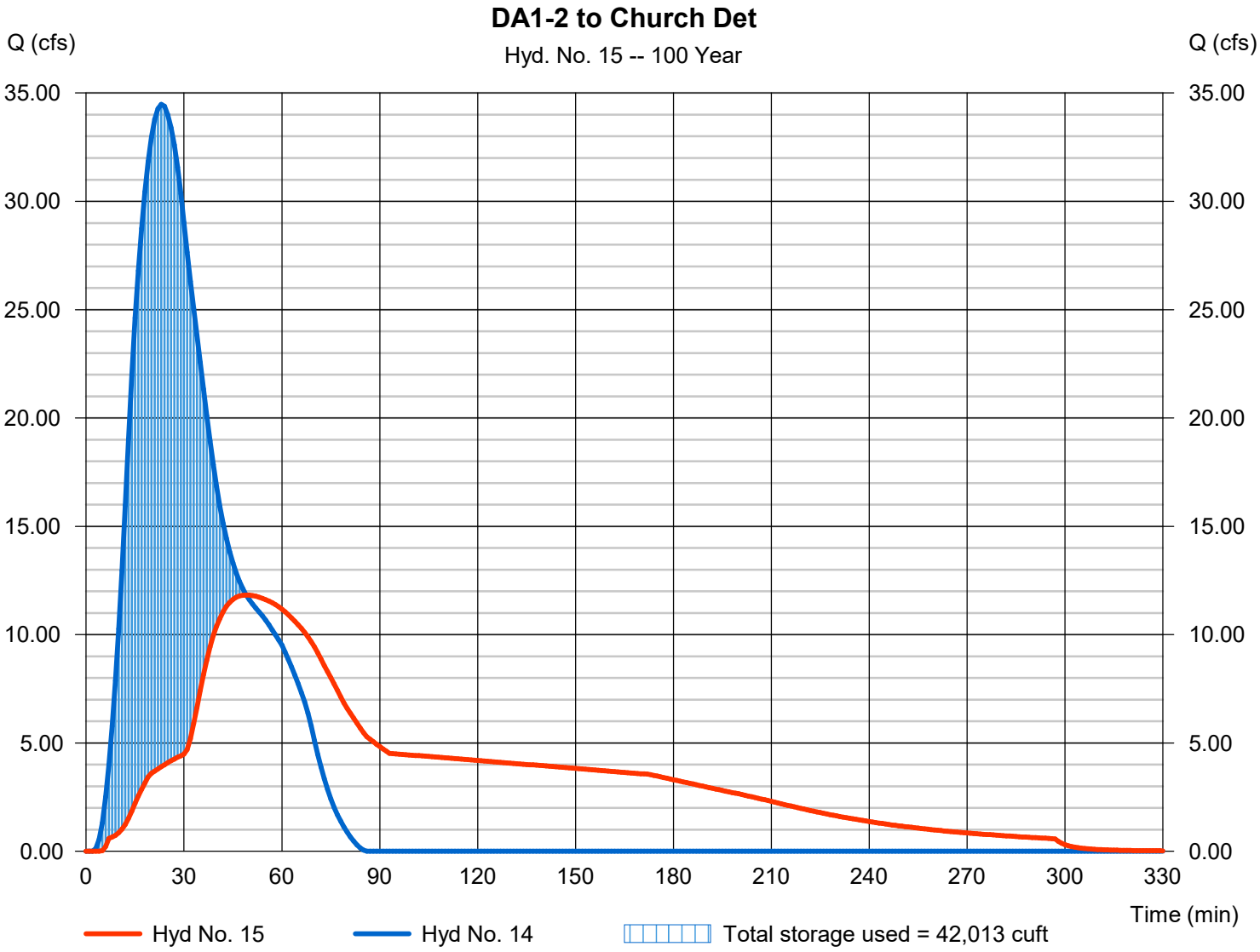
Hydrograph Report

Hyd. No. 15

DA1-2 to Church Det

Hydrograph type	=	Reservoir	Peak discharge	=	11.83 cfs
Storm frequency	=	100 yrs	Time to peak	=	49 min
Time interval	=	1 min	Hyd. volume	=	69,823 cuft
Inflow hyd. No.	=	14 - DA1-2	Max. Elevation	=	1294.75 ft
Reservoir name	=	Church Detention	Max. Storage	=	42,013 cuft

Storage Indication method used.



Pond Report

Pond No. 1 - Church Detention

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 1292.58 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	1292.58	00	0	0
0.42	1293.00	2,109	295	295
1.42	1294.00	28,716	12,868	13,163
1.97	1294.55	41,993	19,331	32,494
2.42	1295.00	52,471	21,204	53,698
3.42	1296.00	63,643	57,961	111,660

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 12.00	0.00	0.00	0.00
Span (in)	= 12.00	0.00	0.00	0.00
No. Barrels	= 1	0	0	0
Invert El. (ft)	= 1292.62	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

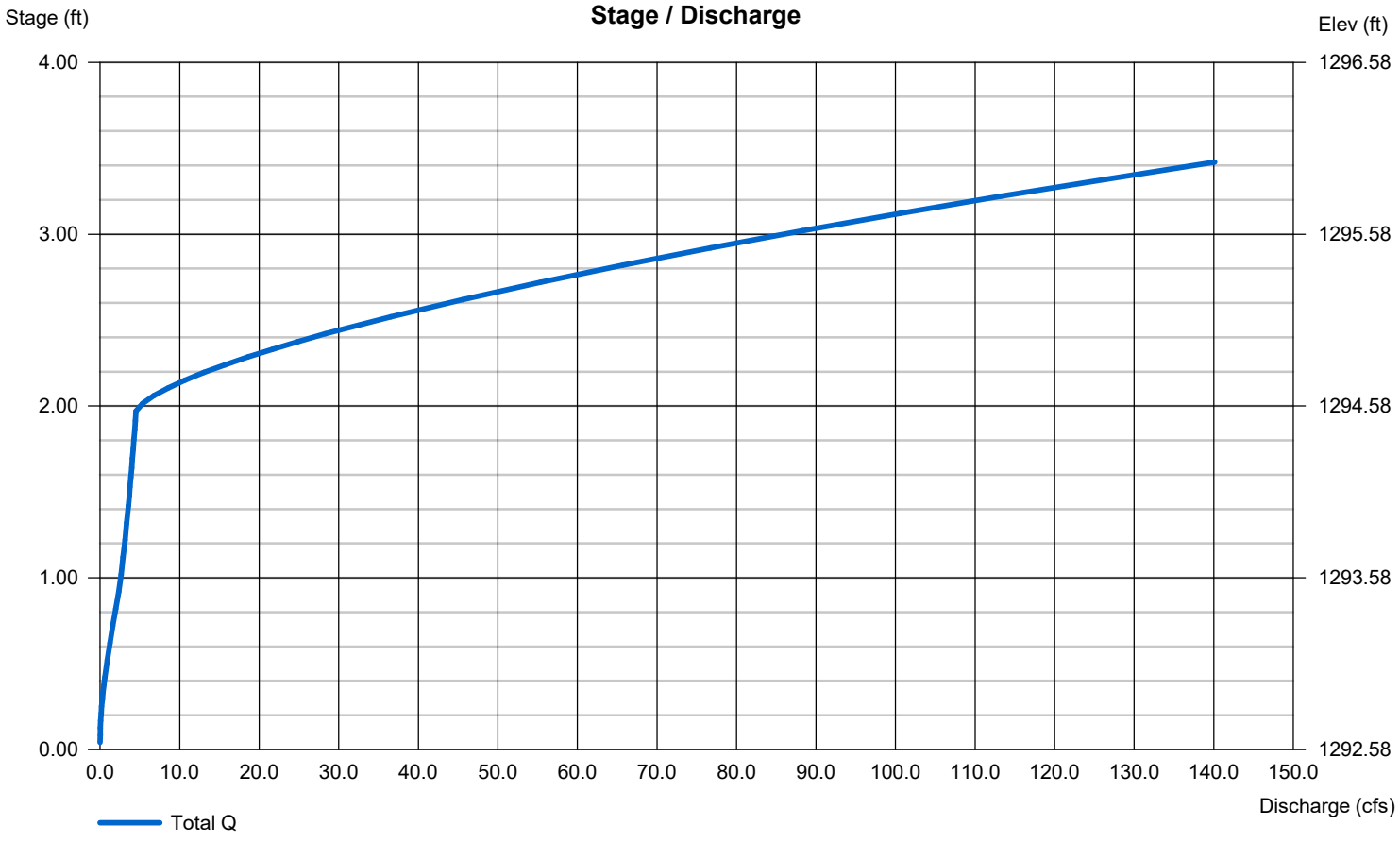
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 23.00	0.00	0.00	0.00
Crest El. (ft)	= 1294.55	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= Ciplti	Rect	---	---
Multi-Stage	= No	No	No	No

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

TW Elev. (ft) = 0.00

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

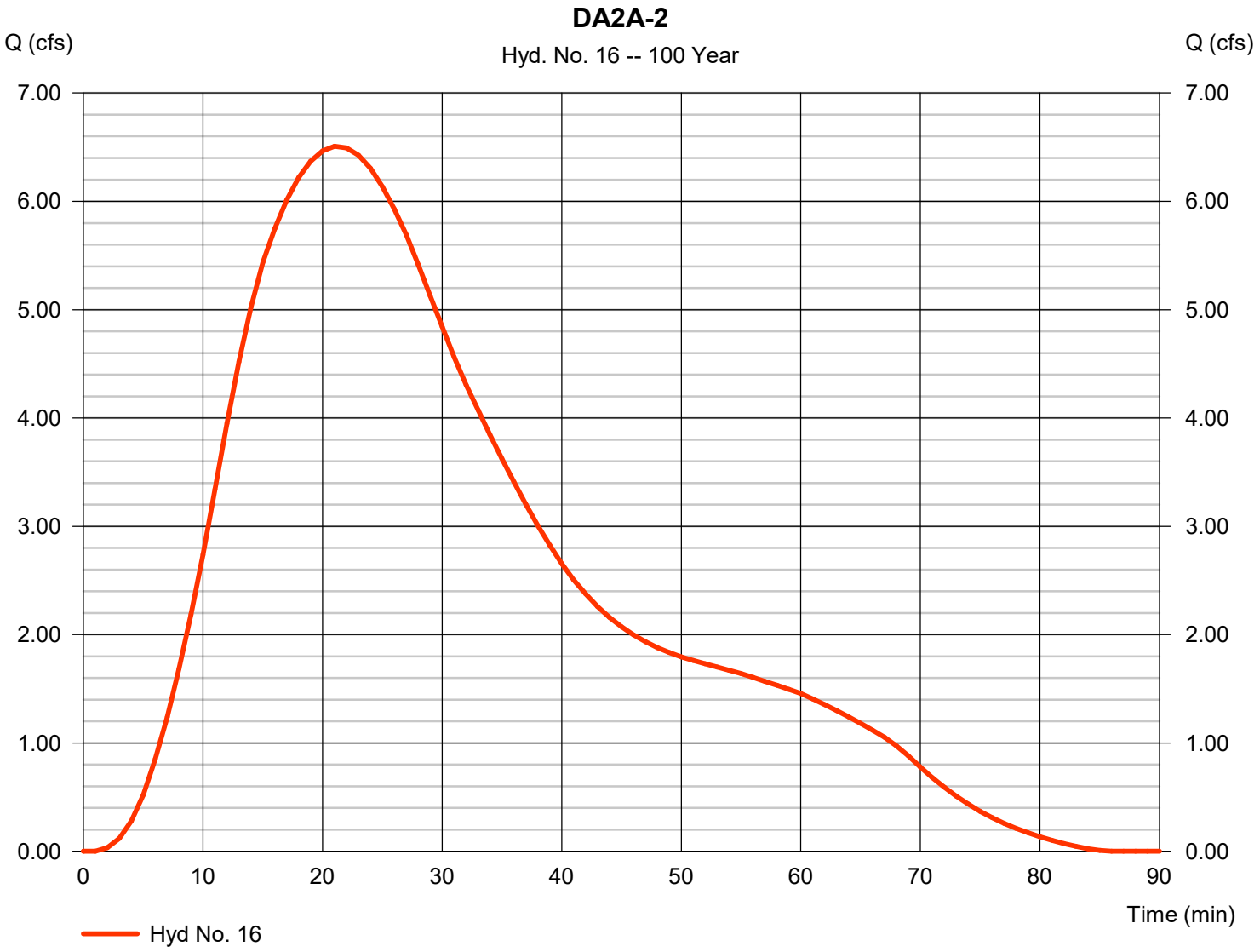


Hydrograph Report

Hyd. No. 16

DA2A-2

Hydrograph type	=	SCS Runoff	Peak discharge	=	6.509 cfs
Storm frequency	=	100 yrs	Time to peak	=	21 min
Time interval	=	1 min	Hyd. volume	=	12,558 cuft
Drainage area	=	1.380 ac	Curve number	=	94
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	16.00 min
Total precip.	=	3.13 in	Distribution	=	Huff-1st
Storm duration	=	1.00 hrs	Shape factor	=	484

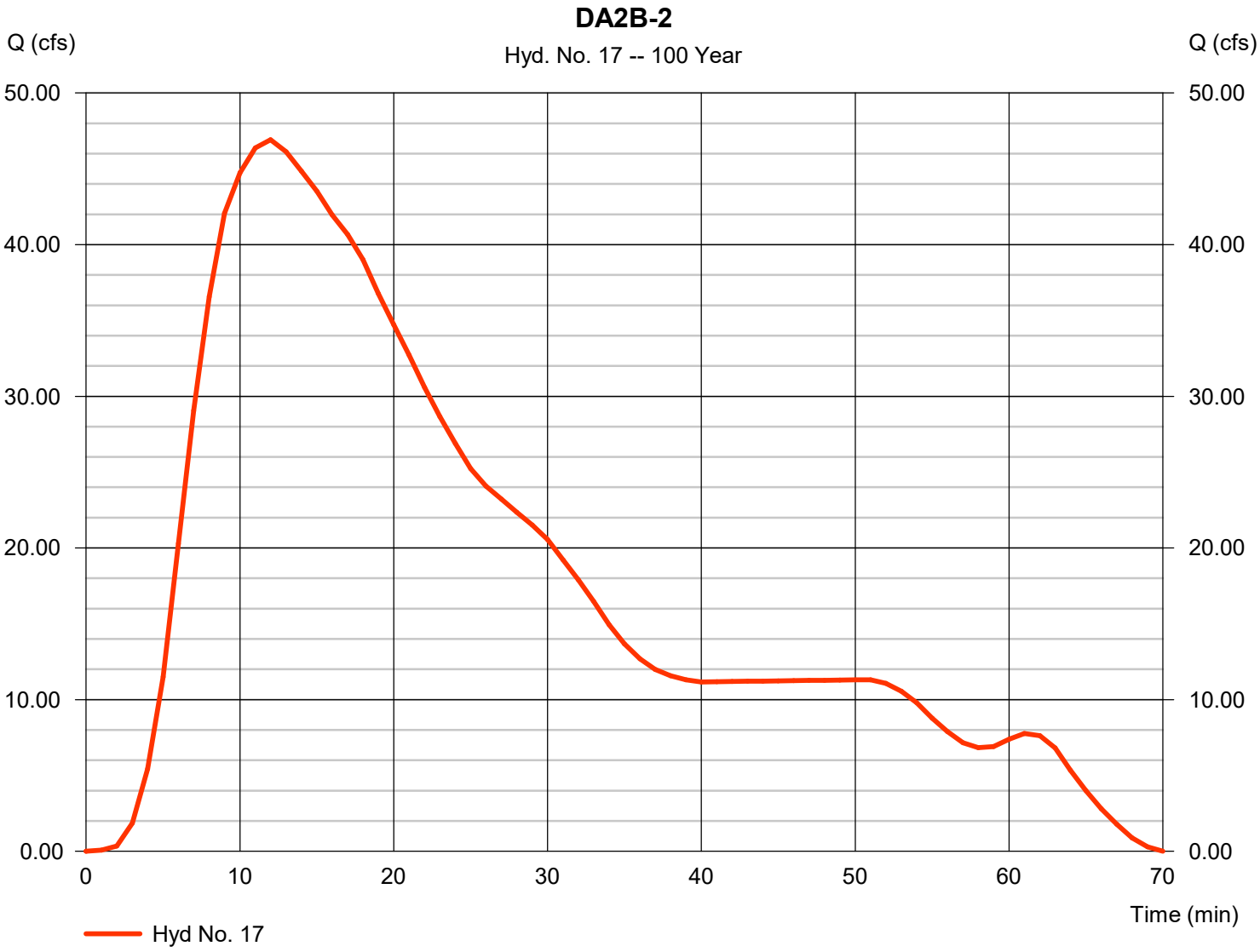


Hydrograph Report

Hyd. No. 17

DA2B-2

Hydrograph type	=	SCS Runoff	Peak discharge	=	46.91 cfs
Storm frequency	=	100 yrs	Time to peak	=	12 min
Time interval	=	1 min	Hyd. volume	=	74,819 cuft
Drainage area	=	9.500 ac	Curve number	=	90
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	3.13 in	Distribution	=	Huff-1st
Storm duration	=	1.00 hrs	Shape factor	=	484

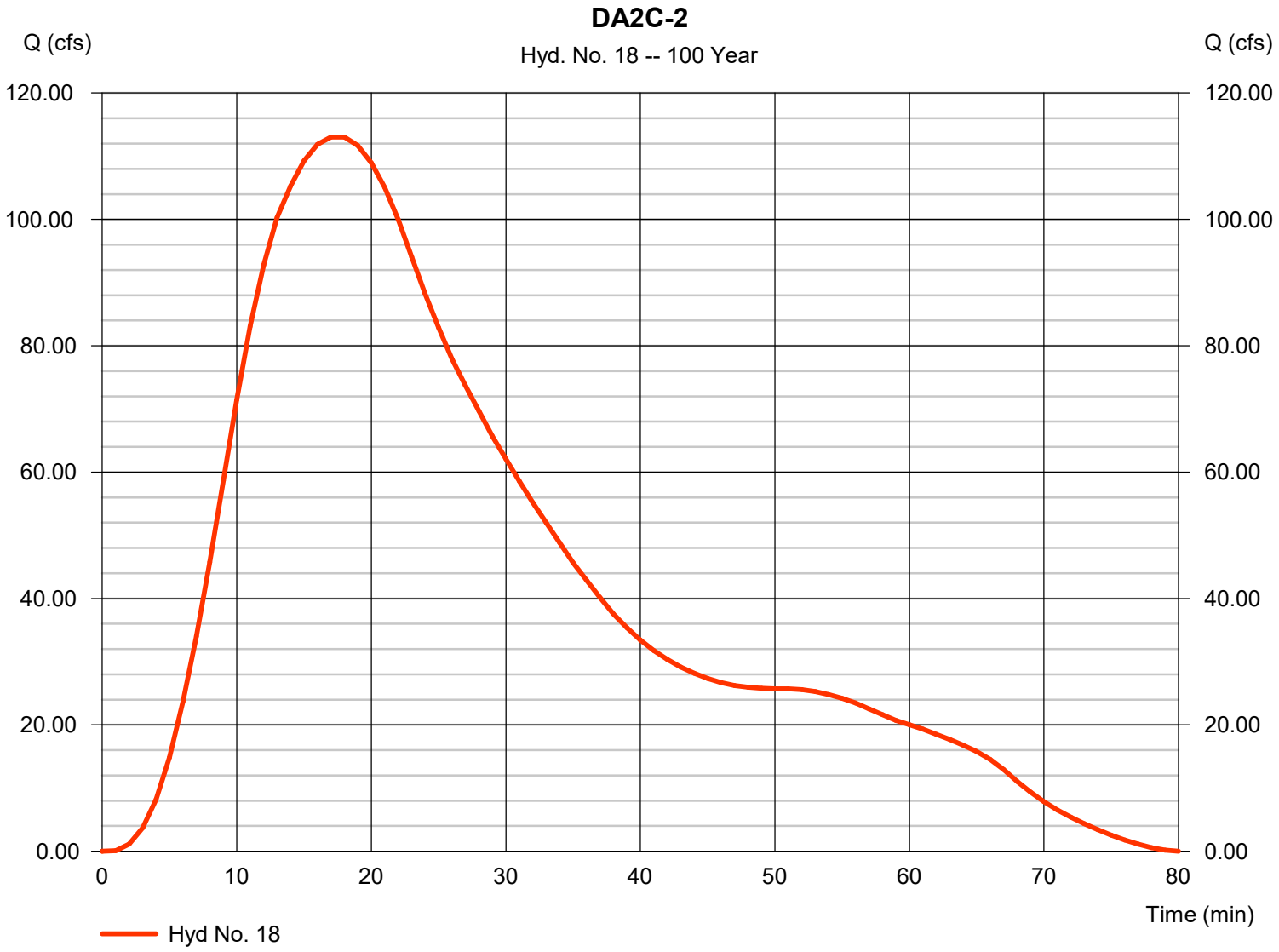


Hydrograph Report

Hyd. No. 18

DA2C-2

Hydrograph type	=	SCS Runoff	Peak discharge	=	113.05 cfs
Storm frequency	=	100 yrs	Time to peak	=	17 min
Time interval	=	1 min	Hyd. volume	=	195,634 cuft
Drainage area	=	21.250 ac	Curve number	=	95
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	11.90 min
Total precip.	=	3.13 in	Distribution	=	Huff-1st
Storm duration	=	1.00 hrs	Shape factor	=	484

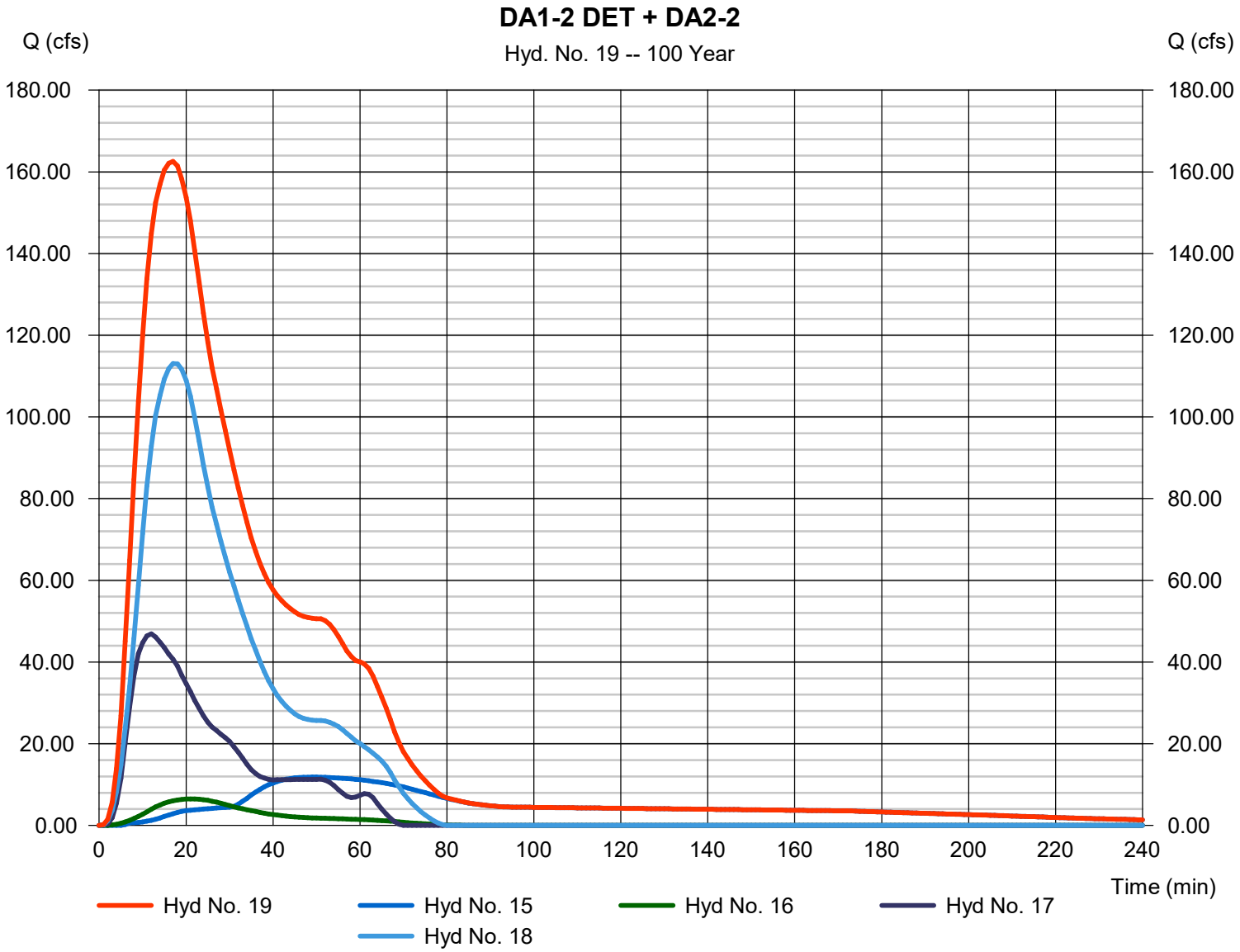


Hydrograph Report

Hyd. No. 19

DA1-2 DET + DA2-2

Hydrograph type	=	Combine	Peak discharge	=	162.59 cfs
Storm frequency	=	100 yrs	Time to peak	=	17 min
Time interval	=	1 min	Hyd. volume	=	352,834 cuft
Inflow hyds.	=	15, 16, 17, 18	Contrib. drain. area	=	32.130 ac



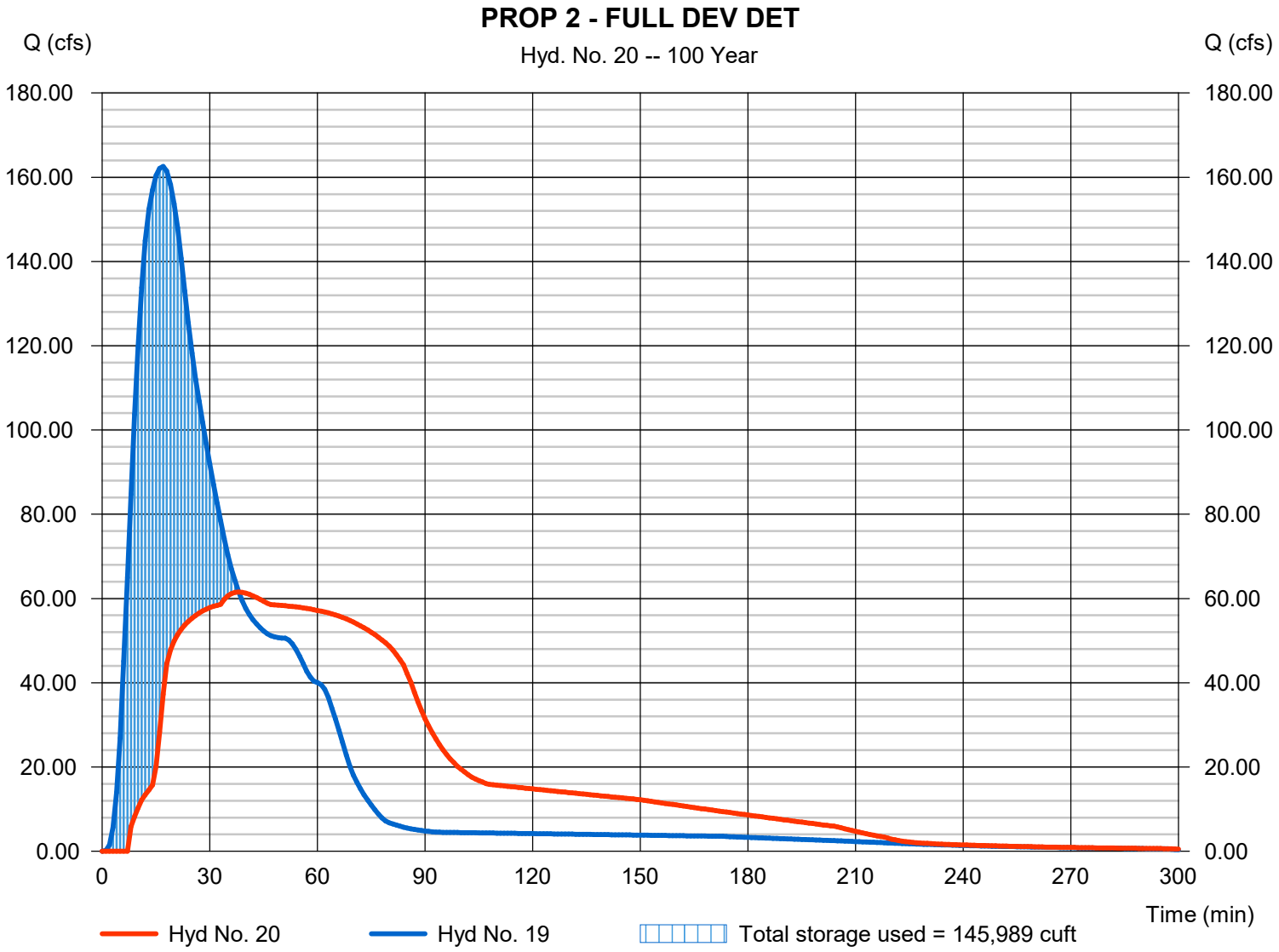
Hydrograph Report

Hyd. No. 20

PROP 2 - FULL DEV DET

Hydrograph type	=	Reservoir	Peak discharge	=	61.54 cfs
Storm frequency	=	100 yrs	Time to peak	=	38 min
Time interval	=	1 min	Hyd. volume	=	343,755 cuft
Inflow hyd. No.	=	19 - DA1-2 DET + DA2-2	Max. Elevation	=	1290.05 ft
Reservoir name	=	Phase 2	Max. Storage	=	145,989 cuft

Storage Indication method used.



Pond Report

Pond No. 2 - Phase 2

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 1283.45 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	1283.45	00	0	0
0.55	1284.00	650	119	119
1.55	1285.00	5,157	2,546	2,665
2.55	1286.00	13,875	9,163	11,828
3.55	1287.00	23,575	18,510	30,338
4.55	1288.00	33,464	28,373	58,710
5.55	1289.00	42,792	38,029	96,739
6.55	1290.00	50,595	46,634	143,374
7.55	1291.00	56,302	53,418	196,791
7.60	1291.05	56,448	2,816	199,607

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 24.00	21.00	0.00	0.00
Span (in)	= 24.00	21.00	0.00	0.00
No. Barrels	= 2	1	0	0
Invert El. (ft)	= 1283.35	1283.45	0.00	0.00
Length (ft)	= 153.83	0.00	0.00	0.00
Slope (%)	= 0.42	0.00	0.00	n/a
N-Value	= .012	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	Yes	No	No

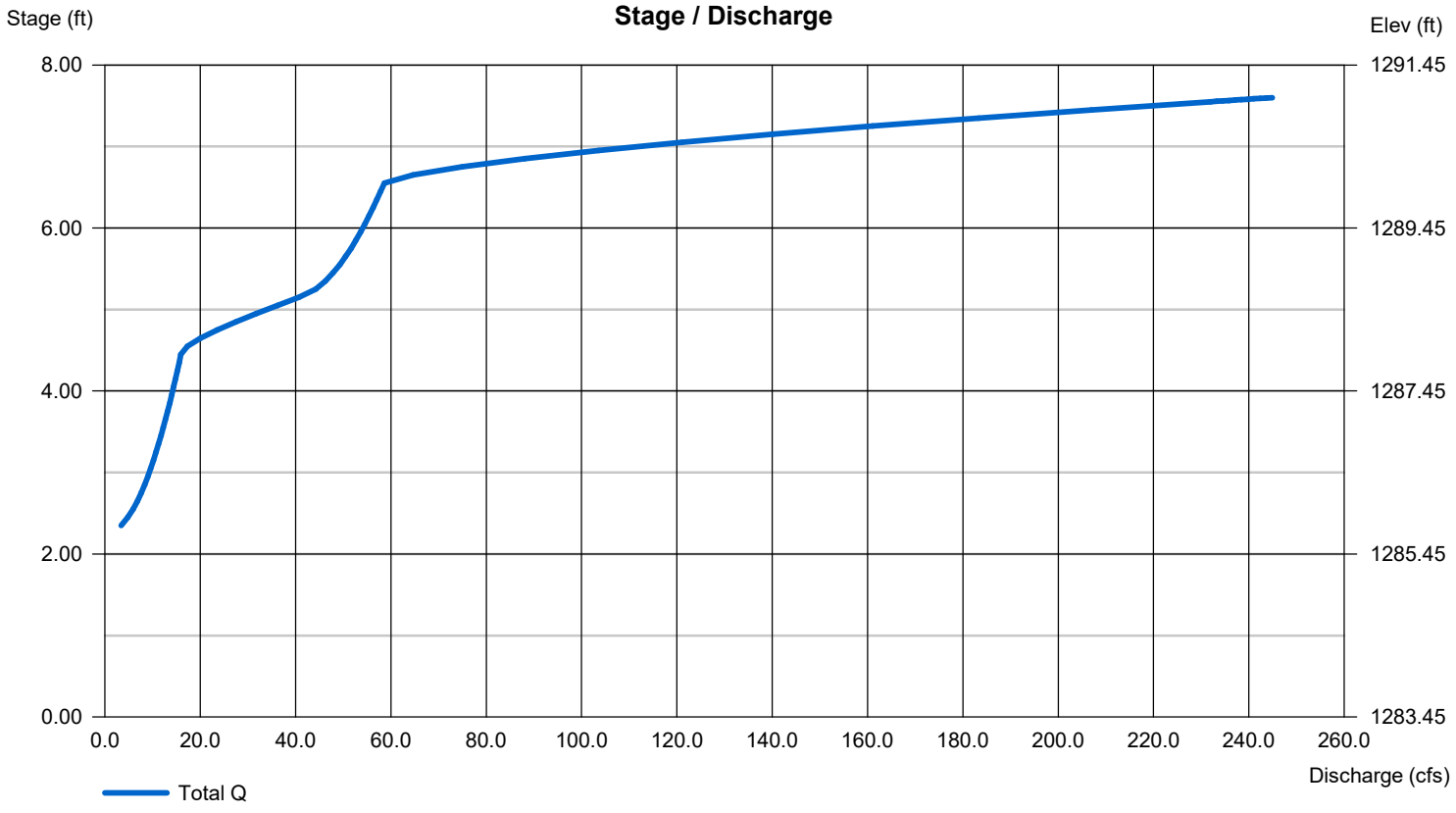
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 16.00	50.00	Inactive	0.00
Crest El. (ft)	= 1287.92	1290.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= Rect	Ciplti	Rect	---
Multi-Stage	= Yes	No	No	No

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

TW Elev. (ft) = 1285.70

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



Hydraflow Table of Contents

Hydrograph Summary Report

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

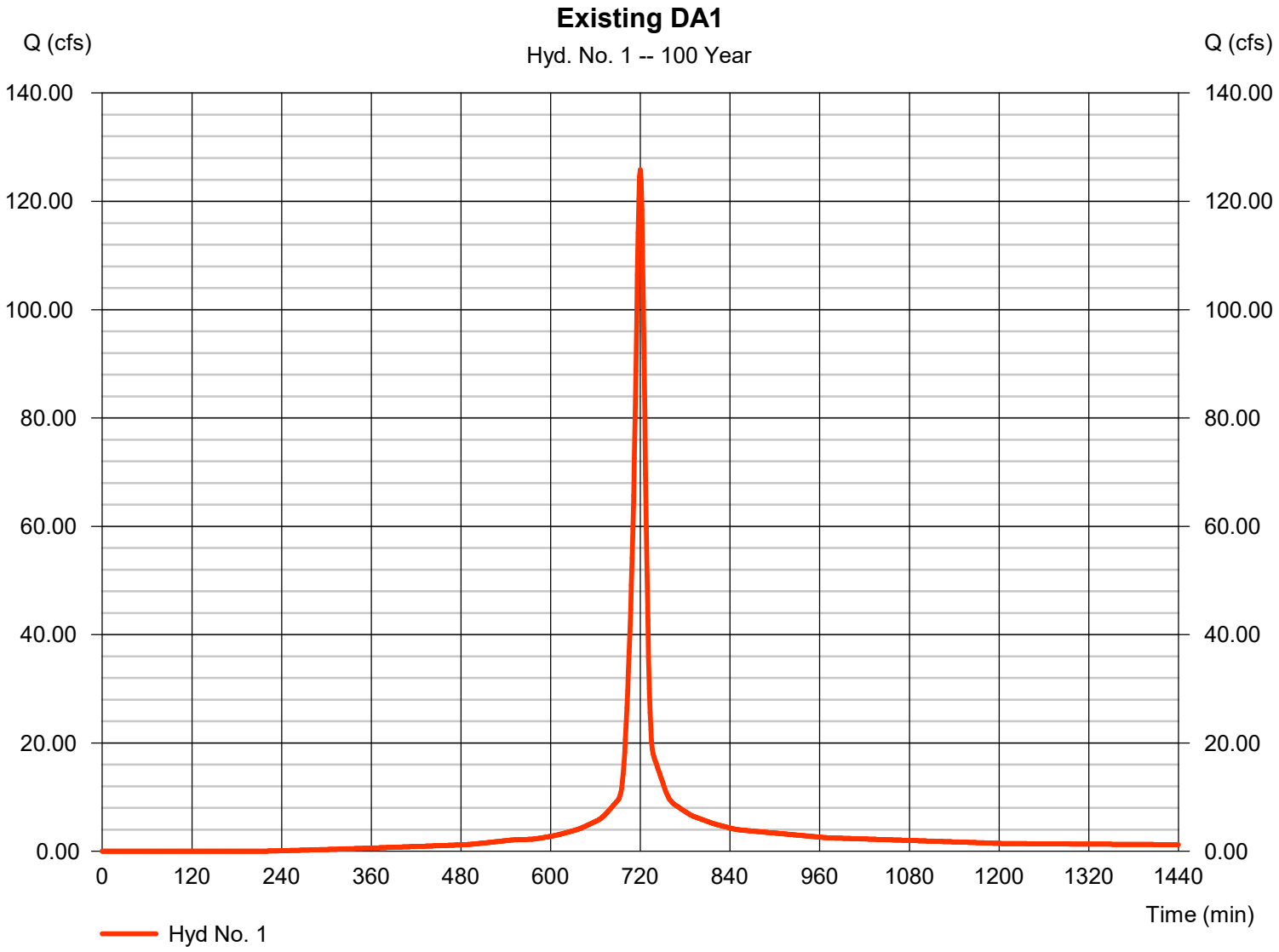
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	125.85	1	720	323,136	------	------	------	Existing DA1
2	Reservoir	86.81	1	725	323,103	1	1295.59	87,714	Exist DA1 - Church Det
3	SCS Runoff	205.16	1	722	571,857	------	------	------	Existing DA2
4	Combine	285.01	1	723	894,960	2, 3	------	------	Pre
6	SCS Runoff	77.37	1	726	264,423	------	------	------	DA1-1
7	Reservoir	55.04	1	734	264,390	6	1295.30	70,924	DA1-1 to Church Det
8	SCS Runoff	18.69	1	723	59,052	------	------	------	DA2A-1
9	SCS Runoff	110.59	1	717	245,578	------	------	------	DA2B-1
10	SCS Runoff	122.22	1	721	323,301	------	------	------	DA2C-1
11	Combine	250.69	1	719	892,320	7, 8, 9, 10	------	------	DA1-1 DET + DA2-1
12	Reservoir	166.73	1	726	883,240	11	1290.72	182,099	PROP-1 DETENTION
14	SCS Runoff	66.71	1	724	218,569	------	------	------	DA1-2
15	Reservoir	43.45	1	734	218,536	14	1295.18	63,922	DA1-2 to Church Det
16	SCS Runoff	10.96	1	722	34,615	------	------	------	DA2A-2
17	SCS Runoff	100.91	1	717	225,934	------	------	------	DA2B-2
18	SCS Runoff	183.82	1	721	527,214	------	------	------	DA2C-2
19	Combine	291.38	1	719	1,006,299	15, 16, 17, 18	------	------	DA1-2 DET + DA2-2
20	Reservoir	237.69	1	724	997,220	19	1291.02	198,039	PROP 2 - FULL DEV DET

Hydrograph Report

Hyd. No. 1

Existing DA1

Hydrograph type	=	SCS Runoff	Peak discharge	=	125.85 cfs
Storm frequency	=	100 yrs	Time to peak	=	720 min
Time interval	=	1 min	Hyd. volume	=	323,136 cuft
Drainage area	=	14.570 ac	Curve number	=	87
Basin Slope	=	2.0 %	Hydraulic length	=	2185 ft
Tc method	=	User	Time of conc. (Tc)	=	10.10 min
Total precip.	=	7.54 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484



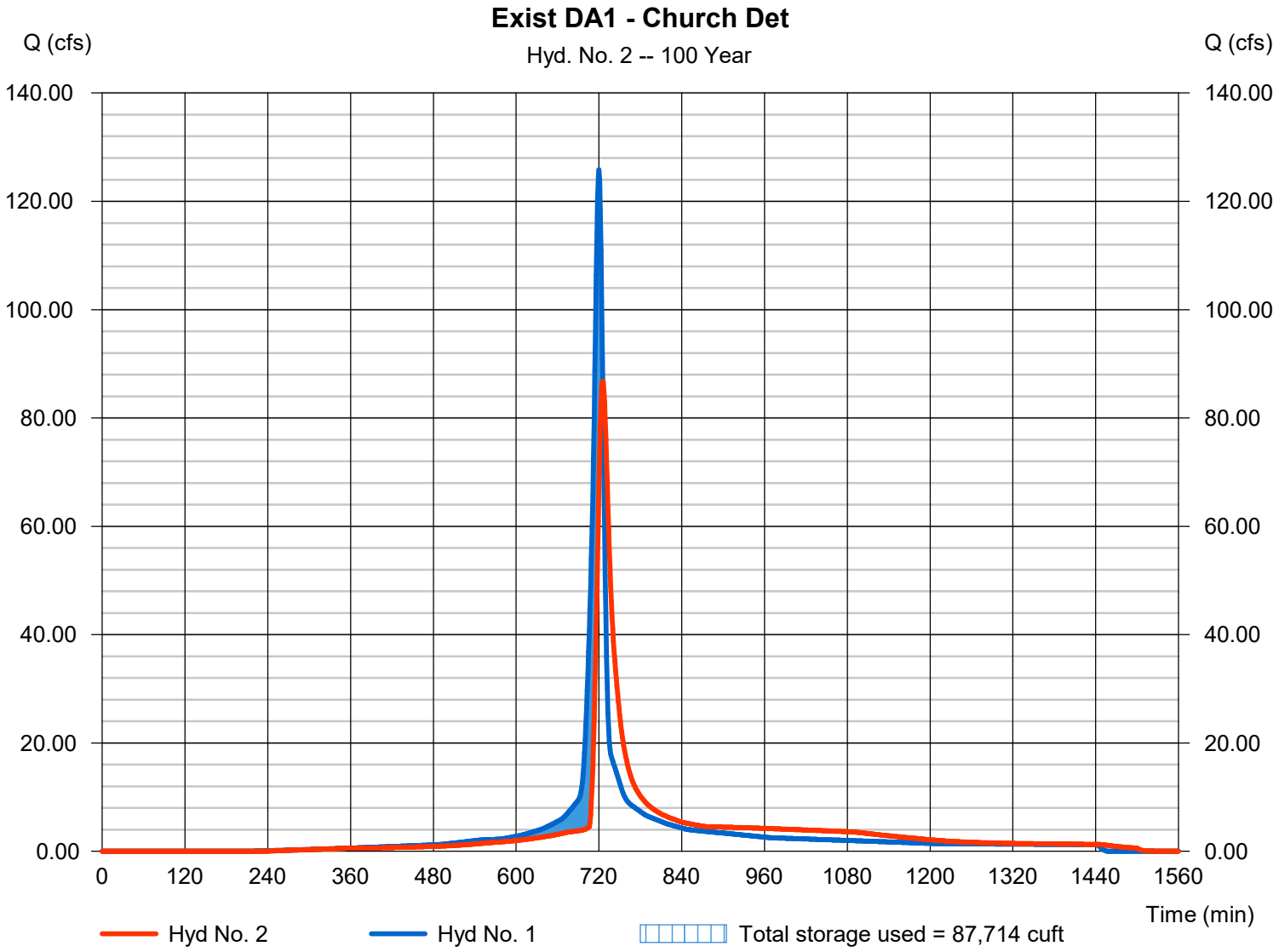
Hydrograph Report

Hyd. No. 2

Exist DA1 - Church Det

Hydrograph type	=	Reservoir	Peak discharge	=	86.81 cfs
Storm frequency	=	100 yrs	Time to peak	=	725 min
Time interval	=	1 min	Hyd. volume	=	323,103 cuft
Inflow hyd. No.	=	1 - Existing DA1	Max. Elevation	=	1295.59 ft
Reservoir name	=	Church Detention	Max. Storage	=	87,714 cuft

Storage Indication method used.



Pond Report

Pond No. 1 - Church Detention

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 1292.58 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	1292.58	00	0	0
0.42	1293.00	2,109	295	295
1.42	1294.00	28,716	12,868	13,163
1.97	1294.55	41,993	19,331	32,494
2.42	1295.00	52,471	21,204	53,698
3.42	1296.00	63,643	57,961	111,660

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 12.00	0.00	0.00	0.00
Span (in)	= 12.00	0.00	0.00	0.00
No. Barrels	= 1	0	0	0
Invert El. (ft)	= 1292.62	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

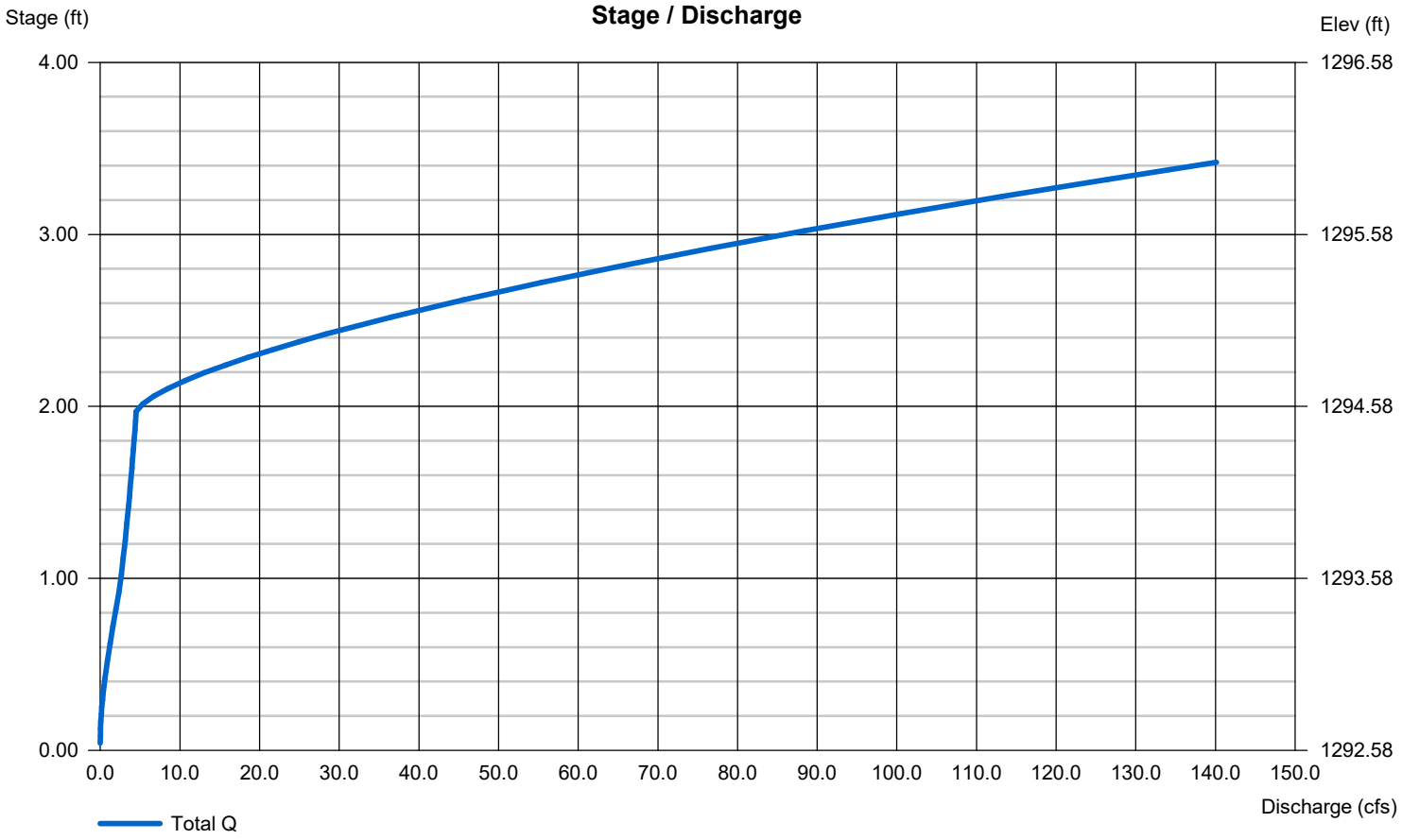
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 23.00	0.00	0.00	0.00
Crest El. (ft)	= 1294.55	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= Ciplti	Rect	---	---
Multi-Stage	= No	No	No	No

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

TW Elev. (ft) = 0.00

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

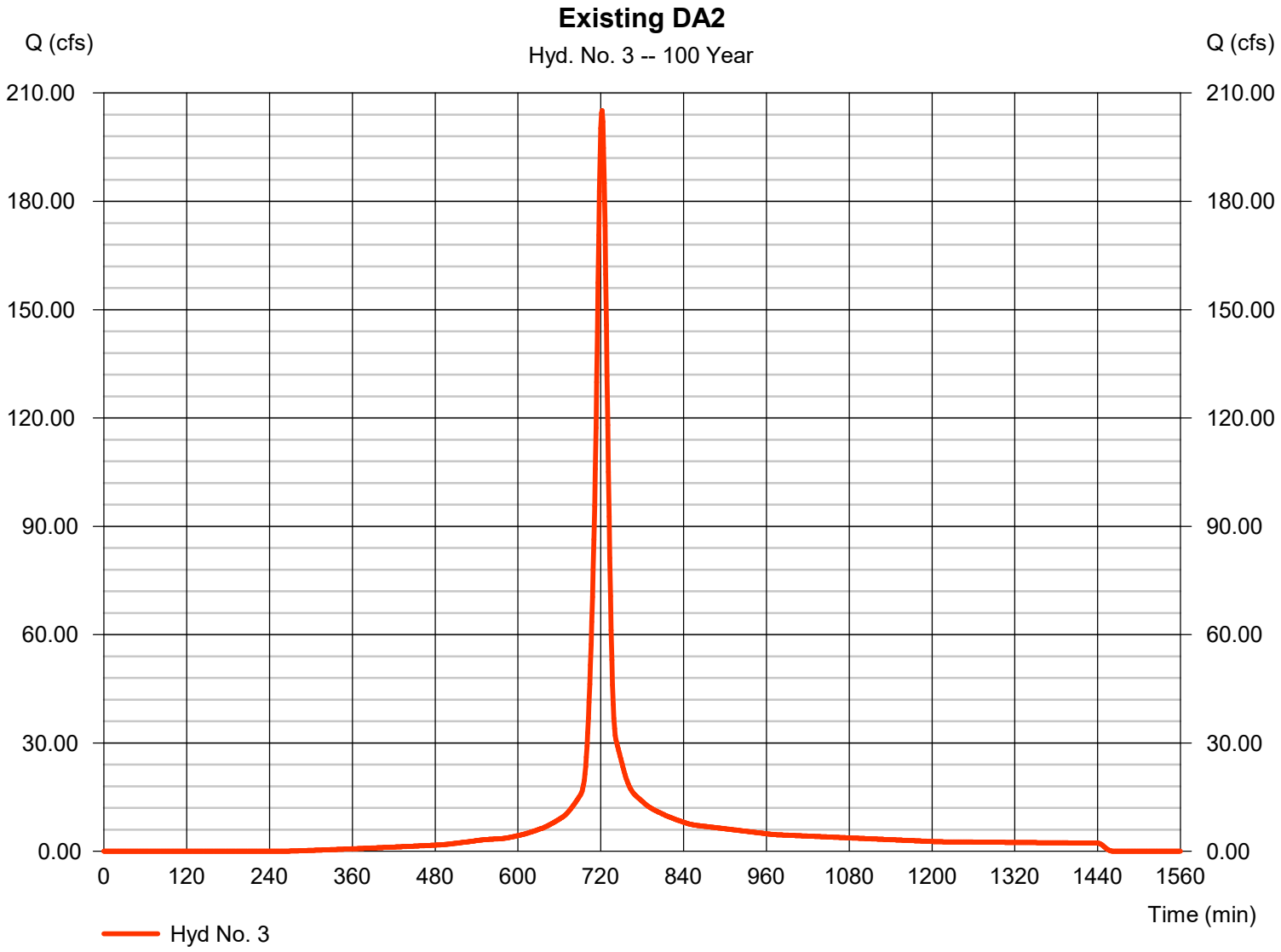


Hydrograph Report

Hyd. No. 3

Existing DA2

Hydrograph type	=	SCS Runoff	Peak discharge	=	205.16 cfs
Storm frequency	=	100 yrs	Time to peak	=	722 min
Time interval	=	1 min	Hyd. volume	=	571,857 cuft
Drainage area	=	27.860 ac	Curve number	=	84
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	13.90 min
Total precip.	=	7.54 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

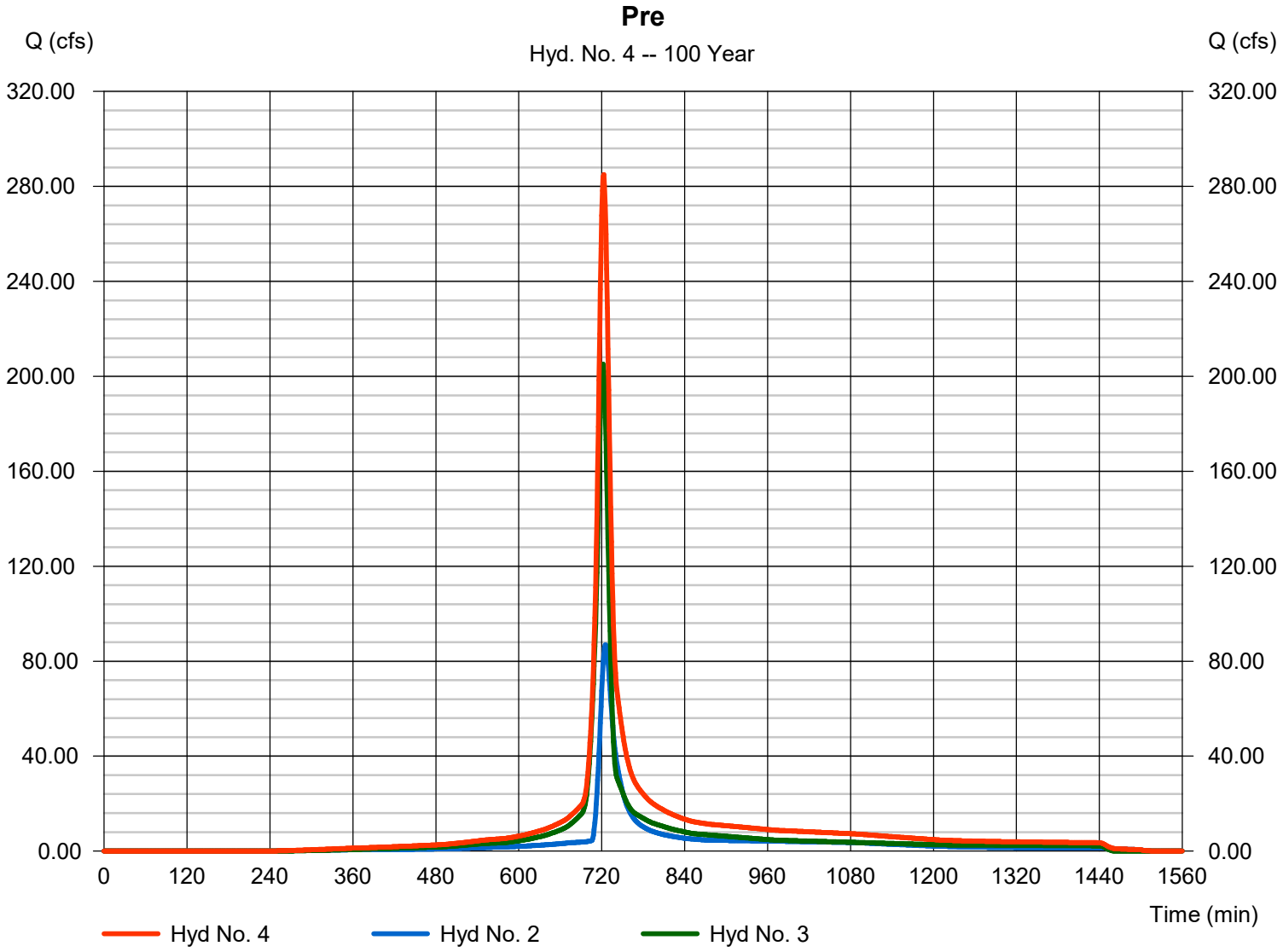


Hydrograph Report

Hyd. No. 4

Pre

Hydrograph type	=	Combine	Peak discharge	=	285.01 cfs
Storm frequency	=	100 yrs	Time to peak	=	723 min
Time interval	=	1 min	Hyd. volume	=	894,960 cuft
Inflow hyds.	=	2, 3	Contrib. drain. area	=	27.860 ac



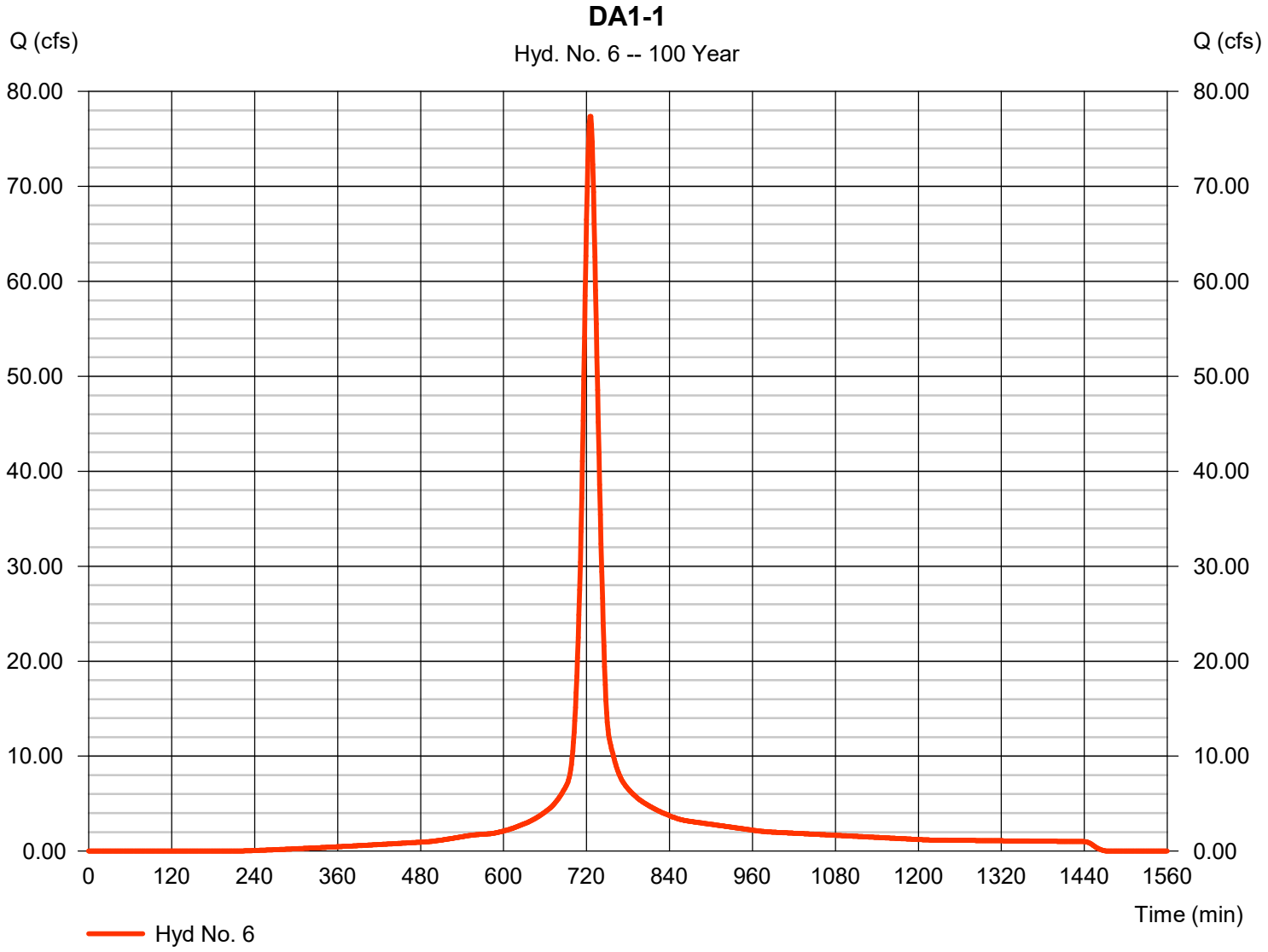
Hydrograph Report

Hyd. No. 6

DA1-1

Hydrograph type	=	SCS Runoff	Peak discharge	=	77.37 cfs
Storm frequency	=	100 yrs	Time to peak	=	726 min
Time interval	=	1 min	Hyd. volume	=	264,423 cuft
Drainage area	=	12.020 ac	Curve number	=	87*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	21.10 min
Total precip.	=	7.54 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(4.755 x 90) + (1.295 x 75)] / 12.020



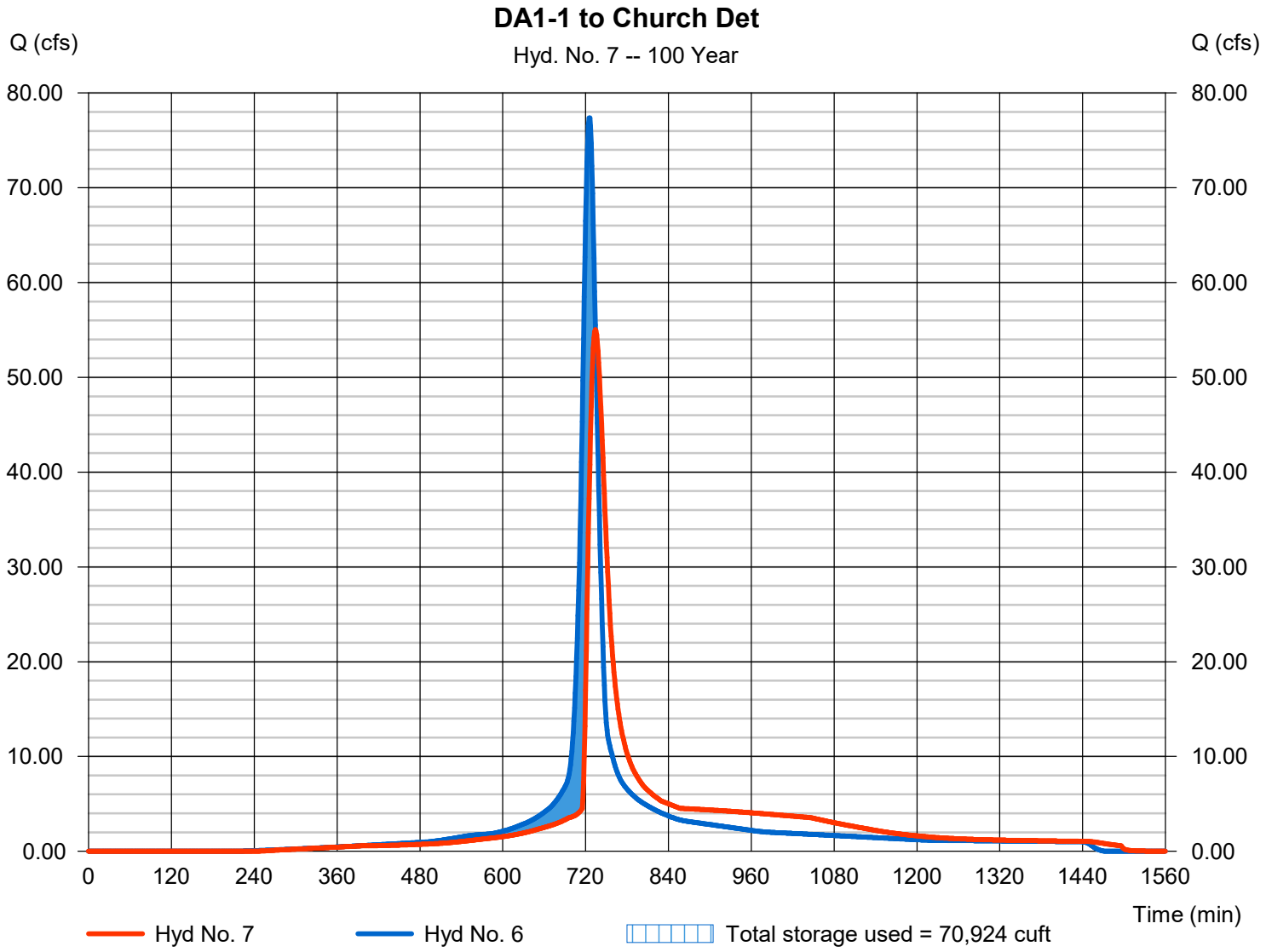
Hydrograph Report

Hyd. No. 7

DA1-1 to Church Det

Hydrograph type	=	Reservoir	Peak discharge	=	55.04 cfs
Storm frequency	=	100 yrs	Time to peak	=	734 min
Time interval	=	1 min	Hyd. volume	=	264,390 cuft
Inflow hyd. No.	=	6 - DA1-1	Max. Elevation	=	1295.30 ft
Reservoir name	=	Church Detention	Max. Storage	=	70,924 cuft

Storage Indication method used.



