

**PRELIMINARY DRAINAGE STUDY
FOR
Waxwing Drive Subdivision**

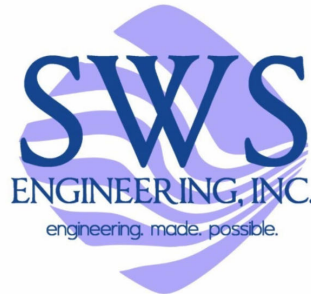
**552 W Bobier Drive
Vista, CA 92083**

APN: 161-030-07

Prepared for:

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I HEREBY DECLARE THAT I AM THE ENGINEER OF WORK FOR THIS PROJECT, THAT I HAVE EXERCISED RESPONSIBLE CHARGE OVER THE DESIGN OF THE PROJECT AS DEFINED IN SECTION 6703 OF THE BUSINESS AND PROFESSIONAL CODE, AND THAT THE DESIGN IS CONSISTENT WITH CURRENT STANDARDS.

I UNDERSTAND THAT THE CHECK OF PROJECT DRAWINGS AND SPECIFICATIONS BY THE COUNTY OF SAN DIEGO IS CONFINED TO A REVIEW ONLY AND DOES NOT RELIEVE ME, AS ENGINEER OF WORK, OF MY RESPONSIBILITIES FOR THE PROJECT DESIGN.

Prepared by: _____ **Date:** _____

Michael D. Schweitzer RCE# 59658 Exp. 12-31-25

Date	Comments
4/23/2024	1st
11/04/2024	2nd
1/08/2025	3rd
3/17/2025	4th
4/17/2025	5th

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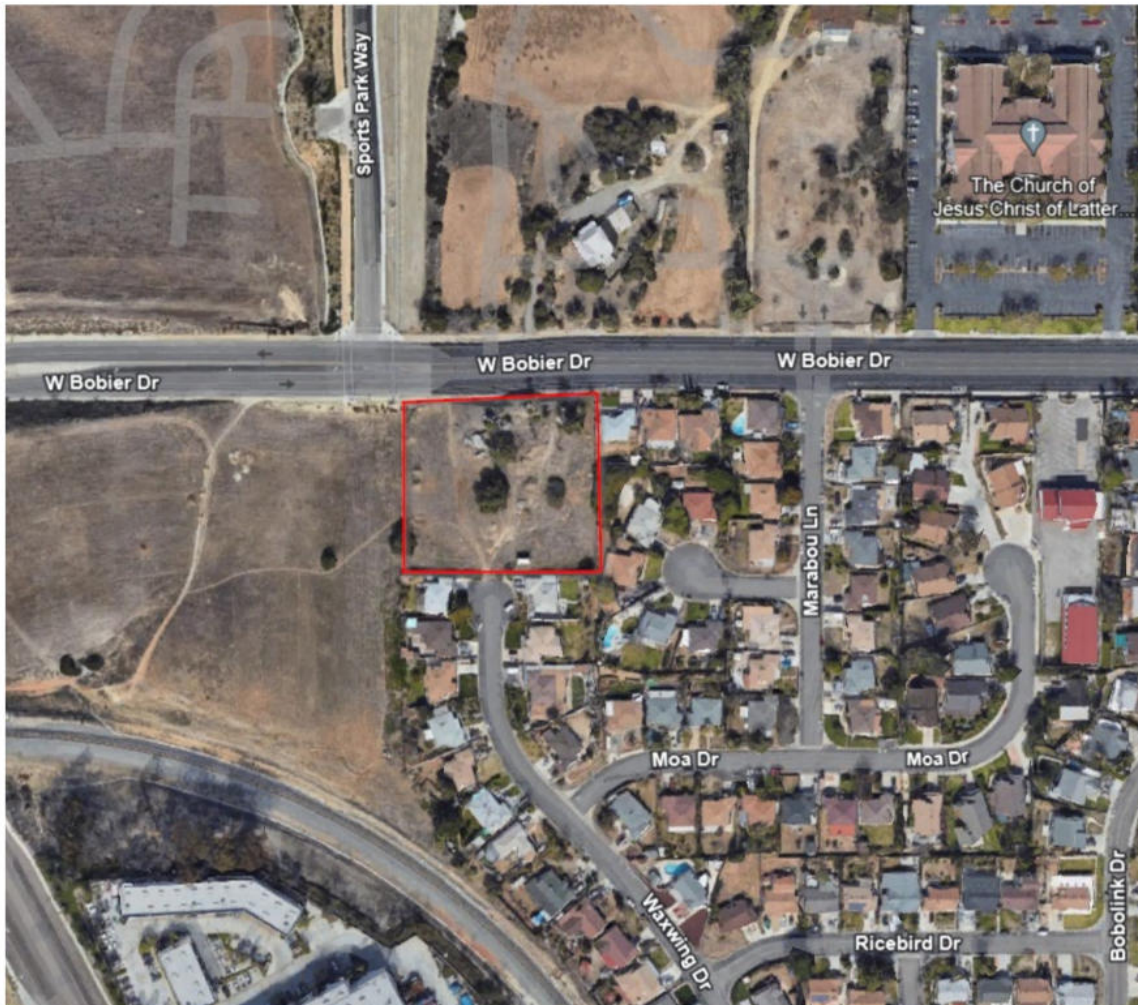
EXHIBITS

Exhibit “A” – Pre-Development Hydrology Map

Exhibit “B” – Post-Development Hydrology Map

1.0 PROJECT DESCRIPTION

The proposed project site consists of 15 townhomes (two-story structure) with associated driveway, private street, utilities, and other associated improvements and treatment basins. The project site is one parcel with a total area of 1.67 ac that is located south of West Bobier Drive and at the north end of the current extent of Waxwing Drive in the City of Vista, California. The site is located on R-1-B (7.5) Single-Family Residential zone. It is an exciting improvement to be demolished. The proposed land use for this project is MDR (Medium Density Residential).



2.0 PURPOSE

The purpose of this study is to determine the peak runoff rates and velocities for the pre-development and post-development conditions. Comparisons will be made between each condition to determine the extent of the effects of the proposed improvements on site drainage and adjacent properties. The adequacy of proposed conveyance facilities (riser structures for 100-yr flow and available freeboard of equal or greater than 6") will also be determined. Refer to section 5 (conclusion) for more detail and attenuation analysis in appendix D.

3.0 METHODOLOGY

The Rational Method as outlined in the San Diego County Hydrology Manual, dated June 2003, was used to determine the runoff flow rate. The 100-year frequency storm event was analyzed to determine peak runoff rates discharging the site for both the existing and post-development condition.

Soil type was determined to be type D from the Soil Hydrologic Groups map, NRCS Web Soil Survey (see Appendix A). Per the Web Soil Survey, the site has Bonsall sandy loam and Diablo clay, with slopes ranging from 2-15 percent. The runoff coefficient “C” was determined by using the closes matching land use category in Table 3-1 (Appendix A). The exhibits have been prepared for the pre-development and post-development conditions and are attached as Exhibits “A” and “B”.

Runoff coefficients, “C” are summarized below.

- Pre-Development
 - Undisturbed Natural Terrain C = 0.35 (soil type D)
- Post-Development
 - From the table 3-1, the nearest weighted C coefficient was selected per %impervious area for each basin and sub-basin. Due to site limited available space, 100 sf future impervious contingency has been accounted for each lot.

Basin	Area	Impervious Area (ac)	% IMP	HSG	Weighted C*
1	0.14	0.03	21.1	D	0.47
2	0.09	0.019	20.2	D	0.46
3	0.11	0.065	57.1	D	0.66
4.1	0.038	0.00	0.00	D	0.35
4.2	0.022	0.00	0.00	D	0.35
4.3	0.028	0.00	0.00	D	0.35
5	0.26	0.22	84.3	D	0.81
6	0.17	0.059	35.6	D	0.55
7	0.78	0.54	70.0	D	0.73
8	0.03	0.00	0.00	D	0.35

* weighted C factor $[(0.9 \times \text{impervious A}) + (0.35 \text{ pervious A})]/\text{Total Area}$

4.0 HYDROLOGY

4.1 Pre-Development Conditions

The project is situated on one parcel of total area 1.67 ac undeveloped land. The site had an existing structure that has been demolished around 2008-2009 with no new development. The site slopes range from 2-25%. Runoff from Basin 1 of the project site will surface flow from the undisturbed natural terrain north onto West Bobier Drive, where it enters the existing storm drain system located on the west of the high point on Bobier that drains to Guajome Lake and ultimately into San Luis Rey River. Basin 2 also drains into W Bobier Drive where it also enters into existing storm drain systems located on Moa Dr (east of Marabou Ln) and ultimately

discharges into Buena Vista Creek. Runoff from basins (3-5) sheet flow along natural terrain in the southeasterly direction (not concentrated) towards the existing residential development on Waxwing Drive and Mynah Place which then discharge into existing storm drain systems located on Moa Dr (east of Marabou Ln) and ultimately into Buena Vista Creek. (See attached exhibit for the confluence point).

Runoff from Basin 6 surface flows along the natural terrain that discharges offsite (adjacent property) in the southwesterly direction into existing concrete lined channel along the southern portion of the adjacent property then into public storm drain system and ultimately into Loma Alta Creek and finally into Pacific Ocean.

Majority of the site runoffs discharge into Loma Alta Creek and smaller area into Buena Vista Creek and ultimately into the Pacific Ocean. The small area draining toward Guajome Lake will be routed toward Buena Vista Creek in post condition.

The development of the site will not have any negative impact to the adjacent properties on the east, west and south as the development of the site will reduce the site runoff below the existing condition by constructing multiple basins to detain any excess water onsite. Also, much of the existing runoff to the east toward adjacent properties will be routed to the southwest in post condition. Rip rap will be added at the discharge point of each basin and POC points to reduce the runoff velocity of the discharge. The discharge points of the site will also be reduced.

There is no offsite run on in the existing condition. The improvement of the adjacent property on the west won't have any negative impact to our site as there is slope along site the project site drains away from our site and therefore there won't be any offsite draining to our project site.

A pre-development hydrology map delineating basin areas, flow paths, and concentration points has been prepared and is attached to this report as Exhibit "A". Pre-development hydrology calculations can be found in Appendix "B)

4.2 Post-Development Conditions

The proposed site is undeveloped land that consists of 15 townhomes (two-story structure) with associated driveway, private street, utilities, and other associated improvements and treatment basins. The project site is one parcel with a total area of 1.67 ac that is located south of West Bobier Drive, and on the north end of the existing Waxwing Drive within the City of Vista, California.

The proposed site drainage from Basins 1 and 3 will surface flow via proposed site roofs, hardscape, and curb-gutter into a proposed treatment basins located in the north and northeast portion of the site prior to discharging into W Bobier Drive east of high point. Basin 2 that has small improvement will also surface flow in northerly direction into W Bobier Drive east of high point. Basins (4.1, 4.2, 4.3) which are landscape area will sheet flow offsite in the easterly direction as it does in the existing condition with very minor runoffs less/equal than 0.1 cfs. All the runoff from basins (1-4) ultimately discharge into existing storm drain systems located on Moa Dr (east of Marabou Ln) similar to the existing condition prior to discharging in Buena Vista Creek.

Basin 5 will sheet flow in the easterly direction into proposed treatment basin and then routed offsite via proposed storm drain system into southwest corner of the site. Basins 6 and 7 will discharge via curb gutter and catch basins into proposed treatment basins located on the west

north and south side of the project site prior to discharging toward southwest offsite corner of the site via proposed storm drain systems. All the discharge runoff from basins (5-8) will discharge into existing lined channel along southern portion of the adjacent property on the west via concrete ditch that is built along eastside of the adjacent property (after the adjacent property development is completed). Basin 8 is a small landscape area that will sheet flow offsite on the westerly direction.

Majority of the site 1.24 ac (basins 5-8) runoffs will discharge into Loma Alta Creek and smaller area on the east portion of the site 0.43 ac (basins 1-4) into Buena Vista Creek via sheet flow and existing public storm drain systems and ultimately discharge into the Pacific Ocean.

The discharging runoff from basins 1-3 into W Babier Drive, will confluence with the runoff from basins (4.1, 4.2, 4.3) at Mynah Pl and Marabou Ln which ultimately discharge in an existing storm drain systems located on Moa Dr (east of Marabou Ln).

The proposed project site will have an increase in flow compared to the existing condition due to the coefficient C, diversion and time of concentration. The excess Q will be detained by multiple proposed biofiltration basins to reduce the Q below the existing condition at the two POCs, one from basins (1-4) at the confluence point of Mynah Pl and Marabou Ln and the second at the southwest corner of the site from basins (5-8).

There is no offsite run-on in the post-condition. The improvement of the adjacent property on the west won't have any negative impact to our site as there is slope along site the project site drains away from our site and therefore there won't be any offsite draining to our project site. The development of our project site won't have any negative impact to the adjacent property since the excess runoff compared to existing condition will be detained onsite. The attenuated runoff will discharge into existing lined channel along the southern portion of the adjacent property via concrete ditch that is built along eastside of the adjacent property (after the property development is completed).

A post-development hydrology map delineating basin area, flow paths, concentration points, and proposed drainage facilities has been prepared and is attached to this report as Exhibit "B". Post-development hydrology calculations can be found in Appendix C.

4.3 FEMA NFIP

Per FEMA-NFIP Map (Panel 0757, Map Number 06073C-0757G), the project is located within Zone X (0.2% annual chance flood, 1% annual chance flood with average depth of less than 1 foot or with drainage areas less than 1 square mile, and areas protected by levees from 1% annual chance flood).

5.0 CONCLUSION

The proposed project will change the flow patterns from that of the pre-developed site, while maintaining the discharge points from the site. Development of the project site will increase the runoff compared to the pre-developed condition with the addition of imperviousness. Table 1 provides a summary of the pre-development areas and flows. Table 2 provides a summary of the post-development areas and flows before and after attenuation analysis. Table 3 provides the total Q comparison between the pre and post-development conditions.

Table 1 – Pre-Development Areas and Flows

	Basins	Node #	Area Pre (ac)	Pre Q100 (cfs)
Basin-100	100*	102	0.034	0.10
POC-1	200**	202	0.056	0.16
	300**	303	0.13	0.33
	400**	402	0.19	0.49
	500**	502	0.27	0.67
	Total	-	-	1.65
POC-2	600***	603	0.99	2.20
	Total	-	-	2.20
Basin 100 + POC-1 + POC-2	-	-	1.67	3.95

* Basin 100 drains into San Luis Rey River which will be routed to Buena Vista Creek in post condition (The Q not included at POC-1)

** **POC-1:** Q from basins (200-500) conferencing at Mynah PI and Marabou Ln = 0.16 + 0.33 + 0.49 + 0.67 = **1.65 cfs**

*** **POC-2:** Q from basin 600 = **2.2 cfs**

Table 2 – Post-Development Areas and Flows

	Basins	Node #	Area Post (ac)	Post Q100 (cfs)	Attenuated Q Before Confluence (cfs)	Attenuated Q @ POCs (cfs)
POC-1	100	104	0.14	0.54	0.31	
	200	202	0.09	0.35	0.35	
	300	304	0.11	0.57	0.31	
	400.1	402	0.038	0.11	0.11	
	400.2	404	0.022	0.06	0.06	
	400.3	406	0.028	0.08	0.08	
	Total	-	-	1.71	1.22	1.22*
POC-2	500	503	0.26	1.79	1.01	
	600	602	0.17	0.73	0.38	
	700	703	0.78	4.88	0.90	
	800	802	0.03	0.09	0.09	
	Total	-	-	6.22	-	2.2**
POC-1 + POC-2	-	-	1.67	7.93		3.42<3.95 (ex)

* **POC-1:** Attenuated Q from basins (100-400) confluence at Mynah PI and Marabou Ln = 0.31 + 0.35 + 0.31 + 0.11 + 0.06 + 0.08= 1.22 cfs (post) < 1.65 cfs (Ex)

** **POC-2:** Attenuated Q from basin 500-800 = 2.2 cfs (post) =< 2.2 cfs (Ex), See mitigated drainage analysis for confluence point at nodes 802-704

Table 3 – Increase in Q Between Pre and Post-Condition

Condition	Area (ac)	Total Q100 (cfs)
Pre-Development	1.67	3.95
Post Development	1.67	7.93
Increased Q ± (cfs)	-	+3.98
Attenuated Q	-	3.42
Results	-	3.42<3.95*

*Construction of onsite five biofiltration basins will reduce the site overall post Q below pre Q for 100-yr, reduction at the POC points (1 and 2) as well as satisfying the WQ and HMP requirements. There will be riser structure constructed on each basin to convey the 100-yr storm runoff offsite via proposed SD outlet in emergencies and failure. The provided freeboard in each basin is equal or greater than 6-inch. Multiple Tree-Wells will be proposed to treat the site frontage improvement area as well as the frontage half street in exchange to the basin 2 that won't be treated. Tree-Well will also help further reduction on discharge runoff flow into W Bobier Drive.

The development of the site will not have any negative impact to the adjacent properties on the east, west and south as the development of the site will reduce the site runoff below the existing condition by constructing multiple basins to detain any excess water onsite. Rip rap will be added at the discharge point of each basin to reduce the velocity of runoffs as well as the discharge point into offsite.

REFERENCES

CivilDesign Corporation. *San Diego County Rational Method*. (Software Version 7.7)

County of San Diego Department of Public Works Flood Control Section. *San Diego County Hydrology Manual*. (2003)

County of San Diego Department of Public Works Flood Control Section. *San Diego County Drainage Design Manual*. (2005)

APPENDIX A – REFERENCE CHARTS

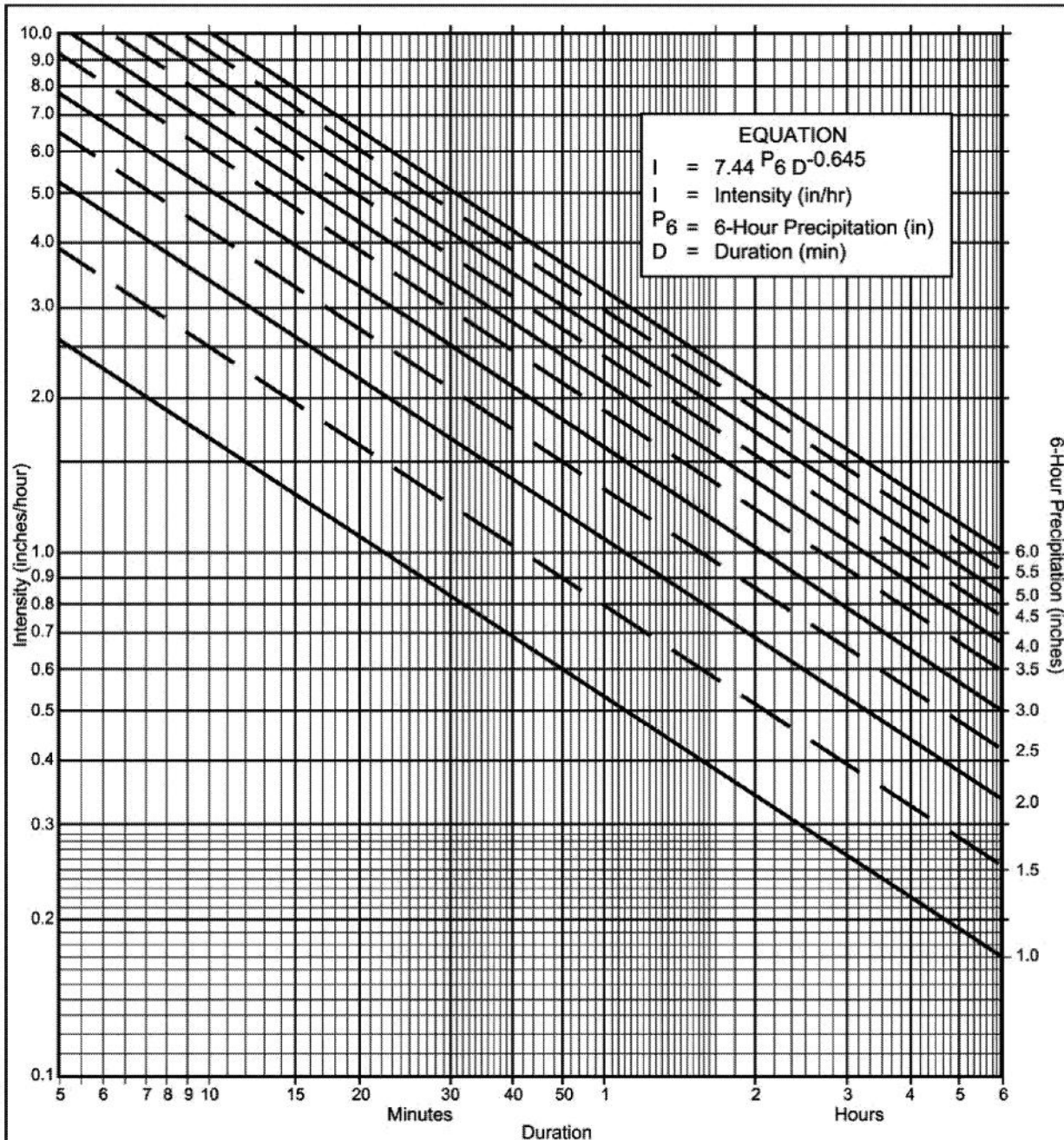
**Table 3-1
RUNOFF COEFFICIENTS FOR URBAN AREAS**

Land Use		Runoff Coefficient "C"				
NRCS Elements	County Elements	% IMPER.	Soil Type			
			A	B	C	D
Undisturbed Natural Terrain (Natural)	Permanent Open Space	0*	0.20	0.25	0.30	0.35
Low Density Residential (LDR)	Residential, 1.0 DU/A or less	10	0.27	0.32	0.36	0.41
Low Density Residential (LDR)	Residential, 2.0 DU/A or less	20	0.34	0.38	0.42	0.46
Low Density Residential (LDR)	Residential, 2.9 DU/A or less	25	0.38	0.41	0.45	0.49
Medium Density Residential (MDR)	Residential, 4.3 DU/A or less	30	0.41	0.45	0.48	0.52
Medium Density Residential (MDR)	Residential, 7.3 DU/A or less	40	0.48	0.51	0.54	0.57
Medium Density Residential (MDR)	Residential, 10.9 DU/A or less	45	0.52	0.54	0.57	0.60
Medium Density Residential (MDR)	Residential, 14.5 DU/A or less	50	0.55	0.58	0.60	0.63
High Density Residential (HDR)	Residential, 24.0 DU/A or less	65	0.66	0.67	0.69	0.71
High Density Residential (HDR)	Residential, 43.0 DU/A or less	80	0.76	0.77	0.78	0.79
Commercial/Industrial (N. Com)	Neighborhood Commercial	80	0.76	0.77	0.78	0.79
Commercial/Industrial (G. Com)	General Commercial	85	0.80	0.80	0.81	0.82
Commercial/Industrial (O.P. Com)	Office Professional/Commercial	90	0.83	0.84	0.84	0.85
Commercial/Industrial (Limited I.)	Limited Industrial	90	0.83	0.84	0.84	0.85
Commercial/Industrial (General I.)	General Industrial	95	0.87	0.87	0.87	0.87

*The values associated with 0% impervious may be used for direct calculation of the runoff coefficient as described in Section 3.1.2 (representing the pervious runoff coefficient, C_p , for the soil type), or for areas that will remain undisturbed in perpetuity. Justification must be given that the area will remain natural forever (e.g., the area is located in Cleveland National Forest).

DU/A = dwelling units per acre

NRCS = National Resources Conservation Service



Directions for Application:

- (1) From precipitation maps determine 6 hr and 24 hr amounts for the selected frequency. These maps are included in the County Hydrology Manual (10, 50, and 100 yr maps included in the Design and Procedure Manual).
- (2) Adjust 6 hr precipitation (if necessary) so that it is within the range of 45% to 65% of the 24 hr precipitation (not applicable to Desert).
- (3) Plot 6 hr precipitation on the right side of the chart.
- (4) Draw a line through the point parallel to the plotted lines.
- (5) This line is the intensity-duration curve for the location being analyzed.

Application Form:

- (a) Selected frequency 100 year
- (b) $P_6 = \underline{3.2}$ in., $P_{24} = \underline{5.6}$, $\frac{P_6}{P_{24}} = \underline{57.1} \%$ (2)
- (c) Adjusted $P_6^{(2)} = \underline{\hspace{1cm}}$ in.
- (d) $t_x = \underline{\hspace{1cm}}$ min.
- (e) $I = \underline{\hspace{1cm}}$ in./hr.

Note: This chart replaces the Intensity-Duration-Frequency curves used since 1965.

P6	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6
Duration	I	I	I	I	I	I	I	I	I	I	I
5	2.63	3.95	5.27	6.59	7.90	9.22	10.54	11.86	13.17	14.49	15.81
7	2.12	3.18	4.24	5.30	6.36	7.42	8.48	9.54	10.60	11.66	12.72
10	1.68	2.53	3.37	4.21	5.05	5.90	6.74	7.58	8.42	9.27	10.11
15	1.30	1.95	2.59	3.24	3.89	4.54	5.19	5.84	6.49	7.13	7.78
20	1.08	1.62	2.15	2.69	3.23	3.77	4.31	4.85	5.39	5.93	6.46
25	0.93	1.40	1.87	2.33	2.80	3.27	3.73	4.20	4.67	5.13	5.60
30	0.83	1.24	1.66	2.07	2.49	2.90	3.32	3.73	4.15	4.56	4.98
40	0.69	1.03	1.38	1.72	2.07	2.41	2.76	3.10	3.45	3.79	4.13
50	0.60	0.90	1.19	1.49	1.79	2.09	2.39	2.69	2.98	3.28	3.58
60	0.53	0.80	1.06	1.33	1.59	1.86	2.12	2.39	2.65	2.92	3.18
90	0.41	0.61	0.82	1.02	1.23	1.43	1.63	1.84	2.04	2.25	2.45
120	0.34	0.51	0.68	0.85	1.02	1.19	1.36	1.53	1.70	1.87	2.04
150	0.29	0.44	0.59	0.73	0.88	1.03	1.18	1.32	1.47	1.62	1.76
180	0.26	0.39	0.52	0.65	0.78	0.91	1.04	1.18	1.31	1.44	1.57
240	0.22	0.33	0.43	0.54	0.65	0.76	0.87	0.98	1.08	1.19	1.30
300	0.19	0.28	0.38	0.47	0.56	0.66	0.75	0.85	0.94	1.03	1.13
360	0.17	0.25	0.33	0.42	0.50	0.58	0.67	0.75	0.84	0.92	1.00

Intensity-Duration Design Chart - Template

FIGURE

3-1

Hydrologic Soil Group—San Diego County Area, California



MAP LEGEND

Area of Interest (AOI)

 Area of Interest (AOI)

Soils

Soil Rating Polygons

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

Soil Rating Lines

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

Soil Rating Points

 A
 A/D
 B
 B/D

 C
 C/D
 D
 Not rated or not available

Water Features

 Streams and Canals

Transportation

 Rails
 Interstate Highways
 US Routes
 Major Roads
 Local Roads

Background

 Aerial Photography

MAP INFORMATION

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

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

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

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

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

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

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

Soil Survey Area: San Diego County Area, California
 Survey Area Data: Version 19, Aug 30, 2023

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

Date(s) aerial images were photographed: Mar 14, 2022—Mar 17, 2022

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

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
hb8n	Bonsall sandy loam, 9 to 15 percent slopes, eroded	D	0.0	0.0%
hbb8	Diablo clay, 2 to 9 percent slopes	D	1.7	100.0%
Totals for Area of Interest			1.7	100.0%

Description

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

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

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

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

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

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

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

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

County of San Diego Hydrology Manual



Rainfall Isopluvials

100 Year Rainfall Event - 6 Hours

----- Isopluvial (inches)

DPW
GIS
Department of Public Works
Geographic Information Services

SanGIS
We Have San Diego Covered!

