Parkside Subdivision Offsite Improvements

A distinguished project by:

Symmetry Ventures

Job No. 031.060

Stormwater Management Report

New Braunfels, Texas

June 2020

Chris Van Heerde, PE
6/9/2020

Prepared by:

HMT
ENGINEERING & SURVEYING

290 S. Castell Avenue, Ste 100
New Braunfels, TX 78130
TBPE-FIRM F-10961
TBPLS FIRM 10153600

Table of Contents

1.0 GENERAL INFORMATION....3
2.0 HYDROLOGY METHODOLOGY SCS METHOD....3
3.0 EXISTING HYDROLOGIC ANALYSIS....5
4.0 PROPOSED CONDITIONS HYDRAULICS....7
5.0 CULVERT COMPARISON....11
6.0 TXDOT ANALYSIS....12
7.0 ULTIMATE CONDITIONS HYDRAULICS....12
8.0 CONCLUSION....13
ATTACHMENT A LOCATION MAP....14
ATTACHMENT B FEMA FIRM MAP....15
ATTACHMENT C DRAINAGE AREA MAP AND HYDROLOGY CALCULATIONS....16
ATTACHMENT D HYDRAFLOW HYDROGRAPHS CALCULATIONS....17
- PROPOSED CONDITIONS....17
- ULTIMATE CONDITIONS....17
ATTACHMENT E EXISTING CONDITIONS HYDRAULIC ANALYSIS....20
ATTACHMENT F PROPOSED CONDITIONS HYDRAULIC ANALYSIS & COMPARISON WITH EXISTING CONDITIONS....21
ATTACHMENT G STATE HIGHWAY 46 CONSTRUCTION PLANS (BY CIVIL ENGINEERING CONSULTANTS)....22
ATTACHMENT H PARKSIDE PHASE 1 CONSTRUCTION DOCUMENTS AND DRAINAGE REPORT....23

1.0 General Information

HMT Engineering and Surveying has been retained by Symmetry Ventures to provide professional engineering services for the future improvements of State Highway 46 (HWY 46) and Pieper Road, in the City of New Braunfels, Texas (Reference Attachment A). The property is not within the 100-year floodplain, according to FEMA Flood Insurance Rate Map (FIRM) Number 48187C0120F date November 2, 2007 (Reference Attachment B). The western portion of the proposed subdivision including the proposed offsite improvements to Pieper and HWY 46 are within the Guadalupe Tributary 20 watershed. This report addresses the hydrology and hydraulics of the proposed HWY 46 and Piper Road improvements on the watershed.

The City of New Braunfels Drainage and Erosion Control Manual revised July 2018 were used during the design of this project.

2.0 Hydrology Methodology SCS Method

The peak storm water runoff calculations were determined using the SCS Method as described in the City of New Braunfels Drainage and Erosion Control Manual. The time of concentration was calculated using sheet flow, shallow concentrated flow, and channel flow. The length of overland sheet flow conditions is limited to a maximum of 100 feet. The time of travel for sheet flow conditions is calculated using Manning's kinematic solution (Overtop and Meadows 1976). After 100 feet, the average velocity of the flow is determined using Figure 3-1 of the USDA Technical Release 55 Urban Hydrology for Small Watersheds. The time of travel for concentrated flow conditions is calculated using the equation below:

Sheet Flow

Eq 4-4 $T_t = \frac{0.007(nL)^{0.8}}{(P_2^{0.5})(S^{0.4})} * 60$

For shallow concentrated flow, using the average velocity as described above, the time of travel is calculated using this equation:

Shallow Concentration Flow

Eq 4-5 $T_t = \frac{L}{(60)(16.1345)(S^{0.5})}$

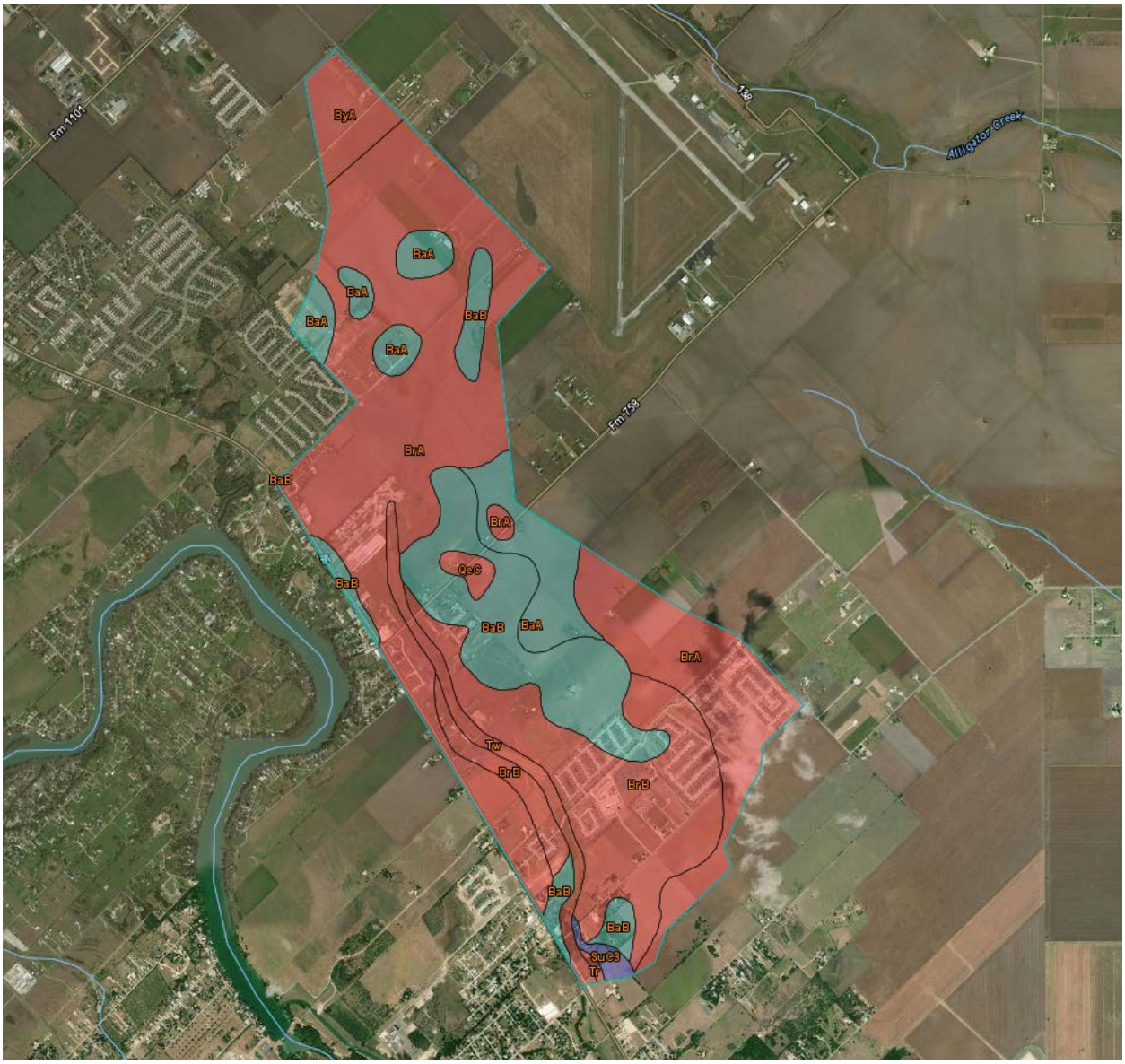
For channelized flow, an estimated peak flow is used to calculate the velocity within the channel cross section for this segment. The time is then calculated using this velocity and the length of flow as shown in Eq 4-8 below.

Channel Flow

Eq 4-8 $T_t = \frac{L}{60*V}$

The runoff coefficient was determined based on the impervious cover within each sub-watershed. Rainfall intensities were calculated using the time of concentration and constants from Table 3-2 of the City of New Braunfels Drainage and Erosion Control Manual for each storm event respectively (reference Attachment C for Hydrology Calculations).

The Curve Numbers used for calculations were taken from Table 4-3: NRCS Runoff Curve Number for Urban Areas and Agricultural Lands, Table 4-4: Curve Numbers for Fully Developed Conditions, and Table 4-19: Runoff Curve Numbers for Urban Areas from the City of New Braunfels Drainage and Erosion Control Manual and the TxDOT Drainage Manual. Existing zoning was used for the corresponding drainage areas. In the event that the current zoning district was agricultural (APD) the future land use map was used for the Ultimate Condition Calculations. The SCS Drainage Area Map with Curve Number Calculations can be found in Attachment C. An excerpt of the soil types based on this drainage area and future land use are shown below. The drainage area consists of Type B, Type C, and D soils. In order to ensure our calculations were the most conservative, Type D soils were assumed for the entire site. A Type III storm distribution was used in the Hydraflow Hydrograph calculations.



Tables — Hydrologic Soil Group — Summary By Map Unit

Summary by Map Unit — Comal and Hays Counties, Texas (TX604)
Summary by Map Unit — Guadalupe County, Texas (TX187)

Summary by Map Unit — Comal and Hays Counties, Texas (TX604)

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
ByA	Branyon clay, 0 to 1 percent slopes	D	73.4	3.5%
Subtotals for Soil Survey Area			73.4	3.5%

Summary by Map Unit — Guadalupe County, Texas (TX187)

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
BaA	Barbarosa silty clay, 0 to 1 percent slopes	C	180.4	8.6%
BaB	Barbarosa silty clay, 1 to 3 percent slopes	C	329.8	15.7%
BrA	Branyon clay, 0 to 1 percent slopes	D	998.6	47.7%
BrB	Branyon clay, 1 to 3 percent slopes	D	410.4	19.6%
QeC	Queeny gravelly loam, 1 to 5 percent slopes	D	16.2	0.8%
SuC3	Sunev loam, 3 to 5 percent slopes, eroded	B	13.4	0.6%
Tr	Tinn clay, 0 to 1 percent slopes, occasionally flooded	D	3.0	0.1%
Tw	Tinn clay, 0 to 1 percent slopes, frequently flooded	D	69.1	3.3%
Subtotals for Soil Survey Area			2,020.9	96.5%
Totals for Area of Interest			2,094.3	100.0%

Cover Description	Curve Number	Curve Number
Undeveloped/Agricultural Grass (Fair)	D	84
Commercial	D	95
Industrial	D	90
Mixed use	D	90
Residential	D	87
Asphalt	D	98

3.0 Existing Hydrologic Analysis

In order to analyze the existing conditions of Guadalupe Tributary 20 a HEC-RAS Model was created. This model used field survey information collected by HMT and from City of New Braunfels Aerial contours where field survey could not be obtained. The flows generated from the Hydrology Analysis described above were used in this model.

The existing culverts of Pieper Road consist of three existing 24" corrugated metal pipes which are in poor condition. The inlet and outlet of these CMPs have been deformed by traffic or damaged during storms; however, for this analysis, it was assumed that the CMPs were in good condition without damage. The flows from the upstream drainage area are significant when compared with the size of these culverts therefore this road acts a low water crossing.

After stormwater overtops Pieper Road, it flows through Ric and Sonia Martinez Lot 1 property owned by LS & Sons Concrete (at the southeast corner of Highway 46 and Pieper) and enters into the HWY 46 Channel. The HWY 46 channel is not able to contain the fully developed flow from the upstream area. The RAS Model shows it to be overtopping the elevation of centerline of Highway 46 during larger storm events. Elevations for the Existing Conditions Analysis are shown in the table below and Cross Sections used for this analysis are shown on the Workmap that is included in Attachment E.

The HWY 46 culverts were modeled based on plan information and field survey by HMT.

The existing drainage areas within the Guadalupe Tributary 20 watershed consists of developed and undeveloped properties (please refer to Attachment C for the existing drainage area and zoning map.

- Drainage area EX A flows to concentration point EX A where the flow is channelized and discharges into the existing culverts crossing HWY 46. The proposed Parkside development will reduce flows discharging into Pieper road, routing the storm water through drainage structures and into three tired detention basins. The three-tiered detention basins have been designed to reduce the total flow discharging at concentration point EX A. Existing Drainage Area EX A has been further analyzed into six drainage sub-areas to accurately compare discharge points. Please refer to the drainage sub-area descriptions below.

    - Drainage sub-area EX A1 flows to concentration point EX A1 which occurs at the existing culverts of Pieper Road and only includes acreage from upstream (northwest) of Pieper Road. Concentration Point EX A1 represents the flow generated by the portion of the Guadalupe Tributary 20 watershed upstream of these culverts. Drainage sub-area EX A1 was analyzed to compare proposed drainage sub-area A1, and to analyze the flow from river station 174+32.85 to 184+94.57.

    - Drainage sub-area EX A2 flows to concentration point EX A2 at the outfall of the existing culvert at the intersection of HWY 46 and Pieper Rd and consists of the storm water draining to the existing roadside ditch along HWY 46. Drainage sub-area EX A2 was analyzed to compare proposed drainage sub-area A2.

    - Drainage sub-area EX A3 consists of developed and undeveloped area that drains and becomes concentrate flow at the natural existing channel on Ric and Sonia Martinez Lot 1 property owned by LS & Sons Concrete (at the southeast corner of Highway 46 and Pieper). Drainage EX A3 discharges into the existing HWY 46 concrete channel at concentration point EX A3. Drainage sub-area EX A3 was analyzed to compare proposed drainage sub-area A3.

    - Drainage sub-areas EX A1 through EX A3 was analyzed to analyze the flow of the existing grassy channel and concrete channel from river station 165+38.15 to 174+32.85 and compare proposed drainage sub-areas A1-A3.

    - Drainage sub-area EX A4 consists of the existing grassy roadside ditch and concrete HWY 46 channel that discharges into the existing culverts crossing HWY 46 at concentration point EX A4. Drainage sub-area EX A4 was analyzed to compare proposed drainage sub-area A4.

    - Drainage sub-area EX A5 consists of the undeveloped area from the Friesenhahn property and becomes concentrate flow at the existing natural channel that discharges in the existing HWY 46 concrete channel at concentration point EX A5. Drainage sub-area EX A5 was analyzed to compare proposed drainage sub-area A5.

- Drainage sub-area EX A6 consists of undeveloped and developed area that discharges into the existing HWY 46 concrete channel at concertation point EX A6. Drainage sub-area EX A6 was analyzed to compare proposed drainage sub-area A6.

Calculation point EX A was created to compare flows within Guadalupe Tributary 20 for HEC-RAS Modeling.

Times of Concentration and Curve Number calculations are shown in Attachment C.

The peak flows at these calculation points are shown in Table 1 below.

Table 1 - Existing Conditions Hydrology Calculations - City of New Braunfels

Point of Concentration	Description	Drainage Area	Area	T_c	Curve Number	Q_2 (cfs)	Q_5 (cfs)	Q_{10} (cfs)	Q_{25} (cfs)	Q_{50} (cfs)	Q_{100} (cfs)
EX A1	Drainage sub-area A1 Comparison	EX A1	1906.93	122.26	85.27	1002.62	1713.53	2312.98	3291.98	4218.96	5355.58
EX A2	Drainage sub-area A2 Comparison	EX A2	21.96	31.98	98.00	38.71	56.38	70.91	94.50	116.89	144.44
EX A3	Drainage sub-area A3 Comparison	EX A3	117.84	59.61	78.46	72.66	137.54	194.37	289.37	380.59	492.94
EX A1-A3						1056.56	1812.75	2451.33	3495.48	4485.49	5698.02
EX A4	Drainage sub-area A4 Comparison	EX A4	4.45	10.00	94.00	11.19	16.88	21.53	29.03	36.11	44.80
EX A5	Basin A3 Discharge + Drainage Sub-Area A6 Comparison	EX A5	24.99	63.10	78.00	14.49	27.69	39.30	58.74	77.45	100.52
EX A6	Drainage sub-area A6 Comparison	EX A6	31.11	40.82	78.01	22.75	43.33	61.45	91.70	120.72	156.45
EX A						1076.03	1848.80	2502.49	3570.74	4582.87	5823.16

4.0 Proposed Conditions Hydraulics

The Existing Conditions HEC-RAS Model was modified to include proposed changes to HWY 46 and Pieper Road. The flows generated through a proposed conditions Hydrology Analysis were used in this model. The proposed detention basins on the site reduce flows that are going to the HWY 46 Culverts and intercept a portion of the watershed that is currently flowing to Pieper Road thereby reducing flows in the section of Guadalupe Tributary 20 between Pieper Road and HWY 46.

The Parkside Subdivision contains 2 proposed tiered detention basins that will discharge into an improved channel. The upper detention basin is named Extended Detention Basin A1 and will be built with Unit 1. The lower basin named Detention Basin A2 will be constructed with a later unit. The purpose of these detention basins is to ensure that the flows within the HWY 46 channel are not increased with the development. With Unit 1, Temporary Channel A will convey the discharge from Extended Detention Basin A1 downstream. This channel will be replaced with Detention Basin A2 in the future. At the location of the future control structure of Detention Basin A2, the ultimate Channel A1 will start. This channel flows in a southwesterly direction and ultimately discharges directly into the existing concrete HWY 46 Channel. This channel can be seen in the Parkside Subdivision Unit 1 Plans.

The proposed conditions include the build out of the Parkside development that will be flowing to the three-tiered basins and discharging into the existing HWY 46 concrete channel. The area of the Parkside development that has not been analyzed as developed will discharge into a separate basin to be analyzed, designed, and built with a future phase and will not discharge into the TxDOT right of way.

- Drainage area A consists of was analyzed with the existing development impervious cover conditions for the areas not within the Parkside Subdivision and Offsite Development. Drainage Area A has been further analyzed into six drainage sub-areas to accurately compare discharge points. Please refer to the drainage sub-area descriptions below.

    - Drainage sub-area A1 flows to concentration point A1 which occurs at the existing culverts of Pieper Road and only includes acreage from upstream (northwest) of Pieper Road. Concentration Point A1 represents the flow generated by the portion of the Guadalupe Tributary 20 watershed upstream of these culverts. Drainage sub-area A1 was analyzed to compare proposed drainage sub-area EX A1, and to analyze the flow from river station 174+32.85 to 184+94.57.

    - Drainage sub-area A2 flows to concentration point A2 at the outfall of the existing culvert at the intersection of HWY 46 and Pieper Rd and consists of the storm water draining to the existing roadside ditch along HWY 46. Drainage sub-area A2 was analyzed to compare proposed drainage sub-area EX A2.

    - Drainage sub-area A3 consists of developed and undeveloped area that drains and becomes concentrate flow at the natural existing channel on Ric and Sonia Martinez Lot 1 property owned by LS & Sons Concrete (at the southeast corner of Highway 46 and Pieper). Drainage A3 discharges into the existing HWY 46 concrete channel at concentration point A3. Drainage sub-area A3 was analyzed to compare proposed drainage sub-area EX A3.

    - Drainage sub-area A1 through A3 was analyzed to analyze the flow of the existing grassy channel and concrete channel from river station 165+38.15 to 174+32.85 and compare proposed drainage sub-areas EX A1 - EX A3.

    - Drainage sub-area A4 consists of the existing grassy roadside ditch and concrete HWY 46 channel that discharges into the existing culverts crossing HWY 46 at concentration point A4. Drainage sub-area A4 was analyzed to compare proposed drainage sub-area EX A4.

    - Drainage sub-area A5 consists of the area in the Parkside Subdivision Development that drains into the three-tiered basin and discharges into the existing HWY 46 Concrete Channel. Drainage sub-area A5 was analyzed to compare existing drainage sub-area EX A5.

- Drainage sub-area A6 consists of the Parkside Development Channel A1 and discharges to concentration point A6. Drainage sub-area A6 was analyzed to ensure longest time of concentration.

- Drainage sub-area A7 consists of undeveloped and developed area that discharges into the existing HWY 46 concrete channel at concertation point A7. Drainage sub-area A7 was analyzed to compare proposed drainage sub-area EX A6.

Table 2 - Proposed Conditions Hydrology Calculations - City of New Braunfels *** Parkside development being fully developed and containing detention***											
Point of Concentration	Description	Drainage Area	Area (acres)	T_c	Curve Number	Q_2 (cfs)	Q_5 (cfs)	Q_{10} (cfs)	Q_{25} (cfs)	Q_{50} (cfs)	Q_{100} (cfs)
A1	Drainage sub-area EX A1 Comparison	A1	1906.93	122.26	85.27	1002.62	1713.53	2312.98	3291.98	4218.96	5355.58
A2	Drainage sub-area EX A2 Comparison	A2	21.96	31.98	98.00	38.71	56.38	70.91	94.50	116.89	144.44
A3	Drainage sub-area EX A3 Comparison	A3	33.05	25.60	79.66	33.81	62.43	87.35	128.59	167.93	216.22
A1-A3						1014.34	1732.33	2338.07	3326.44	4263.63	5411.44
A4	Drainage sub-area EX A4 Comparison	A4	4.45	10.00	94.00	8.96	13.54	17.29	23.32	29.02	36.02
A5	Longest Time of Concentration Analysis	A5	139.2	42.03	94.00	22.24	61.62	101.75	173.26	243.14	328.26
A6	Longest Time of Concentration Analysis	A6	2.20	10.00	84.00	3.48	5.77	7.67	10.74	13.64	17.17
Basin A3 Release + A6	Drainage sub-area EX A5 Comparison					22.43	62.06	102.40	174.27	244.47	330.09
A7	Drainage sub-area EX A6 Comparison	A7	31.11	40.82	78.01	17.72	33.92	48.19	72.05	95.02	123.39
A						1027.52	1791.00	2449.13	3532.38	4559.23	5814.79

Table 3 - Existing to Proposed Discharge Comparison						
Drainage Area	2YR	5YR	10R	25YR	50YR	100YR
EX A	1076.03	1848.80	2502.49	3570.74	4582.87	5823.16
A	1027.52	1791.00	2449.13	3532.38	4559.23	5814.79
Proposed <= Existing	YES	YES	YES	YES	YES	YES
Drainage Area	2YR	10YR	10YR	25YR	50YR	100YR
EX A1	1002.62	1713.53	2312.98	3291.98	4218.96	5355.58
A1	1002.62	1713.53	2312.98	3291.98	4218.96	5355.58
Proposed <= Existing	YES	YES	YES	YES	YES	YES
Drainage Area	2YR	10YR	10YR	25YR	50YR	100YR
EX A2	38.71	56.38	70.91	94.50	116.89	144.44
ULT A2	38.71	56.38	70.91	94.50	116.89	144.44
Proposed <= Existing	YES	YES	YES	YES	YES	YES
Drainage Area	2YR	10YR	10YR	25YR	50YR	100YR
EX A3	72.66	137.54	194.37	289.37	380.59	492.94
A3	33.81	62.43	87.35	128.59	167.93	216.22
Proposed <= Existing	YES	YES	YES	YES	YES	YES
Drainage Area	2YR	10YR	10YR	25YR	50YR	100YR
EX A1-A3	1056.56	1812.75	2451.33	3495.48	4485.49	5698.02
A1-A3	1014.34	1732.33	2338.07	3326.44	4263.63	5411.44
Proposed <= Existing	YES	YES	YES	YES	YES	YES
Drainage Area	2YR	10YR	10YR	25YR	50YR	100YR
EX A4	11.19	16.88	21.53	29.03	36.11	44.80
A4	8.96	13.54	17.29	23.32	29.02	36.02
Proposed <= Existing	YES	YES	YES	YES	YES	YES
Drainage Area	2YR	10YR	10YR	25YR	50YR	100YR
EX A5	14.49	27.69	39.30	58.74	77.45	100.52
Basin A3 Release + A6	22.43	62.06	102.40	174.27	244.47	330.09
Proposed <= Existing	NO	NO	NO	NO	NO	NO
Drainage Area	2YR	10YR	10YR	25YR	50YR	100YR
EX A6	22.75	43.33	61.45	91.70	120.72	156.45
A7	17.72	33.92	48.19	72.05	95.02	123.39
Proposed <= Existing	YES	YES	YES	YES	YES	YES

Specifically, these were the modifications to the Existing Conditions HEC-RAS model to create the Proposed Conditions HEC-RAS Model (from downstream to upstream)

- XS17328.83 was modified to show the channel modifications necessary to allow a storm drain extension at the HWY 46/Pieper Intersection for the shortened deceleration lane

- Flows were reduced based on the inclusion of Detention Basins and removing the flows from Drainage area EX A4
- The existing road profile for the Pieper Road culvert crossing BR17615 was lengthened to show the proposed road deck widening

However, as the design of facilities must accommodate the future development of upstream areas, the hydraulic analysis was performed based on ultimate development conditions. For areas that are not within the city of New Braunfels currently and therefore have no zoning, a residential use was assumed. The drainage area map was analyzed as detailed below.

5.0 Culvert Comparison

The proposed Pieper Road Culverts were analyzed for the 2, 5, 10, 25, and 100-year storm events. This analysis was performed in accordance with the City of New Braunfels Drainage and Erosion Control Manual revised July 2018.

Because of costs concerns and hydraulic complications with increasing the size of the culverts and requested addition of guardrails, the revised plans now include a replacement of the existing Pieper Road culverts with the same sized culverts. However, for durability and as required in City of New Braunfels Right-of-way (ROW); instead of the corrugated pipes the proposed design includes 3~24" RCP Culverts. This proposed culvert crossing will remain as a low-water crossing as the RAS Model shows the 2-year storm event overtopping the road; however, as the culverts are not crushed at the entrance, it will perform better than the existing structure. Based on our analysis and comparison of the existing culvert and road geometry and the proposed culverts and road geometry, the water surface elevation over topping Pieper Road has been decreased in all storm events (please refer to attachments E and F for the comparison or the existing and proposed Pieper Road).

The reasons that the design does not convey the 25-year peak flow are as follows:

- The Parkside Development does not have any proposed conditions flow going to this culvert crossing.
- City requirements for upgrading a marginal access road is to meet an average width of 24'. The widening of Pieper Road could be accomplished without modifying the culvert and meet the average width requirement.
- In order to pass the 25-year flow, our analysis showed that an arch bridge structure with 5 ~ 30' wide by 6' arch spans would be required. This option was deemed to be cost prohibitive.
- The developer wants to improve the access for the development and area residents.
- There is no condition of approval of either the Master Plan or Unit 1 Plat that specifies that the culvert crossing must be improved.

Based on our analysis and comparison of the existing and proposed HWY 46 Channel geometry, the water surface elevation is decreased in the proposed conditions (please refer to Attachments E and F for the existing and proposed channel calculations). Additionally, Attachment F has tables, sections, and profiles that compare the existing and proposed conditions models.

6.0 TxDOT Analysis

Currently there is a TxDOT 24" CMP culvert under Pieper Road that is roughly 17 feet from the travel lanes of HWY 46. The culvert outfall is within the proposed deceleration lane. Therefore, the proposed design includes the demolition of the existing pipe outfall headwall and connection to a proposed junction box with an additional length of 24" CMP. This 24" CMP allows the discharge directly into the HWY 46 earthen roadside channel. The proposed modifications to that culvert/channel do not increase water surface elevations based on the provision of detention on the project.

7.0 Ultimate Conditions Hydraulics

**The Ultimate Conditions was analyzed with the assumption that all area analyzed is completely developed (based on the City of New Braunfels future and existing zoning map) and no additional detention (apart from the Parkside Development Basins) will be provided. It is our engineering judgement that this will not occur due to the City of New Braunfels DECDM (please refer to the snip it below):

2.2 Type 3 Drainage and Water Quality Report Criteria

The planning and design of drainage systems should ensure that problems are not transferred from one location to another. Grading and other construction activities may not change the terrain in such a way to cause damage to public or private property from drainage or flood problems, increased runoff, or increased erosion or sediment movement.

Existing drainage between developed lots will remain the responsibility of the affected property owners. Commercial developments are required to drain surface runoff from an individual lot to a public right-of-way or to a drainage system contained in an easement. Residential lot-to-lot drainage of sheet flows should be avoided, and residential developments are encouraged to direct surface runoff to a public right-of-way or to a drainage system contained in an easement.

2-3

The Engineering Division shall not approve any drainage report pertaining to proposed construction, platting or other development where the proposed activity or change in the land would result in post-development discharge from the site exceeding discharge under pre-developed conditions (for new development) or existing conditions (for re-development). Downstream capacity shall not be exceeded as a result of development. Exemptions from this provision are as follows:

Table 2 - Proposed Conditions Hydrology Calculations - City of New Braunfels *** Parkside development being fully developed and containing detention***											
Point of Concentration	Description	Drainage Area	Area (acres)	T_c	Curve Number	Q_2 (cfs)	Q_5 (cfs)	Q_{10} (cfs)	Q_{25} (cfs)	Q_{50} (cfs)	Q_{100} (cfs)
A1	Drainage sub-area EX A1 Comparison	A1	1906.93	122.26	85.27	1002.62	1713.53	2312.98	3291.98	4218.96	5355.58
A2	Drainage sub-area EX A2 Comparison	A2	21.96	31.98	98.00	38.71	56.38	70.91	94.50	116.89	144.44
A3	Drainage sub-area EX A3 Comparison	A3	33.05	25.60	79.66	33.81	62.43	87.35	128.59	167.93	216.22
A1-A3						1014.34	1732.33	2338.07	3326.44	4263.63	5411.44
A4	Drainage sub-area EX A4 Comparison	A4	4.45	10.00	94.00	8.96	13.54	17.29	23.32	29.02	36.02
A5	Longest Time of Concentration Analysis	A5	139.2	42.03	94.00	22.24	61.62	101.75	173.26	243.14	328.26
A6	Longest Time of Concentration Analysis	A6	2.20	10.00	84.00	3.48	5.77	7.67	10.74	13.64	17.17
Basin A3 Release + A6	Drainage sub-area EX A5 Comparison					22.43	62.06	102.40	174.27	244.47	330.09
A7	Drainage sub-area EX A6 Comparison	A7	31.11	40.82	78.01	17.72	33.92	48.19	72.05	95.02	123.39
A						1027.52	1791.00	2449.13	3532.38	4559.23	5814.79

Based on the City of New Braunfels DECDM criteria, it is our engineering judgment that it is not the responsibility of the downstream developers to detain, reduce flows, or design drainage features with the capacity for the Ultimate Conditions flow rates (assuming no detention is provided on property not associated with this development). Because increases to flow rates from any new and/or proposed development is not allowed, the assumption that the flow rate of the drainage areas (not affected by this proposed development) will maintain the existing flow rate is valid. Based on this assumption the comparison between the Existing and Ultimate conditions is irrelevant, but has been provided per the request of the City of New Braunfels Engineering Department.

8.0 Conclusion

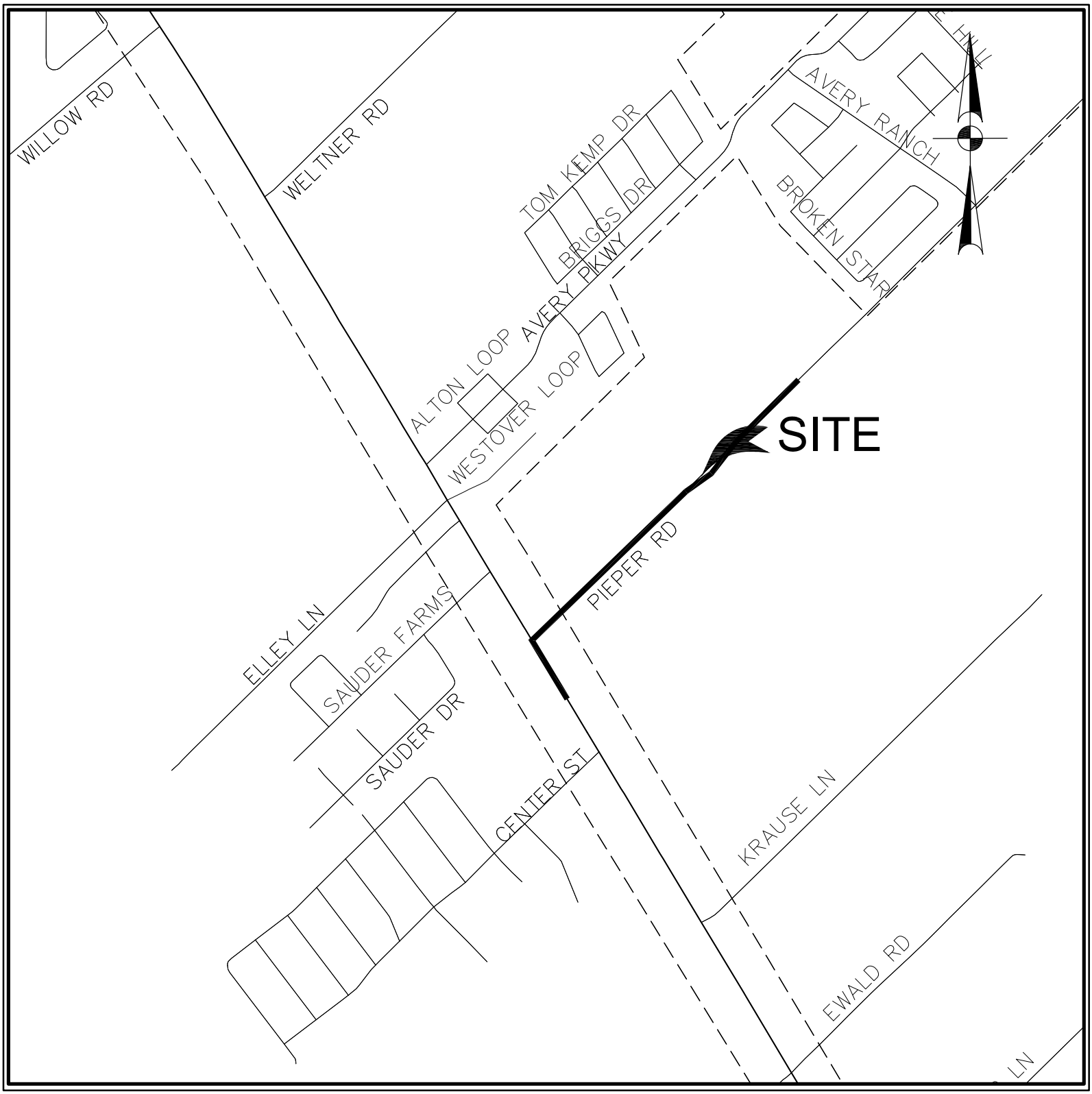
The proposed improvements for the Parkside Offsite Improvements was analyzed for the 2, 5, 10, 25, and 100-year storm events. This analysis was performed in accordance with the City of New Braunfels Drainage and Erosion Control Manual revised July 2016.

Attachment A

Location Map

Attachment A

Location Map

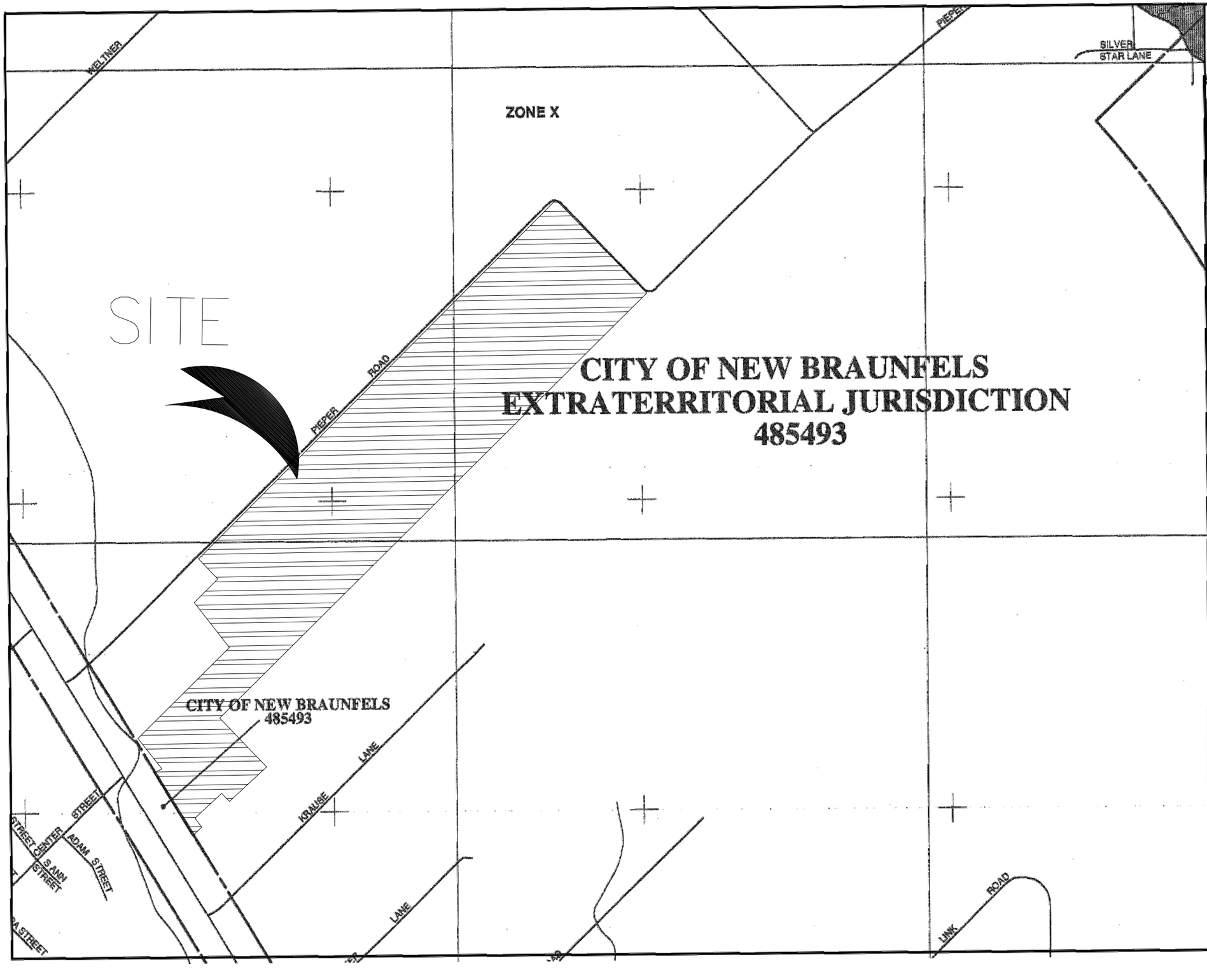


PROJECT LOCATION MAP

SCALE: N.T.S.

Attachment B

FEMA FIRM Map



MAP SCALE 1" = 1000'

500 0 1000 2000 FEET

FIRM

FLOOD INSURANCE RATE MAP

GUADALUPE COUNTY, TEXAS

AND INCORPORATED AREAS

PANEL 120 OF 480

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
GUADALUPE COUNTY	480266	0120	F
NEW BRAUNFELS, CITY OF	485493	0120	F

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
48187C0120F

EFFECTIVE DATE
NOVEMBER 2, 2007

Federal Emergency Management Agency

This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at www.msc.fema.gov

Attachment C

Drainage Area Map and Hydrology Calculations

0 500 1000 2000
HORIZONTAL SCALE: 1:1000

LEGEND

- EXISTING CONTOURS
- PROPOSED CONTOURS
- B.L. BUILDING SETBACK LINE
- U.E. UTILITY EASEMENT
- D.E. DRAINAGE EASEMENT
- DRAINAGE AREA
- TC TC TIME OF CONCENTRATION
- A POINT OF CONCENTRATION
- DRAINAGE FLOW DIRECTION
- DA / ACRES DRAINAGE AREA LABEL
- UNDEVELOPED/AGRICULTURAL GRASS (FAIR) ZONING
- COMMERCIAL ZONING
- INDUSTRIAL ZONING
- MIXED USE ZONING
- RESIDENTIAL
- ASPHALT

Table 1 - Existing Conditions Hydrology Calculations - City of New Braunfels

Point of Concentration	Description	Drainage Area	Area	T_c	Curve Number	Q_2 (cfs)	Q_5 (cfs)	Q_{10} (cfs)	Q_{25} (cfs)	Q_{50} (cfs)	Q_{100} (cfs)
EX A1	Drainage sub-area A1 Comparison	EX A1	1906.93	122.26	85.27	1002.62	1713.53	2312.98	3291.98	4218.96	5355.58
EX A2	Drainage sub-area A2 Comparison	EX A2	21.96	31.98	98.00	38.71	56.38	70.91	94.50	116.89	144.44
EX A3	Drainage sub-area A3 Comparison	EX A3	117.84	59.61	78.46	72.66	137.54	194.37	289.37	380.59	492.94
EX A1-A3						1056.56	1812.75	2451.33	3495.48	4485.49	5698.02
EX A4	Drainage sub-area A4 Comparison	EX A4	4.45	10.00	94.00	11.19	16.88	21.53	29.03	36.11	44.80
EX A5	Basin A3 Discharge + Drainage Sub-Area A6 Comparison	EX A5	24.99	63.10	78.00	14.49	27.69	39.30	58.74	77.45	100.52
EX A6	Drainage sub-area A6 Comparison	EX A6	31.11	40.82	78.01	22.75	43.33	61.45	91.70	120.72	156.45
EX A						1076.03	1848.80	2502.49	3570.74	4582.87	5823.16

290 S. CASTELL AVE., STE. 100
NEW BRAUNFELS, TX 78130
TBPE FIRM F-10961
TBPLS FIRM 1053600
HMT ENGINEERING & SURVEYING

STATE OF TEXAS
CHRISTOPHER P. VAN HEERDE
93047
LICENSED
PROFESSIONAL ENGINEER

06/10/2020

EXISTING CONDITIONS DRAINAGE AREA MAP

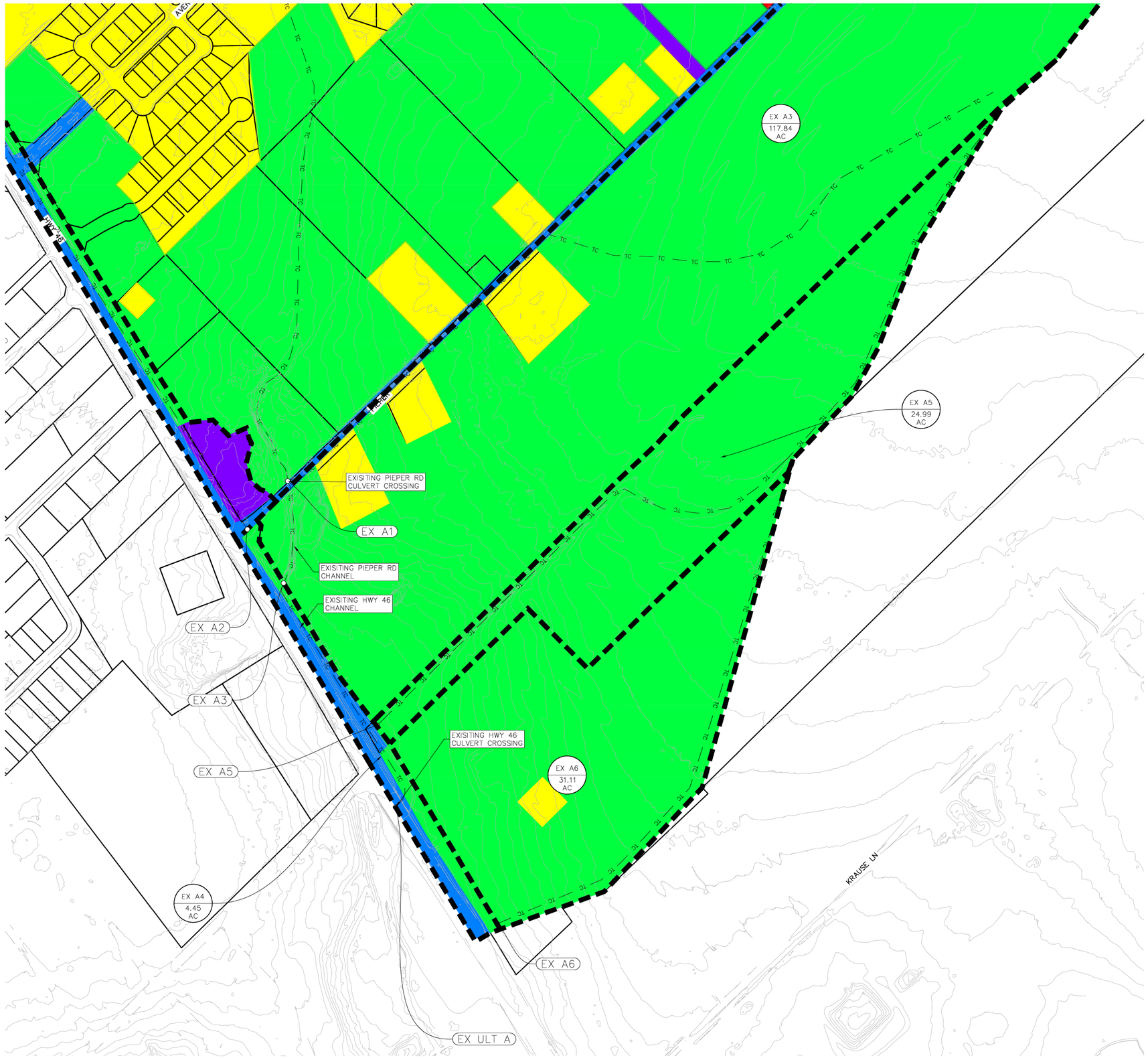
PARKSIDE OFFSITE
HWY 46 - PIEPER RD IMPROVEMENTS

NO.	REVISION DESCRIPTION	REVISION DATE

DATE: APRIL 2020
DRAWN BY: MK
DESIGNED BY: CAM
REVIEWED BY: CVH/SWH
HMT PROJECT NO.: 031.061

SHEET
C2.01

Drawing Name: N:_Projects\031 - DR Horton\031.060 - 175 Ac Friesenhahn Cib\Cib\Offsite\031.60_DRNG EXIST.dwg User: chrisvh Jun 11, 2020 - 12:30pm



DRAINAGE AREA INSET

LEGEND

- EXISTING CONTOURS
- PROPOSED CONTOURS
- B.L. BUILDING SETBACK LINE
- U.E. UTILITY EASEMENT
- D.E. DRAINAGE EASEMENT
- DRAINAGE AREA
- TC TIME OF CONCENTRATION
- A POINT OF CONCENTRATION
- DRAINAGE FLOW DIRECTION
- DA / ACRES DRAINAGE AREA LABEL
- UNDEVELOPED/AGRICULTURAL GRASS (FAIR) ZONING
- COMMERCIAL ZONING
- INDUSTRIAL ZONING
- MIXED USE ZONING
- RESIDENTIAL
- ASPHALT

0 100 200 400
HORIZONTAL SCALE: 1:200

HMT ENGINEERING & SURVEYING
290 S. CASTELL AVE., STE. 100
NEW BRAUNFELS, TX 78130
TBPE FIRM F-10961
TBPLS FIRM 1053600

STATE OF TEXAS
CHRISTOPHER P. VAN HEERDE
93047
LICENSED
PROFESSIONAL ENGINEER

06/10/2020

EXISTING CONDITIONS DRAINAGE AREA MAP

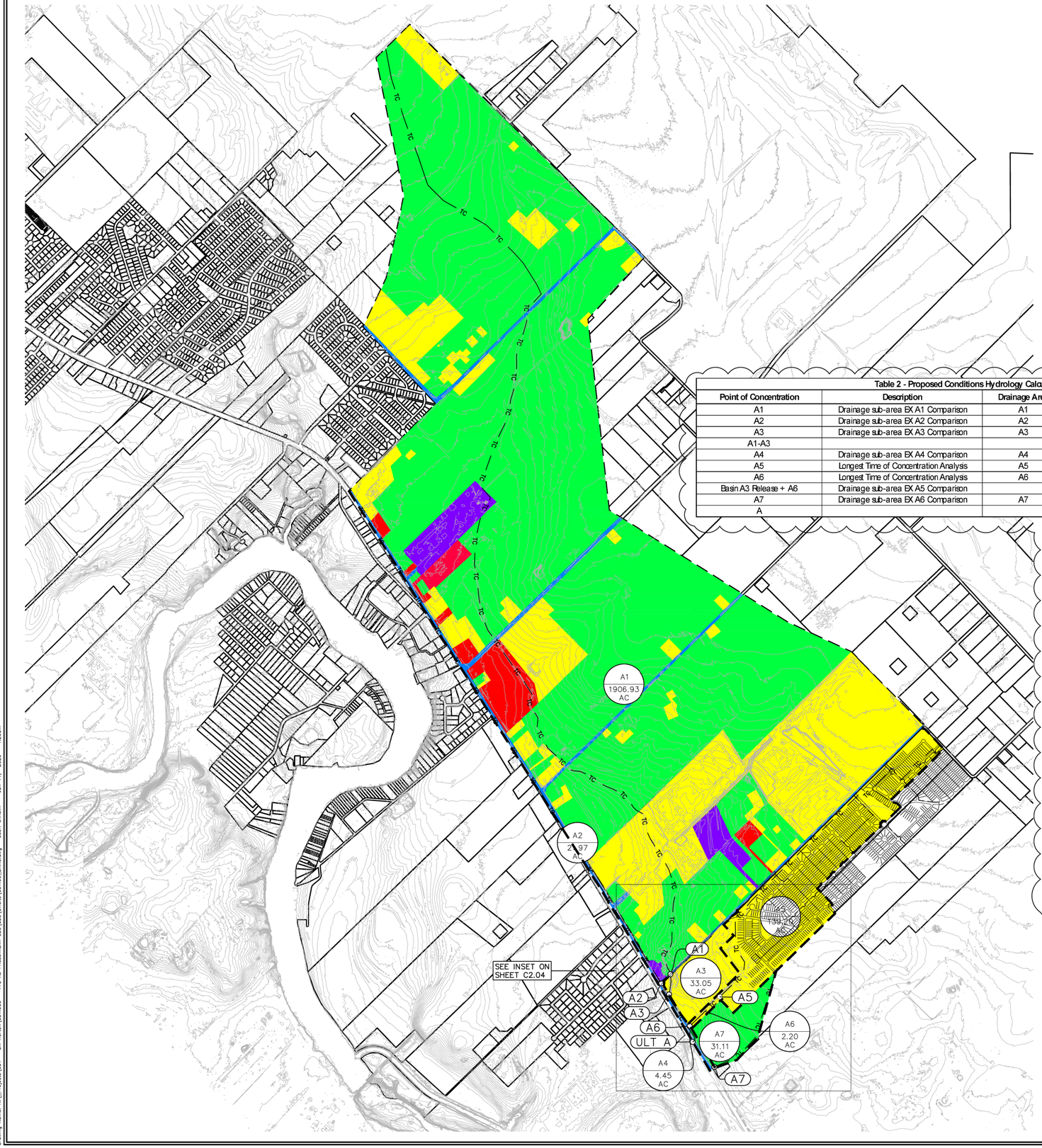
PARKSIDE OFFSITE
HWY 46 - PIEPER RD IMPROVEMENTS

NO.	REVISION DESCRIPTION	REVISION DATE

DATE: APRIL 2020
DRAWN BY: MK
DESIGNED BY: CAM
REVIEWED BY: CVH/SWH
HMT PROJECT NO.: 031.061

SHEET
C2.02

Drawing Name: N:_Projects\031 - DR Horton\031.060 - 175 Ac. Friesenhahn Cib\Cibolo\Offsite\031.60_DRNG EXIST.dwg User: chrisvh Jun 11, 2020 - 12:31pm



0 500 1000 2000

HORIZONTAL SCALE: 1:1000

LEGEND

- EXISTING CONTOURS
- PROPOSED CONTOURS
- B.L. BUILDING SETBACK LINE
- U.E. UTILITY EASEMENT
- D.E. DRAINAGE EASEMENT
- DRAINAGE AREA
- TC TC TIME OF CONCENTRATION
- A POINT OF CONCENTRATION
- DRAINAGE FLOW DIRECTION
- DA / ACRES DRAINAGE AREA LABEL
- UNDEVELOPED/AGRICULTURAL GRASS (FAIR) ZONING
- COMMERCIAL ZONING
- INDUSTRIAL ZONING
- MIXED USE ZONING
- RESIDENTIAL
- ASPHALT

Table 2 - Proposed Conditions Hydrology Calculations - City of New Braunfels * Parkside development being fully developed and containing detention*****

Point of Concentration	Description	Drainage Area	Area (acres)	T_c	Curve Number	Q_2 (cfs)	Q_5 (cfs)	Q_{10} (cfs)	Q_{25} (cfs)	Q_{50} (cfs)	Q_{100} (cfs)
A1	Drainage sub-area EX A1 Comparison	A1	1906.93	122.26	85.27	1002.62	1713.53	2312.98	3291.98	4218.96	5355.58
A2	Drainage sub-area EX A2 Comparison	A2	21.96	31.98	98.00	38.71	56.38	70.91	94.50	116.89	144.44
A3	Drainage sub-area EX A3 Comparison	A3	33.05	25.60	79.66	33.81	62.43	87.35	128.59	167.93	216.22
A1-A3						1014.34	1732.33	2338.07	3326.44	4263.63	5411.44
A4	Drainage sub-area EX A4 Comparison	A4	4.45	10.00	94.00	8.96	13.54	17.29	23.32	29.02	36.02
A5	Longest Time of Concentration Analysis	A5	139.2	42.03	94.00	22.24	61.62	101.75	173.26	243.14	328.26
A6	Longest Time of Concentration Analysis	A6	2.20	10.00	84.00	3.48	5.77	7.67	10.74	13.64	17.17
Basin A3 Release + A6	Drainage sub-area EX A5 Comparison					22.43	62.06	102.40	174.27	244.47	330.09
A7	Drainage sub-area EX A6 Comparison	A7	31.11	40.82	78.01	17.72	33.92	48.19	72.05	95.02	123.39
A						1027.52	1791.00	2449.13	3532.38	4559.23	5814.79

Table 3 - Existing to Proposed Discharge Comparison

Drainage Area	2YR	5YR	10R	25YR	50YR	100YR
EX A	1076.03	1848.80	2502.49	3570.74	4582.87	5823.16
A	1027.52	1791.00	2449.13	3532.38	4559.23	5814.79
Proposed <= Existing	YES	YES	YES	YES	YES	YES
Drainage Area	2YR	10YR	10YR	25YR	50YR	100YR
EX A1	1002.62	1713.53	2312.98	3291.98	4218.96	5355.58
A1	1002.62	1713.53	2312.98	3291.98	4218.96	5355.58
Proposed <= Existing	YES	YES	YES	YES	YES	YES
Drainage Area	2YR	10YR	10YR	25YR	50YR	100YR
EX A2	38.71	56.38	70.91	94.50	116.89	144.44
ULT A2	38.71	56.38	70.91	94.50	116.89	144.44
Proposed <= Existing	YES	YES	YES	YES	YES	YES
Drainage Area	2YR	10YR	10YR	25YR	50YR	100YR
EX A3	72.66	137.54	194.37	289.37	380.59	492.94
A3	33.81	62.43	87.35	128.59	167.93	216.22
Proposed <= Existing	YES	YES	YES	YES	YES	YES
Drainage Area	2YR	10YR	10YR	25YR	50YR	100YR
EX A1-A3	1056.56	1812.75	2451.33	3495.48	4485.49	5698.02
A1-A3	1014.34	1732.33	2338.07	3326.44	4263.63	5411.44
Proposed <= Existing	YES	YES	YES	YES	YES	YES
Drainage Area	2YR	10YR	10YR	25YR	50YR	100YR
EX A4	11.19	16.88	21.53	29.03	36.11	44.80
A4	8.96	13.54	17.29	23.32	29.02	36.02
Proposed <= Existing	YES	YES	YES	YES	YES	YES
Drainage Area	2YR	10YR	10YR	25YR	50YR	100YR
EX A5	14.49	27.69	39.30	58.74	77.45	100.52
Basin A3 Release + A6	22.43	62.06	102.40	174.27	244.47	330.09
Proposed <= Existing	NO	NO	NO	NO	NO	NO
Drainage Area	2YR	10YR	10YR	25YR	50YR	100YR
EX A6	22.75	43.33	61.45	91.70	120.72	156.45
A7	17.72	33.92	48.19	72.05	95.02	123.39
Proposed <= Existing	YES	YES	YES	YES	YES	YES

290 S. CASTELL AVE., STE. 100
NEW BRAUNFELS, TX 78130
TBPE FIRM F-10961
TBPLS FIRM 1053600

HMT
ENGINEERING & SURVEYING

STATE OF TEXAS
CHRISTOPHER P. VAN HEERDE
93047
LICENSED
PROFESSIONAL ENGINEER

06/10/2020

PROPOSED CONDITIONS DRAINAGE AREA MAP

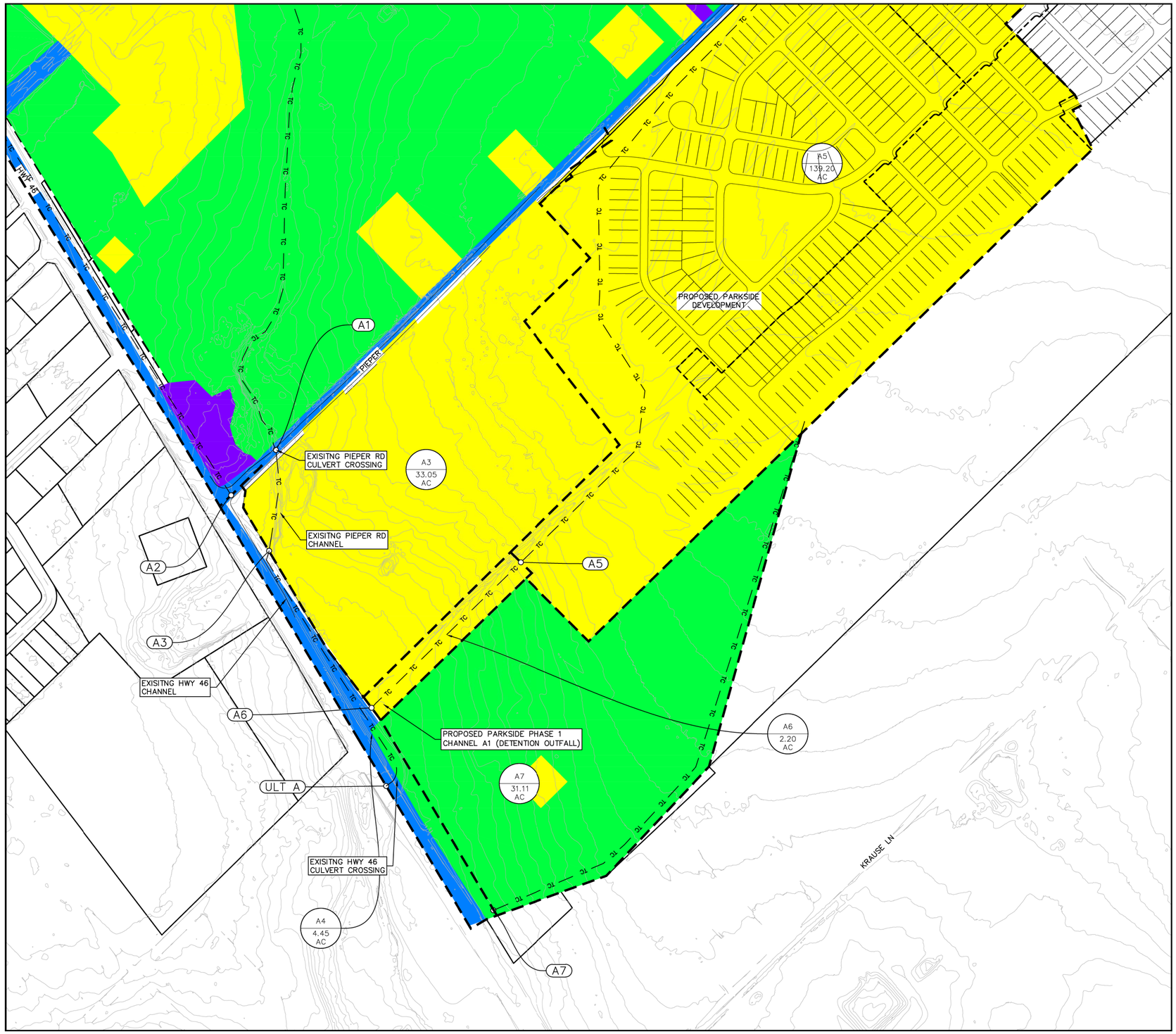
PARKSIDE OFFSITE
HWY 46 - PIEPER RD IMPROVEMENTS

NO.	REVISION DESCRIPTION	REVISION DATE
1	UPDATED DRAINAGE CALCULATIONS	06/10/20

DATE: JUNE 2020
DRAWN BY: MK
DESIGNED BY: CAM
REVIEWED BY: CVH/SWH
HMT PROJECT NO.: 031.061

SHEET
C2.03

Drawing Name: N:_Projects\031 - DR Horton\031.060 - 175 Ac Freiemann Cbk\Cbk\Offsite\031.60_DRNG.dwg User: cnrivin Jun 11, 2020 - 1:20pm



DRAINAGE AREA INSET

LEGEND

- EXISTING CONTOURS
- PROPOSED CONTOURS
- B.L. BUILDING SETBACK LINE
- U.E. UTILITY EASEMENT
- D.E. DRAINAGE EASEMENT
- DRAINAGE AREA
- TC TIME OF CONCENTRATION
- A POINT OF CONCENTRATION
- DRAINAGE FLOW DIRECTION
- DA / ACRES DRAINAGE AREA LABEL
- UNDEVELOPED/AGRICULTURAL GRASS (FAIR) ZONING
- COMMERCIAL ZONING
- INDUSTRIAL ZONING
- MIXED USE ZONING
- RESIDENTIAL
- ASPHALT

0 100 200 400
HORIZONTAL SCALE: 1:200

290 S. CASTELL AVE., STE. 100
NEW BRAUNFELS, TX 78130
TBPE FIRM F-10961
TBPLS FIRM 1053600

HMT
ENGINEERING & SURVEYING

STATE OF TEXAS
CHRISTOPHER P. VAN HEERDE
93047
LICENSED
PROFESSIONAL ENGINEER

06/10/2020

PROPOSED CONDITIONS DRAINAGE AREA INSET

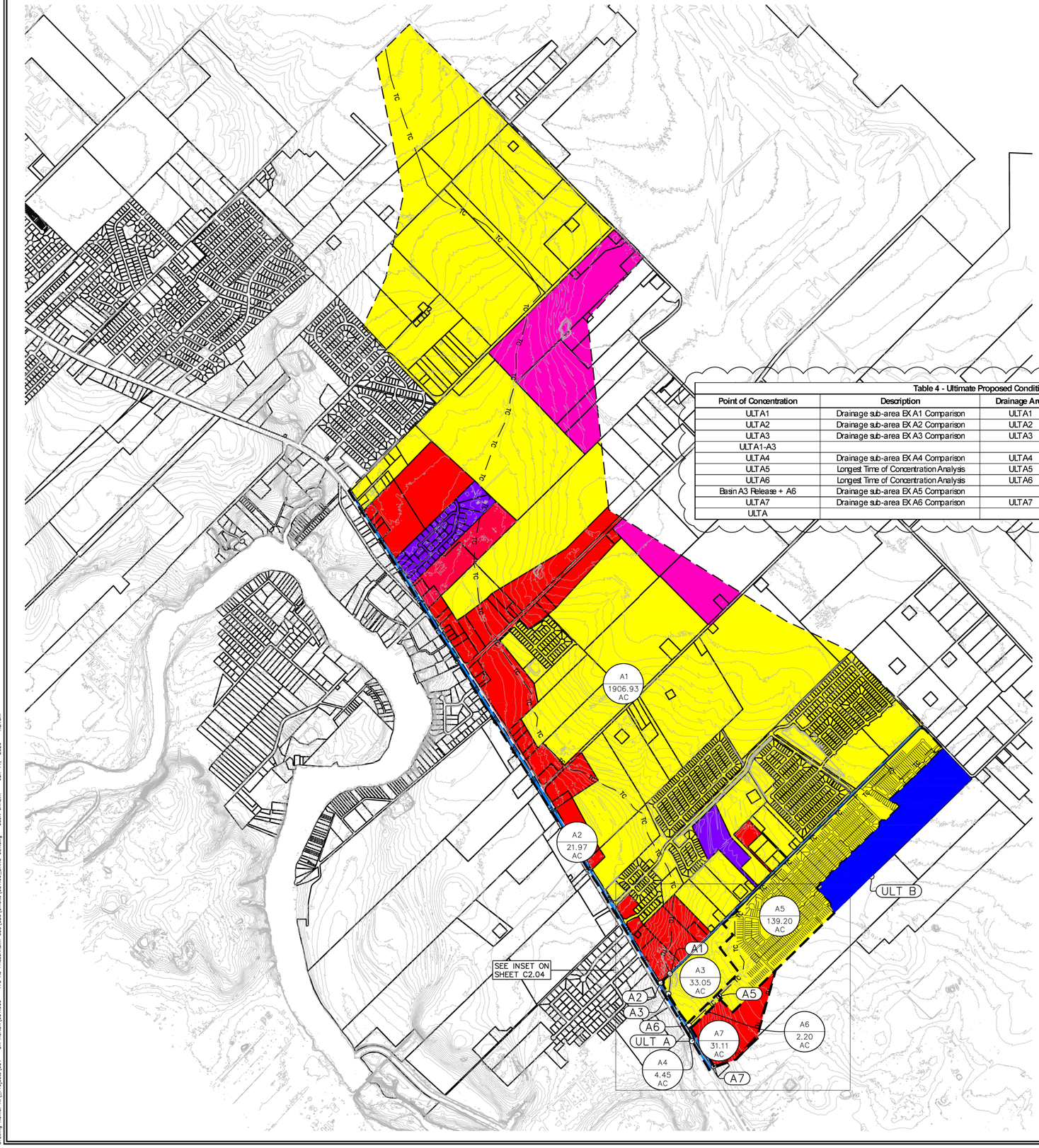
PARKSIDE OFFSITE
HWY 46 - PIEPER RD IMPROVEMENTS

NO.	REVISION NOTES	REVISION DESCRIPTION	DATE
1			

DATE: JUNE 2020
DRAWN BY: MK
DESIGNED BY: CAM
REVIEWED BY: CVH/SWH
HMT PROJECT NO.: 031.061

SHEET
C2.04

Drawing Name: N:_Projects\031 - DR Horton\031.060 - 175 Ac Friesenhahn CDA\CDA\Offsite\031.60_DRNG.dwg User: chrisvh Jun 11, 2020 - 1:20pm



0 500 1000 2000

HORIZONTAL SCALE: 1:1000

LEGEND

- EXISTING CONTOURS
- PROPOSED CONTOURS
- B.L. BUILDING SETBACK LINE
- U.E. UTILITY EASEMENT
- D.E. DRAINAGE EASEMENT
- DRAINAGE AREA
- TC TC TIME OF CONCENTRATION
- A POINT OF CONCENTRATION
- DRAINAGE FLOW DIRECTION
- DA / ACRES DRAINAGE AREA LABEL
- UNDEVELOPED/AGRICULTURAL GRASS (FAIR) ZONING
- COMMERCIAL ZONING
- INDUSTRIAL ZONING
- MIXED USE ZONING
- RESIDENTIAL
- ASPHALT

Table 4 - Ultimate Proposed Conditions Hydrology Calculations - City of New Braunfels **Assuming no other development details***

Point of Concentration	Description	Drainage Area	Area (acres)	T_c	Curve Number	Q_2 (cfs)	Q_5 (cfs)	Q_{10} (cfs)	Q_{25} (cfs)	Q_{50} (cfs)	Q_{100} (cfs)
ULTA1	Drainage sub-area EX A1 Comparison	ULTA1	1906.93	122.26	88.44	1141.60	1866.75	2468.89	3444.27	4365.42	5935.32
ULTA2	Drainage sub-area EX A2 Comparison	ULTA2	21.96	31.98	98.00	38.71	56.38	70.91	94.50	116.89	144.44
ULTA3	Drainage sub-area EX A3 Comparison	ULTA3	33.72	25.60	87.82	49.33	80.72	106.68	148.61	188.11	236.38
ULTA1-A3						1155.19	1887.79	2495.72	3481.58	4411.85	5549.89
ULTA4	Drainage sub-area EX A4 Comparison	ULTA4	4.45	10.00	94.00	11.19	16.88	21.53	29.03	36.11	44.80
ULTA5	Longest Time of Concentration Analysis	ULTA5	138.53	42.03	87.00	120.49	200.06	266.47	374.12		599.84
ULTA6	Longest Time of Concentration Analysis	ULTA6	2.2	10.00	84.00	3.64	6.29	6.52	12.15	15.58	19.77
Basin A3 Release + A6	Drainage sub-area EX A5 Comparison					43.47	98.43	149.58	241.81	322.39	418.81
ULTA7	Drainage sub-area EX A6 Comparison	ULTA7	31.11	40.82	95.00	45.07	67.45	85.74	115.29		177.52
ULTA						1168.50	1928.79	2571.00	3636.02	4659.92	5910.76

290 S. CASTELL AVE., STE. 100
NEW BRAUNFELS, TX 78130
TBPE FIRM F-10961
TBPLS FIRM 1053600

HMT
ENGINEERING & SURVEYING

STATE OF TEXAS
CHRISTOPHER P. VAN HEERDE
93047
LICENSED
PROFESSIONAL ENGINEER

06/10/2020

ULTIMATE CONDITIONS DRAINAGE AREA MAP

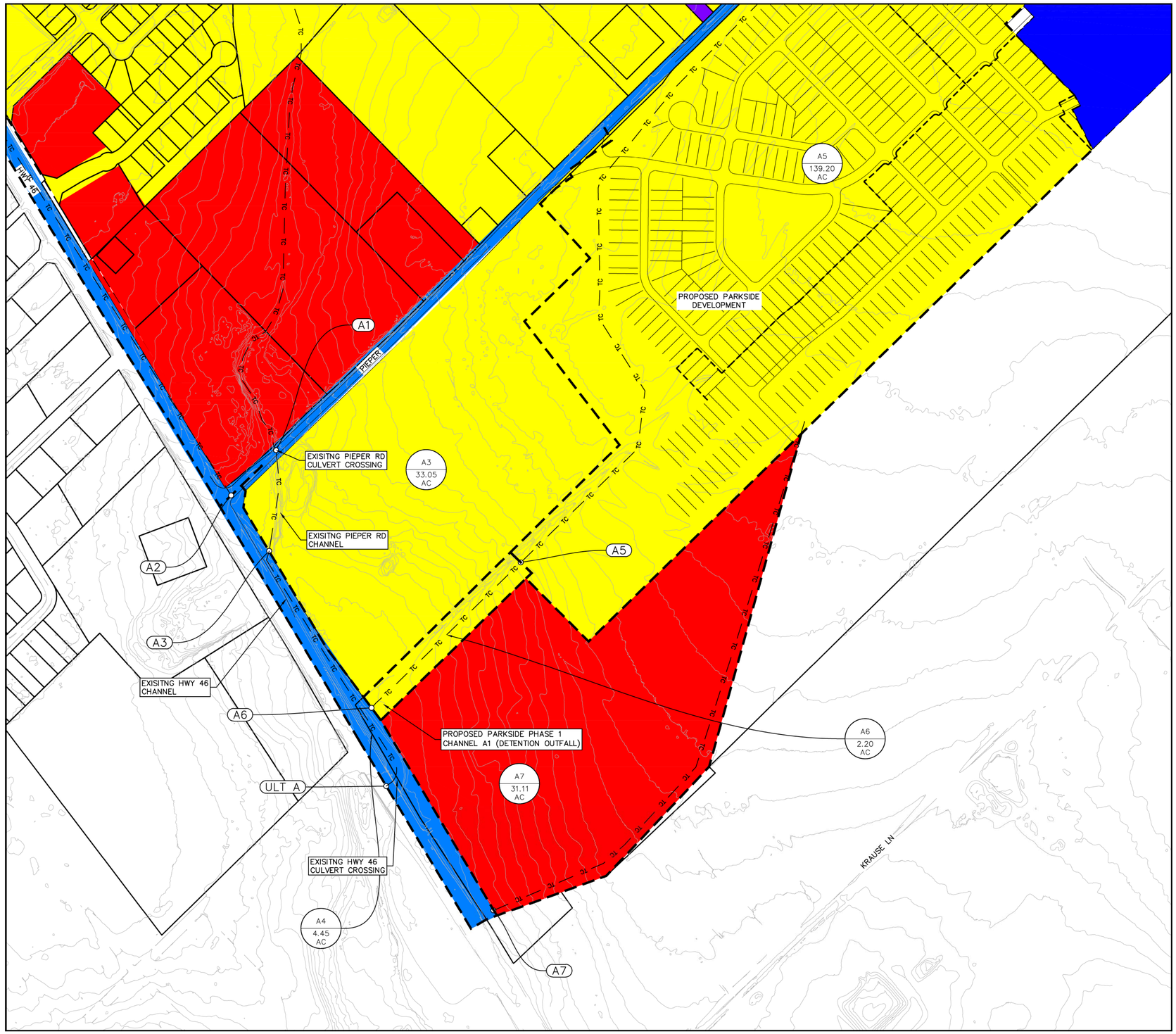
PARKSIDE OFFSITE
HWY 46 - PIEPER RD IMPROVEMENTS

NO.	REVISION DESCRIPTION	REVISION DATE
1	UPDATED DRAINAGE CALCULATIONS	06/10/20

DATE: **JUNE 2020**
DRAWN BY: **MK**
DESIGNED BY: **CAM**
REVIEWED BY: **CVH/SWH**
HMT PROJECT NO.: **031.061**

SHEET
C2.05

Drawing Name: N:_Projects\031 - DR Horton\031.060 - 175 AC Friesenhahn Cib\Cib\Offsite\031.60_DRNG ULT.dwg User: cnrlevh Jun 11, 2020 - 1:21pm



DRAINAGE AREA INSET

LEGEND

- EXISTING CONTOURS
- PROPOSED CONTOURS
- B.L. BUILDING SETBACK LINE
- U.E. UTILITY EASEMENT
- D.E. DRAINAGE EASEMENT
- DRAINAGE AREA
- TC TIME OF CONCENTRATION
- A POINT OF CONCENTRATION
- DRAINAGE FLOW DIRECTION
- DA / ACRES DRAINAGE AREA LABEL
- UNDEVELOPED/AGRICULTURAL GRASS (FAIR) ZONING
- COMMERCIAL ZONING
- INDUSTRIAL ZONING
- MIXED USE ZONING
- RESIDENTIAL
- ASPHALT

0 100 200 400
HORIZONTAL SCALE: 1:200

290 S. CASTELL AVE., STE. 100
NEW BRAUNFELS, TX 78130
TBPE FIRM F-10961
TBPLS FIRM 1053600

HMT
ENGINEERING & SURVEYING

STATE OF TEXAS
CHRISTOPHER P. VAN HEERDE
93047
LICENSED
PROFESSIONAL ENGINEER

06/10/2020

ULTIMATE CONDITIONS DRAINAGE AREA MAP INSET

PARKSIDE OFFSITE
HWY 46 - PIEPER RD IMPROVEMENTS

NO.	REVISION NOTES	REVISION DATE
		DATE

DATE: JUNE 2020
DRAWN BY: MK
DESIGNED BY: CAM
REVIEWED BY: CVH/SWH
HMT PROJECT NO.: 031.061

SHEET
C2.06

Drawing Name: N:_Projects\031 - DR Horton\031.060 - 175 Ac Friesenhahn Cbd\Cbd\Offsite\031.60_DRNG ULT.dwg User: chrivan Jun 11, 2020 - 1:21pm

Wdeoh#4#0#H{lvwlqj#Frqglwlrqv#K|gurorj|#Fdofxodwlrqv#0#Flw|#ri#Qhz#Eudxqihov

Srlqw#ri#Frqfhqwudwlrq	Ghvfulswlrq	Gudlqdjh#Duhd	Duhd	W_E	Fxuyh#Qxpehu	T_5#+fiv,	T_8#+fiv,	T_{43}#+fiv,	T_{58}#+fiv,	T_{83}#+fiv,	T_{433}#+fiv,
H[#D4	Gudlqdjh#vxe0duhd#D4#Frpsdulvrq	H[#D4	4<391<6	455159	;815:	4335195	4:46186	56451<;	65<41<;	754;1<9	868818;
H[#D5	Gudlqdjh#vxe0duhd#D5#Frpsdulvrq	H[#D5	541<9	641<;	<;133	6;1:4	8916;	:31<4	<7183	4491;<	477177
H[#D6	Gudlqdjh#vxe0duhd#D6#Frpsdulvrq	H[#D6	44:1;7	8<194	:;179	:5199	46:187	4<716:	5;<16:	6;318<	7<51<7
H[#D40D6						4389189	4;451:8	5784166	67<817;	77;817<	89<;135
H[#D7	Gudlqdjh#vxe0duhd#D7#Frpsdulvrq	H[#D7	7178	43133	<7133	4414<	491;;	54186	5<136	69144	771;3
H[#D8	Edvlq#D6#Glvfkdujh#.#Gudlqdjh#Vxe0Duhd#D9 Frpsdulvrq	H[#D8	571<<	96143	:;133	4717<	5:19<	6<163	8;1:7	::178	433185
H[#D9	Gudlqdjh#vxe0duhd#D9#Frpsdulvrq	H[#D9	64144	731;5	:;134	551:8	76166	94178	<41:3	4531:5	489178
H[#D						43:9136	4;7;1;3	583517<	68:31:7	78;51;:	8;56149

Wdeoh#5#0#Sursrvhg#Frqglwlrqv#K|gurorj|#Fdofxodwlrqv#0#Flw|#ri#Qhz#Eudxqihov#---#Sdunvlgh#ghyhorsphqw#ehlqj#ixoo|#ghyhorshg#dqg#frqwdlqlqj#ghwhqwlrq---

Srlqw#ri#Frqfhqwudwlrq	Ghvfulswlrq	Gudlqdjh#Duhd	Duhd#+dfuhv,	W_E	Fxuyh#Qxpehu	T_5#+fiv,	T_8#+fiv,	T_{43}#+fiv,	T_{58}#+fiv,	T_{83}#+fiv,	T_{433}#+fiv,
D4	Gudlqdjh#vxe0duhd#H[#D4#Frpsdulvrq	D4	4<391<6	455159	;815:	4335195	4:46186	56451<;	65<41<;	754;1<9	868818;
D5	Gudlqdjh#vxe0duhd#H[#D5#Frpsdulvrq	D5	541<9	641<;	<;133	6;1:4	8916;	:31<4	<7183	4491;<	477177
D6	Gudlqdjh#vxe0duhd#H[#D6#Frpsdulvrq	D6	66138	58193	:<199	661;4	95176	;:168	45;18<	49:1<6	549155
D40D6						4347167	4:65166	566;13:	6659177	7596196	8744177
D7	Gudlqdjh#vxe0duhd#H[#D7#Frpsdulvrq	D7	7178	43133	<7133	;1<9	46187	4:15<	56165	5<135	69135
D8	Orqjhvw#Wlph#ri#Frqfhqwudwlrq#Dqdo|vlvD8		46<15	75136	<7133	55157	94195	4341:8	4:6159	576147	65;159
D9	Orqjhvw#Wlph#ri#Frqfhqwudwlrq#Dqdo|vlvD9		5153	43133	;7133	617;	81::	:19:	431:7	46197	4:14:
Edvlq#D6#Uhohdvh#.#D9	Gudlqdjh#vxe0duhd#H[#D8#Frpsdulvrq					55176	95139	435173	4:715:	57717:	66313<
D:	Gudlqdjh#vxe0duhd#H[#D9#Frpsdulvrq	D:	64144	731;5	:;134	4:1:5	661<5	7;14<	:5138	<8135	45616<
D						435:185	4:<4133	577<146	686516;	788<156	8;471:<

Wdeoh#6#0#H{lvwlqj#wr#Sursrvhg#Glvfkdujh#Frpsdulvrq

Gudlqdjh#Duhd	5\U	8\U	43U	58\U	83\U	433\U
H[#D	43:9136	4;7;1;3	583517<	68:31:7	78;51;:	8;56149
D	435:185	4:<4133	577<146	686516;	788<156	8;471:<
Sursrvhg#?@#H{lvwlqj	\HV	\HV	\HV	\HV	\HV	\HV
Gudlqdjh#Duhd	5\U	43\U	43\U	58\U	83\U	433\U
H[#D4	4335195	4:46186	56451<;	65<41<;	754;1<9	868818;
D4	4335195	4:46186	56451<;	65<41<;	754;1<9	868818;
Sursrvhg#?@#H{lvwlqj	\HV	\HV	\HV	\HV	\HV	\HV
Gudlqdjh#Duhd	5\U	43\U	43\U	58\U	83\U	433\U
H[#D5	6;1:4	8916;	:31<4	<7183	4491;<	477177
XOW#D5	6;1:4	8916;	:31<4	<7183	4491;<	477177
Sursrvhg#?@#H{lvwlqj	\HV	\HV	\HV	\HV	\HV	\HV
Gudlqdjh#Duhd	5\U	43\U	43\U	58\U	83\U	433\U
H[#D6	:5199	46:187	4<716:	5;<16:	6;318<	7<51<7
D6	661;4	95176	;:168	45;18<	49:1<6	549155
Sursrvhg#?@#H{lvwlqj	\HV	\HV	\HV	\HV	\HV	\HV
Gudlqdjh#Duhd	5\U	43\U	43\U	58\U	83\U	433\U
H[#D40D6	4389189	4;451:8	5784166	67<817;	77;817<	89<;135
D40D6	4347167	4:65166	566;13:	6659177	7596196	8744177
Sursrvhg#?@#H{lvwlqj	\HV	\HV	\HV	\HV	\HV	\HV
Gudlqdjh#Duhd	5\U	43\U	43\U	58\U	83\U	433\U
H[#D7	4414<	491;;	54186	5<136	69144	771;3
D7	;1<9	46187	4:15<	56165	5<135	69135
Sursrvhg#?@#H{lvwlqj	\HV	\HV	\HV	\HV	\HV	\HV
Gudlqdjh#Duhd	5\U	43\U	43\U	58\U	83\U	433\U
H[#D8	4717<	5:19<	6<163	8;1:7	::178	433185
Edvlq#D6#Uhohdvh#.#D9	55176	95139	435173	4:715:	57717:	66313<
Sursrvhg#?@#H{lvwlqj	QR	QR	QR	QR	QR	QR
Gudlqdjh#Duhd	5\U	43\U	43\U	58\U	83\U	433\U
H[#D9	551:8	76166	94178	<41:3	4531:5	489178
D:	4:1:5	661<5	7;14<	:5138	<8135	45616<
Sursrvhg#?@#H{lvwlqj	\HV	\HV	\HV	\HV	\HV	\HV

Wdeoh#7#0#Xowlpdwh#Sursrvhg#Frqglwlrqv#K|gurorj|#Fdofxodwlrqv#0#Flw|#ri#Qhz#Eudxqihov#--Dvvxplqj#qr#rwkhu#ghyhorsphqw#ghwdlqv---

Srlqw#ri#Frqfhqwudwlrq	Ghvfulswlrq	Gudlqdjh#Duhd	Duhd#+dfuhv,	W_E	Fxuyh#Qxpehu	T_5#+fiv,	T_8#+fiv,	T_{43}#+fiv,	T_{58}#+fiv,	T_{83}#+fiv,	T_{433}#+fiv,
XOW#D4	Gudlqdjh#vxe0duhd#H[#D4#Frpsdulvrq	XOW#D4	4<391<6	455159	;;177	4474193	4;991:8	579;1;<	677715:	7698175	8<68165
XOW#D5	Gudlqdjh#vxe0duhd#H[#D5#Frpsdulvrq	XOW#D5	541<9	641<;	<;133	6;1:4	8916;	:31<4	<7183	4491;<	477177
XOW#D6	Gudlqdjh#vxe0duhd#H[#D6#Frpsdulvrq	XOW#D6	66138	58193	;:1;6	7;168	:<145	437189	478199	4;716:	56419;
XOW#D40D6						4488138	4;;:188	57<8174	67;4149	7744165	887<156
XOW#D7	Gudlqdjh#vxe0duhd#H[#D7#Frpsdulvrq	XOW#D7	7178	43133	<7133	;1<9	46187	4:15<	56165	5<135	69135
XOW#D8	Orqjhvw#Wlph#ri#Frqfhqwudwlrq#Dqdo|vlvXOW#D8		46<153	75136	;:133	55157	94195	4341:8	4:6159	576147	65;159
XOW#D9	Orqjhvw#Wlph#ri#Frqfhqwudwlrq#Dqdo|vlvXOW#D9		515	43133	;7133	617;	81::	:19:	431:7	46197	4:14:
Edvlq#D6#Uhohdvh#.#D9	Gudlqdjh#vxe0duhd#H[#D8#Frpsdulvrq					55176	95139	435173	4:715:	57717:	66313<
XOW#D:	Gudlqdjh#vxe0duhd#H[#D9#Frpsdulvrq	XOW#D:	64144	731;5	<8133	68194	86168	9:1;8	<415:	446175	473194
XOW#D						44::138	4<87183	594817:	69<8159	7:4815<	8<93158

Existing

Watershed - **EX A1** **1906.93 Acres**

Time of Concentration **EX A1**

Description **Drainage sub-area A1 Comparison**

				hrs	min.
Sheet Flow	L (ft) =	100	Tt=	$.007(n*L)^{0.8}/P_2{}^{0.5}xS^{0.4}$	
	n=	0.24			
	S (%) =	1.00			
	P_2=	3.34	Tt=	**0.31**	**18.4**
Shallow Flow	L (ft) =	5878	Tt=	(L)/(60*16.1345*S^(0.5))	
(Unpaved)	S (%) =	1	Tt=		
				Tt=	**60.72**
Channel Flow	L (ft) =	15518			
(Channel Flow)	Est. V (ft/sec)=	6	V (fps) =	6.00	
			Tt=	L/(60*V)	
			Tt=	**0.72**	**43.1**

Tc	**122.3 min.**

Curve Number	**85.27**

Weighted Curve Number	Hydrologic Soil Group	Curve Number	Area (acres)
Undeveloped/Agricultral Grass (Fair)	D	84	1358.04
Commercial	D	95	42.36
Industrial	D	90	42.4
Mixed Use	D	90	9.5
Residential	D	87	429.87
Asphalt	D	98	24.76

Weighted Curve Number **85.27**

Table 4-3: NRCS Runoff Curve Numbers for Urban Areas and Agricultural Lands

Cover Description	Average % Impervious Area[1]	Curve Numbers for Hydrologic Soil Group			
Cover Type and Hydrologic Condition		**A**	**B**	**C**	**D**
Fully developed urban areas (vegetation established)					
Open space (lawns, parks, golf courses, cemeteries, etc.):					
Poor condition (grass cover 50%)		68	79	86	89
Fair condition (grass cover 50% to 75%)		49	69	79	84
Good condition (grass cover 75%)		39	61	74	80
Impervious areas:					
Paved parking lots, roofs, driveways, etc. (excluding right of way)		98	98	98	98
Streets and roads:					
Paved; curbs and storm drains (excluding right of way)		98	98	98	98
Paved; open ditches (including right of way)		83	89	92	93
Gravel (including right of way)		76	85	89	91
Dirt (including right of way)		72	82	87	89
Developing urban areas					
Newly graded areas (pervious areas only, no vegetation)		77	86	91	94
Agricultural lands					
Grassland, or range-continuous forage for grazing[2]	Poor	68	79	86	89
	Fair	49	69	79	84
	Good	39	61	74	80
Meadow-continuous grass, protected from grazing and generally mowed for hay		30	58	71	78
Brush—brush-weed-grass mixture with brush the major element[3]	Poor	48	67	77	83
	Fair	35	56	70	77
	Good	30	48	65	73
Woods—grass combination (orchard or tree farm).[4]	Poor	57	73	82	86
	Fair	43	65	76	82
	Good	32	58	72	79
Woods[5]	Poor	45	66	77	83
	Fair	36	60	73	79
	Good	30	55	70	77
Farmsteads—buildings, lanes, driveways and surrounding lots		59	74	82	86

[1] Poor: less than 50 percent ground cover or heavily grazed with no mulch.

Table 4-4: Curve Numbers for Fully Developed Conditions

Zone	Curve Numbers for Hy	
	A	B
R-1/R-1A Single family	61	75
R-2/R-2A Single and two family	77	85
R-3/R-3L Multi family high density	77	89
R-3/R-3H Multi family low density	77	85
B-1/B-1A Convent & mobile homes	61	75
TH/TH-A Townhouse	77	89
ZH/ZH-A Zero lot line homes	68	79
C-1/C1A Neighborhood business	83	89
C-2/C-1B General Business	77	86
C-3 Commercial	89	92
C-4/C-4A Resort Commercial/PUD (must use composite values)	-	-
M-1/M1A Light industry	68	79
M-2/M-2A Heavy industry	89	92

Source: *TR-55* [3]

Existing

Watershed - **EX A2** **21.96 Acres**

Time of Concentration **EX A2**

Description **Drainage sub-area A2 Comparison**

				hrs	min.
Sheet Flow	L (ft) =	0	Tt=	$.007(n*L)^{0.8}/P_2{}^{0.5}xS^{0.4}$	
	n=	0.24			
	S (%) =	1.00			
	P_2=	3.34	Tt=	**0.00**	**0.0**
Shallow Flow	L (ft) =	0	Tt=	(L)/(60*16.1345*S^(0.5))	
(Unpaved)	S (%) =	1	Tt=		
				Tt=	**0.00**
Channel Flow	L (ft) =	11513			
(Channel Flow)	Est. V (ft/sec)=	6	V (fps) =	6.00	
			Tt=	L/(60*V)	
			Tt=	**0.53**	**32.0**

Tc	**32.0 min.**

Curve Number	**98.00**

Table 4-3: NRCS Runoff Curve Numbers for Urban Areas and Agricultural Lands

Cover Description	Average % Impervious Area[1]	Curve Numbers for Hydrologic Soil Group			
Cover Type and Hydrologic Condition		**A**	**B**	**C**	**D**
Fully developed urban areas (vegetation established)					
Open space (lawns, parks, golf courses, cemeteries, etc.):					
Poor condition (grass cover 50%)		68	79	86	89
Fair condition (grass cover 50% to 75%)		49	69	79	84
Good condition (grass cover 75%)		39	61	74	80
Impervious areas:					
Paved parking lots, roofs, driveways, etc. (excluding right of way)		98	98	98	98
Streets and roads:					
Paved; curbs and storm drains (excluding right of way)		98	98	98	98
Paved; open ditches (including right of way)		83	89	92	93
Gravel (including right of way)		76	85	89	91
Dirt (including right of way)		72	82	87	89
Developing urban areas					
Newly graded areas (pervious areas only, no vegetation)		77	86	91	94
Agricultural lands					
Grassland, or range-continuous forage for grazing[2]	Poor	68	79	86	89
	Fair	49	69	79	84
	Good	39	61	74	80
Meadow-continuous grass, protected from grazing and generally mowed for hay		30	58	71	78
Brush—brush-weed-grass mixture with brush the major element[3]	Poor	48	67	77	83
	Fair	35	56	70	77
	Good	30	48	65	73
Woods—grass combination (orchard or tree farm).[4]	Poor	57	73	82	86
	Fair	43	65	76	82
	Good	32	58	72	79
Woods[5]	Poor	45	66	77	83
	Fair	36	60	73	79
	Good	30	55	70	77
Farmsteads—buildings, lanes, driveways and surrounding lots		59	74	82	86

[1] Poor: less than 50 percent ground cover or heavily grazed with no mulch.
Fair: 50 to 75 percent ground cover and not heavily grazed.
Good: greater than 75 percent ground cover and lightly or only occasionally grazed.
[2] Poor: less than 50 percent ground cover.
Fair: 50 to 75 percent ground cover.
Good: greater than 75 percent ground cover.
[3] Curve numbers shown were computed for areas with 50 percent woods and 50 percent grass (pasture) cover. Other combinations of conditions may be computed from the curve numbers for woods and pasture.
[4] Poor: Forest litter, small trees and brush are destroyed by heavy grazing or regular burning.
Fair: Woods are grazed but not burned, and some forest litter covers the soil.
Good: Woods are protected from grazing, and litter and brush adequately cover the soil.

Source: *TR-55* [3]

Table 4-4: Curve Numbers for Fully Developed Conditions

Zone	Curve Numbers for Hydrologic Soil Group			
	A	**B**	**C**	**D**
R-1/R-1A Single family	61	75	83	87
R-2/R-2A Single and two family	77	85	90	92
R-3/R-3L Multi family high density	77	89	92	94
R-3/R-3H Multi family low density	77	85	90	92
B-1/B-1A Convent & mobile homes	61	75	83	87
TH/TH-A Townhouse	77	89	92	92
ZH/ZH-A Zero lot line homes	68	79	87	90
C-1/C1A Neighborhood business	83	89	92	93
C-2/C-1B General Business	77	86	93	94
C-3 Commercial	89	92	94	95
C-4/C-4A Resort Commercial/PUD (must use composite values)	-	-	-	-
M-1/M1A Light industry	68	79	87	90
M-2/M-2A Heavy industry	89	92	94	95

Source: *TR-55* [3]

Existing

Watershed - **EX A3** **117.84 Acres**

Time of Concentration **EX A3**

Description **Drainage sub-area A3 Comparison**

				hrs	min.
Sheet Flow	L (ft) =	100	Tt=	$.007(n*L)^{0.8}/P_2{}^{0.5}xS^{0.4}$	
	n=	0.24			
	S (%) =	0.20			
	P_2=	3.34	Tt=	**0.33**	**20.0**
Shallow Flow	L (ft) =	3837	Tt=	(L)/(60*16.1345*S^(0.5))	
(Unpaved)	S (%) =	1.1	Tt=		
				Tt=	**37.79**
Channel Flow	L (ft) =	662			
(Channel Flow)	Est. V (ft/sec)=	6	V (fps) =	6.00	
			Tt=	L/(60*V)	
			Tt=	**0.03**	**1.8**

Tc	**59.6 min.**

Curve Number	**78.46**

Weighted Curve Number	Hydrologic Soil Group	Curve Number	Area (acres)
Residential	D	87	0.53
Paved	D	98	2.50
Meadow	D	78	114.81

Weighted Curve Number **78.46**

Table 4-3: NRCS Runoff Curve Numbers for Urban Areas and Agricultural Lands

Cover Description / Cover Type and Hydrologic Condition	Average % Impervious Area[1]	Curve Numbers for Hydrologic Soil Group A	B	C	D
Fully developed urban areas (vegetation established)					
Open space (lawns, parks, golf courses, cemeteries, etc.):					
Poor condition (grass cover 50%)		68	79	86	89
Fair condition (grass cover 50% to 75%)		49	69	79	84
Good condition (grass cover 75%)		39	61	74	80
Impervious areas:					
Paved parking lots, roofs, driveways, etc. (excluding right of way)		98	98	98	98
Streets and roads:					
Paved; curbs and storm drains (excluding right of way)		98	98	98	98
Paved; open ditches (including right of way)		83	89	92	93
Gravel (including right of way)		76	85	89	91
Dirt (including right of way)		72	82	87	89
Developing urban areas					
Newly graded areas (pervious areas only, no vegetation)		77	86	91	94
Agricultural lands					
Grassland, or range-continuous forage for grazing[2]	Poor	68	79	86	89
	Fair	49	69	79	84
	Good	39	61	74	80
Meadow-continuous grass, protected from grazing and generally mowed for hay		30	58	71	78
Brush—brush-weed-grass mixture with brush the major element[3]	Poor	48	67	77	83
	Fair	35	56	70	77
	Good	30	48	65	73
Woods—grass combination (orchard or tree farm).[4]	Poor	57	73	82	86
	Fair	43	65	76	82
	Good	32	58	72	79
Woods[5]	Poor	45	66	77	83
	Fair	36	60	73	79
	Good	30	55	70	77
Farmsteads—buildings, lanes, driveways and surrounding lots		59	74	82	86

[1] Poor: less than 50 percent ground cover or heavily grazed with no mulch.
Fair: 50 to 75 percent ground cover and not heavily grazed.
Good: greater than 75 percent ground cover and lightly or only occasionally grazed.
[2] Poor: less than 50 percent ground cover.
Fair: 50 to 75 percent ground cover.
Good: greater than 75 percent ground cover.
[3] Curve numbers shown were computed for areas with 50 percent woods and 50 percent grass (pasture) cover. Other combinations of conditions may be computed from the curve numbers for woods and pasture.
[4] Poor: Forest litter, small trees and brush are destroyed by heavy grazing or regular burning.
Fair: Woods are grazed but not burned, and some forest litter covers the soil.
Good: Woods are protected from grazing, and litter and brush adequately cover the soil.

Source: *TR-55* [3]

Table 4-4: Curve Numbers for Fully Developed Conditions

Zone	Curve Numbers for Hydrologic Soil Group A	B	C	D
R-1/R-1A Single family	61	75	83	87
R-2/R-2A Single and two family	77	85	90	92
R-3/R-3L Multi family high density	77	89	92	94
R-3/R-3H Multi family low density	77	85	90	92
B-1/B-1A Convent & mobile homes	61	75	83	87
TH/TH-A Townhouse	77	89	92	92
ZH/ZH-A Zero lot line homes	68	79	87	90
C-1/C1A Neighborhood business	83	89	92	93
C-2/C-1B General Business	77	86	93	94
C-3 Commercial	89	92	94	95
C-4/C-4A Resort Commercial/PUD (must use composite values)	-	-	-	-
M-1/M1A Light industry	68	79	87	90
M-2/M-2A Heavy industry	89	92	94	95

Source: *TR-55* [3]

Existing

Watershed - **EX A4** **4.45 Acres**

Time of Concentration **EX A4**

Description **Drainage sub-area A4 Comparison**

				hrs	min.
Sheet Flow	L (ft) =	0	Tt=	$.007(n*L)^{0.8}/P_2{}^{0.5}xS^{0.4}$	
	n=	0.24			
	S (%) =	1.00			
	P_2=	3.34	Tt=	**0.00**	**0.0**
Shallow Flow	L (ft) =	0	Tt=	(L)/(60*16.1345*S^(0.5))	
(Unpaved)	S (%) =	1	Tt=		
				Tt=	**0.00**
Channel Flow	L (ft) =	1102			
(Channel Flow)	Est. V (ft/sec)=	6	V (fps) =	6.00	
			Tt=	L/(60*V)	
			Tt=	**0.05**	**3.1**

Tc	**10.0 min.**

Curve Number	**94.00**

Weighted Curve Number	Hydrologic Soil Group	Curve Number	Area (acres)
Paved	D	98	3.56
Meadow	D	78	0.89

Weighted Curve Number **94.00**

Table 4-3: NRCS Runoff Curve Numbers for Urban Areas and Agricultural Lands

Cover Description	Average % Impervious	Curve Numbers for Hydrologic Soil Group			
Cover Type and Hydrologic Condition	**Area[1]**	**A**	**B**	**C**	**D**
Fully developed urban areas (vegetation established)					
Open space (lawns, parks, golf courses, cemeteries, etc.):					
Poor condition (grass cover 50%)		68	79	86	89
Fair condition (grass cover 50% to 75%)		49	69	79	84
Good condition (grass cover 75%)		39	61	74	80
Impervious areas:					
Paved parking lots, roofs, driveways, etc. (excluding right of way)		98	98	98	98
Streets and roads:					
Paved; curbs and storm drains (excluding right of way)		98	98	98	98
Paved; open ditches (including right of way)		83	89	92	93
Gravel (including right of way)		76	85	89	91
Dirt (including right of way)		72	82	87	89
Developing urban areas					
Newly graded areas (pervious areas only, no vegetation)		77	86	91	94
Agricultural lands					
Grassland, or range-continuous forage for grazing[2]	Poor	68	79	86	89
	Fair	49	69	79	84
	Good	39	61	74	80
Meadow-continuous grass, protected from grazing and generally mowed for hay		30	58	71	78
Brush—brush-weed-grass mixture with brush the major element[3]	Poor	48	67	77	83
	Fair	35	56	70	77
	Good	30	48	65	73
Woods—grass combination (orchard or tree farm).[4]	Poor	57	73	82	86
	Fair	43	65	76	82
	Good	32	58	72	79
Woods[5]	Poor	45	66	77	83
	Fair	36	60	73	79
	Good	30	55	70	77
Farmsteads—buildings, lanes, driveways and surrounding lots		59	74	82	86

[1] Poor: less than 50 percent ground cover or heavily grazed with no mulch.
Fair: 50 to 75 percent ground cover and not heavily grazed.
Good: greater than 75 percent ground cover and lightly or only occasionally grazed.
[2] Poor: less than 50 percent ground cover.
Fair: 50 to 75 percent ground cover.
Good: greater than 75 percent ground cover.
[3] Curve numbers shown were computed for areas with 50 percent woods and 50 percent grass (pasture) cover. Other combinations of conditions may be computed from the curve numbers for woods and pasture.
[4] Poor: Forest litter, small trees and brush are destroyed by heavy grazing or regular burning.
Fair: Woods are grazed but not burned, and some forest litter covers the soil.
Good: Woods are protected from grazing, and litter and brush adequately cover the soil.

Source: *TR-55* [3]

Table 4-4: Curve Numbers for Fully Developed Conditions

Zone	Curve Numbers for Hydrologic Soil Group			
	A	**B**	**C**	**D**
R-1/R-1A Single family	61	75	83	87
R-2/R-2A Single and two family	77	85	90	92
R-3/R-3L Multi family high density	77	89	92	94
R-3/R-3H Multi family low density	77	85	90	92
B-1/B-1A Convent & mobile homes	61	75	83	87
TH/TH-A Townhouse	77	89	92	92
ZH/ZH-A Zero lot line homes	68	79	87	90
C-1/C1A Neighborhood business	83	89	92	93
C-2/C-1B General Business	77	86	93	94
C-3 Commercial	89	92	94	95
C-4/C-4A Resort Commercial/PUD (must use composite values)	-	-	-	-
M-1/M1A Light industry	68	79	87	90
M-2/M-2A Heavy industry	89	92	94	95

Source: *TR-55* [3]

Existing

Watershed - **EX A5** **24.99 Acres**

Time of Concentration **EX A5**

Description **Drainage sub-area A5 Comparison**

				hrs	min.
Sheet Flow	L (ft) =	100	Tt=	$.007(n*L)^{0.8}/P_2{}^{0.5}xS^{0.4}$	
	n=	0.24			
	S (%) =	0.20			
	P_2=	3.34	Tt=	**0.33**	**20.0**
Shallow Flow	L (ft) =	1601	Tt=	(L)/(60*16.1345*S^(0.5))	
(Unpaved)	S (%) =	0.2	Tt=		
				Tt=	**36.98**
Channel Flow	L (ft) =	2211			
(Channel Flow)	Est. V (ft/sec)=	6	V (fps) =	6.00	
			Tt=	L/(60*V)	
			Tt=	**0.10**	**6.1**

Tc	**63.1 min.**

Curve Number	**78.00**

Table 4-3: NRCS Runoff Curve Numbers for Urban Areas and Agricultural Lands

Cover Description	Average % Impervious Area[1]	Curve Numbers for Hydrologic Soil Group			
Cover Type and Hydrologic Condition		**A**	**B**	**C**	**D**
Fully developed urban areas (vegetation established)					
Open space (lawns, parks, golf courses, cemeteries, etc.):					
Poor condition (grass cover 50%)		68	79	86	89
Fair condition (grass cover 50% to 75%)		49	69	79	84
Good condition (grass cover 75%)		39	61	74	80
Impervious areas:					
Paved parking lots, roofs, driveways, etc. (excluding right of way)		98	98	98	98
Streets and roads:					
Paved; curbs and storm drains (excluding right of way)		98	98	98	98
Paved; open ditches (including right of way)		83	89	92	93
Gravel (including right of way)		76	85	89	91
Dirt (including right of way)		72	82	87	89
Developing urban areas					
Newly graded areas (pervious areas only, no vegetation)		77	86	91	94
Agricultural lands					
Grassland, or range-continuous forage for grazing[2]	Poor	68	79	86	89
	Fair	49	69	79	84
	Good	39	61	74	80
Meadow-continuous grass, protected from grazing and generally mowed for hay		30	58	71	78
Brush—brush-weed-grass mixture with brush the major element[3]	Poor	48	67	77	83
	Fair	35	56	70	77
	Good	30	48	65	73
Woods—grass combination (orchard or tree farm).[4]	Poor	57	73	82	86
	Fair	43	65	76	82
	Good	32	58	72	79
Woods[5]	Poor	45	66	77	83
	Fair	36	60	73	79
	Good	30	55	70	77
Farmsteads—buildings, lanes, driveways and surrounding lots		59	74	82	86

[1] Poor: less than 50 percent ground cover or heavily grazed with no mulch.
Fair: 50 to 75 percent ground cover and not heavily grazed.
Good: greater than 75 percent ground cover and lightly or only occasionally grazed.
[2] Poor: less than 50 percent ground cover.
Fair: 50 to 75 percent ground cover.
Good: greater than 75 percent ground cover.
[3] Curve numbers shown were computed for areas with 50 percent woods and 50 percent grass (pasture) cover. Other combinations of conditions may be computed from the curve numbers for woods and pasture.
[4] Poor: Forest litter, small trees and brush are destroyed by heavy grazing or regular burning.
Fair: Woods are grazed but not burned, and some forest litter covers the soil.
Good: Woods are protected from grazing, and litter and brush adequately cover the soil.

Source: *TR-55* [3]

Table 4-4: Curve Numbers for Fully Developed Conditions

Zone	Curve Numbers for Hydrologic Soil Group			
	A	**B**	**C**	**D**
R-1/R-1A Single family	61	75	83	87
R-2/R-2A Single and two family	77	85	90	92
R-3/R-3L Multi family high density	77	89	92	94
R-3/R-3H Multi family low density	77	85	90	92
B-1/B-1A Convent & mobile homes	61	75	83	87
TH/TH-A Townhouse	77	89	92	92
ZH/ZH-A Zero lot line homes	68	79	87	90
C-1/C1A Neighborhood business	83	89	92	93
C-2/C-1B General Business	77	86	93	94
C-3 Commercial	89	92	94	95
C-4/C-4A Resort Commercial/PUD (must use composite values)	-	-	-	-
M-1/M1A Light industry	68	79	87	90
M-2/M-2A Heavy industry	89	92	94	95

Source: *TR-55* [3]

Existing

Watershed - **EX A6** **31.11 Acres**

Time of Concentration **EX A6**

Description **Drainage sub-**

				hrs	min.
Sheet Flow	L (ft) =	100	Tt=	$.007(n*L)^{0.8}/P_2{}^{0.5}xS^{0.4}$	
	n=	0.24			
	S (%) =	0.20			
	P_2=	3.34	Tt=	**0.33**	**20.0**
Shallow Flow	L (ft) =	2344	Tt=	(L)/(60*16.1345*S^(0.5))	
(Unpaved)	S (%) =	1.35	Tt=		
				Tt=	**20.84**
Channel Flow	L (ft) =	0			
(Channel Flow)	Est. V (ft/sec)=	6	V (fps) =	6.00	
			Tt=	L/(60*V)	
			Tt=	**0.00**	**0.0**

Tc	**40.8 min.**

Curve Number	**78.01**

Weighted Curve Number	Hydrologic Soil Group	Curve Number	Area (acres)
Meadow	D	78	31.06
Residential	D	87	0.05

Weighted Curve Number **78.01**

Table 4-3: NRCS Runoff Curve Numbers for Urban Areas and Agricultural Lands

Cover Description	Average % Impervious	Curve Numbers for Hydrologic Soil Group			
Cover Type and Hydrologic Condition	Area[1]	A	B	C	D
Fully developed urban areas (vegetation established)					
Open space (lawns, parks, golf courses, cemeteries, etc.):					
Poor condition (grass cover 50%)		68	79	86	89
Fair condition (grass cover 50% to 75%)		49	69	79	84
Good condition (grass cover 75%)		39	61	74	80
Impervious areas:					
Paved parking lots, roofs, driveways, etc. (excluding right of way)		98	98	98	98
Streets and roads:					
Paved; curbs and storm drains (excluding right of way)		98	98	98	98
Paved; open ditches (including right of way)		83	89	92	93
Gravel (including right of way)		76	85	89	91
Dirt (including right of way)		72	82	87	89
Developing urban areas					
Newly graded areas (pervious areas only, no vegetation)		77	86	91	94
Agricultural lands					
Grassland, or range-continuous forage for grazing[2]	Poor	68	79	86	89
	Fair	49	69	79	84
	Good	39	61	74	80
Meadow-continuous grass, protected from grazing and generally mowed for hay		30	58	71	78
Brush—brush-weed-grass mixture with brush the major element[3]	Poor	48	67	77	83
	Fair	35	56	70	77
	Good	30	48	65	73
Woods—grass combination (orchard or tree farm).[4]	Poor	57	73	82	86
	Fair	43	65	76	82
	Good	32	58	72	79
Woods[5]	Poor	45	66	77	83
	Fair	36	60	73	79
	Good	30	55	70	77
Farmsteads—buildings, lanes, driveways and surrounding lots		59	74	82	86

[1] Poor: less than 50 percent ground cover or heavily grazed with no mulch.
Fair: 50 to 75 percent ground cover and not heavily grazed.
Good: greater than 75 percent ground cover and lightly or only occasionally grazed.
[2] Poor: less than 50 percent ground cover.
Fair: 50 to 75 percent ground cover.
Good: greater than 75 percent ground cover.
[3] Curve numbers shown were computed for areas with 50 percent woods and 50 percent grass (pasture) cover. Other combinations of conditions may be computed from the curve numbers for woods and pasture.
[4] Poor: Forest litter, small trees and brush are destroyed by heavy grazing or regular burning.
Fair: Woods are grazed but not burned, and some forest litter covers the soil.
Good: Woods are protected from grazing, and litter and brush adequately cover the soil.

Source: *TR-55* [3]

Table 4-4: Curve Numbers for Fully Developed Conditions

Zone	Curve Numbers for Hydrologic Soil Group			
	A	B	C	D
R-1/R-1A Single family	61	75	83	87
R-2/R-2A Single and two family	77	85	90	92
R-3/R-3L Multi family high density	77	89	92	94
R-3/R-3H Multi family low density	77	85	90	92
B-1/B-1A Convent & mobile homes	61	75	83	87
TH/TH-A Townhouse	77	89	92	92
ZH/ZH-A Zero lot line homes	68	79	87	90
C-1/C1A Neighborhood business	83	89	92	93
C-2/C-1B General Business	77	86	93	94
C-3 Commercial	89	92	94	95
C-4/C-4A Resort Commercial/PUD (must use composite values)	-	-	-	-
M-1/M1A Light industry	68	79	87	90
M-2/M-2A Heavy industry	89	92	94	95

Source: *TR-55* [3]

Proposed

Watershed - **A1** **1906.93 Acres**

Time of Concentration **A1**

Description **Drainage sub-area EX A1 Comparison**

				hrs	min.
Sheet Flow	L (ft) =	100	Tt=	$.007(n*L)^{0.8}/P_2{}^{0.5}xS^{0.4}$	
	n=	0.24			
	S (%) =	1.00			
	P_2=	3.34	Tt=	**0.31**	**18.4**
Shallow Flow	L (ft) =	5878	Tt=	(L)/(60*16.1345*S^(0.5))	
(Unpaved)	S (%) =	1	Tt=		
				Tt=	**60.72**
Channel Flow	L (ft) =	15518			
(Channel Flow)	Est. V (ft/sec)=	6	V (fps) =	6.00	
			Tt=	L/(60*V)	
			Tt=	**0.72**	**43.1**

Tc	**122.3 min.**

Curve Number	**85.27**

Weighted Curve Number	Hydrologic Soil Group	Curve Number	Area (acres)
Undeveloped/Agricultral Grass (Fair)	D	84	1358.04
Commercial	D	95	42.36
Industrial	D	90	42.4
Mixed Use	D	90	9.5
Residential	D	87	429.87
Asphalt	D	98	24.76

Weighted Curve Number **85.27**

Table 4-3: NRCS Runoff Curve Numbers for Urban Areas and Agricultural Lands

Cover Description	Average % Impervious Area[1]	Curve Numbers for Hydrologic Soil Group			
Cover Type and Hydrologic Condition		**A**	**B**	**C**	**D**
Fully developed urban areas (vegetation established)					
Open space (lawns, parks, golf courses, cemeteries, etc.):					
Poor condition (grass cover 50%)		68	79	86	89
Fair condition (grass cover 50% to 75%)		49	69	79	84
Good condition (grass cover 75%)		39	61	74	80
Impervious areas:					
Paved parking lots, roofs, driveways, etc. (excluding right of way)		98	98	98	98
Streets and roads:					
Paved; curbs and storm drains (excluding right of way)		98	98	98	98
Paved; open ditches (including right of way)		83	89	92	93
Gravel (including right of way)		76	85	89	91
Dirt (including right of way)		72	82	87	89
Developing urban areas					
Newly graded areas (pervious areas only, no vegetation)		77	86	91	94
Agricultural lands					
Grassland, or range-continuous forage for grazing[2]	Poor	68	79	86	89
	Fair	49	69	79	84
	Good	39	61	74	80
Meadow-continuous grass, protected from grazing and generally mowed for hay		30	58	71	78
Brush—brush-weed-grass mixture with brush the major element[3]	Poor	48	67	77	83
	Fair	35	56	70	77
	Good	30	48	65	73
Woods—grass combination (orchard or tree farm).[4]	Poor	57	73	82	86
	Fair	43	65	76	82
	Good	32	58	72	79
Woods[5]	Poor	45	66	77	83
	Fair	36	60	73	79
	Good	30	55	70	77
Farmsteads—buildings, lanes, driveways and surrounding lots		59	74	82	86

[1] Poor: less than 50 percent ground cover or heavily grazed with no mulch.
Fair: 50 to 75 percent ground cover and not heavily grazed.
Good: greater than 75 percent ground cover and lightly or only occasionally grazed.
[2] Poor: less than 50 percent ground cover.
Fair: 50 to 75 percent ground cover.
Good: greater than 75 percent ground cover.
[3] Curve numbers shown were computed for areas with 50 percent woods and 50 percent grass (pasture) cover. Other combinations of conditions may be computed from the curve numbers for woods and pasture.
[4] Poor: Forest litter, small trees and brush are destroyed by heavy grazing or regular burning.
Fair: Woods are grazed but not burned, and some forest litter covers the soil.
Good: Woods are protected from grazing, and litter and brush adequately cover the soil.

Source: *TR-55* [3]

Table 4-4: Curve Numbers for Fully Developed Conditions

Zone	Curve Numbers for Hydrologic Soil Group			
	A	**B**	**C**	**D**
R-1/R-1A Single family	61	75	83	87
R-2/R-2A Single and two family	77	85	90	92
R-3/R-3L Multi family high density	77	89	92	94
R-3/R-3H Multi family low density	77	85	90	92
B-1/B-1A Convent & mobile homes	61	75	83	87
TH/TH-A Townhouse	77	89	92	92
ZH/ZH-A Zero lot line homes	68	79	87	90
C-1/C1A Neighborhood business	83	89	92	93
C-2/C-1B General Business	77	86	93	94
C-3 Commercial	89	92	94	95
C-4/C-4A Resort Commercial/PUD (must use composite values)	-	-	-	-
M-1/M1A Light industry	68	79	87	90
M-2/M-2A Heavy industry	89	92	94	95

Source: *TR-55* [3]

Proposed

Watershed - **A2** **21.96 Acres**

Time of Concentration **A2** .

Description **Drainage sub-area EX A2 Comparison**

				hrs	min.
Sheet Flow	L (ft) =	0	Tt=	$.007(n*L)^{0.8}/P_2{}^{0.5}xS^{0.4}$	
	n=	0.24			
	S (%) =	1.00			
	P_2=	3.34	Tt=	**0.00**	**0.0**
Shallow Flow	L (ft) =	0	Tt=	(L)/(60*16.1345*S^(0.5))	
(Unpaved)	S (%) =	1	Tt=		
				Tt=	**0.00**
Channel Flow	L (ft) =	11513			
(Channel Flow)	Est. V (ft/sec)=	6	V (fps) =	6.00	
			Tt=	L/(60*V)	
			Tt=	**0.53**	**32.0**

Tc	**32.0 min.**

Curve Number	**98.00**

Table 4-3: NRCS Runoff Curve Numbers for Urban Areas and Agricultural Lands

Cover Description	Average % Impervious Area[1]	Curve Numbers for Hydrologic Soil Group			
Cover Type and Hydrologic Condition		**A**	**B**	**C**	**D**
Fully developed urban areas (vegetation established)					
Open space (lawns, parks, golf courses, cemeteries, etc.):					
Poor condition (grass cover 50%)		68	79	86	89
Fair condition (grass cover 50% to 75%)		49	69	79	84
Good condition (grass cover 75%)		39	61	74	80
Impervious areas:					
Paved parking lots, roofs, driveways, etc. (excluding right of way)		98	98	98	98
Streets and roads:					
Paved; curbs and storm drains (excluding right of way)		98	98	98	98
Paved; open ditches (including right of way)		83	89	92	93
Gravel (including right of way)		76	85	89	91
Dirt (including right of way)		72	82	87	89
Developing urban areas					
Newly graded areas (pervious areas only, no vegetation)		77	86	91	94
Agricultural lands					
Grassland, or range-continuous forage for grazing[2]	Poor	68	79	86	89
	Fair	49	69	79	84
	Good	39	61	74	80
Meadow-continuous grass, protected from grazing and generally mowed for hay		30	58	71	78
Brush—brush-weed-grass mixture with brush the major element[3]	Poor	48	67	77	83
	Fair	35	56	70	77
	Good	30	48	65	73
Woods—grass combination (orchard or tree farm).[4]	Poor	57	73	82	86
	Fair	43	65	76	82
	Good	32	58	72	79
Woods[5]	Poor	45	66	77	83
	Fair	36	60	73	79
	Good	30	55	70	77
Farmsteads—buildings, lanes, driveways and surrounding lots		59	74	82	86

[1] Poor: less than 50 percent ground cover or heavily grazed with no mulch.
Fair: 50 to 75 percent ground cover and not heavily grazed.
Good: greater than 75 percent ground cover and lightly or only occasionally grazed.
[2] Poor: less than 50 percent ground cover.
Fair: 50 to 75 percent ground cover.
Good: greater than 75 percent ground cover.
[3] Curve numbers shown were computed for areas with 50 percent woods and 50 percent grass (pasture) cover. Other combinations of conditions may be computed from the curve numbers for woods and pasture.
[4] Poor: Forest litter, small trees and brush are destroyed by heavy grazing or regular burning.
Fair: Woods are grazed but not burned, and some forest litter covers the soil.
Good: Woods are protected from grazing, and litter and brush adequately cover the soil.

Source: *TR-55* [3]

Table 4-4: Curve Numbers for Fully Developed Conditions

Zone	Curve Numbers for Hydrologic Soil Group			
	A	**B**	**C**	**D**
R-1/R-1A Single family	61	75	83	87
R-2/R-2A Single and two family	77	85	90	92
R-3/R-3L Multi family high density	77	89	92	94
R-3/R-3H Multi family low density	77	85	90	92
B-1/B-1A Convent & mobile homes	61	75	83	87
TH/TH-A Townhouse	77	89	92	92
ZH/ZH-A Zero lot line homes	68	79	87	90
C-1/C1A Neighborhood business	83	89	92	93
C-2/C-1B General Business	77	86	93	94
C-3 Commercial	89	92	94	95
C-4/C-4A Resort Commercial/PUD (must use composite values)	-	-	-	-
M-1/M1A Light industry	68	79	87	90
M-2/M-2A Heavy industry	89	92	94	95

Source: *TR-55* [3]

Proposed

Watershed - **A3** **33.05 Acres**

Time of Concentration **A3**

Description **Drainage sub-area EX A3 Comparison**

				hrs	min.
Sheet Flow	L (ft) =	100	Tt=	$.007(n*L)^{0.8}/P_2{}^{0.5}xS^{0.4}$	
	n=	0.24			
	S (%) =	1.70			
	P_2=	3.34	Tt=	**0.25**	**14.9**
Shallow Flow	L (ft) =	1300	Tt=	(L)/(60*16.1345*S^(0.5))	
(Unpaved)	S (%) =	2.3	Tt=		
				Tt=	**8.85**
Channel Flow	L (ft) =	662			
(Channel Flow)	Est. V (ft/sec)=	6	V (fps) =	6.00	
			Tt=	L/(60*V)	
			Tt=	**0.03**	**1.8**

Tc	**25.6 min.**

Curve Number	**79.66**

Weighted Curve Number	Hydrologic Soil Group	Curve Number	Area (acres)
Residential	D	87	0.53
Paved	D	98	2.50
Meadow	D	78	30.02

Weighted Curve Number **79.66**

Table 4-3: NRCS Runoff Curve Numbers for Urban Areas and Agricultural Lands

Cover Description	Average % Impervious Area[1]	Curve Numbers for Hydrologic Soil Group			
Cover Type and Hydrologic Condition		**A**	**B**	**C**	**D**
Fully developed urban areas (vegetation established)					
Open space (lawns, parks, golf courses, cemeteries, etc.):					
Poor condition (grass cover 50%)		68	79	86	89
Fair condition (grass cover 50% to 75%)		49	69	79	84
Good condition (grass cover 75%)		39	61	74	80
Impervious areas:					
Paved parking lots, roofs, driveways, etc. (excluding right of way)		98	98	98	98
Streets and roads:					
Paved; curbs and storm drains (excluding right of way)		98	98	98	98
Paved; open ditches (including right of way)		83	89	92	93
Gravel (including right of way)		76	85	89	91
Dirt (including right of way)		72	82	87	89
Developing urban areas					
Newly graded areas (pervious areas only, no vegetation)		77	86	91	94
Agricultural lands					
Grassland, or range-continuous forage for grazing[2]	Poor Fair Good	68 49 39	79 69 61	86 79 74	89 84 80
Meadow-continuous grass, protected from grazing and generally mowed for hay		30	58	71	78
Brush—brush-weed-grass mixture with brush the major element[3]	Poor Fair Good	48 35 30	67 56 48	77 70 65	83 77 73
Woods—grass combination (orchard or tree farm).[4]	Poor Fair Good	57 43 32	73 65 58	82 76 72	86 82 79
Woods[5]	Poor Fair	45 36	66 60	77 73	83 79

Table 4-4: Curve Numbers for Fully Developed Conditions

Zone	Curve Numbers for Hy	
	A	**B**
R-1/R-1A Single family	61	75
R-2/R-2A Single and two family	77	85
R-3/R-3L Multi family high density	77	89
R-3/R-3H Multi family low density	77	85
B-1/B-1A Convent & mobile homes	61	75
TH/TH-A Townhouse	77	89
ZH/ZH-A Zero lot line homes	68	79
C-1/C1A Neighborhood business	83	89
C-2/C-1B General Business	77	86
C-3 Commercial	89	92
C-4/C-4A Resort Commercial/PUD (must use composite values)	-	-
M-1/M1A Light industry	68	79
M-2/M-2A Heavy industry	89	92
Source: *TR-55* [3]		

Proposed

Watershed - **A4** **4.45 Acres**

Time of Concentration **A4**

Description **Drainage sub-area EX A4 Comparison**

				hrs	min.
Sheet Flow	L (ft) =	0	Tt=	$.007(n*L)^{0.8}/P_2{}^{0.5}xS^{0.4}$	
	n=	0.24			
	S (%) =	1.00			
	P_2=	3.34	Tt=	**0.00**	**0.0**
Shallow Flow	L (ft) =	0	Tt=	(L)/(60*16.1345*S^(0.5))	
(Unpaved)	S (%) =	1	Tt=		
				Tt=	**0.00**
Channel Flow	L (ft) =	1102			
(Channel Flow)	Est. V (ft/sec)=	6	V (fps) =	6.00	
			Tt=	L/(60*V)	
			Tt=	**0.05**	**3.1**

Tc	**10.0 min.**

Curve Number	**94.00**

Weighted Curve Number	Hydrologic Soil Group	Curve Number	Area (acres)
Paved	D	98	3.56
Meadow	D	78	0.89

Weighted Curve Number **94.00**

Table 4-3: NRCS Runoff Curve Numbers for Urban Areas and Agricultural Lands

Cover Description / Cover Type and Hydrologic Condition	Average % Impervious Area[1]	Curve Numbers for Hydrologic Soil Group A	B	C	D
Fully developed urban areas (vegetation established)					
Open space (lawns, parks, golf courses, cemeteries, etc.):					
Poor condition (grass cover 50%)		68	79	86	89
Fair condition (grass cover 50% to 75%)		49	69	79	84
Good condition (grass cover 75%)		39	61	74	80
Impervious areas:					
Paved parking lots, roofs, driveways, etc. (excluding right of way)		98	98	98	98
Streets and roads:					
Paved; curbs and storm drains (excluding right of way)		98	98	98	98
Paved; open ditches (including right of way)		83	89	92	93
Gravel (including right of way)		76	85	89	91
Dirt (including right of way)		72	82	87	89
Developing urban areas					
Newly graded areas (pervious areas only, no vegetation)		77	86	91	94
Agricultural lands					
Grassland, or range-continuous forage for grazing[2]	Poor	68	79	86	89
	Fair	49	69	79	84
	Good	39	61	74	80
Meadow-continuous grass, protected from grazing and generally mowed for hay		30	58	71	78
Brush—brush-weed-grass mixture with brush the major element[3]	Poor	48	67	77	83
	Fair	35	56	70	77
	Good	30	48	65	73
Woods—grass combination (orchard or tree farm).[4]	Poor	57	73	82	86
	Fair	43	65	76	82
	Good	32	58	72	79
Woods[5]	Poor	45	66	77	83
	Fair	36	60	73	79

Table 4-4: Curve Numbers for Fully Developed Conditions

Zone	Curve Numbers for Hy A	B
R-1/R-1A Single family	61	75
R-2/R-2A Single and two family	77	85
R-3/R-3L Multi family high density	77	89
R-3/R-3H Multi family low density	77	85
B-1/B-1A Convent & mobile homes	61	75
TH/TH-A Townhouse	77	89
ZH/ZH-A Zero lot line homes	68	79
C-1/C1A Neighborhood business	83	89
C-2/C-1B General Business	77	86
C-3 Commercial	89	92
C-4/C-4A Resort Commercial/PUD (must use composite values)	-	-
M-1/M1A Light industry	68	79
M-2/M-2A Heavy industry	89	92

Source: *TR-55* [3]

Proposed

Watershed - **A5** **139.20 Acres**

Time of Concentration **A5**

Description **Drainage sub-area EX A5 Comparison**

				hrs	min.
Sheet Flow	L (ft) =	100	Tt=	$.007(n*L)^{0.8}/P_2{}^{0.5}xS^{0.4}$	
	n=	0.24			
	S (%) =	1.00			
	P_2=	3.34	Tt=	**0.31**	**18.4**
Shallow Flow	L (ft) =	63	Tt=	(L)/(60*16.1345*S^(0.5))	
(Unpaved)	S (%) =	1	Tt=		
				Tt=	**0.65**
Channel Flow	L (ft) =	8261			
(Channel Flow)	Est. V (ft/sec)=	6	V (fps) =	6.00	
			Tt=	L/(60*V)	
			Tt=	**0.38**	**22.9**

Tc	**42.0 min.**

Curve Number	**94.00**

Weighted Curve Number	Hydrologic Soil Group	Curve Number	Area (acres)
Paved	D	98	111.36
Meadow	D	78	27.84

Weighted Curve Number **94.00**

Table 4-3: NRCS Runoff Curve Numbers for Urban Areas and Agricultural Lands

Cover Description / Cover Type and Hydrologic Condition	Average % Impervious Area[1]	Curve Numbers for Hydrologic Soil Group A	B	C	D
Fully developed urban areas (vegetation established)					
Open space (lawns, parks, golf courses, cemeteries, etc.):					
Poor condition (grass cover 50%)		68	79	86	89
Fair condition (grass cover 50% to 75%)		49	69	79	84
Good condition (grass cover 75%)		39	61	74	80
Impervious areas:					
Paved parking lots, roofs, driveways, etc. (excluding right of way)		98	98	98	98
Streets and roads:					
Paved; curbs and storm drains (excluding right of way)		98	98	98	98
Paved; open ditches (including right of way)		83	89	92	93
Gravel (including right of way)		76	85	89	91
Dirt (including right of way)		72	82	87	89
Developing urban areas					
Newly graded areas (pervious areas only, no vegetation)		77	86	91	94
Agricultural lands					
Grassland, or range-continuous forage for grazing[2]	Poor	68	79	86	89
	Fair	49	69	79	84
	Good	39	61	74	80
Meadow-continuous grass, protected from grazing and generally mowed for hay		30	58	71	78
Brush—brush-weed-grass mixture with brush the major element[3]	Poor	48	67	77	83
	Fair	35	56	70	77
	Good	30	48	65	73
Woods—grass combination (orchard or tree farm).[4]	Poor	57	73	82	86
	Fair	43	65	76	82
	Good	32	58	72	79
Woods[5]	Poor	45	66	77	83
	Fair	36	60	73	79

Table 4-4: Curve Numbers for Fully Developed Conditions

Zone	Curve Numbers for Hy A	B
R-1/R-1A Single family	61	75
R-2/R-2A Single and two family	77	85
R-3/R-3L Multi family high density	77	89
R-3/R-3H Multi family low density	77	85
B-1/B-1A Convent & mobile homes	61	75
TH/TH-A Townhouse	77	89
ZH/ZH-A Zero lot line homes	68	79
C-1/C1A Neighborhood business	83	89
C-2/C-1B General Business	77	86
C-3 Commercial	89	92
C-4/C-4A Resort Commercial/PUD (must use composite values)	-	-
M-1/M1A Light industry	68	79
M-2/M-2A Heavy industry	89	92

Source: *TR-55* [3]

Proposed

Watershed - **A6** **2.20 Acres**

Time of Concentration **A6**

Description **Longest Time of Concentration Analysis**

				hrs	min.
Sheet Flow	L (ft) =	0	Tt=	$.007(n*L)^{0.8}/P_2{}^{0.5}xS^{0.4}$	
	n=	0.20			
	S (%) =	1.00			
	P_2=	3.34	Tt=	**0.00**	**0.0**
Shallow Flow	L (ft) =	0	Tt=	(L)/(60*16.1345*S^(0.5))	
(Unpaved)	S (%) =	1	Tt=		
				Tt=	**0.00**
Channel Flow	L (ft) =	795			
(Channel Flow)	Est. V (ft/sec)=	6	V (fps) =	6.00	
			Tt=	L/(60*V)	
			Tt=	**0.04**	**2.2**

Tc	**10.0 min.**

Curve Number	**84.00**

Weighted Curve Number	Hydrologic Soil Group	Curve Number	Area (acres)
Paved	D	98	1.76
Meadow	D	78	0.44

Weighted Curve Number **94.00**

Table 4-3: NRCS Runoff Curve Numbers for Urban Areas and Agricultural Lands

Cover Description / Cover Type and Hydrologic Condition	Average % Impervious Area[1]	Curve Numbers for Hydrologic Soil Group A	B	C	D
Fully developed urban areas (vegetation established)					
Open space (lawns, parks, golf courses, cemeteries, etc.):					
Poor condition (grass cover 50%)		68	79	86	89
Fair condition (grass cover 50% to 75%)		49	69	79	84
Good condition (grass cover 75%)		39	61	74	80
Impervious areas:					
Paved parking lots, roofs, driveways, etc. (excluding right of way)		98	98	98	98
Streets and roads:					
Paved; curbs and storm drains (excluding right of way)		98	98	98	98
Paved; open ditches (including right of way)		83	89	92	93
Gravel (including right of way)		76	85	89	91
Dirt (including right of way)		72	82	87	89
Developing urban areas					
Newly graded areas (pervious areas only, no vegetation)		77	86	91	94
Agricultural lands					
Grassland, or range-continuous forage for grazing[2]	Poor	68	79	86	89
	Fair	49	69	79	84
	Good	39	61	74	80
Meadow-continuous grass, protected from grazing and generally mowed for hay		30	58	71	78
Brush—brush-weed-grass mixture with brush the major element[3]	Poor	48	67	77	83
	Fair	35	56	70	77
	Good	30	48	65	73
Woods—grass combination (orchard or tree farm).[4]	Poor	57	73	82	86
	Fair	43	65	76	82
	Good	32	58	72	79
Woods[5]	Poor	45	66	77	83
	Fair	36	60	73	79

Table 4-4: Curve Numbers for Fully Developed Conditions

Zone	Curve Numbers for Hy A	B
R-1/R-1A Single family	61	75
R-2/R-2A Single and two family	77	85
R-3/R-3L Multi family high density	77	89
R-3/R-3H Multi family low density	77	85
B-1/B-1A Convent & mobile homes	61	75
TH/TH-A Townhouse	77	89
ZH/ZH-A Zero lot line homes	68	79
C-1/C1A Neighborhood business	83	89
C-2/C-1B General Business	77	86
C-3 Commercial	89	92
C-4/C-4A Resort Commercial/PUD (must use composite values)	-	-
M-1/M1A Light industry	68	79
M-2/M-2A Heavy industry	89	92

Source: *TR-55* [3]

Proposed

Watershed - **A7** **31.11 Acres**

Time of Concentration **A7**

Description **Drainage sub-area EX A6 Comparison**

				hrs	min.
Sheet Flow	L (ft) =	100	Tt=	$.007(n*L)^{0.8}/P_2{}^{0.5}xS^{0.4}$	
	n=	0.24			
	S (%) =	0.20			
	P_2=	3.34	Tt=	**0.33**	**20.0**
Shallow Flow	L (ft) =	2344	Tt=	(L)/(60*16.1345*S^(0.5))	
(Unpaved)	S (%) =	1.35	Tt=		
				Tt=	**20.84**
Channel Flow	L (ft) =	0			
(Channel Flow)	Est. V (ft/sec)=	6	V (fps) =	6.00	
			Tt=	L/(60*V)	
			Tt=	**0.00**	**0.0**

Tc	**40.8 min.**

Curve Number	**78.01**

Weighted Curve Number	Hydrologic Soil Group	Curve Number	Area (acres)
Meadow	D	78	31.06
Residential	D	87	0.05

Weighted Curve Number **78.01**

Table 4-3: NRCS Runoff Curve Numbers for Urban Areas and Agricultural Lands

Cover Description / Cover Type and Hydrologic Condition	Average % Impervious Area[1]	Curve Numbers for Hydrologic Soil Group A	B	C	D
Fully developed urban areas (vegetation established)					
Open space (lawns, parks, golf courses, cemeteries, etc.):					
Poor condition (grass cover 50%)		68	79	86	89
Fair condition (grass cover 50% to 75%)		49	69	79	84
Good condition (grass cover 75%)		39	61	74	80
Impervious areas:					
Paved parking lots, roofs, driveways, etc. (excluding right of way)		98	98	98	98
Streets and roads:					
Paved; curbs and storm drains (excluding right of way)		98	98	98	98
Paved; open ditches (including right of way)		83	89	92	93
Gravel (including right of way)		76	85	89	91
Dirt (including right of way)		72	82	87	89
Developing urban areas					
Newly graded areas (pervious areas only, no vegetation)		77	86	91	94
Agricultural lands					
Grassland, or range-continuous forage for grazing[2]	Poor	68	79	86	89
	Fair	49	69	79	84
	Good	39	61	74	80
Meadow-continuous grass, protected from grazing and generally		30	58	71	78

Table 4-4: Curve Numbers for Fully Developed Conditions

Zone	Curve Numbers for A	B
R-1/R-1A Single family	61	75
R-2/R-2A Single and two family	77	85
R-3/R-3L Multi family high density	77	89
R-3/R-3H Multi family low density	77	85
B-1/B-1A Convent & mobile homes	61	75
TH/TH-A Townhouse	77	89
ZH/ZH-A Zero lot line homes	68	79
C-1/C1A Neighborhood business	83	89
C-2/C-1B General Business	77	86
C-3 Commercial	89	92
C-4/C-4A Resort Commercial/PUD (must use composite values)	-	-
M-1/M1A Light industry	68	79
M-2/M-2A Heavy industry	89	92

Ultimate

Watershed - **ULT A1** **1906.93 Acres**

Time of Concentration **ULT A1**

Description **Drainage sub-area EX A1 Comparison**

				hrs	min.
Sheet Flow	L (ft) =	100	Tt=	$.007(n*L)^{0.8}/P_2{}^{0.5}xS^{0.4}$	
	n=	0.24			
	S (%) =	1.00			
	P_2=	3.34	Tt=	**0.31**	**18.4**
Shallow Flow	L (ft) =	5878	Tt=	(L)/(60*16.1345*S^(0.5))	
(Unpaved)	S (%) =	1	Tt=		
				Tt=	**60.72**
Channel Flow	L (ft) =	15518			
(Channel Flow)	Est. V (ft/sec)=	6	V (fps) =	6.00	
			Tt=	L/(60*V)	
			Tt=	**0.72**	**43.1**

Tc	**122.3 min.**

Curve Number	**88.44**

Weighted Curve Number	Hydrologic Soil Group	Curve Number	Area (acres)
Undeveloped/Agricultral Grass (Fair)	D	84	5.26
Commercial	D	95	232.29
Industrial	D	90	202.16
Mixed Use	D	90	9.5
Residential	D	87	1432.96
Asphalt	D	98	24.76

Weighted Curve Number **88.44**

Table 4-3: NRCS Runoff Curve Numbers for Urban Areas and Agricultural Lands

Cover Description	Average % Impervious Area[1]	Curve Numbers for Hydrologic Soil Group			
Cover Type and Hydrologic Condition		**A**	**B**	**C**	**D**
Fully developed urban areas (vegetation established)					
Open space (lawns, parks, golf courses, cemeteries, etc.):					
Poor condition (grass cover 50%)		68	79	86	89
Fair condition (grass cover 50% to 75%)		49	69	79	84
Good condition (grass cover 75%)		39	61	74	80
Impervious areas:					
Paved parking lots, roofs, driveways, etc. (excluding right of way)		98	98	98	98
Streets and roads:					
Paved; curbs and storm drains (excluding right of way)		98	98	98	98
Paved; open ditches (including right of way)		83	89	92	93
Gravel (including right of way)		76	85	89	91
Dirt (including right of way)		72	82	87	89
Developing urban areas					
Newly graded areas (pervious areas only, no vegetation)		77	86	91	94
Agricultural lands					
Grassland, or range-continuous forage for grazing[2]	Poor	68	79	86	89
	Fair	49	69	79	84
	Good	39	61	74	80
Meadow-continuous grass, protected from grazing and generally mowed for hay		30	58	71	78
Brush—brush-weed-grass mixture with brush the major element[3]	Poor	48	67	77	83
	Fair	35	56	70	77
	Good	30	48	65	73
Woods—grass combination (orchard or tree farm).[4]	Poor	57	73	82	86
	Fair	43	65	76	82
	Good	32	58	72	79
Woods[5]	Poor	45	66	77	83
	Fair	36	60	73	79
	Good	30	55	70	77
Farmsteads—buildings, lanes, driveways and surrounding lots		59	74	82	86

[1] Poor: less than 50 percent ground cover or heavily grazed with no mulch.
Fair: 50 to 75 percent ground cover and not heavily grazed.
Good: greater than 75 percent ground cover and lightly or only occasionally grazed.
[2] Poor: less than 50 percent ground cover.
Fair: 50 to 75 percent ground cover.
Good: greater than 75 percent ground cover.
[3] Curve numbers shown were computed for areas with 50 percent woods and 50 percent grass (pasture) cover. Other combinations of conditions may be computed from the curve numbers for woods and pasture.
[4] Poor: Forest litter, small trees and brush are destroyed by heavy grazing or regular burning.
Fair: Woods are grazed but not burned, and some forest litter covers the soil.
Good: Woods are protected from grazing, and litter and brush adequately cover the soil.

Source: *TR-55* [3]

Table 4-4: Curve Numbers for Fully Developed Conditions

Zone	Curve Numbers for Hydrologic Soil Group			
	A	**B**	**C**	**D**
R-1/R-1A Single family	61	75	83	87
R-2/R-2A Single and two family	77	85	90	92
R-3/R-3L Multi family high density	77	89	92	94
R-3/R-3H Multi family low density	77	85	90	92
B-1/B-1A Convent & mobile homes	61	75	83	87
TH/TH-A Townhouse	77	89	92	92
ZH/ZH-A Zero lot line homes	68	79	87	90
C-1/C1A Neighborhood business	83	89	92	93
C-2/C-1B General Business	77	86	93	94
C-3 Commercial	89	92	94	95
C-4/C-4A Resort Commercial/PUD (must use composite values)	-	-	-	-
M-1/M1A Light industry	68	79	87	90
M-2/M-2A Heavy industry	89	92	94	95

Source: *TR-55* [3]

Ultimate

Watershed - **ULT A2** **21.96 Acres**

Time of Concentration **ULT A2** .

Description **Drainage sub-area EX A2 Comparison**

				hrs	min.
Sheet Flow	L (ft) =	0	Tt=	$.007(n*L)^{0.8}/P_2{}^{0.5}xS^{0.4}$	
	n=	0.24			
	S (%) =	1.00			
	P_2=	3.34	Tt=	**0.00**	**0.0**
Shallow Flow	L (ft) =	0	Tt=	(L)/(60*16.1345*S^(0.5))	
(Unpaved)	S (%) =	1	Tt=		
				Tt=	**0.00**
Channel Flow	L (ft) =	11513			
(Channel Flow)	Est. V (ft/sec)=	6	V (fps) =	6.00	
			Tt=	L/(60*V)	
			Tt=	**0.53**	**32.0**

Tc	**32.0 min.**

Curve Number	**98.00**

Table 4-3: NRCS Runoff Curve Numbers for Urban Areas and Agricultural Lands

Cover Description	Average % Impervious Area[1]	Curve Numbers for Hydrologic Soil Group			
Cover Type and Hydrologic Condition		**A**	**B**	**C**	**D**
Fully developed urban areas (vegetation established)					
Open space (lawns, parks, golf courses, cemeteries, etc.):					
Poor condition (grass cover 50%)		68	79	86	89
Fair condition (grass cover 50% to 75%)		49	69	79	84
Good condition (grass cover 75%)		39	61	74	80
Impervious areas:					
Paved parking lots, roofs, driveways, etc. (excluding right of way)		98	98	98	98
Streets and roads:					
Paved; curbs and storm drains (excluding right of way)		98	98	98	98
Paved; open ditches (including right of way)		83	89	92	93
Gravel (including right of way)		76	85	89	91
Dirt (including right of way)		72	82	87	89
Developing urban areas					
Newly graded areas (pervious areas only, no vegetation)		77	86	91	94
Agricultural lands					
Grassland, or range-continuous forage for grazing[2]	Poor	68	79	86	89
	Fair	49	69	79	84
	Good	39	61	74	80
Meadow-continuous grass, protected from grazing and generally mowed for hay		30	58	71	78
Brush—brush-weed-grass mixture with brush the major element[3]	Poor	48	67	77	83
	Fair	35	56	70	77
	Good	30	48	65	73
Woods—grass combination (orchard or tree farm).[4]	Poor	57	73	82	86
	Fair	43	65	76	82
	Good	32	58	72	79
Woods[5]	Poor	45	66	77	83
	Fair	36	60	73	79
	Good	30	55	70	77
Farmsteads—buildings, lanes, driveways and surrounding lots		59	74	82	86

[1] Poor: less than 50 percent ground cover or heavily grazed with no mulch.
Fair: 50 to 75 percent ground cover and not heavily grazed.
Good: greater than 75 percent ground cover and lightly or only occasionally grazed.
[2] Poor: less than 50 percent ground cover.
Fair: 50 to 75 percent ground cover.
Good: greater than 75 percent ground cover.
[3] Curve numbers shown were computed for areas with 50 percent woods and 50 percent grass (pasture) cover. Other combinations of conditions may be computed from the curve numbers for woods and pasture.
[4] Poor: Forest litter, small trees and brush are destroyed by heavy grazing or regular burning.
Fair: Woods are grazed but not burned, and some forest litter covers the soil.
Good: Woods are protected from grazing, and litter and brush adequately cover the soil.

Source: *TR-55* [3]

Table 4-4: Curve Numbers for Fully Developed Conditions

Zone	Curve Numbers for Hydrologic Soil Group			
	A	**B**	**C**	**D**
R-1/R-1A Single family	61	75	83	87
R-2/R-2A Single and two family	77	85	90	92
R-3/R-3L Multi family high density	77	89	92	94
R-3/R-3H Multi family low density	77	85	90	92
B-1/B-1A Convent & mobile homes	61	75	83	87
TH/TH-A Townhouse	77	89	92	92
ZH/ZH-A Zero lot line homes	68	79	87	90
C-1/C1A Neighborhood business	83	89	92	93
C-2/C-1B General Business	77	86	93	94
C-3 Commercial	89	92	94	95
C-4/C-4A Resort Commercial/PUD (must use composite values)	-	-	-	-
M-1/M1A Light industry	68	79	87	90
M-2/M-2A Heavy industry	89	92	94	95

Source: *TR-55* [3]

Ultimate

Watershed - **ULT A3** **33.05 Acres**

Time of Concentration **ULT A3**

Description **Drainage sub-area EX A3 Comparison**

				hrs	min.
Sheet Flow	L (ft) =	100	Tt=	$.007(n*L)^{0.8}/P_2{}^{0.5}xS^{0.4}$	
	n=	0.24			
	S (%) =	1.70			
	P_2=	3.34	Tt=	**0.25**	**14.9**
Shallow Flow	L (ft) =	1300	Tt=	(L)/(60*16.1345*S^(0.5))	
(Unpaved)	S (%) =	2.3	Tt=		
				Tt=	**8.85**
Channel Flow	L (ft) =	662			
(Channel Flow)	Est. V (ft/sec)=	6	V (fps) =	6.00	
			Tt=	L/(60*V)	
			Tt=	**0.03**	**1.8**

Tc	**25.6 min.**

Curve Number	**87.83**

Weighted Curve Number	Hydrologic Soil Group	Curve Number	Area (acres)
Paved	D	98	2.50
Residential	D	87	30.55

Weighted Curve Number **87.83**

Table 4-3: NRCS Runoff Curve Numbers for Urban Areas and Agricultural Lands

Cover Description	Average % Impervious Area[1]	Curve Numbers for Hydrologic Soil Group			
Cover Type and Hydrologic Condition		**A**	**B**	**C**	**D**
Fully developed urban areas (vegetation established)					
Open space (lawns, parks, golf courses, cemeteries, etc.):					
Poor condition (grass cover 50%)		68	79	86	89
Fair condition (grass cover 50% to 75%)		49	69	79	84
Good condition (grass cover 75%)		39	61	74	80
Impervious areas:					
Paved parking lots, roofs, driveways, etc. (excluding right of way)		98	98	98	98
Streets and roads:					
Paved; curbs and storm drains (excluding right of way)		98	98	98	98
Paved; open ditches (including right of way)		83	89	92	93
Gravel (including right of way)		76	85	89	91
Dirt (including right of way)		72	82	87	89
Developing urban areas					
Newly graded areas (pervious areas only, no vegetation)		77	86	91	94
Agricultural lands					
Grassland, or range-continuous forage for grazing[2]	Poor	68	79	86	89
	Fair	49	69	79	84
	Good	39	61	74	80
Meadow-continuous grass, protected from grazing and generally mowed for hay		30	58	71	78
Brush—brush-weed-grass mixture with brush the major element[3]	Poor	48	67	77	83
	Fair	35	56	70	77
	Good	30	48	65	73
Woods—grass combination (orchard or tree farm).[4]	Poor	57	73	82	86
	Fair	43	65	76	82
	Good	32	58	72	79
Woods[5]	Poor	45	66	77	83
	Fair	36	60	73	79

Table 4-4: Curve Numbers for Fully Developed Conditions

Zone	Curve Numbers for Hy	
	A	**B**
R-1/R-1A Single family	61	75
R-2/R-2A Single and two family	77	85
R-3/R-3L Multi family high density	77	89
R-3/R-3H Multi family low density	77	85
B-1/B-1A Convent & mobile homes	61	75
TH/TH-A Townhouse	77	89
ZH/ZH-A Zero lot line homes	68	79
C-1/C1A Neighborhood business	83	89
C-2/C-1B General Business	77	86
C-3 Commercial	89	92
C-4/C-4A Resort Commercial/PUD (must use composite values)	-	-
M-1/M1A Light industry	68	79
M-2/M-2A Heavy industry	89	92
Source: *TR-55* [3]		

Ultimate

Watershed - **ULT A4** **4.45 Acres**

Time of Concentration **ULT A4**

Description **Drainage sub-area EX A4 Comparison**

				hrs	min.
Sheet Flow	L (ft) =	0	Tt=	$.007(n*L)^{0.8}/P_2{}^{0.5}xS^{0.4}$	
	n=	0.24			
	S (%) =	1.00			
	P_2=	3.34	Tt=	**0.00**	**0.0**
Shallow Flow	L (ft) =	0	Tt=	(L)/(60*16.1345*S^(0.5))	
(Unpaved)	S (%) =	1	Tt=		
				Tt=	**0.00**
Channel Flow	L (ft) =	1102			
(Channel Flow)	Est. V (ft/sec)=	6	V (fps) =	6.00	
			Tt=	L/(60*V)	
			Tt=	**0.05**	**3.1**

Tc	**10.0 min.**

Curve Number	**94.00**

Weighted Curve Number	Hydrologic Soil Group	Curve Number	Area (acres)
Paved	D	98	3.56
Meadow	D	78	0.89

Weighted Curve Number **94.00**

Table 4-3: NRCS Runoff Curve Numbers for Urban Areas and Agricultural Lands

Cover Description	Average % Impervious Area[1]	Curve Numbers for Hydrologic Soil Group			
Cover Type and Hydrologic Condition		A	B	C	D
Fully developed urban areas (vegetation established)					
Open space (lawns, parks, golf courses, cemeteries, etc.):					
Poor condition (grass cover 50%)		68	79	86	89
Fair condition (grass cover 50% to 75%)		49	69	79	84
Good condition (grass cover 75%)		39	61	74	80
Impervious areas:					
Paved parking lots, roofs, driveways, etc. (excluding right of way)		98	98	98	98
Streets and roads:					
Paved; curbs and storm drains (excluding right of way)		98	98	98	98
Paved; open ditches (including right of way)		83	89	92	93
Gravel (including right of way)		76	85	89	91
Dirt (including right of way)		72	82	87	89
Developing urban areas					
Newly graded areas (pervious areas only, no vegetation)		77	86	91	94
Agricultural lands					
Grassland, or range-continuous forage for grazing[2]	Poor	68	79	86	89
	Fair	49	69	79	84
	Good	39	61	74	80
Meadow-continuous grass, protected from grazing and generally mowed for hay		30	58	71	78
Brush—brush-weed-grass mixture with brush the major element[3]	Poor	48	67	77	83
	Fair	35	56	70	77
	Good	30	48	65	73
Woods—grass combination (orchard or tree farm).[4]	Poor	57	73	82	86
	Fair	43	65	76	82
	Good	32	58	72	79
Woods[5]	Poor	45	66	77	83
	Fair	36	60	73	79

Table 4-4: Curve Numbers for Fully Developed Conditions

Zone	Curve Numbers for Hy	
	A	B
R-1/R-1A Single family	61	75
R-2/R-2A Single and two family	77	85
R-3/R-3L Multi family high density	77	89
R-3/R-3H Multi family low density	77	85
B-1/B-1A Convent & mobile homes	61	75
TH/TH-A Townhouse	77	89
ZH/ZH-A Zero lot line homes	68	79
C-1/C1A Neighborhood business	83	89
C-2/C-1B General Business	77	86
C-3 Commercial	89	92
C-4/C-4A Resort Commercial/PUD (must use composite values)	-	-
M-1/M1A Light industry	68	79
M-2/M-2A Heavy industry	89	92
Source: *TR-55* [3]		

Ultimate

Watershed - **ULT A5** **139.20 Acres**

Time of Concentration **ULT A5** .

Description **Drainage sub-area EX A5 Comparison**

				hrs	min.
Sheet Flow	L (ft) =	100	Tt=	$.007(n*L)^{0.8}/P_2{}^{0.5}xS^{0.4}$	
	n=	0.24			
	S (%) =	1.00			
	P_2=	3.34	Tt=	**0.31**	**18.4**
Shallow Flow	L (ft) =	63	Tt=	(L)/(60*16.1345*S^(0.5))	
(Unpaved)	S (%) =	1	Tt=		
				Tt=	**0.65**
Channel Flow	L (ft) =	8261			
(Channel Flow)	Est. V (ft/sec)=	6	V (fps) =	6.00	
			Tt=	L/(60*V)	
			Tt=	**0.38**	**22.9**

Tc	**42.0 min.**

Curve Number	**87.00**

Table 4-3: NRCS Runoff Curve Numbers for Urban Areas and Agricultural Lands

Cover Description	Average % Impervious Area[1]	Curve Numbers for Hydrologic Soil Group			
Cover Type and Hydrologic Condition		**A**	**B**	**C**	**D**
Fully developed urban areas (vegetation established)					
Open space (lawns, parks, golf courses, cemeteries, etc.):					
Poor condition (grass cover 50%)		68	79	86	89
Fair condition (grass cover 50% to 75%)		49	69	79	84
Good condition (grass cover 75%)		39	61	74	80
Impervious areas:					
Paved parking lots, roofs, driveways, etc. (excluding right of way)		98	98	98	98
Streets and roads:					
Paved; curbs and storm drains (excluding right of way)		98	98	98	98
Paved; open ditches (including right of way)		83	89	92	93
Gravel (including right of way)		76	85	89	91
Dirt (including right of way)		72	82	87	89
Developing urban areas					
Newly graded areas (pervious areas only, no vegetation)		77	86	91	94
Agricultural lands					
Grassland, or range-continuous forage for grazing[2]	Poor Fair Good	68 49 39	79 69 61	86 79 74	89 84 80
Meadow-continuous grass, protected from grazing and generally mowed for hay		30	58	71	78
Brush—brush-weed-grass mixture with brush the major element[3]	Poor Fair Good	48 35 30	67 56 48	77 70 65	83 77 73
Woods—grass combination (orchard or tree farm).[4]	Poor Fair Good	57 43 32	73 65 58	82 76 72	86 82 79
Woods[5]	Poor Fair Good	45 36 30	66 60 55	77 73 70	83 79 77
Farmsteads—buildings, lanes, driveways and surrounding lots		59	74	82	86

Table 4-4: Curve Numbers for Fully Developed Conditions

Zone	Curve Numbers for Hy	
	A	**B**
R-1/R-1A Single family	61	75
R-2/R-2A Single and two family	77	85
R-3/R-3L Multi family high density	77	89
R-3/R-3H Multi family low density	77	85
B-1/B-1A Convent & mobile homes	61	75
TH/TH-A Townhouse	77	89
ZH/ZH-A Zero lot line homes	68	79
C-1/C1A Neighborhood business	83	89
C-2/C-1B General Business	77	86
C-3 Commercial	89	92
C-4/C-4A Resort Commercial/PUD (must use composite values)	-	-
M-1/M1A Light industry	68	79
M-2/M-2A Heavy industry	89	92
Source: *TR-55* [3]		

Ultimate

Watershed - **ULT A6** **2.20 Acres**

Time of Concentration **ULT A6** .

Description **Longest Time of Concentration Analysis**

				hrs	min.
Sheet Flow	L (ft) =	0	Tt=	$.007(n*L)^{0.8}/P_2{}^{0.5}xS^{0.4}$	
	n=	0.20			
	S (%) =	1.00			
	P_2=	3.34	Tt=	**0.00**	**0.0**
Shallow Flow	L (ft) =	0	Tt=	(L)/(60*16.1345*S^(0.5))	
(Unpaved)	S (%) =	1	Tt=		
				Tt=	**0.00**
Channel Flow	L (ft) =	795			
(Channel Flow)	Est. V (ft/sec)=	6	V (fps) =	6.00	
			Tt=	L/(60*V)	
			Tt=	**0.04**	**2.2**

Tc	**10.0 min.**

Curve Number	**84.00**

Table 4-3: NRCS Runoff Curve Numbers for Urban Areas and Agricultural Lands

Cover Description	Average % Impervious Area[1]	Curve Numbers for Hydrologic Soil Group			
Cover Type and Hydrologic Condition		**A**	**B**	**C**	**D**
Fully developed urban areas (vegetation established)					
Open space (lawns, parks, golf courses, cemeteries, etc.):					
Poor condition (grass cover 50%)		68	79	86	89
Fair condition (grass cover 50% to 75%)		49	69	79	84
Good condition (grass cover 75%)		39	61	74	80
Impervious areas:					
Paved parking lots, roofs, driveways, etc. (excluding right of way)		98	98	98	98
Streets and roads:					
Paved; curbs and storm drains (excluding right of way)		98	98	98	98
Paved; open ditches (including right of way)		83	89	92	93
Gravel (including right of way)		76	85	89	91
Dirt (including right of way)		72	82	87	89
Developing urban areas					
Newly graded areas (pervious areas only, no vegetation)		77	86	91	94
Agricultural lands					
Grassland, or range-continuous forage for grazing[2]	Poor Fair Good	68 49 39	79 69 61	86 79 74	89 84 80
Meadow-continuous grass, protected from grazing and generally mowed for hay		30	58	71	78
Brush—brush-weed-grass mixture with brush the major element[3]	Poor Fair Good	48 35 30	67 56 48	77 70 65	83 77 73
Woods—grass combination (orchard or tree farm).[4]	Poor Fair Good	57 43 32	73 65 58	82 76 72	86 82 79
Woods[5]	Poor Fair Good	45 36 30	66 60 55	77 73 70	83 79 77
Farmsteads—buildings, lanes, driveways and surrounding lots		59	74	82	86

Table 4-4: Curve Numbers for Fully Developed Conditions

Zone	Curve Numbers for Hy	
	A	**B**
R-1/R-1A Single family	61	75
R-2/R-2A Single and two family	77	85
R-3/R-3L Multi family high density	77	89
R-3/R-3H Multi family low density	77	85
B-1/B-1A Convent & mobile homes	61	75
TH/TH-A Townhouse	77	89
ZH/ZH-A Zero lot line homes	68	79
C-1/C1A Neighborhood business	83	89
C-2/C-1B General Business	77	86
C-3 Commercial	89	92
C-4/C-4A Resort Commercial/PUD (must use composite values)	-	-
M-1/M1A Light industry	68	79
M-2/M-2A Heavy industry	89	92
Source: *TR-55* [3]		

Ultimate

Watershed - **ULT A7** **31.11 Acres**

Time of Concentration **ULT A7**

Description **Drainage sub-area EX A6 Comparison**

				hrs	min.
Sheet Flow	L (ft) =	100	Tt=	$.007(n*L)^{0.8}/P_2{}^{0.5}xS^{0.4}$	
	n=	0.24			
	S (%) =	0.20			
	P_2=	3.34	Tt=	**0.33**	**20.0**
Shallow Flow	L (ft) =	2344	Tt=	(L)/(60*16.1345*S^(0.5))	
(Unpaved)	S (%) =	1.35	Tt=		
				Tt=	**20.84**
Channel Flow	L (ft) =	0			
(Channel Flow)	Est. V (ft/sec)=	6	V (fps) =	6.00	
			Tt=	L/(60*V)	
			Tt=	**0.00**	**0.0**

Tc	**40.8 min.**

Curve Number	**95.00**

Table 4-3: NRCS Runoff Curve Numbers for Urban Areas and Agricultural Lands

Cover Description	Average % Impervious Area[1]	Curve Numbers for Hydrologic Soil Group			
Cover Type and Hydrologic Condition		A	B	C	D
Fully developed urban areas (vegetation established)					
Open space (lawns, parks, golf courses, cemeteries, etc.):					
Poor condition (grass cover 50%)		68	79	86	89
Fair condition (grass cover 50% to 75%)		49	69	79	84
Good condition (grass cover 75%)		39	61	74	80
Impervious areas:					
Paved parking lots, roofs, driveways, etc. (excluding right of way)		98	98	98	98
Streets and roads:					
Paved; curbs and storm drains (excluding right of way)		98	98	98	98
Paved; open ditches (including right of way)		83	89	92	93
Gravel (including right of way)		76	85	89	91
Dirt (including right of way)		72	82	87	89
Developing urban areas					
Newly graded areas (pervious areas only, no vegetation)		77	86	91	94
Agricultural lands					
Grassland, or range-continuous forage for grazing[2]	Poor	68	79	86	89
	Fair	49	69	79	84
	Good	39	61	74	80
Meadow-continuous grass, protected from grazing and generally mowed for hay		30	58	71	78
Brush—brush-weed-grass mixture with brush the major element[3]	Poor	48	67	77	83
	Fair	35	56	70	77
	Good	30	48	65	73
Woods—grass combination (orchard or tree farm).[4]	Poor	57	73	82	86
	Fair	43	65	76	82
	Good	32	58	72	79
Woods[5]	Poor	45	66	77	83
	Fair	36	60	73	79

Table 4-4: Curve Numbers for Fully Developed Conditions

Zone	Curve Numbers for Hy	
	A	B
R-1/R-1A Single family	61	75
R-2/R-2A Single and two family	77	85
R-3/R-3L Multi family high density	77	89
R-3/R-3H Multi family low density	77	85
B-1/B-1A Convent & mobile homes	61	75
TH/TH-A Townhouse	77	89
ZH/ZH-A Zero lot line homes	68	79
C-1/C1A Neighborhood business	83	89
C-2/C-1B General Business	77	86
C-3 Commercial	89	92
C-4/C-4A Resort Commercial/PUD (must use composite values)	-	-
M-1/M1A Light industry	68	79
M-2/M-2A Heavy industry	89	92
Source: *TR-55* [3]		

Attachment D

Hydraflow Hydrographs Calculations

- Proposed Conditions
- Ultimate Conditions

Proposed Conditions Hydraflow Hydrographs Analysis

Hydraflow Table of Contents

031.060_Parkside Offsite.gpw

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2 Wednesday, 06 / 10 / 2020

Watershed Model Schematic 1

Hydrograph Return Period Recap 2

2 - Year

Summary Report 3
Hydrograph Reports 4
Hydrograph No. 1, SCS Runoff, EX A1 4
Hydrograph No. 2, SCS Runoff, EX A2 5
Hydrograph No. 3, SCS Runoff, EX A3 6
Hydrograph No. 4, Combine, EX A1 - EX A3 7
Hydrograph No. 5, SCS Runoff, EX A4 8
Hydrograph No. 6, SCS Runoff, EX A5 9
Hydrograph No. 7, SCS Runoff, EX A6 10
Hydrograph No. 8, Combine, EX A 11
Hydrograph No. 9, SCS Runoff, A1 12
Hydrograph No. 10, SCS Runoff, A2 13
Hydrograph No. 11, SCS Runoff, A3 14
Hydrograph No. 12, Combine, A1-A3 15
Hydrograph No. 13, SCS Runoff, A4 16
Hydrograph No. 14, SCS Runoff, Parkside Bain A1 Inflow 17
Hydrograph No. 15, Reservoir, A1-A9 + Basin A1 18
Pond Report - BASIN A1 19
Hydrograph No. 16, SCS Runoff, Parksie Development 20
Hydrograph No. 17, Combine, Parkside Basin A2 Inflow 21
Hydrograph No. 18, Reservoir, BASIN A2 22
Pond Report - BASIN A2 23
Hydrograph No. 19, SCS Runoff, A6 24
Hydrograph No. 20, Combine, Parkside Discharge Into TxDOT Channel 25
Hydrograph No. 21, SCS Runoff, A7 26
Hydrograph No. 22, Combine, A 27

5 - Year

Summary Report 28
Hydrograph Reports 29
Hydrograph No. 1, SCS Runoff, EX A1 29
Hydrograph No. 2, SCS Runoff, EX A2 30
Hydrograph No. 3, SCS Runoff, EX A3 31
Hydrograph No. 4, Combine, EX A1 - EX A3 32
Hydrograph No. 5, SCS Runoff, EX A4 33
Hydrograph No. 6, SCS Runoff, EX A5 34
Hydrograph No. 7, SCS Runoff, EX A6 35
Hydrograph No. 8, Combine, EX A 36
Hydrograph No. 9, SCS Runoff, A1 37
Hydrograph No. 10, SCS Runoff, A2 38
Hydrograph No. 11, SCS Runoff, A3 39
Hydrograph No. 12, Combine, A1-A3 40
Hydrograph No. 13, SCS Runoff, A4 41

Hydrograph No. 14, SCS Runoff, Parkside Bain A1 Inflow 42
Hydrograph No. 15, Reservoir, A1-A9 + Basin A1 43
Hydrograph No. 16, SCS Runoff, Parksie Development 44
Hydrograph No. 17, Combine, Parkside Basin A2 Inflow 45
Hydrograph No. 18, Reservoir, BASIN A2 46
Hydrograph No. 19, SCS Runoff, A6 47
Hydrograph No. 20, Combine, Parkside Discharge Into TxDOT Channel 48
Hydrograph No. 21, SCS Runoff, A7 49
Hydrograph No. 22, Combine, A 50

10 - Year

Summary Report 51
Hydrograph Reports 52
Hydrograph No. 1, SCS Runoff, EX A1 52
Hydrograph No. 2, SCS Runoff, EX A2 53
Hydrograph No. 3, SCS Runoff, EX A3 54
Hydrograph No. 4, Combine, EX A1 - EX A3 55
Hydrograph No. 5, SCS Runoff, EX A4 56
Hydrograph No. 6, SCS Runoff, EX A5 57
Hydrograph No. 7, SCS Runoff, EX A6 58
Hydrograph No. 8, Combine, EX A 59
Hydrograph No. 9, SCS Runoff, A1 60
Hydrograph No. 10, SCS Runoff, A2 61
Hydrograph No. 11, SCS Runoff, A3 62
Hydrograph No. 12, Combine, A1-A3 63
Hydrograph No. 13, SCS Runoff, A4 64
Hydrograph No. 14, SCS Runoff, Parkside Bain A1 Inflow 65
Hydrograph No. 15, Reservoir, A1-A9 + Basin A1 66
Hydrograph No. 16, SCS Runoff, Parksie Development 67
Hydrograph No. 17, Combine, Parkside Basin A2 Inflow 68
Hydrograph No. 18, Reservoir, BASIN A2 69
Hydrograph No. 19, SCS Runoff, A6 70
Hydrograph No. 20, Combine, Parkside Discharge Into TxDOT Channel 71
Hydrograph No. 21, SCS Runoff, A7 72
Hydrograph No. 22, Combine, A 73

25 - Year

Summary Report 74
Hydrograph Reports 75
Hydrograph No. 1, SCS Runoff, EX A1 75
Hydrograph No. 2, SCS Runoff, EX A2 76
Hydrograph No. 3, SCS Runoff, EX A3 77
Hydrograph No. 4, Combine, EX A1 - EX A3 78
Hydrograph No. 5, SCS Runoff, EX A4 79
Hydrograph No. 6, SCS Runoff, EX A5 80
Hydrograph No. 7, SCS Runoff, EX A6 81
Hydrograph No. 8, Combine, EX A 82
Hydrograph No. 9, SCS Runoff, A1 83
Hydrograph No. 10, SCS Runoff, A2 84
Hydrograph No. 11, SCS Runoff, A3 85

Hydrograph No. 12, Combine, A1-A3 86
Hydrograph No. 13, SCS Runoff, A4 87
Hydrograph No. 14, SCS Runoff, Parkside Bain A1 Inflow 88
Hydrograph No. 15, Reservoir, A1-A9 + Basin A1 89
Hydrograph No. 16, SCS Runoff, Parksie Development 90
Hydrograph No. 17, Combine, Parkside Basin A2 Inflow 91
Hydrograph No. 18, Reservoir, BASIN A2 92
Hydrograph No. 19, SCS Runoff, A6 93
Hydrograph No. 20, Combine, Parkside Discharge Into TxDOT Channel 94
Hydrograph No. 21, SCS Runoff, A7 95
Hydrograph No. 22, Combine, A 96

50 - Year

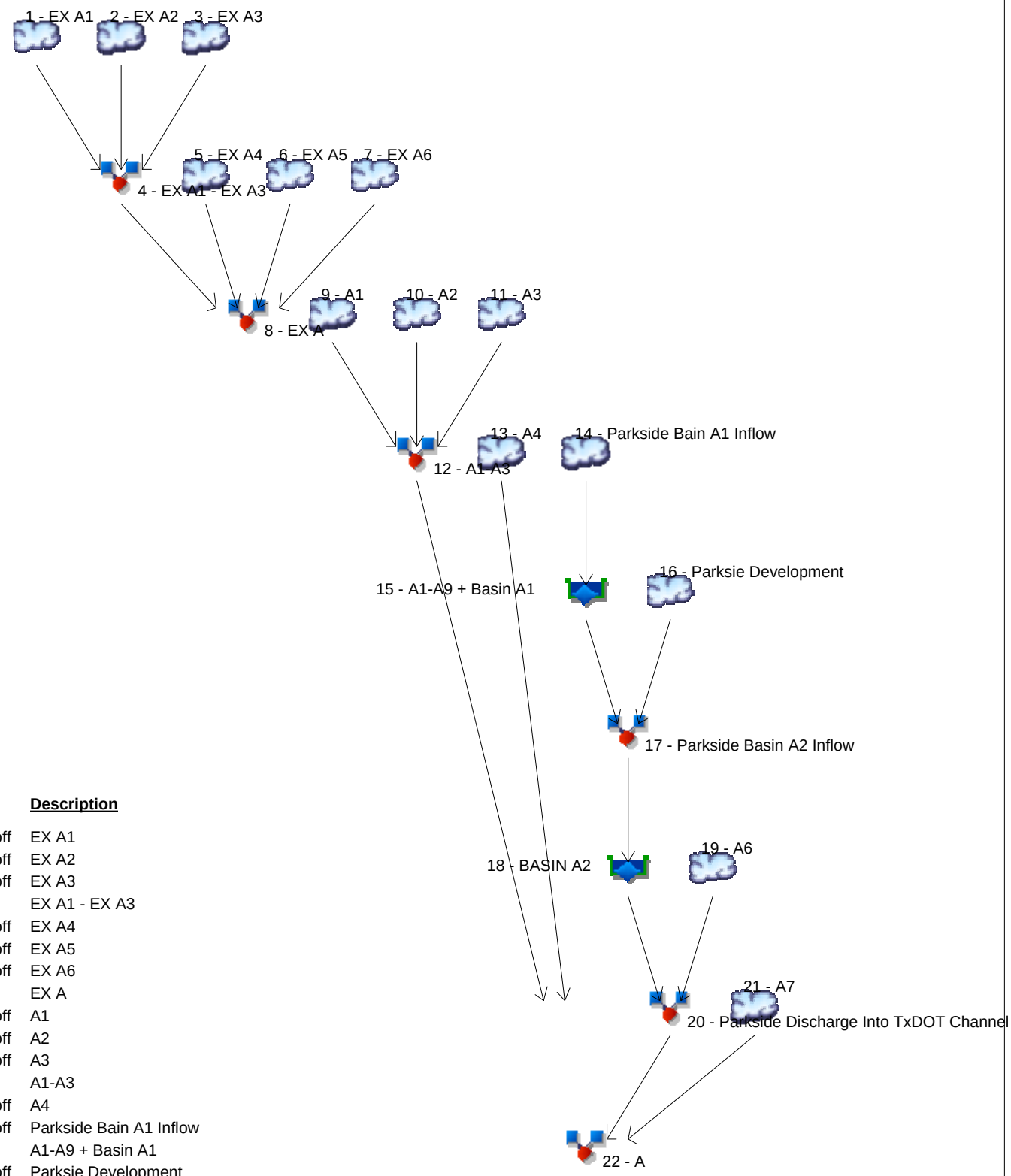
Summary Report 97
Hydrograph Reports 98
Hydrograph No. 1, SCS Runoff, EX A1 98
Hydrograph No. 2, SCS Runoff, EX A2 99
Hydrograph No. 3, SCS Runoff, EX A3 100
Hydrograph No. 4, Combine, EX A1 - EX A3 101
Hydrograph No. 5, SCS Runoff, EX A4 102
Hydrograph No. 6, SCS Runoff, EX A5 103
Hydrograph No. 7, SCS Runoff, EX A6 104
Hydrograph No. 8, Combine, EX A 105
Hydrograph No. 9, SCS Runoff, A1 106
Hydrograph No. 10, SCS Runoff, A2 107
Hydrograph No. 11, SCS Runoff, A3 108
Hydrograph No. 12, Combine, A1-A3 109
Hydrograph No. 13, SCS Runoff, A4 110
Hydrograph No. 14, SCS Runoff, Parkside Bain A1 Inflow 111
Hydrograph No. 15, Reservoir, A1-A9 + Basin A1 112
Hydrograph No. 16, SCS Runoff, Parksie Development 113
Hydrograph No. 17, Combine, Parkside Basin A2 Inflow 114
Hydrograph No. 18, Reservoir, BASIN A2 115
Hydrograph No. 19, SCS Runoff, A6 116
Hydrograph No. 20, Combine, Parkside Discharge Into TxDOT Channel 117
Hydrograph No. 21, SCS Runoff, A7 118
Hydrograph No. 22, Combine, A 119

100 - Year

Summary Report 120
Hydrograph Reports 121
Hydrograph No. 1, SCS Runoff, EX A1 121
Hydrograph No. 2, SCS Runoff, EX A2 122
Hydrograph No. 3, SCS Runoff, EX A3 123
Hydrograph No. 4, Combine, EX A1 - EX A3 124
Hydrograph No. 5, SCS Runoff, EX A4 125
Hydrograph No. 6, SCS Runoff, EX A5 126
Hydrograph No. 7, SCS Runoff, EX A6 127
Hydrograph No. 8, Combine, EX A 128
Hydrograph No. 9, SCS Runoff, A1 129

Hydrograph No. 10, SCS Runoff, A2 130
Hydrograph No. 11, SCS Runoff, A3 131
Hydrograph No. 12, Combine, A1-A3 132
Hydrograph No. 13, SCS Runoff, A4 133
Hydrograph No. 14, SCS Runoff, Parkside Bain A1 Inflow 134
Hydrograph No. 15, Reservoir, A1-A9 + Basin A1 135
Hydrograph No. 16, SCS Runoff, Parksie Development 136
Hydrograph No. 17, Combine, Parkside Basin A2 Inflow 137
Hydrograph No. 18, Reservoir, BASIN A2 138
Hydrograph No. 19, SCS Runoff, A6 139
Hydrograph No. 20, Combine, Parkside Discharge Into TxDOT Channel 140
Hydrograph No. 21, SCS Runoff, A7 141
Hydrograph No. 22, Combine, A 142

Watershed Model Schematic



Legend

Hyd.	Origin	Description
1	SCS Runoff	EX A1
2	SCS Runoff	EX A2
3	SCS Runoff	EX A3
4	Combine	EX A1 - EX A3
5	SCS Runoff	EX A4
6	SCS Runoff	EX A5
7	SCS Runoff	EX A6
8	Combine	EX A
9	SCS Runoff	A1
10	SCS Runoff	A2
11	SCS Runoff	A3
12	Combine	A1-A3
13	SCS Runoff	A4
14	SCS Runoff	Parkside Bain A1 Inflow
15	Reservoir	A1-A9 + Basin A1
16	SCS Runoff	Parksie Development
17	Combine	Parkside Basin A2 Inflow
18	Reservoir	BASIN A2
19	SCS Runoff	A6
20	Combine	Parkside Discharge Into TxDOT Channel
21	SCS Runoff	A7
22	Combine	A

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	------	-------	1002.62	-------	1713.53	2312.98	3291.98	4218.96	5355.58	EX A1
2	SCS Runoff	------	-------	38.71	-------	56.38	70.91	94.50	116.89	144.44	EX A2
3	SCS Runoff	------	-------	72.66	-------	137.54	194.37	289.37	380.59	492.94	EX A3
4	Combine	1, 2, 3	-------	1056.58	-------	1812.75	2451.33	3495.48	4485.49	5698.02	EX A1 - EX A3
5	SCS Runoff	------	-------	11.19	-------	16.88	21.53	29.03	36.11	44.80	EX A4
6	SCS Runoff	------	-------	14.49	-------	27.69	39.30	58.74	77.45	100.52	EX A5
7	SCS Runoff	------	-------	22.75	-------	43.33	61.45	91.70	120.72	156.45	EX A6
8	Combine	4, 5, 6, 7	-------	1076.03	-------	1848.80	2502.49	3570.74	4582.87	5823.16	EX A
9	SCS Runoff	------	-------	1002.62	-------	1713.53	2312.98	3291.98	4218.96	5355.58	A1
10	SCS Runoff	------	-------	38.71	-------	56.38	70.91	94.50	116.89	144.44	A2
11	SCS Runoff	------	-------	33.81	-------	62.43	87.35	128.59	167.93	216.22	A3
12	Combine	9, 10, 11	-------	1014.34	-------	1732.33	2338.07	3326.45	4263.63	5411.44	A1-A3
13	SCS Runoff	------	-------	8.962	-------	13.54	17.29	23.32	29.02	36.02	A4
14	SCS Runoff	------	-------	100.07	-------	166.09	221.13	310.34	394.48	497.35	Parkside Bain A1 Inflow
15	Reservoir	14	-------	34.49	-------	81.81	123.26	189.09	251.12	327.41	A1-A9 + Basin A1
16	SCS Runoff	------	-------	32.44	-------	53.73	71.42	100.16	127.27	160.40	Parksie Development
17	Combine	15, 16	-------	41.38	-------	101.43	153.89	238.36	317.40	413.63	Parkside Basin A2 Inflow
18	Reservoir	17	-------	22.24	-------	61.62	101.75	173.26	243.14	328.36	BASIN A2
19	SCS Runoff	------	-------	3.482	-------	5.770	7.669	10.74	13.64	17.17	A6
20	Combine	18, 19	-------	22.43	-------	62.06	102.40	174.27	244.47	330.09	Parkside Discharge Into TxDOT Chan
21	SCS Runoff	------	-------	17.72	-------	33.92	48.19	72.05	95.02	123.39	A7
22	Combine	12, 13, 20, 21	-------	1027.52	-------	1791.00	2449.13	3532.38	4559.23	5814.79	A

Hydrograph Summary Report

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

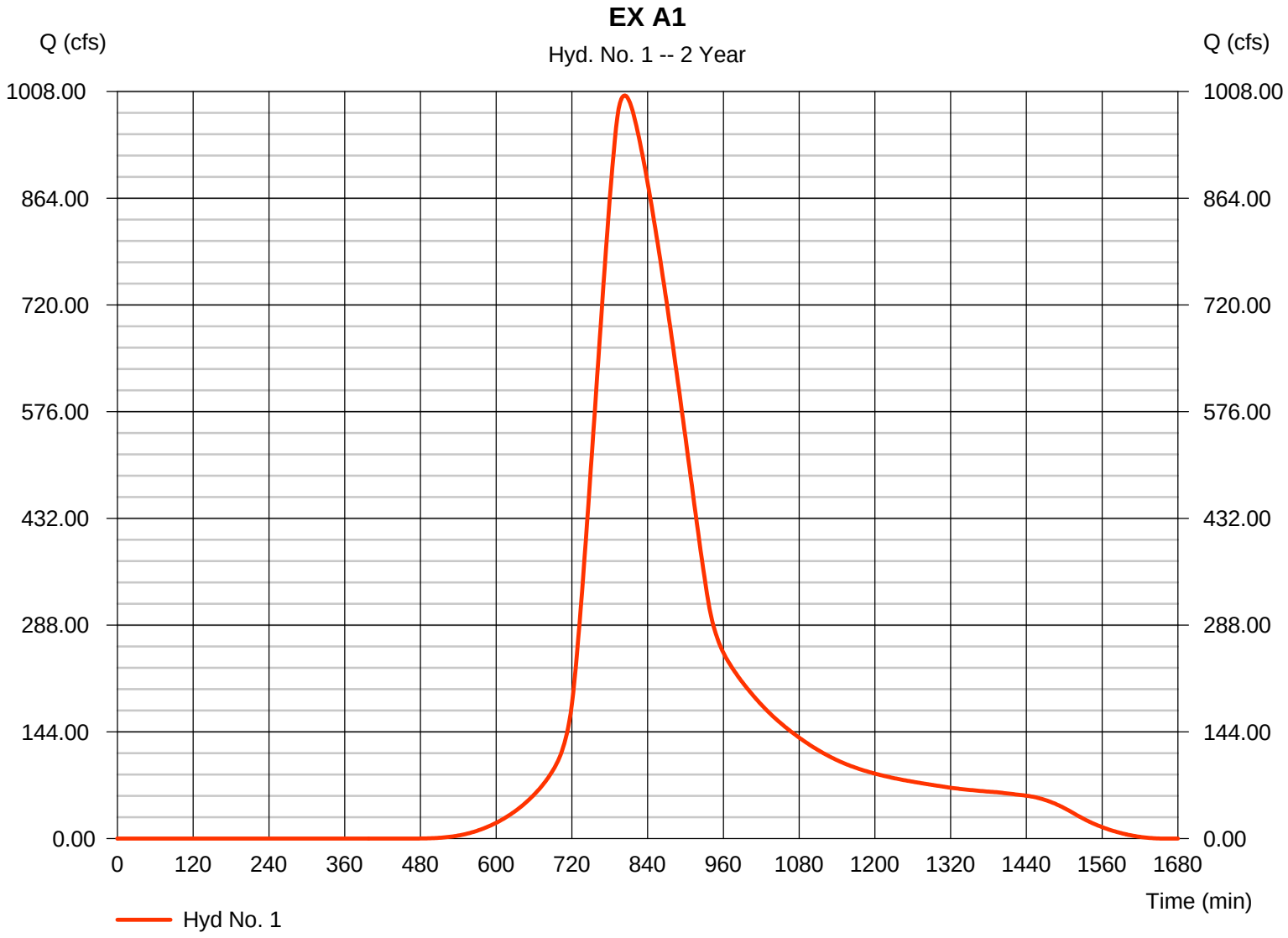
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	1002.62	2	804	13,157,680	------	------	------	EX A1
2	SCS Runoff	38.71	2	742	249,848	------	------	------	EX A2
3	SCS Runoff	72.66	2	764	608,258	------	------	------	EX A3
4	Combine	1056.58	2	800	14,015,800	1, 2, 3	------	------	EX A1 - EX A3
5	SCS Runoff	11.19	2	728	44,642	------	------	------	EX A4
6	SCS Runoff	14.49	2	766	125,999	------	------	------	EX A5
7	SCS Runoff	22.75	2	752	156,856	------	------	------	EX A6
8	Combine	1076.03	2	800	14,343,290	4, 5, 6, 7	------	------	EX A
9	SCS Runoff	1002.62	2	804	13,157,680	------	------	------	A1
10	SCS Runoff	38.71	2	742	249,848	------	------	------	A2
11	SCS Runoff	33.81	2	740	180,317	------	------	------	A3
12	Combine	1014.34	2	804	13,587,860	9, 10, 11	------	------	A1-A3
13	SCS Runoff	8.962	2	730	42,763	------	------	------	A4
14	SCS Runoff	100.07	2	754	814,623	------	------	------	Parkside Bain A1 Inflow
15	Reservoir	34.49	2	818	630,308	14	603.49	420,644	A1-A9 + Basin A1
16	SCS Runoff	32.44	2	746	223,227	------	------	------	Parksie Development
17	Combine	41.38	2	788	853,535	15, 16	------	------	Parkside Basin A2 Inflow
18	Reservoir	22.24	2	954	660,659	17	600.82	355,514	BASIN A2
19	SCS Runoff	3.482	2	730	16,087	------	------	------	A6
20	Combine	22.43	2	952	676,746	18, 19	------	------	Parkside Discharge Into TxDOT Chan
21	SCS Runoff	17.72	2	760	155,688	------	------	------	A7
22	Combine	1027.52	2	802	14,463,030	12, 13, 20, 21	------	------	A

Hydrograph Report

Hyd. No. 1

EX A1

Hydrograph type	=	SCS Runoff	Peak discharge	=	1002.62 cfs
Storm frequency	=	2 yrs	Time to peak	=	804 min
Time interval	=	2 min	Hyd. volume	=	13,157,680 cuft
Drainage area	=	1906.930 ac	Curve number	=	85.3
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	122.30 min
Total precip.	=	3.34 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	434

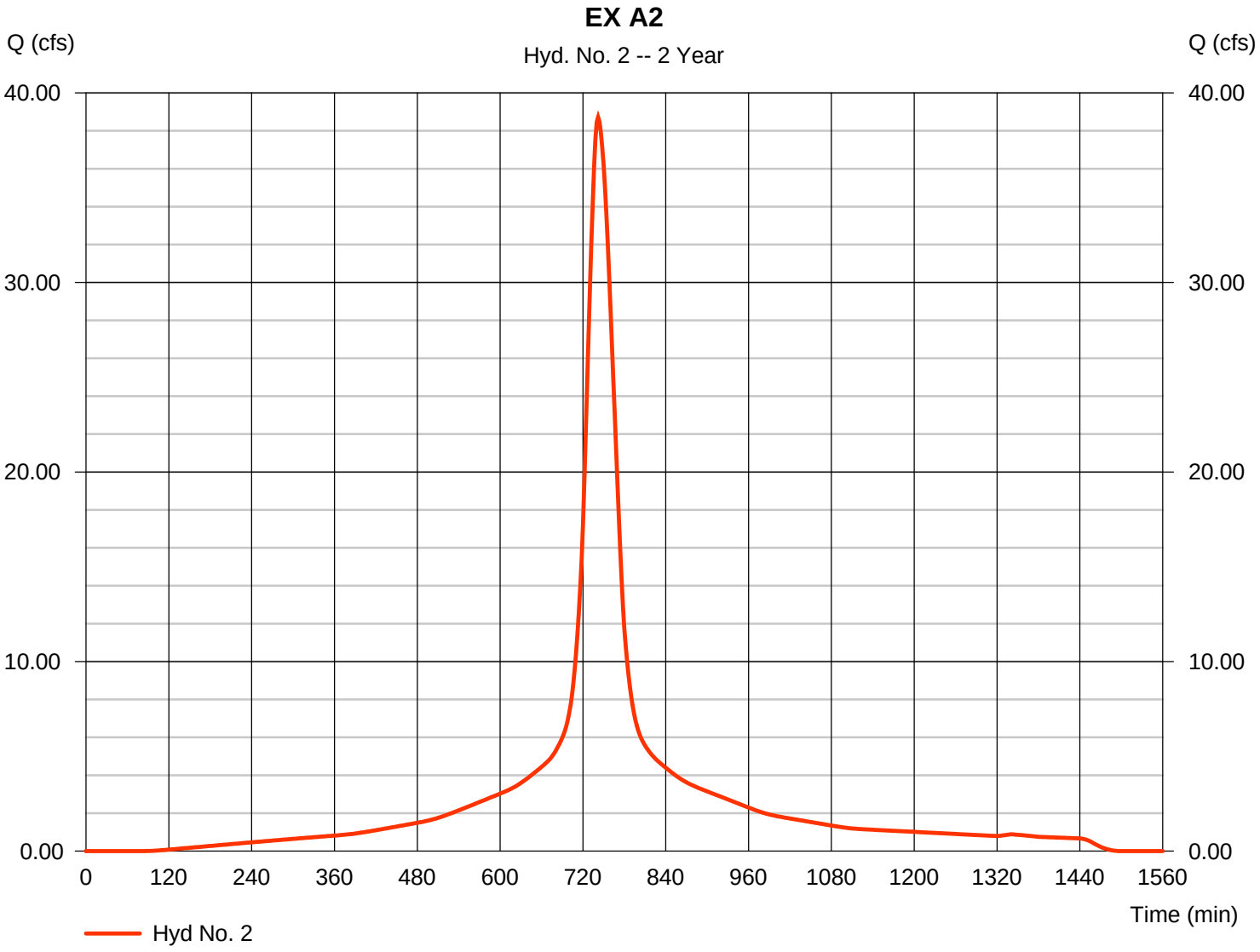


Hydrograph Report

Hyd. No. 2

EX A2

Hydrograph type	=	SCS Runoff	Peak discharge	=	38.71 cfs
Storm frequency	=	2 yrs	Time to peak	=	742 min
Time interval	=	2 min	Hyd. volume	=	249,848 cuft
Drainage area	=	21.960 ac	Curve number	=	98
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	32.00 min
Total precip.	=	3.34 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	434

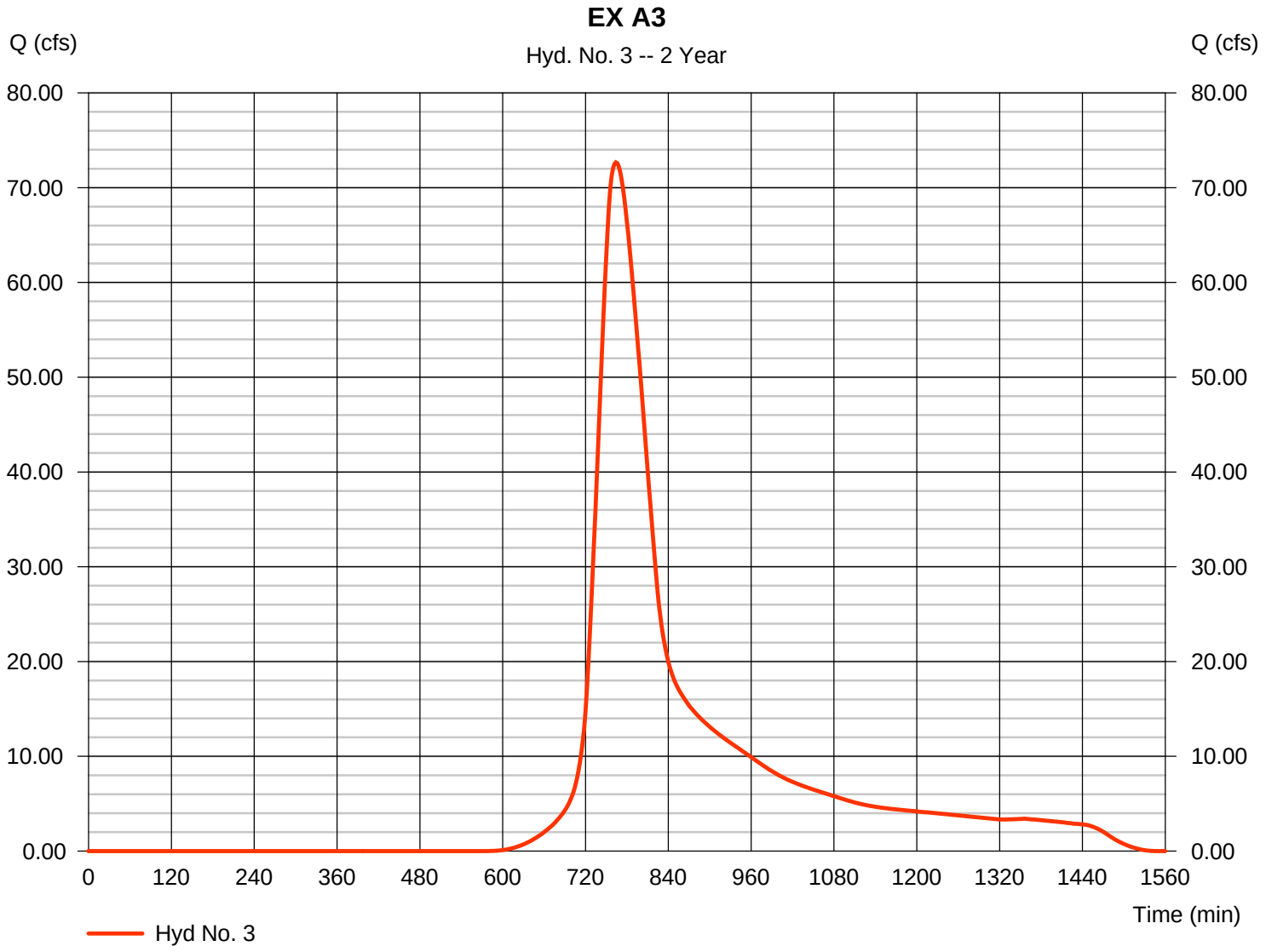


Hydrograph Report

Hyd. No. 3

EX A3

Hydrograph type	=	SCS Runoff	Peak discharge	=	72.66 cfs
Storm frequency	=	2 yrs	Time to peak	=	764 min
Time interval	=	2 min	Hyd. volume	=	608,258 cuft
Drainage area	=	117.840 ac	Curve number	=	78.5
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	59.60 min
Total precip.	=	3.34 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	434

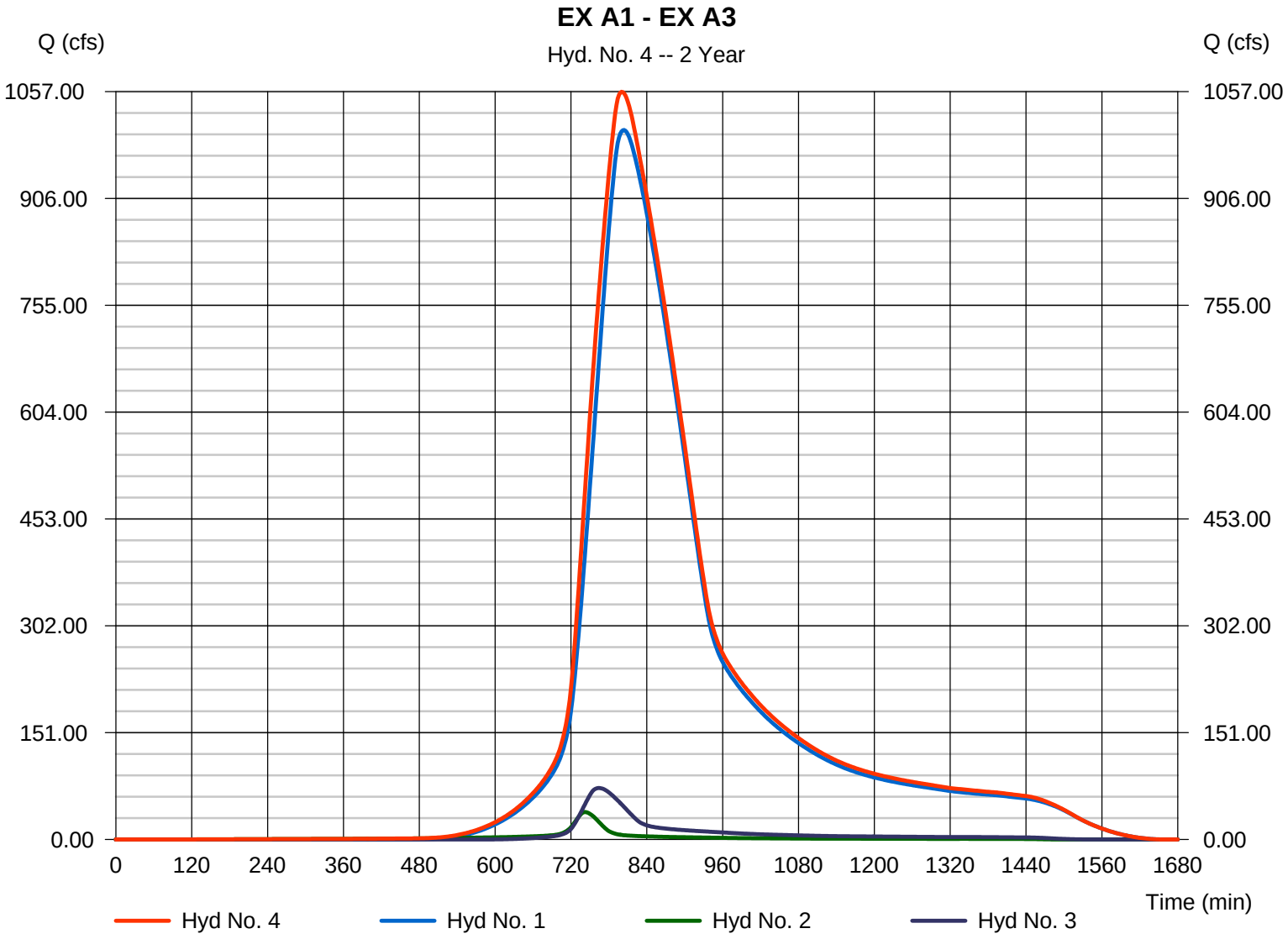


Hydrograph Report

Hyd. No. 4

EX A1 - EX A3

Hydrograph type	=	Combine	Peak discharge	=	1056.58 cfs
Storm frequency	=	2 yrs	Time to peak	=	800 min
Time interval	=	2 min	Hyd. volume	=	14,015,800 cuft
Inflow hyds.	=	1, 2, 3	Contrib. drain. area	=	2046.730 ac

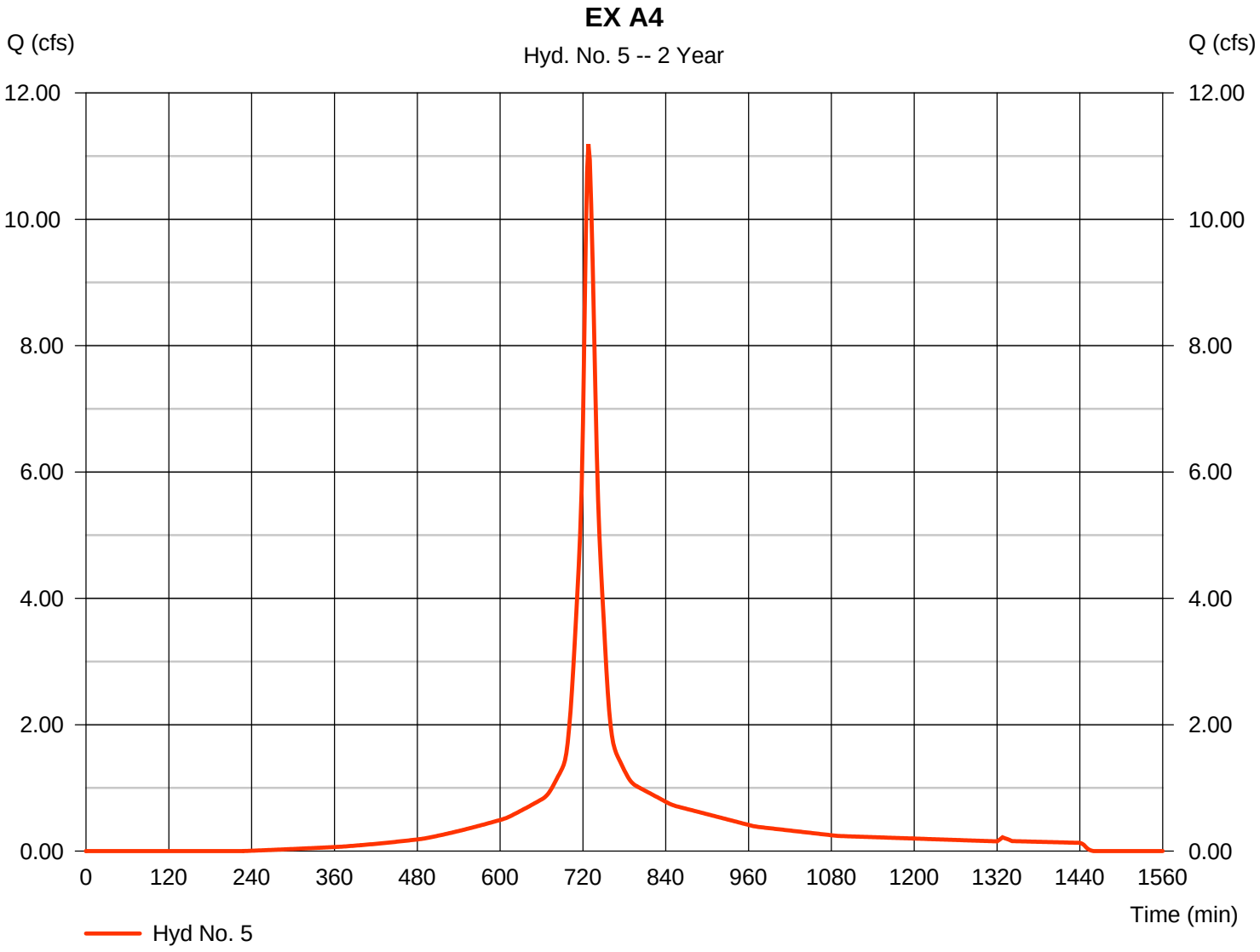


Hydrograph Report

Hyd. No. 5

EX A4

Hydrograph type	=	SCS Runoff	Peak discharge	=	11.19 cfs
Storm frequency	=	2 yrs	Time to peak	=	728 min
Time interval	=	2 min	Hyd. volume	=	44,642 cuft
Drainage area	=	4.450 ac	Curve number	=	94
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	10.00 min
Total precip.	=	3.34 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484

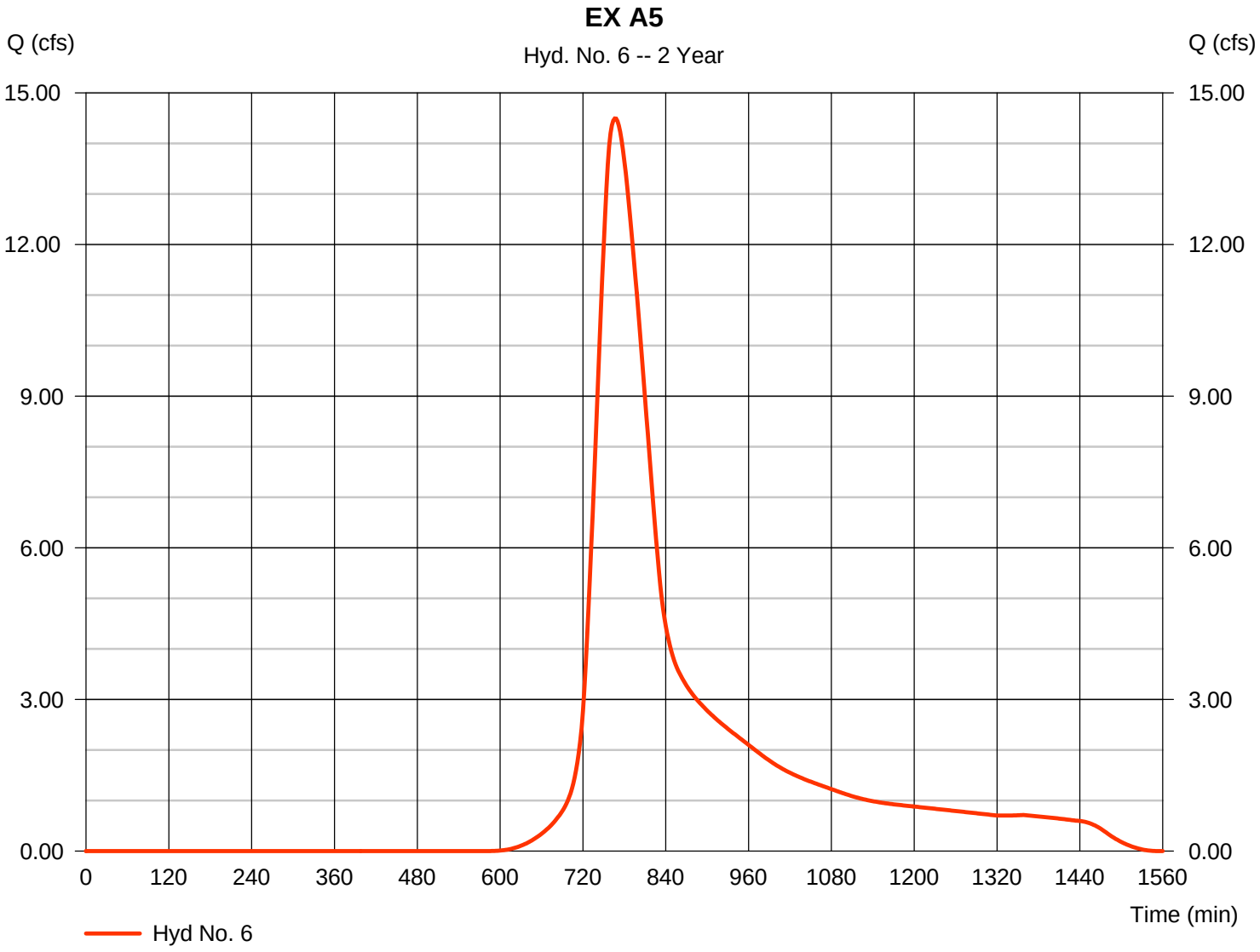


Hydrograph Report

Hyd. No. 6

EX A5

Hydrograph type	=	SCS Runoff	Peak discharge	=	14.49 cfs
Storm frequency	=	2 yrs	Time to peak	=	766 min
Time interval	=	2 min	Hyd. volume	=	125,999 cuft
Drainage area	=	24.990 ac	Curve number	=	78
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	63.10 min
Total precip.	=	3.34 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	434

