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**BCA ENGINEERING CORP.**

**19531 Hwy 18  
Apple Valley, Ca. 92307  
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**PRELIMINARY HYDROLOGY STUDY &  
HYDRAULIC CALCULATIONS**

**CITY OF VICTORVILLE: ENG 14-00317**

**PROPOSED RESIDENTIAL SUBDIVISION**

**TT 18980  
APN 3094-141-01  
SECOND AVENUE  
VICTORVILLE**

**PREPARED FOR**

**Mr. John Kavak  
Kavak Family Trust**

**Date Prepared:  
January, 2015**

**W.O.# 143-14**

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**DISCUSSION****PURPOSE**

This study was performed to determine the drainage flows that affect the proposed development of a residential subdivision so that an adequate drainage plan could be designed to conduct these flows through the site and reduce the outflows from the site.

**LOCATION & DISCUSSION**

This property is located on the west side of Second Avenue approximately 660 feet north of Silica Drive in Victorville. The site is approximately 5 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 current proposed site improvements include the construction of approximately  $20 \pm .25$  acre single family residential lots. On-site storm run-off will be directed away from the proposed buildings to existing storm drain facilities in the area.

**OFF-SITE RUNOFF**

There is no off-site runoff that affects the site. The area to the south drains to either Second Avenue or a storm drain located along the westerly property line of the site. The storm drain is an open concrete box culvert 48" wide and 24" deep. The open channel connects to a 24" diameter reinforced concrete pipe with a grated entrance. This carries the flows northerly into progressively larger storm drains.

**ON -SITE RUNOFF**

The on-site runoff was determined using a combination of the San Bernardino County Rational Method and San Bernardino County Unit Hydrograph Method. The Rational Method was used to determine the Time of Concentration for the site. This was then used in the Unit Hydrograph to determine the runoff volume. Both the current land use and the proposed land use were analyzed. This information was used to determine the amount of runoff from the site.

The site is divided by a ridge line that runs north to south approximately 270 feet east of the west

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property line. There are 2.06 acres that drain west to an existing improved concrete box and drainage easement. The remaining 2.94 acres will drain east to Second Avenue. The high point of the site is at an elevation of 3007 feet. The low point at the northwest corner of the site is at an elevation of 2991 feet and the low point at the northeast corner of the site is at an elevation of 2996 feet.

### WEST SIDE OF SITE

The runoff from the existing undeveloped site was found to be 4.95 cubic feet per second with a volume of .45 acre feet. The runoff from the developed site was found to be 6.15 cubic feet per second with a volume of .43 acre feet.

Existing	Developed
4.95 cfs	6.15 cfs
.45 a.f.	.43 a.f.

### EAST SIDE OF SITE

The runoff from the existing undeveloped site was found to be 6.76 cubic feet per second with a volume of .65 acre feet. The runoff from the developed site was found to be 7.32 cubic feet per second with a volume of .61 acre feet.

Existing	Developed
6.76 cfs	7.32 cfs
.65 a.f.	.61 a.f.

### METHODOLOGY

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

- (a) 100 -year design storm frequency.
- (b) Hydrologic soils group "C"
- (c) Development type: Residential

- 
- (d) 100 Year Intensity
    - 1 hour – 1.11
    - 6 hour – 2.20
    - 24 hour – 3.98
  - (e) SCS Curve Number – 85 existing, 4 units/acre developed

## CONCLUSION

The storm run-off for a 100-year storm event created by the site in its existing undeveloped condition is 11.71 cubic feet per second. The storm run-off for the proposed developed condition is 13.47 cubic feet per second. These flows can be controlled within the existing storm drain and streets.

- $Q_{developed} < Q_{existing}$ : The totals of the post development creates a lower volume and does not create a typical volume for calculations for a Retention Volume.
- $V_{developed} > V_{existing}$ : However the post development Velocity is higher than the pre-development velocity, for as estimated time for each of approximate 10 minutes reviewing the Unit Hydrograph and is the following:
  - West 2.06 acres:       $6.15 \text{ CFS} - 4.95 \text{ CFS} * 10 \text{ minutes} = 720 \text{ CF}$
  - East 2.94 acres:       $7.52 \text{ CFS} - 6.76 \text{ CFS} * 10 \text{ minutes} = 456 \text{ CF}$
  - CONCLUSION: The Final Street and Grading Plan Design will require bioswale volumes for 720 cubic feet for the western 2.06 acres and 456 cubic feet for the eastern 2.94 acres.
- Therefore the  $V_{developed}$  being higher does warrant a Water Quality Management Plan
- This site is a Priority Project per MS4.

The final design of this site is too include a 30 feet long by 4 feet wide bio-swale incorporated into the drainage easement located at the west end of the cul-de-sac.

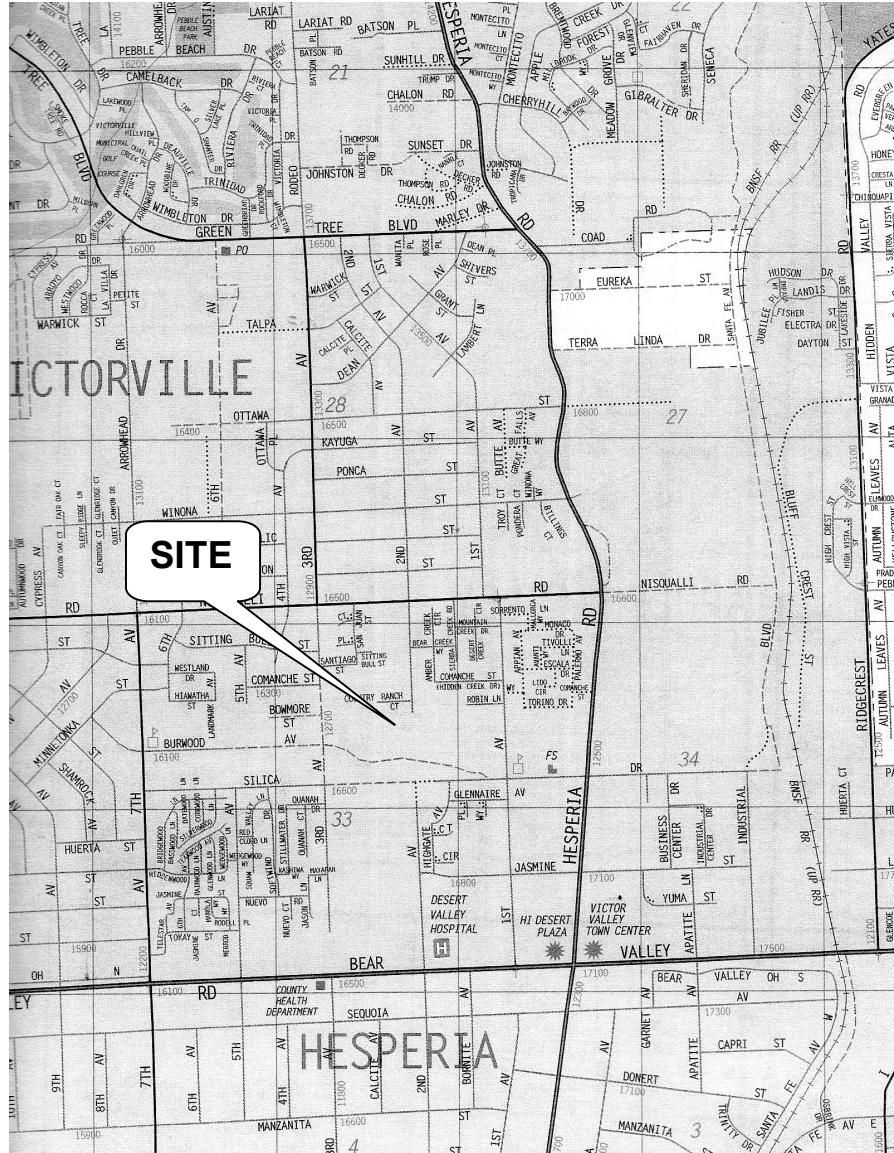
The development of this site will have no adverse drainage affect on this or surrounding properties.

Randolph J. Coleman RCE 36293, Exp 6-30-2016

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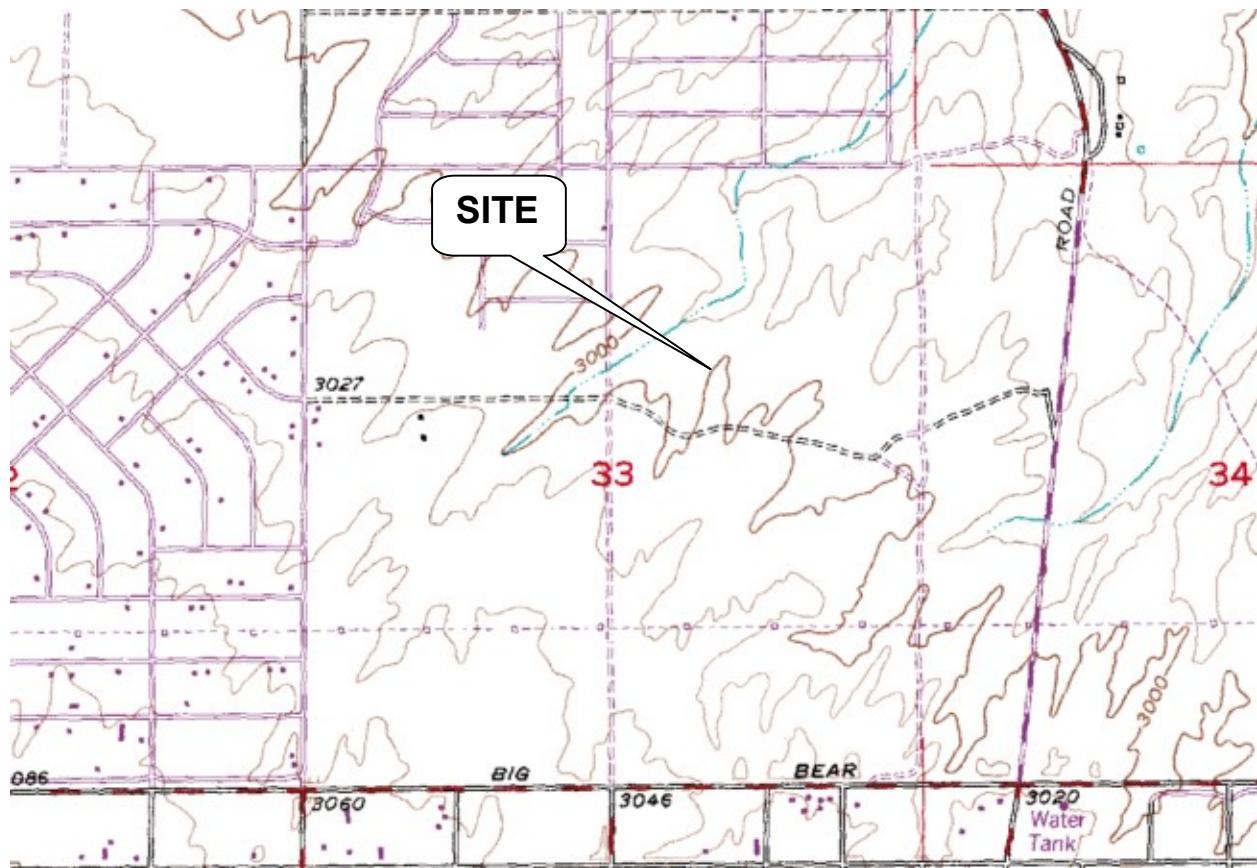
**LOCATION MAP – WEST SIDE SECOND AVENUE SOUTH OF NISQUALLI ROAD  
APPLE VALLEY**

