APPENDIX I4B: PRELIMINARY HYDROLOGY STUDY SITE 4

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PRELIMINARY DRAINAGE STUDY

BLOOMINGTON BUSINESS PARK SP SITE 4
APN # 0256-091-07

Bloomington, San Bernardino County, California
May 7, 2021

Prepared for:

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JN 17-006

This report has been prepared by or under the direction of the following registered civil engineer who attests to the technical information contained herein. The registered civil engineer has also judged the qualifications of any technical specialists providing engineering data upon which recommendations, conclusions, and decisions are based.

	5/7/2021	
Francisco Martinez RCE Registered Civil Engineer	Date	Seal

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I. PURPOSE AND SCOPE

The purpose of this study is to determine the necessary drainage and increased runoff mitigation improvements required for the Bloomington Commerce Center SP3 project and proposed for industrial development.

The scope of this study includes the following:

1. Determination of points of flow concentration and watershed subareas for onsite and offsite areas.
2. Determination of the 10 & 100-year peak storm flows based upon the post-project onsite and existing condition offsite areas utilizing the Rational Method as outlined in the San Bernardino County Flood Control Hydrology Manual.
3. Determination of the 25-year peak storm flows based on the existing condition utilizing the utilizing the Rational Method (1-hour) as outlined in the San Bernardino County Flood Control Hydrology Manual.
4. Determination of the 25-year peak storm flows for the 24-hr duration based on the existing condition utilizing the Unit Hydrograph Method as outlined in the San Bernardino County Flood Control Hydrology Manual.
5. Determine the 100-year peak storm flows based upon the pre-project and post-project condition for the 24-hour storm duration utilizing the Unit Hydrograph Method as outlined in the San Bernardino County Flood Control Hydrology Manual.
6. Determine the required underground retention facilities and outlet control structure to mitigate the 100-year peak storm flows for the 24-hour storm duration in the post-project condition to flows less than or equal to 90% of the 25-year peak flow rate for existing conditions.
7. Determine the required storm drain infrastructure to flood protect the project site for the 100-year, 1-hour storm event.
8. Determine the required outlet control structure to safely by-pass the 100-year peak storm event.
9. Preparation of a hydrology report, which consist of hydrological and analytical results and exhibits.

II. PROJECT SITE AND DRAINAGE AREA OVERVIEW

The project site is comprised of one residential parcel with a total acreage of 9.56 acres; located in Bloomington, an unincorporated area of the County of San Bernardino, more precisely bounded by Santa Ana Avenue to the north, Laurel Avenue to the East, and private properties to the west and south (see Figure 1). The current land use is rural residential and proposed for development of a freight truck parking lot. The proposed development is comprised of truck and auto parking lot, landscaped areas, an onsite storm drain system with a retention/infiltration subsurface system and frontage street improvements.

Existing Conditions

The project site is part of a larger watershed of approximately 871acres that is tributary to an existing low point at Jurupa Avenue, and within the San Bernardino County *"Comprehensive Storm Drain Plan No. 3, Project 3-4 (CSDP 3-4)".* See excerpt under appendix G.8. The watershed's upper limits are roughly at the south side of the I-10 freeway and railroad tracks, it is comprised primarily of rural residential parcels and public streets that vary win widths, lacking full improvements and no storm drain system. All storm water flows developed from the watershed area travel predominantly is a southerly direction, where it ultimately drains to Jurupa Avenue. There are few local street curb type inlets with 18"-24" diameter culverts that help collect and convey storm flows at street intersections

but then released immediately downstream to roadside ditches, passing through driveway culvert crossings and onto the streets.

A culvert system can be found west of the site at the street intersections of Santa Ana Avenue and Laurel Avenue; see google imagery below:

Photo 1. Santa Ana and Locust, Looking North

Photo 2(a) Laurel Street, +/-220' South of Santa Ana Looking North

Photo 2 (b) Laurel Street, +/- 310' South of Santa Ana Looking North

The street inlets located on Laurel Avenue are tributary to approximately 95.8 acres, and they partially intercept storm flows which are conveyed to the south of the intersection on Laurel, all other flows in excess of inlet and culvert capacity will overtop Santa Ana Avenue and continue south on Laurel Avenue. See photo 1. Santa Ana Avenue between Laurel and Locust Avenue is a crown street but does not have curb or gutter either north or south side of the street; a high point roughly 250 feet east of Laurel will cause drainage to travel to the west and east towards Laurel and Locust Avenue, respectively. However, the lack of curb will allow the storm water runoff from the south half of the street to continue unobstructed beyond the edge of pavement, and beyond road right-of-way across residential lots. The surface and culvert storm water flows on Laurel do not enter the site but continue to travel south beyond the project boundary, then easterly towards Locust Avenue to two existing sump inlets located 400 feet north of Jurupa

From this location, flows are conveyed via combination of a shallow culvert system that discharges into an earthen ditch located between two residential parcels. The earthen ditch travels easterly but then it changes to a southerly direction along the back of the lots; further downstream it transitions to a paved drainage ditch out-letting at the north side of Jurupa, approximately 225 feet east of Locust Avenue. However, flows that exceed channel capacity over-top upstream of Jurupa and disperse across existing easterly parcels where they pond at an existing low point on Jurupa Avenue at the intersection of Birch Street, this is located about 665 feet east of Locust Avenue. Ultimately, storm water runoff ponds at the low point and overtops Jurupa Avenue where they continue traveling south beyond the project limits towards an existing private sump basin located on the northeast corner of Locust Avenue and 11th street in the City of Fontana.

Post Developed Conditions

There will be no run-on/offsite flows comingling and/or entering the project site. The combined offsite areas of approximately 19.1 acres that drains towards the site from the north will be intercepted and directed to Laurel Avenue via the use of an underground pipe and concrete channel. The onsite storm water flows will be collected via the proposed onsite storm drain system and directed to an underground retention system for water quality treatment and increased runoff mitigation.

The water quality treatment for the project site is provided under the preliminary Water Quality Management Plan. The required increase runoff mitigation for the project has been estimated by modifying the "*input parameters (procedures)*" described in the County Manual to those that are shown in the "*San Bernardino County Detention Basin Criteria*" memorandum (Appendix E.7). More specific and for purposes of this preliminary drainage report, the 100-year 24-hour peak flow rates for the post developed condition and the 25-year 24-hour peak flow rates in the predeveloped condition were the only storm events analyzed for mitigation applying the County's basin criteria; this requires that the 100-year 24-hour design storm peak flow rate be mitigated to levels "at or less" than the 90% of the predeveloped 25-year 24-hour peak flow rate. The project storm mitigation is provided by utilizing the underground storm drain retention system and outlet control structures. Smaller storm events were analyzed in this preliminary phase however, since the storm volume demand to mitigate the storm flows from the 100-year 24 hour event to the 90% of the 25-year predeveloped storm event is expected to be considerably larger than volumes produced by the smaller storm events, thus a conservative approach.

III. HYDROLOGY

The San Bernardino County Hydrology Manual (Reference 1) was used to develop the hydrological parameters for the hydrology analyses. The rational method and unit hydrograph method were used for the analyses and the computations were performed using the computer program developed by Civil CADD/Civil Design.

The rainfall depths for used in the hydrology calculations for the rational method and the unit hydrograph method are as follows:

Storm Event & Duration	Rainfall (inches)
2-Year, 6-Hour	**1.35**
2-Year, 24-Hour	**2.44**
10-Year, 1-Hour	**0.819**
10-Year, 6-Hour	**2.04**
10-Year, 24-Hour	**3.76**
25-Year, 1-Hour	**1.01**
25-Year, 6-Hour	**2.46**
25-Year, 24-Hour	**4.53**
100-Year, 1-Hour	**1.31**
100-Year, 6-Hour	**3.11**
100-Year, 24-Hour	**5.70**

The rainfall depths were obtained from NOAA Atlas 14, which has been included in Appendix E.

The existing soil classification for the area consists of Hydrologic Soil Group "A", as shown in

Appendix E; it is a Soils Map obtained from the USDA Websoil Survey. For 10-year, 25-year and for the 100-year storm events AMC II was used.

The hydrology utilized the following land use covers:

Land Use Cover	Runoff Index Number (Soil "A")	Pervious Ratio
Urban Covers – Residential or Commercial landscaping	32	0.8
Commercial	98	0.1

The pre-project condition and post-project condition for offsite and onsite undeveloped, natural ground or areas restored to natural ground were analyzed as Urban Covers for "Residential or Commercial Landscaping", good cover, condition and offsite street areas were analyzed as Commercial.

Rational Method Analyses

The Rational Method analysis for the existing conditions considered a single watershed area designated as "A" that is tributary to Laurel Ave. Watershed "A" is considered to be a sub-watershed to the larger watershed of approximately 871 acres that drains to two (2) existing street sump inlets/low points located on Laurel Avenue, about 400 feet north of Jurupa Avenue.

The Rational Method Analysis results are shown in the table below:

TABLE 1. RATIONAL METHOD - OVERALL ONSITE & OFFSITE

WATERSHED AREA	STORM EVENT	EXISTING CONDITIONS Q (CFS)	ADJUSTED Q (CFS)	PROPOSED CONDITIONS Q (CFS)	DELTA Q(CFS)
*A	10	17.70	Q_5=21.17	31.25	13.55
	25	22.70	Q_{10}=17.70	40.39	17.69
	100	35.22	Q_{25}=22.70	54.90	19.68

*Watershed Area "A" is tributary to Laurel Ave and only includes offsite areas from south of the centerline of Santa Ana Ave, east of Alder Ave and West of the Laurel street centerline

Unit Hydrograph Analyses

To determine the increased runoff mitigation required for the project, a Unit Hydrograph calculation was performed for the existing and the proposed onsite conditions. For the existing and proposed onsite conditions area "A" was analyzed.

The unit hydrographs were performed using a lag time that was calculated by the following formula:

Lag (hrs) = TC_{RM} (hrs) × 80%, where TC_{RM} is the corresponding rational method time of concentration.

The pre-project unit hydrograph calculations utilized urban residential or commercial landscaping, good cover, with a pervious ratio of 0.8. The post project condition perviousness was calculated using a unit area method to determine the average perviousness for each subarea.

The following tables summarize the unit hydrograph calculations:

TABLE 2. UNIT HYDROGRAPH - ONSITE					
WATERSHED AREA	STORM EVENT	EXISTING CONDITIONS PEAK Q (CFS)	[2]ADJUSTED PEAK Q (CFS)	[1]MAXIMUM ALLOWABLE DISCHARGE (CFS)	PROPOSED CONDITIONS PEAK Q (CFS)
*A	10	9.51	Q_5=7.10	6.39	17.10
	25	13.19	Q_{10}=9.49	8.54	21.41
	100	15.00	Q_{25}=13.19	11.87	28.29

* Watershed Area "A" is tributary to Laurel Ave and only includes offsite areas from south of the centerline of Santa Ana Ave, east of Alder Ave and West of the Laurel street centerline

[1]Maximum allowable discharge is equal to 90% of the adjusted pre-developed peak Q per the San Bernardino County Memorandum (Appendix G.7)

[2]Rainfall shift per the San Bernardino County Memorandum (Appendix G.7)

The pre-project unit hydrograph calculations have been included in Appendix B and the post-project unit hydrograph calculations have been included in Appendix C. The pre and post project unit hydrograph watershed is based on the total onsite area "A" of 9.56 acres.

The pre-project and post-project rational method hydrology calculations have been included in Appendix A. The pre-project rational method hydrology map has been included as Figure 2, and the post-project rational method hydrology map has been included as Figure 3. The pre-project and post-project unit hydrograph hydrology calculations have been included in Appendix B and C, respectively.

IV. HYDRAULICS

The project will utilize a combination of surface improvements, subsurface storm drain, drainage inlets an underground infiltration system to collect, convey peak flows to an onsite underground retention/infiltration system that will be used to mitigate increased runoff and water quality. The onsite storm flows will be directed to an underground retention system. The underground retention/infiltration system will have a weir outlet control structure. Both the weir outlet control structure and outlet pipe are preliminarily sized to safely by-pass the 100-year storm flow in case of an emergency. Ultimately, the outlet pipe will connect to a 66-inch storm drainpipe on Locust as shown on Figure 5 of Bloomington Business Park Master Storm Drain Plan (future by others). A normal depth analysis was used for the 36-inch outlet pipe assuming soffit control at the connection point. A WSPG analysis for onsite storm drainpipe system will be performed during final engineering.

The offsite street flows for both the 100-year and 10-year, (1- hour) storm were analyzed for Laurel for any impacts the development would have on the existing street section. An analysis was performed on Laurel Ave with the existing street section and the pre-project condition flow from the overall watershed "B". Both the 10-year and 100-year storm flows are topping the right of way in the existing street section. In order to reduce the water surface elevation to be at or below top of curb and right of way respectively, the project will construct half width street improvements on the westerly side of Laurel Avenue, a roadside earthen channel along its frontage that will intercept storm flows and four catch basins upstream of the site, just south of Santa Ana Avenue; comprised of a 28-foot catch basin on the westerly half of Laurel Avenue, and a 21-foot catch basin on the easterly side. Another set of street inlet catch basins are proposed on Laurel Avenue immediately upstream of the northerly property boundary. The preliminary sizes are 14-foot catch basin on the westerly half of Laurel Ave and a 7-foot catch basin on the easterly half are being proposed. The bypass flow from the series of catch basin systems described will help maintain the 10-year storm within both the existing and proposed top of curb. The 100-year storm flow for the developed condition, however, will exceed the proposed right of way. Therefore, an earthen roadside channel is being proposed that will extend along the frontage road as to intercept storm flows and direct them to an outlet pipe that will connect and discharge at Laurel

Avenue to the Bloomington Business Park SP master storm drain (by others).

V. INCREASED RUNOFF MITIGATION

In accordance with the "San Bernardino County Detention Basin Criteria" memorandum (appendix G.7), when a basin is to be used, "the County should be at least 50% confident a detention basin outflow will not adversely impact properties downstream of the basin." Therefore, the basin's capacity and outlet drain system shall be sized such that the post-development 10, 25 and 100-year peak flow rates generated by the site be less than or equal to 90% of the predevelopment 10, 25 and 100-year peak flow rates, except that the predevelopment peak flow rates shall be calculated using the 5, 10 and 25-year rainfall values, respectively. That is, the predeveloped 10-year peak flow rate shall be estimated by using the 5-year rainfall data, the 25-year peak flow rate calculated using the 10-year rainfall and 100-year using the 25-year rainfall values.

The project site will utilize a subsurface infiltration system (CMP retention system) to mitigate flows for increased runoff and serve as the water quality treatment facility for the project site. The water quality calculations and discussion have been provided in the Water Quality Management Plan. The required water quality volume for Watershed "A" is 36,846 ft^3. The calculation for the Design Capture Volume (DCV) has been included in Appendix E. Infiltration testing were performed within the single retention system. An excerpt of the Soils Infiltration test report has been included in Appendix E. The area tested in the retention system provides a rate of approximately 12.10 in/hr, after applying a safety factor in accordance with the technical guidance manual, the design infiltration rate is calculated to be **4.03**; a worksheet has been included in Appendix E. To determine a flow rate through the soil that could be utilized in the basin routing calculations (to be performed in the final engineering phase), the infiltration rate was multiplied by the bottom surface area of the subsurface infiltration system. The bottom surface area of the infiltration system is 20,184 ft^2, converting the calculated design infiltration rate to the appropriate units and multiplying by the surface area, the equivalent flow rate for the infiltration system is 1.88 ft^3/s. This flow rate will be utilized in the basin routing analyses during the final engineering phase.

Since the water quality volume (DCV) must infiltrate through the chamber bottom, the underground basin outlet structure did not include outlets below the DCV elevations. This would allow the water quality volume to pond and infiltrate through the soil. To control the discharge rates, the retentions and infiltration system will have an outlet weir control structure.

Stormwater mitigation information for watershed "A" can be seen in the table provided below:

TABLE 3. UNIT HYDROGRAPH VOLUME ANALYSIS - ONSITE

WATERSHED AREA	STORM EVENT	EXISTING PEAK Q (CFS)	PROPOSED PEAK Q (CFS)	[1]MITIGATED PEAK/ALLOWABLE Q (CFS)	MITIGATED DISCHARGE Q (CFS)	MITIGATED DISCHARGE VOLUME (AF)	U/G RETENTION VOLUME (AF)	TOTAL STORM VOLUME (AF)	STORM CAPTURE (%)
*A	10	9.51	17.10	6.39	4.85	1.69	2.66	2.30	100%
	25	13.19	21.41	8.54	6.07	2.06		2.81	95%
	100	15.00	28.29	11.87	8.04	2.66		3.60	74%

[1]Maximum allowable discharge is equal to 90% of the adjusted pre-developed peak Q per the San Bernardino County Memorandum (Appendix G.7)

The total mitigation volume required for watershed area "A" was determined by finding the "mitigated peak/allowable" (see Table 3) flow rates for the retention system. We then selected the flow rates from

the recess limb of the proposed unit hydrograph runs that are equal or less than the "mitigated peak/allowable"; and they were compiled and shown in Table 5 under the "Mitigated Discharge" column. Since the storm volume demand to mitigate the storm flows from the 100-year 24-hour event to the 90% of the 25-year predeveloped storm event is larger than volumes produced by the smaller storm events, the proposed underground retention system has been sized to accommodate this volume which corresponds to the "Mitigated Discharge Volume" column from Table 3(e.g. underground retention system V=2.66 Acre-ft), thus a conservative approach.

VI. FINDINGS

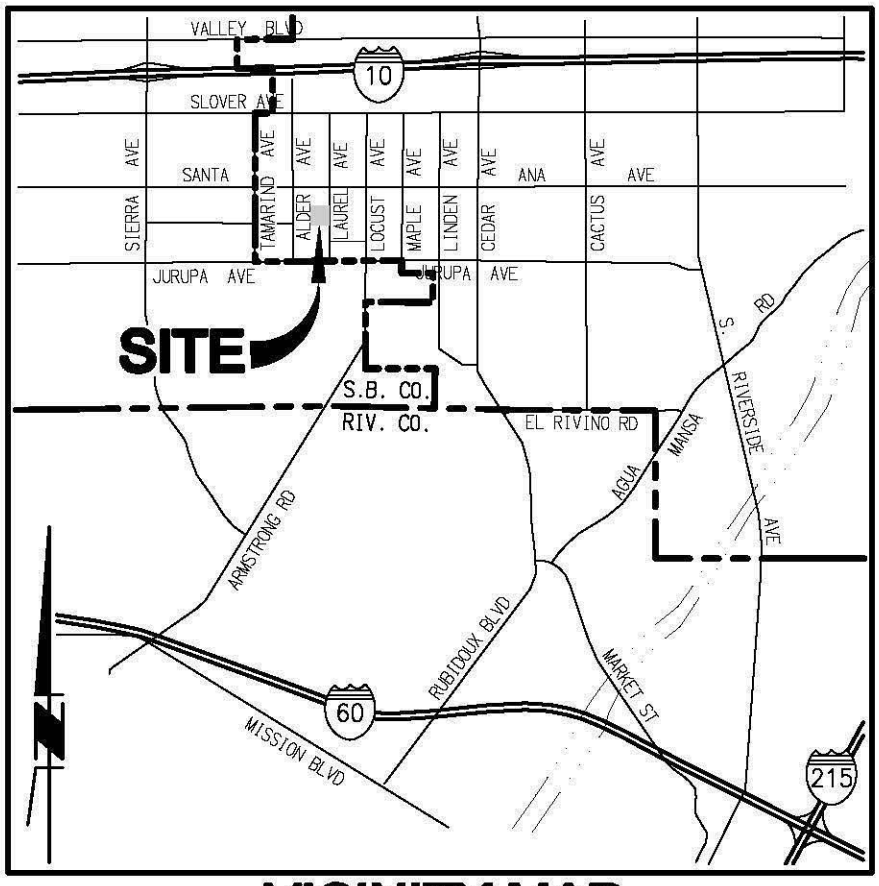
The hydrology analyses evaluated the proposed development to determine the necessary drainage improvements required to mitigate flows for increased runoff. It has been concluded that:

1. The proposed drainage facilities will adequately convey the 100-year flows and provide flood protection to the project site.
2. The proposed retention/infiltration subsurface system will adequately mitigate for water quality and increased runoff.

VII. REFERENCES

1. San Bernardino Flood Control Hydrology Manual, August 1986.
2. Brater, Ernest F., and Horace Williams King. 1976. *Handbook of Hydraulics for the Solution of Hydraulic Engineering Problems.* 6th ed. McGraw-Hill, Inc.
3. San Bernardino Rational Method and Unit Hydrograph modules, CivilDesign Engineering Software Version 9.0.

FIGURE 1:
VICINITY MAP



VICINITY MAP

T01S, R05W, SEC. 28
NOT TO SCALE

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BLOOMINGTON CC SP4

FIGURE 1
VICINITY MAP

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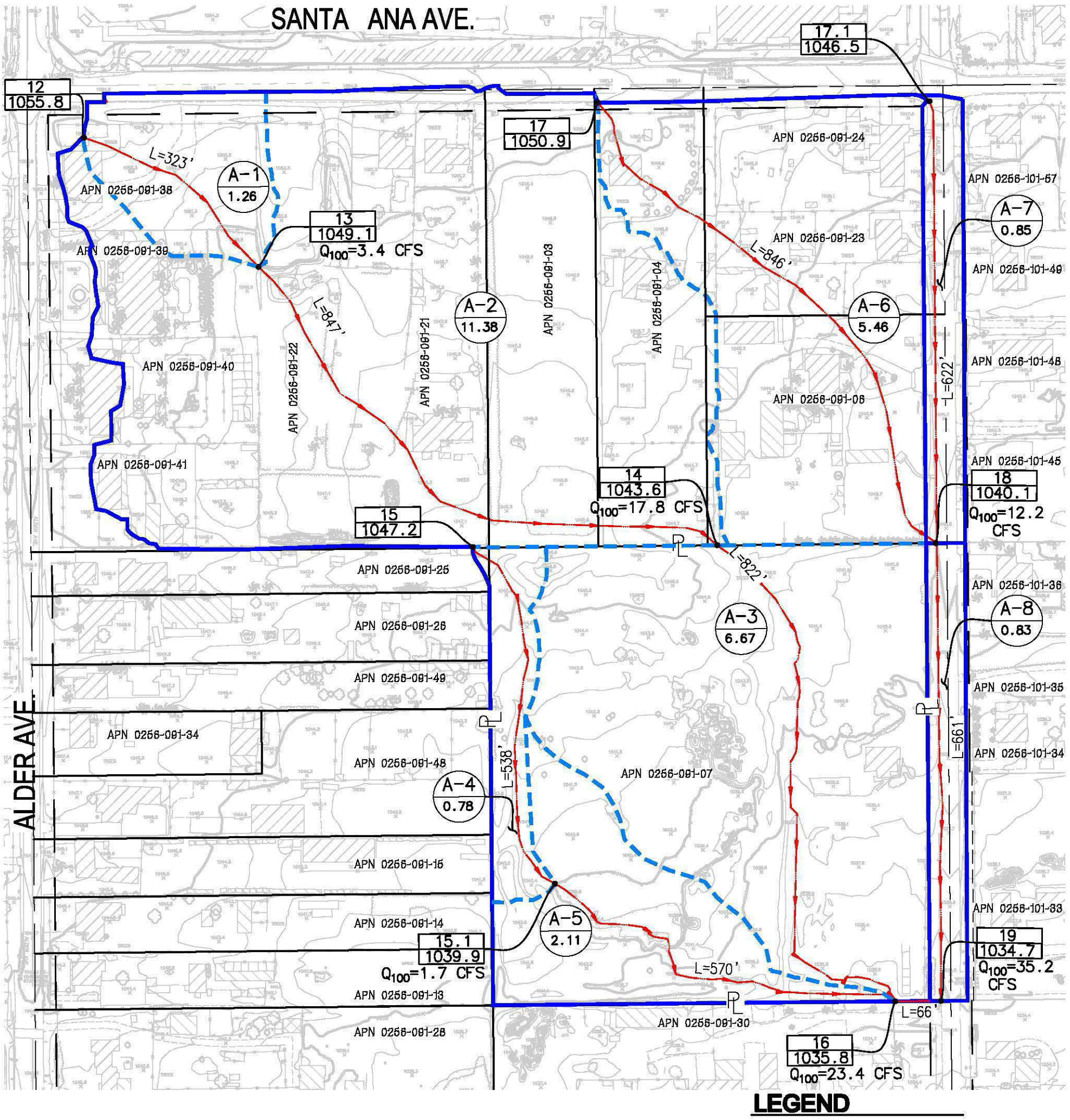
FIGURE 2:
EXISTING CONDITION HYDROLOGY MAP



LEGEND

- D-2 / 2.16 — DRAINAGE BASIN NAME; DRAINAGE BASIN AREA(AC.)
- 11 / 1027.0 — NODE I.D.; SURFACE ELEVATION
- DRAINAGE BOUNDARY
- DRAINAGE SUB-BOUNDARY
- FLOW DIRECTION
- PROPERTY LINE
- 126 / 1042.1 — FLOW RATE & TIME OF CONCENTRATION BASED ON "PRELIMINARY HYDROLOGY & HYDRAULICS STUDY FOR THE CLOOMINGTON COMMERCE CENTER" DATED MARCH 7,2018 PREPARED BY JLC

SCALE 1"=150'

150 75 0 150

SCALE: 1"=150'

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BLOOMINGTON BUSINESS PARK

EXISTING CONDITIONS W/ OFFSITES HYDROLOGY MAP-SITE 4

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FIGURE 3:
PROPOSED CONDITION HYDROLOGY MAP

SANTA ANA AVE.

10
1055.8

L=323'

A-1
1.26

11
1049.0
Q_{100}=3.4 CFS

A-2
11.38

13.1
1050.9

EXIST. CB #1
13.2
1046.5

APN 0256-091-24

EXIST. CB #2

APN 0256-101-57

A-5
0.44

APN 0256-101-49

L=846'

APN 0256-091-23

A-4
5.46

L=622'

APN 0256-091-21

APN 0256-091-03

APN 0256-091-04

APN 0256-091-06

APN 0256-101-48

APN 0256-101-45

12
1042.7
Q_{100}=17.8 CFS

L=852'

13.3
1040.10
Q_{100}=28.1 CFS

L=308'

APN 0256-091-25

14
1050.6

APN 0256-101-36

APN 0256-091-26

APN 0256-091-49

APN 0256-101-35

ALDER AVE

APN 0256-091-34

APN 0256-091-48

L=852'

A-7
9.55

L=663'

LAUREL AVE.

APN 0256-101-34

APN 0256-091-15

CONTECH CMP
DETENTION
SYSTEM

15
1039.2
Q_{100}=29.9 CFS

A-6
0.47

27,301.58 SF
0.627 ACRES

APN 0256-091-14

APN 0256-101-33

APN 0256-091-13

APN 0256-091-30

15.1
1034.5
Q_{100}=54.9 CFS

LEGEND

D-2
2.16
DRAINAGE BASIN NAME
DRAINAGE BASIN AREA(AC.)

11
1027.0
NODE I.D.
SURFACE ELEVATION

DRAINAGE BOUNDARY

DRAINAGE SUB-BOUNDARY

FLOW DIRECTION

PROPERTY LINE

126
1042.1
FLOW RATE & TIME OF CONCENTRATION BASED ON "PRELIMINARY HYDROLOGY & HYDRAULICS STUDY FOR THE BLOOMINGTON COMMERCE CENTER" DATED MARCH 7,2018 PREPARED BY JLC

SCALE 1"=150'

150 75 0 150

SCALE: 1"=150'

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BLOOMINGTON BUSINESS PARK

PROPOSED CONDITION W/ OFFSITES HYDROLOGY MAP-SITE 4

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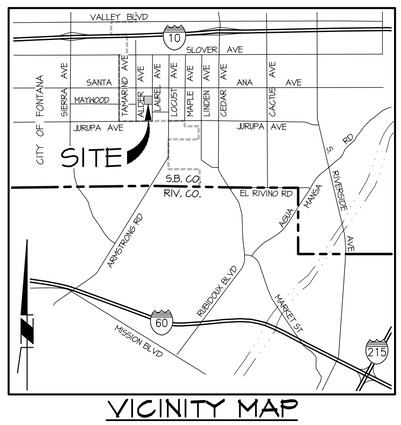
FIGURE 4:
CONCEPTUAL GRADING

IN THE UNINCORPORATED AREA OF THE
COUNTY OF SAN BERNARDINO, CALIFORNIA

APN 0256-091-07 - CONCEPTUAL GRADING



VICINITY MAP
T01S, R05W, SEC. 28
NOT TO SCALE

APPLICANT/OWNER
HOWARD INDUSTRIAL PARTNERS
1944 NORTH TUSTIN STREET, SUITE 122
ORANGE, CA 92865
CONTACT: TIM HOWARD
(TEL)714-769-9155

ENGINEER
FMCIVIL ENGINEERS INC.
29995 TECHNOLOGY DRIVE, SUITE 306
MURRIETA, CA 92563
CONTACT: FRANCISCO MARTINEZ
(TEL)951-331-9873

ARCHITECT
AO ARCHITECTURE
144 NORTH STREET
ORANGE, CA 92866
CONTACT: STEPHEN PRZYBYLOWSKI
(TEL)714-639-9860

LEGAL DESCRIPTION
THE LAND REFERRED TO HEREIN BELOW IS SITUATED SAN BERNARDINO IN THE COUNTY OF SAN BERNARDINO, STATE OF CALIFORNIA, AND IS DESCRIBED AS FOLLOWS:

THE EAST 1/2 OF FARM LOT 479, ACCORDING TO MAP SHOWING SUBDIVISION OF LAND BELONGING TO THE SEMI-TROPIC LAND AND WATER COMPANY, AS PER PLAT RECORDED IN BOOK 11 OF MAPS, PAGE(S) 12, RECORDS OF SAN BERNARDINO

APN:0256-091-07

ZONING ORDINANCE
EXISTING ZONING:
BLOOMINGTON/SINGLE FAMILY RESIDENTIAL (BL/RS-20M)

PROPOSED ZONING:
REGIONAL INDUSTRIAL (IR)

TOPOGRAPHY:
PROVIDED BY ROBERT J. LUNG & ASSOCIATES, INC.
FLOWN ON 11/14/17.
2832 WALNUT AVE E, TUSTIN, CA 92780
TEL: (714) 832-2077

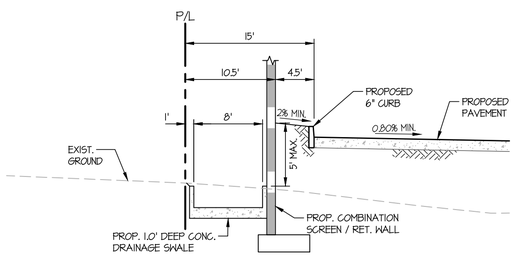
FLOOD ZONE:
THE SITE LIES WITHIN FLOOD ZONE "X" AREAS OF 0.2% ANNUAL CHANCE FLOOD AND AREAS OF 1% ANNUAL CHANCE FLOOD WITH AVERAGE DEPTHS OF LESS THAN 1 FOOT OR WITH DRAINAGE AREAS LESS THAN 1 SQUARE MILE; INUNDATION BY THE 1% ANNUAL CHANCE FLOOD, BASE FLOOD ELEVATIONS DETERMINED AS SHOWN ON FLOOD INSURANCE RATE MAP NUMBER 06071C8666H, EFFECTIVE DATE AUGUST 28, 2008

SITE PLAN KEYNOTES
3. CONCRETE CURB
4. CONCRETE CURB & GUTTER
7. TRAILER PARKING STALL MIN. 12' X 55' - STRIPE PER STANDARDS SHOWN ON ARCHITECT'S PLANS
9. PORTLAND CONC. CEMENT (PCC) PAVED TRUCK YARD ARCHITECT'S PLANS
14. COMMERCIAL DRIVEWAY APPROACH PER SAN BERNARDINO COUNTY STD. 129B, LOCATED PER STD. 130, WITH DECORATIVE CONCRETE PAVING PER ARCHITECT'S PLANS
16. UNDERGROUND STORM WATER CHAMBER SYSTEM
17. PROPOSED COMBINATION SCREEN- CONCRETE RETAINING WALL PER ARCHITECT'S PLANS
19. VEGETATED SWALE
23. LANDSCAPE AREA PER LANDSCAPE ARCHITECT'S PLANS
25. CONCRETE DRAINAGE CHANNEL

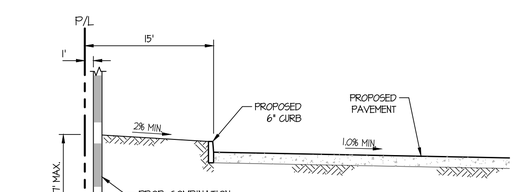
LEGEND
- 1025 — INDEX CONTOUR
- RETAINING WALL
- FENCE
- EDGE OF PAVEMENT
- SIGN
- MH — MANHOLE
- RIGHT OF WAY
- EASEMENT
- PARCEL LINE
- PARCEL MAP BOUNDARY
- STREET CENTER LINE
- SCREEN WALL
- COMBINATION SCREEN/ RETAINING WALL
- EXISTING LOT LINE
- RIDGE LINE
- RIBBON GUTTER
- FLOW ARROW
- PROPOSED EDGE OF PAVEMENT
- EX W — EXISTING WATER LINE
- EX SS — EXISTING SEWER LINE
- SD — EXISTING STORM DRAIN PIPE
- SD — PROPOSED STORM DRAIN PIPE
- CUT/FILL LINE
- SLOPE SYMBOL
- PROPOSED STREET AC PAVEMENT
- GRIND AND OVERLAY
- A — EXISTING STRUCTURE(S) TO BE REMOVED
- B — EXISTING STRUCTURE(S) TO REMAIN

EARTHWORK ESTIMATE:
RAW CUT:	560 CY	
RAW FILL:	37,290 CY	
NET:	36,730 CY	IMPORT

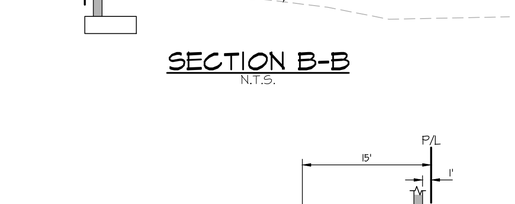
HAUL TRIPS:
ASSUMED (13 CY PER TRIP) = 2,825



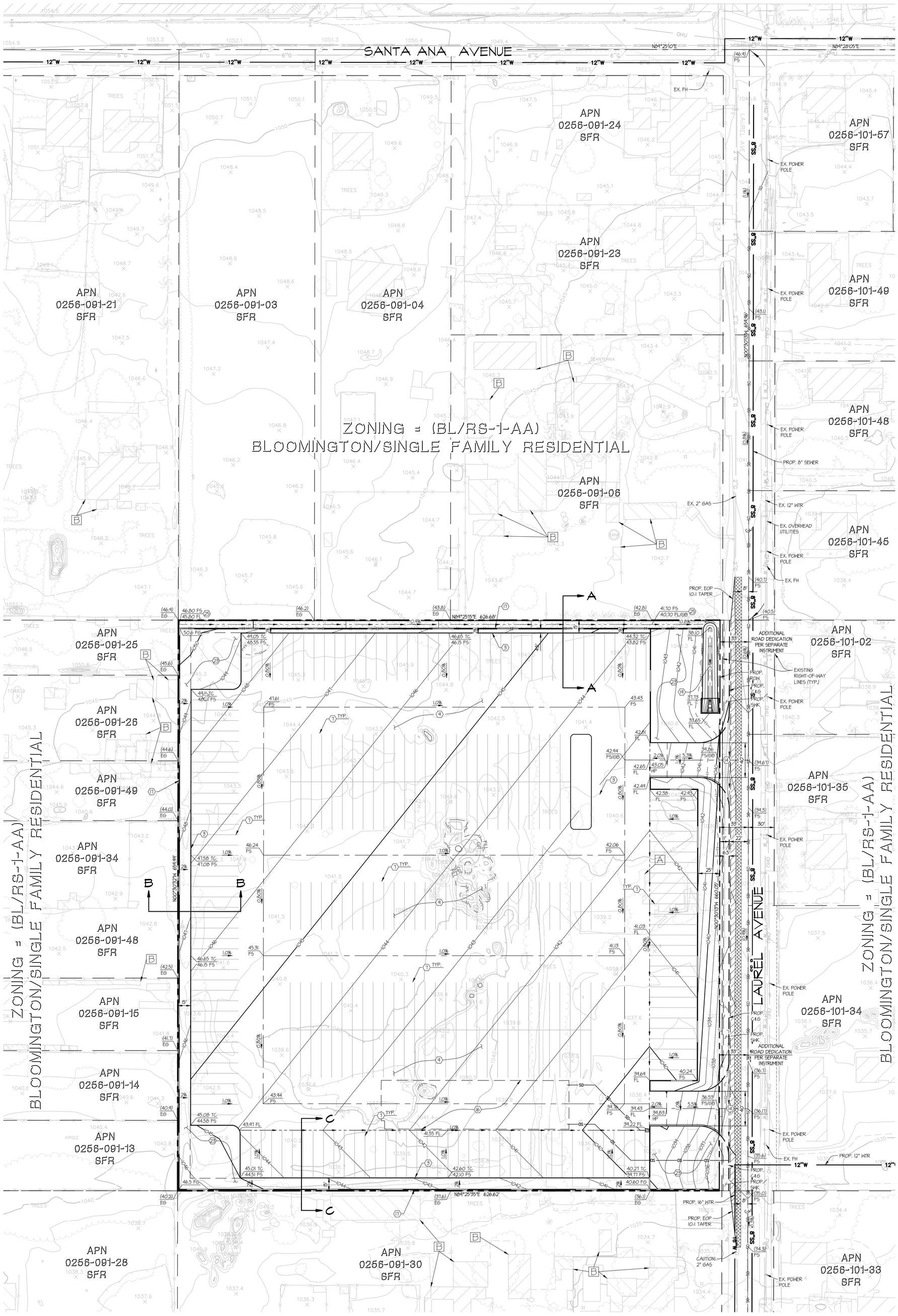
SECTION A-A
N.T.S.



SECTION B-B
N.T.S.



SECTION C-C
N.T.S.

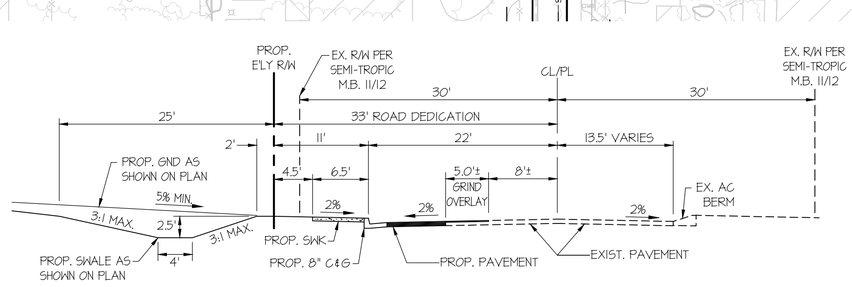


SCALE 1"=50'

50 25 0 50 100 150
SCALE: 1"=50'

PARECL DATA
PROPOSED PARCEL	AREA	USE
PARCEL 1	413,784.89 SF 9.50 AC	WAREHOUSE
PARCEL A	21,784.98 SF 0.50 AC	RIGHT OF WAY DEDICATION
TOTAL	435,569.87 SF 10.00 AC	

NOTES:
1. THERE ARE NO-KNOWN WATER WELLS; HOWEVER IF ANY WATER WELLS ARE TO BE FOUND ON-SITE THEY ARE TO BE ABANDONED PER STATE OF CALIFORNIA STANDARDS.
2. ALL EXISTING ON-SITE SEPTIC SYSTEMS SHALL BE REMOVED IN ACCORDANCE TO THE REQUIREMENTS OF COUNTY SAN BERNARDINO DEPT. ENVIRONMENTAL HEALTH SERVICES.



*TYPICAL COLLECTOR STREET PER SAN BERNARDINO COUNTY STD. NO. 103

TYPICAL SECTION LAUREL AVENUE
*COLLECTOR STREET
HOR. SCALE: 1"=10'

BENCHMARK
BM UF 628 NAVD88 EL. = 1006.35 FEET

FOUND STANDARD MAIDSC 3-1/4 INCH ALUMINUM DISC, STAMPED "UF 628 1992" SET IN TOP OF HEADWALL. MONUMENT IS LOCATED 0.1 MILE (0.2 KM) SOUTH FROM THE INTERSECTION OF POPLAR AVE AND JURUPA AVE, 55 FEET (16.8 M) SOUTH OF NICOLE WAY, 26.5 FEET (8.1 M) WEST OF POPLAR AVE AT THE NORTH END OF A 44 FOOT (13.4 M) LONG FLOOD CONTROL CHANNEL WALL.

BASIS OF BEARING
THE BASIS OF BEARINGS FOR THIS SURVEY IS THE CALIFORNIA COORDINATE SYSTEM, ZONE V, NAD83 (EPOCH 2011.00) AS DETERMINED LOCALLY BY A LINE BETWEEN CONTINUOUS OPERATING REFERENCE STATIONS (CORS) MLFP AND EWPP BEING N43-16-17.55W AS DERIVED FROM GEODETIC VALUES PUBLISHED BY THE CALIFORNIA SPATIAL REFERENCE CENTER (CSRC) AND/OR NATIONAL GEODETIC SURVEY (NGS), RESPECTIVELY.

REGISTERED PROFESSIONAL ENGINEER
FRANCISCO MARTINEZ JR.
C-84640
CIVIL
STATE OF CALIFORNIA

PREPARED BY:
FMCIVIL ENGINEERS INC.
29995 TECHNOLOGY DRIVE, SUITE 306 | MURRIETA | CA 92563
951.973.0201 - FMCIVIL.COM

#84640 3/31/22
FRANCISCO MARTINEZ JR. R.C.E. / EXP. DATE

COUNTY OF SAN BERNARDINO

BLOOMINGTON BUSINESS PARK SP4
APN 0256-091-07
CONCEPTUAL GRADING

SCALE:	AS SHOWN
DATE:	FEB. 2021
DESIGNED:	AJ
CHECKED:	FM
PLN CK REF:	

FMCIVIL ENGINEERS INC.
29995 TECHNOLOGY DRIVE, SUITE 306
MURRIETA | CA 92563
951.973.0201 - FMCIVIL.COM

SHEET 1 OF 1 SHEETS

H:\PDATA\17-006 BLOOMINGTON\DWGS\PLNG\ENTITLEMENT\CONCEPT\SITE-A\17-006-CG-SP4.DWG ALLAN 3/17/2021 4:07 PM

FIGURE 5:

BLOOMINGTON BUSINESS PARK MASTER STORM DRAIN PLAN

SP BOUNDARY
SANTA ANA AVE.
66" SD
SPECIFIC PLAN AREA
+/-213 ACRES
SP BOUNDARY
78" SD
78" SD
LAUREL AVE.
72" SD - FUTURE
BY OTHERS
LOCUST AVE.
±1000'
MAPLE AVE.
54" SD
SP BOUNDARY
SP BOUNDARY
JURUPA AVE.
78" SD
BUBBLERS (TYP.)
LINDEN AVE.
OAK ST.
CEDAR AVE.
11TH ST.
9TH ST.
54" SD
±6300 LF
CONNECT TO
EXISTING CATCH
BASIN ON 5TH STREET
7TH ST.
EXISTING CATCH
BASIN AND STORM
DRAIN
EXISTING FLOW PATH
ALONG PAVED GUTTER
LINDEN AVE.
5TH ST.
DISCHARGE POINT
EXISTING
STORM DRAIN
EXISTING BASIN
EXISTING TRAP
CHANNEL TO
DAYLIGHT
STREET FLOW
EL RIVINO RD.
SCALE 1"=400.001'
400.001 200 0 400.001
SCALE: 1"=400.001'

FMCIVIL ENGINEERS INC.
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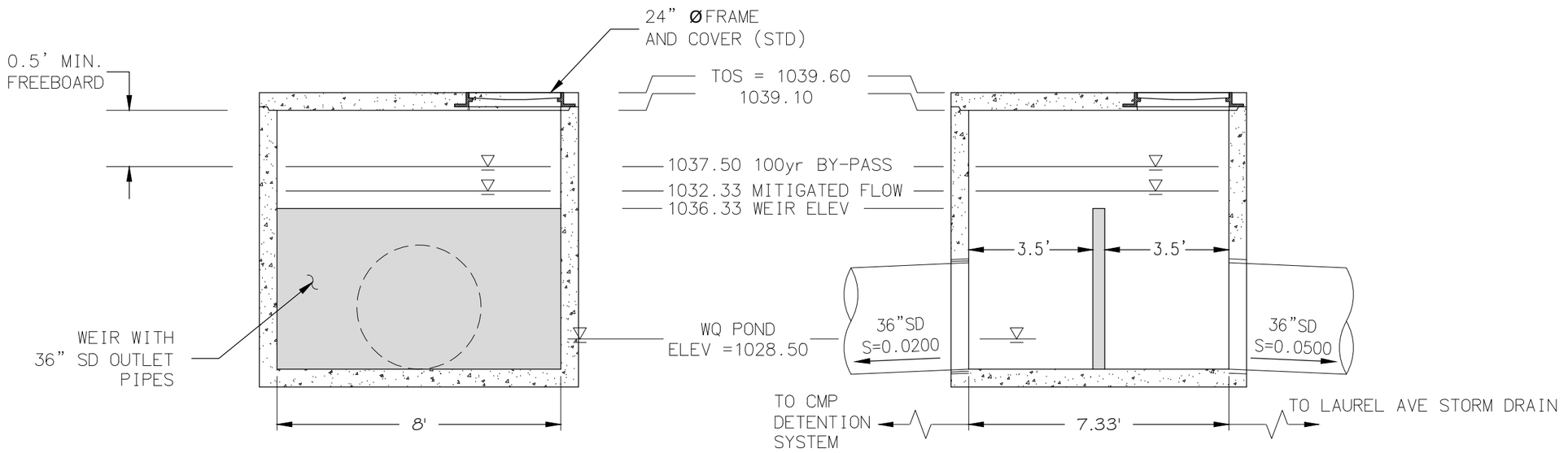
29995 TECHNOLOGY DRIVE, SUITE 306
MURRIETA | CA 92563
951.331.9673 - FMCIVIL.COM

BLOOMINGTON BUSINESS PARK SP

MASTER STORM DRAIN PLAN
ALTERNATE ALIGNMENT #1

Howard Industrial Partners

FIGURE 6:
OUTLET CONTROL STRUCTURE DETAIL



BASIN "A" STRUCTURE

BASIN BTM = 1027.5

FMCIVIL ENGINEERS INC.
29995 TECHNOLOGY DRIVE, SUITE 306 | MURRIETA | CA 92563
951.331.9873 - FMCIVIL.COM

BLOOMINGTON BUSINESS PARK-SITE 4

OUTLET CONTROL STRUCTURE DETAIL

1

OF 1 SHEETS

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APPENDIX A

RATIONAL METHOD HYDROLOGY (ONSITE AND OFFSITE)

A.1: EXISITNG CONDITION-100 YR

A.2: EXISTING CONDITION-100 YR-25 YR ADJUSTED RAINFALL DATA

A.3: PROPOSED CONDITION - 100 YR

A.4: EXISTING CONDITION - 25 YR

A.5: EXISTING CONDITION - 25 YR – 10 YR ADJUSTED RAINFALL DATA

A.6: PROPOSED CONDITION - 25 YR

A.7: EXISITNG CONDITION - 10 YR

A.8: EXISITNG CONDITION - 10 YR – 5 YR ADJUSTED RAINFALL DATA

A.9: PROPOSED CONDITION - 10 YR

San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2014 Version 9.0
Rational Hydrology Study Date: 04/06/21

BLOOMINGTON COMMERCE CENTER - SITE 4
EXISTING CONDITION
100-YEAR STORM ANALYSIS

Program License Serial Number 6405

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

Rational hydrology study storm event year is 100.0
Computed rainfall intensity:
Storm year = 100.00 1 hour rainfall = 1.310 (In.)
Slope used for rainfall intensity curve b = 0.6000
Soil antecedent moisture condition (AMC) = 2

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++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       12.000 to Point/Station       13.000
**** INITIAL AREA EVALUATION ****

____________________________________________________________________________
RESIDENTIAL(1 acre lot)
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
Pervious ratio(Ap) = 0.8000     Max loss rate(Fm)=     0.782(In/Hr)
Initial subarea data:
Initial area flow distance =   323.000(Ft.)
Top (of initial area) elevation =  1055.800(Ft.)
Bottom (of initial area) elevation =  1049.100(Ft.)
Difference in elevation =     6.700(Ft.)
Slope =    0.02074  s(%)=       2.07
TC = k(0.469)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   10.268 min.
Rainfall intensity =      3.778(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.714
Subarea runoff =      3.397(CFS)
Total initial stream area =        1.260(Ac.)
Pervious area fraction = 0.800
Initial area Fm value =    0.782(In/Hr)
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++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       13.000 to Point/Station       14.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
________________________________________________________________________
Estimated mean flow rate at midpoint of channel =     21.305(CFS)
Depth of flow =   0.306(Ft.), Average velocity =   1.141(Ft/s)
      ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00              1.00
      2            100.00              0.00
      3            200.00              1.00
Manning's 'N' friction factor =   0.030
------------------------------------------------------------------
Sub-Channel flow  =     10.653(CFS)
  '     '    flow top width =     61.117(Ft.)
  '     '    velocity=    1.141(Ft/s)
  '     '    area =      9.338(Sq.Ft)
  '     '    Froude number =     0.514

Upstream point elevation =  1049.100(Ft.)
Downstream point elevation =  1043.600(Ft.)
Flow length =   847.000(Ft.)
Travel time  =   12.37 min.
Time of concentration =   22.64 min.
Depth of flow =   0.306(Ft.)
Average velocity =   1.141(Ft/s)
Total irregular channel flow =    10.653(CFS)
Irregular channel normal depth above invert elev. =   0.306(Ft.)
Average velocity of channel(s) =   1.141(Ft/s)
 Adding area flow to channel
RESIDENTIAL(1 acre lot)
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
Pervious ratio(Ap) = 0.8000     Max loss rate(Fm)=     0.782(In/Hr)
Rainfall intensity =      2.351(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.601
Subarea runoff =     14.446(CFS) for   11.380(Ac.)
Total runoff =     17.843(CFS)
Effective area this stream =       12.64(Ac.)
Total Study Area (Main Stream No. 1) =       12.64(Ac.)
Area averaged Fm value =    0.782(In/Hr)
Depth of flow =   0.371(Ft.), Average velocity =   1.298(Ft/s)
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++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       14.000 to Point/Station       16.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
________________________________________________________________________
Estimated mean flow rate at midpoint of channel =     37.722(CFS)
Depth of flow =   0.353(Ft.), Average velocity =   1.517(Ft/s)
      ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00              1.00
      2            100.00              0.00
      3            200.00              1.00
Manning's 'N' friction factor =   0.030
------------------------------------------------------------------
Sub-Channel flow  =     18.861(CFS)
  '     '    flow top width =     70.521(Ft.)
  '     '    velocity=    1.517(Ft/s)
  '     '    area =     12.433(Sq.Ft)
  '     '    Froude number =     0.637

Upstream point elevation =  1043.600(Ft.)
Downstream point elevation =  1035.800(Ft.)
Flow length =   822.000(Ft.)
Travel time  =    9.03 min.
Time of concentration =   31.67 min.
Depth of flow =   0.353(Ft.)
Average velocity =   1.517(Ft/s)
Total irregular channel flow =    18.861(CFS)
Irregular channel normal depth above invert elev. =   0.353(Ft.)
Average velocity of channel(s) =   1.517(Ft/s)
 Adding area flow to channel
RESIDENTIAL(1 acre lot)
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
Pervious ratio(Ap) = 0.8000     Max loss rate(Fm)=     0.782(In/Hr)
Rainfall intensity =      1.922(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.534
Subarea runoff =      1.964(CFS) for    6.670(Ac.)
Total runoff =     19.807(CFS)
Effective area this stream =       19.31(Ac.)
Total Study Area (Main Stream No. 1) =       19.31(Ac.)
Area averaged Fm value =    0.782(In/Hr)
Depth of flow =   0.359(Ft.), Average velocity =   1.536(Ft/s)
```

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++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       14.000 to Point/Station       16.000
**** CONFLUENCE OF MAIN STREAMS ****
______________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =     19.310(Ac.)
Runoff from this stream =     19.807(CFS)
Time of concentration =   31.67 min.
Rainfall intensity =     1.922(In/Hr)
Area averaged loss rate (Fm) =    0.7822(In/Hr)
Area averaged Pervious ratio (Ap) = 0.8000
Program is now starting with Main Stream No. 2


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       15.000 to Point/Station       15.100
**** INITIAL AREA EVALUATION ****
______________________________________________________________________________
RESIDENTIAL(1 acre lot)
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
Pervious ratio(Ap) = 0.8000     Max loss rate(Fm)=     0.782(In/Hr)
Initial subarea data:
Initial area flow distance =   538.000(Ft.)
Top (of initial area) elevation =  1047.200(Ft.)
Bottom (of initial area) elevation =  1039.900(Ft.)
Difference in elevation =     7.300(Ft.)
Slope =    0.01357  s(%)=       1.36
TC = k(0.469)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   13.708 min.
Rainfall intensity =      3.177(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.678
Subarea runoff =      1.681(CFS)
Total initial stream area =        0.780(Ac.)
Pervious area fraction = 0.800
Initial area Fm value =    0.782(In/Hr)
```

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++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       15.100 to Point/Station       16.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
________________________________________________________________________
Estimated mean flow rate at midpoint of channel =      5.516(CFS)
Depth of flow =   0.181(Ft.), Average velocity =   0.846(Ft/s)
      ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00              1.00
      2            100.00              0.00
      3            200.00              1.00
Manning's 'N' friction factor =   0.030
------------------------------------------------------------------
Sub-Channel flow  =      2.758(CFS)
  '     '    flow top width =     36.120(Ft.)
  '     '    velocity=    0.846(Ft/s)
  '     '    area =      3.262(Sq.Ft)
  '     '    Froude number =     0.496