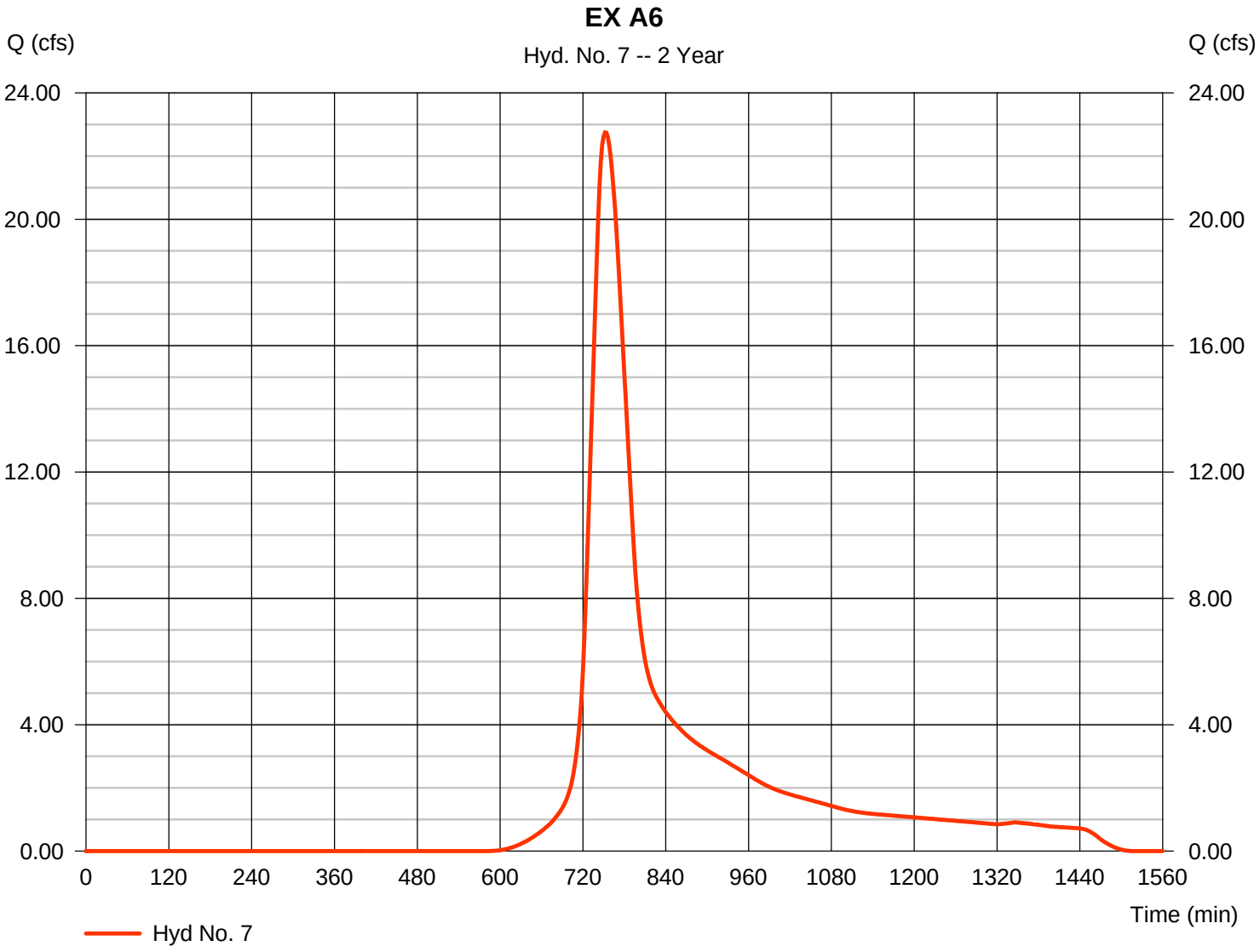


Hydrograph Report

Hyd. No. 7

EX A6

Hydrograph type	=	SCS Runoff	Peak discharge	=	22.75 cfs
Storm frequency	=	2 yrs	Time to peak	=	752 min
Time interval	=	2 min	Hyd. volume	=	156,856 cuft
Drainage area	=	31.110 ac	Curve number	=	78
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	40.80 min
Total precip.	=	3.34 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	434

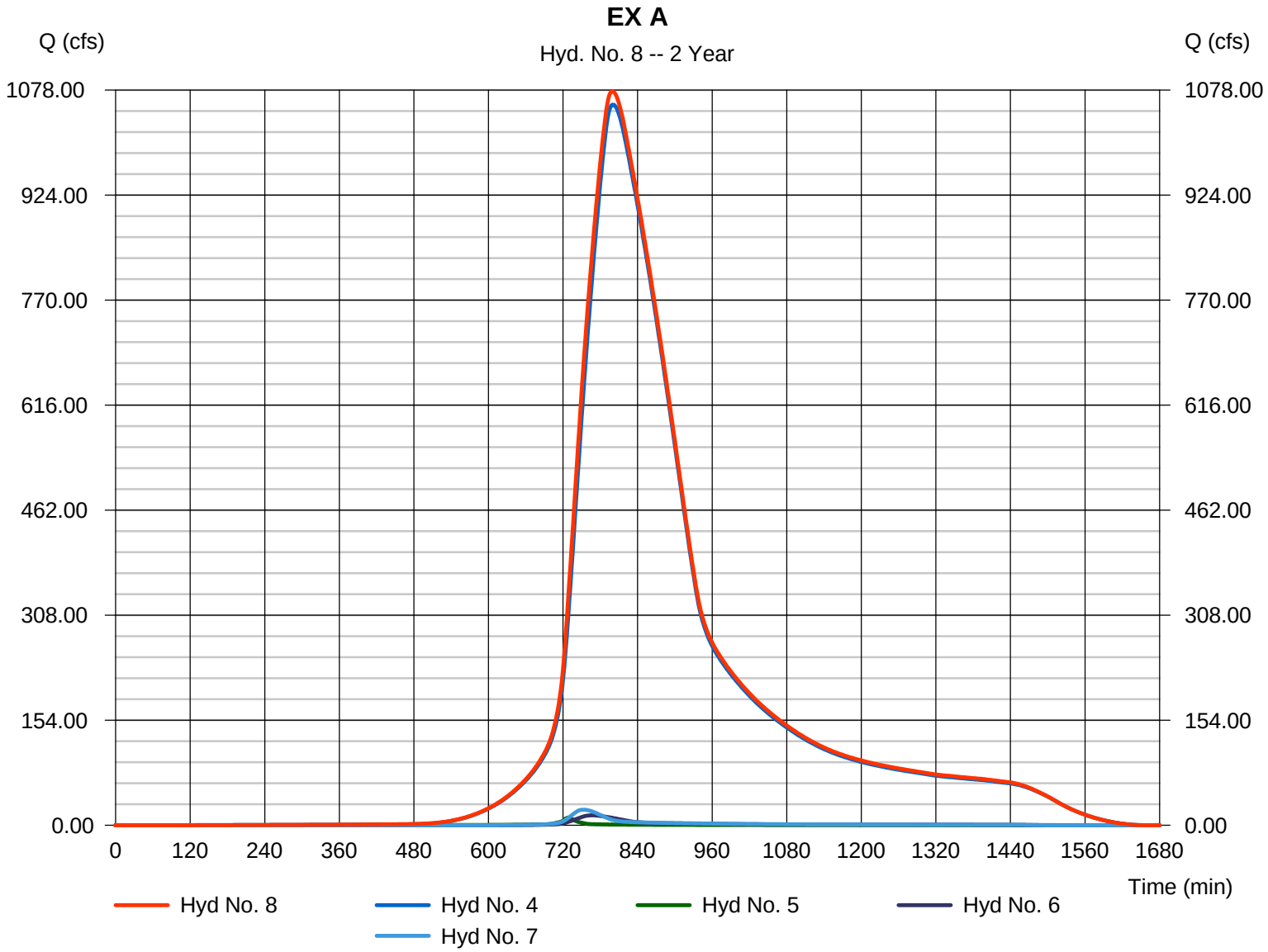


Hydrograph Report

Hyd. No. 8

EX A

Hydrograph type	=	Combine	Peak discharge	=	1076.03 cfs
Storm frequency	=	2 yrs	Time to peak	=	800 min
Time interval	=	2 min	Hyd. volume	=	14,343,290 cuft
Inflow hyds.	=	4, 5, 6, 7	Contrib. drain. area	=	60.550 ac

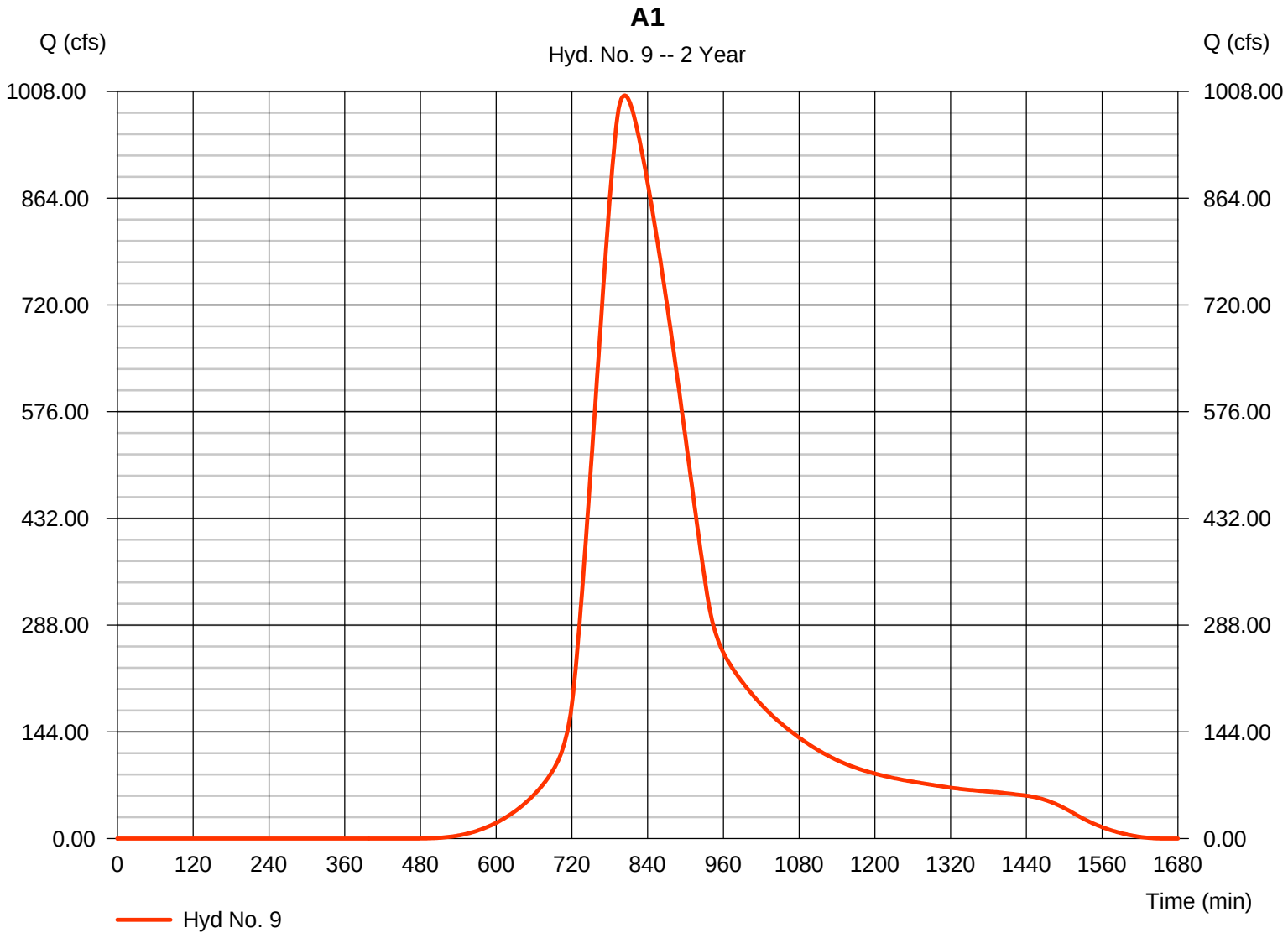


Hydrograph Report

Hyd. No. 9

A1

Hydrograph type	=	SCS Runoff	Peak discharge	=	1002.62 cfs
Storm frequency	=	2 yrs	Time to peak	=	804 min
Time interval	=	2 min	Hyd. volume	=	13,157,680 cuft
Drainage area	=	1906.930 ac	Curve number	=	85.3
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	122.30 min
Total precip.	=	3.34 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	434

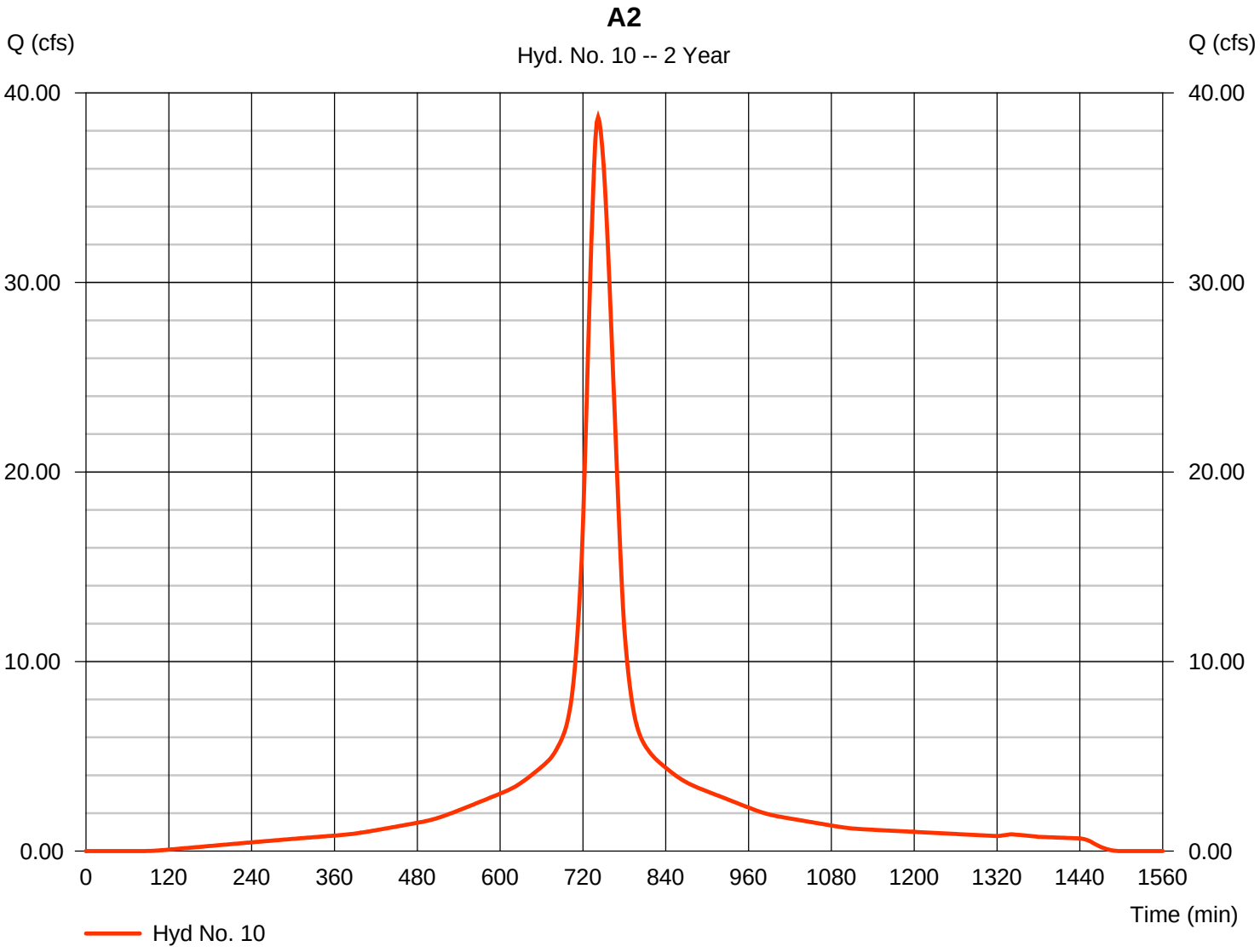


Hydrograph Report

Hyd. No. 10

A2

Hydrograph type	=	SCS Runoff	Peak discharge	=	38.71 cfs
Storm frequency	=	2 yrs	Time to peak	=	742 min
Time interval	=	2 min	Hyd. volume	=	249,848 cuft
Drainage area	=	21.960 ac	Curve number	=	98
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	32.00 min
Total precip.	=	3.34 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	434

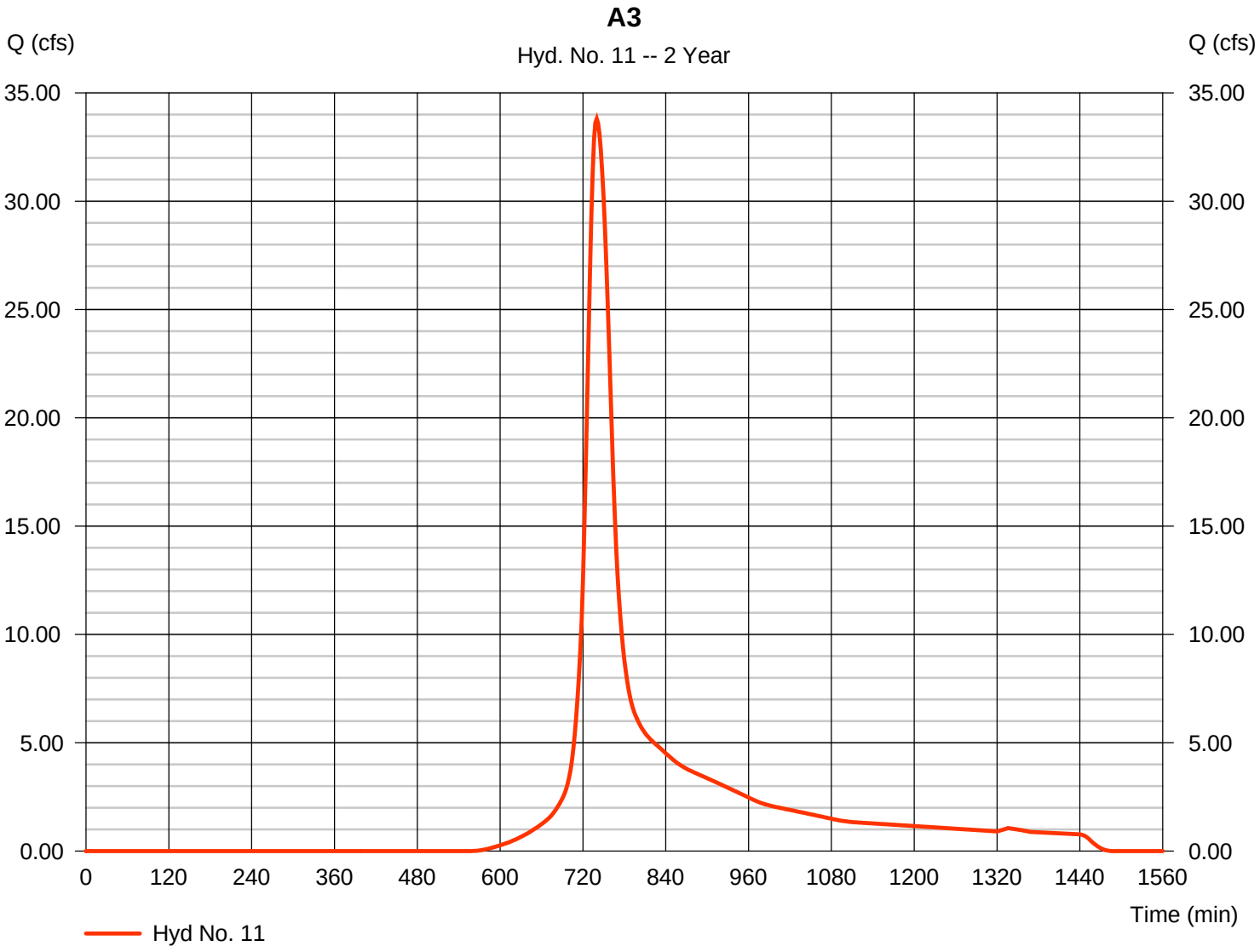


Hydrograph Report

Hyd. No. 11

A3

Hydrograph type	=	SCS Runoff	Peak discharge	=	33.81 cfs
Storm frequency	=	2 yrs	Time to peak	=	740 min
Time interval	=	2 min	Hyd. volume	=	180,317 cuft
Drainage area	=	33.050 ac	Curve number	=	79.7
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	25.60 min
Total precip.	=	3.34 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	434

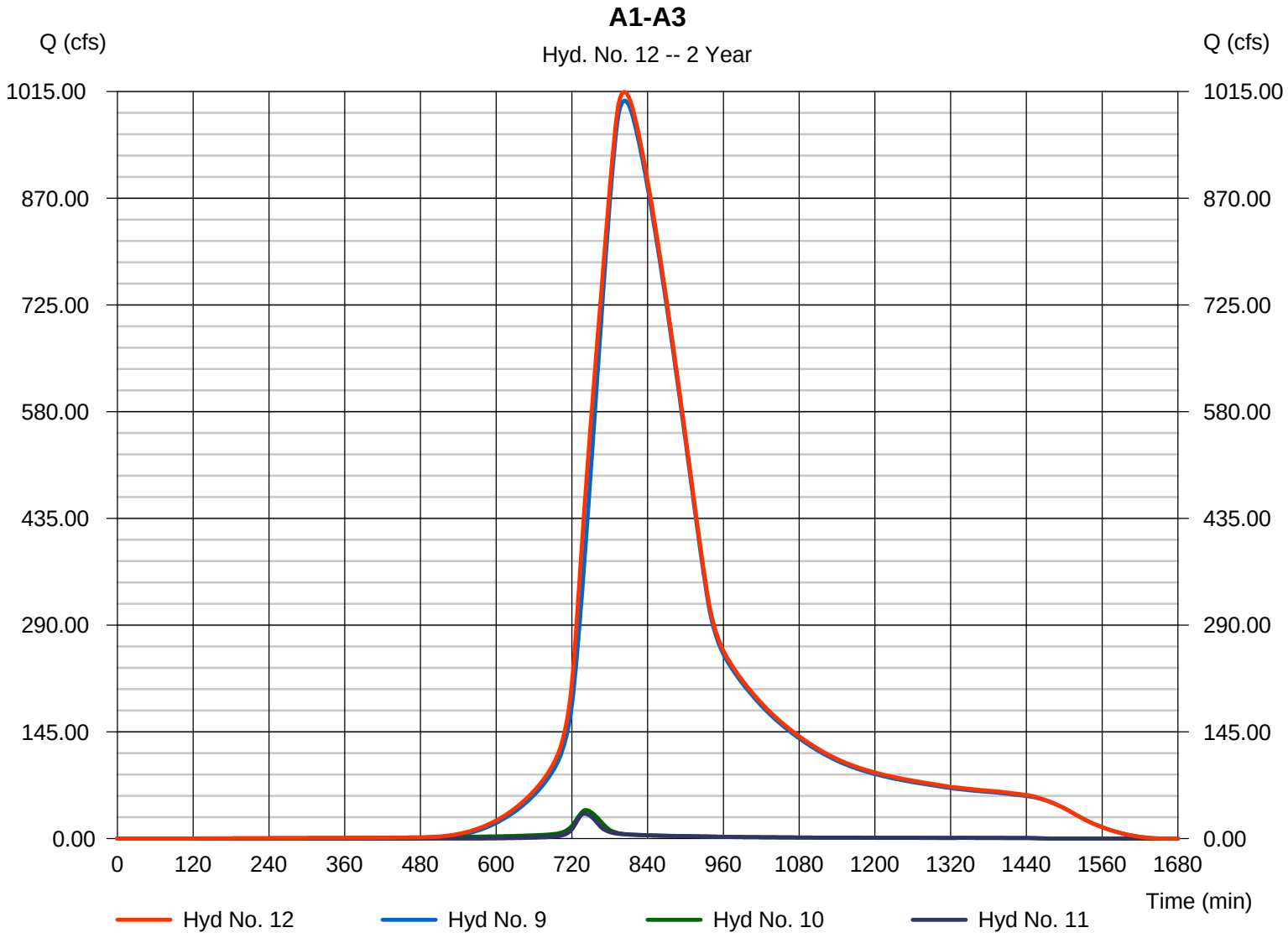


Hydrograph Report

Hyd. No. 12

A1-A3

Hydrograph type	=	Combine	Peak discharge	=	1014.34 cfs
Storm frequency	=	2 yrs	Time to peak	=	804 min
Time interval	=	2 min	Hyd. volume	=	13,587,860 cuft
Inflow hyds.	=	9, 10, 11	Contrib. drain. area	=	1961.940 ac

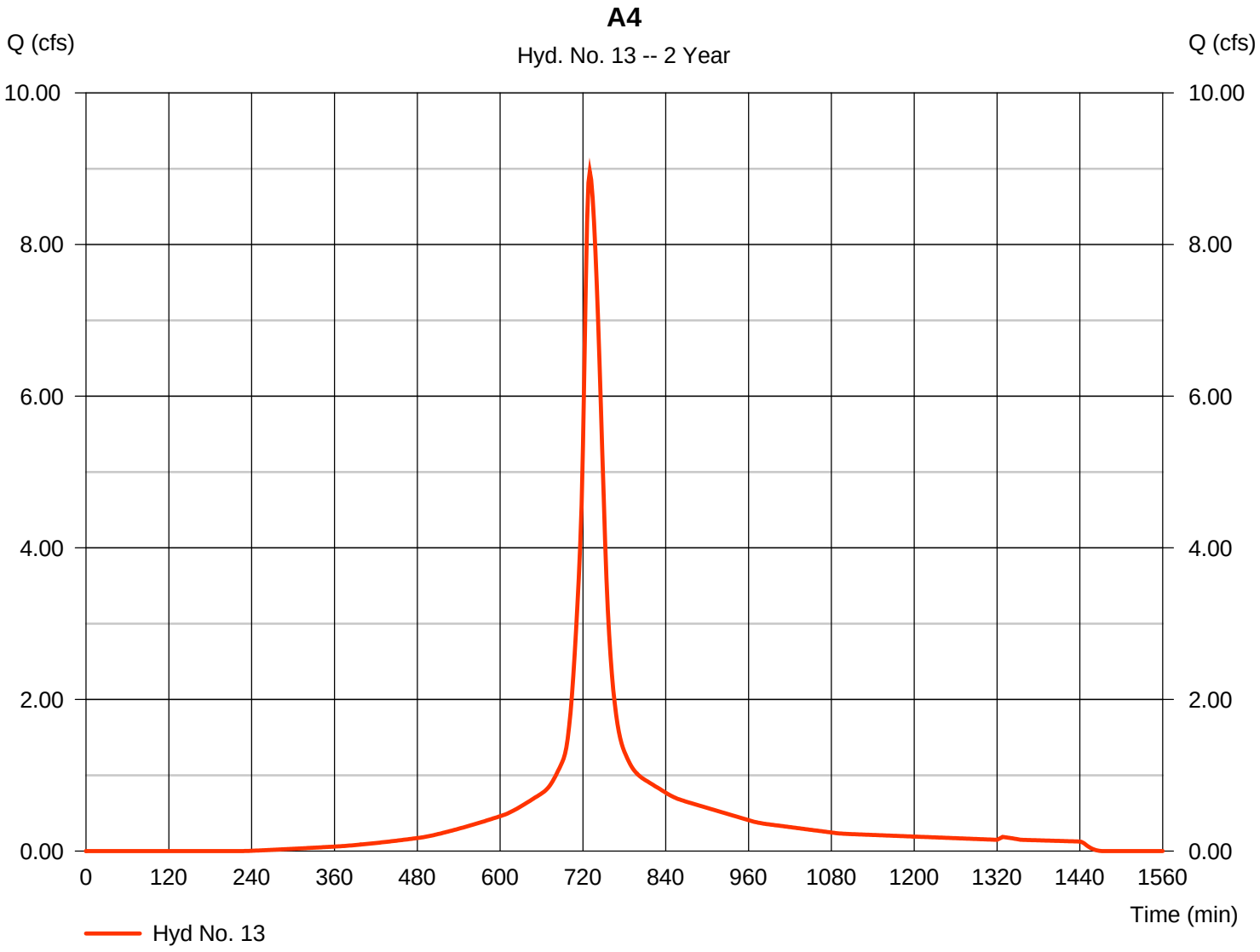


Hydrograph Report

Hyd. No. 13

A4

Hydrograph type	=	SCS Runoff	Peak discharge	=	8.962 cfs
Storm frequency	=	2 yrs	Time to peak	=	730 min
Time interval	=	2 min	Hyd. volume	=	42,763 cuft
Drainage area	=	4.450 ac	Curve number	=	94
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	10.00 min
Total precip.	=	3.34 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	300

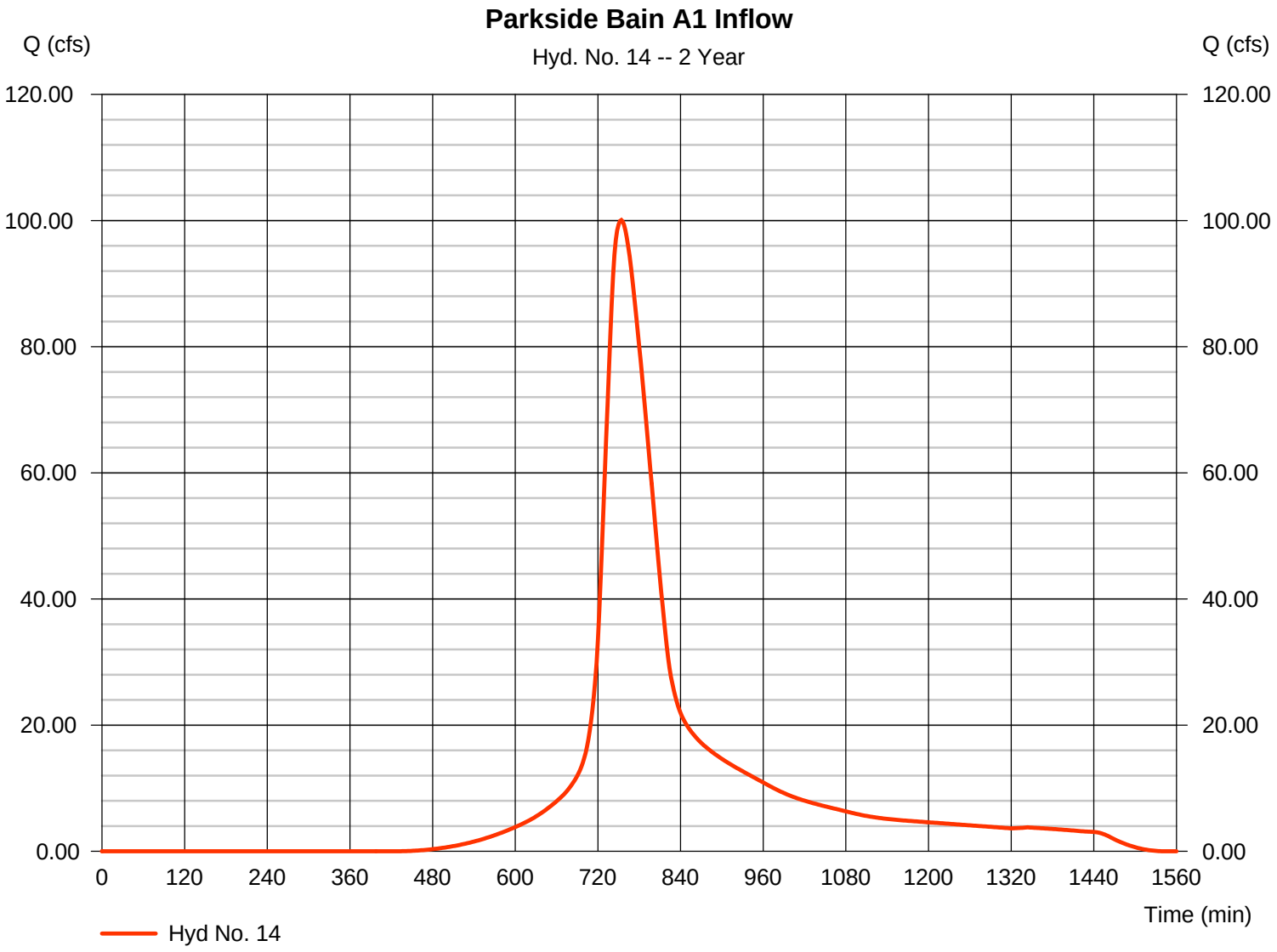


Hydrograph Report

Hyd. No. 14

Parkside Bain A1 Inflow

Hydrograph type	=	SCS Runoff	Peak discharge	=	100.07 cfs
Storm frequency	=	2 yrs	Time to peak	=	754 min
Time interval	=	2 min	Hyd. volume	=	814,623 cuft
Drainage area	=	109.260 ac	Curve number	=	87
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	37.90 min
Total precip.	=	3.34 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	300



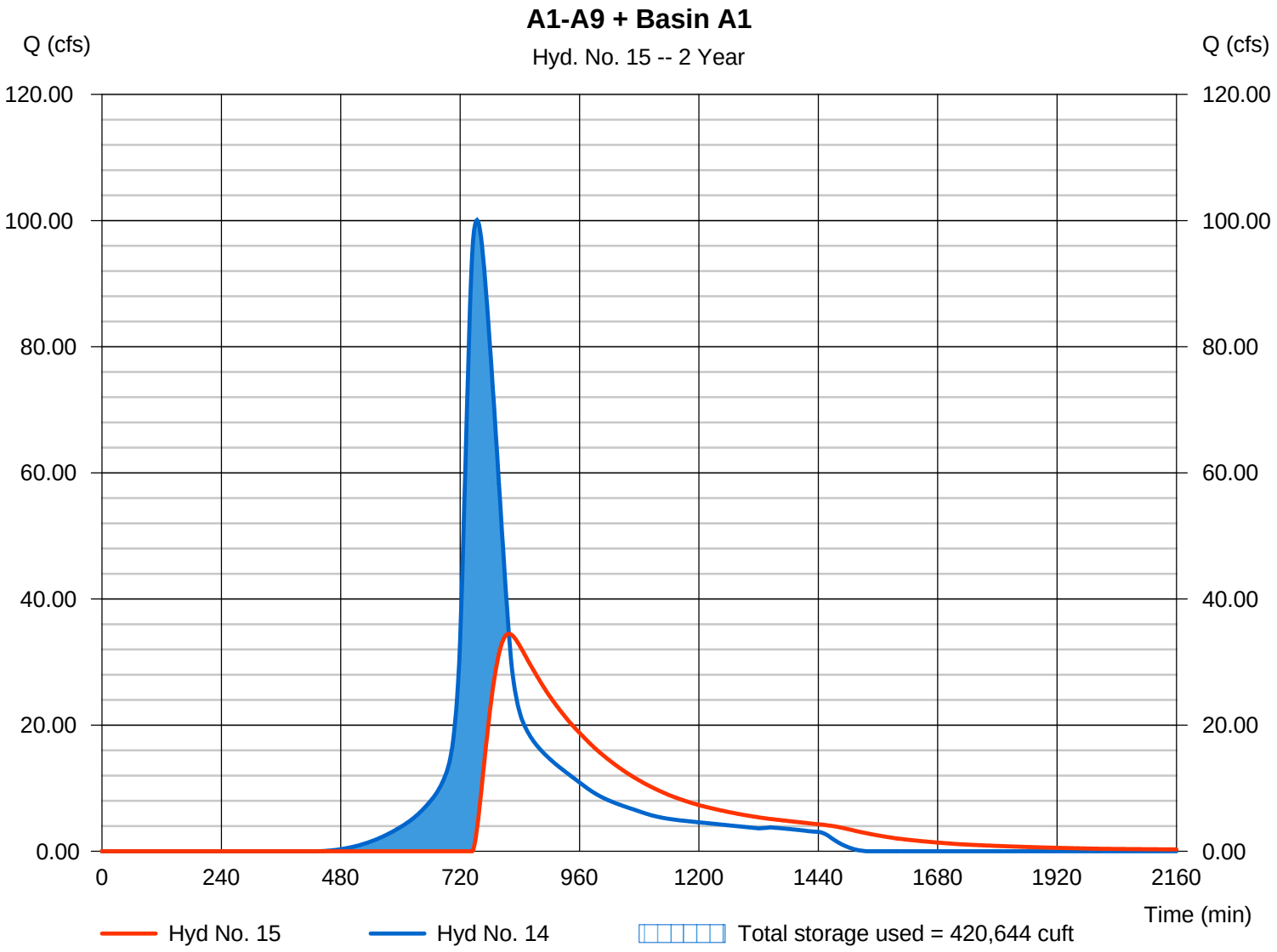
Hydrograph Report

Hyd. No. 15

A1-A9 + Basin A1

Hydrograph type	=	Reservoir	Peak discharge	=	34.49 cfs
Storm frequency	=	2 yrs	Time to peak	=	818 min
Time interval	=	2 min	Hyd. volume	=	630,308 cuft
Inflow hyd. No.	=	14 - Parkside Bain A1 Inflow	Max. Elevation	=	603.49 ft
Reservoir name	=	BASIN A1	Max. Storage	=	420,644 cuft

Storage Indication method used.



Pond Report

Pond No. 1 - BASIN A1

Pond Data

Contours -User-defined contour areas. Average end area method used for volume calculation. Begining Elevation = 601.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	601.00	62,767	0	0
1.00	602.00	126,224	94,496	94,496
1.50	602.50	232,937	89,790	184,286
2.00	603.00	237,423	117,590	301,876
3.00	604.00	246,471	241,947	543,823
4.00	605.00	279,202	262,837	806,659
5.00	606.00	289,970	284,586	1,091,245
6.00	607.00	298,355	294,163	1,385,408
7.00	608.00	301,306	299,830	1,685,238

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	Inactive	Inactive	Inactive	Inactive
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

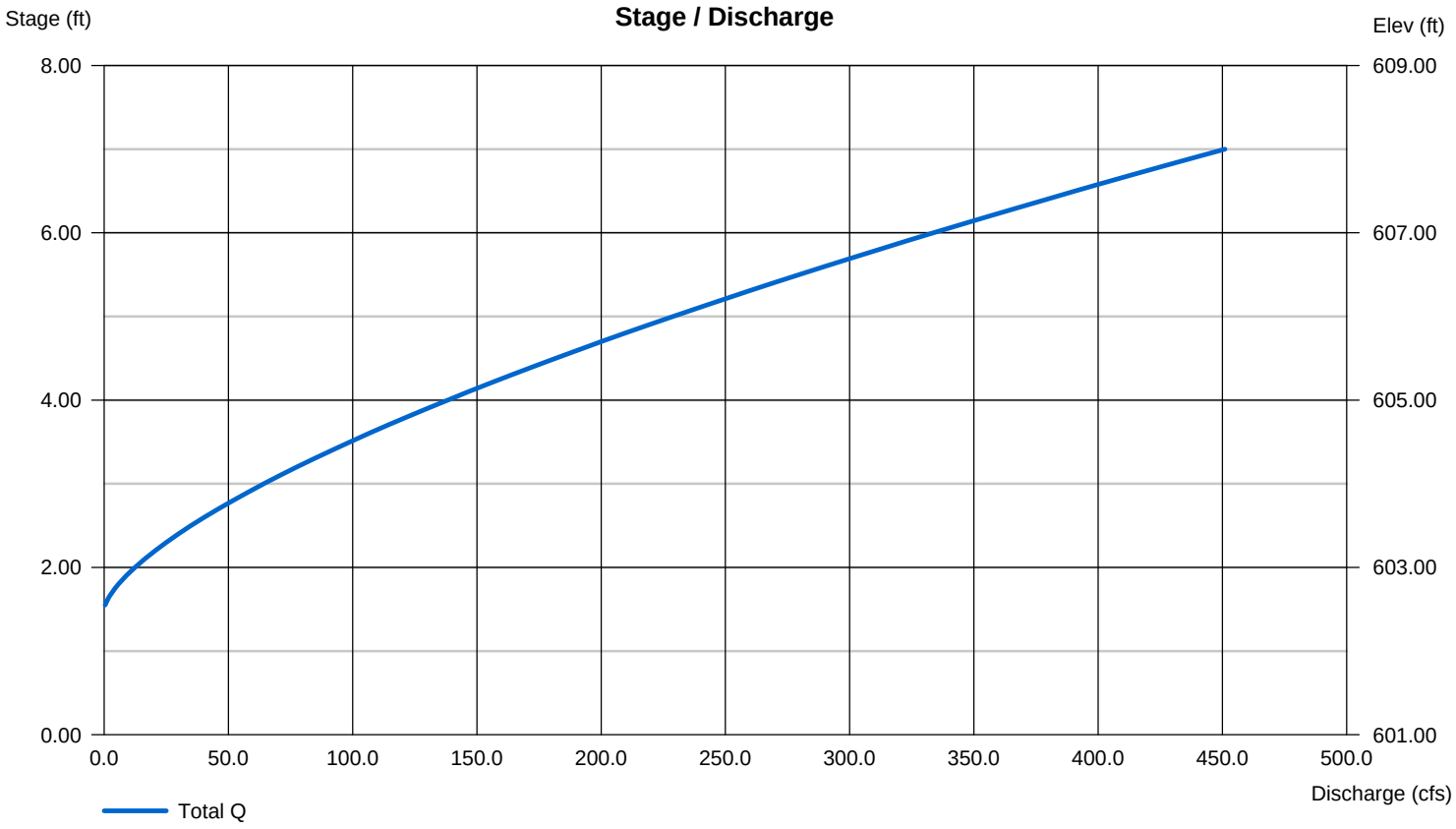
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 10.50	Inactive	Inactive	Inactive
Crest El. (ft)	= 602.50	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= Rect	---	---	---
Multi-Stage	= No	No	No	No

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

TW Elev. (ft) = 0.00

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

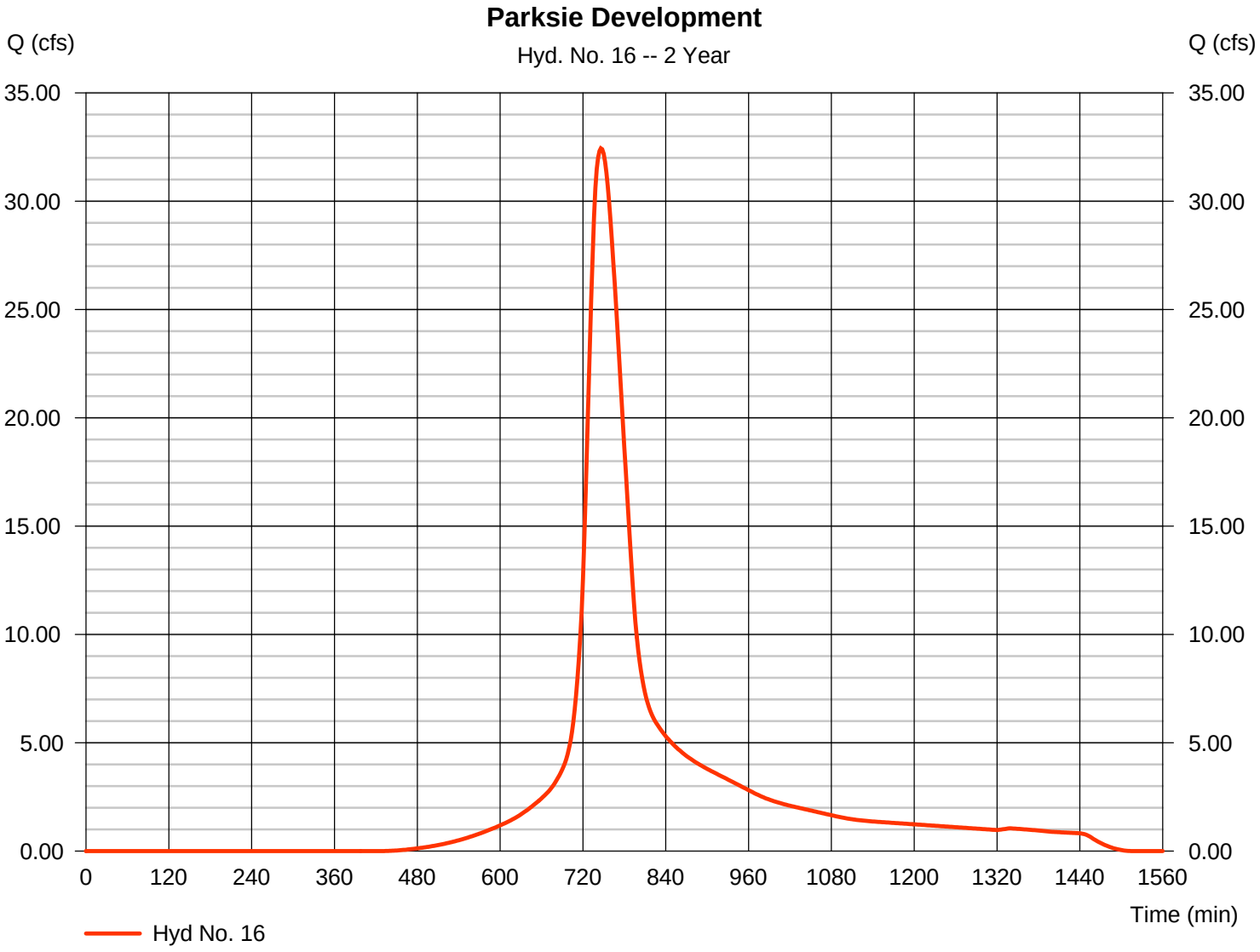


Hydrograph Report

Hyd. No. 16

Parksie Development

Hydrograph type	=	SCS Runoff	Peak discharge	=	32.44 cfs
Storm frequency	=	2 yrs	Time to peak	=	746 min
Time interval	=	2 min	Hyd. volume	=	223,227 cuft
Drainage area	=	29.940 ac	Curve number	=	87
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	28.50 min
Total precip.	=	3.34 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	300

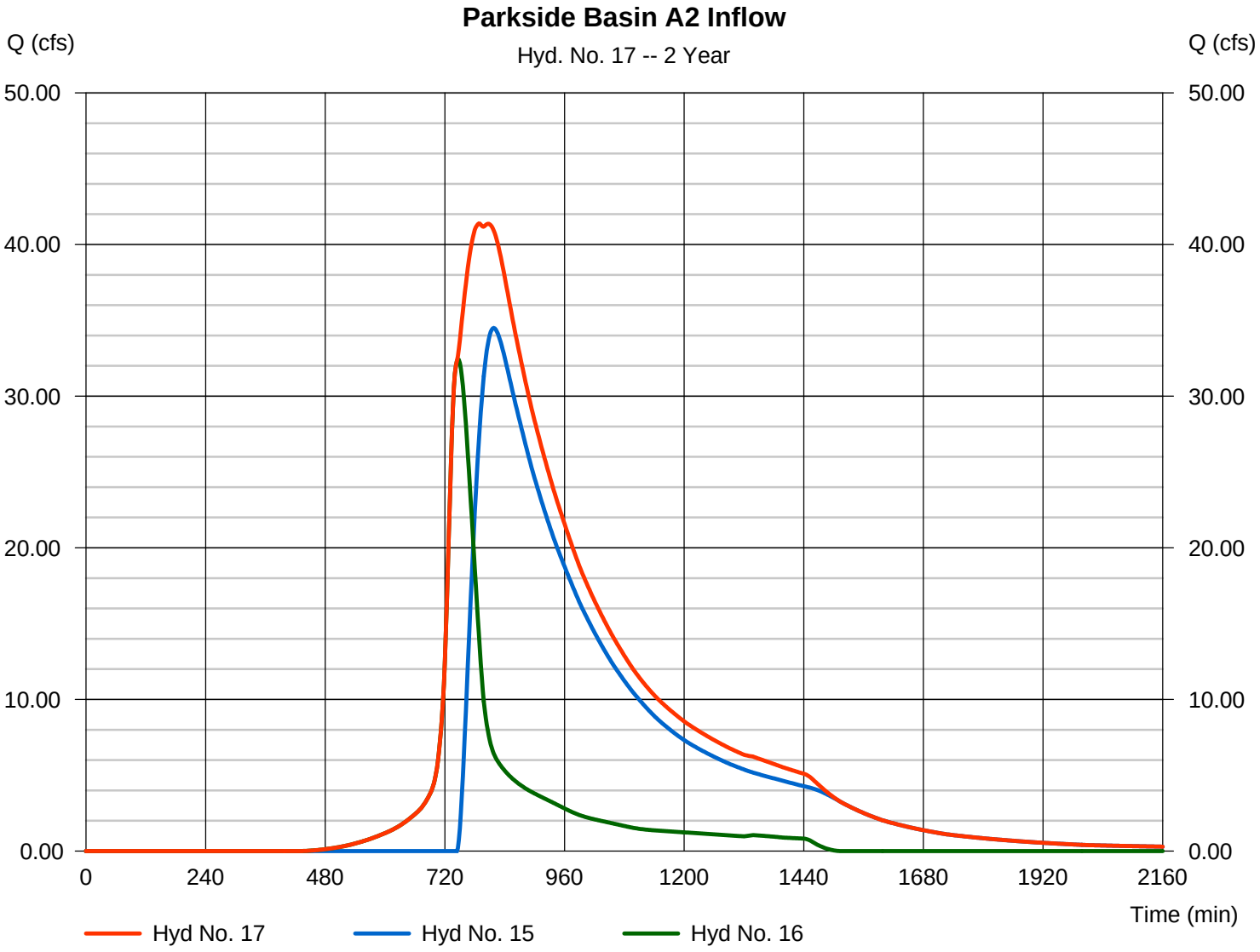


Hydrograph Report

Hyd. No. 17

Parkside Basin A2 Inflow

Hydrograph type	=	Combine	Peak discharge	=	41.38 cfs
Storm frequency	=	2 yrs	Time to peak	=	788 min
Time interval	=	2 min	Hyd. volume	=	853,535 cuft
Inflow hyds.	=	15, 16	Contrib. drain. area	=	29.940 ac



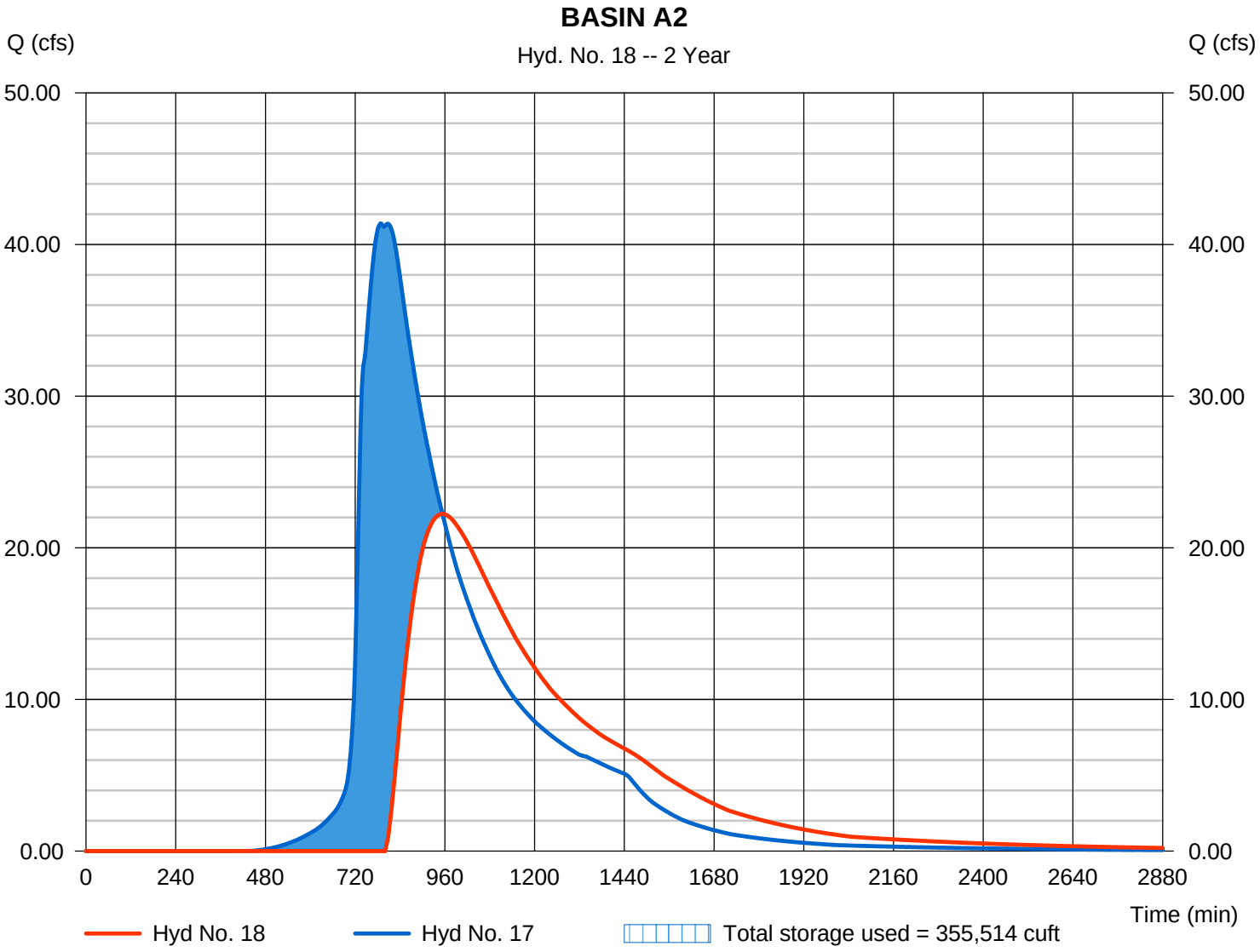
Hydrograph Report

Hyd. No. 18

BASIN A2

Hydrograph type	=	Reservoir	Peak discharge	=	22.24 cfs
Storm frequency	=	2 yrs	Time to peak	=	954 min
Time interval	=	2 min	Hyd. volume	=	660,659 cuft
Inflow hyd. No.	=	17 - Parkside Basin A2 Inflow	Max. Elevation	=	600.82 ft
Reservoir name	=	BASIN A2	Max. Storage	=	355,514 cuft

Storage Indication method used.



Pond Report

Pond No. 2 - BASIN A2

Pond Data

Contours -User-defined contour areas. Average end area method used for volume calculation. Begining Elevation = 599.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	599.00	190,080	0	0
1.00	600.00	195,630	192,855	192,855
2.00	601.00	201,440	198,535	391,390
3.00	602.00	207,077	204,259	595,649
4.00	603.00	212,770	209,924	805,572
5.00	604.00	218,520	215,645	1,021,217
6.00	605.00	224,327	221,424	1,242,641
7.00	606.00	230,190	227,258	1,469,899

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	Inactive	Inactive	Inactive	Inactive
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

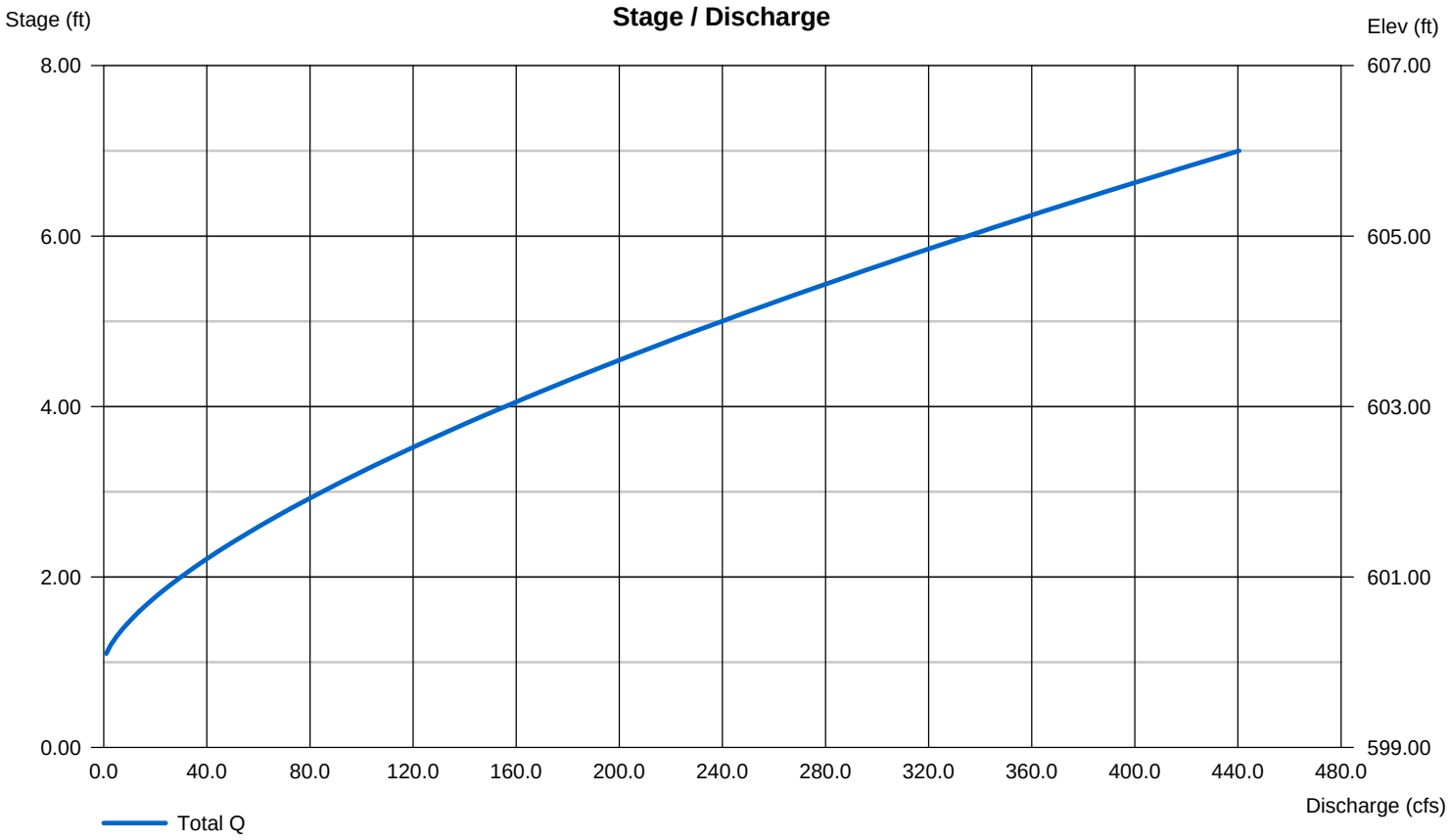
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 9.00	Inactive	Inactive	Inactive
Crest El. (ft)	= 600.00	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= Rect	---	---	---
Multi-Stage	= No	No	No	No

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

TW Elev. (ft) = 0.00

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

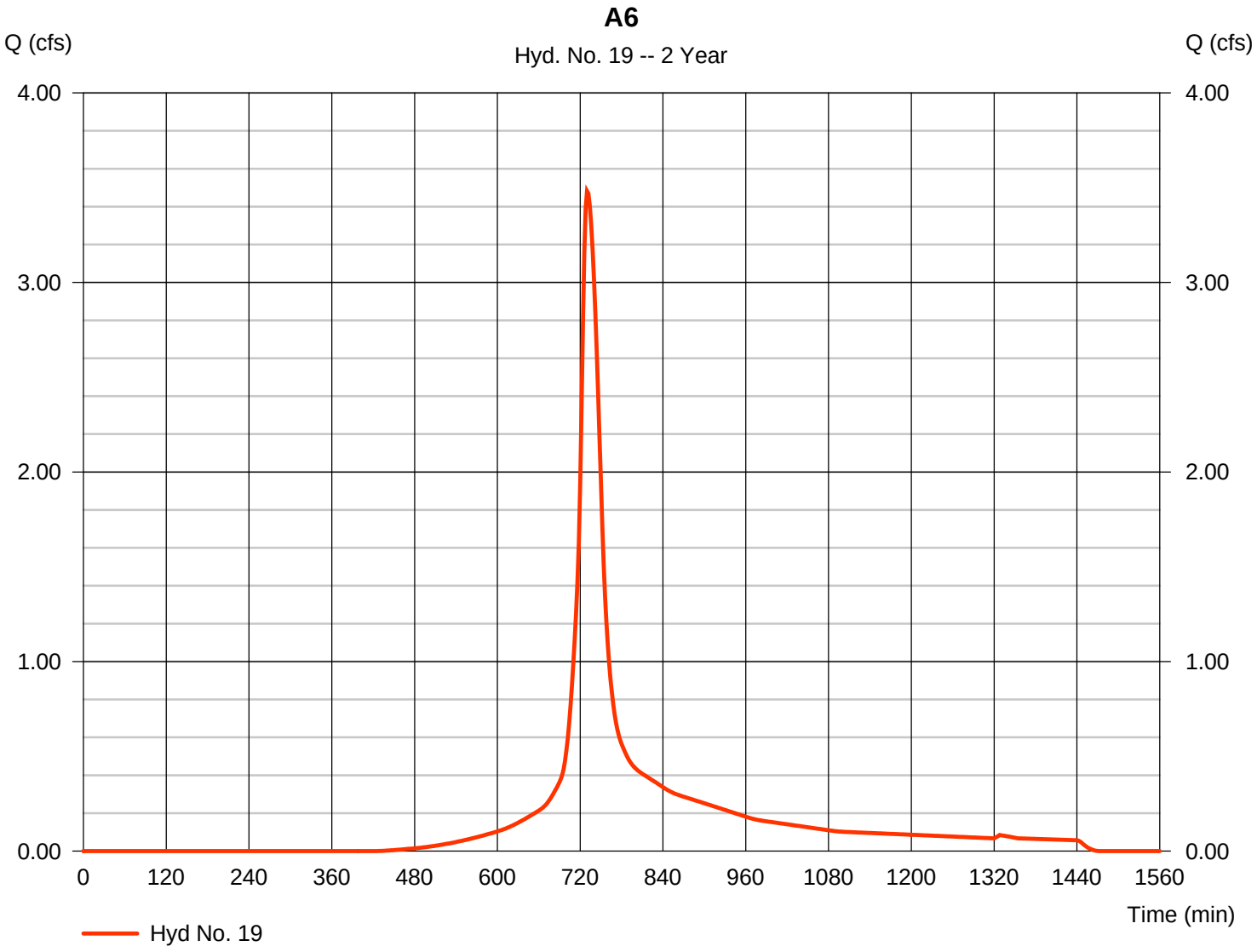


Hydrograph Report

Hyd. No. 19

A6

Hydrograph type	=	SCS Runoff	Peak discharge	=	3.482 cfs
Storm frequency	=	2 yrs	Time to peak	=	730 min
Time interval	=	2 min	Hyd. volume	=	16,087 cuft
Drainage area	=	2.200 ac	Curve number	=	87
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	10.00 min
Total precip.	=	3.34 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	300

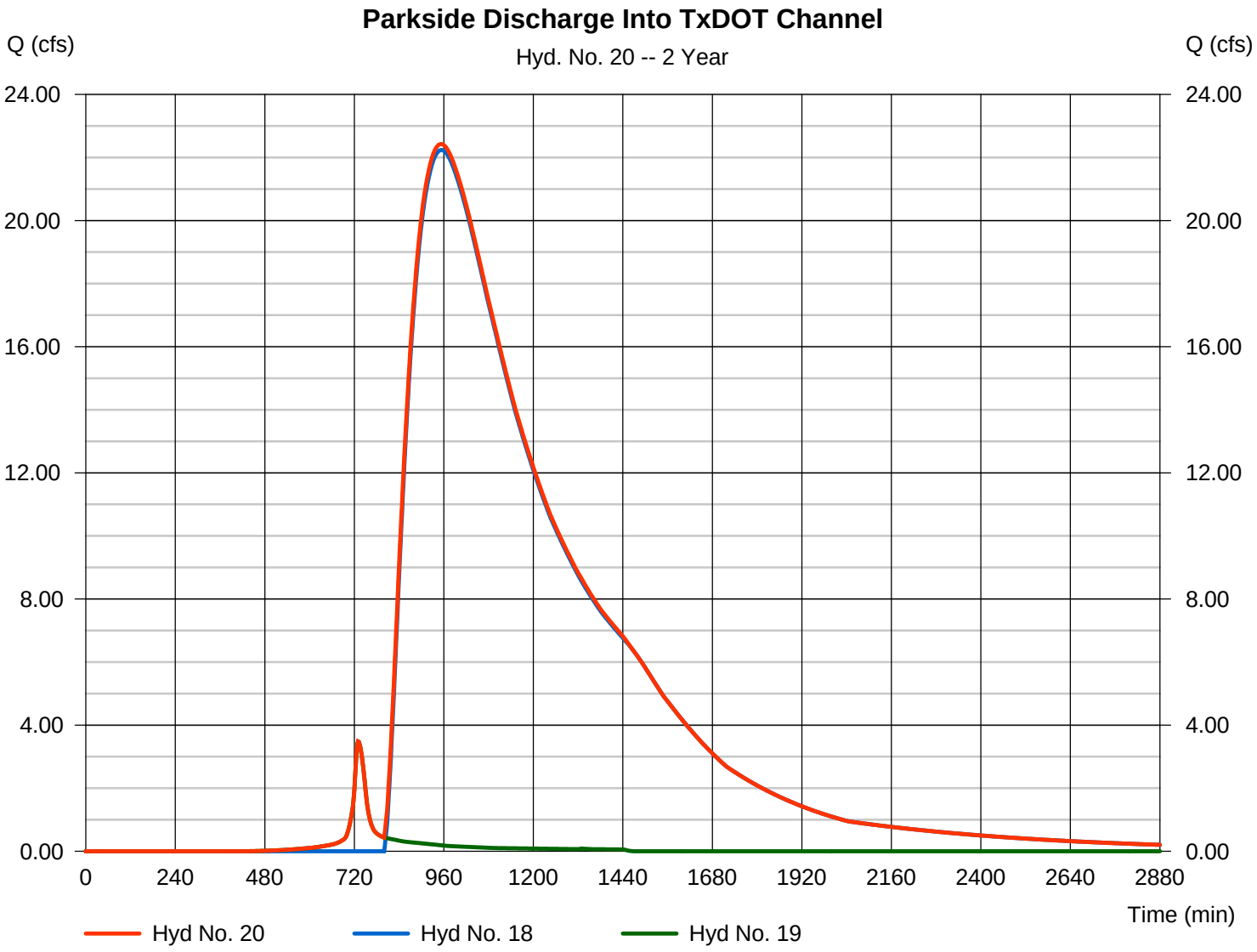


Hydrograph Report

Hyd. No. 20

Parkside Discharge Into TxDOT Channel

Hydrograph type	= Combine	Peak discharge	= 22.43 cfs
Storm frequency	= 2 yrs	Time to peak	= 952 min
Time interval	= 2 min	Hyd. volume	= 676,746 cuft
Inflow hyds.	= 18, 19	Contrib. drain. area	= 2.200 ac

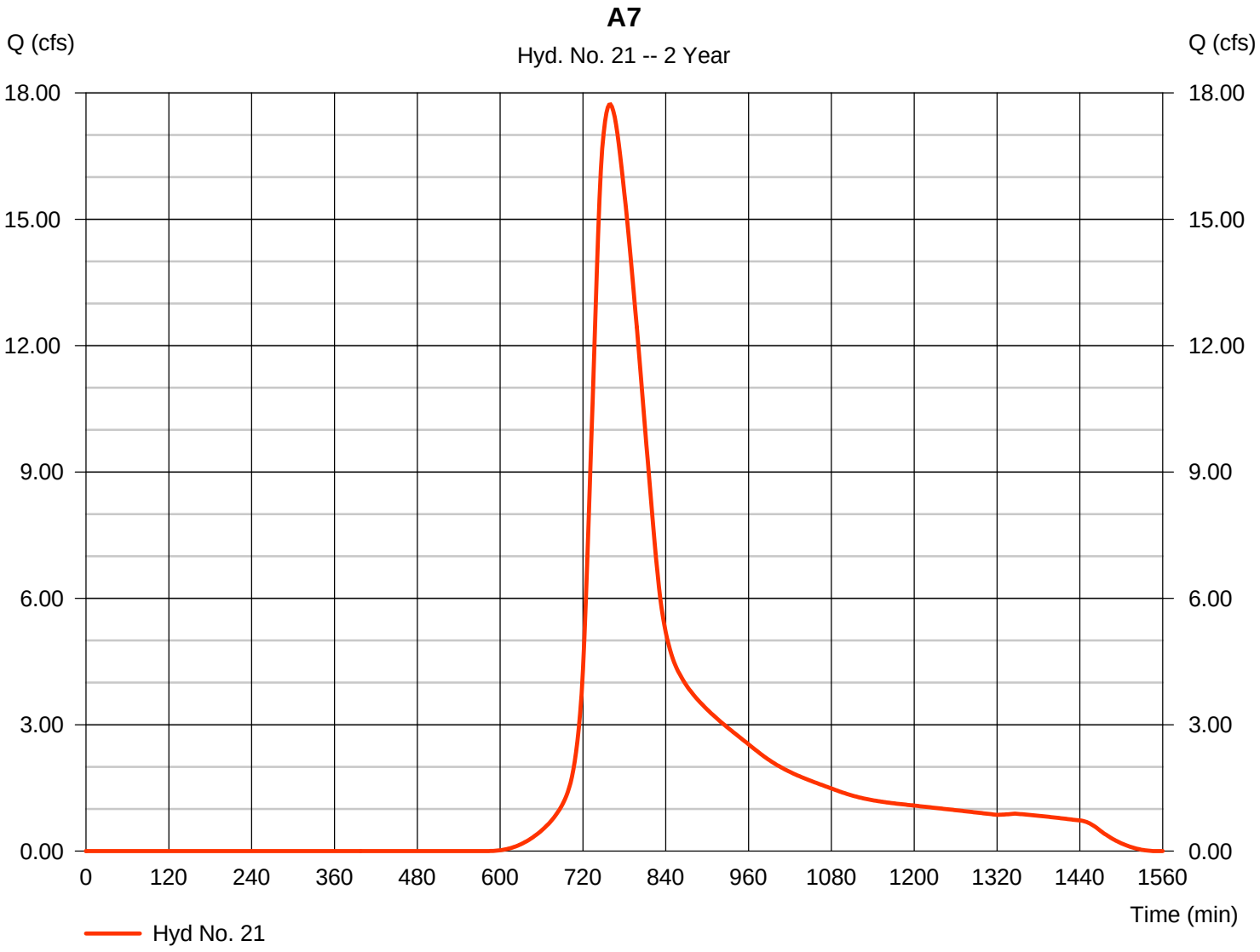


Hydrograph Report

Hyd. No. 21

A7

Hydrograph type	=	SCS Runoff	Peak discharge	=	17.72 cfs
Storm frequency	=	2 yrs	Time to peak	=	760 min
Time interval	=	2 min	Hyd. volume	=	155,688 cuft
Drainage area	=	31.110 ac	Curve number	=	78
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	40.80 min
Total precip.	=	3.34 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	300

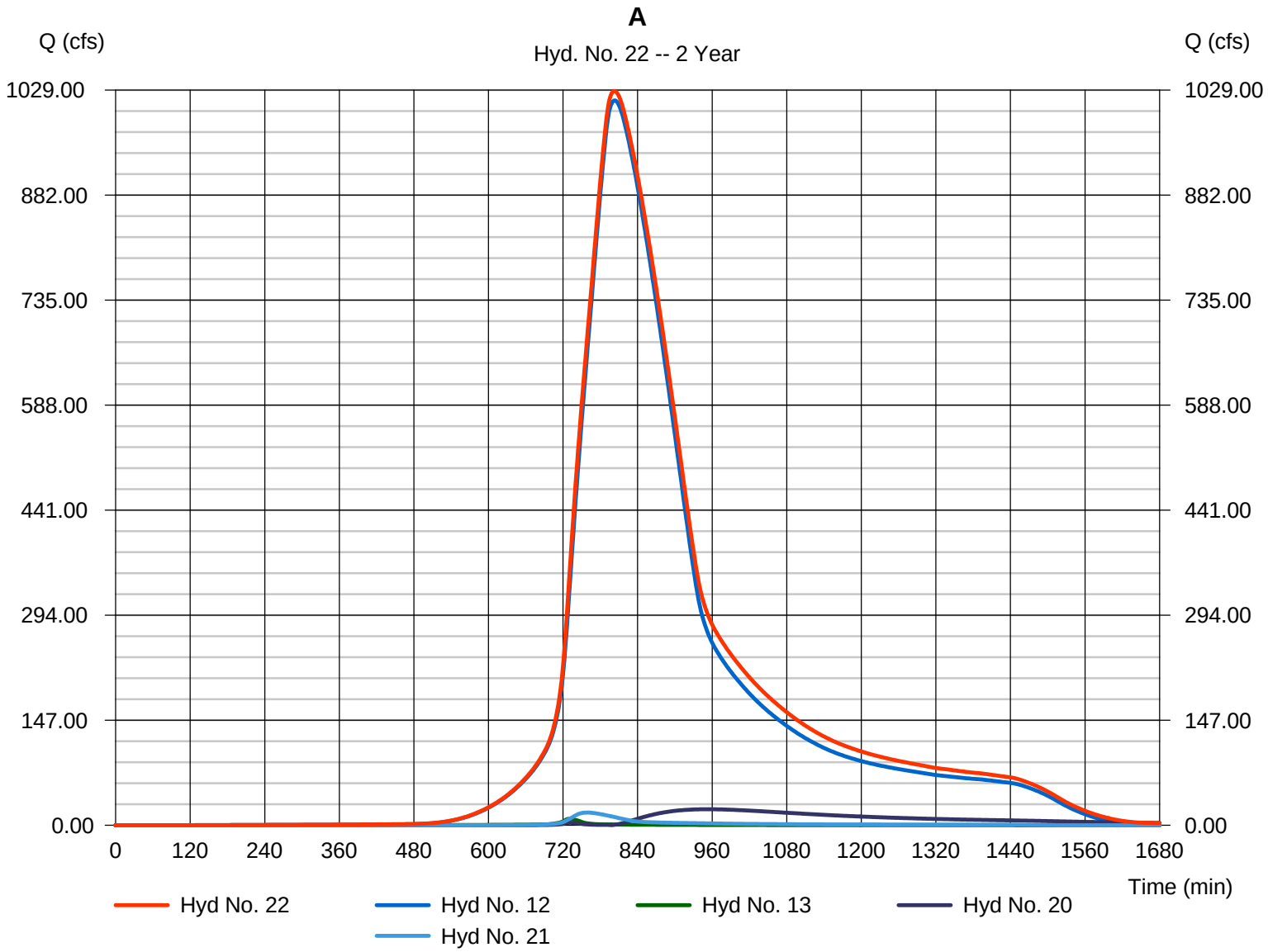


Hydrograph Report

Hyd. No. 22

A

Hydrograph type	=	Combine	Peak discharge	=	1027.52 cfs
Storm frequency	=	2 yrs	Time to peak	=	802 min
Time interval	=	2 min	Hyd. volume	=	14,463,030 cuft
Inflow hyds.	=	12, 13, 20, 21	Contrib. drain. area	=	35.560 ac



Hydrograph Summary Report

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

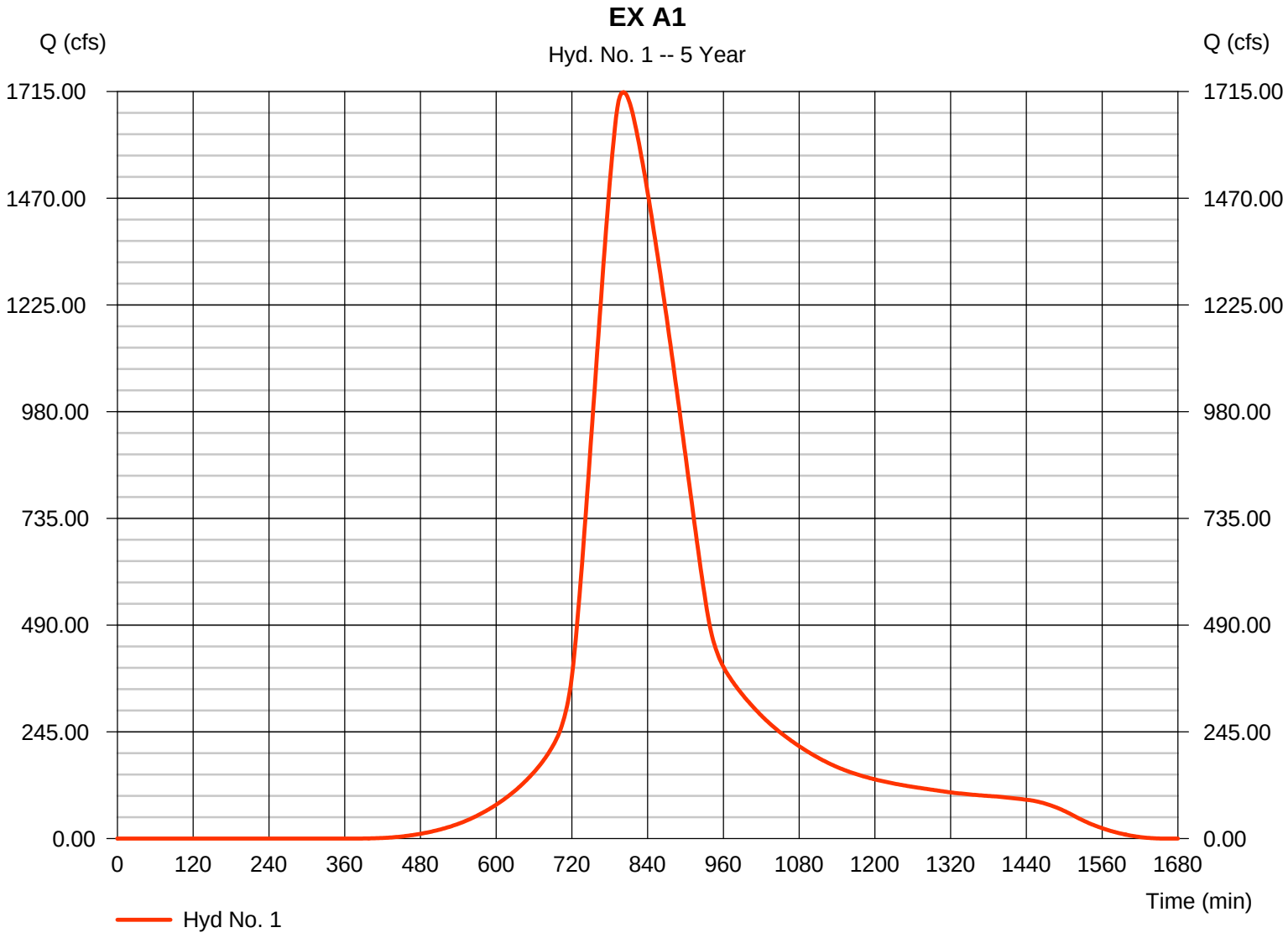
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	1713.53	2	802	22,423,310	------	------	------	EX A1
2	SCS Runoff	56.38	2	742	369,381	------	------	------	EX A2
3	SCS Runoff	137.54	2	762	1,127,021	------	------	------	EX A3
4	Combine	1812.75	2	798	23,919,710	1, 2, 3	------	------	EX A1 - EX A3
5	SCS Runoff	16.88	2	728	68,971	------	------	------	EX A4
6	SCS Runoff	27.69	2	764	234,998	------	------	------	EX A5
7	SCS Runoff	43.33	2	752	292,549	------	------	------	EX A6
8	Combine	1848.80	2	798	24,516,240	4, 5, 6, 7	------	------	EX A
9	SCS Runoff	1713.53	2	802	22,423,310	------	------	------	A1
10	SCS Runoff	56.38	2	742	369,381	------	------	------	A2
11	SCS Runoff	62.43	2	738	328,968	------	------	------	A3
12	Combine	1732.33	2	802	23,121,660	9, 10, 11	------	------	A1-A3
13	SCS Runoff	13.54	2	730	66,069	------	------	------	A4
14	SCS Runoff	166.09	2	752	1,361,220	------	------	------	Parkside Bain A1 Inflow
15	Reservoir	81.81	2	804	1,176,901	14	604.26	612,736	A1-A9 + Basin A1
16	SCS Runoff	53.73	2	746	373,008	------	------	------	Parksie Development
17	Combine	101.43	2	780	1,549,909	15, 16	------	------	Parkside Basin A2 Inflow
18	Reservoir	61.62	2	868	1,357,034	17	601.62	517,379	BASIN A2
19	SCS Runoff	5.770	2	730	26,882	------	------	------	A6
20	Combine	62.06	2	868	1,383,915	18, 19	------	------	Parkside Discharge Into TxDOT Chan
21	SCS Runoff	33.92	2	758	290,371	------	------	------	A7
22	Combine	1791.00	2	802	24,861,890	12, 13, 20, 21	------	------	A

Hydrograph Report

Hyd. No. 1

EX A1

Hydrograph type	=	SCS Runoff	Peak discharge	=	1713.53 cfs
Storm frequency	=	5 yrs	Time to peak	=	802 min
Time interval	=	2 min	Hyd. volume	=	22,423,310 cuft
Drainage area	=	1906.930 ac	Curve number	=	85.3
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	122.30 min
Total precip.	=	4.83 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	434

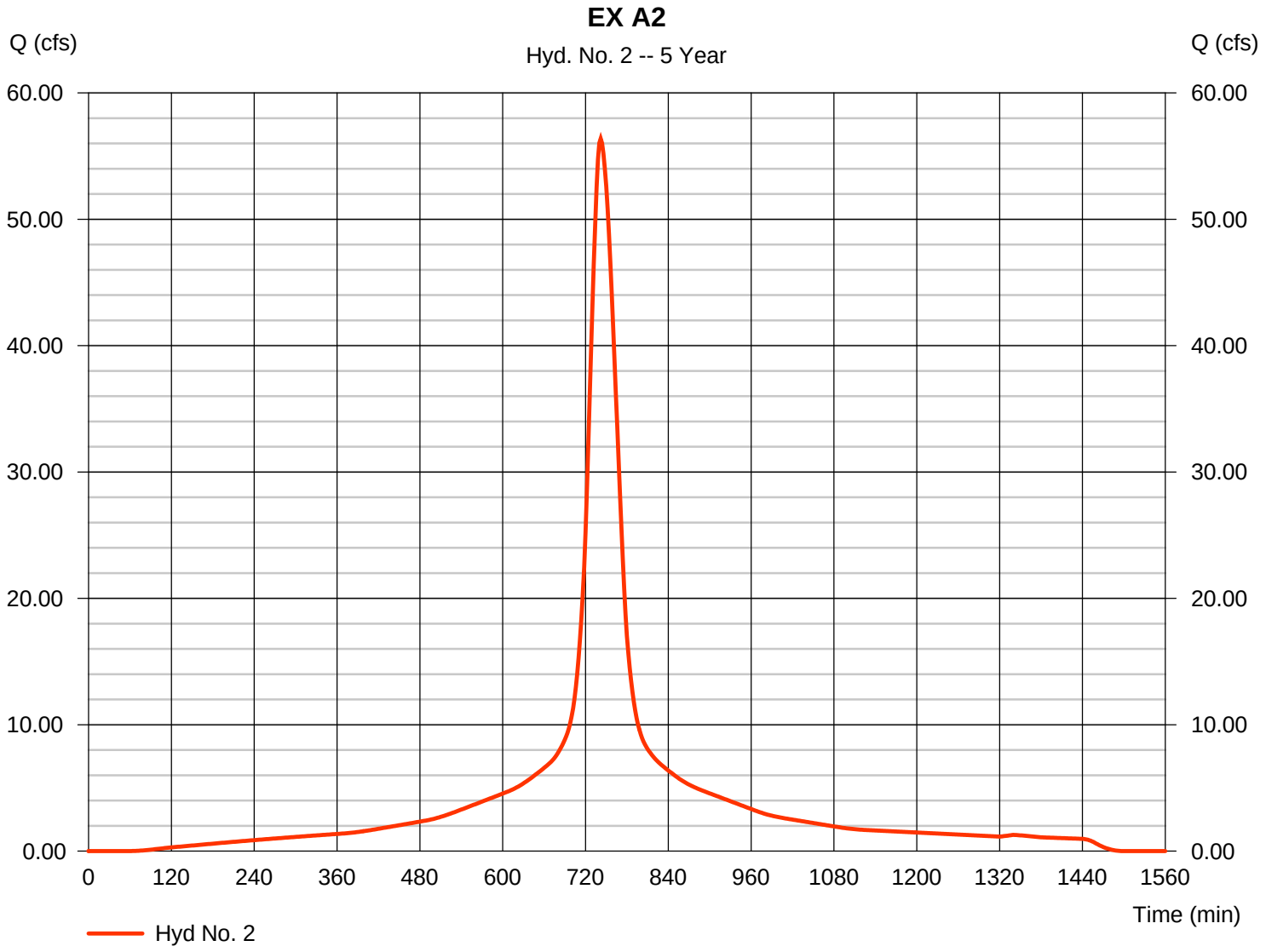


Hydrograph Report

Hyd. No. 2

EX A2

Hydrograph type	=	SCS Runoff	Peak discharge	=	56.38 cfs
Storm frequency	=	5 yrs	Time to peak	=	742 min
Time interval	=	2 min	Hyd. volume	=	369,381 cuft
Drainage area	=	21.960 ac	Curve number	=	98
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	32.00 min
Total precip.	=	4.83 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	434

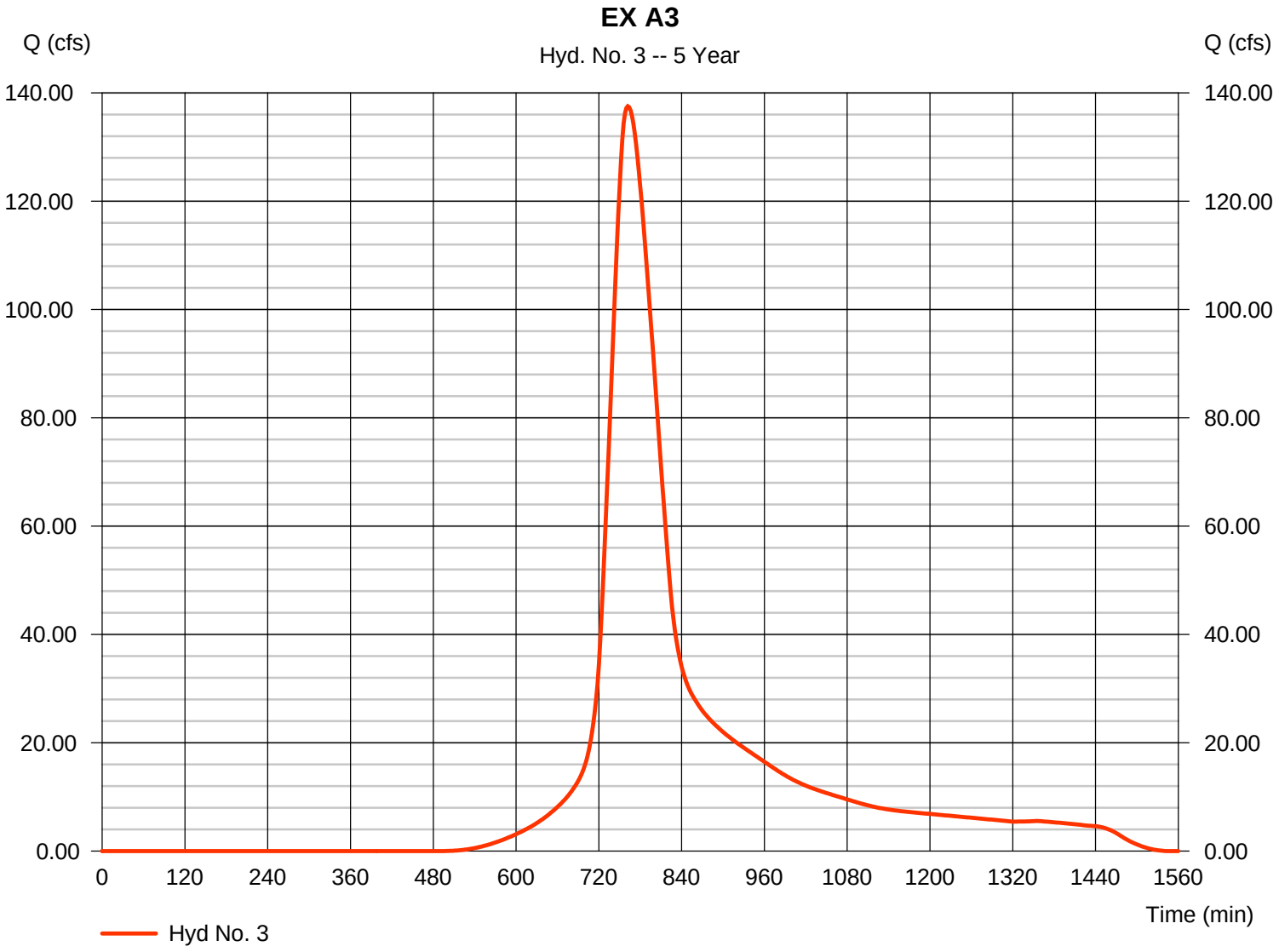


Hydrograph Report

Hyd. No. 3

EX A3

Hydrograph type	=	SCS Runoff	Peak discharge	=	137.54 cfs
Storm frequency	=	5 yrs	Time to peak	=	762 min
Time interval	=	2 min	Hyd. volume	=	1,127,021 cuft
Drainage area	=	117.840 ac	Curve number	=	78.5
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	59.60 min
Total precip.	=	4.83 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	434

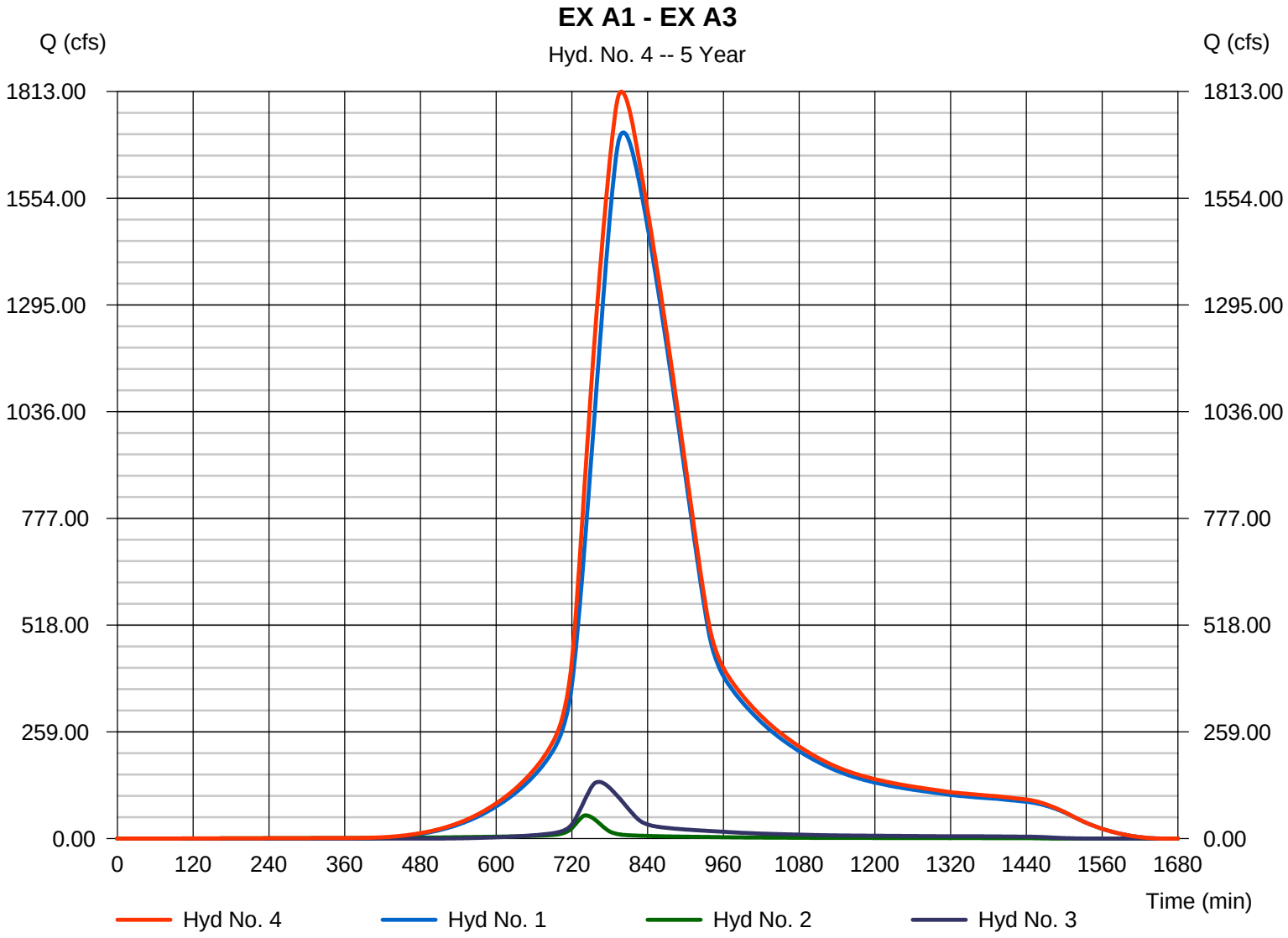


Hydrograph Report

Hyd. No. 4

EX A1 - EX A3

Hydrograph type	=	Combine	Peak discharge	=	1812.75 cfs
Storm frequency	=	5 yrs	Time to peak	=	798 min
Time interval	=	2 min	Hyd. volume	=	23,919,710 cuft
Inflow hyds.	=	1, 2, 3	Contrib. drain. area	=	2046.730 ac

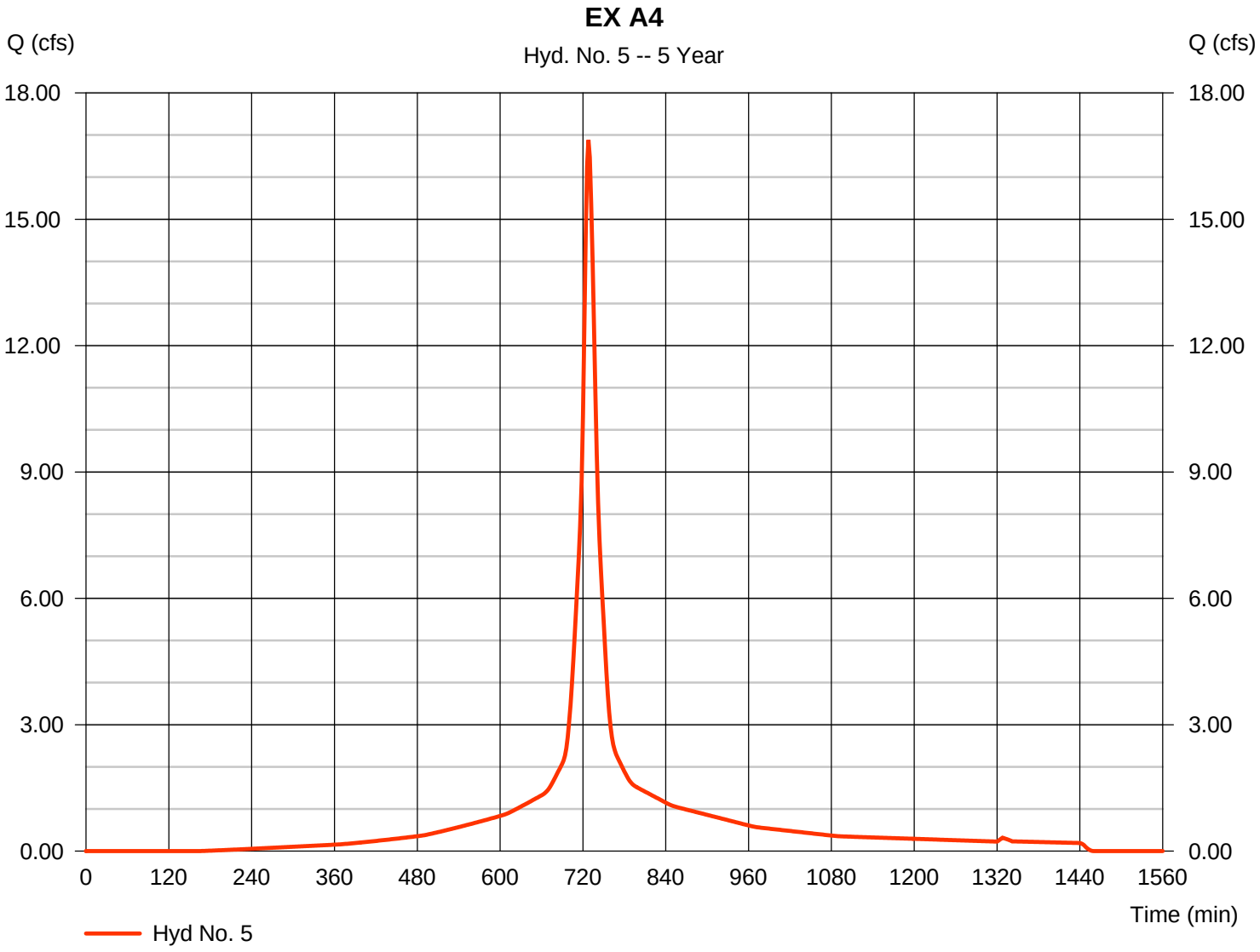


Hydrograph Report

Hyd. No. 5

EX A4

Hydrograph type	=	SCS Runoff	Peak discharge	=	16.88 cfs
Storm frequency	=	5 yrs	Time to peak	=	728 min
Time interval	=	2 min	Hyd. volume	=	68,971 cuft
Drainage area	=	4.450 ac	Curve number	=	94
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	10.00 min
Total precip.	=	4.83 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484

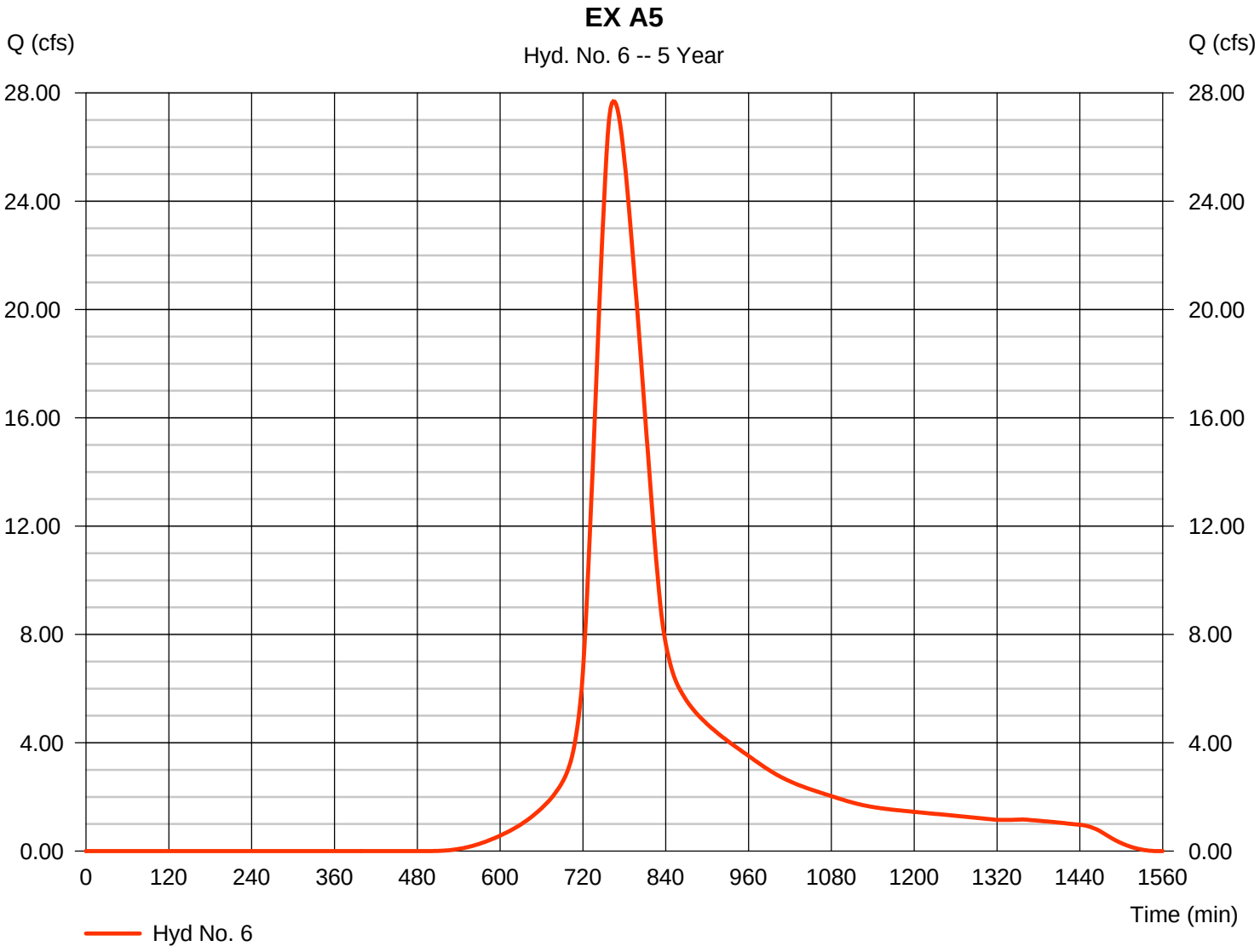


Hydrograph Report

Hyd. No. 6

EX A5

Hydrograph type	=	SCS Runoff	Peak discharge	=	27.69 cfs
Storm frequency	=	5 yrs	Time to peak	=	764 min
Time interval	=	2 min	Hyd. volume	=	234,998 cuft
Drainage area	=	24.990 ac	Curve number	=	78
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	63.10 min
Total precip.	=	4.83 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	434

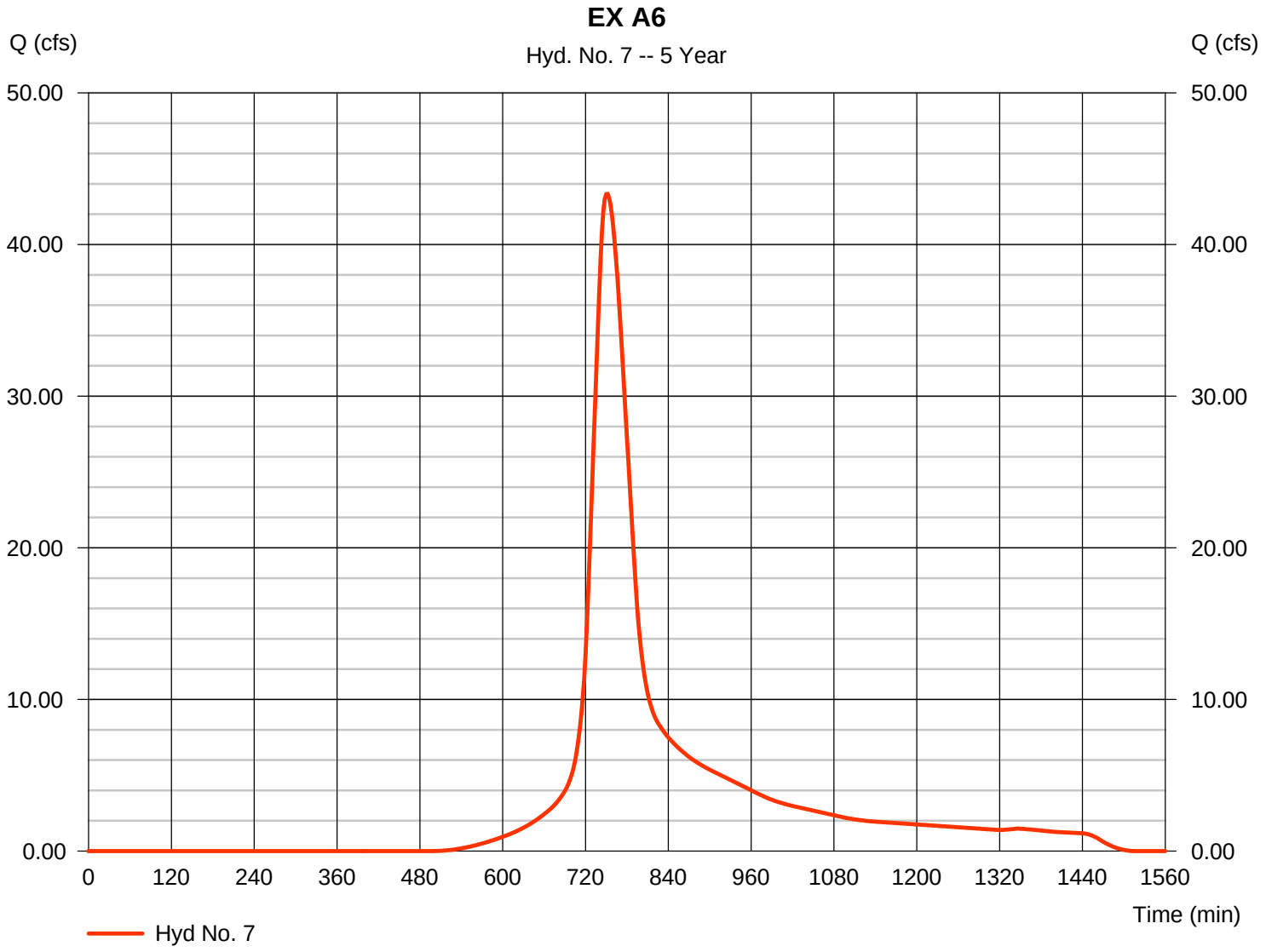


Hydrograph Report

Hyd. No. 7

EX A6

Hydrograph type	=	SCS Runoff	Peak discharge	=	43.33 cfs
Storm frequency	=	5 yrs	Time to peak	=	752 min
Time interval	=	2 min	Hyd. volume	=	292,549 cuft
Drainage area	=	31.110 ac	Curve number	=	78
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	40.80 min
Total precip.	=	4.83 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	434

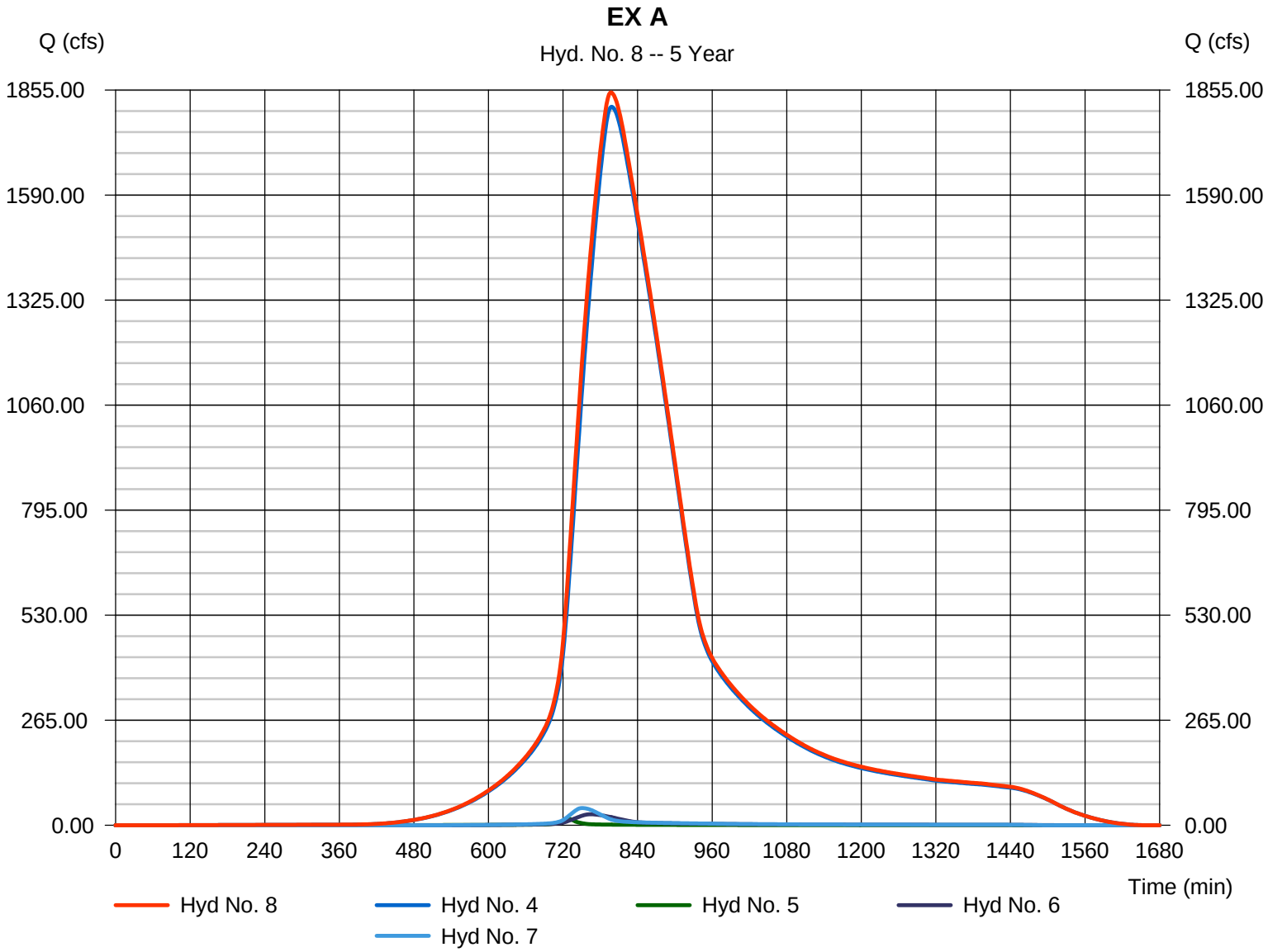


Hydrograph Report

Hyd. No. 8

EX A

Hydrograph type	=	Combine	Peak discharge	=	1848.80 cfs
Storm frequency	=	5 yrs	Time to peak	=	798 min
Time interval	=	2 min	Hyd. volume	=	24,516,240 cuft
Inflow hyds.	=	4, 5, 6, 7	Contrib. drain. area	=	60.550 ac

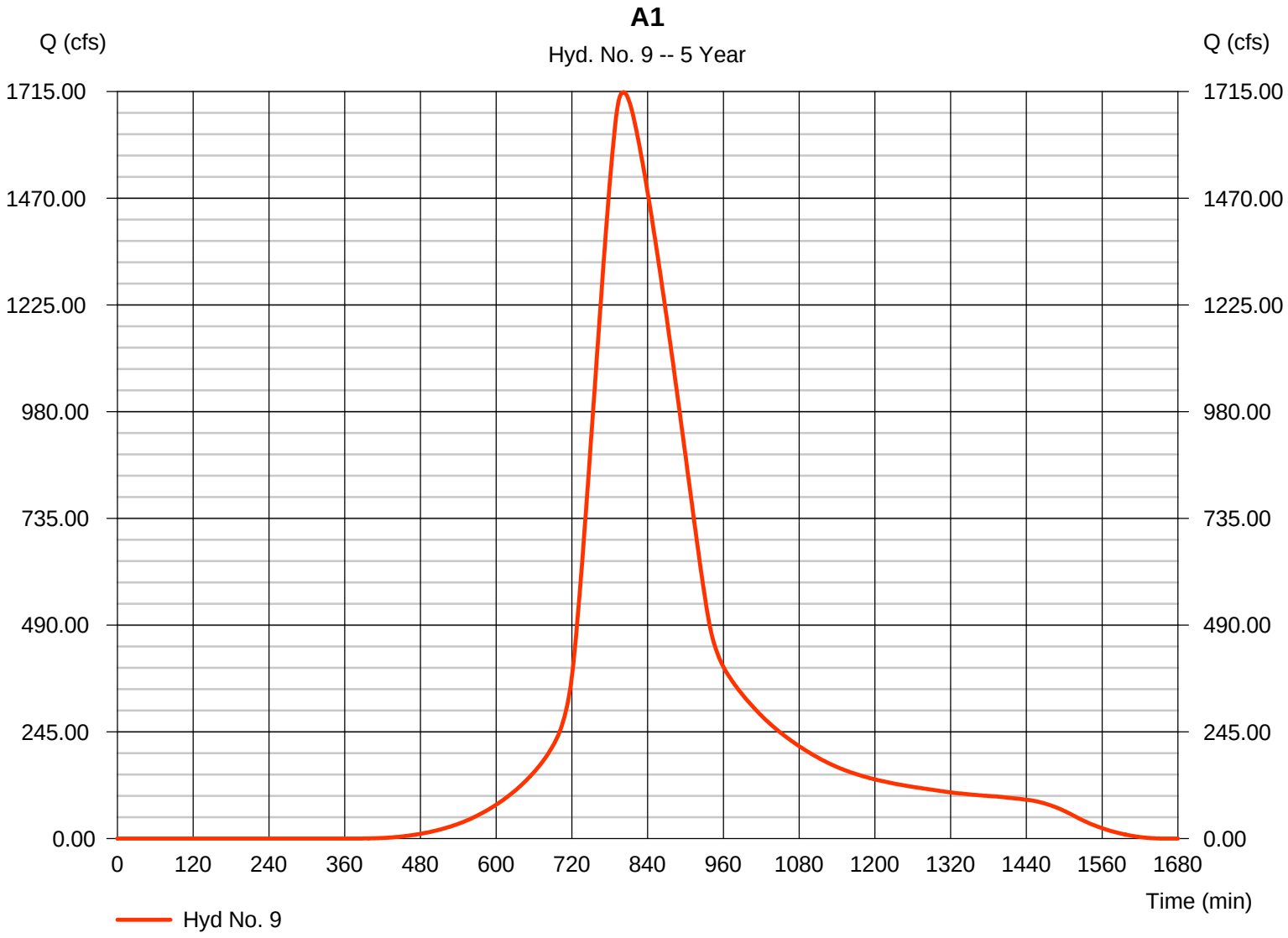


Hydrograph Report

Hyd. No. 9

A1

Hydrograph type	=	SCS Runoff	Peak discharge	=	1713.53 cfs
Storm frequency	=	5 yrs	Time to peak	=	802 min
Time interval	=	2 min	Hyd. volume	=	22,423,310 cuft
Drainage area	=	1906.930 ac	Curve number	=	85.3
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	122.30 min
Total precip.	=	4.83 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	434

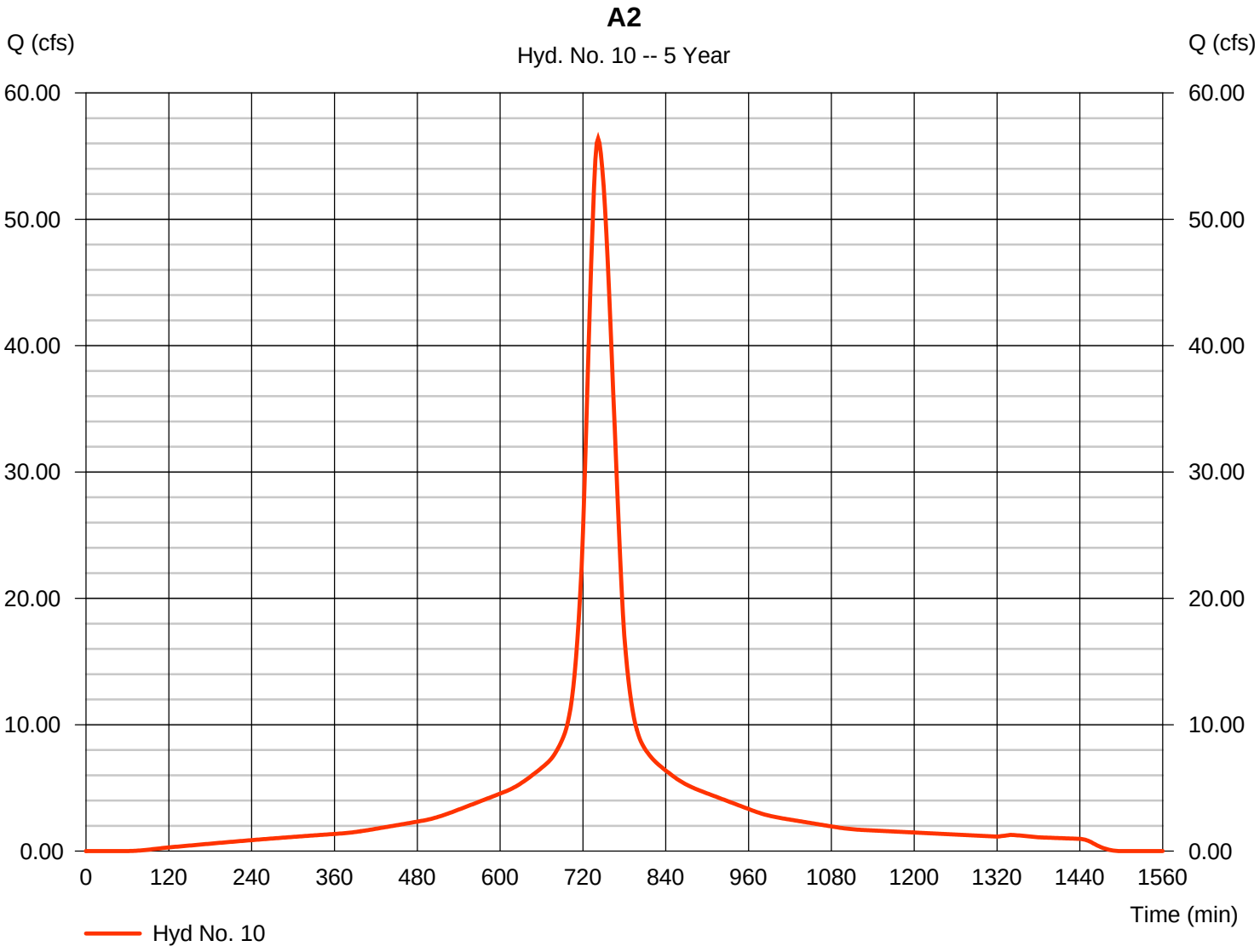


Hydrograph Report

Hyd. No. 10

A2

Hydrograph type	=	SCS Runoff	Peak discharge	=	56.38 cfs
Storm frequency	=	5 yrs	Time to peak	=	742 min
Time interval	=	2 min	Hyd. volume	=	369,381 cuft
Drainage area	=	21.960 ac	Curve number	=	98
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	32.00 min
Total precip.	=	4.83 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	434

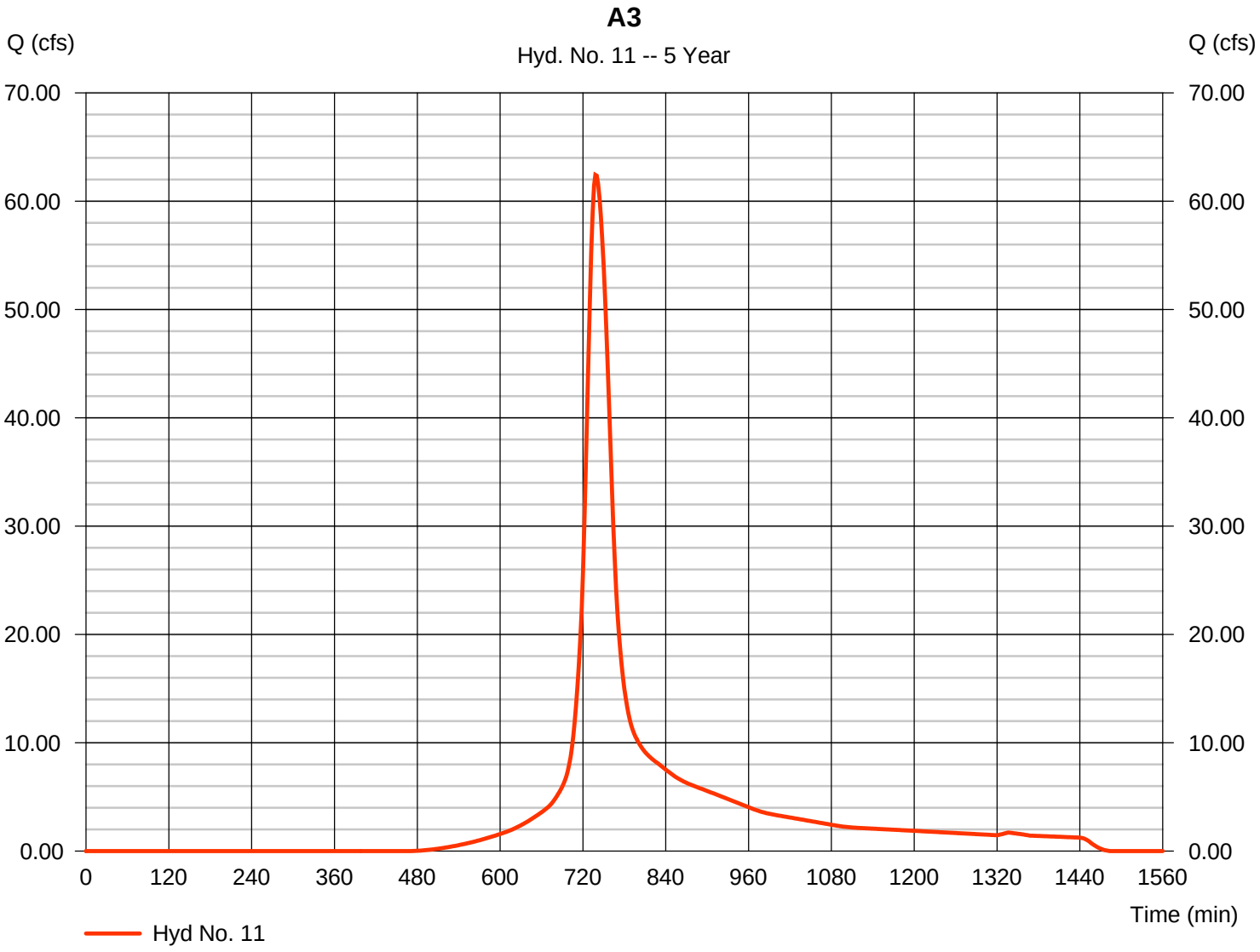


Hydrograph Report

Hyd. No. 11

A3

Hydrograph type	=	SCS Runoff	Peak discharge	=	62.43 cfs
Storm frequency	=	5 yrs	Time to peak	=	738 min
Time interval	=	2 min	Hyd. volume	=	328,968 cuft
Drainage area	=	33.050 ac	Curve number	=	79.7
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	25.60 min
Total precip.	=	4.83 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	434

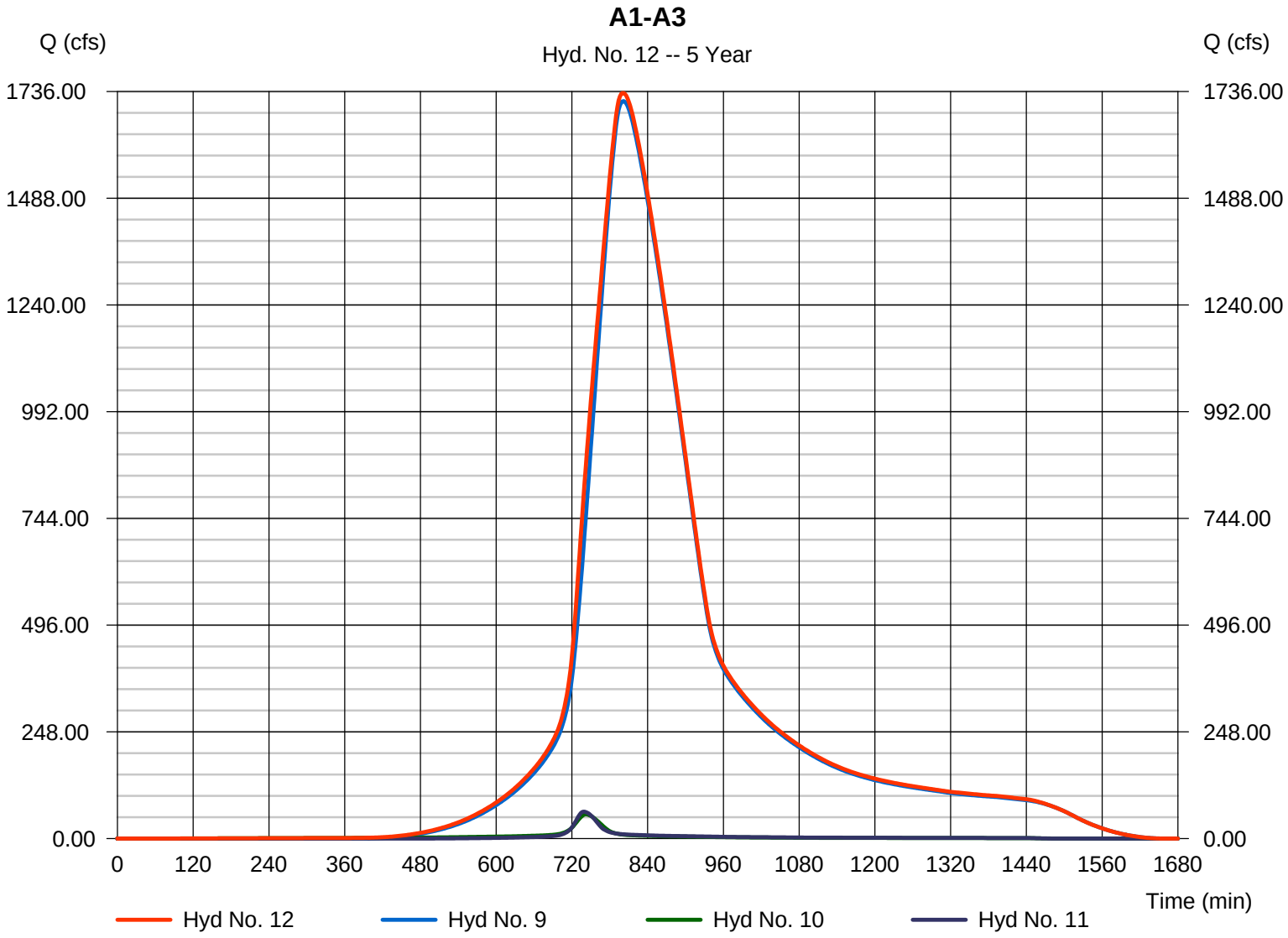


Hydrograph Report

Hyd. No. 12

A1-A3

Hydrograph type	=	Combine	Peak discharge	=	1732.33 cfs
Storm frequency	=	5 yrs	Time to peak	=	802 min
Time interval	=	2 min	Hyd. volume	=	23,121,660 cuft
Inflow hyds.	=	9, 10, 11	Contrib. drain. area	=	1961.940 ac

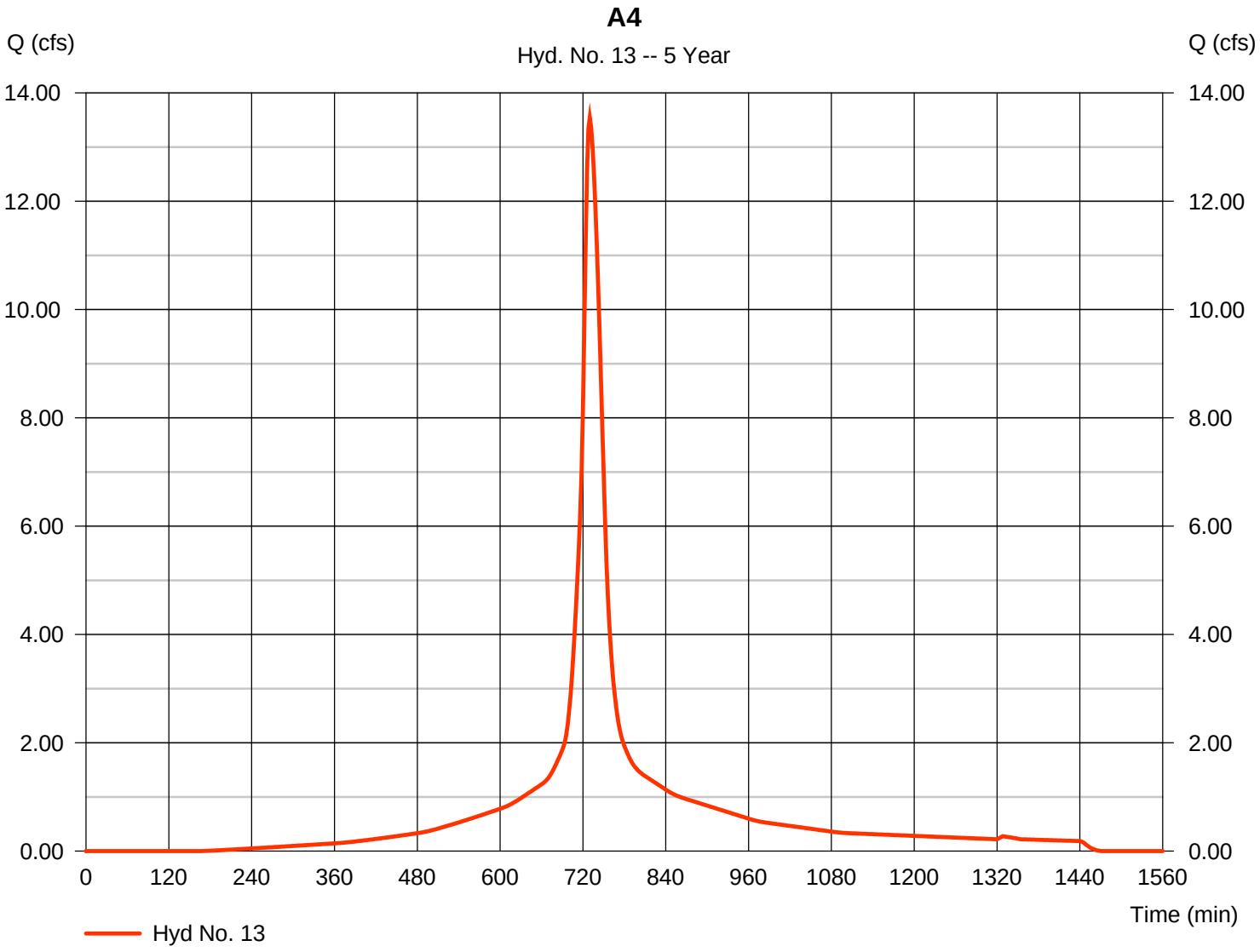


Hydrograph Report

Hyd. No. 13

A4

Hydrograph type	=	SCS Runoff	Peak discharge	=	13.54 cfs
Storm frequency	=	5 yrs	Time to peak	=	730 min
Time interval	=	2 min	Hyd. volume	=	66,069 cuft
Drainage area	=	4.450 ac	Curve number	=	94
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	10.00 min
Total precip.	=	4.83 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	300

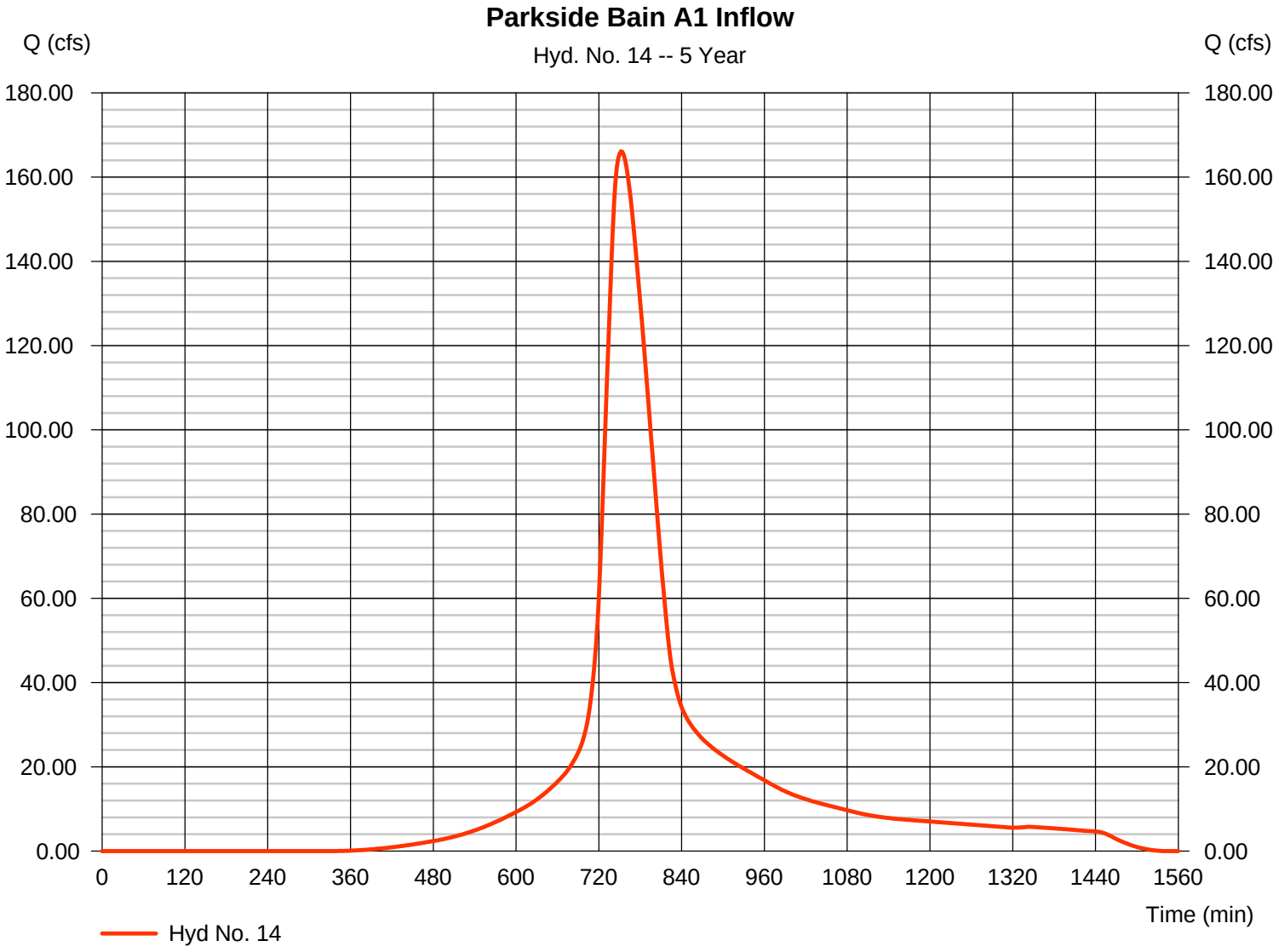


Hydrograph Report

Hyd. No. 14

Parkside Bain A1 Inflow

Hydrograph type	=	SCS Runoff	Peak discharge	=	166.09 cfs
Storm frequency	=	5 yrs	Time to peak	=	752 min
Time interval	=	2 min	Hyd. volume	=	1,361,220 cuft
Drainage area	=	109.260 ac	Curve number	=	87
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	37.90 min
Total precip.	=	4.83 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	300



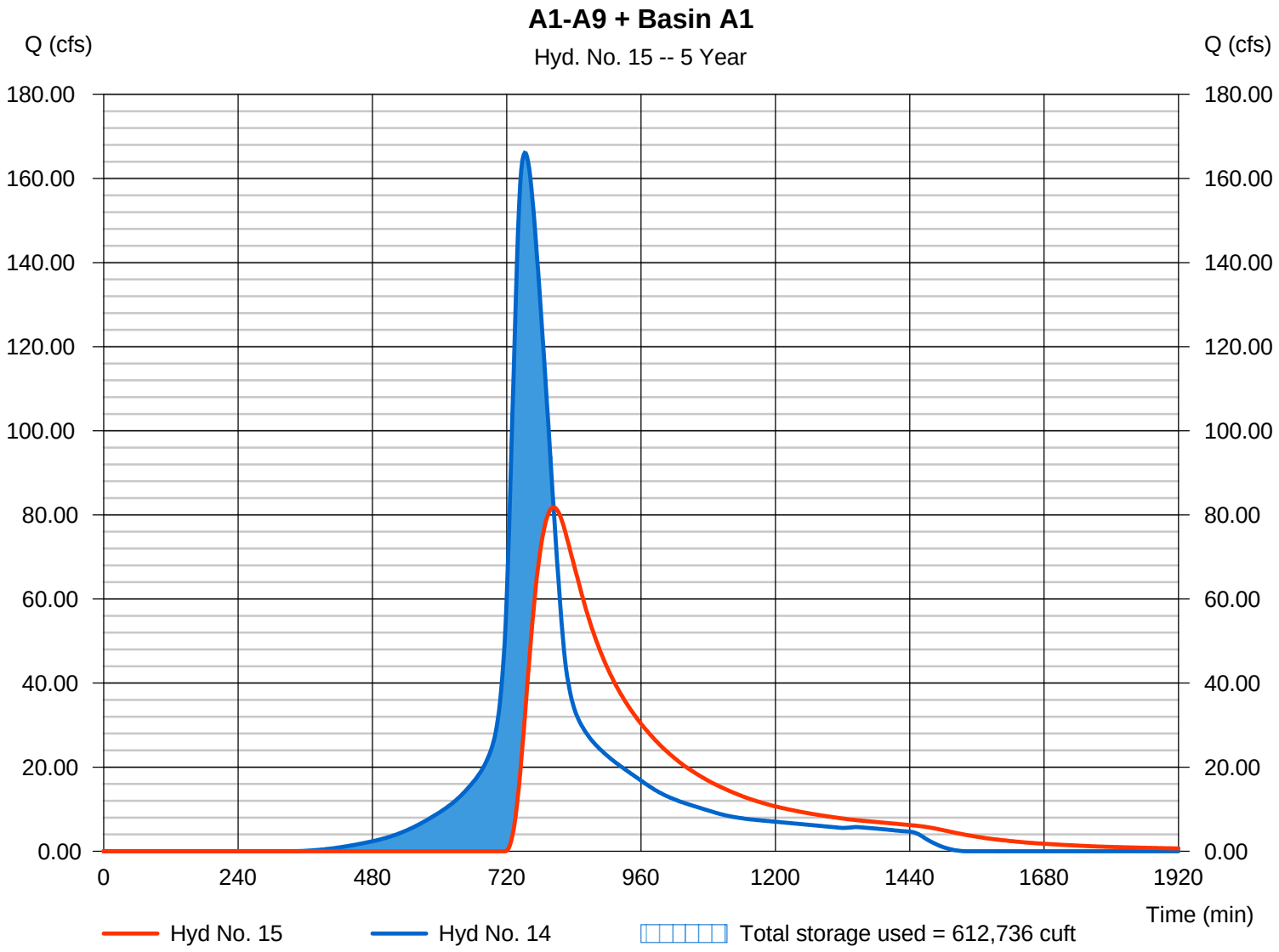
Hydrograph Report

Hyd. No. 15

A1-A9 + Basin A1

Hydrograph type	=	Reservoir	Peak discharge	=	81.81 cfs
Storm frequency	=	5 yrs	Time to peak	=	804 min
Time interval	=	2 min	Hyd. volume	=	1,176,901 cuft
Inflow hyd. No.	=	14 - Parkside Bain A1 Inflow	Max. Elevation	=	604.26 ft
Reservoir name	=	BASIN A1	Max. Storage	=	612,736 cuft

Storage Indication method used.

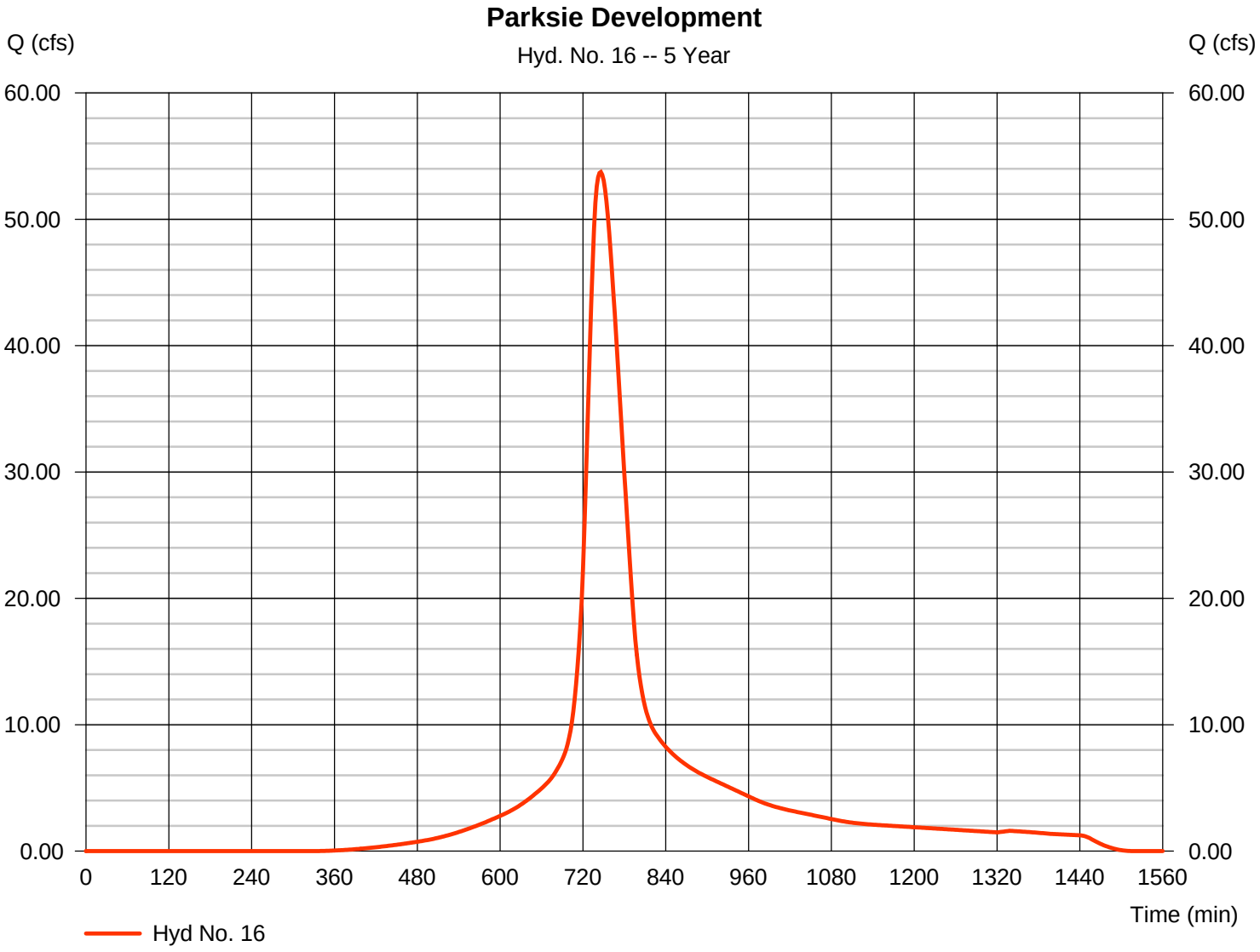


Hydrograph Report

Hyd. No. 16

Parksie Development

Hydrograph type	=	SCS Runoff	Peak discharge	=	53.73 cfs
Storm frequency	=	5 yrs	Time to peak	=	746 min
Time interval	=	2 min	Hyd. volume	=	373,008 cuft
Drainage area	=	29.940 ac	Curve number	=	87
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	28.50 min
Total precip.	=	4.83 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	300

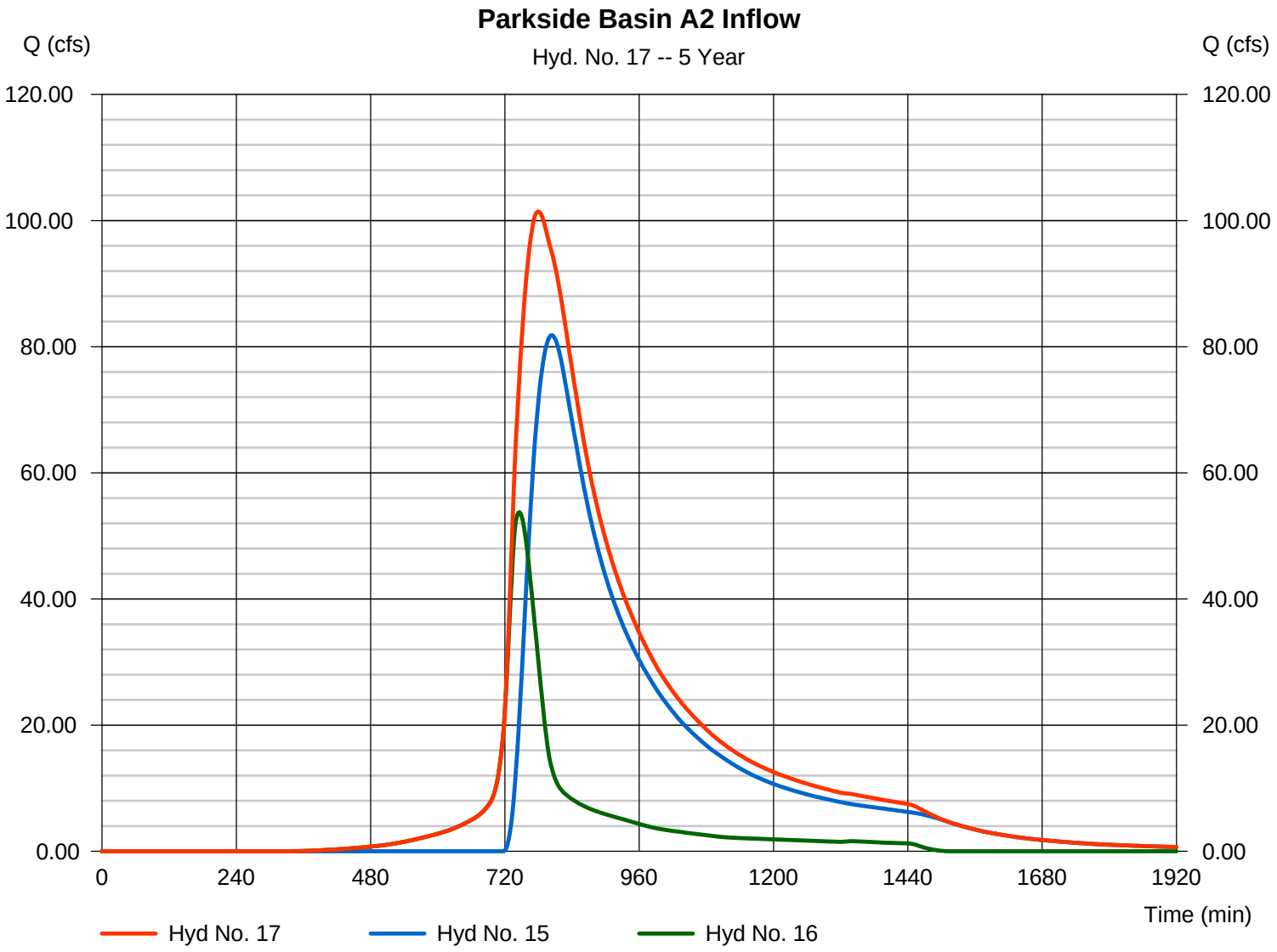


Hydrograph Report

Hyd. No. 17

Parkside Basin A2 Inflow

Hydrograph type	=	Combine	Peak discharge	=	101.43 cfs
Storm frequency	=	5 yrs	Time to peak	=	780 min
Time interval	=	2 min	Hyd. volume	=	1,549,909 cuft
Inflow hyds.	=	15, 16	Contrib. drain. area	=	29.940 ac



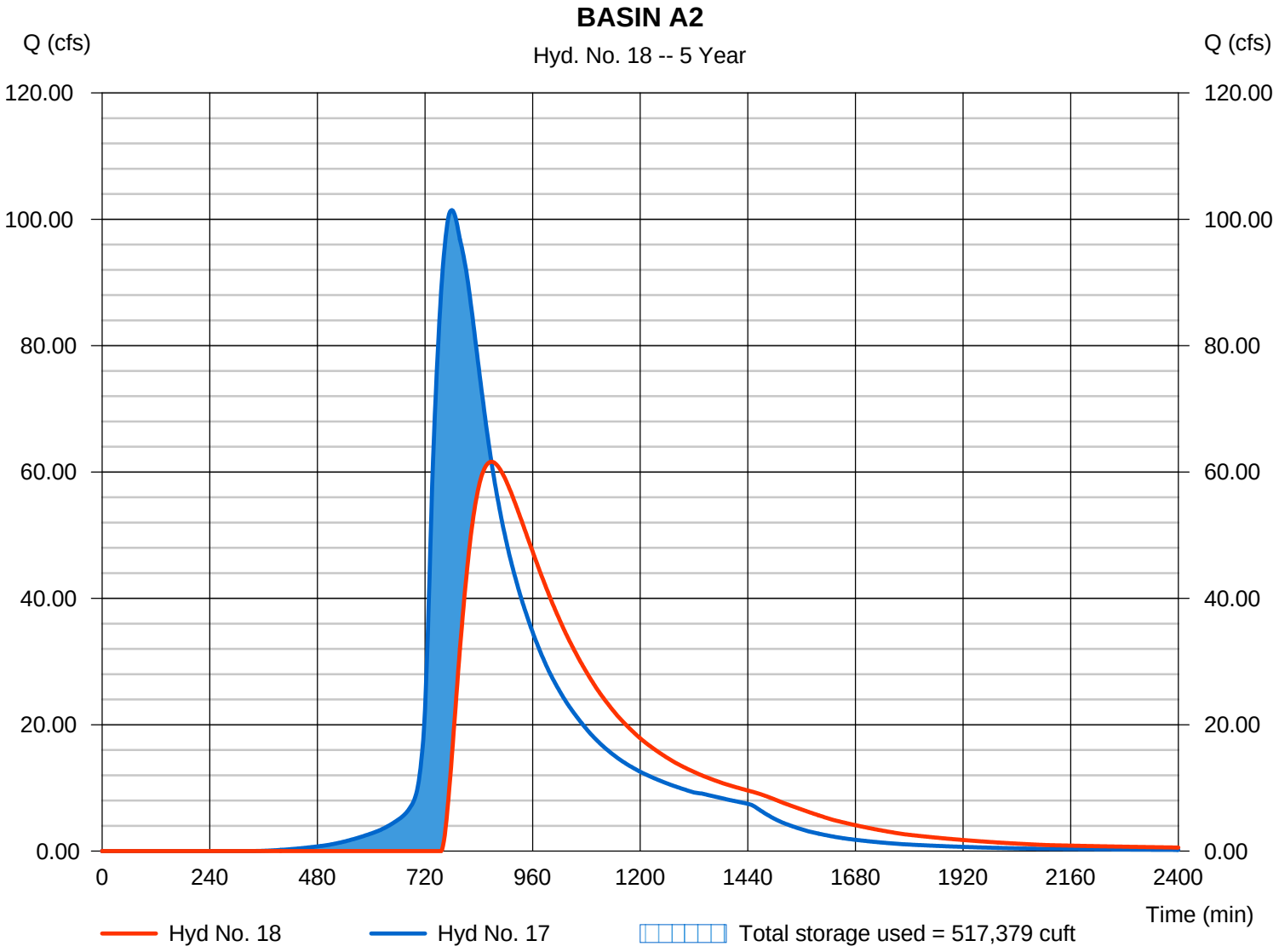
Hydrograph Report

Hyd. No. 18

BASIN A2

Hydrograph type	=	Reservoir	Peak discharge	=	61.62 cfs
Storm frequency	=	5 yrs	Time to peak	=	868 min
Time interval	=	2 min	Hyd. volume	=	1,357,034 cuft
Inflow hyd. No.	=	17 - Parkside Basin A2 Inflow	Max. Elevation	=	601.62 ft
Reservoir name	=	BASIN A2	Max. Storage	=	517,379 cuft

Storage Indication method used.

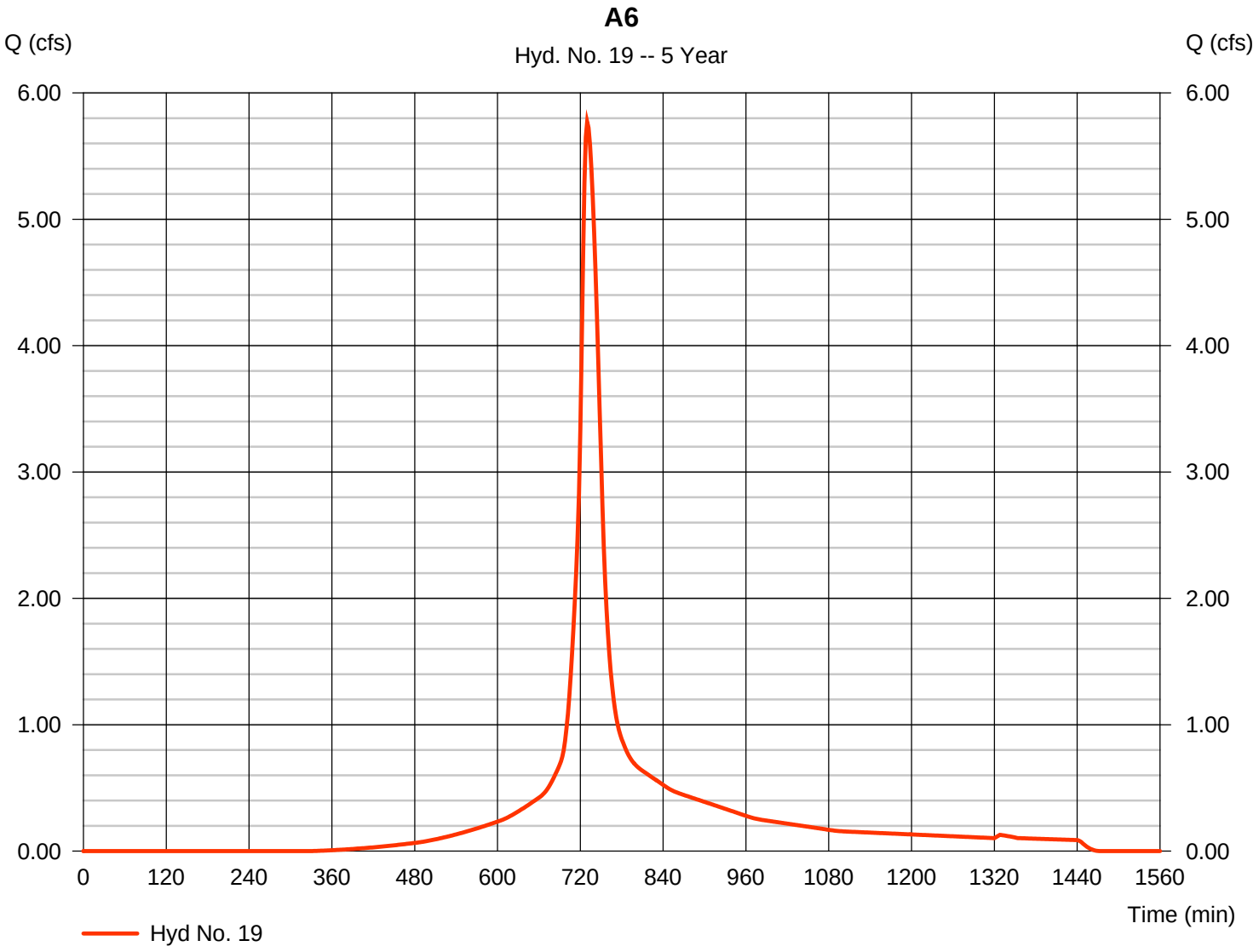


Hydrograph Report

Hyd. No. 19

A6

Hydrograph type	=	SCS Runoff	Peak discharge	=	5.770 cfs
Storm frequency	=	5 yrs	Time to peak	=	730 min
Time interval	=	2 min	Hyd. volume	=	26,882 cuft
Drainage area	=	2.200 ac	Curve number	=	87
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	10.00 min
Total precip.	=	4.83 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	300

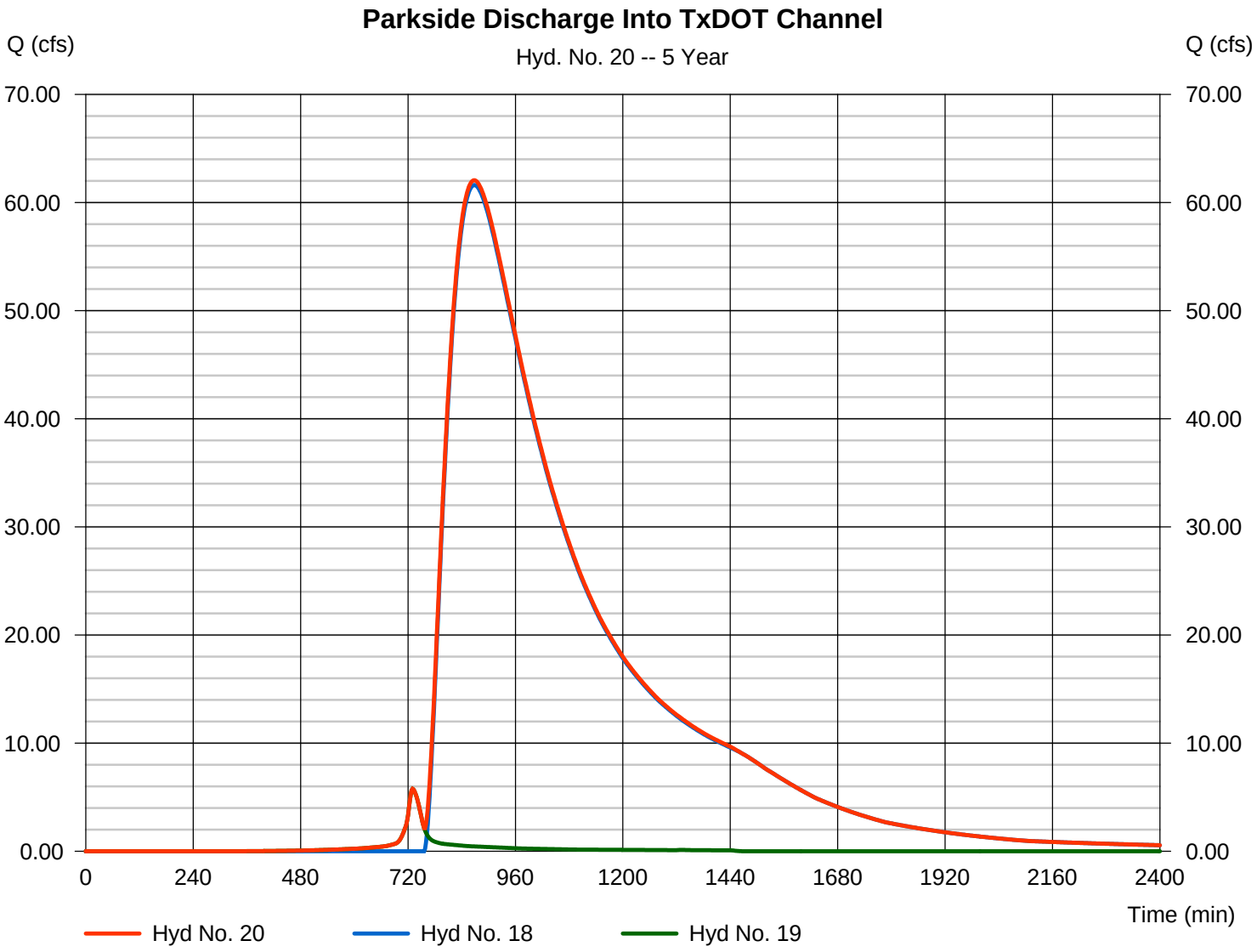


Hydrograph Report

Hyd. No. 20

Parkside Discharge Into TxDOT Channel

Hydrograph type	= Combine	Peak discharge	= 62.06 cfs
Storm frequency	= 5 yrs	Time to peak	= 868 min
Time interval	= 2 min	Hyd. volume	= 1,383,915 cuft
Inflow hyds.	= 18, 19	Contrib. drain. area	= 2.200 ac

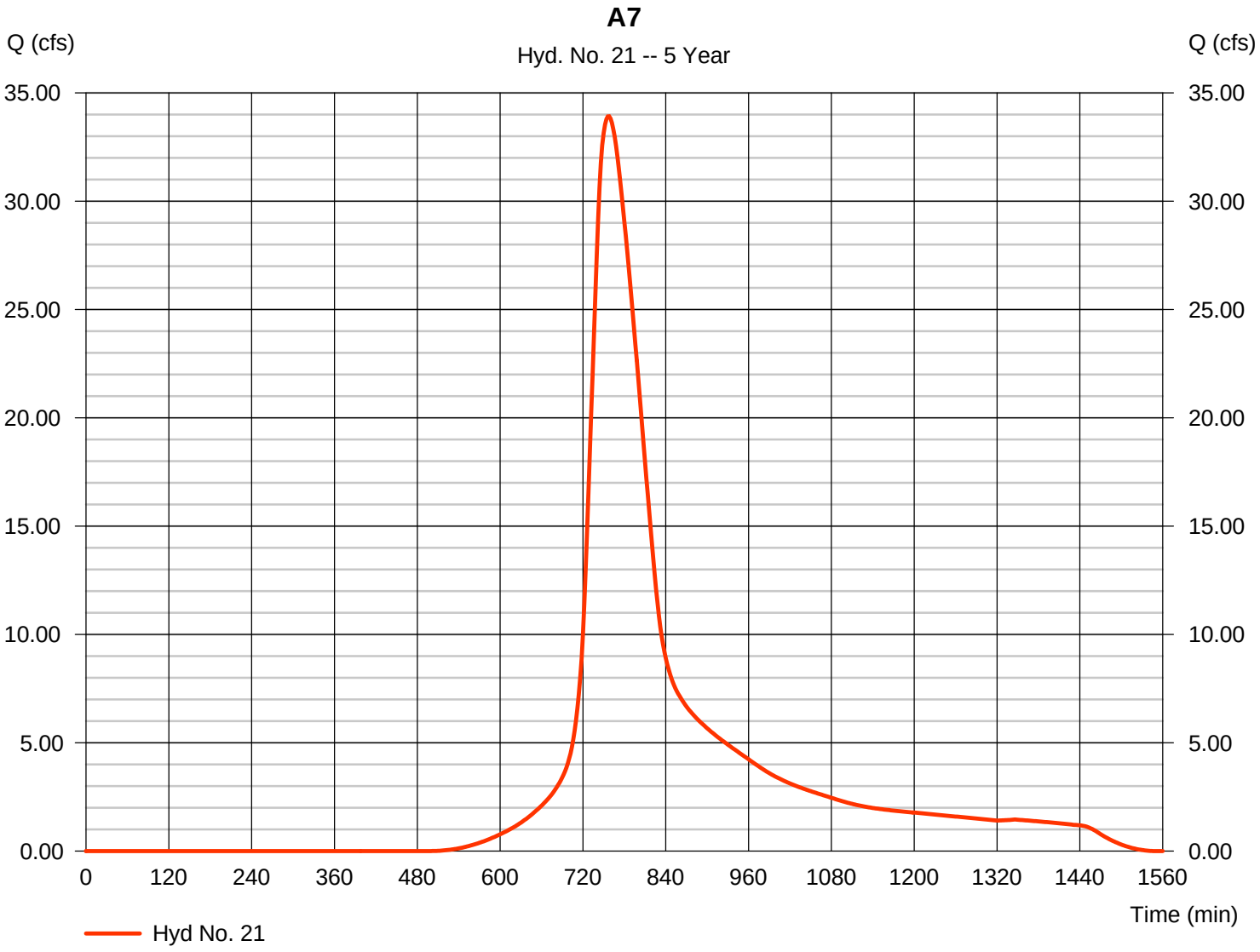


Hydrograph Report

Hyd. No. 21

A7

Hydrograph type	=	SCS Runoff	Peak discharge	=	33.92 cfs
Storm frequency	=	5 yrs	Time to peak	=	758 min
Time interval	=	2 min	Hyd. volume	=	290,371 cuft
Drainage area	=	31.110 ac	Curve number	=	78
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	40.80 min
Total precip.	=	4.83 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	300

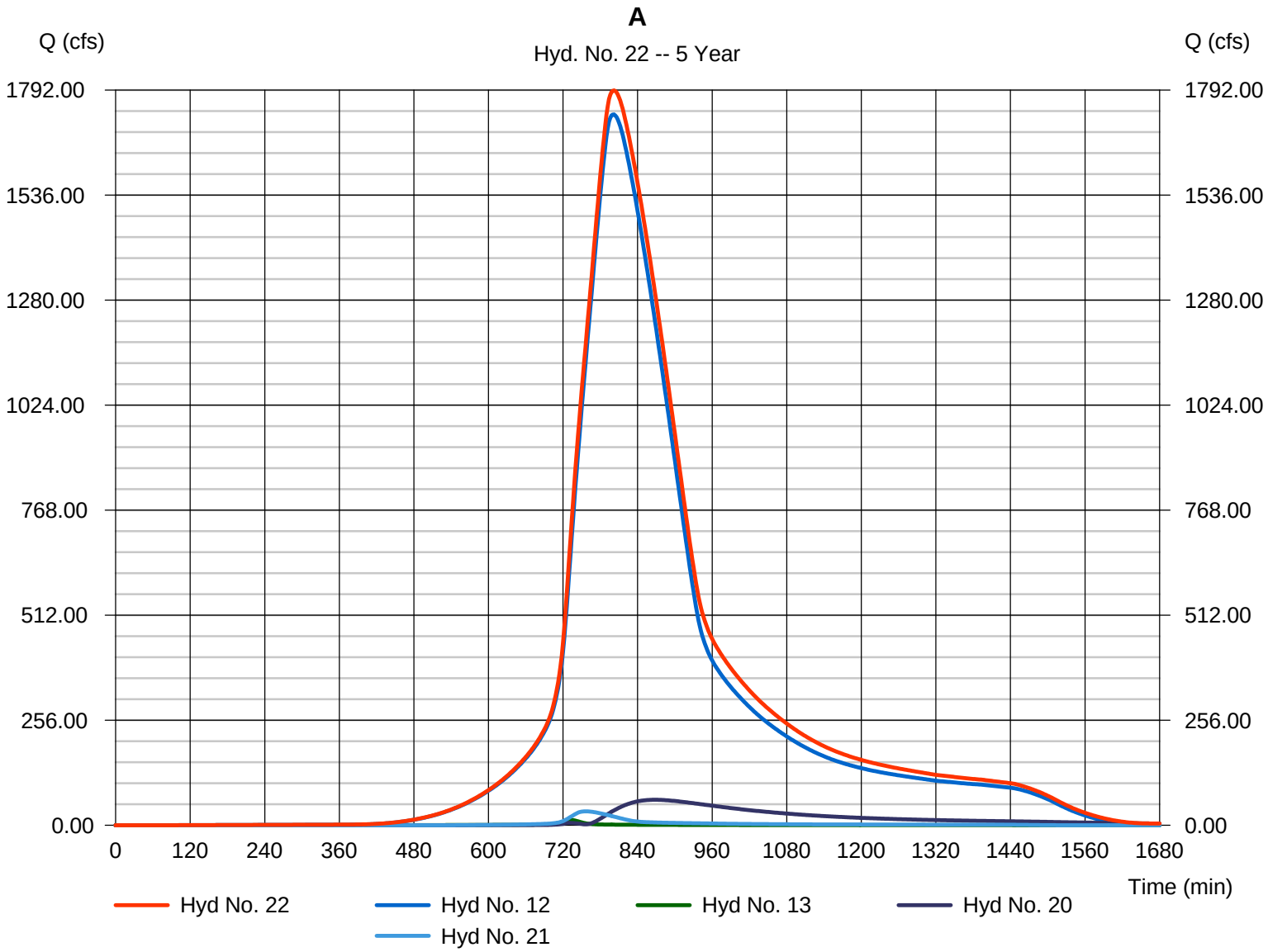


Hydrograph Report

Hyd. No. 22

A

Hydrograph type	=	Combine	Peak discharge	=	1791.00 cfs
Storm frequency	=	5 yrs	Time to peak	=	802 min
Time interval	=	2 min	Hyd. volume	=	24,861,890 cuft
Inflow hyds.	=	12, 13, 20, 21	Contrib. drain. area	=	35.560 ac



Hydrograph Summary Report

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

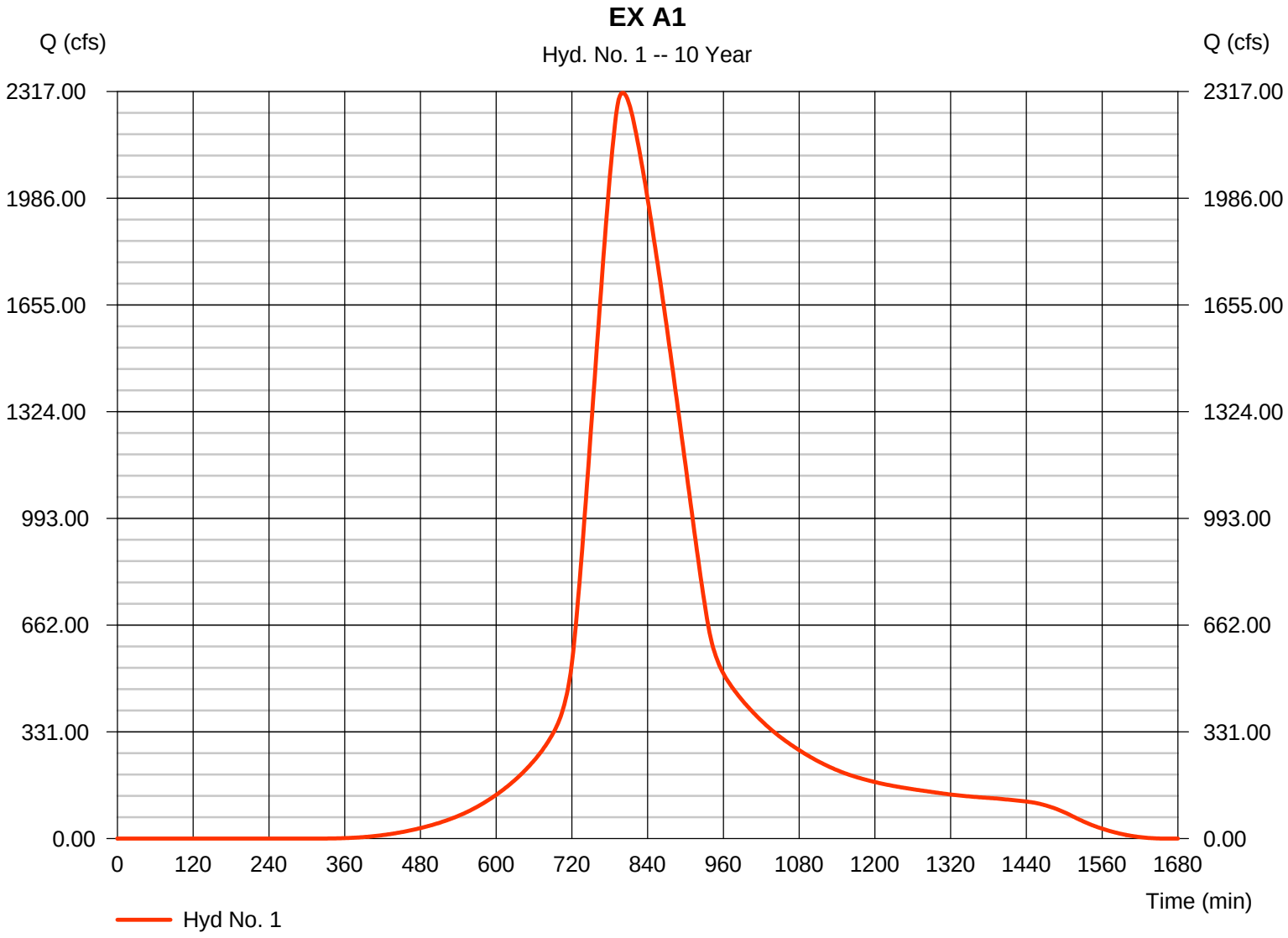
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	2312.98	2	800	30,387,610	------	------	------	EX A1
2	SCS Runoff	70.91	2	742	468,158	------	------	------	EX A2
3	SCS Runoff	194.37	2	762	1,589,059	------	------	------	EX A3
4	Combine	2451.33	2	798	32,444,810	1, 2, 3	------	------	EX A1 - EX A3
5	SCS Runoff	21.53	2	728	89,223	------	------	------	EX A4
6	SCS Runoff	39.30	2	764	332,362	------	------	------	EX A5
7	SCS Runoff	61.45	2	750	413,757	------	------	------	EX A6
8	Combine	2502.49	2	796	33,280,150	4, 5, 6, 7	------	------	EX A
9	SCS Runoff	2312.98	2	800	30,387,610	------	------	------	A1
10	SCS Runoff	70.91	2	742	468,158	------	------	------	A2
11	SCS Runoff	87.35	2	738	460,463	------	------	------	A3
12	Combine	2338.07	2	800	31,316,220	9, 10, 11	------	------	A1-A3
13	SCS Runoff	17.29	2	730	85,469	------	------	------	A4
14	SCS Runoff	221.13	2	752	1,827,487	------	------	------	Parkside Bain A1 Inflow
15	Reservoir	123.26	2	798	1,643,168	14	604.82	758,401	A1-A9 + Basin A1
16	SCS Runoff	71.42	2	746	500,777	------	------	------	Parksie Development
17	Combine	153.89	2	776	2,143,953	15, 16	------	------	Parkside Basin A2 Inflow
18	Reservoir	101.75	2	844	1,951,070	17	602.26	649,941	BASIN A2
19	SCS Runoff	7.669	2	730	36,090	------	------	------	A6
20	Combine	102.40	2	844	1,987,160	18, 19	------	------	Parkside Discharge Into TxDOT Chan
21	SCS Runoff	48.19	2	756	410,676	------	------	------	A7
22	Combine	2449.13	2	800	33,799,248	12, 13, 20, 21	------	------	A

Hydrograph Report

Hyd. No. 1

EX A1

Hydrograph type	=	SCS Runoff	Peak discharge	=	2312.98 cfs
Storm frequency	=	10 yrs	Time to peak	=	800 min
Time interval	=	2 min	Hyd. volume	=	30,387,610 cuft
Drainage area	=	1906.930 ac	Curve number	=	85.3
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	122.30 min
Total precip.	=	6.06 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	434

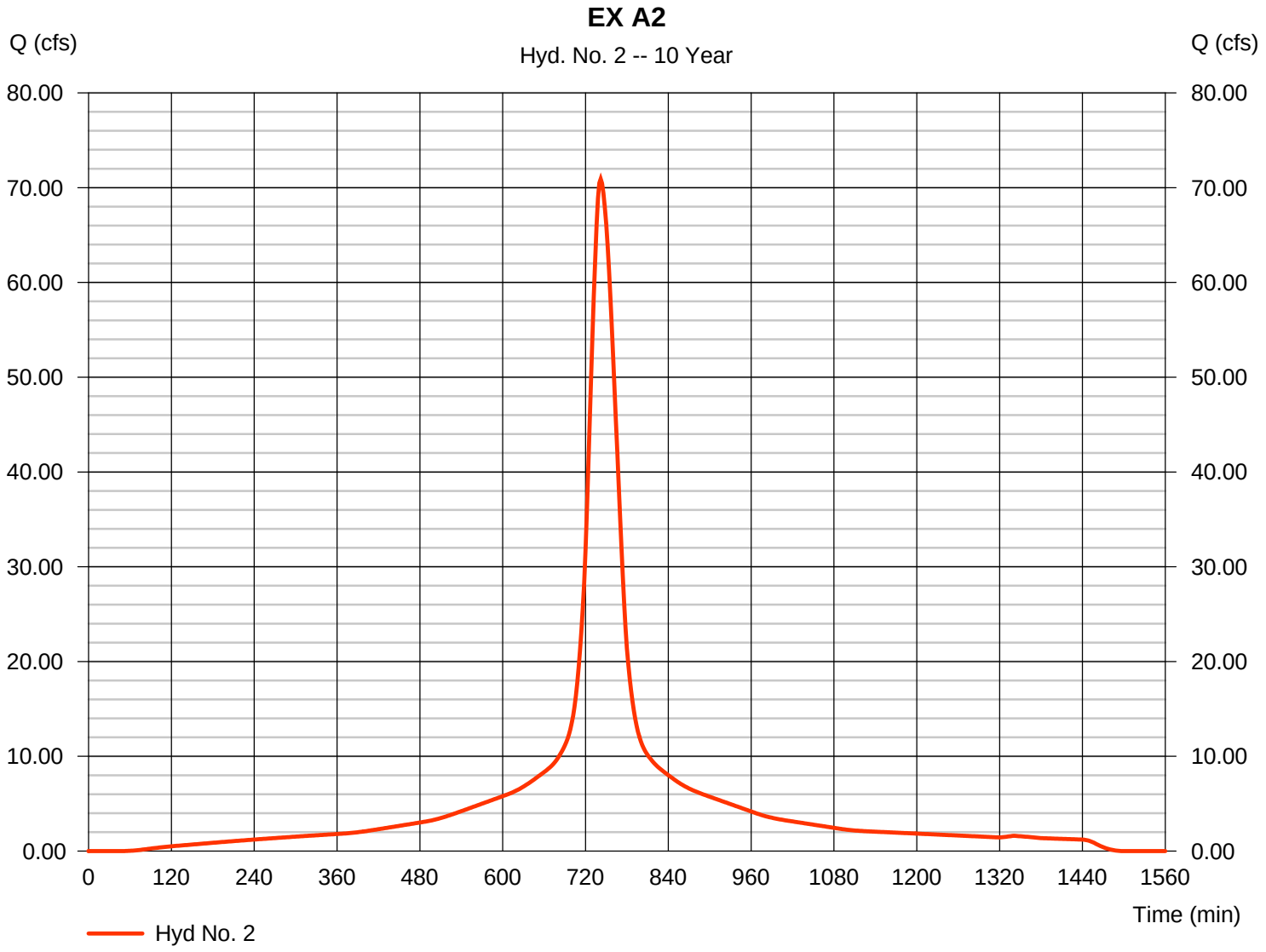


Hydrograph Report

Hyd. No. 2

EX A2

Hydrograph type	=	SCS Runoff	Peak discharge	=	70.91 cfs
Storm frequency	=	10 yrs	Time to peak	=	742 min
Time interval	=	2 min	Hyd. volume	=	468,158 cuft
Drainage area	=	21.960 ac	Curve number	=	98
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	32.00 min
Total precip.	=	6.06 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	434

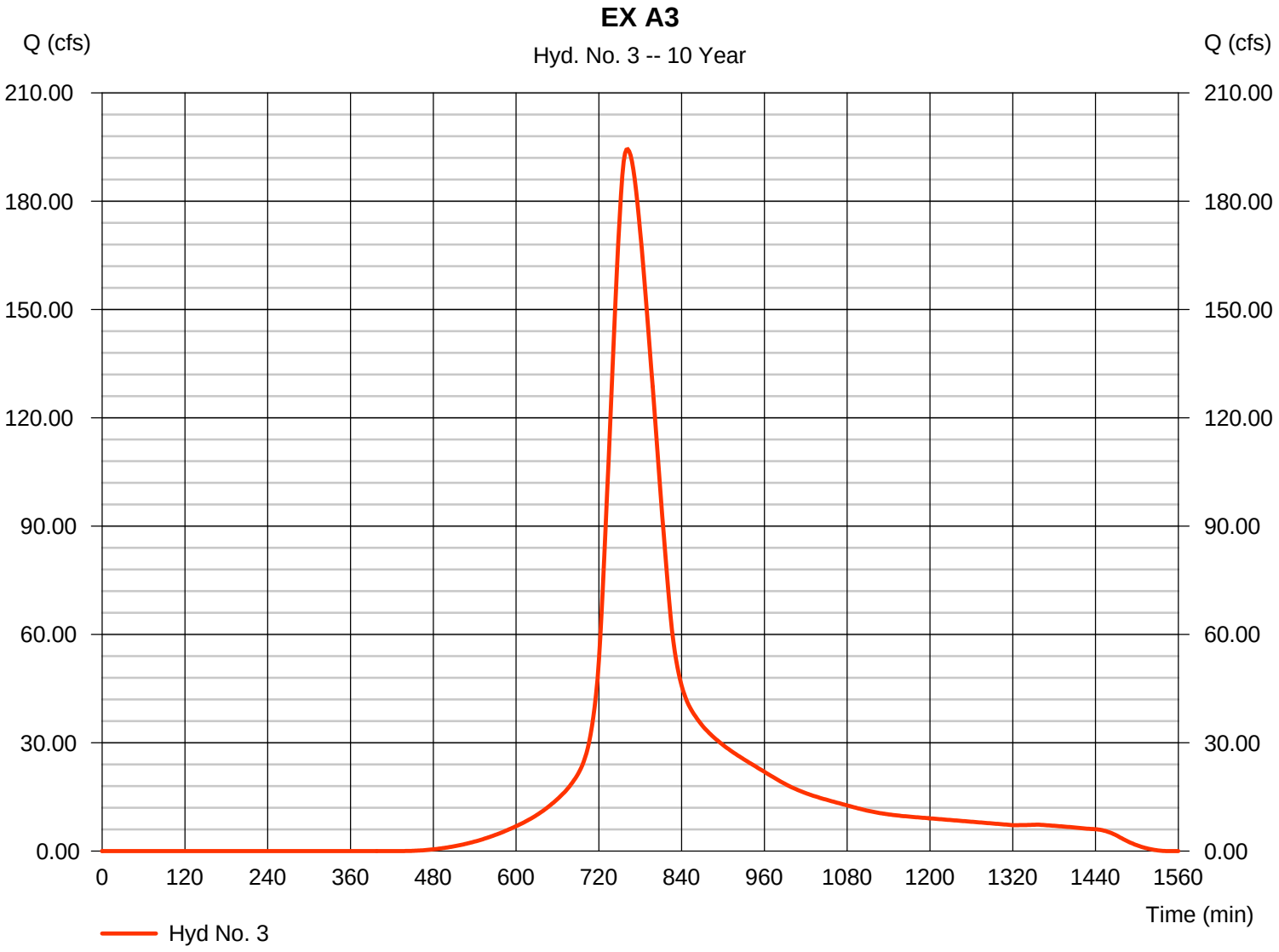


Hydrograph Report

Hyd. No. 3

EX A3

Hydrograph type	=	SCS Runoff	Peak discharge	=	194.37 cfs
Storm frequency	=	10 yrs	Time to peak	=	762 min
Time interval	=	2 min	Hyd. volume	=	1,589,059 cuft
Drainage area	=	117.840 ac	Curve number	=	78.5
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	59.60 min
Total precip.	=	6.06 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	434

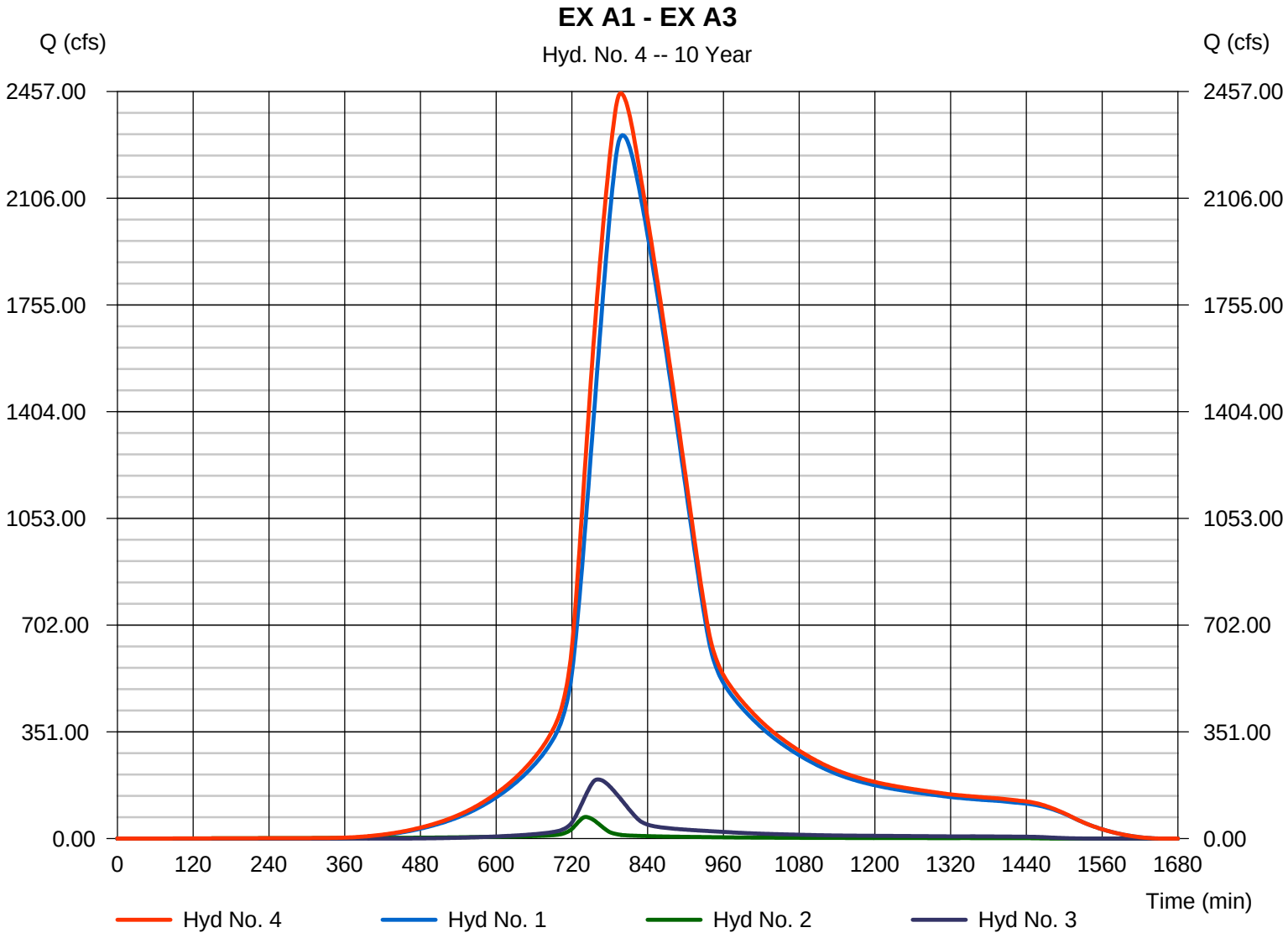


Hydrograph Report

Hyd. No. 4

EX A1 - EX A3

Hydrograph type	=	Combine	Peak discharge	=	2451.33 cfs
Storm frequency	=	10 yrs	Time to peak	=	798 min
Time interval	=	2 min	Hyd. volume	=	32,444,810 cuft
Inflow hyds.	=	1, 2, 3	Contrib. drain. area	=	2046.730 ac

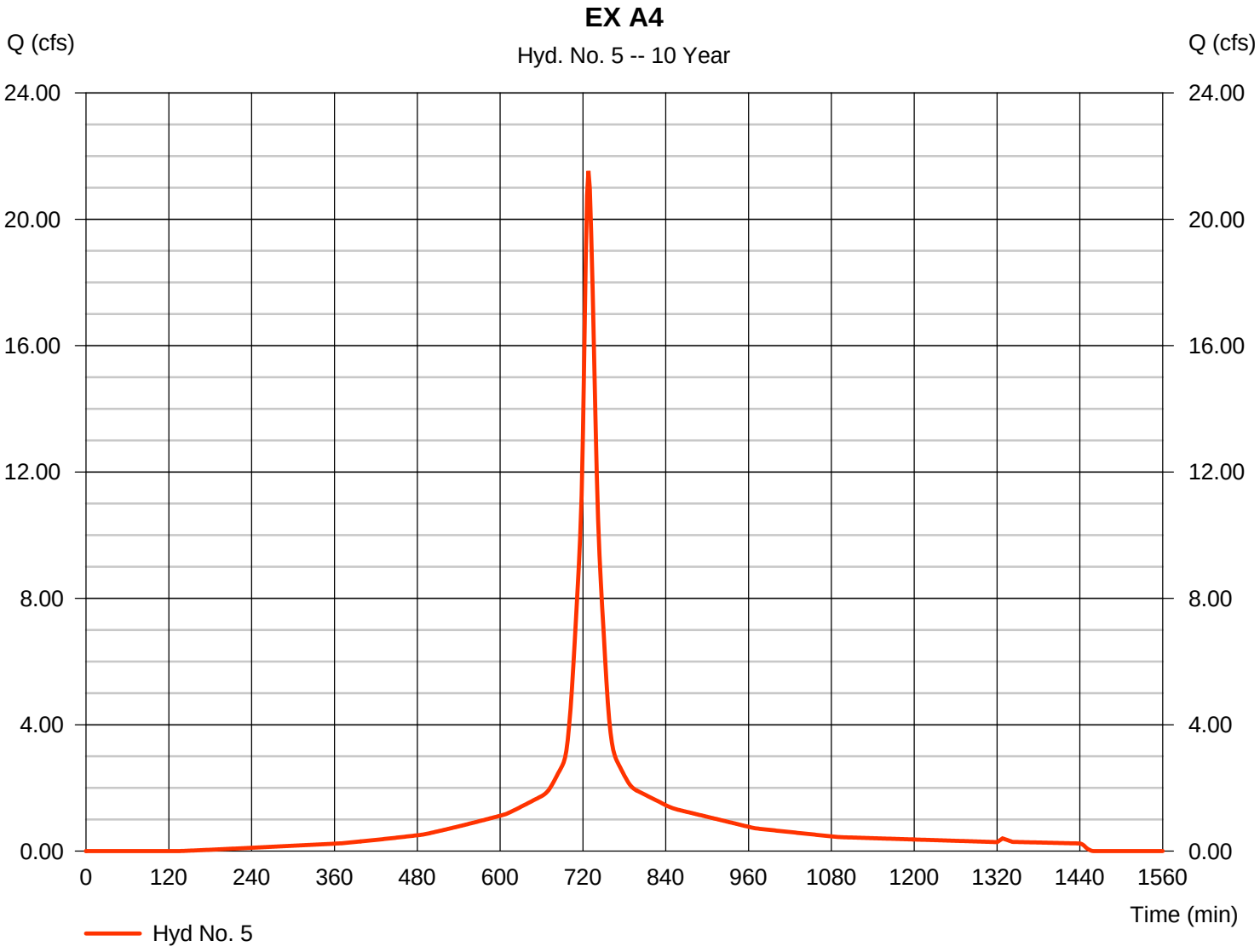


Hydrograph Report

Hyd. No. 5

EX A4

Hydrograph type	=	SCS Runoff	Peak discharge	=	21.53 cfs
Storm frequency	=	10 yrs	Time to peak	=	728 min
Time interval	=	2 min	Hyd. volume	=	89,223 cuft
Drainage area	=	4.450 ac	Curve number	=	94
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	10.00 min
Total precip.	=	6.06 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484

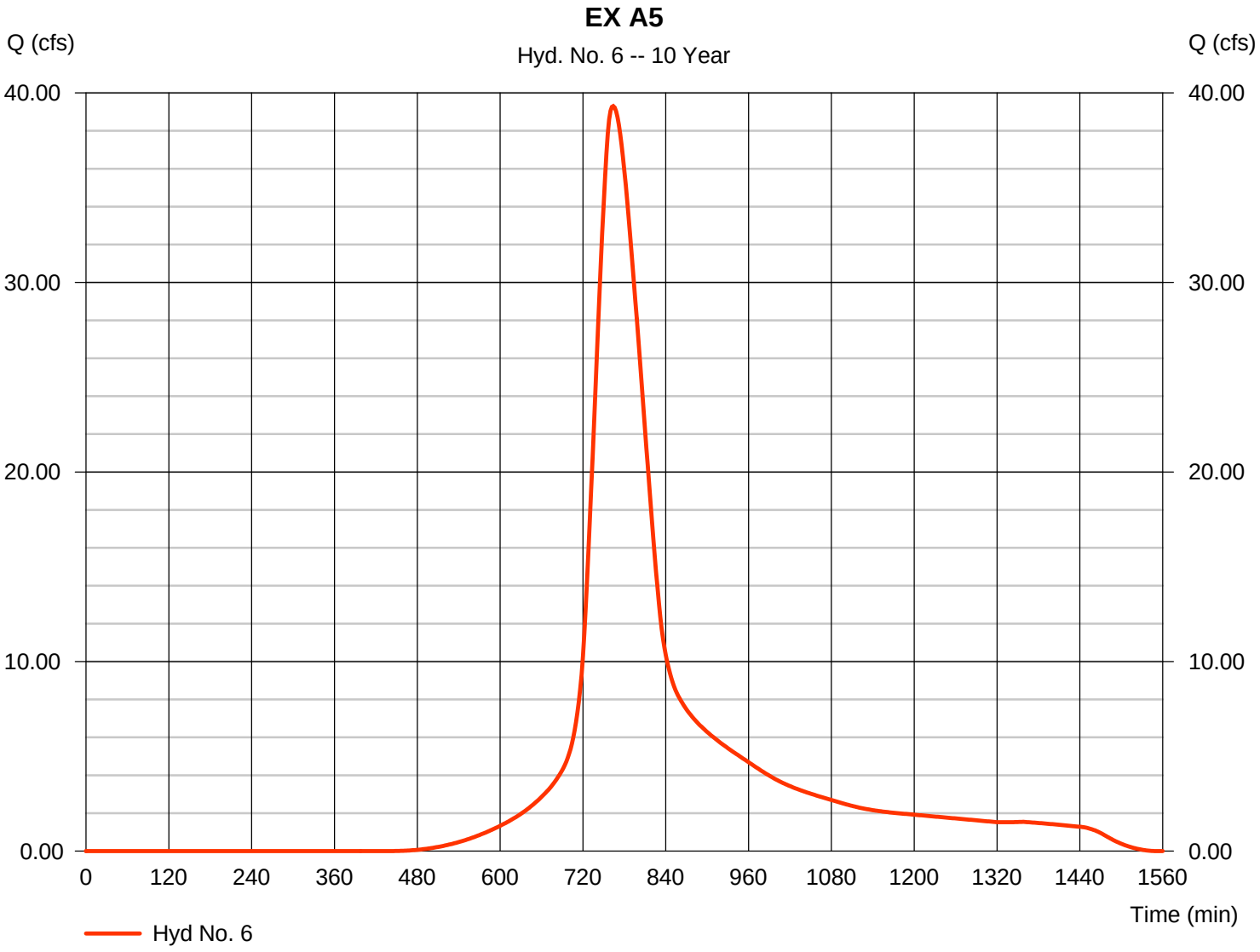


Hydrograph Report

Hyd. No. 6

EX A5

Hydrograph type	=	SCS Runoff	Peak discharge	=	39.30 cfs
Storm frequency	=	10 yrs	Time to peak	=	764 min
Time interval	=	2 min	Hyd. volume	=	332,362 cuft
Drainage area	=	24.990 ac	Curve number	=	78
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	63.10 min
Total precip.	=	6.06 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	434

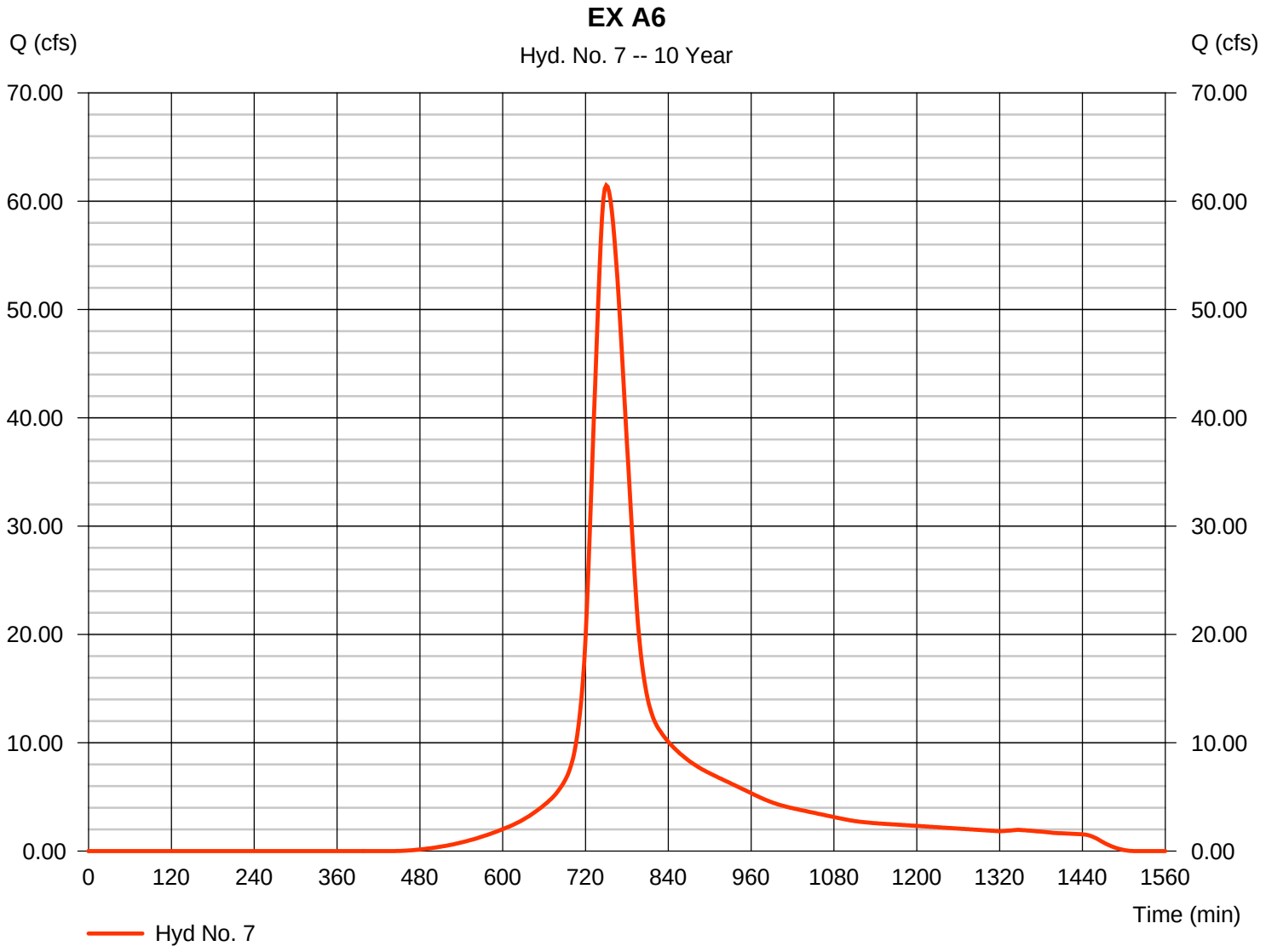


Hydrograph Report

Hyd. No. 7

EX A6

Hydrograph type	=	SCS Runoff	Peak discharge	=	61.45 cfs
Storm frequency	=	10 yrs	Time to peak	=	750 min
Time interval	=	2 min	Hyd. volume	=	413,757 cuft
Drainage area	=	31.110 ac	Curve number	=	78
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	40.80 min
Total precip.	=	6.06 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	434

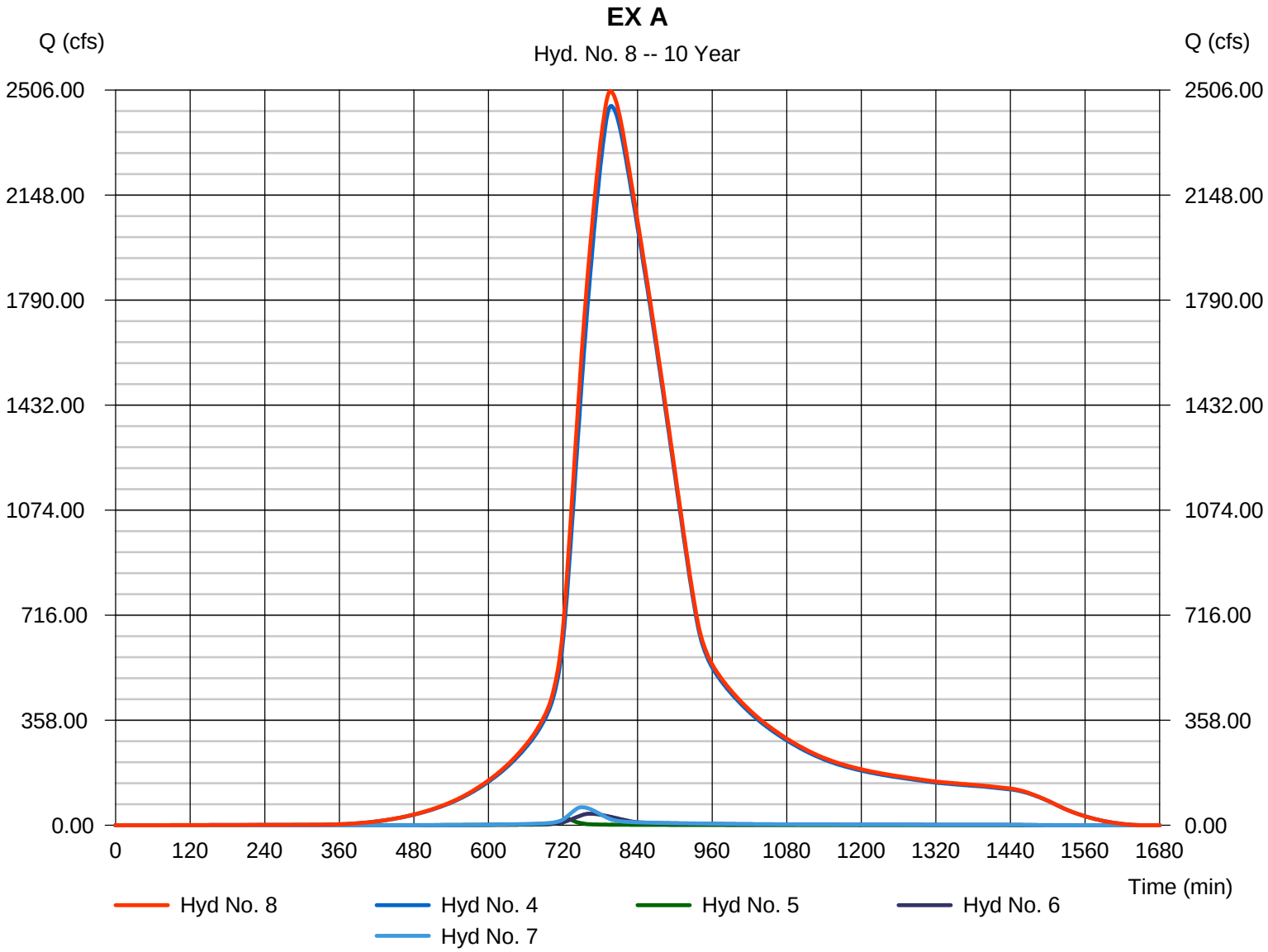


Hydrograph Report

Hyd. No. 8

EX A

Hydrograph type	=	Combine	Peak discharge	=	2502.49 cfs
Storm frequency	=	10 yrs	Time to peak	=	796 min
Time interval	=	2 min	Hyd. volume	=	33,280,150 cuft
Inflow hyds.	=	4, 5, 6, 7	Contrib. drain. area	=	60.550 ac

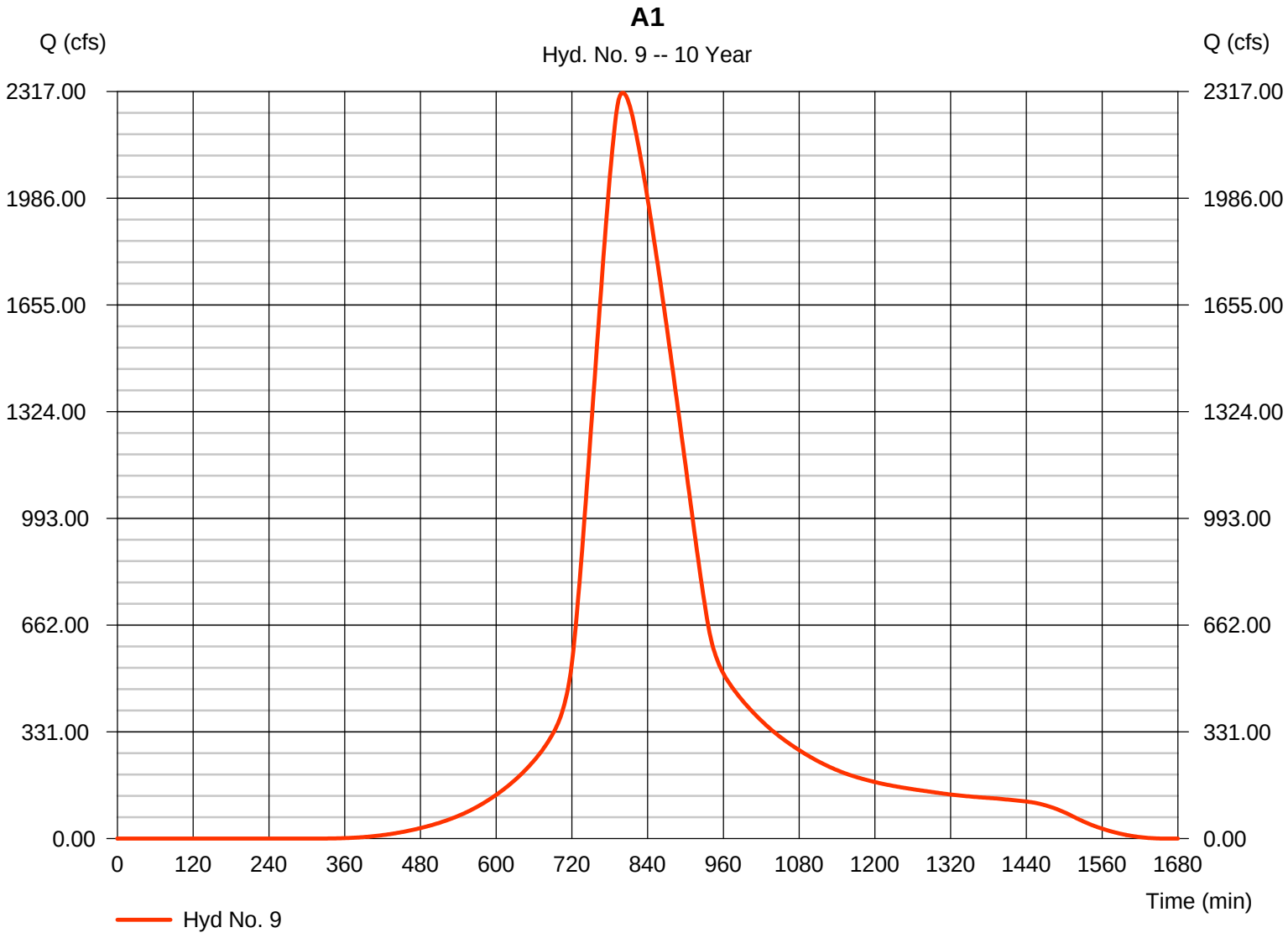


Hydrograph Report

Hyd. No. 9

A1

Hydrograph type	=	SCS Runoff	Peak discharge	=	2312.98 cfs
Storm frequency	=	10 yrs	Time to peak	=	800 min
Time interval	=	2 min	Hyd. volume	=	30,387,610 cuft
Drainage area	=	1906.930 ac	Curve number	=	85.3
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	122.30 min
Total precip.	=	6.06 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	434

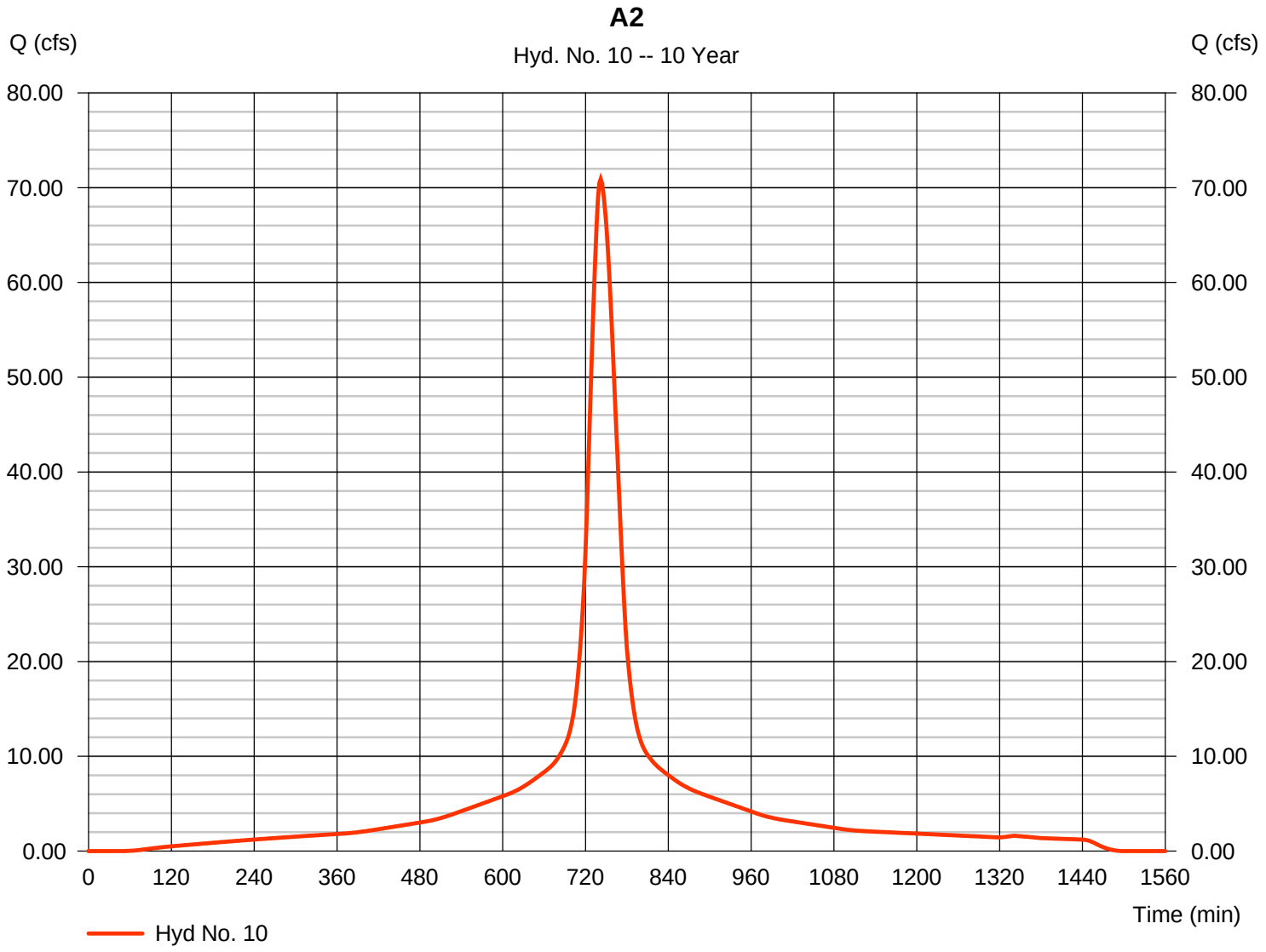


Hydrograph Report

Hyd. No. 10

A2

Hydrograph type	=	SCS Runoff	Peak discharge	=	70.91 cfs
Storm frequency	=	10 yrs	Time to peak	=	742 min
Time interval	=	2 min	Hyd. volume	=	468,158 cuft
Drainage area	=	21.960 ac	Curve number	=	98
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	32.00 min
Total precip.	=	6.06 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	434

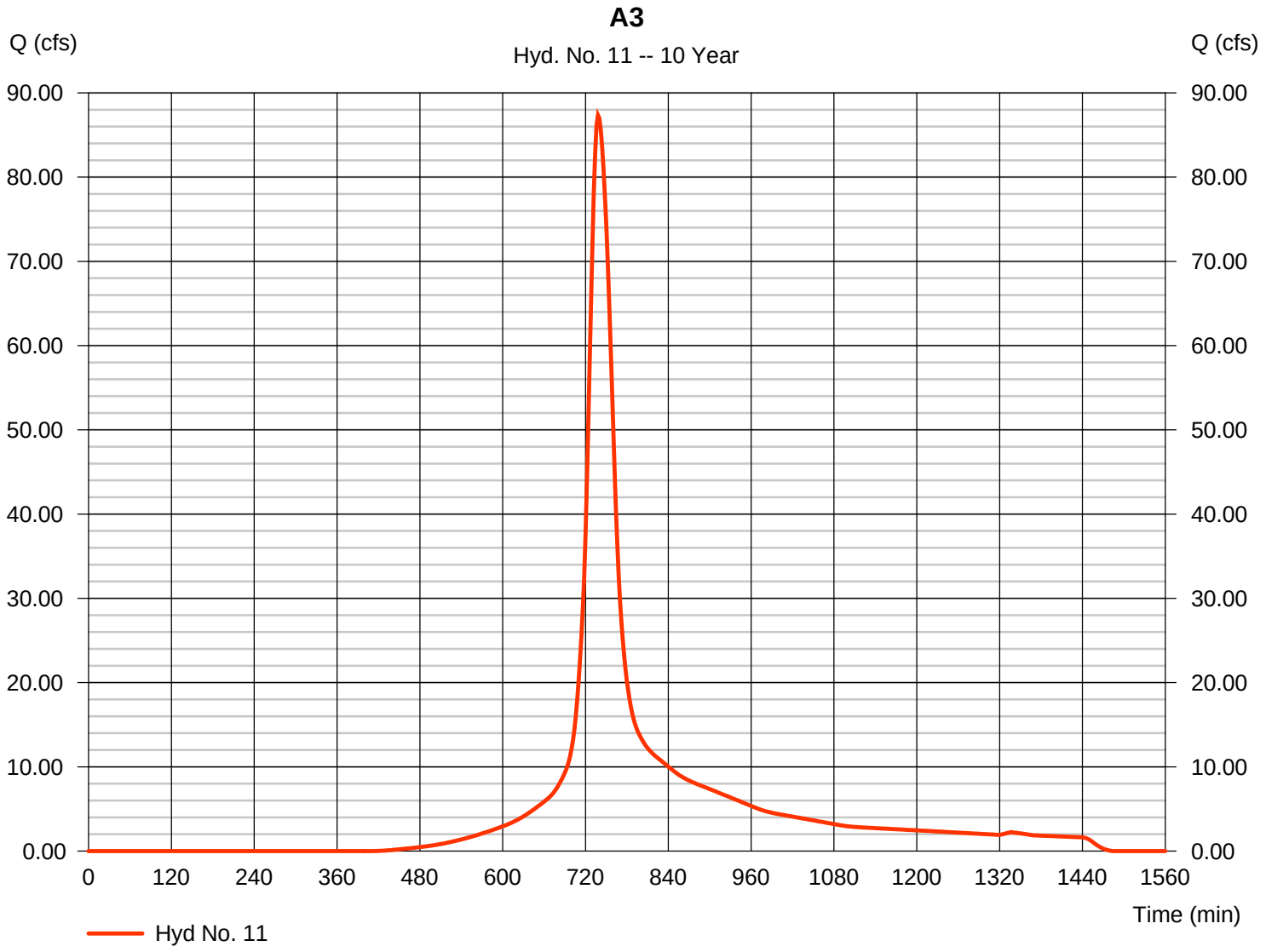


Hydrograph Report

Hyd. No. 11

A3

Hydrograph type	=	SCS Runoff	Peak discharge	=	87.35 cfs
Storm frequency	=	10 yrs	Time to peak	=	738 min
Time interval	=	2 min	Hyd. volume	=	460,463 cuft
Drainage area	=	33.050 ac	Curve number	=	79.7
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	25.60 min
Total precip.	=	6.06 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	434

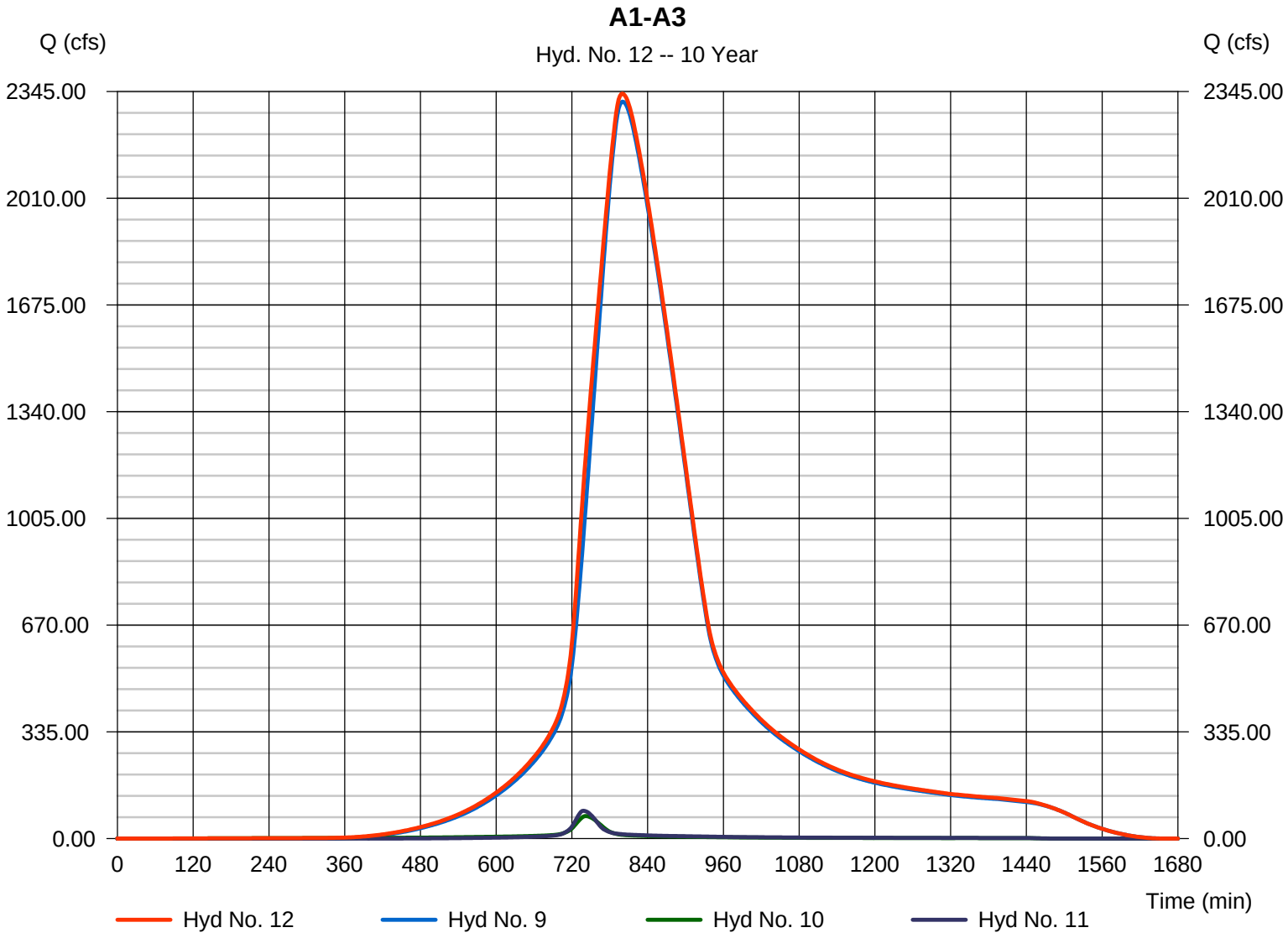


Hydrograph Report

Hyd. No. 12

A1-A3

Hydrograph type	=	Combine	Peak discharge	=	2338.07 cfs
Storm frequency	=	10 yrs	Time to peak	=	800 min
Time interval	=	2 min	Hyd. volume	=	31,316,220 cuft
Inflow hyds.	=	9, 10, 11	Contrib. drain. area	=	1961.940 ac

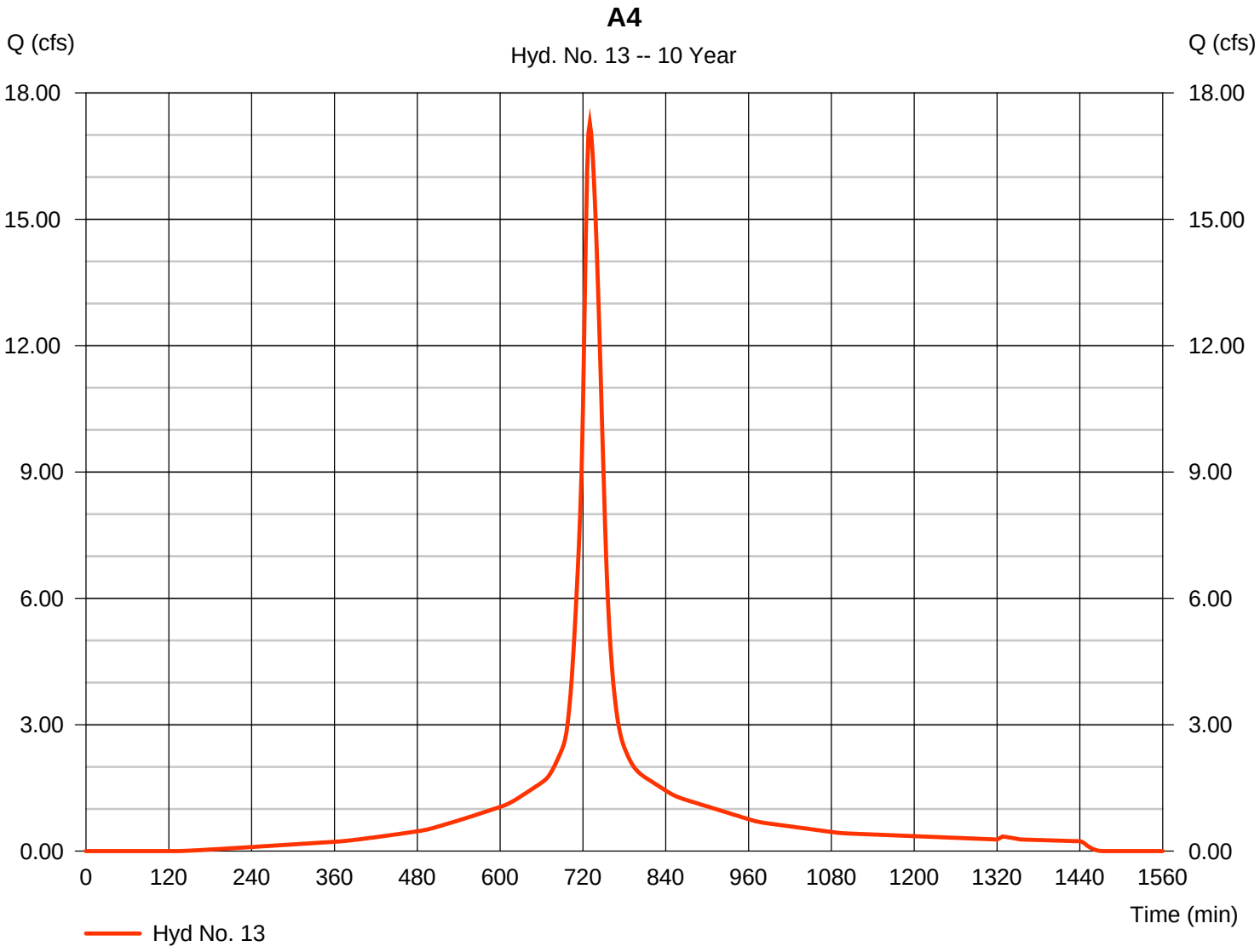


Hydrograph Report

Hyd. No. 13

A4

Hydrograph type	=	SCS Runoff	Peak discharge	=	17.29 cfs
Storm frequency	=	10 yrs	Time to peak	=	730 min
Time interval	=	2 min	Hyd. volume	=	85,469 cuft
Drainage area	=	4.450 ac	Curve number	=	94
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	10.00 min
Total precip.	=	6.06 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	300

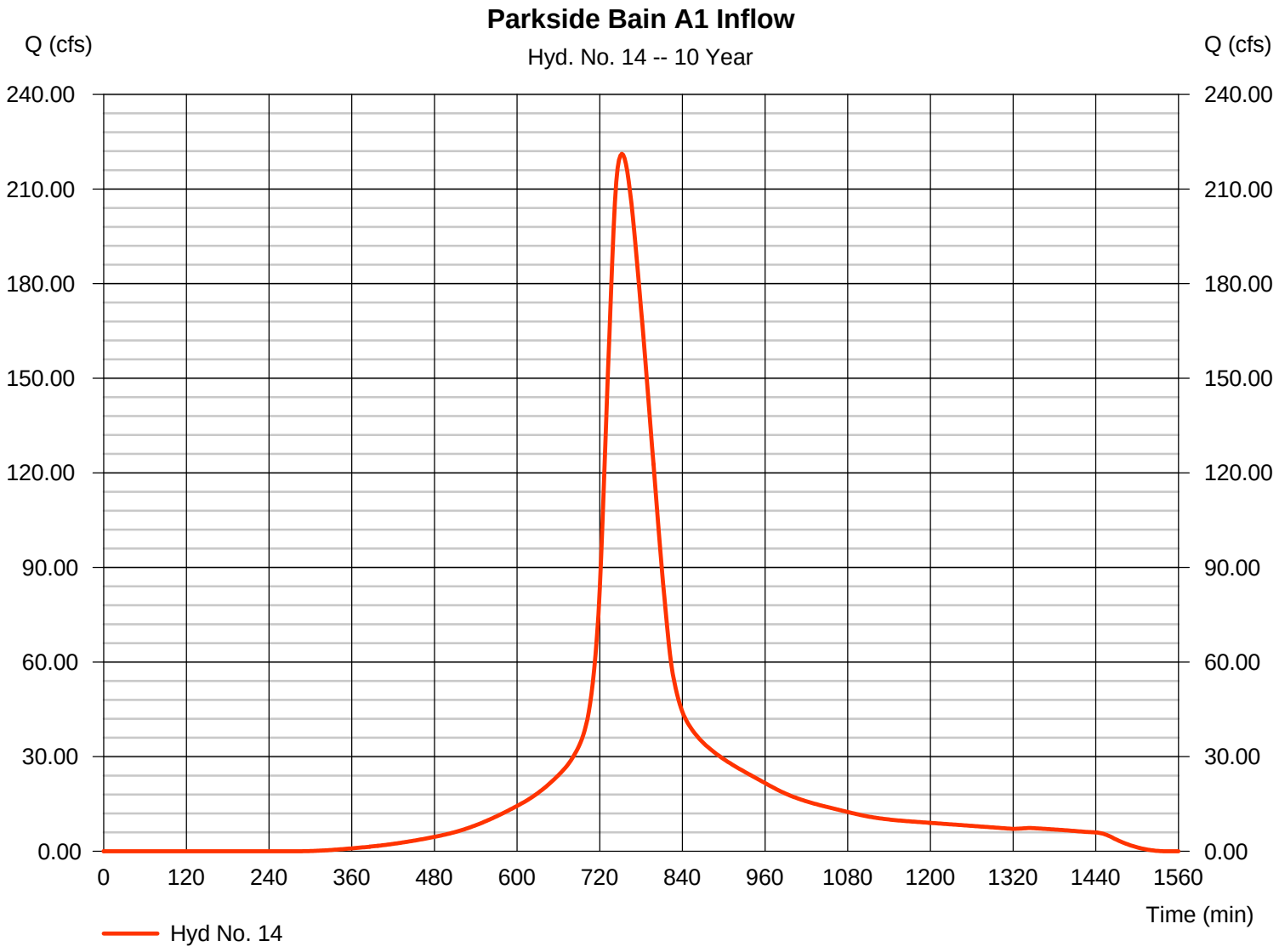


Hydrograph Report

Hyd. No. 14

Parkside Bain A1 Inflow

Hydrograph type	= SCS Runoff	Peak discharge	= 221.13 cfs
Storm frequency	= 10 yrs	Time to peak	= 752 min
Time interval	= 2 min	Hyd. volume	= 1,827,487 cuft
Drainage area	= 109.260 ac	Curve number	= 87
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 37.90 min
Total precip.	= 6.06 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 300



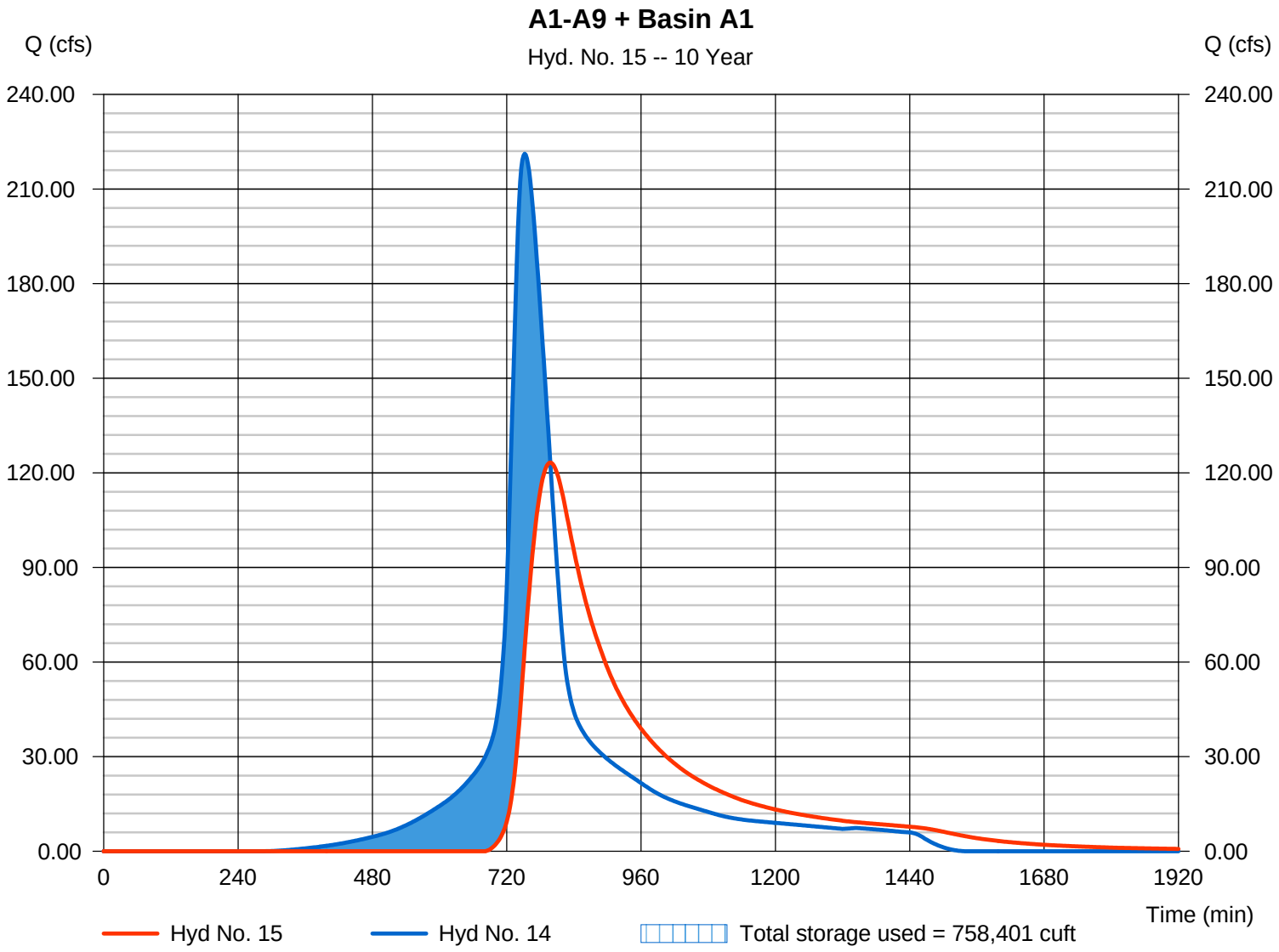
Hydrograph Report

Hyd. No. 15

A1-A9 + Basin A1

Hydrograph type	=	Reservoir	Peak discharge	=	123.26 cfs
Storm frequency	=	10 yrs	Time to peak	=	798 min
Time interval	=	2 min	Hyd. volume	=	1,643,168 cuft
Inflow hyd. No.	=	14 - Parkside Bain A1 Inflow	Max. Elevation	=	604.82 ft
Reservoir name	=	BASIN A1	Max. Storage	=	758,401 cuft

Storage Indication method used.