Pond Report

Pond No. 1 - Church Detention

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 1292.58 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	1292.58	00	0	0
0.42	1293.00	2,109	295	295
1.42	1294.00	28,716	12,868	13,163
1.97	1294.55	41,993	19,331	32,494
2.42	1295.00	52,471	21,204	53,698
3.42	1296.00	63,643	57,961	111,660

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 12.00	0.00	0.00	0.00
Span (in)	= 12.00	0.00	0.00	0.00
No. Barrels	= 1	0	0	0
Invert El. (ft)	= 1292.62	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

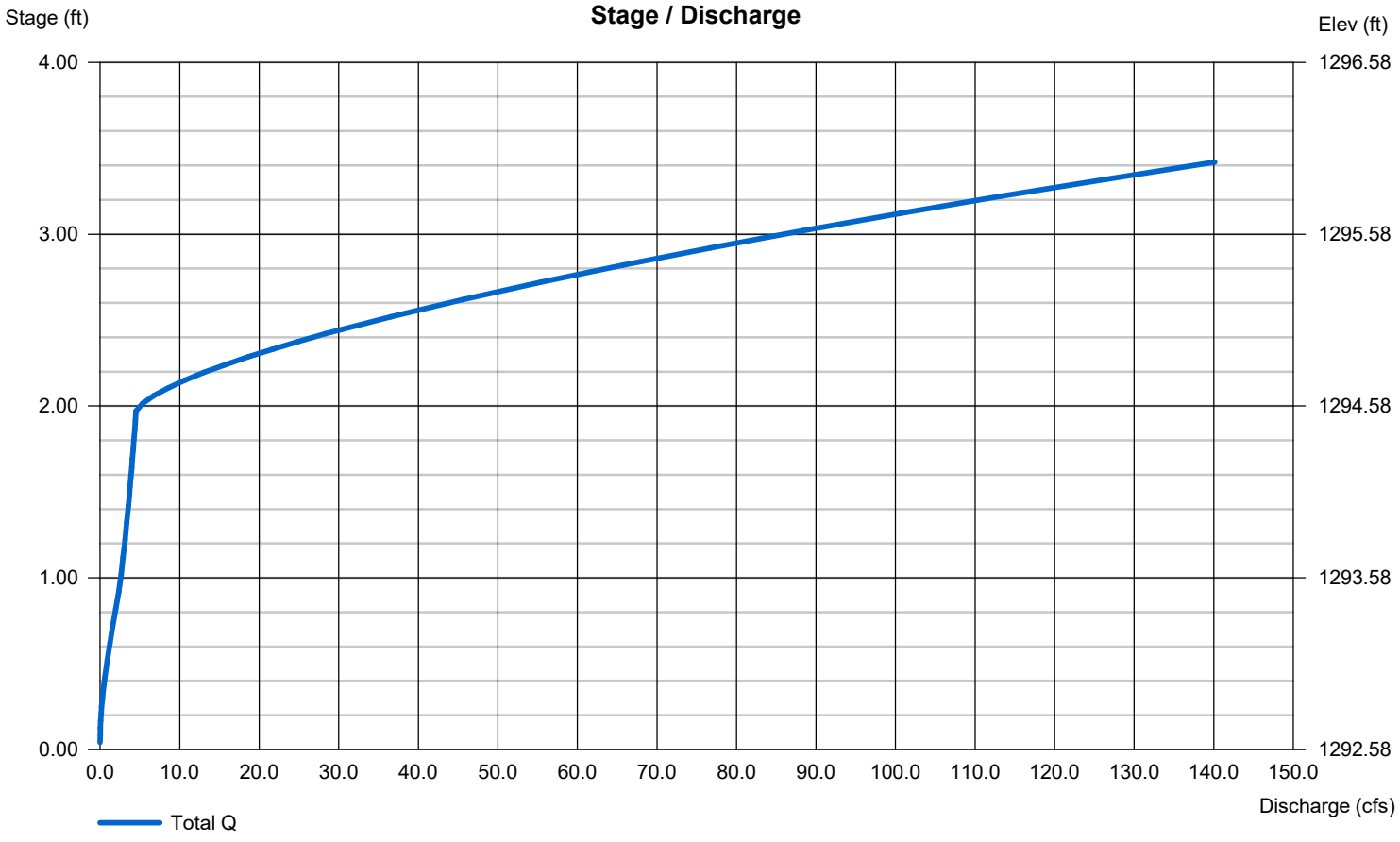
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 23.00	0.00	0.00	0.00
Crest El. (ft)	= 1294.55	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= Ciplti	Rect	---	---
Multi-Stage	= No	No	No	No

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

TW Elev. (ft) = 0.00

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



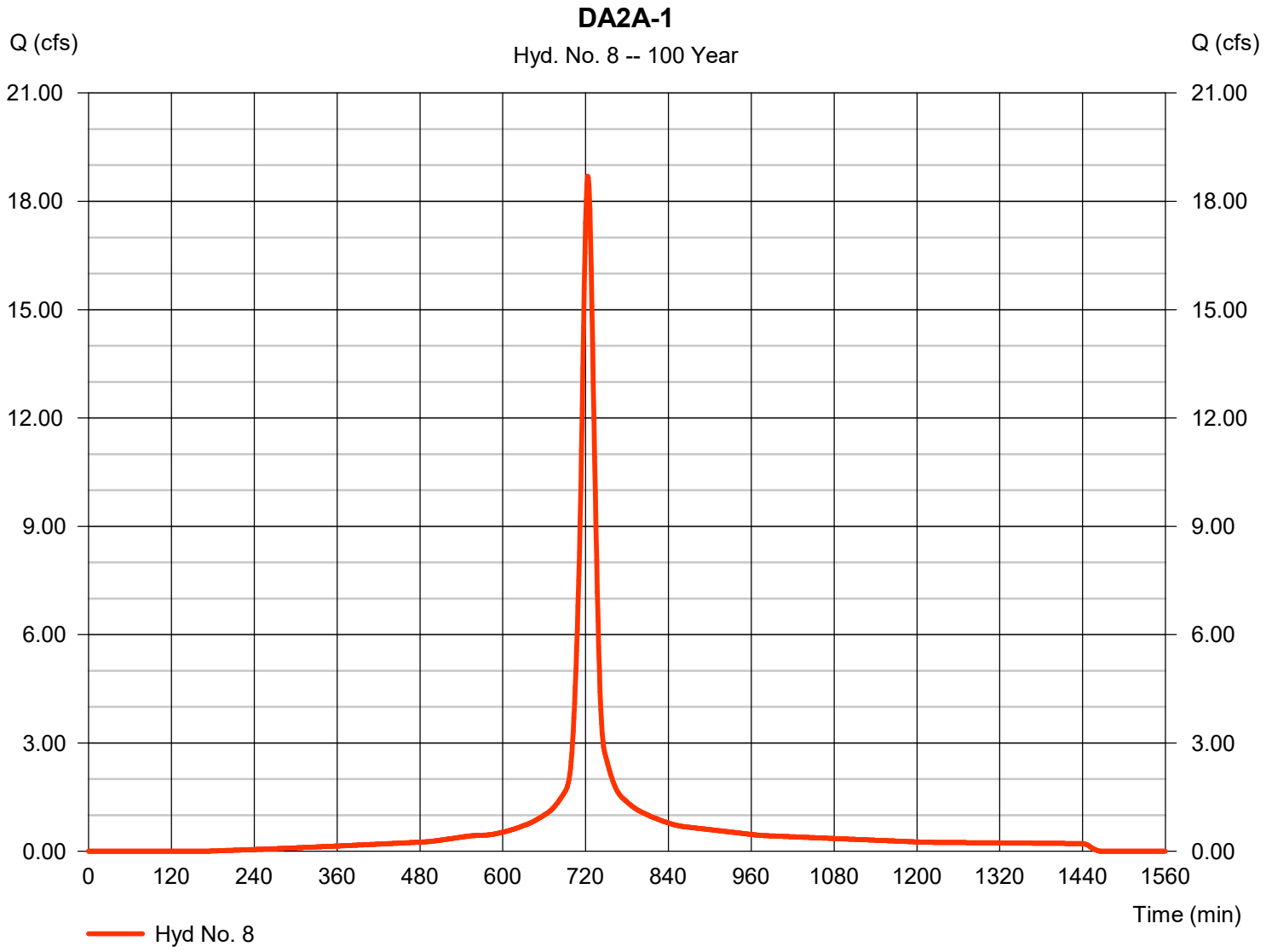
Hydrograph Report

Hyd. No. 8

DA2A-1

Hydrograph type	=	SCS Runoff	Peak discharge	=	18.69 cfs
Storm frequency	=	100 yrs	Time to peak	=	723 min
Time interval	=	1 min	Hyd. volume	=	59,052 cuft
Drainage area	=	2.590 ac	Curve number	=	90*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	17.90 min
Total precip.	=	7.54 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(4.880 x 90) + (2.170 x 75)] / 2.590



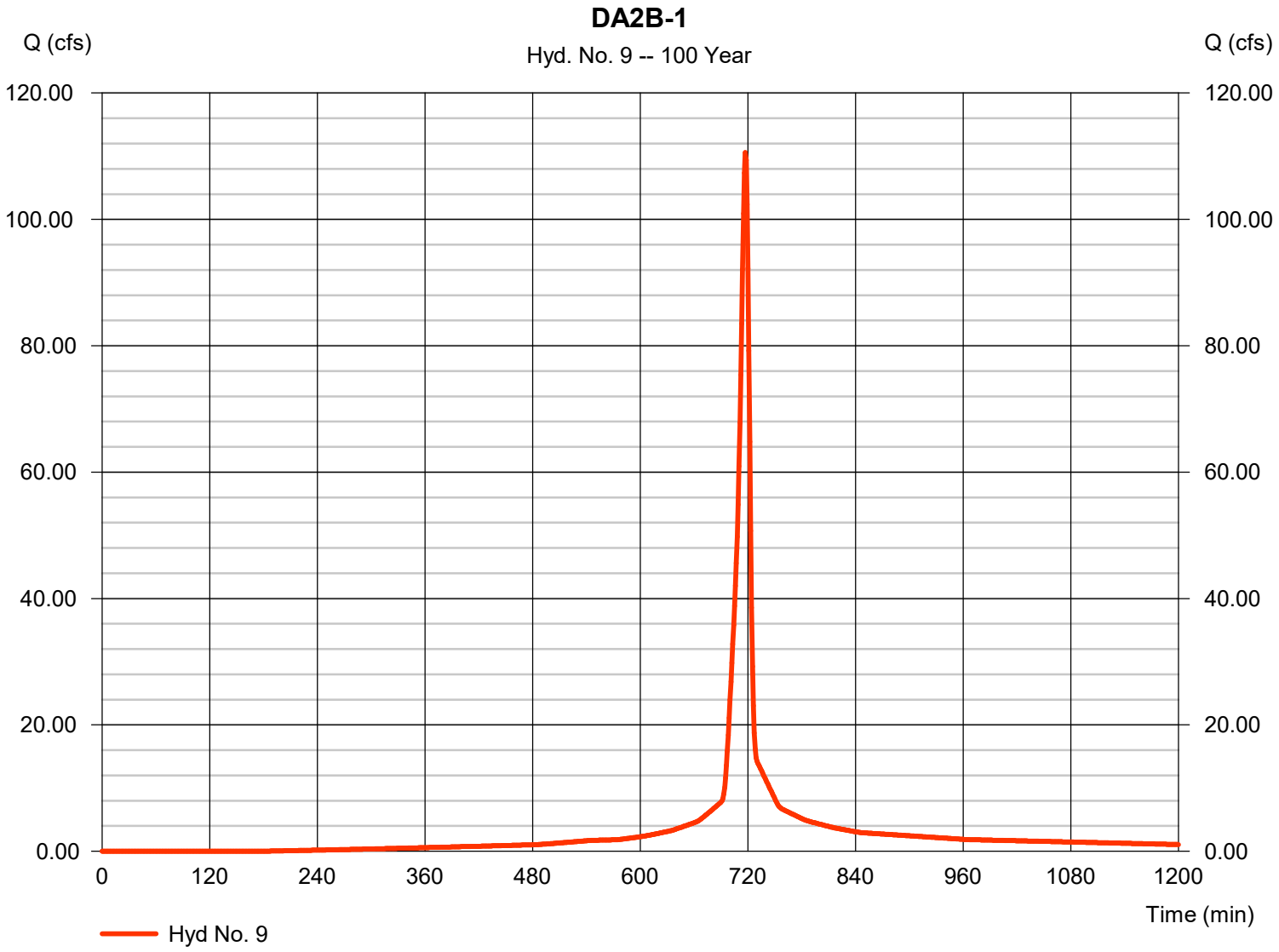
Hydrograph Report

Hyd. No. 9

DA2B-1

Hydrograph type	=	SCS Runoff	Peak discharge	=	110.59 cfs
Storm frequency	=	100 yrs	Time to peak	=	717 min
Time interval	=	1 min	Hyd. volume	=	245,578 cuft
Drainage area	=	10.520 ac	Curve number	=	89*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	7.54 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(4.880 x 90) + (2.170 x 75)] / 10.520



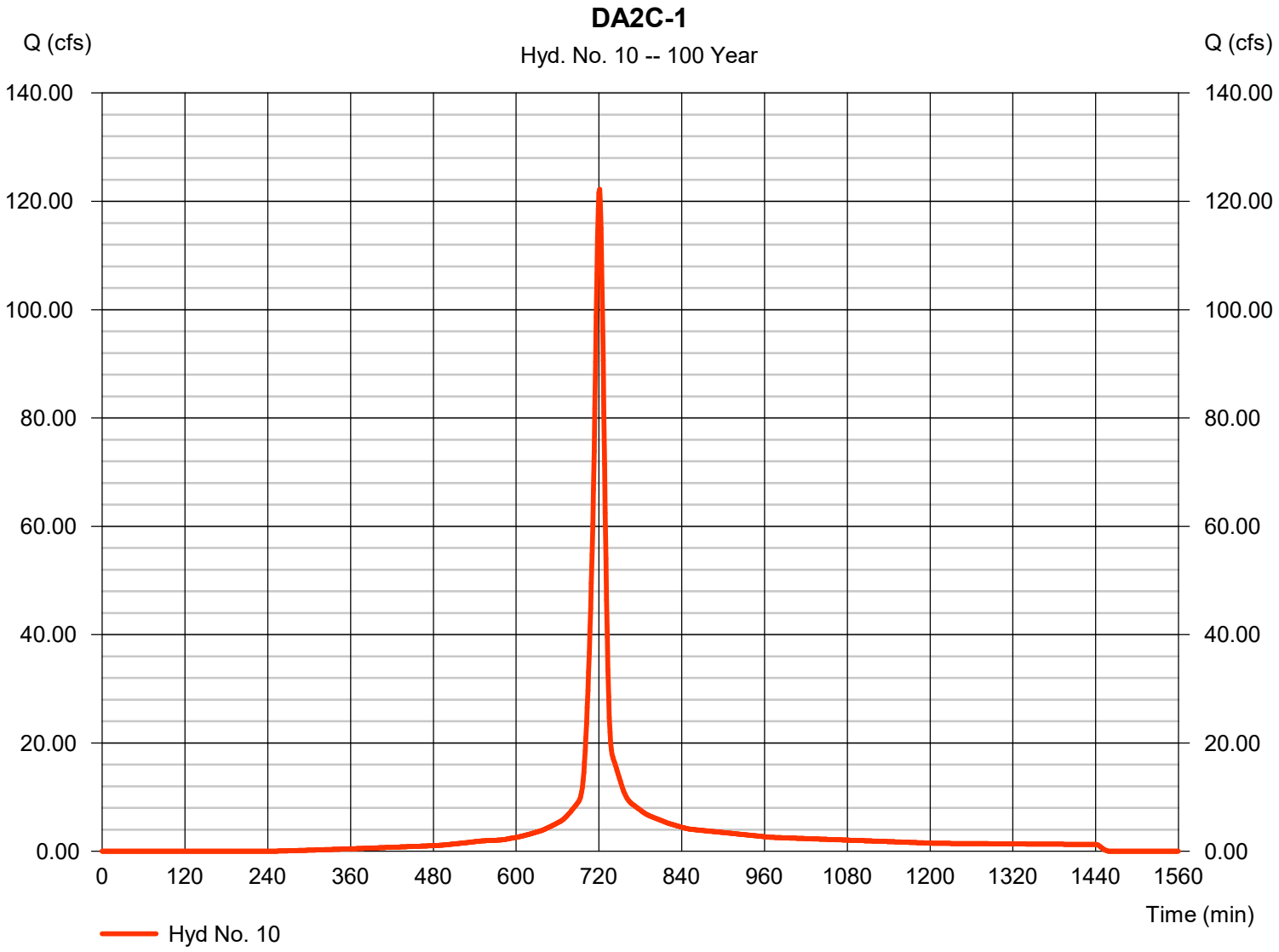
Hydrograph Report

Hyd. No. 10

DA2C-1

Hydrograph type	=	SCS Runoff	Peak discharge	=	122.22 cfs
Storm frequency	=	100 yrs	Time to peak	=	721 min
Time interval	=	1 min	Hyd. volume	=	323,301 cuft
Drainage area	=	15.680 ac	Curve number	=	85*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	11.90 min
Total precip.	=	7.54 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(4.880 x 90) + (2.170 x 75)] / 15.680

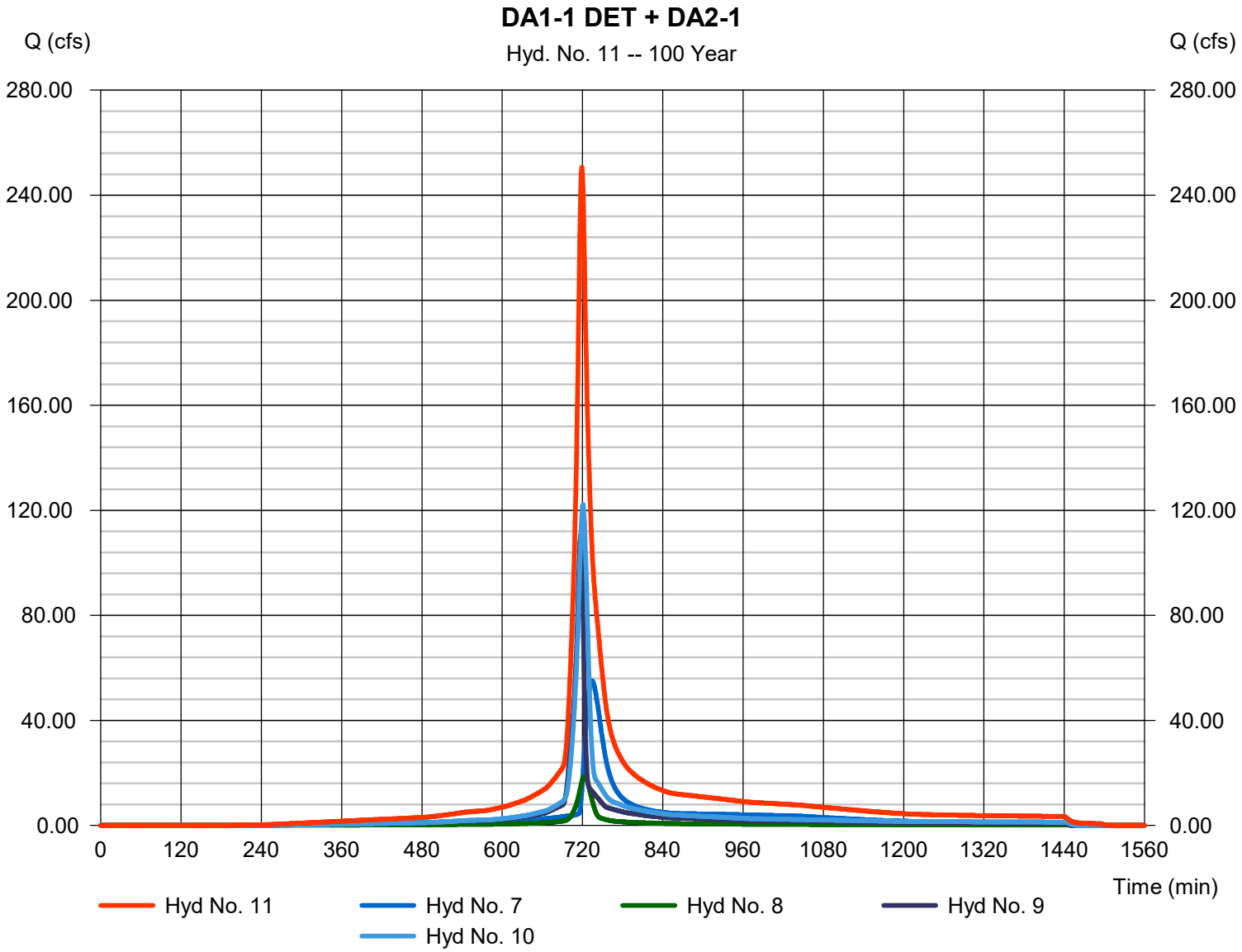


Hydrograph Report

Hyd. No. 11

DA1-1 DET + DA2-1

Hydrograph type	=	Combine	Peak discharge	=	250.69 cfs
Storm frequency	=	100 yrs	Time to peak	=	719 min
Time interval	=	1 min	Hyd. volume	=	892,320 cuft
Inflow hyds.	=	7, 8, 9, 10	Contrib. drain. area	=	28.790 ac



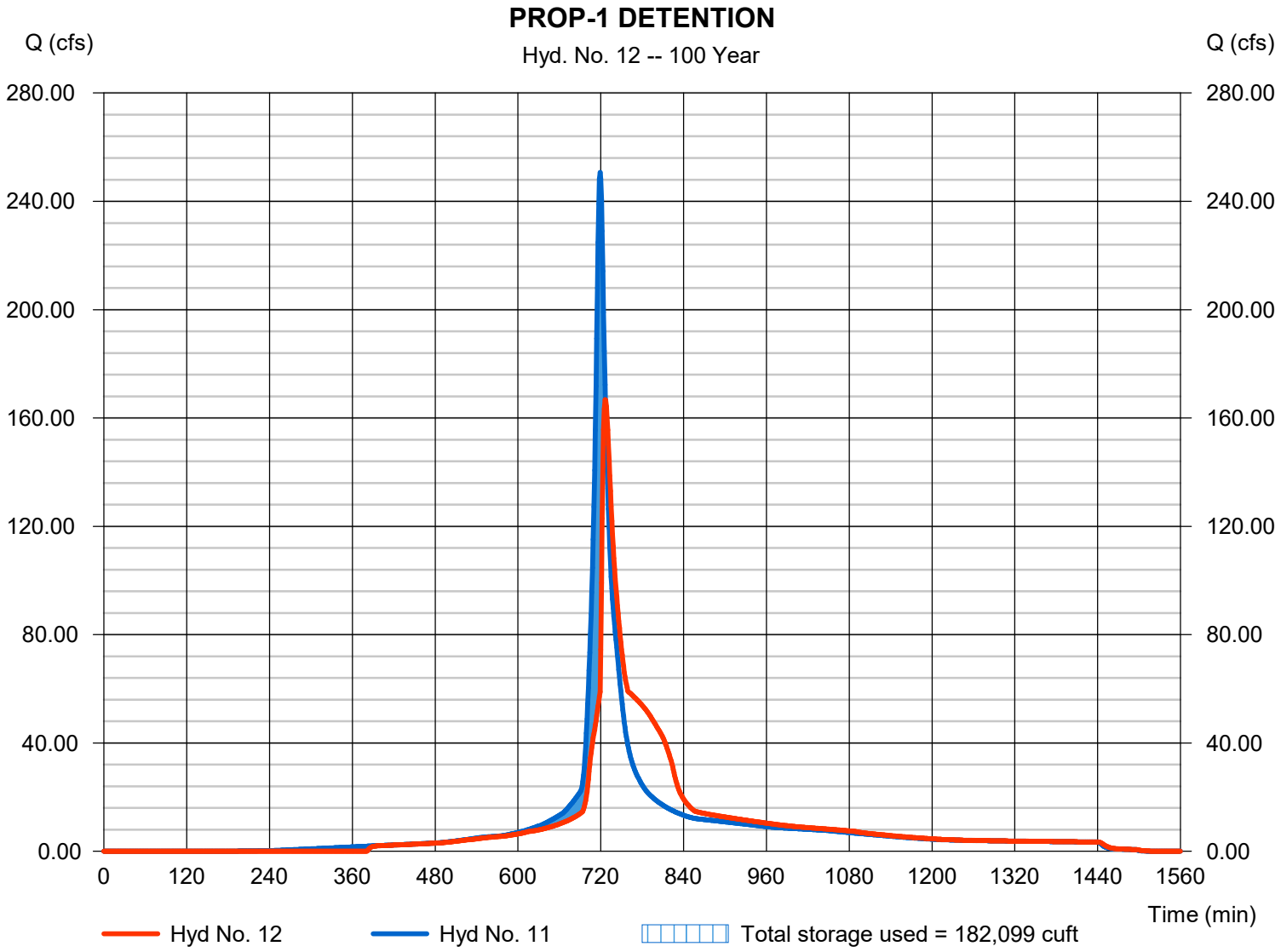
Hydrograph Report

Hyd. No. 12

PROP-1 DETENTION

Hydrograph type	=	Reservoir	Peak discharge	=	166.73 cfs
Storm frequency	=	100 yrs	Time to peak	=	726 min
Time interval	=	1 min	Hyd. volume	=	883,240 cuft
Inflow hyd. No.	=	11 - DA1-1 DET + DA2-1	Max. Elevation	=	1290.72 ft
Reservoir name	=	Phase 1	Max. Storage	=	182,099 cuft

Storage Indication method used.



Pond Report

Pond No. 3 - Phase 1

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 1283.45 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	1283.45	00	0	0
0.55	1284.00	650	119	119
1.55	1285.00	5,157	2,546	2,665
2.55	1286.00	13,875	9,163	11,828
3.55	1287.00	23,575	18,510	30,338
4.55	1288.00	33,464	28,373	58,710
5.55	1289.00	42,792	38,029	96,739
6.55	1290.00	50,595	46,634	143,374
7.55	1291.00	56,302	53,418	196,791
7.60	1291.05	56,448	2,816	199,607

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 24.00	24.00	0.00	0.00
Span (in)	= 24.00	24.00	0.00	0.00
No. Barrels	= 2	1	0	0
Invert El. (ft)	= 1283.35	1283.45	0.00	0.00
Length (ft)	= 153.83	0.00	0.00	0.00
Slope (%)	= 0.42	0.00	0.00	n/a
N-Value	= .012	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	Yes	No	No

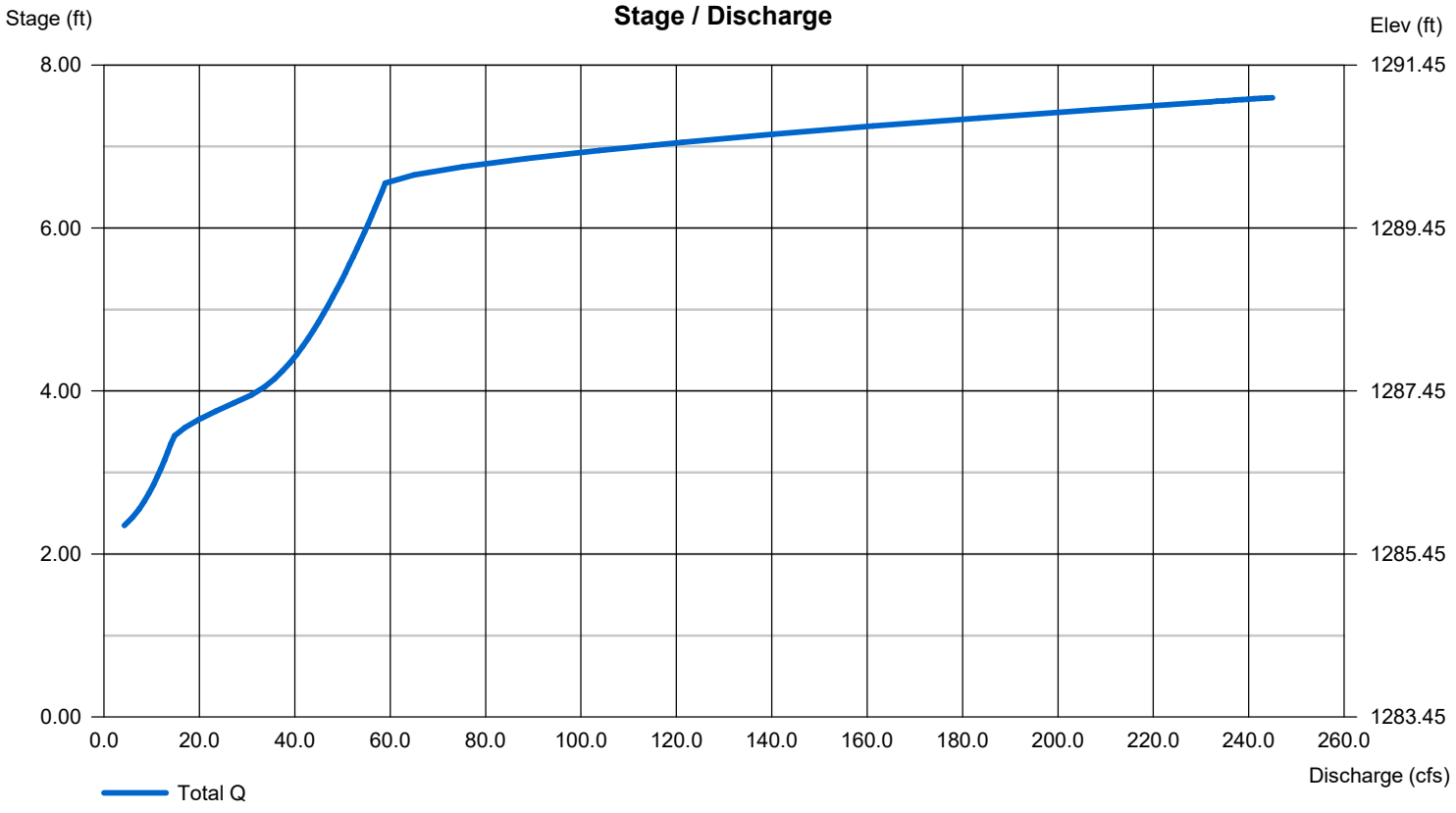
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 16.00	50.00	Inactive	0.00
Crest El. (ft)	= 1286.88	1290.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= Rect	Ciplti	---	---
Multi-Stage	= Yes	No	No	No

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

TW Elev. (ft) = 1285.70

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

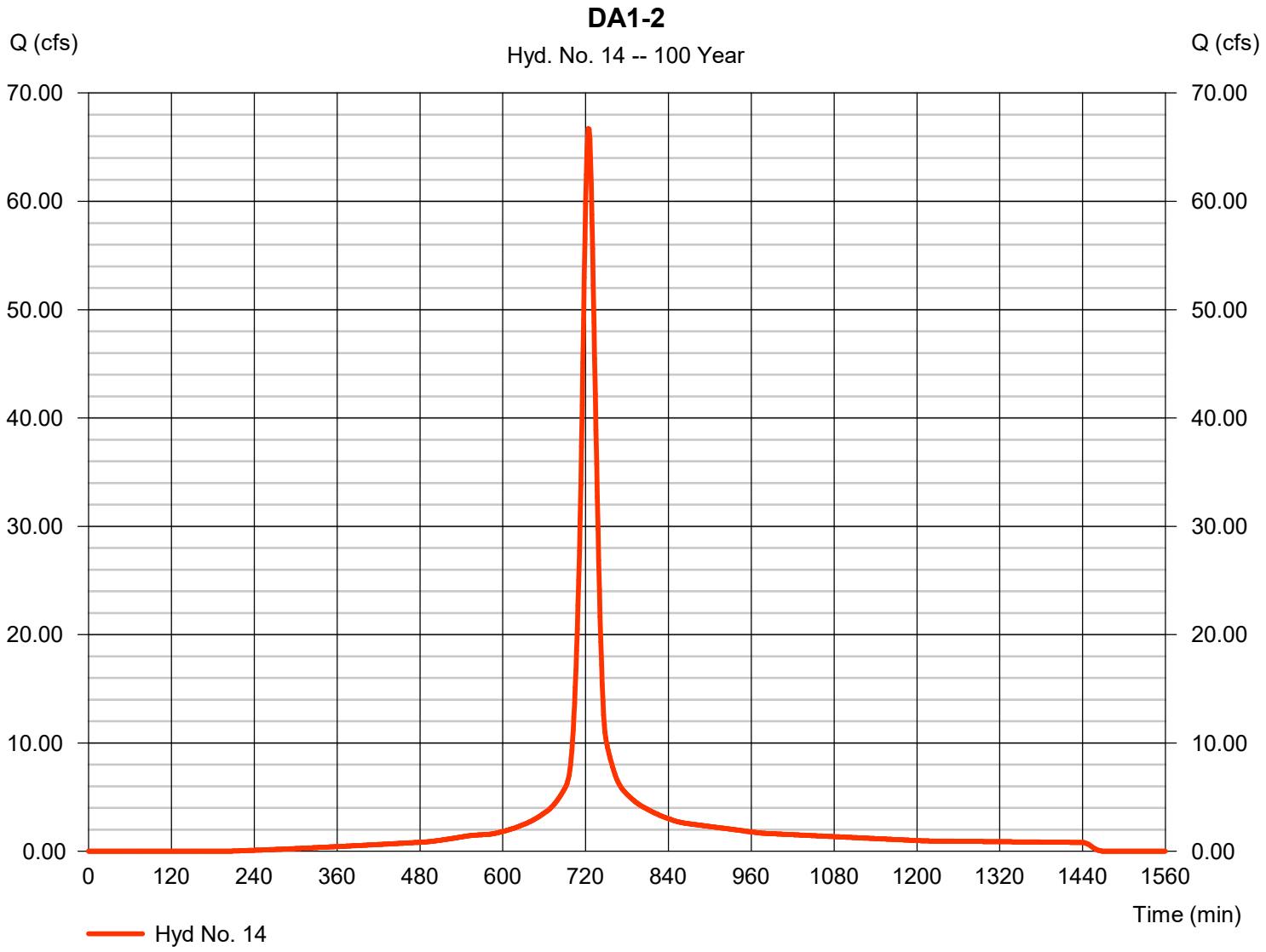


Hydrograph Report

Hyd. No. 14

DA1-2

Hydrograph type	=	SCS Runoff	Peak discharge	=	66.71 cfs
Storm frequency	=	100 yrs	Time to peak	=	724 min
Time interval	=	1 min	Hyd. volume	=	218,569 cuft
Drainage area	=	9.840 ac	Curve number	=	88
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	19.40 min
Total precip.	=	7.54 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484



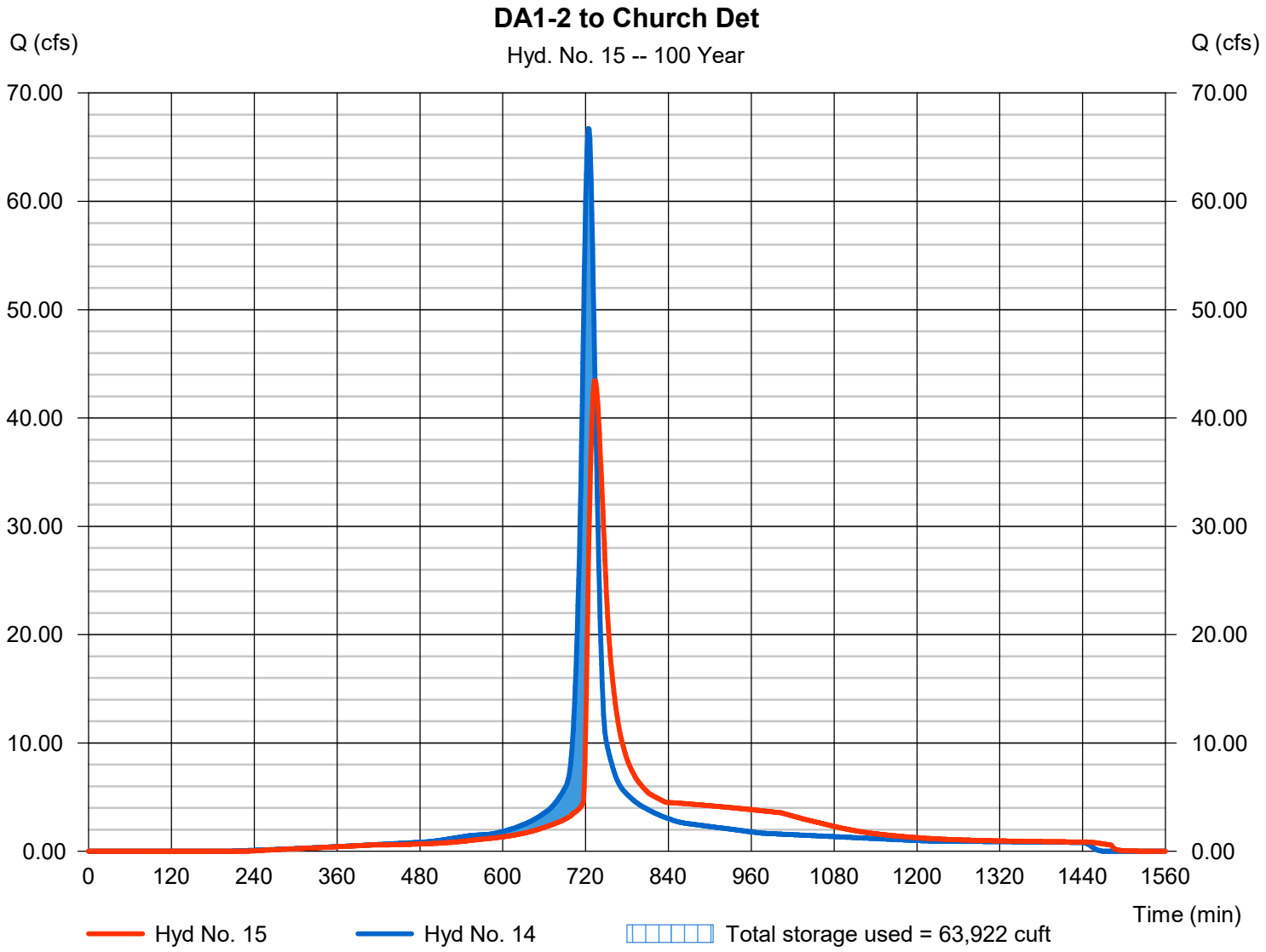
Hydrograph Report

Hyd. No. 15

DA1-2 to Church Det

Hydrograph type	=	Reservoir	Peak discharge	=	43.45 cfs
Storm frequency	=	100 yrs	Time to peak	=	734 min
Time interval	=	1 min	Hyd. volume	=	218,536 cuft
Inflow hyd. No.	=	14 - DA1-2	Max. Elevation	=	1295.18 ft
Reservoir name	=	Church Detention	Max. Storage	=	63,922 cuft

Storage Indication method used.



Pond Report

Pond No. 1 - Church Detention

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 1292.58 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	1292.58	00	0	0
0.42	1293.00	2,109	295	295
1.42	1294.00	28,716	12,868	13,163
1.97	1294.55	41,993	19,331	32,494
2.42	1295.00	52,471	21,204	53,698
3.42	1296.00	63,643	57,961	111,660

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 12.00	0.00	0.00	0.00
Span (in)	= 12.00	0.00	0.00	0.00
No. Barrels	= 1	0	0	0
Invert El. (ft)	= 1292.62	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

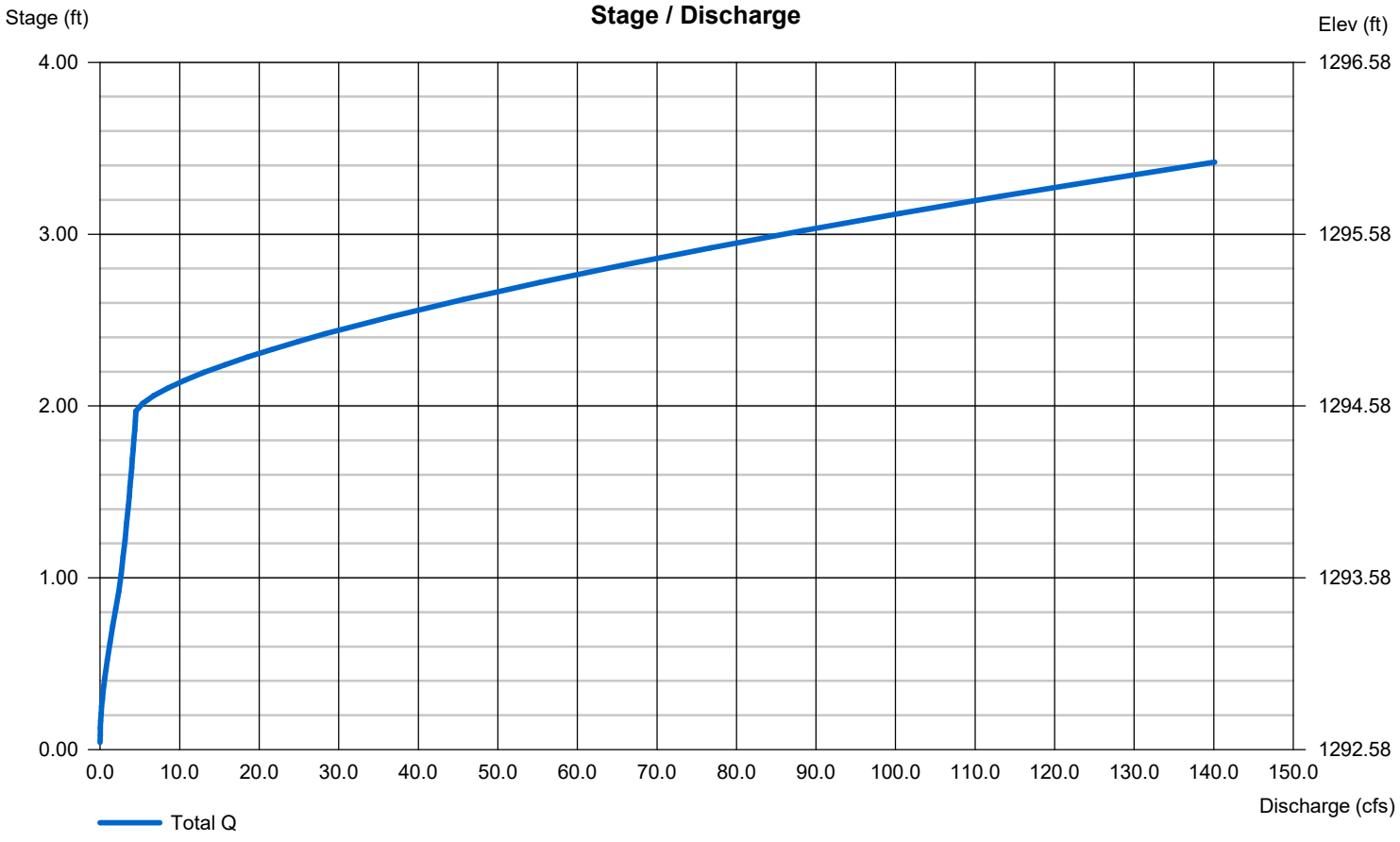
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 23.00	0.00	0.00	0.00
Crest El. (ft)	= 1294.55	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= Ciplti	Rect	---	---
Multi-Stage	= No	No	No	No

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

TW Elev. (ft) = 0.00

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

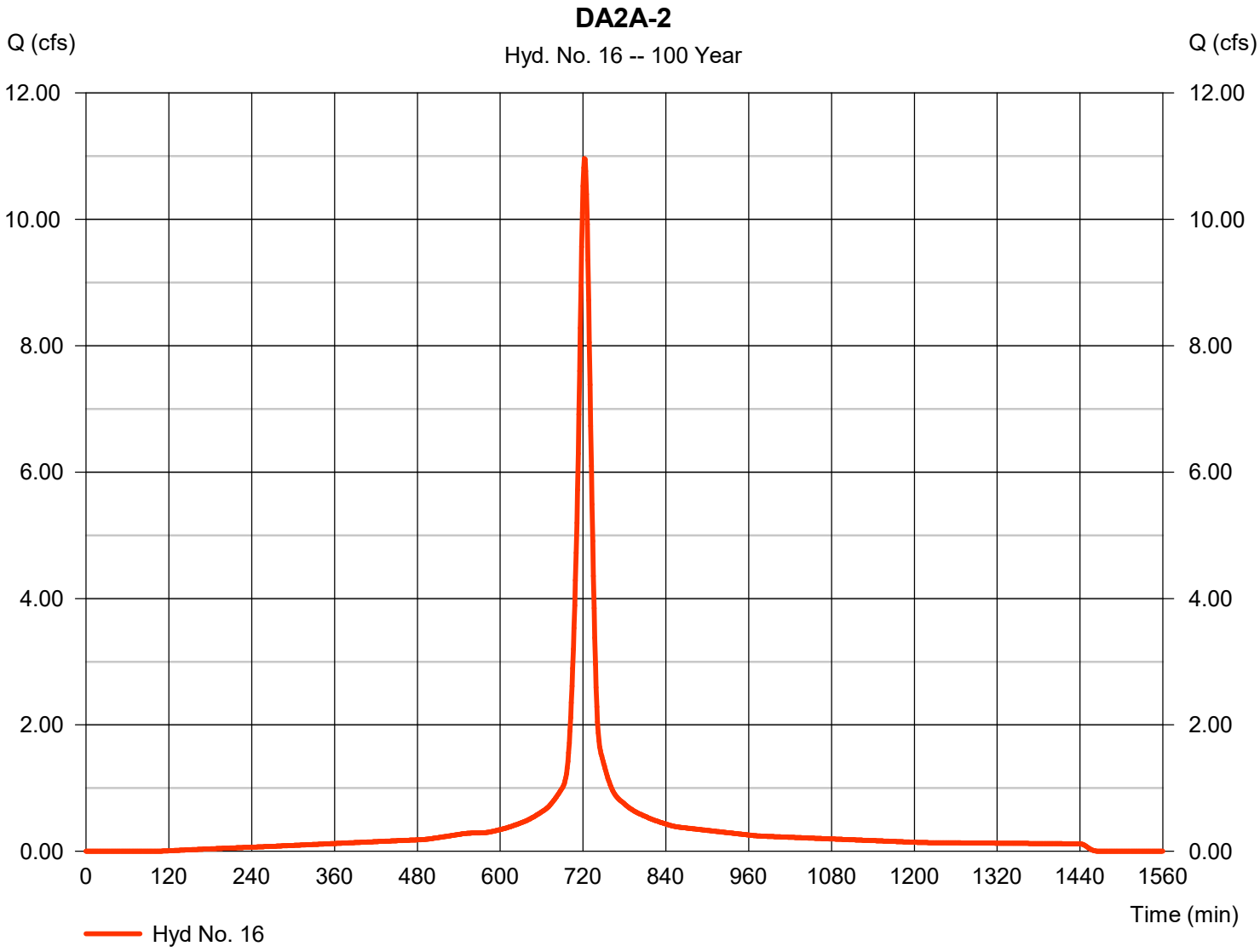


Hydrograph Report

Hyd. No. 16

DA2A-2

Hydrograph type	=	SCS Runoff	Peak discharge	=	10.96 cfs
Storm frequency	=	100 yrs	Time to peak	=	722 min
Time interval	=	1 min	Hyd. volume	=	34,615 cuft
Drainage area	=	1.380 ac	Curve number	=	94
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	15.80 min
Total precip.	=	7.54 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

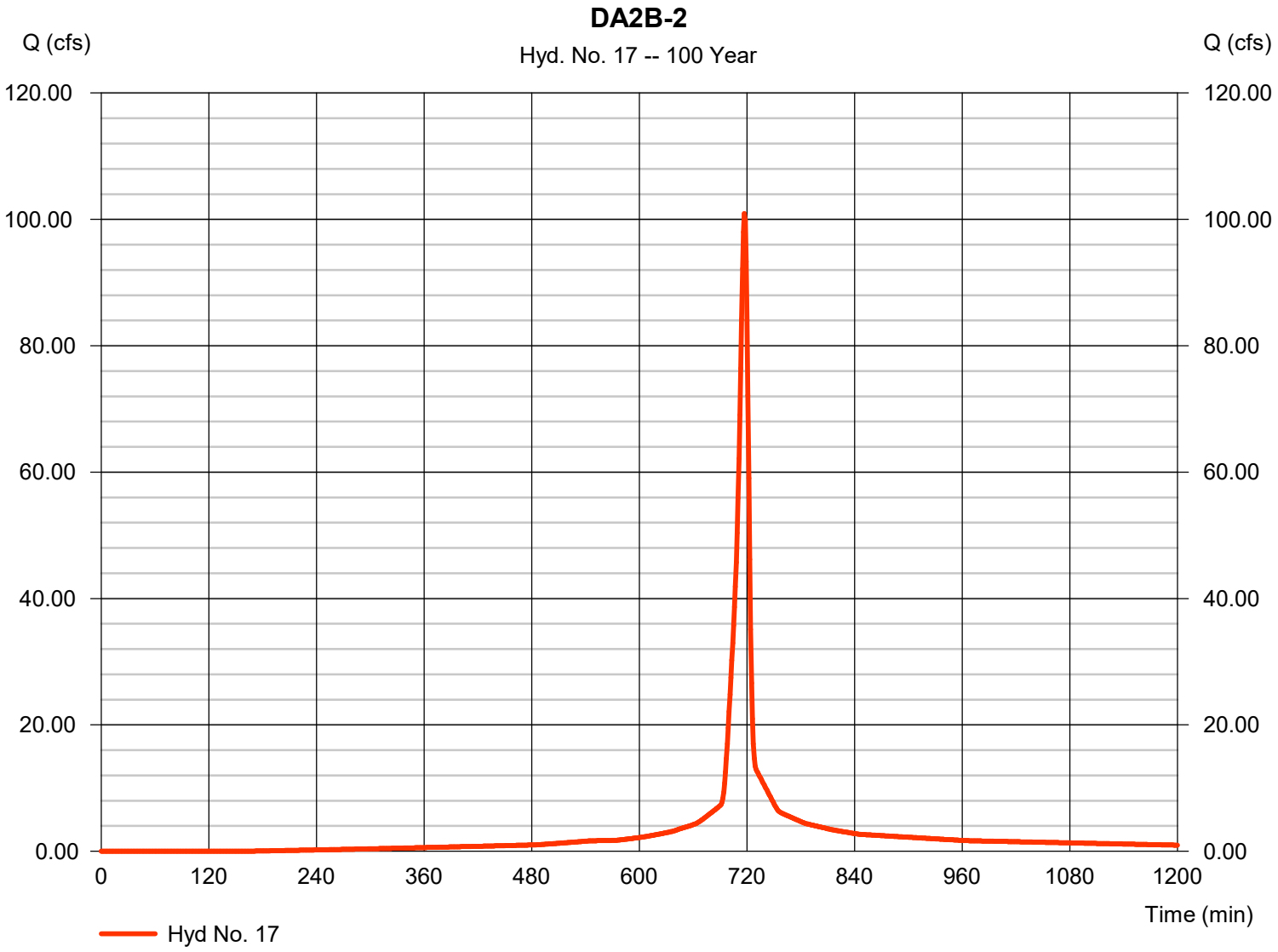


Hydrograph Report

Hyd. No. 17

DA2B-2

Hydrograph type	=	SCS Runoff	Peak discharge	=	100.91 cfs
Storm frequency	=	100 yrs	Time to peak	=	717 min
Time interval	=	1 min	Hyd. volume	=	225,934 cuft
Drainage area	=	9.500 ac	Curve number	=	90
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	7.54 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

