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ALTEC ENGINEERING CORP.

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**HYDROLOGY STUDY &
HYDRAULIC CALCULATIONS**

PROPOSED RESIDENTIAL SUBDIVISION

APN 3135-361-05 & 06
Tentative Tract Map 20088
VICTORVILLE, CA

PREPARED FOR

Purendar Amin
18442 Villa Drive
Villa Park, CA. 92861

**Date Prepared:
December 8, 2017
Updated November 29, 2018**

W.O.# AMIN

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DISCUSSION

PURPOSE & INTRODUCTION

This study was performed to determine the drainage flows that affect the proposed development of a new proposed residential subdivision so that an adequate drainage plan could be designed to conduct these stormwater flows through the site and reduce the outflows from the site. During the preparation and approval of the Final Engineering Design Plans, all onsite catch basins, pipe sizing, and retention basin systems will be calculated and designed to be in compliance and due to the size of the project being 10 (gross) acres, the following two items will also be required, as applicable:

- Complete and execute a Water Quality Management Plan with Priority Project designation
- Complete and execute a Storm Water Pollution Prevention Plan (SWPPP) and attain a National Pollutant Discharge Elimination System (NPDES) General Permit

LOCATION & DISCUSSION

This property is located on the north side of Seneca Road approximately 1,320 feet east of Highway 395 in Victorville. The site is approximately 20 acres and is rectangular in shape (see attached map). The site is currently vacant. There are no existing structures or improvements on the site. The entire site is pervious. The native site slopes at approximately 1.5% from the southwest to the northeast. The roughness coefficient for the native site used in this study is to be 0.030. The roughness coefficient for the developed site and offsite drainage areas used in this study is to be 0.020. There is an existing natural drainage course that crosses the southeast corner of the site.

The existing natural drainage course is identified as Channel E-01 (Base width of 15' and total depth of 7') in the City of Victorville Master Plan of Drainage (March 1992). The Channel E-01 shows the Q100 for the channel in this area to be 2,373 cubic feet per second. As of this time there are no provisions in place to carry these potential flows across Highway 395 and the toward the site.

The current proposed site improvements include the construction of 61 new single-family residences, new streets, and open space. The site will be developed in a single phase. On-site storm run-off shall be directed away from the proposed buildings.

OTHER STUDIES

There are two other studies performed on this site, being an Archeological Study and an Air Quality Study. There have been no Percolation or Preliminary Soils Reports done.

METHODOLOGY

The on-site storm flow volume was determined using the Rational Method to determine the Time of Concentration for the pre-developed and fully developed site. This information was then used in the Unit Hydrograph Method to determine the runoff volume. The following analysis values were used to determine the required on-site runoff for determining the required retention volume:

- (a) 100 -year design storm frequency.
- (b) Hydrologic soils group "A"
- (c) Onsite Development Type: Single Family Residential
- (d) 10 Year 1 hour – 0.64 (Per NOAA Point Precipitation Frequency Estimates)
- (e) 10 Year 6 hour – 1.32 (Per NOAA Point Precipitation Frequency Estimates)
- (f) 10 Year 24 hour – 2.52 (Per NOAA Point Precipitation Frequency Estimates)
- (g) 100 Year 1 hour – 1.08 (Per NOAA Point Precipitation Frequency Estimates)
- (h) 100 Year 6 hour – 2.24 (Per NOAA Point Precipitation Frequency Estimates)
- (i) 100 Year 24 hour – 4.42 (Per NOAA Point Precipitation Frequency Estimates)
- (j) Existing SCS Curve Number – 46 Per SBCFCD Hydrology Manual
- (k) Existing Pervious Area – 100%
- (l) Developed SCS Curve Number – 32 Per SBCFCD Hydrology Manual
- (m) Developed Pervious Area – 40%

The off-site storm flow was determined using the Unit Hydrograph Method to determine the storm runoff that affects the site. The following analysis values were used to determine the required on-site runoff for determining the required retention volume:

- (a) 100 -year design storm frequency.
- (b) Hydrologic soils group "A" – 71 acres
- (c) Development type: Commercial – 10 acres
Residential: 4 Units per acre – 48 acres
Residential: 15 Units per acre – 13 acres
- (d) 100 Year 1 hour – 1.08 inches per hour (Per NOAA Point Precipitation Frequency Estimates)
100 Year 6 hour – 2.24 inches per hour (Per NOAA Point Precipitation Frequency Estimates)
100 Year 24 hour – 4.42 inches per hour (Per NOAA Point Precipitation Frequency Estimates)
- (e) SCS Curve Number – 32 Per SBCFCD Hydrology Manual
- (f) Developed Pervious Area – 40%

ON-SITE RUNOFF

The on-site runoff was determined using the San Bernardino County Rational Method. The proposed land use was analyzed to determine the total runoff for a 100-year storm event. This information was used to determine the required drainage facilities to safely convey the drainage through the site.

The site was broken down into 2 separate drainage areas, essentially being determined by the natural topography and the proposed layout, as tentatively supported by staff, of the Tentative Tract Map and the slopes of the proposed streets. The west drainage area covers 8.75 acres and the east area covers 10.25 acres. The locations of the areas are shown on the full-size map titled “DEVELOPED DRAINAGE NODES” for clarity. The runoff from the future proposed fully developed site areas is shown in the following tables.

10-YEAR STORM EVENT

	Predeveloped:	Developed:
Area – Acres	19.07	16.61
Length of Travel – Feet	1320	1320
Time of Concentration –Minutes/hour	20.5/0.34	23.2/0.39
Q ₁₀ – CFS	13.1	11.809

Why is developed
smaller than predev?

100-YEAR STORM EVENT

	Predeveloped:	Developed:
Area – Acres	19.07	16.61
Length of Travel – Feet	1320	1320
Time of Concentration –Minutes/hour	20.5/0.34	21.07/0.35
Q ₁₀₀ – CFS	29.124	27.132

ON-SITE RUNOFF VOLUME

The on-site runoff volume was determined using the San Bernardino County Unit Hydrograph Method. The proposed land use was analyzed to determine the total runoff volume for a 10-year (10-yr) and a 100-year (100-yr) storm event. This information was used to determine the required drainage facilities to safely convey the drainage through the site and stormwater retention volumes.

For a ten-year (10-yr) storm event the runoff volume increased for the undeveloped site from 0.88 acre-feet (38,333 cubic feet) to 2.1137 acre-feet (92,073 cubic feet). The increased (10-yr) volume is 53,740 cubic feet. For a one-hundred-year (100-yr) storm event the runoff volume increased for the undeveloped site from 2.6696 acre-feet (116,288 cubic feet) to 4.1071 acre-feet (178,905 cubic feet). The increased (100-yr) volume is 62,617 cubic feet.

ON-SITE DISCUSSION

ON-SITE RETENTION VOLUME: The proposed has two –(2) locations with retention basins to retain a minimum of 100% of the increase stormwater volume from the natural conditions of both pre and post Q_{10} and Q_{100} conditions and impacts to potential downstream developments. The runoff created from the residential home and lot development can be carried in the new proposed streets, being a minimum of 36-feet wide from 8-inch curb face to curb face. Curb inlets can either have a 2-foot deep triangular concrete channel or an 8-inch deep by 6-foot wide rectangular concrete channel can be used to carry the runoff from the streets into the retention basins. The curb inlets, and On-Site Retention Basin Designs will be determined in the Final Design Plans.

ON-SITE STORMWATER TREATMENT: Generally, the Site's existing natural soils are sandy loams with excellent percolation rates providing stormwater treatment as the stormwater percolates into the soils and to the water table which is at an extended depth to provide a natural stormwater treatment.

Additionally, the Certified Arborist for the project (RJ Coleman., Certified Arborist/Tree Risk Assessment Qualified: WE#8024A by the International Arborist Society proposes relocation of Joshua Trees and any other Cactus to be relocated into the retention basins to provide natural stormwater to mimic natural desert conditions. Other endemic and native plants, both perennials and annuals will naturally re-establish in the retention basins and provide long-term natural conditions for excellent stormwater percolation conditions and provide shallow soils from creating soil crusts at the surfaces.

The attached Tentative Tract delineates the On-Site Sub-Watersheds, including directional arrows for clarity purposes to each of the Retention Basins and around the Site and into the City's MS4 Permit.

OFF-SITE RUNOFF

The off-site runoff that affects the site originates along the north side of the Super Walmart Center located at the northeast corner of Highway 395 and Palmdale Road (Highway 18). The length of the watercourse 2,350 feet and has an elevation drop of 30 feet. The tributary area covers 71 acres. The zoning in this area consists of 10 acres zoned C-2, 13 acres zoned R-3 (15 units/acre), and 48

acres zoned R-1 (4 units/acre). The entire area is not developed but was considered to be fully developed for this study. This is based upon current zoning maps. The zoning in some of the area may be subject to change in the future as development occurs. The adjacent property to the south drains by way of sheet flows onto the site. The flow from this area for a 100 Year Storm Event was found to be 227.5 cfs.

OFF-SITE DISCUSSION

OFF-SITE: The Southeast corner of the Site is being left in a AS-IS condition due to the off-site stormwater flows bisecting this location and this design feature eliminates pre and post Q_{10} and Q_{100} impacts to potential downstream developments.

It should be noted that as the area developed the zoning in the tributary area will most likely change somewhat. As development occurs and on-site or sub-surface retention basins are developed and utilized to meet various stormwater rules and regulations, this runoff amount will most likely be reduced.

BMP'S DISCUSSION

NOTED: It is noted this project has not received Conditions of Approval from staff or any jurisdictional approval by staff or the City of Victorville Planning Commission, therefore these BMP discussions and other criteria may change as additional information and Final Design Plans are ultimately approved.

Due to the size of the project and the proposed development of 69 detached single-family residential lots; This project is considered to be a Priority Project. The Pre-Construction/temporary BMP's will be limited to fiber rolls along the down-gradient portions of the Site, being the northern and eastern boundary of the Site.

The Post-Construction/Permanent BMP's are essentially three –(3) components, being the off-site stormwater being limited to the southeastern corner of the Site remaining natural native desert conditions and the two retention basins will be the permanent Post-Construction BMP's.

The “Rough BMP Calcs” for the southerly and northerly retention basin will have a minimum total volume size of be roughly Q_{10} – 53,740 cubic feet and will be completed in the final design plans to mitigate for the 85th percentile 24-hour storm and the pre-project flow for the 10-year 24-hour storm. The 20-acre site size provides adequate on-site space to implement both the preliminary and the permanent BMP's.

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The temporary BMP's will be maintained by the project developer and the permanent BMP's will be maintained by the project Home Owners Association (HOA), being the ultimate homeowners.

The Water Quality Management Plan (WQMP) Operations and Maintenance Manual Final Report shall be completed and included in the Final Plan check process. At this time no unforeseen issues and challenges are anticipated at this time.

A stormwater percolation testing at each retention basin shall be completed and provided to the City with the Final Design Plans and shall meet all appropriate requirements for permanent BMP's sizing and anticipated maintenance concerns.

The attached full-size Tentative Tract delineates the preliminary and permanent BMP locations, including directional arrows for clarity purposes to each of the Retention Basins and around the Site and into the City's MS4 Permit.

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SUMMARY DISCUSSIONS:

The proposed project is located in an area that has seen significant national and regional builders developing residential and corresponding commercial development since the 1990's as the economic conditions support.

Additionally, the soils in this area generally provide excellent percolation conditions and provide stormwater treatment. The size of the Site provides adequate area for development in a single phase or for multiple phases.

Conclusion: No unforeseen conditions are presently known that would create a development that does not meet or exceed all stormwater concerns, either with flooding conditions, stormwater retention requirements nor preliminary or permanent BMP's.

Sincerely,



Randolph J. Coleman, Dated November 29, 2018
AICP CEP, PE-Civil #36293, PLS #5413, QSD/P #21595

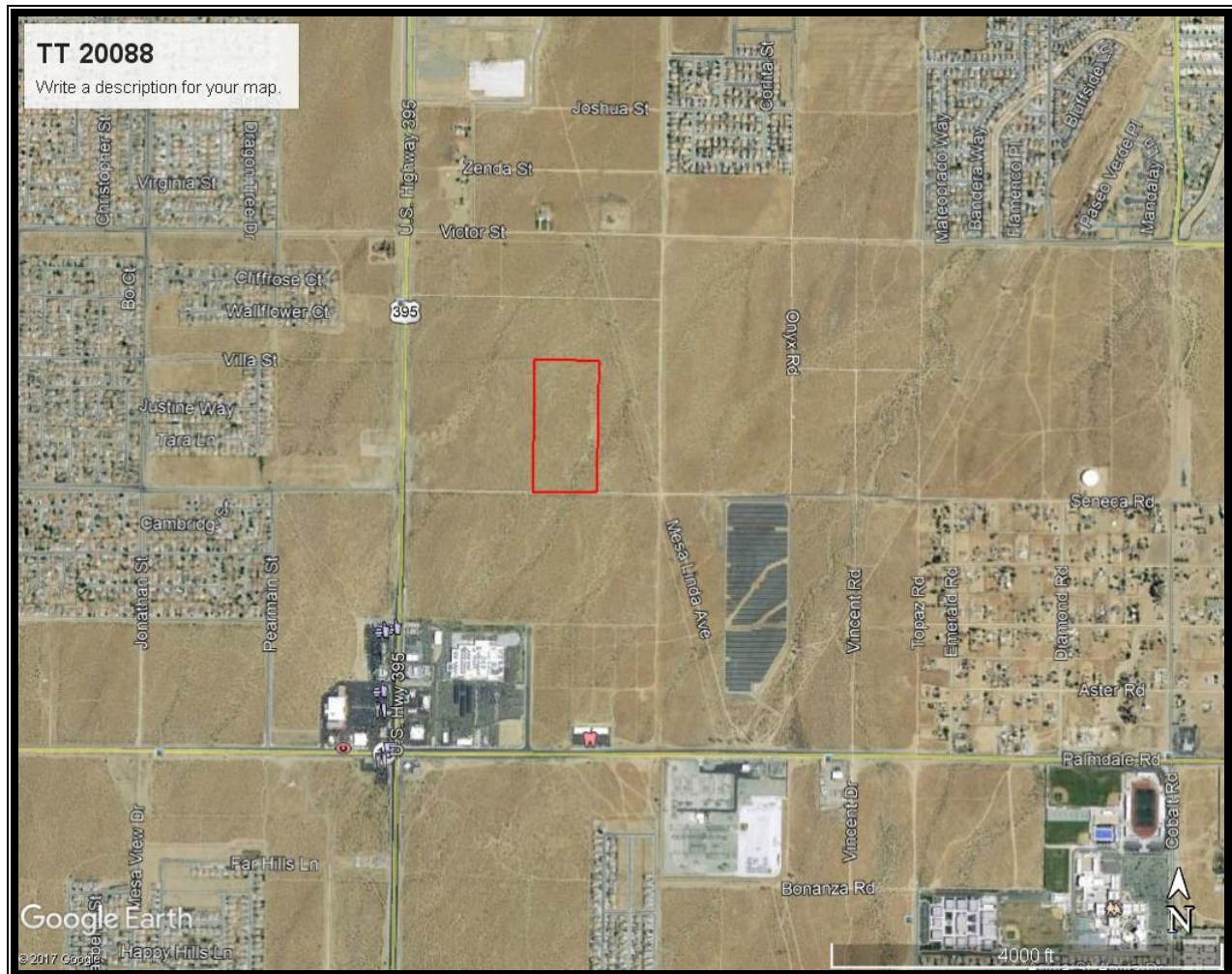
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Appendix 1: Aerial/Location Map



SENECA ROAD EAST OF HIGHWAY 395, VICTORVILLE

Planning: Land, GIS & Cannabis
Surveying: Construction, Land & ALTA
Engineering: Civil, Structural & Soils

CEQA, Biological, Native Plant & Phase 1 Assessments
Community Relations & Marketing Studies

Real Estate & R/W Services
Feasibility & Fiscal Analysis
Construction Management & Inspection

©

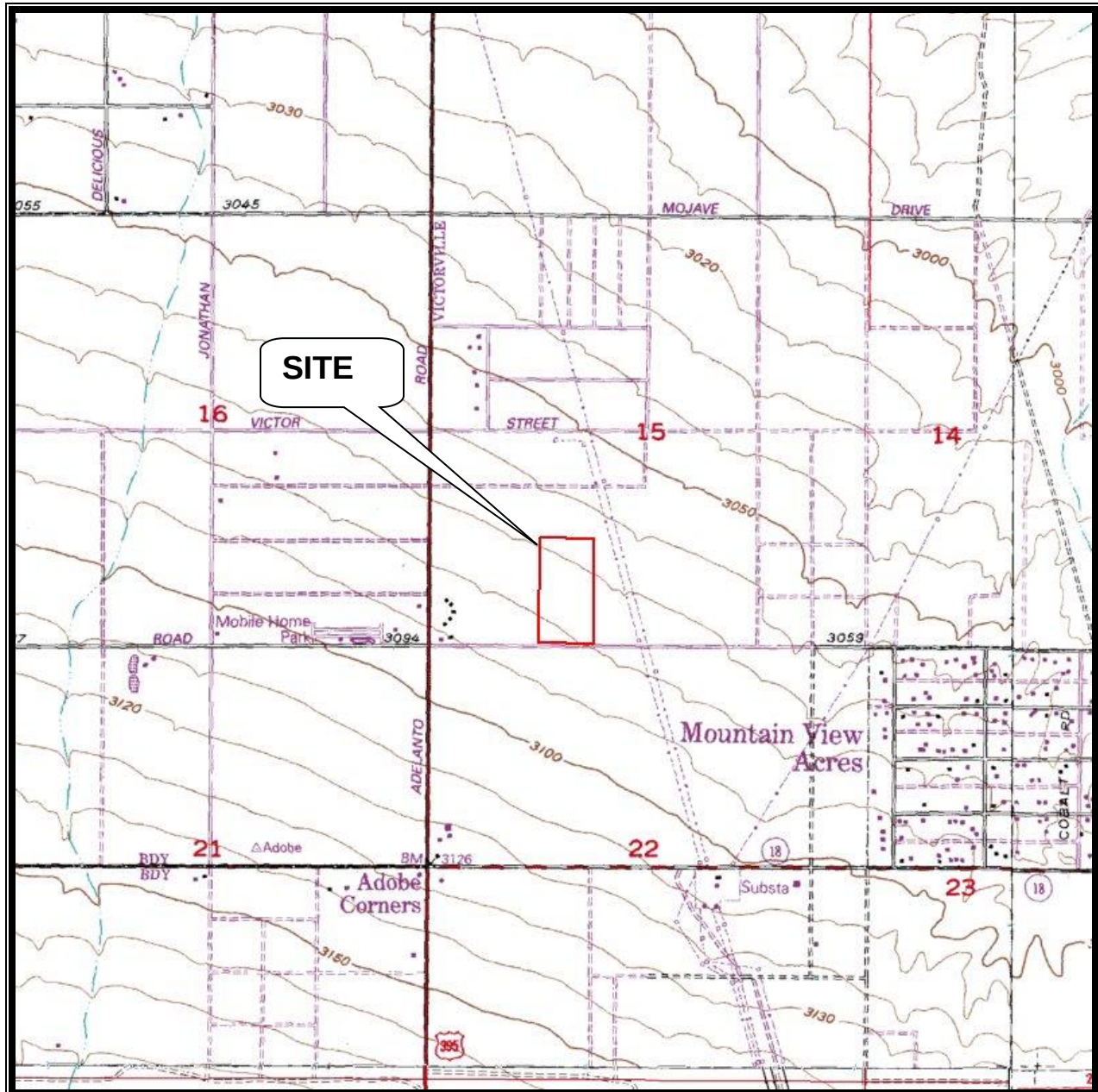
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Appendix 2: USGS Quad Sheet



