DRAINAGE STUDY

Hidden Canyon at Rancho Summit Drive for 3 Proposed Residential Pads

Abstract

Evaluation of the proposed onsite drainage system for the Hidden Canyon at Rancho Summit Drive, 3 Residential pads and Driveways

S H A P O U R I & A S S O C I A T E S

PROJECT MANAGEMENT SERVICES

ENGINEERING • INFORMATION SYSTEMS • PLANNING

Rancho Santa Fe, CA

THE DRAINAGE DESIGN IS FOR CEQA LEVEL PURPOSES ONLY. AT FINAL ENGINEERING, DESIGN MUST BE IN CONFORMANCE WITH THE COUNTY OF SAN DIEGO DRAINAGE DESIGN AND HYDROLOGY MANUALS AND ALL ONSITE FLOW INCREASES DUE TO THE PROPOSED WORK SHALL BE MITIGATED TO PRE-CONSTRUCTION Q100 FLOWS RATES AND VELOCITIES OR LESS PRIOR TO GRADING PLAN APPROVAL.

Drainage Study
For;

3 Proposed Single Family Residential Dwelling Pads & Driveways

Located in:

Hidden Canyon at Rancho Summit Drive
San Diego County, CA 92024

Prepared for

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Prepared by

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~~September 30, 2016~~
~~May 1, 2017~~
~~January 9, 2020~~
January 28, 2020

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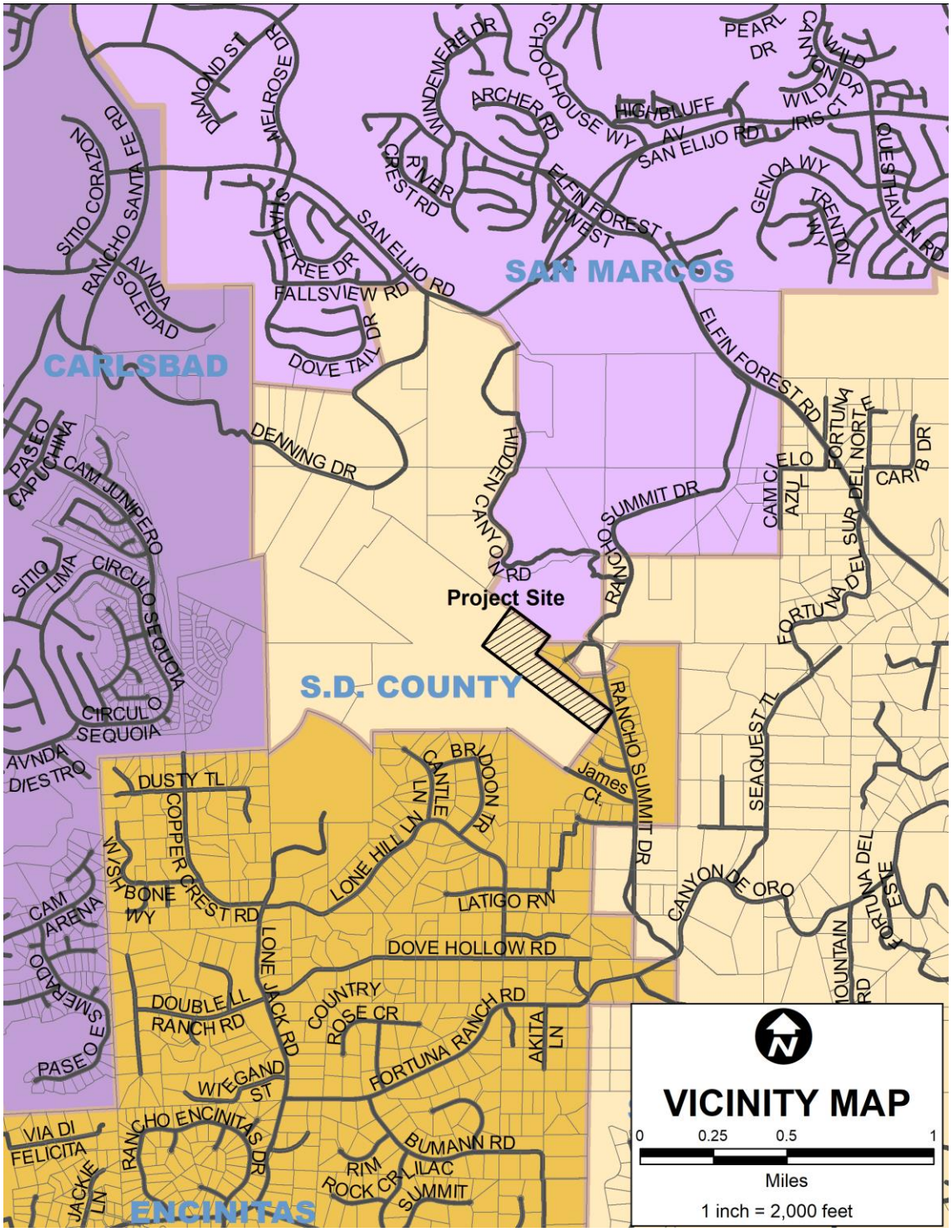

Figure 1: Vicinity Map

Purpose

This drainage study has been prepared to provide an evaluation of the proposed onsite drainage system for the Hidden Canyon at Rancho Summit Drive (Hidden Canyon) residential pads and their access driveways from the existing Rancho Summit Drive. This study is based on the proposed grading plans for the 3 proposed residential pads on existing legal parcels of land within San Diego County jurisdictional boundary, identified by Assessor Parcel Numbers; **223-081-48, Parcel "A"**, **223-081-49, Parcel "B" & APN 223-081-50** designated as **Parcel "C"**, the grading permit no. for this project is: **PDS2016-LDGRMJ-30097.**

Background

The main access driveway begins from the existing Rancho Summit Drive and terminates at a private 48' radius cul-de-sac at Parcel "C". Rancho Summit Drive is currently constructed (per City of Encinitas Grading and Private Street & Public Recreational Trail Improvement Plans for: Fortuna Ranch Road & Rancho Summit Drive, City of Encinitas T. M. 89-031, Drawing No.: 6242-G, **Attachment "4"**) as the main access for the adjacent development called: **Fortuna Ranch**.

Hidden Canyon is a phased development; with Phase 1 being the construction of the proposed 24 feet wide graded driveway which will have a 16 feet wide all-weather surface of compacted & stabilized Disintegrated Granite (DG) of at least 2 inches in thickness and the creation of the 3 proposed pads and driveways. The Second Phase of this project will be the construction of the proposed 3 homes on each pad.

Project Location

The project site is located adjacent to and west of Rancho Summit Drive, in San Diego County, California. Figure Number 1, provides a vicinity map showing the location of the project. (**See: Fig. 1, Vicinity Map**)

Project Description:

The first phase of Hidden Canyon will require the construction of the main access driveway and the proposed residential building pads as shown on the proposed grading plans, designated as: **PDS2016-LDGRMJ-30097**. The driveway will require the construction a steel single radius arch culvert, 9'-0" span x 2'-11" rise as manufactured by Contech Co., in addition 2.5' wide concrete Brow Ditches per San Diego Regional Standards Drawings (SDRSD) D-75, Type "A" will be placed at the top of proposed cut slopes to collect and route the anticipated storm water flows towards the arch culvert. The same brow ditch will also be placed at the top of proposed pad cut slope to collect and convey the storm water towards the proposed Type "F" Catch Basin located within the proposed residential pad on Parcel "C". Existing site is on a side of a hill with moderate slopes to the west and south, the existing topography creates 3 distinct drainage basins with defined collection points designated as Design Points 1-3 as shown on **Exhibit "A" Existing Hydrology Basins Map.** The remaining areas outside of these basins are on a uniform surface and stormwater sheet flows across these areas.

Portions of the project site is situated south of existing Lots 23-28 of a residential development called: **Fortuna Ranch**, (see **Attachment "5"** City of Encinitas Grading Plans drawing no. 6857-G for Tract 89-031 Lots 1 thru 28 of Map No. 14032) as a part of this study we have reviewed and attached for reference the "Drainage Calculations for City of Encinitas, TM 89-031 for Torrey Pacific Corp." prepared by Laret Engineering Co. in May 2000, as: **Attachment "6"**.

The anticipated storm water flows from this development are contained and treated by onsite Interim Sediment Basins as shown on Sheet 5C of **Attachment "5"**. After construction of the proposed homes in Fortuna Ranch the storm water flow will be regulated in the proposed Bio-Retention/Sediment Basins for each home, as shown on Sheet 7C of **Attachment "5"**.

The project site is located on a side of a naturally vegetated hill. In the existing condition, runoff drains via sheet flow originate from a central high point; the existing Olivenhain Municipal Water District (OMWD) water tank called: Gatty II Reservoir to the proposed drainage improvements on the upper end of Rancho Summit Drive, to the proposed 18" diameter Reinforced Concrete Pipe (RCP) at Station 49+17.10. The 100-year design flow (Q_{100}) for this culvert is shown on

Sheet 19B of **Attachment "5"** to be 3.85 Cubic feet per Second (CFS). At the end of Rancho Summit Drive an additional drainage ditch is shown and it appears that the anticipated Q_{100} flow for this outlet is 2.2 CFS. This is based on the calculations for Basin "G" as shown in **Attachment "6".**

It should be noted that the existing site is completely pervious and no impervious surfaces are currently proposed. After pads are constructed and building plans are completed the increased runoff due to addition of impervious surfaces, i.e., roofs, and hardscapes will have to be detained on the individual pad.

Exhibit "B" Proposed Hydrology Site Plan shows the proposed Pads, Driveways and the tributary basins and brow ditches. The project proposes to install 4 private underground storm drain culverts to convey the storm water runoff from the area upstream of the proposed main driveway to the existing natural drainage channel. Both inlet and outlet of this culvert will be provided with adequate riprap to prevent any sediment flow and scour.

Surrounding Land Uses

Hidden Canyon project is located in the North part of the San Diego County just below the OMWD Gatty II Water, at about 800 feet above the Mean Seal Level elevation. See **Attachment "1",** USGS Area Map and County of San Diego Hydrographic Map showing the project location within San Elijo Hydrologic Subarea 1 of Escondido Creek Hydrologic Area 6 of Carlsbad Hydrologic Unit 904.

Methodology

Onsite Drainage: On Parcel "C", the onsite drainage system will consist of private storm drain brow ditches above the pad cut slopes, collecting stormwater and directing the flow into the Type "F" Catch Basin located on the corner of the pad. Parcels "A" and "B" are mostly all fill pads and do not require a brow ditch. The pads will sheet flow towards the 4' wide biofiltration swales located on each side of the driveway. See **Exhibit "B" Proposed Hydrology Site Plan**.

Method of Analysis

The County of San Diego Rational Method is used to analyze the anticipated drainage flows. The limits of drainage basins are determined based on the available topographic maps, in addition site inspection and observation was conducted to verify the drainage basins and flow patterns.
The rational method (Q=CIA) was used to calculate the runoff. Intensity is based on the 100-year frequency storm and Time of Concentration (T_C) is calculated based on;

$$T_C = T_i + T_t$$

where Ti (initial time of concentration) is from San Diego County Drainage Manual Table 3-2 and Tt (time of travel) is based on Figure 3-4, Nomograph for determination of travel time for natural watersheds.

All the site hydrology data was modeled in the CivilDesign program, see **Exhibit "C", CivilDesign Report**. The proposed culverts were modeled and analyzed in the Culvert Studio program, see **Exhibit "D", Culvert Studio Report**.

Pre-development and Post-development Comparison

Appendix A provides the results of this analysis of the existing site. **Appendix B** provides the results of this analysis for the proposed site. A soils analysis report is provided from NRCS, (See **Soil Map Exhibits, Attachment "3".**) only soil Type D is used in the following calculations as specified in the County of San Diego Hydrology Manual, 2003 edition.

Precipitation

Total precipitation P for various design storms is determined from Isopluvial Maps in County of San Diego Hydrology Manual, 2003 edition. The appropriate design storm for this study is the 100-year, 6-hour storm (P_6), adjusted if necessary to be within 45% and 65% of the 24-hour precipitation (P_{24}). Based on the above Isopluvial Values table:

100- Year $P_6 =$ 3.2 inches

100- Year P_{24} = 5.4 inches
Use P = 3.2 inches for the 100-year storm event.

Tributary Areas

The contributing drainage areas are shown on **Exhibit "A"** (Existing Hydrology Basins Map) for the existing site and **Exhibit "B" (**Proposed Hydrology Site Plan) for the proposed site. For this study the primary concentration point for analysis and comparison of the pre-development and the post-development conditions is limited to the legal boundaries of the project site.

Runoff Coefficients

The principal physical watershed characteristics affecting the relationship between rainfall and runoff are land use, land treatment, soil types, and land slope. The rational method of calculation is based on the runoff coefficients for urban areas as shown on Table 3-1 of the drainage design manual. The proposed driveways are paved with stabilized disintegrated granite (DG) and the runoff coefficient of 0.41 in combination with a Manning coefficient of 0.025 is used to calculate the flows. The C value of 0.41 was also used on the proposed pads.

For the undisturbed basins a C value of 0.35 used. The Rock lined bio-swale ditch on both sides of the driveways, being 4' wide and 6" deep, provide a cross sectional area of 1.6 sq. ft. with a wetted perimeter of 3.9 feet, which was used to determine the travel time.

Table 3-1
RUNOFF COEFFICIENTS FOR URBAN AREAS

Land Use		Runoff Coefficient "C"				
			Soil Type			
NRCS Elements	County Elements	% IMPER.	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, Cp, 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

Pre-Development and Post-Development Comparative Results

A summary of the flow calculation data is as follows:

Results:	BASIN AREAS, ACRES		Q-100, CFS	
Point of Compliance:	PRE	POST	PRE	POST
POC-400	3.10	0.47	6.30	1.02
POC-200	5.65	8.32	8.00	8.93
POC-600	2.36	2.47	4.29	4.05
POC-700	2.58	2.86	3.69	5.95
POC-800	3.89	1.13	7.28	2.71
POC-900	8.06	9.43	15.75	15.75
POC-950	9.40	10.34	12.33	16.20
Totals:	**35.04**	**35.01**	**57.63**	**54.60**
Diff.	**0.0**		**3.03**	

Proposed Drainage Facilities

The Hidden Canyon at Rancho Summit Drive Residential sites will have the following major components;

1. A detention basin with Type "G" riser box, 4" diameter low flow orifice, that connects to a 24" diameter RCP culvert, this culvert is designed with a restrictor rectangular plate to reduce the flow which conveys the main drainage flow on Parcel B.
2. Type "F" catch basin on Parcel "C" to collect the stormwater from the pad cut slope brow ditch and its access driveway, in addition to the sheet flow from the pad surface.
3. An 18" diameter HDPE pipe culvert to convey the Stormwater under the proposed driveway at Parcel "C" from the Type "F" catch basin to the lower Type "G-1" catch basin.
4. A Type "G-1" grated inlet on the side of the main driveway that collects water from the north side of the main driveway.
5. A 24" diameter RCP culvert that conveys stormwater from the Type "G-1" catch basin to the natural drainage swale with a headwall and riprap.
6. 4 additional Type "G-1" grated inlets on the main driveway, with 12" diameter HDPE pipes, headwalls and riprap energy dissipation.
7. 4' wide rock lined bioswales at the sides of all driveways.

All proposed culverts & channels are sized for the 100-year storm event.

All proposed major cut slopes for the pad and the driveway are protected from slope erosion by placement of concrete brow ditches (Type "A") above the cut slope surface. Open channel flow calculations are attached To demonstrate the onsite drainage links flow capacities (See **Exhibits "D" Culvert and Channel Capacity Calculations**)

Summary and Conclusions

The proposed development of the Hidden Canyon at Rancho Summit Drive site from the existing vacant parcels is to create the proposed 3 pads which will ultimately be used to construct 3 single family homes. This project requires a main access driveway and 2 side driveway extensions to reach the pads. Once the proposed homes are designed the additional impervious surfaces, i.e., roof and hardscapes will create additional flows. This future increased flow must be contained and controlled on the proposed pads.

The current project will result in an overall minor net decrease of approximately 3 CFS (5% of the overall pre-development flow) in the peak discharge rates from the site during a 100-year event and it will not substantially alter the existing drainage patterns. A detention basin is also incorporated to control the discharge rate at the main swale on Parcel "B", located upstream of POC 200. Erosion at the major discharge points are minimized by using properly sized rip rap energy dissipation.

I certify that the proposed improvement will not increase the volume and/or velocity of surface flows to the detriment of downstream landowners and/or facilities.

Declaration of Responsible Charge

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 professions code, and that the design is consistent with the 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 project design.