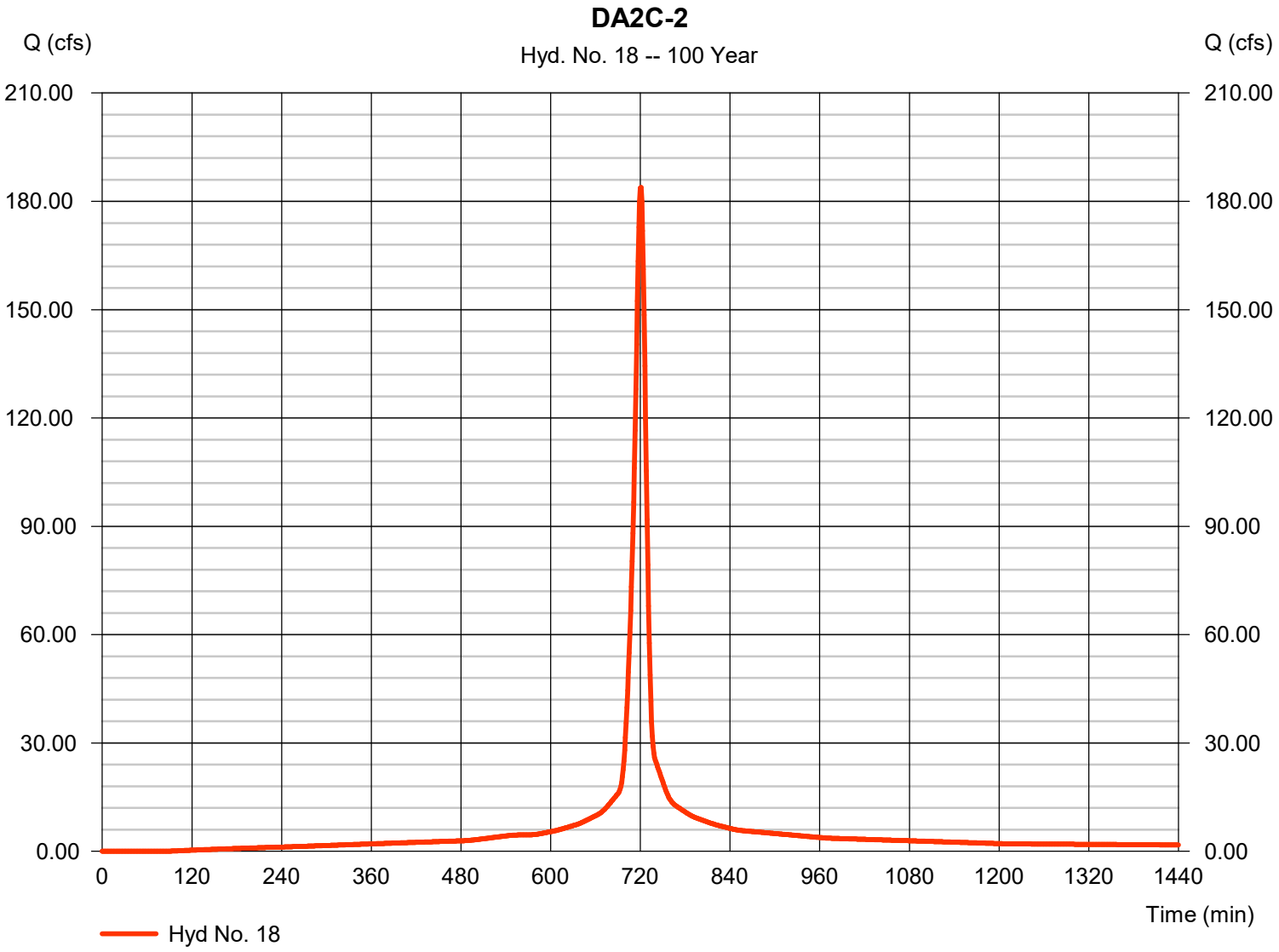


Hydrograph Report

Hyd. No. 18

DA2C-2

Hydrograph type	=	SCS Runoff	Peak discharge	=	183.82 cfs
Storm frequency	=	100 yrs	Time to peak	=	721 min
Time interval	=	1 min	Hyd. volume	=	527,214 cuft
Drainage area	=	21.250 ac	Curve number	=	95
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	11.90 min
Total precip.	=	7.54 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

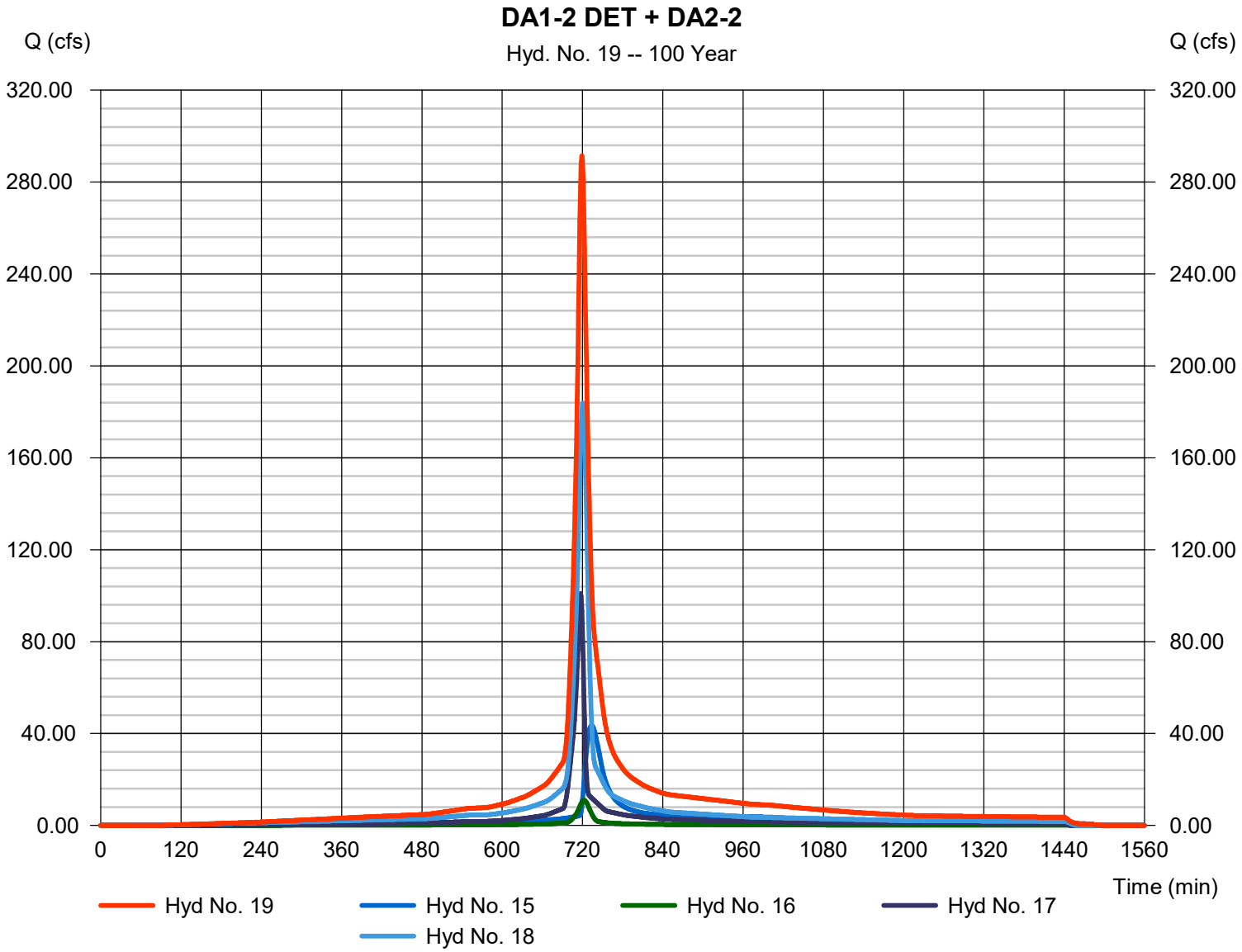


Hydrograph Report

Hyd. No. 19

DA1-2 DET + DA2-2

Hydrograph type	=	Combine	Peak discharge	=	291.38 cfs
Storm frequency	=	100 yrs	Time to peak	=	719 min
Time interval	=	1 min	Hyd. volume	=	1,006,299 cuft
Inflow hyds.	=	15, 16, 17, 18	Contrib. drain. area	=	32.130 ac



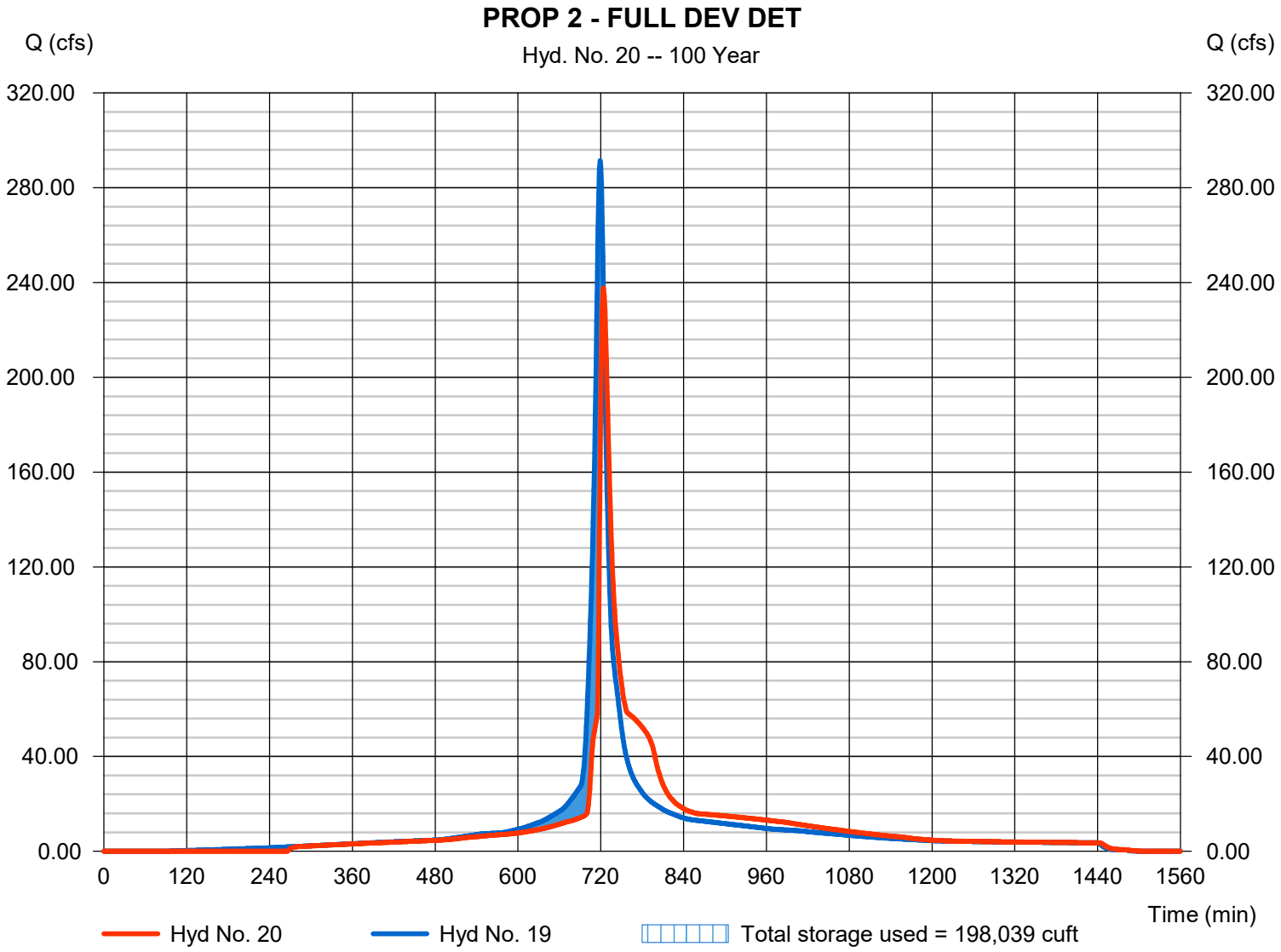
Hydrograph Report

Hyd. No. 20

PROP 2 - FULL DEV DET

Hydrograph type	= Reservoir	Peak discharge	= 237.69 cfs
Storm frequency	= 100 yrs	Time to peak	= 724 min
Time interval	= 1 min	Hyd. volume	= 997,220 cuft
Inflow hyd. No.	= 19 - DA1-2 DET + DA2-2	Max. Elevation	= 1291.02 ft
Reservoir name	= Phase 2	Max. Storage	= 198,039 cuft

Storage Indication method used.



Pond Report

Pond No. 2 - Phase 2

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 1283.45 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	1283.45	00	0	0
0.55	1284.00	650	119	119
1.55	1285.00	5,157	2,546	2,665
2.55	1286.00	13,875	9,163	11,828
3.55	1287.00	23,575	18,510	30,338
4.55	1288.00	33,464	28,373	58,710
5.55	1289.00	42,792	38,029	96,739
6.55	1290.00	50,595	46,634	143,374
7.55	1291.00	56,302	53,418	196,791
7.60	1292.00	56,448	2,816	199,607

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 24.00	21.00	0.00	0.00
Span (in)	= 24.00	21.00	0.00	0.00
No. Barrels	= 2	1	0	0
Invert El. (ft)	= 1283.35	1283.45	0.00	0.00
Length (ft)	= 153.83	0.00	0.00	0.00
Slope (%)	= 0.42	0.00	0.00	n/a
N-Value	= .012	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	Yes	No	No

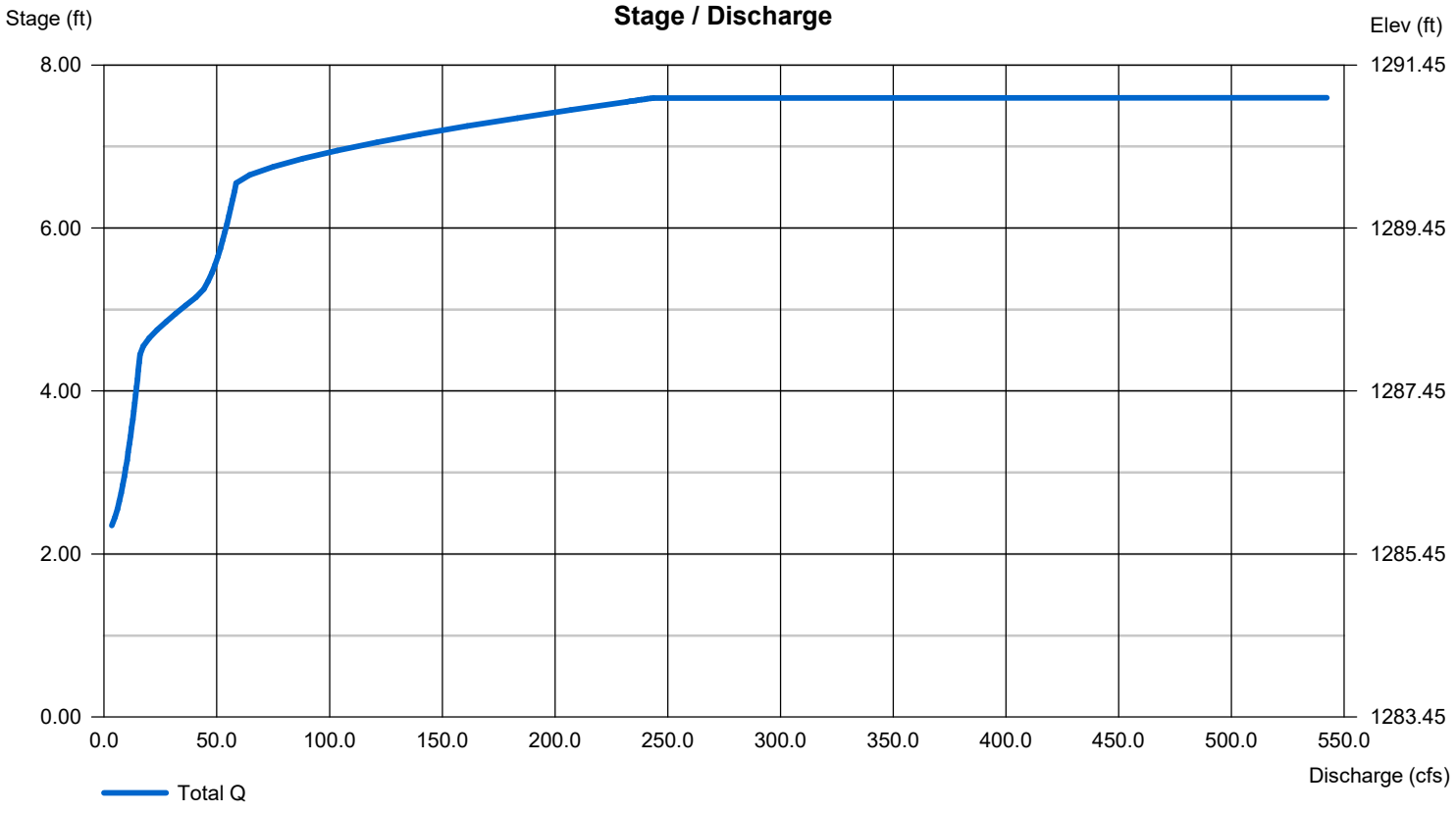
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 16.00	50.00	Inactive	0.00
Crest El. (ft)	= 1287.92	1290.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= Rect	Ciplti	Rect	---
Multi-Stage	= Yes	No	No	No

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

TW Elev. (ft) = 1285.70

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



PRE-DEVELOPED CONDITION

EDUENOW XTREME
PRE
Christian County, Missouri

Sub-Area Summary Table

Sub-Area Identifier	Drainage Area (ac)	Time of Concentration (hr)	Curve Number	Receiving Reach	Sub-Area Description
EXIST DA1	14.57	0.168	87		
EXIST DA2	27.86	0.230	84		

Total Area: 42.43 (ac)

Sub-Area Land Use and Curve Number Details

Sub-Area Identifier	Land Use	Hydrologic Soil Group	Sub-Area Area (ac)	Curve Number
EXIST DA1	Open space; grass cover 50% to 75% (fair)	D	6.351	84
	Paved parking lots, roofs, driveways	D	2.227	98
	Gravel (w/ right-of-way)	D	.909	91
	Pasture, grassland or range (fair)	D	5.079	84
	Total Area / Weighted Curve Number		14.57	87
EXIST DA2	Paved parking lots, roofs, driveways	D	.863	98
	Pasture, grassland or range (fair)	D	26.993	84
	Total Area / Weighted Curve Number		27.86	84

POST-DEVELOPED CONDITION

EDUENOW

XTREME
PROPOSED
Christian County, Missouri

Sub-Area Summary Table

Sub-Area Identifier	Drainage Area (ac)	Time of Concentration (hr)	Curve Number	Receiving Reach	Sub-Area Description
PROP 1-1	12.02	0.351	87		
PROP 2A-1	2.59	0.298	90		
PROP 2B-1	10.52	0.100	89		
PROP 2C-1	15.68	0.198	85		
PROP 1-2	9.84	0.323	88		
PROP 2A-2	1.38	0.264	94		
PROP 2B-2	9.50	0.100	90		
PROP 2C-2	21.25	0.199	95		

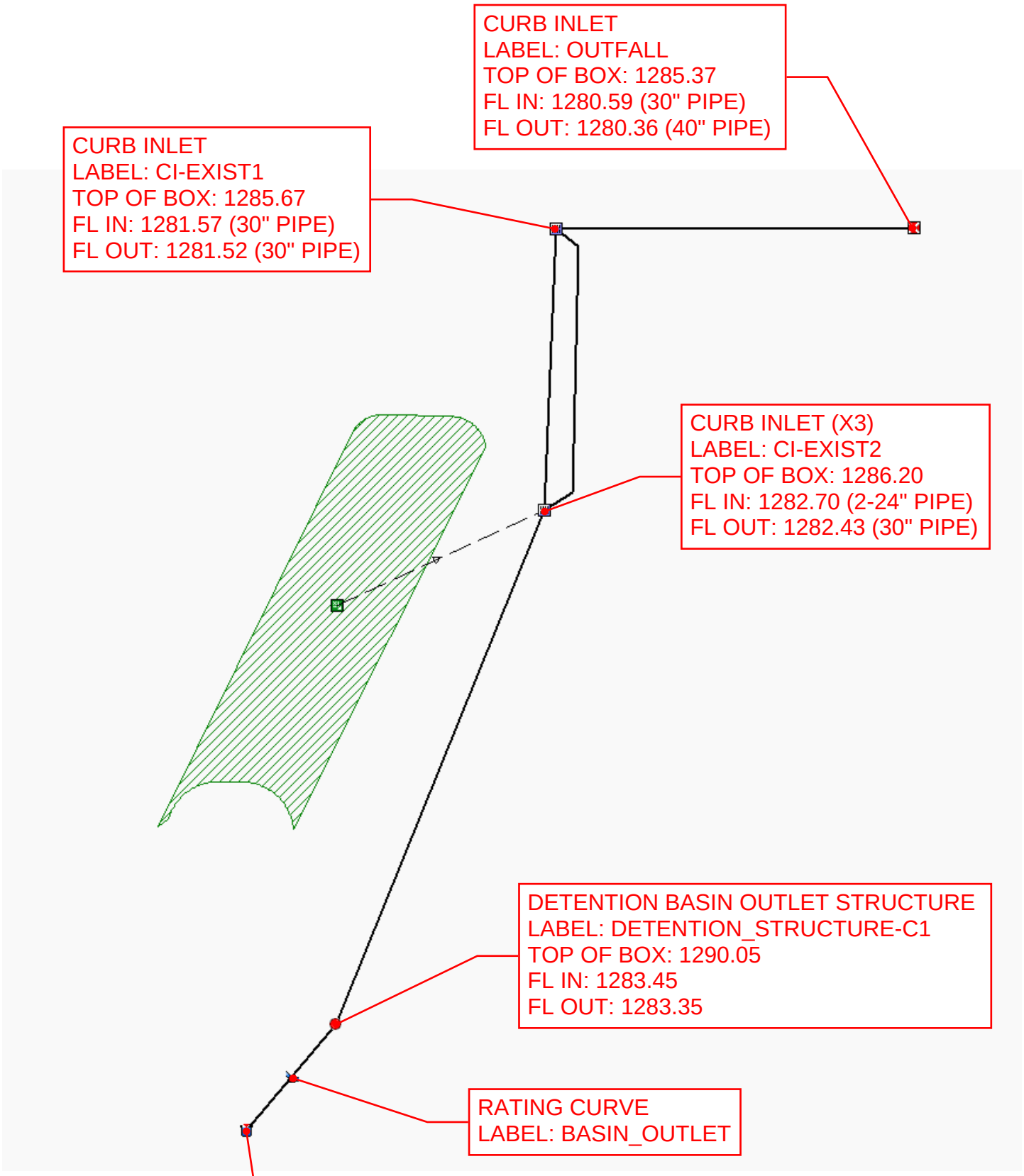
Total Area: 82.78 (ac)

PROPOSED
Christian County, Missouri

Sub-Area Land Use and Curve Number Details

Sub-Area Identifier	Land Use	Hydrologic Soil Group	Sub-Area Area (ac)	Curve Number
PROP 1-1	Open space; grass cover 50% to 75% (fair)	D	6.011	84
	Paved parking lots, roofs, driveways	D	2.227	98
	Gravel (w/ right-of-way)	D	.909	91
	Pasture, grassland or range (fair)	D	2.875	84
	Total Area / Weighted Curve Number		12.02	87
PROP 2A-1	Open space; grass cover > 75% (good)	D	.222	80
	Paved parking lots, roofs, driveways	D	1.106	98
	Pasture, grassland or range (fair)	D	1.259	84
	Total Area / Weighted Curve Number		2.59	90
PROP 2B-1	Open space; grass cover > 75% (good)	D	2.14	80
	Paved parking lots, roofs, driveways	D	4.544	98
	Pasture, grassland or range (fair)	D	3.836	84
	Total Area / Weighted Curve Number		10.52	89
PROP 2C-1	Paved parking lots, roofs, driveways	D	.863	98
	Pasture, grassland or range (fair)	D	14.818	84
	Total Area / Weighted Curve Number		15.68	85
PROP 1-2	Open space; grass cover 50% to 75% (fair)	D	6.7	84
	Paved parking lots, roofs, driveways	D	2.227	98
	Gravel (w/ right-of-way)	D	.909	91
	Total Area / Weighted Curve Number		9.84	88
PROP 2A-2	Open space; grass cover > 75% (good)	D	.272	80
	Paved parking lots, roofs, driveways	D	1.106	98
	Total Area / Weighted Curve Number		1.38	94
PROP 2B-2	Open space; grass cover > 75% (good)	D	1.118	80
	Paved parking lots, roofs, driveways	D	4.544	98
	Pasture, grassland or range (fair)	D	3.836	84
	Total Area / Weighted Curve Number		9.5	90
PROP 2C-2	Open space; grass cover > 75% (good)	D	4.018	80
	Paved parking lots, roofs, driveways	D	17.233	98
	Total Area / Weighted Curve Number		21.25	95

Existing Downstream - SSA Map



Existing Downstream - 2-Year SSA Report

```
  Autodesk® Storm and Sanitary Analysis 2016 - Version 13.5.302 (Build 0)
  --------------------------------------------------------------------------------

  ******************
  Project Description
  ******************
  File Name ..................... XtremeExteriors_Downstream_V2.SPF


  ***************
  Analysis Options
  ***************
  Flow Units ..................... cfs
  Subbasin Hydrograph Method. Rational
  Time of Concentration...... User-Defined
  Return Period.............. 2 years
  Link Routing Method ....... Hydrodynamic
  Storage Node Exfiltration.. None
  Starting Date ............. NOV-17-2020 00:00:00
  Ending Date ............... NOV-17-2020 01:00:00
  Report Time Step .......... 00:00:10


  *************
  Element Count
  *************
  Number of subbasins ....... 1
  Number of nodes ........... 5
  Number of links ........... 5


  ****************
  Subbasin Summary
  ****************
  Subbasin                Total
                           Area
  ID                      acres
  ------------------------------
  A1                       1.43


  ************
  Node Summary
  ************
  Node                Element            Invert   Maximum    Ponded    External
  ID                  Type             Elevation     Elev.      Area      Inflow
                                              ft        ft       ft²
  ----------------------------------------------------------------------------
  Detention_Structure-C1JUNCTION          1283.35   1290.05  50000.00
  OUTFALL             OUTFALL             1280.59   1283.09      0.00
  Detention_Basin     STORAGE             1283.45   1291.05  56000.00    Yes


  *************
  Inlet Summary
  *************
  Inlet               Inlet                     Manufacturer             Inlet      Number   Catchbasin        Inlet    Ponded
 Initial      Grate
  ID                  Manufacturer              Part                     Location       of       Invert          Rim      Area
   Water   Clogging
                                                Number                                Inlets    Elevation    Elevation
Elevation     Factor
                                                                                                      ft           ft       ft²
      ft          %
-------------------------------------------------------------------------------------------------------------------------------
------------------
  CI-EXIST1           FHWA HEC-22 GENERIC       N/A                      On Sag          1      1281.52      1285.17   1000.00
 1281.52      50.00
  CI-EXIST2           FHWA HEC-22 GENERIC       N/A                      On Grade        3      1282.43      1285.70         -
 1282.43       6.00


  *************************
  Roadway and Gutter Summary
  *************************
  Inlet                    Roadway   Roadway     Roadway    Gutter   Gutter       Gutter
  ID                  Longitudinal     Cross   Manning's     Cross    Width   Depression
```

	Slope ft/ft	Slope ft/ft	Roughness	Slope ft/ft	ft	in
CI-EXIST1	-	0.0200	0.0160	0.0620	2.00	2.00
CI-EXIST2	0.0100	0.0200	0.0160	0.0620	2.00	2.00

****
Link Summary
****

Link ID	From Node	To Node	Element Type	Length ft	Slope %	Manning's Roughness	
Bypass-CI-EXIST2	CI-EXIST2	CI-EXIST1	CHANNEL	87.7	0.6044	0.0320	
C1-EXIST2	Detention_Structure-C1	CI-EXIST2	CONDUIT	153.8	0.4225	0.0120	
EXIST1-OUTFALL	CI-EXIST1	OUTFALL	CONDUIT	64.0	1.4531	0.0130	
EXIST2-EXIST1	CI-EXIST2	CI-EXIST1	CONDUIT	57.1	1.5053	0.0130	
Basin_Outlet	Detention_Basin	Detention_Structure-C1	OUTLET				

****
Cross Section Summary
****

Link ID	Shape	Depth/ Diameter ft	Width ft	No. of Barrels	Cross Sectional Area ft²	Full Flow Hydraulic Radius ft	Design Flow Capacity cfs
Bypass-CI-EXIST2	IRREGULAR	0.53	18.00	1	4.46	0.17	5.02
C1-EXIST2	CIRCULAR	2.00	2.00	2	3.14	0.50	15.93
EXIST1-OUTFALL	CIRCULAR	2.50	2.50	1	4.91	0.63	49.44
EXIST2-EXIST1	CIRCULAR	2.50	2.50	1	4.91	0.63	50.32

****
Transect Summary
****

Transect XS-01
Area:

0.0002	0.0010	0.0021	0.0038	0.0060
0.0087	0.0118	0.0156	0.0201	0.0256
0.0320	0.0393	0.0476	0.0567	0.0668
0.0778	0.0898	0.1026	0.1164	0.1311
0.1467	0.1632	0.1807	0.1990	0.2183
0.2385	0.2597	0.2817	0.3047	0.3286
0.3534	0.3792	0.4058	0.4334	0.4619
0.4914	0.5217	0.5530	0.5852	0.6183
0.6523	0.6872	0.7231	0.7599	0.7976
0.8363	0.8758	0.9163	0.9577	1.0000

Hrad:

0.0208	0.0417	0.0625	0.0832	0.1041
0.1251	0.1462	0.1600	0.1695	0.1826
0.1979	0.2147	0.2324	0.2509	0.2698
0.2892	0.3088	0.3287	0.3488	0.3691
0.3895	0.4100	0.4305	0.4512	0.4720
0.4928	0.5136	0.5345	0.5555	0.5764
0.5975	0.6185	0.6396	0.6606	0.6818
0.7029	0.7240	0.7452	0.7664	0.7876
0.8088	0.8300	0.8512	0.8724	0.8937
0.9149	0.9362	0.9574	0.9787	1.0000

Width:

0.0112	0.0223	0.0336	0.0451	0.0567
0.0682	0.0798	0.0959	0.1174	0.1389
0.1604	0.1820	0.2035	0.2250	0.2465
0.2681	0.2896	0.3111	0.3327	0.3542
0.3757	0.3972	0.4188	0.4403	0.4618
0.4833	0.5049	0.5264	0.5479	0.5695
0.5910	0.6125	0.6340	0.6556	0.6771
0.6986	0.7201	0.7417	0.7632	0.7847
0.8063	0.8278	0.8493	0.8708	0.8924
0.9139	0.9354	0.9569	0.9785	1.0000

********** Runoff Quantity Continuity **********	Volume acre-ft	Depth inches
Total Precipitation	0.054	0.450
Continuity Error (%)	0.603	

```
*************************        Volume        Volume
Flow Routing Continuity          acre-ft      Mgallons
*************************     ---------     ---------
External Inflow ..........         1.521         0.496
External Outflow .........         1.090         0.355
Initial Stored Volume ....         0.000         0.000
Final Stored Volume ......         0.452         0.147
Continuity Error (%) .....         0.000


*************************************
Runoff Coefficient Computations Report
*************************************

--------------
Subbasin A1
--------------
                                                        Area          Soil       Runoff
Soil/Surface Description                               (acres)        Group       Coeff.
-----------------------------------------------------------------------------------------
-                                                        1.43            -         0.40
Composite Area & Weighted Runoff Coeff.                  1.43                      0.40

**********************
Subbasin Runoff Summary
**********************

-----------------------------------------------------------------------------------------
Subbasin       Accumulated     Rainfall     Total      Peak  Weighted           Time of
ID                  Precip    Intensity    Runoff    Runoff    Runoff     Concentration
                        in        in/hr        in       cfs     Coeff     days  hh:mm:ss
-----------------------------------------------------------------------------------------
A1                    0.45         5.40      0.18      3.09     0.400        0  00:05:00
-----------------------------------------------------------------------------------------


******************
Node Depth Summary
******************

-----------------------------------------------------------------------------------------------
Node            Average   Maximum   Maximum   Time of Max     Total     Total   Retention
ID                Depth     Depth       HGL    Occurrence   Flooded      Time        Time
                Attained  Attained  Attained                Volume   Flooded
                      ft        ft        ft   days  hh:mm   acre-in   minutes    hh:mm:ss
-----------------------------------------------------------------------------------------------
Detention_Structure-C1   1.01      1.13   1284.48      0  01:00         0         0     0:00:00
OUTFALL            0.87      0.96   1281.55      0  01:00         0         0     0:00:00
Detention_Basin    2.40      2.95   1286.40      0  01:00         0         0     0:00:00


*****************
Node Flow Summary
*****************

-----------------------------------------------------------------------------------
Node                Element     Maximum     Peak      Time of   Maximum Time of Peak
ID                     Type     Lateral   Inflow  Peak Inflow  Flooding     Flooding
                             Inflow            Occurrence  Overflow   Occurrence
                                cfs      cfs  days  hh:mm       cfs  days  hh:mm
-----------------------------------------------------------------------------------
Detention_Structure-C1 JUNCTION      0.00    15.47     0  01:00      0.00
OUTFALL              OUTFALL       0.00    15.44     0  01:00      0.00
Detention_Basin      STORAGE      18.40    18.40     0  00:00      0.00


*******************
Inlet Depth Summary
*******************

-------------------------------------------------------------------------
Inlet              Max Gutter     Max Gutter      Max Gutter        Time of
ID                     Spread     Water Elev     Water Depth        Maximum
                       during         during          during          Depth
                    Peak Flow      Peak Flow       Peak Flow     Occurrence
                           ft             ft              ft    days  hh:mm
-------------------------------------------------------------------------
```

CI-EXIST1	0.00	1285.17	0.00	0	01:00
CI-EXIST2	10.35	1285.99	0.29	0	01:00

****
Inlet Flow Summary
****

Inlet ID	Peak Flow	Peak Lateral Flow	Peak Flow Intercepted by Inlet	Peak Flow Bypassing Inlet	Inlet Efficiency during Peak Flow	Total Flooding	Total Time Flooded
	cfs	cfs	cfs	cfs	%	acre-in	minutes
CI-EXIST1	0.00	0.00	-	-	-	0.000	0
CI-EXIST2	3.08	3.08	3.08	0.00	100.00	0.000	0

****
Storage Node Summary
****

Storage Node ID	Maximum Ponded Volume	Maximum Ponded Volume	Time of Max Ponded Volume	Average Ponded Volume	Average Ponded Volume	Maximum Storage Node Outflow	Maximum Exfiltration Rate	Time of Max. Exfiltration Rate	Total Exfiltrated Volume
	1000 ft³	(%)	days hh:mm	1000 ft³	(%)	cfs	cfm	hh:mm:ss	1000 ft³
Detention_Basin	18.890	9	0 01:00	11.635	6	15.47	0.00	0:00:00	0.000

****
Outfall Loading Summary
****

Outfall Node ID	Flow Frequency (%)	Average Flow cfs	Peak Inflow cfs
OUTFALL	99.39	13.27	15.44
System	99.39	13.27	15.44

****
Link Flow Summary
****

Link ID	Element Type	Time of Peak Flow Occurrence days hh:mm	Maximum Velocity Attained ft/sec	Length Factor	Peak Flow during Analysis cfs	Design Flow Capacity cfs	Ratio of Maximum /Design Flow	Ratio of Maximum Flow Depth	Total Time Surcharged minutes	Reported Condition
Bypass-CI-EXIST2	CHANNEL	0 00:00	0.00	1.00	0.00	5.02	0.00	0.00	0	Calculated
C1-EXIST2	CONDUIT	0 01:00	4.55	1.00	15.46	31.86	0.49	0.53	0	Calculated
EXIST1-OUTFALL	CONDUIT	0 01:00	7.45	1.00	15.44	49.44	0.31	0.44	0	Calculated
EXIST2-EXIST1	CONDUIT	0 01:00	6.46	1.00	15.44	50.32	0.31	0.49	0	Calculated
Basin_Outlet	OUTLET	0 01:00			15.47					

****
Highest Flow Instability Indexes
****

All links are stable.

WARNING 142 : Outlet invert elevation defined for Upstream Roadway Link Bypass-CI-EXIST2 is below the storm drain inlet rim elevation.
Assumed the upstream roadway link outlet invert elevation equal to the storm drain inlet rim elevation. Please verify the “Upstream roadway links” defined for storm drain inlet CI-EXIST1.

Analysis began on: Fri Nov 22 08:39:58 2024
Analysis ended on: Fri Nov 22 08:39:58 2024
Total elapsed time: < 1 sec

Existing Downstream - 5-Year SSA Report

```
  Autodesk® Storm and Sanitary Analysis 2016 - Version 13.5.302 (Build 0)
  --------------------------------------------------------------------------------

  ******************
  Project Description
  ******************
  File Name ..................  XtremeExteriors_Downstream_V2.SPF


  ***************
  Analysis Options
  ***************
  Flow Units ................. cfs
  Subbasin Hydrograph Method. Rational
  Time of Concentration...... User-Defined
  Return Period.............. 5 years
  Link Routing Method ....... Hydrodynamic
  Storage Node Exfiltration.. None
  Starting Date ..............  NOV-17-2020 00:00:00
  Ending Date ................  NOV-17-2020 01:00:00
  Report Time Step ..........  00:00:10


  *************
  Element Count
  *************
  Number of subbasins ....... 1
  Number of nodes ........... 5
  Number of links ........... 5


  ****************
  Subbasin Summary
  ****************
  Subbasin                Total
                           Area
  ID                      acres
  ------------------------------
  A1                       1.43


  ************
  Node Summary
  ************
  Node                Element            Invert   Maximum    Ponded    External
  ID                  Type            Elevation     Elev.      Area      Inflow
                                             ft        ft       ft²
  ----------------------------------------------------------------------------
  Detention_Structure-C1JUNCTION          1283.35   1290.05  50000.00
  OUTFALL             OUTFALL             1280.59   1283.09      0.00
  Detention_Basin     STORAGE             1283.45   1291.05  56000.00    Yes


  *************
  Inlet Summary
  *************
  Inlet               Inlet                     Manufacturer             Inlet      Number   Catchbasin        Inlet    Ponded
 Initial      Grate
  ID                  Manufacturer              Part                     Location       of       Invert          Rim      Area
   Water   Clogging
                                                Number                                Inlets    Elevation    Elevation
Elevation     Factor
                                                                                                      ft           ft       ft²
      ft          %
-------------------------------------------------------------------------------------------------------------------------------
------------------
  CI-EXIST1           FHWA HEC-22 GENERIC       N/A                      On Sag          1      1281.52      1285.17   1000.00
 1281.52      50.00
  CI-EXIST2           FHWA HEC-22 GENERIC       N/A                      On Grade        3      1282.43      1285.70         -
 1282.43       6.00


  *************************
  Roadway and Gutter Summary
  *************************
  Inlet                    Roadway   Roadway     Roadway    Gutter   Gutter       Gutter
  ID                  Longitudinal     Cross   Manning's     Cross    Width   Depression
```

	Slope ft/ft	Slope ft/ft	Roughness	Slope ft/ft	ft	in
CI-EXIST1	-	0.0200	0.0160	0.0620	2.00	2.00
CI-EXIST2	0.0100	0.0200	0.0160	0.0620	2.00	2.00

****
Link Summary
****

Link ID	From Node	To Node	Element Type	Length ft	Slope %	Manning's Roughness
Bypass-CI-EXIST2	CI-EXIST2	CI-EXIST1	CHANNEL	87.7	0.6044	0.0320
C1-EXIST2	Detention_Structure-C1	CI-EXIST2	CONDUIT	153.8	0.4225	0.0120
EXIST1-OUTFALL	CI-EXIST1	OUTFALL	CONDUIT	64.0	1.4531	0.0130
EXIST2-EXIST1	CI-EXIST2	CI-EXIST1	CONDUIT	57.1	1.5053	0.0130
Basin_Outlet	Detention_Basin	Detention_Structure-C1	OUTLET			

****
Cross Section Summary
****

Link ID	Shape	Depth/ Diameter ft	Width ft	No. of Barrels	Cross Sectional Area ft²	Full Flow Hydraulic Radius ft	Design Flow Capacity cfs
Bypass-CI-EXIST2	IRREGULAR	0.53	18.00	1	4.46	0.17	5.02
C1-EXIST2	CIRCULAR	2.00	2.00	2	3.14	0.50	15.93
EXIST1-OUTFALL	CIRCULAR	2.50	2.50	1	4.91	0.63	49.44
EXIST2-EXIST1	CIRCULAR	2.50	2.50	1	4.91	0.63	50.32

****
Transect Summary
****

Transect XS-01
Area:

0.0002	0.0010	0.0021	0.0038	0.0060
0.0087	0.0118	0.0156	0.0201	0.0256
0.0320	0.0393	0.0476	0.0567	0.0668
0.0778	0.0898	0.1026	0.1164	0.1311
0.1467	0.1632	0.1807	0.1990	0.2183
0.2385	0.2597	0.2817	0.3047	0.3286
0.3534	0.3792	0.4058	0.4334	0.4619
0.4914	0.5217	0.5530	0.5852	0.6183
0.6523	0.6872	0.7231	0.7599	0.7976
0.8363	0.8758	0.9163	0.9577	1.0000

Hrad:

0.0208	0.0417	0.0625	0.0832	0.1041
0.1251	0.1462	0.1600	0.1695	0.1826
0.1979	0.2147	0.2324	0.2509	0.2698
0.2892	0.3088	0.3287	0.3488	0.3691
0.3895	0.4100	0.4305	0.4512	0.4720
0.4928	0.5136	0.5345	0.5555	0.5764
0.5975	0.6185	0.6396	0.6606	0.6818
0.7029	0.7240	0.7452	0.7664	0.7876
0.8088	0.8300	0.8512	0.8724	0.8937
0.9149	0.9362	0.9574	0.9787	1.0000

Width:

0.0112	0.0223	0.0336	0.0451	0.0567
0.0682	0.0798	0.0959	0.1174	0.1389
0.1604	0.1820	0.2035	0.2250	0.2465
0.2681	0.2896	0.3111	0.3327	0.3542
0.3757	0.3972	0.4188	0.4403	0.4618
0.4833	0.5049	0.5264	0.5479	0.5695
0.5910	0.6125	0.6340	0.6556	0.6771
0.6986	0.7201	0.7417	0.7632	0.7847
0.8063	0.8278	0.8493	0.8708	0.8924
0.9139	0.9354	0.9569	0.9785	1.0000

********** Runoff Quantity Continuity **********	Volume acre-ft	Depth inches
Total Precipitation	0.065	0.546
Continuity Error (%)	0.603	

Flow Routing Continuity	Volume acre-ft	Volume Mgallons
External Inflow	2.617	0.853
External Outflow	1.388	0.452
Initial Stored Volume	0.000	0.000
Final Stored Volume	1.255	0.409
Continuity Error (%)	-0.000	

Runoff Coefficient Computations Report

Subbasin A1

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
-	1.43	-	0.40
Composite Area & Weighted Runoff Coeff.	1.43		0.40

Subbasin Runoff Summary

Subbasin ID	Accumulated Precip in	Rainfall Intensity in/hr	Total Runoff in	Peak Runoff cfs	Weighted Runoff Coeff	Time of Concentration days	Time of Concentration hh:mm:ss
A1	0.55	6.55	0.22	3.75	0.400	0	00:05:00

Node Depth Summary

Node ID	Average Depth Attained ft	Maximum Depth Attained ft	Maximum HGL Attained ft	Time of Max Occurrence days	Time of Max Occurrence hh:mm	Total Flooded Volume acre-in	Total Flooded minutes	Retention Time hh:mm:ss
Detention_Structure-C1	1.20	1.41	1284.76	0	01:00	0	0	0:00:00
OUTFALL	1.00	1.12	1281.71	0	01:00	0	0	0:00:00
Detention_Basin	3.35	4.36	1287.81	0	01:00	0	0	0:00:00

Node Flow Summary

Node ID	Element Type	Maximum Lateral Inflow cfs	Peak Inflow cfs	Time of Peak Inflow Occurrence days	Time of Peak Inflow Occurrence hh:mm	Maximum Flooding Overflow cfs	Time of Maximum Flooding Occurrence days	Time of Maximum Flooding Occurrence hh:mm
Detention_Structure-C1	JUNCTION	0.00	20.61	0	01:00	0.00		
OUTFALL	OUTFALL	0.00	20.56	0	01:00	0.00		
Detention_Basin	STORAGE	31.66	31.66	0	00:00	0.00		

Inlet Depth Summary

Inlet ID	Max Gutter Spread during Peak Flow ft	Max Gutter Water Elev during Peak Flow ft	Max Gutter Water Depth during Peak Flow ft	Time of Maximum Depth Occurrence days	Time of Maximum Depth Occurrence hh:mm

CI-EXIST1	0.00	1285.17	0.00	0	01:00
CI-EXIST2	11.22	1286.01	0.31	0	01:00

****
Inlet Flow Summary
****

Inlet ID	Peak Flow	Peak Lateral Flow	Peak Flow Intercepted by Inlet	Peak Flow Bypassing Inlet	Inlet Efficiency during Peak Flow	Total Flooding	Total Time Flooded
	cfs	cfs	cfs	cfs	%	acre-in	minutes
CI-EXIST1	0.00	0.00	-	-	-	0.000	0
CI-EXIST2	3.74	3.74	3.74	0.00	100.00	0.000	0

****
Storage Node Summary
****

Storage Node ID	Maximum Ponded Volume	Maximum Ponded Volume	Time of Max Ponded Volume	Average Ponded Volume	Average Ponded Volume	Maximum Storage Node Outflow	Maximum Exfiltration Rate	Time of Max. Exfiltration Rate	Total Exfiltrated Volume
	1000 ft³	(%)	days hh:mm	1000 ft³	(%)	cfs	cfm	hh:mm:ss	1000 ft³
Detention_Basin	53.626	27	0 01:00	29.935	15	20.61	0.00	0:00:00	0.000

****
Outfall Loading Summary
****

Outfall Node ID	Flow Frequency (%)	Average Flow cfs	Peak Inflow cfs
OUTFALL	99.42	16.89	20.56
System	99.42	16.89	20.56

****
Link Flow Summary
****

Link ID	Element Type	Time of Peak Flow Occurrence days hh:mm	Maximum Velocity Attained ft/sec	Length Factor	Peak Flow during Analysis cfs	Design Flow Capacity cfs	Ratio of Maximum /Design Flow	Ratio of Maximum Flow Depth	Total Time Surcharged minutes	Reported Condition
Bypass-CI-EXIST2	CHANNEL	0 00:00	0.00	1.00	0.00	5.02	0.00	0.00	0	Calculated
C1-EXIST2	CONDUIT	0 01:00	4.59	1.00	20.59	31.86	0.65	0.67	0	Calculated
EXIST1-OUTFALL	CONDUIT	0 01:00	7.93	1.00	20.56	49.44	0.42	0.52	0	Calculated
EXIST2-EXIST1	CONDUIT	0 01:00	6.73	1.00	20.57	50.32	0.41	0.60	0	Calculated
Basin_Outlet	OUTLET	0 01:00			20.61					

****
Highest Flow Instability Indexes
****

```
  All links are stable.


  WARNING 142 : Outlet invert elevation defined for Upstream Roadway Link Bypass-CI-EXIST2 is below the storm drain inlet rim
elevation.
                Assumed the upstream roadway link outlet invert elevation equal to the storm drain inlet rim elevation. Please
verify the “Upstream roadway links” defined for storm drain inlet CI-EXIST1.

  Analysis began on:  Fri Nov 22 08:37:20 2024
  Analysis ended on:  Fri Nov 22 08:37:21 2024
  Total elapsed time: 00:00:01
```

Existing Downstream - 10-Year SSA Report

Autodesk® Storm and Sanitary Analysis 2016 - Version 13.5.302 (Build 0)

****
Project Description
****
File Name ..... XtremeExteriors_Downstream_V2.SPF

****
Analysis Options
****
Flow Units ..... cfs
Subbasin Hydrograph Method. Rational
Time of Concentration..... User-Defined
Return Period..... 10 years
Link Routing Method ..... Hydrodynamic
Storage Node Exfiltration.. None
Starting Date NOV-17-2020 00:00:00
Ending Date NOV-17-2020 01:00:00
Report Time Step 00:00:10

****
Element Count
****
Number of subbasins 1
Number of nodes 5
Number of links 5

****
Subbasin Summary
****

Subbasin ID	Total Area acres
A1	1.43

****
Node Summary
****

Node ID	Element Type	Invert Elevation ft	Maximum Elev. ft	Ponded Area ft²	External Inflow
Detention_Structure-C1JUNCTION		1283.35	1290.05	50000.00	
OUTFALL	OUTFALL	1280.59	1283.09	0.00	
Detention_Basin	STORAGE	1283.45	1291.05	56000.00	Yes

****
Inlet Summary
****

Inlet ID	Inlet Manufacturer	Manufacturer Part Number	Inlet Location	Number of Inlets	Catchbasin Invert Elevation ft	Inlet Rim Elevation ft	Ponded Area ft²	Initial Water Elevation ft	Grate Clogging Factor %
CI-EXIST1	FHWA HEC-22 GENERIC	N/A	On Sag	1	1281.52	1285.17	1000.00	1281.52	50.00
CI-EXIST2	FHWA HEC-22 GENERIC	N/A	On Grade	3	1282.43	1285.70	-	1282.43	6.00

****
Roadway and Gutter Summary
****

Inlet ID	Roadway Longitudinal	Roadway Cross	Roadway Manning's	Gutter Cross	Gutter Width	Gutter Depression

	Slope ft/ft	Slope ft/ft	Roughness	Slope ft/ft	ft	in
CI-EXIST1	-	0.0200	0.0160	0.0620	2.00	2.00
CI-EXIST2	0.0100	0.0200	0.0160	0.0620	2.00	2.00

****
Link Summary
****

Link ID	From Node	To Node	Element Type	Length ft	Slope %	Manning's Roughness
Bypass-CI-EXIST2	CI-EXIST2	CI-EXIST1	CHANNEL	87.7	0.6044	0.0320
C1-EXIST2	Detention_Structure-C1	CI-EXIST2	CONDUIT	153.8	0.4225	0.0120
EXIST1-OUTFALL	CI-EXIST1	OUTFALL	CONDUIT	64.0	1.4531	0.0130
EXIST2-EXIST1	CI-EXIST2	CI-EXIST1	CONDUIT	57.1	1.5053	0.0130
Basin_Outlet	Detention_Basin	Detention_Structure-C1	OUTLET			

****
Cross Section Summary
****

Link ID	Shape	Depth/ Diameter ft	Width ft	No. of Barrels	Cross Sectional Area ft²	Full Flow Hydraulic Radius ft	Design Flow Capacity cfs
Bypass-CI-EXIST2	IRREGULAR	0.53	18.00	1	4.46	0.17	5.02
C1-EXIST2	CIRCULAR	2.00	2.00	2	3.14	0.50	15.93
EXIST1-OUTFALL	CIRCULAR	2.50	2.50	1	4.91	0.63	49.44
EXIST2-EXIST1	CIRCULAR	2.50	2.50	1	4.91	0.63	50.32

****
Transect Summary
****

Transect XS-01
Area:

0.0002	0.0010	0.0021	0.0038	0.0060
0.0087	0.0118	0.0156	0.0201	0.0256
0.0320	0.0393	0.0476	0.0567	0.0668
0.0778	0.0898	0.1026	0.1164	0.1311
0.1467	0.1632	0.1807	0.1990	0.2183
0.2385	0.2597	0.2817	0.3047	0.3286
0.3534	0.3792	0.4058	0.4334	0.4619
0.4914	0.5217	0.5530	0.5852	0.6183
0.6523	0.6872	0.7231	0.7599	0.7976
0.8363	0.8758	0.9163	0.9577	1.0000

Hrad:

0.0208	0.0417	0.0625	0.0832	0.1041
0.1251	0.1462	0.1600	0.1695	0.1826
0.1979	0.2147	0.2324	0.2509	0.2698
0.2892	0.3088	0.3287	0.3488	0.3691
0.3895	0.4100	0.4305	0.4512	0.4720
0.4928	0.5136	0.5345	0.5555	0.5764
0.5975	0.6185	0.6396	0.6606	0.6818
0.7029	0.7240	0.7452	0.7664	0.7876
0.8088	0.8300	0.8512	0.8724	0.8937
0.9149	0.9362	0.9574	0.9787	1.0000

Width:

0.0112	0.0223	0.0336	0.0451	0.0567
0.0682	0.0798	0.0959	0.1174	0.1389
0.1604	0.1820	0.2035	0.2250	0.2465
0.2681	0.2896	0.3111	0.3327	0.3542
0.3757	0.3972	0.4188	0.4403	0.4618
0.4833	0.5049	0.5264	0.5479	0.5695
0.5910	0.6125	0.6340	0.6556	0.6771
0.6986	0.7201	0.7417	0.7632	0.7847
0.8063	0.8278	0.8493	0.8708	0.8924
0.9139	0.9354	0.9569	0.9785	1.0000

********** Runoff Quantity Continuity **********	Volume acre-ft	Depth inches
Total Precipitation	0.073	0.612
Continuity Error (%)	0.603	

Flow Routing Continuity	Volume acre-ft	Volume Mgallons
External Inflow	3.622	1.180
External Outflow	1.853	0.604
Initial Stored Volume	0.000	0.000
Final Stored Volume	1.797	0.586
Continuity Error (%)	0.000	

Runoff Coefficient Computations Report

Subbasin A1

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
-	1.43	-	0.40
Composite Area & Weighted Runoff Coeff.	1.43		0.40

Subbasin Runoff Summary

Subbasin ID	Accumulated Precip in	Rainfall Intensity in/hr	Total Runoff in	Peak Runoff cfs	Weighted Runoff Coeff	Time of Concentration days	Time of Concentration hh:mm:ss
A1	0.61	7.35	0.24	4.20	0.400	0	00:05:00

Node Depth Summary

Node ID	Average Depth Attained ft	Maximum Depth Attained ft	Maximum HGL Attained ft	Time of Max Occurrence days	Time of Max Occurrence hh:mm	Total Flooded Volume acre-in	Total Flooded Time minutes	Retention Time hh:mm:ss
Detention_Structure-C1	1.68	3.46	1286.81	0	01:00	0	0	0:00:00
OUTFALL	1.17	1.63	1282.22	0	01:00	0	0	0:00:00
Detention_Basin	3.96	5.02	1288.47	0	01:00	0	0	0:00:00

Node Flow Summary

Node ID	Element Type	Maximum Lateral Inflow cfs	Peak Inflow cfs	Time of Peak Inflow Occurrence days	Time of Peak Inflow Occurrence hh:mm	Maximum Flooding Overflow cfs	Time of Peak Flooding Occurrence days	Time of Peak Flooding Occurrence hh:mm
Detention_Structure-C1	JUNCTION	0.00	37.76	0	01:00	0.00		
OUTFALL	OUTFALL	0.00	37.71	0	01:00	0.00		
Detention_Basin	STORAGE	43.83	43.83	0	00:00	0.00		

Inlet Depth Summary

Inlet ID	Max Gutter Spread during Peak Flow ft	Max Gutter Water Elev during Peak Flow ft	Max Gutter Water Depth during Peak Flow ft	Time of Maximum Depth Occurrence days	Time of Maximum Depth Occurrence hh:mm

CI-EXIST1	0.00	1285.17	0.00	0	01:00	
CI-EXIST2	11.82	1286.02	0.32	0	01:00	

****
Inlet Flow Summary
****

Inlet ID	Peak Flow	Peak Lateral Flow	Peak Flow Intercepted by Inlet	Peak Flow Bypassing Inlet	Inlet Efficiency during Peak Flow	Total Flooding	Total Time Flooded
	cfs	cfs	cfs	cfs	%	acre-in	minutes
CI-EXIST1	0.00	0.00	-	-	-	0.000	0
CI-EXIST2	4.20	4.20	4.20	0.00	100.00	0.000	0

****
Storage Node Summary
****

Storage Node ID	Maximum Ponded Volume	Maximum Ponded	Time of Max Ponded Volume	Average Ponded Volume	Average Ponded	Maximum Storage Node Outflow	Maximum Exfiltration Rate	Time of Max. Exfiltration Rate	Total Exfiltrated Volume
	1000 ft³	(%)	days hh:mm	1000 ft³	(%)	cfs	cfm	hh:mm:ss	1000 ft³
Detention_Basin	76.777	38	0 01:00	46.496	23	37.76	0.00	0:00:00	0.000

****
Outfall Loading Summary
****

Outfall Node ID	Flow Frequency (%)	Average Flow cfs	Peak Inflow cfs
OUTFALL	99.44	22.55	37.71
System	99.44	22.55	37.71

****
Link Flow Summary
****

Link ID	Element Type	Time of Peak Flow Occurrence days hh:mm	Maximum Velocity Attained ft/sec	Length Factor	Peak Flow during Analysis cfs	Design Flow Capacity cfs	Ratio of Maximum /Design Flow	Ratio of Maximum Flow Depth	Total Time Surcharged minutes	Reported Condition
Bypass-CI-EXIST2	CHANNEL	0 00:00	0.00	1.00	0.00	5.02	0.00	0.00	0	Calculated
C1-EXIST2	CONDUIT	0 01:00	6.01	1.00	37.75	31.86	1.18	1.00	12	SURCHARGED
EXIST1-OUTFALL	CONDUIT	0 01:00	8.91	1.00	37.71	49.44	0.76	0.80	0	Calculated
EXIST2-EXIST1	CONDUIT	0 01:00	7.77	1.00	37.75	50.32	0.75	0.97	0	Calculated
Basin_Outlet	OUTLET	0 01:00			37.76					

****
Highest Flow Instability Indexes
****

All links are stable.

WARNING 142 : Outlet invert elevation defined for Upstream Roadway Link Bypass-CI-EXIST2 is below the storm drain inlet rim elevation.
Assumed the upstream roadway link outlet invert elevation equal to the storm drain inlet rim elevation. Please verify the “Upstream roadway links” defined for storm drain inlet CI-EXIST1.