## DRAWING 1

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USGS QUAD SHEET - VICTORVILLE

DRAWING 2

Civil Engineering  
Land Surveying & GPS  
Land Planning & GIS

Biological, Native Plant & Phase 1 Assessments  
Valuations & Marketing Studies

©

Real Estate Services  
Feasibility Analysis  
Construction Management & Inspection

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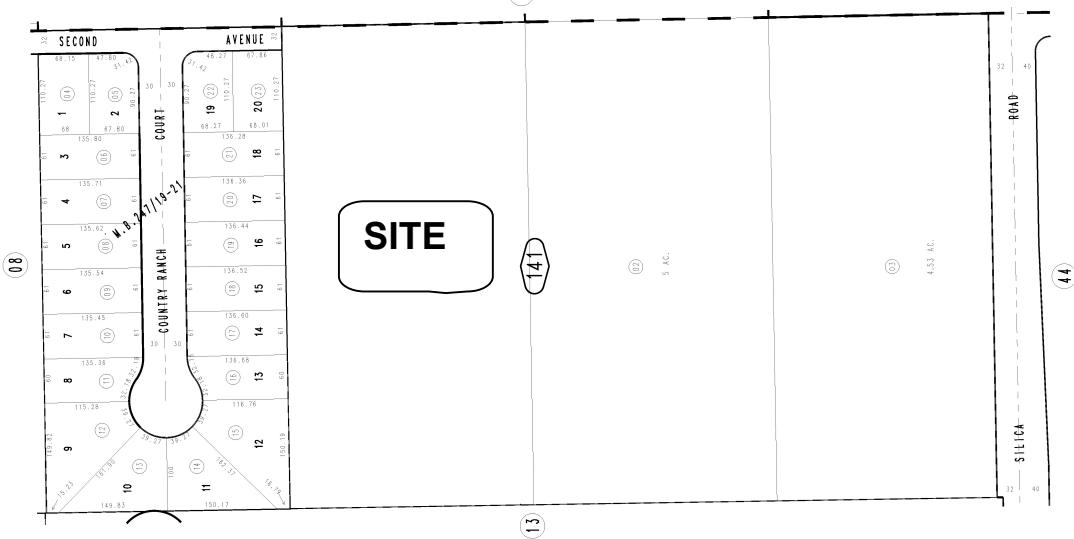
THIS MAP IS FOR THE PURPOSE  
OF AD VALOREM TAXATION ONLY.

Ptn. E.1/2, S.W.1/4, N.E.1/4 Sec. 33, T.5N., R.4W., S.B.M.

City of Victorville  
Tax Rate Area  
12064 3091 - 14



Road



OCTOBER 1993

Tract No. 14823, M.B. 247/19-21

Assessor's Map  
Book 3091 Page 14  
San Bernardino County

REVISED  
08/03/06 GW

## **ASSESSOR'S MAP - APN 3091-141-01**

### **DRAWING 3**

Civil Engineering  
Land Surveying & GPS  
Land Planning & GIS

Biological, Native Plant & Phase 1 Assessments  
Valuations & Marketing Studies

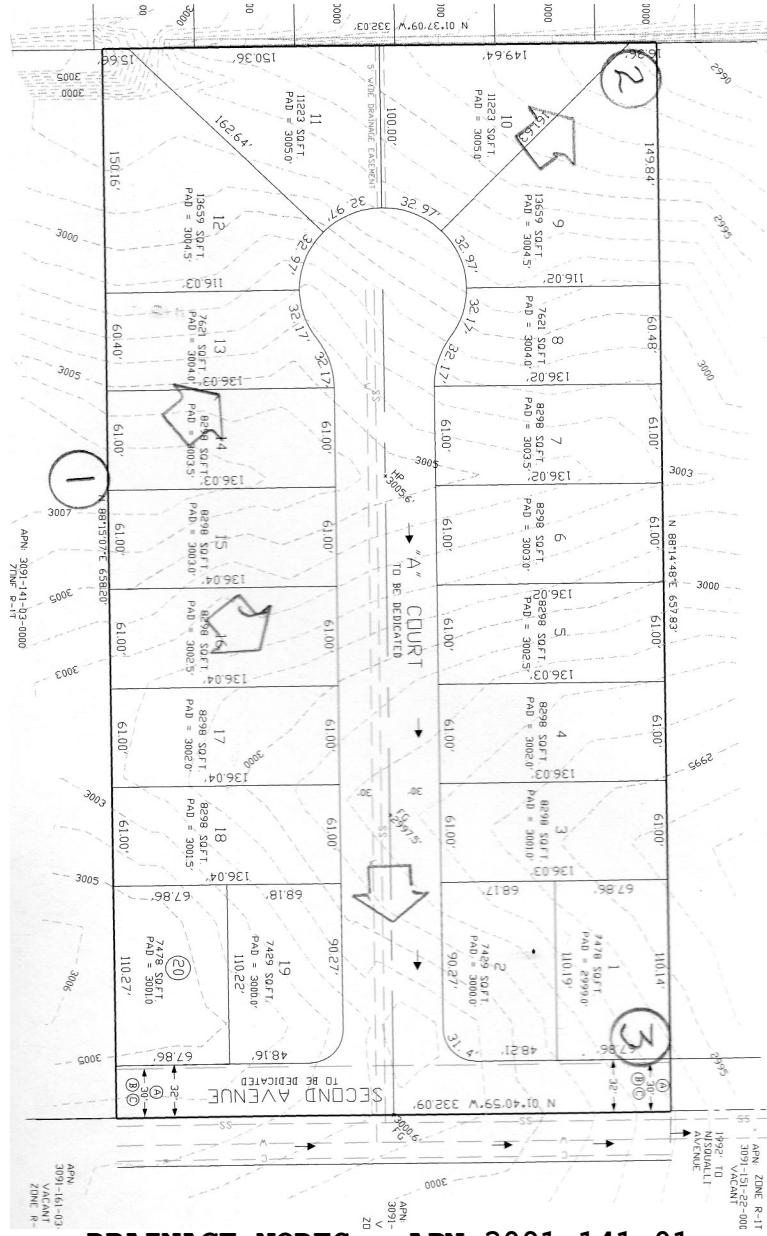
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Real Estate Services  
Feasibility Analysis  
Construction Management & Inspection

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**DRAINAGE NODES - APN 3091-141-01**

**DRAWING 4**

**BCA Engineering, Inc.**

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**AERIAL - APN 3091-141-01**

