HALEY ALDRICH

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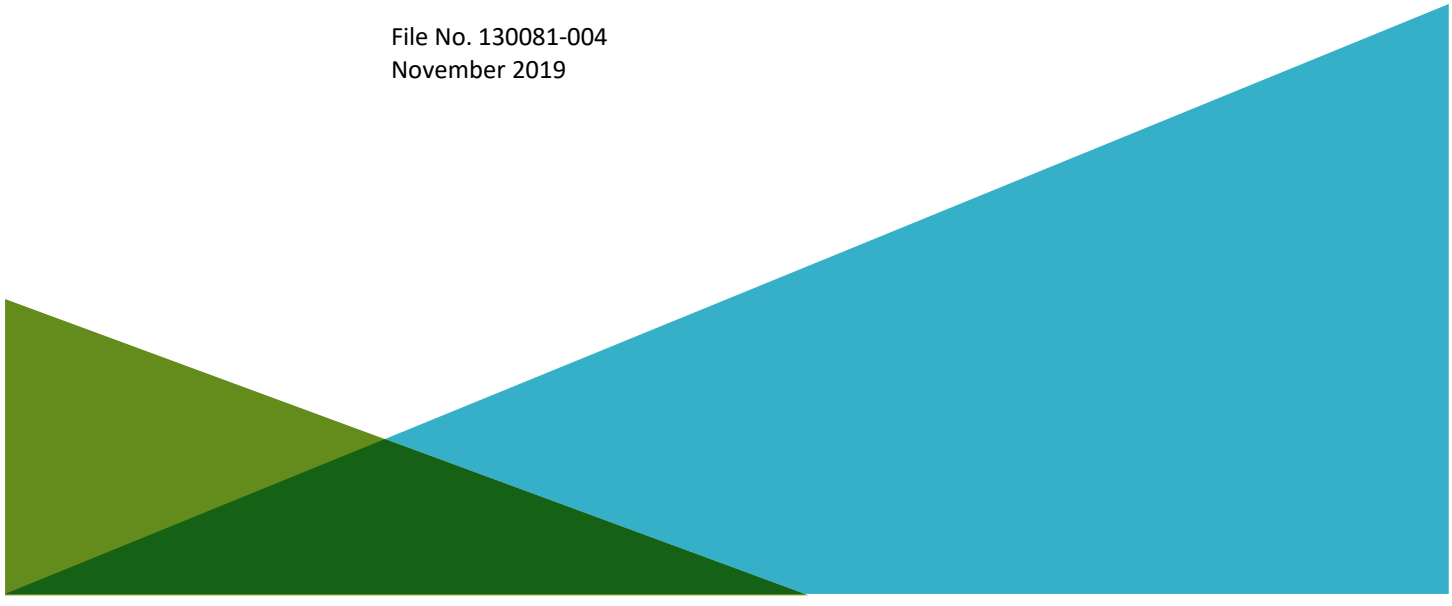
REPORT ON

CEQA PRELIMINARY DRAINAGE STUDY
FALLBROOK BATTERY ENERGY STORAGE SYSTEM
1405 E. MISSION ROAD
FALLBROOK, CALIFORNIA

by
Haley & Aldrich, Inc.
Oakland, California

for
Fluence Energy
Arlington, Virginia

File No. 130081-004
November 2019



Declaration of Responsible Charge

I hereby declare that I am the engineer of work for this study. That I have exercised responsible charge over the work associated with this study as defined in section 6703 of the business and professions code, and that the design is consistent with current standards.

I understand that the check of this study 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.

11/14/2019

Andrew Cox P.E. C66649 Date

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SIGNATURE PAGE FOR

REPORT ON

CEQA PRELIMINARY DRAINAGE STUDY
FALLBROOK BATTERY ENERGY STORAGE SYSTEM
1405 E. MISSION RD.
FALLBROOK, CA

PREPARED FOR

FLUENCE ENERGY
ARLINGTON, VA

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Table of Contents

List of Tables (in text)

List of Figures

List of Abbreviations

Abbreviation	Definition
cf	cubic feet
cfs	cubic feet per second
SF	square feet
APN	assessor's parcel number
BFE	base flood elevation
BMP	best management practice
BMP Manual	County of San Diego BMP Design Manual
CEQA	California Environmental Quality Act
DMA	drainage management areas
DP	detention pond
FEMA	Federal Emergency Management Agency
Haley & Aldrich	Haley & Aldrich, Inc.
HMP	hydromodification plan
Hydraulics Manual	County of San Diego Hydraulic Design Manual
Hydrology Manual	San Diego County Hydrology Manual
NOAA	National Oceanic and Atmospheric Administration
Psomas	Psomas, Inc.
Site	Fallbrook Energy Storage project
SC	Sub-Catchment
SDCC	San Diego County Copermittees

1. Introduction and Summary

This California Environmental Quality Act (CEQA) Preliminary Drainage Study has been prepared in support of Fluence Energy's proposed Fallbrook Energy Storage project in Fallbrook, California (Site). Fluence Energy is a Siemens and AES company. The purpose of the project is to assist San Diego Gas & Electric (SDG&E) in meeting the California state energy storage mandate (AB 2514) while providing local area capacity for electrical system reliability and flexibility. Haley & Aldrich, Inc. (Haley & Aldrich) prepared the report and performed the hydrology and hydraulic calculations. Psomas, Inc. (Psomas), prepared the site layout and grading drawings and performed preliminary sizing of biofiltration basins.

The Site is south of East Mission Road and is bounded on the west by Industrial Road and on the east by Mercedes Road and Industrial Way respectively as shown on the site location map presented as Figure 1. The Site historically was used as orchard space but is currently not developed. The existing conditions survey is presented as Figure 2.

The proposed project, which generally consists of a battery storage facility and a paved access road, is located within three parcels owned by AES: Assessor's Parcel Number (APN) 105-410-10-00, APN 105-410-11-00, and APN 105-410-19-00, totaling 14.13 acres. In addition, a utility easement will occupy a 0.43-acre sliver of APN 105-420-44-00 owned by Benjamin Keck (see Figure 3).

This study includes an analysis of site drainage before and after development of the Site, and includes preliminary sizing of stormwater best management practices (BMPs) to control runoff rate and quality, and therefore ensure that there are no adverse effects from the development of the Site to downgradient neighboring properties.

This study follows the guidelines included in the following San Diego County manuals:

- Hydrology Manual;
- Hydraulic Design Manual; and
- BMP Design Manual

It includes the information requested in Figure 1-8 – "Required Report Format for Unit Hydrograph Study" of the Hydrology Manual.

The analysis performed and summarized in this report shows that two detention basins are to be installed that are sized to:

- Detain the excess runoff generated by the changed land use such that peak runoff flows off-site are maintained at or below their pre-development values; and
- Retain and treat the 85th percentile storm runoff volume.

Pre-development drainage conditions are shown on Figure A1 in Appendix A. In summary, the Site can be divided into two primary watersheds: Watershed 2, consisting of four overland flow sub-catchments 2A, 2B, 2C and the existing access road sub-catchment (R), drains to the existing 48-inch diameter culvert which runs under the existing access road. The location where this culvert crosses the property line is designated as Analysis Point 2 (AP-2) on Figure A1. Watershed 3, consisting of property APN 105-410-19-00 on which the future energy storage facility will be constructed, plus a small portion of an off-

site property to the southwest, drains to the northwest corner of the property, and then runs overland across the property boundary. This location is designated Analysis Point 3 on Figure A1. (Note that there is no Watershed 1.)

Post-development drainage conditions are shown on Figure A2. It can be seen that the configuration of the watersheds and the general directions of overland flow are very similar to pre-development conditions, and the points where runoff leaves the property at AP-2 and AP-3 are at the same locations. However, as indicated in Tables A1 and A2 in Appendix A, without the inclusion of flow control elements, the post-development flow will exceed the pre-development, primarily due to the areas of less permeable surfaces that will be provided for the battery storage area and the paved access road. In order to mitigate these increases, two bioretention basins have been designed for the development; one each for Watersheds 2 and 3. As demonstrated by the hydrologic modeling included in Appendix A, and summarized in Tables A1 through A3 these basins will control the flows at points AP-2 and AP-3 such that the post-development off-site peak discharge is less than the pre-development peak discharge. We therefore conclude that the development will not increase the risk of off-site flooding. Furthermore, since the Site is not currently prone to flooding and future site grading will not substantially alter the drainage patterns, neither will the Site be prone to on-site flooding under design peak flow conditions. A detailed description of pre-development and post-development flows is presented in Appendix A as Table A3, of which a summary is re-presented here.

TABLE 1
Pre-Development and Post-Development Velocity and Flow Rate Summary

		Pre-Development,				Post-Development			
		$I_{100,\ 24\text{-}hr}$ = 6.13"							
Watershed	**Sub-catchment**	**CN*** **	**Tc (mins)**	**V_{100} (fps)**	**$Q_{p\text{-}100}$ (cfs)**	**CN*** **	**Tc (mins)**	**V_{100} (fps)**	**$Q_{p\text{-}100}$ (cfs)**
SC-2	2A	71	10.6	4.2*	52.1	71	11.0	2.9*	36.9
	2B	71	5.0			71	5.0		
	2C	71	5.0			71	5.0		
	2D	-	-			71	6.2		
	R	92	5.0			98	5.0		
SC-3	3A	71	15.4	2.4**	16.9	87****	19.5	2.4**	16.5
	3B	-	-			71	15.4		

Notes:
*Runoff from SC-2 leaves the site inside of an existing 48-inch diameter culvert.
**Runoff from SC-3 leaves the site at an existing low point with a natural channel. Based on existing grade contours, the existing channel was assumed to have an average cross-sectional area of 7 square feet.
*** Curve numbers as provided from USDA TR-55 Table 2-2a,
**** Value is weighted average

2. Existing Conditions and Drainage

2.1 EXISTING SITE CONDITIONS

Historically, the Site was used as an orchard, however the project parcels currently do not have fruit trees and are moderately to heavily vegetated vacant lots (see Figure 2).

Topographic survey of the Site was provided by Psomas. The survey contours were derived from aerial photography that was flown on 16 October 2018. The survey is reproduced on Figure 2 on top of a satellite image.

According to the United States Department of Agriculture soil survey, on-site soils are classified as belonging to Hydrologic Soil Group C and consist of Fallbrook sandy loam, Fallbrook-Vista sandy loam, and Placentia sandy loam. A map of the soil types is provided in Appendix B. When this soil group is entered into the County's BMP Sizing Spreadsheet V3.0, an infiltration rate of 0.1 inch per hour automatically populates the BMP Infiltration Rate cell (see Appendix B). However, a geotechnical site investigation including percolation tests was performed by AECOM in 2017, and AECOM recommended that a zero-infiltration rate be used in design of BMPs. Consequently, in the County's sizing spreadsheet, the BMP's are assumed to be of the "Biofiltration" type, with an impermeable liner on the bottom of the basin so that there is no infiltration into the underlying soils.

According to the Federal Emergency Management Agency (FEMA), the Site is in an Area of Minimal Flood Hazard. On the FEMA map, the area is labeled as Zone X (unshaded) designating: "Minimal risk areas outside the 1-percent and .2-percent-annual-chance floodplains. No Base Flood Elevations (BFEs) or base flood depths are shown within these zones."

2.2 EXISTING SITE DRAINAGE

Parcel APN 105-410-19-00 is gently sloping to the northwest. Thus, the northwest corner of the Site is the low point and is where stormwater runs off the Site overland onto the western abutter's property. This drainage area is referred to as Sub-Catchment 3 (SC-3)[1] as the water from their area drains to Point 3 on the existing conditions plan (see Figure 2). Parcel APN 105-410-10-00 also drains to the northwest, before flowing into a swale north of the residence on the property and south of East Mission Road. The swale then conveys runoff into a 48-inch corrugated metal culvert. The runoff leaves the property via the culvert at Point 2 (see Figure 2). The culvert then continues underneath a parking area on the neighboring property where it also picks up flow contributions from several surface drains before daylighting through a retaining wall at another property to the west. The area that drains to Point 2 is referred to as SC-2 in subsequent sections of this report.

The Site is mostly undeveloped and as such, the existing hydraulic structures are limited to the 48-inch diameter corrugated metal culvert described above, and natural earthen swales and berms. One berm exists along the western edge of the property line, conveying water north from the western portion of SC-3 to outfall Point 3. An earthen swale exists in the center of the Site, conveying water north from the southern portion of SC-2 outfall Point 2 via the 48-inch culvert.

[1] Sub-Catchment designations follow Psomas' convention. There is no SC-1. See Appendix A.

The existing hydrology was modeled using HydroCAD, which is computer software that utilizes the SCS TR-20 methodology[2] to route hydrographs of particular return periods through the watershed. The model is dynamic and factors in ground covers, existing slopes, and time of concentrations as well as the sequencing of flow through sub-catchments that are connected to each other. In accordance with the Hydraulics Manual, Haley & Aldrich modelled both the 100-year return period, 24-hour duration storm and the 100-year, 6-hour duration storm, applying a Type II storm. According to the National Oceanic and Atmospheric Administration's (NOAA) Precipitation Frequency Data Center[3], the 100-year, 24-hour rainfall depth for Fallbrook, CA at Station 92-1080 is 6.13 inches; and the depth of the 6-hour storm is 3.83 inches. These values sourced from NOAA were than compared to the isopluvial maps that are included in the County of San Diego Hydrology Manual for the storm of the same return period. The isopluvial maps indicated that these same storms had values of approximately 5.5 inches and 3 inches respectively. However, Haley & Aldrich used the NOAA data in the stormwater model as those values were more conservative. The isopluvial maps are included in Appendix A.

The goal of the model was to assess the existing peak runoff rates at each of the two points where runoff leaves the Site. The results of the existing conditions modelling are presented below. The details of the pre-development hydrologic model and output are provided in Appendix A.

TABLE 2
100-Year Peak Runoff Flowrates – Existing Conditions

Sub-Catchment	Area (acres)	6-hour Storm (cfs)	24-hour Storm (cfs)
SC-2	11.14	31.6	52.1
SC-3	4.47	9.8	16.9

Notes:
cfs = cubic feet per second

The 24-hour storm produces an approximately 60 percent higher peak runoff flow than the 6-hour storm.

[2] Technical Release No. 20: Computer Program for Project Formulation Hydrology (TR-20), National Resource Conservation Service, United States Department of Agriculture.

[3] https://hdsc.nws.noaa.gov/hdsc/pfds/

3. Proposed Site Layout, Grading and Drainage

3.1 PROPOSED SITE LAYOUT AND GRADING

The proposed battery storage facility will be constructed on APN 105-410-19-00 as shown on Figure 3. The battery storage units will be founded on concrete pads surrounded by gravel surfacing. The access road to the battery storage is proposed to run through APN 105-410-10-00. The existing access road will be widened that connects to East Mission Road at an existing entrance gate. The preliminarily designed road slopes at a 15 percent grade down toward the south from the entrance gate to the low point where it transitions uphill toward the south at an 11 percent slope to the battery storage area. At the battery storage area, the proposed road has a hammerhead for vehicle turn around and the slope varies from 1 percent to 4 percent uphill heading south along the edge of the proposed storage facility before terminating south of the last pad with a turnaround. In its site layout, Psomas has included two bioretention basins, which also function as detention basins. The sizing of these basins for stormwater detention is included in Appendix A and the calculations for bioretention, performed by Psomas, are included in Appendix B.

3.2 PROPOSED DRAINAGE AND DESIGN OF DETENTION BASINS

For the hydrologic analysis, Haley & Aldrich evaluated the development of the Site as proposed by Psomas as shown on Figure 3. The addition of impervious structures, pavement, and gravel pads increases the weighted curve number of the two major sub-catchments (SC-2 and SC-3) and thus, increases the peak runoff flow rates at the properties boundaries absent the inclusion of stormwater control structures. Given this, Psomas included two detention basins, one in each sub-catchment, as shown on Figure 3. Additionally, there are two smaller proposed surface drains on Figure 3 that are west of the road, however these more not modeled as BMPs and were assumed to simply collect surface runoff and route it into the existing 48-inch culvert and not detain water for the purposes of mitigating peak flows.

Haley & Aldrich produced additional HydroCAD TR-20 stormwater models to reflect the proposed conditions and ran the model for two major scenarios. First, the model was run without the detention basins, but with the change in surface condition to show what the increased peak flows would be without the basins. Then the model was run again using the dimensions and storage volumes of the basins from Psomas' biofiltration basin sizing calculations and the post-development drainage conditions included in Appendix B. In both scenarios of the model, to be conservative, the underdrains were assumed to be plugged. The same 100-year, 24-hour storm and 100-year, 6-hour storm were then routed through the proposed watershed model again analyzing runoff with the TR-20 methodology. The goal of the proposed hydrologic model was two-fold. First, to assess the potential for increased runoff with the proposed changes to ground cover conditions associated with the development of the Site, and secondly, to ensure the detention basins sized by Psomas had adequate capacity to mitigate the potential excess runoff in a manner such that the proposed development would not increase the peak runoff from the Site during both design storms. The basins were modelled using the preliminary sizing provided by Psomas in Figure 3 and Haley & Aldrich used the layers in the "Biofiltration" detail that is part of the County's BMP Sizing worksheet to determine the relationship between storage volume and elevation as described in more detail in section 4. The storage volumes provided in section 4 represent the volume of storage below the overflow. However, in the model an additional 1-foot of freeboard was included to allow for the water level to continue rising as the overflow is activated during peak flow

conditions. The hydrologic modelling peak runoff flowrate results for the two main watersheds are summarized in the table below and indicate that the basins provide adequate detention of the excess runoff to prevent adverse effects to adjoining properties. The details and output of the post-development hydrologic model are also included in Appendix B. It should be noted that Psomas conservatively included the entirety of each watershed within the drainage area for BMP sizing when in fact only a portion of each watershed will drain to a BMP. The remainder of the runoff is from areas outside of the developed area, unimpacted by the project, which will continue to drain overland directly to existing off-site drainage points, per pre-existing conditions.

TABLE 3
100-Year 24-hour Storm[1], Peak Runoff Flowrates – Existing and Proposed Conditions

Watershed	Area of Watershed (acres)	Existing Conditions (cfs)	Proposed Conditions without BMPs (cfs)	Proposed Conditions with BMPs (cfs)
SC-2	11.14	52.1	58.1	36.9
SC-3	4.47	16.9	19.4	16.5

Notes:
[1] See Appendix A for results for the 100-year, 6-hour storm. These are less than the 24-hour storm and have therefore not been included in this table.
cfs = cubic feet per second

Outlet flow control for Detention Pond 2 (DP-2) serving sub-catchment SC-2 would be provided by a conventional overflow riser pipe (see Appendix A). An overflow weir will be provided to safely pass the peak flow from the 100-year, 24-hour storm. The diameter of the riser pipe was selected to limit the post-development peak runoff at Point 2 to a value less than pre-development peak runoff contributed by the Site. The control of flow through the perforated underdrains will be by an orifice in the base of the riser (see Section 4 and Appendix B for sizing of the orifice). DP-2 was sized by Psomas to accommodate runoff contributions from the entire 11.14 acres of SC-2. However, only SC-2A , consisting of 5.9 acres, drains to DP-2, which is reflected in the HydroCAD model included in Appendix A.

For Detention Pond 3 (DP-3), serving sub-catchment SC-3, outlet flow control was provided by a two-level weir. This weir was sized to limit the post-development peak runoff at Point 2 to a value less than the pre-development peak runoff, as well as, to maintain discharge velocities below 3 feet per second to minimize the potential for erosion. When the inflow raises the water level above the flow control weir, overflow occurs over the rip-rap protected level spreader shown on Figure 3. A flow control weir was selected for this basin to avoid an overflow pipe and erosion protection encroaching on the oak tree exclusion area. For this basin, the rate of flow through the underdrains could be controlled by an orifice in a riser sealed at the top so that all overflow occurs over the weir. DP-3 was sized by Psomas to accommodate runoff contributions from the entire 4.47 acres of SC-2. However, only SC-2A consisting of 2.0 acres drains to DP-3 which is reflected in the HydroCAD model included in Appendix A.

Again, for the HydroCAD SCS TR-20 model, the conservative assumption was made that the underdrains were blocked and therefore did not contribute to outflow during storm events. During the 100-year, 24-hour storm, the model shows that the water level would rise to the second higher weir, but even with both weirs discharging the peak flow discharge, velocities are maintained below 3 feet per second and the peak flows are mitigated to below the pre-development values. Elsewhere in the watershed if the model predicts velocities above 3 feet per second, energy dissipation such as erosion control matting, riprap, or other BMPs would be selected during the detail design to lower velocities and mitigate erosion potential.

The outlet of DP-2 is hard piped to an existing stormwater pipe and thus it does not need the energy dissipation. In Appendix B, Psomas presents calculations to size the rip-rap downstream of the level spreader overflow from DP-3.

4. Sizing of Proposed Post-Construction BMPs

Detention basins were designed in a "unified BMP design approach" to meet the requirements for stormwater treatment and hydromodification management using biofiltration basins for each sub-catchment area (BMP Manual). Two biofiltration basins are proposed, each capturing and treating the required Design Capture Volume as required for an 85th percentile 24-hour event.

Psomas sized the basins using the spreadsheet "BMP Sizing Spreadsheet V3" provided with the BMP Manual for sizing biofiltration basins with an integrated stormwater flow control and pollutant control configuration. The biofiltration basins are used to treat the required Design Capture Volume indicated in BMP Manual as well as sized for flow control associated with the hydromodification plan. The full calculation sizing spreadsheet package is included as Appendix B. The process for designing each BMP is as follows:

1. Identify sub-catchment areas which require biofiltration basins.
2. Delineate post project surface type and area (as individual Drainage Management Areas [DMA]) and identify the corresponding pre-project slope and soil type for each DMA.
3. Using Table G.2-1 in Appendix G of the BMP Manual (to be used only for hydromodification management flow control) identify the runoff factor for each DMA.
4. Determine the Hydromodification Plan (HMP) Sizing Factor which is based on the project location to determine the reference rain gauge, the pre-project soil group, the pre-project slope, and the channel erosion susceptibility.
5. Multiply the DMA area by the area weighted runoff factor and the HMP Sizing Factor to determine the required biofiltration basin size.
6. Sum the individual DMAs into a single biofiltration basin minimum size.
7. Determine the subdrain orifice diameter to confirm the drawdown time is less than 96 hours.

The calculations for sizing each detention basin are provided in Appendix B and summarized below.

TABLE 4
Summary of Post-Construction BMPs

Sub-catchment	BMP Type	BMP Surface Area[1] (sf)	BMP Volume[2] (cf)
SC-2	Biofiltration	8,055	14,499
SC-3	Biofiltration	4,545	8,181

Notes:
[1] The surface area is defined as the area of the media layer.
[2] This volume includes 1 foot of ponding, 18 inches of media material with a porosity of 0.2, 6 inches of filter course with a porosity of 0.2, and 12 inches of aggregate/gravel with a porosity of 0.4.
sf = square feet
cf = cubic feet

The subdrain orifice diameter is selected to be 1.4 inches for DP-2 and 1.2 inches for DP-3, which allows for 23 hours and 22 hours of drawdown for surface ponding for SC-2 and SC-3 respectively.

Each biofiltration basin is sized to allow for 12 inches of surface ponding, 18 inches of bioretention soil media, 6 inches of filter course, and 12 inches of gravel storage.

Each of the storage capacities are greater than the required detention volume to limit post-development peak runoff to pre-development peak runoff.

Therefore, basins perform the required treatment of the 85th percentile 24-hour storm event, also meet the requirements for hydromodification factors. Additionally, the basins control the excess volume resulting from the proposed development resulting from the 100-year storm event.

A requirement for biofiltration design, as presented in checklist BF-1 in the BMP Manual, is to limit the biofiltration basin drainage area to 5 acres. The area draining to DP-2 is 5.9 acres, thus requiring additional modeling to verify the 85th percentile 24-hour storm event does not result in runoff short-circuiting / bypassing DP-2. In the case of DP-2, short-circuiting would occur if the water level rose above the grate on the top of the riser allowing flow into and down the riser before discharging directly out the outlet pipe without being detained. A model run was performed for a 2-year storm which shows that none of the flow into DP-2 would go over the riser pipe or over the side of the basin, thus all water is detained in the pond and would slowly drain out through the small orifice in the vertical plane of the riser pipe as designed. A 2-year storm is 2.64 inches over 24 hours, compared to 0.86 inches over 24-hours in the 85th percentile storm. Therefore, despite receiving runoff from 5.9 acres, short-circuiting of DP-2 would not occur during the 85th percentile, 24-hour storm event. The model run performed that led to this conclusion is included Appendix A.

The basins are designed in accordance with the requirements outlined for water quality and hydromodification control. Additionally, as the basins are providing flood control as well, they are also subject to the requirements identified in the Hydraulic Design Manual (Section 6.2.3), which requires 1-foot of freeboard when passing the 100-year, 24-hour storm event. For DP-2 and DP-3 , the freeboard between the 100-year peak water level and the top of the basin is approximately 3-inches. For this site, the 3-inches of freeboard is judged to be adequate for the following reasons:.

- The post-development 100-year, 24-hour storm runoff flows are less than the pre-development flows;
- The site is for private industrial use with no public access;
- The basins are not to be maintained by the County; and
- The overflow weirs can safely pass the 100-year storm without any impact to abutters, nor any risks to public safety.

References

1. AECOM. 2017. Geotechnical Investigation San Diego Gas & Electric Fallbrook Battery Storage Project; Parcel 1, Fallbrook, California. February.

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6. State of California Department of Transportation. 2018. Highway Design Manual – Sixth Edition.

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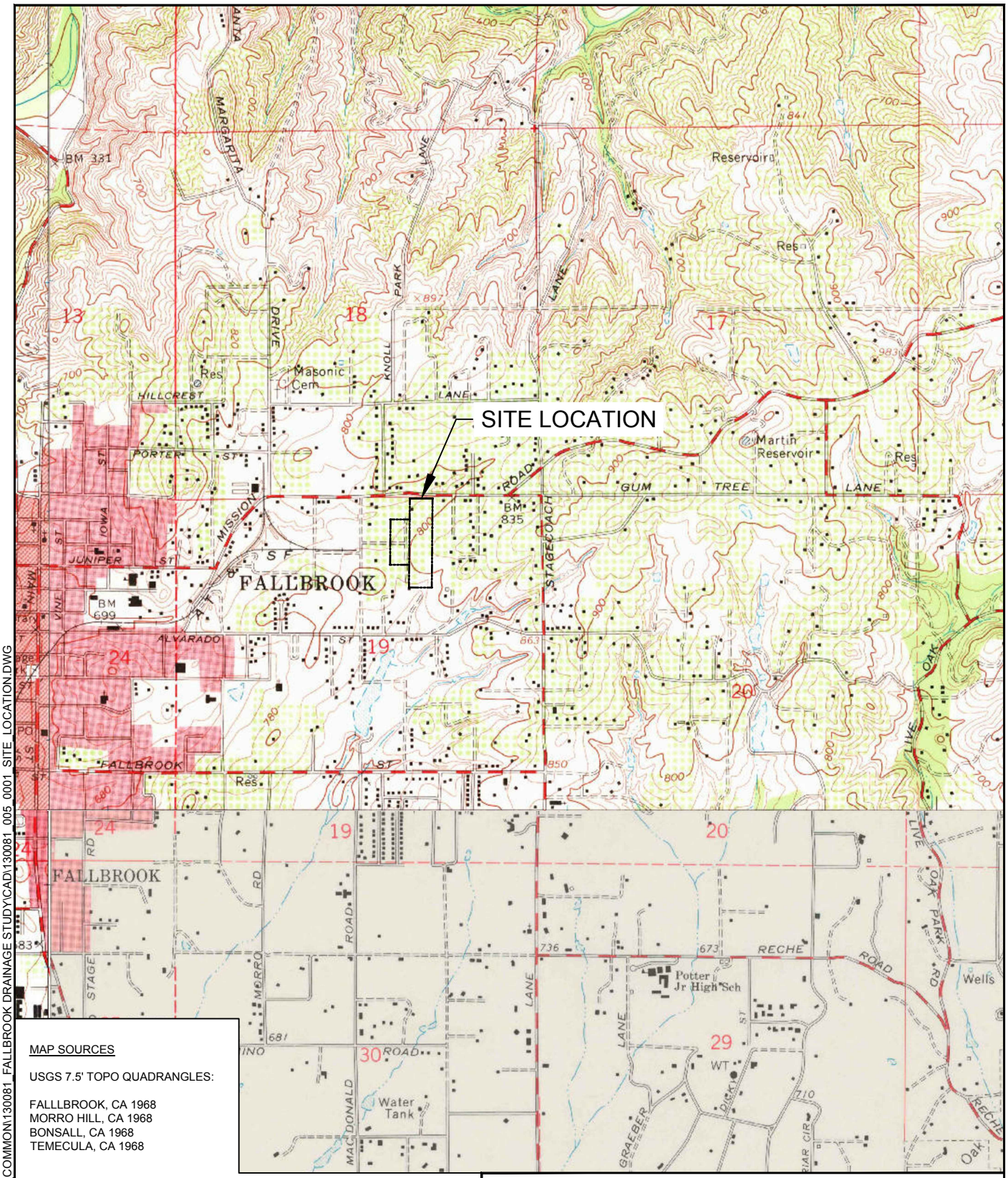
FIGURES



MAP SOURCES

USGS 7.5' TOPO QUADRANGLES:

FALLLBROOK, CA 1968
MORRO HILL, CA 1968
BONSALL, CA 1968
TEMECULA, CA 1968

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CEQA PRELIMINARY DRAINAGE STUDY
FALLBROOK BATTERY ENERGY STORAGE SYSTEM
1405 E. MISSION ROAD, FALLBROOK, CALIFORNIA

SITE LOCATION

SCALE: AS SHOWN
DECEMBER 2018

FIGURE 1

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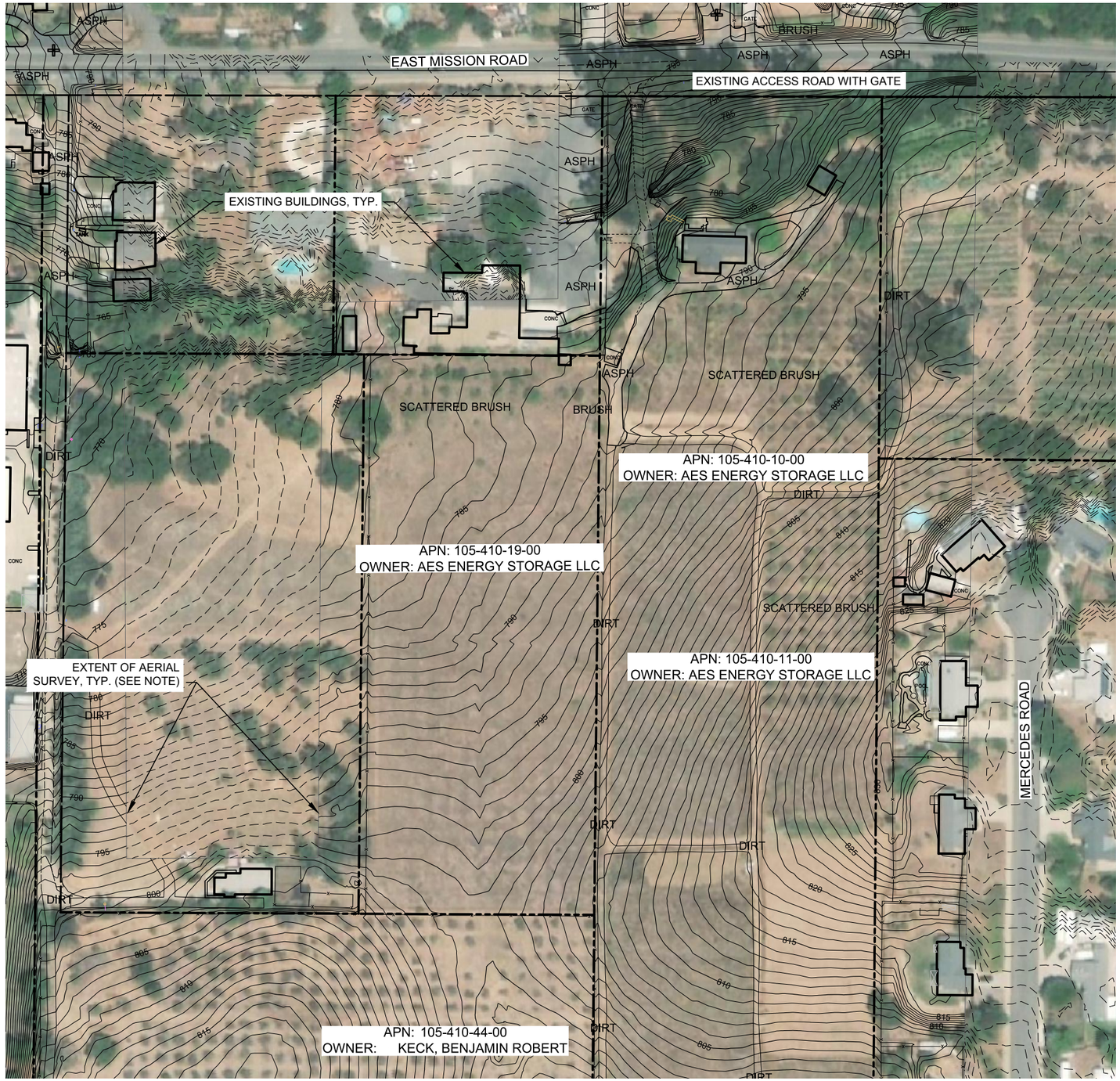

LEGEND

- PROPERTY LINE
- CHAIN LINK FENCE
- 5' TOPO CONTOUR (SEE NOTE)
- 1' TOPO CONTOUR (SEE NOTE)

NOTES

1. EXISTING CONTOURING OF THE SITE WAS PROVIDED BY PSOMAS. THE CONTOURS WERE DERIVED FROM AERIAL PHOTOGRAPHY THAT WAS FLOWN OCTOBER 16TH, 2018. ADDITIONAL DASHED CONTOURS WERE PROVIDED BY PSOMAS OUTSIDE THE PROJECT AREAS. THE SOURCE OF THE DASHED CONTOURS IS UNKNOWN, BUT THEY RESIDE EXCLUSIVELY OUTSIDE OF THE PROPOSED SCOPE OF THIS PROJECT.

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SCALE IN FEET

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CEQA PRELIMINARY DRAINAGE STUDY
FALLBROOK BATTERY ENERGY STORAGE SYSTEM
1405 E. MISSION ROAD, FALLBROOK, CALIFORNIA

EXISTING CONDITIONS

SCALE: AS SHOWN
DECEMBER 2018

FIGURE 2

LEGEND

- PROPERTY LINE
- CHAIN LINK FENCE
- 5' TOPO CONTOUR (SEE NOTE)
- 1' TOPO CONTOUR (SEE NOTE)
- ASPHALT PAVEMENT 6"AC/6"AB (GEOTECHNICAL ENGINEER TO VERIFY)
- CRUSHED AGGREGATE BASE - 6 INCH THICK
- LANDSCAPING
- STORM DRAIN PIPE
- FIRE WATER LINE
- ELECTRIC LINE
- IRRIGATION LINE
- EASEMENT
- GRATE INLET
- FENCE
- SWALE
- 790 FG — PROPOSED ELEVATION SPOT GRADE

NOTES

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SCALE IN FEET

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CEQA PRELIMINARY DRAINAGE STUDY
FALLBROOK BATTERY ENERGY STORAGE SYSTEM
1405 E. MISSION ROAD, FALLBROOK, CALIFORNIA

PROPOSED CONDITIONS

SCALE: AS SHOWN
DECEMBER 2018

FIGURE 3

APPENDIX A

Hydrology and Hydraulic Calculations

HALEY ALDRICH

Appendix A - Hydrology and Hydraulic Calculations

Appendix A contains the hydrologic and hydraulic calculations performed by Haley & Aldrich. Haley & Aldrich compared NOAA rainfall data from the Fallbrook Station (Station 92-1080) to Isopluvial maps provided in the County of Sand Diego Hydrology Manual and determined the NOAA data was more conservative. The NOAA values for the 100-year, 24-hour storm and the 100-year, 6-hour storm were routed through models developed for pre-development conditions, post-development surface and grading changes, but with no stormwater control best management practices (BMPs), and finally the post-development conditions including detention basins sized by Psomas.

The peak flows were determined using the SCS TR20 methodology using HydroCAD. The peak flows were compared to each other to confirm that the basins were adequately sized to attenuate increases in peak flows caused by the proposed development. The summary table below shows that for both design storm scenarios, the basins sized by Psomas included adequate storage and retention to mitigate flow increases from changed land use and cover materials.

Summary Tables for 100-Year, 24-hour and 6-hour Storm Analysis:

TABLE A1	100-Year Storm, 24-hour Peak Runoff Flowrates		
Watershed	Existing Conditions, (cfs)	Proposed Conditions **without** BMPs, (cfs)	Proposed Conditions **with** BMPs, (cfs)
SC-2	52.1	58.1	36.9
SC-3	16.9	19.4	16.5

TABLE A2	100-Year Storm, 6-hour Peak Runoff Flowrates		
Watershed	Existing Conditions, (cfs)	Proposed Conditions **without** BMPs, (cfs)	Proposed Conditions **with** BMPs, (cfs)
SC-2	31.6	36.2	18.3
SC-3	9.8	13.2	5.4

Detailed Watershed Characteristics and Output for 100-Year, 24-hour Storm Analysis:

TABLE A3		Pre-Development, $I_{100,\ 24\text{-}hr}$ = 6.13”				Post-Development			
Watershed	Sub-catchment	CN***	Tc (mins)	V_{100} (fps)	$Q_{p\text{-}100}$ (cfs)	CN***	Tc (mins)	V_{100} (fps)	$Q_{p\text{-}100}$ (cfs)
SC-2	2A	71	10.6	4.2*	52.1	71	11.0	2.9*	36.9
	2B	71	5.0			71	5.0		
	2C	71	5.0			71	5.0		
	2D	-	-			71	6.2		
	R	92	5.0			98	5.0		
SC-3	3A	71	15.4	2.4**	16.9	87****	19.5	2.4**	16.5
	3B	-	-			71	15.4		

*Runoff from SC-2 leaves the site inside of an existing 48-inch diameter culvert.

**Runoff from SC-3 leaves the site at an existing low point with a natural channel. Based on existing grade contours, the existing channel was assumed to have an average cross-sectional area of 7 square feet.

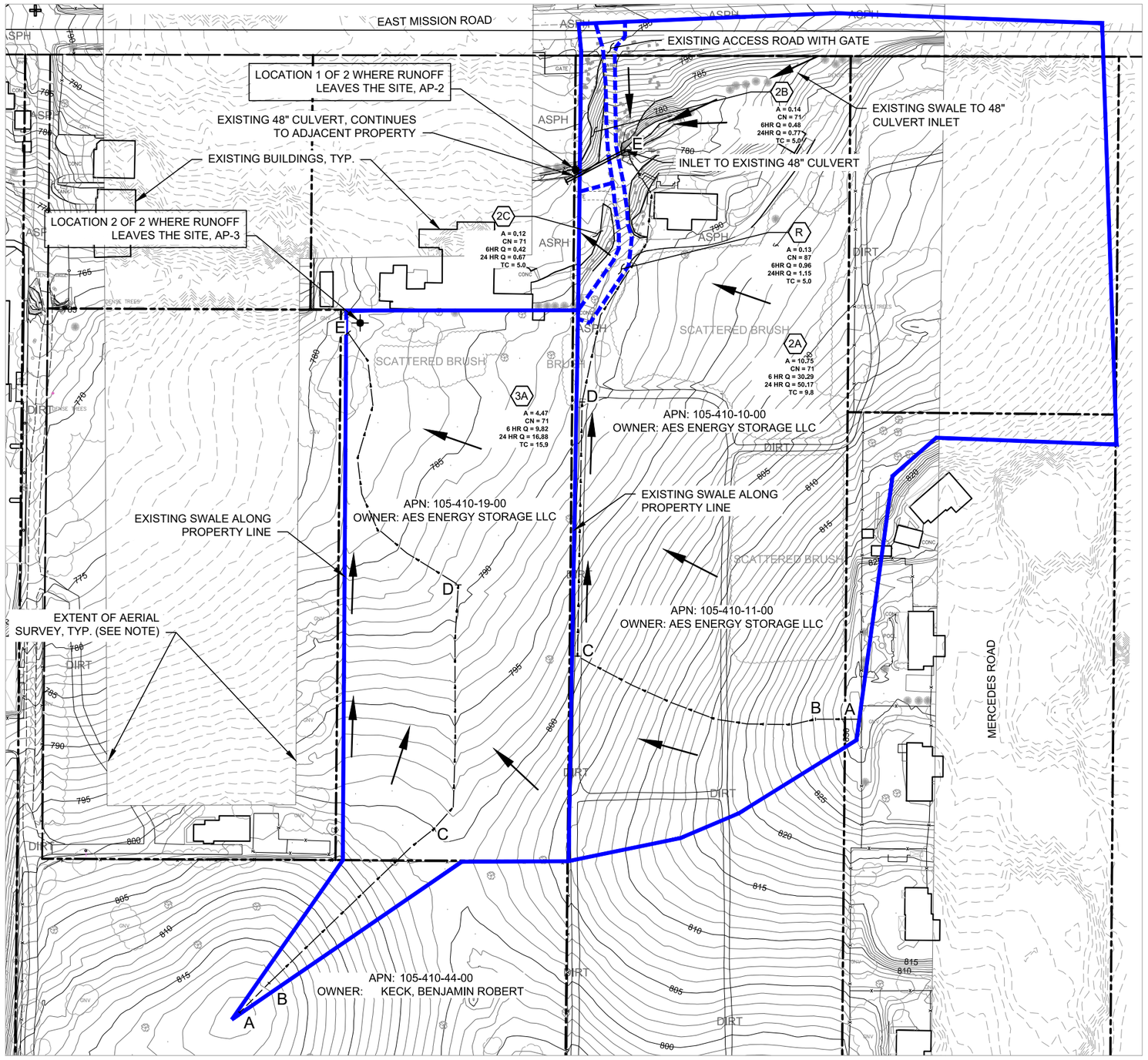
*** Curve numbers as provided from USDA TR-55 Table 2-2a,

**** Value is weighted average

Additionally, to confirm the 85th percentile 24-hour storm event does not induce short-circuiting in DP-2, additional modeling was performed. The BMP Manual 85th percentile isopluvial map indicates the rainfall depth for the site is 0.86 inches. However, to be conservative, a 2-year, 24-hour storm event was used instead, which corresponds to a rainfall depth of 2.64 inches, significantly greater than the 85th percentile, 24-hour storm event. Focusing on DP-2, the 2-year 24-hour storm does not short-circuit the BMP by entering the overflow riser, instead, all drainage into DP-2 will leave via the underdrain and/or small orifice in the vertical riser. Therefore, the 85th percentile 24-hour storm event of 0.86 inches will also be detained without short-circuiting.

Appendix A contains the supporting documentation for the information provided in the tables, including:

1. Figure A1 - Pre-development Drainage Conditions
2. Figure A2 - Post-development Drainage Conditions
3. Pre-Development Stormwater Watershed Analysis
    a. Existing Watershed Model Run, 100-year Return Period, 6-hour Duration Storm
    b. Existing Watershed Model Run, 100-year Return Period, 24-hour Duration Storm
4. Post-Development Stormwater Watershed Analysis (HydroCAD)
    a. Post-Development Watershed Model Run, 100-year Return Period, 6-hour Duration Storm – No BMPs
    b. Post-Development Watershed Model Run, 100-year Return Period, 24-hour Duration Storm– No BMPs
    c. Post-Development Watershed Model Run, 100-year Return Period, 24-hour Duration Storm – with BMPs
    d. Post-Development Watershed Model Run, 100-year Return Period, 6-hour Duration Storm– with BMPs
    e. Post-Development DP-2 Model Run, 2-year Return Period, 24-hour Duration Storm– with BMPs (Included as confirmation that no BMP short-circuiting occurs)
5. Source/Reference Data
    a. 100-Year, 6-hour Isopluvial Map San Diego County
    b. 100-Year, 24-hour Isopluvial Map San Diego County
    c. 85th Percentile 24-hour Isopluvial Map San Diego County
    d. NOAA Precipitation Data, Fallbrook, CA Station 92-1080
    e. USDA TR-55 Curve Number Table 2-2a
    f. San Diego Hydrology Manual Figure 4-7



LEGEND

- PROPERTY LINE
- CHAIN LINK FENCE
- VEGETATION
- 5' TOPO CONTOUR (SEE NOTE)
- 1' TOPO CONTOUR (SEE NOTE)
- DRAINAGE AREA BOUNDARY
- DRAINAGE SUBCATCHMENT AREA BOUNDARY
- TIME OF CONCENTRATION FLOW PATHS
- AP-3 — ANALYSIS POINT
- DRAINAGE FLOW ARROW
- 2A — SUBCATCHMENT IDENTIFICATION

A = 10.75	AREA (ACRES)
CN = 71	CURVE NUMBER
6HR Q = 30.29	6-HOUR, 100-YEAR STORM EVENT (CFS)
24 HR Q = 50.17	24-HOUR, 100-YEAR STORM EVENT (CFS)
TC = 9.8	TIME OF CONCENTRATION (MIN)

NOTES

1. EXISTING CONTOURING OF THE SITE WAS PROVIDED BY PSOMAS. THE CONTOURS WERE DERIVED FROM AERIAL PHOTOGRAPHY THAT WAS FLOWN OCTOBER 16TH, 2018. ADDITIONAL DASHED CONTOURS WERE PROVIDED BY PSOMAS OUTSIDE THE PROJECT AREAS. THE SOURCE OF THE DASHED CONTOURS IS UNKNOWN, BUT THEY RESIDE EXCLUSIVELY OUTSIDE OF THE PROPOSED SCOPE OF THIS PROJECT.