Upstream point elevation =  1039.900(Ft.)
Downstream point elevation =  1035.800(Ft.)
Flow length =   570.000(Ft.)
Travel time  =   11.24 min.
Time of concentration =   24.94 min.
Depth of flow =   0.181(Ft.)
Average velocity =   0.846(Ft/s)
Total irregular channel flow =     2.758(CFS)
Irregular channel normal depth above invert elev. =   0.181(Ft.)
Average velocity of channel(s) =   0.846(Ft/s)
 Adding area flow to channel
RESIDENTIAL(1 acre lot)
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
Pervious ratio(Ap) = 0.8000     Max loss rate(Fm)=     0.782(In/Hr)
Rainfall intensity =      2.218(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.583
Subarea runoff =      2.054(CFS) for    2.110(Ac.)
Total runoff =      3.735(CFS)
Effective area this stream =        2.89(Ac.)
Total Study Area (Main Stream No. 2) =       22.20(Ac.)
Area averaged Fm value =    0.782(In/Hr)
Depth of flow =   0.202(Ft.), Average velocity =   0.912(Ft/s)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       15.100 to Point/Station       16.000
**** CONFLUENCE OF MAIN STREAMS ****
________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =      2.890(Ac.)
Runoff from this stream =      3.735(CFS)
Time of concentration =   24.94 min.
Rainfall intensity =     2.218(In/Hr)
Area averaged loss rate (Fm) =    0.7822(In/Hr)
Area averaged Pervious ratio (Ap) = 0.8000
Summary of stream data:

Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)    (Ac.)       (min) (In/Hr)     (In/Hr)


1     19.81    19.310     31.67    0.782      1.922
2      3.73     2.890     24.94    0.782      2.218
Qmax(1) =
         1.000 *    1.000 *    19.807) +
         0.794 *    1.000 *     3.735) + =      22.771
Qmax(2) =
         1.260 *    0.788 *    19.807) +
         1.000 *    1.000 *     3.735) + =      23.387

Total of 2 main streams to confluence:
Flow rates before confluence point:
      20.807       4.735
Maximum flow rates at confluence using above data:
       22.771       23.387
Area of streams before confluence:
       19.310        2.890
Effective area values after confluence:
       22.200       18.097


Results of confluence:
Total flow rate =     23.387(CFS)
Time of concentration =    24.944 min.
Effective stream area after confluence  =     18.097(Ac.)
Study area average Pervious fraction(Ap) =  0.800
Study area average soil loss rate(Fm) =    0.782(In/Hr)
Study area total =      22.20(Ac.)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       16.000 to Point/Station       19.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
________________________________________________________________________
Depth of flow =   0.344(Ft.), Average velocity =   1.977(Ft/s)
      ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00              1.00
      2            100.00              0.00
      3            200.00              1.00
Manning's 'N' friction factor =   0.030
------------------------------------------------------------------
Sub-Channel flow  =     23.387(CFS)
  '     '    flow top width =     68.782(Ft.)
  '     '    velocity=    1.977(Ft/s)
  '     '    area =     11.827(Sq.Ft)
  '     '    Froude number =     0.840

Upstream point elevation =  1035.800(Ft.)
Downstream point elevation =  1034.700(Ft.)
Flow length =    66.000(Ft.)
Travel time  =    0.56 min.
Time of concentration =   25.50 min.
Depth of flow =   0.344(Ft.)
Average velocity =   1.977(Ft/s)
Total irregular channel flow =    23.387(CFS)
Irregular channel normal depth above invert elev. =   0.344(Ft.)
Average velocity of channel(s) =   1.977(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       16.000 to Point/Station       19.000
**** CONFLUENCE OF MAIN STREAMS ****
________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =     18.097(Ac.)
Runoff from this stream =     23.387(CFS)
Time of concentration =   25.50 min.
Rainfall intensity =     2.189(In/Hr)
Area averaged loss rate (Fm) =    0.7822(In/Hr)
Area averaged Pervious ratio (Ap) = 0.8000
Program is now starting with Main Stream No. 2
```

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++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       17.000 to Point/Station       18.000
**** INITIAL AREA EVALUATION ****
_____________________________________________________________________________
RESIDENTIAL(1 acre lot)
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
Pervious ratio(Ap) = 0.8000     Max loss rate(Fm)=     0.782(In/Hr)
Initial subarea data:
Initial area flow distance =   846.000(Ft.)
Top (of initial area) elevation =  1050.900(Ft.)
Bottom (of initial area) elevation =  1040.100(Ft.)
Difference in elevation =    10.800(Ft.)
Slope =    0.01277  s(%)=       1.28
TC = k(0.469)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   16.631 min.
Rainfall intensity =      2.829(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.651
Subarea runoff =     10.057(CFS)
Total initial stream area =        5.460(Ac.)
Pervious area fraction = 0.800
Initial area Fm value =    0.782(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       17.000 to Point/Station       18.000
**** CONFLUENCE OF MINOR STREAMS ****
_____________________________________________________________________________
Along Main Stream number: 2 in normal stream number 1
Stream flow area =      5.460(Ac.)
Runoff from this stream =     10.057(CFS)
Time of concentration =   16.63 min.
Rainfall intensity =     2.829(In/Hr)
Area averaged loss rate (Fm) =    0.7822(In/Hr)
Area averaged Pervious ratio (Ap) = 0.8000
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       17.100 to Point/Station       18.000
**** INITIAL AREA EVALUATION ****
_____________________________________________________________________________
COMMERCIAL subarea type
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
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.098(In/Hr)
Initial subarea data:
Initial area flow distance =   622.000(Ft.)
Top (of initial area) elevation =  1046.500(Ft.)
Bottom (of initial area) elevation =  1040.100(Ft.)
Difference in elevation =     6.400(Ft.)
Slope =    0.01029  s(%)=       1.03
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    9.952 min.
Rainfall intensity =      3.850(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.877
Subarea runoff =      2.870(CFS)
Total initial stream area =        0.850(Ac.)
Pervious area fraction = 0.100
Initial area Fm value =    0.098(In/Hr)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       17.100 to Point/Station       18.000
**** CONFLUENCE OF MINOR STREAMS ****
________________________________________________________________________
Along Main Stream number: 2 in normal stream number 2
Stream flow area =      0.850(Ac.)
Runoff from this stream =      2.870(CFS)
Time of concentration =    9.95 min.
Rainfall intensity =     3.850(In/Hr)
Area averaged loss rate (Fm) =    0.0978(In/Hr)
Area averaged Pervious ratio (Ap) = 0.1000
Summary of stream data:

Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)    (Ac.)       (min) (In/Hr)     (In/Hr)


1     10.06     5.460     16.63    0.782      2.829
2      2.87     0.850      9.95    0.098      3.850
Qmax(1) =
         1.000 *    1.000 *    10.057) +
         0.728 *    1.000 *     2.870) + =      12.146
Qmax(2) =
         1.499 *    0.598 *    10.057) +
         1.000 *    1.000 *     2.870) + =      11.890

Total of 2 streams to confluence:
Flow rates before confluence point:
      10.057       2.870
Maximum flow rates at confluence using above data:
       12.146       11.890
Area of streams before confluence:
        5.460        0.850
Effective area values after confluence:
        6.310        4.117
Results of confluence:
Total flow rate =     12.146(CFS)
Time of concentration =    16.631 min.
Effective stream area after confluence =      6.310(Ac.)
Study area average Pervious fraction(Ap) =  0.706
Study area average soil loss rate(Fm) =    0.690(In/Hr)
Study area total (this main stream) =       6.31(Ac.)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       18.000 to Point/Station       19.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
_____________________________________________________________________________
Top of street segment elevation =  1040.100(Ft.)
End of street segment elevation =  1034.700(Ft.)
Length of street segment  =   661.000(Ft.)
Height of curb above gutter flowline  =    8.0(In.)
Width of half street (curb to crown)  =  22.000(Ft.)
Distance from crown to crossfall grade break  =  20.500(Ft.)
Slope from gutter to grade break (v/hz) =   0.083
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  =  11.000(Ft.)
Slope from curb to property line (v/hz) =   0.020
Gutter width =   1.500(Ft.)
Gutter hike from flowline =  1.500(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 =     12.246(CFS)
Depth of flow =   0.432(Ft.), Average velocity =   2.101(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =  16.864(Ft.)
Flow velocity =   2.10(Ft/s)
Travel time =    5.24 min.     TC =   21.88  min.
 Adding area flow to street
COMMERCIAL subarea type
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
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.098(In/Hr)
The area added to the existing stream causes a
a lower flow rate of Q =     11.430(CFS)
therefore the upstream flow rate of Q =     12.146(CFS) is being used
Rainfall intensity =      2.400(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 =      0.000(CFS) for    0.830(Ac.)
Total runoff =     12.146(CFS)
Effective area this stream =        7.14(Ac.)
Total Study Area (Main Stream No. 2) =       29.34(Ac.)
Area averaged Fm value =    0.621(In/Hr)
Street flow at end of street =     12.146(CFS)
Half street flow at end of street =      6.073(CFS)
Depth of flow =   0.431(Ft.), Average velocity =   2.096(Ft/s)
Flow width (from curb towards crown)=  16.810(Ft.)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       18.000 to Point/Station       19.000
**** CONFLUENCE OF MAIN STREAMS ****
________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =      7.140(Ac.)
Runoff from this stream =     12.146(CFS)
Time of concentration =   21.88 min.
Rainfall intensity =     2.400(In/Hr)
Area averaged loss rate (Fm) =    0.6212(In/Hr)
Area averaged Pervious ratio (Ap) = 0.6353
Summary of stream data:

Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)    (Ac.)       (min) (In/Hr)     (In/Hr)


1     23.39    18.097     25.50    0.782      2.189
2     12.15     7.140     21.88    0.621      2.400
Qmax(1) =
         1.000 *    1.000 *    23.387) +
         0.881 *    1.000 *    12.146) + =      34.093
Qmax(2) =
         1.150 *    0.858 *    23.387) +
         1.000 *    1.000 *    12.146) + =      35.217

Total of 2 main streams to confluence:
Flow rates before confluence point:
      24.387      13.146
Maximum flow rates at confluence using above data:
       34.093       35.217
Area of streams before confluence:
       18.097        7.140
Effective area values after confluence:
       25.237       22.665


Results of confluence:
Total flow rate =     35.217(CFS)
Time of concentration =    21.875 min.
Effective stream area after confluence  =     22.665(Ac.)
Study area average Pervious fraction(Ap) =  0.753
Study area average soil loss rate(Fm) =    0.737(In/Hr)
Study area total =      25.24(Ac.)
End of computations, Total Study Area =           29.34 (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) = 0.760
Area averaged SCS curve number =  32.0
```

San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2014 Version 9.0
Rational Hydrology Study Date: 04/20/21

BLOOMINGTON COMMERCE CENTER - SITE 4
EXISTING CONDITION
100-YEAR STORM ANALYSIS WITH ADJUSTED 25 YEAR RAINFALL DATA

Program License Serial Number 6405

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

Rational hydrology study storm event year is 100.0
Computed rainfall intensity:
Storm year = 100.00 1 hour rainfall = 1.010 (In.)
Slope used for rainfall intensity curve b = 0.6000
Soil antecedent moisture condition (AMC) = 2

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       12.000 to Point/Station       13.000
**** INITIAL AREA EVALUATION ****
_____________________________________________________________________________
RESIDENTIAL(1 acre lot)
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
Pervious ratio(Ap) = 0.8000     Max loss rate(Fm)=     0.782(In/Hr)
Initial subarea data:
Initial area flow distance =   323.000(Ft.)
Top (of initial area) elevation =  1055.800(Ft.)
Bottom (of initial area) elevation =  1049.100(Ft.)
Difference in elevation =     6.700(Ft.)
Slope =    0.02074  s(%)=       2.07
TC = k(0.469)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   10.268 min.
Rainfall intensity =      2.913(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.658
Subarea runoff =      2.416(CFS)
Total initial stream area =        1.260(Ac.)
Pervious area fraction = 0.800
Initial area Fm value =    0.782(In/Hr)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       13.000 to Point/Station       14.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
____________________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.257(Ft.), Average velocity =   1.016(Ft/s)
      ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00              1.00
      2            100.00              0.00
      3            200.00              1.00
Manning's 'N' friction factor =   0.030
------------------------------------------------------------------
Sub-Channel flow  =      6.704(CFS)
  '     '    flow top width =     51.375(Ft.)
  '     '    velocity=    1.016(Ft/s)
  '     '    area =      6.598(Sq.Ft)
  '     '    Froude number =     0.500

Upstream point elevation =  1049.100(Ft.)
Downstream point elevation =  1043.600(Ft.)
Flow length =   847.000(Ft.)
Travel time  =   13.89 min.
Time of concentration =   24.16 min.
Depth of flow =   0.257(Ft.)
Average velocity =   1.016(Ft/s)
Total irregular channel flow =     6.704(CFS)
Irregular channel normal depth above invert elev. =   0.257(Ft.)
Average velocity of channel(s) =   1.016(Ft/s)
 Adding area flow to channel
RESIDENTIAL(1 acre lot)
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
Pervious ratio(Ap) = 0.8000     Max loss rate(Fm)=     0.782(In/Hr)
Rainfall intensity =      1.743(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.496
Subarea runoff =      8.515(CFS) for   11.380(Ac.)
Total runoff =     10.931(CFS)
Effective area this stream =       12.64(Ac.)
Total Study Area (Main Stream No. 1) =       12.64(Ac.)
Area averaged Fm value =    0.782(In/Hr)
Depth of flow =   0.309(Ft.), Average velocity =   1.148(Ft/s)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       14.000 to Point/Station       16.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
____________________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.288(Ft.), Average velocity =   1.325(Ft/s)
      ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1             0.00              1.00
      2           100.00              0.00
      3           200.00              1.00
Manning's 'N' friction factor =   0.030
------------------------------------------------------------------
Sub-Channel flow  =     10.979(CFS)
  '     '    flow top width =     57.570(Ft.)
  '     '    velocity=    1.325(Ft/s)
  '     '    area =      8.286(Sq.Ft)
  '     '    Froude number =     0.616

Upstream point elevation =  1043.600(Ft.)
Downstream point elevation =  1035.800(Ft.)
Flow length =   822.000(Ft.)
Travel time  =   10.34 min.
Time of concentration =   34.50 min.
Depth of flow =   0.288(Ft.)
Average velocity =   1.325(Ft/s)
Total irregular channel flow =    10.979(CFS)
Irregular channel normal depth above invert elev. =   0.288(Ft.)
Average velocity of channel(s) =   1.325(Ft/s)
 Adding area flow to channel
RESIDENTIAL(1 acre lot)
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
Pervious ratio(Ap) = 0.8000     Max loss rate(Fm)=     0.782(In/Hr)
The area added to the existing stream causes a
a lower flow rate of Q =     10.870(CFS)
therefore the upstream flow rate of Q =     10.931(CFS) is being used
Rainfall intensity =      1.408(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.400
Subarea runoff =      0.000(CFS) for    6.670(Ac.)
Total runoff =     10.931(CFS)
Effective area this stream =       19.31(Ac.)
Total Study Area (Main Stream No. 1) =       19.31(Ac.)
Area averaged Fm value =    0.782(In/Hr)
Depth of flow =   0.287(Ft.), Average velocity =   1.324(Ft/s)
```

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++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       14.000 to Point/Station       16.000
**** CONFLUENCE OF MAIN STREAMS ****
_____________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =     19.310(Ac.)
Runoff from this stream =     10.931(CFS)
Time of concentration =   34.50 min.
Rainfall intensity =     1.408(In/Hr)
Area averaged loss rate (Fm) =    0.7822(In/Hr)
Area averaged Pervious ratio (Ap) = 0.8000
Program is now starting with Main Stream No. 2
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       15.000 to Point/Station       15.100
**** INITIAL AREA EVALUATION ****
_____________________________________________________________________________
RESIDENTIAL(1 acre lot)
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
Pervious ratio(Ap) = 0.8000     Max loss rate(Fm)=     0.782(In/Hr)
Initial subarea data:
Initial area flow distance =   538.000(Ft.)
Top (of initial area) elevation =  1047.200(Ft.)
Bottom (of initial area) elevation =  1039.900(Ft.)
Difference in elevation =     7.300(Ft.)
Slope =    0.01357  s(%)=       1.36
TC = k(0.469)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   13.708 min.
Rainfall intensity =      2.449(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.613
Subarea runoff =      1.170(CFS)
Total initial stream area =        0.780(Ac.)
Pervious area fraction = 0.800
Initial area Fm value =    0.782(In/Hr)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       15.100 to Point/Station       16.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
________________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.153(Ft.), Average velocity =   0.757(Ft/s)
      ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00              1.00
      2            100.00              0.00
      3            200.00              1.00
Manning's 'N' friction factor =   0.030
------------------------------------------------------------------
Sub-Channel flow  =      1.767(CFS)
  '     '    flow top width =     30.569(Ft.)
  '     '    velocity=    0.757(Ft/s)
  '     '    area =      2.336(Sq.Ft)
  '     '    Froude number =     0.482

Upstream point elevation =  1039.900(Ft.)
Downstream point elevation =  1035.800(Ft.)
Flow length =   570.000(Ft.)
Travel time  =   12.56 min.
Time of concentration =   26.27 min.
Depth of flow =   0.153(Ft.)
Average velocity =   0.757(Ft/s)
Total irregular channel flow =     1.767(CFS)
Irregular channel normal depth above invert elev. =   0.153(Ft.)
Average velocity of channel(s) =   0.757(Ft/s)
 Adding area flow to channel
RESIDENTIAL(1 acre lot)
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
Pervious ratio(Ap) = 0.8000     Max loss rate(Fm)=     0.782(In/Hr)
Rainfall intensity =      1.658(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.475
Subarea runoff =      1.108(CFS) for    2.110(Ac.)
Total runoff =      2.278(CFS)
Effective area this stream =        2.89(Ac.)
Total Study Area (Main Stream No. 2) =       22.20(Ac.)
Area averaged Fm value =    0.782(In/Hr)
Depth of flow =   0.168(Ft.), Average velocity =   0.806(Ft/s)
```

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++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       15.100 to Point/Station       16.000
**** CONFLUENCE OF MAIN STREAMS ****
________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =      2.890(Ac.)
Runoff from this stream =      2.278(CFS)
Time of concentration =   26.27 min.
Rainfall intensity =     1.658(In/Hr)
Area averaged loss rate (Fm) =    0.7822(In/Hr)
Area averaged Pervious ratio (Ap) = 0.8000
Summary of stream data:

Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)    (Ac.)        (min) (In/Hr)     (In/Hr)


1     10.93    19.310     34.50    0.782      1.408
2      2.28     2.890     26.27    0.782      1.658
Qmax(1) =
         1.000 *    1.000 *    10.931) +
         0.714 *    1.000 *     2.278) + =      12.558
Qmax(2) =
         1.400 *    0.761 *    10.931) +
         1.000 *    1.000 *     2.278) + =      13.930

Total of 2 main streams to confluence:
Flow rates before confluence point:
      11.931       3.278
Maximum flow rates at confluence using above data:
       12.558       13.930
Area of streams before confluence:
       19.310        2.890
Effective area values after confluence:
       22.200       17.591


Results of confluence:
Total flow rate =     13.930(CFS)
Time of concentration =    26.266 min.
Effective stream area after confluence  =     17.591(Ac.)
Study area average Pervious fraction(Ap) =  0.800
Study area average soil loss rate(Fm) =    0.782(In/Hr)
Study area total =      22.20(Ac.)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       16.000 to Point/Station       19.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
____________________________________________________________________________
Depth of flow =   0.283(Ft.), Average velocity =   1.737(Ft/s)
      ******* Irregular Channel Data ***********
----------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00              1.00
      2            100.00              0.00
      3            200.00              1.00
Manning's 'N' friction factor =   0.030
----------------------------------------------------------------
Sub-Channel flow  =     13.930(CFS)
  '     '    flow top width =     56.636(Ft.)
  '     '    velocity=    1.737(Ft/s)
  '     '    area =      8.019(Sq.Ft)
  '     '    Froude number =     0.814

Upstream point elevation =  1035.800(Ft.)
Downstream point elevation =  1034.700(Ft.)
Flow length =    66.000(Ft.)
Travel time  =    0.63 min.
Time of concentration =   26.90 min.
Depth of flow =   0.283(Ft.)
Average velocity =   1.737(Ft/s)
Total irregular channel flow =    13.930(CFS)
Irregular channel normal depth above invert elev. =   0.283(Ft.)
Average velocity of channel(s) =   1.737(Ft/s)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       16.000 to Point/Station       19.000
**** CONFLUENCE OF MAIN STREAMS ****
_____________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =     17.591(Ac.)
Runoff from this stream =     13.930(CFS)
Time of concentration =   26.90 min.
Rainfall intensity =     1.634(In/Hr)
Area averaged loss rate (Fm) =    0.7822(In/Hr)
Area averaged Pervious ratio (Ap) = 0.8000
Program is now starting with Main Stream No. 2
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       17.000 to Point/Station       18.000
**** INITIAL AREA EVALUATION ****
_____________________________________________________________________________
RESIDENTIAL(1 acre lot)
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
Pervious ratio(Ap) = 0.8000     Max loss rate(Fm)=     0.782(In/Hr)
Initial subarea data:
Initial area flow distance =   846.000(Ft.)
Top (of initial area) elevation =  1050.900(Ft.)
Bottom (of initial area) elevation =  1040.100(Ft.)
Difference in elevation =    10.800(Ft.)
Slope =    0.01277  s(%)=       1.28
TC = k(0.469)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   16.631 min.
Rainfall intensity =      2.181(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.577
Subarea runoff =      6.874(CFS)
Total initial stream area =        5.460(Ac.)
Pervious area fraction = 0.800
Initial area Fm value =    0.782(In/Hr)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       17.000 to Point/Station       18.000
**** CONFLUENCE OF MINOR STREAMS ****
____________________________________________________________________________
Along Main Stream number: 2 in normal stream number 1
Stream flow area =      5.460(Ac.)
Runoff from this stream =      6.874(CFS)
Time of concentration =   16.63 min.
Rainfall intensity =     2.181(In/Hr)
Area averaged loss rate (Fm) =    0.7822(In/Hr)
Area averaged Pervious ratio (Ap) = 0.8000
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       17.100 to Point/Station       18.000
**** INITIAL AREA EVALUATION ****
_____________________________________________________________________________
COMMERCIAL subarea type
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
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.098(In/Hr)
Initial subarea data:
Initial area flow distance =   622.000(Ft.)
Top (of initial area) elevation =  1046.500(Ft.)
Bottom (of initial area) elevation =  1040.100(Ft.)
Difference in elevation =     6.400(Ft.)
Slope =    0.01029  s(%)=       1.03
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    9.952 min.
Rainfall intensity =      2.968(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.870
Subarea runoff =      2.196(CFS)
Total initial stream area =        0.850(Ac.)
Pervious area fraction = 0.100
Initial area Fm value =    0.098(In/Hr)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       17.100 to Point/Station       18.000
**** CONFLUENCE OF MINOR STREAMS ****
________________________________________________________________________
Along Main Stream number: 2 in normal stream number 2
Stream flow area =      0.850(Ac.)
Runoff from this stream =      2.196(CFS)
Time of concentration =    9.95 min.
Rainfall intensity =     2.968(In/Hr)
Area averaged loss rate (Fm) =    0.0978(In/Hr)
Area averaged Pervious ratio (Ap) = 0.1000
Summary of stream data:

Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)    (Ac.)       (min) (In/Hr)     (In/Hr)


1      6.87     5.460     16.63    0.782      2.181
2      2.20     0.850      9.95    0.098      2.968
Qmax(1) =
         1.000 *    1.000 *     6.874) +
         0.726 *    1.000 *     2.196) + =       8.467
Qmax(2) =
         1.563 *    0.598 *     6.874) +
         1.000 *    1.000 *     2.196) + =       8.623

Total of 2 streams to confluence:
Flow rates before confluence point:
       6.874       2.196
Maximum flow rates at confluence using above data:
        8.467        8.623
Area of streams before confluence:
        5.460        0.850
Effective area values after confluence:
        6.310        4.117
Results of confluence:
Total flow rate =      8.623(CFS)
Time of concentration =     9.952 min.
Effective stream area after confluence =      4.117(Ac.)
Study area average Pervious fraction(Ap) =  0.706
Study area average soil loss rate(Fm) =    0.690(In/Hr)
Study area total (this main stream) =       6.31(Ac.)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       18.000 to Point/Station       19.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
_____________________________________________________________________________
Top of street segment elevation =  1040.100(Ft.)
End of street segment elevation =  1034.700(Ft.)
Length of street segment  =   661.000(Ft.)
Height of curb above gutter flowline  =    8.0(In.)
Width of half street (curb to crown)  =  22.000(Ft.)
Distance from crown to crossfall grade break  =  20.500(Ft.)
Slope from gutter to grade break (v/hz) =   0.083
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  =  11.000(Ft.)
Slope from curb to property line (v/hz) =   0.020
Gutter width =   1.500(Ft.)
Gutter hike from flowline =  1.500(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 =      8.678(CFS)
Depth of flow =   0.390(Ft.), Average velocity =   1.934(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =  14.737(Ft.)
Flow velocity =   1.93(Ft/s)
Travel time =    5.70 min.     TC =   15.65  min.
 Adding area flow to street
COMMERCIAL subarea type
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
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.098(In/Hr)
The area added to the existing stream causes a
a lower flow rate of Q =      7.443(CFS)
therefore the upstream flow rate of Q =      8.623(CFS) is being used
Rainfall intensity =      2.262(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.665
Subarea runoff =      0.000(CFS) for    0.830(Ac.)
Total runoff =      8.623(CFS)
Effective area this stream =        4.95(Ac.)
Total Study Area (Main Stream No. 2) =       29.34(Ac.)
Area averaged Fm value =    0.591(In/Hr)
Street flow at end of street =      8.623(CFS)
Half street flow at end of street =      4.312(CFS)
Depth of flow =   0.389(Ft.), Average velocity =   1.932(Ft/s)
Flow width (from curb towards crown)=  14.700(Ft.)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       18.000 to Point/Station       19.000
**** CONFLUENCE OF MAIN STREAMS ****
________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =      4.947(Ac.)
Runoff from this stream =      8.623(CFS)
Time of concentration =   15.65 min.
Rainfall intensity =     2.262(In/Hr)
Area averaged loss rate (Fm) =    0.5907(In/Hr)
Area averaged Pervious ratio (Ap) = 0.6041
Summary of stream data:

Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)    (Ac.)        (min) (In/Hr)     (In/Hr)


1     13.93    17.591     26.90    0.782      1.634
2      8.62     4.947     15.65    0.591      2.262
Qmax(1) =
         1.000 *    1.000 *    13.930) +
         0.624 *    1.000 *     8.623) + =      19.314
Qmax(2) =
         1.737 *    0.582 *    13.930) +
         1.000 *    1.000 *     8.623) + =      22.696

Total of 2 main streams to confluence:
Flow rates before confluence point:
      14.930       9.623
Maximum flow rates at confluence using above data:
       19.314       22.696
Area of streams before confluence:
       17.591        4.947
Effective area values after confluence:
       22.538       15.180


Results of confluence:
Total flow rate =     22.696(CFS)
Time of concentration =    15.647 min.
Effective stream area after confluence  =     15.180(Ac.)
Study area average Pervious fraction(Ap) =  0.757
Study area average soil loss rate(Fm) =    0.740(In/Hr)
Study area total =      22.54(Ac.)
End of computations, Total Study Area =           29.34 (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) = 0.760
Area averaged SCS curve number =  32.0
```

San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2014 Version 9.0
Rational Hydrology Study Date: 04/06/21

BLOOMINGTON COMMERCE CENTER
PROPOSED CONDITION
100-YEAR STORM EVENT ANALYSIS

Program License Serial Number 6405

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

Rational hydrology study storm event year is 100.0
Computed rainfall intensity:
Storm year = 100.00 1 hour rainfall = 1.310 (In.)
Slope used for rainfall intensity curve b = 0.6000
Soil antecedent moisture condition (AMC) = 2

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       10.000 to Point/Station       11.000
**** INITIAL AREA EVALUATION ****

______________________________________________________________________________
RESIDENTIAL(1 acre lot)
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
Pervious ratio(Ap) = 0.8000     Max loss rate(Fm)=     0.782(In/Hr)
Initial subarea data:
Initial area flow distance =   323.000(Ft.)
Top (of initial area) elevation =  1055.800(Ft.)
Bottom (of initial area) elevation =  1049.100(Ft.)
Difference in elevation =     6.700(Ft.)
Slope =    0.02074  s(%)=       2.07
TC = k(0.469)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   10.268 min.
Rainfall intensity =      3.778(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.714
Subarea runoff =      3.397(CFS)
Total initial stream area =        1.260(Ac.)
Pervious area fraction = 0.800
Initial area Fm value =    0.782(In/Hr)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       11.000 to Point/Station       12.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
________________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.306(Ft.), Average velocity =   1.141(Ft/s)
      ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00              1.00
      2            100.00              0.00
      3            200.00              1.00
Manning's 'N' friction factor =   0.030
------------------------------------------------------------------
Sub-Channel flow  =     10.653(CFS)
  '     '    flow top width =     61.117(Ft.)
  '     '    velocity=    1.141(Ft/s)
  '     '    area =      9.338(Sq.Ft)
  '     '    Froude number =     0.514

Upstream point elevation =  1049.100(Ft.)
Downstream point elevation =  1043.600(Ft.)
Flow length =   847.000(Ft.)
Travel time  =   12.37 min.
Time of concentration =   22.64 min.
Depth of flow =   0.306(Ft.)
Average velocity =   1.141(Ft/s)
Total irregular channel flow =    10.653(CFS)
Irregular channel normal depth above invert elev. =   0.306(Ft.)
Average velocity of channel(s) =   1.141(Ft/s)
 Adding area flow to channel
RESIDENTIAL(1 acre lot)
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
Pervious ratio(Ap) = 0.8000     Max loss rate(Fm)=     0.782(In/Hr)
Rainfall intensity =      2.351(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.601
Subarea runoff =     14.446(CFS) for   11.380(Ac.)
Total runoff =     17.843(CFS)
Effective area this stream =       12.64(Ac.)
Total Study Area (Main Stream No. 1) =       12.64(Ac.)
Area averaged Fm value =    0.782(In/Hr)
Depth of flow =   0.371(Ft.), Average velocity =   1.298(Ft/s)
```

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++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       12.000 to Point/Station       13.300
**** IMPROVED CHANNEL TRAVEL TIME ****
_____________________________________________________________________________
Upstream point elevation =  1042.700(Ft.)
Downstream point elevation =  1040.100(Ft.)
Channel length thru subarea  =   308.000(Ft.)
Channel base width      =    8.000(Ft.)
Slope or 'Z' of left channel bank = 100.000
Slope or 'Z' of right channel bank = 100.000
Manning's 'N'    = 0.020
Maximum depth of channel  =    1.000(Ft.)
Flow(q) thru subarea =     17.843(CFS)
Depth of flow =   0.266(Ft.), Average velocity =   1.933(Ft/s)
Channel flow top width =   61.296(Ft.)
Flow Velocity =    1.93(Ft/s)
Travel time  =    2.66 min.
Time of concentration =   25.30 min.
Critical depth =      0.252(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       12.000 to Point/Station       13.300
**** CONFLUENCE OF MAIN STREAMS ****
_____________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =     12.640(Ac.)
Runoff from this stream =     17.843(CFS)
Time of concentration =   25.30 min.
Rainfall intensity =     2.199(In/Hr)
Area averaged loss rate (Fm) =    0.7822(In/Hr)
Area averaged Pervious ratio (Ap) = 0.8000
Program is now starting with Main Stream No. 2
```

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++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       13.100 to Point/Station       13.300
**** INITIAL AREA EVALUATION ****
_____________________________________________________________________________
RESIDENTIAL(1 acre lot)
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
Pervious ratio(Ap) = 0.8000     Max loss rate(Fm)=     0.782(In/Hr)
Initial subarea data:
Initial area flow distance =   846.000(Ft.)
Top (of initial area) elevation =  1050.900(Ft.)
Bottom (of initial area) elevation =  1040.100(Ft.)
Difference in elevation =    10.800(Ft.)
Slope =    0.01277  s(%)=       1.28
TC = k(0.469)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   16.631 min.
Rainfall intensity =      2.829(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.651
Subarea runoff =     10.057(CFS)
Total initial stream area =        5.460(Ac.)
Pervious area fraction = 0.800
Initial area Fm value =    0.782(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       13.100 to Point/Station       13.300
**** CONFLUENCE OF MAIN STREAMS ****
_____________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =      5.460(Ac.)
Runoff from this stream =     10.057(CFS)
Time of concentration =   16.63 min.
Rainfall intensity =     2.829(In/Hr)
Area averaged loss rate (Fm) =    0.7822(In/Hr)
Area averaged Pervious ratio (Ap) = 0.8000
Program is now starting with Main Stream No. 3
```

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++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       13.200 to Point/Station       13.300
**** INITIAL AREA EVALUATION ****

____________________________________________________________________________
COMMERCIAL subarea type
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
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.098(In/Hr)
Initial subarea data:
Initial area flow distance =   622.000(Ft.)
Top (of initial area) elevation =  1046.500(Ft.)
Bottom (of initial area) elevation =  1040.100(Ft.)
Difference in elevation =     6.400(Ft.)
Slope =    0.01029  s(%)=       1.03
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    9.952 min.
Rainfall intensity =      3.850(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.877
Subarea runoff =      1.486(CFS)
Total initial stream area =        0.440(Ac.)
Pervious area fraction = 0.100
Initial area Fm value =    0.098(In/Hr)
```

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++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       13.200 to Point/Station       13.300
**** CONFLUENCE OF MAIN STREAMS ****
________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 3
Stream flow area =      0.440(Ac.)
Runoff from this stream =      1.486(CFS)
Time of concentration =    9.95 min.
Rainfall intensity =     3.850(In/Hr)
Area averaged loss rate (Fm) =    0.0978(In/Hr)
Area averaged Pervious ratio (Ap) = 0.1000
Summary of stream data:

Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)    (Ac.)       (min) (In/Hr)     (In/Hr)


1     17.84    12.640     25.30    0.782      2.199
2     10.06     5.460     16.63    0.782      2.829
3      1.49     0.440      9.95    0.098      3.850
Qmax(1) =
         1.000 *    1.000 *    17.843) +
         0.692 *    1.000 *    10.057) +
         0.560 *    1.000 *     1.486) + =      25.639
Qmax(2) =
         1.444 *    0.657 *    17.843) +
         1.000 *    1.000 *    10.057) +
         0.728 *    1.000 *     1.486) + =      28.079
Qmax(3) =
         2.164 *    0.393 *    17.843) +
         1.499 *    0.598 *    10.057) +
         1.000 *    1.000 *     1.486) + =      25.698

Total of 3 main streams to confluence:
Flow rates before confluence point:
      18.843      11.057       2.486
Maximum flow rates at confluence using above data:
       25.639       28.079       25.698
Area of streams before confluence:
       12.640        5.460        0.440
Effective area values after confluence:
       18.540       14.209        8.680


Results of confluence:
Total flow rate =     28.079(CFS)
Time of concentration =    16.631 min.
Effective stream area after confluence  =     14.209(Ac.)
Study area average Pervious fraction(Ap) =  0.783
Study area average soil loss rate(Fm) =    0.766(In/Hr)
Study area total =      18.54(Ac.)
```

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++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       13.300 to Point/Station       15.100
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
____________________________________________________________________________
Top of street segment elevation =  1040.100(Ft.)
End of street segment elevation =  1034.500(Ft.)
Length of street segment  =   663.000(Ft.)
Height of curb above gutter flowline  =    8.0(In.)
Width of half street (curb to crown)  =  22.000(Ft.)
Distance from crown to crossfall grade break  =  20.000(Ft.)
Slope from gutter to grade break (v/hz) =   0.083
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  =  11.000(Ft.)
Slope from curb to property line (v/hz) =   0.020
Gutter width =   1.500(Ft.)
Gutter hike from flowline =  0.125(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 =     28.137(CFS)
Depth of flow =   0.430(Ft.), Average velocity =   3.184(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =  20.922(Ft.)
Flow velocity =   3.18(Ft/s)
Travel time =    3.47 min.     TC =   20.10  min.
 Adding area flow to street
COMMERCIAL subarea type
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
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.098(In/Hr)
The area added to the existing stream causes a
a lower flow rate of Q =     23.519(CFS)
therefore the upstream flow rate of Q =     28.079(CFS) is being used
Rainfall intensity =      2.525(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.635
Subarea runoff =      0.000(CFS) for    0.470(Ac.)
Total runoff =     28.079(CFS)
Effective area this stream =       14.68(Ac.)
Total Study Area (Main Stream No. 1) =       19.01(Ac.)
Area averaged Fm value =    0.745(In/Hr)
Street flow at end of street =     28.079(CFS)
Half street flow at end of street =     14.039(CFS)
Depth of flow =   0.430(Ft.), Average velocity =   3.183(Ft/s)
Flow width (from curb towards crown)=  20.906(Ft.)
```

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++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       13.300 to Point/Station       15.100
**** CONFLUENCE OF MAIN STREAMS ****
______________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =     14.679(Ac.)
Runoff from this stream =     28.079(CFS)
Time of concentration =   20.10 min.
Rainfall intensity =     2.525(In/Hr)
Area averaged loss rate (Fm) =    0.7446(In/Hr)
Area averaged Pervious ratio (Ap) = 0.7615
Program is now starting with Main Stream No. 2


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       14.000 to Point/Station       15.000
**** 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)  = 32.00
Pervious ratio(Ap) = 0.1500     Max loss rate(Fm)=     0.147(In/Hr)
Initial subarea data:
Initial area flow distance =   852.000(Ft.)
Top (of initial area) elevation =  1050.600(Ft.)
Bottom (of initial area) elevation =  1039.200(Ft.)
Difference in elevation =    11.400(Ft.)
Slope =    0.01338  s(%)=       1.34
TC = k(0.311)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   10.973 min.
Rainfall intensity =      3.630(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.864
Subarea runoff =     29.943(CFS)
Total initial stream area =        9.550(Ac.)
Pervious area fraction = 0.150
Initial area Fm value =    0.147(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       15.000 to Point/Station       15.100
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________________
Upstream point/station elevation =  1036.700(Ft.)
Downstream point/station elevation =  1034.500(Ft.)
Pipe length  =   120.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    29.943(CFS)
Nearest computed pipe diameter  =     24.00(In.)
Calculated individual pipe flow  =    29.943(CFS)
Normal flow depth in pipe =   19.22(In.)
Flow top width inside pipe =   19.17(In.)
Critical Depth =   22.33(In.)
Pipe flow velocity =     11.11(Ft/s)
Travel time through pipe =    0.18 min.
Time of concentration (TC) =    11.15 min.
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       15.000 to Point/Station       15.100
**** CONFLUENCE OF MAIN STREAMS ****
________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =      9.550(Ac.)
Runoff from this stream =     29.943(CFS)
Time of concentration =   11.15 min.
Rainfall intensity =     3.595(In/Hr)
Area averaged loss rate (Fm) =    0.1467(In/Hr)
Area averaged Pervious ratio (Ap) = 0.1500
Summary of stream data:

Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)    (Ac.)       (min) (In/Hr)     (In/Hr)


1     28.08    14.679     20.10    0.745      2.525
2     29.94     9.550     11.15    0.147      3.595
Qmax(1) =
         1.000 *    1.000 *    28.079) +
         0.690 *    1.000 *    29.943) + =      48.728
Qmax(2) =
         1.601 *    0.555 *    28.079) +
         1.000 *    1.000 *    29.943) + =      54.890

Total of 2 main streams to confluence:
Flow rates before confluence point:
      29.079      30.943
Maximum flow rates at confluence using above data:
       48.728       54.890
Area of streams before confluence:
       14.679        9.550
Effective area values after confluence:
       24.229       17.695


Results of confluence:
Total flow rate =     54.890(CFS)
Time of concentration =    11.153 min.
Effective stream area after confluence  =     17.695(Ac.)
Study area average Pervious fraction(Ap) =  0.520
Study area average soil loss rate(Fm) =    0.509(In/Hr)
Study area total =      24.23(Ac.)
End of computations, Total Study Area =           28.56 (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) = 0.560
Area averaged SCS curve number =  32.0
```

San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2014 Version 9.0
Rational Hydrology Study Date: 04/06/21

BLOOMINGTON COMMERCE CENTER - SITE 4
EXISTING CONDITION
25-YEAR STORM EVENT ANALYSIS

Program License Serial Number 6405

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

Rational hydrology study storm event year is 25.0
Computed rainfall intensity:
Storm year = 25.00 1 hour rainfall = 1.010 (In.)
Slope used for rainfall intensity curve b = 0.6000
Soil antecedent moisture condition (AMC) = 2

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       12.000 to Point/Station       13.000
**** INITIAL AREA EVALUATION ****

______________________________________________________________________________
RESIDENTIAL(1 acre lot)
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
Pervious ratio(Ap) = 0.8000     Max loss rate(Fm)=     0.782(In/Hr)
Initial subarea data:
Initial area flow distance =   323.000(Ft.)
Top (of initial area) elevation =  1055.800(Ft.)
Bottom (of initial area) elevation =  1049.100(Ft.)
Difference in elevation =     6.700(Ft.)
Slope =    0.02074  s(%)=       2.07
TC = k(0.469)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   10.268 min.
Rainfall intensity =      2.913(In/Hr) for a    25.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.658
Subarea runoff =      2.416(CFS)
Total initial stream area =        1.260(Ac.)
Pervious area fraction = 0.800
Initial area Fm value =    0.782(In/Hr)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       13.000 to Point/Station       14.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
____________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.257(Ft.), Average velocity =   1.016(Ft/s)
      ******* Irregular Channel Data ***********
--------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00              1.00
      2            100.00              0.00
      3            200.00              1.00
Manning's 'N' friction factor =   0.030
--------------------------------------------------------------------
Sub-Channel flow  =      6.704(CFS)
  '     '    flow top width =     51.375(Ft.)
  '     '    velocity=    1.016(Ft/s)
  '     '    area =      6.598(Sq.Ft)
  '     '    Froude number =     0.500

Upstream point elevation =  1049.100(Ft.)
Downstream point elevation =  1043.600(Ft.)
Flow length =   847.000(Ft.)
Travel time  =   13.89 min.
Time of concentration =   24.16 min.
Depth of flow =   0.257(Ft.)
Average velocity =   1.016(Ft/s)
Total irregular channel flow =     6.704(CFS)
Irregular channel normal depth above invert elev. =   0.257(Ft.)
Average velocity of channel(s) =   1.016(Ft/s)
 Adding area flow to channel
RESIDENTIAL(1 acre lot)
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
Pervious ratio(Ap) = 0.8000     Max loss rate(Fm)=     0.782(In/Hr)
Rainfall intensity =      1.743(In/Hr) for a    25.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.496
Subarea runoff =      8.515(CFS) for   11.380(Ac.)
Total runoff =     10.931(CFS)
Effective area this stream =       12.64(Ac.)
Total Study Area (Main Stream No. 1) =       12.64(Ac.)
Area averaged Fm value =    0.782(In/Hr)
Depth of flow =   0.309(Ft.), Average velocity =   1.148(Ft/s)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       14.000 to Point/Station       16.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
________________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.288(Ft.), Average velocity =   1.325(Ft/s)
      ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00              1.00
      2            100.00              0.00
      3            200.00              1.00
Manning's 'N' friction factor =   0.030
------------------------------------------------------------------
Sub-Channel flow  =     10.979(CFS)
  '     '    flow top width =     57.570(Ft.)
  '     '    velocity=    1.325(Ft/s)
  '     '    area =      8.286(Sq.Ft)
  '     '    Froude number =     0.616

Upstream point elevation =  1043.600(Ft.)
Downstream point elevation =  1035.800(Ft.)
Flow length =   822.000(Ft.)
Travel time  =   10.34 min.
Time of concentration =   34.50 min.
Depth of flow =   0.288(Ft.)
Average velocity =   1.325(Ft/s)
Total irregular channel flow =    10.979(CFS)
Irregular channel normal depth above invert elev. =   0.288(Ft.)
Average velocity of channel(s) =   1.325(Ft/s)
 Adding area flow to channel
RESIDENTIAL(1 acre lot)
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
Pervious ratio(Ap) = 0.8000     Max loss rate(Fm)=     0.782(In/Hr)
The area added to the existing stream causes a
a lower flow rate of Q =     10.870(CFS)
therefore the upstream flow rate of Q =     10.931(CFS) is being used
Rainfall intensity =      1.408(In/Hr) for a    25.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.400
Subarea runoff =      0.000(CFS) for    6.670(Ac.)
Total runoff =     10.931(CFS)
Effective area this stream =       19.31(Ac.)
Total Study Area (Main Stream No. 1) =       19.31(Ac.)
Area averaged Fm value =    0.782(In/Hr)
Depth of flow =   0.287(Ft.), Average velocity =   1.324(Ft/s)
```

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++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       14.000 to Point/Station       16.000
**** CONFLUENCE OF MAIN STREAMS ****
______________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =     19.310(Ac.)
Runoff from this stream =     10.931(CFS)
Time of concentration =   34.50 min.
Rainfall intensity =     1.408(In/Hr)
Area averaged loss rate (Fm) =    0.7822(In/Hr)
Area averaged Pervious ratio (Ap) = 0.8000
Program is now starting with Main Stream No. 2


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       15.000 to Point/Station       15.100
**** INITIAL AREA EVALUATION ****
______________________________________________________________________________
RESIDENTIAL(1 acre lot)
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
Pervious ratio(Ap) = 0.8000     Max loss rate(Fm)=     0.782(In/Hr)
Initial subarea data:
Initial area flow distance =   538.000(Ft.)
Top (of initial area) elevation =  1047.200(Ft.)
Bottom (of initial area) elevation =  1039.900(Ft.)
Difference in elevation =     7.300(Ft.)
Slope =    0.01357  s(%)=       1.36
TC = k(0.469)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   13.708 min.
Rainfall intensity =      2.449(In/Hr) for a    25.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.613
Subarea runoff =      1.170(CFS)
Total initial stream area =        0.780(Ac.)
Pervious area fraction = 0.800
Initial area Fm value =    0.782(In/Hr)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       15.100 to Point/Station       16.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
________________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.153(Ft.), Average velocity =   0.757(Ft/s)
      ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00              1.00
      2            100.00              0.00
      3            200.00              1.00
Manning's 'N' friction factor =   0.030
------------------------------------------------------------------
Sub-Channel flow  =      1.767(CFS)
  '     '    flow top width =     30.569(Ft.)
  '     '    velocity=    0.757(Ft/s)
  '     '    area =      2.336(Sq.Ft)
  '     '    Froude number =     0.482

Upstream point elevation =  1039.900(Ft.)
Downstream point elevation =  1035.800(Ft.)
Flow length =   570.000(Ft.)
Travel time  =   12.56 min.
Time of concentration =   26.27 min.
Depth of flow =   0.153(Ft.)
Average velocity =   0.757(Ft/s)
Total irregular channel flow =     1.767(CFS)
Irregular channel normal depth above invert elev. =   0.153(Ft.)
Average velocity of channel(s) =   0.757(Ft/s)
 Adding area flow to channel
RESIDENTIAL(1 acre lot)
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
Pervious ratio(Ap) = 0.8000     Max loss rate(Fm)=     0.782(In/Hr)
Rainfall intensity =      1.658(In/Hr) for a    25.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.475
Subarea runoff =      1.108(CFS) for    2.110(Ac.)
Total runoff =      2.278(CFS)
Effective area this stream =        2.89(Ac.)
Total Study Area (Main Stream No. 2) =       22.20(Ac.)
Area averaged Fm value =    0.782(In/Hr)
Depth of flow =   0.168(Ft.), Average velocity =   0.806(Ft/s)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       15.100 to Point/Station       16.000
**** CONFLUENCE OF MAIN STREAMS ****
________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =      2.890(Ac.)
Runoff from this stream =      2.278(CFS)
Time of concentration =   26.27 min.
Rainfall intensity =     1.658(In/Hr)
Area averaged loss rate (Fm) =    0.7822(In/Hr)
Area averaged Pervious ratio (Ap) = 0.8000
Summary of stream data:

Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)    (Ac.)       (min) (In/Hr)     (In/Hr)


1     10.93    19.310     34.50    0.782      1.408
2      2.28     2.890     26.27    0.782      1.658
Qmax(1) =
         1.000 *    1.000 *    10.931) +
         0.714 *    1.000 *     2.278) + =      12.558
Qmax(2) =
         1.400 *    0.761 *    10.931) +
         1.000 *    1.000 *     2.278) + =      13.930

Total of 2 main streams to confluence:
Flow rates before confluence point:
      11.931       3.278
Maximum flow rates at confluence using above data:
       12.558       13.930
Area of streams before confluence:
       19.310        2.890
Effective area values after confluence:
       22.200       17.591


Results of confluence:
Total flow rate =     13.930(CFS)
Time of concentration =    26.266 min.
Effective stream area after confluence  =     17.591(Ac.)
Study area average Pervious fraction(Ap) =  0.800
Study area average soil loss rate(Fm) =    0.782(In/Hr)
Study area total =      22.20(Ac.)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       16.000 to Point/Station       19.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
______________________________________________________________________________
Depth of flow =   0.283(Ft.), Average velocity =   1.737(Ft/s)
      ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00              1.00
      2            100.00              0.00
      3            200.00              1.00
Manning's 'N' friction factor =   0.030
------------------------------------------------------------------
Sub-Channel flow  =     13.930(CFS)
  '     '    flow top width =     56.636(Ft.)
  '     '    velocity=    1.737(Ft/s)
  '     '    area =      8.019(Sq.Ft)
  '     '    Froude number =     0.814

Upstream point elevation =  1035.800(Ft.)
Downstream point elevation =  1034.700(Ft.)
Flow length =    66.000(Ft.)
Travel time  =    0.63 min.
Time of concentration =   26.90 min.
Depth of flow =   0.283(Ft.)
Average velocity =   1.737(Ft/s)
Total irregular channel flow =    13.930(CFS)
Irregular channel normal depth above invert elev. =   0.283(Ft.)
Average velocity of channel(s) =   1.737(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       16.000 to Point/Station       19.000
**** CONFLUENCE OF MAIN STREAMS ****
______________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =     17.591(Ac.)
Runoff from this stream =     13.930(CFS)
Time of concentration =   26.90 min.
Rainfall intensity =     1.634(In/Hr)
Area averaged loss rate (Fm) =    0.7822(In/Hr)
Area averaged Pervious ratio (Ap) = 0.8000
Program is now starting with Main Stream No. 2
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       17.000 to Point/Station       18.000
**** INITIAL AREA EVALUATION ****

------------------------------------------------------------------------------
RESIDENTIAL(1 acre lot)
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
Pervious ratio(Ap) = 0.8000     Max loss rate(Fm)=     0.782(In/Hr)
Initial subarea data:
Initial area flow distance =   846.000(Ft.)
Top (of initial area) elevation =  1050.900(Ft.)
Bottom (of initial area) elevation =  1040.100(Ft.)
Difference in elevation =    10.800(Ft.)
Slope =    0.01277  s(%)=       1.28
TC = k(0.469)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   16.631 min.
Rainfall intensity =      2.181(In/Hr) for a    25.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.577
Subarea runoff =      6.874(CFS)
Total initial stream area =        5.460(Ac.)
Pervious area fraction = 0.800
Initial area Fm value =    0.782(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       17.000 to Point/Station       18.000
**** CONFLUENCE OF MINOR STREAMS ****

------------------------------------------------------------------------------
Along Main Stream number: 2 in normal stream number 1
Stream flow area =      5.460(Ac.)
Runoff from this stream =      6.874(CFS)
Time of concentration =   16.63 min.
Rainfall intensity =     2.181(In/Hr)
Area averaged loss rate (Fm) =    0.7822(In/Hr)
Area averaged Pervious ratio (Ap) = 0.8000
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       17.100 to Point/Station       18.000
**** INITIAL AREA EVALUATION ****

_____________________________________________________________________________
COMMERCIAL subarea type
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
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.098(In/Hr)
Initial subarea data:
Initial area flow distance =   622.000(Ft.)
Top (of initial area) elevation =  1046.500(Ft.)
Bottom (of initial area) elevation =  1040.100(Ft.)
Difference in elevation =     6.400(Ft.)
Slope =    0.01029  s(%)=       1.03
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    9.952 min.
Rainfall intensity =      2.968(In/Hr) for a    25.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.870
Subarea runoff =      2.196(CFS)
Total initial stream area =        0.850(Ac.)
Pervious area fraction = 0.100
Initial area Fm value =    0.098(In/Hr)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       17.100 to Point/Station       18.000
**** CONFLUENCE OF MINOR STREAMS ****
________________________________________________________________________
Along Main Stream number: 2 in normal stream number 2
Stream flow area =      0.850(Ac.)
Runoff from this stream =      2.196(CFS)
Time of concentration =    9.95 min.
Rainfall intensity =     2.968(In/Hr)
Area averaged loss rate (Fm) =    0.0978(In/Hr)
Area averaged Pervious ratio (Ap) = 0.1000
Summary of stream data:

Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)    (Ac.)       (min) (In/Hr)     (In/Hr)


1      6.87     5.460     16.63    0.782      2.181
2      2.20     0.850      9.95    0.098      2.968
Qmax(1) =
         1.000 *    1.000 *     6.874) +
         0.726 *    1.000 *     2.196) + =       8.467
Qmax(2) =
         1.563 *    0.598 *     6.874) +
         1.000 *    1.000 *     2.196) + =       8.623

Total of 2 streams to confluence:
Flow rates before confluence point:
       6.874       2.196
Maximum flow rates at confluence using above data:
        8.467        8.623
Area of streams before confluence:
        5.460        0.850
Effective area values after confluence:
        6.310        4.117
Results of confluence:
Total flow rate =      8.623(CFS)
Time of concentration =     9.952 min.
Effective stream area after confluence =      4.117(Ac.)
Study area average Pervious fraction(Ap) =  0.706
Study area average soil loss rate(Fm) =    0.690(In/Hr)
Study area total (this main stream) =       6.31(Ac.)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       18.000 to Point/Station       19.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
____________________________________________________________________________
Top of street segment elevation =  1040.100(Ft.)
End of street segment elevation =  1034.700(Ft.)
Length of street segment  =   661.000(Ft.)
Height of curb above gutter flowline  =    8.0(In.)
Width of half street (curb to crown)  =  22.000(Ft.)
Distance from crown to crossfall grade break  =  20.500(Ft.)
Slope from gutter to grade break (v/hz) =   0.083
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  =  11.000(Ft.)
Slope from curb to property line (v/hz) =   0.020
Gutter width =   1.500(Ft.)
Gutter hike from flowline =  1.500(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 =      8.678(CFS)
Depth of flow =   0.390(Ft.), Average velocity =   1.934(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =  14.737(Ft.)
Flow velocity =   1.93(Ft/s)
Travel time =    5.70 min.     TC =   15.65  min.
 Adding area flow to street
COMMERCIAL subarea type
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
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.098(In/Hr)
The area added to the existing stream causes a
a lower flow rate of Q =      7.443(CFS)
therefore the upstream flow rate of Q =      8.623(CFS) is being used
Rainfall intensity =      2.262(In/Hr) for a    25.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.665
Subarea runoff =      0.000(CFS) for    0.830(Ac.)
Total runoff =      8.623(CFS)
Effective area this stream =        4.95(Ac.)
Total Study Area (Main Stream No. 2) =       29.34(Ac.)
Area averaged Fm value =    0.591(In/Hr)
Street flow at end of street =      8.623(CFS)
Half street flow at end of street =      4.312(CFS)
Depth of flow =   0.389(Ft.), Average velocity =   1.932(Ft/s)
Flow width (from curb towards crown)=  14.700(Ft.)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       18.000 to Point/Station       19.000
**** CONFLUENCE OF MAIN STREAMS ****
________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =      4.947(Ac.)
Runoff from this stream =      8.623(CFS)
Time of concentration =   15.65 min.
Rainfall intensity =     2.262(In/Hr)
Area averaged loss rate (Fm) =    0.5907(In/Hr)
Area averaged Pervious ratio (Ap) = 0.6041
Summary of stream data:

Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)    (Ac.)       (min) (In/Hr)     (In/Hr)


1     13.93    17.591     26.90    0.782      1.634
2      8.62     4.947     15.65    0.591      2.262
Qmax(1) =
         1.000 *    1.000 *    13.930) +
         0.624 *    1.000 *     8.623) + =      19.314
Qmax(2) =
         1.737 *    0.582 *    13.930) +
         1.000 *    1.000 *     8.623) + =      22.696

Total of 2 main streams to confluence:
Flow rates before confluence point:
      14.930       9.623
Maximum flow rates at confluence using above data:
       19.314       22.696
Area of streams before confluence:
       17.591        4.947
Effective area values after confluence:
       22.538       15.180


Results of confluence:
Total flow rate =     22.696(CFS)
Time of concentration =    15.647 min.
Effective stream area after confluence  =     15.180(Ac.)
Study area average Pervious fraction(Ap) =  0.757
Study area average soil loss rate(Fm) =    0.740(In/Hr)
Study area total =      22.54(Ac.)
End of computations, Total Study Area =           29.34 (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) = 0.760
Area averaged SCS curve number =  32.0
```