**DRAWING 5**

Civil Engineering  
Land Surveying & GPS  
Land Planning & GIS

Biological, Native Plant & Phase 1 Assessments  
Valuations & Marketing Studies

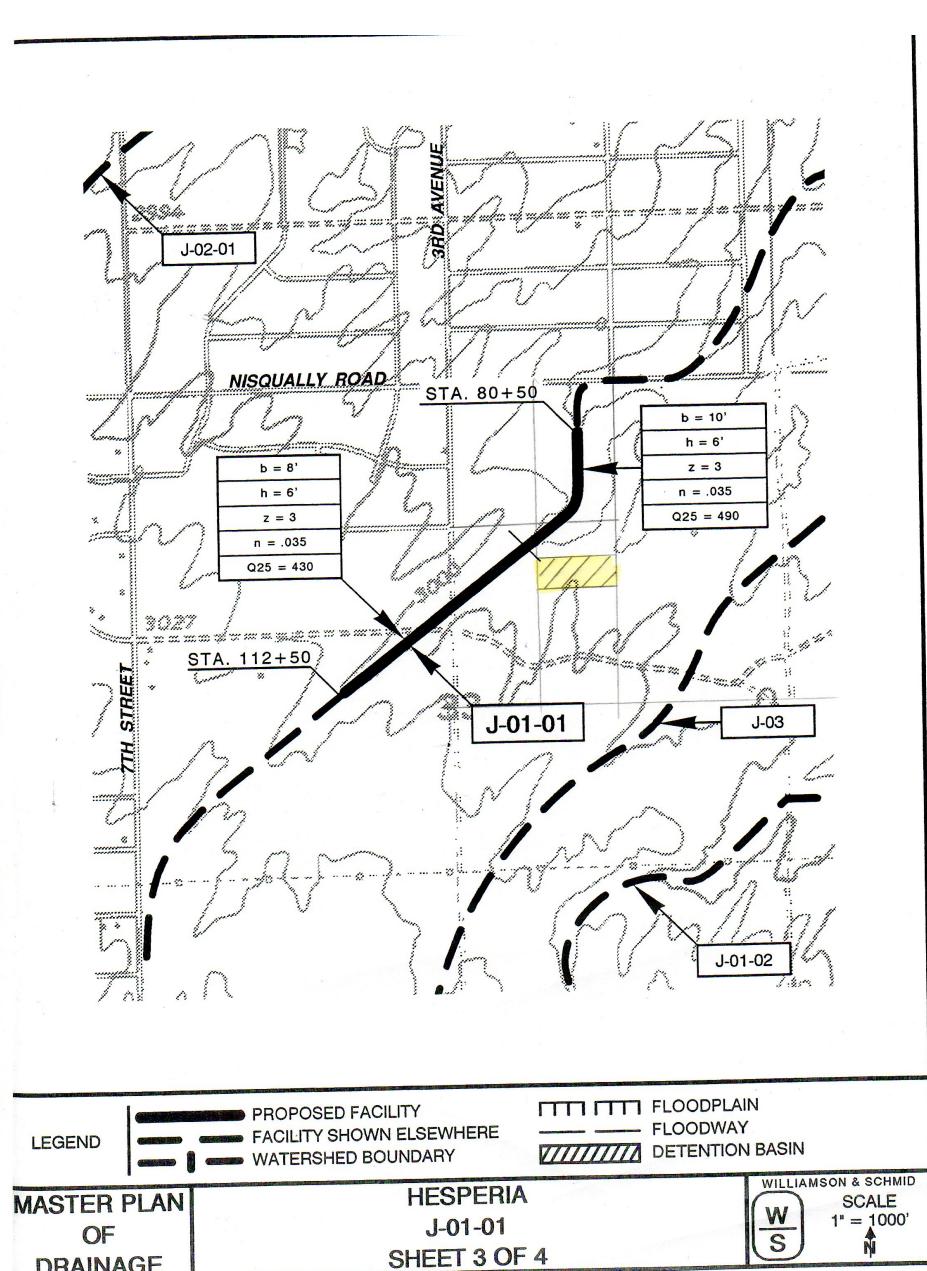
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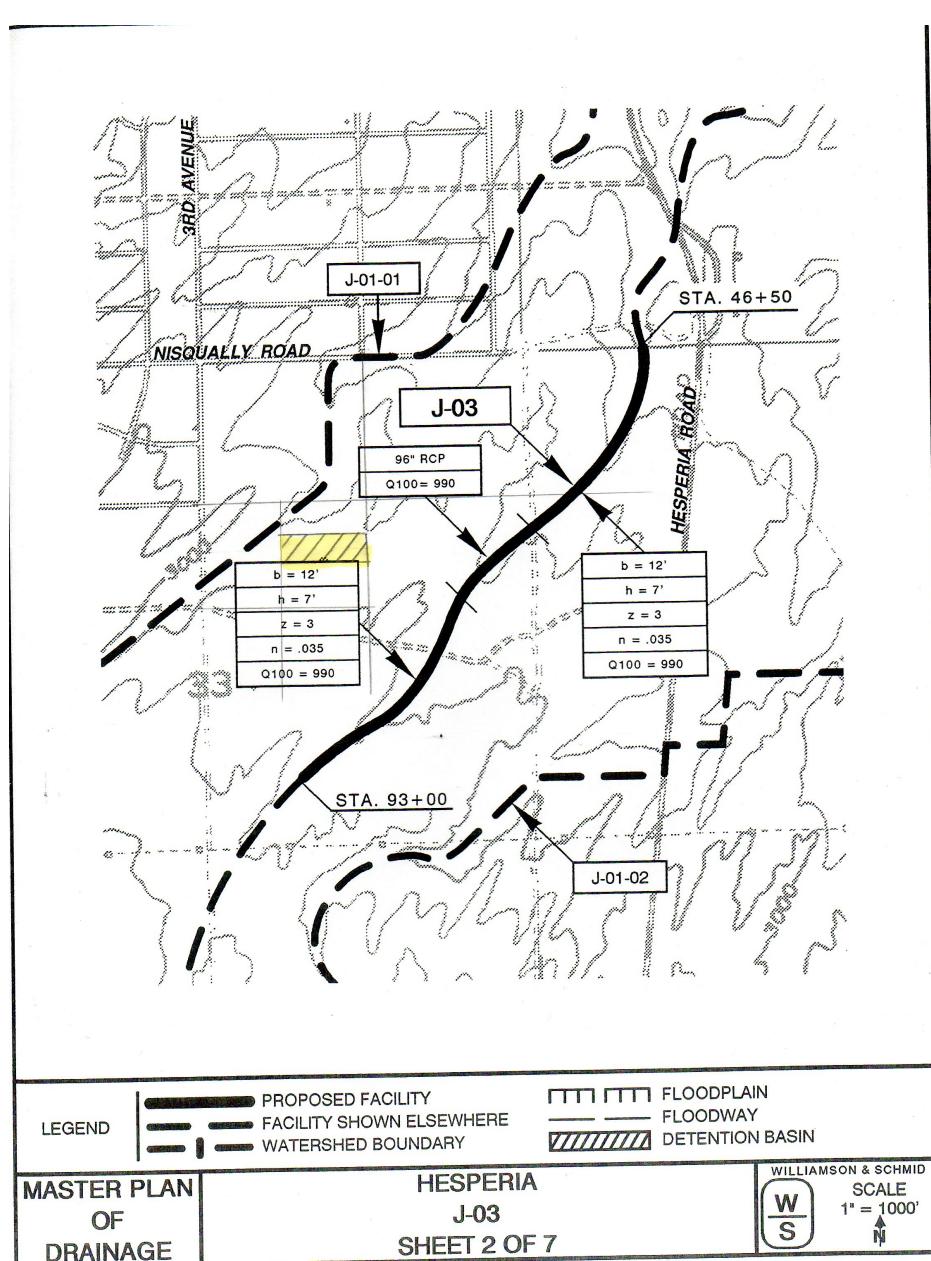


**MASTER PLAN OF DRAINAGE J-01-01  
DRAWING 6**

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**WEST PORTION**

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: 12/15/14

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TT 18980 (west portion)  
Predevelopment Time of Concentration  
100 Year Storm Event  
tt18980pretcw.out

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Program License Serial Number 6286

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

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Rational hydrology study storm event year is 100.0  
Computed rainfall intensity:  
Storm year = 100.00 1 hour rainfall = 1.110 (In.)  
Slope used for rainfall intensity curve b = 0.7000  
Soil antecedent moisture condition (AMC) = 2

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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) = 85.00  
Pervious ratio(Ap) = 1.0000 Max loss rate(Fm)= 0.283 (In/Hr)  
Initial subarea data:  
Initial area flow distance = 428.000(Ft.)  
Top (of initial area) elevation = 3007.000(Ft.)  
Bottom (of initial area) elevation = 2991.000(Ft.)  
Difference in elevation = 16.000(Ft.)  
Slope = 0.03738 s(%)= 3.74  
TC = k(0.529)\*[(length^3)/(elevation change)]^0.2  
**Initial area time of concentration = 11.523 min.**  
Rainfall intensity = 3.523(In/Hr) for a 100.0 year storm  
Effective runoff coefficient used for area (Q=KCIA) is C = 0.828  
Subarea runoff = 6.007(CFS)  
Total initial stream area = 2.060(Ac.)  
Pervious area fraction = 1.000  
Initial area Fm value = 0.283(In/Hr)  
End of computations, Total Study Area = 2.06 (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 = 85.0

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Unit Hydrograph Analysis

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

Study date 12/15/14

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

Program License Serial Number 6286

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TT 18980 (west portion)  
Predevelopment Runoff Volume  
100 Year Storm Event  
tt18980prevolw.out  
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Storm Event Year = 100

Antecedent Moisture Condition = 2

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 2.06	1	1.11
Rainfall data for year 100 2.06	6	2.20
Rainfall data for year 100 2.06	24	3.98

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

SCS curve No. (AMCII)	SCS curve NO. (AMC 2)	Area (Ac.)	Area Fraction	Fp (Fig C6) (In/Hr)	Ap (dec.)	Fm (In/Hr)
85.0	85.0	2.06	1.000	0.283	1.000	0.283

Area-averaged adjusted loss rate Fm (In/Hr) = 0.283

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

Area (Ac.)	Area Fract	SCS CN (AMC2)	SCS CN (AMC2)	S	Pervious Yield Fr
2.06	1.000	85.0	85.0	1.76	0.613

Area-averaged catchment yield fraction, Y = 0.613

Area-averaged low loss fraction, Yb = 0.387

User entry of time of concentration = 0.192 (hours)

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Watershed area = 2.06(Ac.)

Catchment Lag time = 0.154 hours

Unit interval = 5.000 minutes

Unit interval percentage of lag time = 54.2252

Hydrograph baseflow = 0.00(CFS)

Average maximum watershed loss rate(Fm) = 0.283(In/Hr)

Average low loss rate fraction (Yb) = 0.387 (decimal)

DESERT S-Graph Selected

Computed peak 5-minute rainfall = 0.527(In)

Computed peak 30-minute rainfall = 0.902(In)

Specified peak 1-hour rainfall = 1.110(In)

Computed peak 3-hour rainfall = 1.688(In)

Specified peak 6-hour rainfall = 2.200(In)

Specified peak 24-hour rainfall = 3.980(In)

Rainfall depth area reduction factors:

Using a total area of 2.06(Ac.) (Ref: fig. E-4)

5-minute factor = 1.000 Adjusted rainfall = 0.527(In)

30-minute factor = 1.000 Adjusted rainfall = 0.902(In)

1-hour factor = 1.000 Adjusted rainfall = 1.110(In)

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

6-hour factor = 1.000 Adjusted rainfall = 2.200(In)

24-hour factor = 1.000 Adjusted rainfall = 3.980(In)

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Unit Hydrograph

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

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(K = 24.91 (CFS))

1	4.577	1.140
2	35.346	7.665
3	64.077	7.158
4	76.411	3.073
5	83.590	1.789
6	88.438	1.208
7	91.673	0.806
8	94.089	0.602
9	95.864	0.442
10	97.162	0.323
11	97.989	0.206
12	98.583	0.148
13	99.232	0.162
14	99.700	0.117
15	100.000	0.075

Total soil rain loss = 1.33 (In)  
Total effective rainfall = 2.65 (In)  
Peak flow rate in flood hydrograph = 4.95 (CFS)

24 - H O U R      S T O R M  
Run off              Hydrograph

Hydrograph in 5 Minute intervals ((CFS))

Time (h+m)	Volume Ac.Ft	Q(CFS)	0	2.5	5.0	7.5	10.0
0+ 5	0.0000	0.00 Q					
0+10	0.0002	0.03 Q					
0+15	0.0006	0.06 Q					
0+20	0.0011	0.07 Q					
0+25	0.0016	0.08 Q					
0+30	0.0022	0.08 Q					
0+35	0.0028	0.08 Q					
0+40	0.0034	0.09 Q					
0+45	0.0040	0.09 Q					
0+50	0.0046	0.09 Q					
0+55	0.0052	0.09 Q					
1+ 0	0.0058	0.09 Q					
1+ 5	0.0065	0.09 Q					
1+10	0.0071	0.09 Q					
1+15	0.0078	0.09 Q					
1+20	0.0084	0.09 Q					
1+25	0.0091	0.09 Q					
1+30	0.0097	0.09 Q					