Planning: Land, GIS & Cannabis
Surveying: Construction, Land & ALTA
Engineering: Civil, Structural & Soils

CEQA, Biological, Native Plant & Phase 1 Assessments
Community Relations & Marketing Studies

Real Estate & R/W Services
Feasibility & Fiscal Analysis
Construction Management & Inspection

©

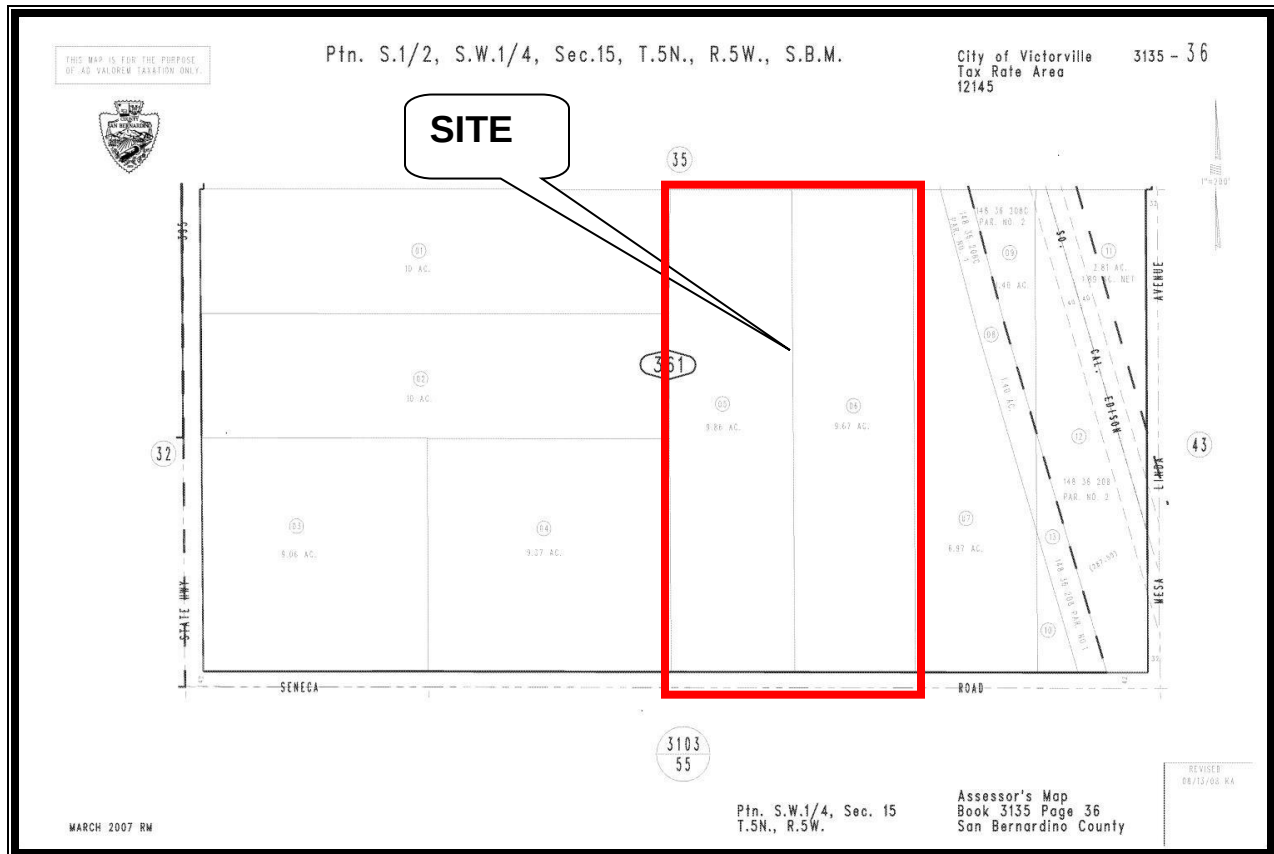
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Appendix 3: Assessor's Parcel Map



APN 3135-361-05 & 06

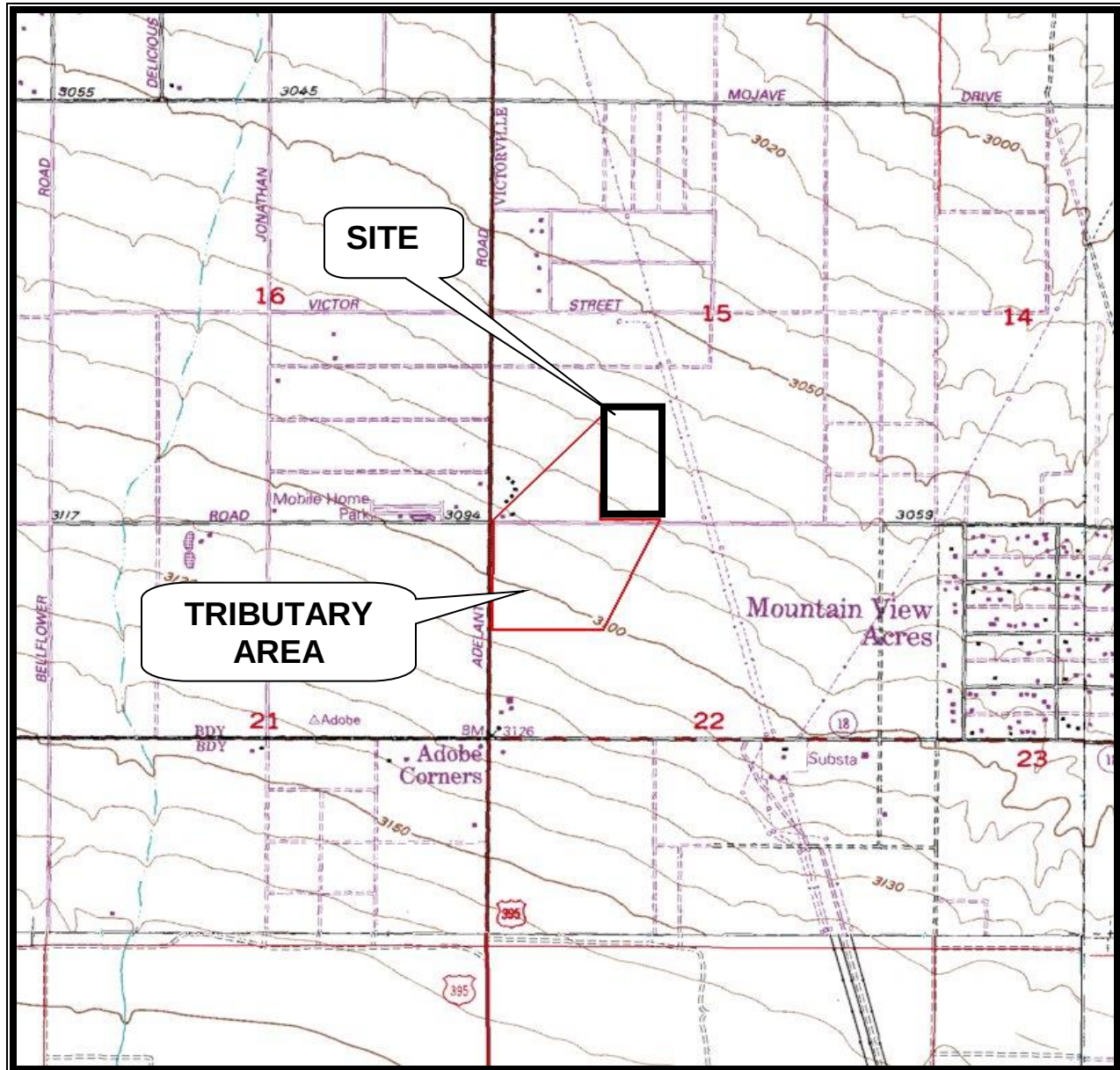
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Appendix 4: Offsite Tributary Area



USGS QUAD SHEETS - NOT TO SCALE

Planning: Land, GIS & Cannabis
Surveying: Construction, Land & ALTA
Engineering: Civil, Structural & Soils

CEQA, Biological, Native Plant & Phase 1 Assessments
Community Relations & Marketing Studies

Real Estate & R/W Services
Feasibility & Fiscal Analysis
Construction Management & Inspection

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Appendix 5: Photographs

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LOOKING WEST ALONG SENECA ROAD FROM SE CORNER



LOOKING EAST ALONG SENECA ROAD FROM SW CORNER



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RETENTION BASIN AT SUPER WALMART CENTER



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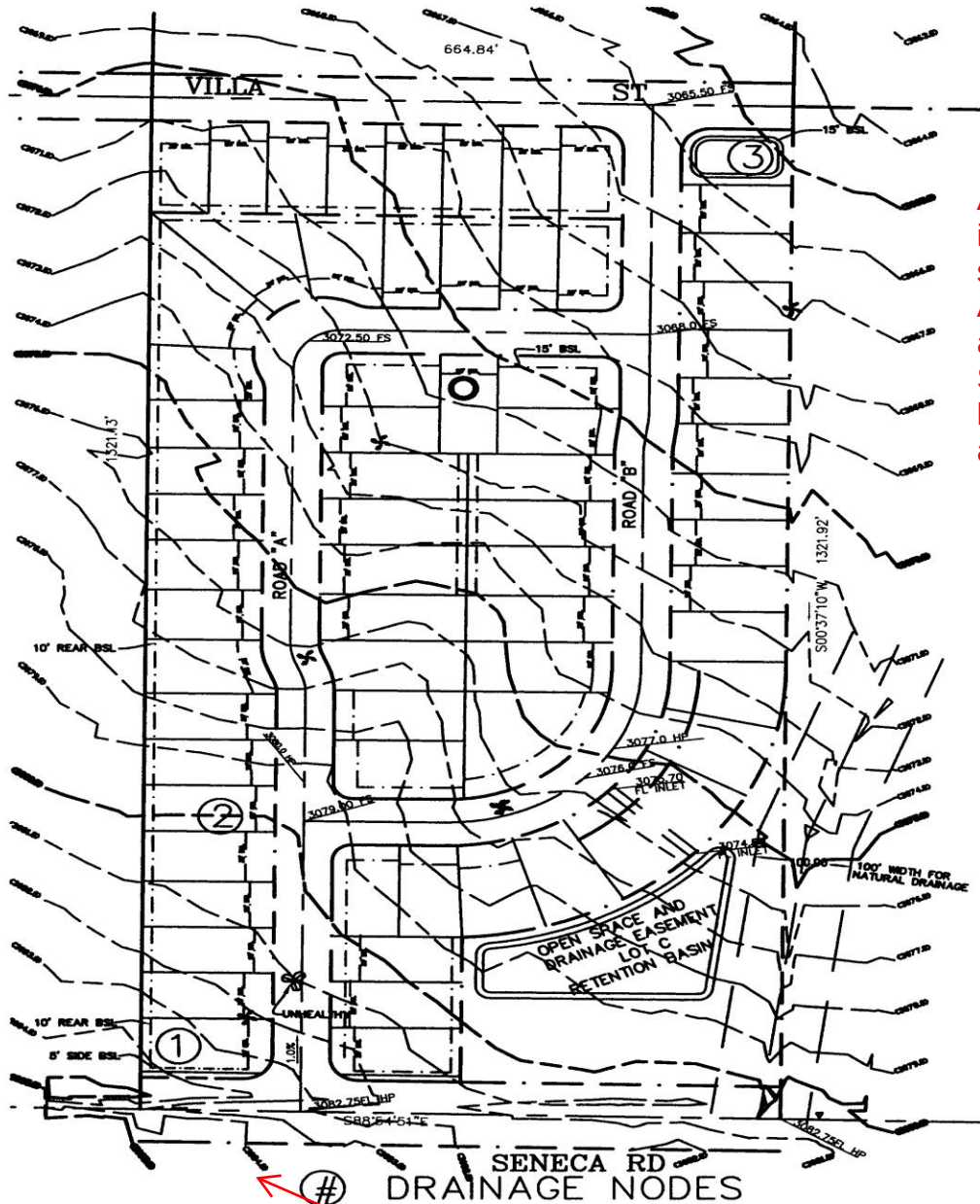
Appendix 6: Drainage Nodes

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Add flow rates
in table
showing nodes.
Add flow
arrows
Show drainage
boundaries and
areas of each

EXISTING DRAINAGE NODES

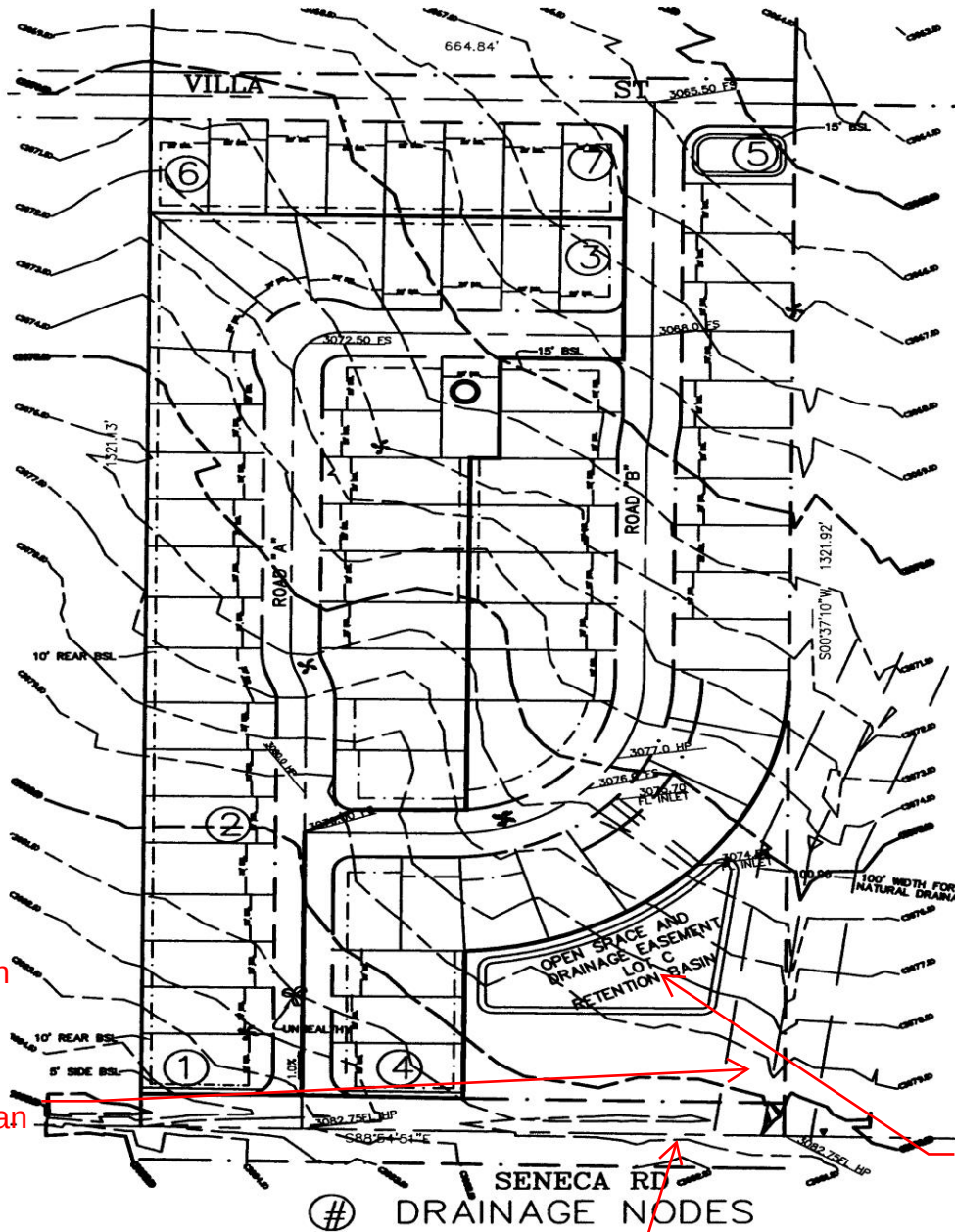
Show where off-site flows come onto the site.

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Provide a discussion of how this development will address the offsite flows and master plan facility development that is on the property.

Add flow rates in table showing nodes. Add flow arrows. Clearly show drainage boundaries and areas of each. Clearly show drainage paths.

Explain why you are putting the large detention basin at the upstream end of the development. Usually the detention basin is placed where the development drains to it. This normally addresses the BMP/WQMP requirements of the Water Board.

DEVELOPED DRAINAGE NODES

Show where off-site flows come onto the site.