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SCALE IN FEET

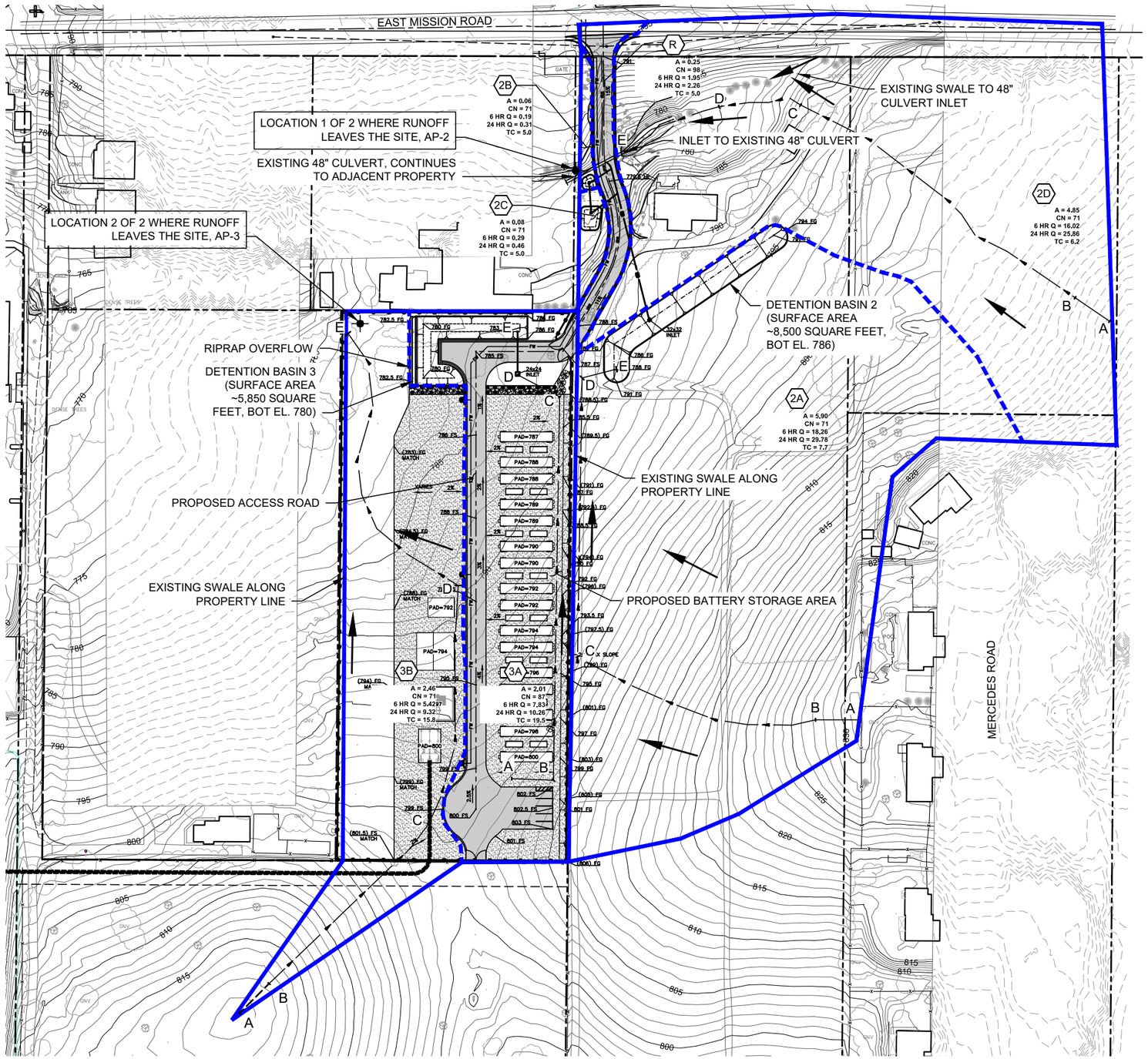
HALEY ALDRICH

CEQA PRELIMINARY DRAINAGE STUDY
FALLBROOK BATTERY ENERGY STORAGE SYSTEM
1405 E. MISSION ROAD, FALLBROOK, CALIFORNIA

PRE-DEVELOPMENT DRAINAGE CONDITIONS

SCALE: AS SHOWN
OCTOBER 2019

FIGURE A1



LEGEND

- PROPERTY LINE
- CHAIN LINK FENCE
- 5' TOPO CONTOUR (SEE NOTE)
- 1' TOPO CONTOUR (SEE NOTE)
- ASPHALT PAVEMENT 6"AC/6"AB (GEOTECHNICAL ENGINEER TO VERIFY)
- CRUSHED AGGREGATE BASE - 6 INCH THICK
- LANDSCAPING
- STORM DRAIN PIPE
- FIRE WATER LINE
- ELECTRIC LINE
- IRRIGATION LINE
- EASEMENT
- GRATE INLET
- FENCE
- SWALE
- 790 FG — PROPOSED ELEVATION SPOT GRADE
- DRAINAGE AREA BOUNDARY
- DRAINAGE SUBCATCHMENT AREA BOUNDARY
- TIME OF CONCENTRATION FLOW PATHS
- DRAINAGE FLOW ARROW
- AP-3 — ANALYSIS POINT

NOTES

1. EXISTING CONTOURING OF THE SITE WAS PROVIDED BY PSOMAS. THE CONTOURS WERE DERIVED FROM AERIAL PHOTOGRAPHY THAT WAS FLOWN OCTOBER 16TH, 2018. ADDITIONAL DASHED CONTOURS WERE PROVIDED BY PSOMAS OUTSIDE THE PROJECT AREAS. THE SOURCE OF THE DASHED CONTOURS IS UNKNOWN, BUT THEY RESIDE EXCLUSIVELY OUTSIDE OF THE PROPOSED SCOPE OF THIS PROJECT.

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0 140 280
SCALE IN FEET

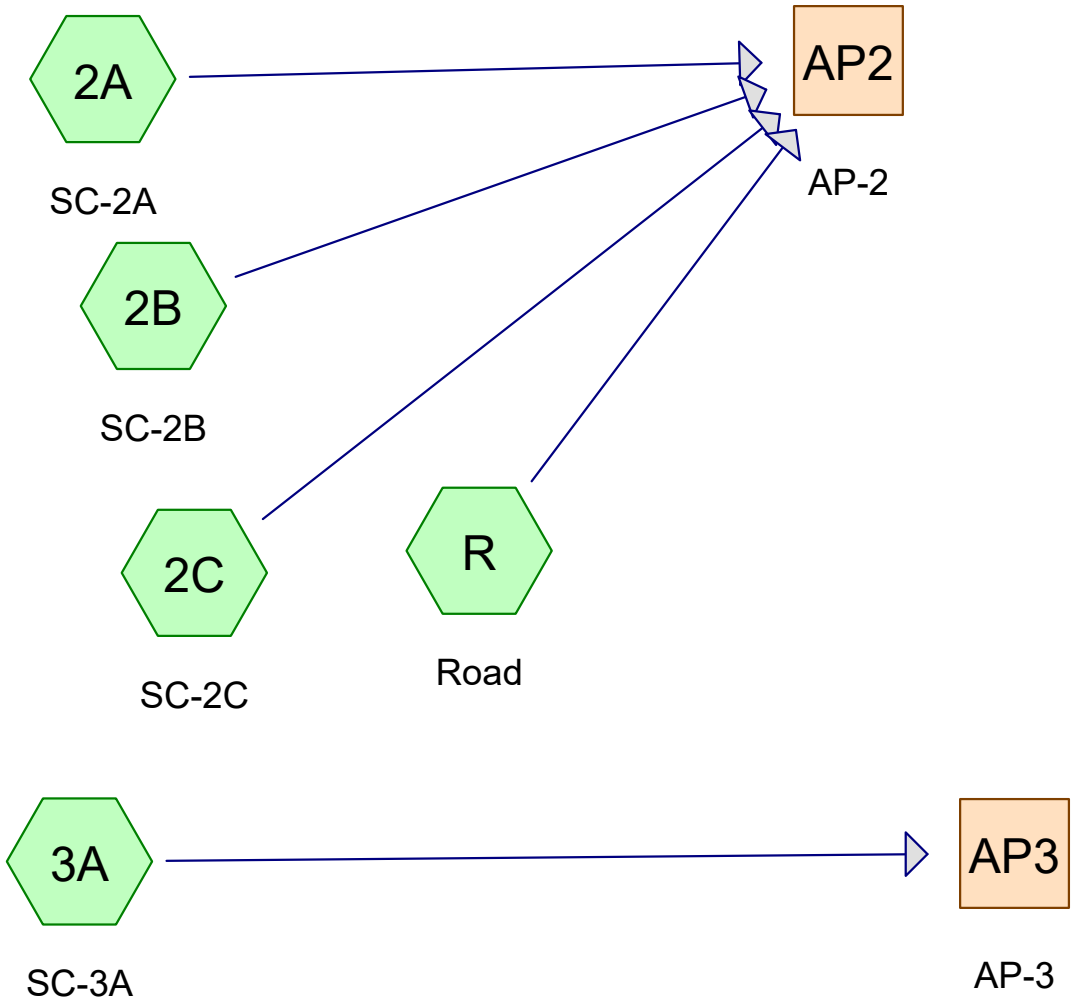
HALEY ALDRICH

CEQA PRELIMINARY DRAINAGE STUDY
FALLBROOK BATTERY ENERGY STORAGE SYSTEM
1405 E. MISSION ROAD, FALLBROOK, CALIFORNIA

POST-DEVELOPMENT DRAINAGE CONDITIONS

SCALE: AS SHOWN
OCTOBER 2019

FIGURE A2



Subcat Reach Pond Link

Routing Diagram for Fallbrook Pre
Prepared by Haley & Aldrich, Printed 12/13/2018

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
15.477	71	Meadow, non-grazed, HSG C (2A, 2B, 2C, 3A)
0.133	92	Paved roads w/open ditches, 50% imp, HSG C (R)
15.610	**71**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
15.610	HSG C	2A, 2B, 2C, 3A, R
0.000	HSG D	
0.000	Other	
15.610		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatch Numbers
0.000	0.000	15.477	0.000	0.000	15.477	Meadow, non-grazed	
0.000	0.000	0.133	0.000	0.000	0.133	Paved roads w/open ditches, 50% imp	
0.000	**0.000**	**15.610**	**0.000**	**0.000**	**15.610**	**TOTAL AREA**	

Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment2A: SC-2A Runoff Area=10.750 ac 0.00% Impervious Runoff Depth=1.28"
Flow Length=991' Tc=9.8 min CN=71 Runoff=30.29 cfs 1.146 af

Subcatchment2B: SC-2B Runoff Area=6,000 sf 0.00% Impervious Runoff Depth=1.28"
Tc=5.0 min CN=71 Runoff=0.48 cfs 0.015 af

Subcatchment2C: SC-2C Runoff Area=5,200 sf 0.00% Impervious Runoff Depth=1.28"
Tc=5.0 min CN=71 Runoff=0.42 cfs 0.013 af

Subcatchment3A: SC-3A Runoff Area=4.470 ac 0.00% Impervious Runoff Depth=1.28"
Flow Length=1,005' Tc=15.9 min CN=71 Runoff=9.82 cfs 0.476 af

SubcatchmentR: Road Runoff Area=5,800 sf 50.00% Impervious Runoff Depth=2.95"
Tc=5.0 min CN=92 Runoff=0.96 cfs 0.033 af

Reach AP2: AP-2 Inflow=31.56 cfs 1.206 af
Outflow=31.56 cfs 1.206 af

Reach AP3: AP-3 Inflow=9.82 cfs 0.476 af
Outflow=9.82 cfs 0.476 af

Total Runoff Area = 15.610 ac Runoff Volume = 1.683 af Average Runoff Depth = 1.29"
99.57% Pervious = 15.544 ac 0.43% Impervious = 0.067 ac

Summary for Subcatchment 2A: SC-2A

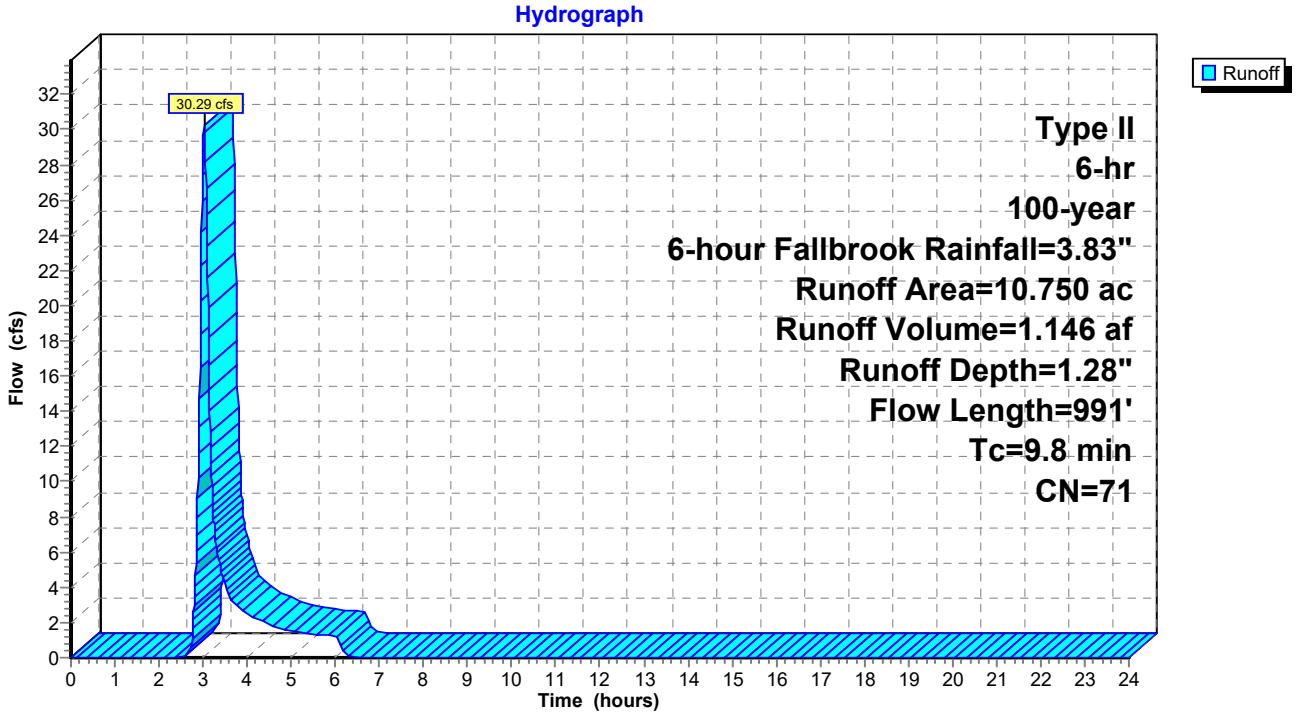
Runoff = 30.29 cfs @ 3.03 hrs, Volume= 1.146 af, Depth= 1.28"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type II 6-hr 100-year, 6-hour Fallbrook Rainfall=3.83"

Area (ac)	CN	Description
10.750	71	Meadow, non-grazed, HSG C
10.750		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.6	50	0.0800	0.23		**Sheet Flow, A-B** Grass: Short n= 0.150 P2= 2.54"
2.3	303	0.0960	2.17		**Shallow Concentrated Flow, B-C** Short Grass Pasture Kv= 7.0 fps
0.7	314	0.0318	7.33	21.98	**Trap/Vee/Rect Channel Flow, C-D** Bot.W=0.00' D=1.00' Z= 3.0 '/' Top.W=6.00' n= 0.022 Earth, clean & straight
3.2	324	0.0580	1.69		**Shallow Concentrated Flow, D-E** Short Grass Pasture Kv= 7.0 fps
9.8	991	Total			

Subcatchment 2A: SC-2A



Summary for Subcatchment 2B: SC-2B

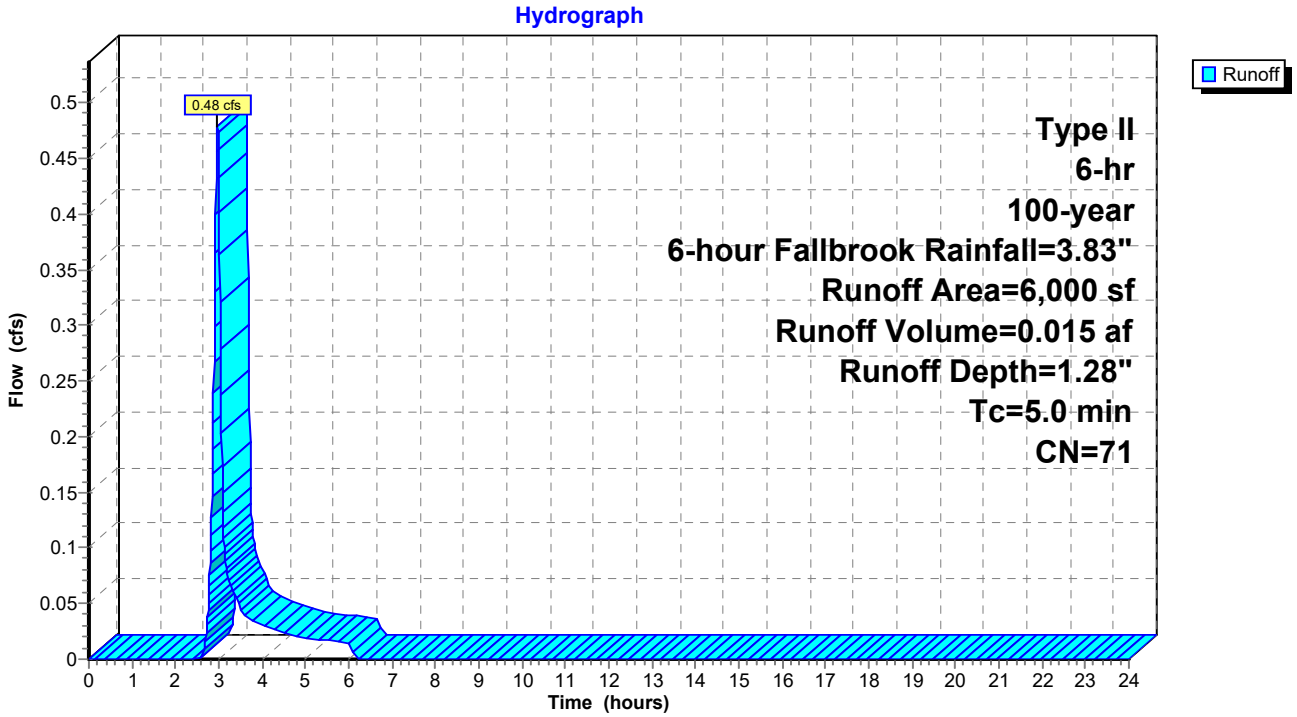
Runoff = 0.48 cfs @ 2.97 hrs, Volume= 0.015 af, Depth= 1.28"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type II 6-hr 100-year, 6-hour Fallbrook Rainfall=3.83"

Area (sf)	CN	Description
6,000	71	Meadow, non-grazed, HSG C
6,000		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, 5 minute min.**

Subcatchment 2B: SC-2B



Summary for Subcatchment 2C: SC-2C

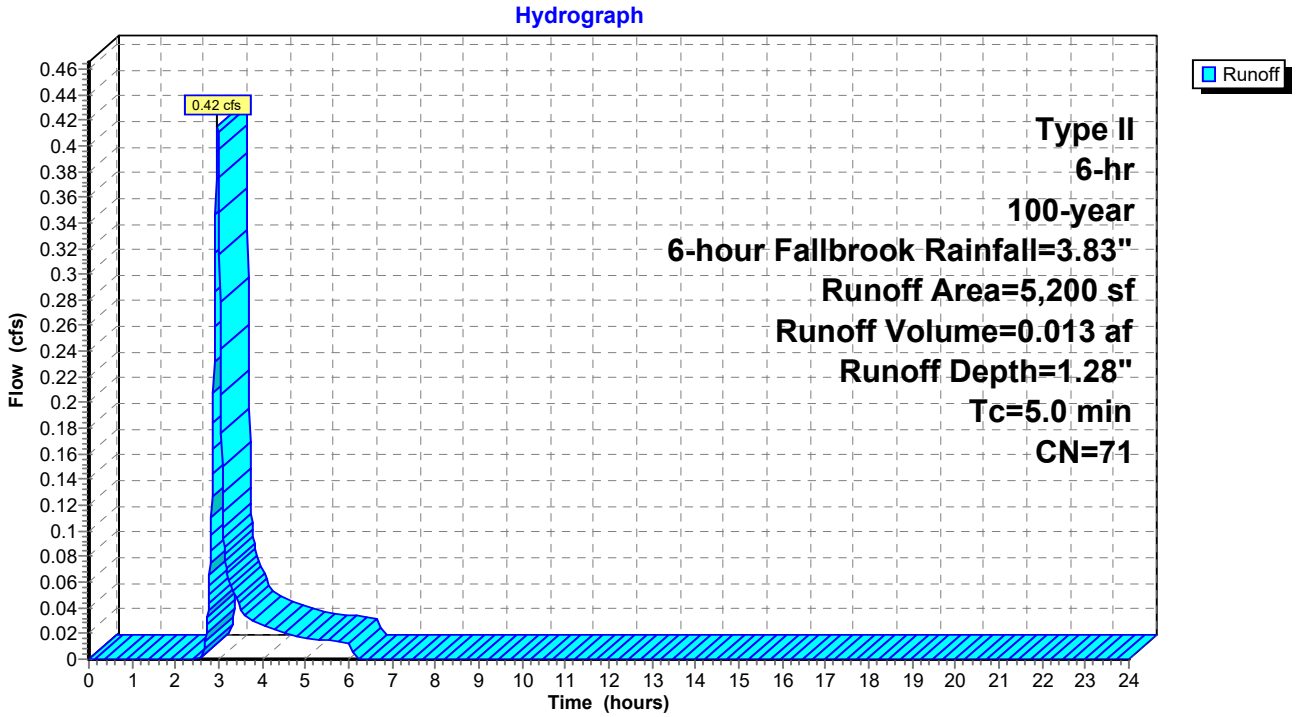
Runoff = 0.42 cfs @ 2.97 hrs, Volume= 0.013 af, Depth= 1.28"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type II 6-hr 100-year, 6-hour Fallbrook Rainfall=3.83"

Area (sf)	CN	Description
5,200	71	Meadow, non-grazed, HSG C
5,200		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, 5 minute min.**

Subcatchment 2C: SC-2C



Summary for Subcatchment 3A: SC-3A

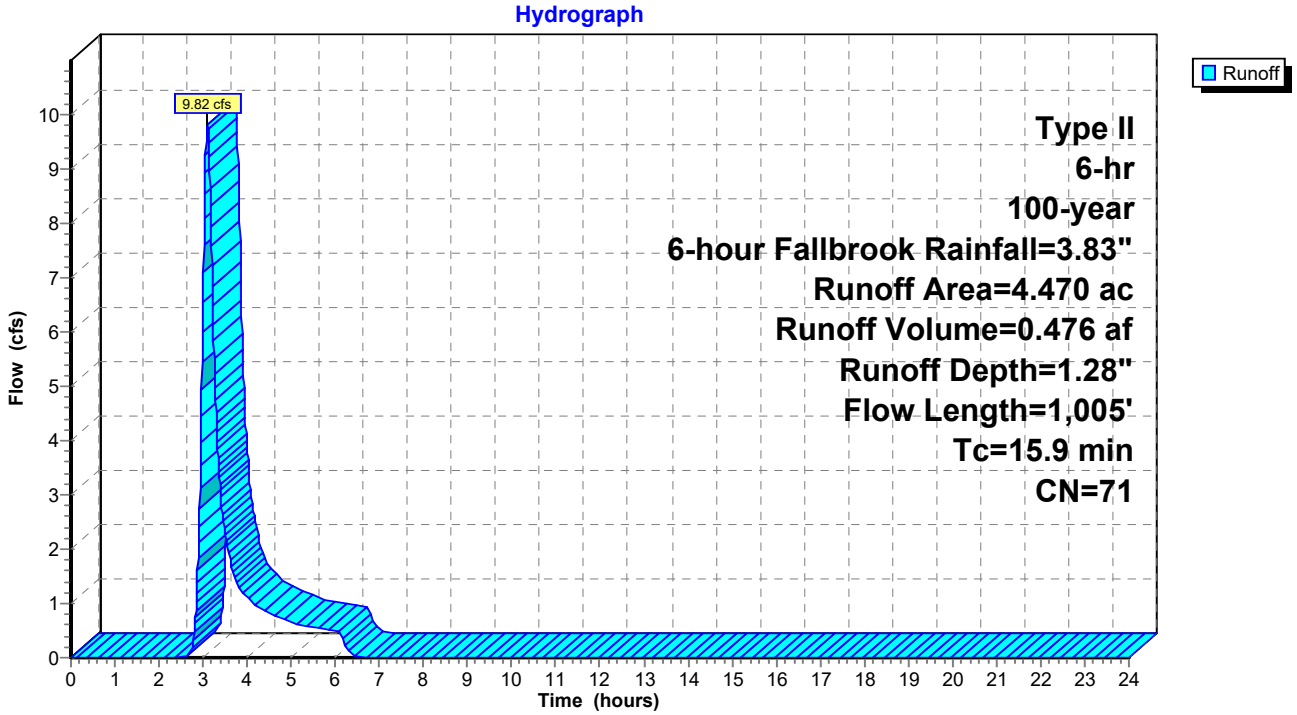
Runoff = 9.82 cfs @ 3.10 hrs, Volume= 0.476 af, Depth= 1.28"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type II 6-hr 100-year, 6-hour Fallbrook Rainfall=3.83"

Area (ac)	CN	Description
4.470	71	Meadow, non-grazed, HSG C
4.470		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.8	50	0.0400	0.17		**Sheet Flow, A-B** Grass: Short n= 0.150 P2= 2.54"
2.5	269	0.0669	1.81		**Shallow Concentrated Flow, B-C** Short Grass Pasture Kv= 7.0 fps
2.2	305	0.0400	2.30	0.29	**Trap/Vee/Rect Channel Flow, C-D** Bot.W=0.00' D=0.25' Z= 2.0 '/' Top.W=1.00' n= 0.030 Earth, grassed & winding
6.4	381	0.0200	0.99		**Shallow Concentrated Flow, D-E** Short Grass Pasture Kv= 7.0 fps
15.9	1,005	Total			

Subcatchment 3A: SC-3A



Summary for Subcatchment R: Road

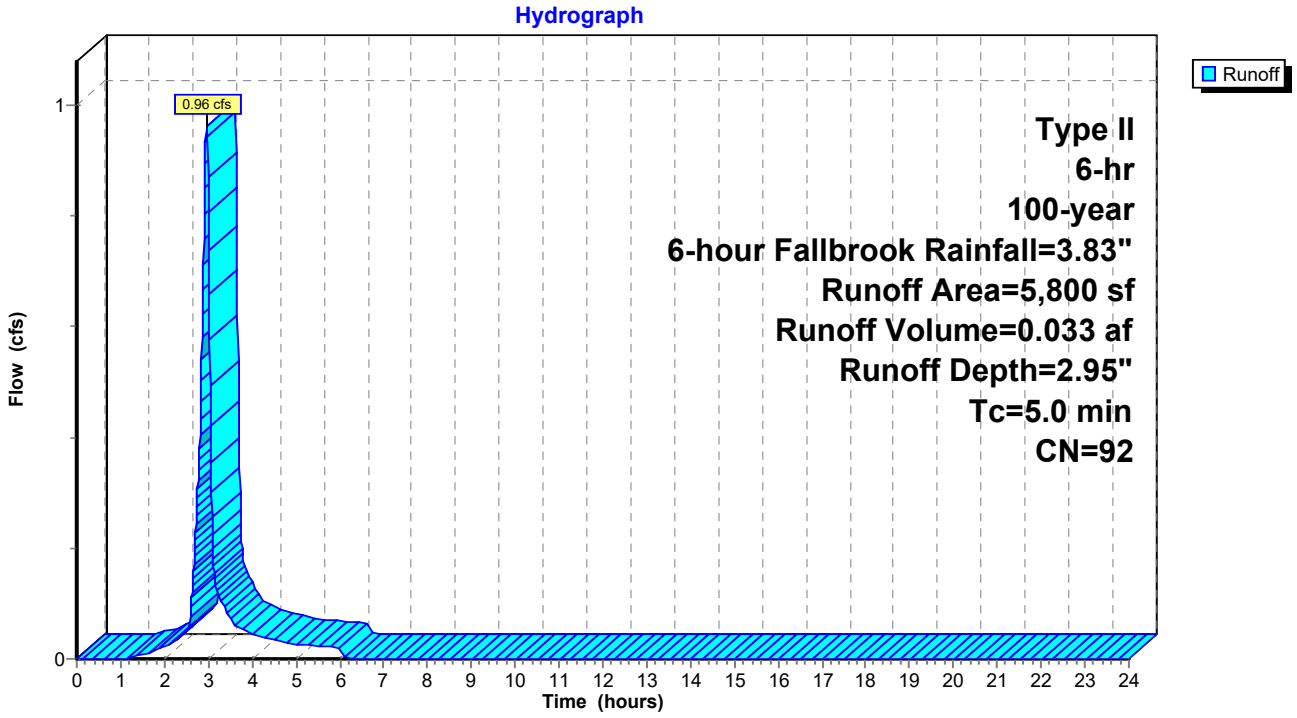
Runoff = 0.96 cfs @ 2.96 hrs, Volume= 0.033 af, Depth= 2.95"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type II 6-hr 100-year, 6-hour Fallbrook Rainfall=3.83"

Area (sf)	CN	Description
5,800	92	Paved roads w/open ditches, 50% imp, HSG C
2,900		50.00% Pervious Area
2,900		50.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, 5 minute min.**

Subcatchment R: Road



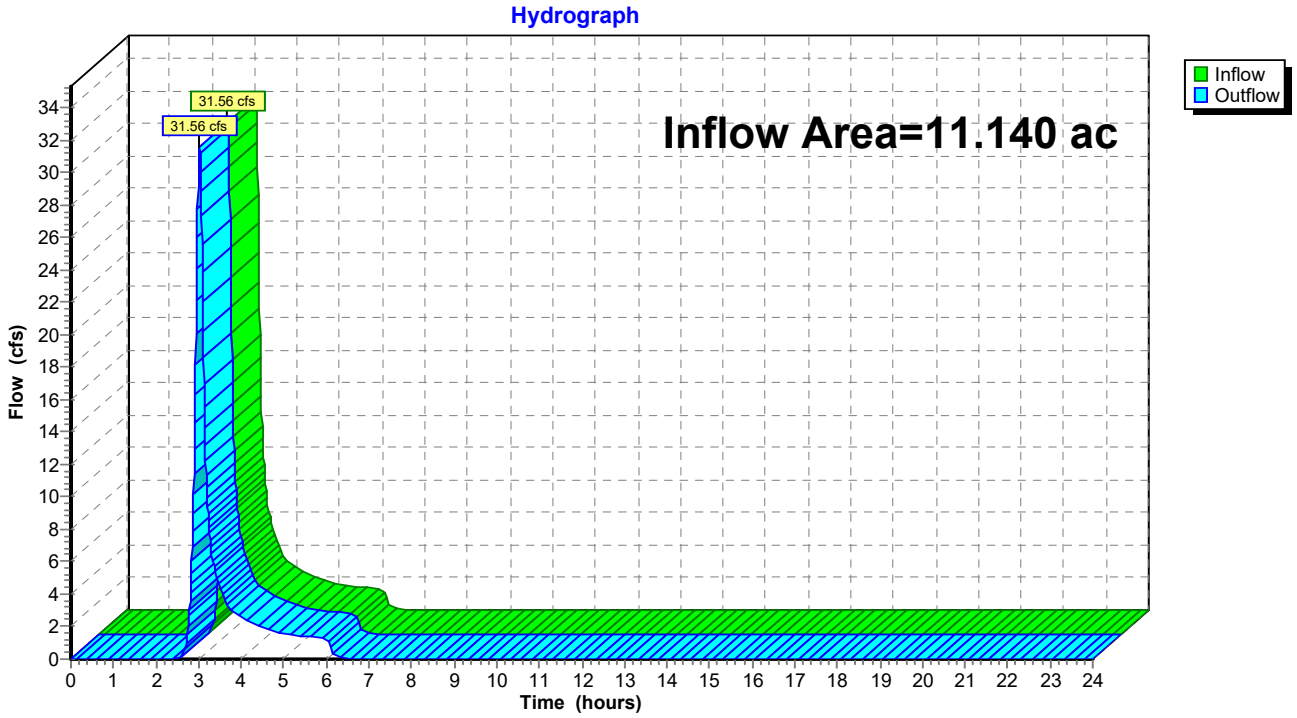
Summary for Reach AP2: AP-2

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 11.140 ac, 0.60% Impervious, Inflow Depth = 1.30" for 100-year, 6-hour Fallbrook event
Inflow = 31.56 cfs @ 3.02 hrs, Volume= 1.206 af
Outflow = 31.56 cfs @ 3.02 hrs, Volume= 1.206 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Reach AP2: AP-2



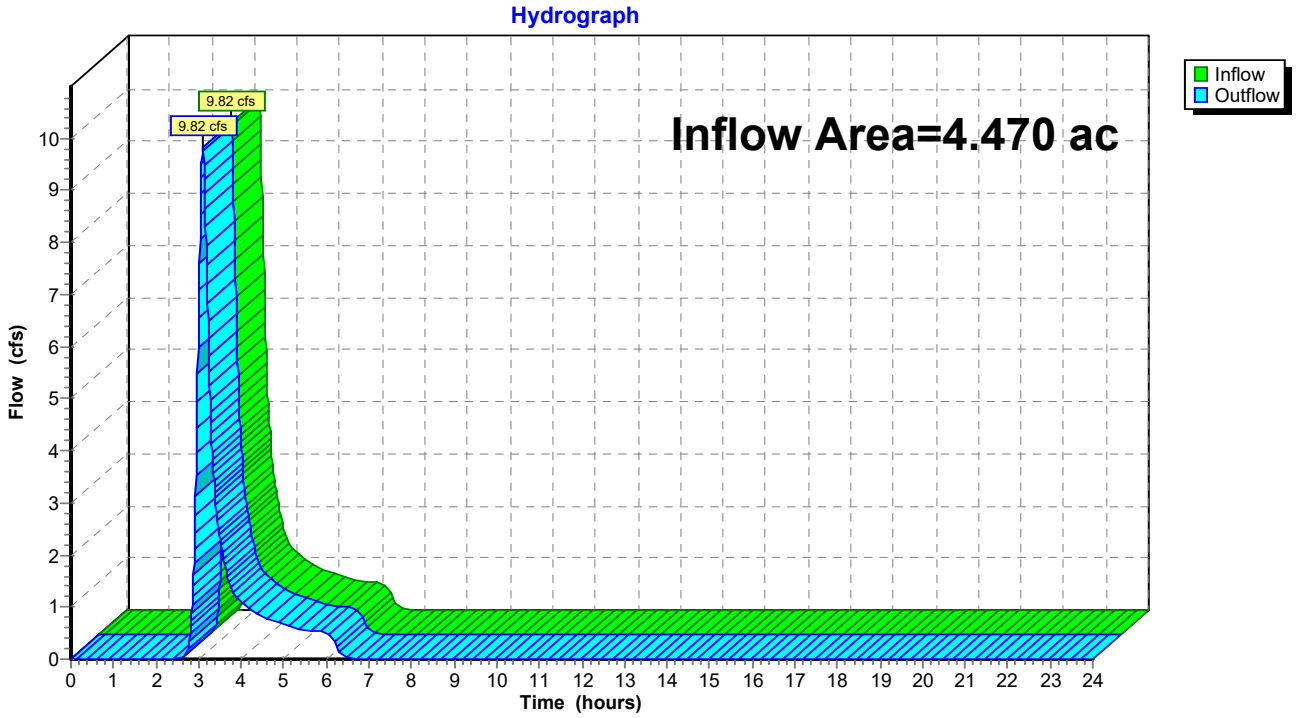
Summary for Reach AP3: AP-3

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 4.470 ac, 0.00% Impervious, Inflow Depth = 1.28" for 100-year, 6-hour Fallbrook event
Inflow = 9.82 cfs @ 3.10 hrs, Volume= 0.476 af
Outflow = 9.82 cfs @ 3.10 hrs, Volume= 0.476 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Reach AP3: AP-3



Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment2A: SC-2A Runoff Area=10.750 ac 0.00% Impervious Runoff Depth>3.00"
Flow Length=991' Tc=9.8 min CN=71 Runoff=50.17 cfs 2.684 af

Subcatchment2B: SC-2B Runoff Area=6,000 sf 0.00% Impervious Runoff Depth>3.00"
Tc=5.0 min CN=71 Runoff=0.77 cfs 0.034 af

Subcatchment2C: SC-2C Runoff Area=5,200 sf 0.00% Impervious Runoff Depth>3.00"
Tc=5.0 min CN=71 Runoff=0.67 cfs 0.030 af

Subcatchment3A: SC-3A Runoff Area=4.470 ac 0.00% Impervious Runoff Depth>2.99"
Flow Length=1,005' Tc=15.9 min CN=71 Runoff=16.88 cfs 1.114 af

SubcatchmentR: Road Runoff Area=5,800 sf 50.00% Impervious Runoff Depth>5.19"
Tc=5.0 min CN=92 Runoff=1.15 cfs 0.058 af

Reach AP2: AP-2 Inflow=52.11 cfs 2.806 af
Outflow=52.11 cfs 2.806 af

Reach AP3: AP-3 Inflow=16.88 cfs 1.114 af
Outflow=16.88 cfs 1.114 af

Total Runoff Area = 15.610 ac Runoff Volume = 3.920 af Average Runoff Depth = 3.01"
99.57% Pervious = 15.544 ac 0.43% Impervious = 0.067 ac

Summary for Subcatchment 2A: SC-2A

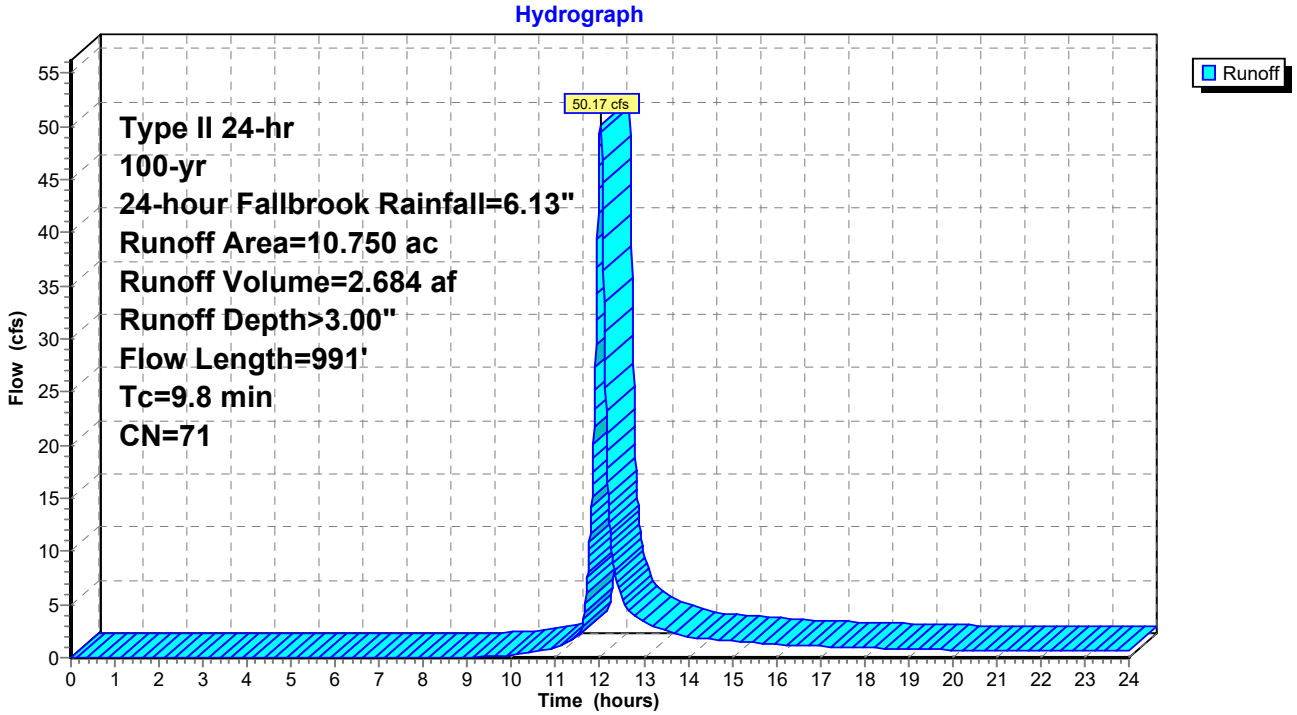
Runoff = 50.17 cfs @ 12.02 hrs, Volume= 2.684 af, Depth> 3.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-yr, 24-hour Fallbrook Rainfall=6.13"

Area (ac)	CN	Description
10.750	71	Meadow, non-grazed, HSG C
10.750		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.6	50	0.0800	0.23		**Sheet Flow, A-B** Grass: Short n= 0.150 P2= 2.54"
2.3	303	0.0960	2.17		**Shallow Concentrated Flow, B-C** Short Grass Pasture Kv= 7.0 fps
0.7	314	0.0318	7.33	21.98	**Trap/Vee/Rect Channel Flow, C-D** Bot.W=0.00' D=1.00' Z= 3.0 '/' Top.W=6.00' n= 0.022 Earth, clean & straight
3.2	324	0.0580	1.69		**Shallow Concentrated Flow, D-E** Short Grass Pasture Kv= 7.0 fps
9.8	991	Total			

Subcatchment 2A: SC-2A



Summary for Subcatchment 2B: SC-2B

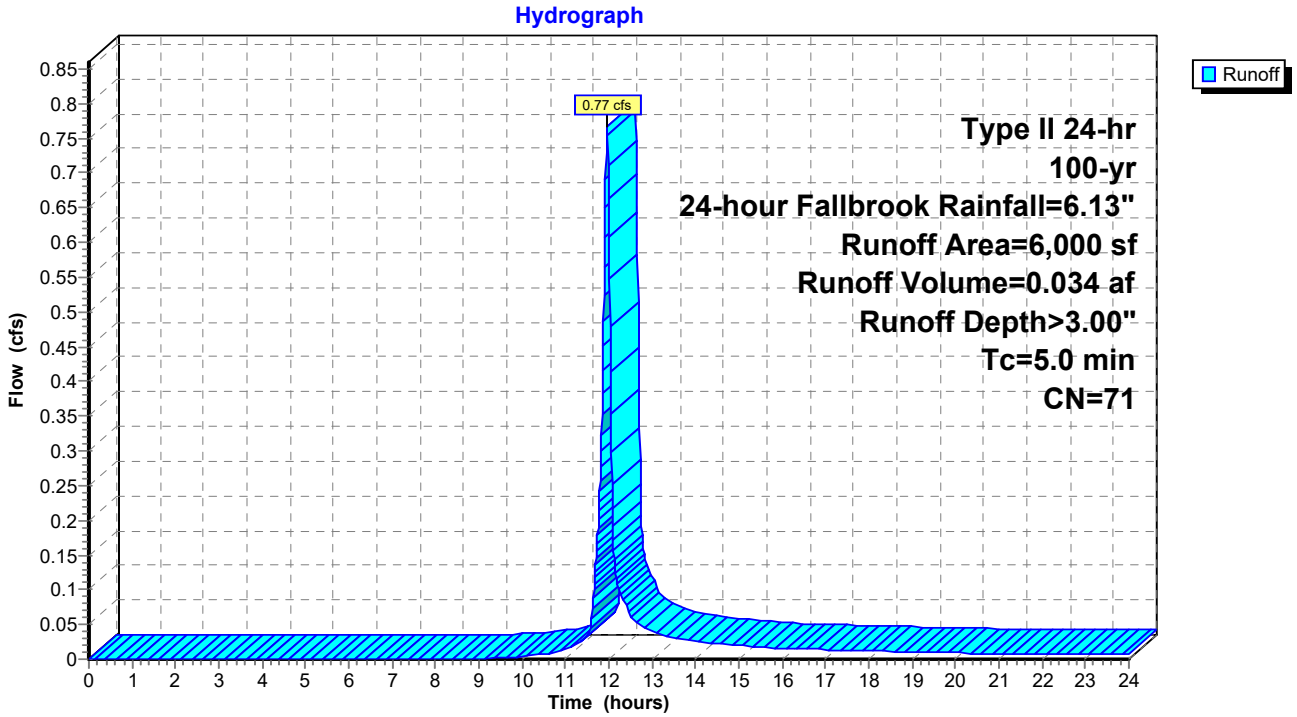
Runoff = 0.77 cfs @ 11.96 hrs, Volume= 0.034 af, Depth> 3.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-yr, 24-hour Fallbrook Rainfall=6.13"

Area (sf)	CN	Description
6,000	71	Meadow, non-grazed, HSG C
6,000		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, 5 minute min.**

Subcatchment 2B: SC-2B



Summary for Subcatchment 2C: SC-2C

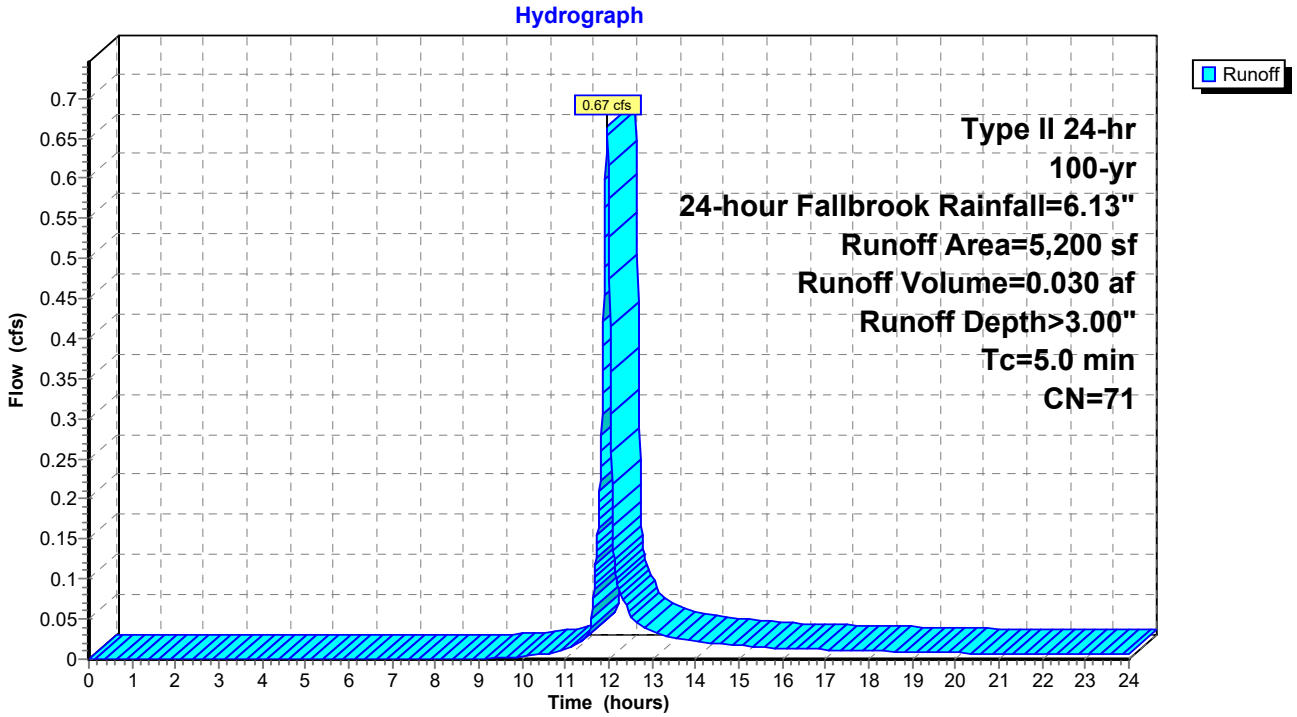
Runoff = 0.67 cfs @ 11.96 hrs, Volume= 0.030 af, Depth> 3.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-yr, 24-hour Fallbrook Rainfall=6.13"

Area (sf)	CN	Description
5,200	71	Meadow, non-grazed, HSG C
5,200		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, 5 minute min.**

Subcatchment 2C: SC-2C



Summary for Subcatchment 3A: SC-3A

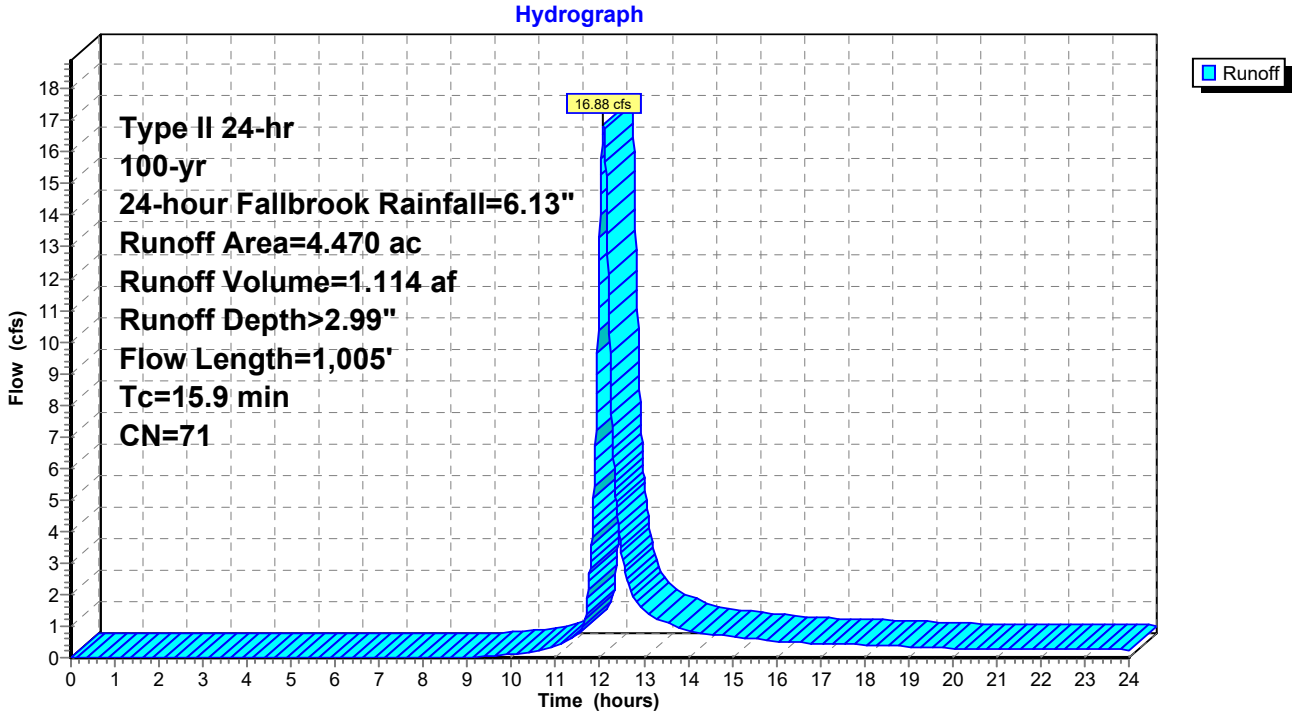
Runoff = 16.88 cfs @ 12.08 hrs, Volume= 1.114 af, Depth> 2.99"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-yr, 24-hour Fallbrook Rainfall=6.13"