San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2014 Version 9.0
Rational Hydrology Study Date: 04/20/21

BLOOMINGTON COMMERCE CENTER - SITE 4
EXISTING CONDITION
5-YEAR STORM ANALYSIS WITH ADJUSTED 10 YEAR RAINFALL DATA

Program License Serial Number 6405

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

Rational hydrology study storm event year is 25.0
Computed rainfall intensity:
Storm year = 25.00 1 hour rainfall = 0.819 (In.)
Slope used for rainfall intensity curve b = 0.6000
Soil antecedent moisture condition (AMC) = 2

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       12.000 to Point/Station       13.000
**** INITIAL AREA EVALUATION ****
_____________________________________________________________________________
RESIDENTIAL(1 acre lot)
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
Pervious ratio(Ap) = 0.8000     Max loss rate(Fm)=     0.782(In/Hr)
Initial subarea data:
Initial area flow distance =   323.000(Ft.)
Top (of initial area) elevation =  1055.800(Ft.)
Bottom (of initial area) elevation =  1049.100(Ft.)
Difference in elevation =     6.700(Ft.)
Slope =    0.02074  s(%)=       2.07
TC = k(0.469)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   10.268 min.
Rainfall intensity =      2.362(In/Hr) for a    25.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.602
Subarea runoff =      1.791(CFS)
Total initial stream area =        1.260(Ac.)
Pervious area fraction = 0.800
Initial area Fm value =    0.782(In/Hr)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       13.000 to Point/Station       14.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
________________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.215(Ft.), Average velocity =   0.903(Ft/s)
      ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1             0.00              1.00
      2           100.00              0.00
      3           200.00              1.00
Manning's 'N' friction factor =   0.030
------------------------------------------------------------------
Sub-Channel flow  =      4.192(CFS)
  '     '    flow top width =     43.079(Ft.)
  '     '    velocity=    0.903(Ft/s)
  '     '    area =      4.639(Sq.Ft)
  '     '    Froude number =     0.485

Upstream point elevation =  1049.100(Ft.)
Downstream point elevation =  1043.600(Ft.)
Flow length =   847.000(Ft.)
Travel time  =   15.62 min.
Time of concentration =   25.89 min.
Depth of flow =   0.215(Ft.)
Average velocity =   0.903(Ft/s)
Total irregular channel flow =     4.192(CFS)
Irregular channel normal depth above invert elev. =   0.215(Ft.)
Average velocity of channel(s) =   0.903(Ft/s)
 Adding area flow to channel
RESIDENTIAL(1 acre lot)
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
Pervious ratio(Ap) = 0.8000     Max loss rate(Fm)=     0.782(In/Hr)
Rainfall intensity =      1.356(In/Hr) for a    25.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.381
Subarea runoff =      4.736(CFS) for   11.380(Ac.)
Total runoff =      6.527(CFS)
Effective area this stream =       12.64(Ac.)
Total Study Area (Main Stream No. 1) =       12.64(Ac.)
Area averaged Fm value =    0.782(In/Hr)
Depth of flow =   0.254(Ft.), Average velocity =   1.009(Ft/s)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       14.000 to Point/Station       16.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
____________________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.237(Ft.), Average velocity =   1.165(Ft/s)
      ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1             0.00              1.00
      2           100.00              0.00
      3           200.00              1.00
Manning's 'N' friction factor =   0.030
------------------------------------------------------------------
Sub-Channel flow  =      6.554(CFS)
  '     '    flow top width =     47.443(Ft.)
  '     '    velocity=    1.165(Ft/s)
  '     '    area =      5.627(Sq.Ft)
  '     '    Froude number =     0.596

Upstream point elevation =  1043.600(Ft.)
Downstream point elevation =  1035.800(Ft.)
Flow length =   822.000(Ft.)
Travel time  =   11.76 min.
Time of concentration =   37.65 min.
Depth of flow =   0.237(Ft.)
Average velocity =   1.165(Ft/s)
Total irregular channel flow =     6.554(CFS)
Irregular channel normal depth above invert elev. =   0.237(Ft.)
Average velocity of channel(s) =   1.165(Ft/s)
 Adding area flow to channel
RESIDENTIAL(1 acre lot)
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
Pervious ratio(Ap) = 0.8000     Max loss rate(Fm)=     0.782(In/Hr)
The area added to the existing stream causes a
a lower flow rate of Q =      5.229(CFS)
therefore the upstream flow rate of Q =      6.527(CFS) is being used
Rainfall intensity =      1.083(In/Hr) for a    25.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.250
Subarea runoff =      0.000(CFS) for    6.670(Ac.)
Total runoff =      6.527(CFS)
Effective area this stream =       19.31(Ac.)
Total Study Area (Main Stream No. 1) =       19.31(Ac.)
Area averaged Fm value =    0.782(In/Hr)
Depth of flow =   0.237(Ft.), Average velocity =   1.164(Ft/s)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       14.000 to Point/Station       16.000
**** CONFLUENCE OF MAIN STREAMS ****
_____________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =     19.310(Ac.)
Runoff from this stream =      6.527(CFS)
Time of concentration =   37.65 min.
Rainfall intensity =     1.083(In/Hr)
Area averaged loss rate (Fm) =    0.7822(In/Hr)
Area averaged Pervious ratio (Ap) = 0.8000
Program is now starting with Main Stream No. 2
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       15.000 to Point/Station       15.100
**** INITIAL AREA EVALUATION ****
_____________________________________________________________________________
RESIDENTIAL(1 acre lot)
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
Pervious ratio(Ap) = 0.8000     Max loss rate(Fm)=     0.782(In/Hr)
Initial subarea data:
Initial area flow distance =   538.000(Ft.)
Top (of initial area) elevation =  1047.200(Ft.)
Bottom (of initial area) elevation =  1039.900(Ft.)
Difference in elevation =     7.300(Ft.)
Slope =    0.01357  s(%)=       1.36
TC = k(0.469)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   13.708 min.
Rainfall intensity =      1.986(In/Hr) for a    25.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.546
Subarea runoff =      0.845(CFS)
Total initial stream area =        0.780(Ac.)
Pervious area fraction = 0.800
Initial area Fm value =    0.782(In/Hr)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       15.100 to Point/Station       16.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
________________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.130(Ft.), Average velocity =   0.678(Ft/s)
      ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00              1.00
      2            100.00              0.00
      3            200.00              1.00
Manning's 'N' friction factor =   0.030
------------------------------------------------------------------
Sub-Channel flow  =      1.138(CFS)
  '     '    flow top width =     25.917(Ft.)
  '     '    velocity=    0.678(Ft/s)
  '     '    area =      1.679(Sq.Ft)
  '     '    Froude number =     0.469

Upstream point elevation =  1039.900(Ft.)
Downstream point elevation =  1035.800(Ft.)
Flow length =   570.000(Ft.)
Travel time  =   14.02 min.
Time of concentration =   27.73 min.
Depth of flow =   0.130(Ft.)
Average velocity =   0.678(Ft/s)
Total irregular channel flow =     1.138(CFS)
Irregular channel normal depth above invert elev. =   0.130(Ft.)
Average velocity of channel(s) =   0.678(Ft/s)
 Adding area flow to channel
RESIDENTIAL(1 acre lot)
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
Pervious ratio(Ap) = 0.8000     Max loss rate(Fm)=     0.782(In/Hr)
Rainfall intensity =      1.301(In/Hr) for a    25.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.359
Subarea runoff =      0.505(CFS) for    2.110(Ac.)
Total runoff =      1.351(CFS)
Effective area this stream =        2.89(Ac.)
Total Study Area (Main Stream No. 2) =       22.20(Ac.)
Area averaged Fm value =    0.782(In/Hr)
Depth of flow =   0.138(Ft.), Average velocity =   0.707(Ft/s)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       15.100 to Point/Station       16.000
**** CONFLUENCE OF MAIN STREAMS ****
_____________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =      2.890(Ac.)
Runoff from this stream =      1.351(CFS)
Time of concentration =   27.73 min.
Rainfall intensity =     1.301(In/Hr)
Area averaged loss rate (Fm) =    0.7822(In/Hr)
Area averaged Pervious ratio (Ap) = 0.8000
Summary of stream data:

Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)    (Ac.)        (min) (In/Hr)     (In/Hr)


1      6.53    19.310     37.65    0.782      1.083
2      1.35     2.890     27.73    0.782      1.301
Qmax(1) =
         1.000 *    1.000 *     6.527) +
         0.580 *    1.000 *     1.351) + =       7.310
Qmax(2) =
         1.726 *    0.736 *     6.527) +
         1.000 *    1.000 *     1.351) + =       9.645

Total of 2 main streams to confluence:
Flow rates before confluence point:
       7.527       2.351
Maximum flow rates at confluence using above data:
        7.310        9.645
Area of streams before confluence:
       19.310        2.890
Effective area values after confluence:
       22.200       17.109


Results of confluence:
Total flow rate =      9.645(CFS)
Time of concentration =    27.727 min.
Effective stream area after confluence  =     17.109(Ac.)
Study area average Pervious fraction(Ap) =  0.800
Study area average soil loss rate(Fm) =    0.782(In/Hr)
Study area total =      22.20(Ac.)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       16.000 to Point/Station       19.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
____________________________________________________________________________
Depth of flow =   0.247(Ft.), Average velocity =   1.585(Ft/s)
      ******* Irregular Channel Data ***********
----------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00              1.00
      2            100.00              0.00
      3            200.00              1.00
Manning's 'N' friction factor =   0.030
----------------------------------------------------------------
Sub-Channel flow  =      9.645(CFS)
  '     '    flow top width =     49.342(Ft.)
  '     '    velocity=    1.585(Ft/s)
  '     '    area =      6.087(Sq.Ft)
  '     '    Froude number =     0.795

Upstream point elevation =  1035.800(Ft.)
Downstream point elevation =  1034.700(Ft.)
Flow length =    66.000(Ft.)
Travel time  =    0.69 min.
Time of concentration =   28.42 min.
Depth of flow =   0.247(Ft.)
Average velocity =   1.585(Ft/s)
Total irregular channel flow =     9.645(CFS)
Irregular channel normal depth above invert elev. =   0.247(Ft.)
Average velocity of channel(s) =   1.585(Ft/s)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       16.000 to Point/Station       19.000
**** CONFLUENCE OF MAIN STREAMS ****
_____________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =     17.109(Ac.)
Runoff from this stream =      9.645(CFS)
Time of concentration =   28.42 min.
Rainfall intensity =     1.282(In/Hr)
Area averaged loss rate (Fm) =    0.7822(In/Hr)
Area averaged Pervious ratio (Ap) = 0.8000
Program is now starting with Main Stream No. 2
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       17.000 to Point/Station       18.000
**** INITIAL AREA EVALUATION ****
_____________________________________________________________________________
RESIDENTIAL(1 acre lot)
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
Pervious ratio(Ap) = 0.8000     Max loss rate(Fm)=     0.782(In/Hr)
Initial subarea data:
Initial area flow distance =   846.000(Ft.)
Top (of initial area) elevation =  1050.900(Ft.)
Bottom (of initial area) elevation =  1040.100(Ft.)
Difference in elevation =    10.800(Ft.)
Slope =    0.01277  s(%)=       1.28
TC = k(0.469)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   16.631 min.
Rainfall intensity =      1.769(In/Hr) for a    25.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.502
Subarea runoff =      4.847(CFS)
Total initial stream area =        5.460(Ac.)
Pervious area fraction = 0.800
Initial area Fm value =    0.782(In/Hr)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       17.000 to Point/Station       18.000
**** CONFLUENCE OF MINOR STREAMS ****
____________________________________________________________________________
Along Main Stream number: 2 in normal stream number 1
Stream flow area =      5.460(Ac.)
Runoff from this stream =      4.847(CFS)
Time of concentration =   16.63 min.
Rainfall intensity =     1.769(In/Hr)
Area averaged loss rate (Fm) =    0.7822(In/Hr)
Area averaged Pervious ratio (Ap) = 0.8000
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       17.100 to Point/Station       18.000
**** INITIAL AREA EVALUATION ****
_____________________________________________________________________________
COMMERCIAL subarea type
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
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.098(In/Hr)
Initial subarea data:
Initial area flow distance =   622.000(Ft.)
Top (of initial area) elevation =  1046.500(Ft.)
Bottom (of initial area) elevation =  1040.100(Ft.)
Difference in elevation =     6.400(Ft.)
Slope =    0.01029  s(%)=       1.03
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    9.952 min.
Rainfall intensity =      2.407(In/Hr) for a    25.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.863
Subarea runoff =      1.766(CFS)
Total initial stream area =        0.850(Ac.)
Pervious area fraction = 0.100
Initial area Fm value =    0.098(In/Hr)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       17.100 to Point/Station       18.000
**** CONFLUENCE OF MINOR STREAMS ****
________________________________________________________________________
Along Main Stream number: 2 in normal stream number 2
Stream flow area =      0.850(Ac.)
Runoff from this stream =      1.766(CFS)
Time of concentration =    9.95 min.
Rainfall intensity =     2.407(In/Hr)
Area averaged loss rate (Fm) =    0.0978(In/Hr)
Area averaged Pervious ratio (Ap) = 0.1000
Summary of stream data:

Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)    (Ac.)       (min) (In/Hr)     (In/Hr)


1      4.85     5.460     16.63    0.782      1.769
2      1.77     0.850      9.95    0.098      2.407
Qmax(1) =
         1.000 *    1.000 *     4.847) +
         0.724 *    1.000 *     1.766) + =       6.125
Qmax(2) =
         1.647 *    0.598 *     4.847) +
         1.000 *    1.000 *     1.766) + =       6.543

Total of 2 streams to confluence:
Flow rates before confluence point:
       4.847       1.766
Maximum flow rates at confluence using above data:
        6.125        6.543
Area of streams before confluence:
        5.460        0.850
Effective area values after confluence:
        6.310        4.117
Results of confluence:
Total flow rate =      6.543(CFS)
Time of concentration =     9.952 min.
Effective stream area after confluence =      4.117(Ac.)
Study area average Pervious fraction(Ap) =  0.706
Study area average soil loss rate(Fm) =    0.690(In/Hr)
Study area total (this main stream) =       6.31(Ac.)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       18.000 to Point/Station       19.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
_____________________________________________________________________________
Top of street segment elevation =  1040.100(Ft.)
End of street segment elevation =  1034.700(Ft.)
Length of street segment  =   661.000(Ft.)
Height of curb above gutter flowline  =    8.0(In.)
Width of half street (curb to crown)  =  22.000(Ft.)
Distance from crown to crossfall grade break  =  20.500(Ft.)
Slope from gutter to grade break (v/hz) =   0.083
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  =  11.000(Ft.)
Slope from curb to property line (v/hz) =   0.020
Gutter width =   1.500(Ft.)
Gutter hike from flowline =  1.500(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 =      6.626(CFS)
Depth of flow =   0.360(Ft.), Average velocity =   1.815(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =  13.245(Ft.)
Flow velocity =   1.81(Ft/s)
Travel time =    6.07 min.     TC =   16.02  min.
 Adding area flow to street
COMMERCIAL subarea type
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
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.098(In/Hr)
The area added to the existing stream causes a
a lower flow rate of Q =      5.423(CFS)
therefore the upstream flow rate of Q =      6.543(CFS) is being used
Rainfall intensity =      1.809(In/Hr) for a    25.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.606
Subarea runoff =      0.000(CFS) for    0.830(Ac.)
Total runoff =      6.543(CFS)
Effective area this stream =        4.95(Ac.)
Total Study Area (Main Stream No. 2) =       29.34(Ac.)
Area averaged Fm value =    0.591(In/Hr)
Street flow at end of street =      6.543(CFS)
Half street flow at end of street =      3.272(CFS)
Depth of flow =   0.359(Ft.), Average velocity =   1.809(Ft/s)
Flow width (from curb towards crown)=  13.179(Ft.)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       18.000 to Point/Station       19.000
**** CONFLUENCE OF MAIN STREAMS ****
________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =      4.947(Ac.)
Runoff from this stream =      6.543(CFS)
Time of concentration =   16.02 min.
Rainfall intensity =     1.809(In/Hr)
Area averaged loss rate (Fm) =    0.5907(In/Hr)
Area averaged Pervious ratio (Ap) = 0.6041
Summary of stream data:

Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)    (Ac.)        (min) (In/Hr)     (In/Hr)


1      9.64    17.109     28.42    0.782      1.282
2      6.54     4.947     16.02    0.591      1.809
Qmax(1) =
         1.000 *    1.000 *     9.645) +
         0.568 *    1.000 *     6.543) + =      13.360
Qmax(2) =
         2.052 *    0.564 *     9.645) +
         1.000 *    1.000 *     6.543) + =      17.703

Total of 2 main streams to confluence:
Flow rates before confluence point:
      10.645       7.543
Maximum flow rates at confluence using above data:
       13.360       17.703
Area of streams before confluence:
       17.109        4.947
Effective area values after confluence:
       22.056       14.593


Results of confluence:
Total flow rate =     17.703(CFS)
Time of concentration =    16.023 min.
Effective stream area after confluence  =     14.593(Ac.)
Study area average Pervious fraction(Ap) =  0.756
Study area average soil loss rate(Fm) =    0.739(In/Hr)
Study area total =      22.06(Ac.)
End of computations, Total Study Area =           29.34 (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) = 0.760
Area averaged SCS curve number =  32.0
```

San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2014 Version 9.0
Rational Hydrology Study Date: 04/06/21

BLOOMINGTON COMMERCE CENTER - SITE 4
PROPOSED CONDITION
25-YEAR STORM EVENT ANALYSIS

Program License Serial Number 6405

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

Rational hydrology study storm event year is 25.0
Computed rainfall intensity:
Storm year = 25.00 1 hour rainfall = 1.010 (In.)
Slope used for rainfall intensity curve b = 0.6000
Soil antecedent moisture condition (AMC) = 2

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       10.000 to Point/Station       11.000
**** INITIAL AREA EVALUATION ****

_____________________________________________________________________________
RESIDENTIAL(1 acre lot)
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
Pervious ratio(Ap) = 0.8000     Max loss rate(Fm)=     0.782(In/Hr)
Initial subarea data:
Initial area flow distance =   323.000(Ft.)
Top (of initial area) elevation =  1055.800(Ft.)
Bottom (of initial area) elevation =  1049.100(Ft.)
Difference in elevation =     6.700(Ft.)
Slope =    0.02074  s(%)=       2.07
TC = k(0.469)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   10.268 min.
Rainfall intensity =      2.913(In/Hr) for a    25.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.658
Subarea runoff =      2.416(CFS)
Total initial stream area =        1.260(Ac.)
Pervious area fraction = 0.800
Initial area Fm value =    0.782(In/Hr)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       11.000 to Point/Station       12.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
________________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.257(Ft.), Average velocity =   1.016(Ft/s)
      ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00              1.00
      2            100.00              0.00
      3            200.00              1.00
Manning's 'N' friction factor =   0.030
------------------------------------------------------------------
Sub-Channel flow  =      6.704(CFS)
  '     '    flow top width =     51.375(Ft.)
  '     '    velocity=    1.016(Ft/s)
  '     '    area =      6.598(Sq.Ft)
  '     '    Froude number =     0.500

Upstream point elevation =  1049.100(Ft.)
Downstream point elevation =  1043.600(Ft.)
Flow length =   847.000(Ft.)
Travel time  =   13.89 min.
Time of concentration =   24.16 min.
Depth of flow =   0.257(Ft.)
Average velocity =   1.016(Ft/s)
Total irregular channel flow =     6.704(CFS)
Irregular channel normal depth above invert elev. =   0.257(Ft.)
Average velocity of channel(s) =   1.016(Ft/s)
 Adding area flow to channel
RESIDENTIAL(1 acre lot)
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
Pervious ratio(Ap) = 0.8000     Max loss rate(Fm)=     0.782(In/Hr)
Rainfall intensity =      1.743(In/Hr) for a    25.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.496
Subarea runoff =      8.515(CFS) for   11.380(Ac.)
Total runoff =     10.931(CFS)
Effective area this stream =       12.64(Ac.)
Total Study Area (Main Stream No. 1) =       12.64(Ac.)
Area averaged Fm value =    0.782(In/Hr)
Depth of flow =   0.309(Ft.), Average velocity =   1.148(Ft/s)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       12.000 to Point/Station       13.300
**** IMPROVED CHANNEL TRAVEL TIME ****
_____________________________________________________________________________
Upstream point elevation =  1042.700(Ft.)
Downstream point elevation =  1040.100(Ft.)
Channel length thru subarea  =   308.000(Ft.)
Channel base width      =    8.000(Ft.)
Slope or 'Z' of left channel bank = 100.000
Slope or 'Z' of right channel bank = 100.000
Manning's 'N'    = 0.020
Maximum depth of channel  =    1.000(Ft.)
Flow(q) thru subarea =     10.931(CFS)
Depth of flow =   0.216(Ft.), Average velocity =   1.707(Ft/s)
Channel flow top width =   51.247(Ft.)
Flow Velocity =    1.71(Ft/s)
Travel time  =    3.01 min.
Time of concentration =   27.17 min.
Critical depth =      0.201(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       12.000 to Point/Station       13.300
**** CONFLUENCE OF MAIN STREAMS ****
_____________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =     12.640(Ac.)
Runoff from this stream =     10.931(CFS)
Time of concentration =   27.17 min.
Rainfall intensity =     1.625(In/Hr)
Area averaged loss rate (Fm) =    0.7822(In/Hr)
Area averaged Pervious ratio (Ap) = 0.8000
Program is now starting with Main Stream No. 2
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       13.100 to Point/Station       13.300
**** INITIAL AREA EVALUATION ****
_____________________________________________________________________________
RESIDENTIAL(1 acre lot)
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
Pervious ratio(Ap) = 0.8000     Max loss rate(Fm)=     0.782(In/Hr)
Initial subarea data:
Initial area flow distance =   846.000(Ft.)
Top (of initial area) elevation =  1050.900(Ft.)
Bottom (of initial area) elevation =  1040.100(Ft.)
Difference in elevation =    10.800(Ft.)
Slope =    0.01277  s(%)=       1.28
TC = k(0.469)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   16.631 min.
Rainfall intensity =      2.181(In/Hr) for a    25.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.577
Subarea runoff =      6.874(CFS)
Total initial stream area =        5.460(Ac.)
Pervious area fraction = 0.800
Initial area Fm value =    0.782(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       13.100 to Point/Station       13.300
**** CONFLUENCE OF MAIN STREAMS ****
_____________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =      5.460(Ac.)
Runoff from this stream =      6.874(CFS)
Time of concentration =   16.63 min.
Rainfall intensity =     2.181(In/Hr)
Area averaged loss rate (Fm) =    0.7822(In/Hr)
Area averaged Pervious ratio (Ap) = 0.8000
Program is now starting with Main Stream No. 3
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       13.200 to Point/Station       13.300
**** INITIAL AREA EVALUATION ****

____________________________________________________________________________
COMMERCIAL subarea type
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
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.098(In/Hr)
Initial subarea data:
Initial area flow distance =   622.000(Ft.)
Top (of initial area) elevation =  1046.500(Ft.)
Bottom (of initial area) elevation =  1040.100(Ft.)
Difference in elevation =     6.400(Ft.)
Slope =    0.01029  s(%)=       1.03
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    9.952 min.
Rainfall intensity =      2.968(In/Hr) for a    25.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.870
Subarea runoff =      1.137(CFS)
Total initial stream area =        0.440(Ac.)
Pervious area fraction = 0.100
Initial area Fm value =    0.098(In/Hr)
```

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++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       13.200 to Point/Station       13.300
**** CONFLUENCE OF MAIN STREAMS ****
________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 3
Stream flow area =      0.440(Ac.)
Runoff from this stream =      1.137(CFS)
Time of concentration =    9.95 min.
Rainfall intensity =     2.968(In/Hr)
Area averaged loss rate (Fm) =    0.0978(In/Hr)
Area averaged Pervious ratio (Ap) = 0.1000
Summary of stream data:

Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)    (Ac.)       (min) (In/Hr)     (In/Hr)


1     10.93    12.640     27.17    0.782      1.625
2      6.87     5.460     16.63    0.782      2.181
3      1.14     0.440      9.95    0.098      2.968
Qmax(1) =
         1.000 *    1.000 *    10.931) +
         0.602 *    1.000 *     6.874) +
         0.532 *    1.000 *     1.137) + =      15.676
Qmax(2) =
         1.660 *    0.612 *    10.931) +
         1.000 *    1.000 *     6.874) +
         0.726 *    1.000 *     1.137) + =      18.809
Qmax(3) =
         2.595 *    0.366 *    10.931) +
         1.563 *    0.598 *     6.874) +
         1.000 *    1.000 *     1.137) + =      17.953

Total of 3 main streams to confluence:
Flow rates before confluence point:
      11.931       7.874       2.137
Maximum flow rates at confluence using above data:
       15.676       18.809       17.953
Area of streams before confluence:
       12.640        5.460        0.440
Effective area values after confluence:
       18.540       13.637        8.337


Results of confluence:
Total flow rate =     18.809(CFS)
Time of concentration =    16.631 min.
Effective stream area after confluence  =     13.637(Ac.)
Study area average Pervious fraction(Ap) =  0.783
Study area average soil loss rate(Fm) =    0.766(In/Hr)
Study area total =      18.54(Ac.)
```

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++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       13.300 to Point/Station       15.100
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
_____________________________________________________________________________
Top of street segment elevation =  1040.100(Ft.)
End of street segment elevation =  1034.500(Ft.)
Length of street segment  =   663.000(Ft.)
Height of curb above gutter flowline  =    8.0(In.)
Width of half street (curb to crown)  =  22.000(Ft.)
Distance from crown to crossfall grade break  =  20.000(Ft.)
Slope from gutter to grade break (v/hz) =   0.083
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  =  11.000(Ft.)
Slope from curb to property line (v/hz) =   0.020
Gutter width =   1.500(Ft.)
Gutter hike from flowline =  0.125(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 =     18.890(CFS)
Depth of flow =   0.372(Ft.), Average velocity =   2.885(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =  17.983(Ft.)
Flow velocity =   2.88(Ft/s)
Travel time =    3.83 min.     TC =   20.46  min.
 Adding area flow to street
COMMERCIAL subarea type
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
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.098(In/Hr)
The area added to the existing stream causes a
a lower flow rate of Q =     15.010(CFS)
therefore the upstream flow rate of Q =     18.809(CFS) is being used
Rainfall intensity =      1.926(In/Hr) for a    25.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.552
Subarea runoff =      0.000(CFS) for    0.470(Ac.)
Total runoff =     18.809(CFS)
Effective area this stream =       14.11(Ac.)
Total Study Area (Main Stream No. 1) =       19.01(Ac.)
Area averaged Fm value =    0.744(In/Hr)
Street flow at end of street =     18.809(CFS)
Half street flow at end of street =      9.405(CFS)
Depth of flow =   0.371(Ft.), Average velocity =   2.882(Ft/s)
Flow width (from curb towards crown)=  17.953(Ft.)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       13.300 to Point/Station       15.100
**** CONFLUENCE OF MAIN STREAMS ****
______________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =     14.107(Ac.)
Runoff from this stream =     18.809(CFS)
Time of concentration =   20.46 min.
Rainfall intensity =     1.926(In/Hr)
Area averaged loss rate (Fm) =    0.7437(In/Hr)
Area averaged Pervious ratio (Ap) = 0.7606
Program is now starting with Main Stream No. 2


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       14.000 to Point/Station       15.000
**** 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)  = 32.00
Pervious ratio(Ap) = 0.1500     Max loss rate(Fm)=     0.147(In/Hr)
Initial subarea data:
Initial area flow distance =   852.000(Ft.)
Top (of initial area) elevation =  1050.600(Ft.)
Bottom (of initial area) elevation =  1039.200(Ft.)
Difference in elevation =    11.400(Ft.)
Slope =    0.01338  s(%)=       1.34
TC = k(0.311)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   10.973 min.
Rainfall intensity =      2.799(In/Hr) for a    25.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.853
Subarea runoff =     22.797(CFS)
Total initial stream area =        9.550(Ac.)
Pervious area fraction = 0.150
Initial area Fm value =    0.147(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       15.000 to Point/Station       15.100
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________________
Upstream point/station elevation =  1036.700(Ft.)
Downstream point/station elevation =  1034.500(Ft.)
Pipe length  =   120.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    22.797(CFS)
Nearest computed pipe diameter  =     24.00(In.)
Calculated individual pipe flow  =    22.797(CFS)
Normal flow depth in pipe =   15.42(In.)
Flow top width inside pipe =   23.00(In.)
Critical Depth =   20.40(In.)
Pipe flow velocity =     10.68(Ft/s)
Travel time through pipe =    0.19 min.
Time of concentration (TC) =    11.16 min.
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       15.000 to Point/Station       15.100
**** CONFLUENCE OF MAIN STREAMS ****
________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =      9.550(Ac.)
Runoff from this stream =     22.797(CFS)
Time of concentration =   11.16 min.
Rainfall intensity =     2.771(In/Hr)
Area averaged loss rate (Fm) =    0.1467(In/Hr)
Area averaged Pervious ratio (Ap) = 0.1500
Summary of stream data:

Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)    (Ac.)       (min) (In/Hr)     (In/Hr)


1     18.81    14.107     20.46    0.744      1.926
2     22.80     9.550     11.16    0.147      2.771
Qmax(1) =
         1.000 *    1.000 *    18.809) +
         0.678 *    1.000 *    22.797) + =      34.267
Qmax(2) =
         1.715 *    0.545 *    18.809) +
         1.000 *    1.000 *    22.797) + =      40.388

Total of 2 main streams to confluence:
Flow rates before confluence point:
      19.809      23.797
Maximum flow rates at confluence using above data:
       34.267       40.388
Area of streams before confluence:
       14.107        9.550
Effective area values after confluence:
       23.657       17.244


Results of confluence:
Total flow rate =     40.388(CFS)
Time of concentration =    11.160 min.
Effective stream area after confluence  =     17.244(Ac.)
Study area average Pervious fraction(Ap) =  0.514
Study area average soil loss rate(Fm) =    0.503(In/Hr)
Study area total =      23.66(Ac.)
End of computations, Total Study Area =           28.56 (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) = 0.560
Area averaged SCS curve number =  32.0
```

San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2014 Version 9.0
Rational Hydrology Study Date: 04/06/21

BLOOMINGTON COMMERCE CENTER - SITE 4
EXISTING CONDITION
10-YEAR STORM EVENT ANALYSIS

Program License Serial Number 6405

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

Rational hydrology study storm event year is 10.0
Computed rainfall intensity:
Storm year = 10.00 1 hour rainfall = 0.819 (In.)
Slope used for rainfall intensity curve b = 0.6000
Soil antecedent moisture condition (AMC) = 2

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++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       12.000 to Point/Station       13.000
**** INITIAL AREA EVALUATION ****

_____________________________________________________________________________
RESIDENTIAL(1 acre lot)
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
Pervious ratio(Ap) = 0.8000     Max loss rate(Fm)=     0.782(In/Hr)
Initial subarea data:
Initial area flow distance =   323.000(Ft.)
Top (of initial area) elevation =  1055.800(Ft.)
Bottom (of initial area) elevation =  1049.100(Ft.)
Difference in elevation =     6.700(Ft.)
Slope =    0.02074  s(%)=       2.07
TC = k(0.469)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   10.268 min.
Rainfall intensity =      2.362(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.602
Subarea runoff =      1.791(CFS)
Total initial stream area =        1.260(Ac.)
Pervious area fraction = 0.800
Initial area Fm value =    0.782(In/Hr)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       13.000 to Point/Station       14.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
________________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.215(Ft.), Average velocity =   0.903(Ft/s)
      ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00              1.00
      2            100.00              0.00
      3            200.00              1.00
Manning's 'N' friction factor =   0.030
------------------------------------------------------------------
Sub-Channel flow  =      4.192(CFS)
  '     '    flow top width =     43.079(Ft.)
  '     '    velocity=    0.903(Ft/s)
  '     '    area =      4.639(Sq.Ft)
  '     '    Froude number =     0.485

Upstream point elevation =  1049.100(Ft.)
Downstream point elevation =  1043.600(Ft.)
Flow length =   847.000(Ft.)
Travel time  =   15.62 min.
Time of concentration =   25.89 min.
Depth of flow =   0.215(Ft.)
Average velocity =   0.903(Ft/s)
Total irregular channel flow =     4.192(CFS)
Irregular channel normal depth above invert elev. =   0.215(Ft.)
Average velocity of channel(s) =   0.903(Ft/s)
 Adding area flow to channel
RESIDENTIAL(1 acre lot)
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
Pervious ratio(Ap) = 0.8000     Max loss rate(Fm)=     0.782(In/Hr)
Rainfall intensity =      1.356(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.381
Subarea runoff =      4.736(CFS) for   11.380(Ac.)
Total runoff =      6.527(CFS)
Effective area this stream =       12.64(Ac.)
Total Study Area (Main Stream No. 1) =       12.64(Ac.)
Area averaged Fm value =    0.782(In/Hr)
Depth of flow =   0.254(Ft.), Average velocity =   1.009(Ft/s)
```

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++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       14.000 to Point/Station       16.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
________________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.237(Ft.), Average velocity =   1.165(Ft/s)
      ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00              1.00
      2            100.00              0.00
      3            200.00              1.00
Manning's 'N' friction factor =   0.030
------------------------------------------------------------------
Sub-Channel flow  =      6.554(CFS)
  '     '    flow top width =     47.443(Ft.)
  '     '    velocity=    1.165(Ft/s)
  '     '    area =      5.627(Sq.Ft)
  '     '    Froude number =     0.596

Upstream point elevation =  1043.600(Ft.)
Downstream point elevation =  1035.800(Ft.)
Flow length =   822.000(Ft.)
Travel time  =   11.76 min.
Time of concentration =   37.65 min.
Depth of flow =   0.237(Ft.)
Average velocity =   1.165(Ft/s)
Total irregular channel flow =     6.554(CFS)
Irregular channel normal depth above invert elev. =   0.237(Ft.)
Average velocity of channel(s) =   1.165(Ft/s)
 Adding area flow to channel
RESIDENTIAL(1 acre lot)
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
Pervious ratio(Ap) = 0.8000     Max loss rate(Fm)=     0.782(In/Hr)
The area added to the existing stream causes a
a lower flow rate of Q =      5.229(CFS)
therefore the upstream flow rate of Q =      6.527(CFS) is being used
Rainfall intensity =      1.083(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.250
Subarea runoff =      0.000(CFS) for    6.670(Ac.)
Total runoff =      6.527(CFS)
Effective area this stream =       19.31(Ac.)
Total Study Area (Main Stream No. 1) =       19.31(Ac.)
Area averaged Fm value =    0.782(In/Hr)
Depth of flow =   0.237(Ft.), Average velocity =   1.164(Ft/s)
```

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++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       14.000 to Point/Station       16.000
**** CONFLUENCE OF MAIN STREAMS ****
______________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =     19.310(Ac.)
Runoff from this stream =      6.527(CFS)
Time of concentration =   37.65 min.
Rainfall intensity =     1.083(In/Hr)
Area averaged loss rate (Fm) =    0.7822(In/Hr)
Area averaged Pervious ratio (Ap) = 0.8000
Program is now starting with Main Stream No. 2


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       15.000 to Point/Station       15.100
**** INITIAL AREA EVALUATION ****
______________________________________________________________________________
RESIDENTIAL(1 acre lot)
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
Pervious ratio(Ap) = 0.8000     Max loss rate(Fm)=     0.782(In/Hr)
Initial subarea data:
Initial area flow distance =   538.000(Ft.)
Top (of initial area) elevation =  1047.200(Ft.)
Bottom (of initial area) elevation =  1039.900(Ft.)
Difference in elevation =     7.300(Ft.)
Slope =    0.01357  s(%)=       1.36
TC = k(0.469)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   13.708 min.
Rainfall intensity =      1.986(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.546
Subarea runoff =      0.845(CFS)
Total initial stream area =        0.780(Ac.)
Pervious area fraction = 0.800
Initial area Fm value =    0.782(In/Hr)
```

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++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       15.100 to Point/Station       16.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
____________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.130(Ft.), Average velocity =   0.678(Ft/s)
      ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00              1.00
      2            100.00              0.00
      3            200.00              1.00
Manning's 'N' friction factor =   0.030
------------------------------------------------------------------
Sub-Channel flow  =      1.138(CFS)
  '     '    flow top width =     25.917(Ft.)
  '     '    velocity=    0.678(Ft/s)
  '     '    area =      1.679(Sq.Ft)
  '     '    Froude number =     0.469

Upstream point elevation =  1039.900(Ft.)
Downstream point elevation =  1035.800(Ft.)
Flow length =   570.000(Ft.)
Travel time  =   14.02 min.
Time of concentration =   27.73 min.
Depth of flow =   0.130(Ft.)
Average velocity =   0.678(Ft/s)
Total irregular channel flow =     1.138(CFS)
Irregular channel normal depth above invert elev. =   0.130(Ft.)
Average velocity of channel(s) =   0.678(Ft/s)
 Adding area flow to channel
RESIDENTIAL(1 acre lot)
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
Pervious ratio(Ap) = 0.8000     Max loss rate(Fm)=     0.782(In/Hr)
Rainfall intensity =      1.301(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.359
Subarea runoff =      0.505(CFS) for    2.110(Ac.)
Total runoff =      1.351(CFS)
Effective area this stream =        2.89(Ac.)
Total Study Area (Main Stream No. 2) =       22.20(Ac.)
Area averaged Fm value =    0.782(In/Hr)
Depth of flow =   0.138(Ft.), Average velocity =   0.707(Ft/s)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       15.100 to Point/Station       16.000
**** CONFLUENCE OF MAIN STREAMS ****
________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =      2.890(Ac.)
Runoff from this stream =      1.351(CFS)
Time of concentration =   27.73 min.
Rainfall intensity =     1.301(In/Hr)
Area averaged loss rate (Fm) =    0.7822(In/Hr)
Area averaged Pervious ratio (Ap) = 0.8000
Summary of stream data:

Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)    (Ac.)       (min) (In/Hr)     (In/Hr)


1      6.53    19.310     37.65    0.782      1.083
2      1.35     2.890     27.73    0.782      1.301
Qmax(1) =
         1.000 *    1.000 *     6.527) +
         0.580 *    1.000 *     1.351) + =       7.310
Qmax(2) =
         1.726 *    0.736 *     6.527) +
         1.000 *    1.000 *     1.351) + =       9.645

Total of 2 main streams to confluence:
Flow rates before confluence point:
       7.527       2.351
Maximum flow rates at confluence using above data:
        7.310        9.645
Area of streams before confluence:
       19.310        2.890
Effective area values after confluence:
       22.200       17.109


Results of confluence:
Total flow rate =      9.645(CFS)
Time of concentration =    27.727 min.
Effective stream area after confluence  =     17.109(Ac.)
Study area average Pervious fraction(Ap) =  0.800
Study area average soil loss rate(Fm) =    0.782(In/Hr)
Study area total =      22.20(Ac.)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       16.000 to Point/Station       19.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
________________________________________________________________________
Depth of flow =   0.247(Ft.), Average velocity =   1.585(Ft/s)
      ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00              1.00
      2            100.00              0.00
      3            200.00              1.00
Manning's 'N' friction factor =   0.030
------------------------------------------------------------------
Sub-Channel flow  =      9.645(CFS)
  '     '    flow top width =     49.342(Ft.)
  '     '    velocity=    1.585(Ft/s)
  '     '    area =      6.087(Sq.Ft)
  '     '    Froude number =     0.795

Upstream point elevation =  1035.800(Ft.)
Downstream point elevation =  1034.700(Ft.)
Flow length =    66.000(Ft.)
Travel time  =    0.69 min.
Time of concentration =   28.42 min.
Depth of flow =   0.247(Ft.)
Average velocity =   1.585(Ft/s)
Total irregular channel flow =     9.645(CFS)
Irregular channel normal depth above invert elev. =   0.247(Ft.)
Average velocity of channel(s) =   1.585(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       16.000 to Point/Station       19.000
**** CONFLUENCE OF MAIN STREAMS ****
________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =     17.109(Ac.)
Runoff from this stream =      9.645(CFS)
Time of concentration =   28.42 min.
Rainfall intensity =     1.282(In/Hr)
Area averaged loss rate (Fm) =    0.7822(In/Hr)
Area averaged Pervious ratio (Ap) = 0.8000
Program is now starting with Main Stream No. 2
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       17.000 to Point/Station       18.000
**** INITIAL AREA EVALUATION ****

------------------------------------------------------------------------------
RESIDENTIAL(1 acre lot)
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
Pervious ratio(Ap) = 0.8000     Max loss rate(Fm)=     0.782(In/Hr)
Initial subarea data:
Initial area flow distance =   846.000(Ft.)
Top (of initial area) elevation =  1050.900(Ft.)
Bottom (of initial area) elevation =  1040.100(Ft.)
Difference in elevation =    10.800(Ft.)
Slope =    0.01277  s(%)=       1.28
TC = k(0.469)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   16.631 min.
Rainfall intensity =      1.769(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.502
Subarea runoff =      4.847(CFS)
Total initial stream area =        5.460(Ac.)
Pervious area fraction = 0.800
Initial area Fm value =    0.782(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       17.000 to Point/Station       18.000
**** CONFLUENCE OF MINOR STREAMS ****

------------------------------------------------------------------------------
Along Main Stream number: 2 in normal stream number 1
Stream flow area =      5.460(Ac.)
Runoff from this stream =      4.847(CFS)
Time of concentration =   16.63 min.
Rainfall intensity =     1.769(In/Hr)
Area averaged loss rate (Fm) =    0.7822(In/Hr)
Area averaged Pervious ratio (Ap) = 0.8000
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       17.100 to Point/Station       18.000
**** INITIAL AREA EVALUATION ****

_____________________________________________________________________________
COMMERCIAL subarea type
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
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.098(In/Hr)
Initial subarea data:
Initial area flow distance =   622.000(Ft.)
Top (of initial area) elevation =  1046.500(Ft.)
Bottom (of initial area) elevation =  1040.100(Ft.)
Difference in elevation =     6.400(Ft.)
Slope =    0.01029  s(%)=       1.03
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    9.952 min.
Rainfall intensity =      2.407(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.863
Subarea runoff =      1.766(CFS)
Total initial stream area =        0.850(Ac.)
Pervious area fraction = 0.100
Initial area Fm value =    0.098(In/Hr)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       17.100 to Point/Station       18.000
**** CONFLUENCE OF MINOR STREAMS ****
________________________________________________________________________
Along Main Stream number: 2 in normal stream number 2
Stream flow area =      0.850(Ac.)
Runoff from this stream =      1.766(CFS)
Time of concentration =    9.95 min.
Rainfall intensity =     2.407(In/Hr)
Area averaged loss rate (Fm) =    0.0978(In/Hr)
Area averaged Pervious ratio (Ap) = 0.1000
Summary of stream data:

Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)    (Ac.)       (min) (In/Hr)     (In/Hr)


1      4.85     5.460     16.63    0.782      1.769
2      1.77     0.850      9.95    0.098      2.407
Qmax(1) =
         1.000 *    1.000 *     4.847) +
         0.724 *    1.000 *     1.766) + =       6.125
Qmax(2) =
         1.647 *    0.598 *     4.847) +
         1.000 *    1.000 *     1.766) + =       6.543

Total of 2 streams to confluence:
Flow rates before confluence point:
       4.847       1.766
Maximum flow rates at confluence using above data:
        6.125        6.543
Area of streams before confluence:
        5.460        0.850
Effective area values after confluence:
        6.310        4.117
Results of confluence:
Total flow rate =      6.543(CFS)
Time of concentration =     9.952 min.
Effective stream area after confluence =      4.117(Ac.)
Study area average Pervious fraction(Ap) =  0.706
Study area average soil loss rate(Fm) =    0.690(In/Hr)
Study area total (this main stream) =       6.31(Ac.)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       18.000 to Point/Station       19.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
____________________________________________________________________________
Top of street segment elevation =  1040.100(Ft.)
End of street segment elevation =  1034.700(Ft.)
Length of street segment  =   661.000(Ft.)
Height of curb above gutter flowline  =    8.0(In.)
Width of half street (curb to crown)  =  22.000(Ft.)
Distance from crown to crossfall grade break  =  20.500(Ft.)
Slope from gutter to grade break (v/hz) =   0.083
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  =  11.000(Ft.)
Slope from curb to property line (v/hz) =   0.020
Gutter width =   1.500(Ft.)
Gutter hike from flowline =  1.500(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 =      6.626(CFS)
Depth of flow =   0.360(Ft.), Average velocity =   1.815(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =  13.245(Ft.)
Flow velocity =   1.81(Ft/s)
Travel time =    6.07 min.     TC =   16.02  min.
 Adding area flow to street
COMMERCIAL subarea type
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
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.098(In/Hr)
The area added to the existing stream causes a
a lower flow rate of Q =      5.423(CFS)
therefore the upstream flow rate of Q =      6.543(CFS) is being used
Rainfall intensity =      1.809(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.606
Subarea runoff =      0.000(CFS) for    0.830(Ac.)
Total runoff =      6.543(CFS)
Effective area this stream =        4.95(Ac.)
Total Study Area (Main Stream No. 2) =       29.34(Ac.)
Area averaged Fm value =    0.591(In/Hr)
Street flow at end of street =      6.543(CFS)
Half street flow at end of street =      3.272(CFS)
Depth of flow =   0.359(Ft.), Average velocity =   1.809(Ft/s)
Flow width (from curb towards crown)=  13.179(Ft.)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       18.000 to Point/Station       19.000
**** CONFLUENCE OF MAIN STREAMS ****
________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =      4.947(Ac.)
Runoff from this stream =      6.543(CFS)
Time of concentration =   16.02 min.
Rainfall intensity =     1.809(In/Hr)
Area averaged loss rate (Fm) =    0.5907(In/Hr)
Area averaged Pervious ratio (Ap) = 0.6041
Summary of stream data:

Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)    (Ac.)       (min) (In/Hr)     (In/Hr)


1      9.64    17.109     28.42    0.782      1.282
2      6.54     4.947     16.02    0.591      1.809
Qmax(1) =
         1.000 *    1.000 *     9.645) +
         0.568 *    1.000 *     6.543) + =      13.360
Qmax(2) =
         2.052 *    0.564 *     9.645) +
         1.000 *    1.000 *     6.543) + =      17.703

Total of 2 main streams to confluence:
Flow rates before confluence point:
      10.645       7.543
Maximum flow rates at confluence using above data:
       13.360       17.703
Area of streams before confluence:
       17.109        4.947
Effective area values after confluence:
       22.056       14.593


Results of confluence:
Total flow rate =     17.703(CFS)
Time of concentration =    16.023 min.
Effective stream area after confluence  =     14.593(Ac.)
Study area average Pervious fraction(Ap) =  0.756
Study area average soil loss rate(Fm) =    0.739(In/Hr)
Study area total =      22.06(Ac.)
End of computations, Total Study Area =           29.34 (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) = 0.760
Area averaged SCS curve number =  32.0
```

San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2014 Version 9.0
Rational Hydrology Study Date: 04/20/21

BLOOMINGTON COMMERCE CENTER - SITE 4
EXISTING CONDITION
10 YEAR STORM ANALYSIS WITH ADJUSTED 5 YEAR RAINFALL DATA

Program License Serial Number 6405

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

Rational hydrology study storm event year is 10.0
Computed rainfall intensity:
Storm year = 10.00 1 hour rainfall = 0.684 (In.)
Slope used for rainfall intensity curve b = 0.6000
Soil antecedent moisture condition (AMC) = 2

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       12.000 to Point/Station       13.000
**** INITIAL AREA EVALUATION ****
_____________________________________________________________________________
RESIDENTIAL(1 acre lot)
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
Pervious ratio(Ap) = 0.8000     Max loss rate(Fm)=     0.782(In/Hr)
Initial subarea data:
Initial area flow distance =   323.000(Ft.)
Top (of initial area) elevation =  1055.800(Ft.)
Bottom (of initial area) elevation =  1049.100(Ft.)
Difference in elevation =     6.700(Ft.)
Slope =    0.02074  s(%)=       2.07
TC = k(0.469)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   10.268 min.
Rainfall intensity =      1.973(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.543
Subarea runoff =      1.350(CFS)
Total initial stream area =        1.260(Ac.)
Pervious area fraction = 0.800
Initial area Fm value =    0.782(In/Hr)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       13.000 to Point/Station       14.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
____________________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.174(Ft.), Average velocity =   0.784(Ft/s)
      ******* Irregular Channel Data ***********
----------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1             0.00              1.00
      2           100.00              0.00
      3           200.00              1.00
Manning's 'N' friction factor =   0.030
----------------------------------------------------------------
Sub-Channel flow  =      2.378(CFS)
  '     '    flow top width =     34.827(Ft.)
  '     '    velocity=    0.784(Ft/s)
  '     '    area =      3.032(Sq.Ft)
  '     '    Froude number =     0.468

Upstream point elevation =  1049.100(Ft.)
Downstream point elevation =  1043.600(Ft.)
Flow length =   847.000(Ft.)
Travel time  =   18.00 min.
Time of concentration =   28.27 min.
Depth of flow =   0.174(Ft.)
Average velocity =   0.784(Ft/s)
Total irregular channel flow =     2.378(CFS)
Irregular channel normal depth above invert elev. =   0.174(Ft.)
Average velocity of channel(s) =   0.784(Ft/s)
 Adding area flow to channel
RESIDENTIAL(1 acre lot)
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
Pervious ratio(Ap) = 0.8000     Max loss rate(Fm)=     0.782(In/Hr)
Rainfall intensity =      1.074(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.245
Subarea runoff =      1.973(CFS) for   11.380(Ac.)
Total runoff =      3.323(CFS)
Effective area this stream =       12.64(Ac.)
Total Study Area (Main Stream No. 1) =       12.64(Ac.)
Area averaged Fm value =    0.782(In/Hr)
Depth of flow =   0.197(Ft.), Average velocity =   0.852(Ft/s)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       14.000 to Point/Station       16.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
____________________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.184(Ft.), Average velocity =   0.985(Ft/s)
      ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1             0.00              1.00
      2           100.00              0.00
      3           200.00              1.00
Manning's 'N' friction factor =   0.030
------------------------------------------------------------------
Sub-Channel flow  =      3.350(CFS)
  '     '    flow top width =     36.887(Ft.)
  '     '    velocity=    0.985(Ft/s)
  '     '    area =      3.402(Sq.Ft)
  '     '    Froude number =     0.572