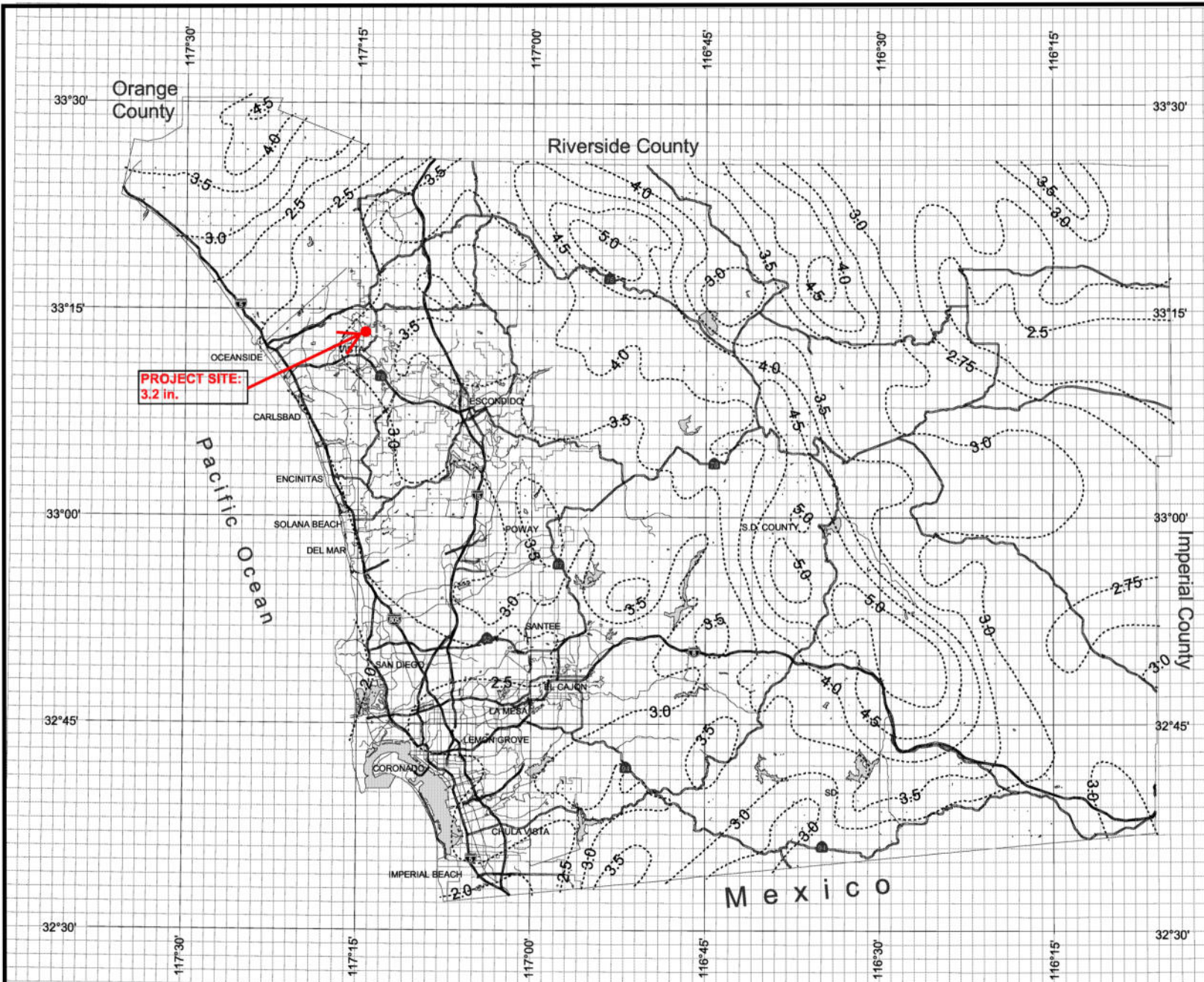


3 0 3 Miles

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County of San Diego Hydrology Manual



Rainfall Isopluvials

100 Year Rainfall Event - 24 Hours

----- Isopluvial (inches)

**DPW
GIS**
Department of Public Works
Geographic Information Services

SanGIS
We Have San Diego Covered!

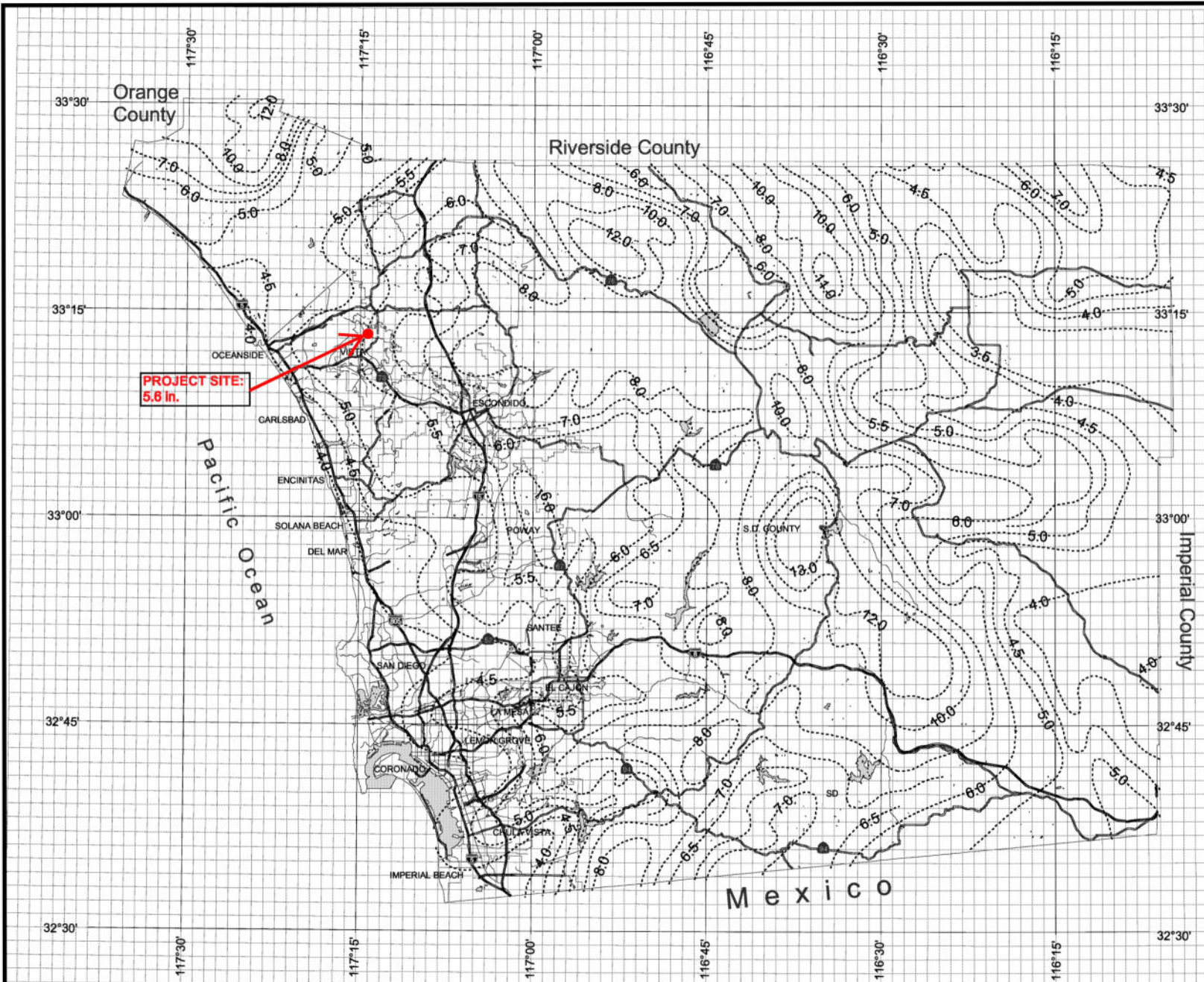


3 0 3 Miles

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APPENDIX B –
PRE-DEVELOPMENT
HYDROLOGY CALCULATIONS

San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software, (c)1991-2006 Version 7.7

Rational method hydrology program based on
San Diego County Flood Control Division 2003 hydrology manual
Rational Hydrology Study Date: 02/24/25

23-299 Pre Development Condition
100-Year Pre Development
Basin 100-600
Onsite Area

***** Hydrology Study Control Information *****

Program License Serial Number 6144

Rational hydrology study storm event year is 100.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour, precipitation(inches) = 3.200
24 hour precipitation(inches) = 5.600
P6/P24 = 57.1%
San Diego hydrology manual 'C' values used

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Process from Point/Station 101.000 to Point/Station
102.000
**** INITIAL AREA EVALUATION ****

Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[UNDISTURBED NATURAL TERRAIN]
(Permanent Open Space)
Impervious value, Ai = 0.000
Sub-Area C Value = 0.350
Initial subarea total flow distance = 35.000 (Ft.)
Highest elevation = 464.880 (Ft.)
Lowest elevation = 459.000 (Ft.)

Elevation difference = 5.880(Ft.) Slope = 16.800 %
 Top of Initial Area Slope adjusted by User to 30.000 %
 INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
 The maximum overland flow distance is 100.00 (Ft)
 for the top area slope value of 30.00 %, in a development type of
 Permanent Open Space
 In Accordance With Figure 3-3
 Initial Area Time of Concentration = 4.34 minutes
 $TC = [1.8 * (1.1 - C) * \text{distance}(\text{Ft.})^{.5} / (\% \text{ slope}^{(1/3)})]$
 $TC = [1.8 * (1.1 - 0.3500) * (100.000^{.5}) / (30.000^{(1/3)})] = 4.34$
 Calculated TC of 4.345 minutes is less than 5 minutes,
 resetting TC to 5.0 minutes for rainfall intensity calculations
 Rainfall intensity (I) = 8.431(In/Hr) for a 100.0 year storm
 Effective runoff coefficient used for area (Q=KCIA) is C = 0.350
 Subarea runoff = 0.027(CFS)
 Total initial stream area = 0.009(Ac.)

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 Process from Point/Station 201.000 to Point/Station
 202.000
 **** INITIAL AREA EVALUATION ****

Decimal fraction soil group A = 0.000
 Decimal fraction soil group B = 0.000
 Decimal fraction soil group C = 0.000
 Decimal fraction soil group D = 1.000
 [MEDIUM DENSITY RESIDENTIAL]
 (4.3 DU/A or Less)
 Impervious value, Ai = 0.300
 Sub-Area C Value = 0.520
 Initial subarea total flow distance = 71.000(Ft.)
 Highest elevation = 468.000(Ft.)
 Lowest elevation = 458.170(Ft.)
 Elevation difference = 9.830(Ft.) Slope = 13.845 %
 Top of Initial Area Slope adjusted by User to 25.000 %
 INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
 The maximum overland flow distance is 100.00 (Ft)
 for the top area slope value of 25.00 %, in a development type of
 4.3 DU/A or Less
 In Accordance With Figure 3-3
 Initial Area Time of Concentration = 3.57 minutes
 $TC = [1.8 * (1.1 - C) * \text{distance}(\text{Ft.})^{.5} / (\% \text{ slope}^{(1/3)})]$
 $TC = [1.8 * (1.1 - 0.5200) * (100.000^{.5}) / (25.000^{(1/3)})] = 3.57$
 Calculated TC of 3.570 minutes is less than 5 minutes,
 resetting TC to 5.0 minutes for rainfall intensity calculations
 Rainfall intensity (I) = 8.431(In/Hr) for a 100.0 year storm
 Effective runoff coefficient used for area (Q=KCIA) is C = 0.520
 Subarea runoff = 0.614(CFS)
 Total initial stream area = 0.140(Ac.)

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Process from Point/Station      301.000 to Point/Station
302.000
**** INITIAL AREA EVALUATION ****
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Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[MEDIUM DENSITY RESIDENTIAL          ]
(4.3 DU/A or Less          )
Impervious value, Ai = 0.300
Sub-Area C Value = 0.520
Initial subarea total flow distance = 92.000(Ft.)
Highest elevation = 467.640(Ft.)
Lowest elevation = 457.430(Ft.)
Elevation difference = 10.210(Ft.) Slope = 11.098 %
Top of Initial Area Slope adjusted by User to 11.000 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of 11.00 %, in a development type of
4.3 DU/A or Less
In Accordance With Figure 3-3
Initial Area Time of Concentration = 4.69 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5]/(% slope^(1/3)]
TC = [1.8*(1.1-0.5200)*(100.000^.5)/(11.000^(1/3))]= 4.69
Calculated TC of 4.694 minutes is less than 5 minutes,
resetting TC to 5.0 minutes for rainfall intensity calculations
Rainfall intensity (I) = 8.431(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.520
Subarea runoff = 0.395(CFS)
Total initial stream area = 0.090(Ac.)
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Process from Point/Station      401.000 to Point/Station
402.000
**** INITIAL AREA EVALUATION ****
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Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[MEDIUM DENSITY RESIDENTIAL          ]
(7.3 DU/A or Less          )
Impervious value, Ai = 0.400
Sub-Area C Value = 0.570
Initial subarea total flow distance = 116.000(Ft.)
Highest elevation = 467.000(Ft.)
Lowest elevation = 454.530(Ft.)
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Elevation difference = 12.470(Ft.) Slope = 10.750 %
Top of Initial Area Slope adjusted by User to 11.000 %
Bottom of Initial Area Slope adjusted by User to 11.000 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of 11.00 %, in a development type of
7.3 DU/A or Less
In Accordance With Figure 3-3
Initial Area Time of Concentration = 4.29 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5]/(% slope^(1/3)]
TC = [1.8*(1.1-0.5700)*( 100.000^.5)/( 11.000^(1/3))]= 4.29
The initial area total distance of 116.00 (Ft.) entered leaves a
remaining distance of 16.00 (Ft.)
Using Figure 3-4, the travel time for this distance is 0.15
minutes
for a distance of 16.00 (Ft.) and a slope of 11.00 %
with an elevation difference of 1.76(Ft.) from the end of the top
area
Tt = [11.9*length(Mi)^3]/(elevation change(Ft.))]^.385 *60(min/hr)
= 0.154 Minutes
Tt=[(11.9*0.0030^3)/( 1.76)]^.385= 0.15
Total initial area Ti = 4.29 minutes from Figure 3-3 formula plus
0.15 minutes from the Figure 3-4 formula = 4.44 minutes
Calculated TC of 4.444 minutes is less than 5 minutes,
resetting TC to 5.0 minutes for rainfall intensity calculations
Rainfall intensity (I) = 8.431(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.570
Subarea runoff = 0.913(CFS)
Total initial stream area = 0.190(Ac.)

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Process from Point/Station 501.000 to Point/Station
502.000
**** INITIAL AREA EVALUATION ****

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Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[LOW DENSITY RESIDENTIAL ]
(1.0 DU/A or Less )
Impervious value, Ai = 0.100
Sub-Area C Value = 0.410
Initial subarea total flow distance = 133.000(Ft.)
Highest elevation = 462.830(Ft.)
Lowest elevation = 451.150(Ft.)
Elevation difference = 11.680(Ft.) Slope = 8.782 %
Top of Initial Area Slope adjusted by User to 10.000 %
Bottom of Initial Area Slope adjusted by User to 10.000 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)

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for the top area slope value of 10.00 %, in a development type of 1.0 DU/A or Less
 In Accordance With Figure 3-3
 Initial Area Time of Concentration = 5.76 minutes
 $TC = [1.8 * (1.1 - C) * \text{distance}(\text{Ft.})^{.5}] / (\% \text{ slope}^{(1/3)})]$
 $TC = [1.8 * (1.1 - 0.4100) * (100.000^{.5})] / (10.000^{(1/3)}) = 5.76$
 The initial area total distance of 133.00 (Ft.) entered leaves a remaining distance of 33.00 (Ft.)
 Using Figure 3-4, the travel time for this distance is 0.28 minutes
 for a distance of 33.00 (Ft.) and a slope of 10.00 %
 with an elevation difference of 3.30 (Ft.) from the end of the top area
 $Tt = [11.9 * \text{length}(\text{Mi})^3 / (\text{elevation change}(\text{Ft.}))]^{.385} * 60 (\text{min/hr})$
 $= 0.280 \text{ Minutes}$
 $Tt = [(11.9 * 0.0063^3) / (3.30)]^{.385} = 0.28$
 Total initial area Ti = 5.76 minutes from Figure 3-3 formula plus 0.28 minutes from the Figure 3-4 formula = 6.04 minutes
 Rainfall intensity (I) = 7.460 (In/Hr) for a 100.0 year storm
 Effective runoff coefficient used for area (Q=KCIA) is C = 0.410
 Subarea runoff = 0.826 (CFS)
 Total initial stream area = 0.270 (Ac.)

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+++ Process from Point/Station 601.000 to Point/Station 602.000

**** INITIAL AREA EVALUATION ****

Decimal fraction soil group A = 0.000
 Decimal fraction soil group B = 0.000
 Decimal fraction soil group C = 0.000
 Decimal fraction soil group D = 1.000
 [UNDISTURBED NATURAL TERRAIN]
 (Permanent Open Space)
 Impervious value, Ai = 0.000
 Sub-Area C Value = 0.350
 Initial subarea total flow distance = 86.000 (Ft.)
 Highest elevation = 467.990 (Ft.)
 Lowest elevation = 464.060 (Ft.)
 Elevation difference = 3.930 (Ft.) Slope = 4.570 %
 Top of Initial Area Slope adjusted by User to 5.300 %
 INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
 The maximum overland flow distance is 100.00 (Ft)
 for the top area slope value of 5.30 %, in a development type of Permanent Open Space
 In Accordance With Figure 3-3
 Initial Area Time of Concentration = 7.74 minutes
 $TC = [1.8 * (1.1 - C) * \text{distance}(\text{Ft.})^{.5}] / (\% \text{ slope}^{(1/3)})]$
 $TC = [1.8 * (1.1 - 0.3500) * (100.000^{.5})] / (5.300^{(1/3)}) = 7.74$
 Rainfall intensity (I) = 6.359 (In/Hr) for a 100.0 year storm
 Effective runoff coefficient used for area (Q=KCIA) is C = 0.350

Subarea runoff = 0.378 (CFS)
Total initial stream area = 0.170 (Ac.)

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Process from Point/Station 602.000 to Point/Station

603.000

**** SUBAREA FLOW ADDITION ****

Rainfall intensity (I) = 6.359 (In/Hr) for a 100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[UNDISTURBED NATURAL TERRAIN]
(Permanent Open Space)
Impervious value, Ai = 0.000
Sub-Area C Value = 0.350
Time of concentration = 7.74 min.
Rainfall intensity = 6.359 (In/Hr) for a 100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.350 CA = 0.339
Subarea runoff = 1.780 (CFS) for 0.800 (Ac.)
Total runoff = 2.159 (CFS) Total area = 0.970 (Ac.)
End of computations, total study area = 1.669 (Ac.)

APPENDIX C –
POST-DEVELOPMENT
HYDROLOGY CALCULATIONS

UNMITIGATED

San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software, (c)1991-2006 Version 7.7

Rational method hydrology program based on
San Diego County Flood Control Division 2003 hydrology manual
Rational Hydrology Study Date: 03/10/25

23-299 Post Development Condition
100-Year Post Development
Basins 100-800
Onsite Area

***** Hydrology Study Control Information *****

Program License Serial Number 6144

Rational hydrology study storm event year is 100.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour, precipitation(inches) = 3.200
24 hour precipitation(inches) = 5.600
P6/P24 = 57.1%
San Diego hydrology manual 'C' values used

+++++
+++ Process from Point/Station 101.000 to Point/Station
102.000
**** INITIAL AREA EVALUATION ****

Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[HIGH DENSITY RESIDENTIAL]
(24.0 DU/A or Less)
Impervious value, Ai = 0.650
Sub-Area C Value = 0.710
Initial subarea total flow distance = 39.000 (Ft.)
Highest elevation = 465.100 (Ft.)
Lowest elevation = 464.300 (Ft.)

Elevation difference = 0.800(Ft.) Slope = 2.051 %
 Top of Initial Area Slope adjusted by User to 2.000 %
 INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
 The maximum overland flow distance is 75.00 (Ft)
 for the top area slope value of 2.00 %, in a development type of
 24.0 DU/A or Less
 In Accordance With Figure 3-3
 Initial Area Time of Concentration = 4.83 minutes
 $TC = [1.8 * (1.1 - C) * distance(Ft.)^{.5} / (\% slope^{(1/3)})]$
 $TC = [1.8 * (1.1 - 0.7100) * (75.000^{.5}) / (2.000^{(1/3)})] = 4.83$
 Calculated TC of 4.825 minutes is less than 5 minutes,
 resetting TC to 5.0 minutes for rainfall intensity calculations
 Rainfall intensity (I) = 8.431(In/Hr) for a 100.0 year storm
 Effective runoff coefficient used for area (Q=KCIA) is C = 0.710
 Subarea runoff = 0.251(CFS)
 Total initial stream area = 0.042(Ac.)

++++++
 +++ Process from Point/Station 102.000 to Point/Station
 103.000
 **** SUBAREA FLOW ADDITION ****

Calculated TC of 4.825 minutes is less than 5 minutes,
 resetting TC to 5.0 minutes for rainfall intensity calculations
 Rainfall intensity (I) = 8.431(In/Hr) for a 100.0 year storm
 Decimal fraction soil group A = 0.000
 Decimal fraction soil group B = 0.000
 Decimal fraction soil group C = 0.000
 Decimal fraction soil group D = 1.000
 [UNDISTURBED NATURAL TERRAIN]
 (Permanent Open Space)
 Impervious value, Ai = 0.000
 Sub-Area C Value = 0.350
 Time of concentration = 4.83 min.
 Rainfall intensity = 8.431(In/Hr) for a 100.0 year storm
 Effective runoff coefficient used for total area
 (Q=KCIA) is C = 0.458 CA = 0.064
 Subarea runoff = 0.289(CFS) for 0.098(Ac.)
 Total runoff = 0.541(CFS) Total area = 0.140(Ac.)

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 +++ Process from Point/Station 103.000 to Point/Station
 104.000
 **** PIPEFLOW TRAVEL TIME (User specified size) ****

Upstream point/station elevation = 495.250(Ft.)
 Downstream point/station elevation = 495.000(Ft.)
 Pipe length = 44.65(Ft.) Slope = 0.0056 Manning's N = 0.009

No. of pipes = 1 Required pipe flow = 0.541 (CFS)
Given pipe size = 6.00 (In.)
Calculated individual pipe flow = 0.541 (CFS)
Normal flow depth in pipe = 4.42 (In.)
Flow top width inside pipe = 5.29 (In.)
Critical Depth = 4.50 (In.)
Pipe flow velocity = 3.49 (Ft/s)
Travel time through pipe = 0.21 min.
Time of concentration (TC) = 5.04 min.

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Process from Point/Station 201.000 to Point/Station
202.000

**** INITIAL AREA EVALUATION ****

Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[LOW DENSITY RESIDENTIAL]
(2.0 DU/A or Less)
Impervious value, Ai = 0.200
Sub-Area C Value = 0.460
Initial subarea total flow distance = 62.000 (Ft.)
Highest elevation = 475.000 (Ft.)
Lowest elevation = 459.500 (Ft.)
Elevation difference = 15.500 (Ft.) Slope = 25.000 %
Top of Initial Area Slope adjusted by User to 26.000 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of 26.00 %, in a development type of
2.0 DU/A or Less
In Accordance With Figure 3-3
Initial Area Time of Concentration = 3.89 minutes
 $TC = [1.8 * (1.1 - C) * \text{distance (Ft.)}^{.5} / (\% \text{ slope}^{(1/3)})]$
 $TC = [1.8 * (1.1 - 0.4600) * (100.000^{.5}) / (26.000^{(1/3)})] = 3.89$
Calculated TC of 3.889 minutes is less than 5 minutes,
resetting TC to 5.0 minutes for rainfall intensity calculations
Rainfall intensity (I) = 8.431 (In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.460
Subarea runoff = 0.349 (CFS)
Total initial stream area = 0.090 (Ac.)

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Process from Point/Station 202.000 to Point/Station
304.000

**** IMPROVED CHANNEL TRAVEL TIME ****

Upstream point elevation = 457.450(Ft.)
Downstream point elevation = 456.260(Ft.)
Channel length thru subarea = 47.900(Ft.)
Channel base width = 1.500(Ft.)
Slope or 'Z' of left channel bank = 0.000
Slope or 'Z' of right channel bank = 1.000
Manning's 'N' = 0.015
Maximum depth of channel = 0.330(Ft.)
Flow(q) thru subarea = 0.349(CFS)
Depth of flow = 0.082(Ft.), Average velocity = 2.762(Ft/s)
Channel flow top width = 1.582(Ft.)
Flow Velocity = 2.76(Ft/s)
Travel time = 0.29 min.
Time of concentration = 4.18 min.
Critical depth = 0.117(Ft.)

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Process from Point/Station 202.000 to Point/Station

304.000

**** CONFLUENCE OF MINOR STREAMS ****

Along Main Stream number: 1 in normal stream number 1
Stream flow area = 0.090(Ac.)
Runoff from this stream = 0.349(CFS)
Time of concentration = 4.18 min.
Rainfall intensity = 8.431(In/Hr)

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Process from Point/Station 301.000 to Point/Station

302.000

**** INITIAL AREA EVALUATION ****

Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[MEDIUM DENSITY RESIDENTIAL]
(14.5 DU/A or Less)
Impervious value, Ai = 0.500
Sub-Area C Value = 0.630
Initial subarea total flow distance = 50.000(Ft.)
Highest elevation = 465.100(Ft.)
Lowest elevation = 464.000(Ft.)
Elevation difference = 1.100(Ft.) Slope = 2.200 %
Top of Initial Area Slope adjusted by User to 2.000 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 80.00 (Ft)
for the top area slope value of 2.00 %, in a development type of

14.5 DU/A or Less
 In Accordance With Figure 3-3
 Initial Area Time of Concentration = 6.01 minutes
 $TC = [1.8 * (1.1 - C) * \text{distance}(\text{Ft.})^{.5}] / (\% \text{ slope}^{(1/3)})]$
 $TC = [1.8 * (1.1 - 0.6300) * (80.000^{.5})] / (2.000^{(1/3)}) = 6.01$
 Rainfall intensity (I) = 7.491(In/Hr) for a 100.0 year storm
 Effective runoff coefficient used for area (Q=KCIA) is C = 0.630
 Subarea runoff = 0.250(CFS)
 Total initial stream area = 0.053(Ac.)

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 +++ Process from Point/Station 302.000 to Point/Station
 303.000
 **** SUBAREA FLOW ADDITION ****

Rainfall intensity (I) = 7.491(In/Hr) for a 100.0 year storm
 User specified 'C' value of 0.760 given for subarea
 Time of concentration = 6.01 min.
 Rainfall intensity = 7.491(In/Hr) for a 100.0 year storm
 Effective runoff coefficient used for total area
 (Q=KCIA) is C = 0.697 CA = 0.077
 Subarea runoff = 0.325(CFS) for 0.057(Ac.)
 Total runoff = 0.575(CFS) Total area = 0.110(Ac.)

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 +++ Process from Point/Station 303.000 to Point/Station
 304.000
 **** PIPEFLOW TRAVEL TIME (User specified size) ****

Upstream point/station elevation = 457.250(Ft.)
 Downstream point/station elevation = 456.260(Ft.)
 Pipe length = 22.40(Ft.) Slope = 0.0442 Manning's N = 0.009
 No. of pipes = 1 Required pipe flow = 0.575(CFS)
 Given pipe size = 6.00(In.)
 Calculated individual pipe flow = 0.575(CFS)
 Normal flow depth in pipe = 2.40(In.)
 Flow top width inside pipe = 5.88(In.)
 Critical Depth = 4.63(In.)
 Pipe flow velocity = 7.83(Ft/s)
 Travel time through pipe = 0.05 min.
 Time of concentration (TC) = 6.05 min.

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 +++ Process from Point/Station 303.000 to Point/Station
 304.000
 **** CONFLUENCE OF MINOR STREAMS ****

Along Main Stream number: 1 in normal stream number 2
Stream flow area = 0.110 (Ac.)
Runoff from this stream = 0.575 (CFS)
Time of concentration = 6.05 min.
Rainfall intensity = 7.453 (In/Hr)
Summary of stream data:

Stream No.	Flow rate (CFS)	TC (min)	Rainfall Intensity (In/Hr)
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1	0.349	4.18	8.431
2	0.575	6.05	7.453

Qmax(1) =
1.000 * 1.000 * 0.349) +
1.000 * 0.690 * 0.575) + = 0.746

Qmax(2) =
0.884 * 1.000 * 0.349) +
1.000 * 1.000 * 0.575) + = 0.883

Total of 2 streams to confluence:
Flow rates before confluence point:
0.349 0.575

Maximum flow rates at confluence using above data:
0.746 0.883

Area of streams before confluence:
0.090 0.110

Results of confluence:
Total flow rate = 0.883 (CFS)
Time of concentration = 6.053 min.
Effective stream area after confluence = 0.200 (Ac.)

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Process from Point/Station 401.000 to Point/Station
402.000
**** INITIAL AREA EVALUATION ****

Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[UNDISTURBED NATURAL TERRAIN]
(Permanent Open Space)
Impervious value, Ai = 0.000
Sub-Area C Value = 0.350
Initial subarea total flow distance = 23.000 (Ft.)
Highest elevation = 462.300 (Ft.)
Lowest elevation = 458.000 (Ft.)
Elevation difference = 4.300 (Ft.) Slope = 18.696 %

Top of Initial Area Slope adjusted by User to 19.200 %
 INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
 The maximum overland flow distance is 100.00 (Ft)
 for the top area slope value of 19.20 %, in a development type of
 Permanent Open Space
 In Accordance With Figure 3-3
 Initial Area Time of Concentration = 5.04 minutes
 $TC = [1.8 * (1.1 - C) * distance(Ft.)^{.5} / (% slope^{(1/3)})]$
 $TC = [1.8 * (1.1 - 0.3500) * (100.000^{.5}) / (19.200^{(1/3)})] = 5.04$
 Rainfall intensity (I) = 8.386 (In/Hr) for a 100.0 year storm
 Effective runoff coefficient used for area (Q=KCIA) is C = 0.350
 Subarea runoff = 0.112 (CFS)
 Total initial stream area = 0.038 (Ac.)