Area (ac)	CN	Description
4.470	71	Meadow, non-grazed, HSG C
4.470		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.8	50	0.0400	0.17		**Sheet Flow, A-B** Grass: Short n= 0.150 P2= 2.54"
2.5	269	0.0669	1.81		**Shallow Concentrated Flow, B-C** Short Grass Pasture Kv= 7.0 fps
2.2	305	0.0400	2.30	0.29	**Trap/Vee/Rect Channel Flow, C-D** Bot.W=0.00' D=0.25' Z= 2.0 '/' Top.W=1.00' n= 0.030 Earth, grassed & winding
6.4	381	0.0200	0.99		**Shallow Concentrated Flow, D-E** Short Grass Pasture Kv= 7.0 fps
15.9	1,005	Total			

Subcatchment 3A: SC-3A



Summary for Subcatchment R: Road

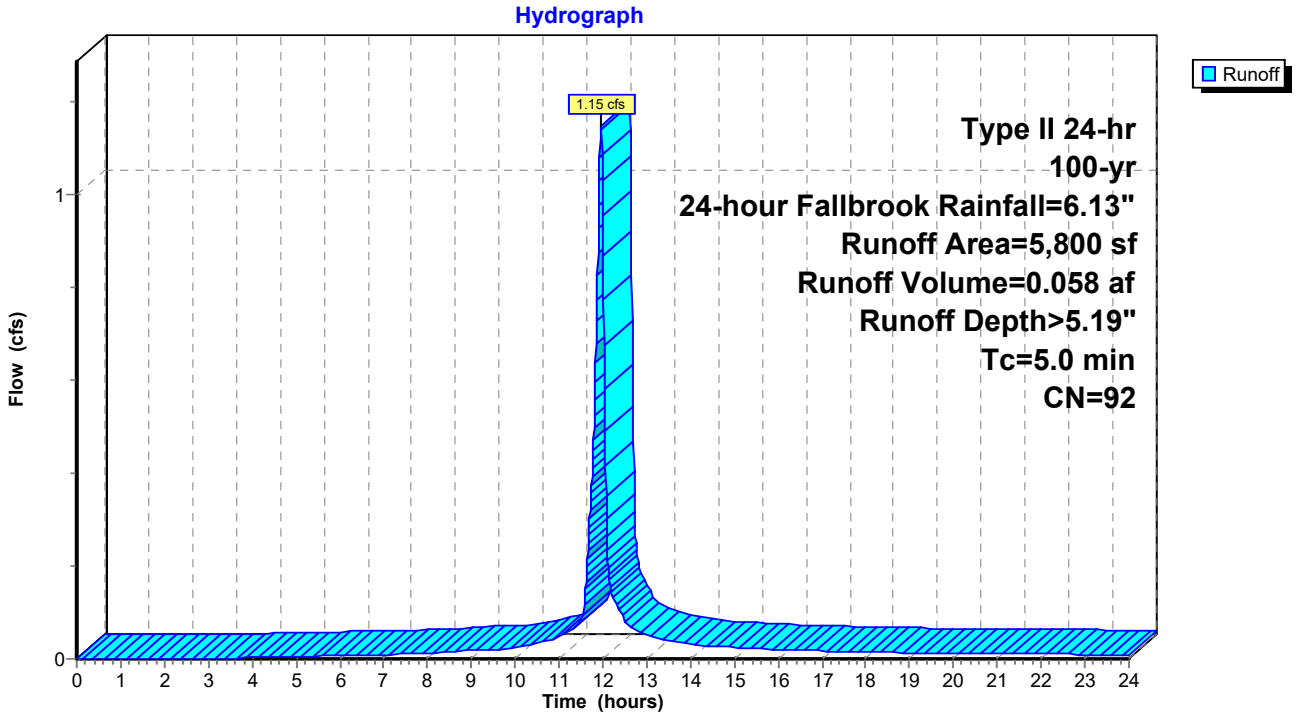
Runoff = 1.15 cfs @ 11.96 hrs, Volume= 0.058 af, Depth> 5.19"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-yr, 24-hour Fallbrook Rainfall=6.13"

Area (sf)	CN	Description
5,800	92	Paved roads w/open ditches, 50% imp, HSG C
2,900		50.00% Pervious Area
2,900		50.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, 5 minute min.**

Subcatchment R: Road



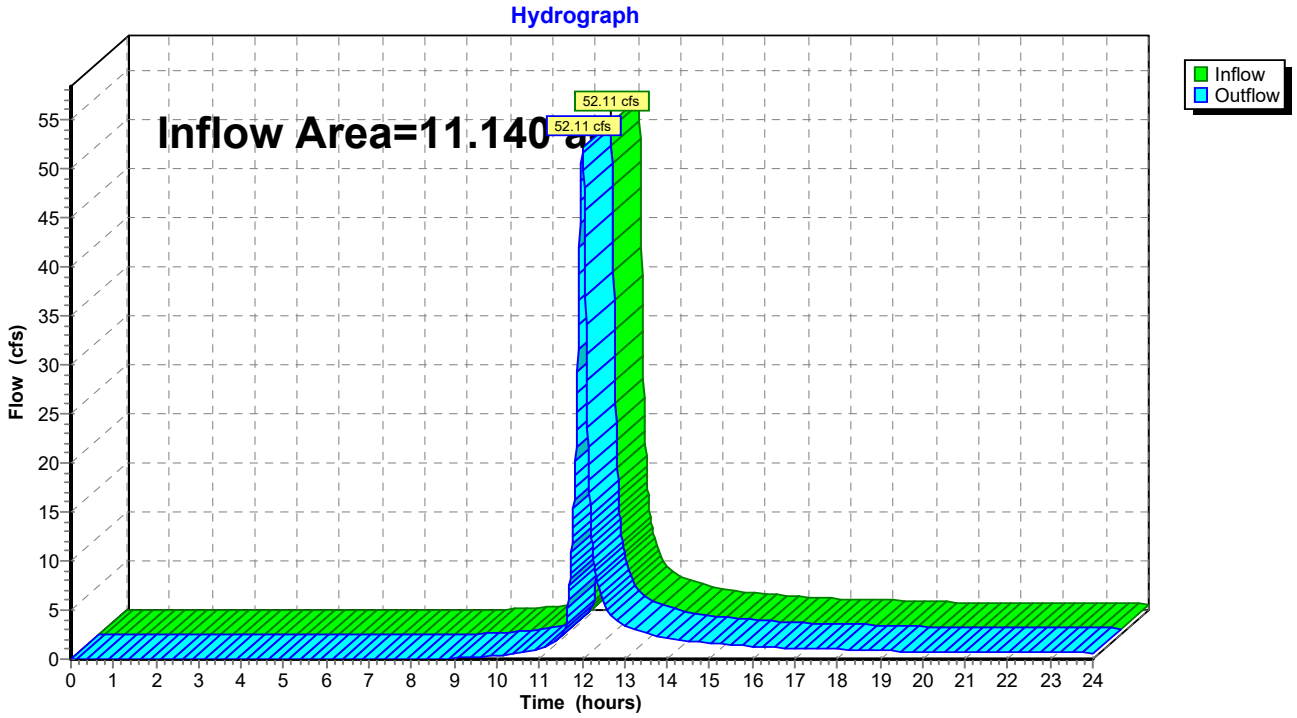
Summary for Reach AP2: AP-2

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 11.140 ac, 0.60% Impervious, Inflow Depth > 3.02" for 100-yr, 24-hour Fallbrook event
Inflow = 52.11 cfs @ 12.01 hrs, Volume= 2.806 af
Outflow = 52.11 cfs @ 12.01 hrs, Volume= 2.806 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Reach AP2: AP-2



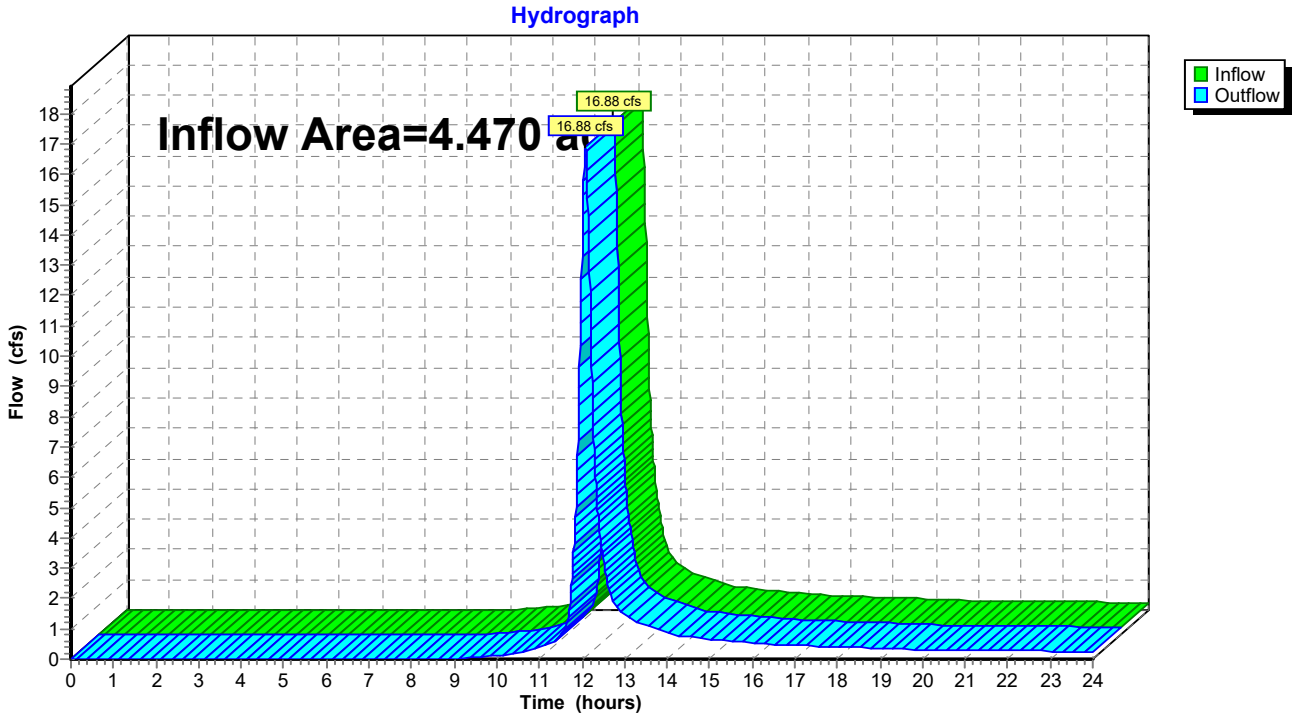
Summary for Reach AP3: AP-3

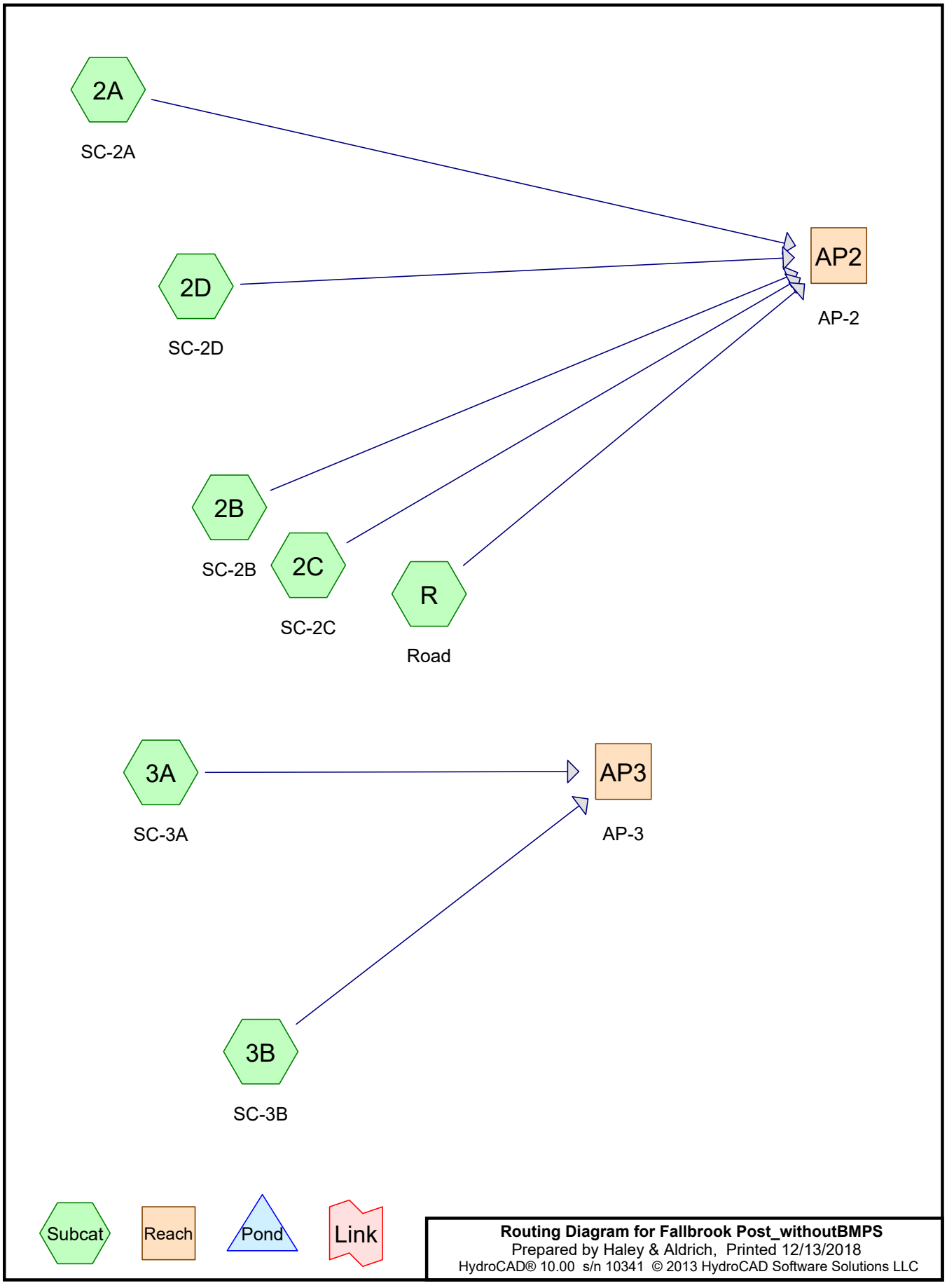
[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 4.470 ac, 0.00% Impervious, Inflow Depth > 2.99" for 100-yr, 24-hour Fallbrook event
Inflow = 16.88 cfs @ 12.08 hrs, Volume= 1.114 af
Outflow = 16.88 cfs @ 12.08 hrs, Volume= 1.114 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Reach AP3: AP-3





Routing Diagram for Fallbrook Post_withoutBMPS
Prepared by Haley & Aldrich, Printed 12/13/2018

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
14.191	71	Meadow, non-grazed, HSG C (2A, 2B, 2C, 2D, 3A, 3B)
1.170	98	Paved parking, HSG C (3A)
0.250	98	Paved roads w/curbs & sewers, HSG C (R)
15.611	**73**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
15.611	HSG C	2A, 2B, 2C, 2D, 3A, 3B, R
0.000	HSG D	
0.000	Other	
15.611		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.000	14.191	0.000	0.000	14.191	Meadow, non-grazed	2A, 2B, 2C, 2D, 3A, 3B
0.000	0.000	1.170	0.000	0.000	1.170	Paved parking	3A
0.000	0.000	0.250	0.000	0.000	0.250	Paved roads w/curbs & sewers	R
0.000	**0.000**	**15.611**	**0.000**	**0.000**	**15.611**	**TOTAL AREA**	

Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Diam/Width (inches)	Height (inches)	Inside-Fill (inches)
1	3A	0.00	0.00	43.0	0.0200	0.010	12.0	0.0	0.0

Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment2A: SC-2A Runoff Area=5.903 ac 0.00% Impervious Runoff Depth=1.28"
Flow Length=746' Tc=7.7 min CN=71 Runoff=18.26 cfs 0.629 af

Subcatchment2B: SC-2B Runoff Area=2,400 sf 0.00% Impervious Runoff Depth=1.28"
Tc=5.0 min CN=71 Runoff=0.19 cfs 0.006 af

Subcatchment2C: SC-2C Runoff Area=3,600 sf 0.00% Impervious Runoff Depth=1.28"
Tc=5.0 min CN=71 Runoff=0.29 cfs 0.009 af

Subcatchment2D: SC-2D Runoff Area=4.850 ac 0.00% Impervious Runoff Depth=1.28"
Flow Length=681' Tc=6.2 min CN=71 Runoff=16.02 cfs 0.517 af

Subcatchment3A: SC-3A Runoff Area=2.010 ac 58.21% Impervious Runoff Depth=2.48"
Flow Length=603' Tc=19.5 min CN=87 Runoff=7.83 cfs 0.416 af

Subcatchment3B: SC-3B Runoff Area=2.460 ac 0.00% Impervious Runoff Depth=1.28"
Flow Length=1,005' Tc=15.8 min CN=71 Runoff=5.42 cfs 0.262 af

SubcatchmentR: Road Runoff Area=0.250 ac 100.00% Impervious Runoff Depth=3.60"
Tc=5.0 min CN=98 Runoff=1.98 cfs 0.075 af

Reach AP2: AP-2 Inflow=36.20 cfs 1.236 af
Outflow=36.20 cfs 1.236 af

Reach AP3: AP-3 Inflow=13.19 cfs 0.678 af
Outflow=13.19 cfs 0.678 af

Total Runoff Area = 15.611 ac Runoff Volume = 1.914 af Average Runoff Depth = 1.47"
90.90% Pervious = 14.191 ac 9.10% Impervious = 1.420 ac

Summary for Subcatchment 2A: SC-2A

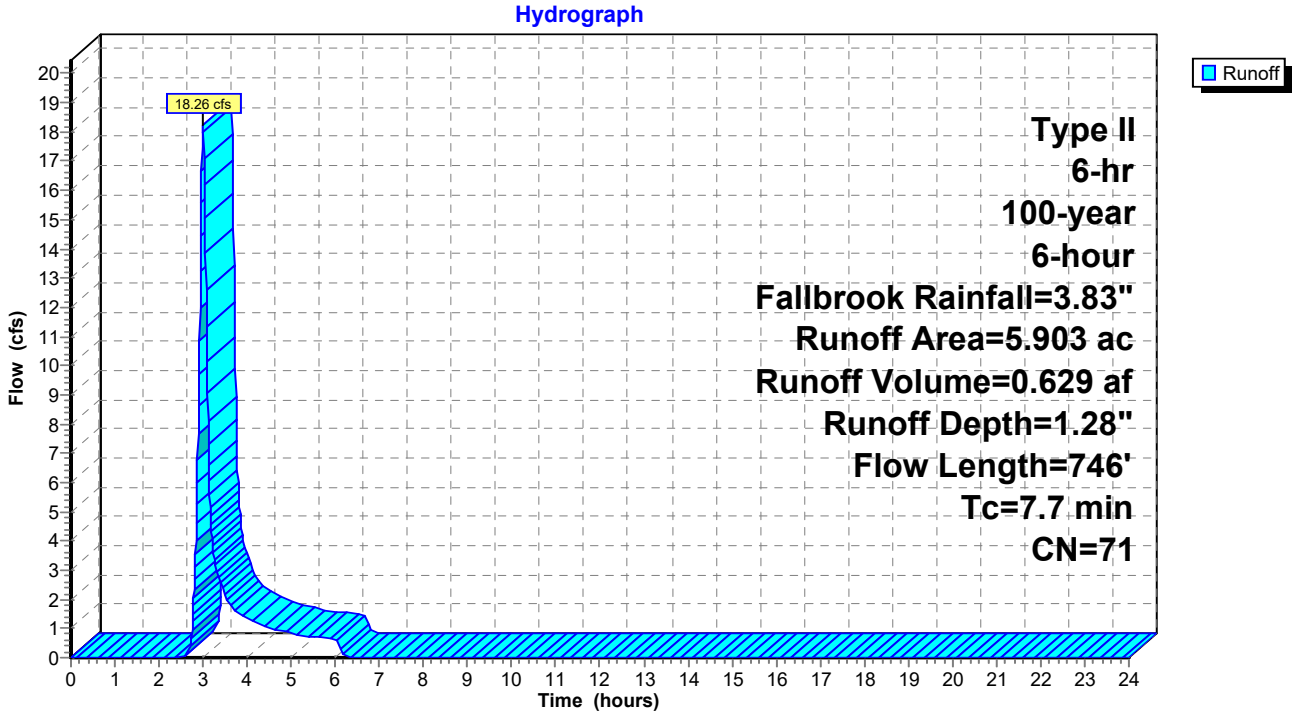
Runoff = 18.26 cfs @ 3.00 hrs, Volume= 0.629 af, Depth= 1.28"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type II 6-hr 100-year, 6-hour Fallbrook Rainfall=3.83"

Area (ac)	CN	Description
5.903	71	Meadow, non-grazed, HSG C
5.903		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.0	50	0.0800	0.21		**Sheet Flow, A-B** Cultivated: Residue>20% n= 0.170 P2= 2.54"
2.4	314	0.0960	2.17		**Shallow Concentrated Flow, B-C** Short Grass Pasture Kv= 7.0 fps
0.8	340	0.0318	7.33	21.98	**Trap/Vee/Rect Channel Flow, C-D** Bot.W=0.00' D=1.00' Z= 3.0 '/' Top.W=6.00' n= 0.022 Earth, clean & straight
0.5	42	0.0357	1.32		**Shallow Concentrated Flow, D-E** Short Grass Pasture Kv= 7.0 fps
7.7	746	Total			

Subcatchment 2A: SC-2A



Summary for Subcatchment 2B: SC-2B

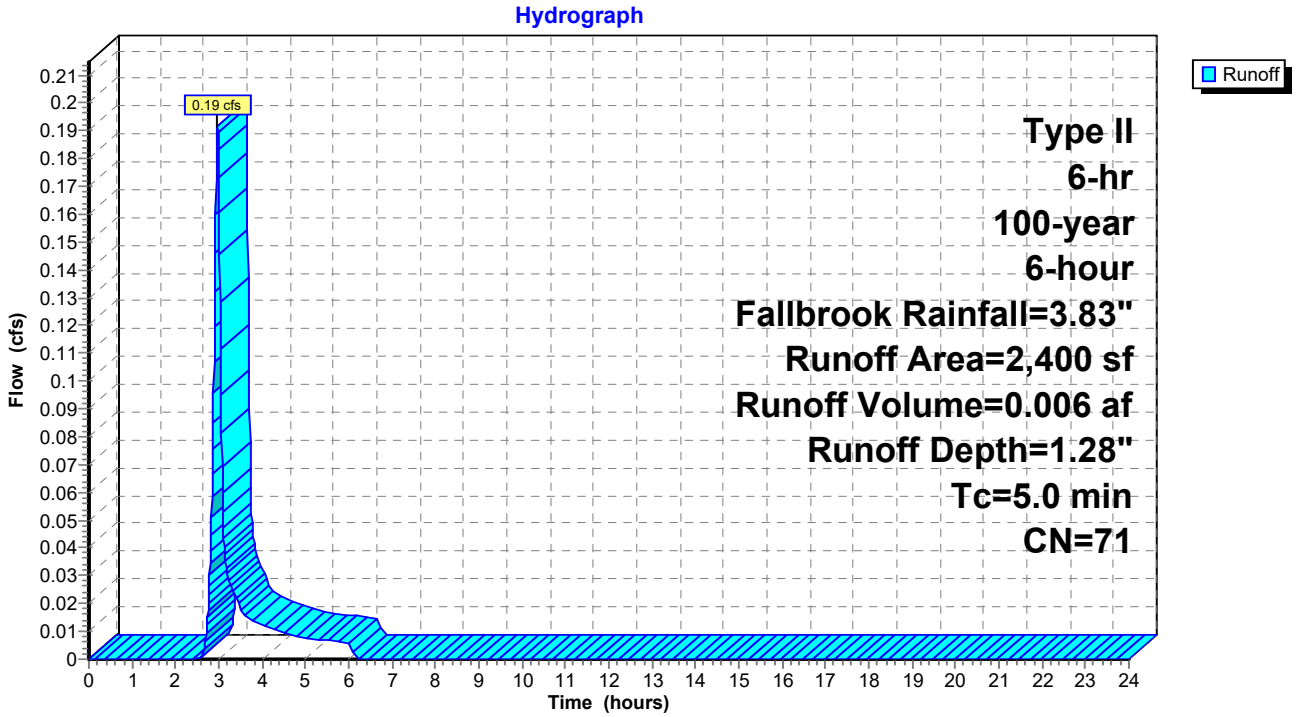
Runoff = 0.19 cfs @ 2.97 hrs, Volume= 0.006 af, Depth= 1.28"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type II 6-hr 100-year, 6-hour Fallbrook Rainfall=3.83"

Area (sf)	CN	Description
2,400	71	Meadow, non-grazed, HSG C
2,400		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, 5 minute min.**

Subcatchment 2B: SC-2B



Summary for Subcatchment 2C: SC-2C

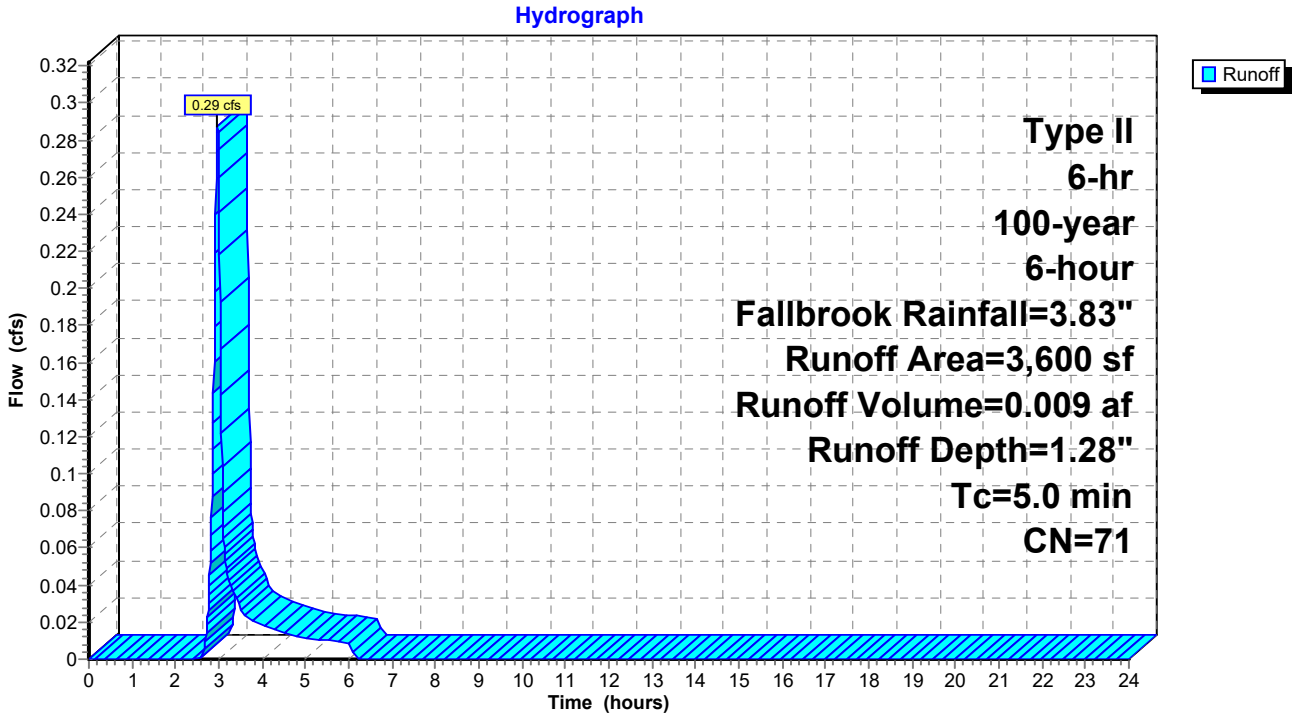
Runoff = 0.29 cfs @ 2.97 hrs, Volume= 0.009 af, Depth= 1.28"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type II 6-hr 100-year, 6-hour Fallbrook Rainfall=3.83"

Area (sf)	CN	Description
3,600	71	Meadow, non-grazed, HSG C
3,600		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, 5 minute min.**

Subcatchment 2C: SC-2C



Summary for Subcatchment 2D: SC-2D

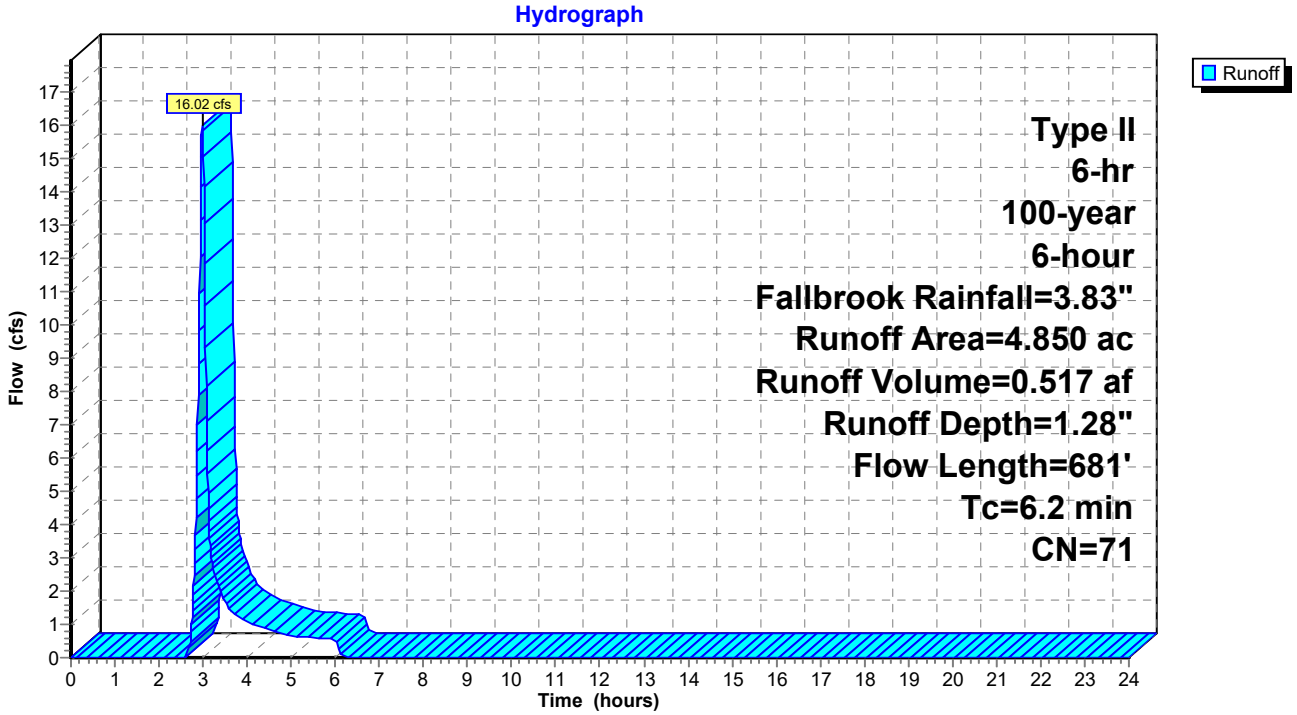
Runoff = 16.02 cfs @ 2.98 hrs, Volume= 0.517 af, Depth= 1.28"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type II 6-hr 100-year, 6-hour Fallbrook Rainfall=3.83"

Area (ac)	CN	Description
4.850	71	Meadow, non-grazed, HSG C
4.850		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.2	50	0.1400	0.69		**Sheet Flow, A-B** Fallow n= 0.050 P2= 2.54"
4.0	406	0.0580	1.69		**Shallow Concentrated Flow, B-C** Short Grass Pasture Kv= 7.0 fps
0.8	100	0.1000	2.21		**Shallow Concentrated Flow, C-D** Short Grass Pasture Kv= 7.0 fps
0.2	125	0.0640	12.10	145.18	**Trap/Vee/Rect Channel Flow, D-E** Bot.W=0.00' D=2.00' Z= 3.0 '/' Top.W=12.00' n= 0.030 Earth, grassed & winding
6.2	681	Total			

Subcatchment 2D: SC-2D



Summary for Subcatchment 3A: SC-3A

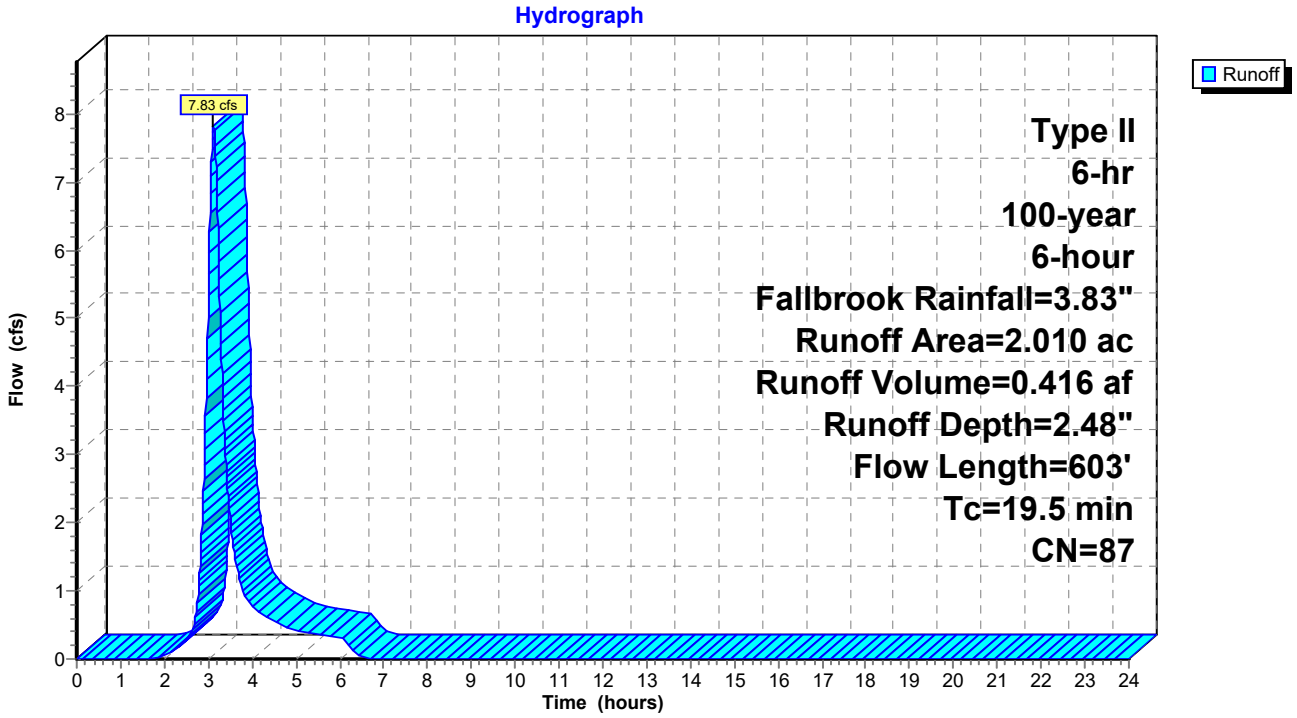
Runoff = 7.83 cfs @ 3.12 hrs, Volume= 0.416 af, Depth= 2.48"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type II 6-hr 100-year, 6-hour Fallbrook Rainfall=3.83"

Area (ac)	CN	Description
0.840	71	Meadow, non-grazed, HSG C
1.170	98	Paved parking, HSG C
2.010	87	Weighted Average
0.840		41.79% Pervious Area
1.170		58.21% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.5	50	0.0200	0.55		**Sheet Flow, A-B, Gravel Overland Flow** n= 0.025 P2= 2.54"
17.1	460	0.0500	0.45		**Shallow Concentrated Flow, B-C, Slope of 5%, nearly bare grour** Kv= 2.0 fps
0.8	50	0.0200	0.99		**Shallow Concentrated Flow, C-D** Short Grass Pasture Kv= 7.0 fps
0.1	43	0.0200	8.34	6.55	**Pipe Channel, D-E** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.010 PVC, smooth interior
19.5	603	Total			

Subcatchment 3A: SC-3A



Summary for Subcatchment 3B: SC-3B

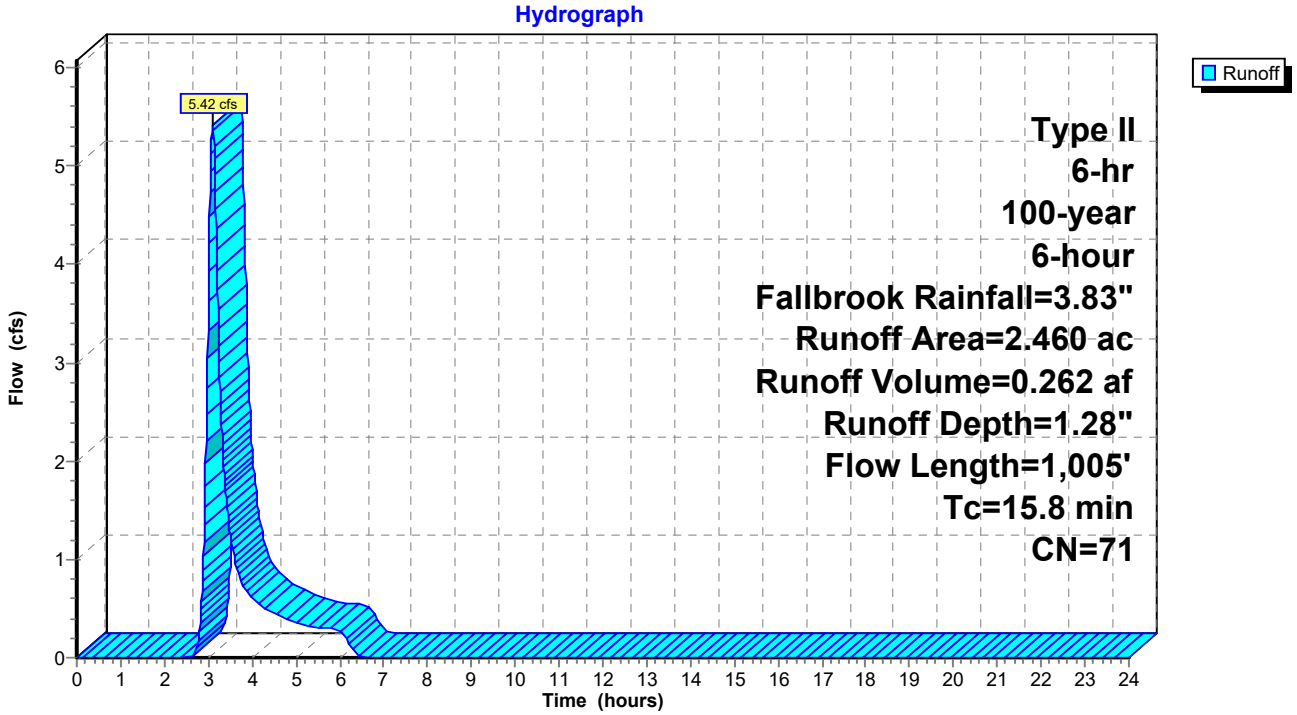
Runoff = 5.42 cfs @ 3.10 hrs, Volume= 0.262 af, Depth= 1.28"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type II 6-hr 100-year, 6-hour Fallbrook Rainfall=3.83"

Area (ac)	CN	Description
2.460	71	Meadow, non-grazed, HSG C
2.460		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.3	50	0.0400	0.16		**Sheet Flow, A-B** Cultivated: Residue>20% n= 0.170 P2= 2.54"
2.5	269	0.0669	1.81		**Shallow Concentrated Flow, B-C** Short Grass Pasture Kv= 7.0 fps
1.6	305	0.0400	3.14	0.39	**Trap/Vee/Rect Channel Flow, C-D** Bot.W=0.00' D=0.25' Z= 2.0 '/' Top.W=1.00' n= 0.022 Earth, clean & straight
6.4	381	0.0200	0.99		**Shallow Concentrated Flow, D-E** Short Grass Pasture Kv= 7.0 fps
15.8	1,005	Total			

Subcatchment 3B: SC-3B



Summary for Subcatchment R: Road

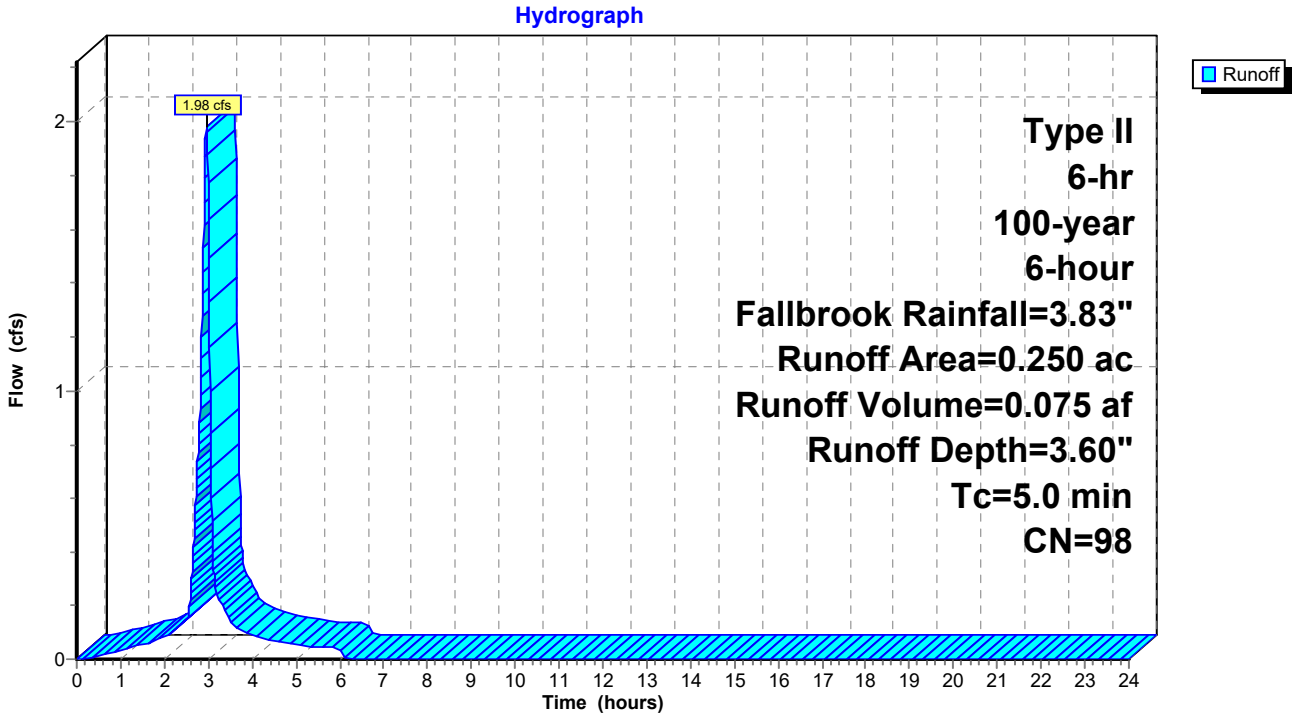
Runoff = 1.98 cfs @ 2.96 hrs, Volume= 0.075 af, Depth= 3.60"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type II 6-hr 100-year, 6-hour Fallbrook Rainfall=3.83"

Area (ac)	CN	Description
0.250	98	Paved roads w/curbs & sewers, HSG C
0.250		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, 5 minute min.**

Subcatchment R: Road



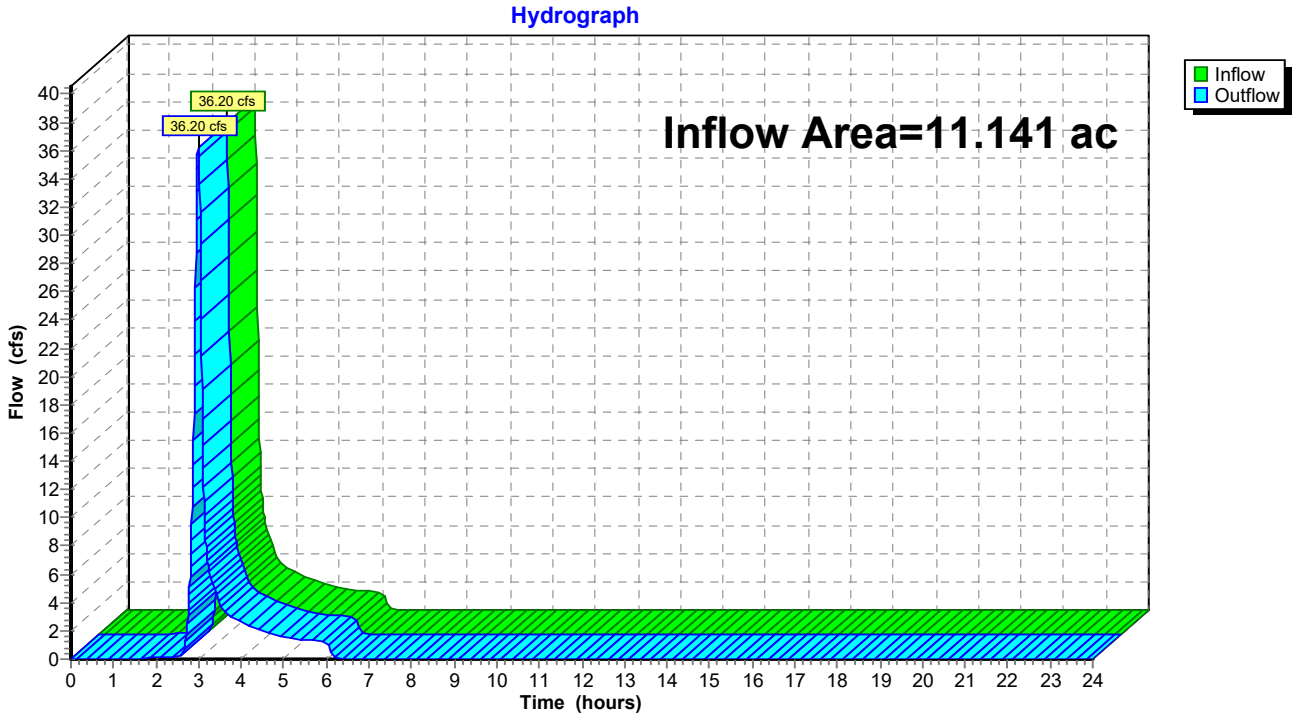
Summary for Reach AP2: AP-2

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 11.141 ac, 2.24% Impervious, Inflow Depth = 1.33" for 100-year, 6-hour Fallbrook event
Inflow = 36.20 cfs @ 2.99 hrs, Volume= 1.236 af
Outflow = 36.20 cfs @ 2.99 hrs, Volume= 1.236 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Reach AP2: AP-2