Planning: Land, GIS & Cannabis
Surveying: Construction, Land & ALTA
Engineering: Civil, Structural & Soils

CEQA, Biological, Native Plant & Phase 1 Assessments
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Appendix 7: Rainfall Data

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NOAA Atlas 14, Volume 6, Version 2
Location name: Victorville, California, USA*
Latitude: 34.5142°, Longitude: -117.3953°
Elevation: 3087.37 ft**
* source: ESRI Maps
** source: USGS



POINT PRECIPITATION FREQUENCY ESTIMATES

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

NOAA, National Weather Service, Silver Spring, Maryland

[PF tabular](#) | [PF graphical](#) | [Maps & arials](#)

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches/hour) ¹										
Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.984 (0.816-1.20)	1.40 (1.15-1.72)	1.96 (1.61-2.40)	2.41 (1.97-2.99)	3.06 (2.41-3.91)	3.56 (2.75-4.66)	4.08 (3.08-5.47)	4.63 (3.40-6.37)	5.39 (3.79-7.73)	5.99 (4.08-8.89)
10-min	0.708 (0.582-0.864)	1.00 (0.828-1.23)	1.40 (1.15-1.72)	1.73 (1.41-2.14)	2.19 (1.73-2.80)	2.55 (1.97-3.34)	2.93 (2.21-3.92)	3.32 (2.44-4.57)	3.86 (2.72-5.54)	4.29 (2.92-6.37)
15-min	0.568 (0.472-0.696)	0.808 (0.668-0.988)	1.13 (0.928-1.39)	1.40 (1.14-1.73)	1.77 (1.40-2.26)	2.06 (1.59-2.69)	2.36 (1.78-3.16)	2.68 (1.96-3.68)	3.12 (2.19-4.47)	3.46 (2.36-5.14)
30-min	0.410 (0.338-0.502)	0.582 (0.480-0.712)	0.814 (0.670-0.998)	1.00 (0.820-1.24)	1.27 (1.00-1.63)	1.48 (1.15-1.94)	1.70 (1.28-2.27)	1.93 (1.41-2.65)	2.24 (1.58-3.22)	2.49 (1.70-3.70)
60-min	0.261 (0.216-0.319)	0.371 (0.306-0.454)	0.518 (0.426-0.636)	0.640 (0.522-0.792)	0.810 (0.639-1.04)	0.944 (0.730-1.23)	1.08 (0.817-1.45)	1.23 (0.901-1.69)	1.43 (1.01-2.05)	1.59 (1.08-2.36)
2-hr	0.182 (0.150-0.223)	0.247 (0.204-0.302)	0.336 (0.276-0.412)	0.410 (0.335-0.508)	0.516 (0.408-0.660)	0.602 (0.465-0.786)	0.691 (0.522-0.925)	0.786 (0.577-1.08)	0.918 (0.647-1.32)	1.02 (0.698-1.52)
3-hr	0.150 (0.124-0.183)	0.199 (0.165-0.244)	0.269 (0.221-0.330)	0.328 (0.267-0.405)	0.412 (0.325-0.527)	0.481 (0.372-0.628)	0.552 (0.417-0.740)	0.630 (0.462-0.867)	0.739 (0.520-1.06)	0.827 (0.563-1.23)
6-hr	0.102 (0.084-0.124)	0.135 (0.111-0.165)	0.181 (0.149-0.222)	0.220 (0.180-0.272)	0.277 (0.219-0.355)	0.324 (0.250-0.423)	0.374 (0.282-0.500)	0.428 (0.314-0.589)	0.505 (0.356-0.725)	0.568 (0.387-0.844)
12-hr	0.063 (0.052-0.077)	0.086 (0.071-0.105)	0.118 (0.097-0.145)	0.146 (0.119-0.180)	0.185 (0.146-0.237)	0.216 (0.168-0.284)	0.252 (0.190-0.337)	0.289 (0.212-0.398)	0.342 (0.241-0.491)	0.386 (0.262-0.573)
24-hr	0.042 (0.038-0.049)	0.060 (0.053-0.069)	0.084 (0.074-0.097)	0.105 (0.092-0.122)	0.135 (0.114-0.162)	0.159 (0.132-0.195)	0.184 (0.149-0.232)	0.212 (0.167-0.274)	0.251 (0.190-0.339)	0.284 (0.207-0.396)
2-day	0.023 (0.020-0.027)	0.033 (0.029-0.038)	0.046 (0.041-0.053)	0.058 (0.051-0.067)	0.074 (0.063-0.089)	0.088 (0.073-0.108)	0.102 (0.083-0.129)	0.118 (0.093-0.152)	0.140 (0.106-0.189)	0.158 (0.116-0.221)
3-day	0.016 (0.015-0.019)	0.023 (0.021-0.027)	0.033 (0.029-0.038)	0.041 (0.036-0.048)	0.053 (0.045-0.064)	0.063 (0.052-0.077)	0.073 (0.059-0.092)	0.084 (0.066-0.109)	0.100 (0.076-0.136)	0.114 (0.083-0.159)
4-day	0.013 (0.012-0.015)	0.019 (0.017-0.022)	0.026 (0.023-0.031)	0.033 (0.029-0.038)	0.042 (0.036-0.051)	0.050 (0.042-0.062)	0.058 (0.047-0.074)	0.067 (0.053-0.087)	0.080 (0.061-0.108)	0.091 (0.066-0.127)
7-day	0.008 (0.007-0.009)	0.011 (0.010-0.013)	0.016 (0.014-0.019)	0.020 (0.018-0.023)	0.026 (0.022-0.031)	0.030 (0.025-0.037)	0.035 (0.028-0.044)	0.040 (0.032-0.052)	0.048 (0.036-0.064)	0.054 (0.039-0.075)
10-day	0.006 (0.005-0.007)	0.008 (0.007-0.010)	0.012 (0.010-0.014)	0.015 (0.013-0.017)	0.019 (0.016-0.023)	0.022 (0.018-0.027)	0.026 (0.021-0.033)	0.030 (0.023-0.038)	0.035 (0.026-0.047)	0.039 (0.029-0.055)
20-day	0.004 (0.003-0.004)	0.005 (0.004-0.006)	0.007 (0.006-0.008)	0.009 (0.008-0.010)	0.011 (0.010-0.014)	0.013 (0.011-0.016)	0.015 (0.013-0.020)	0.018 (0.014-0.023)	0.021 (0.016-0.028)	0.024 (0.017-0.033)
30-day	0.003 (0.002-0.003)	0.004 (0.003-0.004)	0.005 (0.005-0.006)	0.007 (0.006-0.008)	0.009 (0.007-0.010)	0.010 (0.009-0.013)	0.012 (0.010-0.015)	0.014 (0.011-0.018)	0.016 (0.012-0.022)	0.018 (0.013-0.026)
45-day	0.002 (0.002-0.002)	0.003 (0.003-0.003)	0.004 (0.004-0.005)	0.005 (0.005-0.006)	0.007 (0.006-0.008)	0.008 (0.007-0.010)	0.009 (0.008-0.012)	0.011 (0.009-0.014)	0.013 (0.010-0.017)	0.015 (0.011-0.020)
60-day	0.002 (0.002-0.002)	0.002 (0.002-0.003)	0.003 (0.003-0.004)	0.004 (0.004-0.005)	0.006 (0.005-0.007)	0.007 (0.006-0.008)	0.008 (0.006-0.010)	0.009 (0.007-0.012)	0.011 (0.008-0.015)	0.012 (0.009-0.017)

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.

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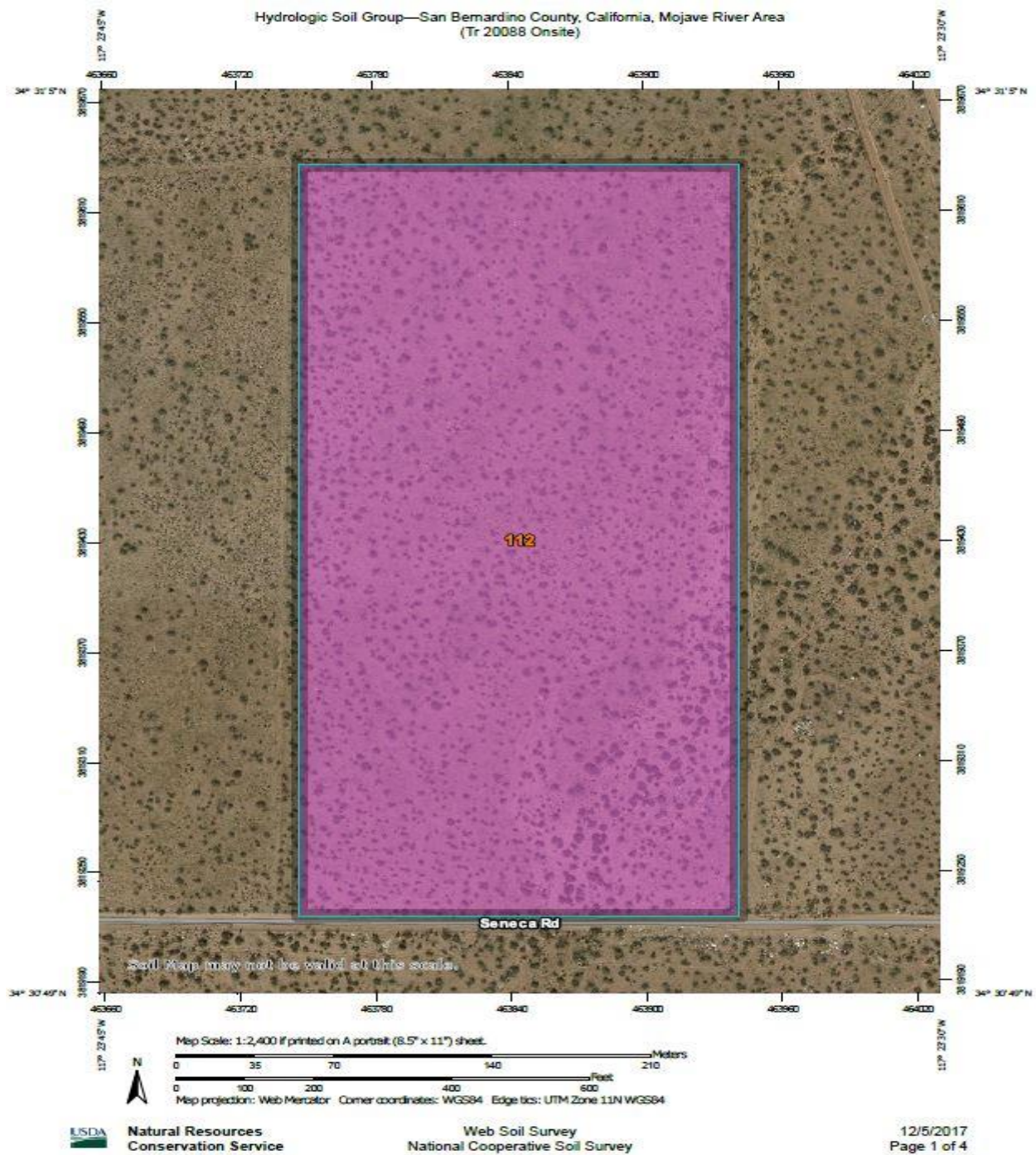
Appendix 8: On Site Soil Data

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Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
112	CAJON SAND, 0 TO 2 PERCENT SLOPES	A	19.8	100.0%
Totals for Area of Interest			19.8	100.0%

Description

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

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

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

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

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

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

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

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Appendix 9: Off Site Soil Data

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Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
112	CAJON SAND, 0 TO 2 PERCENT SLOPES	A	63.9	89.9%
173	WASCO SANDY LOAM, COOL, 0 TO 2 PERCENT SLOPES	A	7.2	10.1%
Totals for Area of Interest			71.0	100.0%

Description

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

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

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

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

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

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

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Appendix 10: On Site Hydrology

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San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2005 Version 7.1
Rational Hydrology Study Date: 11/29/18

TT 20088
Existing Time of Concentration
10 Year Storm Event
tt20088exist10yrct.out

Program License Serial Number 6286

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

Rational hydrology study storm event year is 10.0
Computed rainfall intensity:
Storm year = 10.00 1 hour rainfall = 0.640 (In.)
Slope used for rainfall intensity curve b = 0.7000
Soil antecedent moisture condition (AMC) = 3

+++++
Process from Point/Station 1.000 to Point/Station 2.000
**** INITIAL AREA EVALUATION ****

Soil classification AP and SCS values input by user
USER INPUT of soil data for subarea
SCS curve number for soil(AMC 2) = 46.00
Adjusted SCS curve number for AMC 3 = 66.00
Pervious ratio(Ap) = 1.0000 Max loss rate(Fm)= 0.593(In/Hr)
Initial subarea data:
Initial area flow distance = 320.000(Ft.)
Top (of initial area) elevation = 3084.000(Ft.)
Bottom (of initial area) elevation = 3077.000(Ft.)
Difference in elevation = 7.000(Ft.)
Slope = 0.02187 s(%)= 2.19
 $TC = k(0.950)*[(length^3)/(elevation\ change)]^{0.2}$
Initial area time of concentration = 20.502 min.
Rainfall intensity = 1.357(In/Hr) for a 10.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.507
Subarea runoff = 1.691(CFS)
Total initial stream area = 2.460(Ac.)
Pervious area fraction = 1.000
Initial area Fm value = 0.593(In/Hr)

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+++++
Process from Point/Station 2.000 to Point/Station 3.000
**** SUBAREA FLOW ADDITION ****

Soil classification AP and SCS values input by user
USER INPUT of soil data for subarea
SCS curve number for soil(AMC 2) = 46.00
Adjusted SCS curve number for AMC 3 = 66.00
Pervious ratio(Ap) = 1.0000 Max loss rate(Fm)= 0.593(In/Hr)
Time of concentration = 20.50 min.
Rainfall intensity = 1.357(In/Hr) for a 10.0 year storm
Effective runoff coefficient used for area, (total area with modified
rational method) (Q=KCIA) is C = 0.507
Subarea runoff = 11.419(CFS) for 16.610(Ac.)
Total runoff = 13.110(CFS)
Effective area this stream = 19.07(Ac.)
Total Study Area (Main Stream No. 1) = 19.07(Ac.)
Area averaged Fm value = 0.593(In/Hr)
End of computations, Total Study Area = 19.07 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 1.000
Area averaged SCS curve number = 46.0

U n i t H y d r o g r a p h A n a l y s i s

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Study date 11/29/18

+++++

San Bernardino County Synthetic Unit Hydrology Method
Manual date - August 1986

Program License Serial Number 6286

TT 20088
Existing Runoff Volume
10 Year Storm Event
tt20088exist10yrvol.out

Storm Event Year = 10

Antecedent Moisture Condition = 3

English (in-lb) Input Units Used

English Rainfall Data (Inches) Input Values Used

English Units used in output format

Area averaged rainfall intensity isohyetal data:

Sub-Area (Ac.)	Duration (hours)	Isohyetal (In)
Rainfall data for year 10		
19.07	1	0.64

Rainfall data for year 10
19.07 6 1.32

Rainfall data for year 10
19.07 24 2.52

+++++

***** Area-averaged max loss rate, Fm *****

SCS curve No. (AMCII)	SCS curve NO. (AMC 3)	Area (Ac.)	Area Fraction	Fp (Fig C6) (In/Hr)	Ap (dec.)	Fm (In/Hr)
46.0	66.0	19.07	1.000	0.593	1.000	0.593

Area-averaged adjusted loss rate Fm (In/Hr) = 0.593

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***** Area-Averaged low loss rate fraction, Yb *****

Area (Ac.)	Area Fract	SCS CN (AMC2)	SCS CN (AMC3)	S	Pervious Yield Fr
19.07	1.000	46.0	66.0	5.15	0.133

Area-averaged catchment yield fraction, Y = 0.133

Area-averaged low loss fraction, Yb = 0.867

User entry of time of concentration = 0.340 (hours)

+++++

Watershed area = 19.07 (Ac.)

Catchment Lag time = 0.272 hours

Unit interval = 5.000 minutes

Unit interval percentage of lag time = 30.6373

Hydrograph baseflow = 0.00 (CFS)

Average maximum watershed loss rate (Fm) = 0.593 (In/Hr)

Average low loss rate fraction (Yb) = 0.867 (decimal)

DESERT S-Graph Selected

Computed peak 5-minute rainfall = 0.304 (In)

Computed peak 30-minute rainfall = 0.520 (In)

Specified peak 1-hour rainfall = 0.640 (In)

Computed peak 3-hour rainfall = 0.998 (In)

Specified peak 6-hour rainfall = 1.320 (In)

Specified peak 24-hour rainfall = 2.520 (In)

Rainfall depth area reduction factors:

Using a total area of 19.07 (Ac.) (Ref: fig. E-4)

5-minute factor = 0.999 Adjusted rainfall = 0.303 (In)

30-minute factor = 0.999 Adjusted rainfall = 0.519 (In)

1-hour factor = 0.999 Adjusted rainfall = 0.639 (In)

3-hour factor = 1.000 Adjusted rainfall = 0.997 (In)

6-hour factor = 1.000 Adjusted rainfall = 1.320 (In)

24-hour factor = 1.000 Adjusted rainfall = 2.520 (In)

U n i t H y d r o g r a p h

+++++

Interval Number	'S' Graph Mean values	Unit Hydrograph (CFS)
--------------------	--------------------------	--------------------------

(K = 230.63 (CFS))

1	1.819	4.195
2	9.839	18.497
3	32.088	51.311
4	53.408	49.169
5	65.111	26.991
6	72.614	17.304
7	78.031	12.494
8	82.073	9.321
9	85.295	7.432

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10	87.971	6.171
11	89.992	4.661
12	91.690	3.915
13	93.147	3.361
14	94.362	2.802
15	95.392	2.376
16	96.247	1.971
17	96.987	1.706
18	97.550	1.300
19	97.968	0.963
20	98.280	0.719
21	98.637	0.824
22	99.004	0.848
23	99.370	0.843
24	99.625	0.588
25	99.816	0.442
26	100.000	0.424

Total soil rain loss = 1.96(In)
Total effective rainfall = 0.56(In)
Peak flow rate in flood hydrograph = 14.57(CFS)

+++++
24 - H O U R S T O R M
R u n o f f H y d r o g r a p h

Hydrograph in 5 Minute intervals ((CFS))

Time(h+m)	Volume	Ac.Ft	Q(CFS)	0	5.0	10.0	15.0	20.0
0+ 5	0.0000	0.00	Q					
0+10	0.0001	0.01	Q					
0+15	0.0004	0.04	Q					
0+20	0.0008	0.07	Q					
0+25	0.0014	0.08	Q					
0+30	0.0020	0.09	Q					
0+35	0.0027	0.10	Q					
0+40	0.0034	0.10	Q					
0+45	0.0042	0.11	Q					
0+50	0.0049	0.11	Q					
0+55	0.0057	0.11	Q					
1+ 0	0.0065	0.12	Q					
1+ 5	0.0073	0.12	Q					
1+10	0.0082	0.12	Q					
1+15	0.0090	0.12	Q					
1+20	0.0099	0.12	Q					
1+25	0.0107	0.13	Q					
1+30	0.0116	0.13	Q					
1+35	0.0125	0.13	Q					
1+40	0.0134	0.13	Q					

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1+45	0.0142	0.13	Q				
1+50	0.0151	0.13	Q				
1+55	0.0160	0.13	Q				
2+ 0	0.0169	0.13	Q				
2+ 5	0.0179	0.13	Q				
2+10	0.0188	0.13	Q				
2+15	0.0197	0.13	Q				
2+20	0.0206	0.13	Q				
2+25	0.0215	0.13	Q				
2+30	0.0224	0.13	QV				
2+35	0.0234	0.13	QV				
2+40	0.0243	0.14	QV				
2+45	0.0252	0.14	QV				
2+50	0.0262	0.14	QV				
2+55	0.0271	0.14	QV				
3+ 0	0.0281	0.14	QV				
3+ 5	0.0290	0.14	QV				
3+10	0.0299	0.14	QV				
3+15	0.0309	0.14	QV				
3+20	0.0319	0.14	QV				
3+25	0.0328	0.14	QV				
3+30	0.0338	0.14	QV				
3+35	0.0347	0.14	QV				
3+40	0.0357	0.14	QV				
3+45	0.0367	0.14	QV				
3+50	0.0377	0.14	QV				
3+55	0.0386	0.14	QV				
4+ 0	0.0396	0.14	QV				
4+ 5	0.0406	0.14	QV				
4+10	0.0416	0.14	QV				
4+15	0.0426	0.14	QV				
4+20	0.0436	0.14	QV				
4+25	0.0446	0.15	Q V				
4+30	0.0456	0.15	Q V				
4+35	0.0466	0.15	Q V				
4+40	0.0476	0.15	Q V				
4+45	0.0486	0.15	Q V				
4+50	0.0496	0.15	Q V				
4+55	0.0507	0.15	Q V				
5+ 0	0.0517	0.15	Q V				
5+ 5	0.0527	0.15	Q V				
5+10	0.0538	0.15	Q V				
5+15	0.0548	0.15	Q V				
5+20	0.0558	0.15	Q V				
5+25	0.0569	0.15	Q V				
5+30	0.0579	0.15	Q V				
5+35	0.0590	0.15	Q V				
5+40	0.0601	0.15	Q V				
5+45	0.0611	0.15	Q V				
5+50	0.0622	0.16	Q V				
5+55	0.0633	0.16	Q V				
6+ 0	0.0643	0.16	Q V				
6+ 5	0.0654	0.16	Q V				