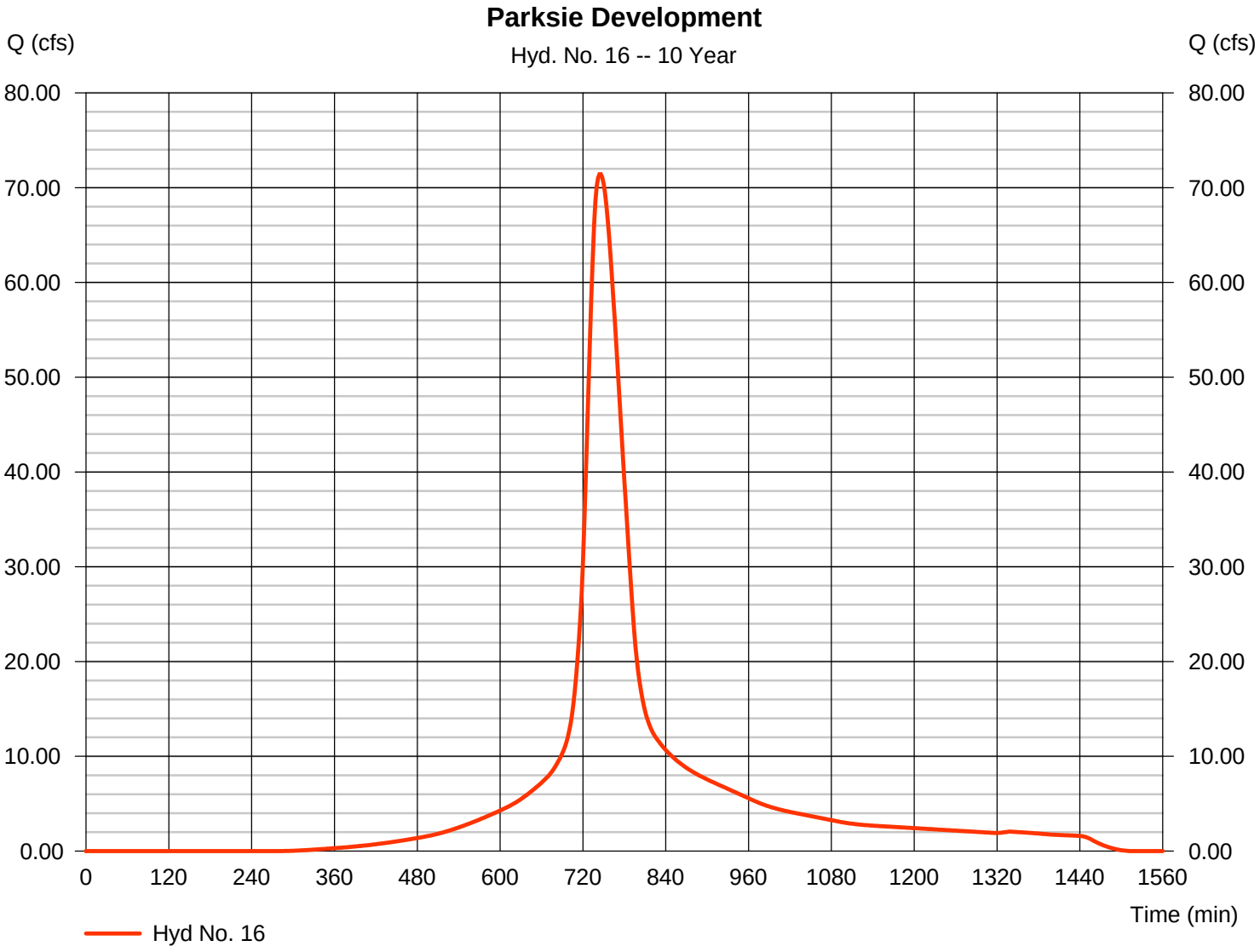


Hydrograph Report

Hyd. No. 16

Parksie Development

Hydrograph type	=	SCS Runoff	Peak discharge	=	71.42 cfs
Storm frequency	=	10 yrs	Time to peak	=	746 min
Time interval	=	2 min	Hyd. volume	=	500,777 cuft
Drainage area	=	29.940 ac	Curve number	=	87
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	28.50 min
Total precip.	=	6.06 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	300

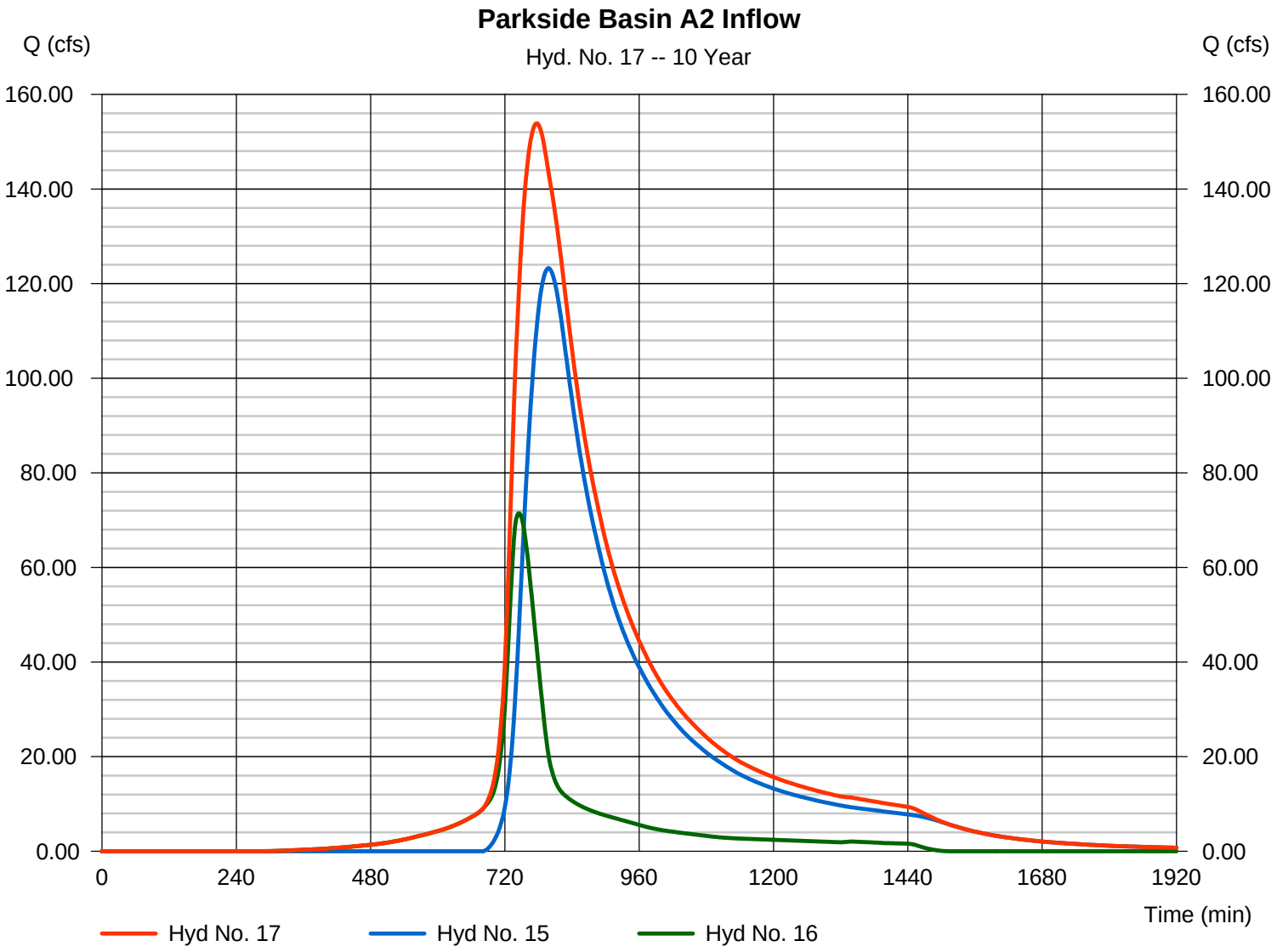


Hydrograph Report

Hyd. No. 17

Parkside Basin A2 Inflow

Hydrograph type	=	Combine	Peak discharge	=	153.89 cfs
Storm frequency	=	10 yrs	Time to peak	=	776 min
Time interval	=	2 min	Hyd. volume	=	2,143,953 cuft
Inflow hyds.	=	15, 16	Contrib. drain. area	=	29.940 ac



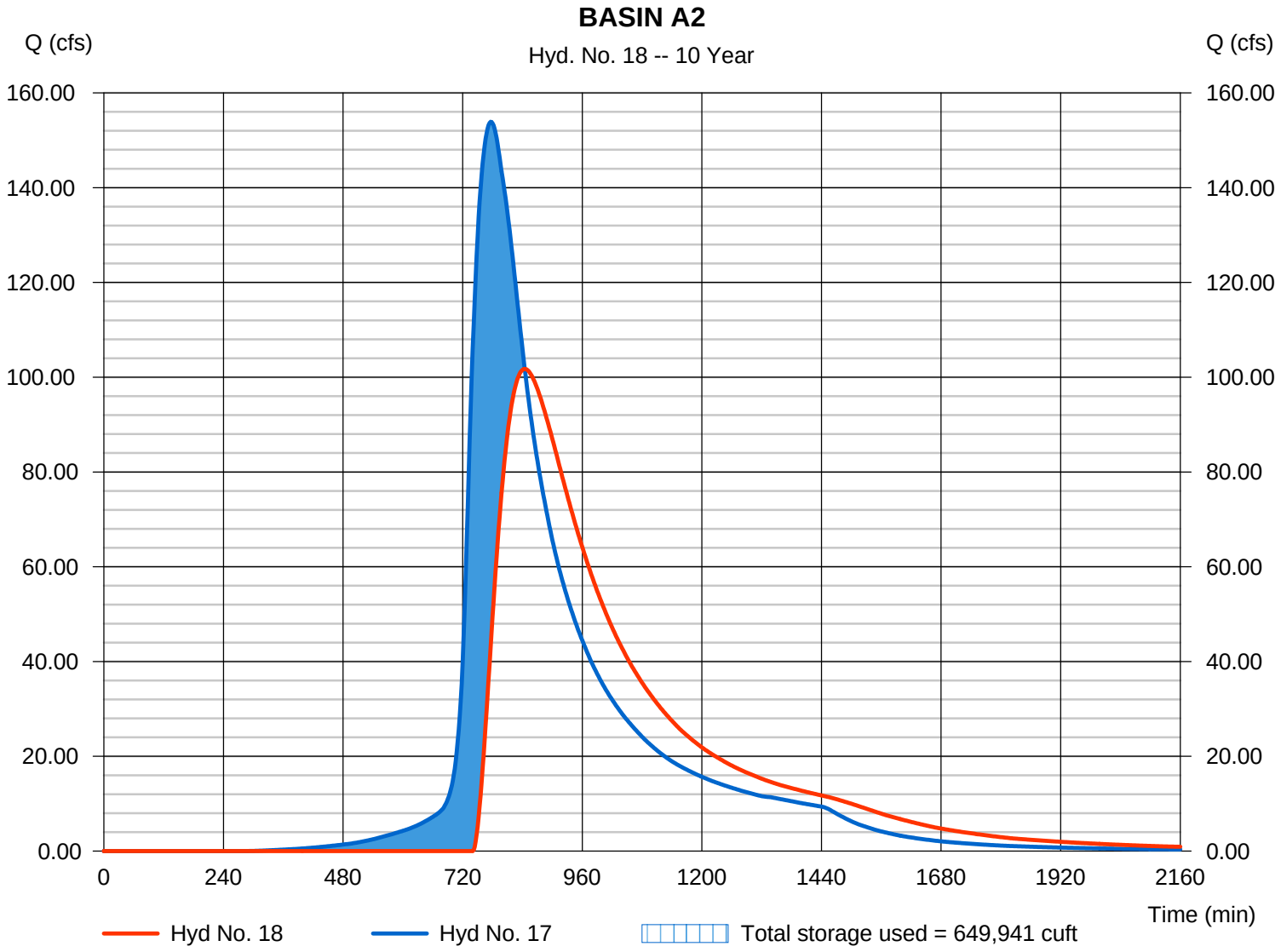
Hydrograph Report

Hyd. No. 18

BASIN A2

Hydrograph type	=	Reservoir	Peak discharge	=	101.75 cfs
Storm frequency	=	10 yrs	Time to peak	=	844 min
Time interval	=	2 min	Hyd. volume	=	1,951,070 cuft
Inflow hyd. No.	=	17 - Parkside Basin A2 Inflow	Max. Elevation	=	602.26 ft
Reservoir name	=	BASIN A2	Max. Storage	=	649,941 cuft

Storage Indication method used.

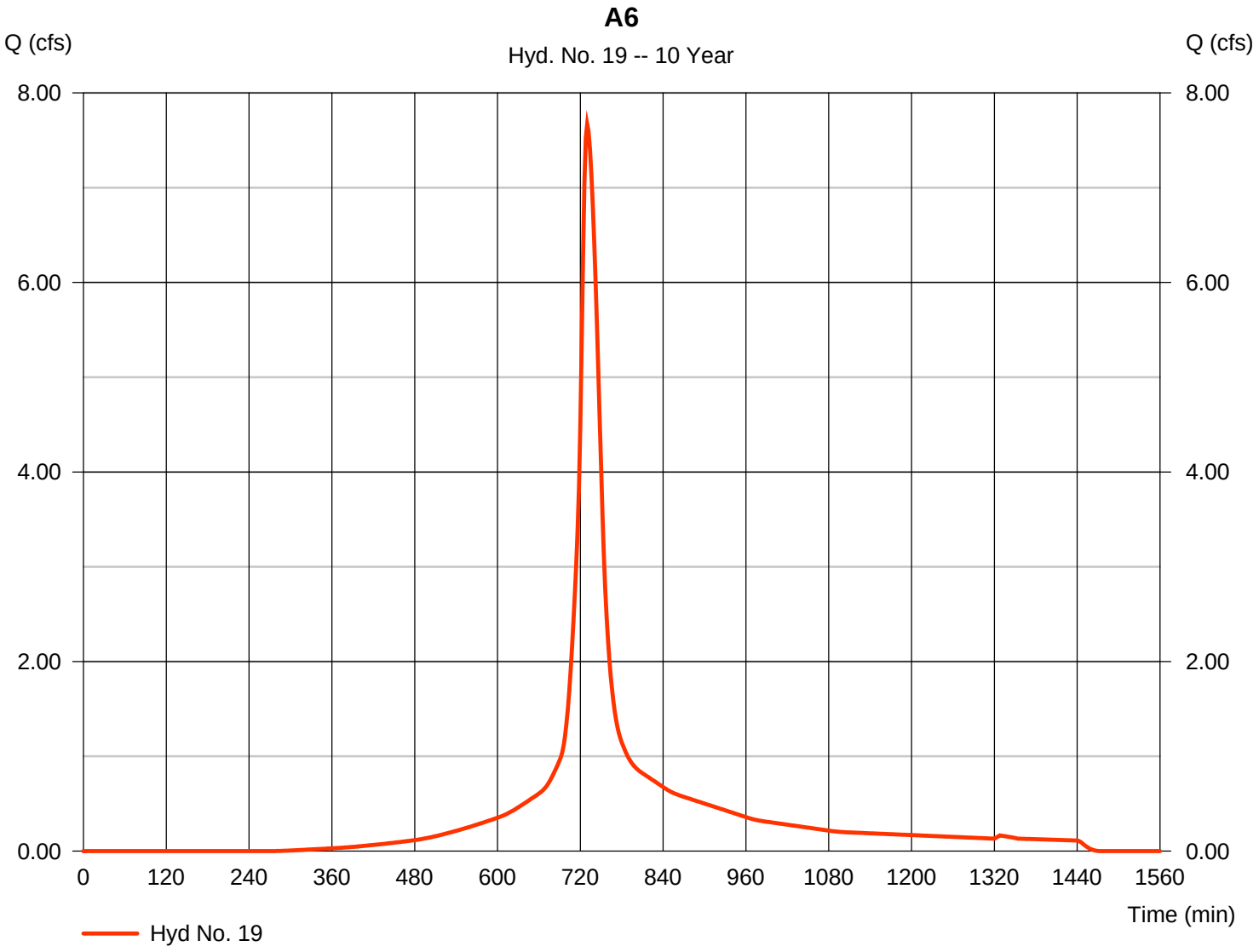


Hydrograph Report

Hyd. No. 19

A6

Hydrograph type	=	SCS Runoff	Peak discharge	=	7.669 cfs
Storm frequency	=	10 yrs	Time to peak	=	730 min
Time interval	=	2 min	Hyd. volume	=	36,090 cuft
Drainage area	=	2.200 ac	Curve number	=	87
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	10.00 min
Total precip.	=	6.06 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	300

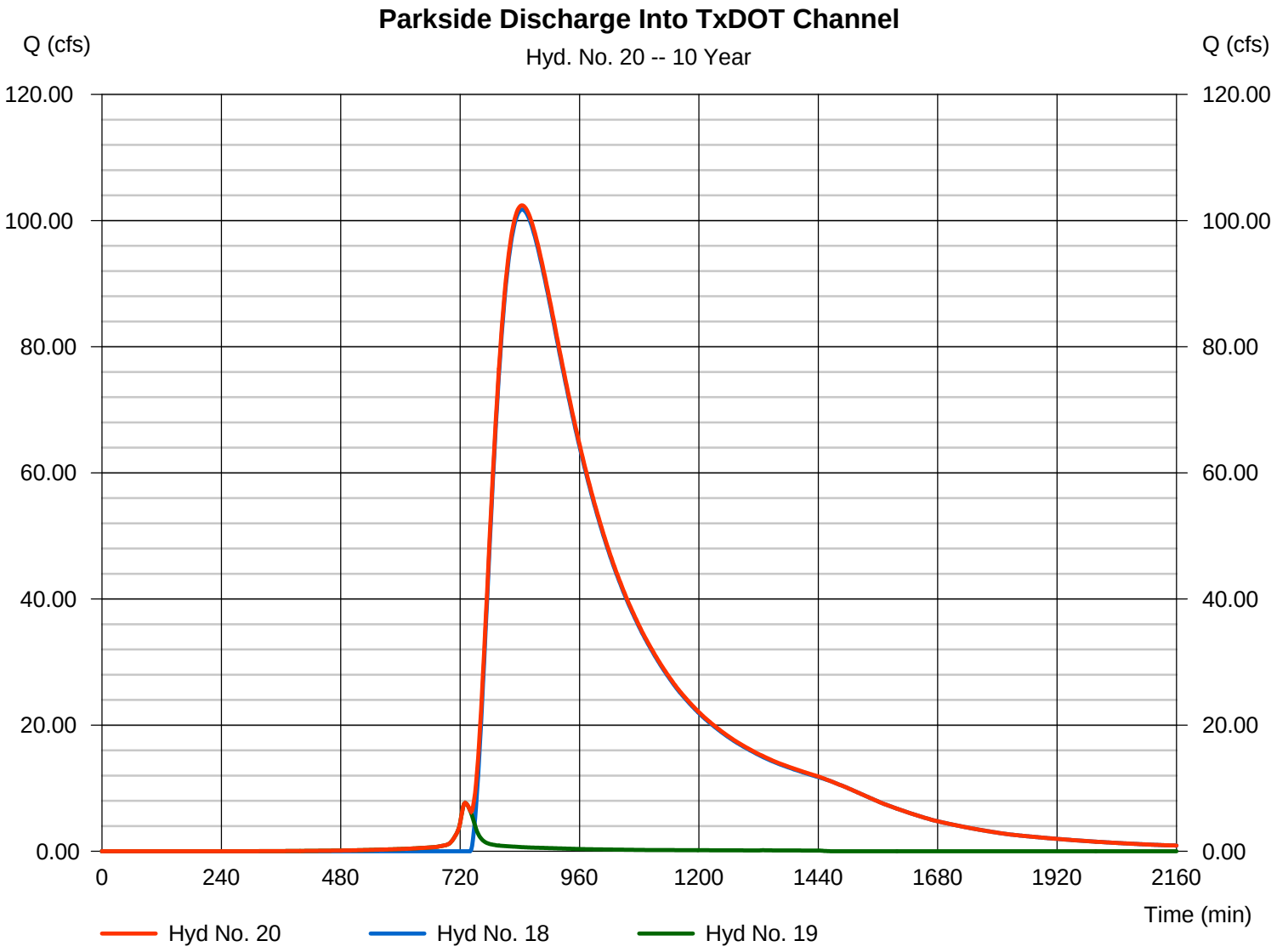


Hydrograph Report

Hyd. No. 20

Parkside Discharge Into TxDOT Channel

Hydrograph type	= Combine	Peak discharge	= 102.40 cfs
Storm frequency	= 10 yrs	Time to peak	= 844 min
Time interval	= 2 min	Hyd. volume	= 1,987,160 cuft
Inflow hyds.	= 18, 19	Contrib. drain. area	= 2.200 ac

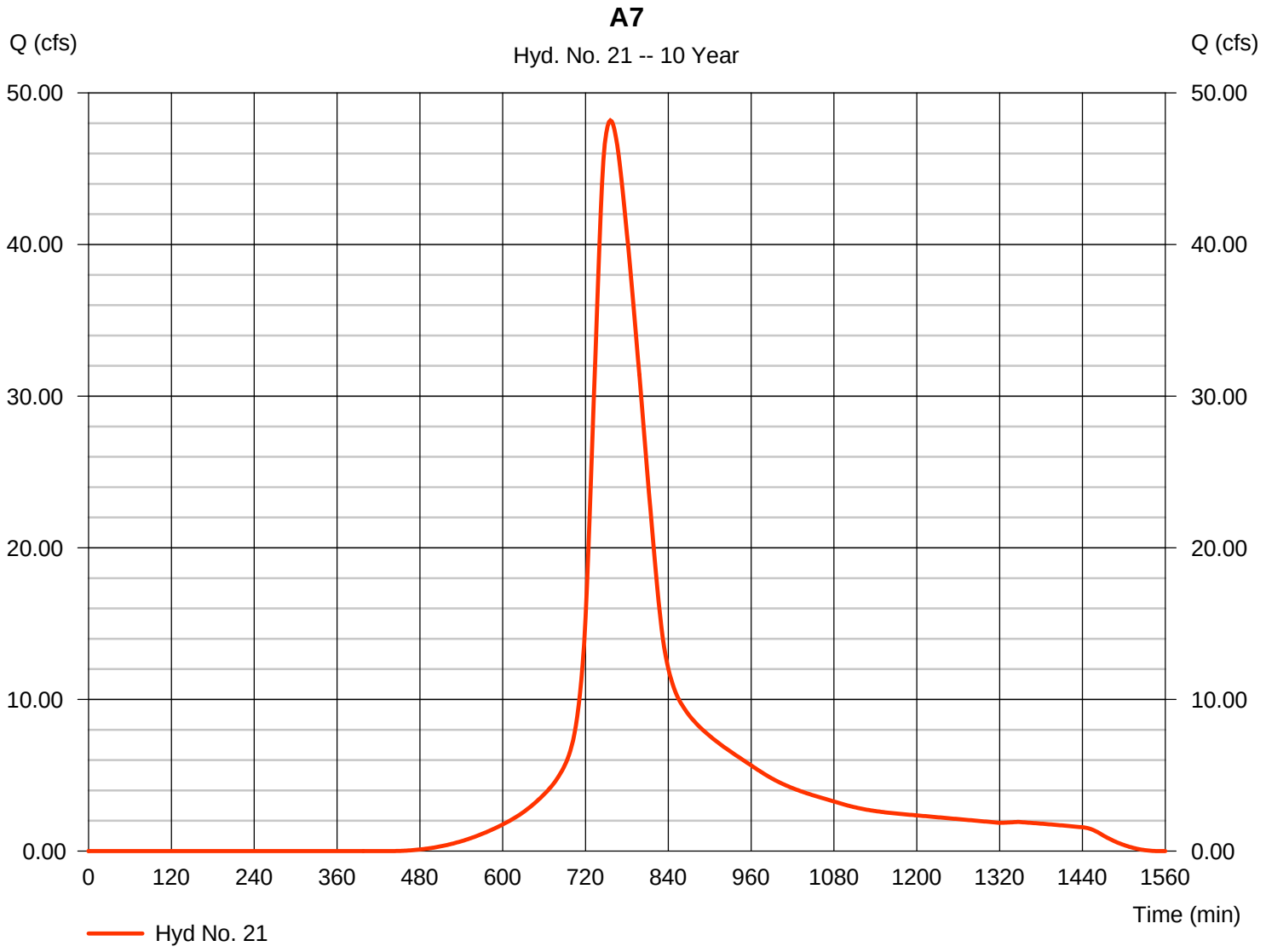


Hydrograph Report

Hyd. No. 21

A7

Hydrograph type	=	SCS Runoff	Peak discharge	=	48.19 cfs
Storm frequency	=	10 yrs	Time to peak	=	756 min
Time interval	=	2 min	Hyd. volume	=	410,676 cuft
Drainage area	=	31.110 ac	Curve number	=	78
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	40.80 min
Total precip.	=	6.06 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	300

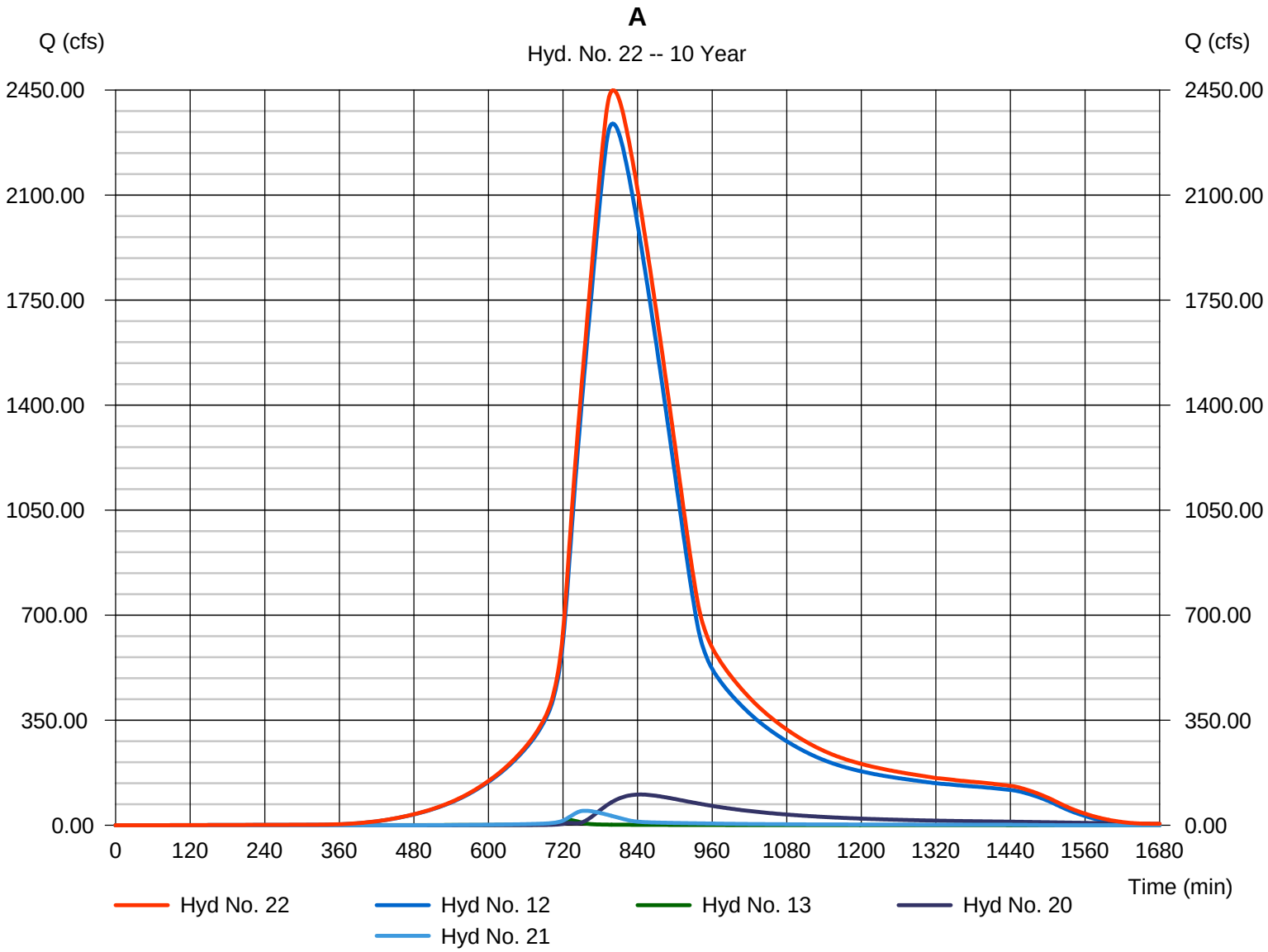


Hydrograph Report

Hyd. No. 22

A

Hydrograph type	=	Combine	Peak discharge	=	2449.13 cfs
Storm frequency	=	10 yrs	Time to peak	=	800 min
Time interval	=	2 min	Hyd. volume	=	33,799,248 cuft
Inflow hyds.	=	12, 13, 20, 21	Contrib. drain. area	=	35.560 ac



Hydrograph Summary Report

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

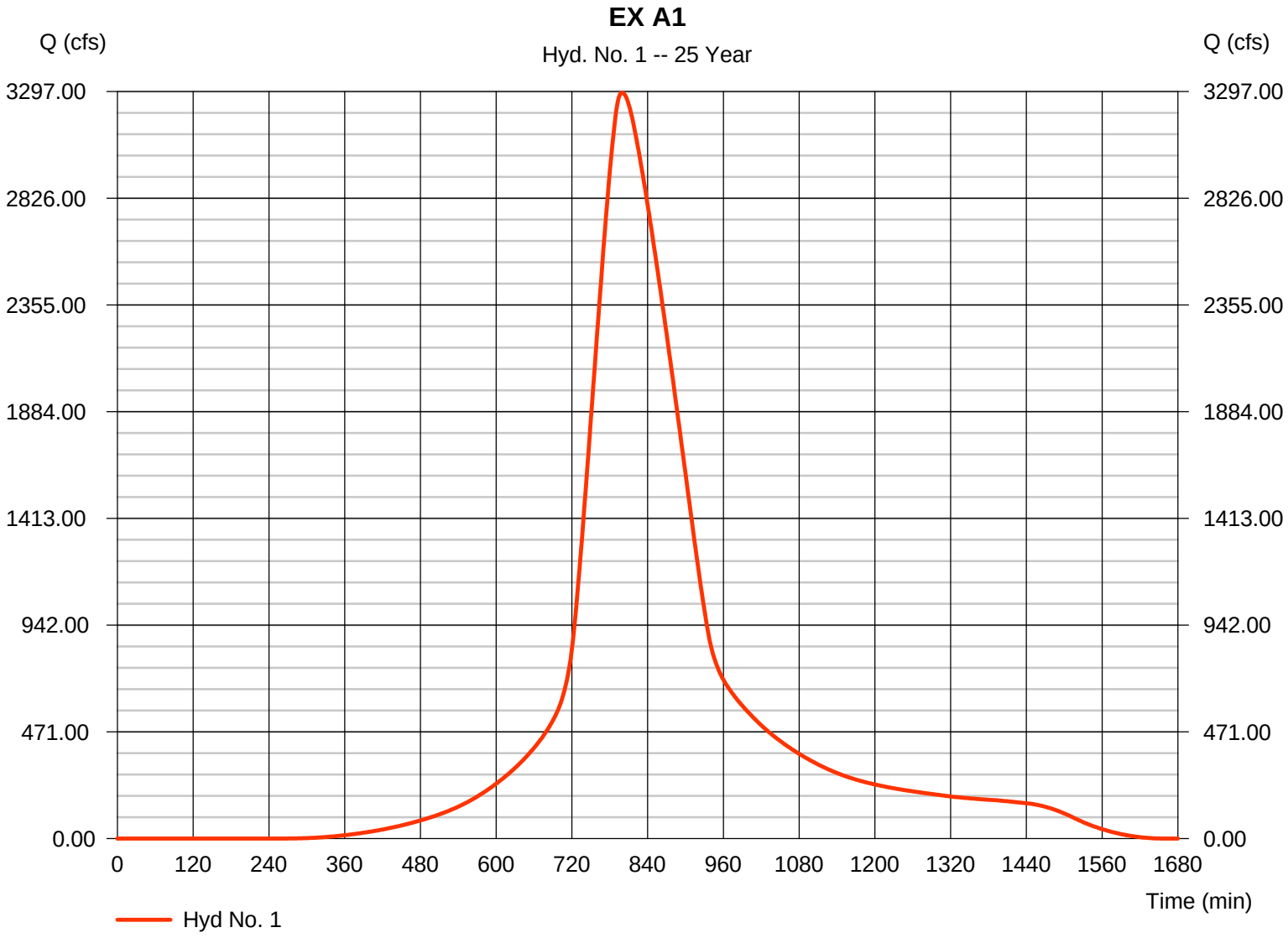
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	3291.98	2	800	43,642,248	------	------	------	EX A1
2	SCS Runoff	94.50	2	742	628,857	------	------	------	EX A2
3	SCS Runoff	289.37	2	760	2,375,550	------	------	------	EX A3
4	Combine	3495.48	2	796	46,646,688	1, 2, 3	------	------	EX A1 - EX A3
5	SCS Runoff	29.03	2	728	122,298	------	------	------	EX A4
6	SCS Runoff	58.74	2	762	498,412	------	------	------	EX A5
7	SCS Runoff	91.70	2	750	620,473	------	------	------	EX A6
8	Combine	3570.74	2	796	47,887,840	4, 5, 6, 7	------	------	EX A
9	SCS Runoff	3291.98	2	800	43,642,248	------	------	------	A1
10	SCS Runoff	94.50	2	742	628,857	------	------	------	A2
11	SCS Runoff	128.59	2	738	683,309	------	------	------	A3
12	Combine	3326.45	2	800	44,954,448	9, 10, 11	------	------	A1-A3
13	SCS Runoff	23.32	2	730	117,153	------	------	------	A4
14	SCS Runoff	310.34	2	752	2,599,887	------	------	------	Parkside Bain A1 Inflow
15	Reservoir	189.09	2	794	2,415,578	14	605.58	972,007	A1-A9 + Basin A1
16	SCS Runoff	100.16	2	744	712,434	------	------	------	Parksie Development
17	Combine	238.36	2	774	3,128,010	15, 16	------	------	Parkside Basin A2 Inflow
18	Reservoir	173.26	2	826	2,935,132	17	603.22	853,241	BASIN A2
19	SCS Runoff	10.74	2	730	51,343	------	------	------	A6
20	Combine	174.27	2	826	2,986,477	18, 19	------	------	Parkside Discharge Into TxDOT Chan
21	SCS Runoff	72.05	2	756	615,853	------	------	------	A7
22	Combine	3532.38	2	800	48,673,620	12, 13, 20, 21	------	------	A

Hydrograph Report

Hyd. No. 1

EX A1

Hydrograph type	=	SCS Runoff	Peak discharge	=	3291.98 cfs
Storm frequency	=	25 yrs	Time to peak	=	800 min
Time interval	=	2 min	Hyd. volume	=	43,642,248 cuft
Drainage area	=	1906.930 ac	Curve number	=	85.3
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	122.30 min
Total precip.	=	8.06 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	434

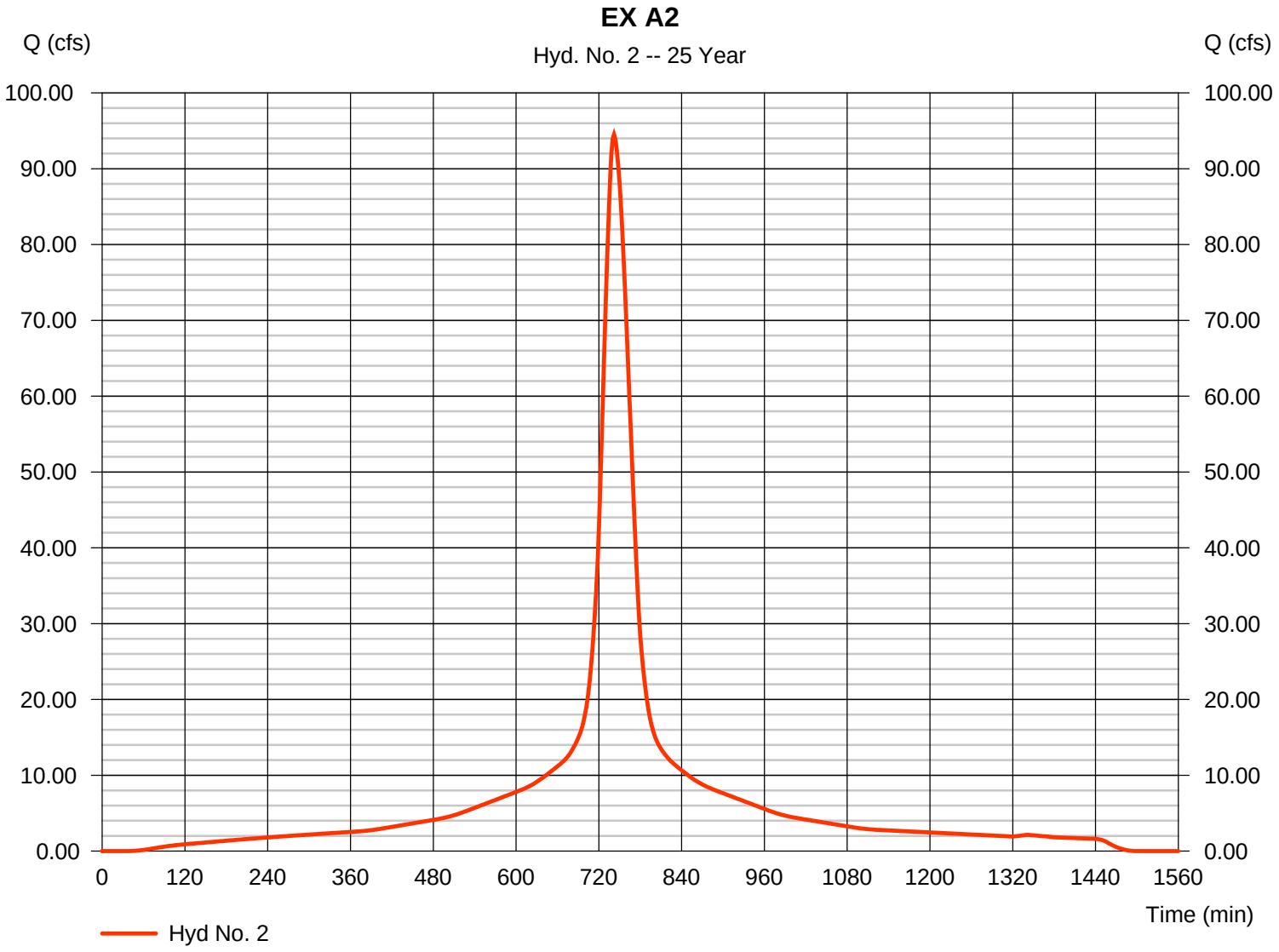


Hydrograph Report

Hyd. No. 2

EX A2

Hydrograph type	=	SCS Runoff	Peak discharge	=	94.50 cfs
Storm frequency	=	25 yrs	Time to peak	=	742 min
Time interval	=	2 min	Hyd. volume	=	628,857 cuft
Drainage area	=	21.960 ac	Curve number	=	98
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	32.00 min
Total precip.	=	8.06 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	434

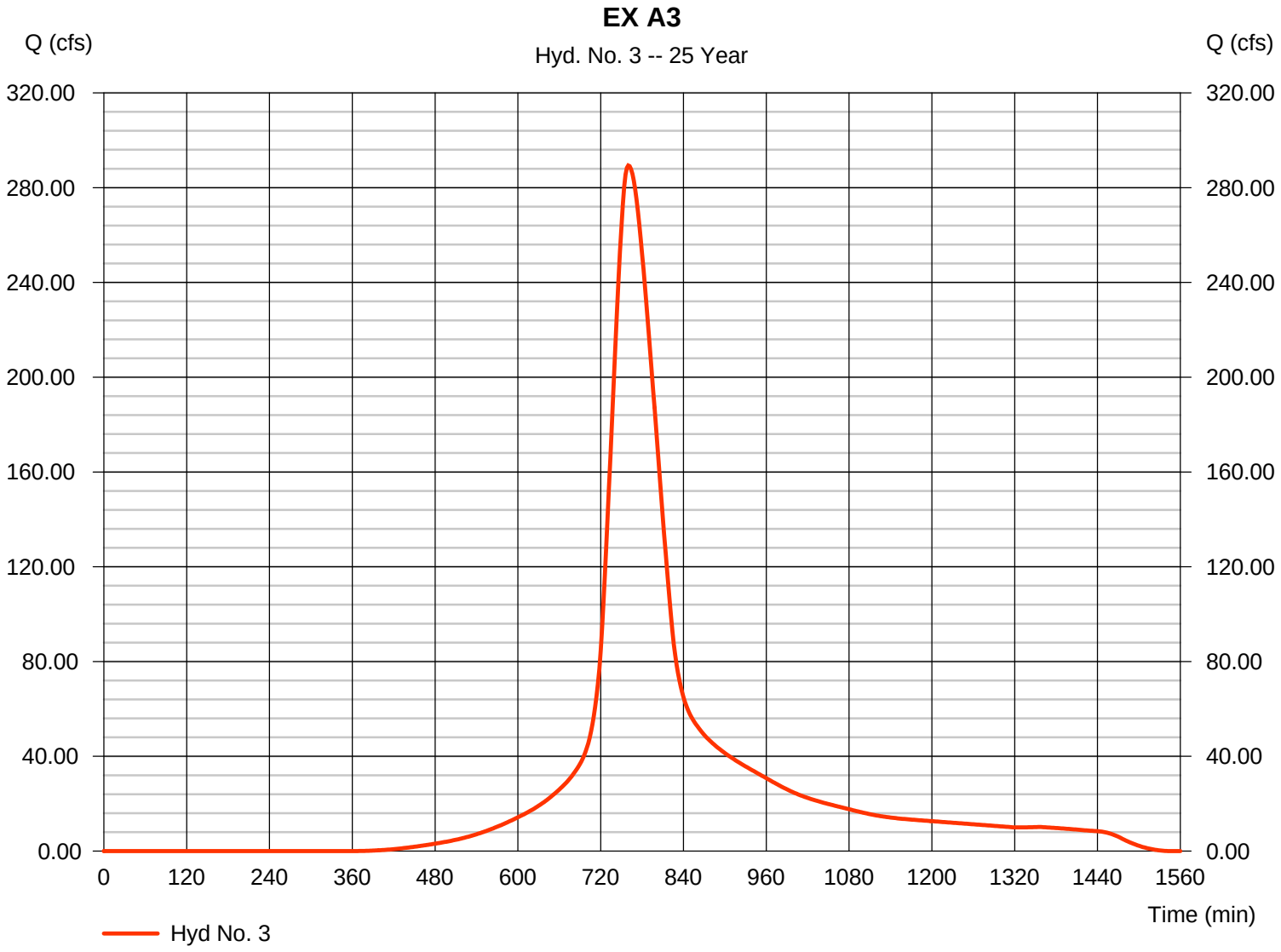


Hydrograph Report

Hyd. No. 3

EX A3

Hydrograph type	=	SCS Runoff	Peak discharge	=	289.37 cfs
Storm frequency	=	25 yrs	Time to peak	=	760 min
Time interval	=	2 min	Hyd. volume	=	2,375,550 cuft
Drainage area	=	117.840 ac	Curve number	=	78.5
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	59.60 min
Total precip.	=	8.06 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	434

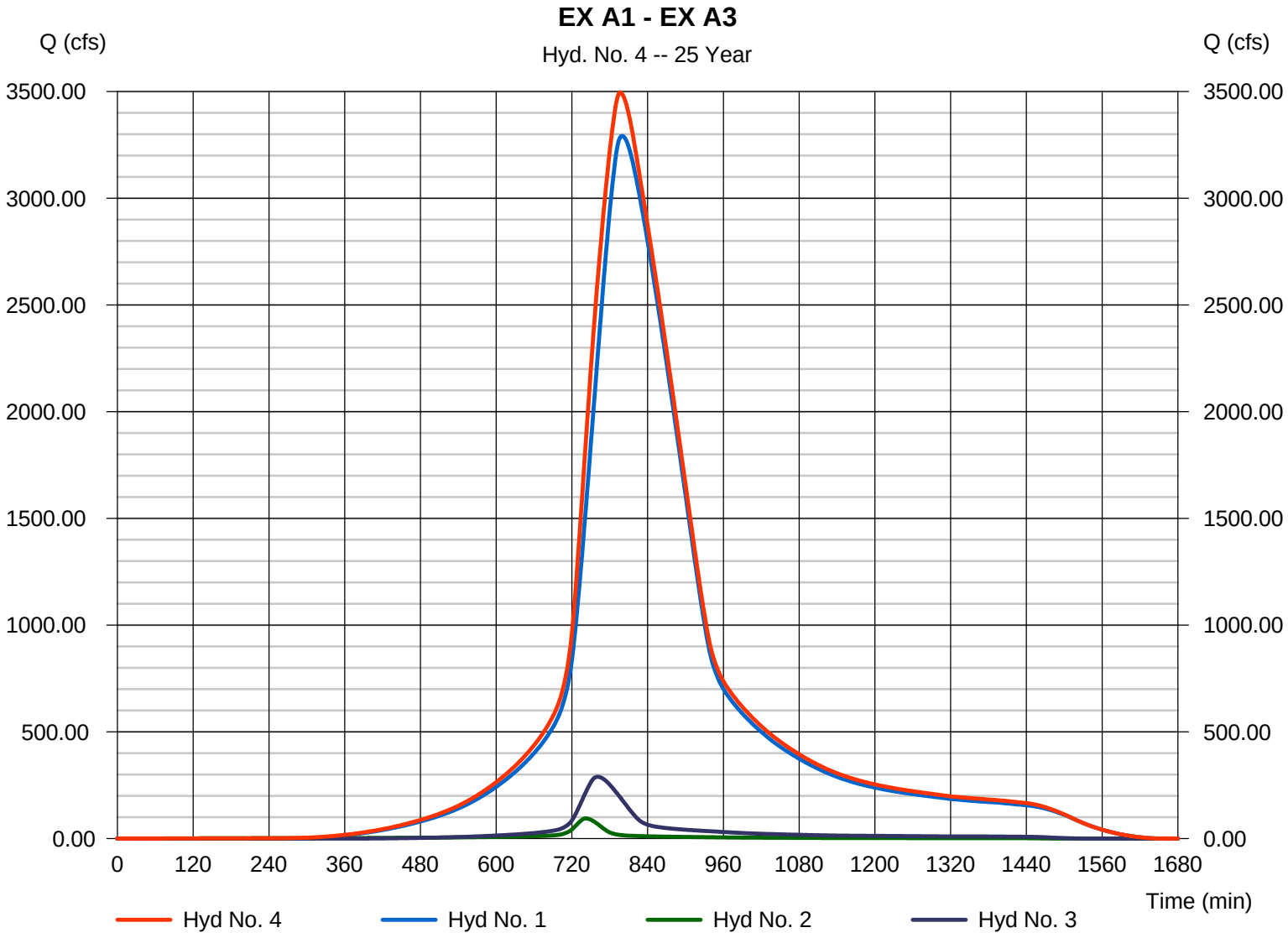


Hydrograph Report

Hyd. No. 4

EX A1 - EX A3

Hydrograph type	=	Combine	Peak discharge	=	3495.48 cfs
Storm frequency	=	25 yrs	Time to peak	=	796 min
Time interval	=	2 min	Hyd. volume	=	46,646,688 cuft
Inflow hyds.	=	1, 2, 3	Contrib. drain. area	=	2046.730 ac

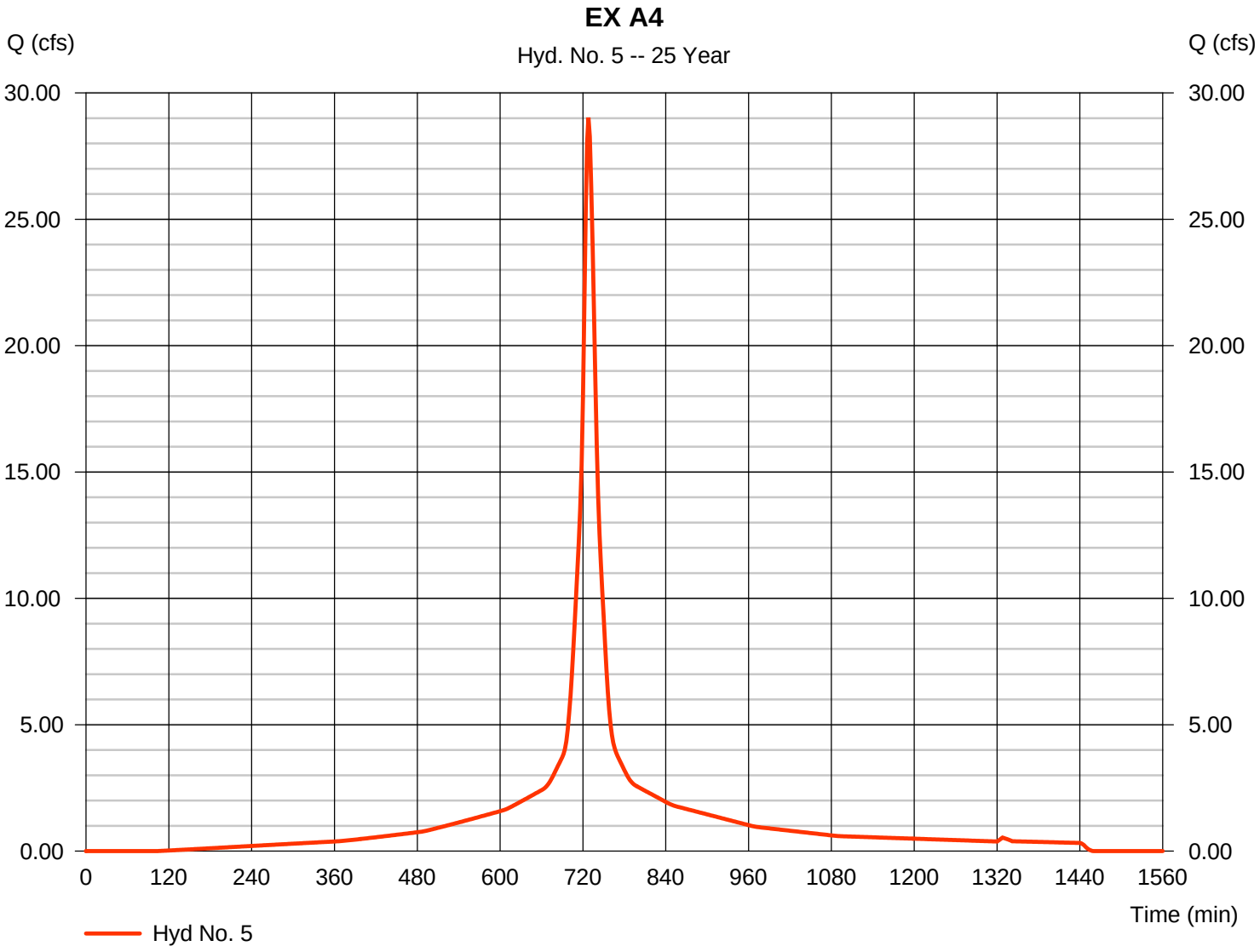


Hydrograph Report

Hyd. No. 5

EX A4

Hydrograph type	=	SCS Runoff	Peak discharge	=	29.03 cfs
Storm frequency	=	25 yrs	Time to peak	=	728 min
Time interval	=	2 min	Hyd. volume	=	122,298 cuft
Drainage area	=	4.450 ac	Curve number	=	94
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	10.00 min
Total precip.	=	8.06 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484

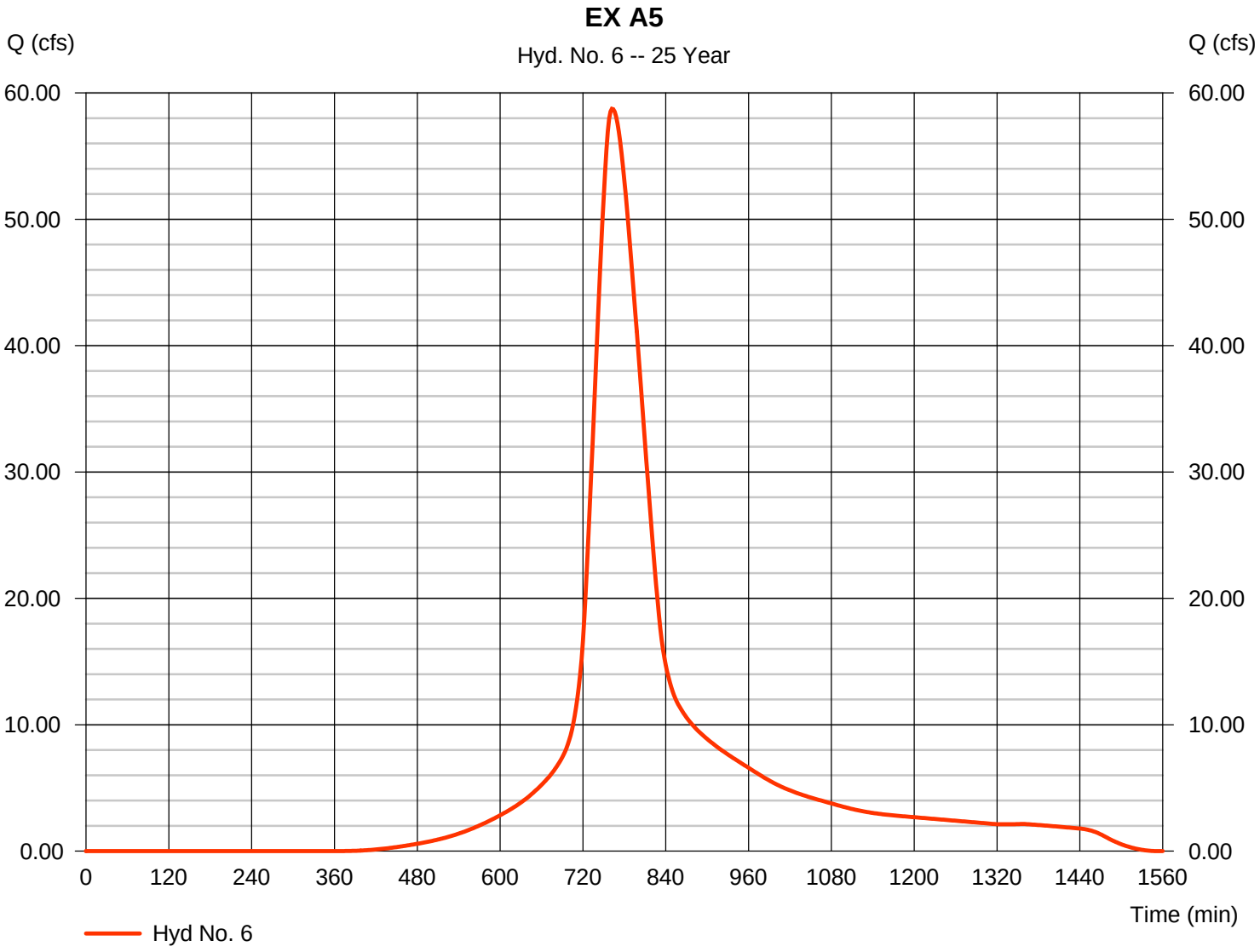


Hydrograph Report

Hyd. No. 6

EX A5

Hydrograph type	=	SCS Runoff	Peak discharge	=	58.74 cfs
Storm frequency	=	25 yrs	Time to peak	=	762 min
Time interval	=	2 min	Hyd. volume	=	498,412 cuft
Drainage area	=	24.990 ac	Curve number	=	78
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	63.10 min
Total precip.	=	8.06 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	434

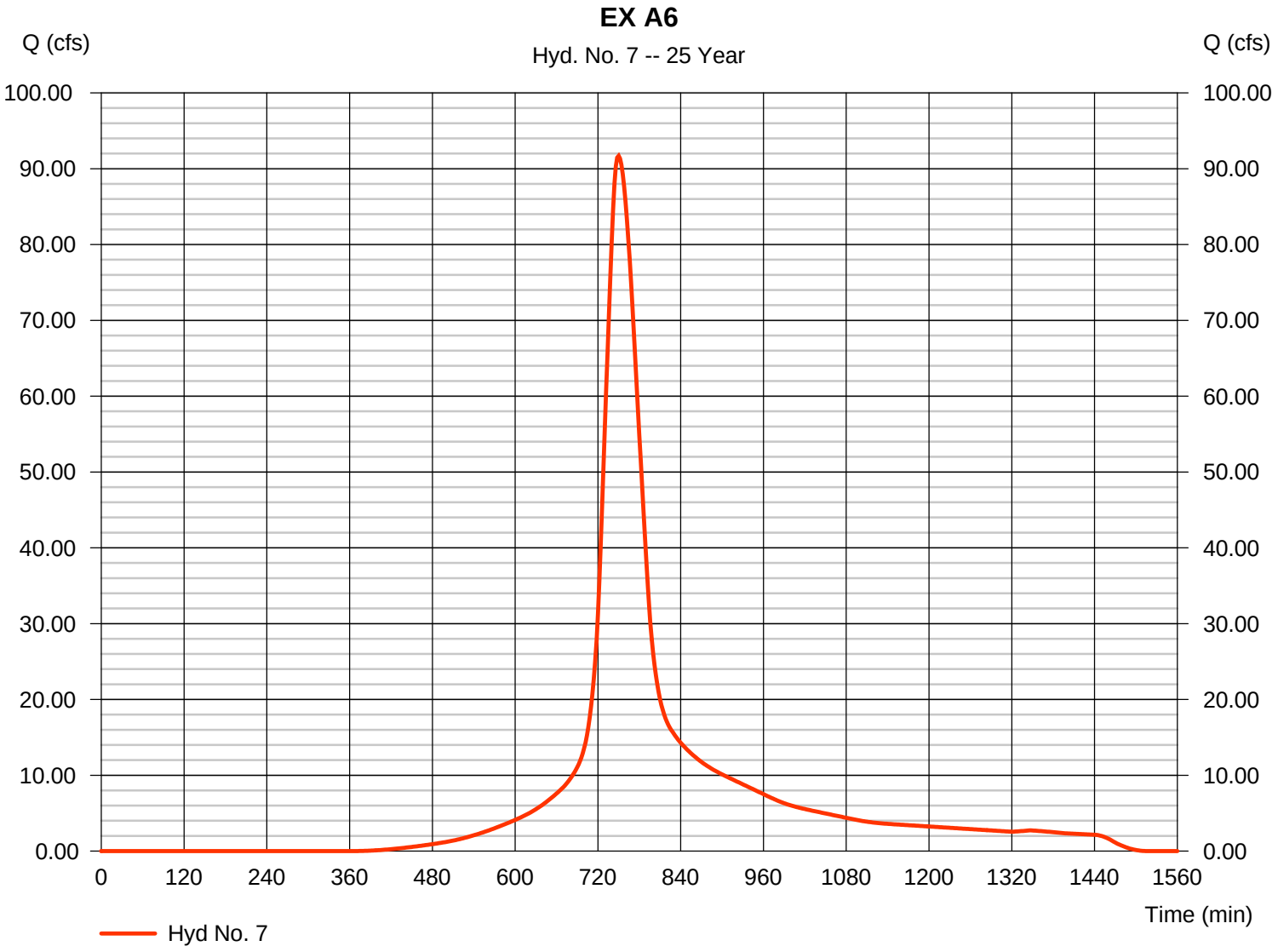


Hydrograph Report

Hyd. No. 7

EX A6

Hydrograph type	=	SCS Runoff	Peak discharge	=	91.70 cfs
Storm frequency	=	25 yrs	Time to peak	=	750 min
Time interval	=	2 min	Hyd. volume	=	620,473 cuft
Drainage area	=	31.110 ac	Curve number	=	78
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	40.80 min
Total precip.	=	8.06 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	434

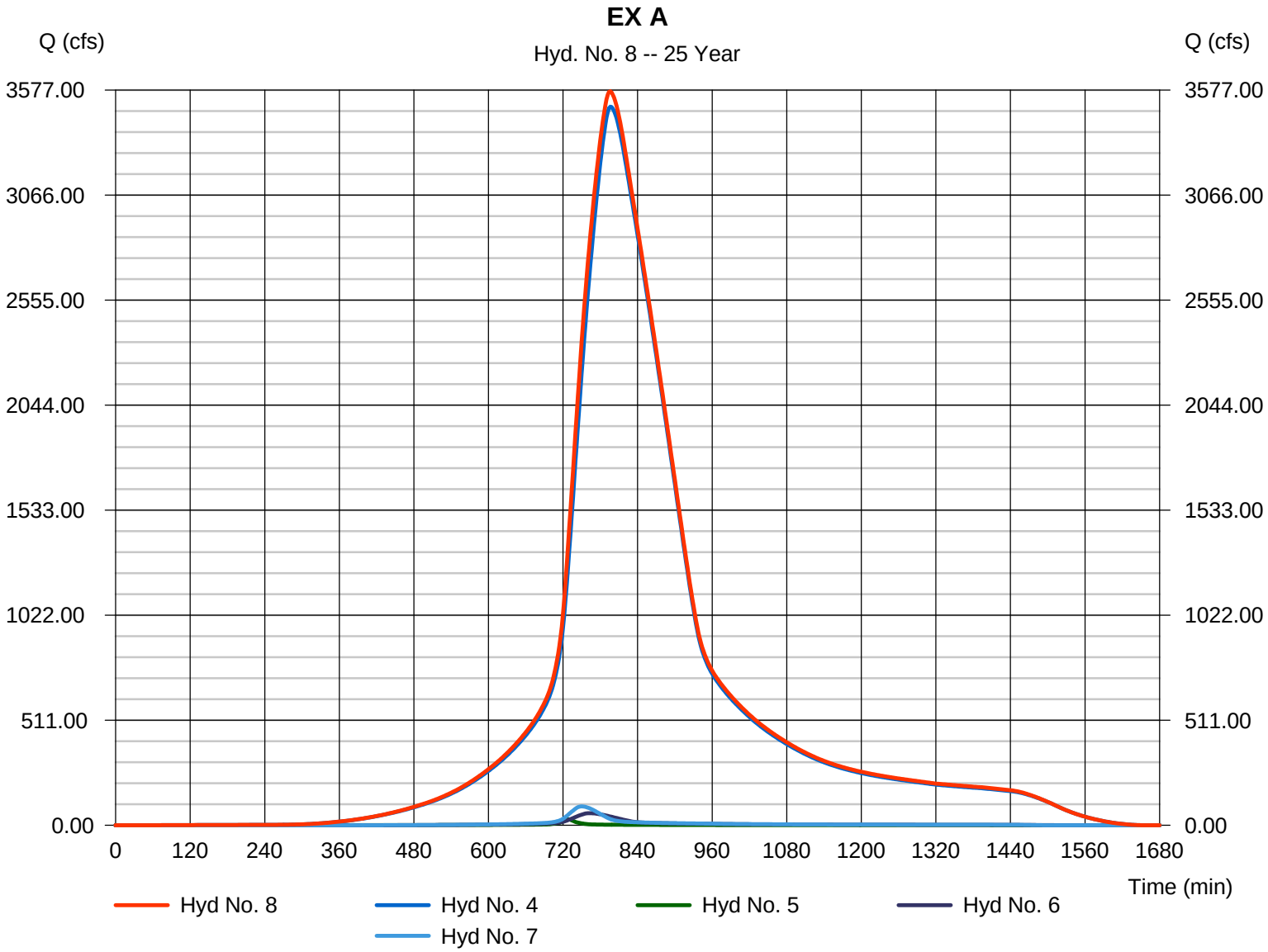


Hydrograph Report

Hyd. No. 8

EX A

Hydrograph type	=	Combine	Peak discharge	=	3570.74 cfs
Storm frequency	=	25 yrs	Time to peak	=	796 min
Time interval	=	2 min	Hyd. volume	=	47,887,840 cuft
Inflow hyds.	=	4, 5, 6, 7	Contrib. drain. area	=	60.550 ac

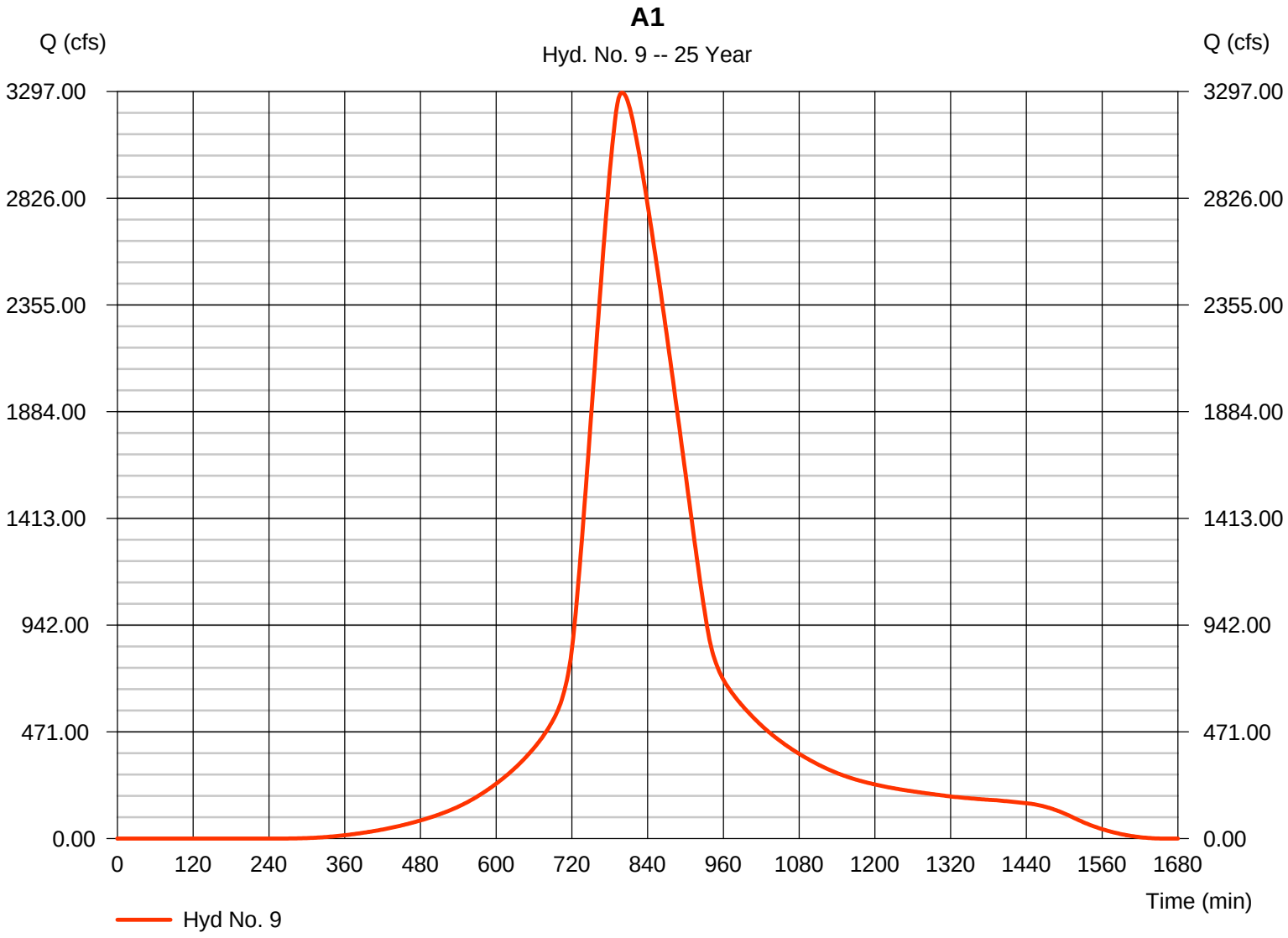


Hydrograph Report

Hyd. No. 9

A1

Hydrograph type	=	SCS Runoff	Peak discharge	=	3291.98 cfs
Storm frequency	=	25 yrs	Time to peak	=	800 min
Time interval	=	2 min	Hyd. volume	=	43,642,248 cuft
Drainage area	=	1906.930 ac	Curve number	=	85.3
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	122.30 min
Total precip.	=	8.06 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	434

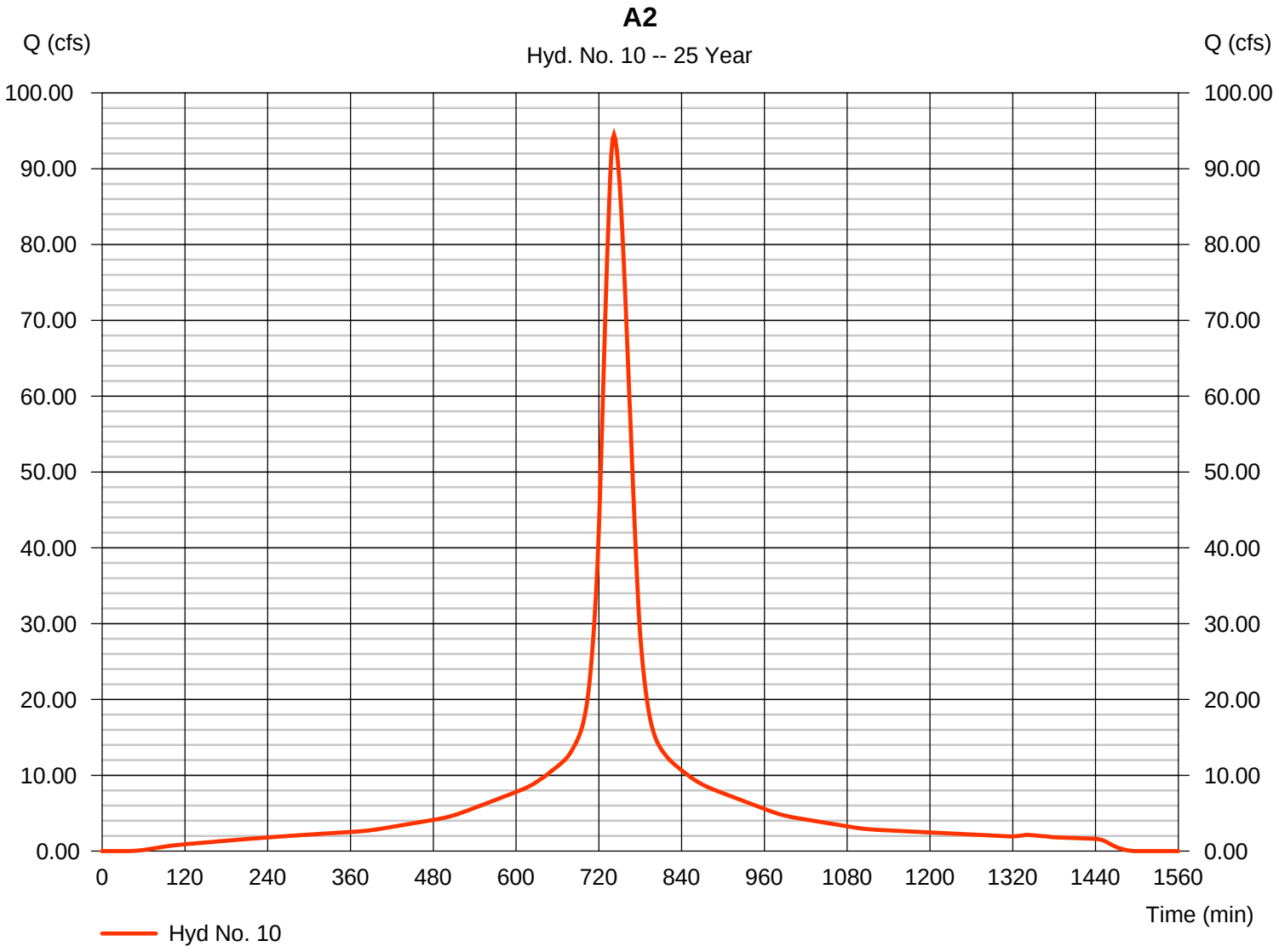


Hydrograph Report

Hyd. No. 10

A2

Hydrograph type	=	SCS Runoff	Peak discharge	=	94.50 cfs
Storm frequency	=	25 yrs	Time to peak	=	742 min
Time interval	=	2 min	Hyd. volume	=	628,857 cuft
Drainage area	=	21.960 ac	Curve number	=	98
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	32.00 min
Total precip.	=	8.06 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	434

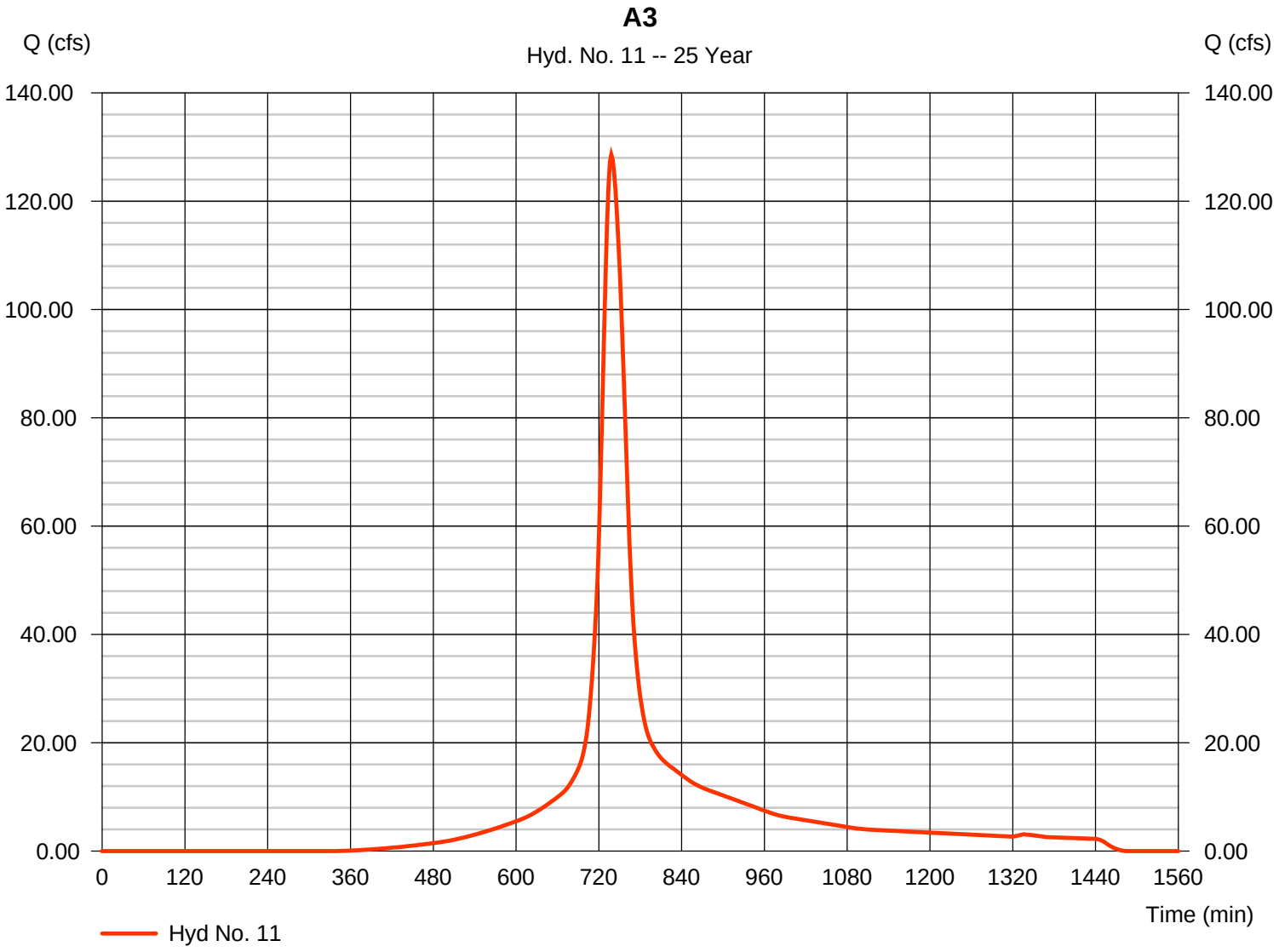


Hydrograph Report

Hyd. No. 11

A3

Hydrograph type	=	SCS Runoff	Peak discharge	=	128.59 cfs
Storm frequency	=	25 yrs	Time to peak	=	738 min
Time interval	=	2 min	Hyd. volume	=	683,309 cuft
Drainage area	=	33.050 ac	Curve number	=	79.7
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	25.60 min
Total precip.	=	8.06 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	434

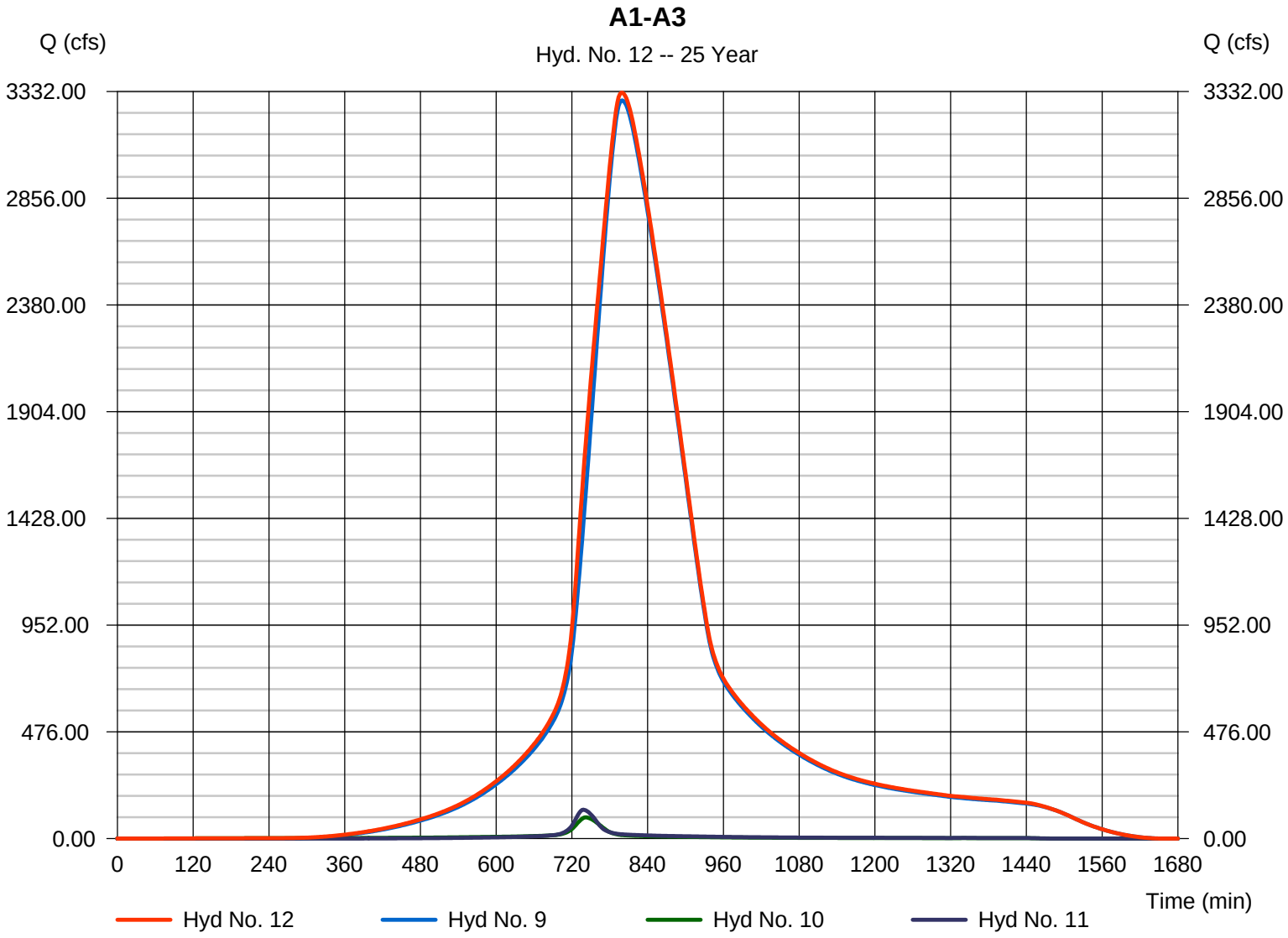


Hydrograph Report

Hyd. No. 12

A1-A3

Hydrograph type	=	Combine	Peak discharge	=	3326.45 cfs
Storm frequency	=	25 yrs	Time to peak	=	800 min
Time interval	=	2 min	Hyd. volume	=	44,954,448 cuft
Inflow hyds.	=	9, 10, 11	Contrib. drain. area	=	1961.940 ac

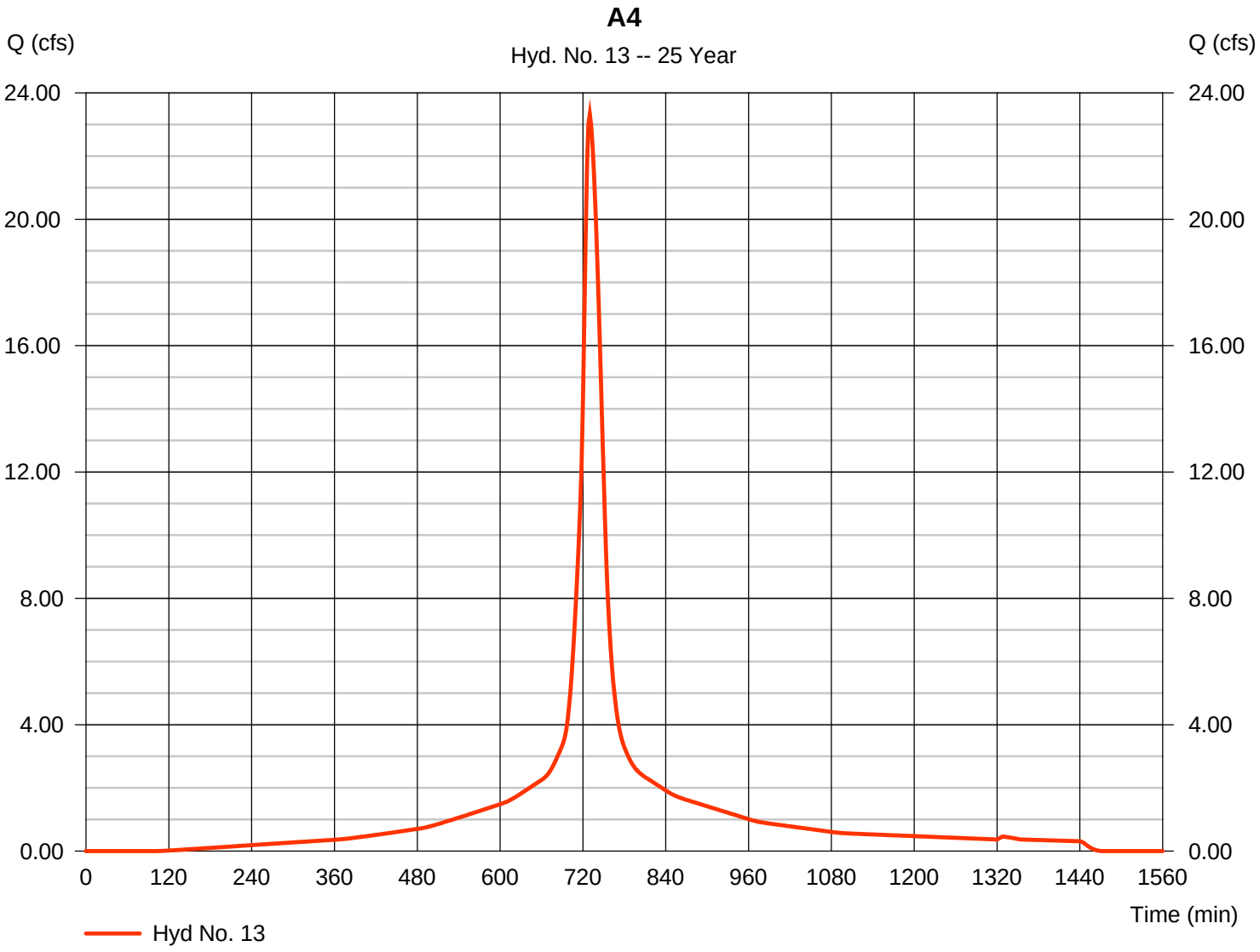


Hydrograph Report

Hyd. No. 13

A4

Hydrograph type	=	SCS Runoff	Peak discharge	=	23.32 cfs
Storm frequency	=	25 yrs	Time to peak	=	730 min
Time interval	=	2 min	Hyd. volume	=	117,153 cuft
Drainage area	=	4.450 ac	Curve number	=	94
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	10.00 min
Total precip.	=	8.06 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	300

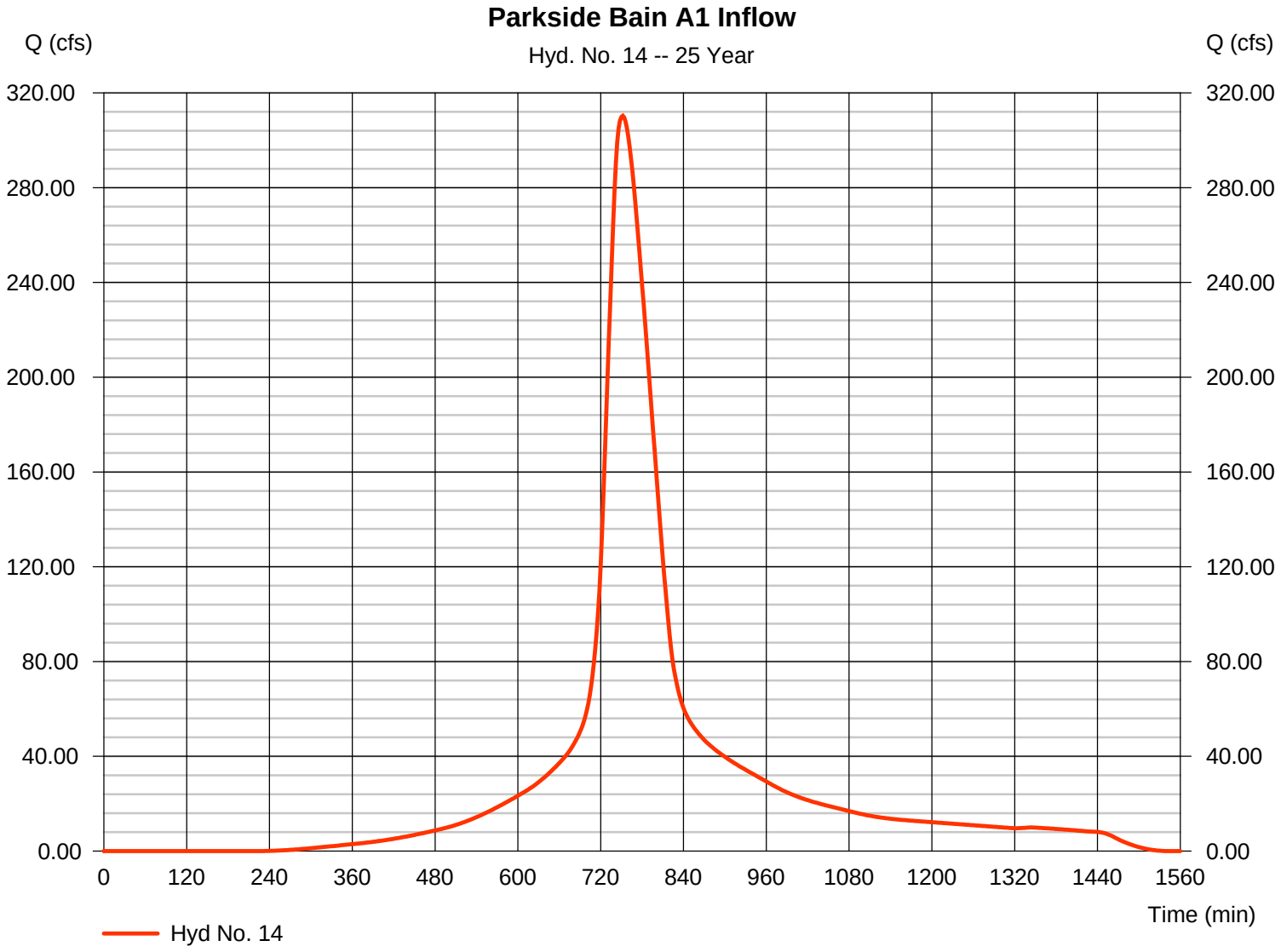


Hydrograph Report

Hyd. No. 14

Parkside Bain A1 Inflow

Hydrograph type	=	SCS Runoff	Peak discharge	=	310.34 cfs
Storm frequency	=	25 yrs	Time to peak	=	752 min
Time interval	=	2 min	Hyd. volume	=	2,599,887 cuft
Drainage area	=	109.260 ac	Curve number	=	87
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	37.90 min
Total precip.	=	8.06 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	300



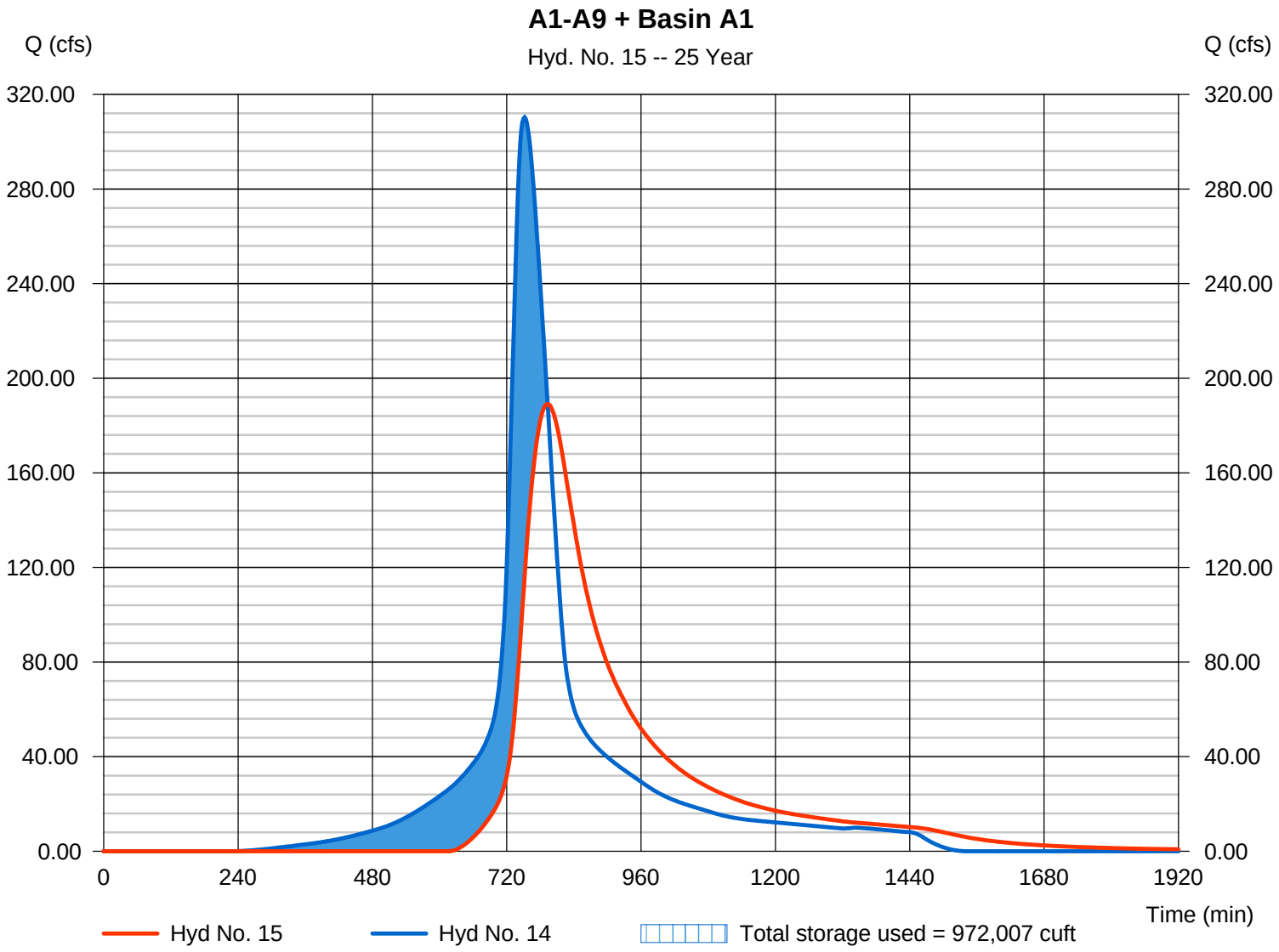
Hydrograph Report

Hyd. No. 15

A1-A9 + Basin A1

Hydrograph type	=	Reservoir	Peak discharge	=	189.09 cfs
Storm frequency	=	25 yrs	Time to peak	=	794 min
Time interval	=	2 min	Hyd. volume	=	2,415,578 cuft
Inflow hyd. No.	=	14 - Parkside Bain A1 Inflow	Max. Elevation	=	605.58 ft
Reservoir name	=	BASIN A1	Max. Storage	=	972,007 cuft

Storage Indication method used.

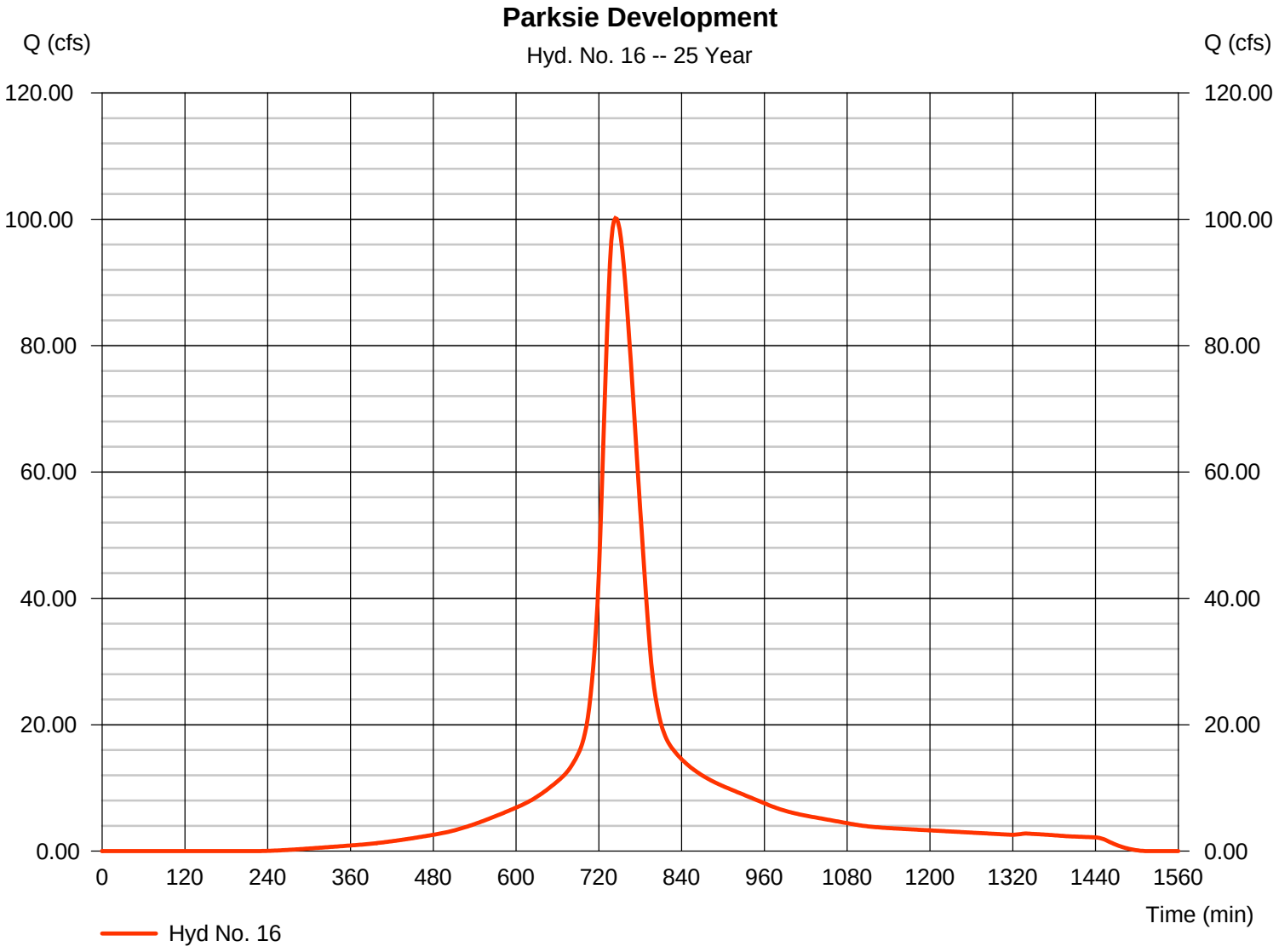


Hydrograph Report

Hyd. No. 16

Parksie Development

Hydrograph type	=	SCS Runoff	Peak discharge	=	100.16 cfs
Storm frequency	=	25 yrs	Time to peak	=	744 min
Time interval	=	2 min	Hyd. volume	=	712,434 cuft
Drainage area	=	29.940 ac	Curve number	=	87
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	28.50 min
Total precip.	=	8.06 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	300

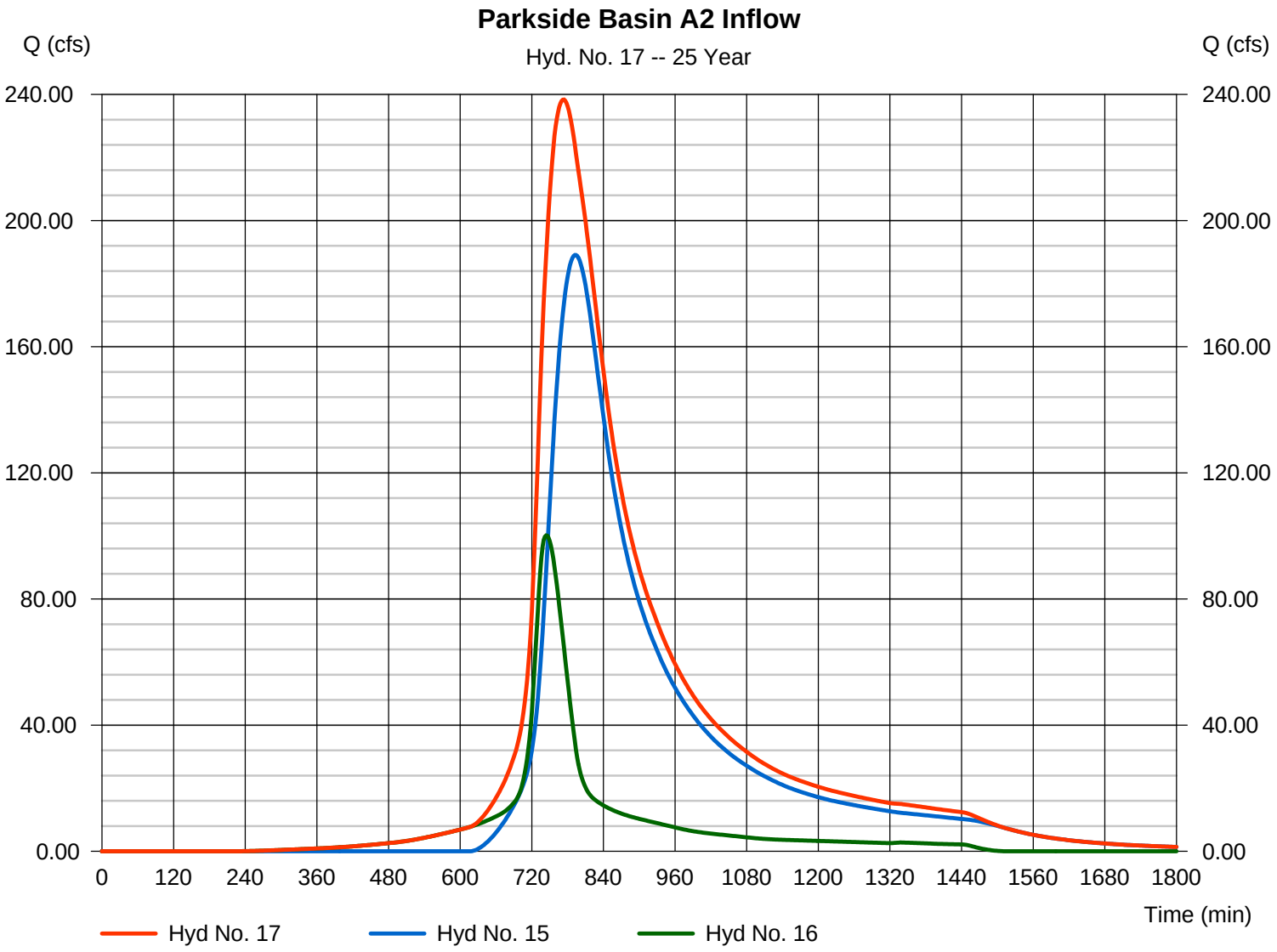


Hydrograph Report

Hyd. No. 17

Parkside Basin A2 Inflow

Hydrograph type	=	Combine	Peak discharge	=	238.36 cfs
Storm frequency	=	25 yrs	Time to peak	=	774 min
Time interval	=	2 min	Hyd. volume	=	3,128,010 cuft
Inflow hyds.	=	15, 16	Contrib. drain. area	=	29.940 ac



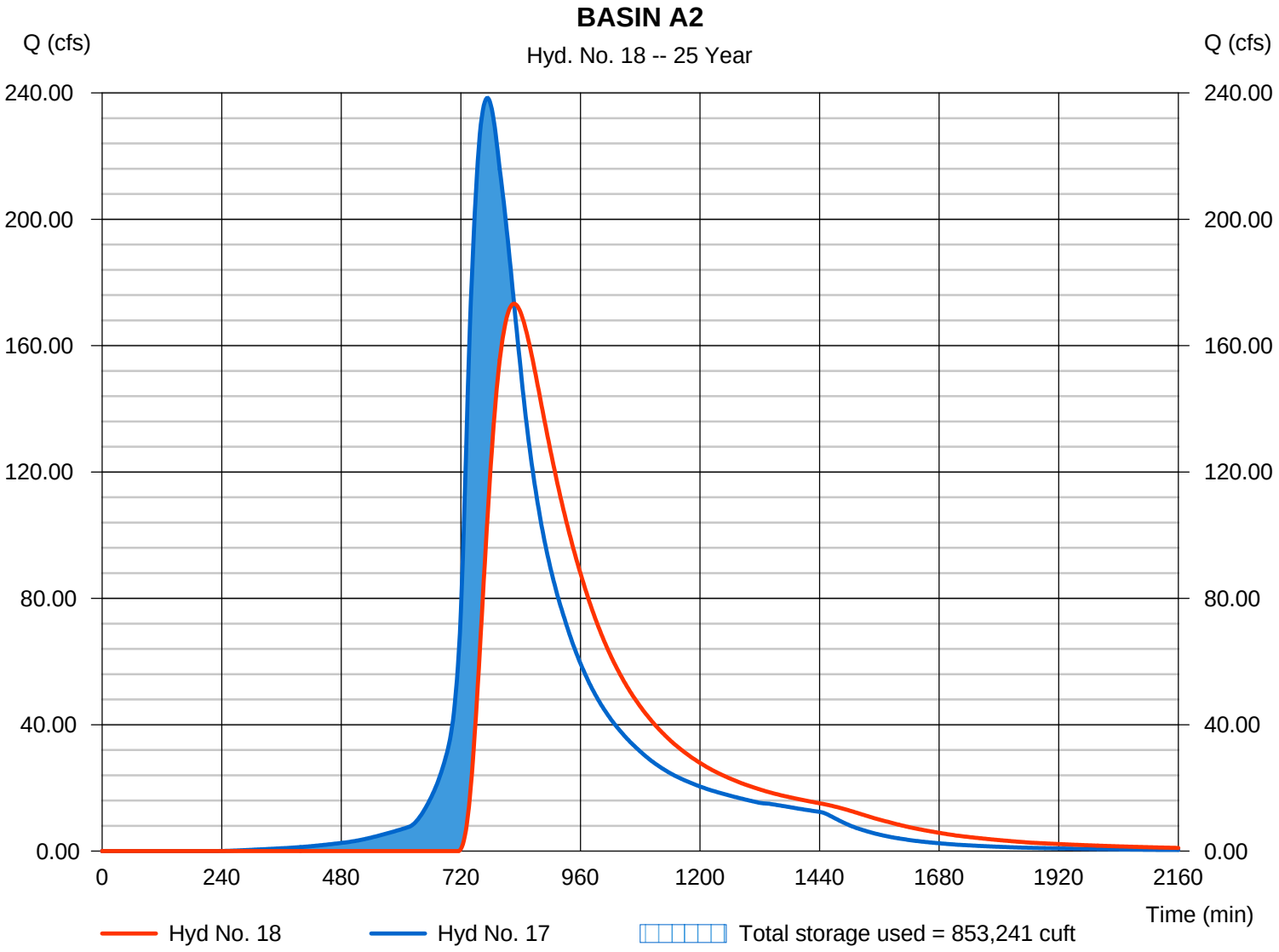
Hydrograph Report

Hyd. No. 18

BASIN A2

Hydrograph type	=	Reservoir	Peak discharge	=	173.26 cfs
Storm frequency	=	25 yrs	Time to peak	=	826 min
Time interval	=	2 min	Hyd. volume	=	2,935,132 cuft
Inflow hyd. No.	=	17 - Parkside Basin A2 Inflow	Max. Elevation	=	603.22 ft
Reservoir name	=	BASIN A2	Max. Storage	=	853,241 cuft

Storage Indication method used.

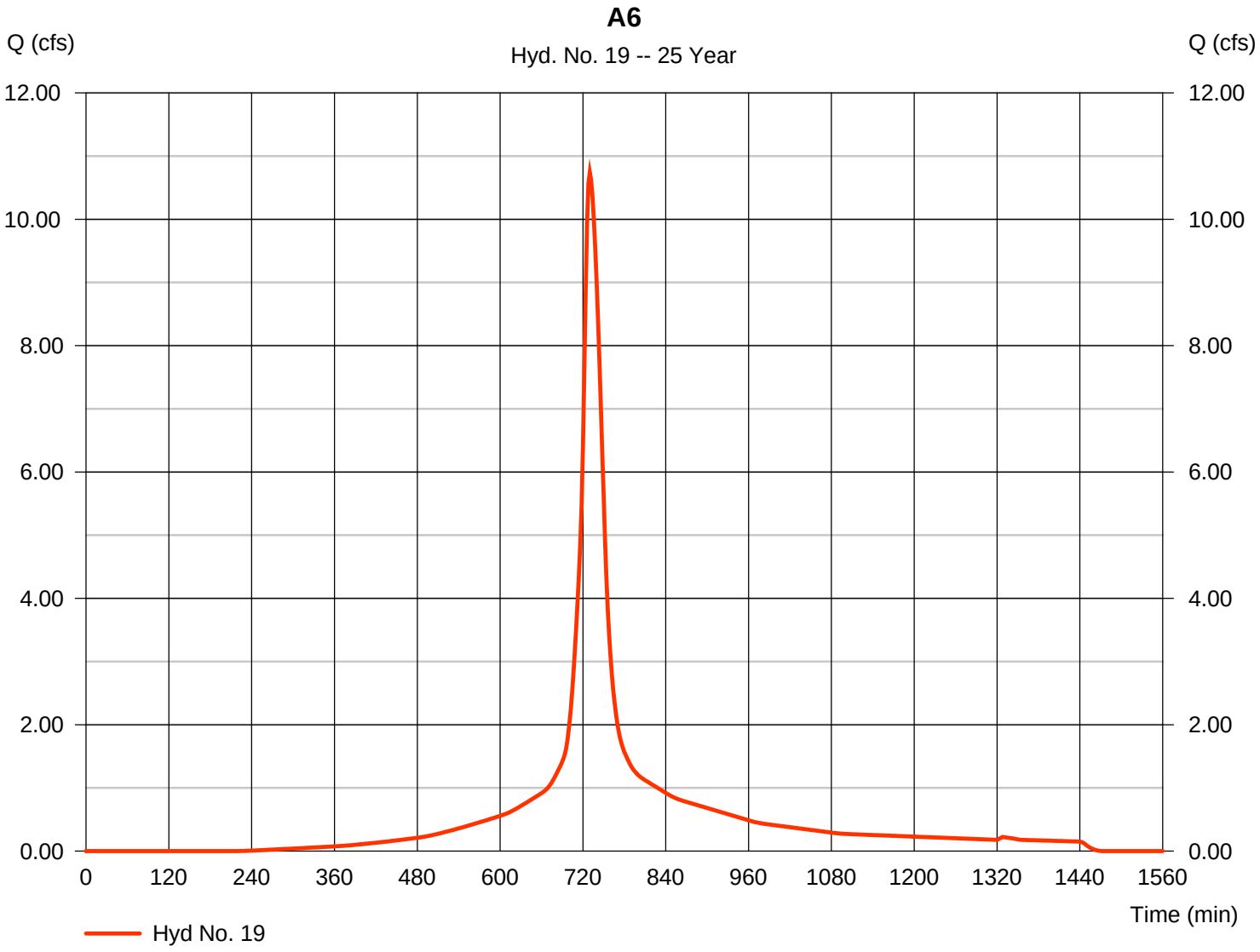


Hydrograph Report

Hyd. No. 19

A6

Hydrograph type	=	SCS Runoff	Peak discharge	=	10.74 cfs
Storm frequency	=	25 yrs	Time to peak	=	730 min
Time interval	=	2 min	Hyd. volume	=	51,343 cuft
Drainage area	=	2.200 ac	Curve number	=	87
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	10.00 min
Total precip.	=	8.06 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	300

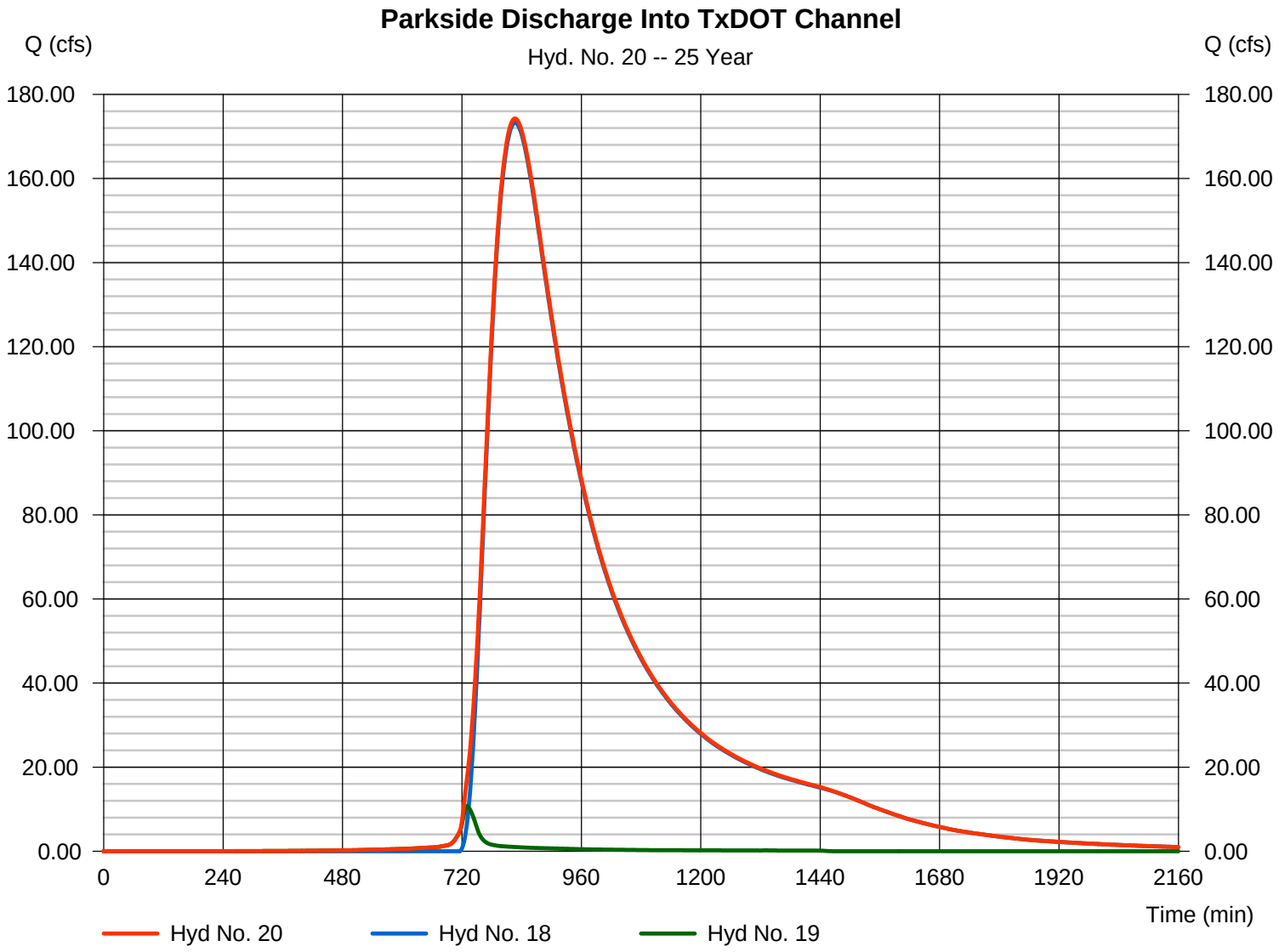


Hydrograph Report

Hyd. No. 20

Parkside Discharge Into TxDOT Channel

Hydrograph type	=	Combine	Peak discharge	=	174.27 cfs
Storm frequency	=	25 yrs	Time to peak	=	826 min
Time interval	=	2 min	Hyd. volume	=	2,986,477 cuft
Inflow hyds.	=	18, 19	Contrib. drain. area	=	2.200 ac

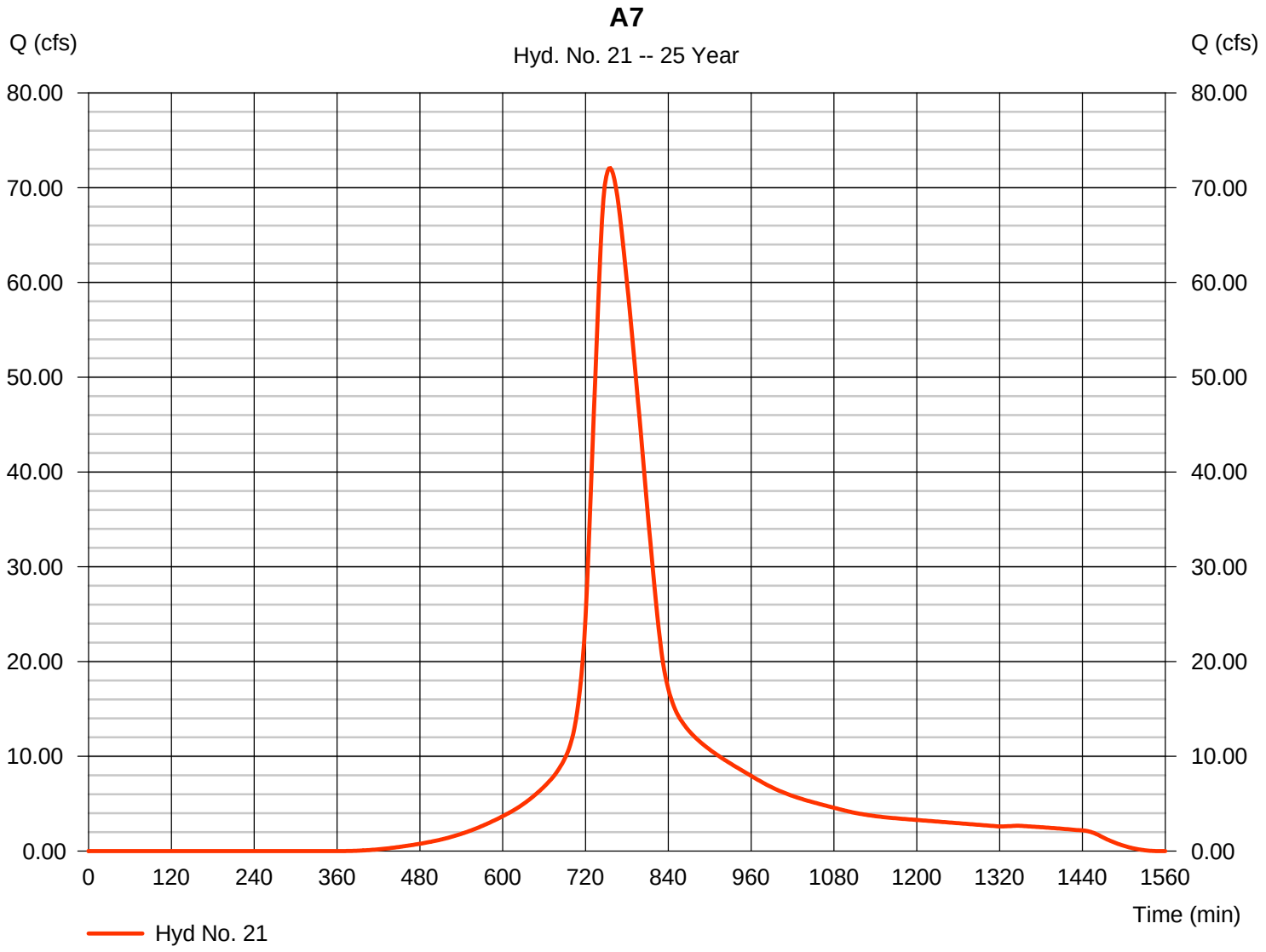


Hydrograph Report

Hyd. No. 21

A7

Hydrograph type	=	SCS Runoff	Peak discharge	=	72.05 cfs
Storm frequency	=	25 yrs	Time to peak	=	756 min
Time interval	=	2 min	Hyd. volume	=	615,853 cuft
Drainage area	=	31.110 ac	Curve number	=	78
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	40.80 min
Total precip.	=	8.06 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	300

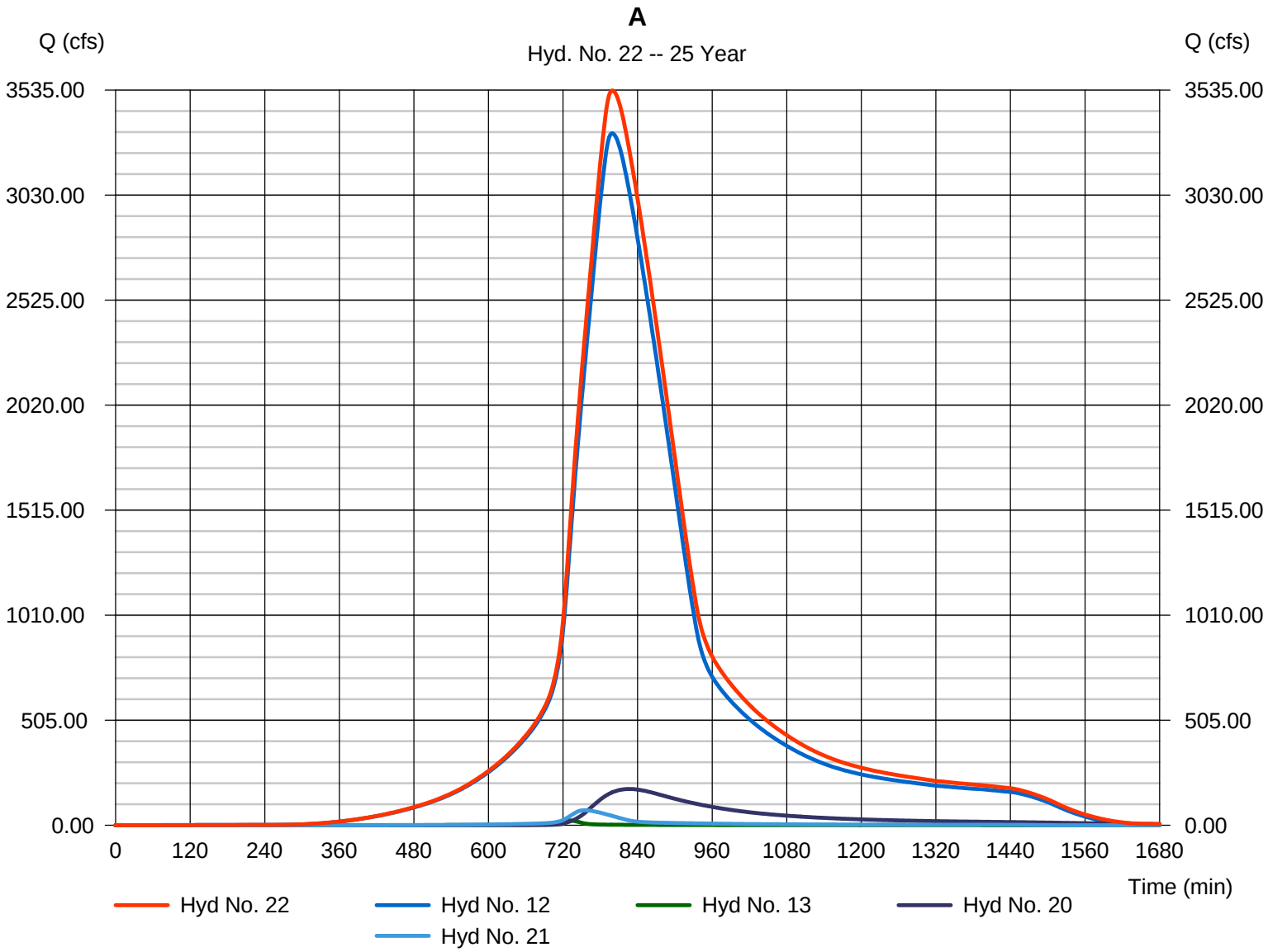


Hydrograph Report

Hyd. No. 22

A

Hydrograph type	=	Combine	Peak discharge	=	3532.38 cfs
Storm frequency	=	25 yrs	Time to peak	=	800 min
Time interval	=	2 min	Hyd. volume	=	48,673,620 cuft
Inflow hyds.	=	12, 13, 20, 21	Contrib. drain. area	=	35.560 ac



Hydrograph Summary Report

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

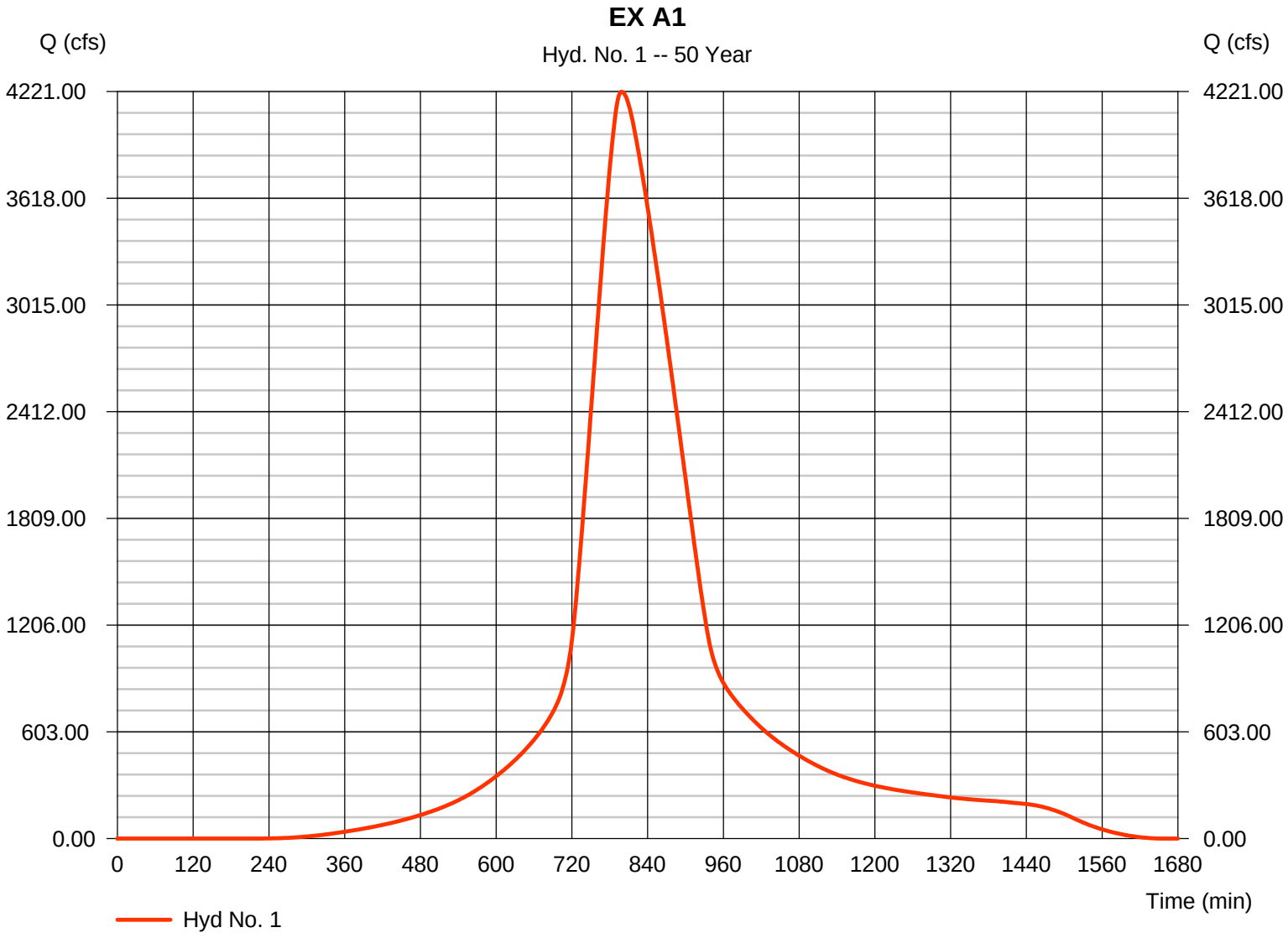
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	4218.96	2	798	56,425,472	------	------	------	EX A1
2	SCS Runoff	116.89	2	742	781,568	------	------	------	EX A2
3	SCS Runoff	380.59	2	760	3,146,054	------	------	------	EX A3
4	Combine	4485.49	2	796	60,353,120	1, 2, 3	------	------	EX A1 - EX A3
5	SCS Runoff	36.11	2	728	153,805	------	------	------	EX A4
6	SCS Runoff	77.45	2	762	661,307	------	------	------	EX A5
7	SCS Runoff	120.72	2	750	823,260	------	------	------	EX A6
8	Combine	4582.87	2	796	61,991,440	4, 5, 6, 7	------	------	EX A
9	SCS Runoff	4218.96	2	798	56,425,472	------	------	------	A1
10	SCS Runoff	116.89	2	742	781,568	------	------	------	A2
11	SCS Runoff	167.93	2	738	900,942	------	------	------	A3
12	Combine	4263.63	2	798	58,107,980	9, 10, 11	------	------	A1-A3
13	SCS Runoff	29.02	2	730	147,334	------	------	------	A4
14	SCS Runoff	394.48	2	752	3,342,488	------	------	------	Parkside Bain A1 Inflow
15	Reservoir	251.12	2	790	3,158,184	14	606.22	1,156,680	A1-A9 + Basin A1
16	SCS Runoff	127.27	2	744	915,925	------	------	------	Parksie Development
17	Combine	317.40	2	772	4,074,110	15, 16	------	------	Parkside Basin A2 Inflow
18	Reservoir	243.14	2	818	3,881,226	17	604.04	1,029,480	BASIN A2
19	SCS Runoff	13.64	2	730	66,008	------	------	------	A6
20	Combine	244.47	2	818	3,947,233	18, 19	------	------	Parkside Discharge Into TxDOT Chan
21	SCS Runoff	95.02	2	754	817,131	------	------	------	A7
22	Combine	4559.23	2	798	63,019,312	12, 13, 20, 21	------	------	A

Hydrograph Report

Hyd. No. 1

EX A1

Hydrograph type	=	SCS Runoff	Peak discharge	=	4218.96 cfs
Storm frequency	=	50 yrs	Time to peak	=	798 min
Time interval	=	2 min	Hyd. volume	=	56,425,472 cuft
Drainage area	=	1906.930 ac	Curve number	=	85.3
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	122.30 min
Total precip.	=	9.96 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	434

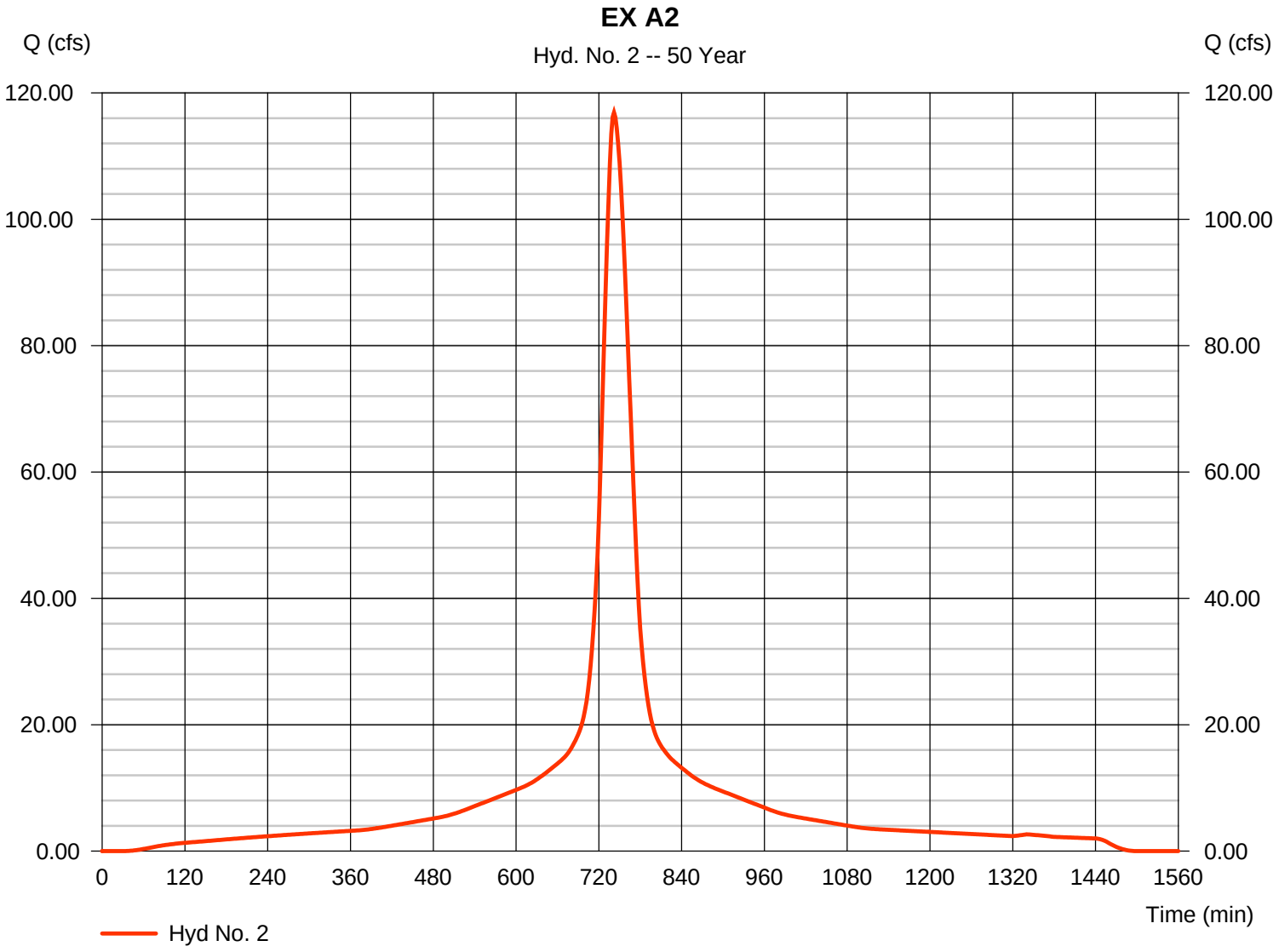


Hydrograph Report

Hyd. No. 2

EX A2

Hydrograph type	=	SCS Runoff	Peak discharge	=	116.89 cfs
Storm frequency	=	50 yrs	Time to peak	=	742 min
Time interval	=	2 min	Hyd. volume	=	781,568 cuft
Drainage area	=	21.960 ac	Curve number	=	98
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	32.00 min
Total precip.	=	9.96 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	434

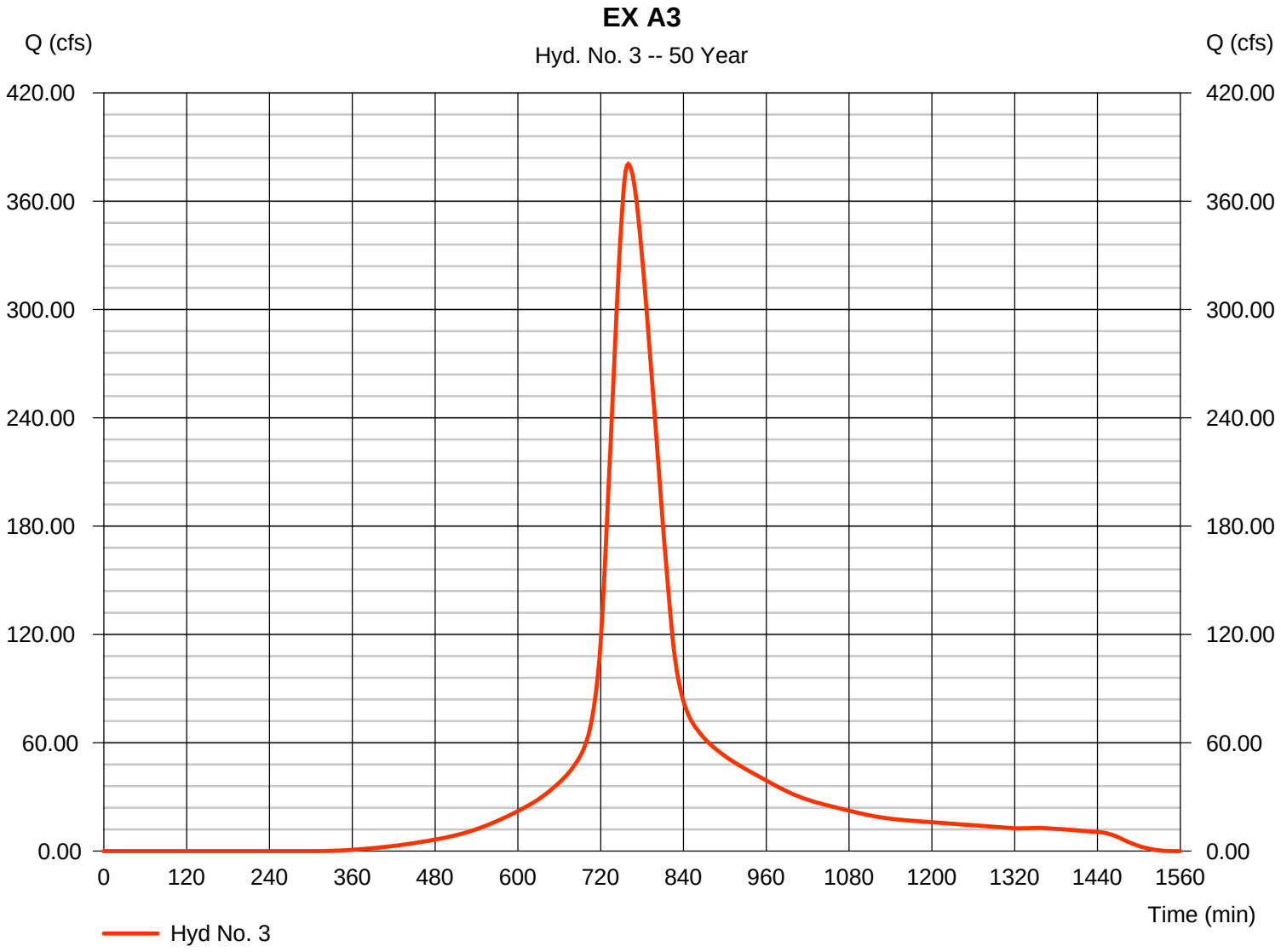


Hydrograph Report

Hyd. No. 3

EX A3

Hydrograph type	=	SCS Runoff	Peak discharge	=	380.59 cfs
Storm frequency	=	50 yrs	Time to peak	=	760 min
Time interval	=	2 min	Hyd. volume	=	3,146,054 cuft
Drainage area	=	117.840 ac	Curve number	=	78.5
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	59.60 min
Total precip.	=	9.96 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	434

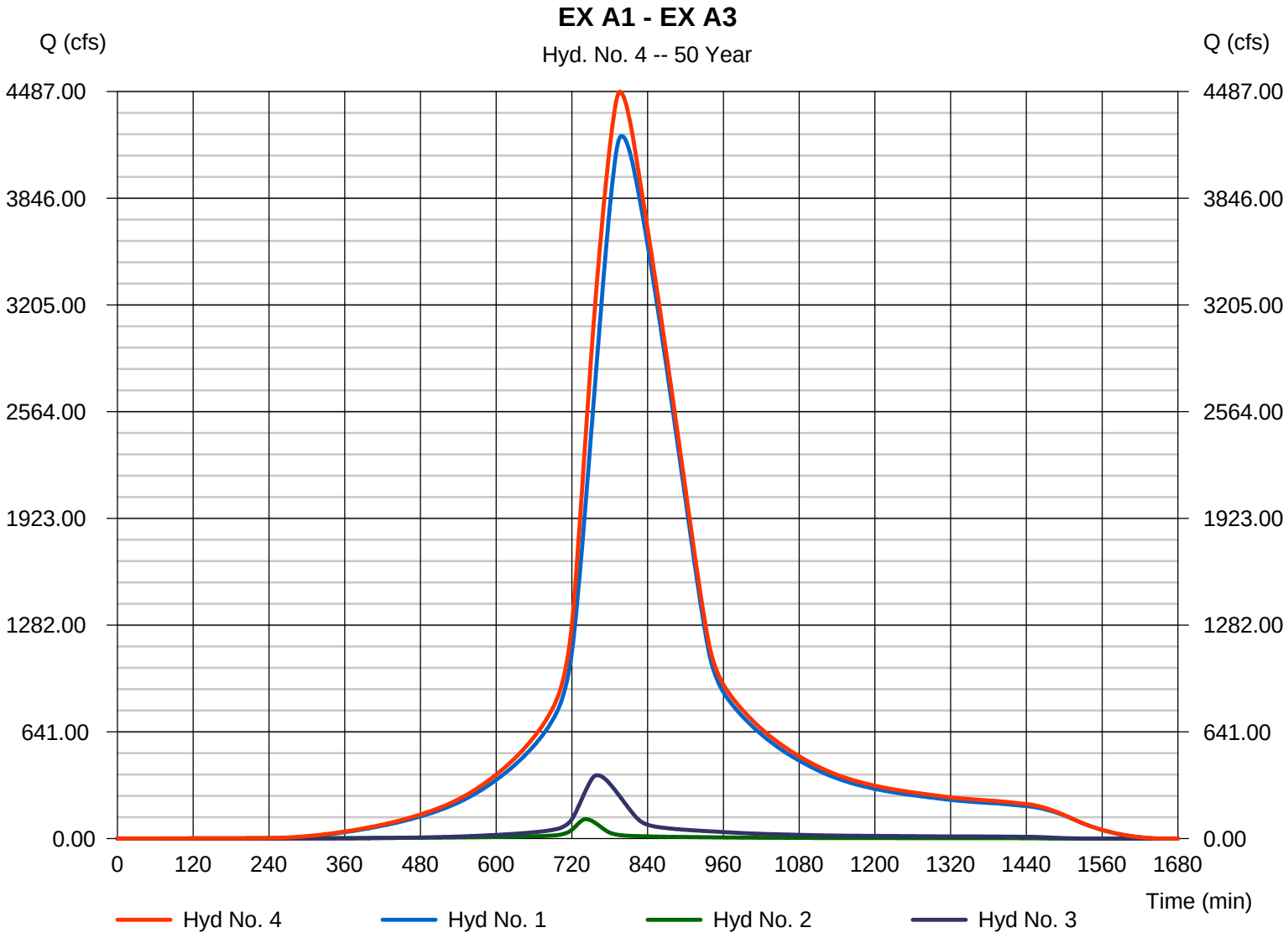


Hydrograph Report

Hyd. No. 4

EX A1 - EX A3

Hydrograph type	=	Combine	Peak discharge	=	4485.49 cfs
Storm frequency	=	50 yrs	Time to peak	=	796 min
Time interval	=	2 min	Hyd. volume	=	60,353,120 cuft
Inflow hyds.	=	1, 2, 3	Contrib. drain. area	=	2046.730 ac

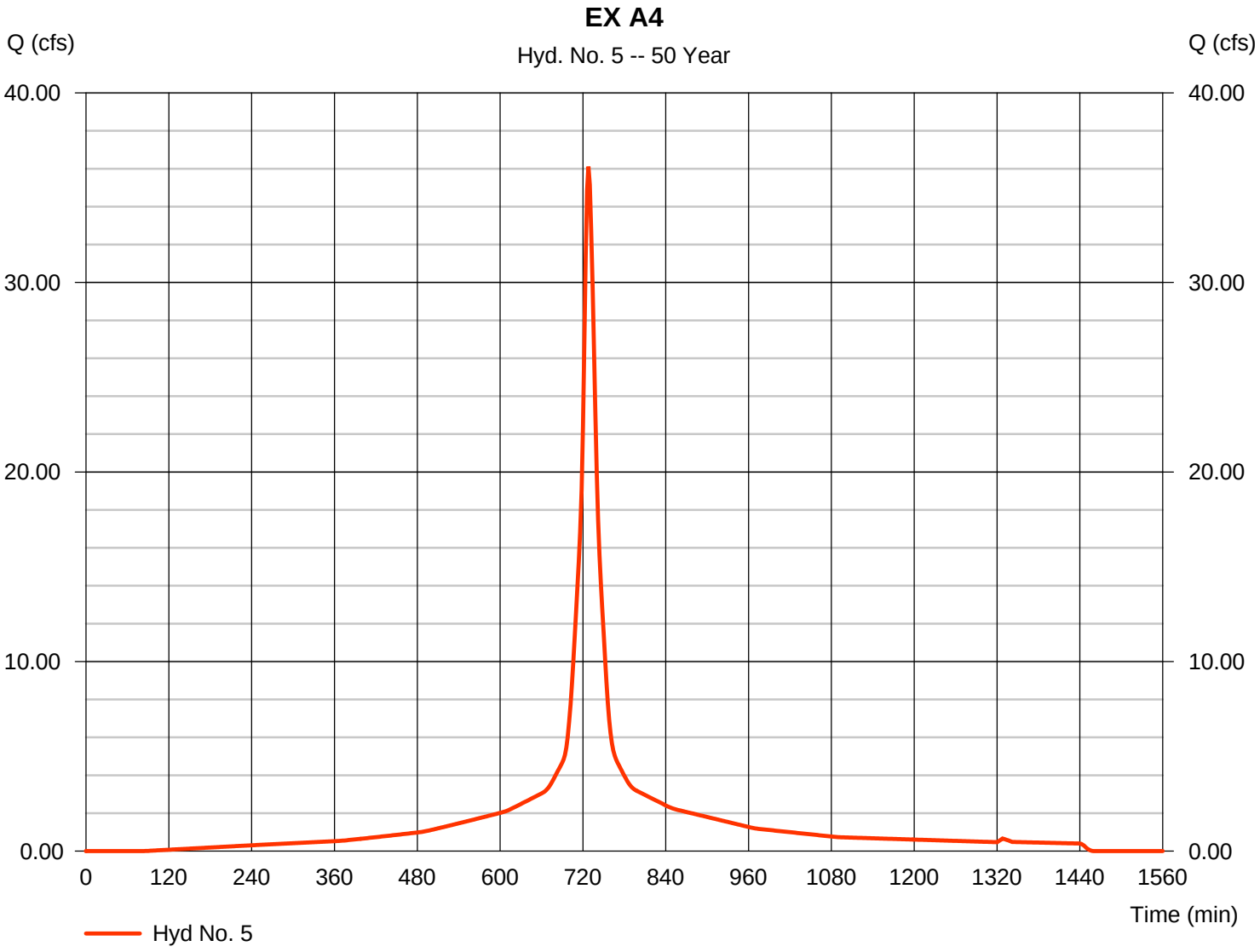


Hydrograph Report

Hyd. No. 5

EX A4

Hydrograph type	=	SCS Runoff	Peak discharge	=	36.11 cfs
Storm frequency	=	50 yrs	Time to peak	=	728 min
Time interval	=	2 min	Hyd. volume	=	153,805 cuft
Drainage area	=	4.450 ac	Curve number	=	94
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	10.00 min
Total precip.	=	9.96 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484

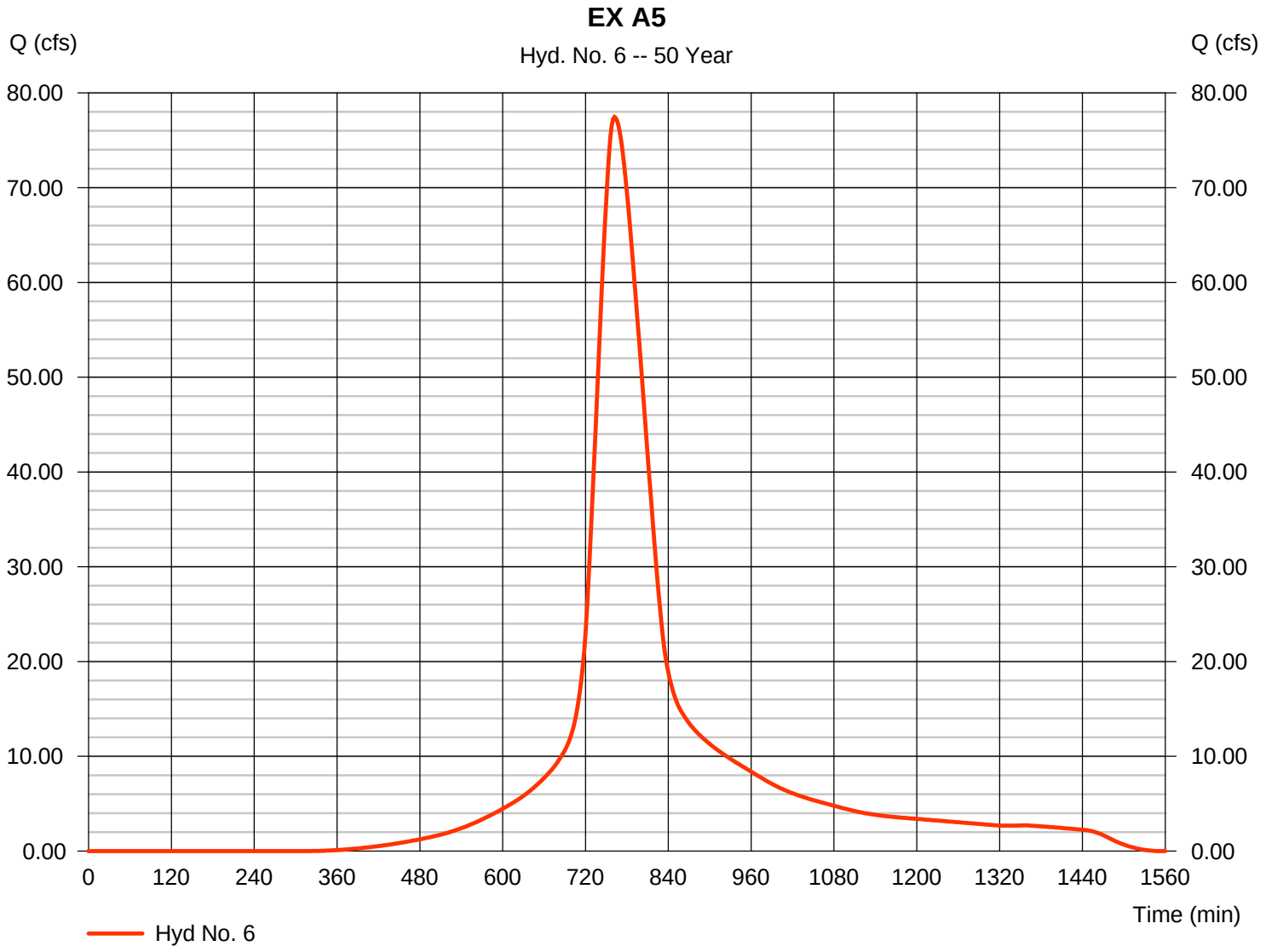


Hydrograph Report

Hyd. No. 6

EX A5

Hydrograph type	=	SCS Runoff	Peak discharge	=	77.45 cfs
Storm frequency	=	50 yrs	Time to peak	=	762 min
Time interval	=	2 min	Hyd. volume	=	661,307 cuft
Drainage area	=	24.990 ac	Curve number	=	78
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	63.10 min
Total precip.	=	9.96 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	434

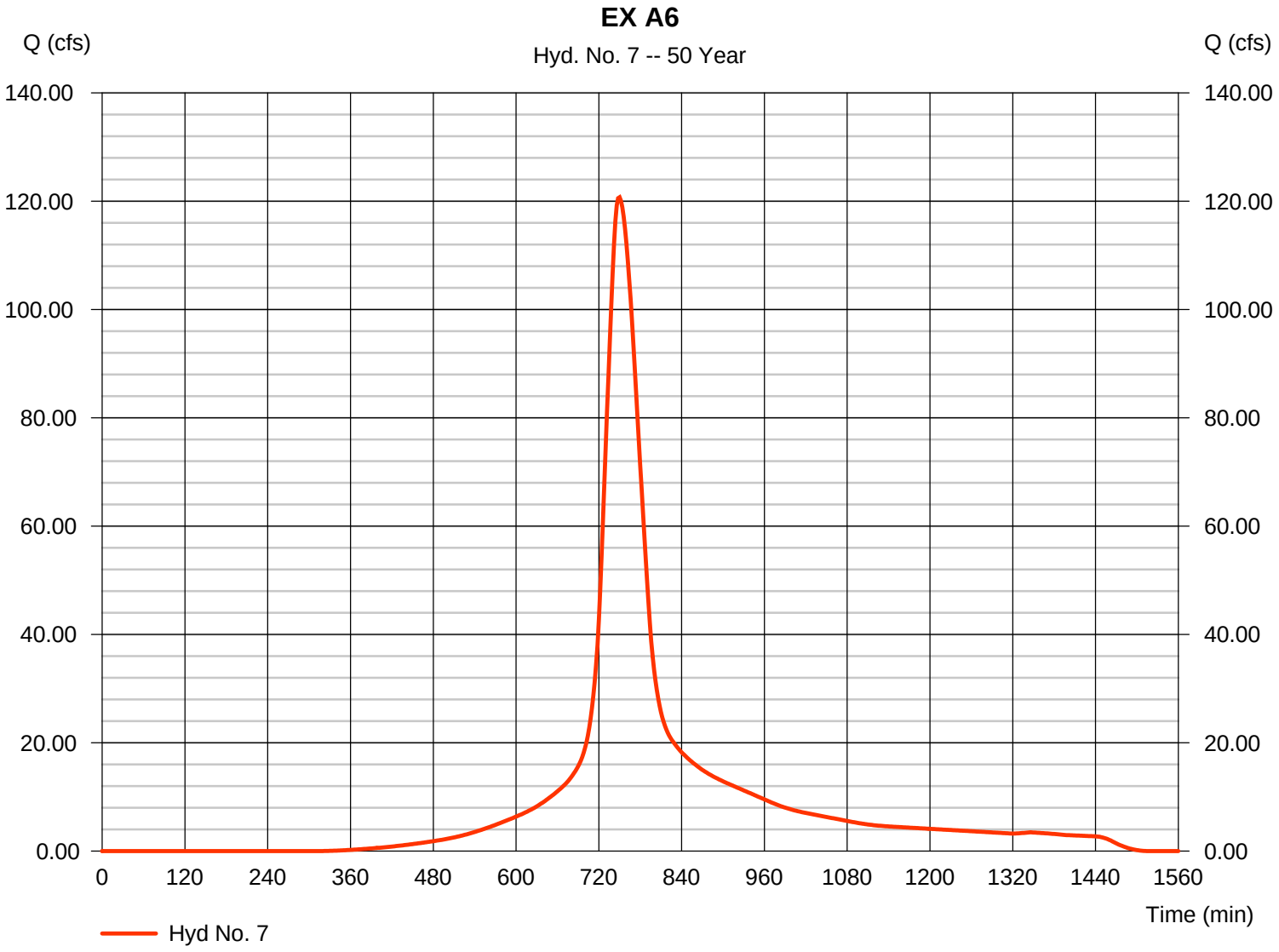


Hydrograph Report

Hyd. No. 7

EX A6

Hydrograph type	=	SCS Runoff	Peak discharge	=	120.72 cfs
Storm frequency	=	50 yrs	Time to peak	=	750 min
Time interval	=	2 min	Hyd. volume	=	823,260 cuft
Drainage area	=	31.110 ac	Curve number	=	78
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	40.80 min
Total precip.	=	9.96 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	434

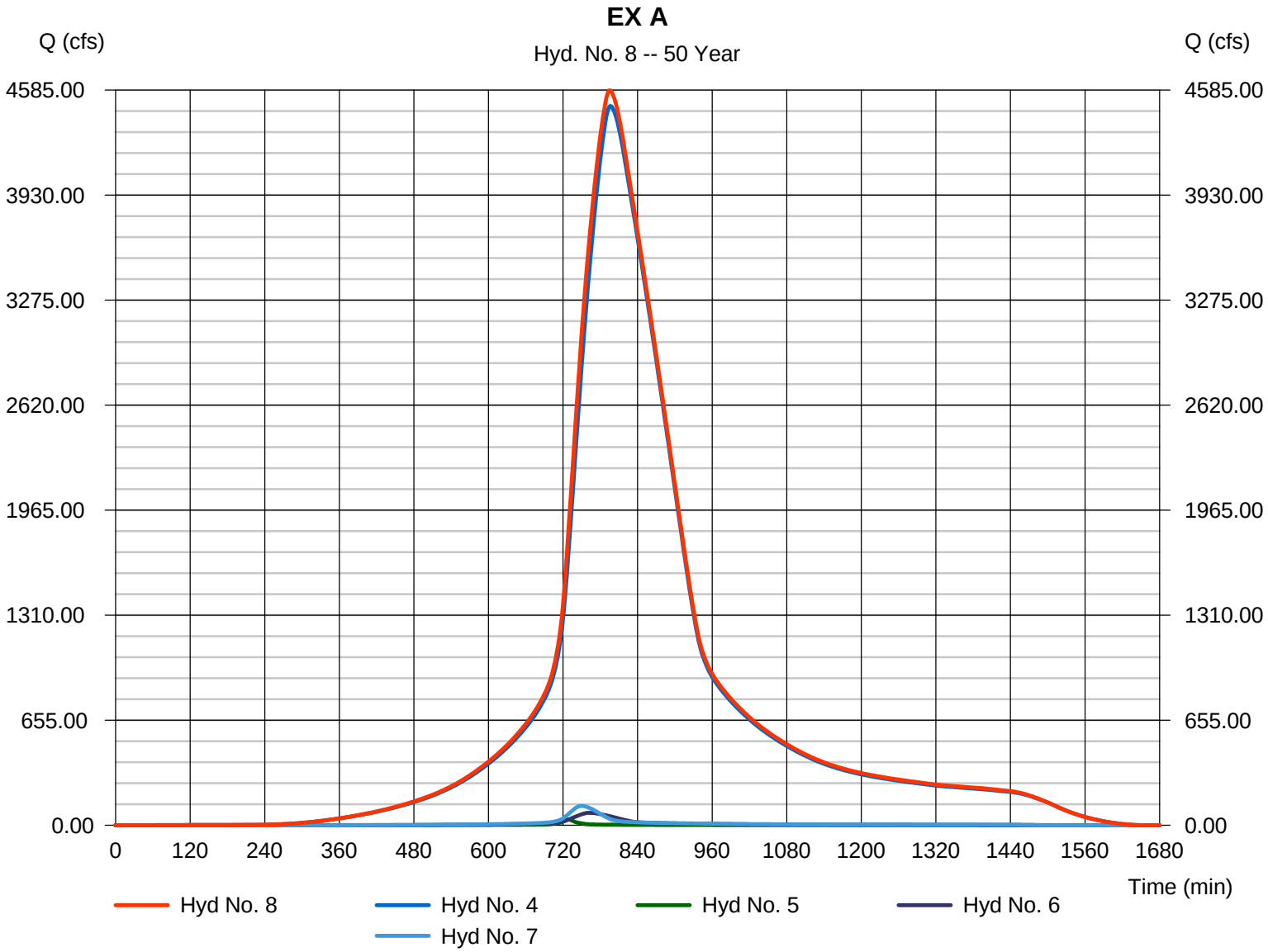


Hydrograph Report

Hyd. No. 8

EX A

Hydrograph type	=	Combine	Peak discharge	=	4582.87 cfs
Storm frequency	=	50 yrs	Time to peak	=	796 min
Time interval	=	2 min	Hyd. volume	=	61,991,440 cuft
Inflow hyds.	=	4, 5, 6, 7	Contrib. drain. area	=	60.550 ac

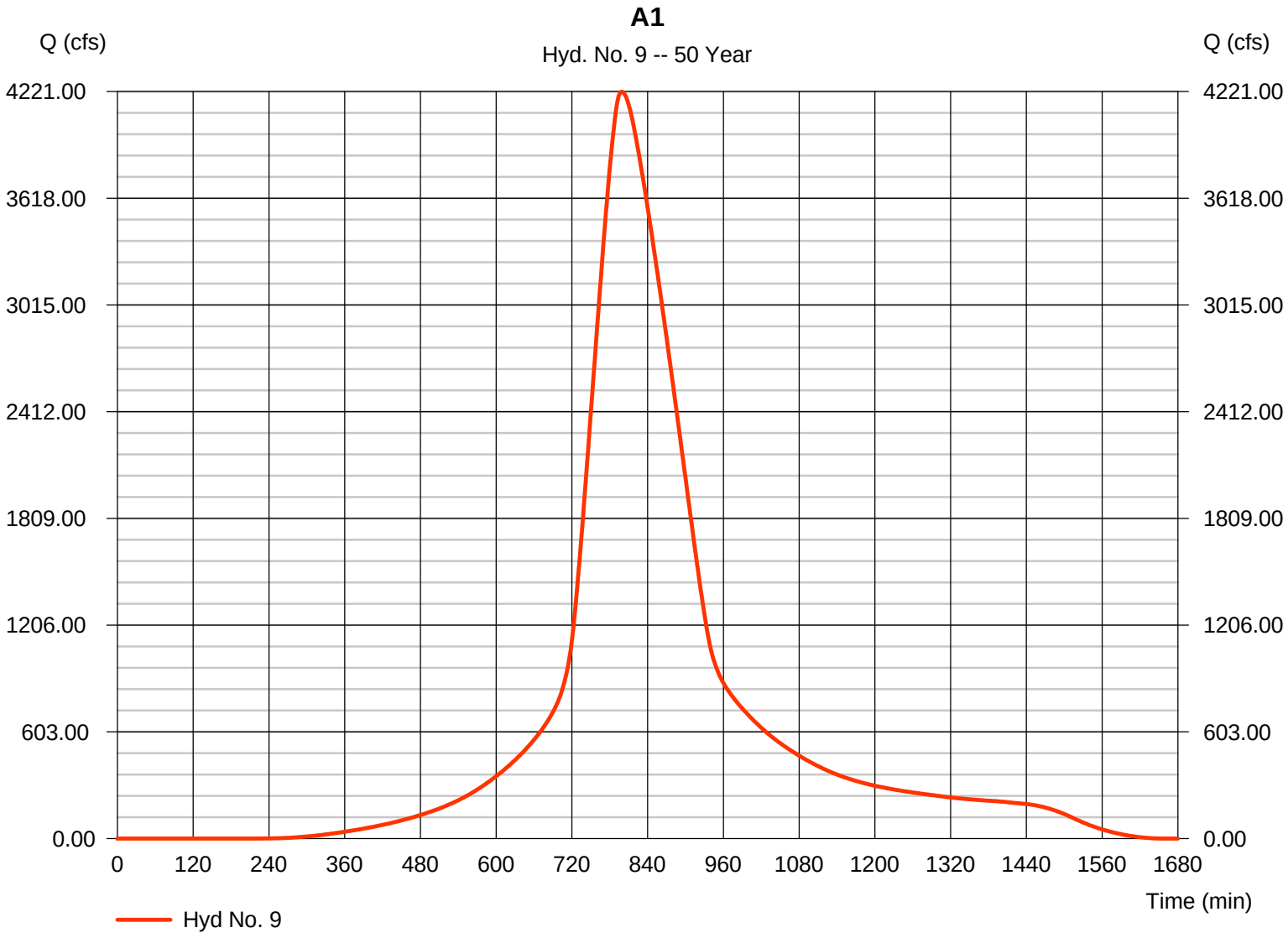


Hydrograph Report

Hyd. No. 9

A1

Hydrograph type	=	SCS Runoff	Peak discharge	=	4218.96 cfs
Storm frequency	=	50 yrs	Time to peak	=	798 min
Time interval	=	2 min	Hyd. volume	=	56,425,472 cuft
Drainage area	=	1906.930 ac	Curve number	=	85.3
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	122.30 min
Total precip.	=	9.96 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	434

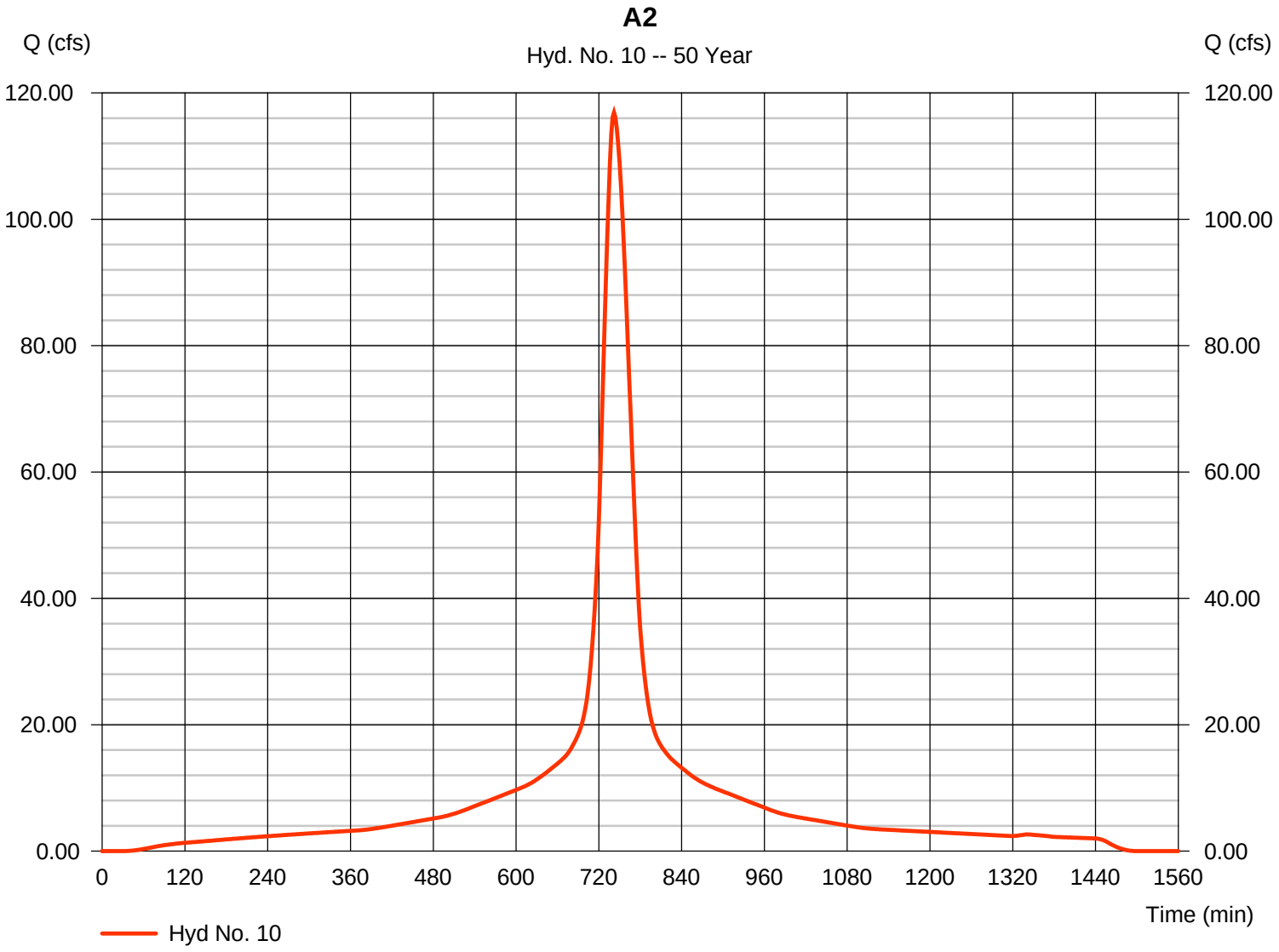


Hydrograph Report

Hyd. No. 10

A2

Hydrograph type	=	SCS Runoff	Peak discharge	=	116.89 cfs
Storm frequency	=	50 yrs	Time to peak	=	742 min
Time interval	=	2 min	Hyd. volume	=	781,568 cuft
Drainage area	=	21.960 ac	Curve number	=	98
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	32.00 min
Total precip.	=	9.96 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	434

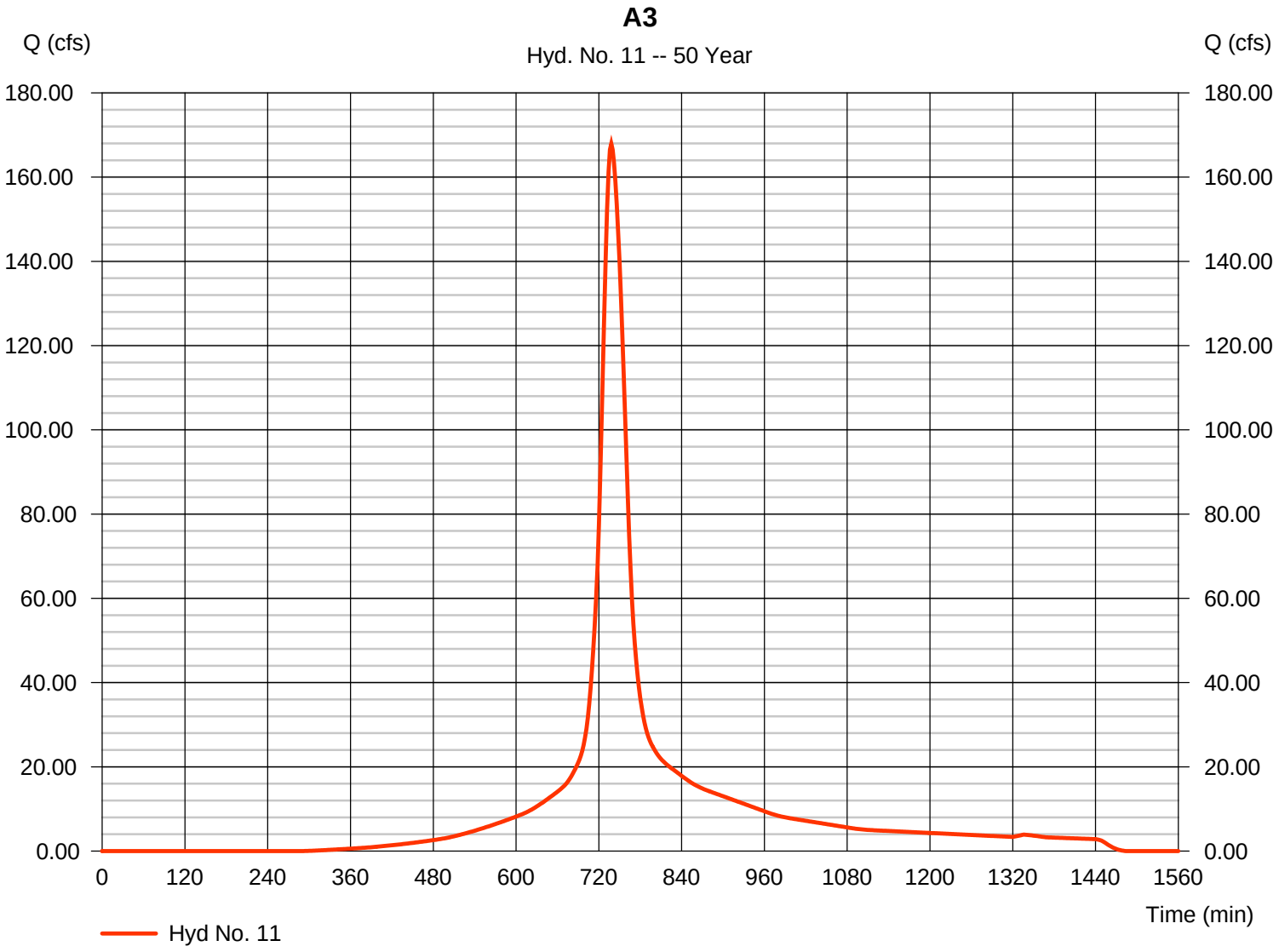


Hydrograph Report

Hyd. No. 11

A3

Hydrograph type	=	SCS Runoff	Peak discharge	=	167.93 cfs
Storm frequency	=	50 yrs	Time to peak	=	738 min
Time interval	=	2 min	Hyd. volume	=	900,942 cuft
Drainage area	=	33.050 ac	Curve number	=	79.7
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	25.60 min
Total precip.	=	9.96 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	434

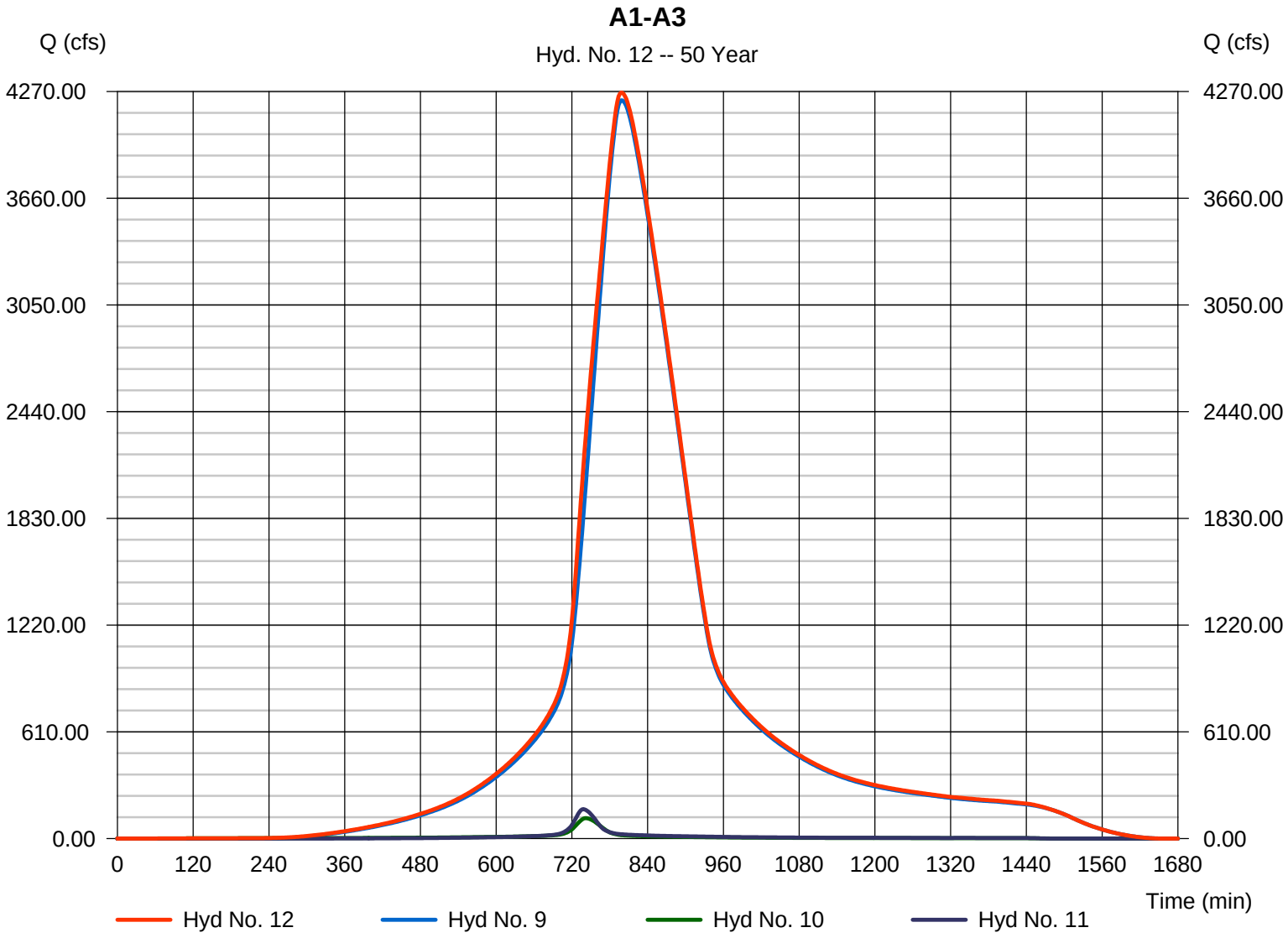


Hydrograph Report

Hyd. No. 12

A1-A3

Hydrograph type	=	Combine	Peak discharge	=	4263.63 cfs
Storm frequency	=	50 yrs	Time to peak	=	798 min
Time interval	=	2 min	Hyd. volume	=	58,107,980 cuft
Inflow hyds.	=	9, 10, 11	Contrib. drain. area	=	1961.940 ac

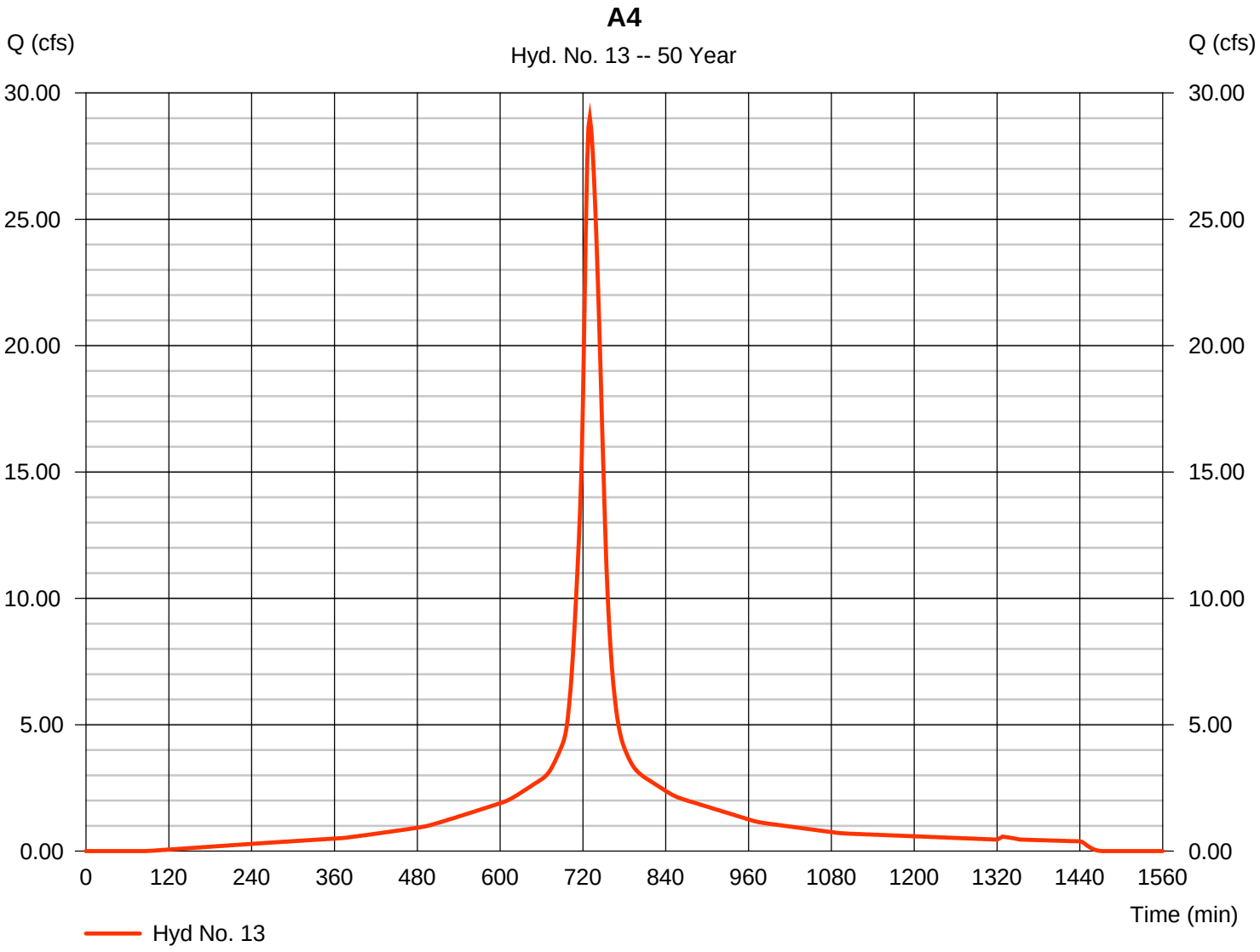


Hydrograph Report

Hyd. No. 13

A4

Hydrograph type	=	SCS Runoff	Peak discharge	=	29.02 cfs
Storm frequency	=	50 yrs	Time to peak	=	730 min
Time interval	=	2 min	Hyd. volume	=	147,334 cuft
Drainage area	=	4.450 ac	Curve number	=	94
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	10.00 min
Total precip.	=	9.96 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	300

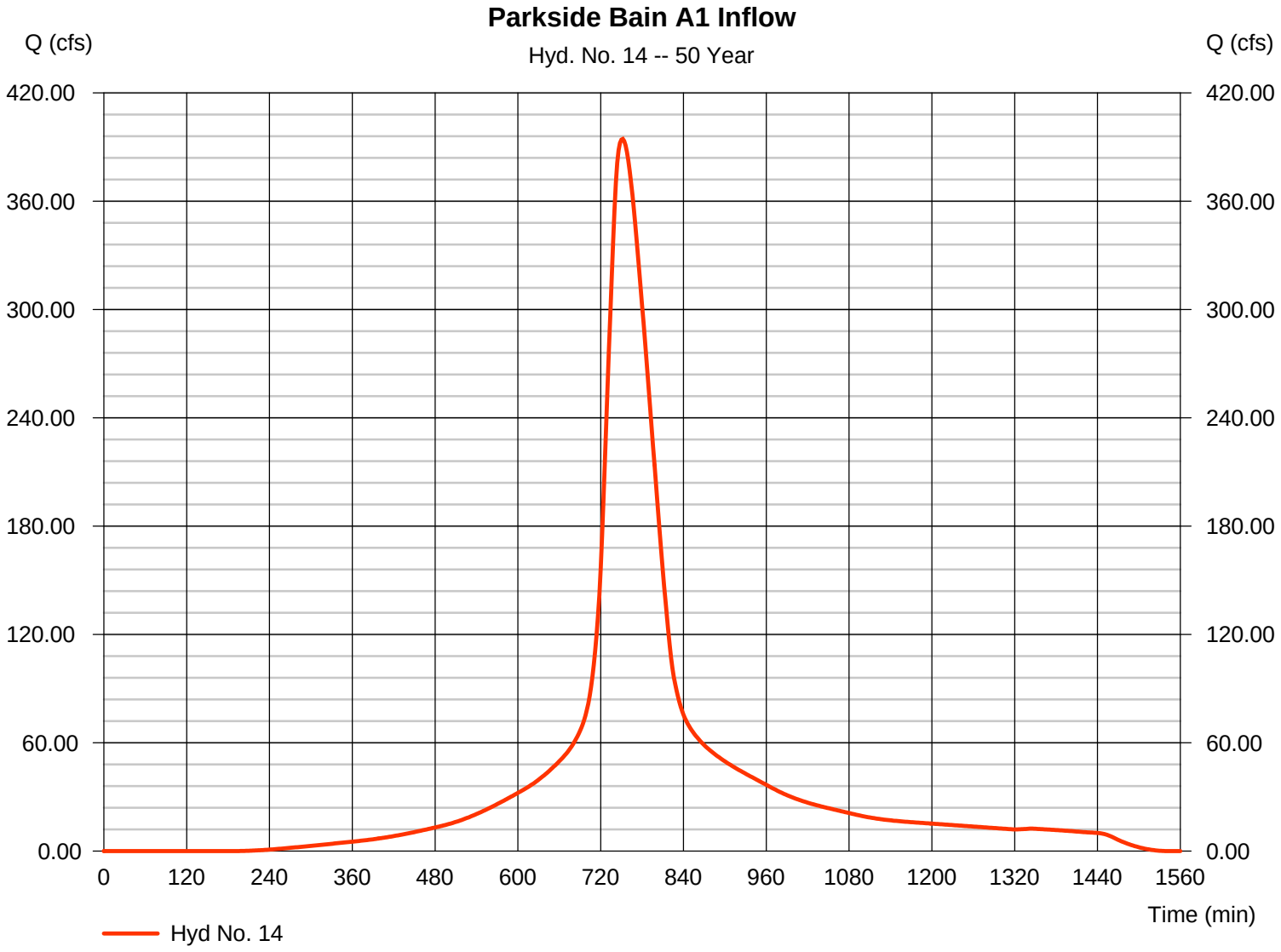


Hydrograph Report

Hyd. No. 14

Parkside Bain A1 Inflow

Hydrograph type	=	SCS Runoff	Peak discharge	=	394.48 cfs
Storm frequency	=	50 yrs	Time to peak	=	752 min
Time interval	=	2 min	Hyd. volume	=	3,342,488 cuft
Drainage area	=	109.260 ac	Curve number	=	87
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	37.90 min
Total precip.	=	9.96 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	300



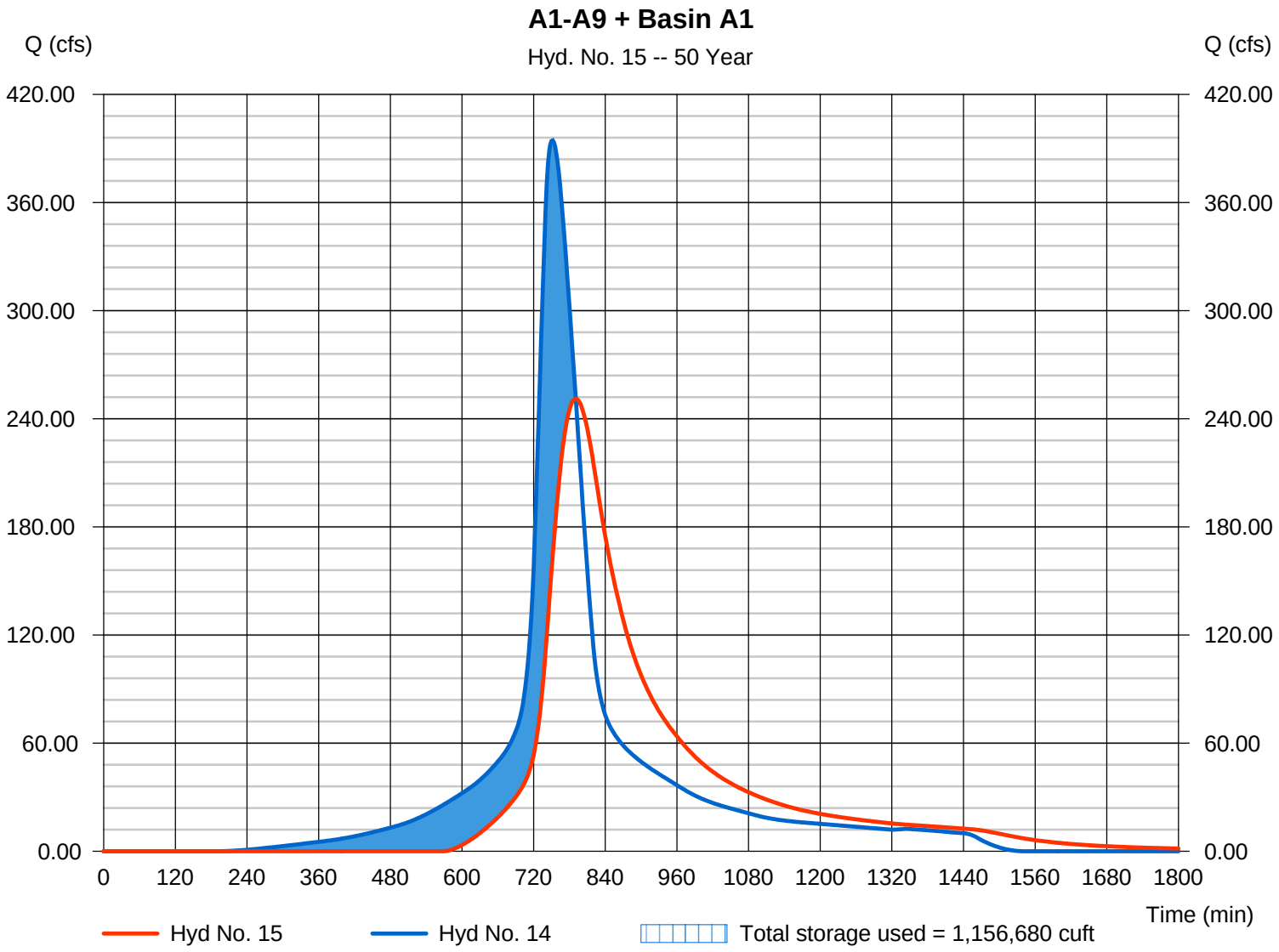
Hydrograph Report

Hyd. No. 15

A1-A9 + Basin A1

Hydrograph type	=	Reservoir	Peak discharge	=	251.12 cfs
Storm frequency	=	50 yrs	Time to peak	=	790 min
Time interval	=	2 min	Hyd. volume	=	3,158,184 cuft
Inflow hyd. No.	=	14 - Parkside Bain A1 Inflow	Max. Elevation	=	606.22 ft
Reservoir name	=	BASIN A1	Max. Storage	=	1,156,680 cuft

Storage Indication method used.