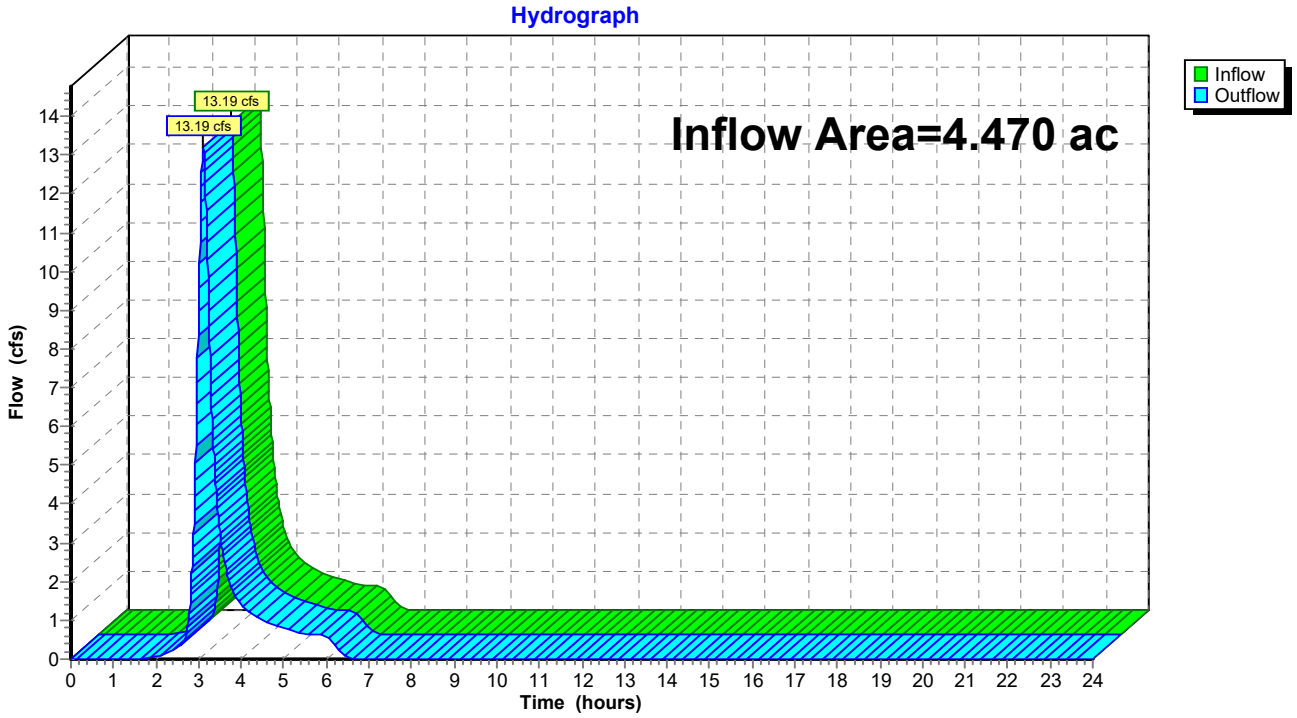
Summary for Reach AP3: AP-3

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 4.470 ac, 26.17% Impervious, Inflow Depth = 1.82" for 100-year, 6-hour Fallbrook event
Inflow = 13.19 cfs @ 3.11 hrs, Volume= 0.678 af
Outflow = 13.19 cfs @ 3.11 hrs, Volume= 0.678 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Reach AP3: AP-3



Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment2A: SC-2A Runoff Area=5.903 ac 0.00% Impervious Runoff Depth>3.00"
Flow Length=746' Tc=7.7 min CN=71 Runoff=29.78 cfs 1.475 af

Subcatchment2B: SC-2B Runoff Area=2,400 sf 0.00% Impervious Runoff Depth>3.00"
Tc=5.0 min CN=71 Runoff=0.31 cfs 0.014 af

Subcatchment2C: SC-2C Runoff Area=3,600 sf 0.00% Impervious Runoff Depth>3.00"
Tc=5.0 min CN=71 Runoff=0.46 cfs 0.021 af

Subcatchment2D: SC-2D Runoff Area=4.850 ac 0.00% Impervious Runoff Depth>3.00"
Flow Length=681' Tc=6.2 min CN=71 Runoff=25.86 cfs 1.212 af

Subcatchment3A: SC-3A Runoff Area=2.010 ac 58.21% Impervious Runoff Depth>4.62"
Flow Length=603' Tc=19.5 min CN=87 Runoff=10.26 cfs 0.774 af

Subcatchment3B: SC-3B Runoff Area=2.460 ac 0.00% Impervious Runoff Depth>2.99"
Flow Length=1,005' Tc=15.8 min CN=71 Runoff=9.32 cfs 0.613 af

SubcatchmentR: Road Runoff Area=0.250 ac 100.00% Impervious Runoff Depth>5.89"
Tc=5.0 min CN=98 Runoff=2.26 cfs 0.123 af

Reach AP2: AP-2 Inflow=58.11 cfs 2.844 af
Outflow=58.11 cfs 2.844 af

Reach AP3: AP-3 Inflow=19.43 cfs 1.387 af
Outflow=19.43 cfs 1.387 af

Total Runoff Area = 15.611 ac Runoff Volume = 4.231 af Average Runoff Depth = 3.25"
90.90% Pervious = 14.191 ac 9.10% Impervious = 1.420 ac

Summary for Subcatchment 2A: SC-2A

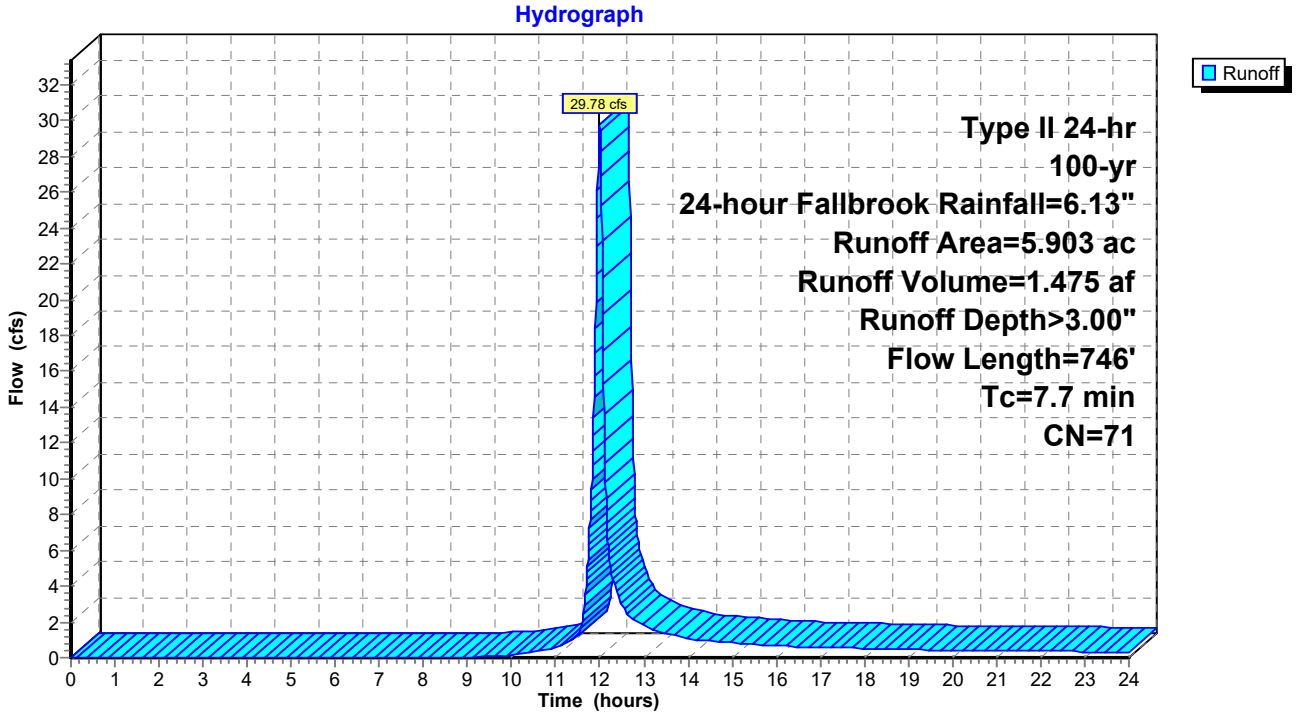
Runoff = 29.78 cfs @ 11.99 hrs, Volume= 1.475 af, Depth> 3.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-yr, 24-hour Fallbrook Rainfall=6.13"

Area (ac)	CN	Description
5.903	71	Meadow, non-grazed, HSG C
5.903		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.0	50	0.0800	0.21		**Sheet Flow, A-B** Cultivated: Residue>20% n= 0.170 P2= 2.54"
2.4	314	0.0960	2.17		**Shallow Concentrated Flow, B-C** Short Grass Pasture Kv= 7.0 fps
0.8	340	0.0318	7.33	21.98	**Trap/Vee/Rect Channel Flow, C-D** Bot.W=0.00' D=1.00' Z= 3.0 '/' Top.W=6.00' n= 0.022 Earth, clean & straight
0.5	42	0.0357	1.32		**Shallow Concentrated Flow, D-E** Short Grass Pasture Kv= 7.0 fps
7.7	746	Total			

Subcatchment 2A: SC-2A



Summary for Subcatchment 2B: SC-2B

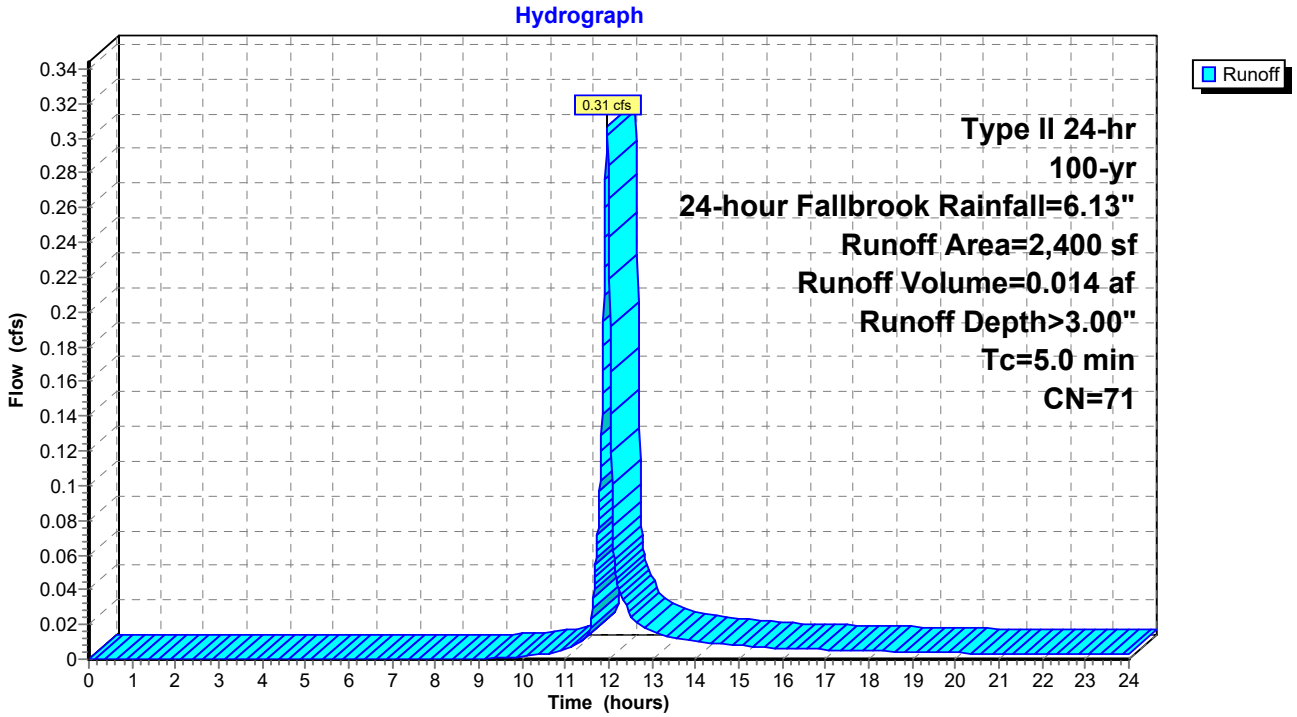
Runoff = 0.31 cfs @ 11.96 hrs, Volume= 0.014 af, Depth> 3.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-yr, 24-hour Fallbrook Rainfall=6.13"

Area (sf)	CN	Description
2,400	71	Meadow, non-grazed, HSG C
2,400		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, 5 minute min.**

Subcatchment 2B: SC-2B



Summary for Subcatchment 2C: SC-2C

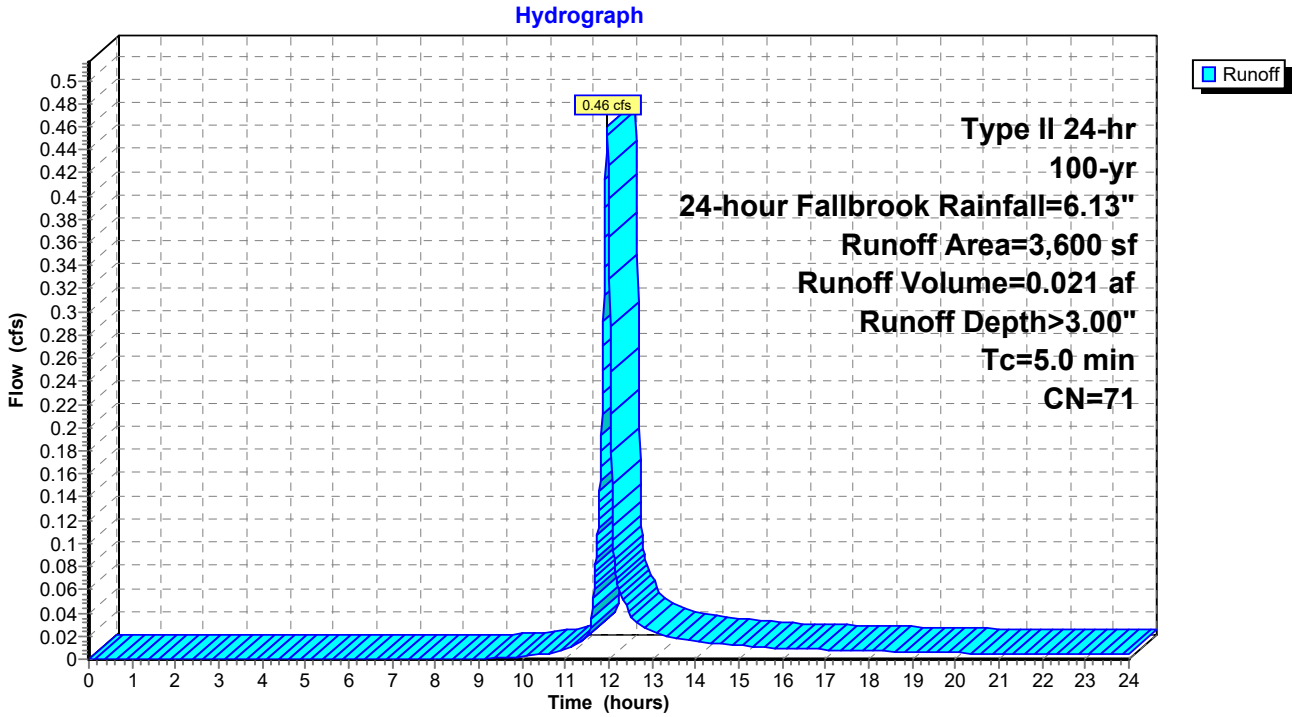
Runoff = 0.46 cfs @ 11.96 hrs, Volume= 0.021 af, Depth> 3.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-yr, 24-hour Fallbrook Rainfall=6.13"

Area (sf)	CN	Description
3,600	71	Meadow, non-grazed, HSG C
3,600		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, 5 minute min.**

Subcatchment 2C: SC-2C



Summary for Subcatchment 2D: SC-2D

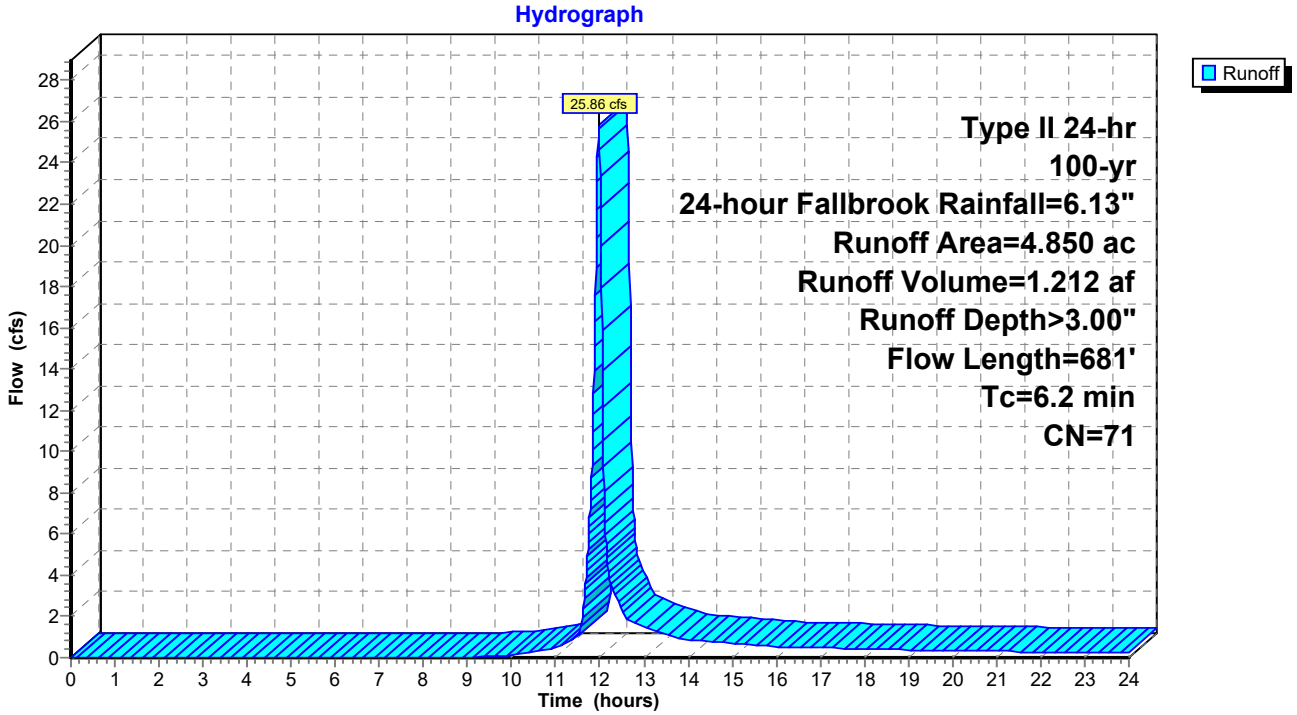
Runoff = 25.86 cfs @ 11.98 hrs, Volume= 1.212 af, Depth> 3.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-yr, 24-hour Fallbrook Rainfall=6.13"

Area (ac)	CN	Description
4.850	71	Meadow, non-grazed, HSG C
4.850		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.2	50	0.1400	0.69		**Sheet Flow, A-B** Fallow n= 0.050 P2= 2.54"
4.0	406	0.0580	1.69		**Shallow Concentrated Flow, B-C** Short Grass Pasture Kv= 7.0 fps
0.8	100	0.1000	2.21		**Shallow Concentrated Flow, C-D** Short Grass Pasture Kv= 7.0 fps
0.2	125	0.0640	12.10	145.18	**Trap/Vee/Rect Channel Flow, D-E** Bot.W=0.00' D=2.00' Z= 3.0 '/' Top.W=12.00' n= 0.030 Earth, grassed & winding
6.2	681	Total			

Subcatchment 2D: SC-2D



Summary for Subcatchment 3A: SC-3A

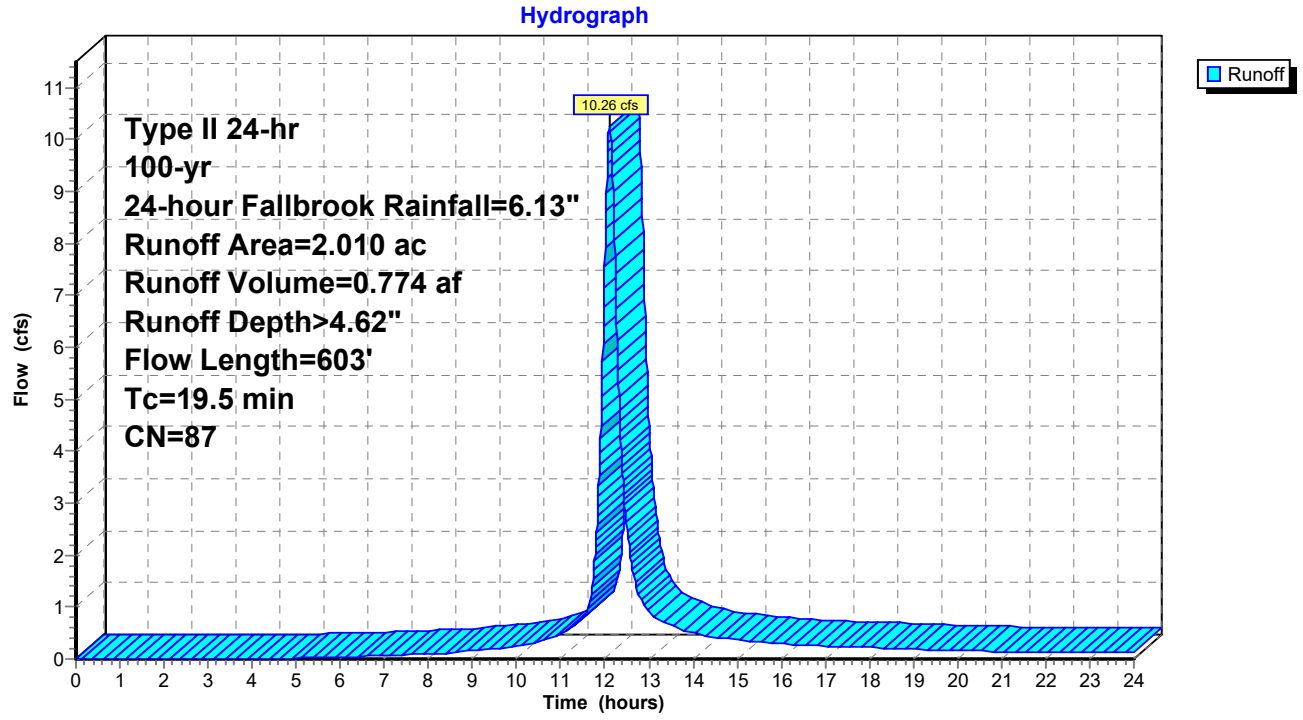
Runoff = 10.26 cfs @ 12.11 hrs, Volume= 0.774 af, Depth> 4.62"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-yr, 24-hour Fallbrook Rainfall=6.13"

Area (ac)	CN	Description
0.840	71	Meadow, non-grazed, HSG C
1.170	98	Paved parking, HSG C
2.010	87	Weighted Average
0.840		41.79% Pervious Area
1.170		58.21% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.5	50	0.0200	0.55		**Sheet Flow, A-B, Gravel Overland Flow** n= 0.025 P2= 2.54"
17.1	460	0.0500	0.45		**Shallow Concentrated Flow, B-C, Slope of 5%, nearly bare grour** Kv= 2.0 fps
0.8	50	0.0200	0.99		**Shallow Concentrated Flow, C-D** Short Grass Pasture Kv= 7.0 fps
0.1	43	0.0200	8.34	6.55	**Pipe Channel, D-E** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.010 PVC, smooth interior
19.5	603	Total			

Subcatchment 3A: SC-3A



Summary for Subcatchment 3B: SC-3B

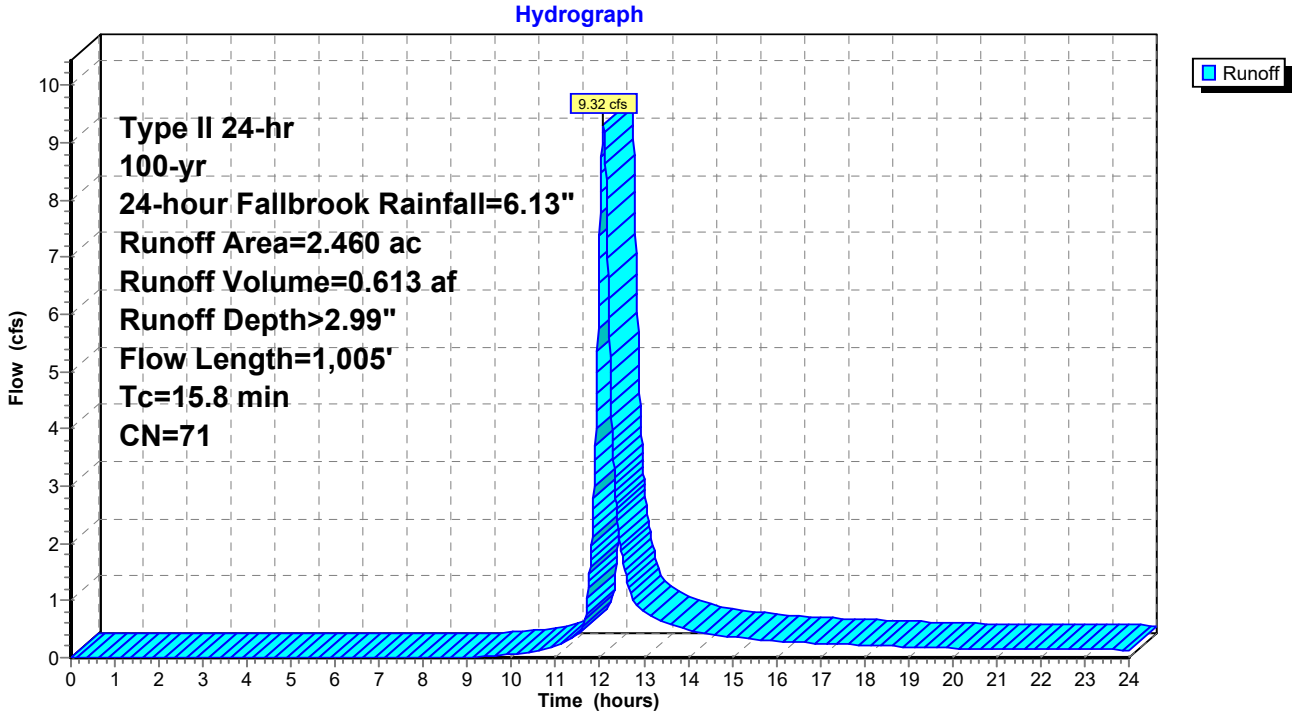
Runoff = 9.32 cfs @ 12.08 hrs, Volume= 0.613 af, Depth> 2.99"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-yr, 24-hour Fallbrook Rainfall=6.13"

Area (ac)	CN	Description
2.460	71	Meadow, non-grazed, HSG C
2.460		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.3	50	0.0400	0.16		**Sheet Flow, A-B** Cultivated: Residue>20% n= 0.170 P2= 2.54"
2.5	269	0.0669	1.81		**Shallow Concentrated Flow, B-C** Short Grass Pasture Kv= 7.0 fps
1.6	305	0.0400	3.14	0.39	**Trap/Vee/Rect Channel Flow, C-D** Bot.W=0.00' D=0.25' Z= 2.0 '/' Top.W=1.00' n= 0.022 Earth, clean & straight
6.4	381	0.0200	0.99		**Shallow Concentrated Flow, D-E** Short Grass Pasture Kv= 7.0 fps
15.8	1,005	Total			

Subcatchment 3B: SC-3B



Summary for Subcatchment R: Road

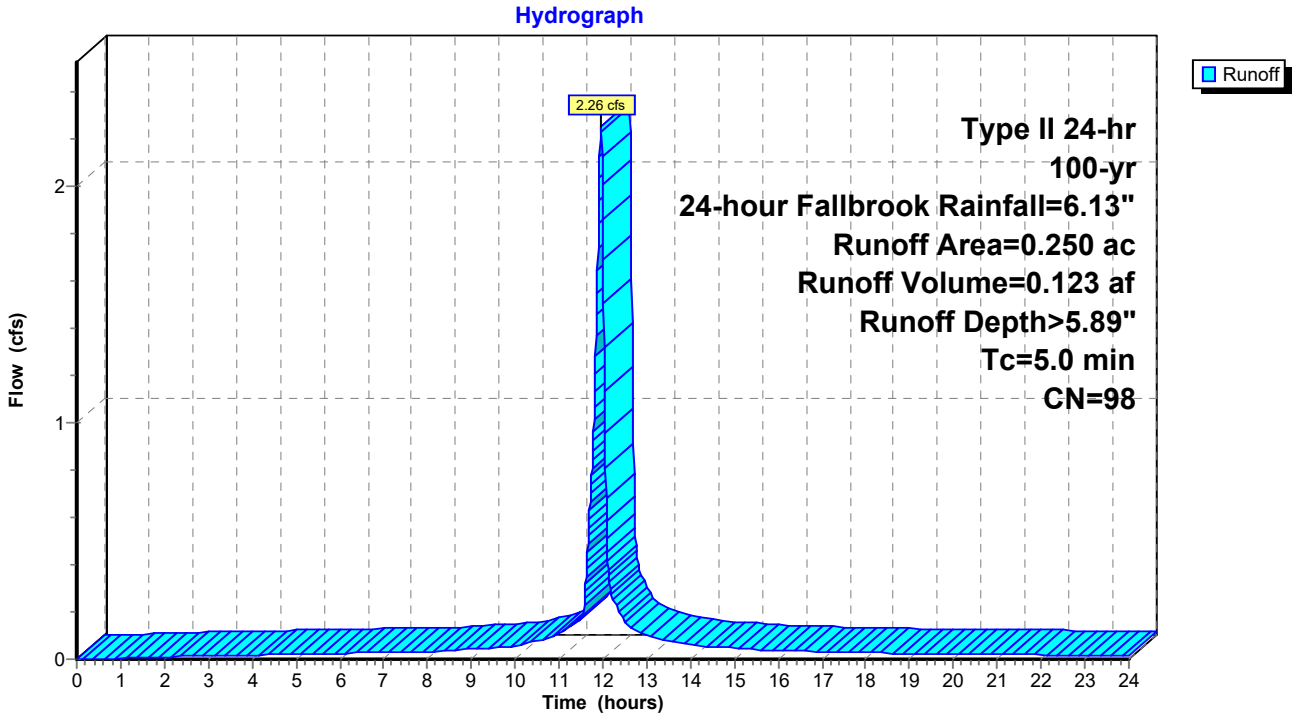
Runoff = 2.26 cfs @ 11.96 hrs, Volume= 0.123 af, Depth> 5.89"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-yr, 24-hour Fallbrook Rainfall=6.13"

Area (ac)	CN	Description
0.250	98	Paved roads w/curbs & sewers, HSG C
0.250		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, 5 minute min.**

Subcatchment R: Road



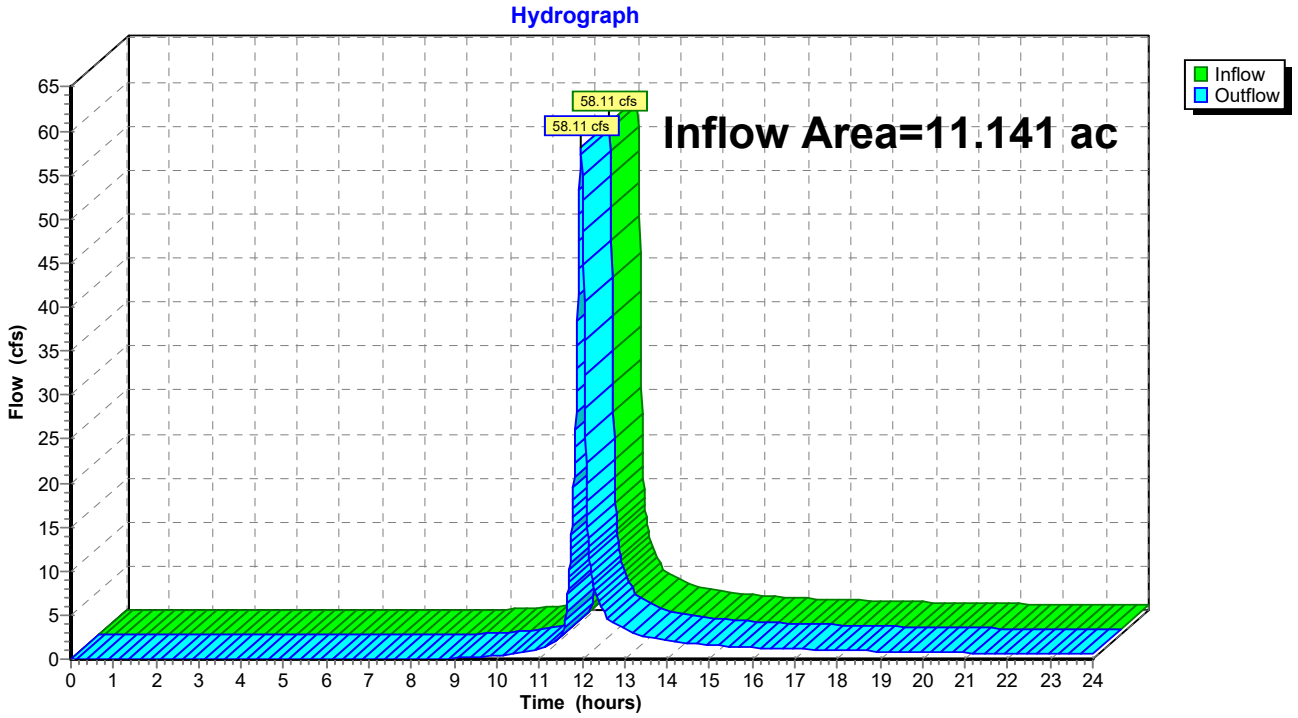
Summary for Reach AP2: AP-2

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 11.141 ac, 2.24% Impervious, Inflow Depth > 3.06" for 100-yr, 24-hour Fallbrook event
Inflow = 58.11 cfs @ 11.98 hrs, Volume= 2.844 af
Outflow = 58.11 cfs @ 11.98 hrs, Volume= 2.844 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Reach AP2: AP-2



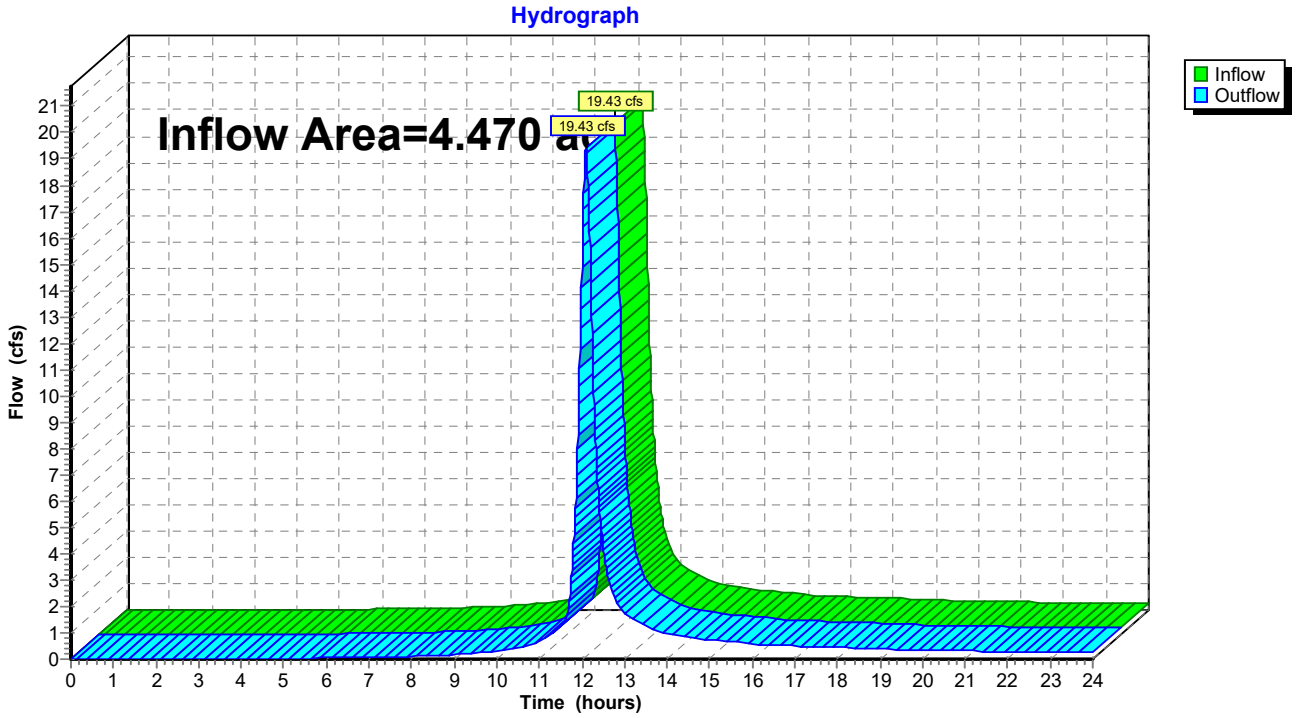
Summary for Reach AP3: AP-3

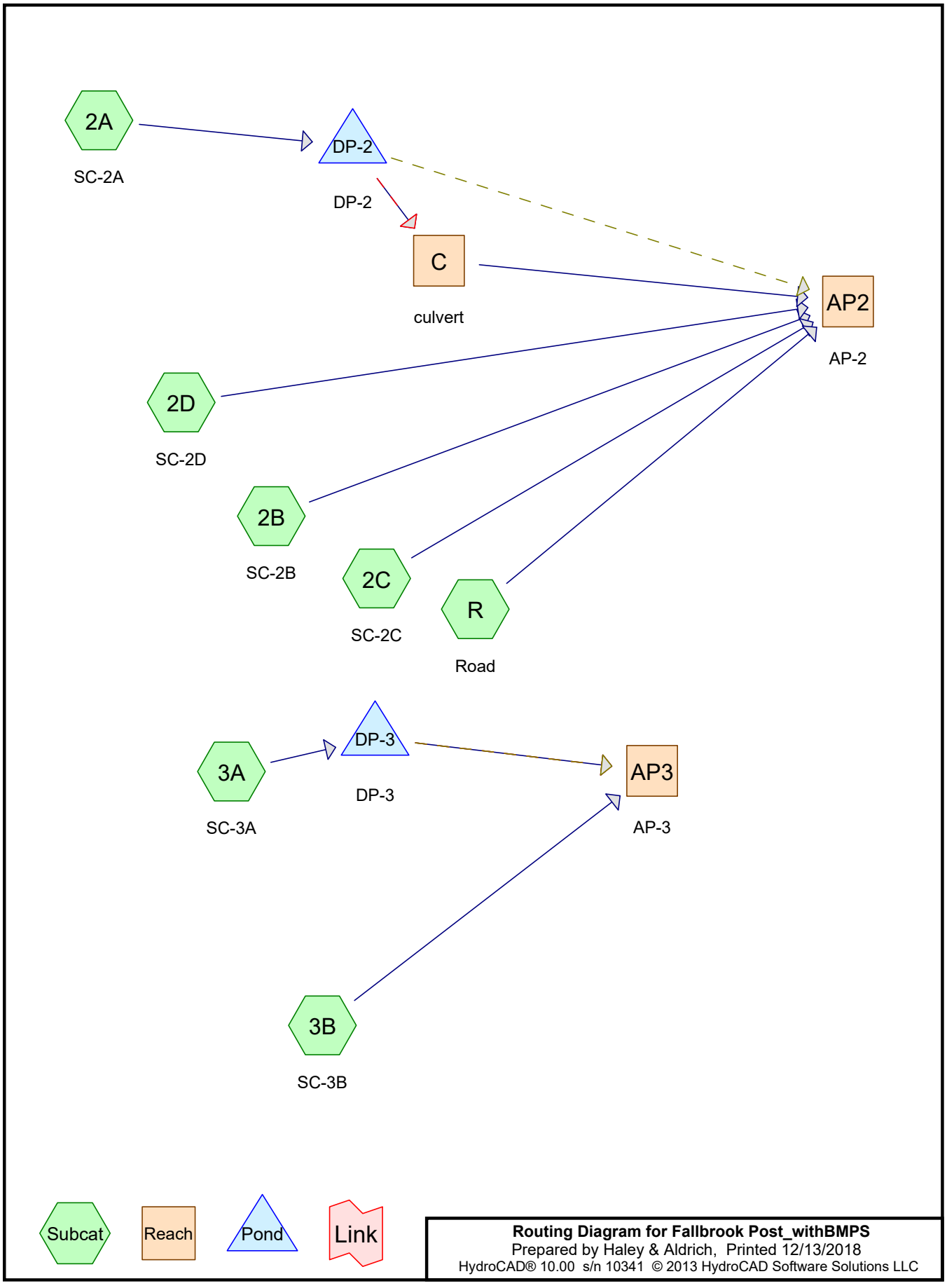
[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 4.470 ac, 26.17% Impervious, Inflow Depth > 3.72" for 100-yr, 24-hour Fallbrook event
Inflow = 19.43 cfs @ 12.10 hrs, Volume= 1.387 af
Outflow = 19.43 cfs @ 12.10 hrs, Volume= 1.387 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Reach AP3: AP-3





Routing Diagram for Fallbrook Post_withBMPS
Prepared by Haley & Aldrich, Printed 12/13/2018

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
14.191	71	Meadow, non-grazed, HSG C (2A, 2B, 2C, 2D, 3A, 3B)
1.170	98	Paved parking, HSG C (3A)
0.250	98	Paved roads w/curbs & sewers, HSG C (R)
15.611	**73**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
15.611	HSG C	2A, 2B, 2C, 2D, 3A, 3B, R
0.000	HSG D	
0.000	Other	
15.611		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.000	14.191	0.000	0.000	14.191	Meadow, non-grazed	2A, 2B, 2C, 2D, 3A, 3B
0.000	0.000	1.170	0.000	0.000	1.170	Paved parking	3A
0.000	0.000	0.250	0.000	0.000	0.250	Paved roads w/curbs & sewers	R
0.000	**0.000**	**15.611**	**0.000**	**0.000**	**15.611**	**TOTAL AREA**	

Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Diam/Width (inches)	Height (inches)	Inside-Fill (inches)
1	3A	0.00	0.00	43.0	0.0200	0.010	12.0	0.0	0.0
2	C	0.00	-6.00	200.0	0.0300	0.010	18.0	0.0	0.0

Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment2A: SC-2A Runoff Area=5.903 ac 0.00% Impervious Runoff Depth>3.00"
Flow Length=746' Tc=7.7 min CN=71 Runoff=29.78 cfs 1.475 af

Subcatchment2B: SC-2B Runoff Area=2,400 sf 0.00% Impervious Runoff Depth>3.00"
Tc=5.0 min CN=71 Runoff=0.31 cfs 0.014 af

Subcatchment2C: SC-2C Runoff Area=3,600 sf 0.00% Impervious Runoff Depth>3.00"
Tc=5.0 min CN=71 Runoff=0.46 cfs 0.021 af

Subcatchment2D: SC-2D Runoff Area=4.850 ac 0.00% Impervious Runoff Depth>3.00"
Flow Length=681' Tc=6.2 min CN=71 Runoff=25.86 cfs 1.212 af

Subcatchment3A: SC-3A Runoff Area=2.010 ac 58.21% Impervious Runoff Depth>4.62"
Flow Length=603' Tc=19.5 min CN=87 Runoff=10.26 cfs 0.774 af

Subcatchment3B: SC-3B Runoff Area=2.460 ac 0.00% Impervious Runoff Depth>2.99"
Flow Length=1,005' Tc=15.8 min CN=71 Runoff=9.32 cfs 0.613 af

SubcatchmentR: Road Runoff Area=0.250 ac 100.00% Impervious Runoff Depth>5.89"
Tc=5.0 min CN=98 Runoff=2.26 cfs 0.123 af

Reach AP2: AP-2 Inflow=36.94 cfs 2.498 af
Outflow=36.94 cfs 2.498 af

Reach AP3: AP-3 Inflow=16.50 cfs 1.191 af
Outflow=16.50 cfs 1.191 af

Reach C: culvert Avg. Flow Depth=1.10' Max Vel=15.09 fps Inflow=21.04 cfs 1.130 af
18.0" Round Pipe n=0.010 L=200.0' S=0.0300 '/' Capacity=23.65 cfs Outflow=20.71 cfs 1.129 af

Pond DP-2: DP-2 Peak Elev=4.95' Storage=22,132 cf Inflow=29.78 cfs 1.475 af
Primary=14.72 cfs 1.108 af Secondary=6.32 cfs 0.022 af Outflow=21.04 cfs 1.130 af

Pond DP-3: DP-3 Peak Elev=4.82' Storage=11,906 cf Inflow=10.26 cfs 0.774 af
Primary=4.90 cfs 0.492 af Secondary=4.15 cfs 0.085 af Outflow=9.04 cfs 0.578 af

Total Runoff Area = 15.611 ac Runoff Volume = 4.231 af Average Runoff Depth = 3.25"
90.90% Pervious = 14.191 ac 9.10% Impervious = 1.420 ac

Summary for Subcatchment 2A: SC-2A

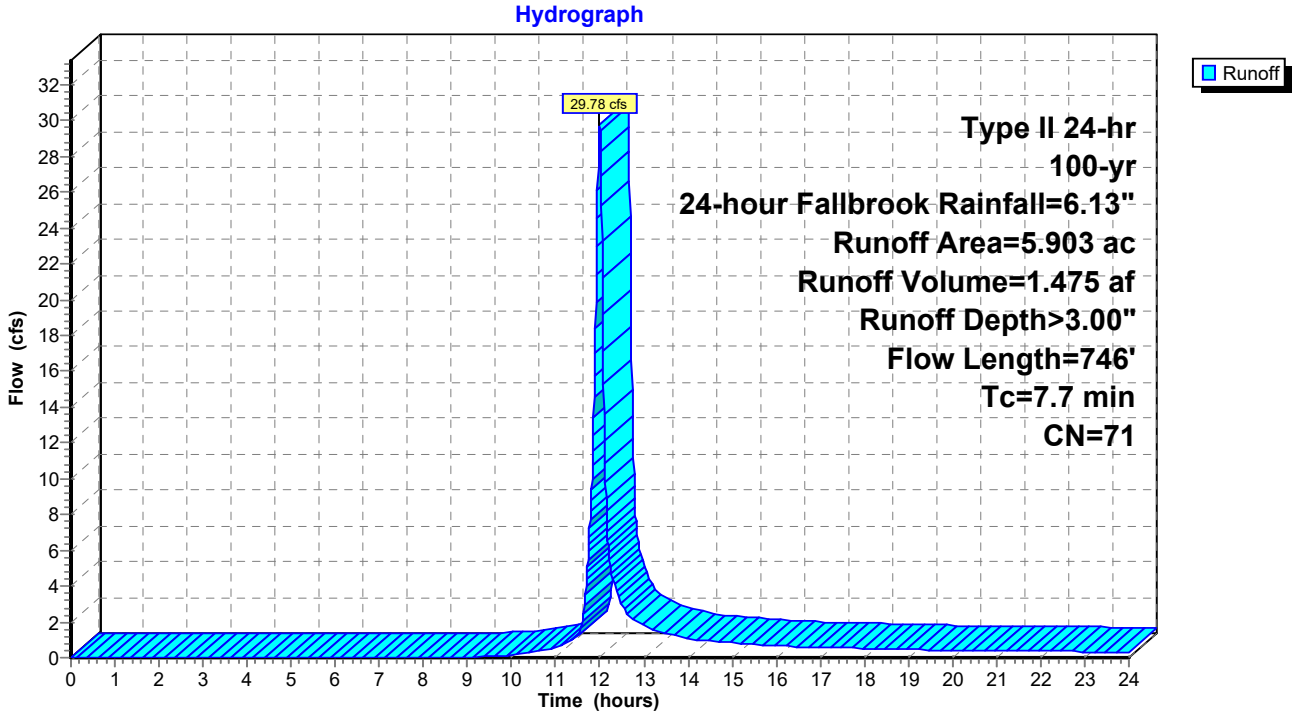
Runoff = 29.78 cfs @ 11.99 hrs, Volume= 1.475 af, Depth> 3.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-yr, 24-hour Fallbrook Rainfall=6.13"

Area (ac)	CN	Description
5.903	71	Meadow, non-grazed, HSG C
5.903		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.0	50	0.0800	0.21		**Sheet Flow, A-B** Cultivated: Residue>20% n= 0.170 P2= 2.54"
2.4	314	0.0960	2.17		**Shallow Concentrated Flow, B-C** Short Grass Pasture Kv= 7.0 fps
0.8	340	0.0318	7.33	21.98	**Trap/Vee/Rect Channel Flow, C-D** Bot.W=0.00' D=1.00' Z= 3.0 '/' Top.W=6.00' n= 0.022 Earth, clean & straight
0.5	42	0.0357	1.32		**Shallow Concentrated Flow, D-E** Short Grass Pasture Kv= 7.0 fps
7.7	746	Total			