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6+10	0.0665	0.16	Q	V				
6+15	0.0676	0.16	Q	V				
6+20	0.0687	0.16	Q	V				
6+25	0.0698	0.16	Q	V				
6+30	0.0709	0.16	Q	V				
6+35	0.0720	0.16	Q	V				
6+40	0.0731	0.16	Q	V				
6+45	0.0743	0.16	Q	V				
6+50	0.0754	0.16	Q	V				
6+55	0.0765	0.16	Q	V				
7+ 0	0.0777	0.17	Q	V				
7+ 5	0.0788	0.17	Q	V				
7+10	0.0799	0.17	Q	V				
7+15	0.0811	0.17	Q	V				
7+20	0.0823	0.17	Q	V				
7+25	0.0834	0.17	Q	V				
7+30	0.0846	0.17	Q	V				
7+35	0.0858	0.17	Q	V				
7+40	0.0870	0.17	Q	V				
7+45	0.0881	0.17	Q	V				
7+50	0.0893	0.17	Q	V				
7+55	0.0905	0.17	Q	V				
8+ 0	0.0917	0.18	Q	V				
8+ 5	0.0930	0.18	Q	V				
8+10	0.0942	0.18	Q	V				
8+15	0.0954	0.18	Q	V				
8+20	0.0966	0.18	Q	V				
8+25	0.0979	0.18	Q	V				
8+30	0.0991	0.18	Q	V				
8+35	0.1004	0.18	Q	V				
8+40	0.1016	0.18	Q	V				
8+45	0.1029	0.18	Q	V				
8+50	0.1042	0.19	Q	V				
8+55	0.1055	0.19	Q	V				
9+ 0	0.1068	0.19	Q	V				
9+ 5	0.1081	0.19	Q	V				
9+10	0.1094	0.19	Q	V				
9+15	0.1107	0.19	Q	V				
9+20	0.1120	0.19	Q	V				
9+25	0.1133	0.19	Q	V				
9+30	0.1147	0.19	Q	V				
9+35	0.1160	0.20	Q	V				
9+40	0.1174	0.20	Q	V				
9+45	0.1188	0.20	Q	V				
9+50	0.1201	0.20	Q	V				
9+55	0.1215	0.20	Q	V				
10+ 0	0.1229	0.20	Q	V				
10+ 5	0.1243	0.20	Q	V				
10+10	0.1257	0.21	Q	V				
10+15	0.1272	0.21	Q	V				
10+20	0.1286	0.21	Q	V				
10+25	0.1300	0.21	Q	V				
10+30	0.1315	0.21	Q	V				

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10+35	0.1330	0.21	Q	V				
10+40	0.1344	0.21	Q	V				
10+45	0.1359	0.22	Q	V				
10+50	0.1374	0.22	Q	V				
10+55	0.1389	0.22	Q	V				
11+ 0	0.1405	0.22	Q	V				
11+ 5	0.1420	0.22	Q	V				
11+10	0.1436	0.23	Q	V				
11+15	0.1451	0.23	Q	V				
11+20	0.1467	0.23	Q	V				
11+25	0.1483	0.23	Q	V				
11+30	0.1499	0.23	Q	V				
11+35	0.1515	0.24	Q	V				
11+40	0.1532	0.24	Q	V				
11+45	0.1548	0.24	Q	V				
11+50	0.1565	0.24	Q	V				
11+55	0.1582	0.24	Q	V				
12+ 0	0.1599	0.25	Q	V				
12+ 5	0.1616	0.25	Q	V				
12+10	0.1633	0.25	Q	V				
12+15	0.1650	0.24	Q	V				
12+20	0.1666	0.24	Q	V				
12+25	0.1682	0.24	Q	V				
12+30	0.1699	0.24	Q	V				
12+35	0.1715	0.24	Q	V				
12+40	0.1732	0.24	Q	V				
12+45	0.1749	0.24	Q	V				
12+50	0.1765	0.24	Q	V				
12+55	0.1782	0.25	Q	V				
13+ 0	0.1800	0.25	Q	V				
13+ 5	0.1817	0.25	Q	V				
13+10	0.1835	0.26	Q	V				
13+15	0.1853	0.26	Q	V				
13+20	0.1871	0.26	Q	V				
13+25	0.1890	0.27	Q	V				
13+30	0.1908	0.27	Q	V				
13+35	0.1927	0.28	Q	V				
13+40	0.1947	0.28	Q	V				
13+45	0.1967	0.29	Q	V				
13+50	0.1987	0.29	Q	V				
13+55	0.2007	0.30	Q	V				
14+ 0	0.2028	0.30	Q	V				
14+ 5	0.2050	0.31	Q	V				
14+10	0.2072	0.32	Q	V				
14+15	0.2094	0.32	Q	V				
14+20	0.2117	0.33	Q	V				
14+25	0.2140	0.34	Q	V				
14+30	0.2164	0.35	Q	V				
14+35	0.2189	0.36	Q	V				
14+40	0.2215	0.37	Q	V				
14+45	0.2241	0.38	Q	V				
14+50	0.2268	0.39	Q	V				
14+55	0.2296	0.41	Q	V				

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15+ 0	0.2325	0.42	Q		V					
15+ 5	0.2355	0.44	Q		V					
15+10	0.2386	0.45	Q		V					
15+15	0.2419	0.47	Q		V					
15+20	0.2453	0.50	Q		V					
15+25	0.2489	0.52	Q		V					
15+30	0.2525	0.53	Q		V					
15+35	0.2562	0.53	Q		V					
15+40	0.2599	0.53	Q		V					
15+45	0.2637	0.56	Q		V					
15+50	0.2679	0.61	Q		V					
15+55	0.2727	0.69	Q		V					
16+ 0	0.2787	0.87	Q		V					
16+ 5	0.2944	2.28		Q	V					
16+10	0.3386	6.43			Q	V				
16+15	0.4390	14.57				V		Q		
16+20	0.5332	13.67					V	Q		
16+25	0.5877	7.92				Q		V		
16+30	0.6243	5.32			Q			V		
16+35	0.6519	4.01			Q			V		
16+40	0.6736	3.14			Q			V		
16+45	0.6915	2.60			Q			V		
16+50	0.7067	2.21		Q				V		
16+55	0.7190	1.78		Q				V		
17+ 0	0.7297	1.55		Q				V		
17+ 5	0.7391	1.37		Q				V		
17+10	0.7474	1.20		Q				V		
17+15	0.7546	1.06		Q				V		
17+20	0.7610	0.93	Q					V		
17+25	0.7667	0.83	Q					V		
17+30	0.7716	0.71	Q					V		
17+35	0.7757	0.60	Q					V		
17+40	0.7794	0.53	Q					V		
17+45	0.7831	0.54	Q					V		
17+50	0.7867	0.53	Q					V		
17+55	0.7903	0.51	Q					V		
18+ 0	0.7933	0.44	Q					V		
18+ 5	0.7960	0.39	Q					V		
18+10	0.7985	0.37	Q					V		
18+15	0.8003	0.26	Q					V		
18+20	0.8021	0.26	Q					V		
18+25	0.8039	0.26	Q					V		
18+30	0.8057	0.26	Q					V		
18+35	0.8074	0.25	Q					V		
18+40	0.8091	0.25	Q					V		
18+45	0.8108	0.24	Q					V		
18+50	0.8124	0.24	Q					V		
18+55	0.8140	0.23	Q					V		
19+ 0	0.8156	0.23	Q					V		
19+ 5	0.8172	0.23	Q					V		
19+10	0.8187	0.22	Q					V		
19+15	0.8202	0.22	Q					V		
19+20	0.8217	0.22	Q					V		

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19+25	0.8232	0.21	Q				V	
19+30	0.8247	0.21	Q				V	
19+35	0.8261	0.21	Q				V	
19+40	0.8275	0.20	Q				V	
19+45	0.8289	0.20	Q				V	
19+50	0.8303	0.20	Q				V	
19+55	0.8316	0.20	Q				V	
20+ 0	0.8329	0.19	Q				V	
20+ 5	0.8343	0.19	Q				V	
20+10	0.8356	0.19	Q				V	
20+15	0.8369	0.19	Q				V	
20+20	0.8381	0.18	Q				V	
20+25	0.8394	0.18	Q				V	
20+30	0.8406	0.18	Q				V	
20+35	0.8419	0.18	Q				V	
20+40	0.8431	0.18	Q				V	
20+45	0.8443	0.17	Q				V	
20+50	0.8455	0.17	Q				V	
20+55	0.8467	0.17	Q				V	
21+ 0	0.8478	0.17	Q				V	
21+ 5	0.8490	0.17	Q				V	
21+10	0.8501	0.17	Q				V	
21+15	0.8513	0.16	Q				V	
21+20	0.8524	0.16	Q				V	
21+25	0.8535	0.16	Q				V	
21+30	0.8546	0.16	Q				V	
21+35	0.8557	0.16	Q				V	
21+40	0.8568	0.16	Q				V	
21+45	0.8579	0.16	Q				V	
21+50	0.8589	0.15	Q				V	
21+55	0.8600	0.15	Q				V	
22+ 0	0.8610	0.15	Q				V	
22+ 5	0.8621	0.15	Q				V	
22+10	0.8631	0.15	Q				V	
22+15	0.8641	0.15	Q				V	
22+20	0.8651	0.15	Q				V	
22+25	0.8662	0.15	Q				V	
22+30	0.8672	0.15	Q				V	
22+35	0.8682	0.14	Q				V	
22+40	0.8691	0.14	Q				V	
22+45	0.8701	0.14	Q				V	
22+50	0.8711	0.14	Q				V	
22+55	0.8721	0.14	Q				V	
23+ 0	0.8730	0.14	Q				V	
23+ 5	0.8740	0.14	Q				V	
23+10	0.8749	0.14	Q				V	
23+15	0.8759	0.14	Q				V	
23+20	0.8768	0.14	Q				V	
23+25	0.8777	0.13	Q				V	
23+30	0.8786	0.13	Q				V	
23+35	0.8796	0.13	Q				V	
23+40	0.8805	0.13	Q				V	
23+45	0.8814	0.13	Q				V	

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23+50	0.8823	0.13	Q				V
23+55	0.8832	0.13	Q				V
24+ 0	0.8841	0.13	Q				V

San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2005 Version 7.1
Rational Hydrology Study Date: 11/29/18

TT 20088
Existing Time of Concentration
100 Year Storm Event
tt20088exist100yrtrc.out

Program License Serial Number 6286

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

Rational hydrology study storm event year is 100.0
Computed rainfall intensity:

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Storm year = 100.00 1 hour rainfall = 1.080 (In.)
Slope used for rainfall intensity curve b = 0.7000
Soil antecedent moisture condition (AMC) = 3

+++++
Process from Point/Station 1.000 to Point/Station 2.000
**** INITIAL AREA EVALUATION ****

Soil classification AP and SCS values input by user
USER INPUT of soil data for subarea
SCS curve number for soil(AMC 2) = 46.00
Adjusted SCS curve number for AMC 3 = 66.00
Pervious ratio(Ap) = 1.0000 Max loss rate(Fm)= 0.593(In/Hr)
Initial subarea data:
Initial area flow distance = 320.000(Ft.)
Top (of initial area) elevation = 3084.000(Ft.)
Bottom (of initial area) elevation = 3077.000(Ft.)
Difference in elevation = 7.000(Ft.)
Slope = 0.02187 s(%)= 2.19
TC = k(0.950)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 20.502 min.
Rainfall intensity = 2.290(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.667
Subarea runoff = 3.757(CFS)
Total initial stream area = 2.460(Ac.)
Pervious area fraction = 1.000
Initial area Fm value = 0.593(In/Hr)

+++++
Process from Point/Station 2.000 to Point/Station 3.000
**** SUBAREA FLOW ADDITION ****

Soil classification AP and SCS values input by user
USER INPUT of soil data for subarea
SCS curve number for soil(AMC 2) = 46.00
Adjusted SCS curve number for AMC 3 = 66.00
Pervious ratio(Ap) = 1.0000 Max loss rate(Fm)= 0.593(In/Hr)
Time of concentration = 20.50 min.
Rainfall intensity = 2.290(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area, (total area with modified rational method) (Q=KCIA) is C = 0.667
Subarea runoff = 25.367(CFS) for 16.610(Ac.)
Total runoff = 29.124(CFS)
Effective area this stream = 19.07(Ac.)
Total Study Area (Main Stream No. 1) = 19.07(Ac.)
Area averaged Fm value = 0.593(In/Hr)
End of computations, Total Study Area = 19.07 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area effects caused by confluences in the rational equation.

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Area averaged pervious area fraction(Ap) = 1.000
Area averaged SCS curve number = 46.0

U n i t H y d r o g r a p h A n a l y s i s

Copyright (c) CIVILCADD/CIVILDESIGN, 1989 - 2004, Version 7.0

Study date 11/29/18

+++++

San Bernardino County Synthetic Unit Hydrology Method
Manual date - August 1986

Program License Serial Number 6286

TT 20088
Existing Runoff Volume
100 Year Storm Event
tt20088exist100yrvol.out

Storm Event Year = 100

Antecedent Moisture Condition = 3

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English (in-lb) Input Units Used

English Rainfall Data (Inches) Input Values Used

English Units used in output format

Area averaged rainfall intensity isohyetal data:

Sub-Area (Ac.)	Duration (hours)	Isohyetal (In)
Rainfall data for year 100 19.07	1	1.08

Rainfall data for year 100 19.07	6	2.24
-------------------------------------	---	------

Rainfall data for year 100 19.07	24	4.42
-------------------------------------	----	------

***** Area-averaged max loss rate, Fm *****

SCS curve No. (AMCII)	SCS curve NO. (AMC 3)	Area (Ac.)	Area Fraction	Fp (Fig C6) (In/Hr)	Ap (dec.)	Fm (In/Hr)
46.0	66.0	19.07	1.000	0.593	1.000	0.593

Area-averaged adjusted loss rate Fm (In/Hr) = 0.593

***** Area-Averaged low loss rate fraction, Yb *****

Area (Ac.)	Area Fract	SCS CN (AMC2)	SCS CN (AMC3)	S	Pervious Yield Fr
19.07	1.000	46.0	66.0	5.15	0.304

Area-averaged catchment yield fraction, Y = 0.304

Area-averaged low loss fraction, Yb = 0.696

User entry of time of concentration = 0.340 (hours)

+++++

Watershed area = 19.07 (Ac.)

Catchment Lag time = 0.272 hours

Unit interval = 5.000 minutes

Unit interval percentage of lag time = 30.6373

Hydrograph baseflow = 0.00 (CFS)

Average maximum watershed loss rate (Fm) = 0.593 (In/Hr)

Average low loss rate fraction (Yb) = 0.696 (decimal)

DESERT S-Graph Selected

Computed peak 5-minute rainfall = 0.512 (In)

Computed peak 30-minute rainfall = 0.877 (In)

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Specified peak 1-hour rainfall = 1.080 (In)
 Computed peak 3-hour rainfall = 1.689 (In)
 Specified peak 6-hour rainfall = 2.240 (In)
 Specified peak 24-hour rainfall = 4.420 (In)

Rainfall depth area reduction factors:

Using a total area of 19.07 (Ac.) (Ref: fig. E-4)

5-minute factor = 0.999	Adjusted rainfall = 0.512 (In)
30-minute factor = 0.999	Adjusted rainfall = 0.876 (In)
1-hour factor = 0.999	Adjusted rainfall = 1.079 (In)
3-hour factor = 1.000	Adjusted rainfall = 1.689 (In)
6-hour factor = 1.000	Adjusted rainfall = 2.240 (In)
24-hour factor = 1.000	Adjusted rainfall = 4.420 (In)

Unit Hydrograph

+++++
 Interval 'S' Graph Unit Hydrograph
 Number Mean values ((CFS))

(K = 230.63 (CFS))

1	1.819	4.195
2	9.839	18.497
3	32.088	51.311
4	53.408	49.169
5	65.111	26.991
6	72.614	17.304
7	78.031	12.494
8	82.073	9.321
9	85.295	7.432
10	87.971	6.171
11	89.992	4.661
12	91.690	3.915
13	93.147	3.361
14	94.362	2.802
15	95.392	2.376
16	96.247	1.971
17	96.987	1.706
18	97.550	1.300
19	97.968	0.963
20	98.280	0.719
21	98.637	0.824
22	99.004	0.848
23	99.370	0.843
24	99.625	0.588
25	99.816	0.442
26	100.000	0.424

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Total soil rain loss = 2.73(In)
Total effective rainfall = 1.69(In)
Peak flow rate in flood hydrograph = 29.34(CFS)

+++++

24 - H O U R S T O R M
R u n o f f H y d r o g r a p h

Hydrograph in 5 Minute intervals ((CFS))

Time(h+m)	Volume	Ac.Ft	Q(CFS)	0	7.5	15.0	22.5	30.0
0+ 5	0.0001		0.01 Q					
0+10	0.0004		0.05 Q					
0+15	0.0016		0.17 Q					
0+20	0.0035		0.28 Q					
0+25	0.0059		0.35 Q					
0+30	0.0086		0.39 Q					
0+35	0.0114		0.42 Q					
0+40	0.0145		0.44 Q					
0+45	0.0176		0.46 Q					
0+50	0.0209		0.47 Q					
0+55	0.0242		0.48 Q					
1+ 0	0.0276		0.49 Q					
1+ 5	0.0311		0.50 Q					
1+10	0.0346		0.51 Q					
1+15	0.0381		0.52 Q					
1+20	0.0417		0.52 Q					
1+25	0.0454		0.53 Q					
1+30	0.0491		0.53 Q					
1+35	0.0528		0.54 Q					
1+40	0.0565		0.54 Q					
1+45	0.0602		0.54 Q					
1+50	0.0640		0.55 Q					
1+55	0.0678		0.55 QV					
2+ 0	0.0716		0.55 QV					
2+ 5	0.0754		0.56 QV					
2+10	0.0793		0.56 QV					
2+15	0.0832		0.56 QV					
2+20	0.0870		0.56 QV					
2+25	0.0909		0.56 QV					
2+30	0.0948		0.57 QV					
2+35	0.0987		0.57 QV					
2+40	0.1027		0.57 QV					
2+45	0.1066		0.57 QV					
2+50	0.1105		0.57 QV					
2+55	0.1145		0.57 QV					
3+ 0	0.1185		0.58 QV					
3+ 5	0.1225		0.58 QV					
3+10	0.1265		0.58 QV					
3+15	0.1305		0.58 QV					
3+20	0.1345		0.58 Q V					