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1+35	0.0104	0.09	Q					
1+40	0.0110	0.10	Q					
1+45	0.0117	0.10	QV					
1+50	0.0123	0.10	QV					
1+55	0.0130	0.10	QV					
2+ 0	0.0137	0.10	QV					
2+ 5	0.0143	0.10	QV					
2+10	0.0150	0.10	QV					
2+15	0.0157	0.10	QV					
2+20	0.0163	0.10	QV					
2+25	0.0170	0.10	QV					
2+30	0.0177	0.10	QV					
2+35	0.0184	0.10	QV					
2+40	0.0190	0.10	QV					
2+45	0.0197	0.10	QV					
2+50	0.0204	0.10	QV					
2+55	0.0211	0.10	QV					
3+ 0	0.0218	0.10	QV					
3+ 5	0.0225	0.10	QV					
3+10	0.0232	0.10	Q V					
3+15	0.0239	0.10	Q V					
3+20	0.0246	0.10	Q V					
3+25	0.0253	0.10	Q V					
3+30	0.0260	0.10	Q V					
3+35	0.0267	0.10	Q V					
3+40	0.0274	0.10	Q V					
3+45	0.0281	0.10	Q V					
3+50	0.0288	0.10	Q V					
3+55	0.0296	0.10	Q V					
4+ 0	0.0303	0.10	Q V					
4+ 5	0.0310	0.11	Q V					
4+10	0.0317	0.11	Q V					
4+15	0.0325	0.11	Q V					
4+20	0.0332	0.11	Q V					
4+25	0.0339	0.11	Q V					
4+30	0.0347	0.11	Q V					
4+35	0.0354	0.11	Q V					
4+40	0.0362	0.11	Q V					
4+45	0.0369	0.11	Q V					
4+50	0.0377	0.11	Q V					
4+55	0.0384	0.11	Q V					
5+ 0	0.0392	0.11	Q V					
5+ 5	0.0400	0.11	Q V					
5+10	0.0407	0.11	Q V					
5+15	0.0415	0.11	Q V					
5+20	0.0423	0.11	Q V					
5+25	0.0430	0.11	Q V					
5+30	0.0438	0.11	Q V					
5+35	0.0446	0.11	Q V					
5+40	0.0454	0.11	Q V					
5+45	0.0462	0.11	Q V					

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5+50	0.0470	0.12	Q	V								
5+55	0.0478	0.12	Q	V								
6+ 0	0.0486	0.12	Q	V								
6+ 5	0.0494	0.12	Q	V								
6+10	0.0502	0.12	Q	V								
6+15	0.0510	0.12	Q	V								
6+20	0.0518	0.12	Q	V								
6+25	0.0526	0.12	Q	V								
6+30	0.0534	0.12	Q	V								
6+35	0.0543	0.12	Q	V								
6+40	0.0551	0.12	Q	V								
6+45	0.0559	0.12	Q	V								
6+50	0.0568	0.12	Q	V								
6+55	0.0576	0.12	Q	V								
7+ 0	0.0585	0.12	Q	V								
7+ 5	0.0593	0.12	Q	V								
7+10	0.0602	0.12	Q	V								
7+15	0.0610	0.13	Q	V								
7+20	0.0619	0.13	Q	V								
7+25	0.0628	0.13	Q	V								
7+30	0.0636	0.13	Q	V								
7+35	0.0645	0.13	Q	V								
7+40	0.0654	0.13	Q	V								
7+45	0.0663	0.13	Q	V								
7+50	0.0672	0.13	Q	V								
7+55	0.0681	0.13	Q	V								
8+ 0	0.0690	0.13	Q	V								
8+ 5	0.0699	0.13	Q	V								
8+10	0.0708	0.13	Q	V								
8+15	0.0718	0.13	Q	V								
8+20	0.0727	0.13	Q	V								
8+25	0.0736	0.14	Q	V								
8+30	0.0746	0.14	Q	V								
8+35	0.0755	0.14	Q	V								
8+40	0.0764	0.14	Q	V								
8+45	0.0774	0.14	Q	V								
8+50	0.0784	0.14	Q	V								
8+55	0.0793	0.14	Q	V								
9+ 0	0.0803	0.14	Q	V								
9+ 5	0.0813	0.14	Q	V								
9+10	0.0823	0.14	Q	V								
9+15	0.0833	0.14	Q	V								
9+20	0.0843	0.15	Q	V								
9+25	0.0853	0.15	Q	V								
9+30	0.0863	0.15	Q	V								
9+35	0.0873	0.15	Q	V								
9+40	0.0883	0.15	Q	V								
9+45	0.0894	0.15	Q	V								
9+50	0.0904	0.15	Q	V								
9+55	0.0915	0.15	Q	V								
10+ 0	0.0925	0.15	Q	V								

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10+ 5	0.0936	0.16	Q	V				
10+10	0.0947	0.16	Q	V				
10+15	0.0958	0.16	Q	V				
10+20	0.0969	0.16	Q	V				
10+25	0.0980	0.16	Q	V				
10+30	0.0991	0.16	Q	V				
10+35	0.1002	0.16	Q	V				
10+40	0.1013	0.16	Q	V				
10+45	0.1025	0.17	Q	V				
10+50	0.1036	0.17	Q	V				
10+55	0.1048	0.17	Q	V				
11+ 0	0.1060	0.17	Q	V				
11+ 5	0.1071	0.17	Q	V				
11+10	0.1083	0.17	Q	V				
11+15	0.1095	0.17	Q	V				
11+20	0.1107	0.18	Q	V				
11+25	0.1120	0.18	Q	V				
11+30	0.1132	0.18	Q	V				
11+35	0.1145	0.18	Q	V				
11+40	0.1157	0.18	Q	V				
11+45	0.1170	0.19	Q	V				
11+50	0.1183	0.19	Q	V				
11+55	0.1196	0.19	Q	V				
12+ 0	0.1209	0.19	Q	V				
12+ 5	0.1223	0.19	Q	V				
12+10	0.1236	0.19	Q	V				
12+15	0.1248	0.18	Q	V				
12+20	0.1261	0.18	Q	V				
12+25	0.1274	0.19	Q	V				
12+30	0.1287	0.19	Q	V				
12+35	0.1300	0.19	Q	V				
12+40	0.1313	0.19	Q	V				
12+45	0.1326	0.19	Q	V				
12+50	0.1340	0.20	Q	V				
12+55	0.1353	0.20	Q	V				
13+ 0	0.1367	0.20	Q	V				
13+ 5	0.1381	0.20	Q	V				
13+10	0.1395	0.21	Q	V				
13+15	0.1410	0.21	Q	V				
13+20	0.1425	0.21	Q	V				
13+25	0.1440	0.22	Q	V				
13+30	0.1455	0.22	Q	V				
13+35	0.1471	0.23	Q	V				
13+40	0.1487	0.23	Q	V				
13+45	0.1503	0.24	Q	V				
13+50	0.1520	0.24	Q	V				
13+55	0.1537	0.25	Q	V				
14+ 0	0.1554	0.25	Q	V				
14+ 5	0.1572	0.26	Q	V				
14+10	0.1590	0.26	Q	V				
14+15	0.1609	0.27	Q	V				

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14+20	0.1628	0.28	Q		V				
14+25	0.1647	0.29	Q		V				
14+30	0.1668	0.29	Q		V				
14+35	0.1688	0.30	Q		V				
14+40	0.1710	0.31	Q		V				
14+45	0.1732	0.32	Q		V				
14+50	0.1755	0.33	Q		V				
14+55	0.1779	0.35	Q		V				
15+ 0	0.1804	0.36	Q		V				
15+ 5	0.1830	0.38	Q		V				
15+10	0.1857	0.39	Q		V				
15+15	0.1886	0.41	Q		V				
15+20	0.1916	0.44	Q		V				
15+25	0.1947	0.46	Q		V				
15+30	0.1979	0.45	Q		V				
15+35	0.2010	0.46	Q		V				
15+40	0.2043	0.49	Q		V				
15+45	0.2080	0.53	Q		V				
15+50	0.2122	0.61	Q		V				
15+55	0.2172	0.72	Q		V				
16+ 0	0.2243	1.03	Q		V				
16+ 5	0.2380	2.00	Q		V				
<b>16+10</b>	<b>0.2721</b>	<b>4.95</b>			Q	V	V		
16+15	0.3029	4.47			Q	V	V		
16+20	0.3194	2.40			Q	V	V		
16+25	0.3306	1.62				V	V		
16+30	0.3391	1.24				V	V		
16+35	0.3459	0.99				V	V		
16+40	0.3516	0.83				V	V		
16+45	0.3564	0.70				V	V		
16+50	0.3605	0.59				V	V		
16+55	0.3640	0.50				V	V		
17+ 0	0.3670	0.44				V	V		
17+ 5	0.3699	0.42				V	V		
17+10	0.3725	0.37				V	V		
17+15	0.3747	0.33				V	V		
17+20	0.3766	0.28				V	V		
17+25	0.3784	0.26				V	V		
17+30	0.3802	0.25				V	V		
17+35	0.3818	0.24				V	V		
17+40	0.3834	0.23				V	V		
17+45	0.3849	0.22				V	V		
17+50	0.3864	0.21				V	V		
17+55	0.3878	0.21				V	V		
18+ 0	0.3891	0.20				V	V		
18+ 5	0.3905	0.19				V	V		
18+10	0.3918	0.19				V	V		
18+15	0.3932	0.20				V	V		
18+20	0.3945	0.19				V	V		
18+25	0.3958	0.19				V	V		
18+30	0.3971	0.19				V	V		