Name: M. H. Shapouri

Address: 18025 Calle Ambiente Suite 501, Rancho Santa Fe, CA 92067

Telephone No: (858) 756-8340

Date: January 28, 2020

R.C.E. No: C52794 Expires: 12/31/2020

References

County of San Diego Hydrology Manual, June, 2003 edition

EXHIBIT "A"
PRE-DEVELOPMENT MAP

PRE DEV-POC-950
AREA=9.4 ACRES
L= 1,872', C= 0.35
Q100-PRE= 12.3 CFS
Q100-POST; 100TO950=9.97 CFS+
921TO950=6.23
TOTAL CFS=16.2

PRE DEV POC-900
AREA= 8.1 ACRES
L= 1,104', C= 0.35
Q100-PRE= 13.65 CFS
Q100-POST;
NODE 905TO920=8.48+
915TO930=0.705+
NODE 510TO900=6.56
= 15.75 CFS

PRE DEV POC-800
AREA= 3.89 ACRES
L= 464', C= 0.35
Q100-PRE= 7.28 CFS
Q100-POST= 2.71 CFS

PRE DEV POC-700
AREA=2.58 ACRES
L= 858', C= 0.35
Q100-PRE= 3.69 CFS
Q100-POST= 5.95 CFS

PRE DEV POC-600
AREA= 2.36 ACRES
L= 712', C= 0.35
Q100-PRE= 4.29 CFS
Q100-POST= 4.05 CFS

PRE DEV POC-200
AREA=5.65 ACRES
L= 998', C= 0.35
Q100-PRE= 8.0 CFS
Q100-POST;
NODES 340-200=7.7 CFS+
NODES 317-200=1.23
TOTAL=8.93 CFS

PRE DEV POC-400
AREA= 3.09 ACRES
L= 703', C= 0.35
Q100-PRE= 6.3 CFS
Q100-POST= 1.0 CFS

950 EL=555'
900 EL=638'
EL=659'
EL=855'
100
140 EL=814'
150 EL=823'
EL=854'
EL=848'
500
300 EL=814'
800 EL=739'
700 EL=738'
EL=712'
600
EL=684'
200
EL=687'
400

PRE DEVELOPMENT BASINS

NORTH
Scale: 1"=100'

Plot Date: 2020-01-22

SHAPOURI & ASSOCIATES
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REGISTERED PROFESSIONAL ENGINEER
M.H. SHAPOURI
C 52794
EXP.12-31-2020
CIVIL
STATE OF CALIFORNIA

PRIVATE CONTRACT

SHEET	COUNTY OF SAN DIEGO DEPARTMENT OF PUBLIC WORKS	SHEETS
1		2

PRE DEVELOPMENT BASINS

PADS AND DRIVEWAYS ACCESS FOR
3 PRIVATE RESIDENCES

CALIFORNIA COORDINATE INDEX: 334-1707 AND 330-1707

APPROVED WILLIAM P. MORGAN COUNTY ENGINEER	ENGINEER OF WORK: M. H. SHAPOURI, R.C.E. C52794
NAME: DATE:	PDS2016-LDGRMJ-30097 GRADING PERMIT NO:

ENGINEER: M.H. SHAPOURI
TELEPHONE NO.: (858) 756-8340 MIKE@SHAPOURI.COM

EXHIBIT "B"
POST-DEVELOPMENT MAP

POST DEVELOPMENT BASINS

PRE DEV-POC-950
AREA=9.4 ACRES
L= 1,872', C= 0.35
Q100-PRE= 12.3 CFS
Q100-POST; 100TO950=9.97 CFS+
921TO950=6.23
TOTAL CFS=16.2

PRE DEV POC-900
AREA= 8.1 ACRES
L= 1,104', C= 0.35
Q100-PRE= 13.65 CFS
Q100-POST;
NODE 905TO920=8.48+
915TO930=0.705+
NODE 510TO900=6.56
= 15.75 CFS

SDRSD D-40 TYPE 2,
1/2 TON ROCK, 10'W
X 12' LONG, T=3.5'
OVER FILTER
BLANKET
Q100= 12.3 CFS,
V100= 13.6 FPS

PRE DEV POC-800
AREA= 3.89 ACRES
L= 464', C= 0.35
Q100-PRE= 7.28 CFS
Q100-POST= 2.71 CFS

PRE DEV POC-700
AREA=2.58 ACRES
L= 858', C= 0.35
Q100-PRE= 3.69 CFS
Q100-POST= 5.95 CFS

PRE DEV POC-600
AREA= 2.36 ACRES
L= 712', C= 0.35
Q100-PRE= 4.29 CFS
Q100-POST= 4.05 CFS

PRE DEV POC-200
AREA=5.65 ACRES
L= 998', C= 0.35
Q100-PRE= 8.0 CFS
Q100-POST;
NODES 340-200=7.7 CFS+
NODES 317-200=1.23
TOTAL=8.93 CFS

PRE DEV POC-400
AREA= 3.09 ACRES
L= 703', C= 0.35
Q100-PRE= 6.3 CFS
Q100-POST= 1.0 CFS

Q100= 1.0 CFS,
SDRSD D-40 TYPE 2,
NO. 2 BACKING
ROCK, 6' W X 10'
LONG, T=1.1' OVER
FILTER BLANKET

950 EL=555'
900 EL=638'
948 EL=659'
EL=659'
947 EL=688'
949 EL=712'
924 EL=734'
923 EL=762'
925 EL=735'
932 EL=712'
515 EL=660'
933 EL=735'
930 EL=712'
935 EL=705'
920
921 EL=775'
922
916 EL=738'
905 EL=802'
906 EL=802'
140 EL=814'
931 EL=729'
915 EL=742'
150 EL=822'
500
350 EL=845'
910 EL=790'
911 EL=786'
800 EL=739'
805 EL=749'
505 EL=750'
510 EL=760'
700 EL=738'
355 EL=743'
600 EL=712'
340 EL=700'
337 EL=754'
335 EL=754'
345 EL=703'
325 EL=704'
200 EL=684'
400 EL=687'
100 EL=855'
EL=854'
EL=848'
305 EL=808'
300 EL=814'
330 EL=756'
306 EL=757'
310 EL=752'
315 EL=748'
317 EL=746'
320 EL=745'

POST BASIN-35
AREA= 0.17 ACRES
L= 88', C= 0.35
Q100= 0.29 CFS

POST BASIN-11
AREA=1.76 ACRES
L=522', C= 0.35
Q100=4.0 CFS

POST BASIN-10
AREA= 7.6 ACRES
L= 1,872', C= 0.35
Q100= CFS

POST BASIN-12
AREA= 0.4 ACRES
L= 239', C= 0.35
Q100=0.89 CFS

POST BASIN-38
AREA= 0.18 ACRES
L= 382', C= 0.41
Q100= 0.36 CFS

POST BASIN-13
AREA= 0.2 ACRES
L= 113', C= 0.35
Q100 = 0..48 CFS

POST BASIN-15
AREA= 0.15 ACRES
L= 30', C= 0.35
Q100= .224 CFS

POST BASIN-20
AREA= 0.05 ACRES
L= 155', C= 0.41
Q100= 0.14 CFS

PROPOSED BROW DITCH
TYPE A PER SDRSD D-75
HIGH POINT=749.6'

POST BASIN-39
AREA= 0.29 ACRES
L=1,072', C= 0.41
Q100= 0.57 CFS

POST BASIN-16
AREA= 1.12 ACRES
L=257', C= 0.41
Q100=1.96 CFS

24"Ø RCP PIPE
SEE SECTION (B/3)

CATCH BASIN TYPE
G-1 STD. DWG. D-8
Q100=0.705 CFS

TYPE A CATCH BASIN
PER SDRSD D-7, WEIR
SHORT ELEV.= 733.94'
Q100=8.48 CFS

18"Ø RCP PIPE
SEE SECTION (B/3)

POST BASIN-21
AREA= 0.17 ACRES
L=48', C= 0.35
Q100=0.29 CFS

POST BASIN-27
AREA= 1.14 ACRES
L= 566', C= 0.35
Q100= 2.8 CFS

POST BASIN-43
AREA= 0.06 ACRES
L= 222', C= 0.41
Q100= 0.10 CFS

POST BASIN-17
AREA= 0.23 ACRES
L=73', C= 0.35
Q100= 0.45 CFS

POST BASIN-19
AREA= 0.4 ACRES
L= 456', C= 0.38
Q100= 1.2 CFS

POST BASIN-26
AREA= 5.27 ACRES
L= 919', C= 0.35
Q100= 9.7 CFS

POST BASIN-36
AREA= 0.08 ACRES
L= 328', C= 0.41
Q100= 0.14 CFS

POST BASIN-37
AREA= 0.11 ACRES
L= 354', C= 0.41
Q100= 0.25 CFS

POST BASIN-18
AREA= 1.2 ACRES
L=571', C= 0.35
Q100=2.5 CFS

POST BASIN-29
AREA= 0.51 ACRES
L= 237', C= 0.35
Q100= 1.1 CFS

POST BASIN-14
AREA= 1.5 ACRES
L=403', C= 0.35
Q100= 2.24 CFS

POST BASIN-22
AREA= 0.99 ACRES
L= 323', C= 0.35
Q100 = 1.48 CFS

POST BASIN-28
AREA= 0.45 ACRES
L= 327', C= 0.35
Q100= 1.0 CFS

POST BASIN-30
AREA= 0.07 ACRES
L= 210', C= 0.41
Q100= 0.18 CFS

POST BASIN-42
AREA= 0.10 ACRES
L= 351', C= 0.41
Q100= 0.17 CFS

POST BASIN-24
AREA= 0.95 ACRES
L= 350', C= 0.41
Q= 1.7 CFS

POST BASIN-25
AREA= 1.91 ACRES
L= 531', C= 0.35
Q100= 4.0 CFS

POST BASIN-31
AREA= 0.66 ACRES
L=272', C= 0.41
Q100= 1.16 CFS

POST BASIN-34
AREA= 0.02 ACRES
L= 57', C= 0.41
Q100= 0.05 CFS

POST BASIN-23
AREA= 0.33 ACRES
L= 900', C= 0.35
Q100= 0.49 CFS

CATCH BASIN TYPE
G-1 STD. DWG. D-8

CATCH BASIN TYPE
G-1 STD. DWG. D-8

POST BASIN-32
AREA= 0.53 ACRES
L= 298', C= 0.35
Q100= 0.97 CFS

POST BASIN-33
AREA= 0.1 ACRES
L= 120', C= 0.35
Q100= 0.18 CFS

POST BASIN-41
AREA= 0.31 ACRES
L=511', C= 0.41
Q100= 1.0 CFS

NORTH
Scale: 1"=100'

Plot Date: 2020-01-22

SHAPOURI & ASSOCIATES
PROJECT MANAGEMENT SERVICES
ENGINEERING · ARCHITECTURE · PLANNING
CIELO VILLAGE, 18029 CALLE AMBIENTE, SUITE 502
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REGISTERED PROFESSIONAL ENGINEER
M.H. SHAPOURI
C 52794
EXP.12-31-2020
CIVIL
STATE OF CALIFORNIA

PRIVATE CONTRACT

SHEET 2	COUNTY OF SAN DIEGO DEPARTMENT OF PUBLIC WORKS	2 SHEETS

POST DEVELOPMENT BASINS

PADS AND DRIVEWAYS ACCESS FOR
3 PRIVATE RESIDENCES

CALIFORNIA COORDINATE INDEX: 334-1707 AND 330-1707

APPROVED WILLIAM P. MORGAN COUNTY ENGINEER	ENGINEER OF WORK M. H. SHAPOURI, R.C.E. C52794
NAME: DATE:	PDS2016-LDGRMJ-30097 GRADING PERMIT NO:

ENGINEER: M.H. SHAPOURI
TELEPHONE NO.: (858) 756-8340 MIKE@SHAPOURI.COM

S H A P O U R I & A S S O C I A T E S

PROJECT MANAGEMENT SERVICES

ENGINEERING . ARCHITECTURE . PLANNING

EXHIBIT "C"
CIVILDESIGN REPORT

San Diego County Rational Hydrology Program

Hidden Canyon Project

EXISTING BASIN CALCULATIONS

San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2019 Version 9.1

Rational method hydrology program based on
San Diego County Flood Control Division 2003 hydrology manual
Rational Hydrology Study Date: 01/21/20

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

Program License Serial Number 6466

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) = 5.400
P6/P24 = 59.3%
San Diego hydrology manual 'C' values used

++
Process from Point/Station 100.000 to Point/Station 200.000
**** 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 = 998.000(Ft.)
Highest elevation = 855.000(Ft.)
Lowest elevation = 684.000(Ft.)
Elevation difference = 171.000(Ft.) Slope = 17.134 %
Top of Initial Area Slope adjusted by User to 1.000 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 70.00 (Ft)
for the top area slope value of 1.00 %, in a development type of
Permanent Open Space
In Accordance With Table 3-2
Initial Area Time of Concentration = 12.50 minutes
(for slope value of 1.00 %)
The initial area total distance of 998.00 (Ft.) entered leaves a
remaining distance of 928.00 (Ft.)
Using Figure 3-4, the travel time for this distance is 2.97 minutes
for a distance of 928.00 (Ft.) and a slope of 17.13 %
with an elevation difference of 159.00(Ft.) from the end of the top area
Tt = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr)

```
 =    2.969 Minutes
Tt=[(11.9*0.1758^3)/(159.00)]^.385=  2.97
Total initial area Ti =  12.50 minutes from Table 3-2 plus
  2.97 minutes from the Figure 3-4 formula =  15.47 minutes
Rainfall intensity (I) =      4.069(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.350
Subarea runoff =      8.047(CFS)
Total initial stream area =        5.650(Ac.)

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End of computations, total study area =           5.650 (Ac.)

            San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2019 Version 9.1

Rational method hydrology  program based on
San Diego County Flood Control Division 2003 hydrology manual
      Rational Hydrology Study        Date: 01/23/20
------------------------------------------------------------------------
 *********   Hydrology Study Control Information **********

------------------------------------------------------------------------

Program License Serial Number 6466

------------------------------------------------------------------------
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) =  5.400
P6/P24 =    59.3%
San Diego hydrology manual 'C' values used

++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      300.000 to Point/Station      400.000
**** 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  =  703.000(Ft.)
Highest elevation =  814.000(Ft.)
Lowest elevation =  687.000(Ft.)
Elevation difference =  127.000(Ft.) Slope = 18.065 %
Top 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)
for the top area slope value of  10.00 %, in a development type of
 Permanent Open Space
In Accordance With Table 3-2
Initial Area Time of Concentration =   6.90 minutes
 (for slope value of  10.00 %)
The initial area total distance of  703.00 (Ft.) entered leaves a
remaining distance of  603.00 (Ft.)
Using Figure 3-4, the travel time for this distance is   2.09 minutes
for a distance of 603.00 (Ft.) and a slope of 18.07 %
with an elevation difference of 108.93(Ft.) from the end of the top area
Tt = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr)
 =    2.087 Minutes
Tt=[(11.9*0.1142^3)/(108.93)]^.385=  2.09
Total initial area Ti =   6.90 minutes from Table 3-2 plus
  2.09 minutes from the Figure 3-4 formula =   8.99 minutes
Rainfall intensity (I) =      5.776(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.350
Subarea runoff =      6.267(CFS)
Total initial stream area =        3.100(Ac.)
End of computations, total study area =           3.100 (Ac.)
```

San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2019 Version 9.1

Rational method hydrology program based on
San Diego County Flood Control Division 2003 hydrology manual
      Rational Hydrology Study   Date: 01/21/20

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

Program License Serial Number 6466

```
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) =  5.400
P6/P24 =    59.3%
San Diego hydrology manual 'C' values used
```

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++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      500.000 to Point/Station      600.000
**** 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  =  650.000(Ft.)
Highest elevation =  848.000(Ft.)
Lowest elevation =  712.000(Ft.)
Elevation difference =  136.000(Ft.) Slope = 20.923 %
Top of Initial Area Slope adjusted by User to  7.400 %
Bottom of Initial Area Slope adjusted by User to 19.101 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of   7.40 %, in a development type of
 Permanent Open Space
In Accordance With Table 3-2
Initial Area Time of Concentration =   8.70 minutes
 (for slope value of   5.00 %)
The initial area total distance of  650.00 (Ft.) entered leaves a
remaining distance of  550.00 (Ft.)
Using Figure 3-4, the travel time for this distance is   1.90 minutes
for a distance of 550.00 (Ft.) and a slope of 19.10 %
with an elevation difference of 105.06(Ft.) from the end of the top area
Tt = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr)
 =    1.903 Minutes
Tt=[(11.9*0.1042^3)/(105.06)]^.385=  1.90
Total initial area Ti =   8.70 minutes from Table 3-2 plus
  1.90 minutes from the Figure 3-4 formula =  10.60 minutes
Rainfall intensity (I) =      5.192(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.350
Subarea runoff =      4.288(CFS)
Total initial stream area =        2.360(Ac.)