Analysis began on: Fri Nov 22 08:17:06 2024
Analysis ended on: Fri Nov 22 08:17:06 2024
Total elapsed time: < 1 sec

Existing Downstream - 25-Year SSA Report

Autodesk® Storm and Sanitary Analysis 2016 - Version 13.5.302 (Build 0)

****
Project Description
****
File Name ..... XtremeExteriors_Downstream_V2.SPF

****
Analysis Options
****
Flow Units ..... cfs
Subbasin Hydrograph Method. Rational
Time of Concentration..... User-Defined
Return Period..... 25 years
Link Routing Method ..... Hydrodynamic
Storage Node Exfiltration.. None
Starting Date NOV-17-2020 00:00:00
Ending Date NOV-17-2020 01:00:00
Report Time Step 00:00:10

****
Element Count
****
Number of subbasins 1
Number of nodes 5
Number of links 5

****
Subbasin Summary
****

Subbasin ID	Total Area acres
A1	1.43

****
Node Summary
****

Node ID	Element Type	Invert Elevation ft	Maximum Elev. ft	Ponded Area ft²	External Inflow
Detention_Structure-C1JUNCTION		1283.35	1290.05	50000.00	
OUTFALL	OUTFALL	1280.59	1283.09	0.00	
Detention_Basin	STORAGE	1283.45	1291.05	56000.00	Yes

****
Inlet Summary
****

Inlet ID	Inlet Manufacturer	Manufacturer Part Number	Inlet Location	Number of Inlets	Catchbasin Invert Elevation ft	Inlet Rim Elevation ft	Ponded Area ft²	Initial Water Elevation ft	Grate Clogging Factor %
CI-EXIST1	FHWA HEC-22 GENERIC	N/A	On Sag	1	1281.52	1285.17	1000.00	1281.52	50.00
CI-EXIST2	FHWA HEC-22 GENERIC	N/A	On Grade	3	1282.43	1285.70	-	1282.43	6.00

****
Roadway and Gutter Summary
****

Inlet ID	Roadway Longitudinal	Roadway Cross	Roadway Manning's	Gutter Cross	Gutter Width	Gutter Depression

	Slope ft/ft	Slope ft/ft	Roughness	Slope ft/ft	ft	in
CI-EXIST1	-	0.0200	0.0160	0.0620	2.00	2.00
CI-EXIST2	0.0100	0.0200	0.0160	0.0620	2.00	2.00

****
Link Summary
****

Link ID	From Node	To Node	Element Type	Length ft	Slope %	Manning's Roughness
Bypass-CI-EXIST2	CI-EXIST2	CI-EXIST1	CHANNEL	87.7	0.6044	0.0320
C1-EXIST2	Detention_Structure-C1	CI-EXIST2	CONDUIT	153.8	0.4225	0.0120
EXIST1-OUTFALL	CI-EXIST1	OUTFALL	CONDUIT	64.0	1.4531	0.0130
EXIST2-EXIST1	CI-EXIST2	CI-EXIST1	CONDUIT	57.1	1.5053	0.0130
Basin_Outlet	Detention_Basin	Detention_Structure-C1	OUTLET			

****
Cross Section Summary
****

Link ID	Shape	Depth/ Diameter ft	Width ft	No. of Barrels	Cross Sectional Area ft²	Full Flow Hydraulic Radius ft	Design Flow Capacity cfs
Bypass-CI-EXIST2	IRREGULAR	0.53	18.00	1	4.46	0.17	5.02
C1-EXIST2	CIRCULAR	2.00	2.00	2	3.14	0.50	15.93
EXIST1-OUTFALL	CIRCULAR	2.50	2.50	1	4.91	0.63	49.44
EXIST2-EXIST1	CIRCULAR	2.50	2.50	1	4.91	0.63	50.32

****
Transect Summary
****

Transect XS-01
Area:

0.0002	0.0010	0.0021	0.0038	0.0060
0.0087	0.0118	0.0156	0.0201	0.0256
0.0320	0.0393	0.0476	0.0567	0.0668
0.0778	0.0898	0.1026	0.1164	0.1311
0.1467	0.1632	0.1807	0.1990	0.2183
0.2385	0.2597	0.2817	0.3047	0.3286
0.3534	0.3792	0.4058	0.4334	0.4619
0.4914	0.5217	0.5530	0.5852	0.6183
0.6523	0.6872	0.7231	0.7599	0.7976
0.8363	0.8758	0.9163	0.9577	1.0000

Hrad:

0.0208	0.0417	0.0625	0.0832	0.1041
0.1251	0.1462	0.1600	0.1695	0.1826
0.1979	0.2147	0.2324	0.2509	0.2698
0.2892	0.3088	0.3287	0.3488	0.3691
0.3895	0.4100	0.4305	0.4512	0.4720
0.4928	0.5136	0.5345	0.5555	0.5764
0.5975	0.6185	0.6396	0.6606	0.6818
0.7029	0.7240	0.7452	0.7664	0.7876
0.8088	0.8300	0.8512	0.8724	0.8937
0.9149	0.9362	0.9574	0.9787	1.0000

Width:

0.0112	0.0223	0.0336	0.0451	0.0567
0.0682	0.0798	0.0959	0.1174	0.1389
0.1604	0.1820	0.2035	0.2250	0.2465
0.2681	0.2896	0.3111	0.3327	0.3542
0.3757	0.3972	0.4188	0.4403	0.4618
0.4833	0.5049	0.5264	0.5479	0.5695
0.5910	0.6125	0.6340	0.6556	0.6771
0.6986	0.7201	0.7417	0.7632	0.7847
0.8063	0.8278	0.8493	0.8708	0.8924
0.9139	0.9354	0.9569	0.9785	1.0000

********** Runoff Quantity Continuity **********	Volume acre-ft	Depth inches
Total Precipitation	0.083	0.700
Continuity Error (%)	0.603	

```
*************************        Volume        Volume
Flow Routing Continuity          acre-ft      Mgallons
*************************     ---------     ---------
External Inflow ..........         4.240         1.382
External Outflow .........         2.194         0.715
Initial Stored Volume ....         0.000         0.000
Final Stored Volume ......         2.007         0.654
Continuity Error (%) .....         0.015


*************************************
Runoff Coefficient Computations Report
*************************************

--------------
Subbasin A1
--------------
                                                        Area          Soil       Runoff
Soil/Surface Description                               (acres)        Group       Coeff.
-----------------------------------------------------------------------------------------
-                                                        1.43            -         0.40
Composite Area & Weighted Runoff Coeff.                  1.43                      0.40

**********************
Subbasin Runoff Summary
**********************

-----------------------------------------------------------------------------------------
Subbasin       Accumulated     Rainfall     Total      Peak  Weighted           Time of
ID                  Precip    Intensity    Runoff    Runoff    Runoff     Concentration
                        in        in/hr        in       cfs     Coeff     days  hh:mm:ss
-----------------------------------------------------------------------------------------
A1                    0.70         8.40      0.28      4.80     0.400        0  00:05:00
-----------------------------------------------------------------------------------------


******************
Node Depth Summary
******************

-----------------------------------------------------------------------------------------------
Node            Average   Maximum   Maximum   Time of Max     Total     Total   Retention
ID                Depth     Depth       HGL    Occurrence   Flooded      Time        Time
                Attained  Attained  Attained                Volume   Flooded
                      ft        ft        ft   days  hh:mm   acre-in   minutes    hh:mm:ss
-----------------------------------------------------------------------------------------------
Detention_Structure-C1   2.33      4.53   1287.88      0  01:00         0         0     0:00:00
OUTFALL            1.29      1.69   1282.28      0  00:45         0         0     0:00:00
Detention_Basin    4.23      5.26   1288.71      0  01:00         0         0     0:00:00


*****************
Node Flow Summary
*****************

-----------------------------------------------------------------------------------
Node                Element     Maximum     Peak      Time of   Maximum Time of Peak
ID                     Type     Lateral   Inflow  Peak Inflow  Flooding     Flooding
                             Inflow            Occurrence  Overflow   Occurrence
                                cfs      cfs  days  hh:mm       cfs  days  hh:mm
-----------------------------------------------------------------------------------
Detention_Structure-C1 JUNCTION      0.00    45.87     0  01:00      0.00
OUTFALL             OUTFALL       0.00    39.61     0  00:45      0.00
Detention_Basin     STORAGE      51.31    51.31     0  00:00      0.00


******************
Inlet Depth Summary
******************

-------------------------------------------------------------------------
Inlet              Max Gutter     Max Gutter      Max Gutter        Time of
ID                     Spread     Water Elev     Water Depth        Maximum
                       during         during          during          Depth
                    Peak Flow      Peak Flow       Peak Flow     Occurrence
                           ft             ft              ft    days  hh:mm
-------------------------------------------------------------------------
```

CI-EXIST1	0.00	1285.17	0.00	0	00:45
CI-EXIST2	12.46	1286.03	0.33	0	00:45

****
Inlet Flow Summary
****

Inlet ID	Peak Flow	Peak Lateral Flow	Peak Flow Intercepted by Inlet	Peak Flow Bypassing Inlet	Inlet Efficiency during Peak Flow	Total Flooding	Total Time Flooded
	cfs	cfs	cfs	cfs	%	acre-in	minutes
CI-EXIST1	0.00	0.00	-	-	-	0.000	0
CI-EXIST2	4.80	4.80	4.80	0.00	100.00	0.852	15

****
Storage Node Summary
****

Storage Node ID	Maximum Ponded Volume	Maximum Ponded	Time of Max Ponded Volume	Average Ponded Volume	Average Ponded	Maximum Storage Node Outflow	Maximum Exfiltration Rate	Time of Max. Exfiltration Rate	Total Exfiltrated Volume
	1000 ft³	(%)	days hh:mm	1000 ft³	(%)	cfs	cfm	hh:mm:ss	1000 ft³
Detention_Basin	85.927	43	0 01:00	54.768	27	45.87	0.00	0:00:00	0.000

****
Outfall Loading Summary
****

Outfall Node ID	Flow Frequency (%)	Average Flow cfs	Peak Inflow cfs
OUTFALL	99.47	26.70	39.61
System	99.47	26.70	39.61

****
Link Flow Summary
****

Link ID	Element Type	Time of Peak Flow Occurrence days hh:mm	Maximum Velocity Attained ft/sec	Length Factor	Peak Flow during Analysis cfs	Design Flow Capacity cfs	Ratio of Maximum /Design Flow	Ratio of Maximum Flow Depth	Total Time Surcharged minutes	Reported Condition
Bypass-CI-EXIST2	CHANNEL	0 00:00	0.00	1.00	0.00	5.02	0.00	0.00	0	Calculated
C1-EXIST2	CONDUIT	0 01:00	7.30	1.00	45.87	31.86	1.44	1.00	24	SURCHARGED
EXIST1-OUTFALL	CONDUIT	0 00:45	9.01	1.00	39.61	49.44	0.80	0.84	0	Calculated
EXIST2-EXIST1	CONDUIT	0 00:45	8.07	1.00	39.61	50.32	0.79	1.00	16	SURCHARGED
Basin_Outlet	OUTLET	0 01:00			45.87					

****
Highest Flow Instability Indexes
****

```
  All links are stable.


  WARNING 142 : Outlet invert elevation defined for Upstream Roadway Link Bypass-CI-EXIST2 is below the storm drain inlet rim
elevation.
               Assumed the upstream roadway link outlet invert elevation equal to the storm drain inlet rim elevation. Please
verify the “Upstream roadway links” defined for storm drain inlet CI-EXIST1.

  Analysis began on:  Fri Nov 22 08:15:39 2024
  Analysis ended on:  Fri Nov 22 08:15:40 2024
  Total elapsed time: 00:00:01
```

Existing Downstream - 100-Year SSA Report

Autodesk® Storm and Sanitary Analysis 2016 - Version 13.5.302 (Build 0)

****
Project Description
****
File Name ..... XtremeExteriors_Downstream_V2.SPF

****
Analysis Options
****
Flow Units ..... cfs
Subbasin Hydrograph Method. Rational
Time of Concentration..... User-Defined
Return Period..... 100 years
Link Routing Method ..... Hydrodynamic
Storage Node Exfiltration.. None
Starting Date NOV-17-2020 00:00:00
Ending Date NOV-17-2020 01:00:00
Report Time Step 00:00:10

****
Element Count
****
Number of subbasins 1
Number of nodes 5
Number of links 5

****
Subbasin Summary
****

Subbasin ID	Total Area acres
A1	1.43

****
Node Summary
****

Node ID	Element Type	Invert Elevation ft	Maximum Elev. ft	Ponded Area ft²	External Inflow
Detention_Structure-C1JUNCTION		1283.35	1290.05	50000.00	
OUTFALL	OUTFALL	1280.59	1283.09	0.00	
Detention_Basin	STORAGE	1283.45	1291.05	56000.00	Yes

****
Inlet Summary
****

Inlet ID	Inlet Manufacturer	Manufacturer Part Number	Inlet Location	Number of Inlets	Catchbasin Invert Elevation ft	Inlet Rim Elevation ft	Ponded Area ft²	Initial Water Elevation ft	Grate Clogging Factor %
CI-EXIST1	FHWA HEC-22 GENERIC	N/A	On Sag	1	1281.52	1285.17	1000.00	1281.52	50.00
CI-EXIST2	FHWA HEC-22 GENERIC	N/A	On Grade	3	1282.43	1285.70	-	1282.43	6.00

****
Roadway and Gutter Summary
****

Inlet ID	Roadway Longitudinal	Roadway Cross	Roadway Manning's	Gutter Cross	Gutter Width	Gutter Depression

	Slope ft/ft	Slope ft/ft	Roughness	Slope ft/ft	ft	in
CI-EXIST1	-	0.0200	0.0160	0.0620	2.00	2.00
CI-EXIST2	0.0100	0.0200	0.0160	0.0620	2.00	2.00

****
Link Summary
****

Link ID	From Node	To Node	Element Type	Length ft	Slope %	Manning's Roughness
Bypass-CI-EXIST2	CI-EXIST2	CI-EXIST1	CHANNEL	87.7	0.6044	0.0320
C1-EXIST2	Detention_Structure-C1	CI-EXIST2	CONDUIT	153.8	0.4225	0.0120
EXIST1-OUTFALL	CI-EXIST1	OUTFALL	CONDUIT	64.0	1.4531	0.0130
EXIST2-EXIST1	CI-EXIST2	CI-EXIST1	CONDUIT	57.1	1.5053	0.0130
Basin_Outlet	Detention_Basin	Detention_Structure-C1	OUTLET			

****
Cross Section Summary
****

Link ID	Shape	Depth/ Diameter ft	Width ft	No. of Barrels	Cross Sectional Area ft²	Full Flow Hydraulic Radius ft	Design Flow Capacity cfs
Bypass-CI-EXIST2	IRREGULAR	0.53	18.00	1	4.46	0.17	5.02
C1-EXIST2	CIRCULAR	2.00	2.00	2	3.14	0.50	15.93
EXIST1-OUTFALL	CIRCULAR	2.50	2.50	1	4.91	0.63	49.44
EXIST2-EXIST1	CIRCULAR	2.50	2.50	1	4.91	0.63	50.32

****
Transect Summary
****

Transect XS-01
Area:

0.0002	0.0010	0.0021	0.0038	0.0060
0.0087	0.0118	0.0156	0.0201	0.0256
0.0320	0.0393	0.0476	0.0567	0.0668
0.0778	0.0898	0.1026	0.1164	0.1311
0.1467	0.1632	0.1807	0.1990	0.2183
0.2385	0.2597	0.2817	0.3047	0.3286
0.3534	0.3792	0.4058	0.4334	0.4619
0.4914	0.5217	0.5530	0.5852	0.6183
0.6523	0.6872	0.7231	0.7599	0.7976
0.8363	0.8758	0.9163	0.9577	1.0000

Hrad:

0.0208	0.0417	0.0625	0.0832	0.1041
0.1251	0.1462	0.1600	0.1695	0.1826
0.1979	0.2147	0.2324	0.2509	0.2698
0.2892	0.3088	0.3287	0.3488	0.3691
0.3895	0.4100	0.4305	0.4512	0.4720
0.4928	0.5136	0.5345	0.5555	0.5764
0.5975	0.6185	0.6396	0.6606	0.6818
0.7029	0.7240	0.7452	0.7664	0.7876
0.8088	0.8300	0.8512	0.8724	0.8937
0.9149	0.9362	0.9574	0.9787	1.0000

Width:

0.0112	0.0223	0.0336	0.0451	0.0567
0.0682	0.0798	0.0959	0.1174	0.1389
0.1604	0.1820	0.2035	0.2250	0.2465
0.2681	0.2896	0.3111	0.3327	0.3542
0.3757	0.3972	0.4188	0.4403	0.4618
0.4833	0.5049	0.5264	0.5479	0.5695
0.5910	0.6125	0.6340	0.6556	0.6771
0.6986	0.7201	0.7417	0.7632	0.7847
0.8063	0.8278	0.8493	0.8708	0.8924
0.9139	0.9354	0.9569	0.9785	1.0000

********** Runoff Quantity Continuity **********	Volume acre-ft	Depth inches
Total Precipitation	0.100	0.842
Continuity Error (%)	0.603	

```
*************************        Volume        Volume
Flow Routing Continuity          acre-ft      Mgallons
*************************     ---------     ---------
External Inflow ..........         5.087         1.658
External Outflow .........         2.461         0.802
Initial Stored Volume ....         0.000         0.000
Final Stored Volume ......         2.285         0.745
Continuity Error (%) .....         0.067


*************************************
Runoff Coefficient Computations Report
*************************************

--------------
Subbasin A1
--------------
                                                        Area          Soil       Runoff
Soil/Surface Description                               (acres)        Group      Coeff.
----------------------------------------------------------------------------------------
-                                                        1.43            -         0.40
Composite Area & Weighted Runoff Coeff.                  1.43                      0.40

**********************
Subbasin Runoff Summary
**********************

----------------------------------------------------------------------------------------
Subbasin       Accumulated     Rainfall     Total      Peak  Weighted           Time of
ID                  Precip    Intensity    Runoff    Runoff    Runoff     Concentration
                        in        in/hr        in       cfs     Coeff     days  hh:mm:ss
----------------------------------------------------------------------------------------
A1                    0.84        10.10      0.34      5.78     0.400        0  00:05:00
----------------------------------------------------------------------------------------


******************
Node Depth Summary
******************

----------------------------------------------------------------------------------------
Node            Average   Maximum   Maximum   Time of Max     Total     Total   Retention
ID                Depth     Depth       HGL    Occurrence   Flooded      Time        Time
                Attained  Attained  Attained                Volume   Flooded
                      ft        ft        ft   days  hh:mm   acre-in   minutes    hh:mm:ss
----------------------------------------------------------------------------------------
Detention_Structure-C1   3.12      5.59   1288.94      0  00:59         0         0     0:00:00
OUTFALL            1.39      1.69   1282.28      0  00:33         0         0     0:00:00
Detention_Basin    4.54      5.55   1289.00      0  01:00         0         0     0:00:00


*****************
Node Flow Summary
*****************

----------------------------------------------------------------------------------
Node                Element     Maximum     Peak      Time of   Maximum Time of Peak
ID                     Type     Lateral   Inflow  Peak Inflow  Flooding     Flooding
                              Inflow            Occurrence  Overflow   Occurrence
                                 cfs       cfs  days  hh:mm       cfs  days  hh:mm
----------------------------------------------------------------------------------
Detention_Structure-C1 JUNCTION      0.00    55.94      0  01:00      0.00
OUTFALL             OUTFALL       0.00    39.61      0  00:33      0.00
Detention_Basin     STORAGE      61.54    61.54      0  00:00      0.00


******************
Inlet Depth Summary
******************

--------------------------------------------------------------------------
Inlet              Max Gutter     Max Gutter      Max Gutter        Time of
ID                     Spread     Water Elev     Water Depth        Maximum
                       during         during          during          Depth
                    Peak Flow      Peak Flow       Peak Flow     Occurrence
                           ft             ft              ft    days  hh:mm
--------------------------------------------------------------------------
```

CI-EXIST1	0.00	1285.17	0.00	0	00:32
CI-EXIST2	13.35	1286.05	0.35	0	00:32

****
Inlet Flow Summary
****

Inlet ID	Peak Flow	Peak Lateral Flow	Peak Flow Intercepted by Inlet	Peak Flow Bypassing Inlet	Inlet Efficiency during Peak Flow	Total Flooding	Total Time Flooded
	cfs	cfs	cfs	cfs	%	acre-in	minutes
CI-EXIST1	0.00	0.00	-	-	-	0.000	0
CI-EXIST2	5.77	5.77	5.77	0.00	100.00	4.543	27

****
Storage Node Summary
****

Storage Node ID	Maximum Ponded Volume	Maximum Ponded Volume	Time of Max Ponded Volume	Average Ponded Volume	Average Ponded Volume	Maximum Storage Node Outflow	Maximum Exfiltration Rate	Time of Max. Exfiltration Rate	Total Exfiltrated Volume
	1000 ft³	(%)	days hh:mm	1000 ft³	(%)	cfs	cfm	hh:mm:ss	1000 ft³
Detention_Basin	98.023	49	0 01:00	64.915	32	55.94	0.00	0:00:00	0.000

****
Outfall Loading Summary
****

Outfall Node ID	Flow Frequency (%)	Average Flow cfs	Peak Inflow cfs
OUTFALL	99.47	29.94	39.61
System	99.47	29.94	39.61

****
Link Flow Summary
****

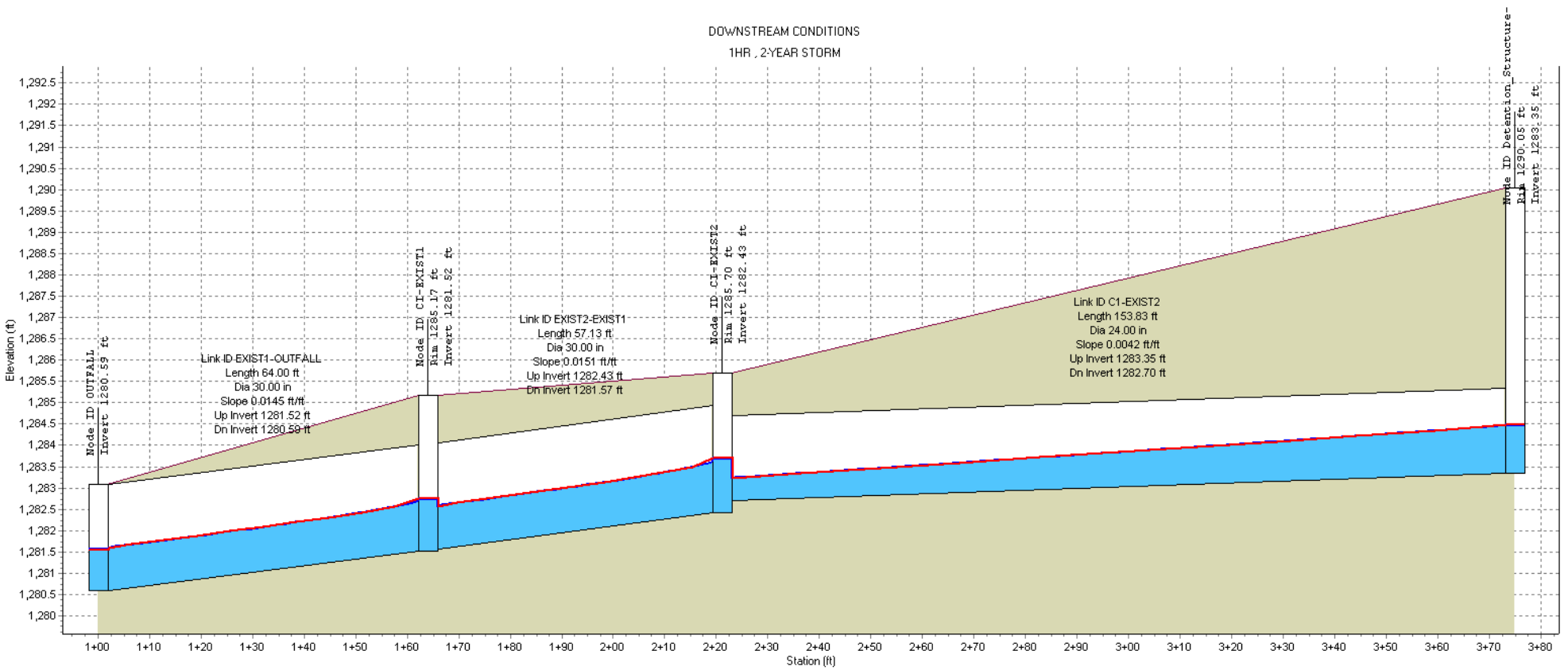
Link ID	Element Type	Time of Peak Flow Occurrence days hh:mm	Maximum Velocity Attained ft/sec	Length Factor	Peak Flow during Analysis cfs	Design Flow Capacity cfs	Ratio of Maximum /Design Flow	Ratio of Maximum Flow Depth	Total Time Surcharged minutes	Reported Condition
Bypass-CI-EXIST2	CHANNEL	0 00:00	0.00	1.00	0.00	5.02	0.00	0.00	0	Calculated
C1-EXIST2	CONDUIT	0 01:00	8.90	1.00	55.94	31.86	1.76	1.00	33	SURCHARGED
EXIST1-OUTFALL	CONDUIT	0 00:33	9.01	1.00	39.61	49.44	0.80	0.84	0	Calculated
EXIST2-EXIST1	CONDUIT	0 00:33	8.07	1.00	39.61	50.32	0.79	1.00	28	SURCHARGED
Basin_Outlet	OUTLET	0 01:00			55.94					

****
Highest Flow Instability Indexes
****

All links are stable.

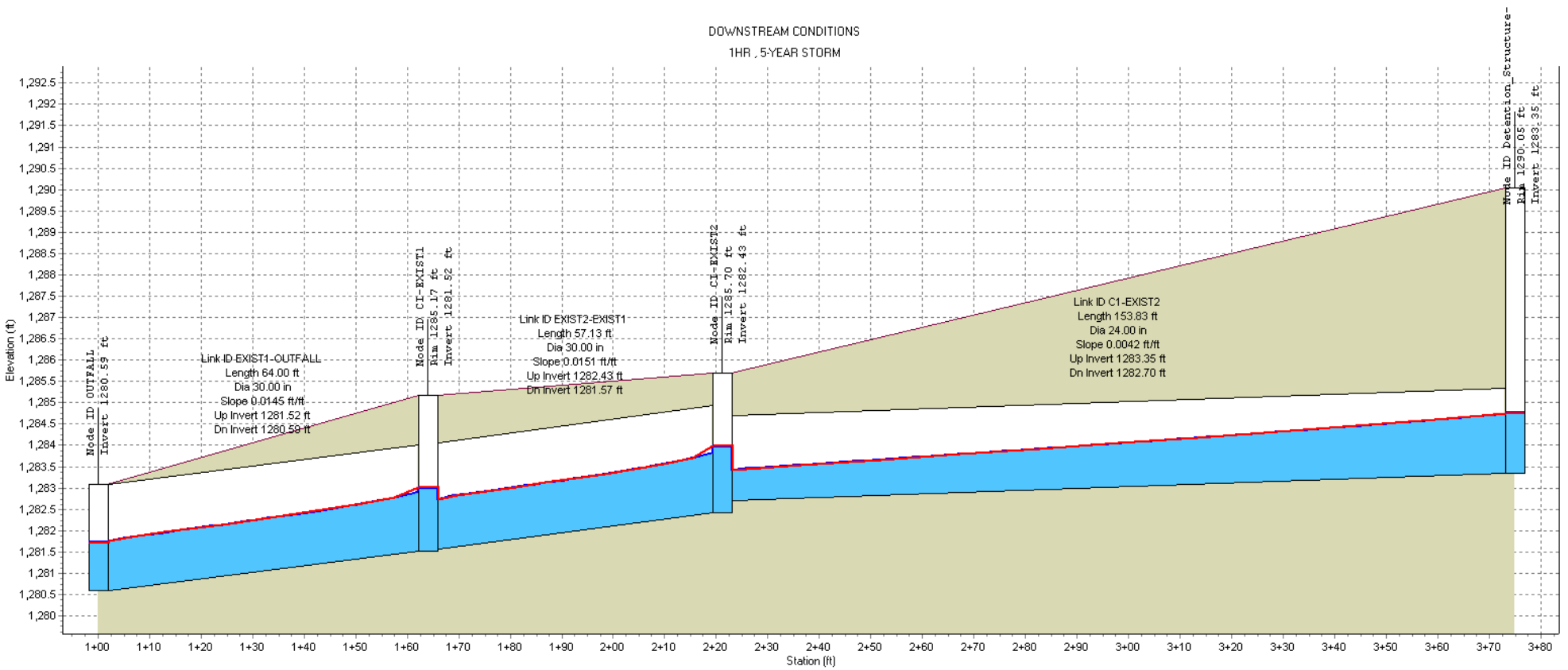
WARNING 142 : Outlet invert elevation defined for Upstream Roadway Link Bypass-CI-EXIST2 is below the storm drain inlet rim elevation.
Assumed the upstream roadway link outlet invert elevation equal to the storm drain inlet rim elevation. Please verify the “Upstream roadway links” defined for storm drain inlet CI-EXIST1.

Analysis began on: Fri Nov 22 07:51:13 2024
Analysis ended on: Fri Nov 22 07:51:13 2024
Total elapsed time: < 1 sec



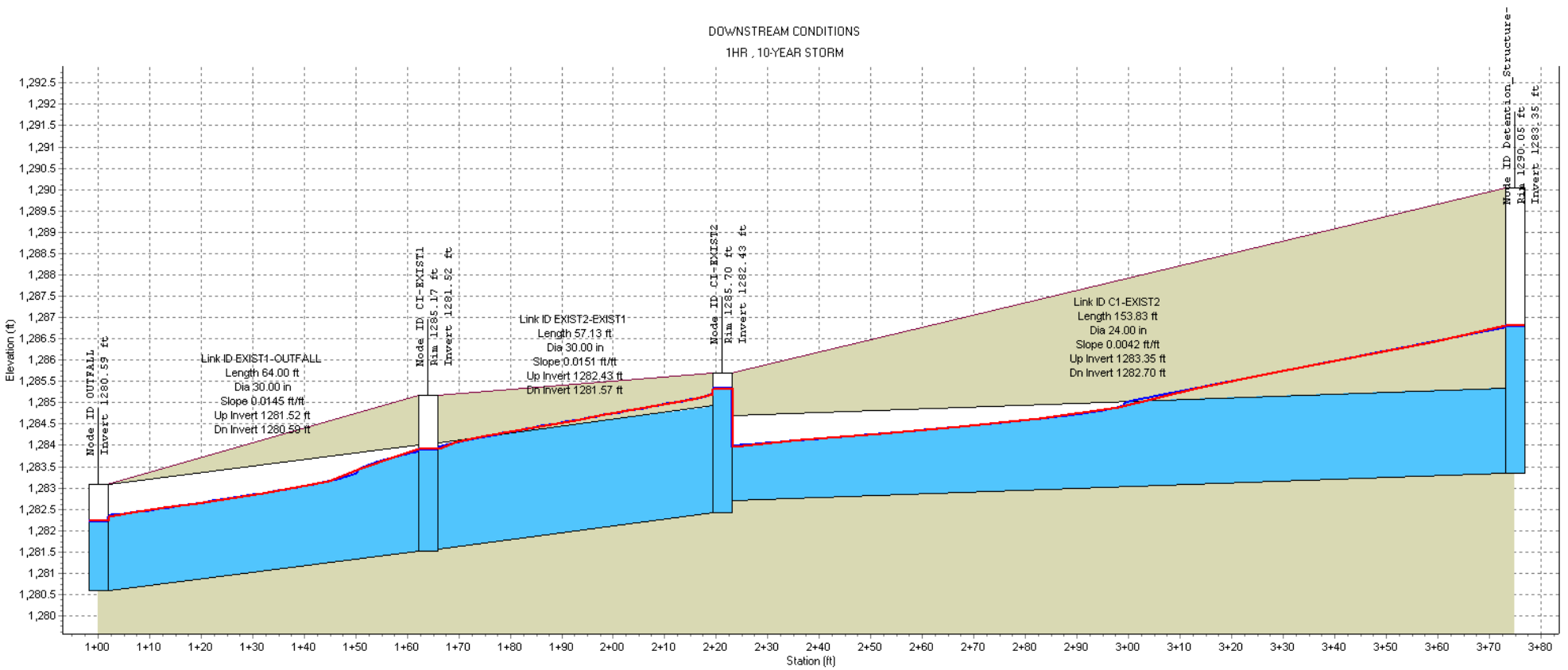
Node ID:	OUTFALL	C1-EXIST1	C1-EXIST2	
Rim (ft):		1285.17	1285.70	1290.05
Invert (ft):	1280.59	1281.52	1282.43	1283.35
Min Pipe Cover (ft):				0.00
Max HGL (ft):	1281.55	1282.75	1283.70	1284.48

Link ID:	EXIST1-OUTFALL	EXIST2-EXIST1	C1-EXIST2
Length (ft):	64.00	57.13	153.83
Dia (in):	30.00	30.00	24.00
Slope (ft/ft):	0.0145	0.0151	0.0042
Up Invert (ft):	1281.52	1282.43	1283.35
Dn Invert (ft):	1280.59	1281.57	1282.70
Max Q (cfs):	15.44	15.44	15.46
Max Vel (ft/s):	7.45	6.46	4.55
Max Depth (ft):	1.10	1.23	1.06



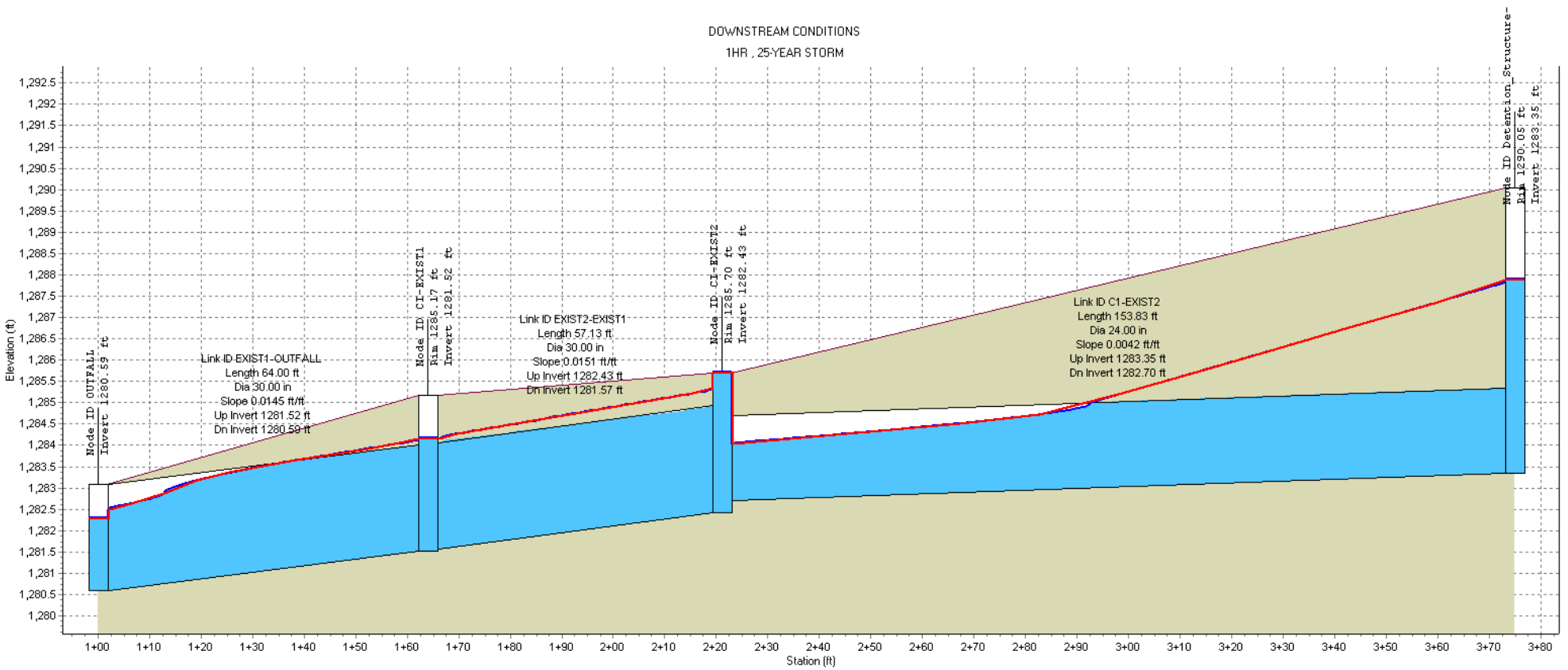
Node ID:	OUTFALL	CI-EXIST1	CI-EXIST2	
Rim (ft):		1285.17	1285.70	1290.05
Invert (ft):	1280.59	1281.52	1282.43	1283.35
Min Pipe Cover (ft):				0.00
Max HGL (ft):	1281.71	1283.01	1283.98	1284.76

Link ID:	EXIST1-OUTFALL	EXIST2-EXIST1	C1-EXIST2
Length (ft):	64.00	57.13	153.83
Dia (in):	30.00	30.00	24.00
Slope (ft/ft):	0.0145	0.0151	0.0042
Up Invert (ft):	1281.52	1282.43	1283.35
Dn Invert (ft):	1280.59	1281.57	1282.70
Max Q (cfs):	20.56	20.57	20.59
Max Vel (ft/s):	7.93	6.73	4.59
Max Depth (ft):	1.30	1.49	1.34



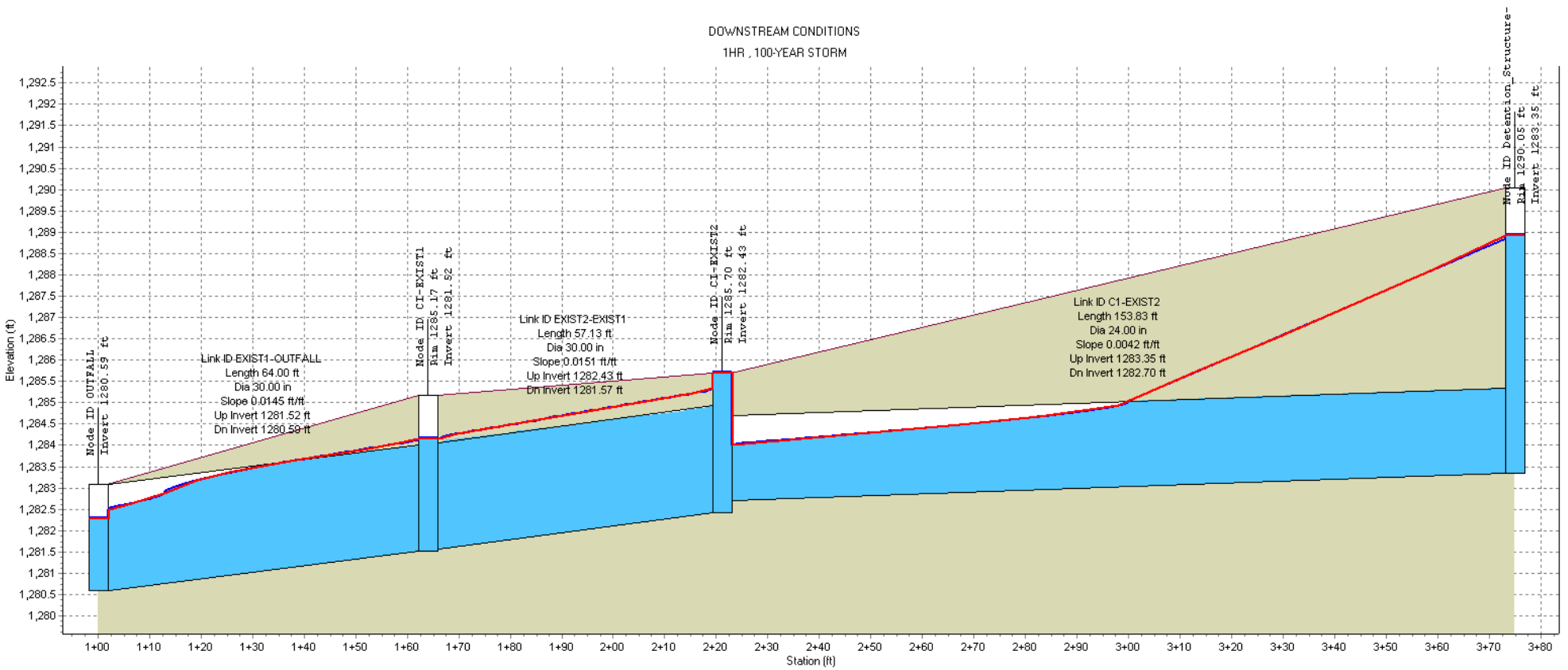
Node ID:	OUTFALL	C1-EXIST1	C1-EXIST2	
Rim (ft):		1285.17	1285.70	1290.05
Invert (ft):	1280.59	1281.52	1282.43	1283.35
Min Pipe Cover (ft):				0.00
Max HGL (ft):	1282.22	1283.91	1285.33	1286.81

Link ID:	EXIST1-OUTFALL	EXIST2-EXIST1	C1-EXIST2
Length (ft):	64.00	57.13	153.83
Dia (in):	30.00	30.00	24.00
Slope (ft/ft):	0.0145	0.0151	0.0042
Up Invert (ft):	1281.52	1282.43	1283.35
Dn Invert (ft):	1280.59	1281.57	1282.70
Max Q (cfs):	37.71	37.75	37.75
Max Vel (ft/s):	8.91	7.77	6.01
Max Depth (ft):	2.01	2.42	2.00



Node ID:	OUTFALL	CI-EXIST1	CI-EXIST2	
Rim (ft):		1285.17	1285.70	1290.05
Invert (ft):	1280.59	1281.52	1282.43	1283.35
Min Pipe Cover (ft):				0.00
Max HGL (ft):	1282.28	1284.16	1285.70	1287.88

Link ID:	EXIST1-OUTFALL	EXIST2-EXIST1	C1-EXIST2
Length (ft):	64.00	57.13	153.83
Dia (in):	30.00	30.00	24.00
Slope (ft/ft):	0.0145	0.0151	0.0042
Up Invert (ft):	1281.52	1282.43	1283.35
Dn Invert (ft):	1280.59	1281.57	1282.70
Max Q (cfs):	39.61	39.61	45.87
Max Vel (ft/s):	9.01	8.07	7.30
Max Depth (ft):	2.10	2.50	2.00



Node ID:	OUTFALL	C1-EXIST1	C1-EXIST2	
Rim (ft):		1285.17	1285.70	1290.05
Invert (ft):	1280.59	1281.52	1282.43	1283.35
Min Pipe Cover (ft):				0.00
Max HGL (ft):	1282.28	1284.16	1285.70	1288.94

Link ID:	EXIST1-OUTFALL	EXIST2-EXIST1	C1-EXIST2
Length (ft):	64.00	57.13	153.83
Dia (in):	30.00	30.00	24.00
Slope (ft/ft):	0.0145	0.0151	0.0042
Up Invert (ft):	1281.52	1282.43	1283.35
Dn Invert (ft):	1280.59	1281.57	1282.70
Max Q (cfs):	39.61	39.61	55.94
Max Vel (ft/s):	9.01	8.07	8.90
Max Depth (ft):	2.10	2.50	2.00

APPENDIX C

WATER QUALITY ANALYSIS CALCULATIONS

1550 E. Republic Road
Springfield, MO 65804
Ph: 417.888.0645

Xtreme Exteriors - Police + Xtreme **11.22.2024**
Nixa, MO
Water Quality Calculations

Volume Required for Dry Detention (DCIA Method)	1/2" Runoff From DCIA
Paved Street Area (sqft):	250,334
Number of Lots:	-
Average Impervious Area per Lot (sqft):	-
Impervious Area (sqft):	250,334
DCIA (sqft):	
WQCV for the First 1/2" of Runoff (ft^3):	10,431
Volume Required for Dry Detention (125% of WQCV) (ft^3):	**13,038**

Volume Required for Dry Detention (SCS Method)	Runoff From First 1" Over 24 Hrs
Drainage Area (ac):	28.00
Curve Number (TR-55):	86.74
P, Rainfall (in/hr):	1.00
S, maximum potential retention (in):	1.53
Ia, Initial Abstraction (in):	0.31
Q, Runoff (in):	0.22
Runoff Volume (ft^3):	22,038
Volume Required for Dry Detention (125% of WQCV) (ft^3):	**27,548**

Volume Provided (Conic Method)					
Elevation (ft)	Area (sqft)	Area (ac)	Volume (ft^3)	Cumulative Volume (ft^3)	Cumulative Volume (acre-ft)
1,283.45	-	0.0000	-	-	0.0000
1,284.00	650	0.0149	119	119	0.0027
1,285.00	5,157	0.1184	2,546	2,665	0.0612
1,286.00	13,875	0.3185	9,164	11,829	0.2716
1,286.88	22,411	0.5145	15,816	27,645	0.6346
1,287.00	23,575	0.5412	2,759	30,404	0.6980
1,288.00	33,464	0.7682	28,376	58,780	1.3494
1,289.00	42,792	0.9824	38,033	96,812	2.2225
1,290.00	50,595	1.1615	46,639	143,451	3.2932
1,291.00	56,302	1.2925	53,423	196,874	4.5196

Volume Provided (Conic Method)	
Controlling Volume (ft^3):	27,548
Elevation at Controlling Volume (ft):	1,286.88

1550 E. Republic Road
Springfield, MO 65804
Ph: 417.888.0645

Xtreme Exteriors - Full Buildout **09.20.2024**
Nixa, MO
Water Quality Calculations

Volume Required for Dry Detention (DCIA Method)	1/2" Runoff From DCIA
Paved Street Area (sqft):	996,783
Number of Lots:	-
Average Impervious Area per Lot (sqft):	-
Impervious Area (sqft):	996,783
DCIA (sqft):	
WQCV for the First 1/2" of Runoff (ft^3):	41,533
Volume Required for Dry Detention (125% of WQCV) (ft^3):	**51,916**

Volume Required for Dry Detention (SCS Method)	Runoff From First 1" Over 24 Hrs
Drainage Area (ac):	28.00
Curve Number (TR-55):	92.80
P, Rainfall (in/hr):	1.00
S, maximum potential retention (in):	0.78
Ia, Initial Abstraction (in):	0.16
Q, Runoff (in):	0.44
Runoff Volume (ft^3):	44,761
Volume Required for Dry Detention (125% of WQCV) (ft^3):	**55,951**

Volume Provided (Conic Method)					
Elevation (ft)	Area (sqft)	Area (ac)	Volume (ft^3)	Cumulative Volume (ft^3)	Cumulative Volume (acre-ft)
1,283.45	-	0.0000	-	-	0.0000
1,284.00	650	0.0149	119	119	0.0027
1,285.00	5,157	0.1184	2,546	2,665	0.0612
1,286.00	13,875	0.3185	9,164	11,829	0.2716
1,287.00	23,575	0.5412	18,512	30,341	0.6965
1,287.92	32,673	0.7501	25,761	56,101	1.2879
1,288.00	33,464	0.7682	2,645	58,747	1.3486
1,289.00	42,792	0.9824	38,033	96,779	2.2217
1,290.00	50,595	1.1615	46,639	143,418	3.2924
1,291.00	56,302	1.2925	53,423	196,841	4.5189

Volume Provided (Conic Method)	
Controlling Volume (ft^3):	55,951
Elevation at Controlling Volume (ft):	1,287.92

OUTLET STRUCTURE DISCHARGE COMPUTATIONS
FOR EXTENDED DETENTION BASINS

TOTH & ASSOCIATES
1550 E. Republic Road
Springfield, MO 65804
Ph: 417.888.0645

****ENTER THE FOLLOWING INFORMATION*****

PROJECT: **Xtreme Exteriors (Police + Xtreme)**
Date Printed: 9/20/2024

RED TEXT INDICATES INPUT CELLS

RISER PIPE DIAMETER:		INCHES
OUTLET PIPE DIA.:		INCHES
PERFORATION DIA:	1	INCHES
# HOLES PER ROW:	4	
ORIFICE AREA: (TOTAL FOR ROW)	3.1400	SQ. IN.
ROW SPACING:	4	INCHES
NUMBER OF ROWS:	2	

FLOWLINE ELEVATION AT BOTTOM OF BASIN: 1283.45

MAXIMUM PONDING ELEV. FOR EXTENDED DETENTION: 1286.88

****

IN COLUMN A, ENTER WATER ELEVATIONS AT 3" INCREMENTS BEGINNING WITH THE ELEVATION ENTERED ABOVE FOR MAXIMUM PONDING ELEVATION FOR EXTENDED DETENTION AND PROCEEDING DOWNWARD TO THE FLOWLINE ELEVATION AT THE BOTTOM OF THE BASIN

IN COLUMN B ENTER THE AREA CORRESPONDING TO THE ELEVATION IN COLUMN A

ENTER THE ELEVATION OF EACH ROW OF HOLES BELOW THE ROW NUMBER
ENTER ELEVATION 9999.0 FOR ROWS NOT USED (ROW 1 to be the bottom row)

RESULT IS DISPLAYED AT THE BOTTOM OF COLUMN K

WATER ELEVATION	AREA AT ELEVATION	AVERAGE AREA (SF)	AVERAGE VOL (CF)	OUTFLOW RATE (CFS)											COMBINED OUTFLOW	DRAIN TIME (HOURS)
				ROW 1	ROW 2	ROW 3	ROW 4	ROW 5	ROW 6	ROW 7	ROW 8	ROW 9	ROW 10	ROW 11		
				1283.45	1284.78	99999.00	99999.00	9999.00	9999.00	9999.00	9999.00	9999.00	9999.00	9999.00		
1286.88	22411	21198.50	5300	0.194	0.152	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.346	4.249
1286.63	19986	18773.50	4693	0.187	0.143	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.330	3.952
1286.38	17561	16348.50	4087	0.180	0.133	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.312	3.634
1286.13	15136	13982.50	3496	0.172	0.122	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.294	3.306
1285.88	12829	11739.00	2935	0.164	0.110	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.274	2.979
1285.63	10649	9559.50	2390	0.155	0.097	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.252	2.638
1285.38	8470	7380.00	1845	0.146	0.081	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.227	2.258
1285.13	6290	5453.00	1363	0.136	0.062	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.198	1.913
1284.88	4616	4052.50	1013	0.126	0.033	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.158	1.779
1284.63	3489	2926.00	732	0.114	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.114	1.782
1284.38	2363	1799.50	450	0.101	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.101	1.234
1284.13	1236	872.00	218	0.087	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.087	0.699
1283.88	508	360.50	90	0.069	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.069	0.364
1283.63	213	106.50	19	0.045	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.045	0.120
1283.45	0	0.00	0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
			28630													

TOTAL DRAIN TIME 30.9 hours

OUTLET STRUCTURE DISCHARGE COMPUTATIONS
FOR EXTENDED DETENTION BASINS

TOTH & ASSOCIATES
1550 E. Republic Road
Springfield, MO 65804
Ph: 417.888.0645

****ENTER THE FOLLOWING INFORMATION*****

PROJECT: **Xtreme Exteriors (Full Buildout)**
Date Printed: 9/20/2024

RED TEXT INDICATES INPUT CELLS

RISER PIPE DIAMETER:		INCHES
OUTLET PIPE DIA.:		INCHES
PERFORATION DIA:	1	INCHES
# HOLES PER ROW:	6	
ORIFICE AREA: (TOTAL FOR ROW)	4.7100	SQ. IN.
ROW SPACING:	4	INCHES
NUMBER OF ROWS:	3	
FLOWLINE ELEVATION AT BOTTOM OF BASIN:	1283.45	
MAXIMUM PONDING ELEV. FOR EXTENDED DETENTION:	1287.92	

****

IN COLUMN A, ENTER WATER ELEVATIONS AT 3" INCREMENTS BEGINNING WITH THE ELEVATION ENTERED ABOVE FOR MAXIMUM PONDING ELEVATION FOR EXTENDED DETENTION AND PROCEEDING DOWNWARD TO THE FLOWLINE ELEVATION AT THE BOTTOM OF THE BASIN

IN COLUMN B ENTER THE AREA CORRESPONDING TO THE ELEVATION IN COLUMN A

ENTER THE ELEVATION OF EACH ROW OF HOLES BELOW THE ROW NUMBER
ENTER ELEVATION 9999.0 FOR ROWS NOT USED (ROW 1 to be the bottom row)

RESULT IS DISPLAYED AT THE BOTTOM OF COLUMN K

WATER ELEVATION	AREA AT ELEVATION	AVERAGE AREA (SF)	AVERAGE VOL (CF)	OUTFLOW RATE (CFS)											COMBINED OUTFLOW	DRAIN TIME (HOURS)
				ROW 1	ROW 2	ROW 3	ROW 4	ROW 5	ROW 6	ROW 7	ROW 8	ROW 9	ROW 10	ROW 11		
				1283.45	1284.78	1286.12	9999.00	9999.00	9999.00	9999.00	9999.00	9999.00	9999.00	9999.00		
1287.92	32673	31437.00	7859	0.333	0.279	0.211	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.823	2.651
1287.67	30201	28964.50	7241	0.324	0.268	0.196	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.787	2.555
1287.42	27728	26492.00	6623	0.314	0.256	0.180	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.749	2.455
1287.17	25256	24027.50	6007	0.304	0.243	0.162	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.709	2.354
1286.92	22799	21586.50	5397	0.293	0.230	0.141	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.665	2.255
1286.67	20374	19161.50	4790	0.283	0.216	0.117	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.616	2.160
1286.42	17949	16736.50	4184	0.271	0.201	0.087	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.560	2.077
1286.17	15524	14351.00	3588	0.260	0.185	0.036	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.482	2.069
1285.92	13178	12088.00	3022	0.248	0.168	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.415	2.021
1285.67	10998	9908.50	2477	0.235	0.148	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.383	1.797
1285.42	8819	7729.00	1932	0.221	0.126	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.347	1.548
1285.17	6639	5717.50	1429	0.207	0.098	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.304	1.304
1284.92	4796	4233.00	1058	0.191	0.058	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.249	1.180
1284.67	3670	3106.50	777	0.174	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.174	1.240
1284.42	2543	1979.50	495	0.155	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.155	0.886
1284.17	1416	985.50	246	0.134	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.134	0.512
1283.92	555	407.50	102	0.108	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.108	0.262
1283.67	260	130.00	29	0.074	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.074	0.108
1283.45	0	0.00	0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
			57256													

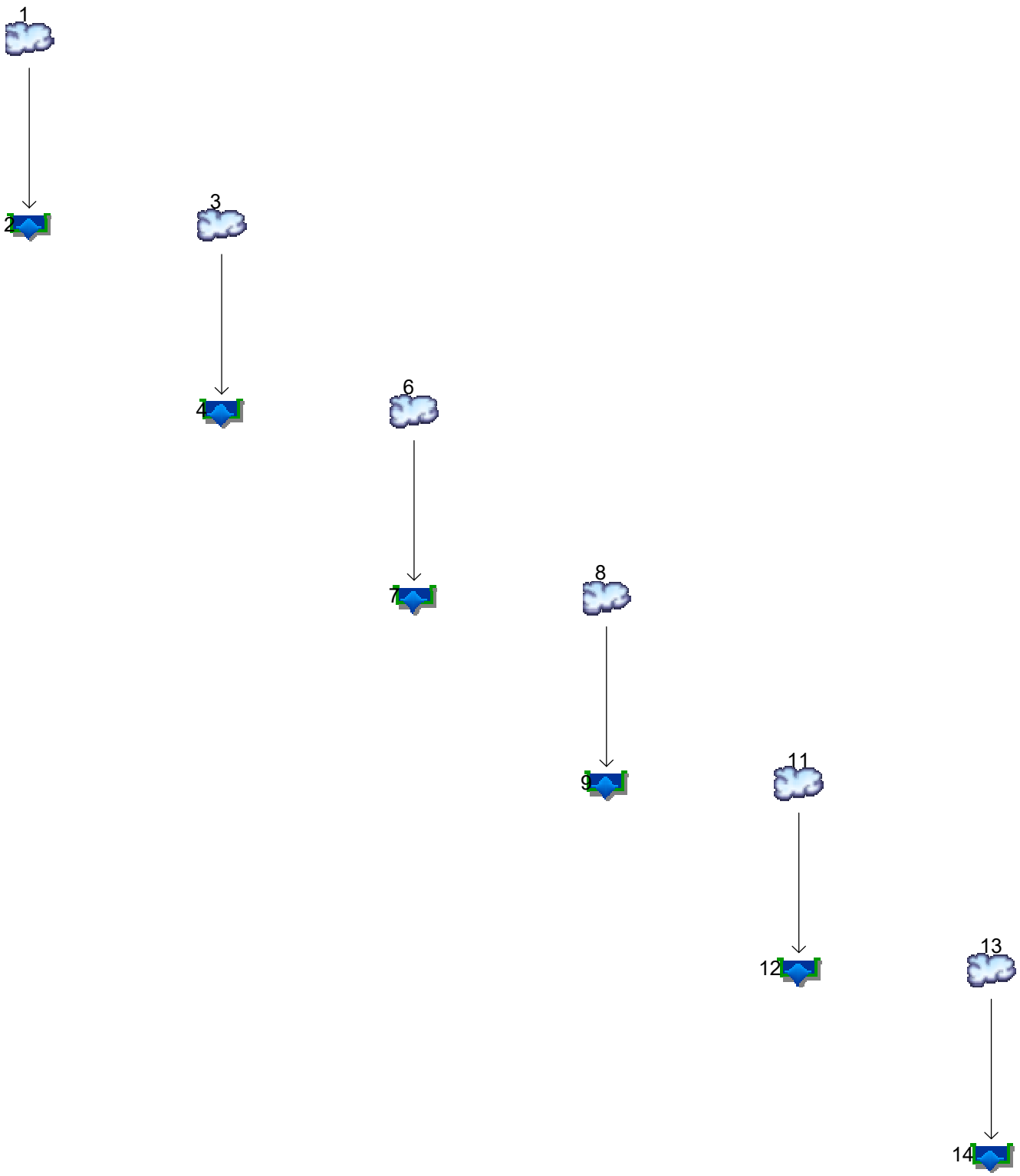
TOTAL DRAIN TIME 29.4 hours

APPENDIX D

SINKHOLE ANALYSIS

TOTH & ASSOCIATES

Watershed Model Schematic



Hydrograph Return Period Recap

Hyd. No.	Hydrograph type (origin)	Inflow hyd(s)	Peak Outflow (cfs)								Hydrograph Description
			1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr	
1	SCS Runoff	------	-------	-------	-------	-------	-------	-------	-------	3.441	Existing SH-A
2	Reservoir	1	-------	-------	-------	-------	-------	-------	-------	3.367	SH-A to SINKHOLE A
3	SCS Runoff	------	-------	-------	-------	-------	-------	-------	-------	7.146	Existing SH-D
4	Reservoir	3	-------	-------	-------	-------	-------	-------	-------	7.115	SH-D to SINKHOLE D
6	SCS Runoff	------	-------	-------	-------	-------	-------	-------	-------	3.441	SH-A-1
7	Reservoir	6	-------	-------	-------	-------	-------	-------	-------	3.367	SH-A-1 to SINKHOLE A
8	SCS Runoff	------	-------	-------	-------	-------	-------	-------	-------	4.590	SH-D-1
9	Reservoir	8	-------	-------	-------	-------	-------	-------	-------	4.546	SH-D-1 to SINKHOLE D
11	SCS Runoff	------	-------	-------	-------	-------	-------	-------	-------	3.441	SH-A-2
12	Reservoir	11	-------	-------	-------	-------	-------	-------	-------	3.367	SH-A-2 to SINKHOLE A
13	SCS Runoff	------	-------	-------	-------	-------	-------	-------	-------	1.359	Existing SH-D-2
14	Reservoir	13	-------	-------	-------	-------	-------	-------	-------	1.059	SH-D-2 to SINKHOLE D

Hydrograph Summary Report

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

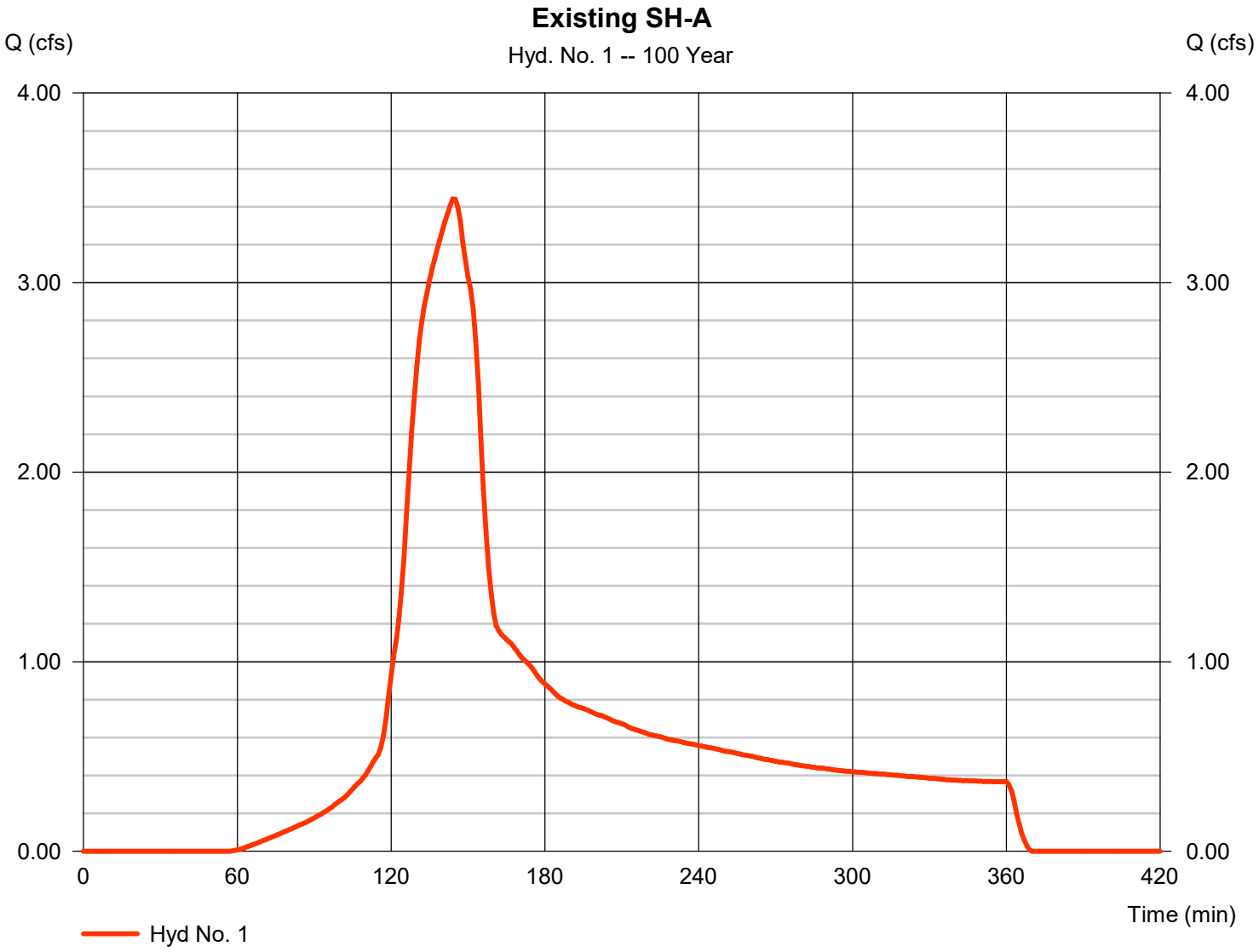
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	3.441	1	144	13,827	------	------	------	Existing SH-A
2	Reservoir	3.367	1	146	10,272	1	1287.54	3,865	SH-A to SINKHOLE A
3	SCS Runoff	7.146	1	150	30,546	------	------	------	Existing SH-D
4	Reservoir	7.115	1	152	28,934	3	1289.85	2,606	SH-D to SINKHOLE D
6	SCS Runoff	3.441	1	144	13,827	------	------	------	SH-A-1
7	Reservoir	3.367	1	146	10,272	6	1287.54	3,865	SH-A-1 to SINKHOLE A
8	SCS Runoff	4.590	1	145	18,558	------	------	------	SH-D-1
9	Reservoir	4.546	1	147	16,946	8	1289.76	2,349	SH-D-1 to SINKHOLE D
11	SCS Runoff	3.441	1	144	13,827	------	------	------	SH-A-2
12	Reservoir	3.367	1	146	10,272	11	1287.54	3,865	SH-A-2 to SINKHOLE A
13	SCS Runoff	1.359	1	145	5,432	------	------	------	Existing SH-D-2
14	Reservoir	1.059	1	153	3,820	13	1289.60	1,891	SH-D-2 to SINKHOLE D

Hydrograph Report

Hyd. No. 1

Existing SH-A

Hydrograph type	=	SCS Runoff	Peak discharge	=	3.441 cfs
Storm frequency	=	100 yrs	Time to peak	=	144 min
Time interval	=	1 min	Hyd. volume	=	13,827 cuft
Drainage area	=	1.000 ac	Curve number	=	84
Basin Slope	=	2.0 %	Hydraulic length	=	325 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	5.46 in	Distribution	=	SCS 6-Hr
Storm duration	=	6.00 hrs	Shape factor	=	484



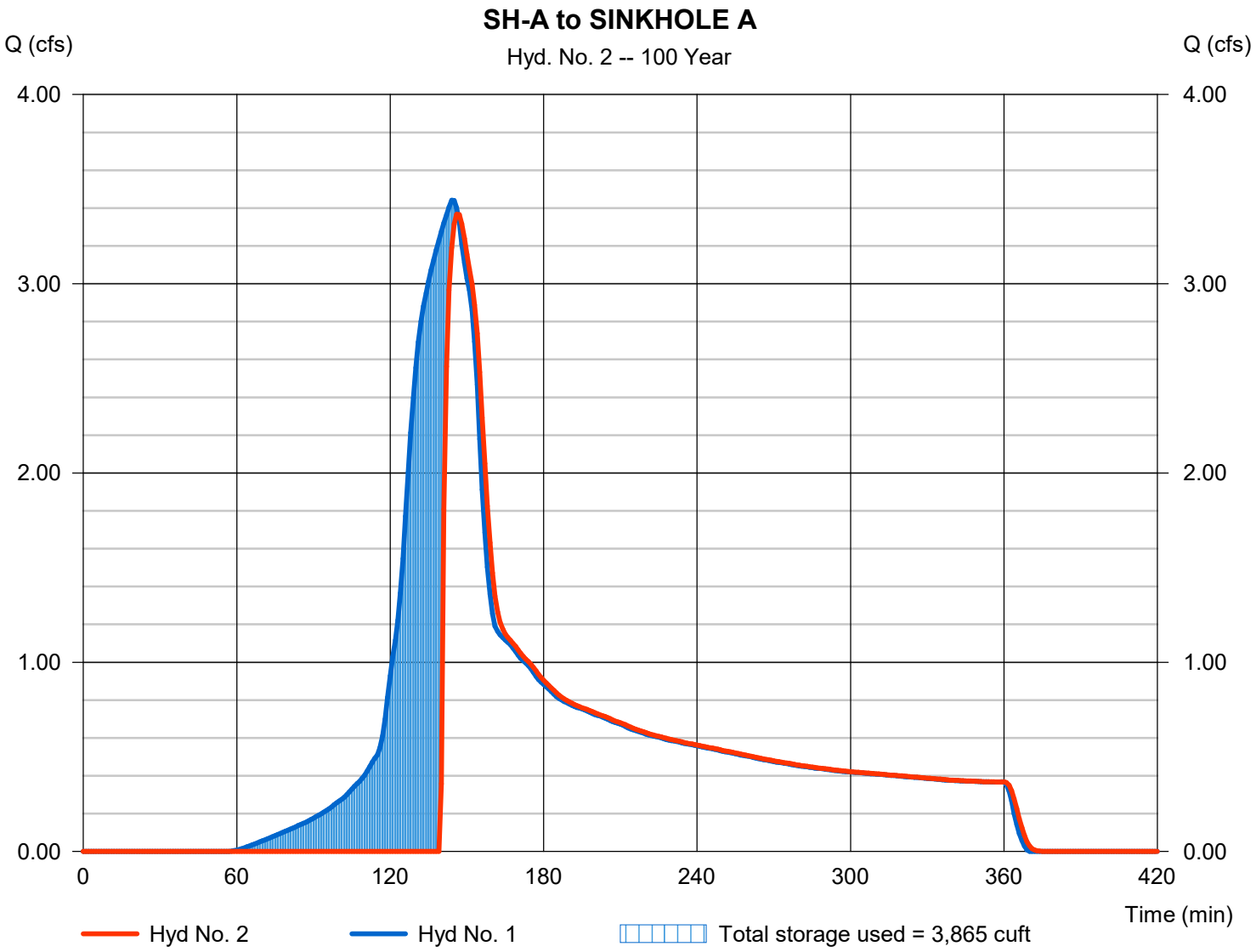
Hydrograph Report

Hyd. No. 2

SH-A to SINKHOLE A

Hydrograph type	=	Reservoir	Peak discharge	=	3.367 cfs
Storm frequency	=	100 yrs	Time to peak	=	146 min
Time interval	=	1 min	Hyd. volume	=	10,272 cuft
Inflow hyd. No.	=	1 - Existing SH-A	Max. Elevation	=	1287.54 ft
Reservoir name	=	Sinkhole A	Max. Storage	=	3,865 cuft

Storage Indication method used.