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18+35	0.3984	0.18	Q				V	
18+40	0.3996	0.18	Q				V	
18+45	0.4008	0.18	Q				V	
18+50	0.4020	0.17	Q				V	
18+55	0.4032	0.17	Q				V	
19+ 0	0.4044	0.17	Q				V	
19+ 5	0.4055	0.17	Q				V	
19+10	0.4066	0.16	Q				V	
19+15	0.4077	0.16	Q				V	
19+20	0.4088	0.16	Q				V	
19+25	0.4099	0.16	Q				V	
19+30	0.4109	0.15	Q				V	
19+35	0.4120	0.15	Q				V	
19+40	0.4130	0.15	Q				V	
19+45	0.4140	0.15	Q				V	
19+50	0.4150	0.14	Q				V	
19+55	0.4160	0.14	Q				V	
20+ 0	0.4169	0.14	Q				V	
20+ 5	0.4179	0.14	Q				V	
20+10	0.4188	0.14	Q				V	
20+15	0.4198	0.14	Q				V	
20+20	0.4207	0.13	Q				V	
20+25	0.4216	0.13	Q				V	
20+30	0.4225	0.13	Q				V	
20+35	0.4234	0.13	Q				V	
20+40	0.4243	0.13	Q				V	
20+45	0.4251	0.13	Q				V	
20+50	0.4260	0.13	Q				V	
20+55	0.4269	0.12	Q				V	
21+ 0	0.4277	0.12	Q				V	
21+ 5	0.4285	0.12	Q				V	
21+10	0.4294	0.12	Q				V	
21+15	0.4302	0.12	Q				V	
21+20	0.4310	0.12	Q				V	
21+25	0.4318	0.12	Q				V	
21+30	0.4326	0.12	Q				V	
21+35	0.4334	0.11	Q				V	
21+40	0.4342	0.11	Q				V	
21+45	0.4349	0.11	Q				V	
21+50	0.4357	0.11	Q				V	
21+55	0.4365	0.11	Q				V	
22+ 0	0.4372	0.11	Q				V	
22+ 5	0.4380	0.11	Q				V	
22+10	0.4387	0.11	Q				V	
22+15	0.4394	0.11	Q				V	
22+20	0.4402	0.11	Q				V	
22+25	0.4409	0.11	Q				V	
22+30	0.4416	0.10	Q				V	
22+35	0.4423	0.10	Q				V	
22+40	0.4430	0.10	Q				V	
22+45	0.4437	0.10	Q				V	

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22+50	0.4444	0.10	Q				V
22+55	0.4451	0.10	Q				V
23+ 0	0.4458	0.10	Q				V
23+ 5	0.4465	0.10	Q				V
23+10	0.4472	0.10	Q				V
23+15	0.4479	0.10	Q				V
23+20	0.4485	0.10	Q				V
23+25	0.4492	0.10	Q				V
23+30	0.4499	0.10	Q				V
23+35	0.4505	0.10	Q				V
23+40	0.4512	0.09	Q				V
23+45	0.4518	0.09	Q				V
23+50	0.4525	0.09	Q				V
23+55	0.4531	0.09	Q				V
24+ 0	0.4537	0.09	Q				V
24+ 5	0.4543	0.09	Q				V
24+10	0.4547	0.06	Q				V
24+15	0.4550	0.03	Q				V
24+20	0.4551	0.02	Q				V
24+25	0.4552	0.02	Q				V
24+30	0.4553	0.01	Q				V
24+35	0.4553	0.01	Q				V
24+40	0.4554	0.01	Q				V
24+45	0.4554	0.00	Q				V
24+50	0.4554	0.00	Q				V
24+55	0.4554	0.00	Q				V
25+ 0	0.4554	0.00	Q				V
25+ 5	0.4555	0.00	Q				V
<b>25+10</b>	<b>0.4555</b>	<b>0.00</b>	<b>Q</b>	<b> </b>	<b> </b>	<b> </b>	<b>V</b>

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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: 12/15/14

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TT 18980 (west portion)  
Postdevelopment Time of Concentration  
100 Year Storm Event  
tt18980posttcw.out

---

Program License Serial Number 6286

---

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

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Rational hydrology study storm event year is 100.0  
Computed rainfall intensity:  
Storm year = 100.00 1 hour rainfall = 1.110 (In.)  
Slope used for rainfall intensity curve b = 0.7000  
Soil antecedent moisture condition (AMC) = 2

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

RESIDENTIAL(3 - 4 dwl/acre)  
Decimal fraction soil group A = 0.000  
Decimal fraction soil group B = 0.000  
Decimal fraction soil group C = 1.000  
Decimal fraction soil group D = 0.000  
SCS curve number for soil(AMC 2) = 69.00  
Pervious ratio(Ap) = 0.6000 Max loss rate(Fm)= 0.329(In/Hr)  
Initial subarea data:  
Initial area flow distance = 428.000(Ft.)  
Top (of initial area) elevation = 3007.000(Ft.)  
Bottom (of initial area) elevation = 2991.000(Ft.)  
Difference in elevation = 16.000(Ft.)  
Slope = 0.03738 s(%)= 3.74  
TC = k(0.412)\*[(length^3)/(elevation change)]^0.2  
**Initial area time of concentration = 8.973 min.**  
Rainfall intensity = 4.197(In/Hr) for a 100.0 year storm  
Effective runoff coefficient used for area (Q=KCIA) is C = 0.830  
Subarea runoff = 7.172(CFS)  
Total initial stream area = 2.060(Ac.)  
Pervious area fraction = 0.600  
Initial area Fm value = 0.329(In/Hr)  
End of computations, Total Study Area = 2.06 (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 = 69.0

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Unit Hydrograph Analysis

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

Study date 12/15/14

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

Program License Serial Number 6286

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TT 18980 (west portion)  
Postdevelopment Runoff Volume  
100 Year Storm Event  
tt18980postvolw.out  
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Storm Event Year = 100

Antecedent Moisture Condition = 2

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		
2.06	1	1.11

-----

Rainfall data for year 100		
2.06	6	2.20

-----

Rainfall data for year 100		
2.06	24	3.98

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+++++-----

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

SCS curve No. (AMCII)	SCS curve NO. (AMC 2)	Area (Ac.)	Area Fraction	Fp (Fig C6) (In/Hr)	Ap (dec.)	Fm (In/Hr)
69.0	69.0	2.06	1.000	0.548	0.600	0.329

Area-averaged adjusted loss rate Fm (In/Hr) = 0.329

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

Area (Ac.)	Area Fract	SCS CN (AMC2)	SCS CN (AMC2)	S	Pervious Yield Fr
1.24	0.600	69.0	69.0	4.49	0.315
0.82	0.400	98.0	98.0	0.20	0.941

Area-averaged catchment yield fraction, Y = 0.565

Area-averaged low loss fraction, Yb = 0.435

User entry of time of concentration = 0.150 (hours)

+++++ Watershed area = 2.06 (Ac.)

Catchment Lag time = 0.120 hours

Unit interval = 5.000 minutes

Unit interval percentage of lag time = 69.6301

Hydrograph baseflow = 0.00 (CFS)

Average maximum watershed loss rate (Fm) = 0.329 (In/Hr)

Average low loss rate fraction (Yb) = 0.435 (decimal)

DESERT S-Graph Selected

Computed peak 5-minute rainfall = 0.527 (In)

Computed peak 30-minute rainfall = 0.902 (In)

Specified peak 1-hour rainfall = 1.110 (In)

Computed peak 3-hour rainfall = 1.688 (In)

Specified peak 6-hour rainfall = 2.200 (In)

Specified peak 24-hour rainfall = 3.980 (In)

Rainfall depth area reduction factors:

Using a total area of 2.06 (Ac.) (Ref: fig. E-4)

5-minute factor = 1.000 Adjusted rainfall = 0.527 (In)

30-minute factor = 1.000 Adjusted rainfall = 0.902 (In)

1-hour factor = 1.000 Adjusted rainfall = 1.110 (In)

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

6-hour factor = 1.000 Adjusted rainfall = 2.200 (In)

24-hour factor = 1.000 Adjusted rainfall = 3.980 (In)

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

+++++ Interval 'S' Graph Unit Hydrograph

Number Mean values ((CFS))

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(K = 24.91 (CFS))

1	7.717	1.922
2	50.181	10.579
3	73.395	5.783
4	83.504	2.518
5	89.418	1.473
6	93.107	0.919
7	95.608	0.623
8	97.288	0.419
9	98.229	0.234
10	99.038	0.202
11	99.694	0.163
12	100.000	0.076

Total soil rain loss = 1.49 (In)  
Total effective rainfall = 2.49 (In)  
Peak flow rate in flood hydrograph = 6.15 (CFS)

+++++  
24 - H O U R S T O R M  
Run off Hydrograph

Hydrograph in 5 Minute intervals ((CFS))

Time(h+m)	Volume Ac.Ft	Q(CFS)	0	2.5	5.0	7.5	10.0
0+ 5	0.0000	0.01 Q					
0+10	0.0003	0.04 Q					
0+15	0.0008	0.06 Q					
0+20	0.0012	0.07 Q					
0+25	0.0018	0.08 Q					
0+30	0.0023	0.08 Q					
0+35	0.0028	0.08 Q					
0+40	0.0034	0.08 Q					
0+45	0.0040	0.08 Q					
0+50	0.0046	0.08 Q					
0+55	0.0052	0.09 Q					
1+ 0	0.0057	0.09 Q					
1+ 5	0.0063	0.09 Q					
1+10	0.0069	0.09 Q					
1+15	0.0075	0.09 Q					
1+20	0.0081	0.09 Q					
1+25	0.0087	0.09 Q					
1+30	0.0093	0.09 Q					
1+35	0.0099	0.09 Q					
1+40	0.0105	0.09 Q					

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1+45	0.0111	0.09	QV					
1+50	0.0117	0.09	QV					
1+55	0.0124	0.09	QV					
2+ 0	0.0130	0.09	QV					
2+ 5	0.0136	0.09	QV					
2+10	0.0142	0.09	QV					
2+15	0.0148	0.09	QV					
2+20	0.0154	0.09	QV					
2+25	0.0161	0.09	QV					
2+30	0.0167	0.09	QV					
2+35	0.0173	0.09	QV					
2+40	0.0179	0.09	QV					
2+45	0.0186	0.09	QV					
2+50	0.0192	0.09	QV					
2+55	0.0198	0.09	QV					
3+ 0	0.0205	0.09	QV					
3+ 5	0.0211	0.09	QV					
3+10	0.0218	0.09	Q V					
3+15	0.0224	0.09	Q V					
3+20	0.0231	0.09	Q V					
3+25	0.0237	0.09	Q V					
3+30	0.0244	0.09	Q V					
3+35	0.0250	0.10	Q V					
3+40	0.0257	0.10	Q V					
3+45	0.0263	0.10	Q V					
3+50	0.0270	0.10	Q V					
3+55	0.0277	0.10	Q V					
4+ 0	0.0283	0.10	Q V					
4+ 5	0.0290	0.10	Q V					
4+10	0.0297	0.10	Q V					
4+15	0.0304	0.10	Q V					
4+20	0.0310	0.10	Q V					
4+25	0.0317	0.10	Q V					
4+30	0.0324	0.10	Q V					
4+35	0.0331	0.10	Q V					
4+40	0.0338	0.10	Q V					
4+45	0.0345	0.10	Q V					
4+50	0.0352	0.10	Q V					
4+55	0.0359	0.10	Q V					
5+ 0	0.0366	0.10	Q V					
5+ 5	0.0373	0.10	Q V					
5+10	0.0380	0.10	Q V					
5+15	0.0387	0.10	Q V					
5+20	0.0394	0.10	Q V					
5+25	0.0401	0.10	Q V					
5+30	0.0408	0.10	Q V					
5+35	0.0416	0.10	Q V					
5+40	0.0423	0.11	Q V					
5+45	0.0430	0.11	Q V					
5+50	0.0438	0.11	Q V					
5+55	0.0445	0.11	Q V					