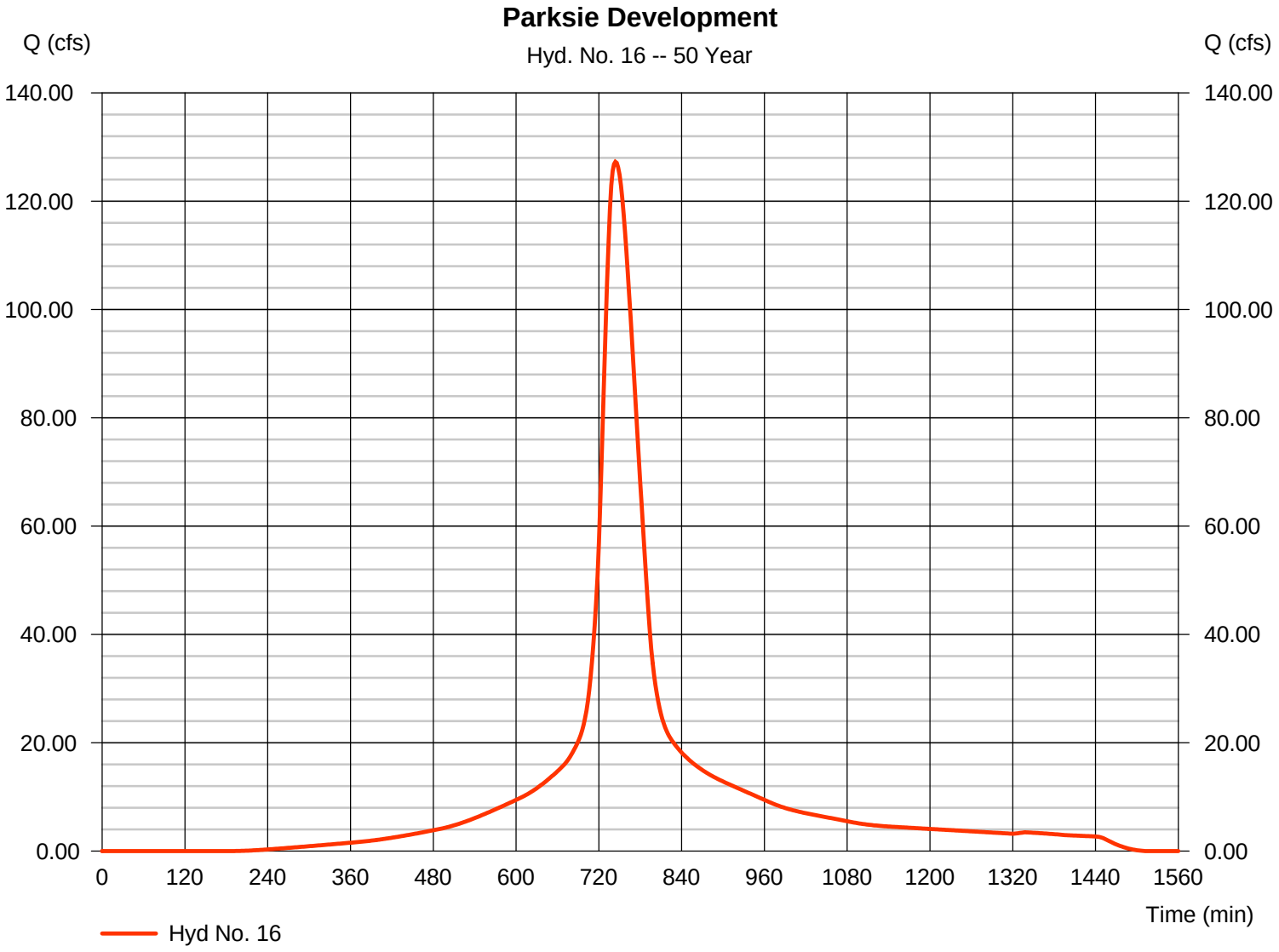


Hydrograph Report

Hyd. No. 16

Parksie Development

Hydrograph type	=	SCS Runoff	Peak discharge	=	127.27 cfs
Storm frequency	=	50 yrs	Time to peak	=	744 min
Time interval	=	2 min	Hyd. volume	=	915,925 cuft
Drainage area	=	29.940 ac	Curve number	=	87
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	28.50 min
Total precip.	=	9.96 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	300

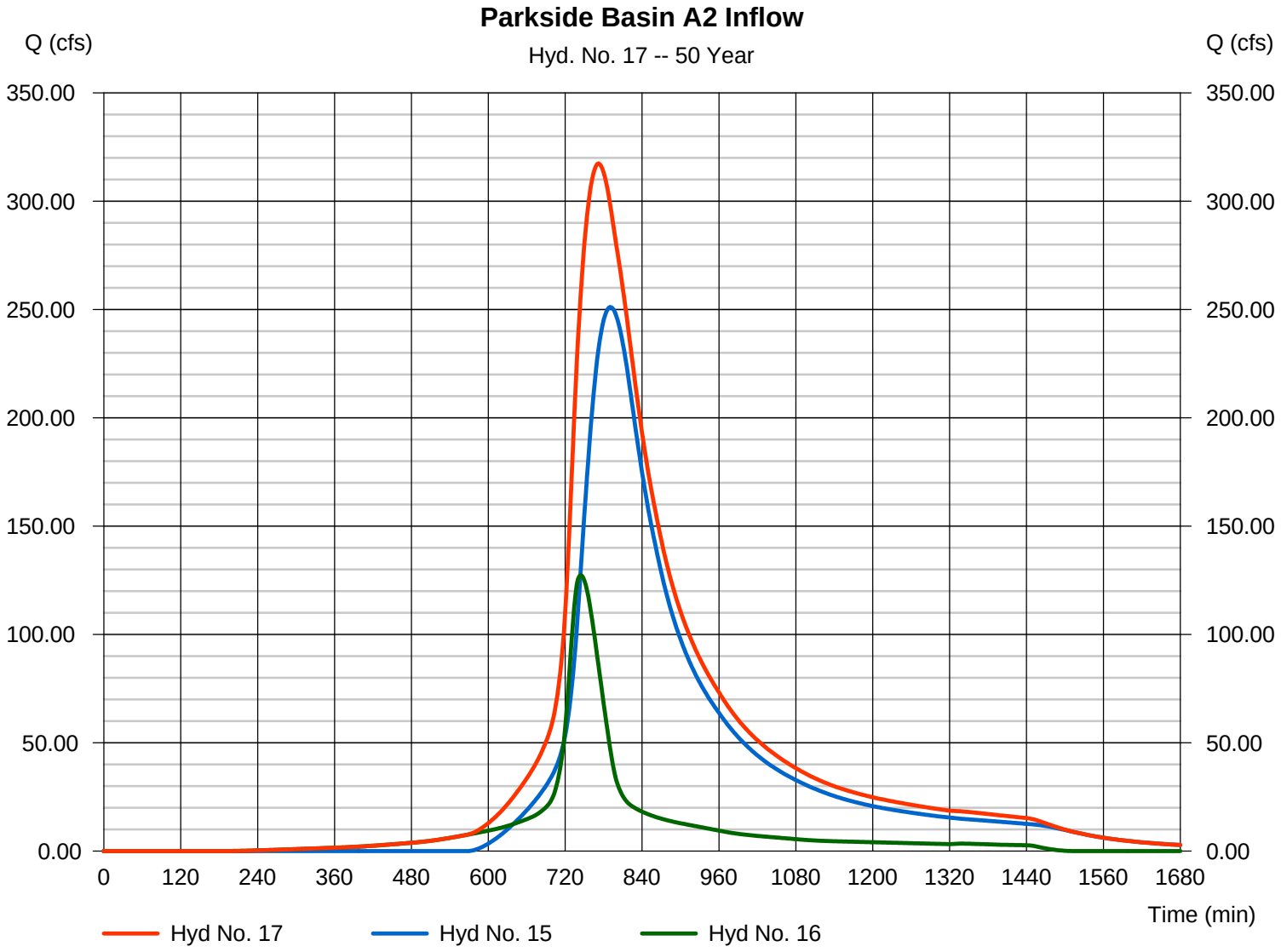


Hydrograph Report

Hyd. No. 17

Parkside Basin A2 Inflow

Hydrograph type	=	Combine	Peak discharge	=	317.40 cfs
Storm frequency	=	50 yrs	Time to peak	=	772 min
Time interval	=	2 min	Hyd. volume	=	4,074,110 cuft
Inflow hyds.	=	15, 16	Contrib. drain. area	=	29.940 ac



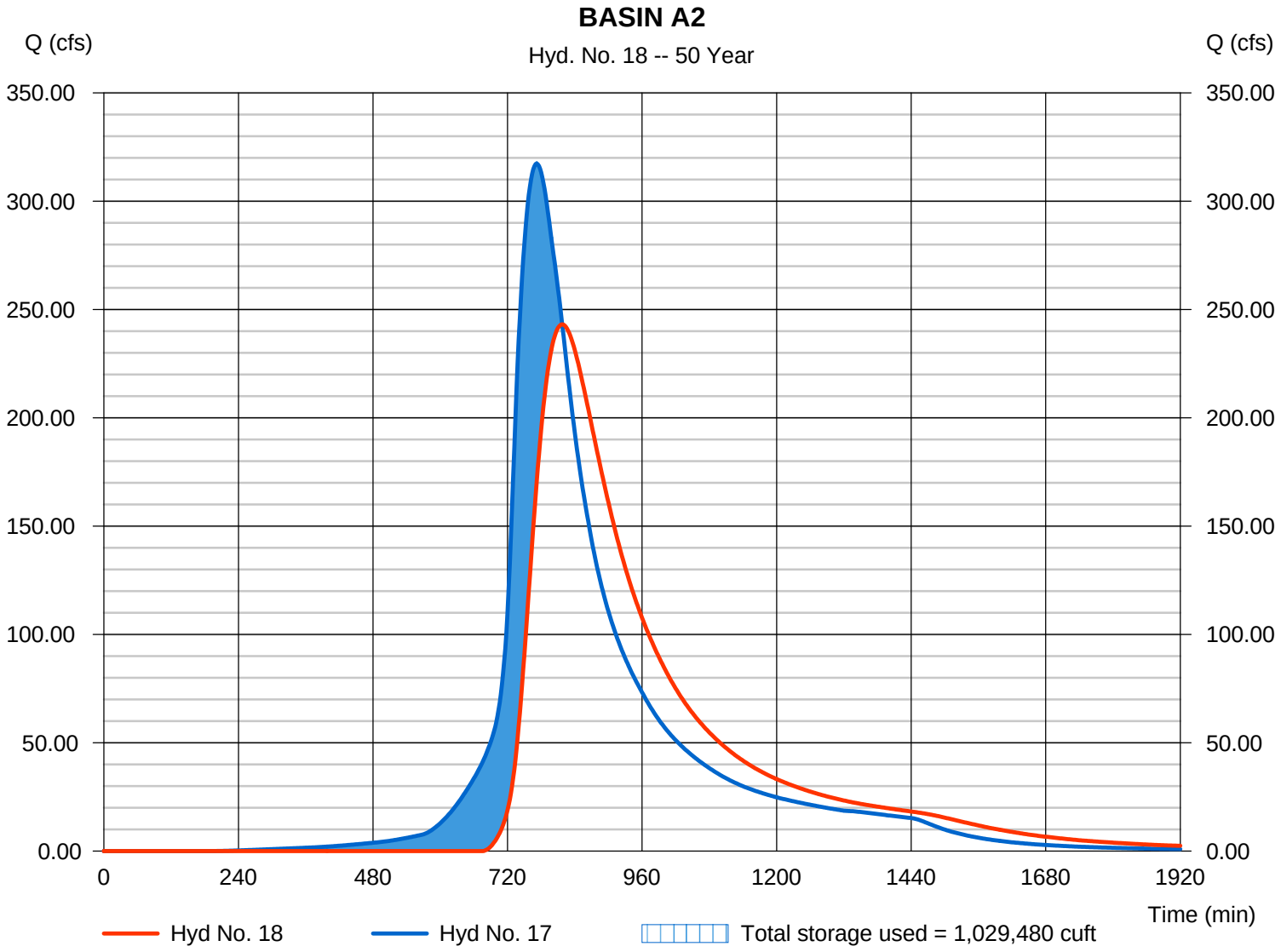
Hydrograph Report

Hyd. No. 18

BASIN A2

Hydrograph type	=	Reservoir	Peak discharge	=	243.14 cfs
Storm frequency	=	50 yrs	Time to peak	=	818 min
Time interval	=	2 min	Hyd. volume	=	3,881,226 cuft
Inflow hyd. No.	=	17 - Parkside Basin A2 Inflow	Max. Elevation	=	604.04 ft
Reservoir name	=	BASIN A2	Max. Storage	=	1,029,480 cuft

Storage Indication method used.

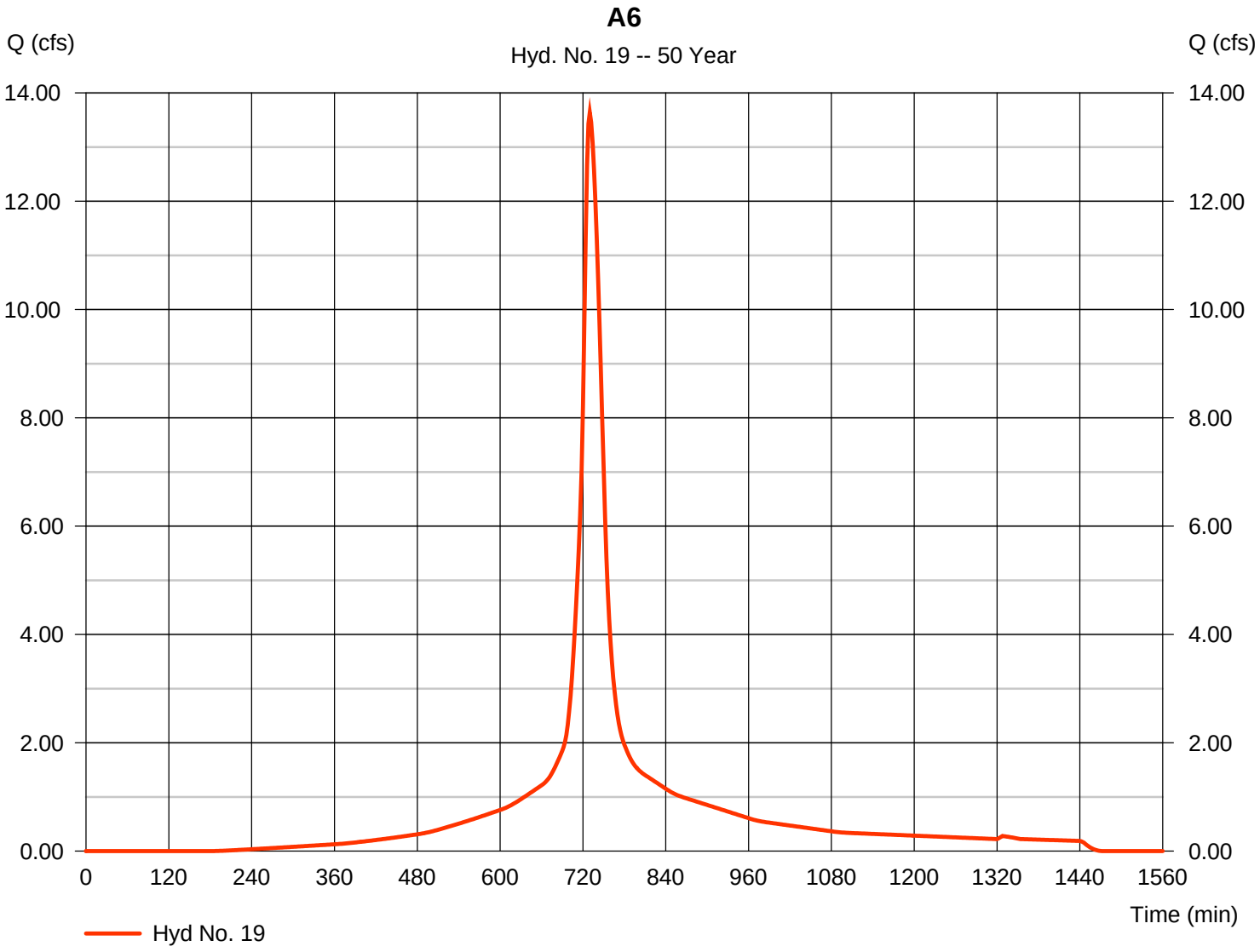


Hydrograph Report

Hyd. No. 19

A6

Hydrograph type	=	SCS Runoff	Peak discharge	=	13.64 cfs
Storm frequency	=	50 yrs	Time to peak	=	730 min
Time interval	=	2 min	Hyd. volume	=	66,008 cuft
Drainage area	=	2.200 ac	Curve number	=	87
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	10.00 min
Total precip.	=	9.96 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	300

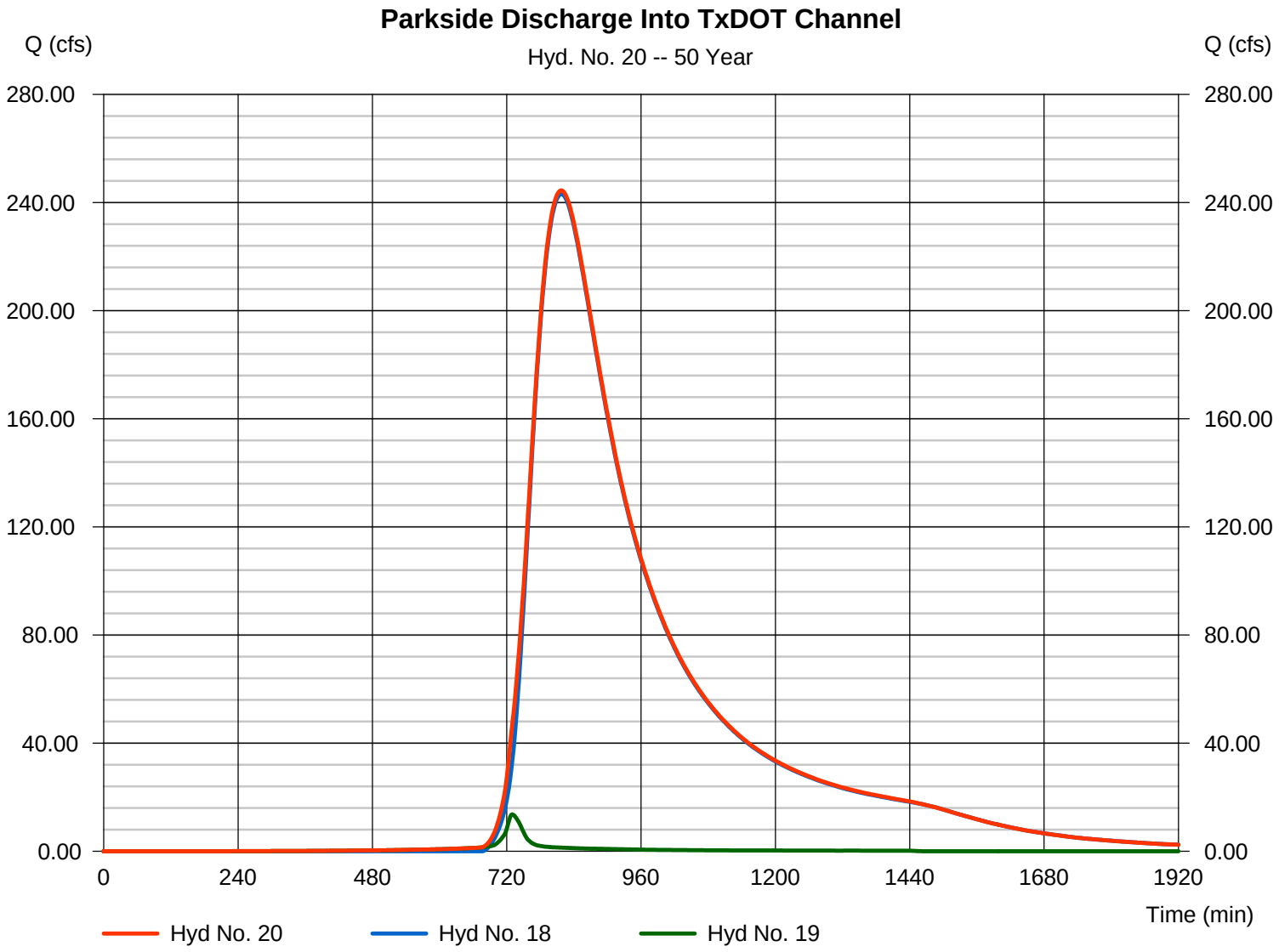


Hydrograph Report

Hyd. No. 20

Parkside Discharge Into TxDOT Channel

Hydrograph type	= Combine	Peak discharge	= 244.47 cfs
Storm frequency	= 50 yrs	Time to peak	= 818 min
Time interval	= 2 min	Hyd. volume	= 3,947,233 cuft
Inflow hyds.	= 18, 19	Contrib. drain. area	= 2.200 ac

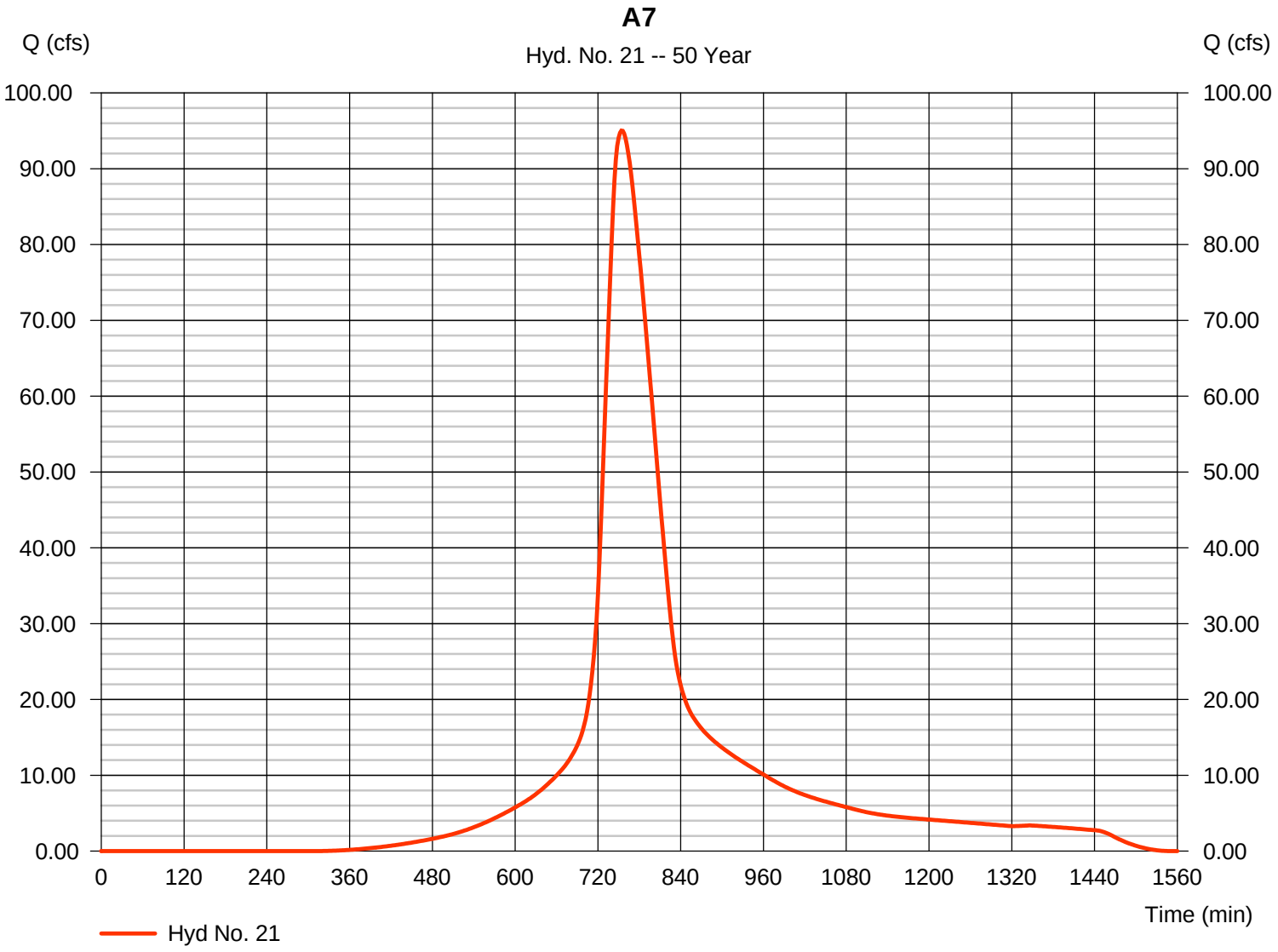


Hydrograph Report

Hyd. No. 21

A7

Hydrograph type	=	SCS Runoff	Peak discharge	=	95.02 cfs
Storm frequency	=	50 yrs	Time to peak	=	754 min
Time interval	=	2 min	Hyd. volume	=	817,131 cuft
Drainage area	=	31.110 ac	Curve number	=	78
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	40.80 min
Total precip.	=	9.96 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	300

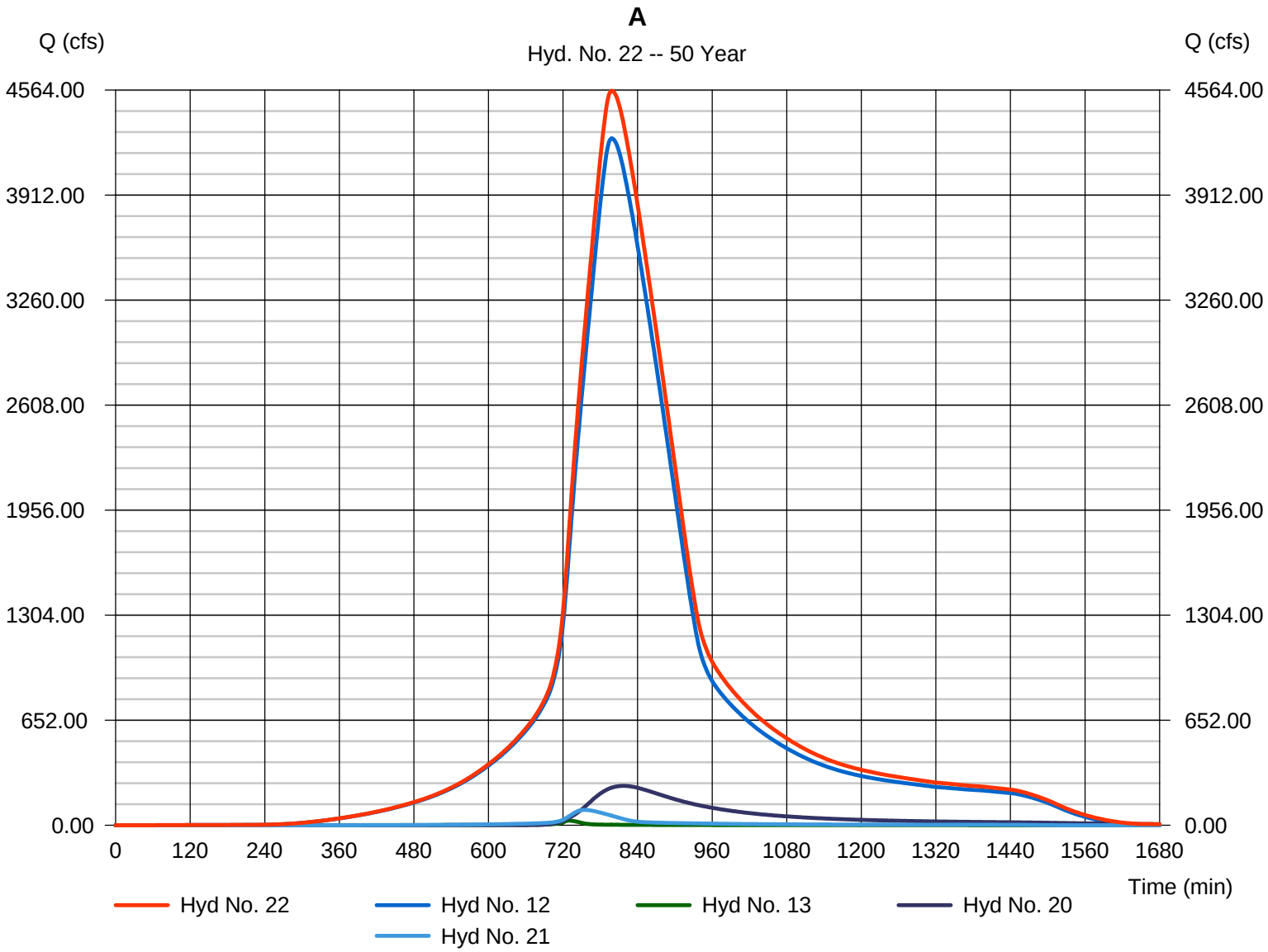


Hydrograph Report

Hyd. No. 22

A

Hydrograph type	=	Combine	Peak discharge	=	4559.23 cfs
Storm frequency	=	50 yrs	Time to peak	=	798 min
Time interval	=	2 min	Hyd. volume	=	63,019,312 cuft
Inflow hyds.	=	12, 13, 20, 21	Contrib. drain. area	=	35.560 ac



Hydrograph Summary Report

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

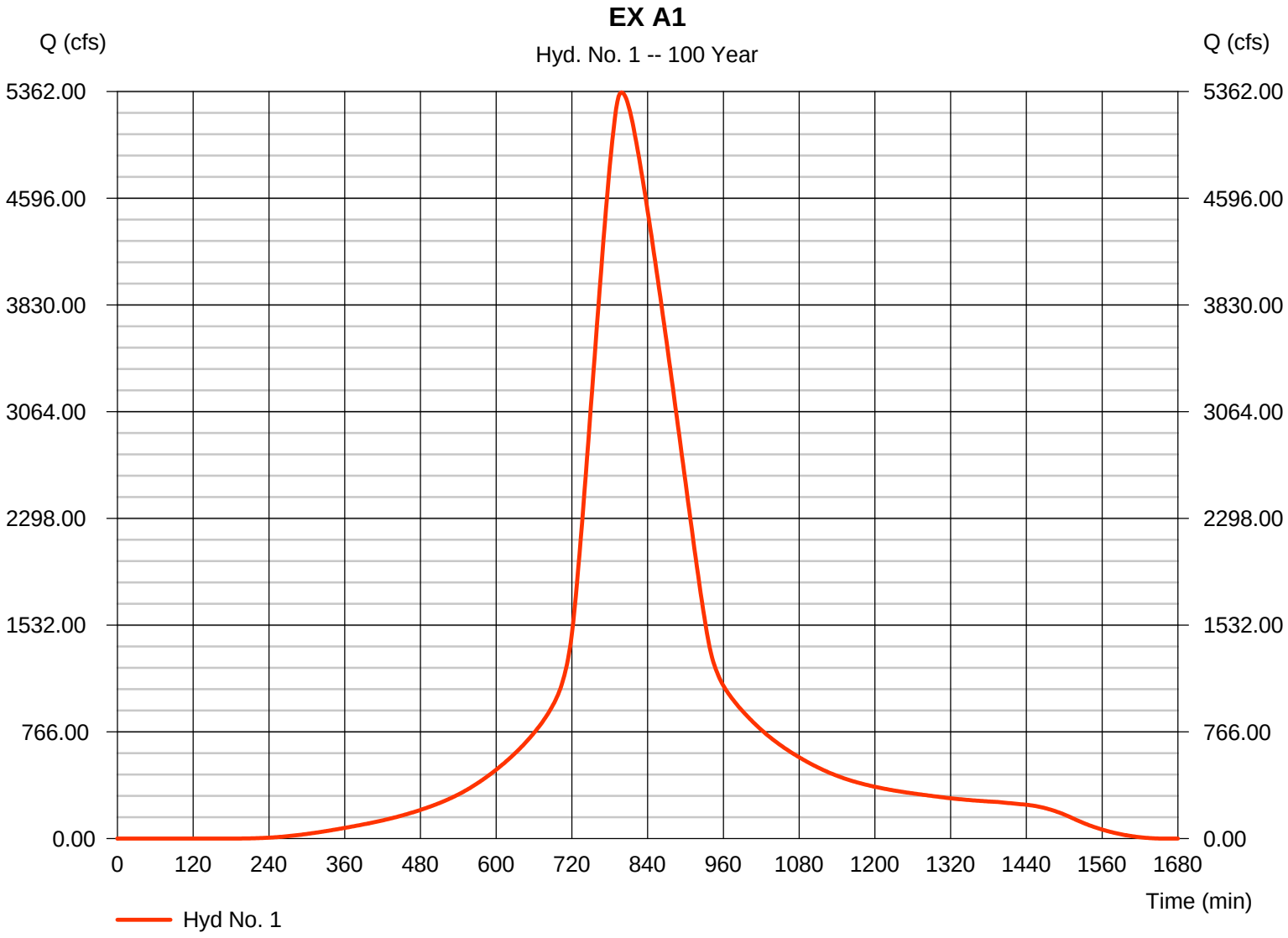
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	5355.58	2	798	72,308,288	------	------	------	EX A1
2	SCS Runoff	144.44	2	742	969,677	------	------	------	EX A2
3	SCS Runoff	492.94	2	760	4,112,785	------	------	------	EX A3
4	Combine	5698.02	2	796	77,390,728	1, 2, 3	------	------	EX A1 - EX A3
5	SCS Runoff	44.80	2	728	192,667	------	------	------	EX A4
6	SCS Runoff	100.52	2	762	865,861	------	------	------	EX A5
7	SCS Runoff	156.45	2	750	1,077,908	------	------	------	EX A6
8	Combine	5823.16	2	794	79,527,248	4, 5, 6, 7	------	------	EX A
9	SCS Runoff	5355.58	2	798	72,308,288	------	------	------	A1
10	SCS Runoff	144.44	2	742	969,677	------	------	------	A2
11	SCS Runoff	216.22	2	738	1,173,457	------	------	------	A3
12	Combine	5411.44	2	798	74,451,376	9, 10, 11	------	------	A1-A3
13	SCS Runoff	36.02	2	730	184,561	------	------	------	A4
14	SCS Runoff	497.35	2	752	4,263,412	------	------	------	Parkside Bain A1 Inflow
15	Reservoir	327.41	2	788	4,079,100	14	606.94	1,368,535	A1-A9 + Basin A1
16	SCS Runoff	160.40	2	744	1,168,281	------	------	------	Parksie Development
17	Combine	413.63	2	772	5,247,361	15, 16	------	------	Parkside Basin A2 Inflow
18	Reservoir	328.36	2	812	5,054,492	17	604.93	1,227,808	BASIN A2
19	SCS Runoff	17.17	2	730	84,195	------	------	------	A6
20	Combine	330.09	2	810	5,138,687	18, 19	------	------	Parkside Discharge Into TxDOT Chan
21	SCS Runoff	123.39	2	754	1,069,885	------	------	------	A7
22	Combine	5814.79	2	798	80,843,920	12, 13, 20, 21	------	------	A

Hydrograph Report

Hyd. No. 1

EX A1

Hydrograph type	=	SCS Runoff	Peak discharge	=	5355.58 cfs
Storm frequency	=	100 yrs	Time to peak	=	798 min
Time interval	=	2 min	Hyd. volume	=	72,308,288 cuft
Drainage area	=	1906.930 ac	Curve number	=	85.3
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	122.30 min
Total precip.	=	12.30 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	434

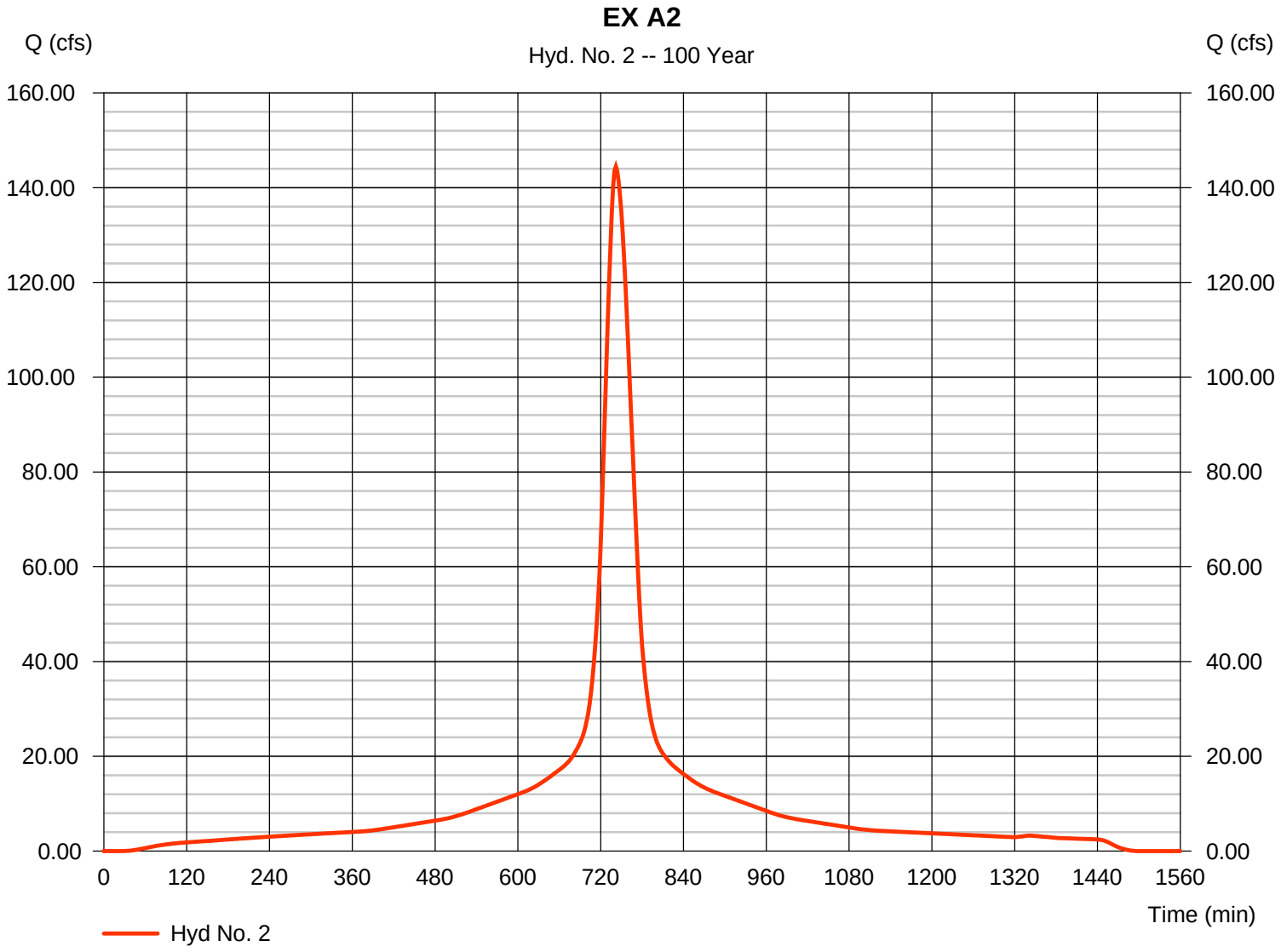


Hydrograph Report

Hyd. No. 2

EX A2

Hydrograph type	=	SCS Runoff	Peak discharge	=	144.44 cfs
Storm frequency	=	100 yrs	Time to peak	=	742 min
Time interval	=	2 min	Hyd. volume	=	969,677 cuft
Drainage area	=	21.960 ac	Curve number	=	98
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	32.00 min
Total precip.	=	12.30 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	434

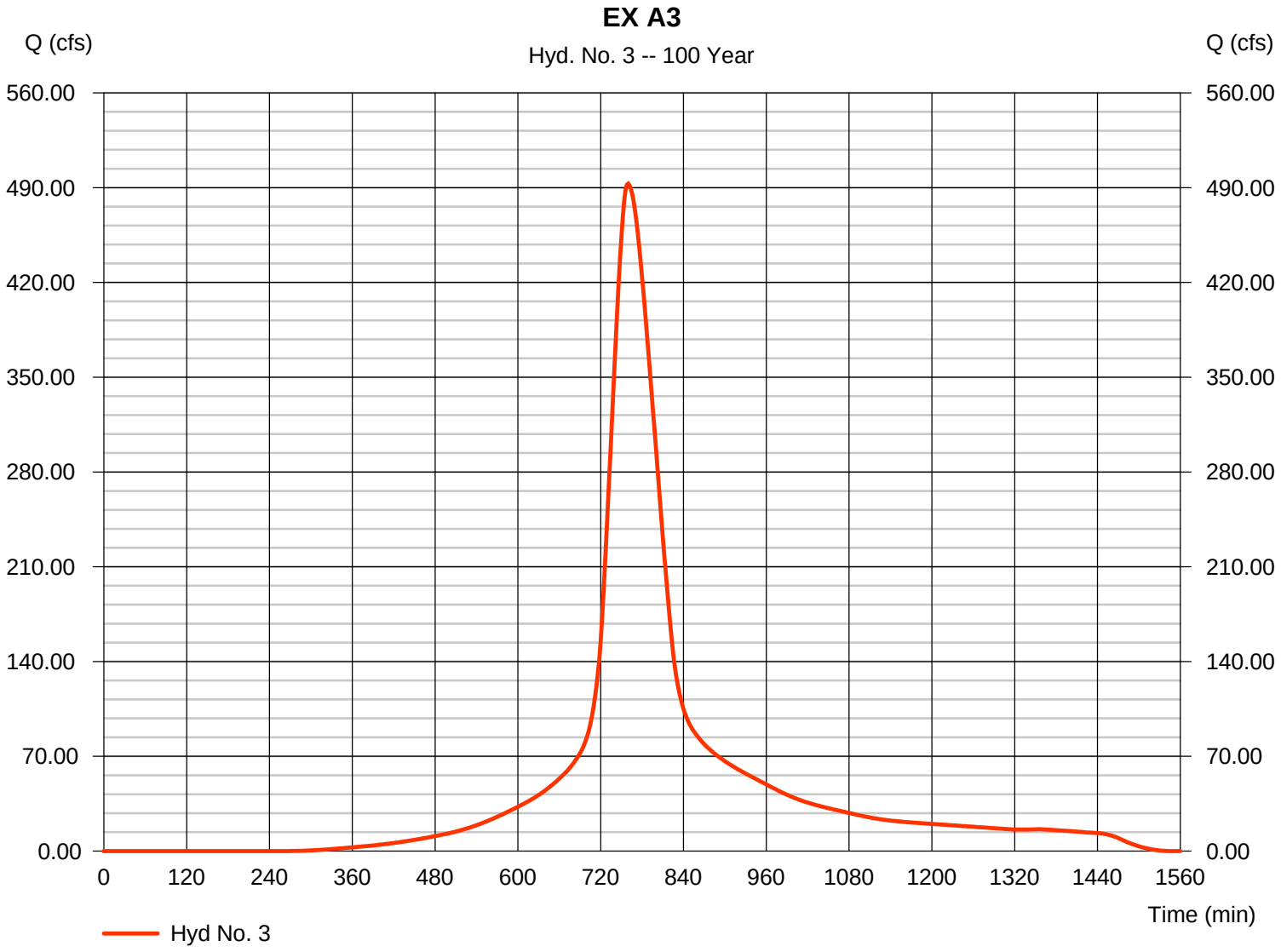


Hydrograph Report

Hyd. No. 3

EX A3

Hydrograph type	=	SCS Runoff	Peak discharge	=	492.94 cfs
Storm frequency	=	100 yrs	Time to peak	=	760 min
Time interval	=	2 min	Hyd. volume	=	4,112,785 cuft
Drainage area	=	117.840 ac	Curve number	=	78.5
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	59.60 min
Total precip.	=	12.30 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	434

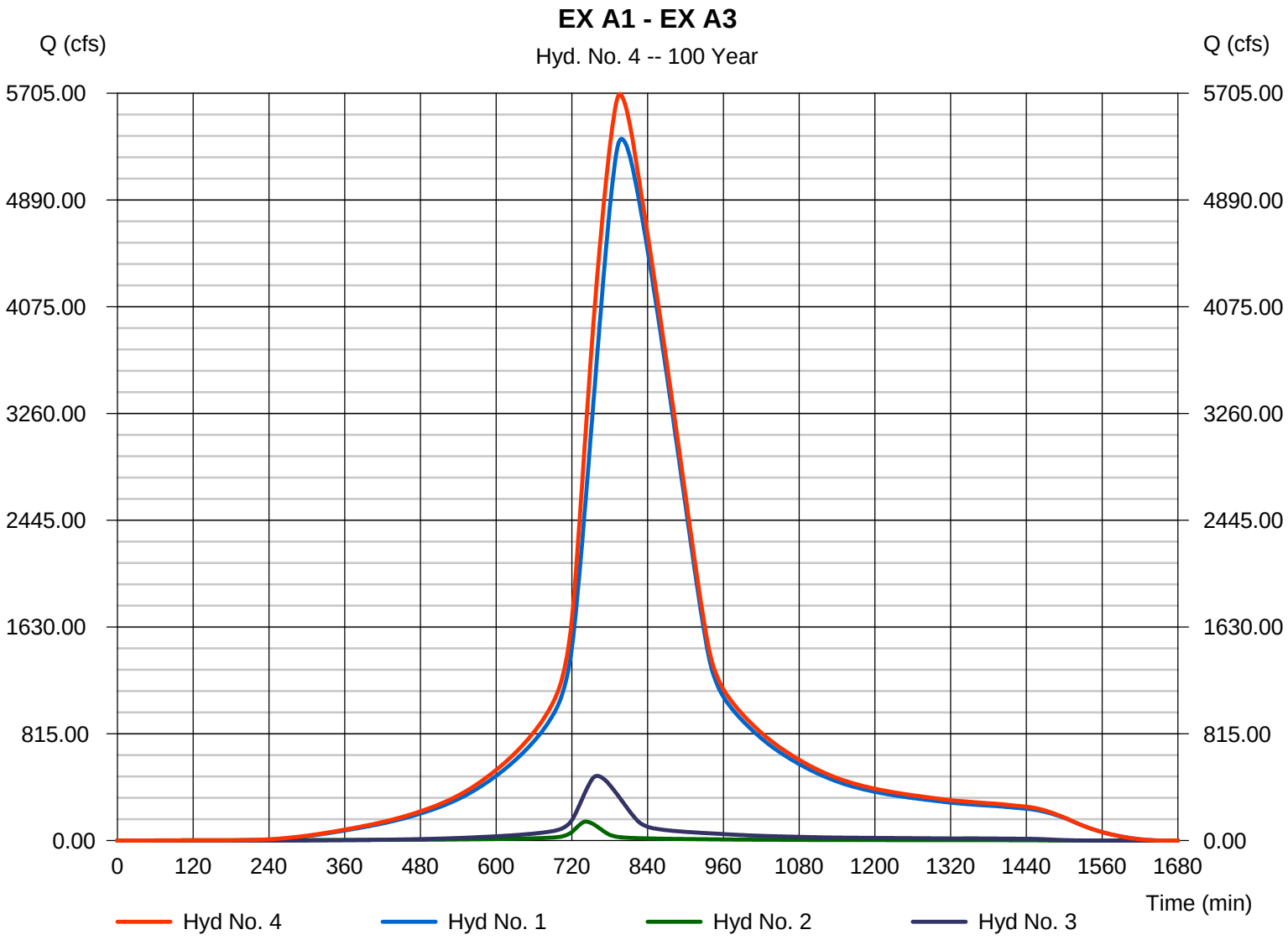


Hydrograph Report

Hyd. No. 4

EX A1 - EX A3

Hydrograph type	=	Combine	Peak discharge	=	5698.02 cfs
Storm frequency	=	100 yrs	Time to peak	=	796 min
Time interval	=	2 min	Hyd. volume	=	77,390,728 cuft
Inflow hyds.	=	1, 2, 3	Contrib. drain. area	=	2046.730 ac

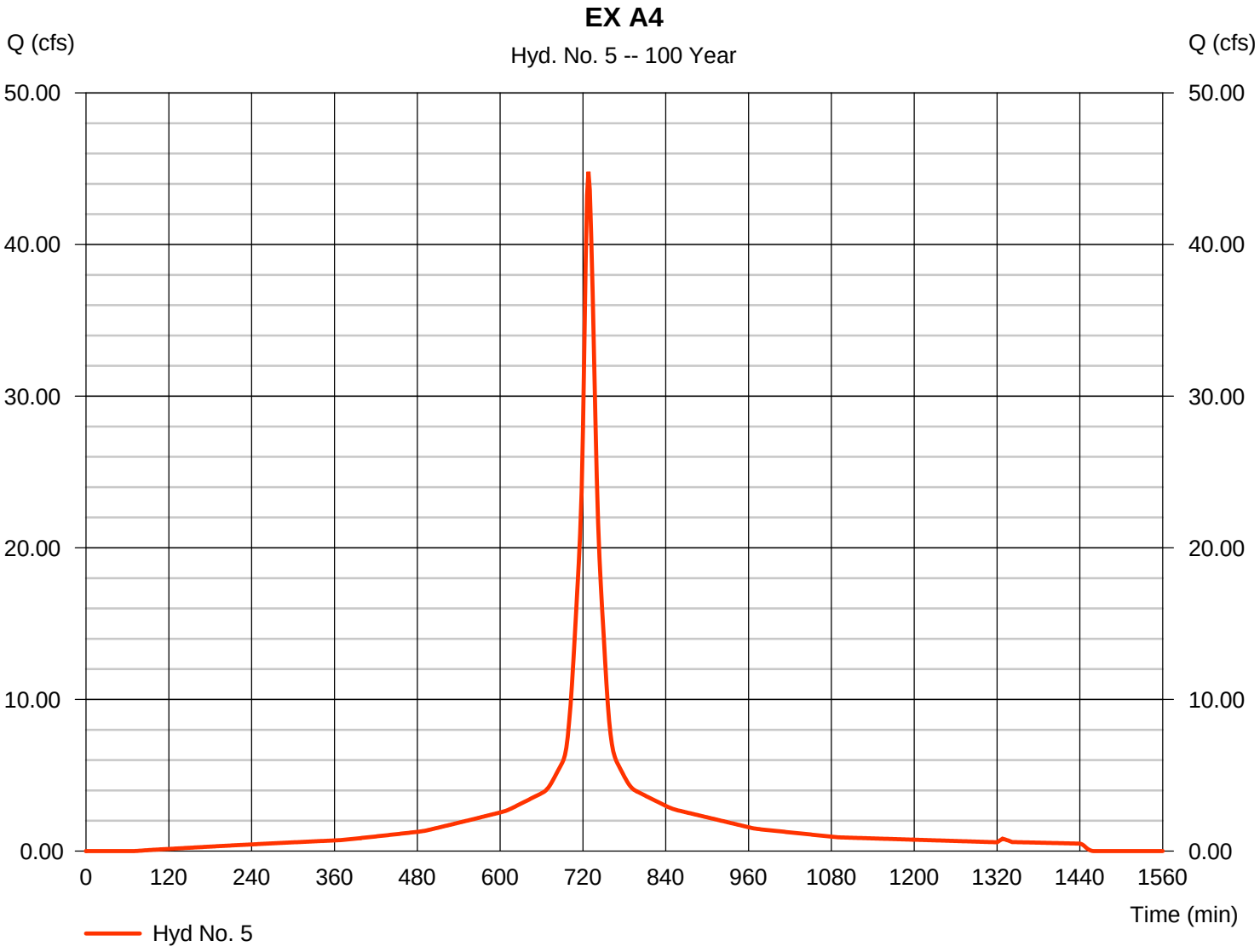


Hydrograph Report

Hyd. No. 5

EX A4

Hydrograph type	=	SCS Runoff	Peak discharge	=	44.80 cfs
Storm frequency	=	100 yrs	Time to peak	=	728 min
Time interval	=	2 min	Hyd. volume	=	192,667 cuft
Drainage area	=	4.450 ac	Curve number	=	94
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	10.00 min
Total precip.	=	12.30 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484

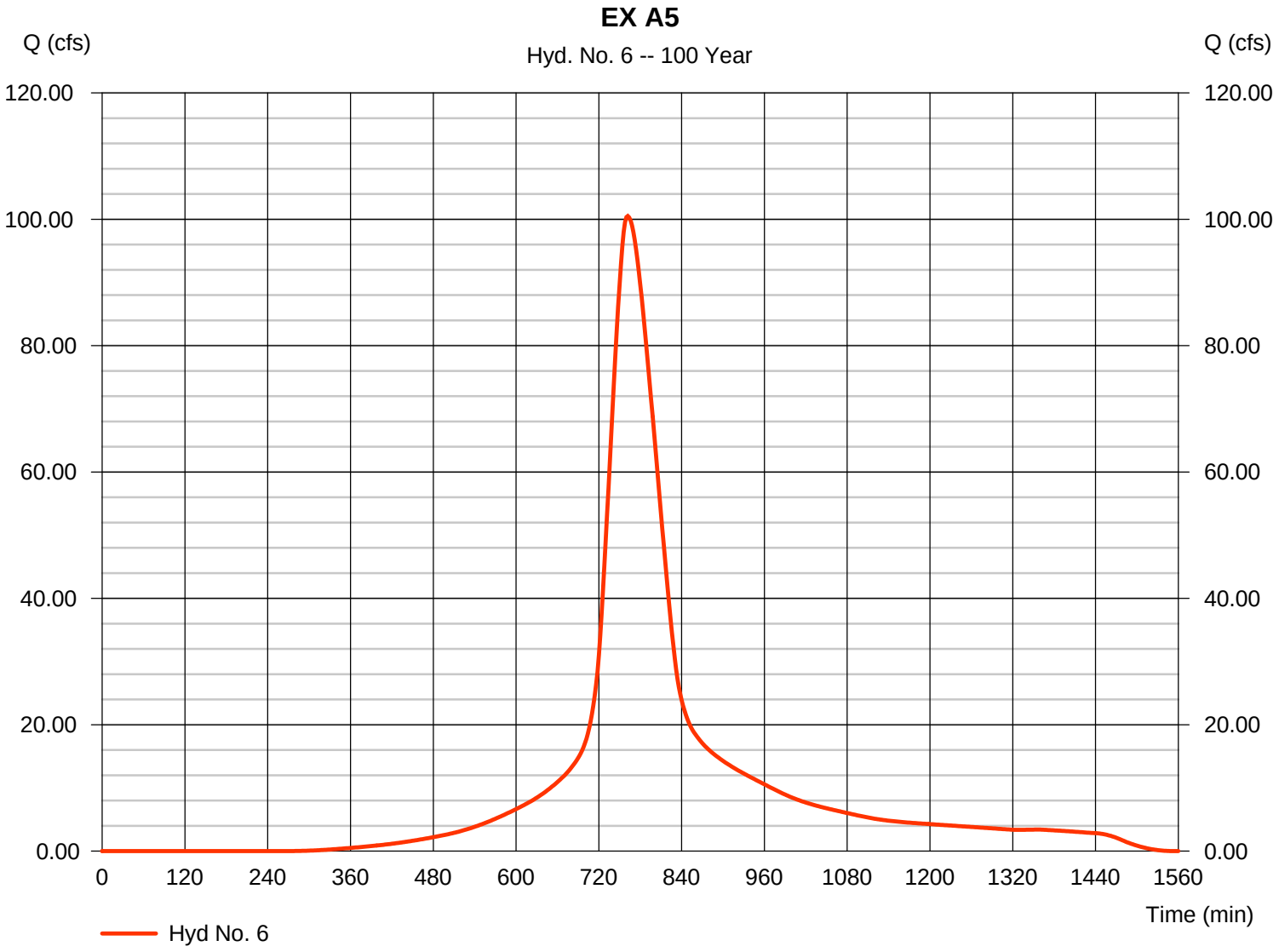


Hydrograph Report

Hyd. No. 6

EX A5

Hydrograph type	=	SCS Runoff	Peak discharge	=	100.52 cfs
Storm frequency	=	100 yrs	Time to peak	=	762 min
Time interval	=	2 min	Hyd. volume	=	865,861 cuft
Drainage area	=	24.990 ac	Curve number	=	78
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	63.10 min
Total precip.	=	12.30 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	434

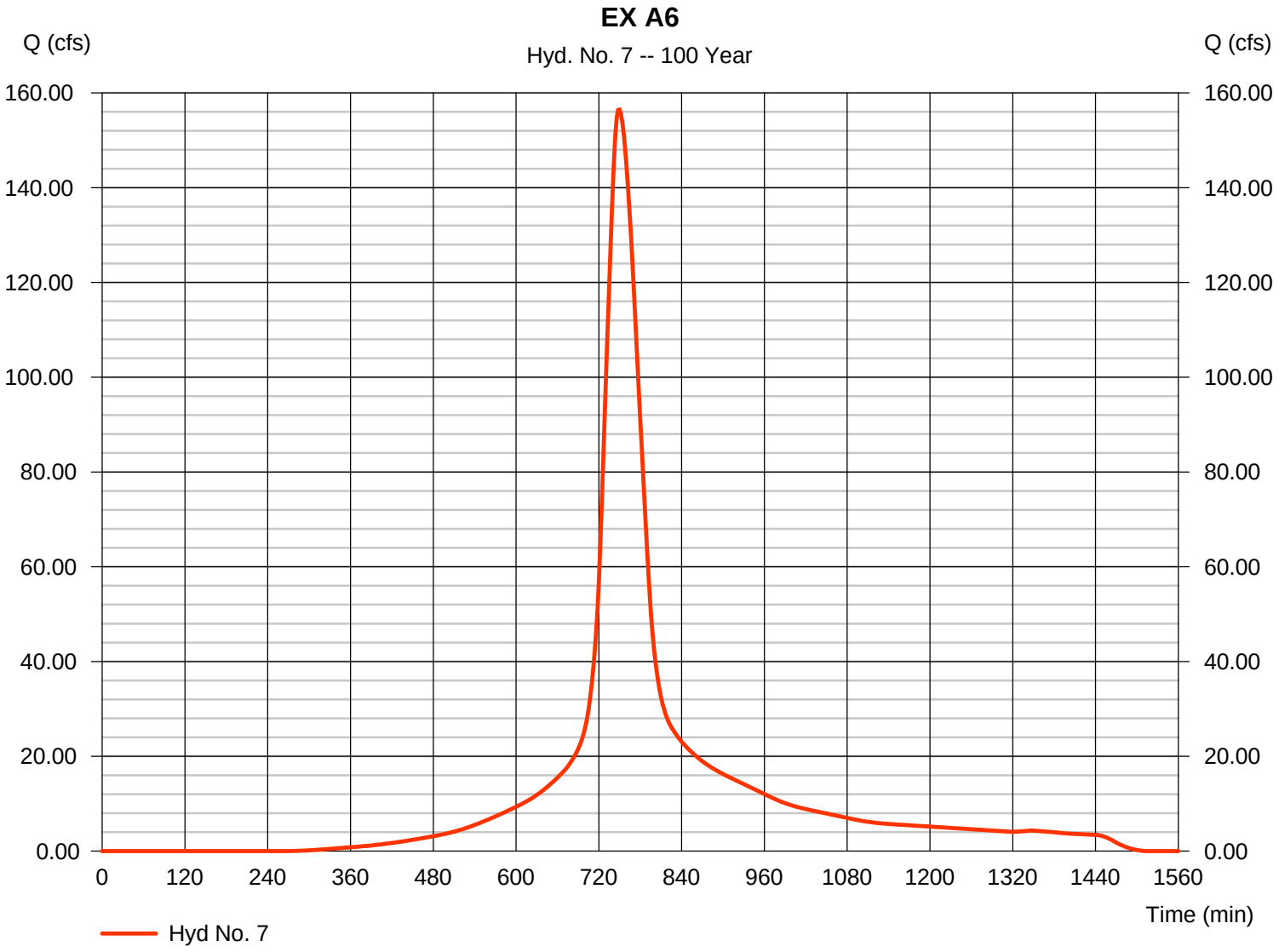


Hydrograph Report

Hyd. No. 7

EX A6

Hydrograph type	=	SCS Runoff	Peak discharge	=	156.45 cfs
Storm frequency	=	100 yrs	Time to peak	=	750 min
Time interval	=	2 min	Hyd. volume	=	1,077,908 cuft
Drainage area	=	31.110 ac	Curve number	=	78
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	40.80 min
Total precip.	=	12.30 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	434

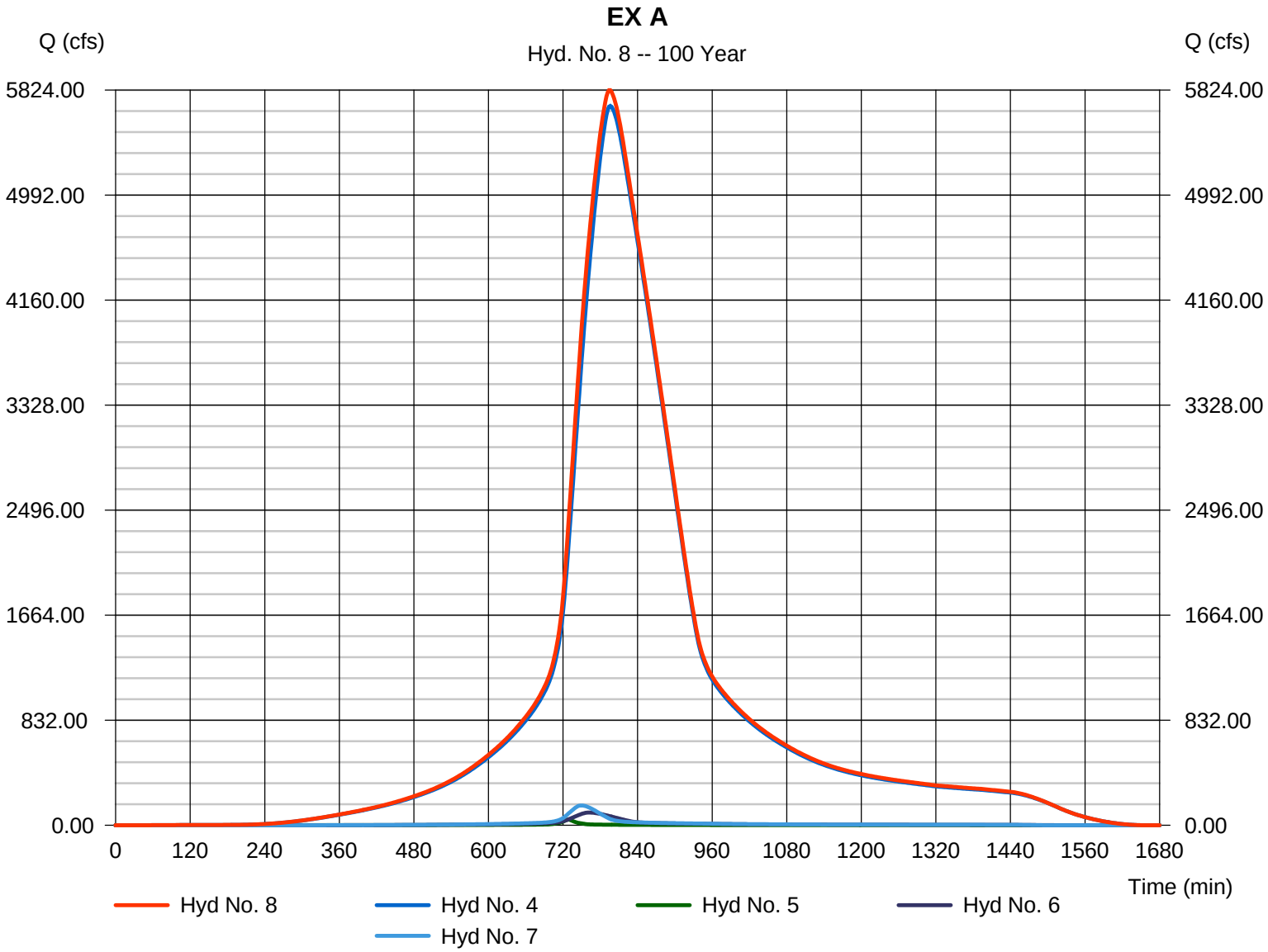


Hydrograph Report

Hyd. No. 8

EX A

Hydrograph type	=	Combine	Peak discharge	=	5823.16 cfs
Storm frequency	=	100 yrs	Time to peak	=	794 min
Time interval	=	2 min	Hyd. volume	=	79,527,248 cuft
Inflow hyds.	=	4, 5, 6, 7	Contrib. drain. area	=	60.550 ac

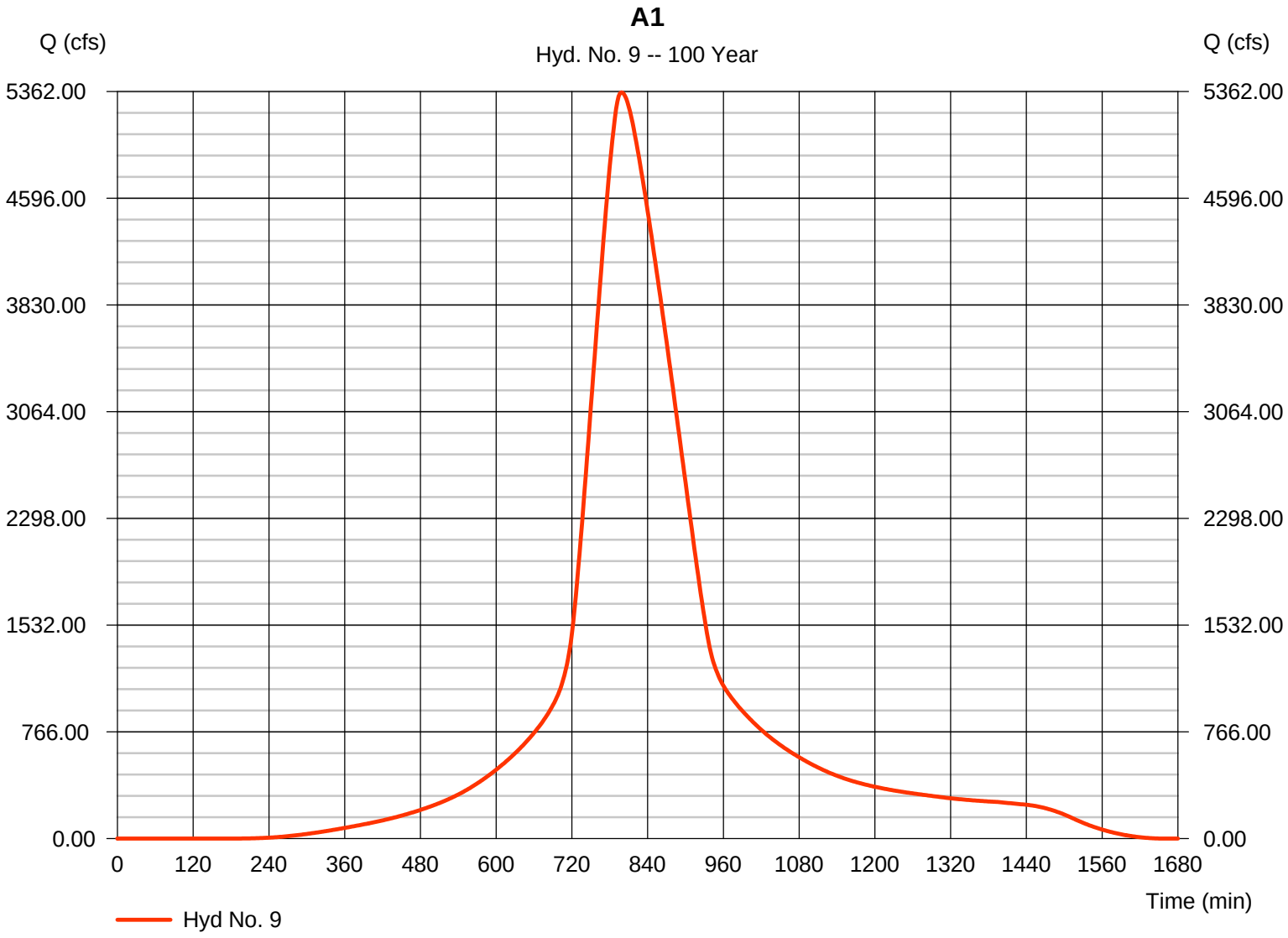


Hydrograph Report

Hyd. No. 9

A1

Hydrograph type	=	SCS Runoff	Peak discharge	=	5355.58 cfs
Storm frequency	=	100 yrs	Time to peak	=	798 min
Time interval	=	2 min	Hyd. volume	=	72,308,288 cuft
Drainage area	=	1906.930 ac	Curve number	=	85.3
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	122.30 min
Total precip.	=	12.30 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	434

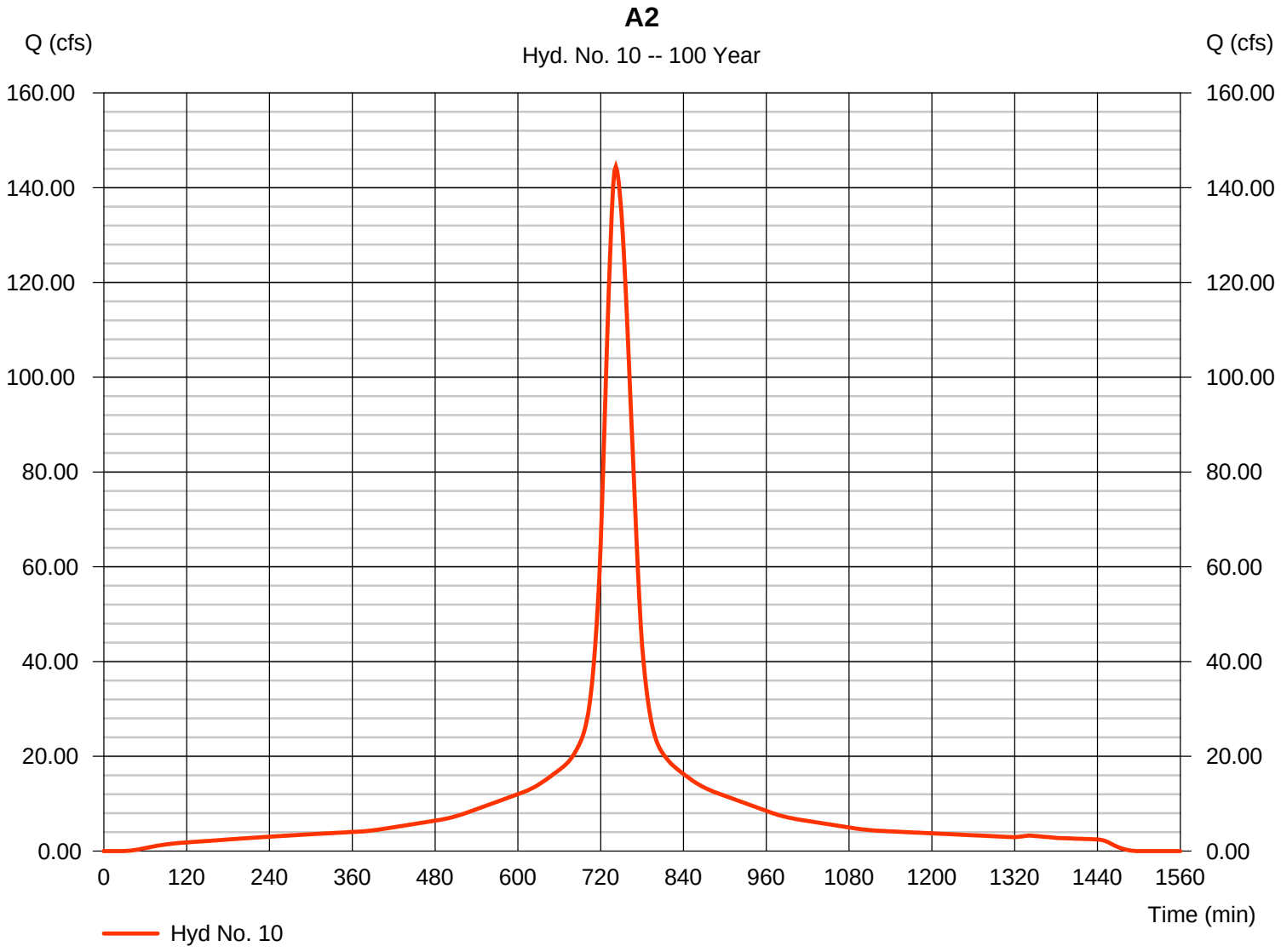


Hydrograph Report

Hyd. No. 10

A2

Hydrograph type	=	SCS Runoff	Peak discharge	=	144.44 cfs
Storm frequency	=	100 yrs	Time to peak	=	742 min
Time interval	=	2 min	Hyd. volume	=	969,677 cuft
Drainage area	=	21.960 ac	Curve number	=	98
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	32.00 min
Total precip.	=	12.30 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	434



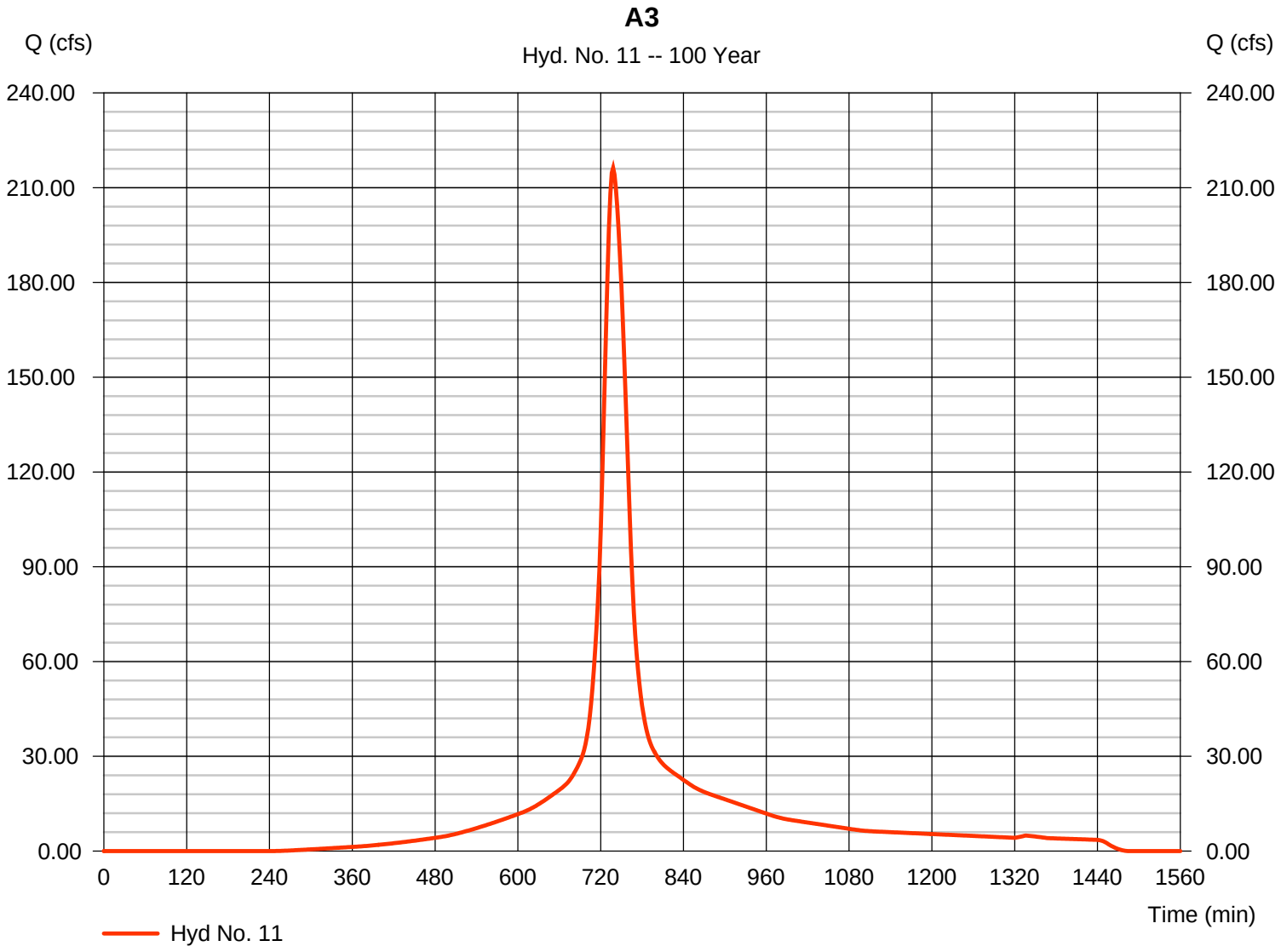
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2 Wednesday, 06 / 10 / 2020

Hyd. No. 11

A3

Hydrograph type	=	SCS Runoff	Peak discharge	=	216.22 cfs
Storm frequency	=	100 yrs	Time to peak	=	738 min
Time interval	=	2 min	Hyd. volume	=	1,173,457 cuft
Drainage area	=	33.050 ac	Curve number	=	79.7
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	25.60 min
Total precip.	=	12.30 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	434

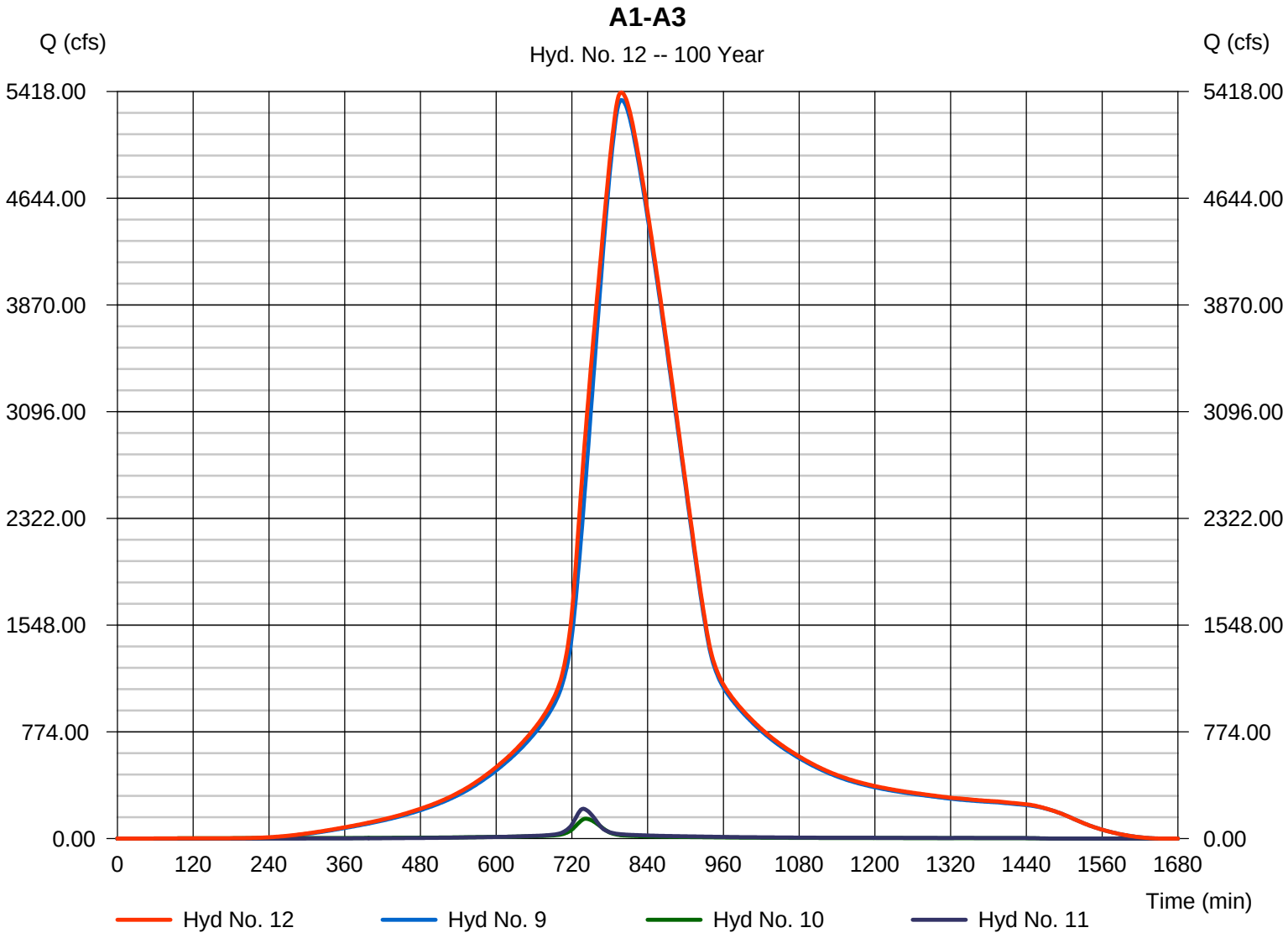


Hydrograph Report

Hyd. No. 12

A1-A3

Hydrograph type	=	Combine	Peak discharge	=	5411.44 cfs
Storm frequency	=	100 yrs	Time to peak	=	798 min
Time interval	=	2 min	Hyd. volume	=	74,451,376 cuft
Inflow hyds.	=	9, 10, 11	Contrib. drain. area	=	1961.940 ac



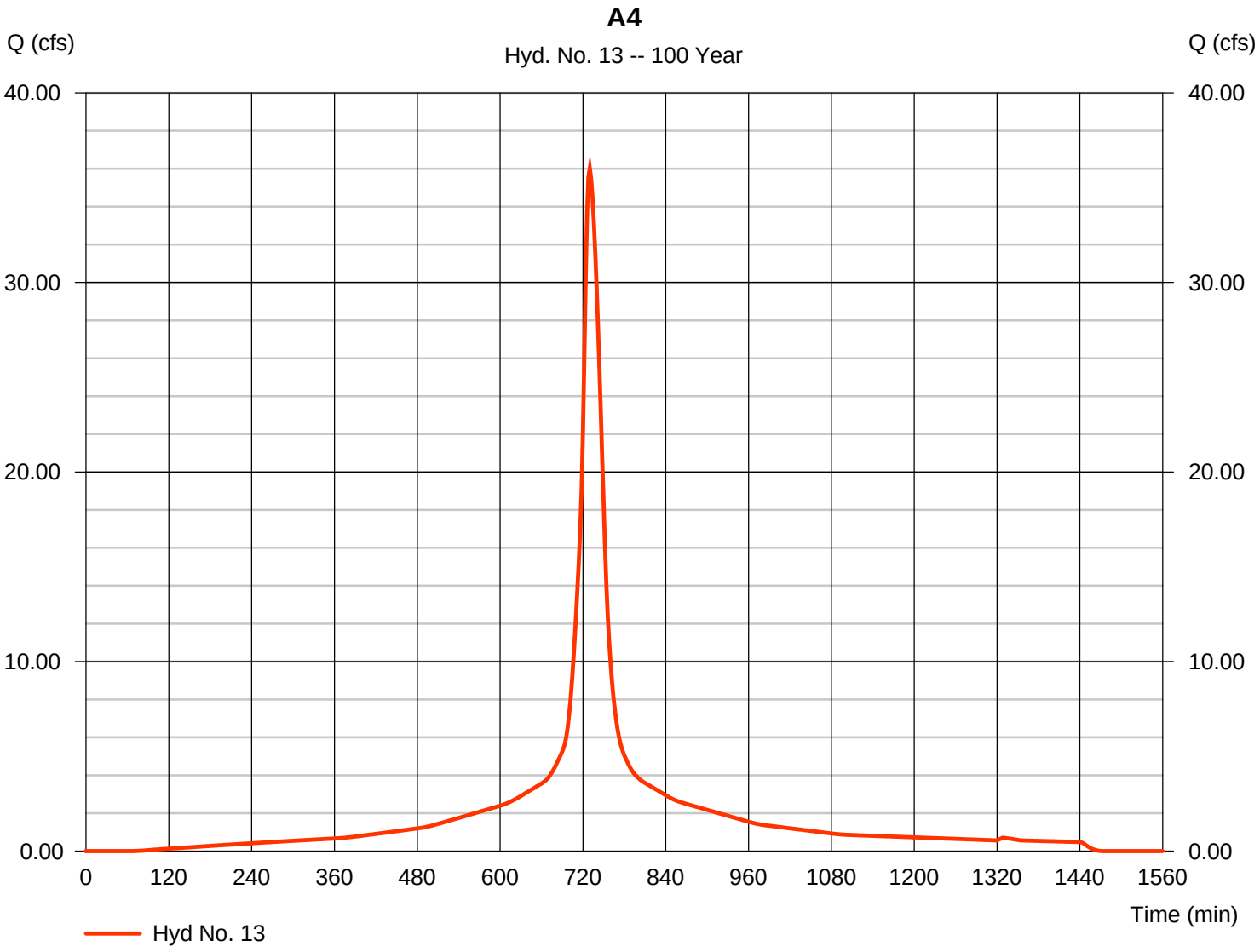
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2 Wednesday, 06 / 10 / 2020

Hyd. No. 13

A4

Hydrograph type	=	SCS Runoff	Peak discharge	=	36.02 cfs
Storm frequency	=	100 yrs	Time to peak	=	730 min
Time interval	=	2 min	Hyd. volume	=	184,561 cuft
Drainage area	=	4.450 ac	Curve number	=	94
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	10.00 min
Total precip.	=	12.30 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	300

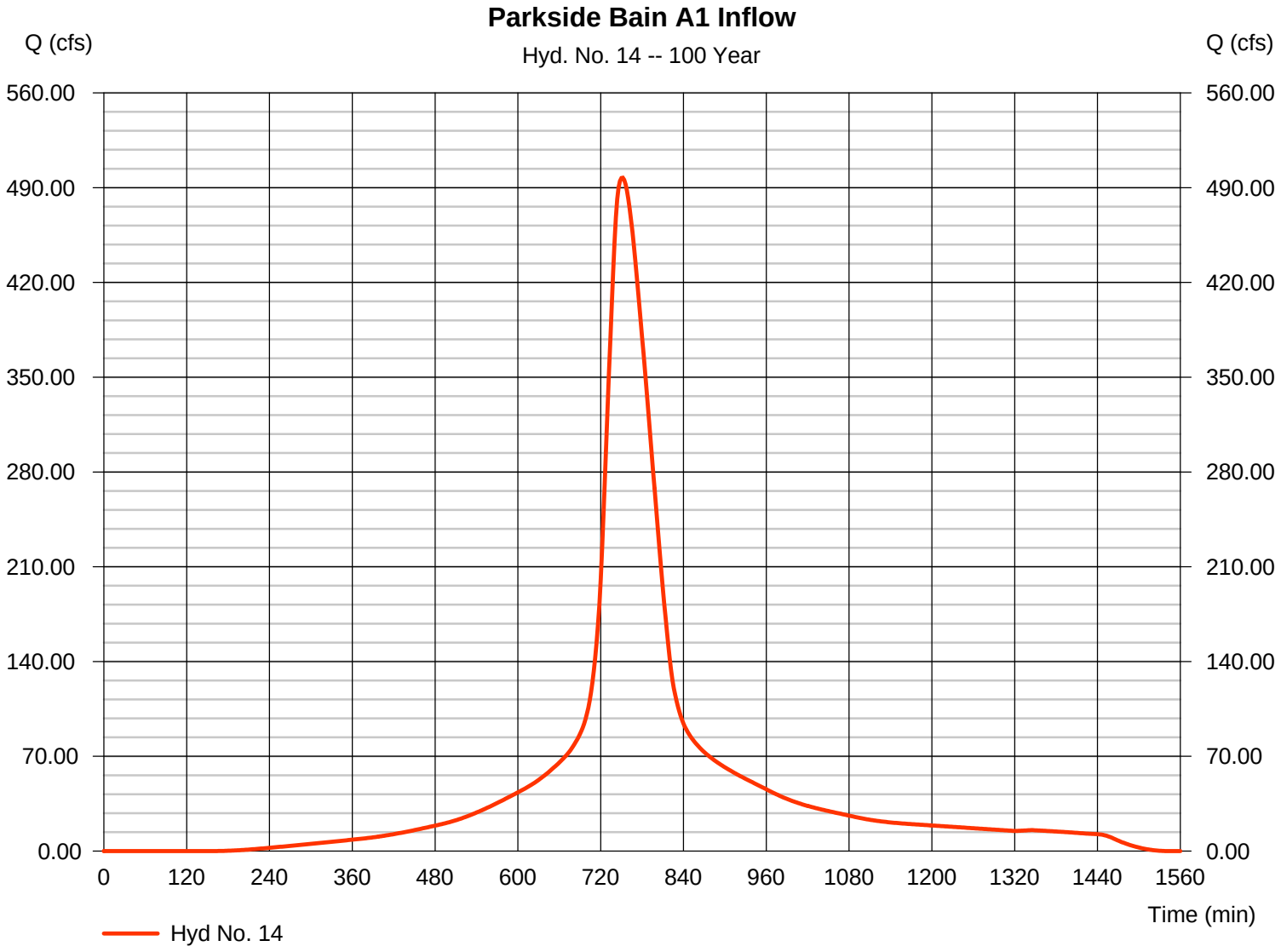


Hydrograph Report

Hyd. No. 14

Parkside Bain A1 Inflow

Hydrograph type	=	SCS Runoff	Peak discharge	=	497.35 cfs
Storm frequency	=	100 yrs	Time to peak	=	752 min
Time interval	=	2 min	Hyd. volume	=	4,263,412 cuft
Drainage area	=	109.260 ac	Curve number	=	87
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	37.90 min
Total precip.	=	12.30 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	300



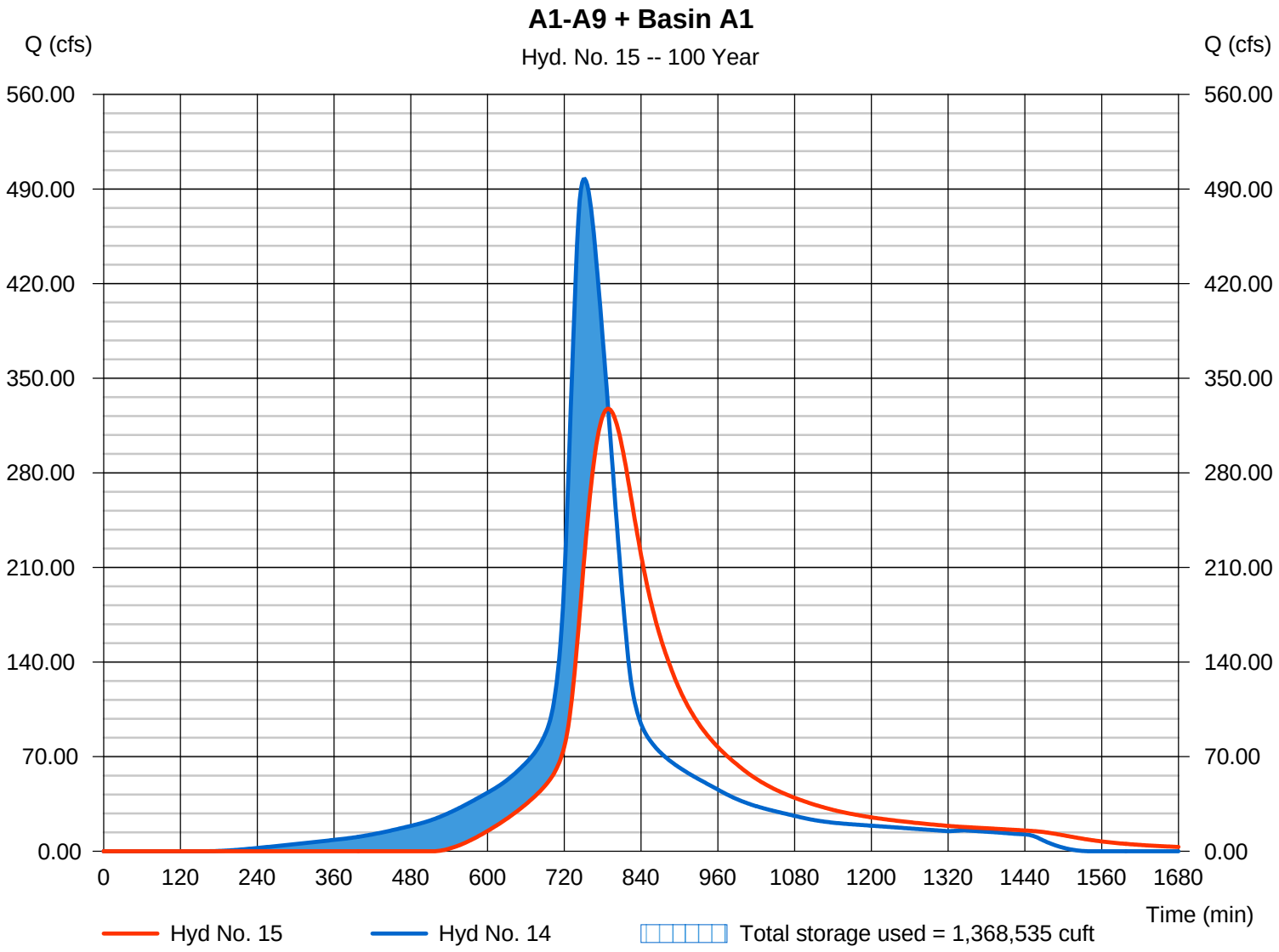
Hydrograph Report

Hyd. No. 15

A1-A9 + Basin A1

Hydrograph type	=	Reservoir	Peak discharge	=	327.41 cfs
Storm frequency	=	100 yrs	Time to peak	=	788 min
Time interval	=	2 min	Hyd. volume	=	4,079,100 cuft
Inflow hyd. No.	=	14 - Parkside Bain A1 Inflow	Max. Elevation	=	606.94 ft
Reservoir name	=	BASIN A1	Max. Storage	=	1,368,535 cuft

Storage Indication method used.

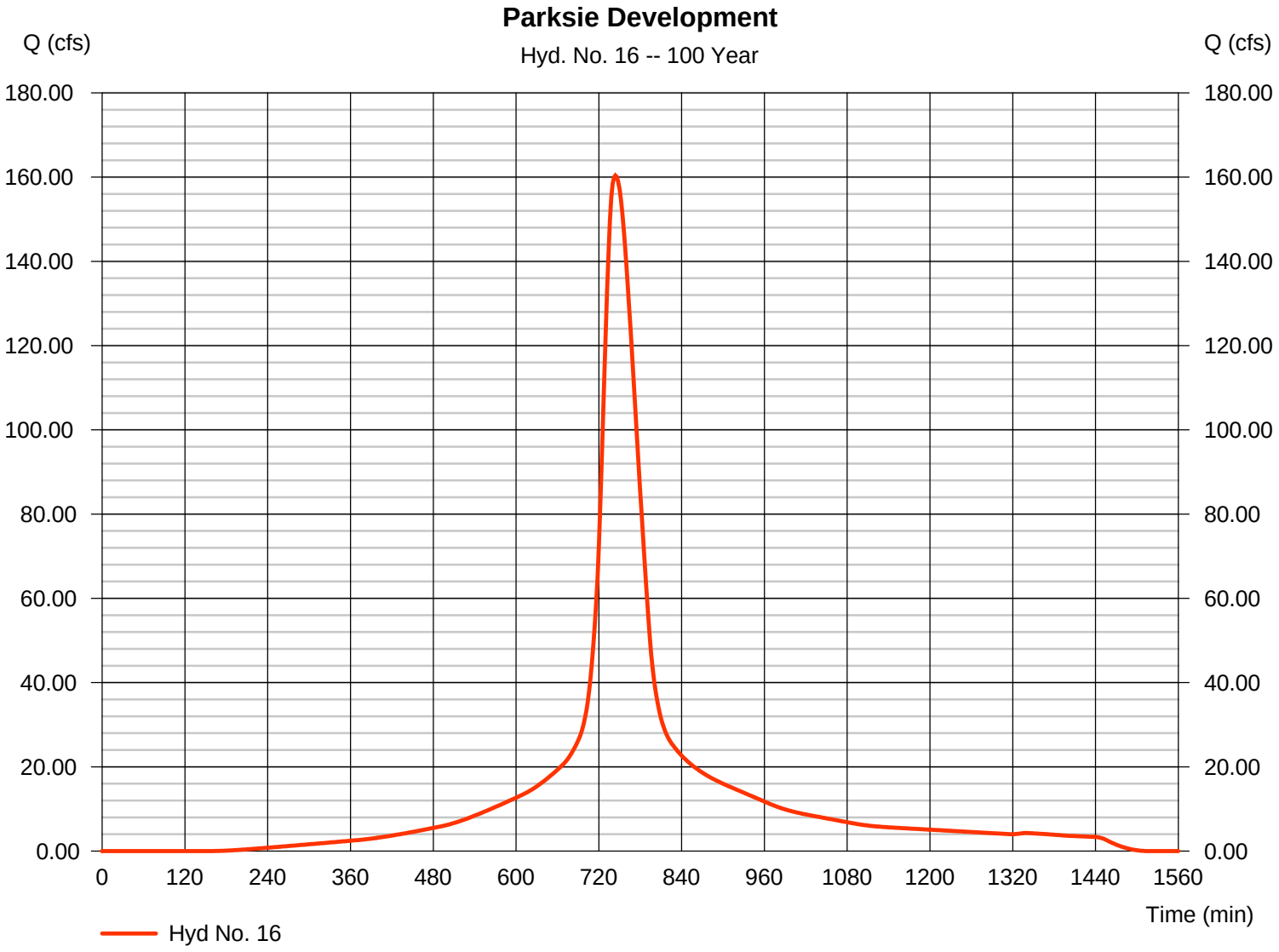


Hydrograph Report

Hyd. No. 16

Parksie Development

Hydrograph type	=	SCS Runoff	Peak discharge	=	160.40 cfs
Storm frequency	=	100 yrs	Time to peak	=	744 min
Time interval	=	2 min	Hyd. volume	=	1,168,281 cuft
Drainage area	=	29.940 ac	Curve number	=	87
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	28.50 min
Total precip.	=	12.30 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	300

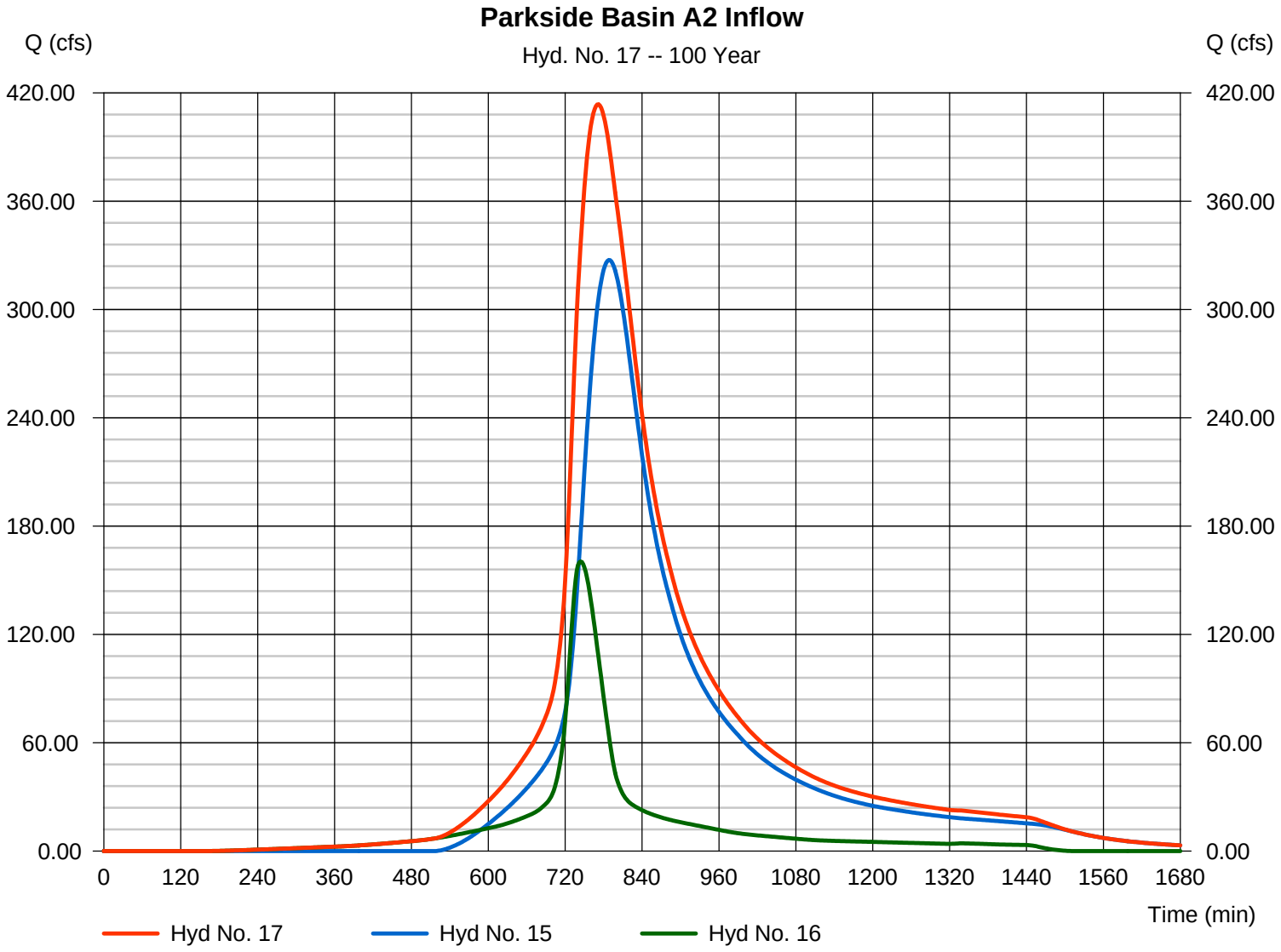


Hydrograph Report

Hyd. No. 17

Parkside Basin A2 Inflow

Hydrograph type	=	Combine	Peak discharge	=	413.63 cfs
Storm frequency	=	100 yrs	Time to peak	=	772 min
Time interval	=	2 min	Hyd. volume	=	5,247,361 cuft
Inflow hyds.	=	15, 16	Contrib. drain. area	=	29.940 ac



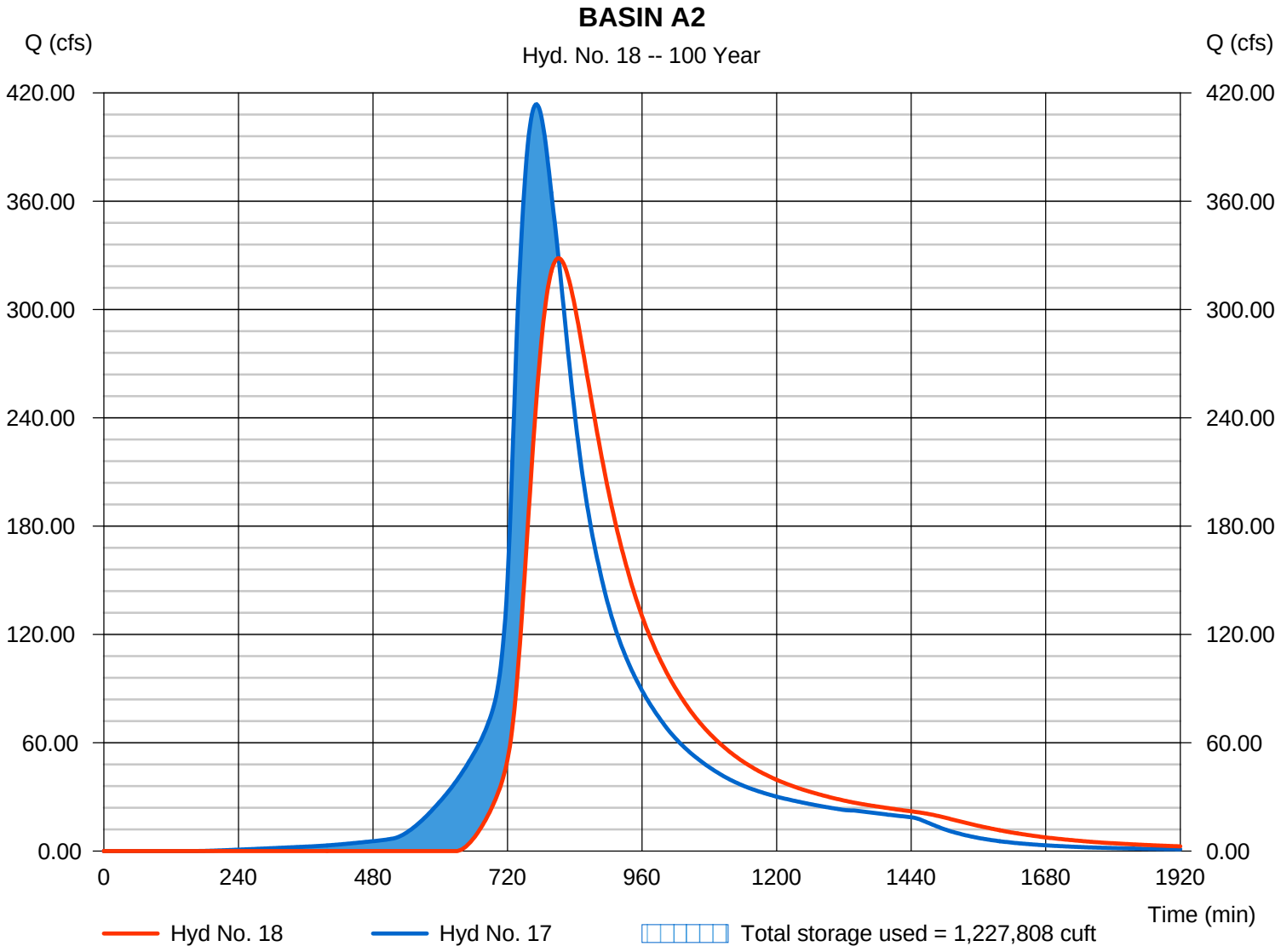
Hydrograph Report

Hyd. No. 18

BASIN A2

Hydrograph type	=	Reservoir	Peak discharge	=	328.36 cfs
Storm frequency	=	100 yrs	Time to peak	=	812 min
Time interval	=	2 min	Hyd. volume	=	5,054,492 cuft
Inflow hyd. No.	=	17 - Parkside Basin A2 Inflow	Max. Elevation	=	604.93 ft
Reservoir name	=	BASIN A2	Max. Storage	=	1,227,808 cuft

Storage Indication method used.

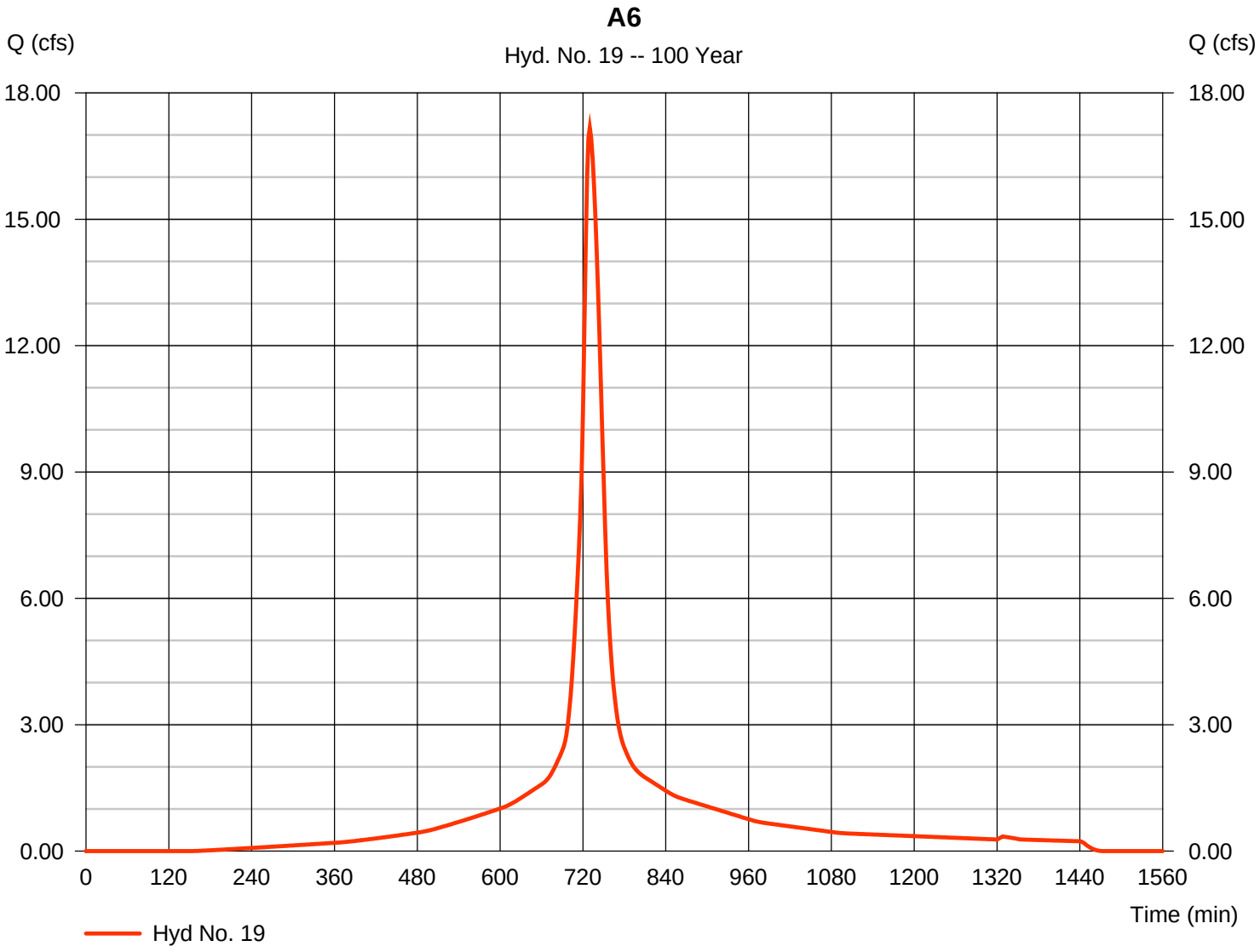


Hydrograph Report

Hyd. No. 19

A6

Hydrograph type	=	SCS Runoff	Peak discharge	=	17.17 cfs
Storm frequency	=	100 yrs	Time to peak	=	730 min
Time interval	=	2 min	Hyd. volume	=	84,195 cuft
Drainage area	=	2.200 ac	Curve number	=	87
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	10.00 min
Total precip.	=	12.30 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	300

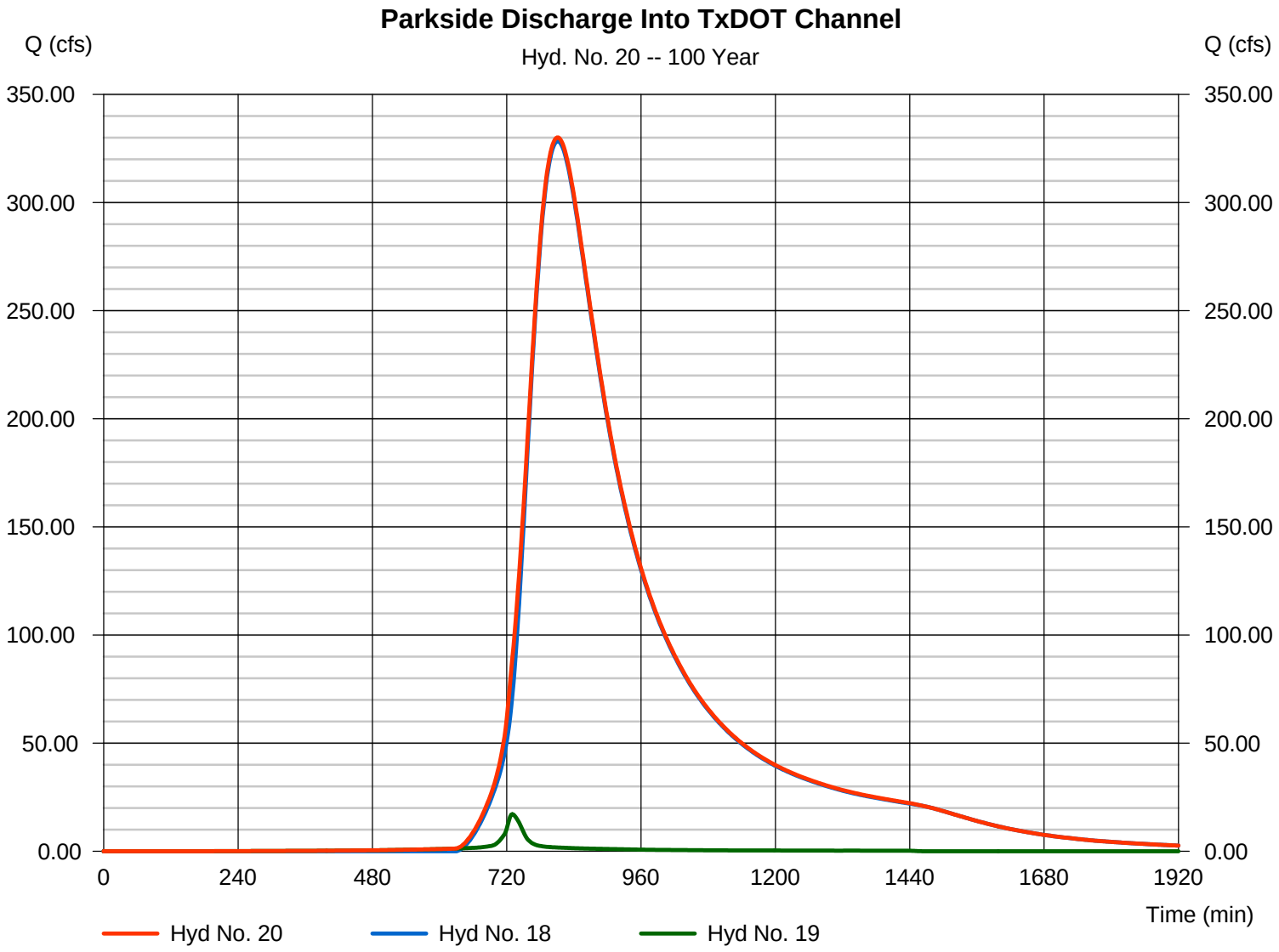


Hydrograph Report

Hyd. No. 20

Parkside Discharge Into TxDOT Channel

Hydrograph type	=	Combine	Peak discharge	=	330.09 cfs
Storm frequency	=	100 yrs	Time to peak	=	810 min
Time interval	=	2 min	Hyd. volume	=	5,138,687 cuft
Inflow hyds.	=	18, 19	Contrib. drain. area	=	2.200 ac

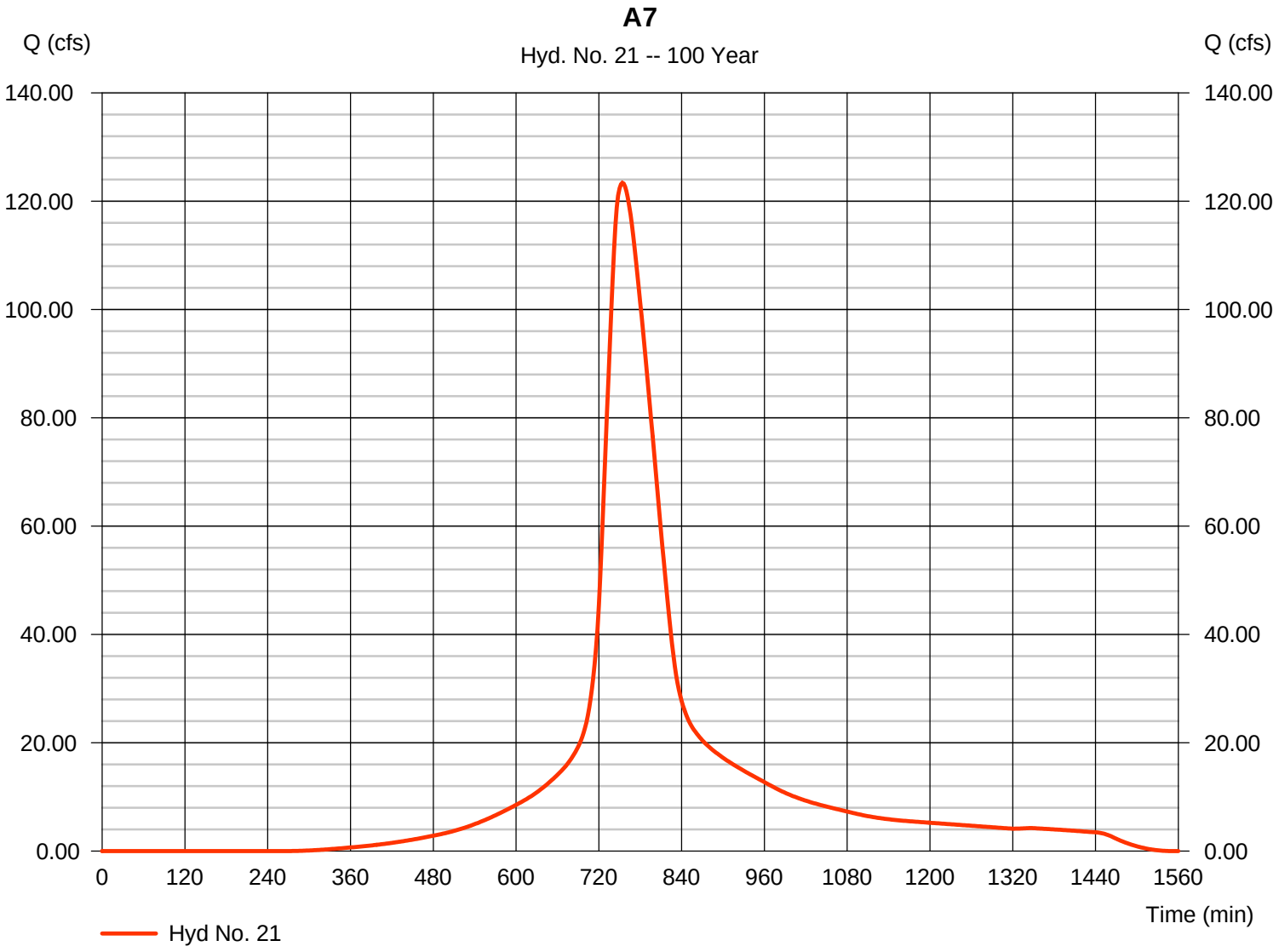


Hydrograph Report

Hyd. No. 21

A7

Hydrograph type	=	SCS Runoff	Peak discharge	=	123.39 cfs
Storm frequency	=	100 yrs	Time to peak	=	754 min
Time interval	=	2 min	Hyd. volume	=	1,069,885 cuft
Drainage area	=	31.110 ac	Curve number	=	78
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	40.80 min
Total precip.	=	12.30 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	300

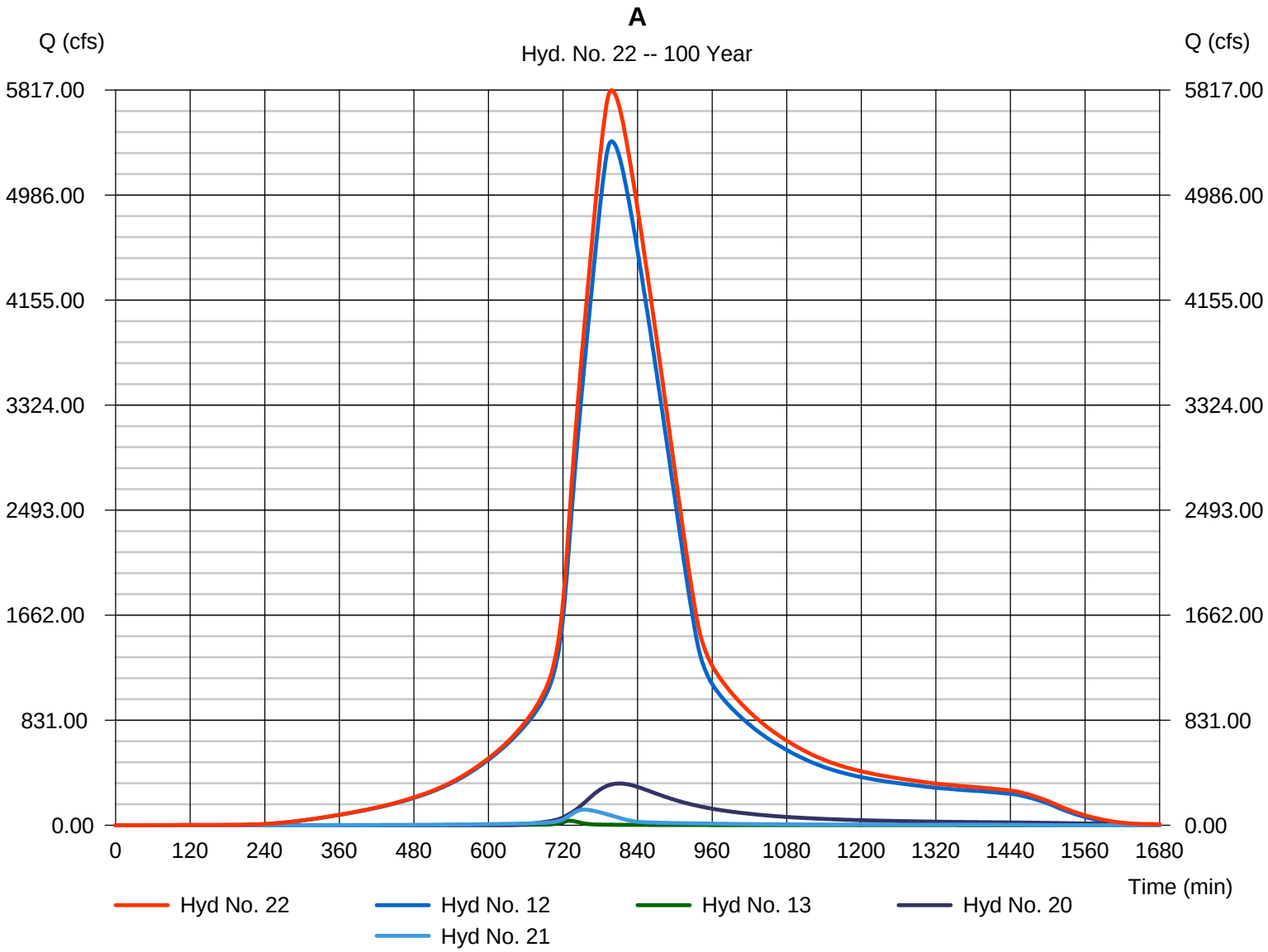


Hydrograph Report

Hyd. No. 22

A

Hydrograph type	=	Combine	Peak discharge	=	5814.79 cfs
Storm frequency	=	100 yrs	Time to peak	=	798 min
Time interval	=	2 min	Hyd. volume	=	80,843,920 cuft
Inflow hyds.	=	12, 13, 20, 21	Contrib. drain. area	=	35.560 ac



Ultimate Conditions Hydraflow Hydrographs Analysis

Hydraflow Table of Contents

031.060_Parkside Offsite ULT.gpw

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2 Wednesday, 06 / 10 / 2020

Watershed Model Schematic 1

Hydrograph Return Period Recap 2

2 - Year

Summary Report 3
Hydrograph Reports 4
Hydrograph No. 1, SCS Runoff, EX A1 4
Hydrograph No. 2, SCS Runoff, EX A2 5
Hydrograph No. 3, SCS Runoff, EX A3 6
Hydrograph No. 4, Combine, EX A1 - EX A3 7
Hydrograph No. 5, SCS Runoff, EX A4 8
Hydrograph No. 6, SCS Runoff, EX A5 9
Hydrograph No. 7, SCS Runoff, EX A6 10
Hydrograph No. 8, Combine, EX A 11
Hydrograph No. 9, SCS Runoff, ULT A1 12
Hydrograph No. 10, SCS Runoff, ULT A2 13
Hydrograph No. 11, SCS Runoff, ULT A3 14
Hydrograph No. 12, Combine, A1-A3 15
Hydrograph No. 13, SCS Runoff, ULT A4 16
Hydrograph No. 14, SCS Runoff, Parkside Bain A1 Inflow 17
Hydrograph No. 15, Reservoir, A1-A9 + Basin A1 18
Pond Report - BASIN A1 19
Hydrograph No. 16, SCS Runoff, Parksie Development 20
Hydrograph No. 17, Combine, Parkside Basin A2 Inflow 21
Hydrograph No. 18, Reservoir, BASIN A2 22
Pond Report - BASIN A2 23
Hydrograph No. 19, SCS Runoff, ULT A6 24
Hydrograph No. 20, Combine, Parkside Discharge Into TxDOT Channel 25
Hydrograph No. 21, SCS Runoff, ULT A7 26
Hydrograph No. 22, Combine, ULT A 27

5 - Year

Summary Report 28
Hydrograph Reports 29
Hydrograph No. 1, SCS Runoff, EX A1 29
Hydrograph No. 2, SCS Runoff, EX A2 30
Hydrograph No. 3, SCS Runoff, EX A3 31
Hydrograph No. 4, Combine, EX A1 - EX A3 32
Hydrograph No. 5, SCS Runoff, EX A4 33
Hydrograph No. 6, SCS Runoff, EX A5 34
Hydrograph No. 7, SCS Runoff, EX A6 35
Hydrograph No. 8, Combine, EX A 36
Hydrograph No. 9, SCS Runoff, ULT A1 37
Hydrograph No. 10, SCS Runoff, ULT A2 38
Hydrograph No. 11, SCS Runoff, ULT A3 39
Hydrograph No. 12, Combine, A1-A3 40
Hydrograph No. 13, SCS Runoff, ULT A4 41

Hydrograph No. 14, SCS Runoff, Parkside Bain A1 Inflow 42
Hydrograph No. 15, Reservoir, A1-A9 + Basin A1 43
Hydrograph No. 16, SCS Runoff, Parksie Development 44
Hydrograph No. 17, Combine, Parkside Basin A2 Inflow 45
Hydrograph No. 18, Reservoir, BASIN A2 46
Hydrograph No. 19, SCS Runoff, ULT A6 47
Hydrograph No. 20, Combine, Parkside Discharge Into TxDOT Channel 48
Hydrograph No. 21, SCS Runoff, ULT A7 49
Hydrograph No. 22, Combine, ULT A 50

10 - Year

Summary Report 51
Hydrograph Reports 52
Hydrograph No. 1, SCS Runoff, EX A1 52
Hydrograph No. 2, SCS Runoff, EX A2 53
Hydrograph No. 3, SCS Runoff, EX A3 54
Hydrograph No. 4, Combine, EX A1 - EX A3 55
Hydrograph No. 5, SCS Runoff, EX A4 56
Hydrograph No. 6, SCS Runoff, EX A5 57
Hydrograph No. 7, SCS Runoff, EX A6 58
Hydrograph No. 8, Combine, EX A 59
Hydrograph No. 9, SCS Runoff, ULT A1 60
Hydrograph No. 10, SCS Runoff, ULT A2 61
Hydrograph No. 11, SCS Runoff, ULT A3 62
Hydrograph No. 12, Combine, A1-A3 63
Hydrograph No. 13, SCS Runoff, ULT A4 64
Hydrograph No. 14, SCS Runoff, Parkside Bain A1 Inflow 65
Hydrograph No. 15, Reservoir, A1-A9 + Basin A1 66
Hydrograph No. 16, SCS Runoff, Parksie Development 67
Hydrograph No. 17, Combine, Parkside Basin A2 Inflow 68
Hydrograph No. 18, Reservoir, BASIN A2 69
Hydrograph No. 19, SCS Runoff, ULT A6 70
Hydrograph No. 20, Combine, Parkside Discharge Into TxDOT Channel 71
Hydrograph No. 21, SCS Runoff, ULT A7 72
Hydrograph No. 22, Combine, ULT A 73

25 - Year

Summary Report 74
Hydrograph Reports 75
Hydrograph No. 1, SCS Runoff, EX A1 75
Hydrograph No. 2, SCS Runoff, EX A2 76
Hydrograph No. 3, SCS Runoff, EX A3 77
Hydrograph No. 4, Combine, EX A1 - EX A3 78
Hydrograph No. 5, SCS Runoff, EX A4 79
Hydrograph No. 6, SCS Runoff, EX A5 80
Hydrograph No. 7, SCS Runoff, EX A6 81
Hydrograph No. 8, Combine, EX A 82
Hydrograph No. 9, SCS Runoff, ULT A1 83
Hydrograph No. 10, SCS Runoff, ULT A2 84
Hydrograph No. 11, SCS Runoff, ULT A3 85

Hydrograph No. 12, Combine, A1-A3 86
Hydrograph No. 13, SCS Runoff, ULT A4 87
Hydrograph No. 14, SCS Runoff, Parkside Bain A1 Inflow 88
Hydrograph No. 15, Reservoir, A1-A9 + Basin A1 89
Hydrograph No. 16, SCS Runoff, Parksie Development 90
Hydrograph No. 17, Combine, Parkside Basin A2 Inflow 91
Hydrograph No. 18, Reservoir, BASIN A2 92
Hydrograph No. 19, SCS Runoff, ULT A6 93
Hydrograph No. 20, Combine, Parkside Discharge Into TxDOT Channel 94
Hydrograph No. 21, SCS Runoff, ULT A7 95
Hydrograph No. 22, Combine, ULT A 96

50 - Year

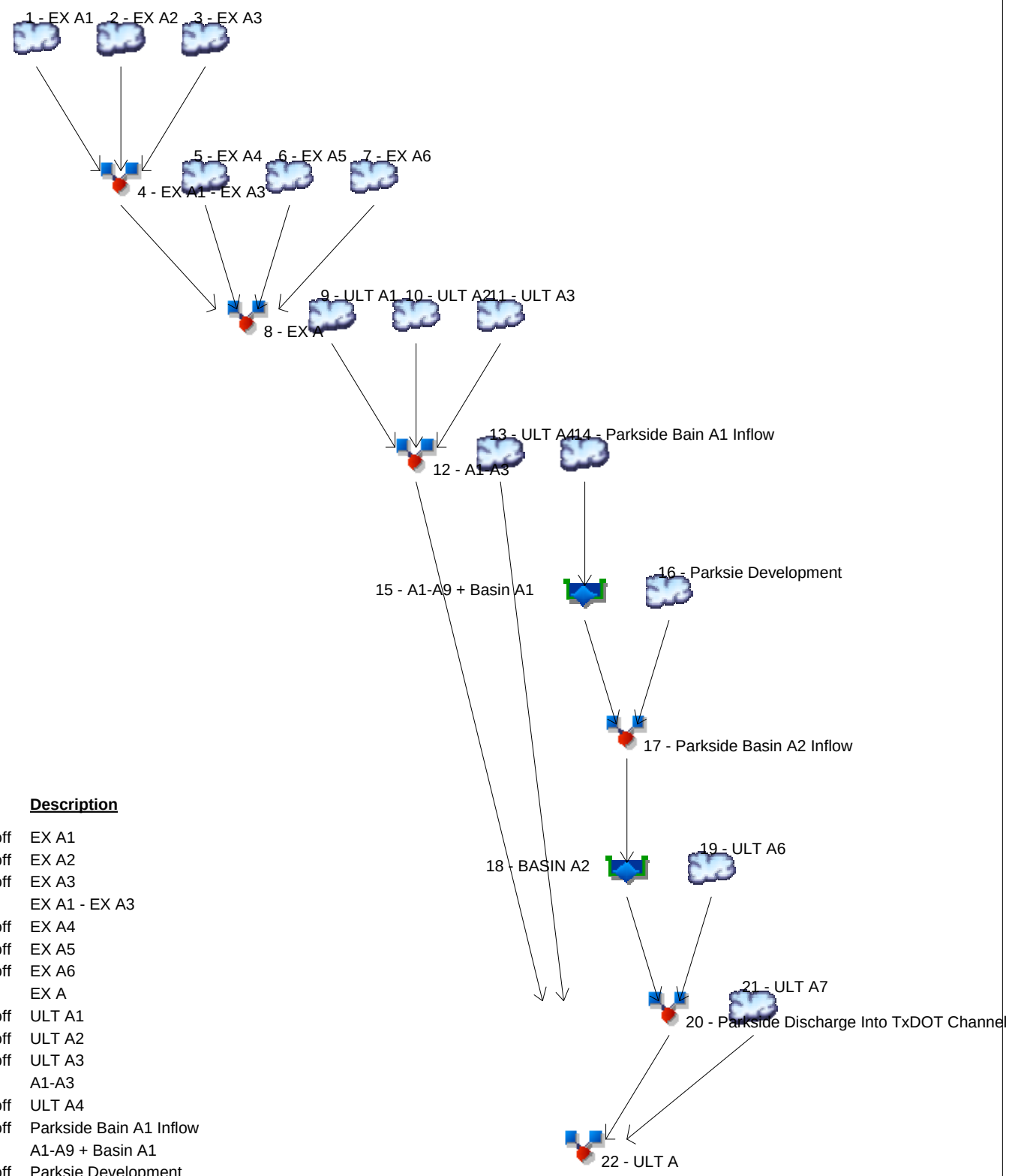
Summary Report 97
Hydrograph Reports 98
Hydrograph No. 1, SCS Runoff, EX A1 98
Hydrograph No. 2, SCS Runoff, EX A2 99
Hydrograph No. 3, SCS Runoff, EX A3 100
Hydrograph No. 4, Combine, EX A1 - EX A3 101
Hydrograph No. 5, SCS Runoff, EX A4 102
Hydrograph No. 6, SCS Runoff, EX A5 103
Hydrograph No. 7, SCS Runoff, EX A6 104
Hydrograph No. 8, Combine, EX A 105
Hydrograph No. 9, SCS Runoff, ULT A1 106
Hydrograph No. 10, SCS Runoff, ULT A2 107
Hydrograph No. 11, SCS Runoff, ULT A3 108
Hydrograph No. 12, Combine, A1-A3 109
Hydrograph No. 13, SCS Runoff, ULT A4 110
Hydrograph No. 14, SCS Runoff, Parkside Bain A1 Inflow 111
Hydrograph No. 15, Reservoir, A1-A9 + Basin A1 112
Hydrograph No. 16, SCS Runoff, Parksie Development 113
Hydrograph No. 17, Combine, Parkside Basin A2 Inflow 114
Hydrograph No. 18, Reservoir, BASIN A2 115
Hydrograph No. 19, SCS Runoff, ULT A6 116
Hydrograph No. 20, Combine, Parkside Discharge Into TxDOT Channel 117
Hydrograph No. 21, SCS Runoff, ULT A7 118
Hydrograph No. 22, Combine, ULT A 119

100 - Year

Summary Report 120
Hydrograph Reports 121
Hydrograph No. 1, SCS Runoff, EX A1 121
Hydrograph No. 2, SCS Runoff, EX A2 122
Hydrograph No. 3, SCS Runoff, EX A3 123
Hydrograph No. 4, Combine, EX A1 - EX A3 124
Hydrograph No. 5, SCS Runoff, EX A4 125
Hydrograph No. 6, SCS Runoff, EX A5 126
Hydrograph No. 7, SCS Runoff, EX A6 127
Hydrograph No. 8, Combine, EX A 128
Hydrograph No. 9, SCS Runoff, ULT A1 129

Hydrograph No. 10, SCS Runoff, ULT A2 130
Hydrograph No. 11, SCS Runoff, ULT A3 131
Hydrograph No. 12, Combine, A1-A3 132
Hydrograph No. 13, SCS Runoff, ULT A4 133
Hydrograph No. 14, SCS Runoff, Parkside Bain A1 Inflow 134
Hydrograph No. 15, Reservoir, A1-A9 + Basin A1 135
Hydrograph No. 16, SCS Runoff, Parksie Development 136
Hydrograph No. 17, Combine, Parkside Basin A2 Inflow 137
Hydrograph No. 18, Reservoir, BASIN A2 138
Hydrograph No. 19, SCS Runoff, ULT A6 139
Hydrograph No. 20, Combine, Parkside Discharge Into TxDOT Channel 140
Hydrograph No. 21, SCS Runoff, ULT A7 141
Hydrograph No. 22, Combine, ULT A 142

Watershed Model Schematic



Legend

Hyd.	Origin	Description
1	SCS Runoff	EX A1
2	SCS Runoff	EX A2
3	SCS Runoff	EX A3
4	Combine	EX A1 - EX A3
5	SCS Runoff	EX A4
6	SCS Runoff	EX A5
7	SCS Runoff	EX A6
8	Combine	EX A
9	SCS Runoff	ULT A1
10	SCS Runoff	ULT A2
11	SCS Runoff	ULT A3
12	Combine	A1-A3
13	SCS Runoff	ULT A4
14	SCS Runoff	Parkside Bain A1 Inflow
15	Reservoir	A1-A9 + Basin A1
16	SCS Runoff	Parksie Development
17	Combine	Parkside Basin A2 Inflow
18	Reservoir	BASIN A2
19	SCS Runoff	ULT A6
20	Combine	Parkside Discharge Into TxDOT Channel
21	SCS Runoff	ULT A7
22	Combine	ULT A

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	------	-------	1002.62	-------	1713.53	2312.98	3291.98	4218.96	5355.58	EX A1
2	SCS Runoff	------	-------	38.71	-------	56.38	70.91	94.50	116.89	144.44	EX A2
3	SCS Runoff	------	-------	72.66	-------	137.54	194.37	289.37	380.59	492.94	EX A3
4	Combine	1, 2, 3	-------	1056.58	-------	1812.75	2451.33	3495.48	4485.49	5698.02	EX A1 - EX A3
5	SCS Runoff	------	-------	11.19	-------	16.88	21.53	29.03	36.11	44.80	EX A4
6	SCS Runoff	------	-------	14.49	-------	27.69	39.30	58.74	77.45	100.52	EX A5
7	SCS Runoff	------	-------	22.75	-------	43.33	61.45	91.70	120.72	156.45	EX A6
8	Combine	4, 5, 6, 7	-------	1076.03	-------	1848.80	2502.49	3570.74	4582.87	5823.16	EX A
9	SCS Runoff	------	-------	1141.60	-------	1866.75	2468.89	3444.27	4365.42	5492.26	ULT A1
10	SCS Runoff	------	-------	38.71	-------	56.38	70.91	94.50	116.89	144.44	ULT A2
11	SCS Runoff	------	-------	48.35	-------	79.12	104.56	145.66	184.37	231.68	ULT A3
12	Combine	9, 10, 11	-------	1155.05	-------	1887.55	2495.41	3481.16	4411.32	5549.23	A1-A3
13	SCS Runoff	------	-------	8.962	-------	13.54	17.29	23.32	29.02	36.02	ULT A4
14	SCS Runoff	------	-------	100.07	-------	166.09	221.13	310.34	394.48	497.35	Parkside Bain A1 Inflow
15	Reservoir	14	-------	34.49	-------	81.81	123.26	189.09	251.12	327.41	A1-A9 + Basin A1
16	SCS Runoff	------	-------	32.44	-------	53.73	71.42	100.16	127.27	160.40	Parksie Development
17	Combine	15, 16	-------	41.38	-------	101.43	153.89	238.36	317.40	413.63	Parkside Basin A2 Inflow
18	Reservoir	17	-------	22.24	-------	61.62	101.75	173.26	243.14	328.36	BASIN A2
19	SCS Runoff	------	-------	3.482	-------	5.770	7.669	10.74	13.64	17.17	ULT A6
20	Combine	18, 19	-------	22.43	-------	62.06	102.40	174.27	244.47	330.09	Parkside Discharge Into TxDOT Chan
21	SCS Runoff	------	-------	35.61	-------	53.35	67.85	91.27	113.42	140.61	ULT A7
22	Combine	12, 13, 20, 21	-------	1177.05	-------	1954.50	2615.47	3695.26	4715.29	5960.25	ULT A

Hydrograph Summary Report

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

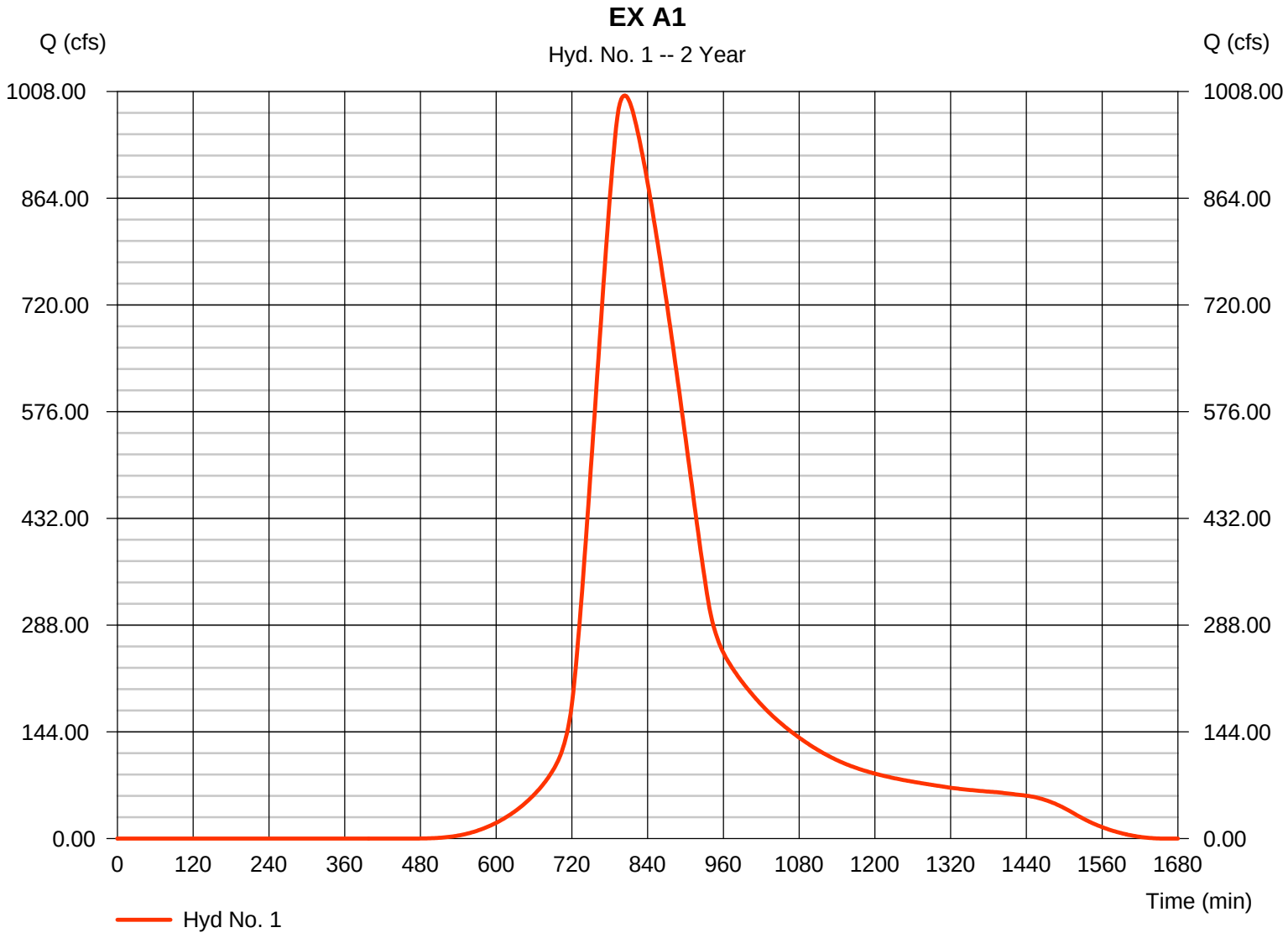
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	1002.62	2	804	13,157,684	------	------	------	EX A1
2	SCS Runoff	38.71	2	742	249,848	------	------	------	EX A2
3	SCS Runoff	72.66	2	764	608,258	------	------	------	EX A3
4	Combine	1056.58	2	800	14,015,804	1, 2, 3	------	------	EX A1 - EX A3
5	SCS Runoff	11.19	2	728	44,642	------	------	------	EX A4
6	SCS Runoff	14.49	2	766	125,999	------	------	------	EX A5
7	SCS Runoff	22.75	2	752	156,856	------	------	------	EX A6
8	Combine	1076.03	2	800	14,343,294	4, 5, 6, 7	------	------	EX A
9	SCS Runoff	1141.60	2	802	14,930,622	------	------	------	ULT A1
10	SCS Runoff	38.71	2	742	249,848	------	------	------	ULT A2
11	SCS Runoff	48.35	2	738	254,914	------	------	------	ULT A3
12	Combine	1155.05	2	802	15,435,390	9, 10, 11	------	------	A1-A3
13	SCS Runoff	8.962	2	730	42,763	------	------	------	ULT A4
14	SCS Runoff	100.07	2	754	814,623	------	------	------	Parkside Bain A1 Inflow
15	Reservoir	34.49	2	818	630,308	14	603.49	420,644	A1-A9 + Basin A1
16	SCS Runoff	32.44	2	746	223,227	------	------	------	Parksie Development
17	Combine	41.38	2	788	853,535	15, 16	------	------	Parkside Basin A2 Inflow
18	Reservoir	22.24	2	954	660,659	17	600.82	355,514	BASIN A2
19	SCS Runoff	3.482	2	730	16,087	------	------	------	ULT A6
20	Combine	22.43	2	952	676,746	18, 19	------	------	Parkside Discharge Into TxDOT Chan
21	SCS Runoff	35.61	2	754	314,577	------	------	------	ULT A7
22	Combine	1177.05	2	800	16,469,443	12, 13, 20, 21	------	------	ULT A

Hydrograph Report

Hyd. No. 1

EX A1

Hydrograph type	=	SCS Runoff	Peak discharge	=	1002.62 cfs
Storm frequency	=	2 yrs	Time to peak	=	804 min
Time interval	=	2 min	Hyd. volume	=	13,157,684 cuft
Drainage area	=	1906.930 ac	Curve number	=	85.3
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	122.30 min
Total precip.	=	3.34 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	434

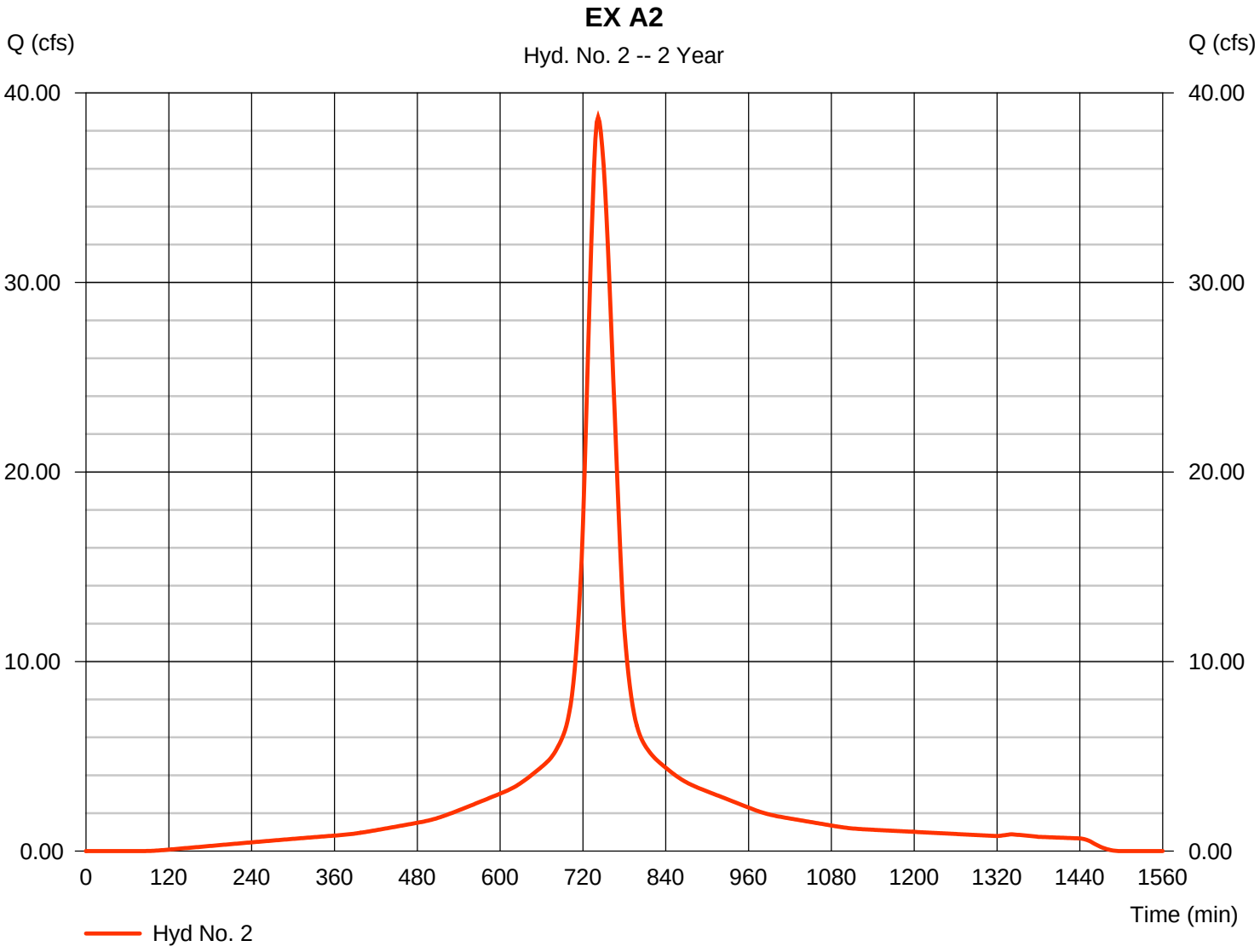


Hydrograph Report

Hyd. No. 2

EX A2

Hydrograph type	=	SCS Runoff	Peak discharge	=	38.71 cfs
Storm frequency	=	2 yrs	Time to peak	=	742 min
Time interval	=	2 min	Hyd. volume	=	249,848 cuft
Drainage area	=	21.960 ac	Curve number	=	98
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	32.00 min
Total precip.	=	3.34 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	434

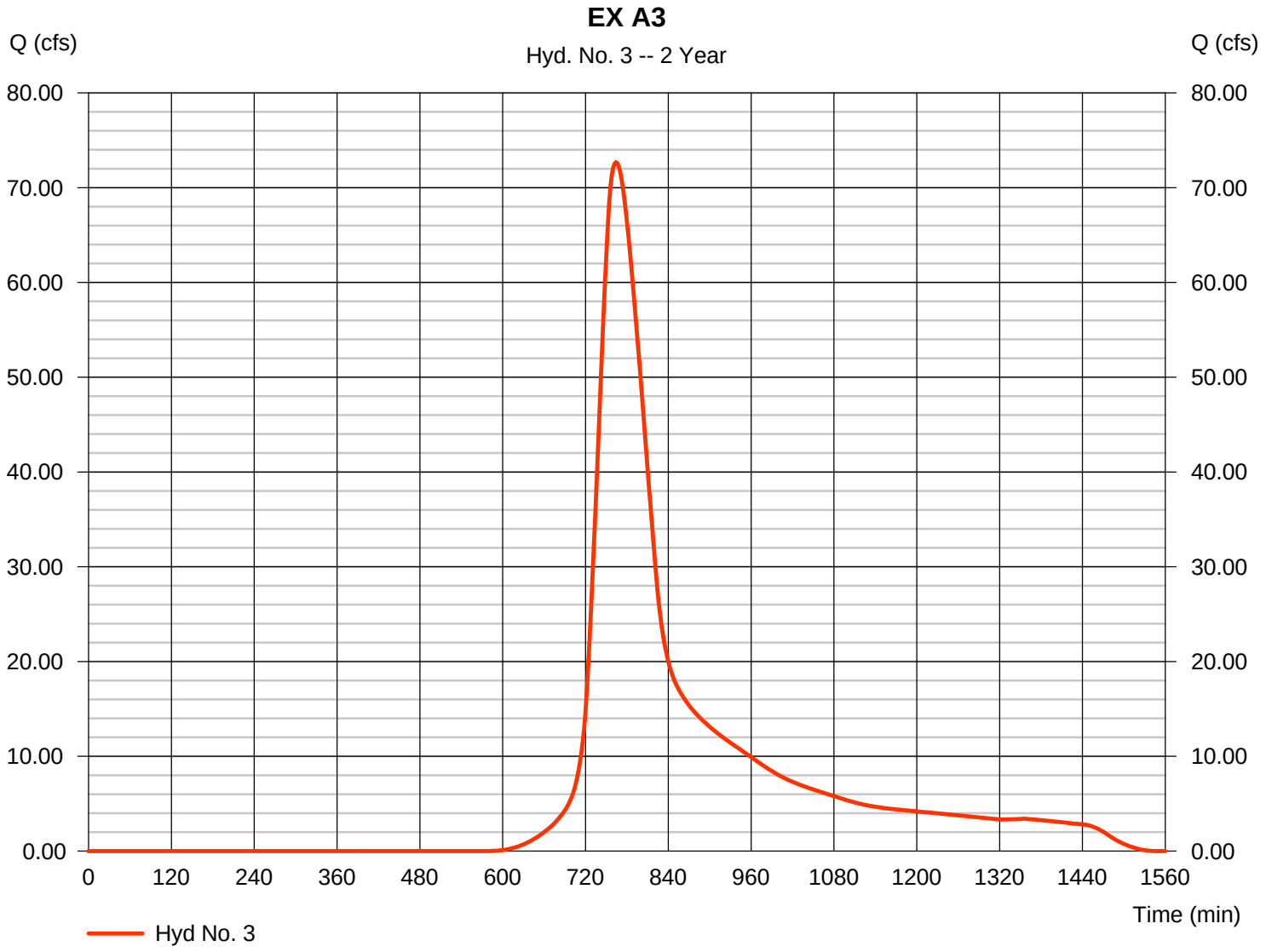


Hydrograph Report

Hyd. No. 3

EX A3

Hydrograph type	=	SCS Runoff	Peak discharge	=	72.66 cfs
Storm frequency	=	2 yrs	Time to peak	=	764 min
Time interval	=	2 min	Hyd. volume	=	608,258 cuft
Drainage area	=	117.840 ac	Curve number	=	78.5
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	59.60 min
Total precip.	=	3.34 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	434

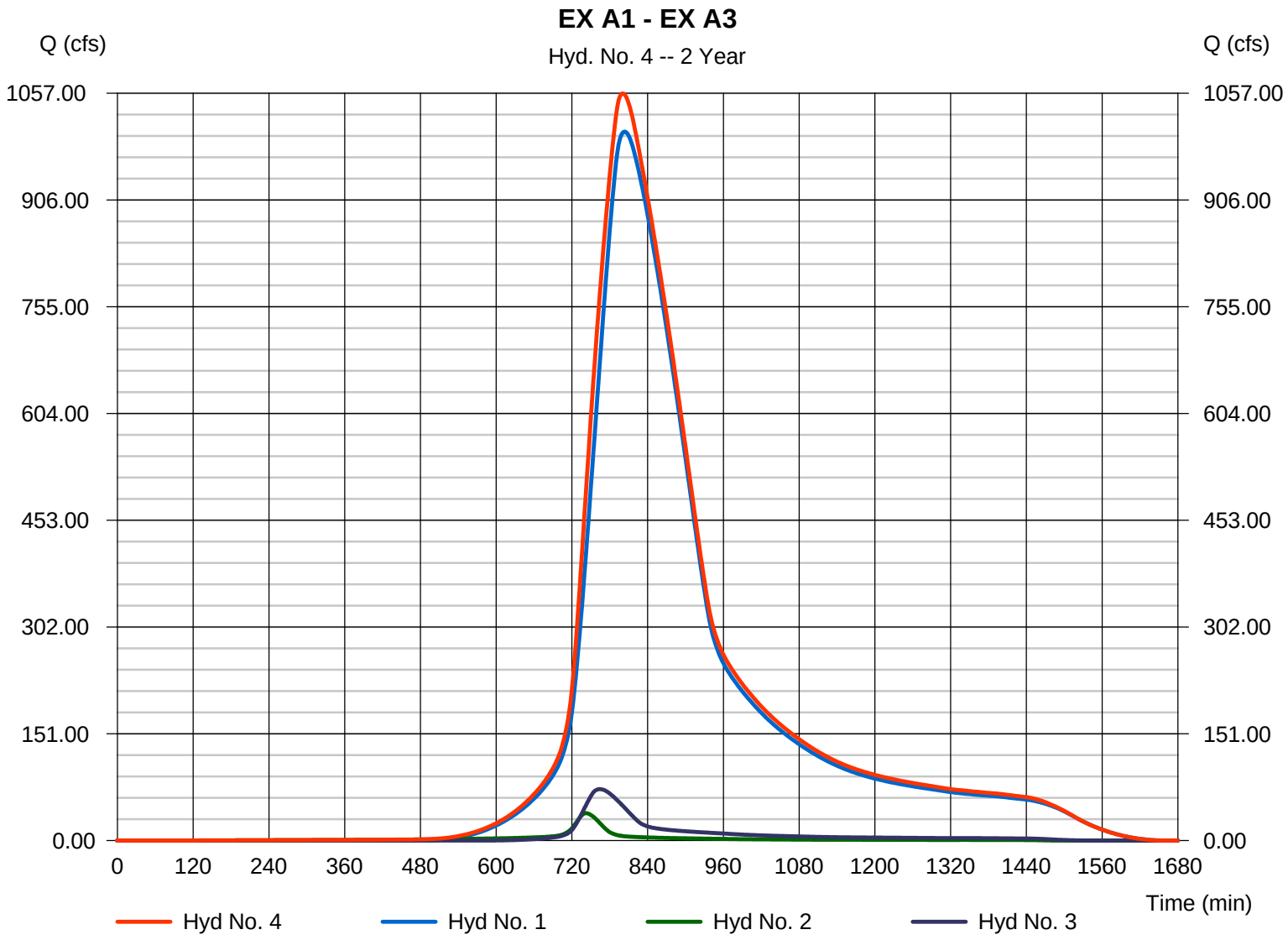


Hydrograph Report

Hyd. No. 4

EX A1 - EX A3

Hydrograph type	=	Combine	Peak discharge	=	1056.58 cfs
Storm frequency	=	2 yrs	Time to peak	=	800 min
Time interval	=	2 min	Hyd. volume	=	14,015,804 cuft
Inflow hyds.	=	1, 2, 3	Contrib. drain. area	=	2046.730 ac

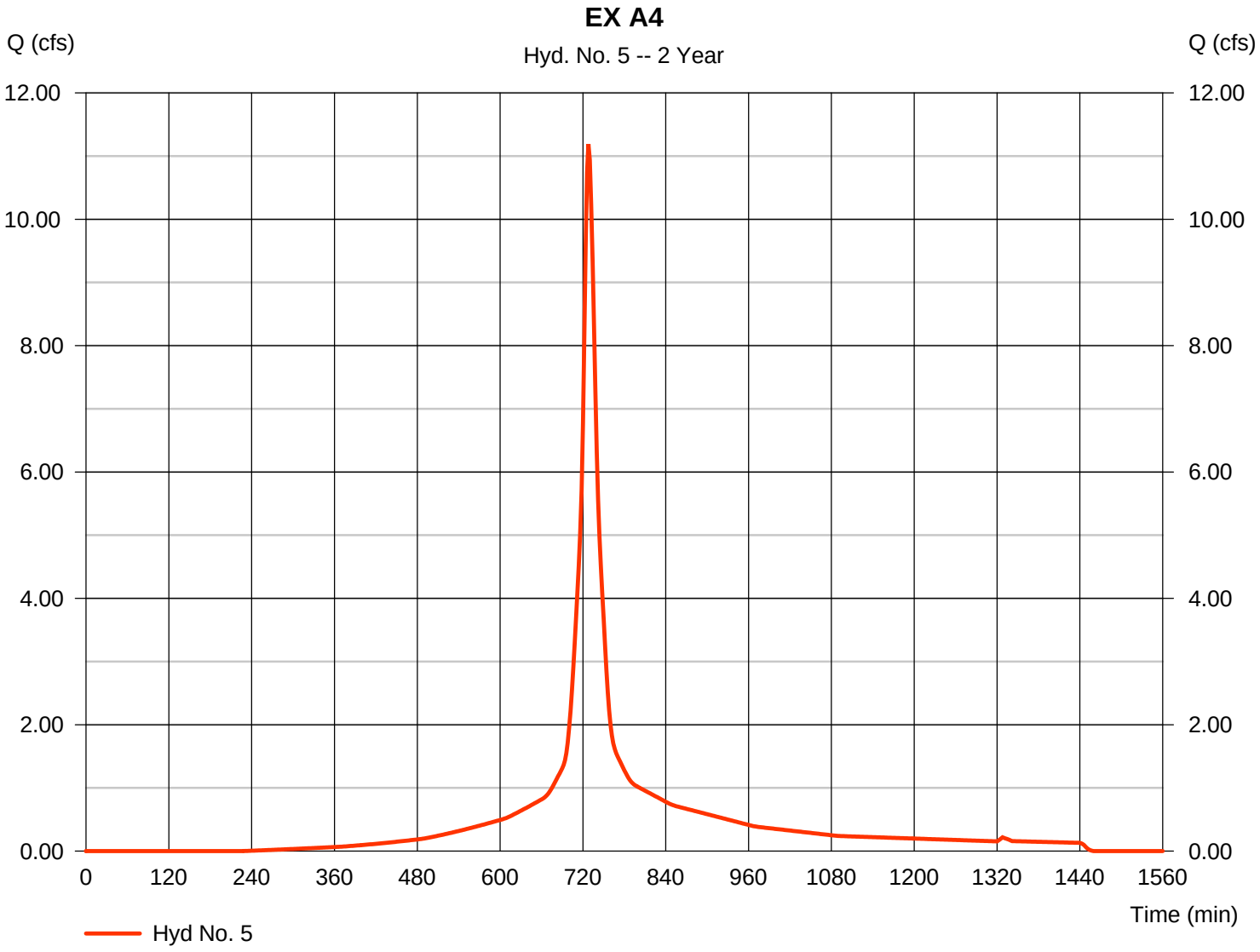


Hydrograph Report

Hyd. No. 5

EX A4

Hydrograph type	=	SCS Runoff	Peak discharge	=	11.19 cfs
Storm frequency	=	2 yrs	Time to peak	=	728 min
Time interval	=	2 min	Hyd. volume	=	44,642 cuft
Drainage area	=	4.450 ac	Curve number	=	94
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	10.00 min
Total precip.	=	3.34 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484

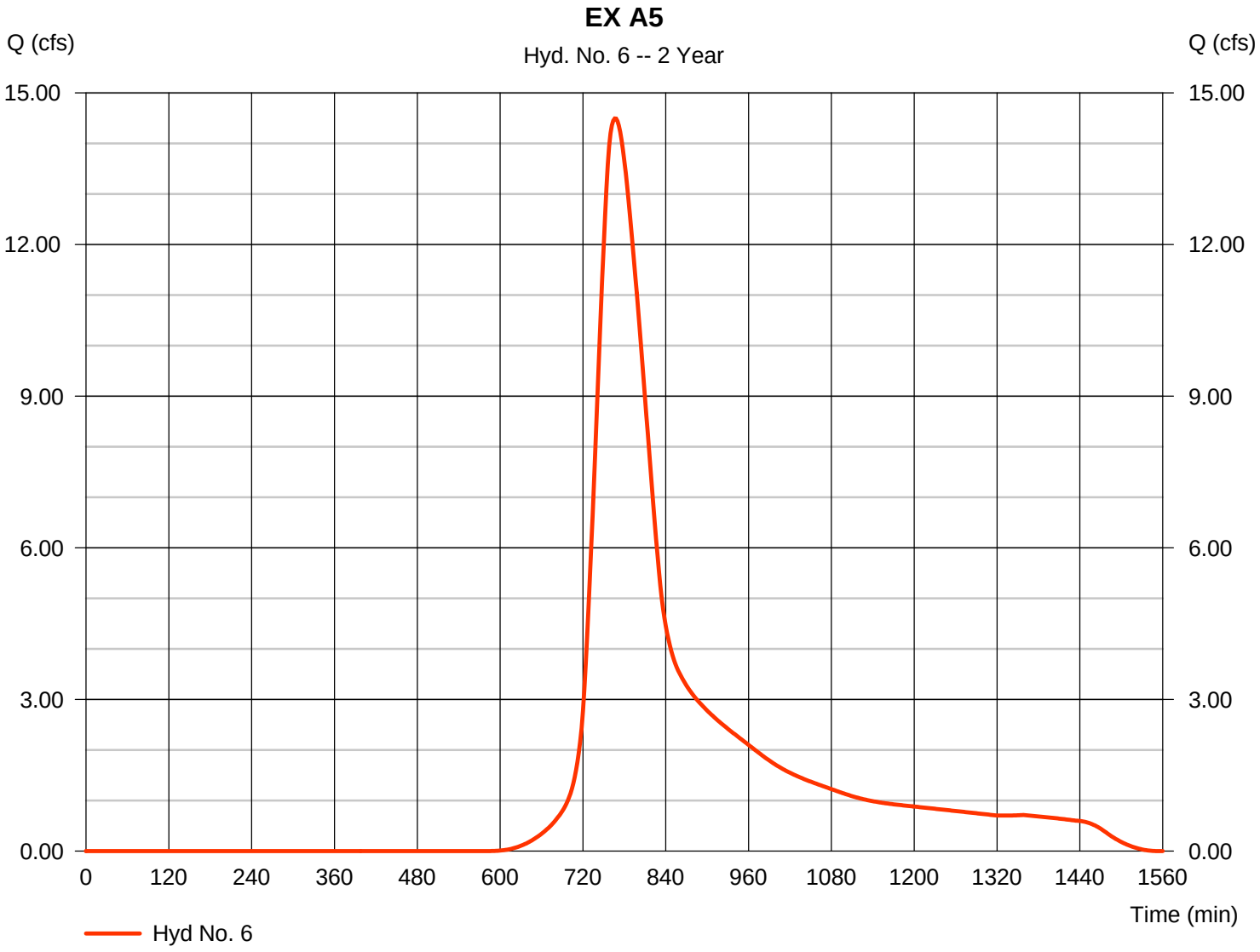


Hydrograph Report

Hyd. No. 6

EX A5

Hydrograph type	=	SCS Runoff	Peak discharge	=	14.49 cfs
Storm frequency	=	2 yrs	Time to peak	=	766 min
Time interval	=	2 min	Hyd. volume	=	125,999 cuft
Drainage area	=	24.990 ac	Curve number	=	78
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	63.10 min
Total precip.	=	3.34 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	434

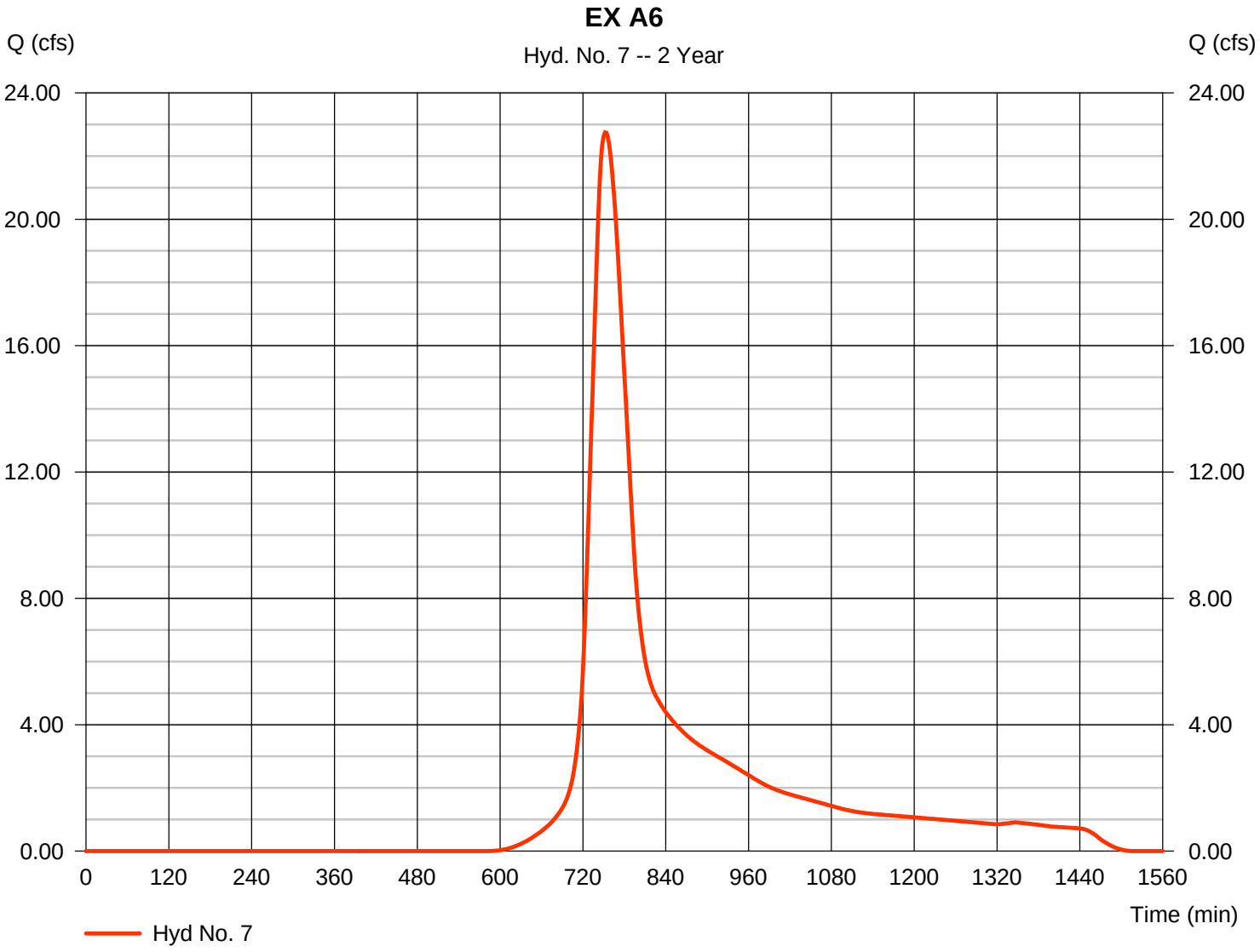


Hydrograph Report

Hyd. No. 7

EX A6

Hydrograph type	=	SCS Runoff	Peak discharge	=	22.75 cfs
Storm frequency	=	2 yrs	Time to peak	=	752 min
Time interval	=	2 min	Hyd. volume	=	156,856 cuft
Drainage area	=	31.110 ac	Curve number	=	78
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	40.80 min
Total precip.	=	3.34 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	434

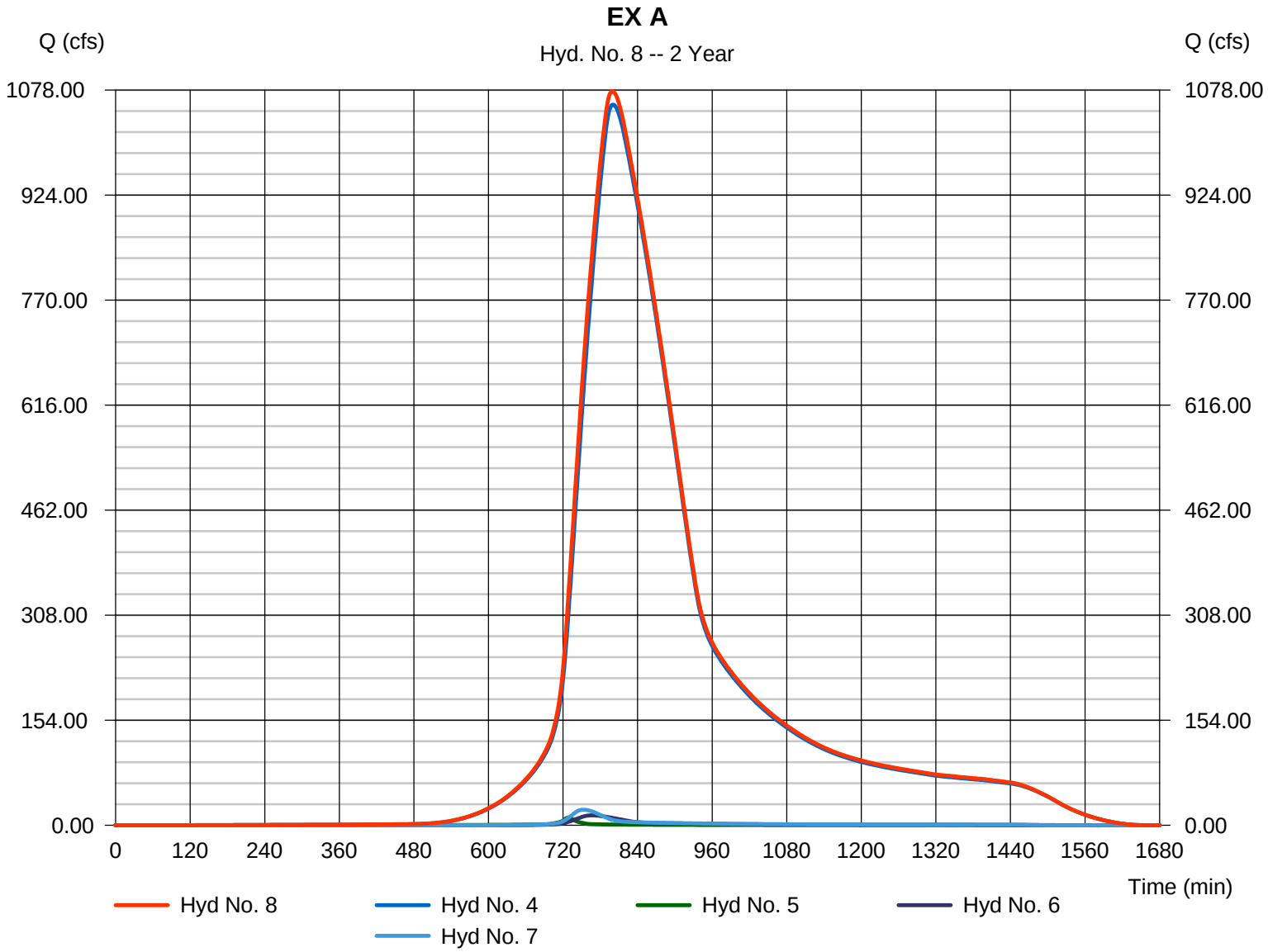


Hydrograph Report

Hyd. No. 8

EX A

Hydrograph type	=	Combine	Peak discharge	=	1076.03 cfs
Storm frequency	=	2 yrs	Time to peak	=	800 min
Time interval	=	2 min	Hyd. volume	=	14,343,294 cuft
Inflow hyds.	=	4, 5, 6, 7	Contrib. drain. area	=	60.550 ac

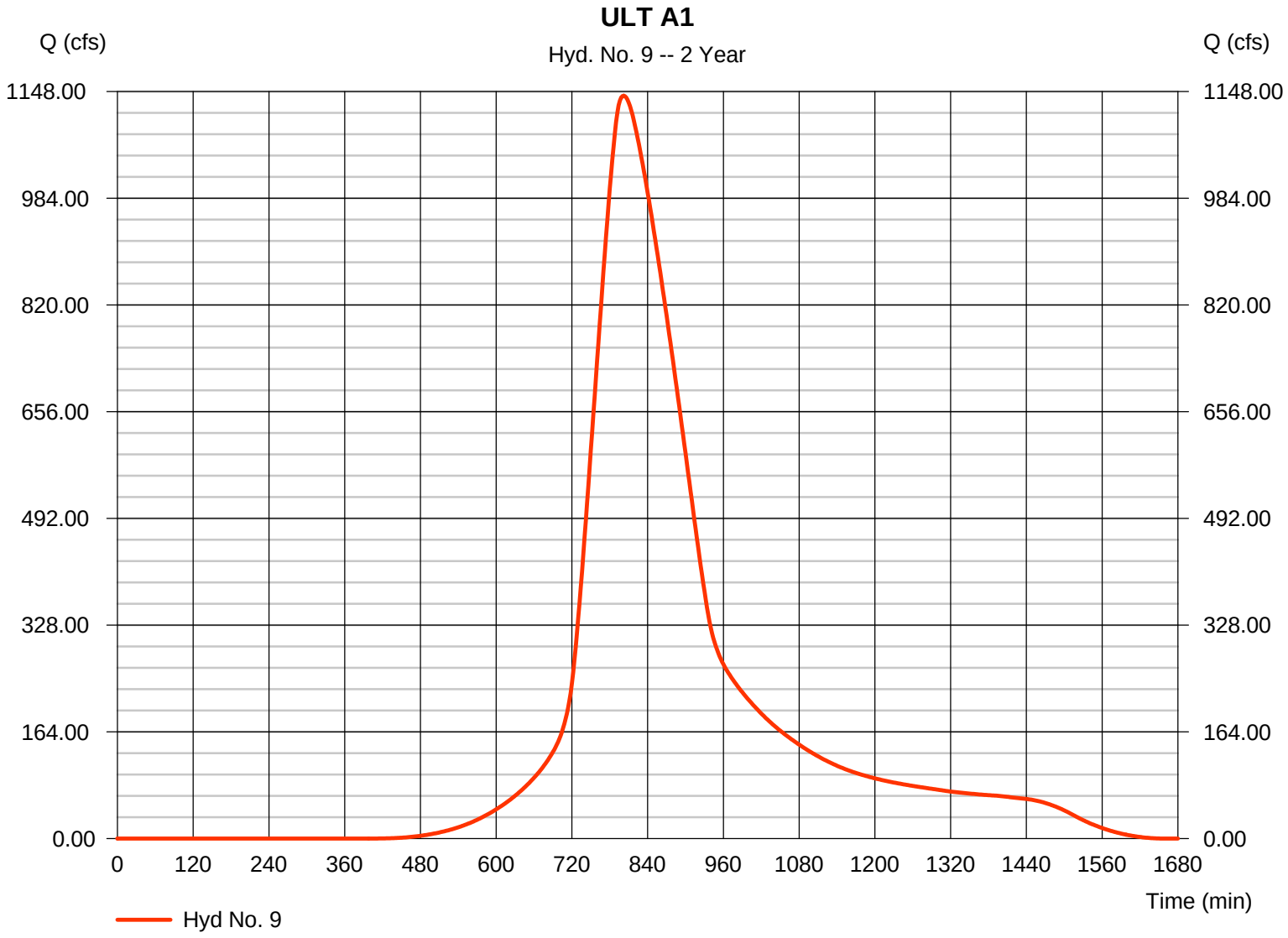


Hydrograph Report

Hyd. No. 9

ULT A1

Hydrograph type	=	SCS Runoff	Peak discharge	=	1141.60 cfs
Storm frequency	=	2 yrs	Time to peak	=	802 min
Time interval	=	2 min	Hyd. volume	=	14,930,622 cuft
Drainage area	=	1906.930 ac	Curve number	=	88.4
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	122.30 min
Total precip.	=	3.34 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	434

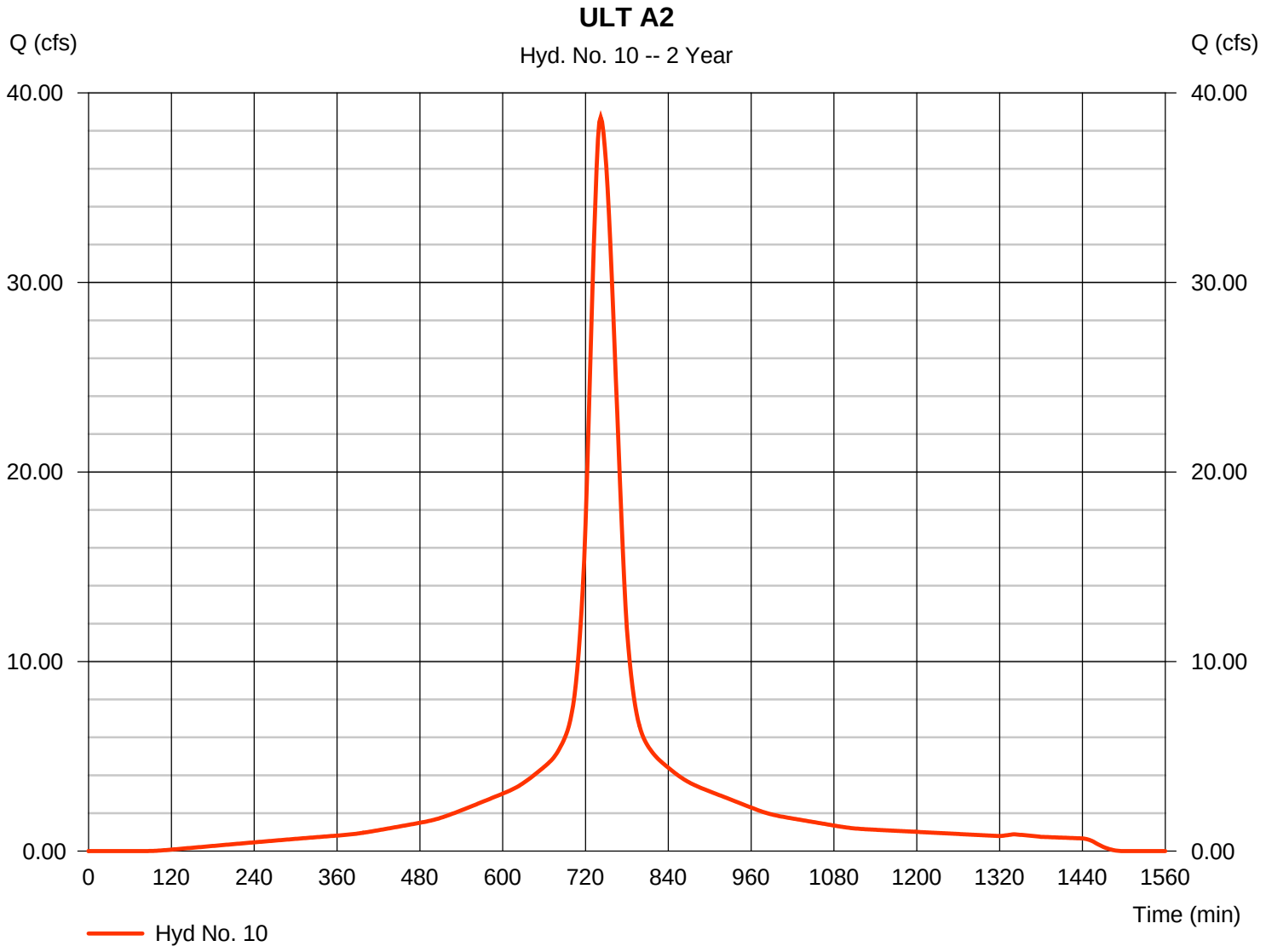


Hydrograph Report

Hyd. No. 10

ULT A2

Hydrograph type	=	SCS Runoff	Peak discharge	=	38.71 cfs
Storm frequency	=	2 yrs	Time to peak	=	742 min
Time interval	=	2 min	Hyd. volume	=	249,848 cuft
Drainage area	=	21.960 ac	Curve number	=	98
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	32.00 min
Total precip.	=	3.34 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	434

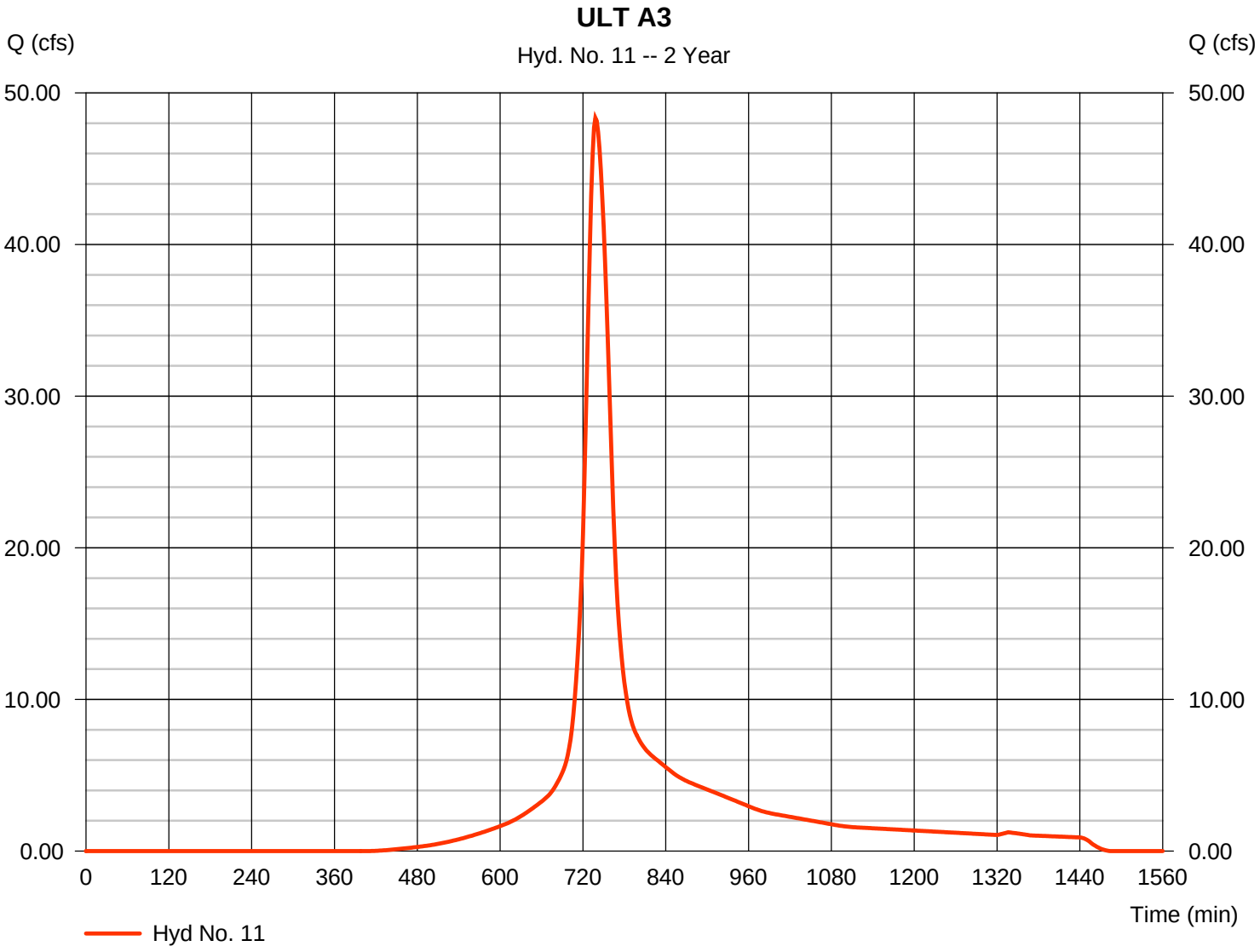


Hydrograph Report

Hyd. No. 11

ULT A3

Hydrograph type	=	SCS Runoff	Peak discharge	=	48.35 cfs
Storm frequency	=	2 yrs	Time to peak	=	738 min
Time interval	=	2 min	Hyd. volume	=	254,914 cuft
Drainage area	=	33.050 ac	Curve number	=	87.8
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	25.60 min
Total precip.	=	3.34 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	434

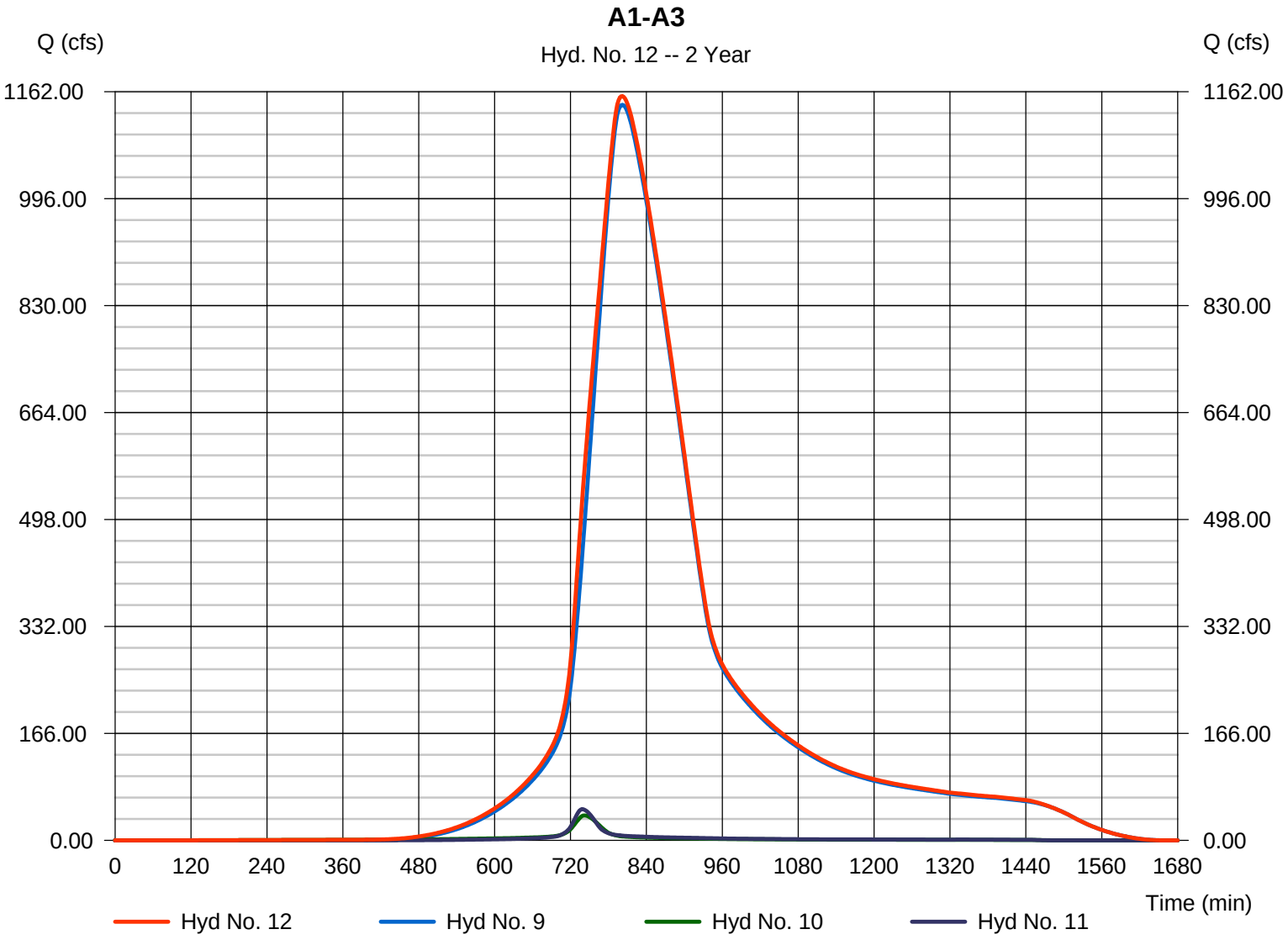


Hydrograph Report

Hyd. No. 12

A1-A3

Hydrograph type	=	Combine	Peak discharge	=	1155.05 cfs
Storm frequency	=	2 yrs	Time to peak	=	802 min
Time interval	=	2 min	Hyd. volume	=	15,435,390 cuft
Inflow hyds.	=	9, 10, 11	Contrib. drain. area	=	1961.940 ac

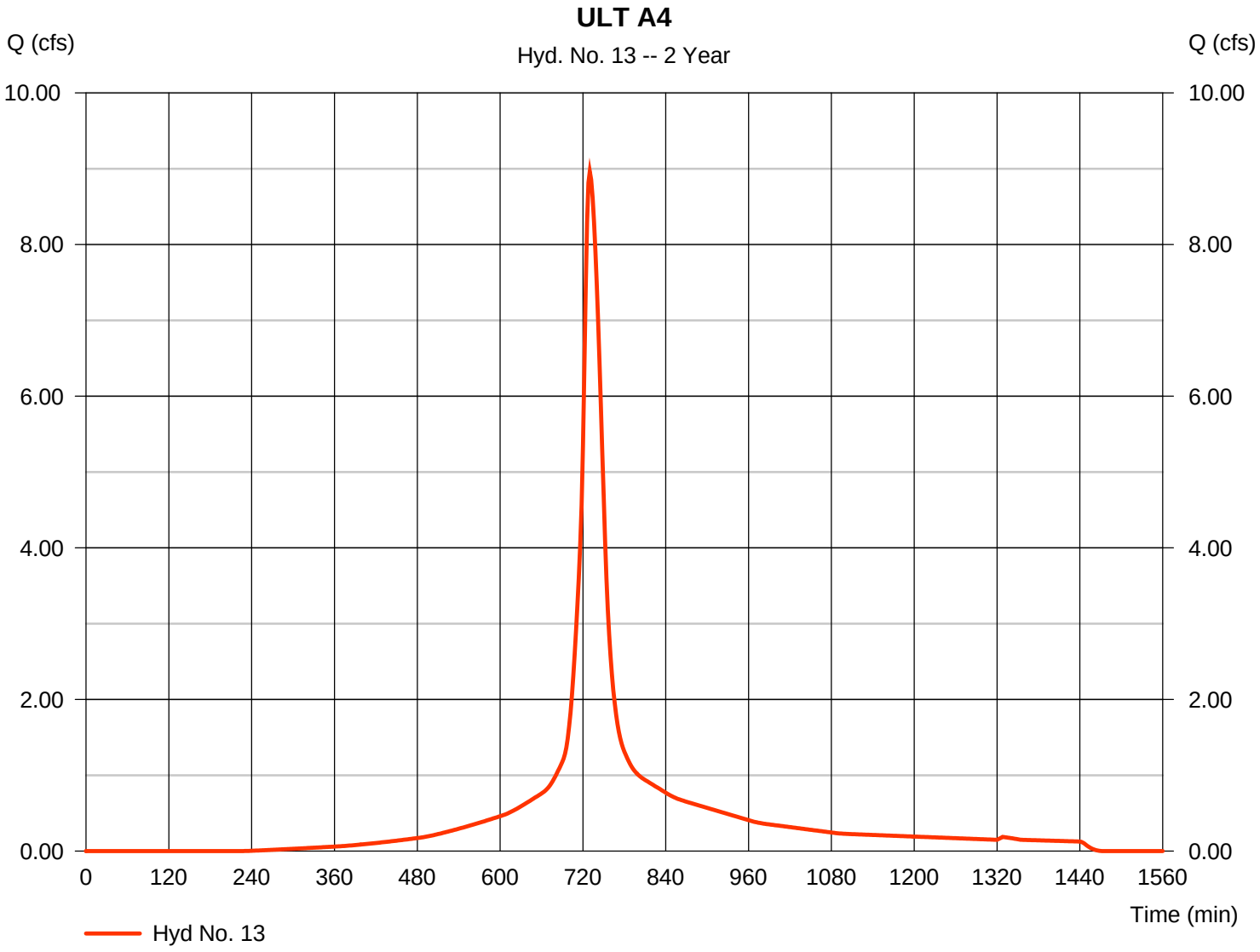


Hydrograph Report

Hyd. No. 13

ULT A4

Hydrograph type	=	SCS Runoff	Peak discharge	=	8.962 cfs
Storm frequency	=	2 yrs	Time to peak	=	730 min
Time interval	=	2 min	Hyd. volume	=	42,763 cuft
Drainage area	=	4.450 ac	Curve number	=	94
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	10.00 min
Total precip.	=	3.34 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	300

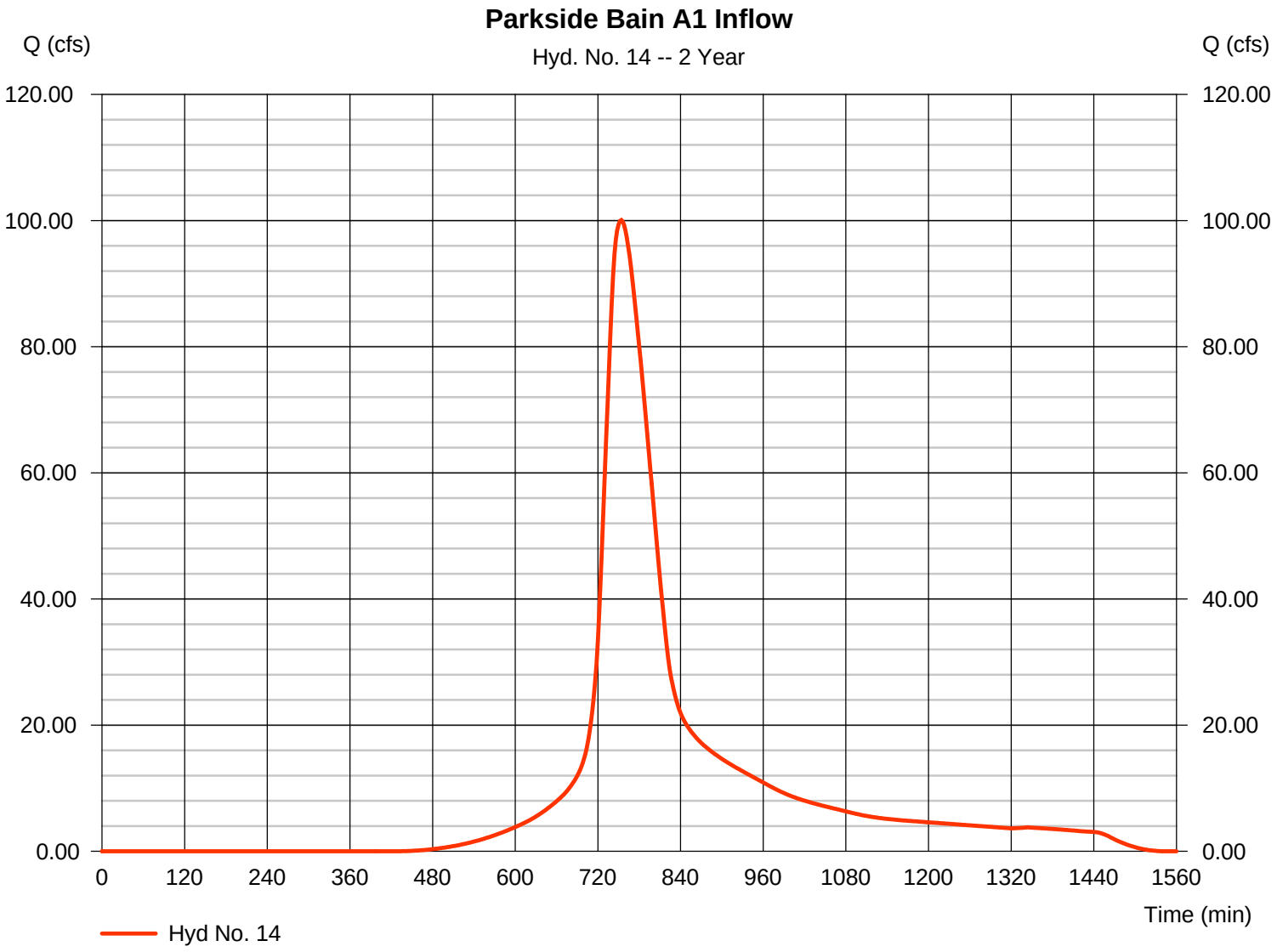


Hydrograph Report

Hyd. No. 14

Parkside Bain A1 Inflow

Hydrograph type	=	SCS Runoff	Peak discharge	=	100.07 cfs
Storm frequency	=	2 yrs	Time to peak	=	754 min
Time interval	=	2 min	Hyd. volume	=	814,623 cuft
Drainage area	=	109.260 ac	Curve number	=	87
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	37.90 min
Total precip.	=	3.34 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	300



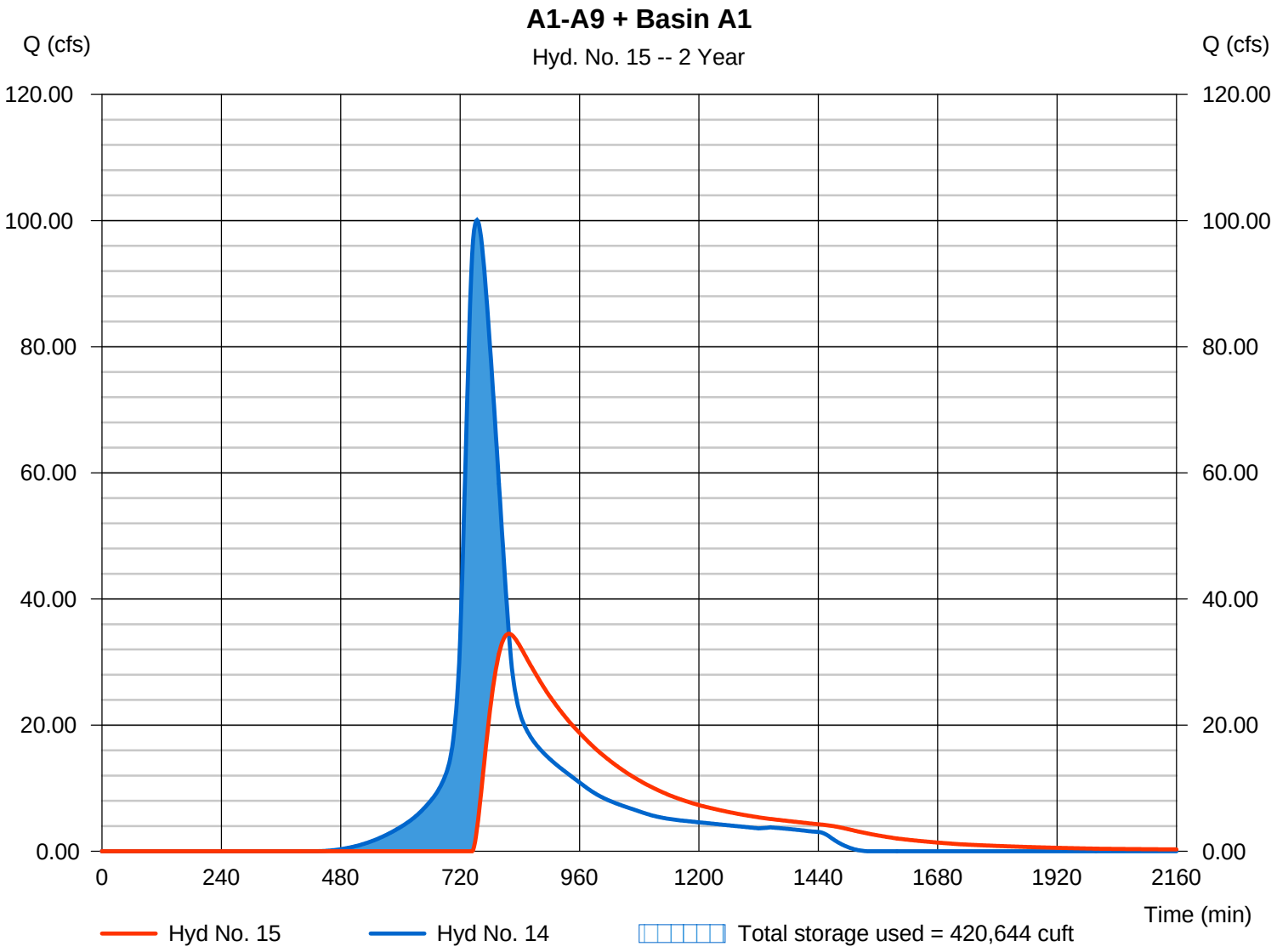
Hydrograph Report

Hyd. No. 15

A1-A9 + Basin A1

Hydrograph type	=	Reservoir	Peak discharge	=	34.49 cfs
Storm frequency	=	2 yrs	Time to peak	=	818 min
Time interval	=	2 min	Hyd. volume	=	630,308 cuft
Inflow hyd. No.	=	14 - Parkside Bain A1 Inflow	Max. Elevation	=	603.49 ft
Reservoir name	=	BASIN A1	Max. Storage	=	420,644 cuft

Storage Indication method used.