End of computations, total study area =           2.360 (Ac.)


               San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2019 Version 9.1

Rational method hydrology  program based on
San Diego County Flood Control Division 2003 hydrology manual
      Rational Hydrology Study        Date: 01/21/20
---------------------------------------------------------------------------
 *********   Hydrology Study Control Information **********

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Program License Serial Number 6466

------------------------------------------------------------------------
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) =  5.400
P6/P24 =    59.3%
San Diego hydrology manual 'C' values used


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      100.000 to Point/Station      700.000
**** 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  =  858.000(Ft.)
Highest elevation =  855.000(Ft.)
Lowest elevation =  738.000(Ft.)
Elevation difference =  117.000(Ft.) Slope = 13.636 %
Top of Initial Area Slope adjusted by User to  1.000 %
Bottom of Initial Area Slope adjusted by User to 13.605 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 70.00 (Ft)
for the top area slope value of   1.00 %, in a development type of
 Permanent Open Space
In Accordance With Table 3-2
Initial Area Time of Concentration =  12.50 minutes
 (for slope value of   1.00 %)
The initial area total distance of  858.00 (Ft.) entered leaves a
remaining distance of  788.00 (Ft.)
Using Figure 3-4, the travel time for this distance is   2.86 minutes
for a distance of 788.00 (Ft.) and a slope of 13.61 %
with an elevation difference of 107.21(Ft.) from the end of the top area
Tt = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr)
 =    2.861 Minutes
Tt=[(11.9*0.1492^3)/(107.21)]^.385=  2.86
Total initial area Ti =  12.50 minutes from Table 3-2 plus
  2.86 minutes from the Figure 3-4 formula =  15.36 minutes
Rainfall intensity (I) =      4.088(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.350
Subarea runoff =      3.691(CFS)
Total initial stream area =        2.580(Ac.)
End of computations, total study area =          2.580 (Ac.)
```

San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2019 Version 9.1

Rational method hydrology program based on
San Diego County Flood Control Division 2003 hydrology manual
Rational Hydrology Study Date: 01/21/20

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

Program License Serial Number 6466

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) = 5.400
P6/P24 = 59.3%
San Diego hydrology manual 'C' values used

++
Process from Point/Station 150.000 to Point/Station 800.000
**** 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 = 464.000(Ft.)
Highest elevation = 823.000(Ft.)
Lowest elevation = 739.000(Ft.)
Elevation difference = 84.000(Ft.) Slope = 18.103 %
Top of Initial Area Slope adjusted by User to 6.500 %
Bottom of Initial Area Slope adjusted by User to 17.508 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of 6.50 %, in a development type of
Permanent Open Space
In Accordance With Table 3-2
Initial Area Time of Concentration = 8.70 minutes
(for slope value of 5.00 %)
The initial area total distance of 464.00 (Ft.) entered leaves a
remaining distance of 364.00 (Ft.)
Using Figure 3-4, the travel time for this distance is 1.43 minutes

```
for a distance of 364.00 (Ft.) and a slope of 17.51 %
with an elevation difference of  63.73(Ft.) from the end of the top area
Tt = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr)
 =    1.432 Minutes
Tt=[(11.9*0.0689^3)/( 63.73)]^.385=  1.43
Total initial area Ti =   8.70 minutes from Table 3-2 plus
  1.43 minutes from the Figure 3-4 formula =  10.13 minutes
Rainfall intensity (I) =      5.346(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.350
Subarea runoff =      7.279(CFS)
Total initial stream area =        3.890(Ac.)


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End of computations, total study area =           3.890 (Ac.)


            San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2019 Version 9.1

Rational method hydrology  program based on
San Diego County Flood Control Division 2003 hydrology manual
      Rational Hydrology Study        Date: 01/21/20
------------------------------------------------------------------------
 *********   Hydrology Study Control Information **********

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Program License Serial Number 6466

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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) =  5.400
P6/P24 =    59.3%
San Diego hydrology manual 'C' values used


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Process from Point/Station      140.000 to Point/Station      900.000
**** 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  = 1104.000(Ft.)
Highest elevation =  814.000(Ft.)
Lowest elevation =  638.000(Ft.)
Elevation difference =  176.000(Ft.) Slope = 15.942 %
Top of Initial Area Slope adjusted by User to  6.700 %
Bottom of Initial Area Slope adjusted by User to 17.500 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of   6.70 %, in a development type of
 Permanent Open Space
In Accordance With Table 3-2
Initial Area Time of Concentration =   8.70 minutes
 (for slope value of   5.00 %)
The initial area total distance of 1104.00 (Ft.) entered leaves a
remaining distance of 1004.00 (Ft.)
Using Figure 3-4, the travel time for this distance is   3.13 minutes
for a distance of 1004.00 (Ft.) and a slope of 17.50 %
with an elevation difference of 175.70(Ft.) from the end of the top area
Tt = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr)
 =    3.129 Minutes
Tt=[(11.9*0.1902^3)/(175.70)]^.385=  3.13
Total initial area Ti =   8.70 minutes from Table 3-2 plus
  3.13 minutes from the Figure 3-4 formula =  11.83 minutes
Rainfall intensity (I) =      4.838(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.350
Subarea runoff =     13.648(CFS)
Total initial stream area =        8.060(Ac.)
End of computations, total study area =           8.060 (Ac.)


           San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2019 Version 9.1

Rational method hydrology  program based on
San Diego County Flood Control Division 2003 hydrology manual
      Rational Hydrology Study        Date: 01/21/20
------------------------------------------------------------------------
 *********   Hydrology Study Control Information **********

------------------------------------------------------------------------


Program License Serial Number 6466

------------------------------------------------------------------------
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
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```
24 hour precipitation(inches) =  5.400
P6/P24 =    59.3%
San Diego hydrology manual 'C' values used


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      100.000 to Point/Station      950.000
**** 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  = 1872.000(Ft.)
Highest elevation =  855.000(Ft.)
Lowest elevation =  555.000(Ft.)
Elevation difference =  300.000(Ft.) Slope = 16.026 %
Top of Initial Area Slope adjusted by User to  1.000 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 70.00 (Ft)
for the top area slope value of   1.00 %, in a development type of
 Permanent Open Space
In Accordance With Table 3-2
Initial Area Time of Concentration =  12.50 minutes
 (for slope value of   1.00 %)
The initial area total distance of 1872.00 (Ft.) entered leaves a
remaining distance of 1802.00 (Ft.)
Using Figure 3-4, the travel time for this distance is   5.08 minutes
for a distance of 1802.00 (Ft.) and a slope of 16.03 %
with an elevation difference of 288.79(Ft.) from the end of the top area
Tt = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr)
 =    5.078 Minutes
Tt=[(11.9*0.3413^3)/(288.79)]^.385=  5.08
Total initial area Ti =  12.50 minutes from Table 3-2 plus
  5.08 minutes from the Figure 3-4 formula =  17.58 minutes
Rainfall intensity (I) =      3.747(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.350
Subarea runoff =     12.329(CFS)
Total initial stream area =        9.400(Ac.)


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End of computations, total study area =           9.400 (Ac.)
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S H A P O U R I & A S S O C I A T E S

PROJECT MANAGEMENT SERVICES

ENGINEERING . ARCHITECTURE . PLANNING

San Diego County Rational Hydrology Program

Hidden Canyon Project

POST DEVELOPMENT DRAINAGE CALCULATIONS

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            San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2019 Version 9.1

Rational method hydrology  program based on
San Diego County Flood Control Division 2003 hydrology manual
     Rational Hydrology Study        Date: 01/22/20
------------------------------------------------------------------------
 *********   Hydrology Study Control Information **********

------------------------------------------------------------------------


Program License Serial Number 6466

------------------------------------------------------------------------
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) =  5.400
P6/P24 =    59.3%
San Diego hydrology manual 'C' values used


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      317.000 to Point/Station      400.000
**** 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  =  357.000(Ft.)
Highest elevation =  746.000(Ft.)
Lowest elevation =  687.000(Ft.)
Elevation difference =   59.000(Ft.) Slope = 16.527 %
Top of Initial Area Slope adjusted by User to 13.400 %
Bottom of Initial Area Slope adjusted by User to 17.100 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of  13.40 %, in a development type of
 Permanent Open Space
In Accordance With Table 3-2
Initial Area Time of Concentration =   6.90 minutes
 (for slope value of  10.00 %)
The initial area total distance of  357.00 (Ft.) entered leaves a
remaining distance of  257.00 (Ft.)
Using Figure 3-4, the travel time for this distance is   1.11 minutes
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```
for a distance of 257.00 (Ft.) and a slope of 17.10 %
with an elevation difference of  43.95(Ft.) from the end of the top area
Tt = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr)
 =    1.105 Minutes
Tt=[(11.9*0.0487^3)/( 43.95)]^.385=  1.11
Total initial area Ti =   6.90 minutes from Table 3-2 plus
  1.11 minutes from the Figure 3-4 formula =   8.01 minutes
Rainfall intensity (I) =      6.224(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.350
Subarea runoff =      1.024(CFS)
Total initial stream area =        0.470(Ac.)
End of computations, total study area =           0.470 (Ac.)


            San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2019 Version 9.1

Rational method hydrology  program based on
San Diego County Flood Control Division 2003 hydrology manual
      Rational Hydrology Study        Date: 01/22/20
------------------------------------------------------------------------
 *********   Hydrology Study Control Information **********

------------------------------------------------------------------------


Program License Serial Number 6466

------------------------------------------------------------------------
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) =  5.400
P6/P24 =    59.3%
San Diego hydrology manual 'C' values used


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      300.000 to Point/Station      310.000
**** 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  =  327.000(Ft.)
Highest elevation =  814.000(Ft.)
```

```
Lowest elevation =  752.000(Ft.)
Elevation difference =   62.000(Ft.) Slope = 18.960 %
Top of Initial Area Slope adjusted by User to  8.000 %
Bottom of Initial Area Slope adjusted by User to 17.800 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of   8.00 %, in a development type of
 Permanent Open Space
In Accordance With Table 3-2
Initial Area Time of Concentration =   6.90 minutes
 (for slope value of  10.00 %)
The initial area total distance of  327.00 (Ft.) entered leaves a
remaining distance of  227.00 (Ft.)
Using Figure 3-4, the travel time for this distance is   0.99 minutes
for a distance of 227.00 (Ft.) and a slope of 17.80 %
with an elevation difference of  40.41(Ft.) from the end of the top area
Tt = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr)
 =    0.989 Minutes
Tt=[(11.9*0.0430^3)/( 40.41)]^.385=  0.99
Total initial area Ti =   6.90 minutes from Table 3-2 plus
  0.99 minutes from the Figure 3-4 formula =   7.89 minutes
Rainfall intensity (I) =      6.283(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.350
Subarea runoff =      0.989(CFS)
Total initial stream area =        0.450(Ac.)


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Process from Point/Station      305.000 to Point/Station      306.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
Rainfall intensity (I) =      6.283(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 =     7.89 min.
Rainfall intensity =      6.283(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.350  CA =      0.336
Subarea runoff =      1.121(CFS) for      0.510(Ac.)
Total runoff =      2.111(CFS)    Total area =       0.960(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      306.000 to Point/Station      310.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
Rainfall intensity (I) =      6.283(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
[LOW DENSITY RESIDENTIAL                    ]
(1.0 DU/A or Less       )
Impervious value, Ai = 0.100
Sub-Area C Value = 0.410
Time of concentration =     7.89 min.
Rainfall intensity =      6.283(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.354  CA =      0.365
Subarea runoff =      0.180(CFS) for      0.070(Ac.)
Total runoff =      2.291(CFS)    Total area =       1.030(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      310.000 to Point/Station      315.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
Rainfall intensity (I) =      6.283(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 =     7.89 min.
Rainfall intensity =      6.283(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.354  CA =      0.365
Subarea runoff =      0.000(CFS) for      0.000(Ac.)
Total runoff =      2.291(CFS)    Total area =       1.030(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      330.000 to Point/Station      335.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
Rainfall intensity (I) =      6.283(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
[LOW DENSITY RESIDENTIAL                    ]
(1.0 DU/A or Less       )
Impervious value, Ai = 0.100
Sub-Area C Value = 0.410
Time of concentration =     7.89 min.
Rainfall intensity =      6.283(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.376  CA =      0.635
Subarea runoff =      1.700(CFS) for      0.660(Ac.)
Total runoff =      3.991(CFS)    Total area =       1.690(Ac.)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      315.000 to Point/Station      320.000
**** IMPROVED CHANNEL TRAVEL TIME ****
________________________________________________________________________
Upstream point elevation =   748.000(Ft.)
Downstream point elevation =   745.000(Ft.)
Channel length thru subarea  =    20.000(Ft.)
Channel base width     =    4.000(Ft.)
Slope or 'Z' of left channel bank =   4.000
Slope or 'Z' of right channel bank =   4.000
Manning's 'N'    = 0.030
Maximum depth of channel  =    0.500(Ft.)
Flow(q) thru subarea =      3.991(CFS)
Depth of flow =   0.164(Ft.), Average velocity =   5.234(Ft/s)
Channel flow top width =    5.310(Ft.)
Flow Velocity =    5.23(Ft/s)
Travel time  =    0.06 min.
Time of concentration =    7.95 min.
Critical depth =      0.285(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      335.000 to Point/Station      320.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
Rainfall intensity (I) =      6.250(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
[LOW DENSITY RESIDENTIAL                    ]
(1.0 DU/A or Less       )
Impervious value, Ai = 0.100
Sub-Area C Value = 0.410
Time of concentration =     7.95 min.
Rainfall intensity =      6.250(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.376  CA =      0.643
Subarea runoff =      0.031(CFS) for      0.020(Ac.)
Total runoff =      4.022(CFS)    Total area =       1.710(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      320.000 to Point/Station      340.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
________________________________________________________________________
Top of street segment elevation =   745.000(Ft.)
End of street segment elevation =   700.000(Ft.)
Length of street segment  =   506.000(Ft.)
Height of curb above gutter flowline  =    6.0(In.)
Width of half street (curb to crown)  =  12.000(Ft.)
Distance from crown to crossfall grade break  =   8.000(Ft.)
Slope from gutter to grade break (v/hz) =  -0.100
Slope from grade break to crown (v/hz)  =   0.020
```

```
Street flow is on [1] side(s) of the street
Distance from curb to property line  =   0.000(Ft.)
Slope from curb to property line (v/hz) =   0.000
Gutter width =   4.000(Ft.)
Gutter hike from flowline =  0.000(In.)
 Manning's N in gutter =  0.0300
 Manning's N from gutter to grade break =  0.0300
 Manning's N from grade break to crown =  0.0250
Estimated mean flow rate at midpoint of street =      4.063(CFS)
Depth of flow =   0.149(Ft.), Average velocity =   3.531(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =  11.449(Ft.)
Flow velocity =   3.53(Ft/s)
Travel time =    2.39 min.     TC =   10.34  min.
 Adding area flow to street
Rainfall intensity (I) =      5.276(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
[LOW DENSITY RESIDENTIAL                     ]
(1.0 DU/A or Less       )
Impervious value, Ai = 0.100
Sub-Area C Value = 0.410
The area added to the existing stream causes a
a lower flow rate of Q =      3.698(CFS)
therefore the upstream flow rate of Q =      4.022(CFS) is being used
Rainfall intensity =      5.276(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.379  CA =      0.701
Subarea runoff =      0.000(CFS) for      0.140(Ac.)
Total runoff =      4.022(CFS)    Total area =       1.850(Ac.)
Street flow at end of street =      4.022(CFS)
Half street flow at end of street =      4.022(CFS)
Depth of flow =   0.148(Ft.), Average velocity =   3.521(Ft/s)
Flow width (from curb towards crown)=  11.412(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      335.000 to Point/Station      325.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
Rainfall intensity (I) =      5.276(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 =    10.34 min.
Rainfall intensity =      5.276(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.372  CA =      0.886
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```
Subarea runoff =      0.655(CFS) for      0.530(Ac.)
Total runoff =      4.677(CFS)    Total area =       2.380(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      337.000 to Point/Station      325.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________________
Rainfall intensity (I) =      5.276(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 =    10.34 min.
Rainfall intensity =      5.276(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.372  CA =      0.921
Subarea runoff =      0.185(CFS) for      0.100(Ac.)
Total runoff =      4.861(CFS)    Total area =       2.480(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      100.000 to Point/Station      340.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________________
Rainfall intensity (I) =      5.276(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 =    10.34 min.
Rainfall intensity =      5.276(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.357  CA =      2.766
Subarea runoff =      9.732(CFS) for      5.270(Ac.)
Total runoff =     14.593(CFS)    Total area =       7.750(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      355.000 to Point/Station      340.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________________
Rainfall intensity (I) =      5.276(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
```