Subcatchment 2A: SC-2A



Summary for Subcatchment 2B: SC-2B

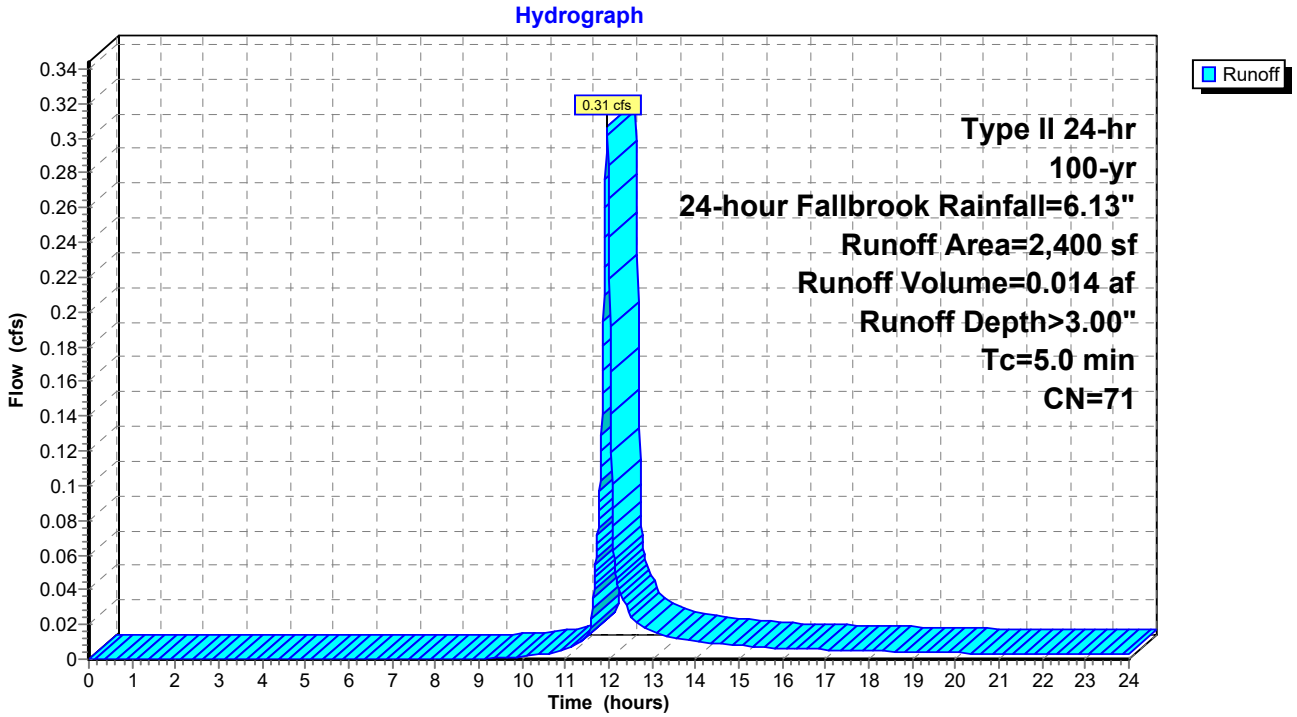
Runoff = 0.31 cfs @ 11.96 hrs, Volume= 0.014 af, Depth> 3.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-yr, 24-hour Fallbrook Rainfall=6.13"

Area (sf)	CN	Description
2,400	71	Meadow, non-grazed, HSG C
2,400		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, 5 minute min.**

Subcatchment 2B: SC-2B



Summary for Subcatchment 2C: SC-2C

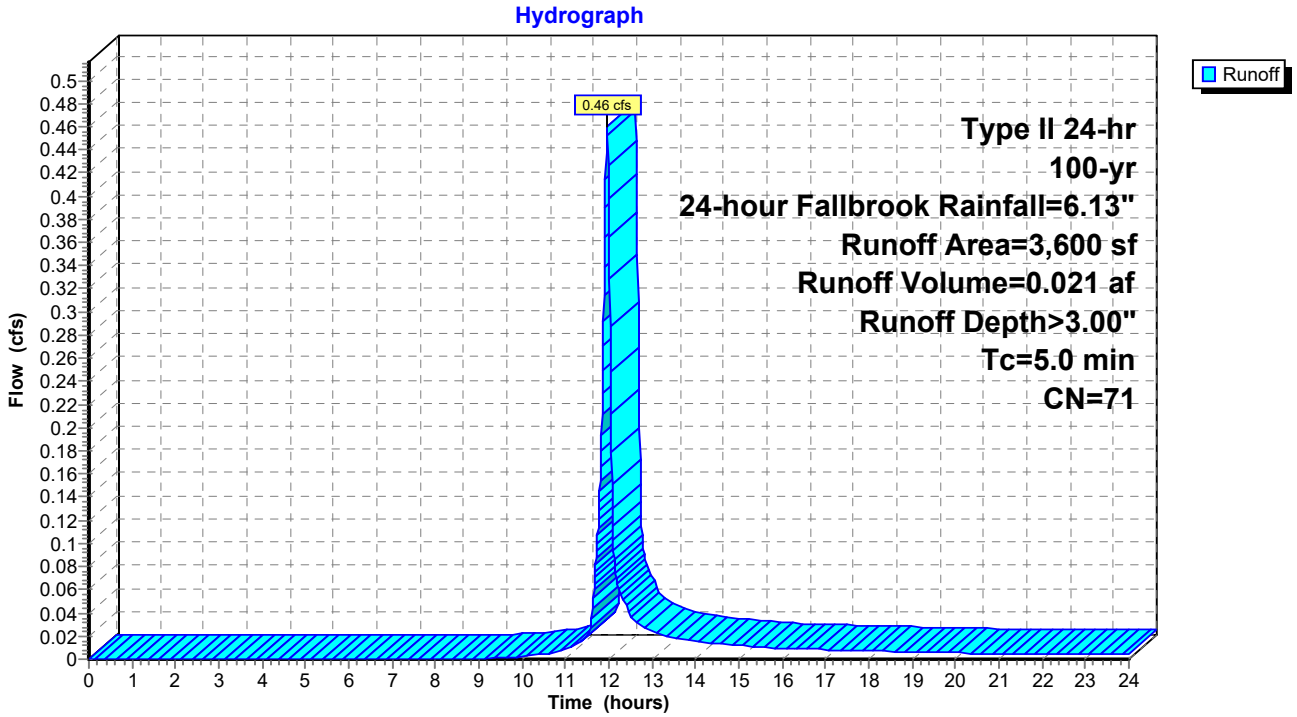
Runoff = 0.46 cfs @ 11.96 hrs, Volume= 0.021 af, Depth> 3.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-yr, 24-hour Fallbrook Rainfall=6.13"

Area (sf)	CN	Description
3,600	71	Meadow, non-grazed, HSG C
3,600		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, 5 minute min.**

Subcatchment 2C: SC-2C



Summary for Subcatchment 2D: SC-2D

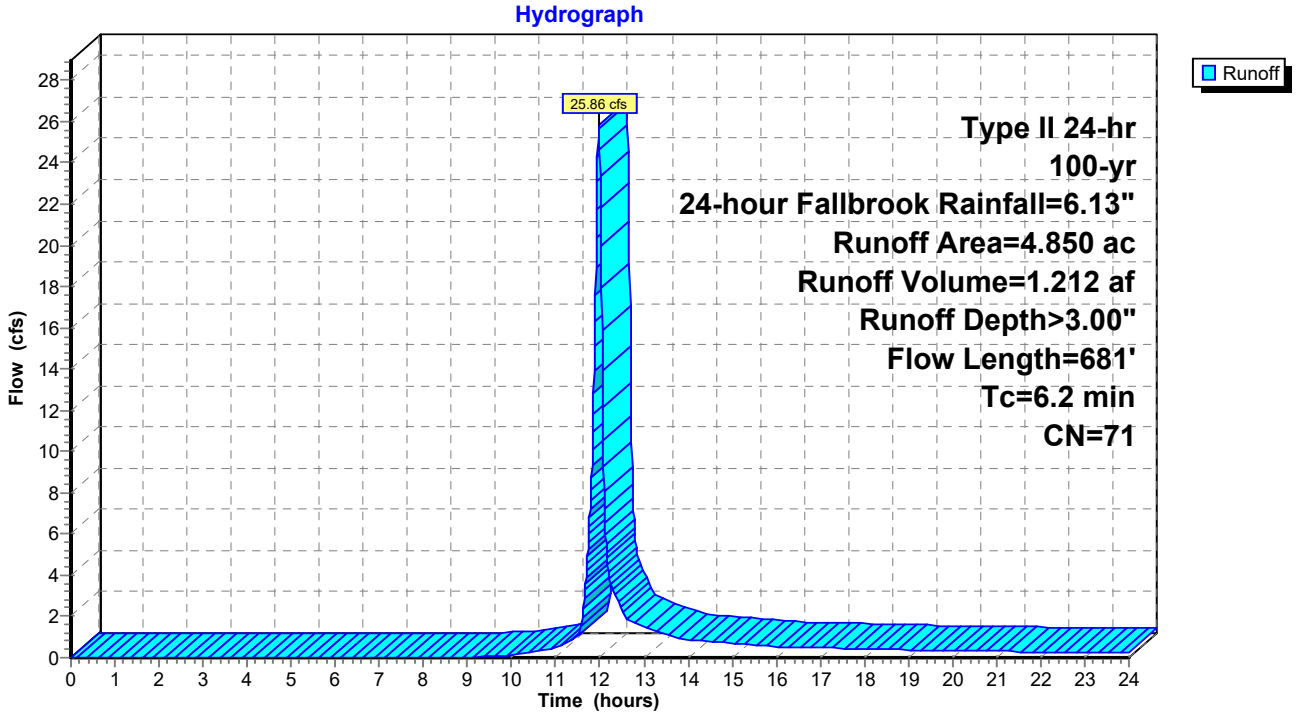
Runoff = 25.86 cfs @ 11.98 hrs, Volume= 1.212 af, Depth> 3.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-yr, 24-hour Fallbrook Rainfall=6.13"

Area (ac)	CN	Description
4.850	71	Meadow, non-grazed, HSG C
4.850		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.2	50	0.1400	0.69		**Sheet Flow, A-B** Fallow n= 0.050 P2= 2.54"
4.0	406	0.0580	1.69		**Shallow Concentrated Flow, B-C** Short Grass Pasture Kv= 7.0 fps
0.8	100	0.1000	2.21		**Shallow Concentrated Flow, C-D** Short Grass Pasture Kv= 7.0 fps
0.2	125	0.0640	12.10	145.18	**Trap/Vee/Rect Channel Flow, D-E** Bot.W=0.00' D=2.00' Z= 3.0 '/' Top.W=12.00' n= 0.030 Earth, grassed & winding
6.2	681	Total			

Subcatchment 2D: SC-2D



Summary for Subcatchment 3A: SC-3A

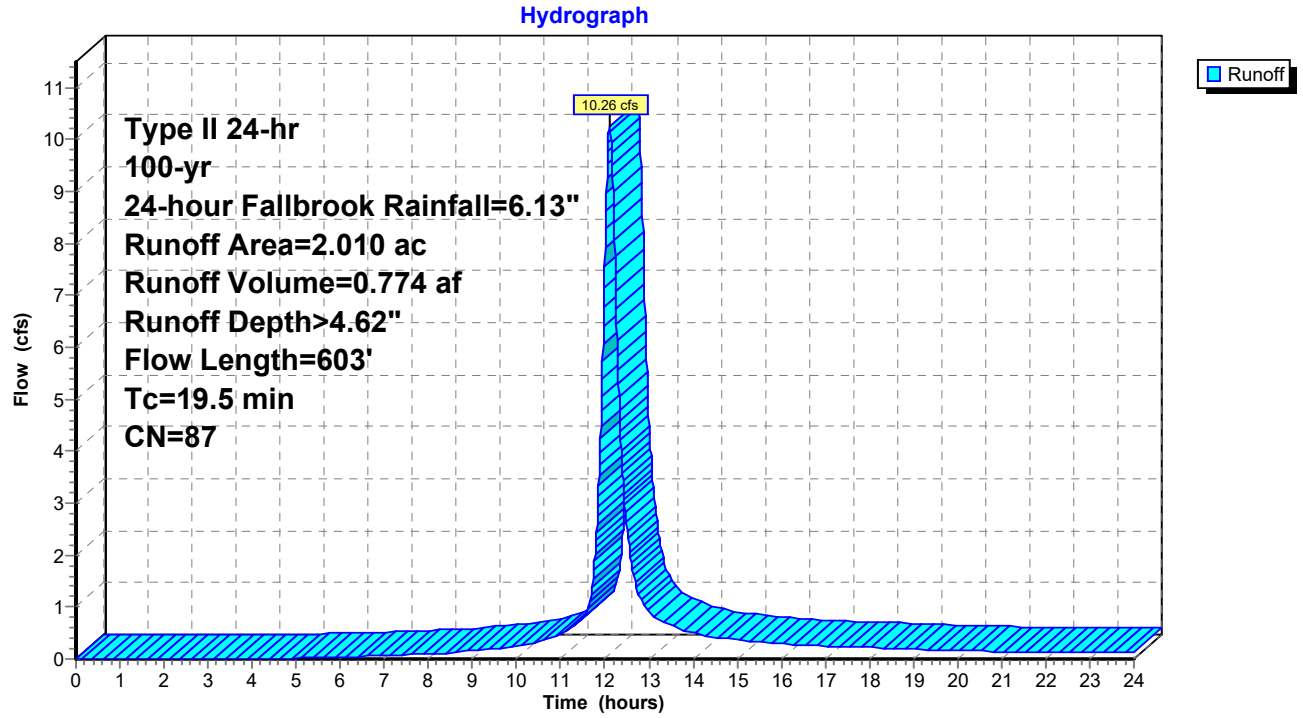
Runoff = 10.26 cfs @ 12.11 hrs, Volume= 0.774 af, Depth> 4.62"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-yr, 24-hour Fallbrook Rainfall=6.13"

Area (ac)	CN	Description
0.840	71	Meadow, non-grazed, HSG C
1.170	98	Paved parking, HSG C
2.010	87	Weighted Average
0.840		41.79% Pervious Area
1.170		58.21% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.5	50	0.0200	0.55		**Sheet Flow, A-B, Gravel Overland Flow** n= 0.025 P2= 2.54"
17.1	460	0.0500	0.45		**Shallow Concentrated Flow, B-C, Slope of 5%, nearly bare grour** Kv= 2.0 fps
0.8	50	0.0200	0.99		**Shallow Concentrated Flow, C-D** Short Grass Pasture Kv= 7.0 fps
0.1	43	0.0200	8.34	6.55	**Pipe Channel, D-E** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.010 PVC, smooth interior
19.5	603	Total			

Subcatchment 3A: SC-3A



Summary for Subcatchment 3B: SC-3B

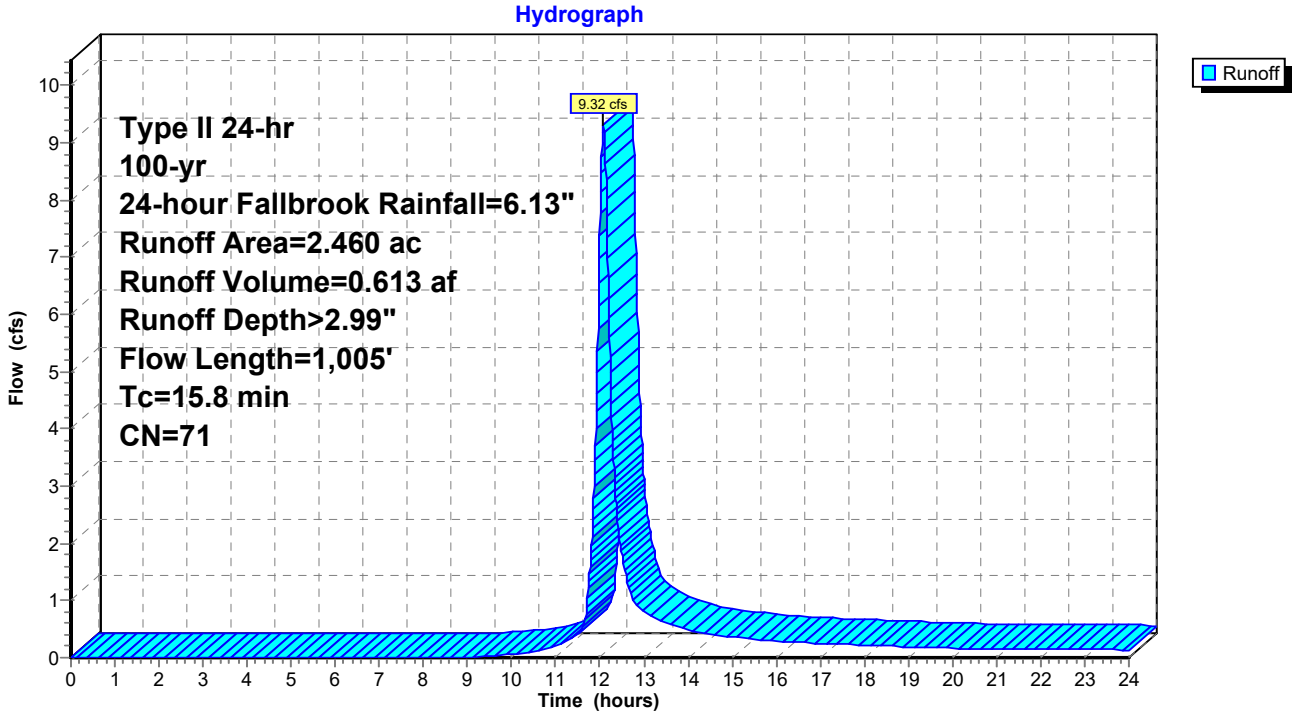
Runoff = 9.32 cfs @ 12.08 hrs, Volume= 0.613 af, Depth> 2.99"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-yr, 24-hour Fallbrook Rainfall=6.13"

Area (ac)	CN	Description
2.460	71	Meadow, non-grazed, HSG C
2.460		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.3	50	0.0400	0.16		**Sheet Flow, A-B** Cultivated: Residue>20% n= 0.170 P2= 2.54"
2.5	269	0.0669	1.81		**Shallow Concentrated Flow, B-C** Short Grass Pasture Kv= 7.0 fps
1.6	305	0.0400	3.14	0.39	**Trap/Vee/Rect Channel Flow, C-D** Bot.W=0.00' D=0.25' Z= 2.0 '/' Top.W=1.00' n= 0.022 Earth, clean & straight
6.4	381	0.0200	0.99		**Shallow Concentrated Flow, D-E** Short Grass Pasture Kv= 7.0 fps
15.8	1,005	Total			

Subcatchment 3B: SC-3B



Summary for Subcatchment R: Road

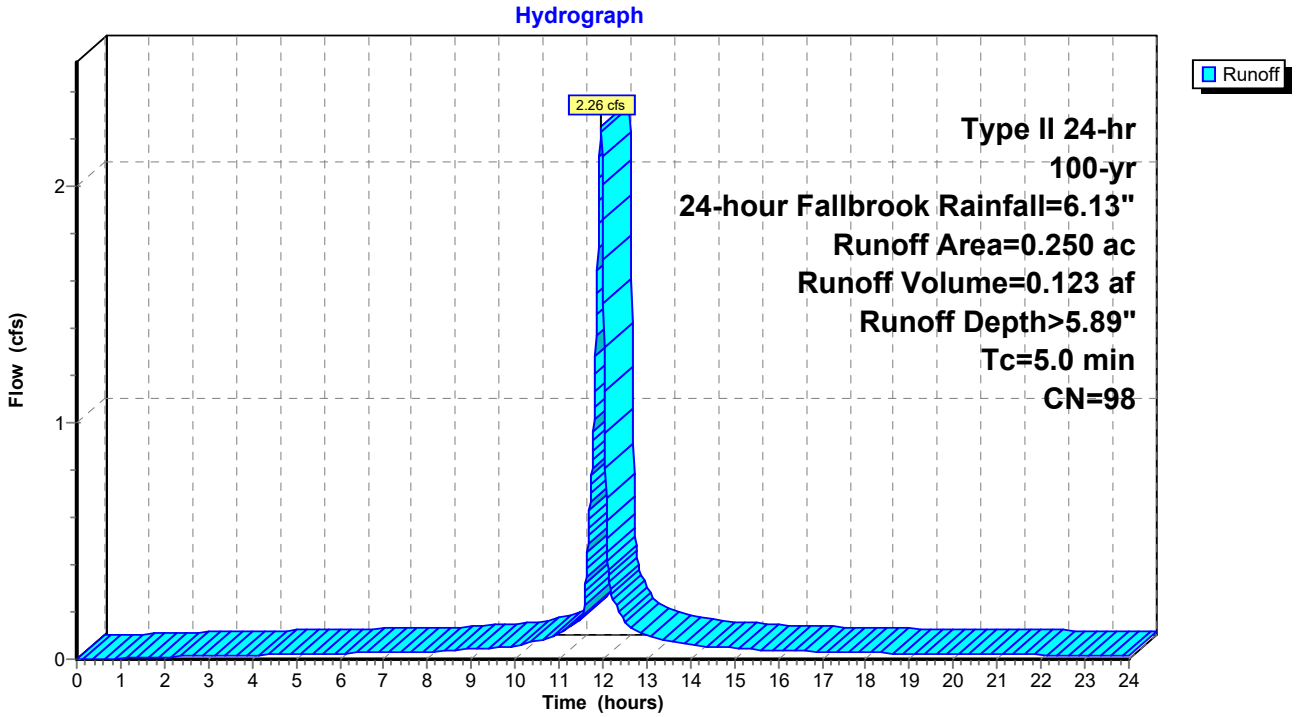
Runoff = 2.26 cfs @ 11.96 hrs, Volume= 0.123 af, Depth> 5.89"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-yr, 24-hour Fallbrook Rainfall=6.13"

Area (ac)	CN	Description
0.250	98	Paved roads w/curbs & sewers, HSG C
0.250		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, 5 minute min.**

Subcatchment R: Road



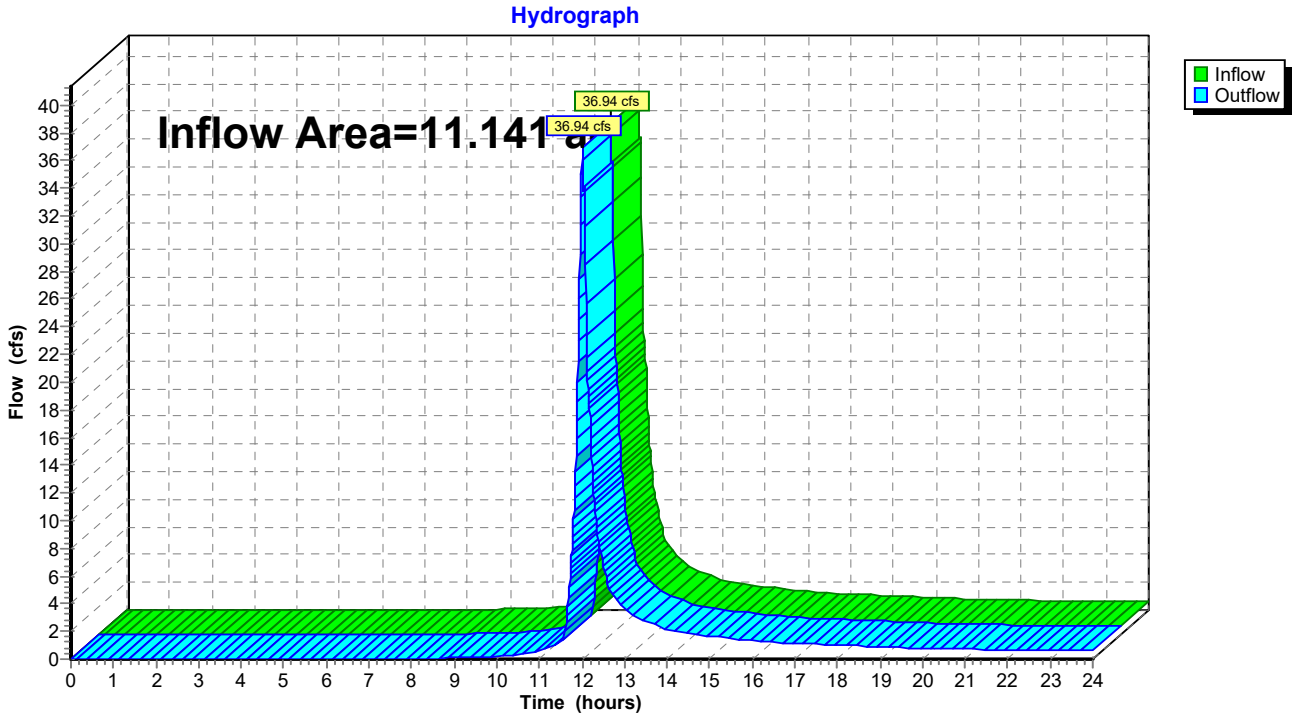
Summary for Reach AP2: AP-2

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 11.141 ac, 2.24% Impervious, Inflow Depth > 2.69" for 100-yr, 24-hour Fallbrook event
Inflow = 36.94 cfs @ 12.01 hrs, Volume= 2.498 af
Outflow = 36.94 cfs @ 12.01 hrs, Volume= 2.498 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Reach AP2: AP-2



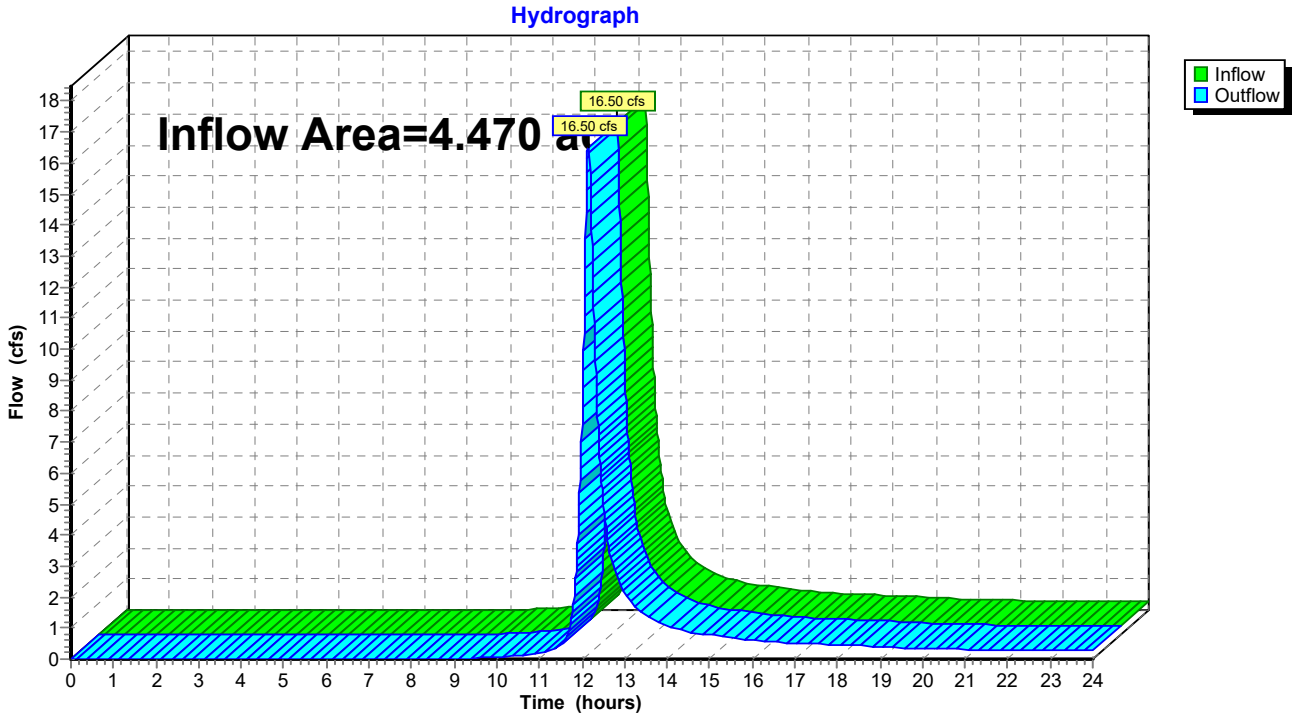
Summary for Reach AP3: AP-3

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 4.470 ac, 26.17% Impervious, Inflow Depth > 3.20" for 100-yr, 24-hour Fallbrook event
Inflow = 16.50 cfs @ 12.15 hrs, Volume= 1.191 af
Outflow = 16.50 cfs @ 12.15 hrs, Volume= 1.191 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Reach AP3: AP-3



Summary for Reach C: culvert

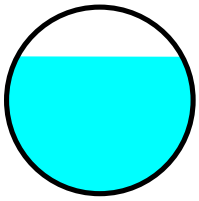
[52] Hint: Inlet/Outlet conditions not evaluated
[65] Warning: Inlet elevation not specified

Inflow Area = 5.903 ac, 0.00% Impervious, Inflow Depth > 2.30" for 100-yr, 24-hour Fallbrook event
Inflow = 21.04 cfs @ 12.06 hrs, Volume= 1.130 af
Outflow = 20.71 cfs @ 12.07 hrs, Volume= 1.129 af, Atten= 2%, Lag= 0.5 min

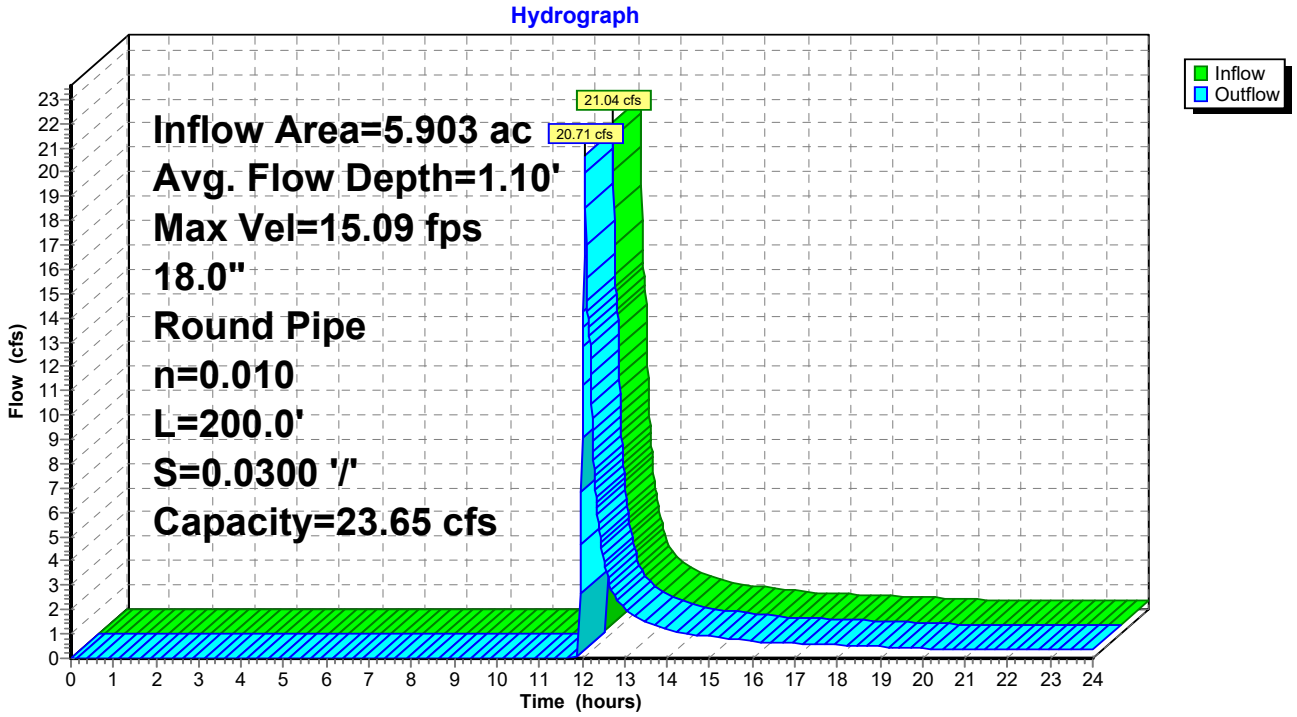
Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 15.09 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 6.07 fps, Avg. Travel Time= 0.5 min

Peak Storage= 279 cf @ 12.06 hrs
Average Depth at Peak Storage= 1.10'
Bank-Full Depth= 1.50' Flow Area= 1.8 sf, Capacity= 23.65 cfs

18.0" Round Pipe
n= 0.010 PVC, smooth interior
Length= 200.0' Slope= 0.0300 '/'
Inlet Invert= 0.00', Outlet Invert= -6.00'



Reach C: culvert



Summary for Pond DP-2: DP-2

Inflow Area = 5.903 ac, 0.00% Impervious, Inflow Depth > 3.00" for 100-yr, 24-hour Fallbrook event
Inflow = 29.78 cfs @ 11.99 hrs, Volume= 1.475 af
Outflow = 21.04 cfs @ 12.06 hrs, Volume= 1.130 af, Atten= 29%, Lag= 4.1 min
Primary = 14.72 cfs @ 12.06 hrs, Volume= 1.108 af
Secondary = 6.32 cfs @ 12.06 hrs, Volume= 0.022 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 4.95' @ 12.06 hrs Surf.Area= 0 sf Storage= 22,132 cf

Plug-Flow detention time= 140.1 min calculated for 1.130 af (77% of inflow)
Center-of-Mass det. time= 48.4 min (880.3 - 831.9)

Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	22,555 cf	**Custom Stage Data** Listed below

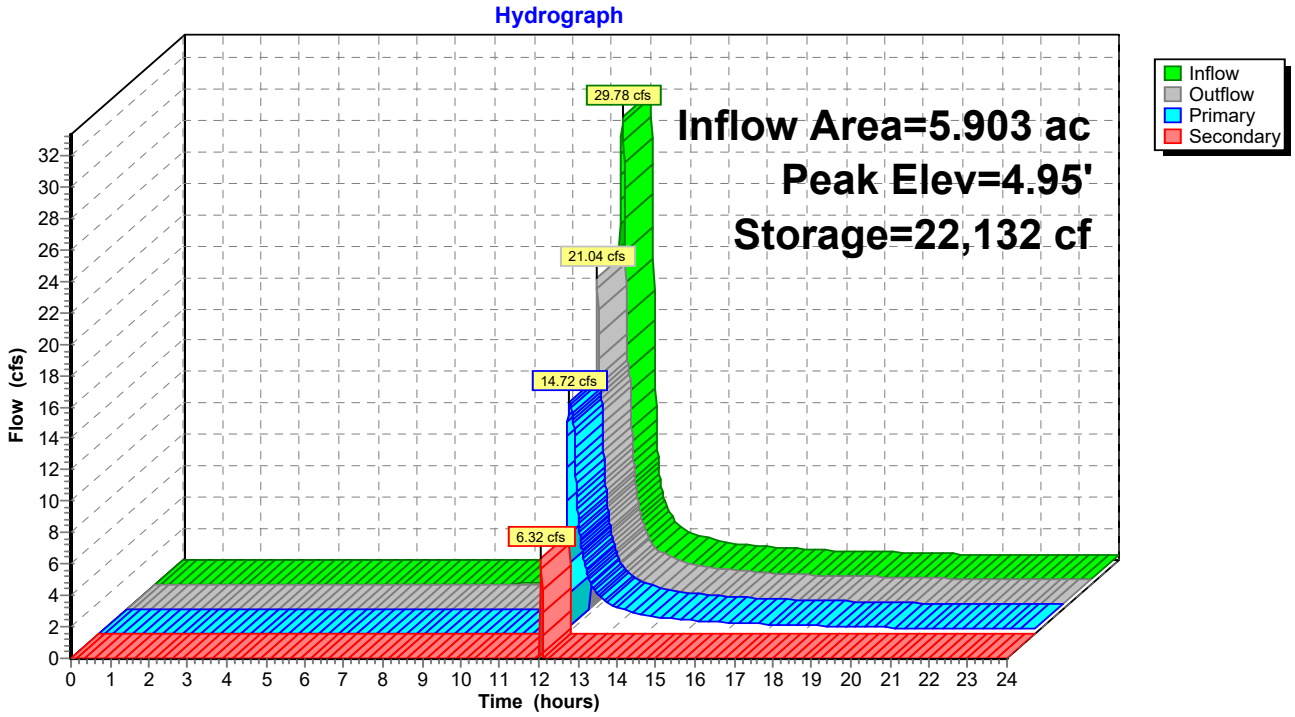
Elevation (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
0.00	0	0
1.00	3,222	3,222
1.50	806	4,028
3.00	2,417	6,445
4.00	8,055	14,500
5.00	8,055	22,555

Device	Routing	Invert	Outlet Devices
#1	Secondary	4.90'	**227.0' long x 1.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 Coef. (English) 2.69 2.72 2.75 2.85 2.98 3.08 3.20 3.28 3.31 3.30 3.31 3.32
#2	Primary	4.00'	**24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=14.72 cfs @ 12.06 hrs HW=4.95' (Free Discharge)
└**2=Orifice/Grate** (Orifice Controls 14.72 cfs @ 4.68 fps)

Secondary OutFlow Max=6.11 cfs @ 12.06 hrs HW=4.95' (Free Discharge)
└**1=Broad-Crested Rectangular Weir** (Weir Controls 6.11 cfs @ 0.58 fps)

Pond DP-2: DP-2


Hydrograph
Inflow Area=5.903 ac
Peak Elev=4.95'
Storage=22,132 cf
29.78 cfs
21.04 cfs
14.72 cfs
6.32 cfs
Inflow
Outflow
Primary
Secondary
Flow (cfs)
Time (hours)
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24

Summary for Pond DP-3: DP-3

Inflow Area = 2.010 ac, 58.21% Impervious, Inflow Depth > 4.62" for 100-yr, 24-hour Fallbrook event
Inflow = 10.26 cfs @ 12.11 hrs, Volume= 0.774 af
Outflow = 9.04 cfs @ 12.19 hrs, Volume= 0.578 af, Atten= 12%, Lag= 4.6 min
Primary = 4.90 cfs @ 12.19 hrs, Volume= 0.492 af
Secondary = 4.15 cfs @ 12.19 hrs, Volume= 0.085 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 4.82' @ 12.19 hrs Surf.Area= 0 sf Storage= 11,906 cf

Plug-Flow detention time= 149.7 min calculated for 0.577 af (75% of inflow)
Center-of-Mass det. time= 62.0 min (862.6 - 800.5)

Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	12,727 cf	**Custom Stage Data** Listed below

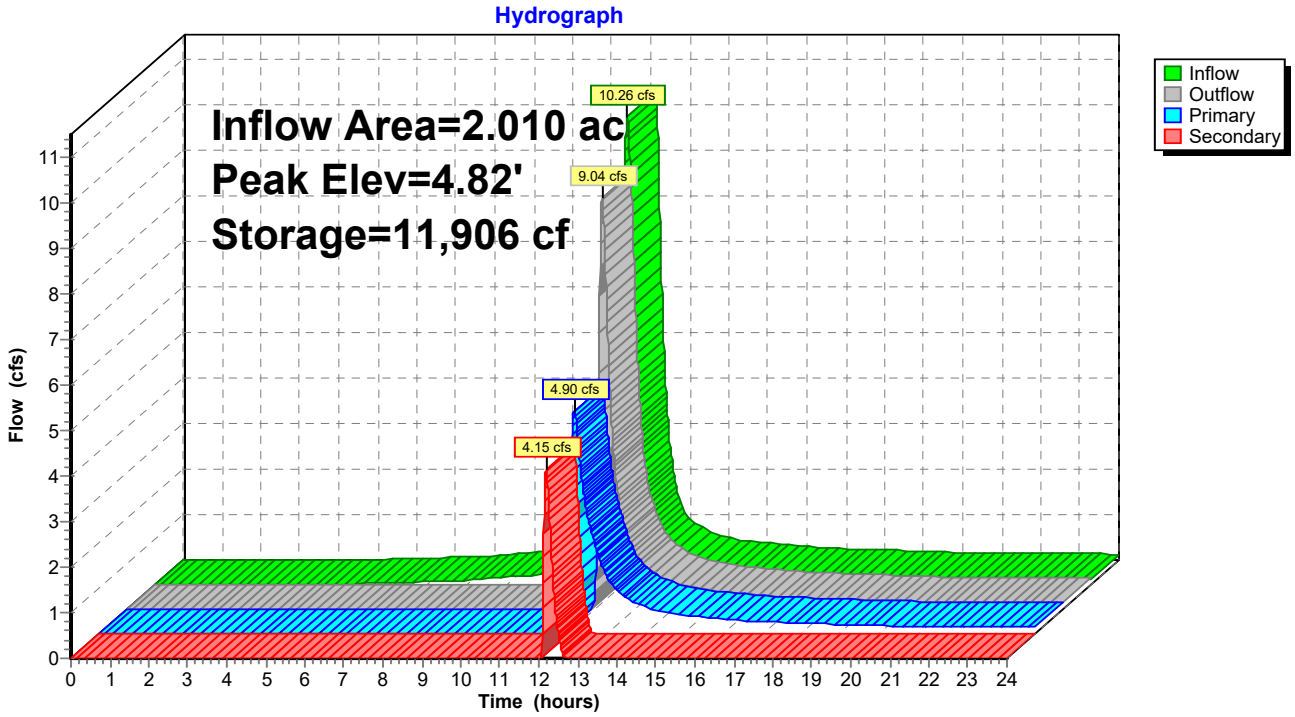
Elevation (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
0.00	0	0
1.00	1,818	1,818
1.50	455	2,273
3.00	1,364	3,637
4.00	4,545	8,182
5.00	4,545	12,727

Device	Routing	Invert	Outlet Devices
#1	Secondary	4.50'	**8.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32
#2	Primary	4.00'	**2.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Primary OutFlow Max=4.90 cfs @ 12.19 hrs HW=4.82' (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Weir Controls 4.90 cfs @ 2.99 fps)

Secondary OutFlow Max=4.14 cfs @ 12.19 hrs HW=4.82' (Free Discharge)
↑—**1=Broad-Crested Rectangular Weir** (Weir Controls 4.14 cfs @ 1.62 fps)

Pond DP-3: DP-3


Hydrograph
Inflow Area=2.010 ac
Peak Elev=4.82'
Storage=11,906 cf
10.26 cfs
9.04 cfs
4.90 cfs
4.15 cfs
Inflow
Outflow
Primary
Secondary
Flow (cfs)
Time (hours)
0 1 2 3 4 5 6 7 8 9 10 11
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24

Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment2A: SC-2A Runoff Area=5.903 ac 0.00% Impervious Runoff Depth=1.28"
Flow Length=746' Tc=7.7 min CN=71 Runoff=18.26 cfs 0.629 af

Subcatchment2B: SC-2B Runoff Area=2,400 sf 0.00% Impervious Runoff Depth=1.28"
Tc=5.0 min CN=71 Runoff=0.19 cfs 0.006 af

Subcatchment2C: SC-2C Runoff Area=3,600 sf 0.00% Impervious Runoff Depth=1.28"
Tc=5.0 min CN=71 Runoff=0.29 cfs 0.009 af

Subcatchment2D: SC-2D Runoff Area=4.850 ac 0.00% Impervious Runoff Depth=1.28"
Flow Length=681' Tc=6.2 min CN=71 Runoff=16.02 cfs 0.517 af

Subcatchment3A: SC-3A Runoff Area=2.010 ac 58.21% Impervious Runoff Depth=2.48"
Flow Length=603' Tc=19.5 min CN=87 Runoff=7.83 cfs 0.416 af

Subcatchment3B: SC-3B Runoff Area=2.460 ac 0.00% Impervious Runoff Depth=1.28"
Flow Length=1,005' Tc=15.8 min CN=71 Runoff=5.42 cfs 0.262 af

SubcatchmentR: Road Runoff Area=0.250 ac 100.00% Impervious Runoff Depth=3.60"
Tc=5.0 min CN=98 Runoff=1.98 cfs 0.075 af

Reach AP2: AP-2 Inflow=18.33 cfs 0.903 af
Outflow=18.33 cfs 0.903 af

Reach AP3: AP-3 Inflow=5.42 cfs 0.490 af
Outflow=5.42 cfs 0.490 af

Reach C: culvert Avg. Flow Depth=0.30' Max Vel=8.28 fps Inflow=2.11 cfs 0.296 af
18.0" Round Pipe n=0.010 L=200.0' S=0.0300 '/' Capacity=23.65 cfs Outflow=2.11 cfs 0.296 af

Pond DP-2: DP-2 Peak Elev=4.22' Storage=16,269 cf Inflow=18.26 cfs 0.629 af
Primary=2.11 cfs 0.296 af Secondary=0.00 cfs 0.000 af Outflow=2.11 cfs 0.296 af

Pond DP-3: DP-3 Peak Elev=4.52' Storage=10,566 cf Inflow=7.83 cfs 0.416 af
Primary=2.29 cfs 0.227 af Secondary=0.09 cfs 0.001 af Outflow=2.38 cfs 0.228 af

Total Runoff Area = 15.611 ac Runoff Volume = 1.914 af Average Runoff Depth = 1.47"
90.90% Pervious = 14.191 ac 9.10% Impervious = 1.420 ac

Summary for Subcatchment 2A: SC-2A

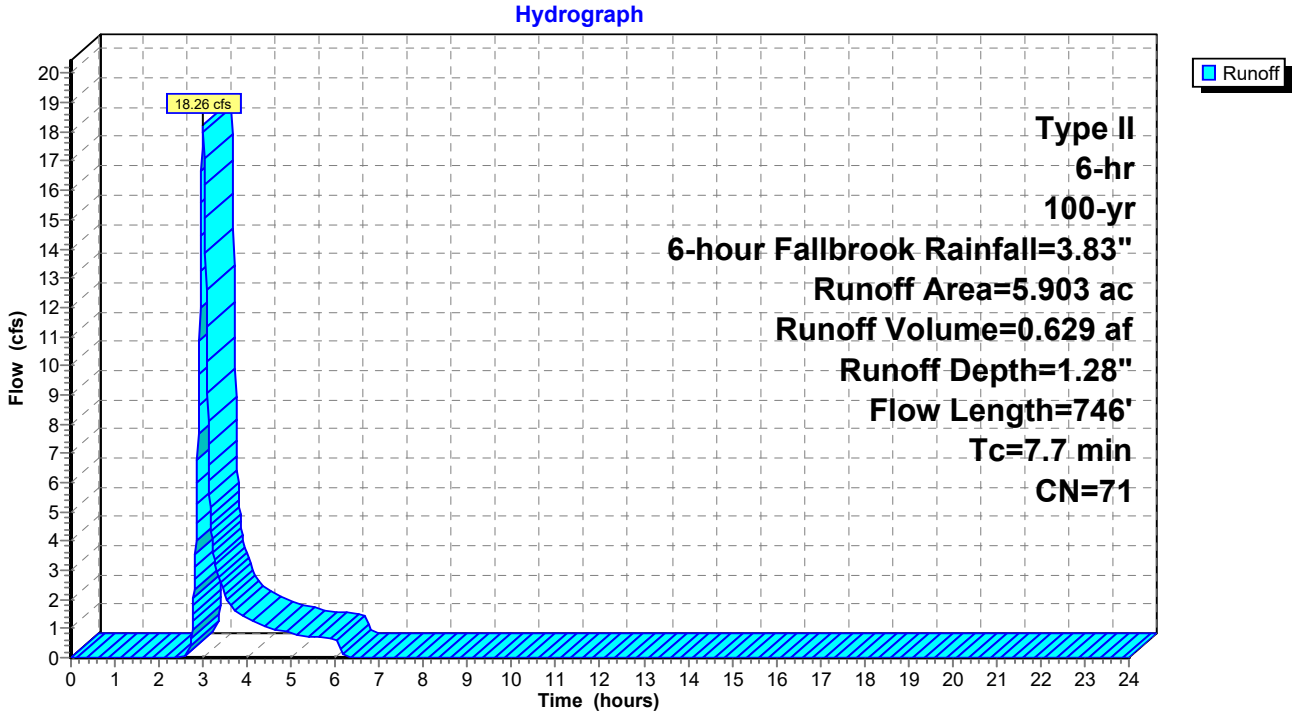
Runoff = 18.26 cfs @ 3.00 hrs, Volume= 0.629 af, Depth= 1.28"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type II 6-hr 100-yr, 6-hour Fallbrook Rainfall=3.83"