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3+30	0.1426	0.59	Q V				
3+35	0.1466	0.59	Q V				
3+40	0.1507	0.59	Q V				
3+45	0.1548	0.59	Q V				
3+50	0.1589	0.60	Q V				
3+55	0.1630	0.60	Q V				
4+ 0	0.1671	0.60	Q V				
4+ 5	0.1713	0.60	Q V				
4+10	0.1755	0.60	Q V				
4+15	0.1796	0.61	Q V				
4+20	0.1838	0.61	Q V				
4+25	0.1880	0.61	Q V				
4+30	0.1922	0.61	Q V				
4+35	0.1965	0.61	Q V				
4+40	0.2007	0.62	Q V				
4+45	0.2050	0.62	Q V				
4+50	0.2093	0.62	Q V				
4+55	0.2136	0.62	Q V				
5+ 0	0.2179	0.63	Q V				
5+ 5	0.2222	0.63	Q V				
5+10	0.2265	0.63	Q V				
5+15	0.2309	0.63	Q V				
5+20	0.2353	0.64	Q V				
5+25	0.2397	0.64	Q V				
5+30	0.2441	0.64	Q V				
5+35	0.2485	0.64	Q V				
5+40	0.2530	0.65	Q V				
5+45	0.2574	0.65	Q V				
5+50	0.2619	0.65	Q V				
5+55	0.2664	0.65	Q V				
6+ 0	0.2709	0.66	Q V				
6+ 5	0.2754	0.66	Q V				
6+10	0.2800	0.66	Q V				
6+15	0.2846	0.66	Q V				
6+20	0.2892	0.67	Q V				
6+25	0.2938	0.67	Q V				
6+30	0.2984	0.67	Q V				
6+35	0.3031	0.68	Q V				
6+40	0.3077	0.68	Q V				
6+45	0.3124	0.68	Q V				
6+50	0.3171	0.68	Q V				
6+55	0.3219	0.69	Q V				
7+ 0	0.3266	0.69	Q V				
7+ 5	0.3314	0.69	Q V				
7+10	0.3362	0.70	Q V				
7+15	0.3410	0.70	Q V				
7+20	0.3458	0.70	Q V				
7+25	0.3507	0.71	Q V				
7+30	0.3556	0.71	Q V				
7+35	0.3605	0.71	Q V				
7+40	0.3654	0.72	Q V				
7+45	0.3704	0.72	Q V				

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7+55	0.3804	0.73	Q	V					
8+ 0	0.3854	0.73	Q	V					
8+ 5	0.3905	0.73	Q	V					
8+10	0.3956	0.74	Q	V					
8+15	0.4007	0.74	Q	V					
8+20	0.4058	0.75	Q	V					
8+25	0.4110	0.75	Q	V					
8+30	0.4162	0.75	IQ	V					
8+35	0.4214	0.76	IQ	V					
8+40	0.4266	0.76	IQ	V					
8+45	0.4319	0.77	IQ	V					
8+50	0.4372	0.77	IQ	V					
8+55	0.4426	0.77	IQ	V					
9+ 0	0.4479	0.78	IQ	V					
9+ 5	0.4533	0.78	IQ	V					
9+10	0.4588	0.79	IQ	V					
9+15	0.4642	0.79	IQ	V					
9+20	0.4697	0.80	IQ	V					
9+25	0.4752	0.80	IQ	V					
9+30	0.4808	0.81	IQ	V					
9+35	0.4864	0.81	IQ	V					
9+40	0.4920	0.82	IQ	V					
9+45	0.4977	0.82	IQ	V					
9+50	0.5034	0.83	IQ	V					
9+55	0.5091	0.83	IQ	V					
10+ 0	0.5149	0.84	IQ	V					
10+ 5	0.5207	0.84	IQ	V					
10+10	0.5266	0.85	IQ	V					
10+15	0.5325	0.86	IQ	V					
10+20	0.5384	0.86	IQ	V					
10+25	0.5444	0.87	IQ	V					
10+30	0.5504	0.87	IQ	V					
10+35	0.5564	0.88	IQ	V					
10+40	0.5626	0.89	IQ	V					
10+45	0.5687	0.89	IQ	V					
10+50	0.5749	0.90	IQ	V					
10+55	0.5811	0.91	IQ	V					
11+ 0	0.5874	0.91	IQ	V					
11+ 5	0.5938	0.92	IQ	V					
11+10	0.6002	0.93	IQ	V					
11+15	0.6066	0.94	IQ	V					
11+20	0.6131	0.94	IQ	V					
11+25	0.6197	0.95	IQ	V					
11+30	0.6263	0.96	IQ	V					
11+35	0.6330	0.97	IQ	V					
11+40	0.6397	0.98	IQ	V					
11+45	0.6465	0.99	IQ	V					
11+50	0.6533	0.99	IQ	V					
11+55	0.6602	1.00	IQ	V					
12+ 0	0.6672	1.01	IQ	V					
12+ 5	0.6743	1.02	IQ	V					
12+10	0.6812	1.02	IQ	V					

Planning: Land, GIS & Cannabis
Surveying: Construction, Land & ALTA
Engineering: Civil, Structural & Soils

CEQA, Biological, Native Plant & Phase 1 Assessments
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Construction Management & Inspection

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12+15	0.6880	0.99	Q	V				
12+20	0.6946	0.96	Q	V				
12+25	0.7012	0.95	Q	V				
12+30	0.7077	0.94	Q	V				
12+35	0.7142	0.95	Q	V				
12+40	0.7207	0.95	Q	V				
12+45	0.7273	0.96	Q	V				
12+50	0.7340	0.97	Q	V				
12+55	0.7407	0.98	Q	V				
13+ 0	0.7475	0.99	Q	V				
13+ 5	0.7544	1.00	Q	V				
13+10	0.7613	1.01	Q	V				
13+15	0.7684	1.02	Q	V				
13+20	0.7755	1.04	Q	V				
13+25	0.7828	1.05	Q	V				
13+30	0.7902	1.07	Q	V				
13+35	0.7977	1.09	Q	V				
13+40	0.8053	1.11	Q	V				
13+45	0.8130	1.13	Q	V				
13+50	0.8209	1.15	Q	V				
13+55	0.8290	1.17	Q	V				
14+ 0	0.8372	1.19	Q	V				
14+ 5	0.8456	1.22	Q	V				
14+10	0.8542	1.24	Q	V				
14+15	0.8629	1.27	Q	V				
14+20	0.8719	1.30	Q	V				
14+25	0.8811	1.34	Q	V				
14+30	0.8906	1.37	Q	V				
14+35	0.9002	1.41	Q	V				
14+40	0.9102	1.45	Q	V				
14+45	0.9205	1.49	Q	V				
14+50	0.9311	1.54	Q	V				
14+55	0.9420	1.59	Q	V				
15+ 0	0.9533	1.64	Q	V				
15+ 5	0.9651	1.71	Q	V				
15+10	0.9773	1.77	Q	V				
15+15	0.9900	1.85	Q	V				
15+20	1.0034	1.94	Q	V				
15+25	1.0173	2.03	Q	V				
15+30	1.0317	2.08	Q	V				
15+35	1.0459	2.07	Q	V				
15+40	1.0602	2.07	Q	V				
15+45	1.0752	2.18	Q	V				
15+50	1.0915	2.37	Q	V				
15+55	1.1102	2.71	Q	V				
16+ 0	1.1340	3.46	Q	V				
16+ 5	1.1810	6.82		Q	V			
16+10	1.2845	15.04			VQ			
16+15	1.4866	29.34			V			Q
16+20	1.6737	27.16			V		Q	
16+25	1.7873	16.49			Q	V		
16+30	1.8666	11.52		Q		V		
16+35	1.9284	8.97		Q		V		

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16+40	1.9786	7.28			Q			V	
16+45	2.0211	6.17			Q			V	
16+50	2.0579	5.35			Q			V	
16+55	2.0887	4.47			Q			V	
17+ 0	2.1160	3.96			Q			V	
17+ 5	2.1405	3.56			Q			V	
17+10	2.1623	3.17			Q			V	
17+15	2.1820	2.86			Q			V	
17+20	2.1997	2.56			Q			V	
17+25	2.2158	2.34			Q			V	
17+30	2.2300	2.06			Q			V	
17+35	2.2426	1.84			Q			V	
17+40	2.2542	1.67			Q			V	
17+45	2.2656	1.67			Q			V	
17+50	2.2768	1.63			Q			V	
17+55	2.2876	1.56			Q			V	
18+ 0	2.2972	1.40			Q			V	
18+ 5	2.3061	1.29			Q			V	
18+10	2.3146	1.23			Q			V	
18+15	2.3218	1.05			Q			V	
18+20	2.3291	1.05			Q			V	
18+25	2.3363	1.05			Q			V	
18+30	2.3434	1.04			Q			V	
18+35	2.3504	1.02			Q			V	
18+40	2.3574	1.00			Q			V	
18+45	2.3642	0.99			Q			V	
18+50	2.3709	0.97			Q			V	
18+55	2.3775	0.96			Q			V	
19+ 0	2.3840	0.95			Q			V	
19+ 5	2.3904	0.93			Q			V	
19+10	2.3967	0.92			Q			V	
19+15	2.4030	0.90			Q			V	
19+20	2.4091	0.89			Q			V	
19+25	2.4152	0.88			Q			V	
19+30	2.4212	0.87			Q			V	
19+35	2.4271	0.86			Q			V	
19+40	2.4329	0.85			Q			V	
19+45	2.4386	0.83			Q			V	
19+50	2.4443	0.82			Q			V	
19+55	2.4499	0.81			Q			V	
20+ 0	2.4555	0.80			Q			V	
20+ 5	2.4609	0.80			Q			V	
20+10	2.4664	0.79			Q			V	
20+15	2.4717	0.78			Q			V	
20+20	2.4770	0.77			Q			V	
20+25	2.4822	0.76			Q			V	
20+30	2.4874	0.75			Q			V	
20+35	2.4925	0.74			Q			V	
20+40	2.4976	0.74			Q			V	
20+45	2.5026	0.73			Q			V	
20+50	2.5076	0.72			Q			V	
20+55	2.5125	0.71			Q			V	
21+ 0	2.5174	0.71			Q			V	

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21+ 5	2.5222	0.70	Q				V	
21+10	2.5270	0.69	Q				V	
21+15	2.5318	0.69	Q				V	
21+20	2.5365	0.68	Q				V	
21+25	2.5411	0.68	Q				V	
21+30	2.5457	0.67	Q				V	
21+35	2.5503	0.67	Q				V	
21+40	2.5549	0.66	Q				V	
21+45	2.5594	0.65	Q				V	
21+50	2.5638	0.65	Q				V	
21+55	2.5683	0.64	Q				V	
22+ 0	2.5727	0.64	Q				V	
22+ 5	2.5770	0.63	Q				V	
22+10	2.5814	0.63	Q				V	
22+15	2.5857	0.62	Q				V	
22+20	2.5899	0.62	Q				V	
22+25	2.5942	0.62	Q				V	
22+30	2.5984	0.61	Q				V	
22+35	2.6026	0.61	Q				V	
22+40	2.6067	0.60	Q				V	
22+45	2.6108	0.60	Q				V	
22+50	2.6149	0.59	Q				V	
22+55	2.6190	0.59	Q				V	
23+ 0	2.6230	0.59	Q				V	
23+ 5	2.6271	0.58	Q				V	
23+10	2.6310	0.58	Q				V	
23+15	2.6350	0.58	Q				V	
23+20	2.6389	0.57	Q				V	
23+25	2.6429	0.57	Q				V	
23+30	2.6467	0.56	Q				V	
23+35	2.6506	0.56	Q				V	
23+40	2.6545	0.56	Q				V	
23+45	2.6583	0.55	Q				V	
23+50	2.6621	0.55	Q				V	
23+55	2.6659	0.55	Q				V	
24+ 0	2.6696	0.55	Q				V	

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San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2005 Version 7.1
Rational Hydrology Study Date: 11/29/18

TT 20088
Developed Time of Concentration
10 Year Storm Event
tt20088dev10yrhc.out

Program License Serial Number 6286

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

Rational hydrology study storm event year is 10.0
Computed rainfall intensity:
Storm year = 10.00 1 hour rainfall = 0.640 (In.)
Slope used for rainfall intensity curve b = 0.7000
Soil antecedent moisture condition (AMC) = 3

+++++
Process from Point/Station 1.000 to Point/Station 2.000
**** INITIAL AREA EVALUATION ****

RESIDENTIAL(3 - 4 dwl/acre)
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2) = 32.00
Adjusted SCS curve number for AMC 3 = 52.00
Pervious ratio(Ap) = 0.6000 Max loss rate(Fm)= 0.471 (In/Hr)
Initial subarea data:
Initial area flow distance = 325.000 (Ft.)
Top (of initial area) elevation = 3084.000 (Ft.)
Bottom (of initial area) elevation = 3080.000 (Ft.)
Difference in elevation = 4.000 (Ft.)

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Slope = 0.01231 s(%)= 1.23
 TC = $k(0.412)*[(length^3)/(elevation\ change)]^{0.2}$
 Initial area time of concentration = 10.037 min.
 Rainfall intensity = 2.237(In/Hr) for a 10.0 year storm
 Effective runoff coefficient used for area (Q=KCIA) is C = 0.711
 Subarea runoff = 2.003(CFS)
 Total initial stream area = 1.260(Ac.)
 Pervious area fraction = 0.600
 Initial area Fm value = 0.471(In/Hr)

+++++
 Process from Point/Station 2.000 to Point/Station 3.000
 **** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****

Top of street segment elevation = 3080.000(Ft.)
 End of street segment elevation = 3068.000(Ft.)
 Length of street segment = 760.000(Ft.)
 Height of curb above gutter flowline = 8.0(In.)
 Width of half street (curb to crown) = 18.000(Ft.)
 Distance from crown to crossfall grade break = 16.500(Ft.)
 Slope from gutter to grade break (v/hz) = 0.020
 Slope from grade break to crown (v/hz) = 0.020
 Street flow is on [2] side(s) of the street
 Distance from curb to property line = 12.000(Ft.)
 Slope from curb to property line (v/hz) = 0.020
 Gutter width = 1.500(Ft.)
 Gutter hike from flowline = 2.000(In.)
 Manning's N in gutter = 0.0150
 Manning's N from gutter to grade break = 0.0150
 Manning's N from grade break to crown = 0.0200
 Estimated mean flow rate at midpoint of street = 5.258(CFS)
 Depth of flow = 0.344(Ft.), Average velocity = 2.228(Ft/s)
 Streetflow hydraulics at midpoint of street travel:
 Halfstreet flow width = 10.380(Ft.)
 Flow velocity = 2.23(Ft/s)
 Travel time = 5.69 min. TC = 15.72 min.
 Adding area flow to street
 RESIDENTIAL(3 - 4 dwl/acre)
 Decimal fraction soil group A = 1.000
 Decimal fraction soil group B = 0.000
 Decimal fraction soil group C = 0.000
 Decimal fraction soil group D = 0.000
 SCS curve number for soil(AMC 2) = 32.00
 Adjusted SCS curve number for AMC 3 = 52.00
 Pervious ratio(Ap) = 0.6000 Max loss rate(Fm)= 0.471(In/Hr)
 Rainfall intensity = 1.634(In/Hr) for a 10.0 year storm
 Effective runoff coefficient used for area, (total area with modified
 rational method) (Q=KCIA) is C = 0.641
 Subarea runoff = 6.340(CFS) for 6.710(Ac.)
 Total runoff = 8.344(CFS)
 Effective area this stream = 7.97(Ac.)
 Total Study Area (Main Stream No. 1) = 7.97(Ac.)

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Area averaged Fm value = 0.471 (In/Hr)
 Street flow at end of street = 8.344 (CFS)
 Half street flow at end of street = 4.172 (CFS)
 Depth of flow = 0.388 (Ft.), Average velocity = 2.474 (Ft/s)
 Flow width (from curb towards crown) = 12.583 (Ft.)

+++++
 Process from Point/Station 4.000 to Point/Station 5.000
 **** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****

Top of street segment elevation = 3082.000 (Ft.)
 End of street segment elevation = 3065.000 (Ft.)
 Length of street segment = 1300.000 (Ft.)
 Height of curb above gutter flowline = 8.0 (In.)
 Width of half street (curb to crown) = 18.000 (Ft.)
 Distance from crown to crossfall grade break = 16.500 (Ft.)
 Slope from gutter to grade break (v/hz) = 0.020
 Slope from grade break to crown (v/hz) = 0.020
 Street flow is on [2] side(s) of the street
 Distance from curb to property line = 12.000 (Ft.)
 Slope from curb to property line (v/hz) = 0.025
 Gutter width = 1.500 (Ft.)
 Gutter hike from flowline = 2.000 (In.)
 Manning's N in gutter = 0.0150
 Manning's N from gutter to grade break = 0.0150
 Manning's N from grade break to crown = 0.0150
 Estimated mean flow rate at midpoint of street = 9.665 (CFS)
 Depth of flow = 0.387 (Ft.), Average velocity = 2.896 (Ft/s)
 Streetflow hydraulics at midpoint of street travel:
 Halfstreet flow width = 12.515 (Ft.)
 Flow velocity = 2.90 (Ft/s)
 Travel time = 7.48 min. TC = 23.20 min.
 Adding area flow to street
 RESIDENTIAL (3 - 4 dwl/acre)
 Decimal fraction soil group A = 1.000
 Decimal fraction soil group B = 0.000
 Decimal fraction soil group C = 0.000
 Decimal fraction soil group D = 0.000
 SCS curve number for soil (AMC 2) = 32.00
 Adjusted SCS curve number for AMC 3 = 52.00
 Pervious ratio (Ap) = 0.6000 Max loss rate (Fm) = 0.471 (In/Hr)
 Rainfall intensity = 1.244 (In/Hr) for a 10.0 year storm
 Effective runoff coefficient used for area, (total area with modified
 rational method) (Q=KCIA) is C = 0.559
 Subarea runoff = 2.536 (CFS) for 7.660 (Ac.)
 Total runoff = 10.879 (CFS)
 Effective area this stream = 15.63 (Ac.)
 Total Study Area (Main Stream No. 1) = 15.63 (Ac.)
 Area averaged Fm value = 0.471 (In/Hr)
 Street flow at end of street = 10.879 (CFS)
 Half street flow at end of street = 5.440 (CFS)
 Depth of flow = 0.399 (Ft.), Average velocity = 2.979 (Ft/s)

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Flow width (from curb towards crown)= 13.127(Ft.)

+++++
 Process from Point/Station 6.000 to Point/Station 7.000
 ***** SUBAREA FLOW ADDITION *****

RESIDENTIAL(3 - 4 dwl/acre)
 Decimal fraction soil group A = 1.000
 Decimal fraction soil group B = 0.000
 Decimal fraction soil group C = 0.000
 Decimal fraction soil group D = 0.000
 SCS curve number for soil(AMC 2) = 32.00
 Adjusted SCS curve number for AMC 3 = 52.00
 Pervious ratio(Ap) = 0.6000 Max loss rate(Fm)= 0.471(In/Hr)
Time of concentration = 23.20 min.
 Rainfall intensity = 1.244(In/Hr) for a 10.0 year storm
 Effective runoff coefficient used for area, (total area with modified
 rational method) (Q=KCIA) is C = 0.559
 Subarea runoff = 0.940(CFS) for 1.350(Ac.)
Total runoff = 11.819(CFS)
 Effective area this stream = 16.98(Ac.)
 Total Study Area (Main Stream No. 1) = 16.98(Ac.)
 Area averaged Fm value = 0.471(In/Hr)
 End of computations, Total Study Area = 16.98 (Ac.)
 The following figures may
 be used for a unit hydrograph study of the same area.
 Note: These figures do not consider reduced effective area
 effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 0.600
 Area averaged SCS curve number = 32.0

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U n i t H y d r o g r a p h A n a l y s i s

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Study date 11/29/18

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San Bernardino County Synthetic Unit Hydrology Method
Manual date - August 1986

Program License Serial Number 6286

TT 20088
Developed Runoff Volume
10 Year Storm Event
tt20088dev10yrvol.out

Storm Event Year = 10

Antecedent Moisture Condition = 3

English (in-lb) Input Units Used

English Rainfall Data (Inches) Input Values Used

English Units used in output format

Area averaged rainfall intensity isohyetal data:

Sub-Area (Ac.)	Duration (hours)	Isohyetal (In)
Rainfall data for year 10		
16.98	1	0.64

Rainfall data for year 10		
16.98	6	1.32

Rainfall data for year 10		
16.98	24	2.52

+++++

***** Area-averaged max loss rate, Fm *****

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SCS curve No. (AMCII)	SCS curve NO. (AMC 3)	Area (Ac.)	Area Fraction	Fp (Fig C6) (In/Hr)	Ap (dec.)	Fm (In/Hr)
32.0	52.0	16.98	1.000	0.785	0.400	0.314

Area-averaged adjusted loss rate Fm (In/Hr) = 0.314

***** Area-Averaged low loss rate fraction, Yb *****

Area (Ac.)	Area Fract	SCS CN (AMC2)	SCS CN (AMC3)	S	Pervious Yield Fr
6.79	0.400	32.0	52.0	9.23	0.018
10.19	0.600	98.0	98.0	0.20	0.909

Area-averaged catchment yield fraction, Y = 0.553

Area-averaged low loss fraction, Yb = 0.447

User entry of time of concentration = 0.390 (hours)

+++++ Watershed area = 16.98 (Ac.)