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6+ 0	0.0452	0.11	Q	V							
6+ 5	0.0460	0.11	Q	V							
6+10	0.0467	0.11	Q	V							
6+15	0.0475	0.11	Q	V							
6+20	0.0482	0.11	Q	V							
6+25	0.0490	0.11	Q	V							
6+30	0.0497	0.11	Q	V							
6+35	0.0505	0.11	Q	V							
6+40	0.0513	0.11	Q	V							
6+45	0.0520	0.11	Q	V							
6+50	0.0528	0.11	Q	V							
6+55	0.0536	0.11	Q	V							
7+ 0	0.0544	0.11	Q	V							
7+ 5	0.0552	0.11	Q	V							
7+10	0.0560	0.12	Q	V							
7+15	0.0568	0.12	Q	V							
7+20	0.0576	0.12	Q	V							
7+25	0.0584	0.12	Q	V							
7+30	0.0592	0.12	Q	V							
7+35	0.0600	0.12	Q	V							
7+40	0.0608	0.12	Q	V							
7+45	0.0616	0.12	Q	V							
7+50	0.0625	0.12	Q	V							
7+55	0.0633	0.12	Q	V							
8+ 0	0.0641	0.12	Q	V							
8+ 5	0.0650	0.12	Q	V							
8+10	0.0658	0.12	Q	V							
8+15	0.0667	0.12	Q	V							
8+20	0.0675	0.12	Q	V							
8+25	0.0684	0.13	Q	V							
8+30	0.0693	0.13	Q	V							
8+35	0.0702	0.13	Q	V							
8+40	0.0710	0.13	Q	V							
8+45	0.0719	0.13	Q	V							
8+50	0.0728	0.13	Q	V							
8+55	0.0737	0.13	Q	V							
9+ 0	0.0746	0.13	Q	V							
9+ 5	0.0755	0.13	Q	V							
9+10	0.0764	0.13	Q	V							
9+15	0.0773	0.13	Q	V							
9+20	0.0783	0.13	Q	V							
9+25	0.0792	0.14	Q	V							
9+30	0.0801	0.14	Q	V							
9+35	0.0811	0.14	Q	V							
9+40	0.0820	0.14	Q	V							
9+45	0.0830	0.14	Q	V							
9+50	0.0840	0.14	Q	V							
9+55	0.0850	0.14	Q	V							
10+ 0	0.0859	0.14	Q	V							
10+ 5	0.0869	0.14	Q	V							
10+10	0.0879	0.14	Q	V							

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10+15	0.0889	0.15	Q	V				
10+20	0.0899	0.15	Q	V				
10+25	0.0910	0.15	Q	V				
10+30	0.0920	0.15	Q	V				
10+35	0.0930	0.15	Q	V				
10+40	0.0941	0.15	Q	V				
10+45	0.0951	0.15	Q	V				
10+50	0.0962	0.15	Q	V				
10+55	0.0973	0.16	Q	V				
11+ 0	0.0984	0.16	Q	V				
11+ 5	0.0995	0.16	Q	V				
11+10	0.1006	0.16	Q	V				
11+15	0.1017	0.16	Q	V				
11+20	0.1028	0.16	Q	V				
11+25	0.1039	0.17	Q	V				
11+30	0.1051	0.17	Q	V				
11+35	0.1063	0.17	Q	V				
11+40	0.1074	0.17	Q	V				
11+45	0.1086	0.17	Q	V				
11+50	0.1098	0.17	Q	V				
11+55	0.1110	0.18	Q	V				
12+ 0	0.1123	0.18	Q	V				
12+ 5	0.1135	0.18	Q	V				
12+10	0.1147	0.17	Q	V				
12+15	0.1158	0.17	Q	V				
12+20	0.1170	0.17	Q	V				
12+25	0.1182	0.17	Q	V				
12+30	0.1194	0.17	Q	V				
12+35	0.1206	0.17	Q	V				
12+40	0.1218	0.18	Q	V				
12+45	0.1230	0.18	Q	V				
12+50	0.1243	0.18	Q	V				
12+55	0.1255	0.18	Q	V				
13+ 0	0.1268	0.19	Q	V				
13+ 5	0.1281	0.19	Q	V				
13+10	0.1295	0.19	Q	V				
13+15	0.1308	0.20	Q	V				
13+20	0.1322	0.20	Q	V				
13+25	0.1336	0.20	Q	V				
13+30	0.1350	0.21	Q	V				
13+35	0.1365	0.21	Q	V				
13+40	0.1380	0.22	Q	V				
13+45	0.1395	0.22	Q	V				
13+50	0.1411	0.23	Q	V				
13+55	0.1426	0.23	Q	V				
14+ 0	0.1443	0.24	Q	V				
14+ 5	0.1459	0.24	Q	V				
14+10	0.1476	0.25	Q	V				
14+15	0.1494	0.25	Q	V				
14+20	0.1512	0.26	Q	V				
14+25	0.1530	0.27	Q	V				

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14+30	0.1549	0.28	Q		V				
14+35	0.1568	0.28	Q		V				
14+40	0.1589	0.29	Q		V				
14+45	0.1610	0.30	Q		V				
14+50	0.1631	0.31	Q		V				
14+55	0.1654	0.33	Q		V				
15+ 0	0.1677	0.34	Q		V				
15+ 5	0.1702	0.35	Q		V				
15+10	0.1727	0.37	Q		V				
15+15	0.1754	0.39	Q		V				
15+20	0.1783	0.42	Q		V				
15+25	0.1813	0.43	Q		V				
15+30	0.1841	0.42	Q		V				
15+35	0.1871	0.43	Q		V				
15+40	0.1903	0.46	Q		V				
15+45	0.1938	0.51	Q		V				
15+50	0.1979	0.59	Q		V				
15+55	0.2029	0.73	Q		V				
16+ 0	0.2105	1.11	Q		V				
16+ 5	0.2274	2.45	Q		V				
<b>16+10</b>	<b>0.2698</b>	<b>6.15</b>			QV	V			
16+15	0.2955	3.73			V				
16+20	0.3093	2.01			V				
16+25	0.3186	1.36	Q		V				
16+30	0.3256	1.02	Q		V				
16+35	0.3313	0.82	Q		V				
16+40	0.3358	0.66	Q		V				
16+45	0.3394	0.53	Q		V				
16+50	0.3427	0.47	Q		V				
16+55	0.3456	0.42	Q		V				
17+ 0	0.3480	0.35	Q		V				
17+ 5	0.3500	0.29	Q		V				
17+10	0.3518	0.27	Q		V				
17+15	0.3536	0.26	Q		V				
17+20	0.3553	0.24	Q		V				
17+25	0.3569	0.23	Q		V				
17+30	0.3584	0.22	Q		V				
17+35	0.3599	0.21	Q		V				
17+40	0.3613	0.20	Q		V				
17+45	0.3626	0.20	Q		V				
17+50	0.3639	0.19	Q		V				
17+55	0.3652	0.18	Q		V				
18+ 0	0.3665	0.18	Q		V				
18+ 5	0.3677	0.18	Q		V				
18+10	0.3689	0.18	Q		V				
18+15	0.3701	0.18	Q		V				
18+20	0.3713	0.18	Q		V				
18+25	0.3725	0.17	Q		V				
18+30	0.3737	0.17	Q		V				
18+35	0.3749	0.17	Q		V				
18+40	0.3760	0.16	Q		V				

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18+45	0.3771	0.16	Q				V	
18+50	0.3782	0.16	Q				V	
18+55	0.3793	0.16	Q				V	
19+ 0	0.3804	0.15	Q				V	
19+ 5	0.3814	0.15	Q				V	
19+10	0.3824	0.15	Q				V	
19+15	0.3834	0.15	Q				V	
19+20	0.3844	0.14	Q				V	
19+25	0.3854	0.14	Q				V	
19+30	0.3864	0.14	Q				V	
19+35	0.3873	0.14	Q				V	
19+40	0.3882	0.14	Q				V	
19+45	0.3892	0.13	Q				V	
19+50	0.3901	0.13	Q				V	
19+55	0.3910	0.13	Q				V	
20+ 0	0.3918	0.13	Q				V	
20+ 5	0.3927	0.13	Q				V	
20+10	0.3936	0.13	Q				V	
20+15	0.3944	0.12	Q				V	
20+20	0.3953	0.12	Q				V	
20+25	0.3961	0.12	Q				V	
20+30	0.3969	0.12	Q				V	
20+35	0.3977	0.12	Q				V	
20+40	0.3986	0.12	Q				V	
20+45	0.3993	0.12	Q				V	
20+50	0.4001	0.11	Q				V	
20+55	0.4009	0.11	Q				V	
21+ 0	0.4017	0.11	Q				V	
21+ 5	0.4025	0.11	Q				V	
21+10	0.4032	0.11	Q				V	
21+15	0.4040	0.11	Q				V	
21+20	0.4047	0.11	Q				V	
21+25	0.4054	0.11	Q				V	
21+30	0.4062	0.11	Q				V	
21+35	0.4069	0.10	Q				V	
21+40	0.4076	0.10	Q				V	
21+45	0.4083	0.10	Q				V	
21+50	0.4090	0.10	Q				V	
21+55	0.4097	0.10	Q				V	
22+ 0	0.4104	0.10	Q				V	
22+ 5	0.4111	0.10	Q				V	
22+10	0.4118	0.10	Q				V	
22+15	0.4125	0.10	Q				V	
22+20	0.4131	0.10	Q				V	
22+25	0.4138	0.10	Q				V	
22+30	0.4145	0.10	Q				V	
22+35	0.4151	0.10	Q				V	
22+40	0.4158	0.09	Q				V	
22+45	0.4164	0.09	Q				V	
22+50	0.4171	0.09	Q				V	
22+55	0.4177	0.09	Q				V	