Pond Report

Pond No. 1 - BASIN A1

Pond Data

Contours -User-defined contour areas. Average end area method used for volume calculation. Begining Elevation = 601.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	601.00	62,767	0	0
1.00	602.00	126,224	94,496	94,496
1.50	602.50	232,937	89,790	184,286
2.00	603.00	237,423	117,590	301,876
3.00	604.00	246,471	241,947	543,823
4.00	605.00	279,202	262,837	806,659
5.00	606.00	289,970	284,586	1,091,245
6.00	607.00	298,355	294,163	1,385,408
7.00	608.00	301,306	299,830	1,685,238

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	Inactive	Inactive	Inactive	Inactive
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

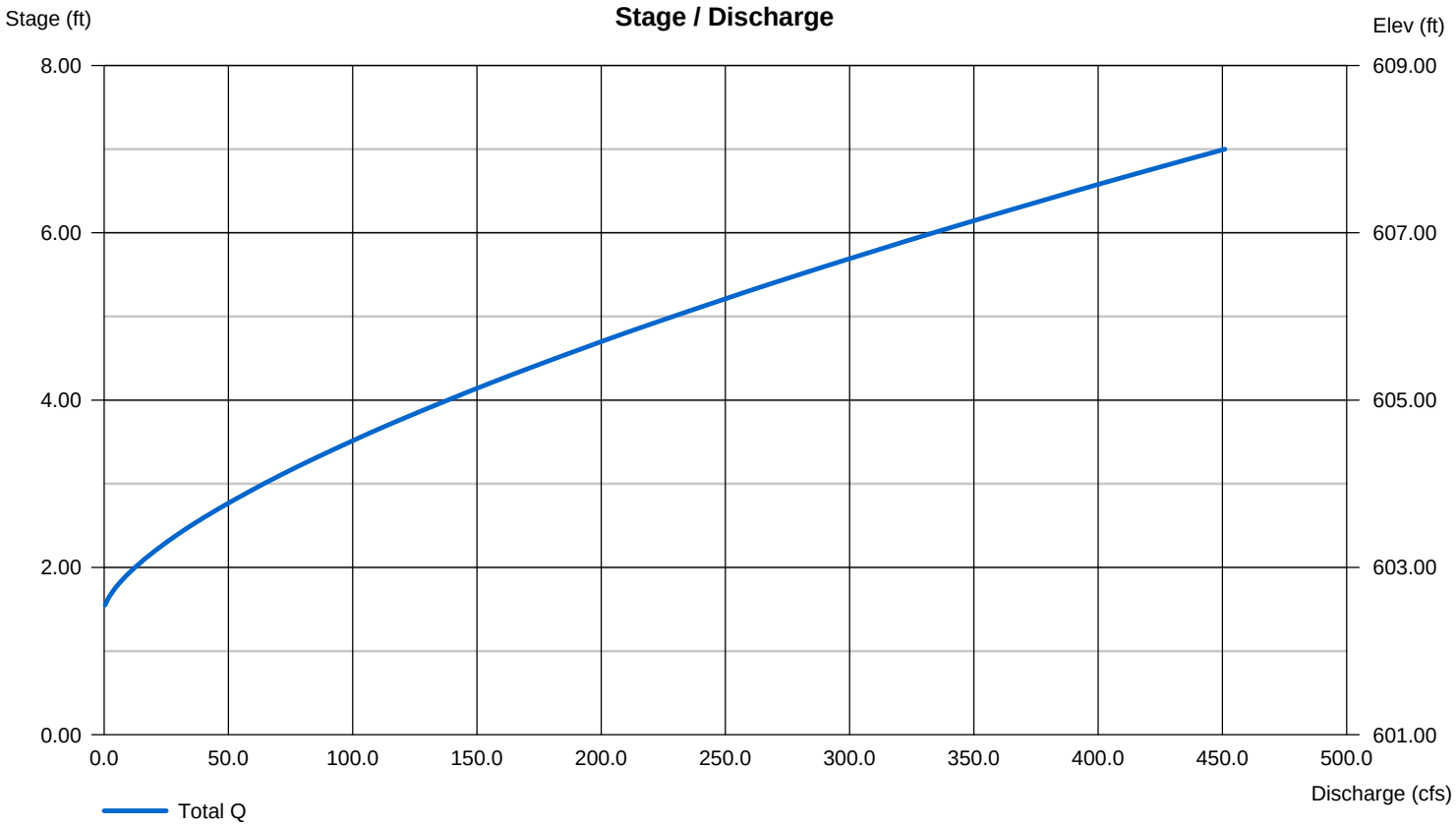
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 10.50	Inactive	Inactive	Inactive
Crest El. (ft)	= 602.50	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= Rect	---	---	---
Multi-Stage	= No	No	No	No

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

TW Elev. (ft) = 0.00

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

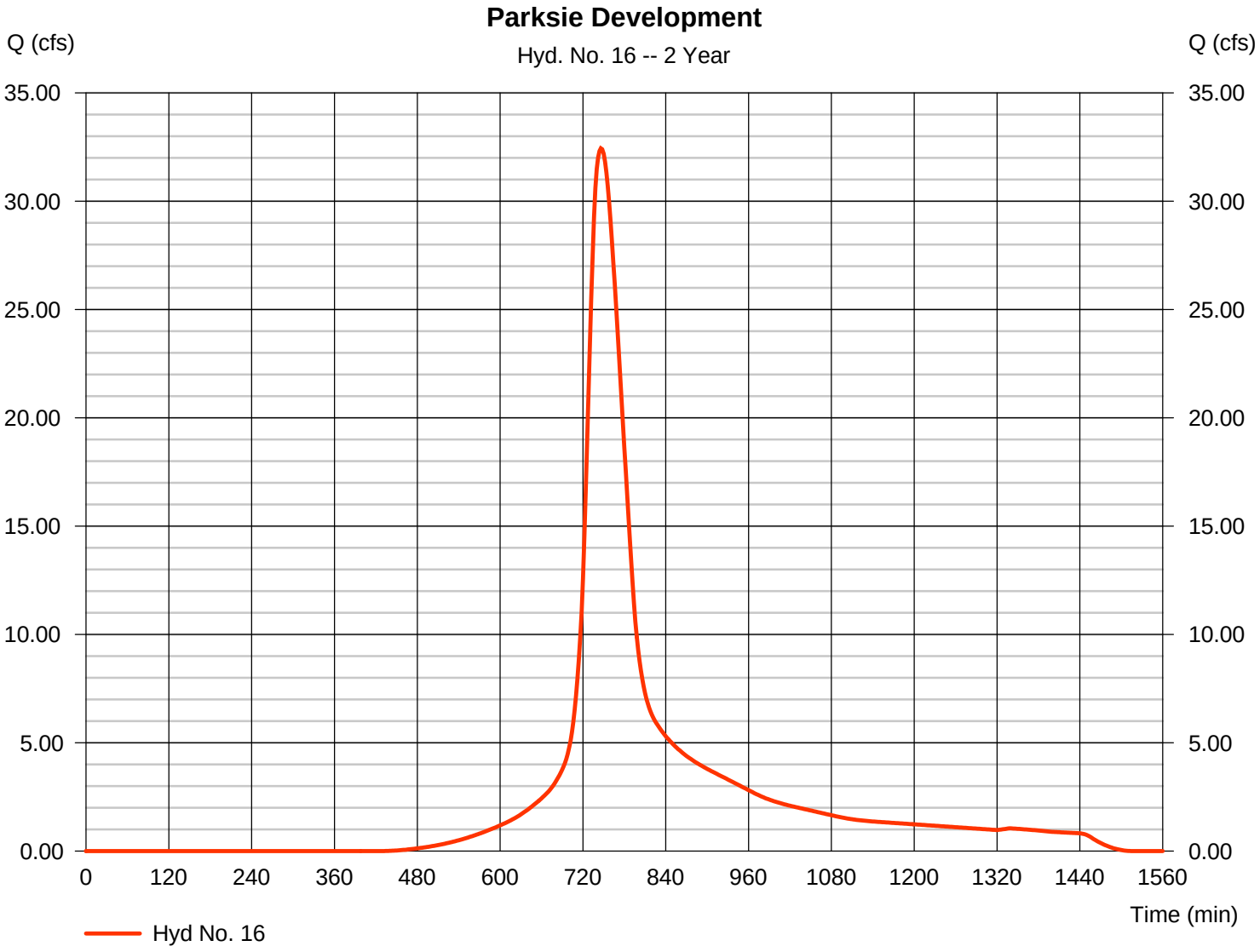


Hydrograph Report

Hyd. No. 16

Parksie Development

Hydrograph type	=	SCS Runoff	Peak discharge	=	32.44 cfs
Storm frequency	=	2 yrs	Time to peak	=	746 min
Time interval	=	2 min	Hyd. volume	=	223,227 cuft
Drainage area	=	29.940 ac	Curve number	=	87
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	28.50 min
Total precip.	=	3.34 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	300

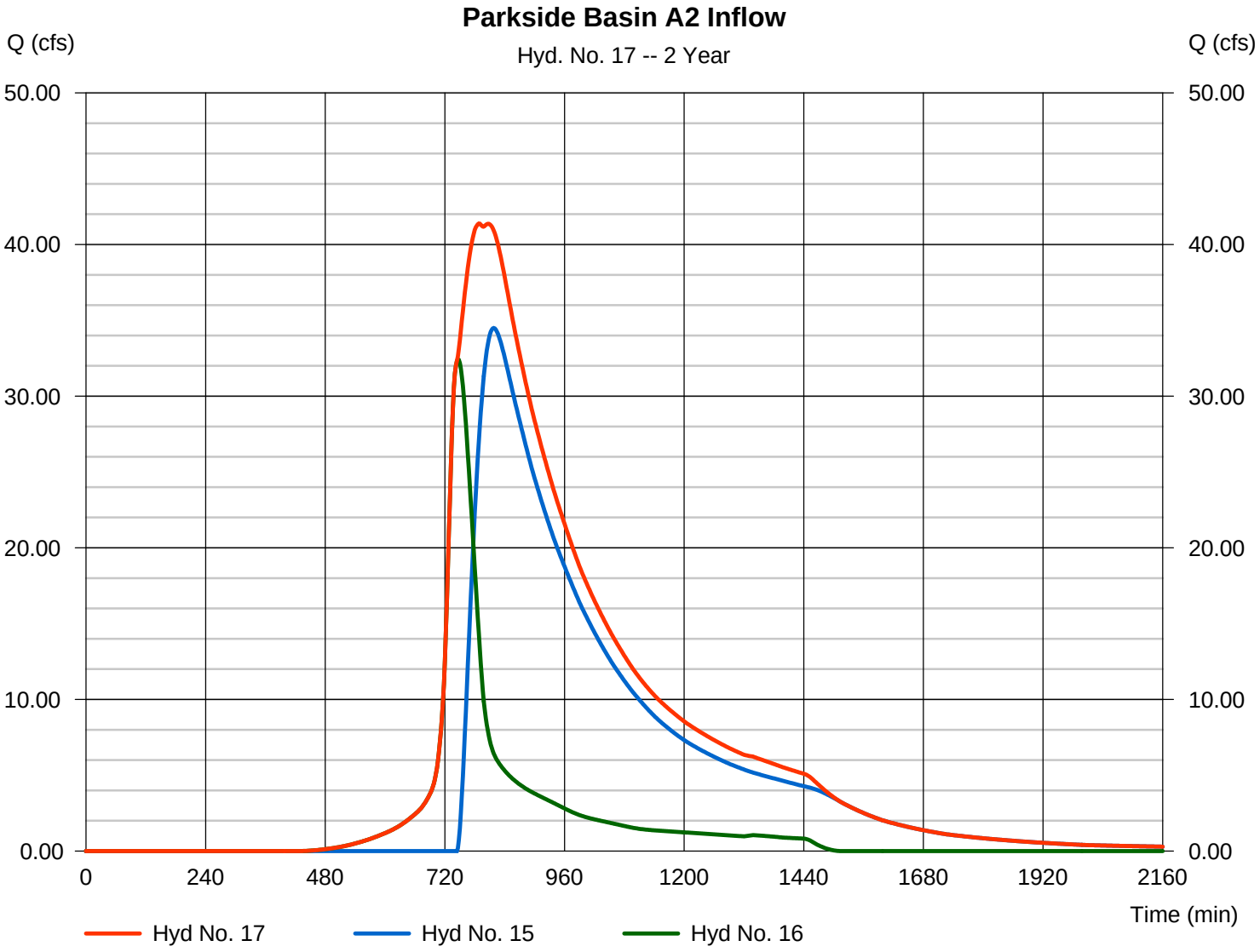


Hydrograph Report

Hyd. No. 17

Parkside Basin A2 Inflow

Hydrograph type	=	Combine	Peak discharge	=	41.38 cfs
Storm frequency	=	2 yrs	Time to peak	=	788 min
Time interval	=	2 min	Hyd. volume	=	853,535 cuft
Inflow hyds.	=	15, 16	Contrib. drain. area	=	29.940 ac



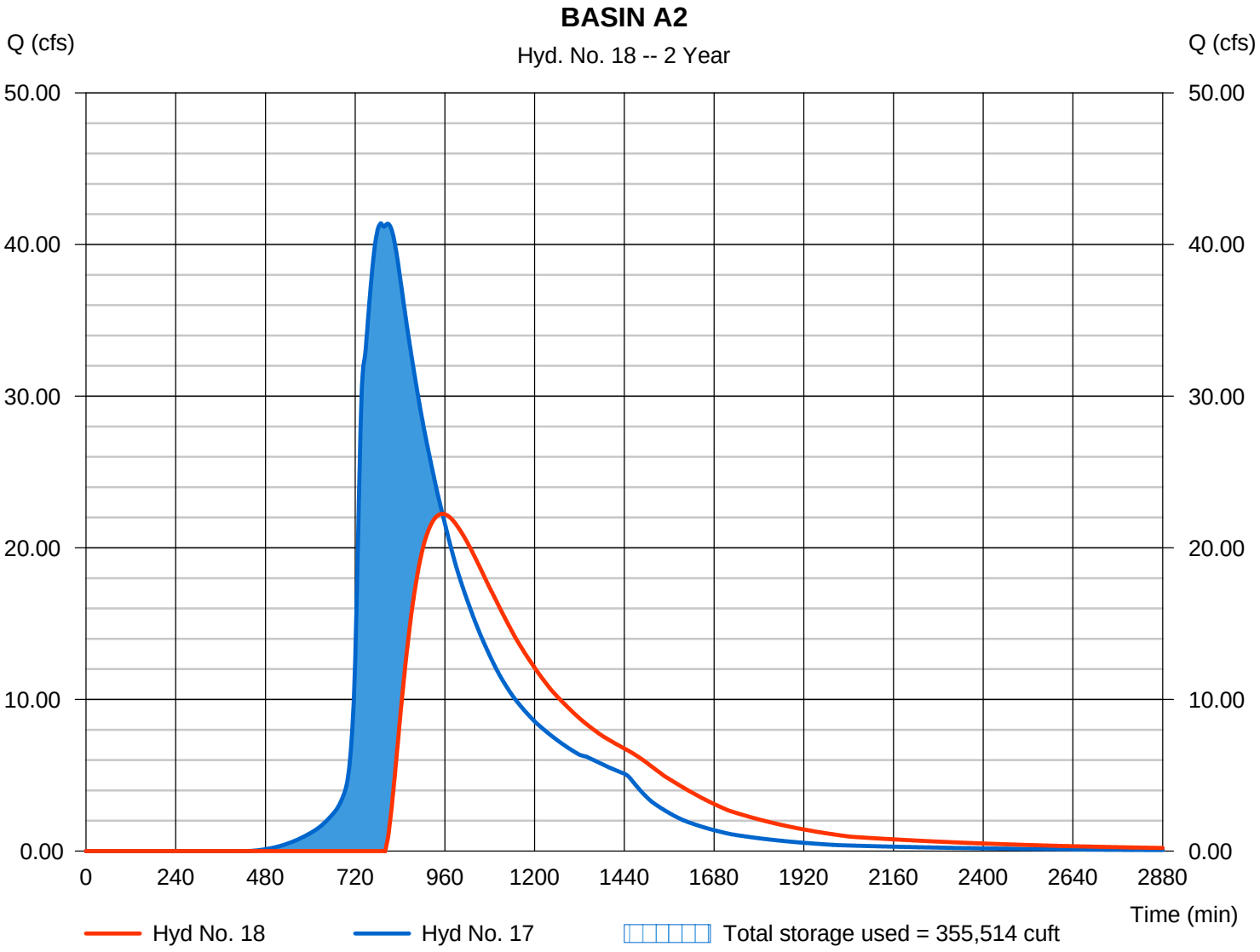
Hydrograph Report

Hyd. No. 18

BASIN A2

Hydrograph type	=	Reservoir	Peak discharge	=	22.24 cfs
Storm frequency	=	2 yrs	Time to peak	=	954 min
Time interval	=	2 min	Hyd. volume	=	660,659 cuft
Inflow hyd. No.	=	17 - Parkside Basin A2 Inflow	Max. Elevation	=	600.82 ft
Reservoir name	=	BASIN A2	Max. Storage	=	355,514 cuft

Storage Indication method used.



Pond Report

Pond No. 2 - BASIN A2

Pond Data

Contours -User-defined contour areas. Average end area method used for volume calculation. Begining Elevation = 599.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	599.00	190,080	0	0
1.00	600.00	195,630	192,855	192,855
2.00	601.00	201,440	198,535	391,390
3.00	602.00	207,077	204,259	595,649
4.00	603.00	212,770	209,924	805,572
5.00	604.00	218,520	215,645	1,021,217
6.00	605.00	224,327	221,424	1,242,641
7.00	606.00	230,190	227,258	1,469,899

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	Inactive	Inactive	Inactive	Inactive
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

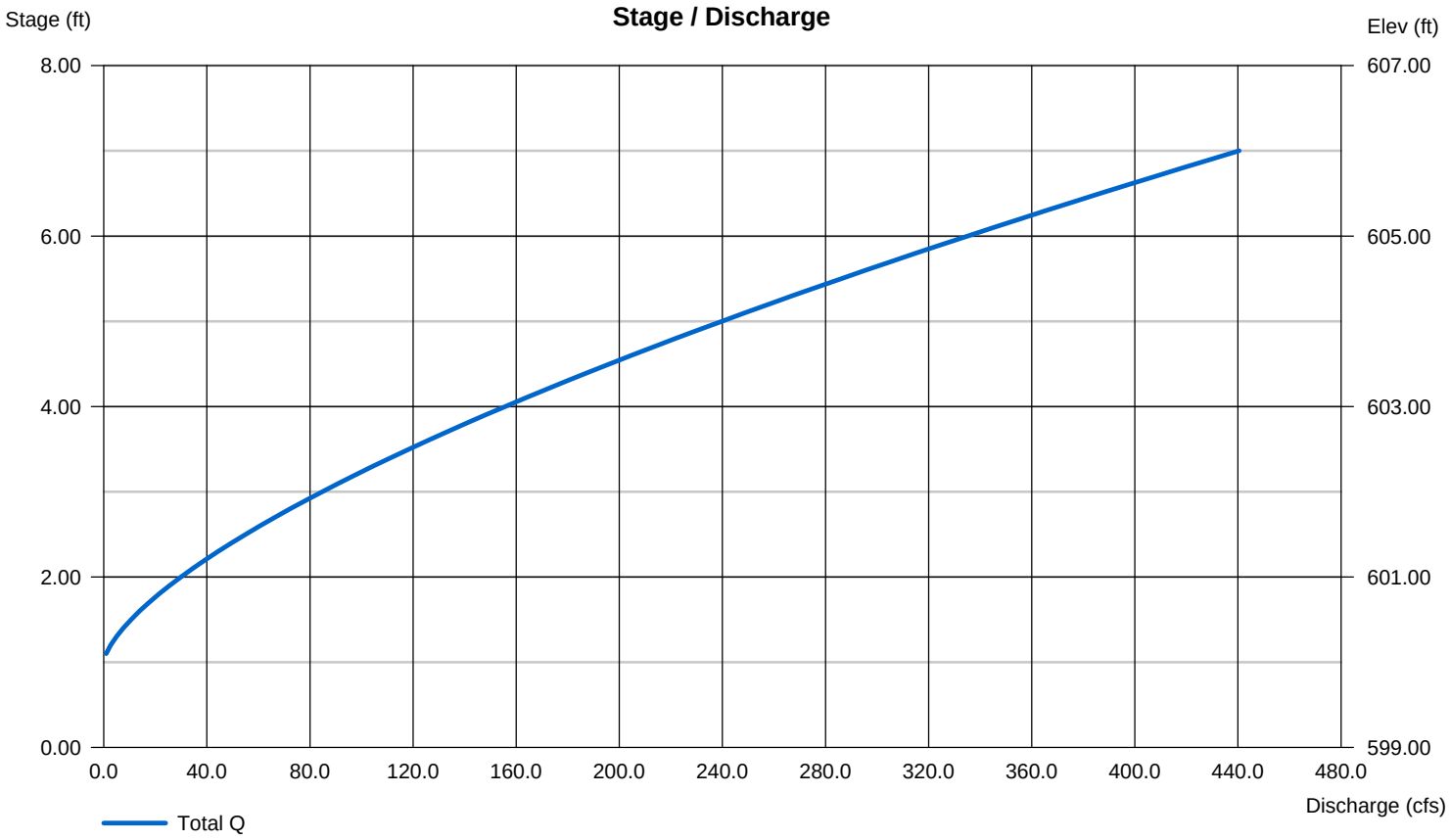
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 9.00	Inactive	Inactive	Inactive
Crest El. (ft)	= 600.00	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= Rect	---	---	---
Multi-Stage	= No	No	No	No

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

TW Elev. (ft) = 0.00

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

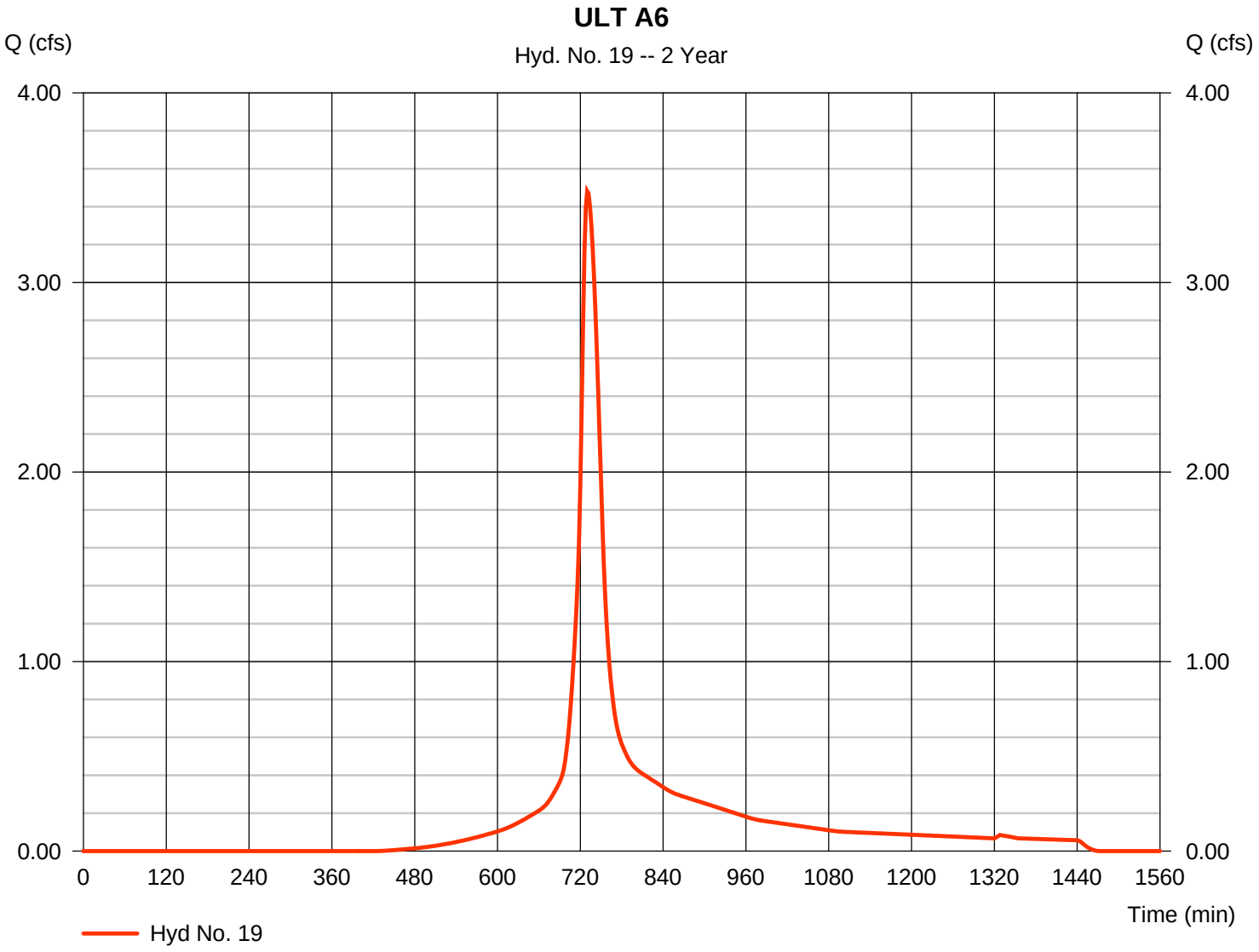


Hydrograph Report

Hyd. No. 19

ULT A6

Hydrograph type	=	SCS Runoff	Peak discharge	=	3.482 cfs
Storm frequency	=	2 yrs	Time to peak	=	730 min
Time interval	=	2 min	Hyd. volume	=	16,087 cuft
Drainage area	=	2.200 ac	Curve number	=	87
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	10.00 min
Total precip.	=	3.34 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	300

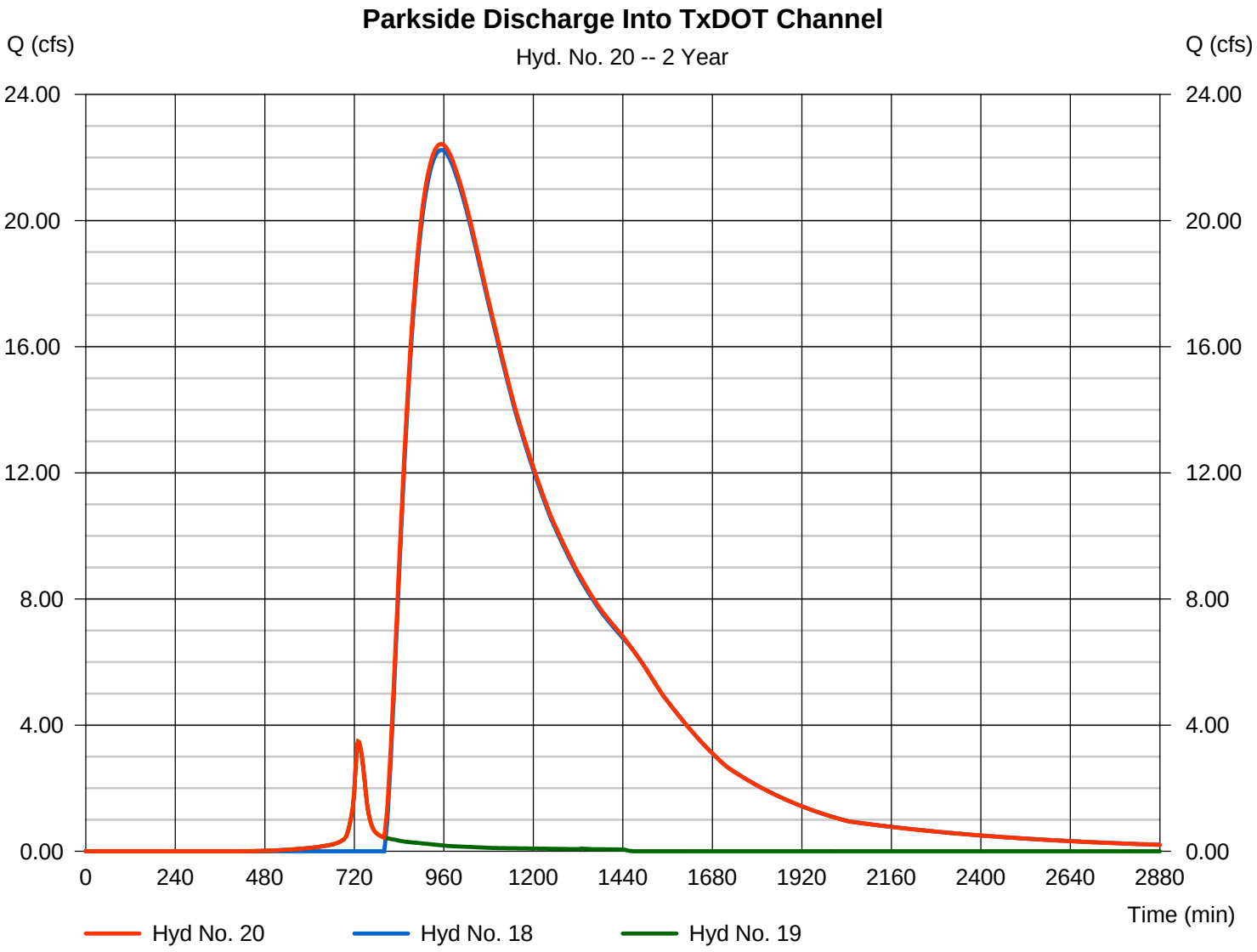


Hydrograph Report

Hyd. No. 20

Parkside Discharge Into TxDOT Channel

Hydrograph type	= Combine	Peak discharge	= 22.43 cfs
Storm frequency	= 2 yrs	Time to peak	= 952 min
Time interval	= 2 min	Hyd. volume	= 676,746 cuft
Inflow hyds.	= 18, 19	Contrib. drain. area	= 2.200 ac

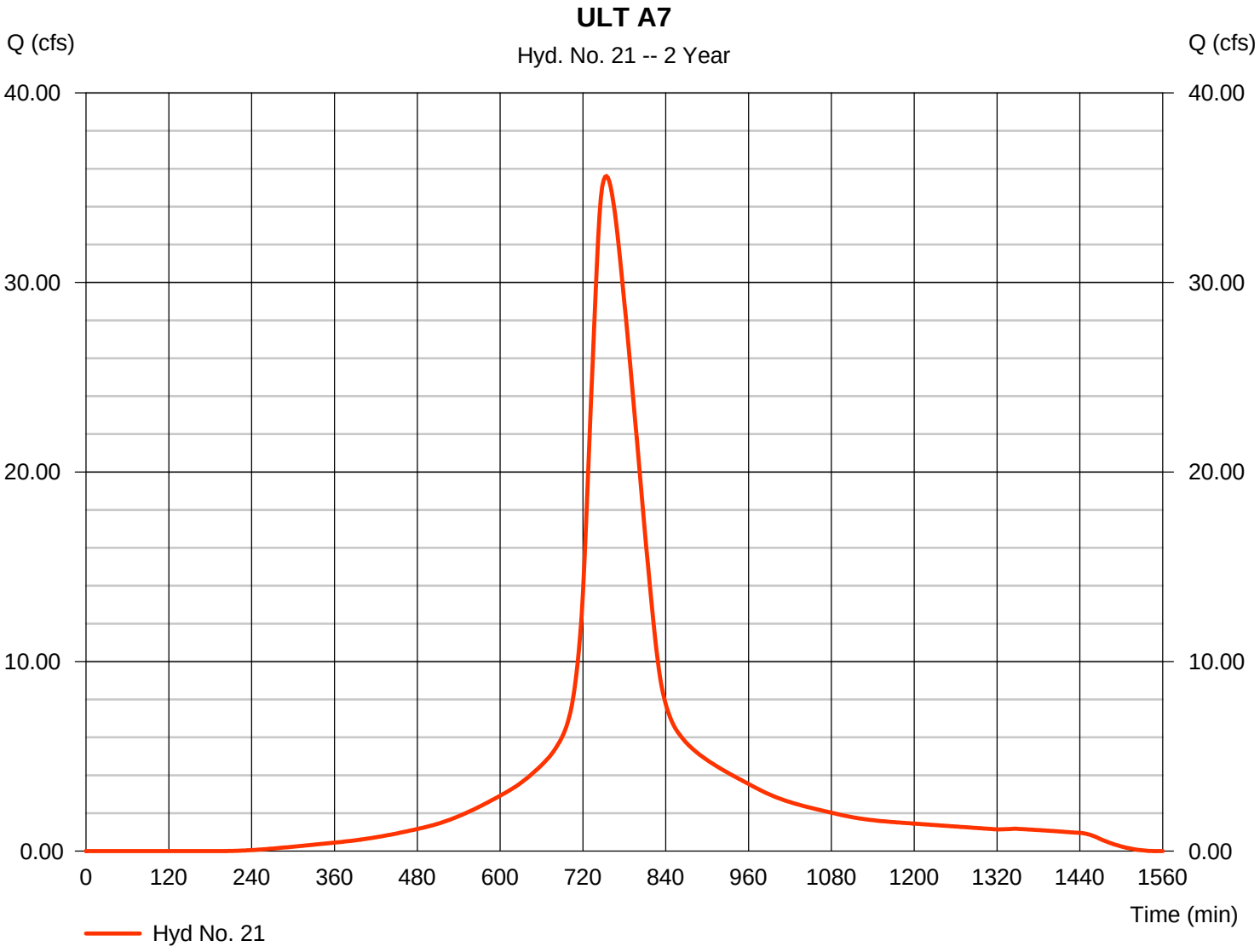


Hydrograph Report

Hyd. No. 21

ULT A7

Hydrograph type	=	SCS Runoff	Peak discharge	=	35.61 cfs
Storm frequency	=	2 yrs	Time to peak	=	754 min
Time interval	=	2 min	Hyd. volume	=	314,577 cuft
Drainage area	=	31.110 ac	Curve number	=	95
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	40.80 min
Total precip.	=	3.34 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	300

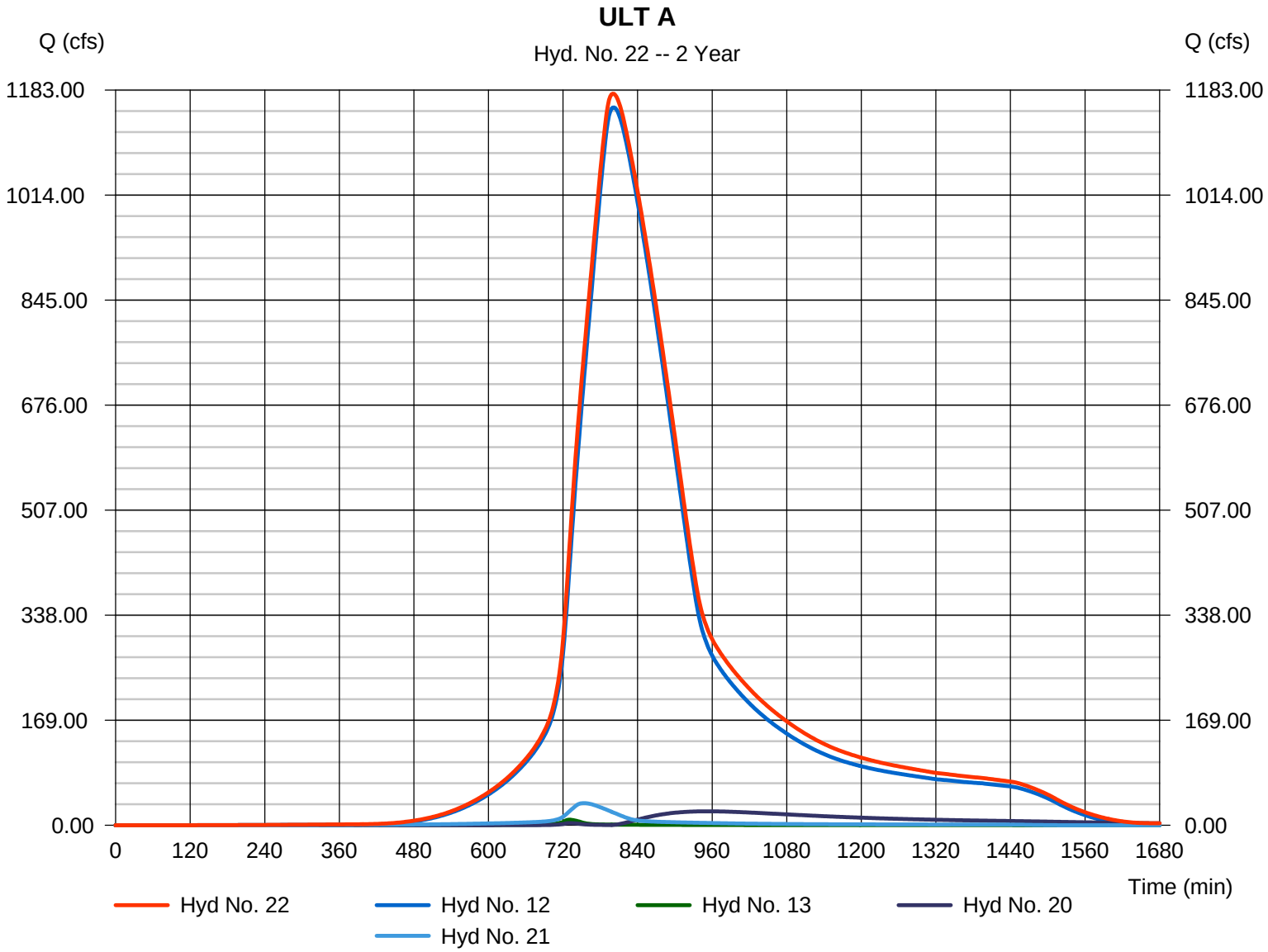


Hydrograph Report

Hyd. No. 22

ULT A

Hydrograph type	=	Combine	Peak discharge	=	1177.05 cfs
Storm frequency	=	2 yrs	Time to peak	=	800 min
Time interval	=	2 min	Hyd. volume	=	16,469,443 cuft
Inflow hyds.	=	12, 13, 20, 21	Contrib. drain. area	=	35.560 ac



Hydrograph Summary Report

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

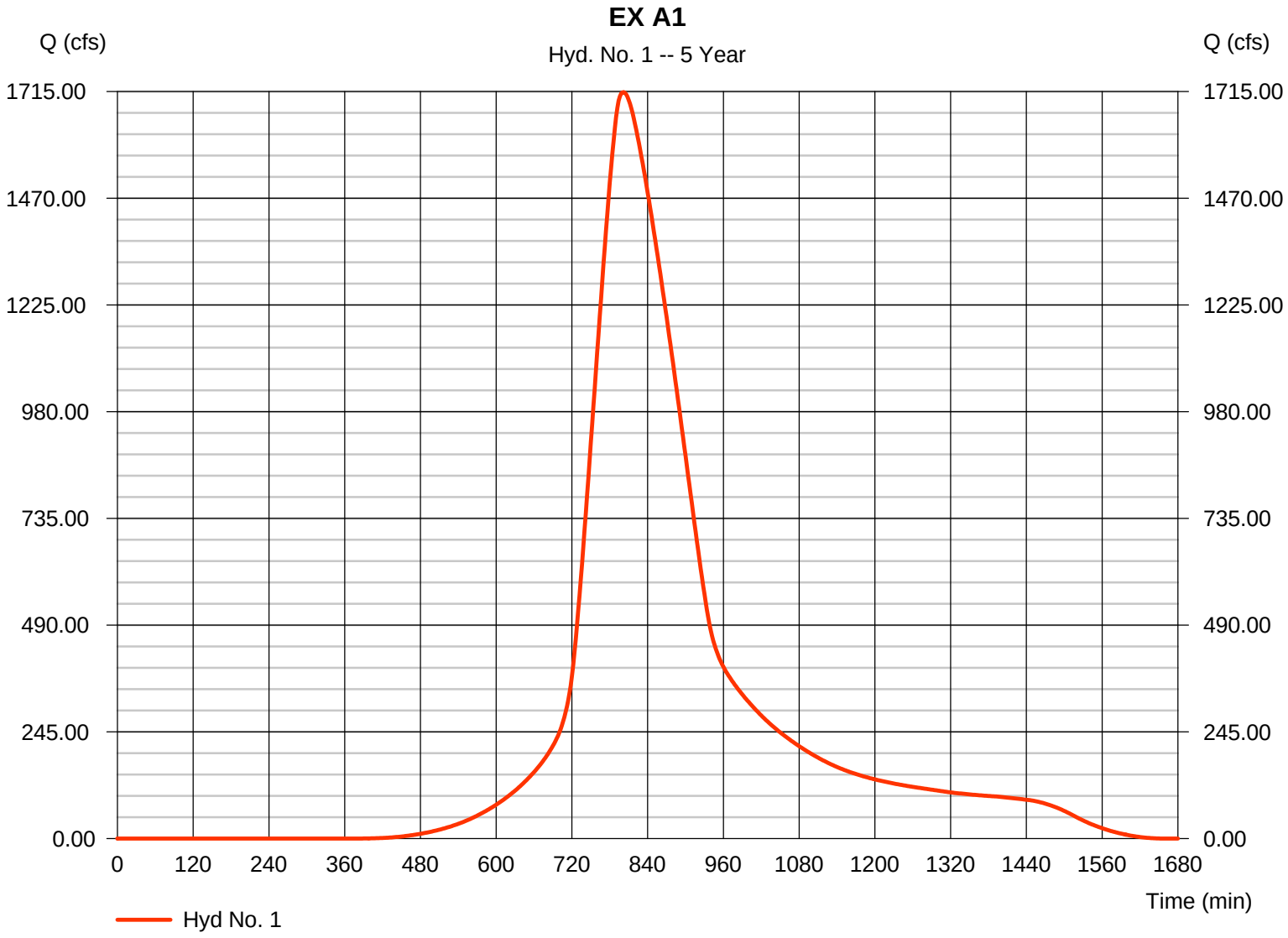
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	1713.53	2	802	22,423,314	------	------	------	EX A1
2	SCS Runoff	56.38	2	742	369,381	------	------	------	EX A2
3	SCS Runoff	137.54	2	762	1,127,021	------	------	------	EX A3
4	Combine	1812.75	2	798	23,919,710	1, 2, 3	------	------	EX A1 - EX A3
5	SCS Runoff	16.88	2	728	68,971	------	------	------	EX A4
6	SCS Runoff	27.69	2	764	234,998	------	------	------	EX A5
7	SCS Runoff	43.33	2	752	292,549	------	------	------	EX A6
8	Combine	1848.80	2	798	24,516,236	4, 5, 6, 7	------	------	EX A
9	SCS Runoff	1866.75	2	800	24,553,634	------	------	------	ULT A1
10	SCS Runoff	56.38	2	742	369,381	------	------	------	ULT A2
11	SCS Runoff	79.12	2	738	422,078	------	------	------	ULT A3
12	Combine	1887.55	2	800	25,345,078	9, 10, 11	------	------	A1-A3
13	SCS Runoff	13.54	2	730	66,069	------	------	------	ULT A4
14	SCS Runoff	166.09	2	752	1,361,220	------	------	------	Parkside Bain A1 Inflow
15	Reservoir	81.81	2	804	1,176,901	14	604.26	612,736	A1-A9 + Basin A1
16	SCS Runoff	53.73	2	746	373,008	------	------	------	Parksie Development
17	Combine	101.43	2	780	1,549,909	15, 16	------	------	Parkside Basin A2 Inflow
18	Reservoir	61.62	2	868	1,357,034	17	601.62	517,379	BASIN A2
19	SCS Runoff	5.770	2	730	26,882	------	------	------	ULT A6
20	Combine	62.06	2	868	1,383,915	18, 19	------	------	Parkside Discharge Into TxDOT Chan
21	SCS Runoff	53.35	2	754	480,693	------	------	------	ULT A7
22	Combine	1954.50	2	800	27,275,642	12, 13, 20, 21	------	------	ULT A

Hydrograph Report

Hyd. No. 1

EX A1

Hydrograph type	=	SCS Runoff	Peak discharge	=	1713.53 cfs
Storm frequency	=	5 yrs	Time to peak	=	802 min
Time interval	=	2 min	Hyd. volume	=	22,423,314 cuft
Drainage area	=	1906.930 ac	Curve number	=	85.3
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	122.30 min
Total precip.	=	4.83 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	434

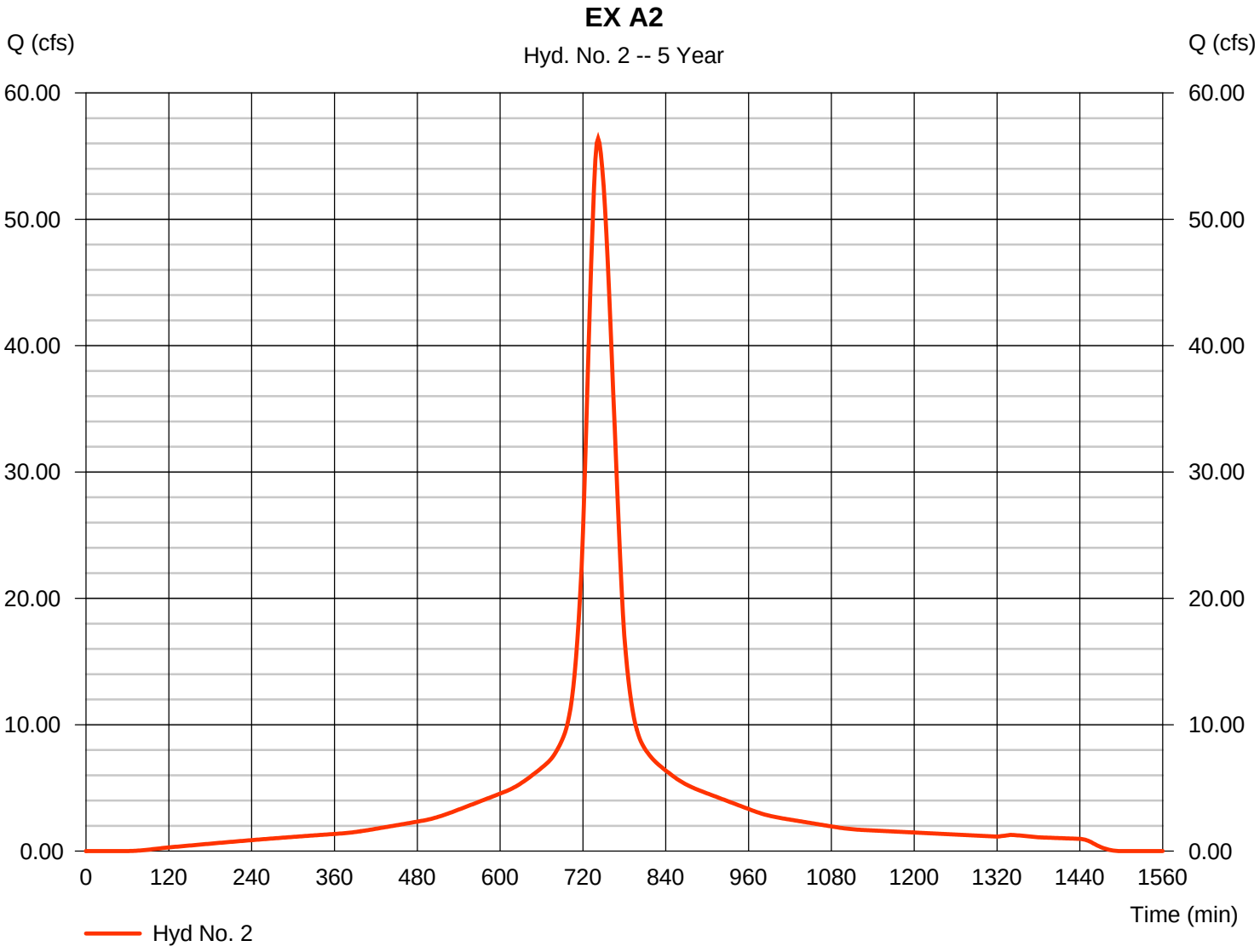


Hydrograph Report

Hyd. No. 2

EX A2

Hydrograph type	=	SCS Runoff	Peak discharge	=	56.38 cfs
Storm frequency	=	5 yrs	Time to peak	=	742 min
Time interval	=	2 min	Hyd. volume	=	369,381 cuft
Drainage area	=	21.960 ac	Curve number	=	98
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	32.00 min
Total precip.	=	4.83 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	434

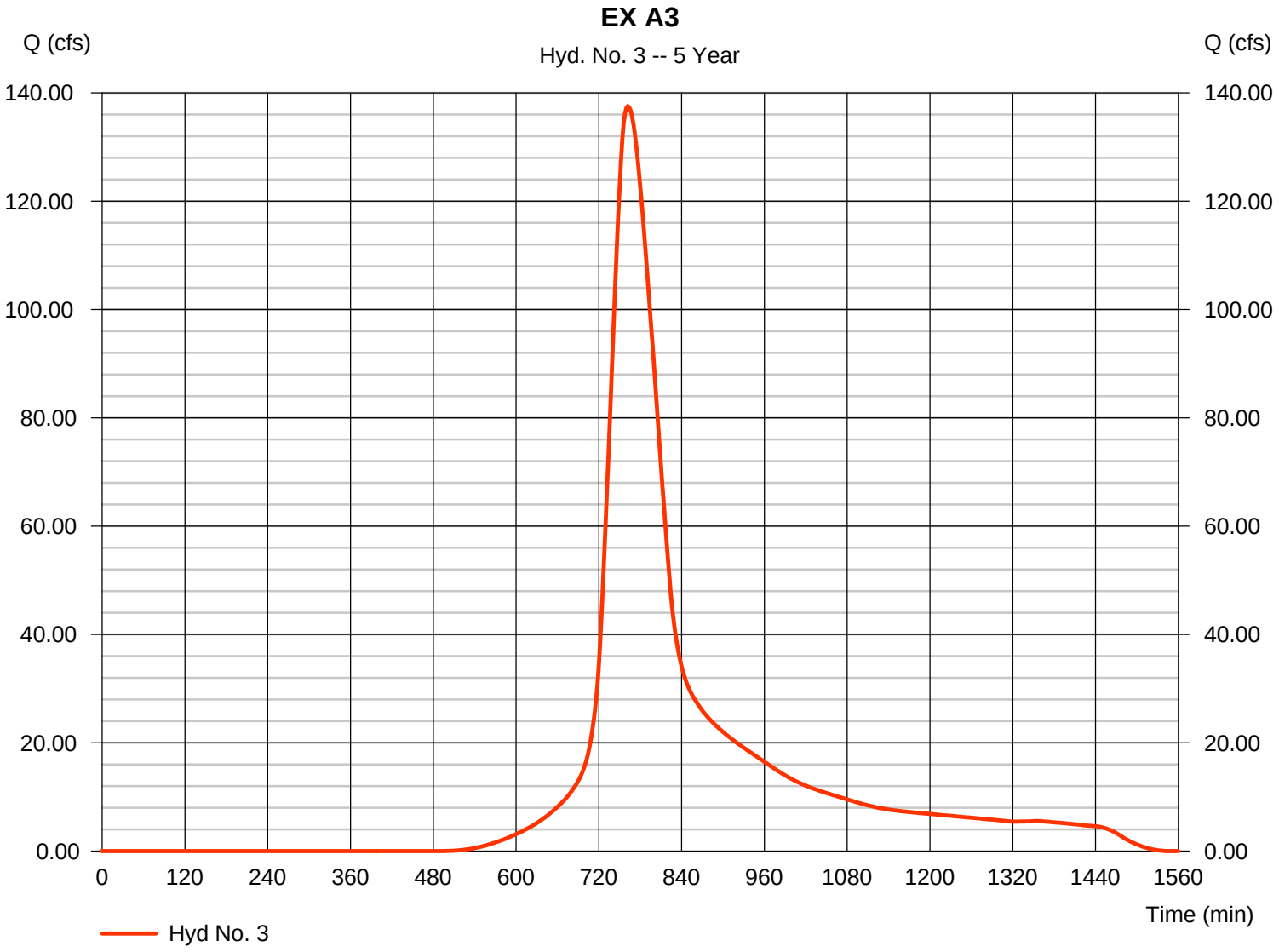


Hydrograph Report

Hyd. No. 3

EX A3

Hydrograph type	=	SCS Runoff	Peak discharge	=	137.54 cfs
Storm frequency	=	5 yrs	Time to peak	=	762 min
Time interval	=	2 min	Hyd. volume	=	1,127,021 cuft
Drainage area	=	117.840 ac	Curve number	=	78.5
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	59.60 min
Total precip.	=	4.83 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	434

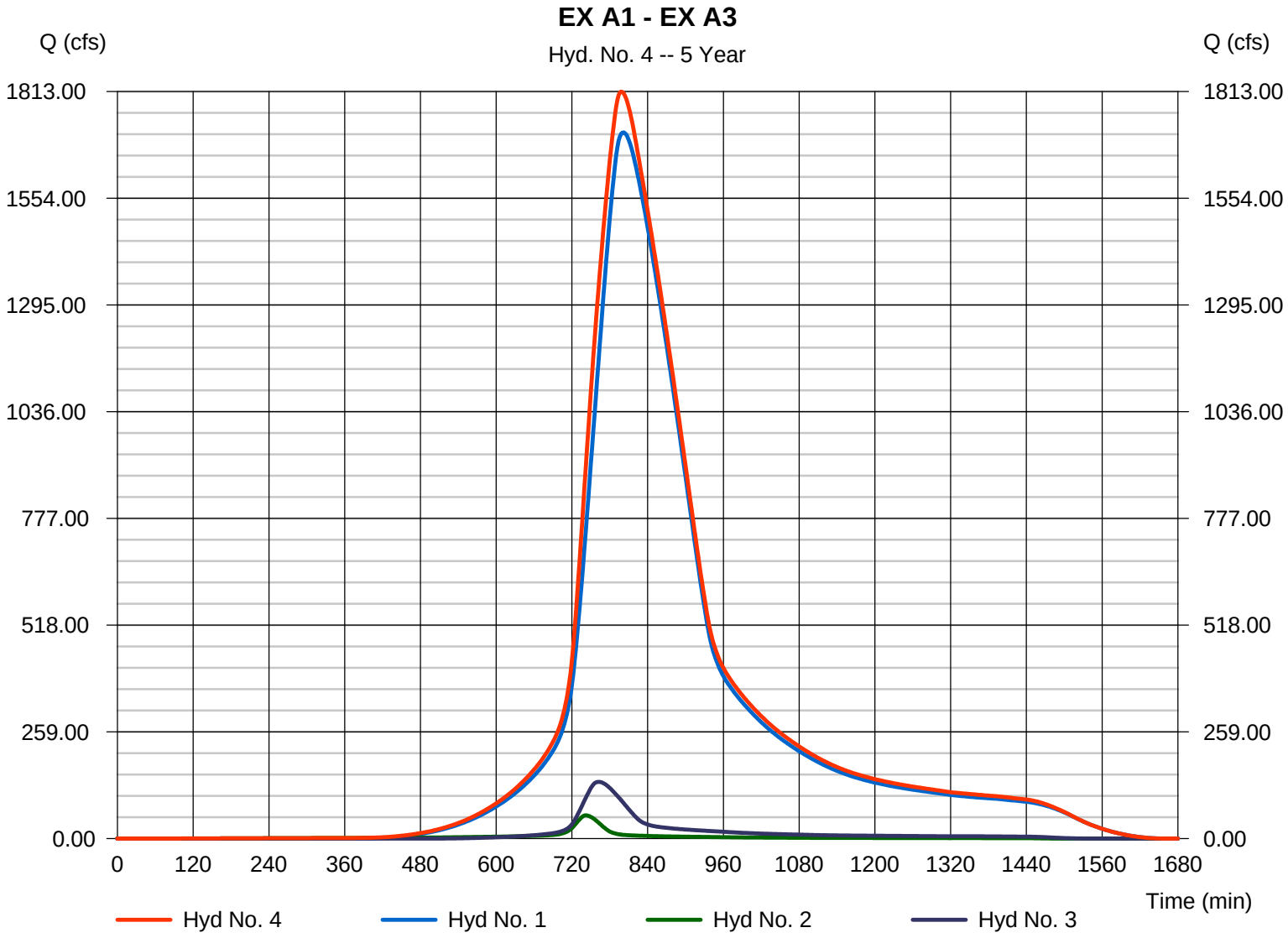


Hydrograph Report

Hyd. No. 4

EX A1 - EX A3

Hydrograph type	=	Combine	Peak discharge	=	1812.75 cfs
Storm frequency	=	5 yrs	Time to peak	=	798 min
Time interval	=	2 min	Hyd. volume	=	23,919,710 cuft
Inflow hyds.	=	1, 2, 3	Contrib. drain. area	=	2046.730 ac

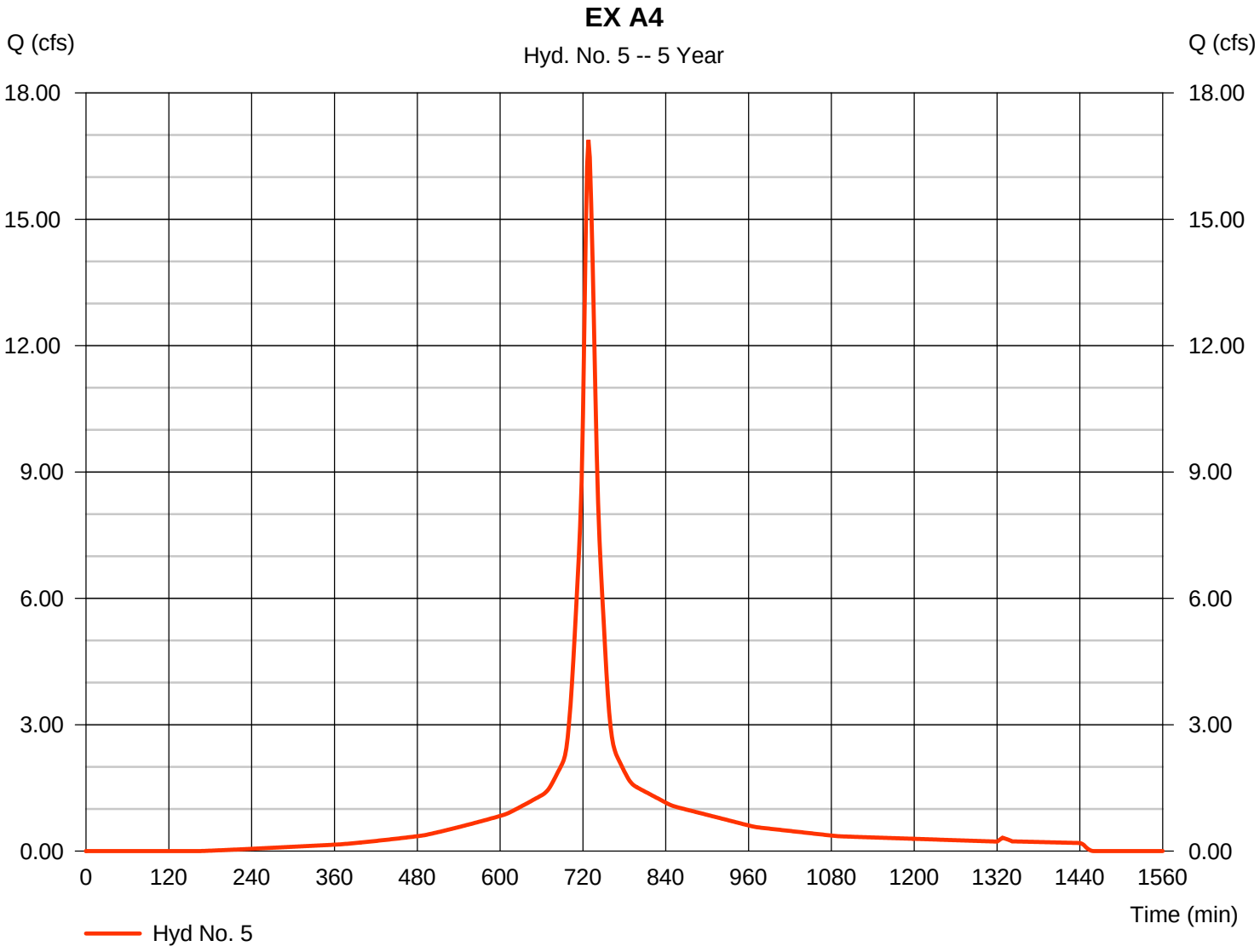


Hydrograph Report

Hyd. No. 5

EX A4

Hydrograph type	=	SCS Runoff	Peak discharge	=	16.88 cfs
Storm frequency	=	5 yrs	Time to peak	=	728 min
Time interval	=	2 min	Hyd. volume	=	68,971 cuft
Drainage area	=	4.450 ac	Curve number	=	94
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	10.00 min
Total precip.	=	4.83 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484

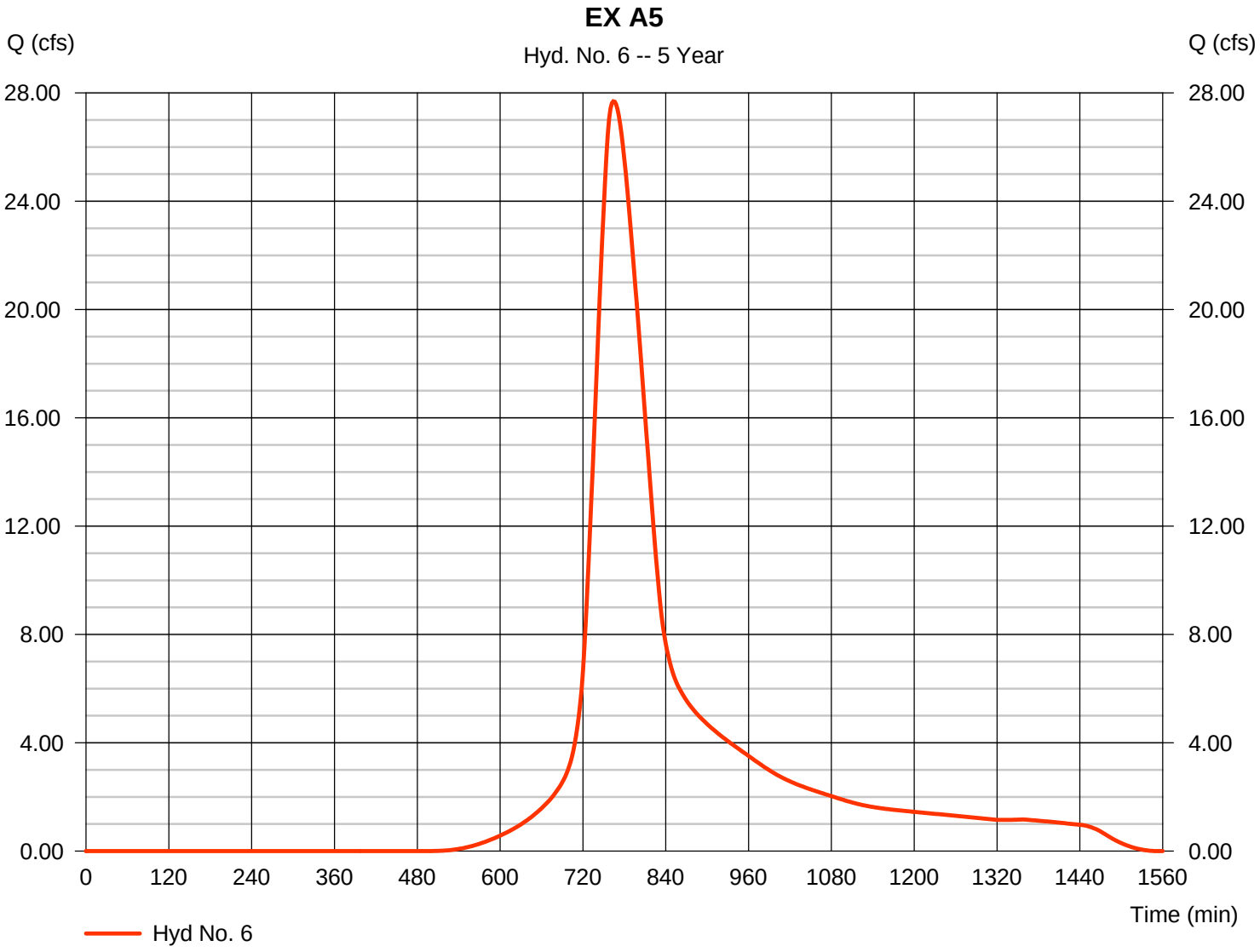


Hydrograph Report

Hyd. No. 6

EX A5

Hydrograph type	=	SCS Runoff	Peak discharge	=	27.69 cfs
Storm frequency	=	5 yrs	Time to peak	=	764 min
Time interval	=	2 min	Hyd. volume	=	234,998 cuft
Drainage area	=	24.990 ac	Curve number	=	78
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	63.10 min
Total precip.	=	4.83 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	434

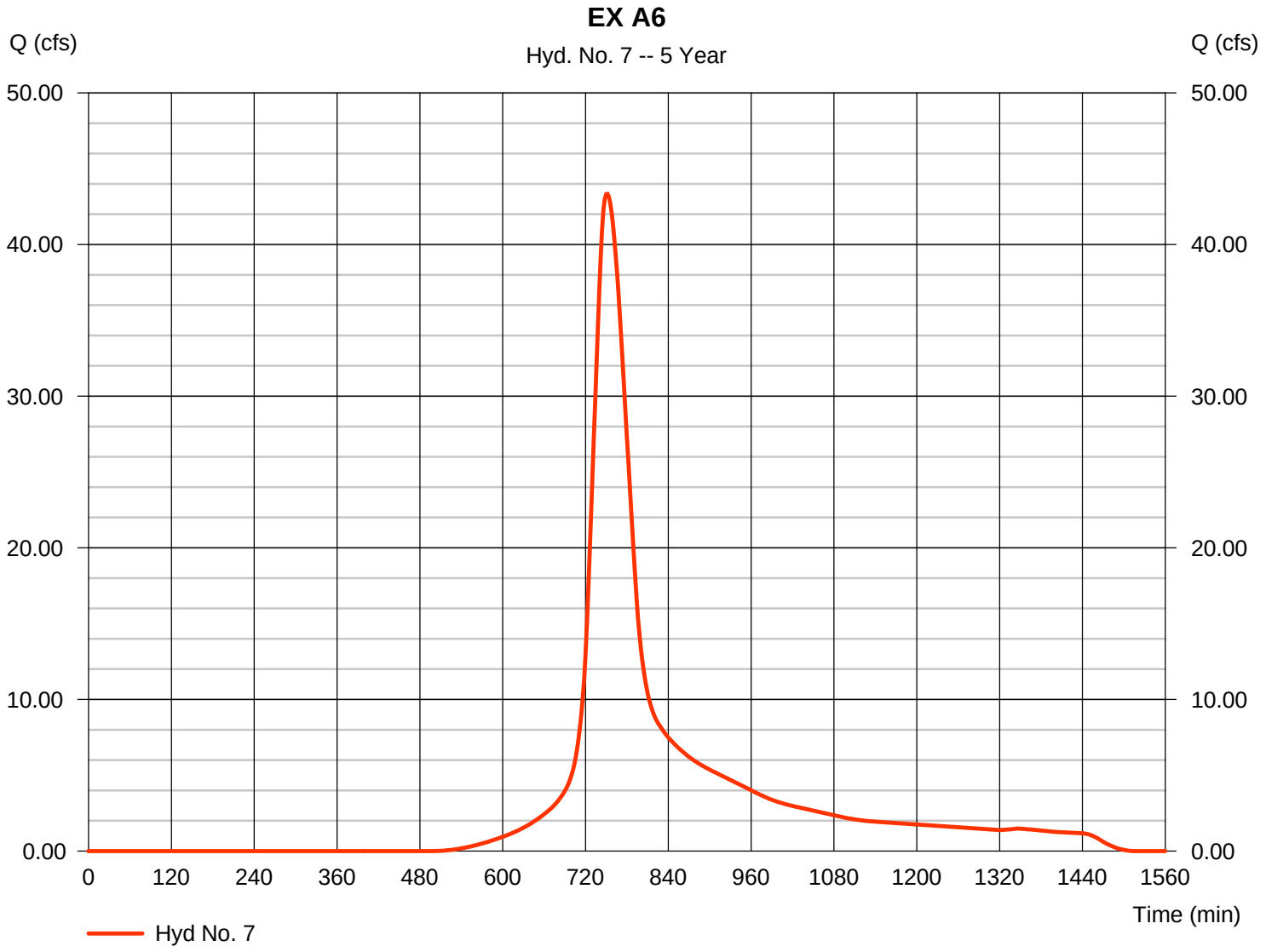


Hydrograph Report

Hyd. No. 7

EX A6

Hydrograph type	=	SCS Runoff	Peak discharge	=	43.33 cfs
Storm frequency	=	5 yrs	Time to peak	=	752 min
Time interval	=	2 min	Hyd. volume	=	292,549 cuft
Drainage area	=	31.110 ac	Curve number	=	78
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	40.80 min
Total precip.	=	4.83 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	434

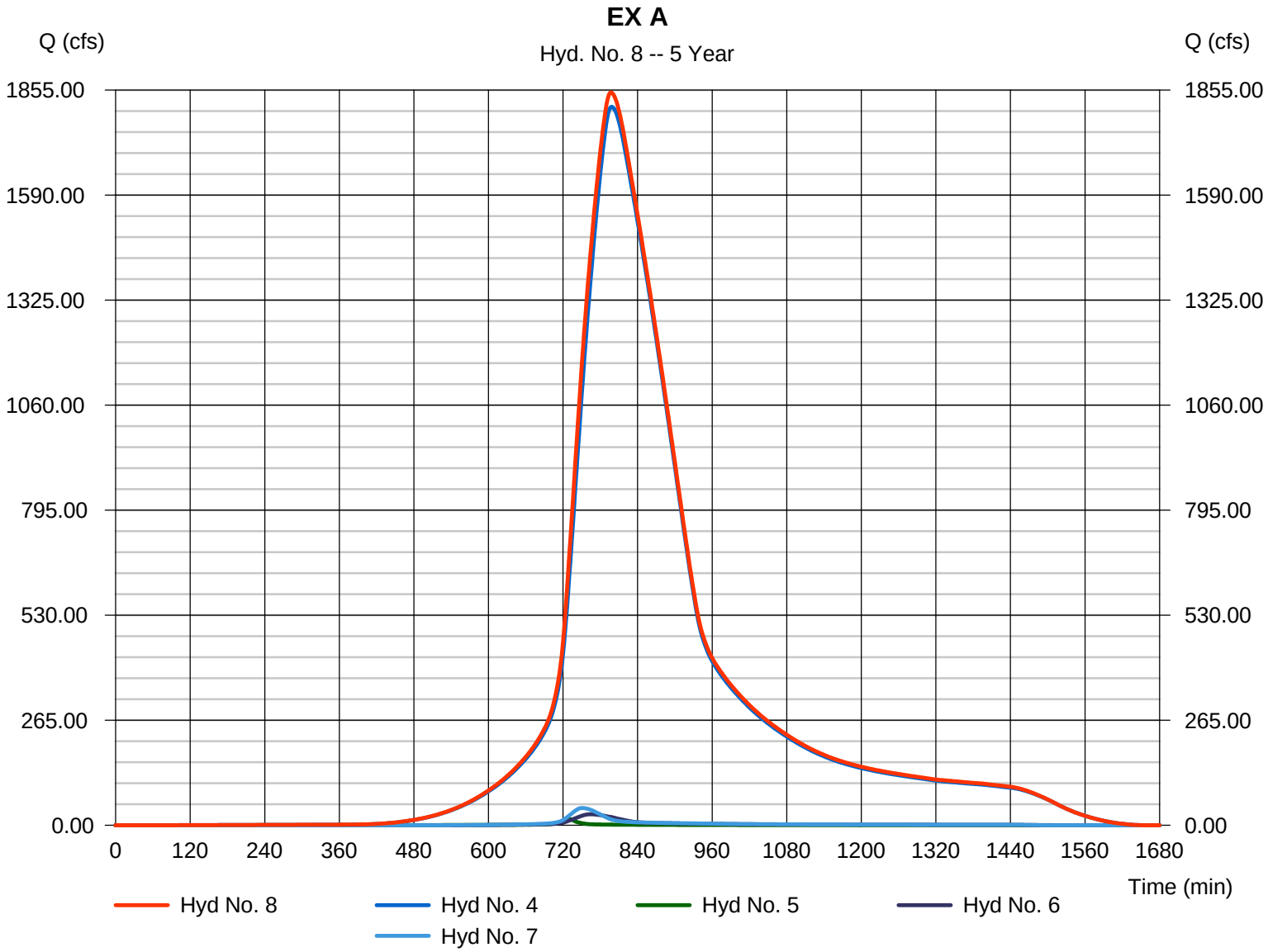


Hydrograph Report

Hyd. No. 8

EX A

Hydrograph type	=	Combine	Peak discharge	=	1848.80 cfs
Storm frequency	=	5 yrs	Time to peak	=	798 min
Time interval	=	2 min	Hyd. volume	=	24,516,236 cuft
Inflow hyds.	=	4, 5, 6, 7	Contrib. drain. area	=	60.550 ac

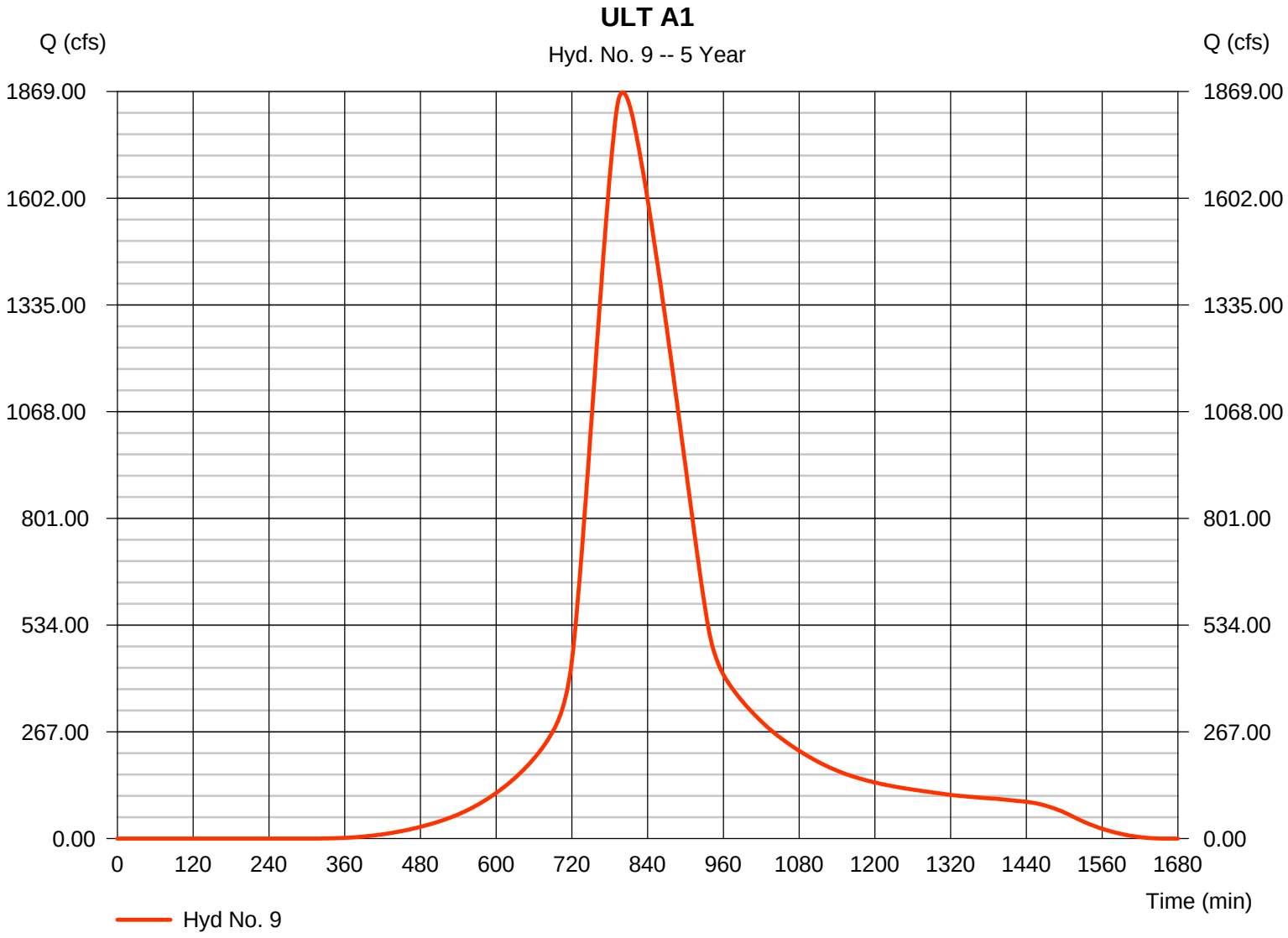


Hydrograph Report

Hyd. No. 9

ULT A1

Hydrograph type	=	SCS Runoff	Peak discharge	=	1866.75 cfs
Storm frequency	=	5 yrs	Time to peak	=	800 min
Time interval	=	2 min	Hyd. volume	=	24,553,634 cuft
Drainage area	=	1906.930 ac	Curve number	=	88.4
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	122.30 min
Total precip.	=	4.83 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	434

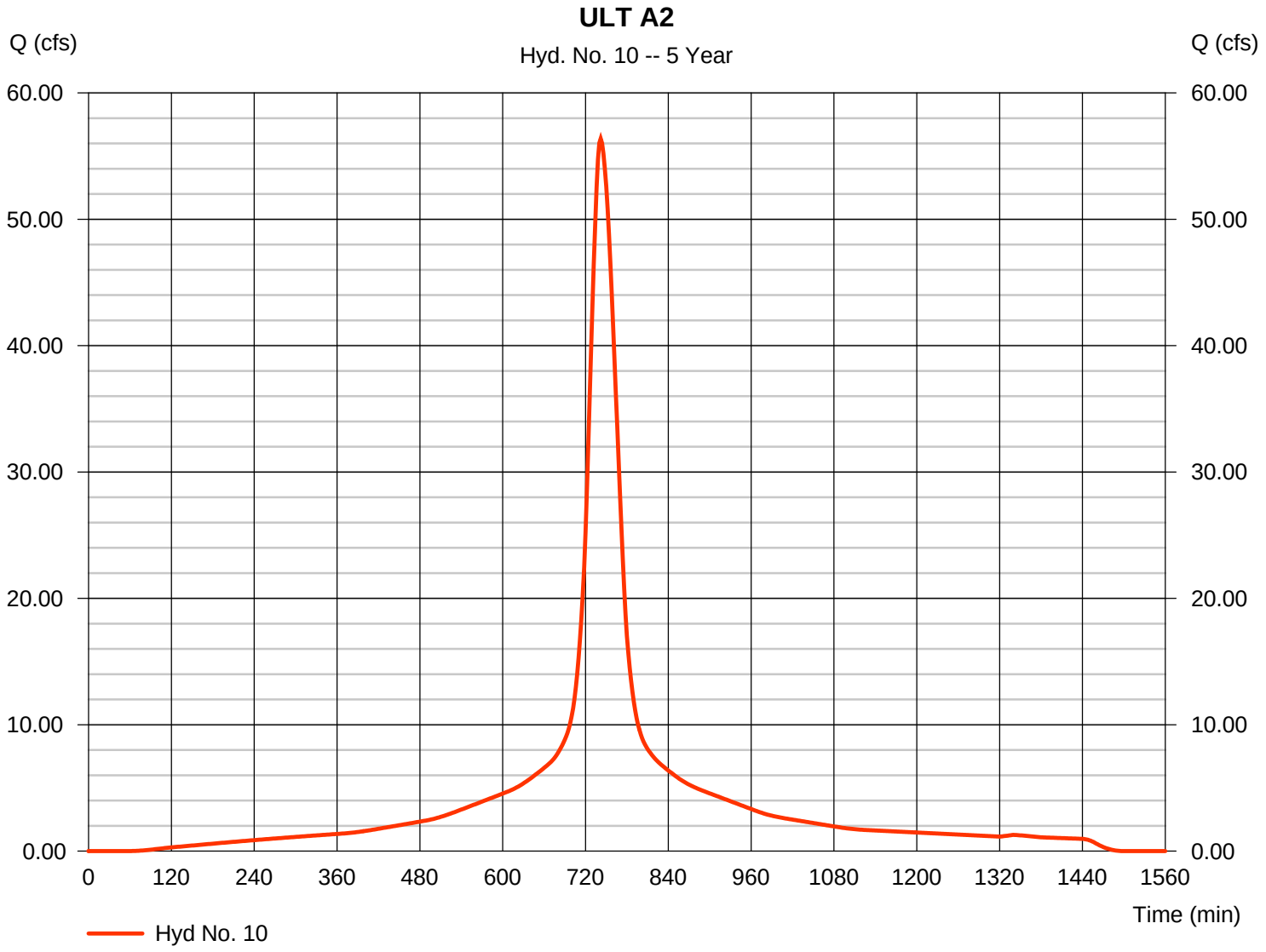


Hydrograph Report

Hyd. No. 10

ULT A2

Hydrograph type	=	SCS Runoff	Peak discharge	=	56.38 cfs
Storm frequency	=	5 yrs	Time to peak	=	742 min
Time interval	=	2 min	Hyd. volume	=	369,381 cuft
Drainage area	=	21.960 ac	Curve number	=	98
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	32.00 min
Total precip.	=	4.83 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	434

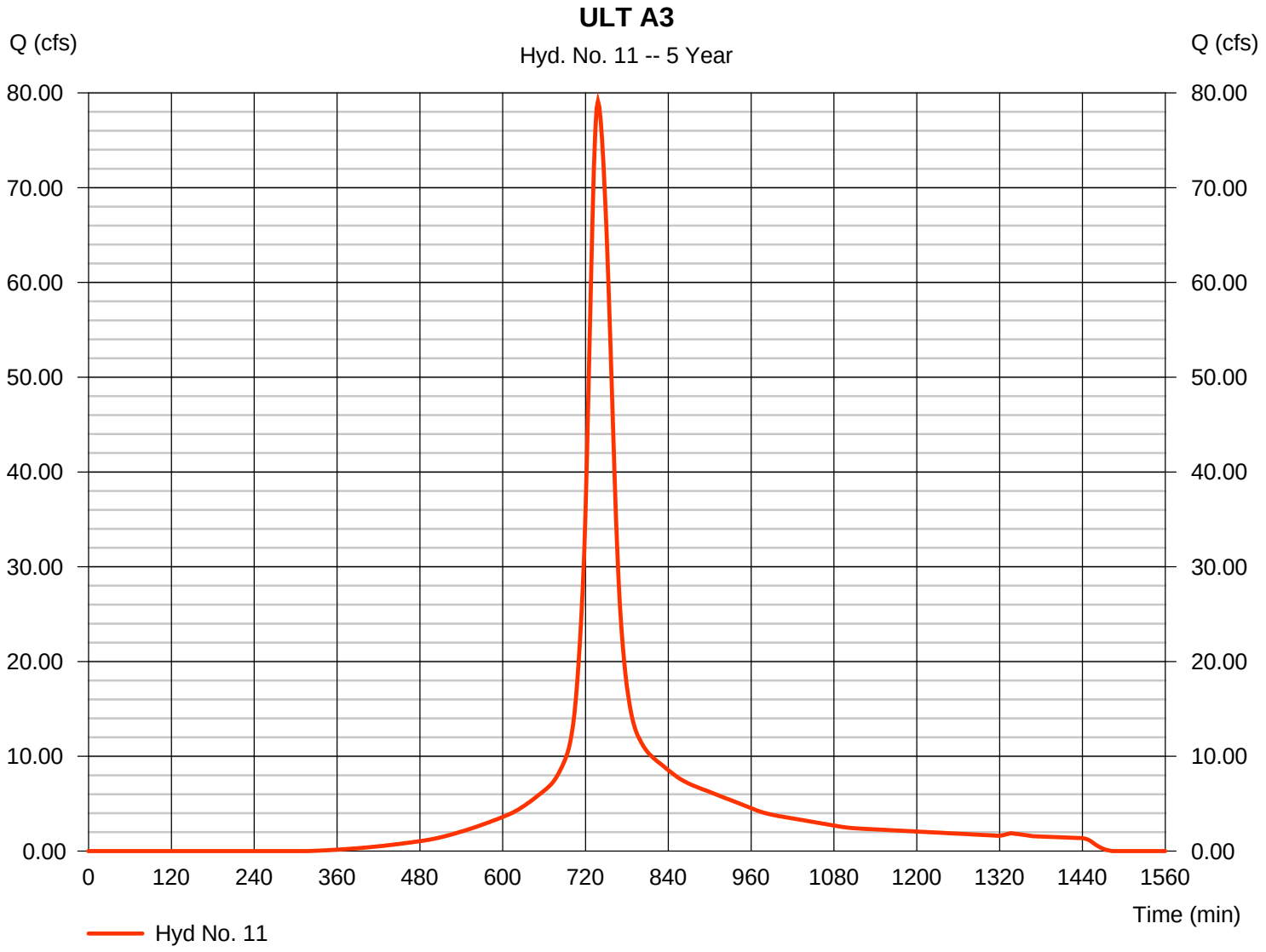


Hydrograph Report

Hyd. No. 11

ULT A3

Hydrograph type	=	SCS Runoff	Peak discharge	=	79.12 cfs
Storm frequency	=	5 yrs	Time to peak	=	738 min
Time interval	=	2 min	Hyd. volume	=	422,078 cuft
Drainage area	=	33.050 ac	Curve number	=	87.8
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	25.60 min
Total precip.	=	4.83 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	434

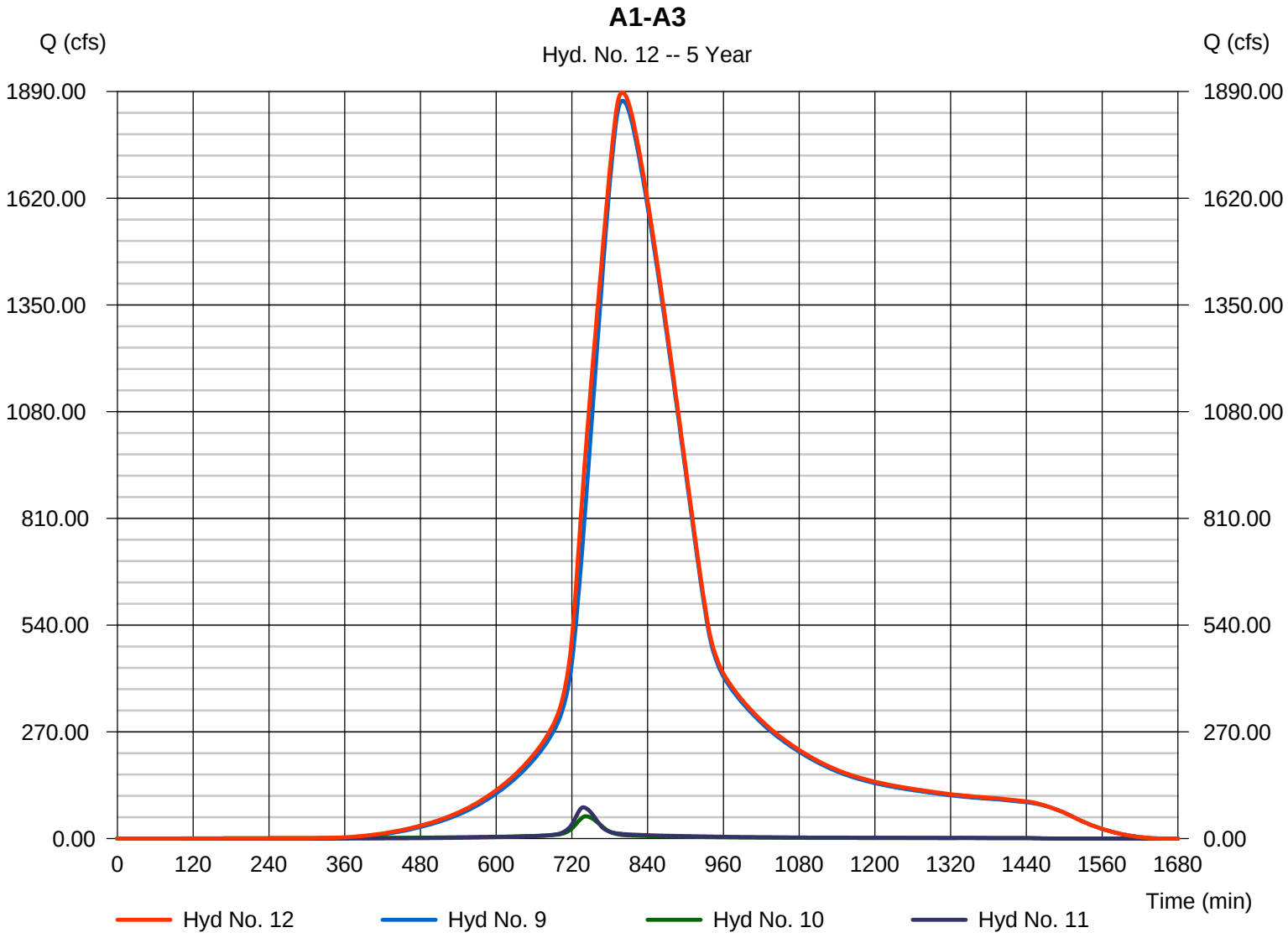


Hydrograph Report

Hyd. No. 12

A1-A3

Hydrograph type	=	Combine	Peak discharge	=	1887.55 cfs
Storm frequency	=	5 yrs	Time to peak	=	800 min
Time interval	=	2 min	Hyd. volume	=	25,345,078 cuft
Inflow hyds.	=	9, 10, 11	Contrib. drain. area	=	1961.940 ac

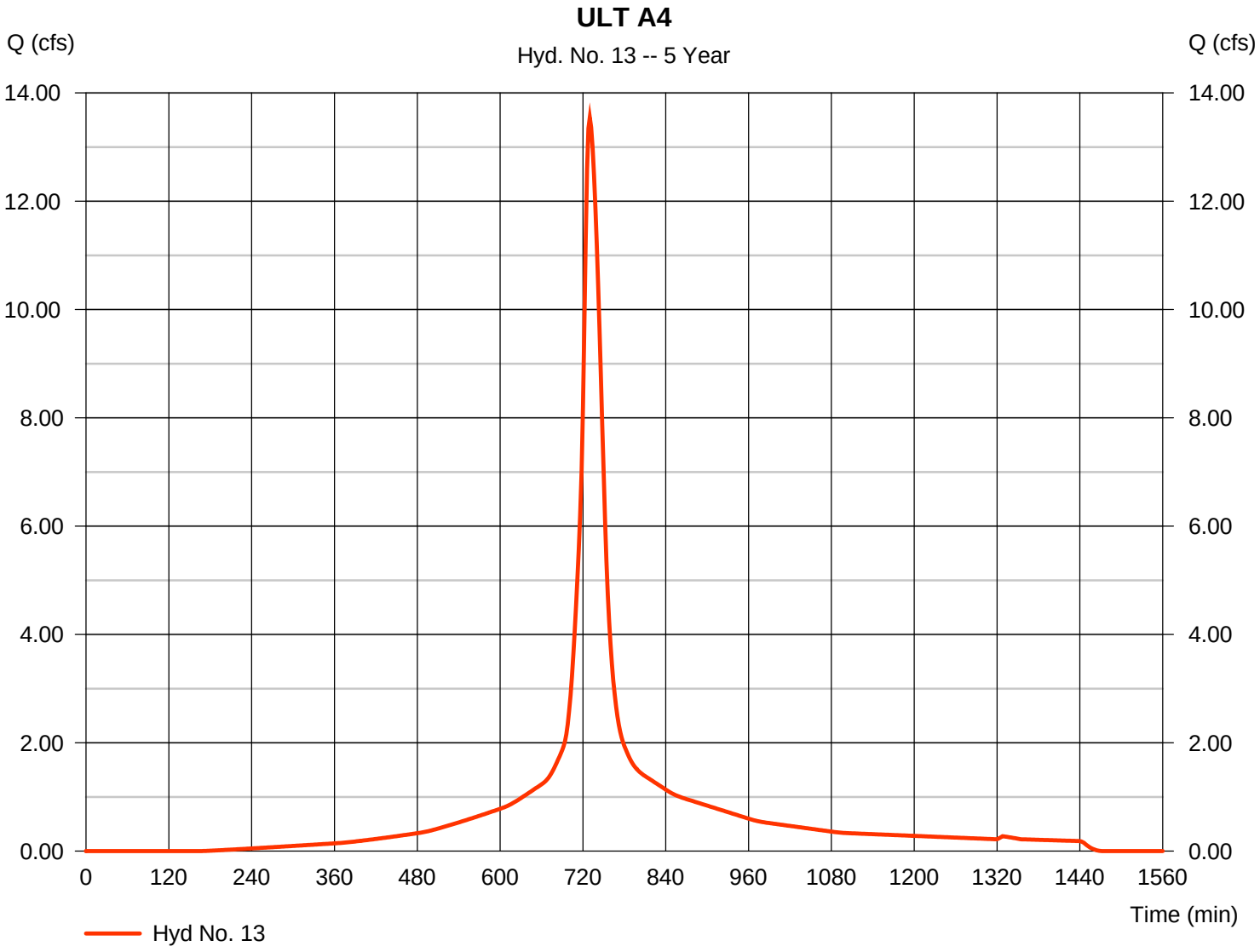


Hydrograph Report

Hyd. No. 13

ULT A4

Hydrograph type	=	SCS Runoff	Peak discharge	=	13.54 cfs
Storm frequency	=	5 yrs	Time to peak	=	730 min
Time interval	=	2 min	Hyd. volume	=	66,069 cuft
Drainage area	=	4.450 ac	Curve number	=	94
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	10.00 min
Total precip.	=	4.83 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	300

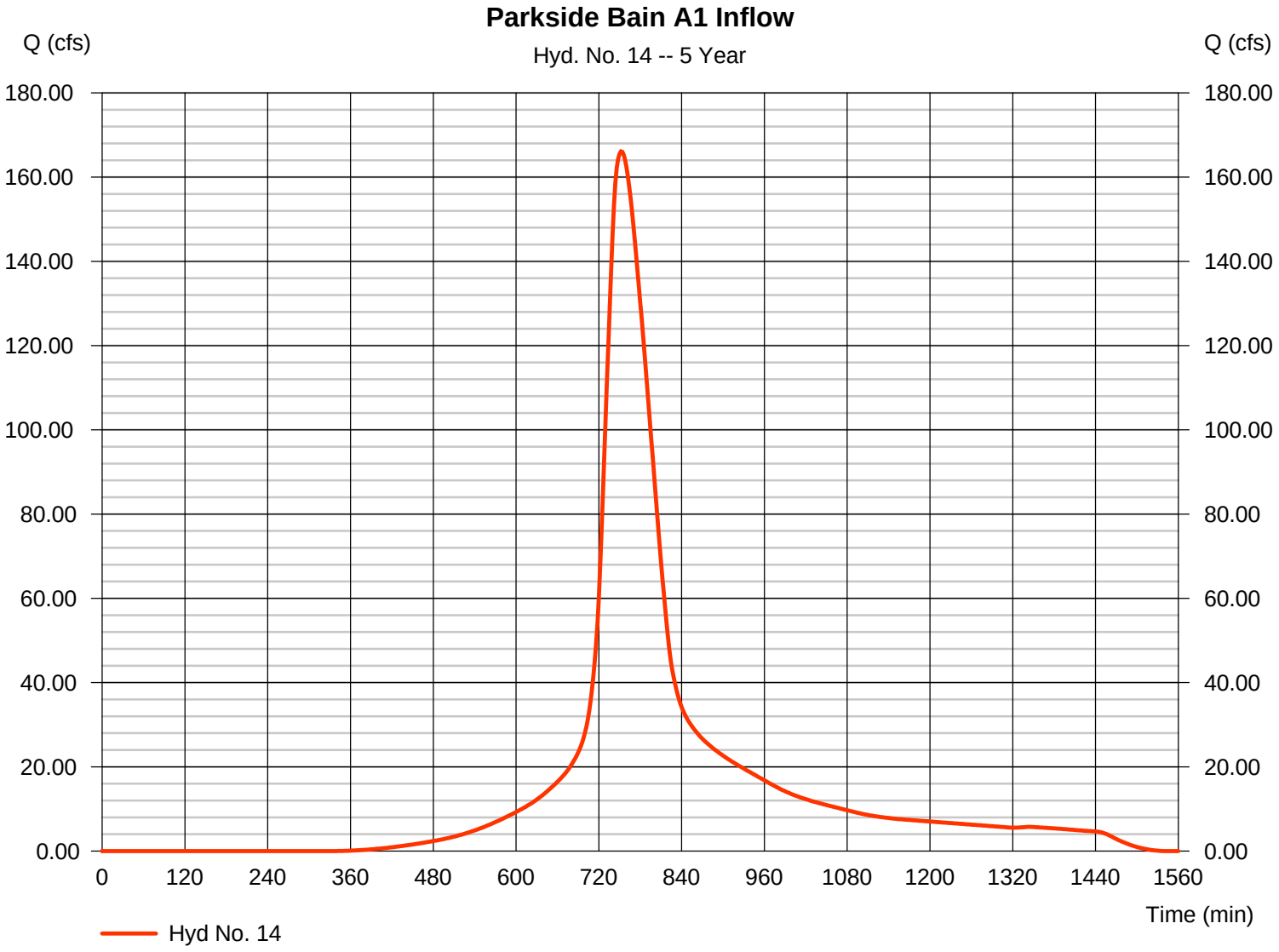


Hydrograph Report

Hyd. No. 14

Parkside Bain A1 Inflow

Hydrograph type	=	SCS Runoff	Peak discharge	=	166.09 cfs
Storm frequency	=	5 yrs	Time to peak	=	752 min
Time interval	=	2 min	Hyd. volume	=	1,361,220 cuft
Drainage area	=	109.260 ac	Curve number	=	87
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	37.90 min
Total precip.	=	4.83 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	300



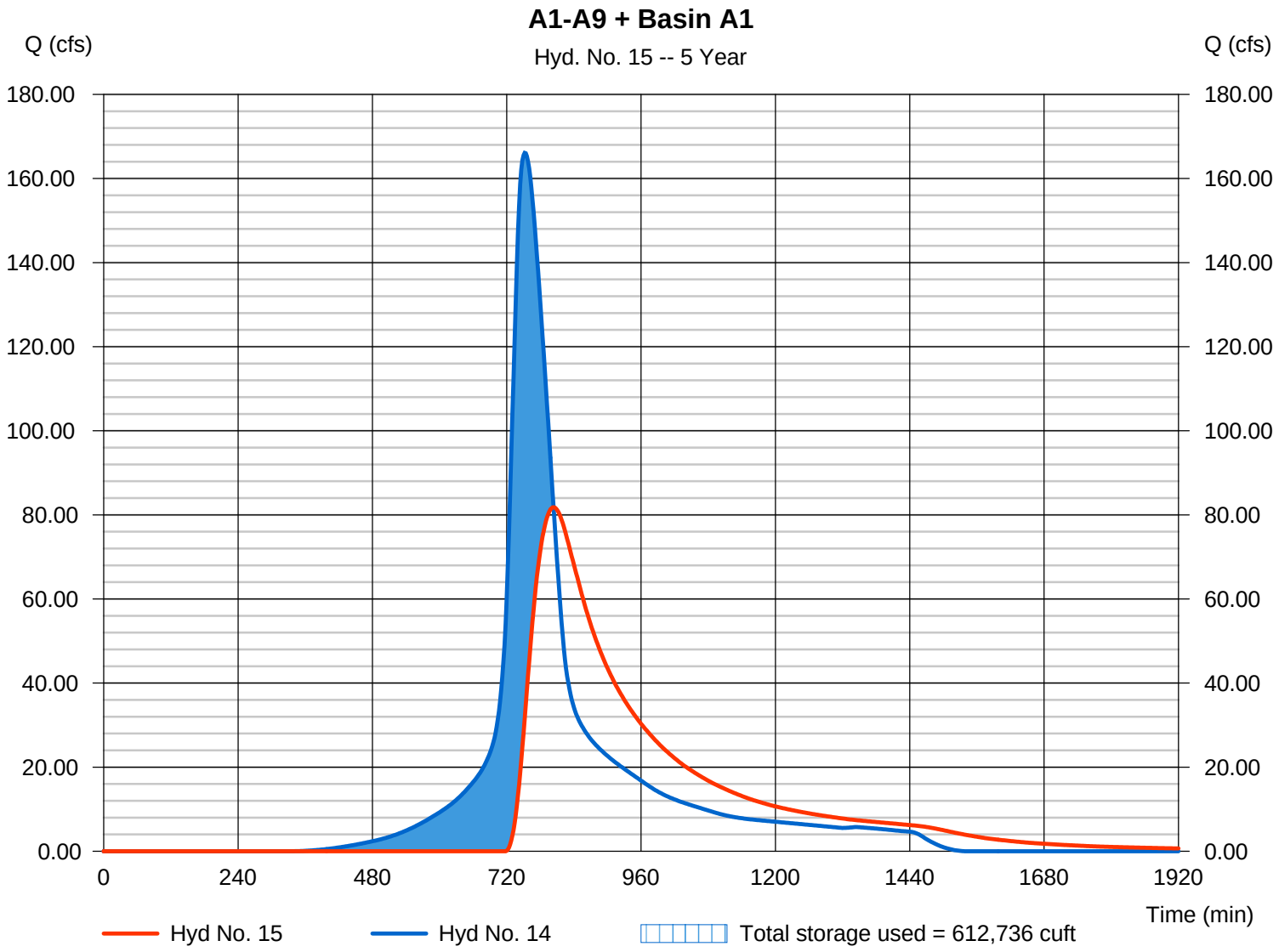
Hydrograph Report

Hyd. No. 15

A1-A9 + Basin A1

Hydrograph type	=	Reservoir	Peak discharge	=	81.81 cfs
Storm frequency	=	5 yrs	Time to peak	=	804 min
Time interval	=	2 min	Hyd. volume	=	1,176,901 cuft
Inflow hyd. No.	=	14 - Parkside Bain A1 Inflow	Max. Elevation	=	604.26 ft
Reservoir name	=	BASIN A1	Max. Storage	=	612,736 cuft

Storage Indication method used.

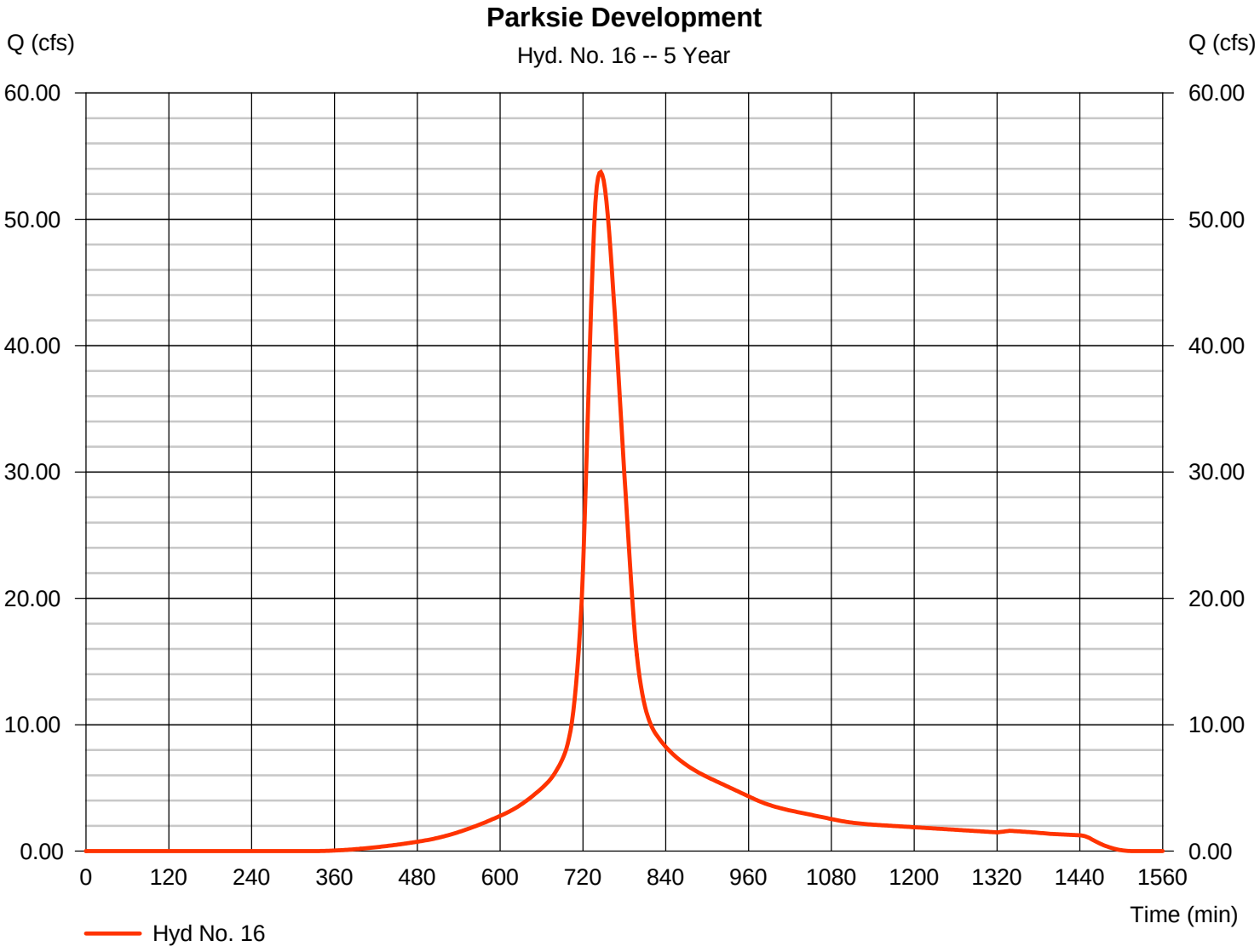


Hydrograph Report

Hyd. No. 16

Parksie Development

Hydrograph type	=	SCS Runoff	Peak discharge	=	53.73 cfs
Storm frequency	=	5 yrs	Time to peak	=	746 min
Time interval	=	2 min	Hyd. volume	=	373,008 cuft
Drainage area	=	29.940 ac	Curve number	=	87
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	28.50 min
Total precip.	=	4.83 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	300

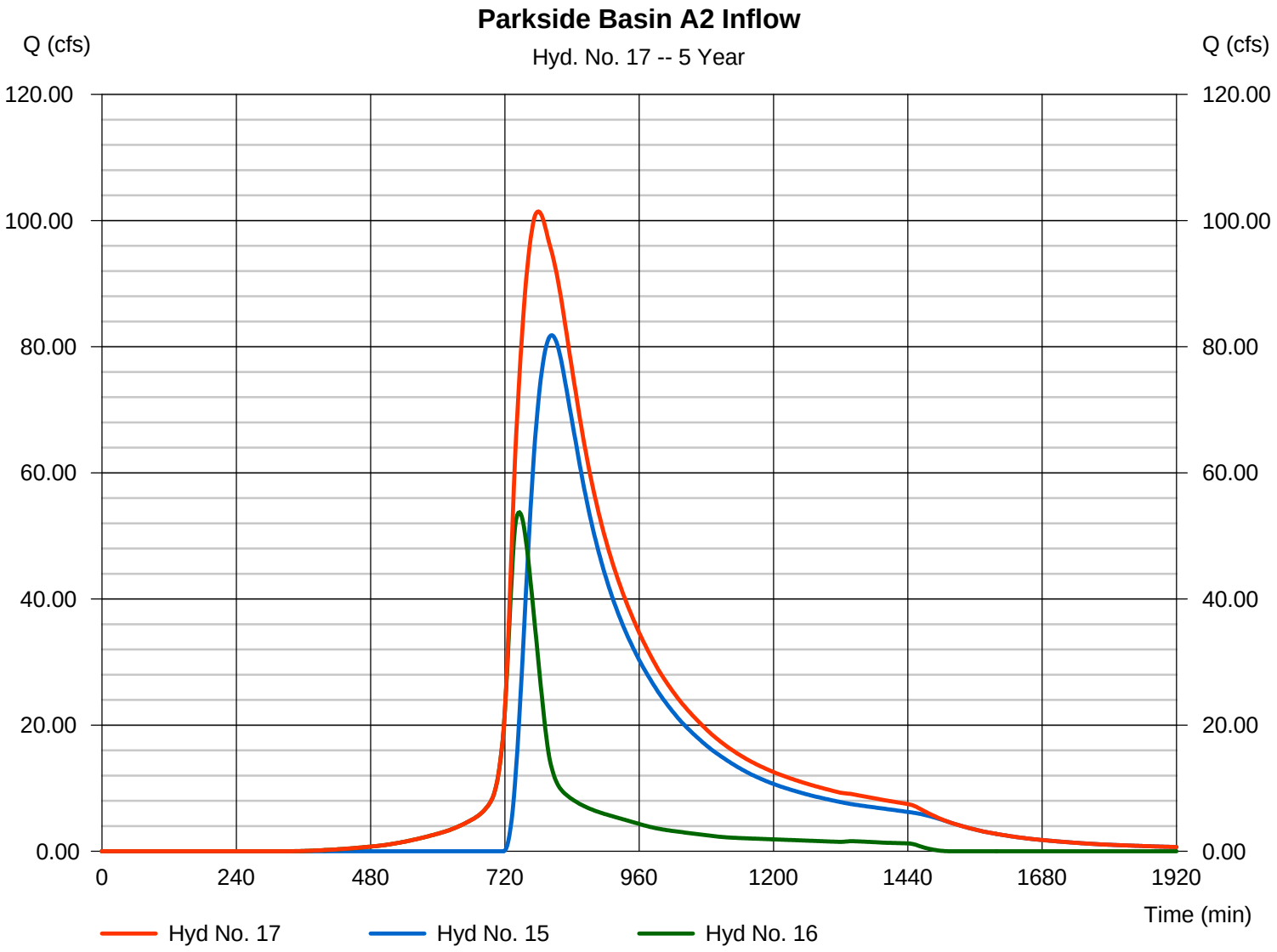


Hydrograph Report

Hyd. No. 17

Parkside Basin A2 Inflow

Hydrograph type	=	Combine	Peak discharge	=	101.43 cfs
Storm frequency	=	5 yrs	Time to peak	=	780 min
Time interval	=	2 min	Hyd. volume	=	1,549,909 cuft
Inflow hyds.	=	15, 16	Contrib. drain. area	=	29.940 ac



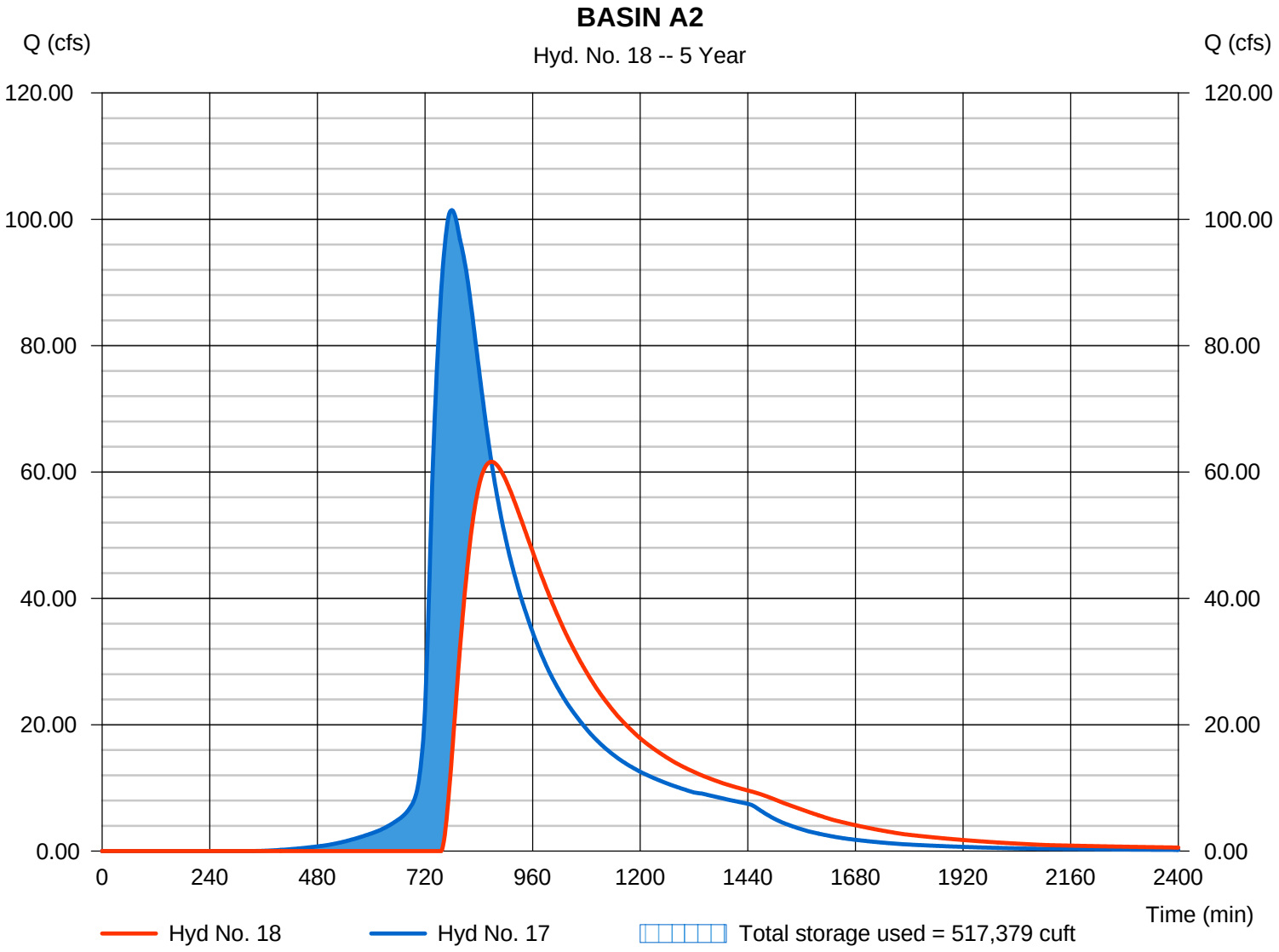
Hydrograph Report

Hyd. No. 18

BASIN A2

Hydrograph type	=	Reservoir	Peak discharge	=	61.62 cfs
Storm frequency	=	5 yrs	Time to peak	=	868 min
Time interval	=	2 min	Hyd. volume	=	1,357,034 cuft
Inflow hyd. No.	=	17 - Parkside Basin A2 Inflow	Max. Elevation	=	601.62 ft
Reservoir name	=	BASIN A2	Max. Storage	=	517,379 cuft

Storage Indication method used.

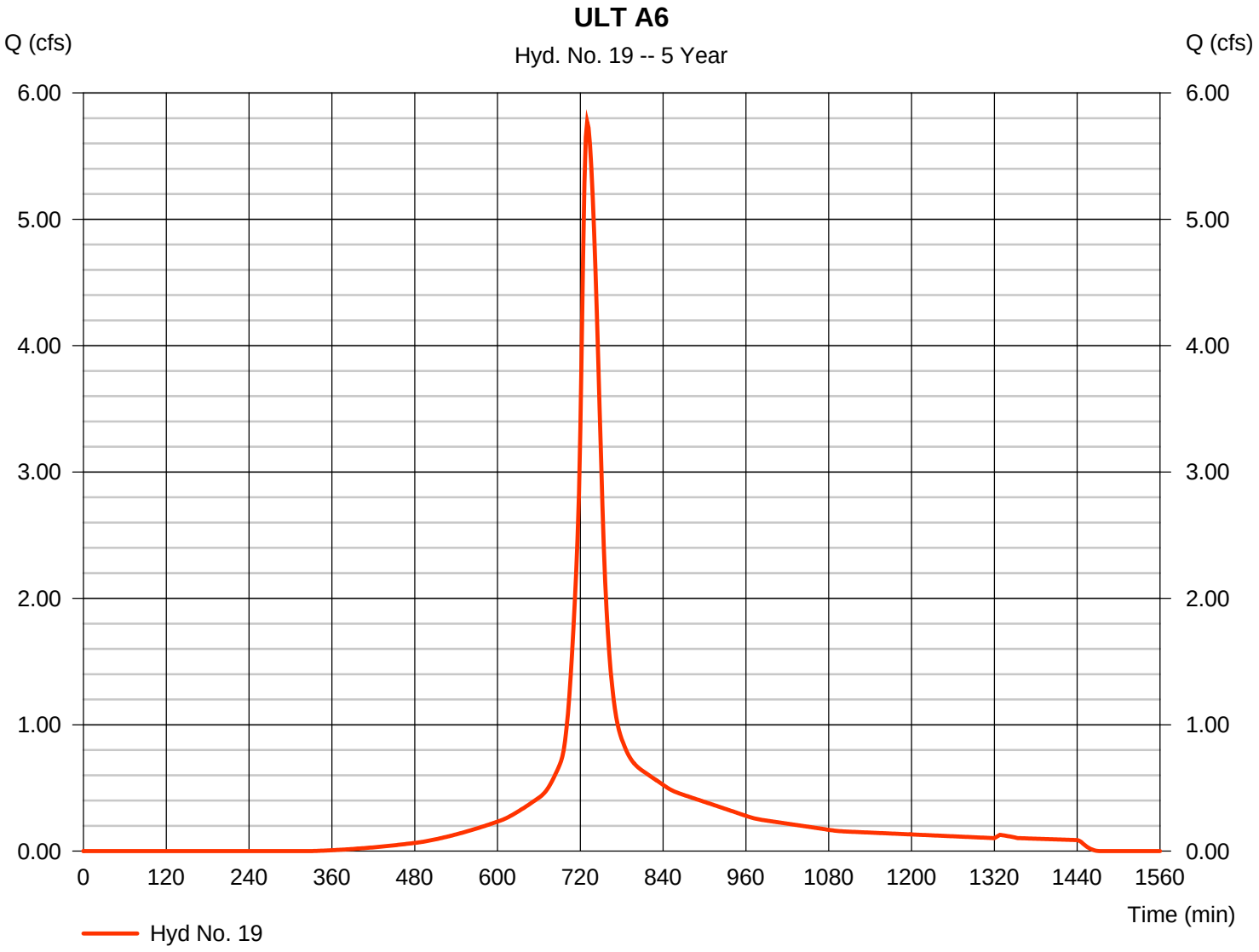


Hydrograph Report

Hyd. No. 19

ULT A6

Hydrograph type	=	SCS Runoff	Peak discharge	=	5.770 cfs
Storm frequency	=	5 yrs	Time to peak	=	730 min
Time interval	=	2 min	Hyd. volume	=	26,882 cuft
Drainage area	=	2.200 ac	Curve number	=	87
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	10.00 min
Total precip.	=	4.83 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	300

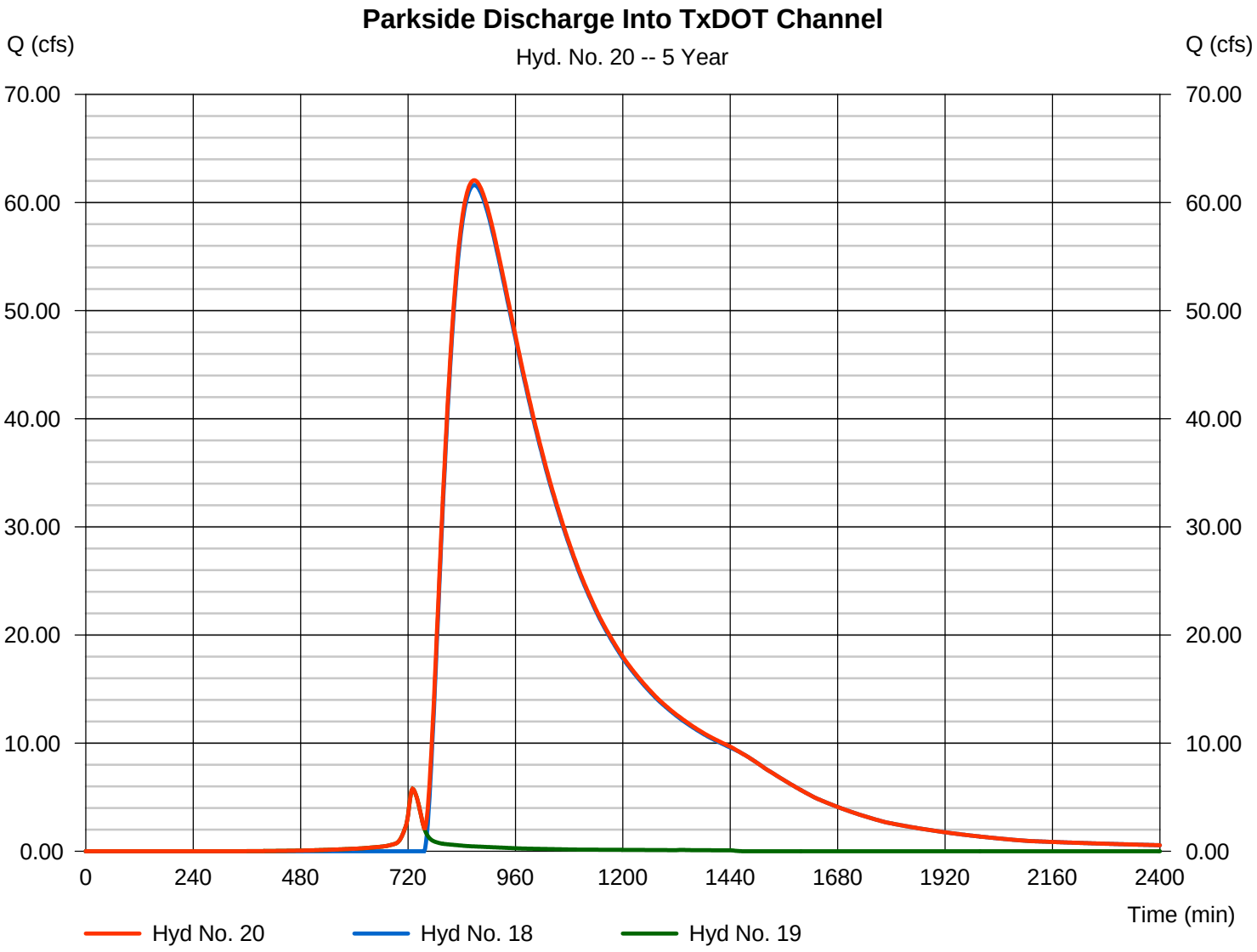


Hydrograph Report

Hyd. No. 20

Parkside Discharge Into TxDOT Channel

Hydrograph type	= Combine	Peak discharge	= 62.06 cfs
Storm frequency	= 5 yrs	Time to peak	= 868 min
Time interval	= 2 min	Hyd. volume	= 1,383,915 cuft
Inflow hyds.	= 18, 19	Contrib. drain. area	= 2.200 ac

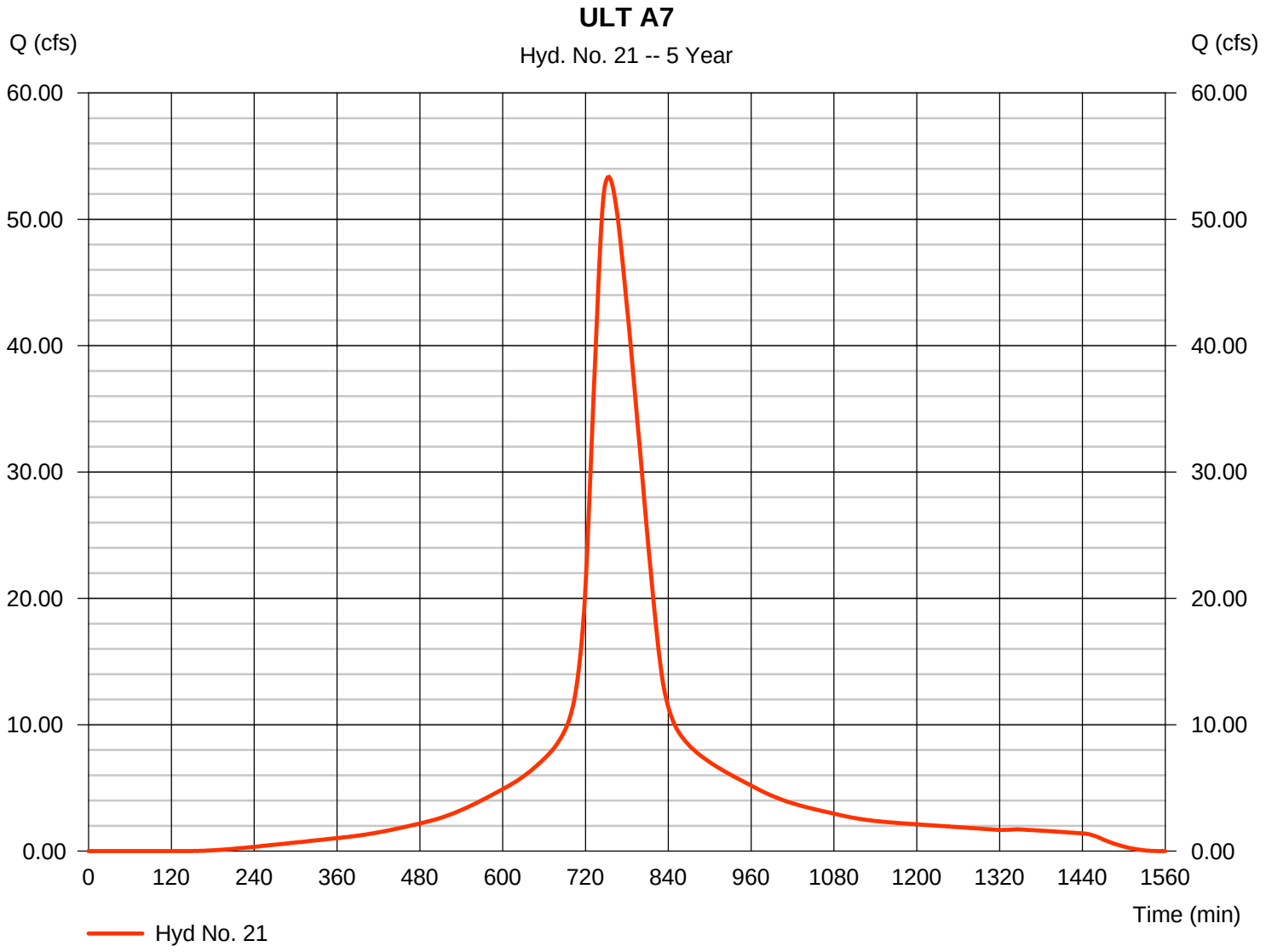


Hydrograph Report

Hyd. No. 21

ULT A7

Hydrograph type	=	SCS Runoff	Peak discharge	=	53.35 cfs
Storm frequency	=	5 yrs	Time to peak	=	754 min
Time interval	=	2 min	Hyd. volume	=	480,693 cuft
Drainage area	=	31.110 ac	Curve number	=	95
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	40.80 min
Total precip.	=	4.83 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	300

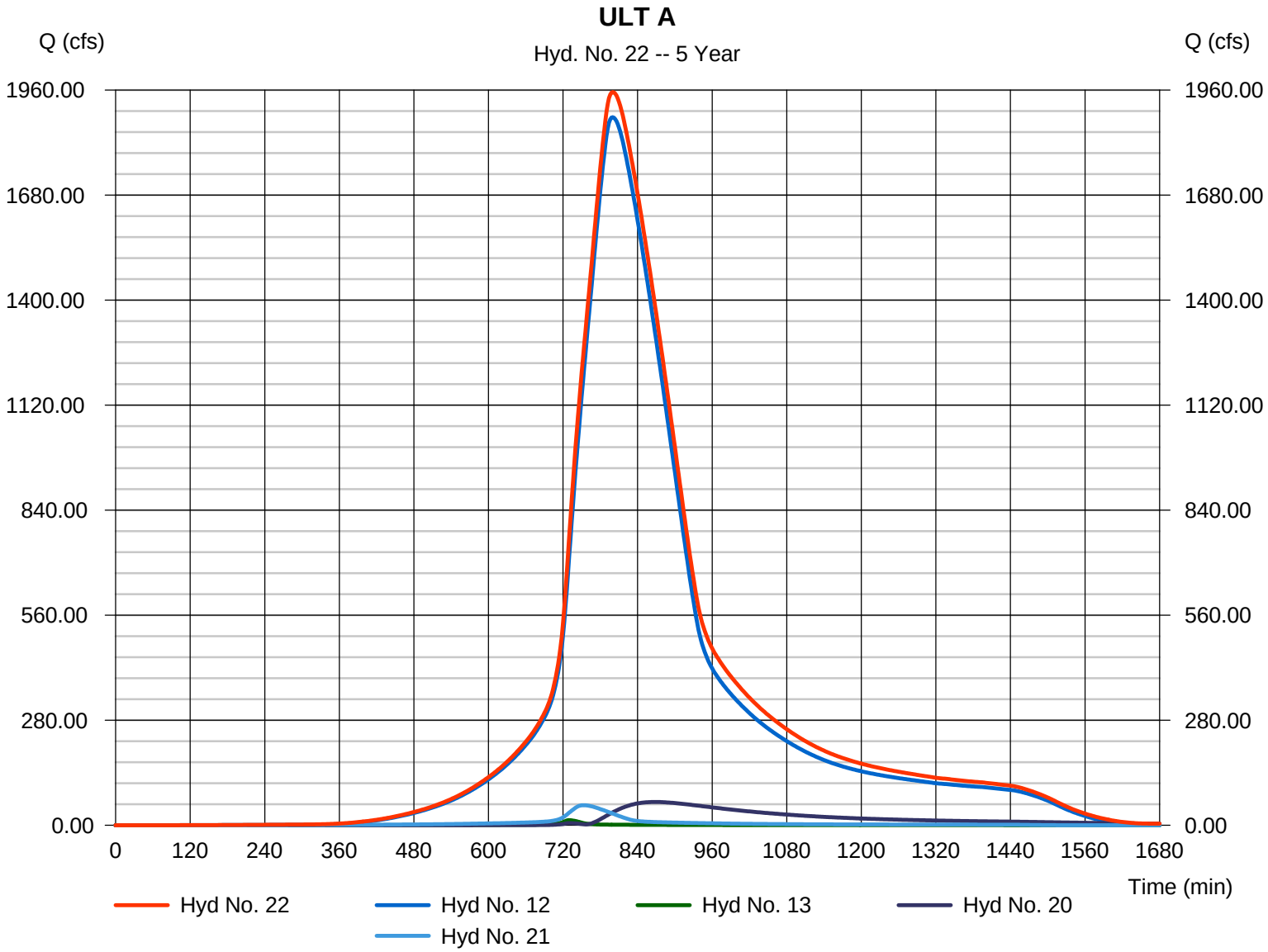


Hydrograph Report

Hyd. No. 22

ULT A

Hydrograph type	=	Combine	Peak discharge	=	1954.50 cfs
Storm frequency	=	5 yrs	Time to peak	=	800 min
Time interval	=	2 min	Hyd. volume	=	27,275,642 cuft
Inflow hyds.	=	12, 13, 20, 21	Contrib. drain. area	=	35.560 ac



Hydrograph Summary Report

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

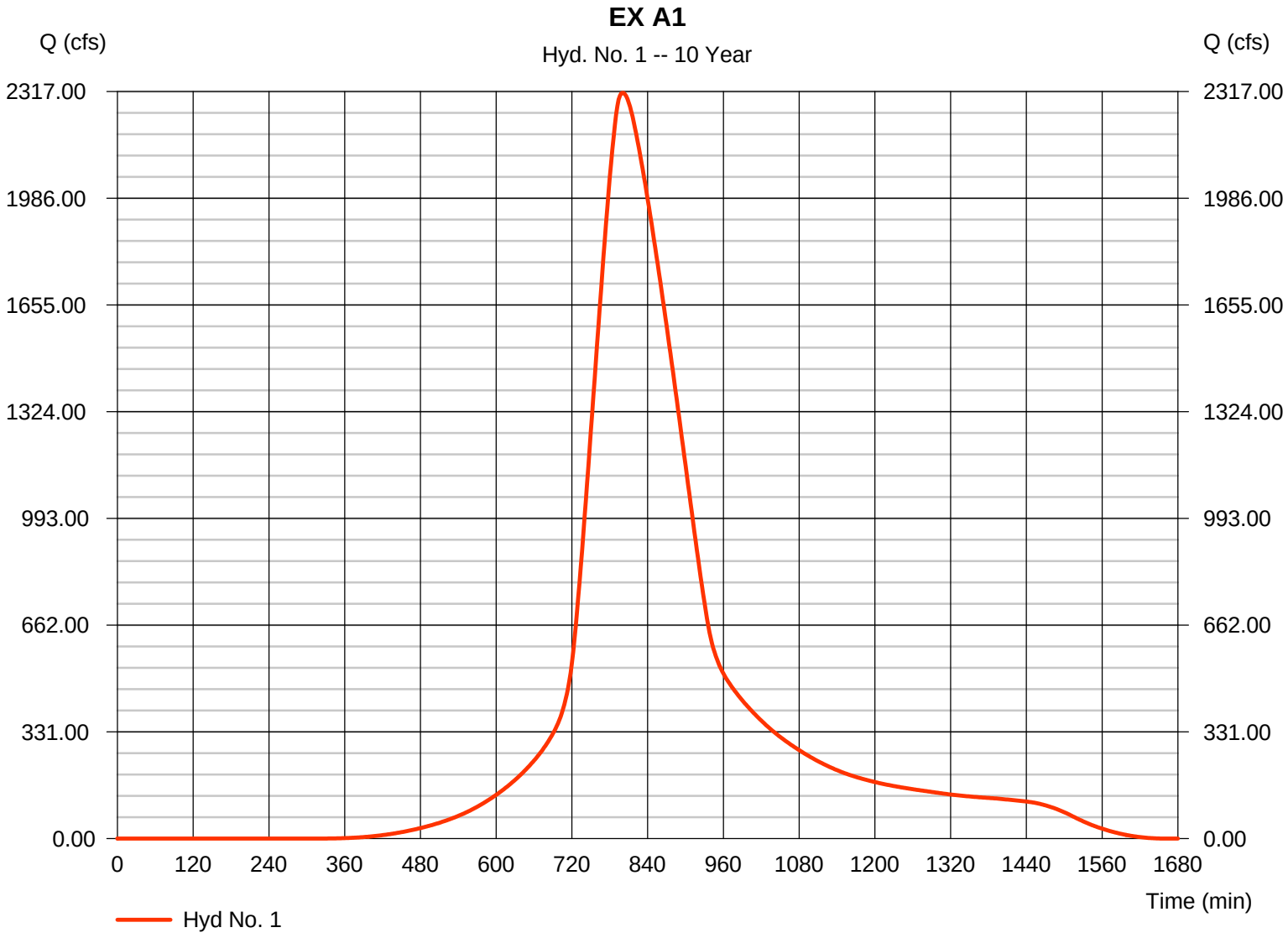
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	2312.98	2	800	30,387,612	------	------	------	EX A1
2	SCS Runoff	70.91	2	742	468,158	------	------	------	EX A2
3	SCS Runoff	194.37	2	762	1,589,059	------	------	------	EX A3
4	Combine	2451.33	2	798	32,444,810	1, 2, 3	------	------	EX A1 - EX A3
5	SCS Runoff	21.53	2	728	89,223	------	------	------	EX A4
6	SCS Runoff	39.30	2	764	332,362	------	------	------	EX A5
7	SCS Runoff	61.45	2	750	413,757	------	------	------	EX A6
8	Combine	2502.49	2	796	33,280,152	4, 5, 6, 7	------	------	EX A
9	SCS Runoff	2468.89	2	800	32,714,668	------	------	------	ULT A1
10	SCS Runoff	70.91	2	742	468,158	------	------	------	ULT A2
11	SCS Runoff	104.56	2	738	564,194	------	------	------	ULT A3
12	Combine	2495.41	2	800	33,747,016	9, 10, 11	------	------	A1-A3
13	SCS Runoff	17.29	2	730	85,469	------	------	------	ULT A4
14	SCS Runoff	221.13	2	752	1,827,487	------	------	------	Parkside Bain A1 Inflow
15	Reservoir	123.26	2	798	1,643,168	14	604.82	758,401	A1-A9 + Basin A1
16	SCS Runoff	71.42	2	746	500,777	------	------	------	Parksie Development
17	Combine	153.89	2	776	2,143,953	15, 16	------	------	Parkside Basin A2 Inflow
18	Reservoir	101.75	2	844	1,951,070	17	602.26	649,941	BASIN A2
19	SCS Runoff	7.669	2	730	36,090	------	------	------	ULT A6
20	Combine	102.40	2	844	1,987,160	18, 19	------	------	Parkside Discharge Into TxDOT Chan
21	SCS Runoff	67.85	2	754	618,640	------	------	------	ULT A7
22	Combine	2615.47	2	800	36,437,980	12, 13, 20, 21	------	------	ULT A

Hydrograph Report

Hyd. No. 1

EX A1

Hydrograph type	=	SCS Runoff	Peak discharge	=	2312.98 cfs
Storm frequency	=	10 yrs	Time to peak	=	800 min
Time interval	=	2 min	Hyd. volume	=	30,387,612 cuft
Drainage area	=	1906.930 ac	Curve number	=	85.3
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	122.30 min
Total precip.	=	6.06 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	434

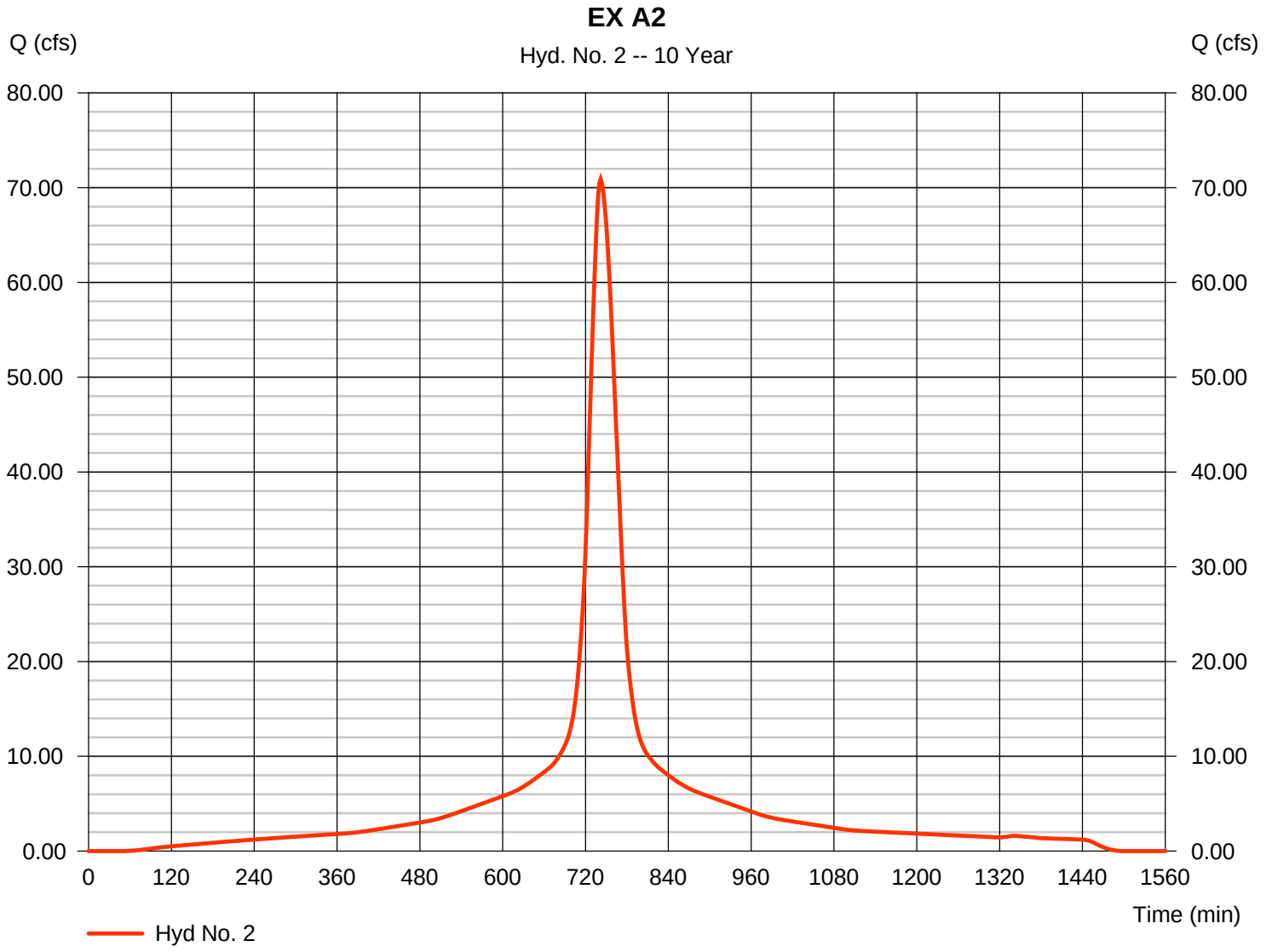


Hydrograph Report

Hyd. No. 2

EX A2

Hydrograph type	=	SCS Runoff	Peak discharge	=	70.91 cfs
Storm frequency	=	10 yrs	Time to peak	=	742 min
Time interval	=	2 min	Hyd. volume	=	468,158 cuft
Drainage area	=	21.960 ac	Curve number	=	98
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	32.00 min
Total precip.	=	6.06 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	434

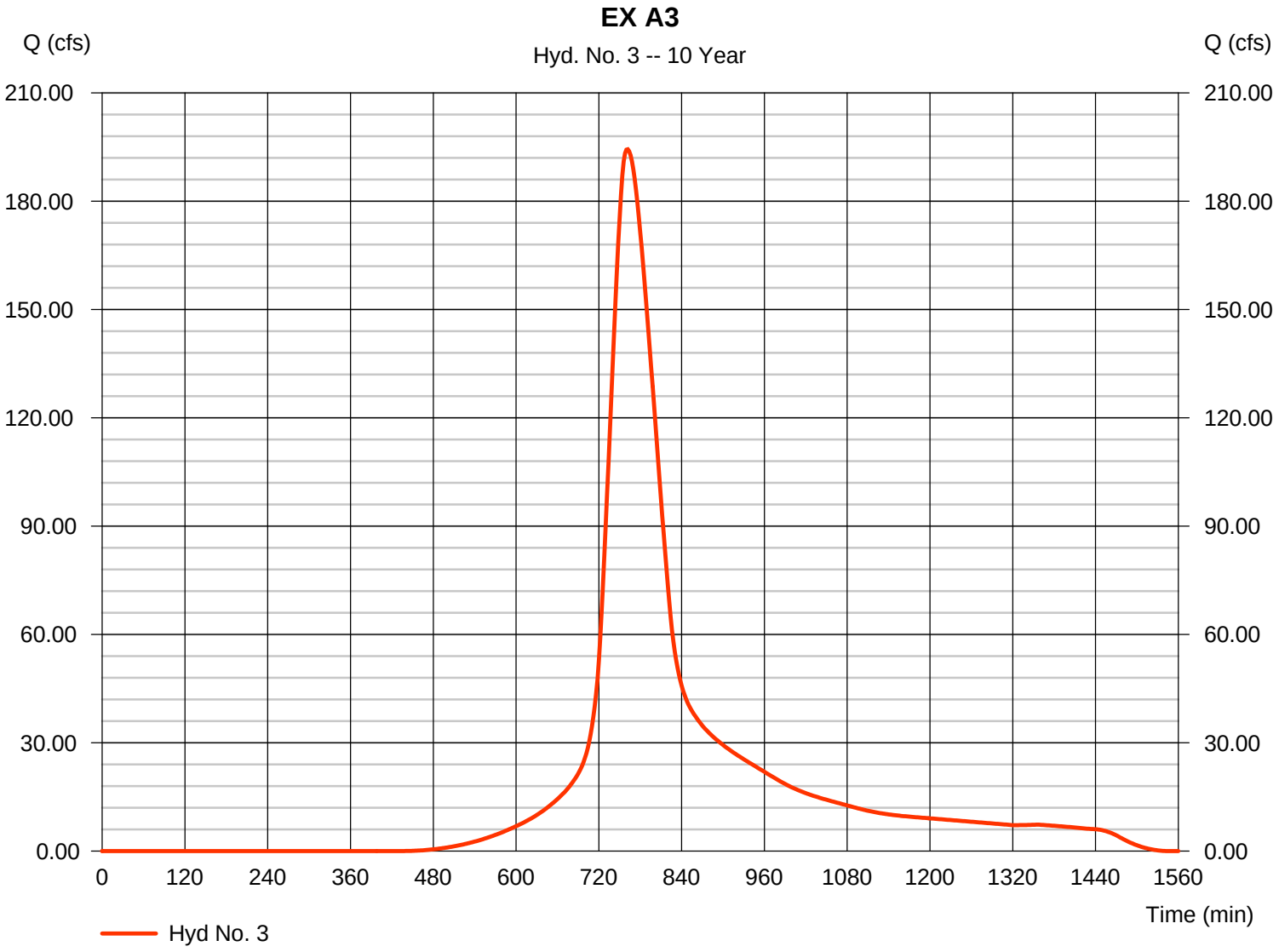


Hydrograph Report

Hyd. No. 3

EX A3

Hydrograph type	=	SCS Runoff	Peak discharge	=	194.37 cfs
Storm frequency	=	10 yrs	Time to peak	=	762 min
Time interval	=	2 min	Hyd. volume	=	1,589,059 cuft
Drainage area	=	117.840 ac	Curve number	=	78.5
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	59.60 min
Total precip.	=	6.06 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	434

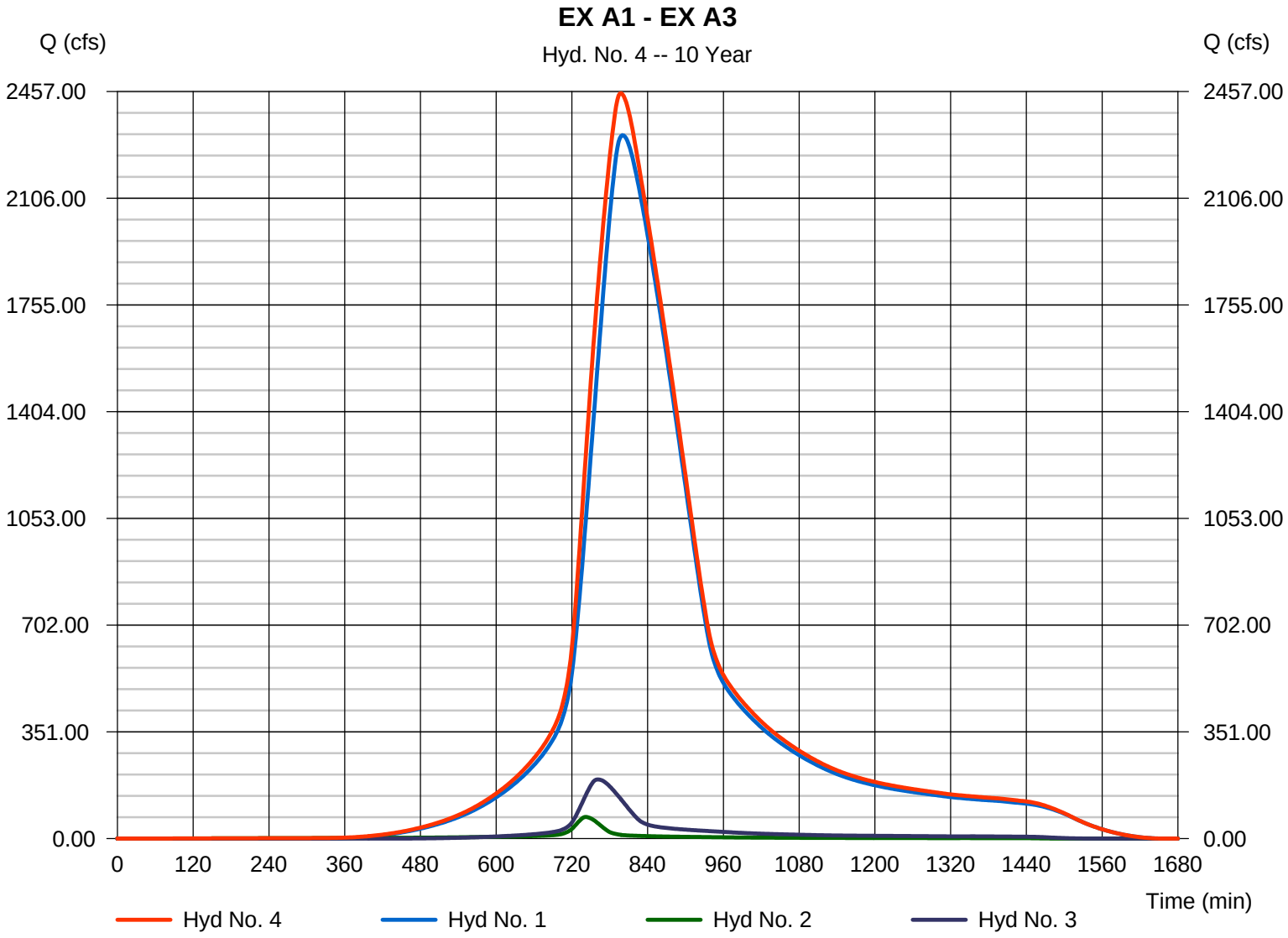


Hydrograph Report

Hyd. No. 4

EX A1 - EX A3

Hydrograph type	=	Combine	Peak discharge	=	2451.33 cfs
Storm frequency	=	10 yrs	Time to peak	=	798 min
Time interval	=	2 min	Hyd. volume	=	32,444,810 cuft
Inflow hyds.	=	1, 2, 3	Contrib. drain. area	=	2046.730 ac

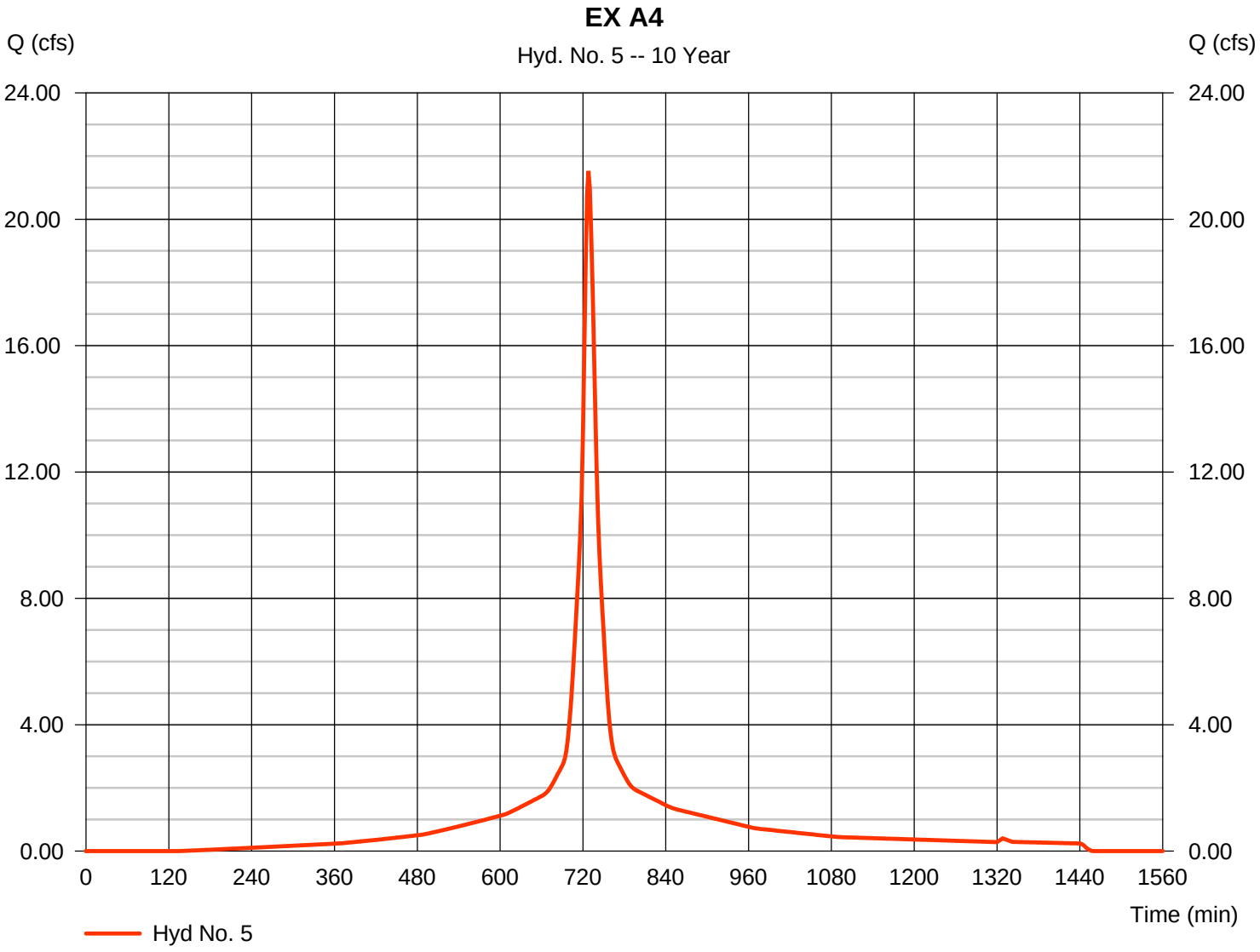


Hydrograph Report

Hyd. No. 5

EX A4

Hydrograph type	=	SCS Runoff	Peak discharge	=	21.53 cfs
Storm frequency	=	10 yrs	Time to peak	=	728 min
Time interval	=	2 min	Hyd. volume	=	89,223 cuft
Drainage area	=	4.450 ac	Curve number	=	94
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	10.00 min
Total precip.	=	6.06 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484

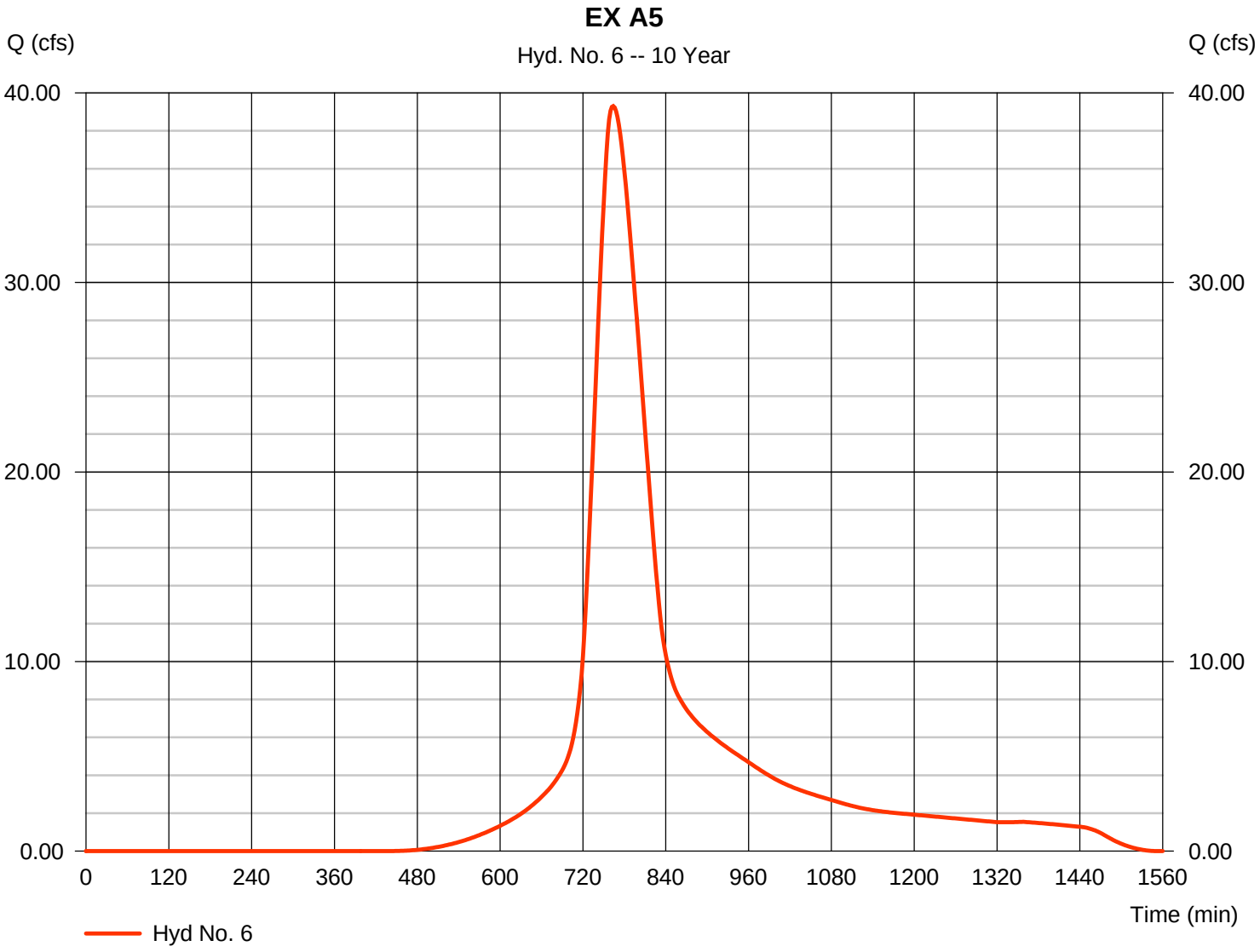


Hydrograph Report

Hyd. No. 6

EX A5

Hydrograph type	=	SCS Runoff	Peak discharge	=	39.30 cfs
Storm frequency	=	10 yrs	Time to peak	=	764 min
Time interval	=	2 min	Hyd. volume	=	332,362 cuft
Drainage area	=	24.990 ac	Curve number	=	78
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	63.10 min
Total precip.	=	6.06 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	434

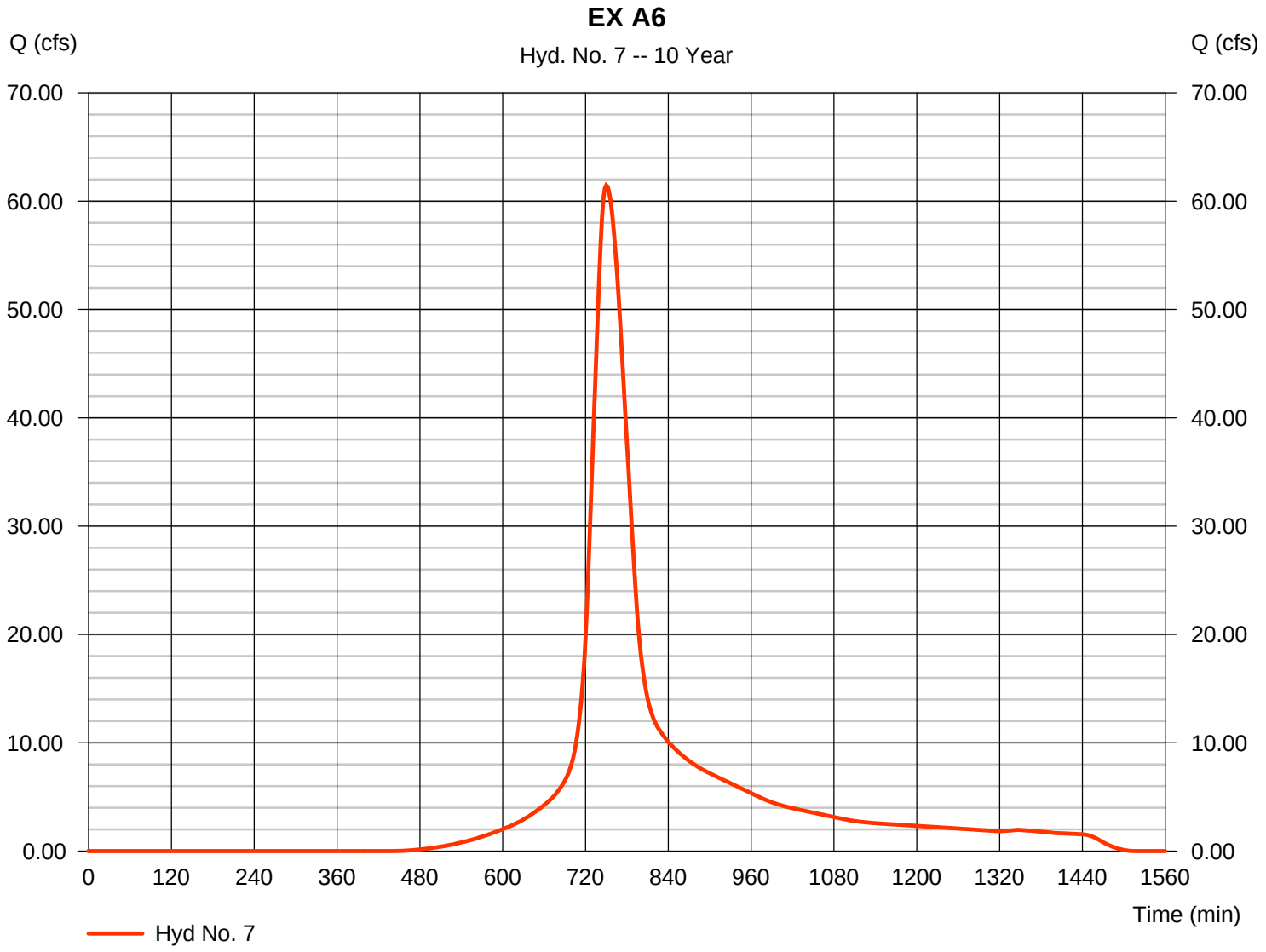


Hydrograph Report

Hyd. No. 7

EX A6

Hydrograph type	=	SCS Runoff	Peak discharge	=	61.45 cfs
Storm frequency	=	10 yrs	Time to peak	=	750 min
Time interval	=	2 min	Hyd. volume	=	413,757 cuft
Drainage area	=	31.110 ac	Curve number	=	78
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	40.80 min
Total precip.	=	6.06 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	434

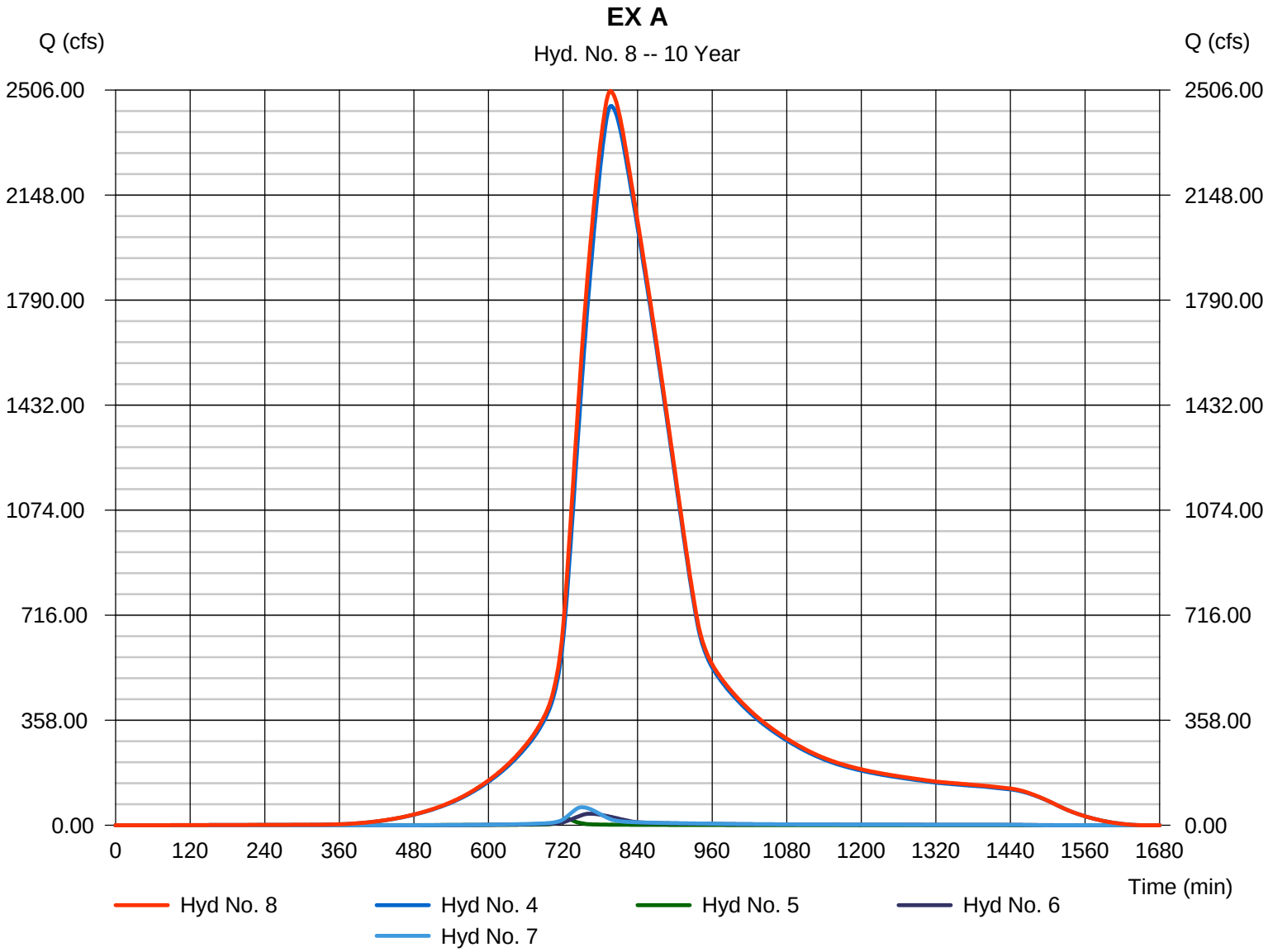


Hydrograph Report

Hyd. No. 8

EX A

Hydrograph type	=	Combine	Peak discharge	=	2502.49 cfs
Storm frequency	=	10 yrs	Time to peak	=	796 min
Time interval	=	2 min	Hyd. volume	=	33,280,152 cuft
Inflow hyds.	=	4, 5, 6, 7	Contrib. drain. area	=	60.550 ac

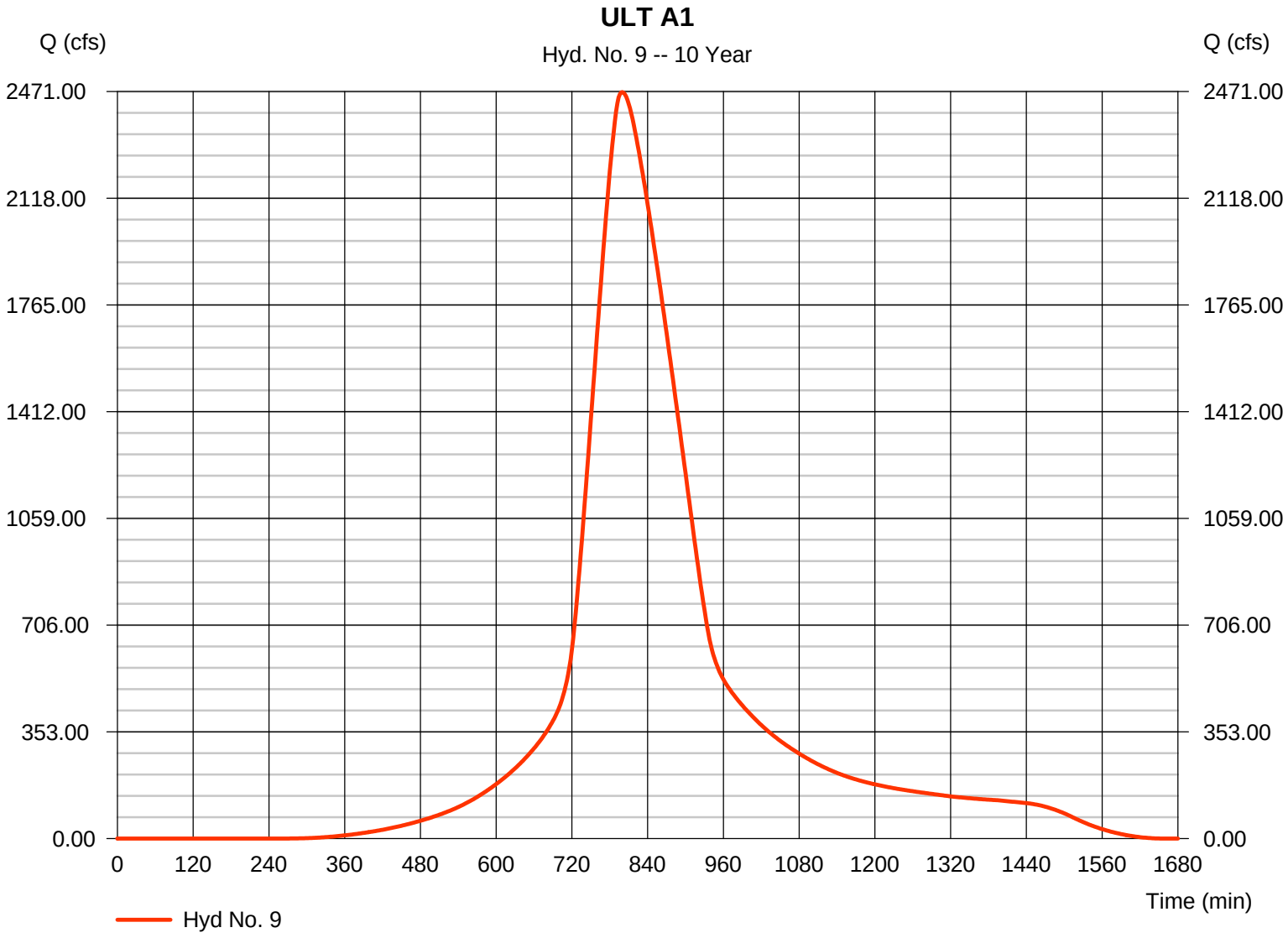


Hydrograph Report

Hyd. No. 9

ULT A1

Hydrograph type	=	SCS Runoff	Peak discharge	=	2468.89 cfs
Storm frequency	=	10 yrs	Time to peak	=	800 min
Time interval	=	2 min	Hyd. volume	=	32,714,668 cuft
Drainage area	=	1906.930 ac	Curve number	=	88.4
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	122.30 min
Total precip.	=	6.06 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	434

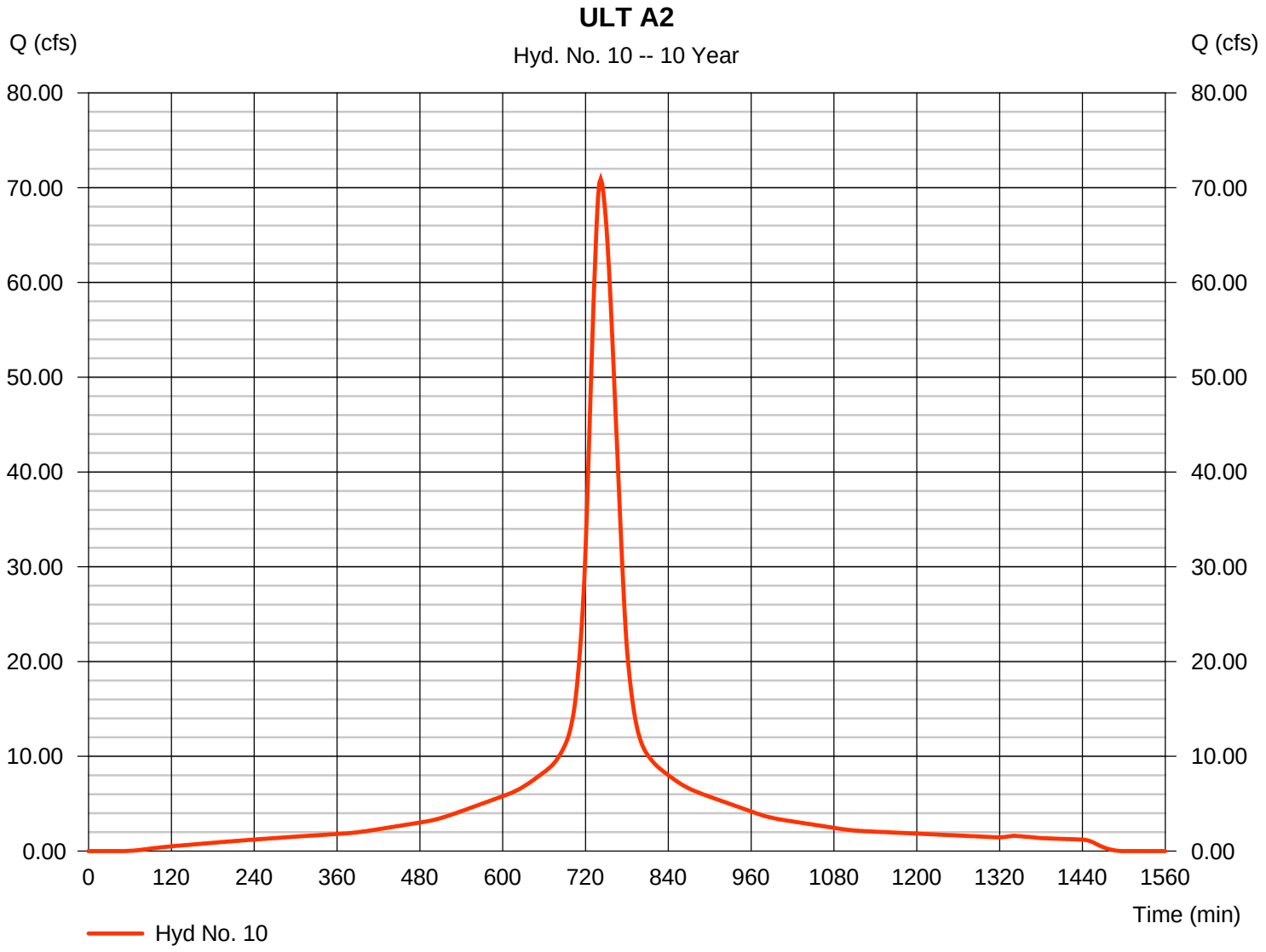


Hydrograph Report

Hyd. No. 10

ULT A2

Hydrograph type	=	SCS Runoff	Peak discharge	=	70.91 cfs
Storm frequency	=	10 yrs	Time to peak	=	742 min
Time interval	=	2 min	Hyd. volume	=	468,158 cuft
Drainage area	=	21.960 ac	Curve number	=	98
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	32.00 min
Total precip.	=	6.06 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	434

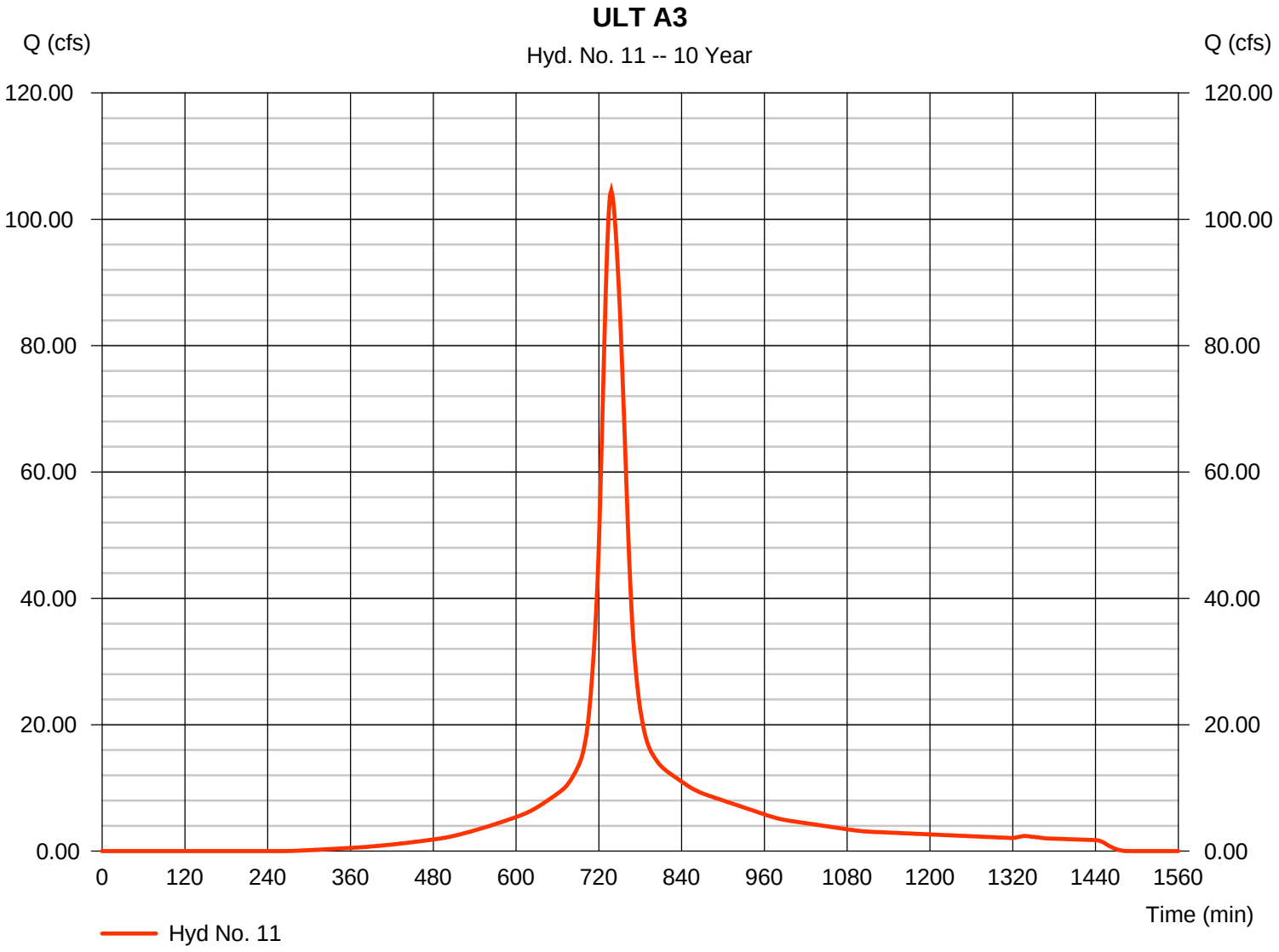


Hydrograph Report

Hyd. No. 11

ULT A3

Hydrograph type	=	SCS Runoff	Peak discharge	=	104.56 cfs
Storm frequency	=	10 yrs	Time to peak	=	738 min
Time interval	=	2 min	Hyd. volume	=	564,194 cuft
Drainage area	=	33.050 ac	Curve number	=	87.8
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	25.60 min
Total precip.	=	6.06 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	434

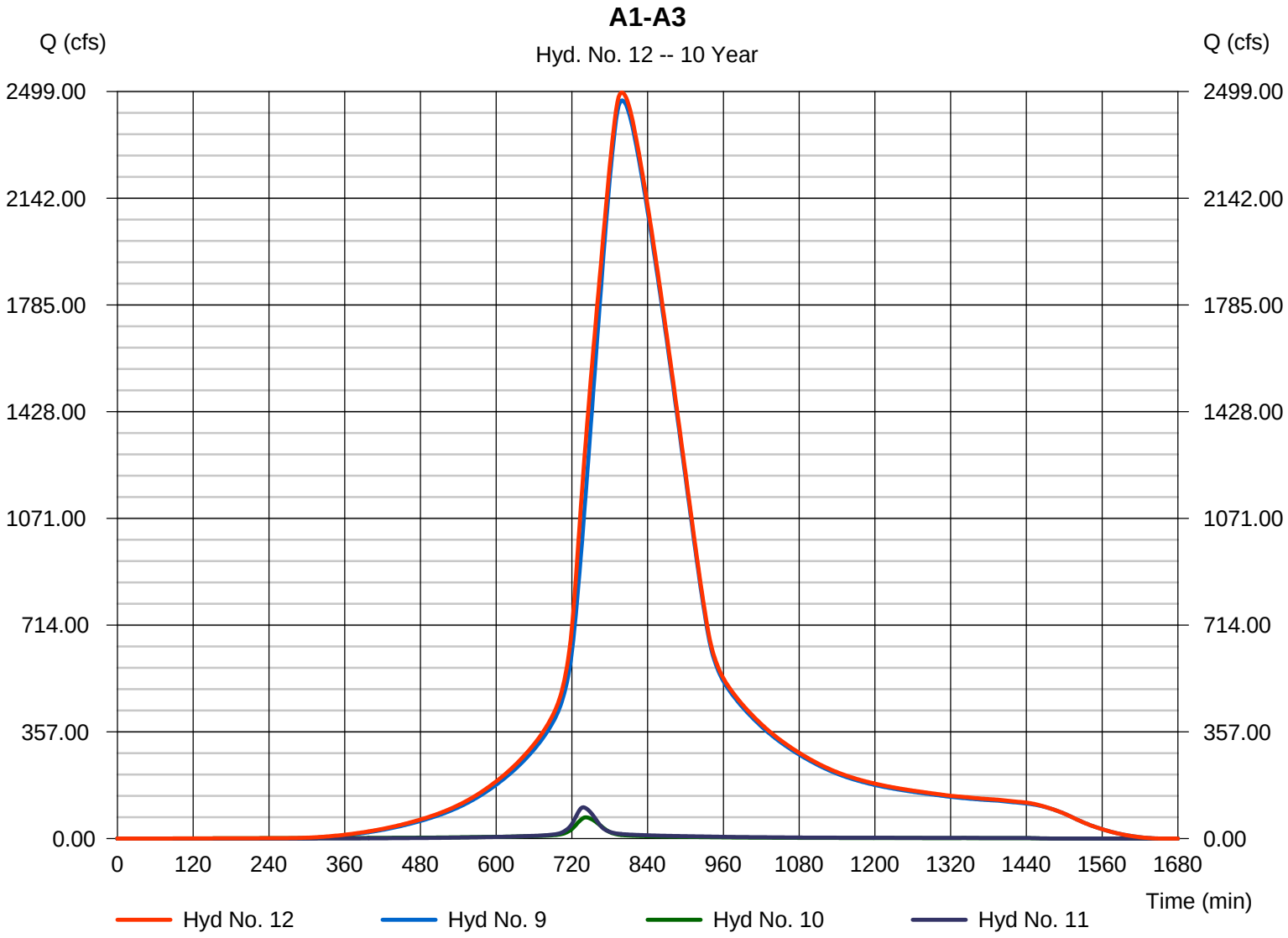


Hydrograph Report

Hyd. No. 12

A1-A3

Hydrograph type	=	Combine	Peak discharge	=	2495.41 cfs
Storm frequency	=	10 yrs	Time to peak	=	800 min
Time interval	=	2 min	Hyd. volume	=	33,747,016 cuft
Inflow hyds.	=	9, 10, 11	Contrib. drain. area	=	1961.940 ac

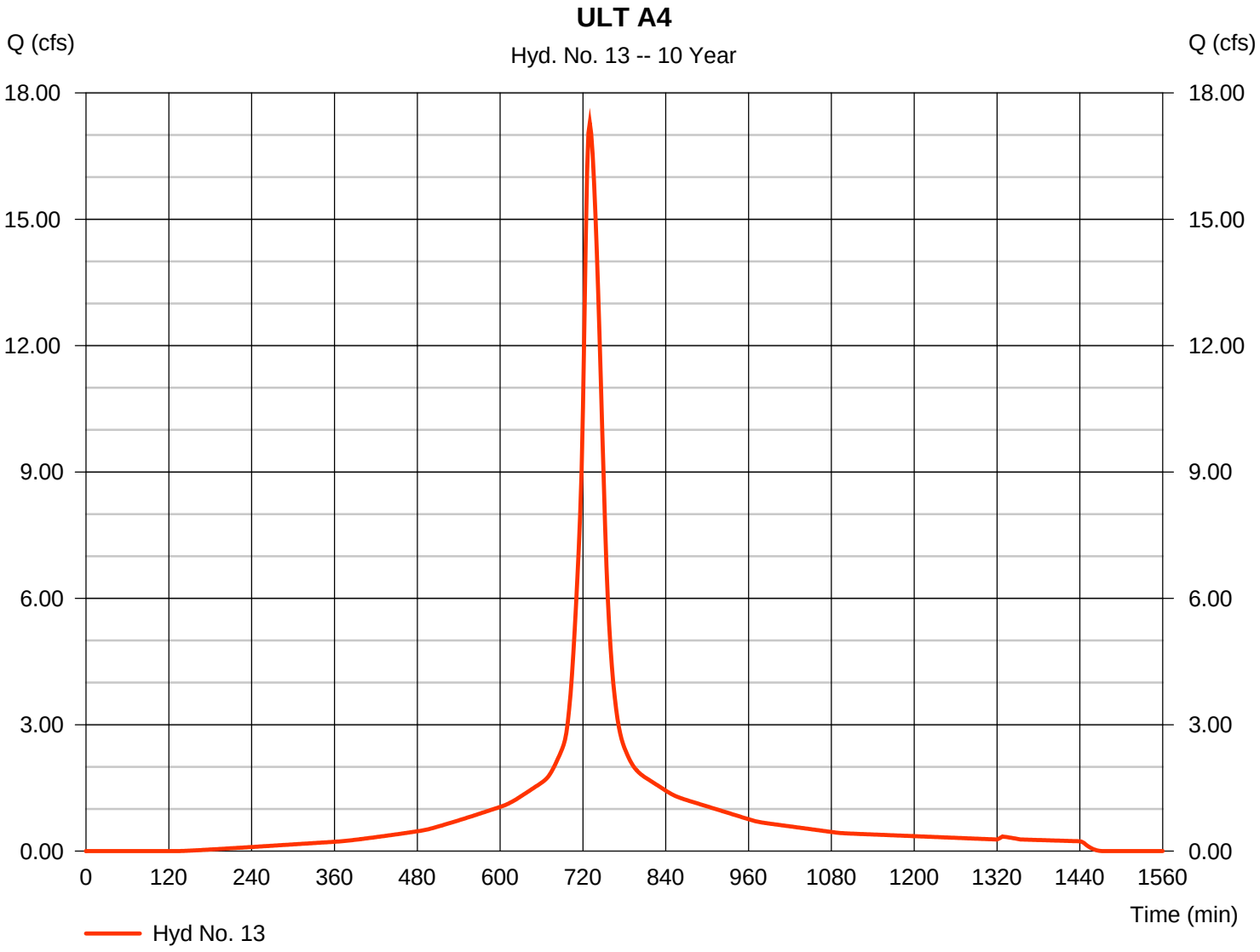


Hydrograph Report

Hyd. No. 13

ULT A4

Hydrograph type	=	SCS Runoff	Peak discharge	=	17.29 cfs
Storm frequency	=	10 yrs	Time to peak	=	730 min
Time interval	=	2 min	Hyd. volume	=	85,469 cuft
Drainage area	=	4.450 ac	Curve number	=	94
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	10.00 min
Total precip.	=	6.06 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	300

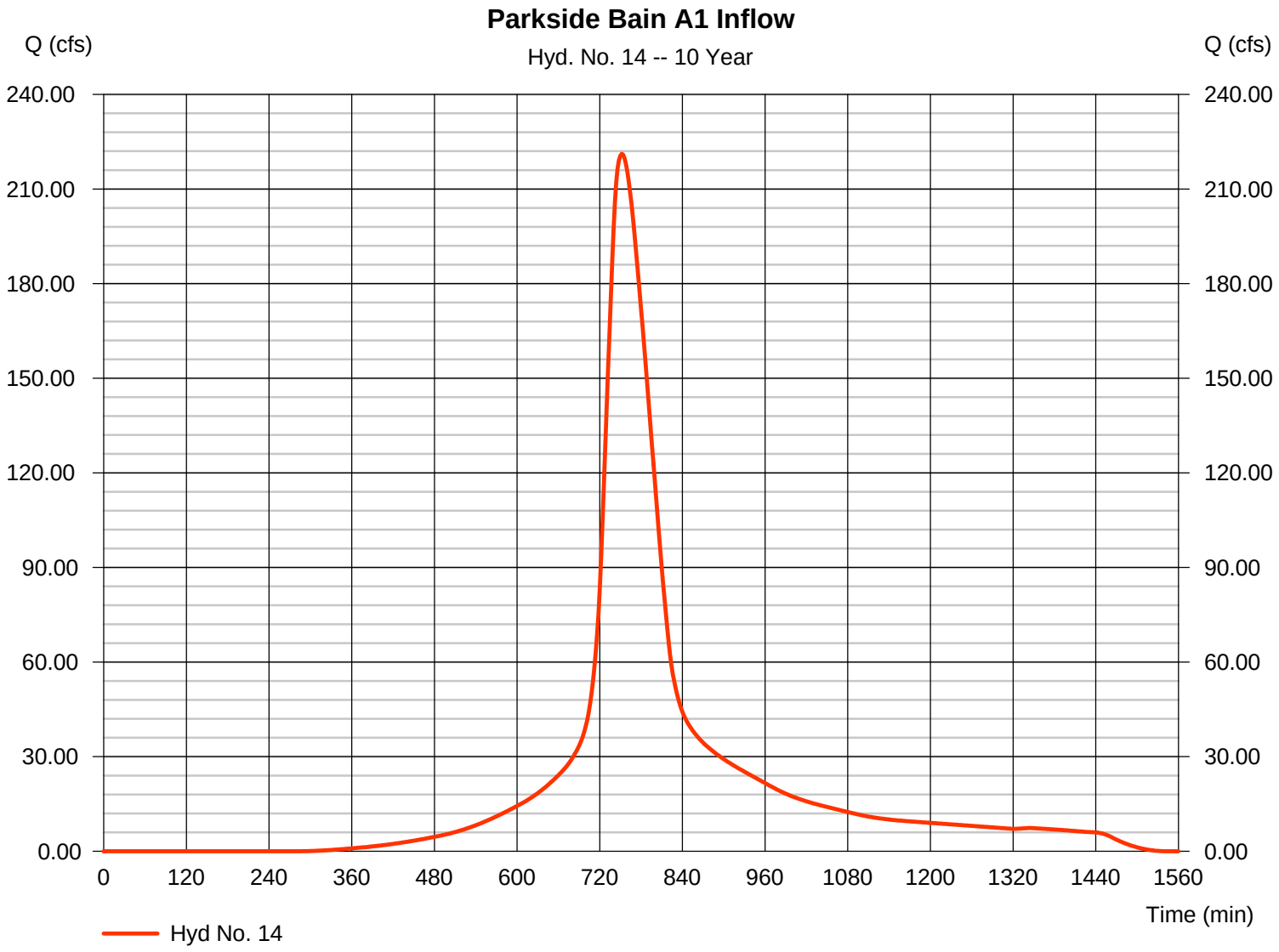


Hydrograph Report

Hyd. No. 14

Parkside Bain A1 Inflow

Hydrograph type	= SCS Runoff	Peak discharge	= 221.13 cfs
Storm frequency	= 10 yrs	Time to peak	= 752 min
Time interval	= 2 min	Hyd. volume	= 1,827,487 cuft
Drainage area	= 109.260 ac	Curve number	= 87
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 37.90 min
Total precip.	= 6.06 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 300



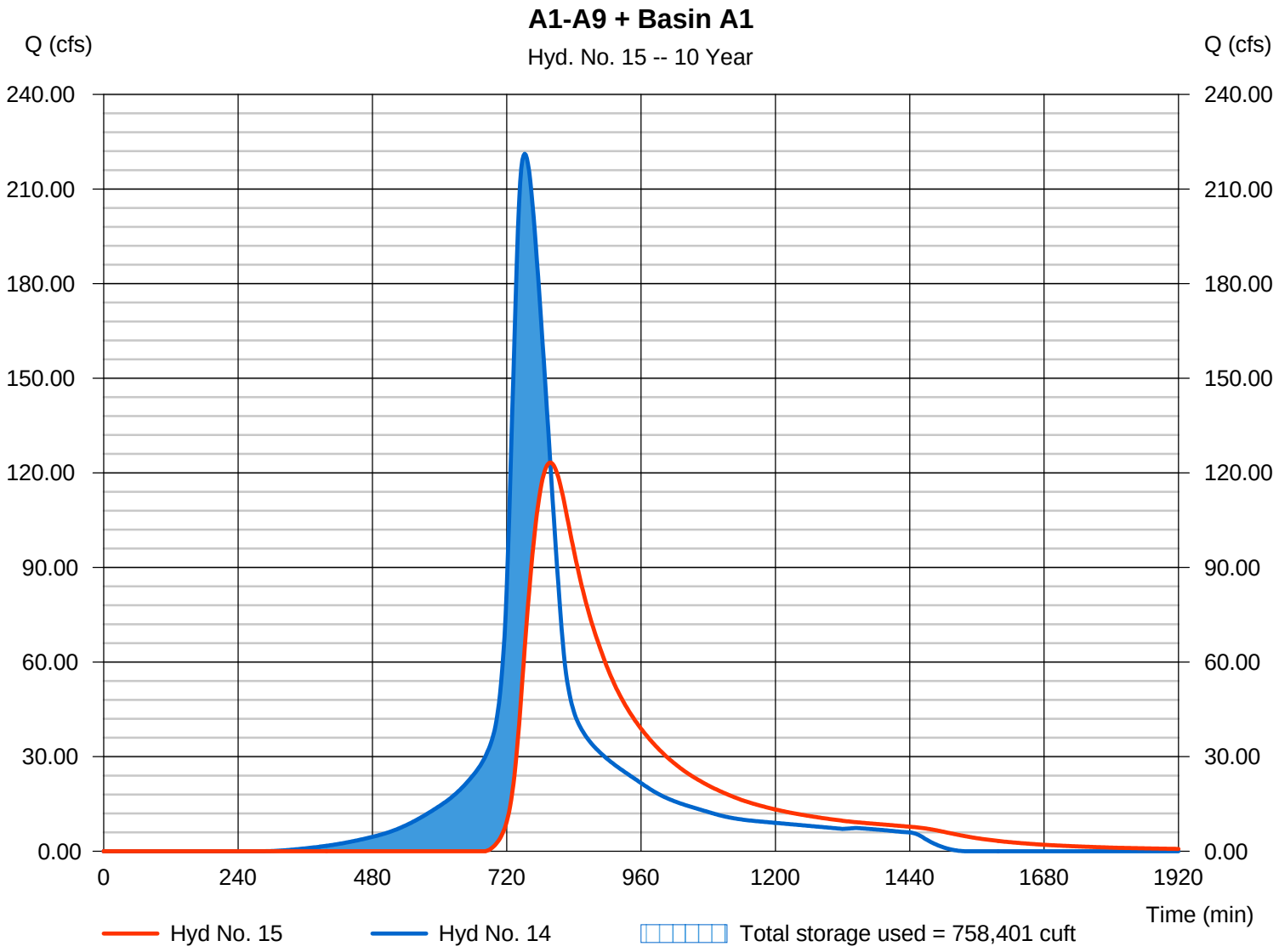
Hydrograph Report

Hyd. No. 15

A1-A9 + Basin A1

Hydrograph type	=	Reservoir	Peak discharge	=	123.26 cfs
Storm frequency	=	10 yrs	Time to peak	=	798 min
Time interval	=	2 min	Hyd. volume	=	1,643,168 cuft
Inflow hyd. No.	=	14 - Parkside Bain A1 Inflow	Max. Elevation	=	604.82 ft
Reservoir name	=	BASIN A1	Max. Storage	=	758,401 cuft

Storage Indication method used.

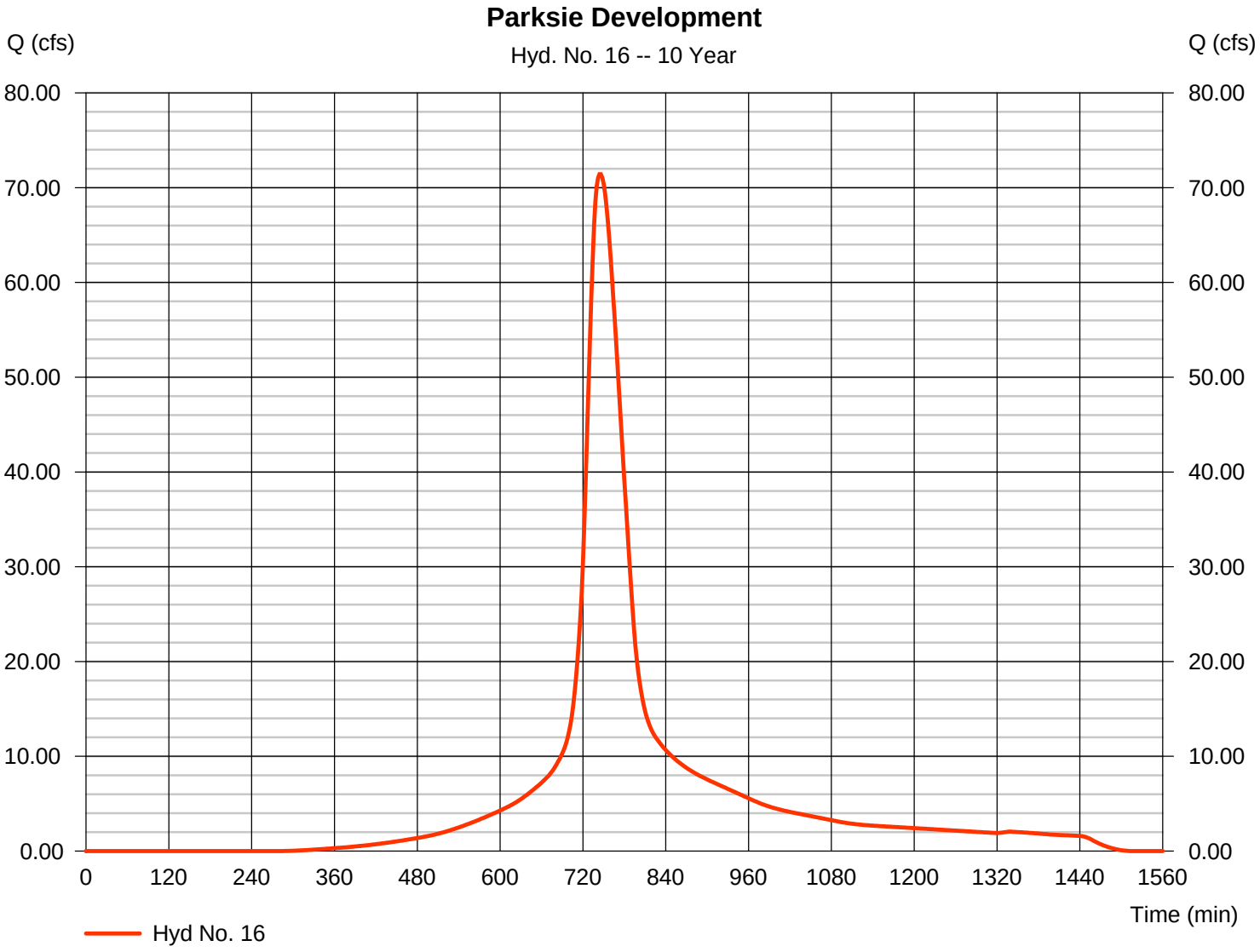


Hydrograph Report

Hyd. No. 16

Parksie Development

Hydrograph type	=	SCS Runoff	Peak discharge	=	71.42 cfs
Storm frequency	=	10 yrs	Time to peak	=	746 min
Time interval	=	2 min	Hyd. volume	=	500,777 cuft
Drainage area	=	29.940 ac	Curve number	=	87
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	28.50 min
Total precip.	=	6.06 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	300

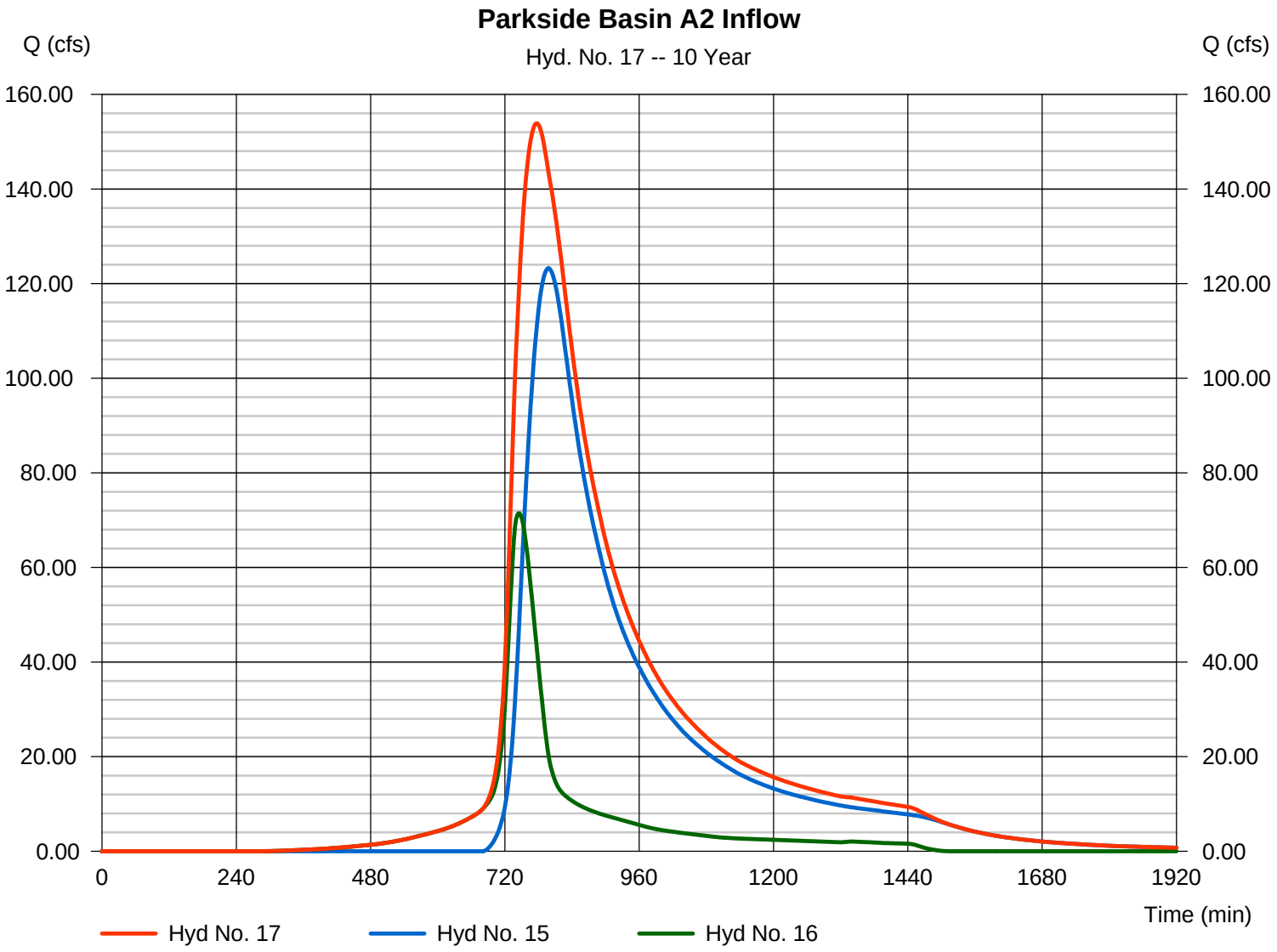


Hydrograph Report

Hyd. No. 17

Parkside Basin A2 Inflow

Hydrograph type	=	Combine	Peak discharge	=	153.89 cfs
Storm frequency	=	10 yrs	Time to peak	=	776 min
Time interval	=	2 min	Hyd. volume	=	2,143,953 cuft
Inflow hyds.	=	15, 16	Contrib. drain. area	=	29.940 ac



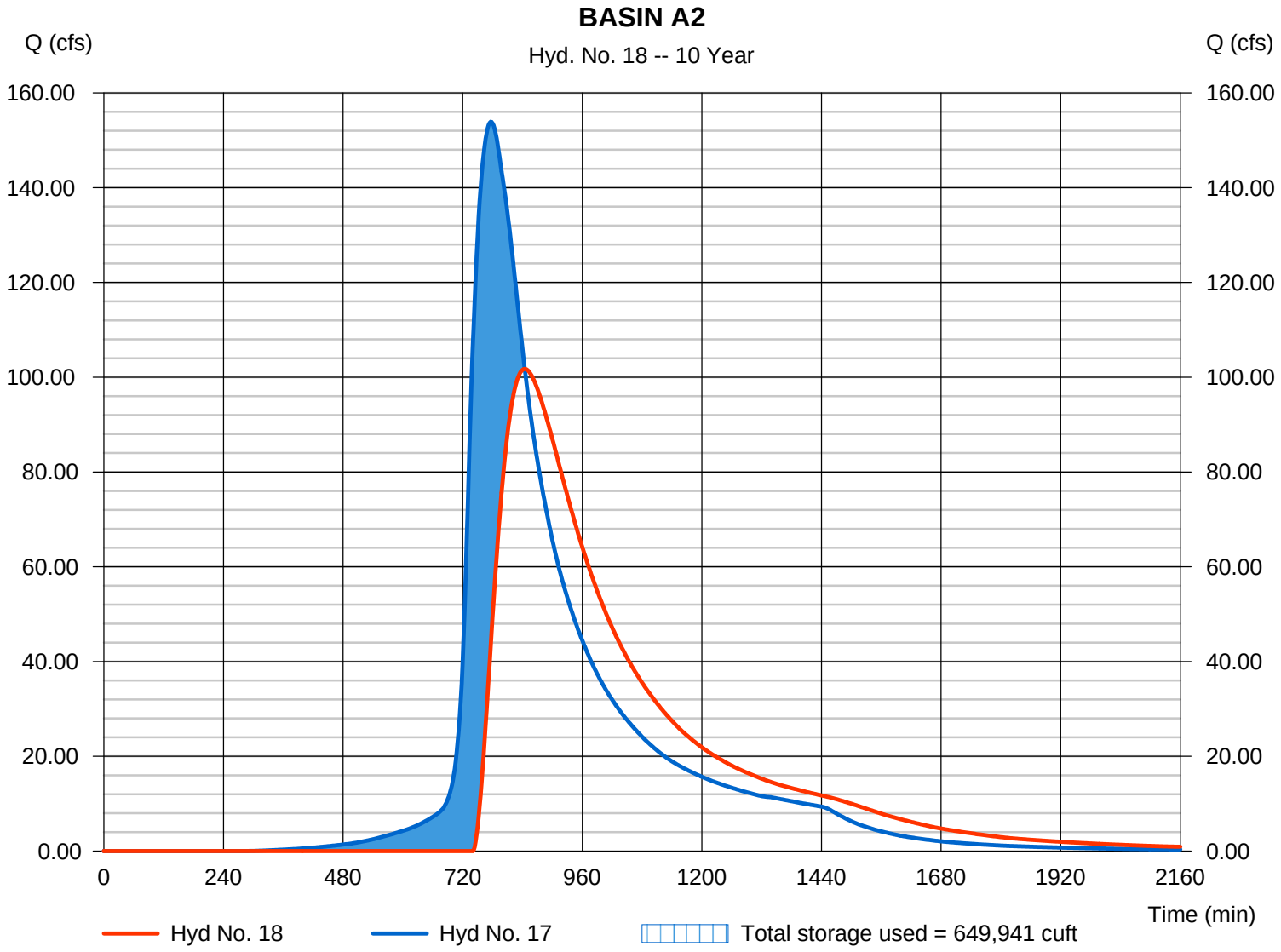
Hydrograph Report

Hyd. No. 18

BASIN A2

Hydrograph type	=	Reservoir	Peak discharge	=	101.75 cfs
Storm frequency	=	10 yrs	Time to peak	=	844 min
Time interval	=	2 min	Hyd. volume	=	1,951,070 cuft
Inflow hyd. No.	=	17 - Parkside Basin A2 Inflow	Max. Elevation	=	602.26 ft
Reservoir name	=	BASIN A2	Max. Storage	=	649,941 cuft

Storage Indication method used.