Upstream point elevation =  1043.600(Ft.)
Downstream point elevation =  1035.800(Ft.)
Flow length =   822.000(Ft.)
Travel time  =   13.91 min.
Time of concentration =   42.18 min.
Depth of flow =   0.184(Ft.)
Average velocity =   0.985(Ft/s)
Total irregular channel flow =     3.350(CFS)
Irregular channel normal depth above invert elev. =   0.184(Ft.)
Average velocity of channel(s) =   0.985(Ft/s)
 Adding area flow to channel
RESIDENTIAL(1 acre lot)
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
Pervious ratio(Ap) = 0.8000     Max loss rate(Fm)=     0.782(In/Hr)
The area added to the existing stream causes a
a lower flow rate of Q =      2.937(CFS)
therefore the upstream flow rate of Q =      3.323(CFS) is being used
Rainfall intensity =      0.845(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.180
Subarea runoff =      0.000(CFS) for    6.670(Ac.)
Total runoff =      3.323(CFS)
Effective area this stream =       19.31(Ac.)
Total Study Area (Main Stream No. 1) =       19.31(Ac.)
Area averaged Fm value =    0.782(In/Hr)
Depth of flow =   0.184(Ft.), Average velocity =   0.983(Ft/s)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       14.000 to Point/Station       16.000
**** CONFLUENCE OF MAIN STREAMS ****
_____________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =     19.310(Ac.)
Runoff from this stream =      3.323(CFS)
Time of concentration =   42.18 min.
Rainfall intensity =     0.845(In/Hr)
Area averaged loss rate (Fm) =    0.7822(In/Hr)
Area averaged Pervious ratio (Ap) = 0.8000
Program is now starting with Main Stream No. 2
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       15.000 to Point/Station       15.100
**** INITIAL AREA EVALUATION ****
_____________________________________________________________________________
RESIDENTIAL(1 acre lot)
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
Pervious ratio(Ap) = 0.8000     Max loss rate(Fm)=     0.782(In/Hr)
Initial subarea data:
Initial area flow distance =   538.000(Ft.)
Top (of initial area) elevation =  1047.200(Ft.)
Bottom (of initial area) elevation =  1039.900(Ft.)
Difference in elevation =     7.300(Ft.)
Slope =    0.01357  s(%)=       1.36
TC = k(0.469)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   13.708 min.
Rainfall intensity =      1.659(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.476
Subarea runoff =      0.615(CFS)
Total initial stream area =        0.780(Ac.)
Pervious area fraction = 0.800
Initial area Fm value =    0.782(In/Hr)
```

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++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       15.100 to Point/Station       16.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
________________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.107(Ft.), Average velocity =   0.598(Ft/s)
      ******* Irregular Channel Data ***********
-------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00              1.00
      2            100.00              0.00
      3            200.00              1.00
Manning's 'N' friction factor =   0.030
-------------------------------------------------------------------
Sub-Channel flow  =      0.690(CFS)
  '     '    flow top width =     21.483(Ft.)
  '     '    velocity=    0.598(Ft/s)
  '     '    area =      1.154(Sq.Ft)
  '     '    Froude number =     0.455

Upstream point elevation =  1039.900(Ft.)
Downstream point elevation =  1035.800(Ft.)
Flow length =   570.000(Ft.)
Travel time  =   15.89 min.
Time of concentration =   29.59 min.
Depth of flow =   0.107(Ft.)
Average velocity =   0.598(Ft/s)
Total irregular channel flow =     0.690(CFS)
Irregular channel normal depth above invert elev. =   0.107(Ft.)
Average velocity of channel(s) =   0.598(Ft/s)
 Adding area flow to channel
RESIDENTIAL(1 acre lot)
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
Pervious ratio(Ap) = 0.8000     Max loss rate(Fm)=     0.782(In/Hr)
Rainfall intensity =      1.045(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.226
Subarea runoff =      0.069(CFS) for    2.110(Ac.)
Total runoff =      0.684(CFS)
Effective area this stream =        2.89(Ac.)
Total Study Area (Main Stream No. 2) =       22.20(Ac.)
Area averaged Fm value =    0.782(In/Hr)
Depth of flow =   0.107(Ft.), Average velocity =   0.597(Ft/s)
```

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++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       15.100 to Point/Station       16.000
**** CONFLUENCE OF MAIN STREAMS ****
________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =      2.890(Ac.)
Runoff from this stream =      0.684(CFS)
Time of concentration =   29.59 min.
Rainfall intensity =     1.045(In/Hr)
Area averaged loss rate (Fm) =    0.7822(In/Hr)
Area averaged Pervious ratio (Ap) = 0.8000
Summary of stream data:

Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)    (Ac.)       (min) (In/Hr)     (In/Hr)


1      3.32    19.310     42.18    0.782      0.845
2      0.68     2.890     29.59    0.782      1.045
Qmax(1) =
         1.000 *    1.000 *     3.323) +
         0.239 *    1.000 *     0.684) + =       3.486
Qmax(2) =
         4.190 *    0.702 *     3.323) +
         1.000 *    1.000 *     0.684) + =      10.452

Total of 2 main streams to confluence:
Flow rates before confluence point:
       4.323       1.684
Maximum flow rates at confluence using above data:
        3.486       10.452
Area of streams before confluence:
       19.310        2.890
Effective area values after confluence:
       22.200       16.437


Results of confluence:
Total flow rate =     10.452(CFS)
Time of concentration =    29.595 min.
Effective stream area after confluence  =     16.437(Ac.)
Study area average Pervious fraction(Ap) =  0.800
Study area average soil loss rate(Fm) =    0.782(In/Hr)
Study area total =      22.20(Ac.)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       16.000 to Point/Station       19.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
____________________________________________________________________________
Depth of flow =   0.254(Ft.), Average velocity =   1.617(Ft/s)
      ******* Irregular Channel Data ***********
----------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00              1.00
      2            100.00              0.00
      3            200.00              1.00
Manning's 'N' friction factor =   0.030
----------------------------------------------------------------
Sub-Channel flow  =     10.452(CFS)
  '     '    flow top width =     50.851(Ft.)
  '     '    velocity=    1.617(Ft/s)
  '     '    area =      6.465(Sq.Ft)
  '     '    Froude number =     0.799

Upstream point elevation =  1035.800(Ft.)
Downstream point elevation =  1034.700(Ft.)
Flow length =    66.000(Ft.)
Travel time  =    0.68 min.
Time of concentration =   30.28 min.
Depth of flow =   0.254(Ft.)
Average velocity =   1.617(Ft/s)
Total irregular channel flow =    10.452(CFS)
Irregular channel normal depth above invert elev. =   0.254(Ft.)
Average velocity of channel(s) =   1.617(Ft/s)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       16.000 to Point/Station       19.000
**** CONFLUENCE OF MAIN STREAMS ****
_____________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =     16.437(Ac.)
Runoff from this stream =     10.452(CFS)
Time of concentration =   30.28 min.
Rainfall intensity =     1.031(In/Hr)
Area averaged loss rate (Fm) =    0.7822(In/Hr)
Area averaged Pervious ratio (Ap) = 0.8000
Program is now starting with Main Stream No. 2
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       17.000 to Point/Station       18.000
**** INITIAL AREA EVALUATION ****
_____________________________________________________________________________
RESIDENTIAL(1 acre lot)
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
Pervious ratio(Ap) = 0.8000     Max loss rate(Fm)=     0.782(In/Hr)
Initial subarea data:
Initial area flow distance =   846.000(Ft.)
Top (of initial area) elevation =  1050.900(Ft.)
Bottom (of initial area) elevation =  1040.100(Ft.)
Difference in elevation =    10.800(Ft.)
Slope =    0.01277  s(%)=       1.28
TC = k(0.469)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   16.631 min.
Rainfall intensity =      1.477(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.423
Subarea runoff =      3.414(CFS)
Total initial stream area =        5.460(Ac.)
Pervious area fraction = 0.800
Initial area Fm value =    0.782(In/Hr)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       17.000 to Point/Station       18.000
**** CONFLUENCE OF MINOR STREAMS ****
____________________________________________________________________________
Along Main Stream number: 2 in normal stream number 1
Stream flow area =      5.460(Ac.)
Runoff from this stream =      3.414(CFS)
Time of concentration =   16.63 min.
Rainfall intensity =     1.477(In/Hr)
Area averaged loss rate (Fm) =    0.7822(In/Hr)
Area averaged Pervious ratio (Ap) = 0.8000
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       17.100 to Point/Station       18.000
**** INITIAL AREA EVALUATION ****
_____________________________________________________________________________
COMMERCIAL subarea type
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
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.098(In/Hr)
Initial subarea data:
Initial area flow distance =   622.000(Ft.)
Top (of initial area) elevation =  1046.500(Ft.)
Bottom (of initial area) elevation =  1040.100(Ft.)
Difference in elevation =     6.400(Ft.)
Slope =    0.01029  s(%)=       1.03
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    9.952 min.
Rainfall intensity =      2.010(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.856
Subarea runoff =      1.463(CFS)
Total initial stream area =        0.850(Ac.)
Pervious area fraction = 0.100
Initial area Fm value =    0.098(In/Hr)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       17.100 to Point/Station       18.000
**** CONFLUENCE OF MINOR STREAMS ****
________________________________________________________________________
Along Main Stream number: 2 in normal stream number 2
Stream flow area =      0.850(Ac.)
Runoff from this stream =      1.463(CFS)
Time of concentration =    9.95 min.
Rainfall intensity =     2.010(In/Hr)
Area averaged loss rate (Fm) =    0.0978(In/Hr)
Area averaged Pervious ratio (Ap) = 0.1000
Summary of stream data:

Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)    (Ac.)       (min) (In/Hr)     (In/Hr)


1      3.41     5.460     16.63    0.782      1.477
2      1.46     0.850      9.95    0.098      2.010
Qmax(1) =
         1.000 *    1.000 *     3.414) +
         0.721 *    1.000 *     1.463) + =       4.470
Qmax(2) =
         1.767 *    0.598 *     3.414) +
         1.000 *    1.000 *     1.463) + =       5.073

Total of 2 streams to confluence:
Flow rates before confluence point:
       3.414       1.463
Maximum flow rates at confluence using above data:
        4.470        5.073
Area of streams before confluence:
        5.460        0.850
Effective area values after confluence:
        6.310        4.117
Results of confluence:
Total flow rate =      5.073(CFS)
Time of concentration =     9.952 min.
Effective stream area after confluence =      4.117(Ac.)
Study area average Pervious fraction(Ap) =  0.706
Study area average soil loss rate(Fm) =    0.690(In/Hr)
Study area total (this main stream) =       6.31(Ac.)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       18.000 to Point/Station       19.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
____________________________________________________________________________
Top of street segment elevation =  1040.100(Ft.)
End of street segment elevation =  1034.700(Ft.)
Length of street segment  =   661.000(Ft.)
Height of curb above gutter flowline  =    8.0(In.)
Width of half street (curb to crown)  =  22.000(Ft.)
Distance from crown to crossfall grade break  =  20.500(Ft.)
Slope from gutter to grade break (v/hz) =   0.083
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  =  11.000(Ft.)
Slope from curb to property line (v/hz) =   0.020
Gutter width =   1.500(Ft.)
Gutter hike from flowline =  1.500(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 =      5.137(CFS)
Depth of flow =   0.334(Ft.), Average velocity =   1.710(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =  11.963(Ft.)
Flow velocity =   1.71(Ft/s)
Travel time =    6.44 min.     TC =   16.40  min.
 Adding area flow to street
COMMERCIAL subarea type
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
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.098(In/Hr)
The area added to the existing stream causes a
a lower flow rate of Q =      4.003(CFS)
therefore the upstream flow rate of Q =      5.073(CFS) is being used
Rainfall intensity =      1.490(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.543
Subarea runoff =      0.000(CFS) for    0.830(Ac.)
Total runoff =      5.073(CFS)
Effective area this stream =        4.95(Ac.)
Total Study Area (Main Stream No. 2) =       29.34(Ac.)
Area averaged Fm value =    0.591(In/Hr)
Street flow at end of street =      5.073(CFS)
Half street flow at end of street =      2.537(CFS)
Depth of flow =   0.333(Ft.), Average velocity =   1.705(Ft/s)
Flow width (from curb towards crown)=  11.903(Ft.)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       18.000 to Point/Station       19.000
**** CONFLUENCE OF MAIN STREAMS ****
________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =      4.947(Ac.)
Runoff from this stream =      5.073(CFS)
Time of concentration =   16.40 min.
Rainfall intensity =     1.490(In/Hr)
Area averaged loss rate (Fm) =    0.5907(In/Hr)
Area averaged Pervious ratio (Ap) = 0.6041
Summary of stream data:

Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)    (Ac.)       (min) (In/Hr)     (In/Hr)


1     10.45    16.437     30.28    0.782      1.031
2      5.07     4.947     16.40    0.591      1.490
Qmax(1) =
         1.000 *    1.000 *    10.452) +
         0.490 *    1.000 *     5.073) + =      12.937
Qmax(2) =
         2.843 *    0.542 *    10.452) +
         1.000 *    1.000 *     5.073) + =      21.166

Total of 2 main streams to confluence:
Flow rates before confluence point:
      11.452       6.073
Maximum flow rates at confluence using above data:
       12.937       21.166
Area of streams before confluence:
       16.437        4.947
Effective area values after confluence:
       21.385       13.849


Results of confluence:
Total flow rate =     21.166(CFS)
Time of concentration =    16.396 min.
Effective stream area after confluence  =     13.849(Ac.)
Study area average Pervious fraction(Ap) =  0.755
Study area average soil loss rate(Fm) =    0.738(In/Hr)
Study area total =      21.38(Ac.)
End of computations, Total Study Area =           29.34 (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) = 0.760
Area averaged SCS curve number =  32.0
```

San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2014 Version 9.0
Rational Hydrology Study Date: 04/06/21

BLOOMINGTON COMMERCE CENTER - SITE 4
PROPOSED CONDITION
10-YEAR STORM EVENT ANALYSIS

Program License Serial Number 6405

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

Rational hydrology study storm event year is 10.0
Computed rainfall intensity:
Storm year = 10.00 1 hour rainfall = 0.819 (In.)
Slope used for rainfall intensity curve b = 0.6000
Soil antecedent moisture condition (AMC) = 2

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       10.000 to Point/Station       11.000
**** INITIAL AREA EVALUATION ****

______________________________________________________________________________
RESIDENTIAL(1 acre lot)
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
Pervious ratio(Ap) = 0.8000     Max loss rate(Fm)=     0.782(In/Hr)
Initial subarea data:
Initial area flow distance =   323.000(Ft.)
Top (of initial area) elevation =  1055.800(Ft.)
Bottom (of initial area) elevation =  1049.100(Ft.)
Difference in elevation =     6.700(Ft.)
Slope =    0.02074  s(%)=       2.07
TC = k(0.469)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   10.268 min.
Rainfall intensity =      2.362(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.602
Subarea runoff =      1.791(CFS)
Total initial stream area =        1.260(Ac.)
Pervious area fraction = 0.800
Initial area Fm value =    0.782(In/Hr)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       11.000 to Point/Station       12.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
________________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.215(Ft.), Average velocity =   0.903(Ft/s)
      ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00              1.00
      2            100.00              0.00
      3            200.00              1.00
Manning's 'N' friction factor =   0.030
------------------------------------------------------------------
Sub-Channel flow  =      4.192(CFS)
  '     '    flow top width =     43.079(Ft.)
  '     '    velocity=    0.903(Ft/s)
  '     '    area =      4.639(Sq.Ft)
  '     '    Froude number =     0.485

Upstream point elevation =  1049.100(Ft.)
Downstream point elevation =  1043.600(Ft.)
Flow length =   847.000(Ft.)
Travel time  =   15.62 min.
Time of concentration =   25.89 min.
Depth of flow =   0.215(Ft.)
Average velocity =   0.903(Ft/s)
Total irregular channel flow =     4.192(CFS)
Irregular channel normal depth above invert elev. =   0.215(Ft.)
Average velocity of channel(s) =   0.903(Ft/s)
 Adding area flow to channel
RESIDENTIAL(1 acre lot)
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
Pervious ratio(Ap) = 0.8000     Max loss rate(Fm)=     0.782(In/Hr)
Rainfall intensity =      1.356(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.381
Subarea runoff =      4.736(CFS) for   11.380(Ac.)
Total runoff =      6.527(CFS)
Effective area this stream =       12.64(Ac.)
Total Study Area (Main Stream No. 1) =       12.64(Ac.)
Area averaged Fm value =    0.782(In/Hr)
Depth of flow =   0.254(Ft.), Average velocity =   1.009(Ft/s)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       12.000 to Point/Station       13.300
**** IMPROVED CHANNEL TRAVEL TIME ****
______________________________________________________________________________
Upstream point elevation =  1042.700(Ft.)
Downstream point elevation =  1040.100(Ft.)
Channel length thru subarea  =   308.000(Ft.)
Channel base width      =    8.000(Ft.)
Slope or 'Z' of left channel bank = 100.000
Slope or 'Z' of right channel bank = 100.000
Manning's 'N'    = 0.020
Maximum depth of channel  =    1.000(Ft.)
Flow(q) thru subarea =      6.527(CFS)
Depth of flow =   0.173(Ft.), Average velocity =   1.496(Ft/s)
Channel flow top width =   42.538(Ft.)
Flow Velocity =    1.50(Ft/s)
Travel time  =    3.43 min.
Time of concentration =   29.32 min.
Critical depth =      0.158(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       12.000 to Point/Station       13.300
**** CONFLUENCE OF MAIN STREAMS ****
______________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =     12.640(Ac.)
Runoff from this stream =      6.527(CFS)
Time of concentration =   29.32 min.
Rainfall intensity =     1.258(In/Hr)
Area averaged loss rate (Fm) =    0.7822(In/Hr)
Area averaged Pervious ratio (Ap) = 0.8000
Program is now starting with Main Stream No. 2
```

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++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       13.100 to Point/Station       13.300
**** INITIAL AREA EVALUATION ****
_____________________________________________________________________________
RESIDENTIAL(1 acre lot)
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
Pervious ratio(Ap) = 0.8000     Max loss rate(Fm)=     0.782(In/Hr)
Initial subarea data:
Initial area flow distance =   846.000(Ft.)
Top (of initial area) elevation =  1050.900(Ft.)
Bottom (of initial area) elevation =  1040.100(Ft.)
Difference in elevation =    10.800(Ft.)
Slope =    0.01277  s(%)=       1.28
TC = k(0.469)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   16.631 min.
Rainfall intensity =      1.769(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.502
Subarea runoff =      4.847(CFS)
Total initial stream area =        5.460(Ac.)
Pervious area fraction = 0.800
Initial area Fm value =    0.782(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       13.100 to Point/Station       13.300
**** CONFLUENCE OF MAIN STREAMS ****
_____________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =      5.460(Ac.)
Runoff from this stream =      4.847(CFS)
Time of concentration =   16.63 min.
Rainfall intensity =     1.769(In/Hr)
Area averaged loss rate (Fm) =    0.7822(In/Hr)
Area averaged Pervious ratio (Ap) = 0.8000
Program is now starting with Main Stream No. 3
```

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++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       13.200 to Point/Station       13.300
**** INITIAL AREA EVALUATION ****

____________________________________________________________________________
COMMERCIAL subarea type
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
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.098(In/Hr)
Initial subarea data:
Initial area flow distance =   622.000(Ft.)
Top (of initial area) elevation =  1046.500(Ft.)
Bottom (of initial area) elevation =  1040.100(Ft.)
Difference in elevation =     6.400(Ft.)
Slope =    0.01029  s(%)=       1.03
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    9.952 min.
Rainfall intensity =      2.407(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.863
Subarea runoff =      0.914(CFS)
Total initial stream area =        0.440(Ac.)
Pervious area fraction = 0.100
Initial area Fm value =    0.098(In/Hr)
```

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++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       13.200 to Point/Station       13.300
**** CONFLUENCE OF MAIN STREAMS ****
________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 3
Stream flow area =      0.440(Ac.)
Runoff from this stream =      0.914(CFS)
Time of concentration =    9.95 min.
Rainfall intensity =     2.407(In/Hr)
Area averaged loss rate (Fm) =    0.0978(In/Hr)
Area averaged Pervious ratio (Ap) = 0.1000
Summary of stream data:

Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)    (Ac.)       (min) (In/Hr)     (In/Hr)


1      6.53    12.640     29.32    0.782      1.258
2      4.85     5.460     16.63    0.782      1.769
3      0.91     0.440      9.95    0.098      2.407
Qmax(1) =
         1.000 *    1.000 *     6.527) +
         0.483 *    1.000 *     4.847) +
         0.503 *    1.000 *     0.914) + =       9.327
Qmax(2) =
         2.071 *    0.567 *     6.527) +
         1.000 *    1.000 *     4.847) +
         0.724 *    1.000 *     0.914) + =      13.176
Qmax(3) =
         3.411 *    0.339 *     6.527) +
         1.647 *    0.598 *     4.847) +
         1.000 *    1.000 *     0.914) + =      13.248

Total of 3 main streams to confluence:
Flow rates before confluence point:
       7.527       5.847       1.914
Maximum flow rates at confluence using above data:
        9.327       13.176       13.248
Area of streams before confluence:
       12.640        5.460        0.440
Effective area values after confluence:
       18.540       13.069        7.997


Results of confluence:
Total flow rate =     13.248(CFS)
Time of concentration =     9.952 min.
Effective stream area after confluence  =      7.997(Ac.)
Study area average Pervious fraction(Ap) =  0.783
Study area average soil loss rate(Fm) =    0.766(In/Hr)
Study area total =      18.54(Ac.)
```

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++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       13.300 to Point/Station       15.100
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
_____________________________________________________________________________
Top of street segment elevation =  1040.100(Ft.)
End of street segment elevation =  1034.500(Ft.)
Length of street segment  =   663.000(Ft.)
Height of curb above gutter flowline  =    8.0(In.)
Width of half street (curb to crown)  =  22.000(Ft.)
Distance from crown to crossfall grade break  =  20.000(Ft.)
Slope from gutter to grade break (v/hz) =   0.083
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  =  11.000(Ft.)
Slope from curb to property line (v/hz) =   0.020
Gutter width =   1.500(Ft.)
Gutter hike from flowline =  0.125(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 =     13.346(CFS)
Depth of flow =   0.327(Ft.), Average velocity =   2.647(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =  15.749(Ft.)
Flow velocity =   2.65(Ft/s)
Travel time =    4.17 min.     TC =   14.13  min.
 Adding area flow to street
COMMERCIAL subarea type
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
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.098(In/Hr)
The area added to the existing stream causes a
a lower flow rate of Q =      9.309(CFS)
therefore the upstream flow rate of Q =     13.248(CFS) is being used
Rainfall intensity =      1.951(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.564
Subarea runoff =      0.000(CFS) for    0.470(Ac.)
Total runoff =     13.248(CFS)
Effective area this stream =        8.47(Ac.)
Total Study Area (Main Stream No. 1) =       19.01(Ac.)
Area averaged Fm value =    0.729(In/Hr)
Street flow at end of street =     13.248(CFS)
Half street flow at end of street =      6.624(CFS)
Depth of flow =   0.326(Ft.), Average velocity =   2.642(Ft/s)
Flow width (from curb towards crown)=  15.705(Ft.)
```

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++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       13.300 to Point/Station       15.100
**** CONFLUENCE OF MAIN STREAMS ****
______________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =      8.467(Ac.)
Runoff from this stream =     13.248(CFS)
Time of concentration =   14.13 min.
Rainfall intensity =     1.951(In/Hr)
Area averaged loss rate (Fm) =    0.7289(In/Hr)
Area averaged Pervious ratio (Ap) = 0.7455
Program is now starting with Main Stream No. 2


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       14.000 to Point/Station       15.000
**** 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)  = 32.00
Pervious ratio(Ap) = 0.1500     Max loss rate(Fm)=     0.147(In/Hr)
Initial subarea data:
Initial area flow distance =   852.000(Ft.)
Top (of initial area) elevation =  1050.600(Ft.)
Bottom (of initial area) elevation =  1039.200(Ft.)
Difference in elevation =    11.400(Ft.)
Slope =    0.01338  s(%)=       1.34
TC = k(0.311)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   10.973 min.
Rainfall intensity =      2.270(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.842
Subarea runoff =     18.248(CFS)
Total initial stream area =        9.550(Ac.)
Pervious area fraction = 0.150
Initial area Fm value =    0.147(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       15.000 to Point/Station       15.100
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________________
Upstream point/station elevation =  1036.700(Ft.)
Downstream point/station elevation =  1034.500(Ft.)
Pipe length  =   120.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    18.248(CFS)
Nearest computed pipe diameter  =     21.00(In.)
Calculated individual pipe flow  =    18.248(CFS)
Normal flow depth in pipe =   14.88(In.)
Flow top width inside pipe =   19.08(In.)
Critical Depth =   18.62(In.)
Pipe flow velocity =     10.01(Ft/s)
Travel time through pipe =    0.20 min.
Time of concentration (TC) =    11.17 min.
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       15.000 to Point/Station       15.100
**** CONFLUENCE OF MAIN STREAMS ****
________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =      9.550(Ac.)
Runoff from this stream =     18.248(CFS)
Time of concentration =   11.17 min.
Rainfall intensity =     2.245(In/Hr)
Area averaged loss rate (Fm) =    0.1467(In/Hr)
Area averaged Pervious ratio (Ap) = 0.1500
Summary of stream data:

Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)    (Ac.)       (min) (In/Hr)     (In/Hr)


1     13.25     8.467     14.13    0.729      1.951
2     18.25     9.550     11.17    0.147      2.245
Qmax(1) =
         1.000 *    1.000 *    13.248) +
         0.860 *    1.000 *    18.248) + =      28.933
Qmax(2) =
         1.241 *    0.791 *    13.248) +
         1.000 *    1.000 *    18.248) + =      31.254

Total of 2 main streams to confluence:
Flow rates before confluence point:
      14.248      19.248
Maximum flow rates at confluence using above data:
       28.933       31.254
Area of streams before confluence:
        8.467        9.550
Effective area values after confluence:
       18.017       16.247