```
[LOW DENSITY RESIDENTIAL                    ]
(1.0 DU/A or Less       )
Impervious value, Ai = 0.100
Sub-Area C Value = 0.410
Time of concentration =    10.34 min.
Rainfall intensity =      5.276(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.357  CA =      2.790
Subarea runoff =      0.130(CFS) for      0.060(Ac.)
Total runoff =     14.723(CFS)    Total area =       7.810(Ac.)
End of computations, total study area =           7.810 (Ac.)
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      340.000 to Point/Station      200.000
**** THIS DATA IS TRANSFERED TO HYDROLOGY STUDIO FOR POND DETENTION
CALCULATIONS ****
```

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            San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2019 Version 9.1

Rational method hydrology  program based on
San Diego County Flood Control Division 2003 hydrology manual
     Rational Hydrology Study        Date: 01/22/20
------------------------------------------------------------------------
 *********   Hydrology Study Control Information **********

------------------------------------------------------------------------


Program License Serial Number 6466

------------------------------------------------------------------------
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) =  5.400
P6/P24 =    59.3%
San Diego hydrology manual 'C' values used


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      317.000 to Point/Station      345.000
**** 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                    ]
(1.0 DU/A or Less       )
Impervious value, Ai = 0.100
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Sub-Area C Value = 0.410
Initial subarea total flow distance  =  511.000(Ft.)
Highest elevation =  746.000(Ft.)
Lowest elevation =  703.000(Ft.)
Elevation difference =   43.000(Ft.) Slope =  8.415 %
Top of Initial Area Slope adjusted by User to 11.000 %
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)
for the top area slope value of  11.00 %, in a development type of
 1.0 DU/A or Less
In Accordance With Table 3-2
Initial Area Time of Concentration =   6.40 minutes
 (for slope value of  10.00 %)
The initial area total distance of  511.00 (Ft.) entered leaves a
remaining distance of  411.00 (Ft.)
Using Figure 3-4, the travel time for this distance is   1.95 minutes
for a distance of 411.00 (Ft.) and a slope of 10.00 %
with an elevation difference of  41.10(Ft.) from the end of the top area
Tt = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr)
 =    1.951 Minutes
Tt=[(11.9*0.0778^3)/( 41.10)]^.385=  1.95
Total initial area Ti =   6.40 minutes from Table 3-2 plus
  1.95 minutes from the Figure 3-4 formula =   8.35 minutes
Rainfall intensity (I) =      6.056(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.410
Subarea runoff =      1.018(CFS)
Total initial stream area =        0.410(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      345.000 to Point/Station      200.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
Rainfall intensity (I) =      6.056(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 =     8.35 min.
Rainfall intensity =      6.056(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.398  CA =      0.203
Subarea runoff =      0.212(CFS) for      0.100(Ac.)
Total runoff =      1.230(CFS)    Total area =       0.510(Ac.)
End of computations, total study area =           0.510 (Ac.)
```

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CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2019 Version 9.1

Rational method hydrology  program based on
San Diego County Flood Control Division 2003 hydrology manual
     Rational Hydrology Study        Date: 01/22/20
------------------------------------------------------------------------
 *********   Hydrology Study Control Information **********

------------------------------------------------------------------------


Program License Serial Number 6466

------------------------------------------------------------------------
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) =  5.400
P6/P24 =    59.3%
San Diego hydrology manual 'C' values used


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      350.000 to Point/Station      355.000
**** 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  =  531.000(Ft.)
Highest elevation =  845.000(Ft.)
Lowest elevation =  743.000(Ft.)
Elevation difference =  102.000(Ft.) Slope = 19.209 %
Top of Initial Area Slope adjusted by User to  6.300 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of   6.30 %, in a development type of
 Permanent Open Space
In Accordance With Table 3-2
Initial Area Time of Concentration =   8.70 minutes
 (for slope value of   5.00 %)
The initial area total distance of  531.00 (Ft.) entered leaves a
remaining distance of  431.00 (Ft.)
Using Figure 3-4, the travel time for this distance is   1.57 minutes
for a distance of 431.00 (Ft.) and a slope of 19.21 %
with an elevation difference of  82.79(Ft.) from the end of the top area
Tt = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr)
 =    1.574 Minutes
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Tt=[(11.9*0.0816^3)/( 82.79)]^.385=  1.57
Total initial area Ti =   8.70 minutes from Table 3-2 plus
  1.57 minutes from the Figure 3-4 formula =  10.27 minutes
Rainfall intensity (I) =      5.298(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.350
Subarea runoff =      3.542(CFS)
Total initial stream area =        1.910(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      505.000 to Point/Station      355.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
________________________________________________________________________
Top of street segment elevation =   750.000(Ft.)
End of street segment elevation =   743.000(Ft.)
Length of street segment  =   250.000(Ft.)
Height of curb above gutter flowline  =    6.0(In.)
Width of half street (curb to crown)  =  12.000(Ft.)
Distance from crown to crossfall grade break  =   8.000(Ft.)
Slope from gutter to grade break (v/hz) =  -0.100
Slope from grade break to crown (v/hz)  =   0.020
Street flow is on [2] side(s) of the street
Distance from curb to property line  =   0.000(Ft.)
Slope from curb to property line (v/hz) =   0.000
Gutter width =   4.000(Ft.)
Gutter hike from flowline =  0.000(In.)
 Manning's N in gutter =  0.0300
 Manning's N from gutter to grade break =  0.0300
 Manning's N from grade break to crown =  0.0250
Estimated mean flow rate at midpoint of street =      3.605(CFS)
Depth of flow =   0.133(Ft.), Average velocity =   1.852(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =  10.646(Ft.)
Flow velocity =   1.85(Ft/s)
Travel time =    2.25 min.     TC =   12.52  min.
 Adding area flow to street
Rainfall intensity (I) =      4.663(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
[LOW DENSITY RESIDENTIAL                    ]
(1.0 DU/A or Less       )
Impervious value, Ai = 0.100
Sub-Area C Value = 0.410
The area added to the existing stream causes a
a lower flow rate of Q =      3.247(CFS)
therefore the upstream flow rate of Q =      3.542(CFS) is being used
Rainfall intensity =      4.663(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.352  CA =      0.696
Subarea runoff =      0.000(CFS) for      0.068(Ac.)
Total runoff =      3.542(CFS)    Total area =       1.978(Ac.)
Street flow at end of street =      3.542(CFS)
Half street flow at end of street =      1.771(CFS)
```

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Depth of flow =   0.132(Ft.), Average velocity =   1.842(Ft/s)
Flow width (from curb towards crown)=  10.589(Ft.)


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Process from Point/Station      505.000 to Point/Station      355.000
**** STREET INLET + AREA  + PIPE  TRAVEL TIME ****
________________________________________________________________________
Top of street segment elevation =   750.000(Ft.)
End of street segment elevation =   743.000(Ft.)
Length of street segment  =   250.000(Ft.)
Height of curb above gutter flowline  =    6.0(In.)
Width of half street (curb to crown)  =  12.000(Ft.)
Distance from crown to crossfall grade break  =   8.000(Ft.)
Slope from gutter to grade break (v/hz) =  -0.100
Slope from grade break to crown (v/hz)  =   0.020
Street flow is on [2] side(s) of the street
Distance from curb to property line  =   0.000(Ft.)
Slope from curb to property line (v/hz) =   0.000
Gutter width =   4.000(Ft.)
Gutter hike from flowline =  0.000(In.)
 Manning's N in gutter =  0.0300
 Manning's N from gutter to grade break =  0.0300
 Manning's N from grade break to crown =  0.0250

Street Inlet Calculations:
Street flow before street inlet =      3.542(CFS)
Half street flow before street inlet =      1.771(CFS)
Existing pipe flow before street inlet =      0.000(CFS)
Number of street inlets = 2
Depth of flow =   0.196(Ft.), Average velocity =   1.899(Ft/s)
U.S. DOT Hydraulic Engineering Circular No. 12 curb inlet calculations:
 Street flow half width at start of inlet =      9.622(Ft.)
 Flow rate in gutter section of street = Qw =      1.337(CFS)
 Ratio of frontal flow to total flow = E0 =  0.7551
 Given curb inlet length  L =      3.000(Ft.)

Half street cross section data points at curb inlet:
            X-coordinate (Ft.)   Y-coordinate (Ft.)
             0.0000                0.5833 right of way
             0.0000                0.5833 top of curb
             0.0000                0.0000 flow line
             4.0000                0.0833 gutter/depression end
             4.0000                0.0833 grade break
            12.0000                0.2433 crown
 Length required for total flow interception = Lt
 Lt = .6 * Q^0.42 * Slope^.3 * (1/(n*Se)^.6 =     -1.#IO(Ft.)
 where Manning's n = 0.0300 and Slope = street slope =  0.0280
 Se = Equivalent Street x-slope including depression = -0.0843
 Gutter depression depth =      1.000(In.)
 Gutter depression width =      4.000(Ft.)
 Efficiency = 1 - (1-L/Lt)^1.8 =  1.0000

Pipe calculations for under street flow rate of      3.542(CFS)
Using a pipe slope =     30.000 %
```

```
Upstream point/station elevation =   750.000(Ft.)
Downstream point/station elevation =   743.000(Ft.)
Pipe length  =   250.00(Ft.) Slope =   0.3000  Manning's N = 0.010
No. of pipes = 1  Required pipe flow  =     3.542(CFS)
Given pipe size =     12.00(In.)
Calculated individual pipe flow  =     3.542(CFS)
Normal flow depth in pipe =    3.03(In.)
Flow top width inside pipe =   10.43(In.)
Critical Depth =    9.65(In.)
Pipe flow velocity =     22.76(Ft/s)
Travel time through pipe =    0.18 min.
Time of concentration (TC) =    12.71 min.
Maximum flow rate of street inlet(s) =      3.542(CFS)
Maximum pipe flow capacity =      3.542(CFS)
Remaining flow in street below inlet =      0.000(CFS)
 Adding area flow to street
Rainfall intensity (I) =      4.620(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
[LOW DENSITY RESIDENTIAL                     ]
(1.0 DU/A or Less       )
Impervious value, Ai = 0.100
Sub-Area C Value = 0.410
The area added to the existing stream causes a
a lower flow rate of Q =      3.482(CFS)
therefore the upstream flow rate of Q =      3.542(CFS) is being used
Rainfall intensity =      4.620(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.356  CA =      0.754
Subarea runoff =      0.000(CFS) for      0.140(Ac.)
Total runoff =      3.542(CFS)    Total area =       2.118(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      355.000 to Point/Station      600.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
Rainfall intensity (I) =      4.620(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 =    12.71 min.
Rainfall intensity =      4.620(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.355  CA =      0.876
Subarea runoff =      0.506(CFS) for      0.350(Ac.)
Total runoff =      4.048(CFS)    Total area =       2.468(Ac.)
End of computations, total study area =           2.468 (Ac.)
```

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            San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2019 Version 9.1

Rational method hydrology  program based on
San Diego County Flood Control Division 2003 hydrology manual
     Rational Hydrology Study        Date: 01/22/20
------------------------------------------------------------------------
 *********   Hydrology Study Control Information **********

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Program License Serial Number 6466

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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) =  5.400
P6/P24 =    59.3%
San Diego hydrology manual 'C' values used


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      500.000 to Point/Station      505.000
**** 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  =  571.000(Ft.)
Highest elevation =  848.000(Ft.)
Lowest elevation =  750.000(Ft.)
Elevation difference =   98.000(Ft.) Slope = 17.163 %
Top of Initial Area Slope adjusted by User to 15.700 %
Bottom of Initial Area Slope adjusted by User to 19.264 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of  15.70 %, in a development type of
 Permanent Open Space
In Accordance With Table 3-2
Initial Area Time of Concentration =   6.90 minutes
 (for slope value of  10.00 %)
The initial area total distance of  571.00 (Ft.) entered leaves a
```

```
remaining distance of  471.00 (Ft.)
Using Figure 3-4, the travel time for this distance is   1.68 minutes
for a distance of 471.00 (Ft.) and a slope of 19.26 %
with an elevation difference of  90.73(Ft.) from the end of the top area
Tt = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr)
 =    1.683 Minutes
Tt=[(11.9*0.0892^3)/( 90.73)]^.385=  1.68
Total initial area Ti =   6.90 minutes from Table 3-2 plus
  1.68 minutes from the Figure 3-4 formula =   8.58 minutes
Rainfall intensity (I) =      5.950(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.350
Subarea runoff =      2.499(CFS)
Total initial stream area =        1.200(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      100.000 to Point/Station      510.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
Rainfall intensity (I) =      5.950(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 =     8.58 min.
Rainfall intensity =      5.950(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.350  CA =      0.976
Subarea runoff =      3.311(CFS) for      1.590(Ac.)
Total runoff =      5.810(CFS)    Total area =       2.790(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      510.000 to Point/Station      505.000
**** STREET INLET + AREA  + PIPE  TRAVEL TIME ****
________________________________________________________________________
Top of street segment elevation =   760.000(Ft.)
End of street segment elevation =   750.000(Ft.)
Length of street segment  =   108.000(Ft.)
Height of curb above gutter flowline  =    6.0(In.)
Width of half street (curb to crown)  =  12.000(Ft.)
Distance from crown to crossfall grade break  =   8.000(Ft.)
Slope from gutter to grade break (v/hz) =  -0.100
Slope from grade break to crown (v/hz)  =   0.020
Street flow is on [2] side(s) of the street
Distance from curb to property line  =   0.000(Ft.)
Slope from curb to property line (v/hz) =   0.000
Gutter width =   4.000(Ft.)
Gutter hike from flowline =  0.000(In.)
 Manning's N in gutter =  0.0300
 Manning's N from gutter to grade break =  0.0300
```

```
 Manning's N from grade break to crown =  0.0250

Street Inlet Calculations:
Street flow before street inlet =      5.810(CFS)
Half street flow before street inlet =      2.905(CFS)
Existing pipe flow before street inlet =      0.000(CFS)
Number of street inlets = 2
Depth of flow =   0.189(Ft.), Average velocity =   3.359(Ft/s)
U.S. DOT Hydraulic Engineering Circular No. 12 curb inlet calculations:
 Street flow half width at start of inlet =      9.264(Ft.)
 Flow rate in gutter section of street = Qw =      2.245(CFS)
 Ratio of frontal flow to total flow = E0 =  0.7727
 Given curb inlet length  L =      4.000(Ft.)