Pond Report

Pond No. 1 - Sinkhole A

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 1286.50 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	1286.50	65	0	0
0.50	1287.00	3,371	651	651
1.00	1287.50	8,659	2,905	3,556
1.50	1288.00	8,659	4,329	7,885
2.00	1288.50	8,659	4,329	12,214

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

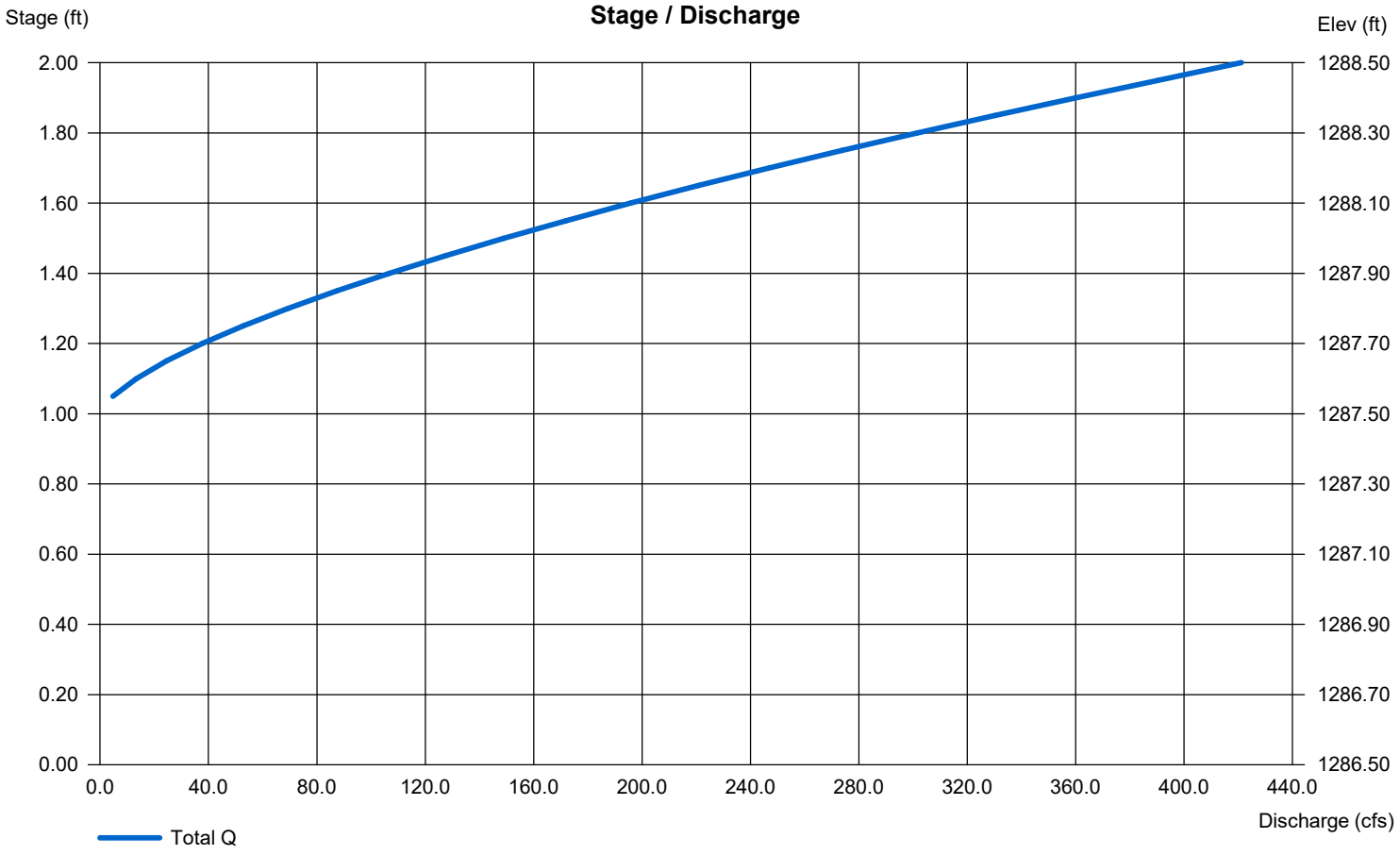
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 162.00	0.00	0.00	0.00
Crest El. (ft)	= 1287.50	0.00	0.00	0.00
Weir Coeff.	= 2.60	3.33	3.33	3.33
Weir Type	= Broad	---	---	---
Multi-Stage	= No	No	No	No

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

TW Elev. (ft) = 0.00

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

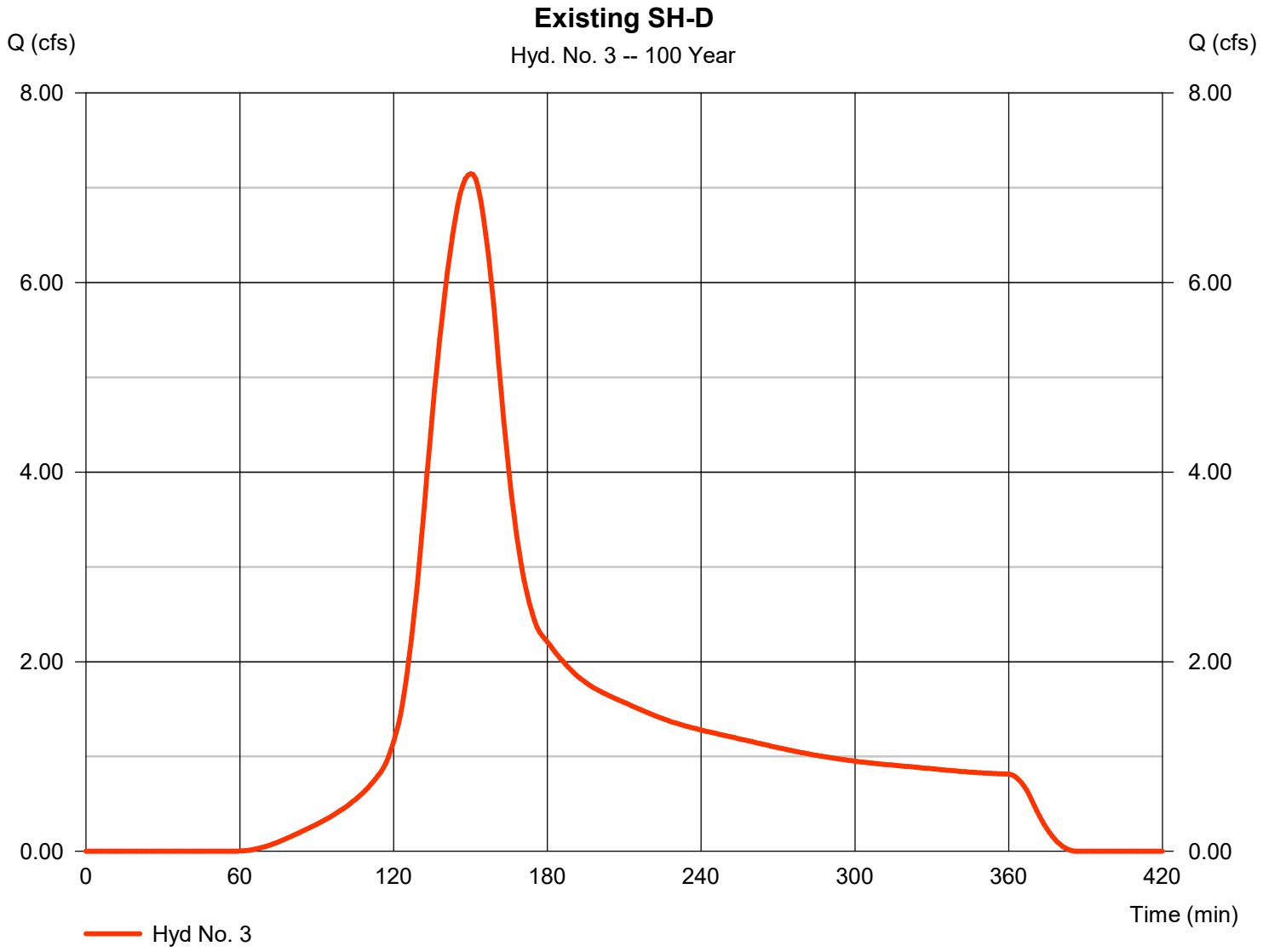


Hydrograph Report

Hyd. No. 3

Existing SH-D

Hydrograph type	=	SCS Runoff	Peak discharge	=	7.146 cfs
Storm frequency	=	100 yrs	Time to peak	=	150 min
Time interval	=	1 min	Hyd. volume	=	30,546 cuft
Drainage area	=	2.250 ac	Curve number	=	84
Basin Slope	=	2.8 %	Hydraulic length	=	777 ft
Tc method	=	User	Time of conc. (Tc)	=	16.30 min
Total precip.	=	5.46 in	Distribution	=	SCS 6-Hr
Storm duration	=	6.00 hrs	Shape factor	=	484



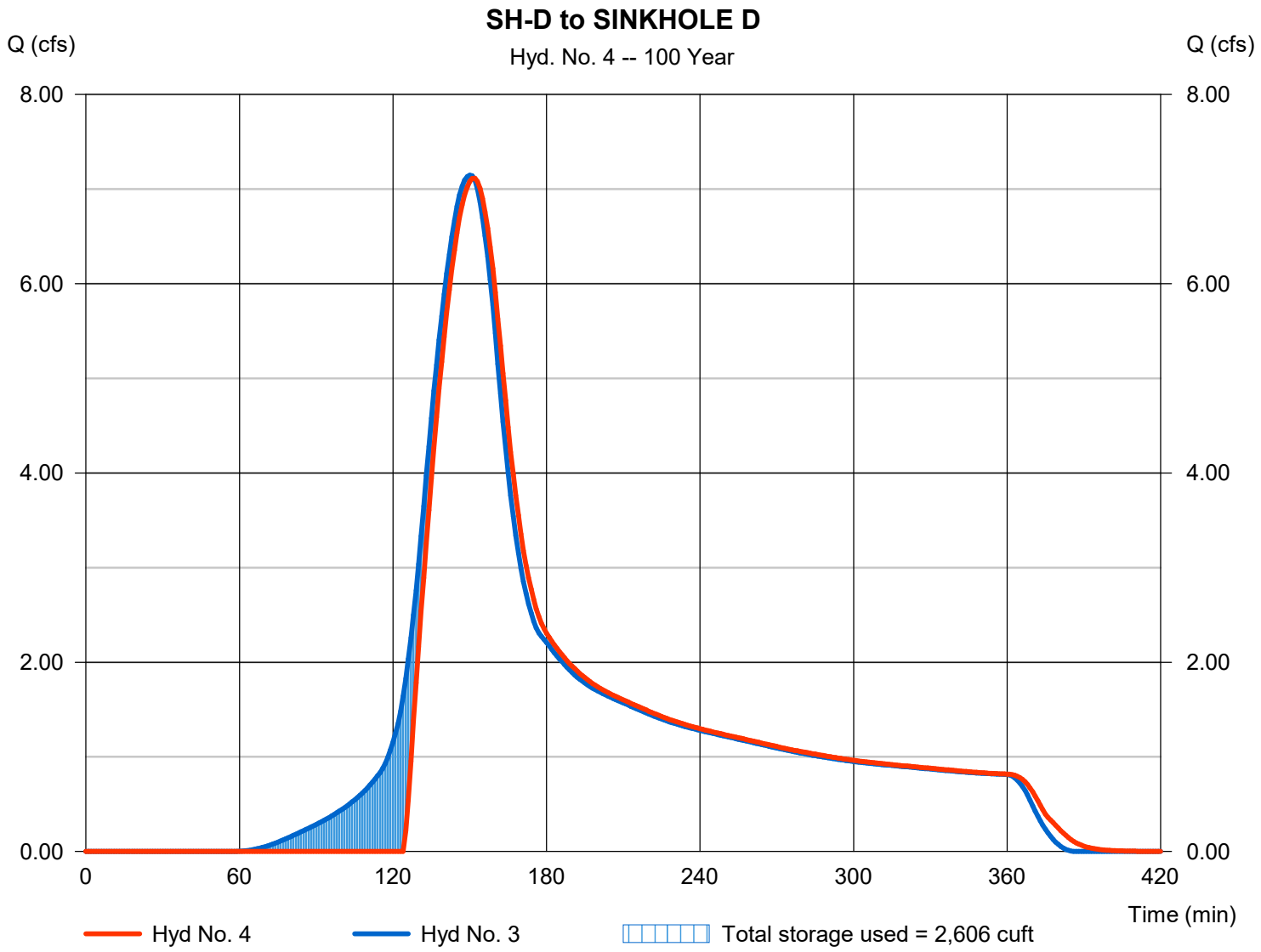
Hydrograph Report

Hyd. No. 4

SH-D to SINKHOLE D

Hydrograph type	=	Reservoir	Peak discharge	=	7.115 cfs
Storm frequency	=	100 yrs	Time to peak	=	152 min
Time interval	=	1 min	Hyd. volume	=	28,934 cuft
Inflow hyd. No.	=	3 - Existing SH-D	Max. Elevation	=	1289.85 ft
Reservoir name	=	Sinkhole D	Max. Storage	=	2,606 cuft

Storage Indication method used.



Pond Report

Pond No. 2 - Sinkhole D

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 1288.50 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	1288.50	589	0	0
0.50	1289.00	1,591	525	525
1.00	1289.50	2,815	1,087	1,612
1.50	1290.00	2,815	1,407	3,019
2.00	1290.50	2,815	1,407	4,426

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

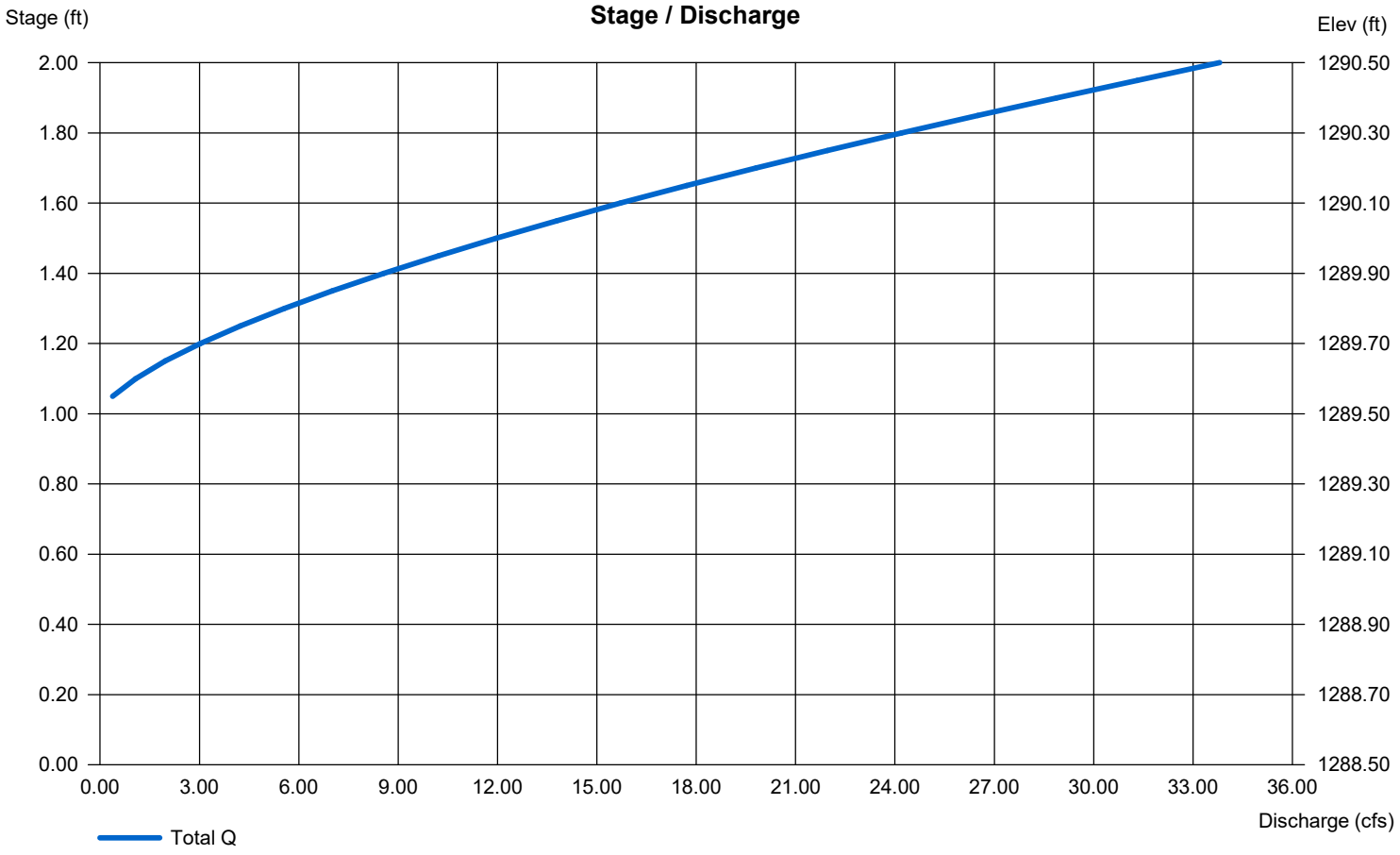
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 13.00	0.00	0.00	0.00
Crest El. (ft)	= 1289.50	0.00	0.00	0.00
Weir Coeff.	= 2.60	3.33	3.33	3.33
Weir Type	= Broad	---	---	---
Multi-Stage	= No	No	No	No

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

TW Elev. (ft) = 0.00

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

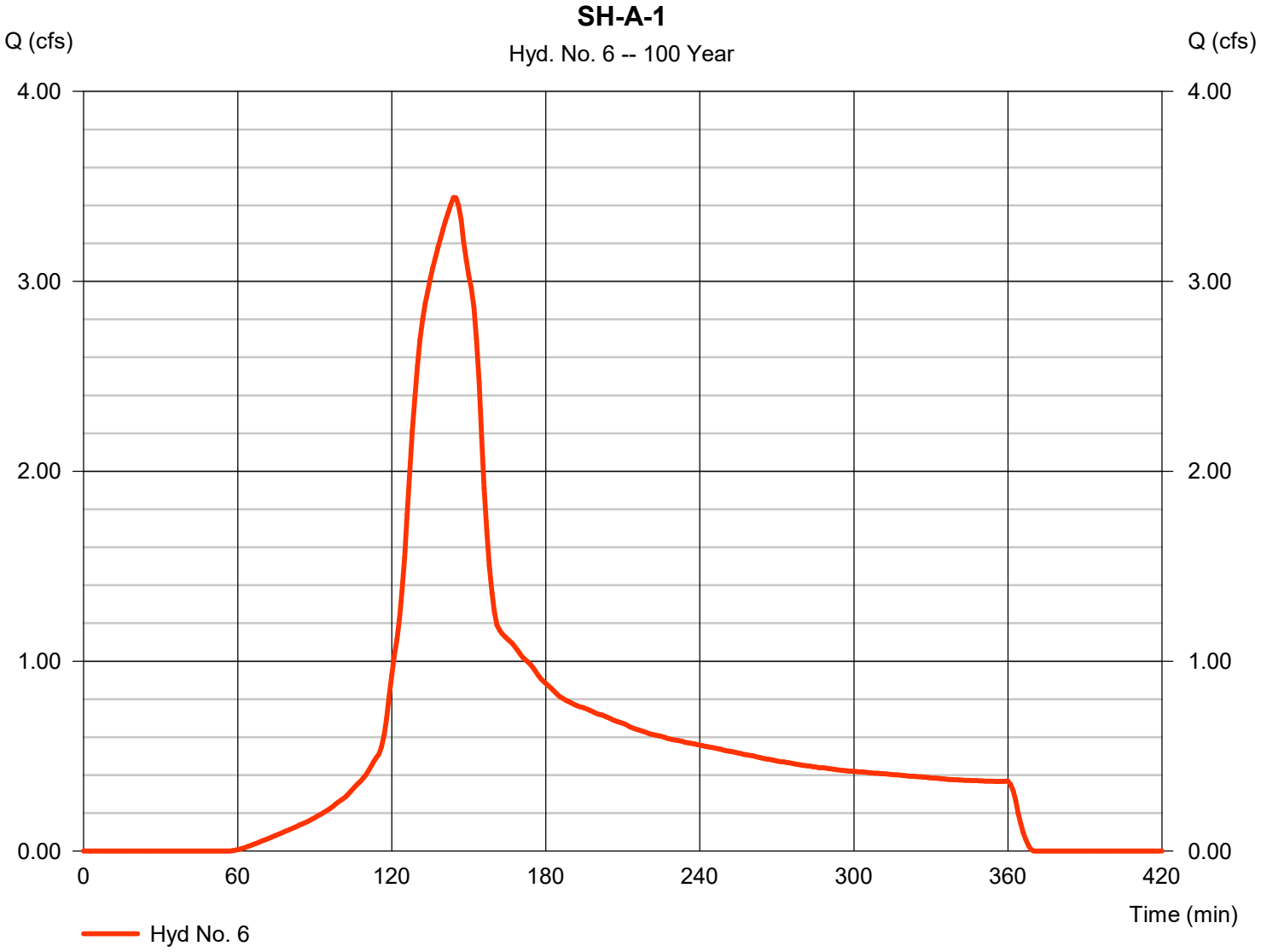


Hydrograph Report

Hyd. No. 6

SH-A-1

Hydrograph type	=	SCS Runoff	Peak discharge	=	3.441 cfs
Storm frequency	=	100 yrs	Time to peak	=	144 min
Time interval	=	1 min	Hyd. volume	=	13,827 cuft
Drainage area	=	1.000 ac	Curve number	=	84
Basin Slope	=	2.0 %	Hydraulic length	=	325 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	5.46 in	Distribution	=	SCS 6-Hr
Storm duration	=	6.00 hrs	Shape factor	=	484



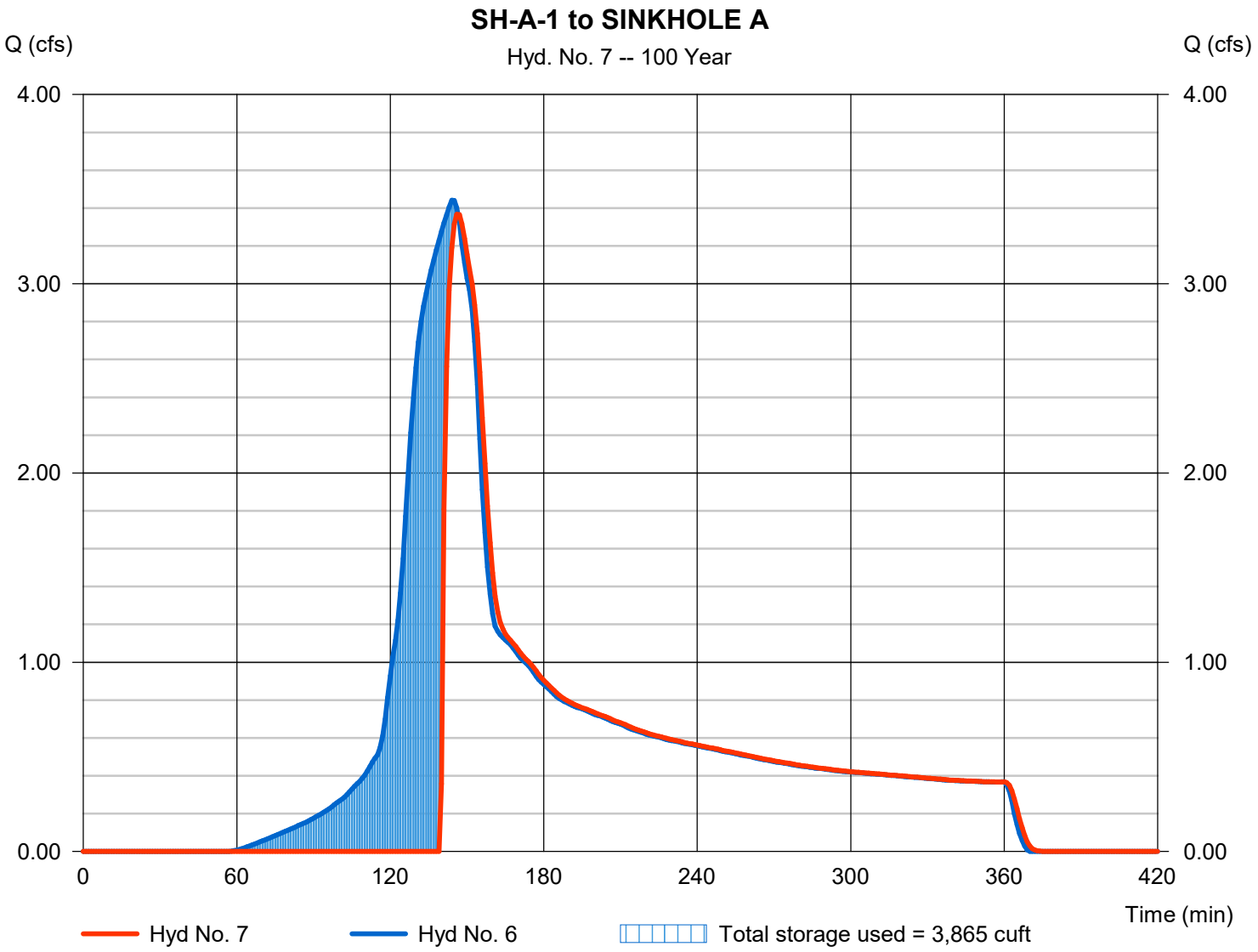
Hydrograph Report

Hyd. No. 7

SH-A-1 to SINKHOLE A

Hydrograph type	=	Reservoir	Peak discharge	=	3.367 cfs
Storm frequency	=	100 yrs	Time to peak	=	146 min
Time interval	=	1 min	Hyd. volume	=	10,272 cuft
Inflow hyd. No.	=	6 - SH-A-1	Max. Elevation	=	1287.54 ft
Reservoir name	=	Sinkhole A	Max. Storage	=	3,865 cuft

Storage Indication method used.



Pond Report

Pond No. 1 - Sinkhole A

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 1286.50 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	1286.50	65	0	0
0.50	1287.00	3,371	651	651
1.00	1287.50	8,659	2,905	3,556
1.50	1288.00	8,659	4,329	7,885
2.00	1288.50	8,659	4,329	12,214

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

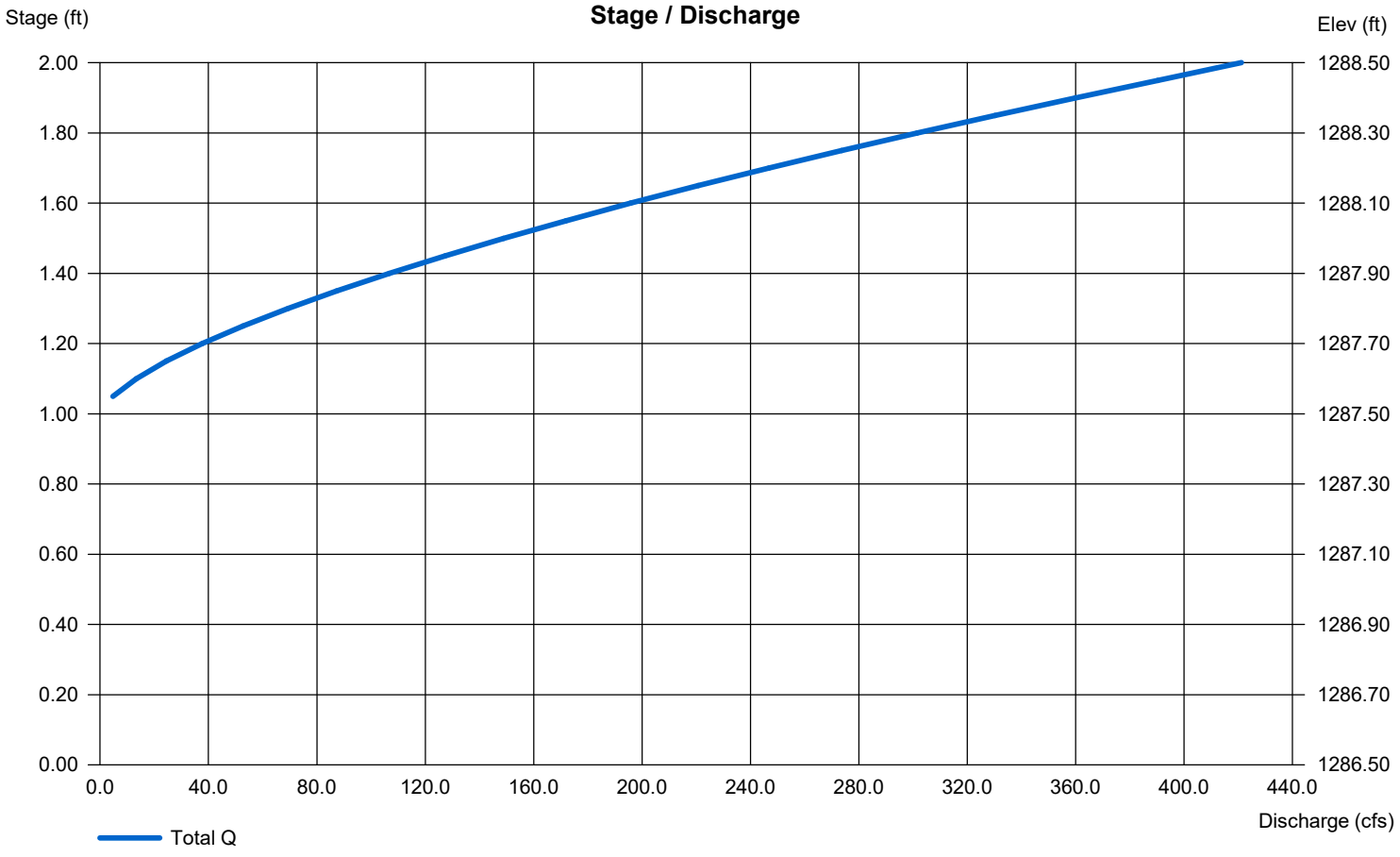
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 162.00	0.00	0.00	0.00
Crest El. (ft)	= 1287.50	0.00	0.00	0.00
Weir Coeff.	= 2.60	3.33	3.33	3.33
Weir Type	= Broad	---	---	---
Multi-Stage	= No	No	No	No

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

TW Elev. (ft) = 0.00

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

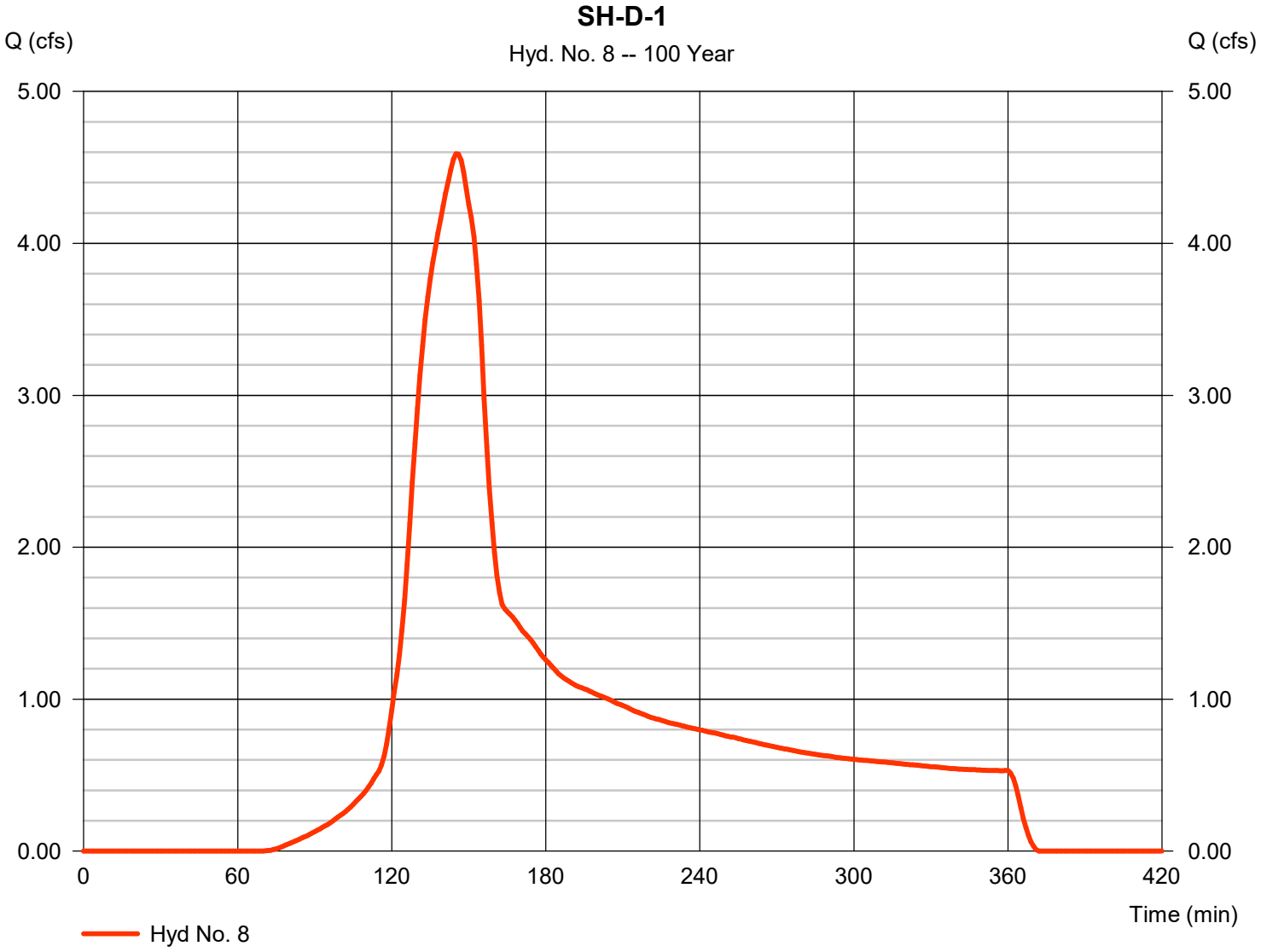


Hydrograph Report

Hyd. No. 8

SH-D-1

Hydrograph type	=	SCS Runoff	Peak discharge	=	4.590 cfs
Storm frequency	=	100 yrs	Time to peak	=	145 min
Time interval	=	1 min	Hyd. volume	=	18,558 cuft
Drainage area	=	1.590 ac	Curve number	=	80
Basin Slope	=	2.8 %	Hydraulic length	=	560 ft
Tc method	=	User	Time of conc. (Tc)	=	8.00 min
Total precip.	=	5.46 in	Distribution	=	SCS 6-Hr
Storm duration	=	6.00 hrs	Shape factor	=	484



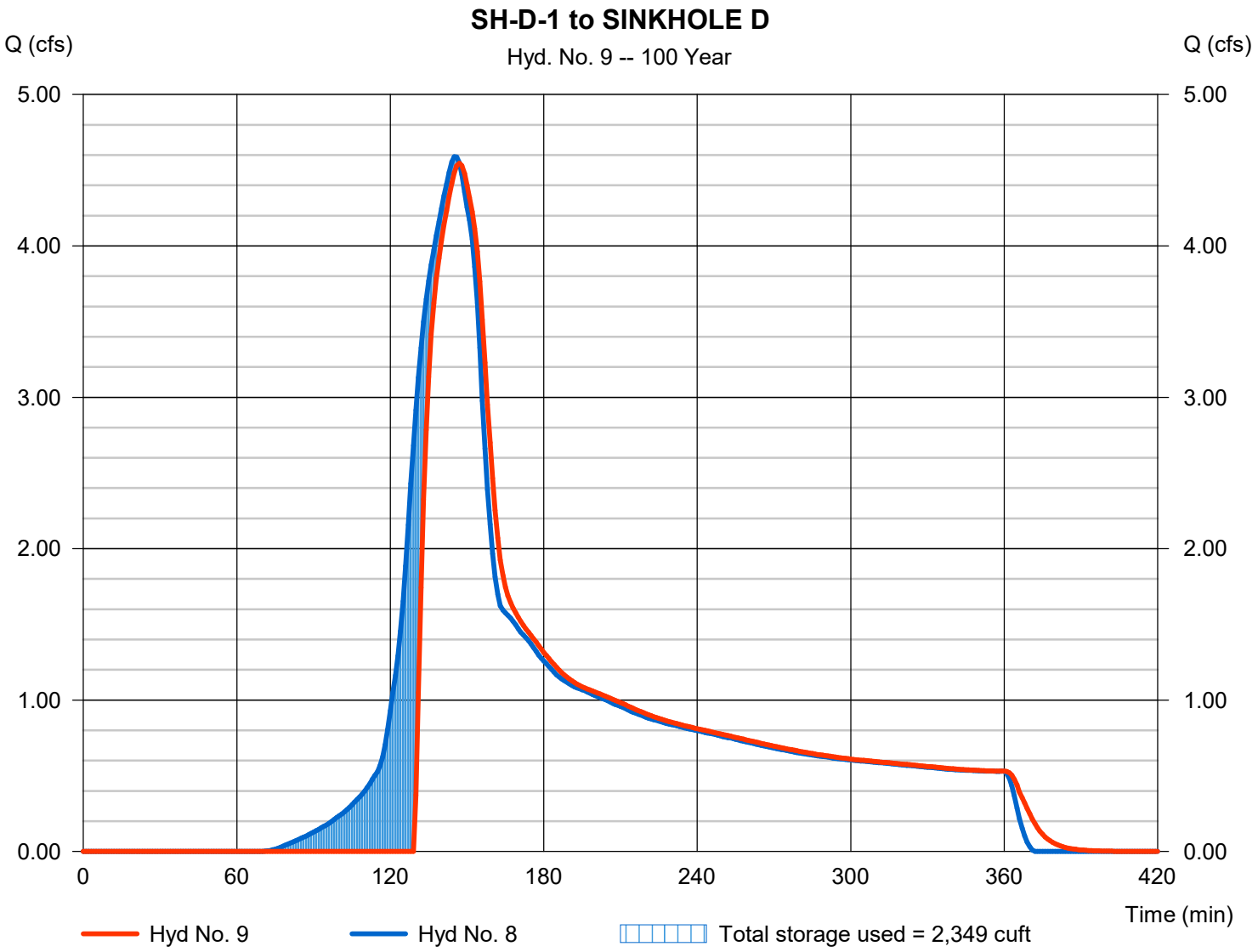
Hydrograph Report

Hyd. No. 9

SH-D-1 to SINKHOLE D

Hydrograph type	=	Reservoir	Peak discharge	=	4.546 cfs
Storm frequency	=	100 yrs	Time to peak	=	147 min
Time interval	=	1 min	Hyd. volume	=	16,946 cuft
Inflow hyd. No.	=	8 - SH-D-1	Max. Elevation	=	1289.76 ft
Reservoir name	=	Sinkhole D	Max. Storage	=	2,349 cuft

Storage Indication method used.



Pond Report

Pond No. 2 - Sinkhole D

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 1288.50 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	1288.50	589	0	0
0.50	1289.00	1,591	525	525
1.00	1289.50	2,815	1,087	1,612
1.50	1290.00	2,815	1,407	3,019
2.00	1290.50	2,815	1,407	4,426

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

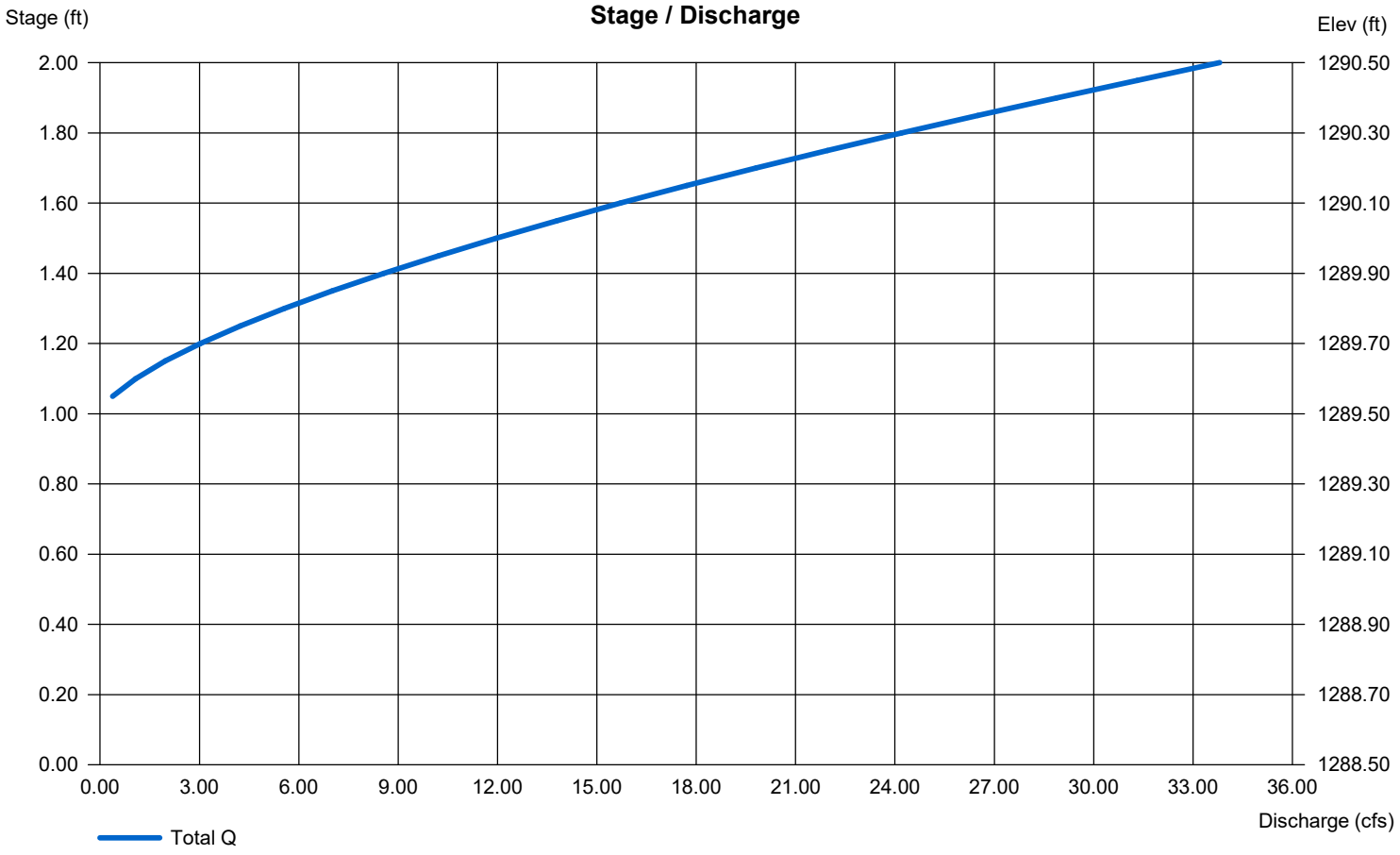
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 13.00	0.00	0.00	0.00
Crest El. (ft)	= 1289.50	0.00	0.00	0.00
Weir Coeff.	= 2.60	3.33	3.33	3.33
Weir Type	= Broad	---	---	---
Multi-Stage	= No	No	No	No

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

TW Elev. (ft) = 0.00

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

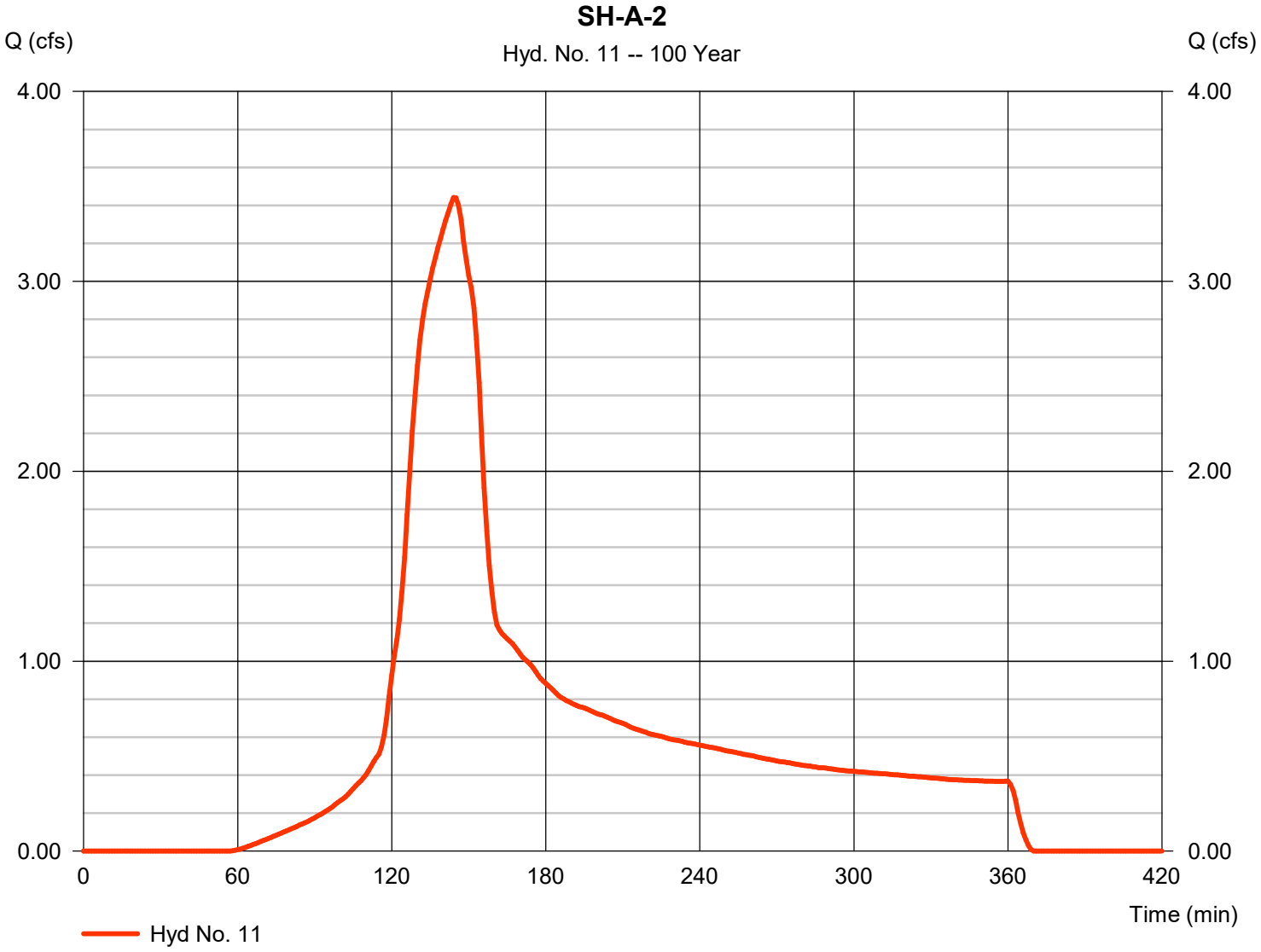


Hydrograph Report

Hyd. No. 11

SH-A-2

Hydrograph type	=	SCS Runoff	Peak discharge	=	3.441 cfs
Storm frequency	=	100 yrs	Time to peak	=	144 min
Time interval	=	1 min	Hyd. volume	=	13,827 cuft
Drainage area	=	1.000 ac	Curve number	=	84
Basin Slope	=	2.0 %	Hydraulic length	=	325 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	5.46 in	Distribution	=	SCS 6-Hr
Storm duration	=	6.00 hrs	Shape factor	=	484



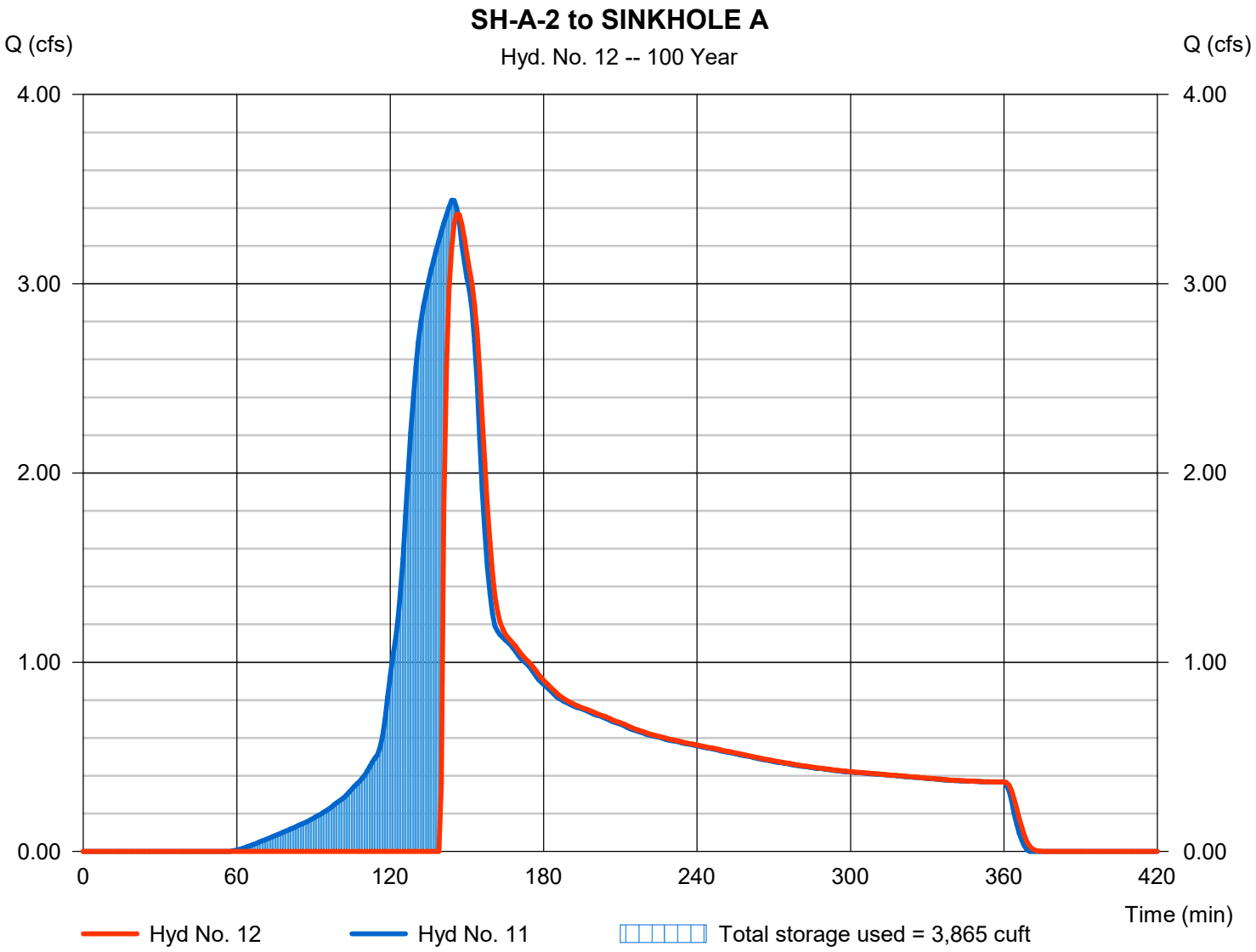
Hydrograph Report

Hyd. No. 12

SH-A-2 to SINKHOLE A

Hydrograph type	=	Reservoir	Peak discharge	=	3.367 cfs
Storm frequency	=	100 yrs	Time to peak	=	146 min
Time interval	=	1 min	Hyd. volume	=	10,272 cuft
Inflow hyd. No.	=	11 - SH-A-2	Max. Elevation	=	1287.54 ft
Reservoir name	=	Sinkhole A	Max. Storage	=	3,865 cuft

Storage Indication method used.