Area (ac)	CN	Description
5.903	71	Meadow, non-grazed, HSG C
5.903		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.0	50	0.0800	0.21		**Sheet Flow, A-B** Cultivated: Residue>20% n= 0.170 P2= 2.54"
2.4	314	0.0960	2.17		**Shallow Concentrated Flow, B-C** Short Grass Pasture Kv= 7.0 fps
0.8	340	0.0318	7.33	21.98	**Trap/Vee/Rect Channel Flow, C-D** Bot.W=0.00' D=1.00' Z= 3.0 '/' Top.W=6.00' n= 0.022 Earth, clean & straight
0.5	42	0.0357	1.32		**Shallow Concentrated Flow, D-E** Short Grass Pasture Kv= 7.0 fps
7.7	746	Total			

Subcatchment 2A: SC-2A



Summary for Subcatchment 2B: SC-2B

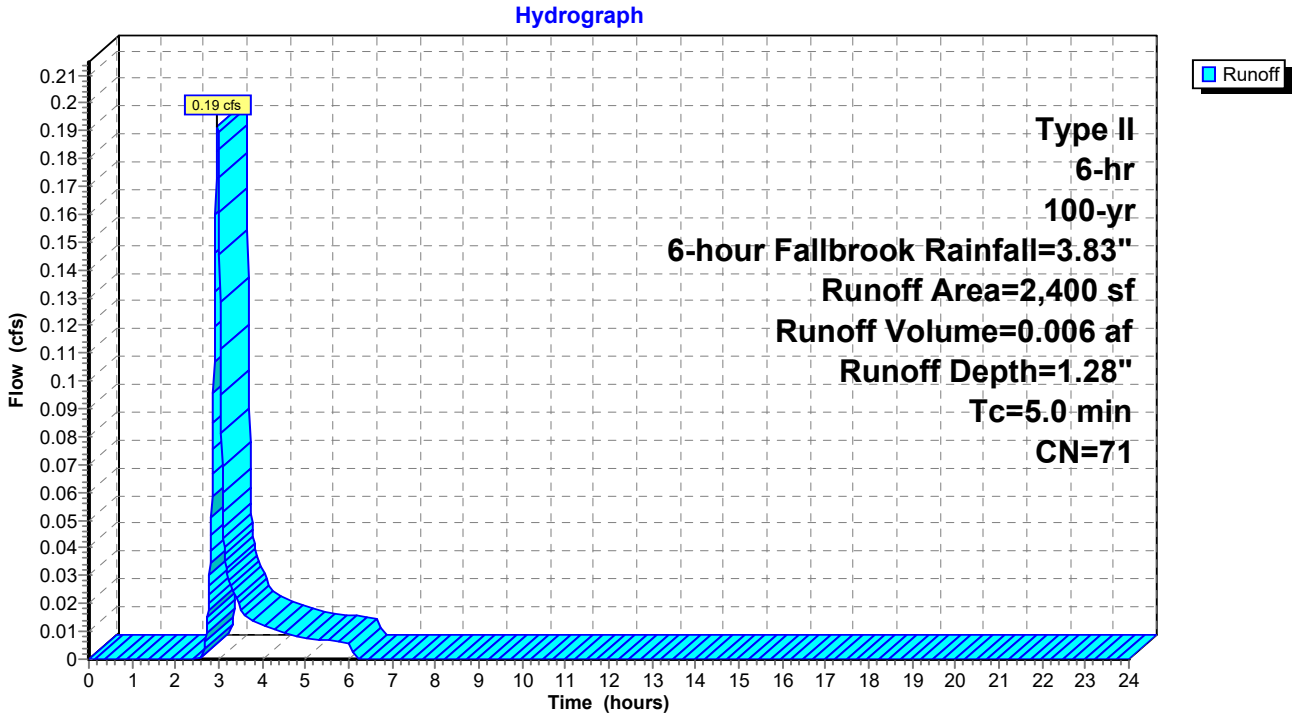
Runoff = 0.19 cfs @ 2.97 hrs, Volume= 0.006 af, Depth= 1.28"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type II 6-hr 100-yr, 6-hour Fallbrook Rainfall=3.83"

Area (sf)	CN	Description
2,400	71	Meadow, non-grazed, HSG C
2,400		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, 5 minute min.**

Subcatchment 2B: SC-2B



Summary for Subcatchment 2C: SC-2C

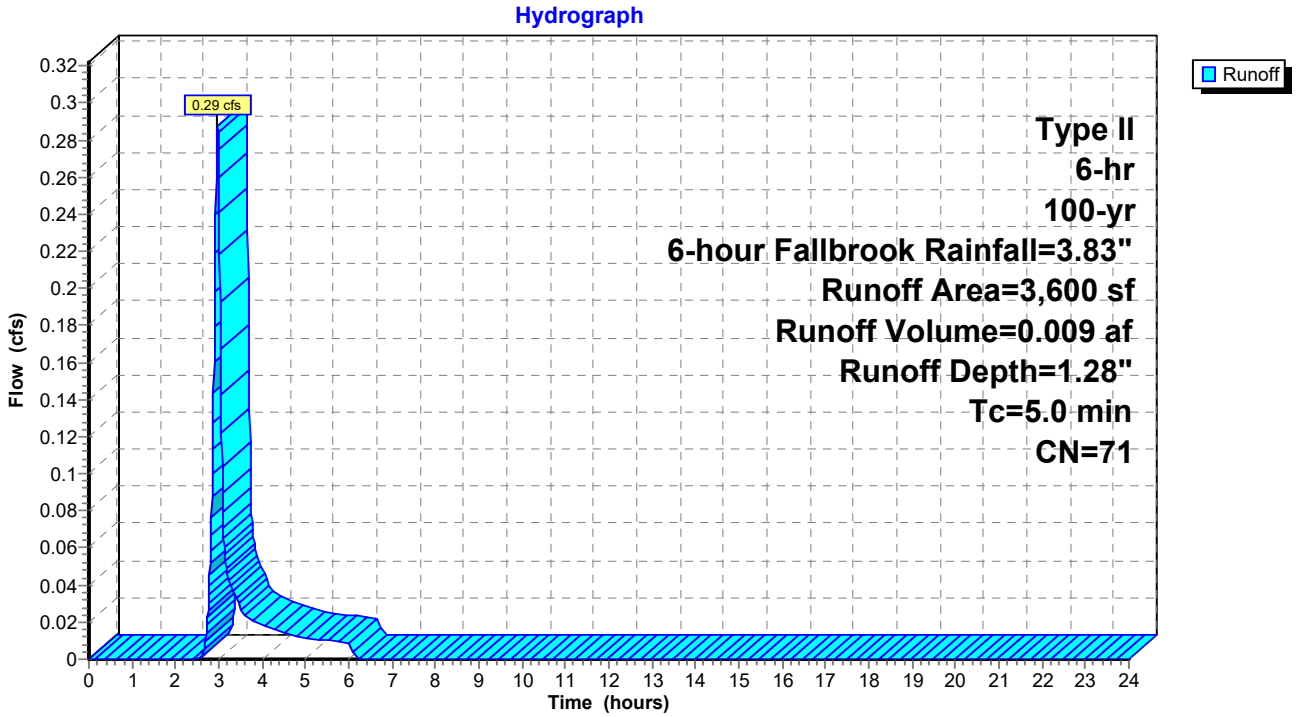
Runoff = 0.29 cfs @ 2.97 hrs, Volume= 0.009 af, Depth= 1.28"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type II 6-hr 100-yr, 6-hour Fallbrook Rainfall=3.83"

Area (sf)	CN	Description
3,600	71	Meadow, non-grazed, HSG C
3,600		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, 5 minute min.**

Subcatchment 2C: SC-2C



Summary for Subcatchment 2D: SC-2D

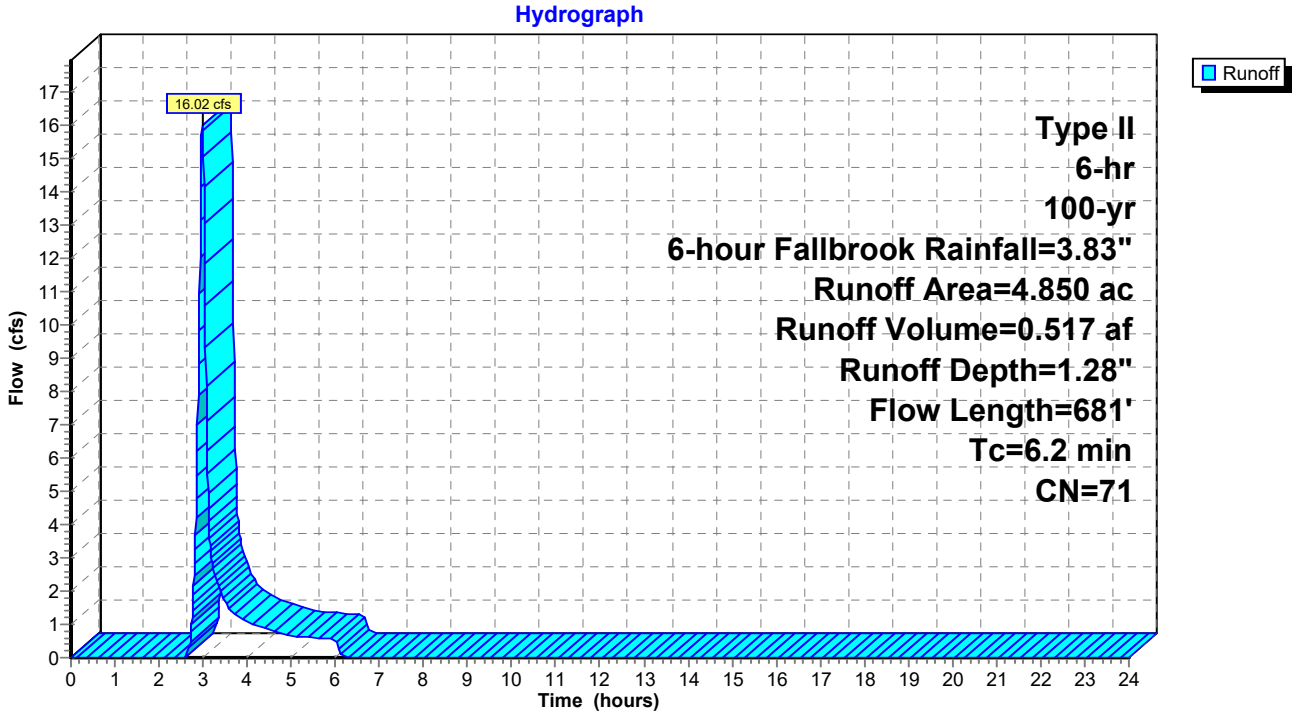
Runoff = 16.02 cfs @ 2.98 hrs, Volume= 0.517 af, Depth= 1.28"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type II 6-hr 100-yr, 6-hour Fallbrook Rainfall=3.83"

Area (ac)	CN	Description
4.850	71	Meadow, non-grazed, HSG C
4.850		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.2	50	0.1400	0.69		**Sheet Flow, A-B** Fallow n= 0.050 P2= 2.54"
4.0	406	0.0580	1.69		**Shallow Concentrated Flow, B-C** Short Grass Pasture Kv= 7.0 fps
0.8	100	0.1000	2.21		**Shallow Concentrated Flow, C-D** Short Grass Pasture Kv= 7.0 fps
0.2	125	0.0640	12.10	145.18	**Trap/Vee/Rect Channel Flow, D-E** Bot.W=0.00' D=2.00' Z= 3.0 '/' Top.W=12.00' n= 0.030 Earth, grassed & winding
6.2	681	Total			

Subcatchment 2D: SC-2D



Summary for Subcatchment 3A: SC-3A

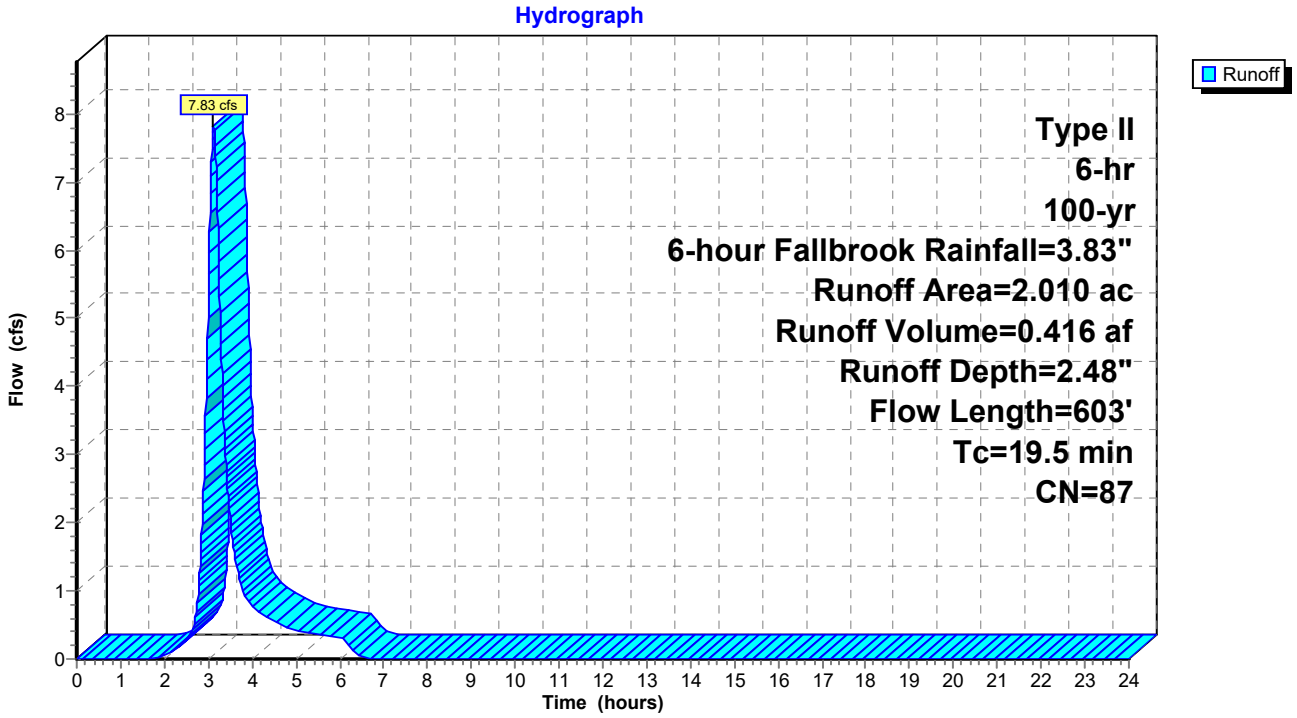
Runoff = 7.83 cfs @ 3.12 hrs, Volume= 0.416 af, Depth= 2.48"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type II 6-hr 100-yr, 6-hour Fallbrook Rainfall=3.83"

Area (ac)	CN	Description
0.840	71	Meadow, non-grazed, HSG C
1.170	98	Paved parking, HSG C
2.010	87	Weighted Average
0.840		41.79% Pervious Area
1.170		58.21% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.5	50	0.0200	0.55		**Sheet Flow, A-B, Gravel Overland Flow** n= 0.025 P2= 2.54"
17.1	460	0.0500	0.45		**Shallow Concentrated Flow, B-C, Slope of 5%, nearly bare grour** Kv= 2.0 fps
0.8	50	0.0200	0.99		**Shallow Concentrated Flow, C-D** Short Grass Pasture Kv= 7.0 fps
0.1	43	0.0200	8.34	6.55	**Pipe Channel, D-E** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.010 PVC, smooth interior
19.5	603	Total			

Subcatchment 3A: SC-3A



Summary for Subcatchment 3B: SC-3B

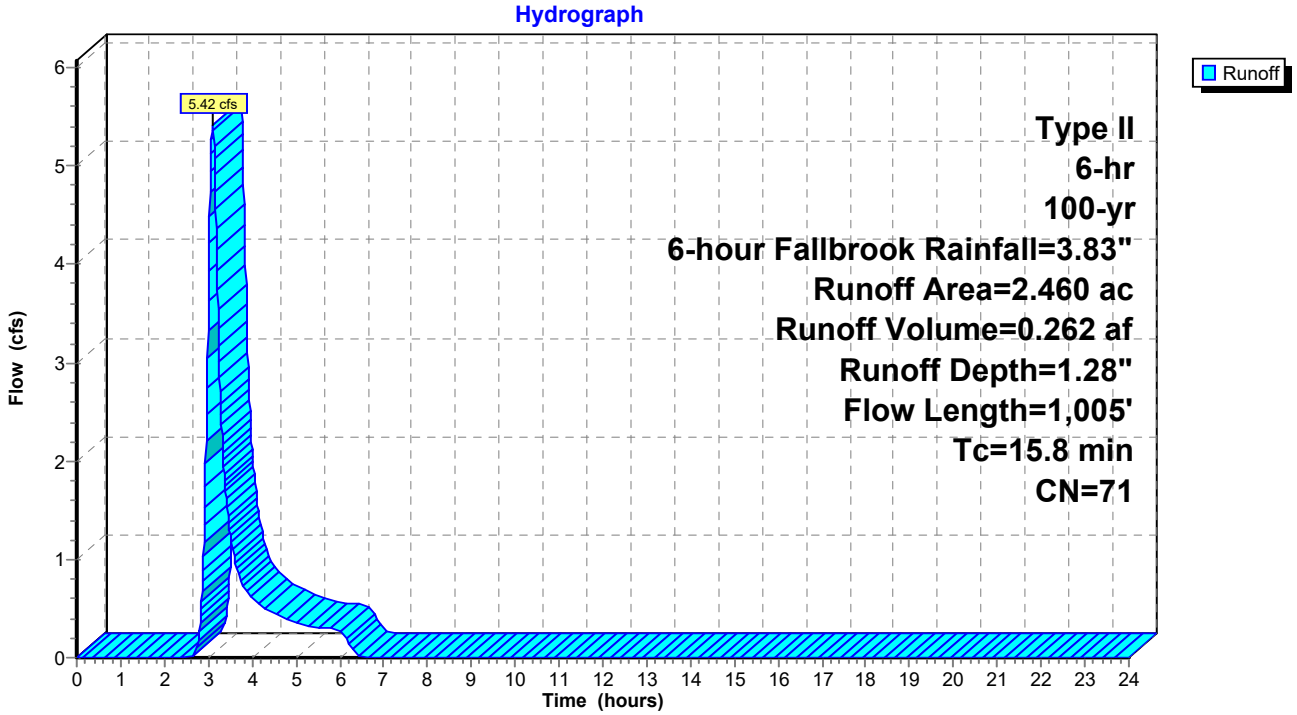
Runoff = 5.42 cfs @ 3.10 hrs, Volume= 0.262 af, Depth= 1.28"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type II 6-hr 100-yr, 6-hour Fallbrook Rainfall=3.83"

Area (ac)	CN	Description
2.460	71	Meadow, non-grazed, HSG C
2.460		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.3	50	0.0400	0.16		**Sheet Flow, A-B** Cultivated: Residue>20% n= 0.170 P2= 2.54"
2.5	269	0.0669	1.81		**Shallow Concentrated Flow, B-C** Short Grass Pasture Kv= 7.0 fps
1.6	305	0.0400	3.14	0.39	**Trap/Vee/Rect Channel Flow, C-D** Bot.W=0.00' D=0.25' Z= 2.0 '/' Top.W=1.00' n= 0.022 Earth, clean & straight
6.4	381	0.0200	0.99		**Shallow Concentrated Flow, D-E** Short Grass Pasture Kv= 7.0 fps
15.8	1,005	Total			

Subcatchment 3B: SC-3B



Summary for Subcatchment R: Road

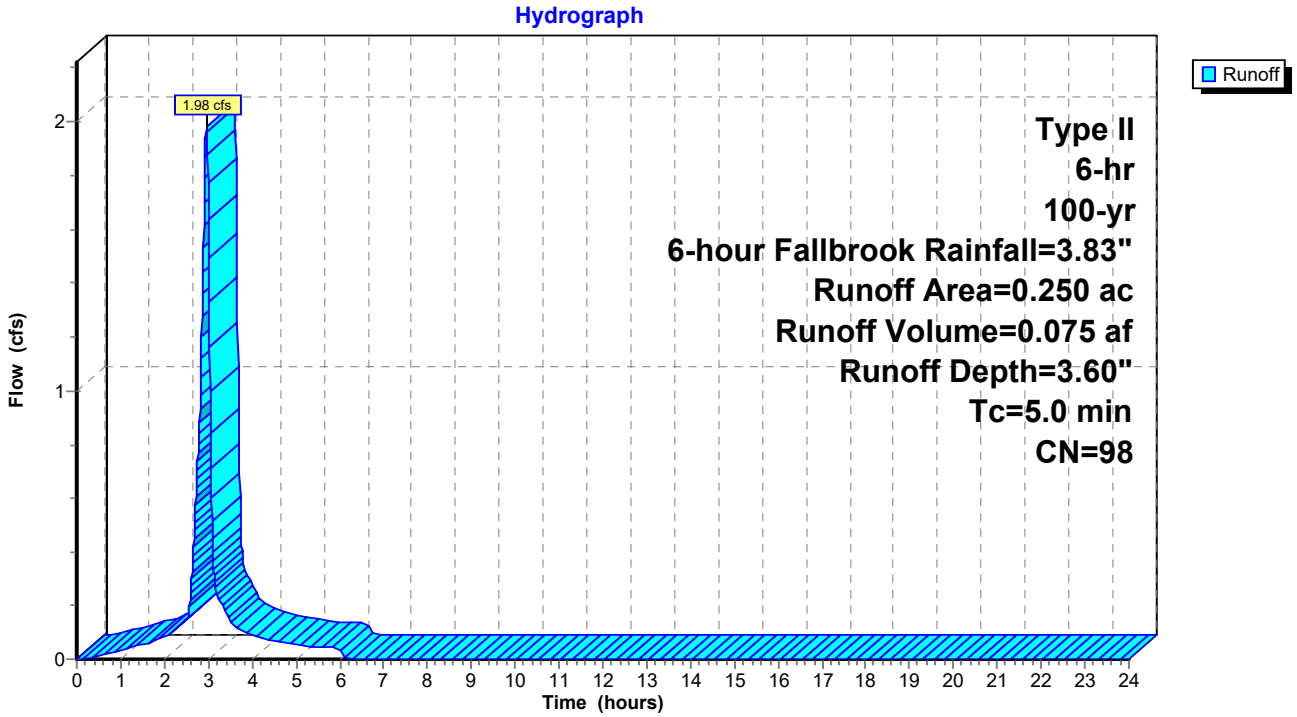
Runoff = 1.98 cfs @ 2.96 hrs, Volume= 0.075 af, Depth= 3.60"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type II 6-hr 100-yr, 6-hour Fallbrook Rainfall=3.83"

Area (ac)	CN	Description
0.250	98	Paved roads w/curbs & sewers, HSG C
0.250		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, 5 minute min.**

Subcatchment R: Road



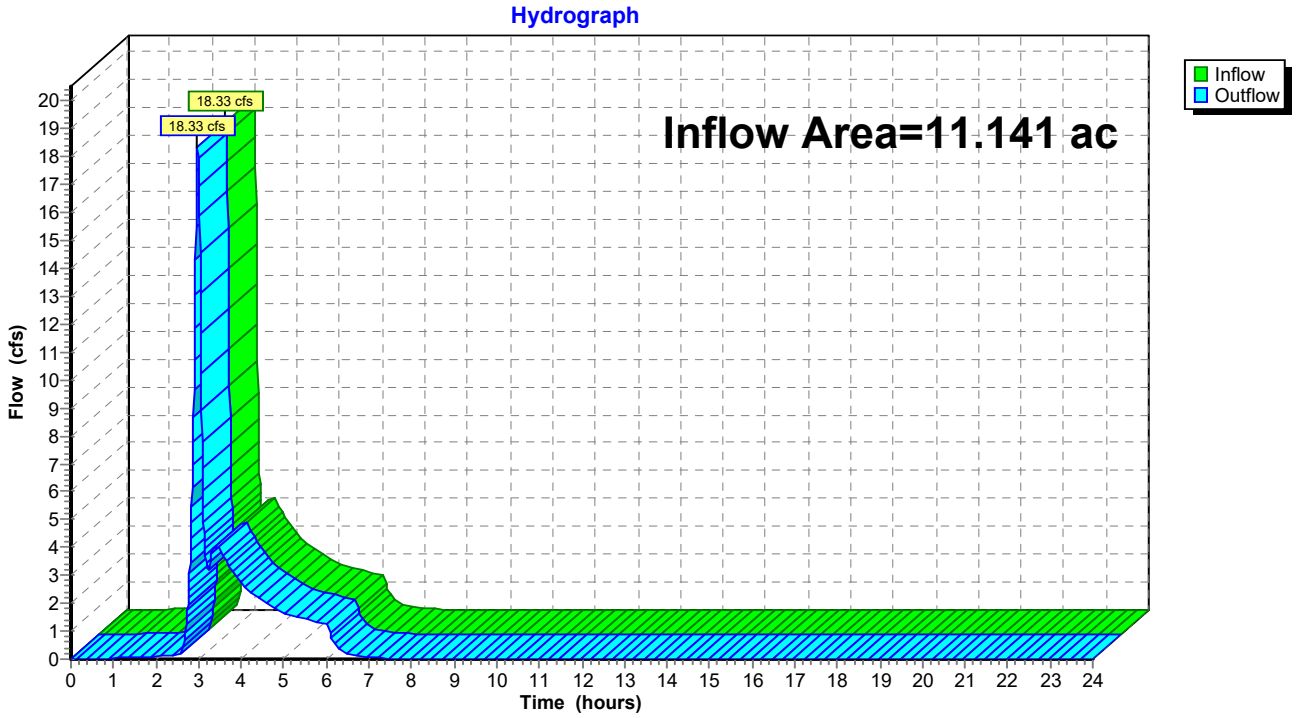
Summary for Reach AP2: AP-2

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 11.141 ac, 2.24% Impervious, Inflow Depth = 0.97" for 100-yr, 6-hour Fallbrook event
Inflow = 18.33 cfs @ 2.98 hrs, Volume= 0.903 af
Outflow = 18.33 cfs @ 2.98 hrs, Volume= 0.903 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Reach AP2: AP-2



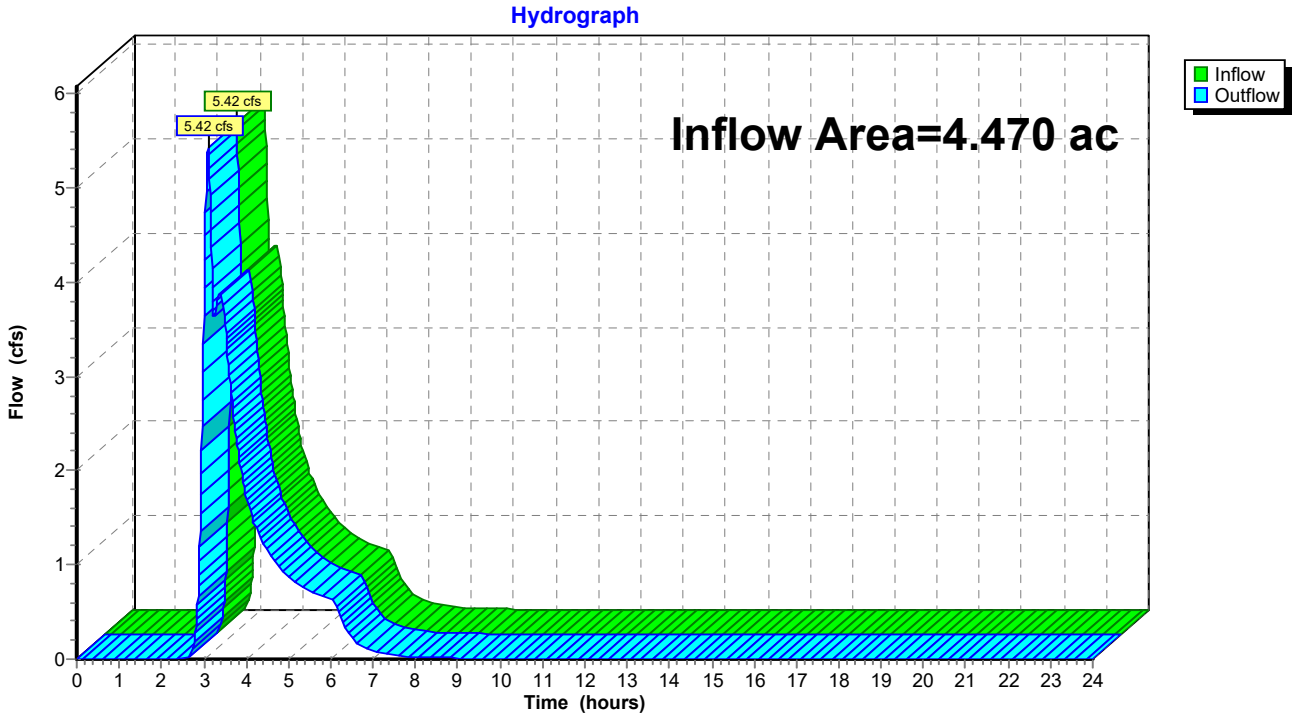
Summary for Reach AP3: AP-3

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 4.470 ac, 26.17% Impervious, Inflow Depth = 1.32" for 100-yr, 6-hour Fallbrook event
Inflow = 5.42 cfs @ 3.10 hrs, Volume= 0.490 af
Outflow = 5.42 cfs @ 3.10 hrs, Volume= 0.490 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Reach AP3: AP-3



Summary for Reach C: culvert

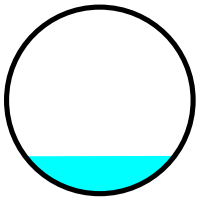
[52] Hint: Inlet/Outlet conditions not evaluated
[65] Warning: Inlet elevation not specified

Inflow Area = 5.903 ac, 0.00% Impervious, Inflow Depth = 0.60" for 100-yr, 6-hour Fallbrook event
Inflow = 2.11 cfs @ 3.52 hrs, Volume= 0.296 af
Outflow = 2.11 cfs @ 3.53 hrs, Volume= 0.296 af, Atten= 0%, Lag= 0.7 min

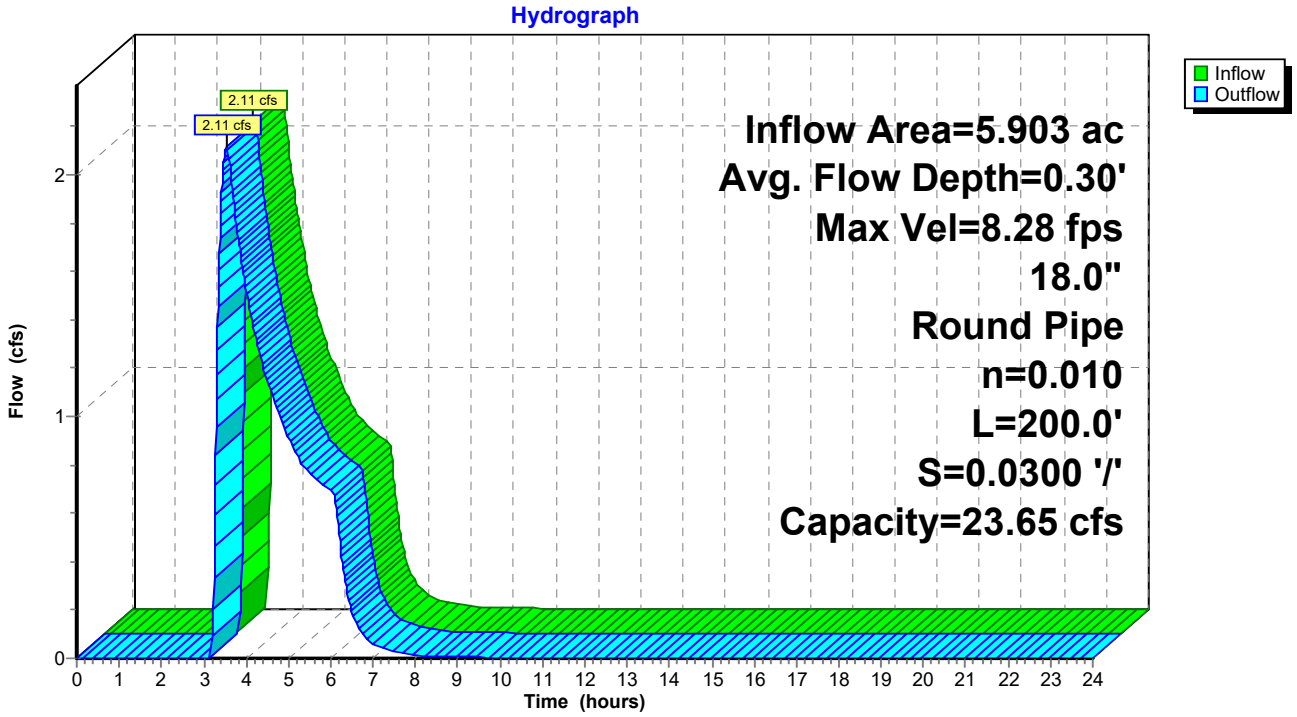
Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 8.28 fps, Min. Travel Time= 0.4 min
Avg. Velocity = 2.93 fps, Avg. Travel Time= 1.1 min

Peak Storage= 51 cf @ 3.52 hrs
Average Depth at Peak Storage= 0.30'
Bank-Full Depth= 1.50' Flow Area= 1.8 sf, Capacity= 23.65 cfs

18.0" Round Pipe
n= 0.010 PVC, smooth interior
Length= 200.0' Slope= 0.0300 '/'
Inlet Invert= 0.00', Outlet Invert= -6.00'



Reach C: culvert



Summary for Pond DP-2: DP-2

Inflow Area = 5.903 ac, 0.00% Impervious, Inflow Depth = 1.28" for 100-yr, 6-hour Fallbrook event
Inflow = 18.26 cfs @ 3.00 hrs, Volume= 0.629 af
Outflow = 2.11 cfs @ 3.52 hrs, Volume= 0.296 af, Atten= 88%, Lag= 30.7 min
Primary = 2.11 cfs @ 3.52 hrs, Volume= 0.296 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 4.22' @ 3.52 hrs Surf.Area= 0 sf Storage= 16,269 cf

Plug-Flow detention time= 94.2 min calculated for 0.296 af (47% of inflow)
Center-of-Mass det. time= 57.9 min (273.0 - 215.1)

Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	22,555 cf	**Custom Stage Data** Listed below

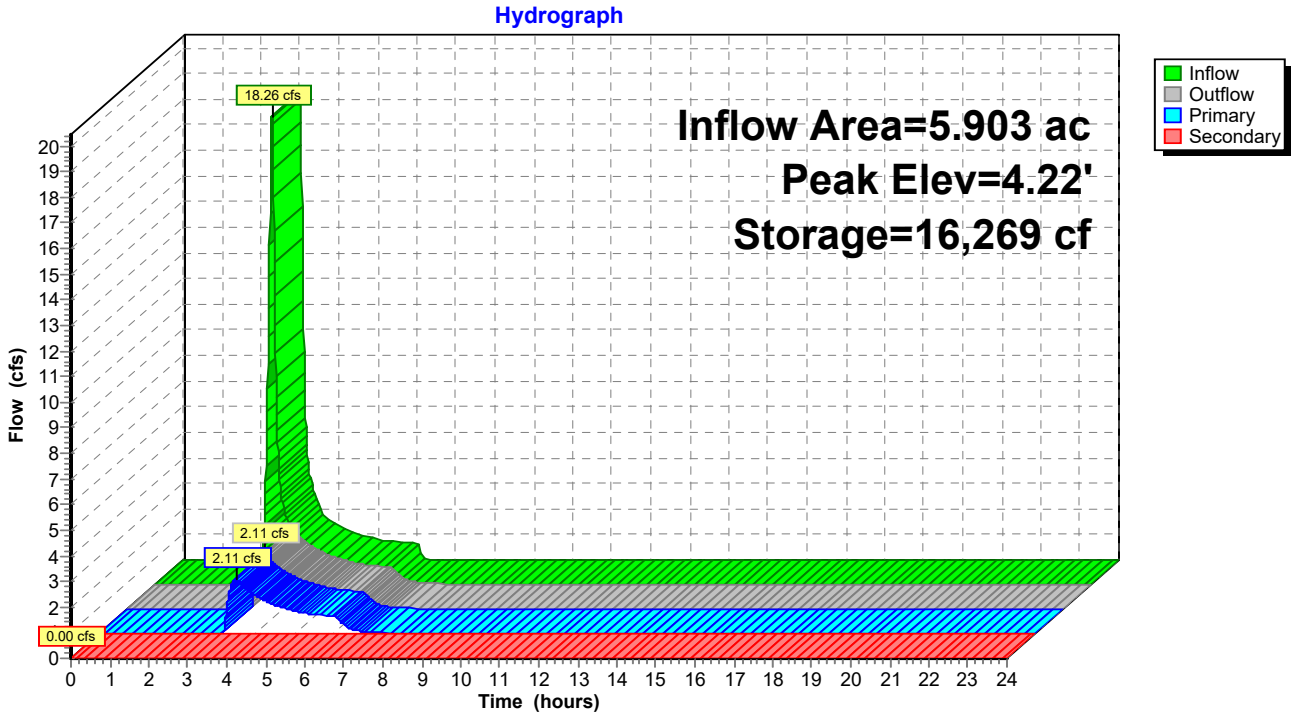
Elevation (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
0.00	0	0
1.00	3,222	3,222
1.50	806	4,028
3.00	2,417	6,445
4.00	8,055	14,500
5.00	8,055	22,555

Device	Routing	Invert	Outlet Devices
#1	Secondary	4.90'	**227.0' long x 1.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 Coef. (English) 2.69 2.72 2.75 2.85 2.98 3.08 3.20 3.28 3.31 3.30 3.31 3.32
#2	Primary	4.00'	**24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=2.11 cfs @ 3.52 hrs HW=4.22' (Free Discharge)
└**2=Orifice/Grate** (Weir Controls 2.11 cfs @ 1.53 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=0.00' (Free Discharge)
└**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond DP-2: DP-2


Hydrograph
Inflow Area=5.903 ac
Peak Elev=4.22'
Storage=16,269 cf
18.26 cfs
2.11 cfs
2.11 cfs
0.00 cfs
Inflow
Outflow
Primary
Secondary
Flow (cfs)
Time (hours)

Summary for Pond DP-3: DP-3

Inflow Area = 2.010 ac, 58.21% Impervious, Inflow Depth = 2.48" for 100-yr, 6-hour Fallbrook event
Inflow = 7.83 cfs @ 3.12 hrs, Volume= 0.416 af
Outflow = 2.38 cfs @ 3.45 hrs, Volume= 0.228 af, Atten= 70%, Lag= 19.9 min
Primary = 2.29 cfs @ 3.45 hrs, Volume= 0.227 af
Secondary = 0.09 cfs @ 3.45 hrs, Volume= 0.001 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 4.52' @ 3.45 hrs Surf.Area= 0 sf Storage= 10,566 cf

Plug-Flow detention time= 84.9 min calculated for 0.228 af (55% of inflow)
Center-of-Mass det. time= 54.3 min (267.6 - 213.3)

Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	12,727 cf	**Custom Stage Data** Listed below

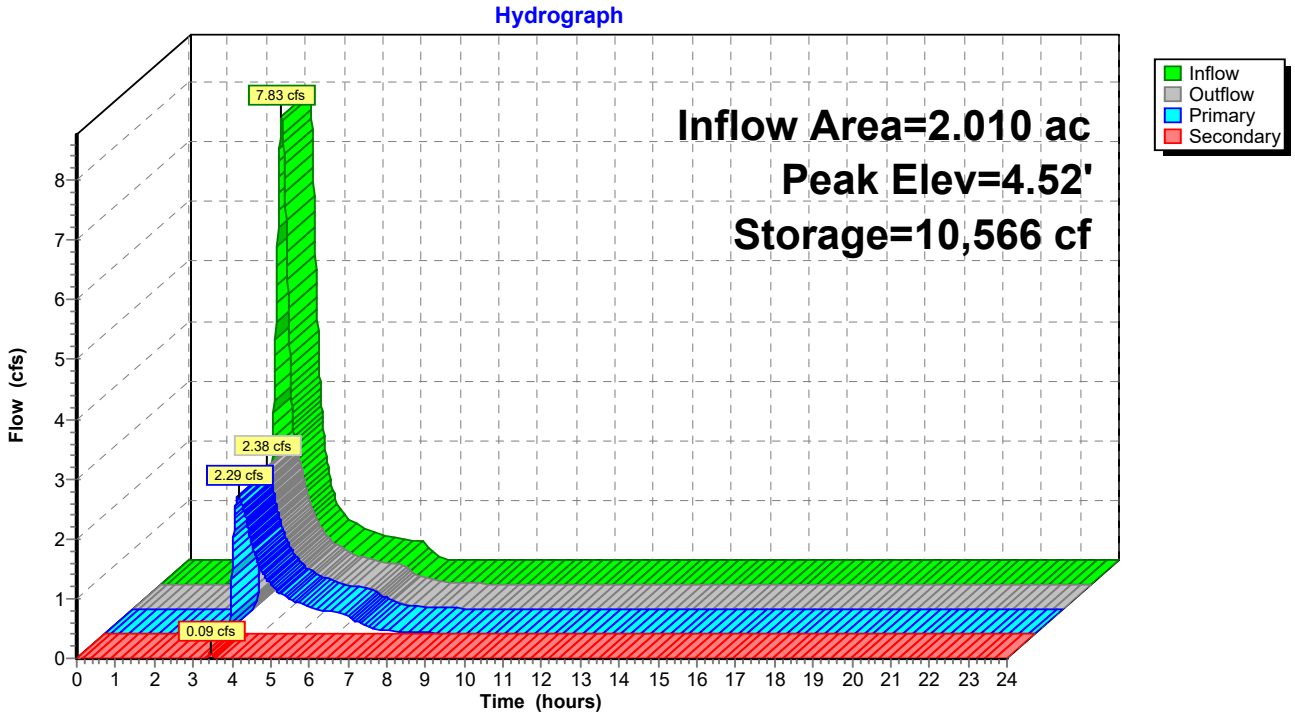
Elevation (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
0.00	0	0
1.00	1,818	1,818
1.50	455	2,273
3.00	1,364	3,637
4.00	4,545	8,182
5.00	4,545	12,727

Device	Routing	Invert	Outlet Devices
#1	Secondary	4.50'	**8.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32
#2	Primary	4.00'	**2.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Primary OutFlow Max=2.29 cfs @ 3.45 hrs HW=4.52' (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Weir Controls 2.29 cfs @ 2.19 fps)

Secondary OutFlow Max=0.09 cfs @ 3.45 hrs HW=4.52' (Free Discharge)
↑—**1=Broad-Crested Rectangular Weir** (Weir Controls 0.09 cfs @ 0.44 fps)

Pond DP-3: DP-3


Hydrograph
Inflow Area=2.010 ac
Peak Elev=4.52'
Storage=10,566 cf
7.83 cfs
2.38 cfs
2.29 cfs
0.09 cfs
Inflow
Outflow
Primary
Secondary
Flow (cfs)
Time (hours)
0 1 2 3 4 5 6 7 8
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24

Summary for Pond DP-2: DP-2

Inflow Area = 5.903 ac, 0.00% Impervious, Inflow Depth = 0.56" for 2-year, 24-hour Fallbrook event
Inflow = 5.11 cfs @ 12.01 hrs, Volume= 0.277 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 3.70' @ 24.44 hrs Surf.Area= 0 sf Storage= 12,056 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	22,555 cf	**Custom Stage Data** Listed below

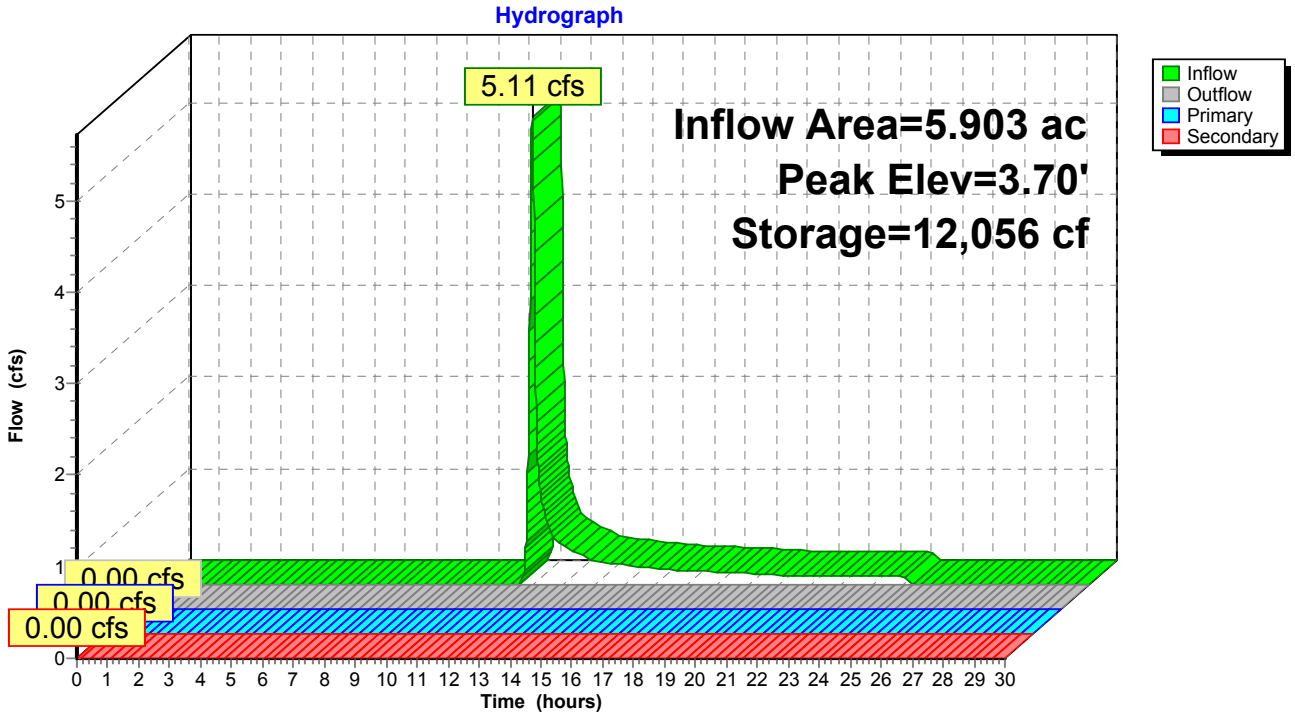
Elevation (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
0.00	0	0
1.00	3,222	3,222
1.50	806	4,028
3.00	2,417	6,445
4.00	8,055	14,500
5.00	8,055	22,555

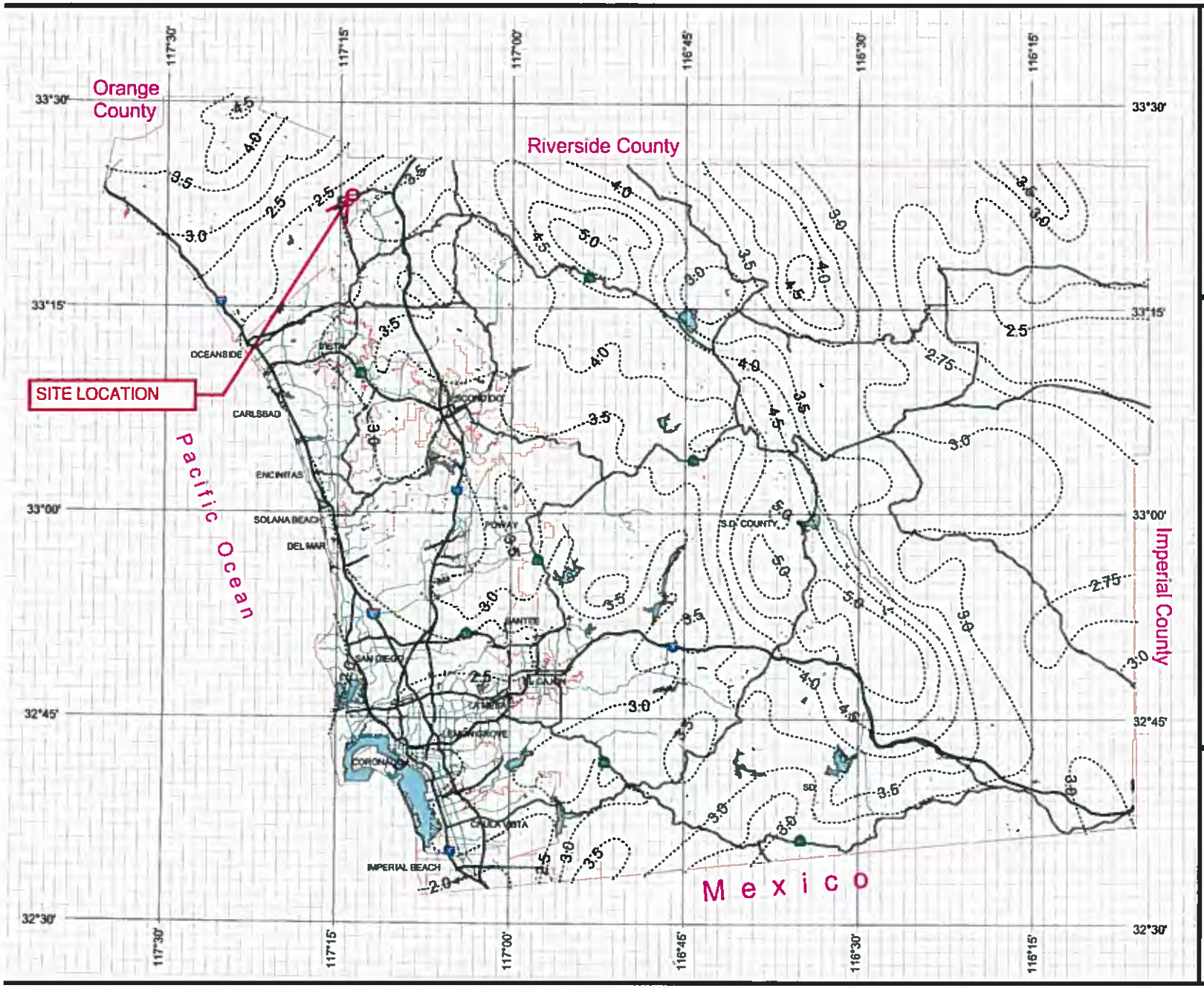
Device	Routing	Invert	Outlet Devices
#1	Secondary	4.90'	**227.0' long x 1.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 Coef. (English) 2.69 2.72 2.75 2.85 2.98 3.08 3.20 3.28 3.31 3.30 3.31 3.32
#2	Primary	4.00'	**24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=0.00' (Free Discharge)
↑—**2=Orifice/Grate** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=0.00' (Free Discharge)
↑—**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond DP-2: DP-2


Hydrograph
5.11 cfs
Inflow Area=5.903 ac
Peak Elev=3.70'
Storage=12,056 cf
Inflow
Outflow
Primary
Secondary
Flow (cfs)
0.00 cfs
0.00 cfs
0.00 cfs
0 1 2 3 4 5
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30
Time (hours)



County of San Diego Hydrology Manual

Rainfall Isopluvials

100 Year Rainfall Event - 6 Hours

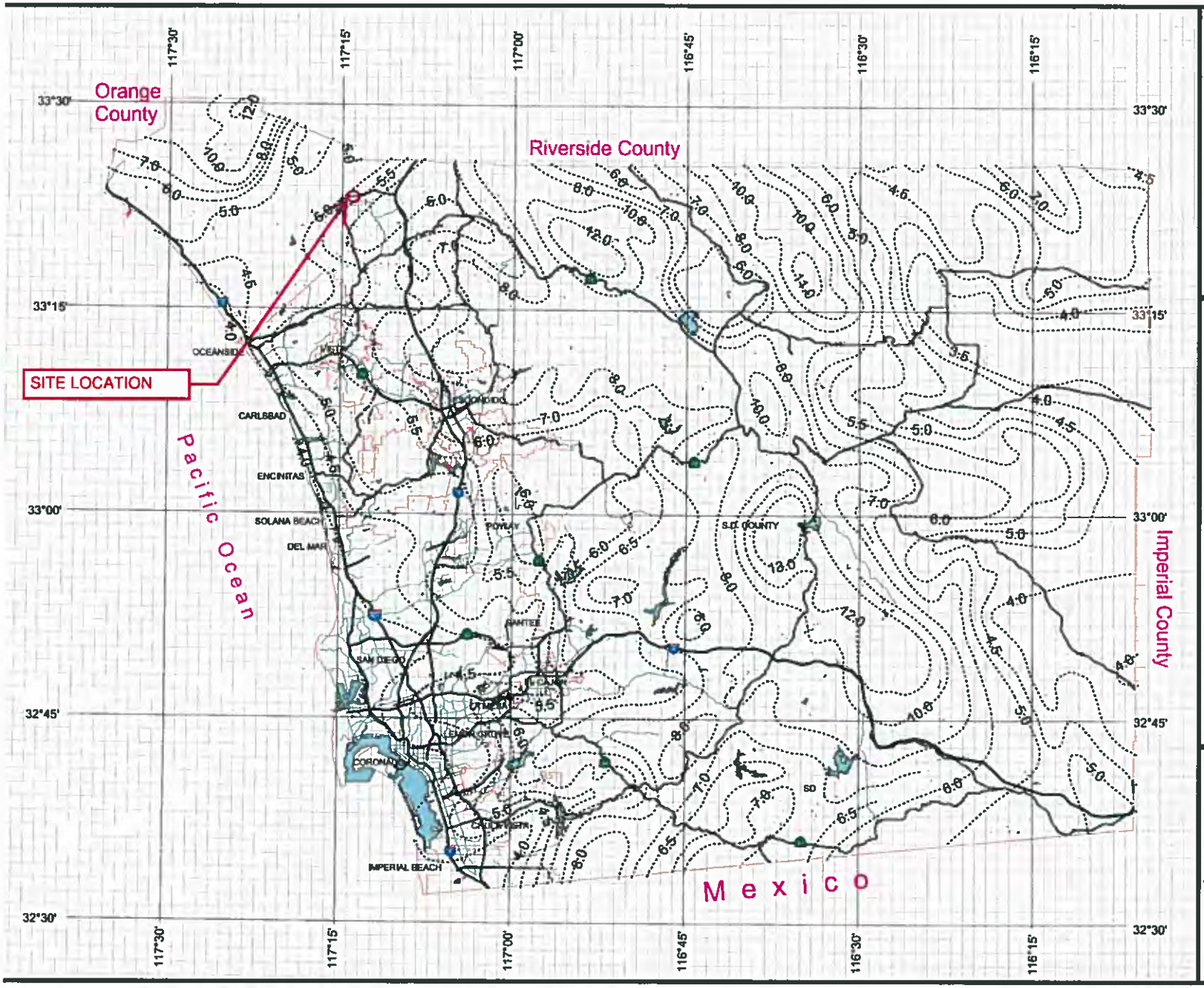
Isopluvial (inches)

DPW GIS

SanGIS
We Have San Diego Covered!