Results of confluence:
Total flow rate =     31.254(CFS)
Time of concentration =    11.173 min.
Effective stream area after confluence  =     16.247(Ac.)
Study area average Pervious fraction(Ap) =  0.430
Study area average soil loss rate(Fm) =    0.420(In/Hr)
Study area total =      18.02(Ac.)
End of computations, Total Study Area =           28.56 (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) = 0.560
Area averaged SCS curve number =  32.0
```

APPENDIX B

PRE-PROJECT CONDITION UNIT HYDROGRAPH HYDROLOGY

B.1: UNIT HYDROGRAPH ANALYSIS, 100 YEAR, 24 HOUR STORM DURATION, AREA “A”

B.2: UNIT HYDROGRAPH ANALYSIS, 100 YEAR, 24 HOUR STORM DURATION, ADJUSTED 25 YEAR RAINFALL DATA, AREA “A”

B.3: UNIT HYDROGRAPH ANALYSIS, 25 YEAR, 24 HOUR STORM DURATION, AREA “A”

B.4: UNIT HYDROGRAPH ANALYSIS, 25 YEAR, 24 HOUR STORM DURATION, ADJUSTED 10 YEAR RAINFALL DATA, AREA “A”

B.5: UNIT HYDROGRAPH ANALYSIS, 10 YEAR, 24 HOUR STORM DURATION, AREA “A”

B.6: UNIT HYDROGRAPH ANALYSIS, 10 YEAR, 24 HOUR STORM DURATION, ADJUSTED 5 YEAR RAINFALL DATA, AREA “A”

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 04/06/21

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

Program License Serial Number 6405

BLOOMINGTON COMMERCE CENTER – SITE 4
EXISTING CONDITION
100-YEAR, 24 HOUR STORM EVENT ANALYSIS

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		
9.56	1	1.31
Rainfall data for year 100		
9.56	6	3.11
Rainfall data for year 100		
9.56	24	5.70

++

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

SCS curve	SCS curve	Area	Area	Fp(Fig C6)	Ap	Fm

No.(AMCII)	NO.(AMC 2)	(Ac.)	Fraction	(In/Hr)	(dec.)	(In/Hr)
32.0	32.0	9.56	1.000	0.978	0.800	0.782

Area-averaged adjusted loss rate Fm (In/Hr) = 0.782

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

Area (Ac.)	Area Fract	SCS CN (AMC2)	SCS CN (AMC2)	S	Pervious Yield Fr
7.65	0.800	32.0	32.0	21.25	0.016
1.91	0.200	98.0	98.0	0.20	0.958

Area-averaged catchment yield fraction, Y = 0.205
Area-averaged low loss fraction, Yb = 0.795
User entry of time of concentration = 0.365 (hours)
++
Watershed area = 9.56(Ac.)
Catchment Lag time = 0.292 hours
Unit interval = 5.000 minutes
Unit interval percentage of lag time = 28.5715
Hydrograph baseflow = 0.00(CFS)
Average maximum watershed loss rate(Fm) = 0.782(In/Hr)
Average low loss rate fraction (Yb) = 0.795 (decimal)
VALLEY DEVELOPED S-Graph Selected
Computed peak 5-minute rainfall = 0.485(In)
Computed peak 30-minute rainfall = 0.993(In)
Specified peak 1-hour rainfall = 1.310(In)
Computed peak 3-hour rainfall = 2.226(In)
Specified peak 6-hour rainfall = 3.110(In)
Specified peak 24-hour rainfall = 5.700(In)

Rainfall depth area reduction factors:
Using a total area of 9.56(Ac.) (Ref: fig. E-4)

5-minute factor = 1.000 Adjusted rainfall = 0.485(In)
30-minute factor = 1.000 Adjusted rainfall = 0.992(In)
1-hour factor = 1.000 Adjusted rainfall = 1.309(In)
3-hour factor = 1.000 Adjusted rainfall = 2.226(In)
6-hour factor = 1.000 Adjusted rainfall = 3.110(In)
24-hour factor = 1.000 Adjusted rainfall = 5.700(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 = 115.62 (CFS))		
1	1.823	2.107
2	10.035	9.495
3	26.745	19.319
4	49.491	26.299
5	72.269	26.335
6	85.261	15.021
7	92.316	8.156

8	96.278	4.580
9	98.088	2.093
10	98.686	0.692
11	99.200	0.595
12	99.712	0.592
13	100.000	0.333

Peak Unit Number	Adjusted mass rainfall (In)	Unit rainfall (In)
1	0.4846	0.4846
2	0.6395	0.1548
3	0.7521	0.1126
4	0.8438	0.0917
5	0.9226	0.0788
6	0.9923	0.0698
7	1.0555	0.0631
8	1.1134	0.0579
9	1.1671	0.0537
10	1.2173	0.0502
11	1.2646	0.0473
12	1.3094	0.0448
13	1.3610	0.0516
14	1.4106	0.0496
15	1.4584	0.0478
16	1.5046	0.0462
17	1.5493	0.0447
18	1.5926	0.0434
19	1.6347	0.0421
20	1.6757	0.0410
21	1.7157	0.0400
22	1.7547	0.0390
23	1.7927	0.0381
24	1.8300	0.0372
25	1.8664	0.0364
26	1.9021	0.0357
27	1.9371	0.0350
28	1.9714	0.0343
29	2.0051	0.0337
30	2.0382	0.0331
31	2.0707	0.0325
32	2.1027	0.0320
33	2.1342	0.0315
34	2.1652	0.0310
35	2.1957	0.0305
36	2.2258	0.0301
37	2.2554	0.0296
38	2.2846	0.0292
39	2.3134	0.0288
40	2.3418	0.0284
41	2.3699	0.0281
42	2.3976	0.0277
43	2.4250	0.0274
44	2.4521	0.0271
45	2.4788	0.0267
46	2.5052	0.0264
47	2.5314	0.0261
48	2.5572	0.0258

49	2.5828	0.0256
50	2.6081	0.0253
51	2.6331	0.0250
52	2.6579	0.0248
53	2.6825	0.0245
54	2.7068	0.0243
55	2.7309	0.0241
56	2.7547	0.0238
57	2.7783	0.0236
58	2.8018	0.0234
59	2.8250	0.0232
60	2.8480	0.0230
61	2.8708	0.0228
62	2.8934	0.0226
63	2.9158	0.0224
64	2.9381	0.0222
65	2.9601	0.0221
66	2.9820	0.0219
67	3.0037	0.0217
68	3.0253	0.0216
69	3.0467	0.0214
70	3.0679	0.0212
71	3.0890	0.0211
72	3.1099	0.0209
73	3.1287	0.0188
74	3.1474	0.0187
75	3.1659	0.0185
76	3.1843	0.0184
77	3.2025	0.0182
78	3.2206	0.0181
79	3.2386	0.0180
80	3.2565	0.0179
81	3.2742	0.0177
82	3.2918	0.0176
83	3.3093	0.0175
84	3.3266	0.0174
85	3.3439	0.0173
86	3.3610	0.0171
87	3.3780	0.0170
88	3.3950	0.0169
89	3.4118	0.0168
90	3.4285	0.0167
91	3.4451	0.0166
92	3.4616	0.0165
93	3.4780	0.0164
94	3.4943	0.0163
95	3.5104	0.0162
96	3.5266	0.0161
97	3.5426	0.0160
98	3.5585	0.0159
99	3.5743	0.0158
100	3.5900	0.0157
101	3.6057	0.0156
102	3.6212	0.0156
103	3.6367	0.0155
104	3.6521	0.0154
105	3.6674	0.0153

106	3.6826	0.0152
107	3.6978	0.0151
108	3.7128	0.0151
109	3.7278	0.0150
110	3.7427	0.0149
111	3.7576	0.0148
112	3.7723	0.0148
113	3.7870	0.0147
114	3.8016	0.0146
115	3.8162	0.0145
116	3.8306	0.0145
117	3.8450	0.0144
118	3.8593	0.0143
119	3.8736	0.0143
120	3.8878	0.0142
121	3.9019	0.0141
122	3.9160	0.0141
123	3.9300	0.0140
124	3.9439	0.0139
125	3.9578	0.0139
126	3.9716	0.0138
127	3.9853	0.0137
128	3.9990	0.0137
129	4.0126	0.0136
130	4.0262	0.0136
131	4.0397	0.0135
132	4.0532	0.0134
133	4.0665	0.0134
134	4.0799	0.0133
135	4.0932	0.0133
136	4.1064	0.0132
137	4.1196	0.0132
138	4.1327	0.0131
139	4.1457	0.0131
140	4.1587	0.0130
141	4.1717	0.0130
142	4.1846	0.0129
143	4.1975	0.0129
144	4.2103	0.0128
145	4.2230	0.0128
146	4.2357	0.0127
147	4.2484	0.0127
148	4.2610	0.0126
149	4.2735	0.0126
150	4.2860	0.0125
151	4.2985	0.0125
152	4.3109	0.0124
153	4.3233	0.0124
154	4.3356	0.0123
155	4.3479	0.0123
156	4.3601	0.0122
157	4.3723	0.0122
158	4.3845	0.0121
159	4.3966	0.0121
160	4.4087	0.0121
161	4.4207	0.0120
162	4.4327	0.0120

163	4.4446	0.0119
164	4.4565	0.0119
165	4.4683	0.0119
166	4.4802	0.0118
167	4.4919	0.0118
168	4.5037	0.0117
169	4.5154	0.0117
170	4.5270	0.0117
171	4.5386	0.0116
172	4.5502	0.0116
173	4.5618	0.0115
174	4.5733	0.0115
175	4.5847	0.0115
176	4.5962	0.0114
177	4.6076	0.0114
178	4.6189	0.0114
179	4.6302	0.0113
180	4.6415	0.0113
181	4.6528	0.0113
182	4.6640	0.0112
183	4.6752	0.0112
184	4.6863	0.0111
185	4.6974	0.0111
186	4.7085	0.0111
187	4.7196	0.0110
188	4.7306	0.0110
189	4.7416	0.0110
190	4.7525	0.0109
191	4.7634	0.0109
192	4.7743	0.0109
193	4.7852	0.0109
194	4.7960	0.0108
195	4.8068	0.0108
196	4.8175	0.0108
197	4.8283	0.0107
198	4.8390	0.0107
199	4.8496	0.0107
200	4.8603	0.0106
201	4.8709	0.0106
202	4.8814	0.0106
203	4.8920	0.0105
204	4.9025	0.0105
205	4.9130	0.0105
206	4.9235	0.0105
207	4.9339	0.0104
208	4.9443	0.0104
209	4.9547	0.0104
210	4.9650	0.0103
211	4.9753	0.0103
212	4.9856	0.0103
213	4.9959	0.0103
214	5.0061	0.0102
215	5.0163	0.0102
216	5.0265	0.0102
217	5.0367	0.0102
218	5.0468	0.0101

219	5.0569	0.0101
220	5.0670	0.0101
221	5.0770	0.0101
222	5.0871	0.0100
223	5.0971	0.0100
224	5.1070	0.0100
225	5.1170	0.0100
226	5.1269	0.0099
227	5.1368	0.0099
228	5.1467	0.0099
229	5.1566	0.0099
230	5.1664	0.0098
231	5.1762	0.0098
232	5.1860	0.0098
233	5.1957	0.0098
234	5.2055	0.0097
235	5.2152	0.0097
236	5.2249	0.0097
237	5.2345	0.0097
238	5.2442	0.0096
239	5.2538	0.0096
240	5.2634	0.0096
241	5.2730	0.0096
242	5.2825	0.0096
243	5.2920	0.0095
244	5.3015	0.0095
245	5.3110	0.0095
246	5.3205	0.0095
247	5.3299	0.0094
248	5.3393	0.0094
249	5.3487	0.0094
250	5.3581	0.0094
251	5.3675	0.0094
252	5.3768	0.0093
253	5.3861	0.0093
254	5.3954	0.0093
255	5.4047	0.0093
256	5.4139	0.0093
257	5.4232	0.0092
258	5.4324	0.0092
259	5.4416	0.0092
260	5.4508	0.0092
261	5.4599	0.0092
262	5.4690	0.0091
263	5.4782	0.0091
264	5.4872	0.0091
265	5.4963	0.0091
266	5.5054	0.0091
267	5.5144	0.0090
268	5.5234	0.0090
269	5.5324	0.0090
270	5.5414	0.0090
271	5.5504	0.0090
272	5.5593	0.0089
273	5.5682	0.0089
274	5.5771	0.0089
275	5.5860	0.0089

276	5.5949	0.0089
277	5.6037	0.0089
278	5.6126	0.0088
279	5.6214	0.0088
280	5.6302	0.0088
281	5.6390	0.0088
282	5.6477	0.0088
283	5.6565	0.0087
284	5.6652	0.0087
285	5.6739	0.0087
286	5.6826	0.0087
287	5.6913	0.0087
288	5.6999	0.0087

Unit Period (number)	Unit Rainfall (In)	Unit Soil-Loss (In)	Effective Rainfall (In)
1	0.0087	0.0069	0.0018
2	0.0087	0.0069	0.0018
3	0.0087	0.0069	0.0018
4	0.0087	0.0069	0.0018
5	0.0088	0.0070	0.0018
6	0.0088	0.0070	0.0018
7	0.0088	0.0070	0.0018
8	0.0088	0.0070	0.0018
9	0.0089	0.0071	0.0018
10	0.0089	0.0071	0.0018
11	0.0089	0.0071	0.0018
12	0.0089	0.0071	0.0018
13	0.0090	0.0071	0.0018
14	0.0090	0.0072	0.0018
15	0.0090	0.0072	0.0018
16	0.0091	0.0072	0.0019
17	0.0091	0.0072	0.0019
18	0.0091	0.0072	0.0019
19	0.0092	0.0073	0.0019
20	0.0092	0.0073	0.0019
21	0.0092	0.0073	0.0019
22	0.0092	0.0073	0.0019
23	0.0093	0.0074	0.0019
24	0.0093	0.0074	0.0019
25	0.0093	0.0074	0.0019
26	0.0094	0.0074	0.0019
27	0.0094	0.0075	0.0019
28	0.0094	0.0075	0.0019
29	0.0095	0.0075	0.0019
30	0.0095	0.0075	0.0019
31	0.0095	0.0076	0.0020
32	0.0096	0.0076	0.0020
33	0.0096	0.0076	0.0020
34	0.0096	0.0076	0.0020
35	0.0097	0.0077	0.0020
36	0.0097	0.0077	0.0020
37	0.0097	0.0077	0.0020
38	0.0098	0.0078	0.0020
39	0.0098	0.0078	0.0020

40	0.0098	0.0078	0.0020
41	0.0099	0.0079	0.0020
42	0.0099	0.0079	0.0020
43	0.0100	0.0079	0.0020
44	0.0100	0.0079	0.0020
45	0.0100	0.0080	0.0021
46	0.0101	0.0080	0.0021
47	0.0101	0.0080	0.0021
48	0.0101	0.0081	0.0021
49	0.0102	0.0081	0.0021
50	0.0102	0.0081	0.0021
51	0.0103	0.0082	0.0021
52	0.0103	0.0082	0.0021
53	0.0103	0.0082	0.0021
54	0.0104	0.0083	0.0021
55	0.0104	0.0083	0.0021
56	0.0105	0.0083	0.0021
57	0.0105	0.0084	0.0022
58	0.0105	0.0084	0.0022
59	0.0106	0.0084	0.0022
60	0.0106	0.0085	0.0022
61	0.0107	0.0085	0.0022
62	0.0107	0.0085	0.0022
63	0.0108	0.0086	0.0022
64	0.0108	0.0086	0.0022
65	0.0109	0.0087	0.0022
66	0.0109	0.0087	0.0022
67	0.0110	0.0087	0.0022
68	0.0110	0.0088	0.0023
69	0.0111	0.0088	0.0023
70	0.0111	0.0088	0.0023
71	0.0112	0.0089	0.0023
72	0.0112	0.0089	0.0023
73	0.0113	0.0090	0.0023
74	0.0113	0.0090	0.0023
75	0.0114	0.0091	0.0023
76	0.0114	0.0091	0.0023
77	0.0115	0.0092	0.0024
78	0.0115	0.0092	0.0024
79	0.0116	0.0092	0.0024
80	0.0117	0.0093	0.0024
81	0.0117	0.0093	0.0024
82	0.0118	0.0094	0.0024
83	0.0119	0.0094	0.0024
84	0.0119	0.0095	0.0024
85	0.0120	0.0095	0.0025
86	0.0120	0.0096	0.0025
87	0.0121	0.0096	0.0025
88	0.0121	0.0097	0.0025
89	0.0122	0.0097	0.0025
90	0.0123	0.0098	0.0025
91	0.0124	0.0098	0.0025
92	0.0124	0.0099	0.0025
93	0.0125	0.0100	0.0026
94	0.0126	0.0100	0.0026
95	0.0127	0.0101	0.0026
96	0.0127	0.0101	0.0026

97	0.0128	0.0102	0.0026
98	0.0129	0.0102	0.0026
99	0.0130	0.0103	0.0027
100	0.0130	0.0103	0.0027
101	0.0131	0.0104	0.0027
102	0.0132	0.0105	0.0027
103	0.0133	0.0106	0.0027
104	0.0133	0.0106	0.0027
105	0.0134	0.0107	0.0028
106	0.0135	0.0107	0.0028
107	0.0136	0.0108	0.0028
108	0.0137	0.0109	0.0028
109	0.0138	0.0110	0.0028
110	0.0139	0.0110	0.0028
111	0.0140	0.0111	0.0029
112	0.0141	0.0112	0.0029
113	0.0142	0.0113	0.0029
114	0.0143	0.0113	0.0029
115	0.0144	0.0115	0.0029
116	0.0145	0.0115	0.0030
117	0.0146	0.0116	0.0030
118	0.0147	0.0117	0.0030
119	0.0148	0.0118	0.0030
120	0.0149	0.0119	0.0031
121	0.0151	0.0120	0.0031
122	0.0151	0.0120	0.0031
123	0.0153	0.0122	0.0031
124	0.0154	0.0122	0.0031
125	0.0156	0.0124	0.0032
126	0.0156	0.0124	0.0032
127	0.0158	0.0126	0.0032
128	0.0159	0.0127	0.0033
129	0.0161	0.0128	0.0033
130	0.0162	0.0129	0.0033
131	0.0164	0.0130	0.0034
132	0.0165	0.0131	0.0034
133	0.0167	0.0133	0.0034
134	0.0168	0.0134	0.0034
135	0.0170	0.0135	0.0035
136	0.0171	0.0136	0.0035
137	0.0174	0.0138	0.0036
138	0.0175	0.0139	0.0036
139	0.0177	0.0141	0.0036
140	0.0179	0.0142	0.0037
141	0.0181	0.0144	0.0037
142	0.0182	0.0145	0.0037
143	0.0185	0.0147	0.0038
144	0.0187	0.0148	0.0038
145	0.0209	0.0166	0.0043
146	0.0211	0.0168	0.0043
147	0.0214	0.0170	0.0044
148	0.0216	0.0171	0.0044
149	0.0219	0.0174	0.0045
150	0.0221	0.0175	0.0045
151	0.0224	0.0178	0.0046
152	0.0226	0.0180	0.0046
153	0.0230	0.0183	0.0047

154	0.0232	0.0185	0.0047
155	0.0236	0.0188	0.0048
156	0.0238	0.0190	0.0049
157	0.0243	0.0193	0.0050
158	0.0245	0.0195	0.0050
159	0.0250	0.0199	0.0051
160	0.0253	0.0201	0.0052
161	0.0258	0.0206	0.0053
162	0.0261	0.0208	0.0053
163	0.0267	0.0213	0.0055
164	0.0271	0.0215	0.0055
165	0.0277	0.0220	0.0057
166	0.0281	0.0223	0.0057
167	0.0288	0.0229	0.0059
168	0.0292	0.0232	0.0060
169	0.0301	0.0239	0.0062
170	0.0305	0.0243	0.0062
171	0.0315	0.0250	0.0064
172	0.0320	0.0254	0.0065
173	0.0331	0.0263	0.0068
174	0.0337	0.0268	0.0069
175	0.0350	0.0278	0.0072
176	0.0357	0.0284	0.0073
177	0.0372	0.0296	0.0076
178	0.0381	0.0303	0.0078
179	0.0400	0.0318	0.0082
180	0.0410	0.0326	0.0084
181	0.0434	0.0345	0.0089
182	0.0447	0.0356	0.0091
183	0.0478	0.0380	0.0098
184	0.0496	0.0394	0.0101
185	0.0448	0.0356	0.0092
186	0.0473	0.0376	0.0097
187	0.0537	0.0427	0.0110
188	0.0579	0.0461	0.0119
189	0.0698	0.0555	0.0143
190	0.0788	0.0627	0.0161
191	0.1126	0.0652	0.0474
192	0.1548	0.0652	0.0897
193	0.4846	0.0652	0.4194
194	0.0917	0.0652	0.0265
195	0.0631	0.0502	0.0129
196	0.0502	0.0400	0.0103
197	0.0516	0.0410	0.0106
198	0.0462	0.0367	0.0094
199	0.0421	0.0335	0.0086
200	0.0390	0.0310	0.0080
201	0.0364	0.0290	0.0075
202	0.0343	0.0273	0.0070
203	0.0325	0.0259	0.0067
204	0.0310	0.0246	0.0063
205	0.0296	0.0236	0.0061
206	0.0284	0.0226	0.0058
207	0.0274	0.0218	0.0056
208	0.0264	0.0210	0.0054
209	0.0256	0.0203	0.0052
210	0.0248	0.0197	0.0051

211	0.0241	0.0191	0.0049
212	0.0234	0.0186	0.0048
213	0.0228	0.0181	0.0047
214	0.0222	0.0177	0.0046
215	0.0217	0.0173	0.0044
216	0.0212	0.0169	0.0043
217	0.0188	0.0150	0.0038
218	0.0184	0.0146	0.0038
219	0.0180	0.0143	0.0037
220	0.0176	0.0140	0.0036
221	0.0173	0.0137	0.0035
222	0.0169	0.0135	0.0035
223	0.0166	0.0132	0.0034
224	0.0163	0.0130	0.0033
225	0.0160	0.0127	0.0033
226	0.0157	0.0125	0.0032
227	0.0155	0.0123	0.0032
228	0.0152	0.0121	0.0031
229	0.0150	0.0119	0.0031
230	0.0148	0.0117	0.0030
231	0.0145	0.0116	0.0030
232	0.0143	0.0114	0.0029
233	0.0141	0.0112	0.0029
234	0.0139	0.0111	0.0029
235	0.0137	0.0109	0.0028
236	0.0136	0.0108	0.0028
237	0.0134	0.0107	0.0027
238	0.0132	0.0105	0.0027
239	0.0131	0.0104	0.0027
240	0.0129	0.0103	0.0026
241	0.0128	0.0101	0.0026
242	0.0126	0.0100	0.0026
243	0.0125	0.0099	0.0026
244	0.0123	0.0098	0.0025
245	0.0122	0.0097	0.0025
246	0.0121	0.0096	0.0025
247	0.0119	0.0095	0.0024
248	0.0118	0.0094	0.0024
249	0.0117	0.0093	0.0024
250	0.0116	0.0092	0.0024
251	0.0115	0.0091	0.0023
252	0.0114	0.0090	0.0023
253	0.0113	0.0089	0.0023
254	0.0111	0.0089	0.0023
255	0.0110	0.0088	0.0023
256	0.0109	0.0087	0.0022
257	0.0109	0.0086	0.0022
258	0.0108	0.0086	0.0022
259	0.0107	0.0085	0.0022
260	0.0106	0.0084	0.0022
261	0.0105	0.0083	0.0021
262	0.0104	0.0083	0.0021
263	0.0103	0.0082	0.0021
264	0.0102	0.0081	0.0021
265	0.0102	0.0081	0.0021
266	0.0101	0.0080	0.0021
267	0.0100	0.0080	0.0020

268	0.0099	0.0079	0.0020
269	0.0099	0.0078	0.0020
270	0.0098	0.0078	0.0020
271	0.0097	0.0077	0.0020
272	0.0096	0.0077	0.0020
273	0.0096	0.0076	0.0020
274	0.0095	0.0076	0.0019
275	0.0094	0.0075	0.0019
276	0.0094	0.0075	0.0019
277	0.0093	0.0074	0.0019
278	0.0093	0.0074	0.0019
279	0.0092	0.0073	0.0019
280	0.0091	0.0073	0.0019
281	0.0091	0.0072	0.0019
282	0.0090	0.0072	0.0018
283	0.0090	0.0071	0.0018
284	0.0089	0.0071	0.0018
285	0.0089	0.0070	0.0018
286	0.0088	0.0070	0.0018
287	0.0087	0.0070	0.0018
288	0.0087	0.0069	0.0018

Total soil rain loss = 4.12(In)
Total effective rainfall = 1.58(In)

Peak flow rate in flood hydrograph = 15.00(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

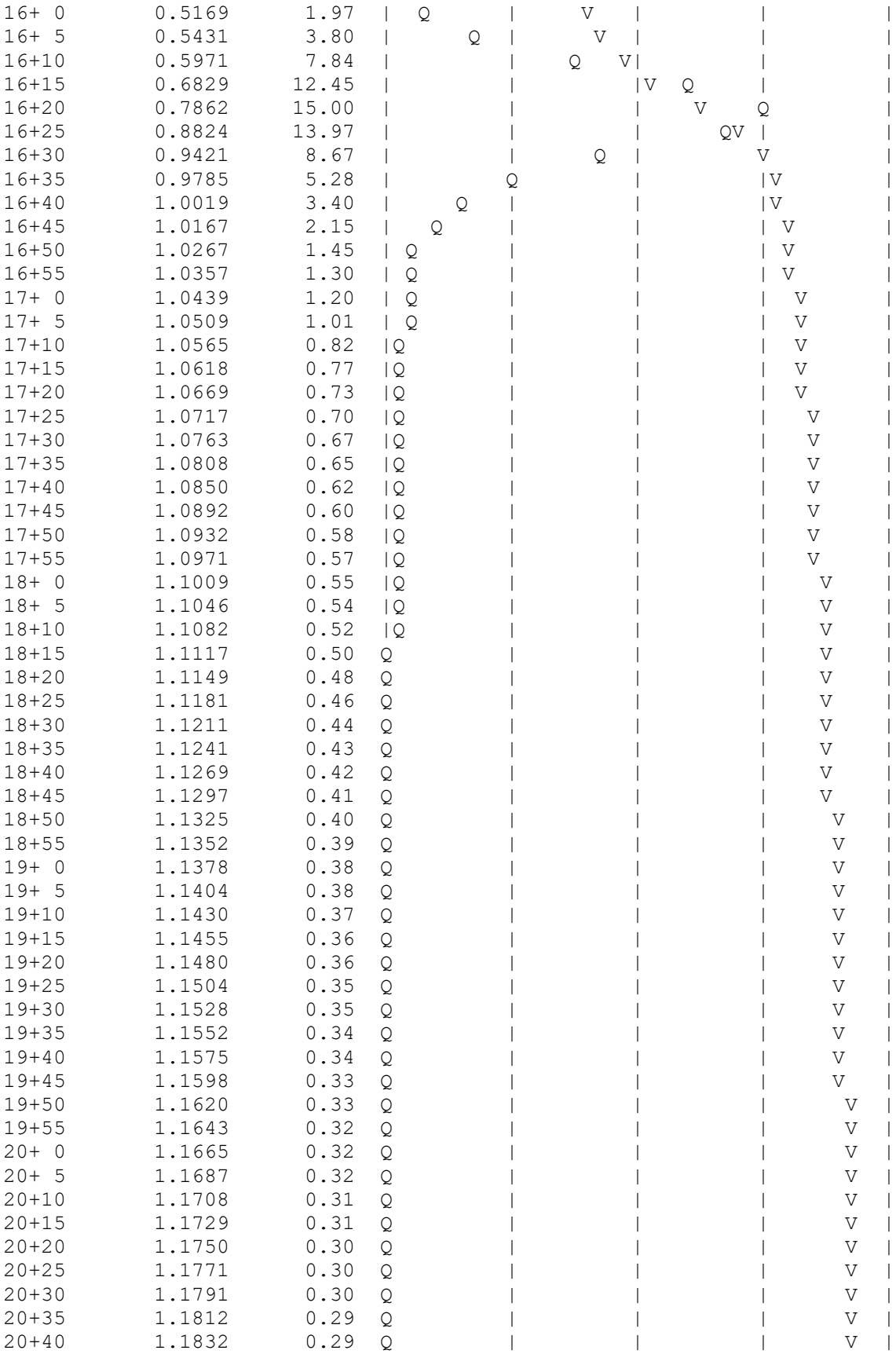
Hydrograph in 5 Minute intervals ((CFS))

Time(h+m)	Volume Ac.Ft	Q(CFS)	0	5.0	10.0	15.0	20.0
0+ 5	0.0000	0.00	Q	|	|	|	|
0+10	0.0002	0.02	Q	|	|	|	|
0+15	0.0005	0.05	Q	|	|	|	|
0+20	0.0012	0.10	Q	|	|	|	|
0+25	0.0023	0.15	Q	|	|	|	|
0+30	0.0035	0.18	Q	|	|	|	|
0+35	0.0048	0.19	Q	|	|	|	|
0+40	0.0062	0.20	Q	|	|	|	|
0+45	0.0076	0.20	Q	|	|	|	|
0+50	0.0090	0.21	Q	|	|	|	|
0+55	0.0104	0.21	Q	|	|	|	|
1+ 0	0.0118	0.21	Q	|	|	|	|
1+ 5	0.0133	0.21	Q	|	|	|	|
1+10	0.0147	0.21	Q	|	|	|	|
1+15	0.0162	0.21	Q	|	|	|	|
1+20	0.0177	0.21	Q	|	|	|	|
1+25	0.0191	0.21	Q	|	|	|	|
1+30	0.0206	0.21	Q	|	|	|	|
1+35	0.0221	0.21	Q	|	|	|	|
1+40	0.0235	0.21	Q	|	|	|	|

1+45	0.0250	0.22	Q	|	|	|	|
1+50	0.0265	0.22	Q	|	|	|	|
1+55	0.0280	0.22	Q	|	|	|	|
2+ 0	0.0295	0.22	Q	|	|	|	|
2+ 5	0.0310	0.22	Q	|	|	|	|
2+10	0.0325	0.22	QV	|	|	|	|
2+15	0.0340	0.22	QV	|	|	|	|
2+20	0.0355	0.22	QV	|	|	|	|
2+25	0.0371	0.22	QV	|	|	|	|
2+30	0.0386	0.22	QV	|	|	|	|
2+35	0.0401	0.22	QV	|	|	|	|
2+40	0.0416	0.22	QV	|	|	|	|
2+45	0.0432	0.22	QV	|	|	|	|
2+50	0.0447	0.22	QV	|	|	|	|
2+55	0.0463	0.23	QV	|	|	|	|
3+ 0	0.0479	0.23	QV	|	|	|	|
3+ 5	0.0494	0.23	QV	|	|	|	|
3+10	0.0510	0.23	QV	|	|	|	|
3+15	0.0526	0.23	QV	|	|	|	|
3+20	0.0541	0.23	QV	|	|	|	|
3+25	0.0557	0.23	QV	|	|	|	|
3+30	0.0573	0.23	QV	|	|	|	|
3+35	0.0589	0.23	QV	|	|	|	|
3+40	0.0605	0.23	QV	|	|	|	|
3+45	0.0621	0.23	QV	|	|	|	|
3+50	0.0638	0.23	Q V	|	|	|	|
3+55	0.0654	0.24	Q V	|	|	|	|
4+ 0	0.0670	0.24	Q V	|	|	|	|
4+ 5	0.0686	0.24	Q V	|	|	|	|
4+10	0.0703	0.24	Q V	|	|	|	|
4+15	0.0719	0.24	Q V	|	|	|	|
4+20	0.0736	0.24	Q V	|	|	|	|
4+25	0.0752	0.24	Q V	|	|	|	|
4+30	0.0769	0.24	Q V	|	|	|	|
4+35	0.0786	0.24	Q V	|	|	|	|
4+40	0.0803	0.24	Q V	|	|	|	|
4+45	0.0820	0.24	Q V	|	|	|	|
4+50	0.0836	0.25	Q V	|	|	|	|
4+55	0.0853	0.25	Q V	|	|	|	|
5+ 0	0.0871	0.25	Q V	|	|	|	|
5+ 5	0.0888	0.25	Q V	|	|	|	|
5+10	0.0905	0.25	Q V	|	|	|	|
5+15	0.0922	0.25	Q V	|	|	|	|
5+20	0.0940	0.25	Q V	|	|	|	|
5+25	0.0957	0.25	Q V	|	|	|	|
5+30	0.0975	0.25	Q V	|	|	|	|
5+35	0.0992	0.26	Q V	|	|	|	|
5+40	0.1010	0.26	Q V	|	|	|	|
5+45	0.1028	0.26	Q V	|	|	|	|
5+50	0.1045	0.26	Q V	|	|	|	|
5+55	0.1063	0.26	Q V	|	|	|	|
6+ 0	0.1081	0.26	Q V	|	|	|	|
6+ 5	0.1099	0.26	Q V	|	|	|	|
6+10	0.1117	0.26	Q V	|	|	|	|
6+15	0.1136	0.26	Q V	|	|	|	|
6+20	0.1154	0.27	Q V	|	|	|	|
6+25	0.1172	0.27	Q V	|	|	|	|

6+30	0.1191	0.27	Q	V				
6+35	0.1210	0.27	Q	V				
6+40	0.1228	0.27	Q	V				
6+45	0.1247	0.27	Q	V				
6+50	0.1266	0.27	Q	V				
6+55	0.1285	0.28	Q	V				
7+ 0	0.1304	0.28	Q	V				
7+ 5	0.1323	0.28	Q	V				
7+10	0.1342	0.28	Q	V				
7+15	0.1362	0.28	Q	V				
7+20	0.1381	0.28	Q	V				
7+25	0.1401	0.28	Q	V				
7+30	0.1420	0.29	Q	V				
7+35	0.1440	0.29	Q	V				
7+40	0.1460	0.29	Q	V				
7+45	0.1480	0.29	Q	V				
7+50	0.1500	0.29	Q	V				
7+55	0.1520	0.29	Q	V				
8+ 0	0.1540	0.29	Q	V				
8+ 5	0.1561	0.30	Q	V				
8+10	0.1581	0.30	Q	V				
8+15	0.1602	0.30	Q	V				
8+20	0.1623	0.30	Q	V				
8+25	0.1643	0.30	Q	V				
8+30	0.1664	0.31	Q	V				
8+35	0.1686	0.31	Q	V				
8+40	0.1707	0.31	Q	V				
8+45	0.1728	0.31	Q	V				
8+50	0.1750	0.31	Q	V				
8+55	0.1771	0.31	Q	V				
9+ 0	0.1793	0.32	Q	V				
9+ 5	0.1815	0.32	Q	V				
9+10	0.1837	0.32	Q	V				
9+15	0.1859	0.32	Q	V				
9+20	0.1882	0.32	Q	V				
9+25	0.1904	0.33	Q	V				
9+30	0.1927	0.33	Q	V				
9+35	0.1950	0.33	Q	V				
9+40	0.1973	0.33	Q	V				
9+45	0.1996	0.34	Q	V				
9+50	0.2019	0.34	Q	V				
9+55	0.2043	0.34	Q	V				
10+ 0	0.2067	0.34	Q	V				
10+ 5	0.2090	0.35	Q	V				
10+10	0.2114	0.35	Q	V				
10+15	0.2139	0.35	Q	V				
10+20	0.2163	0.35	Q	V				
10+25	0.2188	0.36	Q	V				
10+30	0.2212	0.36	Q	V				
10+35	0.2237	0.36	Q	V				
10+40	0.2262	0.37	Q	V				
10+45	0.2288	0.37	Q	V				
10+50	0.2313	0.37	Q	V				
10+55	0.2339	0.37	Q	V				
11+ 0	0.2365	0.38	Q	V				
11+ 5	0.2392	0.38	Q	V				
11+10	0.2418	0.39	Q	V				

11+15	0.2445	0.39	Q	V	|	|	|
11+20	0.2472	0.39	Q	V	|	|	|
11+25	0.2499	0.40	Q	V	|	|	|
11+30	0.2527	0.40	Q	V	|	|	|
11+35	0.2554	0.40	Q	V	|	|	|
11+40	0.2583	0.41	Q	V	|	|	|
11+45	0.2611	0.41	Q	V	|	|	|
11+50	0.2640	0.42	Q	V	|	|	|
11+55	0.2669	0.42	Q	V	|	|	|
12+ 0	0.2698	0.42	Q	V	|	|	|
12+ 5	0.2727	0.43	Q	V	|	|	|
12+10	0.2758	0.44	Q	V	|	|	|
12+15	0.2789	0.45	Q	V	|	|	|
12+20	0.2821	0.47	Q	V	|	|	|
12+25	0.2854	0.48	Q	V	|	|	|
12+30	0.2888	0.49	Q	V	|	|	|
12+35	0.2923	0.50	|Q	V	|	|	|
12+40	0.2958	0.51	|Q	V	|	|	|
12+45	0.2994	0.52	|Q	V	|	|	|
12+50	0.3030	0.52	|Q	V	|	|	|
12+55	0.3067	0.53	|Q	V	|	|	|
13+ 0	0.3104	0.54	|Q	V	|	|	|
13+ 5	0.3141	0.55	|Q	V	|	|	|
13+10	0.3179	0.55	|Q	V	|	|	|
13+15	0.3218	0.56	|Q	V	|	|	|
13+20	0.3257	0.57	|Q	V	|	|	|
13+25	0.3297	0.58	|Q	V	|	|	|
13+30	0.3337	0.59	|Q	V	|	|	|
13+35	0.3378	0.59	|Q	V	|	|	|
13+40	0.3420	0.60	|Q	V	|	|	|
13+45	0.3462	0.61	|Q	|V	|	|	|
13+50	0.3505	0.62	|Q	|V	|	|	|
13+55	0.3549	0.64	|Q	|V	|	|	|
14+ 0	0.3593	0.65	|Q	|V	|	|	|
14+ 5	0.3639	0.66	|Q	|V	|	|	|
14+10	0.3685	0.67	|Q	|V	|	|	|
14+15	0.3732	0.69	|Q	|V	|	|	|
14+20	0.3780	0.70	|Q	| V	|	|	|
14+25	0.3830	0.72	|Q	| V	|	|	|
14+30	0.3880	0.73	|Q	| V	|	|	|
14+35	0.3932	0.75	|Q	| V	|	|	|
14+40	0.3984	0.77	|Q	| V	|	|	|
14+45	0.4039	0.79	|Q	| V	|	|	|
14+50	0.4095	0.81	|Q	| V	|	|	|
14+55	0.4152	0.83	|Q	| V	|	|	|
15+ 0	0.4211	0.86	|Q	| V	|	|	|
15+ 5	0.4273	0.89	|Q	| V	|	|	|
15+10	0.4336	0.92	|Q	| V	|	|	|
15+15	0.4402	0.96	|Q	| V	|	|	|
15+20	0.4471	1.00	|Q	| V	|	|	|
15+25	0.4542	1.04	| Q	| V	|	|	|
15+30	0.4616	1.07	| Q	| V	|	|	|
15+35	0.4692	1.10	| Q	| V	|	|	|
15+40	0.4769	1.12	| Q	| V	|	|	|
15+45	0.4849	1.16	| Q	| V	|	|	|
15+50	0.4935	1.25	| Q	| V	|	|	|
15+55	0.5034	1.44	| Q	| V	|	|	|



20+45	1.1852	0.29	Q	|	|	|	V |
20+50	1.1871	0.28	Q	|	|	|	V |
20+55	1.1891	0.28	Q	|	|	|	V |
21+ 0	1.1910	0.28	Q	|	|	|	V |
21+ 5	1.1929	0.28	Q	|	|	|	V |
21+10	1.1948	0.27	Q	|	|	|	V |
21+15	1.1966	0.27	Q	|	|	|	V |
21+20	1.1985	0.27	Q	|	|	|	V |
21+25	1.2003	0.27	Q	|	|	|	V |
21+30	1.2021	0.26	Q	|	|	|	V |
21+35	1.2039	0.26	Q	|	|	|	V |
21+40	1.2057	0.26	Q	|	|	|	V |
21+45	1.2075	0.26	Q	|	|	|	V |
21+50	1.2092	0.25	Q	|	|	|	V |
21+55	1.2109	0.25	Q	|	|	|	V |
22+ 0	1.2127	0.25	Q	|	|	|	V |
22+ 5	1.2144	0.25	Q	|	|	|	V |
22+10	1.2161	0.25	Q	|	|	|	V |
22+15	1.2177	0.24	Q	|	|	|	V |
22+20	1.2194	0.24	Q	|	|	|	V |
22+25	1.2211	0.24	Q	|	|	|	V |
22+30	1.2227	0.24	Q	|	|	|	V |
22+35	1.2243	0.24	Q	|	|	|	V|
22+40	1.2259	0.23	Q	|	|	|	V|
22+45	1.2275	0.23	Q	|	|	|	V|
22+50	1.2291	0.23	Q	|	|	|	V|
22+55	1.2307	0.23	Q	|	|	|	V|
23+ 0	1.2323	0.23	Q	|	|	|	V|
23+ 5	1.2338	0.23	Q	|	|	|	V|
23+10	1.2354	0.22	Q	|	|	|	V|
23+15	1.2369	0.22	Q	|	|	|	V|
23+20	1.2384	0.22	Q	|	|	|	V|
23+25	1.2400	0.22	Q	|	|	|	V|
23+30	1.2415	0.22	Q	|	|	|	V|
23+35	1.2430	0.22	Q	|	|	|	V|
23+40	1.2444	0.22	Q	|	|	|	V|
23+45	1.2459	0.21	Q	|	|	|	V|
23+50	1.2474	0.21	Q	|	|	|	V|
23+55	1.2488	0.21	Q	|	|	|	V|
24+ 0	1.2503	0.21	Q	|	|	|	V|
24+ 5	1.2517	0.21	Q	|	|	|	V|
24+10	1.2530	0.19	Q	|	|	|	V|
24+15	1.2540	0.15	Q	|	|	|	V|
24+20	1.2548	0.10	Q	|	|	|	V|
24+25	1.2552	0.06	Q	|	|	|	V|
24+30	1.2554	0.03	Q	|	|	|	V|
24+35	1.2555	0.02	Q	|	|	|	V|
24+40	1.2555	0.01	Q	|	|	|	V|
24+45	1.2556	0.00	Q	|	|	|	V|
24+50	1.2556	0.00	Q	|	|	|	V|
24+55	1.2556	0.00	Q	|	|	|	V|
25+ 0	1.2556	0.00	Q	|	|	|	V

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 04/20/21

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

Program License Serial Number 6405

BLOOMINGTON COMMERCE CENTER - SITE 4
EXISTING CONDITION
100 YEAR WITH ADJUSTED 25 YEAR STORM RAINFALL DATA

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		
9.56	1	1.01
Rainfall data for year 100		
9.56	6	2.46
Rainfall data for year 100		
9.56	24	4.53

++

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

SCS curve	SCS curve	Area	Area	Fp(Fig C6)	Ap	Fm

No.(AMCII)	NO.(AMC 2)	(Ac.)	Fraction	(In/Hr)	(dec.)	(In/Hr)
32.0	32.0	9.56	1.000	0.978	0.800	0.782

Area-averaged adjusted loss rate Fm (In/Hr) = 0.782

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

Area (Ac.)	Area Fract	SCS CN (AMC2)	SCS CN (AMC2)	S	Pervious Yield Fr
7.65	0.800	32.0	32.0	21.25	0.001
1.91	0.200	98.0	98.0	0.20	0.948

Area-averaged catchment yield fraction, Y = 0.190
Area-averaged low loss fraction, Yb = 0.810
User entry of time of concentration = 0.261 (hours)
++
Watershed area = 9.56(Ac.)
Catchment Lag time = 0.209 hours
Unit interval = 5.000 minutes
Unit interval percentage of lag time = 39.9412
Hydrograph baseflow = 0.00(CFS)
Average maximum watershed loss rate(Fm) = 0.782(In/Hr)
Average low loss rate fraction (Yb) = 0.810 (decimal)
VALLEY DEVELOPED S-Graph Selected
Computed peak 5-minute rainfall = 0.374(In)
Computed peak 30-minute rainfall = 0.765(In)
Specified peak 1-hour rainfall = 1.010(In)
Computed peak 3-hour rainfall = 1.743(In)
Specified peak 6-hour rainfall = 2.460(In)
Specified peak 24-hour rainfall = 4.530(In)

Rainfall depth area reduction factors:
Using a total area of 9.56(Ac.) (Ref: fig. E-4)

5-minute factor = 1.000 Adjusted rainfall = 0.374(In)
30-minute factor = 1.000 Adjusted rainfall = 0.765(In)
1-hour factor = 1.000 Adjusted rainfall = 1.010(In)
3-hour factor = 1.000 Adjusted rainfall = 1.743(In)
6-hour factor = 1.000 Adjusted rainfall = 2.460(In)
24-hour factor = 1.000 Adjusted rainfall = 4.530(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 = 115.62 (CFS))	
1	3.030	3.504
2	19.521	19.066
3	49.496	34.656
4	77.828	32.756
5	91.167	15.422
6	96.688	6.382
7	98.473	2.064

8	99.192	0.831
9	100.000	0.416

Peak Unit Number	Adjusted mass rainfall (In)	Unit rainfall (In)
1	0.3736	0.3736
2	0.4930	0.1194
3	0.5798	0.0868
4	0.6505	0.0707
5	0.7113	0.0607
6	0.7651	0.0538
7	0.8138	0.0487
8	0.8584	0.0446
9	0.8998	0.0414
10	0.9385	0.0387
11	0.9750	0.0365
12	1.0095	0.0345
13	1.0505	0.0410
14	1.0900	0.0394
15	1.1280	0.0380
16	1.1648	0.0368
17	1.2004	0.0356
18	1.2350	0.0346
19	1.2687	0.0337
20	1.3015	0.0328
21	1.3334	0.0320
22	1.3646	0.0312
23	1.3951	0.0305
24	1.4249	0.0298
25	1.4542	0.0292
26	1.4828	0.0286
27	1.5109	0.0281
28	1.5384	0.0276
29	1.5655	0.0271
30	1.5921	0.0266
31	1.6183	0.0262
32	1.6441	0.0257
33	1.6694	0.0253
34	1.6944	0.0250
35	1.7190	0.0246
36	1.7432	0.0242
37	1.7671	0.0239
38	1.7907	0.0236
39	1.8139	0.0233
40	1.8369	0.0230
41	1.8596	0.0227
42	1.8820	0.0224
43	1.9041	0.0221
44	1.9260	0.0219
45	1.9476	0.0216
46	1.9690	0.0214
47	1.9901	0.0212
48	2.0111	0.0209
49	2.0318	0.0207
50	2.0523	0.0205
51	2.0726	0.0203
52	2.0927	0.0201

53	2.1126	0.0199
54	2.1323	0.0197
55	2.1518	0.0195
56	2.1712	0.0194
57	2.1903	0.0192
58	2.2093	0.0190
59	2.2282	0.0188
60	2.2469	0.0187
61	2.2654	0.0185
62	2.2838	0.0184
63	2.3020	0.0182
64	2.3201	0.0181
65	2.3380	0.0179
66	2.3558	0.0178
67	2.3735	0.0177
68	2.3910	0.0175
69	2.4085	0.0174
70	2.4257	0.0173
71	2.4429	0.0172
72	2.4599	0.0170
73	2.4749	0.0150
74	2.4898	0.0149
75	2.5046	0.0148
76	2.5192	0.0147
77	2.5338	0.0145
78	2.5482	0.0144
79	2.5625	0.0143
80	2.5768	0.0142
81	2.5909	0.0141
82	2.6049	0.0140
83	2.6189	0.0139
84	2.6327	0.0139
85	2.6465	0.0138
86	2.6602	0.0137
87	2.6737	0.0136
88	2.6872	0.0135
89	2.7006	0.0134
90	2.7140	0.0133
91	2.7272	0.0132
92	2.7404	0.0132
93	2.7534	0.0131
94	2.7665	0.0130
95	2.7794	0.0129
96	2.7922	0.0128
97	2.8050	0.0128
98	2.8177	0.0127
99	2.8303	0.0126
100	2.8429	0.0126
101	2.8554	0.0125
102	2.8678	0.0124
103	2.8801	0.0123
104	2.8924	0.0123
105	2.9046	0.0122
106	2.9168	0.0122
107	2.9289	0.0121
108	2.9409	0.0120
109	2.9529	0.0120

110	2.9648	0.0119
111	2.9766	0.0118
112	2.9884	0.0118
113	3.0001	0.0117
114	3.0118	0.0117
115	3.0234	0.0116
116	3.0349	0.0116
117	3.0464	0.0115
118	3.0579	0.0114
119	3.0693	0.0114
120	3.0806	0.0113
121	3.0919	0.0113
122	3.1031	0.0112
123	3.1143	0.0112
124	3.1254	0.0111
125	3.1365	0.0111
126	3.1475	0.0110
127	3.1585	0.0110
128	3.1694	0.0109
129	3.1803	0.0109
130	3.1911	0.0108
131	3.2019	0.0108
132	3.2127	0.0107
133	3.2234	0.0107
134	3.2340	0.0107
135	3.2446	0.0106
136	3.2552	0.0106
137	3.2657	0.0105
138	3.2762	0.0105
139	3.2866	0.0104
140	3.2970	0.0104
141	3.3074	0.0104
142	3.3177	0.0103
143	3.3279	0.0103
144	3.3382	0.0102
145	3.3484	0.0102
146	3.3585	0.0102
147	3.3686	0.0101
148	3.3787	0.0101
149	3.3887	0.0100
150	3.3987	0.0100
151	3.4087	0.0100
152	3.4186	0.0099
153	3.4285	0.0099
154	3.4383	0.0099
155	3.4482	0.0098
156	3.4579	0.0098
157	3.4677	0.0097
158	3.4774	0.0097
159	3.4871	0.0097
160	3.4967	0.0096
161	3.5063	0.0096
162	3.5159	0.0096
163	3.5254	0.0095
164	3.5350	0.0095
165	3.5444	0.0095
166	3.5539	0.0094

167	3.5633	0.0094
168	3.5727	0.0094
169	3.5820	0.0094