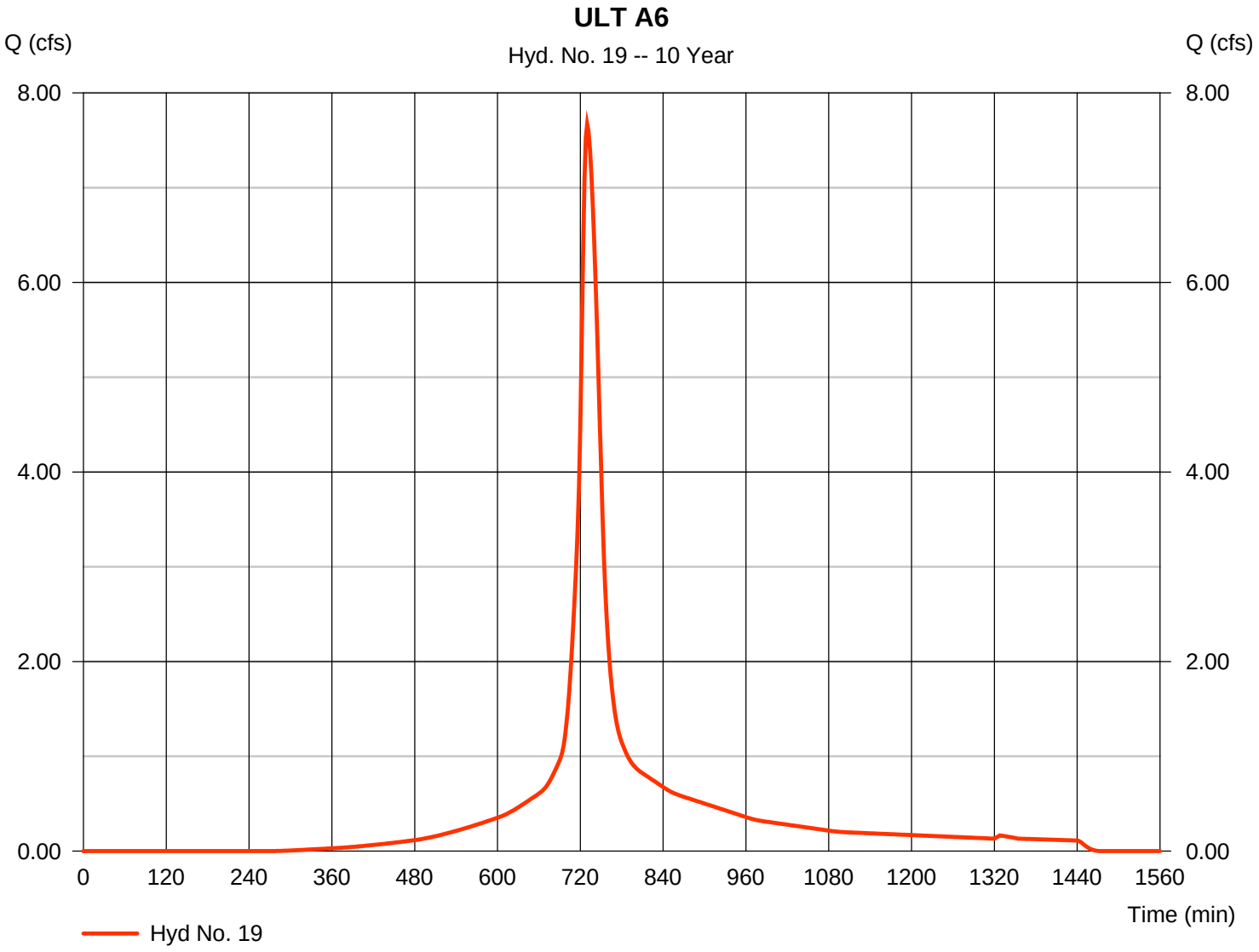


Hydrograph Report

Hyd. No. 19

ULT A6

Hydrograph type	=	SCS Runoff	Peak discharge	=	7.669 cfs
Storm frequency	=	10 yrs	Time to peak	=	730 min
Time interval	=	2 min	Hyd. volume	=	36,090 cuft
Drainage area	=	2.200 ac	Curve number	=	87
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	10.00 min
Total precip.	=	6.06 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	300

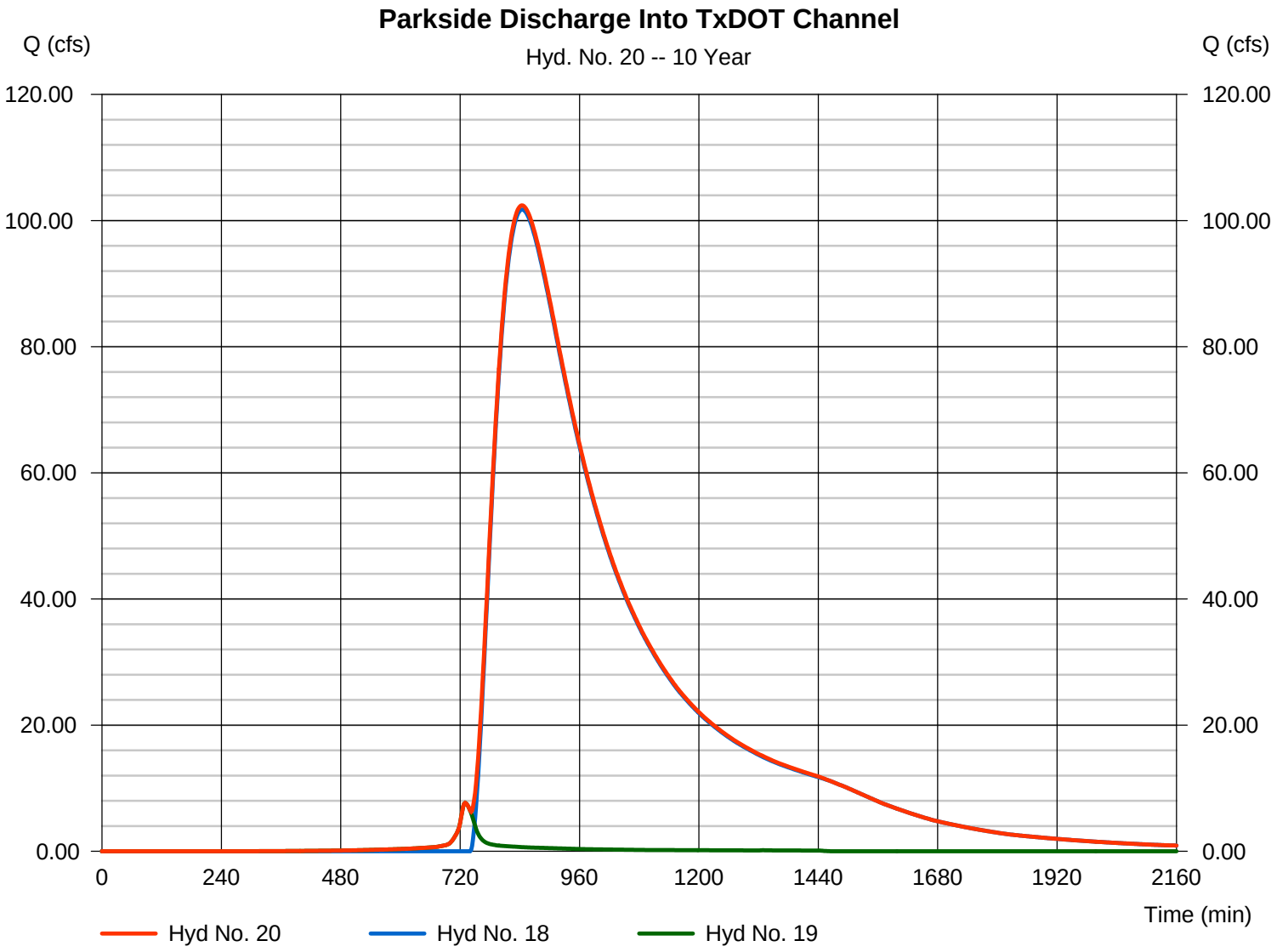


Hydrograph Report

Hyd. No. 20

Parkside Discharge Into TxDOT Channel

Hydrograph type	= Combine	Peak discharge	= 102.40 cfs
Storm frequency	= 10 yrs	Time to peak	= 844 min
Time interval	= 2 min	Hyd. volume	= 1,987,160 cuft
Inflow hyds.	= 18, 19	Contrib. drain. area	= 2.200 ac

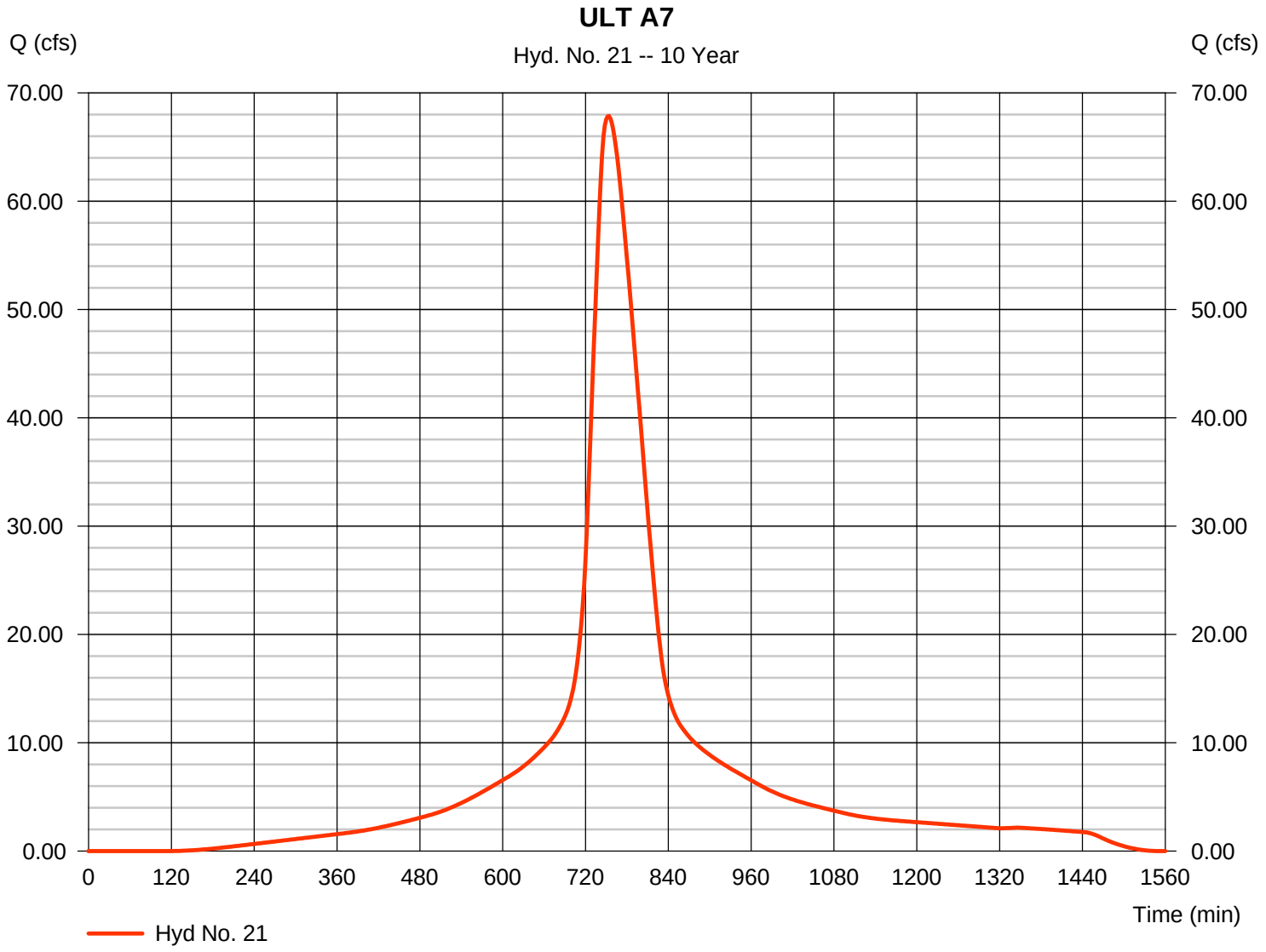


Hydrograph Report

Hyd. No. 21

ULT A7

Hydrograph type	=	SCS Runoff	Peak discharge	=	67.85 cfs
Storm frequency	=	10 yrs	Time to peak	=	754 min
Time interval	=	2 min	Hyd. volume	=	618,640 cuft
Drainage area	=	31.110 ac	Curve number	=	95
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	40.80 min
Total precip.	=	6.06 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	300

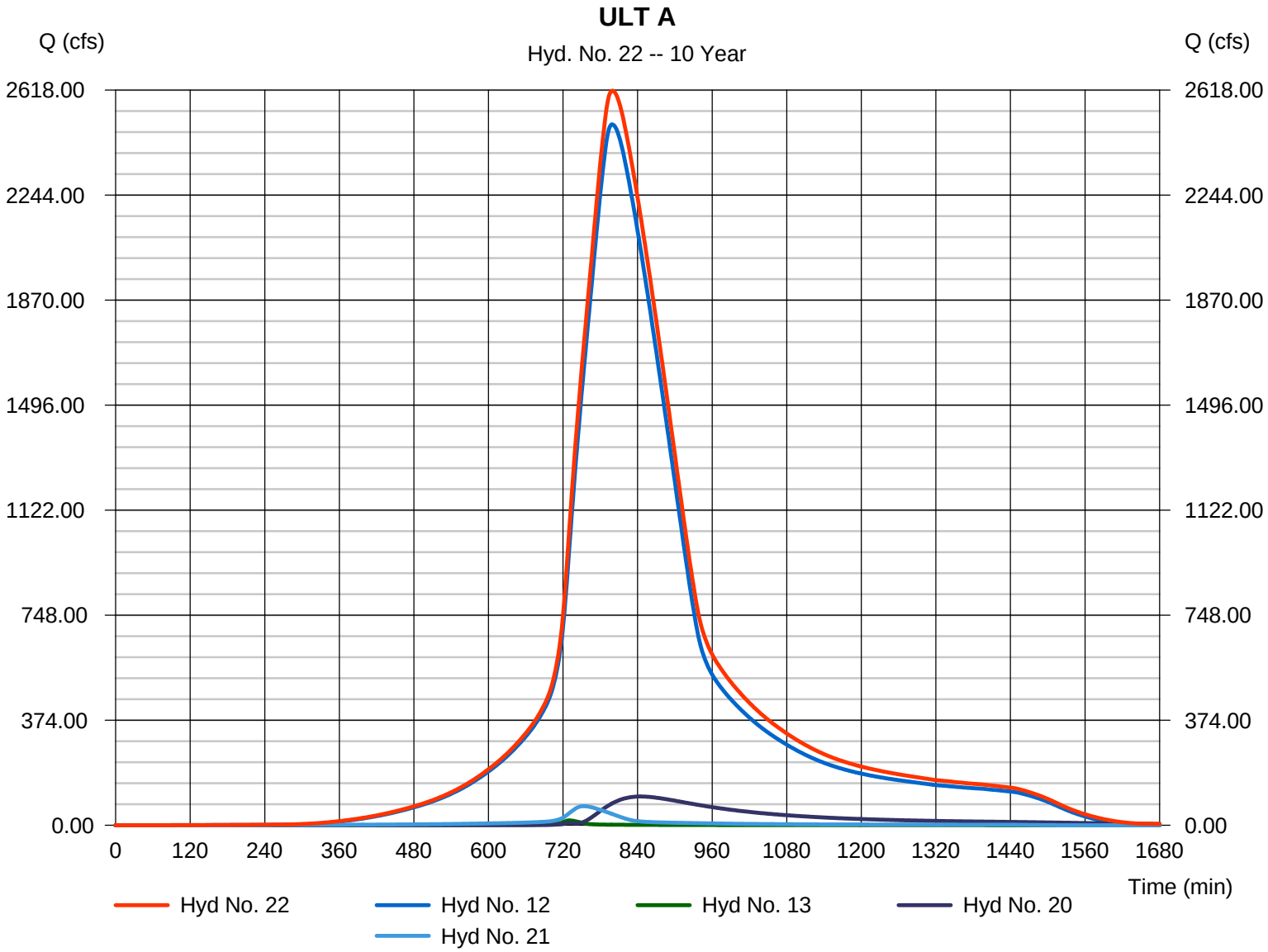


Hydrograph Report

Hyd. No. 22

ULT A

Hydrograph type	=	Combine	Peak discharge	=	2615.47 cfs
Storm frequency	=	10 yrs	Time to peak	=	800 min
Time interval	=	2 min	Hyd. volume	=	36,437,980 cuft
Inflow hyds.	=	12, 13, 20, 21	Contrib. drain. area	=	35.560 ac



Hydrograph Summary Report

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

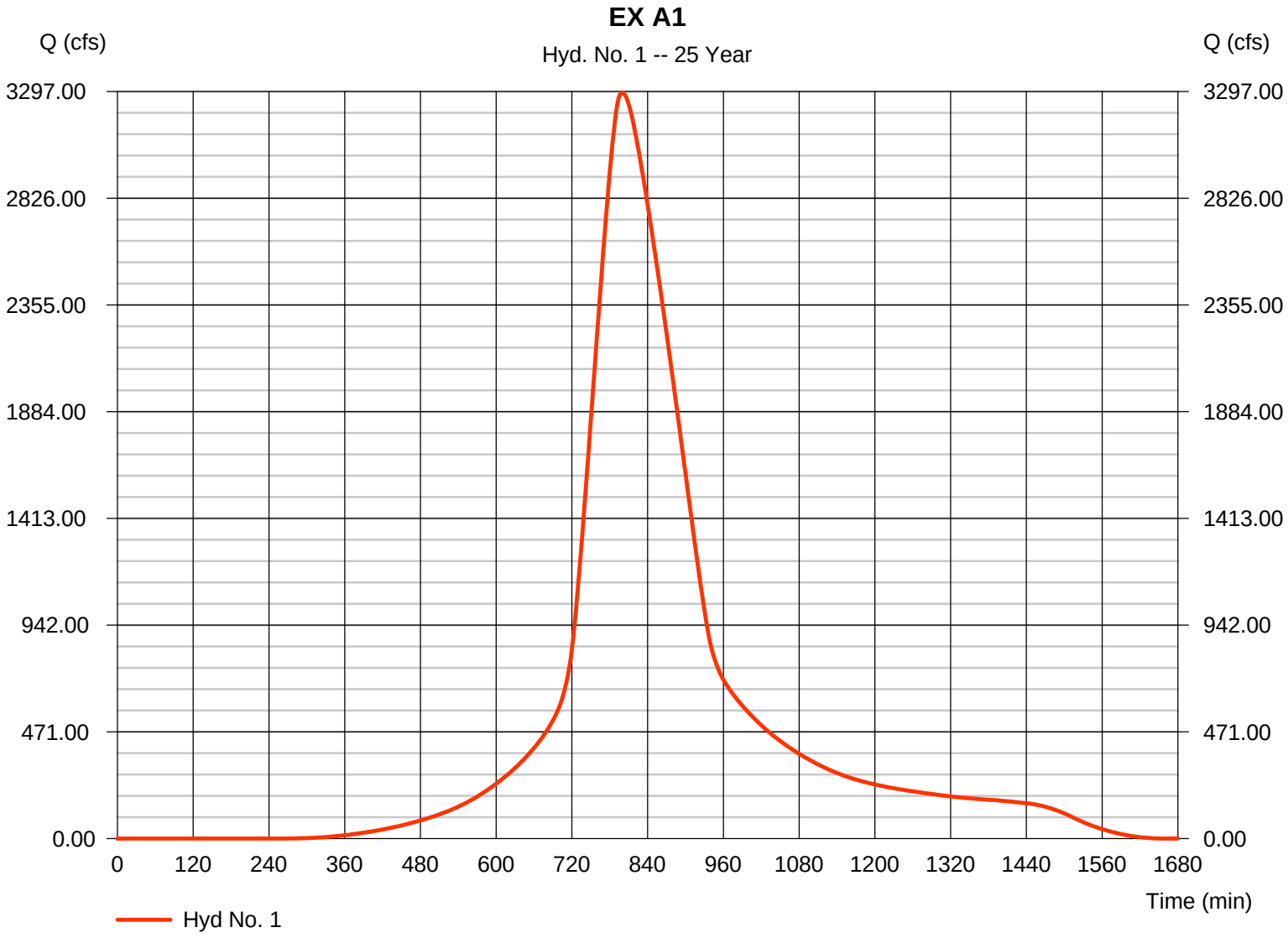
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	3291.98	2	800	43,642,248	------	------	------	EX A1
2	SCS Runoff	94.50	2	742	628,857	------	------	------	EX A2
3	SCS Runoff	289.37	2	760	2,375,550	------	------	------	EX A3
4	Combine	3495.48	2	796	46,646,692	1, 2, 3	------	------	EX A1 - EX A3
5	SCS Runoff	29.03	2	728	122,298	------	------	------	EX A4
6	SCS Runoff	58.74	2	762	498,412	------	------	------	EX A5
7	SCS Runoff	91.70	2	750	620,473	------	------	------	EX A6
8	Combine	3570.74	2	796	47,887,844	4, 5, 6, 7	------	------	EX A
9	SCS Runoff	3444.27	2	798	46,186,816	------	------	------	ULT A1
10	SCS Runoff	94.50	2	742	628,857	------	------	------	ULT A2
11	SCS Runoff	145.66	2	738	799,139	------	------	------	ULT A3
12	Combine	3481.16	2	798	47,614,772	9, 10, 11	------	------	A1-A3
13	SCS Runoff	23.32	2	730	117,153	------	------	------	ULT A4
14	SCS Runoff	310.34	2	752	2,599,887	------	------	------	Parkside Bain A1 Inflow
15	Reservoir	189.09	2	794	2,415,579	14	605.58	972,007	A1-A9 + Basin A1
16	SCS Runoff	100.16	2	744	712,434	------	------	------	Parksie Development
17	Combine	238.36	2	774	3,128,010	15, 16	------	------	Parkside Basin A2 Inflow
18	Reservoir	173.26	2	826	2,935,131	17	603.22	853,241	BASIN A2
19	SCS Runoff	10.74	2	730	51,343	------	------	------	ULT A6
20	Combine	174.27	2	826	2,986,476	18, 19	------	------	Parkside Discharge Into TxDOT Chan
21	SCS Runoff	91.27	2	754	843,647	------	------	------	ULT A7
22	Combine	3695.26	2	798	51,561,716	12, 13, 20, 21	------	------	ULT A

Hydrograph Report

Hyd. No. 1

EX A1

Hydrograph type	=	SCS Runoff	Peak discharge	=	3291.98 cfs
Storm frequency	=	25 yrs	Time to peak	=	800 min
Time interval	=	2 min	Hyd. volume	=	43,642,248 cuft
Drainage area	=	1906.930 ac	Curve number	=	85.3
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	122.30 min
Total precip.	=	8.06 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	434

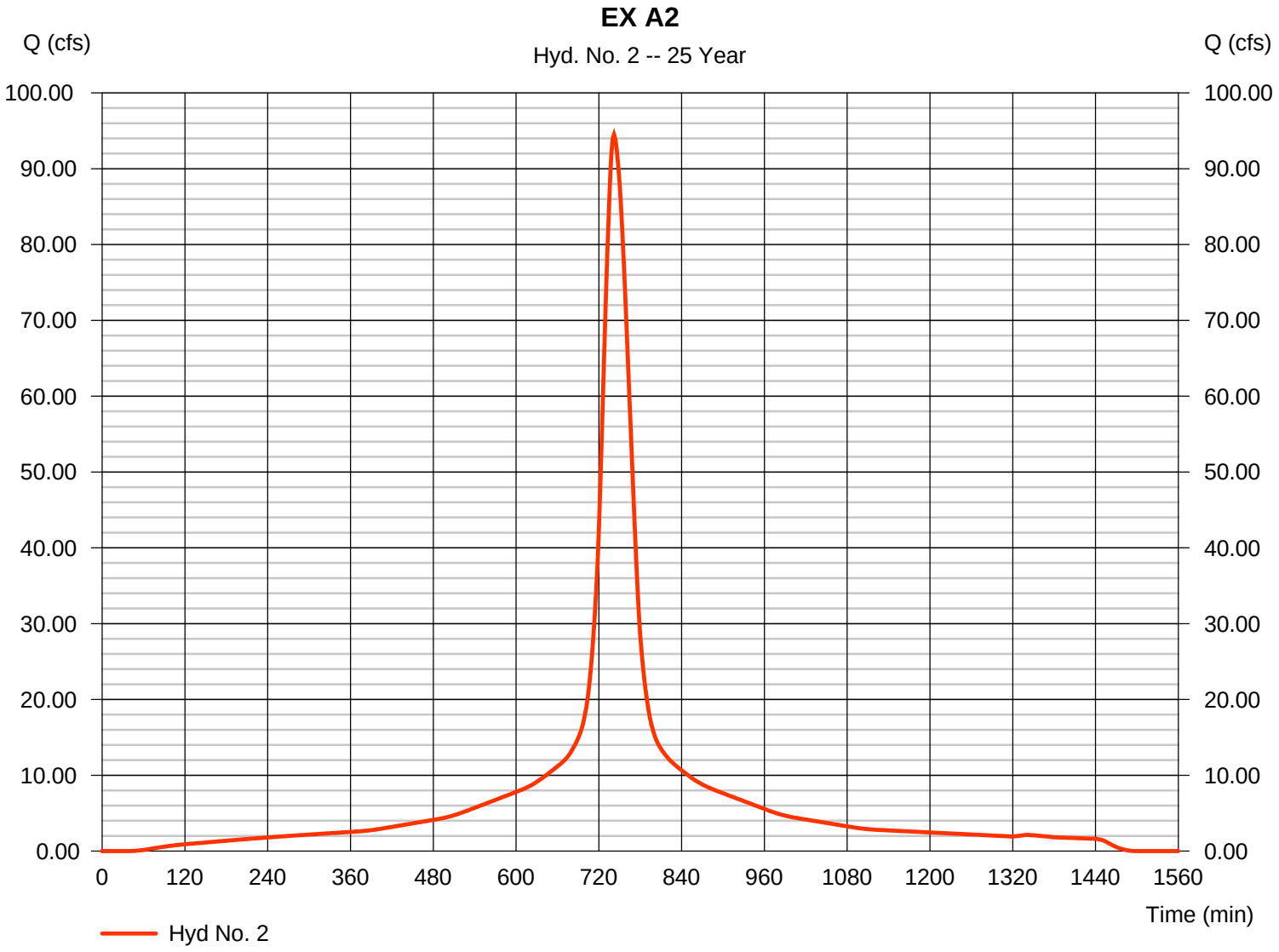


Hydrograph Report

Hyd. No. 2

EX A2

Hydrograph type	=	SCS Runoff	Peak discharge	=	94.50 cfs
Storm frequency	=	25 yrs	Time to peak	=	742 min
Time interval	=	2 min	Hyd. volume	=	628,857 cuft
Drainage area	=	21.960 ac	Curve number	=	98
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	32.00 min
Total precip.	=	8.06 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	434

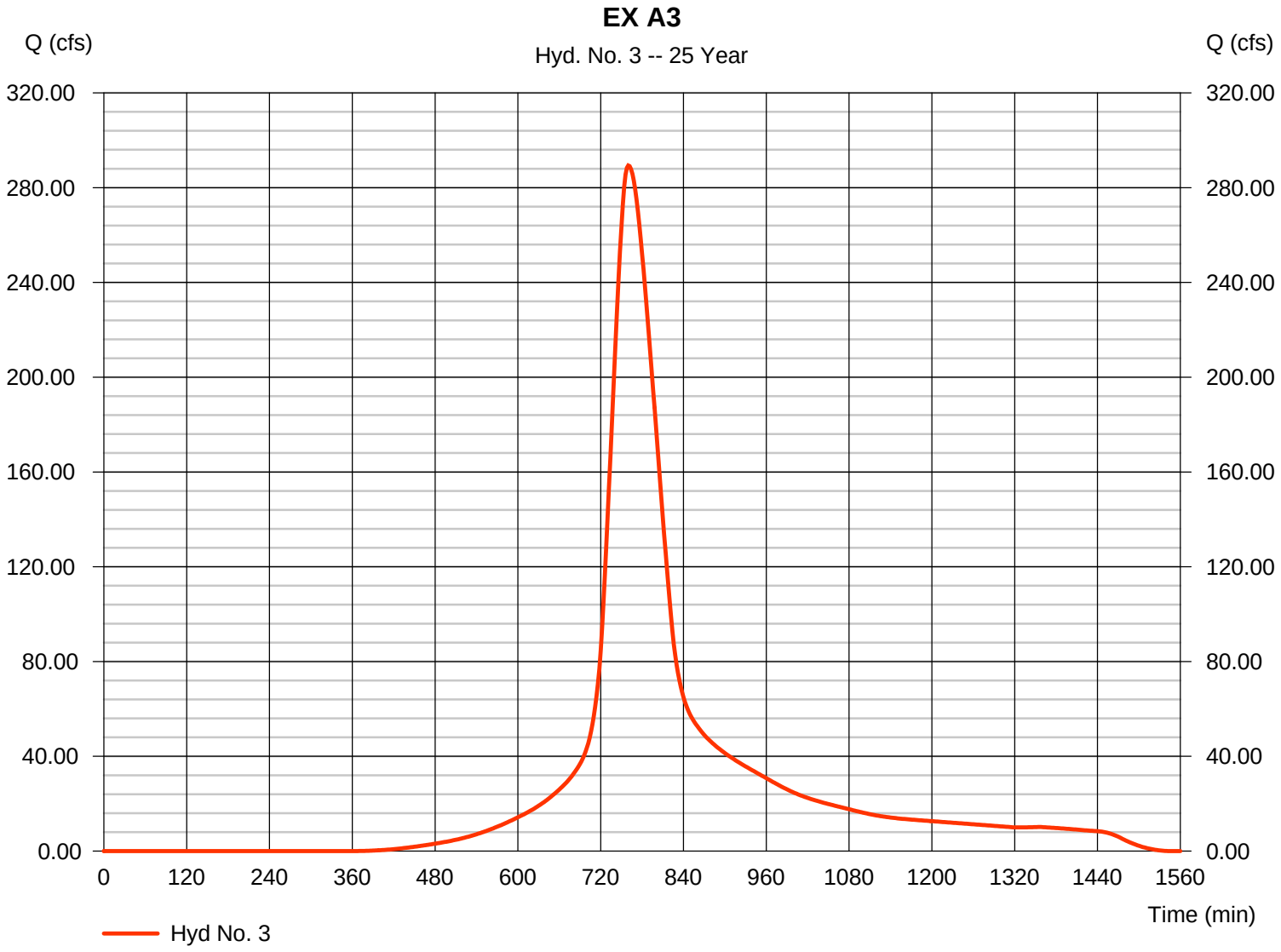


Hydrograph Report

Hyd. No. 3

EX A3

Hydrograph type	=	SCS Runoff	Peak discharge	=	289.37 cfs
Storm frequency	=	25 yrs	Time to peak	=	760 min
Time interval	=	2 min	Hyd. volume	=	2,375,550 cuft
Drainage area	=	117.840 ac	Curve number	=	78.5
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	59.60 min
Total precip.	=	8.06 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	434

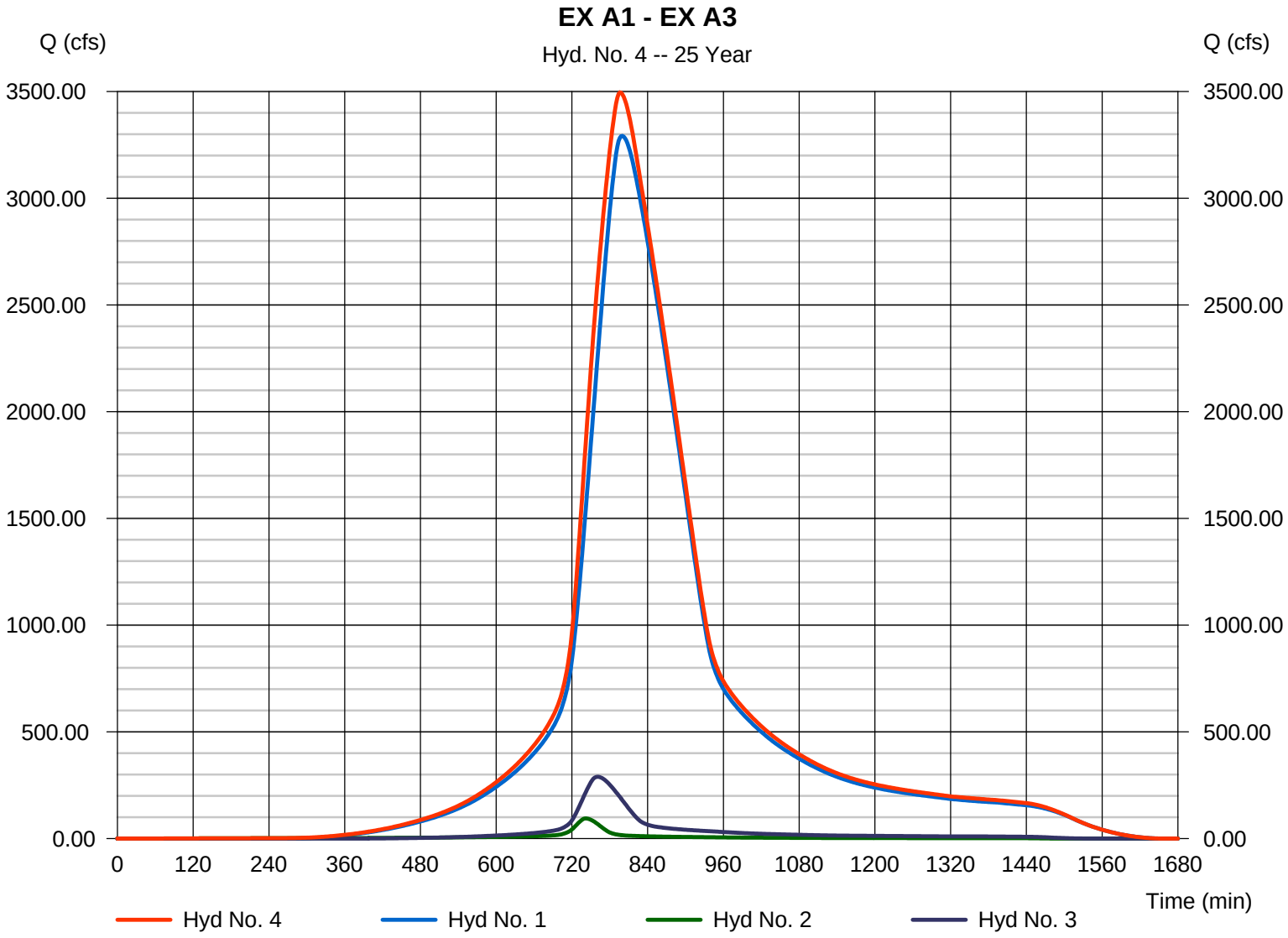


Hydrograph Report

Hyd. No. 4

EX A1 - EX A3

Hydrograph type	=	Combine	Peak discharge	=	3495.48 cfs
Storm frequency	=	25 yrs	Time to peak	=	796 min
Time interval	=	2 min	Hyd. volume	=	46,646,692 cuft
Inflow hyds.	=	1, 2, 3	Contrib. drain. area	=	2046.730 ac

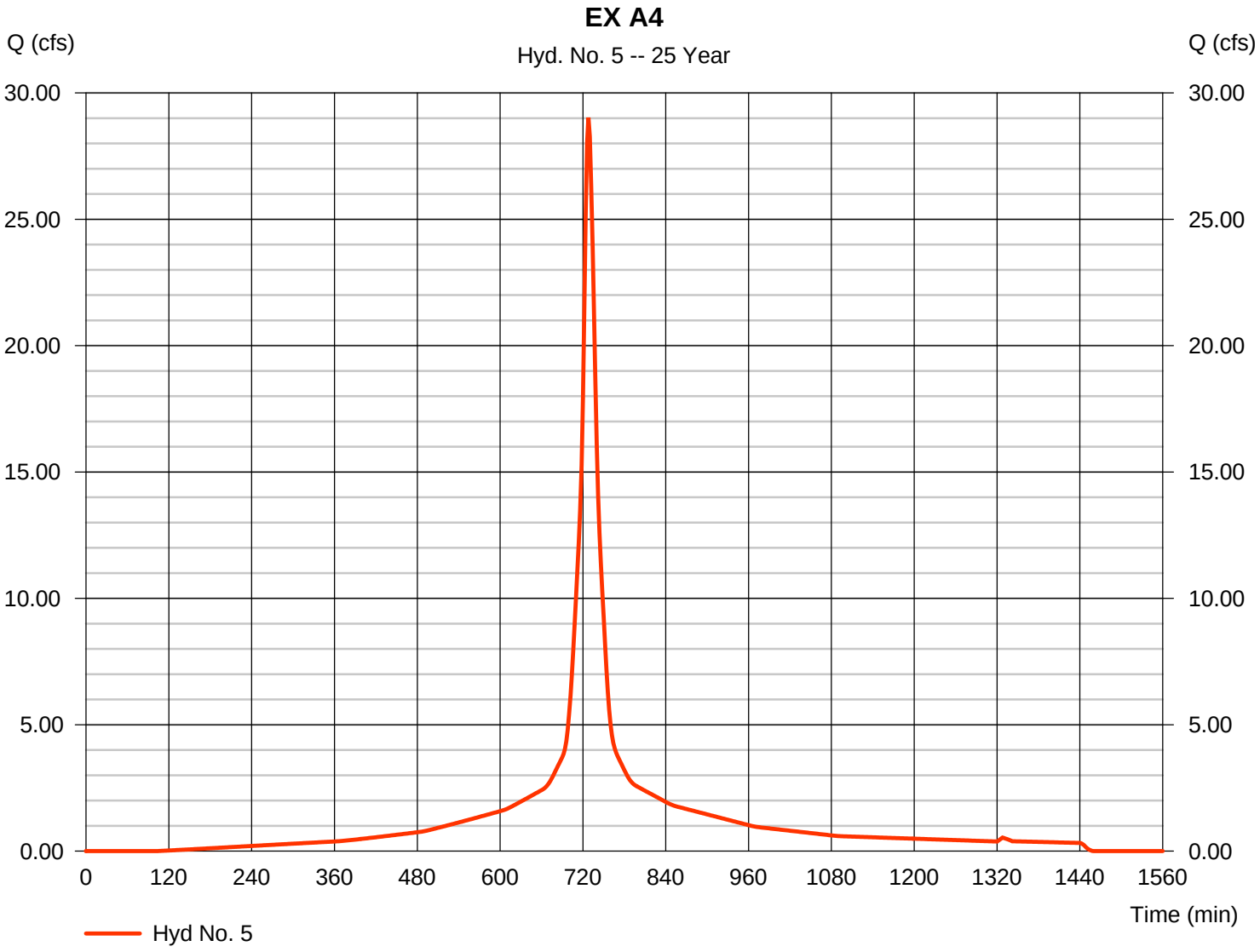


Hydrograph Report

Hyd. No. 5

EX A4

Hydrograph type	=	SCS Runoff	Peak discharge	=	29.03 cfs
Storm frequency	=	25 yrs	Time to peak	=	728 min
Time interval	=	2 min	Hyd. volume	=	122,298 cuft
Drainage area	=	4.450 ac	Curve number	=	94
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	10.00 min
Total precip.	=	8.06 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484

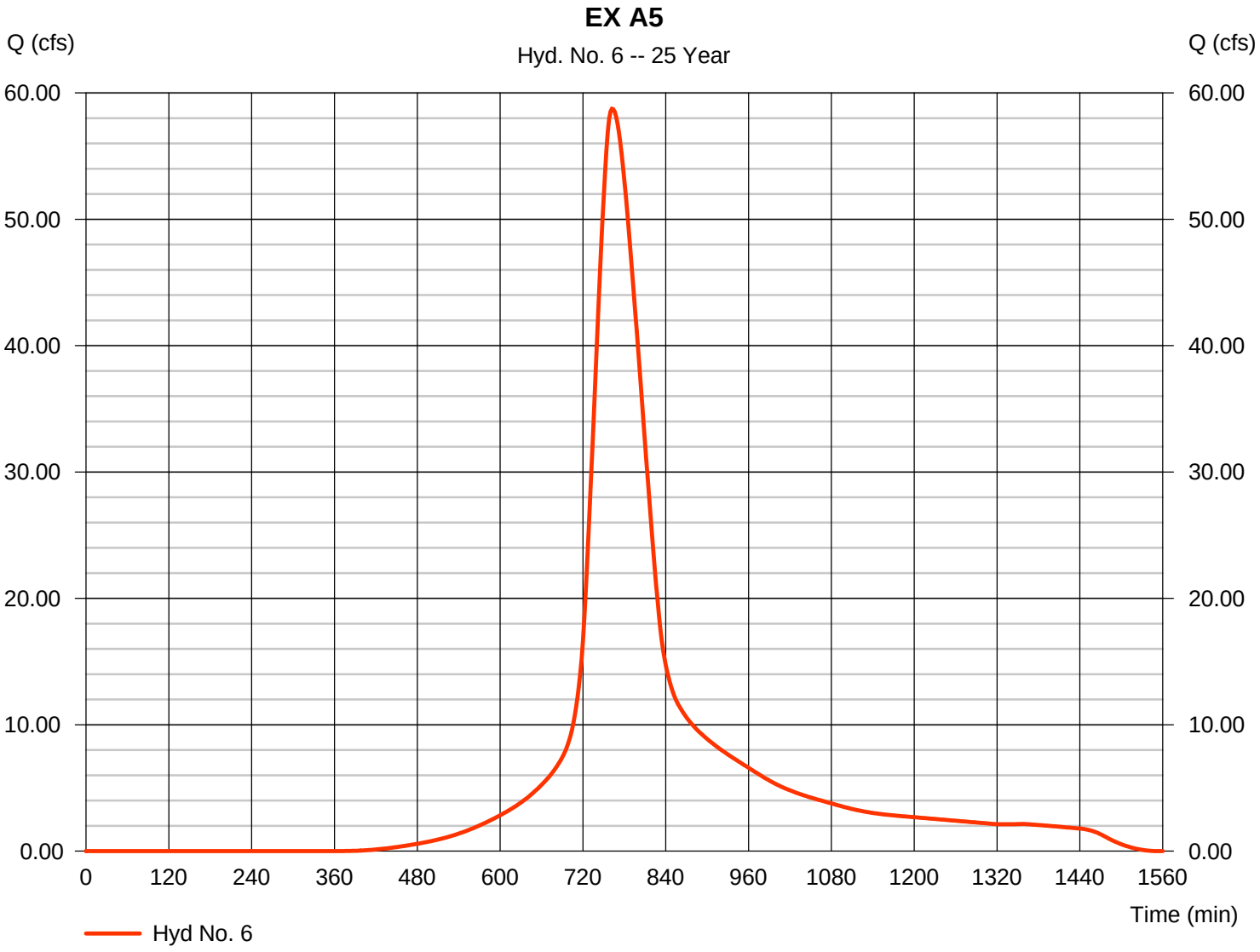


Hydrograph Report

Hyd. No. 6

EX A5

Hydrograph type	=	SCS Runoff	Peak discharge	=	58.74 cfs
Storm frequency	=	25 yrs	Time to peak	=	762 min
Time interval	=	2 min	Hyd. volume	=	498,412 cuft
Drainage area	=	24.990 ac	Curve number	=	78
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	63.10 min
Total precip.	=	8.06 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	434

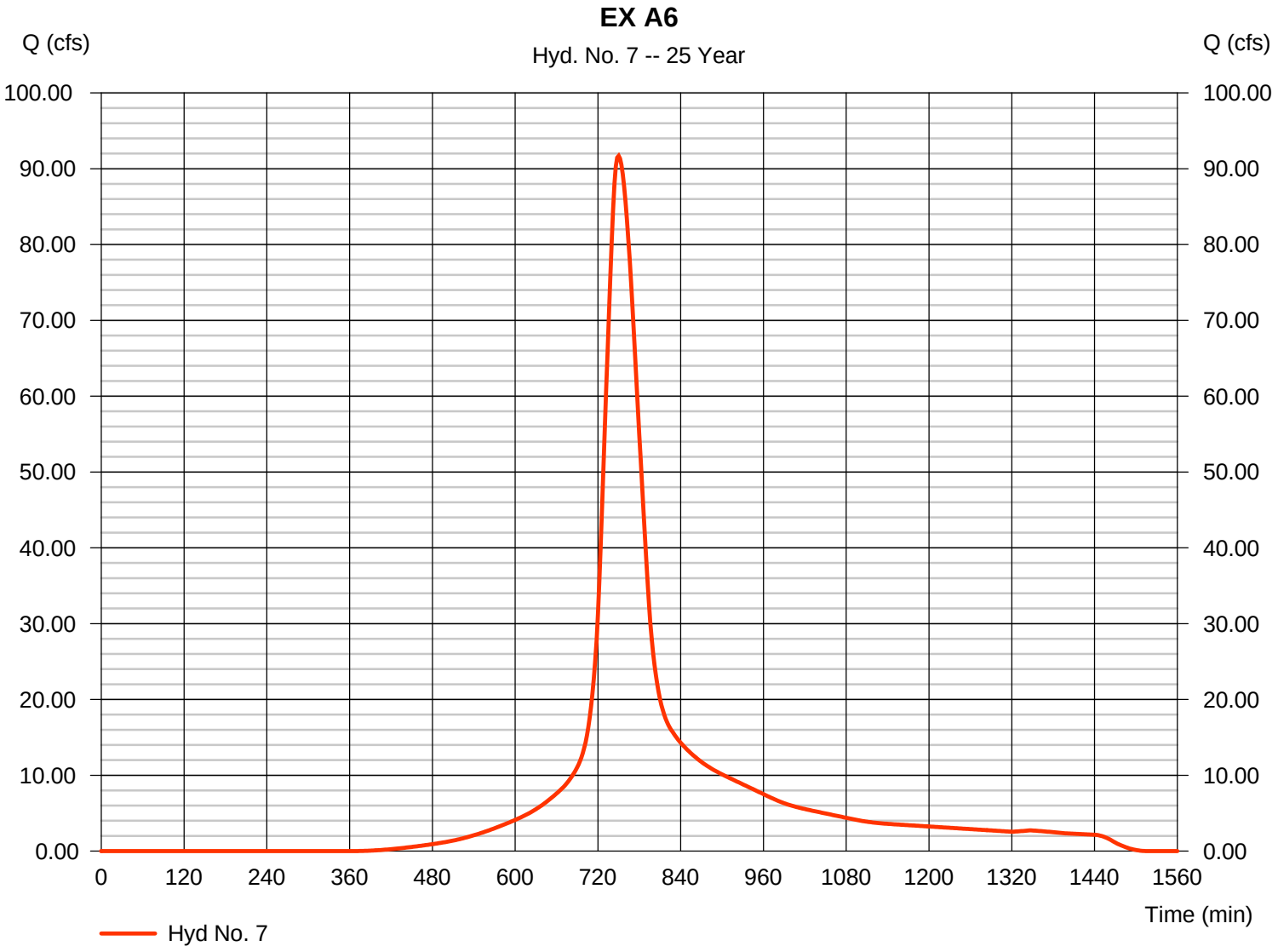


Hydrograph Report

Hyd. No. 7

EX A6

Hydrograph type	=	SCS Runoff	Peak discharge	=	91.70 cfs
Storm frequency	=	25 yrs	Time to peak	=	750 min
Time interval	=	2 min	Hyd. volume	=	620,473 cuft
Drainage area	=	31.110 ac	Curve number	=	78
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	40.80 min
Total precip.	=	8.06 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	434

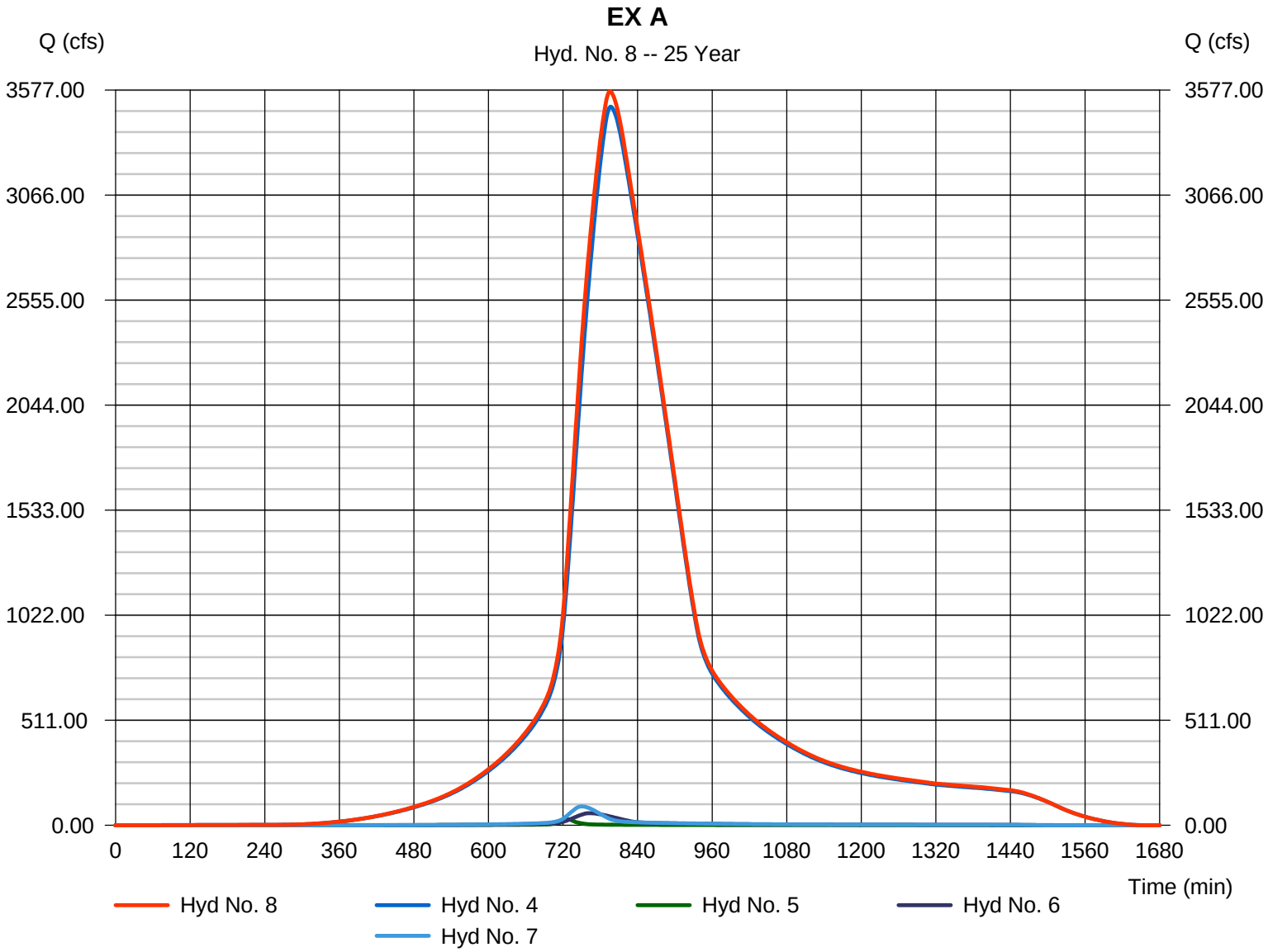


Hydrograph Report

Hyd. No. 8

EX A

Hydrograph type	=	Combine	Peak discharge	=	3570.74 cfs
Storm frequency	=	25 yrs	Time to peak	=	796 min
Time interval	=	2 min	Hyd. volume	=	47,887,844 cuft
Inflow hyds.	=	4, 5, 6, 7	Contrib. drain. area	=	60.550 ac

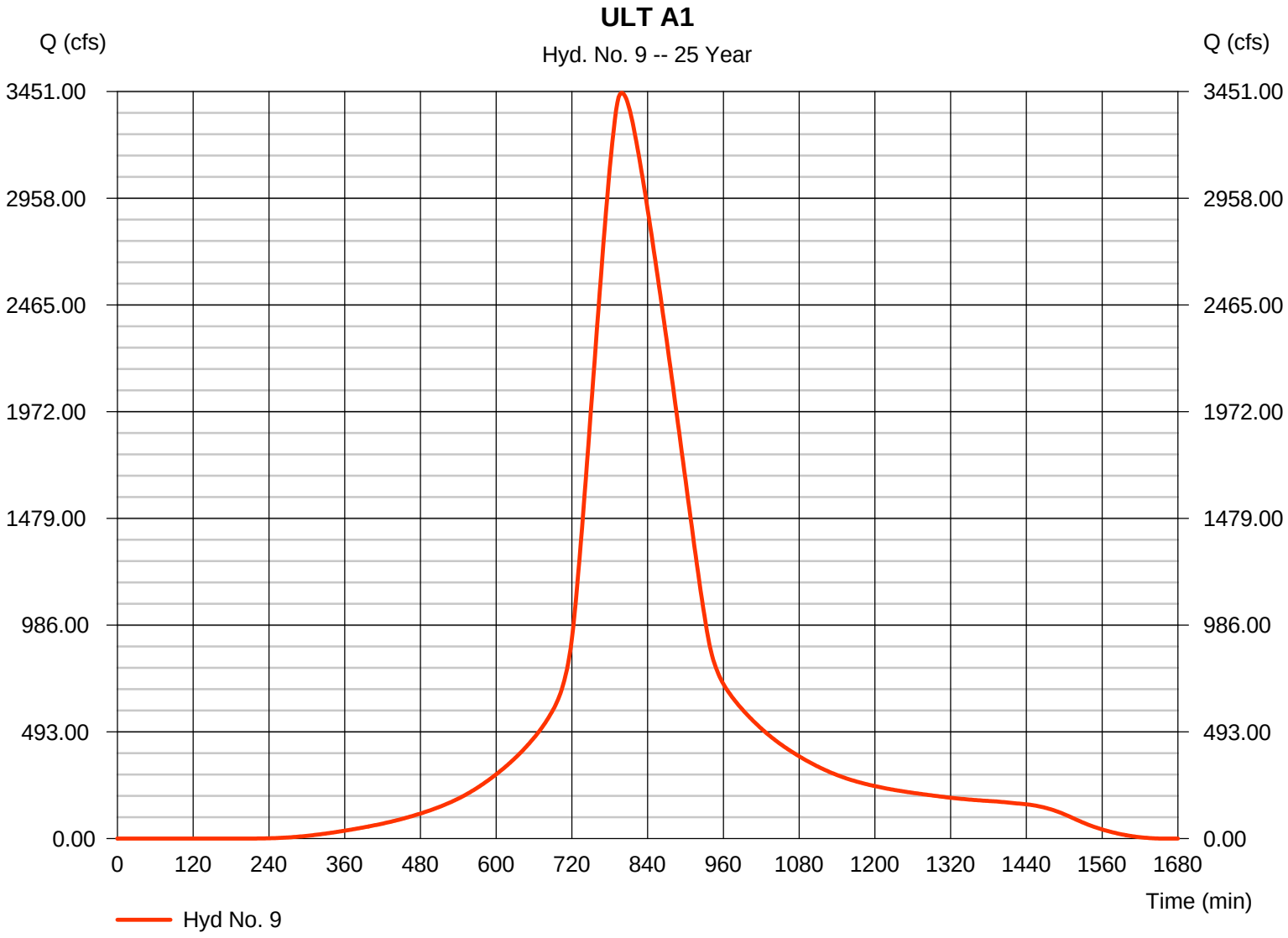


Hydrograph Report

Hyd. No. 9

ULT A1

Hydrograph type	=	SCS Runoff	Peak discharge	=	3444.27 cfs
Storm frequency	=	25 yrs	Time to peak	=	798 min
Time interval	=	2 min	Hyd. volume	=	46,186,816 cuft
Drainage area	=	1906.930 ac	Curve number	=	88.4
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	122.30 min
Total precip.	=	8.06 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	434

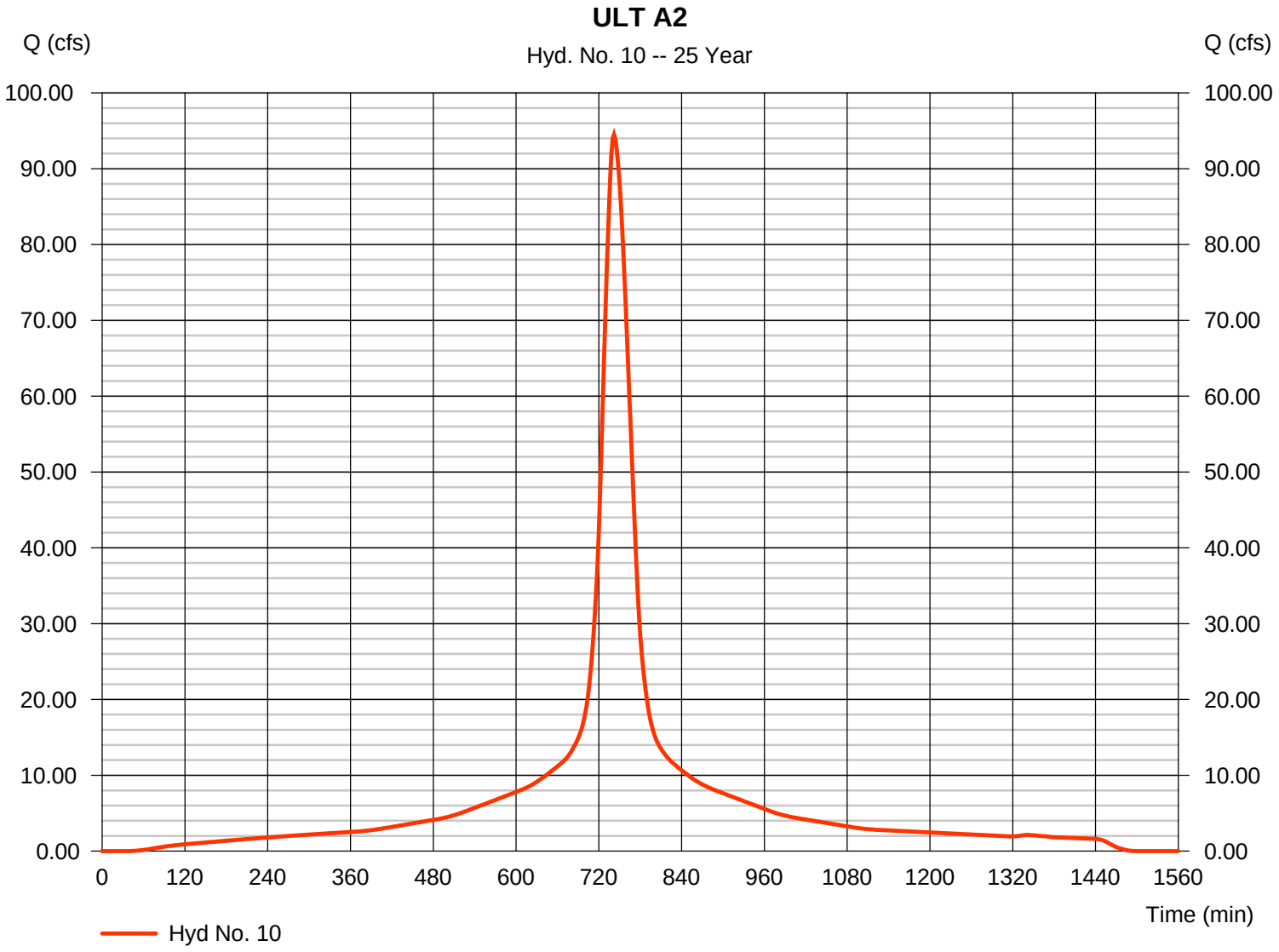


Hydrograph Report

Hyd. No. 10

ULT A2

Hydrograph type	=	SCS Runoff	Peak discharge	=	94.50 cfs
Storm frequency	=	25 yrs	Time to peak	=	742 min
Time interval	=	2 min	Hyd. volume	=	628,857 cuft
Drainage area	=	21.960 ac	Curve number	=	98
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	32.00 min
Total precip.	=	8.06 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	434

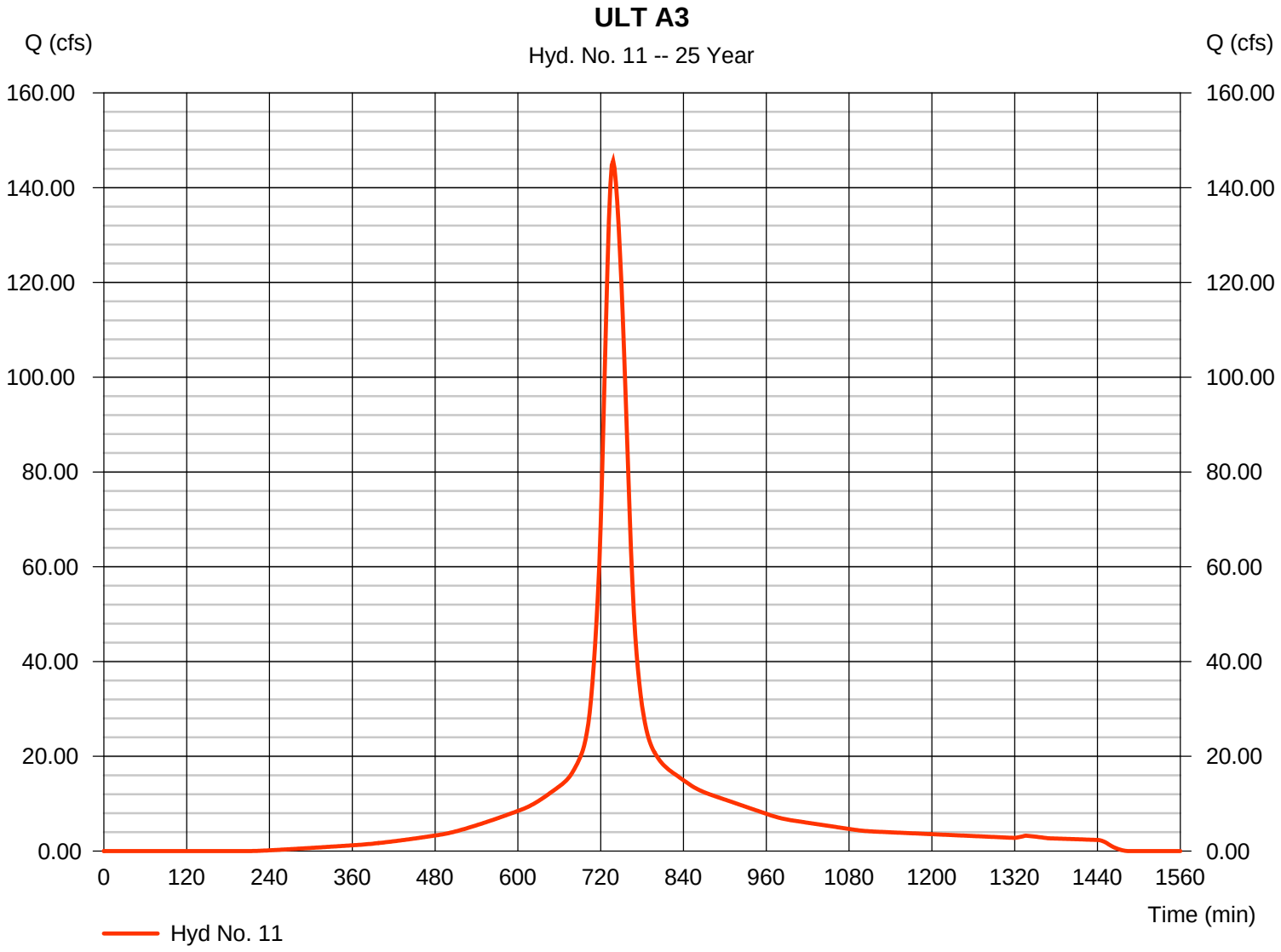


Hydrograph Report

Hyd. No. 11

ULT A3

Hydrograph type	=	SCS Runoff	Peak discharge	=	145.66 cfs
Storm frequency	=	25 yrs	Time to peak	=	738 min
Time interval	=	2 min	Hyd. volume	=	799,139 cuft
Drainage area	=	33.050 ac	Curve number	=	87.8
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	25.60 min
Total precip.	=	8.06 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	434

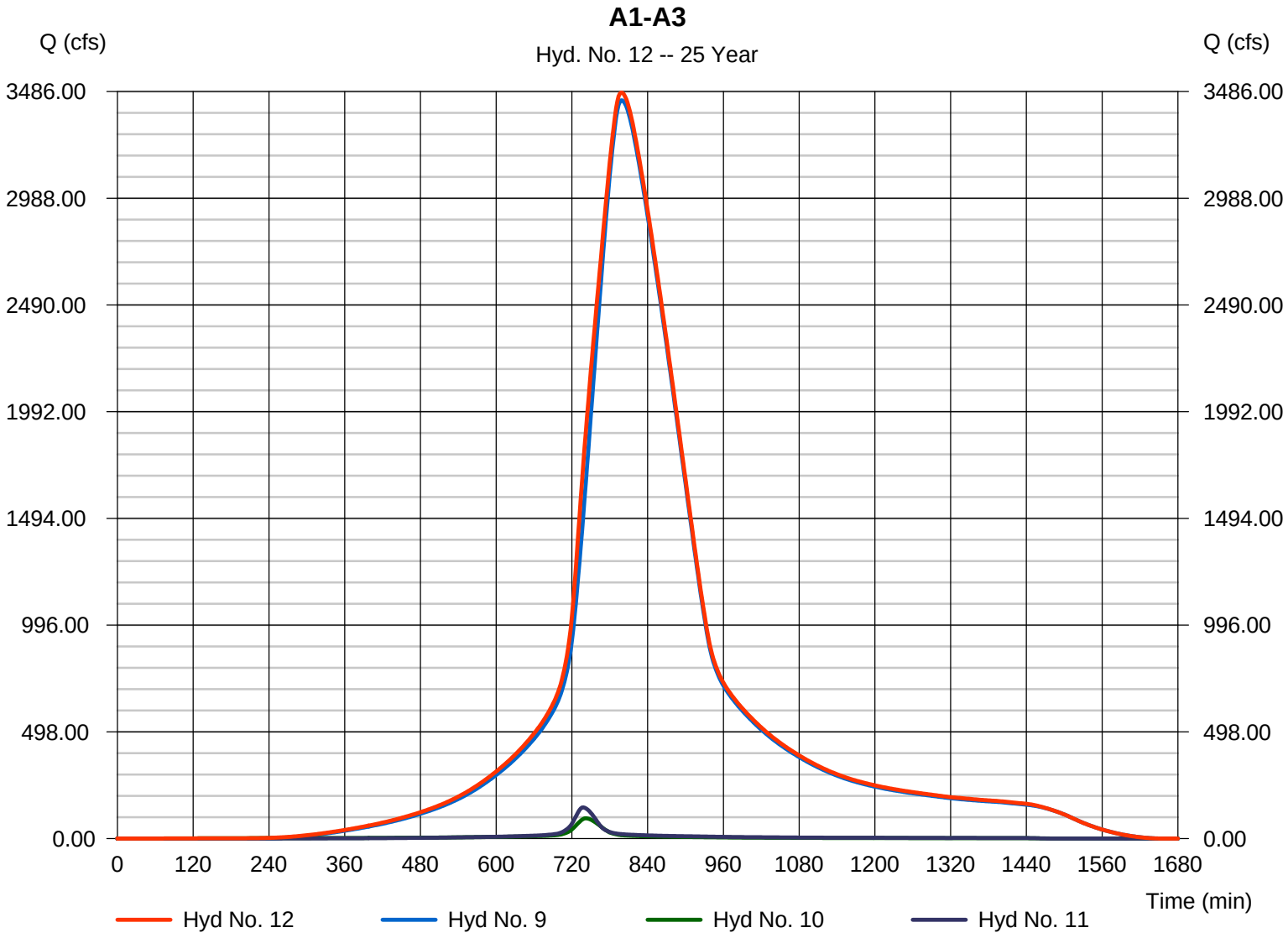


Hydrograph Report

Hyd. No. 12

A1-A3

Hydrograph type	=	Combine	Peak discharge	=	3481.16 cfs
Storm frequency	=	25 yrs	Time to peak	=	798 min
Time interval	=	2 min	Hyd. volume	=	47,614,772 cuft
Inflow hyds.	=	9, 10, 11	Contrib. drain. area	=	1961.940 ac

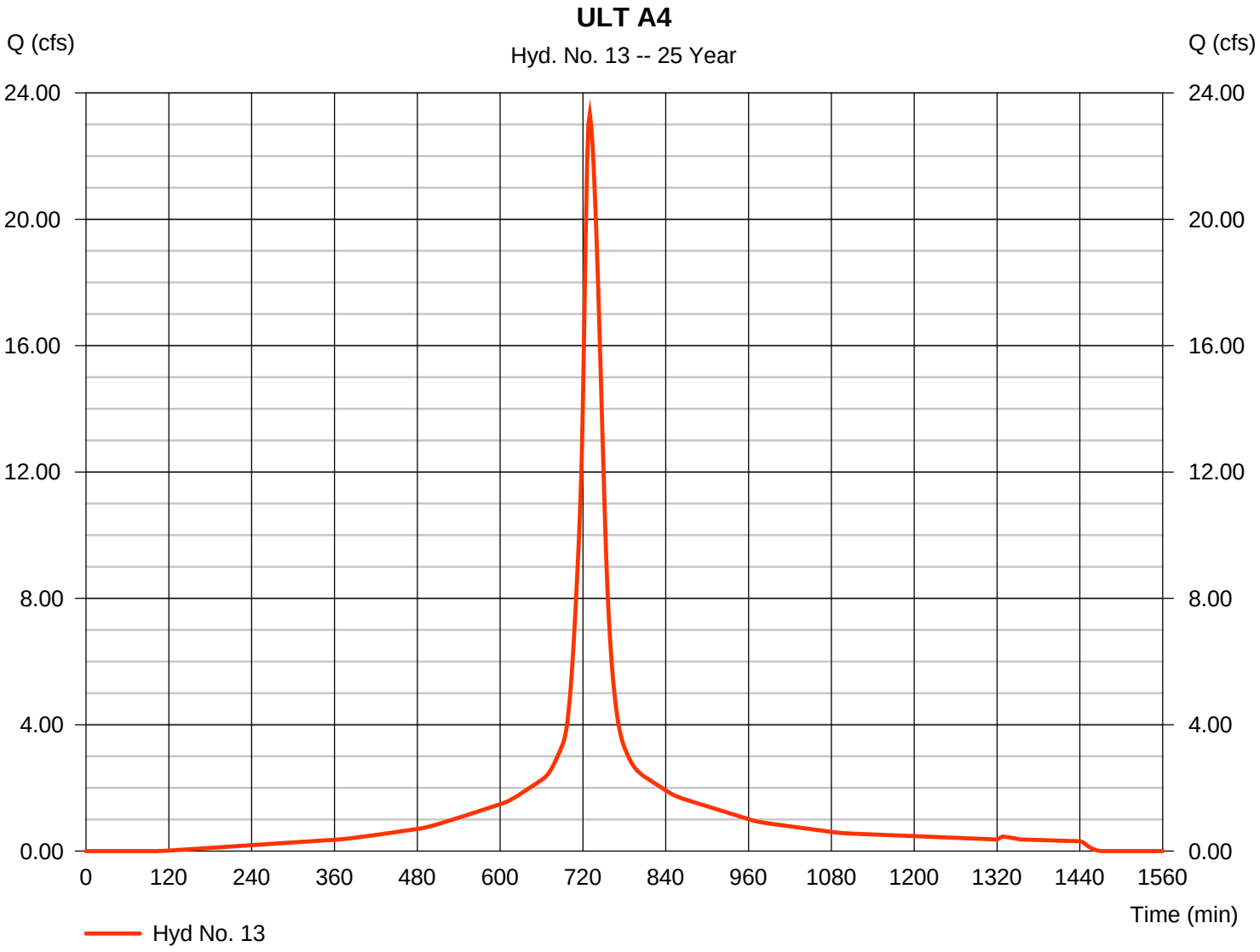


Hydrograph Report

Hyd. No. 13

ULT A4

Hydrograph type	=	SCS Runoff	Peak discharge	=	23.32 cfs
Storm frequency	=	25 yrs	Time to peak	=	730 min
Time interval	=	2 min	Hyd. volume	=	117,153 cuft
Drainage area	=	4.450 ac	Curve number	=	94
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	10.00 min
Total precip.	=	8.06 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	300

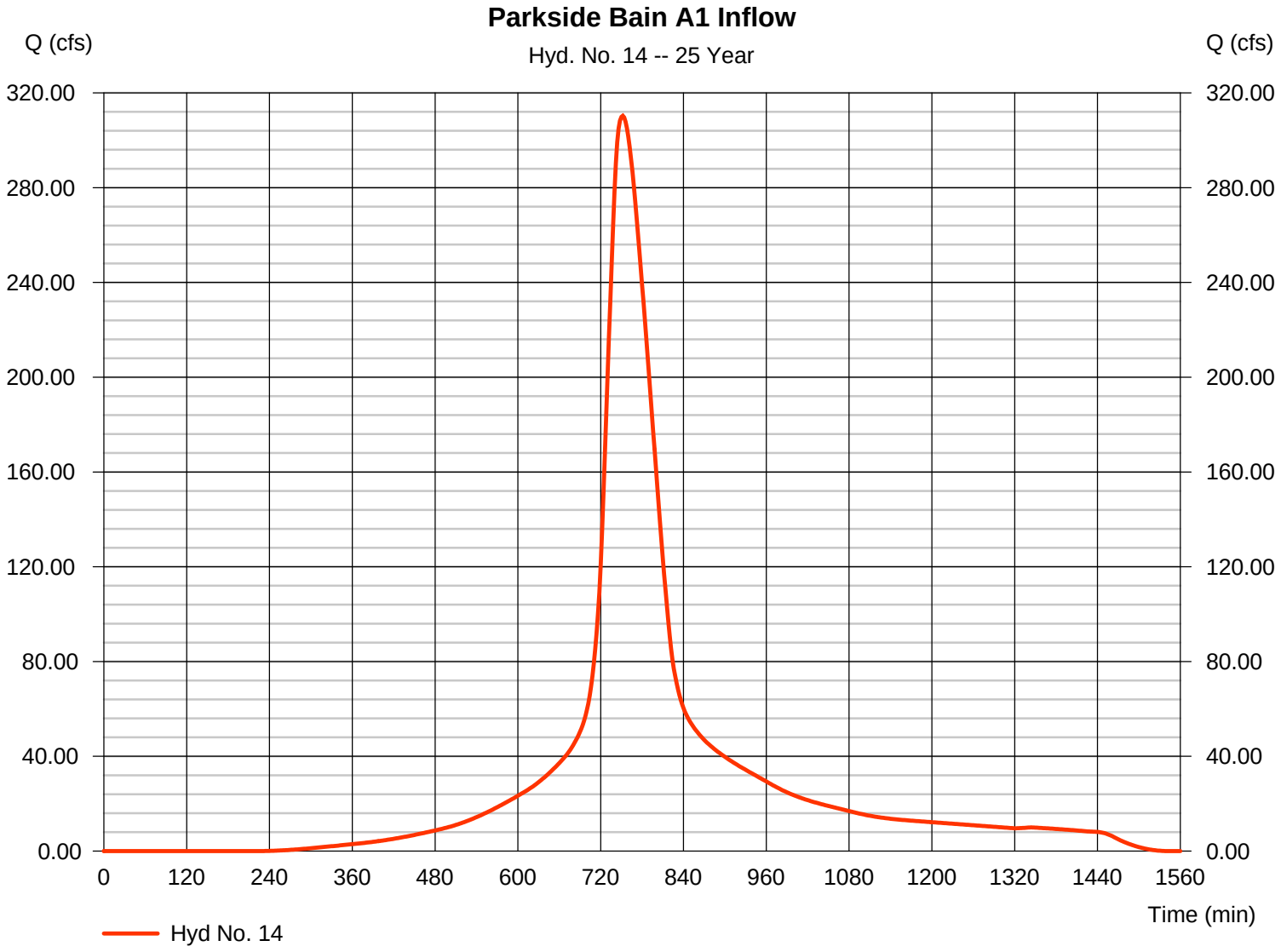


Hydrograph Report

Hyd. No. 14

Parkside Bain A1 Inflow

Hydrograph type	=	SCS Runoff	Peak discharge	=	310.34 cfs
Storm frequency	=	25 yrs	Time to peak	=	752 min
Time interval	=	2 min	Hyd. volume	=	2,599,887 cuft
Drainage area	=	109.260 ac	Curve number	=	87
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	37.90 min
Total precip.	=	8.06 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	300



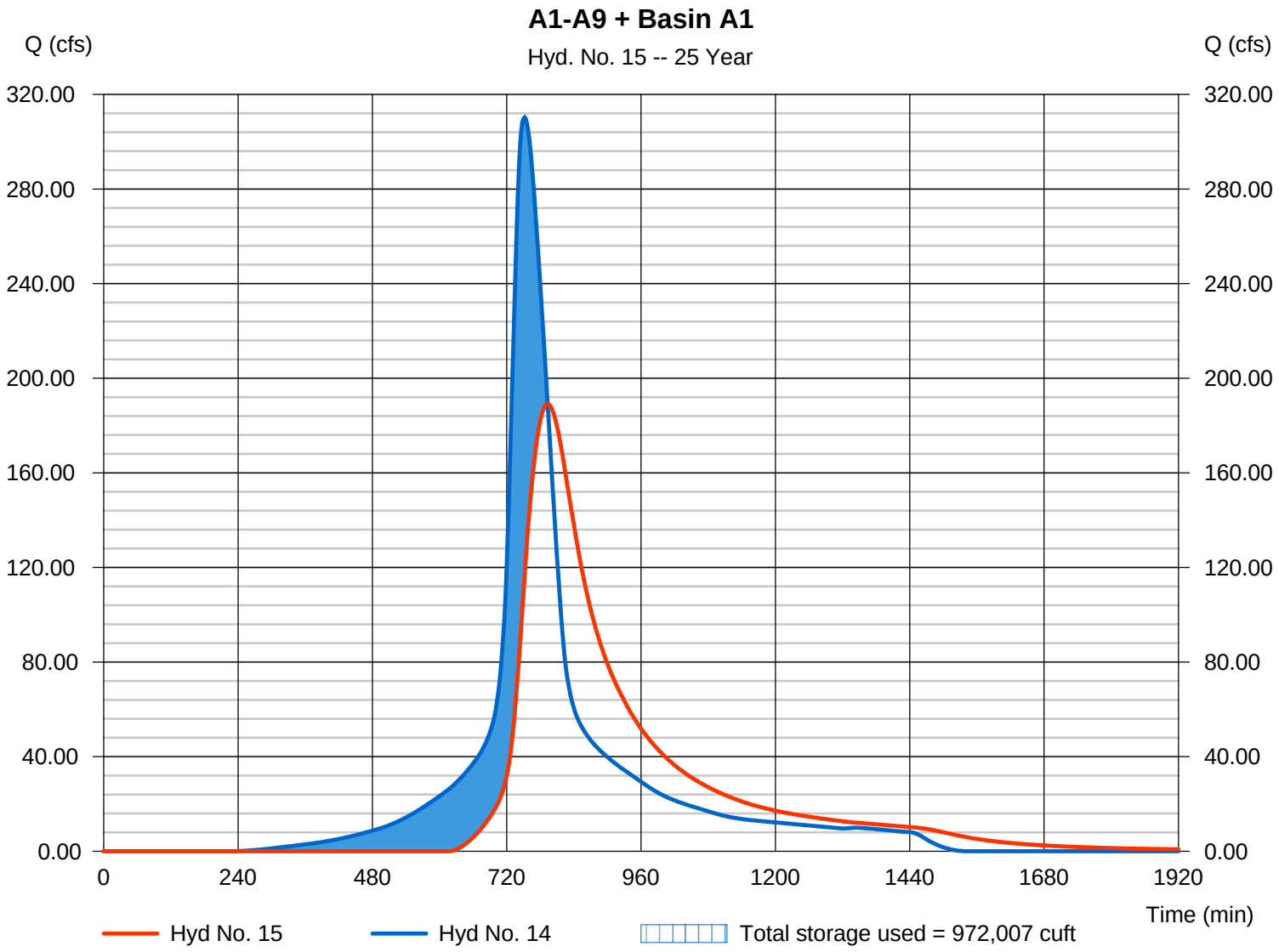
Hydrograph Report

Hyd. No. 15

A1-A9 + Basin A1

Hydrograph type	=	Reservoir	Peak discharge	=	189.09 cfs
Storm frequency	=	25 yrs	Time to peak	=	794 min
Time interval	=	2 min	Hyd. volume	=	2,415,579 cuft
Inflow hyd. No.	=	14 - Parkside Bain A1 Inflow	Max. Elevation	=	605.58 ft
Reservoir name	=	BASIN A1	Max. Storage	=	972,007 cuft

Storage Indication method used.

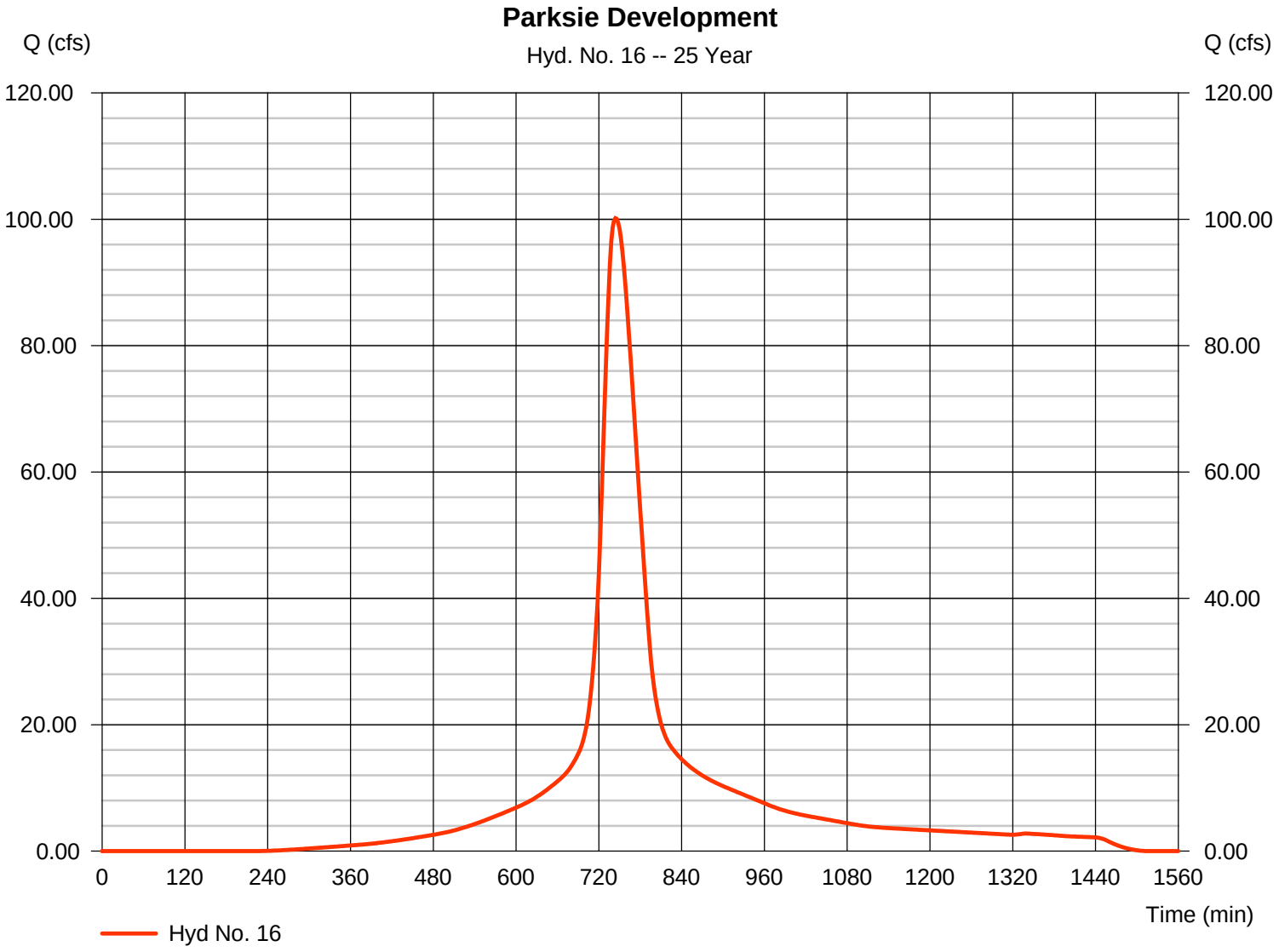


Hydrograph Report

Hyd. No. 16

Parksie Development

Hydrograph type	=	SCS Runoff	Peak discharge	=	100.16 cfs
Storm frequency	=	25 yrs	Time to peak	=	744 min
Time interval	=	2 min	Hyd. volume	=	712,434 cuft
Drainage area	=	29.940 ac	Curve number	=	87
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	28.50 min
Total precip.	=	8.06 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	300

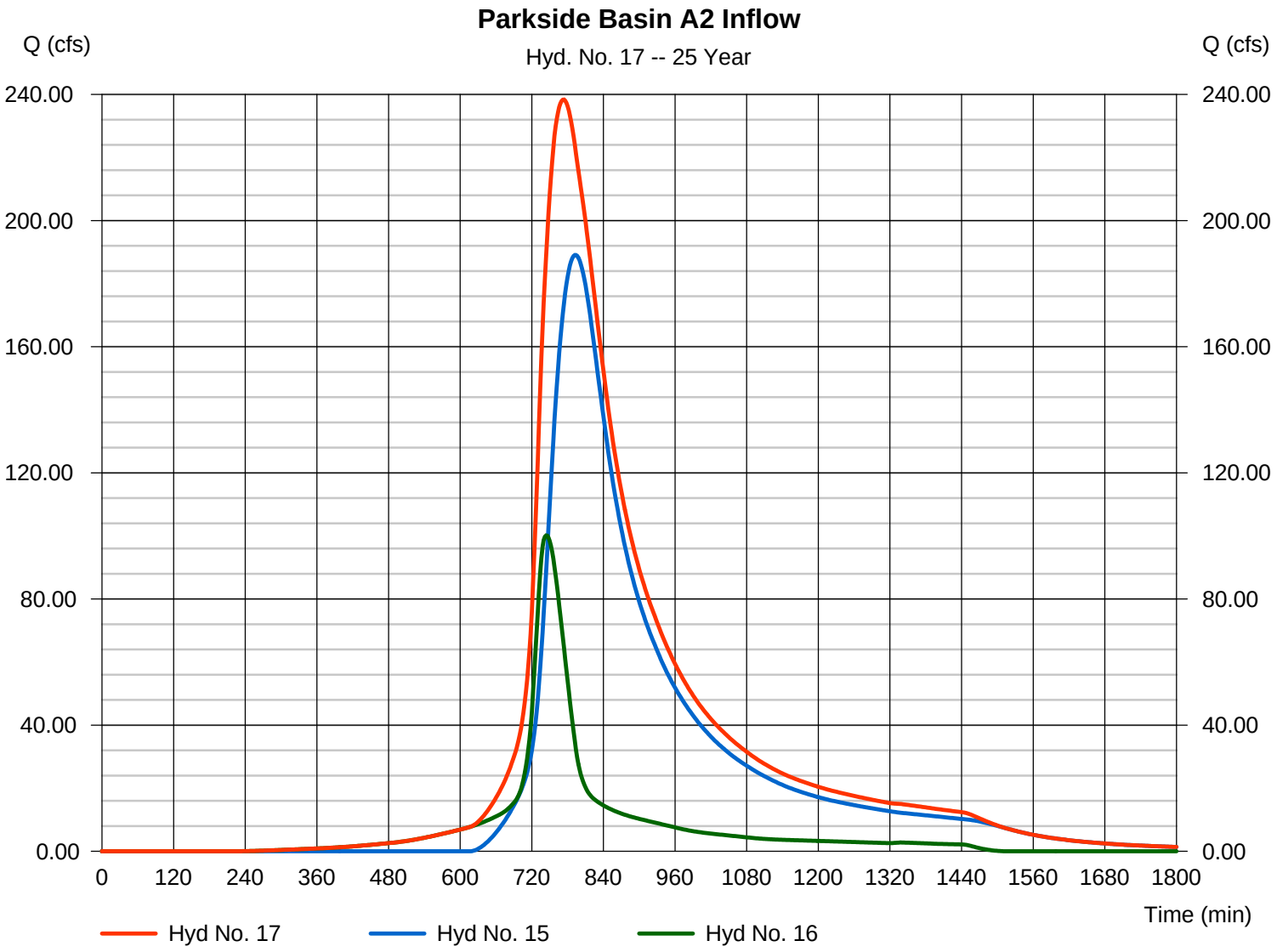


Hydrograph Report

Hyd. No. 17

Parkside Basin A2 Inflow

Hydrograph type	=	Combine	Peak discharge	=	238.36 cfs
Storm frequency	=	25 yrs	Time to peak	=	774 min
Time interval	=	2 min	Hyd. volume	=	3,128,010 cuft
Inflow hyds.	=	15, 16	Contrib. drain. area	=	29.940 ac



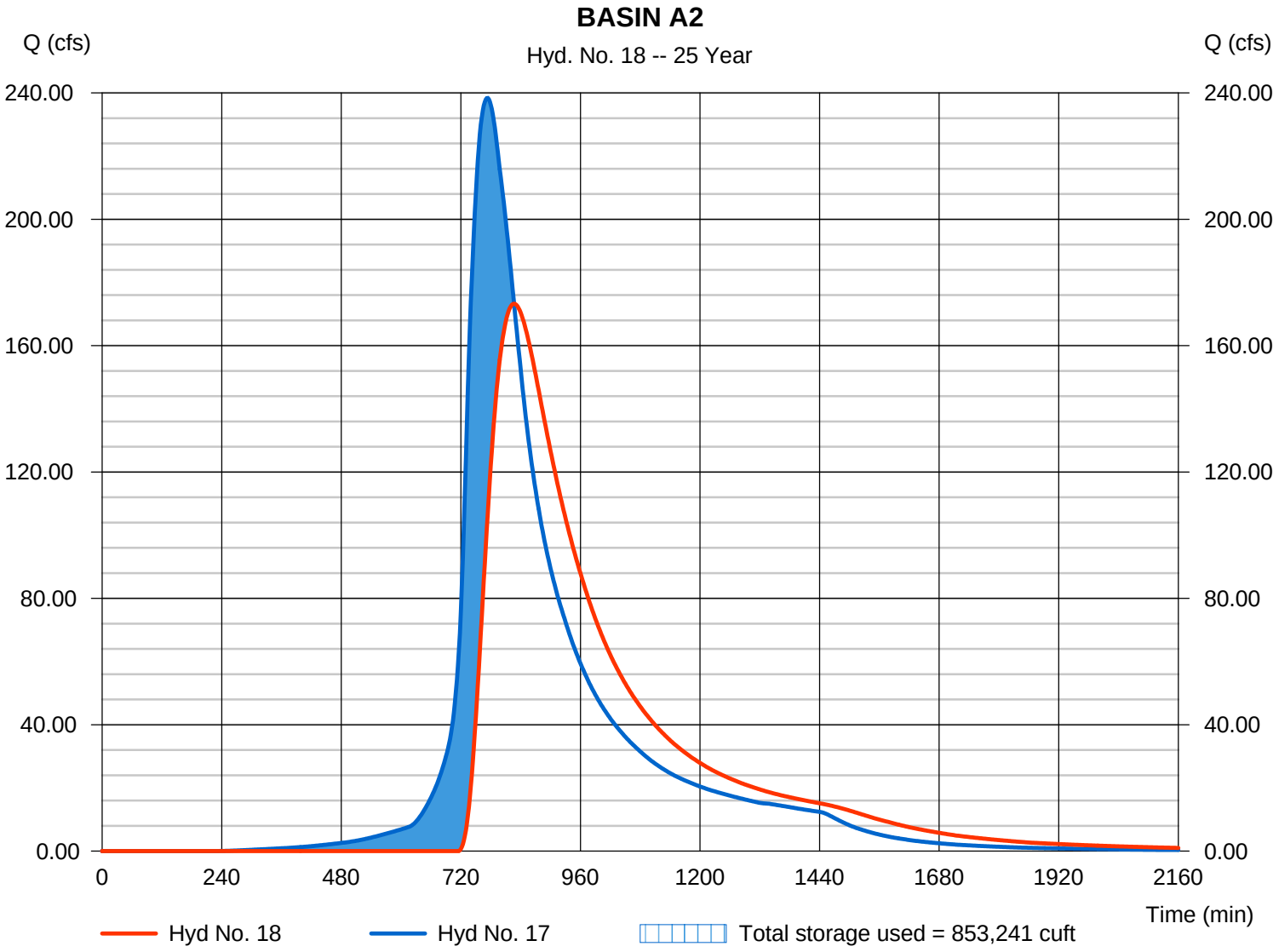
Hydrograph Report

Hyd. No. 18

BASIN A2

Hydrograph type	=	Reservoir	Peak discharge	=	173.26 cfs
Storm frequency	=	25 yrs	Time to peak	=	826 min
Time interval	=	2 min	Hyd. volume	=	2,935,131 cuft
Inflow hyd. No.	=	17 - Parkside Basin A2 Inflow	Max. Elevation	=	603.22 ft
Reservoir name	=	BASIN A2	Max. Storage	=	853,241 cuft

Storage Indication method used.

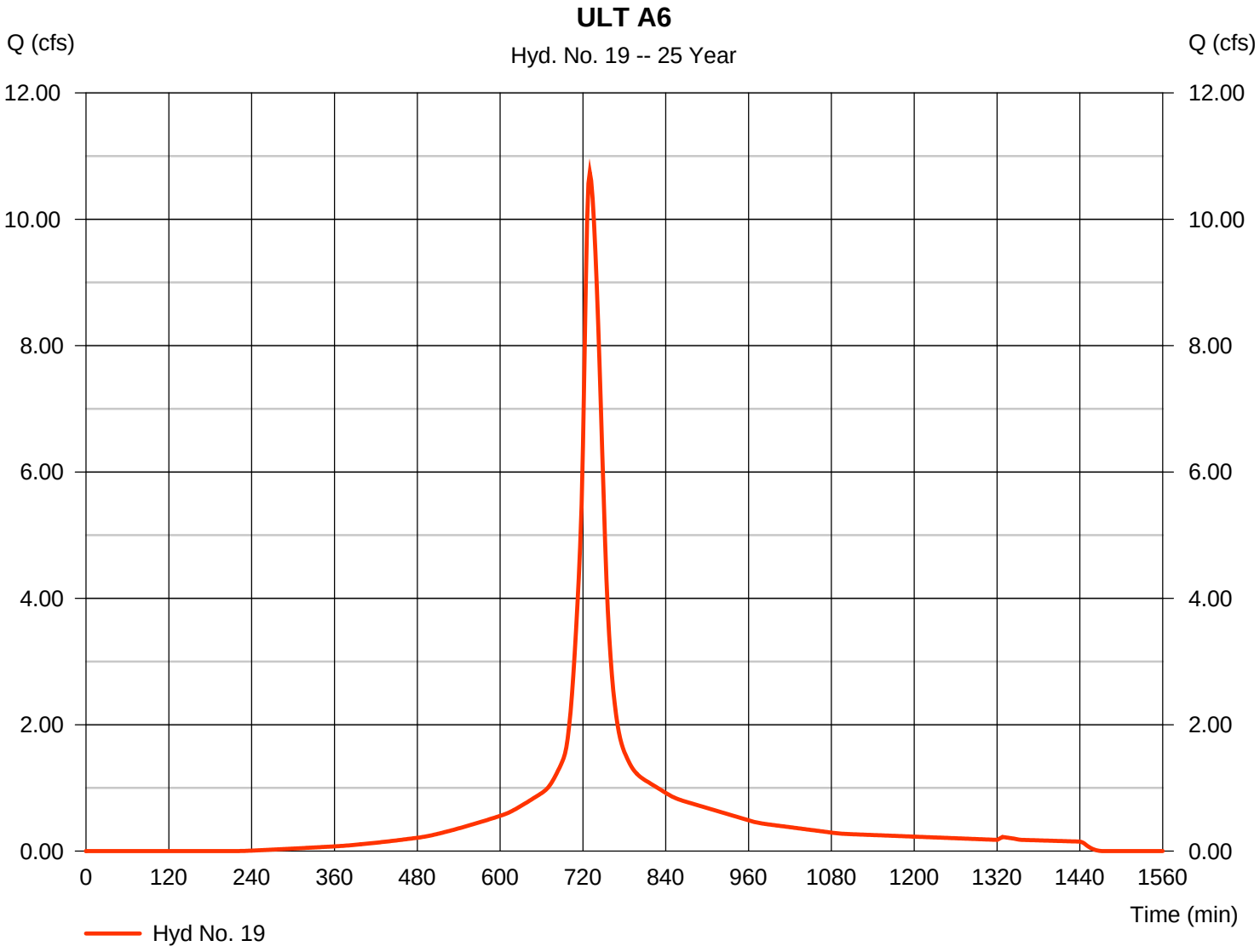


Hydrograph Report

Hyd. No. 19

ULT A6

Hydrograph type	=	SCS Runoff	Peak discharge	=	10.74 cfs
Storm frequency	=	25 yrs	Time to peak	=	730 min
Time interval	=	2 min	Hyd. volume	=	51,343 cuft
Drainage area	=	2.200 ac	Curve number	=	87
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	10.00 min
Total precip.	=	8.06 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	300

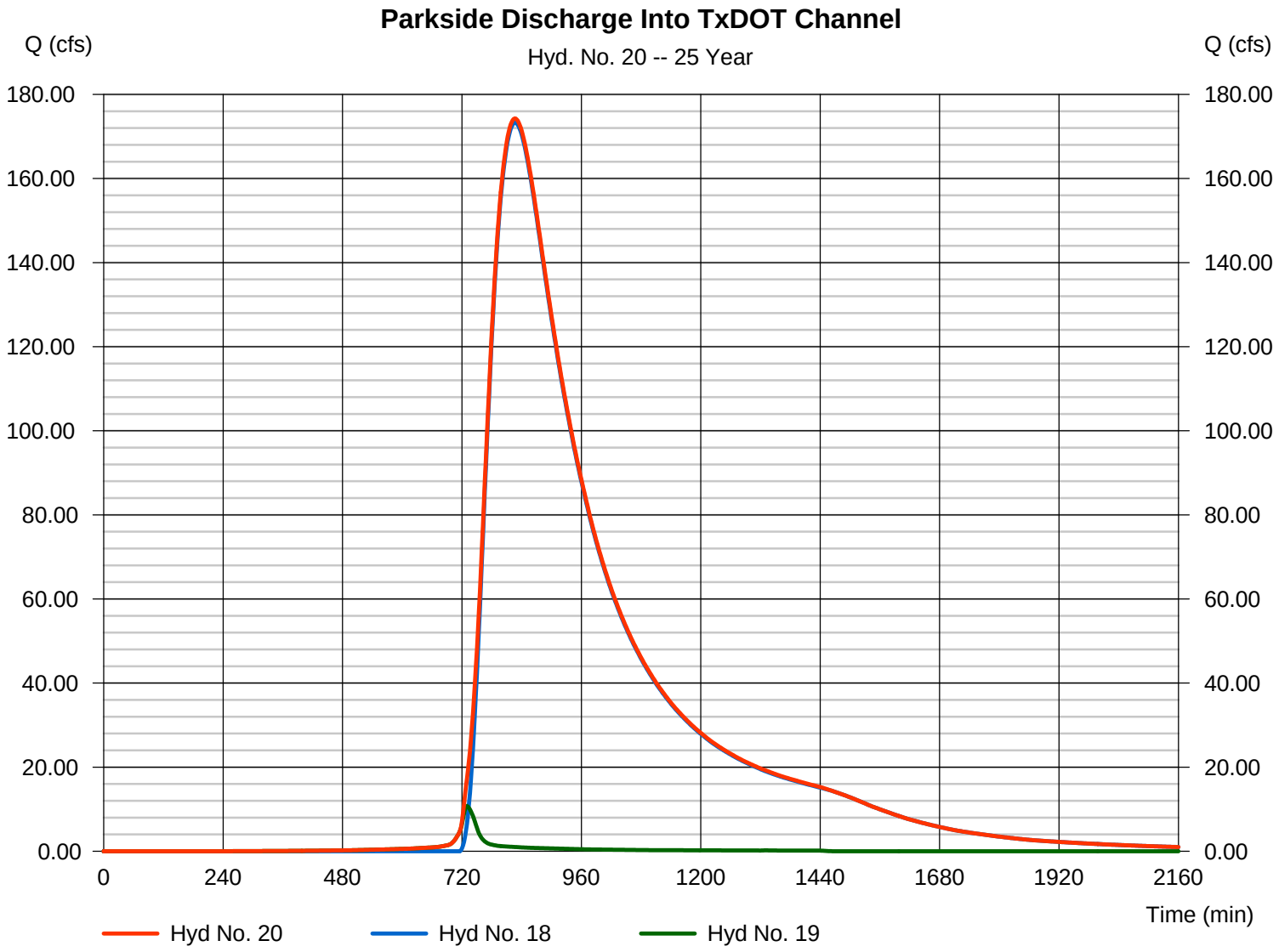


Hydrograph Report

Hyd. No. 20

Parkside Discharge Into TxDOT Channel

Hydrograph type	= Combine	Peak discharge	= 174.27 cfs
Storm frequency	= 25 yrs	Time to peak	= 826 min
Time interval	= 2 min	Hyd. volume	= 2,986,476 cuft
Inflow hyds.	= 18, 19	Contrib. drain. area	= 2.200 ac

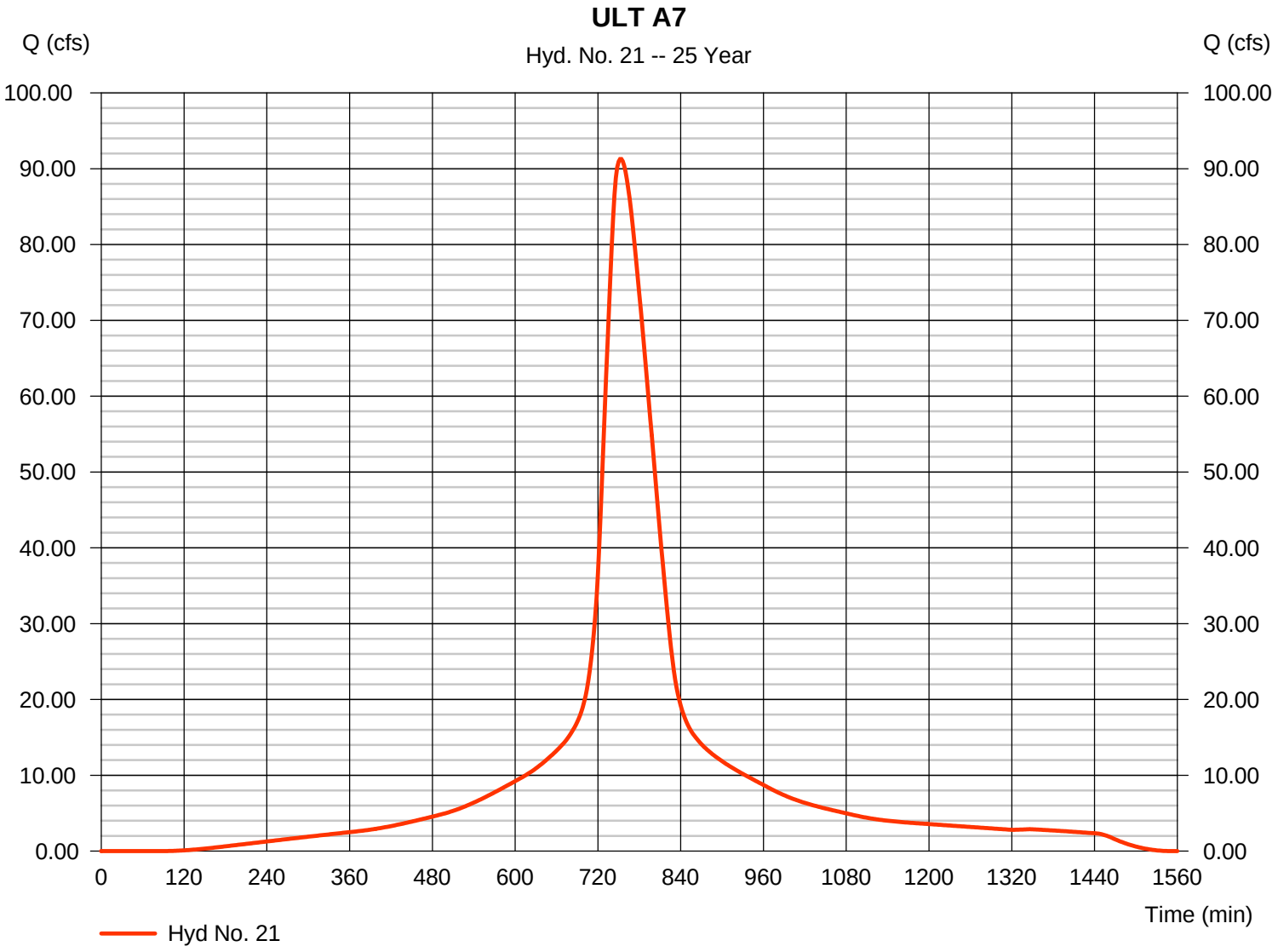


Hydrograph Report

Hyd. No. 21

ULT A7

Hydrograph type	=	SCS Runoff	Peak discharge	=	91.27 cfs
Storm frequency	=	25 yrs	Time to peak	=	754 min
Time interval	=	2 min	Hyd. volume	=	843,647 cuft
Drainage area	=	31.110 ac	Curve number	=	95
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	40.80 min
Total precip.	=	8.06 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	300

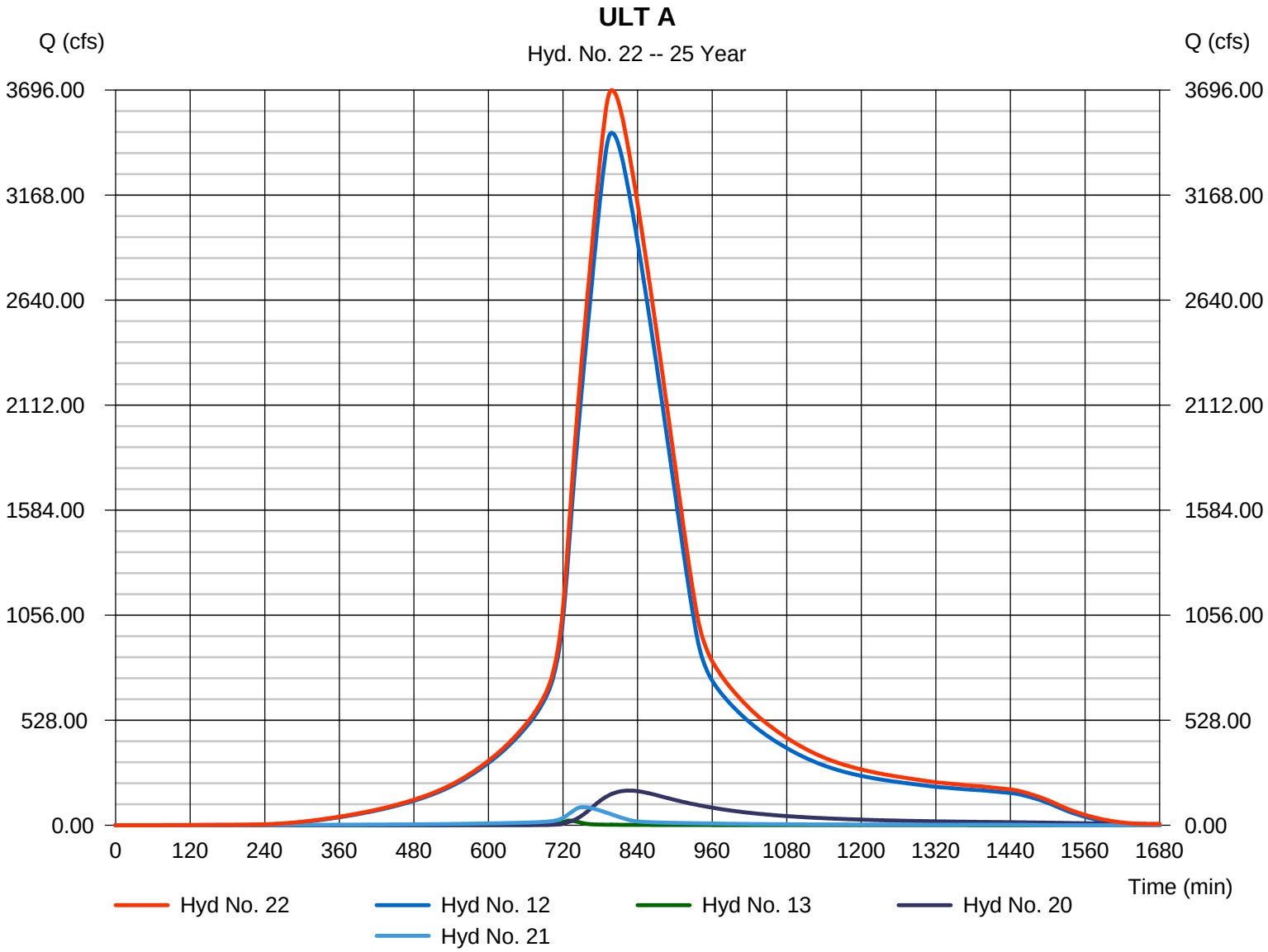


Hydrograph Report

Hyd. No. 22

ULT A

Hydrograph type	=	Combine	Peak discharge	=	3695.26 cfs
Storm frequency	=	25 yrs	Time to peak	=	798 min
Time interval	=	2 min	Hyd. volume	=	51,561,716 cuft
Inflow hyds.	=	12, 13, 20, 21	Contrib. drain. area	=	35.560 ac



Hydrograph Summary Report

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

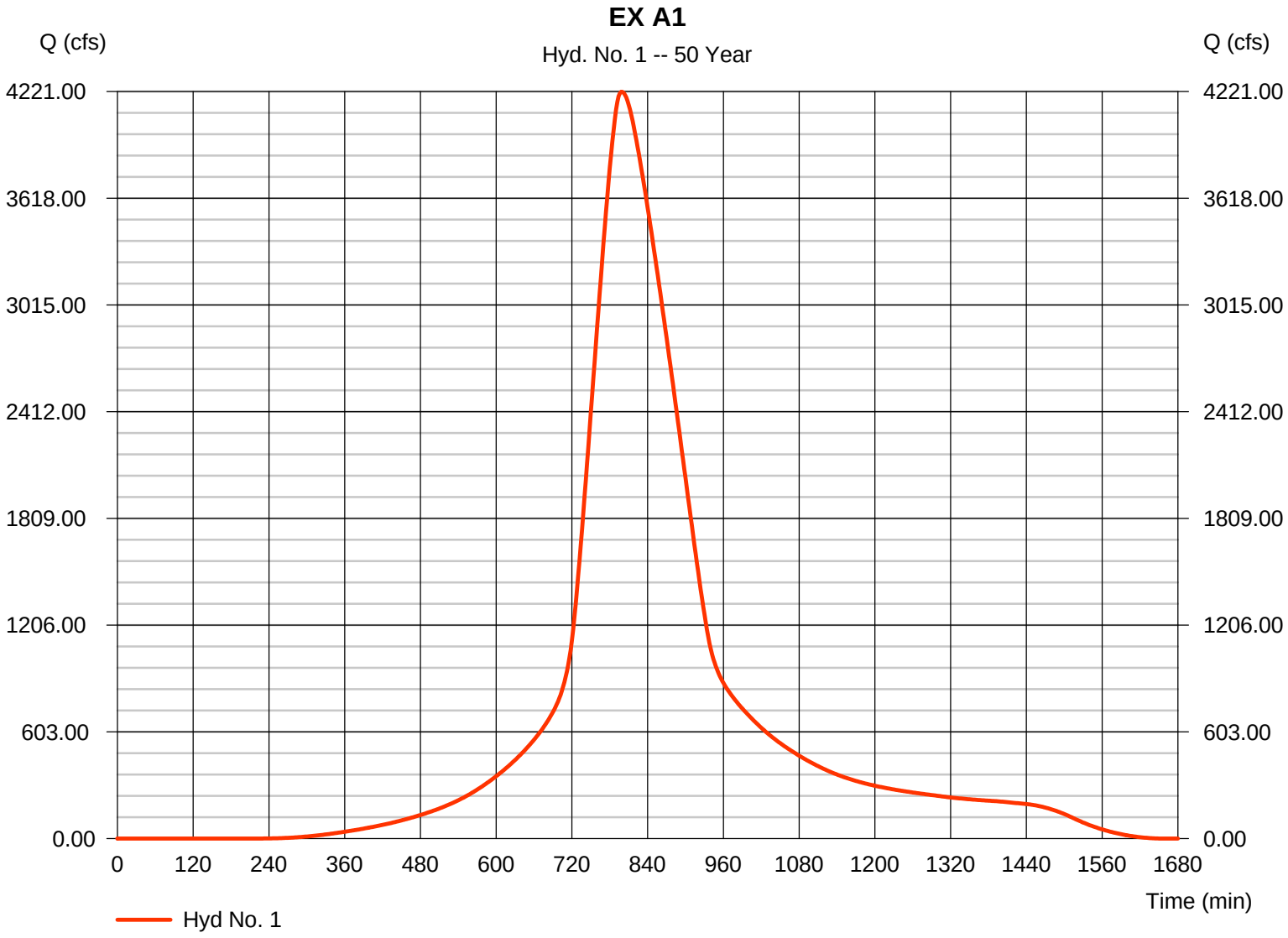
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	4218.96	2	798	56,425,468	------	------	------	EX A1
2	SCS Runoff	116.89	2	742	781,568	------	------	------	EX A2
3	SCS Runoff	380.59	2	760	3,146,054	------	------	------	EX A3
4	Combine	4485.49	2	796	60,353,116	1, 2, 3	------	------	EX A1 - EX A3
5	SCS Runoff	36.11	2	728	153,805	------	------	------	EX A4
6	SCS Runoff	77.45	2	762	661,307	------	------	------	EX A5
7	SCS Runoff	120.72	2	750	823,260	------	------	------	EX A6
8	Combine	4582.87	2	796	61,991,436	4, 5, 6, 7	------	------	EX A
9	SCS Runoff	4365.42	2	798	59,109,112	------	------	------	ULT A1
10	SCS Runoff	116.89	2	742	781,568	------	------	------	ULT A2
11	SCS Runoff	184.37	2	738	1,024,714	------	------	------	ULT A3
12	Combine	4411.32	2	798	60,915,384	9, 10, 11	------	------	A1-A3
13	SCS Runoff	29.02	2	730	147,334	------	------	------	ULT A4
14	SCS Runoff	394.48	2	752	3,342,488	------	------	------	Parkside Bain A1 Inflow
15	Reservoir	251.12	2	790	3,158,184	14	606.22	1,156,680	A1-A9 + Basin A1
16	SCS Runoff	127.27	2	744	915,925	------	------	------	Parksie Development
17	Combine	317.40	2	772	4,074,110	15, 16	------	------	Parkside Basin A2 Inflow
18	Reservoir	243.14	2	818	3,881,226	17	604.04	1,029,480	BASIN A2
19	SCS Runoff	13.64	2	730	66,008	------	------	------	ULT A6
20	Combine	244.47	2	818	3,947,234	18, 19	------	------	Parkside Discharge Into TxDOT Chan
21	SCS Runoff	113.42	2	752	1,057,809	------	------	------	ULT A7
22	Combine	4715.29	2	798	66,067,436	12, 13, 20, 21	------	------	ULT A

Hydrograph Report

Hyd. No. 1

EX A1

Hydrograph type	=	SCS Runoff	Peak discharge	=	4218.96 cfs
Storm frequency	=	50 yrs	Time to peak	=	798 min
Time interval	=	2 min	Hyd. volume	=	56,425,468 cuft
Drainage area	=	1906.930 ac	Curve number	=	85.3
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	122.30 min
Total precip.	=	9.96 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	434

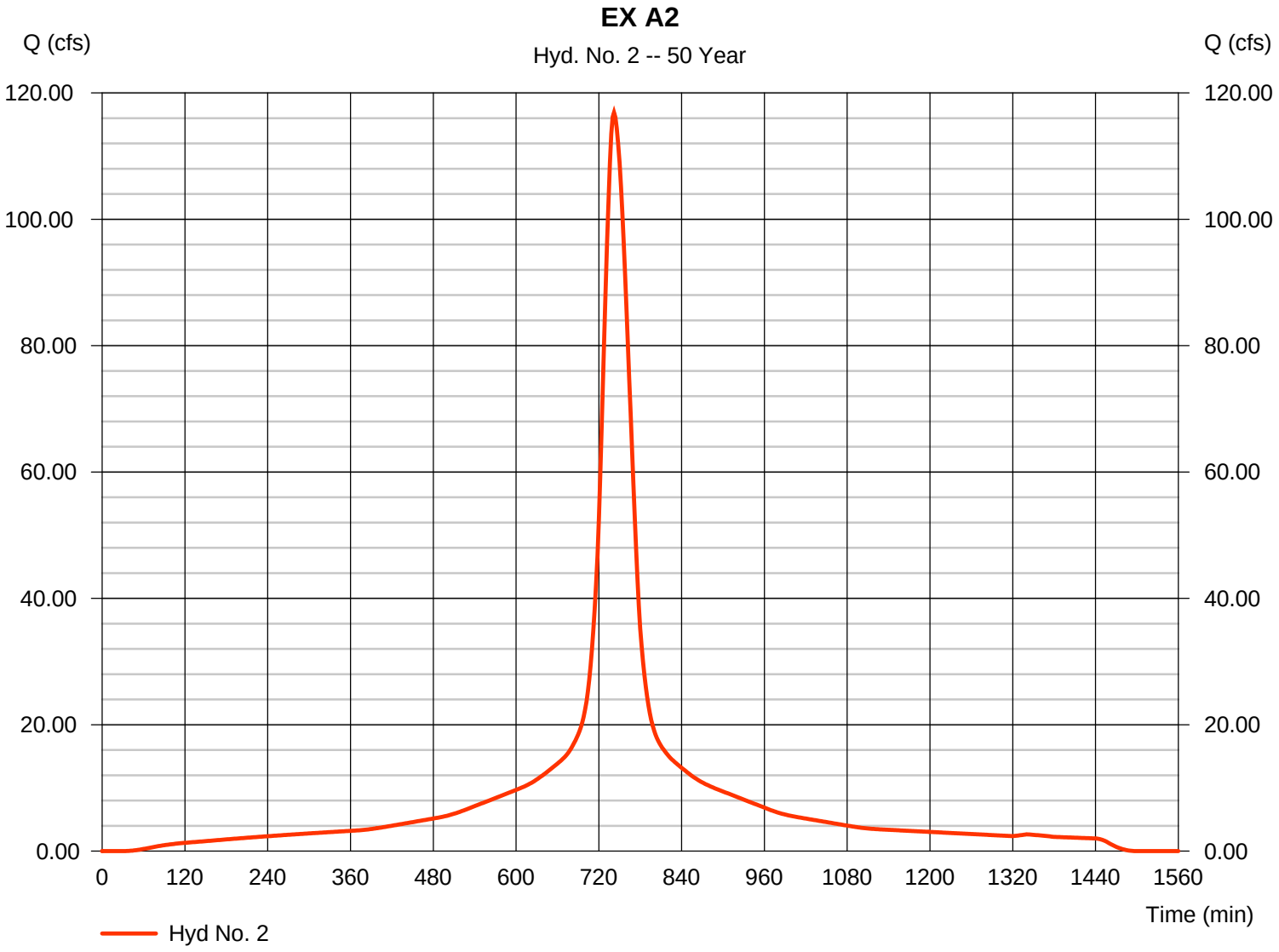


Hydrograph Report

Hyd. No. 2

EX A2

Hydrograph type	=	SCS Runoff	Peak discharge	=	116.89 cfs
Storm frequency	=	50 yrs	Time to peak	=	742 min
Time interval	=	2 min	Hyd. volume	=	781,568 cuft
Drainage area	=	21.960 ac	Curve number	=	98
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	32.00 min
Total precip.	=	9.96 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	434

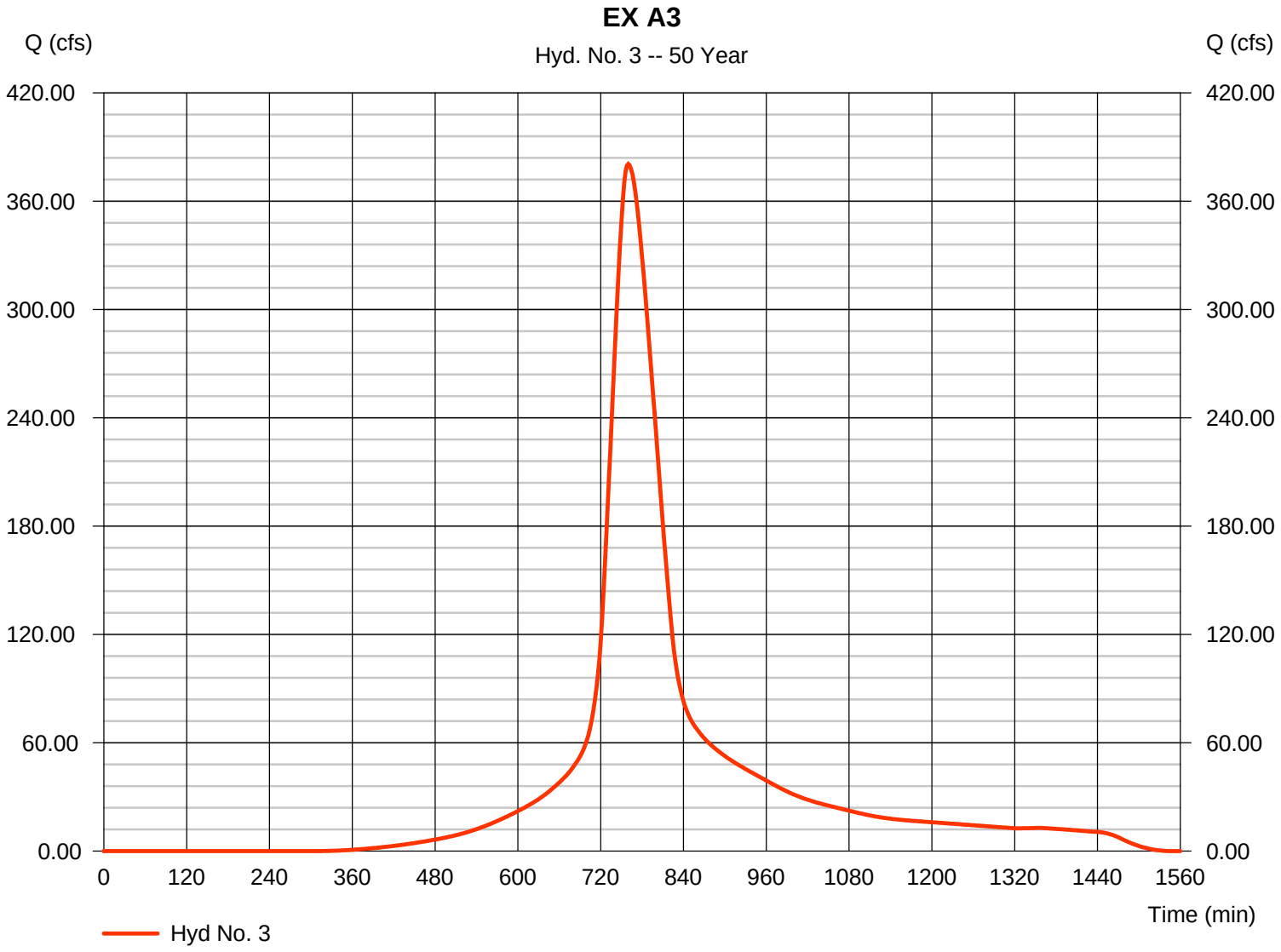


Hydrograph Report

Hyd. No. 3

EX A3

Hydrograph type	=	SCS Runoff	Peak discharge	=	380.59 cfs
Storm frequency	=	50 yrs	Time to peak	=	760 min
Time interval	=	2 min	Hyd. volume	=	3,146,054 cuft
Drainage area	=	117.840 ac	Curve number	=	78.5
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	59.60 min
Total precip.	=	9.96 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	434

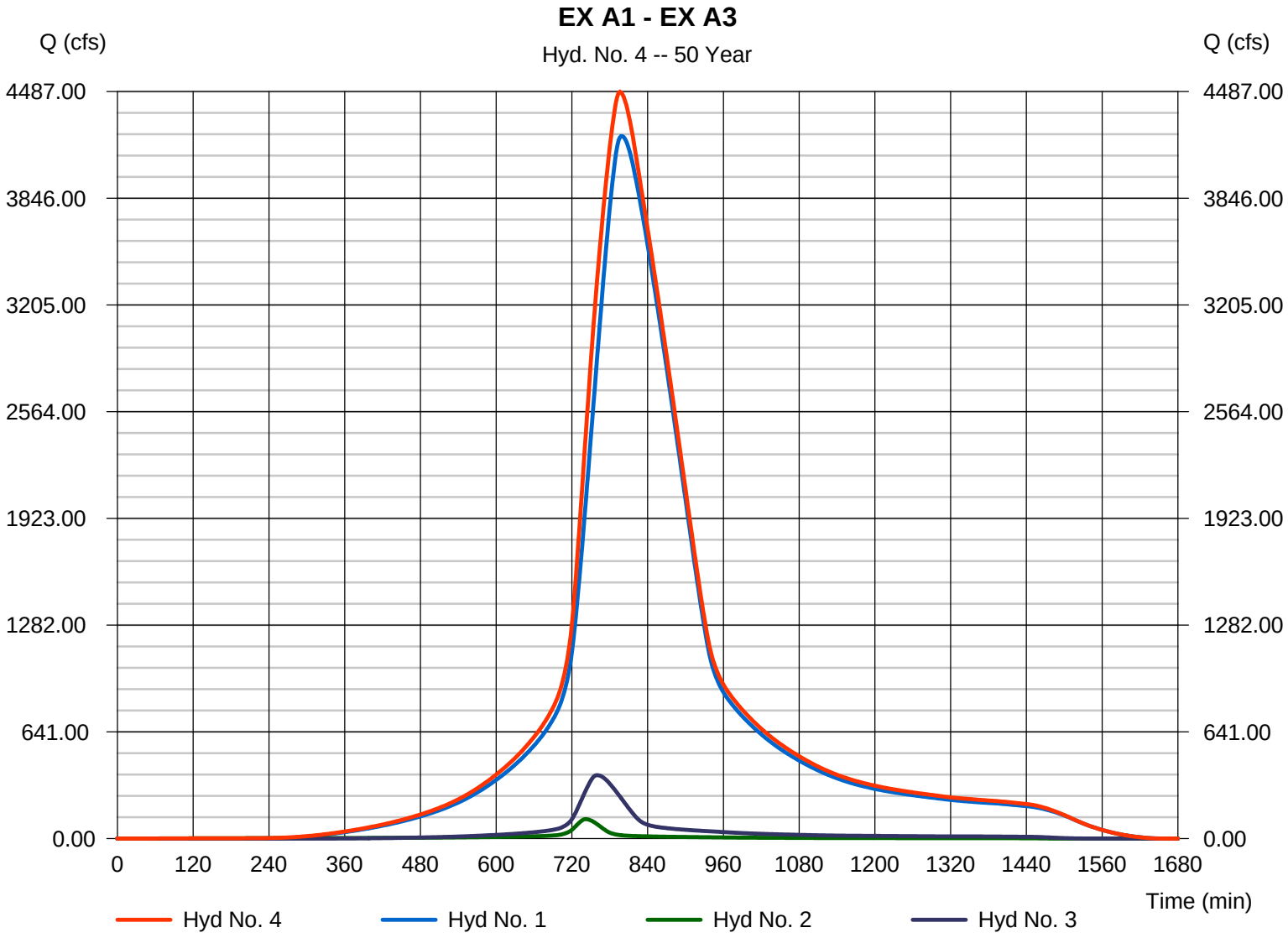


Hydrograph Report

Hyd. No. 4

EX A1 - EX A3

Hydrograph type	=	Combine	Peak discharge	=	4485.49 cfs
Storm frequency	=	50 yrs	Time to peak	=	796 min
Time interval	=	2 min	Hyd. volume	=	60,353,116 cuft
Inflow hyds.	=	1, 2, 3	Contrib. drain. area	=	2046.730 ac

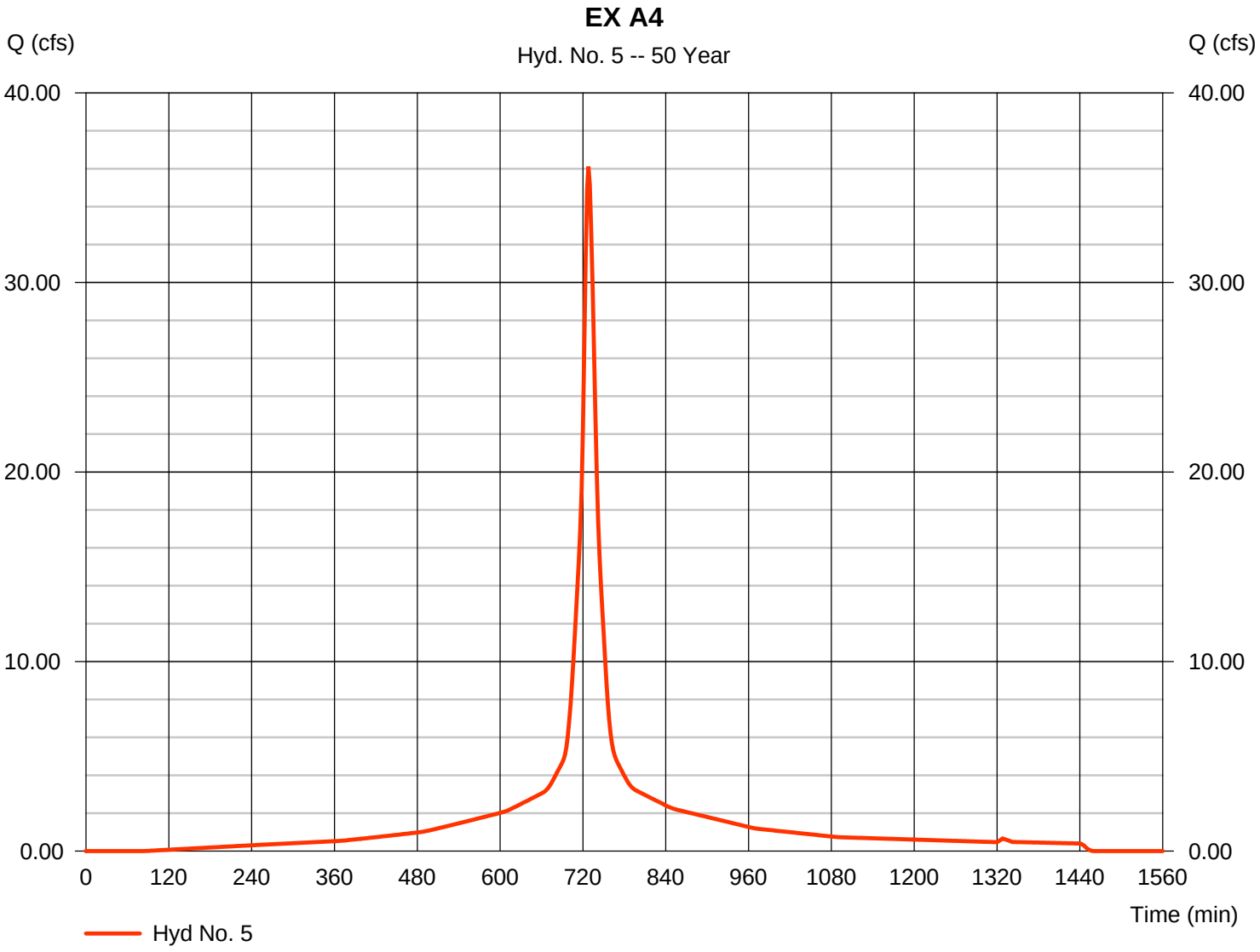


Hydrograph Report

Hyd. No. 5

EX A4

Hydrograph type	=	SCS Runoff	Peak discharge	=	36.11 cfs
Storm frequency	=	50 yrs	Time to peak	=	728 min
Time interval	=	2 min	Hyd. volume	=	153,805 cuft
Drainage area	=	4.450 ac	Curve number	=	94
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	10.00 min
Total precip.	=	9.96 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484

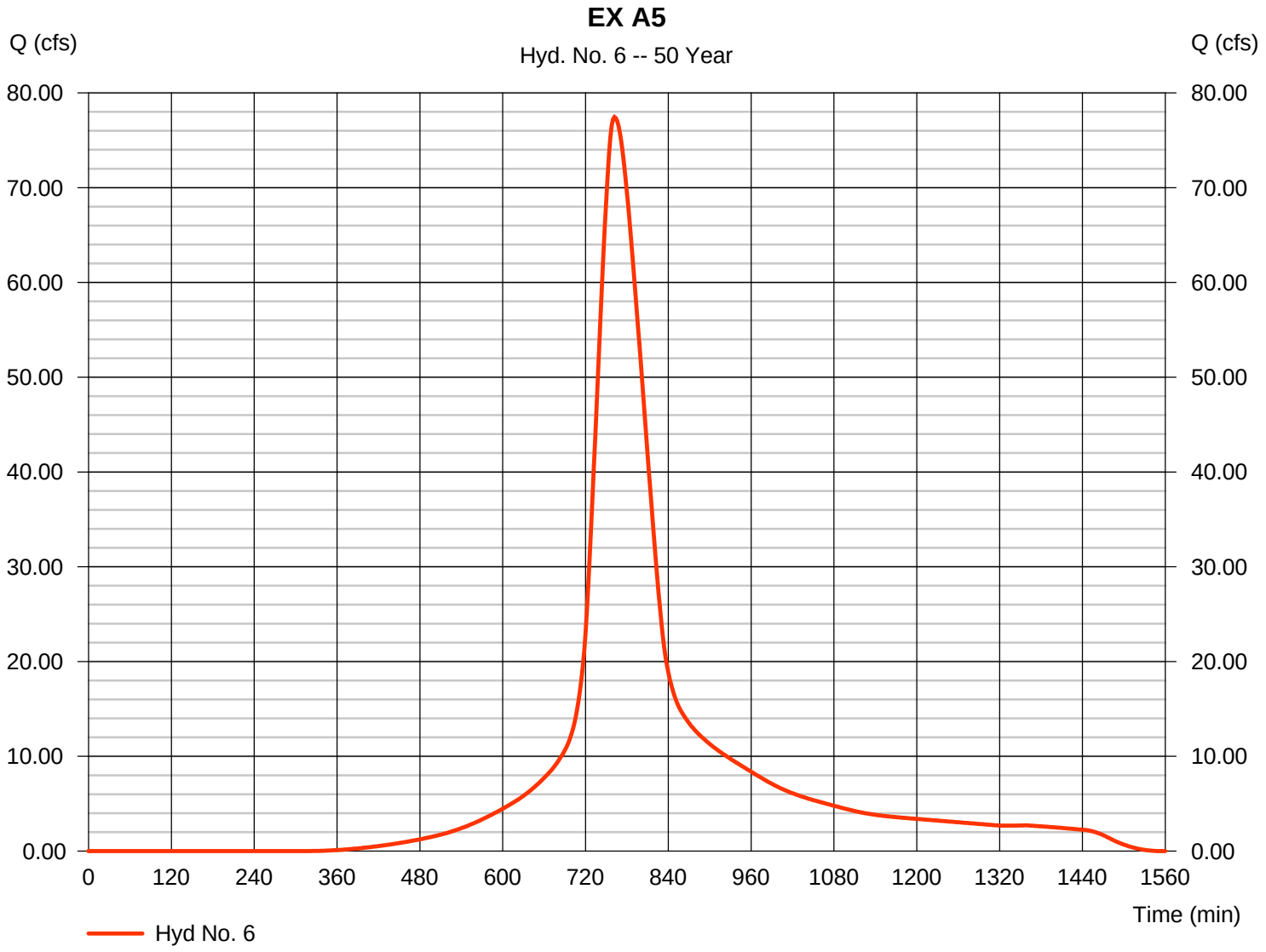


Hydrograph Report

Hyd. No. 6

EX A5

Hydrograph type	=	SCS Runoff	Peak discharge	=	77.45 cfs
Storm frequency	=	50 yrs	Time to peak	=	762 min
Time interval	=	2 min	Hyd. volume	=	661,307 cuft
Drainage area	=	24.990 ac	Curve number	=	78
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	63.10 min
Total precip.	=	9.96 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	434

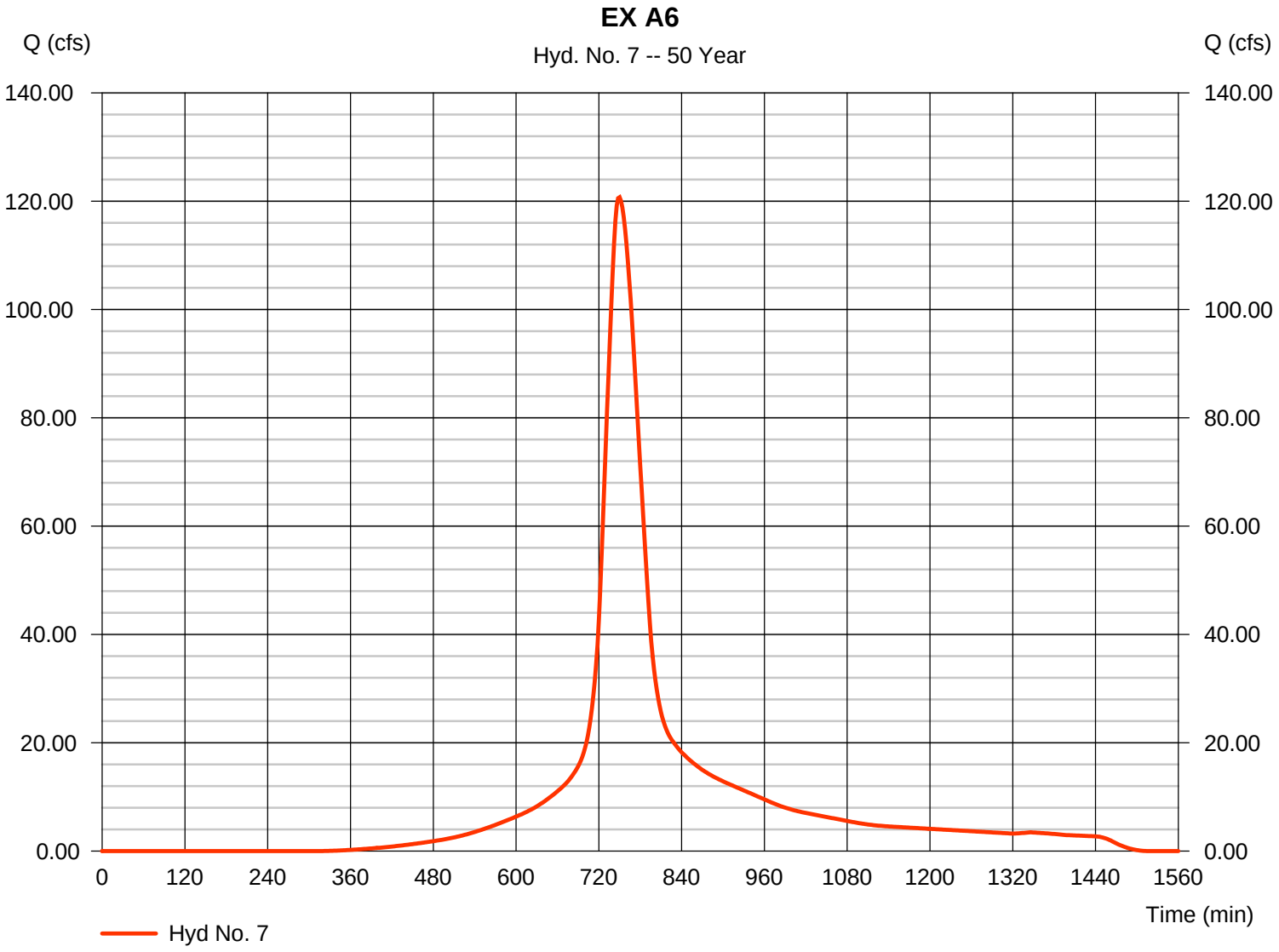


Hydrograph Report

Hyd. No. 7

EX A6

Hydrograph type	=	SCS Runoff	Peak discharge	=	120.72 cfs
Storm frequency	=	50 yrs	Time to peak	=	750 min
Time interval	=	2 min	Hyd. volume	=	823,260 cuft
Drainage area	=	31.110 ac	Curve number	=	78
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	40.80 min
Total precip.	=	9.96 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	434

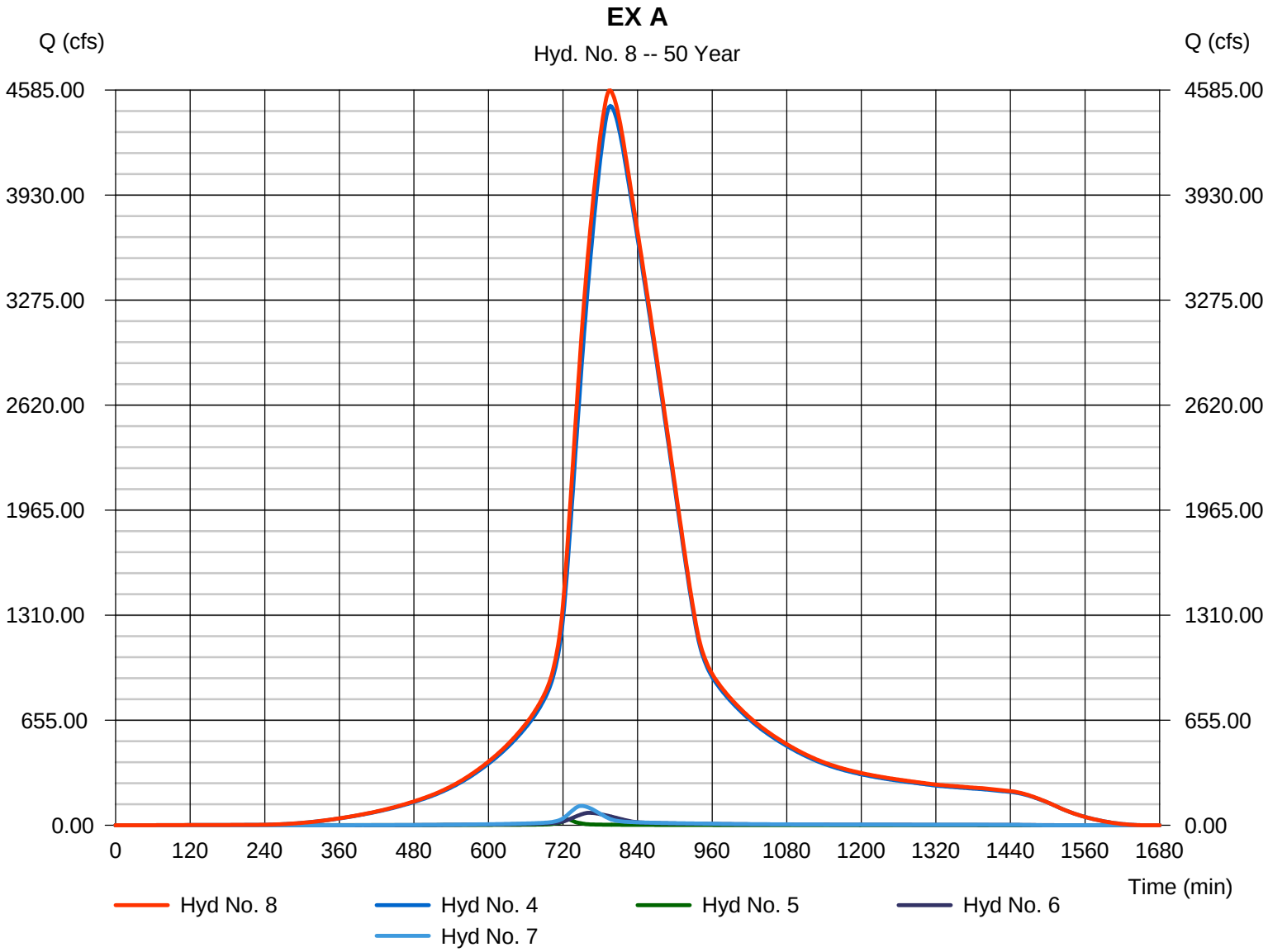


Hydrograph Report

Hyd. No. 8

EX A

Hydrograph type	=	Combine	Peak discharge	=	4582.87 cfs
Storm frequency	=	50 yrs	Time to peak	=	796 min
Time interval	=	2 min	Hyd. volume	=	61,991,436 cuft
Inflow hyds.	=	4, 5, 6, 7	Contrib. drain. area	=	60.550 ac

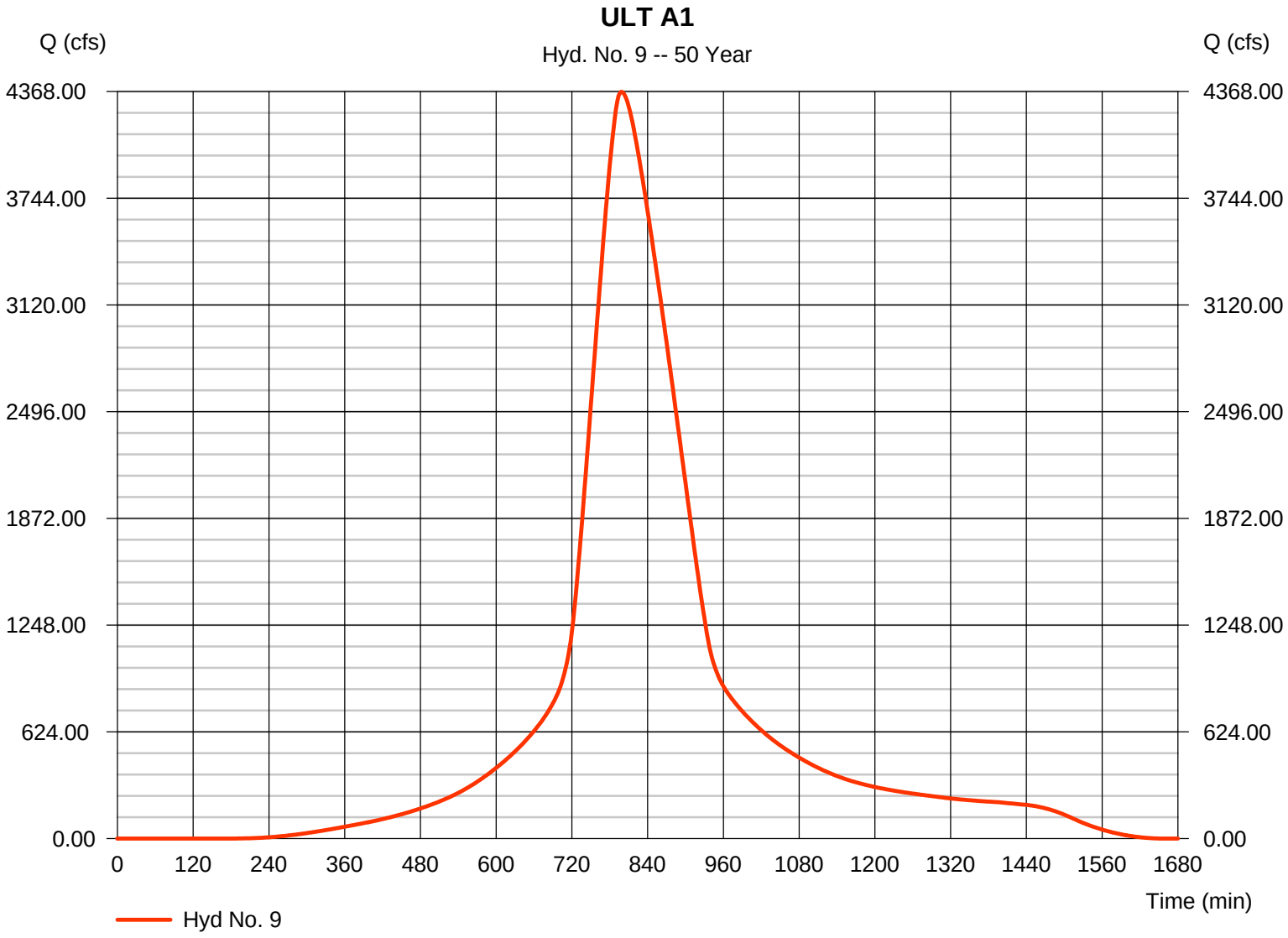


Hydrograph Report

Hyd. No. 9

ULT A1

Hydrograph type	=	SCS Runoff	Peak discharge	=	4365.42 cfs
Storm frequency	=	50 yrs	Time to peak	=	798 min
Time interval	=	2 min	Hyd. volume	=	59,109,112 cuft
Drainage area	=	1906.930 ac	Curve number	=	88.4
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	122.30 min
Total precip.	=	9.96 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	434

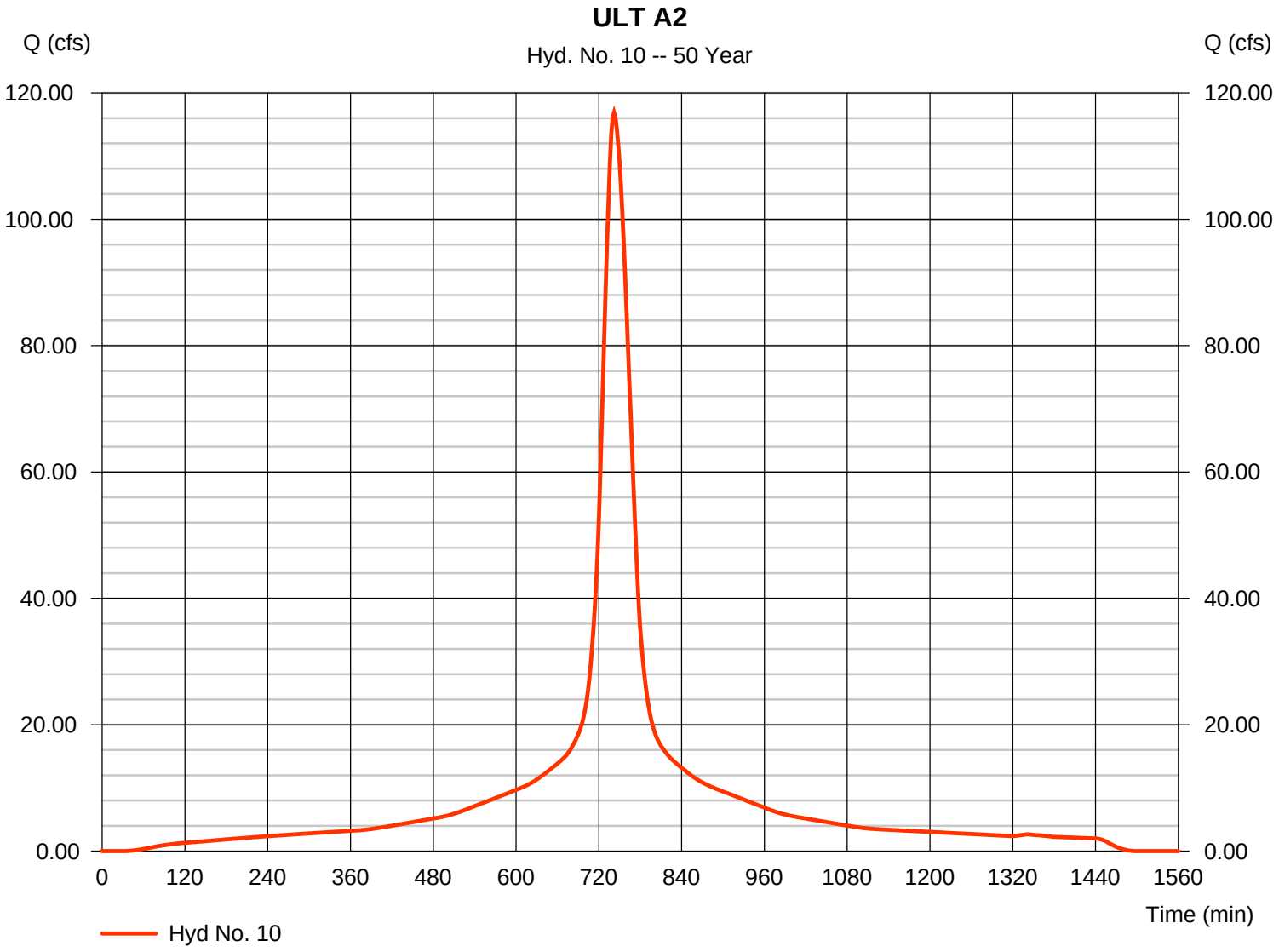


Hydrograph Report

Hyd. No. 10

ULT A2

Hydrograph type	=	SCS Runoff	Peak discharge	=	116.89 cfs
Storm frequency	=	50 yrs	Time to peak	=	742 min
Time interval	=	2 min	Hyd. volume	=	781,568 cuft
Drainage area	=	21.960 ac	Curve number	=	98
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	32.00 min
Total precip.	=	9.96 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	434



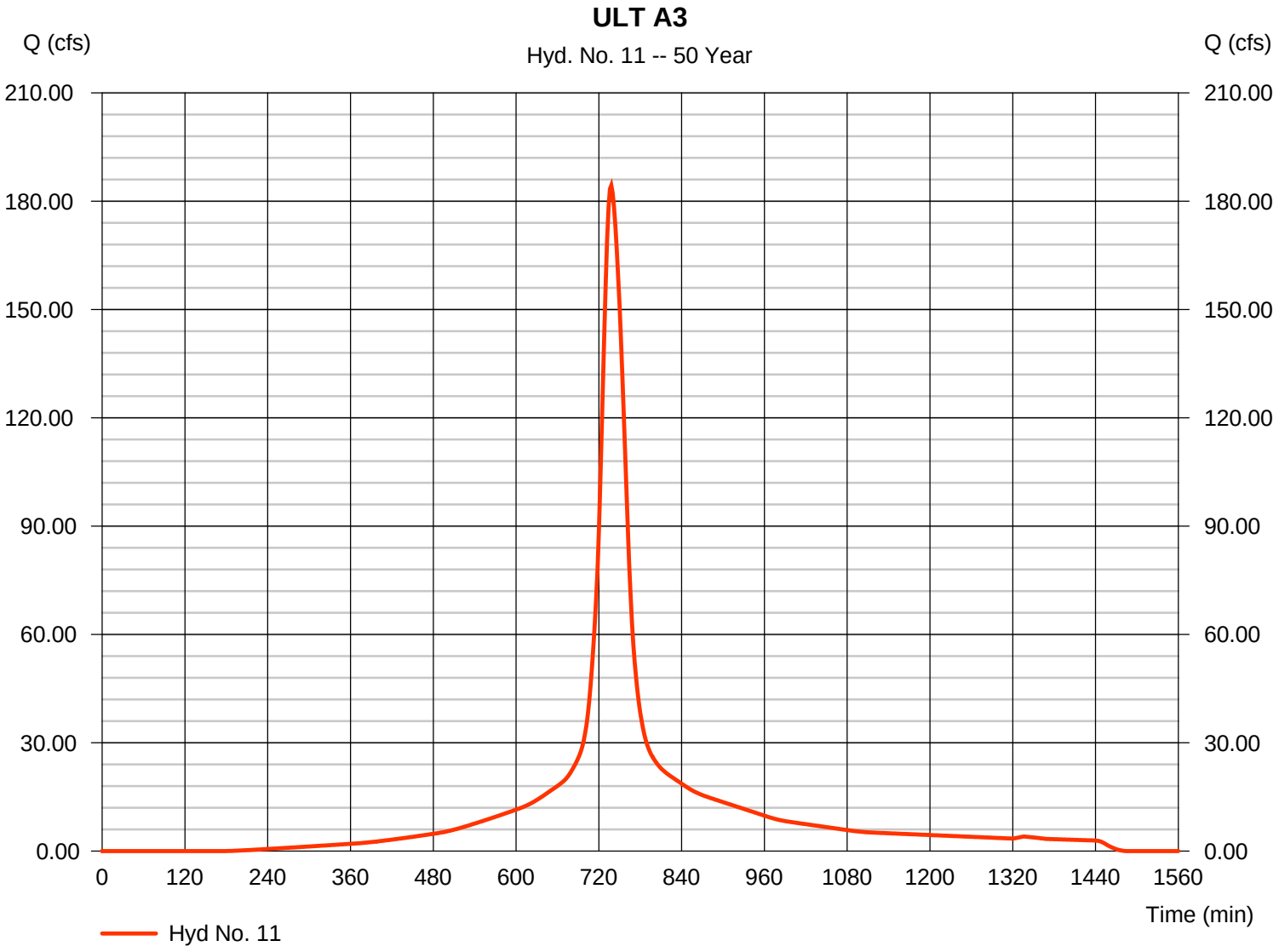
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2 Wednesday, 06 / 10 / 2020

Hyd. No. 11

ULT A3

Hydrograph type	=	SCS Runoff	Peak discharge	=	184.37 cfs
Storm frequency	=	50 yrs	Time to peak	=	738 min
Time interval	=	2 min	Hyd. volume	=	1,024,714 cuft
Drainage area	=	33.050 ac	Curve number	=	87.8
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	25.60 min
Total precip.	=	9.96 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	434

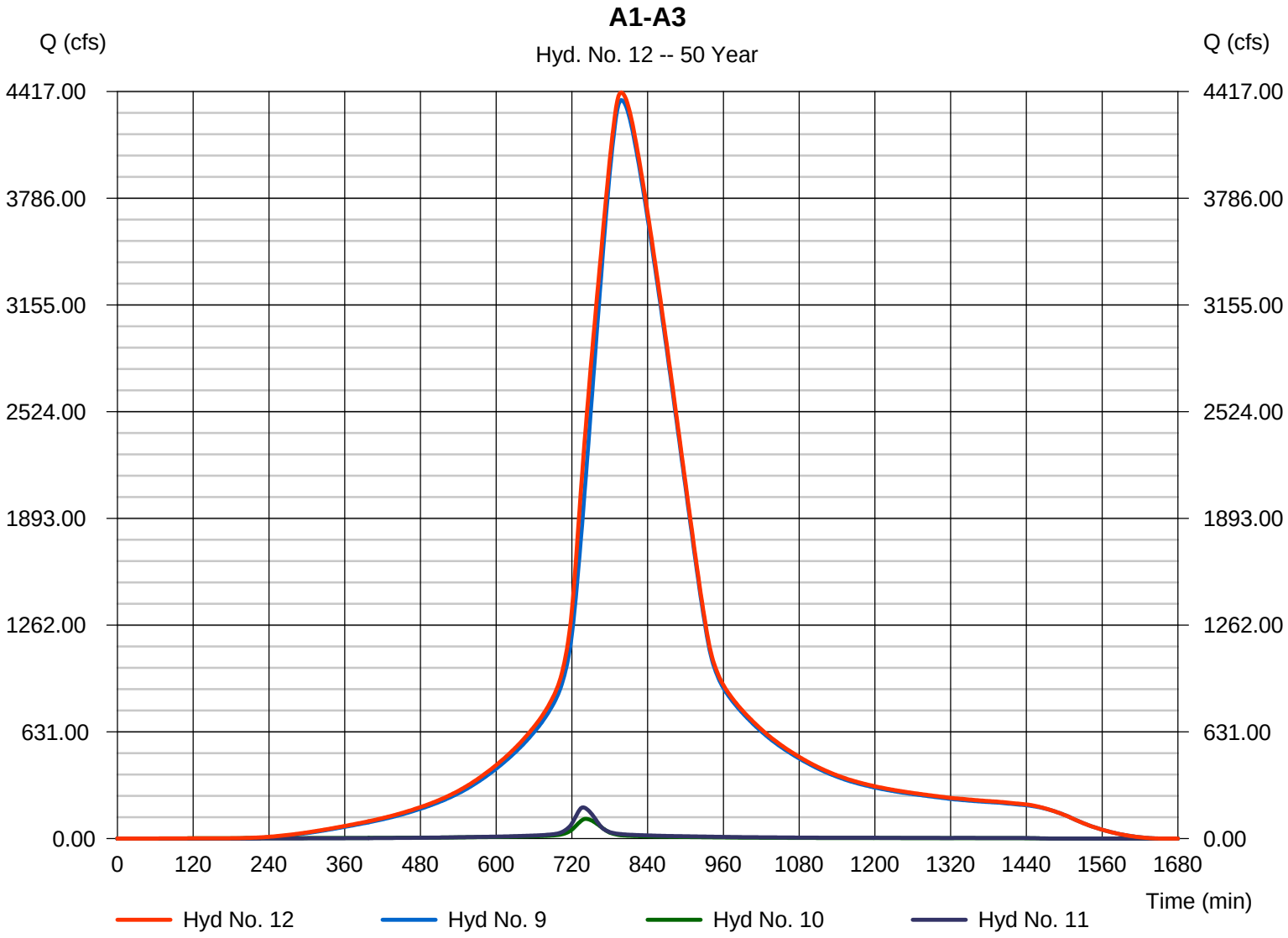


Hydrograph Report

Hyd. No. 12

A1-A3

Hydrograph type	=	Combine	Peak discharge	=	4411.32 cfs
Storm frequency	=	50 yrs	Time to peak	=	798 min
Time interval	=	2 min	Hyd. volume	=	60,915,384 cuft
Inflow hyds.	=	9, 10, 11	Contrib. drain. area	=	1961.940 ac

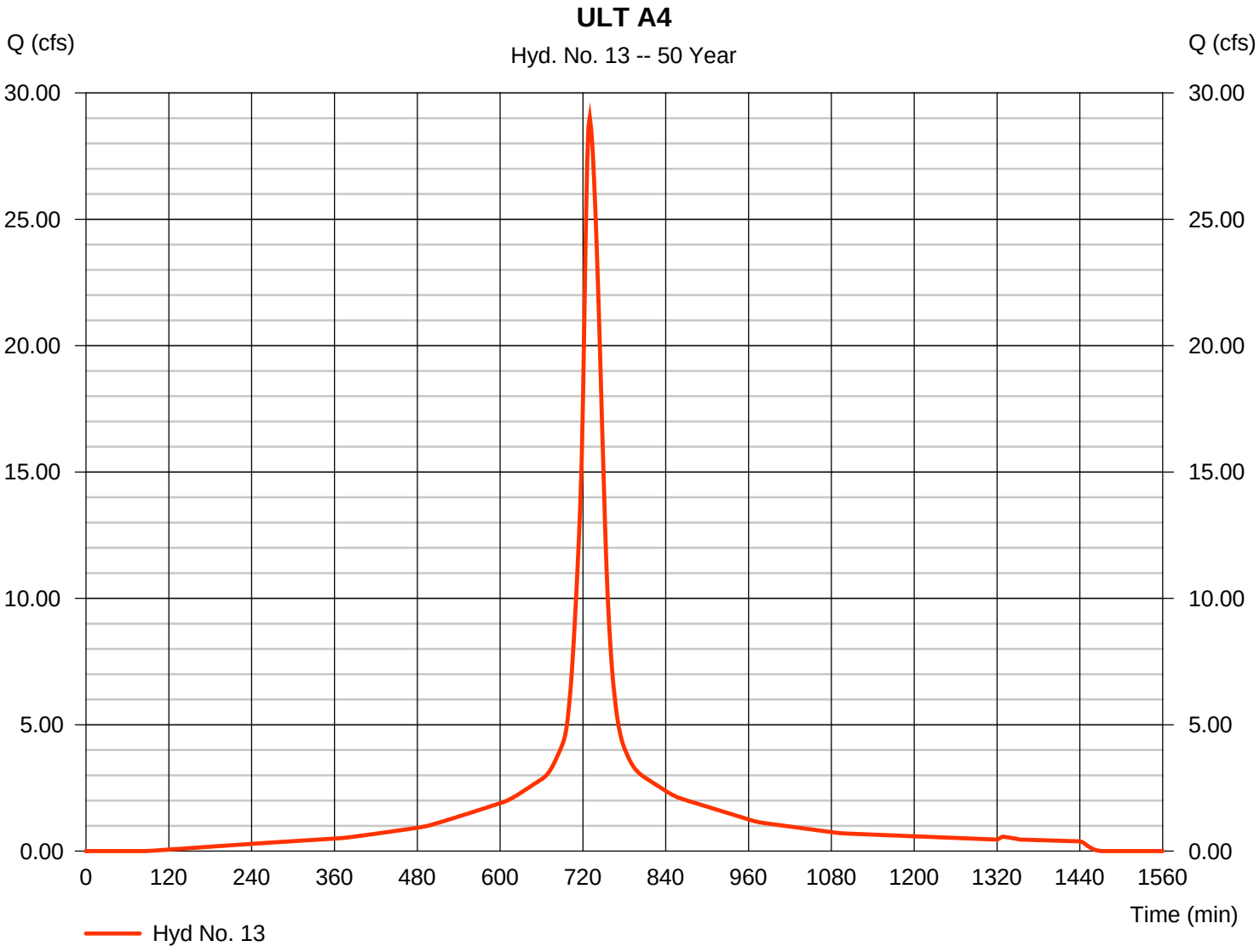


Hydrograph Report

Hyd. No. 13

ULT A4

Hydrograph type	=	SCS Runoff	Peak discharge	=	29.02 cfs
Storm frequency	=	50 yrs	Time to peak	=	730 min
Time interval	=	2 min	Hyd. volume	=	147,334 cuft
Drainage area	=	4.450 ac	Curve number	=	94
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	10.00 min
Total precip.	=	9.96 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	300

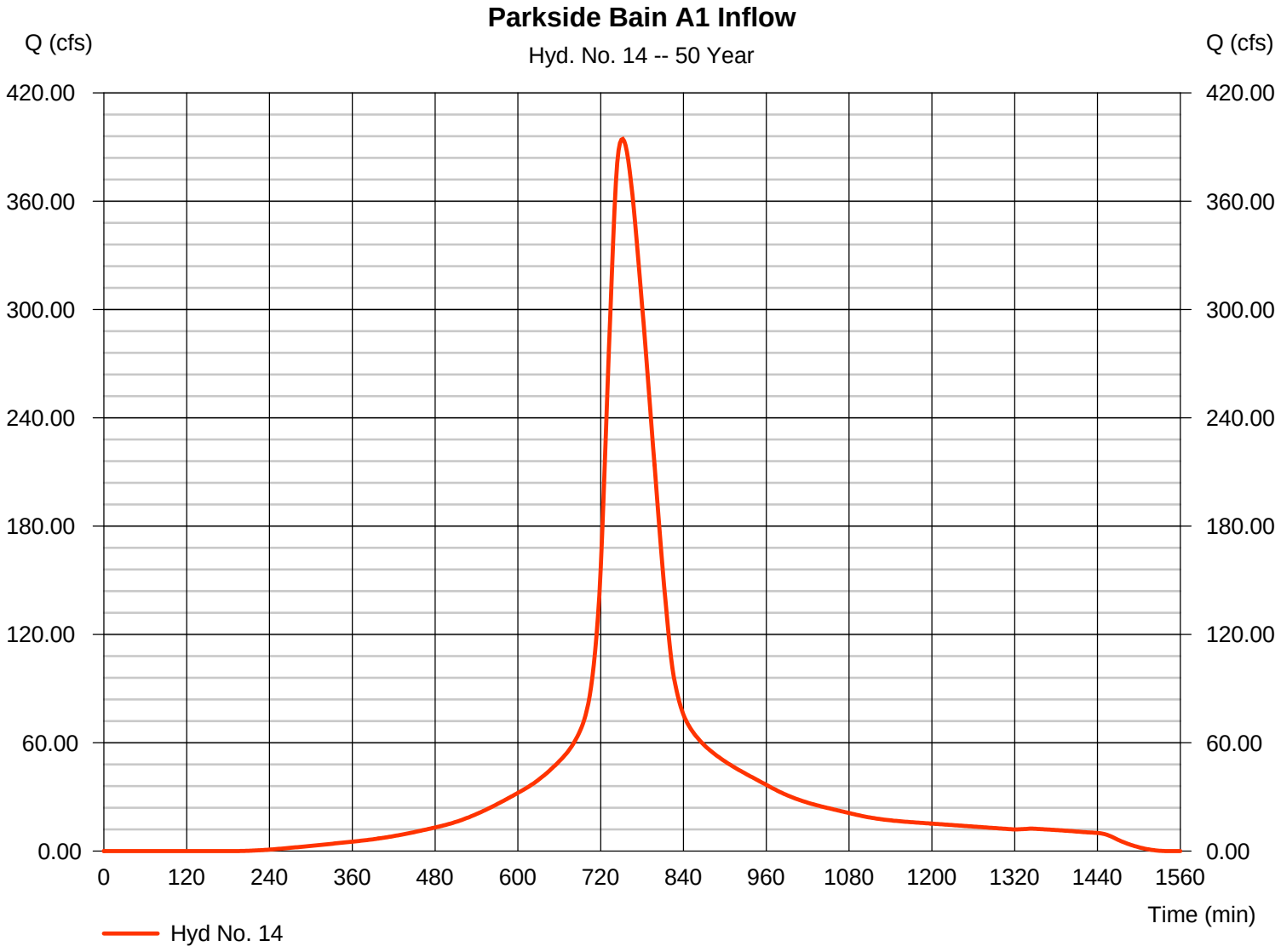


Hydrograph Report

Hyd. No. 14

Parkside Bain A1 Inflow

Hydrograph type	=	SCS Runoff	Peak discharge	=	394.48 cfs
Storm frequency	=	50 yrs	Time to peak	=	752 min
Time interval	=	2 min	Hyd. volume	=	3,342,488 cuft
Drainage area	=	109.260 ac	Curve number	=	87
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	37.90 min
Total precip.	=	9.96 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	300



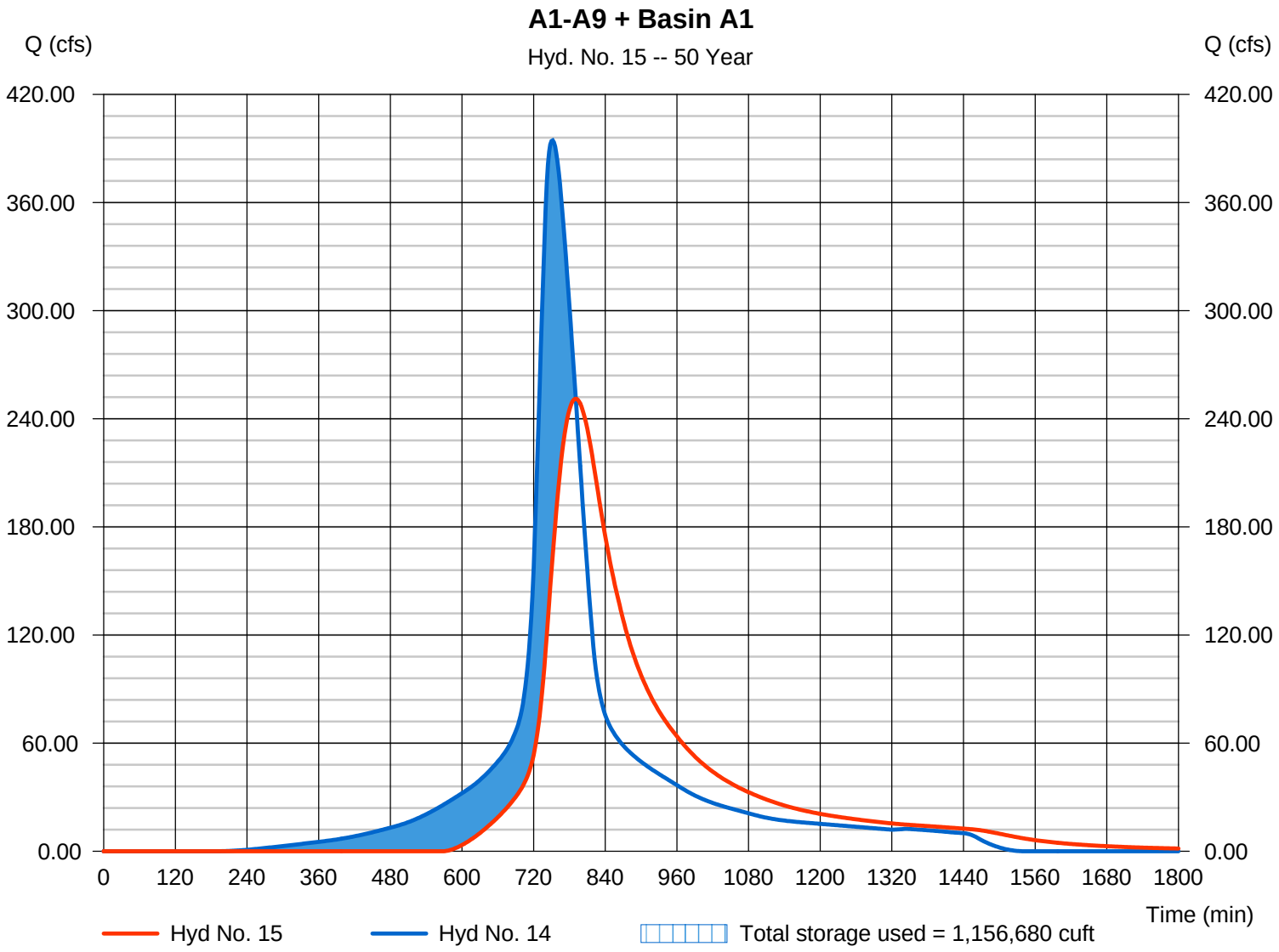
Hydrograph Report

Hyd. No. 15

A1-A9 + Basin A1

Hydrograph type	=	Reservoir	Peak discharge	=	251.12 cfs
Storm frequency	=	50 yrs	Time to peak	=	790 min
Time interval	=	2 min	Hyd. volume	=	3,158,184 cuft
Inflow hyd. No.	=	14 - Parkside Bain A1 Inflow	Max. Elevation	=	606.22 ft
Reservoir name	=	BASIN A1	Max. Storage	=	1,156,680 cuft

Storage Indication method used.

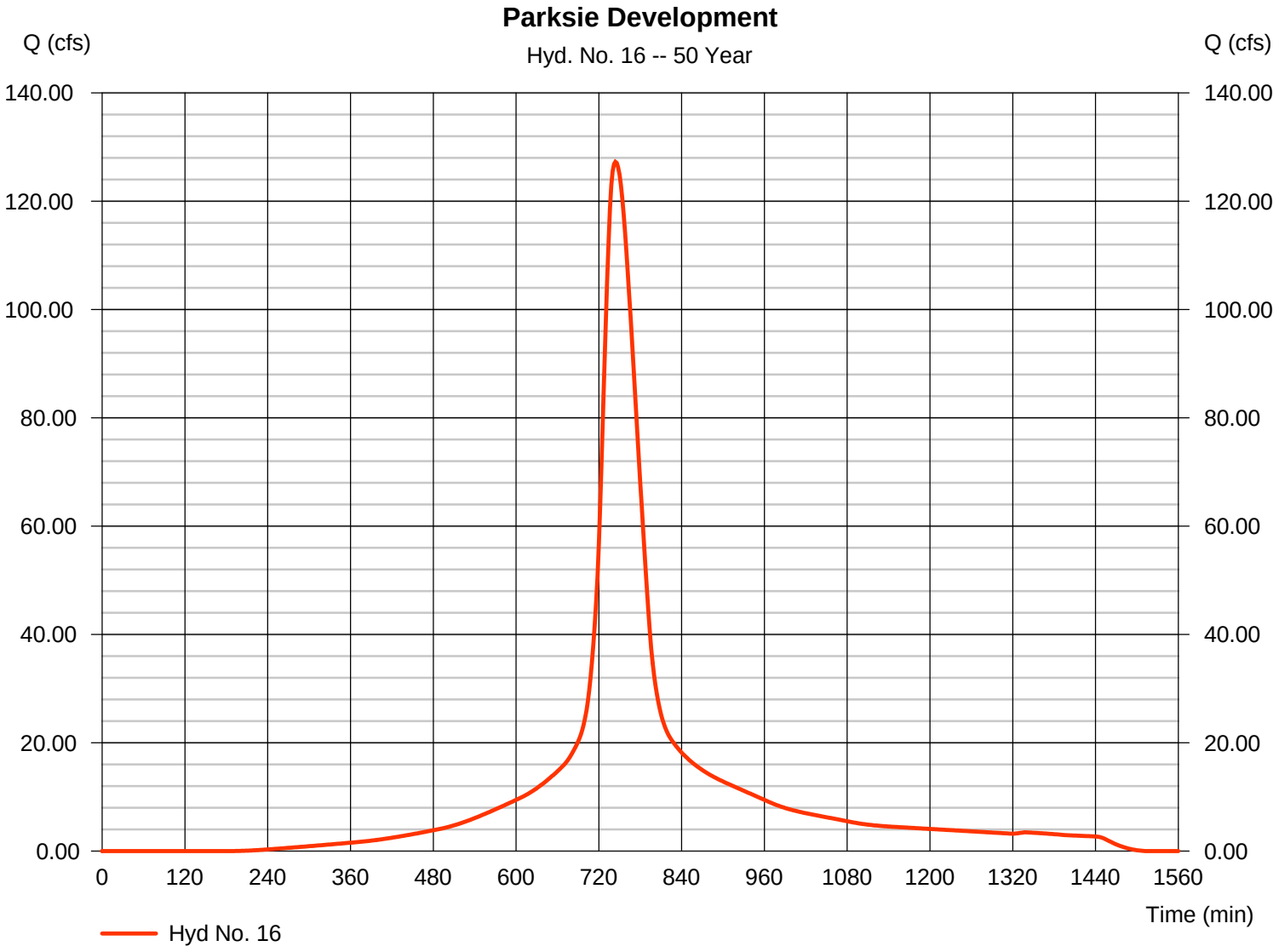


Hydrograph Report

Hyd. No. 16

Parksie Development

Hydrograph type	=	SCS Runoff	Peak discharge	=	127.27 cfs
Storm frequency	=	50 yrs	Time to peak	=	744 min
Time interval	=	2 min	Hyd. volume	=	915,925 cuft
Drainage area	=	29.940 ac	Curve number	=	87
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	28.50 min
Total precip.	=	9.96 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	300

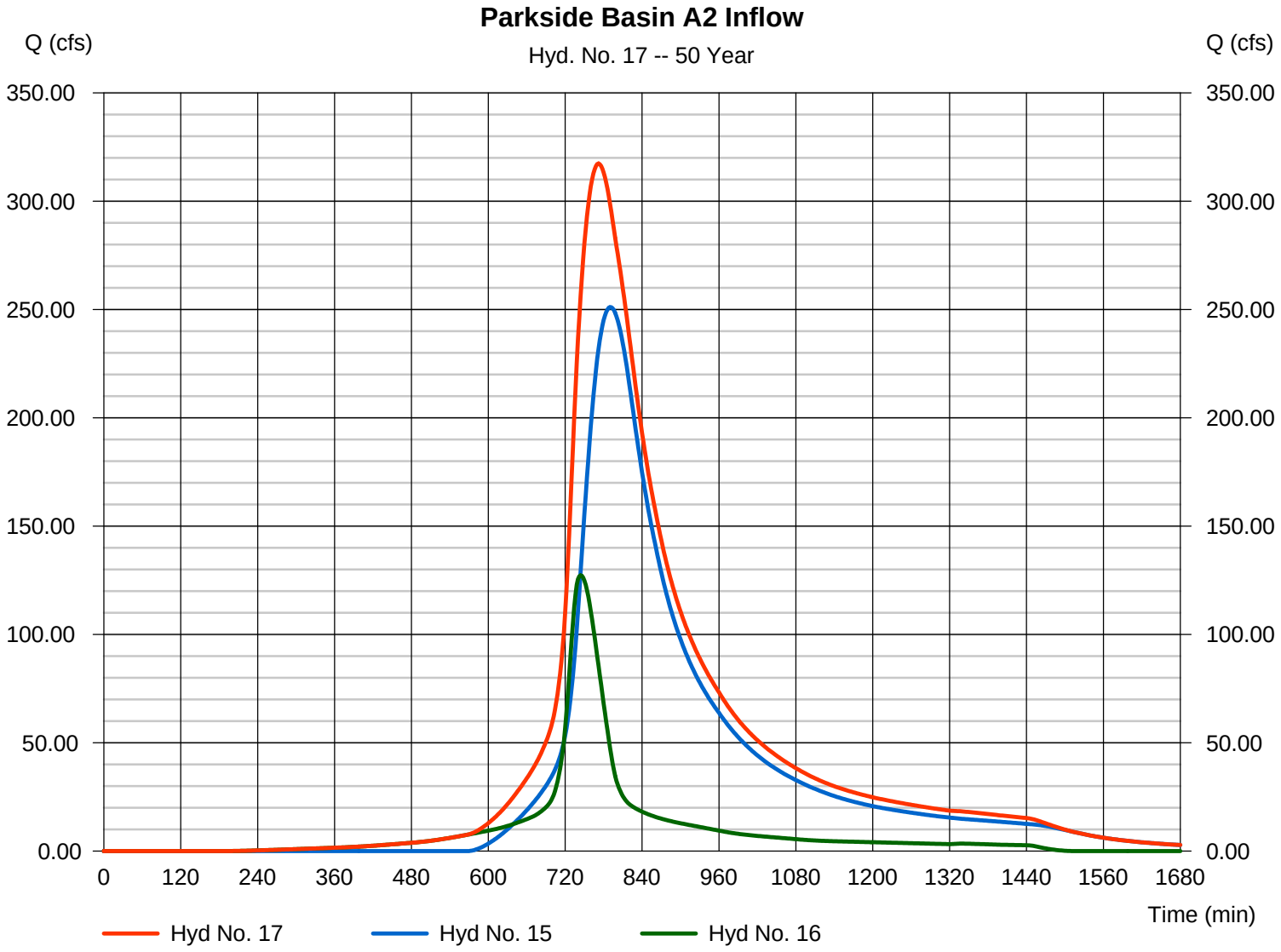


Hydrograph Report

Hyd. No. 17

Parkside Basin A2 Inflow

Hydrograph type	=	Combine	Peak discharge	=	317.40 cfs
Storm frequency	=	50 yrs	Time to peak	=	772 min
Time interval	=	2 min	Hyd. volume	=	4,074,110 cuft
Inflow hyds.	=	15, 16	Contrib. drain. area	=	29.940 ac



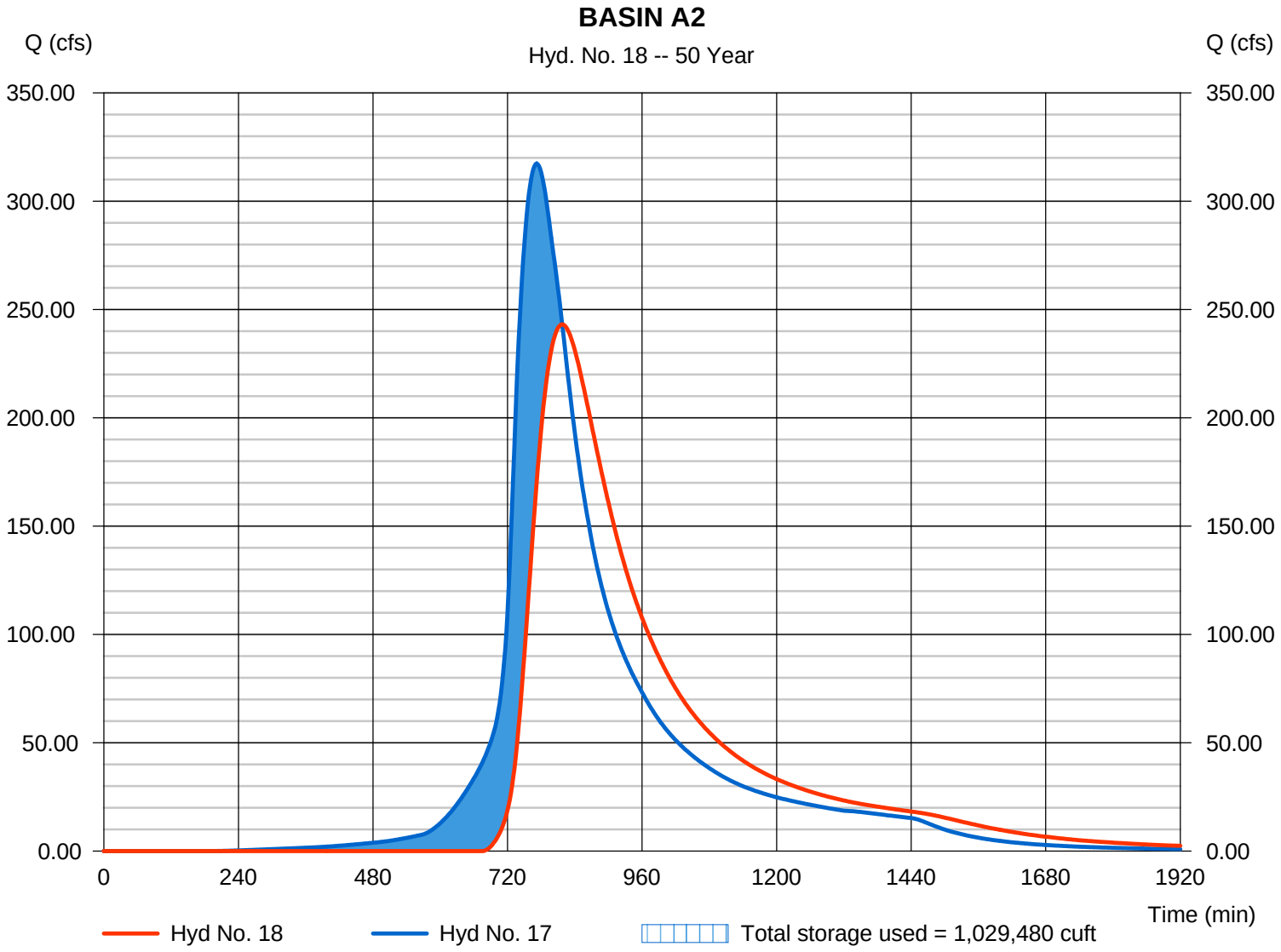
Hydrograph Report

Hyd. No. 18

BASIN A2

Hydrograph type	=	Reservoir	Peak discharge	=	243.14 cfs
Storm frequency	=	50 yrs	Time to peak	=	818 min
Time interval	=	2 min	Hyd. volume	=	3,881,226 cuft
Inflow hyd. No.	=	17 - Parkside Basin A2 Inflow	Max. Elevation	=	604.04 ft
Reservoir name	=	BASIN A2	Max. Storage	=	1,029,480 cuft

Storage Indication method used.