N W E S

3 0 3 Miles



County of San Diego Hydrology Manual

Rainfall Isopluvials

100 Year Rainfall Event - 24 Hours

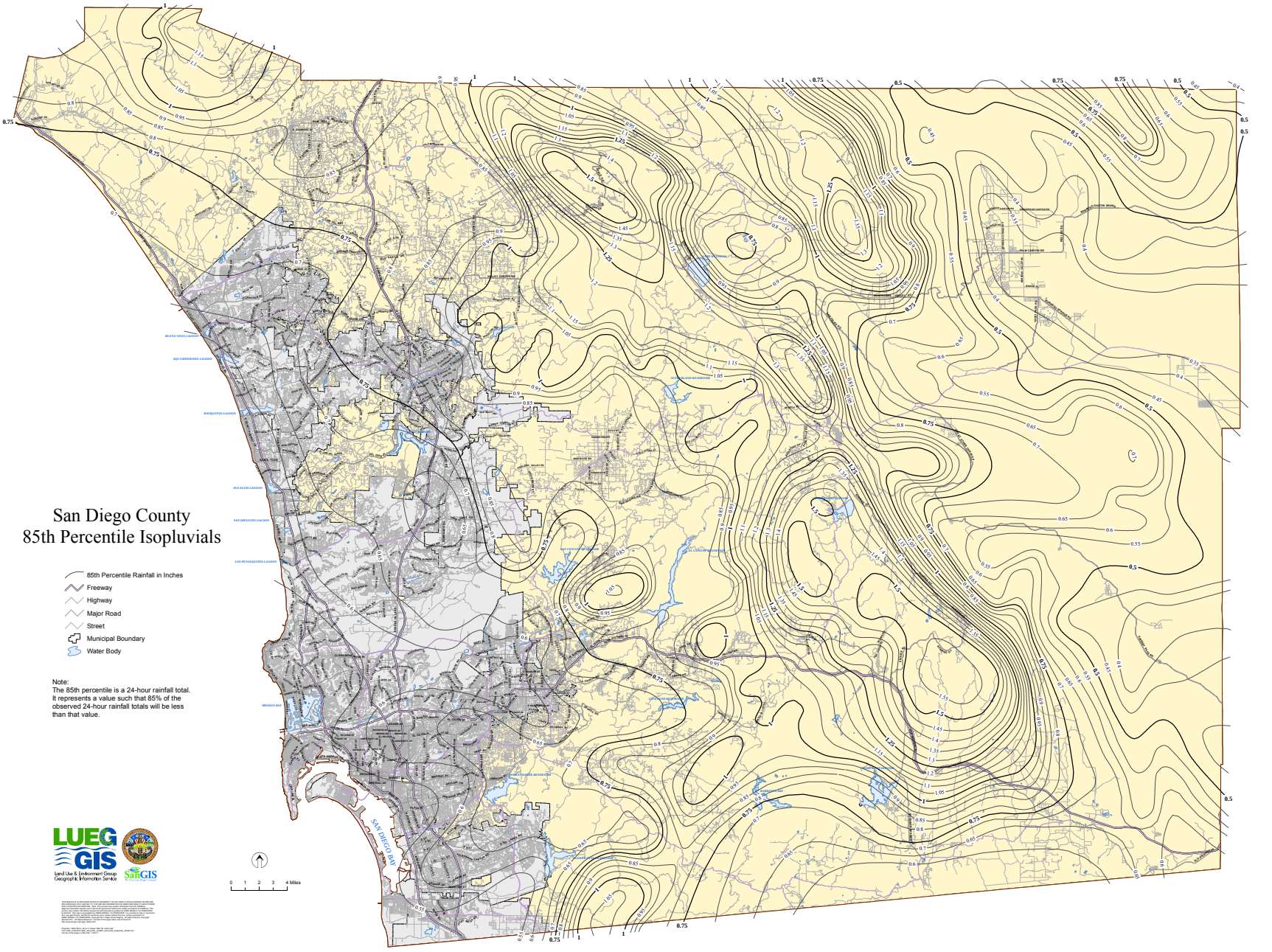
Isopluvial (inches)

DPW GIS

SanGIS
We Have San Diego Covered!

N W E S

3 0 3 Miles


San Diego County
85th Percentile Isopluvials
85th Percentile Rainfall in Inches
Freeway
Highway
Major Road
Street
Municipal Boundary
Water Body
Note:
The 85th percentile is a 24-hour rainfall total.
It represents a value such that 85% of the
observed 24-hour rainfall totals will be less
than that value.
LUEG GIS
Land Use & Environment Group
Geographic Information Service
SanGIS
SAN DIEGO BAY
0 1 2 3 4 Miles

NOAA Atlas 14, Volume 6, Version 2 FALLBROOK FIRE DEPT.
Station ID: 92-1080
Location name: Fallbrook, California, USA*
Latitude: 33.3833°, Longitude: -117.2481°
Elevation:
Elevation (station metadata): 604 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sarah Dietz, Sarah Heim, Lillian Hiner, Kazungu Maitaria, Deborah Martin, Sandra Pavlovic, Ishani Roy, Carl Trypaluk, Dale Unruh, Fenglin Yan, Michael Yekta, Tan Zhao, Geoffrey Bonnin, Daniel Brewer, Li-Chuan Chen, Tye Parzybok, John Yarchoan

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**0.150** (0.126-0.180)	**0.190** (0.160-0.229)	**0.245** (0.205-0.295)	**0.289** (0.240-0.352)	**0.352** (0.282-0.444)	**0.401** (0.314-0.517)	**0.451** (0.344-0.597)	**0.504** (0.373-0.687)	**0.577** (0.409-0.823)	**0.634** (0.433-0.938)
10-min	**0.215** (0.181-0.258)	**0.273** (0.229-0.328)	**0.350** (0.294-0.423)	**0.415** (0.344-0.505)	**0.504** (0.404-0.636)	**0.574** (0.450-0.741)	**0.647** (0.493-0.856)	**0.722** (0.535-0.985)	**0.827** (0.586-1.18)	**0.909** (0.621-1.35)
15-min	**0.260** (0.219-0.312)	**0.330** (0.277-0.397)	**0.424** (0.355-0.511)	**0.502** (0.417-0.610)	**0.610** (0.488-0.769)	**0.694** (0.544-0.896)	**0.782** (0.597-1.03)	**0.874** (0.647-1.19)	**1.00** (0.708-1.43)	**1.10** (0.751-1.63)
30-min	**0.375** (0.316-0.451)	**0.477** (0.401-0.573)	**0.612** (0.513-0.738)	**0.725** (0.602-0.882)	**0.881** (0.706-1.11)	**1.00** (0.786-1.29)	**1.13** (0.862-1.50)	**1.26** (0.934-1.72)	**1.44** (1.02-2.06)	**1.59** (1.08-2.35)
60-min	**0.537** (0.452-0.645)	**0.682** (0.573-0.820)	**0.876** (0.734-1.06)	**1.04** (0.861-1.26)	**1.26** (1.01-1.59)	**1.44** (1.12-1.85)	**1.62** (1.23-2.14)	**1.81** (1.34-2.46)	**2.07** (1.46-2.95)	**2.27** (1.55-3.36)
2-hr	**0.760** (0.640-0.913)	**0.965** (0.811-1.16)	**1.24** (1.04-1.49)	**1.47** (1.22-1.78)	**1.78** (1.42-2.24)	**2.02** (1.59-2.61)	**2.28** (1.74-3.01)	**2.54** (1.88-3.47)	**2.91** (2.06-4.14)	**3.19** (2.18-4.72)
3-hr	**0.926** (0.779-1.11)	**1.18** (0.988-1.41)	**1.51** (1.26-1.82)	**1.78** (1.48-2.17)	**2.16** (1.73-2.73)	**2.46** (1.93-3.17)	**2.77** (2.11-3.66)	**3.09** (2.29-4.21)	**3.53** (2.50-5.03)	**3.88** (2.65-5.73)
6-hr	**1.29** (1.08-1.55)	**1.64** (1.37-1.97)	**2.10** (1.76-2.53)	**2.48** (2.06-3.02)	**3.00** (2.40-3.79)	**3.41** (2.67-4.40)	**3.83** (2.92-5.07)	**4.27** (3.16-5.82)	**4.87** (3.45-6.94)	**5.34** (3.65-7.90)
12-hr	**1.68** (1.41-2.02)	**2.14** (1.80-2.57)	**2.75** (2.30-3.31)	**3.24** (2.69-3.95)	**3.92** (3.14-4.95)	**4.45** (3.48-5.74)	**4.99** (3.80-6.60)	**5.54** (4.10-7.56)	**6.30** (4.46-8.98)	**6.89** (4.71-10.2)
24-hr	**2.06** (1.82-2.38)	**2.64** (2.33-3.05)	**3.39** (2.98-3.93)	**4.00** (3.50-4.68)	**4.84** (4.09-5.84)	**5.48** (4.55-6.74)	**6.13** (4.97-7.72)	**6.80** (5.37-8.80)	**7.71** (5.85-10.4)	**8.42** (6.18-11.7)
2-day	**2.61** (2.31-3.02)	**3.39** (2.99-3.92)	**4.41** (3.88-5.11)	**5.24** (4.58-6.12)	**6.38** (5.40-7.70)	**7.26** (6.02-8.94)	**8.16** (6.62-10.3)	**9.10** (7.18-11.8)	**10.4** (7.86-14.0)	**11.4** (8.34-15.8)
3-day	**2.93** (2.58-3.38)	**3.85** (3.40-4.45)	**5.08** (4.47-5.89)	**6.10** (5.33-7.13)	**7.51** (6.35-9.06)	**8.62** (7.15-10.6)	**9.76** (7.91-12.3)	**11.0** (8.64-14.2)	**12.6** (9.56-17.0)	**13.9** (10.2-19.3)
4-day	**3.19** (2.82-3.69)	**4.23** (3.73-4.89)	**5.63** (4.96-6.53)	**6.80** (5.94-7.95)	**8.43** (7.13-10.2)	**9.72** (8.06-12.0)	**11.1** (8.96-13.9)	**12.5** (9.84-16.1)	**14.4** (10.9-19.4)	**16.0** (11.7-22.3)
7-day	**3.80** (3.35-4.39)	**5.06** (4.47-5.86)	**6.78** (5.96-7.86)	**8.22** (7.18-9.61)	**10.3** (8.68-12.4)	**11.9** (9.85-14.6)	**13.6** (11.0-17.1)	**15.4** (12.1-19.9)	**17.9** (13.6-24.1)	**19.9** (14.6-27.7)
10-day	**4.13** (3.65-4.77)	**5.53** (4.88-6.40)	**7.44** (6.55-8.63)	**9.07** (7.92-10.6)	**11.4** (9.62-13.7)	**13.2** (11.0-16.3)	**15.2** (12.3-19.1)	**17.3** (13.6-22.3)	**20.2** (15.3-27.2)	**22.6** (16.6-31.5)
20-day	**4.87** (4.30-5.62)	**6.58** (5.80-7.61)	**8.97** (7.90-10.4)	**11.1** (9.65-12.9)	**14.1** (11.9-17.0)	**16.6** (13.7-20.4)	**19.2** (15.6-24.2)	**22.2** (17.5-28.7)	**26.4** (20.0-35.5)	**29.9** (21.9-41.6)
30-day	**5.77** (5.10-6.67)	**7.85** (6.92-9.08)	**10.8** (9.51-12.5)	**13.4** (11.7-15.7)	**17.3** (14.6-20.8)	**20.5** (17.0-25.2)	**24.0** (19.4-30.2)	**27.9** (22.0-36.1)	**33.6** (25.5-45.2)	**38.4** (28.2-53.5)
45-day	**6.87** (6.07-7.94)	**9.37** (8.27-10.8)	**13.0** (11.4-15.1)	**16.2** (14.1-18.9)	**21.0** (17.8-25.4)	**25.2** (20.9-31.0)	**29.7** (24.1-37.4)	**34.8** (27.5-45.0)	**42.4** (32.2-57.1)	**48.9** (35.9-68.1)
60-day	**7.84** (6.92-9.06)	**10.7** (9.43-12.4)	**14.8** (13.0-17.2)	**18.5** (16.2-21.7)	**24.1** (20.4-29.1)	**28.9** (24.0-35.5)	**34.2** (27.7-43.0)	**40.1** (31.7-51.9)	**49.1** (37.2-66.1)	**56.8** (41.7-79.0)

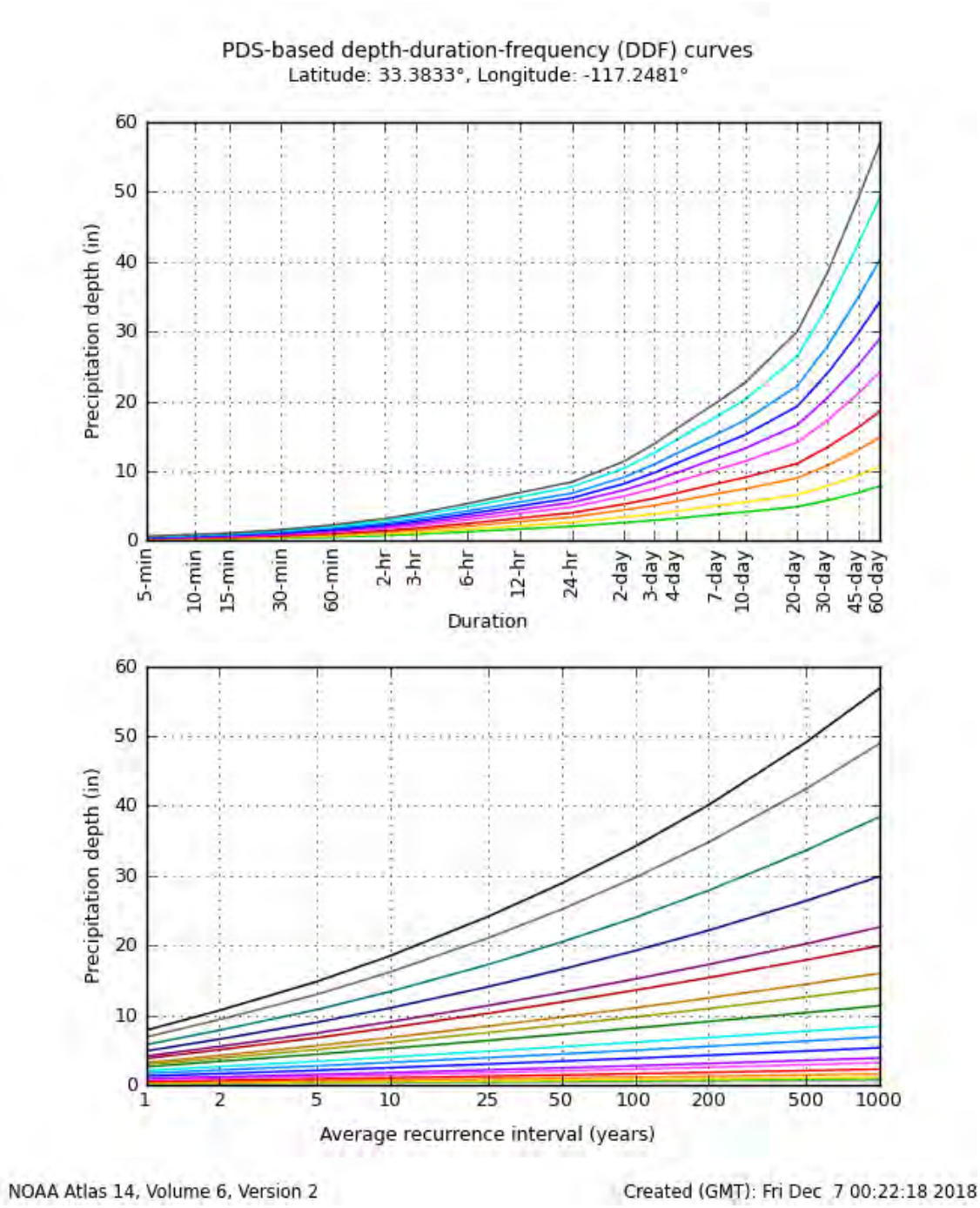
[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

Back to Top

PF graphical

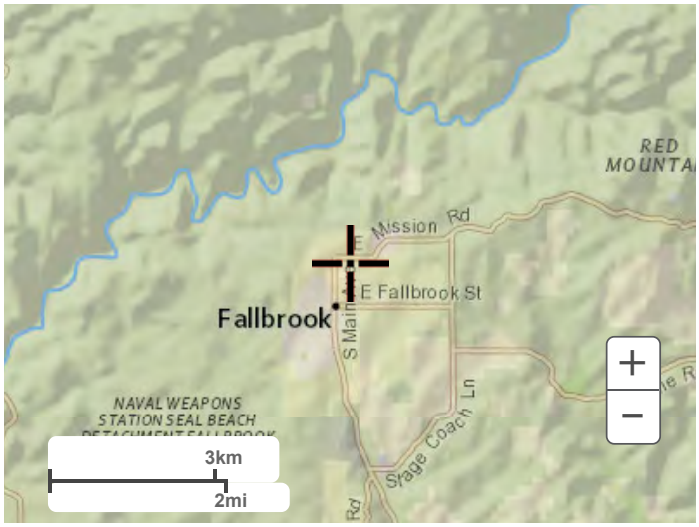


NOAA Atlas 14, Volume 6, Version 2 Created (GMT): Fri Dec 7 00:22:18 2018

Back to Top

Maps & aerials

Small scale terrain



Large scale terrain

Large scale map

Large scale aerial

Back to Top

US Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service
National Water Center
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

Disclaimer

United States Department of Agriculture

Natural Resources Conservation Service

Conservation Engineering Division

Technical Release 55

June 1986

Urban Hydrology for Small Watersheds

TR-55

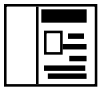
To show bookmarks which navigate through the document. Click the show/hide navigation pane button  , and then click the bookmarks tab. It will navigate you to the contents, chapters, rainfall maps, and printable forms.

Table 2-2a Runoff curve numbers for urban areas [1/]

Cover description: Cover type and hydrologic condition	Average percent impervious area [2/]	Curve numbers for hydrologic soil group: A	B	C	D
Fully developed urban areas (vegetation established)					
Open space (lawns, parks, golf courses, cemeteries, etc.) [3/]:					
Poor condition (grass cover < 50%)		68	79	86	89
Fair condition (grass cover 50% to 75%)		49	69	79	84
Good condition (grass cover > 75%)		39	61	74	80
Impervious areas:					
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)		98	98	98	98
Streets and roads:					
Paved; curbs and storm sewers (excluding right-of-way)		98	98	98	98
Paved; open ditches (including right-of-way)		83	89	92	93
Gravel (including right-of-way)		76	85	89	91
Dirt (including right-of-way)		72	82	87	89
Western desert urban areas:					
Natural desert landscaping (pervious areas only) [4/]		63	77	85	88
Artificial desert landscaping (impervious weed barrier, desert shrub with 1- to 2-inch sand or gravel mulch and basin borders)		96	96	96	96
Urban districts:					
Commercial and business	85	89	92	94	95
Industrial	72	81	88	91	93
Residential districts by average lot size:					
1/8 acre or less (town houses)	65	77	85	90	92
1/4 acre	38	61	75	83	87
1/3 acre	30	57	72	81	86
1/2 acre	25	54	70	80	85
1 acre	20	51	68	79	84
2 acres	12	46	65	77	82
Developing urban areas					
Newly graded areas (pervious areas only, no vegetation) [5/]		77	86	91	94
Idle lands (CN's are determined using cover types similar to those in table 2-2c).					

[1] Average runoff condition, and $I_a = 0.2S$.

[2] The average percent impervious area shown was used to develop the composite CN's. Other assumptions are as follows: impervious areas are directly connected to the drainage system, impervious areas have a CN of 98, and pervious areas are considered equivalent to open space in good hydrologic condition. CN's for other combinations of conditions may be computed using figure 2-3 or 2-4.

[3] CN's shown are equivalent to those of pasture. Composite CN's may be computed for other combinations of open space cover type.

[4] Composite CN's for natural desert landscaping should be computed using figures 2-3 or 2-4 based on the impervious area percentage (CN = 98) and the pervious area CN. The pervious area CN's are assumed equivalent to desert shrub in poor hydrologic condition.

[5] Composite CN's to use for the design of temporary measures during grading and construction should be computed using figure 2-3 or 2-4 based on the degree of development (impervious area percentage) and the CN's for the newly graded pervious areas.

Table 2-2b Runoff curve numbers for cultivated agricultural lands [1/]

Cover description			Curve numbers for hydrologic soil group			
Cover type	Treatment [2/]	Hydrologic condition [3/]	A	B	C	D
Fallow	Bare soil	—	77	86	91	94
	Crop residue cover (CR)	Poor	76	85	90	93
		Good	74	83	88	90
Row crops	Straight row (SR)	Poor	72	81	88	91
		Good	67	78	85	89
	SR + CR	Poor	71	80	87	90
		Good	64	75	82	85
	Contoured (C)	Poor	70	79	84	88
		Good	65	75	82	86
	C + CR	Poor	69	78	83	87
		Good	64	74	81	85
	Contoured & terraced (C&T)	Poor	66	74	80	82
		Good	62	71	78	81
	C&T+ CR	Poor	65	73	79	81
		Good	61	70	77	80
Small grain	SR	Poor	65	76	84	88
		Good	63	75	83	87
	SR + CR	Poor	64	75	83	86
		Good	60	72	80	84
	C	Poor	63	74	82	85
		Good	61	73	81	84
	C + CR	Poor	62	73	81	84
		Good	60	72	80	83
	C&T	Poor	61	72	79	82
		Good	59	70	78	81
	C&T+ CR	Poor	60	71	78	81
		Good	58	69	77	80
Close-seeded or broadcast legumes or rotation meadow	SR	Poor	66	77	85	89
		Good	58	72	81	85
	C	Poor	64	75	83	85
		Good	55	69	78	83
	C&T	Poor	63	73	80	83
		Good	51	67	76	80

[1] Average runoff condition, and I_a=0.2S

[2] Crop residue cover applies only if residue is on at least 5% of the surface throughout the year.

[3] Hydraulic condition is based on combination factors that affect infiltration and runoff, including (a) density and canopy of vegetative areas, (b) amount of year-round cover, (c) amount of grass or close-seeded legumes, (d) percent of residue cover on the land surface (good ≥ 20%), and (e) degree of surface roughness.

Poor: Factors impair infiltration and tend to increase runoff.

Good: Factors encourage average and better than average infiltration and tend to decrease runoff.

Table 2-2c Runoff curve numbers for other agricultural lands [1/]

Cover description		Curve numbers for hydrologic soil group			
Cover type	Hydrologic condition	A	B	C	D
Pasture, grassland, or range—continuous forage for grazing. [2/]	Poor	68	79	86	89
	Fair	49	69	79	84
	Good	39	61	74	80
Meadow—continuous grass, protected from grazing and generally mowed for hay.	—	30	58	71	78
Brush—brush-weed-grass mixture with brush the major element. [3/]	Poor	48	67	77	83
	Fair	35	56	70	77
	Good	30 [4/]	48	65	73
Woods—grass combination (orchard or tree farm). [5/]	Poor	57	73	82	86
	Fair	43	65	76	82
	Good	32	58	72	79
Woods. [6/]	Poor	45	66	77	83
	Fair	36	60	73	79
	Good	30 [4/]	55	70	77
Farmsteads—buildings, lanes, driveways, and surrounding lots.	—	59	74	82	86

1 Average runoff condition, and $I_a = 0.2S$.

2 *Poor:* <50%) ground cover or heavily grazed with no mulch.
Fair: 50 to 75% ground cover and not heavily grazed.
Good: > 75% ground cover and lightly or only occasionally grazed.

3 *Poor:* <50% ground cover.
Fair: 50 to 75% ground cover.
Good: >75% ground cover.

4 Actual curve number is less than 30; use CN = 30 for runoff computations.

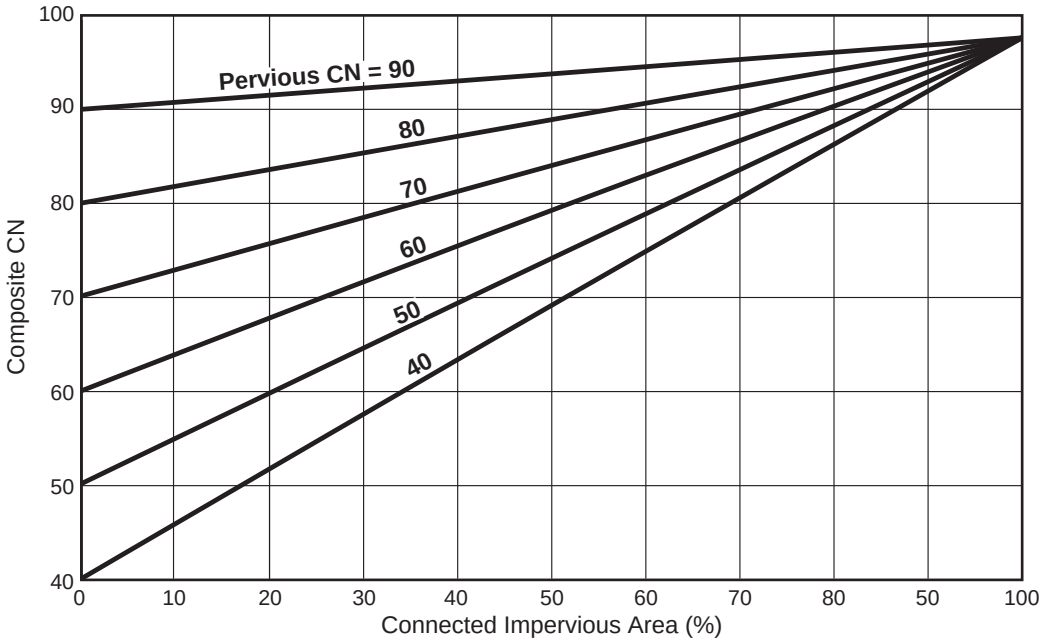
5 CN's shown were computed for areas with 50% woods and 50% grass (pasture) cover. Other combinations of conditions may be computed from the CN's for woods and pasture.

6 *Poor:* Forest litter, small trees, and brush are destroyed by heavy grazing or regular burning.
Fair: Woods are grazed but not burned, and some forest litter covers the soil.
Good: Woods are protected from grazing, and litter and brush adequately cover the soil.

Table 2-2d Runoff curve numbers for arid and semiarid rangelands [1/]

Cover description		Curve numbers for hydrologic soil group			
Cover type	Hydrologic condition [2/]	A [3/]	B	C	D
Herbaceous—mixture of grass, weeds, and low-growing brush, with brush the minor element.	Poor		80	87	93
	Fair		71	81	89
	Good		62	74	85
Oak-aspen—mountain brush mixture of oak brush, aspen, mountain mahogany, bitter brush, maple, and other brush.	Poor		66	74	79
	Fair		48	57	63
	Good		30	41	48
Pinyon-juniper—pinyon, juniper, or both; grass understory.	Poor		75	85	89
	Fair		58	73	80
	Good		41	61	71
Sagebrush with grass understory.	Poor		67	80	85
	Fair		51	63	70
	Good		35	47	55
Desert shrub—major plants include saltbush, greasewood, creosotebush, blackbrush, bursage, palo verde, mesquite, and cactus.	Poor	63	77	85	88
	Fair	55	72	81	86
	Good	49	68	79	84

1 Average runoff condition, and I_a, = 0.2S. For range in humid regions, use table 2-2c.
2 Poor: <30% ground cover (litter, grass, and brush overstory).
Fair: 30 to 70% ground cover.
Good: > 70% ground cover.
3 Curve numbers for group A have been developed only for desert shrub.



SOURCE: TR-55, Second Ed. June 1986

FIGURE 4-7

Composite CN with Connected Impervious Areas

APPENDIX B

Post-Construction BMP Design Calculations

HALEY ALDRICH

Fallbrook Energy Storage

Brea, California

HYDROLOGY REPORT

PREPARED FOR

AES Energy – Fallbrook Site

October 2018

Balancing the Natural and Built Environment

PSOMAS

Hydrology Report – Fallbrook Energy Storage

October 31, 2018

INTRODUCTION & PURPOSE

The purpose of this Technical Memorandum is to describe the methods used to develop the pre- and post-construction conditions hydrology, hydraulic trespass basin sizing, and rip-rap sizing for basin overflow (erosion protection) for the Fallbrook project. Calculations rely on the San Diego County Hydrology Manual (SDCHM), San Diego Region Model BMP Design Manual (SDMBM), and US Army Corps of Engineers (USACE).

PROJECT DESCRIPTION

The proposed project is in the unincorporated township of Fallbrook, San Diego County, California. The proposed project is bounded approximately by East Mission Road to the north, Industrial Way to the west, Mercedes Road to the East and Belair Drive to the south (Figure 1).

The project is comprised of two subareas of 4.47 and 13.42 acres, referred to herein as the battery subarea and the road subarea, respectively. The proposed improvements in the battery subarea include the placement of electrical grid improvements, grid attendant features, detention basin, and an access road. The proposed improvements of the road subarea are limited to a detention basin and an access road. The proposed project is shown in Figure 2.

HYDROLOGY

Hydrologic analysis is based on Section 3 of SDCHM, and the modified rational method is employed for all calculations. The basis for the modified rational method is:

$$Q=CIA$$

where Q is the discharge in cfs, C is a runoff coefficient, I is the rainfall intensity in in/hr, and A is the drainage area in acres. The runoff coefficient, C, is first determined for hydrologic soil group C (Figure 3), the soil at the project site, which has imperviousness of 0%. The proposed conditions C value is then determined for each runoff area using the equation on page 3-5 of SDCHM:

$$C=0.9 \times \%\ \text{imperviousness} + C_p \times (1 - \%\ \text{imperviousness})$$

where C_p is the runoff coefficient for undeveloped land.

Next, the time of concentration, Tc, is calculated for each drainage area. Because of their small size, 4.47 and 13.42 acres, each of the two subareas in the proposed project is considered a single drainage area. Time of concentration is calculated using the equation on Figure 3-4:

$$T_c=60*(11.9L^3/\Delta E)^{0.385}$$

where Tc is in minutes, L is the watercourse distance in miles, and ΔE is the change in elevation along the water course in feet. The time of concentration is used to develop the rainfall intensity, I,

$$I=7.44P_6T_c^{-0.645}$$

where I is in in/hr, and P_6 is the 6-hour precipitation in inches. (Note: in the SDCHM Tc on Figure 3-2 is referenced as "D.") The precipitation depth is taken from the isopluvial maps in Appendix B of SDCHM. The values of P_6 and P_{24}, the 24-hour precipitation, are compared to ensure that the values are in accordance with:

$$45\% < P_6/P_{24} < 65\%$$

No adjustments to P_6 were needed for the proposed project site, as described on page 3-7 of SDCHM. Once the modified rational method values C, I and A, are determined Q is calculated. Calculations are included for the 2-, 5-, 10-, 25-, 50- and 100-year return periods for both subareas within the proposed project in the attached Appendix.

BASIN SIZING

Basin sizing is based on the sizing factor method discussed in Appendix G of SDMBM and the BMP sizing spreadsheet that accompanies it. The sizing factor method utilizes sizing factors that were created to facilitate sizing of specific BMPs for hydromodification management using continuous simulation models in accordance with the SDMBM. These specific BMPs include Infiltration and Biofiltration basins, flow-through planters and cistern facilities. All sizing factors are in relation to the effective impervious area draining to the BMP.

For this project we will utilize Infiltration and Biofiltration basins to capture and treat the runoff from the project site. The following information is needed when using the sizing factor method to size these BMPs:

First, determine the fraction of Q_2, the 2-year discharge, to control based on the level of erosion susceptibility the receiving stream experiences from the tributary area (subarea). Values of $0.1Q_2$, $0.3Q_2$ and $0.5Q_2$ can be used to represent steams with high, medium and low susceptibility to erosion, respectively. This project does not include a stream susceptibility study (the area of the proposed project drains to a storm drain) and conservatively will utilize a value of $0.1Q_2$ to represent a high susceptibility to erosion.

Next, the rainfall basin and Hydrologic Soil Group at the project site are identified. The project lies within the Lake Wohlford rainfall basin and is underlain by type C soil per NRCS's Web Soil Survey. Soil and rainfall basin maps are provided in the attached Appendix.

Finally, pre-project slope category determination requires a break-up of the area tributary to the BMP into different surface types, including roof, concrete, crushed aggregate and landscape, as represented in Table G.2-1 of SDMBM. Each individual surface type shall be treated as a separate Drainage Management Area (DMA) in the spreadsheet. Each of these surface types shall be placed in a slope category that represents the average slope through that DMA. The slope categories are as follows:

- Flat = 0% - 5%
- Moderate = 5% - 10%
- Steep = >10%

Utilizing the above information, the spreadsheet uses the following equation to determine the surface area for each DMA tributary to the BMP:

$$\text{Surface Area}_{DMA} = A\ C_f\ A_i$$

where A is the drainage area in square feet of each DMA, C_f is the runoff factor from Table G.2-1 of SDMBM and A_i is the surface area sizing factor per Tables G.2-3 and G.2-4 for infiltration and Biofiltration BMPs, respectively. (Note: Ai is identified in the SDMBM as A; Ai is used herein for clarity.) Calculations for the minimum required BMP surface area for each tributary area can be found in the Appendix.

RIP-RAP SIZING

The rip-rap sizing is based on the US Army Corps of Engineers (USACE) method. The basis for determining rip-rap sizing is the discharge calculated using the weir equation:

$$Q_w = 2/3\ C_w\ (2g)^{1/2}\ L_w\ H^{3/2}$$

where Q_w is the weir discharge in cfs, C_w is the weir coefficient, $C_w = 0.61$ for narrow crested weirs, g is gravity, $g=32.2\ ft/s^2$, L_w is the length of the weir in ft, and H is the height of nap over the weir in ft. Then the velocity is calculated with the following equation:

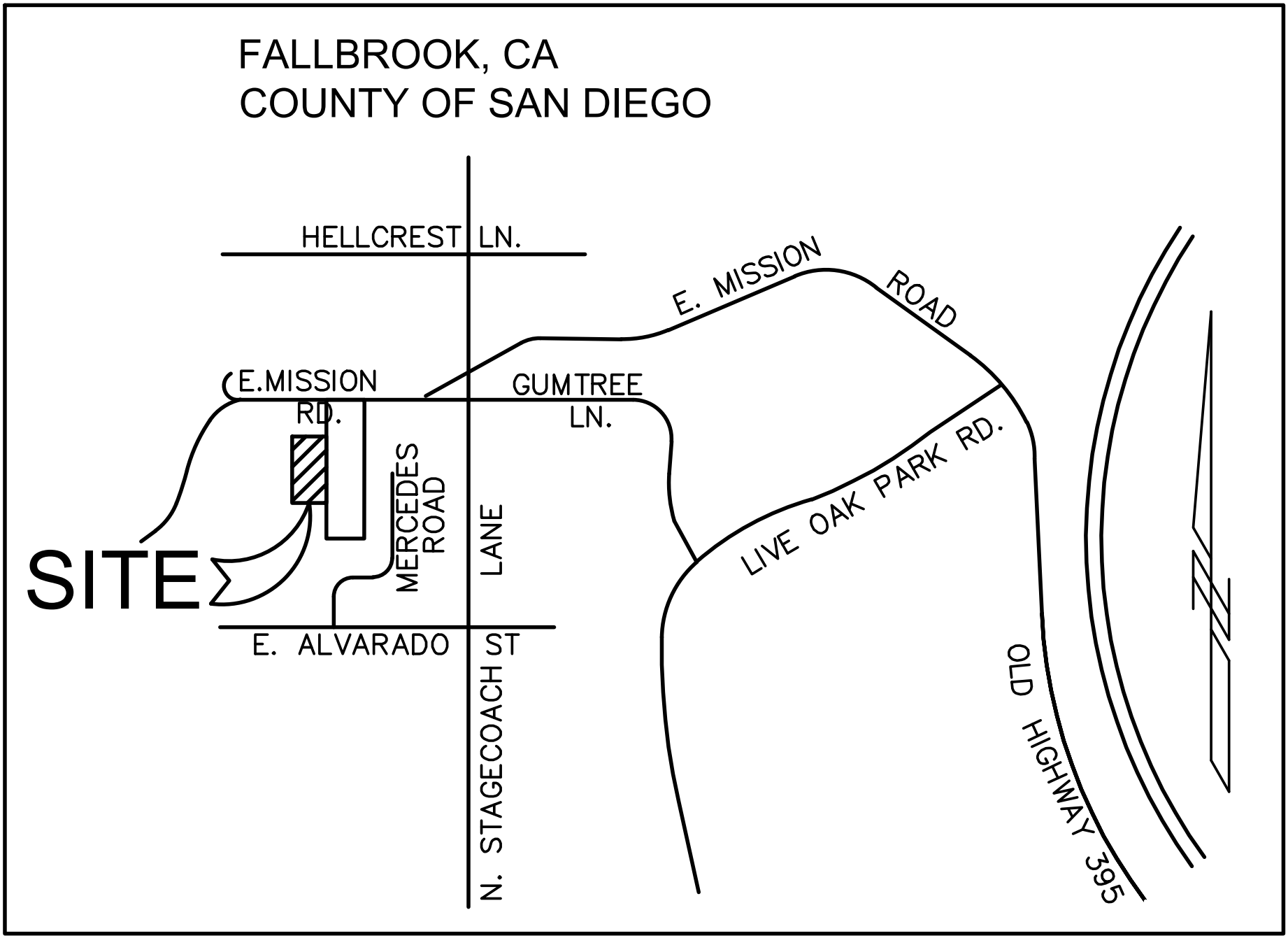
$$V = Q_w/(H\ L_w)$$

where V is the velocity in ft/s, Q_w is the weir discharge in cfs, H is the height of nap over weir in ft, and L_w is length of weir in ft. The USACE method is then used to calculate the rip-rap sizing. This calculation, using RDS software is provided in the appendix.

REFERENCES

San Diego County Hydrology Manual (2013) June.

Model BMP Design Manual, San Diego Region (2018) May.



VICINITY MAP

NTS

Figure 1

E. MISSION ROAD

N 89°54'17" W

315.02'

315.00'

311.48'

330.04'

329.80'

321.65'

INV=774.00'

FL=780.00'

A-2
0.45 ac

N 89°44'36" W

315.00'

630.01'

315.01'

351.72'

278.23'

APN: 105-410-10-00
OWNER: AES ENERGY STORAGE LLC
AREA: 4.87 AC

427.00'

429.29'

297.14'

321.65'

A-1
12.97 ac

1298.06'

N 00°27'35" W

PAD=787

PAD=788

PAD=789

PAD=790

PAD=792

PAD=794

PAD=796

PAD=798

PAD=800

1%

2%

3%

4%

668.15'

L=1006'

660.00'

APN: 105-410-19-00
OWNER: AES ENERGY STORAGE LLC
AREA: 4.22 AC

N 00°31'45" W

660.00'

APN: 105-410-11-00
OWNER: AES ENERGY STORAGE LLC
AREA: 5.04 AC

1296.21'

L=996'

FG=831.50'

MERCEDES RD.

868.77'

870.14'

B-1
4.47 ac

351.72'

278.29'

L=316'

APN: 105-410-44-00
OWNER: KECK, BENJAMIN ROBERT
AREA: 5.79 AC

340.00'

FG=820.00'

80' 40' 0' 80' 160'

GRAPHIC SCALE

Note: For reduced sized prints, original scale is in inches

FIGURE 2

FALLBROOK
ENERGY STORAGE PROJECT
PROPOSED HYDROLOGY

PSOMAS

DATE: 10-31-18 REVISED ON:
JOB No: 2COR090200

SHEET 1 OF 1

CORGAN

Oct 31, 2018 - 2:14PM - M:\2COR090200\ENGR\EXHIB\PLANNING EXHIBITS\PROPOSED HYDROLOGY.DWG

Custom Soil Resource Report
Map—Hydrologic Soil Group

Map Scale: 1:3,320 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 45 90 180 270

Feet: 0 150 300 600 900

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

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

Soil Rating Polygons

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

Soil Rating Lines

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

Soil Rating Points

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

Water Features

- Streams and Canals

Transportation

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

Background

- Aerial Photography

MAP INFORMATION

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

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

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

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

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

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

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

Soil Survey Area: San Diego County Area, California
Survey Area Data: Version 13, Sep 12, 2018

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

Date(s) aerial images were photographed: Dec 31, 2009—Oct 22, 2017

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

Table—Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
FaD2	Fallbrook sandy loam, 9 to 15 percent slopes, eroded	C	15.2	32.8%
FvD	Fallbrook-Vista sandy loams, 9 to 15 percent slopes	C	7.2	15.6%
PeC	Placentia sandy loam, 2 to 9 percent slopes, warm MAAT, MLRA 19	C	23.9	51.6%
Totals for Area of Interest			**46.3**	**100.0%**

Rating Options—Hydrologic Soil Group

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

BMP Sizing Spreadsheet V3.0

Project Name:	AES Energy - Fallbrook Site
Project Applicant:	Corgan
Jurisdiction:	County of San Diego
Parcel (APN):	105-410-19-00
Hydrologic Unit:	San Luis Rey
Rain Gauge:	Lake Wohlford
Total Project Area (sf):	Enter Total Project Area
Channel Susceptibility:	High

BMP Sizing Spreadsheet V3.0			
Project Name:	AES Energy - Fallbrook Site	Hydrologic Unit:	Enter Hydrologic Unit
Project Applicant:	Corgan	Rain Gauge:	Lake Wohlford
Jurisdiction:	County of San Diego	Total Project Area:	Enter Total Project Area
Parcel (APN):	105-410-19-00	Low Flow Threshold:	0.1Q2
BMP Name:	Area A - BMP	BMP Type:	Biofiltration
BMP Native Soil Type:	C	BMP Infiltration Rate (in/hr):	0.1

Areas Draining to BMP						HMP Sizing Factors	Minimum BMP Size
DMA Name	Area (sf)	Pre Project Soil Type	Pre-Project Slope	Post Project Surface Type	Area Weighted Runoff Factor (Table G.2-1)[1]	Surface Area	Surface Area (SF)
DMA 1	53,810	C	Flat	Concrete	1.0	0.07	3767
DMA 2	9,100	C	Flat	Roofs	1.0	0.07	637
DMA 3	521,621	C	Moderate	Landscape	0.1	0.07	3651
						0	0
						0	0
						0	0
						0	0
						0	0
						0	0
						0	0
						0	0
						0	0
						0	0
						0	0
						0	0
BMP Tributary Area	584,531					Minimum BMP Size	8055
						Proposed BMP Size*	8500

* Assumes standard configuration

Surface Ponding Depth	12.00	in
Bioretention Soil Media Depth	18.00	in
Filter Coarse	6.00	in
Gravel Storage Layer Depth	12	in
Underdrain Offset	3.0	in

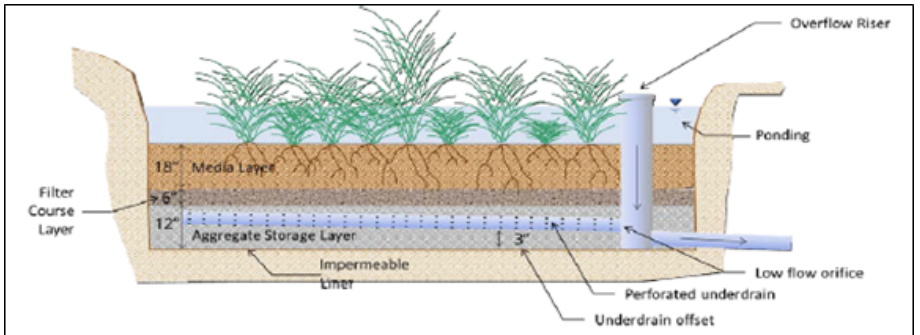
Notes:

1. Runoff factors which are used for hydromodification management flow control (Table G.2-1) are different from the runoff factors used for pollutant control BMP sizing (Table B.1-1). Table references are taken from the San Diego Region Model BMP Design Manu

Describe the BMP's in sufficient detail in your PDP SWQMP to demonstrate the area, volume, and other criteria can be met within the constraints of the site.