170	3.5913	0.0093
171	3.6006	0.0093
172	3.6099	0.0093
173	3.6191	0.0092
174	3.6283	0.0092
175	3.6375	0.0092
176	3.6466	0.0091
177	3.6557	0.0091
178	3.6648	0.0091
179	3.6739	0.0091
180	3.6829	0.0090
181	3.6919	0.0090
182	3.7009	0.0090
183	3.7098	0.0089
184	3.7187	0.0089
185	3.7276	0.0089
186	3.7365	0.0089
187	3.7453	0.0088
188	3.7541	0.0088
189	3.7629	0.0088
190	3.7717	0.0088
191	3.7804	0.0087
192	3.7891	0.0087
193	3.7978	0.0087
194	3.8064	0.0087
195	3.8151	0.0086
196	3.8237	0.0086
197	3.8322	0.0086
198	3.8408	0.0086
199	3.8493	0.0085
200	3.8578	0.0085
201	3.8663	0.0085
202	3.8748	0.0085
203	3.8832	0.0084
204	3.8916	0.0084
205	3.9000	0.0084
206	3.9084	0.0084
207	3.9167	0.0083
208	3.9251	0.0083
209	3.9334	0.0083
210	3.9416	0.0083
211	3.9499	0.0083
212	3.9581	0.0082
213	3.9663	0.0082
214	3.9745	0.0082
215	3.9827	0.0082
216	3.9908	0.0081
217	3.9990	0.0081
218	4.0071	0.0081
219	4.0152	0.0081
220	4.0232	0.0081
221	4.0313	0.0080
222	4.0393	0.0080
223	4.0473	0.0080

224	4.0553	0.0080
225	4.0632	0.0080
226	4.0712	0.0079
227	4.0791	0.0079
228	4.0870	0.0079
229	4.0949	0.0079
230	4.1028	0.0079
231	4.1106	0.0078
232	4.1184	0.0078
233	4.1263	0.0078
234	4.1340	0.0078
235	4.1418	0.0078
236	4.1496	0.0078
237	4.1573	0.0077
238	4.1650	0.0077
239	4.1727	0.0077
240	4.1804	0.0077
241	4.1881	0.0077
242	4.1957	0.0076
243	4.2033	0.0076
244	4.2110	0.0076
245	4.2185	0.0076
246	4.2261	0.0076
247	4.2337	0.0076
248	4.2412	0.0075
249	4.2487	0.0075
250	4.2562	0.0075
251	4.2637	0.0075
252	4.2712	0.0075
253	4.2787	0.0075
254	4.2861	0.0074
255	4.2935	0.0074
256	4.3009	0.0074
257	4.3083	0.0074
258	4.3157	0.0074
259	4.3231	0.0074
260	4.3304	0.0073
261	4.3377	0.0073
262	4.3451	0.0073
263	4.3523	0.0073
264	4.3596	0.0073
265	4.3669	0.0073
266	4.3741	0.0073
267	4.3814	0.0072
268	4.3886	0.0072
269	4.3958	0.0072
270	4.4030	0.0072
271	4.4102	0.0072
272	4.4173	0.0072
273	4.4245	0.0071
274	4.4316	0.0071
275	4.4387	0.0071
276	4.4458	0.0071
277	4.4529	0.0071
278	4.4600	0.0071
279	4.4670	0.0071
280	4.4741	0.0070

281	4.4811	0.0070
282	4.4881	0.0070
283	4.4951	0.0070
284	4.5021	0.0070
285	4.5091	0.0070
286	4.5161	0.0070
287	4.5230	0.0069
288	4.5299	0.0069

Unit Period (number)	Unit Rainfall (In)	Unit Soil-Loss (In)	Effective Rainfall (In)
1	0.0069	0.0056	0.0013
2	0.0069	0.0056	0.0013
3	0.0070	0.0056	0.0013
4	0.0070	0.0057	0.0013
5	0.0070	0.0057	0.0013
6	0.0070	0.0057	0.0013
7	0.0071	0.0057	0.0013
8	0.0071	0.0057	0.0013
9	0.0071	0.0058	0.0014
10	0.0071	0.0058	0.0014
11	0.0071	0.0058	0.0014
12	0.0072	0.0058	0.0014
13	0.0072	0.0058	0.0014
14	0.0072	0.0058	0.0014
15	0.0072	0.0059	0.0014
16	0.0073	0.0059	0.0014
17	0.0073	0.0059	0.0014
18	0.0073	0.0059	0.0014
19	0.0073	0.0059	0.0014
20	0.0073	0.0059	0.0014
21	0.0074	0.0060	0.0014
22	0.0074	0.0060	0.0014
23	0.0074	0.0060	0.0014
24	0.0074	0.0060	0.0014
25	0.0075	0.0061	0.0014
26	0.0075	0.0061	0.0014
27	0.0075	0.0061	0.0014
28	0.0075	0.0061	0.0014
29	0.0076	0.0061	0.0014
30	0.0076	0.0061	0.0014
31	0.0076	0.0062	0.0015
32	0.0076	0.0062	0.0015
33	0.0077	0.0062	0.0015
34	0.0077	0.0062	0.0015
35	0.0077	0.0063	0.0015
36	0.0078	0.0063	0.0015
37	0.0078	0.0063	0.0015
38	0.0078	0.0063	0.0015
39	0.0078	0.0064	0.0015
40	0.0079	0.0064	0.0015
41	0.0079	0.0064	0.0015
42	0.0079	0.0064	0.0015
43	0.0080	0.0064	0.0015
44	0.0080	0.0065	0.0015

45	0.0080	0.0065	0.0015
46	0.0080	0.0065	0.0015
47	0.0081	0.0065	0.0015
48	0.0081	0.0066	0.0015
49	0.0081	0.0066	0.0015
50	0.0082	0.0066	0.0016
51	0.0082	0.0067	0.0016
52	0.0082	0.0067	0.0016
53	0.0083	0.0067	0.0016
54	0.0083	0.0067	0.0016
55	0.0083	0.0068	0.0016
56	0.0084	0.0068	0.0016
57	0.0084	0.0068	0.0016
58	0.0084	0.0068	0.0016
59	0.0085	0.0069	0.0016
60	0.0085	0.0069	0.0016
61	0.0086	0.0069	0.0016
62	0.0086	0.0069	0.0016
63	0.0086	0.0070	0.0016
64	0.0087	0.0070	0.0016
65	0.0087	0.0070	0.0017
66	0.0087	0.0071	0.0017
67	0.0088	0.0071	0.0017
68	0.0088	0.0071	0.0017
69	0.0089	0.0072	0.0017
70	0.0089	0.0072	0.0017
71	0.0089	0.0072	0.0017
72	0.0090	0.0073	0.0017
73	0.0090	0.0073	0.0017
74	0.0091	0.0073	0.0017
75	0.0091	0.0074	0.0017
76	0.0091	0.0074	0.0017
77	0.0092	0.0074	0.0017
78	0.0092	0.0075	0.0018
79	0.0093	0.0075	0.0018
80	0.0093	0.0075	0.0018
81	0.0094	0.0076	0.0018
82	0.0094	0.0076	0.0018
83	0.0095	0.0077	0.0018
84	0.0095	0.0077	0.0018
85	0.0096	0.0078	0.0018
86	0.0096	0.0078	0.0018
87	0.0097	0.0078	0.0018
88	0.0097	0.0079	0.0018
89	0.0098	0.0079	0.0019
90	0.0098	0.0079	0.0019
91	0.0099	0.0080	0.0019
92	0.0099	0.0080	0.0019
93	0.0100	0.0081	0.0019
94	0.0100	0.0081	0.0019
95	0.0101	0.0082	0.0019
96	0.0102	0.0082	0.0019
97	0.0102	0.0083	0.0019
98	0.0103	0.0083	0.0020
99	0.0104	0.0084	0.0020
100	0.0104	0.0084	0.0020
101	0.0105	0.0085	0.0020

102	0.0105	0.0085	0.0020
103	0.0106	0.0086	0.0020
104	0.0107	0.0086	0.0020
105	0.0107	0.0087	0.0020
106	0.0108	0.0087	0.0021
107	0.0109	0.0088	0.0021
108	0.0109	0.0089	0.0021
109	0.0110	0.0089	0.0021
110	0.0111	0.0090	0.0021
111	0.0112	0.0091	0.0021
112	0.0112	0.0091	0.0021
113	0.0113	0.0092	0.0022
114	0.0114	0.0092	0.0022
115	0.0115	0.0093	0.0022
116	0.0116	0.0094	0.0022
117	0.0117	0.0094	0.0022
118	0.0117	0.0095	0.0022
119	0.0118	0.0096	0.0023
120	0.0119	0.0096	0.0023
121	0.0120	0.0097	0.0023
122	0.0121	0.0098	0.0023
123	0.0122	0.0099	0.0023
124	0.0123	0.0099	0.0023
125	0.0124	0.0101	0.0024
126	0.0125	0.0101	0.0024
127	0.0126	0.0102	0.0024
128	0.0127	0.0103	0.0024
129	0.0128	0.0104	0.0024
130	0.0129	0.0105	0.0025
131	0.0131	0.0106	0.0025
132	0.0132	0.0107	0.0025
133	0.0133	0.0108	0.0025
134	0.0134	0.0109	0.0026
135	0.0136	0.0110	0.0026
136	0.0137	0.0111	0.0026
137	0.0139	0.0112	0.0026
138	0.0139	0.0113	0.0027
139	0.0141	0.0114	0.0027
140	0.0142	0.0115	0.0027
141	0.0144	0.0117	0.0027
142	0.0145	0.0118	0.0028
143	0.0148	0.0120	0.0028
144	0.0149	0.0120	0.0028
145	0.0170	0.0138	0.0032
146	0.0172	0.0139	0.0033
147	0.0174	0.0141	0.0033
148	0.0175	0.0142	0.0033
149	0.0178	0.0144	0.0034
150	0.0179	0.0145	0.0034
151	0.0182	0.0148	0.0035
152	0.0184	0.0149	0.0035
153	0.0187	0.0151	0.0036
154	0.0188	0.0153	0.0036
155	0.0192	0.0155	0.0036
156	0.0194	0.0157	0.0037
157	0.0197	0.0160	0.0037
158	0.0199	0.0161	0.0038

159	0.0203	0.0164	0.0039
160	0.0205	0.0166	0.0039
161	0.0209	0.0169	0.0040
162	0.0212	0.0171	0.0040
163	0.0216	0.0175	0.0041
164	0.0219	0.0177	0.0042
165	0.0224	0.0181	0.0043
166	0.0227	0.0184	0.0043
167	0.0233	0.0188	0.0044
168	0.0236	0.0191	0.0045
169	0.0242	0.0196	0.0046
170	0.0246	0.0199	0.0047
171	0.0253	0.0205	0.0048
172	0.0257	0.0209	0.0049
173	0.0266	0.0215	0.0051
174	0.0271	0.0219	0.0052
175	0.0281	0.0227	0.0053
176	0.0286	0.0232	0.0054
177	0.0298	0.0242	0.0057
178	0.0305	0.0247	0.0058
179	0.0320	0.0259	0.0061
180	0.0328	0.0265	0.0062
181	0.0346	0.0280	0.0066
182	0.0356	0.0289	0.0068
183	0.0380	0.0308	0.0072
184	0.0394	0.0319	0.0075
185	0.0345	0.0280	0.0066
186	0.0365	0.0295	0.0069
187	0.0414	0.0335	0.0079
188	0.0446	0.0362	0.0085
189	0.0538	0.0436	0.0102
190	0.0607	0.0492	0.0116
191	0.0868	0.0652	0.0216
192	0.1194	0.0652	0.0542
193	0.3736	0.0652	0.3085
194	0.0707	0.0573	0.0135
195	0.0487	0.0394	0.0093
196	0.0387	0.0314	0.0074
197	0.0410	0.0332	0.0078
198	0.0368	0.0298	0.0070
199	0.0337	0.0272	0.0064
200	0.0312	0.0253	0.0059
201	0.0292	0.0237	0.0056
202	0.0276	0.0223	0.0052
203	0.0262	0.0212	0.0050
204	0.0250	0.0202	0.0047
205	0.0239	0.0193	0.0045
206	0.0230	0.0186	0.0044
207	0.0221	0.0179	0.0042
208	0.0214	0.0173	0.0041
209	0.0207	0.0168	0.0039
210	0.0201	0.0163	0.0038
211	0.0195	0.0158	0.0037
212	0.0190	0.0154	0.0036
213	0.0185	0.0150	0.0035
214	0.0181	0.0146	0.0034
215	0.0177	0.0143	0.0034

216	0.0173	0.0140	0.0033
217	0.0150	0.0121	0.0029
218	0.0147	0.0119	0.0028
219	0.0143	0.0116	0.0027
220	0.0140	0.0114	0.0027
221	0.0138	0.0111	0.0026
222	0.0135	0.0109	0.0026
223	0.0132	0.0107	0.0025
224	0.0130	0.0105	0.0025
225	0.0128	0.0103	0.0024
226	0.0126	0.0102	0.0024
227	0.0123	0.0100	0.0023
228	0.0122	0.0098	0.0023
229	0.0120	0.0097	0.0023
230	0.0118	0.0095	0.0022
231	0.0116	0.0094	0.0022
232	0.0114	0.0093	0.0022
233	0.0113	0.0091	0.0021
234	0.0111	0.0090	0.0021
235	0.0110	0.0089	0.0021
236	0.0108	0.0088	0.0021
237	0.0107	0.0087	0.0020
238	0.0106	0.0086	0.0020
239	0.0104	0.0085	0.0020
240	0.0103	0.0083	0.0020
241	0.0102	0.0083	0.0019
242	0.0101	0.0082	0.0019
243	0.0100	0.0081	0.0019
244	0.0099	0.0080	0.0019
245	0.0097	0.0079	0.0019
246	0.0096	0.0078	0.0018
247	0.0095	0.0077	0.0018
248	0.0094	0.0076	0.0018
249	0.0094	0.0076	0.0018
250	0.0093	0.0075	0.0018
251	0.0092	0.0074	0.0017
252	0.0091	0.0074	0.0017
253	0.0090	0.0073	0.0017
254	0.0089	0.0072	0.0017
255	0.0088	0.0072	0.0017
256	0.0088	0.0071	0.0017
257	0.0087	0.0070	0.0017
258	0.0086	0.0070	0.0016
259	0.0085	0.0069	0.0016
260	0.0085	0.0069	0.0016
261	0.0084	0.0068	0.0016
262	0.0083	0.0067	0.0016
263	0.0083	0.0067	0.0016
264	0.0082	0.0066	0.0016
265	0.0081	0.0066	0.0015
266	0.0081	0.0065	0.0015
267	0.0080	0.0065	0.0015
268	0.0079	0.0064	0.0015
269	0.0079	0.0064	0.0015
270	0.0078	0.0063	0.0015
271	0.0078	0.0063	0.0015
272	0.0077	0.0062	0.0015

273	0.0077	0.0062	0.0015
274	0.0076	0.0062	0.0014
275	0.0076	0.0061	0.0014
276	0.0075	0.0061	0.0014
277	0.0075	0.0060	0.0014
278	0.0074	0.0060	0.0014
279	0.0074	0.0060	0.0014
280	0.0073	0.0059	0.0014
281	0.0073	0.0059	0.0014
282	0.0072	0.0058	0.0014
283	0.0072	0.0058	0.0014
284	0.0071	0.0058	0.0014
285	0.0071	0.0057	0.0013
286	0.0070	0.0057	0.0013
287	0.0070	0.0057	0.0013
288	0.0070	0.0056	0.0013

Total soil rain loss = 3.39(In)
Total effective rainfall = 1.14(In)
Peak flow rate in flood hydrograph = 13.19(CFS)

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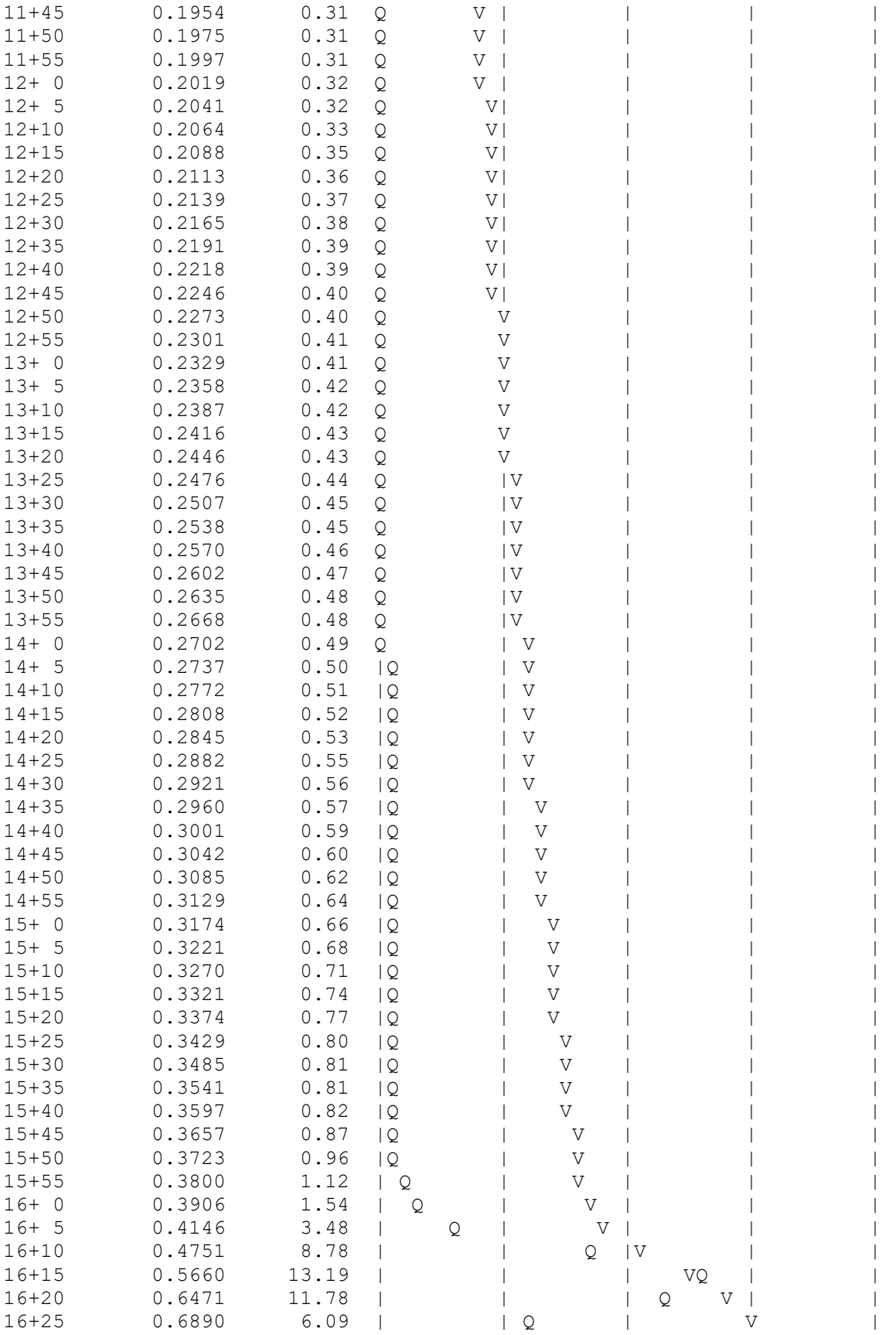
24 - H O U R S T O R M
R u n o f f H y d r o g r a p h

Hydrograph in 5 Minute intervals ((CFS))

Time(h+m)	Volume Ac.Ft	Q(CFS)	0	5.0	10.0	15.0	20.0
0+ 5	0.0000	0.00	Q				
0+10	0.0002	0.03	Q				
0+15	0.0008	0.08	Q				
0+20	0.0016	0.12	Q				
0+25	0.0025	0.14	Q				
0+30	0.0036	0.15	Q				
0+35	0.0046	0.15	Q				
0+40	0.0057	0.15	Q				
0+45	0.0067	0.15	Q				
0+50	0.0078	0.15	Q				
0+55	0.0089	0.16	Q				
1+ 0	0.0099	0.16	Q				
1+ 5	0.0110	0.16	Q				
1+10	0.0121	0.16	Q				
1+15	0.0132	0.16	Q				
1+20	0.0142	0.16	Q				
1+25	0.0153	0.16	Q				
1+30	0.0164	0.16	Q				
1+35	0.0175	0.16	Q				
1+40	0.0186	0.16	Q				
1+45	0.0197	0.16	Q				
1+50	0.0208	0.16	Q				
1+55	0.0219	0.16	Q				
2+ 0	0.0231	0.16	QV				
2+ 5	0.0242	0.16	QV				
2+10	0.0253	0.16	QV				

2+15	0.0264	0.16	QV				
2+20	0.0275	0.16	QV				
2+25	0.0287	0.16	QV				
2+30	0.0298	0.16	QV				
2+35	0.0309	0.17	QV				
2+40	0.0321	0.17	QV				
2+45	0.0332	0.17	QV				
2+50	0.0344	0.17	QV				
2+55	0.0355	0.17	QV				
3+ 0	0.0367	0.17	QV				
3+ 5	0.0379	0.17	QV				
3+10	0.0390	0.17	QV				
3+15	0.0402	0.17	QV				
3+20	0.0414	0.17	QV				
3+25	0.0426	0.17	QV				
3+30	0.0437	0.17	QV				
3+35	0.0449	0.17	QV				
3+40	0.0461	0.17	Q V				
3+45	0.0473	0.17	Q V				
3+50	0.0485	0.17	Q V				
3+55	0.0497	0.18	Q V				
4+ 0	0.0509	0.18	Q V				
4+ 5	0.0522	0.18	Q V				
4+10	0.0534	0.18	Q V				
4+15	0.0546	0.18	Q V				
4+20	0.0558	0.18	Q V				
4+25	0.0571	0.18	Q V				
4+30	0.0583	0.18	Q V				
4+35	0.0595	0.18	Q V				
4+40	0.0608	0.18	Q V				
4+45	0.0621	0.18	Q V				
4+50	0.0633	0.18	Q V				
4+55	0.0646	0.18	Q V				
5+ 0	0.0658	0.18	Q V				
5+ 5	0.0671	0.19	Q V				
5+10	0.0684	0.19	Q V				
5+15	0.0697	0.19	Q V				
5+20	0.0710	0.19	Q V				
5+25	0.0723	0.19	Q V				
5+30	0.0736	0.19	Q V				
5+35	0.0749	0.19	Q V				
5+40	0.0762	0.19	Q V				
5+45	0.0775	0.19	Q V				
5+50	0.0788	0.19	Q V				
5+55	0.0802	0.19	Q V				
6+ 0	0.0815	0.19	Q V				
6+ 5	0.0829	0.20	Q V				
6+10	0.0842	0.20	Q V				
6+15	0.0856	0.20	Q V				
6+20	0.0869	0.20	Q V				
6+25	0.0883	0.20	Q V				
6+30	0.0897	0.20	Q V				
6+35	0.0911	0.20	Q V				
6+40	0.0924	0.20	Q V				
6+45	0.0938	0.20	Q V				
6+50	0.0952	0.20	Q V				
6+55	0.0966	0.20	Q V				

7+ 0	0.0981	0.21	Q	V	|	|	|	|
7+ 5	0.0995	0.21	Q	V	|	|	|	|
7+10	0.1009	0.21	Q	V	|	|	|	|
7+15	0.1024	0.21	Q	V	|	|	|	|
7+20	0.1038	0.21	Q	V	|	|	|	|
7+25	0.1053	0.21	Q	V	|	|	|	|
7+30	0.1067	0.21	Q	V	|	|	|	|
7+35	0.1082	0.21	Q	V	|	|	|	|
7+40	0.1097	0.21	Q	V	|	|	|	|
7+45	0.1111	0.22	Q	V	|	|	|	|
7+50	0.1126	0.22	Q	V	|	|	|	|
7+55	0.1141	0.22	Q	V	|	|	|	|
8+ 0	0.1156	0.22	Q	V	|	|	|	|
8+ 5	0.1172	0.22	Q	V	|	|	|	|
8+10	0.1187	0.22	Q	V	|	|	|	|
8+15	0.1202	0.22	Q	V	|	|	|	|
8+20	0.1218	0.22	Q	V	|	|	|	|
8+25	0.1233	0.23	Q	V	|	|	|	|
8+30	0.1249	0.23	Q	V	|	|	|	|
8+35	0.1265	0.23	Q	V	|	|	|	|
8+40	0.1280	0.23	Q	V	|	|	|	|
8+45	0.1296	0.23	Q	V	|	|	|	|
8+50	0.1312	0.23	Q	V	|	|	|	|
8+55	0.1328	0.23	Q	V	|	|	|	|
9+ 0	0.1345	0.24	Q	V	|	|	|	|
9+ 5	0.1361	0.24	Q	V	|	|	|	|
9+10	0.1377	0.24	Q	V	|	|	|	|
9+15	0.1394	0.24	Q	V	|	|	|	|
9+20	0.1411	0.24	Q	V	|	|	|	|
9+25	0.1427	0.24	Q	V	|	|	|	|
9+30	0.1444	0.25	Q	V	|	|	|	|
9+35	0.1461	0.25	Q	V	|	|	|	|
9+40	0.1478	0.25	Q	V	|	|	|	|
9+45	0.1496	0.25	Q	V	|	|	|	|
9+50	0.1513	0.25	Q	V	|	|	|	|
9+55	0.1531	0.25	Q	V	|	|	|	|
10+ 0	0.1548	0.26	Q	V	|	|	|	|
10+ 5	0.1566	0.26	Q	V	|	|	|	|
10+10	0.1584	0.26	Q	V	|	|	|	|
10+15	0.1602	0.26	Q	V	|	|	|	|
10+20	0.1620	0.26	Q	V	|	|	|	|
10+25	0.1638	0.27	Q	V	|	|	|	|
10+30	0.1657	0.27	Q	V	|	|	|	|
10+35	0.1675	0.27	Q	V	|	|	|	|
10+40	0.1694	0.27	Q	V	|	|	|	|
10+45	0.1713	0.27	Q	V	|	|	|	|
10+50	0.1732	0.28	Q	V	|	|	|	|
10+55	0.1751	0.28	Q	V	|	|	|	|
11+ 0	0.1771	0.28	Q	V	|	|	|	|
11+ 5	0.1790	0.28	Q	V	|	|	|	|
11+10	0.1810	0.29	Q	V	|	|	|	|
11+15	0.1830	0.29	Q	V	|	|	|	|
11+20	0.1850	0.29	Q	V	|	|	|	|
11+25	0.1871	0.30	Q	V	|	|	|	|
11+30	0.1891	0.30	Q	V	|	|	|	|
11+35	0.1912	0.30	Q	V	|	|	|	|
11+40	0.1933	0.30	Q	V	|	|	|	|



16+30	0.7100	3.04		Q		V
16+35	0.7209	1.59		Q		V
16+40	0.7286	1.12		Q		V
16+45	0.7349	0.91	Q			V
16+50	0.7399	0.73	Q			V
16+55	0.7445	0.67	Q			V
17+ 0	0.7489	0.63	Q			V
17+ 5	0.7530	0.60	Q			V
17+10	0.7569	0.57	Q			V
17+15	0.7606	0.54	Q			V
17+20	0.7642	0.52	Q			V
17+25	0.7676	0.50	Q			V
17+30	0.7709	0.48	Q			V
17+35	0.7741	0.46	Q			V
17+40	0.7772	0.45	Q			V
17+45	0.7802	0.44	Q			V
17+50	0.7831	0.42	Q			V
17+55	0.7860	0.41	Q			V
18+ 0	0.7888	0.40	Q			V
18+ 5	0.7915	0.39	Q			V
18+10	0.7940	0.38	Q			V
18+15	0.7965	0.35	Q			V
18+20	0.7988	0.34	Q			V
18+25	0.8010	0.32	Q			V
18+30	0.8032	0.31	Q			V
18+35	0.8053	0.31	Q			V
18+40	0.8073	0.30	Q			V
18+45	0.8094	0.29	Q			V
18+50	0.8113	0.29	Q			V
18+55	0.8133	0.28	Q			V
19+ 0	0.8152	0.28	Q			V
19+ 5	0.8171	0.27	Q			V
19+10	0.8189	0.27	Q			V
19+15	0.8208	0.26	Q			V
19+20	0.8226	0.26	Q			V
19+25	0.8243	0.26	Q			V
19+30	0.8261	0.25	Q			V
19+35	0.8278	0.25	Q			V
19+40	0.8295	0.25	Q			V
19+45	0.8311	0.24	Q			V
19+50	0.8328	0.24	Q			V
19+55	0.8344	0.24	Q			V
20+ 0	0.8360	0.23	Q			V
20+ 5	0.8376	0.23	Q			V
20+10	0.8392	0.23	Q			V
20+15	0.8407	0.22	Q			V
20+20	0.8423	0.22	Q			V
20+25	0.8438	0.22	Q			V
20+30	0.8453	0.22	Q			V
20+35	0.8467	0.21	Q			V
20+40	0.8482	0.21	Q			V
20+45	0.8497	0.21	Q			V
20+50	0.8511	0.21	Q			V
20+55	0.8525	0.21	Q			V
21+ 0	0.8539	0.20	Q			V
21+ 5	0.8553	0.20	Q			V
21+10	0.8567	0.20	Q			V

21+15	0.8581	0.20	Q	|	|	|	V |
21+20	0.8594	0.20	Q	|	|	|	V |
21+25	0.8607	0.19	Q	|	|	|	V |
21+30	0.8621	0.19	Q	|	|	|	V |
21+35	0.8634	0.19	Q	|	|	|	V |
21+40	0.8647	0.19	Q	|	|	|	V |
21+45	0.8660	0.19	Q	|	|	|	V |
21+50	0.8673	0.19	Q	|	|	|	V |
21+55	0.8685	0.18	Q	|	|	|	V |
22+ 0	0.8698	0.18	Q	|	|	|	V |
22+ 5	0.8711	0.18	Q	|	|	|	V |
22+10	0.8723	0.18	Q	|	|	|	V |
22+15	0.8735	0.18	Q	|	|	|	V |
22+20	0.8747	0.18	Q	|	|	|	V |
22+25	0.8760	0.18	Q	|	|	|	V |
22+30	0.8772	0.17	Q	|	|	|	V |
22+35	0.8784	0.17	Q	|	|	|	V|
22+40	0.8795	0.17	Q	|	|	|	V|
22+45	0.8807	0.17	Q	|	|	|	V|
22+50	0.8819	0.17	Q	|	|	|	V|
22+55	0.8831	0.17	Q	|	|	|	V|
23+ 0	0.8842	0.17	Q	|	|	|	V|
23+ 5	0.8854	0.17	Q	|	|	|	V|
23+10	0.8865	0.17	Q	|	|	|	V|
23+15	0.8876	0.16	Q	|	|	|	V|
23+20	0.8887	0.16	Q	|	|	|	V|
23+25	0.8899	0.16	Q	|	|	|	V|
23+30	0.8910	0.16	Q	|	|	|	V|
23+35	0.8921	0.16	Q	|	|	|	V|
23+40	0.8932	0.16	Q	|	|	|	V|
23+45	0.8942	0.16	Q	|	|	|	V|
23+50	0.8953	0.16	Q	|	|	|	V|
23+55	0.8964	0.16	Q	|	|	|	V|
24+ 0	0.8975	0.15	Q	|	|	|	V|
24+ 5	0.8985	0.15	Q	|	|	|	V|
24+10	0.8993	0.12	Q	|	|	|	V|
24+15	0.8999	0.08	Q	|	|	|	V|
24+20	0.9001	0.03	Q	|	|	|	V|
24+25	0.9002	0.01	Q	|	|	|	V|
24+30	0.9002	0.00	Q	|	|	|	V|
24+35	0.9002	0.00	Q	|	|	|	V|
24+40	0.9002	0.00	Q	|	|	|	V

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 04/06/21

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

Program License Serial Number 6405

BLOOMINGTON COMMERCE CENTER - SITE 4
EXISTING CONDITION
25-YEAR, 24 HOUR STORM EVENT ANALYSIS

Storm Event Year = 25

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 25		
9.56	1	1.01
Rainfall data for year 25		
9.56	6	2.46
Rainfall data for year 25		
9.56	24	4.53

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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)
32.0	32.0	9.56	1.000	0.978	0.800	0.782

Area-averaged adjusted loss rate Fm (In/Hr) = 0.782

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

Area (Ac.)	Area Fract	SCS CN (AMC2)	SCS CN (AMC2)	S	Pervious Yield Fr
7.65	0.800	32.0	32.0	21.25	0.001
1.91	0.200	98.0	98.0	0.20	0.948

Area-averaged catchment yield fraction, Y = 0.190
Area-averaged low loss fraction, Yb = 0.810
User entry of time of concentration = 0.261 (hours)
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Watershed area = 9.56(Ac.)
Catchment Lag time = 0.209 hours
Unit interval = 5.000 minutes
Unit interval percentage of lag time = 39.9438
Hydrograph baseflow = 0.00(CFS)
Average maximum watershed loss rate(Fm) = 0.782(In/Hr)
Average low loss rate fraction (Yb) = 0.810 (decimal)
VALLEY DEVELOPED S-Graph Selected
Computed peak 5-minute rainfall = 0.374(In)
Computed peak 30-minute rainfall = 0.765(In)
Specified peak 1-hour rainfall = 1.010(In)
Computed peak 3-hour rainfall = 1.743(In)
Specified peak 6-hour rainfall = 2.460(In)
Specified peak 24-hour rainfall = 4.530(In)

Rainfall depth area reduction factors:
Using a total area of 9.56(Ac.) (Ref: fig. E-4)

5-minute factor = 1.000 Adjusted rainfall = 0.374(In)
30-minute factor = 1.000 Adjusted rainfall = 0.765(In)
1-hour factor = 1.000 Adjusted rainfall = 1.010(In)
3-hour factor = 1.000 Adjusted rainfall = 1.743(In)
6-hour factor = 1.000 Adjusted rainfall = 2.460(In)
24-hour factor = 1.000 Adjusted rainfall = 4.530(In)

U n i t H y d r o g r a p h
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Interval Number	'S' Graph Mean values	Unit Hydrograph ((CFS))
	(K = 115.62 (CFS))	
1	3.031	3.504
2	19.523	19.068
3	49.502	34.660
4	77.833	32.755
5	91.170	15.420
6	96.689	6.381

7	98.473	2.063
8	99.192	0.831
9	100.000	0.416

Peak Unit Number	Adjusted mass rainfall (In)	Unit rainfall (In)
1	0.3736	0.3736
2	0.4930	0.1194
3	0.5798	0.0868
4	0.6505	0.0707
5	0.7113	0.0607
6	0.7651	0.0538
7	0.8138	0.0487
8	0.8584	0.0446
9	0.8998	0.0414
10	0.9385	0.0387
11	0.9750	0.0365
12	1.0095	0.0345
13	1.0505	0.0410
14	1.0900	0.0394
15	1.1280	0.0380
16	1.1648	0.0368
17	1.2004	0.0356
18	1.2350	0.0346
19	1.2687	0.0337
20	1.3015	0.0328
21	1.3334	0.0320
22	1.3646	0.0312
23	1.3951	0.0305
24	1.4249	0.0298
25	1.4542	0.0292
26	1.4828	0.0286
27	1.5109	0.0281
28	1.5384	0.0276
29	1.5655	0.0271
30	1.5921	0.0266
31	1.6183	0.0262
32	1.6441	0.0257
33	1.6694	0.0253
34	1.6944	0.0250
35	1.7190	0.0246
36	1.7432	0.0242
37	1.7671	0.0239
38	1.7907	0.0236
39	1.8139	0.0233
40	1.8369	0.0230
41	1.8596	0.0227
42	1.8820	0.0224
43	1.9041	0.0221
44	1.9260	0.0219
45	1.9476	0.0216
46	1.9690	0.0214
47	1.9901	0.0212
48	2.0111	0.0209
49	2.0318	0.0207
50	2.0523	0.0205
51	2.0726	0.0203

52	2.0927	0.0201
53	2.1126	0.0199
54	2.1323	0.0197
55	2.1518	0.0195
56	2.1712	0.0194
57	2.1903	0.0192
58	2.2093	0.0190
59	2.2282	0.0188
60	2.2469	0.0187
61	2.2654	0.0185
62	2.2838	0.0184
63	2.3020	0.0182
64	2.3201	0.0181
65	2.3380	0.0179
66	2.3558	0.0178
67	2.3735	0.0177
68	2.3910	0.0175
69	2.4085	0.0174
70	2.4257	0.0173
71	2.4429	0.0172
72	2.4599	0.0170
73	2.4749	0.0150
74	2.4898	0.0149
75	2.5046	0.0148
76	2.5192	0.0147
77	2.5338	0.0145
78	2.5482	0.0144
79	2.5625	0.0143
80	2.5768	0.0142
81	2.5909	0.0141
82	2.6049	0.0140
83	2.6189	0.0139
84	2.6327	0.0139
85	2.6465	0.0138
86	2.6602	0.0137
87	2.6737	0.0136
88	2.6872	0.0135
89	2.7006	0.0134
90	2.7140	0.0133
91	2.7272	0.0132
92	2.7404	0.0132
93	2.7534	0.0131
94	2.7665	0.0130
95	2.7794	0.0129
96	2.7922	0.0128
97	2.8050	0.0128
98	2.8177	0.0127
99	2.8303	0.0126
100	2.8429	0.0126
101	2.8554	0.0125
102	2.8678	0.0124
103	2.8801	0.0123
104	2.8924	0.0123
105	2.9046	0.0122
106	2.9168	0.0122
107	2.9289	0.0121
108	2.9409	0.0120

109	2.9529	0.0120
110	2.9648	0.0119
111	2.9766	0.0118
112	2.9884	0.0118
113	3.0001	0.0117
114	3.0118	0.0117
115	3.0234	0.0116
116	3.0349	0.0116
117	3.0464	0.0115
118	3.0579	0.0114
119	3.0693	0.0114
120	3.0806	0.0113
121	3.0919	0.0113
122	3.1031	0.0112
123	3.1143	0.0112
124	3.1254	0.0111
125	3.1365	0.0111
126	3.1475	0.0110
127	3.1585	0.0110
128	3.1694	0.0109
129	3.1803	0.0109
130	3.1911	0.0108
131	3.2019	0.0108
132	3.2127	0.0107
133	3.2234	0.0107
134	3.2340	0.0107
135	3.2446	0.0106
136	3.2552	0.0106
137	3.2657	0.0105
138	3.2762	0.0105
139	3.2866	0.0104
140	3.2970	0.0104
141	3.3074	0.0104
142	3.3177	0.0103
143	3.3279	0.0103
144	3.3382	0.0102
145	3.3484	0.0102
146	3.3585	0.0102
147	3.3686	0.0101
148	3.3787	0.0101
149	3.3887	0.0100
150	3.3987	0.0100
151	3.4087	0.0100
152	3.4186	0.0099
153	3.4285	0.0099
154	3.4383	0.0099
155	3.4482	0.0098
156	3.4579	0.0098
157	3.4677	0.0097
158	3.4774	0.0097
159	3.4871	0.0097
160	3.4967	0.0096
161	3.5063	0.0096
162	3.5159	0.0096
163	3.5254	0.0095
164	3.5350	0.0095
165	3.5444	0.0095

166	3.5539	0.0094
167	3.5633	0.0094
168	3.5727	0.0094
169	3.5820	0.0094
170	3.5913	0.0093
171	3.6006	0.0093
172	3.6099	0.0093
173	3.6191	0.0092
174	3.6283	0.0092
175	3.6375	0.0092
176	3.6466	0.0091
177	3.6557	0.0091
178	3.6648	0.0091
179	3.6739	0.0091
180	3.6829	0.0090
181	3.6919	0.0090
182	3.7009	0.0090
183	3.7098	0.0089
184	3.7187	0.0089
185	3.7276	0.0089
186	3.7365	0.0089
187	3.7453	0.0088
188	3.7541	0.0088
189	3.7629	0.0088
190	3.7717	0.0088
191	3.7804	0.0087
192	3.7891	0.0087
193	3.7978	0.0087
194	3.8064	0.0087
195	3.8151	0.0086
196	3.8237	0.0086
197	3.8322	0.0086
198	3.8408	0.0086
199	3.8493	0.0085
200	3.8578	0.0085
201	3.8663	0.0085
202	3.8748	0.0085
203	3.8832	0.0084
204	3.8916	0.0084
205	3.9000	0.0084
206	3.9084	0.0084
207	3.9167	0.0083
208	3.9251	0.0083
209	3.9334	0.0083
210	3.9416	0.0083
211	3.9499	0.0083
212	3.9581	0.0082
213	3.9663	0.0082
214	3.9745	0.0082
215	3.9827	0.0082
216	3.9908	0.0081
217	3.9990	0.0081
218	4.0071	0.0081
219	4.0152	0.0081
220	4.0232	0.0081
221	4.0313	0.0080
222	4.0393	0.0080

223	4.0473	0.0080
224	4.0553	0.0080
225	4.0632	0.0080
226	4.0712	0.0079
227	4.0791	0.0079
228	4.0870	0.0079
229	4.0949	0.0079
230	4.1028	0.0079
231	4.1106	0.0078
232	4.1184	0.0078
233	4.1263	0.0078
234	4.1340	0.0078
235	4.1418	0.0078
236	4.1496	0.0078
237	4.1573	0.0077
238	4.1650	0.0077
239	4.1727	0.0077
240	4.1804	0.0077
241	4.1881	0.0077
242	4.1957	0.0076
243	4.2033	0.0076
244	4.2110	0.0076
245	4.2185	0.0076
246	4.2261	0.0076
247	4.2337	0.0076
248	4.2412	0.0075
249	4.2487	0.0075
250	4.2562	0.0075
251	4.2637	0.0075
252	4.2712	0.0075
253	4.2787	0.0075
254	4.2861	0.0074
255	4.2935	0.0074
256	4.3009	0.0074
257	4.3083	0.0074
258	4.3157	0.0074
259	4.3231	0.0074
260	4.3304	0.0073
261	4.3377	0.0073
262	4.3451	0.0073
263	4.3523	0.0073
264	4.3596	0.0073
265	4.3669	0.0073
266	4.3741	0.0073
267	4.3814	0.0072
268	4.3886	0.0072
269	4.3958	0.0072
270	4.4030	0.0072
271	4.4102	0.0072
272	4.4173	0.0072
273	4.4245	0.0071
274	4.4316	0.0071
275	4.4387	0.0071
276	4.4458	0.0071
277	4.4529	0.0071
278	4.4600	0.0071
279	4.4670	0.0071

280	4.4741	0.0070
281	4.4811	0.0070
282	4.4881	0.0070
283	4.4951	0.0070
284	4.5021	0.0070
285	4.5091	0.0070
286	4.5161	0.0070
287	4.5230	0.0069
288	4.5299	0.0069

Unit Period (number)	Unit Rainfall (In)	Unit Soil-Loss (In)	Effective Rainfall (In)
1	0.0069	0.0056	0.0013
2	0.0069	0.0056	0.0013
3	0.0070	0.0056	0.0013
4	0.0070	0.0057	0.0013
5	0.0070	0.0057	0.0013
6	0.0070	0.0057	0.0013
7	0.0071	0.0057	0.0013
8	0.0071	0.0057	0.0013
9	0.0071	0.0058	0.0014
10	0.0071	0.0058	0.0014
11	0.0071	0.0058	0.0014
12	0.0072	0.0058	0.0014
13	0.0072	0.0058	0.0014
14	0.0072	0.0058	0.0014
15	0.0072	0.0059	0.0014
16	0.0073	0.0059	0.0014
17	0.0073	0.0059	0.0014
18	0.0073	0.0059	0.0014
19	0.0073	0.0059	0.0014
20	0.0073	0.0059	0.0014
21	0.0074	0.0060	0.0014
22	0.0074	0.0060	0.0014
23	0.0074	0.0060	0.0014
24	0.0074	0.0060	0.0014
25	0.0075	0.0061	0.0014
26	0.0075	0.0061	0.0014
27	0.0075	0.0061	0.0014
28	0.0075	0.0061	0.0014
29	0.0076	0.0061	0.0014
30	0.0076	0.0061	0.0014
31	0.0076	0.0062	0.0015
32	0.0076	0.0062	0.0015
33	0.0077	0.0062	0.0015
34	0.0077	0.0062	0.0015
35	0.0077	0.0063	0.0015
36	0.0078	0.0063	0.0015
37	0.0078	0.0063	0.0015
38	0.0078	0.0063	0.0015
39	0.0078	0.0064	0.0015
40	0.0079	0.0064	0.0015
41	0.0079	0.0064	0.0015
42	0.0079	0.0064	0.0015
43	0.0080	0.0064	0.0015

44	0.0080	0.0065	0.0015
45	0.0080	0.0065	0.0015
46	0.0080	0.0065	0.0015
47	0.0081	0.0065	0.0015
48	0.0081	0.0066	0.0015
49	0.0081	0.0066	0.0015
50	0.0082	0.0066	0.0016
51	0.0082	0.0067	0.0016
52	0.0082	0.0067	0.0016
53	0.0083	0.0067	0.0016
54	0.0083	0.0067	0.0016
55	0.0083	0.0068	0.0016
56	0.0084	0.0068	0.0016
57	0.0084	0.0068	0.0016
58	0.0084	0.0068	0.0016
59	0.0085	0.0069	0.0016
60	0.0085	0.0069	0.0016
61	0.0086	0.0069	0.0016
62	0.0086	0.0069	0.0016
63	0.0086	0.0070	0.0016
64	0.0087	0.0070	0.0016
65	0.0087	0.0070	0.0017
66	0.0087	0.0071	0.0017
67	0.0088	0.0071	0.0017
68	0.0088	0.0071	0.0017
69	0.0089	0.0072	0.0017
70	0.0089	0.0072	0.0017
71	0.0089	0.0072	0.0017
72	0.0090	0.0073	0.0017
73	0.0090	0.0073	0.0017
74	0.0091	0.0073	0.0017
75	0.0091	0.0074	0.0017
76	0.0091	0.0074	0.0017
77	0.0092	0.0074	0.0017
78	0.0092	0.0075	0.0018
79	0.0093	0.0075	0.0018
80	0.0093	0.0075	0.0018
81	0.0094	0.0076	0.0018
82	0.0094	0.0076	0.0018
83	0.0095	0.0077	0.0018
84	0.0095	0.0077	0.0018
85	0.0096	0.0078	0.0018
86	0.0096	0.0078	0.0018
87	0.0097	0.0078	0.0018
88	0.0097	0.0079	0.0018
89	0.0098	0.0079	0.0019
90	0.0098	0.0079	0.0019
91	0.0099	0.0080	0.0019
92	0.0099	0.0080	0.0019
93	0.0100	0.0081	0.0019
94	0.0100	0.0081	0.0019
95	0.0101	0.0082	0.0019
96	0.0102	0.0082	0.0019
97	0.0102	0.0083	0.0019
98	0.0103	0.0083	0.0020
99	0.0104	0.0084	0.0020
100	0.0104	0.0084	0.0020

101	0.0105	0.0085	0.0020
102	0.0105	0.0085	0.0020
103	0.0106	0.0086	0.0020
104	0.0107	0.0086	0.0020
105	0.0107	0.0087	0.0020
106	0.0108	0.0087	0.0021
107	0.0109	0.0088	0.0021
108	0.0109	0.0089	0.0021
109	0.0110	0.0089	0.0021
110	0.0111	0.0090	0.0021
111	0.0112	0.0091	0.0021
112	0.0112	0.0091	0.0021
113	0.0113	0.0092	0.0022
114	0.0114	0.0092	0.0022
115	0.0115	0.0093	0.0022
116	0.0116	0.0094	0.0022
117	0.0117	0.0094	0.0022
118	0.0117	0.0095	0.0022
119	0.0118	0.0096	0.0023
120	0.0119	0.0096	0.0023
121	0.0120	0.0097	0.0023
122	0.0121	0.0098	0.0023
123	0.0122	0.0099	0.0023
124	0.0123	0.0099	0.0023
125	0.0124	0.0101	0.0024
126	0.0125	0.0101	0.0024
127	0.0126	0.0102	0.0024
128	0.0127	0.0103	0.0024
129	0.0128	0.0104	0.0024
130	0.0129	0.0105	0.0025
131	0.0131	0.0106	0.0025
132	0.0132	0.0107	0.0025
133	0.0133	0.0108	0.0025
134	0.0134	0.0109	0.0026
135	0.0136	0.0110	0.0026
136	0.0137	0.0111	0.0026
137	0.0139	0.0112	0.0026
138	0.0139	0.0113	0.0027
139	0.0141	0.0114	0.0027
140	0.0142	0.0115	0.0027
141	0.0144	0.0117	0.0027
142	0.0145	0.0118	0.0028
143	0.0148	0.0120	0.0028
144	0.0149	0.0120	0.0028
145	0.0170	0.0138	0.0032
146	0.0172	0.0139	0.0033
147	0.0174	0.0141	0.0033
148	0.0175	0.0142	0.0033
149	0.0178	0.0144	0.0034
150	0.0179	0.0145	0.0034
151	0.0182	0.0148	0.0035
152	0.0184	0.0149	0.0035
153	0.0187	0.0151	0.0036
154	0.0188	0.0153	0.0036
155	0.0192	0.0155	0.0036
156	0.0194	0.0157	0.0037
157	0.0197	0.0160	0.0037

158	0.0199	0.0161	0.0038
159	0.0203	0.0164	0.0039
160	0.0205	0.0166	0.0039
161	0.0209	0.0169	0.0040
162	0.0212	0.0171	0.0040
163	0.0216	0.0175	0.0041
164	0.0219	0.0177	0.0042
165	0.0224	0.0181	0.0043
166	0.0227	0.0184	0.0043
167	0.0233	0.0188	0.0044
168	0.0236	0.0191	0.0045
169	0.0242	0.0196	0.0046
170	0.0246	0.0199	0.0047
171	0.0253	0.0205	0.0048
172	0.0257	0.0209	0.0049
173	0.0266	0.0215	0.0051
174	0.0271	0.0219	0.0052
175	0.0281	0.0227	0.0053
176	0.0286	0.0232	0.0054
177	0.0298	0.0242	0.0057
178	0.0305	0.0247	0.0058
179	0.0320	0.0259	0.0061
180	0.0328	0.0265	0.0062
181	0.0346	0.0280	0.0066
182	0.0356	0.0289	0.0068
183	0.0380	0.0308	0.0072
184	0.0394	0.0319	0.0075