Half street cross section data points at curb inlet:
            X-coordinate (Ft.)   Y-coordinate (Ft.)
             0.0000                0.5833 right of way
             0.0000                0.5833 top of curb
             0.0000                0.0000 flow line
             4.0000                0.0833 gutter/depression end
             4.0000                0.0833 grade break
            12.0000                0.2433 crown
 Length required for total flow interception = Lt
 Lt = .6 * Q^0.42 * Slope^.3 * (1/(n*Se)^.6 =     -1.#IO(Ft.)
 where Manning's n = 0.0300 and Slope = street slope =  0.0926
 Se = Equivalent Street x-slope including depression = -0.0839
 Gutter depression depth =      1.000(In.)
 Gutter depression width =      4.000(Ft.)
 Efficiency = 1 - (1-L/Lt)^1.8 =  1.0000

Pipe calculations for under street flow rate of      5.810(CFS)
Using a pipe slope =     30.000 %
Upstream point/station elevation =   760.000(Ft.)
Downstream point/station elevation =   750.000(Ft.)
Pipe length  =   108.00(Ft.) Slope =   0.3000  Manning's N = 0.010
No. of pipes = 1  Required pipe flow  =     5.810(CFS)
Given pipe size =     12.00(In.)
Calculated individual pipe flow  =     5.810(CFS)
Normal flow depth in pipe =    3.91(In.)
Flow top width inside pipe =   11.24(In.)
Critical Depth =   11.39(In.)
Pipe flow velocity =     26.20(Ft/s)
Travel time through pipe =    0.07 min.
Time of concentration (TC) =     8.65 min.
Maximum flow rate of street inlet(s) =      5.810(CFS)
Maximum pipe flow capacity =      5.810(CFS)
Remaining flow in street below inlet =      0.000(CFS)
 Adding area flow to street
Rainfall intensity (I) =      5.919(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
[LOW DENSITY RESIDENTIAL                    ]
(1.0 DU/A or Less       )
```

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Impervious value, Ai = 0.100
Sub-Area C Value = 0.410
Rainfall intensity =      5.919(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.351  CA =      1.001
Subarea runoff =      0.116(CFS) for      0.060(Ac.)
Total runoff =      5.926(CFS)    Total area =       2.850(Ac.)
Street flow at end of street =      0.116(CFS)
Half street flow at end of street =      0.058(CFS)
Depth of flow =   0.015(Ft.), Average velocity =   0.886(Ft/s)
Flow width (from curb towards crown)=   4.748(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      505.000 to Point/Station      700.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
Rainfall intensity (I) =      5.919(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 =     8.65 min.
Rainfall intensity =      5.919(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.351  CA =      1.022
Subarea runoff =      0.124(CFS) for      0.060(Ac.)
Total runoff =      6.050(CFS)    Total area =       2.910(Ac.)
End of computations, total study area =          2.910 (Ac.)


            San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2019 Version 9.1

Rational method hydrology  program based on
San Diego County Flood Control Division 2003 hydrology manual
     Rational Hydrology Study        Date: 01/22/20
------------------------------------------------------------------------
 *********   Hydrology Study Control Information **********

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Program License Serial Number 6466

------------------------------------------------------------------------
Rational hydrology study storm event year is   100.0
English (in-lb) input data Units used
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```
Map data precipitation entered:
6 hour,  precipitation(inches) =  3.200
24 hour precipitation(inches) =  5.400
P6/P24 =    59.3%
San Diego hydrology manual 'C' values used


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      805.000 to Point/Station      800.000
**** 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  =   48.000(Ft.)
Highest elevation =  749.000(Ft.)
Lowest elevation =  739.000(Ft.)
Elevation difference =   10.000(Ft.) Slope = 20.833 %
Top of Initial Area Slope adjusted by User to 18.000 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of  18.00 %, in a development type of
 Permanent Open Space
In Accordance With Table 3-2
Initial Area Time of Concentration =   6.90 minutes
 (for slope value of  10.00 %)
Rainfall intensity (I) =      6.850(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.350
Subarea runoff =      2.709(CFS)
Total initial stream area =        1.130(Ac.)
End of computations, total study area =          1.130 (Ac.)



           San Diego County Rational Hydrology Program

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Rational method hydrology  program based on
San Diego County Flood Control Division 2003 hydrology manual
     Rational Hydrology Study        Date: 01/22/20
------------------------------------------------------------------------
 *********   Hydrology Study Control Information **********

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Program License Serial Number 6466

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```
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) =  5.400
P6/P24 =    59.3%
San Diego hydrology manual 'C' values used


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      915.000 to Point/Station      930.000
**** 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                    ]
(1.0 DU/A or Less       )
Impervious value, Ai = 0.100
Sub-Area C Value = 0.410
Initial subarea total flow distance  =  354.000(Ft.)
Highest elevation =  742.000(Ft.)
Lowest elevation =  712.000(Ft.)
Elevation difference =   30.000(Ft.) Slope =  8.475 %
Top of Initial Area Slope adjusted by User to  6.100 %
Bottom of Initial Area Slope adjusted by User to  9.200 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of   6.10 %, in a development type of
 1.0 DU/A or Less
In Accordance With Table 3-2
Initial Area Time of Concentration =   8.00 minutes
 (for slope value of   5.00 %)
The initial area total distance of  354.00 (Ft.) entered leaves a
remaining distance of  254.00 (Ft.)
Using Figure 3-4, the travel time for this distance is   1.39 minutes
for a distance of 254.00 (Ft.) and a slope of  9.20 %
with an elevation difference of  23.37(Ft.) from the end of the top area
Tt = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr)
 =    1.391 Minutes
Tt=[(11.9*0.0481^3)/( 23.37)]^.385=  1.39
Total initial area Ti =   8.00 minutes from Table 3-2 plus
  1.39 minutes from the Figure 3-4 formula =   9.39 minutes
Rainfall intensity (I) =      5.615(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.410
Subarea runoff =      0.253(CFS)
Total initial stream area =        0.110(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      916.000 to Point/Station      930.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
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```
Rainfall intensity (I) =      5.615(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 =     9.39 min.
Rainfall intensity =      5.615(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.369  CA =      0.126
Subarea runoff =      0.452(CFS) for      0.230(Ac.)
Total runoff =      0.705(CFS)    Total area =       0.340(Ac.)
End of computations, total study area =           0.340 (Ac.)

THIS FLOW IS CAPTURED BY TYPE "G" INLET.


            San Diego County Rational Hydrology Program

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Rational method hydrology  program based on
San Diego County Flood Control Division 2003 hydrology manual
      Rational Hydrology Study        Date: 01/22/20
--------------------------------------------------------------------------
 *********   Hydrology Study Control Information **********

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Program License Serial Number 6466

--------------------------------------------------------------------------
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) =  5.400
P6/P24 =    59.3%
San Diego hydrology manual 'C' values used


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      905.000 to Point/Station      910.000
**** 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                    ]
```

```
(1.0 DU/A or Less       )
Impervious value, Ai = 0.100
Sub-Area C Value = 0.410
Initial subarea total flow distance  =  350.000(Ft.)
Highest elevation =  802.000(Ft.)
Lowest elevation =  796.000(Ft.)
Elevation difference =    6.000(Ft.) Slope =  1.714 %
Top of Initial Area Slope adjusted by User to  1.000 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 70.00 (Ft)
for the top area slope value of   1.00 %, in a development type of
 1.0 DU/A or Less
In Accordance With Table 3-2
Initial Area Time of Concentration =  11.50 minutes
 (for slope value of   1.00 %)
The initial area total distance of  350.00 (Ft.) entered leaves a
remaining distance of  280.00 (Ft.)
Using Figure 3-4, the travel time for this distance is   2.86 minutes
for a distance of 280.00 (Ft.) and a slope of  1.71 %
with an elevation difference of   4.80(Ft.) from the end of the top area
Tt = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr)
 =    2.863 Minutes
Tt=[(11.9*0.0530^3)/(  4.80)]^.385=  2.86
Total initial area Ti =  11.50 minutes from Table 3-2 plus
  2.86 minutes from the Figure 3-4 formula =  14.36 minutes
Rainfall intensity (I) =      4.269(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.410
Subarea runoff =      1.663(CFS)
Total initial stream area =        0.950(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      910.000 to Point/Station      510.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
Rainfall intensity (I) =      4.269(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 =    14.36 min.
Rainfall intensity =      4.269(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.395  CA =      0.505
Subarea runoff =      0.493(CFS) for      0.330(Ac.)
Total runoff =      2.156(CFS)    Total area =       1.280(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      510.000 to Point/Station      915.000
**** SUBAREA FLOW ADDITION ****
```

```
Rainfall intensity (I) =      4.269(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
[LOW DENSITY RESIDENTIAL                    ]
(1.0 DU/A or Less       )
Impervious value, Ai = 0.100
Sub-Area C Value = 0.410
Time of concentration =    14.36 min.
Rainfall intensity =      4.269(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.396  CA =      0.546
Subarea runoff =      0.175(CFS) for      0.100(Ac.)
Total runoff =      2.331(CFS)    Total area =       1.380(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      911.000 to Point/Station      915.000
**** SUBAREA FLOW ADDITION ****
------------------------------------------------------------------------
Rainfall intensity (I) =      4.269(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 =    14.36 min.
Rainfall intensity =      4.269(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.377  CA =      0.892
Subarea runoff =      1.479(CFS) for      0.990(Ac.)
Total runoff =      3.810(CFS)    Total area =       2.370(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      915.000 to Point/Station      920.000
**** SUBAREA FLOW ADDITION ****
------------------------------------------------------------------------
Rainfall intensity (I) =      4.269(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
[LOW DENSITY RESIDENTIAL                    ]
(1.0 DU/A or Less       )
Impervious value, Ai = 0.100
Sub-Area C Value = 0.410
Time of concentration =    14.36 min.
Rainfall intensity =      4.269(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
```

```
(Q=KCIA) is C = 0.378  CA =      0.925
Subarea runoff =      0.140(CFS) for      0.080(Ac.)
Total runoff =      3.950(CFS)    Total area =       2.450(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      906.000 to Point/Station      920.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
Rainfall intensity (I) =      4.269(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 =    14.36 min.
Rainfall intensity =      4.269(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.367  CA =      1.450
Subarea runoff =      2.241(CFS) for      1.500(Ac.)
Total runoff =      6.191(CFS)    Total area =       3.950(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      925.000 to Point/Station      920.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
Rainfall intensity (I) =      4.269(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
[LOW DENSITY RESIDENTIAL                    ]
(1.0 DU/A or Less       )
Impervious value, Ai = 0.100
Sub-Area C Value = 0.410
Time of concentration =    14.36 min.
Rainfall intensity =      4.269(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.377  CA =      1.909
Subarea runoff =      1.960(CFS) for      1.120(Ac.)
Total runoff =      8.151(CFS)    Total area =       5.070(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      922.000 to Point/Station      920.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
Rainfall intensity (I) =      4.269(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 =    14.36 min.
Rainfall intensity =      4.269(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.376  CA =      1.962
Subarea runoff =      0.224(CFS) for      0.150(Ac.)
Total runoff =      8.375(CFS)    Total area =       5.220(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      916.000 to Point/Station      920.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
Rainfall intensity (I) =      4.269(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
[LOW DENSITY RESIDENTIAL                    ]
(1.0 DU/A or Less       )
Impervious value, Ai = 0.100
Sub-Area C Value = 0.410
Time of concentration =    14.36 min.
Rainfall intensity =      4.269(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.376  CA =      1.987
Subarea runoff =      0.105(CFS) for      0.060(Ac.)
Total runoff =      8.480(CFS)    Total area =       5.280(Ac.)
End of computations, total study area =           5.280 (Ac.)

THIS FLOW IS CAPTURED BY TYPE "F" INLET AT NODE 920


            San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2019 Version 9.1

Rational method hydrology  program based on
San Diego County Flood Control Division 2003 hydrology manual
     Rational Hydrology Study        Date: 01/22/20
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 *********   Hydrology Study Control Information **********

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Program License Serial Number 6466

------------------------------------------------------------------------
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) =  5.400
P6/P24 =    59.3%
San Diego hydrology manual 'C' values used


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      510.000 to Point/Station      515.000
**** 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                    ]
(1.0 DU/A or Less       )
Impervious value, Ai = 0.100
Sub-Area C Value = 0.410
Initial subarea total flow distance  = 1072.000(Ft.)
Highest elevation =  760.000(Ft.)
Lowest elevation =  666.000(Ft.)
Elevation difference =   94.000(Ft.) Slope =  8.769 %
Top of Initial Area Slope adjusted by User to  5.500 %
Bottom of Initial Area Slope adjusted by User to  9.300 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of   5.50 %, in a development type of
 1.0 DU/A or Less
In Accordance With Table 3-2
Initial Area Time of Concentration =   8.00 minutes
 (for slope value of   5.00 %)
The initial area total distance of 1072.00 (Ft.) entered leaves a
remaining distance of  972.00 (Ft.)
Using Figure 3-4, the travel time for this distance is   3.89 minutes
for a distance of 972.00 (Ft.) and a slope of  9.30 %
with an elevation difference of  90.40(Ft.) from the end of the top area
Tt = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr)
 =    3.893 Minutes
Tt=[(11.9*0.1841^3)/( 90.40)]^.385=  3.89
Total initial area Ti =   8.00 minutes from Table 3-2 plus
  3.89 minutes from the Figure 3-4 formula =  11.89 minutes
Rainfall intensity (I) =      4.821(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.410
Subarea runoff =      0.573(CFS)
Total initial stream area =        0.290(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      931.000 to Point/Station      900.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
Rainfall intensity (I) =      4.821(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 =    11.89 min.
Rainfall intensity =      4.821(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.356  CA =      1.064
Subarea runoff =      4.556(CFS) for      2.700(Ac.)
Total runoff =      5.129(CFS)    Total area =       2.990(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      930.000 to Point/Station      932.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
Rainfall intensity (I) =      4.821(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 =    11.89 min.
Rainfall intensity =      4.821(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.356  CA =      1.123
Subarea runoff =      0.287(CFS) for      0.170(Ac.)
Total runoff =      5.416(CFS)    Total area =       3.160(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      930.000 to Point/Station      948.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
Rainfall intensity (I) =      4.821(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
[LOW DENSITY RESIDENTIAL                    ]
(1.0 DU/A or Less       )
Impervious value, Ai = 0.100
Sub-Area C Value = 0.410
Time of concentration =    11.89 min.
Rainfall intensity =      4.821(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.358  CA =      1.197
Subarea runoff =      0.356(CFS) for      0.180(Ac.)
Total runoff =      5.772(CFS)    Total area =       3.340(Ac.)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      932.000 to Point/Station      948.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
Rainfall intensity (I) =      4.821(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 =    11.89 min.
Rainfall intensity =      4.821(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.358  CA =      1.301
Subarea runoff =      0.501(CFS) for      0.297(Ac.)
Total runoff =      6.273(CFS)    Total area =       3.637(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      933.000 to Point/Station      932.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
Rainfall intensity (I) =      4.821(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 =    11.89 min.
Rainfall intensity =      4.821(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.357  CA =      1.361
Subarea runoff =      0.287(CFS) for      0.170(Ac.)
Total runoff =      6.560(CFS)    Total area =       3.807(Ac.)
End of computations, total study area =           3.807 (Ac.)


            San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2019 Version 9.1

Rational method hydrology  program based on
San Diego County Flood Control Division 2003 hydrology manual
      Rational Hydrology Study        Date: 01/22/20
------------------------------------------------------------------------
 *********   Hydrology Study Control Information **********
```

```
------------------------------------------------------------------------


Program License Serial Number 6466

------------------------------------------------------------------------
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) =  5.400
P6/P24 =    59.3%
San Diego hydrology manual 'C' values used


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      921.000 to Point/Station      922.000
**** 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  =  113.000(Ft.)
Highest elevation =  775.000(Ft.)
Lowest elevation =    0.000(Ft.)
Elevation difference =  775.000(Ft.) Slope = 685.841 %
Top of Initial Area Slope adjusted by User to 21.800 %
Bottom of Initial Area Slope adjusted by User to 22.000 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of  21.80 %, in a development type of
 Permanent Open Space
In Accordance With Table 3-2
Initial Area Time of Concentration =   6.90 minutes
 (for slope value of  10.00 %)
The initial area total distance of  113.00 (Ft.) entered leaves a
remaining distance of   13.00 (Ft.)
Using Figure 3-4, the travel time for this distance is   0.10 minutes
for a distance of  13.00 (Ft.) and a slope of 22.00 %
with an elevation difference of   2.86(Ft.) from the end of the top area
Tt = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr)
 =    0.101 Minutes
Tt=[(11.9*0.0025^3)/(  2.86)]^.385=  0.10
Total initial area Ti =   6.90 minutes from Table 3-2 plus
  0.10 minutes from the Figure 3-4 formula =   7.00 minutes
Rainfall intensity (I) =      6.786(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.350
Subarea runoff =      0.475(CFS)
```

```
Total initial stream area =        0.200(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      922.000 to Point/Station      924.000
**** IMPROVED CHANNEL TRAVEL TIME ****
________________________________________________________________________
Upstream point elevation =   749.600(Ft.)
Downstream point elevation =   734.000(Ft.)
Channel length thru subarea  =   178.000(Ft.)
Channel base width     =    0.000(Ft.)
Slope or 'Z' of left channel bank =   1.250
Slope or 'Z' of right channel bank =   1.250
Manning's 'N'    = 0.015
Maximum depth of channel  =    1.000(Ft.)
Flow(q) thru subarea =      0.475(CFS)
Depth of flow =   0.248(Ft.), Average velocity =   6.183(Ft/s)
Channel flow top width =    0.620(Ft.)
Flow Velocity =    6.18(Ft/s)
Travel time  =    0.48 min.
Time of concentration =    7.48 min.
Critical depth =      0.391(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      923.000 to Point/Station      949.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
Rainfall intensity (I) =      6.502(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 =     7.48 min.
Rainfall intensity =      6.502(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.350  CA =      0.210
Subarea runoff =      0.890(CFS) for      0.400(Ac.)
Total runoff =      1.365(CFS)    Total area =       0.600(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      924.000 to Point/Station      947.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
Rainfall intensity (I) =      6.502(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 =     7.48 min.
Rainfall intensity =      6.502(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.350  CA =      0.343
Subarea runoff =      0.865(CFS) for      0.380(Ac.)
Total runoff =      2.230(CFS)    Total area =       0.980(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      947.000 to Point/Station      950.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
Rainfall intensity (I) =      6.502(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 =     7.48 min.
Rainfall intensity =      6.502(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.350  CA =      0.958
Subarea runoff =      3.996(CFS) for      1.756(Ac.)
Total runoff =      6.226(CFS)    Total area =       2.736(Ac.)
End of computations, total study area =           2.736 (Ac.)


            San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2019 Version 9.1

Rational method hydrology  program based on
San Diego County Flood Control Division 2003 hydrology manual
     Rational Hydrology Study        Date: 01/22/20
------------------------------------------------------------------------
 *********   Hydrology Study Control Information **********

------------------------------------------------------------------------


Program License Serial Number 6466

------------------------------------------------------------------------
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) =  5.400
P6/P24 =    59.3%
San Diego hydrology manual 'C' values used


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      100.000 to Point/Station      950.000
**** 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  = 1872.000(Ft.)
Highest elevation =  855.000(Ft.)
Lowest elevation =  555.000(Ft.)
Elevation difference =  300.000(Ft.) Slope = 16.026 %
Top of Initial Area Slope adjusted by User to  1.000 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 70.00 (Ft)
for the top area slope value of   1.00 %, in a development type of
 Permanent Open Space
In Accordance With Table 3-2
Initial Area Time of Concentration =  12.50 minutes
 (for slope value of   1.00 %)
The initial area total distance of 1872.00 (Ft.) entered leaves a
remaining distance of 1802.00 (Ft.)
Using Figure 3-4, the travel time for this distance is   5.08 minutes
for a distance of 1802.00 (Ft.) and a slope of 16.03 %
with an elevation difference of 288.79(Ft.) from the end of the top area
Tt = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr)
 =    5.078 Minutes
Tt=[(11.9*0.3413^3)/(288.79)]^.385=  5.08
Total initial area Ti =  12.50 minutes from Table 3-2 plus
  5.08 minutes from the Figure 3-4 formula =  17.58 minutes
Rainfall intensity (I) =      3.747(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.350
Subarea runoff =      9.968(CFS)
Total initial stream area =        7.600(Ac.)
End of computations, total study area =           7.600 (Ac.)
```