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Process from Point/Station 403.000 to Point/Station
 404.000

**** INITIAL AREA EVALUATION ****

Decimal fraction soil group A = 0.000
 Decimal fraction soil group B = 0.000
 Decimal fraction soil group C = 0.000
 Decimal fraction soil group D = 1.000
 [UNDISTURBED NATURAL TERRAIN]
 (Permanent Open Space)
 Impervious value, Ai = 0.000
 Sub-Area C Value = 0.350
 Initial subarea total flow distance = 13.000 (Ft.)
 Highest elevation = 459.600 (Ft.)
 Lowest elevation = 453.500 (Ft.)
 Elevation difference = 6.100 (Ft.) Slope = 46.923 %
 Top of Initial Area Slope adjusted by User to 30.000 %
 INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
 The maximum overland flow distance is 100.00 (Ft)
 for the top area slope value of 30.00 %, in a development type of
 Permanent Open Space
 In Accordance With Figure 3-3
 Initial Area Time of Concentration = 4.34 minutes
 $TC = [1.8 * (1.1 - C) * distance(Ft.)^{.5} / (% slope^{(1/3)})]$
 $TC = [1.8 * (1.1 - 0.3500) * (100.000^{.5}) / (30.000^{(1/3)})] = 4.34$
 Calculated TC of 4.345 minutes is less than 5 minutes,
 resetting TC to 5.0 minutes for rainfall intensity calculations
 Rainfall intensity (I) = 8.431 (In/Hr) for a 100.0 year storm
 Effective runoff coefficient used for area (Q=KCIA) is C = 0.350
 Subarea runoff = 0.065 (CFS)
 Total initial stream area = 0.022 (Ac.)

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Process from Point/Station 405.000 to Point/Station
406.000

**** INITIAL AREA EVALUATION ****

Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[UNDISTURBED NATURAL TERRAIN]
(Permanent Open Space)
Impervious value, Ai = 0.000
Sub-Area C Value = 0.350
Initial subarea total flow distance = 16.000 (Ft.)
Highest elevation = 461.000 (Ft.)
Lowest elevation = 452.100 (Ft.)
Elevation difference = 8.900 (Ft.) Slope = 55.625 %
Top of Initial Area Slope adjusted by User to 30.000 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of 30.00 %, in a development type of
Permanent Open Space
In Accordance With Figure 3-3
Initial Area Time of Concentration = 4.34 minutes
 $TC = [1.8 * (1.1 - C) * \text{distance (Ft.)}^{0.5} / (\% \text{ slope}^{1/3})]$
 $TC = [1.8 * (1.1 - 0.3500) * (100.000^{0.5}) / (30.000^{1/3})] = 4.34$
Calculated TC of 4.345 minutes is less than 5 minutes,
resetting TC to 5.0 minutes for rainfall intensity calculations
Rainfall intensity (I) = 8.431 (In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.350
Subarea runoff = 0.083 (CFS)
Total initial stream area = 0.028 (Ac.)

+++++

+++

Process from Point/Station 501.000 to Point/Station
502.000

**** INITIAL AREA EVALUATION ****

Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[INDUSTRIAL area type]
(General Industrial)
Impervious value, Ai = 0.950
Sub-Area C Value = 0.870
Initial subarea total flow distance = 45.000 (Ft.)
Highest elevation = 463.200 (Ft.)
Lowest elevation = 462.200 (Ft.)
Elevation difference = 1.000 (Ft.) Slope = 2.222 %
Top of Initial Area Slope adjusted by User to 2.000 %

INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:

The maximum overland flow distance is 70.00 (Ft)
for the top area slope value of 2.00 %, in a development type of
General Industrial

In Accordance With Figure 3-3

Initial Area Time of Concentration = 2.75 minutes

$TC = [1.8 * (1.1 - C) * \text{distance}(\text{Ft.})^{.5} / (\% \text{ slope}^{(1/3)})]$

$TC = [1.8 * (1.1 - 0.8700) * (70.000^{.5}) / (2.000^{(1/3)})] = 2.75$

Calculated TC of 2.749 minutes is less than 5 minutes,
resetting TC to 5.0 minutes for rainfall intensity calculations

Rainfall intensity (I) = 8.431 (In/Hr) for a 100.0 year storm

Effective runoff coefficient used for area (Q=KCIA) is C = 0.870

Subarea runoff = 0.587 (CFS)

Total initial stream area = 0.080 (Ac.)

+++++

+++

Process from Point/Station 502.000 to Point/Station

503.000

**** SUBAREA FLOW ADDITION ****

Calculated TC of 2.749 minutes is less than 5 minutes,
resetting TC to 5.0 minutes for rainfall intensity calculations
Rainfall intensity (I) = 8.431 (In/Hr) for a 100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[HIGH DENSITY RESIDENTIAL]
(43.0 DU/A or Less)
Impervious value, Ai = 0.800
Sub-Area C Value = 0.790
Time of concentration = 2.75 min.
Rainfall intensity = 8.431 (In/Hr) for a 100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.815 CA = 0.212
Subarea runoff = 1.199 (CFS) for 0.180 (Ac.)
Total runoff = 1.786 (CFS) Total area = 0.260 (Ac.)

+++++

+++

Process from Point/Station 503.000 to Point/Station

603.000

**** PIPEFLOW TRAVEL TIME (User specified size) ****

Upstream point/station elevation = 455.250 (Ft.)
Downstream point/station elevation = 450.500 (Ft.)
Pipe length = 255.11 (Ft.) Slope = 0.0186 Manning's N = 0.009
No. of pipes = 1 Required pipe flow = 1.786 (CFS)
Given pipe size = 10.00 (In.)

Calculated individual pipe flow = 1.786(CFS)
Normal flow depth in pipe = 4.48(In.)
Flow top width inside pipe = 9.95(In.)
Critical Depth = 7.20(In.)
Pipe flow velocity = 7.54(Ft/s)
Travel time through pipe = 0.56 min.
Time of concentration (TC) = 3.31 min.

+++++

+++

Process from Point/Station 503.000 to Point/Station

603.000

**** CONFLUENCE OF MINOR STREAMS ****

Along Main Stream number: 1 in normal stream number 1
Stream flow area = 0.260(Ac.)
Runoff from this stream = 1.786(CFS)
Time of concentration = 3.31 min.
Rainfall intensity = 8.431(In/Hr)

+++++

+++

Process from Point/Station 601.000 to Point/Station

602.000

**** INITIAL AREA EVALUATION ****

Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[MEDIUM DENSITY RESIDENTIAL]
(7.3 DU/A or Less)
Impervious value, Ai = 0.400
Sub-Area C Value = 0.570
Initial subarea total flow distance = 49.000(Ft.)
Highest elevation = 457.800(Ft.)
Lowest elevation = 455.500(Ft.)
Elevation difference = 2.300(Ft.) Slope = 4.694 %
Top of Initial Area Slope adjusted by User to 4.000 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of 4.00 %, in a development type of
7.3 DU/A or Less
In Accordance With Figure 3-3
Initial Area Time of Concentration = 6.01 minutes
 $TC = [1.8 * (1.1 - C) * distance(Ft.)^{.5}] / (% slope^{(1/3)})]$
 $TC = [1.8 * (1.1 - 0.5700) * (100.000^{.5}) / (4.000^{(1/3)})] = 6.01$
Rainfall intensity (I) = 7.488(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.570
Subarea runoff = 0.726(CFS)

Total initial stream area = 0.170 (Ac.)

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+++

Process from Point/Station 602.000 to Point/Station
603.000

**** PIPEFLOW TRAVEL TIME (User specified size) ****

Upstream point/station elevation = 450.750 (Ft.)
Downstream point/station elevation = 450.500 (Ft.)
Pipe length = 95.60 (Ft.) Slope = 0.0026 Manning's N = 0.009
No. of pipes = 1 Required pipe flow = 0.726 (CFS)
Given pipe size = 10.00 (In.)
Calculated individual pipe flow = 0.726 (CFS)
Normal flow depth in pipe = 4.69 (In.)
Flow top width inside pipe = 9.98 (In.)
Critical Depth = 4.51 (In.)
Pipe flow velocity = 2.89 (Ft/s)
Travel time through pipe = 0.55 min.
Time of concentration (TC) = 6.56 min.

++++
+++

Process from Point/Station 603.000 to Point/Station
603.000

**** CONFLUENCE OF MINOR STREAMS ****

Along Main Stream number: 1 in normal stream number 2
Stream flow area = 0.170 (Ac.)
Runoff from this stream = 0.726 (CFS)
Time of concentration = 6.56 min.
Rainfall intensity = 7.075 (In/Hr)
Summary of stream data:

Stream No.	Flow rate (CFS)	TC (min)	Rainfall Intensity (In/Hr)
------------	-----------------	----------	----------------------------

1	1.786	3.31	8.431
---	-------	------	-------

2	0.726	6.56	7.075
---	-------	------	-------

Qmax(1) =

1.000	*	1.000	*	1.786	+
-------	---	-------	---	-------	---

1.000	*	0.505	*	0.726	+	=	2.152
-------	---	-------	---	-------	---	---	-------

Qmax(2) =

0.839	*	1.000	*	1.786	+
-------	---	-------	---	-------	---

1.000	*	1.000	*	0.726	+	=	2.224
-------	---	-------	---	-------	---	---	-------

Total of 2 streams to confluence:

Flow rates before confluence point:

1.786	0.726
-------	-------

Maximum flow rates at confluence using above data:

2.152 2.224

Area of streams before confluence:

0.260 0.170

Results of confluence:

Total flow rate = 2.224 (CFS)

Time of concentration = 6.562 min.

Effective stream area after confluence = 0.430 (Ac.)

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+++

Process from Point/Station 603.000 to Point/Station

703.000

**** PIPEFLOW TRAVEL TIME (User specified size) ****

Upstream point/station elevation = 450.500 (Ft.)
Downstream point/station elevation = 450.170 (Ft.)
Pipe length = 109.32 (Ft.) Slope = 0.0030 Manning's N = 0.009
No. of pipes = 1 Required pipe flow = 2.224 (CFS)
Given pipe size = 10.00 (In.)
NOTE: Normal flow is pressure flow in user selected pipe size.
The approximate hydraulic grade line above the pipe invert is
 0.597 (Ft.) at the headworks or inlet of the pipe(s)
Pipe friction loss = 0.540 (Ft.)
Minor friction loss = 0.387 (Ft.) K-factor = 1.50
Pipe flow velocity = 4.08 (Ft/s)
Travel time through pipe = 0.45 min.
Time of concentration (TC) = 7.01 min.

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+++

Process from Point/Station 603.000 to Point/Station

703.000

**** CONFLUENCE OF MINOR STREAMS ****

Along Main Stream number: 1 in normal stream number 1
Stream flow area = 0.430 (Ac.)
Runoff from this stream = 2.224 (CFS)
Time of concentration = 7.01 min.
Rainfall intensity = 6.781 (In/Hr)

+++++

+++

Process from Point/Station 701.000 to Point/Station

702.000

**** INITIAL AREA EVALUATION ****

Decimal fraction soil group A = 0.000

Decimal fraction soil group B = 0.000
 Decimal fraction soil group C = 0.000
 Decimal fraction soil group D = 1.000
 [HIGH DENSITY RESIDENTIAL]
 (43.0 DU/A or Less)
 Impervious value, Ai = 0.800
 Sub-Area C Value = 0.790
 Initial subarea total flow distance = 45.000 (Ft.)
 Highest elevation = 465.100 (Ft.)
 Lowest elevation = 463.200 (Ft.)
 Elevation difference = 1.900 (Ft.) Slope = 4.222 %
 Top of Initial Area Slope adjusted by User to 4.200 %
 INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
 The maximum overland flow distance is 95.00 (Ft)
 for the top area slope value of 4.20 %, in a development type of
 43.0 DU/A or Less
 In Accordance With Figure 3-3
 Initial Area Time of Concentration = 3.37 minutes
 $TC = [1.8 * (1.1 - C) * distance(Ft.)^{.5} / (% slope^{(1/3)})]$
 $TC = [1.8 * (1.1 - 0.7900) * (95.000^{.5}) / (4.200^{(1/3)})] = 3.37$
 Calculated TC of 3.371 minutes is less than 5 minutes,
 resetting TC to 5.0 minutes for rainfall intensity calculations
 Rainfall intensity (I) = 8.431 (In/Hr) for a 100.0 year storm
 Effective runoff coefficient used for area (Q=KCIA) is C = 0.790
 Subarea runoff = 1.066 (CFS)
 Total initial stream area = 0.160 (Ac.)

+++++

+++

Process from Point/Station 702.000 to Point/Station
 703.000
 **** SUBAREA FLOW ADDITION ****

Calculated TC of 3.371 minutes is less than 5 minutes,
 resetting TC to 5.0 minutes for rainfall intensity calculations
 Rainfall intensity (I) = 8.431 (In/Hr) for a 100.0 year storm
 User specified 'C' value of 0.730 given for subarea
 Time of concentration = 3.37 min.
 Rainfall intensity = 8.431 (In/Hr) for a 100.0 year storm
 Effective runoff coefficient used for total area
 (Q=KCIA) is C = 0.742 CA = 0.579
 Subarea runoff = 3.816 (CFS) for 0.620 (Ac.)
 Total runoff = 4.882 (CFS) Total area = 0.780 (Ac.)

+++++

+++

Process from Point/Station 703.000 to Point/Station
 703.000
 **** CONFLUENCE OF MINOR STREAMS ****

Along Main Stream number: 1 in normal stream number 2
 Stream flow area = 0.780 (Ac.)
 Runoff from this stream = 4.882 (CFS)
 Time of concentration = 3.37 min.
 Rainfall intensity = 8.431 (In/Hr)
 Summary of stream data:

Stream No.	Flow rate (CFS)	TC (min)	Rainfall Intensity (In/Hr)
1	2.224	7.01	6.781
2	4.882	3.37	8.431

Qmax(1) =
 1.000 * 1.000 * 2.224) +
 0.804 * 1.000 * 4.882) + = 6.150
 Qmax(2) =
 1.000 * 0.481 * 2.224) +
 1.000 * 1.000 * 4.882) + = 5.951

Total of 2 streams to confluence:
 Flow rates before confluence point:
 2.224 4.882
 Maximum flow rates at confluence using above data:
 6.150 5.951
 Area of streams before confluence:
 0.430 0.780
 Results of confluence:
 Total flow rate = 6.150 (CFS)
 Time of concentration = 7.009 min.
 Effective stream area after confluence = 1.210 (Ac.)

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 +++
 Process from Point/Station 703.000 to Point/Station
 704.000
 **** PIPEFLOW TRAVEL TIME (User specified size) ****

Upstream point/station elevation = 450.170 (Ft.)
 Downstream point/station elevation = 450.000 (Ft.)
 Pipe length = 7.98 (Ft.) Slope = 0.0213 Manning's N = 0.009
 No. of pipes = 1 Required pipe flow = 6.150 (CFS)
 Given pipe size = 12.00 (In.)
 Calculated individual pipe flow = 6.150 (CFS)
 Normal flow depth in pipe = 8.26 (In.)
 Flow top width inside pipe = 11.11 (In.)
 Critical depth could not be calculated.
 Pipe flow velocity = 10.67 (Ft/s)
 Travel time through pipe = 0.01 min.
 Time of concentration (TC) = 7.02 min.

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+++++
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      Process from Point/Station      801.000 to Point/Station
802.000
      **** INITIAL AREA EVALUATION ****

-----
      Decimal fraction soil group A = 0.000
      Decimal fraction soil group B = 0.000
      Decimal fraction soil group C = 0.000
      Decimal fraction soil group D = 1.000
      [UNDISTURBED NATURAL TERRAIN                ]
      (Permanent Open Space      )
      Impervious value, Ai = 0.000
      Sub-Area C Value = 0.350
      Initial subarea total flow distance = 16.000(Ft.)
      Highest elevation = 457.700(Ft.)
      Lowest elevation = 450.500(Ft.)
      Elevation difference = 7.200(Ft.) Slope = 45.000 %
      Top of Initial Area Slope adjusted by User to 30.000 %
      INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
      The maximum overland flow distance is 100.00 (Ft)
      for the top area slope value of 30.00 %, in a development type of
      Permanent Open Space
      In Accordance With Figure 3-3
      Initial Area Time of Concentration = 4.34 minutes
      TC = [1.8*(1.1-C)*distance(Ft.)^.5]/(% slope^(1/3)]
      TC = [1.8*(1.1-0.3500)*( 100.000^.5)/( 30.000^(1/3))]= 4.34
      Calculated TC of 4.345 minutes is less than 5 minutes,
      resetting TC to 5.0 minutes for rainfall intensity calculations
      Rainfall intensity (I) = 8.431(In/Hr) for a 100.0 year storm
      Effective runoff coefficient used for area (Q=KCIA) is C = 0.350
      Subarea runoff = 0.091(CFS)
      Total initial stream area = 0.031(Ac.)
      End of computations, total study area = 1.669 (Ac.)

```

MITIGATED

San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software, (c)1991-2006 Version 7.7

Rational method hydrology program based on
San Diego County Flood Control Division 2003 hydrology manual
Rational Hydrology Study Date: 03/13/25

23-299 Post Development Condition
100-Year Post Development
Basins 100-800
Onsite Area

***** Hydrology Study Control Information *****

Program License Serial Number 6144

Rational hydrology study storm event year is 100.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour, precipitation(inches) = 3.200
24 hour precipitation(inches) = 5.600
P6/P24 = 57.1%
San Diego hydrology manual 'C' values used

+++++
+++ Process from Point/Station 101.000 to Point/Station
102.000
**** INITIAL AREA EVALUATION ****

Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[HIGH DENSITY RESIDENTIAL]
(24.0 DU/A or Less)
Impervious value, Ai = 0.650
Sub-Area C Value = 0.710
Initial subarea total flow distance = 39.000 (Ft.)
Highest elevation = 465.100 (Ft.)
Lowest elevation = 464.300 (Ft.)

Elevation difference = 0.800(Ft.) Slope = 2.051 %
Top of Initial Area Slope adjusted by User to 2.000 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 75.00 (Ft)
for the top area slope value of 2.00 %, in a development type of
24.0 DU/A or Less
In Accordance With Figure 3-3
Initial Area Time of Concentration = 4.83 minutes
 $TC = [1.8 * (1.1 - C) * distance(Ft.)^{.5} / (\% slope^{(1/3)})]$
 $TC = [1.8 * (1.1 - 0.7100) * (75.000^{.5}) / (2.000^{(1/3)})] = 4.83$
Calculated TC of 4.825 minutes is less than 5 minutes,
resetting TC to 5.0 minutes for rainfall intensity calculations
Rainfall intensity (I) = 8.431(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.710
Subarea runoff = 0.251(CFS)
Total initial stream area = 0.042(Ac.)

+++++
+++
Process from Point/Station 102.000 to Point/Station
103.000
**** SUBAREA FLOW ADDITION ****

Calculated TC of 4.825 minutes is less than 5 minutes,
resetting TC to 5.0 minutes for rainfall intensity calculations
Rainfall intensity (I) = 8.431(In/Hr) for a 100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[UNDISTURBED NATURAL TERRAIN]
(Permanent Open Space)
Impervious value, Ai = 0.000
Sub-Area C Value = 0.350
Time of concentration = 4.83 min.
Rainfall intensity = 8.431(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.458 CA = 0.064
Subarea runoff = 0.289(CFS) for 0.098(Ac.)
Total runoff = 0.541(CFS) Total area = 0.140(Ac.)

+++++
+++
Process from Point/Station 103.000 to Point/Station
104.000
**** USER DEFINED FLOW INFORMATION AT A POINT ****

Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000

Decimal fraction soil group D = 1.000
[HIGH DENSITY RESIDENTIAL]
(24.0 DU/A or Less)
Impervious value, Ai = 0.650
Sub-Area C Value = 0.710
Rainfall intensity (I) = 8.431(In/Hr) for a 100.0 year storm
User specified values are as follows:
TC = 5.00 min. Rain intensity = 8.43(In/Hr)
Total area = 0.014(Ac.) Total runoff = 0.370(CFS)

++++
+++ Process from Point/Station 103.000 to Point/Station
104.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****

Upstream point/station elevation = 495.250(Ft.)
Downstream point/station elevation = 495.000(Ft.)
Pipe length = 44.65(Ft.) Slope = 0.0056 Manning's N = 0.009
No. of pipes = 1 Required pipe flow = 0.370(CFS)
Given pipe size = 6.00(In.)
Calculated individual pipe flow = 0.370(CFS)
Normal flow depth in pipe = 3.39(In.)
Flow top width inside pipe = 5.95(In.)
Critical Depth = 3.71(In.)
Pipe flow velocity = 3.24(Ft/s)
Travel time through pipe = 0.23 min.
Time of concentration (TC) = 5.23 min.

++++
+++ Process from Point/Station 201.000 to Point/Station
202.000
**** INITIAL AREA EVALUATION ****

Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[LOW DENSITY RESIDENTIAL]
(2.0 DU/A or Less)
Impervious value, Ai = 0.200
Sub-Area C Value = 0.460
Initial subarea total flow distance = 62.000(Ft.)
Highest elevation = 475.000(Ft.)
Lowest elevation = 459.500(Ft.)
Elevation difference = 15.500(Ft.) Slope = 25.000 %
Top of Initial Area Slope adjusted by User to 26.000 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)

for the top area slope value of 26.00 %, in a development type of
 2.0 DU/A or Less
 In Accordance With Figure 3-3
 Initial Area Time of Concentration = 3.89 minutes
 $TC = [1.8 * (1.1 - C) * distance(Ft.)^{.5}] / (\% \text{ slope}^{(1/3)})$
 $TC = [1.8 * (1.1 - 0.4600) * (100.000^{.5})] / (26.000^{(1/3)}) = 3.89$
 Calculated TC of 3.889 minutes is less than 5 minutes,
 resetting TC to 5.0 minutes for rainfall intensity calculations
 Rainfall intensity (I) = 8.431(In/Hr) for a 100.0 year storm
 Effective runoff coefficient used for area (Q=KCIA) is C = 0.460
 Subarea runoff = 0.349(CFS)
 Total initial stream area = 0.090(Ac.)

+++++

+++ Process from Point/Station 202.000 to Point/Station
 304.000
 **** IMPROVED CHANNEL TRAVEL TIME ****

Upstream point elevation = 457.450(Ft.)
 Downstream point elevation = 456.260(Ft.)
 Channel length thru subarea = 47.900(Ft.)
 Channel base width = 1.500(Ft.)
 Slope or 'Z' of left channel bank = 0.000
 Slope or 'Z' of right channel bank = 1.000
 Manning's 'N' = 0.015
 Maximum depth of channel = 0.330(Ft.)
 Flow(q) thru subarea = 0.349(CFS)
 Depth of flow = 0.082(Ft.), Average velocity = 2.762(Ft/s)
 Channel flow top width = 1.582(Ft.)
 Flow Velocity = 2.76(Ft/s)
 Travel time = 0.29 min.
 Time of concentration = 4.18 min.
 Critical depth = 0.117(Ft.)

+++++

+++ Process from Point/Station 202.000 to Point/Station
 304.000
 **** CONFLUENCE OF MINOR STREAMS ****

Along Main Stream number: 1 in normal stream number 1
 Stream flow area = 0.090(Ac.)
 Runoff from this stream = 0.349(CFS)
 Time of concentration = 4.18 min.
 Rainfall intensity = 8.431(In/Hr)

+++++

+++

Process from Point/Station 301.000 to Point/Station
302.000

**** INITIAL AREA EVALUATION ****

Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[MEDIUM DENSITY RESIDENTIAL]
(14.5 DU/A or Less)
Impervious value, Ai = 0.500
Sub-Area C Value = 0.630
Initial subarea total flow distance = 50.000(Ft.)
Highest elevation = 465.100(Ft.)
Lowest elevation = 464.000(Ft.)
Elevation difference = 1.100(Ft.) Slope = 2.200 %
Top of Initial Area Slope adjusted by User to 2.000 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 80.00 (Ft)
for the top area slope value of 2.00 %, in a development type of
14.5 DU/A or Less
In Accordance With Figure 3-3
Initial Area Time of Concentration = 6.01 minutes
 $TC = [1.8 * (1.1 - C) * distance(Ft.)^{.5} / (% slope^{(1/3)})]$
 $TC = [1.8 * (1.1 - 0.6300) * (80.000^{.5}) / (2.000^{(1/3)})] = 6.01$
Rainfall intensity (I) = 7.491(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.630
Subarea runoff = 0.250(CFS)
Total initial stream area = 0.053(Ac.)

+++++

+++
Process from Point/Station 302.000 to Point/Station
303.000

**** SUBAREA FLOW ADDITION ****

Rainfall intensity (I) = 7.491(In/Hr) for a 100.0 year storm
User specified 'C' value of 0.760 given for subarea
Time of concentration = 6.01 min.
Rainfall intensity = 7.491(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.697 CA = 0.077
Subarea runoff = 0.325(CFS) for 0.057(Ac.)
Total runoff = 0.575(CFS) Total area = 0.110(Ac.)

+++++

+++
Process from Point/Station 303.000 to Point/Station
304.000

**** USER DEFINED FLOW INFORMATION AT A POINT ****

```

User specified 'C' value of 0.760 given for subarea
Rainfall intensity (I) =      7.496(In/Hr) for a   100.0 year storm
User specified values are as follows:
TC =    6.00 min.  Rain intensity =      7.50(In/Hr)
Total area =      0.110(Ac.)  Total runoff =      0.360(CFS)

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+++
  Process from Point/Station      303.000 to Point/Station
304.000
  **** PIPEFLOW TRAVEL TIME (User specified size) ****

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Upstream point/station elevation =   457.250(Ft.)
Downstream point/station elevation =   456.260(Ft.)
Pipe length =    22.40(Ft.) Slope =    0.0442  Manning's N = 0.009
No. of pipes = 1  Required pipe flow =      0.360(CFS)
Given pipe size =      6.00(In.)
Calculated individual pipe flow =      0.360(CFS)
Normal flow depth in pipe =      1.87(In.)
Flow top width inside pipe =      5.56(In.)
Critical Depth =      3.65(In.)
Pipe flow velocity =      6.88(Ft/s)
Travel time through pipe =      0.05 min.
Time of concentration (TC) =      6.05 min.