Pond Report

Pond No. 1 - Sinkhole A

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 1286.50 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	1286.50	65	0	0
0.50	1287.00	3,371	651	651
1.00	1287.50	8,659	2,905	3,556
1.50	1288.00	8,659	4,329	7,885
2.00	1288.50	8,659	4,329	12,214

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

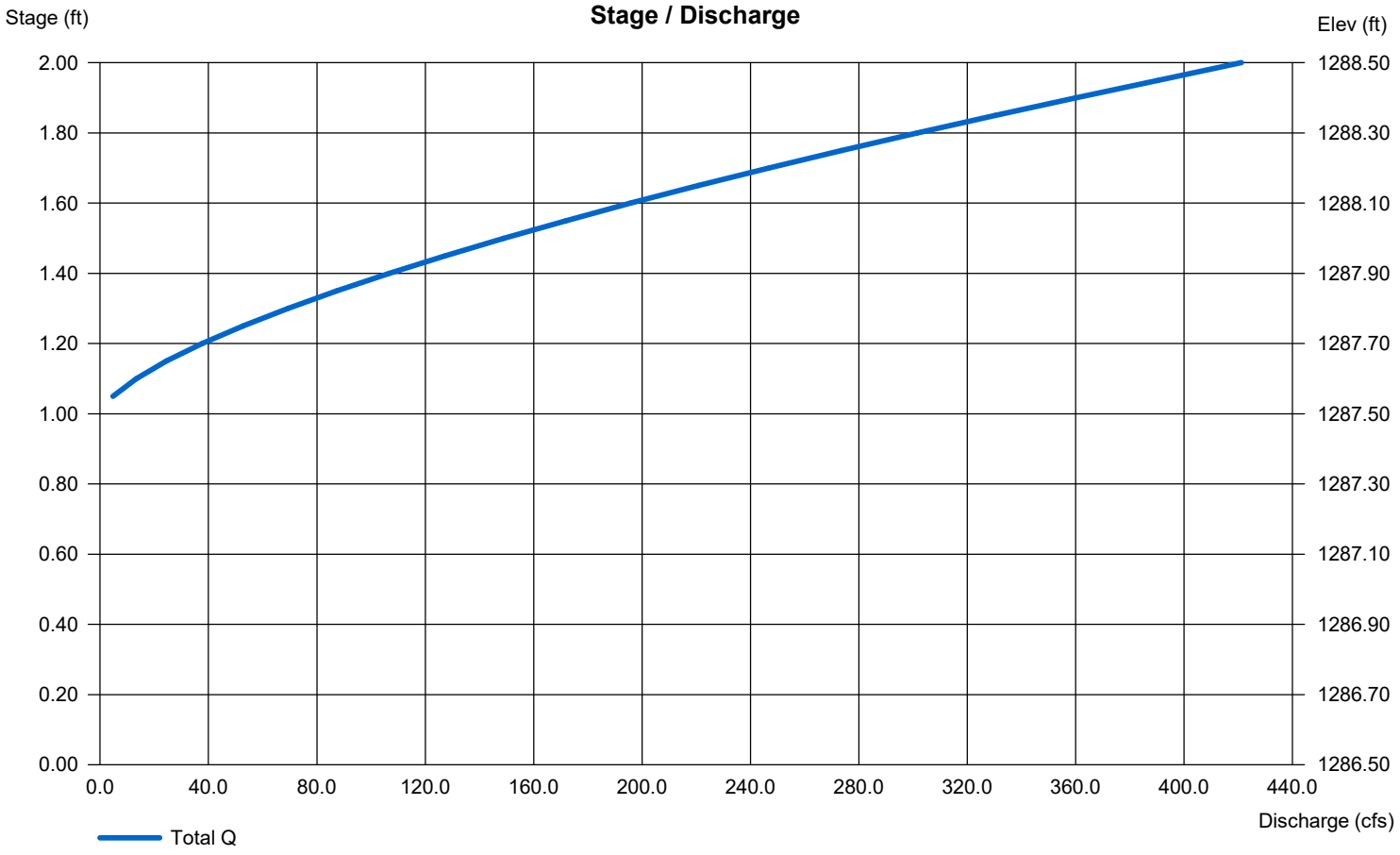
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 162.00	0.00	0.00	0.00
Crest El. (ft)	= 1287.50	0.00	0.00	0.00
Weir Coeff.	= 2.60	3.33	3.33	3.33
Weir Type	= Broad	---	---	---
Multi-Stage	= No	No	No	No

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

TW Elev. (ft) = 0.00

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

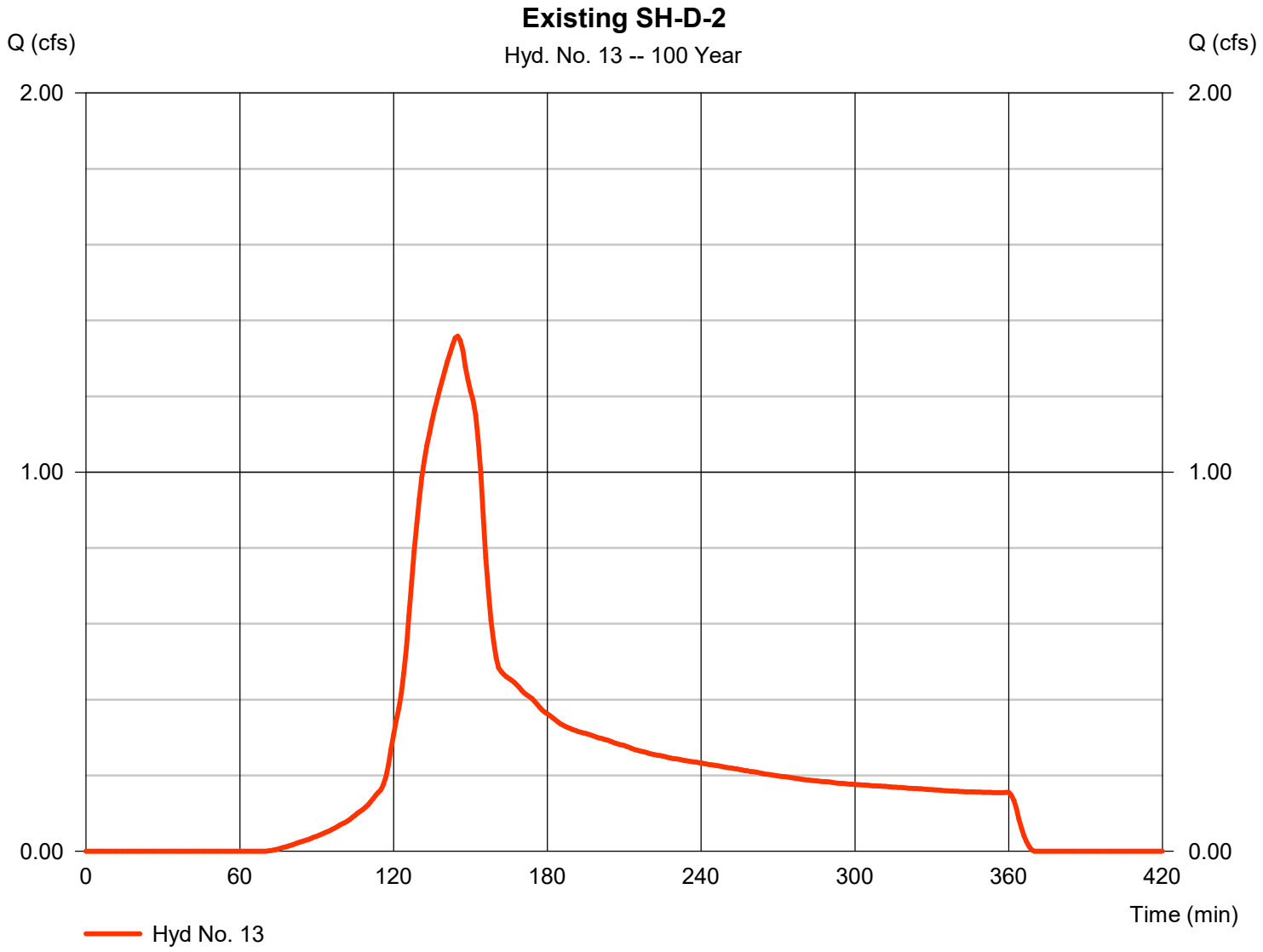


Hydrograph Report

Hyd. No. 13

Existing SH-D-2

Hydrograph type	=	SCS Runoff	Peak discharge	=	1.359 cfs
Storm frequency	=	100 yrs	Time to peak	=	145 min
Time interval	=	1 min	Hyd. volume	=	5,432 cuft
Drainage area	=	0.440 ac	Curve number	=	80
Basin Slope	=	2.8 %	Hydraulic length	=	230 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	5.46 in	Distribution	=	SCS 6-Hr
Storm duration	=	6.00 hrs	Shape factor	=	484



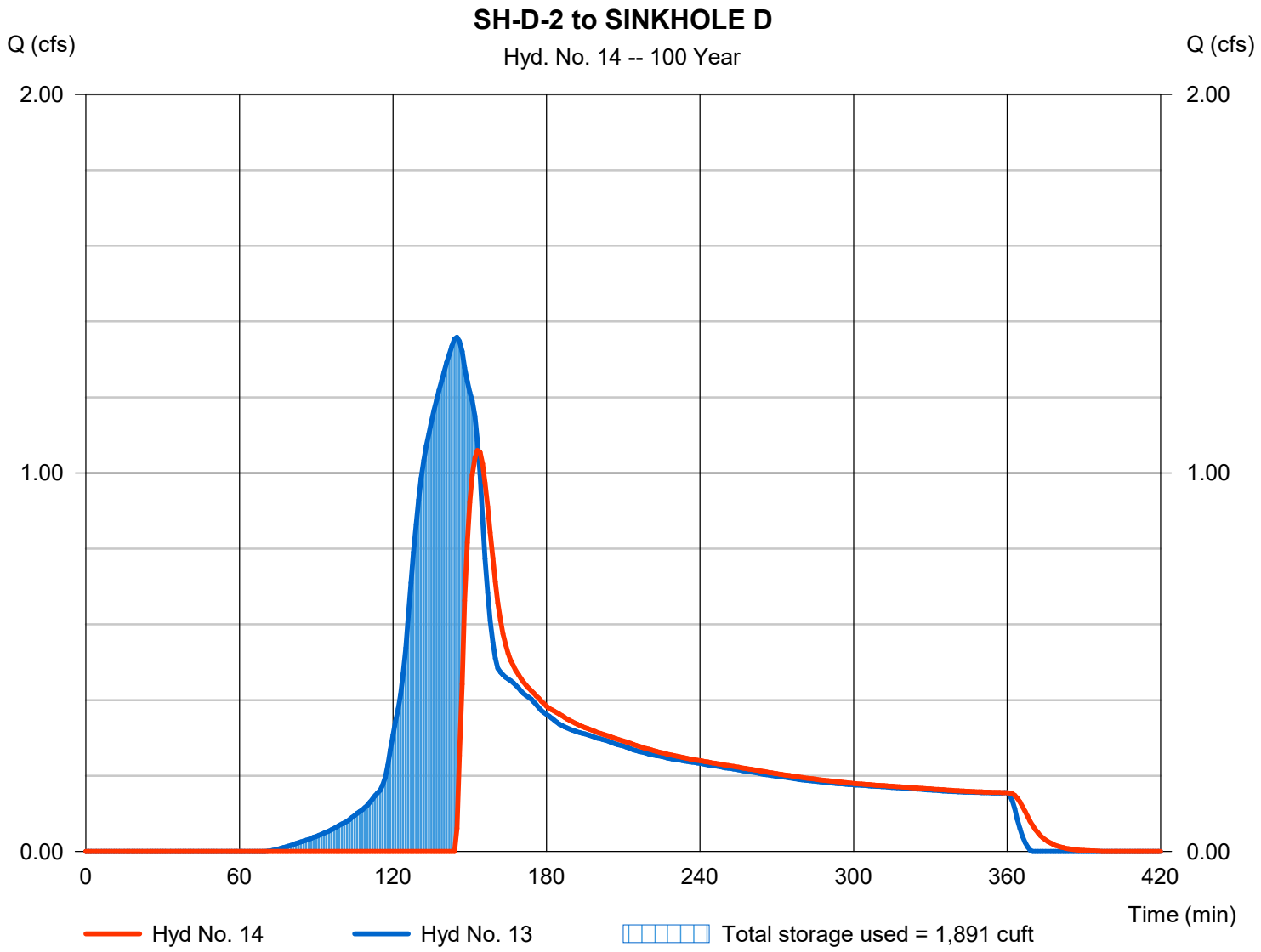
Hydrograph Report

Hyd. No. 14

SH-D-2 to SINKHOLE D

Hydrograph type	=	Reservoir	Peak discharge	=	1.059 cfs
Storm frequency	=	100 yrs	Time to peak	=	153 min
Time interval	=	1 min	Hyd. volume	=	3,820 cuft
Inflow hyd. No.	=	13 - Existing SH-D-2	Max. Elevation	=	1289.60 ft
Reservoir name	=	Sinkhole D	Max. Storage	=	1,891 cuft

Storage Indication method used.



Pond Report

Pond No. 2 - Sinkhole D

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 1288.50 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	1288.50	589	0	0
0.50	1289.00	1,591	525	525
1.00	1289.50	2,815	1,087	1,612
1.50	1290.00	2,815	1,407	3,019
2.00	1290.50	2,815	1,407	4,426

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

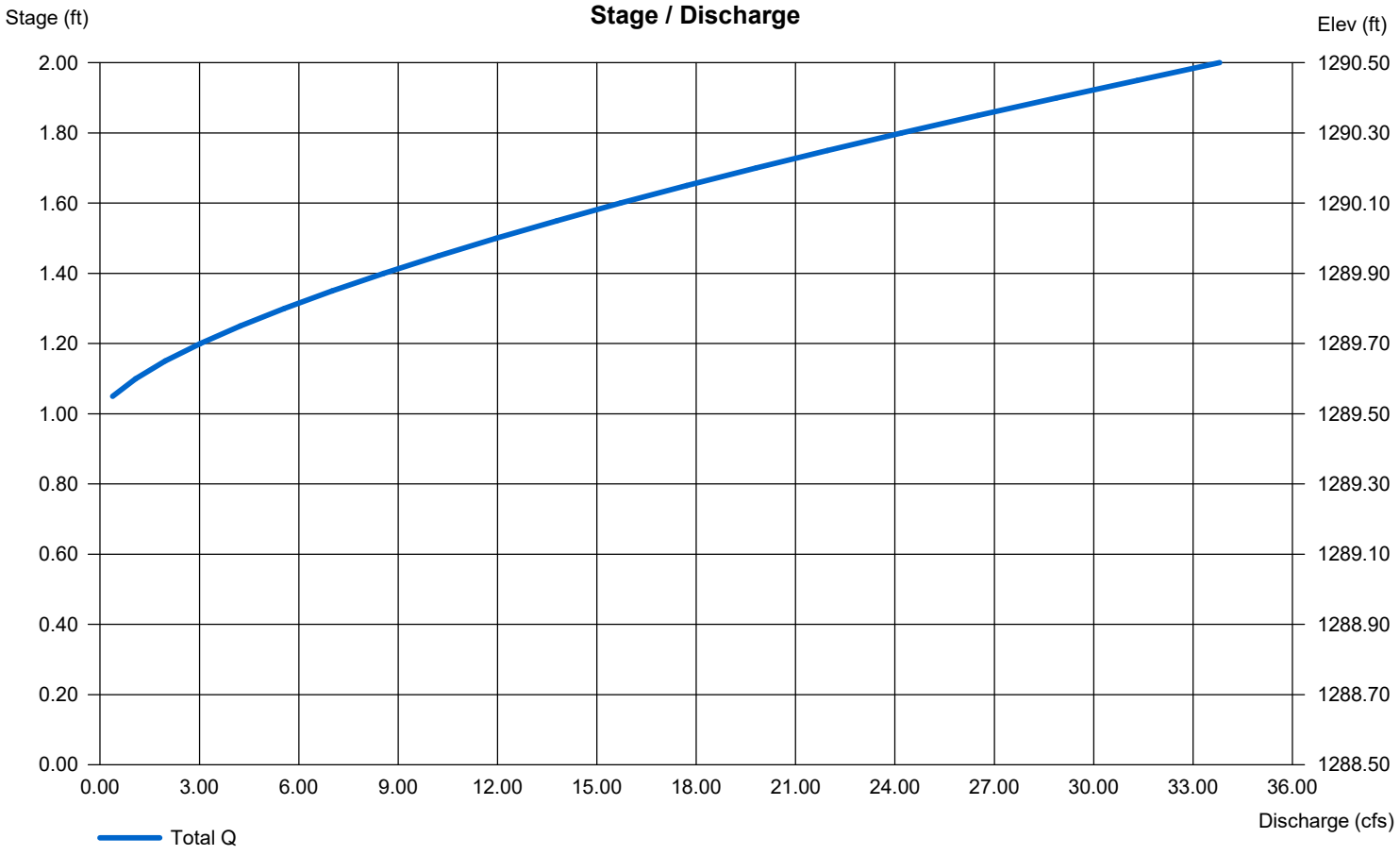
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 13.00	0.00	0.00	0.00
Crest El. (ft)	= 1289.50	0.00	0.00	0.00
Weir Coeff.	= 2.60	3.33	3.33	3.33
Weir Type	= Broad	---	---	---
Multi-Stage	= No	No	No	No

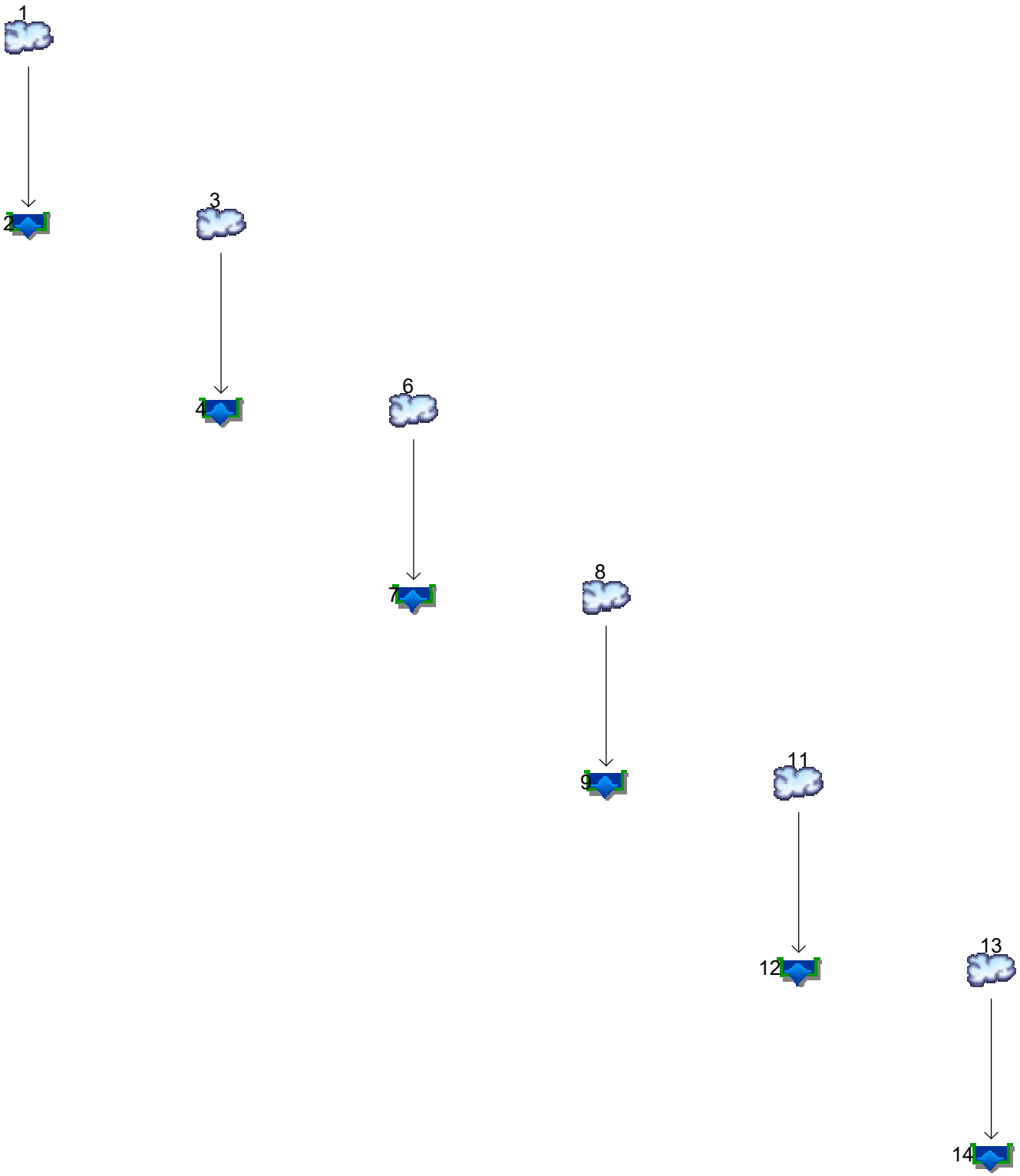
Exfil.(in/hr) = 0.000 (by Contour)

TW Elev. (ft) = 0.00

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



Watershed Model Schematic



Hydrograph Return Period Recap

Hyd. No.	Hydrograph type (origin)	Inflow hyd(s)	Peak Outflow (cfs)								Hydrograph Description
			1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr	
1	SCS Runoff	------	-------	-------	-------	-------	-------	-------	-------	9.866	Existing SH-A
2	Reservoir	1	-------	-------	-------	-------	-------	-------	-------	9.751	SH-A to SINKHOLE A
3	SCS Runoff	------	-------	-------	-------	-------	-------	-------	-------	15.88	Existing SH-D
4	Reservoir	3	-------	-------	-------	-------	-------	-------	-------	15.72	SH-D to SINKHOLE D
6	SCS Runoff	------	-------	-------	-------	-------	-------	-------	-------	9.866	SH-A-1
7	Reservoir	6	-------	-------	-------	-------	-------	-------	-------	9.751	SH-A-1 to SINKHOLE A
8	SCS Runoff	------	-------	-------	-------	-------	-------	-------	-------	13.37	SH-D-1
9	Reservoir	8	-------	-------	-------	-------	-------	-------	-------	13.00	SH-D-1 to SINKHOLE D
11	SCS Runoff	------	-------	-------	-------	-------	-------	-------	-------	9.866	SH-A-2
12	Reservoir	11	-------	-------	-------	-------	-------	-------	-------	9.751	SH-A-2 to SINKHOLE A
13	SCS Runoff	------	-------	-------	-------	-------	-------	-------	-------	4.071	Existing SH-D-2
14	Reservoir	13	-------	-------	-------	-------	-------	-------	-------	3.830	SH-D-2 to SINKHOLE D

Hydrograph Summary Report

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

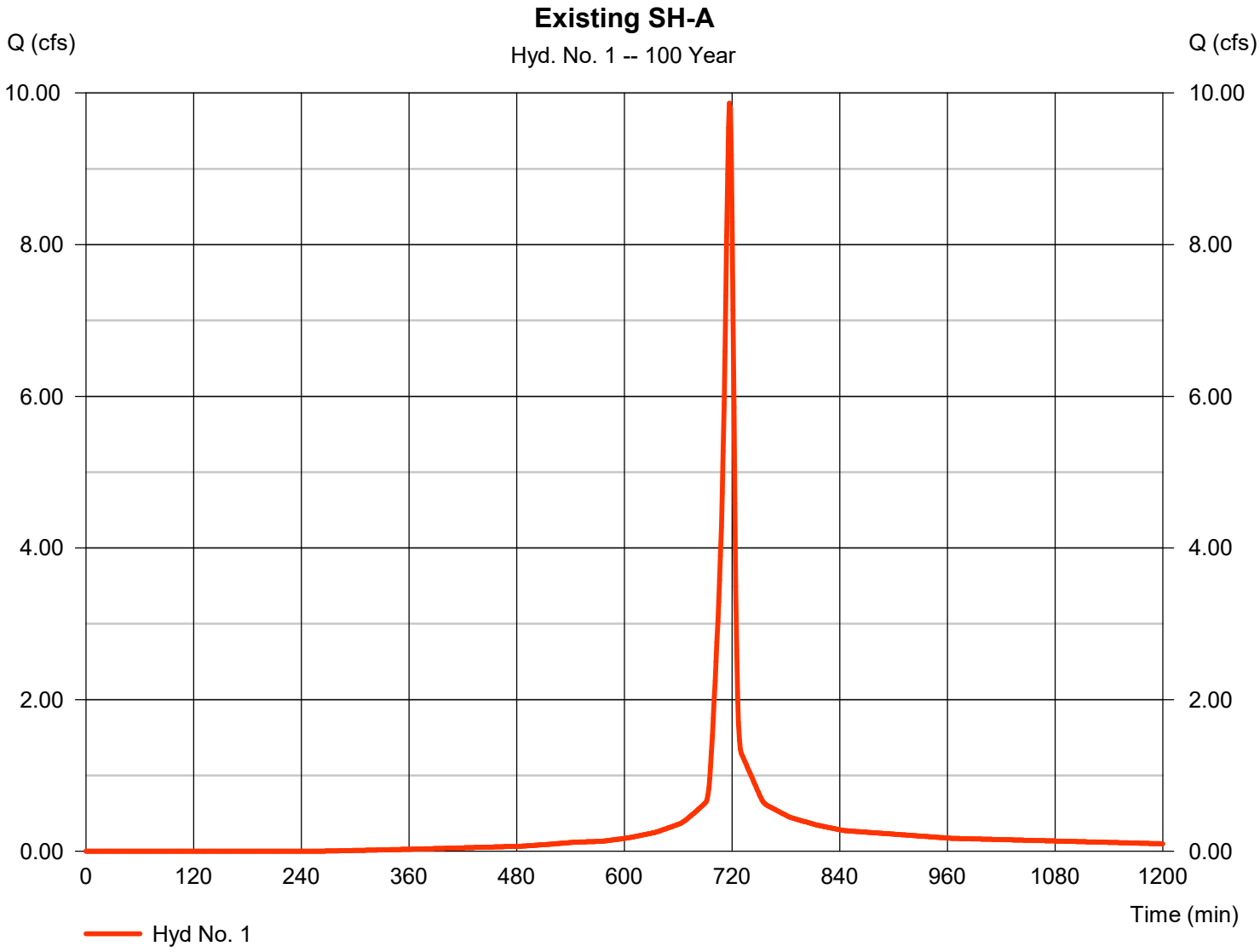
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	9.866	1	717	21,168	------	------	------	Existing SH-A
2	Reservoir	9.751	1	718	17,612	1	1287.58	4,241	SH-A to SINKHOLE A
3	SCS Runoff	15.88	1	723	46,761	------	------	------	Existing SH-D
4	Reservoir	15.72	1	724	45,149	3	1290.10	3,301	SH-D to SINKHOLE D
6	SCS Runoff	9.866	1	717	21,168	------	------	------	SH-A-1
7	Reservoir	9.751	1	718	17,612	6	1287.58	4,241	SH-A-1 to SINKHOLE A
8	SCS Runoff	13.37	1	718	29,235	------	------	------	SH-D-1
9	Reservoir	13.00	1	719	27,623	8	1290.03	3,099	SH-D-1 to SINKHOLE D
11	SCS Runoff	9.866	1	717	21,168	------	------	------	SH-A-2
12	Reservoir	9.751	1	718	17,612	11	1287.58	4,241	SH-A-2 to SINKHOLE A
13	SCS Runoff	4.071	1	717	8,557	------	------	------	Existing SH-D-2
14	Reservoir	3.830	1	719	6,945	13	1289.73	2,268	SH-D-2 to SINKHOLE D

Hydrograph Report

Hyd. No. 1

Existing SH-A

Hydrograph type	=	SCS Runoff	Peak discharge	=	9.866 cfs
Storm frequency	=	100 yrs	Time to peak	=	717 min
Time interval	=	1 min	Hyd. volume	=	21,168 cuft
Drainage area	=	1.000 ac	Curve number	=	84
Basin Slope	=	2.0 %	Hydraulic length	=	325 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	7.54 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484



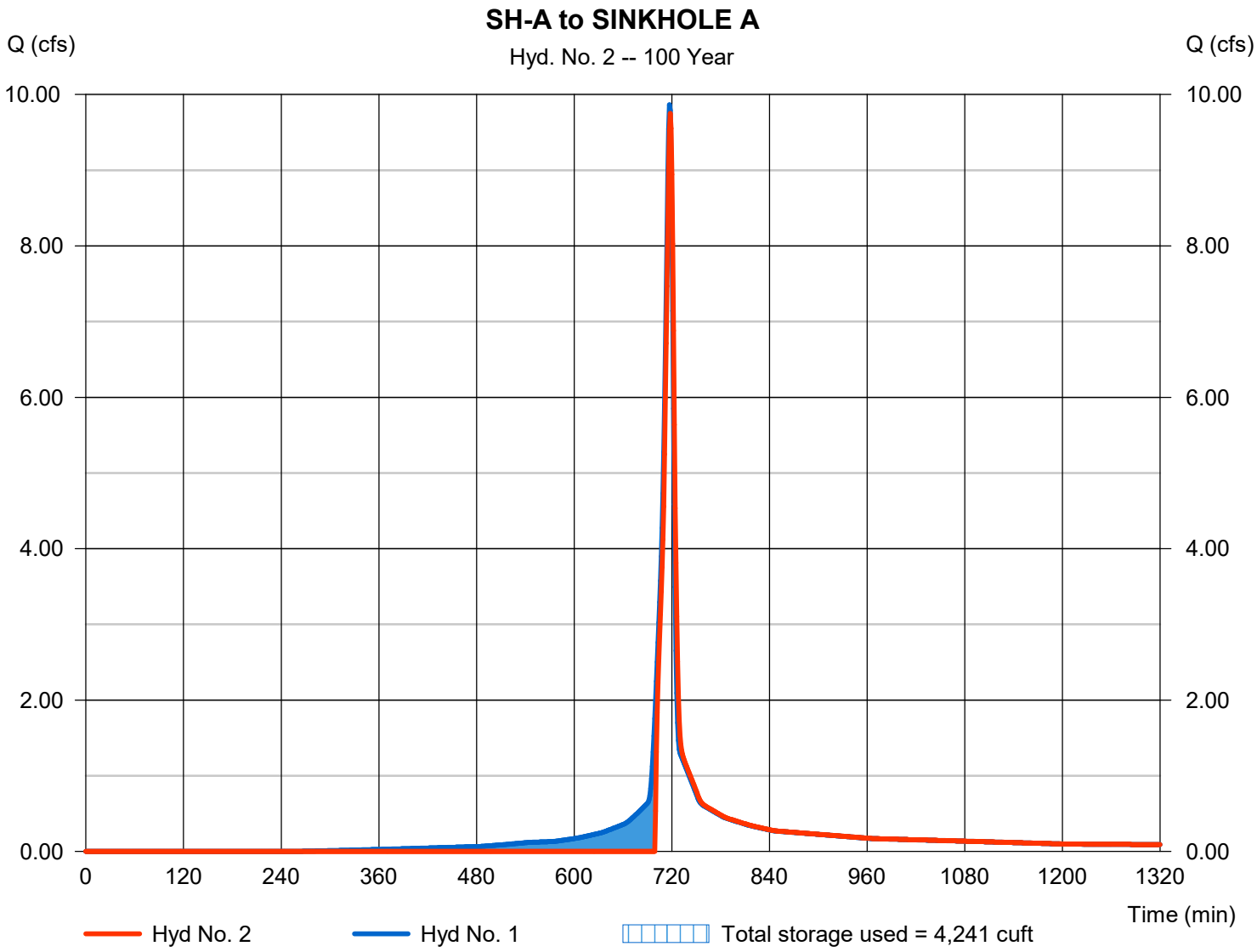
Hydrograph Report

Hyd. No. 2

SH-A to SINKHOLE A

Hydrograph type	=	Reservoir	Peak discharge	=	9.751 cfs
Storm frequency	=	100 yrs	Time to peak	=	718 min
Time interval	=	1 min	Hyd. volume	=	17,612 cuft
Inflow hyd. No.	=	1 - Existing SH-A	Max. Elevation	=	1287.58 ft
Reservoir name	=	Sinkhole A	Max. Storage	=	4,241 cuft

Storage Indication method used.



Pond Report

Pond No. 1 - Sinkhole A

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 1286.50 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	1286.50	65	0	0
0.50	1287.00	3,371	651	651
1.00	1287.50	8,659	2,905	3,556
1.50	1288.00	8,659	4,329	7,885
2.00	1288.50	8,659	4,329	12,214

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

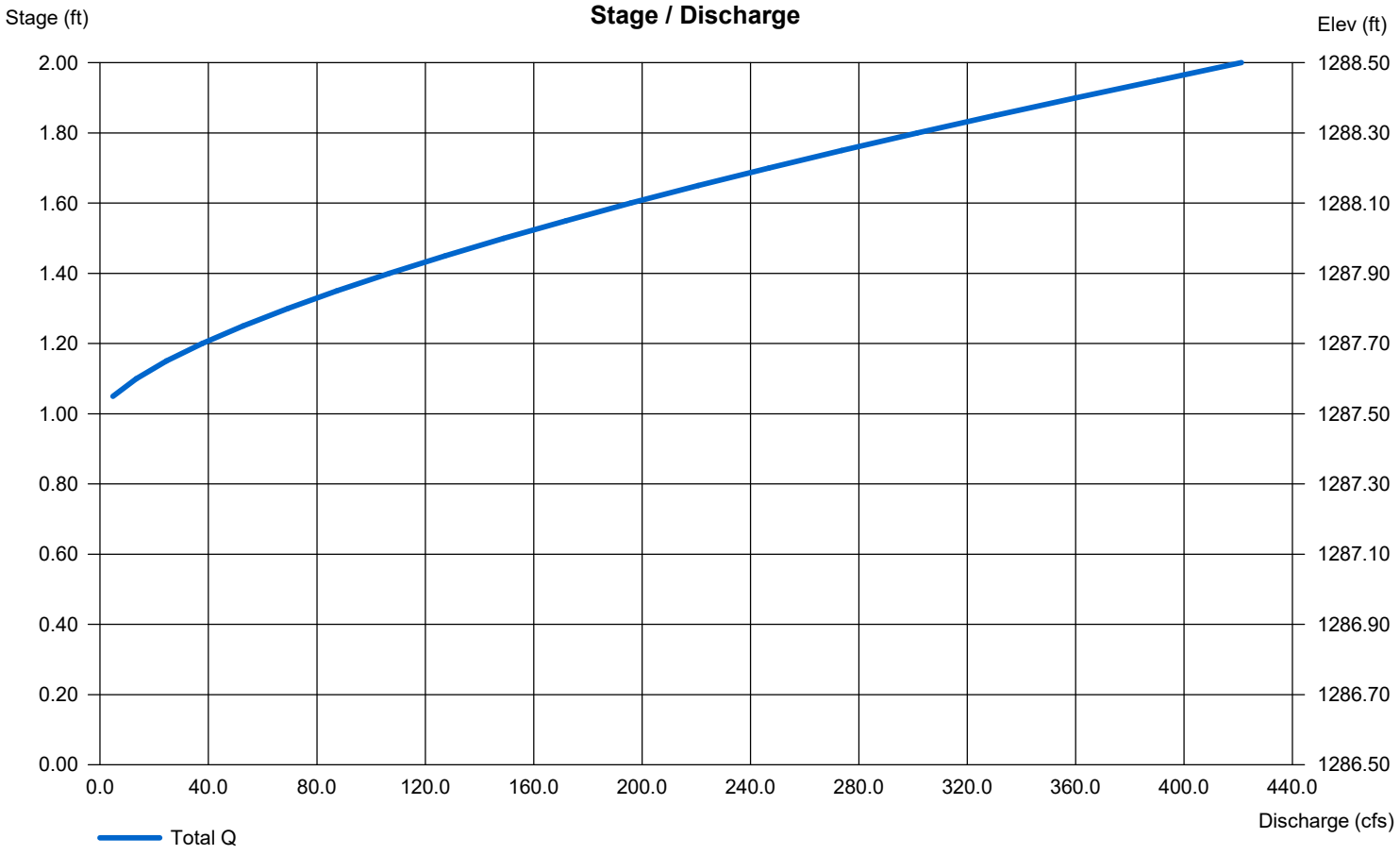
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 162.00	0.00	0.00	0.00
Crest El. (ft)	= 1287.50	0.00	0.00	0.00
Weir Coeff.	= 2.60	3.33	3.33	3.33
Weir Type	= Broad	---	---	---
Multi-Stage	= No	No	No	No

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

TW Elev. (ft) = 0.00

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

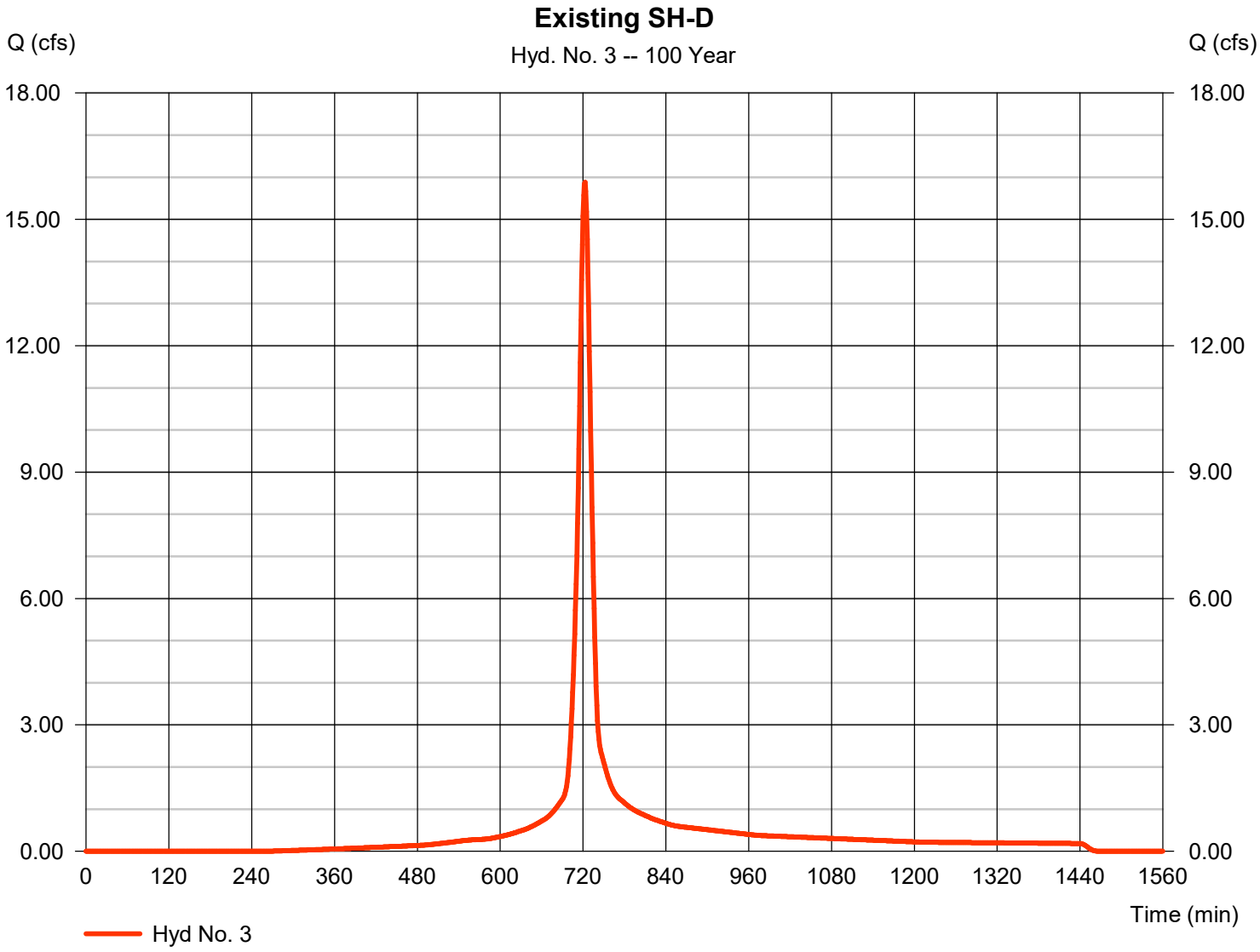


Hydrograph Report

Hyd. No. 3

Existing SH-D

Hydrograph type	=	SCS Runoff	Peak discharge	=	15.88 cfs
Storm frequency	=	100 yrs	Time to peak	=	723 min
Time interval	=	1 min	Hyd. volume	=	46,761 cuft
Drainage area	=	2.250 ac	Curve number	=	84
Basin Slope	=	2.8 %	Hydraulic length	=	777 ft
Tc method	=	User	Time of conc. (Tc)	=	16.30 min
Total precip.	=	7.54 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484



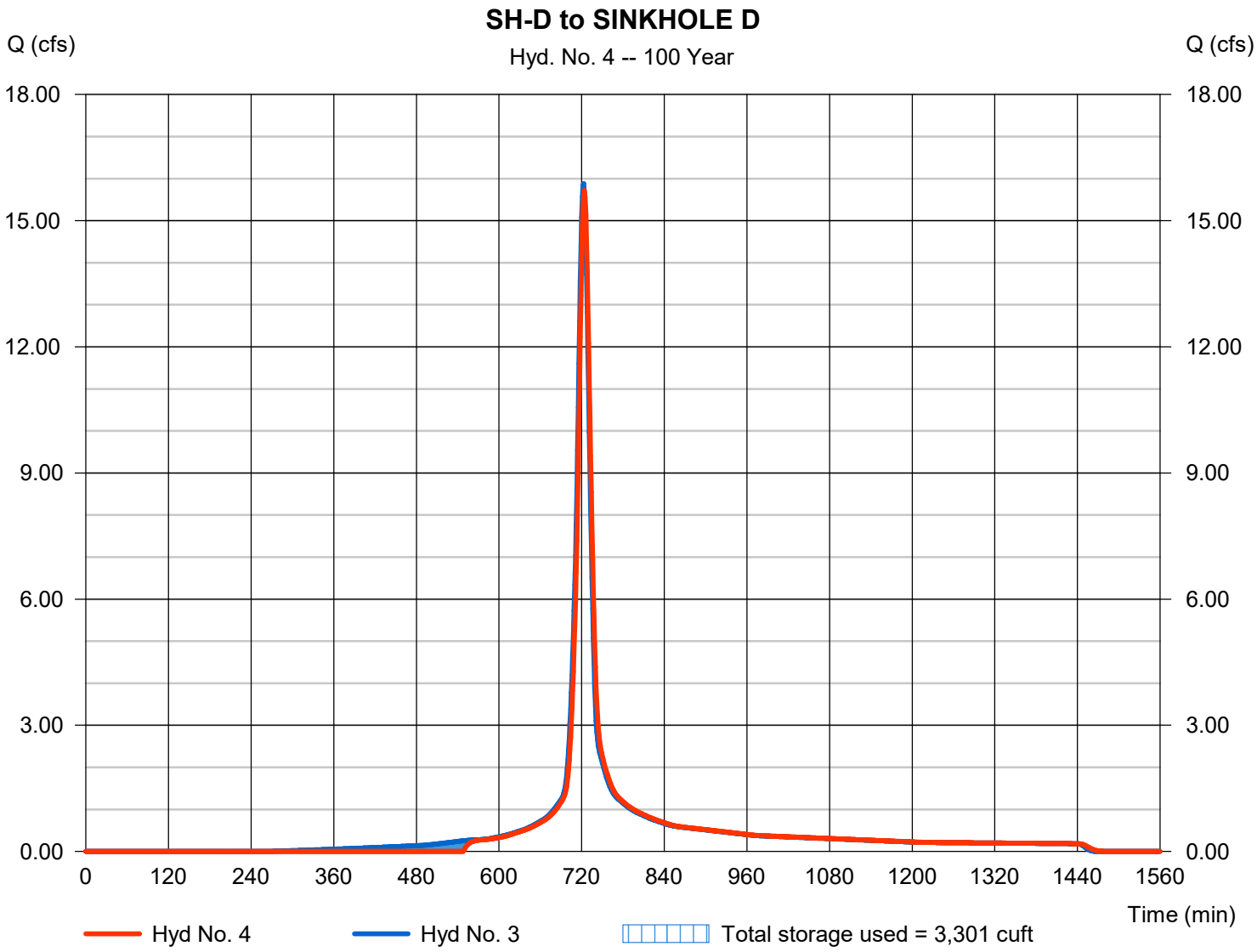
Hydrograph Report

Hyd. No. 4

SH-D to SINKHOLE D

Hydrograph type	=	Reservoir	Peak discharge	=	15.72 cfs
Storm frequency	=	100 yrs	Time to peak	=	724 min
Time interval	=	1 min	Hyd. volume	=	45,149 cuft
Inflow hyd. No.	=	3 - Existing SH-D	Max. Elevation	=	1290.10 ft
Reservoir name	=	Sinkhole D	Max. Storage	=	3,301 cuft

Storage Indication method used.



Pond Report

Pond No. 2 - Sinkhole D

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 1288.50 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	1288.50	589	0	0
0.50	1289.00	1,591	525	525
1.00	1289.50	2,815	1,087	1,612
1.50	1290.00	2,815	1,407	3,019
2.00	1290.50	2,815	1,407	4,426

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

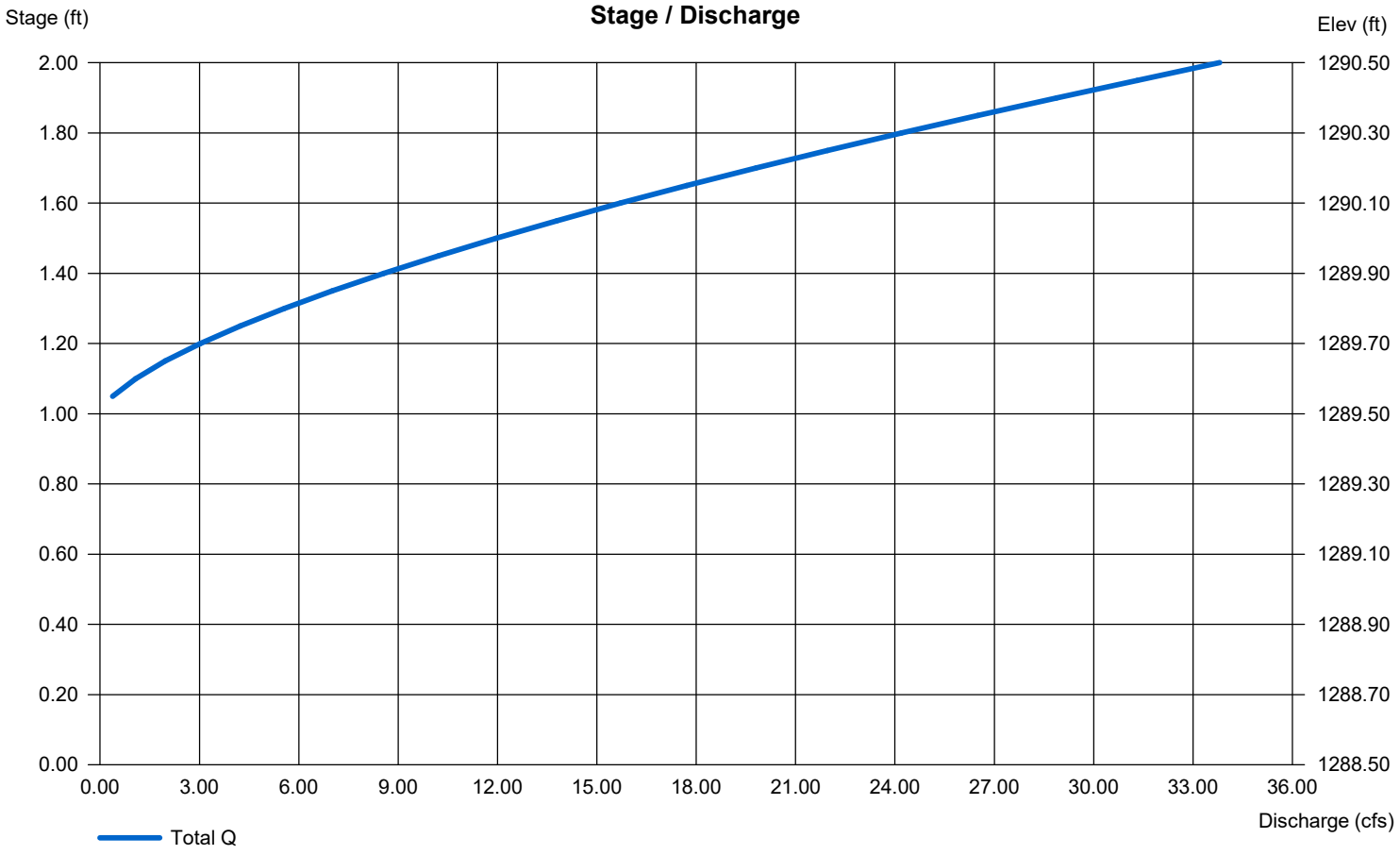
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 13.00	0.00	0.00	0.00
Crest El. (ft)	= 1289.50	0.00	0.00	0.00
Weir Coeff.	= 2.60	3.33	3.33	3.33
Weir Type	= Broad	---	---	---
Multi-Stage	= No	No	No	No

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

TW Elev. (ft) = 0.00

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

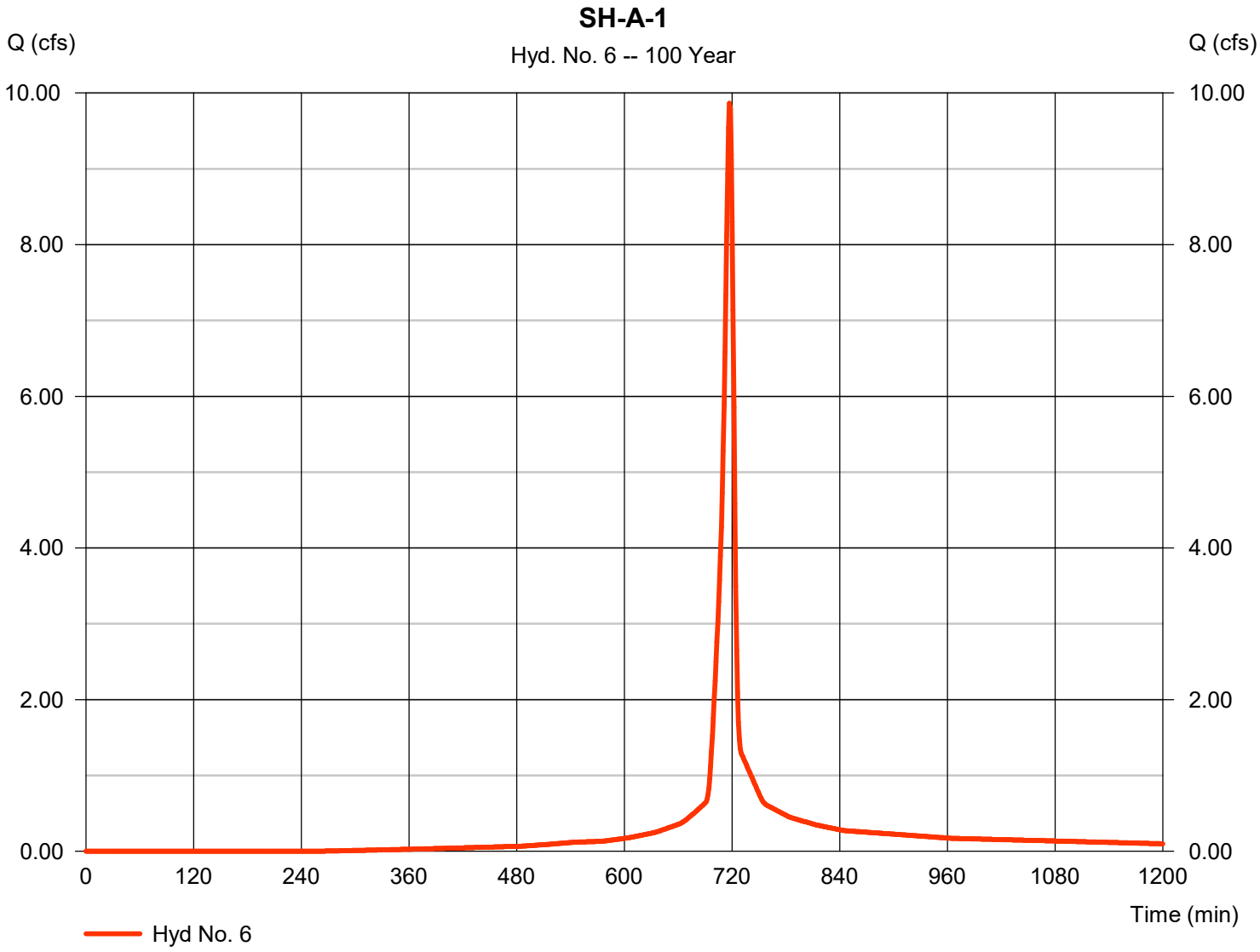


Hydrograph Report

Hyd. No. 6

SH-A-1

Hydrograph type	=	SCS Runoff	Peak discharge	=	9.866 cfs
Storm frequency	=	100 yrs	Time to peak	=	717 min
Time interval	=	1 min	Hyd. volume	=	21,168 cuft
Drainage area	=	1.000 ac	Curve number	=	84
Basin Slope	=	2.0 %	Hydraulic length	=	325 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	7.54 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484



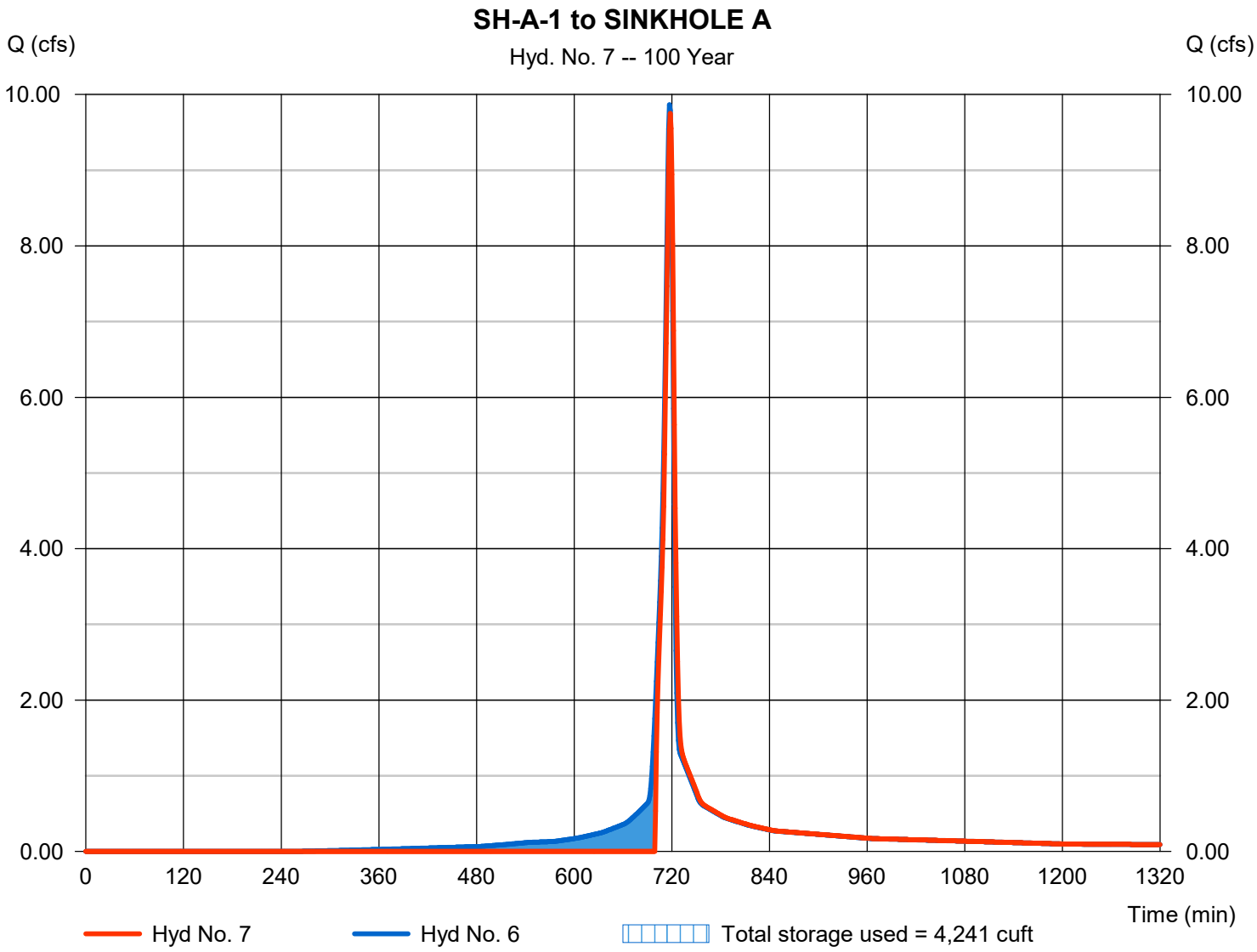
Hydrograph Report

Hyd. No. 7

SH-A-1 to SINKHOLE A

Hydrograph type	=	Reservoir	Peak discharge	=	9.751 cfs
Storm frequency	=	100 yrs	Time to peak	=	718 min
Time interval	=	1 min	Hyd. volume	=	17,612 cuft
Inflow hyd. No.	=	6 - SH-A-1	Max. Elevation	=	1287.58 ft
Reservoir name	=	Sinkhole A	Max. Storage	=	4,241 cuft

Storage Indication method used.