Catchment Lag time = 0.312 hours

Unit interval = 5.000 minutes

Unit interval percentage of lag time = 26.7094

Hydrograph baseflow = 0.00 (CFS)

Average maximum watershed loss rate (Fm) = 0.314 (In/Hr)

Average low loss rate fraction (Yb) = 0.447 (decimal)

DESERT S-Graph Selected

Computed peak 5-minute rainfall = 0.304 (In)

Computed peak 30-minute rainfall = 0.520 (In)

Specified peak 1-hour rainfall = 0.640 (In)

Computed peak 3-hour rainfall = 0.998 (In)

Specified peak 6-hour rainfall = 1.320 (In)

Specified peak 24-hour rainfall = 2.520 (In)

Rainfall depth area reduction factors:

Using a total area of 16.98 (Ac.) (Ref: fig. E-4)

5-minute factor = 0.999 Adjusted rainfall = 0.303 (In)

30-minute factor = 0.999 Adjusted rainfall = 0.519 (In)

1-hour factor = 0.999 Adjusted rainfall = 0.639 (In)

3-hour factor = 1.000 Adjusted rainfall = 0.997 (In)

6-hour factor = 1.000 Adjusted rainfall = 1.320 (In)

24-hour factor = 1.000 Adjusted rainfall = 2.520 (In)

Unit Hydrograph

Interval Number	'S' Graph Mean values	Unit Hydrograph (CFS)
--------------------	--------------------------	--------------------------

(K = 205.35 (CFS))

1	1.482	3.043
2	7.420	12.194

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3	23.386	32.787
4	45.504	45.420
5	59.274	28.276
6	67.621	17.141
7	73.654	12.390
8	78.228	9.392
9	81.762	7.257
10	84.638	5.907
11	87.117	5.091
12	89.115	4.103
13	90.695	3.244
14	92.107	2.898
15	93.340	2.534
16	94.376	2.126
17	95.282	1.860
18	96.053	1.584
19	96.739	1.409
20	97.275	1.101
21	97.738	0.951
22	98.043	0.625
23	98.317	0.564
24	98.632	0.646
25	98.953	0.658
26	99.273	0.658
27	99.545	0.559
28	99.716	0.350
29	99.883	0.343
30	100.000	0.241

Total soil rain loss = 1.01 (In)
 Total effective rainfall = 1.51 (In)
 Peak flow rate in flood hydrograph = 15.99 (CFS)

+++++
 24 - H O U R S T O R M
 R u n o f f H y d r o g r a p h

Hydrograph in 5 Minute intervals ((CFS))

Time (h+m)	Volume Ac.Ft	Q (CFS)	0	5.0	10.0	15.0	20.0
0+ 5	0.0000	0.01	Q				
0+10	0.0003	0.03	Q				
0+15	0.0010	0.11	Q				
0+20	0.0025	0.21	Q				
0+25	0.0044	0.28	Q				
0+30	0.0066	0.32	Q				
0+35	0.0089	0.34	Q				
0+40	0.0114	0.37	Q				
0+45	0.0141	0.38	Q				

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0+50	0.0168	0.40	Q				
0+55	0.0197	0.41	Q				
1+ 0	0.0226	0.42	Q				
1+ 5	0.0255	0.43	Q				
1+10	0.0285	0.44	Q				
1+15	0.0316	0.44	Q				
1+20	0.0347	0.45	Q				
1+25	0.0378	0.46	Q				
1+30	0.0410	0.46	Q				
1+35	0.0442	0.47	Q				
1+40	0.0474	0.47	Q				
1+45	0.0507	0.47	Q				
1+50	0.0540	0.48	QV				
1+55	0.0573	0.48	QV				
2+ 0	0.0606	0.48	QV				
2+ 5	0.0639	0.48	QV				
2+10	0.0673	0.49	QV				
2+15	0.0707	0.49	QV				
2+20	0.0741	0.49	QV				
2+25	0.0775	0.49	QV				
2+30	0.0809	0.50	QV				
2+35	0.0843	0.50	QV				
2+40	0.0878	0.50	IQ				
2+45	0.0912	0.50	IQ				
2+50	0.0947	0.50	IQ				
2+55	0.0982	0.51	IQ				
3+ 0	0.1017	0.51	IQ				
3+ 5	0.1052	0.51	IQ				
3+10	0.1087	0.51	IQV				
3+15	0.1122	0.51	IQV				
3+20	0.1157	0.51	IQV				
3+25	0.1193	0.52	IQV				
3+30	0.1228	0.52	IQV				
3+35	0.1264	0.52	IQV				
3+40	0.1300	0.52	IQV				
3+45	0.1336	0.52	IQV				
3+50	0.1372	0.52	IQV				
3+55	0.1408	0.53	IQV				
4+ 0	0.1445	0.53	IQV				
4+ 5	0.1481	0.53	IQV				
4+10	0.1518	0.53	IQV				
4+15	0.1555	0.53	IQV				
4+20	0.1591	0.54	IQV				
4+25	0.1628	0.54	IQ V				
4+30	0.1666	0.54	IQ V				
4+35	0.1703	0.54	IQ V				
4+40	0.1740	0.54	IQ V				
4+45	0.1778	0.55	IQ V				
4+50	0.1816	0.55	IQ V				
4+55	0.1853	0.55	IQ V				
5+ 0	0.1891	0.55	IQ V				
5+ 5	0.1930	0.55	IQ V				
5+10	0.1968	0.56	IQ V				

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5+15	0.2006	0.56	Q	V				
5+20	0.2045	0.56	Q	V				
5+25	0.2084	0.56	Q	V				
5+30	0.2123	0.57	Q	V				
5+35	0.2162	0.57	Q	V				
5+40	0.2201	0.57	Q	V				
5+45	0.2240	0.57	Q	V				
5+50	0.2280	0.57	Q	V				
5+55	0.2320	0.58	Q	V				
6+ 0	0.2360	0.58	Q	V				
6+ 5	0.2400	0.58	Q	V				
6+10	0.2440	0.58	Q	V				
6+15	0.2480	0.59	Q	V				
6+20	0.2521	0.59	Q	V				
6+25	0.2562	0.59	Q	V				
6+30	0.2603	0.59	Q	V				
6+35	0.2644	0.60	Q	V				
6+40	0.2685	0.60	Q	V				
6+45	0.2727	0.60	Q	V				
6+50	0.2768	0.61	Q	V				
6+55	0.2810	0.61	Q	V				
7+ 0	0.2852	0.61	Q	V				
7+ 5	0.2895	0.61	Q	V				
7+10	0.2937	0.62	Q	V				
7+15	0.2980	0.62	Q	V				
7+20	0.3023	0.62	Q	V				
7+25	0.3066	0.63	Q	V				
7+30	0.3109	0.63	Q	V				
7+35	0.3153	0.63	Q	V				
7+40	0.3196	0.64	Q	V				
7+45	0.3240	0.64	Q	V				
7+50	0.3284	0.64	Q	V				
7+55	0.3329	0.65	Q	V				
8+ 0	0.3374	0.65	Q	V				
8+ 5	0.3418	0.65	Q	V				
8+10	0.3464	0.66	Q	V				
8+15	0.3509	0.66	Q	V				
8+20	0.3555	0.66	Q	V				
8+25	0.3600	0.67	Q	V				
8+30	0.3647	0.67	Q	V				
8+35	0.3693	0.67	Q	V				
8+40	0.3740	0.68	Q	V				
8+45	0.3787	0.68	Q	V				
8+50	0.3834	0.69	Q	V				
8+55	0.3881	0.69	Q	V				
9+ 0	0.3929	0.69	Q	V				
9+ 5	0.3977	0.70	Q	V				
9+10	0.4025	0.70	Q	V				
9+15	0.4074	0.71	Q	V				
9+20	0.4123	0.71	Q	V				
9+25	0.4172	0.71	Q	V				
9+30	0.4222	0.72	Q	V				
9+35	0.4271	0.72	Q	V				

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9+40	0.4322	0.73	Q	V				
9+45	0.4372	0.73	Q	V				
9+50	0.4423	0.74	Q	V				
9+55	0.4474	0.74	Q	V				
10+ 0	0.4526	0.75	Q	V				
10+ 5	0.4577	0.75	Q	V				
10+10	0.4630	0.76	Q	V				
10+15	0.4682	0.76	Q	V				
10+20	0.4735	0.77	Q	V				
10+25	0.4789	0.78	Q	V				
10+30	0.4842	0.78	Q	V				
10+35	0.4897	0.79	Q	V				
10+40	0.4951	0.79	Q	V				
10+45	0.5006	0.80	Q	V				
10+50	0.5062	0.81	Q	V				
10+55	0.5118	0.81	Q	V				
11+ 0	0.5174	0.82	Q	V				
11+ 5	0.5231	0.82	Q	V				
11+10	0.5288	0.83	Q	V				
11+15	0.5346	0.84	Q	V				
11+20	0.5404	0.85	Q	V				
11+25	0.5463	0.85	Q	V				
11+30	0.5522	0.86	Q	V				
11+35	0.5582	0.87	Q	V				
11+40	0.5642	0.88	Q	V				
11+45	0.5703	0.88	Q	V				
11+50	0.5765	0.89	Q	V				
11+55	0.5827	0.90	Q	V				
12+ 0	0.5889	0.91	Q	V				
12+ 5	0.5953	0.92	Q	V				
12+10	0.6016	0.92	Q	V				
12+15	0.6079	0.91	Q	V				
12+20	0.6140	0.89	Q	V				
12+25	0.6201	0.88	Q	V				
12+30	0.6261	0.88	Q	V				
12+35	0.6322	0.88	Q	V				
12+40	0.6383	0.89	Q	V				
12+45	0.6445	0.90	Q	V				
12+50	0.6508	0.90	Q	V				
12+55	0.6570	0.91	Q	V				
13+ 0	0.6634	0.92	Q	V				
13+ 5	0.6699	0.94	Q	V				
13+10	0.6764	0.95	Q	V				
13+15	0.6830	0.96	Q	V				
13+20	0.6897	0.97	Q	V				
13+25	0.6965	0.99	Q	V				
13+30	0.7034	1.00	Q	V				
13+35	0.7104	1.02	Q	V				
13+40	0.7176	1.04	Q	V				
13+45	0.7249	1.06	Q	V				
13+50	0.7323	1.07	Q	V				
13+55	0.7398	1.10	Q	V				
14+ 0	0.7475	1.12	Q	V				

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14+ 5	0.7554	1.14	Q		V			
14+10	0.7634	1.16	Q		V			
14+15	0.7716	1.19	Q		V			
14+20	0.7799	1.22	Q		V			
14+25	0.7885	1.25	Q		V			
14+30	0.7973	1.28	Q		V			
14+35	0.8064	1.31	Q		V			
14+40	0.8157	1.35	Q		V			
14+45	0.8252	1.39	Q		V			
14+50	0.8351	1.43	Q		V			
14+55	0.8453	1.48	Q		V			
15+ 0	0.8558	1.53	Q		V			
15+ 5	0.8667	1.58	Q		V			
15+10	0.8781	1.65	Q		V			
15+15	0.8899	1.72	Q		V			
15+20	0.9023	1.80	Q		V			
15+25	0.9152	1.87	Q		V			
15+30	0.9285	1.94	Q		V			
15+35	0.9420	1.96	Q		V			
15+40	0.9555	1.95	Q		V			
15+45	0.9695	2.03	Q		V			
15+50	0.9846	2.19	Q		V			
15+55	1.0014	2.44	Q		V			
16+ 0	1.0212	2.88	Q		V			
16+ 5	1.0510	4.33	Q	Q	V			
16+10	1.1029	7.53			Q	V		
16+15	1.1936	13.17				V	Q	
16+20	1.3037	15.99					V	Q
16+25	1.3804	11.14				Q	V	
16+30	1.4341	7.81			Q		V	
16+35	1.4771	6.24		Q			V	
16+40	1.5132	5.25		Q			V	
16+45	1.5441	4.49		Q			V	
16+50	1.5713	3.94		Q			V	
16+55	1.5957	3.55		Q			V	
17+ 0	1.6174	3.14		Q			V	
17+ 5	1.6366	2.79		Q			V	
17+10	1.6543	2.58		Q			V	
17+15	1.6707	2.38		Q			V	
17+20	1.6857	2.17		Q			V	
17+25	1.6996	2.02		Q			V	
17+30	1.7124	1.86		Q			V	
17+35	1.7244	1.74		Q			V	
17+40	1.7354	1.60		Q			V	
17+45	1.7457	1.49		Q			V	
17+50	1.7550	1.36		Q			V	
17+55	1.7640	1.30		Q			V	
18+ 0	1.7728	1.28		Q			V	
18+ 5	1.7814	1.25		Q			V	
18+10	1.7898	1.21		Q			V	
18+15	1.7978	1.17		Q			V	
18+20	1.8054	1.11		Q			V	
18+25	1.8129	1.09		Q			V	

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18+30	1.8201	1.04	Q				V	
18+35	1.8267	0.96	Q				V	
18+40	1.8331	0.94	Q				V	
18+45	1.8394	0.92	Q				V	
18+50	1.8456	0.90	Q				V	
18+55	1.8517	0.88	Q				V	
19+ 0	1.8577	0.87	Q				V	
19+ 5	1.8636	0.85	Q				V	
19+10	1.8694	0.84	Q				V	
19+15	1.8751	0.83	Q				V	
19+20	1.8807	0.81	Q				V	
19+25	1.8862	0.80	Q				V	
19+30	1.8916	0.79	Q				V	
19+35	1.8970	0.78	Q				V	
19+40	1.9023	0.77	Q				V	
19+45	1.9075	0.76	Q				V	
19+50	1.9126	0.75	Q				V	
19+55	1.9177	0.74	Q				V	
20+ 0	1.9227	0.73	Q				V	
20+ 5	1.9276	0.72	Q				V	
20+10	1.9325	0.71	Q				V	
20+15	1.9373	0.70	Q				V	
20+20	1.9421	0.69	Q				V	
20+25	1.9468	0.68	Q				V	
20+30	1.9515	0.68	Q				V	
20+35	1.9561	0.67	Q				V	
20+40	1.9607	0.66	Q				V	
20+45	1.9652	0.65	Q				V	
20+50	1.9696	0.65	Q				V	
20+55	1.9741	0.64	Q				V	
21+ 0	1.9784	0.63	Q				V	
21+ 5	1.9827	0.63	Q				V	
21+10	1.9870	0.62	Q				V	
21+15	1.9913	0.62	Q				V	
21+20	1.9955	0.61	Q				V	
21+25	1.9996	0.60	Q				V	
21+30	2.0038	0.60	Q				V	
21+35	2.0079	0.59	Q				V	
21+40	2.0119	0.59	Q				V	
21+45	2.0159	0.58	Q				V	
21+50	2.0199	0.58	Q				V	
21+55	2.0239	0.57	Q				V	
22+ 0	2.0278	0.57	Q				V	
22+ 5	2.0317	0.56	Q				V	
22+10	2.0355	0.56	Q				V	
22+15	2.0394	0.56	Q				V	
22+20	2.0432	0.55	Q				V	
22+25	2.0469	0.55	Q				V	
22+30	2.0507	0.54	Q				V	
22+35	2.0544	0.54	Q				V	
22+40	2.0580	0.53	Q				V	
22+45	2.0617	0.53	Q				V	
22+50	2.0653	0.53	Q				V	

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22+55	2.0689	0.52	Q				V	
23+ 0	2.0725	0.52	Q				V	
23+ 5	2.0761	0.52	Q				V	
23+10	2.0796	0.51	Q				V	
23+15	2.0831	0.51	Q				V	
23+20	2.0866	0.51	Q				V	
23+25	2.0901	0.50	Q				V	
23+30	2.0935	0.50	Q				V	
23+35	2.0969	0.50	Q				V	
23+40	2.1003	0.49	Q				V	
23+45	2.1037	0.49	Q				V	
23+50	2.1070	0.49	Q				V	
23+55	2.1104	0.48	Q				V	
24+ 0	2.1137	0.48	Q				V	

San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2005 Version 7.1
 Rational Hydrology Study Date: 11/29/18

TT 20088
 Developed Time of Concentration
 100 Year Storm Event
 tt20088dev100yrtrc.out

Program License Serial Number 6286

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

Planning: Land, GIS & Cannabis
 Surveying: Construction, Land & ALTA
 Engineering: Civil, Structural & Soils

CEQA, Biological, Native Plant & Phase 1 Assessments
 Community Relations & Marketing Studies

Real Estate & R/W Services
 Feasibility & Fiscal Analysis
 Construction Management & Inspection

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```
-----
Rational hydrology study storm event year is 100.0
Computed rainfall intensity:
Storm year = 100.00 1 hour rainfall = 1.080 (In.)
Slope used for rainfall intensity curve b = 0.7000
Soil antecedent moisture condition (AMC) = 3
```

```
+++++
Process from Point/Station 1.000 to Point/Station 2.000
**** INITIAL AREA EVALUATION ****
```

```
RESIDENTIAL(3 - 4 dwl/acre)
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2) = 32.00
Adjusted SCS curve number for AMC 3 = 52.00
Pervious ratio(Ap) = 0.6000 Max loss rate(Fm)= 0.471 (In/Hr)
Initial subarea data:
Initial area flow distance = 325.000 (Ft.)
Top (of initial area) elevation = 3084.000 (Ft.)
Bottom (of initial area) elevation = 3080.000 (Ft.)
Difference in elevation = 4.000 (Ft.)
Slope = 0.01231 s(%) = 1.23
TC = k(0.412)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 10.037 min.
Rainfall intensity = 3.776 (In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.788
Subarea runoff = 3.747 (CFS)
Total initial stream area = 1.260 (Ac.)
Pervious area fraction = 0.600
Initial area Fm value = 0.471 (In/Hr)
```

```
+++++
Process from Point/Station 2.000 to Point/Station 3.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
```