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+++
  Process from Point/Station      303.000 to Point/Station
304.000
  **** CONFLUENCE OF MINOR STREAMS ****

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Along Main Stream number: 1 in normal stream number 2
Stream flow area =      0.110(Ac.)
Runoff from this stream =      0.360(CFS)
Time of concentration =      6.05 min.
Rainfall intensity =      7.452(In/Hr)
Summary of stream data:

```

Stream No.	Flow rate (CFS)	TC (min)	Rainfall Intensity (In/Hr)
1	0.349	4.18	8.431
2	0.360	6.05	7.452
Qmax(1) =			
	1.000 *	1.000 *	0.349) +
	1.000 *	0.690 *	0.360) + =
Qmax(2) =			0.597

0.884	*	1.000	*	0.349)	+	
1.000	*	1.000	*	0.360)	+	= 0.669

Total of 2 streams to confluence:

Flow rates before confluence point:

0.349	0.360
-------	-------

Maximum flow rates at confluence using above data:

0.597	0.669
-------	-------

Area of streams before confluence:

0.090	0.110
-------	-------

Results of confluence:

Total flow rate = 0.669(CFS)

Time of concentration = 6.054 min.

Effective stream area after confluence = 0.200(Ac.)

+++++

+++

Process from Point/Station 401.000 to Point/Station

402.000

**** INITIAL AREA EVALUATION ****

Decimal fraction soil group A = 0.000

Decimal fraction soil group B = 0.000

Decimal fraction soil group C = 0.000

Decimal fraction soil group D = 1.000

[UNDISTURBED NATURAL TERRAIN]

(Permanent Open Space)

Impervious value, Ai = 0.000

Sub-Area C Value = 0.350

Initial subarea total flow distance = 23.000(Ft.)

Highest elevation = 462.300(Ft.)

Lowest elevation = 458.000(Ft.)

Elevation difference = 4.300(Ft.) Slope = 18.696 %

Top of Initial Area Slope adjusted by User to 19.200 %

INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:

The maximum overland flow distance is 100.00 (Ft)

for the top area slope value of 19.20 %, in a development type of

Permanent Open Space

In Accordance With Figure 3-3

Initial Area Time of Concentration = 5.04 minutes

TC = $[1.8 * (1.1 - C) * \text{distance}(\text{Ft.})^{.5}] / (\% \text{ slope}^{(1/3)})]$

TC = $[1.8 * (1.1 - 0.3500) * (100.000^{.5}) / (19.200^{(1/3)})] = 5.04$

Rainfall intensity (I) = 8.386(In/Hr) for a 100.0 year storm

Effective runoff coefficient used for area (Q=KCIA) is C = 0.350

Subarea runoff = 0.112(CFS)

Total initial stream area = 0.038(Ac.)

+++++

+++

Process from Point/Station 403.000 to Point/Station

404.000

**** INITIAL AREA EVALUATION ****

Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[UNDISTURBED NATURAL TERRAIN]
(Permanent Open Space)
Impervious value, Ai = 0.000
Sub-Area C Value = 0.350
Initial subarea total flow distance = 13.000(Ft.)
Highest elevation = 459.600(Ft.)
Lowest elevation = 453.500(Ft.)
Elevation difference = 6.100(Ft.) Slope = 46.923 %
Top of Initial Area Slope adjusted by User to 30.000 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of 30.00 %, in a development type of
Permanent Open Space
In Accordance With Figure 3-3
Initial Area Time of Concentration = 4.34 minutes
 $TC = [1.8 * (1.1 - C) * distance(Ft.)^{.5} / (% slope^{(1/3)})]$
 $TC = [1.8 * (1.1 - 0.3500) * (100.000^{.5}) / (30.000^{(1/3)})] = 4.34$
Calculated TC of 4.345 minutes is less than 5 minutes,
resetting TC to 5.0 minutes for rainfall intensity calculations
Rainfall intensity (I) = 8.431(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.350
Subarea runoff = 0.065(CFS)
Total initial stream area = 0.022(Ac.)

+++++

+++

Process from Point/Station 405.000 to Point/Station
406.000

**** INITIAL AREA EVALUATION ****

Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[UNDISTURBED NATURAL TERRAIN]
(Permanent Open Space)
Impervious value, Ai = 0.000
Sub-Area C Value = 0.350
Initial subarea total flow distance = 16.000(Ft.)
Highest elevation = 461.000(Ft.)
Lowest elevation = 452.100(Ft.)
Elevation difference = 8.900(Ft.) Slope = 55.625 %
Top of Initial Area Slope adjusted by User to 30.000 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)

for the top area slope value of 30.00 %, in a development type of
 Permanent Open Space
 In Accordance With Figure 3-3
 Initial Area Time of Concentration = 4.34 minutes
 $TC = [1.8 * (1.1 - C) * distance(Ft.)^{.5} / (\% \text{ slope}^{(1/3)})]$
 $TC = [1.8 * (1.1 - 0.3500) * (100.000^{.5}) / (30.000^{(1/3)})] = 4.34$
 Calculated TC of 4.345 minutes is less than 5 minutes,
 resetting TC to 5.0 minutes for rainfall intensity calculations
 Rainfall intensity (I) = 8.431(In/Hr) for a 100.0 year storm
 Effective runoff coefficient used for area (Q=KCIA) is C = 0.350
 Subarea runoff = 0.083(CFS)
 Total initial stream area = 0.028(Ac.)

+++++

+++

Process from Point/Station 501.000 to Point/Station
 502.000

**** INITIAL AREA EVALUATION ****

Decimal fraction soil group A = 0.000
 Decimal fraction soil group B = 0.000
 Decimal fraction soil group C = 0.000
 Decimal fraction soil group D = 1.000
 [INDUSTRIAL area type]
 (General Industrial)
 Impervious value, Ai = 0.950
 Sub-Area C Value = 0.870
 Initial subarea total flow distance = 45.000(Ft.)
 Highest elevation = 463.200(Ft.)
 Lowest elevation = 462.200(Ft.)
 Elevation difference = 1.000(Ft.) Slope = 2.222 %
 Top of Initial Area Slope adjusted by User to 2.000 %
 INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
 The maximum overland flow distance is 70.00 (Ft)
 for the top area slope value of 2.00 %, in a development type of
 General Industrial
 In Accordance With Figure 3-3
 Initial Area Time of Concentration = 2.75 minutes
 $TC = [1.8 * (1.1 - C) * distance(Ft.)^{.5} / (\% \text{ slope}^{(1/3)})]$
 $TC = [1.8 * (1.1 - 0.8700) * (70.000^{.5}) / (2.000^{(1/3)})] = 2.75$
 Calculated TC of 2.749 minutes is less than 5 minutes,
 resetting TC to 5.0 minutes for rainfall intensity calculations
 Rainfall intensity (I) = 8.431(In/Hr) for a 100.0 year storm
 Effective runoff coefficient used for area (Q=KCIA) is C = 0.870
 Subarea runoff = 0.587(CFS)
 Total initial stream area = 0.080(Ac.)

+++++

+++

Process from Point/Station 502.000 to Point/Station
 503.000

**** SUBAREA FLOW ADDITION ****

Calculated TC of 2.749 minutes is less than 5 minutes,
resetting TC to 5.0 minutes for rainfall intensity calculations
Rainfall intensity (I) = 8.431(In/Hr) for a 100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[HIGH DENSITY RESIDENTIAL]
(43.0 DU/A or Less)
Impervious value, Ai = 0.800
Sub-Area C Value = 0.790
Time of concentration = 2.75 min.
Rainfall intensity = 8.431(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.815 CA = 0.212
Subarea runoff = 1.199(CFS) for 0.180(Ac.)
Total runoff = 1.786(CFS) Total area = 0.260(Ac.)

+++++

+++

Process from Point/Station 503.000 to Point/Station

603.000

**** USER DEFINED FLOW INFORMATION AT A POINT ****

User specified 'C' value of 0.790 given for subarea
Rainfall intensity (I) = 8.431(In/Hr) for a 100.0 year storm
User specified values are as follows:
TC = 5.00 min. Rain intensity = 8.43(In/Hr)
Total area = 0.260(Ac.) Total runoff = 1.010(CFS)

+++++

+++

Process from Point/Station 503.000 to Point/Station

603.000

**** PIPEFLOW TRAVEL TIME (User specified size) ****

Upstream point/station elevation = 455.250(Ft.)
Downstream point/station elevation = 450.500(Ft.)
Pipe length = 255.11(Ft.) Slope = 0.0186 Manning's N = 0.009
No. of pipes = 1 Required pipe flow = 1.010(CFS)
Given pipe size = 10.00(In.)
Calculated individual pipe flow = 1.010(CFS)
Normal flow depth in pipe = 3.29(In.)
Flow top width inside pipe = 9.40(In.)
Critical Depth = 5.35(In.)
Pipe flow velocity = 6.46(Ft/s)
Travel time through pipe = 0.66 min.

Time of concentration (TC) = 5.66 min.

```
+++++
+++
  Process from Point/Station      503.000 to Point/Station
603.000
  **** CONFLUENCE OF MINOR STREAMS ****

-----
  Along Main Stream number: 1 in normal stream number 1
  Stream flow area = 0.260 (Ac.)
  Runoff from this stream = 1.010 (CFS)
  Time of concentration = 5.66 min.
  Rainfall intensity = 7.785 (In/Hr)

+++++
+++
  Process from Point/Station      601.000 to Point/Station
602.000
  **** INITIAL AREA EVALUATION ****

-----
  Decimal fraction soil group A = 0.000
  Decimal fraction soil group B = 0.000
  Decimal fraction soil group C = 0.000
  Decimal fraction soil group D = 1.000
  [MEDIUM DENSITY RESIDENTIAL ]
  (7.3 DU/A or Less )
  Impervious value, Ai = 0.400
  Sub-Area C Value = 0.570
  Initial subarea total flow distance = 49.000 (Ft.)
  Highest elevation = 457.800 (Ft.)
  Lowest elevation = 455.500 (Ft.)
  Elevation difference = 2.300 (Ft.) Slope = 4.694 %
  Top of Initial Area Slope adjusted by User to 4.000 %
  INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
  The maximum overland flow distance is 100.00 (Ft)
  for the top area slope value of 4.00 %, in a development type of
  7.3 DU/A or Less
  In Accordance With Figure 3-3
  Initial Area Time of Concentration = 6.01 minutes
  TC = [1.8*(1.1-C)*distance(Ft.)^.5]/(% slope^(1/3)]
  TC = [1.8*(1.1-0.5700)*( 100.000^.5)/( 4.000^(1/3)]= 6.01
  Rainfall intensity (I) = 7.488 (In/Hr) for a 100.0 year storm
  Effective runoff coefficient used for area (Q=KCIA) is C = 0.570
  Subarea runoff = 0.726 (CFS)
  Total initial stream area = 0.170 (Ac.)

+++++
+++
```

Process from Point/Station 602.000 to Point/Station
603.000

**** USER DEFINED FLOW INFORMATION AT A POINT ****

User specified 'C' value of 0.570 given for subarea
Rainfall intensity (I) = 7.496(In/Hr) for a 100.0 year storm
User specified values are as follows:
TC = 6.00 min. Rain intensity = 7.50(In/Hr)
Total area = 0.170(Ac.) Total runoff = 0.420(CFS)

+++++

+++

Process from Point/Station 602.000 to Point/Station
603.000

**** PIPEFLOW TRAVEL TIME (User specified size) ****

Upstream point/station elevation = 450.750(Ft.)
Downstream point/station elevation = 450.500(Ft.)
Pipe length = 95.60(Ft.) Slope = 0.0026 Manning's N = 0.009
No. of pipes = 1 Required pipe flow = 0.420(CFS)
Given pipe size = 10.00(In.)
Calculated individual pipe flow = 0.420(CFS)
Normal flow depth in pipe = 3.47(In.)
Flow top width inside pipe = 9.52(In.)
Critical Depth = 3.39(In.)
Pipe flow velocity = 2.49(Ft/s)
Travel time through pipe = 0.64 min.
Time of concentration (TC) = 6.64 min.

+++++

+++

Process from Point/Station 603.000 to Point/Station
603.000

**** CONFLUENCE OF MINOR STREAMS ****

Along Main Stream number: 1 in normal stream number 2
Stream flow area = 0.170(Ac.)
Runoff from this stream = 0.420(CFS)
Time of concentration = 6.64 min.
Rainfall intensity = 7.022(In/Hr)
Summary of stream data:

Stream No.	Flow rate (CFS)	TC (min)	Rainfall Intensity (In/Hr)
------------	-----------------	----------	----------------------------

1	1.010	5.66	7.785
2	0.420	6.64	7.022

Qmax(1) =

	1.000	*	1.000	*	1.010)	+	
	1.000	*	0.852	*	0.420)	+	= 1.368
Qmax(2)	=						
	0.902	*	1.000	*	1.010)	+	
	1.000	*	1.000	*	0.420)	+	= 1.331

Total of 2 streams to confluence:
Flow rates before confluence point:
1.010 0.420
Maximum flow rates at confluence using above data:
1.368 1.331
Area of streams before confluence:
0.260 0.170
Results of confluence:
Total flow rate = 1.368 (CFS)
Time of concentration = 5.658 min.
Effective stream area after confluence = 0.430 (Ac.)

+++++

+++
Process from Point/Station 603.000 to Point/Station
703.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****

Upstream point/station elevation = 450.500 (Ft.)
Downstream point/station elevation = 450.170 (Ft.)
Pipe length = 109.32 (Ft.) Slope = 0.0030 Manning's N = 0.009
No. of pipes = 1 Required pipe flow = 1.368 (CFS)
Given pipe size = 10.00 (In.)
Calculated individual pipe flow = 1.368 (CFS)
Normal flow depth in pipe = 6.68 (In.)
Flow top width inside pipe = 9.42 (In.)
Critical Depth = 6.27 (In.)
Pipe flow velocity = 3.53 (Ft/s)
Travel time through pipe = 0.52 min.
Time of concentration (TC) = 6.17 min.

+++++

+++
Process from Point/Station 603.000 to Point/Station
703.000
**** CONFLUENCE OF MINOR STREAMS ****

Along Main Stream number: 1 in normal stream number 1
Stream flow area = 0.430 (Ac.)
Runoff from this stream = 1.368 (CFS)
Time of concentration = 6.17 min.
Rainfall intensity = 7.359 (In/Hr)

```
+++++
+++ Process from Point/Station      701.000 to Point/Station
702.000
**** INITIAL AREA EVALUATION ****
```

```
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[HIGH DENSITY RESIDENTIAL          ]
(43.0 DU/A or Less              )
Impervious value, Ai = 0.800
Sub-Area C Value = 0.790
Initial subarea total flow distance = 45.000(Ft.)
Highest elevation = 465.100(Ft.)
Lowest elevation = 463.200(Ft.)
Elevation difference = 1.900(Ft.) Slope = 4.222 %
Top of Initial Area Slope adjusted by User to 4.200 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 95.00 (Ft)
for the top area slope value of 4.20 %, in a development type of
43.0 DU/A or Less
In Accordance With Figure 3-3
Initial Area Time of Concentration = 3.37 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5]/(% slope^(1/3)]
TC = [1.8*(1.1-0.7900)*( 95.000^.5)/( 4.200^(1/3))]= 3.37
Calculated TC of 3.371 minutes is less than 5 minutes,
resetting TC to 5.0 minutes for rainfall intensity calculations
Rainfall intensity (I) = 8.431(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.790
Subarea runoff = 1.066(CFS)
Total initial stream area = 0.160(Ac.)
```

```
+++++
+++ Process from Point/Station      702.000 to Point/Station
703.000
**** SUBAREA FLOW ADDITION ****
```

```
Calculated TC of 3.371 minutes is less than 5 minutes,
resetting TC to 5.0 minutes for rainfall intensity calculations
Rainfall intensity (I) = 8.431(In/Hr) for a 100.0 year storm
User specified 'C' value of 0.730 given for subarea
Time of concentration = 3.37 min.
Rainfall intensity = 8.431(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.742 CA = 0.579
Subarea runoff = 3.816(CFS) for 0.620(Ac.)
Total runoff = 4.882(CFS) Total area = 0.780(Ac.)
```

```

+++++
+++
Process from Point/Station      702.000 to Point/Station
703.000

```

**** USER DEFINED FLOW INFORMATION AT A POINT ****

```

User specified 'C' value of 0.740 given for subarea
Rainfall intensity (I) =      8.431(In/Hr) for a   100.0 year storm
User specified values are as follows:
TC =   5.00 min.  Rain intensity =      8.43(In/Hr)
Total area =      0.780(Ac.)  Total runoff =      0.590(CFS)

```

```

+++++
+++
Process from Point/Station      703.000 to Point/Station
703.000

```

**** CONFLUENCE OF MINOR STREAMS ****

```

Along Main Stream number: 1 in normal stream number 2
Stream flow area =      0.780(Ac.)
Runoff from this stream =      0.590(CFS)
Time of concentration =      5.00 min.
Rainfall intensity =      8.431(In/Hr)
Summary of stream data:

```

Stream No.	Flow rate (CFS)	TC (min)	Rainfall Intensity (In/Hr)
---------------	--------------------	-------------	-------------------------------

1	1.368	6.17	7.359
2	0.590	5.00	8.431

```

Qmax(1) =
      1.000 *      1.000 *      1.368) +
      0.873 *      1.000 *      0.590) + =      1.883

```