185	0.0345	0.0280	0.0066
186	0.0365	0.0295	0.0069
187	0.0414	0.0335	0.0079
188	0.0446	0.0362	0.0085
189	0.0538	0.0436	0.0102
190	0.0607	0.0492	0.0116
191	0.0868	0.0652	0.0216
192	0.1194	0.0652	0.0542
193	0.3736	0.0652	0.3085
194	0.0707	0.0573	0.0135
195	0.0487	0.0394	0.0093
196	0.0387	0.0314	0.0074
197	0.0410	0.0332	0.0078
198	0.0368	0.0298	0.0070
199	0.0337	0.0272	0.0064
200	0.0312	0.0253	0.0059
201	0.0292	0.0237	0.0056
202	0.0276	0.0223	0.0052
203	0.0262	0.0212	0.0050
204	0.0250	0.0202	0.0047
205	0.0239	0.0193	0.0045
206	0.0230	0.0186	0.0044
207	0.0221	0.0179	0.0042
208	0.0214	0.0173	0.0041
209	0.0207	0.0168	0.0039
210	0.0201	0.0163	0.0038
211	0.0195	0.0158	0.0037
212	0.0190	0.0154	0.0036
213	0.0185	0.0150	0.0035
214	0.0181	0.0146	0.0034

215	0.0177	0.0143	0.0034
216	0.0173	0.0140	0.0033
217	0.0150	0.0121	0.0029
218	0.0147	0.0119	0.0028
219	0.0143	0.0116	0.0027
220	0.0140	0.0114	0.0027
221	0.0138	0.0111	0.0026
222	0.0135	0.0109	0.0026
223	0.0132	0.0107	0.0025
224	0.0130	0.0105	0.0025
225	0.0128	0.0103	0.0024
226	0.0126	0.0102	0.0024
227	0.0123	0.0100	0.0023
228	0.0122	0.0098	0.0023
229	0.0120	0.0097	0.0023
230	0.0118	0.0095	0.0022
231	0.0116	0.0094	0.0022
232	0.0114	0.0093	0.0022
233	0.0113	0.0091	0.0021
234	0.0111	0.0090	0.0021
235	0.0110	0.0089	0.0021
236	0.0108	0.0088	0.0021
237	0.0107	0.0087	0.0020
238	0.0106	0.0086	0.0020
239	0.0104	0.0085	0.0020
240	0.0103	0.0083	0.0020
241	0.0102	0.0083	0.0019
242	0.0101	0.0082	0.0019
243	0.0100	0.0081	0.0019
244	0.0099	0.0080	0.0019
245	0.0097	0.0079	0.0019
246	0.0096	0.0078	0.0018
247	0.0095	0.0077	0.0018
248	0.0094	0.0076	0.0018
249	0.0094	0.0076	0.0018
250	0.0093	0.0075	0.0018
251	0.0092	0.0074	0.0017
252	0.0091	0.0074	0.0017
253	0.0090	0.0073	0.0017
254	0.0089	0.0072	0.0017
255	0.0088	0.0072	0.0017
256	0.0088	0.0071	0.0017
257	0.0087	0.0070	0.0017
258	0.0086	0.0070	0.0016
259	0.0085	0.0069	0.0016
260	0.0085	0.0069	0.0016
261	0.0084	0.0068	0.0016
262	0.0083	0.0067	0.0016
263	0.0083	0.0067	0.0016
264	0.0082	0.0066	0.0016
265	0.0081	0.0066	0.0015
266	0.0081	0.0065	0.0015
267	0.0080	0.0065	0.0015
268	0.0079	0.0064	0.0015
269	0.0079	0.0064	0.0015
270	0.0078	0.0063	0.0015
271	0.0078	0.0063	0.0015

272	0.0077	0.0062	0.0015
273	0.0077	0.0062	0.0015
274	0.0076	0.0062	0.0014
275	0.0076	0.0061	0.0014
276	0.0075	0.0061	0.0014
277	0.0075	0.0060	0.0014
278	0.0074	0.0060	0.0014
279	0.0074	0.0060	0.0014
280	0.0073	0.0059	0.0014
281	0.0073	0.0059	0.0014
282	0.0072	0.0058	0.0014
283	0.0072	0.0058	0.0014
284	0.0071	0.0058	0.0014
285	0.0071	0.0057	0.0013
286	0.0070	0.0057	0.0013
287	0.0070	0.0057	0.0013
288	0.0070	0.0056	0.0013

Total soil rain loss = 3.39(In)
Total effective rainfall = 1.14(In)
Peak flow rate in flood hydrograph = 13.19(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

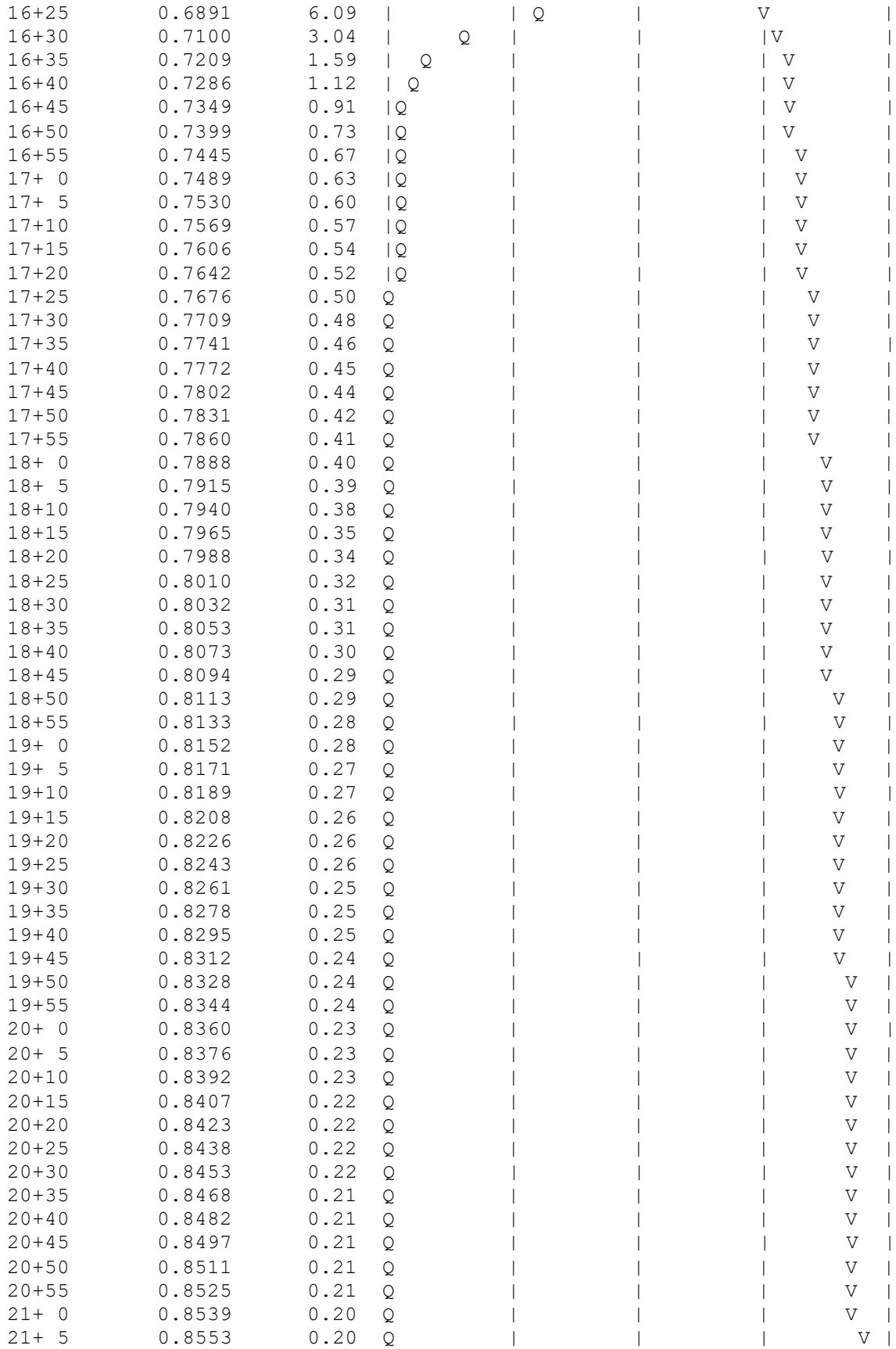
Hydrograph in 5 Minute intervals ((CFS))

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	0.0002	0.03	Q				
0+15	0.0008	0.08	Q				
0+20	0.0016	0.12	Q				
0+25	0.0025	0.14	Q				
0+30	0.0036	0.15	Q				
0+35	0.0046	0.15	Q				
0+40	0.0057	0.15	Q				
0+45	0.0067	0.15	Q				
0+50	0.0078	0.15	Q				
0+55	0.0089	0.16	Q				
1+ 0	0.0099	0.16	Q				
1+ 5	0.0110	0.16	Q				
1+10	0.0121	0.16	Q				
1+15	0.0132	0.16	Q				
1+20	0.0142	0.16	Q				
1+25	0.0153	0.16	Q				
1+30	0.0164	0.16	Q				
1+35	0.0175	0.16	Q				
1+40	0.0186	0.16	Q				
1+45	0.0197	0.16	Q				
1+50	0.0208	0.16	Q				
1+55	0.0219	0.16	Q				
2+ 0	0.0231	0.16	QV				
2+ 5	0.0242	0.16	QV				

2+10	0.0253	0.16	QV	|	|	|	|
2+15	0.0264	0.16	QV	|	|	|	|
2+20	0.0275	0.16	QV	|	|	|	|
2+25	0.0287	0.16	QV	|	|	|	|
2+30	0.0298	0.16	QV	|	|	|	|
2+35	0.0309	0.17	QV	|	|	|	|
2+40	0.0321	0.17	QV	|	|	|	|
2+45	0.0332	0.17	QV	|	|	|	|
2+50	0.0344	0.17	QV	|	|	|	|
2+55	0.0355	0.17	QV	|	|	|	|
3+ 0	0.0367	0.17	QV	|	|	|	|
3+ 5	0.0379	0.17	QV	|	|	|	|
3+10	0.0390	0.17	QV	|	|	|	|
3+15	0.0402	0.17	QV	|	|	|	|
3+20	0.0414	0.17	QV	|	|	|	|
3+25	0.0426	0.17	QV	|	|	|	|
3+30	0.0437	0.17	QV	|	|	|	|
3+35	0.0449	0.17	QV	|	|	|	|
3+40	0.0461	0.17	Q V	|	|	|	|
3+45	0.0473	0.17	Q V	|	|	|	|
3+50	0.0485	0.17	Q V	|	|	|	|
3+55	0.0497	0.18	Q V	|	|	|	|
4+ 0	0.0509	0.18	Q V	|	|	|	|
4+ 5	0.0522	0.18	Q V	|	|	|	|
4+10	0.0534	0.18	Q V	|	|	|	|
4+15	0.0546	0.18	Q V	|	|	|	|
4+20	0.0558	0.18	Q V	|	|	|	|
4+25	0.0571	0.18	Q V	|	|	|	|
4+30	0.0583	0.18	Q V	|	|	|	|
4+35	0.0595	0.18	Q V	|	|	|	|
4+40	0.0608	0.18	Q V	|	|	|	|
4+45	0.0621	0.18	Q V	|	|	|	|
4+50	0.0633	0.18	Q V	|	|	|	|
4+55	0.0646	0.18	Q V	|	|	|	|
5+ 0	0.0658	0.18	Q V	|	|	|	|
5+ 5	0.0671	0.19	Q V	|	|	|	|
5+10	0.0684	0.19	Q V	|	|	|	|
5+15	0.0697	0.19	Q V	|	|	|	|
5+20	0.0710	0.19	Q V	|	|	|	|
5+25	0.0723	0.19	Q V	|	|	|	|
5+30	0.0736	0.19	Q V	|	|	|	|
5+35	0.0749	0.19	Q V	|	|	|	|
5+40	0.0762	0.19	Q V	|	|	|	|
5+45	0.0775	0.19	Q V	|	|	|	|
5+50	0.0788	0.19	Q V	|	|	|	|
5+55	0.0802	0.19	Q V	|	|	|	|
6+ 0	0.0815	0.19	Q V	|	|	|	|
6+ 5	0.0829	0.20	Q V	|	|	|	|
6+10	0.0842	0.20	Q V	|	|	|	|
6+15	0.0856	0.20	Q V	|	|	|	|
6+20	0.0869	0.20	Q V	|	|	|	|
6+25	0.0883	0.20	Q V	|	|	|	|
6+30	0.0897	0.20	Q V	|	|	|	|
6+35	0.0911	0.20	Q V	|	|	|	|
6+40	0.0924	0.20	Q V	|	|	|	|
6+45	0.0938	0.20	Q V	|	|	|	|
6+50	0.0952	0.20	Q V	|	|	|	|

6+55	0.0966	0.20	Q	V				
7+ 0	0.0981	0.21	Q	V				
7+ 5	0.0995	0.21	Q	V				
7+10	0.1009	0.21	Q	V				
7+15	0.1024	0.21	Q	V				
7+20	0.1038	0.21	Q	V				
7+25	0.1053	0.21	Q	V				
7+30	0.1067	0.21	Q	V				
7+35	0.1082	0.21	Q	V				
7+40	0.1097	0.21	Q	V				
7+45	0.1111	0.22	Q	V				
7+50	0.1126	0.22	Q	V				
7+55	0.1141	0.22	Q	V				
8+ 0	0.1156	0.22	Q	V				
8+ 5	0.1172	0.22	Q	V				
8+10	0.1187	0.22	Q	V				
8+15	0.1202	0.22	Q	V				
8+20	0.1218	0.22	Q	V				
8+25	0.1233	0.23	Q	V				
8+30	0.1249	0.23	Q	V				
8+35	0.1265	0.23	Q	V				
8+40	0.1280	0.23	Q	V				
8+45	0.1296	0.23	Q	V				
8+50	0.1312	0.23	Q	V				
8+55	0.1329	0.23	Q	V				
9+ 0	0.1345	0.24	Q	V				
9+ 5	0.1361	0.24	Q	V				
9+10	0.1377	0.24	Q	V				
9+15	0.1394	0.24	Q	V				
9+20	0.1411	0.24	Q	V				
9+25	0.1427	0.24	Q	V				
9+30	0.1444	0.25	Q	V				
9+35	0.1461	0.25	Q	V				
9+40	0.1478	0.25	Q	V				
9+45	0.1496	0.25	Q	V				
9+50	0.1513	0.25	Q	V				
9+55	0.1531	0.25	Q	V				
10+ 0	0.1548	0.26	Q	V				
10+ 5	0.1566	0.26	Q	V				
10+10	0.1584	0.26	Q	V				
10+15	0.1602	0.26	Q	V				
10+20	0.1620	0.26	Q	V				
10+25	0.1638	0.27	Q	V				
10+30	0.1657	0.27	Q	V				
10+35	0.1675	0.27	Q	V				
10+40	0.1694	0.27	Q	V				
10+45	0.1713	0.27	Q	V				
10+50	0.1732	0.28	Q	V				
10+55	0.1751	0.28	Q	V				
11+ 0	0.1771	0.28	Q	V				
11+ 5	0.1790	0.28	Q	V				
11+10	0.1810	0.29	Q	V				
11+15	0.1830	0.29	Q	V				
11+20	0.1850	0.29	Q	V				
11+25	0.1871	0.30	Q	V				
11+30	0.1891	0.30	Q	V				
11+35	0.1912	0.30	Q	V				

11+40	0.1933	0.30	Q	V |			
11+45	0.1954	0.31	Q	V |			
11+50	0.1975	0.31	Q	V |			
11+55	0.1997	0.31	Q	V |			
12+ 0	0.2019	0.32	Q	V |			
12+ 5	0.2041	0.32	Q	V|			
12+10	0.2064	0.33	Q	V|			
12+15	0.2088	0.35	Q	V|			
12+20	0.2113	0.36	Q	V|			
12+25	0.2139	0.37	Q	V|			
12+30	0.2165	0.38	Q	V|			
12+35	0.2191	0.39	Q	V|			
12+40	0.2218	0.39	Q	V|			
12+45	0.2246	0.40	Q	V|			
12+50	0.2273	0.40	Q	V			
12+55	0.2301	0.41	Q	V			
13+ 0	0.2329	0.41	Q	V			
13+ 5	0.2358	0.42	Q	V			
13+10	0.2387	0.42	Q	V			
13+15	0.2416	0.43	Q	V			
13+20	0.2446	0.43	Q	V			
13+25	0.2476	0.44	Q	|V			
13+30	0.2507	0.45	Q	|V			
13+35	0.2538	0.45	Q	|V			
13+40	0.2570	0.46	Q	|V			
13+45	0.2602	0.47	Q	|V			
13+50	0.2635	0.48	Q	|V			
13+55	0.2668	0.48	Q	|V			
14+ 0	0.2702	0.49	Q	| V			
14+ 5	0.2737	0.50	|Q	| V			
14+10	0.2772	0.51	|Q	| V			
14+15	0.2808	0.52	|Q	| V			
14+20	0.2845	0.53	|Q	| V			
14+25	0.2882	0.55	|Q	| V			
14+30	0.2921	0.56	|Q	| V			
14+35	0.2960	0.57	|Q	| V			
14+40	0.3001	0.59	|Q	| V			
14+45	0.3042	0.60	|Q	| V			
14+50	0.3085	0.62	|Q	| V			
14+55	0.3129	0.64	|Q	| V			
15+ 0	0.3174	0.66	|Q	| V			
15+ 5	0.3221	0.68	|Q	| V			
15+10	0.3270	0.71	|Q	| V			
15+15	0.3321	0.74	|Q	| V			
15+20	0.3374	0.77	|Q	| V			
15+25	0.3429	0.80	|Q	| V			
15+30	0.3485	0.81	|Q	| V			
15+35	0.3541	0.81	|Q	| V			
15+40	0.3597	0.82	|Q	| V			
15+45	0.3657	0.87	|Q	| V			
15+50	0.3723	0.96	|Q	| V			
15+55	0.3800	1.12	| Q	| V			
16+ 0	0.3906	1.54	| Q	| V			
16+ 5	0.4146	3.48	| Q	| V			
16+10	0.4751	8.79	|	| Q	|V		
16+15	0.5660	13.19	|	|	| VQ		
16+20	0.6471	11.78	|	|	| Q V		



21+10	0.8567	0.20	Q	|	|	|	V |
21+15	0.8581	0.20	Q	|	|	|	V |
21+20	0.8594	0.20	Q	|	|	|	V |
21+25	0.8607	0.19	Q	|	|	|	V |
21+30	0.8621	0.19	Q	|	|	|	V |
21+35	0.8634	0.19	Q	|	|	|	V |
21+40	0.8647	0.19	Q	|	|	|	V |
21+45	0.8660	0.19	Q	|	|	|	V |
21+50	0.8673	0.19	Q	|	|	|	V |
21+55	0.8685	0.18	Q	|	|	|	V |
22+ 0	0.8698	0.18	Q	|	|	|	V |
22+ 5	0.8711	0.18	Q	|	|	|	V |
22+10	0.8723	0.18	Q	|	|	|	V |
22+15	0.8735	0.18	Q	|	|	|	V |
22+20	0.8748	0.18	Q	|	|	|	V |
22+25	0.8760	0.18	Q	|	|	|	V |
22+30	0.8772	0.17	Q	|	|	|	V |
22+35	0.8784	0.17	Q	|	|	|	V|
22+40	0.8796	0.17	Q	|	|	|	V|
22+45	0.8807	0.17	Q	|	|	|	V|
22+50	0.8819	0.17	Q	|	|	|	V|
22+55	0.8831	0.17	Q	|	|	|	V|
23+ 0	0.8842	0.17	Q	|	|	|	V|
23+ 5	0.8854	0.17	Q	|	|	|	V|
23+10	0.8865	0.17	Q	|	|	|	V|
23+15	0.8876	0.16	Q	|	|	|	V|
23+20	0.8887	0.16	Q	|	|	|	V|
23+25	0.8899	0.16	Q	|	|	|	V|
23+30	0.8910	0.16	Q	|	|	|	V|
23+35	0.8921	0.16	Q	|	|	|	V|
23+40	0.8932	0.16	Q	|	|	|	V|
23+45	0.8942	0.16	Q	|	|	|	V|
23+50	0.8953	0.16	Q	|	|	|	V|
23+55	0.8964	0.16	Q	|	|	|	V|
24+ 0	0.8975	0.15	Q	|	|	|	V|
24+ 5	0.8985	0.15	Q	|	|	|	V|
24+10	0.8993	0.12	Q	|	|	|	V|
24+15	0.8999	0.08	Q	|	|	|	V|
24+20	0.9001	0.03	Q	|	|	|	V|
24+25	0.9002	0.01	Q	|	|	|	V|
24+30	0.9002	0.00	Q	|	|	|	V|
24+35	0.9002	0.00	Q	|	|	|	V|
24+40	0.9002	0.00	Q	|	|	|	V

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 04/20/21

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

Program License Serial Number 6405

BLOOMINGTON COMMERCE CENTER - SITE 4
EXISTING CONDITION
25 YEAR WITH ADJUSTED 10 YEAR STORM RAINFALL DATA

Storm Event Year = 25

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 25		
9.56	1	0.82
Rainfall data for year 25		
9.56	6	2.04
Rainfall data for year 25		
9.56	24	3.76

++

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

SCS curve	SCS curve	Area	Area	Fp(Fig C6)	Ap	Fm

No.(AMCII)	NO.(AMC 2)	(Ac.)	Fraction	(In/Hr)	(dec.)	(In/Hr)
32.0	32.0	9.56	1.000	0.978	0.800	0.782

Area-averaged adjusted loss rate Fm (In/Hr) = 0.782

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

Area (Ac.)	Area Fract	SCS CN (AMC2)	SCS CN (AMC2)	S	Pervious Yield Fr
7.65	0.800	32.0	32.0	18.80	0.000
1.91	0.200	98.0	98.0	0.20	0.938

Area-averaged catchment yield fraction, Y = 0.188
Area-averaged low loss fraction, Yb = 0.812
User entry of time of concentration = 0.267 (hours)
++
Watershed area = 9.56(Ac.)
Catchment Lag time = 0.214 hours
Unit interval = 5.000 minutes
Unit interval percentage of lag time = 38.9991
Hydrograph baseflow = 0.00(CFS)
Average maximum watershed loss rate(Fm) = 0.782(In/Hr)
Average low loss rate fraction (Yb) = 0.812 (decimal)
VALLEY DEVELOPED S-Graph Selected
Computed peak 5-minute rainfall = 0.303(In)
Computed peak 30-minute rainfall = 0.621(In)
Specified peak 1-hour rainfall = 0.819(In)
Computed peak 3-hour rainfall = 1.433(In)
Specified peak 6-hour rainfall = 2.040(In)
Specified peak 24-hour rainfall = 3.760(In)

Rainfall depth area reduction factors:
Using a total area of 9.56(Ac.) (Ref: fig. E-4)

5-minute factor = 1.000 Adjusted rainfall = 0.303(In)
30-minute factor = 1.000 Adjusted rainfall = 0.620(In)
1-hour factor = 1.000 Adjusted rainfall = 0.819(In)
3-hour factor = 1.000 Adjusted rainfall = 1.433(In)
6-hour factor = 1.000 Adjusted rainfall = 2.040(In)
24-hour factor = 1.000 Adjusted rainfall = 3.760(In)

U n i t H y d r o g r a p h
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Interval Number	'S' Graph Mean values	Unit Hydrograph ((CFS))
(K = 115.62 (CFS))		
1	2.913	3.368
2	18.645	18.189
3	47.429	33.279
4	76.184	33.246
5	90.294	16.313
6	96.225	6.857

7	98.349	2.456
8	99.065	0.828
9	100.000	0.414

Peak Unit Number	Adjusted mass rainfall (In)	Unit rainfall (In)
1	0.3030	0.3030
2	0.3998	0.0968
3	0.4702	0.0704
4	0.5275	0.0573
5	0.5768	0.0493
6	0.6204	0.0436
7	0.6599	0.0395
8	0.6961	0.0362
9	0.7296	0.0336
10	0.7611	0.0314
11	0.7906	0.0296
12	0.8186	0.0280
13	0.8527	0.0341
14	0.8855	0.0328
15	0.9172	0.0317
16	0.9479	0.0307
17	0.9777	0.0297
18	1.0066	0.0289
19	1.0347	0.0281
20	1.0621	0.0274
21	1.0888	0.0267
22	1.1150	0.0261
23	1.1405	0.0256
24	1.1655	0.0250
25	1.1900	0.0245
26	1.2141	0.0240
27	1.2376	0.0236
28	1.2608	0.0232
29	1.2836	0.0228
30	1.3059	0.0224
31	1.3279	0.0220
32	1.3496	0.0217
33	1.3709	0.0213
34	1.3920	0.0210
35	1.4127	0.0207
36	1.4331	0.0204
37	1.4532	0.0201
38	1.4731	0.0199
39	1.4927	0.0196
40	1.5121	0.0194
41	1.5313	0.0191
42	1.5502	0.0189
43	1.5689	0.0187
44	1.5873	0.0185
45	1.6056	0.0183
46	1.6237	0.0181
47	1.6416	0.0179
48	1.6593	0.0177
49	1.6768	0.0175
50	1.6941	0.0173
51	1.7113	0.0172

52	1.7283	0.0170
53	1.7452	0.0169
54	1.7619	0.0167
55	1.7784	0.0165
56	1.7948	0.0164
57	1.8111	0.0163
58	1.8272	0.0161
59	1.8432	0.0160
60	1.8590	0.0158
61	1.8747	0.0157
62	1.8903	0.0156
63	1.9058	0.0155
64	1.9211	0.0153
65	1.9364	0.0152
66	1.9515	0.0151
67	1.9665	0.0150
68	1.9814	0.0149
69	1.9962	0.0148
70	2.0109	0.0147
71	2.0255	0.0146
72	2.0399	0.0145
73	2.0524	0.0124
74	2.0647	0.0124
75	2.0770	0.0123
76	2.0892	0.0122
77	2.1013	0.0121
78	2.1132	0.0120
79	2.1252	0.0119
80	2.1370	0.0118
81	2.1487	0.0117
82	2.1604	0.0117
83	2.1720	0.0116
84	2.1835	0.0115
85	2.1949	0.0114
86	2.2062	0.0114
87	2.2175	0.0113
88	2.2287	0.0112
89	2.2399	0.0111
90	2.2509	0.0111
91	2.2619	0.0110
92	2.2729	0.0109
93	2.2837	0.0109
94	2.2945	0.0108
95	2.3053	0.0107
96	2.3159	0.0107
97	2.3265	0.0106
98	2.3371	0.0105
99	2.3476	0.0105
100	2.3580	0.0104
101	2.3684	0.0104
102	2.3787	0.0103
103	2.3890	0.0103
104	2.3992	0.0102
105	2.4093	0.0101
106	2.4194	0.0101
107	2.4295	0.0100
108	2.4394	0.0100

109	2.4494	0.0099
110	2.4593	0.0099
111	2.4691	0.0098
112	2.4789	0.0098
113	2.4886	0.0097
114	2.4983	0.0097
115	2.5080	0.0096
116	2.5176	0.0096
117	2.5271	0.0096
118	2.5366	0.0095
119	2.5461	0.0095
120	2.5555	0.0094
121	2.5649	0.0094
122	2.5742	0.0093
123	2.5835	0.0093
124	2.5927	0.0092
125	2.6019	0.0092
126	2.6111	0.0092
127	2.6202	0.0091
128	2.6293	0.0091
129	2.6383	0.0090
130	2.6473	0.0090
131	2.6563	0.0090
132	2.6652	0.0089
133	2.6741	0.0089
134	2.6829	0.0089
135	2.6918	0.0088
136	2.7005	0.0088
137	2.7093	0.0087
138	2.7180	0.0087
139	2.7267	0.0087
140	2.7353	0.0086
141	2.7439	0.0086
142	2.7525	0.0086
143	2.7610	0.0085
144	2.7695	0.0085
145	2.7780	0.0085
146	2.7864	0.0084
147	2.7948	0.0084
148	2.8032	0.0084
149	2.8115	0.0083
150	2.8198	0.0083
151	2.8281	0.0083
152	2.8363	0.0082
153	2.8445	0.0082
154	2.8527	0.0082
155	2.8609	0.0082
156	2.8690	0.0081
157	2.8771	0.0081
158	2.8852	0.0081
159	2.8932	0.0080
160	2.9012	0.0080
161	2.9092	0.0080
162	2.9172	0.0080
163	2.9251	0.0079
164	2.9330	0.0079
165	2.9409	0.0079

166	2.9487	0.0078
167	2.9566	0.0078
168	2.9644	0.0078
169	2.9721	0.0078
170	2.9799	0.0077
171	2.9876	0.0077
172	2.9953	0.0077
173	3.0029	0.0077
174	3.0106	0.0076
175	3.0182	0.0076
176	3.0258	0.0076
177	3.0334	0.0076
178	3.0409	0.0075
179	3.0485	0.0075
180	3.0560	0.0075
181	3.0634	0.0075
182	3.0709	0.0075
183	3.0783	0.0074
184	3.0857	0.0074
185	3.0931	0.0074
186	3.1005	0.0074
187	3.1078	0.0073
188	3.1151	0.0073
189	3.1224	0.0073
190	3.1297	0.0073
191	3.1370	0.0073
192	3.1442	0.0072
193	3.1514	0.0072
194	3.1586	0.0072
195	3.1658	0.0072
196	3.1729	0.0072
197	3.1801	0.0071
198	3.1872	0.0071
199	3.1943	0.0071
200	3.2013	0.0071
201	3.2084	0.0071
202	3.2154	0.0070
203	3.2224	0.0070
204	3.2294	0.0070
205	3.2364	0.0070
206	3.2433	0.0070
207	3.2503	0.0069
208	3.2572	0.0069
209	3.2641	0.0069
210	3.2710	0.0069
211	3.2778	0.0069
212	3.2847	0.0068
213	3.2915	0.0068
214	3.2983	0.0068
215	3.3051	0.0068
216	3.3119	0.0068
217	3.3186	0.0068
218	3.3254	0.0067
219	3.3321	0.0067
220	3.3388	0.0067
221	3.3455	0.0067
222	3.3521	0.0067

223	3.3588	0.0067
224	3.3654	0.0066
225	3.3720	0.0066
226	3.3786	0.0066
227	3.3852	0.0066
228	3.3918	0.0066
229	3.3984	0.0066
230	3.4049	0.0065
231	3.4114	0.0065
232	3.4179	0.0065
233	3.4244	0.0065
234	3.4309	0.0065
235	3.4373	0.0065
236	3.4438	0.0064
237	3.4502	0.0064
238	3.4566	0.0064
239	3.4630	0.0064
240	3.4694	0.0064
241	3.4758	0.0064
242	3.4821	0.0064
243	3.4885	0.0063
244	3.4948	0.0063
245	3.5011	0.0063
246	3.5074	0.0063
247	3.5137	0.0063
248	3.5200	0.0063
249	3.5262	0.0063
250	3.5325	0.0062
251	3.5387	0.0062
252	3.5449	0.0062
253	3.5511	0.0062
254	3.5573	0.0062
255	3.5634	0.0062
256	3.5696	0.0062
257	3.5757	0.0061
258	3.5819	0.0061
259	3.5880	0.0061
260	3.5941	0.0061
261	3.6002	0.0061
262	3.6063	0.0061
263	3.6123	0.0061
264	3.6184	0.0061
265	3.6244	0.0060
266	3.6304	0.0060
267	3.6365	0.0060
268	3.6425	0.0060
269	3.6485	0.0060
270	3.6544	0.0060
271	3.6604	0.0060
272	3.6663	0.0060
273	3.6723	0.0059
274	3.6782	0.0059
275	3.6841	0.0059
276	3.6900	0.0059
277	3.6959	0.0059
278	3.7018	0.0059
279	3.7077	0.0059

280	3.7135	0.0059
281	3.7194	0.0058
282	3.7252	0.0058
283	3.7310	0.0058
284	3.7368	0.0058
285	3.7426	0.0058
286	3.7484	0.0058
287	3.7542	0.0058
288	3.7600	0.0058

Unit Period (number)	Unit Rainfall (In)	Unit Soil-Loss (In)	Effective Rainfall (In)
1	0.0058	0.0047	0.0011
2	0.0058	0.0047	0.0011
3	0.0058	0.0047	0.0011
4	0.0058	0.0047	0.0011
5	0.0058	0.0047	0.0011
6	0.0058	0.0047	0.0011
7	0.0059	0.0048	0.0011
8	0.0059	0.0048	0.0011
9	0.0059	0.0048	0.0011
10	0.0059	0.0048	0.0011
11	0.0059	0.0048	0.0011
12	0.0060	0.0048	0.0011
13	0.0060	0.0049	0.0011
14	0.0060	0.0049	0.0011
15	0.0060	0.0049	0.0011
16	0.0060	0.0049	0.0011
17	0.0061	0.0049	0.0011
18	0.0061	0.0049	0.0011
19	0.0061	0.0049	0.0011
20	0.0061	0.0050	0.0011
21	0.0061	0.0050	0.0011
22	0.0061	0.0050	0.0012
23	0.0062	0.0050	0.0012
24	0.0062	0.0050	0.0012
25	0.0062	0.0050	0.0012
26	0.0062	0.0051	0.0012
27	0.0063	0.0051	0.0012
28	0.0063	0.0051	0.0012
29	0.0063	0.0051	0.0012
30	0.0063	0.0051	0.0012
31	0.0063	0.0052	0.0012
32	0.0064	0.0052	0.0012
33	0.0064	0.0052	0.0012
34	0.0064	0.0052	0.0012
35	0.0064	0.0052	0.0012
36	0.0064	0.0052	0.0012
37	0.0065	0.0053	0.0012
38	0.0065	0.0053	0.0012
39	0.0065	0.0053	0.0012
40	0.0065	0.0053	0.0012
41	0.0066	0.0053	0.0012
42	0.0066	0.0054	0.0012
43	0.0066	0.0054	0.0012

44	0.0066	0.0054	0.0012
45	0.0067	0.0054	0.0013
46	0.0067	0.0054	0.0013
47	0.0067	0.0055	0.0013
48	0.0067	0.0055	0.0013
49	0.0068	0.0055	0.0013
50	0.0068	0.0055	0.0013
51	0.0068	0.0055	0.0013
52	0.0068	0.0056	0.0013
53	0.0069	0.0056	0.0013
54	0.0069	0.0056	0.0013
55	0.0069	0.0056	0.0013
56	0.0070	0.0057	0.0013
57	0.0070	0.0057	0.0013
58	0.0070	0.0057	0.0013
59	0.0071	0.0057	0.0013
60	0.0071	0.0057	0.0013
61	0.0071	0.0058	0.0013
62	0.0071	0.0058	0.0013
63	0.0072	0.0058	0.0013
64	0.0072	0.0058	0.0013
65	0.0072	0.0059	0.0014
66	0.0073	0.0059	0.0014
67	0.0073	0.0059	0.0014
68	0.0073	0.0059	0.0014
69	0.0074	0.0060	0.0014
70	0.0074	0.0060	0.0014
71	0.0074	0.0060	0.0014
72	0.0075	0.0061	0.0014
73	0.0075	0.0061	0.0014
74	0.0075	0.0061	0.0014
75	0.0076	0.0062	0.0014
76	0.0076	0.0062	0.0014
77	0.0076	0.0062	0.0014
78	0.0077	0.0062	0.0014
79	0.0077	0.0063	0.0014
80	0.0077	0.0063	0.0015
81	0.0078	0.0063	0.0015
82	0.0078	0.0064	0.0015
83	0.0079	0.0064	0.0015
84	0.0079	0.0064	0.0015
85	0.0080	0.0065	0.0015
86	0.0080	0.0065	0.0015
87	0.0080	0.0065	0.0015
88	0.0081	0.0066	0.0015
89	0.0081	0.0066	0.0015
90	0.0082	0.0066	0.0015
91	0.0082	0.0067	0.0015
92	0.0082	0.0067	0.0015
93	0.0083	0.0067	0.0016
94	0.0083	0.0068	0.0016
95	0.0084	0.0068	0.0016
96	0.0084	0.0069	0.0016
97	0.0085	0.0069	0.0016
98	0.0085	0.0069	0.0016
99	0.0086	0.0070	0.0016
100	0.0086	0.0070	0.0016

101	0.0087	0.0071	0.0016
102	0.0087	0.0071	0.0016
103	0.0088	0.0072	0.0017
104	0.0089	0.0072	0.0017
105	0.0089	0.0073	0.0017
106	0.0090	0.0073	0.0017
107	0.0090	0.0073	0.0017
108	0.0091	0.0074	0.0017
109	0.0092	0.0074	0.0017
110	0.0092	0.0075	0.0017
111	0.0093	0.0075	0.0017
112	0.0093	0.0076	0.0017
113	0.0094	0.0076	0.0018
114	0.0095	0.0077	0.0018
115	0.0096	0.0078	0.0018
116	0.0096	0.0078	0.0018
117	0.0097	0.0079	0.0018
118	0.0097	0.0079	0.0018
119	0.0098	0.0080	0.0018
120	0.0099	0.0080	0.0019
121	0.0100	0.0081	0.0019
122	0.0100	0.0082	0.0019
123	0.0101	0.0082	0.0019
124	0.0102	0.0083	0.0019
125	0.0103	0.0084	0.0019
126	0.0104	0.0084	0.0019
127	0.0105	0.0085	0.0020
128	0.0105	0.0086	0.0020
129	0.0107	0.0087	0.0020
130	0.0107	0.0087	0.0020
131	0.0109	0.0088	0.0020
132	0.0109	0.0089	0.0020
133	0.0111	0.0090	0.0021
134	0.0111	0.0090	0.0021
135	0.0113	0.0092	0.0021
136	0.0114	0.0092	0.0021
137	0.0115	0.0093	0.0022
138	0.0116	0.0094	0.0022
139	0.0117	0.0095	0.0022
140	0.0118	0.0096	0.0022
141	0.0120	0.0097	0.0022
142	0.0121	0.0098	0.0023
143	0.0123	0.0100	0.0023
144	0.0124	0.0100	0.0023
145	0.0145	0.0118	0.0027
146	0.0146	0.0118	0.0027
147	0.0148	0.0120	0.0028
148	0.0149	0.0121	0.0028
149	0.0151	0.0123	0.0028
150	0.0152	0.0124	0.0029
151	0.0155	0.0126	0.0029
152	0.0156	0.0127	0.0029
153	0.0158	0.0129	0.0030
154	0.0160	0.0130	0.0030
155	0.0163	0.0132	0.0030
156	0.0164	0.0133	0.0031
157	0.0167	0.0136	0.0031

158	0.0169	0.0137	0.0032
159	0.0172	0.0140	0.0032
160	0.0173	0.0141	0.0033
161	0.0177	0.0144	0.0033
162	0.0179	0.0145	0.0034
163	0.0183	0.0148	0.0034
164	0.0185	0.0150	0.0035
165	0.0189	0.0154	0.0035
166	0.0191	0.0156	0.0036
167	0.0196	0.0159	0.0037
168	0.0199	0.0161	0.0037
169	0.0204	0.0166	0.0038
170	0.0207	0.0168	0.0039
171	0.0213	0.0173	0.0040
172	0.0217	0.0176	0.0041
173	0.0224	0.0182	0.0042
174	0.0228	0.0185	0.0043
175	0.0236	0.0192	0.0044
176	0.0240	0.0195	0.0045
177	0.0250	0.0203	0.0047
178	0.0256	0.0208	0.0048
179	0.0267	0.0217	0.0050
180	0.0274	0.0223	0.0051
181	0.0289	0.0235	0.0054
182	0.0297	0.0242	0.0056
183	0.0317	0.0258	0.0059
184	0.0328	0.0267	0.0062
185	0.0280	0.0228	0.0053
186	0.0296	0.0240	0.0055
187	0.0336	0.0273	0.0063
188	0.0362	0.0294	0.0068
189	0.0436	0.0355	0.0082
190	0.0493	0.0400	0.0092
191	0.0704	0.0572	0.0132
192	0.0968	0.0652	0.0316
193	0.3030	0.0652	0.2378
194	0.0573	0.0466	0.0108
195	0.0395	0.0321	0.0074
196	0.0314	0.0255	0.0059
197	0.0341	0.0277	0.0064
198	0.0307	0.0249	0.0058
199	0.0281	0.0229	0.0053
200	0.0261	0.0212	0.0049
201	0.0245	0.0199	0.0046
202	0.0232	0.0188	0.0043
203	0.0220	0.0179	0.0041
204	0.0210	0.0171	0.0039
205	0.0201	0.0164	0.0038
206	0.0194	0.0157	0.0036
207	0.0187	0.0152	0.0035
208	0.0181	0.0147	0.0034
209	0.0175	0.0142	0.0033
210	0.0170	0.0138	0.0032
211	0.0165	0.0134	0.0031
212	0.0161	0.0131	0.0030
213	0.0157	0.0128	0.0029
214	0.0153	0.0125	0.0029

215	0.0150	0.0122	0.0028
216	0.0147	0.0119	0.0028
217	0.0124	0.0101	0.0023
218	0.0122	0.0099	0.0023
219	0.0119	0.0097	0.0022
220	0.0117	0.0095	0.0022
221	0.0114	0.0093	0.0021
222	0.0112	0.0091	0.0021
223	0.0110	0.0089	0.0021
224	0.0108	0.0088	0.0020
225	0.0106	0.0086	0.0020
226	0.0104	0.0085	0.0020
227	0.0103	0.0083	0.0019
228	0.0101	0.0082	0.0019
229	0.0099	0.0081	0.0019
230	0.0098	0.0080	0.0018
231	0.0096	0.0078	0.0018
232	0.0095	0.0077	0.0018
233	0.0094	0.0076	0.0018
234	0.0092	0.0075	0.0017
235	0.0091	0.0074	0.0017
236	0.0090	0.0073	0.0017
237	0.0089	0.0072	0.0017
238	0.0088	0.0071	0.0016
239	0.0087	0.0070	0.0016
240	0.0086	0.0070	0.0016
241	0.0085	0.0069	0.0016
242	0.0084	0.0068	0.0016
243	0.0083	0.0067	0.0016
244	0.0082	0.0067	0.0015
245	0.0081	0.0066	0.0015
246	0.0080	0.0065	0.0015
247	0.0079	0.0064	0.0015
248	0.0078	0.0064	0.0015
249	0.0078	0.0063	0.0015
250	0.0077	0.0063	0.0014
251	0.0076	0.0062	0.0014
252	0.0075	0.0061	0.0014
253	0.0075	0.0061	0.0014
254	0.0074	0.0060	0.0014
255	0.0073	0.0060	0.0014
256	0.0073	0.0059	0.0014
257	0.0072	0.0059	0.0014
258	0.0072	0.0058	0.0013
259	0.0071	0.0058	0.0013
260	0.0070	0.0057	0.0013
261	0.0070	0.0057	0.0013
262	0.0069	0.0056	0.0013
263	0.0069	0.0056	0.0013
264	0.0068	0.0055	0.0013
265	0.0068	0.0055	0.0013
266	0.0067	0.0054	0.0013
267	0.0067	0.0054	0.0012
268	0.0066	0.0054	0.0012
269	0.0066	0.0053	0.0012
270	0.0065	0.0053	0.0012
271	0.0065	0.0052	0.0012

272	0.0064	0.0052	0.0012
273	0.0064	0.0052	0.0012
274	0.0063	0.0051	0.0012
275	0.0063	0.0051	0.0012
276	0.0062	0.0051	0.0012
277	0.0062	0.0050	0.0012
278	0.0062	0.0050	0.0012
279	0.0061	0.0050	0.0011
280	0.0061	0.0049	0.0011
281	0.0060	0.0049	0.0011
282	0.0060	0.0049	0.0011
283	0.0060	0.0048	0.0011
284	0.0059	0.0048	0.0011
285	0.0059	0.0048	0.0011
286	0.0059	0.0048	0.0011
287	0.0058	0.0047	0.0011
288	0.0058	0.0047	0.0011

Total soil rain loss = 2.86(In)
Total effective rainfall = 0.90(In)
Peak flow rate in flood hydrograph = 9.49(CFS)

++

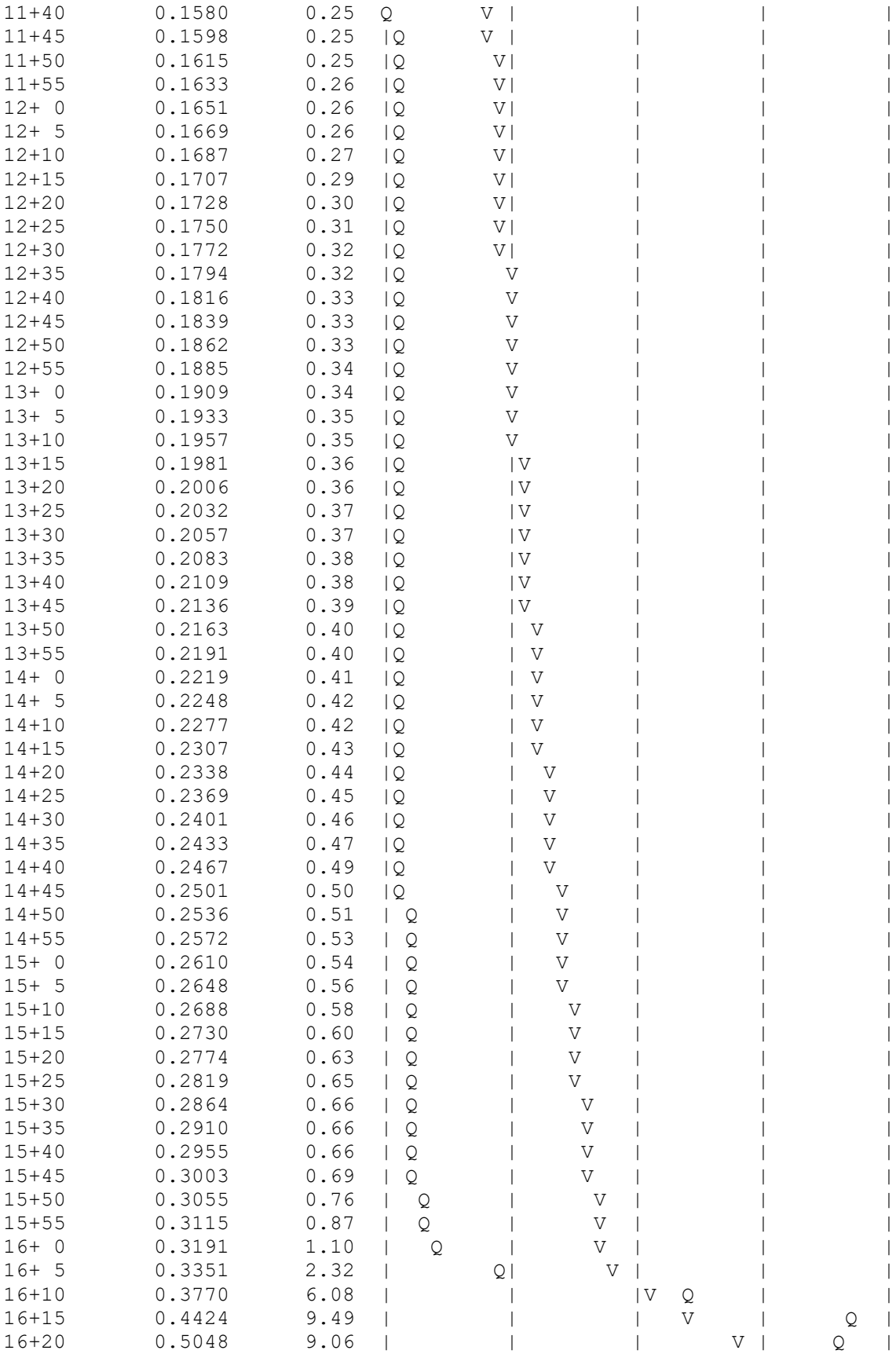
24 - H O U R S T O R M
R u n o f f H y d r o g r a p h

Hydrograph in 5 Minute intervals ((CFS))

Time(h+m)	Volume Ac.Ft	Q(CFS)	0	2.5	5.0	7.5	10.0
0+ 5	0.0000	0.00	Q				
0+10	0.0002	0.02	Q				
0+15	0.0006	0.06	Q				
0+20	0.0013	0.10	Q				
0+25	0.0020	0.11	Q				
0+30	0.0029	0.12	Q				
0+35	0.0037	0.12	Q				
0+40	0.0046	0.13	Q				
0+45	0.0055	0.13	Q				
0+50	0.0063	0.13	Q				
0+55	0.0072	0.13	Q				
1+ 0	0.0081	0.13	Q				
1+ 5	0.0090	0.13	Q				
1+10	0.0098	0.13	Q				
1+15	0.0107	0.13	Q				
1+20	0.0116	0.13	Q				
1+25	0.0125	0.13	Q				
1+30	0.0134	0.13	Q				
1+35	0.0143	0.13	Q				
1+40	0.0152	0.13	Q				
1+45	0.0161	0.13	Q				
1+50	0.0170	0.13	Q				
1+55	0.0179	0.13	QV				
2+ 0	0.0188	0.13	QV				
2+ 5	0.0197	0.13	QV				

2+10	0.0206	0.13	QV	|	|	|	|
2+15	0.0216	0.13	QV	|	|	|	|
2+20	0.0225	0.13	QV	|	|	|	|
2+25	0.0234	0.13	QV	|	|	|	|
2+30	0.0243	0.13	QV	|	|	|	|
2+35	0.0253	0.14	QV	|	|	|	|
2+40	0.0262	0.14	QV	|	|	|	|
2+45	0.0271	0.14	QV	|	|	|	|
2+50	0.0281	0.14	QV	|	|	|	|
2+55	0.0290	0.14	QV	|	|	|	|
3+ 0	0.0300	0.14	QV	|	|	|	|
3+ 5	0.0309	0.14	QV	|	|	|	|
3+10	0.0319	0.14	QV	|	|	|	|
3+15	0.0328	0.14	QV	|	|	|	|
3+20	0.0338	0.14	QV	|	|	|	|
3+25	0.0348	0.14	QV	|	|	|	|
3+30	0.0357	0.14	Q V	|	|	|	|
3+35	0.0367	0.14	Q V	|	|	|	|
3+40	0.0377	0.14	Q V	|	|	|	|
3+45	0.0387	0.14	Q V	|	|	|	|
3+50	0.0397	0.14	Q V	|	|	|	|
3+55	0.0406	0.14	Q V	|	|	|	|
4+ 0	0.0416	0.14	Q V	|	|	|	|
4+ 5	0.0426	0.14	Q V	|	|	|	|
4+10	0.0436	0.14	Q V	|	|	|	|
4+15	0.0446	0.15	Q V	|	|	|	|
4+20	0.0456	0.15	Q V	|	|	|	|
4+25	0.0466	0.15	Q V	|	|	|	|
4+30	0.0477	0.15	Q V	|	|	|	|
4+35	0.0487	0.15	Q V	|	|	|	|
4+40	0.0497	0.15	Q V	|	|	|	|
4+45	0.0507	0.15	Q V	|	|	|	|
4+50	0.0518	0.15	Q V	|	|	|	|
4+55	0.0528	0.15	Q V	|	|	|	|
5+ 0	0.0538	0.15	Q V	|	|	|	|
5+ 5	0.0549	0.15	Q V	|	|	|	|
5+10	0.0559	0.15	Q V	|	|	|	|
5+15	0.0570	0.15	Q V	|	|	|	|
5+20	0.0580	0.15	Q V	|	|	|	|
5+25	0.0591	0.15	Q V	|	|	|	|
5+30	0.0602	0.15	Q V	|	|	|	|
5+35	0.0612	0.16	Q V	|	|	|	|
5+40	0.0623	0.16	Q V	|	|	|	|
5+45	0.0634	0.16	Q V	|	|	|	|
5+50	0.0645	0.16	Q V	|	|	|	|
5+55	0.0656	0.16	Q V	|	|	|	|
6+ 0	0.0666	0.16	Q V	|	|	|	|
6+ 5	0.0677	0.16	Q V	|	|	|	|
6+10	0.0688	0.16	Q V	|	|	|	|
6+15	0.0700	0.16	Q V	|	|	|	|
6+20	0.0711	0.16	Q V	|	|	|	|
6+25	0.0722	0.16	Q V	|	|	|	|
6+30	0.0733	0.16	Q V	|	|	|	|
6+35	0.0744	0.16	Q V	|	|	|	|
6+40	0.0756	0.16	Q V	|	|	|	|
6+45	0.0767	0.17	Q V	|	|	|	|
6+50	0.0779	0.17	Q V	|	|	|	|

6+55	0.0790	0.17	Q	V				
7+ 0	0.0802	0.17	Q	V				
7+ 5	0.0813	0.17	Q	V				
7+10	0.0825	0.17	Q	V				
7+15	0.0837	0.17	Q	V				
7+20	0.0849	0.17	Q	V				
7+25	0.0861	0.17	Q	V				
7+30	0.0873	0.17	Q	V				
7+35	0.0885	0.17	Q	V				
7+40	0.0897	0.18	Q	V				
7+45	0.0909	0.18	Q	V				
7+50	0.0921	0.18	Q	V				
7+55	0.0933	0.18	Q	V				
8+ 0	0.0946	0.18	Q	V				
8+ 5	0.0958	0.18	Q	V				
8+10	0.0971	0.18	Q	V				
8+15	0.0983	0.18	Q	V				
8+20	0.0996	0.18	Q	V				
8+25	0.1008	0.18	Q	V				
8+30	0.1021	0.19	Q	V				
8+35	0.1034	0.19	Q	V				
8+40	0.1047	0.19	Q	V				
8+45	0.1060	0.19	Q	V				
8+50	0.1073	0.19	Q	V				
8+55	0.1086	0.19	Q	V				
9+ 0	0.1100	0.19	Q	V				
9+ 5	0.1113	0.19	Q	V				
9+10	0.1126	0.20	Q	V				
9+15	0.1140	0.20	Q	V				
9+20	0.1154	0.20	Q	V				
9+25	0.1167	0.20	Q	V				
9+30	0.1181	0.20	Q	V				
9+35	0.1195	0.20	Q	V				
9+40	0.1209	0.20	Q	V				
9+45	0.1223	0.20	Q	V				
9+50	0.1237	0.21	Q	V				
9+55	0.1252	0.21	Q	V				
10+ 0	0.1266	0.21	Q	V				
10+ 5	0.1280	0.21	Q	V				
10+10	0.1295	0.21	Q	V				
10+15	0.1310	0.21	Q	V				
10+20	0.1325	0.22	Q	V				
10+25	0.1340	0.22	Q	V				
10+30	0.1355	0.22	Q	V				
10+35	0.1370	0.22	Q	V				
10+40	0.1385	0.22	Q	V				
10+45	0.1401	0.22	Q	V				
10+50	0.1416	0.23	Q	V				
10+55	0.1432	0.23	Q	V				
11+ 0	0.1448	0.23	Q	V				
11+ 5	0.1464	0.23	Q	V				
11+10	0.1480	0.23	Q	V				
11+15	0.1496	0.24	Q	V				
11+20	0.1513	0.24	Q	V				
11+25	0.1529	0.24	Q	V				
11+30	0.1546	0.24	Q	V				
11+35	0.1563	0.25	Q	V				