Pond Report

Pond No. 1 - Sinkhole A

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 1286.50 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	1286.50	65	0	0
0.50	1287.00	3,371	651	651
1.00	1287.50	8,659	2,905	3,556
1.50	1288.00	8,659	4,329	7,885
2.00	1288.50	8,659	4,329	12,214

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

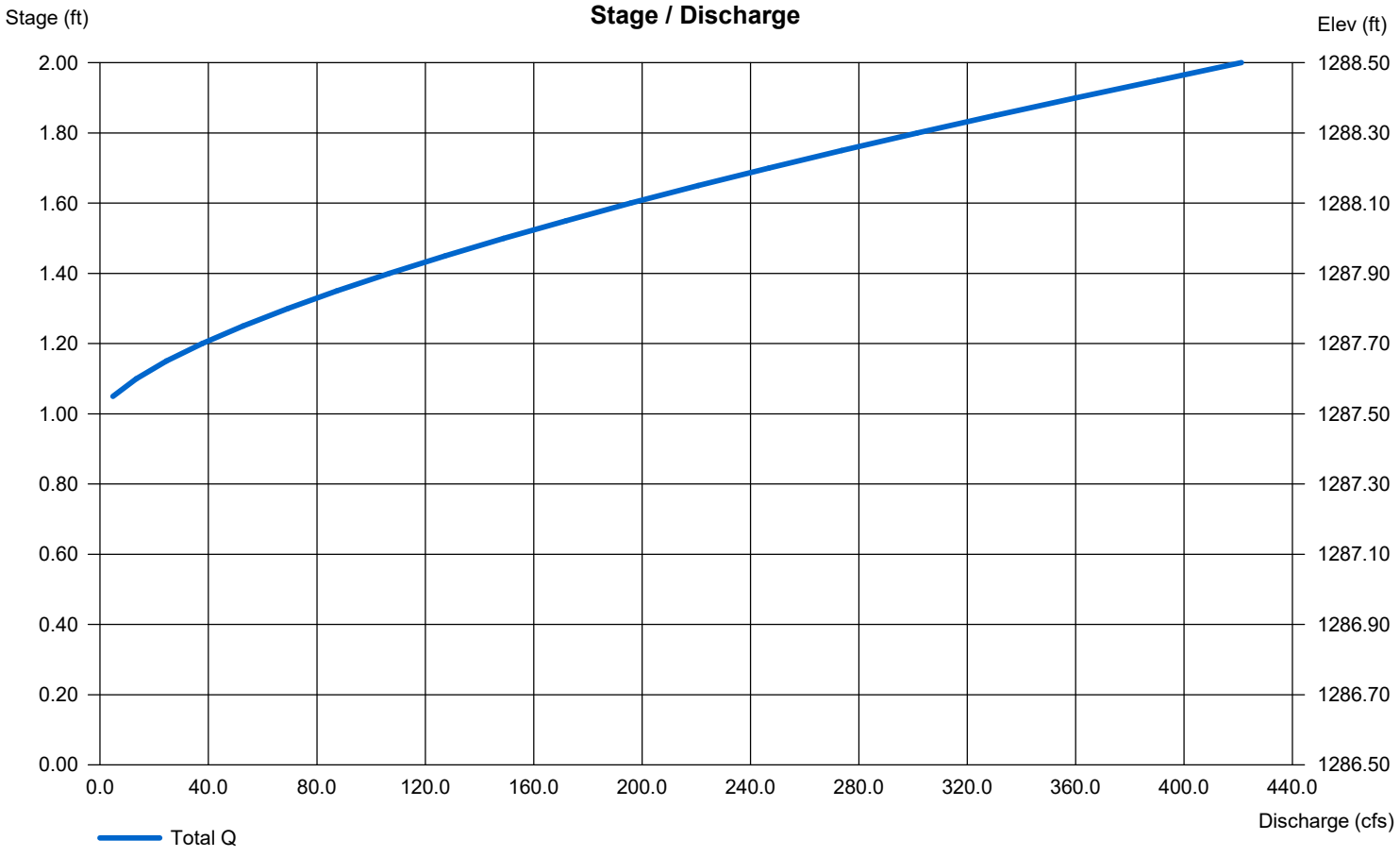
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 162.00	0.00	0.00	0.00
Crest El. (ft)	= 1287.50	0.00	0.00	0.00
Weir Coeff.	= 2.60	3.33	3.33	3.33
Weir Type	= Broad	---	---	---
Multi-Stage	= No	No	No	No

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

TW Elev. (ft) = 0.00

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

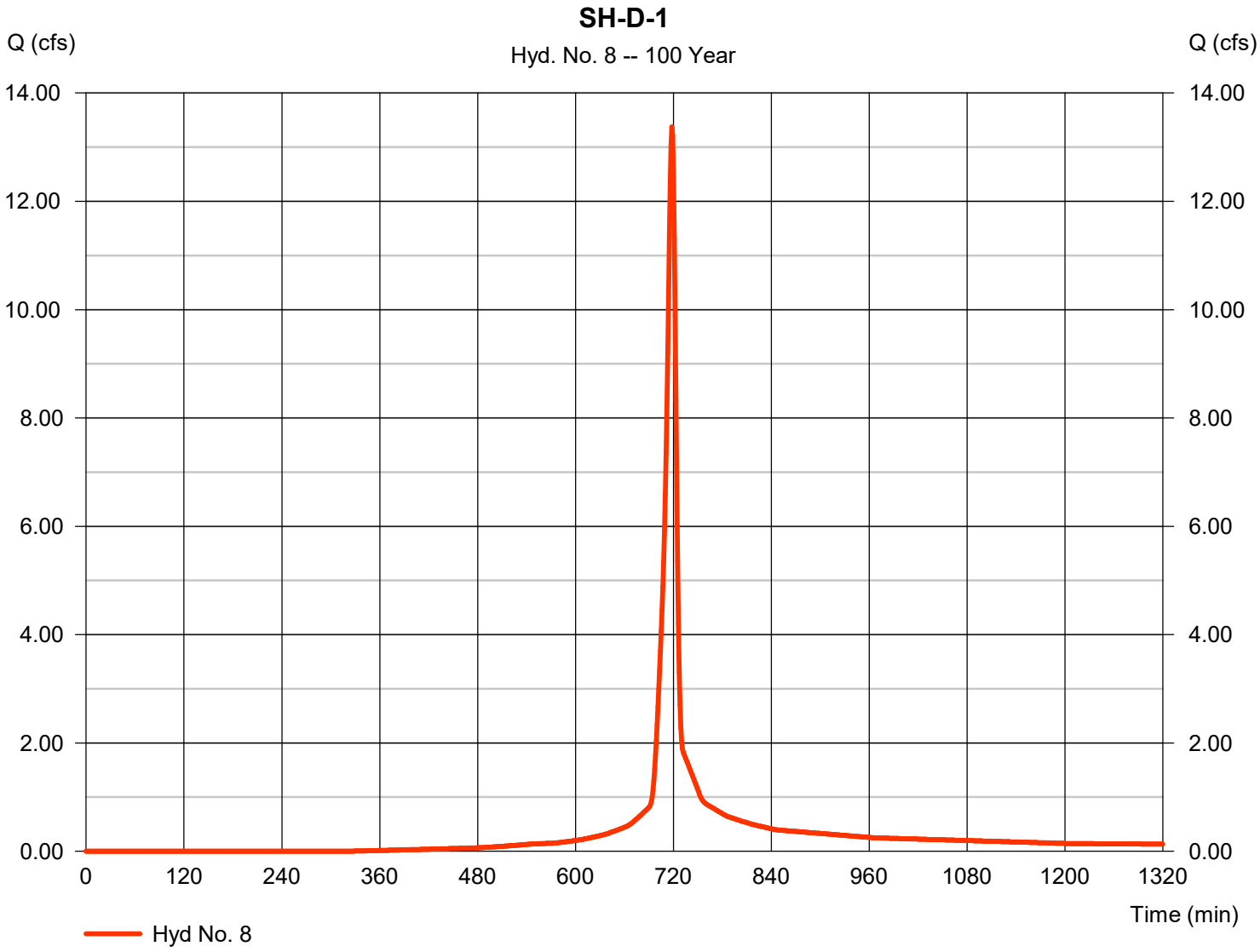


Hydrograph Report

Hyd. No. 8

SH-D-1

Hydrograph type	=	SCS Runoff	Peak discharge	=	13.37 cfs
Storm frequency	=	100 yrs	Time to peak	=	718 min
Time interval	=	1 min	Hyd. volume	=	29,235 cuft
Drainage area	=	1.590 ac	Curve number	=	80
Basin Slope	=	2.8 %	Hydraulic length	=	560 ft
Tc method	=	User	Time of conc. (Tc)	=	8.00 min
Total precip.	=	7.54 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484



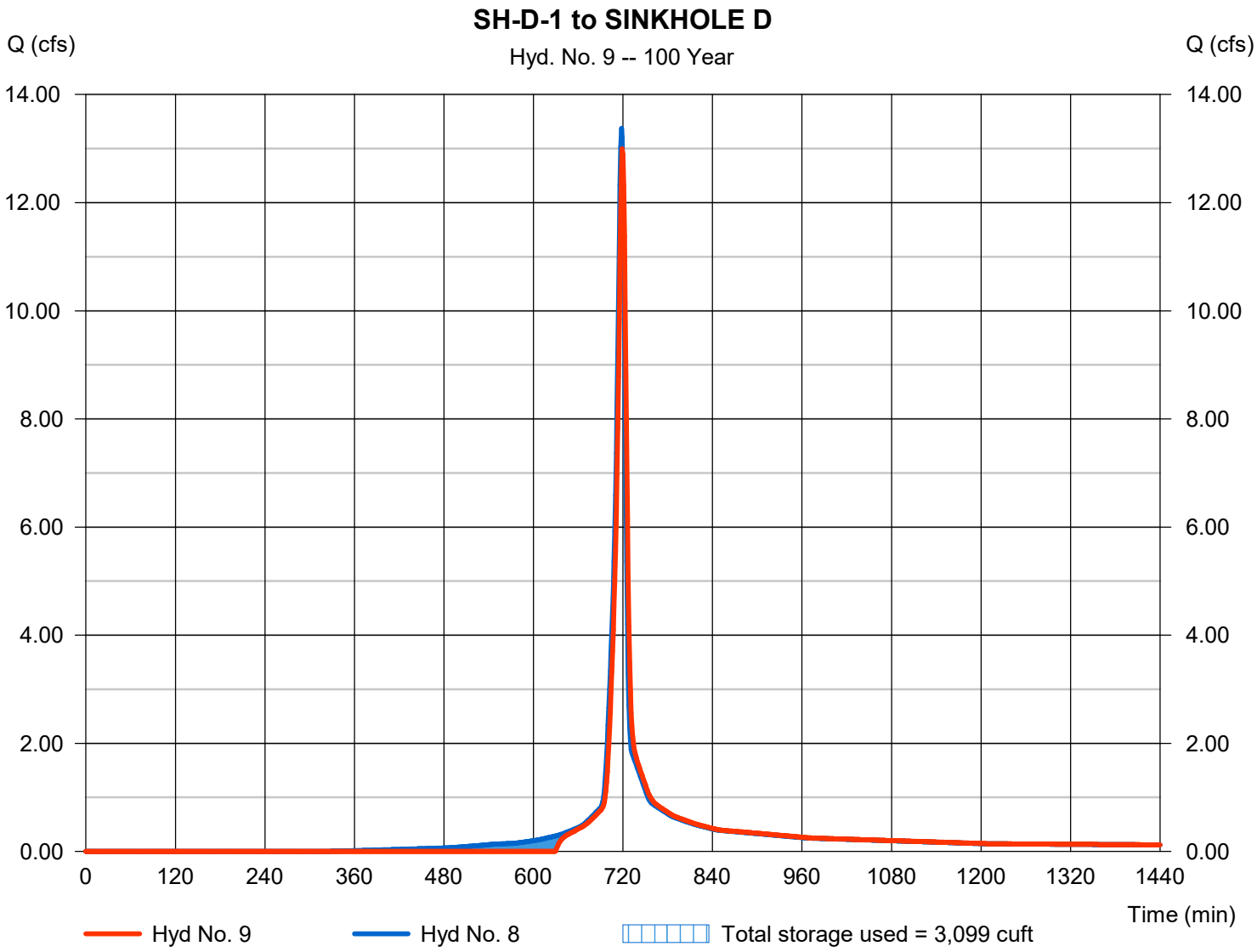
Hydrograph Report

Hyd. No. 9

SH-D-1 to SINKHOLE D

Hydrograph type	=	Reservoir	Peak discharge	=	13.00 cfs
Storm frequency	=	100 yrs	Time to peak	=	719 min
Time interval	=	1 min	Hyd. volume	=	27,623 cuft
Inflow hyd. No.	=	8 - SH-D-1	Max. Elevation	=	1290.03 ft
Reservoir name	=	Sinkhole D	Max. Storage	=	3,099 cuft

Storage Indication method used.



Pond Report

Pond No. 2 - Sinkhole D

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 1288.50 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	1288.50	589	0	0
0.50	1289.00	1,591	525	525
1.00	1289.50	2,815	1,087	1,612
1.50	1290.00	2,815	1,407	3,019
2.00	1290.50	2,815	1,407	4,426

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

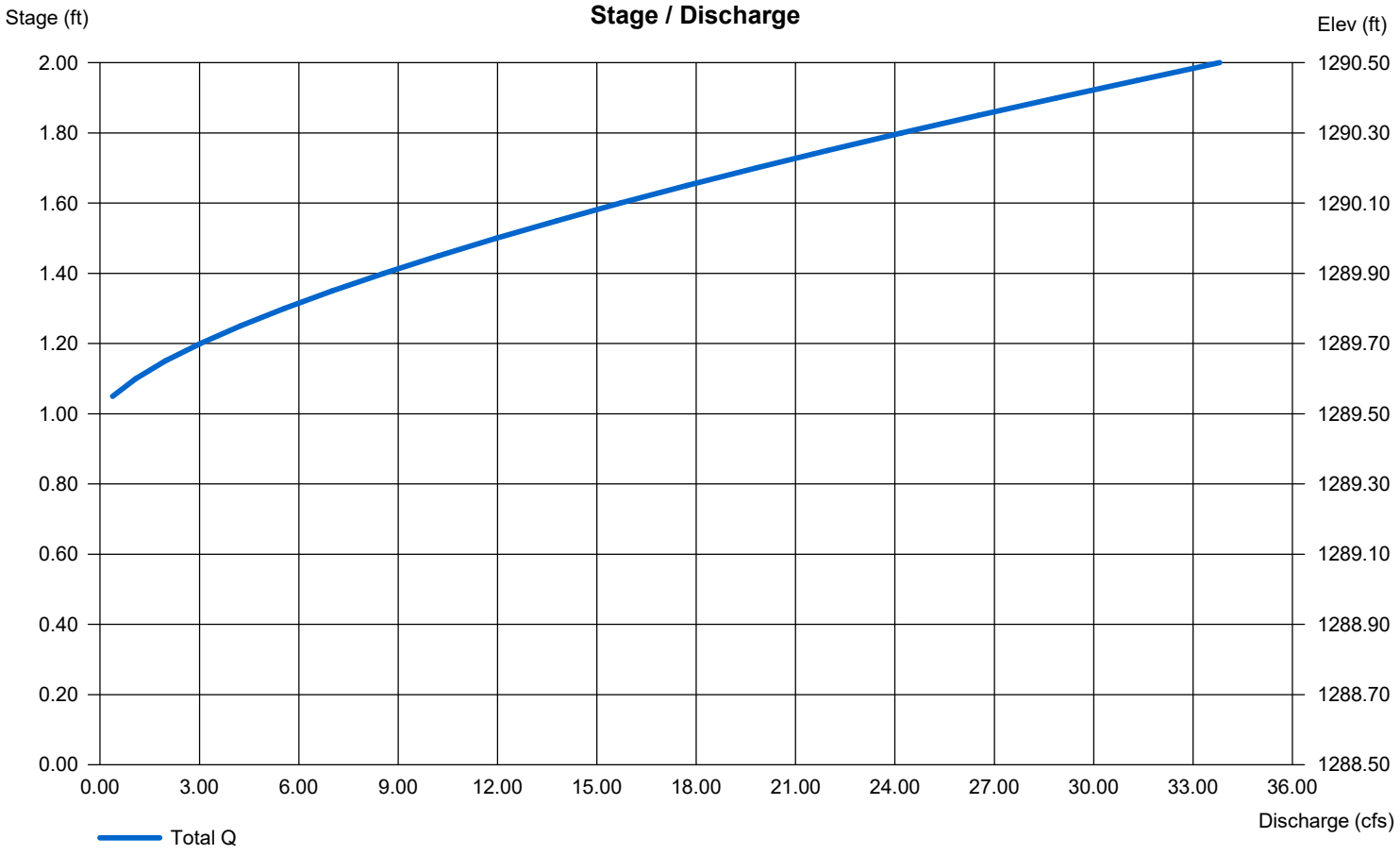
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 13.00	0.00	0.00	0.00
Crest El. (ft)	= 1289.50	0.00	0.00	0.00
Weir Coeff.	= 2.60	3.33	3.33	3.33
Weir Type	= Broad	---	---	---
Multi-Stage	= No	No	No	No

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

TW Elev. (ft) = 0.00

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

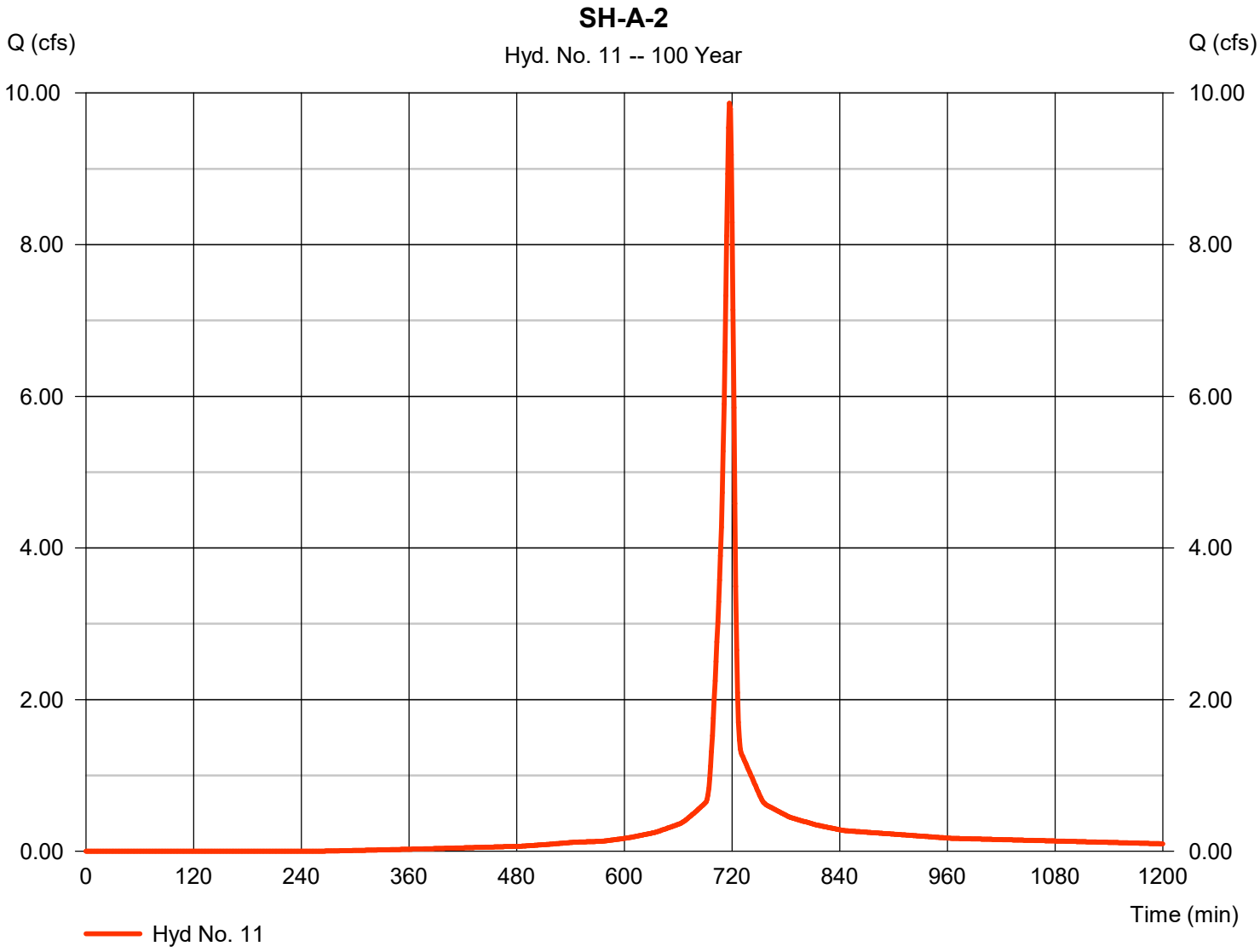


Hydrograph Report

Hyd. No. 11

SH-A-2

Hydrograph type	=	SCS Runoff	Peak discharge	=	9.866 cfs
Storm frequency	=	100 yrs	Time to peak	=	717 min
Time interval	=	1 min	Hyd. volume	=	21,168 cuft
Drainage area	=	1.000 ac	Curve number	=	84
Basin Slope	=	2.0 %	Hydraulic length	=	325 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	7.54 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484



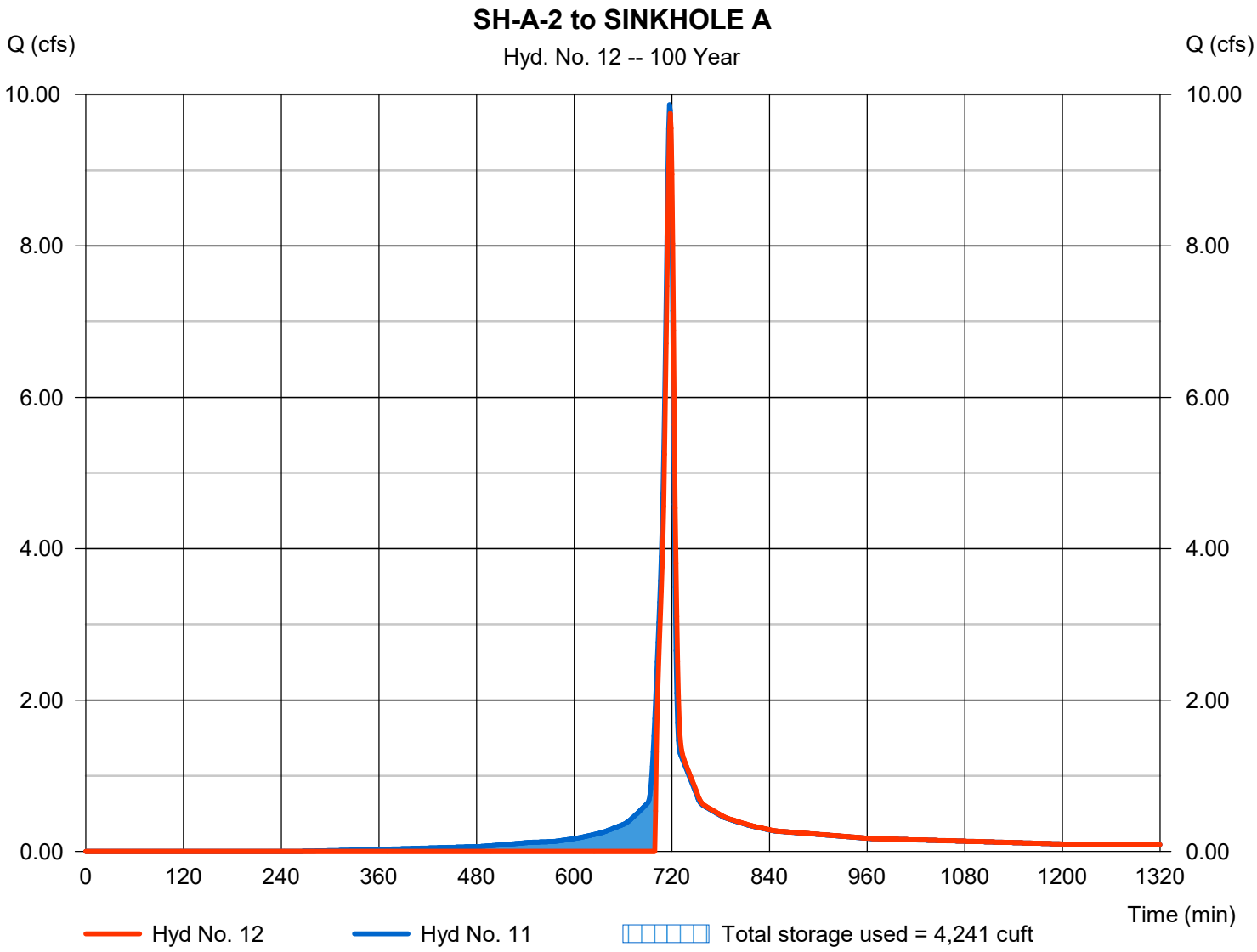
Hydrograph Report

Hyd. No. 12

SH-A-2 to SINKHOLE A

Hydrograph type	=	Reservoir	Peak discharge	=	9.751 cfs
Storm frequency	=	100 yrs	Time to peak	=	718 min
Time interval	=	1 min	Hyd. volume	=	17,612 cuft
Inflow hyd. No.	=	11 - SH-A-2	Max. Elevation	=	1287.58 ft
Reservoir name	=	Sinkhole A	Max. Storage	=	4,241 cuft

Storage Indication method used.



Pond Report

Pond No. 1 - Sinkhole A

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 1286.50 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	1286.50	65	0	0
0.50	1287.00	3,371	651	651
1.00	1287.50	8,659	2,905	3,556
1.50	1288.00	8,659	4,329	7,885
2.00	1288.50	8,659	4,329	12,214

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

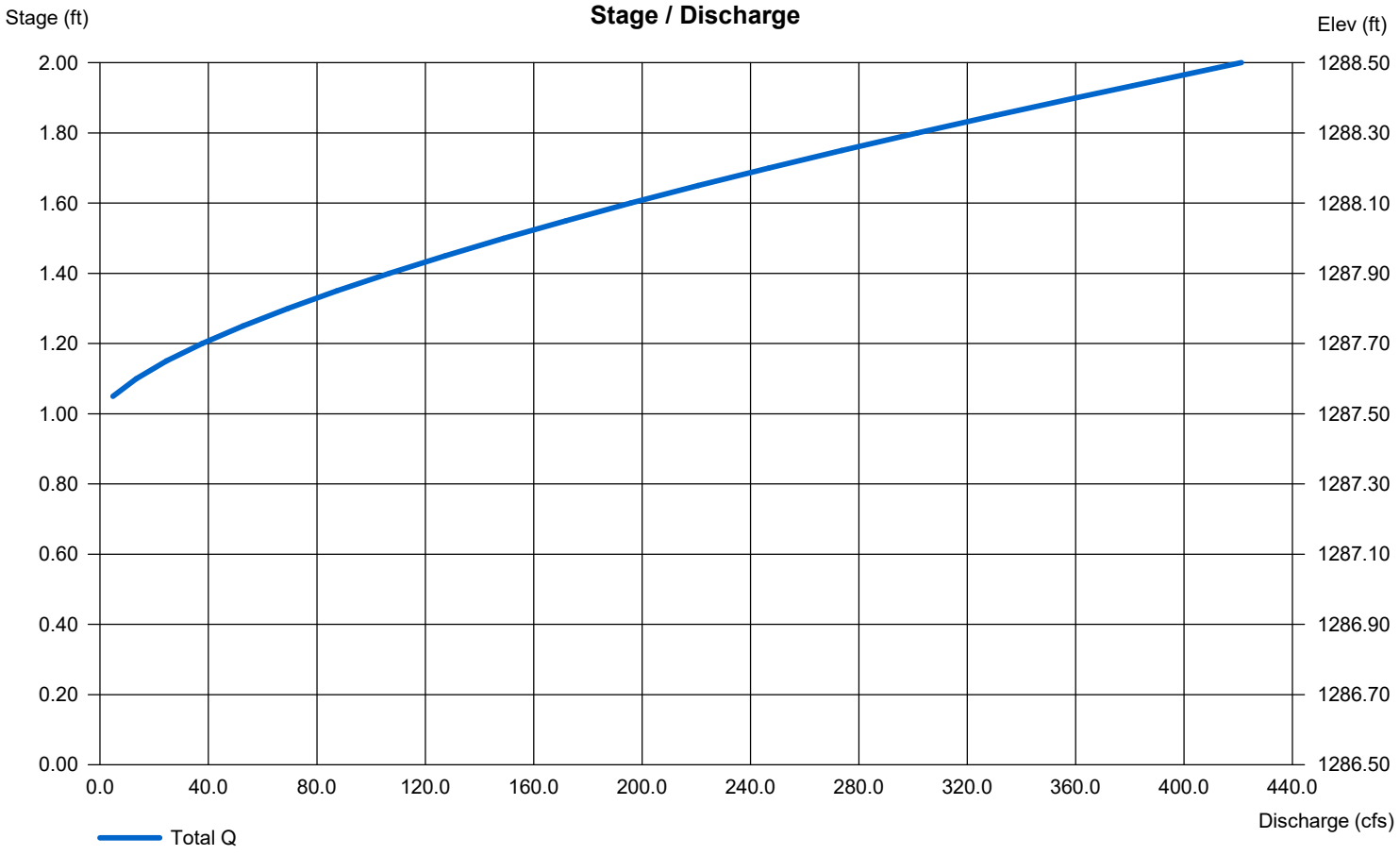
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 162.00	0.00	0.00	0.00
Crest El. (ft)	= 1287.50	0.00	0.00	0.00
Weir Coeff.	= 2.60	3.33	3.33	3.33
Weir Type	= Broad	---	---	---
Multi-Stage	= No	No	No	No

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

TW Elev. (ft) = 0.00

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

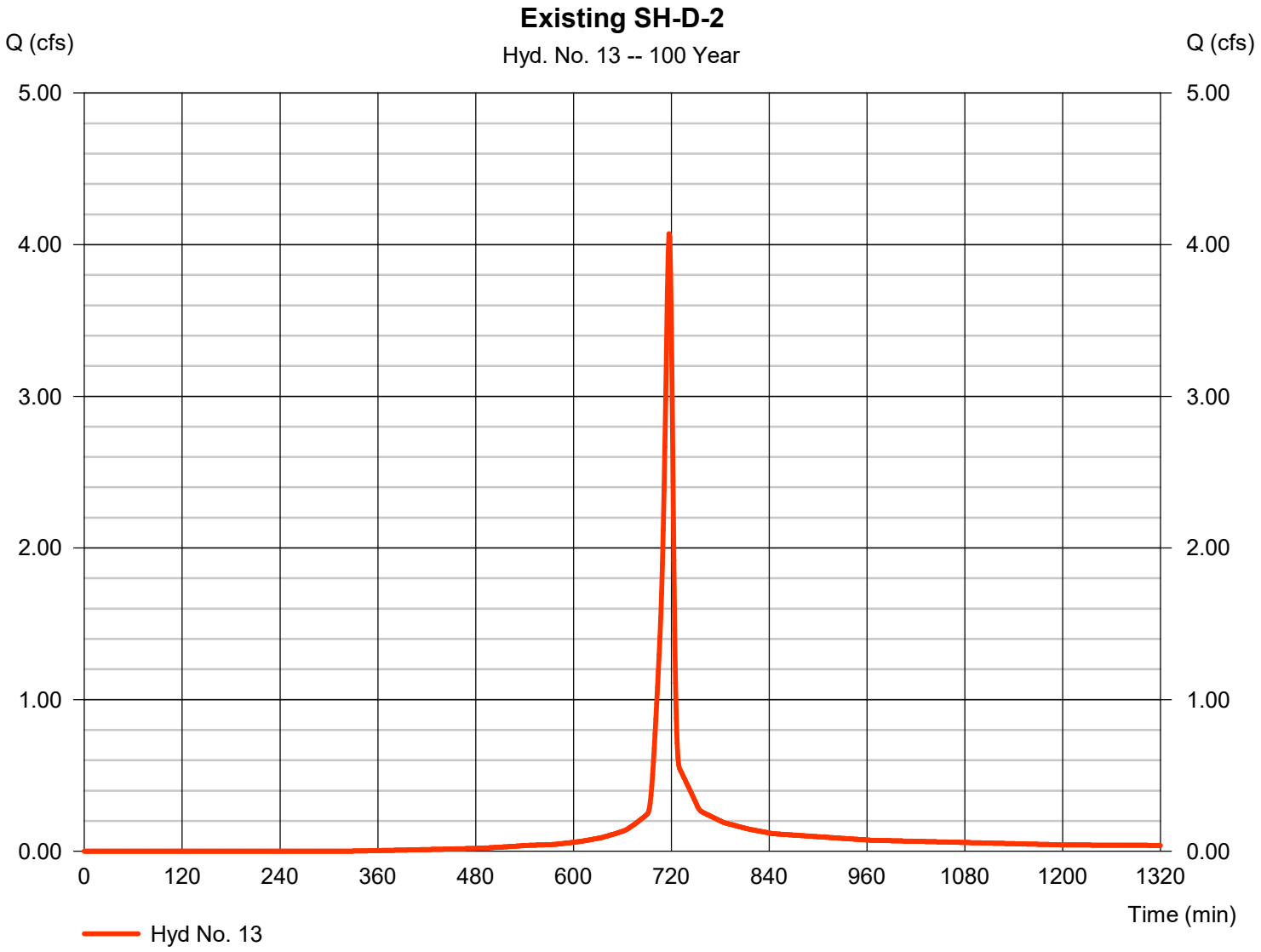


Hydrograph Report

Hyd. No. 13

Existing SH-D-2

Hydrograph type	=	SCS Runoff	Peak discharge	=	4.071 cfs
Storm frequency	=	100 yrs	Time to peak	=	717 min
Time interval	=	1 min	Hyd. volume	=	8,557 cuft
Drainage area	=	0.440 ac	Curve number	=	80
Basin Slope	=	2.8 %	Hydraulic length	=	230 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	7.54 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484



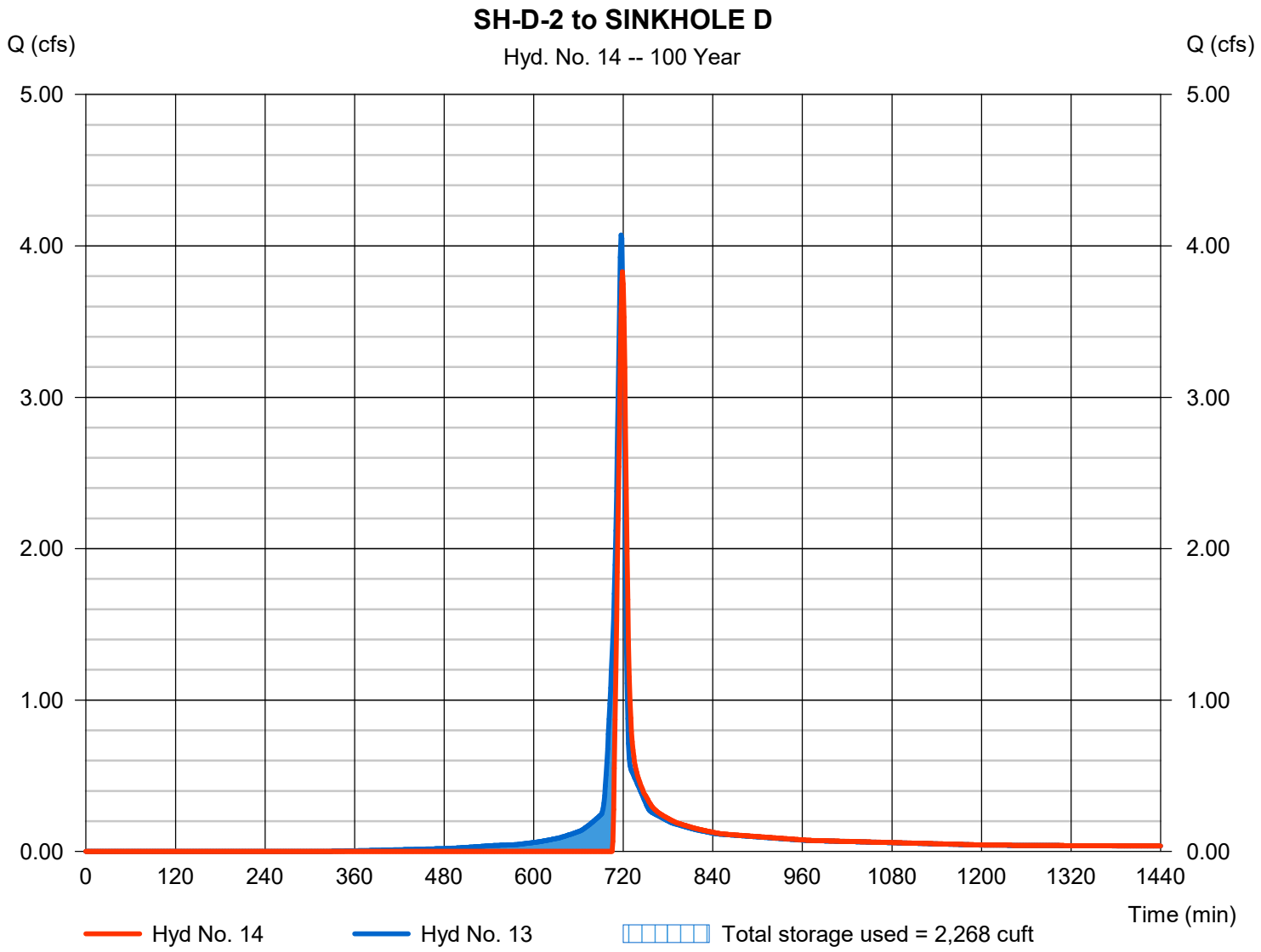
Hydrograph Report

Hyd. No. 14

SH-D-2 to SINKHOLE D

Hydrograph type	=	Reservoir	Peak discharge	=	3.830 cfs
Storm frequency	=	100 yrs	Time to peak	=	719 min
Time interval	=	1 min	Hyd. volume	=	6,945 cuft
Inflow hyd. No.	=	13 - Existing SH-D-2	Max. Elevation	=	1289.73 ft
Reservoir name	=	Sinkhole D	Max. Storage	=	2,268 cuft

Storage Indication method used.



Pond Report

Pond No. 2 - Sinkhole D

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 1288.50 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	1288.50	589	0	0
0.50	1289.00	1,591	525	525
1.00	1289.50	2,815	1,087	1,612
1.50	1290.00	2,815	1,407	3,019
2.00	1290.50	2,815	1,407	4,426

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

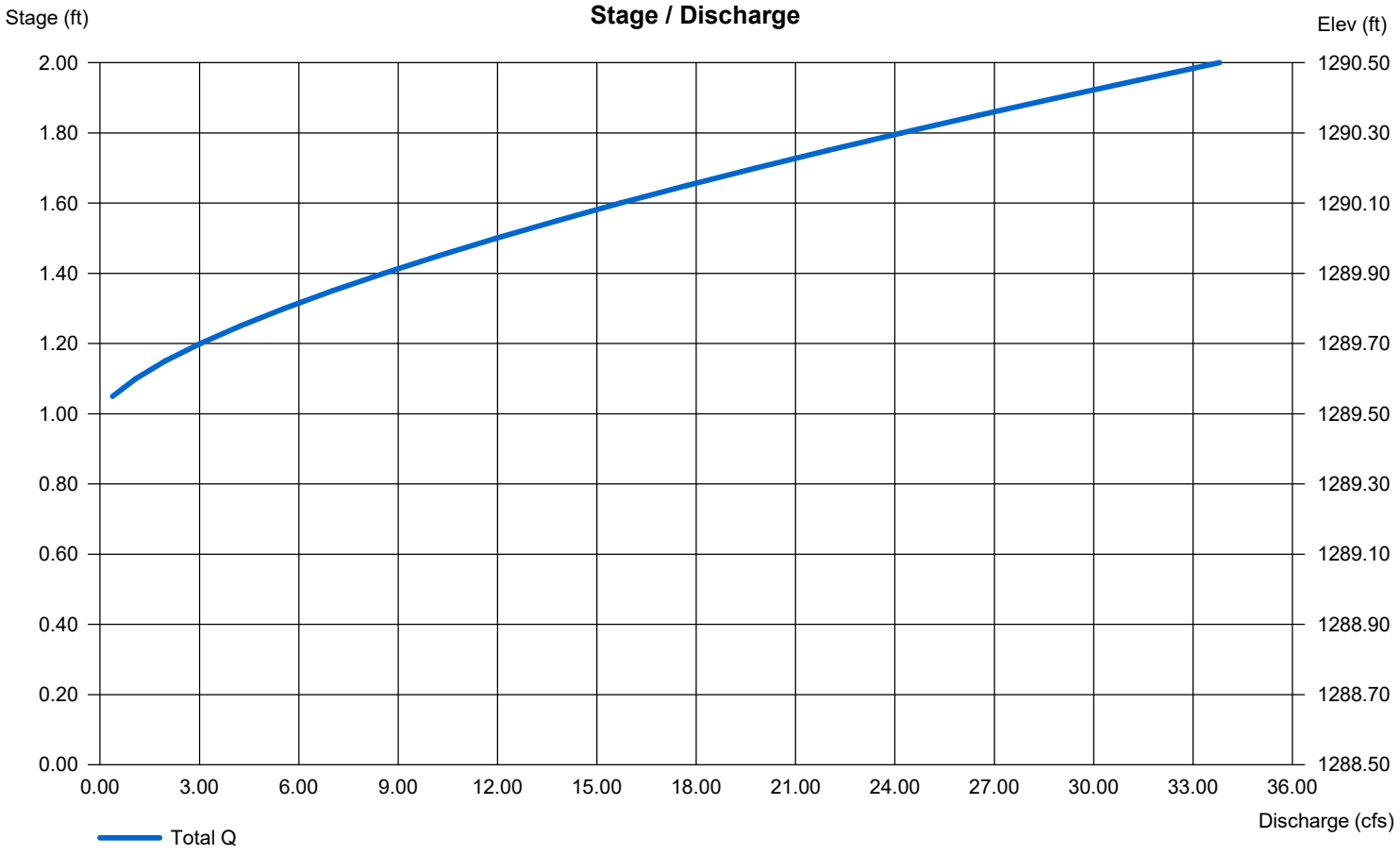
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 13.00	0.00	0.00	0.00
Crest El. (ft)	= 1289.50	0.00	0.00	0.00
Weir Coeff.	= 2.60	3.33	3.33	3.33
Weir Type	= Broad	---	---	---
Multi-Stage	= No	No	No	No

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

TW Elev. (ft) = 0.00

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



GREDELL
ENGINEERING RESOURCES

Sinkhole Evaluation
City of Nixa
New Police Station Development
1209 West Mt. Vernon Street
Nixa, MO 65714

Prepared for:

Mr. Jimmy Liles,
City Administrator
City of Nixa
715 West Mt. Vernon Street
Nixa, MO 65714

July 2024

1505 East High Street
Jefferson City, Missouri 65101-4826

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Sinkhole Evaluation
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July 2024

Prepared by:

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Sinkhole Evaluation
City of Nixa
New Police Station Development

July 2024

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1.0 INTRODUCTION

At the request of the City of Nixa, in accordance with our proposal dated June 10, 2024, and authorized by Cindy Robins, Assistant City Administrator, on June 12, 2024, GREDELL Engineering Resources, Inc. (GER) has completed a sinkhole evaluation at the proposed Nixa Police Station development site (the Site) in Christian County, Missouri. Due to the City's anticipation of annexing the Site, this evaluation has been prepared in general accordance with the requirements of the City of Nixa Technical Specifications Manual, Article VII - Stormwater Management Plan. Our findings and recommendations are summarized below.

2.0 CITY OF NIXA SINKHOLE POLICY

The City of Nixa subscribes to a policy of Avoidance, Minimization and Mitigation with respect to development in areas containing sinkholes. Construction in sinkholes should be avoided. Exceptions to the policy may be made only in situations where it can be conclusively demonstrated that there is no practical alternative to such construction. If construction in sinkholes is deemed necessary, measures may be proposed which will minimize or mitigate the impact on the sinkhole or receiving waters.

The City of Nixa has also established four basic goals for development in sinkhole areas. These goals include assurance of structural integrity, maintenance of the storm water drainage system, protection of groundwater quality, and sustainability. These goals, which are described more fully in the Technical Specification Manual, were addressed in the course of this sinkhole evaluation and development of associated recommendations.

3.0 SITE DESCRIPTION AND SETTING

The Site at the north end (5 acres) of 1209 West Mount Vernon Street is just west of the intersection of North Leeann Drive and Faye Road, and just west of the City of Nixa, Missouri corporate limits in the NE ¼, SW ¼, NE ¼, S-15, T27N, R22W, Christian County, Missouri 65714. It has been historically used for agricultural purposes and currently consists of pasture land with tree lines along the north and west property boundaries. The Site is bounded by residential land and a church to the west, N. Leeann Drive and residential land to the east, residential and undeveloped land to the north, and undeveloped land to the south.

The development, as shown on the Preliminary Development Layout provided in Appendix A, is currently in Christian County jurisdiction. However, the City of Nixa anticipates annexing the Site. Access to the site is provided from N. Leeann Drive. Surface runoff and shallow groundwater movement is generally from southwest to northeast. This area is typified by internal stormwater drainage to losing streams and sinkholes. The Site lies at an approximate elevation of 1290 feet. Topographic contours with a one-foot contour interval are provided on the Figures.

4.0 AREA GEOLOGY

This region of Christian County is underlain by the Burlington-Keokuk Limestone; a Mississippian age, coarsely crystalline, crinoidal limestone within which most of the karst features in the county form. Caves, springs and sinkholes commonly develop within this unit, along with pinnacles and cutters, giving rise to a highly irregular soil-bedrock interface. The Burlington-Keokuk typically caps upland areas and can exceed 100 feet (30 m) in thickness.

Beneath the Burlington-Keokuk Limestone lies the Elsey-Reeds Spring Formation, a fine-grained, gray limestone with large amounts of chert in the form of nodules and beds. The Elsey-Reeds Spring Formation is generally 50 to 60 feet (15-18 m) thick in this region. The Elsey-Reeds Spring Formation crops out along tributaries of the James River to the north. The shallow karst system developed within the Burlington-Keokuk Limestone does not typically extend into the Elsey-Reeds Spring Formation. Consequently, shallow groundwater in the karst system tends to resurface at springs developed within the vertical extent of the Burlington-Keokuk.

Two distinct types of sinkholes exist in this area: solutional sinkholes and collapse sinkholes. Solutional sinkholes form along bedrock joints as slightly acidic groundwater slowly dissolves the limestone. Solutional sinkholes tend to be bowl-shaped with a flat floor covered in sediment and sloping sidewalls. Sinkhole eyes often form on the sinkhole floor as fine-grained soils erode into the underlying solution-widened joints. Sinkhole sidewalls tend to be relatively stable. Solutional sinkholes often form at the intersection of solution-widened joints and can mirror the trends of the joint sets. In the Nixa area, there tends to be a primary set of parallel joints that trend NW-SE and a secondary set of parallel joints that trend NE-SW.

Collapse sinkholes originate at the bedrock surface as fine-grained soils migrate into subsurface cavities. As more and more soil is displaced, the subsurface cavity propagates upward toward the ground surface until the soils can no longer bridge the cavity and a surface collapse occurs. Collapse sinkholes can form with no warning but are often triggered by changes in soil moisture content. As moisture content of the soils increases, unit weight increases and strength decreases. Collapse sinkholes can usually be repaired and stabilized by construction of a properly designed graded filter, provided the depth to bedrock is not too great.

5.0 SINKHOLE IDENTIFICATION AND EVALUATION

Initial site reconnaissance was conducted at the Site on Wednesday, June 19, 2024. After the site was mowed, a supplemental site reconnaissance was conducted on June 27, 2024. A total of four (4) sinkholes were identified onsite and are shown on Figure 1 – Sinkhole Location Map. Descriptions of individual sinkholes follow:

Sinkhole A is a shallow, oval shaped solutional sinkhole located on the northeast corner of the Site with a floor elevation of 1286.5 feet. The sinkhole is approximately 73 feet by 88 feet in dimension and oriented in a W-E direction. The sinkhole is mostly contained on the Site and

extends into the tree line near the property to the north. The sinkhole receives runoff from the residence and pasture to the north, pasture south of the site, and drainage from Sinkholes B, C and D. The spillover point is located on the east side of the sinkhole at approximate elevation 1287.5 feet. The discharge flows to the stormwater inlets located along the west side of N. Leeann Drive and along the eastern border of the tract. The sinkhole floor is grass-covered and appears to be relatively stable with no evidence of an eye or other ground movement noted.

Sinkhole B is a solutional side-slope sinkhole approximately 6 inches deep and 25 feet across, located west of Sinkhole A in the north central area of the Site. Side slope sinkholes do not exhibit a defined depression with a continuous rim and tend to drain freely. In the case of Sinkhole B, the “open” side of the sinkhole occurs on the south side of the sinkhole. The existence of a sloping floor was confirmed by GER with a construction level. The sinkhole floor is grass-covered and appears to be relatively stable with no evidence of an eye or other ground movement noted.

Sinkhole C is a solutional side slope sinkhole located in the northwestern corner of the tract. The sinkhole is approximately 32 feet wide and 4 inches in depth, extending along a W-E trend with the “open” side on the east. The sinkhole receives stormwater from the site and from a detention basin to the west of the property. The existence of a sloping floor was confirmed by GER with a construction level. The sinkhole is generally grass covered and appears to be relatively stable. There was no evidence of an eye or other ground movement, although vegetative cover prevented a detailed inspection.

Sinkhole D is a shallow, oval shaped solutional sinkhole located south of Sinkhole B and extends off the Site into the proposed stormwater detention area. The sinkhole is approximately 58 feet in width and 76 feet in length, oriented in a N-S direction. The spillover point is located on the northeast side of the sinkhole at approximate elevation 1289.5 feet where the sinkhole overflows towards Sinkhole A. Sinkhole D has a small, flat floor holding water, with a low point near the center at approximate elevation 1288.5 feet. Two small sinkhole eyes were identified near the northern edge of the sinkhole rim. The western eye was probed to a depth of two feet. The eastern eye was probed to a depth of six inches. No other evidence of ground movement was noted.

A photolog of the sinkholes and possible karst features is provided in Appendix B.

6.0 FLOODING CONSIDERATIONS

The Technical Specification Manual requires a flooding analysis be conducted for both pre-development and post-development conditions, assuming no subsurface outflow from the sinkholes, and that this analysis continue downstream until the lowest sinkhole of the sinkhole cluster is reached or overflow reaches a surface watercourse. Sinkholes A and D pool water and discharge to surface drainage

Sinkholes B, C, and D discharge to Sinkhole A, located on the Site. Sinkhole A discharges to the street stormwater collection system and ultimately flows to a stormwater detention basin. Therefore, Sinkhole A is considered the Terminal Sinkhole, according to the City of Nixa Technical Specifications Manual. The mapped sinkhole areas, water supply wells, and geological features for the area of interest and documented in the Missouri Geological Survey GeoSTRAT database are shown on Figure 4 – Area Karst Features. Following is a summary of the flooding analysis.

The City of Nixa Technical Specifications Manual requires the computation of the maximum estimated flooding elevations for each sinkhole. The volume of runoff considered must be equivalent to a storm event with an annual probability of one percent (1%) (100-year storm) and a duration of six (6) hours; this corresponds to 5.8 inches of rainfall for the City of Nixa. The runoff volume must be determined by the method outlined in Chapter 2 of the SCS TR-55 Manual (SCS Runoff Curve Number Method). The evaluation assumes no subsurface outflow from the sinkhole. According to the NRCS Web Soil Survey Report (Appendix C), the soils on and around the site are rated as hydrologic soil group Class B, D, and C/D.

In order to evaluate the sinkhole storage capacity, the areas of individual topographic contour lines were measured, and incremental sinkhole volumes (between contours) were calculated by the “average end area” method. The 100-year pre-development flood calculations are provided in Appendix D.

The pre-development drainage, storage, and flood data for the sinkhole flood analyses are summarized in Table 1. A map showing the size and location of the predevelopment drainage areas for each sinkhole is provided in Figure 2 – Sinkhole Drainage Areas.

TABLE 1. PRE-DEVELOPMENT 100-YEAR FLOOD VOLUMES, TERMINAL OVERFLOW VOLUMES AND FLOOD ELEVATIONS

Sinkhole ID	Drainage Area (Acres)	Storage Volume (Acre-ft)	Flood Volume (acre ft)	Overflow (Acre-Ft)	Flood Elevation (ft-asl)
A (Terminal Sinkhole)	39.1	0.082	11.48	11.40	1,287.5
D	4.1	0.037	1.11	1.07	1,289.5

The 100-year post-development flood calculations are also provided in Appendix D. The post-development drainage, storage and flood data for each sinkhole are summarized in Table 2. It is important to note that the stormwater analysis was performed based on existing site topography and by using the impervious areas based on the Preliminary Development Layout. It is understood that the site may be graded to drain to a detention basin south of the development, but the development grading plan was not completed prior to this Sinkhole Evaluation.

TABLE 2. POST-DEVELOPMENT 100-YEAR FLOOD VOLUMES, TERMINAL OVERFLOW VOLUMES AND FLOOD ELEVATIONS

Sinkhole ID	Drainage Area (Acres)	Storage Volume (Acre-ft)	Flood Volume (acre ft)	Overflow (Acre-Ft)	Flood Elevation (ft-asl)
A (Terminal Sinkhole)	39.1	0.082	12.34	12.26	1,287.5
D	4.1	0.037	1.11	1.07	1,289.5

Both the pre-development and post-development flood areas for Sinkholes A and D extend past the Site boundary. A drainage easement should not be required for either sinkhole because the

flood area is at least one foot below the minimum entry elevation of any existing structure and flood elevation increases are within the reasonable tolerance (0.1 ft) outlined in the Technical Specification Manual. For the detailed flooding analysis, the Rational Method was used to obtain peak runoff rates for Sinkholes A and D. The overflow across N. Leeann Drive was evaluated to determine that the flooding depth over the roadway would not exceed the maximum 6 inches depth set forth in the Technical Specification Manual and the increased depth from the development was less than 0.1 foot.

7.0 WATER QUALITY CONSIDERATIONS

The Technical Specification Manual requires that all sinkhole evaluations must consider potential impacts of the proposed construction on receiving ground waters and propose measures to mitigate such impacts. The Site does not lie within a Critical Area sensitive to contamination from urban runoff, as defined by the City of Nixa, since it does not lie within recharge areas of domestic water supply wells or springs used for public or private water supply.

There are also no known caves providing habitat to rare or endangered species. Accordingly, only the onsite sinkholes themselves are classified as Sensitive Areas for groundwater contamination. The Technical Specifications Manual also requires that the relative potential for groundwater contamination be classified as Low, Moderate, and High Hazards depending on the type of land use, development density, and amount of directly connected impervious area. The potential for the proposed development to impact groundwater quality is low provided that all setback and storm water management requirements are followed. Additionally, erosion control measures should be maintained during construction in accordance with the Water Quality Management Measures outlined in the Technical Specification Manual and Best Management Practices.

8.0 PERFORMANCE STANDARDS AND CONSIDERATIONS FOR DEVELOPMENT

The Preliminary Site Layout has generally been laid out to avoid sinkholes to the degree possible, given the configuration of the tract and the locations of the sinkholes. Properly designed and constructed roadways and parking spaces that provide adequate stormwater drainage should provide suitable structural stability.

Underground utilities that are constructed within twenty feet of sinkhole rims must be bedded in flowable fill rather than granular fill. This practice will prevent the utility trench from acting as a French drain and channeling subsurface water to the sinkhole floor. The installation of utilities within a sinkhole will be limited to the sinkhole slope, since the sinkhole floor may be subject to subsidence, collapse, or prolonged ponding of storm water.

9.0 SINKHOLE SETBACKS AND USE RESTRICTIONS

The Technical Specification Manual requires that certain setbacks and use restrictions be established for each sinkhole. No new construction of any of the following is permitted within ten (10) feet of the sinkhole rim:

- Residential, commercial or industrial structures within 10 feet of the rim of a sinkhole that has not been closed as provided in the regulations.
- Swimming pools,
- Streets, highways, or parking lots within 10 feet of the rim of a sinkhole that has not been closed as provided in the regulations; and
- Storage yards for materials, vehicles and equipment.

Use restrictions and guidelines include the following:

- Use of pesticides and fertilizers within thirty (30) feet of the sinkhole rim is prohibited.
- Use of heavy construction equipment in unaltered sinkholes is prohibited.
- Construction of underground utilities is prohibited within the sinkhole rim except as provided for in the regulations.
- Recreational facilities such as hiking, jogging, and bicycle trails, playgrounds, exercise courses, and grass playing fields are permitted within the sinkhole area provided they are not located within the eye of the sinkhole.
- Golf courses are permitted subject to approval of a Management Plan for use of pesticides and fertilizers.
- Clearing and pruning of trees and undergrowth, and limited grubbing of roots is permitted.
- Landscaping and minor gardening is permitted outside of the sinkhole eye provided erosion and sediment discharge is limited through the use of minimum tillage and mulch.

- Construction of light incidental landscaping and recreational structures such as gazebos, playground equipment, etc. is permitted except in the sinkhole eye.

City of Nixa regulations also require that the minimum entry elevation of any existing structure be at least one foot higher than the estimated flooding elevation from the 1 percent annual probability 6-hour storm. The 10-foot construction setback from the sinkhole rim and the estimated flood elevations are shown on Figure 3 – Construction Setbacks and Elevations.

10.0 RECOMMENDATIONS

If approved, following are recommendations specific to the Site development:

- The side slope sinkholes are generally unusable in their current state and will only serve as a breeding ground for mosquitos and other vectors. It is recommended that Sinkholes B and C be closed in accordance with the requirements of the Technical Specification Manual. The sinkhole should be filled to match the surrounding ground surface and graded to promote storm water runoff. This action will also improve the stability of the development.
- The proposed detention basin near Sinkhole D should be lined with an HDPE geosynthetic liner to prevent stormwater storage from infiltrating into the sinkhole and causing instability.
- Sinkhole A, which receives stormwater from the adjacent site to the north, should not be disturbed and should remain in its natural state to drain.
- All residential structures constructed within the sinkhole rim must have the lowest floor elevation set a minimum of 1 foot above the Post-Development sinkhole flooding elevation.
- Underground utilities constructed within the sinkhole rim should incorporate flowable fill, rather than granular bedding, to reduce the risk of migration of groundwater along the trench.
- A geotechnical investigation should be conducted by a qualified Geotechnical Engineer to evaluate engineering properties of onsite materials and provide a basis for design of Site improvements.
- No construction activities or construction traffic should be allowed within the floors of sinkholes, and existing grass cover should be maintained.
- It is recommended that these sinkholes be monitored periodically for ground movement or collapse. Sinkhole collapses are generally unpredictable and can occur in areas with no surface expression of karst. In the event that a sinkhole collapse occurs, the collapse should be stabilized and filled in accordance with the recommendations of the Missouri State Department of Natural Resources provided a sinkhole evaluation has been completed by a qualified Engineer or Geologist.

11.0 LIMITATIONS

This report has been prepared under the direction of a Qualified Professional Engineer and Qualified Geologist in accordance with the requirements of the City of Nixa Technical Specification Manual.

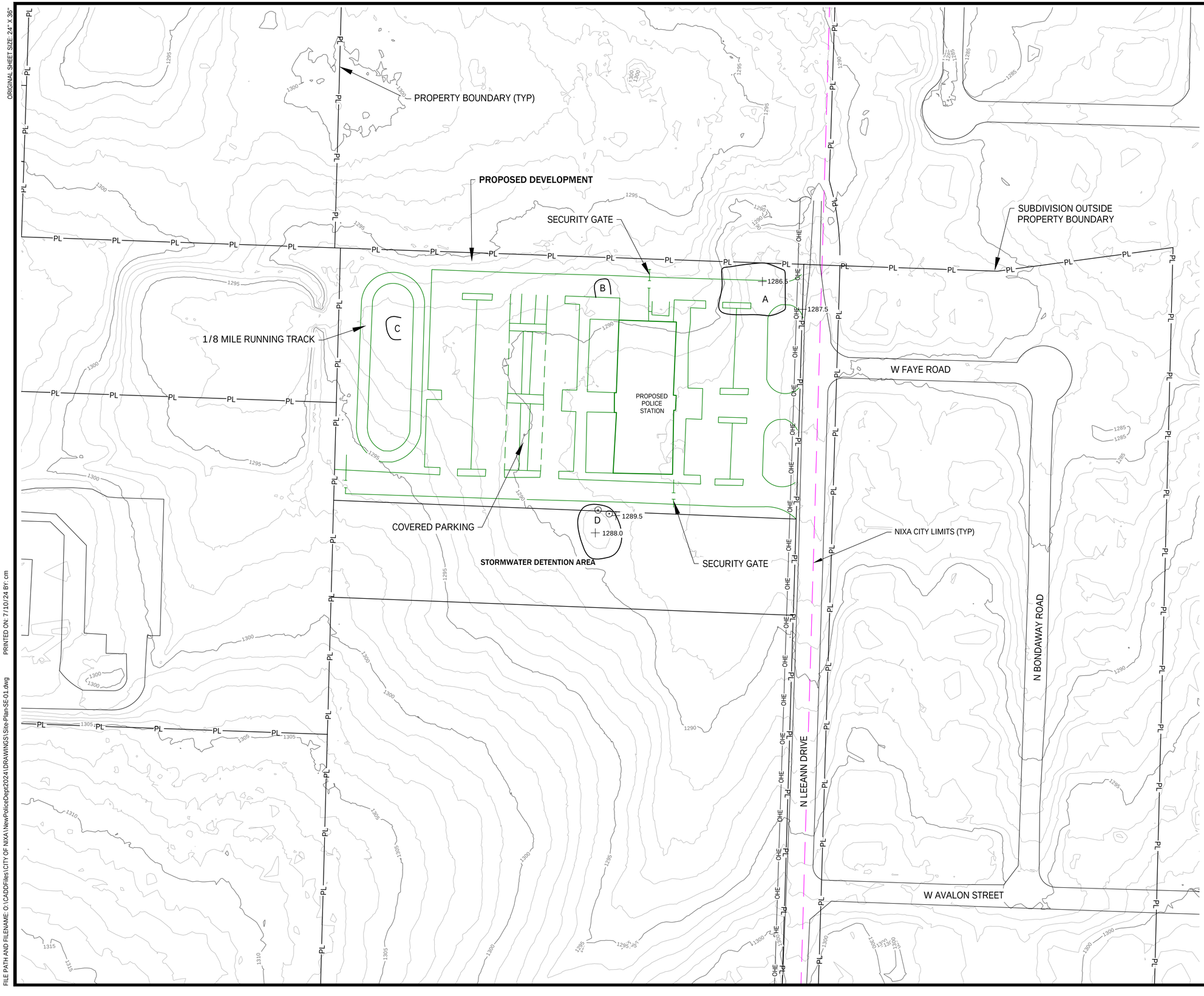
GER prepared this report for the City of Nixa, and their authorized agents, for the New Police Station Development, Nixa, Christian County, Missouri. This report is not intended for use by others, and the information contained herein is not applicable to other locations. The data and report should be provided

to prospective developers, but our report, conclusions and interpretations should not be construed as a warranty of the subsurface conditions.