```

Qmax(2) =
      1.000 *      0.810 *      1.368) +
      1.000 *      1.000 *      0.590) + =      1.698

```

Total of 2 streams to confluence:

Flow rates before confluence point:

1.368 0.590

Maximum flow rates at confluence using above data:

1.883 1.698

Area of streams before confluence:

0.430 0.780

Results of confluence:

Total flow rate = 1.883(CFS)

Time of concentration = 6.174 min.

Effective stream area after confluence = 1.210(Ac.)

+++++
+++ Process from Point/Station 703.000 to Point/Station
704.000

**** PIPEFLOW TRAVEL TIME (User specified size) ****

Upstream point/station elevation = 450.170(Ft.)
Downstream point/station elevation = 450.000(Ft.)
Pipe length = 7.98(Ft.) Slope = 0.0213 Manning's N = 0.009
No. of pipes = 1 Required pipe flow = 1.883(CFS)
Given pipe size = 12.00(In.)
Calculated individual pipe flow = 1.883(CFS)
Normal flow depth in pipe = 4.10(In.)
Flow top width inside pipe = 11.38(In.)
Critical Depth = 7.02(In.)
Pipe flow velocity = 7.96(Ft/s)
Travel time through pipe = 0.02 min.
Time of concentration (TC) = 6.19 min.

+++++
+++ Process from Point/Station 801.000 to Point/Station
802.000

**** INITIAL AREA EVALUATION ****

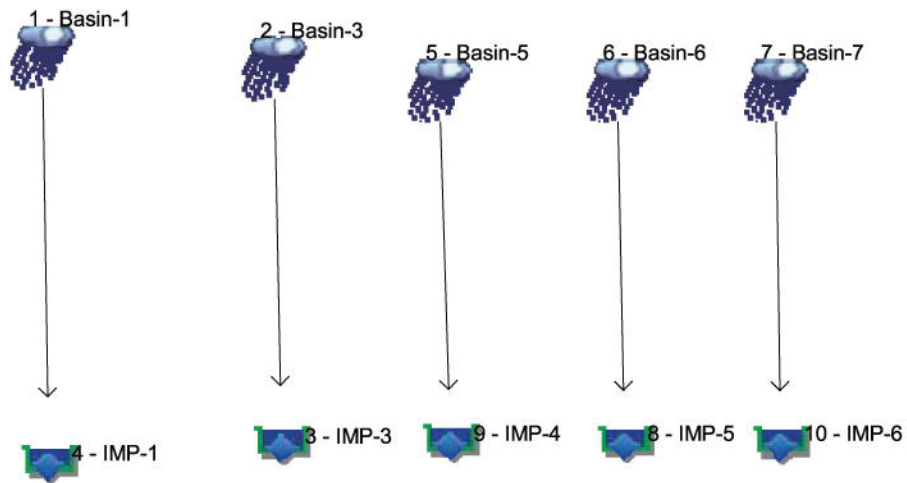
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[UNDISTURBED NATURAL TERRAIN]
(Permanent Open Space)
Impervious value, Ai = 0.000
Sub-Area C Value = 0.350
Initial subarea total flow distance = 16.000(Ft.)
Highest elevation = 457.700(Ft.)
Lowest elevation = 450.500(Ft.)
Elevation difference = 7.200(Ft.) Slope = 45.000 %
Top of Initial Area Slope adjusted by User to 30.000 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of 30.00 %, in a development type of
Permanent Open Space
In Accordance With Figure 3-3
Initial Area Time of Concentration = 4.34 minutes
 $TC = [1.8 * (1.1 - C) * distance(Ft.)^{.5}] / (\% slope^{(1/3)})]$
 $TC = [1.8 * (1.1 - 0.3500) * (100.000^{.5}) / (30.000^{(1/3)})] = 4.34$
Calculated TC of 4.345 minutes is less than 5 minutes,
resetting TC to 5.0 minutes for rainfall intensity calculations
Rainfall intensity (I) = 8.431(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.350

Subarea runoff = 0.091 (CFS)
Total initial stream area = 0.031 (Ac.)
End of computations, total study area = 3.003 (Ac.)

APPENDIX D –
ATTENUATION/HYDRAULIC
ANALYSIS

Watershed Model Schematic

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



Legend

Hyd.	Origin	Description
1	Manual	Basin-1
2	Manual	Basin-3
3	Reservoir	IMP-3
4	Reservoir	IMP-1
5	Manual	Basin-5
6	Manual	Basin-6
7	Manual	Basin-7
8	Reservoir	IMP-5
9	Reservoir	IMP-4
10	Reservoir	IMP-6

Hydrograph Return Period Recap

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

[illegible]

Hydrograph Summary Report

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

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	Manual	0.540	5	245	750	-----	-----	-----	Basin-1
2	Manual	0.570	6	246	853	-----	-----	-----	Basin-3
3	Reservoir	0.364	6	246	853	2	461.53	315	IMP-3
4	Reservoir	0.367	5	245	749	1	463.54	196	IMP-1
5	Manual	1.790	5	245	2,433	-----	-----	-----	Basin-5
6	Manual	0.730	6	246	1,084	-----	-----	-----	Basin-6
7	Manual	4.880	5	245	6,594	-----	-----	-----	Basin-7
8	Reservoir	0.418	6	252	1,083	6	456.63	264	IMP-5
9	Reservoir	1.007	5	250	2,432	5	459.60	548	IMP-4
10	Reservoir	0.593	5	255	6,554	7	456.04	4,834	IMP-6
23-299-Attenuation-100yr-IMP-6-AQS-21in Rimp					Return Period: 100 Year			Tuesday, 03 / 11 / 2025	

BASIN-1:
TIME OF CONCENTRATION = 5 MIN.
6 HOUR RAINFALL = 3.2 INCHES
BASIN AREA = 0.14 ACRES
RUNOFF COEFFICIENT = 0.47
PEAK DISCHARGE = 0.54 CFS

Time(min)	Q(cfs)
0	0
5	0.01
10	0.01
15	0.01
20	0.01
25	0.01
30	0.01
35	0.01
40	0.01
45	0.01
50	0.01
55	0.01
60	0.01
65	0.02
70	0.02
75	0.02
80	0.02
85	0.02
90	0.02
95	0.02
100	0.02
105	0.02
110	0.02
115	0.02
120	0.02
125	0.02
130	0.02
135	0.02
140	0.02
145	0.02
150	0.02
155	0.02
160	0.02
165	0.03
170	0.03
175	0.03
180	0.03
185	0.03
190	0.03
195	0.04
200	0.04
205	0.04
210	0.04

215	0.05
220	0.05
225	0.07
230	0.07
235	0.11
240	0.15
245	0.54
250	0.09
255	0.06
260	0.05
265	0.04
270	0.03
275	0.03
280	0.03
285	0.03
290	0.02
295	0.02
300	0.02
305	0.02
310	0.02
315	0.02
320	0.02
325	0.02
330	0.02
335	0.01
340	0.01
345	0.01
350	0.01
355	0.01
360	0.01

Hydrograph Report

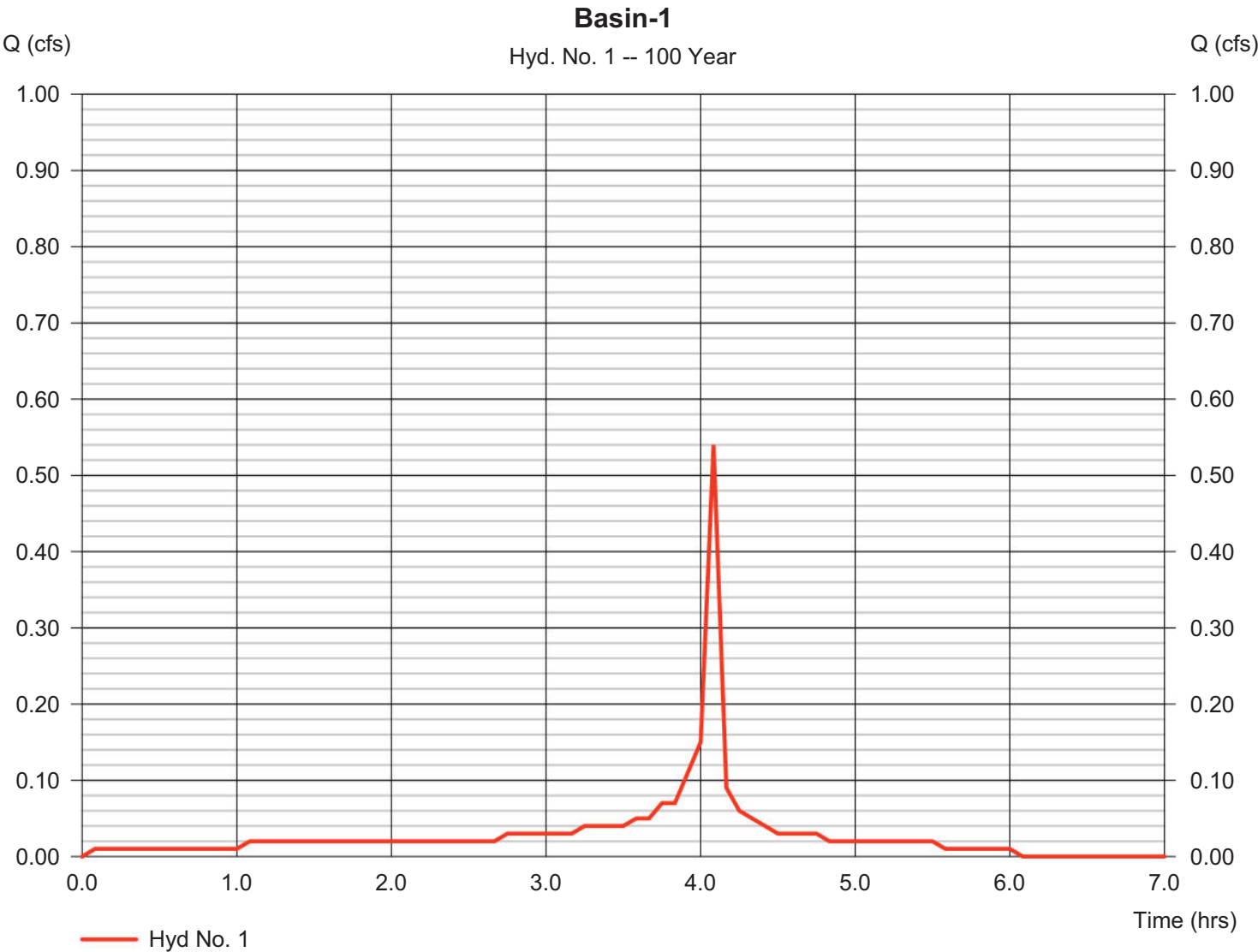
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023

Tuesday, 03 / 11 / 2025

Hyd. No. 1

Basin-1

Hydrograph type	= Manual	Peak discharge	= 0.540 cfs
Storm frequency	= 100 yrs	Time to peak	= 4.08 hrs
Time interval	= 5 min	Hyd. volume	= 750 cuft



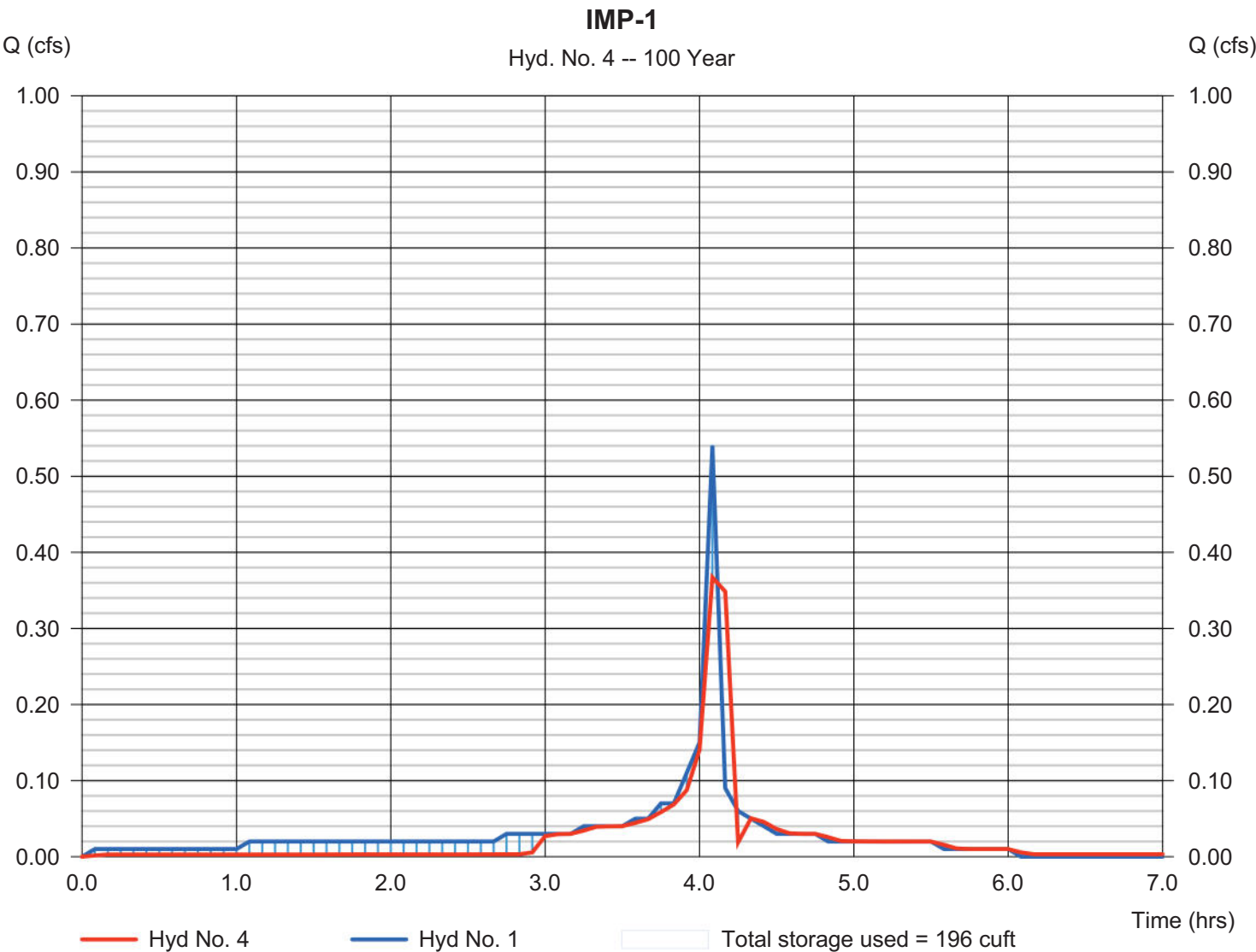
Hydrograph Report

Hyd. No. 4

IMP-1

Hydrograph type	= Reservoir	Peak discharge	= 0.367 cfs
Storm frequency	= 100 yrs	Time to peak	= 4.08 hrs
Time interval	= 5 min	Hyd. volume	= 749 cuft
Inflow hyd. No.	= 1 - Basin-1	Max. Elevation	= 463.54 ft
Reservoir name	= IMP-1	Max. Storage	= 196 cuft

Storage Indication method used.



Pond No. 5 - IMP-1

Pond Data

Contours -User-defined contour areas. Average end area method used for volume calculation. Beginning Elevation = 459.25 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	459.25	01	0	0
1.25	460.50	01	1	1
1.25	460.50	01	0	1
3.25	462.50	01	2	3
3.25	462.50	121	0	3
4.25	463.50	239	180	183
5.00	464.25	345	219	402

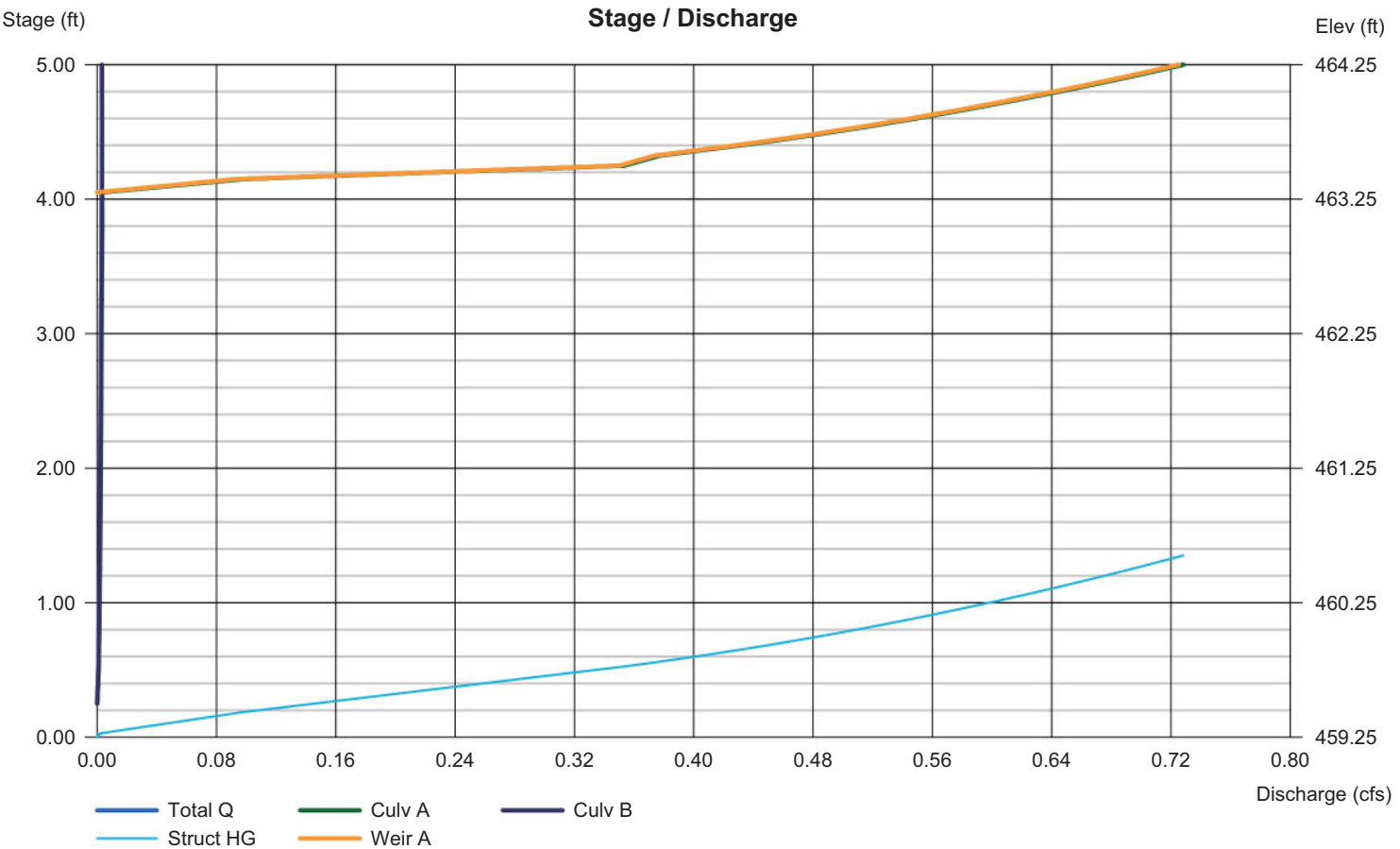
Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 6.00	0.25	0.00	0.00
Span (in)	= 6.00	0.25	0.00	0.00
Nô. Barrels	=	1	1	0
Invert El. (ft)	= 459.25	459.50	0.00	0.00
Length (ft)	= 45.61	0.00	0.00	0.00
Slope (%)	= 0.50	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	Yes	No	No

Weir Structures

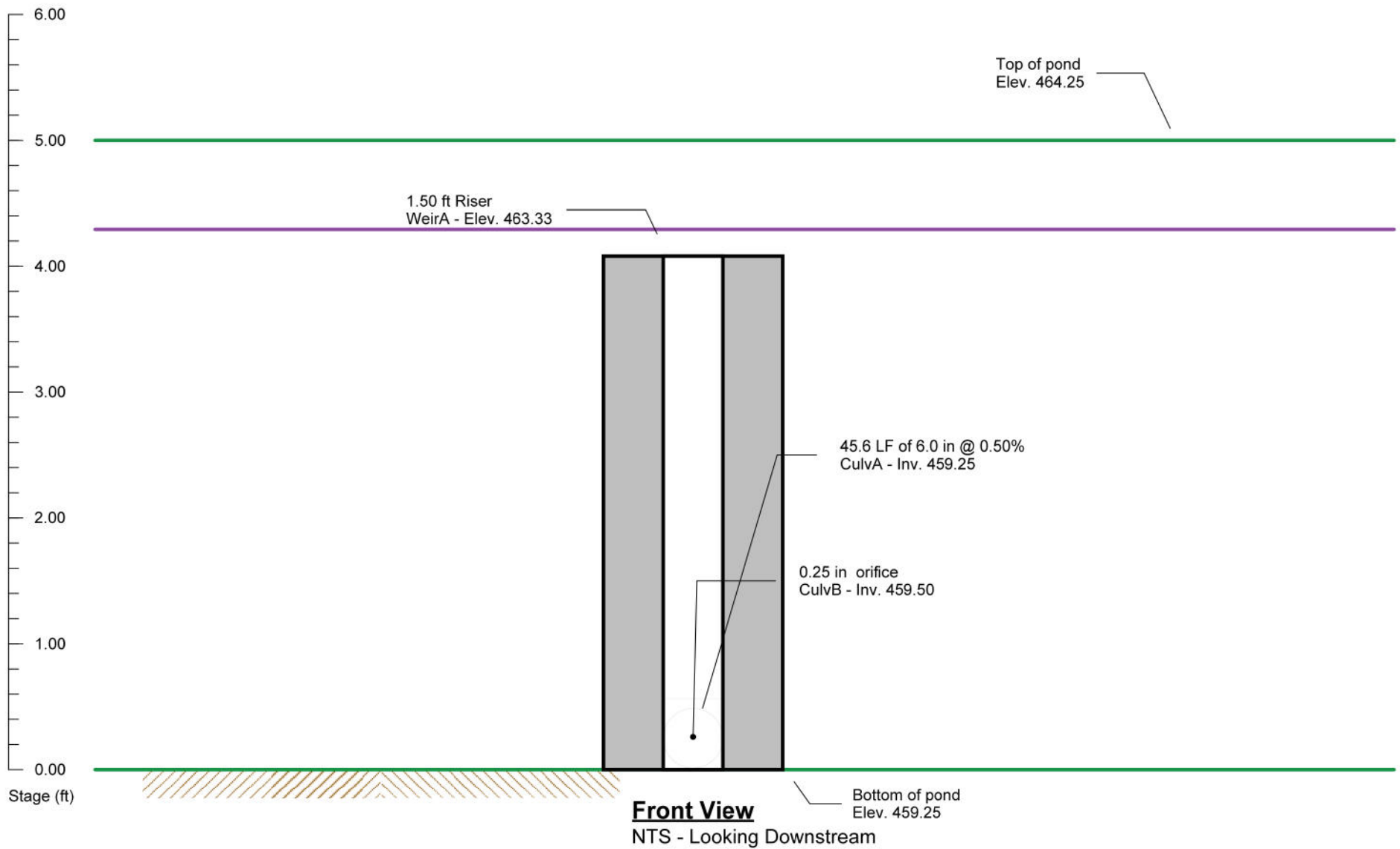
	[A]	[B]	[C]	[D]
Crest Len (ft)	= 1.50	0.00	0.00	0.00
Crest El. (ft)	= 463.33	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= 1	---	---	---
Multi-Stage	= Yes	No	No	No
Exfil.(in/hr)	= 0.000 (by Wet area)			
TW Elev. (ft)	= 0.00			

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



Pond No. 5 - IMP-1

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



BASIN-3:
TIME OF CONCENTRATION = 6 MIN.
6 HOUR RAINFALL = 3.2 INCHES
BASIN AREA = 0.11 ACRES
RUNOFF COEFFICIENT = 0.66
PEAK DISCHARGE = 0.57 CFS

Time(min)	Q(cfs)
0	0
6	0.01
12	0.01
18	0.01
24	0.01
30	0.01
36	0.02
42	0.02
48	0.02
54	0.02
60	0.02
66	0.02
72	0.02
78	0.02
84	0.02
90	0.02
96	0.02
102	0.02
108	0.02
114	0.02
120	0.02
126	0.02
132	0.02
138	0.02
144	0.02
150	0.03
156	0.03
162	0.03
168	0.03
174	0.03
180	0.03
186	0.03
192	0.04
198	0.04
204	0.04
210	0.05
216	0.05
222	0.06
228	0.07
234	0.11
240	0.15
246	0.57
252	0.09

258	0.06
264	0.05
270	0.04
276	0.03
282	0.03
288	0.03
294	0.02
300	0.02
306	0.02
312	0.02
318	0.02
324	0.02
330	0.02
336	0.02
342	0.02
348	0.02
354	0.01
360	0.01

Hydrograph Report

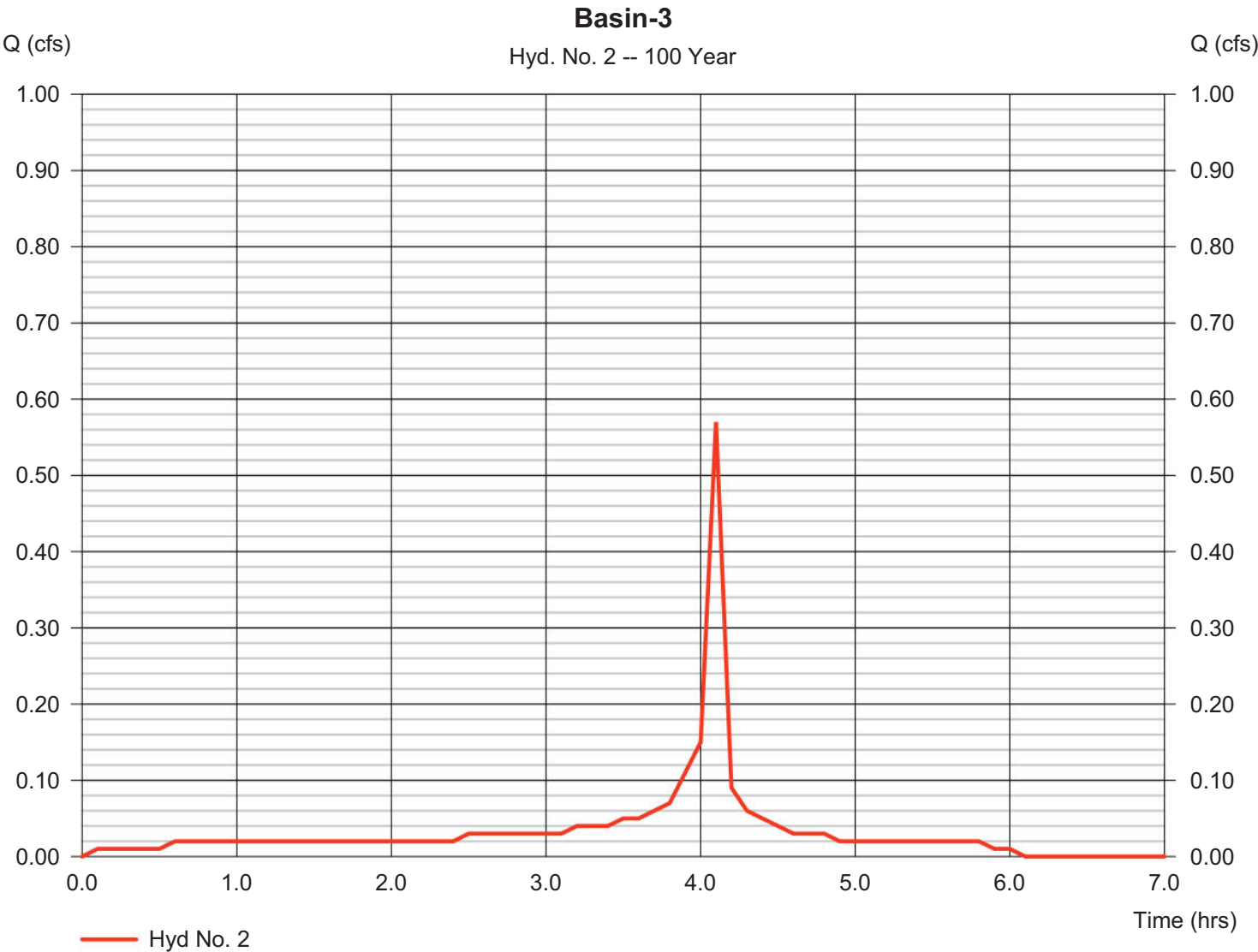
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023

Tuesday, 03 / 11 / 2025

Hyd. No. 2

Basin-3

Hydrograph type	= Manual	Peak discharge	= 0.570 cfs
Storm frequency	= 100 yrs	Time to peak	= 4.10 hrs
Time interval	= 6 min	Hyd. volume	= 853 cuft



Hydrograph Report

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

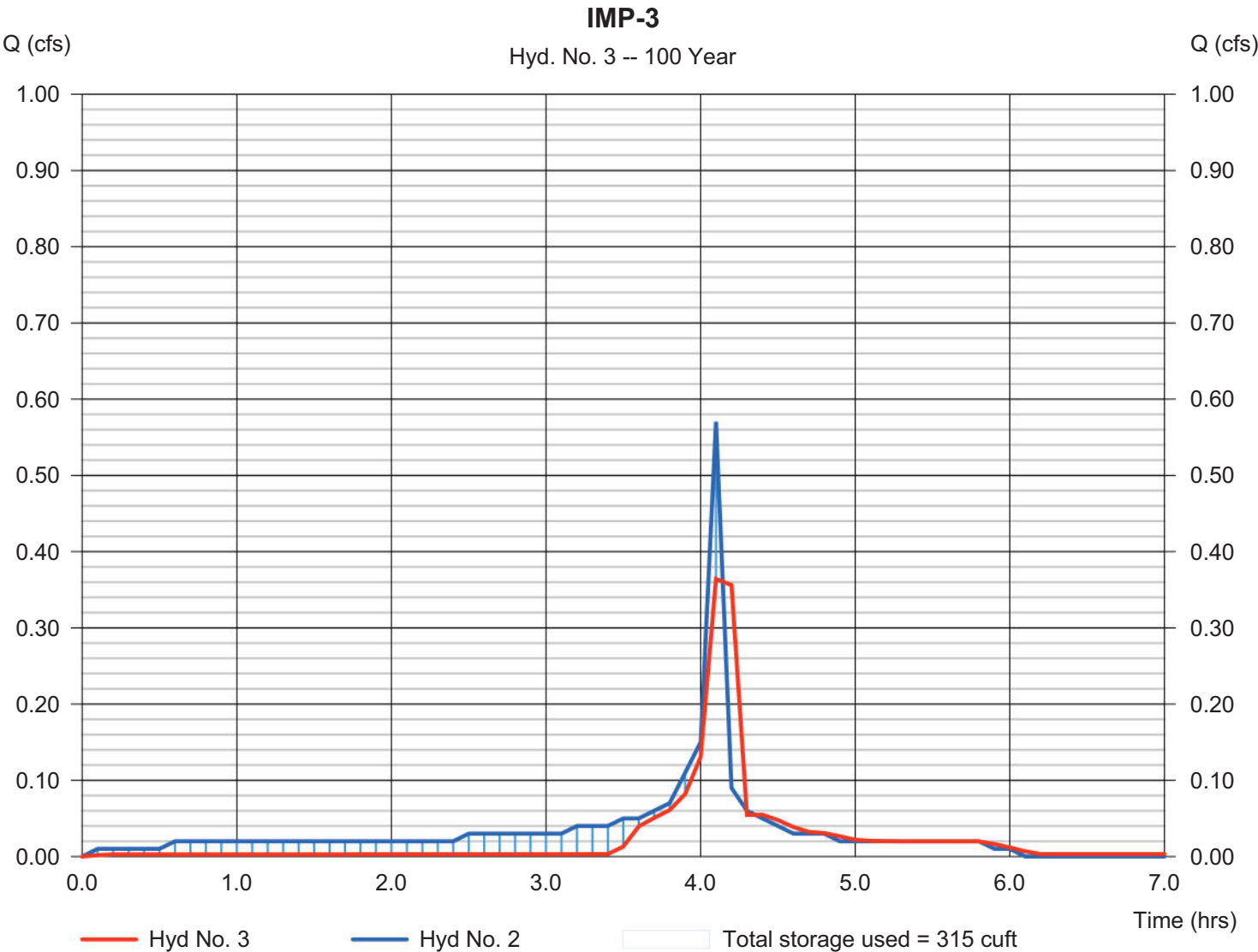
Tuesday, 03 / 11 / 2025

Hyd. No. 3

IMP-3

Hydrograph type	= Reservoir	Peak discharge	= 0.364 cfs
Storm frequency	= 100 yrs	Time to peak	= 4.10 hrs
Time interval	= 6 min	Hyd. volume	= 853 cuft
Inflow hyd. No.	= 2 - Basin-3	Max. Elevation	= 461.53 ft
Reservoir name	= IMP-3	Max. Storage	= 315 cuft

Storage Indication method used.



Pond No. 2 - IMP-3

Pond Data

Contours -User-defined contour areas. Average end area method used for volume calculation. Beginning Elevation = 457.25 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	457.25	01	0	0
1.25	458.50	01	1	1
1.25	458.50	01	0	1
3.25	460.50	01	2	3
3.25	460.50	218	0	3
4.25	461.50	377	297	301
5.00	462.25	512	333	634

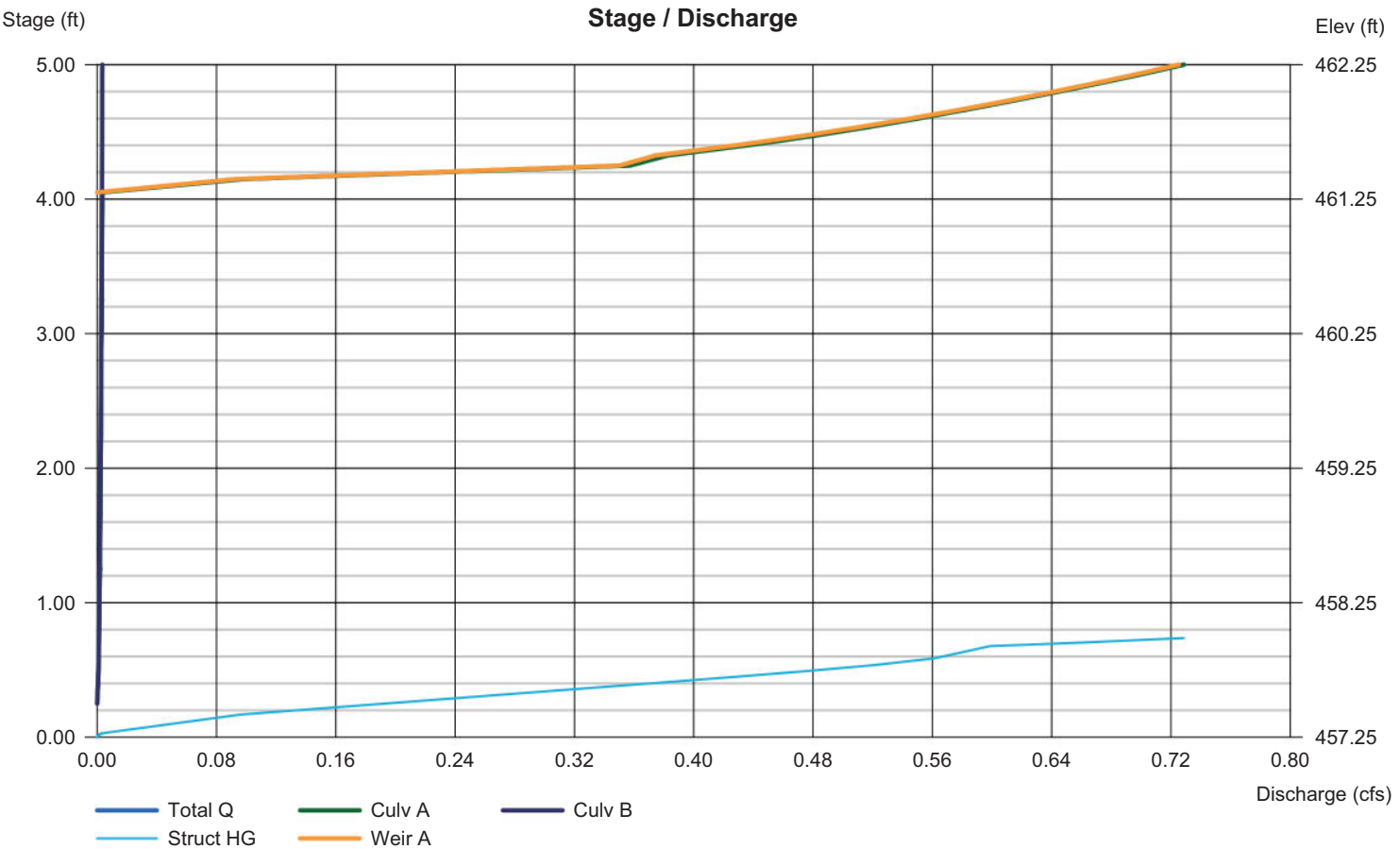
Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 8.00	0.25	0.00	0.00
Span (in)	= 8.00	0.25	0.00	0.00
Nô. Barrels	=	1	0	0
Invert El. (ft)	= 457.25	457.50	0.00	0.00
Length (ft)	= 22.40	0.00	0.00	0.00
Slope (%)	= 0.50	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	Yes	No	No

Weir Structures

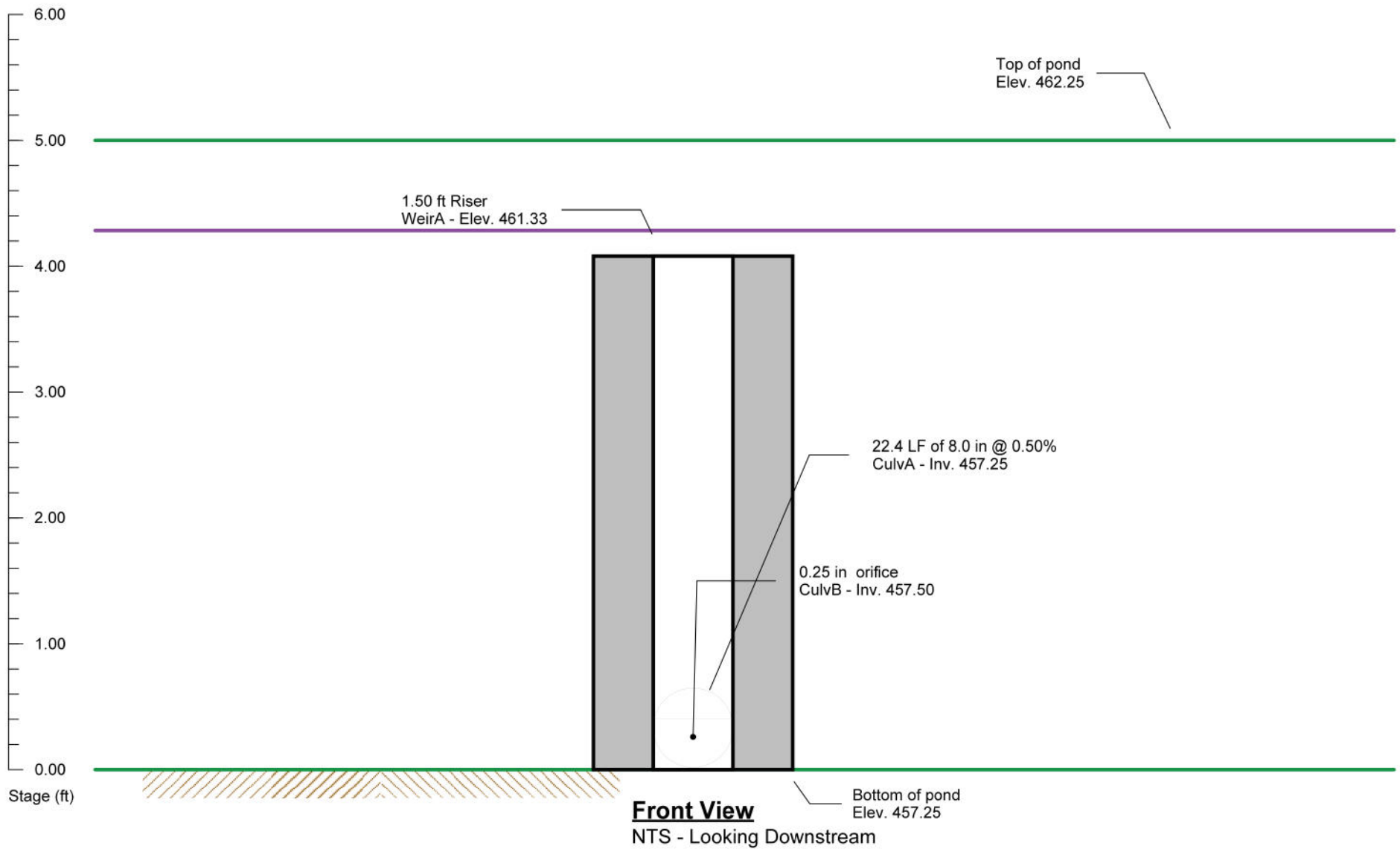
	[A]	[B]	[C]	[D]
Crest Len (ft)	= 1.50	0.00	0.00	0.00
Crest El. (ft)	= 461.33	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= 1	---	---	---
Multi-Stage	= Yes	No	No	No
Exfil.(in/hr)	= 0.000 (by Wet area)			
TW Elev. (ft)	= 0.00			

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



Pond No. 2 - IMP-3

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



BASIN-5:
TIME OF CONCENTRATION = 5 MIN.
6 HOUR RAINFALL = 3.2 INCHES
BASIN AREA = 0.26 ACRES
RUNOFF COEFFICIENT = 0.81
PEAK DISCHARGE = 1.79 CFS

Time(min)	Q(cfs)
0	0
5	0.04
10	0.04
15	0.04
20	0.04
25	0.04
30	0.04
35	0.04
40	0.04
45	0.05
50	0.05
55	0.05
60	0.05
65	0.05
70	0.05
75	0.05
80	0.05
85	0.05
90	0.05
95	0.05
100	0.06
105	0.06
110	0.06
115	0.06
120	0.06
125	0.06
130	0.06
135	0.07
140	0.07
145	0.07
150	0.07
155	0.08
160	0.08
165	0.08
170	0.08
175	0.09
180	0.09
185	0.1
190	0.1
195	0.11
200	0.12
205	0.13
210	0.14

215	0.16
220	0.17
225	0.21
230	0.24
235	0.35
240	0.5
245	1.79
250	0.28
255	0.19
260	0.15
265	0.12
270	0.11
275	0.1
280	0.09
285	0.08
290	0.07
295	0.07
300	0.07
305	0.06
310	0.06
315	0.06
320	0.05
325	0.05
330	0.05
335	0.05
340	0.05
345	0.04
350	0.04
355	0.04
360	0.04

Hydrograph Report

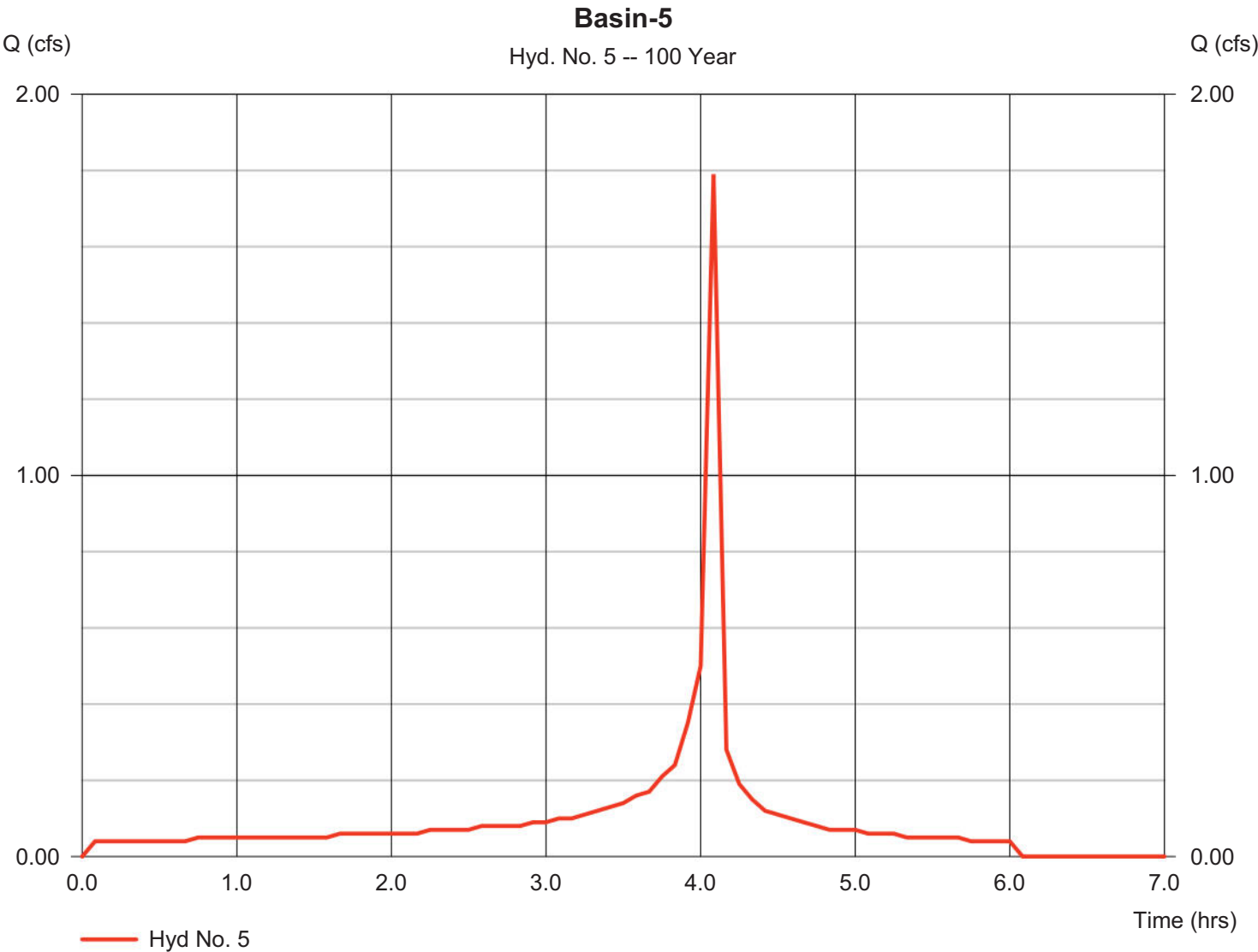
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023

Tuesday, 03 / 11 / 2025

Hyd. No. 5

Basin-5

Hydrograph type	= Manual	Peak discharge	= 1.790 cfs
Storm frequency	= 100 yrs	Time to peak	= 4.08 hrs
Time interval	= 5 min	Hyd. volume	= 2,433 cuft



Hydrograph Report

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

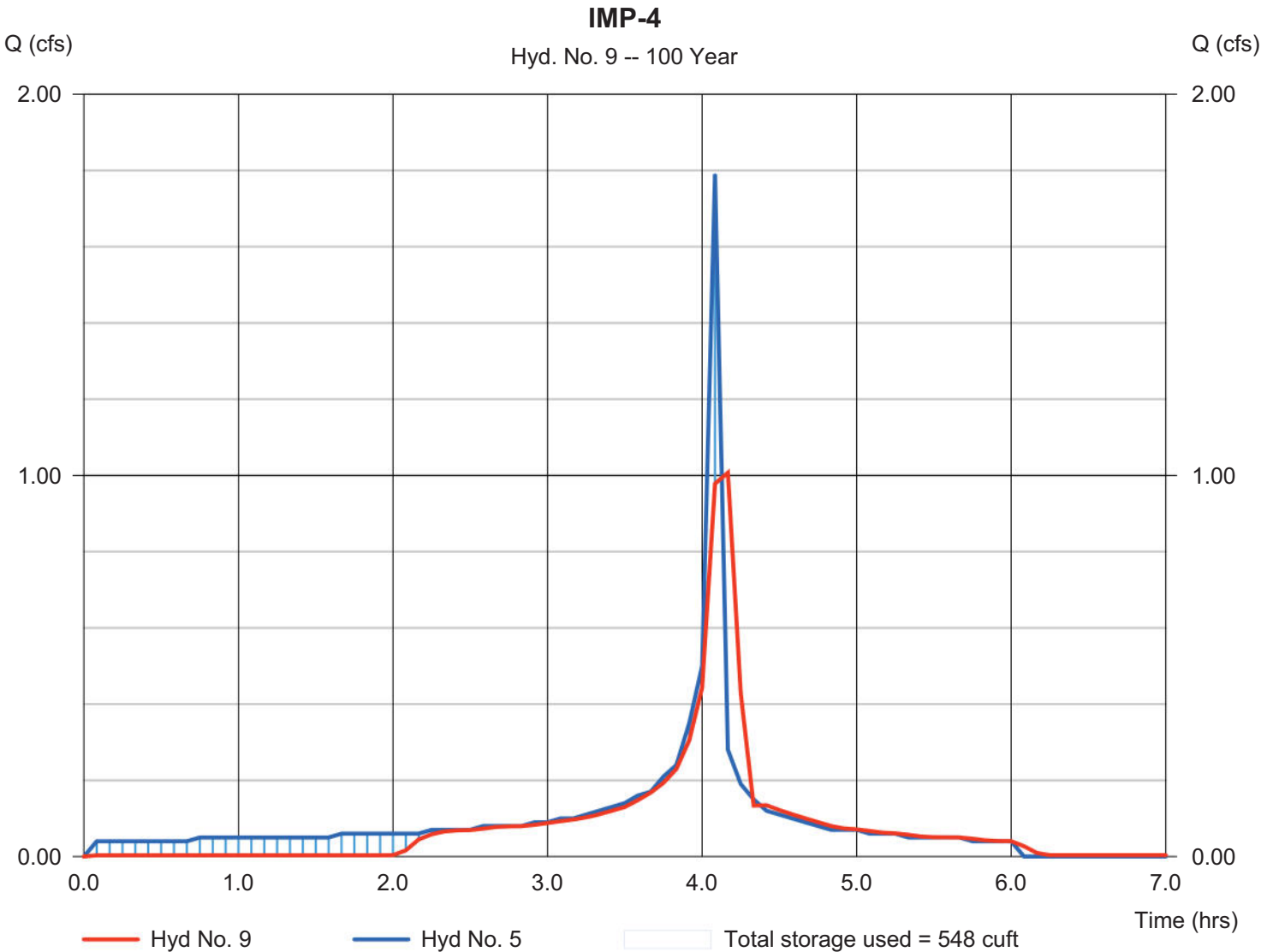
Tuesday, 03 / 11 / 2025

Hyd. No. 9

IMP-4

Hydrograph type	= Reservoir	Peak discharge	= 1.007 cfs
Storm frequency	= 100 yrs	Time to peak	= 4.17 hrs
Time interval	= 5 min	Hyd. volume	= 2,432 cuft
Inflow hyd. No.	= 5 - Basin-5	Max. Elevation	= 459.60 ft
Reservoir name	= IMP-4	Max. Storage	= 548 cuft

Storage Indication method used.



Pond No. 3 - IMP-4

Pond Data

Contours -User-defined contour areas. Average end area method used for volume calculation. Beginning Elevation = 455.25 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	455.25	01	0	0
1.25	456.50	01	1	1
1.25	456.50	01	0	1
3.25	458.50	01	2	3
3.25	458.50	318	0	3
4.25	459.50	500	409	412
4.75	460.00	600	275	687
5.00	460.25	654	157	844

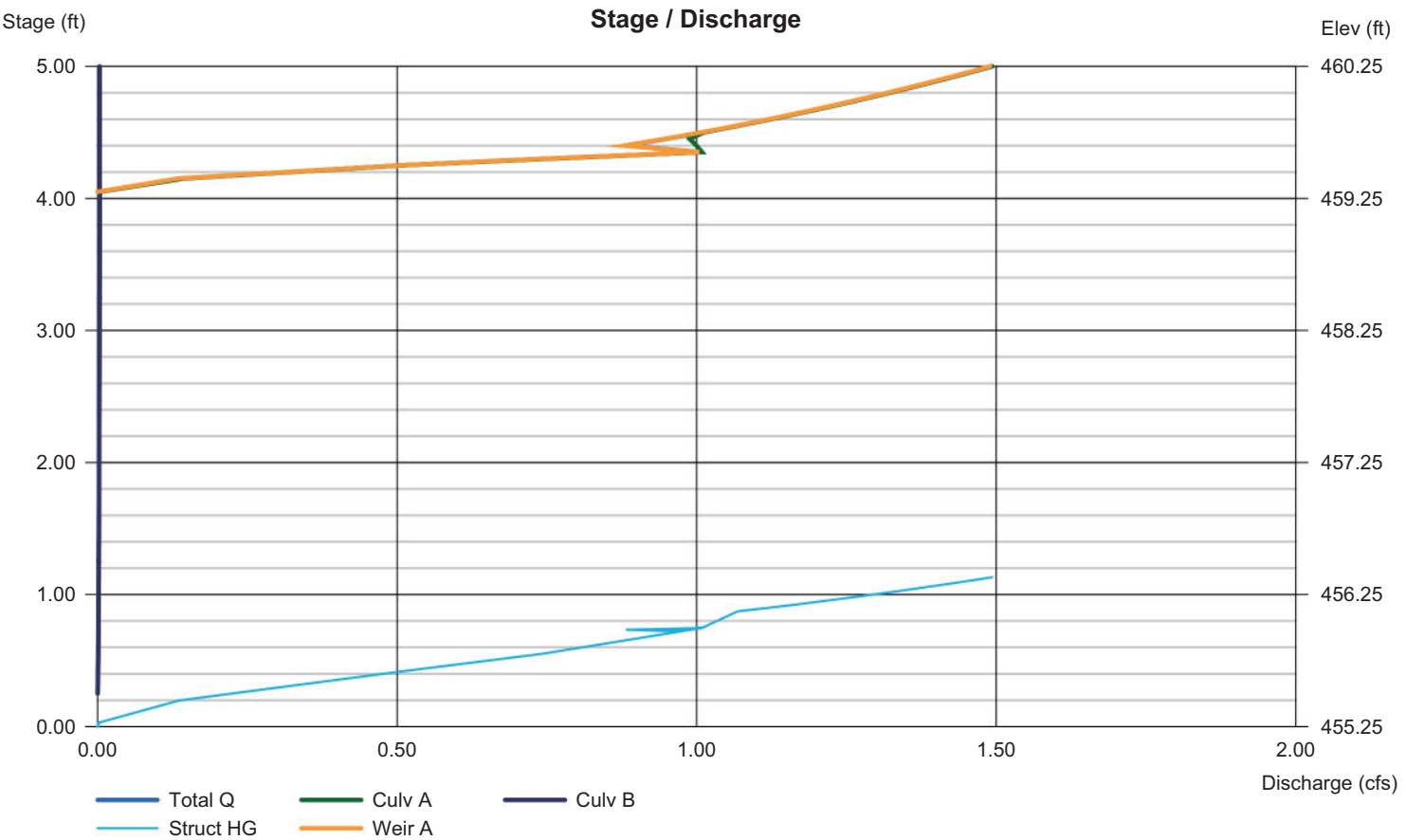
Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 10.00	0.26	0.00	0.00