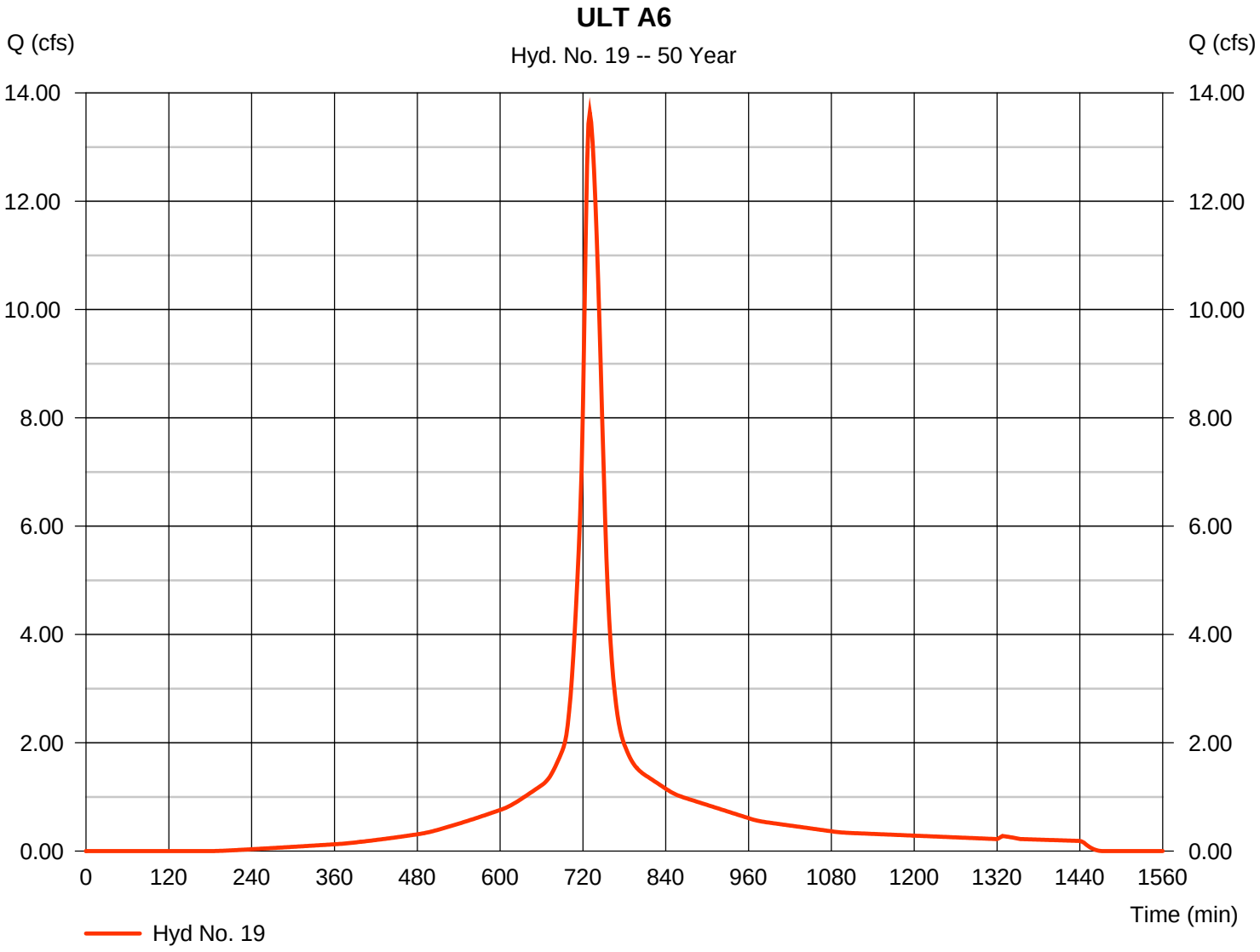


Hydrograph Report

Hyd. No. 19

ULT A6

Hydrograph type	=	SCS Runoff	Peak discharge	=	13.64 cfs
Storm frequency	=	50 yrs	Time to peak	=	730 min
Time interval	=	2 min	Hyd. volume	=	66,008 cuft
Drainage area	=	2.200 ac	Curve number	=	87
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	10.00 min
Total precip.	=	9.96 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	300

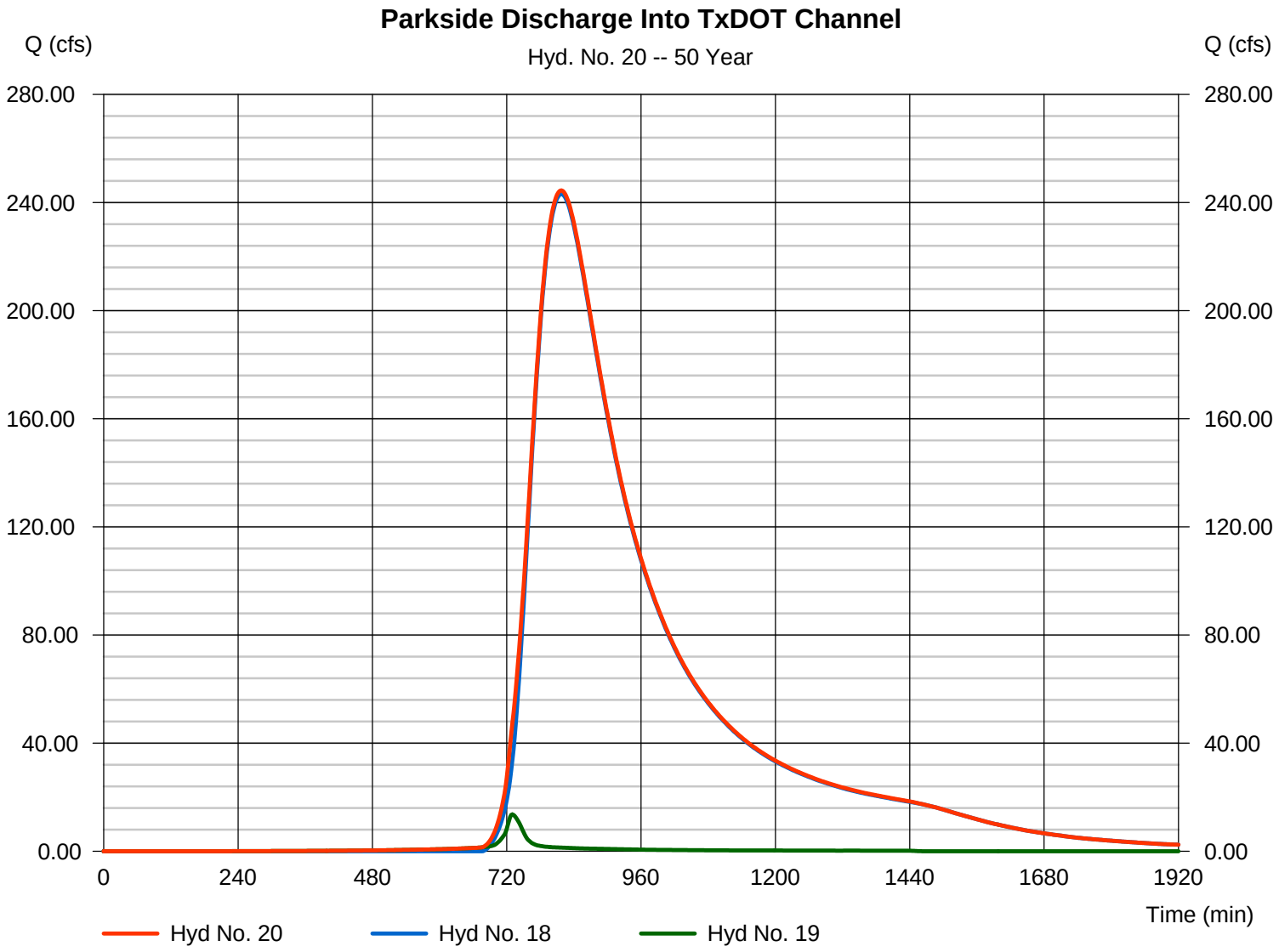


Hydrograph Report

Hyd. No. 20

Parkside Discharge Into TxDOT Channel

Hydrograph type	= Combine	Peak discharge	= 244.47 cfs
Storm frequency	= 50 yrs	Time to peak	= 818 min
Time interval	= 2 min	Hyd. volume	= 3,947,234 cuft
Inflow hyds.	= 18, 19	Contrib. drain. area	= 2.200 ac

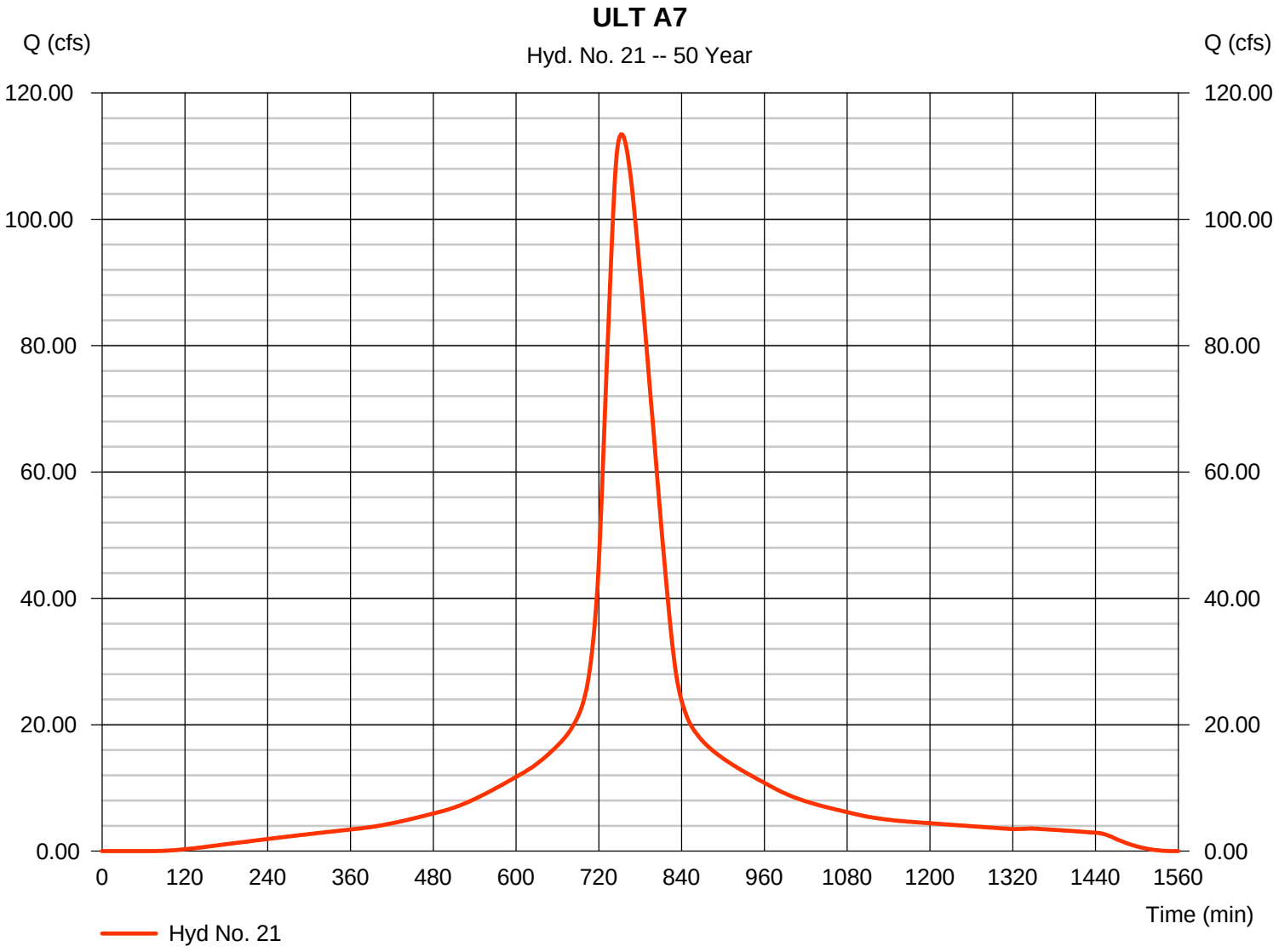


Hydrograph Report

Hyd. No. 21

ULT A7

Hydrograph type	=	SCS Runoff	Peak discharge	=	113.42 cfs
Storm frequency	=	50 yrs	Time to peak	=	752 min
Time interval	=	2 min	Hyd. volume	=	1,057,809 cuft
Drainage area	=	31.110 ac	Curve number	=	95
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	40.80 min
Total precip.	=	9.96 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	300

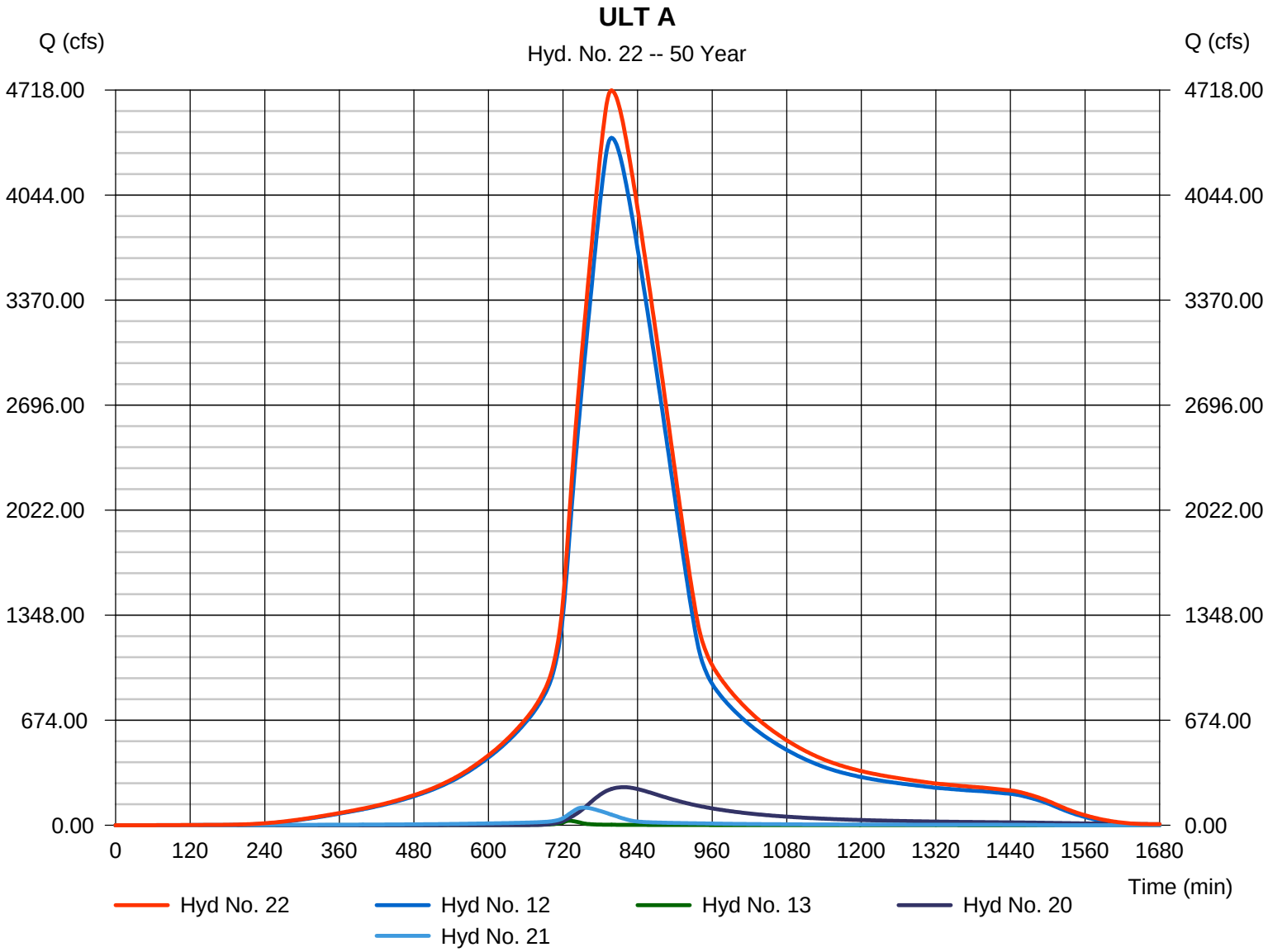


Hydrograph Report

Hyd. No. 22

ULT A

Hydrograph type	=	Combine	Peak discharge	=	4715.29 cfs
Storm frequency	=	50 yrs	Time to peak	=	798 min
Time interval	=	2 min	Hyd. volume	=	66,067,436 cuft
Inflow hyds.	=	12, 13, 20, 21	Contrib. drain. area	=	35.560 ac



Hydrograph Summary Report

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

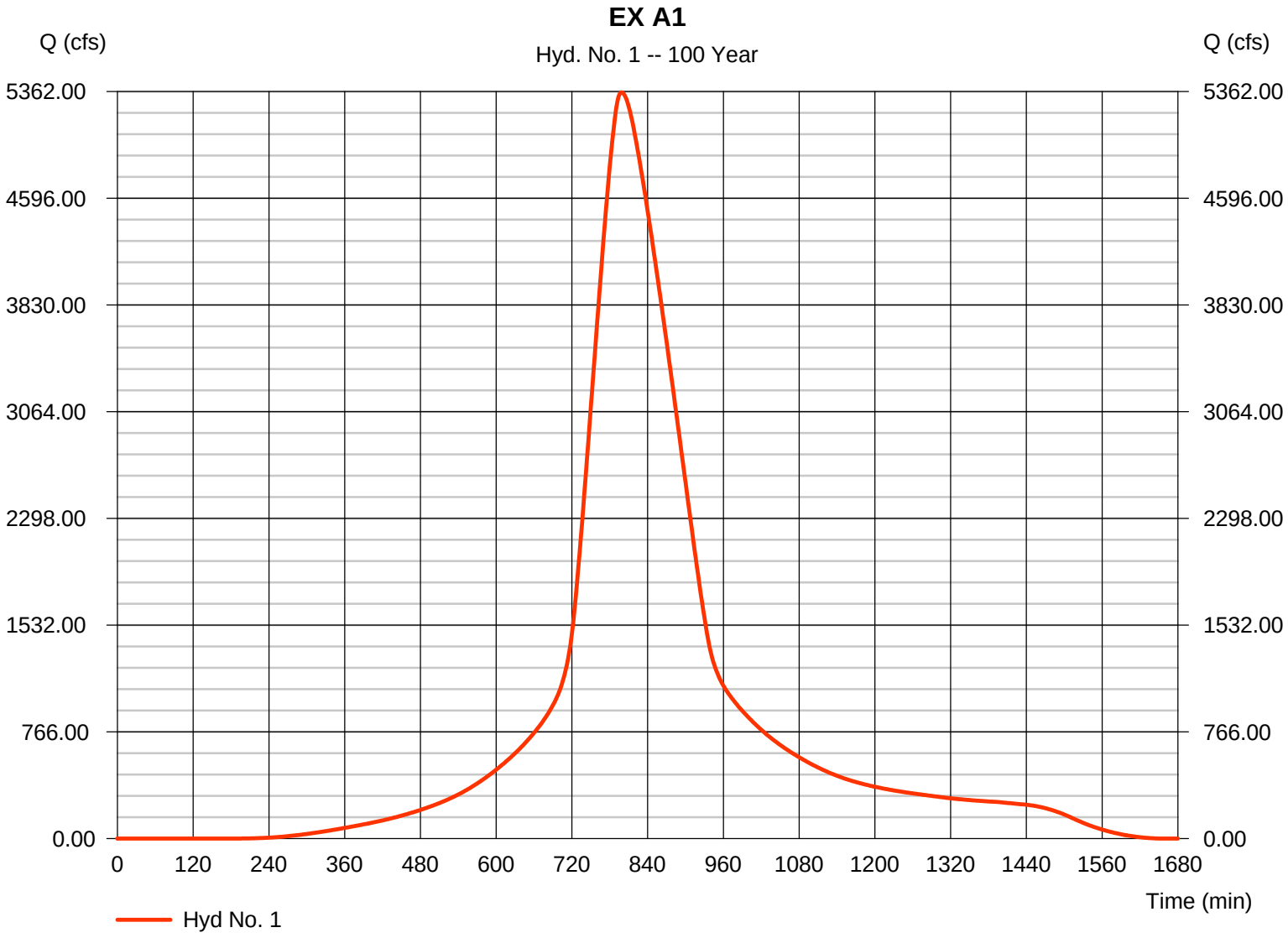
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	5355.58	2	798	72,308,288	------	------	------	EX A1
2	SCS Runoff	144.44	2	742	969,677	------	------	------	EX A2
3	SCS Runoff	492.94	2	760	4,112,785	------	------	------	EX A3
4	Combine	5698.02	2	796	77,390,728	1, 2, 3	------	------	EX A1 - EX A3
5	SCS Runoff	44.80	2	728	192,667	------	------	------	EX A4
6	SCS Runoff	100.52	2	762	865,861	------	------	------	EX A5
7	SCS Runoff	156.45	2	750	1,077,908	------	------	------	EX A6
8	Combine	5823.16	2	794	79,527,248	4, 5, 6, 7	------	------	EX A
9	SCS Runoff	5492.26	2	798	75,112,280	------	------	------	ULT A1
10	SCS Runoff	144.44	2	742	969,677	------	------	------	ULT A2
11	SCS Runoff	231.68	2	738	1,304,229	------	------	------	ULT A3
12	Combine	5549.23	2	798	77,386,184	9, 10, 11	------	------	A1-A3
13	SCS Runoff	36.02	2	730	184,561	------	------	------	ULT A4
14	SCS Runoff	497.35	2	752	4,263,412	------	------	------	Parkside Bain A1 Inflow
15	Reservoir	327.41	2	788	4,079,100	14	606.94	1,368,535	A1-A9 + Basin A1
16	SCS Runoff	160.40	2	744	1,168,281	------	------	------	Parksie Development
17	Combine	413.63	2	772	5,247,361	15, 16	------	------	Parkside Basin A2 Inflow
18	Reservoir	328.36	2	812	5,054,492	17	604.93	1,227,808	BASIN A2
19	SCS Runoff	17.17	2	730	84,195	------	------	------	ULT A6
20	Combine	330.09	2	810	5,138,687	18, 19	------	------	Parkside Discharge Into TxDOT Chan
21	SCS Runoff	140.61	2	752	1,321,845	------	------	------	ULT A7
22	Combine	5960.25	2	798	84,030,592	12, 13, 20, 21	------	------	ULT A

Hydrograph Report

Hyd. No. 1

EX A1

Hydrograph type	=	SCS Runoff	Peak discharge	=	5355.58 cfs
Storm frequency	=	100 yrs	Time to peak	=	798 min
Time interval	=	2 min	Hyd. volume	=	72,308,288 cuft
Drainage area	=	1906.930 ac	Curve number	=	85.3
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	122.30 min
Total precip.	=	12.30 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	434

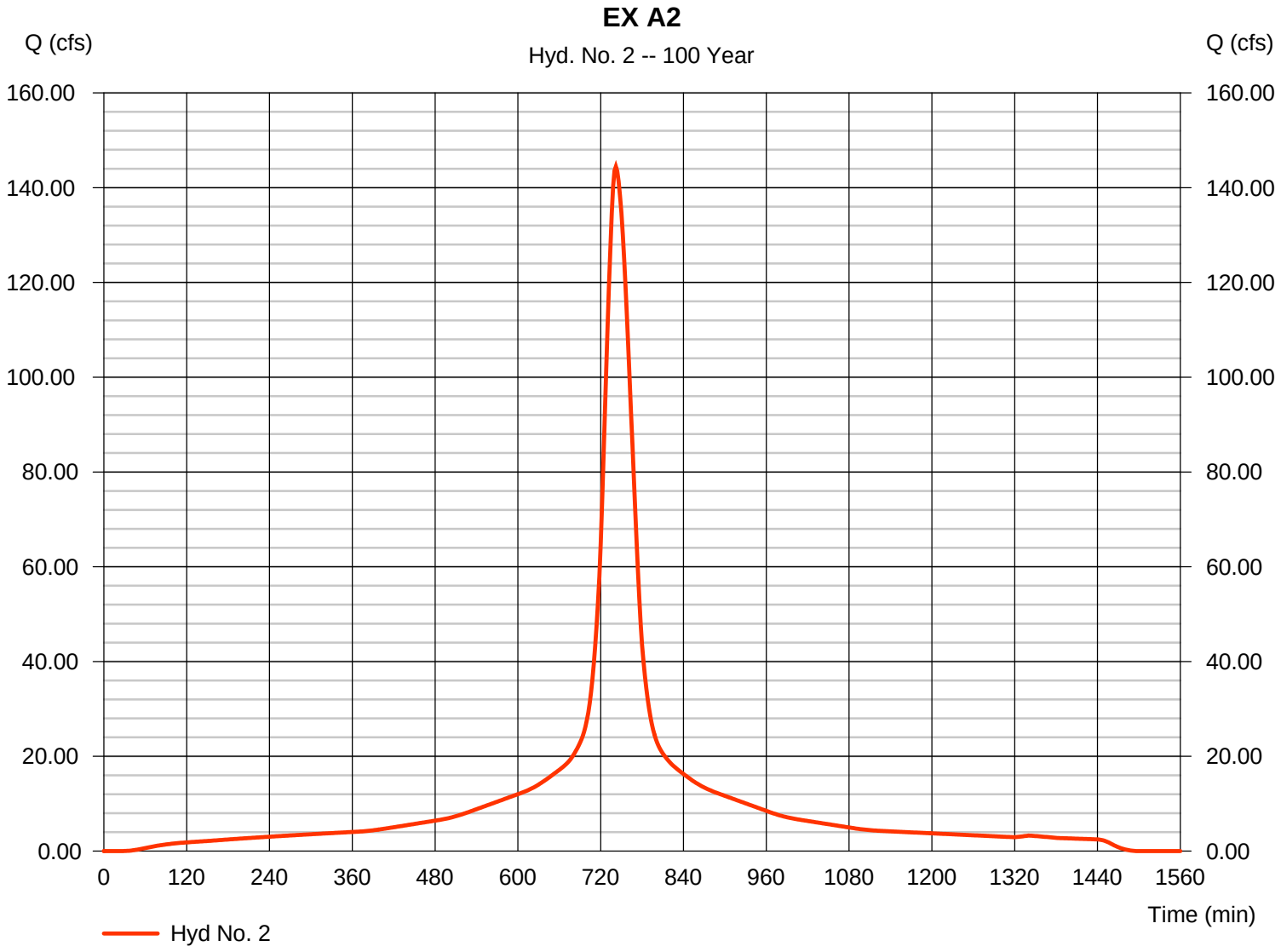


Hydrograph Report

Hyd. No. 2

EX A2

Hydrograph type	=	SCS Runoff	Peak discharge	=	144.44 cfs
Storm frequency	=	100 yrs	Time to peak	=	742 min
Time interval	=	2 min	Hyd. volume	=	969,677 cuft
Drainage area	=	21.960 ac	Curve number	=	98
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	32.00 min
Total precip.	=	12.30 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	434

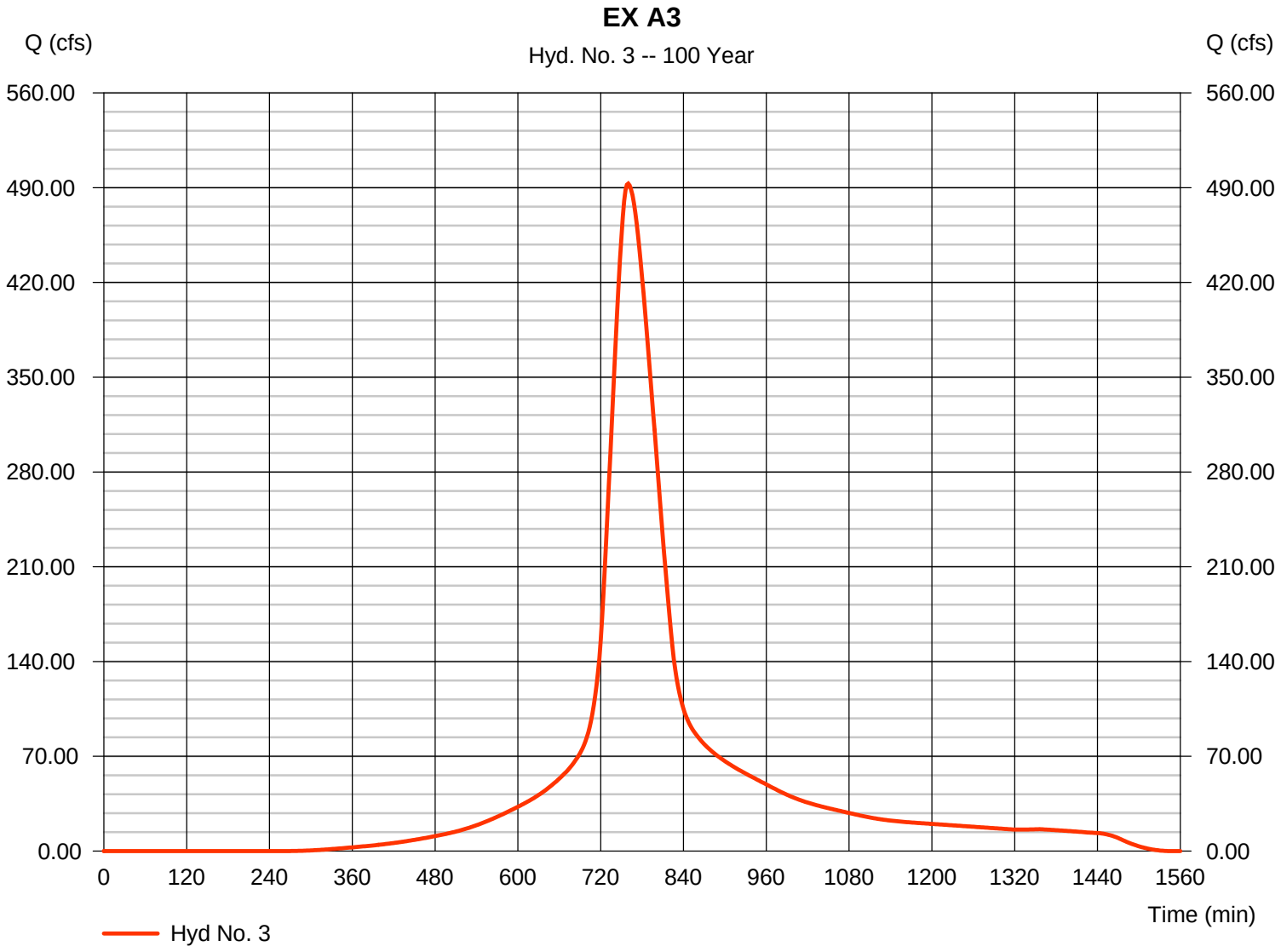


Hydrograph Report

Hyd. No. 3

EX A3

Hydrograph type	=	SCS Runoff	Peak discharge	=	492.94 cfs
Storm frequency	=	100 yrs	Time to peak	=	760 min
Time interval	=	2 min	Hyd. volume	=	4,112,785 cuft
Drainage area	=	117.840 ac	Curve number	=	78.5
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	59.60 min
Total precip.	=	12.30 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	434

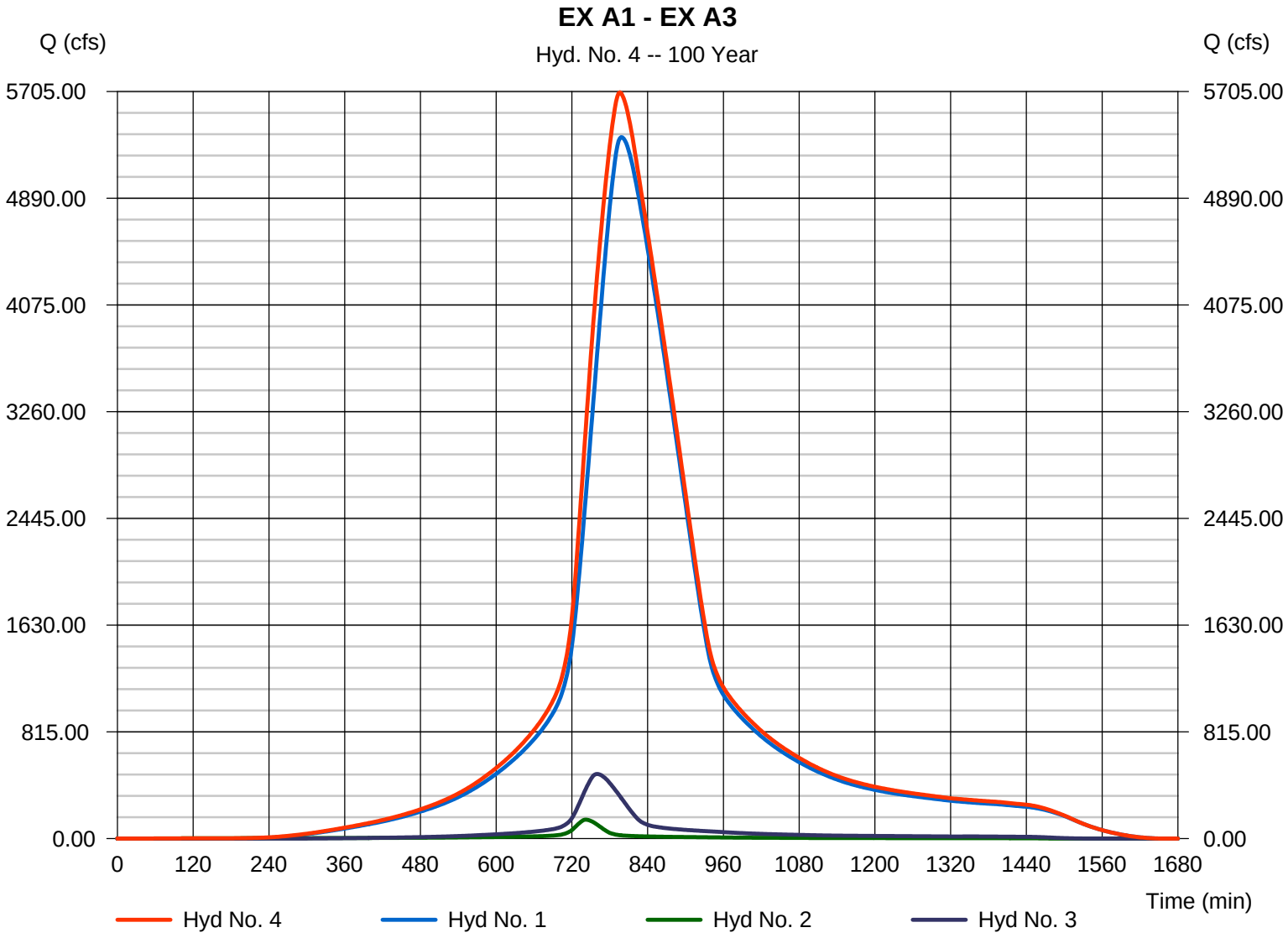


Hydrograph Report

Hyd. No. 4

EX A1 - EX A3

Hydrograph type	=	Combine	Peak discharge	=	5698.02 cfs
Storm frequency	=	100 yrs	Time to peak	=	796 min
Time interval	=	2 min	Hyd. volume	=	77,390,728 cuft
Inflow hyds.	=	1, 2, 3	Contrib. drain. area	=	2046.730 ac

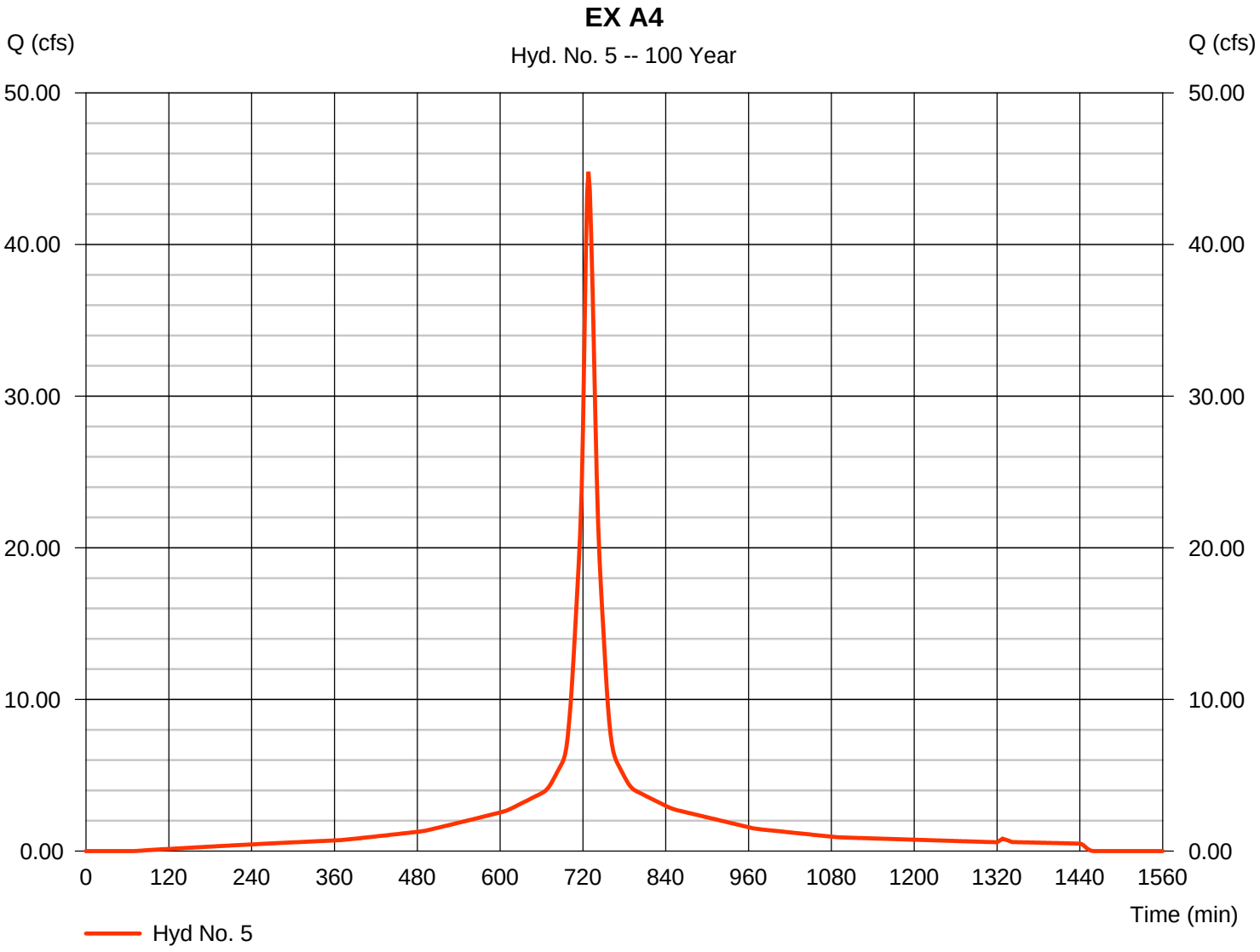


Hydrograph Report

Hyd. No. 5

EX A4

Hydrograph type	=	SCS Runoff	Peak discharge	=	44.80 cfs
Storm frequency	=	100 yrs	Time to peak	=	728 min
Time interval	=	2 min	Hyd. volume	=	192,667 cuft
Drainage area	=	4.450 ac	Curve number	=	94
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	10.00 min
Total precip.	=	12.30 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484

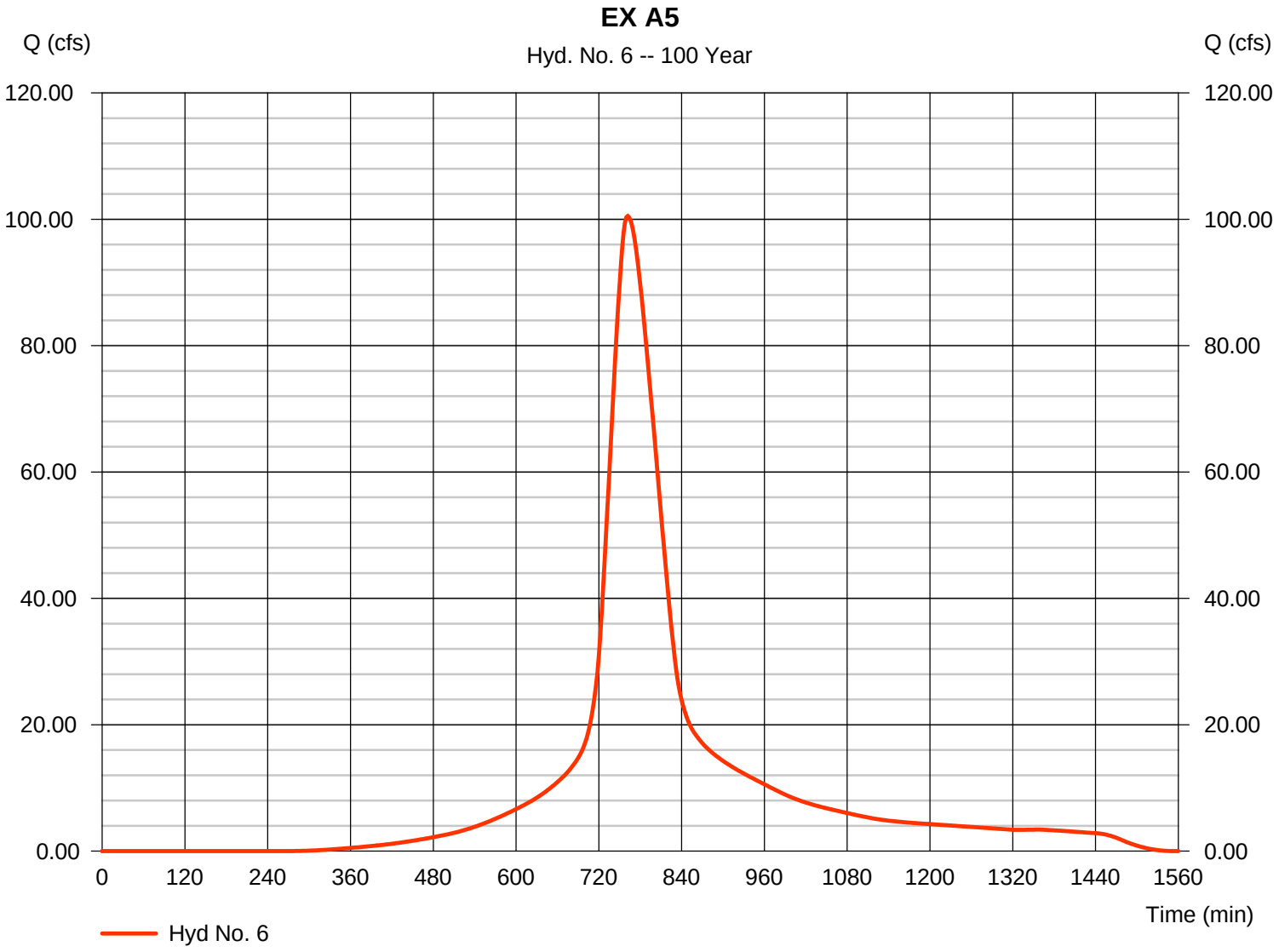


Hydrograph Report

Hyd. No. 6

EX A5

Hydrograph type	=	SCS Runoff	Peak discharge	=	100.52 cfs
Storm frequency	=	100 yrs	Time to peak	=	762 min
Time interval	=	2 min	Hyd. volume	=	865,861 cuft
Drainage area	=	24.990 ac	Curve number	=	78
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	63.10 min
Total precip.	=	12.30 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	434

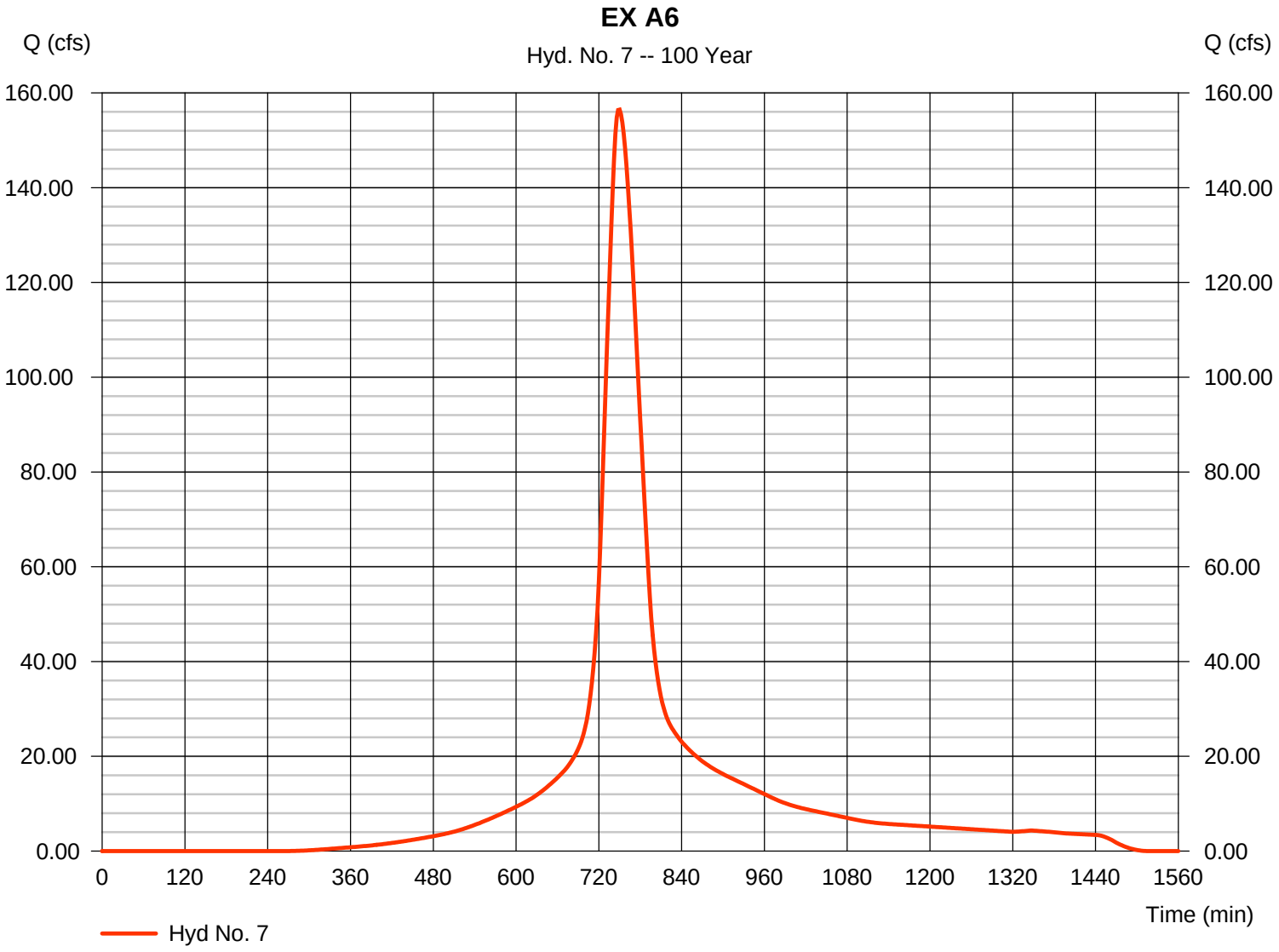


Hydrograph Report

Hyd. No. 7

EX A6

Hydrograph type	=	SCS Runoff	Peak discharge	=	156.45 cfs
Storm frequency	=	100 yrs	Time to peak	=	750 min
Time interval	=	2 min	Hyd. volume	=	1,077,908 cuft
Drainage area	=	31.110 ac	Curve number	=	78
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	40.80 min
Total precip.	=	12.30 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	434

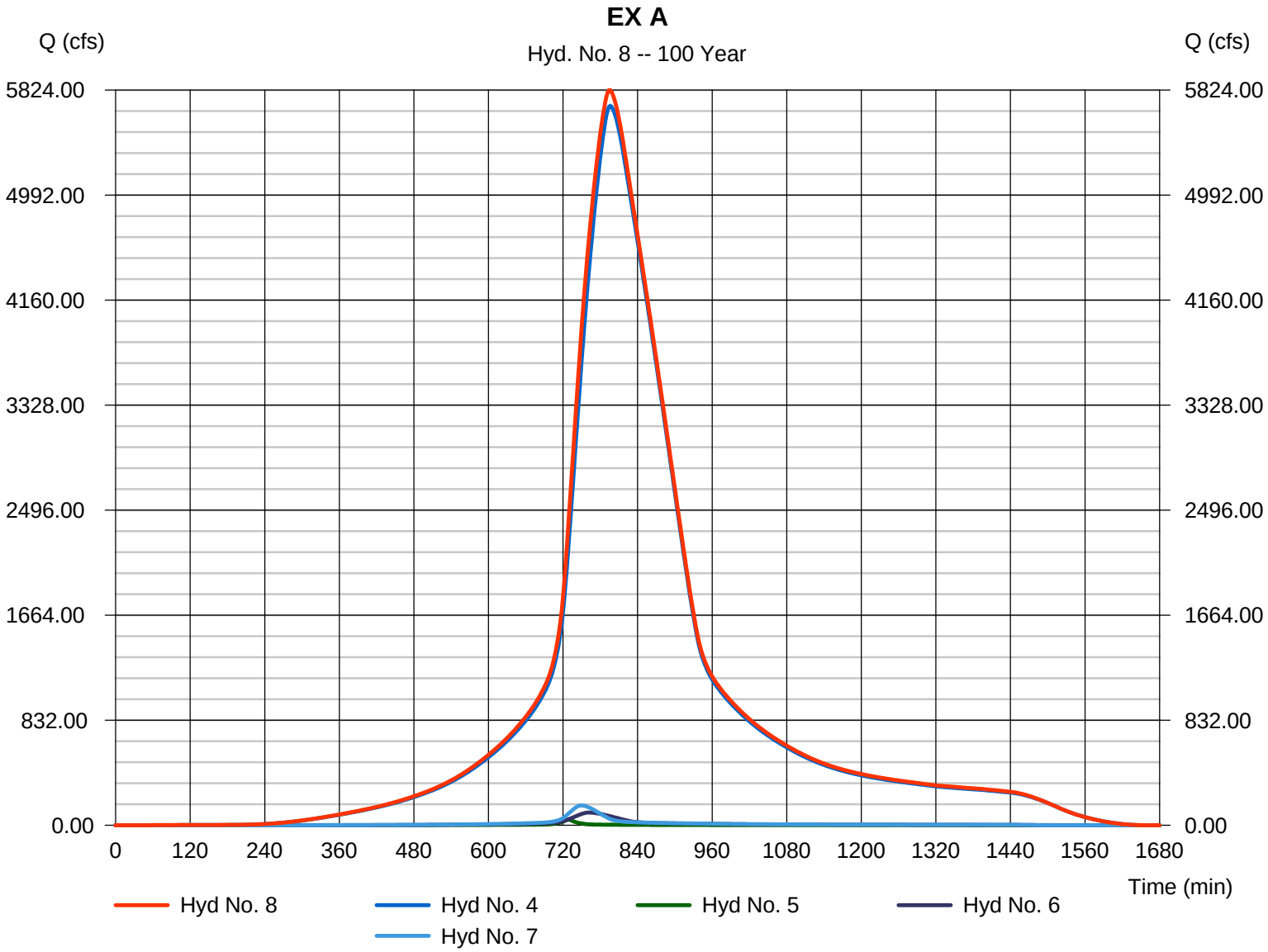


Hydrograph Report

Hyd. No. 8

EX A

Hydrograph type	=	Combine	Peak discharge	=	5823.16 cfs
Storm frequency	=	100 yrs	Time to peak	=	794 min
Time interval	=	2 min	Hyd. volume	=	79,527,248 cuft
Inflow hyds.	=	4, 5, 6, 7	Contrib. drain. area	=	60.550 ac

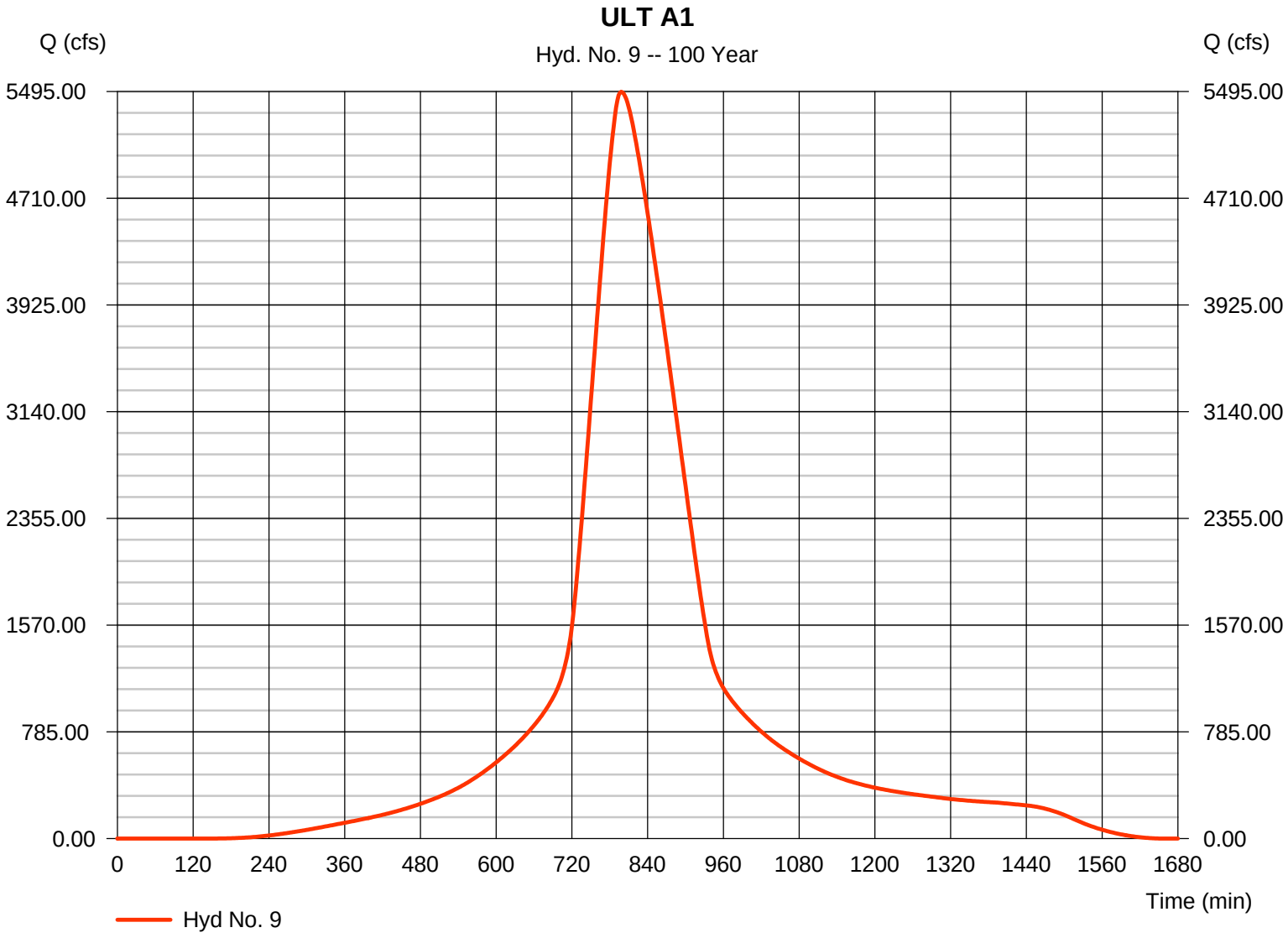


Hydrograph Report

Hyd. No. 9

ULT A1

Hydrograph type	=	SCS Runoff	Peak discharge	=	5492.26 cfs
Storm frequency	=	100 yrs	Time to peak	=	798 min
Time interval	=	2 min	Hyd. volume	=	75,112,280 cuft
Drainage area	=	1906.930 ac	Curve number	=	88.4
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	122.30 min
Total precip.	=	12.30 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	434

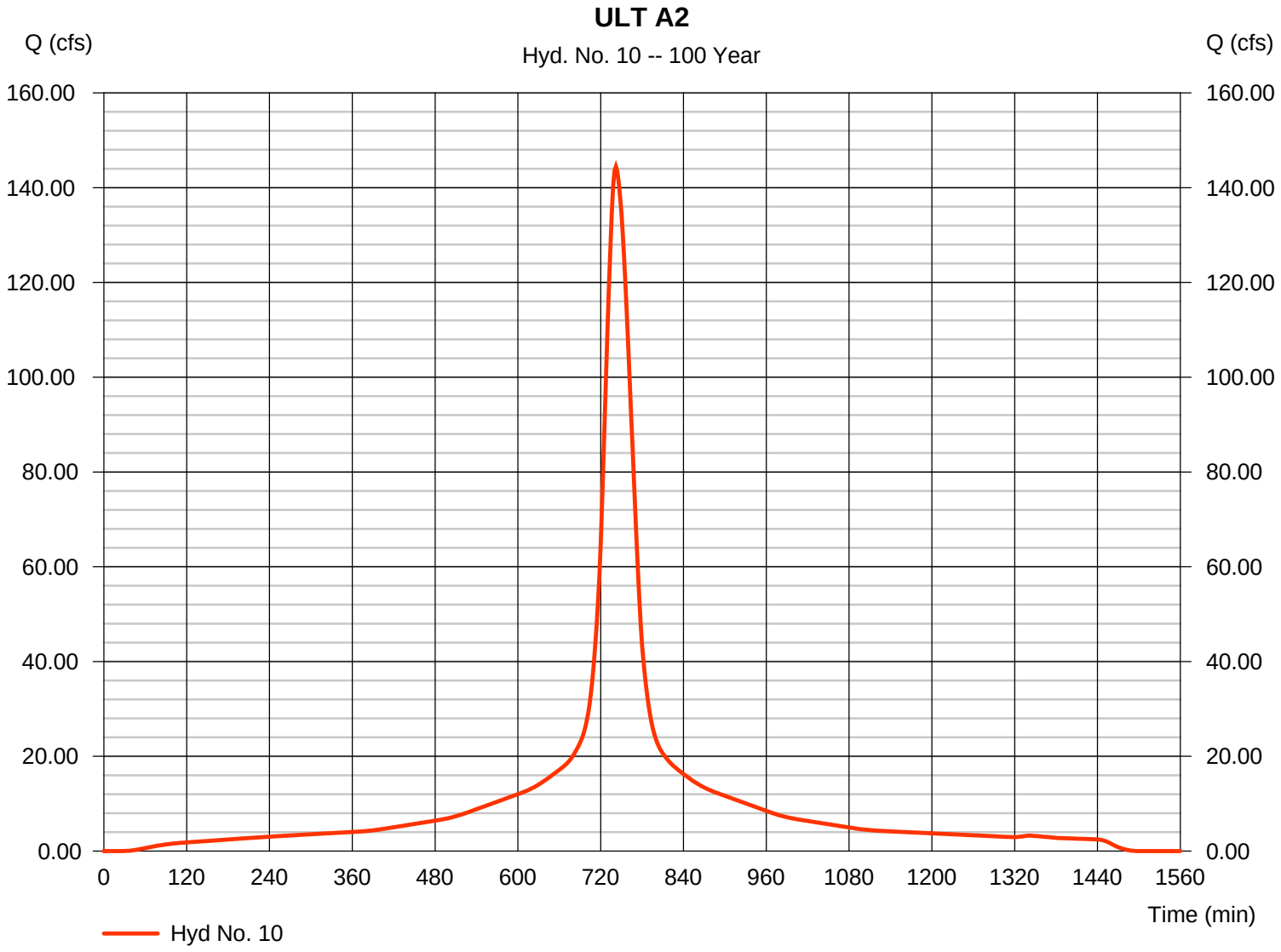


Hydrograph Report

Hyd. No. 10

ULT A2

Hydrograph type	=	SCS Runoff	Peak discharge	=	144.44 cfs
Storm frequency	=	100 yrs	Time to peak	=	742 min
Time interval	=	2 min	Hyd. volume	=	969,677 cuft
Drainage area	=	21.960 ac	Curve number	=	98
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	32.00 min
Total precip.	=	12.30 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	434



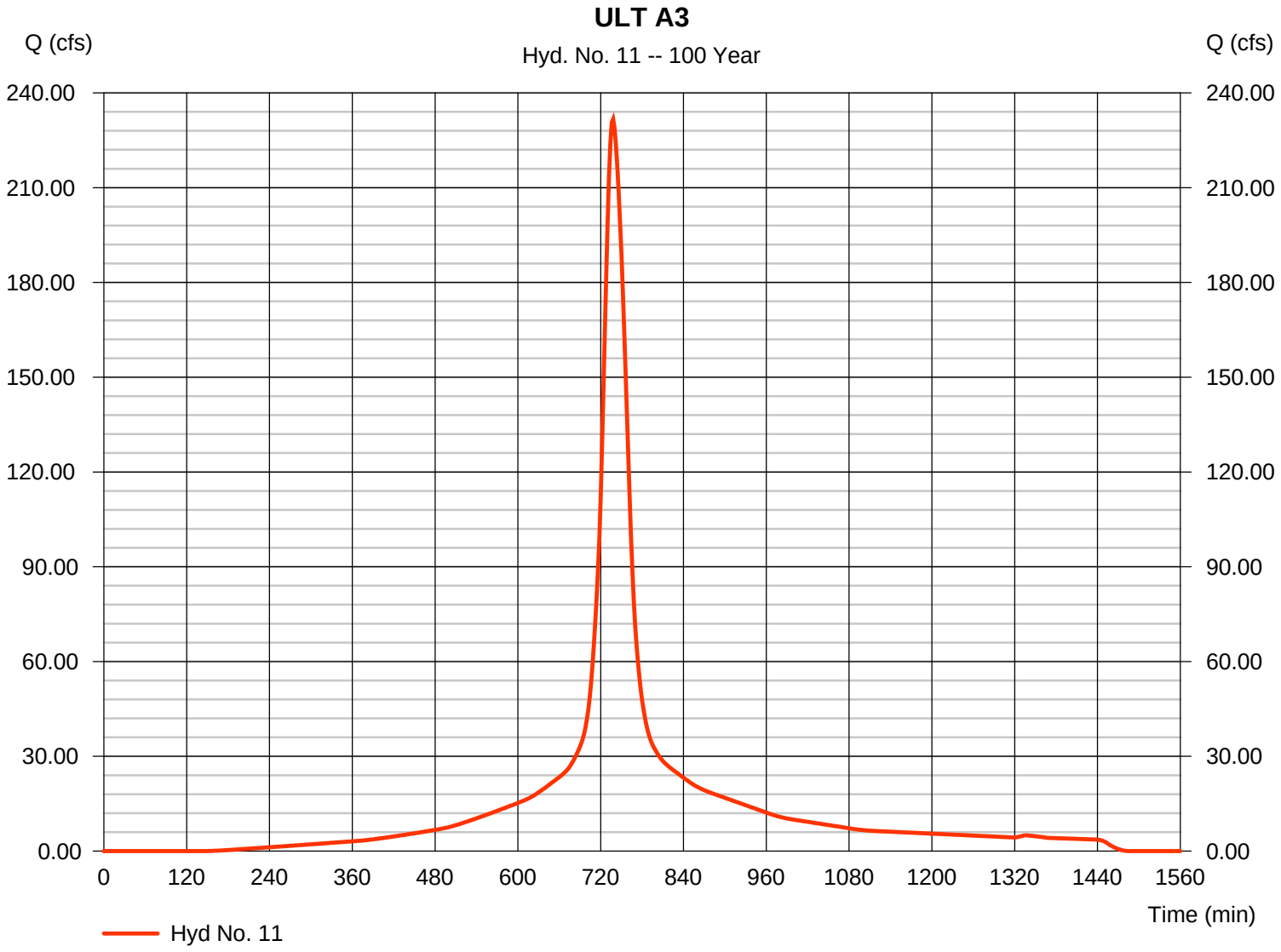
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2 Wednesday, 06 / 10 / 2020

Hyd. No. 11

ULT A3

Hydrograph type	=	SCS Runoff	Peak discharge	=	231.68 cfs
Storm frequency	=	100 yrs	Time to peak	=	738 min
Time interval	=	2 min	Hyd. volume	=	1,304,229 cuft
Drainage area	=	33.050 ac	Curve number	=	87.8
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	25.60 min
Total precip.	=	12.30 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	434

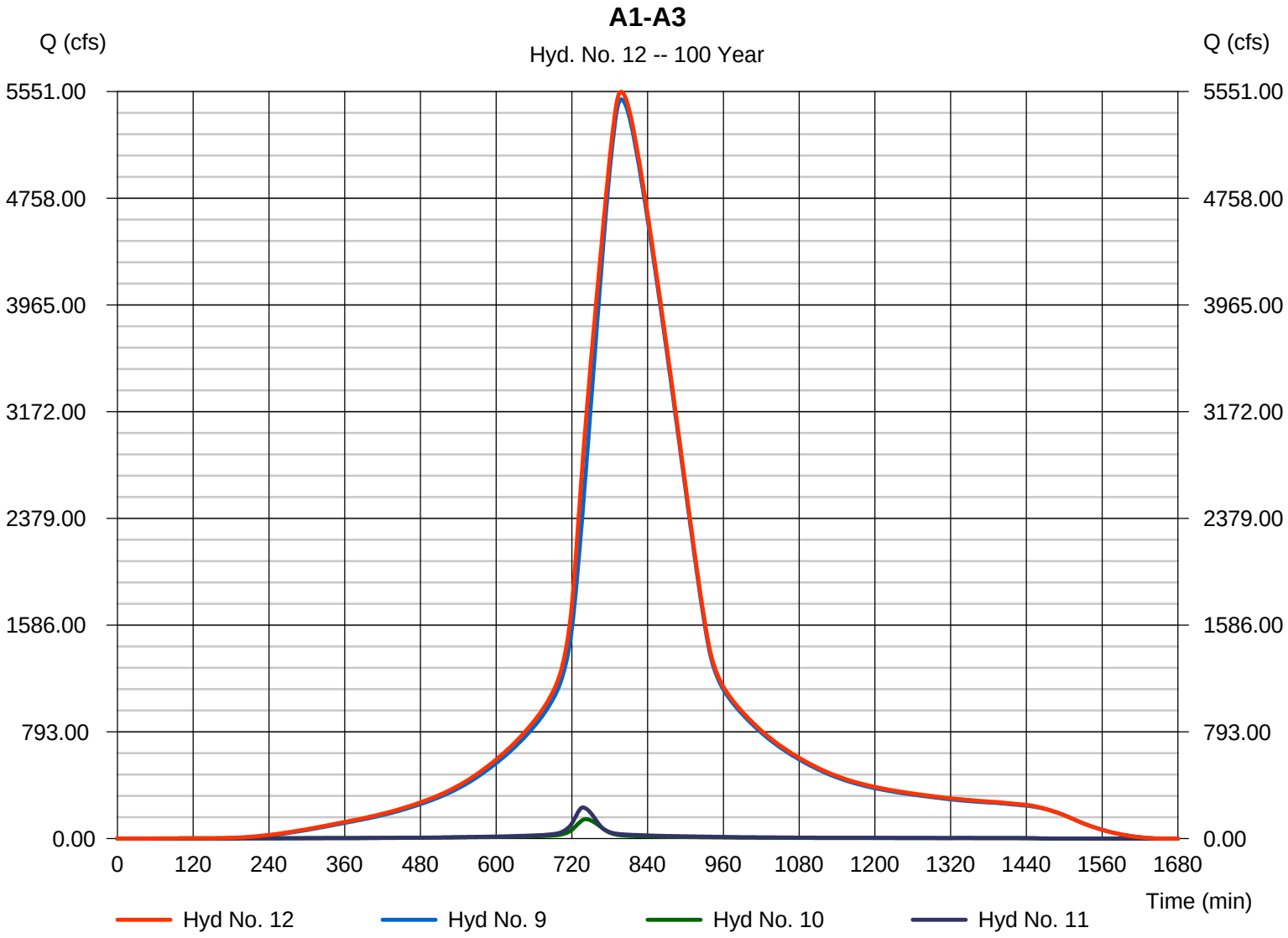


Hydrograph Report

Hyd. No. 12

A1-A3

Hydrograph type	=	Combine	Peak discharge	=	5549.23 cfs
Storm frequency	=	100 yrs	Time to peak	=	798 min
Time interval	=	2 min	Hyd. volume	=	77,386,184 cuft
Inflow hyds.	=	9, 10, 11	Contrib. drain. area	=	1961.940 ac

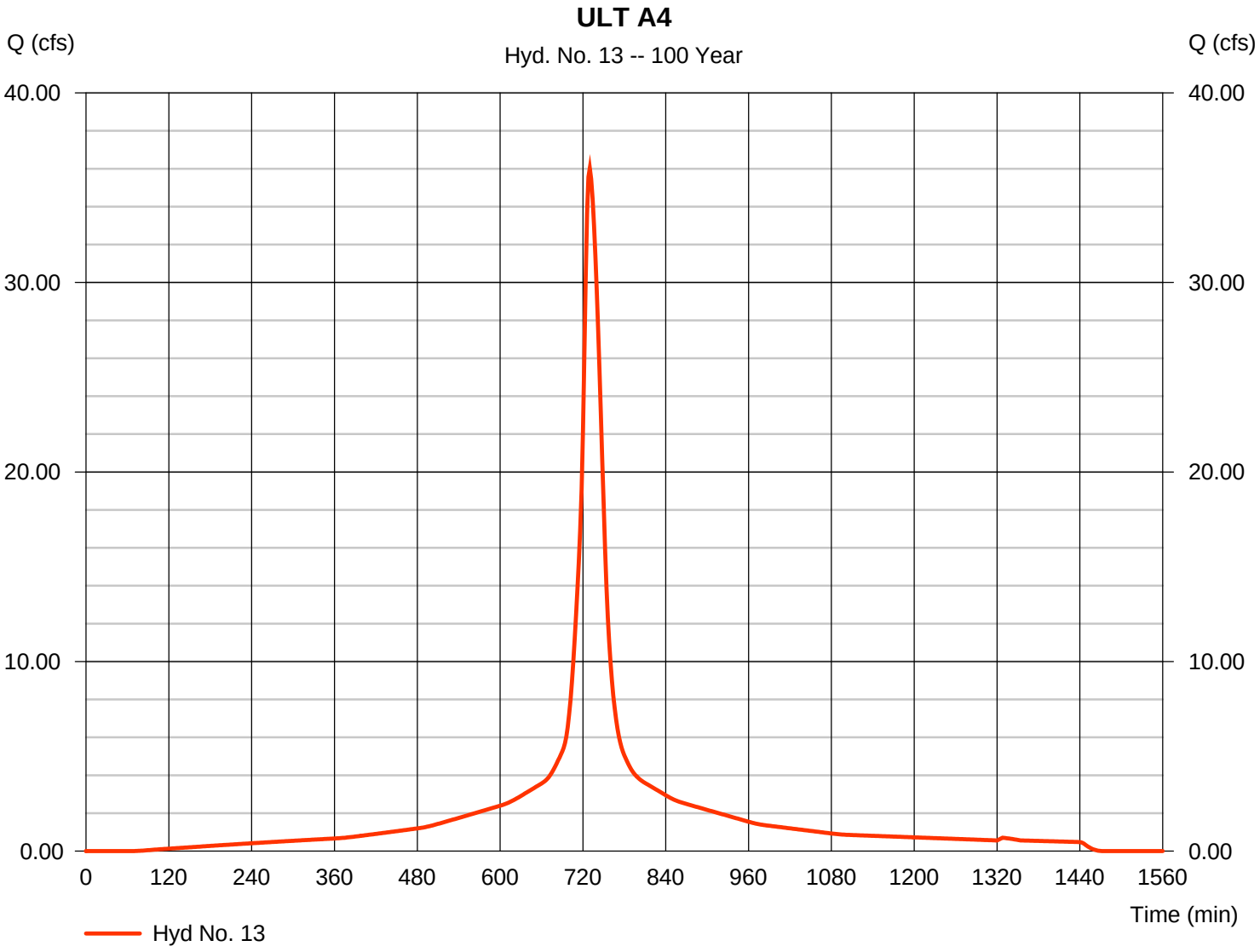


Hydrograph Report

Hyd. No. 13

ULT A4

Hydrograph type	=	SCS Runoff	Peak discharge	=	36.02 cfs
Storm frequency	=	100 yrs	Time to peak	=	730 min
Time interval	=	2 min	Hyd. volume	=	184,561 cuft
Drainage area	=	4.450 ac	Curve number	=	94
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	10.00 min
Total precip.	=	12.30 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	300

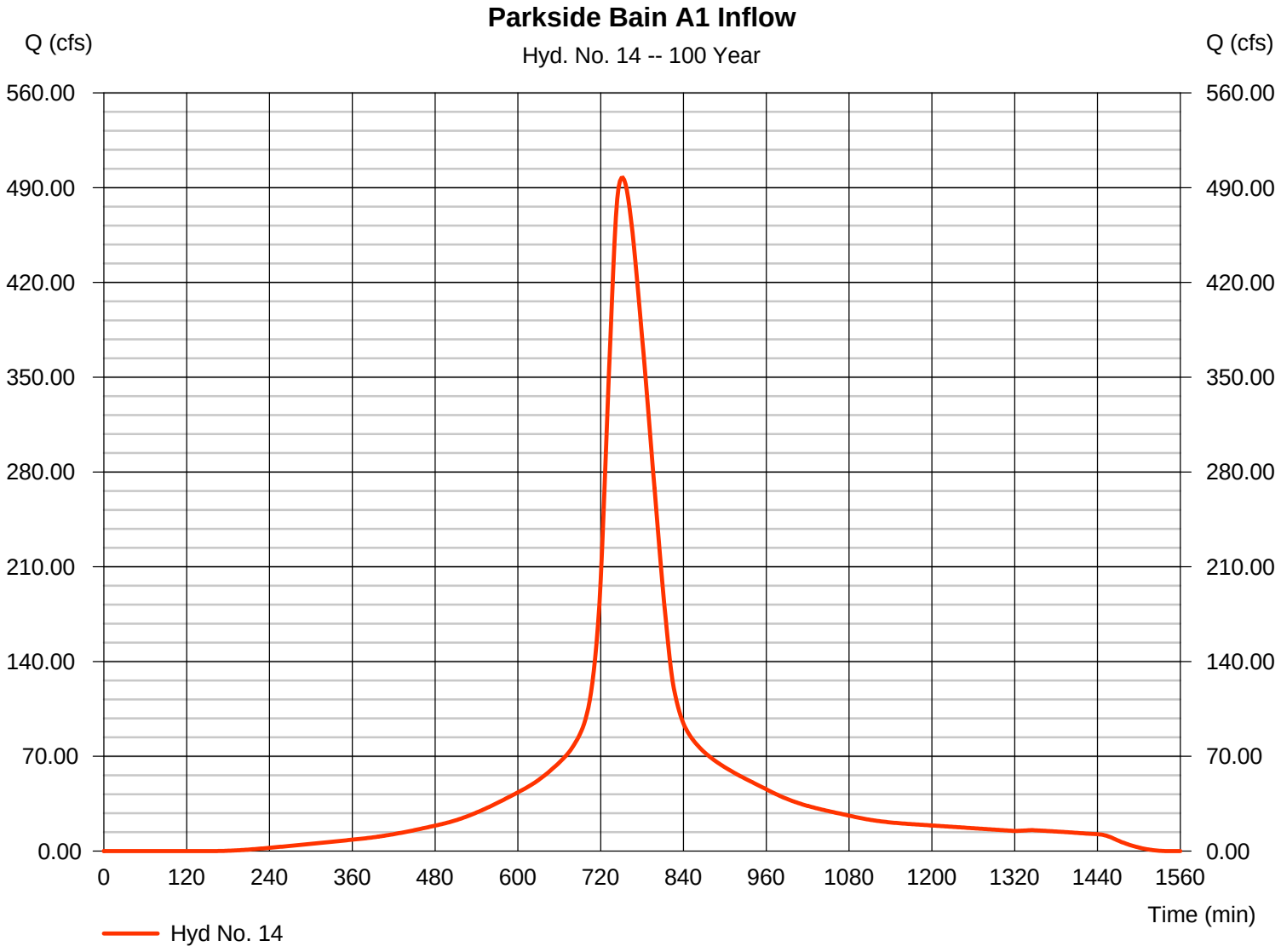


Hydrograph Report

Hyd. No. 14

Parkside Bain A1 Inflow

Hydrograph type	=	SCS Runoff	Peak discharge	=	497.35 cfs
Storm frequency	=	100 yrs	Time to peak	=	752 min
Time interval	=	2 min	Hyd. volume	=	4,263,412 cuft
Drainage area	=	109.260 ac	Curve number	=	87
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	37.90 min
Total precip.	=	12.30 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	300



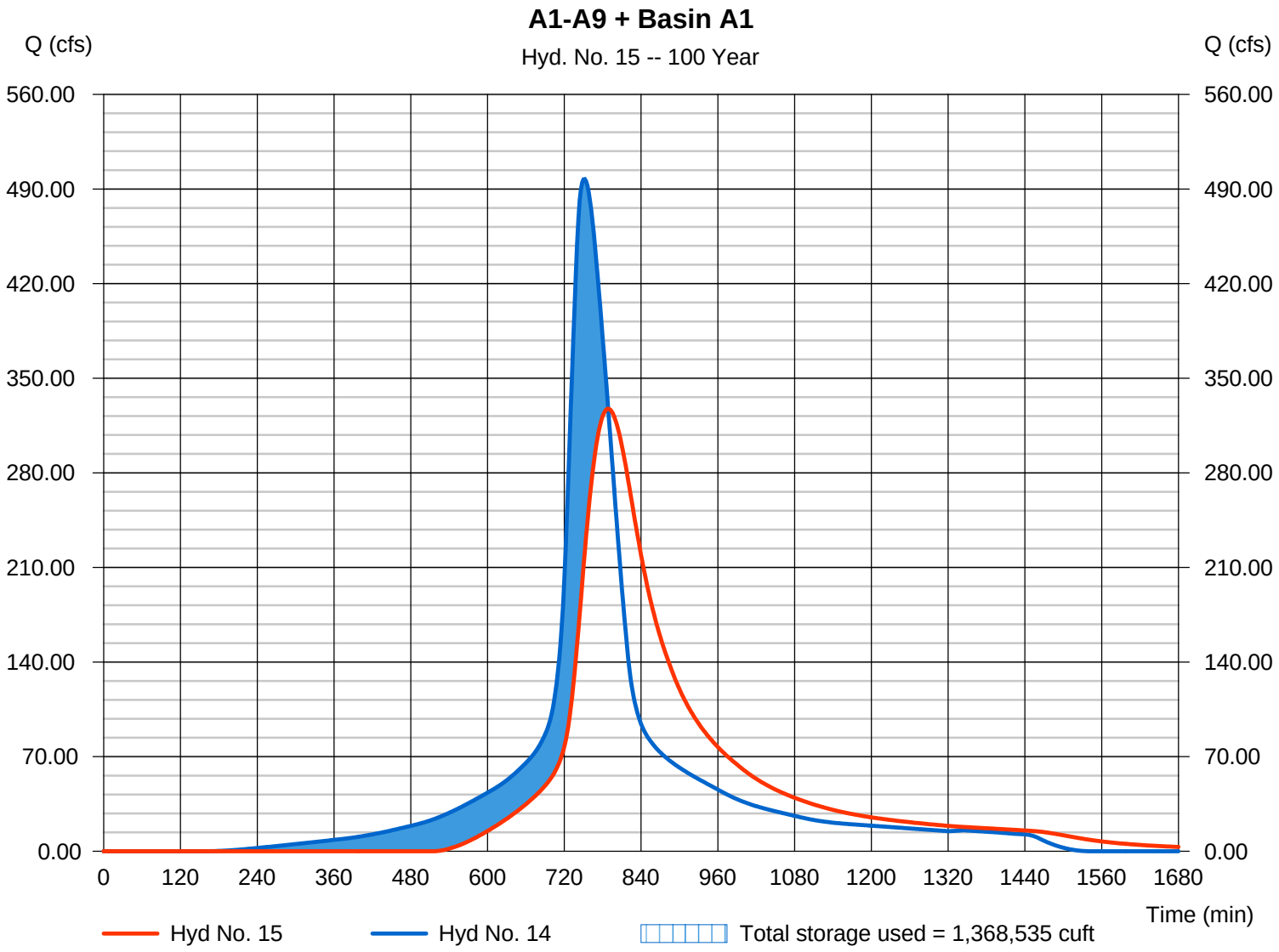
Hydrograph Report

Hyd. No. 15

A1-A9 + Basin A1

Hydrograph type	=	Reservoir	Peak discharge	=	327.41 cfs
Storm frequency	=	100 yrs	Time to peak	=	788 min
Time interval	=	2 min	Hyd. volume	=	4,079,100 cuft
Inflow hyd. No.	=	14 - Parkside Bain A1 Inflow	Max. Elevation	=	606.94 ft
Reservoir name	=	BASIN A1	Max. Storage	=	1,368,535 cuft

Storage Indication method used.

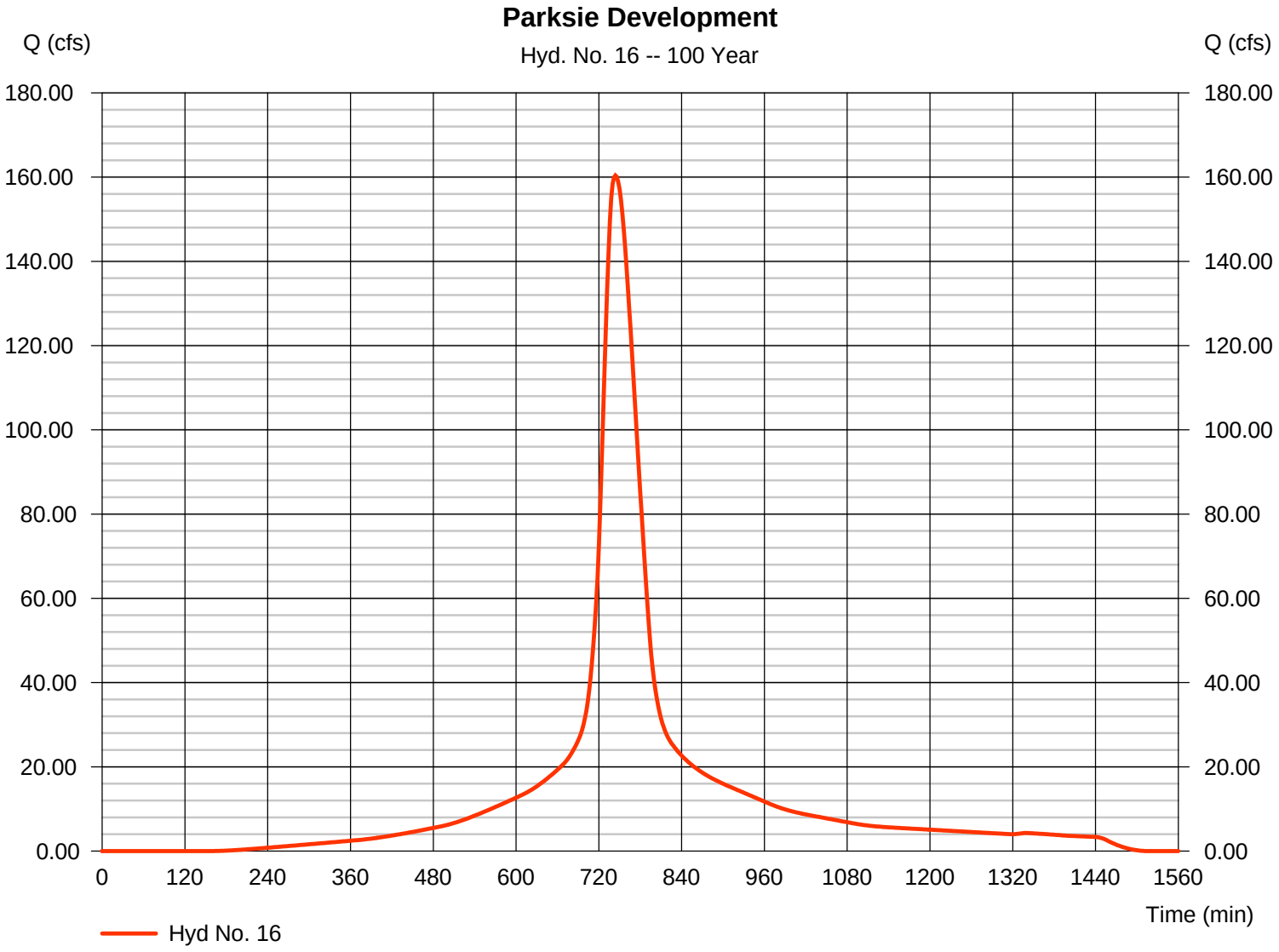


Hydrograph Report

Hyd. No. 16

Parksie Development

Hydrograph type	=	SCS Runoff	Peak discharge	=	160.40 cfs
Storm frequency	=	100 yrs	Time to peak	=	744 min
Time interval	=	2 min	Hyd. volume	=	1,168,281 cuft
Drainage area	=	29.940 ac	Curve number	=	87
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	28.50 min
Total precip.	=	12.30 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	300

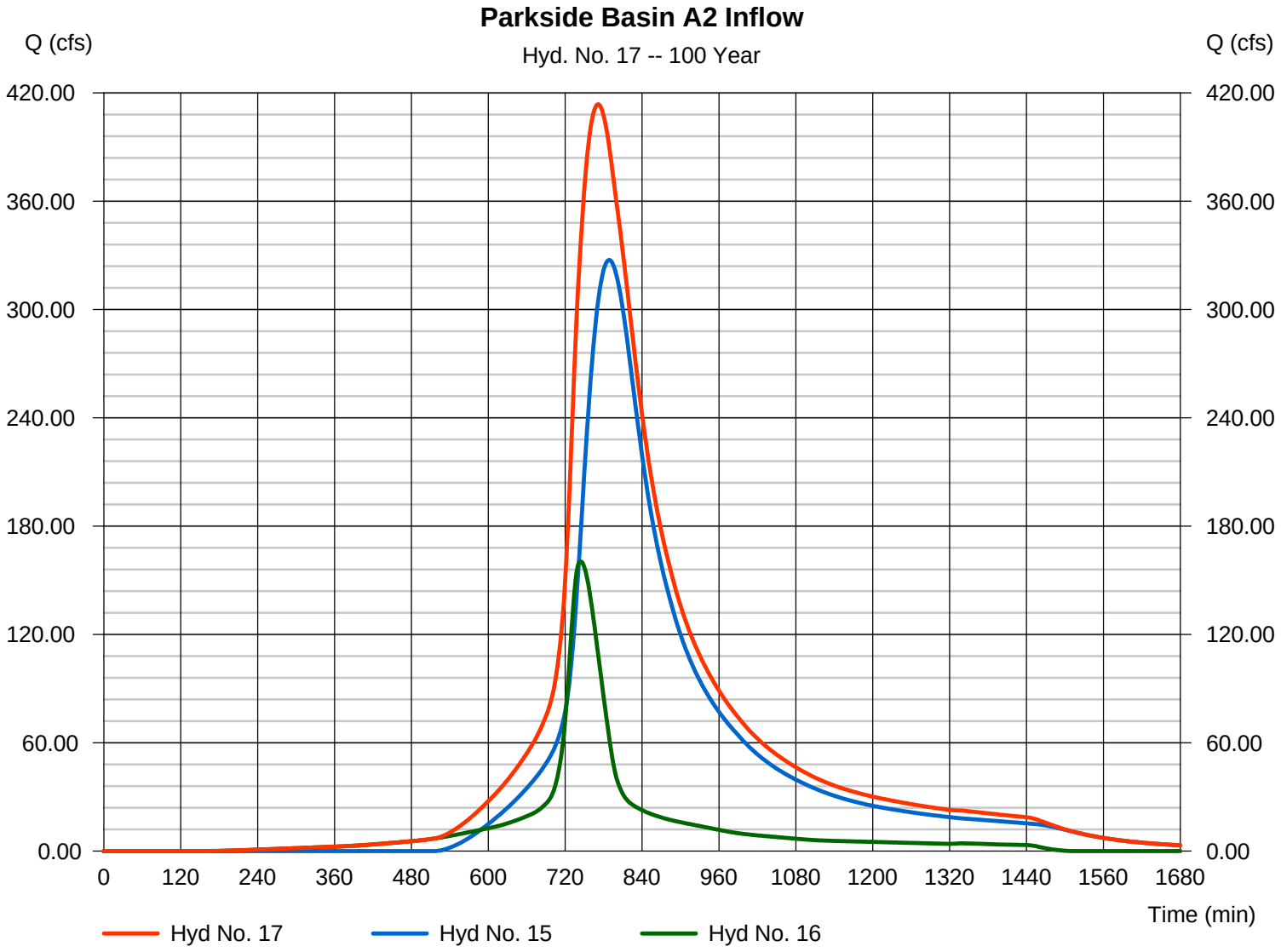


Hydrograph Report

Hyd. No. 17

Parkside Basin A2 Inflow

Hydrograph type	=	Combine	Peak discharge	=	413.63 cfs
Storm frequency	=	100 yrs	Time to peak	=	772 min
Time interval	=	2 min	Hyd. volume	=	5,247,361 cuft
Inflow hyds.	=	15, 16	Contrib. drain. area	=	29.940 ac



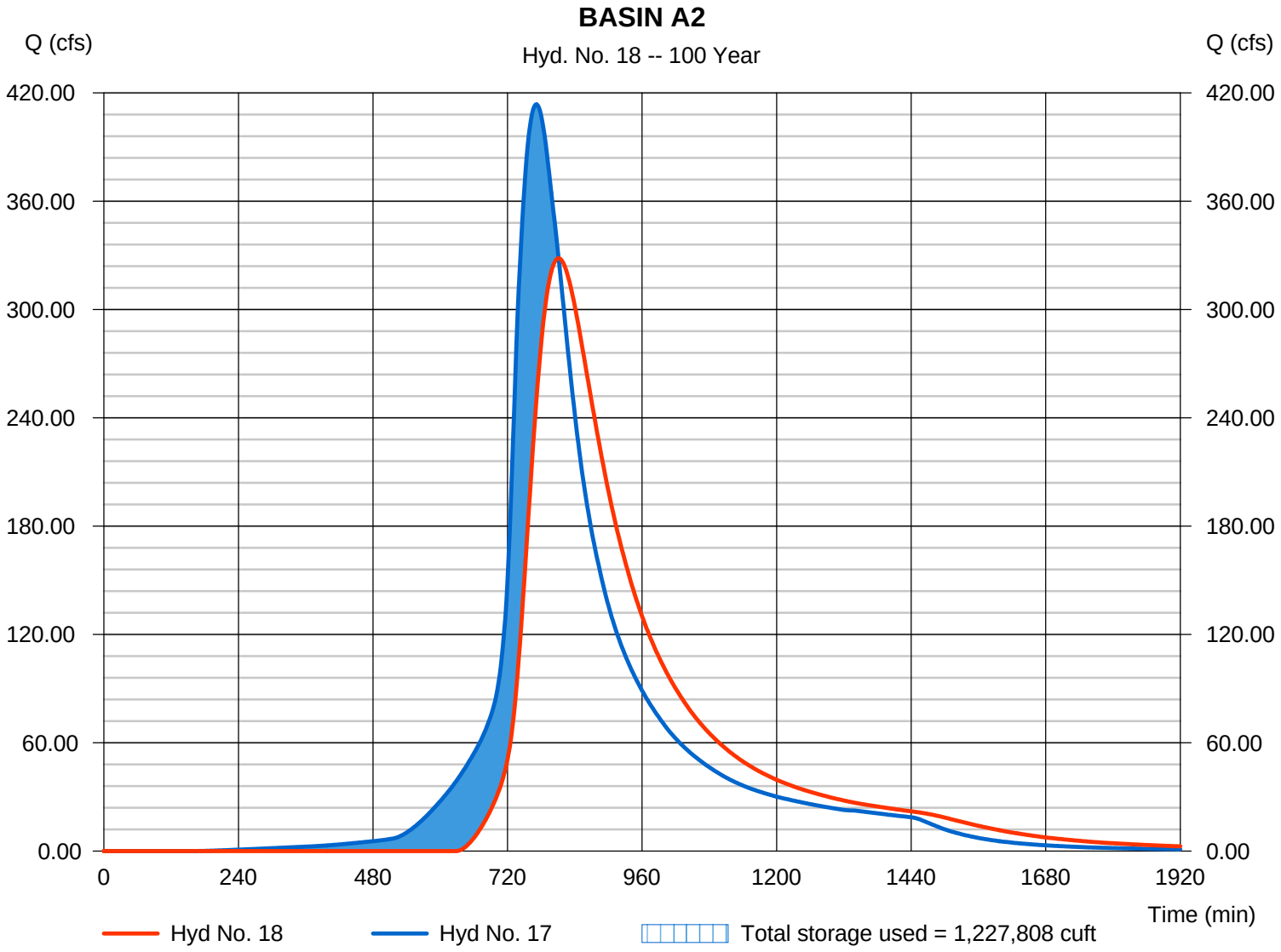
Hydrograph Report

Hyd. No. 18

BASIN A2

Hydrograph type	=	Reservoir	Peak discharge	=	328.36 cfs
Storm frequency	=	100 yrs	Time to peak	=	812 min
Time interval	=	2 min	Hyd. volume	=	5,054,492 cuft
Inflow hyd. No.	=	17 - Parkside Basin A2 Inflow	Max. Elevation	=	604.93 ft
Reservoir name	=	BASIN A2	Max. Storage	=	1,227,808 cuft

Storage Indication method used.

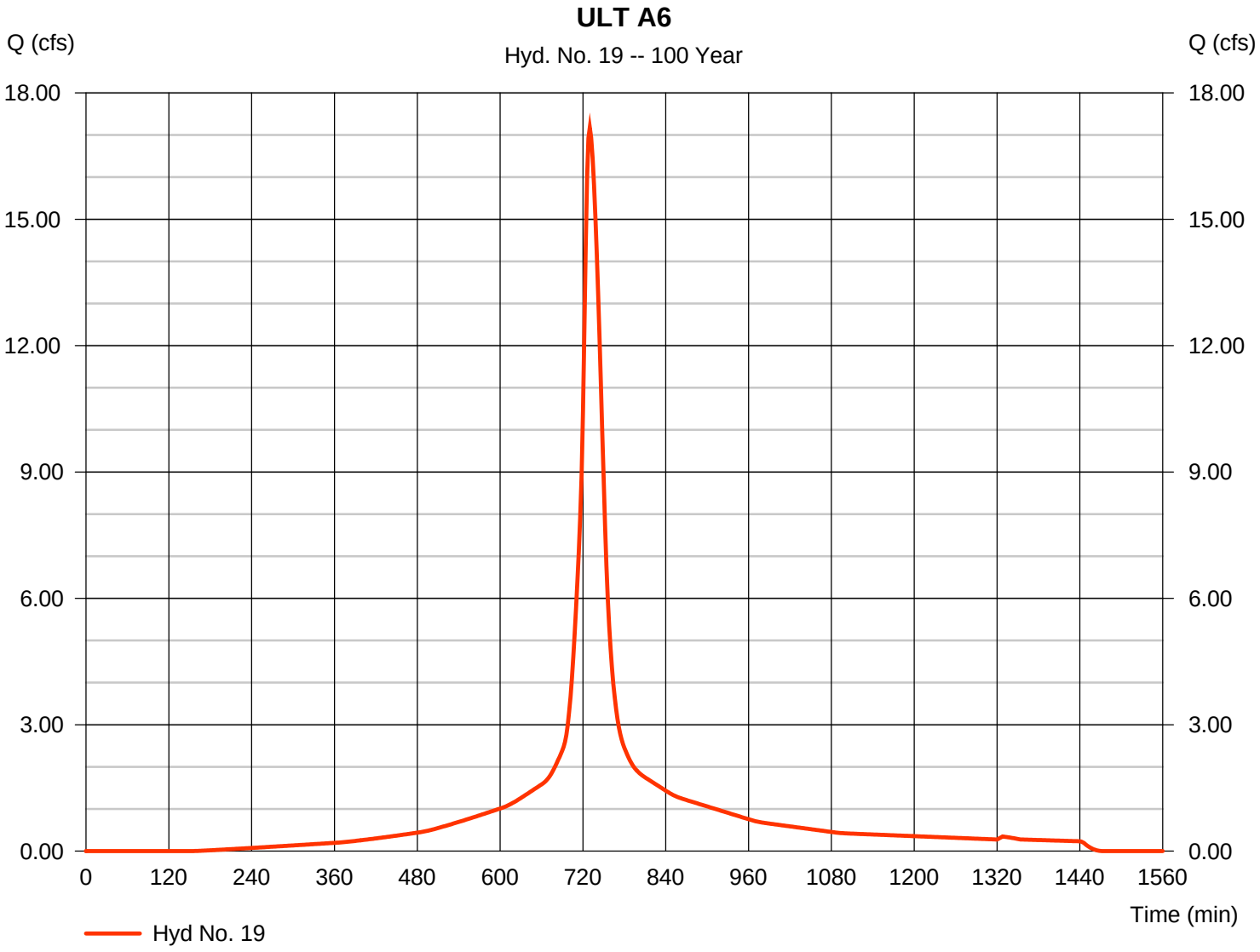


Hydrograph Report

Hyd. No. 19

ULT A6

Hydrograph type	=	SCS Runoff	Peak discharge	=	17.17 cfs
Storm frequency	=	100 yrs	Time to peak	=	730 min
Time interval	=	2 min	Hyd. volume	=	84,195 cuft
Drainage area	=	2.200 ac	Curve number	=	87
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	10.00 min
Total precip.	=	12.30 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	300

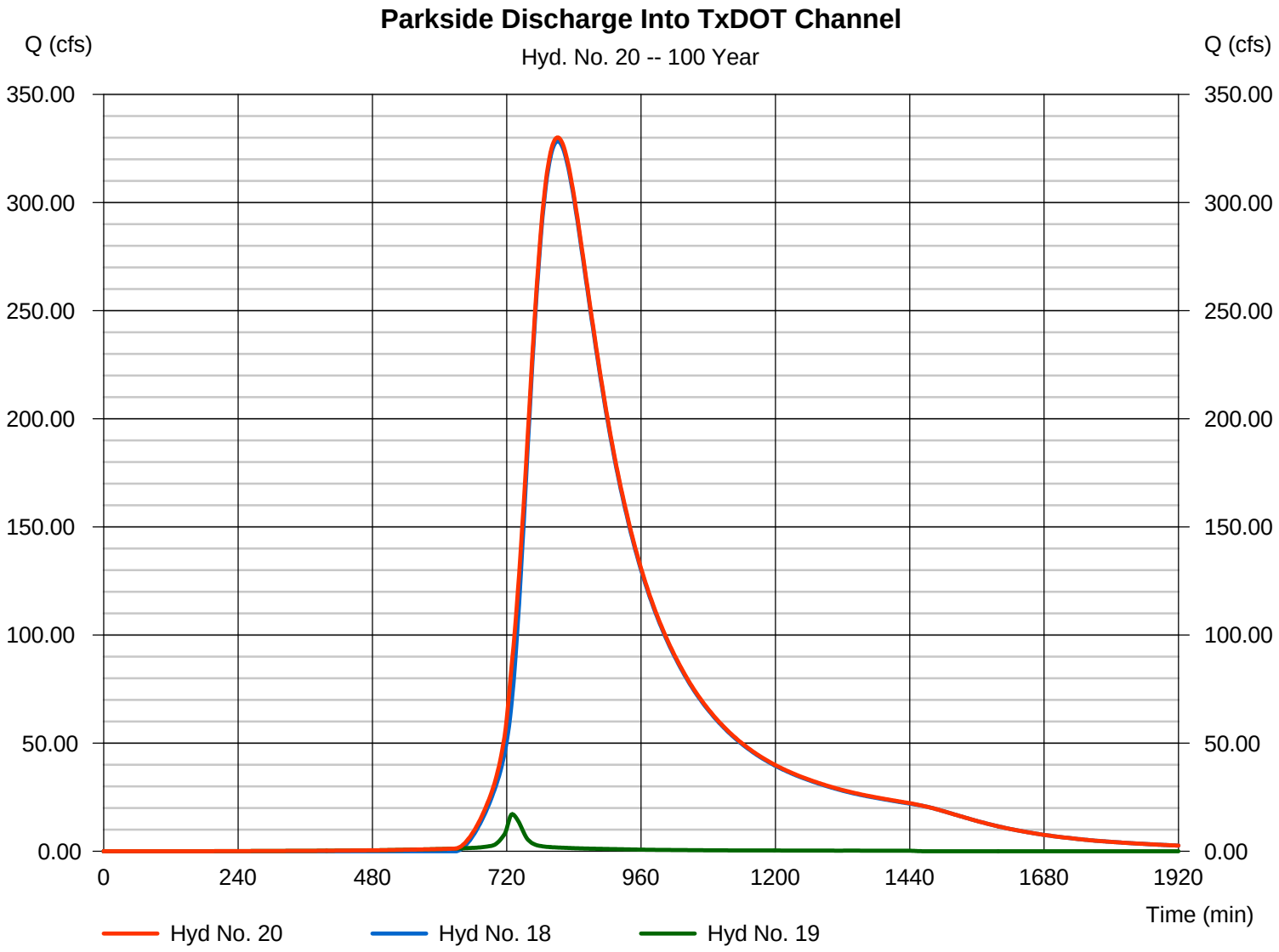


Hydrograph Report

Hyd. No. 20

Parkside Discharge Into TxDOT Channel

Hydrograph type	=	Combine	Peak discharge	=	330.09 cfs
Storm frequency	=	100 yrs	Time to peak	=	810 min
Time interval	=	2 min	Hyd. volume	=	5,138,687 cuft
Inflow hyds.	=	18, 19	Contrib. drain. area	=	2.200 ac

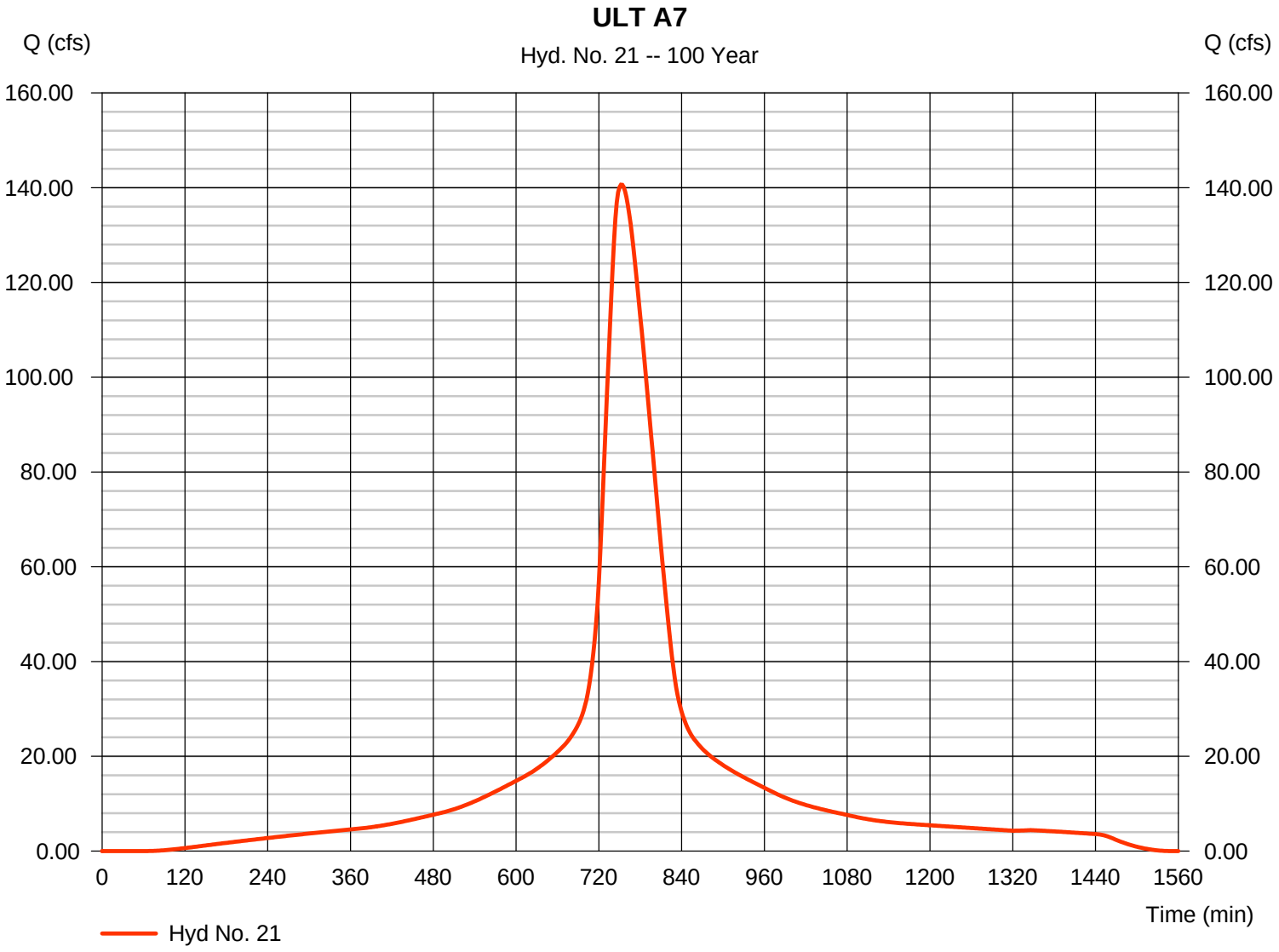


Hydrograph Report

Hyd. No. 21

ULT A7

Hydrograph type	=	SCS Runoff	Peak discharge	=	140.61 cfs
Storm frequency	=	100 yrs	Time to peak	=	752 min
Time interval	=	2 min	Hyd. volume	=	1,321,845 cuft
Drainage area	=	31.110 ac	Curve number	=	95
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	40.80 min
Total precip.	=	12.30 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	300

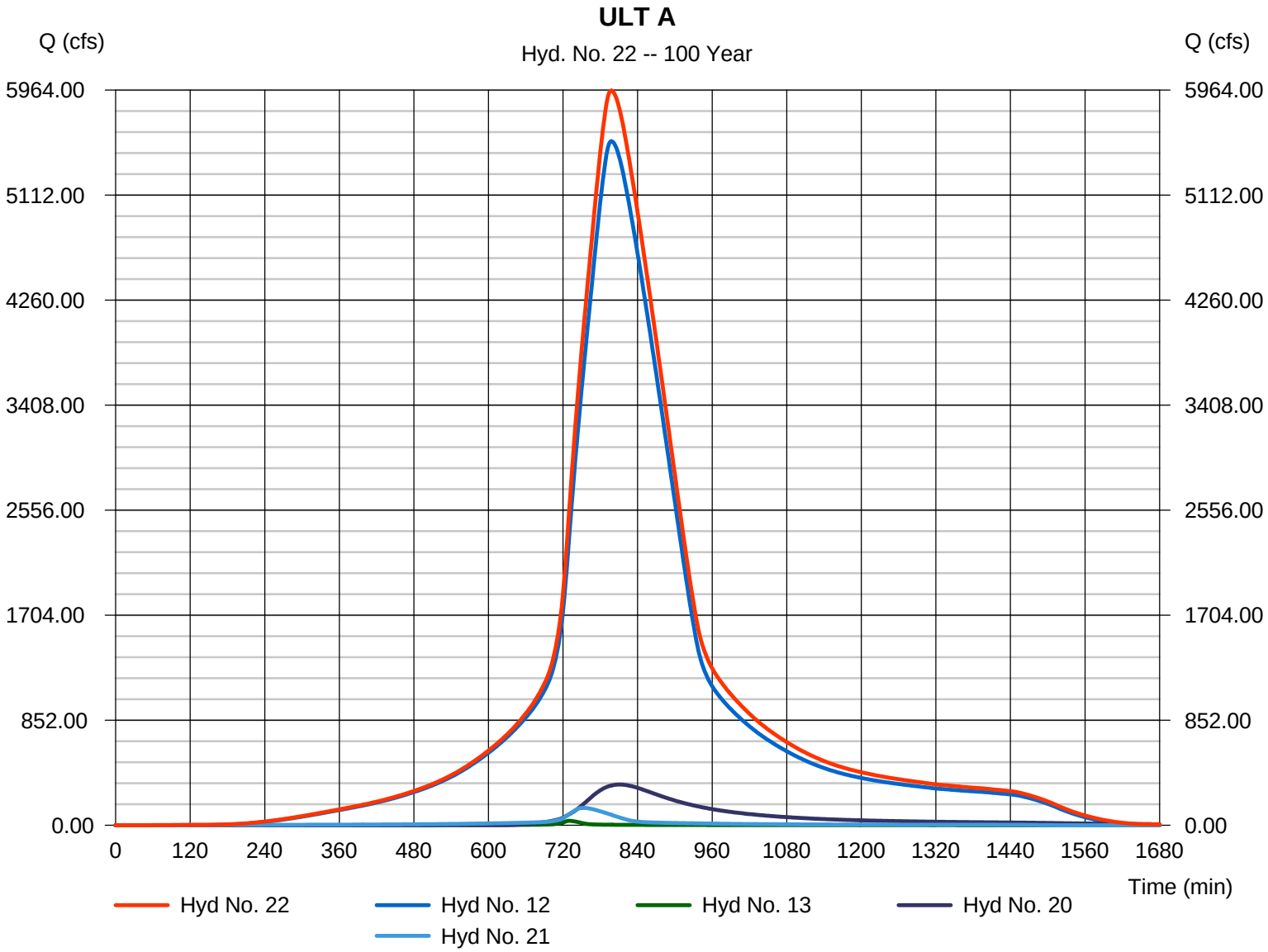


Hydrograph Report

Hyd. No. 22

ULT A

Hydrograph type	=	Combine	Peak discharge	=	5960.25 cfs
Storm frequency	=	100 yrs	Time to peak	=	798 min
Time interval	=	2 min	Hyd. volume	=	84,030,592 cuft
Inflow hyds.	=	12, 13, 20, 21	Contrib. drain. area	=	35.560 ac



Attachment E

Existing Conditions Hydraulic Analysis

0 100 200

SCALE: 1" = 200'

LEGEND

* DENOTES INTERPOLATED CROSS SECTIONS

700 EXISTING CONTOURS

290 S. CASTELL AVE., STE. 100
NEW BRAUNFELS, TX 78130
TBPE FIRM F-10961
TBPLS FIRM 1053600

HMT
ENGINEERING & SURVEYING

STATE OF TEXAS
CHRISTOPHER P. VAN HEERDE
93047
LICENSED
PROFESSIONAL ENGINEER

06/10/2020

CROSS SECTIONS EXHIBIT

NO.	REVISION DESCRIPTION	REVISION DATE

DATE: MARCH 2020
DRAWN BY: LB
DESIGNED BY: CVH
REVIEWED BY: CVH
HMT PROJECT NO.: 031.060

SHEET
EX-1

Drawing Name: N:_Projects\031 - DR Horton\031.060 - 175 Ac Friesenhahn Cib\12cb\Offsite\Drainage Offsite Workmap-Exh.dwg User: chrisvh Jun 10, 2020 - 10:38pm

HEC-RAS Plan: Existing River: GuadTrib20 Reach: GuadTrib20

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
GuadTrib20	18494.57	2-year	1002.62	591.47	592.4	592.30	593.08	0.028339	4.36	211.72	339.02	0.92
GuadTrib20	18494.57	5-year	1713.53	591.47	593.3	593.25	594.01	0.002927	2.37	525.32	410.27	0.34
GuadTrib20	18494.57	10-year	2312.98	591.47	593.6	593.64	594.48	0.002018	2.29	690.96	441.51	0.29
GuadTrib20	18494.57	25-year	3291.98	591.47	594.2	594.16	595.11	0.001450	2.28	931.83	481.70	0.26
GuadTrib20	18494.57	100-year	5355.58	591.47	595.0	594.95	596.12	0.001127	2.42	1332.56	536.83	0.24
GuadTrib20	18233.87	2-year	1002.62	589.93	592.1		592.12	0.001065	1.74	637.95	388.67	0.21
GuadTrib20	18233.87	5-year	1713.53	589.93	592.7		592.72	0.001255	2.23	871.99	416.46	0.24
GuadTrib20	18233.87	10-year	2312.98	589.93	593.0		593.11	0.001420	2.59	1027.71	433.40	0.26
GuadTrib20	18233.87	25-year	3291.98	589.93	593.5		593.64	0.001643	3.08	1247.85	456.29	0.29
GuadTrib20	18233.87	100-year	5355.58	589.93	594.4		594.58	0.001908	3.85	1663.71	496.36	0.33
GuadTrib20	17926.39	2-year	1002.62	589.74	590.8	590.76	591.16	0.029188	5.14	207.56	280.93	0.97
GuadTrib20	17926.39	5-year	1713.53	589.74	591.1	591.12	591.64	0.025249	6.02	314.91	319.15	0.96
GuadTrib20	17926.39	10-year	2312.98	589.74	591.5	591.36	591.99	0.019278	6.17	426.64	350.53	0.87
GuadTrib20	17926.39	25-year	3291.98	589.74	592.1		592.56	0.011070	5.88	670.09	413.94	0.70
GuadTrib20	17926.39	100-year	5355.58	589.74	593.1		593.53	0.007324	6.09	1115.87	507.41	0.60
GuadTrib20	17641.61	2-year	1002.62	585.19	589.5	587.61	589.52	0.001104	2.32	579.44	305.07	0.23
GuadTrib20	17641.61	5-year	1713.53	585.19	590.0	588.26	590.16	0.001621	3.15	762.00	327.10	0.29
GuadTrib20	17641.61	10-year	2312.98	585.19	590.4	588.66	590.56	0.002040	3.76	880.68	341.56	0.33
GuadTrib20	17641.61	25-year	3291.98	585.19	590.9	589.22	591.12	0.002687	4.65	1051.92	379.45	0.39
GuadTrib20	17641.61	100-year	5355.58	585.19	591.6	590.03	592.07	0.003717	6.09	1366.10	425.46	0.47
GuadTrib20	17615		Culvert									
GuadTrib20	17590.17	2-year	1056.58	584.37	587.3	587.35	587.78	0.010220	5.47	235.27	191.10	0.66
GuadTrib20	17590.17	5-year	1812.75	584.37	588.4	587.68	588.76	0.006199	5.53	480.88	284.33	0.55
GuadTrib20	17590.17	10-year	2451.33	584.37	589.0	588.22	589.38	0.005105	5.68	664.95	302.29	0.52
GuadTrib20	17590.17	25-year	3495.48	584.37	589.7	588.72	590.18	0.004718	6.17	905.60	336.11	0.51
GuadTrib20	17590.17	100-year	5698.02	584.37	590.9	589.56	591.42	0.004961	7.33	1309.67	391.12	0.55
GuadTrib20	17432.85	2-year	1056.58	582.00	587.2		587.30	0.000749	2.02	638.60	260.67	0.19
GuadTrib20	17432.85	5-year	1812.75	582.00	588.2		588.31	0.000859	2.56	917.26	290.71	0.22
GuadTrib20	17432.85	10-year	2451.33	582.00	588.8		588.94	0.000945	2.93	1097.27	299.11	0.23
GuadTrib20	17432.85	25-year	3495.48	582.00	589.6		589.71	0.001116	3.49	1320.91	309.03	0.26
GuadTrib20	17432.85	100-year	5698.02	582.00	590.6		590.84	0.001513	4.55	1654.97	323.51	0.31
GuadTrib20	17380		Lat Struct									

HEC-RAS Plan: Existing River: GuadTrib20 Reach: GuadTrib20 (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
GuadTrib20	17328.83	2-year	1056.58	582.00	587.0		587.13	0.004353	2.78	367.54	191.40	0.28
GuadTrib20	17328.83	5-year	1812.75	582.00	587.9		588.13	0.003778	3.11	567.11	229.85	0.28
GuadTrib20	17328.83	10-year	2451.33	582.00	588.6		588.77	0.003015	3.07	780.15	367.03	0.25
GuadTrib20	17328.83	25-year	3484.33	582.00	589.3		589.53	0.002383	3.01	1055.08	386.48	0.23
GuadTrib20	17328.83	100-year	5607.43	582.00	590.3		590.64	0.002188	3.24	1450.57	415.24	0.23
GuadTrib20	17095.77	2-year	1056.58	582.00	585.4	585.44	586.40	0.001908	8.19	196.14	170.28	0.89
GuadTrib20	17095.77	5-year	1812.75	582.00	586.4	586.40	587.49	0.001598	9.21	405.77	261.34	0.86
GuadTrib20	17095.77	10-year	2450.21	582.00	587.0	586.98	588.18	0.001525	9.95	573.56	309.22	0.86
GuadTrib20	17095.77	25-year	3361.65	582.00	587.6	587.62	588.98	0.001543	11.00	784.16	354.03	0.88
GuadTrib20	17095.77	100-year	5021.89	582.00	588.6	588.57	590.10	0.001517	12.29	1148.54	404.62	0.90
GuadTrib20	16812.26	2-year	1076.03	580.27	584.1	584.07	585.08	0.001728	8.25	190.11	165.16	0.85
GuadTrib20	16812.26	5-year	1848.80	580.27	585.1	585.09	586.21	0.001459	9.27	412.13	270.72	0.83
GuadTrib20	16812.26	10-year	2501.37	580.27	585.7	585.67	586.92	0.001449	10.13	586.83	330.95	0.84
GuadTrib20	16812.26	25-year	3436.91	580.27	586.4	586.39	587.73	0.001392	10.96	851.39	402.47	0.85
GuadTrib20	16812.26	100-year	5147.03	580.27	587.4	587.38	588.86	0.001377	12.23	1290.79	489.29	0.87
GuadTrib20	16192.59	2-year	1076.03	577.00	580.2	578.48	580.29	0.000222	2.96	363.64	126.93	0.31
GuadTrib20	16192.59	5-year	1848.80	577.00	581.7	579.09	581.84	0.000168	3.27	565.18	137.24	0.28
GuadTrib20	16192.59	10-year	2501.37	577.00	582.8	579.54	582.99	0.000139	3.46	732.14	162.33	0.27
GuadTrib20	16192.59	25-year	3436.91	577.00	584.3	580.11	584.48	0.000110	3.64	1149.05	463.25	0.25
GuadTrib20	16192.59	100-year	5147.03	577.00	584.9	581.02	585.23	0.000179	4.91	1455.56	562.51	0.32
GuadTrib20	16000		Culvert									
GuadTrib20	15963.4	2-year	1076.03	575.50	579.2	577.36	579.26	0.000176	2.55	421.93	266.17	0.30
GuadTrib20	15963.4	5-year	1848.80	575.50	580.1	578.01	580.20	0.000207	3.00	615.27	314.95	0.32
GuadTrib20	15963.4	10-year	2501.37	575.50	580.7	578.45	580.86	0.000224	3.29	759.63	329.82	0.32
GuadTrib20	15963.4	25-year	3436.91	575.50	581.5	579.08	581.67	0.000241	3.64	948.15	352.46	0.32
GuadTrib20	15963.4	100-year	5147.03	575.50	582.6	579.85	582.90	0.000266	4.18	1273.69	421.44	0.33
GuadTrib20	15855.97	2-year	1076.03	576.00	579.0		579.17	0.003830	3.74	288.07	116.09	0.42
GuadTrib20	15855.97	5-year	1848.80	576.00	579.7		580.07	0.005023	4.89	377.85	124.38	0.49
GuadTrib20	15855.97	10-year	2501.37	576.00	580.2		580.69	0.005747	5.69	440.51	136.16	0.54
GuadTrib20	15855.97	25-year	3436.91	576.00	580.8		581.45	0.006478	6.69	524.91	161.53	0.59
GuadTrib20	15855.97	100-year	5147.03	576.00	581.6	580.47	582.59	0.007629	8.20	670.20	197.73	0.66

HEC-RAS Plan: Existing River: GuadTrib20 Reach: GuadTrib20 (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
GuadTrib20	15636.87	2-year	1076.03	576.00	578.0	577.30	578.16	0.005501	3.35	320.97	200.17	0.47
GuadTrib20	15636.87	5-year	1848.80	576.00	578.6	577.75	578.89	0.005500	4.08	453.17	210.40	0.49
GuadTrib20	15636.87	10-year	2501.37	576.00	579.1	578.07	579.40	0.005506	4.54	550.56	217.61	0.50
GuadTrib20	15636.87	25-year	3436.91	576.00	579.7	578.48	580.05	0.005503	5.07	677.28	226.64	0.52
GuadTrib20	15636.87	100-year	5147.03	576.00	580.5	579.14	581.03	0.005506	5.91	873.10	240.38	0.54

Plan: Proposed GuadTrib20 GuadTrib20 RS: 17615 Culv Group: Culverts Profile: 2-year

Q Culv Group (cfs)	97.49	Culv Full Len (ft)	31.00
# Barrels	3	Culv Vel US (ft/s)	10.34
Q Barrel (cfs)	32.50	Culv Vel DS (ft/s)	10.34
E.G. US. (ft)	589.54	Culv Inv El Up (ft)	584.90
W.S. US. (ft)	589.46	Culv Inv El Dn (ft)	584.41
E.G. DS (ft)	587.75	Culv Frctn Ls (ft)	0.64
W.S. DS (ft)	587.35	Culv Exit Loss (ft)	0.82
Delta EG (ft)	1.79	Culv Entr Loss (ft)	0.33
Delta WS (ft)	2.12	Q Weir (cfs)	905.13
E.G. IC (ft)	589.54	Weir Sta Lft (ft)	132.14
E.G. OC (ft)	589.54	Weir Sta Rgt (ft)	381.78
Culvert Control	Outlet	Weir Submerg	0.00
Culv WS Inlet (ft)	586.90	Weir Max Depth (ft)	2.21
Culv WS Outlet (ft)	586.41	Weir Avg Depth (ft)	1.18
Culv Nml Depth (ft)	2.00	Weir Flow Area (sq ft)	295.26
Culv Crt Depth (ft)	2.00	Min El Weir Flow (ft)	587.34

Plan: Proposed GuadTrib20 GuadTrib20 RS: 17615 Culv Group: Culverts Profile: 5-year

Q Culv Group (cfs)	88.06	Culv Full Len (ft)	31.00
# Barrels	3	Culv Vel US (ft/s)	9.34
Q Barrel (cfs)	29.35	Culv Vel DS (ft/s)	9.34
E.G. US. (ft)	590.14	Culv Inv El Up (ft)	584.90
W.S. US. (ft)	590.00	Culv Inv El Dn (ft)	584.41
E.G. DS (ft)	588.71	Culv Frctn Ls (ft)	0.52
W.S. DS (ft)	588.33	Culv Exit Loss (ft)	0.64
Delta EG (ft)	1.43	Culv Entr Loss (ft)	0.27
Delta WS (ft)	1.67	Q Weir (cfs)	1623.64
E.G. IC (ft)	590.13	Weir Sta Lft (ft)	114.59
E.G. OC (ft)	590.14	Weir Sta Rgt (ft)	400.49
Culvert Control	Outlet	Weir Submerg	0.16
Culv WS Inlet (ft)	586.90	Weir Max Depth (ft)	2.82
Culv WS Outlet (ft)	586.41	Weir Avg Depth (ft)	1.61
Culv Nml Depth (ft)	1.70	Weir Flow Area (sq ft)	459.25
Culv Crt Depth (ft)	1.85	Min El Weir Flow (ft)	587.34

Plan: Proposed GuadTrib20 GuadTrib20 RS: 17615 Culv Group: Culverts Profile: 10-year

Q Culv Group (cfs)	82.22	Culv Full Len (ft)	31.00
# Barrels	3	Culv Vel US (ft/s)	8.72
Q Barrel (cfs)	27.41	Culv Vel DS (ft/s)	8.72
E.G. US. (ft)	590.55	Culv Inv El Up (ft)	584.90
W.S. US. (ft)	590.36	Culv Inv El Dn (ft)	584.41
E.G. DS (ft)	589.32	Culv Frctn Ls (ft)	0.46
W.S. DS (ft)	588.96	Culv Exit Loss (ft)	0.53
Delta EG (ft)	1.23	Culv Entr Loss (ft)	0.24
Delta WS (ft)	1.40	Q Weir (cfs)	2227.56
E.G. IC (ft)	590.55	Weir Sta Lft (ft)	99.87
E.G. OC (ft)	590.55	Weir Sta Rgt (ft)	411.00
Culvert Control	Outlet	Weir Submerg	0.28
Culv WS Inlet (ft)	586.90	Weir Max Depth (ft)	3.23
Culv WS Outlet (ft)	586.41	Weir Avg Depth (ft)	1.87
Culv Nml Depth (ft)		Weir Flow Area (sq ft)	581.11
Culv Crt Depth (ft)	1.82	Min El Weir Flow (ft)	587.34

Plan: Proposed GuadTrib20 GuadTrib20 RS: 17615 Culv Group: Culverts Profile: 25-year

Q Culv Group (cfs)	76.21	Culv Full Len (ft)	31.00
# Barrels	3	Culv Vel US (ft/s)	8.09
Q Barrel (cfs)	25.40	Culv Vel DS (ft/s)	8.09
E.G. US. (ft)	591.12	Culv Inv El Up (ft)	584.90
W.S. US. (ft)	590.86	Culv Inv El Dn (ft)	584.41
E.G. DS (ft)	590.12	Culv Frctn Ls (ft)	0.39
W.S. DS (ft)	589.73	Culv Exit Loss (ft)	0.40
Delta EG (ft)	1.00	Culv Entr Loss (ft)	0.20
Delta WS (ft)	1.13	Q Weir (cfs)	3215.78
E.G. IC (ft)	591.10	Weir Sta Lft (ft)	79.48
E.G. OC (ft)	591.12	Weir Sta Rgt (ft)	425.54
Culvert Control	Outlet	Weir Submerg	0.48
Culv WS Inlet (ft)	586.90	Weir Max Depth (ft)	3.79
Culv WS Outlet (ft)	586.41	Weir Avg Depth (ft)	2.22
Culv Nml Depth (ft)		Weir Flow Area (sq ft)	766.83
Culv Crt Depth (ft)	1.77	Min El Weir Flow (ft)	587.34

Plan: Proposed GuadTrib20 GuadTrib20 RS: 17615 Culv Group: Culverts Profile: 100-year

Q Culv Group (cfs)	69.65	Culv Full Len (ft)	31.00
# Barrels	3	Culv Vel US (ft/s)	7.39
Q Barrel (cfs)	23.22	Culv Vel DS (ft/s)	7.39
E.G. US. (ft)	592.08	Culv Inv El Up (ft)	584.90
W.S. US. (ft)	591.64	Culv Inv El Dn (ft)	584.41
E.G. DS (ft)	591.36	Culv Frctn Ls (ft)	0.33
W.S. DS (ft)	590.85	Culv Exit Loss (ft)	0.22
Delta EG (ft)	0.72	Culv Entr Loss (ft)	0.17
Delta WS (ft)	0.79	Q Weir (cfs)	5285.93
E.G. IC (ft)	592.02	Weir Sta Lft (ft)	45.23
E.G. OC (ft)	592.08	Weir Sta Rgt (ft)	449.97
Culvert Control	Outlet	Weir Submerg	0.62
Culv WS Inlet (ft)	586.90	Weir Max Depth (ft)	4.74
Culv WS Outlet (ft)	586.41	Weir Avg Depth (ft)	2.78
Culv Nml Depth (ft)		Weir Flow Area (sq ft)	1123.18
Culv Crt Depth (ft)	1.71	Min El Weir Flow (ft)	587.34

Plan: Proposed GuadTrib20 GuadTrib20 RS: 16000 Culv Group: Culvert #1 Profile: 2-year

Q Culv Group (cfs)	1030.37	Culv Full Len (ft)	
# Barrels	11	Culv Vel US (ft/s)	5.87
Q Barrel (cfs)	93.67	Culv Vel DS (ft/s)	5.47
E.G. US. (ft)	580.19	Culv Inv El Up (ft)	576.62
W.S. US. (ft)	580.05	Culv Inv El Dn (ft)	576.24
E.G. DS (ft)	579.19	Culv Frctn Ls (ft)	0.26
W.S. DS (ft)	579.09	Culv Exit Loss (ft)	0.37
Delta EG (ft)	1.00	Culv Entr Loss (ft)	0.37
Delta WS (ft)	0.96	Q Weir (cfs)	
E.G. IC (ft)	579.84	Weir Sta Lft (ft)	
E.G. OC (ft)	580.19	Weir Sta Rgt (ft)	
Culvert Control	Outlet	Weir Submerg	
Culv WS Inlet (ft)	579.28	Weir Max Depth (ft)	
Culv WS Outlet (ft)	579.09	Weir Avg Depth (ft)	
Culv Nml Depth (ft)	2.38	Weir Flow Area (sq ft)	
Culv Crt Depth (ft)	1.96	Min El Weir Flow (ft)	588.00

Plan: Proposed GuadTrib20 GuadTrib20 RS: 16000 Culv Group: Culvert #1 Profile: 5-year

Q Culv Group (cfs)	1802.10	Culv Full Len (ft)	
# Barrels	11	Culv Vel US (ft/s)	7.35
Q Barrel (cfs)	163.83	Culv Vel DS (ft/s)	7.24
E.G. US. (ft)	581.76	Culv Inv El Up (ft)	576.62
W.S. US. (ft)	581.59	Culv Inv El Dn (ft)	576.24
E.G. DS (ft)	580.15	Culv Frctn Ls (ft)	0.35
W.S. DS (ft)	580.01	Culv Exit Loss (ft)	0.67
Delta EG (ft)	1.61	Culv Entr Loss (ft)	0.59
Delta WS (ft)	1.58	Q Weir (cfs)	
E.G. IC (ft)	581.29	Weir Sta Lft (ft)	
E.G. OC (ft)	581.76	Weir Sta Rgt (ft)	
Culvert Control	Outlet	Weir Submerg	
Culv WS Inlet (ft)	580.34	Weir Max Depth (ft)	
Culv WS Outlet (ft)	580.01	Weir Avg Depth (ft)	
Culv Nml Depth (ft)	3.62	Weir Flow Area (sq ft)	
Culv Crt Depth (ft)	2.85	Min El Weir Flow (ft)	588.00

Plan: Proposed GuadTrib20 GuadTrib20 RS: 16000 Culv Group: Culvert #1 Profile: 10-year

Q Culv Group (cfs)	2460.95	Culv Full Len (ft)	
# Barrels	11	Culv Vel US (ft/s)	8.32
Q Barrel (cfs)	223.72	Culv Vel DS (ft/s)	8.45
E.G. US. (ft)	582.93	Culv Inv El Up (ft)	576.62
W.S. US. (ft)	582.74	Culv Inv El Dn (ft)	576.24
E.G. DS (ft)	580.82	Culv Frctn Ls (ft)	0.42
W.S. DS (ft)	580.65	Culv Exit Loss (ft)	0.94
Delta EG (ft)	2.11	Culv Entr Loss (ft)	0.75
Delta WS (ft)	2.09	Q Weir (cfs)	
E.G. IC (ft)	582.37	Weir Sta Lft (ft)	
E.G. OC (ft)	582.93	Weir Sta Rgt (ft)	
Culvert Control	Outlet	Weir Submerg	
Culv WS Inlet (ft)	581.10	Weir Max Depth (ft)	
Culv WS Outlet (ft)	580.65	Weir Avg Depth (ft)	
Culv Nml Depth (ft)	4.61	Weir Flow Area (sq ft)	
Culv Crt Depth (ft)	3.51	Min El Weir Flow (ft)	588.00

Plan: Proposed GuadTrib20 GuadTrib20 RS: 16000 Culv Group: Culvert #1 Profile: 25-year

Q Culv Group (cfs)	3411.33	Culv Full Len (ft)	
# Barrels	11	Culv Vel US (ft/s)	9.44
Q Barrel (cfs)	310.12	Culv Vel DS (ft/s)	9.94
E.G. US. (ft)	584.45	Culv Inv El Up (ft)	576.62
W.S. US. (ft)	584.24	Culv Inv El Dn (ft)	576.24
E.G. DS (ft)	581.65	Culv Frctn Ls (ft)	0.50
W.S. DS (ft)	581.44	Culv Exit Loss (ft)	1.33
Delta EG (ft)	2.80	Culv Entr Loss (ft)	0.97
Delta WS (ft)	2.80	Q Weir (cfs)	
E.G. IC (ft)	583.78	Weir Sta Lft (ft)	
E.G. OC (ft)	584.45	Weir Sta Rgt (ft)	
Culvert Control	Outlet	Weir Submerg	
Culv WS Inlet (ft)	582.09	Weir Max Depth (ft)	
Culv WS Outlet (ft)	581.44	Weir Avg Depth (ft)	
Culv Nml Depth (ft)	6.00	Weir Flow Area (sq ft)	
Culv Crt Depth (ft)	4.36	Min El Weir Flow (ft)	588.00

Plan: Proposed GuadTrib20 GuadTrib20 RS: 16000 Culv Group: Culvert #1 Profile: 100-year

Q Culv Group (cfs)	3472.87	Culv Full Len (ft)	126.57
# Barrels	11	Culv Vel US (ft/s)	8.77
Q Barrel (cfs)	315.72	Culv Vel DS (ft/s)	8.77
E.G. US. (ft)	585.22	Culv Inv El Up (ft)	576.62
W.S. US. (ft)	584.86	Culv Inv El Dn (ft)	576.24
E.G. DS (ft)	582.88	Culv Frctn Ls (ft)	0.58
W.S. DS (ft)	582.61	Culv Exit Loss (ft)	0.92
Delta EG (ft)	2.34	Culv Entr Loss (ft)	0.84
Delta WS (ft)	2.25	Q Weir (cfs)	1648.88
E.G. IC (ft)	585.01	Weir Sta Lft (ft)	102.52
E.G. OC (ft)	585.22	Weir Sta Rgt (ft)	674.94
Culvert Control	Outlet	Weir Submerg	0.00
Culv WS Inlet (ft)	582.62	Weir Max Depth (ft)	1.80
Culv WS Outlet (ft)	582.24	Weir Avg Depth (ft)	1.03
Culv Nml Depth (ft)		Weir Flow Area (sq ft)	591.44
Culv Crt Depth (ft)	4.41	Min El Weir Flow (ft)	588.00

Plan: Proposed GuadTrib20 GuadTrib20 RS: 17380 Lat Struct Profile: 2-year

E.G. US. (ft)	587.17	Weir Sta US (ft)	
W.S. US. (ft)	587.03	Weir Sta DS (ft)	
E.G. DS (ft)	586.34	Min El Weir Flow (ft)	588.07
W.S. DS (ft)	585.35	Wr Top Wdth (ft)	
Q US (cfs)	1014.34	Weir Max Depth (ft)	
Q Leaving Total (cfs)	0.00	Weir Avg Depth (ft)	
Q DS (cfs)	1030.37	Weir Flow Area (sq ft)	
Perc Q Leaving	0.00	Weir Coef (ft^1/2)	0.000
Q Weir (cfs)	0.00	Weir Submerg	
Q Gates (cfs)		Q Gate Group (cfs)	
Q Culv (cfs)	0.00	Gate Open Ht (ft)	
Q Lat RC (cfs)		Gate #Open	
		Gate Area (sq ft)	
Q Breach (cfs)		Gate Submerg	
Breach Avg Velocity (ft/s)		Gate Invert (ft)	
Breach Flow Area (sq ft)		Gate Weir Coef	

Plan: Proposed GuadTrib20 GuadTrib20 RS: 17380 Lat Struct Profile: 5-year

E.G. US. (ft)	588.17	Weir Sta US (ft)	
W.S. US. (ft)	587.97	Weir Sta DS (ft)	
E.G. DS (ft)	587.44	Min El Weir Flow (ft)	588.07
W.S. DS (ft)	586.33	Wr Top Wdth (ft)	
Q US (cfs)	1732.33	Weir Max Depth (ft)	
Q Leaving Total (cfs)	0.00	Weir Avg Depth (ft)	
Q DS (cfs)	1802.10	Weir Flow Area (sq ft)	
Perc Q Leaving	0.00	Weir Coef (ft^1/2)	0.000
Q Weir (cfs)	0.00	Weir Submerg	
Q Gates (cfs)		Q Gate Group (cfs)	
Q Culv (cfs)	0.00	Gate Open Ht (ft)	
Q Lat RC (cfs)		Gate #Open	
		Gate Area (sq ft)	
Q Breach (cfs)		Gate Submerg	
Breach Avg Velocity (ft/s)		Gate Invert (ft)	
Breach Flow Area (sq ft)		Gate Weir Coef	

Plan: Proposed GuadTrib20 GuadTrib20 RS: 17380 Lat Struct Profile: 10-year

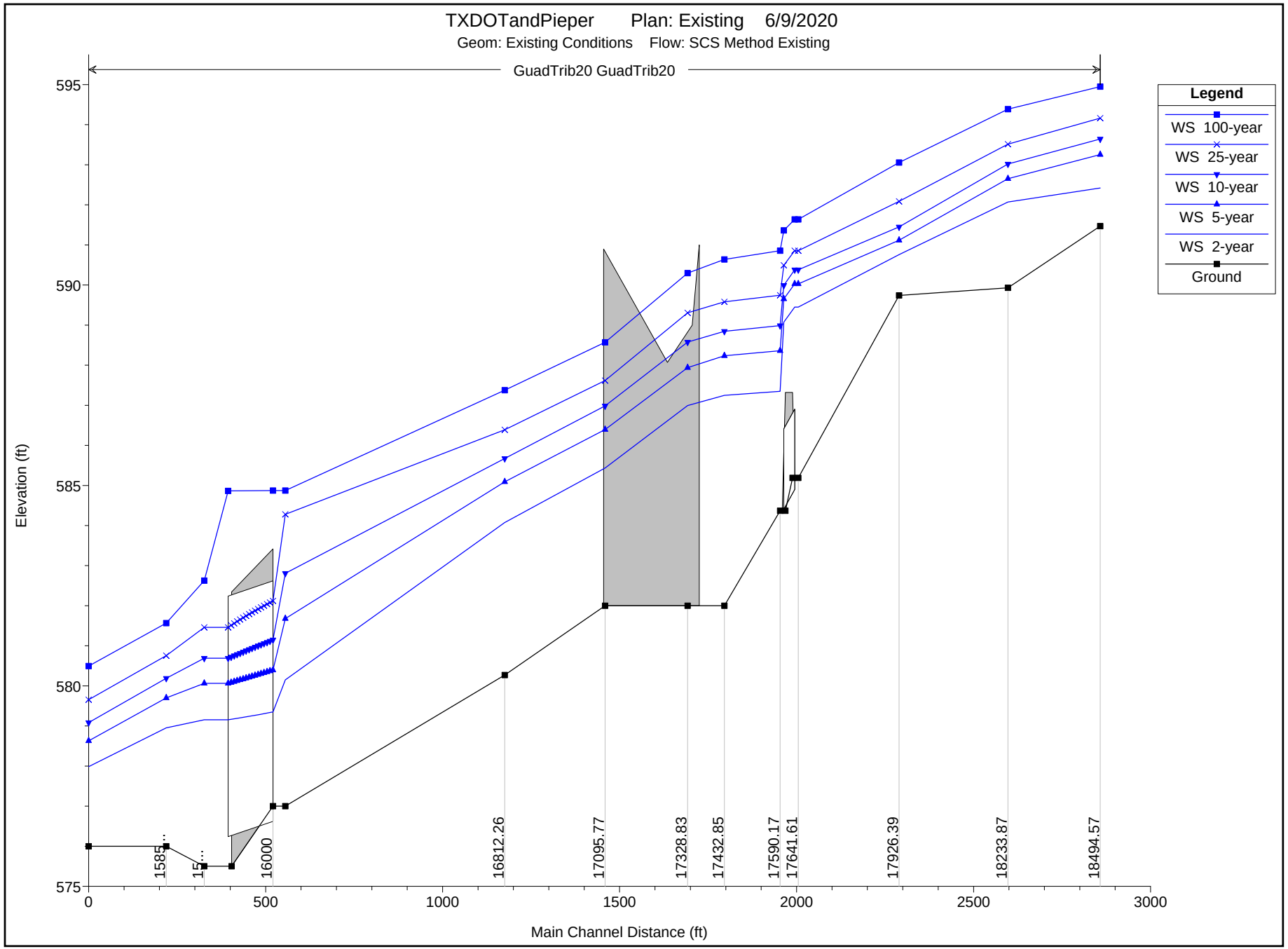
E.G. US. (ft)	588.80	Weir Sta US (ft)	33.02
W.S. US. (ft)	588.63	Weir Sta DS (ft)	266.08
E.G. DS (ft)	588.13	Min El Weir Flow (ft)	588.07
W.S. DS (ft)	586.92	Wr Top Wdth (ft)	15.12
Q US (cfs)	2338.07	Weir Max Depth (ft)	0.08
Q Leaving Total (cfs)	0.38	Weir Avg Depth (ft)	0.04
Q DS (cfs)	2460.95	Weir Flow Area (sq ft)	0.57
Perc Q Leaving	0.02	Weir Coef (ft^1/2)	3.000
Q Weir (cfs)	0.38	Weir Submerg	0.00
Q Gates (cfs)		Q Gate Group (cfs)	
Q Culv (cfs)	0.00	Gate Open Ht (ft)	
Q Lat RC (cfs)		Gate #Open	
		Gate Area (sq ft)	
Q Breach (cfs)		Gate Submerg	
Breach Avg Velocity (ft/s)		Gate Invert (ft)	
Breach Flow Area (sq ft)		Gate Weir Coef	

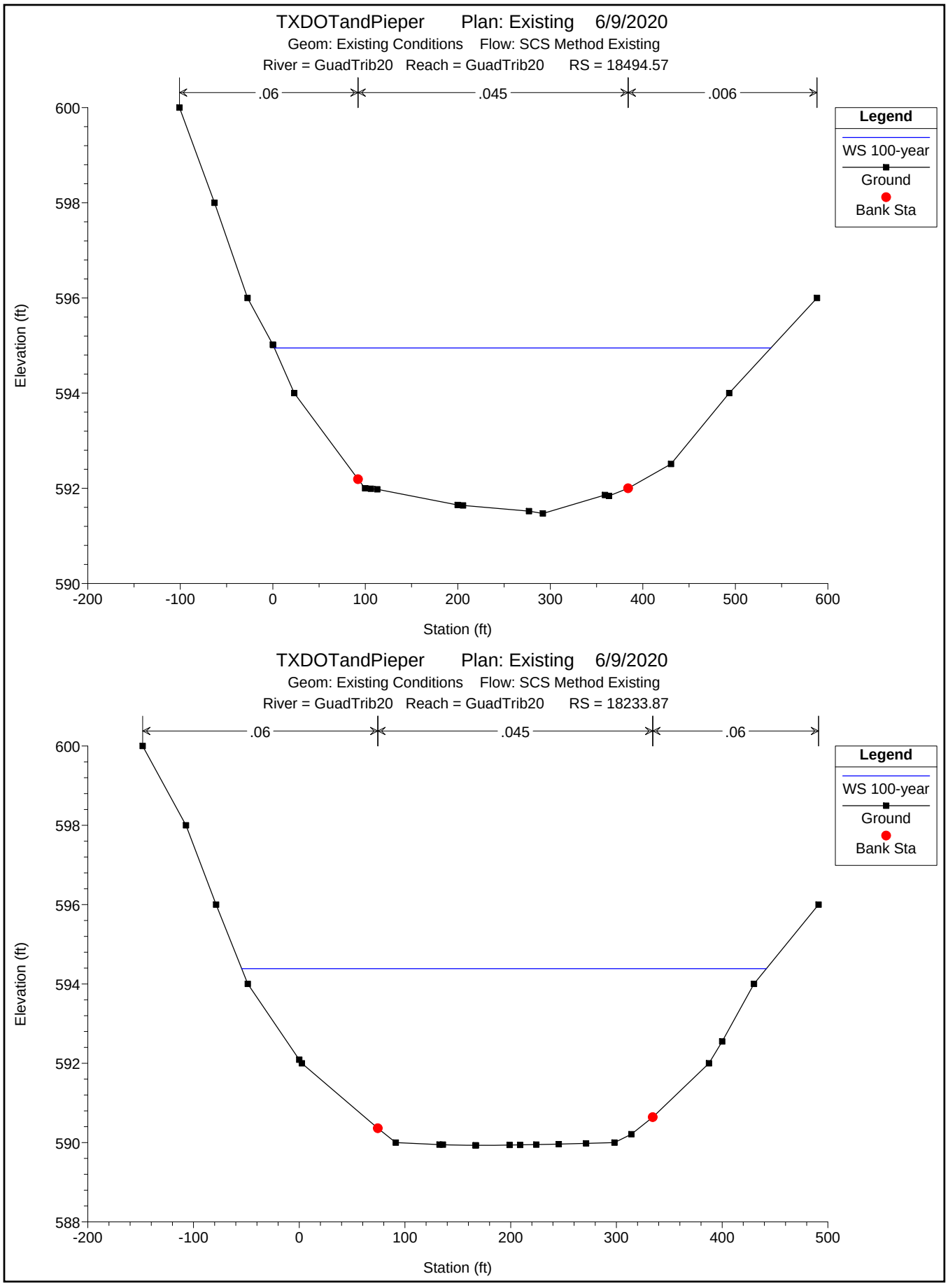
Plan: Proposed GuadTrib20 GuadTrib20 RS: 17380 Lat Struct Profile: 25-year

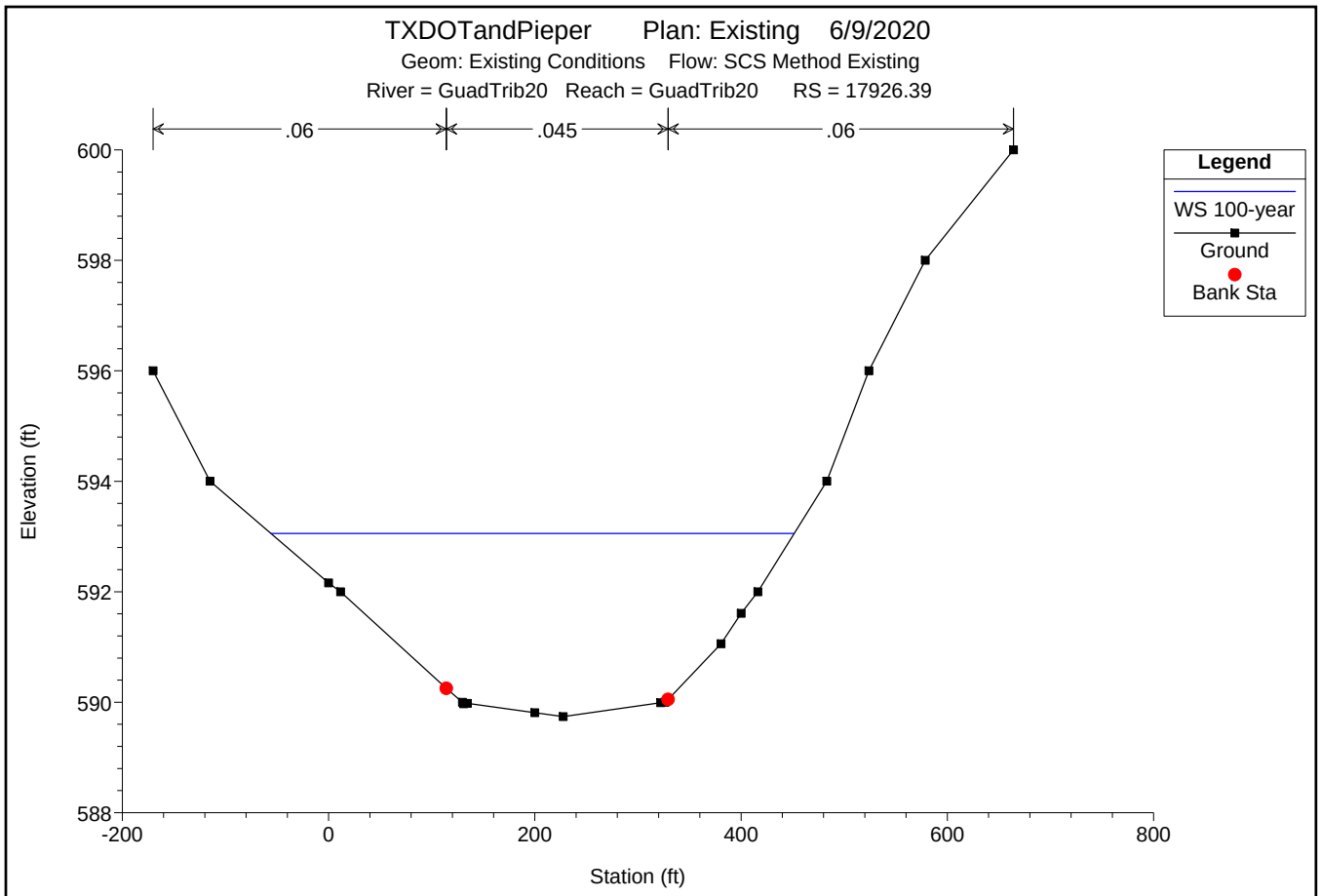
E.G. US. (ft)	589.57	Weir Sta US (ft)	0.00
W.S. US. (ft)	589.39	Weir Sta DS (ft)	266.08
E.G. DS (ft)	588.93	Min El Weir Flow (ft)	588.07
W.S. DS (ft)	587.56	Wr Top Wdth (ft)	108.67
Q US (cfs)	3326.44	Weir Max Depth (ft)	0.81
Q Leaving Total (cfs)	131.67	Weir Avg Depth (ft)	0.53
Q DS (cfs)	3411.33	Weir Flow Area (sq ft)	57.07
Perc Q Leaving	3.90	Weir Coef (ft^1/2)	3.000
Q Weir (cfs)	131.67	Weir Submerg	0.00
Q Gates (cfs)		Q Gate Group (cfs)	
Q Culv (cfs)	0.00	Gate Open Ht (ft)	
Q Lat RC (cfs)		Gate #Open	
		Gate Area (sq ft)	
Q Breach (cfs)		Gate Submerg	
Breach Avg Velocity (ft/s)		Gate Invert (ft)	
Breach Flow Area (sq ft)		Gate Weir Coef	

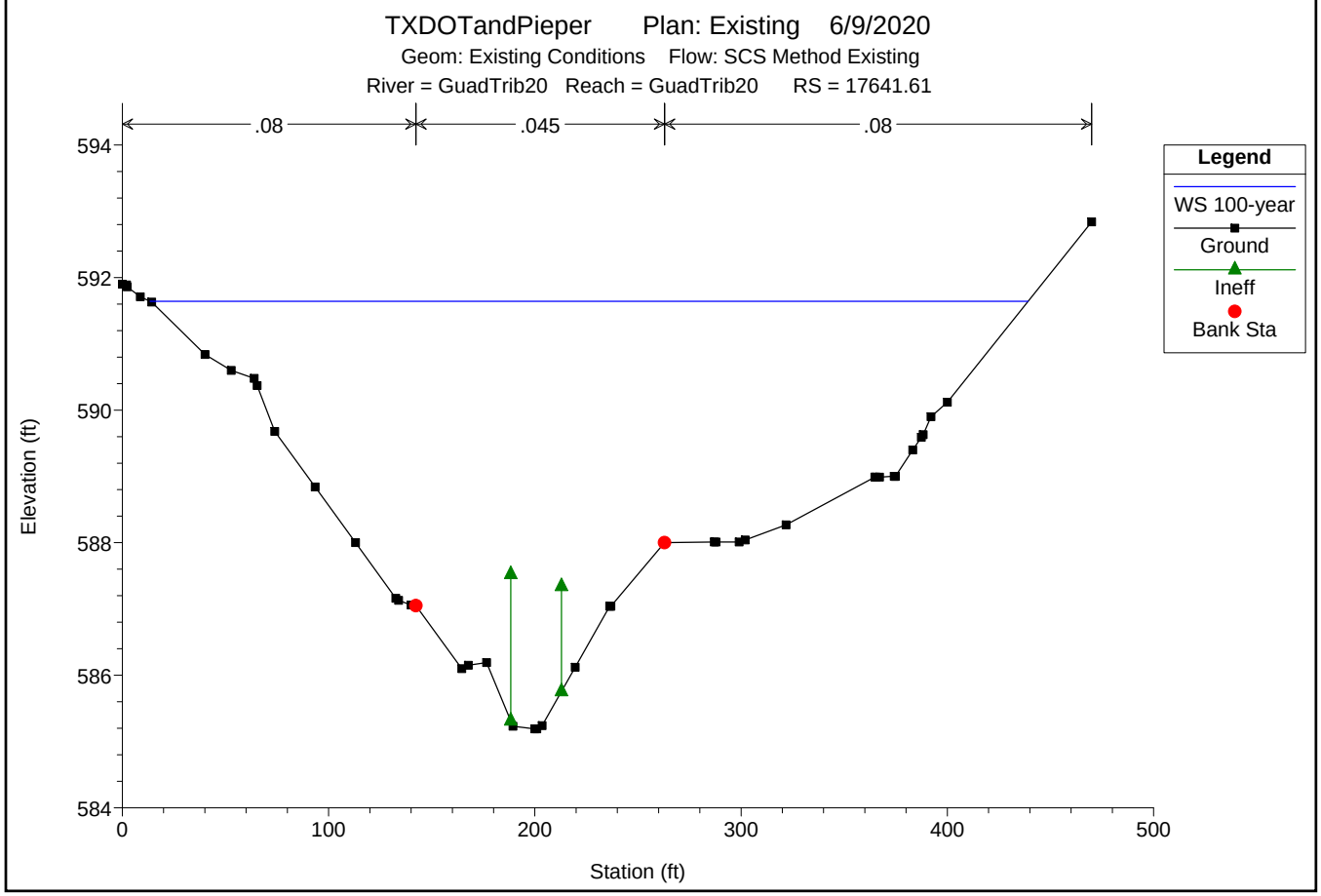
Plan: Proposed GuadTrib20 GuadTrib20 RS: 17380 Lat Struct Profile: 100-year

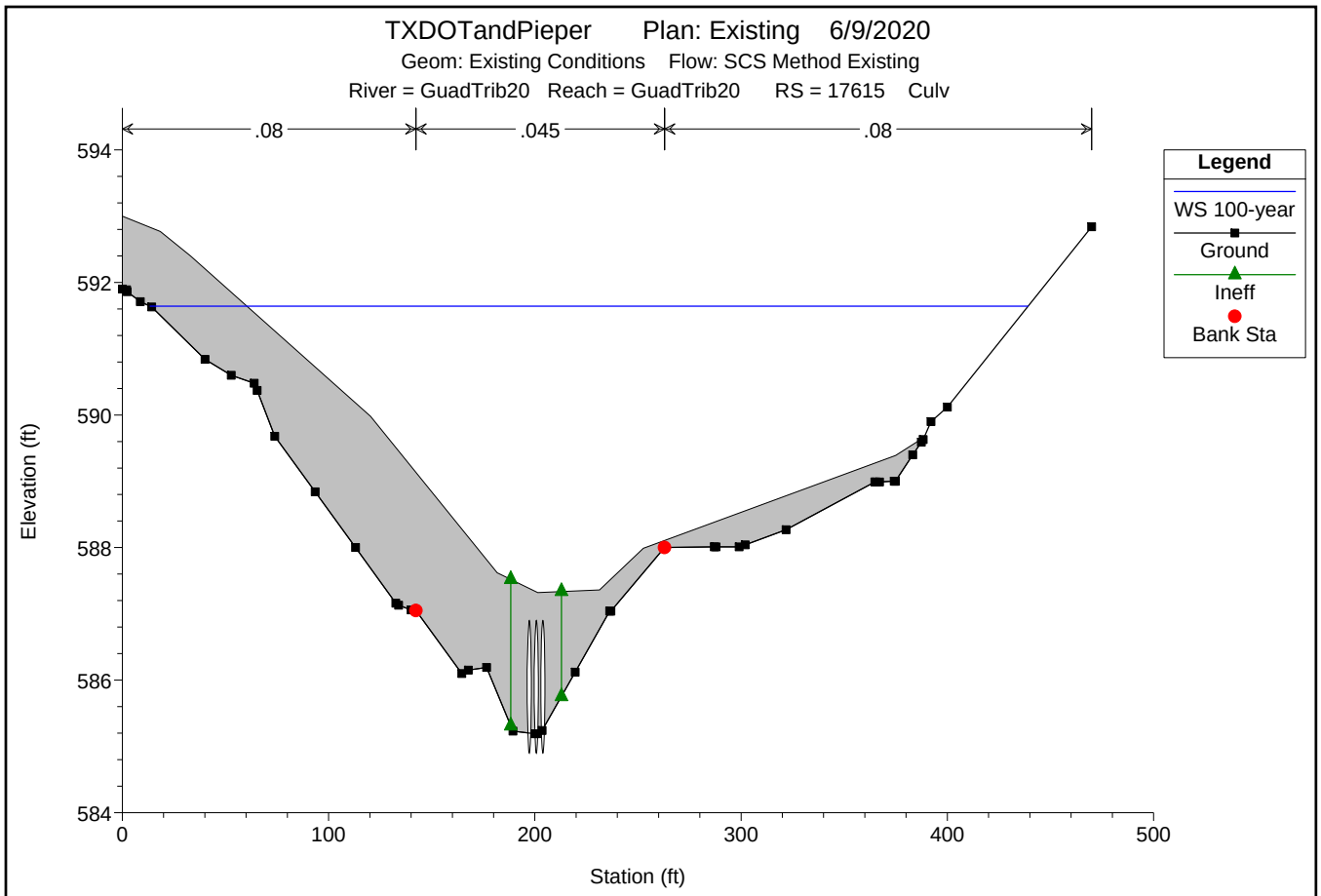
E.G. US. (ft)	590.69	Weir Sta US (ft)	0.00
W.S. US. (ft)	590.43	Weir Sta DS (ft)	266.08
E.G. DS (ft)	590.03	Min El Weir Flow (ft)	588.07
W.S. DS (ft)	588.49	Wr Top Wdth (ft)	161.36
Q US (cfs)	5411.44	Weir Max Depth (ft)	1.82
Q Leaving Total (cfs)	690.19	Weir Avg Depth (ft)	1.20
Q DS (cfs)	5121.75	Weir Flow Area (sq ft)	193.64
Perc Q Leaving	12.74	Weir Coef (ft^1/2)	3.000
Q Weir (cfs)	690.19	Weir Submerg	0.00
Q Gates (cfs)		Q Gate Group (cfs)	
Q Culv (cfs)	0.00	Gate Open Ht (ft)	
Q Lat RC (cfs)		Gate #Open	
		Gate Area (sq ft)	
Q Breach (cfs)		Gate Submerg	
Breach Avg Velocity (ft/s)		Gate Invert (ft)	
Breach Flow Area (sq ft)		Gate Weir Coef	

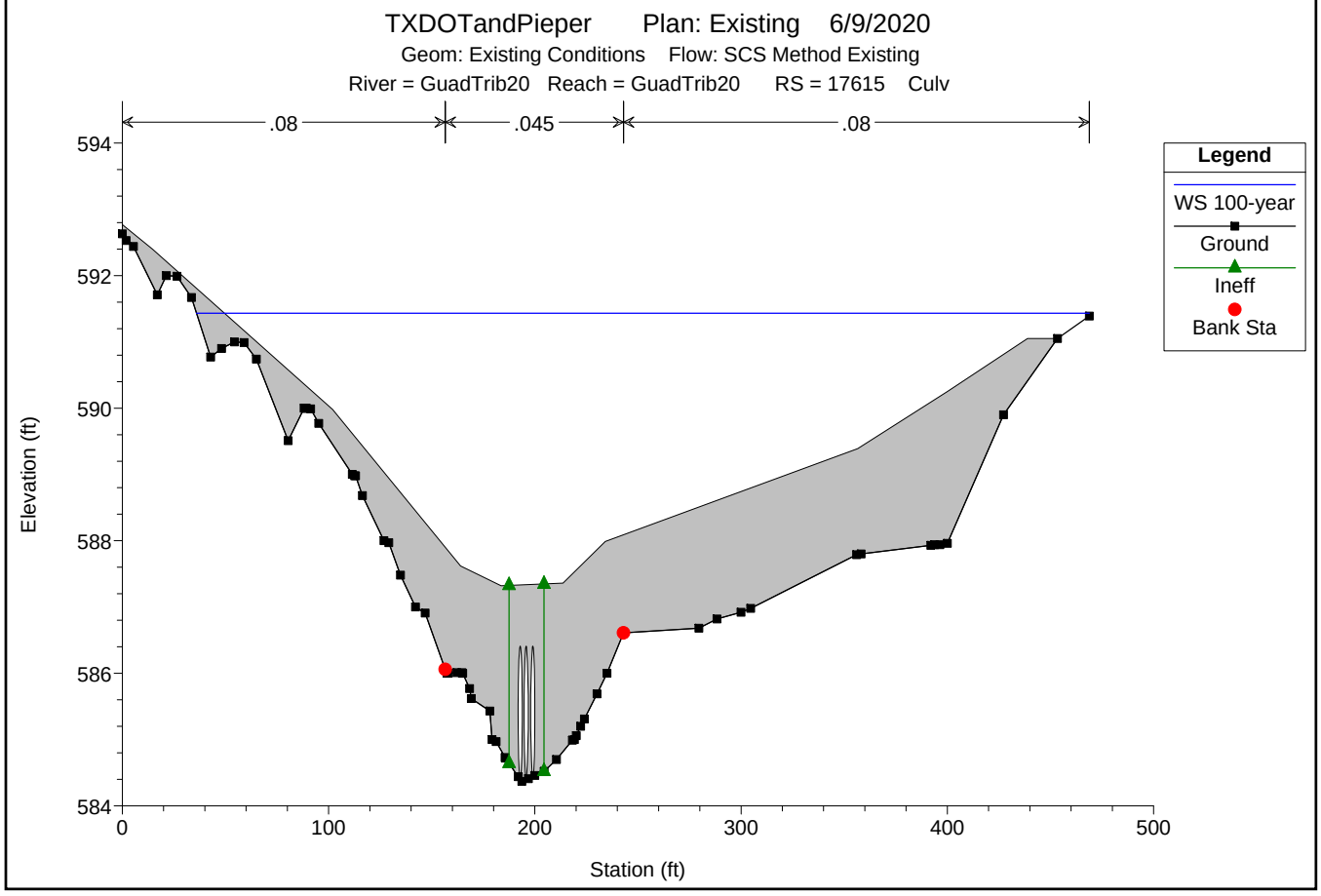

TXDOTandPieper Plan: Existing 6/9/2020
Geom: Existing Conditions Flow: SCS Method Existing
GuadTrib20 GuadTrib20
Legend
WS 100-year
WS 25-year
WS 10-year
WS 5-year
WS 2-year
Ground
Elevation (ft)
595
590
585
580
575
0
500
1000
1500
2000
2500
3000
Main Channel Distance (ft)
1585...
15...
16000
16812.26
17095.77
17328.83
17432.85
17590.17
17641.61
17926.39
18233.87
18494.57

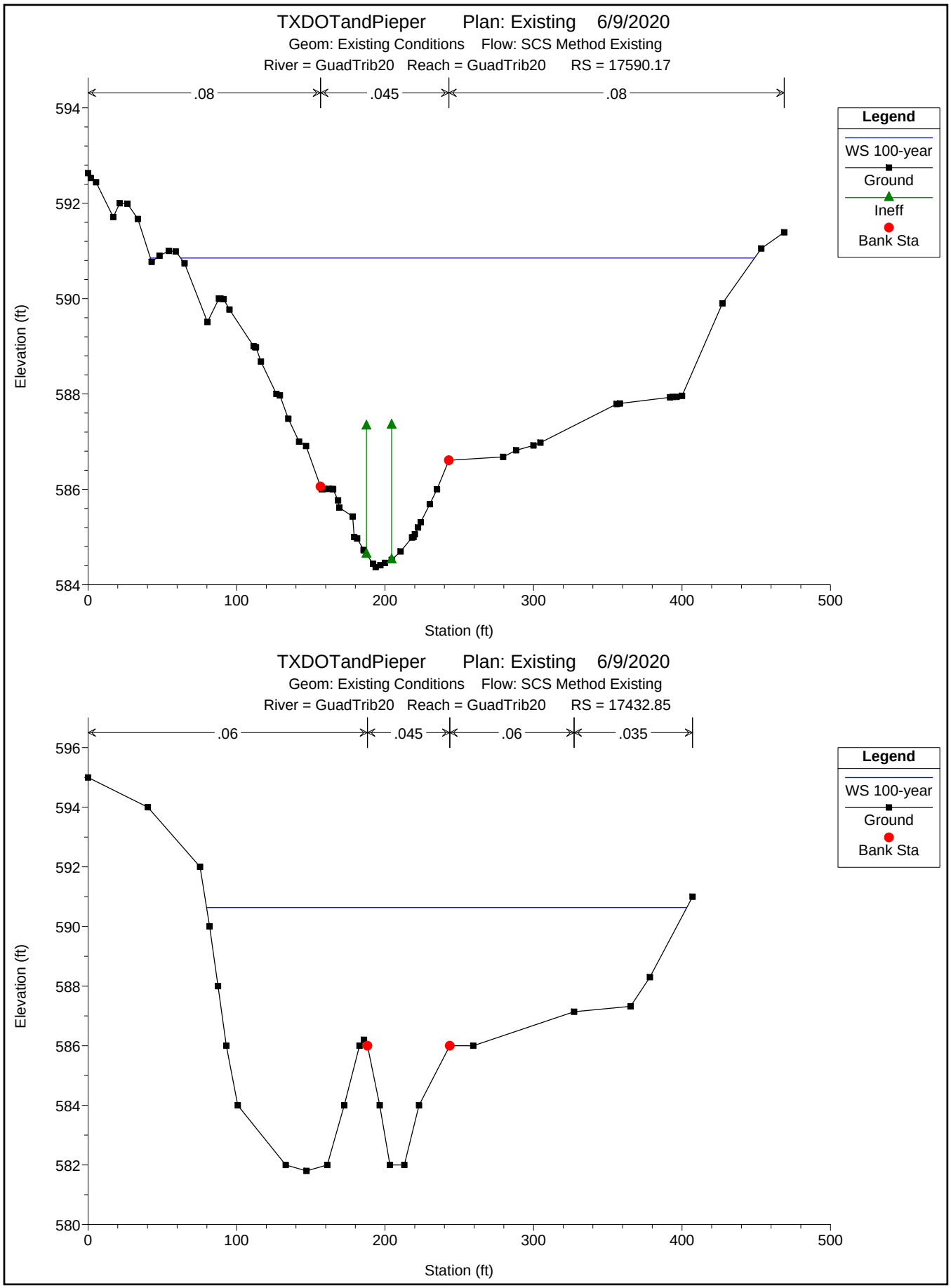

TXDOTandPieper Plan: Existing 6/9/2020
Geom: Existing Conditions Flow: SCS Method Existing
River = GuadTrib20 Reach = GuadTrib20 RS = 18494.57
.06
.045
.006
Legend
WS 100-year
Ground
Bank Sta
Elevation (ft)
Station (ft)
TXDOTandPieper Plan: Existing 6/9/2020
Geom: Existing Conditions Flow: SCS Method Existing
River = GuadTrib20 Reach = GuadTrib20 RS = 18233.87
.06
.045
.06
Legend
WS 100-year
Ground
Bank Sta
Elevation (ft)
Station (ft)

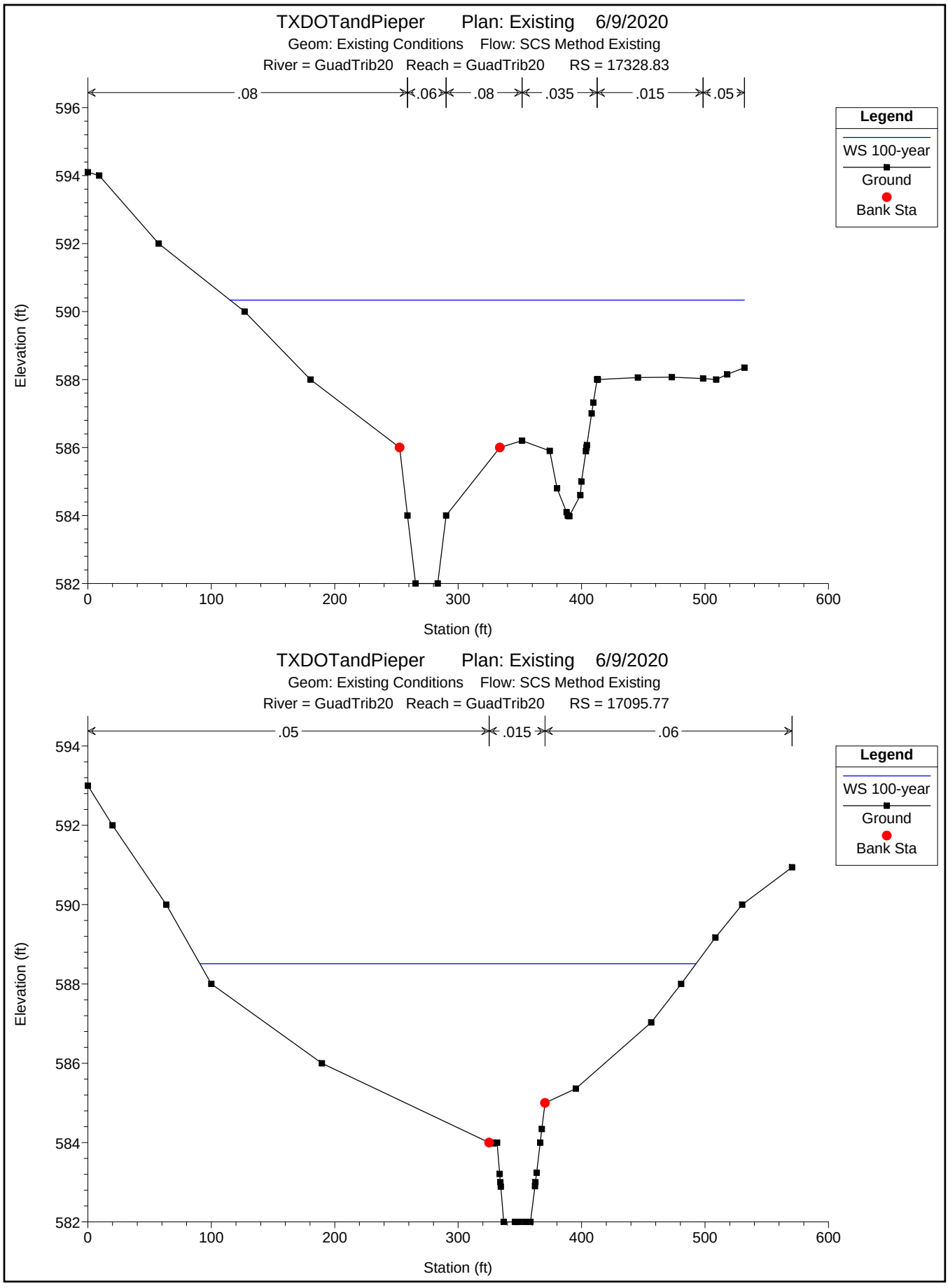

TXDOTandPieper Plan: Existing 6/9/2020
Geom: Existing Conditions Flow: SCS Method Existing
River = GuadTrib20 Reach = GuadTrib20 RS = 17926.39
.06
.045
.06
Legend
WS 100-year
Ground
Bank Sta
Elevation (ft)
600
598
596
594
592
590
588
-200
0
200
400
600
800
Station (ft)

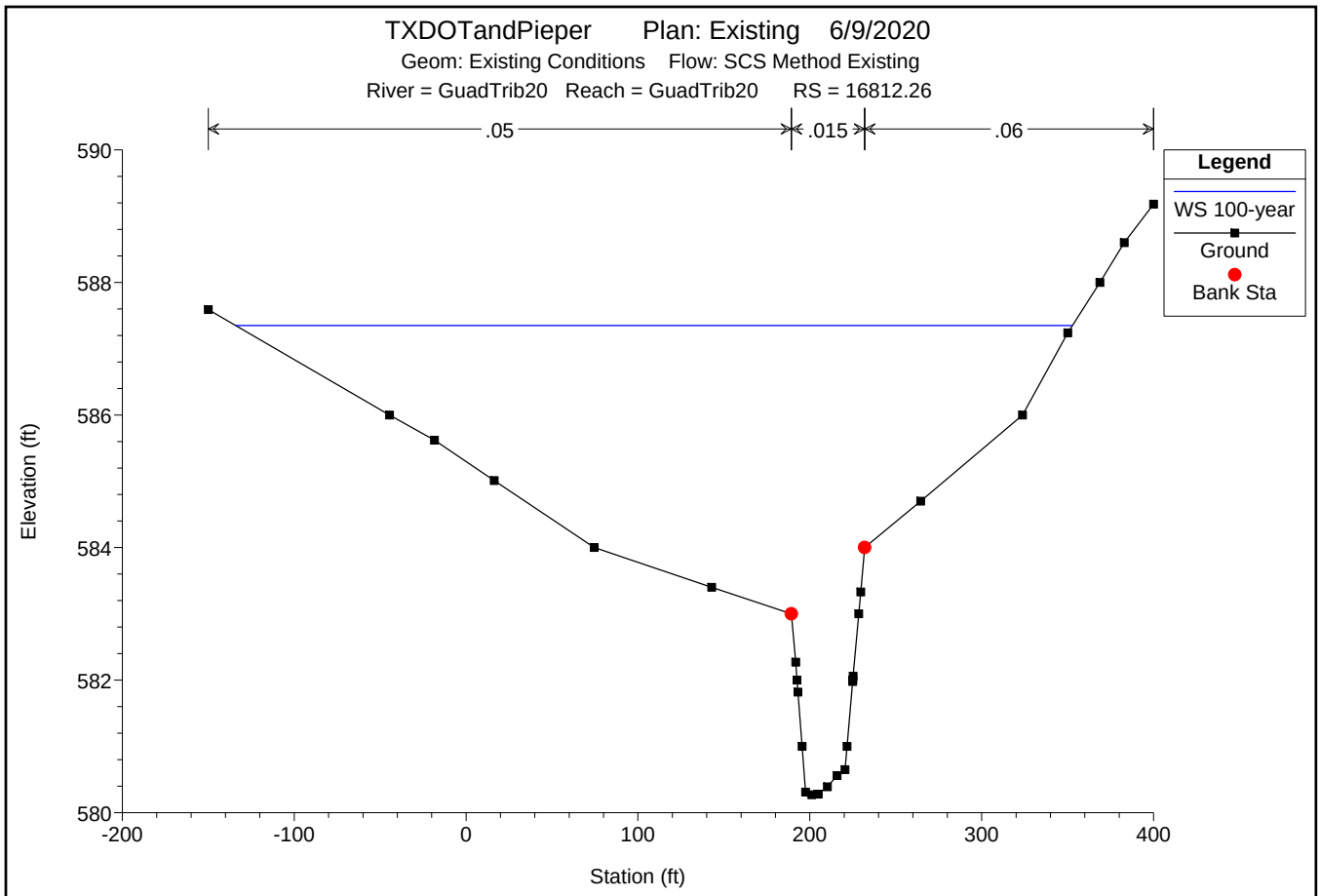

TXDOTandPieper Plan: Existing 6/9/2020
Geom: Existing Conditions Flow: SCS Method Existing
River = GuadTrib20 Reach = GuadTrib20 RS = 17641.61
.08
.045
.08
Legend
WS 100-year
Ground
Ineff
Bank Sta
Elevation (ft)
594
592
590
588
586
584
0
100
200
300
400
500
Station (ft)

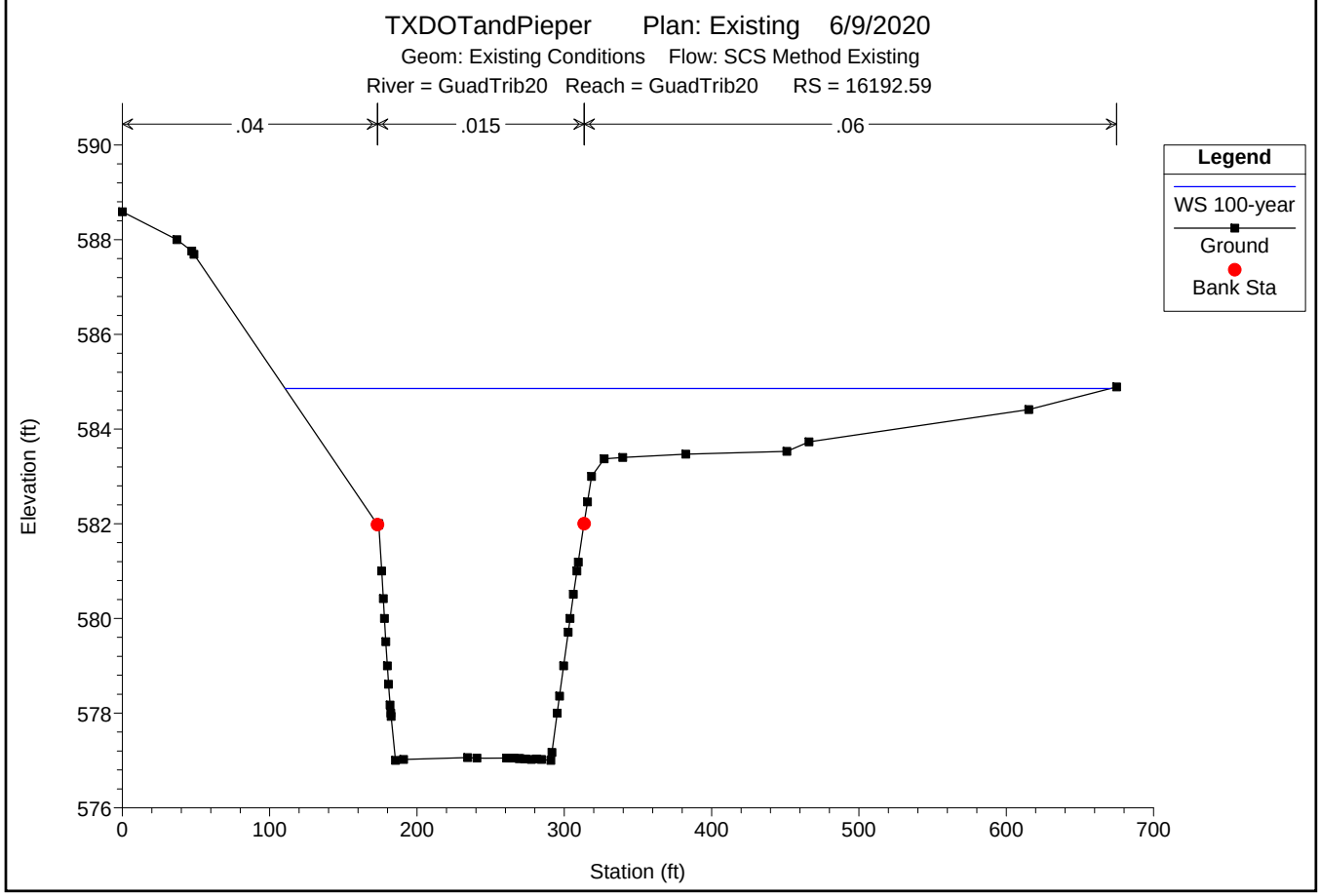

TXDOTandPieper Plan: Existing 6/9/2020
Geom: Existing Conditions Flow: SCS Method Existing
River = GuadTrib20 Reach = GuadTrib20 RS = 17615 Culv
.08
.045
.08
Legend
WS 100-year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
584
586
588
590
592
594
0
100
200
300
400
500

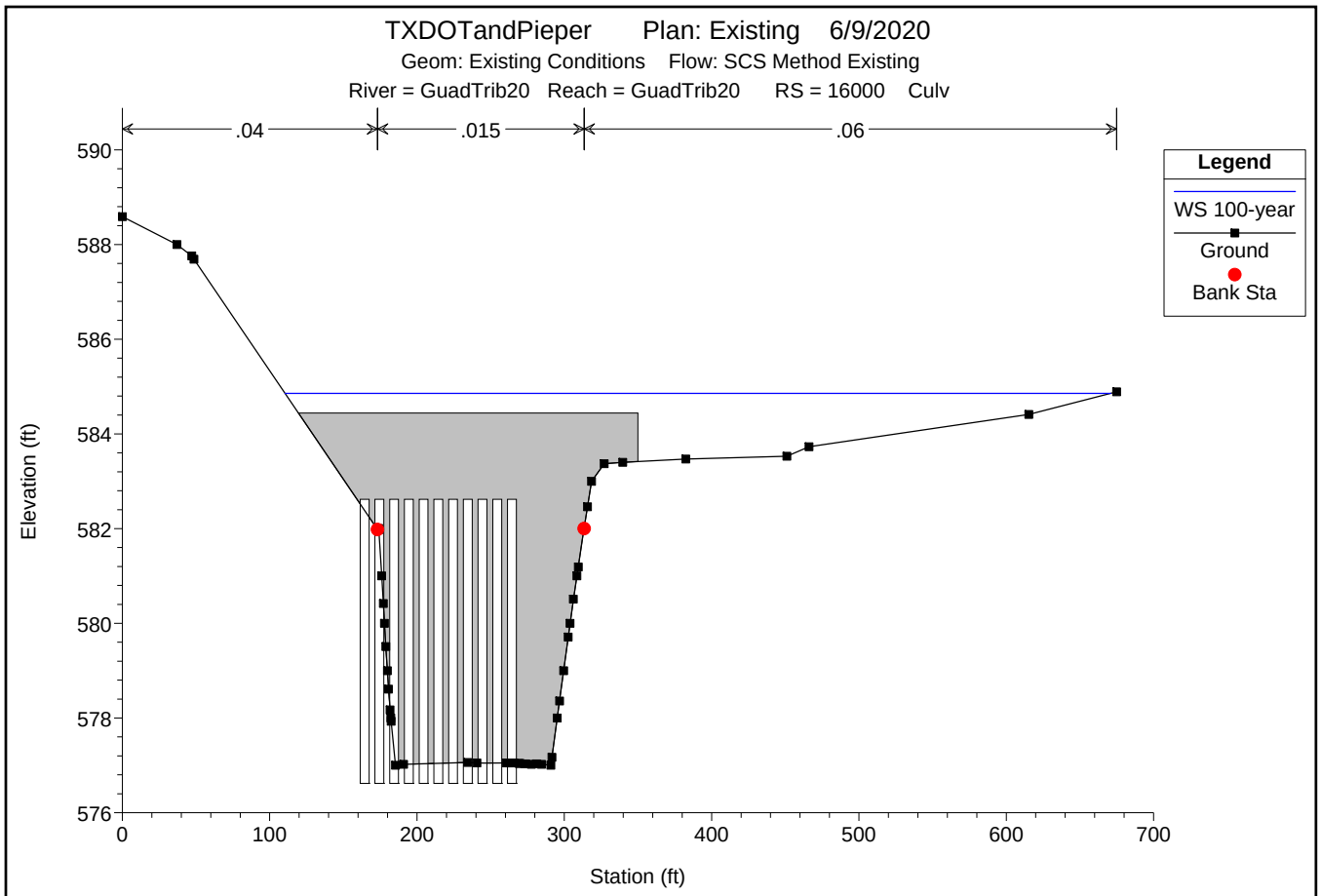

TXDOTandPieper Plan: Existing 6/9/2020
Geom: Existing Conditions Flow: SCS Method Existing
River = GuadTrib20 Reach = GuadTrib20 RS = 17615 Culv
.08
.045
.08
Legend
WS 100-year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
584
586
588
590
592
594
0
100
200
300
400
500

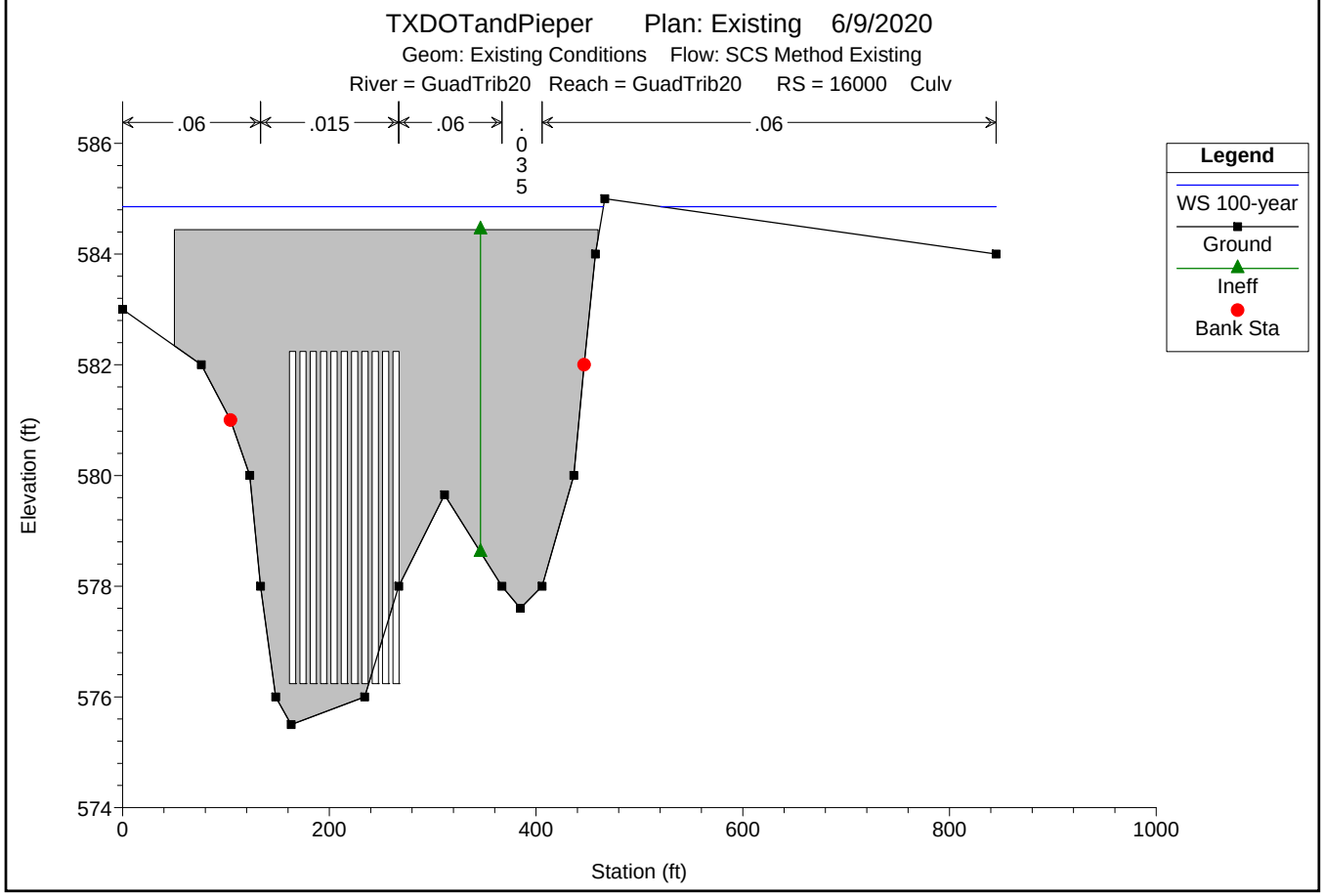

TXDOTandPieper Plan: Existing 6/9/2020
Geom: Existing Conditions Flow: SCS Method Existing
River = GuadTrib20 Reach = GuadTrib20 RS = 17590.17
.08
.045
.08
Legend
WS 100-year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
TXDOTandPieper Plan: Existing 6/9/2020
Geom: Existing Conditions Flow: SCS Method Existing
River = GuadTrib20 Reach = GuadTrib20 RS = 17432.85
.06
.045
.06
.035
Legend
WS 100-year
Ground
Bank Sta
Elevation (ft)
Station (ft)

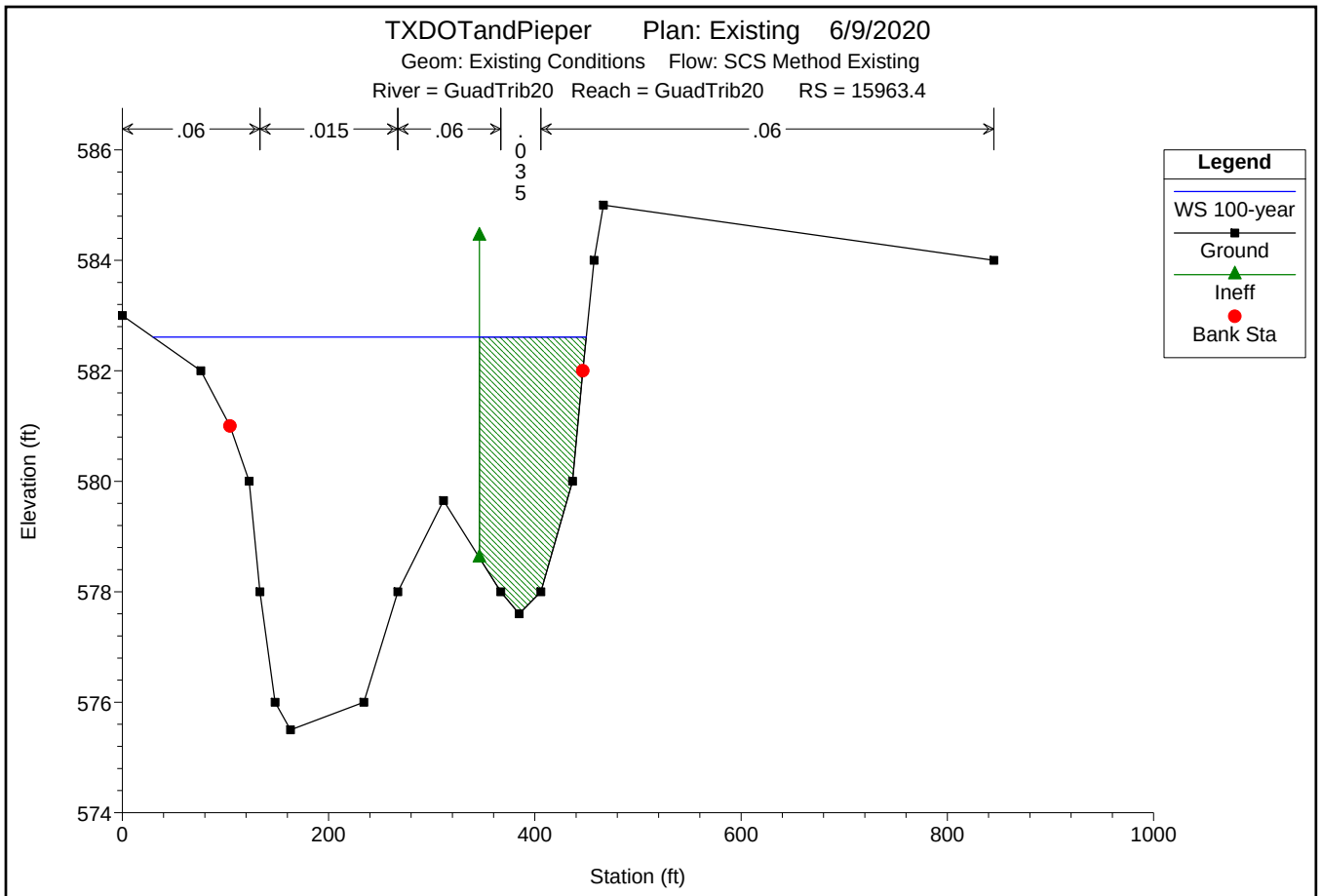

TXDOTandPieper Plan: Existing 6/9/2020
Geom: Existing Conditions Flow: SCS Method Existing
River = GuadTrib20 Reach = GuadTrib20 RS = 17328.83
.08
.06
.08
.035
.015
.05
Legend
WS 100-year
Ground
Bank Sta
Elevation (ft)
Station (ft)
TXDOTandPieper Plan: Existing 6/9/2020
Geom: Existing Conditions Flow: SCS Method Existing
River = GuadTrib20 Reach = GuadTrib20 RS = 17095.77
.05
.015
.06
Legend
WS 100-year
Ground
Bank Sta
Elevation (ft)
Station (ft)

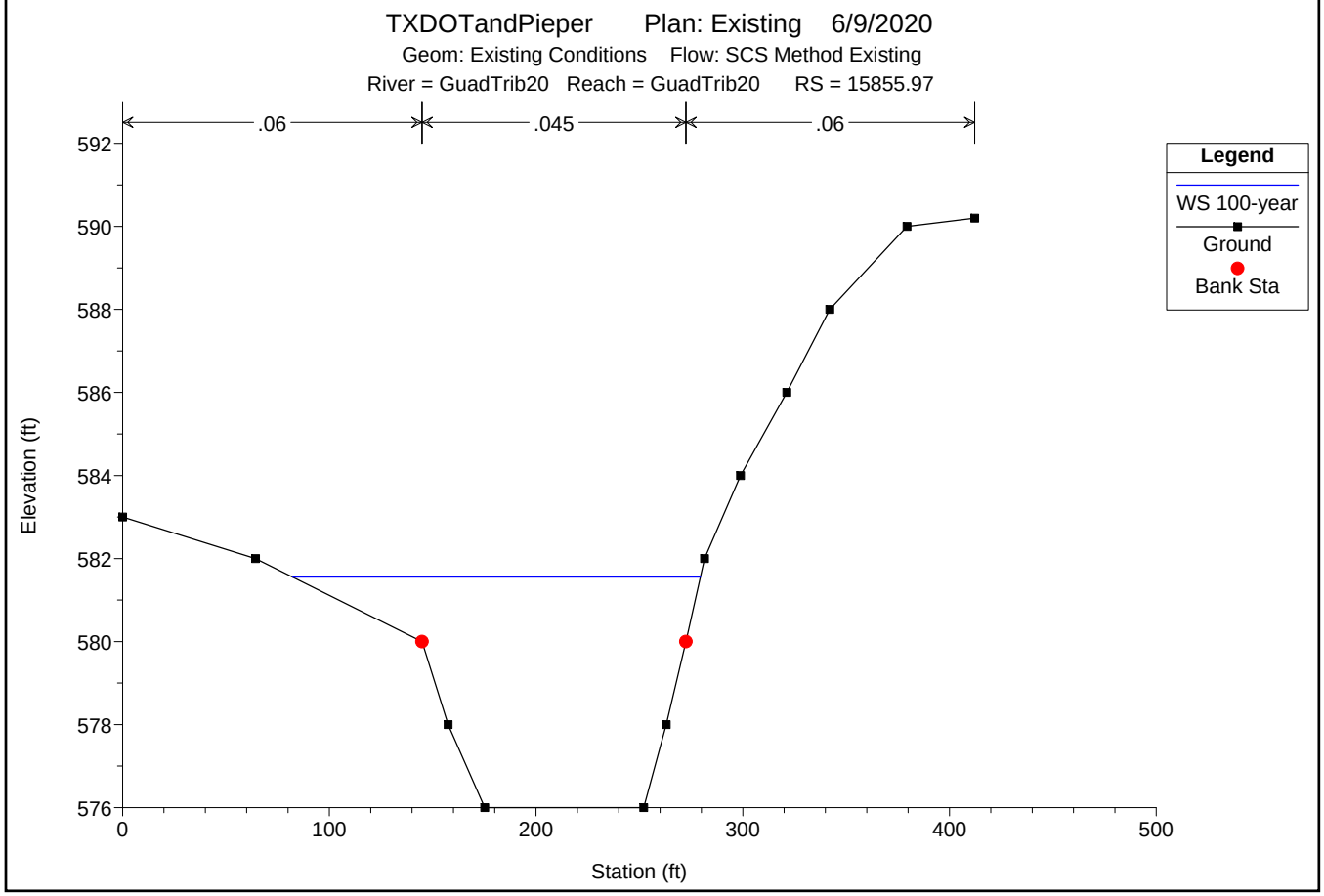

TXDOTandPieper Plan: Existing 6/9/2020
Geom: Existing Conditions Flow: SCS Method Existing
River = GuadTrib20 Reach = GuadTrib20 RS = 16812.26
.05
.015
.06
Legend
WS 100-year
Ground
Bank Sta
Elevation (ft)
Station (ft)
590
588
586
584
582
580
-200
-100
0
100
200
300
400

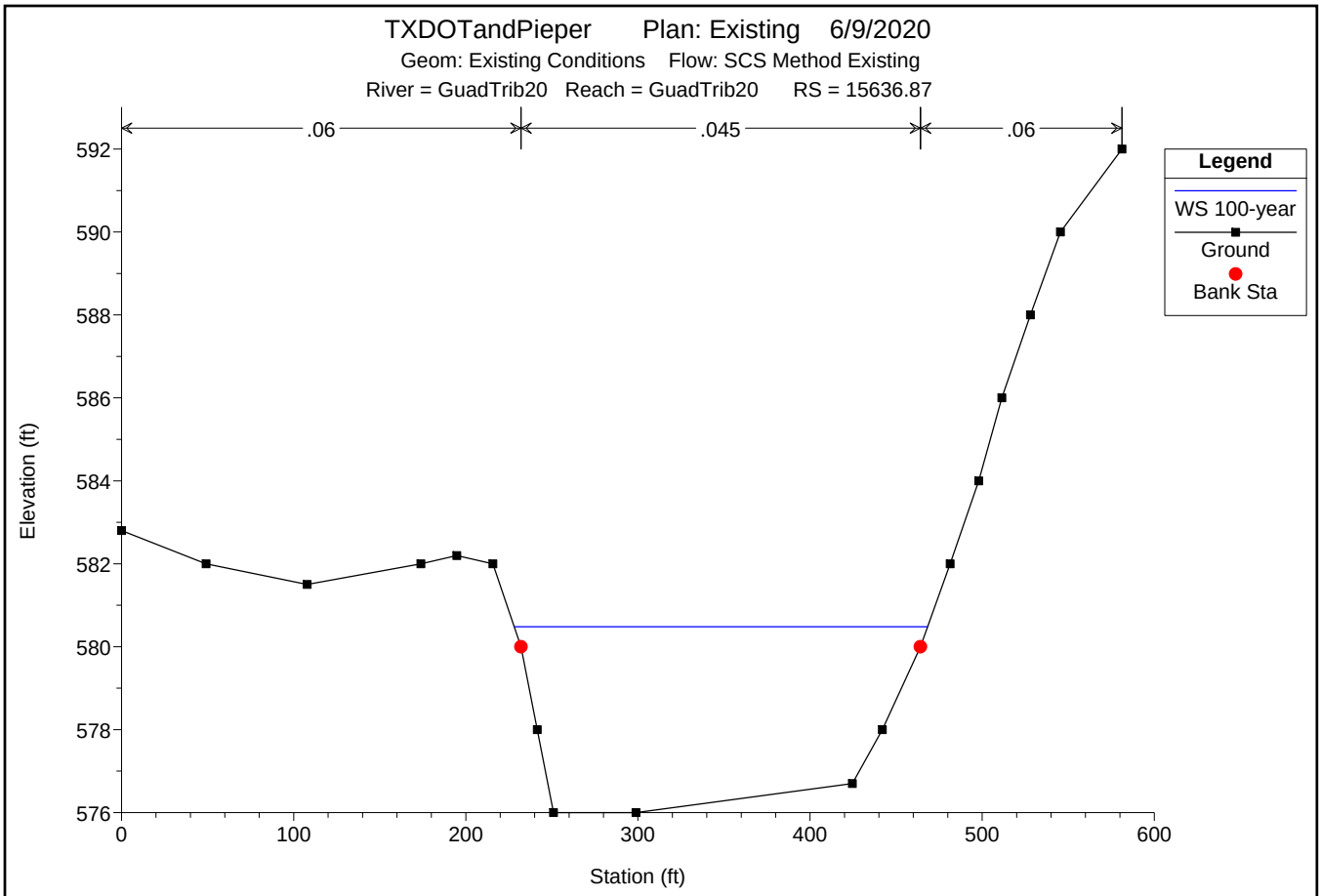

TXDOTandPieper Plan: Existing 6/9/2020
Geom: Existing Conditions Flow: SCS Method Existing
River = GuadTrib20 Reach = GuadTrib20 RS = 16192.59
.04
.015
.06
Legend
WS 100-year
Ground
Bank Sta
Elevation (ft)
Station (ft)
590
588
586
584
582
580
578
576
0
100
200
300
400
500
600
700


TXDOTandPieper Plan: Existing 6/9/2020
Geom: Existing Conditions Flow: SCS Method Existing
River = GuadTrib20 Reach = GuadTrib20 RS = 16000 Culv
.04
.015
.06
Legend
WS 100-year
Ground
Bank Sta
Elevation (ft)
590
588
586
584
582
580
578
576
0
100
200
300
400
500
600
700
Station (ft)


TXDOTandPieper Plan: Existing 6/9/2020
Geom: Existing Conditions Flow: SCS Method Existing
River = GuadTrib20 Reach = GuadTrib20 RS = 16000 Culv
.06
.015
.06
.035
.06
Legend
WS 100-year
Ground
Ineff
Bank Sta
Elevation (ft)
586
584
582
580
578
576
574
0
200
400
600
800
1000
Station (ft)


TXDOTandPieper Plan: Existing 6/9/2020
Geom: Existing Conditions Flow: SCS Method Existing
River = GuadTrib20 Reach = GuadTrib20 RS = 15963.4
.06
.015
.06
.035
.06
Legend
WS 100-year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
574
576
578
580
582
584
586
0
200
400
600
800
1000


TXDOTandPieper Plan: Existing 6/9/2020
Geom: Existing Conditions Flow: SCS Method Existing
River = GuadTrib20 Reach = GuadTrib20 RS = 15855.97
.06
.045
.06
Legend
WS 100-year
Ground
Bank Sta
Elevation (ft)
Station (ft)
576
578
580
582
584
586
588
590
592
0
100
200
300
400
500


TXDOTandPieper Plan: Existing 6/9/2020
Geom: Existing Conditions Flow: SCS Method Existing
River = GuadTrib20 Reach = GuadTrib20 RS = 15636.87
.06
.045
.06
Legend
WS 100-year
Ground
Bank Sta
Elevation (ft)
592
590
588
586
584
582
580
578
576
0
100
200
300
400
500
600
Station (ft)

Attachment F

Proposed Conditions Hydraulic Analysis

HEC-RAS Plan: Proposed River: GuadTrib20 Reach: GuadTrib20

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
GuadTrib20	18494.57	2-year	1002.62	591.47	592.4	592.30	593.08	0.028339	4.36	211.72	339.02	0.92
GuadTrib20	18494.57	5-year	1713.53	591.47	593.3	593.25	594.01	0.002927	2.37	525.32	410.27	0.34
GuadTrib20	18494.57	10-year	2312.98	591.47	593.6	593.64	594.48	0.002018	2.29	690.96	441.51	0.29
GuadTrib20	18494.57	25-year	3291.98	591.47	594.2	594.16	595.11	0.001450	2.28	931.83	481.70	0.26
GuadTrib20	18494.57	100-year	5355.58	591.47	594.9	594.95	596.12	0.001129	2.42	1331.74	536.72	0.24
GuadTrib20	18233.87	2-year	1002.62	589.93	592.1		592.12	0.001065	1.74	637.95	388.67	0.21
GuadTrib20	18233.87	5-year	1713.53	589.93	592.7		592.73	0.001248	2.23	873.84	416.66	0.24
GuadTrib20	18233.87	10-year	2312.98	589.93	593.0		593.11	0.001420	2.59	1027.84	433.42	0.26
GuadTrib20	18233.87	25-year	3291.98	589.93	593.5		593.64	0.001643	3.08	1247.85	456.29	0.29
GuadTrib20	18233.87	100-year	5355.58	589.93	594.4		594.58	0.001908	3.85	1663.74	496.37	0.33
GuadTrib20	17926.39	2-year	1002.62	589.74	590.8	590.76	591.16	0.029188	5.14	207.56	280.93	0.97
GuadTrib20	17926.39	5-year	1713.53	589.74	591.1	591.12	591.64	0.025249	6.02	314.91	319.15	0.96
GuadTrib20	17926.39	10-year	2312.98	589.74	591.5	591.36	591.99	0.019185	6.16	427.37	350.73	0.87
GuadTrib20	17926.39	25-year	3291.98	589.74	592.1		592.56	0.011070	5.88	670.09	413.94	0.70
GuadTrib20	17926.39	100-year	5355.58	589.74	593.1		593.53	0.007320	6.09	1116.12	507.46	0.60
GuadTrib20	17641.61	2-year	1002.62	585.19	589.5	587.61	589.54	0.001084	2.31	583.95	305.74	0.23
GuadTrib20	17641.61	5-year	1713.53	585.19	590.0	588.26	590.13	0.001663	3.18	754.21	325.95	0.29
GuadTrib20	17641.61	10-year	2312.98	585.19	590.4	588.66	590.54	0.002090	3.79	872.42	340.63	0.33
GuadTrib20	17641.61	25-year	3291.98	585.19	590.9	589.22	591.12	0.002690	4.66	1051.42	379.37	0.39
GuadTrib20	17641.61	100-year	5355.58	585.19	591.6	590.03	592.08	0.003710	6.09	1367.24	425.71	0.47
GuadTrib20	17615		Culvert									
GuadTrib20	17590.17	2-year	1014.34	584.37	587.3	587.35	587.75	0.009467	5.26	234.74	190.88	0.64
GuadTrib20	17590.17	5-year	1732.33	584.37	588.3	587.62	588.71	0.005877	5.36	473.32	283.55	0.54
GuadTrib20	17590.17	10-year	2338.07	584.37	589.0	588.16	589.32	0.004785	5.47	656.89	300.76	0.50
GuadTrib20	17590.17	25-year	3326.44	584.37	589.7	588.64	590.12	0.004339	5.90	900.13	335.08	0.49
GuadTrib20	17590.17	100-year	5411.44	584.37	590.9	589.45	591.36	0.004490	6.97	1307.83	390.66	0.52
GuadTrib20	17432.85	2-year	1014.34	582.00	587.2		587.28	0.000699	1.94	635.42	259.22	0.19
GuadTrib20	17432.85	5-year	1732.33	582.00	588.2		588.29	0.000798	2.46	902.58	275.05	0.21
GuadTrib20	17432.85	10-year	2338.07	582.00	588.8		588.91	0.000879	2.82	1071.37	278.85	0.22
GuadTrib20	17432.85	25-year	3326.44	582.00	589.6		589.69	0.001036	3.36	1281.18	283.70	0.25
GuadTrib20	17432.85	100-year	5411.44	582.00	590.6		590.83	0.001455	4.46	1598.95	316.96	0.30
GuadTrib20	17380		Lat Struct									

HEC-RAS Plan: Proposed River: GuadTrib20 Reach: GuadTrib20 (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
GuadTrib20	17328.83	2-year	1014.34	582.00	586.9		587.12	0.004711	2.86	327.98	174.15	0.29
GuadTrib20	17328.83	5-year	1732.33	582.00	587.9		588.11	0.004015	3.16	506.10	212.56	0.28
GuadTrib20	17328.83	10-year	2338.07	582.00	588.5		588.74	0.003176	3.13	721.10	365.91	0.26
GuadTrib20	17328.83	25-year	3315.37	582.00	589.3		589.52	0.002637	3.17	1010.92	386.44	0.24
GuadTrib20	17328.83	100-year	5316.92	582.00	590.3		590.63	0.002578	3.53	1424.05	416.67	0.25
GuadTrib20	17095.77	2-year	1014.34	582.00	585.4	585.37	586.36	0.001978	8.20	185.12	163.39	0.90
GuadTrib20	17095.77	5-year	1732.33	582.00	586.3	586.35	587.46	0.001612	9.17	392.64	257.21	0.86
GuadTrib20	17095.77	10-year	2337.68	582.00	586.9	586.94	588.15	0.001521	9.87	560.59	305.79	0.85
GuadTrib20	17095.77	25-year	3196.73	582.00	587.6	587.58	588.94	0.001525	10.88	770.49	351.32	0.88
GuadTrib20	17095.77	100-year	4722.18	582.00	588.5	588.51	590.05	0.001498	12.13	1123.28	401.99	0.89
GuadTrib20	16812.26	2-year	1027.52	580.27	584.0	583.99	584.99	0.001759	8.17	177.14	156.69	0.86
GuadTrib20	16812.26	5-year	1791.00	580.27	585.0	585.03	586.14	0.001468	9.20	395.46	264.34	0.83
GuadTrib20	16812.26	10-year	2448.74	580.27	585.6	585.63	586.87	0.001451	10.07	572.23	325.86	0.84
GuadTrib20	16812.26	25-year	3402.67	580.27	586.4	586.37	587.70	0.001394	10.93	842.09	400.44	0.85
GuadTrib20	16812.26	100-year	5125.53	580.27	587.4	587.35	588.85	0.001390	12.26	1279.66	487.21	0.87
GuadTrib20	16192.59	2-year	1027.52	577.00	580.0	578.44	580.18	0.000227	2.93	350.22	126.27	0.31
GuadTrib20	16192.59	5-year	1791.00	577.00	581.6	579.05	581.74	0.000170	3.25	550.66	136.52	0.29
GuadTrib20	16192.59	10-year	2448.74	577.00	582.7	579.51	582.90	0.000141	3.44	718.04	159.99	0.27
GuadTrib20	16192.59	25-year	3402.67	577.00	584.2	580.09	584.43	0.000111	3.64	1125.37	450.79	0.25
GuadTrib20	16192.59	100-year	5125.53	577.00	584.9	581.01	585.23	0.000178	4.90	1452.54	561.72	0.32
GuadTrib20	16000		Culvert									
GuadTrib20	15963.4	2-year	1027.52	575.50	579.1	577.32	579.19	0.000173	2.51	409.67	260.84	0.30
GuadTrib20	15963.4	5-year	1791.00	575.50	580.0	577.97	580.14	0.000205	2.98	601.67	313.51	0.32
GuadTrib20	15963.4	10-year	2448.74	575.50	580.6	578.43	580.81	0.000223	3.27	748.19	328.66	0.32
GuadTrib20	15963.4	25-year	3402.67	575.50	581.4	579.05	581.64	0.000241	3.62	941.44	351.59	0.32
GuadTrib20	15963.4	100-year	5125.53	575.50	582.6	579.84	582.88	0.000266	4.18	1269.47	420.35	0.33
GuadTrib20	15855.97	2-year	1027.52	576.00	578.9		579.10	0.003742	3.65	281.54	115.47	0.41
GuadTrib20	15855.97	5-year	1791.00	576.00	579.7		580.01	0.004945	4.82	371.80	123.84	0.49
GuadTrib20	15855.97	10-year	2448.74	576.00	580.2		580.64	0.005714	5.63	435.39	134.47	0.54
GuadTrib20	15855.97	25-year	3402.67	576.00	580.7		581.42	0.006455	6.65	521.82	160.67	0.59
GuadTrib20	15855.97	100-year	5125.53	576.00	581.6	580.45	582.58	0.007616	8.18	668.42	197.33	0.66

HEC-RAS Plan: Proposed River: GuadTrib20 Reach: GuadTrib20 (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
GuadTrib20	15636.87	2-year	1027.52	576.00	577.9	577.27	578.11	0.005502	3.30	311.67	199.32	0.46
GuadTrib20	15636.87	5-year	1791.00	576.00	578.6	577.71	578.84	0.005500	4.03	444.03	209.71	0.49
GuadTrib20	15636.87	10-year	2448.74	576.00	579.0	578.04	579.36	0.005508	4.51	542.96	217.05	0.50
GuadTrib20	15636.87	25-year	3402.67	576.00	579.6	578.47	580.03	0.005503	5.06	672.86	226.33	0.52
GuadTrib20	15636.87	100-year	5125.53	576.00	580.5	579.13	581.02	0.005506	5.90	870.83	240.22	0.54

Plan: Proposed GuadTrib20 GuadTrib20 RS: 17615 Culv Group: Culverts Profile: 2-year

Q Culv Group (cfs)	97.49	Culv Full Len (ft)	31.00
# Barrels	3	Culv Vel US (ft/s)	10.34
Q Barrel (cfs)	32.50	Culv Vel DS (ft/s)	10.34
E.G. US. (ft)	589.54	Culv Inv El Up (ft)	584.90
W.S. US. (ft)	589.46	Culv Inv El Dn (ft)	584.41
E.G. DS (ft)	587.75	Culv Frctn Ls (ft)	0.64
W.S. DS (ft)	587.35	Culv Exit Loss (ft)	0.82
Delta EG (ft)	1.79	Culv Entr Loss (ft)	0.33
Delta WS (ft)	2.12	Q Weir (cfs)	905.13
E.G. IC (ft)	589.54	Weir Sta Lft (ft)	132.14
E.G. OC (ft)	589.54	Weir Sta Rgt (ft)	381.78
Culvert Control	Outlet	Weir Submerg	0.00
Culv WS Inlet (ft)	586.90	Weir Max Depth (ft)	2.21
Culv WS Outlet (ft)	586.41	Weir Avg Depth (ft)	1.18
Culv Nml Depth (ft)	2.00	Weir Flow Area (sq ft)	295.26
Culv Crt Depth (ft)	2.00	Min El Weir Flow (ft)	587.34

Plan: Proposed GuadTrib20 GuadTrib20 RS: 17615 Culv Group: Culverts Profile: 5-year

Q Culv Group (cfs)	88.06	Culv Full Len (ft)	31.00
# Barrels	3	Culv Vel US (ft/s)	9.34
Q Barrel (cfs)	29.35	Culv Vel DS (ft/s)	9.34
E.G. US. (ft)	590.14	Culv Inv El Up (ft)	584.90
W.S. US. (ft)	590.00	Culv Inv El Dn (ft)	584.41
E.G. DS (ft)	588.71	Culv Frctn Ls (ft)	0.52
W.S. DS (ft)	588.33	Culv Exit Loss (ft)	0.64
Delta EG (ft)	1.43	Culv Entr Loss (ft)	0.27
Delta WS (ft)	1.67	Q Weir (cfs)	1623.64
E.G. IC (ft)	590.13	Weir Sta Lft (ft)	114.59
E.G. OC (ft)	590.14	Weir Sta Rgt (ft)	400.49
Culvert Control	Outlet	Weir Submerg	0.16
Culv WS Inlet (ft)	586.90	Weir Max Depth (ft)	2.82
Culv WS Outlet (ft)	586.41	Weir Avg Depth (ft)	1.61
Culv Nml Depth (ft)	1.70	Weir Flow Area (sq ft)	459.25
Culv Crt Depth (ft)	1.85	Min El Weir Flow (ft)	587.34

Plan: Proposed GuadTrib20 GuadTrib20 RS: 17615 Culv Group: Culverts Profile: 10-year

Q Culv Group (cfs)	82.22	Culv Full Len (ft)	31.00
# Barrels	3	Culv Vel US (ft/s)	8.72
Q Barrel (cfs)	27.41	Culv Vel DS (ft/s)	8.72
E.G. US. (ft)	590.55	Culv Inv El Up (ft)	584.90
W.S. US. (ft)	590.36	Culv Inv El Dn (ft)	584.41
E.G. DS (ft)	589.32	Culv Frctn Ls (ft)	0.46
W.S. DS (ft)	588.96	Culv Exit Loss (ft)	0.53
Delta EG (ft)	1.23	Culv Entr Loss (ft)	0.24
Delta WS (ft)	1.40	Q Weir (cfs)	2227.56
E.G. IC (ft)	590.55	Weir Sta Lft (ft)	99.87
E.G. OC (ft)	590.55	Weir Sta Rgt (ft)	411.00
Culvert Control	Outlet	Weir Submerg	0.28
Culv WS Inlet (ft)	586.90	Weir Max Depth (ft)	3.23
Culv WS Outlet (ft)	586.41	Weir Avg Depth (ft)	1.87
Culv Nml Depth (ft)		Weir Flow Area (sq ft)	581.11
Culv Crt Depth (ft)	1.82	Min El Weir Flow (ft)	587.34

Plan: Proposed GuadTrib20 GuadTrib20 RS: 17615 Culv Group: Culverts Profile: 25-year

Q Culv Group (cfs)	76.21	Culv Full Len (ft)	31.00
# Barrels	3	Culv Vel US (ft/s)	8.09
Q Barrel (cfs)	25.40	Culv Vel DS (ft/s)	8.09
E.G. US. (ft)	591.12	Culv Inv El Up (ft)	584.90
W.S. US. (ft)	590.86	Culv Inv El Dn (ft)	584.41
E.G. DS (ft)	590.12	Culv Frctn Ls (ft)	0.39
W.S. DS (ft)	589.73	Culv Exit Loss (ft)	0.40
Delta EG (ft)	1.00	Culv Entr Loss (ft)	0.20
Delta WS (ft)	1.13	Q Weir (cfs)	3215.78
E.G. IC (ft)	591.10	Weir Sta Lft (ft)	79.48
E.G. OC (ft)	591.12	Weir Sta Rgt (ft)	425.54
Culvert Control	Outlet	Weir Submerg	0.48
Culv WS Inlet (ft)	586.90	Weir Max Depth (ft)	3.79
Culv WS Outlet (ft)	586.41	Weir Avg Depth (ft)	2.22
Culv Nml Depth (ft)		Weir Flow Area (sq ft)	766.83
Culv Crt Depth (ft)	1.77	Min El Weir Flow (ft)	587.34

Plan: Proposed GuadTrib20 GuadTrib20 RS: 17615 Culv Group: Culverts Profile: 100-year

Q Culv Group (cfs)	69.65	Culv Full Len (ft)	31.00
# Barrels	3	Culv Vel US (ft/s)	7.39
Q Barrel (cfs)	23.22	Culv Vel DS (ft/s)	7.39
E.G. US. (ft)	592.08	Culv Inv El Up (ft)	584.90
W.S. US. (ft)	591.64	Culv Inv El Dn (ft)	584.41
E.G. DS (ft)	591.36	Culv Frctn Ls (ft)	0.33
W.S. DS (ft)	590.85	Culv Exit Loss (ft)	0.22
Delta EG (ft)	0.72	Culv Entr Loss (ft)	0.17
Delta WS (ft)	0.79	Q Weir (cfs)	5285.93
E.G. IC (ft)	592.02	Weir Sta Lft (ft)	45.23
E.G. OC (ft)	592.08	Weir Sta Rgt (ft)	449.97
Culvert Control	Outlet	Weir Submerg	0.62
Culv WS Inlet (ft)	586.90	Weir Max Depth (ft)	4.74
Culv WS Outlet (ft)	586.41	Weir Avg Depth (ft)	2.78
Culv Nml Depth (ft)		Weir Flow Area (sq ft)	1123.18
Culv Crt Depth (ft)	1.71	Min El Weir Flow (ft)	587.34

Plan: Proposed GuadTrib20 GuadTrib20 RS: 16000 Culv Group: Culvert #1 Profile: 2-year

Q Culv Group (cfs)	1027.52	Culv Full Len (ft)	
# Barrels	11	Culv Vel US (ft/s)	5.86
Q Barrel (cfs)	93.41	Culv Vel DS (ft/s)	5.46
E.G. US. (ft)	580.18	Culv Inv El Up (ft)	576.62
W.S. US. (ft)	580.05	Culv Inv El Dn (ft)	576.24
E.G. DS (ft)	579.19	Culv Frctn Ls (ft)	0.26
W.S. DS (ft)	579.09	Culv Exit Loss (ft)	0.37
Delta EG (ft)	1.00	Culv Entr Loss (ft)	0.37
Delta WS (ft)	0.96	Q Weir (cfs)	
E.G. IC (ft)	579.83	Weir Sta Lft (ft)	
E.G. OC (ft)	580.18	Weir Sta Rgt (ft)	
Culvert Control	Outlet	Weir Submerg	
Culv WS Inlet (ft)	579.28	Weir Max Depth (ft)	
Culv WS Outlet (ft)	579.09	Weir Avg Depth (ft)	
Culv Nml Depth (ft)	2.38	Weir Flow Area (sq ft)	
Culv Crt Depth (ft)	1.96	Min El Weir Flow (ft)	588.00

Plan: Proposed GuadTrib20 GuadTrib20 RS: 16000 Culv Group: Culvert #1 Profile: 5-year

Q Culv Group (cfs)	1791.00	Culv Full Len (ft)	
# Barrels	11	Culv Vel US (ft/s)	7.33
Q Barrel (cfs)	162.82	Culv Vel DS (ft/s)	7.21
E.G. US. (ft)	581.74	Culv Inv El Up (ft)	576.62
W.S. US. (ft)	581.57	Culv Inv El Dn (ft)	576.24
E.G. DS (ft)	580.14	Culv Frctn Ls (ft)	0.35
W.S. DS (ft)	580.00	Culv Exit Loss (ft)	0.67
Delta EG (ft)	1.60	Culv Entr Loss (ft)	0.58
Delta WS (ft)	1.57	Q Weir (cfs)	
E.G. IC (ft)	581.27	Weir Sta Lft (ft)	
E.G. OC (ft)	581.74	Weir Sta Rgt (ft)	
Culvert Control	Outlet	Weir Submerg	
Culv WS Inlet (ft)	580.32	Weir Max Depth (ft)	
Culv WS Outlet (ft)	580.00	Weir Avg Depth (ft)	
Culv Nml Depth (ft)	3.60	Weir Flow Area (sq ft)	
Culv Crt Depth (ft)	2.84	Min El Weir Flow (ft)	588.00

Plan: Proposed GuadTrib20 GuadTrib20 RS: 16000 Culv Group: Culvert #1 Profile: 10-year

Q Culv Group (cfs)	2448.74	Culv Full Len (ft)	
# Barrels	11	Culv Vel US (ft/s)	8.30
Q Barrel (cfs)	222.61	Culv Vel DS (ft/s)	8.43
E.G. US. (ft)	582.91	Culv Inv El Up (ft)	576.62
W.S. US. (ft)	582.72	Culv Inv El Dn (ft)	576.24
E.G. DS (ft)	580.81	Culv Frctn Ls (ft)	0.41
W.S. DS (ft)	580.64	Culv Exit Loss (ft)	0.94
Delta EG (ft)	2.10	Culv Entr Loss (ft)	0.75
Delta WS (ft)	2.08	Q Weir (cfs)	
E.G. IC (ft)	582.35	Weir Sta Lft (ft)	
E.G. OC (ft)	582.91	Weir Sta Rgt (ft)	
Culvert Control	Outlet	Weir Submerg	
Culv WS Inlet (ft)	581.09	Weir Max Depth (ft)	
Culv WS Outlet (ft)	580.64	Weir Avg Depth (ft)	
Culv Nml Depth (ft)	4.59	Weir Flow Area (sq ft)	
Culv Crt Depth (ft)	3.50	Min El Weir Flow (ft)	588.00

Plan: Proposed GuadTrib20 GuadTrib20 RS: 16000 Culv Group: Culvert #1 Profile: 25-year

Q Culv Group (cfs)	3402.67	Culv Full Len (ft)	
# Barrels	11	Culv Vel US (ft/s)	9.43
Q Barrel (cfs)	309.33	Culv Vel DS (ft/s)	9.93
E.G. US. (ft)	584.43	Culv Inv El Up (ft)	576.62
W.S. US. (ft)	584.23	Culv Inv El Dn (ft)	576.24
E.G. DS (ft)	581.64	Culv Frctn Ls (ft)	0.50
W.S. DS (ft)	581.43	Culv Exit Loss (ft)	1.33
Delta EG (ft)	2.80	Culv Entr Loss (ft)	0.97
Delta WS (ft)	2.79	Q Weir (cfs)	
E.G. IC (ft)	583.76	Weir Sta Lft (ft)	
E.G. OC (ft)	584.43	Weir Sta Rgt (ft)	
Culvert Control	Outlet	Weir Submerg	
Culv WS Inlet (ft)	582.08	Weir Max Depth (ft)	
Culv WS Outlet (ft)	581.43	Weir Avg Depth (ft)	
Culv Nml Depth (ft)	5.99	Weir Flow Area (sq ft)	
Culv Crt Depth (ft)	4.35	Min El Weir Flow (ft)	588.00