```
Top of street segment elevation = 3080.000 (Ft.)
End of street segment elevation = 3068.000 (Ft.)
Length of street segment = 760.000 (Ft.)
Height of curb above gutter flowline = 8.0 (In.)
Width of half street (curb to crown) = 18.000 (Ft.)
Distance from crown to crossfall grade break = 16.500 (Ft.)
Slope from gutter to grade break (v/hz) = 0.020
Slope from grade break to crown (v/hz) = 0.020
Street flow is on [2] side(s) of the street
Distance from curb to property line = 12.000 (Ft.)
Slope from curb to property line (v/hz) = 0.020
Gutter width = 1.500 (Ft.)
```

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Gutter hike from flowline = 2.000(In.)
 Manning's N in gutter = 0.0150
 Manning's N from gutter to grade break = 0.0150
 Manning's N from grade break to crown = 0.0200
 Estimated mean flow rate at midpoint of street = 10.525(CFS)
 Depth of flow = 0.413(Ft.), Average velocity = 2.612(Ft/s)
 Streetflow hydraulics at midpoint of street travel:
 Halfstreet flow width = 13.829(Ft.)
 Flow velocity = 2.61(Ft/s)
 Travel time = 4.85 min. TC = 14.89 min.
 Adding area flow to street
 RESIDENTIAL(3 - 4 dwl/acre)
 Decimal fraction soil group A = 1.000
 Decimal fraction soil group B = 0.000
 Decimal fraction soil group C = 0.000
 Decimal fraction soil group D = 0.000
 SCS curve number for soil(AMC 2) = 32.00
 Adjusted SCS curve number for AMC 3 = 52.00
 Pervious ratio(Ap) = 0.6000 Max loss rate(Fm)= 0.471(In/Hr)
 Rainfall intensity = 2.865(In/Hr) for a 100.0 year storm
 Effective runoff coefficient used for area, (total area with modified
 rational method) (Q=KCIA) is C = 0.752
 Subarea runoff = 13.426(CFS) for 6.710(Ac.)
 Total runoff = 17.173(CFS)
 Effective area this stream = 7.97(Ac.)
 Total Study Area (Main Stream No. 1) = 7.97(Ac.)
 Area averaged Fm value = 0.471(In/Hr)
 Street flow at end of street = 17.173(CFS)
 Half street flow at end of street = 8.587(CFS)
 Depth of flow = 0.473(Ft.), Average velocity = 2.932(Ft/s)
 Flow width (from curb towards crown)= 16.811(Ft.)

+++++
 Process from Point/Station 4.000 to Point/Station 5.000
 **** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****

Top of street segment elevation = 3082.000(Ft.)
 End of street segment elevation = 3065.000(Ft.)
 Length of street segment = 1300.000(Ft.)
 Height of curb above gutter flowline = 8.0(In.)
 Width of half street (curb to crown) = 18.000(Ft.)
 Distance from crown to crossfall grade break = 16.500(Ft.)
 Slope from gutter to grade break (v/hz) = 0.020
 Slope from grade break to crown (v/hz) = 0.020
 Street flow is on [2] side(s) of the street
 Distance from curb to property line = 12.000(Ft.)
 Slope from curb to property line (v/hz) = 0.025
 Gutter width = 1.500(Ft.)
 Gutter hike from flowline = 2.000(In.)
 Manning's N in gutter = 0.0150
 Manning's N from gutter to grade break = 0.0150
 Manning's N from grade break to crown = 0.0150

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Estimated mean flow rate at midpoint of street = 21.156(CFS)
 Depth of flow = 0.478(Ft.), Average velocity = 3.502(Ft/s)
 Streetflow hydraulics at midpoint of street travel:
 Halfstreet flow width = 17.082(Ft.)
 Flow velocity = 3.50(Ft/s)
 Travel time = 6.19 min. TC = 21.07 min.
 Adding area flow to street
 RESIDENTIAL(3 - 4 dwl/acre)
 Decimal fraction soil group A = 1.000
 Decimal fraction soil group B = 0.000
 Decimal fraction soil group C = 0.000
 Decimal fraction soil group D = 0.000
 SCS curve number for soil(AMC 2) = 32.00
 Adjusted SCS curve number for AMC 3 = 52.00
 Pervious ratio(Ap) = 0.6000 Max loss rate(Fm)= 0.471(In/Hr)
 Rainfall intensity = 2.247(In/Hr) for a 100.0 year storm
 Effective runoff coefficient used for area, (total area with modified
 rational method) (Q=KCIA) is C = 0.711
 Subarea runoff = 7.802(CFS) for 7.660(Ac.)
 Total runoff = 24.975(CFS)
 Effective area this stream = 15.63(Ac.)
 Total Study Area (Main Stream No. 1) = 15.63(Ac.)
 Area averaged Fm value = 0.471(In/Hr)
 Street flow at end of street = 24.975(CFS)
 Half street flow at end of street = 12.487(CFS)
 Depth of flow = 0.500(Ft.), Average velocity = 3.665(Ft/s)
 Note: depth of flow exceeds top of street crown.
 Flow width (from curb towards crown)= 18.000(Ft.)

+++++
 Process from Point/Station 6.000 to Point/Station 7.000
 **** SUBAREA FLOW ADDITION ****

RESIDENTIAL(3 - 4 dwl/acre)
 Decimal fraction soil group A = 1.000
 Decimal fraction soil group B = 0.000
 Decimal fraction soil group C = 0.000
 Decimal fraction soil group D = 0.000
 SCS curve number for soil(AMC 2) = 32.00
 Adjusted SCS curve number for AMC 3 = 52.00
 Pervious ratio(Ap) = 0.6000 Max loss rate(Fm)= 0.471(In/Hr)
Time of concentration = 21.07 min.
 Rainfall intensity = 2.247(In/Hr) for a 100.0 year storm
 Effective runoff coefficient used for area, (total area with modified
 rational method) (Q=KCIA) is C = 0.711
 Subarea runoff = 2.157(CFS) for 1.350(Ac.)
Total runoff = 27.132(CFS)
 Effective area this stream = 16.98(Ac.)
 Total Study Area (Main Stream No. 1) = 16.98(Ac.)
 Area averaged Fm value = 0.471(In/Hr)
 End of computations, Total Study Area = 16.98 (Ac.)
 The following figures may

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be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(A_p) = 0.600
Area averaged SCS curve number = 32.0

U n i t H y d r o g r a p h A n a l y s i s

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Study date 11/29/18

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San Bernardino County Synthetic Unit Hydrology Method
Manual date - August 1986

Program License Serial Number 6286

TT 20088
Developed Runoff Volume
100 Year Storm Event
tt20088dev100yrvol.out

Storm Event Year = 100

Antecedent Moisture Condition = 3

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English (in-lb) Input Units Used

English Rainfall Data (Inches) Input Values Used

English Units used in output format

Area averaged rainfall intensity isohyetal data:

Sub-Area (Ac.)	Duration (hours)	Isohyetal (In)
Rainfall data for year 100		
16.98	1	1.08

Rainfall data for year 100		
16.98	6	2.24

Rainfall data for year 100		
16.98	24	4.42

+++++

***** Area-averaged max loss rate, Fm *****

SCS curve No. (AMCII)	SCS curve NO. (AMC 3)	Area (Ac.)	Area Fraction	Fp (Fig C6) (In/Hr)	Ap (dec.)	Fm (In/Hr)
32.0	52.0	16.98	1.000	0.785	0.400	0.314

Area-averaged adjusted loss rate Fm (In/Hr) = 0.314

***** Area-Averaged low loss rate fraction, Yb *****

Area (Ac.)	Area Fract	SCS CN (AMC2)	SCS CN (AMC3)	S	Pervious Yield Fr
6.79	0.400	32.0	52.0	9.23	0.127
10.19	0.600	98.0	98.0	0.20	0.947

Area-averaged catchment yield fraction, Y = 0.619

Area-averaged low loss fraction, Yb = 0.381

User entry of time of concentration = 0.350 (hours)

+++++

Watershed area = 16.98 (Ac.)

Catchment Lag time = 0.280 hours

Unit interval = 5.000 minutes

Unit interval percentage of lag time = 29.7619

Hydrograph baseflow = 0.00 (CFS)

Average maximum watershed loss rate (Fm) = 0.314 (In/Hr)

Average low loss rate fraction (Yb) = 0.381 (decimal)

DESERT S-Graph Selected

Computed peak 5-minute rainfall = 0.512 (In)

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Computed peak 30-minute rainfall = 0.877(In)
Specified peak 1-hour rainfall = 1.080(In)
Computed peak 3-hour rainfall = 1.689(In)
Specified peak 6-hour rainfall = 2.240(In)
Specified peak 24-hour rainfall = 4.420(In)

Rainfall depth area reduction factors:

Using a total area of 16.98(Ac.) (Ref: fig. E-4)

5-minute factor = 0.999	Adjusted rainfall = 0.512(In)
30-minute factor = 0.999	Adjusted rainfall = 0.877(In)
1-hour factor = 0.999	Adjusted rainfall = 1.079(In)
3-hour factor = 1.000	Adjusted rainfall = 1.689(In)
6-hour factor = 1.000	Adjusted rainfall = 2.240(In)
24-hour factor = 1.000	Adjusted rainfall = 4.420(In)

U n i t H y d r o g r a p h

+++++
Interval 'S' Graph Unit Hydrograph
Number Mean values ((CFS))

(K = 205.35 (CFS))

1	1.740	3.574
2	9.252	15.425
3	30.160	42.936
4	51.837	44.515
5	63.940	24.853
6	71.606	15.744
7	77.147	11.378
8	81.295	8.518
9	84.557	6.699
10	87.305	5.643
11	89.448	4.399
12	91.160	3.516
13	92.648	3.055
14	93.932	2.637
15	94.973	2.137
16	95.892	1.889
17	96.663	1.583
18	97.275	1.257
19	97.779	1.034
20	98.104	0.667
21	98.422	0.654
22	98.779	0.732
23	99.136	0.733
24	99.473	0.693
25	99.682	0.429
26	99.868	0.382
27	100.000	0.270

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Total soil rain loss =      1.49(In)
Total effective rainfall =    2.93(In)
Peak flow rate in flood hydrograph =    28.80(CFS)
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24 - H O U R S T O R M
 R u n o f f H y d r o g r a p h

 Hydrograph in 5 Minute intervals ((CFS))

Time(h+m)	Volume	Ac.Ft	Q(CFS)	0	7.5	15.0	22.5	30.0
0+ 5	0.0001		0.02	Q				
0+10	0.0007		0.09	Q				
0+15	0.0027		0.29	Q				
0+20	0.0061		0.50	Q				
0+25	0.0104		0.61	Q				
0+30	0.0151		0.69	Q				
0+35	0.0202		0.74	Q				
0+40	0.0256		0.79	VQ				
0+45	0.0313		0.82	VQ				
0+50	0.0371		0.85	VQ				
0+55	0.0431		0.87	VQ				
1+ 0	0.0492		0.89	VQ				
1+ 5	0.0555		0.91	VQ				
1+10	0.0618		0.92	VQ				
1+15	0.0682		0.93	VQ				
1+20	0.0747		0.94	VQ				
1+25	0.0813		0.95	VQ				
1+30	0.0879		0.96	VQ				
1+35	0.0946		0.97	VQ				
1+40	0.1014		0.98	VQ				
1+45	0.1081		0.98	IQ				
1+50	0.1149		0.99	IQ				
1+55	0.1218		0.99	IQ				
2+ 0	0.1287		1.00	IQ				
2+ 5	0.1356		1.01	IQ				
2+10	0.1426		1.01	IQ				
2+15	0.1496		1.02	IQ				
2+20	0.1566		1.02	IQ				
2+25	0.1636		1.02	IQ				
2+30	0.1707		1.02	IQ				
2+35	0.1777		1.03	IQ				
2+40	0.1848		1.03	IQ				
2+45	0.1920		1.03	IQ				
2+50	0.1991		1.04	IQ				
2+55	0.2063		1.04	IQ				
3+ 0	0.2134		1.04	IQV				
3+ 5	0.2207		1.05	IQV				
3+10	0.2279		1.05	IQV				

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3+15	0.2351	1.05	QV				
3+20	0.2424	1.06	QV				
3+25	0.2497	1.06	QV				
3+30	0.2571	1.06	QV				
3+35	0.2644	1.07	QV				
3+40	0.2718	1.07	QV				
3+45	0.2792	1.07	QV				
3+50	0.2866	1.08	QV				
3+55	0.2941	1.08	QV				
4+ 0	0.3015	1.09	QV				
4+ 5	0.3090	1.09	QV				
4+10	0.3166	1.09	Q V				
4+15	0.3241	1.10	Q V				
4+20	0.3317	1.10	Q V				
4+25	0.3393	1.10	Q V				
4+30	0.3469	1.11	Q V				
4+35	0.3546	1.11	Q V				
4+40	0.3623	1.12	Q V				
4+45	0.3700	1.12	Q V				
4+50	0.3777	1.12	Q V				
4+55	0.3855	1.13	Q V				
5+ 0	0.3933	1.13	Q V				
5+ 5	0.4011	1.14	Q V				
5+10	0.4090	1.14	Q V				
5+15	0.4169	1.15	Q V				
5+20	0.4248	1.15	Q V				
5+25	0.4327	1.15	Q V				
5+30	0.4407	1.16	Q V				
5+35	0.4487	1.16	Q V				
5+40	0.4568	1.17	Q V				
5+45	0.4648	1.17	Q V				
5+50	0.4730	1.18	Q V				
5+55	0.4811	1.18	Q V				
6+ 0	0.4893	1.19	Q V				
6+ 5	0.4975	1.19	Q V				
6+10	0.5057	1.20	Q V				
6+15	0.5140	1.20	Q V				
6+20	0.5223	1.21	Q V				
6+25	0.5306	1.21	Q V				
6+30	0.5390	1.22	Q V				
6+35	0.5474	1.22	Q V				
6+40	0.5559	1.23	Q V				
6+45	0.5644	1.23	Q V				
6+50	0.5729	1.24	Q V				
6+55	0.5814	1.24	Q V				
7+ 0	0.5900	1.25	Q V				
7+ 5	0.5987	1.25	Q V				
7+10	0.6074	1.26	Q V				
7+15	0.6161	1.27	Q V				
7+20	0.6248	1.27	Q V				
7+25	0.6336	1.28	Q V				
7+30	0.6425	1.28	Q V				
7+35	0.6514	1.29	Q V				

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7+40	0.6603	1.30	Q	V					
7+45	0.6693	1.30	Q	V					
7+50	0.6783	1.31	Q	V					
7+55	0.6873	1.32	Q	V					
8+ 0	0.6964	1.32	Q	V					
8+ 5	0.7056	1.33	Q	V					
8+10	0.7148	1.34	Q	V					
8+15	0.7240	1.34	Q	V					
8+20	0.7333	1.35	Q	V					
8+25	0.7427	1.36	Q	V					
8+30	0.7521	1.36	Q	V					
8+35	0.7615	1.37	Q	V					
8+40	0.7710	1.38	Q	V					
8+45	0.7805	1.39	Q	V					
8+50	0.7901	1.39	Q	V					
8+55	0.7998	1.40	Q	V					
9+ 0	0.8095	1.41	Q	V					
9+ 5	0.8193	1.42	Q	V					
9+10	0.8291	1.43	Q	V					
9+15	0.8390	1.43	Q	V					
9+20	0.8489	1.44	Q	V					
9+25	0.8589	1.45	Q	V					
9+30	0.8690	1.46	Q	V					
9+35	0.8791	1.47	Q	V					
9+40	0.8893	1.48	Q	V					
9+45	0.8995	1.49	Q	V					
9+50	0.9098	1.50	Q	V					
9+55	0.9202	1.51	Q	V					
10+ 0	0.9306	1.52	Q	V					
10+ 5	0.9412	1.53	Q	V					
10+10	0.9517	1.54	Q	V					
10+15	0.9624	1.55	Q	V					
10+20	0.9731	1.56	Q	V					
10+25	0.9839	1.57	Q	V					
10+30	0.9948	1.58	Q	V					
10+35	1.0058	1.59	Q	V					
10+40	1.0168	1.60	Q	V					
10+45	1.0280	1.62	Q	V					
10+50	1.0392	1.63	Q	V					
10+55	1.0505	1.64	Q	V					
11+ 0	1.0618	1.65	Q	V					
11+ 5	1.0733	1.67	Q	V					
11+10	1.0849	1.68	Q	V					
11+15	1.0965	1.69	Q	V					
11+20	1.1083	1.71	Q	V					
11+25	1.1201	1.72	Q	V					
11+30	1.1321	1.74	Q	V					
11+35	1.1442	1.75	Q	V					
11+40	1.1563	1.77	Q	V					
11+45	1.1686	1.78	Q	V					
11+50	1.1810	1.80	Q	V					
11+55	1.1935	1.82	Q	V					
12+ 0	1.2061	1.83	Q	V					

Planning: Land, GIS & Cannabis
Surveying: Construction, Land & ALTA
Engineering: Civil, Structural & Soils

CEQA, Biological, Native Plant & Phase 1 Assessments
Community Relations & Marketing Studies

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Construction Management & Inspection

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12+ 5	1.2188	1.84	Q	V			
12+10	1.2315	1.84	Q	V			
12+15	1.2438	1.79	Q	V			
12+20	1.2557	1.74	Q	V			
12+25	1.2676	1.72	Q	V			
12+30	1.2793	1.71	Q	V			
12+35	1.2911	1.71	Q	V			
12+40	1.3030	1.72	Q	V			
12+45	1.3149	1.73	Q	V			
12+50	1.3270	1.75	Q	V			
12+55	1.3391	1.76	Q	V			
13+ 0	1.3514	1.78	Q	V			
13+ 5	1.3638	1.80	Q	V			
13+10	1.3764	1.83	Q	V			
13+15	1.3892	1.85	Q	V			
13+20	1.4021	1.88	Q	V			
13+25	1.4152	1.91	Q	V			
13+30	1.4286	1.94	Q	V			
13+35	1.4421	1.97	Q	V			
13+40	1.4559	2.00	Q	V			
13+45	1.4699	2.04	Q	V			
13+50	1.4842	2.07	Q	V			
13+55	1.4987	2.11	Q	V			
14+ 0	1.5136	2.15	Q	V			
14+ 5	1.5287	2.20	Q	V			
14+10	1.5442	2.25	Q	V			
14+15	1.5600	2.30	Q	V			
14+20	1.5762	2.35	Q	V			
14+25	1.5928	2.41	Q	V			
14+30	1.6098	2.47	Q	V			
14+35	1.6273	2.54	Q	V			
14+40	1.6453	2.61	Q	V			
14+45	1.6638	2.69	Q	V			
14+50	1.6829	2.77	Q	V			
14+55	1.7026	2.86	Q	V			
15+ 0	1.7230	2.96	Q	V			
15+ 5	1.7442	3.07	Q	V			
15+10	1.7662	3.20	Q	V			
15+15	1.7892	3.34	Q	V			
15+20	1.8132	3.49	Q	V			
15+25	1.8384	3.65	Q	V			
15+30	1.8642	3.76	Q	V			
15+35	1.8900	3.74	Q	V			
15+40	1.9158	3.74	Q	V			
15+45	1.9428	3.93	Q	V			
15+50	1.9722	4.26	Q	V			
15+55	2.0054	4.82	Q	V			
16+ 0	2.0455	5.83	Q	V			
16+ 5	2.1087	9.17		Q	V		
16+10	2.2220	16.46			Q		
16+15	2.4204	28.80			V		Q
16+20	2.6154	28.32				V	Q
16+25	2.7428	18.49				Q V	

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16+30	2.8354	13.44				Q		V			
16+35	2.9102	10.87				Q		V			
16+40	2.9733	9.16				Q		V			
16+45	3.0280	7.93				Q		V			
16+50	3.0765	7.05				Q		V			
16+55	3.1189	6.16				Q		V			
17+ 0	3.1566	5.47				Q		V			
17+ 5	3.1911	5.00				Q		V			
17+10	3.2226	4.58				Q		V			
17+15	3.2512	4.15				Q		V			
17+20	3.2777	3.85				Q		V			
17+25	3.3021	3.54				Q		V			
17+30	3.3244	3.24				Q		V			
17+35	3.3451	3.00				Q		V			
17+40	3.3638	2.72				Q		V			
17+45	3.3819	2.62				Q		V			
17+50	3.3996	2.57				Q		V			
17+55	3.4166	2.48				Q		V			
18+ 0	3.4329	2.37				Q		V			
18+ 5	3.4479	2.17				Q		V			
18+10	3.4623	2.09				Q		V			
18+15	3.4763	2.03				Q		V			
18+20	3.4895	1.92				Q		V			
18+25	3.5026	1.90				Q		V			
18+30	3.5156	1.88				Q		V			
18+35	3.5283	1.85				Q		V			
18+40	3.5409	1.83				Q		V			
18+45	3.5533	1.80				Q		V			
18+50	3.5655	1.77				Q		V			
18+55	3.5775	1.74				Q		V			
19+ 0	3.5893	1.72				Q		V			
19+ 5	3.6009	1.69				Q		V			
19+10	3.6124	1.67				Q		V			
19+15	3.6237	1.64				Q		V			
19+20	3.6348	1.62				Q		V			
19+25	3.6458	1.60				Q		V			
19+30	3.6567	1.57				Q		V			
19+35	3.6674	1.55				Q		V			
19+40	3.6780	1.53				Q		V			
19+45	3.6884	1.51				Q		V			
19+50	3.6987	1.49				Q		V			
19+55	3.7088	1.48				Q		V			
20+ 0	3.7189	1.46				Q		V			
20+ 5	3.7288	1.44				Q		V			
20+10	3.7387	1.43				Q		V			
20+15	3.7484	1.41				Q		V			
20+20	3.7580	1.39				Q		V			
20+25	3.7675	1.38				Q		V			
20+30	3.7769	1.36				Q		V			
20+35	3.7861	1.35				Q		V			
20+40	3.7953	1.34				Q		V			
20+45	3.8044	1.32				Q		V			
20+50	3.8135	1.31				Q		V			

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20+55	3.8224	1.30	Q				V	
21+ 0	3.8312	1.28	Q				V	
21+ 5	3.8400	1.27	Q				V	
21+10	3.8487	1.26	Q				V	
21+15	3.8573	1.25	Q				V	
21+20	3.8658	1.24	Q				V	
21+25	3.8742	1.23	Q				V	
21+30	3.8826	1.22	Q				V	
21+35	3.8909	1.21	Q				V	
21+40	3.8991	1.20	Q				V	
21+45	3.9073	1.19	Q				V	
21+50	3.9154	1.18	Q				V	
21+55	3.9234	1.17	Q				V	
22+ 0	3.9314	1.16	Q				V	
22+ 5	3.9393	1.15	Q				V	
22+10	3.9472	1.14	Q				V	
22+15	3.9550	1.13	Q				V	
22+20	3.9627	1.12	Q				V	
22+25	3.9704	1.12	Q				V	
22+30	3.9780	1.11	Q				V	
22+35	3.9856	1.10	Q				V	
22+40	3.9931	1.09	Q				V	
22+45	4.0006	1.08	Q				V	
22+50	4.0080	1.08	Q				V	
22+55	4.0154	1.07	Q				V	
23+ 0	4.0227	1.06	Q				V	
23+ 5	4.0300	1.06	Q				V	
23+10	4.0372	1.05	Q				V	
23+15	4.0444	1.04	Q				V	
23+20	4.0515	1.04	Q				V	
23+25	4.0586	1.03	Q				V	
23+30	4.0656	1.02	Q				V	
23+35	4.0727	1.02	Q				V	
23+40	4.0796	1.01	Q				V	
23+45	4.0865	1.01	Q				V	
23+50	4.0934	1.00	Q				V	
23+55	4.1003	0.99	Q				V	
24+ 0	4.1071	0.99	Q				V	

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Appendix 12: Off Site Hydrology

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U n i t H y d r o g r a p h A n a l y s i s

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Study date 12/05/17

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San Bernardino County Synthetic Unit Hydrology Method
Manual date - August 1986

Program License Serial Number 6286

Tract 20088
Offsite Storm Runoff
100 Year Storm Event
tr20088ofsite.out

Storm Event Year = 100

Antecedent Moisture Condition = 3

English (in-lb) Input Units Used

English Rainfall Data (Inches) Input Values Used

English Units used in output format

Area averaged rainfall intensity isohyetal data:

Sub-Area (Ac.)	Duration (hours)	Isohyetal (In)
Rainfall data for year 100		
71.00	1	1.08

Rainfall data for year 100		
71.00	6	2.24

Rainfall data for year 100		
71.00	24	4.42

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***** Area-averaged max loss rate, Fm *****

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SCS curve No. (AMCII)	SCS curve NO. (AMC 3)	Area (Ac.)	Area Fraction	Fp (Fig C6) (In/Hr)	Ap (dec.)	Fm (In/Hr)
32.0	52.0	48.00	0.676	0.785	0.600	0.471
32.0	52.0	13.00	0.183	0.785	0.200	0.157
32.0	52.0	10.00	0.141	0.785	0.100	0.079

Area-averaged adjusted loss rate Fm (In/Hr) = 0.358

***** Area-Averaged low loss rate fraction, Yb *****

Area (Ac.)	Area Fract	SCS CN (AMC2)	SCS CN (AMC3)	S	Pervious Yield Fr
28.80	0.406	32.0	52.0	9.23	0.127
19.20	0.270	98.0	98.0	0.20	0.947
2.60	0.037	32.0	52.0	9.23	0.127
10.40	0.146	98.0	98.0	0.20	0.947
1.00	0.014	32.0	52.0	9.23	0.127
9.00	0.127	98.0	98.0	0.20	0.947

Area-averaged catchment yield fraction, Y = 0.573

Area-averaged low loss fraction, Yb = 0.427

+++++

Watercourse length = 2350.00 (Ft.)

Length from concentration point to centroid = 1175.00 (Ft.)

Elevation difference along watercourse = 30.00 (Ft.)

Mannings friction factor along watercourse = 0.020

Watershed area = 71.00 (Ac.)

Catchment Lag time = 0.090 hours

Unit interval = 5.000 minutes

Unit interval percentage of lag time = 93.0271

Hydrograph baseflow = 0.00 (CFS)

Average maximum watershed loss rate (Fm) = 0.358 (In/Hr)

Average low loss rate fraction (Yb) = 0.427 (decimal)

DESERT S-Graph Selected

Computed peak 5-minute rainfall = 0.512 (In)

Computed peak 30-minute rainfall = 0.877 (In)

Specified peak 1-hour rainfall = 1.080 (In)

Computed peak 3-hour rainfall = 1.689 (In)

Specified peak 6-hour rainfall = 2.240 (In)

Specified peak 24-hour rainfall = 4.420 (In)

Rainfall depth area reduction factors:

Using a total area of 71.00 (Ac.) (Ref: fig. E-4)

5-minute factor = 0.997 Adjusted rainfall = 0.511 (In)

30-minute factor = 0.997 Adjusted rainfall = 0.874 (In)

1-hour factor = 0.997 Adjusted rainfall = 1.076 (In)

3-hour factor = 1.000 Adjusted rainfall = 1.688 (In)

6-hour factor = 1.000 Adjusted rainfall = 2.240 (In)

24-hour factor = 1.000 Adjusted rainfall = 4.420 (In)

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```

-----
                        U n i t   H y d r o g r a p h
+++++
Interval      'S' Graph      Unit Hydrograph
Number        Mean values      ((CFS))
-----