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23+ 0	0.4183	0.09	Q				V
23+ 5	0.4189	0.09	Q				V
23+10	0.4196	0.09	Q				V
23+15	0.4202	0.09	Q				V
23+20	0.4208	0.09	Q				V
23+25	0.4214	0.09	Q				V
23+30	0.4220	0.09	Q				V
23+35	0.4226	0.09	Q				V
23+40	0.4232	0.09	Q				V
23+45	0.4238	0.09	Q				V
23+50	0.4244	0.09	Q				V
23+55	0.4250	0.09	Q				V
24+ 0	0.4256	0.08	Q				V
24+ 5	0.4261	0.08	Q				V
24+10	0.4264	0.04	Q				V
24+15	0.4266	0.02	Q				V
24+20	0.4267	0.01	Q				V
24+25	0.4267	0.01	Q				V
24+30	0.4268	0.01	Q				V
24+35	0.4268	0.00	Q				V
24+40	0.4268	0.00	Q				V
24+45	0.4268	0.00	Q				V
24+50	0.4268	0.00	Q				V
<b>24+55</b>	<b>0.4268</b>	0.00	Q				V

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**EAST PORTION**

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: 12/15/14

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TT 18980 (east portion)  
Predevelopment Time of Concentration  
100 Year Storm Event  
tt18980pretce.out

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Program License Serial Number 6286

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

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Rational hydrology study storm event year is 100.0  
Computed rainfall intensity:  
Storm year = 100.00 1 hour rainfall = 1.110 (In.)  
Slope used for rainfall intensity curve b = 0.7000  
Soil antecedent moisture condition (AMC) = 2

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+++++  
Process from Point/Station 1.000 to Point/Station 3.000  
\*\*\*\* 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) = 85.00  
Pervious ratio(Ap) = 1.0000 Max loss rate(Fm)= 0.283 (In/Hr)  
Initial subarea data:  
Initial area flow distance = 509.000(Ft.)  
Top (of initial area) elevation = 3007.000(Ft.)  
Bottom (of initial area) elevation = 2996.000(Ft.)  
Difference in elevation = 11.000(Ft.)  
Slope = 0.02161 s(%)= 2.16  
TC = k(0.529)\*[(length^3)/(elevation change)]^0.2  
**Initial area time of concentration = 13.781 min.**  
Rainfall intensity = 3.108(In/Hr) for a 100.0 year storm  
Effective runoff coefficient used for area (Q=KCIA) is C = 0.818  
Subarea runoff = 7.476(CFS)  
Total initial stream area = 2.940(Ac.)  
Pervious area fraction = 1.000  
Initial area Fm value = 0.283(In/Hr)  
End of computations, Total Study Area = 2.94 (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 = 85.0

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Unit Hydrograph Analysis

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

Study date 12/15/14

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

Program License Serial Number 6286

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TT 18980 (east portion)  
Predevelopemnt Runoff Volume  
100 Year Storm Event  
tt18980prevole.out  
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Storm Event Year = 100

Antecedent Moisture Condition = 2

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		
2.94	1	1.11

-----

Rainfall data for year 100		
2.94	6	2.20

-----

Rainfall data for year 100		
2.94	24	3.98

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+++++-----

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

SCS curve No. (AMCII)	SCS curve NO. (AMC 2)	Area (Ac.)	Area Fraction	Fp (Fig C6) (In/Hr)	Ap (dec.)	Fm (In/Hr)
85.0	85.0	2.94	1.000	0.283	1.000	0.283

Area-averaged adjusted loss rate Fm (In/Hr) = 0.283

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

Area (Ac.)	Area Fract	SCS CN (AMC2)	SCS CN (AMC2)	S	Pervious Yield Fr
2.94	1.000	85.0	85.0	1.76	0.613

Area-averaged catchment yield fraction, Y = 0.613

Area-averaged low loss fraction, Yb = 0.387

User entry of time of concentration = 0.230 (hours)

+++++ Watershed area = 2.94(Ac.)

Catchment Lag time = 0.184 hours

Unit interval = 5.000 minutes

Unit interval percentage of lag time = 45.3490

Hydrograph baseflow = 0.00(CFS)

Average maximum watershed loss rate(Fm) = 0.283(In/Hr)

Average low loss rate fraction (Yb) = 0.387 (decimal)

DESERT S-Graph Selected

Computed peak 5-minute rainfall = 0.527(In)

Computed peak 30-minute rainfall = 0.902(In)

Specified peak 1-hour rainfall = 1.110(In)

Computed peak 3-hour rainfall = 1.688(In)

Specified peak 6-hour rainfall = 2.200(In)

Specified peak 24-hour rainfall = 3.980(In)

Rainfall depth area reduction factors:

Using a total area of 2.94(Ac.) (Ref: fig. E-4)

5-minute factor = 1.000 Adjusted rainfall = 0.527(In)

30-minute factor = 1.000 Adjusted rainfall = 0.901(In)

1-hour factor = 1.000 Adjusted rainfall = 1.110(In)

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

6-hour factor = 1.000 Adjusted rainfall = 2.200(In)

24-hour factor = 1.000 Adjusted rainfall = 3.980(In)

-----  
U n i t H y d r o g r a p h  
+++++ 'S' Graph Unit Hydrograph

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

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(K = 35.56 (CFS))

1	3.372	1.199
2	24.993	7.687
3	55.911	10.993
4	70.372	5.142
5	78.696	2.960
6	84.173	1.947
7	88.213	1.437
8	91.030	1.002
9	93.247	0.788
10	94.947	0.604
11	96.280	0.474
12	97.287	0.358
13	97.966	0.241
14	98.449	0.172
15	98.991	0.193
16	99.493	0.179
17	99.802	0.110
18	100.000	0.071

Total soil rain loss = 1.33 (In)  
Total effective rainfall = 2.65 (In)  
Peak flow rate in flood hydrograph = 6.76 (CFS)

+++++  
24 - H O U R S T O R M  
Run off Hydrograph

Hydrograph in 5 Minute intervals ((CFS))

Time(h+m)	Volume Ac.Ft	Q(CFS)	0	2.5	5.0	7.5	10.0
0+ 5	0.0000	0.00	Q				
0+10	0.0003	0.03	Q				
0+15	0.0007	0.07	Q				
0+20	0.0014	0.09	Q				
0+25	0.0021	0.10	Q				
0+30	0.0028	0.11	Q				
0+35	0.0036	0.11	Q				
0+40	0.0044	0.12	Q				
0+45	0.0053	0.12	Q				
0+50	0.0061	0.12	Q				
0+55	0.0070	0.13	Q				
1+ 0	0.0079	0.13	Q				
1+ 5	0.0088	0.13	Q				
1+10	0.0097	0.13	Q				
1+15	0.0106	0.13	Q				

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1+20	0.0115	0.13	Q					
1+25	0.0124	0.13	Q					
1+30	0.0134	0.13	Q					
1+35	0.0143	0.13	Q					
1+40	0.0152	0.14	Q					
1+45	0.0162	0.14	Q					
1+50	0.0171	0.14	QV					
1+55	0.0180	0.14	QV					
2+ 0	0.0190	0.14	QV					
2+ 5	0.0199	0.14	QV					
2+10	0.0209	0.14	QV					
2+15	0.0218	0.14	QV					
2+20	0.0228	0.14	QV					
2+25	0.0238	0.14	QV					
2+30	0.0247	0.14	QV					
2+35	0.0257	0.14	QV					
2+40	0.0267	0.14	QV					
2+45	0.0276	0.14	QV					
2+50	0.0286	0.14	QV					
2+55	0.0296	0.14	QV					
3+ 0	0.0306	0.14	QV					
3+ 5	0.0316	0.14	QV					
3+10	0.0326	0.14	Q V					
3+15	0.0336	0.14	Q V					
3+20	0.0346	0.15	Q V					
3+25	0.0356	0.15	Q V					
3+30	0.0366	0.15	Q V					
3+35	0.0376	0.15	Q V					
3+40	0.0386	0.15	Q V					
3+45	0.0396	0.15	Q V					
3+50	0.0406	0.15	Q V					
3+55	0.0417	0.15	Q V					
4+ 0	0.0427	0.15	Q V					
4+ 5	0.0437	0.15	Q V					
4+10	0.0448	0.15	Q V					
4+15	0.0458	0.15	Q V					
4+20	0.0468	0.15	Q V					
4+25	0.0479	0.15	Q V					
4+30	0.0489	0.15	Q V					
4+35	0.0500	0.15	Q V					
4+40	0.0511	0.15	Q V					
4+45	0.0521	0.15	Q V					
4+50	0.0532	0.16	Q V					
4+55	0.0543	0.16	Q V					
5+ 0	0.0554	0.16	Q V					
5+ 5	0.0564	0.16	Q V					
5+10	0.0575	0.16	Q V					
5+15	0.0586	0.16	Q V					
5+20	0.0597	0.16	Q V					
5+25	0.0608	0.16	Q V					
5+30	0.0619	0.16	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: 12/15/14

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TT 18980 (east portion)  
Postdevelopment Time of Concentration  
100 Year Storm Event  
tt18980posttce.out

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Program License Serial Number 6286

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

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Rational hydrology study storm event year is 100.0  
Computed rainfall intensity:  
Storm year = 100.00 1 hour rainfall = 1.110 (In.)  
Slope used for rainfall intensity curve b = 0.7000  
Soil antecedent moisture condition (AMC) = 2

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+++++  
Process from Point/Station 1.000 to Point/Station 3.000  
\*\*\*\* INITIAL AREA EVALUATION \*\*\*\*

RESIDENTIAL(3 - 4 dwl/acre)  
Decimal fraction soil group A = 0.000  
Decimal fraction soil group B = 0.000  
Decimal fraction soil group C = 1.000  
Decimal fraction soil group D = 0.000  
SCS curve number for soil(AMC 2) = 69.00  
Pervious ratio(Ap) = 0.6000 Max loss rate(Fm)= 0.329(In/Hr)  
Initial subarea data:  
Initial area flow distance = 509.000(Ft.)  
Top (of initial area) elevation = 3007.000(Ft.)  
Bottom (of initial area) elevation = 2996.000(Ft.)  
Difference in elevation = 11.000(Ft.)  
Slope = 0.02161 s(%)= 2.16  
TC = k(0.412)\*[(length^3)/(elevation change)]^0.2  
**Initial area time of concentration = 10.731 min.**  
Rainfall intensity = 3.703(In/Hr) for a 100.0 year storm  
Effective runoff coefficient used for area (Q=KCIA) is C = 0.820  
Subarea runoff = 8.929(CFS)  
Total initial stream area = 2.940(Ac.)  
Pervious area fraction = 0.600  
Initial area Fm value = 0.329(In/Hr)  
End of computations, Total Study Area = 2.94 (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 = 69.0