BMP's must be adapted and applied to the conditions specific to the development project such as unstable slopes or the lack of available head.
Designated Staff have final review and approval authority over the project design.

This BMP Sizing Spreadsheet has been updated in conformance with the San Diego Region Model BMP Design Manual, April 2018. For questions or concerns please contact the jurisdiction in which your project is located.



Biofiltration BMP Example Illustration

BMP Sizing Spreadsheet V3.0			
Project Name:	AES Energy - Fallbrook Site	Hydrologic Unit:	Enter Hydrologic Unit
Project Applicant:	Corgan	Rain Gauge:	Lake Wohlford
Jurisdiction:	County of San Diego	Total Project Area:	Enter Total Project Area
Parcel (APN):	105-410-19-00	Low Flow Threshold:	0.1Q2
BMP Name	Area A - BMP	BMP Type:	Biofiltration

DMA Name	Rain Gauge	Pre-developed Condition		Unit Runoff Ratio (cfs/ac)	DMA Area (ac)	Orifice Flow - $\%Q_2$ (cfs)	Orifice Area (in^2)
		Soil Type	Slope				
DMA 1	Lake Wohlford	C	Flat	0.49	1.235	0.061	**0.86**
DMA 2	Lake Wohlford	C	Flat	0.49	0.209	0.010	**0.15**
DMA 3	Lake Wohlford	C	Moderate	0.495	11.975	0.593	**8.45**

3.75	**0.664**	**9.46**	**3.47**
Max Orifice Head (feet)	**Max Tot. Allowable Orifice Flow (cfs)**	**Max Tot. Allowable Orifice Area (in^2)**	**Max Orifice Diameter (in)**

0.042	**0.045**	**0.64**	**0.900**
Average outflow during surface drawdown (cfs)	Max Orifice Outflow (cfs)	Actual Orifice Area (in^2)	Selected Orifice Diameter (in)

Drawdown (Hrs)	56.8

BMP Sizing Spreadsheet V3.0			
Project Name:	AES Energy - Fallbrook Site	Hydrologic Unit:	Enter Hydrologic Unit
Project Applicant:	Corgan	Rain Gauge:	Lake Wohlford
Jurisdiction:	County of San Diego	Total Project Area:	Enter Total Project Area
Parcel (APN):	105-410-19-00	Low Flow Threshold:	0.1Q2
BMP Name:	Area B - BMP	BMP Type:	Biofiltration
BMP Native Soil Type:	C	BMP Infiltration Rate (in/hr):	0.1

Areas Draining to BMP						HMP Sizing Factors	Minimum BMP Size
DMA Name	Area (sf)	Pre Project Soil Type	Pre-Project Slope	Post Project Surface Type	Area Weighted Runoff Factor (Table G.2-1)[1]	Surface Area	Surface Area (SF)
DMA 1	50,500	C	Flat	Concrete	1.0	0.07	3535
DMA 2	74,050	C	Flat	Crushed Aggregate	0.1	0.07	518
DMA 3	53,213	C	Flat	Landscape	0.1	0.07	372
DMA 4	17,026	C	Moderate	Landscape	0.1	0.07	119
						0	0
						0	0
						0	0
						0	0
						0	0
						0	0
						0	0
						0	0
						0	0
						0	0
						0	0
BMP Tributary Area	194,789					Minimum BMP Size	4545
						Proposed BMP Size*	5817

* Assumes standard configuration

Surface Ponding Depth	12.00	in
Bioretention Soil Media Depth	18.00	in
Filter Coarse	6.00	in
Gravel Storage Layer Depth	12	in
Underdrain Offset	3.0	in

Notes:

1. Runoff factors which are used for hydromodification management flow control (Table G.2-1) are different from the runoff factors used for pollutant control BMP sizing (Table B.1-1). Table references are taken from the San Diego Region Model BMP Design Manu

Describe the BMP's in sufficient detail in your PDP SWQMP to demonstrate the area, volume, and other criteria can be met within the constraints of the site.

BMP's must be adapted and applied to the conditions specific to the development project such as unstable slopes or the lack of available head.
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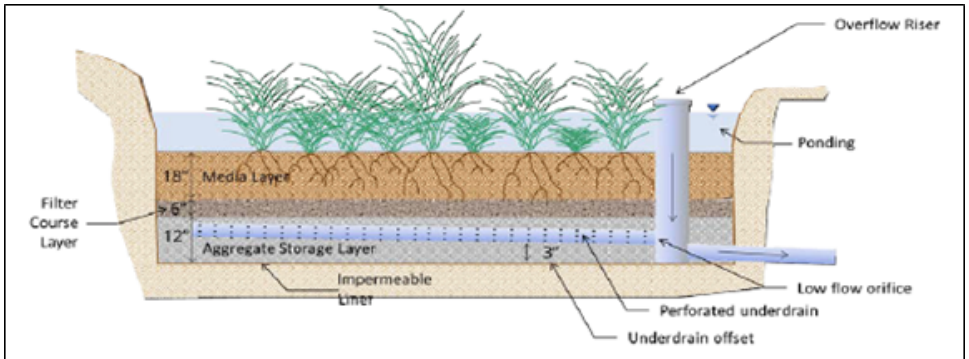


Biofiltration BMP Example Illustration

BMP Sizing Spreadsheet V3.0			
Project Name:	AES Energy - Fallbrook Site	Hydrologic Unit:	Enter Hydrologic Unit
Project Applicant:	Corgan	Rain Gauge:	Lake Wohlford
Jurisdiction:	County of San Diego	Total Project Area:	Enter Total Project Area
Parcel (APN):	105-410-19-00	Low Flow Threshold:	0.1Q2
BMP Name	Area B - BMP	BMP Type:	Biofiltration

DMA Name	Rain Gauge	Pre-developed Condition		Unit Runoff Ratio (cfs/ac)	DMA Area (ac)	Orifice Flow - $\%Q_2$ (cfs)	Orifice Area (in^2)
		Soil Type	Slope				
DMA 1	Lake Wohlford	C	Flat	0.49	1.159	0.057	**0.81**
DMA 2	Lake Wohlford	C	Flat	0.49	1.700	0.083	**1.19**
DMA 3	Lake Wohlford	C	Flat	0.49	1.222	0.060	**0.85**
DMA 4	Lake Wohlford	C	Moderate	0.495	0.391	0.019	**0.28**

3.75	**0.219**	**3.13**	**2.00**
Max Orifice Head (feet)	**Max Tot. Allowable Orifice Flow (cfs)**	**Max Tot. Allowable Orifice Area (in^2)**	**Max Orifice Diameter (in)**

0.042	**0.045**	**0.64**	**0.900**
Average outflow during surface drawdown (cfs)	Max Orifice Outflow (cfs)	Actual Orifice Area (in^2)	Selected Orifice Diameter (in)

Drawdown (Hrs)	38.9

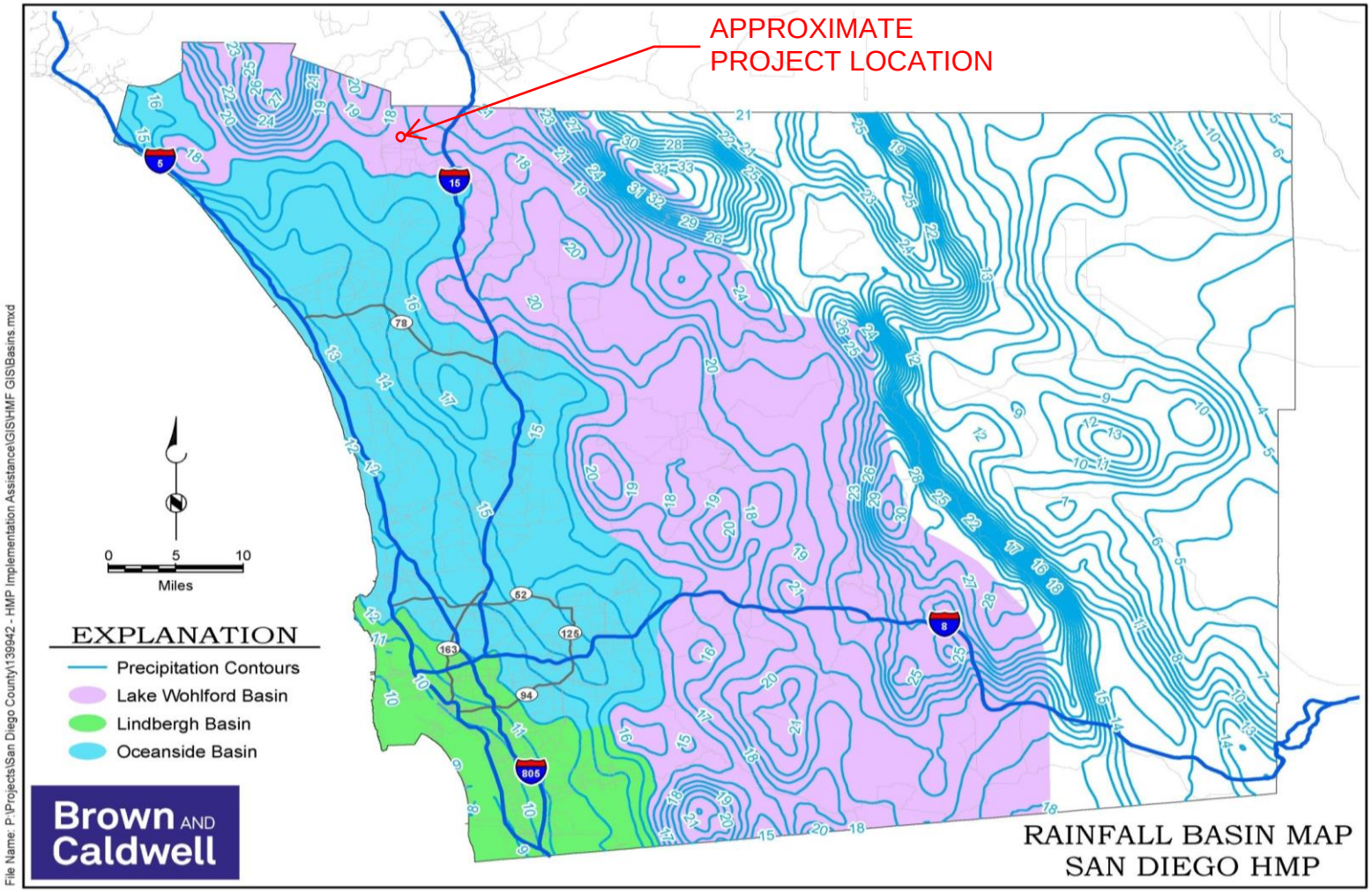

APPROXIMATE
PROJECT LOCATION
0
5
10
Miles
EXPLANATION
Precipitation Contours
Lake Wohlford Basin
Lindbergh Basin
Oceanside Basin
Brown AND Caldwell
RAINFALL BASIN MAP
SAN DIEGO HMP
File Name: P:\Projects\San Diego County\139942 - HMP Implementation Assistance\GIS\HMF GIS\Basins.mxd

Table G.2-3: Sizing Factors for Hydromodification Flow Control Infiltration BMPs Designed Using Sizing Factor Method				
Lower Flow Threshold	Soil Group	Slope	Rain Gauge	A
0.1Q2	A	Flat	Lindbergh	0.055
0.1Q2	A	Moderate	Lindbergh	0.055
0.1Q2	A	Steep	Lindbergh	0.055
0.1Q2	B	Flat	Lindbergh	0.045
0.1Q2	B	Moderate	Lindbergh	0.045
0.1Q2	B	Steep	Lindbergh	0.045
0.1Q2	C	Flat	Lindbergh	0.035
0.1Q2	C	Moderate	Lindbergh	0.035
0.1Q2	C	Steep	Lindbergh	0.035
0.1Q2	D	Flat	Lindbergh	0.03
0.1Q2	D	Moderate	Lindbergh	0.03
0.1Q2	D	Steep	Lindbergh	0.03
0.1Q2	A	Flat	Oceanside	0.06
0.1Q2	A	Moderate	Oceanside	0.06
0.1Q2	A	Steep	Oceanside	0.06
0.1Q2	B	Flat	Oceanside	0.05
0.1Q2	B	Moderate	Oceanside	0.05
0.1Q2	B	Steep	Oceanside	0.05
0.1Q2	C	Flat	Oceanside	0.05
0.1Q2	C	Moderate	Oceanside	0.05
0.1Q2	C	Steep	Oceanside	0.045
0.1Q2	D	Flat	Oceanside	0.035
0.1Q2	D	Moderate	Oceanside	0.035
0.1Q2	D	Steep	Oceanside	0.035
0.1Q2	A	Flat	Lake Wohlford	0.085
0.1Q2	A	Moderate	Lake Wohlford	0.085
0.1Q2	A	Steep	Lake Wohlford	0.085
0.1Q2	B	Flat	Lake Wohlford	0.07

0.1Q2	B	Moderate	Lake Wohlford	0.07
0.1Q2	B	Steep	Lake Wohlford	0.07
0.1Q2	C	Flat	Lake Wohlford	0.055
0.1Q2	C	Moderate	Lake Wohlford	0.055
0.1Q2	C	Steep	Lake Wohlford	0.055
0.1Q2	D	Flat	Lake Wohlford	0.04
0.1Q2	D	Moderate	Lake Wohlford	0.04
0.1Q2	D	Steep	Lake Wohlford	0.04

Table G.2-4: Sizing Factors for Hydromodification Flow Control Biofiltration with Partial Retention Designed Using Sizing Factor Method

Lower Flow Threshold	Soil Group	Slope	below low orifice inv	Rain Gauge	A
0.1Q_2	A	Flat	18	Lindbergh	0.08
0.1Q_2	A	Moderate	18	Lindbergh	0.08
0.1Q_2	A	Steep	18	Lindbergh	0.08
0.1Q_2	B	Flat	18	Lindbergh	0.065
0.1Q_2	B	Moderate	18	Lindbergh	0.065
0.1Q_2	B	Steep	18	Lindbergh	0.06
0.1Q_2	C	Flat	6	Lindbergh	0.05
0.1Q_2	C	Moderate	6	Lindbergh	0.05
0.1Q_2	C	Steep	6	Lindbergh	0.05
0.1Q_2	D	Flat	3	Lindbergh	0.05
0.1Q_2	D	Moderate	3	Lindbergh	0.05
0.1Q_2	D	Steep	3	Lindbergh	0.05
0.1Q_2	A	Flat	18	Oceanside	0.08
0.1Q_2	A	Moderate	18	Oceanside	0.075
0.1Q_2	A	Steep	18	Oceanside	0.075
0.1Q_2	B	Flat	18	Oceanside	0.07
0.1Q_2	B	Moderate	18	Oceanside	0.07
0.1Q_2	B	Steep	18	Oceanside	0.07
0.1Q_2	C	Flat	6	Oceanside	0.07
0.1Q_2	C	Moderate	6	Oceanside	0.07

0.1Q2	C	Steep	6	Oceanside	0.07
0.1Q2	D	Flat	3	Oceanside	0.07
0.1Q2	D	Moderate	3	Oceanside	0.07
0.1Q2	D	Steep	3	Oceanside	0.07
0.1Q2	A	Flat	18	Lake Wohlford	0.11
0.1Q2	A	Moderate	18	Lake Wohlford	0.11
0.1Q2	A	Steep	18	Lake Wohlford	0.105
0.1Q2	B	Flat	18	Lake Wohlford	0.09
0.1Q2	B	Moderate	18	Lake Wohlford	0.085
0.1Q2	B	Steep	18	Lake Wohlford	0.085
0.1Q2	C	Flat	6	Lake Wohlford	0.065
0.1Q2	C	Moderate	6	Lake Wohlford	0.065
0.1Q2	C	Steep	6	Lake Wohlford	0.065
0.1Q2	D	Flat	3	Lake Wohlford	0.06
0.1Q2	D	Moderate	3	Lake Wohlford	0.06
0.1Q2	D	Steep	3	Lake Wohlford	0.06

Table G.2-5: Sizing Factors for Hydromodification Flow Control Biofiltration BMPs Designed Using Sizing Factor Method

Lower Flow Threshold	Soil Group	Slope	Rain Gauge	A
0.1Q2	A	Flat	Lindbergh	0.32
0.1Q2	A	Moderate	Lindbergh	0.3
0.1Q2	A	Steep	Lindbergh	0.285
0.1Q2	B	Flat	Lindbergh	0.105
0.1Q2	B	Moderate	Lindbergh	0.1
0.1Q2	B	Steep	Lindbergh	0.095
0.1Q2	C	Flat	Lindbergh	0.055
0.1Q2	C	Moderate	Lindbergh	0.05
0.1Q2	C	Steep	Lindbergh	0.05
0.1Q2	D	Flat	Lindbergh	0.05
0.1Q2	D	Moderate	Lindbergh	0.05
0.1Q2	D	Steep	Lindbergh	0.05
0.1Q2	A	Flat	Oceanside	0.15
0.1Q2	A	Moderate	Oceanside	0.14
0.1Q2	A	Steep	Oceanside	0.135

0.1Q2	B	Flat	Oceanside	0.085
0.1Q2	B	Moderate	Oceanside	0.085
0.1Q2	B	Steep	Oceanside	0.085
0.1Q2	C	Flat	Oceanside	0.075
0.1Q2	C	Moderate	Oceanside	0.075
0.1Q2	C	Steep	Oceanside	0.075
0.1Q2	D	Flat	Oceanside	0.07
0.1Q2	D	Moderate	Oceanside	0.07
0.1Q2	D	Steep	Oceanside	0.07
0.1Q2	A	Flat	Lake Wohlford	0.285
0.1Q2	A	Moderate	Lake Wohlford	0.275
0.1Q2	A	Steep	Lake Wohlford	0.27
0.1Q2	B	Flat	Lake Wohlford	0.15
0.1Q2	B	Moderate	Lake Wohlford	0.145
0.1Q2	B	Steep	Lake Wohlford	0.145
0.1Q2	C	Flat	Lake Wohlford	0.07
0.1Q2	C	Moderate	Lake Wohlford	0.07
0.1Q2	C	Steep	Lake Wohlford	0.07
0.1Q2	D	Flat	Lake Wohlford	0.06
0.1Q2	D	Moderate	Lake Wohlford	0.06
0.1Q2	D	Steep	Lake Wohlford	0.06

Table G.2-6: Sizing Factors for Hydromodification Flow Control Cistern Facilities Designed Using Sizing Factor Method

Lower Flow Threshold	Soil Group	Slope	Rain Gauge	V
0.1Q2	A	Flat	Lindbergh	0.54
0.1Q2	A	Moderate	Lindbergh	0.51
0.1Q2	A	Steep	Lindbergh	0.49
0.1Q2	B	Flat	Lindbergh	0.19
0.1Q2	B	Moderate	Lindbergh	0.18
0.1Q2	B	Steep	Lindbergh	0.18
0.1Q2	C	Flat	Lindbergh	0.11
0.1Q2	C	Moderate	Lindbergh	0.11
0.1Q2	C	Steep	Lindbergh	0.11
0.1Q2	D	Flat	Lindbergh	0.09

0.1Q2	D	Moderate	Lindbergh	0.09
0.1Q2	D	Steep	Lindbergh	0.09
0.1Q2	A	Flat	Oceanside	0.26
0.1Q2	A	Moderate	Oceanside	0.25
0.1Q2	A	Steep	Oceanside	0.25
0.1Q2	B	Flat	Oceanside	0.16
0.1Q2	B	Moderate	Oceanside	0.16
0.1Q2	B	Steep	Oceanside	0.16
0.1Q2	C	Flat	Oceanside	0.14
0.1Q2	C	Moderate	Oceanside	0.14
0.1Q2	C	Steep	Oceanside	0.14
0.1Q2	D	Flat	Oceanside	0.12
0.1Q2	D	Moderate	Oceanside	0.12
0.1Q2	D	Steep	Oceanside	0.12
0.1Q2	A	Flat	Lake Wohlford	0.53
0.1Q2	A	Moderate	Lake Wohlford	0.49
0.1Q2	A	Steep	Lake Wohlford	0.49
0.1Q2	B	Flat	Lake Wohlford	0.28
0.1Q2	B	Moderate	Lake Wohlford	0.28
0.1Q2	B	Steep	Lake Wohlford	0.28
0.1Q2	C	Flat	Lake Wohlford	0.14
0.1Q2	C	Moderate	Lake Wohlford	0.14
0.1Q2	C	Steep	Lake Wohlford	0.14
0.1Q2	D	Flat	Lake Wohlford	0.12
0.1Q2	D	Moderate	Lake Wohlford	0.12
0.1Q2	D	Steep	Lake Wohlford	0.12

Date: 10/31/2018 Time: 15:23

```
*************************************************************
*                  RIPRAP DESIGN SYSTEM (RDS)               *
*                            BY                             *
*                     WEST Consultants, Inc.                *
*                                                           *
*                                                           *
* Version 3.0                                  March, 2005  *
*                                                           *
*                                                           *
* COPYRIGHT (c) 2005                                        *
* WEST CONSULTANTS, INC.                                    *
* 16870 WEST BERNARDO DRIVE                PH: 858-487-9378 *
* SUITE 340                                FAX:858-487-9448 *
* SAN DIEGO, CA 92127          WEB:WWW.WESTCONSULTANTS.COM  *
*************************************************************
```

Project: FALLBROOK
Description: RIPRAP SIZING FOR WEIR OUTLET

USACE Method

Input Parameters:

Velocity Type	Average
Channel Shape	Trapezoidal
Channel Type	Straight
Bend Angle (deg)	N/A
Average Channel Velocity	1.79 ft/s
Bottom width	N/A
Bend Radius	N/A
Top Width	N/A
Unit Weight of Stone	165. lbs/cu ft
Riprap Layer Thickness	1.50
Local Flow Depth	0.30 ft
Cotangent of Side Slope	N/A
Safety Factor	1.5
Riprap Placement	Channel Bottom
Rock Type	Angular

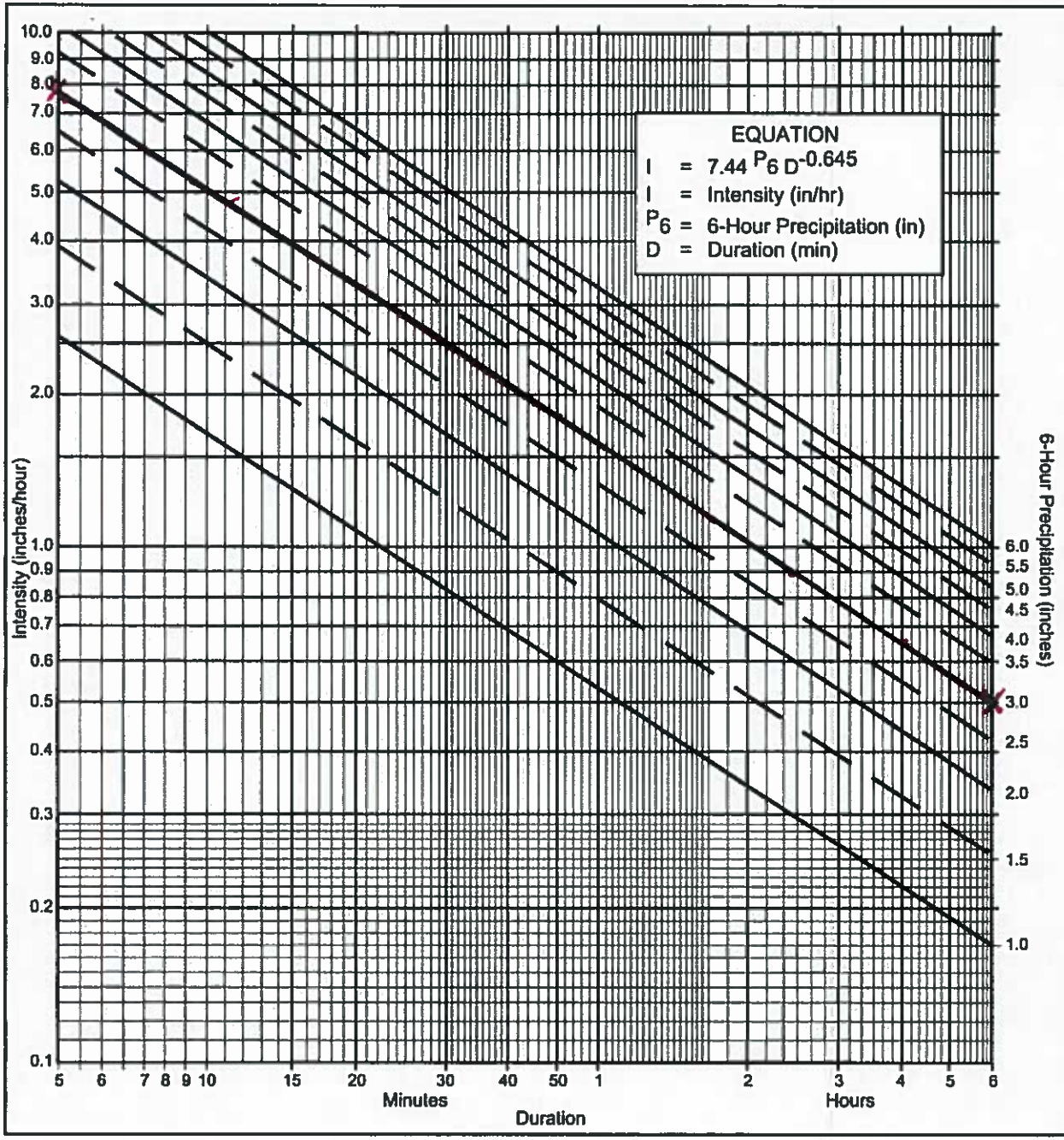
Output Results:

Computed D30	0.02 ft
Computed Local Depth Averaged Velocity	1.79 ft/s
Local Velocity/Avg. Velocity	1.00
Side Slope Correction Factor	1.02
Correction for Layer Thickness	0.89
Correction for Secondary Currents	1.00

*** Using Gradations from COE ETL 1110-2-120 ***

Specific Weight	165.0 lbs/cu ft
Layer Thickness	1.688 ft (Increased by 50%)
Selected Minimum D30	0.37 ft
Selected Minimum D90	0.53 ft

Percent Lighter by Weight	Stone Weight, lbs Minimum	Maximum
W100	15.	36.
W50	7.	11.
W15	2.	5.



Directions for Application:

(1) From precipitation maps determine 6 hr and 24 hr amounts for the selected frequency. These maps are included in the County Hydrology Manual (10, 50, and 100 yr maps included in the Design and Procedure Manual).

(2) Adjust 6 hr precipitation (if necessary) so that it is within the range of 45% to 65% of the 24 hr precipitation (not applicaple to Desert).

(3) Plot 6 hr precipitation on the right side of the chart.

(4) Draw a line through the point parallel to the plotted lines.

(5) This line is the intensity-duration curve for the location being analyzed.

Application Form:

(a) Selected frequency 100 year

(b) P_6 = 3.0 in., P_{24} = 5.5, $\frac{P_6}{P_{24}}$ = 54.5 %(2)

(c) Adjusted P_6(2) = 3 in.

(d) t_x = 5 min.

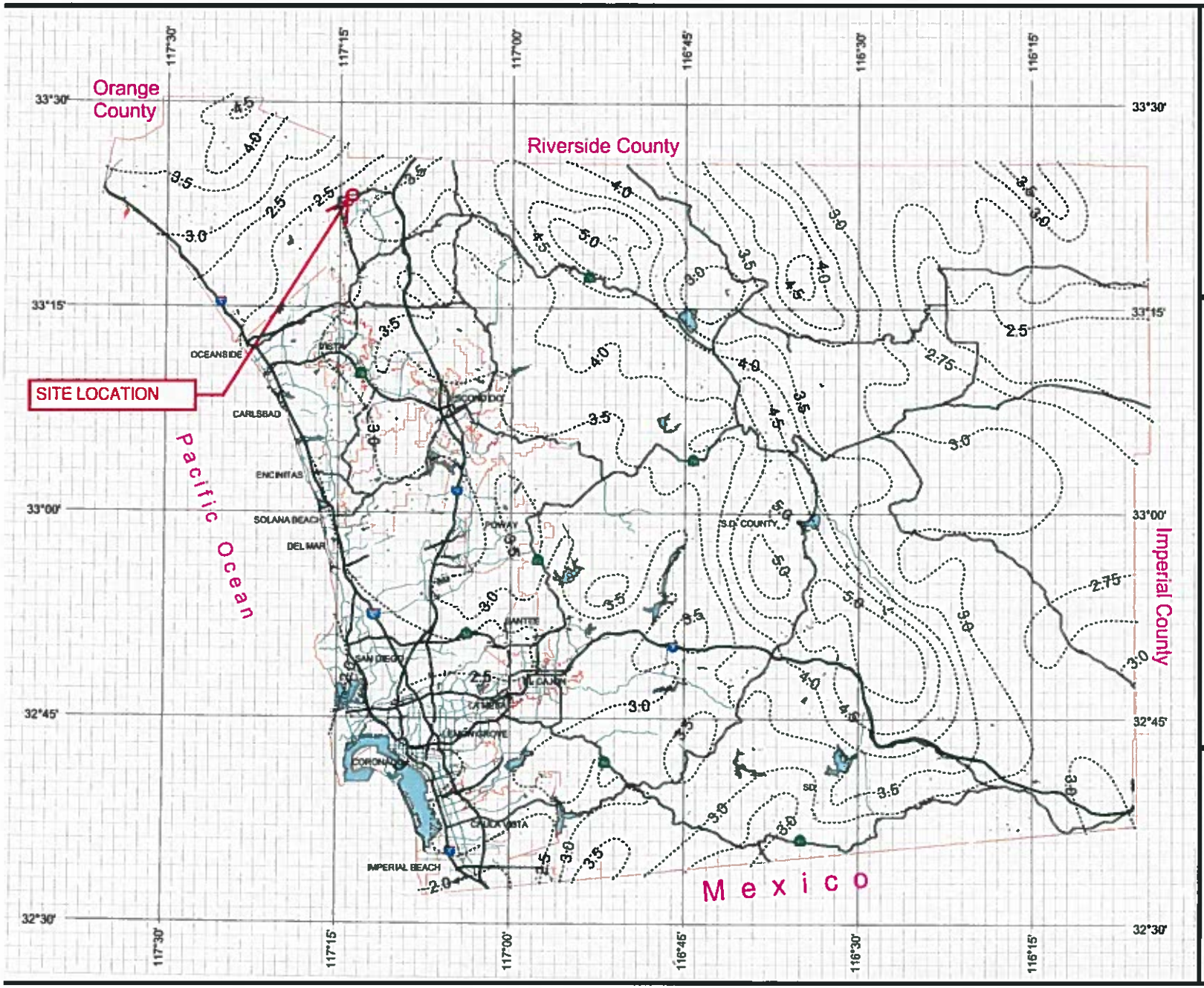
(e) I = 7.9 in./hr.

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

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

Intensity-Duration Design Chart - Template

FIGURE 3-1



County of San Diego Hydrology Manual

Rainfall Isopluvials

100 Year Rainfall Event - 6 Hours

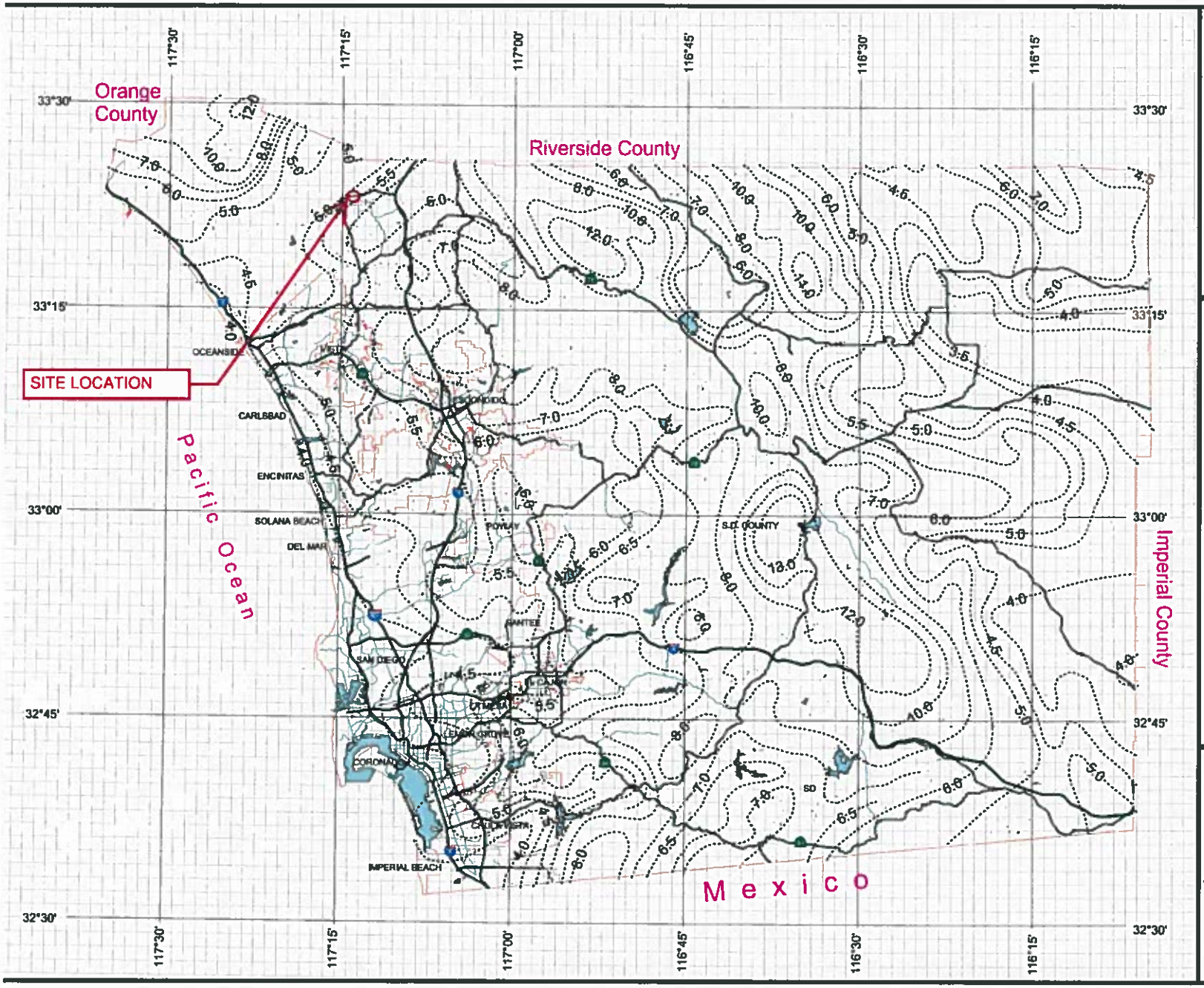
Isopluvial (inches)

DPW GIS

SanGIS
We Have San Diego Covered!

N W E S

3 0 3 Miles



County of San Diego Hydrology Manual

Rainfall Isopluvials

100 Year Rainfall Event - 24 Hours

Isopluvial (inches)

DPW GIS — Department of Public Works

SanGIS — We Have San Diego Covered!

N W E S

3 0 3 Miles

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

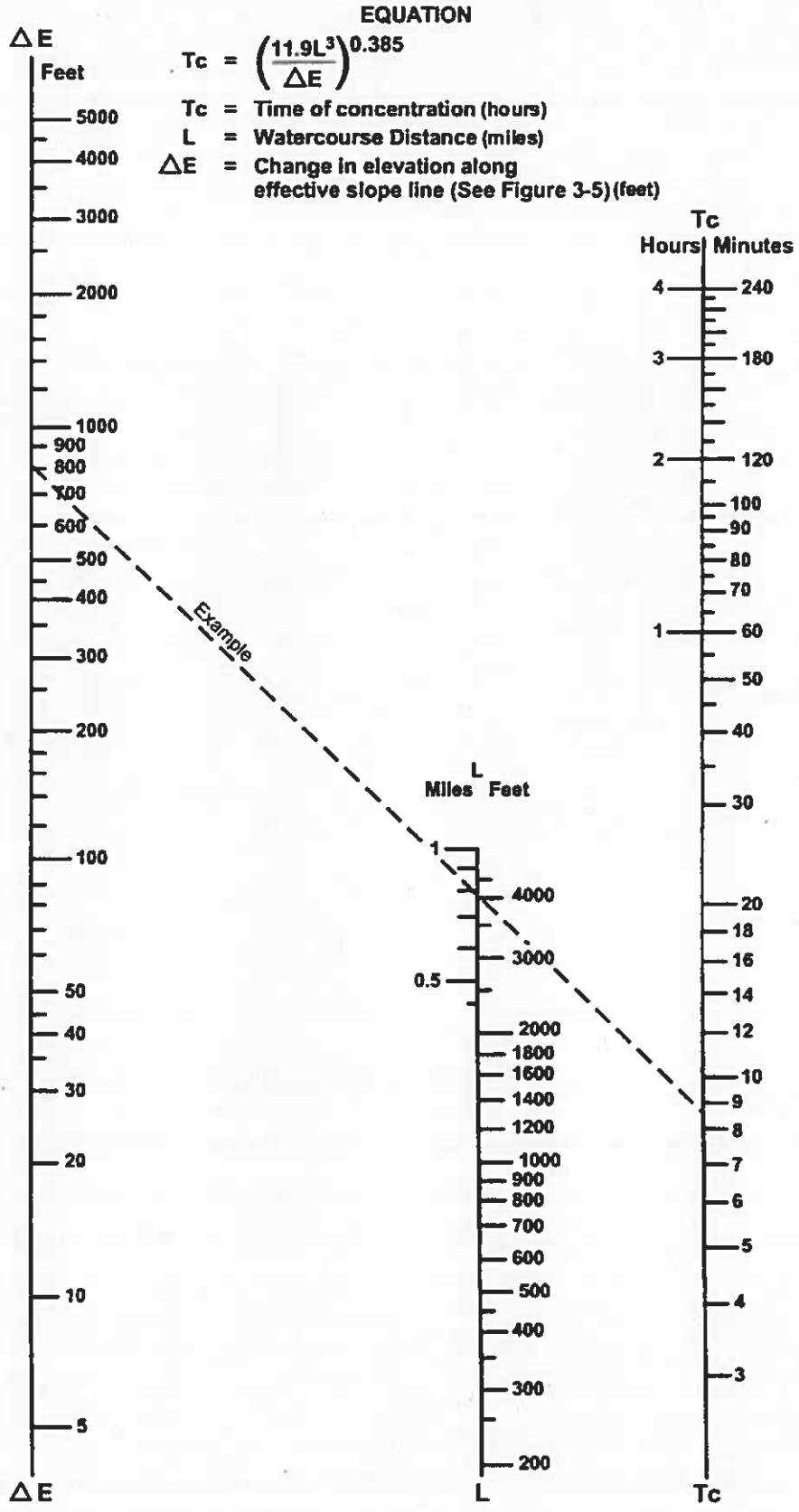
Table 3-2 provides limits of the length (Maximum Length (L_M)) of sheet flow to be used in hydrology studies. Initial T_i values based on average C values for the Land Use Element are also included. These values can be used in planning and design applications as described below. Exceptions may be approved by the "Regulating Agency" when submitted with a detailed study.

Table 3-2

MAXIMUM OVERLAND FLOW LENGTH (L_M) & INITIAL TIME OF CONCENTRATION (T_i)

Element*	DU/ Acre	.5%		1%		2%		3%		5%		10%	
		L_M	T_i	L_M	T_i	L_M	T_i	L_M	T_i	L_M	T_i	L_M	T_i
Natural		50	13.2	70	12.5	85	10.9	100	10.3	100	8.7	100	6.9
LDR	1	50	12.2	70	11.5	85	10.0	100	9.5	100	8.0	100	6.4
LDR	2	50	11.3	70	10.5	85	9.2	100	8.8	100	7.4	100	5.8
LDR	2.9	50	10.7	70	10.0	85	8.8	95	8.1	100	7.0	100	5.6
MDR	4.3	50	10.2	70	9.6	80	8.1	95	7.8	100	6.7	100	5.3
MDR	7.3	50	9.2	65	8.4	80	7.4	95	7.0	100	6.0	100	4.8
MDR	10.9	50	8.7	65	7.9	80	6.9	90	6.4	100	5.7	100	4.5
MDR	14.5	50	8.2	65	7.4	80	6.5	90	6.0	100	5.4	100	4.3
HDR	24	50	6.7	65	6.1	75	5.1	90	4.9	95	4.3	100	3.5
HDR	43	50	5.3	65	4.7	75	4.0	85	3.8	95	3.4	100	2.7
N. Com		50	5.3	60	4.5	75	4.0	85	3.8	95	3.4	100	2.7
G. Com		50	4.7	60	4.1	75	3.6	85	3.4	90	2.9	100	2.4
O.P./Com		50	4.2	60	3.7	70	3.1	80	2.9	90	2.6	100	2.2
Limited I.		50	4.2	60	3.7	70	3.1	80	2.9	90	2.6	100	2.2
General I.		50	3.7	60	3.2	70	2.7	80	2.6	90	2.3	100	1.9

*See Table 3-1 for more detailed description



SOURCE: California Division of Highways (1941) and Kirpich (1940)

FIGURE 3-4

Nomograph for Determination of
Time of Concentration (Tc) or Travel Time (Tt) for Natural Watersheds

Rational Method Hydrology Calculations per Section 3 of the San Diego County Hydrology Manual

Computations by: Psomas, Dated: 11/27/2018

		FIG 3-2	CALCULATED			TC	
	RETURN	I	I	7.44	P6	D	-0.645
	YEAR	IN/HR	IN/HR	CONST	INCH	MINUTE	COEFF
ROAD	2	3.2	3.2	7.44	1.2	5	-0.645
	5	4.7	4.7	7.44	1.8	5	-0.645
	10	5.3	5.3	7.44	2.0	5	-0.645
	25	5.8	5.8	7.44	2.2	5	-0.645
	50	6.6	6.6	7.44	2.5	5	-0.645
	100	7.9	7.9	7.44	3.0	5	-0.645

	RETURN	I	I	7.44	P6	D	-0.645
	YEAR	IN/HR	IN/HR	CONST	INCH	MINUTE	COEFF
BATTERY	2	3.2	3.0	7.44	1.2	5.5	-0.645
	5	4.7	4.4	7.44	1.8	5.5	-0.645
	10	5.3	4.9	7.44	2.0	5.5	-0.645
	25	5.8	5.4	7.44	2.2	5.5	-0.645
	50	6.6	6.2	7.44	2.5	5.5	-0.645
	100	7.9	7.4	7.44	3.0	5.5	-0.645

	FIG 3-4	CALCULATED Proposed									
	TC	TC	11.9	L	3	dE	0.385			TYPE C	% IMPERV
	MIN	MIN	CONST	MILES	COEFF	FEET	COEFF				
ROAD	5	4.8	11.9	0.19	3	57.5	0.385	EXISTING	NATURAL	0.30	0
BATTERY	5	5.5	11.9	0.19	3	40.0	0.385	PROPOSED	ROAD	0.36	0.11
	USE 5 MIN SINCE MIN VALUE ON FIG 3-2							PROPOSED	BATTERY	0.46	0.26

	FIG 3-3	CALCULATED								
	TC	TC	1.8	1.1	CR	L	0.5	S	0.33	
	MIN	MIN	CONST	CONST	UNITLESS	FEET	COEFF	%	COEFF	
ROAD	N/A	25.5	1.8	1.1	0.3	996	0.5	5.77	0.33	
	N/A	23.6	1.8	1.1	0.36	996	0.5	5.77	0.33	
BATTERY	N/A	29.0	1.8	1.1	0.3	1006	0.5	3.98	0.33	
	N/A	23.2	1.8	1.1	0.46	1006	0.5	3.98	0.33	
	EQUATION NOT APPLICABLE SINCE L>Lm AS PER TABLE 3-2									

Q=CIA

2YR	Q	C	I	A
	CFS	UNITLESS	IN/HR	AC
ROAD EX	12.7	0.30	3.2	13.42
ROAD PR	15.5	0.36	3.2	13.42
BATTERY EX	4.0	0.30	3.0	4.47
BATTERY PR	6.0	0.46	3.0	4.47

5YR	Q	C	I	A
	CFS	UNITLESS	IN/HR	AC
ROAD EX	19.1	0.30	4.7	13.42
ROAD PR	23.2	0.36	4.7	13.42
BATTERY EX	6.4	0.30	4.7	4.47
BATTERY PR	9.7	0.46	4.7	4.47

10YR	Q	C	I	A
	CFS	UNITLESS	IN/HR	AC
ROAD EX	21.2	0.30	5.3	13.42
ROAD PR	25.8	0.36	5.3	13.42
BATTERY EX	7.1	0.30	5.3	4.47
BATTERY PR	10.7	0.46	5.3	4.47

25YR	Q	C	I	A
	CFS	UNITLESS	IN/HR	AC
ROAD EX	23.3	0.30	5.8	13.42
ROAD PR	28.4	0.36	5.8	13.42
BATTERY EX	7.8	0.30	5.8	4.47
BATTERY PR	11.8	0.46	5.8	4.47

50YR	Q	C	I	A
	CFS	UNITLESS	IN/HR	AC
ROAD EX	26.5	0.30	6.6	13.42
ROAD PR	32.2	0.36	6.6	13.42
BATTERY EX	8.8	0.30	6.6	4.47
BATTERY PR	13.4	0.46	6.6	4.47

					VOL=CP6A				
100YR	Q	C	I	A	P6 - 100 YR	V	V Change	BMP Depth	BMP Area
	CFS	UNITLESS	IN/HR	AC	Inch	cf	cf	ft	sqft
ROAD EX	31.8	0.30	7.9	13.42	3.0	43843.1			
ROAD PR	38.7	0.36	7.9	13.42	3.0	53313.3	9470.1	3.5	2705.7
BATTERY EX	10.6	0.30	7.9	4.47	3.0	14603.5			
BATTERY PR	16.1	0.46	7.9	4.47	3.0	22197.3	7593.8	3.5	2169.7