```

(K = 858.66 (CFS))

1	14.949	128.361
2	64.222	423.082
3	82.128	153.754
4	90.120	68.623
5	94.481	37.449
6	97.055	22.095
7	98.375	11.337
8	99.412	8.905
9	100.000	5.049

```

-----
Total soil rain loss = 1.68 (In)
Total effective rainfall = 2.74 (In)
Peak flow rate in flood hydrograph = 227.50 (CFS)
-----

```

```

+++++
                        24 - H O U R   S T O R M
                        R u n o f f   H y d r o g r a p h
-----
Hydrograph in 5 Minute intervals ((CFS))
-----

```

Time(h+m)	Volume	Ac.Ft	Q(CFS)	0	75.0	150.0	225.0	300.0
12+ 0	4.8319		7.32 Q		V			
12+ 5	4.8815		7.20 Q		V			
12+10	4.9274		6.66 Q		V			
12+15	4.9721		6.50 Q		V			
12+20	5.0168		6.49 Q		V			
12+25	5.0616		6.51 Q		V			
12+30	5.1068		6.57 Q		V			
12+35	5.1525		6.63 Q		V			
12+40	5.1988		6.72 Q		V			
12+45	5.2456		6.80 Q		V			
12+50	5.2932		6.91 Q		V			
12+55	5.3414		7.00 Q		V			
13+ 0	5.3904		7.12 Q		V			
13+ 5	5.4402		7.22 Q		V			
13+10	5.4908		7.35 Q		V			
13+15	5.5421		7.46 Q		V			
13+20	5.5945		7.60 Q		V			
13+25	5.6477		7.72 Q		V			
13+30	5.7019		7.87 Q		V			

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13+35	5.7571	8.01	Q		V			
13+40	5.8134	8.18	Q		V			
13+45	5.8707	8.33	Q		V			
13+50	5.9294	8.52	Q		V			
13+55	5.9892	8.69	Q		V			
14+ 0	6.0505	8.89	Q		V			
14+ 5	6.1131	9.09	Q		V			
14+10	6.1775	9.36	Q		V			
14+15	6.2435	9.58	Q		V			
14+20	6.3114	9.86	Q		V			
14+25	6.3811	10.11	Q		V			
14+30	6.4529	10.43	Q		V			
14+35	6.5267	10.72	Q		V			
14+40	6.6031	11.09	Q		V			
14+45	6.6818	11.44	Q		V			
14+50	6.7636	11.88	Q		V			
14+55	6.8483	12.30	Q		V			
15+ 0	6.9367	12.84	Q		V			
15+ 5	7.0287	13.36	Q		V			
15+10	7.1254	14.04	Q		V			
15+15	7.2268	14.72	Q		V			
15+20	7.3343	15.61	Q		V			
15+25	7.4431	15.79	Q		V			
15+30	7.5437	14.62	Q		V			
15+35	7.6468	14.97	Q		V			
15+40	7.7593	16.33	Q		V			
15+45	7.8843	18.15	Q		V			
15+50	8.0311	21.32	Q		V			
15+55	8.2151	26.72	Q		V			
16+ 0	8.4997	41.32	Q		V			
16+ 5	9.2641	110.99		Q	V			
16+10	10.8309	227.50				V	Q	
16+15	11.5316	101.74		Q		V		
16+20	11.9182	56.13		Q		V		
16+25	12.1759	37.43	Q			V		
16+30	12.3760	29.05	Q			V		
16+35	12.5299	22.35	Q			V		
16+40	12.6632	19.35	Q			V		
16+45	12.7736	16.03	Q			V		
16+50	12.8607	12.65	Q			V		
16+55	12.9412	11.69	Q			V		
17+ 0	13.0166	10.94	Q			V		
17+ 5	13.0875	10.30	Q			V		
17+10	13.1544	9.71	Q			V		
17+15	13.2179	9.22	Q			V		
17+20	13.2785	8.80	Q			V		
17+25	13.3365	8.42	Q			V		
17+30	13.3923	8.09	Q			V		
17+35	13.4460	7.79	Q			V		
17+40	13.4978	7.52	Q			V		
17+45	13.5479	7.28	Q			V		
17+50	13.5965	7.05	Q			V		
17+55	13.6436	6.84	Q			V		

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18+ 0	13.6894	6.65	Q				V	
18+ 5	13.7353	6.66	Q				V	
18+10	13.7844	7.12	Q				V	
18+15	13.8339	7.19	Q				V	
18+20	13.8831	7.14	Q				V	
18+25	13.9317	7.06	Q				V	
18+30	13.9796	6.96	Q				V	
18+35	14.0268	6.85	Q				V	
18+40	14.0732	6.74	Q				V	
18+45	14.1189	6.63	Q				V	
18+50	14.1639	6.53	Q				V	
18+55	14.2081	6.42	Q				V	
19+ 0	14.2517	6.32	Q				V	
19+ 5	14.2946	6.23	Q				V	
19+10	14.3369	6.14	Q				V	
19+15	14.3786	6.05	Q				V	
19+20	14.4197	5.97	Q				V	
19+25	14.4603	5.89	Q				V	
19+30	14.5003	5.82	Q				V	
19+35	14.5398	5.74	Q				V	
19+40	14.5789	5.67	Q				V	
19+45	14.6175	5.60	Q				V	
19+50	14.6556	5.54	Q				V	
19+55	14.6933	5.47	Q				V	
20+ 0	14.7306	5.41	Q				V	
20+ 5	14.7674	5.35	Q				V	
20+10	14.8039	5.29	Q				V	
20+15	14.8399	5.24	Q				V	
20+20	14.8756	5.18	Q				V	
20+25	14.9110	5.13	Q				V	
20+30	14.9460	5.08	Q				V	
20+35	14.9806	5.03	Q				V	
20+40	15.0149	4.98	Q				V	
20+45	15.0489	4.94	Q				V	
20+50	15.0826	4.89	Q				V	
20+55	15.1159	4.85	Q				V	
21+ 0	15.1490	4.80	Q				V	
21+ 5	15.1818	4.76	Q				V	
21+10	15.2143	4.72	Q				V	
21+15	15.2465	4.68	Q				V	
21+20	15.2785	4.64	Q				V	
21+25	15.3102	4.60	Q				V	
21+30	15.3416	4.57	Q				V	
21+35	15.3728	4.53	Q				V	
21+40	15.4038	4.49	Q				V	
21+45	15.4345	4.46	Q				V	
21+50	15.4650	4.43	Q				V	
21+55	15.4952	4.39	Q				V	
22+ 0	15.5253	4.36	Q				V	
22+ 5	15.5551	4.33	Q				V	
22+10	15.5847	4.30	Q				V	
22+15	15.6141	4.27	Q				V	
22+20	15.6432	4.24	Q				V	

Planning: Land, GIS & Cannabis
Surveying: Construction, Land & ALTA
Engineering: Civil, Structural & Soils

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22+25	15.6722	4.21	Q				V	
22+30	15.7010	4.18	Q				V	
22+35	15.7296	4.15	Q				V	
22+40	15.7580	4.12	Q				V	
22+45	15.7862	4.10	Q				V	
22+50	15.8143	4.07	Q				V	
22+55	15.8422	4.05	Q				V	
23+ 0	15.8698	4.02	Q				V	
23+ 5	15.8974	4.00	Q				V	
23+10	15.9247	3.97	Q				V	
23+15	15.9519	3.95	Q				V	
23+20	15.9789	3.92	Q				V	
23+25	16.0058	3.90	Q				V	
23+30	16.0325	3.88	Q				V	
23+35	16.0590	3.86	Q				V	
23+40	16.0854	3.83	Q				V	
23+45	16.1117	3.81	Q				V	
23+50	16.1378	3.79	Q				V	
23+55	16.1637	3.77	Q				V	
24+ 0	16.1896	3.75	Q				V	

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Appendix 13: Hydraulic Calculations

Hydraulic Analysis Report

Project Data

Project Title:	TT 20088
Designer:	R Coleman, PE#36293, expires 6/30/2019
Project Date:	Friday, December 08, 2017
Project Units:	U.S. Customary Units
Notes:	Street Capacity

Curb and Gutter Analysis: Curb and Gutter Analysis

Notes:	None
--------	------

Gutter Input Parameters

Longitudinal Slope of Road:	0.0100 ft/ft
Cross-Slope of Pavement:	0.0200 ft/ft
Uniform Gutter Geometry	
Manning's n:	0.0200
Gutter Width:	1.5000 ft
Design Flow:	20.5000 cfs

Gutter Result Parameters

Width of Spread:	24.3265 ft
Gutter Depression:	0.0000 in
Area of Flow:	5.9178 ft ²
Eo (Gutter Flow to Total Flow):	0.1563
Gutter Depth at Curb:	5.8384 in

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Inlet Input Parameters

Inlet Location:	Inlet in Sag
Percent Clogging:	0.0000 %
Inlet Type:	Curb Opening
Length of Inlet:	6.0000 ft
Curb opening height:	8.0000 in
Local Depression:	2.0000 in

Inlet Result Parameters

Perimeter:	8.7000 ft
Effective Perimeter:	8.7000 ft
Area:	5.0000 ft ²
Effective Area:	5.0000 ft ²
Depth at curb face (upstream of local depression):	1.0163 ft
Computed Width of Spread at Sag:	50.8130 ft
Flow type:	Weir Flow
Efficiency:	1.0000

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Channel Analysis: Channel Analysis

Notes:

Triangular Channel - Option

Input Parameters

Channel Type:	Triangular
Side Slope 1 (Z1):	1.0000 ft/ft
Side Slope 2 (Z2):	1.0000 ft/ft
Longitudinal Slope:	0.0100 ft/ft
Manning's n:	0.0150
Flow:	20.5000 cfs

Result Parameters

Depth:	1.7034 ft
Area of Flow:	2.9016 ft ²
Wetted Perimeter:	4.8180 ft
Hydraulic Radius:	0.6022 ft
Average Velocity:	7.0650 ft/s
Top Width:	3.4068 ft
Froude Number:	1.3491
Critical Depth:	1.9202 ft
Critical Velocity:	5.5601 ft/s
Critical Slope:	0.0053 ft/ft
Critical Top Width:	3.84 ft
Calculated	
Max Shear Stress:	1.0629 lb/ft ²
Avg Shear Stress:	0.3758 lb/ft ²

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Channel Analysis: Channel Analysis 2

Notes: Rectangular Channel - Option

Input Parameters

Channel Type:	Rectangular
Channel Width:	6.0000 ft
Longitudinal Slope:	0.0100 ft/ft
Manning's n:	0.0150
Flow:	20.5000 cfs

Result Parameters

Depth:	0.5660 ft
Area of Flow:	3.3963 ft ²
Wetted Perimeter:	7.1321 ft
Hydraulic Radius:	0.4762 ft
Average Velocity:	6.0360 ft/s
Top Width:	6.0000 ft
Froude Number:	1.4138
Critical Depth:	0.7130 ft
Critical Velocity:	4.7917 ft/s
Critical Slope:	0.0049 ft/ft
Critical Top Width:	6.00 ft
Calculated	
Max Shear Stress:	0.3532 lb/ft ²
Avg Shear Stress:	0.2971 lb/ft ²