Span (in)	= 10.00	0.26	0.00	0.00
Nº. Barrels	=	1	0	0
Invert El. (ft)	= 455.25	455.50	0.00	0.00
Length (ft)	= 77.07	0.00	0.00	0.00
Slope (%)	= 0.30	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	Yes	No	No

Weir Structures

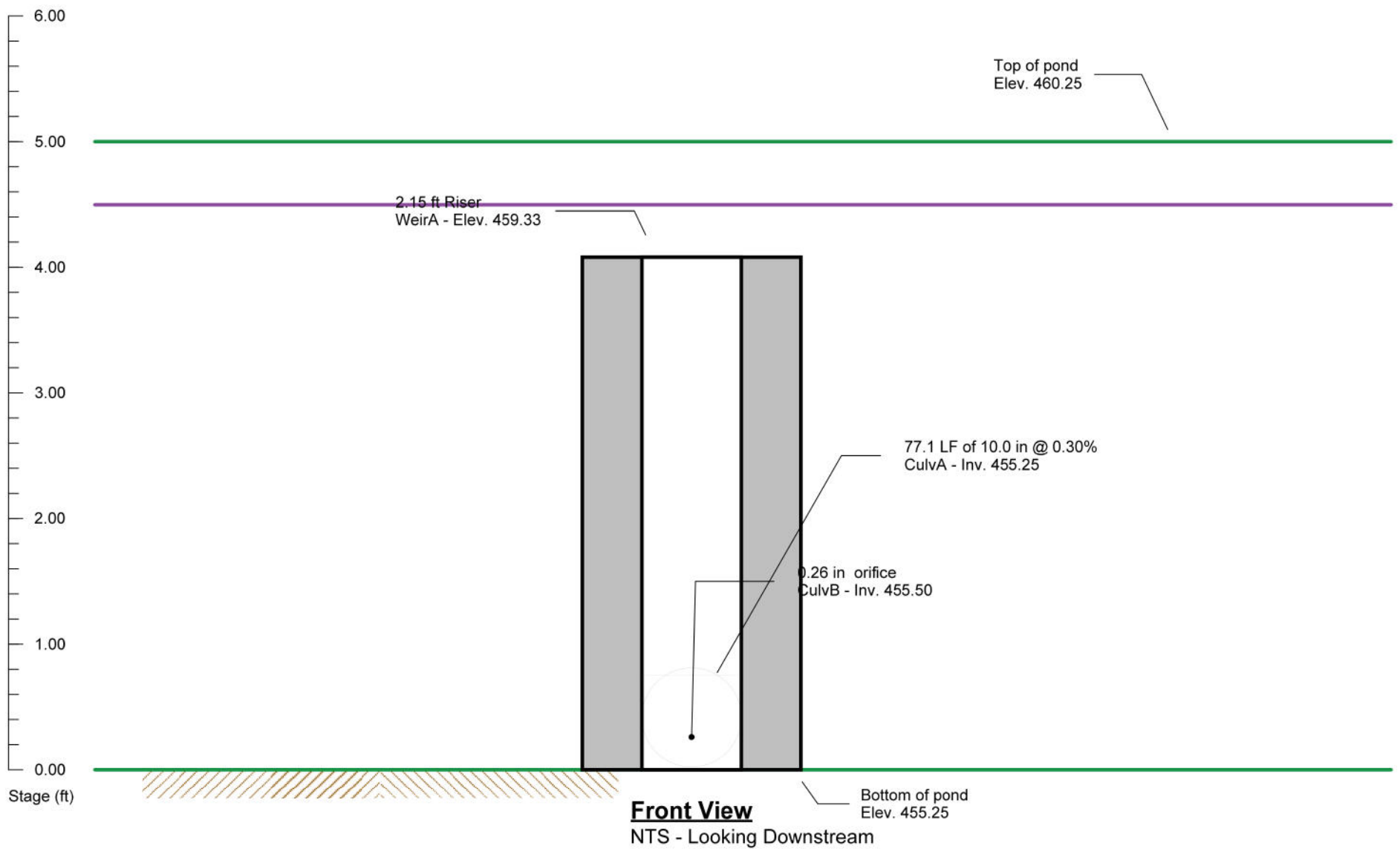
	[A]	[B]	[C]	[D]
Crest Len (ft)	= 2.15	0.00	0.00	0.00
Crest El. (ft)	= 459.33	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= 1	---	---	---
Multi-Stage	= Yes	No	No	No
Exfil.(in/hr)	= 0.000 (by Wet area)			
TW Elev. (ft)	= 0.00			

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



Pond No. 3 - IMP-4

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



Inflow hydrograph = 5. Manual - Basin-5

BASIN-6:
TIME OF CONCENTRATION = 6 MIN.
6 HOUR RAINFALL = 3.2 INCHES
BASIN AREA = 0.17 ACRES
RUNOFF COEFFICIENT = 0.55
PEAK DISCHARGE = 0.73 CFS

Time(min)	Q(cfs)
0	0
6	0.02
12	0.02
18	0.02
24	0.02
30	0.02
36	0.02
42	0.02
48	0.02
54	0.02
60	0.02
66	0.02
72	0.02
78	0.02
84	0.02
90	0.02
96	0.02
102	0.02
108	0.03
114	0.03
120	0.03
126	0.03
132	0.03
138	0.03
144	0.03
150	0.03
156	0.03
162	0.04
168	0.04
174	0.04
180	0.04
186	0.04
192	0.05
198	0.05
204	0.05
210	0.06
216	0.07
222	0.08
228	0.09
234	0.14
240	0.2
246	0.73
252	0.11

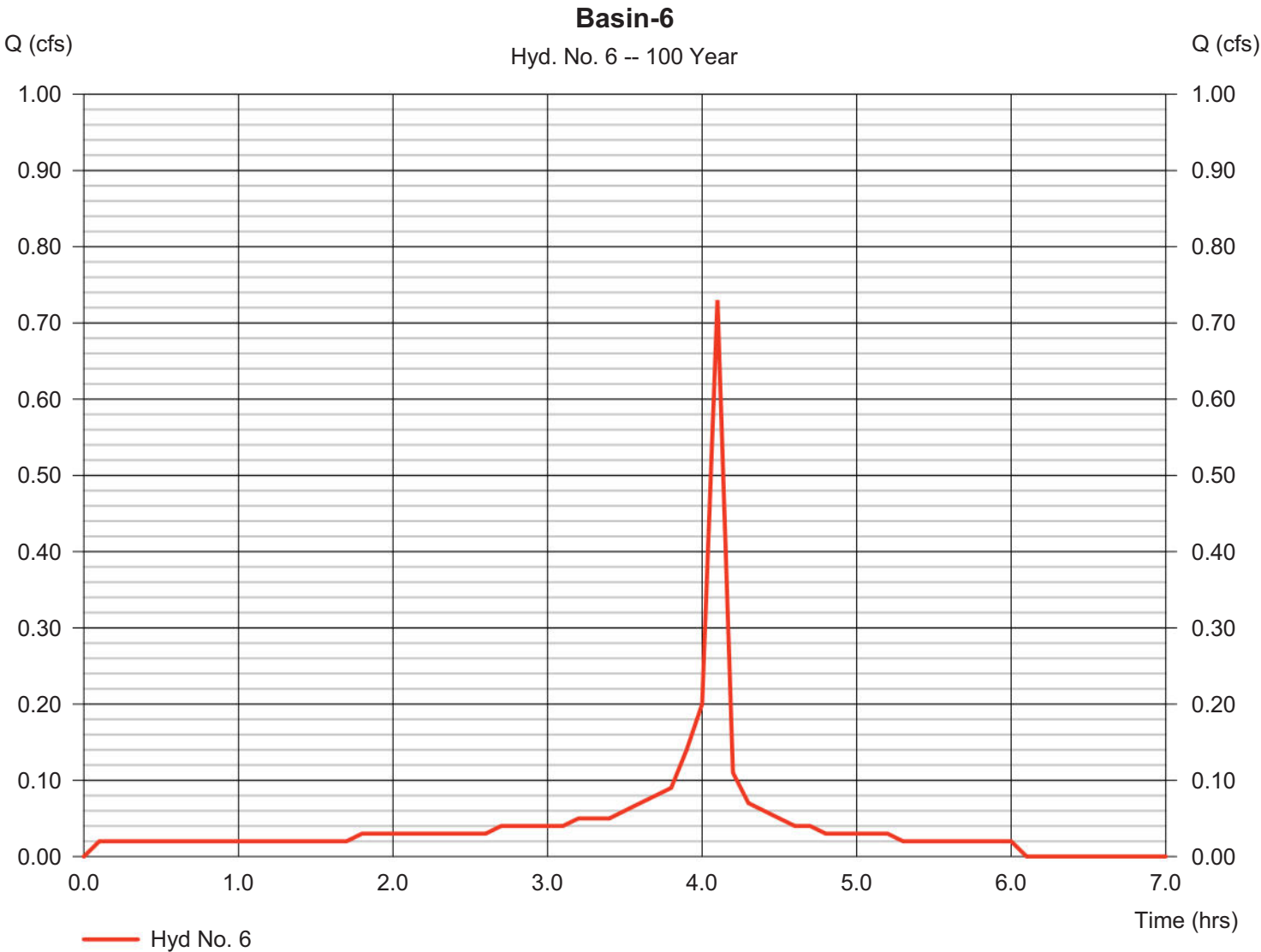
258	0.07
264	0.06
270	0.05
276	0.04
282	0.04
288	0.03
294	0.03
300	0.03
306	0.03
312	0.03
318	0.02
324	0.02
330	0.02
336	0.02
342	0.02
348	0.02
354	0.02
360	0.02

Hydrograph Report

Hyd. No. 6

Basin-6

Hydrograph type	= Manual	Peak discharge	= 0.730 cfs
Storm frequency	= 100 yrs	Time to peak	= 4.10 hrs
Time interval	= 6 min	Hyd. volume	= 1,084 cuft



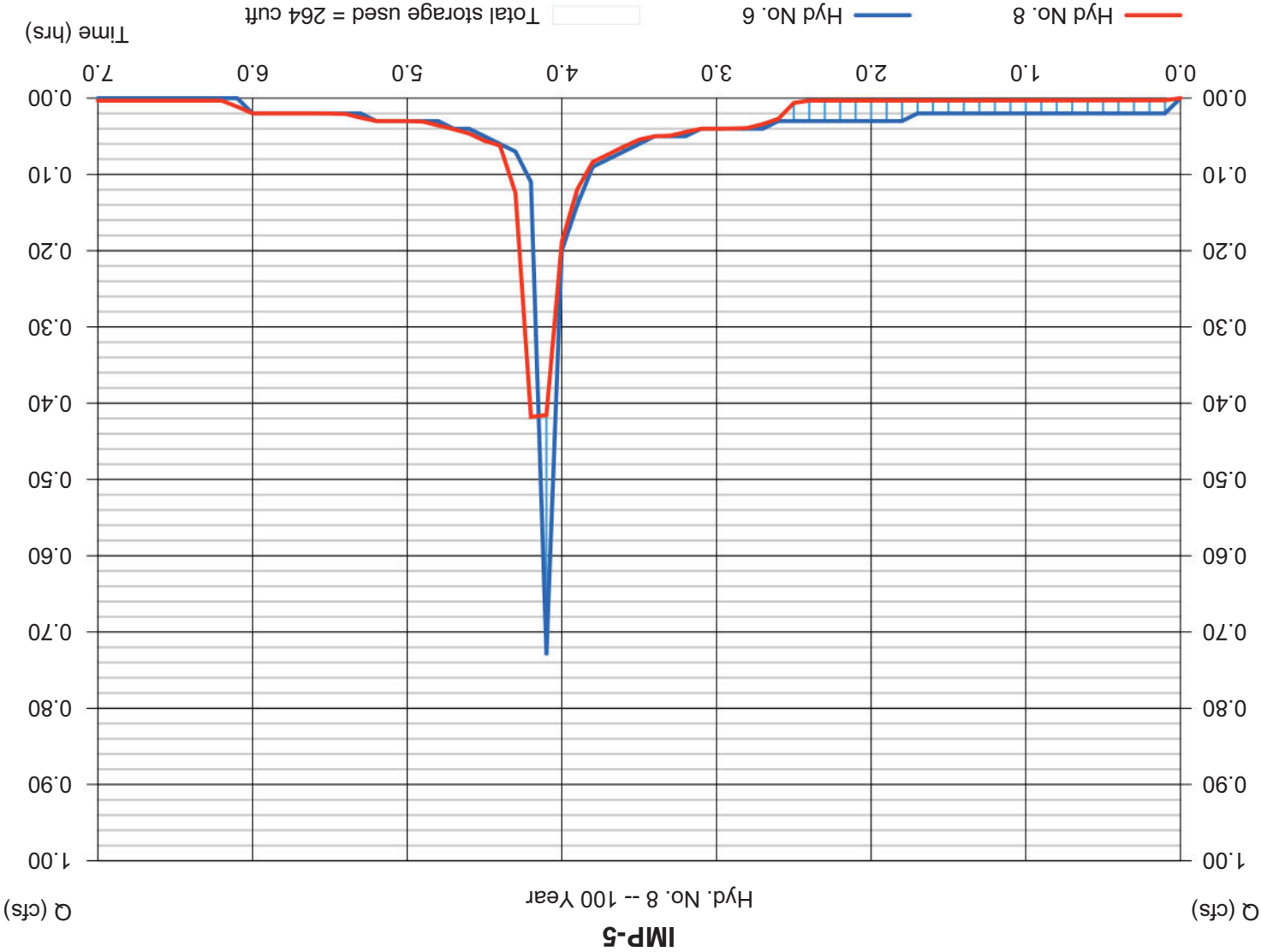
Hydrograph Report

Hyd. No. 8

IMP-5

Hydrograph type	= Reservoir	Peak discharge	= 0.418 cfs
Storm frequency	= 100 yrs	Time to peak	= 4.20 hrs
Time interval	= 6 min	Hyd. volume	= 1,083 cuft
Inflow hyd. No.	= 6 - Basin-6	Max. Elevation	= 456.63 ft
Reservoir name	= IMP-5	Max. Storage	= 264 cuft

Storage Indication method used.



Pond No. 4 - IMP-5

Pond Data

Contours -User-defined contour areas. Average end area method used for volume calculation. Beginning Elevation = 452.25 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	452.25	01	0	0
1.25	453.50	UNDERGROUND	01	1
1.25	453.50		40% VOID	1
1.25	453.50		0	1
3.25	455.50	01	2	3
3.25	455.50	SURFACE	0	3
4.25	456.50		214	218
4.25	456.50		100% VOID	218
5.00	457.25	414	263	481

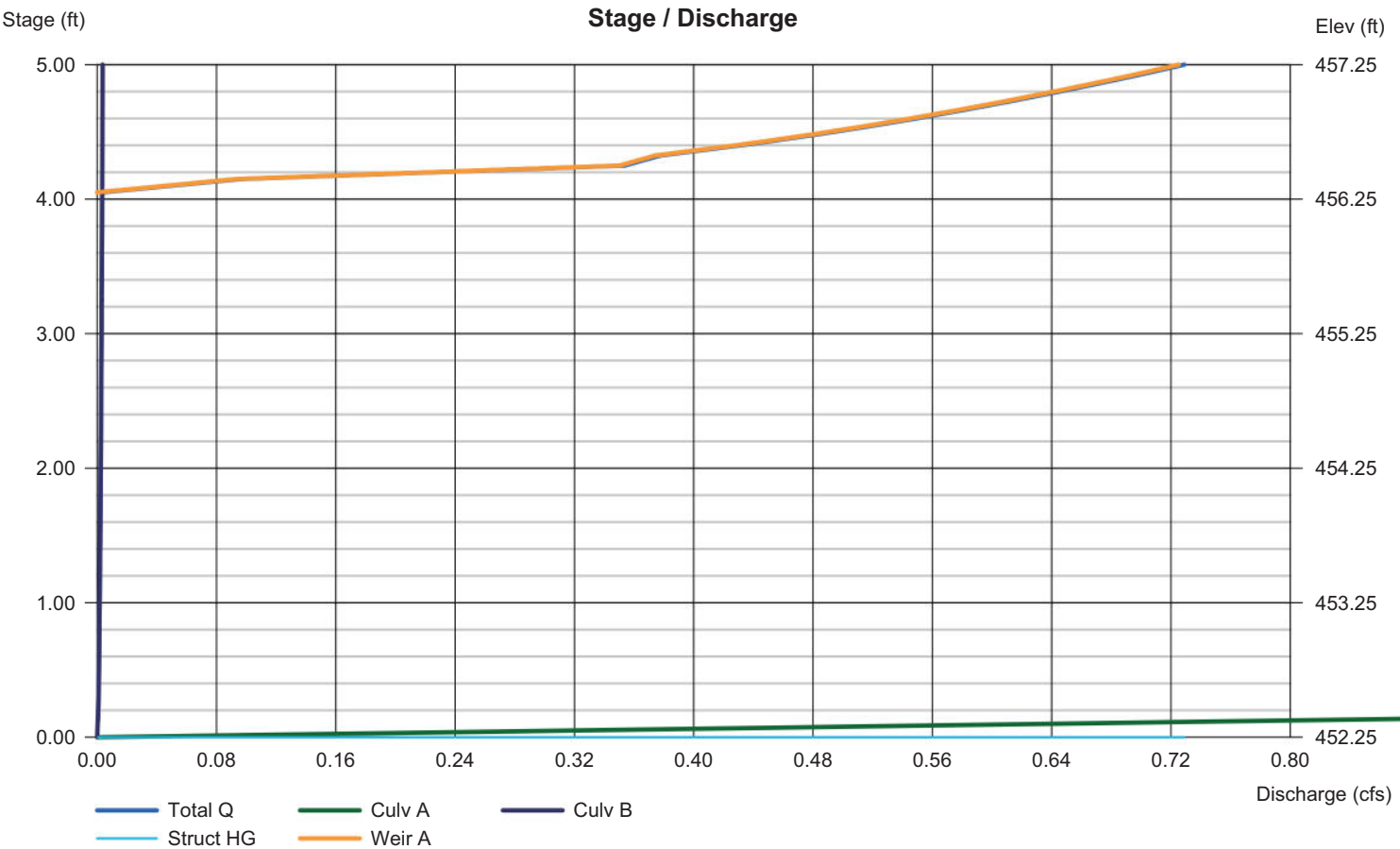
Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 10.00	0.25	0.00	0.00
Span (in)	= 10.00	0.25	0.00	0.00
Nô. Barrels	=	1	0	0
Invert El. (ft)	= 450.75	451.00	0.00	0.00
Length (ft)	= 204.96	0.00	0.00	0.00
Slope (%)	= 0.30	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	Yes	No	No

Weir Structures

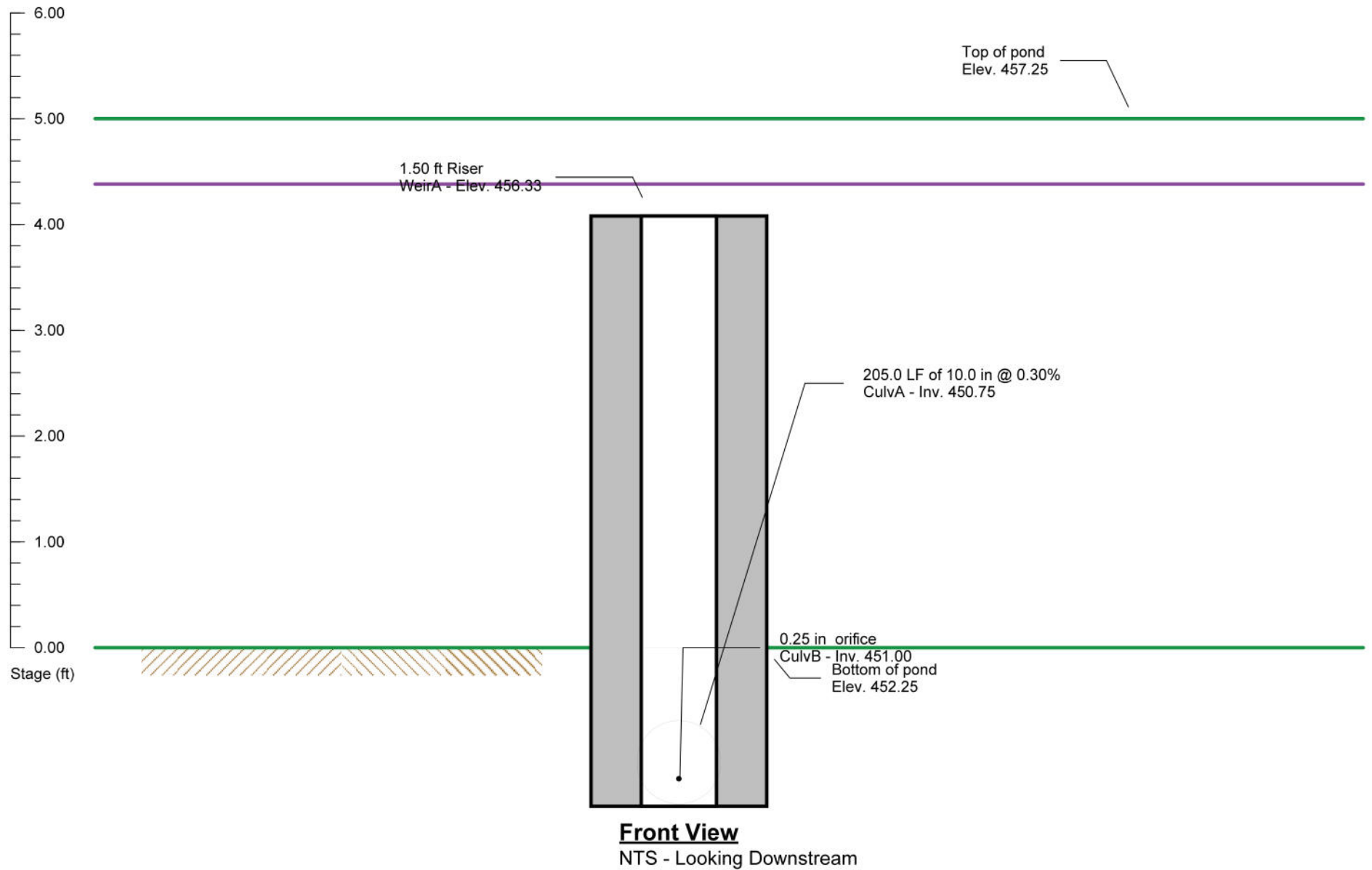
	[A]	[B]	[C]	[D]
Crest Len (ft)	= 1.50	0.00	0.00	0.00
Crest El. (ft)	= 456.33	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= 1	---	---	---
Multi-Stage	= Yes	No	No	No
Exfil.(in/hr)	= 0.000 (by Wet area)			
TW Elev. (ft)	= 0.00			

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



Pond No. 4 - IMP-5

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



BASIN-7:
TIME OF CONCENTRATION = 5 MIN.
6 HOUR RAINFALL = 3.2 INCHES
BASIN AREA = 0.78 ACRES
RUNOFF COEFFICIENT = 0.73
PEAK DISCHARGE = 4.88 CFS

Time(hr)	Q(cfs)
0	0
5	0.11
10	0.11
15	0.11
20	0.11
25	0.11
30	0.12
35	0.12
40	0.12
45	0.12
50	0.12
55	0.13
60	0.13
65	0.13
70	0.13
75	0.14
80	0.14
85	0.14
90	0.14
95	0.15
100	0.15
105	0.15
110	0.16
115	0.16
120	0.16
125	0.17
130	0.17
135	0.18
140	0.18
145	0.19
150	0.2
155	0.21
160	0.21
165	0.22
170	0.23
175	0.24
180	0.25
185	0.27
190	0.28
195	0.3
200	0.32
205	0.35
210	0.37

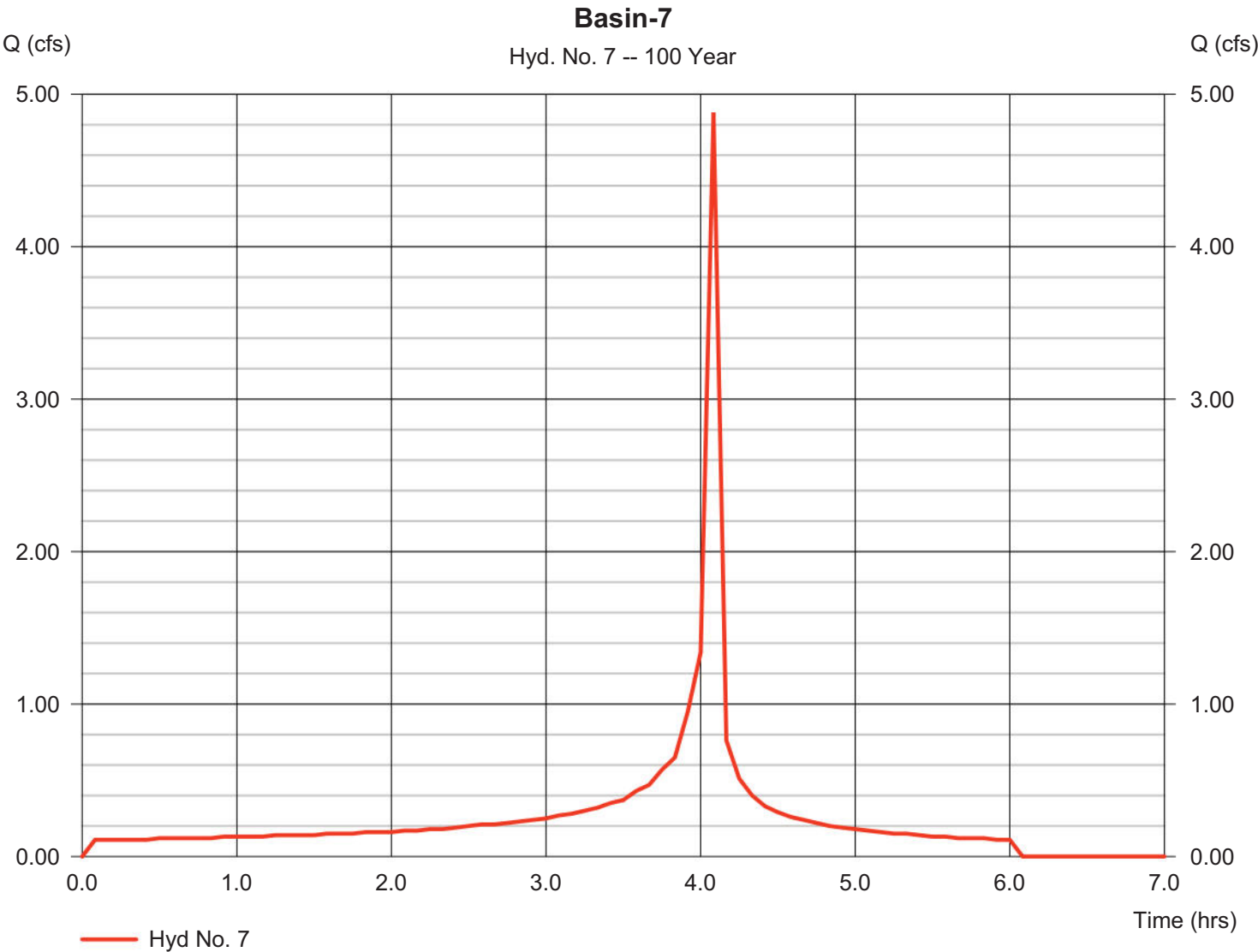
215	0.43
220	0.47
225	0.57
230	0.65
235	0.95
240	1.34
245	4.88
250	0.76
255	0.51
260	0.4
265	0.33
270	0.29
275	0.26
280	0.24
285	0.22
290	0.2
295	0.19
300	0.18
305	0.17
310	0.16
315	0.15
320	0.15
325	0.14
330	0.13
335	0.13
340	0.12
345	0.12
350	0.12
355	0.11
360	0.11

Hydrograph Report

Hyd. No. 7

Basin-7

Hydrograph type	= Manual	Peak discharge	= 4.880 cfs
Storm frequency	= 100 yrs	Time to peak	= 4.08 hrs
Time interval	= 5 min	Hyd. volume	= 6,594 cuft



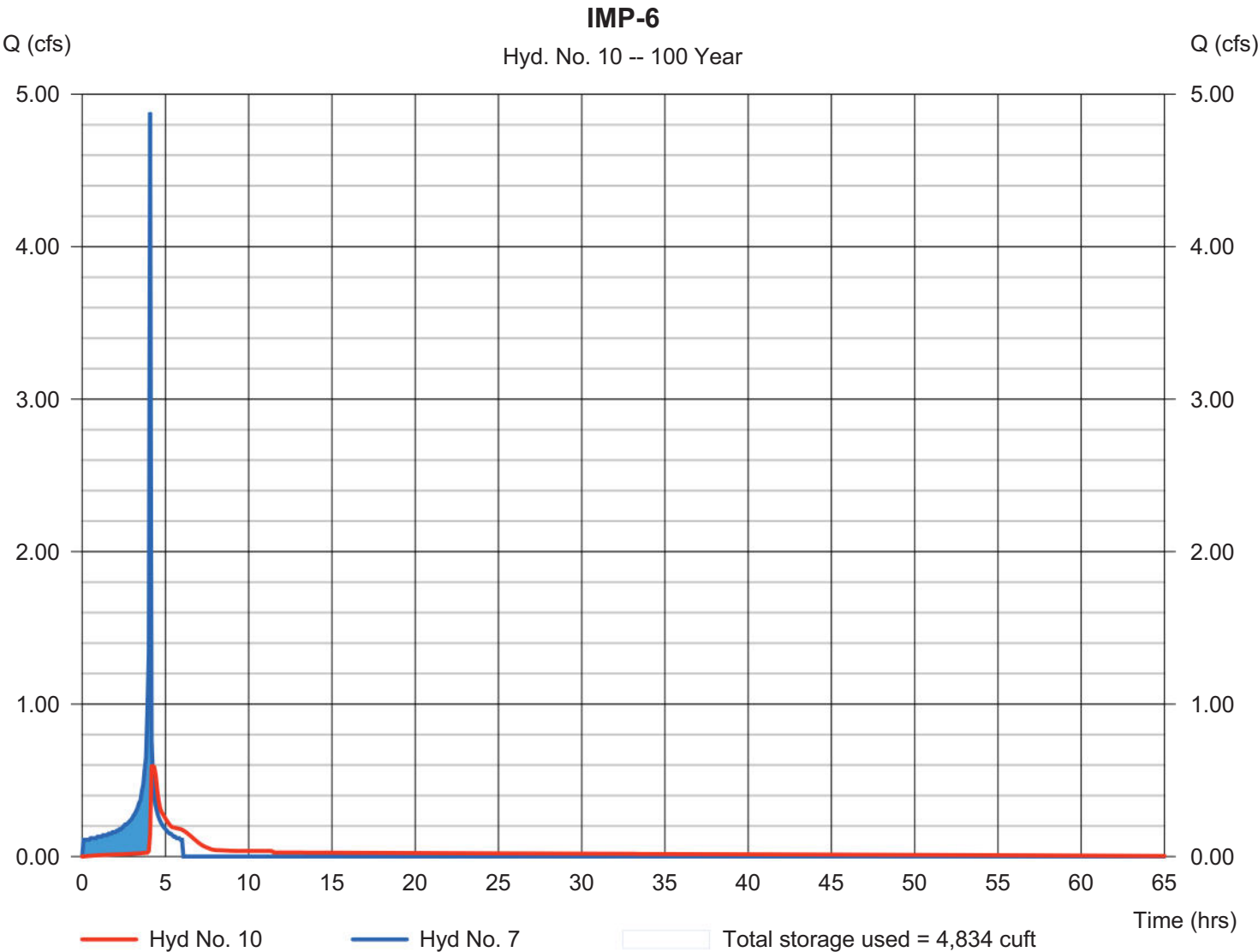
Hydrograph Report

Hyd. No. 10

IMP-6

Hydrograph type	= Reservoir	Peak discharge	= 0.593 cfs
Storm frequency	= 100 yrs	Time to peak	= 4.25 hrs
Time interval	= 5 min	Hyd. volume	= 6,554 cuft
Inflow hyd. No.	= 7 - Basin-7	Max. Elevation	= 456.04 ft
Reservoir name	= IMP-6	Max. Storage	= 4,834 cuft

Storage Indication method used.



Pond No. 1 - IMP-6

Pond Data

Contours -User-defined contour areas. Average end area method used for volume calculation. Beginning Elevation = 450.25 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	450.25	1,260	90% VOID	0
2.50	452.75	1,260	3,150	3,150
2.50	452.75	01	1	3,151
2.75	453.00	01	0	3,151
2.75	453.00	01	0	3,151
4.75	455.00	01	2	3,153
4.75	455.00	1,400	1	3,154
5.75	456.00	1,821	1,609	4,762
6.50	456.75	2,160	1,493	6,255

THIS DEPTH IS COUNTED FOR THE 100-YR STORAGE

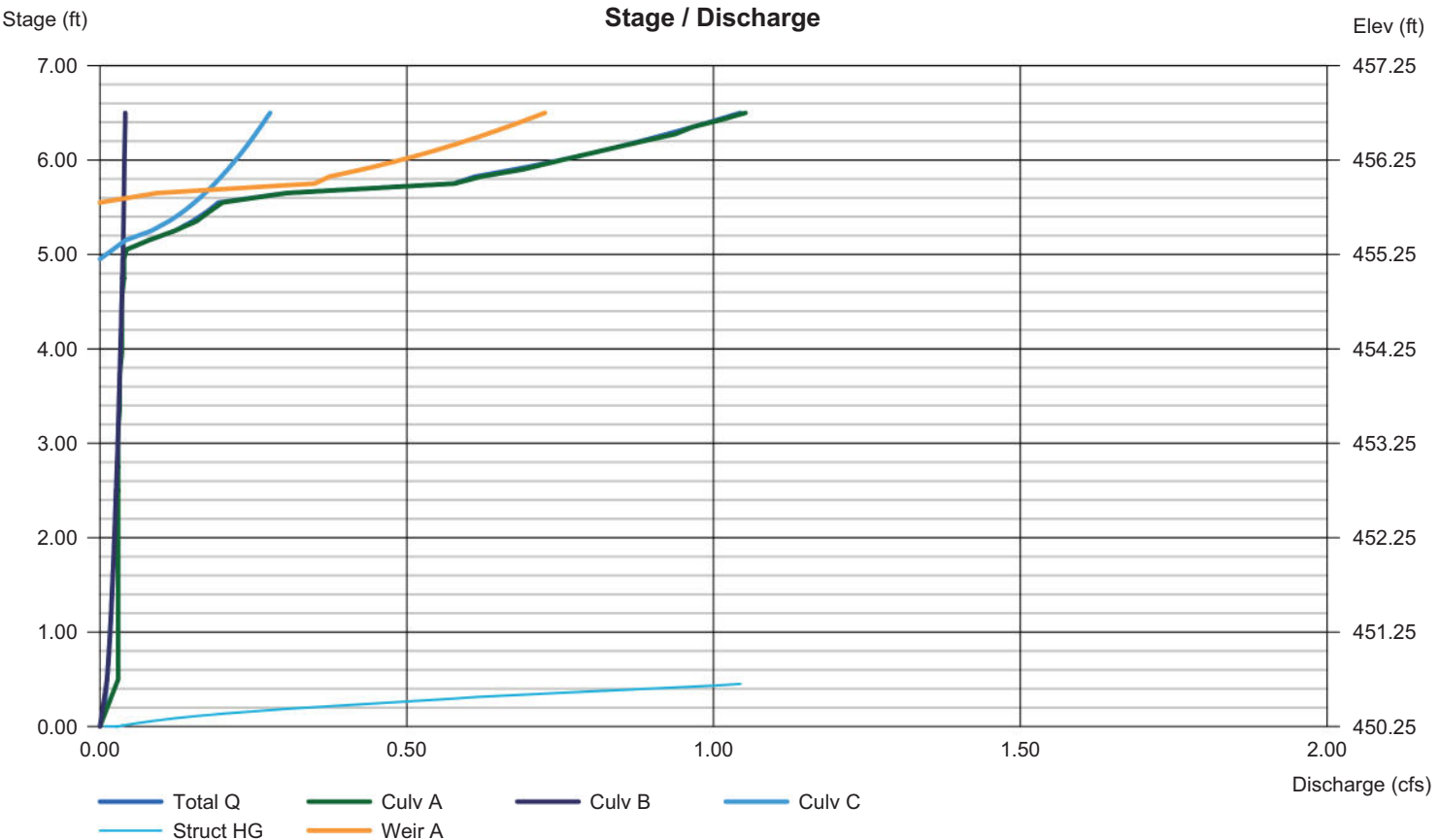
Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 12.00	0.80	3.00	0.00
Span (in)	= 12.00	0.80	3.00	0.00
Nô. Barrels	=	1	1	0
Invert El. (ft)	= 450.17	450.25	455.25	0.00
Length (ft)	= 7.98	0.00	0.00	0.00
Slope (%)	= 2.00	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	Yes	Yes	No