EXHIBIT "D"
CULVERT
CALCULATIONS

Table of Contents

Project Name: HIDDEN CANYON

Hydrology Studio v 3.0.0.13

01-23-2020

100 - Year

Hydrograph 100-yr Summary

Project Name: HIDDEN CANYON

01-23-2020

Hydrology Studio v 3.0.0.13

Hyd. No.	Hydrograph Type	Hydrograph Name	Peak Flow (cfs)	Time to Peak (hrs)	Hydrograph Volume (cuft)	Inflow Hyd(s)	Maximum Elevation (ft)	Maximum Storage (cuft)
1	Rational	Pre 200	8.057	0.25	7,252	----		
2	Rational	Post poc200	14.70	0.17	8,819	----		
3	Pond Route	Post pond-200	7.696	0.25	8,735	2	705.36	3,718

Hydrograph Report

Project Name: HIDDEN CANYON

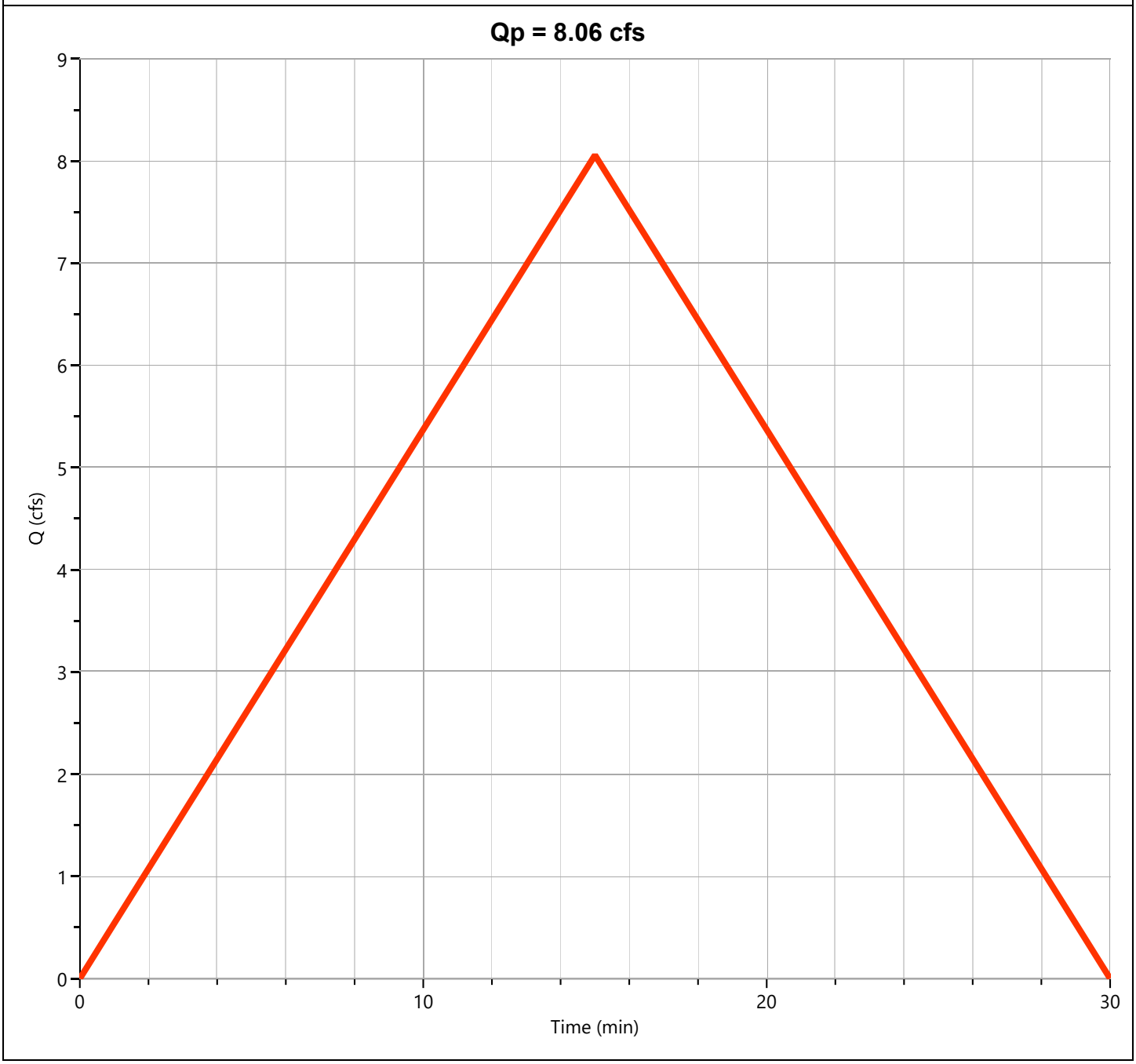
Hydrology Studio v 3.0.0.13

01-23-2020

Pre 200

Hyd. No. 1

Hydrograph Type	= Rational	Peak Flow	= 8.057 cfs
Storm Frequency	= 100-yr	Time to Peak	= 0.25 hrs
Time Interval	= 1 min	Runoff Volume	= 7,252 cuft
Drainage Area	= 5.91 ac	Runoff Coeff.	= 0.35
Tc Method	= User	Time of Conc. (Tc)	= 15.0 min
IDF Curve	= 2020-01-10 - Hyd-Studio-100.idf	Intensity	= 3.90 in/hr
Freq. Corr. Factor	= 1.00	Asc/Rec Limb Factors	= 1/1



Hydrograph Report

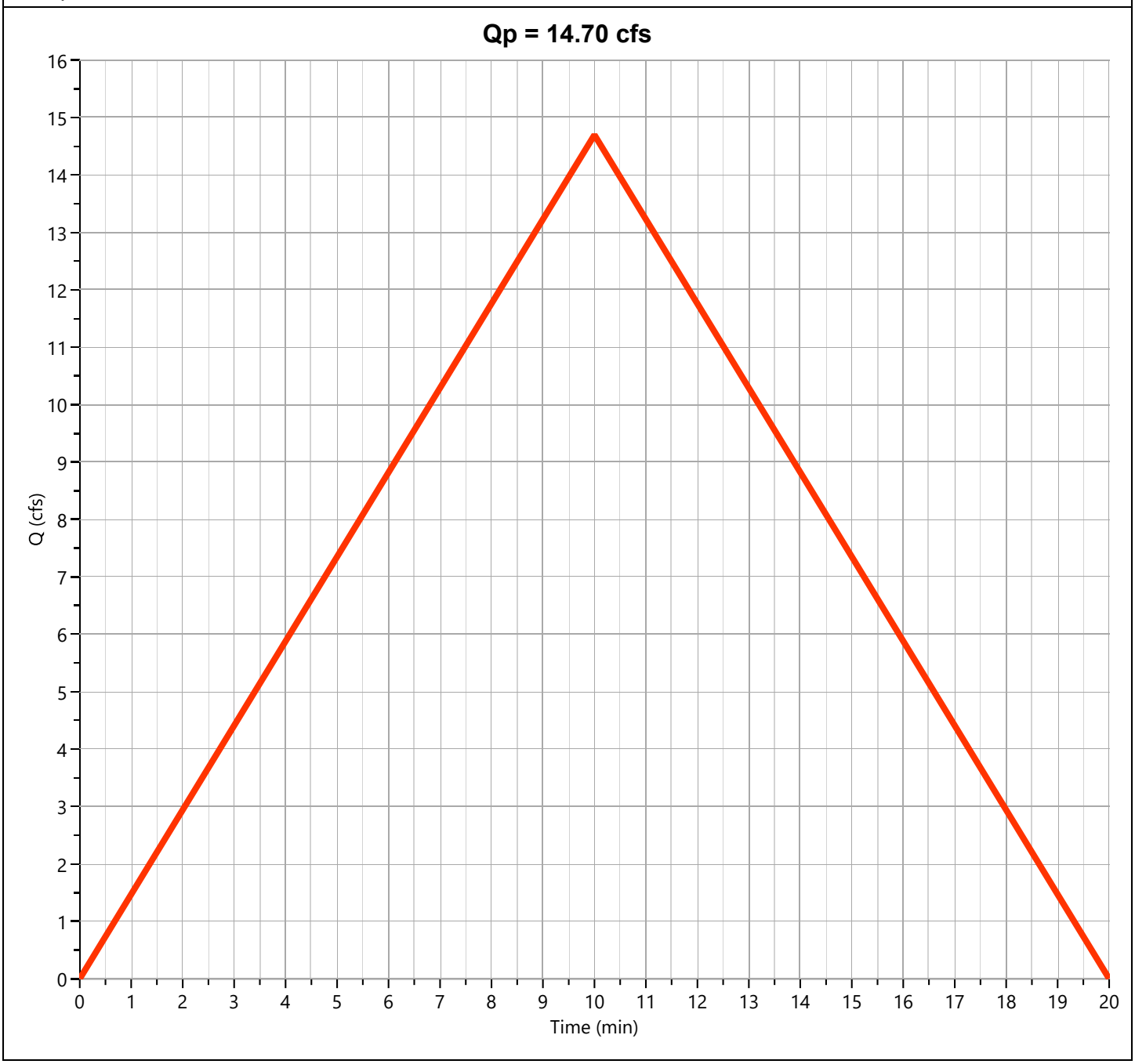
Hydrology Studio v 3.0.0.13

01-23-2020

Post poc200

Hyd. No. 2

Hydrograph Type	= Rational	Peak Flow	= 14.70 cfs
Storm Frequency	= 100-yr	Time to Peak	= 0.17 hrs
Time Interval	= 1 min	Runoff Volume	= 8,819 cuft
Drainage Area	= 7.65 ac	Runoff Coeff.	= 0.38
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
IDF Curve	= 2020-01-10 - Hyd-Studio-100.idf	Intensity	= 5.06 in/hr
Freq. Corr. Factor	= 1.00	Asc/Rec Limb Factors	= 1/1



Hydrograph Report

Hydrology Studio v 3.0.0.13

01-23-2020

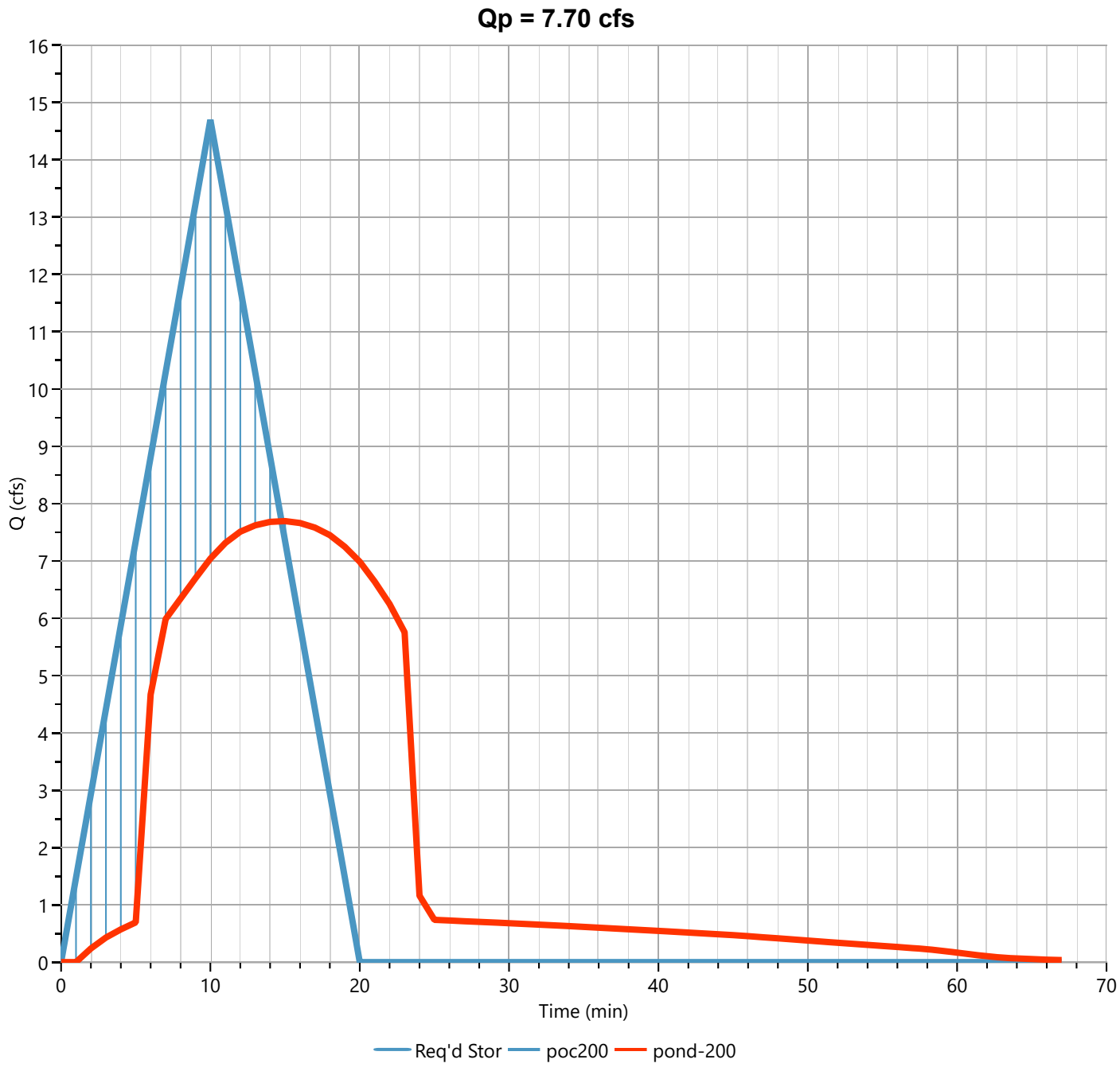
Post pond-200

Hyd. No. 3

Hydrograph Type	= Pond Route	Peak Flow	= 7.696 cfs
Storm Frequency	= 100-yr	Time to Peak	= 0.25 hrs
Time Interval	= 1 min	Hydrograph Volume	= 8,735 cuft
Inflow Hydrograph	= 2 - poc200	Max. Elevation	= 705.36 ft
Pond Name	= NATURAL POND ABOVE THE ARCH CULV	Max. Storage	= 3,718 cuft