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Unit Hydrograph Analysis

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

Study date 12/15/14

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

Program License Serial Number 6286

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TT 18980 (east portion)  
Postdevelopment Runoff Volume  
100 Year Storm Event  
tt18980postvole.out  
-----

Storm Event Year = 100

Antecedent Moisture Condition = 2

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 2.94	1	1.11
Rainfall data for year 100 2.94	6	2.20
Rainfall data for year 100 2.94	24	3.98

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

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SCS curve No. (AMCII)	SCS curve NO. (AMC 2)	Area (Ac.)	Area Fraction	Fp (Fig C6) (In/Hr)	Ap (dec.)	Fm (In/Hr)
69.0	69.0	2.94	1.000	0.548	0.600	0.329

Area-averaged adjusted loss rate Fm (In/Hr) = 0.329

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

Area (Ac.)	Area Fract	SCS CN (AMC2)	SCS CN (AMC2)	S	Pervious Yield Fr
1.76	0.600	69.0	69.0	4.49	0.315
1.18	0.400	98.0	98.0	0.20	0.941

Area-averaged catchment yield fraction, Y = 0.565

Area-averaged low loss fraction, Yb = 0.435

User entry of time of concentration = 0.179 (hours)

+++++ Watershed area = 2.94(Ac.)

Catchment Lag time = 0.143 hours

Unit interval = 5.000 minutes

Unit interval percentage of lag time = 58.2262

Hydrograph baseflow = 0.00(CFS)

Average maximum watershed loss rate(Fm) = 0.329(In/Hr)

Average low loss rate fraction (Yb) = 0.435 (decimal)

DESERT S-Graph Selected

Computed peak 5-minute rainfall = 0.527(In)

Computed peak 30-minute rainfall = 0.902(In)

Specified peak 1-hour rainfall = 1.110(In)

Computed peak 3-hour rainfall = 1.688(In)

Specified peak 6-hour rainfall = 2.200(In)

Specified peak 24-hour rainfall = 3.980(In)

Rainfall depth area reduction factors:

Using a total area of 2.94(Ac.) (Ref: fig. E-4)

5-minute factor = 1.000 Adjusted rainfall = 0.527(In)

30-minute factor = 1.000 Adjusted rainfall = 0.901(In)

1-hour factor = 1.000 Adjusted rainfall = 1.110(In)

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

6-hour factor = 1.000 Adjusted rainfall = 2.200(In)

24-hour factor = 1.000 Adjusted rainfall = 3.980(In)

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Unit Hydrograph

+++++ 'S' Graph Unit Hydrograph

Interval Number Mean values ((CFS))

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(K = 35.56 (CFS))

1	5.258	1.870
2	39.665	12.234
3	66.925	9.693
4	78.578	4.143
5	85.388	2.421
6	89.881	1.597
7	92.925	1.082
8	95.131	0.784
9	96.728	0.568
10	97.785	0.376
11	98.442	0.234
12	99.135	0.247
13	99.674	0.192
14	100.000	0.116

Total soil rain loss = 1.49 (In)  
 Total effective rainfall = 2.49 (In)  
 Peak flow rate in flood hydrograph = 7.52 (CFS)

+++++  
 24 - H O U R S T O R M  
 Run off Hydrograph

Hydrograph in 5 Minute intervals ((CFS))

Time(h+m)	Volume Ac.Ft	Q(CFS)	0	2.5	5.0	7.5	10.0
0+ 5	0.0000	0.01 Q					
0+10	0.0004	0.05 Q					
0+15	0.0009	0.08 Q					
0+20	0.0016	0.09 Q					
0+25	0.0023	0.10 Q					
0+30	0.0030	0.11 Q					
0+35	0.0038	0.11 Q					
0+40	0.0046	0.11 Q					
0+45	0.0054	0.12 Q					
0+50	0.0062	0.12 Q					
0+55	0.0070	0.12 Q					
1+ 0	0.0078	0.12 Q					
1+ 5	0.0087	0.12 Q					
1+10	0.0095	0.12 Q					
1+15	0.0104	0.12 Q					
1+20	0.0112	0.12 Q					
1+25	0.0121	0.12 Q					
1+30	0.0129	0.12 Q					
1+35	0.0138	0.12 Q					

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1+40	0.0147	0.13	Q					
1+45	0.0155	0.13	QV					
1+50	0.0164	0.13	QV					
1+55	0.0173	0.13	QV					
2+ 0	0.0181	0.13	QV					
2+ 5	0.0190	0.13	QV					
2+10	0.0199	0.13	QV					
2+15	0.0208	0.13	QV					
2+20	0.0217	0.13	QV					
2+25	0.0226	0.13	QV					
2+30	0.0234	0.13	QV					
2+35	0.0243	0.13	QV					
2+40	0.0252	0.13	QV					
2+45	0.0261	0.13	QV					
2+50	0.0270	0.13	QV					
2+55	0.0279	0.13	QV					
3+ 0	0.0289	0.13	QV					
3+ 5	0.0298	0.13	QV					
3+10	0.0307	0.13	Q V					
3+15	0.0316	0.13	Q V					
3+20	0.0325	0.13	Q V					
3+25	0.0335	0.13	Q V					
3+30	0.0344	0.14	Q V					
3+35	0.0353	0.14	Q V					
3+40	0.0363	0.14	Q V					
3+45	0.0372	0.14	Q V					
3+50	0.0381	0.14	Q V					
3+55	0.0391	0.14	Q V					
4+ 0	0.0400	0.14	Q V					
4+ 5	0.0410	0.14	Q V					
4+10	0.0420	0.14	Q V					
4+15	0.0429	0.14	Q V					
4+20	0.0439	0.14	Q V					
4+25	0.0449	0.14	Q V					
4+30	0.0458	0.14	Q V					
4+35	0.0468	0.14	Q V					
4+40	0.0478	0.14	Q V					
4+45	0.0488	0.14	Q V					
4+50	0.0498	0.14	Q V					
4+55	0.0508	0.14	Q V					
5+ 0	0.0518	0.15	Q V					
5+ 5	0.0528	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	0.0568	0.15	Q V					
5+30	0.0579	0.15	Q V					
5+35	0.0589	0.15	Q V					
5+40	0.0599	0.15	Q V					
5+45	0.0610	0.15	Q V					
5+50	0.0620	0.15	Q V					

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5+55	0.0631	0.15	Q	V								
6+ 0	0.0641	0.15	Q	V								
6+ 5	0.0652	0.15	Q	V								
6+10	0.0662	0.15	Q	V								
6+15	0.0673	0.16	Q	V								
6+20	0.0684	0.16	Q	V								
6+25	0.0695	0.16	Q	V								
6+30	0.0705	0.16	Q	V								
6+35	0.0716	0.16	Q	V								
6+40	0.0727	0.16	Q	V								
6+45	0.0738	0.16	Q	V								
6+50	0.0749	0.16	Q	V								
6+55	0.0760	0.16	Q	V								
7+ 0	0.0772	0.16	Q	V								
7+ 5	0.0783	0.16	Q	V								
7+10	0.0794	0.16	Q	V								
7+15	0.0806	0.16	Q	V								
7+20	0.0817	0.17	Q	V								
7+25	0.0828	0.17	Q	V								
7+30	0.0840	0.17	Q	V								
7+35	0.0852	0.17	Q	V								
7+40	0.0863	0.17	Q	V								
7+45	0.0875	0.17	Q	V								
7+50	0.0887	0.17	Q	V								
7+55	0.0899	0.17	Q	V								
8+ 0	0.0911	0.17	Q	V								
8+ 5	0.0923	0.17	Q	V								
8+10	0.0935	0.18	Q	V								
8+15	0.0947	0.18	Q	V								
8+20	0.0959	0.18	Q	V								
8+25	0.0971	0.18	Q	V								
8+30	0.0984	0.18	Q	V								
8+35	0.0996	0.18	Q	V								
8+40	0.1009	0.18	Q	V								
8+45	0.1021	0.18	Q	V								
8+50	0.1034	0.18	Q	V								
8+55	0.1047	0.19	Q	V								
9+ 0	0.1059	0.19	Q	V								
9+ 5	0.1072	0.19	Q	V								
9+10	0.1085	0.19	Q	V								
9+15	0.1098	0.19	Q	V								
9+20	0.1112	0.19	Q	V								
9+25	0.1125	0.19	Q	V								
9+30	0.1138	0.19	Q	V								
9+35	0.1152	0.20	Q	V								
9+40	0.1165	0.20	Q	V								
9+45	0.1179	0.20	Q	V								
9+50	0.1193	0.20	Q	V								
9+55	0.1207	0.20	Q	V								
10+ 0	0.1221	0.20	Q	V								
10+ 5	0.1235	0.20	Q	V								







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22+55	0.5957	0.13	Q				V
23+ 0	0.5966	0.13	Q				V
23+ 5	0.5975	0.13	Q				V
23+10	0.5984	0.13	Q				V
23+15	0.5993	0.13	Q				V
23+20	0.6002	0.13	Q				V
23+25	0.6011	0.13	Q				V
23+30	0.6019	0.13	Q				V
23+35	0.6028	0.13	Q				V
23+40	0.6037	0.12	Q				V
23+45	0.6045	0.12	Q				V
23+50	0.6053	0.12	Q				V
23+55	0.6062	0.12	Q				V
24+ 0	0.6070	0.12	Q				V
24+ 5	0.6078	0.11	Q				V
24+10	0.6083	0.07	Q				V
24+15	0.6086	0.04	Q				V
24+20	0.6088	0.03	Q				V
24+25	0.6089	0.02	Q				V
24+30	0.6090	0.01	Q				V
24+35	0.6090	0.01	Q				V
24+40	0.6091	0.01	Q				V
24+45	0.6091	0.00	Q				V
24+50	0.6091	0.00	Q				V
24+55	0.6091	0.00	Q				V
25+ 0	0.6091	0.00	Q				V
<b>25+ 5</b>	<b>0.6091</b>	0.00	Q				V