The scope of our services does not include services related to construction safety precautions. Our recommendations are not intended to direct the contractor's methods, techniques, sequences or procedures, except as specifically described in our report for consideration in design.

Within the limitations of scope, schedule and budget, our services have been executed in accordance with generally accepted practices in the field of geotechnical engineering in this area at the time this report was prepared. No warranty or other conditions, express or implied, should be understood. Please refer to Appendix E titled “Report Limitations and Guidelines for Use” for additional information pertaining to the use of this report.

FIGURES



LEGEND:

- LIDAR MAJOR 5' CONTOUR
- LIDAR MINOR 1' CONTOUR
- OVERHEAD POWER LINES
- PROPERTY BOUNDARY
- SINKHOLE RIM
- SITE DEVELOPMENT FOOTPRINT
- NIXA CITY LIMITS
- SINKHOLE EYE
- APPROXIMATE SPOT ELEVATIONS

NOTES:

1. TOPOGRAPHIC DATA OBTAINED FROM MISSOURI SPATIAL DATA INFORMATION SERVICES (MSDIS) DATED 05/2017.
2. PROPERTY BOUNDARY AND NIXA CITY LIMITS OBTAINED FROM CHRISTIAN COUNTY ASSESSOR'S GIS WEBSITE DATED 06/18/2024.
3. DEVELOPMENT LAYOUT OBTAINED FROM NAVIGATE BUILDING SOLUTIONS DATED 05/28/2024.
4. LOCATIONS OF FIELD OBSERVED FEATURES ARE APPROXIMATE.

#	DATE	REVISION DESCRIPTION	BY

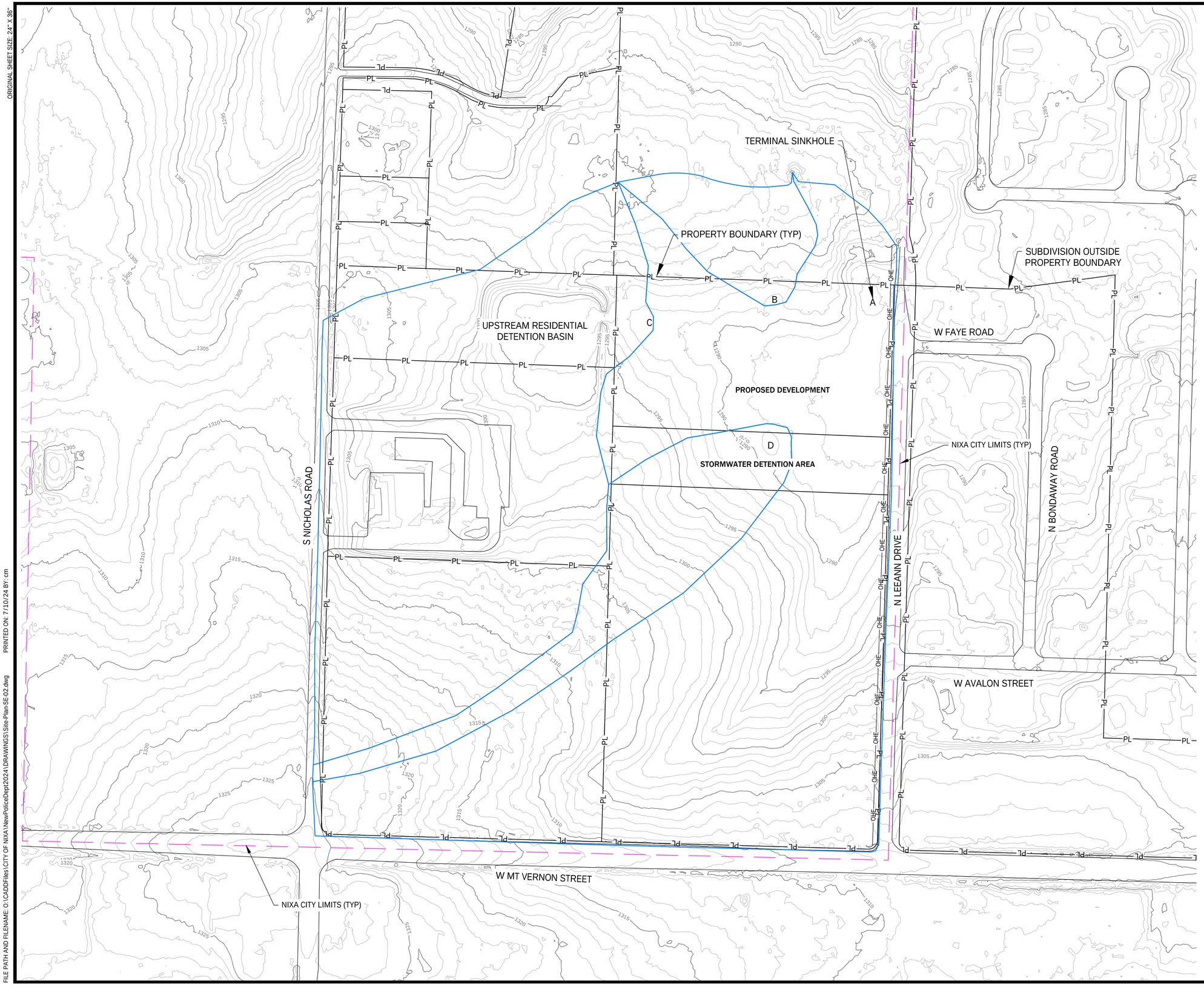
FIGURE 1
SINKHOLE LOCATION MAP
SINKHOLE EVALUATION

CITY OF NIXA
SINKHOLE EVALUATION
TASK ORDER 24-001

SURVEYED	DESIGNED	DRAWN	CHECKED	APPROVED	DATE	SCALE
N/A	JF	CM	JF	GP	07/2024	1" = 60'

PROJECT NAME: SINKHOLE EVAL
FILE NAME: Site-Plan-SE-01
SHEET # 1 OF 4

GREDELL ENGINEERING RESOURCES
CIVIL - GEOTECHNICAL - ENVIRONMENTAL - GEOLOGY - EARTH SCIENCES
1505 East High Street
Jefferson City, Missouri
Telephone: (573) 659-9078
Facsimile: (573) 659-9079
MO CORP. ENGINEERING LICENSE NO. E-2003100169-D



LEGEND:

- LIDAR MAJOR 5' CONTOUR
- LIDAR MINOR 1' CONTOUR
- OVERHEAD POWER LINES
- PROPERTY BOUNDARY
- SINKHOLE DRAINAGE AREA
- NIXA CITY LIMITS

NOTES:

1. TOPOGRAPHIC DATA OBTAINED FROM MISSOURI SPATIAL DATA INFORMATION SERVICES (MSDIS) DATED 05/2017.
2. PROPERTY BOUNDARY AND NIXA CITY LIMITS OBTAINED FROM CHRISTIAN COUNTY ASSESSOR'S GIS WEBSITE DATED 06/18/2024.
3. DEVELOPMENT LAYOUT OBTAINED FROM NAVIGATE BUILDING SOLUTIONS DATED 05/28/2024.
4. LOCATIONS OF FIELD OBSERVED FEATURES ARE APPROXIMATE.

SINKHOLE AND DRAINAGE AREA	
SINKHOLE	DRAINAGE AREA (ACRES)
A	21.4
B	1.8
C	15.9
D	4.1

FIGURE 2
SINKHOLE DRAINAGE AREAS
SINKHOLE EVALUATION

CITY OF NIXA
SINKHOLE EVALUATION
TASK ORDER 24-001

#	DATE	REVISION DESCRIPTION	BY

SURVEYED: N/A | DESIGNED: JF | DRAWN: CM | CHECKED: JF | APPROVED: GP | DATE: 07/2024 | SCALE: 1" = 100'

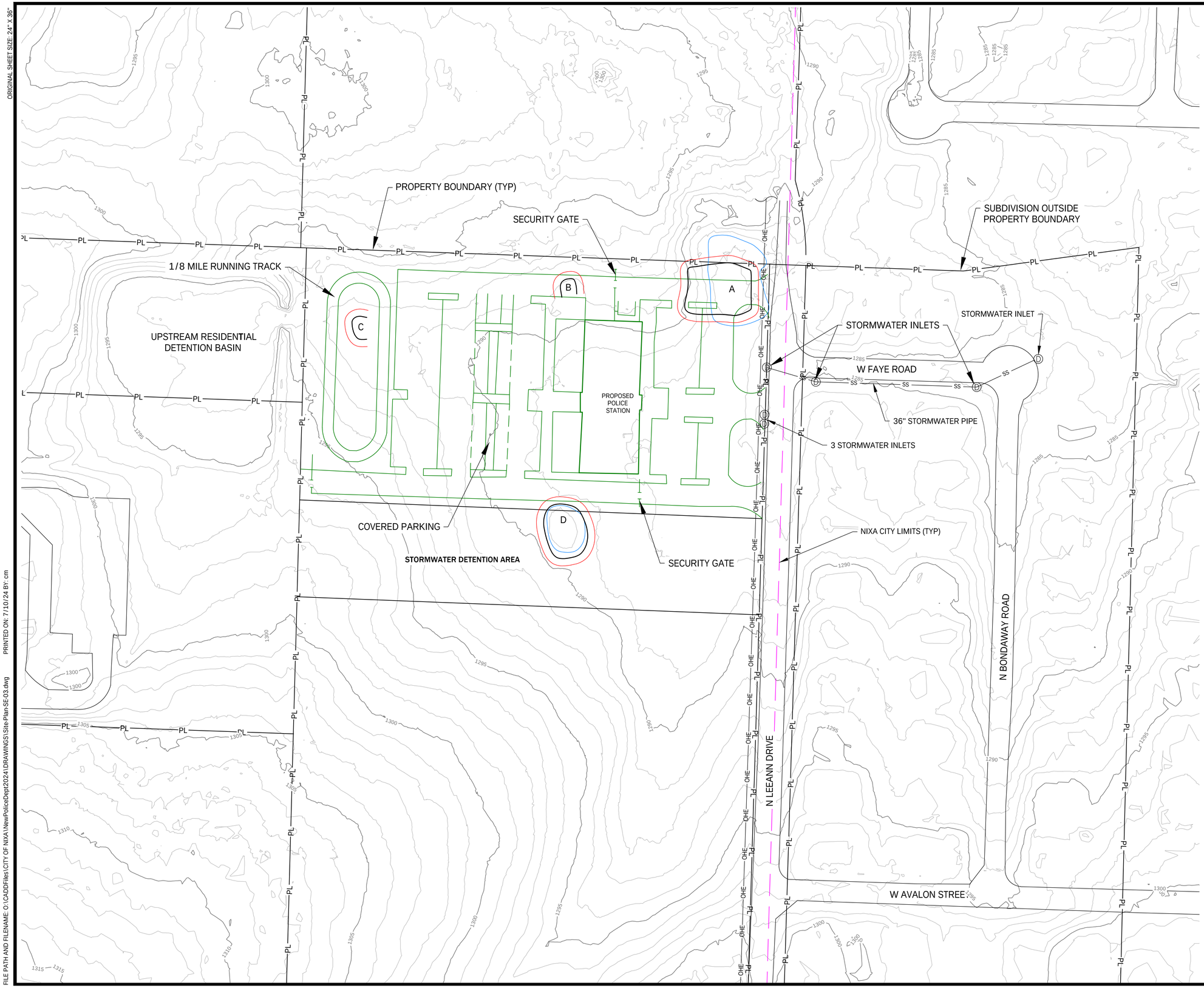
PROJECT NAME: SINKHOLE EVAL | FILE NAME: Site-Plan-SE-02 | SHEET # 2 OF 4

GREDELL ENGINEERING RESOURCES
CIVIL - GEOTECHNICAL - ENVIRONMENTAL - GEOLOGY - EARTH SCIENCES
1505 East High Street
Jefferson City, Missouri
Telephone: (573) 659-9078
Facsimile: (573) 659-9079
MO CORP. ENGINEERING LICENSE NO. E2001001669

ORIGINAL SHEET SIZE: 24" X 36"

FILE PATH AND FILENAME: O:\CADDfiles\CITY OF NIXA\NewPoliceDept2024\DRAWINGS\Site-Plan-SE-02.dwg

PRINTED ON: 7/10/24 BY: cm



SCALE: 1" = 60'
0 30' 60' 120'

LEGEND:

- LIDAR MAJOR 5' CONTOUR
- LIDAR MINOR 1' CONTOUR
- OVERHEAD POWER LINES
- PROPERTY BOUNDARY
- STORMWATER PIPE
- FLOODING AREA
- SINKHOLE RIM
- 10' SETBACK FROM SINKHOLE RIM
- SITE DEVELOPMENT FOOTPRINT
- NIXA CITY LIMITS
- APPROXIMATE SPOT ELEVATIONS
- STORMWATER INLET

NOTES:

1. TOPOGRAPHIC DATA OBTAINED FROM MISSOURI SPATIAL DATA INFORMATION SERVICES (MSDIS) DATED 05/2017.
2. PROPERTY BOUNDARY AND NIXA CITY LIMITS OBTAINED FROM CHRISTIAN COUNTY ASSESSOR'S GIS WEBSITE DATED 06/18/2024.
3. DEVELOPMENT LAYOUT OBTAINED FROM NAVIGATE BUILDING SOLUTIONS DATED 05/28/2024.
4. LOCATIONS OF FIELD OBSERVED FEATURES ARE APPROXIMATE.
5. STORMWATER PIPE AND STRUCTURES ARE APPROXIMATE BASED ON CITY OF NIXA INTERACTIVE MAP APPLICATIONS DATED 07/03/2024.
6. DESIGN FLOOD ELEVATIONS ARE BASED ON A STORM WITH AN ANNUAL PROBABILITY OF 1% (100-YEAR STORM) AND DURATION OF 6 HOURS (5.8" FOR NIXA).

#	DATE	REVISION DESCRIPTION	BY

FIGURE 3
CONSTRUCTION SETBACKS AND ELEVATIONS

CITY OF NIXA
SINKHOLE EVALUATION
TASK ORDER 24-001

SURVEYED	DESIGNED	DRAWN	CHECKED	APPROVED	DATE	SCALE
N/A	JF	CM	JF	GP	07/2024	1" = 60'

PROJECT NAME: SINKHOLE EVAL
FILE NAME: Site-Plan-SE-03
SHEET # 3 OF 4

GREDELL ENGINEERING RESOURCES
CIVIL - GEOTECHNICAL - ENVIRONMENTAL - GEOLOGY - EARTH SCIENCES
1505 East High Street
Jefferson City, Missouri
Telephone: (573) 659-9078
Facsimile: (573) 659-9079
MO CORP. ENGINEERING LICENSE NO. E-2001001669.0

ACTIVE WATER WELL

SINKHOLE AREA

S NICHOLAS ROAD

NIXA CITY LIMITS

DOWNSTREAM RESIDENTIAL DETENTION BASIN

SAC RIVER FAULT

ACTIVE WATER WELL

ACTIVE WATER WELL

UPSTREAM RESIDENTIAL DETENTION BASIN

LOSING STREAM

PROPOSED DEVELOPMENT

STORMWATER DETENTION AREA

N LEEANN DRIVE

N GREGG ROAD

NIXA CITY LIMITS

ACTIVE WATER WELL

SINKHOLE AREA

W MT VERNON STREET

W MT VERNON STREET

N

SCALE: 1" = 200'

0 100' 200' 400'

LEGEND:

- LIDAR MAJOR 5' CONTOUR
- LIDAR MINOR 1' CONTOUR
- MGS GEOSTRAT SINKHOLE AREAS
- LOSING STREAMS
- GEOLOGIC STRUCTURES
- PROPERTY BOUNDARY — PL —
- NIXA CITY LIMITS
- EXISTING ROADWAYS
- ACTIVE WATER WELLS

NOTES:

1. TOPOGRAPHIC DATA OBTAINED FROM MISSOURI SPATIAL DATA INFORMATION SERVICES (MSDIS) DATED 05/2017.
2. PROPERTY BOUNDARY AND NIXA CITY LIMITS OBTAINED FROM CHRISTIAN COUNTY ASSESSOR'S GIS WEBSITE DATED 06/18/2024.
3. DEVELOPMENT LAYOUT OBTAINED FROM NAVIGATE BUILDING SOLUTIONS DATED 05/28/2024.
4. LOCATIONS OF FIELD OBSERVED FEATURES ARE APPROXIMATE.
5. SINKHOLE AREA, LOSING STREAMS, WATER WELLS, AND GEOLOGIC STRUCTURES OBTAINED FROM MISSOURI DEPARTMENT OF NATURAL RESOURCES GEOSTRAT (MDNR GEOSTRAT) DATED 07/03/2024.

#	DATE	REVISION DESCRIPTION	BY

STATE OF MISSOURI
JOSEPH FOSTER
E-26335
07-10-24

FIGURE 4
AREA KARST FEATURES

SHEET # 4 OF 4
FILE NAME Site-Plan-SE-04
PROJECT NAME SINKHOLE EVAL

CITY OF NIXA
SINKHOLE EVALUATION
TASK ORDER 24-001

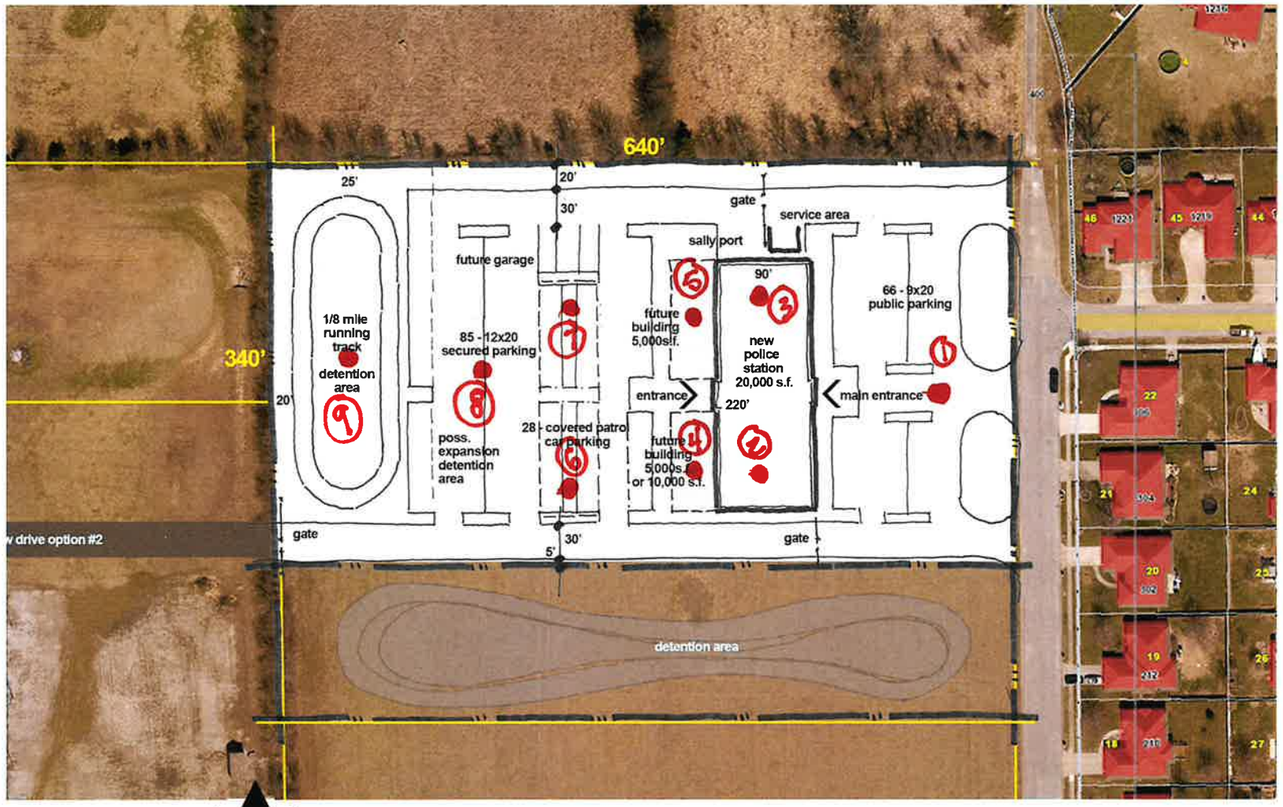
SURVEYED	DESIGNED	DRAWN	CHECKED	APPROVED	DATE	SCALE
N/A	JF	CM	JF	GP	07/2024	1" = 200'

GREDELL ENGINEERING RESOURCES
CIVIL - GEOTECHNICAL - ENVIRONMENTAL - GEOLOGY - EARTH SCIENCES
1505 East High Street
Jefferson City, Missouri
Telephone: (573) 659-9078
Facsimile: (573) 659-9079
MO CORP. ENGINEERING LICENSE NO. E-2001001699-D

APPENDICES

Appendix A

Preliminary Development Layout, 05/28/24



siteplan
scale: 1"=60'-0"+-

N

developmentplan
scale: N.T.S.

N

alt. site study

Sheet Name:

Date: May 28, 2024

NIXA MISSOURI

New Police Station

West Mount Vernon Street & North Leann Drive

Insight Design Architects, LLC
112 South Main Street
PO Box 1962
Nixa, MO 65714

Chiodini ARCHITECTS
Chiodini Associates - Architects | Interior Design | Graphics
1401 South Brentwood Blvd. Studio 575
Saint Louis, Missouri 63144
314.725.5538 | FAX 314.725.9959

Appendix B

Nixa Police Station Photolog

City of Nixa
New Police Station
Sinkhole Evaluation Report
Photolog

PHOTO ID:	1
DATE:	6-27-2024
DIRECTION:	West
DESCRIPTION:	
The depression of Sinkhole A is shown in foreground. The tree line which runs along the west and north property line is shown in the background.	

PHOTO ID:	2
DATE:	6-27-2024
DIRECTION:	East
DESCRIPTION:	
The depression of Sinkhole A is shown in foreground. Neighboring residences are shown in the background.	

City of Nixa
New Police Station
Sinkhole Evaluation Report
Photolog

PHOTO ID:	3
DATE:	6-27-2024
DIRECTION:	Southwest
DESCRIPTION:	
The depression of Sinkhole B is shown in foreground. In the background is the tree line running along the west side of the property.	

PHOTO ID:	4
DATE:	6-27-2024
DIRECTION:	Northwest
DESCRIPTION:	
The depression of Sinkhole A is shown in background, along with the tree line bordering the northern perimeter of the property.	

City of Nixa
New Police Station
Sinkhole Evaluation Report
Photolog

PHOTO ID:	5
DATE:	7-9-2024
DIRECTION:	Northwest
DESCRIPTION:	
The depression of Sinkhole C is shown in foreground. In the background is the tree line running along the west side of the property.	

PHOTO ID:	6
DATE:	7-10-2024
DIRECTION:	North
DESCRIPTION:	
The floor of Sinkhole C is shallow with no ponding water.	

City of Nixa
New Police Station
Sinkhole Evaluation Report
Photolog

PHOTO ID:	7
DATE:	7-9-2024
DIRECTION:	Northeast
DESCRIPTION:	
The depression of Sinkhole D is shown in foreground. In the background are neighboring residences east of Leeann Drive.	

PHOTO ID:	8
DATE:	6-27-2024
DIRECTION:	North
DESCRIPTION:	
The floor of Sinkhole D is shallow with standing water.	

City of Nixa
New Police Station
Sinkhole Evaluation Report
Photolog

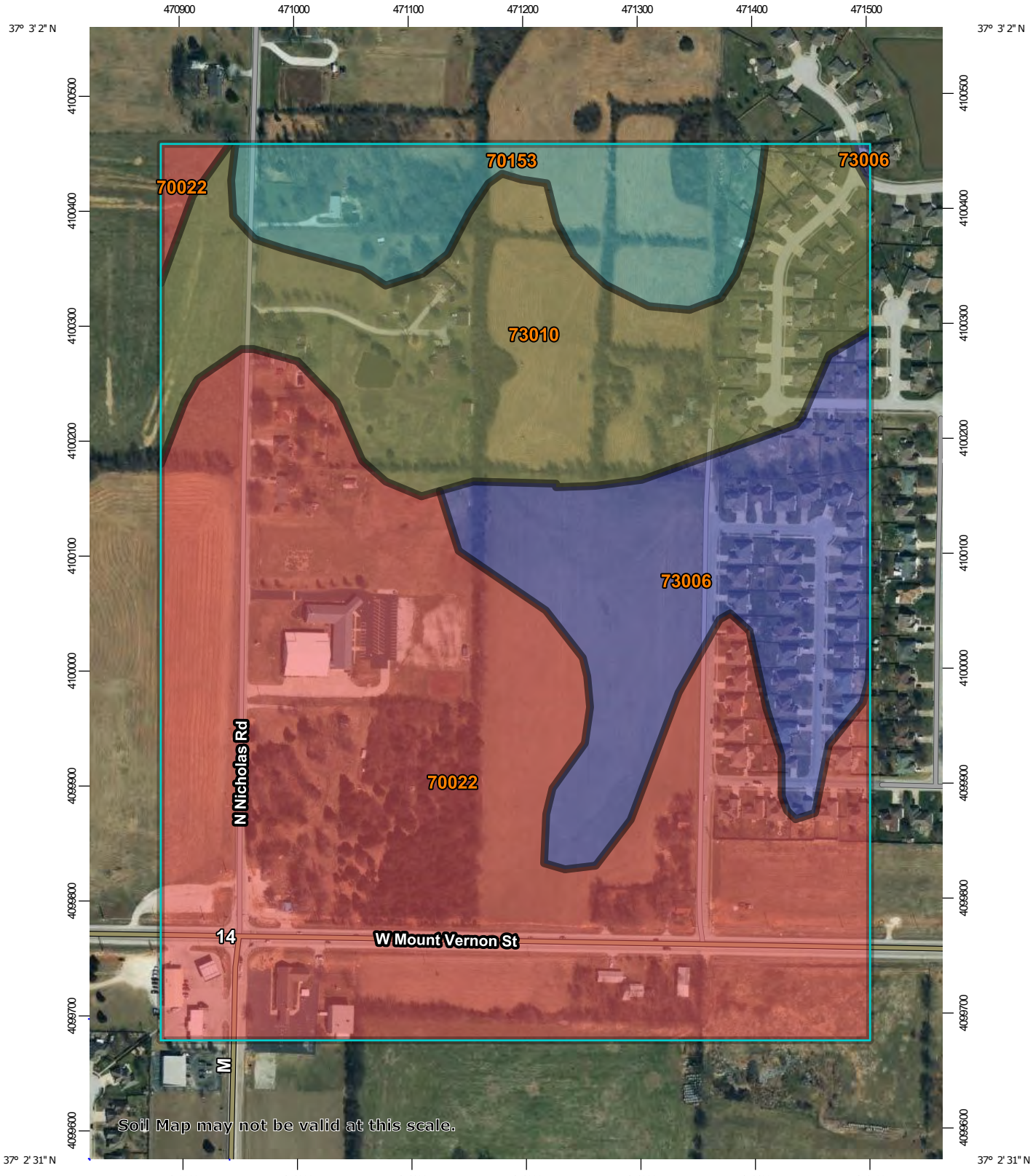
PHOTO ID:	9
DATE:	6-27-2024
DIRECTION:	South
DESCRIPTION:	
Eye 1 of Sinkhole D was approximately 2 feet deep	

PHOTO ID:	10
DATE:	6-27-2024
DIRECTION:	West
DESCRIPTION:	
Eye 2 of Sinkhole D was approximately 6 inches deep.	

Appendix C

NRCS Web Soil Survey Report

Hydrologic Soil Group—Christian County, Missouri
(Nixa PD Soil Groups)



Map Scale: 1:4,800 if printed on A portrait (8.5" x 11") 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 15N WGS84

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

Soil Rating Polygons

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

Soil Rating Lines

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

Soil Rating Points

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

Water Features

- Streams and Canals

Transportation

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

Background

- Aerial Photography

MAP INFORMATION

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

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: Christian County, Missouri
Survey Area Data: Version 31, Aug 22, 2023

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

Date(s) aerial images were photographed: Mar 5, 2020—Mar 6, 2020

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

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
70022	Tonti silt loam, 3 to 8 percent slopes	D	61.8	51.6%
70153	Goss gravelly silt loam, karst, 8 to 15 percent slopes	C	11.1	9.3%
73006	Peridge silt loam, 2 to 5 percent slopes	B	19.8	16.5%
73010	Wilderness gravelly silt loam, 3 to 8 percent slopes	C/D	27.1	22.6%
Totals for Area of Interest			**119.9**	**100.0%**

Description

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

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

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

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

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

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

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

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

Appendix D

Flood Event Calculations

City of Nixa
New Police Station
Sinkhole Evaluation
7/9/2024

Pre-Development

Sinkhole ID	Drainage Area (Acres)	Storage Volume (Acre-ft)	Flood Volume (acre ft)	Overflow (Acre-Ft)	Flood Elevation (ft-asl)
A (Terminal Sinkhole)	39.1	0.082	11.48	11.40	1,287.5
D	4.1	0.037	1.11	1.07	1,289.5

City of Nixa
New Police Station
Sinkhole Evaluation
7/9/2024

Post-Development

Sinkhole ID	Drainage Area (Acres)	Storage Volume (Acre-ft)	Flood Volume (acre ft)	Overflow (Acre-Ft)	Flood Elevation (ft-asl)
A (Terminal Sinkhole)	39.1	0.08	12.34	12.26	1,287.5
D	4.1	0.04	1.11	1.07	1,289.5

City of Nixa
New Police Station
Sinkhole Evaluation

Sinkhole A

Pre-Development

Land Use	Soil Group	Acreage	Curve Number	% Impervious	Acres Impervious	Acreage Adjusted
Paved/Roof	D	2.6	98	100	2.60	0.00
Res 1 ac	D	1.9	80	20	0.38	1.52
Woods	D	8.9	77	0	0.00	8.90
Grass/Pasture	B	9.3	70	0	0.00	9.30
Grass/Pasture	D	16.4	74	0	0.00	16.40
Total		39.1			2.98	

Post-Development

Land Use	Soil Group	Acreage	Curve Number	% Impervious	Acres Impervious	Acreage Adjusted
Paved/Roof	D	6.4	98	100	6.40	0.00
Res 1 ac	D	1.9	80	20	0.38	1.52
Woods	D	8.9	77	0	0.00	8.90
Grass/Pasture	B	5.6	70	0	0.00	5.60
Grass/Pasture	D	16.3	74	0	0.00	16.30
Total		39.1			6.78	

* Curve numbers based on AMC II

City of Nixa
New Police Station
Sinkhole Evaluation

CURVE NUMBER CALCULATION

ID Number: Sinkhole A

	Pre-Development Curve Number												Pre-Development Runoff "Q" (in)			
ID Number	% Impervious	% Land Use 1	CN-1	% Land Use 2	CN-2	% Land Use 3	CN-3	% Land Use 4	CN-4	CN_{eff}	Zone	Retention "S" (in)	2yr	10yr	25yr	100yr
Sinkhole A	7.62	3.89	80	22.76	77	23.79	70	41.94	74	75.79		3.19	0.67	1.39	1.95	3.19

	Volume of Runoff (ft^3)			
Basin Area (ac)	2yr	10yr	25yr	100yr
39.10	95,570	197,045	276,439	452,535

Source	Runoff Volume from Additional Sources (ft^3)			
Sinkhole D Overflow	9,569	20,417	28,860	47,517

Total Runoff (ft^3)	**105,139**	**217,461**	**305,299**	**500,051**
Overflow (ft^3)	101,583	213,906	301,743	496,496

	Post-Development Curve Number												Post-Development Runoff "Q" (in)			
ID Number	% Impervious	% Land Use 1	CN-1	% Land Use 2	CN-2	% Land Use 3	CN-3	% Land Use 4	CN-4	CN_{eff}	Zone	Retention "S" (in)	2yr	10yr	25yr	100yr
Sinkhole A	17.34	3.89	80	22.76	77	14.32	70	41.69	74	78.50		2.74	0.80	1.57	2.16	3.45

	Volume of Runoff (ft^3)			
Basin Area (ac)	2yr	10yr	25yr	100yr
39.10	113,478	222,880	306,744	490,033

Source	Runoff Volume from Additional Sources (ft^3)			
Sinkhole D Overflow	9,569	20,417	28,860	47,517

Total Runoff (ft^3)	**123,048**	**243,296**	**335,603**	**537,550**
Overflow (ft^3)	119,492	239,741	332,048	533,994

Max Volume of Sinkhole (Calculated in *Rating Curve* Worksheet): 3,556 (ft^3)

City of Nixa
New Police Station
Sinkhole Evaluation

Rating Curve Calculations

Bottom Elevation (ft): 1286.5

Elevation Increments (ft): 0.5

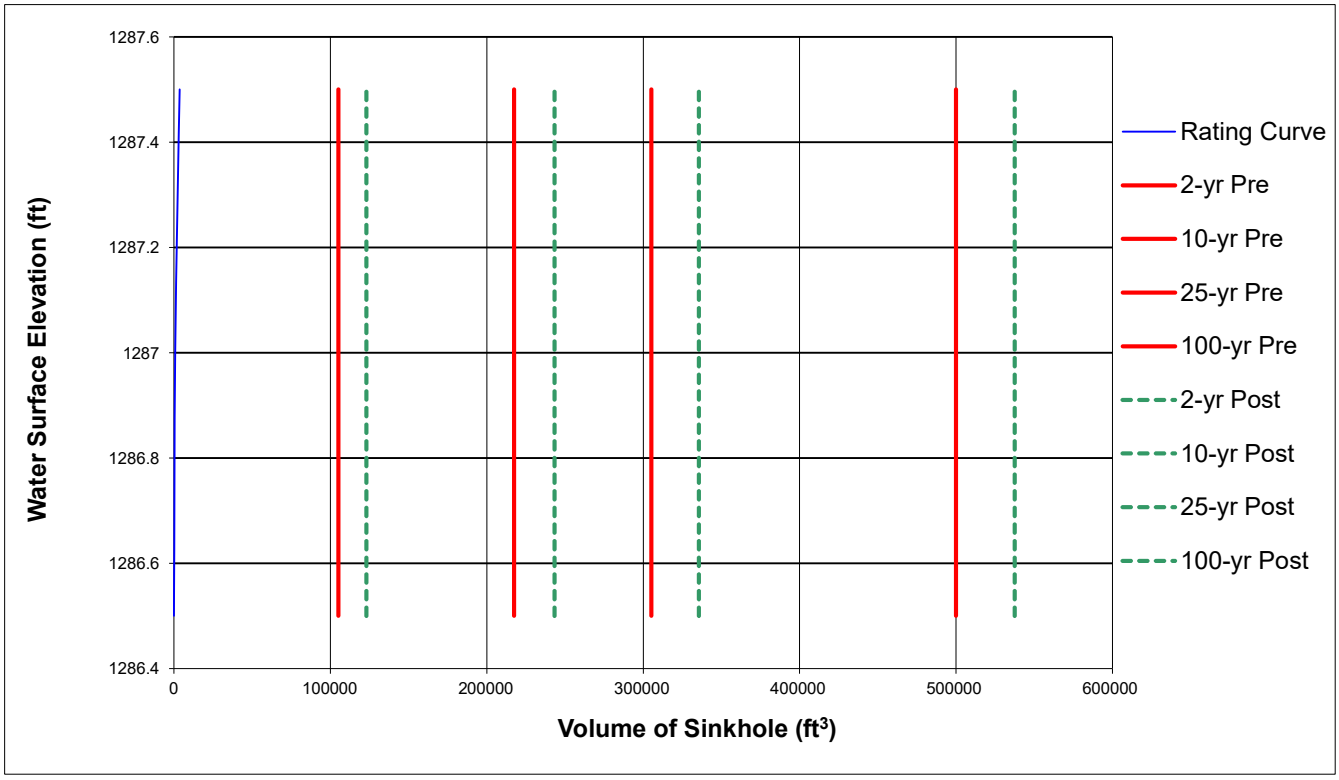
Max Volume (ft^3): 3,556

Contour #	Area of Contour (ft^2)	Water Depth	Total Volume (ft^3)	Elevation
Bottom	65	0	0	1286.5
1	3,371	0.5	650	1287
2	8,659	1	3,556	1287.5
3			3,556	1287.5
4			3,556	1287.5
5			3,556	1287.5
6			3,556	1287.5
7			3,556	1287.5
8			3,556	1287.5
9			3,556	1287.5
10			3,556	1287.5
11			3,556	1287.5
12			3,556	1287.5

Results of Curve Number Method

Rainfall Event	2yr	10 yr	25 yr	100 yr
Pre-Development Runoff Volume	105,139	217,461	305,299	500,051
Post-Development Runoff Volume	123,048	243,296	335,603	537,550

Sinkhole #: **Sinkhole A**



City of Nixa
New Police Station
Sinkhole Evaluation

Rational Method

Sinkhole ID: Sinkhole A

Beginning Elevation (ft)	1320
End Elevation (ft)	1287
Total Flow Length (ft)	1900
Slope (ft/ft)	0.0174

Sheet Flow

Mannings "n"	Flow Length (ft)	$P_{2\text{-yr }24\text{-hr}}$ (in)	Slope (ft/ft)	T_c (hr)
0.3	300	3.55	0.0174	0.69

Shallow Concentrated Flow

Mannings "n"	Flow Length (ft)	Slope (ft/ft)	Average Velocity (ft/s)	T_c (hr)
0.3	1600	0.0174	2.11	0.21

Area of Watershed(ac)	39.10	Total T_c (hr)	0.90

Rainfall (in)

2-year	10-year	25-year	100-year
1.71	2.51	2.99	3.71

Intensity (in/hr)

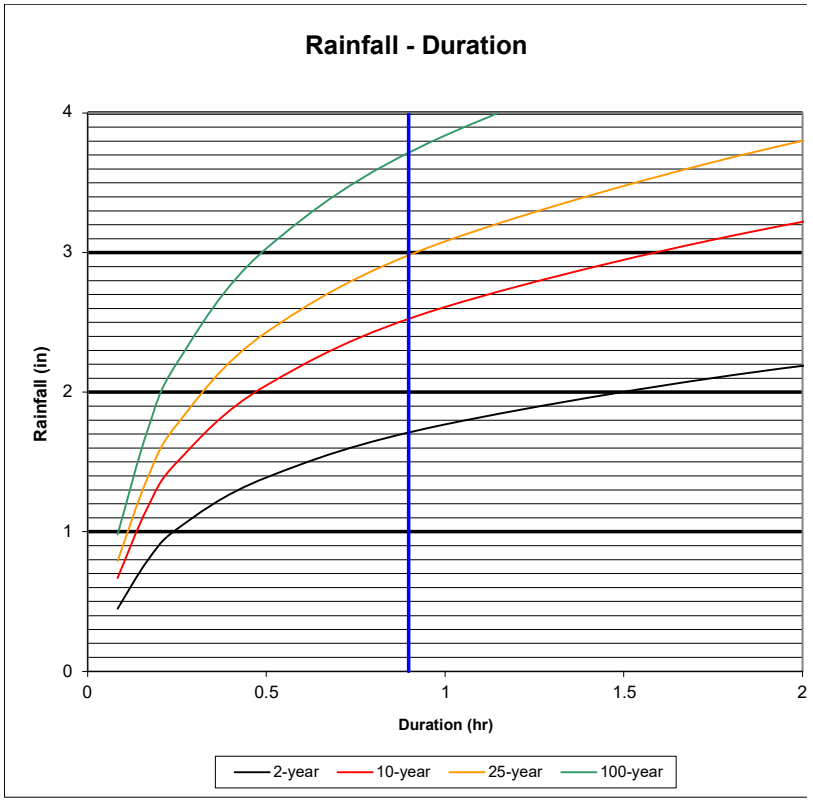
2-year	10-year	25-year	100-year
1.90	2.79	3.33	4.13

Pre-Development Runoff Coeff.= 0.37

Event	2-year	10-year	25-year	100-year
Peak Flow (cfs)	28	41	59	76

Post-Development Runoff Coeff.= 0.42

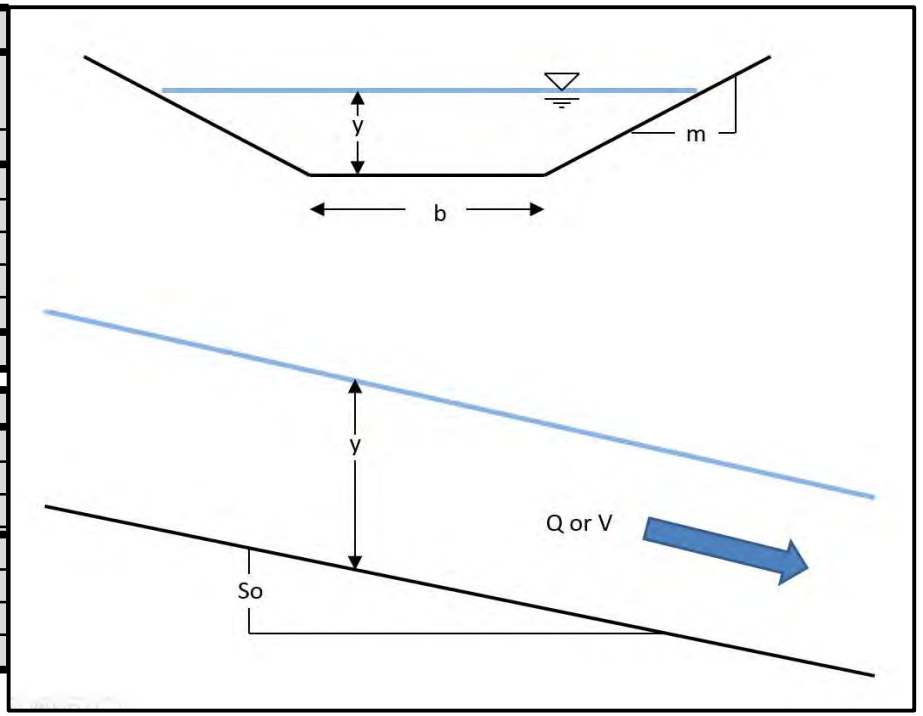
Event	2-year	10-year	25-year	100-year
Peak Flow (cfs)	32	47	67	86



City of Nixa
New Police Station
Sinkhole Evaluation

Sinkhole A
Pre-Development

	Overflow Channel Properties		Eng or SI
Units	Gravity (g)	32.2	32.2 fpss or 9.81mpss
	Unit Correction (cc)	1.49	1.49 or 1
Channel	Bottom Width (b)	20	ft or m
	Depth (y)	0.38	ft or m
	Side Slope (m)	0	
	Bottom Slope (So)	0.020	
	Manning n: (n)	0.011	
	Manning Q	**76**	V^3/sec.
	Discharge (Q)	76	cfs or cms
	Froude Number:	**2.799**	
	Energy (E)	**1.89**	L
	Force (M)	**24.66**	L^3
	Area (A)	7.692556697	L^2
	Velocity (V)	9.85	L/sec
	Wetted Per. (Pw)	20.76925567	L
	Hydraulic Rad.(Rh)	0.37	L

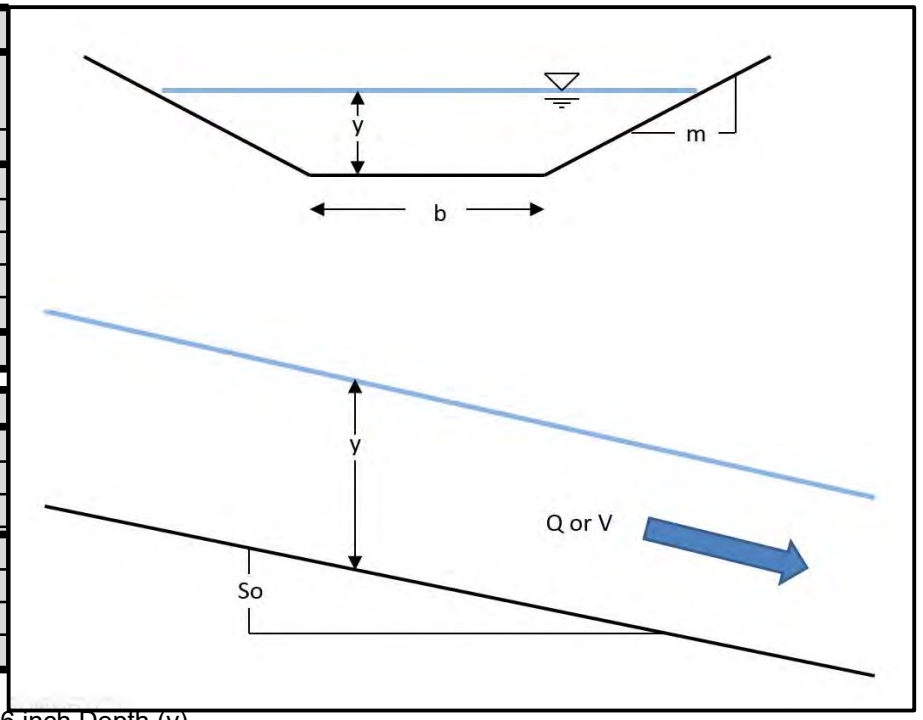


Note: Overflow is over Leeann Drive.

City of Nixa
New Police Station
Sinkhole Evaluation

Sinkhole A
Post-Development

	Overflow Channel Properties		Eng or SI
Units	Gravity (g)	32.2	32.2 fpss or 9.81mpss
	Unit Correction (cc)	1.49	1.49 or 1
Channel	Bottom Width (b)	20	ft or m
	Depth (y)	0.43	ft or m
	Side Slope (m)	0	
	Bottom Slope (So)	0.017	
	Manning n: (n)	0.011	
	Manning Q	**86**	V^3/sec.
	Discharge (Q)	86	cfs or cms
	Froude Number:	**2.672**	
	Energy (E)	**1.98**	L
	Force (M)	**28.64**	L^3
	Area (A)	8.659028175	L^2
	Velocity (V)	9.98	L/sec
	Wetted Per. (Pw)	20.86590282	L
	Hydraulic Rad.(Rh)	0.41	L



Note: Overflow is over Leeann Drive and is below the maximum 6 inch Depth (y).

City of Nixa
New Police Station
Sinkhole Evaluation

Sinkhole D

Pre-Development

Land Use	Soil Group	Acreage	Curve Number	% Impervious	Acres Impervious	Acreage Adjusted
Paved/Parking	B	0.1	98	100	0.1	0.0
Woods	D	1.0	77	0	0.0	1.0
Grass/Pasture	D	2.3	80	0	0.0	2.3
Grass/Pasture	B	0.7	61	0	0.0	0.7
Total		4.1			0.1	

Post-Development

Land Use	Soil Group	Acreage	Curve Number	% Impervious	Acres Impervious	Acreage Adjusted
Paved/Parking	B	0.1	98	100	0.1	0.0
Woods	D	1.0	77	0	0.0	1.0
Grass/Pasture	D	2.3	80	0	0.0	2.3
Grass/Pasture	B	0.7	61	0	0.0	0.7
Total		4.1			0.1	

* Curve numbers based on AMC 2 and Class C Soil Groups

City of Nixa
New Police Station
Sinkhole Evaluation

CURVE NUMBER CALCULATION

ID Number: Sinkhole D

	Pre-Development Curve Number												Pre-Development Runoff "Q" (in)			
ID Number	% Impervious	% Land Use 1	CN-1	% Land Use 2	CN-2	% Land Use 3	CN-3	% Land Use 4	CN-4	CN_{eff}	Zone	Retention "S" (in)	2yr	10yr	25yr	100yr
Sinkhole D	2.43902439	0	98	24.3902439	77	56.09756098	80	17.07317073	61	76.46341		3.08	0.70	1.43	2.00	3.25

	Volume of Runoff (ft^3)			
Basin Area (ac)	2yr	10yr	25yr	100yr
4.10	10,467	21,314	29,757	48,414

Source	Runoff Volume from Additional Sources (ft^3)			

Total Runoff (ft^3)	**10,467**	**21,314**	**29,757**	**48,414**
Overflow (ft^3)	8,855	19,702	28,145	46,802

	Post-Development Curve Number												Post-Development Runoff "Q" (in)			
ID Number	% Impervious	% Land Use 1	CN-1	% Land Use 2	CN-2	% Land Use 3	CN-3	% Land Use 4	CN-4	CN_{eff}	Zone	Retention "S" (in)	2yr	10yr	25yr	100yr
Sinkhole D	2.43902439	0	98	24.3902439	77	56.09756098	80	17.07317073	61	76.46341		3.08	0.70	1.43	2.00	3.25

	Volume of Runoff (ft^3)			
Basin Area (ac)	2yr	10yr	25yr	100yr
4.10	10,467	21,314	29,757	48,414

Source	Runoff Volume from Additional Sources (ft^3)			

Total Runoff (ft^3)	**10,467**	**21,314**	**29,757**	**48,414**
Overflow (ft^3)	8,855	19,702	28,145	46,802

Max Volume of Sinkhole (Calculated in *Rating Curve* Worksheet): 1,612 (ft^3)

City of Nixa
New Police Station
Sinkhole Evaluation

Rating Curve Calculations

Bottom Elevation (ft): 1288.5

Elevation Increments (ft): 0.5

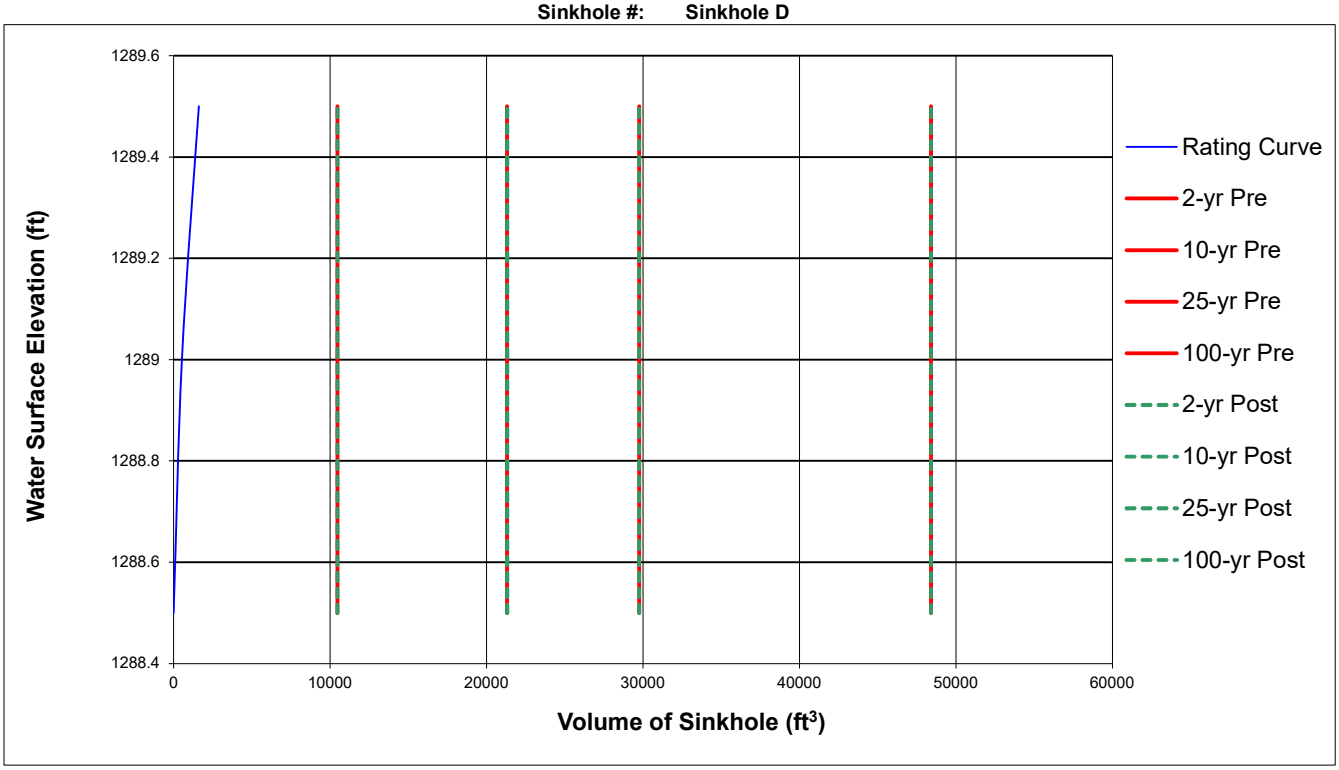
Max Volume (ft^3): 1,612

Contour #	Area of Contour (ft^2)	Water Depth	Total Volume (ft^3)	Elevation
Bottom	589	0	0	1288.5
1	1,591	0.5	525	1289
2	2,815	1	1,612	1289.5
3			1,612	1289.5
4			1,612	1289.5
5			1,612	1289.5
6			1,612	1289.5
7			1,612	1289.5
8			1,612	1289.5
9			1,612	1289.5
10			1,612	1289.5
11			1,612	1289.5
12			1,612	1289.5

Results of Curve Number Method

Rainfall Event	2yr	10 yr	25 yr	100 yr
Pre-Development Runoff Volume	10,467	21,314	29,757	48,414
Post-Development Runoff Volume	10,467	21,314	29,757	48,414

Sinkhole #: **Sinkhole D**



Appendix E

Report Limitations and Guidelines for Use

REPORT LIMITATIONS AND GUIDELINES FOR USE[1]

This Appendix provides information to help you manage your risks with respect to the use of this report.

Geotechnical Services Are Performed for Specific Purposes, Persons and Projects

This report has been prepared for the exclusive use of D & P Development, LLC, and their authorized agents for the Century Heights Development, in Nixa, Christian County, Missouri. This report is not intended for use by others, and the information contained herein is not applicable to other sites.

GREDELL Engineering Resources, Inc. (GER) structures our services to meet the specific needs of our clients. For example, a geotechnical or geologic study conducted for a civil engineer or architect may not fulfill the needs of a construction contractor or even another civil engineer or architect that are involved in the same project. Because each geotechnical or geologic study is unique, each geotechnical engineering or geologic report is unique, prepared solely for the specific client and project site. Our report is prepared for the exclusive use of our Client. No other party may rely on the product of our services unless we agree in advance to such reliance in writing. This is to provide our firm with reasonable protection against open-ended liability claims by third parties with whom there would otherwise be no contractual limits to their actions. Within the limitations of scope, schedule and budget, our services have been executed in accordance with our Agreement with the Client and generally accepted geotechnical practices in this area at the time this report was prepared. This report should not be applied for any purpose or project except the one originally contemplated.

A Geotechnical Engineering or Geologic Report Is Based on a Unique Set of Project-Specific Factors

GER considered a number of unique, project-specific factors when establishing the scope of services for this project and report. Unless GER specifically indicates otherwise, do not rely on this report if it was:

- not prepared for you,
- not prepared for your project,
- not prepared for the specific site explored, or
- completed before important project changes were made.

[1] Developed based on material provided by ASFE/The Best People on Earth, Professional Firms Practicing in the Geosciences; www.asfe.org.

For example, changes that can affect the applicability of this report include those that affect:

- the function of the proposed structure;
- elevation, configuration, location, orientation or weight of the proposed structure;
- composition of the design team; or
- project ownership.

If important changes are made after the date of this report, should be given the opportunity to review our interpretations and recommendations and provide written modifications or confirmation, as appropriate.

Subsurface Conditions Can Change

This geotechnical or geologic report is based on conditions that existed at the time the study was performed. The findings and conclusions of this report may be affected by the passage of time, by manmade events such as construction on or adjacent to the site, or by natural events such as floods, earthquakes, slope instability or ground water fluctuations. Always contact GER before applying a report to determine if it remains applicable.

Topsoil

For the purposes of this report, we consider topsoil to consist of generally fine-grained soil with an appreciable amount of organic matter, based on visual examination, and to be unsuitable for direct support of the proposed improvements. However, the organic content and other mineralogical and gradational characteristics used to evaluate the suitability of soil for use in landscaping and agricultural purposes were not determined, nor were they considered in our analyses. Therefore, the information and recommendations in this report, and our logs and descriptions, should not be used as a basis for estimating the volume of topsoil available for such purposes.

Most Geotechnical and Geologic Findings Are Professional Opinions

Our interpretations of subsurface conditions are based on field observations from widely spaced sampling locations at the site. Site exploration identifies subsurface conditions only at those points where subsurface tests are conducted or samples are taken. GER reviewed field and laboratory data and then applied our professional judgment to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ, sometimes significantly, from those indicated in this report. Our report, conclusions and interpretations should not be construed as a warranty of the subsurface conditions.

Geotechnical Engineering Report Recommendations Are Not Final

Do not over-rely on the preliminary construction recommendations included in this report. These recommendations are not final, because they were developed principally from GER professional judgment and opinion. GER recommendations can be finalized only by observing actual subsurface conditions revealed during construction. GER cannot assume responsibility or liability for this report's recommendations if we do not perform construction observation.

Sufficient monitoring, testing and consultation by GER should be provided during construction to confirm that the conditions encountered are consistent with those indicated by the explorations, to provide recommendations for design changes should the conditions revealed during the work differ from those expected, and to evaluate whether or not earthwork activities are completed in accordance with our recommendations. Retaining GER for construction observation for this project is the most effective method of managing the risks associated with unexpected conditions.

Geotechnical Engineering or Geologic Report Could Be Subject to Misinterpretation

Misinterpretation of this report by other design team members can result in costly problems. You could lower that risk by having GER confer with appropriate members of the design team after submitting the report. Also retain GER to review pertinent elements of the design team's plans and specifications. If important changes are made after the date of this report, GER should be given the opportunity to review our interpretations and recommendations and provide written modifications or confirmation, as appropriate.

Do Not Redraw the Exploration Logs

Geotechnical engineers and geologists prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. To prevent errors or omissions, the logs included in a geotechnical engineering or geologic report should never be redrawn for inclusion in architectural or other design drawings. Only photographic or electronic reproduction is acceptable, but recognize that separating logs from the report can elevate risk.

Give Contractors a Complete Report and Guidance

Some owners and design professionals believe they can make contractors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give contractors the complete geotechnical engineering or geologic report, but preface it with a clearly written letter of transmittal. In that letter, advise contractors that the report was not prepared for purposes of bid development and that the report’s accuracy is limited; encourage them to confer with GER and/or to conduct additional study to obtain the specific types of information they need or prefer. A pre-bid conference can also be valuable. Be sure contractors have sufficient time to perform additional study. Only then might an owner be in a position to give contractors the best information available, while requiring them to at least share the financial responsibilities stemming from unanticipated conditions. Further, a contingency for unanticipated conditions should be included in your project budget and schedule.

Contractors Are Responsible for Site Safety on Their Own Construction Projects

Our geotechnical recommendations are not intended to direct the contractor’s procedures, methods, schedule or management of the work site. The contractor is solely responsible for job site safety and for managing construction operations to minimize risks to onsite personnel and to adjacent properties.

Read These Provisions Closely

Some clients, design professionals and contractors may not recognize that the geoscience practices (geotechnical engineering or geology) are far less exact than other engineering and natural science disciplines. This lack of understanding can create unrealistic expectations that could lead to disappointments, claims and disputes. GER includes these explanatory "limitations" provisions in our reports to help reduce such risks. Please confer with GER if you are unclear how these "Report Limitations and Guidelines for Use" apply to your project or site.

Biological Pollutants

GER's Scope of Work specifically excludes the investigation, detection, prevention or assessment of the presence of Biological Pollutants. Accordingly, this report does not include any interpretations, recommendations, findings, or conclusions regarding the detecting, assessing, preventing or abating of Biological Pollutants and no conclusions or inferences should be drawn regarding Biological Pollutants, as they may relate to this project. The term "Biological Pollutants" includes, but is not limited to, molds, fungi, spores, bacteria and viruses, and/or any of their byproducts.

If Client desires these specialized services, they should be obtained from a consultant who offers services in this specialized field.

TOTH & ASSOCIATES