Pond Routing by Storage Indication Method

Center of mass detention time = 8 min



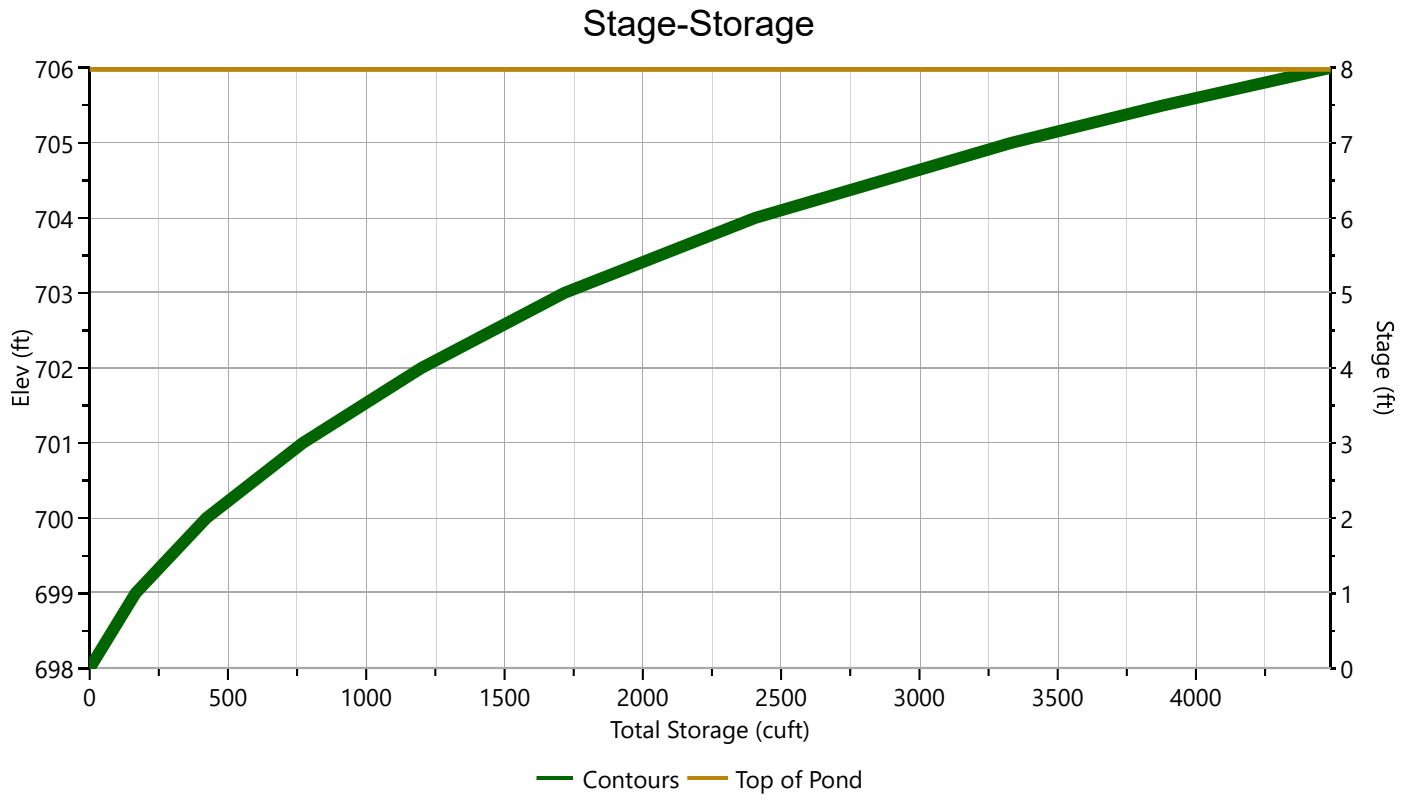
NATURAL POND ABOVE THE ARCH CULV

Stage-Storage

User Defined Contours	
Description	**Input**
Bottom Elevation, ft	698.00
Voids (%)	100.00
Volume Calc	None

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour Area (sqft)	Incr. Storage (cuft)	Total Storage (cuft)
0.00	698.00	126	0.000	0.000
1.00	699.00	206	166	166
2.00	700.00	306	256	422
3.00	701.00	390	348	770
4.00	702.00	469	430	1,200
5.00	703.00	564	517	1,716
6.00	704.00	816	690	2,406
7.00	705.00	1,037	927	3,333
7.50	705.50	1,157	549	3,881
8.00	706.00	1,264	605	4,486

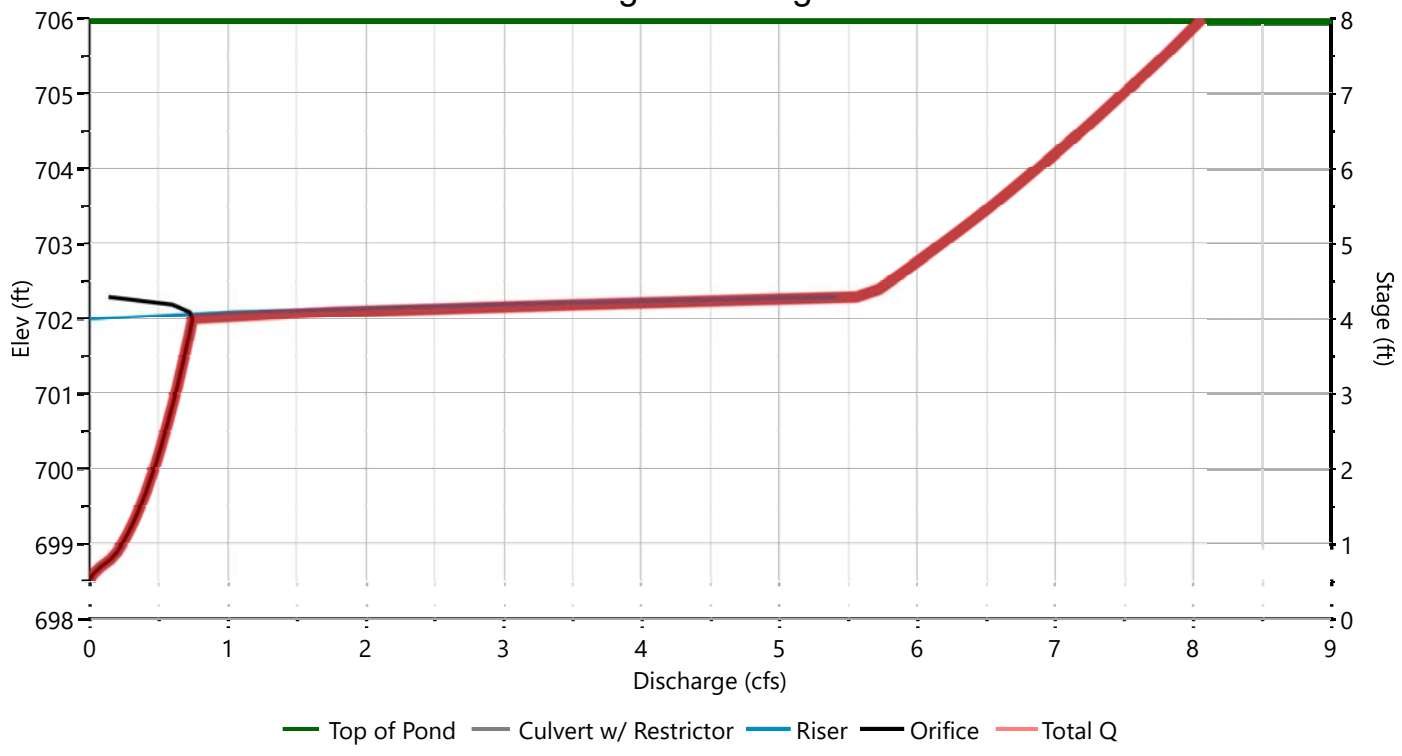


NATURAL POND ABOVE THE ARCH CULV

Stage-Discharge

Culvert / Orifices	Culvert w/ Restrictor Plate	Orifices			Orifice Plate	
		1*	2	3		
Rise, in	24	4			Orifice Dia, in	
Span, in	24	4			No. Orifices	
No. Barrels	1	1			Invert Elevation, ft	
Invert Elevation, ft	Culv: 698.50 Plate: 699.00	698.50			Height, ft	
Orifice Coefficient, Co	0.60	0.60			Orifice Coefficient, Co	
Length, ft	72					
Barrel Slope, %	15.8					
N-Value, n	0.010					
Weirs	**Riser***	**Weirs**			**Ancillary**	
		1	2	3		
Shape / Type	Box	V-notch			Exfiltration, in/hr	
Crest Elevation, ft	702	699.8				
Crest Length, ft	10					
Angle, deg		142				
Weir Coefficient, Cw	3.3	7.38				

**Routes through Culvert.*



NATURAL POND ABOVE THE ARCH CULV

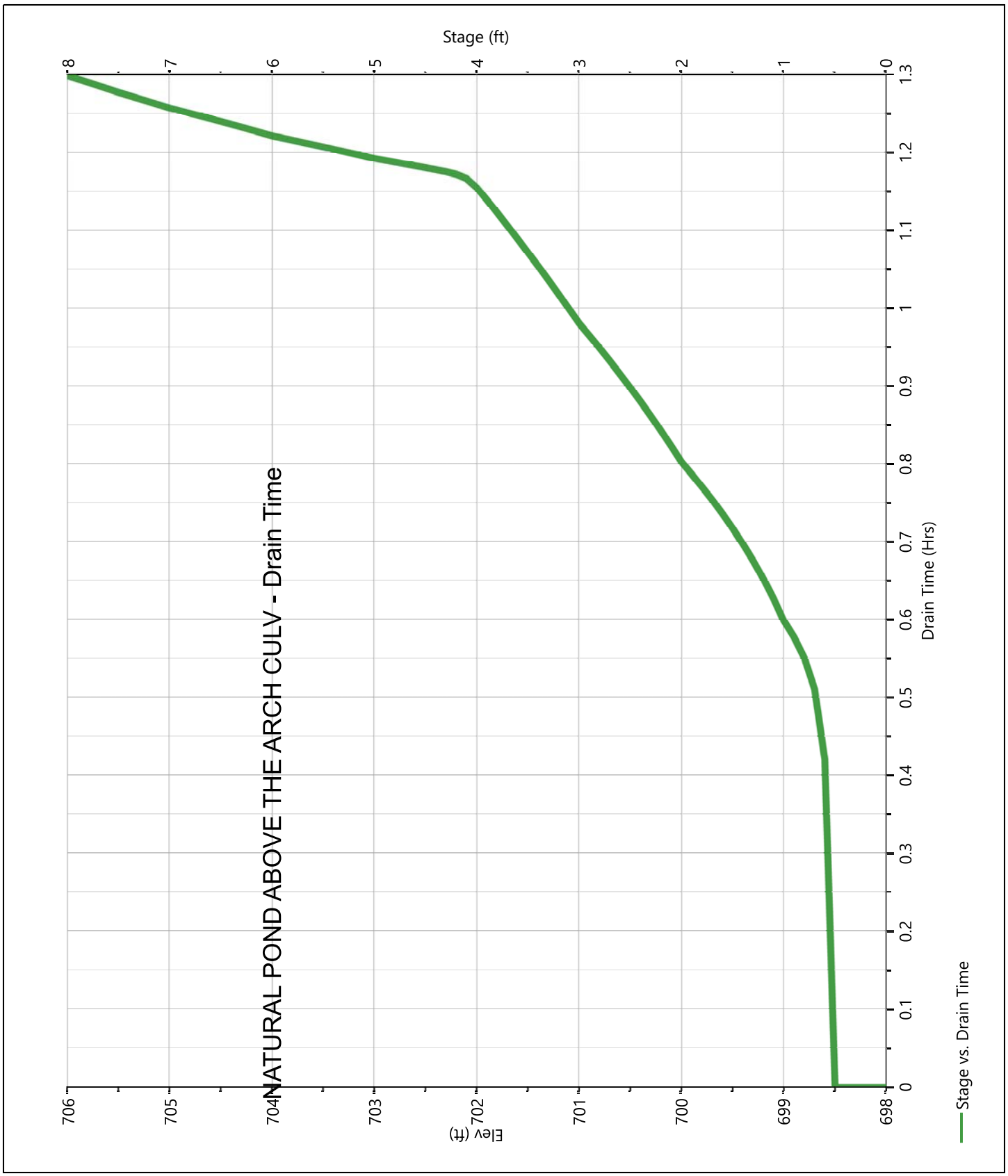
Stage-Storage-Discharge Summary

Stage (ft)	Elev. (ft)	Storage (cuft)	Culvert (cfs)	Orifices, cfs			Riser (cfs)	Weirs, cfs			Pf Riser (cfs)	Exfil (cfs)	User (cfs)	Total (cfs)
				1	2	3		1	2	3				
0.00	698.00	0.000	0.000	0.000			0.000	0.000						0.000
1.00	699.00	166	0.234 ic	0.234			0.000	0.000						0.234
2.00	700.00	422	0.466 ic	0.466			0.000	0.000						0.466
3.00	701.00	770	0.621 ic	0.621			0.000	0.000						0.621
4.00	702.00	1,200	0.746 ic	0.746			0.000	0.000						0.746
5.00	703.00	1,716	6.175 ic	0.000			0.000	0.000						6.175
6.00	704.00	2,406	6.863 ic	0.000			0.000	0.000						6.863
7.00	705.00	3,333	7.488 ic	0.000			0.000	0.000						7.488
7.50	705.50	3,881	7.782 ic	0.000			0.000	0.000						7.782
8.00	706.00	4,486	8.065 ic	0.000			0.000	0.000						8.065

Suffix key: ic = inlet control, oc = outlet control, s = submerged weir

NATURAL POND ABOVE THE ARCH CULV

Pond Drawdown



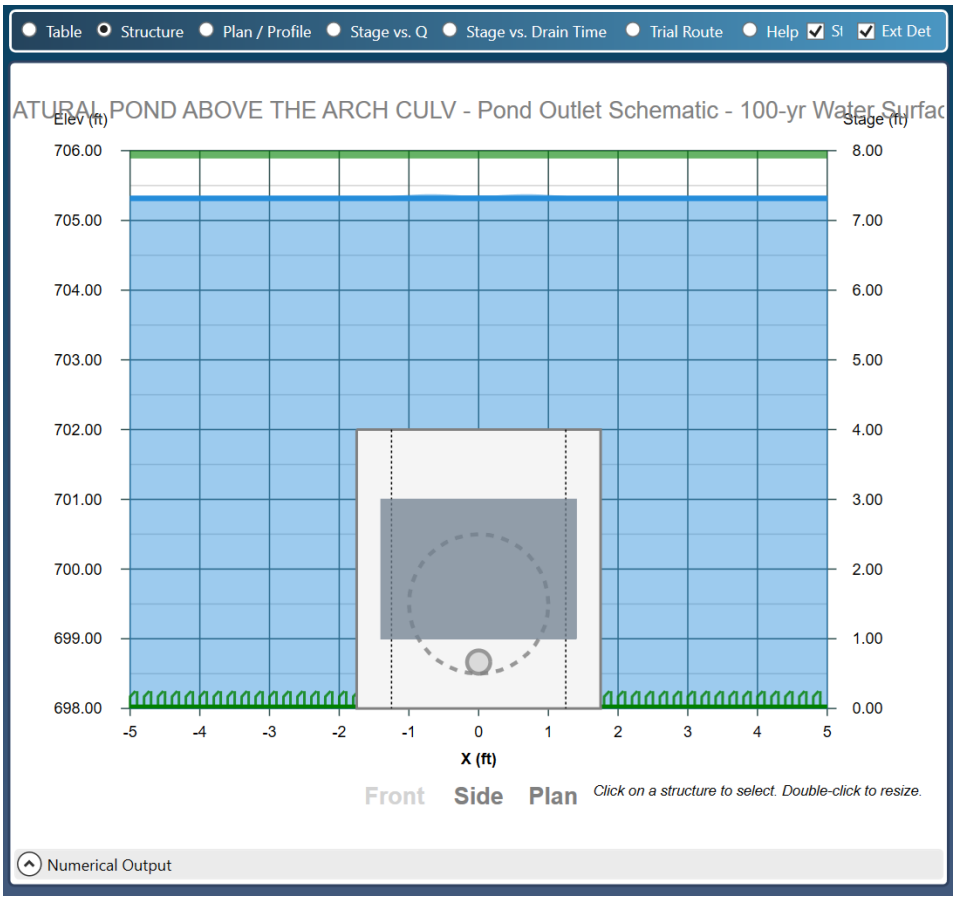
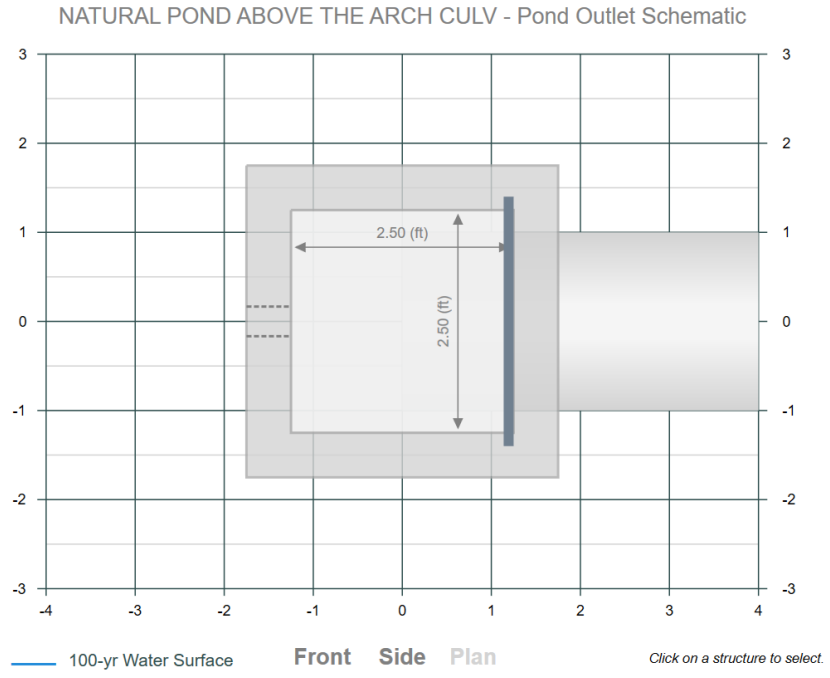


Table
Structure
Plan / Profile
Stage vs. Q
Stage vs. Drain Time
Trial Route
Help
Ext Det
ATURAL POND ABOVE THE ARCH CULV - Pond Outlet Schematic - 100-yr Water Surfac
Elev (ft)
Stage (ft)
706.00
705.00
704.00
703.00
702.00
701.00
700.00
699.00
698.00
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
-5
-4
-3
-2
-1
0
1
2
3
4
5
X (ft)
Front
Side
Plan
Click on a structure to select. Double-click to resize.
Numerical Output


NATURAL POND ABOVE THE ARCH CULV - Pond Outlet Schematic
3
2
1
0
-1
-2
-3
-4
-3
-2
-1
0
1
2
3
4
2.50 (ft)
2.50 (ft)
100-yr Water Surface
Front
Side
Plan
Click on a structure to select.