Plan: Proposed GuadTrib20 GuadTrib20 RS: 16000 Culv Group: Culvert #1 Profile: 100-year

Q Culv Group (cfs)	3476.65	Culv Full Len (ft)	126.57
# Barrels	11	Culv Vel US (ft/s)	8.78
Q Barrel (cfs)	316.06	Culv Vel DS (ft/s)	8.78
E.G. US. (ft)	585.23	Culv Inv El Up (ft)	576.62
W.S. US. (ft)	584.87	Culv Inv El Dn (ft)	576.24
E.G. DS (ft)	582.88	Culv Frctn Ls (ft)	0.58
W.S. DS (ft)	582.61	Culv Exit Loss (ft)	0.93
Delta EG (ft)	2.34	Culv Entr Loss (ft)	0.84
Delta WS (ft)	2.25	Q Weir (cfs)	1648.88
E.G. IC (ft)	585.02	Weir Sta Lft (ft)	102.52
E.G. OC (ft)	585.23	Weir Sta Rgt (ft)	674.94
Culvert Control	Outlet	Weir Submerg	0.00
Culv WS Inlet (ft)	582.62	Weir Max Depth (ft)	1.80
Culv WS Outlet (ft)	582.24	Weir Avg Depth (ft)	1.03
Culv Nml Depth (ft)		Weir Flow Area (sq ft)	591.44
Culv Crt Depth (ft)	4.42	Min El Weir Flow (ft)	588.00

Plan: Proposed GuadTrib20 GuadTrib20 RS: 17380 Lat Struct Profile: 2-year

E.G. US. (ft)	587.17	Weir Sta US (ft)	
W.S. US. (ft)	587.03	Weir Sta DS (ft)	
E.G. DS (ft)	586.34	Min El Weir Flow (ft)	588.07
W.S. DS (ft)	585.35	Wr Top Wdth (ft)	
Q US (cfs)	1014.34	Weir Max Depth (ft)	
Q Leaving Total (cfs)	0.00	Weir Avg Depth (ft)	
Q DS (cfs)	1027.52	Weir Flow Area (sq ft)	
Perc Q Leaving	0.00	Weir Coef (ft^1/2)	0.000
Q Weir (cfs)	0.00	Weir Submerg	
Q Gates (cfs)		Q Gate Group (cfs)	
Q Culv (cfs)	0.00	Gate Open Ht (ft)	
Q Lat RC (cfs)		Gate #Open	
		Gate Area (sq ft)	
Q Breach (cfs)		Gate Submerg	
Breach Avg Velocity (ft/s)		Gate Invert (ft)	
Breach Flow Area (sq ft)		Gate Weir Coef	

Plan: Proposed GuadTrib20 GuadTrib20 RS: 17380 Lat Struct Profile: 5-year

E.G. US. (ft)	588.17	Weir Sta US (ft)	
W.S. US. (ft)	587.97	Weir Sta DS (ft)	
E.G. DS (ft)	587.44	Min El Weir Flow (ft)	588.07
W.S. DS (ft)	586.33	Wr Top Wdth (ft)	
Q US (cfs)	1732.33	Weir Max Depth (ft)	
Q Leaving Total (cfs)	0.00	Weir Avg Depth (ft)	
Q DS (cfs)	1791.00	Weir Flow Area (sq ft)	
Perc Q Leaving	0.00	Weir Coef (ft^1/2)	0.000
Q Weir (cfs)	0.00	Weir Submerg	
Q Gates (cfs)		Q Gate Group (cfs)	
Q Culv (cfs)	0.00	Gate Open Ht (ft)	
Q Lat RC (cfs)		Gate #Open	
		Gate Area (sq ft)	
Q Breach (cfs)		Gate Submerg	
Breach Avg Velocity (ft/s)		Gate Invert (ft)	
Breach Flow Area (sq ft)		Gate Weir Coef	

Plan: Proposed GuadTrib20 GuadTrib20 RS: 17380 Lat Struct Profile: 10-year

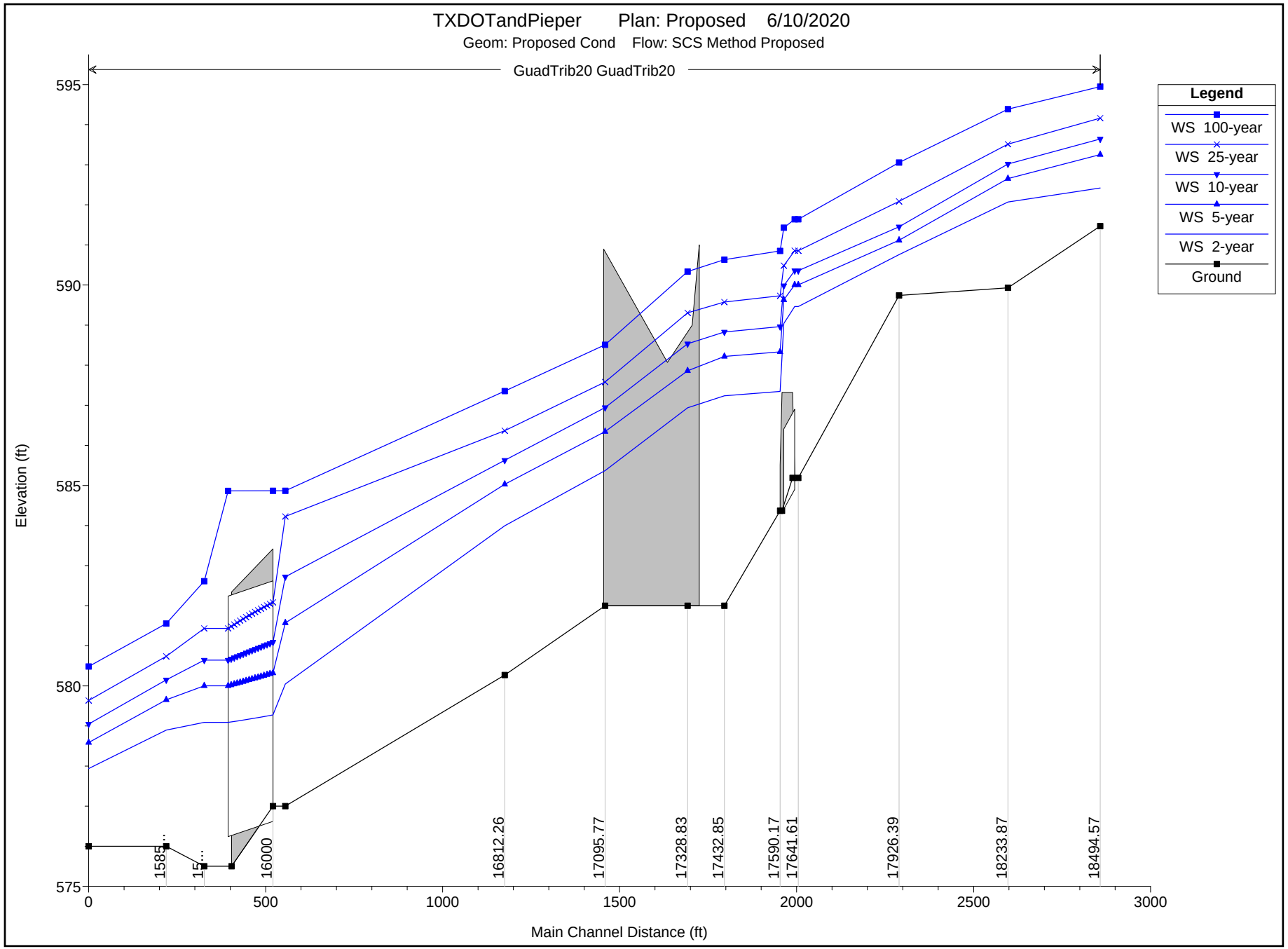
E.G. US. (ft)	588.80	Weir Sta US (ft)	33.02
W.S. US. (ft)	588.63	Weir Sta DS (ft)	266.08
E.G. DS (ft)	588.13	Min El Weir Flow (ft)	588.07
W.S. DS (ft)	586.92	Wr Top Wdth (ft)	15.12
Q US (cfs)	2338.07	Weir Max Depth (ft)	0.08
Q Leaving Total (cfs)	0.38	Weir Avg Depth (ft)	0.04
Q DS (cfs)	2448.74	Weir Flow Area (sq ft)	0.57
Perc Q Leaving	0.02	Weir Coef (ft^1/2)	3.000
Q Weir (cfs)	0.38	Weir Submerg	0.00
Q Gates (cfs)		Q Gate Group (cfs)	
Q Culv (cfs)	0.00	Gate Open Ht (ft)	
Q Lat RC (cfs)		Gate #Open	
		Gate Area (sq ft)	
Q Breach (cfs)		Gate Submerg	
Breach Avg Velocity (ft/s)		Gate Invert (ft)	
Breach Flow Area (sq ft)		Gate Weir Coef	

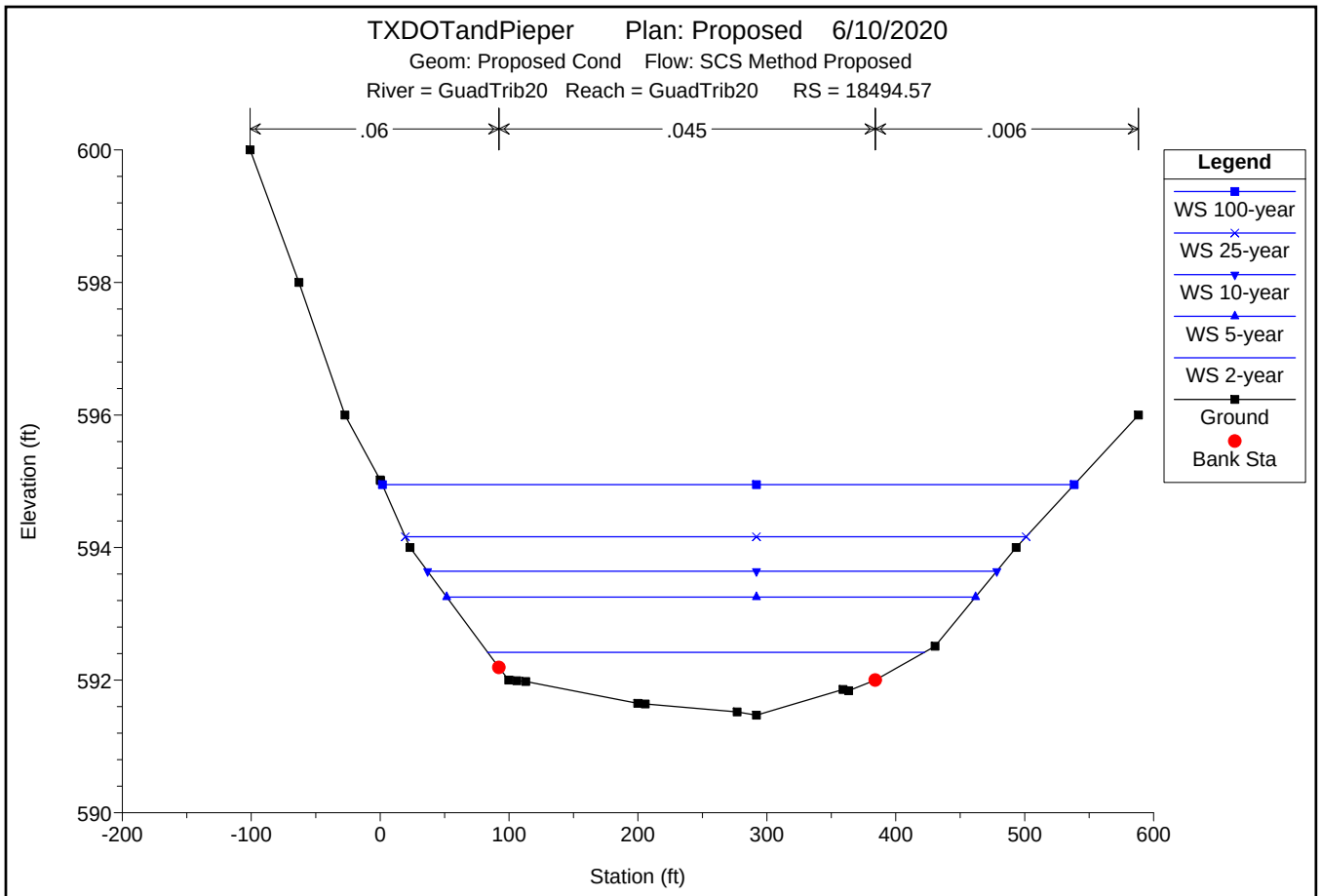
Plan: Proposed GuadTrib20 GuadTrib20 RS: 17380 Lat Struct Profile: 25-year

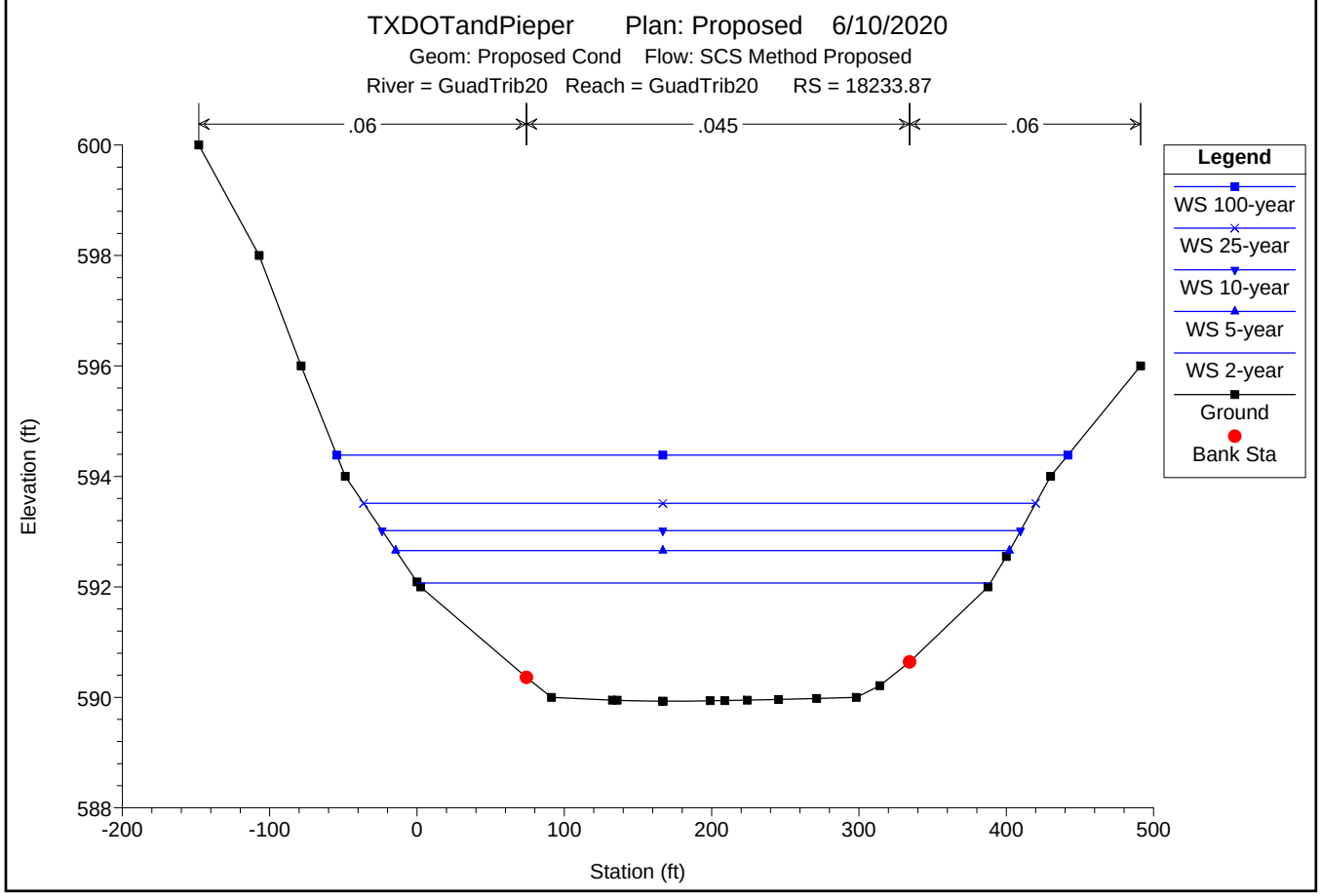
E.G. US. (ft)	589.57	Weir Sta US (ft)	0.00
W.S. US. (ft)	589.39	Weir Sta DS (ft)	266.08
E.G. DS (ft)	588.93	Min El Weir Flow (ft)	588.07
W.S. DS (ft)	587.56	Wr Top Wdth (ft)	108.67
Q US (cfs)	3326.44	Weir Max Depth (ft)	0.81
Q Leaving Total (cfs)	131.67	Weir Avg Depth (ft)	0.53
Q DS (cfs)	3402.67	Weir Flow Area (sq ft)	57.07
Perc Q Leaving	3.90	Weir Coef (ft^1/2)	3.000
Q Weir (cfs)	131.67	Weir Submerg	0.00
Q Gates (cfs)		Q Gate Group (cfs)	
Q Culv (cfs)	0.00	Gate Open Ht (ft)	
Q Lat RC (cfs)		Gate #Open	
		Gate Area (sq ft)	
Q Breach (cfs)		Gate Submerg	
Breach Avg Velocity (ft/s)		Gate Invert (ft)	
Breach Flow Area (sq ft)		Gate Weir Coef	

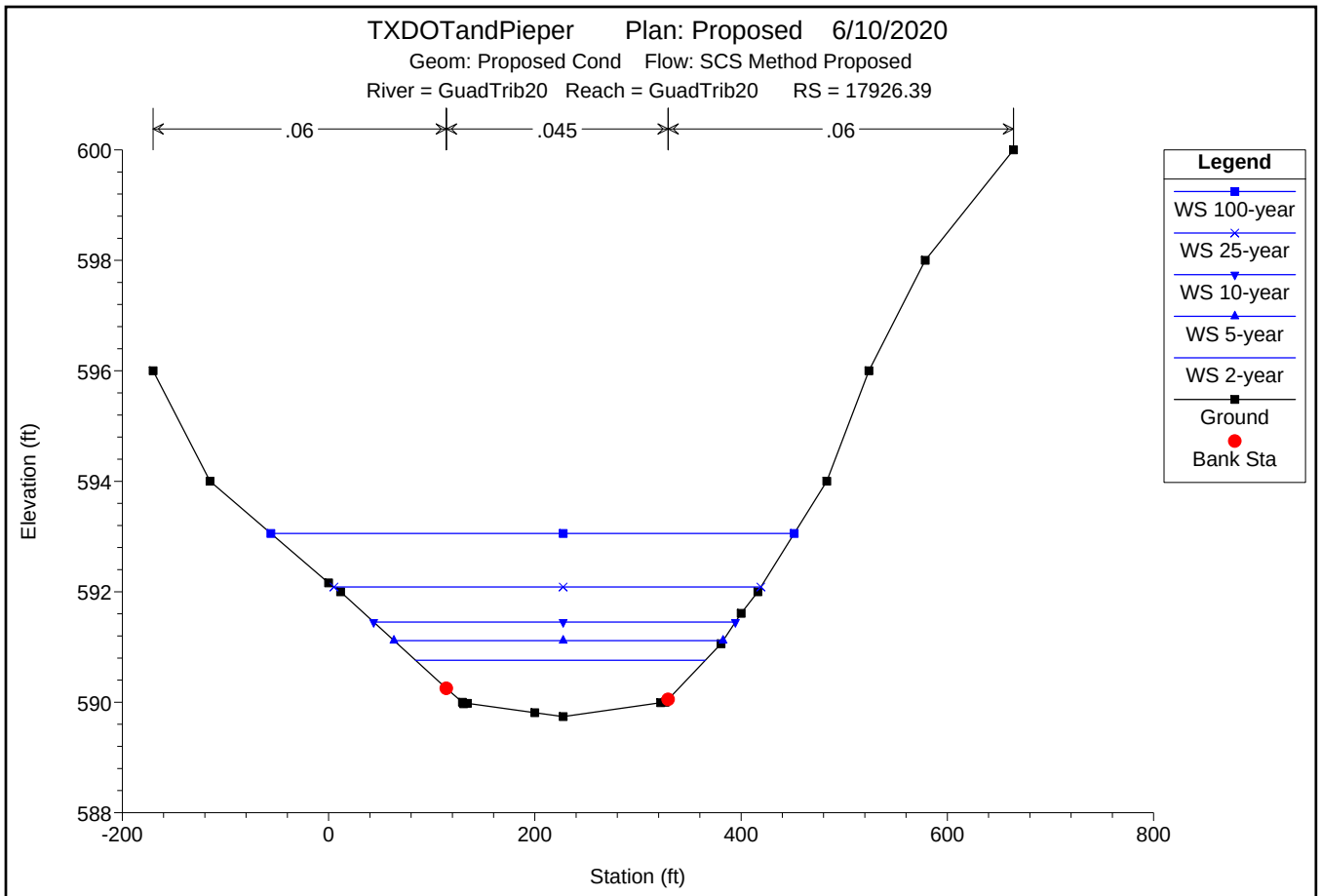
Plan: Proposed GuadTrib20 GuadTrib20 RS: 17380 Lat Struct Profile: 100-year

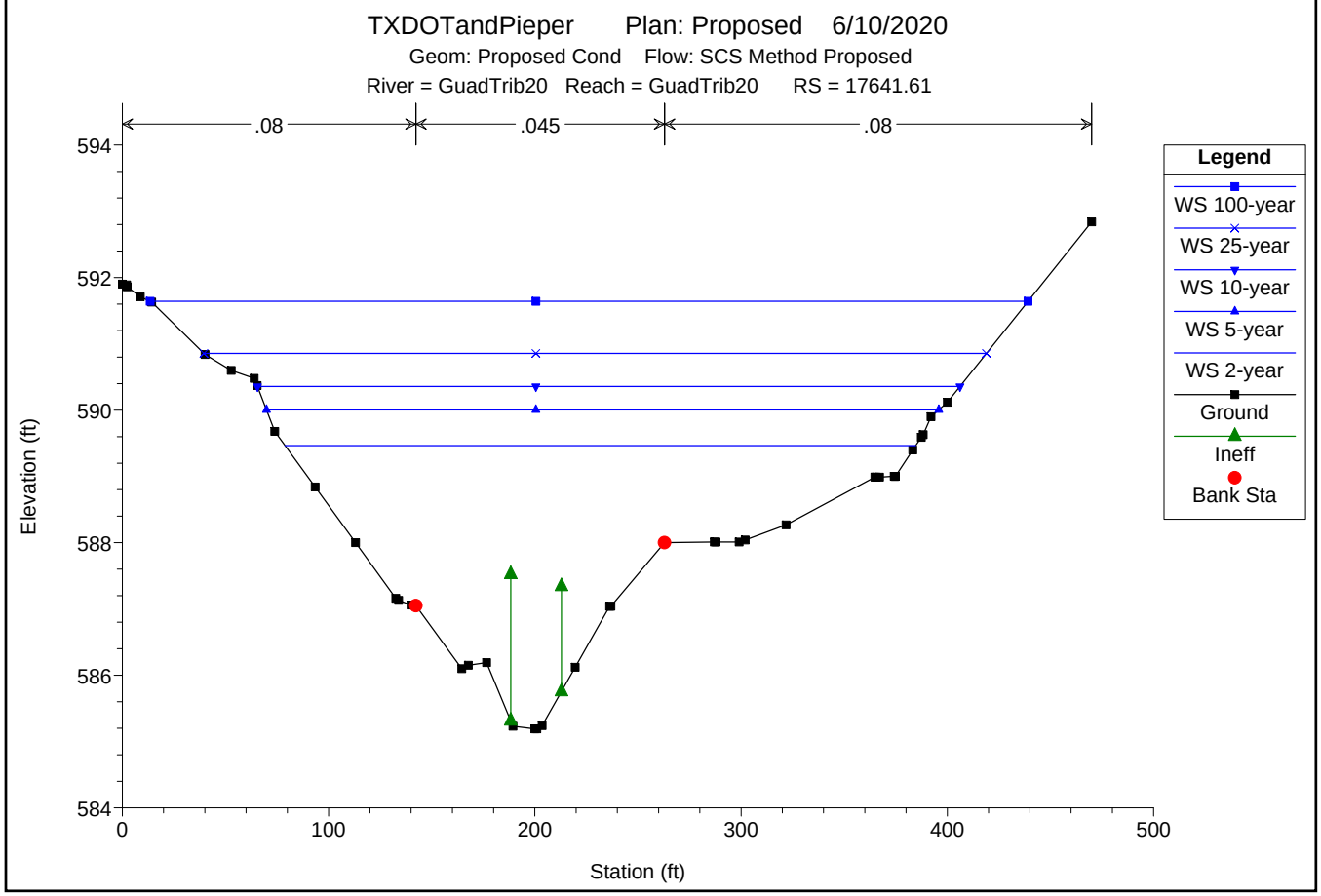
E.G. US. (ft)	590.69	Weir Sta US (ft)	0.00
W.S. US. (ft)	590.43	Weir Sta DS (ft)	266.08
E.G. DS (ft)	590.03	Min El Weir Flow (ft)	588.07
W.S. DS (ft)	588.49	Wr Top Wdth (ft)	161.36
Q US (cfs)	5411.44	Weir Max Depth (ft)	1.82
Q Leaving Total (cfs)	690.19	Weir Avg Depth (ft)	1.20
Q DS (cfs)	5125.53	Weir Flow Area (sq ft)	193.64
Perc Q Leaving	12.74	Weir Coef (ft^1/2)	3.000
Q Weir (cfs)	690.19	Weir Submerg	0.00
Q Gates (cfs)		Q Gate Group (cfs)	
Q Culv (cfs)	0.00	Gate Open Ht (ft)	
Q Lat RC (cfs)		Gate #Open	
		Gate Area (sq ft)	
Q Breach (cfs)		Gate Submerg	
Breach Avg Velocity (ft/s)		Gate Invert (ft)	
Breach Flow Area (sq ft)		Gate Weir Coef	

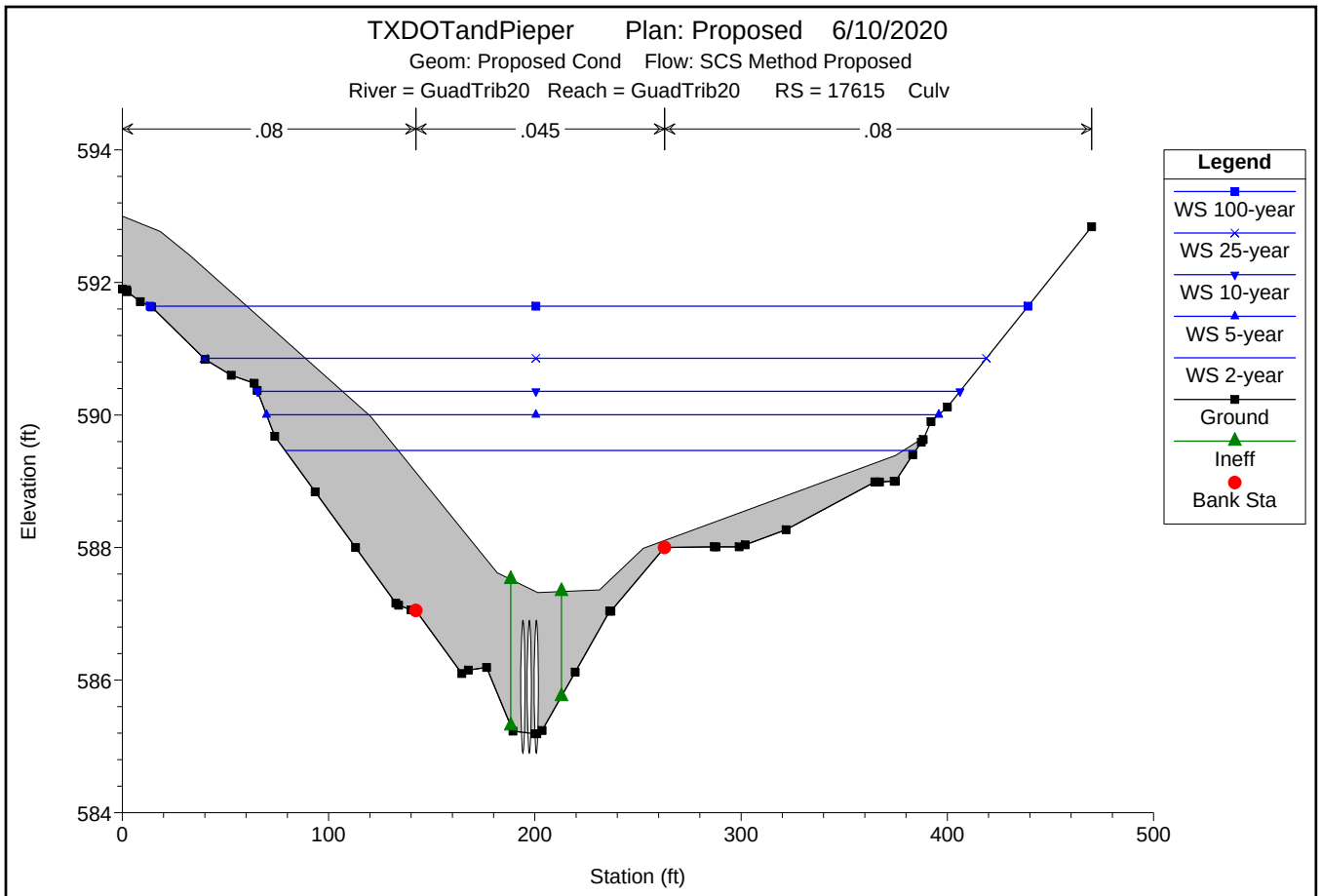

TXDOTandPieper Plan: Proposed 6/10/2020
Geom: Proposed Cond Flow: SCS Method Proposed
GuadTrib20 GuadTrib20
Legend
WS 100-year
WS 25-year
WS 10-year
WS 5-year
WS 2-year
Ground
Elevation (ft)
595
590
585
580
575
0
500
1000
1500
2000
2500
3000
Main Channel Distance (ft)
16000
16812.26
17095.77
17328.83
17432.85
17590.17
17641.61
17926.39
18233.87
18494.57

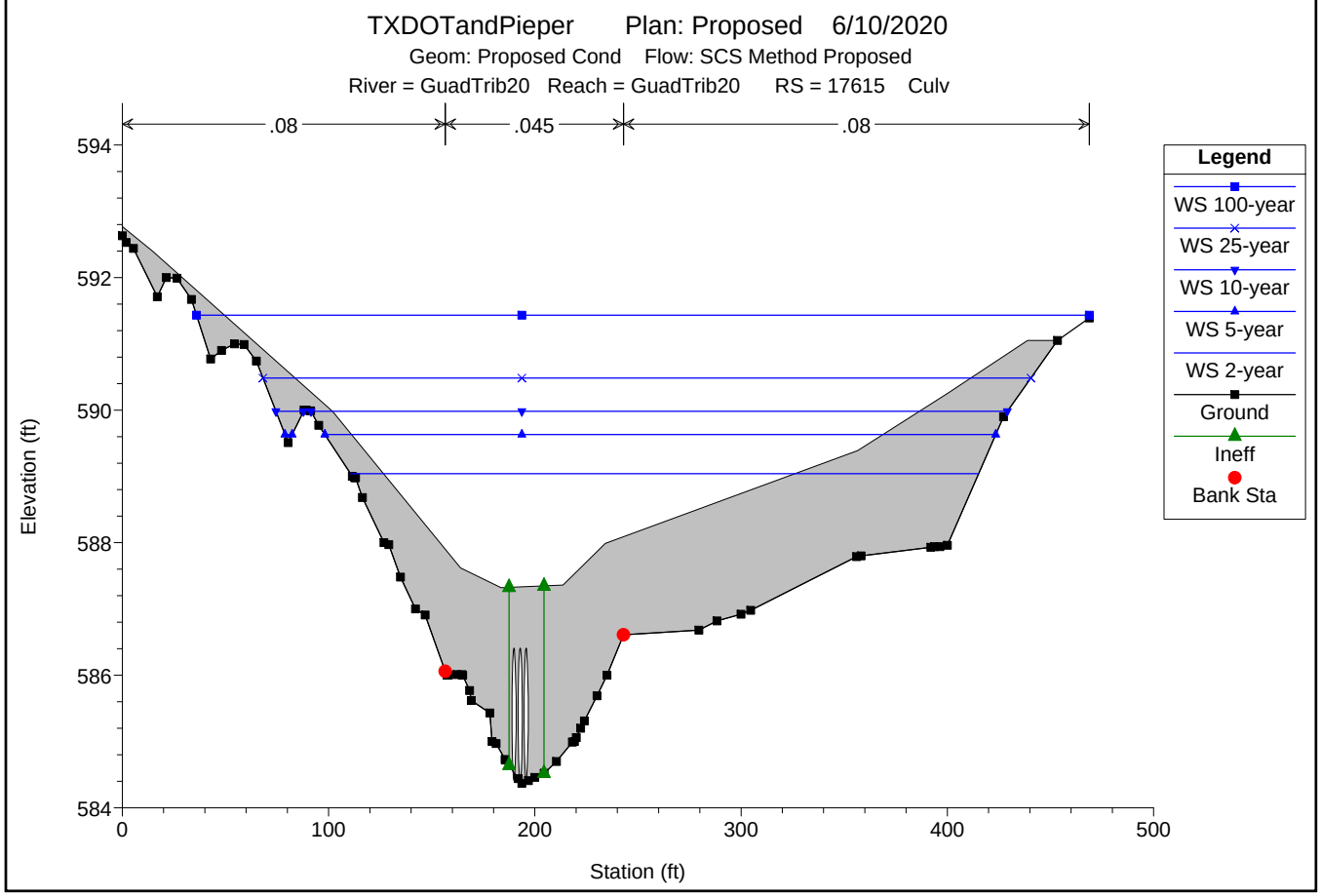

TXDOTandPieper Plan: Proposed 6/10/2020
Geom: Proposed Cond Flow: SCS Method Proposed
River = GuadTrib20 Reach = GuadTrib20 RS = 18494.57
.06
.045
.006
Legend
WS 100-year
WS 25-year
WS 10-year
WS 5-year
WS 2-year
Ground
Bank Sta
Elevation (ft)
Station (ft)
600
598
596
594
592
590
-200
-100
0
100
200
300
400
500
600

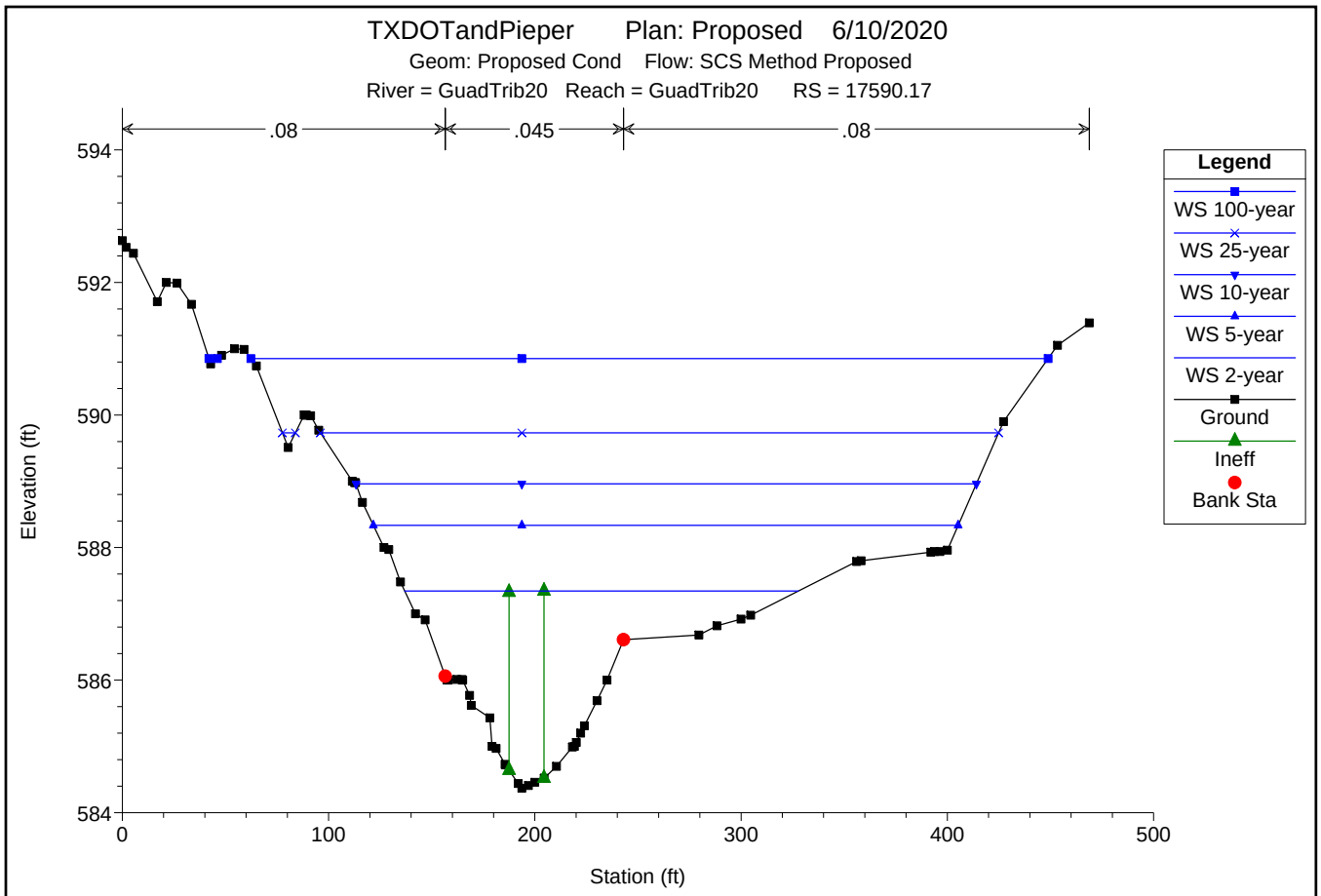

TXDOTandPieper Plan: Proposed 6/10/2020
Geom: Proposed Cond Flow: SCS Method Proposed
River = GuadTrib20 Reach = GuadTrib20 RS = 18233.87
.06
.045
.06
Legend
WS 100-year
WS 25-year
WS 10-year
WS 5-year
WS 2-year
Ground
Bank Sta
Elevation (ft)
Station (ft)
600
598
596
594
592
590
588
-200
-100
0
100
200
300
400
500

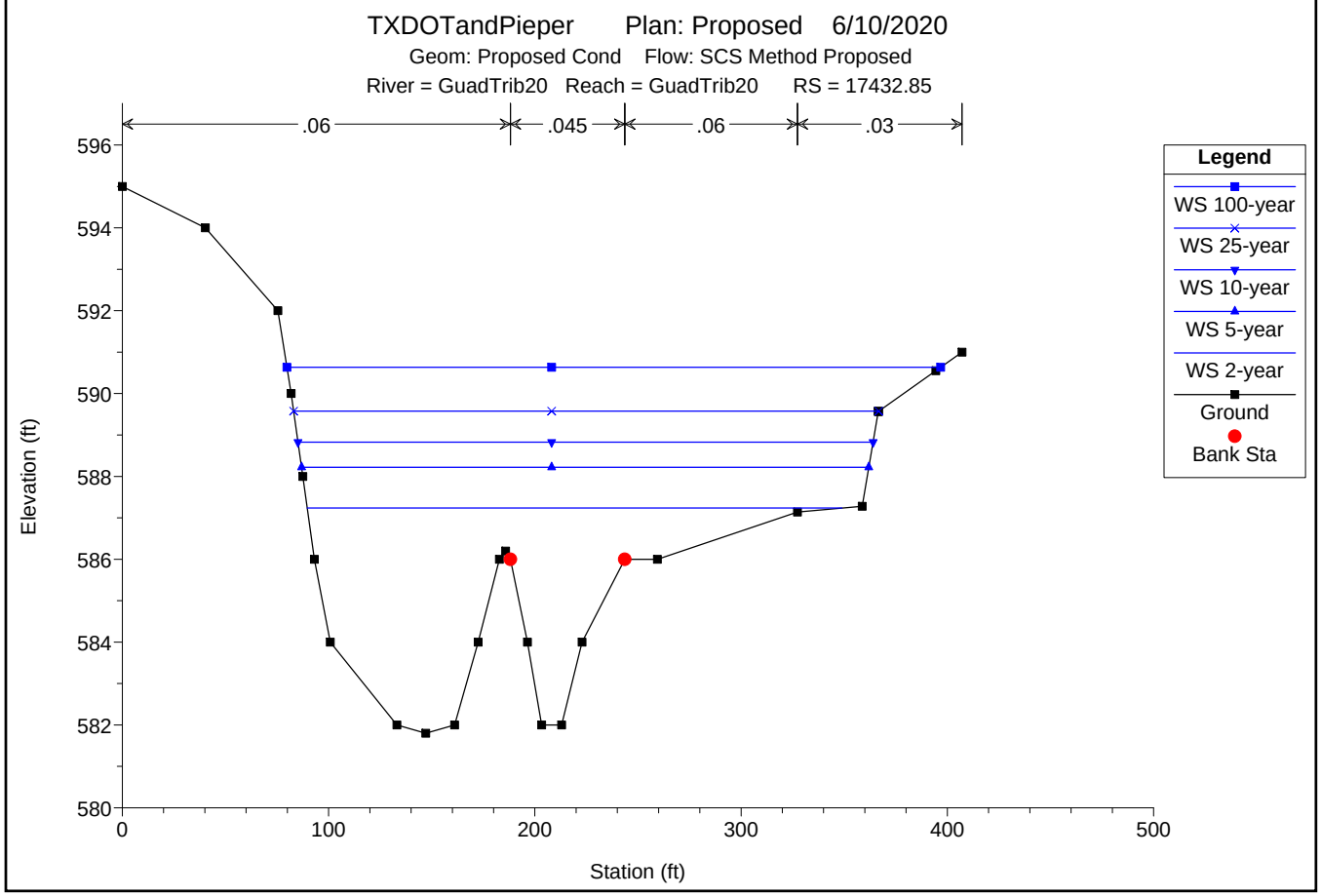

TXDOTandPieper Plan: Proposed 6/10/2020
Geom: Proposed Cond Flow: SCS Method Proposed
River = GuadTrib20 Reach = GuadTrib20 RS = 17926.39
.06
.045
.06
Legend
WS 100-year
WS 25-year
WS 10-year
WS 5-year
WS 2-year
Ground
Bank Sta
Elevation (ft)
Station (ft)
600
598
596
594
592
590
588
-200
0
200
400
600
800

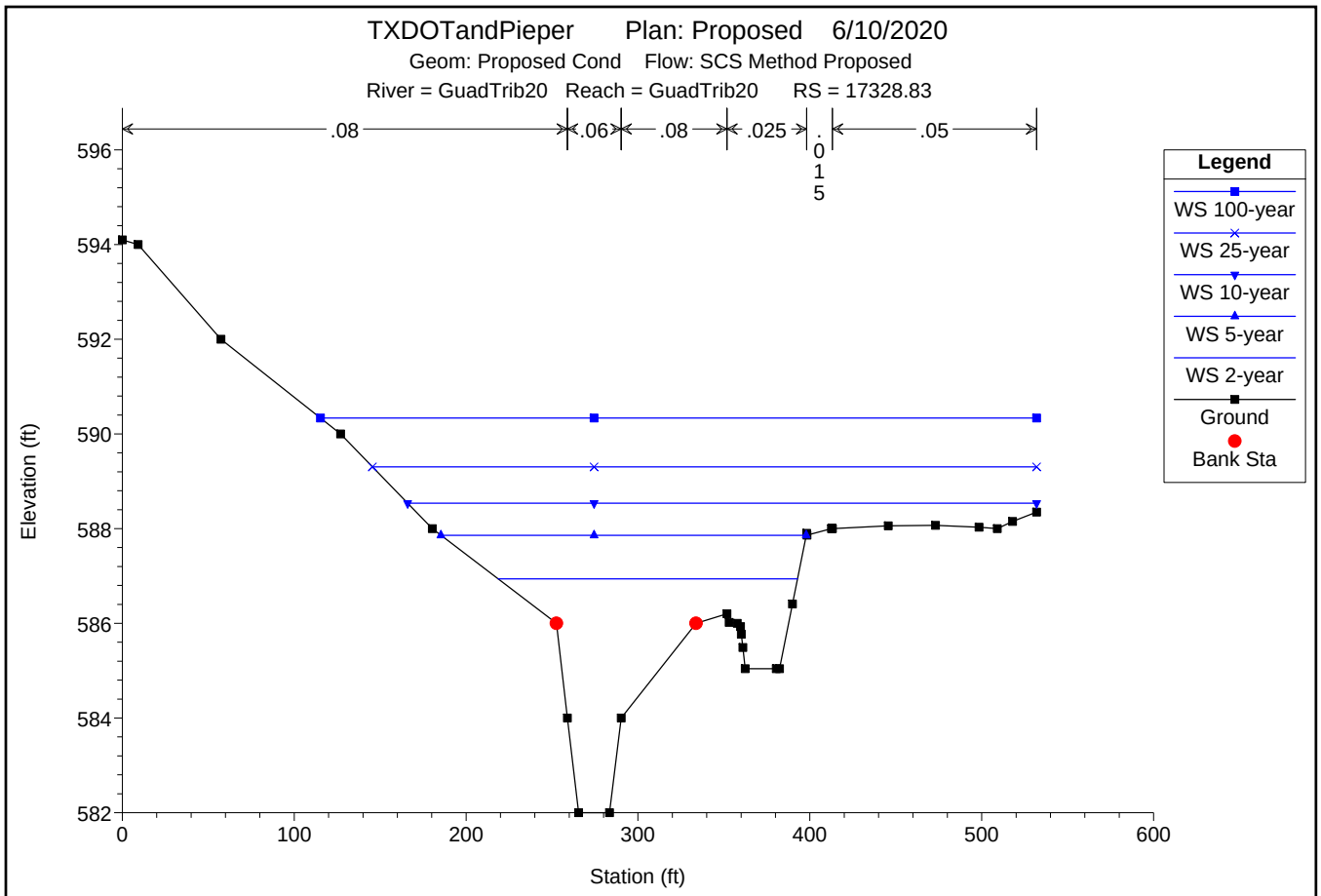

TXDOTandPieper Plan: Proposed 6/10/2020
Geom: Proposed Cond Flow: SCS Method Proposed
River = GuadTrib20 Reach = GuadTrib20 RS = 17641.61
.08
.045
.08
Legend
WS 100-year
WS 25-year
WS 10-year
WS 5-year
WS 2-year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
594
592
590
588
586
584
0
100
200
300
400
500

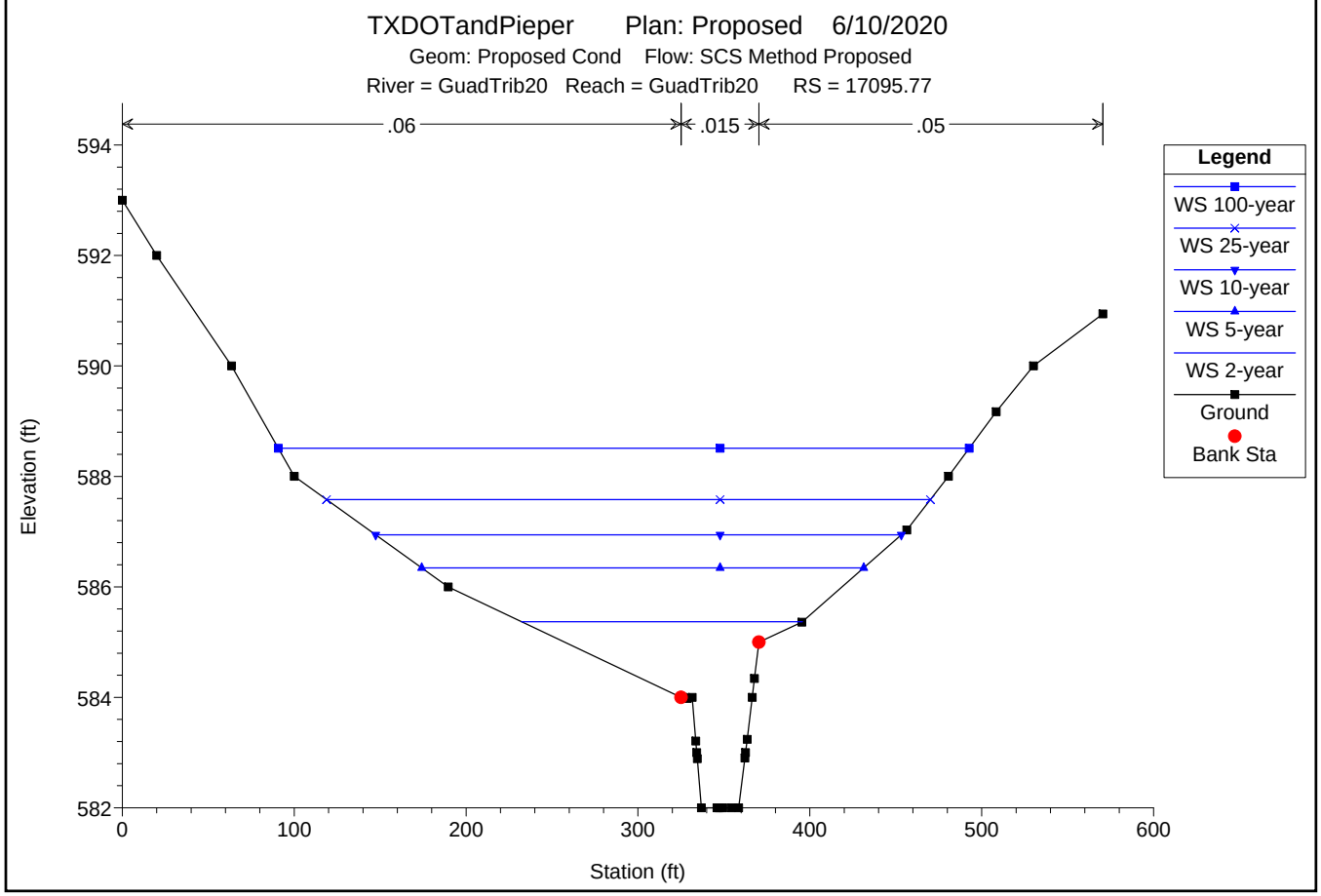

TXDOTandPieper Plan: Proposed 6/10/2020
Geom: Proposed Cond Flow: SCS Method Proposed
River = GuadTrib20 Reach = GuadTrib20 RS = 17615 Culv
.08
.045
.08
Elevation (ft)
Station (ft)
Legend
WS 100-year
WS 25-year
WS 10-year
WS 5-year
WS 2-year
Ground
Ineff
Bank Sta

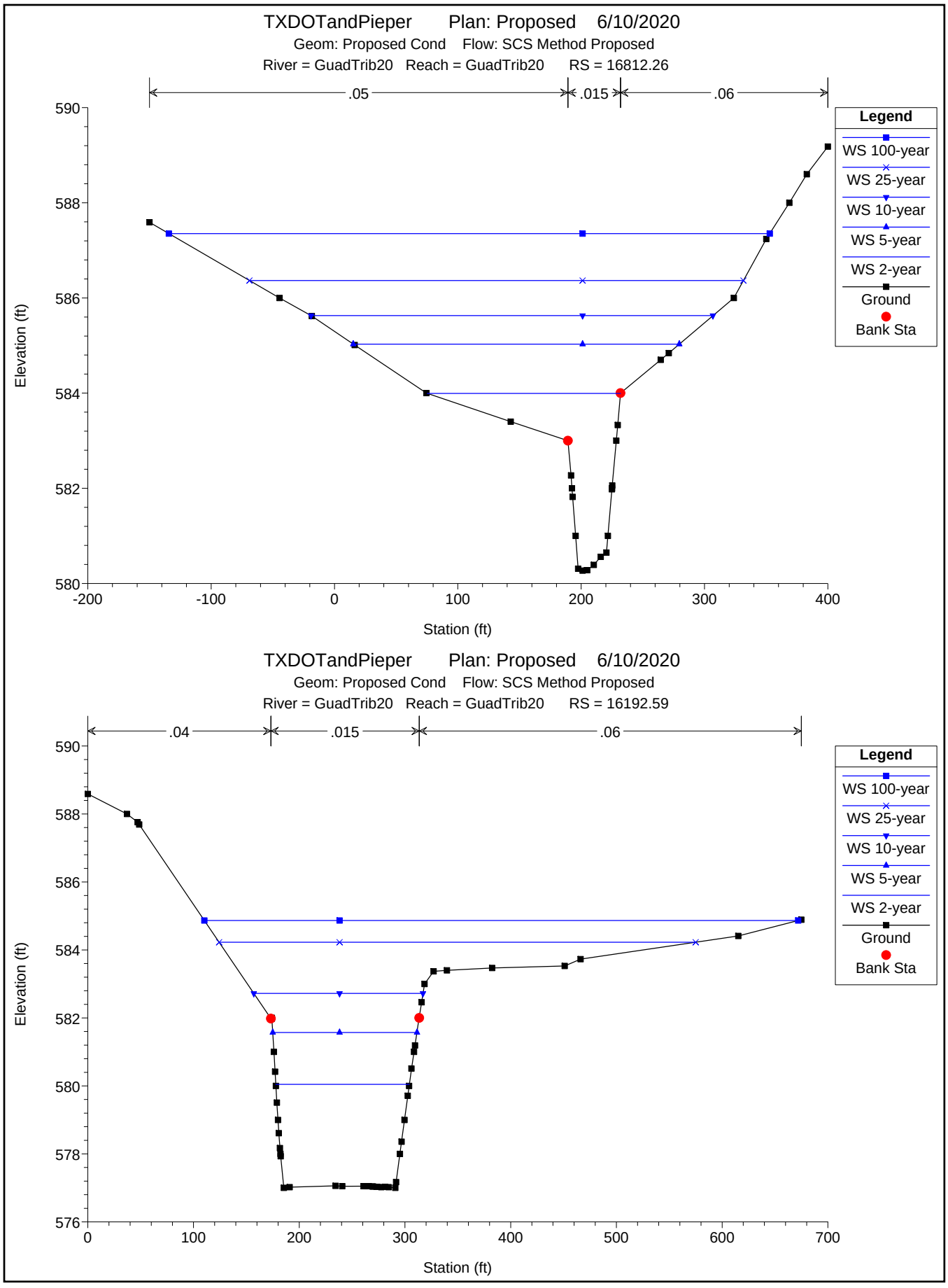

TXDOTandPieper Plan: Proposed 6/10/2020
Geom: Proposed Cond Flow: SCS Method Proposed
River = GuadTrib20 Reach = GuadTrib20 RS = 17615 Culv
.08
.045
.08
Elevation (ft)
Station (ft)
Legend
WS 100-year
WS 25-year
WS 10-year
WS 5-year
WS 2-year
Ground
Ineff
Bank Sta

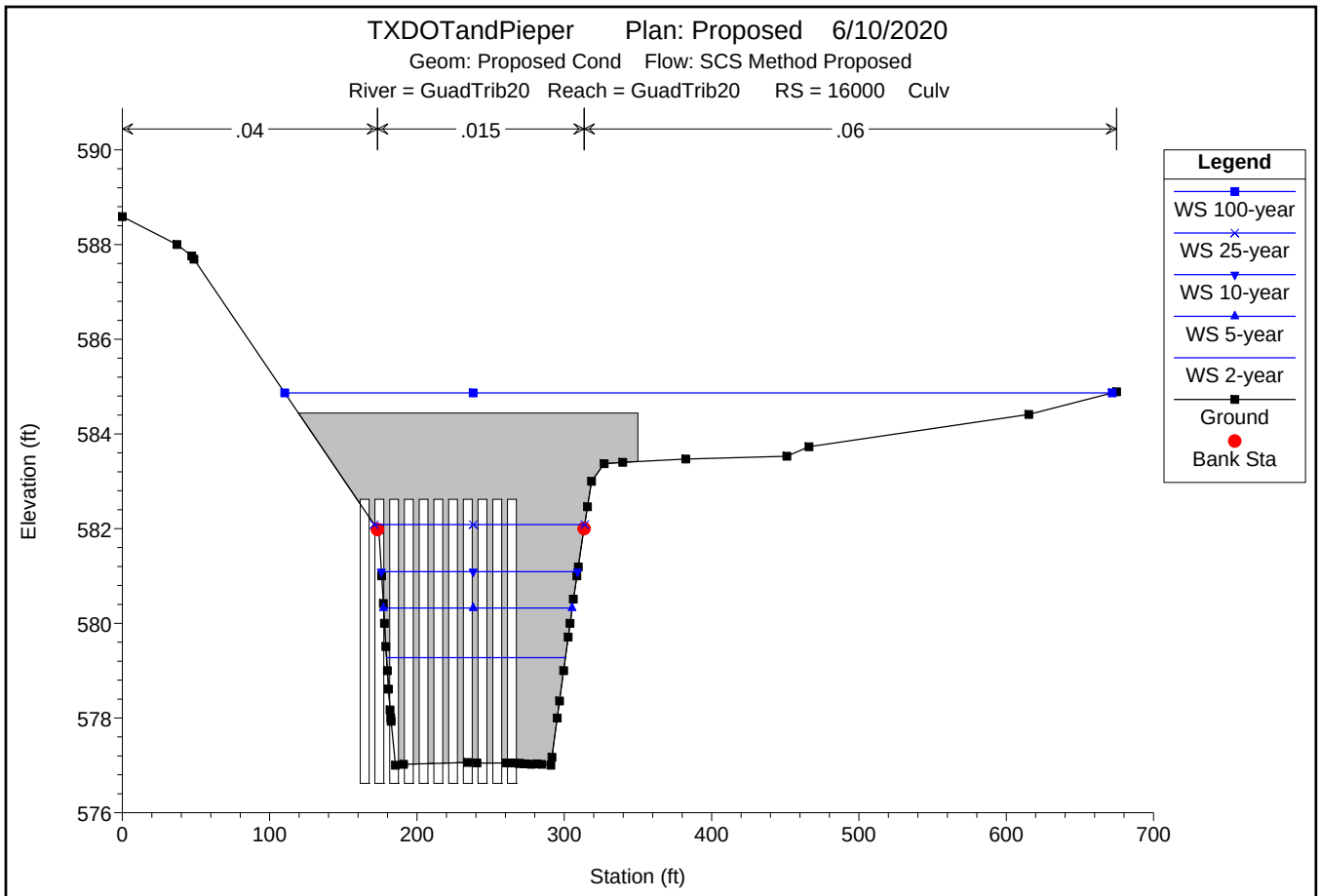

TXDOTandPieper Plan: Proposed 6/10/2020
Geom: Proposed Cond Flow: SCS Method Proposed
River = GuadTrib20 Reach = GuadTrib20 RS = 17590.17
.08
.045
.08
Legend
WS 100-year
WS 25-year
WS 10-year
WS 5-year
WS 2-year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
594
592
590
588
586
584
0
100
200
300
400
500

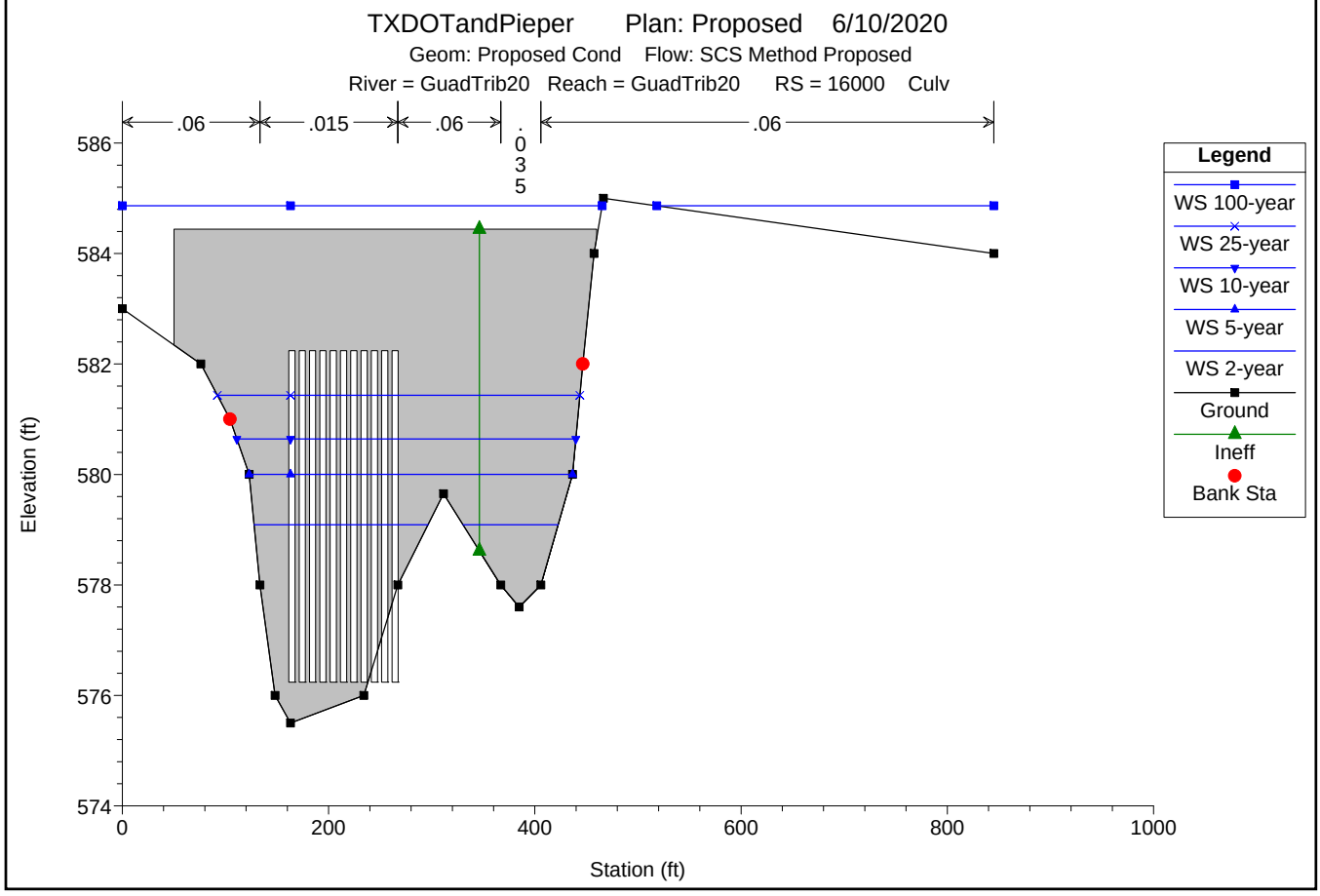

TXDOTandPieper Plan: Proposed 6/10/2020
Geom: Proposed Cond Flow: SCS Method Proposed
River = GuadTrib20 Reach = GuadTrib20 RS = 17432.85
.06
.045
.06
.03
Legend
WS 100-year
WS 25-year
WS 10-year
WS 5-year
WS 2-year
Ground
Bank Sta
Elevation (ft)
Station (ft)
596
594
592
590
588
586
584
582
580
0
100
200
300
400
500

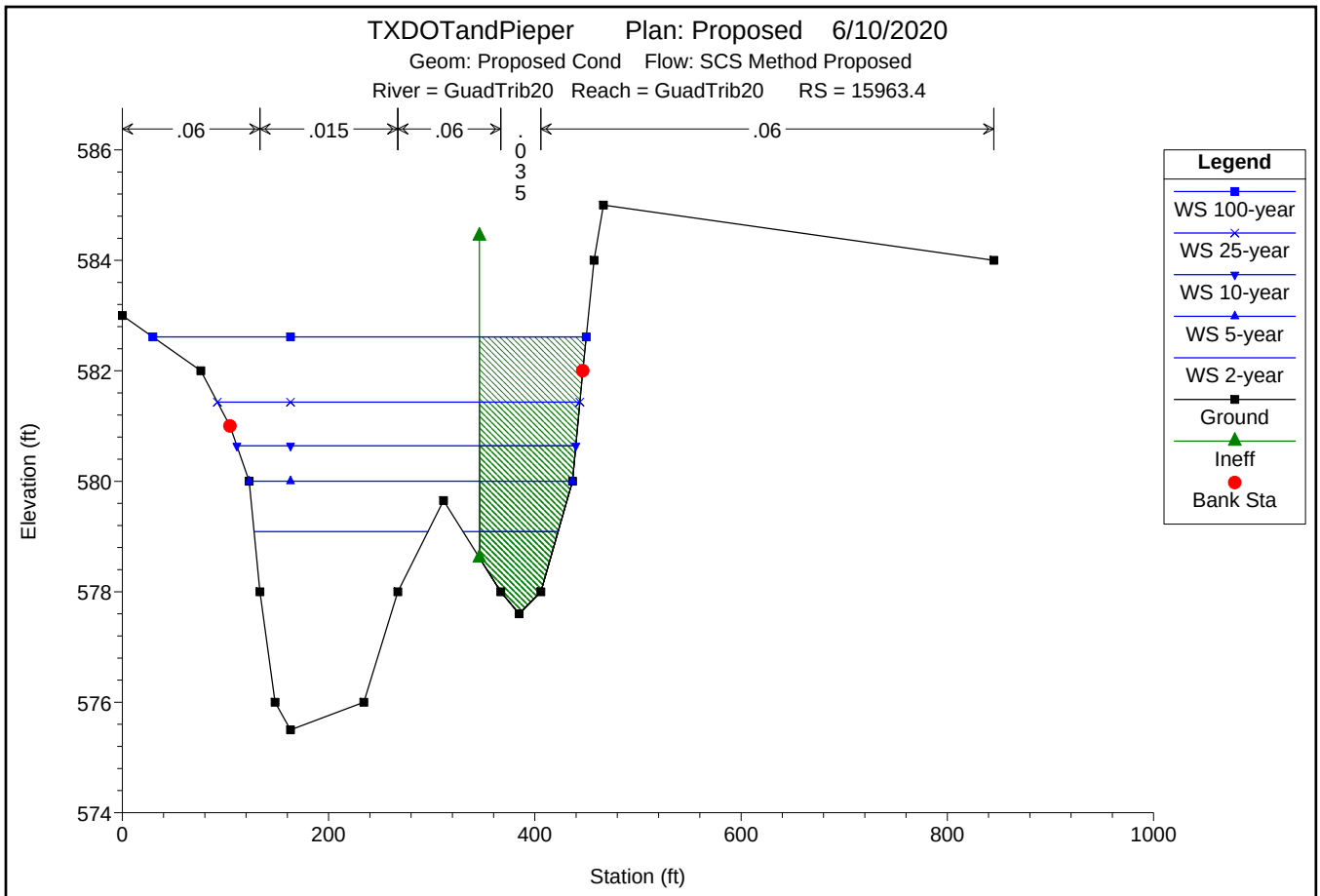

TXDOTandPieper Plan: Proposed 6/10/2020
Geom: Proposed Cond Flow: SCS Method Proposed
River = GuadTrib20 Reach = GuadTrib20 RS = 17328.83
.08
.06
.08
.025
.015
.05
Legend
WS 100-year
WS 25-year
WS 10-year
WS 5-year
WS 2-year
Ground
Bank Sta
Elevation (ft)
Station (ft)
596
594
592
590
588
586
584
582
0
100
200
300
400
500
600

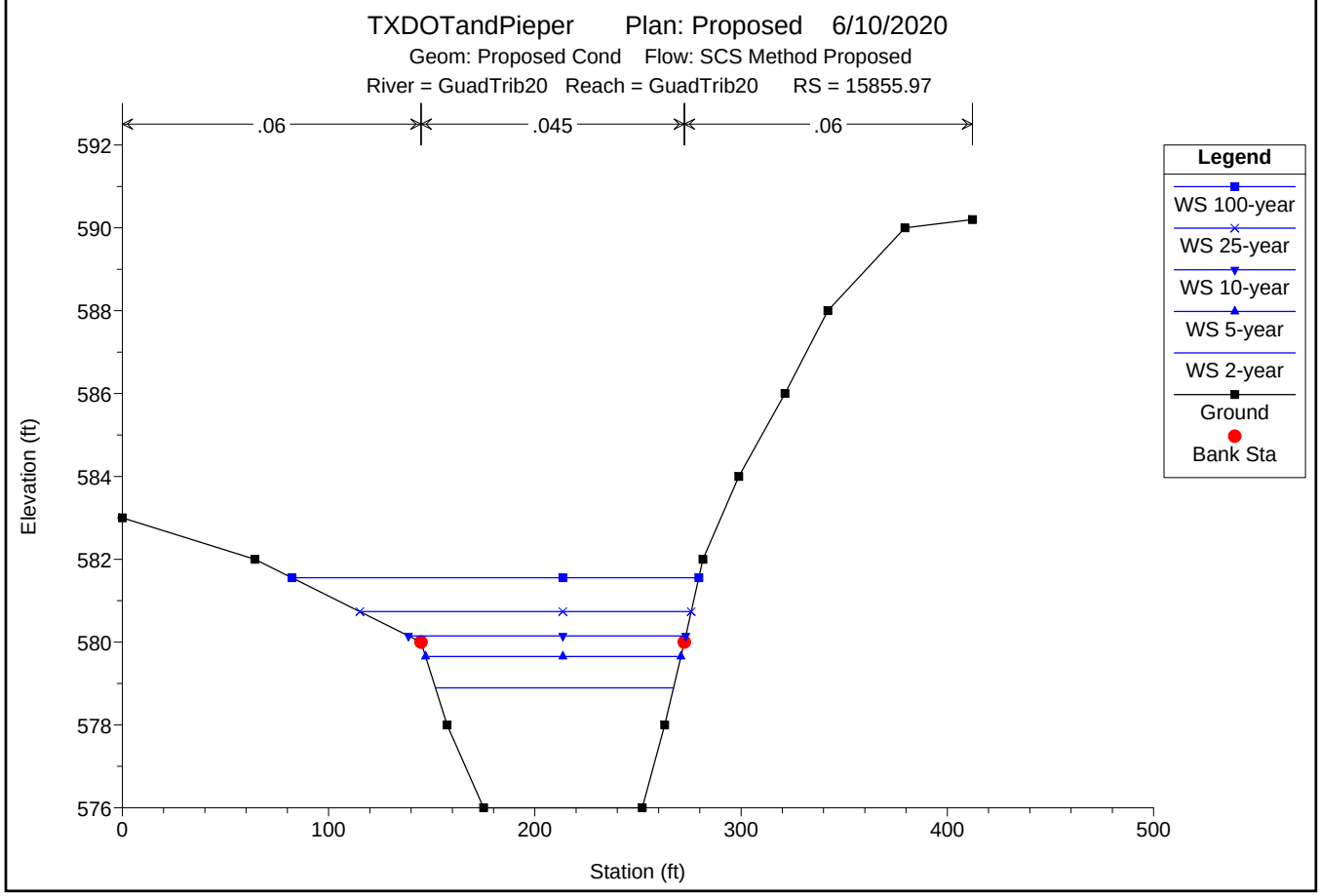

TXDOTandPieper Plan: Proposed 6/10/2020
Geom: Proposed Cond Flow: SCS Method Proposed
River = GuadTrib20 Reach = GuadTrib20 RS = 17095.77
.06
.015
.05
Legend
WS 100-year
WS 25-year
WS 10-year
WS 5-year
WS 2-year
Ground
Bank Sta
Elevation (ft)
Station (ft)
594
592
590
588
586
584
582
0
100
200
300
400
500
600

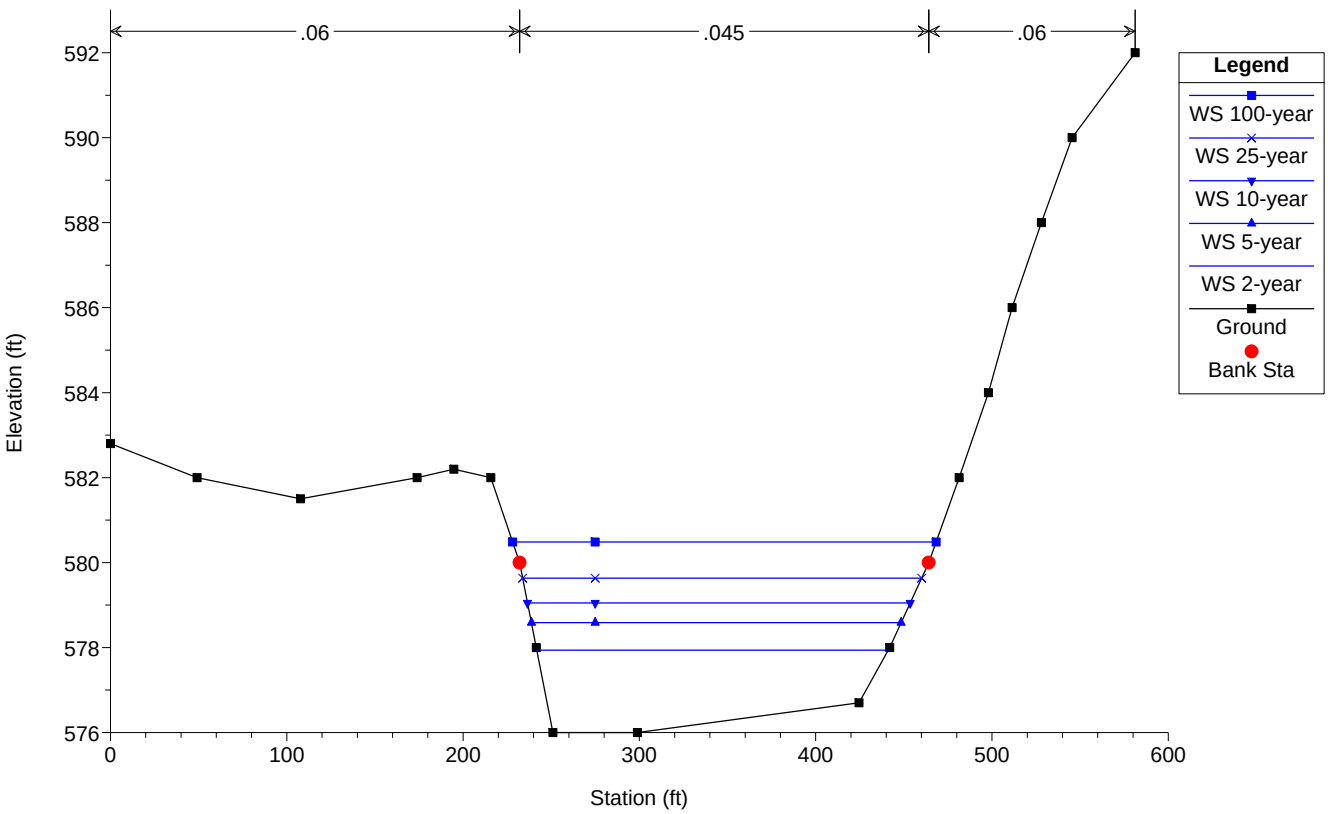

TXDOTandPieper Plan: Proposed 6/10/2020
Geom: Proposed Cond Flow: SCS Method Proposed
River = GuadTrib20 Reach = GuadTrib20 RS = 16812.26
.05
.015
.06
Legend
WS 100-year
WS 25-year
WS 10-year
WS 5-year
WS 2-year
Ground
Bank Sta
Elevation (ft)
Station (ft)
TXDOTandPieper Plan: Proposed 6/10/2020
Geom: Proposed Cond Flow: SCS Method Proposed
River = GuadTrib20 Reach = GuadTrib20 RS = 16192.59
.04
.015
.06
Legend
WS 100-year
WS 25-year
WS 10-year
WS 5-year
WS 2-year
Ground
Bank Sta
Elevation (ft)
Station (ft)


TXDOTandPieper Plan: Proposed 6/10/2020
Geom: Proposed Cond Flow: SCS Method Proposed
River = GuadTrib20 Reach = GuadTrib20 RS = 16000 Culv
.04
.015
.06
Legend
WS 100-year
WS 25-year
WS 10-year
WS 5-year
WS 2-year
Ground
Bank Sta
Elevation (ft)
Station (ft)
590
588
586
584
582
580
578
576
0
100
200
300
400
500
600
700


TXDOTandPieper Plan: Proposed 6/10/2020
Geom: Proposed Cond Flow: SCS Method Proposed
River = GuadTrib20 Reach = GuadTrib20 RS = 16000 Culv
.06
.015
.06
.035
.06
Legend
WS 100-year
WS 25-year
WS 10-year
WS 5-year
WS 2-year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
586
584
582
580
578
576
574
0
200
400
600
800
1000


TXDOTandPieper Plan: Proposed 6/10/2020
Geom: Proposed Cond Flow: SCS Method Proposed
River = GuadTrib20 Reach = GuadTrib20 RS = 15963.4
.06
.015
.06
.035
.06
Legend
WS 100-year
WS 25-year
WS 10-year
WS 5-year
WS 2-year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
574
576
578
580
582
584
586
0
200
400
600
800
1000


TXDOTandPieper Plan: Proposed 6/10/2020
Geom: Proposed Cond Flow: SCS Method Proposed
River = GuadTrib20 Reach = GuadTrib20 RS = 15855.97
.06
.045
.06
Legend
WS 100-year
WS 25-year
WS 10-year
WS 5-year
WS 2-year
Ground
Bank Sta
Elevation (ft)
Station (ft)
576
578
580
582
584
586
588
590
592
0
100
200
300
400
500


TXDOTandPieper Plan: Proposed 6/10/2020
Geom: Proposed Cond Flow: SCS Method Proposed
River = GuadTrib20 Reach = GuadTrib20 RS = 15636.87
.06
.045
.06
Legend
WS 100-year
WS 25-year
WS 10-year
WS 5-year
WS 2-year
Ground
Bank Sta
Elevation (ft)
592
590
588
586
584
582
580
578
576
0
100
200
300
400
500
600
Station (ft)

HEC-RAS River: GuadTrib20 Reach: GuadTrib20

Reach	River Sta	Profile	Plan	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
GuadTrib20	18494.57	2-year	Proposed	1002.62	591.47	592.4	592.30	593.08	0.028339	4.36	211.72	339.02	0.92
GuadTrib20	18494.57	2-year	Existing	1002.62	591.47	592.4	592.30	593.08	0.028339	4.36	211.72	339.02	0.92
GuadTrib20	18494.57	5-year	Proposed	1713.53	591.47	593.3	593.25	594.01	0.002927	2.37	525.32	410.27	0.34
GuadTrib20	18494.57	5-year	Existing	1713.53	591.47	593.3	593.25	594.01	0.002927	2.37	525.32	410.27	0.34
GuadTrib20	18494.57	10-year	Proposed	2312.98	591.47	593.6	593.64	594.48	0.002018	2.29	690.96	441.51	0.29
GuadTrib20	18494.57	10-year	Existing	2312.98	591.47	593.6	593.64	594.48	0.002018	2.29	690.96	441.51	0.29
GuadTrib20	18494.57	25-year	Proposed	3291.98	591.47	594.2	594.16	595.11	0.001450	2.28	931.83	481.70	0.26
GuadTrib20	18494.57	25-year	Existing	3291.98	591.47	594.2	594.16	595.11	0.001450	2.28	931.83	481.70	0.26
GuadTrib20	18494.57	100-year	Proposed	5355.58	591.47	594.9	594.95	596.12	0.001129	2.42	1331.74	536.72	0.24
GuadTrib20	18494.57	100-year	Existing	5355.58	591.47	595.0	594.95	596.12	0.001127	2.42	1332.56	536.83	0.24
GuadTrib20	18233.87	2-year	Proposed	1002.62	589.93	592.1		592.12	0.001065	1.74	637.95	388.67	0.21
GuadTrib20	18233.87	2-year	Existing	1002.62	589.93	592.1		592.12	0.001065	1.74	637.95	388.67	0.21
GuadTrib20	18233.87	5-year	Proposed	1713.53	589.93	592.7		592.73	0.001248	2.23	873.84	416.66	0.24
GuadTrib20	18233.87	5-year	Existing	1713.53	589.93	592.7		592.72	0.001255	2.23	871.99	416.46	0.24
GuadTrib20	18233.87	10-year	Proposed	2312.98	589.93	593.0		593.11	0.001420	2.59	1027.84	433.42	0.26
GuadTrib20	18233.87	10-year	Existing	2312.98	589.93	593.0		593.11	0.001420	2.59	1027.71	433.40	0.26
GuadTrib20	18233.87	25-year	Proposed	3291.98	589.93	593.5		593.64	0.001643	3.08	1247.85	456.29	0.29
GuadTrib20	18233.87	25-year	Existing	3291.98	589.93	593.5		593.64	0.001643	3.08	1247.85	456.29	0.29
GuadTrib20	18233.87	100-year	Proposed	5355.58	589.93	594.4		594.58	0.001908	3.85	1663.74	496.37	0.33
GuadTrib20	18233.87	100-year	Existing	5355.58	589.93	594.4		594.58	0.001908	3.85	1663.71	496.36	0.33
GuadTrib20	17926.39	2-year	Proposed	1002.62	589.74	590.8	590.76	591.16	0.029188	5.14	207.56	280.93	0.97
GuadTrib20	17926.39	2-year	Existing	1002.62	589.74	590.8	590.76	591.16	0.029188	5.14	207.56	280.93	0.97
GuadTrib20	17926.39	5-year	Proposed	1713.53	589.74	591.1	591.12	591.64	0.025249	6.02	314.91	319.15	0.96
GuadTrib20	17926.39	5-year	Existing	1713.53	589.74	591.1	591.12	591.64	0.025249	6.02	314.91	319.15	0.96
GuadTrib20	17926.39	10-year	Proposed	2312.98	589.74	591.5	591.36	591.99	0.019185	6.16	427.37	350.73	0.87
GuadTrib20	17926.39	10-year	Existing	2312.98	589.74	591.5	591.36	591.99	0.019278	6.17	426.64	350.53	0.87
GuadTrib20	17926.39	25-year	Proposed	3291.98	589.74	592.1		592.56	0.011070	5.88	670.09	413.94	0.70
GuadTrib20	17926.39	25-year	Existing	3291.98	589.74	592.1		592.56	0.011070	5.88	670.09	413.94	0.70
GuadTrib20	17926.39	100-year	Proposed	5355.58	589.74	593.1		593.53	0.007320	6.09	1116.12	507.46	0.60
GuadTrib20	17926.39	100-year	Existing	5355.58	589.74	593.1		593.53	0.007324	6.09	1115.87	507.41	0.60
GuadTrib20	17641.61	2-year	Proposed	1002.62	585.19	589.5	587.61	589.54	0.001084	2.31	583.95	305.74	0.23
GuadTrib20	17641.61	2-year	Existing	1002.62	585.19	589.5	587.61	589.52	0.001104	2.32	579.44	305.07	0.23
GuadTrib20	17641.61	5-year	Proposed	1713.53	585.19	590.0	588.26	590.13	0.001663	3.18	754.21	325.95	0.29
GuadTrib20	17641.61	5-year	Existing	1713.53	585.19	590.0	588.26	590.16	0.001621	3.15	762.00	327.10	0.29
GuadTrib20	17641.61	10-year	Proposed	2312.98	585.19	590.4	588.66	590.54	0.002090	3.79	872.42	340.63	0.33
GuadTrib20	17641.61	10-year	Existing	2312.98	585.19	590.4	588.66	590.56	0.002040	3.76	880.68	341.56	0.33
GuadTrib20	17641.61	25-year	Proposed	3291.98	585.19	590.9	589.22	591.12	0.002690	4.66	1051.42	379.37	0.39
GuadTrib20	17641.61	25-year	Existing	3291.98	585.19	590.9	589.22	591.12	0.002687	4.65	1051.92	379.45	0.39
GuadTrib20	17641.61	100-year	Proposed	5355.58	585.19	591.6	590.03	592.08	0.003710	6.09	1367.24	425.71	0.47

HEC-RAS River: GuadTrib20 Reach: GuadTrib20 (Continued)

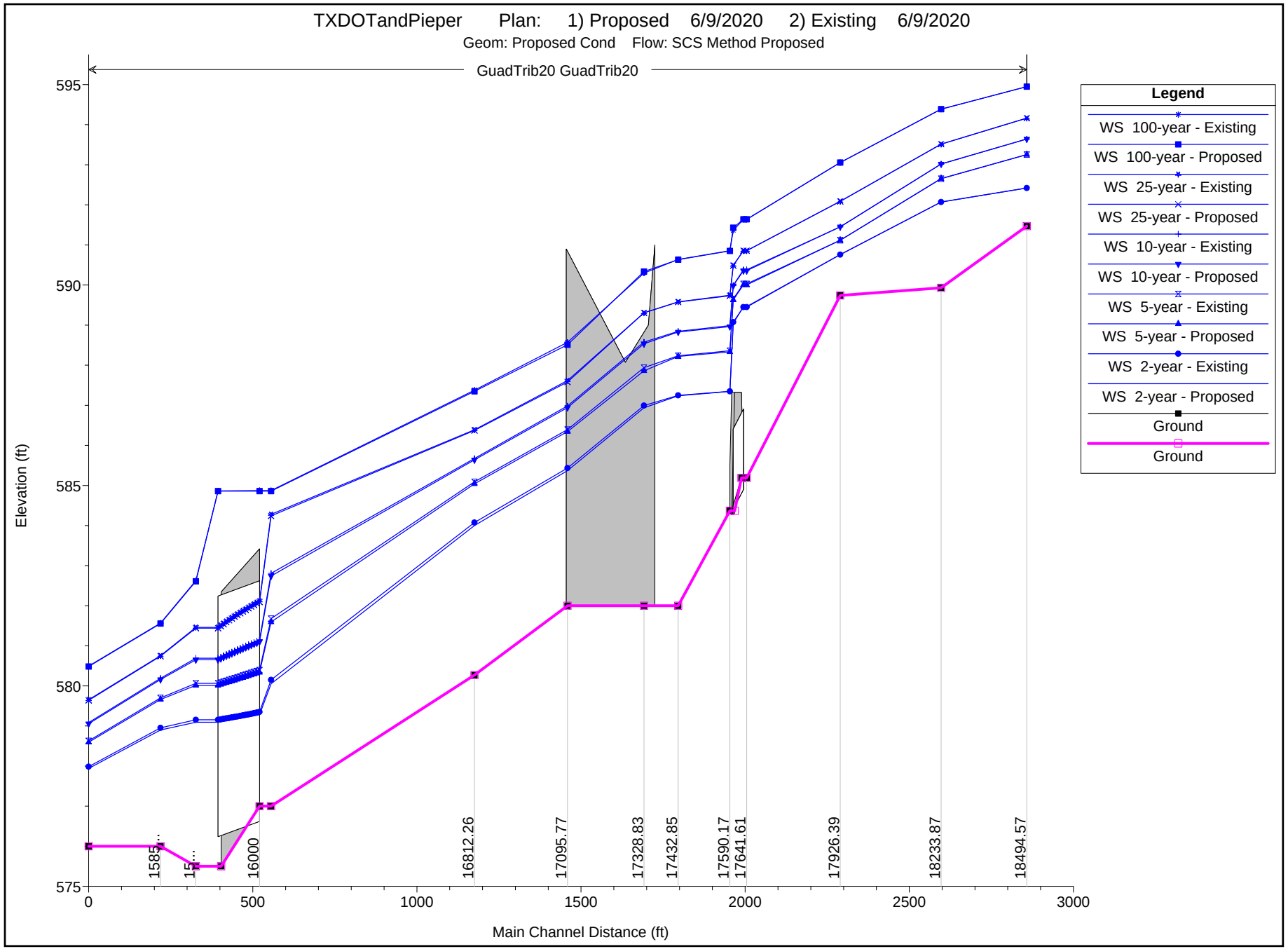
Reach	River Sta	Profile	Plan	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
GuadTrib20	17641.61	100-year	Existing	5355.58	585.19	591.6	590.03	592.07	0.003717	6.09	1366.10	425.46	0.47
GuadTrib20	17615			Culvert									
GuadTrib20	17590.17	2-year	Proposed	1014.34	584.37	587.3	587.35	587.75	0.009467	5.26	234.74	190.88	0.64
GuadTrib20	17590.17	2-year	Existing	1056.58	584.37	587.3	587.35	587.78	0.010220	5.47	235.27	191.10	0.66
GuadTrib20	17590.17	5-year	Proposed	1732.33	584.37	588.3	587.62	588.71	0.005877	5.36	473.32	283.55	0.54
GuadTrib20	17590.17	5-year	Existing	1812.75	584.37	588.4	587.68	588.76	0.006199	5.53	480.88	284.33	0.55
GuadTrib20	17590.17	10-year	Proposed	2338.07	584.37	589.0	588.16	589.32	0.004785	5.47	656.89	300.76	0.50
GuadTrib20	17590.17	10-year	Existing	2451.33	584.37	589.0	588.22	589.38	0.005105	5.68	664.95	302.29	0.52
GuadTrib20	17590.17	25-year	Proposed	3326.44	584.37	589.7	588.64	590.12	0.004339	5.90	900.13	335.08	0.49
GuadTrib20	17590.17	25-year	Existing	3495.48	584.37	589.7	588.72	590.18	0.004718	6.17	905.60	336.11	0.51
GuadTrib20	17590.17	100-year	Proposed	5411.44	584.37	590.9	589.45	591.36	0.004490	6.97	1307.83	390.66	0.52
GuadTrib20	17590.17	100-year	Existing	5698.02	584.37	590.9	589.56	591.42	0.004961	7.33	1309.67	391.12	0.55
GuadTrib20	17432.85	2-year	Proposed	1014.34	582.00	587.2		587.28	0.000699	1.94	635.42	259.22	0.19
GuadTrib20	17432.85	2-year	Existing	1056.58	582.00	587.2		587.30	0.000749	2.02	638.60	260.67	0.19
GuadTrib20	17432.85	5-year	Proposed	1732.33	582.00	588.2		588.29	0.000798	2.46	902.58	275.05	0.21
GuadTrib20	17432.85	5-year	Existing	1812.75	582.00	588.2		588.31	0.000859	2.56	917.26	290.71	0.22
GuadTrib20	17432.85	10-year	Proposed	2338.07	582.00	588.8		588.91	0.000879	2.82	1071.37	278.85	0.22
GuadTrib20	17432.85	10-year	Existing	2451.33	582.00	588.8		588.94	0.000945	2.93	1097.27	299.11	0.23
GuadTrib20	17432.85	25-year	Proposed	3326.44	582.00	589.6		589.69	0.001036	3.36	1281.18	283.70	0.25
GuadTrib20	17432.85	25-year	Existing	3495.48	582.00	589.6		589.71	0.001116	3.49	1320.91	309.03	0.26
GuadTrib20	17432.85	100-year	Proposed	5411.44	582.00	590.6		590.83	0.001455	4.46	1598.95	316.96	0.30
GuadTrib20	17432.85	100-year	Existing	5698.02	582.00	590.6		590.84	0.001513	4.55	1654.97	323.51	0.31
GuadTrib20	17380			Lat Struct									
GuadTrib20	17328.83	2-year	Proposed	1014.34	582.00	586.9		587.12	0.004711	2.86	327.98	174.15	0.29
GuadTrib20	17328.83	2-year	Existing	1056.58	582.00	587.0		587.13	0.004353	2.78	367.54	191.40	0.28
GuadTrib20	17328.83	5-year	Proposed	1732.33	582.00	587.9		588.11	0.004015	3.16	506.10	212.56	0.28
GuadTrib20	17328.83	5-year	Existing	1812.75	582.00	587.9		588.13	0.003778	3.11	567.11	229.85	0.28
GuadTrib20	17328.83	10-year	Proposed	2338.07	582.00	588.5		588.74	0.003176	3.13	721.10	365.91	0.26
GuadTrib20	17328.83	10-year	Existing	2451.33	582.00	588.6		588.77	0.003015	3.07	780.15	367.03	0.25
GuadTrib20	17328.83	25-year	Proposed	3315.38	582.00	589.3		589.52	0.002637	3.17	1010.92	386.44	0.24
GuadTrib20	17328.83	25-year	Existing	3484.33	582.00	589.3		589.53	0.002383	3.01	1055.08	386.48	0.23
GuadTrib20	17328.83	100-year	Proposed	5316.92	582.00	590.3		590.63	0.002578	3.53	1424.05	416.67	0.25
GuadTrib20	17328.83	100-year	Existing	5607.43	582.00	590.3		590.64	0.002188	3.24	1450.57	415.24	0.23
GuadTrib20	17095.77	2-year	Proposed	1014.34	582.00	585.4	585.37	586.36	0.001978	8.20	185.12	163.39	0.90
GuadTrib20	17095.77	2-year	Existing	1056.58	582.00	585.4	585.44	586.40	0.001908	8.19	196.14	170.28	0.89
GuadTrib20	17095.77	5-year	Proposed	1732.33	582.00	586.3	586.35	587.46	0.001612	9.17	392.64	257.21	0.86

HEC-RAS River: GuadTrib20 Reach: GuadTrib20 (Continued)

Reach	River Sta	Profile	Plan	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
GuadTrib20	17095.77	5-year	Existing	1812.75	582.00	586.4	586.40	587.49	0.001598	9.21	405.77	261.34	0.86
GuadTrib20	17095.77	10-year	Proposed	2337.68	582.00	586.9	586.94	588.15	0.001521	9.87	560.59	305.79	0.85
GuadTrib20	17095.77	10-year	Existing	2450.21	582.00	587.0	586.98	588.18	0.001525	9.95	573.56	309.22	0.86
GuadTrib20	17095.77	25-year	Proposed	3196.73	582.00	587.6	587.58	588.94	0.001525	10.88	770.49	351.32	0.88
GuadTrib20	17095.77	25-year	Existing	3361.65	582.00	587.6	587.62	588.98	0.001543	11.00	784.16	354.03	0.88
GuadTrib20	17095.77	100-year	Proposed	4722.18	582.00	588.5	588.51	590.05	0.001498	12.13	1123.28	401.99	0.89
GuadTrib20	17095.77	100-year	Existing	5021.89	582.00	588.6	588.57	590.10	0.001517	12.29	1148.54	404.62	0.90
GuadTrib20	16812.26	2-year	Proposed	1030.37	580.27	584.0	584.00	584.99	0.001755	8.17	178.15	157.45	0.86
GuadTrib20	16812.26	2-year	Existing	1076.03	580.27	584.1	584.07	585.08	0.001728	8.25	190.11	165.16	0.85
GuadTrib20	16812.26	5-year	Proposed	1802.10	580.27	585.0	585.04	586.16	0.001467	9.21	398.50	265.52	0.83
GuadTrib20	16812.26	5-year	Existing	1848.80	580.27	585.1	585.09	586.21	0.001459	9.27	412.13	270.72	0.83
GuadTrib20	16812.26	10-year	Proposed	2460.95	580.27	585.6	585.64	586.88	0.001450	10.08	575.62	327.05	0.84
GuadTrib20	16812.26	10-year	Existing	2501.37	580.27	585.7	585.67	586.92	0.001449	10.13	586.83	330.95	0.84
GuadTrib20	16812.26	25-year	Proposed	3411.33	580.27	586.4	586.37	587.71	0.001394	10.94	844.34	400.93	0.85
GuadTrib20	16812.26	25-year	Existing	3436.91	580.27	586.4	586.39	587.73	0.001392	10.96	851.39	402.47	0.85
GuadTrib20	16812.26	100-year	Proposed	5121.75	580.27	587.3	587.35	588.84	0.001393	12.26	1277.49	486.80	0.87
GuadTrib20	16812.26	100-year	Existing	5147.03	580.27	587.4	587.38	588.86	0.001377	12.23	1290.79	489.29	0.87
GuadTrib20	16192.59	2-year	Proposed	1030.37	577.00	580.1	578.44	580.19	0.000227	2.94	351.00	126.31	0.31
GuadTrib20	16192.59	2-year	Existing	1076.03	577.00	580.2	578.48	580.29	0.000222	2.96	363.64	126.93	0.31
GuadTrib20	16192.59	5-year	Proposed	1802.10	577.00	581.6	579.06	581.76	0.000170	3.26	553.46	136.66	0.29
GuadTrib20	16192.59	5-year	Existing	1848.80	577.00	581.7	579.09	581.84	0.000168	3.27	565.18	137.24	0.28
GuadTrib20	16192.59	10-year	Proposed	2460.95	577.00	582.7	579.52	582.93	0.000140	3.45	721.28	160.53	0.27
GuadTrib20	16192.59	10-year	Existing	2501.37	577.00	582.8	579.54	582.99	0.000139	3.46	732.14	162.33	0.27
GuadTrib20	16192.59	25-year	Proposed	3411.33	577.00	584.2	580.09	584.44	0.000111	3.64	1131.31	453.94	0.25
GuadTrib20	16192.59	25-year	Existing	3436.91	577.00	584.3	580.11	584.48	0.000110	3.64	1149.05	463.25	0.25
GuadTrib20	16192.59	100-year	Proposed	5121.75	577.00	584.9	581.01	585.22	0.000179	4.90	1447.67	560.45	0.32
GuadTrib20	16192.59	100-year	Existing	5147.03	577.00	584.9	581.02	585.23	0.000179	4.91	1455.56	562.51	0.32
GuadTrib20	16000			Culvert									
GuadTrib20	15963.4	2-year	Proposed	1030.37	575.50	579.1	577.33	579.19	0.000173	2.51	410.38	261.15	0.30
GuadTrib20	15963.4	2-year	Existing	1076.03	575.50	579.2	577.36	579.26	0.000176	2.55	421.93	266.17	0.30
GuadTrib20	15963.4	5-year	Proposed	1802.10	575.50	580.0	577.97	580.15	0.000205	2.98	604.27	313.79	0.32
GuadTrib20	15963.4	5-year	Existing	1848.80	575.50	580.1	578.01	580.20	0.000207	3.00	615.27	314.95	0.32
GuadTrib20	15963.4	10-year	Proposed	2460.95	575.50	580.7	578.44	580.82	0.000223	3.28	750.72	328.92	0.32
GuadTrib20	15963.4	10-year	Existing	2501.37	575.50	580.7	578.45	580.86	0.000224	3.29	759.63	329.82	0.32
GuadTrib20	15963.4	25-year	Proposed	3411.33	575.50	581.4	579.06	581.65	0.000241	3.63	943.13	351.81	0.32
GuadTrib20	15963.4	25-year	Existing	3436.91	575.50	581.5	579.08	581.67	0.000241	3.64	948.15	352.46	0.32
GuadTrib20	15963.4	100-year	Proposed	5121.75	575.50	582.6	579.85	582.88	0.000266	4.18	1268.74	420.16	0.33
GuadTrib20	15963.4	100-year	Existing	5147.03	575.50	582.6	579.85	582.90	0.000266	4.18	1273.69	421.44	0.33

HEC-RAS River: GuadTrib20 Reach: GuadTrib20 (Continued)

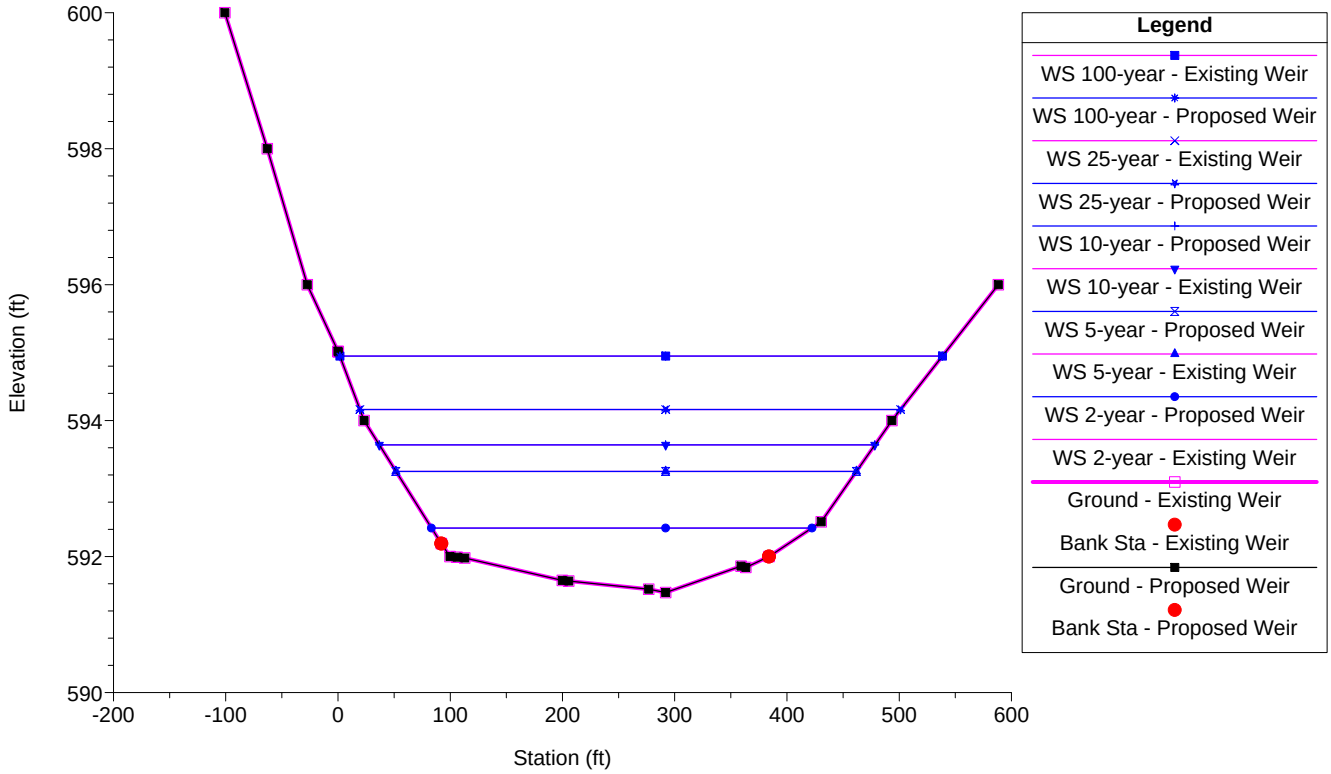
Reach	River Sta	Profile	Plan	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
GuadTrib20	15855.97	2-year	Proposed	1030.37	576.00	578.9		579.11	0.003747	3.65	281.93	115.50	0.41
GuadTrib20	15855.97	2-year	Existing	1076.03	576.00	579.0		579.17	0.003830	3.74	288.07	116.09	0.42
GuadTrib20	15855.97	5-year	Proposed	1802.10	576.00	579.7		580.02	0.004960	4.83	372.97	123.95	0.49
GuadTrib20	15855.97	5-year	Existing	1848.80	576.00	579.7		580.07	0.005023	4.89	377.85	124.38	0.49
GuadTrib20	15855.97	10-year	Proposed	2460.95	576.00	580.2		580.65	0.005726	5.65	436.48	134.83	0.54
GuadTrib20	15855.97	10-year	Existing	2501.37	576.00	580.2		580.69	0.005747	5.69	440.51	136.16	0.54
GuadTrib20	15855.97	25-year	Proposed	3411.33	576.00	580.7		581.43	0.006460	6.66	522.61	160.90	0.59
GuadTrib20	15855.97	25-year	Existing	3436.91	576.00	580.8		581.45	0.006478	6.69	524.91	161.53	0.59
GuadTrib20	15855.97	100-year	Proposed	5121.75	576.00	581.6	580.45	582.57	0.007614	8.18	668.12	197.26	0.66
GuadTrib20	15855.97	100-year	Existing	5147.03	576.00	581.6	580.47	582.59	0.007629	8.20	670.20	197.73	0.66
GuadTrib20	15636.87	2-year	Proposed	1030.37	576.00	577.9	577.27	578.11	0.005501	3.30	312.23	199.37	0.46
GuadTrib20	15636.87	2-year	Existing	1076.03	576.00	578.0	577.30	578.16	0.005501	3.35	320.97	200.17	0.47
GuadTrib20	15636.87	5-year	Proposed	1802.10	576.00	578.6	577.72	578.85	0.005500	4.04	445.80	209.84	0.49
GuadTrib20	15636.87	5-year	Existing	1848.80	576.00	578.6	577.75	578.89	0.005500	4.08	453.17	210.40	0.49
GuadTrib20	15636.87	10-year	Proposed	2460.95	576.00	579.1	578.05	579.37	0.005506	4.52	544.77	217.19	0.50
GuadTrib20	15636.87	10-year	Existing	2501.37	576.00	579.1	578.07	579.40	0.005506	4.54	550.56	217.61	0.50
GuadTrib20	15636.87	25-year	Proposed	3411.33	576.00	579.6	578.47	580.04	0.005503	5.06	673.98	226.41	0.52
GuadTrib20	15636.87	25-year	Existing	3436.91	576.00	579.7	578.48	580.05	0.005503	5.07	677.28	226.64	0.52
GuadTrib20	15636.87	100-year	Proposed	5121.75	576.00	580.5	579.13	581.02	0.005506	5.90	870.43	240.19	0.54
GuadTrib20	15636.87	100-year	Existing	5147.03	576.00	580.5	579.14	581.03	0.005506	5.91	873.10	240.38	0.54


TXDOTandPieper Plan: 1) Proposed 6/9/2020 2) Existing 6/9/2020
Geom: Proposed Cond Flow: SCS Method Proposed
GuadTrib20 GuadTrib20
Elevation (ft)
595
590
585
580
575
0
500
1000
1500
2000
2500
3000
Main Channel Distance (ft)
16000
16812.26
17095.77
17328.83
17432.85
17590.17
17641.61
17926.39
18233.87
18494.57
Legend
WS 100-year - Existing
WS 100-year - Proposed
WS 25-year - Existing
WS 25-year - Proposed
WS 10-year - Existing
WS 10-year - Proposed
WS 5-year - Existing
WS 5-year - Proposed
WS 2-year - Existing
WS 2-year - Proposed
Ground
Ground

TXDOTandPieper Plan: 1) Proposed Weir 2) Existing Weir

Geom: Proposed Cond Flow: SCS Method Proposed

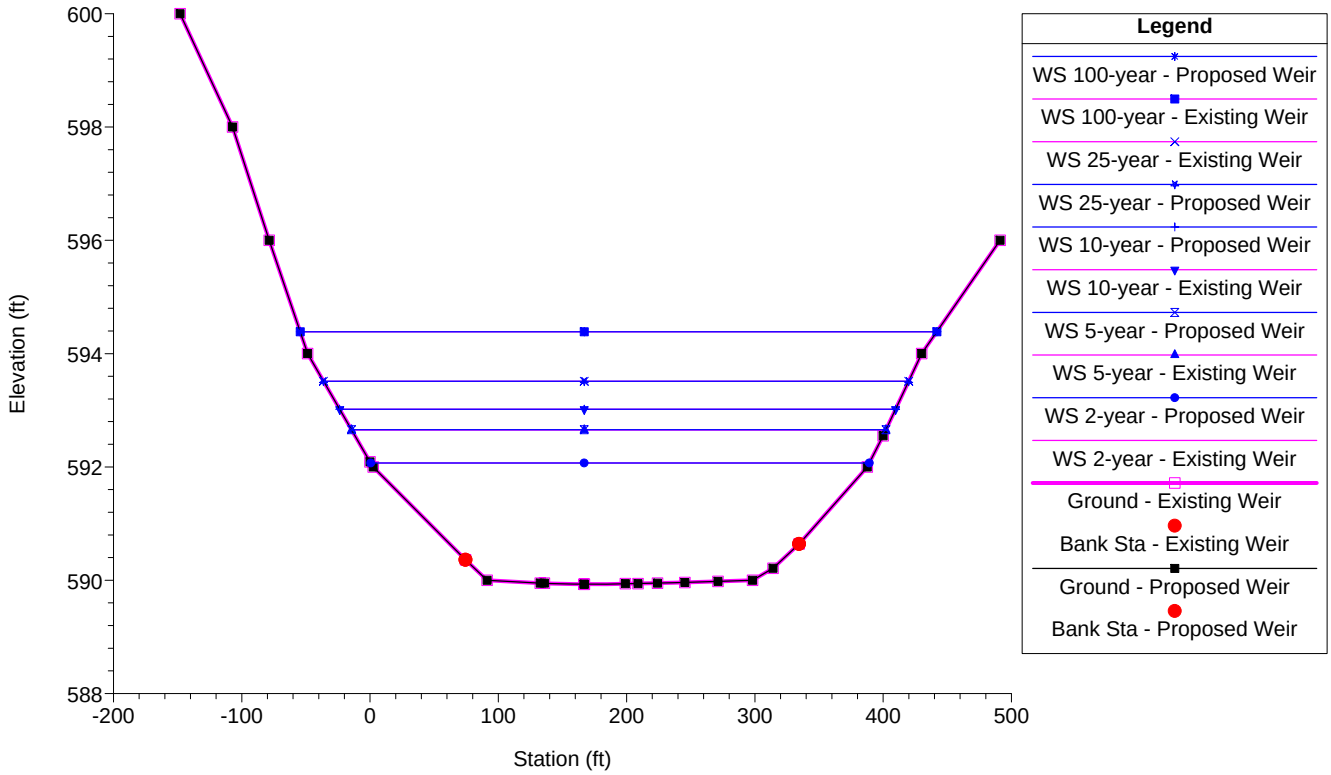
River = GuadTrib20 Reach = GuadTrib20 RS = 18494.57



TXDOTandPieper Plan: 1) Proposed Weir 2) Existing Weir

Geom: Proposed Cond Flow: SCS Method Proposed

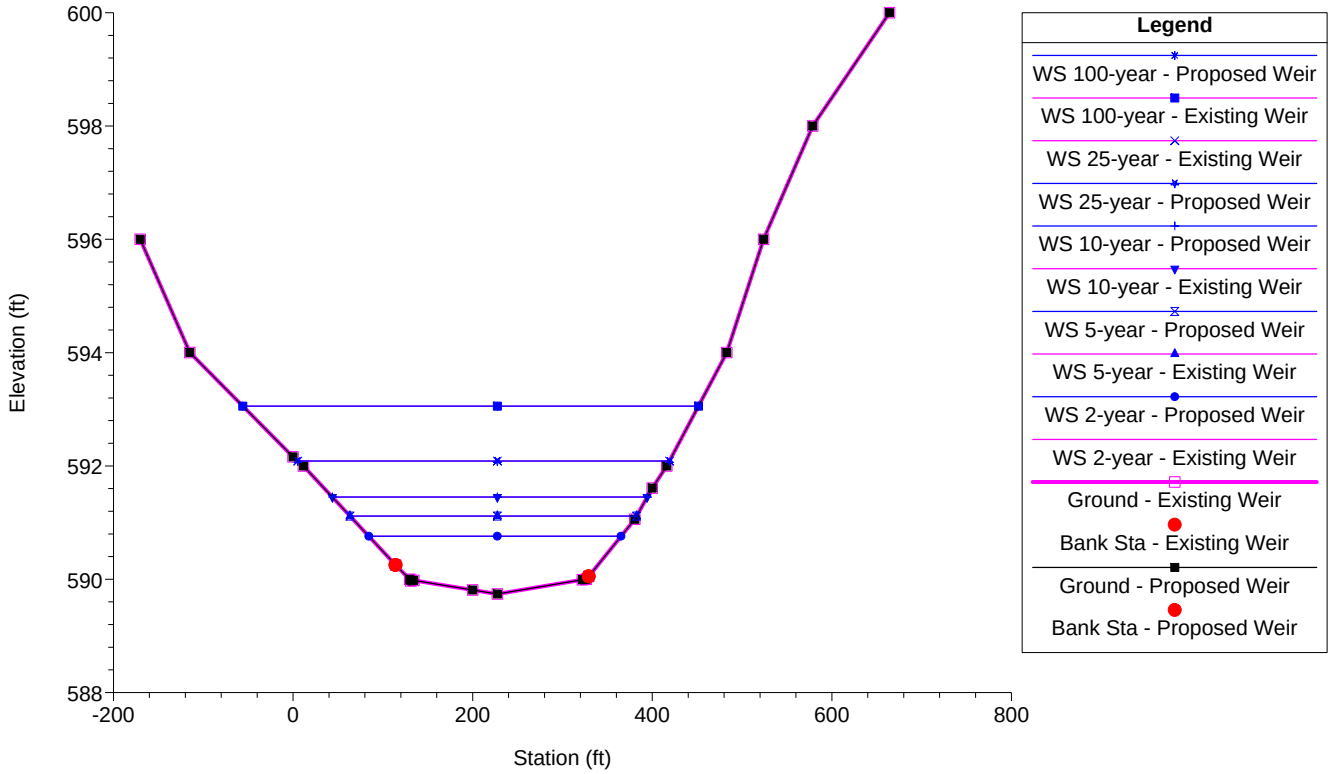
River = GuadTrib20 Reach = GuadTrib20 RS = 18233.87



TXDOTandPieper Plan: 1) Proposed Weir 2) Existing Weir

Geom: Proposed Cond Flow: SCS Method Proposed

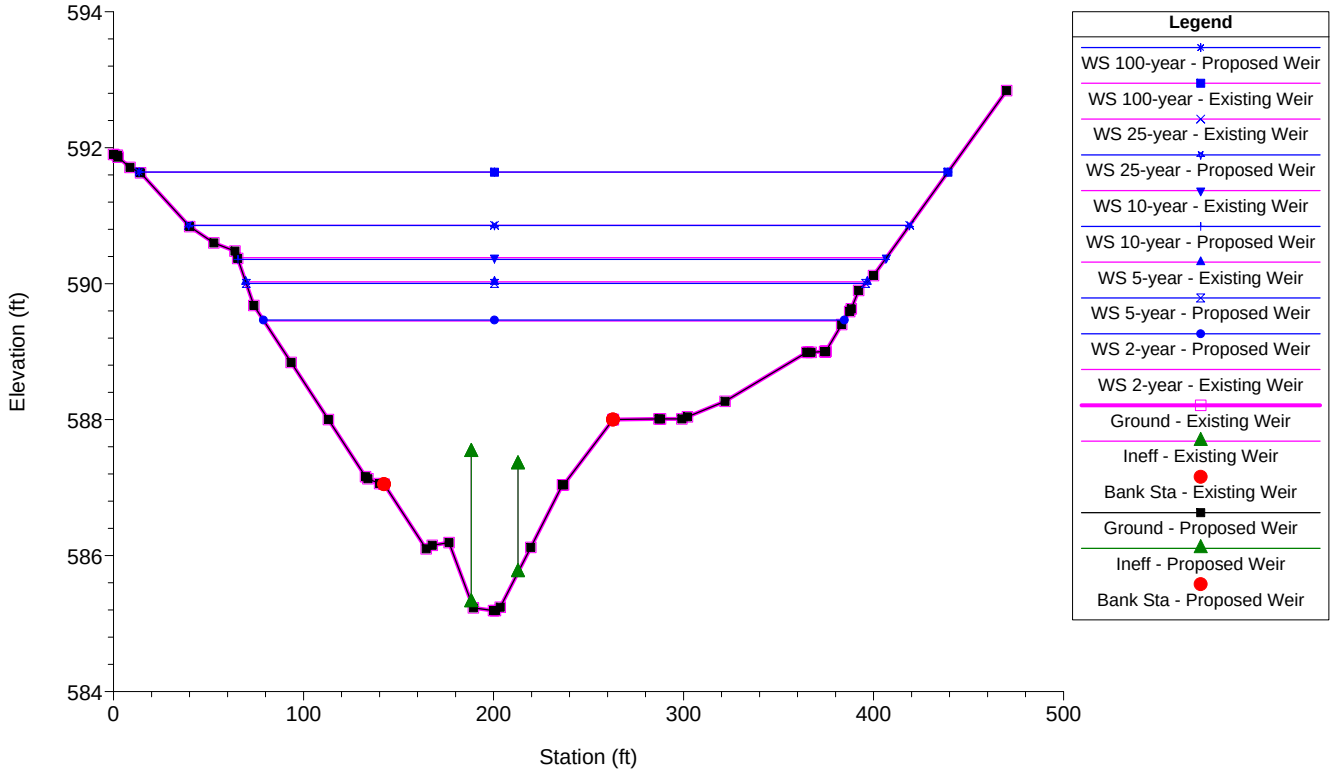
River = GuadTrib20 Reach = GuadTrib20 RS = 17926.39



TXDOTandPieper Plan: 1) Proposed Weir 2) Existing Weir

Geom: Proposed Cond Flow: SCS Method Proposed

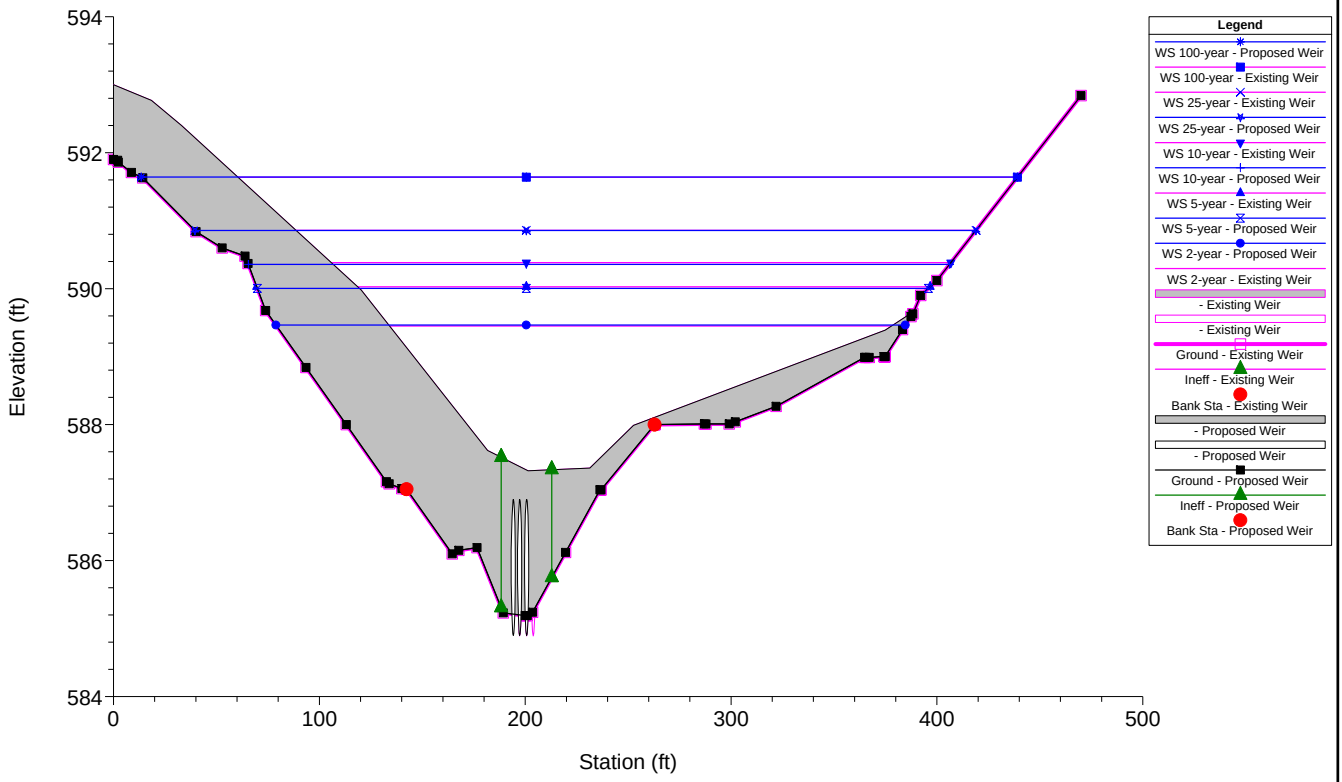
River = GuadTrib20 Reach = GuadTrib20 RS = 17641.61



TXDOTandPieper Plan: 1) Proposed Weir 2) Existing Weir

Geom: Proposed Cond Flow: SCS Method Proposed

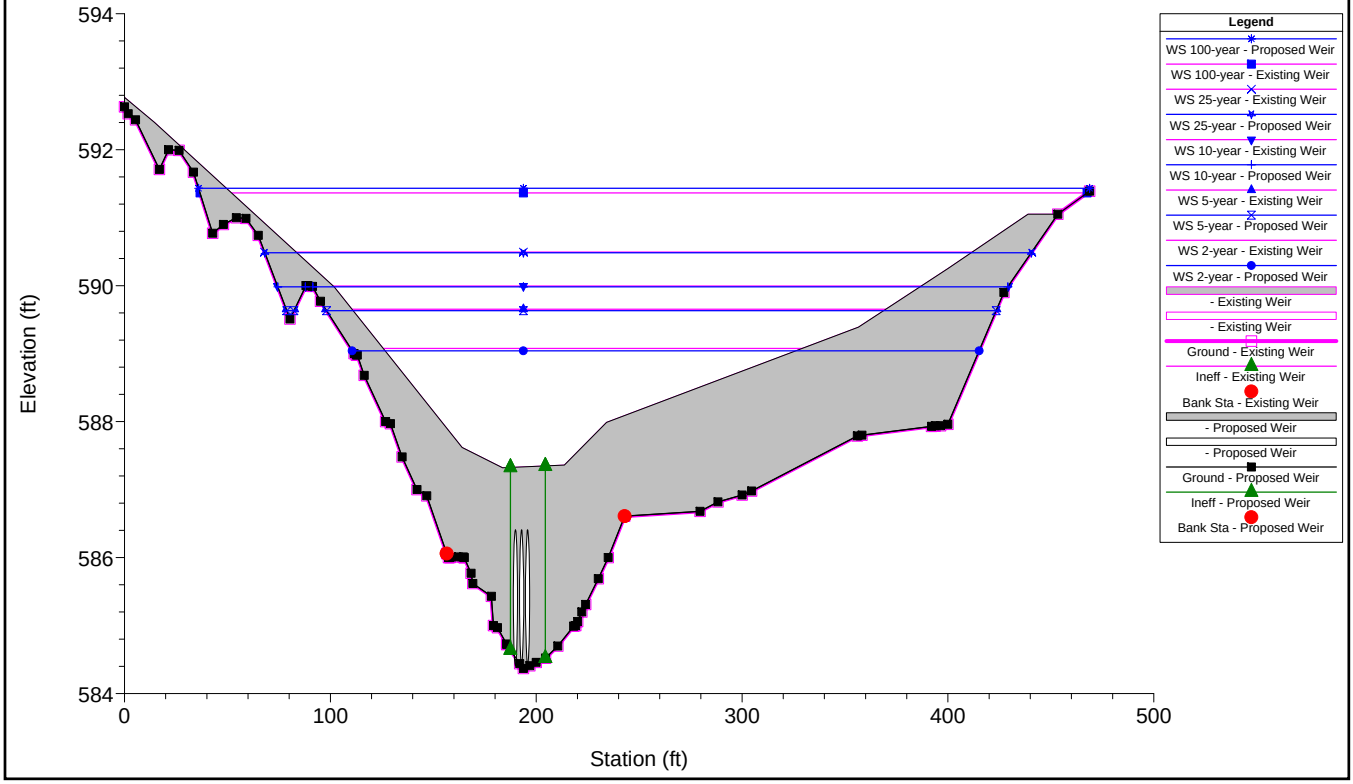
River = GuadTrib20 Reach = GuadTrib20 RS = 17615 Culv



TXDOTandPieper Plan: 1) Proposed Weir 2) Existing Weir

Geom: Proposed Cond Flow: SCS Method Proposed

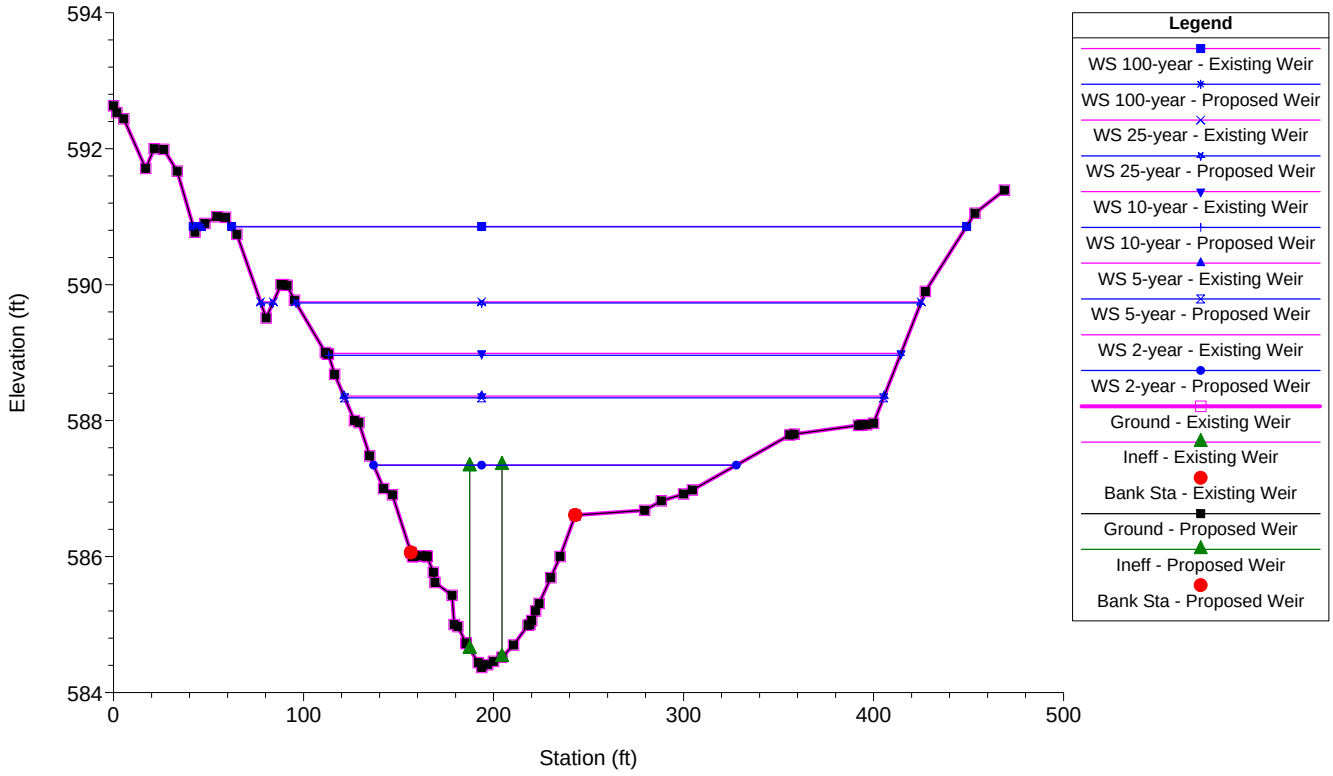
River = GuadTrib20 Reach = GuadTrib20 RS = 17615 Culv



TXDOTandPieper Plan: 1) Proposed Weir 2) Existing Weir

Geom: Proposed Cond Flow: SCS Method Proposed

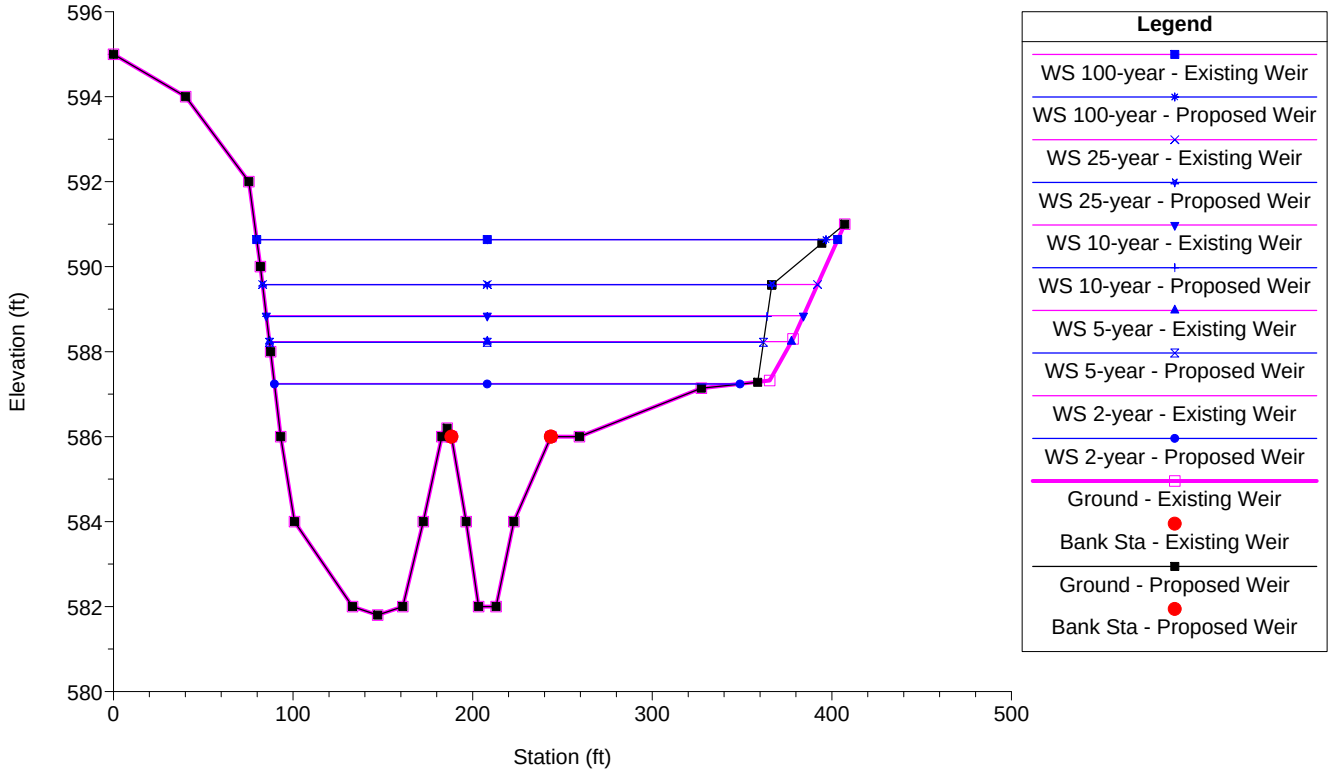
River = GuadTrib20 Reach = GuadTrib20 RS = 17590.17



TXDOTandPieper Plan: 1) Proposed Weir 2) Existing Weir

Geom: Proposed Cond Flow: SCS Method Proposed

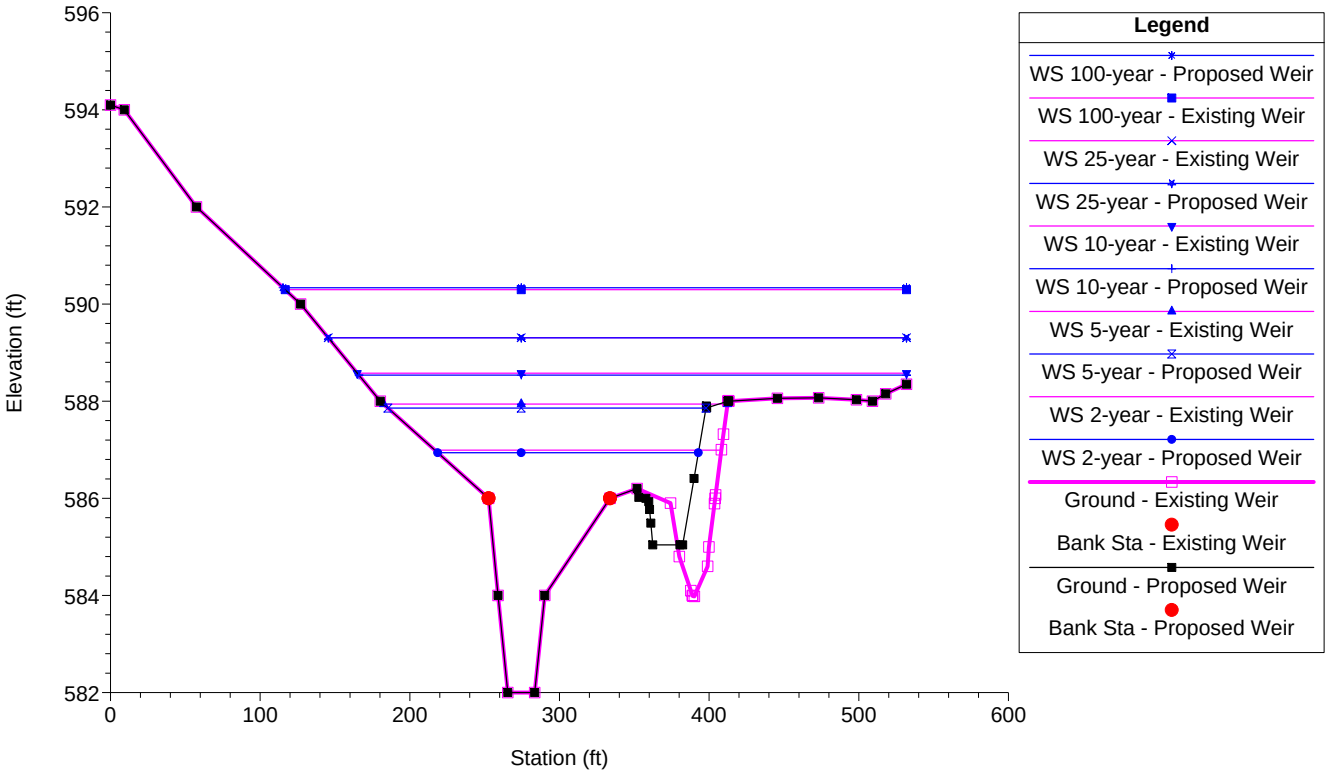
River = GuadTrib20 Reach = GuadTrib20 RS = 17432.85



TXDOTandPieper Plan: 1) Proposed Weir 2) Existing Weir

Geom: Proposed Cond Flow: SCS Method Proposed

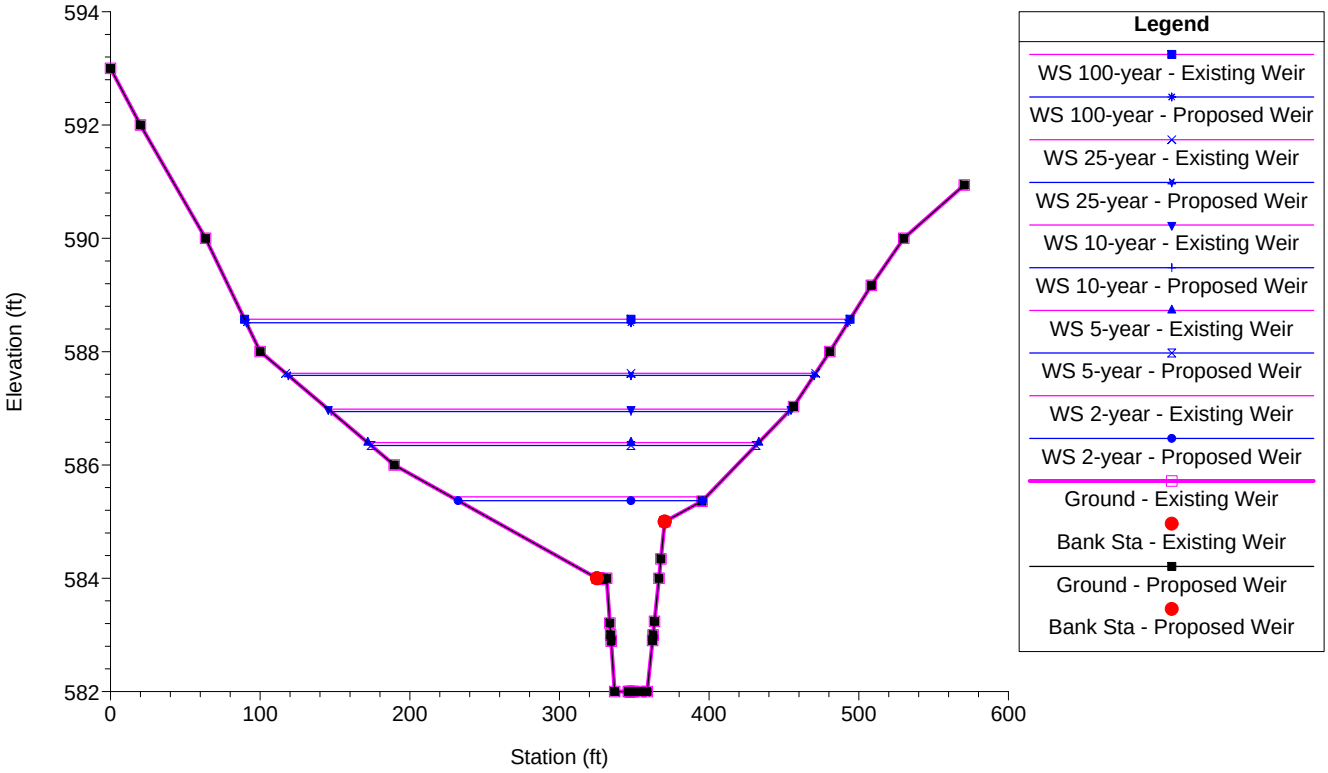
River = GuadTrib20 Reach = GuadTrib20 RS = 17328.83



TXDOTandPieper Plan: 1) Proposed Weir 2) Existing Weir

Geom: Proposed Cond Flow: SCS Method Proposed

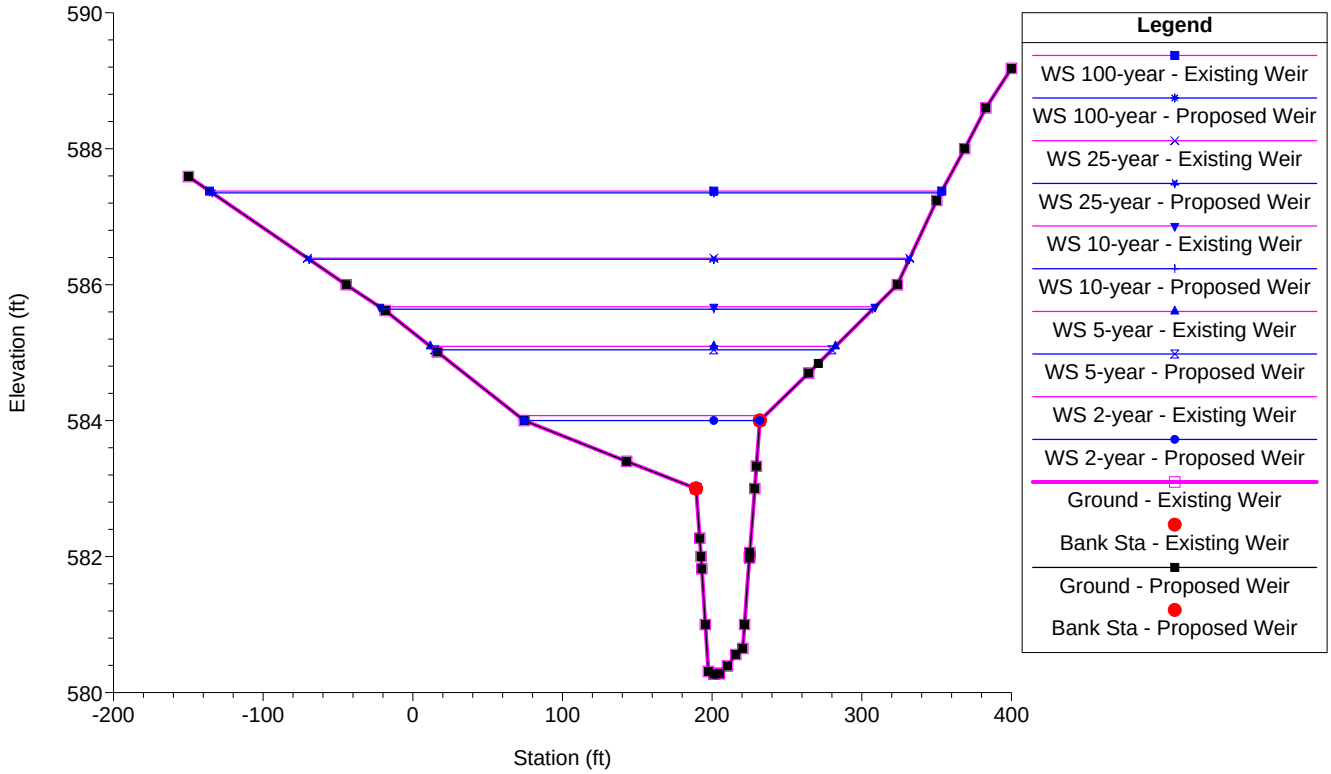
River = GuadTrib20 Reach = GuadTrib20 RS = 17095.77



TXDOTandPieper Plan: 1) Proposed Weir 2) Existing Weir

Geom: Proposed Cond Flow: SCS Method Proposed

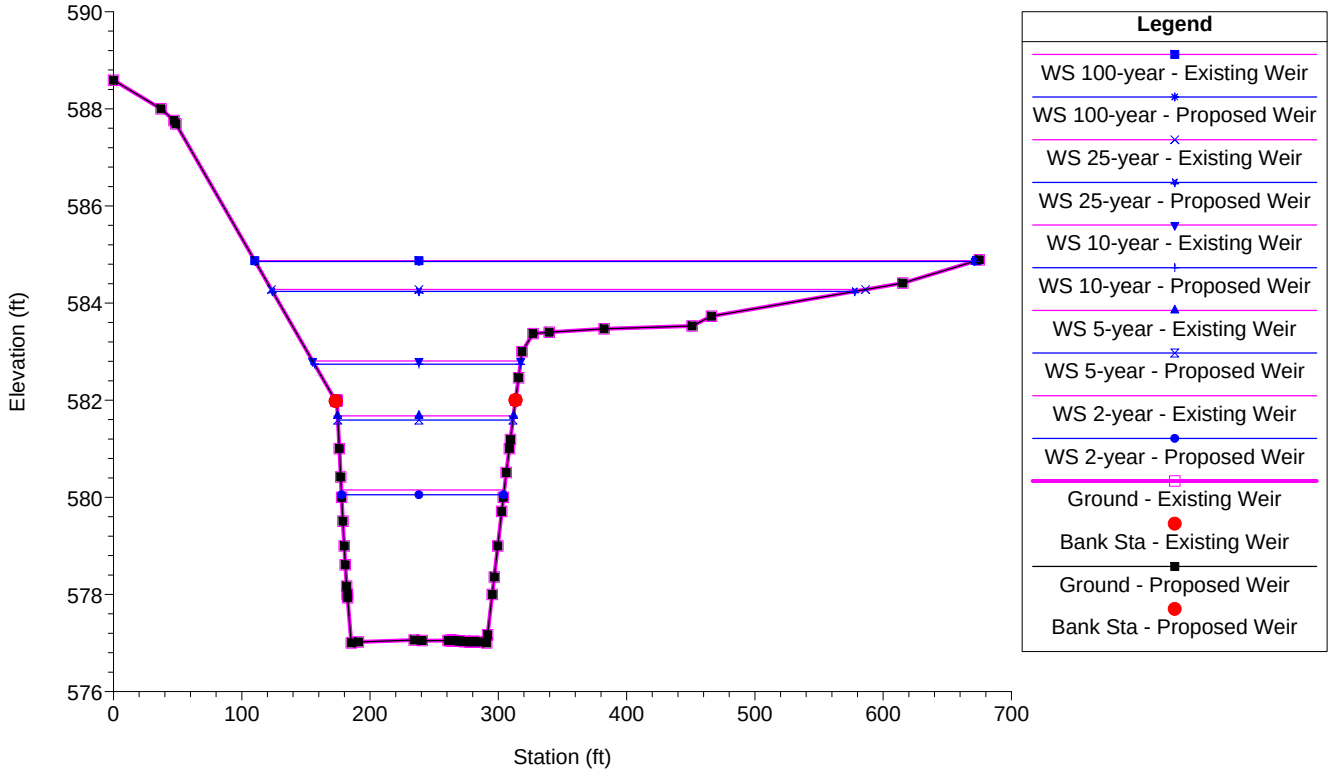
River = GuadTrib20 Reach = GuadTrib20 RS = 16812.26



TXDOTandPieper Plan: 1) Proposed Weir 2) Existing Weir

Geom: Proposed Cond Flow: SCS Method Proposed

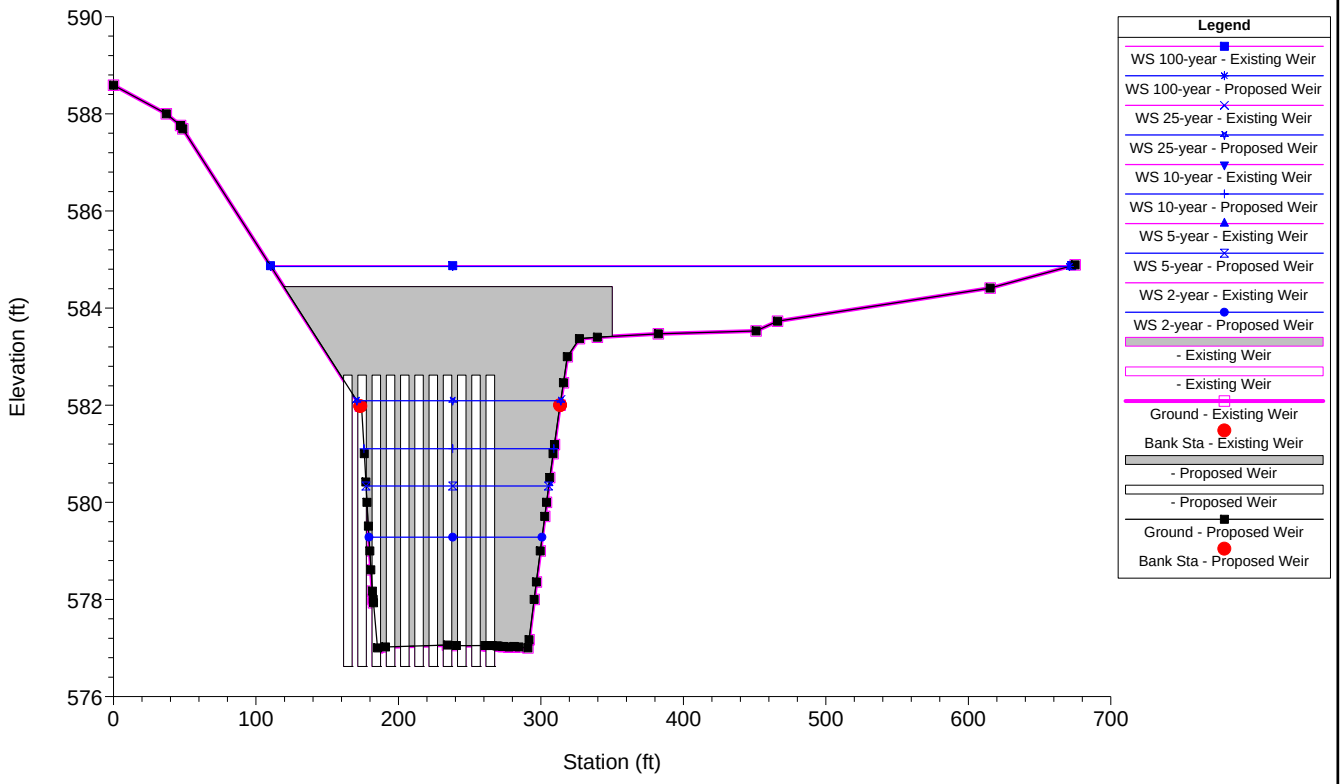
River = GuadTrib20 Reach = GuadTrib20 RS = 16192.59



TXDOTandPieper Plan: 1) Proposed Weir 2) Existing Weir

Geom: Proposed Cond Flow: SCS Method Proposed

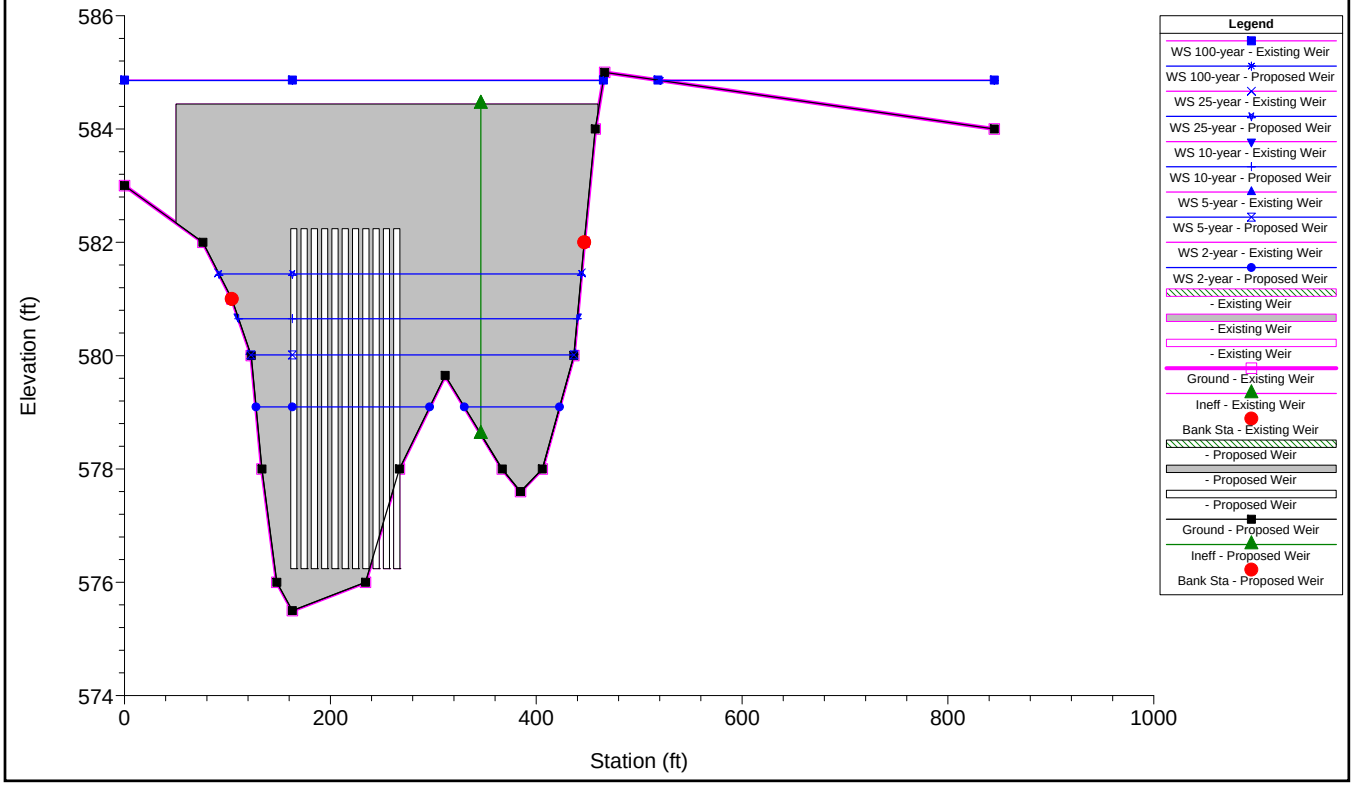
River = GuadTrib20 Reach = GuadTrib20 RS = 16000 Culv



TXDOTandPieper Plan: 1) Proposed Weir 2) Existing Weir

Geom: Proposed Cond Flow: SCS Method Proposed

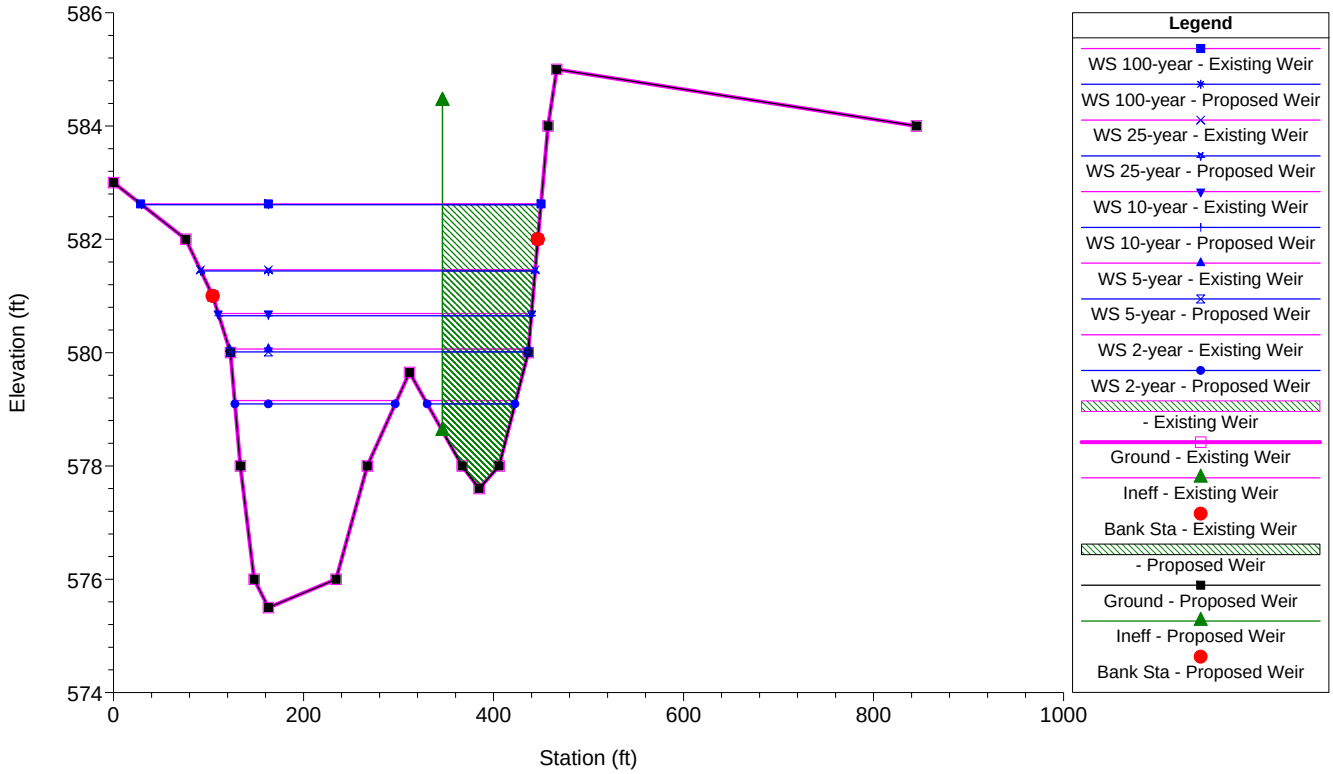
River = GuadTrib20 Reach = GuadTrib20 RS = 16000 Culv



TXDOTandPieper Plan: 1) Proposed Weir 2) Existing Weir

Geom: Proposed Cond Flow: SCS Method Proposed

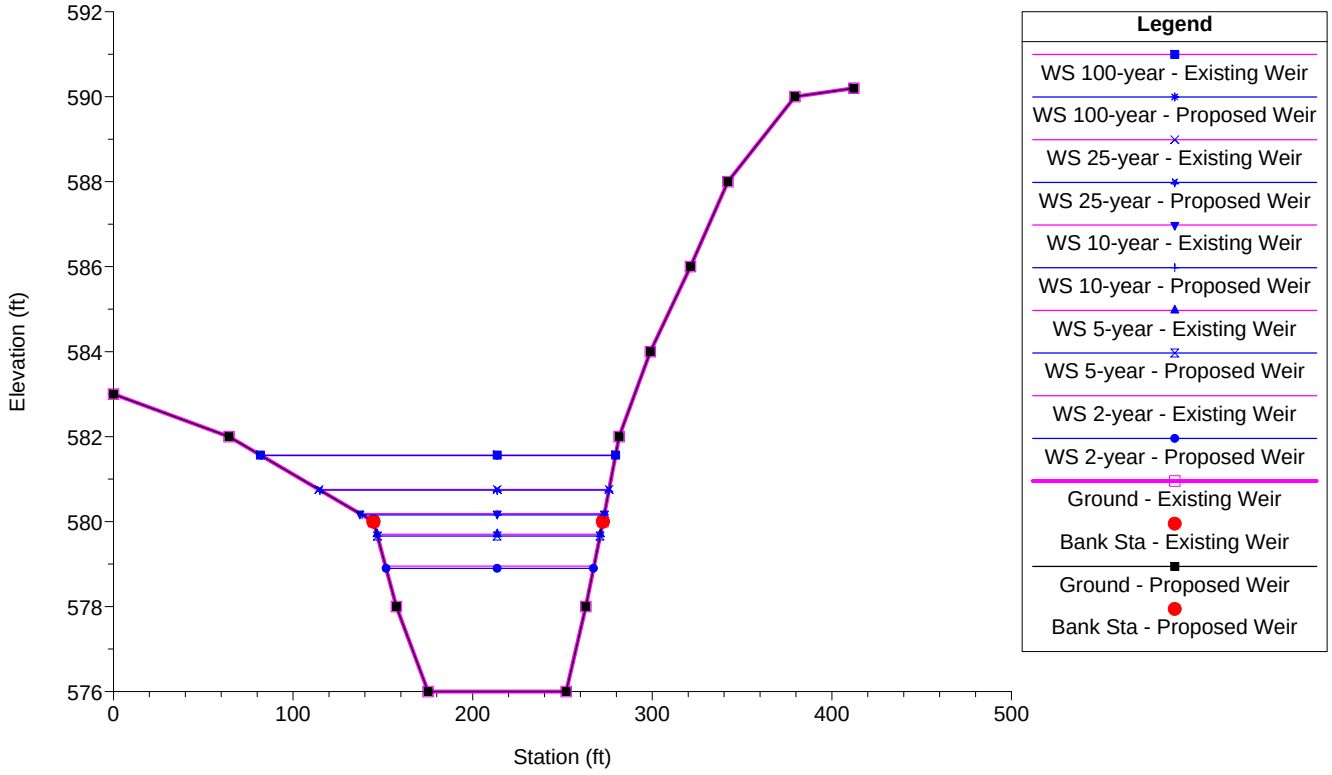
River = GuadTrib20 Reach = GuadTrib20 RS = 15963.4



TXDOTandPieper Plan: 1) Proposed Weir 2) Existing Weir

Geom: Proposed Cond Flow: SCS Method Proposed

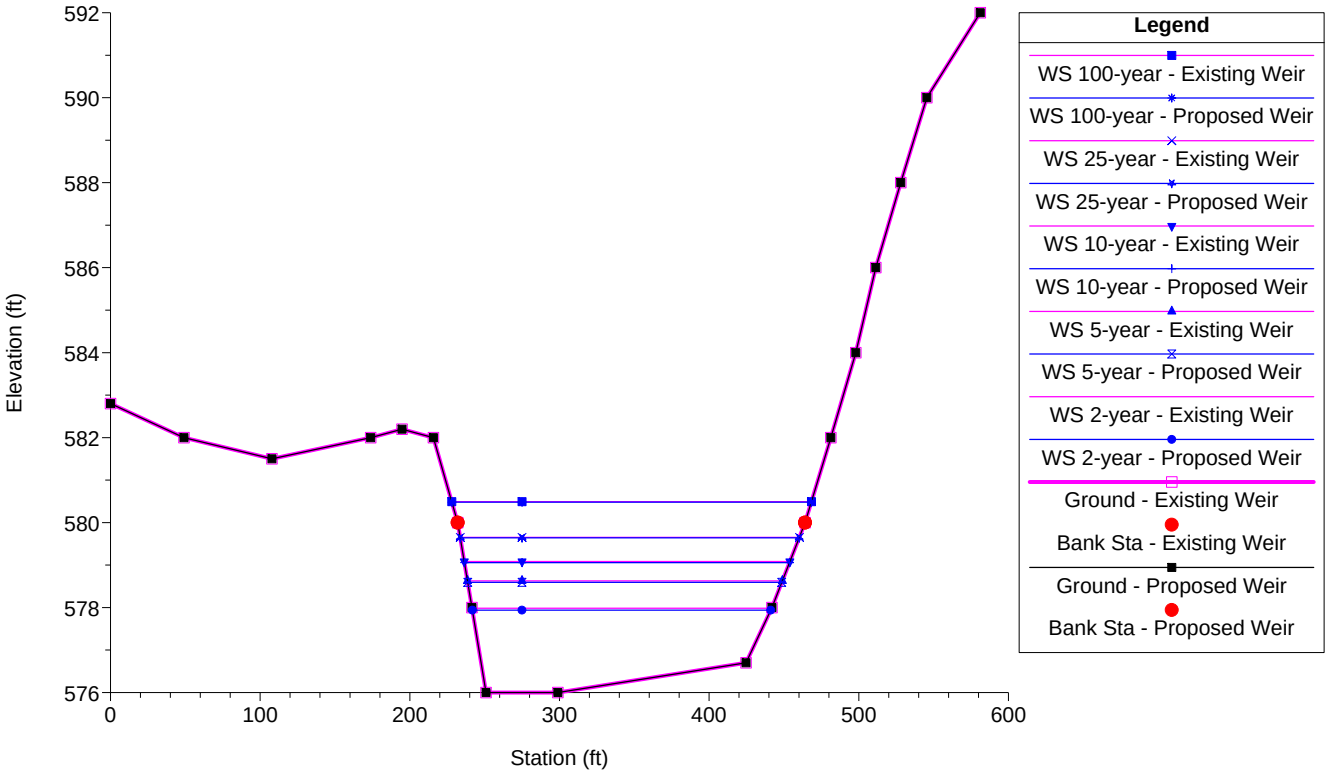
River = GuadTrib20 Reach = GuadTrib20 RS = 15855.97



TXDOTandPieper Plan: 1) Proposed Weir 2) Existing Weir

Geom: Proposed Cond Flow: SCS Method Proposed

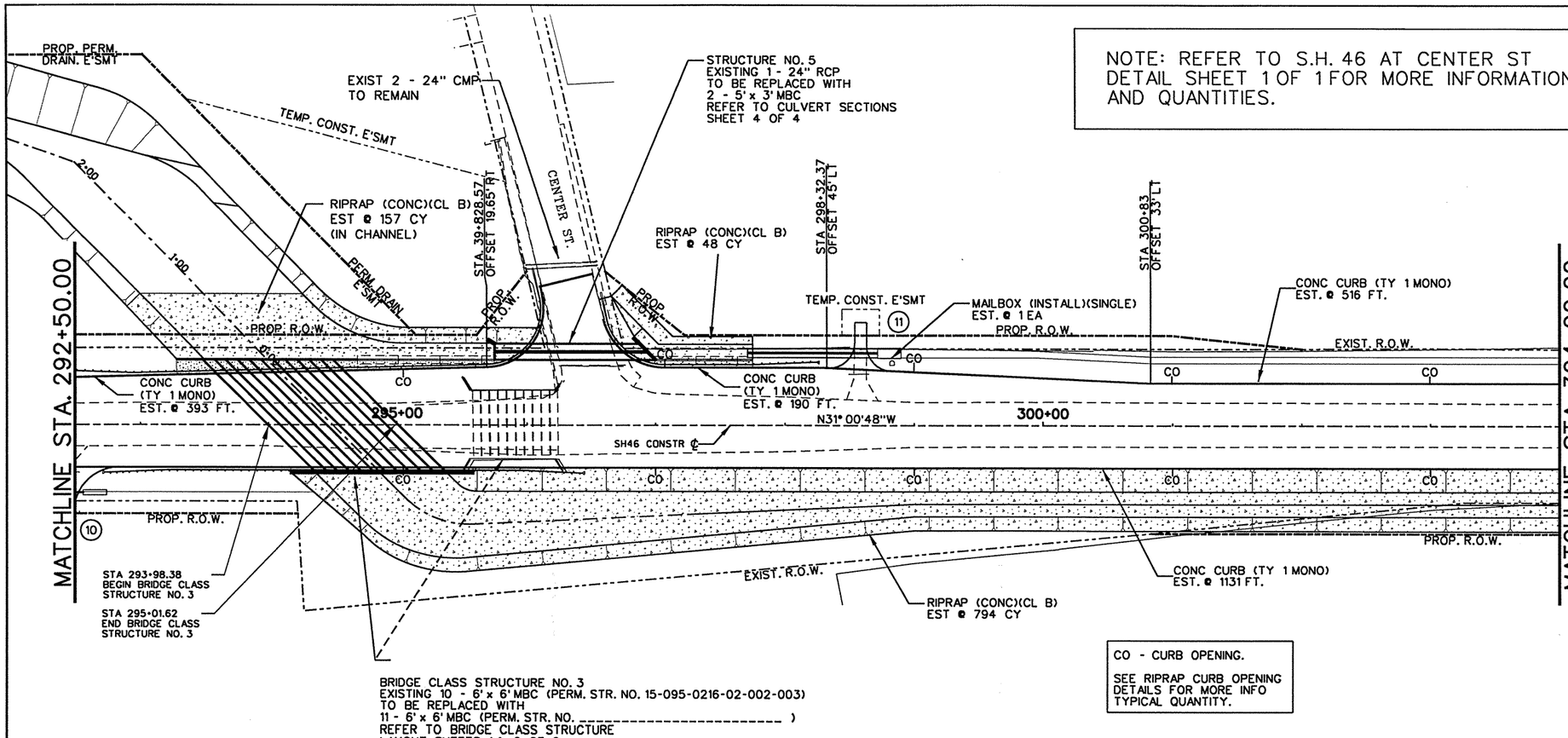
River = GuadTrib20 Reach = GuadTrib20 RS = 15636.87



Attachment G

State Highway 46 Construction Plans (by Civil Engineering Consultants)

NOTE: REFER TO S.H. 46 AT CENTER ST DETAIL SHEET 1 OF 1 FOR MORE INFORMATION AND QUANTITIES.



CO - CURB OPENING.

SEE RIPRAP CURB OPENING DETAILS FOR MORE INFO TYPICAL QUANTITY.

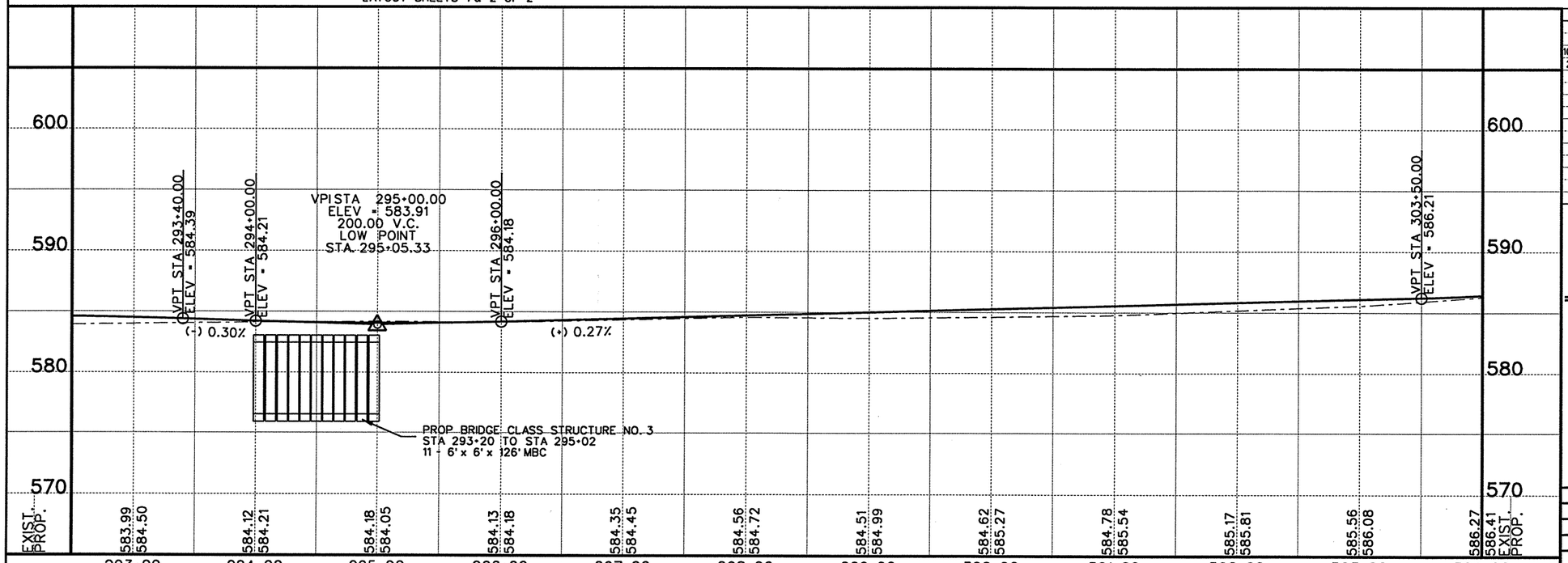
BRIDGE CLASS STRUCTURE NO. 3
EXISTING 10 - 6' x 6' MBC (PERM. STR. NO. 15-095-0216-02-002-003)
TO BE REPLACED WITH
11 - 6' x 6' MBC (PERM. STR. NO. _____)
REFER TO BRIDGE CLASS STRUCTURE
LAYOUT SHEETS 1 & 2 OF 2

PLAN VIEW LEGEND

- PROPOSED EDGE OF PAVEMENT
- EXISTING EDGE OF ROADWAY
- EXISTING FEATURES
- PROPOSED RIGHT OF WAY
- EXISTING RIGHT OF WAY
- EXISTING FENCE (WIRE, CHAINLINK, WOOD)
- DRIVEWAY NUMBER (1)
- PROPOSED DITCH CENTERLINE

PROFILE VIEW LEGEND

- PROPOSED PGL
- EXISTING CENTERLINE



EST.	FINAL	UNIT	ITEM DESCRIPTION
11.5		STA	PREP ROW
11.5		STA	REWRKING BS MATL (OC)(TY B)(CL 1)(10")
1024.3		CY	RIPRAP (CONC)(CL B)
2230		LF	CONC CURB (TY I)(MONO)(REINF)(MOD)
		EA	TERM ANCHOR SECT (12 GA)
		LF	MTL BM GD FEN (BLK OUT)(12 GA)(TIM POST)
		LF	MTL BM GD FEN (BLK OUT)(12 GA)(STL POST)
1		EA	MAILBOX INSTAL (SINGLE)
		EA	MAILBOX INSTAL (DOUBLE)
		EA	SINGLE GDRAIL TERM (TY III)

STATE HIGHWAY 46 STREET PLAN/PROFILES

Scale : 1" = 100' Horz. 1" = 10 Vert.
Sheet 4 of 11

CIVIL ENGINEERING CONSULTANTS
DON DURDEN, INC.
11550 I.H. 10 WEST, SUITE 395
SAN ANTONIO, TEXAS 78230
TEL: (210) 641-9999
FAX: (210) 641-6440
EMAIL: cec@cectexas.com

© 1999 Texas Department of Transportation

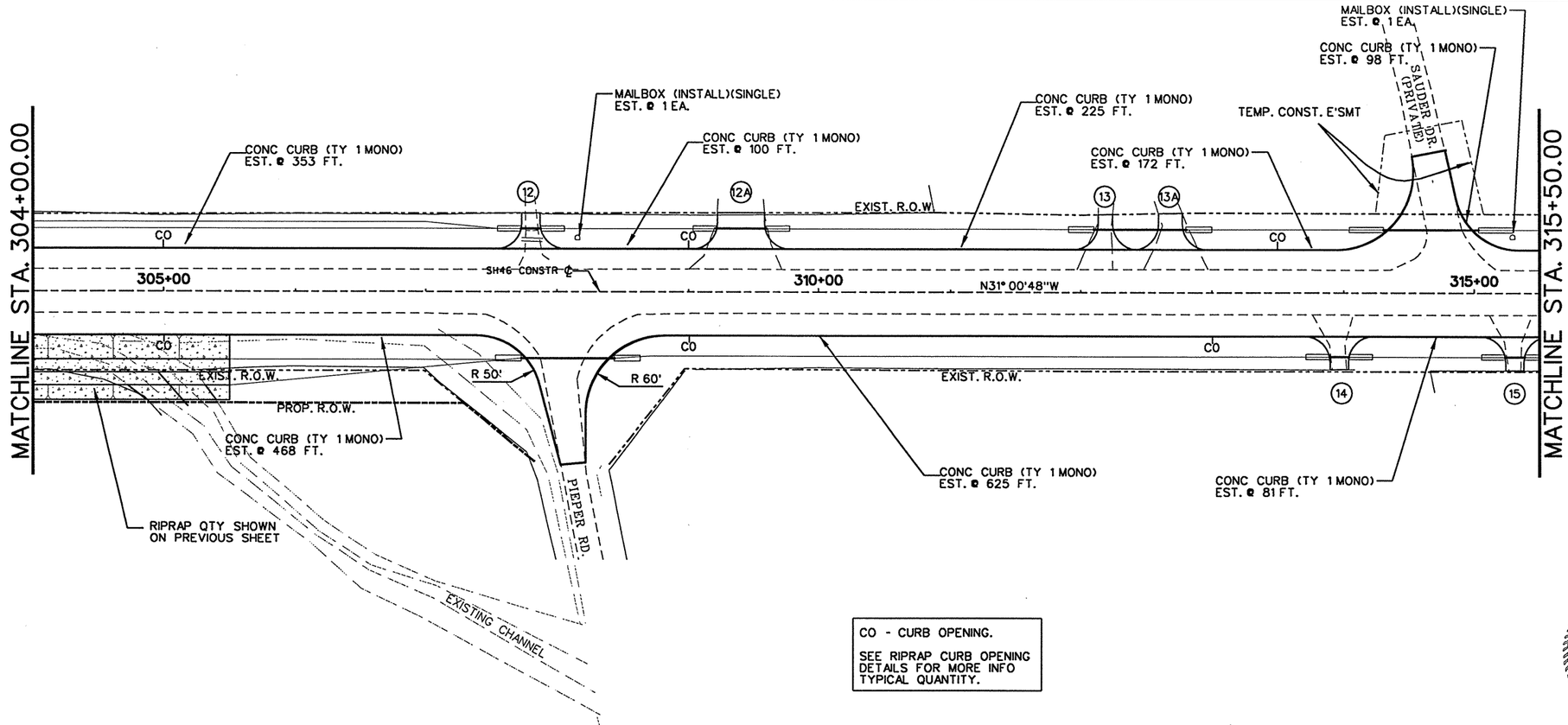
STATE OF TEXAS — Karla M. Nash 73040 — REGISTERED PROFESSIONAL ENGINEER

Karla M. Nash, P.E.

The seal appearing on this document was authorized by Karla M. Nash, P.E. 73040 on 6/15/99

FED.RD. DIV.NO.	FEDERAL AID PROJECT NO.		SHEET NO.
6	STP 99 (521) UM		57
STATE	DIST.	COUNTY	
TEXAS	SA	GUADALUPE	
CONT.	SECT.	JOB	HIGHWAY NO.
0216	02	028	SH 46

...\dgn\178505\street\pp_04.dgn Jun. 15, 1999 16:36:35



CO - CURB OPENING.

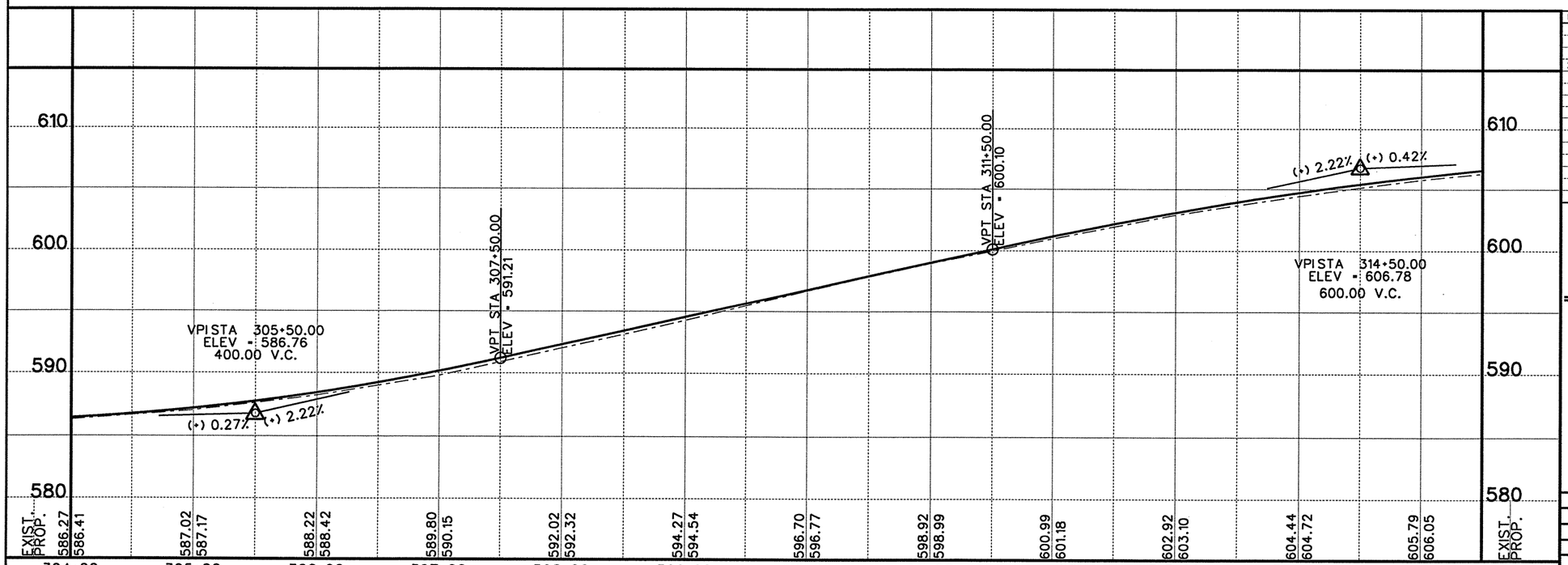
SEE RIPRAP CURB OPENING DETAILS FOR MORE INFO TYPICAL QUANTITY.

PLAN VIEW LEGEND

- PROPOSED EDGE OF PAVEMENT
- EXISTING EDGE OF ROADWAY
- EXISTING FEATURES
- PROPOSED RIGHT OF WAY
- EXISTING RIGHT OF WAY
- EXISTING FENCE (WIRE, CHAINLINK, WOOD)
- DRIVEWAY NUMBER (1)
- PROPOSED DITCH CENTERLINE

PROFILE VIEW LEGEND

- PROPOSED PGL
- EXISTING CENTERLINE



EST.	FINAL	UNIT	ITEM DESCRIPTION
11.5		STA	PREP ROW
11.5		STA	REWRKING BS MATL (OC)(TY B)(CL 1)(10")
15.2		CY	RIPRAP (CONC)(CL B)
2122		LF	CONC CURB (TY 1)(MONO)(REINF)(MOD)
		EA	TERM ANCHOR SECT (12 GA)
		LF	MTL BM GD FEN (BLK OUT)(12 GA)(TIM POST)
		LF	MTL BM GD FEN (BLK OUT)(12 GA)(STL POST)
2		EA	MAILBOX INSTAL (SINGLE)
		EA	MAILBOX INSTAL (DOUBLE)
		EA	SINGLE GDRAIL TERM (TY III)

STATE OF TEXAS — Karla M. Nash — 73040 — REGISTERED PROFESSIONAL ENGINEER

Karla M. Nash, P.E.

The seal appearing on this document was authorized by Karla M. Nash, P.E. 73040 on 6/15/99

STATE HIGHWAY 46 STREET PLAN/PROFILES

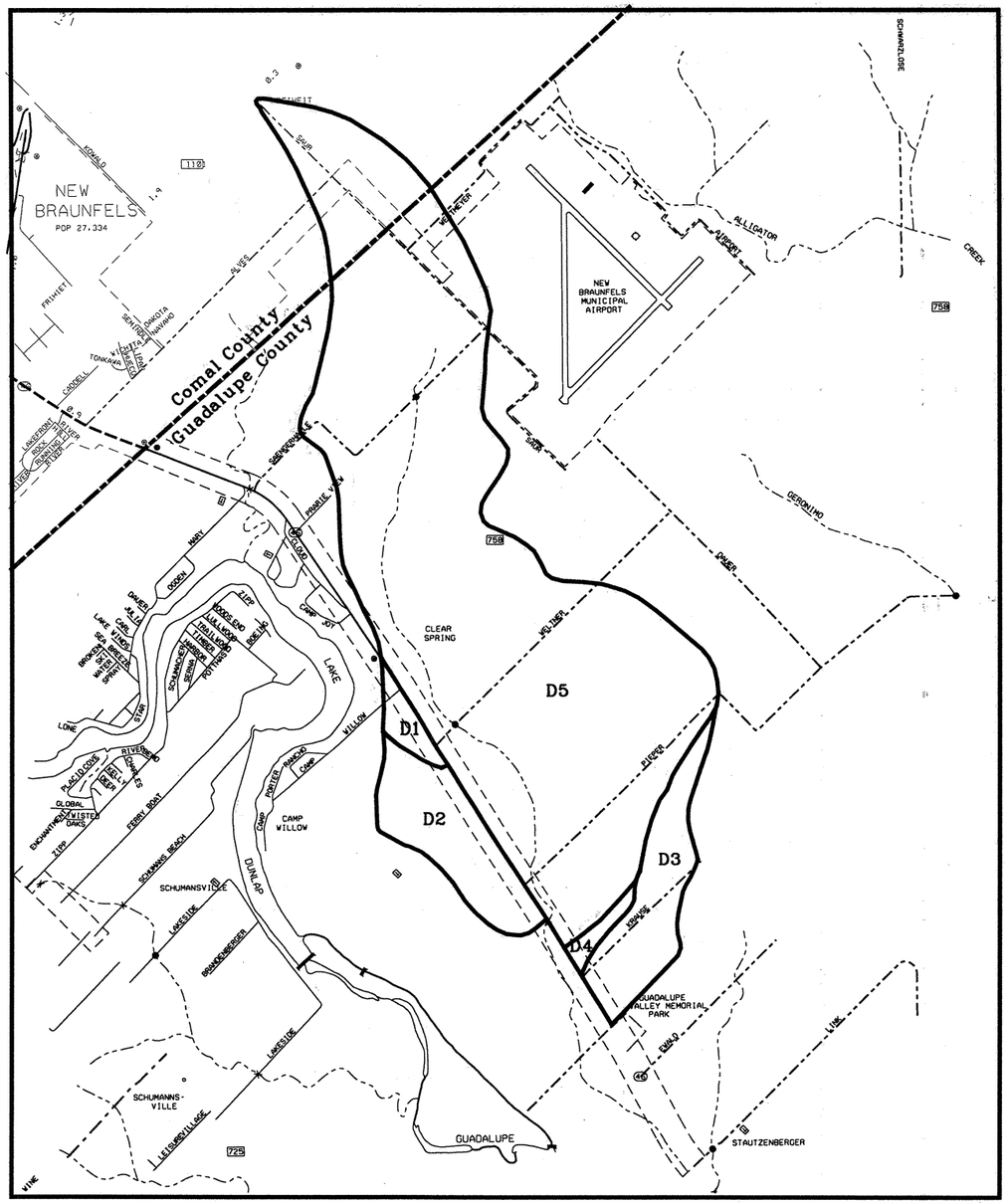
Scale : 1" = 100' Horz. 1" = 10 Vert.
Sheet 5 of 11

CIVIL ENGINEERING CONSULTANTS
DON DURDEN, INC.
11550 I.H. 10 WEST, SUITE 395
SAN ANTONIO, TEXAS 78230
TEL: (210) 641-9999
FAX: (210) 641-6440
EMAIL: cec@cectexas.com

© 1999 Texas Department of Transportation

FED.RD. DIV.NO.	FEDERAL AID PROJECT NO.		SHEET NO.
6	STP 99 (521) UM		58
STATE	DIST.	COUNTY	
TEXAS	SA	GUADALUPE	
CONT.	SECT.	JOB	HIGHWAY NO.
0216	02	028	SH 46

...\dgn\178505\street\pp_05.dgn Jun. 15, 1999 16:36:39



PRELIMINARY RUNOFF CALCULATIONS

SH 46 From 0.2mi South of New Braunfels City Limit to 2.2mi South of New Braunfels City Limits

CSJ : 0216-02-028

MASTER DRAINAGE AREA RUNOFF CALCULATIONS

Rational Method*

Drainage Area	Total Area (Acres)	C	CA	Tc (min.)	Intensity (10 yr) (in/hr)	Q (10 yr) (cfs)	Intensity (25 yr) (in/hr)	Q (25yr) (cfs)	Intensity (100 yr) (in/hr)	Q (100yr) (cfs)	Remarks
D1	42.0	0.5	21.0	116.7	1.87	39.2	2.21	46.4	2.75	57.7	Area Contributing to Str. No. 4
D4	23.9	0.5	11.9	52.1	3.27	39.0	3.85	46.0	4.76	56.8	Area Contributing to Str. No. 2 (North of Krause St.)

Region 5 Regression Equations

Drainage Area	Total Area (mi2)	Slope (ft/mi)	Q (10yr) 624A^.820 (cfs)	Q (25yr) 997A^.866 (cfs)	Q (100yr) 295A^1.01SL^.405 (cfs)	Remarks
D2	0.4	49.4	288.9	442.1	554.5	Area Contributing to Structure under Center St.
D3	0.3	37.6	250.2	379.7	415.7	Area Contributing to Str. No. 1
D5	2.3	20.3	1216.0	2016.9	2271.1	Area Flows to Structure No. 3

*USING GUADALUPE COUNTY VALUES FOR CALCUALTIONS

DRAINAGE AREAS D1 AND D5 WERE USED IN THE CALCULATION OF THE FLOW THROUGH THE BRIDGE CLASS STRUCTURE NO. 3

D1 + D5 = 2.321 mi2
REGION 5 REGRESSION Q25 = 2067.10cfs
REGION 5 REGRESSION Q100 = 2337.20cfs

DRAINAGE AREAS D1, D2 AND D5 WERE USED IN THE CALCULATION OF THE FLOW CONTRIBUTING TO THE TAILWATER ANALYSIS AT THE OUTLET OF THE BRIDGE CLASS STRUCTURE.

D1 + D2 + D5 = 2.712 mi2
REGION 5 REGRESSION Q25 = 2356.4cfs
REGION 5 REGRESSION Q100 = 2722.90cfs

STATE OF TEXAS
Karla M. Nash
73040
REGISTERED PROFESSIONAL ENGINEER

Karla M. Nash, P.E.

The seal appearing on this document was authorized by Karla M. Nash, P.E. 73040 on 4/23/99

STATE HIGHWAY 46
DRAINAGE AREA MAP

Not to Scale
Sheet 1 of 1

CEC
CIVIL ENGINEERING CONSULTANTS
DON DURDEN, INC.
11550 I.H. 10 WEST, SUITE 395
SAN ANTONIO, TEXAS 78230
TEL: (210) 641-9999
FAX: (210) 641-6440
EMAIL: cec@cectexas.com

© 1999 Texas Department of Transportation

FED.RD. DIV.NO.	FEDERAL AID PROJECT NO.		SHEET NO.
6	STP 99 (521) UM		95
STATE	DIST.	COUNTY	
TEXAS	SA	GUADALUPE	
CONT.	SECT.	JOB	HIGHWAY NO.
0216	02	028	SH 46

HYDRAULIC DATA SHEET FOR BRIDGE CLASS STRUCTURES
(PIPES, PIPE ARCHES & BOX CULVERTS)

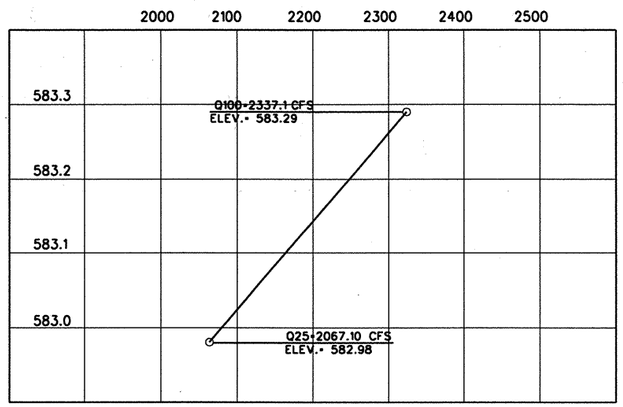
LOCATION STA. 295+90 EXIST STR 6-6'x6'MBC x 54ft DES ADT: 17,600 (2020)

FREQUENCY	25 YR	100 YR
METHOD USED TO DETERMINE Q	REGION 5 REGRESSION EQUATION	
DRAINAGE AREA (sq. mi.)	2.321	2.321
DRAINAGE AREA SLOPE (10% and 85% - ft/mi)	20.3 ft/mi	20.3 ft/mi
Q	2067.10 CFS	2337.20 CFS
CHANNEL SLOPE	0.0021 ft/ft	0.0021 ft/ft
ALLOW HW (ELEV. AT SITE)	581.10 ft	581.10 ft
CALC. TW (ELEV. AT SITE)	582.98 ft	583.29 ft
CALC. HW OR BACKWATER (ELEV. AT SITE)	583.75 ft	584.09 ft
VEL THRU STR OR VEL OUT	5.71 ft/s	5.87 ft/s
VEL THRU NATURAL GROUND	5.48 ft/s	5.81 ft/s
MAX ALLOW VEL OUT	ft/s	ft/s
AREA BELOW DESIGN HW UNDER SPAN BR	NA sq. mi.	NA sq. mi.

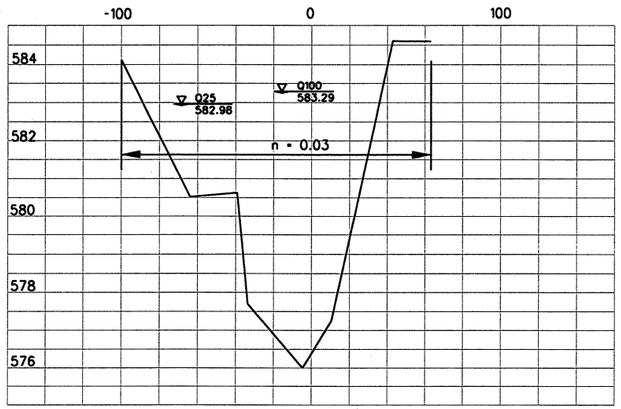
REMARKS: HEC-RAS TW DETERMINATION, THYSYS CULVERT CALCULATIONS.
BRIDGE CULVERT STR. 3 LOCATION DOES NOT COINCIDE WITH ROADWAY LOW POINT. FLOW EXCEEDING ALLOWABLE HEADWATER FLOWS TO MINOR CULVERT STRUCTURES 1 AND 2 PRIOR TO OVERTOPPING THE ROAD. ROADWAY LOW POINT COINCIDES WITH STR. NO. 1. FLOW FROM DRAINAGE AREA NO. D3 CONTRIBUTING TO STR. NO. 1 WAS CONSIDERED IN CALCULATION OF FLOW DEPTH/WIDTH OVER ROAD.

EFFECTS OF Q 100 — OTHER Q 100 COMMENTS:

DEPTH OF OVERFLOW OF ROAD: 0.64 FT
WIDTH OF OVERFLOW OF ROAD: 765.46 FT
Q OVER ROAD: 25.36 % 0.78% OF OVERFLOW GOES THRU MINOR CULVERT STR. NO. 2
Q THRU STRUCTURE: 73.86 %



ELEVATION VS. DISCHARGE CURVE
LOCATION: 100FT DOWNSTREAM



NATURAL STREAM CROSS-SECTION WITH "n" VALUES
LOCATION: 100FT DOWNSTREAM

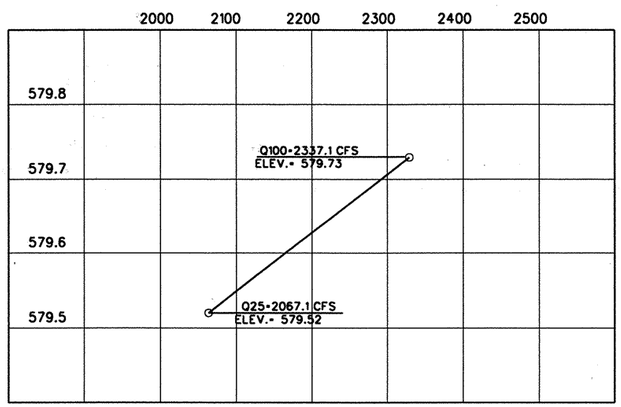
LOCATION STA. 294+50.00 PROP STR 11-6'x6'x113.5' MBC DES ADT: 17,600 (2020)

FREQUENCY	25 YR	100 YR
METHOD USED TO DETERMINE Q	REGION 5 REGRESSION EQUATION	
DRAINAGE AREA (sq. mi.)	2.321	2.321
DRAINAGE AREA SLOPE (10% and 85% - ft/mi)	20.3 ft/mi	20.3 ft/mi
Q	2067.10 CFS	2337.20 CFS
CHANNEL SLOPE ( )	0.0015 ft/ft	0.0015 ft/ft
ALLOW HW (ELEV. AT SITE)	582.30 ft	582.30 ft
CALC. TW (ELEV. AT SITE)	579.52 ft	579.73 ft
CALC. HW OR BACKWATER (ELEV. AT SITE)	581.98 ft	582.42 ft
VEL THRU STR OR VEL OUT	9.59 ft/s	10.17 ft/s
VEL THRU NATURAL GROUND	5.21 ft/s	5.66 ft/s
MAX ALLOW VEL OUT	ft/s	ft/s
AREA BELOW DESIGN HW UNDER SPAN BR	NA sq. mi.	NA sq. mi.

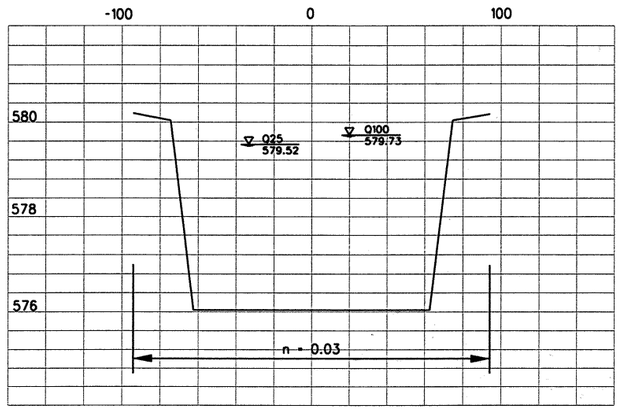
REMARKS: HEC-RAS TW DETERMINATION, THYSYS CULVERT CALCULATIONS.
BRIDGE CULVERT STR. 3 LOCATION DOES NOT COINCIDE WITH ROADWAY LOW POINT. FLOW EXCEEDING ALLOWABLE HEADWATER FLOWS TO MINOR CULVERT STRUCTURES 1 AND 2 PRIOR TO OVERTOPPING THE ROAD. ROADWAY LOW POINT COINCIDES WITH STR. NO. 1. FLOW FROM DRAINAGE AREA NO. D3 CONTRIBUTING TO STR. NO. 1 WAS CONSIDERED IN CALCULATION OF FLOW DEPTH/WIDTH OVER ROAD.

EFFECTS OF Q 100 — OTHER Q 100 COMMENTS:

DEPTH OF OVERFLOW OF ROAD: 0.57 FT
WIDTH OF OVERFLOW OF ROAD: 459.39 FT
Q OVER ROAD: 2.60 % 0.78% OF OVERFLOW GOES THRU MINOR CULVERT STR. NO. 2
Q THRU STRUCTURE: 96.62 %



ELEVATION VS. DISCHARGE CURVE
LOCATION: 140FT DOWNSTREAM



PROPOSED CHANNEL CROSS-SECTION WITH "n" VALUES
LOCATION: 140FT DOWNSTREAM

STATE OF TEXAS
Karla M. Nash
73040
REGISTERED PROFESSIONAL ENGINEER

Karla M. Nash, P.E.

The seal appearing on this document was authorized by Karla M. Nash, P.E. 73040 on 4/23/99.

STATE HIGHWAY 46
HYDRAULIC DATA SHEET

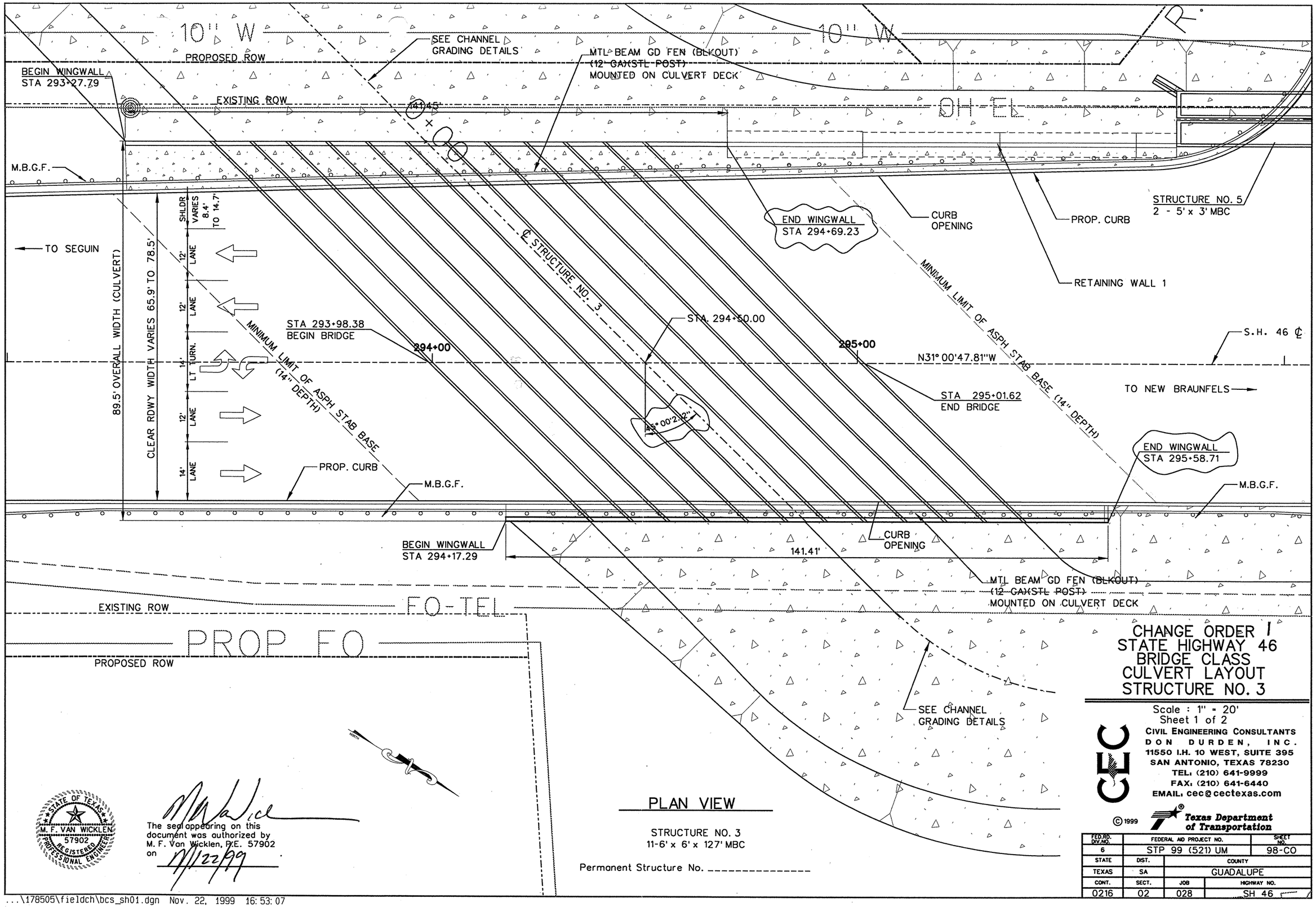
Not to Scale
Sheet 1 of 1

CIVIL ENGINEERING CONSULTANTS
DON DURDEN, INC.
11550 I.H. 10 WEST, SUITE 395
SAN ANTONIO, TEXAS 78230
TEL: (210) 641-9999
FAX: (210) 641-6440
EMAIL: cec@cectexas.com

© 1999

Texas Department of Transportation

FED.RD. DIV.NO.	FEDERAL AID PROJECT NO.		SHEET NO.
6	STP 99 (521) UM		9Lo
STATE	DIST.	COUNTY	
TEXAS	SA	GUADALUPE	
CONT.	SECT.	JOB	HIGHWAY NO.
0216	02	028	SH 46



STATE OF TEXAS
M. F. VAN WICKLEN
57902
REGISTERED
PROFESSIONAL ENGINEER

The seal appearing on this document was authorized by M. F. Van Wicklen, P.E. 57902 on 11/22/99.

PLAN VIEW

STRUCTURE NO. 3
11-6' x 6' x 127' MBC

Permanent Structure No. _____

CHANGE ORDER 1
STATE HIGHWAY 46
BRIDGE CLASS CULVERT LAYOUT
STRUCTURE NO. 3

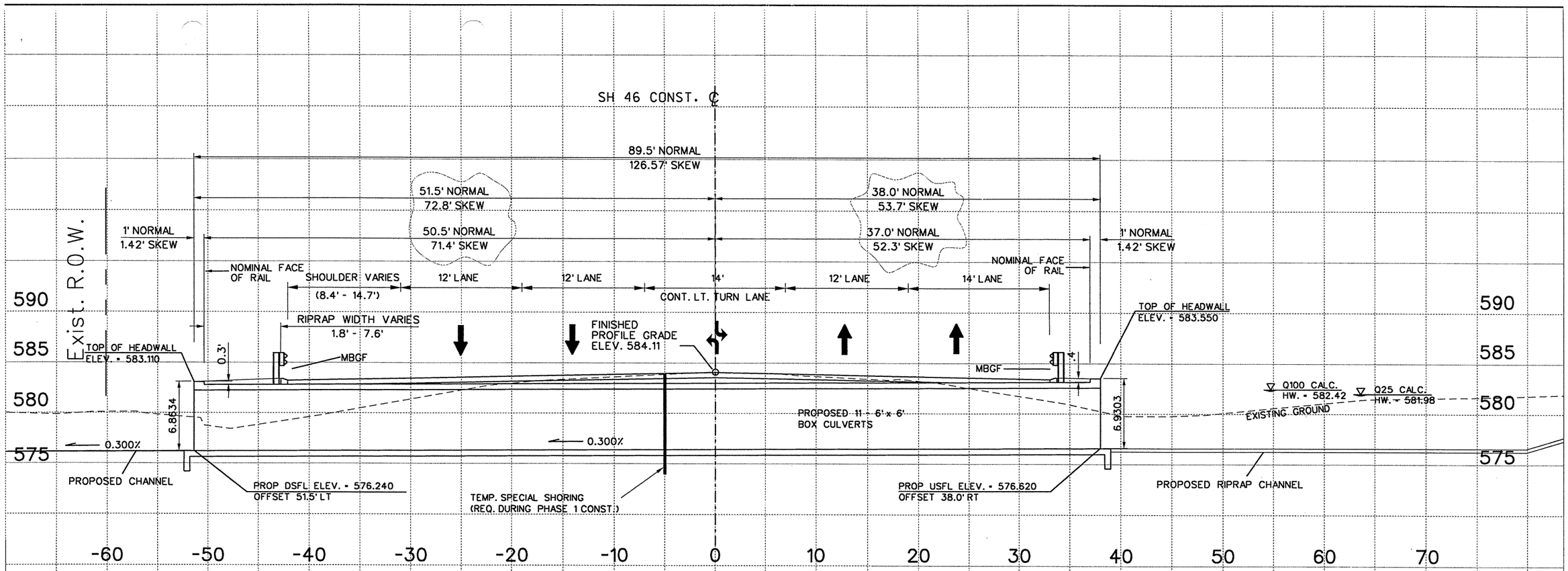
Scale : 1" = 20'
Sheet 1 of 2

CIVIL ENGINEERING CONSULTANTS
DON DURDEN, INC.
11550 I.H. 10 WEST, SUITE 395
SAN ANTONIO, TEXAS 78230
TEL: (210) 641-9999
FAX: (210) 641-6440
EMAIL: cec@cectexas.com

© 1999 Texas Department of Transportation

FED.RD. DIV.NO.	FEDERAL AID PROJECT NO.		SHEET NO.
6	STP 99 (521) UM		98-CO
STATE	DIST.	COUNTY	
TEXAS	SA	GUADALUPE	
CONT.	SECT.	JOB	HIGHWAY NO.
0216	02	028	SH 46

...\178505\fieldch\bcs_sh01.dgn Nov. 22, 1999 16:53:07



STR. NO. 3
STA. 293+98.38 TO STA 295+01.62
PROPOSED 11 - 6' x 6' x 126.57' MBC
(45° RT. FWD SKEW) USING MC6 - 1 (MC - 45°),
WITH MCW-P-45° UPSTRM AND DWNSTRM

Permanent Structure No. _____

ITEM	UNIT	PLAN
TRENCH EXCAV PROTECTION	LF	67
CONC BOX CULV (6FT x 6 FT)	LF	1392.27
WINGWALL (PW-6)(H=6FT)	EA	2
TEMPORARY SPECIAL SHORING	SF	1100
STRUCT EXCAV*	CY	1529

*FOR CONTRACTORS INFORMATION ONLY

NOTE: THE FULL PROPOSED PAVEMENT DEPTH WILL NOT BE ACHIEVED OVER THE ENTIRE CULVERT. IN ORDER TO ACHIEVE THE DESIRED ROADWAY CROSS SLOPES, THE CONTRACTOR SHALL LAY ASPHALT STABILIZED BASE OF VARIABLE THICKNESS, INSTEAD OF FLEXIBLE BASE. THE LIMIT OF THE ASB SHALL NOT BE LESS THAN 25' FROM BEGININING TO END OF STRUCTURE.

STATE OF TEXAS
M. F. VAN WICKLEN
57902
REGISTERED PROFESSIONAL ENGINEER

The seal appearing on this document was authorized by M. F. Van Wicklen, P.E. 57902 on 11/22/99.

CHANGE ORDER 1

STATE HIGHWAY 46
BRIDGE CLASS
CULVERT LAYOUT
STRUCTURE NO. 3

Scale : 1" = 10' Horz. 1" = 10' Vert.
Sheet 2 of 2

CIVIL ENGINEERING CONSULTANTS
DON DURDEN, INC.
11550 I.H. 10 WEST, SUITE 395
SAN ANTONIO, TEXAS 78230
TEL: (210) 641-9999
FAX: (210) 641-6440
EMAIL: cec@cectexas.com

© 1999

Texas Department of Transportation

FED.RD. DIV.NO.	FEDERAL AID PROJECT NO.		SHEET NO.
6	STP 99 (521) UM		99-CO
STATE	DIST.	COUNTY	
TEXAS	SA	GUADALUPE	
CONT.	SECT.	JOB	HIGHWAY NO.
0216	02	028	SH 46

...\178505\fieldch\bcs_sh02.dgn Nov. 22, 1999 16:53:18

Attachment H

Parkside Phase 1 Construction Documents and Drainage Report