Weir Structures

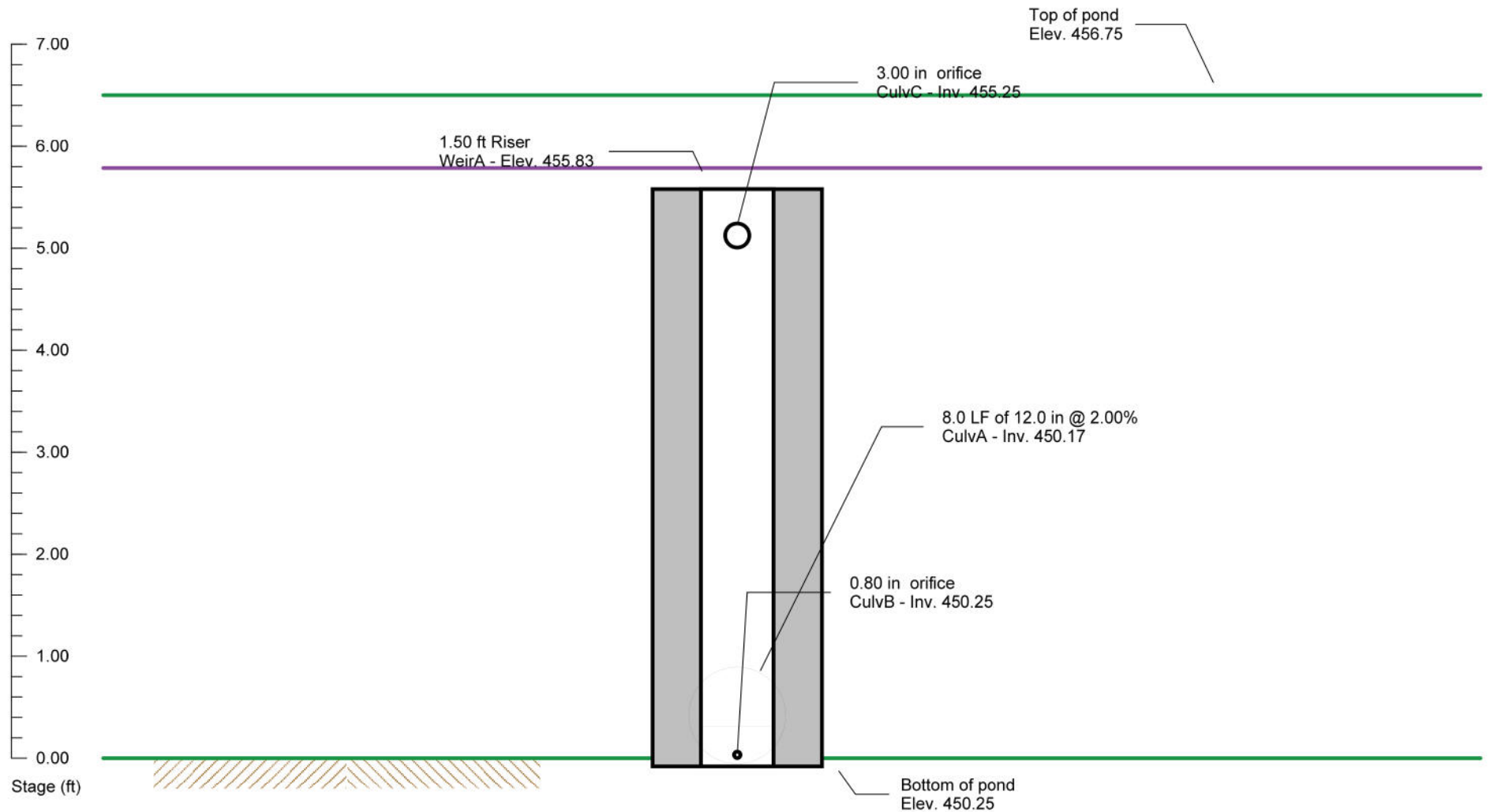
	[A]	[B]	[C]	[D]
Crest Len (ft)	= 1.50	0.00	0.00	0.00
Crest El. (ft)	= 455.83	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= 1	---	---	---
Multi-Stage	= Yes	No	No	No
Exfil.(in/hr)	= 0.000 (by Wet area)			
TW Elev. (ft)	= 0.00			

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



Pond No. 1 - IMP-6

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



Front View

NTS - Looking Downstream

100-yr

Inflow hydrograph = 7. Manual - Basin-7

Channel Report

Basin-1

Circular

Diameter (ft) = 0.50

Invert Elev (ft) = 459.25

Slope (%) = 0.50

N-Value = 0.009

Calculations

Compute by: Known Q

Known Q (cfs) = 0.37

Highlighted

Depth (ft) = 0.30

Q (cfs) = 0.370

Area (sqft) = 0.12

Velocity (ft/s) = 3.00

Wetted Perim (ft) = 0.89

Crit Depth, Yc (ft) = 0.31

Top Width (ft) = 0.49

EGL (ft) = 0.44



Channel Report

Basin-3

Circular

Diameter (ft) = 0.50

Invert Elev (ft) = 457.25

Slope (%) = 0.50

N-Value = 0.009

Calculations

Compute by: Known Q

Known Q (cfs) = 0.36

Highlighted

Depth (ft) = 0.29

Q (cfs) = 0.360

Area (sqft) = 0.12

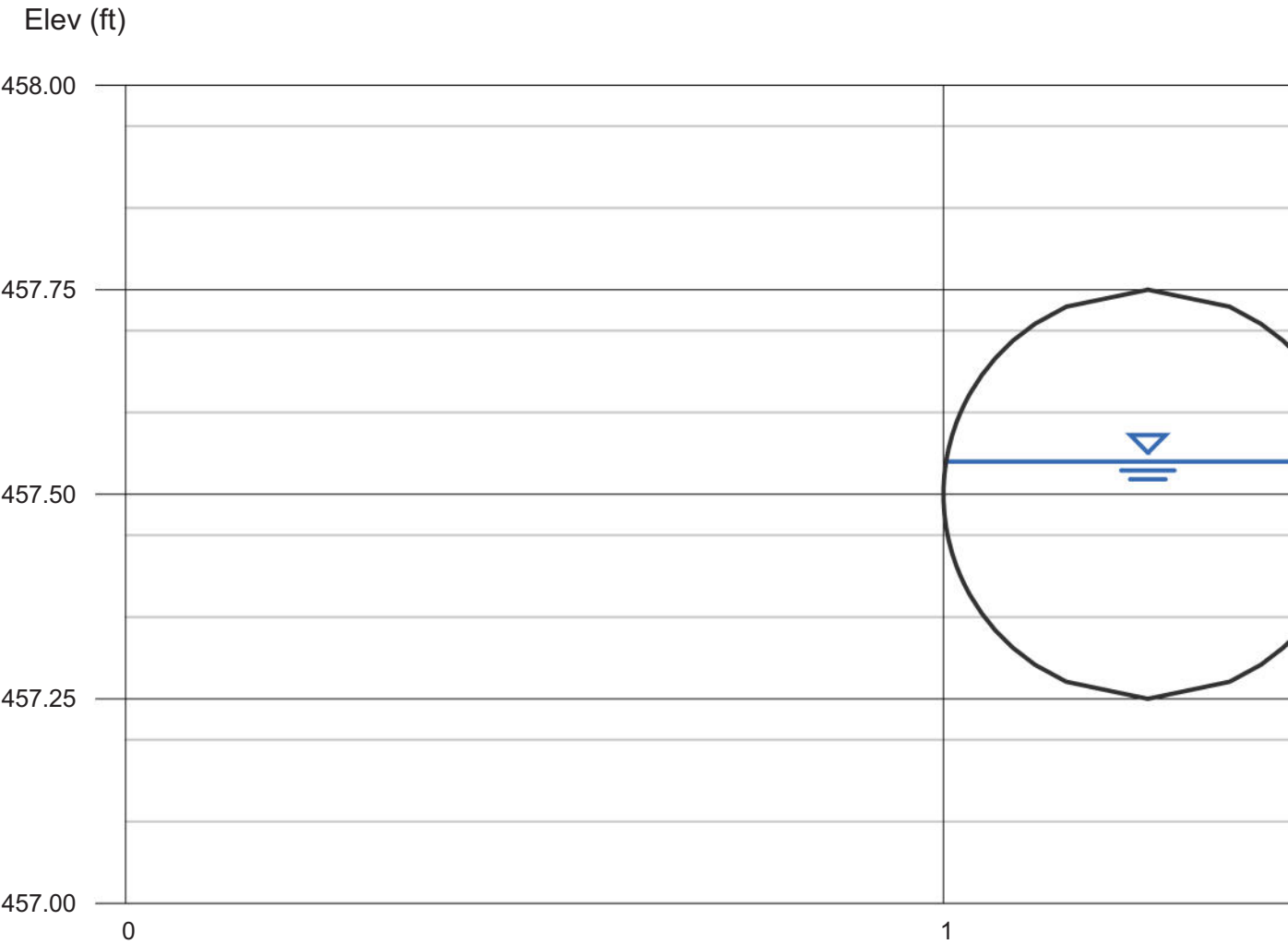
Velocity (ft/s) = 3.04

Wetted Perim (ft) = 0.87

Crit Depth, Yc (ft) = 0.31

Top Width (ft) = 0.49

EGL (ft) = 0.43



Channel Report

Basin-5

Circular

Diameter (ft) = 0.83

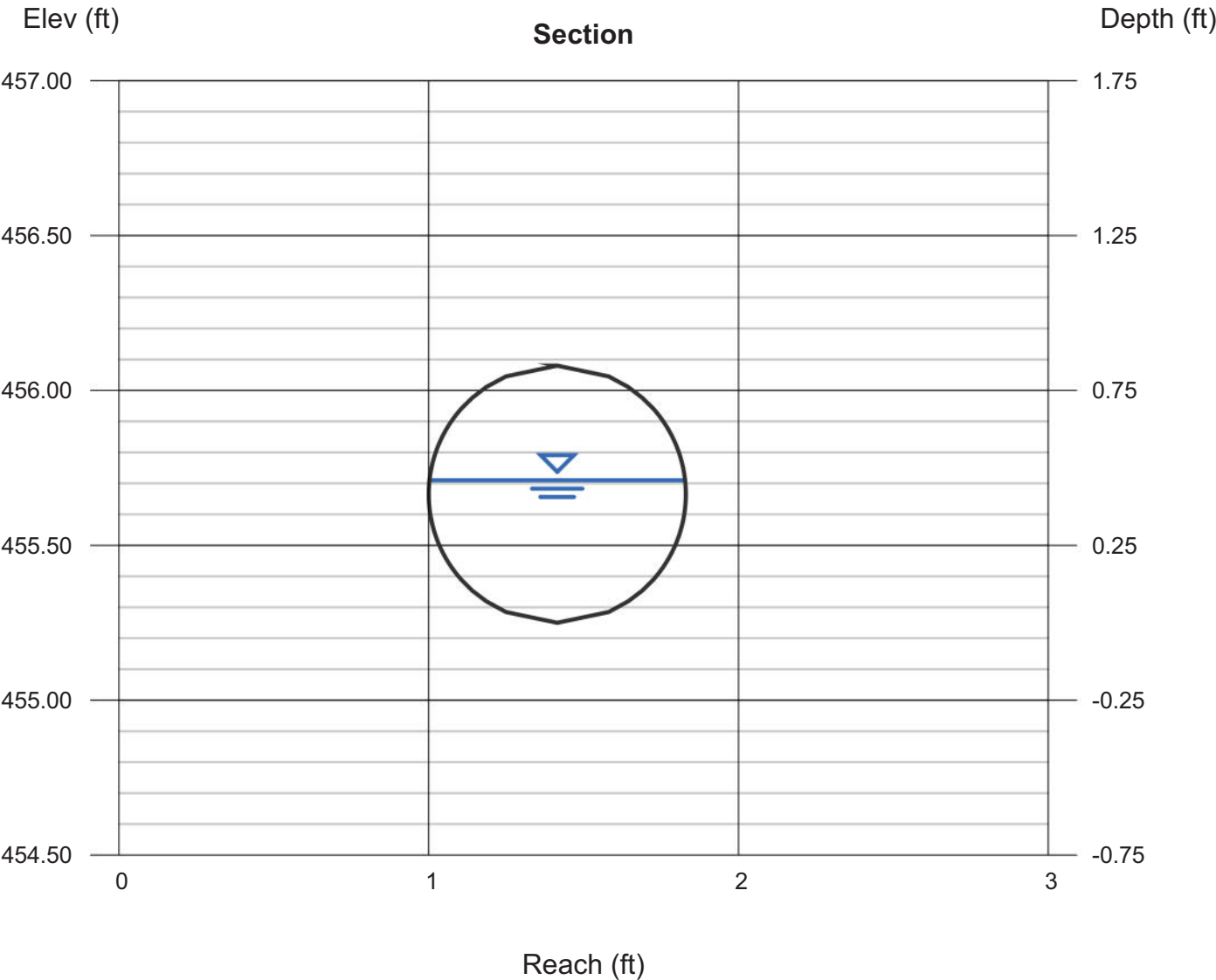
Invert Elev (ft) = 455.25
Slope (%) = 0.30
N-Value = 0.009

Calculations

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

Highlighted

Depth (ft) = 0.46
Q (cfs) = 1.010
Area (sqft) = 0.31
Velocity (ft/s) = 3.28
Wetted Perim (ft) = 1.39
Crit Depth, Yc (ft) = 0.45
Top Width (ft) = 0.83
EGL (ft) = 0.63



Channel Report

Basins 5+6

Circular

Diameter (ft) = 0.83

Invert Elev (ft) = 450.50

Slope (%) = 0.30

N-Value = 0.009

Calculations

Compute by: Known Q

Known Q (cfs) = 1.60

Highlighted

Depth (ft) = 0.64

Q (cfs) = 1.600

Area (sqft) = 0.45

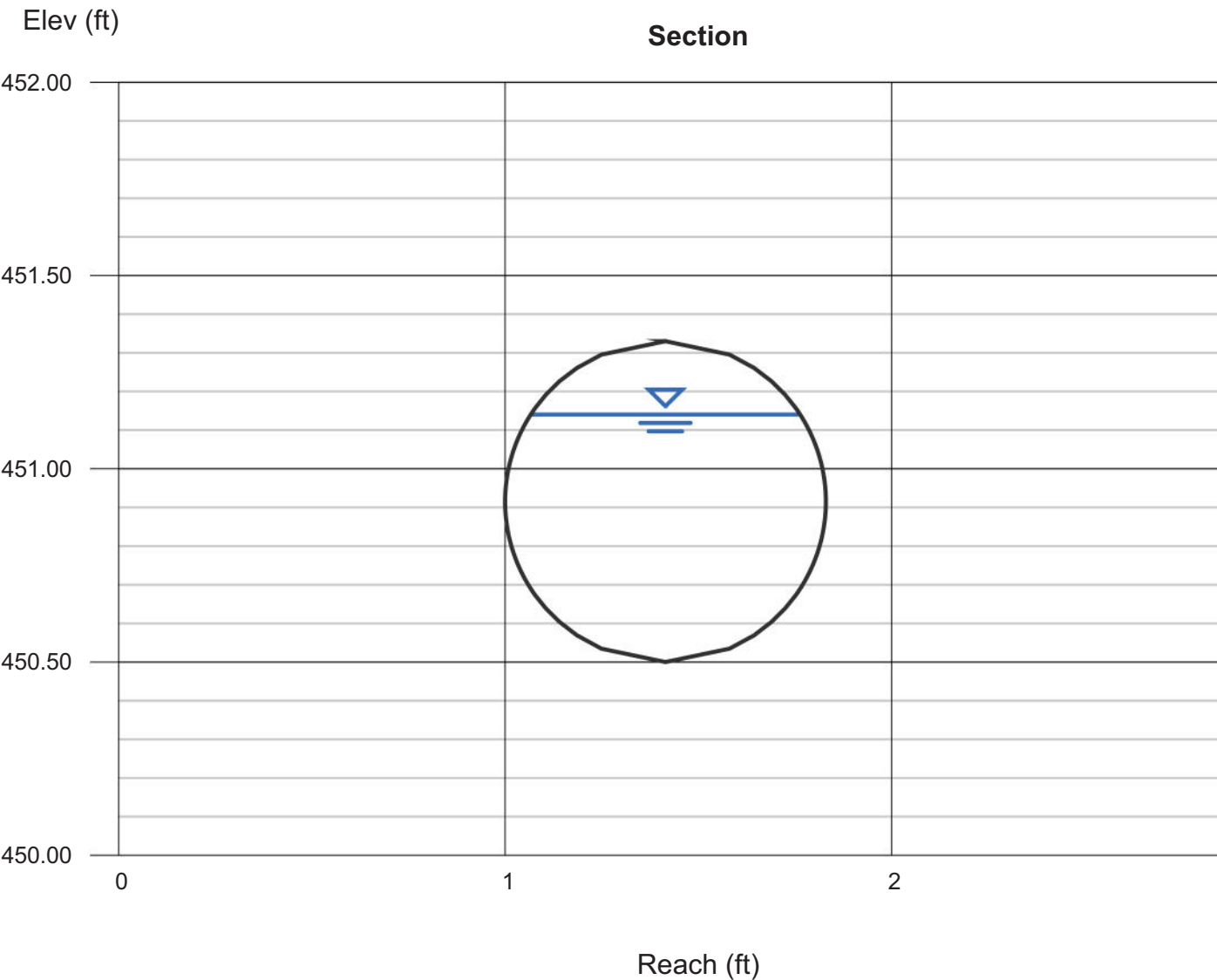
Velocity (ft/s) = 3.57

Wetted Perim (ft) = 1.78

Crit Depth, Yc (ft) = 0.57

Top Width (ft) = 0.70

EGL (ft) = 0.84



Channel Report

Basins 5+6+7

Circular

Diameter (ft) = 1.00

Invert Elev (ft) = 450.17

Slope (%) = 2.00

N-Value = 0.009

Calculations

Compute by: Known Q

Known Q (cfs) = 2.02

Highlighted

Depth (ft) = 0.36

Q (cfs) = 2.020

Area (sqft) = 0.26

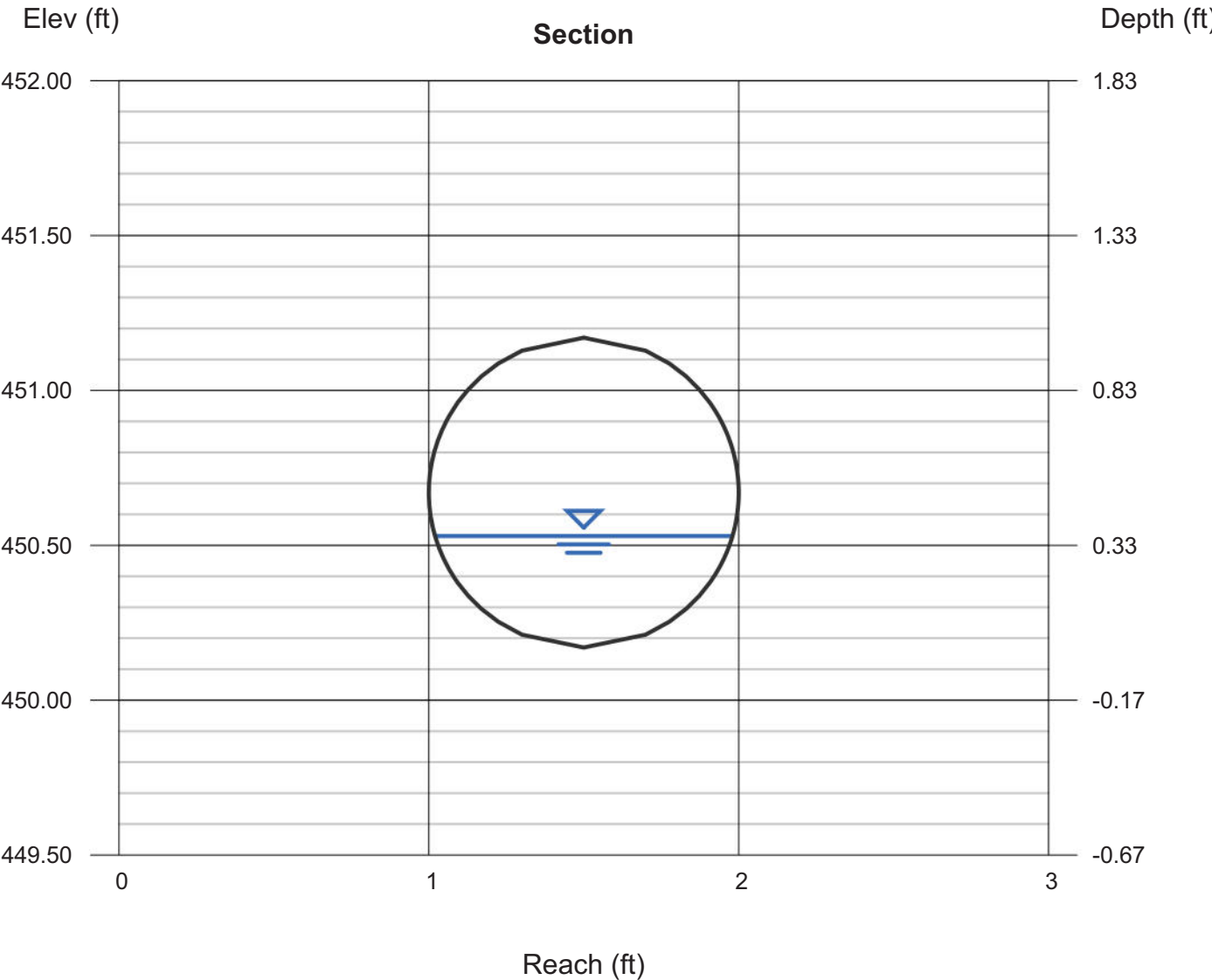
Velocity (ft/s) = 7.89

Wetted Perim (ft) = 1.29

Crit Depth, Yc (ft) = 0.61

Top Width (ft) = 0.96

EGL (ft) = 1.33



Channel Report

Basin-6

Circular

Diameter (ft) = 0.67

Invert Elev (ft) = 450.75

Slope (%) = 0.30

N-Value = 0.009

Calculations

Compute by: Known Q

Known Q (cfs) = 0.42

Highlighted

Depth (ft) = 0.31

Q (cfs) = 0.420

Area (sqft) = 0.16

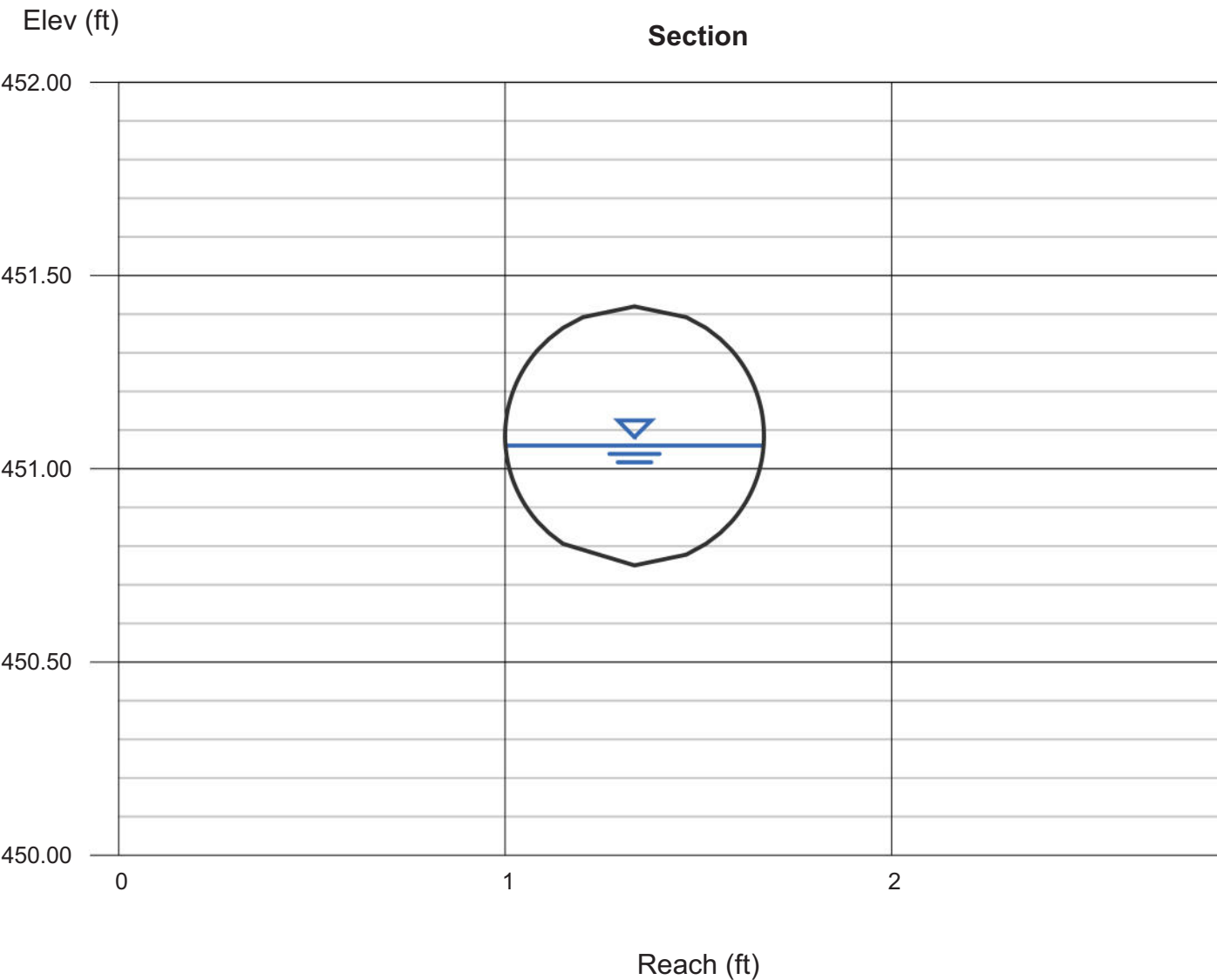
Velocity (ft/s) = 2.62

Wetted Perim (ft) = 1.00

Crit Depth, Yc (ft) = 0.31

Top Width (ft) = 0.67

EGL (ft) = 0.42



EXHIBITS

LEGEND

100

NODE

100
Q₁₀₀ = XXX
T_c = N/A
A = N/A

100-YEAR FREQUENCY DISCHARGE
TIME OF CONCENTRATION
AREA

MAJOR BASIN BOUNDARY

SUB-BASIN BOUNDARY

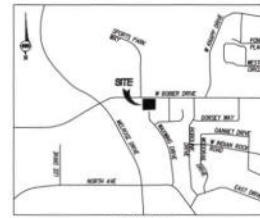
FLOW PATH

SOIL TYPE

"0"



20 10 0 20 40 60
SCALE IN FEET
GRAPHIC SCALE



VICINITY MAP
SCALE: NTS

POC-1 FOR BASINS (200-500)
AT MYNAH PL & MARABOU LN

PRE DRAINAGE MAP

FOR
WAXWING SUBDIVISION

SWS ENGINEERING, INC.
Civil Engineering • Land Planning • Surveying
1437 Lake San Marcos Drive, Suite 200
San Marcos, CA 92079
P: 760-744-8811 F: 760-744-8888
www.sws-engineering.com

600
Q₁₀₀ = 2.20
T_c = 7.74
A = 0.99

100
Q₁₀₀ = 0.10
T_c = 5.00
A = 0.034

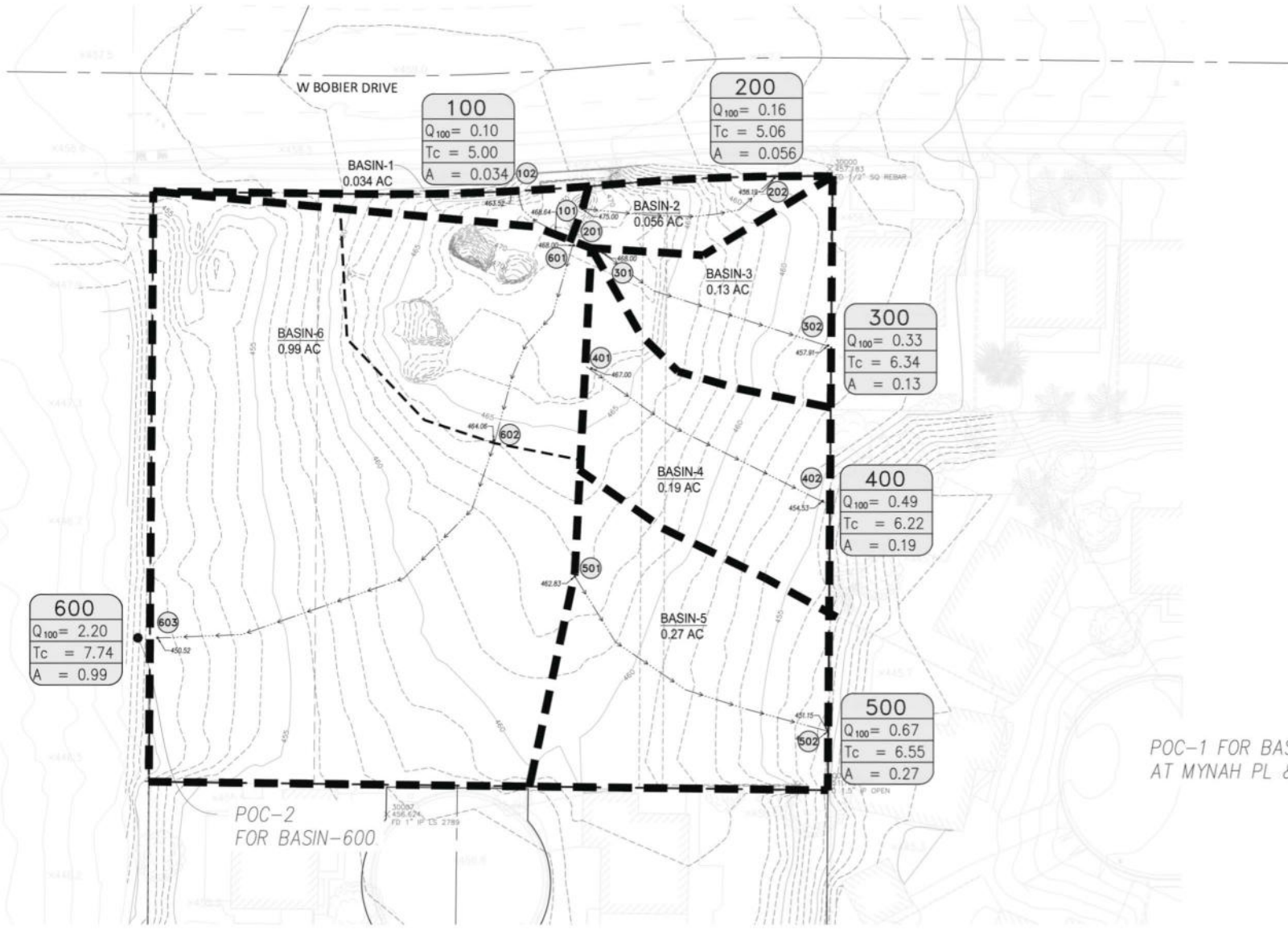
200
Q₁₀₀ = 0.16
T_c = 5.06
A = 0.056

300
Q₁₀₀ = 0.33
T_c = 6.34
A = 0.13

400
Q₁₀₀ = 0.49
T_c = 6.22
A = 0.19

500
Q₁₀₀ = 0.67
T_c = 6.55
A = 0.27

POC-2
FOR BASIN-600



LEGEND

100

NODE

100
Q₁₀₀ = XXX
T_c = N/A
A = N/A

100-YEAR FREQUENCY DISCHARGE
TIME OF CONCENTRATION
AREA

MAJOR BASIN BOUNDARY

SUB-BASIN BOUNDARY

FLOW PATH

"D"

SOIL TYPE

LANDSCAPE AREA

BIOFILTRATION AREA

IMPERVIOUS AREA (BLDG)

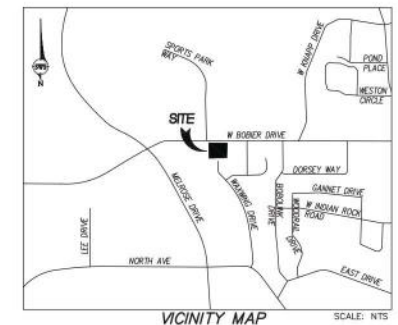
IMPERVIOUS AREA (CONCRETE)

IMPERVIOUS AREA (AC)

TABULAR SUMMARY OF BASINS

BASIN	AREA (AC)	IMPERVIOUS AREA (AC)	% IMP	HSG	AREA WEIGHTED* RUNOFF COEFFICIENT
1	0.14	0.03	21.1	D	0.47
2	0.09	0.019	20.2	D	0.46
3	0.11	0.065	57.1	D	0.66
4.1	0.038	0.00	0.0	D	0.35
4.2	0.022	0.00	0.0	D	0.35
4.3	0.028	0.00	0.0	D	0.35
5	0.26	0.22	84.0	D	0.81
6	0.17	0.059	35.6	D	0.55
7	0.78	0.54	70.0	D	0.73
8	0.03	0.00	0.0	D	0.35

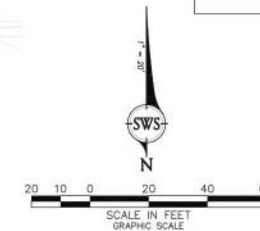
*FOR CALCULATION OF WEIGHTED C COEFFICIENT, 0.35 (SOIL TYPE "D") IS USED FOR PERVIOUS AREA, PER SAN DIEGO COUNTY HYDROLOGY MANUAL, TABLE 3-1)



POST DRAINAGE MAP

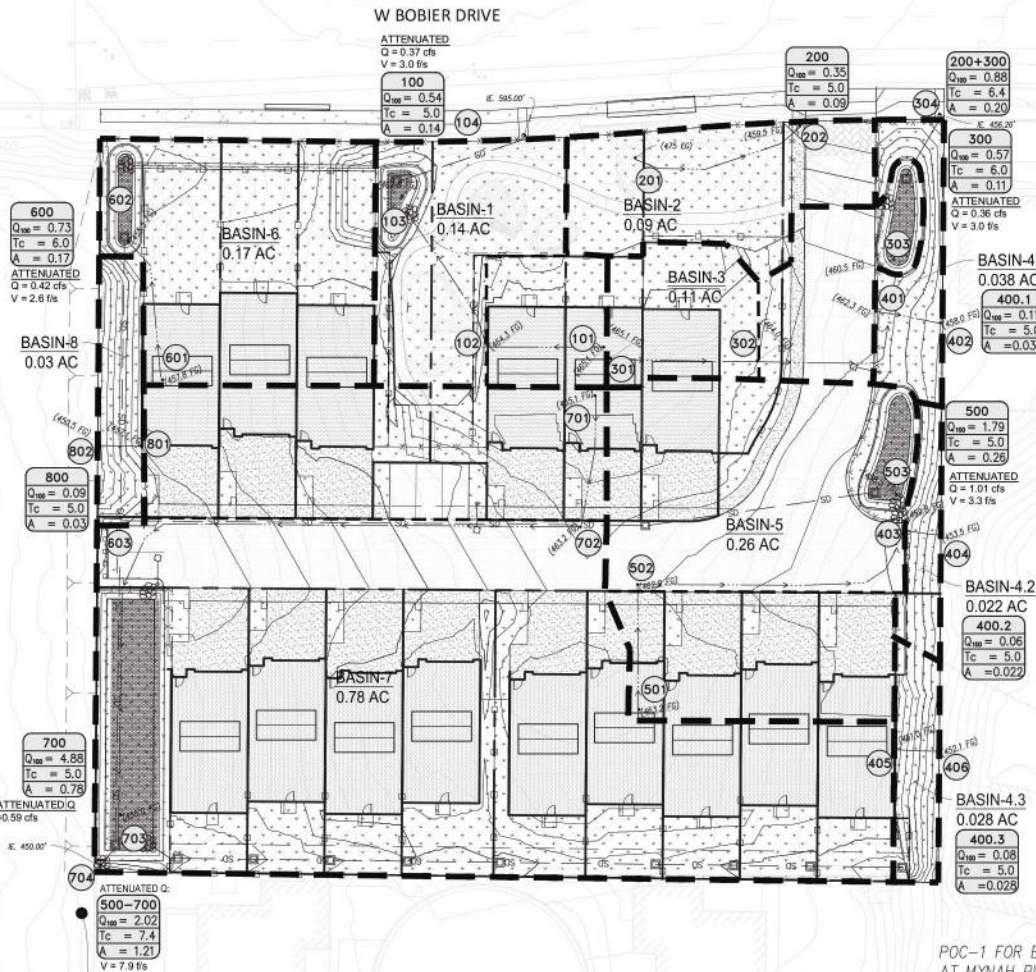
FOR
WAXWING DRIVE SUBDIVISION

SWS ENGINEERING, INC.
Civil, Environmental • Land Development • Sanitation
1875 Lake San Marcos Drive, Suite 200
San Marcos, CA 92078
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POC-1 FOR BASINS (100-400)
AT MYNAH PL & MARABOU LN
(DOWNSTREAM OF THE COL-DE-SAC)

POC-2
BASINS (500-800)





RUNOFF CONFLUENCE POINT:
BASINS 200-500 (EXISTING)
BASINS 100-400 (POST)

CURB INLETS

CURB INLETS

PROJECT SITE

285 ft

Google Earth

Imagery Date: 4/15/2024 Lat: 33.220263 Lon: -117.254079 elev: 431 ft eye alt: 1677 ft