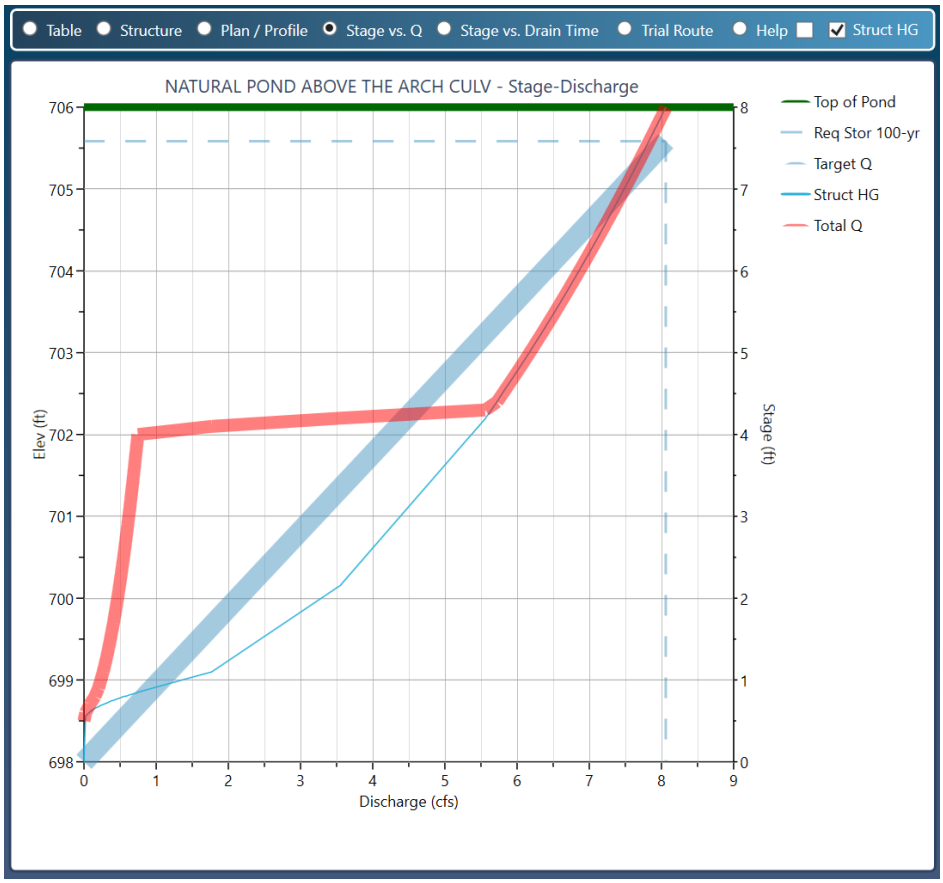


Table
Structure
Plan / Profile
Stage vs. Q
Stage vs. Drain Time
Trial Route
Help
Struct HG
NATURAL POND ABOVE THE ARCH CULV - Stage-Discharge
Top of Pond
Req Stor 100-yr
Target Q
Struct HG
Total Q
Elev (ft)
Stage (ft)
Discharge (cfs)

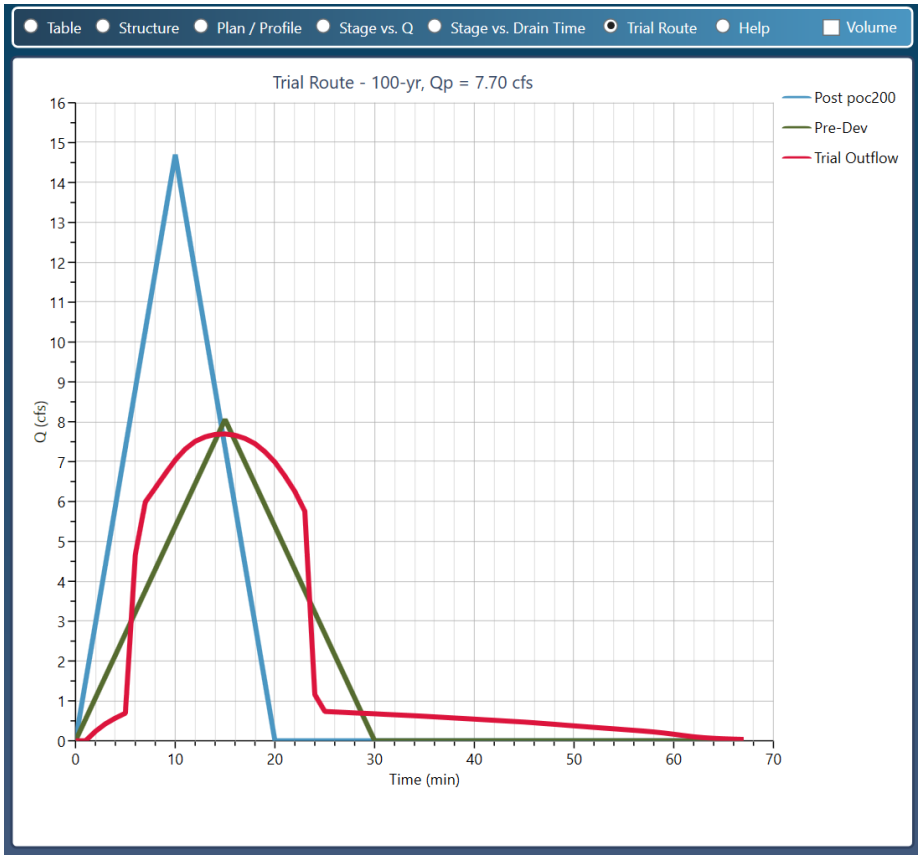


Table
Structure
Plan / Profile
Stage vs. Q
Stage vs. Drain Time
Trial Route
Help
Volume
Trial Route - 100-yr, Qp = 7.70 cfs
Post poc200
Pre-Dev
Trial Outflow
Q (cfs)
Time (min)

Culvert Report

Project filename: 2019-12-08 - Arch Culv.cst

Culvert Studio v 2.0.0.17

01-23-2020

AT-NODE200

Culvert 4

CULVERT

Shape	= Circular
Inlet Edge	= Mitered to Slope
Material	= Concrete
Manning's n	= 0.013
Rise	= 24 in
Span	= 24 in
Invert Elev. Down	= 688.50 ft
Length	= 76.0 ft
Slope	= 0.132 ft/ft
Invert Elev. Up	= 698.50 ft
No. Barrels	= 1
Plan Skew Angle	= -10 degrees

EMBANKMENT

Top Width	= 30.00 ft
Top Elevation	= 703.50 ft
Crest Length	= 22.00 ft

DISCHARGE

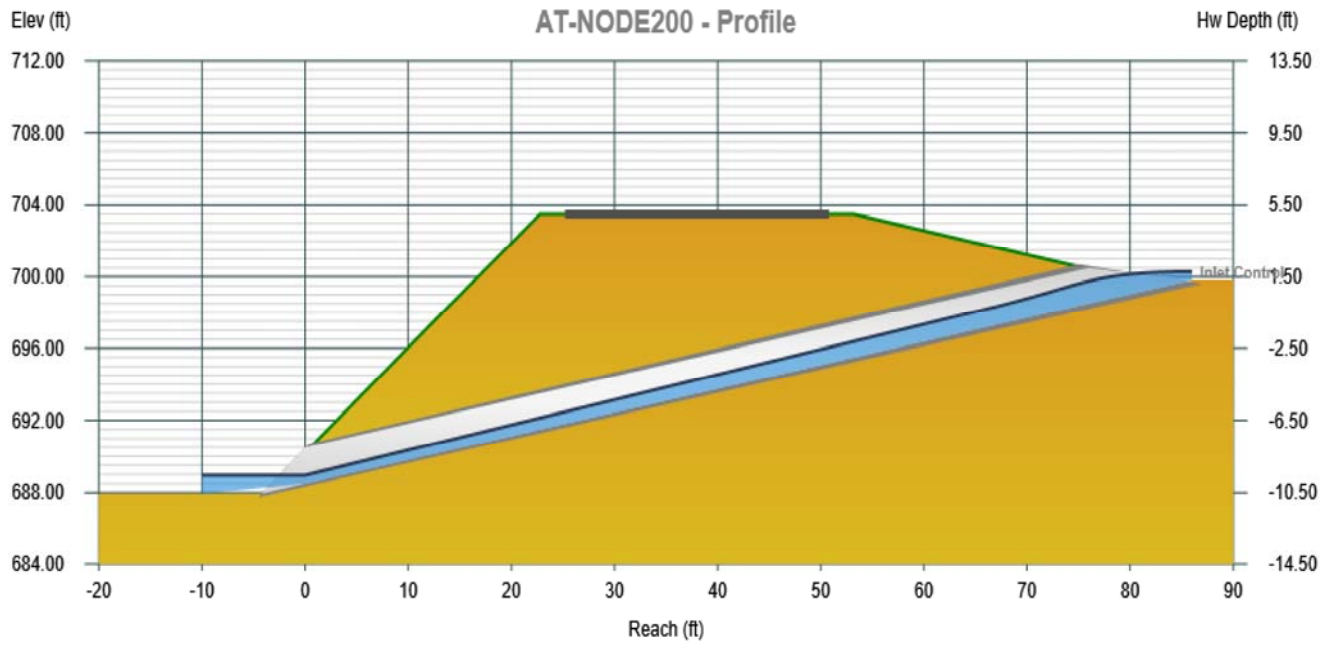
Method	= User-defined

TAILWATER

Tailwater Elevation	= Normal Depth

CALCULATION SAMPLE

Discharge			Velocity		Depth		HGL @ Hw/D = 0.89		
Total	Culvert	Over Top	Down	Up	Down	Up	Down	Up	Hw
(cfs)	(cfs)	(cfs)	(ft/s)	(ft/s)	(in)	(in)	(ft)	(ft)	(ft)
8.93	8.93	0.00	16.81	5.20	5.4	12.9	688.95	699.57	700.28



Culvert Report

Project filename: 2019-12-08 - Arch Culv.cst

Culvert Studio v 2.0.0.17

01-23-2020

18" HDPE PIPE-A

Culvert 3

CULVERT

Shape	= Circular
Inlet Edge	= Projecting
Material	= HDPE
Manning's n	= 0.010
Rise	= 18 in
Span	= 18 in
Invert Elev. Down	= 707.55 ft
Length	= 138 ft
Slope	= 0.156 ft/ft
Invert Elev. Up	= 729.07 ft
No. Barrels	= 1
Plan Skew Angle	= 0 degrees

EMBANKMENT

Top Width	= 30.00 ft
Top Elevation	= 735.00 ft
Crest Length	= 30.00 ft

DISCHARGE

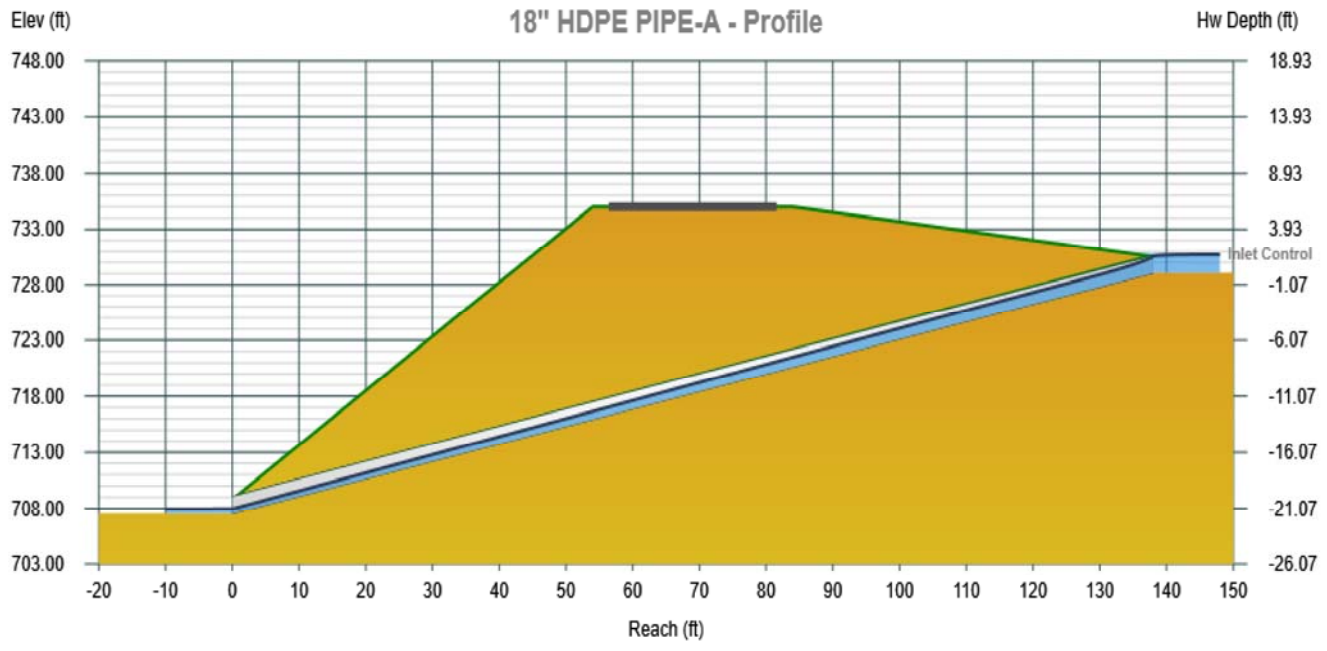
Method	= User-defined

TAILWATER

Tailwater Elevation	= Normal Depth

CALCULATION SAMPLE

Discharge			Velocity		Depth		HGL @ Hw/D = 1.11		
Total	Culvert	Over Top	Down	Up	Down	Up	Down	Up	Hw
(cfs)	(cfs)	(cfs)	(ft/s)	(ft/s)	(in)	(in)	(ft)	(ft)	(ft)
8.48	8.48	0.00	21.92	5.93	4.9	13.6	707.96	730.20	730.73



Culvert Report

Project filename: 2019-12-08 - Arch Culv.cst

Culvert Studio v 2.0.0.17

01-23-2020

24" DIA RCP-SEC A

Culvert 2

CULVERT

Shape	= Circular
Inlet Edge	= Projecting
Material	= Concrete
Manning's n	= 0.013
Rise	= 24 in
Span	= 24 in
Invert Elev. Down	= 703.65 ft
Length	= 60.0 ft
Slope	= 0.065 ft/ft
Invert Elev. Up	= 707.55 ft
No. Barrels	= 1
Plan Skew Angle	= 45 degrees

EMBANKMENT

Top Width	= 30.00 ft
Top Elevation	= 710.00 ft
Crest Length	= 40.00 ft

DISCHARGE

Method	= User-defined

TAILWATER

Tailwater Elevation	= Normal Depth

CALCULATION SAMPLE

Discharge			Velocity		Depth		HGL @ Hw/D = 0.73		
Total	Culvert	Over Top	Down	Up	Down	Up	Down	Up	Hw
(cfs)	(cfs)	(cfs)	(ft/s)	(ft/s)	(in)	(in)	(ft)	(ft)	(ft)
8.93	8.93	0.00	12.69	5.20	6.6	12.9	704.20	708.62	709.02