```
16+25       0.5383      4.87  |          |         Q|          V          |
16+30       0.5554      2.48  |         Q|          |          |V         |
16+35       0.5646      1.34  |    Q     |          |          |V         |
16+40       0.5708      0.90  |  Q       |          |          | V        |
16+45       0.5759      0.74  | Q        |          |          | V        |
16+50       0.5800      0.60  | Q        |          |          | V        |
16+55       0.5839      0.56  | Q        |          |          | V        |
17+ 0       0.5875      0.52  | Q        |          |          | V        |
17+ 5       0.5909      0.50  |Q         |          |          |  V       |
17+10       0.5941      0.47  |Q         |          |          |  V       |
17+15       0.5972      0.45  |Q         |          |          |  V       |
17+20       0.6002      0.43  |Q         |          |          |  V       |
17+25       0.6031      0.41  |Q         |          |          |  V       |
17+30       0.6058      0.40  |Q         |          |          |   V      |
17+35       0.6085      0.39  |Q         |          |          |   V      |
17+40       0.6111      0.38  |Q         |          |          |   V      |
17+45       0.6136      0.36  |Q         |          |          |   V      |
17+50       0.6160      0.35  |Q         |          |          |   V      |
17+55       0.6184      0.35  |Q         |          |          |   V      |
18+ 0       0.6207      0.34  |Q         |          |          |   V      |
18+ 5       0.6230      0.33  |Q         |          |          |   V      |
18+10       0.6251      0.31  |Q         |          |          |    V     |
18+15       0.6272      0.29  |Q         |          |          |    V     |
18+20       0.6291      0.28  |Q         |          |          |    V     |
18+25       0.6309      0.26  |Q         |          |          |    V     |
18+30       0.6326      0.26  |Q         |          |          |    V     |
18+35       0.6344      0.25  |Q         |          |          |    V     |
18+40       0.6361      0.25  Q          |          |          |    V     |
18+45       0.6377      0.24  Q          |          |          |    V     |
18+50       0.6393      0.24  Q          |          |          |    V     |
18+55       0.6409      0.23  Q          |          |          |    V     |
19+ 0       0.6425      0.23  Q          |          |          |     V    |
19+ 5       0.6440      0.22  Q          |          |          |     V    |
19+10       0.6456      0.22  Q          |          |          |     V    |
19+15       0.6471      0.22  Q          |          |          |     V    |
19+20       0.6485      0.21  Q          |          |          |     V    |
19+25       0.6500      0.21  Q          |          |          |     V    |
19+30       0.6514      0.21  Q          |          |          |     V    |
19+35       0.6528      0.20  Q          |          |          |     V    |
19+40       0.6542      0.20  Q          |          |          |     V    |
19+45       0.6556      0.20  Q          |          |          |     V    |
19+50       0.6569      0.20  Q          |          |          |     V    |
19+55       0.6582      0.19  Q          |          |          |     V    |
20+ 0       0.6595      0.19  Q          |          |          |      V   |
20+ 5       0.6608      0.19  Q          |          |          |      V   |
20+10       0.6621      0.19  Q          |          |          |      V   |
20+15       0.6634      0.18  Q          |          |          |      V   |
20+20       0.6646      0.18  Q          |          |          |      V   |
20+25       0.6659      0.18  Q          |          |          |      V   |
20+30       0.6671      0.18  Q          |          |          |      V   |
20+35       0.6683      0.18  Q          |          |          |      V   |
20+40       0.6695      0.17  Q          |          |          |      V   |
20+45       0.6707      0.17  Q          |          |          |      V   |
20+50       0.6719      0.17  Q          |          |          |      V   |
20+55       0.6730      0.17  Q          |          |          |      V   |
21+ 0       0.6742      0.17  Q          |          |          |      V   |
21+ 5       0.6753      0.17  Q          |          |          |      V   |
```

21+10	0.6765	0.16	Q	|	|	|	V |
21+15	0.6776	0.16	Q	|	|	|	V |
21+20	0.6787	0.16	Q	|	|	|	V |
21+25	0.6798	0.16	Q	|	|	|	V |
21+30	0.6809	0.16	Q	|	|	|	V |
21+35	0.6819	0.16	Q	|	|	|	V |
21+40	0.6830	0.16	Q	|	|	|	V |
21+45	0.6841	0.15	Q	|	|	|	V |
21+50	0.6851	0.15	Q	|	|	|	V |
21+55	0.6862	0.15	Q	|	|	|	V |
22+ 0	0.6872	0.15	Q	|	|	|	V |
22+ 5	0.6882	0.15	Q	|	|	|	V |
22+10	0.6892	0.15	Q	|	|	|	V |
22+15	0.6902	0.15	Q	|	|	|	V |
22+20	0.6912	0.15	Q	|	|	|	V |
22+25	0.6922	0.14	Q	|	|	|	V |
22+30	0.6932	0.14	Q	|	|	|	V |
22+35	0.6942	0.14	Q	|	|	|	V |
22+40	0.6952	0.14	Q	|	|	|	V|
22+45	0.6961	0.14	Q	|	|	|	V|
22+50	0.6971	0.14	Q	|	|	|	V|
22+55	0.6980	0.14	Q	|	|	|	V|
23+ 0	0.6990	0.14	Q	|	|	|	V|
23+ 5	0.6999	0.14	Q	|	|	|	V|
23+10	0.7009	0.14	Q	|	|	|	V|
23+15	0.7018	0.13	Q	|	|	|	V|
23+20	0.7027	0.13	Q	|	|	|	V|
23+25	0.7036	0.13	Q	|	|	|	V|
23+30	0.7045	0.13	Q	|	|	|	V|
23+35	0.7054	0.13	Q	|	|	|	V|
23+40	0.7063	0.13	Q	|	|	|	V|
23+45	0.7072	0.13	Q	|	|	|	V|
23+50	0.7081	0.13	Q	|	|	|	V|
23+55	0.7090	0.13	Q	|	|	|	V|
24+ 0	0.7098	0.13	Q	|	|	|	V|
24+ 5	0.7107	0.12	Q	|	|	|	V|
24+10	0.7114	0.10	Q	|	|	|	V|
24+15	0.7118	0.07	Q	|	|	|	V|
24+20	0.7120	0.03	Q	|	|	|	V|
24+25	0.7121	0.01	Q	|	|	|	V|
24+30	0.7121	0.00	Q	|	|	|	V|
24+35	0.7122	0.00	Q	|	|	|	V|
24+40	0.7122	0.00	Q	|	|	|	V

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 05/05/21

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

Program License Serial Number 6405

BLOOMINGTON COMMERCE CENTER - SITE 4
EXISTING CONDITION
10-YEAR, 24 HOUR STORM EVENT ANALYSIS

Storm Event Year = 10

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 10		
9.56	1	0.82
Rainfall data for year 10		
9.56	6	2.04
Rainfall data for year 10		
9.56	24	3.76

++

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

SCS curve	SCS curve	Area	Area	Fp(Fig C6)	Ap	Fm

No.(AMCII)	NO.(AMC 2)	(Ac.)	Fraction	(In/Hr)	(dec.)	(In/Hr)
32.0	32.0	9.56	1.000	0.978	0.800	0.782

Area-averaged adjusted loss rate Fm (In/Hr) = 0.782

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

Area (Ac.)	Area Fract	SCS CN (AMC2)	SCS CN (AMC2)	S	Pervious Yield Fr
7.65	0.800	32.0	32.0	18.80	0.000
1.91	0.200	98.0	98.0	0.20	0.938

Area-averaged catchment yield fraction, Y = 0.188
Area-averaged low loss fraction, Yb = 0.812
User entry of time of concentration = 0.267 (hours)
++
Watershed area = 9.56(Ac.)
Catchment Lag time = 0.214 hours
Unit interval = 5.000 minutes
Unit interval percentage of lag time = 39.0137
Hydrograph baseflow = 0.00(CFS)
Average maximum watershed loss rate(Fm) = 0.782(In/Hr)
Average low loss rate fraction (Yb) = 0.812 (decimal)
VALLEY DEVELOPED S-Graph Selected
Computed peak 5-minute rainfall = 0.303(In)
Computed peak 30-minute rainfall = 0.621(In)
Specified peak 1-hour rainfall = 0.820(In)
Computed peak 3-hour rainfall = 1.434(In)
Specified peak 6-hour rainfall = 2.040(In)
Specified peak 24-hour rainfall = 3.760(In)

Rainfall depth area reduction factors:
Using a total area of 9.56(Ac.) (Ref: fig. E-4)

5-minute factor = 1.000 Adjusted rainfall = 0.303(In)
30-minute factor = 1.000 Adjusted rainfall = 0.621(In)
1-hour factor = 1.000 Adjusted rainfall = 0.820(In)
3-hour factor = 1.000 Adjusted rainfall = 1.434(In)
6-hour factor = 1.000 Adjusted rainfall = 2.040(In)
24-hour factor = 1.000 Adjusted rainfall = 3.760(In)

U n i t H y d r o g r a p h
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Interval Number	'S' Graph Mean values	Unit Hydrograph ((CFS))
(K = 115.62 (CFS))		
1	2.915	3.370
2	18.659	18.203
3	47.461	33.300
4	76.210	33.238
5	90.309	16.300
6	96.233	6.849
7	98.351	2.450

8	99.067	0.827
9	100.000	0.414

Peak Unit Number	Adjusted mass rainfall (In)	Unit rainfall (In)
1	0.3034	0.3034
2	0.4003	0.0969
3	0.4708	0.0705
4	0.5282	0.0574
5	0.5775	0.0493
6	0.6212	0.0437
7	0.6607	0.0395
8	0.6969	0.0362
9	0.7305	0.0336
10	0.7620	0.0314
11	0.7916	0.0296
12	0.8196	0.0280
13	0.8537	0.0341
14	0.8865	0.0328
15	0.9182	0.0317
16	0.9489	0.0307
17	0.9786	0.0297
18	1.0075	0.0289
19	1.0356	0.0281
20	1.0630	0.0274
21	1.0898	0.0267
22	1.1159	0.0261
23	1.1414	0.0255
24	1.1664	0.0250
25	1.1909	0.0245
26	1.2149	0.0240
27	1.2385	0.0236
28	1.2616	0.0231
29	1.2844	0.0227
30	1.3067	0.0224
31	1.3287	0.0220
32	1.3503	0.0216
33	1.3717	0.0213
34	1.3927	0.0210
35	1.4134	0.0207
36	1.4338	0.0204
37	1.4539	0.0201
38	1.4738	0.0199
39	1.4934	0.0196
40	1.5127	0.0194
41	1.5318	0.0191
42	1.5507	0.0189
43	1.5694	0.0187
44	1.5879	0.0185
45	1.6061	0.0183
46	1.6242	0.0181
47	1.6421	0.0179
48	1.6597	0.0177
49	1.6772	0.0175
50	1.6946	0.0173
51	1.7117	0.0172
52	1.7287	0.0170

53	1.7455	0.0168
54	1.7622	0.0167
55	1.7787	0.0165
56	1.7951	0.0164
57	1.8114	0.0162
58	1.8275	0.0161
59	1.8434	0.0160
60	1.8592	0.0158
61	1.8749	0.0157
62	1.8905	0.0156
63	1.9060	0.0155
64	1.9213	0.0153
65	1.9365	0.0152
66	1.9516	0.0151
67	1.9666	0.0150
68	1.9815	0.0149
69	1.9962	0.0148
70	2.0109	0.0147
71	2.0255	0.0146
72	2.0399	0.0145
73	2.0524	0.0124
74	2.0647	0.0124
75	2.0770	0.0123
76	2.0892	0.0122
77	2.1013	0.0121
78	2.1132	0.0120
79	2.1252	0.0119
80	2.1370	0.0118
81	2.1487	0.0117
82	2.1604	0.0117
83	2.1720	0.0116
84	2.1835	0.0115
85	2.1949	0.0114
86	2.2062	0.0114
87	2.2175	0.0113
88	2.2287	0.0112
89	2.2399	0.0111
90	2.2509	0.0111
91	2.2619	0.0110
92	2.2729	0.0109
93	2.2837	0.0109
94	2.2945	0.0108
95	2.3053	0.0107
96	2.3159	0.0107
97	2.3265	0.0106
98	2.3371	0.0105
99	2.3476	0.0105
100	2.3580	0.0104
101	2.3684	0.0104
102	2.3787	0.0103
103	2.3890	0.0103
104	2.3992	0.0102
105	2.4093	0.0101
106	2.4194	0.0101
107	2.4295	0.0100
108	2.4394	0.0100
109	2.4494	0.0099

110	2.4593	0.0099
111	2.4691	0.0098
112	2.4789	0.0098
113	2.4886	0.0097
114	2.4983	0.0097
115	2.5080	0.0096
116	2.5176	0.0096
117	2.5271	0.0096
118	2.5366	0.0095
119	2.5461	0.0095
120	2.5555	0.0094
121	2.5649	0.0094
122	2.5742	0.0093
123	2.5835	0.0093
124	2.5927	0.0092
125	2.6019	0.0092
126	2.6111	0.0092
127	2.6202	0.0091
128	2.6293	0.0091
129	2.6383	0.0090
130	2.6473	0.0090
131	2.6563	0.0090
132	2.6652	0.0089
133	2.6741	0.0089
134	2.6829	0.0089
135	2.6918	0.0088
136	2.7005	0.0088
137	2.7093	0.0087
138	2.7180	0.0087
139	2.7267	0.0087
140	2.7353	0.0086
141	2.7439	0.0086
142	2.7525	0.0086
143	2.7610	0.0085
144	2.7695	0.0085
145	2.7780	0.0085
146	2.7864	0.0084
147	2.7948	0.0084
148	2.8032	0.0084
149	2.8115	0.0083
150	2.8198	0.0083
151	2.8281	0.0083
152	2.8363	0.0082
153	2.8445	0.0082
154	2.8527	0.0082
155	2.8609	0.0082
156	2.8690	0.0081
157	2.8771	0.0081
158	2.8852	0.0081
159	2.8932	0.0080
160	2.9012	0.0080
161	2.9092	0.0080
162	2.9172	0.0080
163	2.9251	0.0079
164	2.9330	0.0079
165	2.9409	0.0079
166	2.9487	0.0078

167	2.9566	0.0078
168	2.9644	0.0078
169	2.9721	0.0078
170	2.9799	0.0077
171	2.9876	0.0077
172	2.9953	0.0077
173	3.0029	0.0077
174	3.0106	0.0076
175	3.0182	0.0076
176	3.0258	0.0076
177	3.0334	0.0076
178	3.0409	0.0075
179	3.0485	0.0075
180	3.0560	0.0075
181	3.0634	0.0075
182	3.0709	0.0075
183	3.0783	0.0074
184	3.0857	0.0074
185	3.0931	0.0074
186	3.1005	0.0074
187	3.1078	0.0073
188	3.1151	0.0073
189	3.1224	0.0073
190	3.1297	0.0073
191	3.1370	0.0073
192	3.1442	0.0072
193	3.1514	0.0072
194	3.1586	0.0072
195	3.1658	0.0072
196	3.1729	0.0072
197	3.1801	0.0071
198	3.1872	0.0071
199	3.1943	0.0071
200	3.2013	0.0071
201	3.2084	0.0071
202	3.2154	0.0070
203	3.2224	0.0070
204	3.2294	0.0070
205	3.2364	0.0070
206	3.2433	0.0070
207	3.2503	0.0069
208	3.2572	0.0069
209	3.2641	0.0069
210	3.2710	0.0069
211	3.2778	0.0069
212	3.2847	0.0068
213	3.2915	0.0068
214	3.2983	0.0068
215	3.3051	0.0068
216	3.3119	0.0068
217	3.3186	0.0068
218	3.3254	0.0067
219	3.3321	0.0067
220	3.3388	0.0067
221	3.3455	0.0067
222	3.3521	0.0067
223	3.3588	0.0067

224	3.3654	0.0066
225	3.3720	0.0066
226	3.3786	0.0066
227	3.3852	0.0066
228	3.3918	0.0066
229	3.3984	0.0066
230	3.4049	0.0065
231	3.4114	0.0065
232	3.4179	0.0065
233	3.4244	0.0065
234	3.4309	0.0065
235	3.4373	0.0065
236	3.4438	0.0064
237	3.4502	0.0064
238	3.4566	0.0064
239	3.4630	0.0064
240	3.4694	0.0064
241	3.4758	0.0064
242	3.4821	0.0064
243	3.4885	0.0063
244	3.4948	0.0063
245	3.5011	0.0063
246	3.5074	0.0063
247	3.5137	0.0063
248	3.5200	0.0063
249	3.5262	0.0063
250	3.5325	0.0062
251	3.5387	0.0062
252	3.5449	0.0062
253	3.5511	0.0062
254	3.5573	0.0062
255	3.5634	0.0062
256	3.5696	0.0062
257	3.5757	0.0061
258	3.5819	0.0061
259	3.5880	0.0061
260	3.5941	0.0061
261	3.6002	0.0061
262	3.6063	0.0061
263	3.6123	0.0061
264	3.6184	0.0061
265	3.6244	0.0060
266	3.6304	0.0060
267	3.6365	0.0060
268	3.6425	0.0060
269	3.6485	0.0060
270	3.6544	0.0060
271	3.6604	0.0060
272	3.6663	0.0060
273	3.6723	0.0059
274	3.6782	0.0059
275	3.6841	0.0059
276	3.6900	0.0059
277	3.6959	0.0059
278	3.7018	0.0059
279	3.7077	0.0059
280	3.7135	0.0059

281	3.7194	0.0058
282	3.7252	0.0058
283	3.7310	0.0058
284	3.7368	0.0058
285	3.7426	0.0058
286	3.7484	0.0058
287	3.7542	0.0058
288	3.7600	0.0058

Unit Period (number)	Unit Rainfall (In)	Unit Soil-Loss (In)	Effective Rainfall (In)
1	0.0058	0.0047	0.0011
2	0.0058	0.0047	0.0011
3	0.0058	0.0047	0.0011
4	0.0058	0.0047	0.0011
5	0.0058	0.0047	0.0011
6	0.0058	0.0047	0.0011
7	0.0059	0.0048	0.0011
8	0.0059	0.0048	0.0011
9	0.0059	0.0048	0.0011
10	0.0059	0.0048	0.0011
11	0.0059	0.0048	0.0011
12	0.0060	0.0048	0.0011
13	0.0060	0.0049	0.0011
14	0.0060	0.0049	0.0011
15	0.0060	0.0049	0.0011
16	0.0060	0.0049	0.0011
17	0.0061	0.0049	0.0011
18	0.0061	0.0049	0.0011
19	0.0061	0.0049	0.0011
20	0.0061	0.0050	0.0011
21	0.0061	0.0050	0.0011
22	0.0061	0.0050	0.0012
23	0.0062	0.0050	0.0012
24	0.0062	0.0050	0.0012
25	0.0062	0.0050	0.0012
26	0.0062	0.0051	0.0012
27	0.0063	0.0051	0.0012
28	0.0063	0.0051	0.0012
29	0.0063	0.0051	0.0012
30	0.0063	0.0051	0.0012
31	0.0063	0.0052	0.0012
32	0.0064	0.0052	0.0012
33	0.0064	0.0052	0.0012
34	0.0064	0.0052	0.0012
35	0.0064	0.0052	0.0012
36	0.0064	0.0052	0.0012
37	0.0065	0.0053	0.0012
38	0.0065	0.0053	0.0012
39	0.0065	0.0053	0.0012
40	0.0065	0.0053	0.0012
41	0.0066	0.0053	0.0012
42	0.0066	0.0054	0.0012
43	0.0066	0.0054	0.0012
44	0.0066	0.0054	0.0012

45	0.0067	0.0054	0.0013
46	0.0067	0.0054	0.0013
47	0.0067	0.0055	0.0013
48	0.0067	0.0055	0.0013
49	0.0068	0.0055	0.0013
50	0.0068	0.0055	0.0013
51	0.0068	0.0055	0.0013
52	0.0068	0.0056	0.0013
53	0.0069	0.0056	0.0013
54	0.0069	0.0056	0.0013
55	0.0069	0.0056	0.0013
56	0.0070	0.0057	0.0013
57	0.0070	0.0057	0.0013
58	0.0070	0.0057	0.0013
59	0.0071	0.0057	0.0013
60	0.0071	0.0057	0.0013
61	0.0071	0.0058	0.0013
62	0.0071	0.0058	0.0013
63	0.0072	0.0058	0.0013
64	0.0072	0.0058	0.0013
65	0.0072	0.0059	0.0014
66	0.0073	0.0059	0.0014
67	0.0073	0.0059	0.0014
68	0.0073	0.0059	0.0014
69	0.0074	0.0060	0.0014
70	0.0074	0.0060	0.0014
71	0.0074	0.0060	0.0014
72	0.0075	0.0061	0.0014
73	0.0075	0.0061	0.0014
74	0.0075	0.0061	0.0014
75	0.0076	0.0062	0.0014
76	0.0076	0.0062	0.0014
77	0.0076	0.0062	0.0014
78	0.0077	0.0062	0.0014
79	0.0077	0.0063	0.0014
80	0.0077	0.0063	0.0015
81	0.0078	0.0063	0.0015
82	0.0078	0.0064	0.0015
83	0.0079	0.0064	0.0015
84	0.0079	0.0064	0.0015
85	0.0080	0.0065	0.0015
86	0.0080	0.0065	0.0015
87	0.0080	0.0065	0.0015
88	0.0081	0.0066	0.0015
89	0.0081	0.0066	0.0015
90	0.0082	0.0066	0.0015
91	0.0082	0.0067	0.0015
92	0.0082	0.0067	0.0015
93	0.0083	0.0067	0.0016
94	0.0083	0.0068	0.0016
95	0.0084	0.0068	0.0016
96	0.0084	0.0069	0.0016
97	0.0085	0.0069	0.0016
98	0.0085	0.0069	0.0016
99	0.0086	0.0070	0.0016
100	0.0086	0.0070	0.0016
101	0.0087	0.0071	0.0016

102	0.0087	0.0071	0.0016
103	0.0088	0.0072	0.0017
104	0.0089	0.0072	0.0017
105	0.0089	0.0073	0.0017
106	0.0090	0.0073	0.0017
107	0.0090	0.0073	0.0017
108	0.0091	0.0074	0.0017
109	0.0092	0.0074	0.0017
110	0.0092	0.0075	0.0017
111	0.0093	0.0075	0.0017
112	0.0093	0.0076	0.0017
113	0.0094	0.0076	0.0018
114	0.0095	0.0077	0.0018
115	0.0096	0.0078	0.0018
116	0.0096	0.0078	0.0018
117	0.0097	0.0079	0.0018
118	0.0097	0.0079	0.0018
119	0.0098	0.0080	0.0018
120	0.0099	0.0080	0.0019
121	0.0100	0.0081	0.0019
122	0.0100	0.0082	0.0019
123	0.0101	0.0082	0.0019
124	0.0102	0.0083	0.0019
125	0.0103	0.0084	0.0019
126	0.0104	0.0084	0.0019
127	0.0105	0.0085	0.0020
128	0.0105	0.0086	0.0020
129	0.0107	0.0087	0.0020
130	0.0107	0.0087	0.0020
131	0.0109	0.0088	0.0020
132	0.0109	0.0089	0.0020
133	0.0111	0.0090	0.0021
134	0.0111	0.0090	0.0021
135	0.0113	0.0092	0.0021
136	0.0114	0.0092	0.0021
137	0.0115	0.0093	0.0022
138	0.0116	0.0094	0.0022
139	0.0117	0.0095	0.0022
140	0.0118	0.0096	0.0022
141	0.0120	0.0097	0.0022
142	0.0121	0.0098	0.0023
143	0.0123	0.0100	0.0023
144	0.0124	0.0100	0.0023
145	0.0145	0.0118	0.0027
146	0.0146	0.0118	0.0027
147	0.0148	0.0120	0.0028
148	0.0149	0.0121	0.0028
149	0.0151	0.0123	0.0028
150	0.0152	0.0124	0.0029
151	0.0155	0.0126	0.0029
152	0.0156	0.0127	0.0029
153	0.0158	0.0129	0.0030
154	0.0160	0.0130	0.0030
155	0.0162	0.0132	0.0030
156	0.0164	0.0133	0.0031
157	0.0167	0.0135	0.0031
158	0.0168	0.0137	0.0032

159	0.0172	0.0139	0.0032
160	0.0173	0.0141	0.0032
161	0.0177	0.0144	0.0033
162	0.0179	0.0145	0.0034
163	0.0183	0.0148	0.0034
164	0.0185	0.0150	0.0035
165	0.0189	0.0154	0.0035
166	0.0191	0.0155	0.0036
167	0.0196	0.0159	0.0037
168	0.0199	0.0161	0.0037
169	0.0204	0.0166	0.0038
170	0.0207	0.0168	0.0039
171	0.0213	0.0173	0.0040
172	0.0216	0.0176	0.0041
173	0.0224	0.0182	0.0042
174	0.0227	0.0185	0.0043
175	0.0236	0.0191	0.0044
176	0.0240	0.0195	0.0045
177	0.0250	0.0203	0.0047
178	0.0255	0.0207	0.0048
179	0.0267	0.0217	0.0050
180	0.0274	0.0223	0.0051
181	0.0289	0.0235	0.0054
182	0.0297	0.0242	0.0056
183	0.0317	0.0257	0.0059
184	0.0328	0.0267	0.0062
185	0.0280	0.0228	0.0053
186	0.0296	0.0241	0.0056
187	0.0336	0.0273	0.0063
188	0.0362	0.0294	0.0068
189	0.0437	0.0355	0.0082
190	0.0493	0.0401	0.0092
191	0.0705	0.0573	0.0132
192	0.0969	0.0652	0.0317
193	0.3034	0.0652	0.2382
194	0.0574	0.0466	0.0108
195	0.0395	0.0321	0.0074
196	0.0314	0.0255	0.0059
197	0.0341	0.0277	0.0064
198	0.0307	0.0249	0.0058
199	0.0281	0.0228	0.0053
200	0.0261	0.0212	0.0049
201	0.0245	0.0199	0.0046
202	0.0231	0.0188	0.0043
203	0.0220	0.0179	0.0041
204	0.0210	0.0171	0.0039
205	0.0201	0.0163	0.0038
206	0.0194	0.0157	0.0036
207	0.0187	0.0152	0.0035
208	0.0181	0.0147	0.0034
209	0.0175	0.0142	0.0033
210	0.0170	0.0138	0.0032
211	0.0165	0.0134	0.0031
212	0.0161	0.0131	0.0030
213	0.0157	0.0128	0.0029
214	0.0153	0.0125	0.0029
215	0.0150	0.0122	0.0028

216	0.0147	0.0119	0.0028
217	0.0124	0.0101	0.0023
218	0.0122	0.0099	0.0023
219	0.0119	0.0097	0.0022
220	0.0117	0.0095	0.0022
221	0.0114	0.0093	0.0021
222	0.0112	0.0091	0.0021
223	0.0110	0.0089	0.0021
224	0.0108	0.0088	0.0020
225	0.0106	0.0086	0.0020
226	0.0104	0.0085	0.0020
227	0.0103	0.0083	0.0019
228	0.0101	0.0082	0.0019
229	0.0099	0.0081	0.0019
230	0.0098	0.0080	0.0018
231	0.0096	0.0078	0.0018
232	0.0095	0.0077	0.0018
233	0.0094	0.0076	0.0018
234	0.0092	0.0075	0.0017
235	0.0091	0.0074	0.0017
236	0.0090	0.0073	0.0017
237	0.0089	0.0072	0.0017
238	0.0088	0.0071	0.0016
239	0.0087	0.0070	0.0016
240	0.0086	0.0070	0.0016
241	0.0085	0.0069	0.0016
242	0.0084	0.0068	0.0016
243	0.0083	0.0067	0.0016
244	0.0082	0.0067	0.0015
245	0.0081	0.0066	0.0015
246	0.0080	0.0065	0.0015
247	0.0079	0.0064	0.0015
248	0.0078	0.0064	0.0015
249	0.0078	0.0063	0.0015
250	0.0077	0.0063	0.0014
251	0.0076	0.0062	0.0014
252	0.0075	0.0061	0.0014
253	0.0075	0.0061	0.0014
254	0.0074	0.0060	0.0014
255	0.0073	0.0060	0.0014
256	0.0073	0.0059	0.0014
257	0.0072	0.0059	0.0014
258	0.0072	0.0058	0.0013
259	0.0071	0.0058	0.0013
260	0.0070	0.0057	0.0013
261	0.0070	0.0057	0.0013
262	0.0069	0.0056	0.0013
263	0.0069	0.0056	0.0013
264	0.0068	0.0055	0.0013
265	0.0068	0.0055	0.0013
266	0.0067	0.0054	0.0013
267	0.0067	0.0054	0.0012
268	0.0066	0.0054	0.0012
269	0.0066	0.0053	0.0012
270	0.0065	0.0053	0.0012
271	0.0065	0.0052	0.0012
272	0.0064	0.0052	0.0012

273	0.0064	0.0052	0.0012
274	0.0063	0.0051	0.0012
275	0.0063	0.0051	0.0012
276	0.0062	0.0051	0.0012
277	0.0062	0.0050	0.0012
278	0.0062	0.0050	0.0012
279	0.0061	0.0050	0.0011
280	0.0061	0.0049	0.0011
281	0.0060	0.0049	0.0011
282	0.0060	0.0049	0.0011
283	0.0060	0.0048	0.0011
284	0.0059	0.0048	0.0011
285	0.0059	0.0048	0.0011
286	0.0059	0.0048	0.0011
287	0.0058	0.0047	0.0011
288	0.0058	0.0047	0.0011

Total soil rain loss = 2.86(In)
Total effective rainfall = 0.90(In)
Peak flow rate in flood hydrograph = 9.51(CFS)

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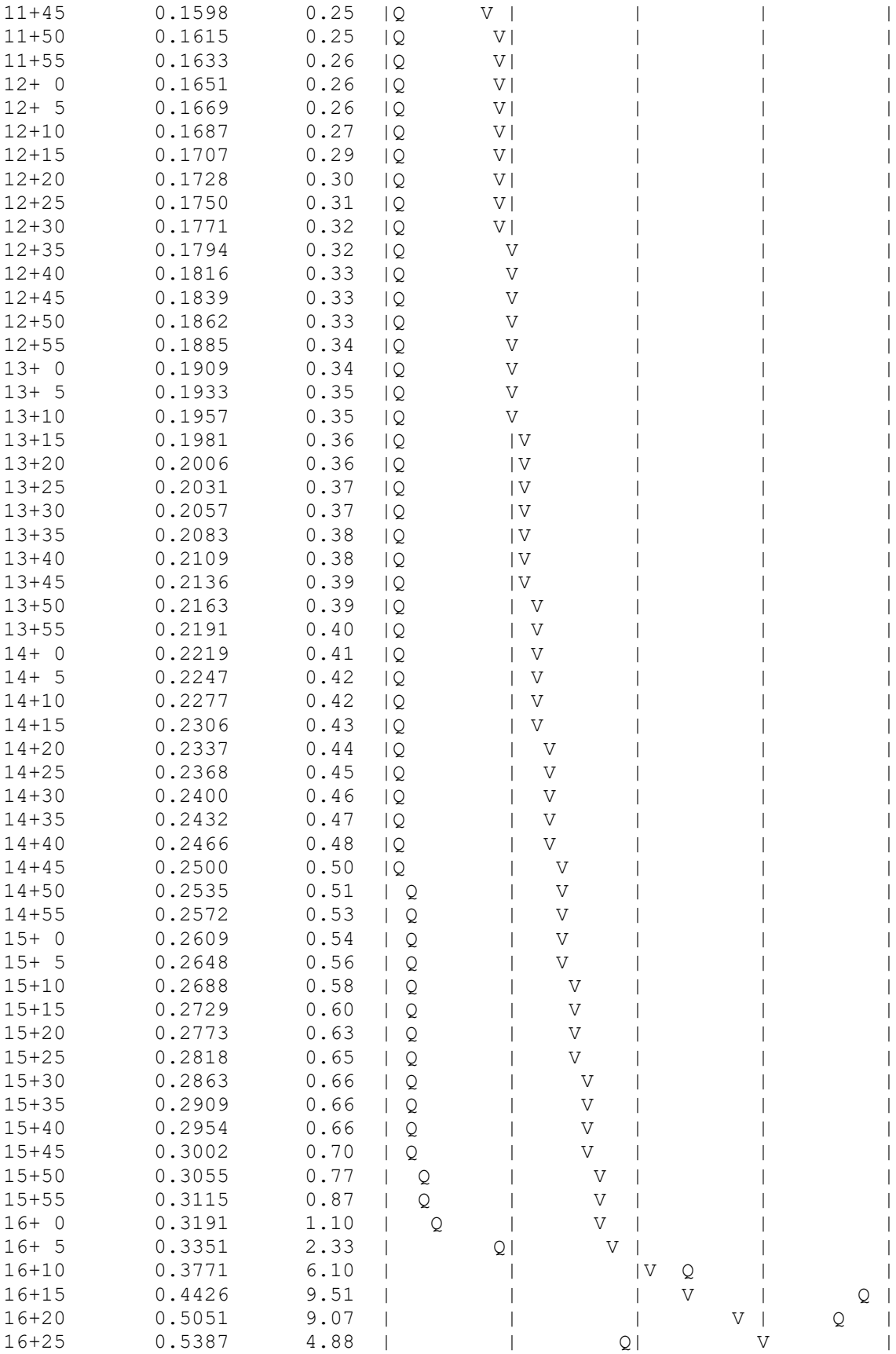
24 - H O U R S T O R M
R u n o f f H y d r o g r a p h

Hydrograph in 5 Minute intervals ((CFS))

Time(h+m)	Volume Ac.Ft	Q(CFS)	0	2.5	5.0	7.5	10.0
0+ 5	0.0000	0.00	Q				
0+10	0.0002	0.02	Q				
0+15	0.0006	0.06	Q				
0+20	0.0013	0.10	Q				
0+25	0.0020	0.11	Q				
0+30	0.0029	0.12	Q				
0+35	0.0037	0.12	Q				
0+40	0.0046	0.13	Q				
0+45	0.0055	0.13	Q				
0+50	0.0063	0.13	Q				
0+55	0.0072	0.13	Q				
1+ 0	0.0081	0.13	Q				
1+ 5	0.0090	0.13	Q				
1+10	0.0098	0.13	Q				
1+15	0.0107	0.13	Q				
1+20	0.0116	0.13	Q				
1+25	0.0125	0.13	Q				
1+30	0.0134	0.13	Q				
1+35	0.0143	0.13	Q				
1+40	0.0152	0.13	Q				
1+45	0.0161	0.13	Q				
1+50	0.0170	0.13	Q				
1+55	0.0179	0.13	QV				
2+ 0	0.0188	0.13	QV				
2+ 5	0.0197	0.13	QV				
2+10	0.0206	0.13	QV				

2+15	0.0216	0.13	QV	|	|	|	|
2+20	0.0225	0.13	QV	|	|	|	|
2+25	0.0234	0.13	QV	|	|	|	|
2+30	0.0243	0.13	QV	|	|	|	|
2+35	0.0253	0.14	QV	|	|	|	|
2+40	0.0262	0.14	QV	|	|	|	|
2+45	0.0271	0.14	QV	|	|	|	|
2+50	0.0281	0.14	QV	|	|	|	|
2+55	0.0290	0.14	QV	|	|	|	|
3+ 0	0.0300	0.14	QV	|	|	|	|
3+ 5	0.0309	0.14	QV	|	|	|	|
3+10	0.0319	0.14	QV	|	|	|	|
3+15	0.0328	0.14	QV	|	|	|	|
3+20	0.0338	0.14	QV	|	|	|	|
3+25	0.0348	0.14	QV	|	|	|	|
3+30	0.0357	0.14	Q V	|	|	|	|
3+35	0.0367	0.14	Q V	|	|	|	|
3+40	0.0377	0.14	Q V	|	|	|	|
3+45	0.0387	0.14	Q V	|	|	|	|
3+50	0.0397	0.14	Q V	|	|	|	|
3+55	0.0406	0.14	Q V	|	|	|	|
4+ 0	0.0416	0.14	Q V	|	|	|	|
4+ 5	0.0426	0.14	Q V	|	|	|	|
4+10	0.0436	0.14	Q V	|	|	|	|
4+15	0.0446	0.15	Q V	|	|	|	|
4+20	0.0456	0.15	Q V	|	|	|	|
4+25	0.0466	0.15	Q V	|	|	|	|
4+30	0.0477	0.15	Q V	|	|	|	|
4+35	0.0487	0.15	Q V	|	|	|	|
4+40	0.0497	0.15	Q V	|	|	|	|
4+45	0.0507	0.15	Q V	|	|	|	|
4+50	0.0518	0.15	Q V	|	|	|	|
4+55	0.0528	0.15	Q V	|	|	|	|
5+ 0	0.0538	0.15	Q V	|	|	|	|
5+ 5	0.0549	0.15	Q V	|	|	|	|
5+10	0.0559	0.15	Q V	|	|	|	|
5+15	0.0570	0.15	Q V	|	|	|	|
5+20	0.0580	0.15	Q V	|	|	|	|
5+25	0.0591	0.15	Q V	|	|	|	|
5+30	0.0602	0.15	Q V	|	|	|	|
5+35	0.0612	0.16	Q V	|	|	|	|
5+40	0.0623	0.16	Q V	|	|	|	|
5+45	0.0634	0.16	Q V	|	|	|	|
5+50	0.0645	0.16	Q V	|	|	|	|
5+55	0.0656	0.16	Q V	|	|	|	|
6+ 0	0.0666	0.16	Q V	|	|	|	|
6+ 5	0.0677	0.16	Q V	|	|	|	|
6+10	0.0689	0.16	Q V	|	|	|	|
6+15	0.0700	0.16	Q V	|	|	|	|
6+20	0.0711	0.16	Q V	|	|	|	|
6+25	0.0722	0.16	Q V	|	|	|	|
6+30	0.0733	0.16	Q V	|	|	|	|
6+35	0.0744	0.16	Q V	|	|	|	|
6+40	0.0756	0.16	Q V	|	|	|	|
6+45	0.0767	0.17	Q V	|	|	|	|
6+50	0.0779	0.17	Q V	|	|	|	|
6+55	0.0790	0.17	Q V	|	|	|	|

7+ 0	0.0802	0.17	Q	V				
7+ 5	0.0813	0.17	Q	V				
7+10	0.0825	0.17	Q	V				
7+15	0.0837	0.17	Q	V				
7+20	0.0849	0.17	Q	V				
7+25	0.0861	0.17	Q	V				
7+30	0.0873	0.17	Q	V				
7+35	0.0885	0.17	Q	V				
7+40	0.0897	0.18	Q	V				
7+45	0.0909	0.18	Q	V				
7+50	0.0921	0.18	Q	V				
7+55	0.0933	0.18	Q	V				
8+ 0	0.0946	0.18	Q	V				
8+ 5	0.0958	0.18	Q	V				
8+10	0.0971	0.18	Q	V				
8+15	0.0983	0.18	Q	V				
8+20	0.0996	0.18	Q	V				
8+25	0.1008	0.18	Q	V				
8+30	0.1021	0.19	Q	V				
8+35	0.1034	0.19	Q	V				
8+40	0.1047	0.19	Q	V				
8+45	0.1060	0.19	Q	V				
8+50	0.1073	0.19	Q	V				
8+55	0.1086	0.19	Q	V				
9+ 0	0.1100	0.19	Q	V				
9+ 5	0.1113	0.19	Q	V				
9+10	0.1126	0.20	Q	V				
9+15	0.1140	0.20	Q	V				
9+20	0.1154	0.20	Q	V				
9+25	0.1167	0.20	Q	V				
9+30	0.1181	0.20	Q	V				
9+35	0.1195	0.20	Q	V				
9+40	0.1209	0.20	Q	V				
9+45	0.1223	0.20	Q	V				
9+50	0.1237	0.21	Q	V				
9+55	0.1252	0.21	Q	V				
10+ 0	0.1266	0.21	Q	V				
10+ 5	0.1280	0.21	Q	V				
10+10	0.1295	0.21	Q	V				
10+15	0.1310	0.21	Q	V				
10+20	0.1325	0.22	Q	V				
10+25	0.1340	0.22	Q	V				
10+30	0.1355	0.22	Q	V				
10+35	0.1370	0.22	Q	V				
10+40	0.1385	0.22	Q	V				
10+45	0.1401	0.22	Q	V				
10+50	0.1416	0.23	Q	V				
10+55	0.1432	0.23	Q	V				
11+ 0	0.1448	0.23	Q	V				
11+ 5	0.1464	0.23	Q	V				
11+10	0.1480	0.23	Q	V				
11+15	0.1496	0.24	Q	V				
11+20	0.1513	0.24	Q	V				
11+25	0.1530	0.24	Q	V				
11+30	0.1546	0.24	Q	V				
11+35	0.1563	0.25	Q	V				
11+40	0.1580	0.25	Q	V				



16+30	0.5557	2.48	| Q|	|	|	|V |
16+35	0.5650	1.34	| Q |	|	|	|V |
16+40	0.5712	0.90	| Q |	|	|	| V |
16+45	0.5763	0.74	| Q |	|	|	| V |
16+50	0.5804	0.60	| Q |	|	|	| V |
16+55	0.5843	0.56	| Q |	|	|	| V |
17+ 0	0.5879	0.52	| Q |	|	|	| V |
17+ 5	0.5913	0.49	|Q |	|	|	| V |
17+10	0.5945	0.47	|Q |	|	|	| V |
17+15	0.5976	0.45	|Q |	|	|	| V |
17+20	0.6006	0.43	|Q |	|	|	| V |
17+25	0.6034	0.41	|Q |	|	|	| V |
17+30	0.6062	0.40	|Q |	|	|	| V |
17+35	0.6088	0.39	|Q |	|	|	| V |
17+40	0.6114	0.37	|Q |	|	|	| V |
17+45	0.6139	0.36	|Q |	|	|	| V |
17+50	0.6163	0.35	|Q |	|	|	| V |
17+55	0.6187	0.34	|Q |	|	|	| V |
18+ 0	0.6210	0.34	|Q |	|	|	| V |
18+ 5	0.6233	0.33	|Q |	|	|	| V |
18+10	0.6254	0.31	|Q |	|	|	| V |
18+15	0.6275	0.29	|Q |	|	|	| V |
18+20	0.6294	0.28	|Q |	|	|	| V |
18+25	0.6312	0.26	|Q |	|	|	| V |
18+30	0.6330	0.26	|Q |	|	|	| V |
18+35	0.6347	0.25	|Q |	|	|	| V |
18+40	0.6364	0.25	Q |	|	|	| V |
18+45	0.6380	0.24	Q |	|	|	| V |
18+50	0.6397	0.24	Q |	|	|	| V |
18+55	0.6413	0.23	Q |	|	|	| V |
19+ 0	0.6428	0.23	Q |	|	|	| V |
19+ 5	0.6444	0.22	Q |	|	|	| V |
19+10	0.6459	0.22	Q |	|	|	| V |
19+15	0.6474	0.22	Q |	|	|	| V |
19+20	0.6488	0.21	Q |	|	|	| V |
19+25	0.6503	0.21	Q |	|	|	| V |
19+30	0.6517	0.21	Q |	|	|	| V |
19+35	0.6531	0.20	Q |	|	|	| V |
19+40	0.6545	0.20	Q |	|	|	| V |
19+45	0.6559	0.20	Q |	|	|	| V |
19+50	0.6572	0.20	Q |	|	|	| V |
19+55	0.6586	0.19	Q |	|	|	| V |
20+ 0	0.6599	0.19	Q |	|	|	| V |
20+ 5	0.6612	0.19	Q |	|	|	| V |
20+10	0.6625	0.19	Q |	|	|	| V |
20+15	0.6637	0.18	Q |	|	|	| V |
20+20	0.6650	0.18	Q |	|	|	| V |
20+25	0.6662	0.18	Q |	|	|	| V |
20+30	0.6674	0.18	Q |	|	|	| V |
20+35	0.6687	0.18	Q |	|	|	| V |
20+40	0.6698	0.17	Q |	|	|	| V |
20+45	0.6710	0.17	Q |	|	|	| V |
20+50	0.6722	0.17	Q |	|	|	| V |
20+55	0.6734	0.17	Q |	|	|	| V |
21+ 0	0.6745	0.17	Q |	|	|	| V |
21+ 5	0.6757	0.17	Q |	|	|	| V |
21+10	0.6768	0.16	Q |	|	|	| V |

21+15	0.6779	0.16	Q	|	|	|	V |
21+20	0.6790	0.16	Q	|	|	|	V |
21+25	0.6801	0.16	Q	|	|	|	V |
21+30	0.6812	0.16	Q	|	|	|	V |
21+35	0.6823	0.16	Q	|	|	|	V |
21+40	0.6833	0.16	Q	|	|	|	V |
21+45	0.6844	0.15	Q	|	|	|	V |
21+50	0.6855	0.15	Q	|	|	|	V |
21+55	0.6865	0.15	Q	|	|	|	V |
22+ 0	0.6875	0.15	Q	|	|	|	V |
22+ 5	0.6885	0.15	Q	|	|	|	V |
22+10	0.6896	0.15	Q	|	|	|	V |
22+15	0.6906	0.15	Q	|	|	|	V |
22+20	0.6916	0.15	Q	|	|	|	V |
22+25	0.6926	0.14	Q	|	|	|	V |
22+30	0.6936	0.14	Q	|	|	|	V |
22+35	0.6945	0.14	Q	|	|	|	V |
22+40	0.6955	0.14	Q	|	|	|	V|
22+45	0.6965	0.14	Q	|	|	|	V|
22+50	0.6974	0.14	Q	|	|	|	V|
22+55	0.6984	0.14	Q	|	|	|	V|
23+ 0	0.6993	0.14	Q	|	|	|	V|
23+ 5	0.7003	0.14	Q	|	|	|	V|
23+10	0.7012	0.14	Q	|	|	|	V|
23+15	0.7021	0.13	Q	|	|	|	V|
23+20	0.7030	0.13	Q	|	|	|	V|
23+25	0.7039	0.13	Q	|	|	|	V|
23+30	0.7048	0.13	Q	|	|	|	V|
23+35	0.7057	0.13	Q	|	|	|	V|
23+40	0.7066	0.13	Q	|	|	|	V|
23+45	0.7075	0.13	Q	|	|	|	V|
23+50	0.7084	0.13	Q	|	|	|	V|
23+55	0.7093	0.13	Q	|	|	|	V|
24+ 0	0.7102	0.13	Q	|	|	|	V|
24+ 5	0.7110	0.12	Q	|	|	|	V|
24+10	0.7117	0.10	Q	|	|	|	V|
24+15	0.7122	0.07	Q	|	|	|	V|
24+20	0.7124	0.03	Q	|	|	|	V|
24+25	0.7124	0.01	Q	|	|	|	V|
24+30	0.7125	0.00	Q	|	|	|	V|
24+35	0.7125	0.00	Q	|	|	|	V|
24+40	0.7125	0.00	Q	|	|	|	V|

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 04/20/21

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

Program License Serial Number 6405

BLOOMINGTON COMMERCE CENTER - SITE 4
EXISITNG CONDITION
10 YEAR WITH ADJUSTED 5 YEAR STORM RAINFALL DATA

Storm Event Year = 10

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 10		
9.56	1	0.68
Rainfall data for year 10		
9.56	6	1.73
Rainfall data for year 10		
9.56	24	3.17

++

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

SCS curve	SCS curve	Area	Area	Fp(Fig C6)	Ap	Fm

No.(AMCII)	NO.(AMC 2)	(Ac.)	Fraction	(In/Hr)	(dec.)	(In/Hr)
32.0	32.0	9.56	1.000	0.978	0.800	0.782

Area-averaged adjusted loss rate Fm (In/Hr) = 0.782

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

Area (Ac.)	Area Fract	SCS CN (AMC2)	SCS CN (AMC2)	S	Pervious Yield Fr
7.65	0.800	32.0	32.0	15.85	0.000
1.91	0.200	98.0	98.0	0.20	0.927

Area-averaged catchment yield fraction, Y = 0.185
Area-averaged low loss fraction, Yb = 0.815
User entry of time of concentration = 0.273 (hours)
++
Watershed area = 9.56(Ac.)
Catchment Lag time = 0.219 hours
Unit interval = 5.000 minutes
Unit interval percentage of lag time = 38.1186
Hydrograph baseflow = 0.00(CFS)
Average maximum watershed loss rate(Fm) = 0.782(In/Hr)
Average low loss rate fraction (Yb) = 0.815 (decimal)
VALLEY DEVELOPED S-Graph Selected
Computed peak 5-minute rainfall = 0.253(In)
Computed peak 30-minute rainfall = 0.518(In)
Specified peak 1-hour rainfall = 0.684(In)
Computed peak 3-hour rainfall = 1.208(In)
Specified peak 6-hour rainfall = 1.730(In)
Specified peak 24-hour rainfall = 3.170(In)

Rainfall depth area reduction factors:
Using a total area of 9.56(Ac.) (Ref: fig. E-4)

5-minute factor = 1.000 Adjusted rainfall = 0.253(In)
30-minute factor = 1.000 Adjusted rainfall = 0.518(In)
1-hour factor = 1.000 Adjusted rainfall = 0.684(In)
3-hour factor = 1.000 Adjusted rainfall = 1.208(In)
6-hour factor = 1.000 Adjusted rainfall = 1.730(In)
24-hour factor = 1.000 Adjusted rainfall = 3.170(In)

U n i t H y d r o g r a p h
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Interval Number	'S' Graph Mean values	Unit Hydrograph ((CFS))
(K = 115.62 (CFS))		
1	2.807	3.246
2	17.839	17.379
3	45.499	31.980
4	74.580	33.622
5	89.358	17.086
6	95.740	7.379
7	98.199	2.843

8	98.946	0.864
9	99.630	0.791
10	100.000	0.428

Peak Unit Number	Adjusted mass rainfall (In)	Unit rainfall (In)
1	0.2530	0.2530
2	0.3339	0.0808
3	0.3927	0.0588
4	0.4406	0.0479
5	0.4817	0.0411
6	0.5181	0.0364
7	0.5511	0.0330
8	0.5813	0.0302
9	0.6094	0.0280
10	0.6356	0.0262
11	0.6603	0.0247
12	0.6837	0.0234
13	0.7127	0.0290
14	0.7406	0.0279
15	0.7675	0.0270
16	0.7936	0.0261
17	0.8189	0.0253
18	0.8436	0.0246
19	0.8675	0.0240
20	0.8909	0.0234
21	0.9137	0.0228
22	0.9360	0.0223
23	0.9578	0.0218
24	0.9792	0.0214
25	1.0001	0.0209
26	1.0207	0.0205
27	1.0408	0.0202
28	1.0606	0.0198
29	1.0801	0.0195
30	1.0992	0.0191
31	1.1181	0.0188
32	1.1366	0.0185
33	1.1549	0.0183
34	1.1729	0.0180
35	1.1906	0.0178
36	1.2082	0.0175
37	1.2254	0.0173
38	1.2425	0.0170
39	1.2593	0.0168
40	1.2759	0.0166
41	1.2923	0.0164
42	1.3086	0.0162
43	1.3246	0.0160
44	1.3405	0.0159
45	1.3562	0.0157
46	1.3717	0.0155
47	1.3871	0.0154
48	1.4023	0.0152
49	1.4173	0.0151
50	1.4322	0.0149
51	1.4470	0.0148

52	1.4616	0.0146
53	1.4761	0.0145
54	1.4905	0.0144
55	1.5047	0.0142
56	1.5188	0.0141
57	1.5328	0.0140
58	1.5467	0.0139
59	1.5604	0.0138
60	1.5741	0.0136
61	1.5876	0.0135
62	1.6010	0.0134
63	1.6144	0.0133
64	1.6276	0.0132
65	1.6407	0.0131
66	1.6537	0.0130
67	1.6666	0.0129
68	1.6795	0.0128
69	1.6922	0.0127
70	1.7049	0.0127
71	1.7175	0.0126
72	1.7299	0.0125
73	1.7404	0.0105
74	1.7508	0.0104
75	1.7611	0.0103
76	1.7713	0.0102
77	1.7814	0.0101
78	1.7915	0.0101
79	1.8015	0.0100
80	1.8114	0.0099
81	1.8213	0.0099
82	1.8311	0.0098
83	1.8408	0.0097
84	1.8505	0.0097
85	1.8601	0.0096
86	1.8696	0.0095
87	1.8790	0.0095
88	1.8885	0.0094
89	1.8978	0.0093
90	1.9071	0.0093
91	1.9163	0.0092
92	1.9255	0.0092
93	1.9346	0.0091
94	1.9437	0.0091
95	1.9527	0.0090
96	1.9616	0.0090
97	1.9705	0.0089
98	1.9794	0.0088
99	1.9882	0.0088
100	1.9969	0.0087
101	2.0056	0.0087
102	2.0143	0.0087
103	2.0229	0.0086
104	2.0314	0.0086
105	2.0399	0.0085
106	2.0484	0.0085
107	2.0568	0.0084
108	2.0652	0.0084

109	2.0735	0.0083
110	2.0818	0.0083
111	2.0901	0.0082
112	2.0983	0.0082
113	2.1064	0.0082
114	2.1146	0.0081
115	2.1226	0.0081
116	2.1307	0.0080
117	2.1387	0.0080
118	2.1467	0.0080
119	2.1546	0.0079
120	2.1625	0.0079
121	2.1703	0.0079
122	2.1782	0.0078
123	2.1859	0.0078
124	2.1937	0.0077
125	2.2014	0.0077
126	2.2091	0.0077
127	2.2167	0.0076
128	2.2243	0.0076
129	2.2319	0.0076
130	2.2394	0.0075
131	2.2469	0.0075
132	2.2544	0.0075
133	2.2619	0.0074
134	2.2693	0.0074
135	2.2767	0.0074
136	2.2840	0.0074
137	2.2913	0.0073
138	2.2986	0.0073
139	2.3059	0.0073
140	2.3131	0.0072
141	2.3203	0.0072
142	2.3275	0.0072
143	2.3346	0.0071
144	2.3418	0.0071
145	2.3489	0.0071
146	2.3559	0.0071
147	2.3630	0.0070
148	2.3700	0.0070
149	2.3769	0.0070
150	2.3839	0.0070
151	2.3908	0.0069
152	2.3977	0.0069
153	2.4046	0.0069
154	2.4115	0.0069
155	2.4183	0.0068
156	2.4251	0.0068
157	2.4319	0.0068
158	2.4386	0.0068
159	2.4454	0.0067
160	2.4521	0.0067
161	2.4588	0.0067
162	2.4654	0.0067
163	2.4721	0.0066
164	2.4787	0.0066
165	2.4853	0.0066

166	2.4918	0.0066
167	2.4984	0.0065
168	2.5049	0.0065
169	2.5114	0.0065
170	2.5179	0.0065
171	2.5243	0.0065
172	2.5308	0.0064
173	2.5372	0.0064
174	2.5436	0.0064
175	2.5500	0.0064
176	2.5563	0.0064
177	2.5627	0.0063
178	2.5690	0.0063
179	2.5753	0.0063
180	2.5815	0.0063
181	2.5878	0.0063
182	2.5940	0.0062
183	2.6003	0.0062
184	2.6065	0.0062
185	2.6126	0.0062
186	2.6188	0.0062
187	2.6249	0.0061
188	2.6311	0.0061
189	2.6372	0.0061
190	2.6433	0.0061
191	2.6493	0.0061
192	2.6554	0.0061
193	2.6614	0.0060
194	2.6674	0.0060
195	2.6734	0.0060
196	2.6794	0.0060
197	2.6854	0.0060
198	2.6913	0.0059
199	2.6972	0.0059
200	2.7032	0.0059
201	2.7090	0.0059
202	2.7149	0.0059
203	2.7208	0.0059
204	2.7266	0.0058
205	2.7325	0.0058
206	2.7383	0.0058
207	2.7441	0.0058
208	2.7499	0.0058
209	2.7556	0.0058
210	2.7614	0.0058
211	2.7671	0.0057
212	2.7728	0.0057
213	2.7786	0.0057
214	2.7842	0.0057
215	2.7899	0.0057
216	2.7956	0.0057
217	2.8012	0.0056
218	2.8069	0.0056
219	2.8125	0.0056
220	2.8181	0.0056
221	2.8237	0.0056
222	2.8292	0.0056

223	2.8348	0.0056
224	2.8404	0.0055
225	2.8459	0.0055
226	2.8514	0.0055
227	2.8569	0.0055
228	2.8624	0.0055
229	2.8679	0.0055
230	2.8733	0.0055
231	2.8788	0.0055
232	2.8842	0.0054
233	2.8897	0.0054
234	2.8951	0.0054
235	2.9005	0.0054
236	2.9059	0.0054
237	2.9112	0.0054
238	2.9166	0.0054
239	2.9219	0.0053
240	2.9273	0.0053
241	2.9326	0.0053
242	2.9379	0.0053
243	2.9432	0.0053
244	2.9485	0.0053
245	2.9538	0.0053
246	2.9590	0.0053
247	2.9643	0.0052
248	2.9695	0.0052
249	2.9747	0.0052
250	2.9799	0.0052
251	2.9851	0.0052
252	2.9903	0.0052
253	2.9955	0.0052
254	3.0007	0.0052
255	3.0058	0.0052
256	3.0110	0.0051
257	3.0161	0.0051
258	3.0212	0.0051
259	3.0263	0.0051
260	3.0314	0.0051
261	3.0365	0.0051
262	3.0416	0.0051
263	3.0467	0.0051
264	3.0517	0.0051
265	3.0568	0.0050
266	3.0618	0.0050
267	3.0668	0.0050
268	3.0718	0.0050
269	3.0768	0.0050
270	3.0818	0.0050
271	3.0868	0.0050
272	3.0918	0.0050
273	3.0967	0.0050
274	3.1017	0.0050
275	3.1066	0.0049
276	3.1116	0.0049
277	3.1165	0.0049
278	3.1214	0.0049
279	3.1263	0.0049

280	3.1312	0.0049
281	3.1361	0.0049
282	3.1409	0.0049
283	3.1458	0.0049
284	3.1507	0.0049
285	3.1555	0.0048
286	3.1603	0.0048
287	3.1651	0.0048
288	3.1700	0.0048

Unit Period (number)	Unit Rainfall (In)	Unit Soil-Loss (In)	Effective Rainfall (In)
1	0.0048	0.0039	0.0009
2	0.0048	0.0039	0.0009
3	0.0048	0.0039	0.0009
4	0.0049	0.0040	0.0009
5	0.0049	0.0040	0.0009
6	0.0049	0.0040	0.0009
7	0.0049	0.0040	0.0009
8	0.0049	0.0040	0.0009
9	0.0049	0.0040	0.0009
10	0.0049	0.0040	0.0009
11	0.0050	0.0040	0.0009
12	0.0050	0.0040	0.0009
13	0.0050	0.0041	0.0009
14	0.0050	0.0041	0.0009
15	0.0050	0.0041	0.0009
16	0.0050	0.0041	0.0009
17	0.0051	0.0041	0.0009
18	0.0051	0.0041	0.0009
19	0.0051	0.0041	0.0009
20	0.0051	0.0042	0.0009
21	0.0051	0.0042	0.0009
22	0.0051	0.0042	0.0010
23	0.0052	0.0042	0.0010
24	0.0052	0.0042	0.0010
25	0.0052	0.0042	0.0010
26	0.0052	0.0042	0.0010
27	0.0052	0.0043	0.0010
28	0.0052	0.0043	0.0010
29	0.0053	0.0043	0.0010
30	0.0053	0.0043	0.0010
31	0.0053	0.0043	0.0010
32	0.0053	0.0043	0.0010
33	0.0053	0.0043	0.0010
34	0.0053	0.0044	0.0010
35	0.0054	0.0044	0.0010
36	0.0054	0.0044	0.0010
37	0.0054	0.0044	0.0010
38	0.0054	0.0044	0.0010
39	0.0055	0.0044	0.0010
40	0.0055	0.0045	0.0010
41	0.0055	0.0045	0.0010
42	0.0055	0.0045	0.0010
43	0.0055	0.0045	0.0010

44	0.0055	0.0045	0.0010
45	0.0056	0.0045	0.0010
46	0.0056	0.0046	0.0010
47	0.0056	0.0046	0.0010
48	0.0056	0.0046	0.0010
49	0.0057	0.0046	0.0010
50	0.0057	0.0046	0.0011
51	0.0057	0.0046	0.0011
52	0.0057	0.0047	0.0011
53	0.0058	0.0047	0.0011
54	0.0058	0.0047	0.0011
55	0.0058	0.0047	0.0011
56	0.0058	0.0047	0.0011
57	0.0058	0.0048	0.0011
58	0.0059	0.0048	0.0011
59	0.0059	0.0048	0.0011
60	0.0059	0.0048	0.0011
61	0.0059	0.0048	0.0011
62	0.0060	0.0049	0.0011
63	0.0060	0.0049	0.0011
64	0.0060	0.0049	0.0011
65	0.0061	0.0049	0.0011
66	0.0061	0.0049	0.0011
67	0.0061	0.0050	0.0011
68	0.0061	0.0050	0.0011
69	0.0062	0.0050	0.0011
70	0.0062	0.0050	0.0011
71	0.0062	0.0051	0.0012
72	0.0062	0.0051	0.0012
73	0.0063	0.0051	0.0012
74	0.0063	0.0051	0.0012
75	0.0063	0.0052	0.0012
76	0.0064	0.0052	0.0012
77	0.0064	0.0052	0.0012
78	0.0064	0.0052	0.0012
79	0.0065	0.0053	0.0012
80	0.0065	0.0053	0.0012
81	0.0065	0.0053	0.0012
82	0.0065	0.0053	0.0012
83	0.0066	0.0054	0.0012
84	0.0066	0.0054	0.0012
85	0.0067	0.0054	0.0012
86	0.0067	0.0054	0.0012
87	0.0067	0.0055	0.0012
88	0.0068	0.0055	0.0013
89	0.0068	0.0055	0.0013
90	0.0068	0.0056	0.0013
91	0.0069	0.0056	0.0013
92	0.0069	0.0056	0.0013
93	0.0070	0.0057	0.0013
94	0.0070	0.0057	0.0013
95	0.0070	0.0057	0.0013
96	0.0071	0.0058	0.0013
97	0.0071	0.0058	0.0013
98	0.0071	0.0058	0.0013
99	0.0072	0.0059	0.0013
100	0.0072	0.0059	0.0013

101	0.0073	0.0059	0.0014
102	0.0073	0.0060	0.0014
103	0.0074	0.0060	0.0014
104	0.0074	0.0060	0.0014
105	0.0075	0.0061	0.0014
106	0.0075	0.0061	0.0014
107	0.0076	0.0062	0.0014
108	0.0076	0.0062	0.0014
109	0.0077	0.0063	0.0014
110	0.0077	0.0063	0.0014
111	0.0078	0.0063	0.0014
112	0.0078	0.0064	0.0014
113	0.0079	0.0064	0.0015
114	0.0079	0.0065	0.0015
115	0.0080	0.0065	0.0015
116	0.0080	0.0066	0.0015
117	0.0081	0.0066	0.0015
118	0.0082	0.0067	0.0015
119	0.0082	0.0067	0.0015
120	0.0083	0.0068	0.0015
121	0.0084	0.0068	0.0016
122	0.0084	0.0069	0.0016
123	0.0085	0.0069	0.0016
124	0.0086	0.0070	0.0016
125	0.0087	0.0070	0.0016
126	0.0087	0.0071	0.0016
127	0.0088	0.0072	0.0016
128	0.0088	0.0072	0.0016
129	0.0090	0.0073	0.0017
130	0.0090	0.0073	0.0017
131	0.0091	0.0074	0.0017
132	0.0092	0.0075	0.0017
133	0.0093	0.0076	0.0017
134	0.0093	0.0076	0.0017
135	0.0095	0.0077	0.0018
136	0.0095	0.0078	0.0018
137	0.0097	0.0079	0.0018
138	0.0097	0.0079	0.0018
139	0.0099	0.0080	0.0018
140	0.0099	0.0081	0.0018
141	0.0101	0.0082	0.0019
142	0.0101	0.0083	0.0019
143	0.0103	0.0084	0.0019
144	0.0104	0.0085	0.0019
145	0.0125	0.0102	0.0023
146	0.0126	0.0102	0.0023
147	0.0127	0.0104	0.0024
148	0.0128	0.0105	0.0024
149	0.0130	0.0106	0.0024
150	0.0131	0.0107	0.0024
151	0.0133	0.0109	0.0025
152	0.0134	0.0109	0.0025
153	0.0136	0.0111	0.0025
154	0.0138	0.0112	0.0025
155	0.0140	0.0114	0.0026
156	0.0141	0.0115	0.0026
157	0.0144	0.0117	0.0027

158	0.0145	0.0118	0.0027
159	0.0148	0.0120	0.0027
160	0.0149	0.0121	0.0028
161	0.0152	0.0124	0.0028
162	0.0154	0.0125	0.0028
163	0.0157	0.0128	0.0029
164	0.0159	0.0129	0.0029
165	0.0162	0.0132	0.0030
166	0.0164	0.0134	0.0030
167	0.0168	0.0137	0.0031
168	0.0170	0.0139	0.0032
169	0.0175	0.0143	0.0032
170	0.0178	0.0145	0.0033
171	0.0183	0.0149	0.0034
172	0.0185	0.0151	0.0034
173	0.0191	0.0156	0.0035
174	0.0195	0.0159	0.0036
175	0.0202	0.0164	0.0037
176	0.0205	0.0167	0.0038
177	0.0214	0.0174	0.0040
178	0.0218	0.0178	0.0040
179	0.0228	0.0186	0.0042
180	0.0234	0.0190	0.0043
181	0.0246	0.0201	0.0046
182	0.0253	0.0206	0.0047
183	0.0270	0.0220	0.0050
184	0.0279	0.0227	0.0052
185	0.0234	0.0191	0.0043
186	0.0247	0.0201	0.0046
187	0.0280	0.0228	0.0052
188	0.0302	0.0246	0.0056
189	0.0364	0.0297	0.0068
190	0.0411	0.0335	0.0076
191	0.0588	0.0479	0.0109
192	0.0808	0.0652	0.0157
193	0.2530	0.0652	0.1879
194	0.0479	0.0390	0.0089
195	0.0330	0.0268	0.0061
196	0.0262	0.0214	0.0049
197	0.0290	0.0236	0.0054
198	0.0261	0.0213	0.0048
199	0.0240	0.0195	0.0044
200	0.0223	0.0182	0.0041
201	0.0209	0.0171	0.0039
202	0.0198	0.0161	0.0037
203	0.0188	0.0153	0.0035
204	0.0180	0.0147	0.0033
205	0.0173	0.0141	0.0032
206	0.0166	0.0135	0.0031
207	0.0160	0.0131	0.0030
208	0.0155	0.0126	0.0029
209	0.0151	0.0123	0.0028
210	0.0146	0.0119	0.0027
211	0.0142	0.0116	0.0026
212	0.0139	0.0113	0.0026
213	0.0135	0.0110	0.0025
214	0.0132	0.0108	0.0025

215	0.0129	0.0105	0.0024
216	0.0127	0.0103	0.0023
217	0.0105	0.0085	0.0019
218	0.0102	0.0083	0.0019
219	0.0100	0.0081	0.0019
220	0.0098	0.0080	0.0018
221	0.0096	0.0078	0.0018
222	0.0094	0.0077	0.0017
223	0.0092	0.0075	0.0017
224	0.0091	0.0074	0.0017
225	0.0089	0.0073	0.0016
226	0.0087	0.0071	0.0016
227	0.0086	0.0070	0.0016
228	0.0085	0.0069	0.0016
229	0.0083	0.0068	0.0015
230	0.0082	0.0067	0.0015
231	0.0081	0.0066	0.0015
232	0.0080	0.0065	0.0015
233	0.0079	0.0064	0.0015
234	0.0077	0.0063	0.0014
235	0.0076	0.0062	0.0014
236	0.0075	0.0061	0.0014
237	0.0074	0.0061	0.0014
238	0.0074	0.0060	0.0014
239	0.0073	0.0059	0.0013
240	0.0072	0.0058	0.0013
241	0.0071	0.0058	0.0013
242	0.0070	0.0057	0.0013
243	0.0069	0.0056	0.0013
244	0.0069	0.0056	0.0013
245	0.0068	0.0055	0.0013
246	0.0067	0.0055	0.0012
247	0.0066	0.0054	0.0012
248	0.0066	0.0054	0.0012
249	0.0065	0.0053	0.0012
250	0.0064	0.0052	0.0012
251	0.0064	0.0052	0.0012
252	0.0063	0.0051	0.0012
253	0.0063	0.0051	0.0012
254	0.0062	0.0050	0.0011
255	0.0061	0.0050	0.0011
256	0.0061	0.0050	0.0011
257	0.0060	0.0049	0.0011
258	0.0060	0.0049	0.0011
259	0.0059	0.0048	0.0011
260	0.0059	0.0048	0.0011
261	0.0058	0.0048	0.0011
262	0.0058	0.0047	0.0011
263	0.0057	0.0047	0.0011
264	0.0057	0.0046	0.0011
265	0.0056	0.0046	0.0010
266	0.0056	0.0046	0.0010
267	0.0056	0.0045	0.0010
268	0.0055	0.0045	0.0010
269	0.0055	0.0045	0.0010
270	0.0054	0.0044	0.0010
271	0.0054	0.0044	0.0010

272	0.0054	0.0044	0.0010
273	0.0053	0.0043	0.0010
274	0.0053	0.0043	0.0010
275	0.0052	0.0043	0.0010
276	0.0052	0.0042	0.0010
277	0.0052	0.0042	0.0010
278	0.0051	0.0042	0.0010
279	0.0051	0.0042	0.0009
280	0.0051	0.0041	0.0009
281	0.0050	0.0041	0.0009
282	0.0050	0.0041	0.0009
283	0.0050	0.0041	0.0009
284	0.0050	0.0040	0.0009
285	0.0049	0.0040	0.0009
286	0.0049	0.0040	0.0009
287	0.0049	0.0040	0.0009
288	0.0048	0.0039	0.0009

Total soil rain loss = 2.44(In)
Total effective rainfall = 0.73(In)
Peak flow rate in flood hydrograph = 7.10(CFS)

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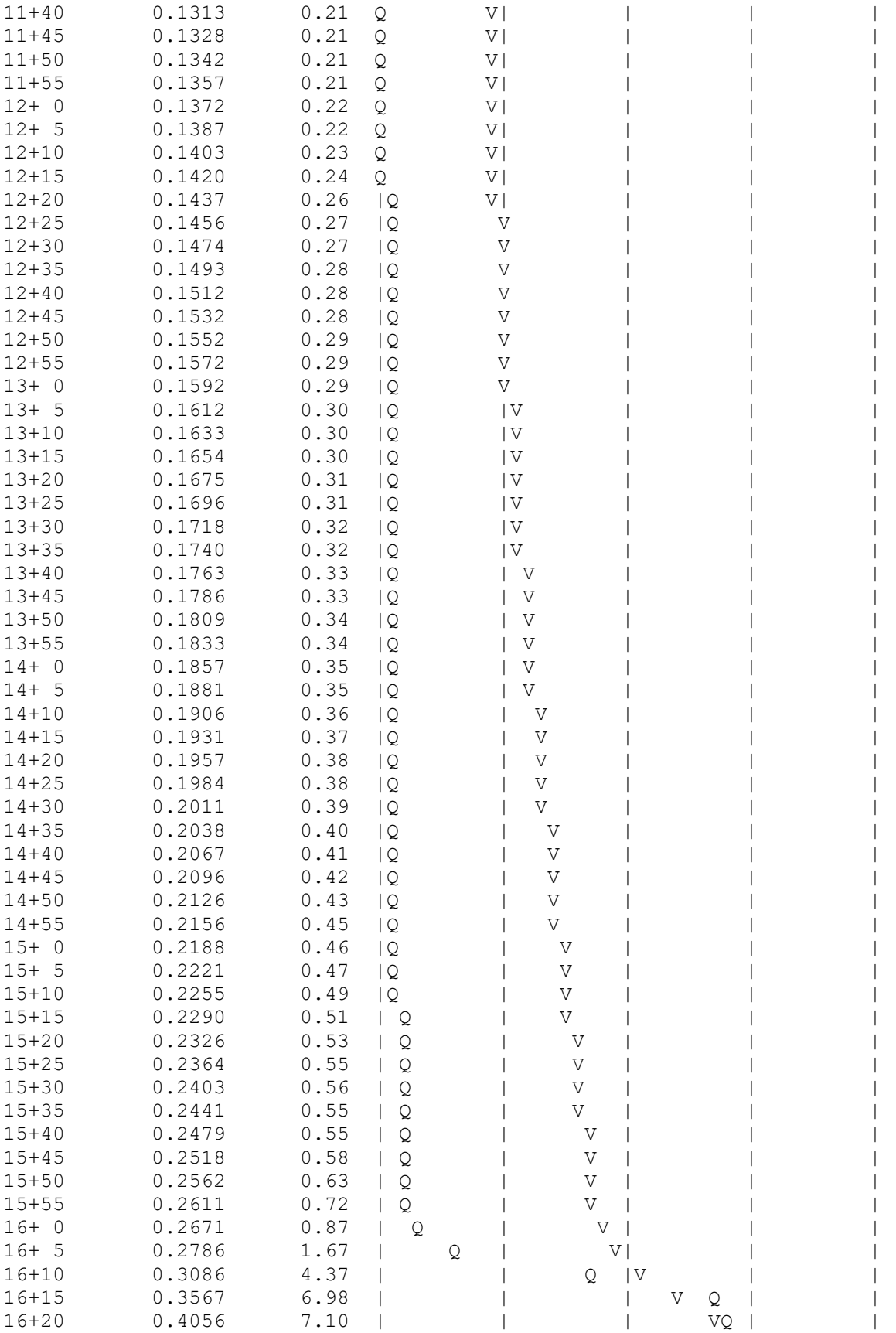
24 - H O U R S T O R M
R u n o f f H y d r o g r a p h

Hydrograph in 5 Minute intervals ((CFS))

Time(h+m)	Volume Ac.Ft	Q(CFS)	0	2.5	5.0	7.5	10.0
0+ 5	0.0000	0.00	Q				
0+10	0.0001	0.02	Q				
0+15	0.0005	0.05	Q				
0+20	0.0010	0.08	Q				
0+25	0.0016	0.09	Q				
0+30	0.0023	0.10	Q				
0+35	0.0030	0.10	Q				
0+40	0.0037	0.10	Q				
0+45	0.0045	0.10	Q				
0+50	0.0052	0.11	Q				
0+55	0.0059	0.11	Q				
1+ 0	0.0066	0.11	Q				
1+ 5	0.0074	0.11	Q				
1+10	0.0081	0.11	Q				
1+15	0.0088	0.11	Q				
1+20	0.0096	0.11	Q				
1+25	0.0103	0.11	Q				
1+30	0.0110	0.11	Q				
1+35	0.0118	0.11	Q				
1+40	0.0125	0.11	Q				
1+45	0.0133	0.11	Q				
1+50	0.0140	0.11	Q				
1+55	0.0148	0.11	QV				
2+ 0	0.0155	0.11	QV				
2+ 5	0.0163	0.11	QV				

2+10	0.0171	0.11	QV	|	|	|	|
2+15	0.0178	0.11	QV	|	|	|	|
2+20	0.0186	0.11	QV	|	|	|	|
2+25	0.0194	0.11	QV	|	|	|	|
2+30	0.0201	0.11	QV	|	|	|	|
2+35	0.0209	0.11	QV	|	|	|	|
2+40	0.0217	0.11	QV	|	|	|	|
2+45	0.0225	0.11	QV	|	|	|	|
2+50	0.0232	0.11	QV	|	|	|	|
2+55	0.0240	0.11	QV	|	|	|	|
3+ 0	0.0248	0.11	QV	|	|	|	|
3+ 5	0.0256	0.11	QV	|	|	|	|
3+10	0.0264	0.12	QV	|	|	|	|
3+15	0.0272	0.12	QV	|	|	|	|
3+20	0.0280	0.12	QV	|	|	|	|
3+25	0.0288	0.12	QV	|	|	|	|
3+30	0.0296	0.12	Q V	|	|	|	|
3+35	0.0304	0.12	Q V	|	|	|	|
3+40	0.0312	0.12	Q V	|	|	|	|
3+45	0.0320	0.12	Q V	|	|	|	|
3+50	0.0329	0.12	Q V	|	|	|	|
3+55	0.0337	0.12	Q V	|	|	|	|
4+ 0	0.0345	0.12	Q V	|	|	|	|
4+ 5	0.0353	0.12	Q V	|	|	|	|
4+10	0.0362	0.12	Q V	|	|	|	|
4+15	0.0370	0.12	Q V	|	|	|	|
4+20	0.0378	0.12	Q V	|	|	|	|
4+25	0.0387	0.12	Q V	|	|	|	|
4+30	0.0395	0.12	Q V	|	|	|	|
4+35	0.0403	0.12	Q V	|	|	|	|
4+40	0.0412	0.12	Q V	|	|	|	|
4+45	0.0420	0.12	Q V	|	|	|	|
4+50	0.0429	0.12	Q V	|	|	|	|
4+55	0.0438	0.12	Q V	|	|	|	|
5+ 0	0.0446	0.13	Q V	|	|	|	|
5+ 5	0.0455	0.13	Q V	|	|	|	|
5+10	0.0464	0.13	Q V	|	|	|	|
5+15	0.0472	0.13	Q V	|	|	|	|
5+20	0.0481	0.13	Q V	|	|	|	|
5+25	0.0490	0.13	Q V	|	|	|	|
5+30	0.0499	0.13	Q V	|	|	|	|
5+35	0.0508	0.13	Q V	|	|	|	|
5+40	0.0517	0.13	Q V	|	|	|	|
5+45	0.0526	0.13	Q V	|	|	|	|
5+50	0.0535	0.13	Q V	|	|	|	|
5+55	0.0544	0.13	Q V	|	|	|	|
6+ 0	0.0553	0.13	Q V	|	|	|	|
6+ 5	0.0562	0.13	Q V	|	|	|	|
6+10	0.0571	0.13	Q V	|	|	|	|
6+15	0.0580	0.13	Q V	|	|	|	|
6+20	0.0590	0.13	Q V	|	|	|	|
6+25	0.0599	0.14	Q V	|	|	|	|
6+30	0.0608	0.14	Q V	|	|	|	|
6+35	0.0618	0.14	Q V	|	|	|	|
6+40	0.0627	0.14	Q V	|	|	|	|
6+45	0.0637	0.14	Q V	|	|	|	|
6+50	0.0646	0.14	Q V	|	|	|	|

6+55	0.0656	0.14	Q	V				
7+ 0	0.0665	0.14	Q	V				
7+ 5	0.0675	0.14	Q	V				
7+10	0.0685	0.14	Q	V				
7+15	0.0695	0.14	Q	V				
7+20	0.0704	0.14	Q	V				
7+25	0.0714	0.14	Q	V				
7+30	0.0724	0.14	Q	V				
7+35	0.0734	0.15	Q	V				
7+40	0.0744	0.15	Q	V				
7+45	0.0754	0.15	Q	V				
7+50	0.0764	0.15	Q	V				
7+55	0.0775	0.15	Q	V				
8+ 0	0.0785	0.15	Q	V				
8+ 5	0.0795	0.15	Q	V				
8+10	0.0806	0.15	Q	V				
8+15	0.0816	0.15	Q	V				
8+20	0.0827	0.15	Q	V				
8+25	0.0837	0.15	Q	V				
8+30	0.0848	0.15	Q	V				
8+35	0.0859	0.16	Q	V				
8+40	0.0869	0.16	Q	V				
8+45	0.0880	0.16	Q	V				
8+50	0.0891	0.16	Q	V				
8+55	0.0902	0.16	Q	V				
9+ 0	0.0913	0.16	Q	V				
9+ 5	0.0924	0.16	Q	V				
9+10	0.0935	0.16	Q	V				
9+15	0.0947	0.16	Q	V				
9+20	0.0958	0.16	Q	V				
9+25	0.0969	0.17	Q	V				
9+30	0.0981	0.17	Q	V				
9+35	0.0992	0.17	Q	V				
9+40	0.1004	0.17	Q	V				
9+45	0.1016	0.17	Q	V				
9+50	0.1028	0.17	Q	V				
9+55	0.1040	0.17	Q	V				
10+ 0	0.1052	0.17	Q	V				
10+ 5	0.1064	0.18	Q	V				
10+10	0.1076	0.18	Q	V				
10+15	0.1088	0.18	Q	V				
10+20	0.1100	0.18	Q	V				
10+25	0.1113	0.18	Q	V				
10+30	0.1125	0.18	Q	V				
10+35	0.1138	0.18	Q	V				
10+40	0.1151	0.19	Q	V				
10+45	0.1164	0.19	Q	V				
10+50	0.1177	0.19	Q	V				
10+55	0.1190	0.19	Q	V				
11+ 0	0.1203	0.19	Q	V				
11+ 5	0.1216	0.19	Q	V				
11+10	0.1230	0.20	Q	V				
11+15	0.1244	0.20	Q	V				
11+20	0.1257	0.20	Q	V				
11+25	0.1271	0.20	Q	V				
11+30	0.1285	0.20	Q	V				
11+35	0.1299	0.21	Q	V				



16+25	0.4330	3.97	|	| Q	|	V|	|
16+30	0.4472	2.07	|	Q |	|	V	|
16+35	0.4552	1.16	|	Q	|	|	V|
16+40	0.4604	0.76	|	Q	|	|	V|
16+45	0.4652	0.70	|	Q	|	|	| V|
16+50	0.4693	0.59	|	Q	|	|	| V|
16+55	0.4726	0.48	|Q	|	|	|	| V|
17+ 0	0.4757	0.45	|Q	|	|	|	| V|
17+ 5	0.4786	0.42	|Q	|	|	|	| V|
17+10	0.4814	0.40	|Q	|	|	|	| V|
17+15	0.4840	0.38	|Q	|	|	|	| V|
17+20	0.4866	0.37	|Q	|	|	|	| V|
17+25	0.4890	0.35	|Q	|	|	|	| V|
17+30	0.4914	0.34	|Q	|	|	|	| V|
17+35	0.4936	0.33	|Q	|	|	|	| V|
17+40	0.4959	0.32	|Q	|	|	|	| V|
17+45	0.4980	0.31	|Q	|	|	|	| V|
17+50	0.5001	0.30	|Q	|	|	|	| V|
17+55	0.5021	0.30	|Q	|	|	|	| V|
18+ 0	0.5041	0.29	|Q	|	|	|	| V|
18+ 5	0.5061	0.28	|Q	|	|	|	| V|
18+10	0.5079	0.27	|Q	|	|	|	| V|
18+15	0.5097	0.25	|Q	|	|	|	| V|
18+20	0.5113	0.23	Q	|	|	|	| V|
18+25	0.5128	0.22	Q	|	|	|	| V|
18+30	0.5143	0.22	Q	|	|	|	| V|
18+35	0.5157	0.21	Q	|	|	|	| V|
18+40	0.5171	0.21	Q	|	|	|	| V|
18+45	0.5185	0.20	Q	|	|	|	| V|
18+50	0.5199	0.20	Q	|	|	|	| V|
18+55	0.5212	0.19	Q	|	|	|	| V|
19+ 0	0.5225	0.19	Q	|	|	|	| V|
19+ 5	0.5238	0.19	Q	|	|	|	| V|
19+10	0.5251	0.18	Q	|	|	|	| V|
19+15	0.5263	0.18	Q	|	|	|	| V|
19+20	0.5275	0.18	Q	|	|	|	| V|
19+25	0.5288	0.18	Q	|	|	|	| V|
19+30	0.5299	0.17	Q	|	|	|	| V|
19+35	0.5311	0.17	Q	|	|	|	| V|
19+40	0.5323	0.17	Q	|	|	|	| V|
19+45	0.5334	0.17	Q	|	|	|	| V|
19+50	0.5345	0.16	Q	|	|	|	| V|
19+55	0.5357	0.16	Q	|	|	|	| V|
20+ 0	0.5367	0.16	Q	|	|	|	| V|
20+ 5	0.5378	0.16	Q	|	|	|	| V|
20+10	0.5389	0.16	Q	|	|	|	| V|
20+15	0.5400	0.15	Q	|	|	|	| V|
20+20	0.5410	0.15	Q	|	|	|	| V|
20+25	0.5420	0.15	Q	|	|	|	| V|
20+30	0.5431	0.15	Q	|	|	|	| V|
20+35	0.5441	0.15	Q	|	|	|	| V|
20+40	0.5451	0.14	Q	|	|	|	| V|
20+45	0.5460	0.14	Q	|	|	|	| V|
20+50	0.5470	0.14	Q	|	|	|	| V|
20+55	0.5480	0.14	Q	|	|	|	| V|
21+ 0	0.5490	0.14	Q	|	|	|	| V|
21+ 5	0.5499	0.14	Q	|	|	|	| V|

21+10	0.5508	0.14	Q				V
21+15	0.5518	0.14	Q				V
21+20	0.5527	0.13	Q				V
21+25	0.5536	0.13	Q				V
21+30	0.5545	0.13	Q				V
21+35	0.5554	0.13	Q				V
21+40	0.5563	0.13	Q				V
21+45	0.5572	0.13	Q				V
21+50	0.5580	0.13	Q				V
21+55	0.5589	0.13	Q				V
22+ 0	0.5598	0.12	Q				V
22+ 5	0.5606	0.12	Q				V
22+10	0.5615	0.12	Q				V
22+15	0.5623	0.12	Q				V
22+20	0.5631	0.12	Q				V
22+25	0.5640	0.12	Q				V
22+30	0.5648	0.12	Q				V
22+35	0.5656	0.12	Q				V
22+40	0.5664	0.12	Q				V
22+45	0.5672	0.12	Q				V
22+50	0.5680	0.12	Q				V
22+55	0.5688	0.11	Q				V
23+ 0	0.5696	0.11	Q				V
23+ 5	0.5704	0.11	Q				V
23+10	0.5711	0.11	Q				V
23+15	0.5719	0.11	Q				V
23+20	0.5727	0.11	Q				V
23+25	0.5734	0.11	Q				V
23+30	0.5742	0.11	Q				V
23+35	0.5749	0.11	Q				V
23+40	0.5757	0.11	Q				V
23+45	0.5764	0.11	Q				V
23+50	0.5771	0.11	Q				V
23+55	0.5779	0.11	Q				V
24+ 0	0.5786	0.11	Q				V
24+ 5	0.5793	0.10	Q				V
24+10	0.5799	0.09	Q				V
24+15	0.5803	0.06	Q				V
24+20	0.5805	0.03	Q				V
24+25	0.5805	0.01	Q				V
24+30	0.5806	0.00	Q				V
24+35	0.5806	0.00	Q				V
24+40	0.5806	0.00	Q				V
24+45	0.5806	0.00	Q				V

APPENDIX C

POST PROJECT CONDITION UNIT HYDROGRAPH HYDROLOGY

C.1: UNIT HYDROGRAPH ANALYSIS, 100 YEAR, 24 HOUR STORM DURATION, AREA “A”

C.2 UNIT HYDROGRAPH ANALYSIS, 25 YEAR, 24 HOUR STORM DURATION, AREA “A”

C.3: UNIT HYDROGRAPH ANALYSIS, 10 YEAR, 24 HOUR STORM DURATION, AREA “A”

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 - 2014, Version 9.0

Study date 04/06/21

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

Program License Serial Number 6405

BLOOMINGTON COMMERCE CENTER – SITE 4
PROPOSED CONDITION
100 YEAR, 24 HOUR STORM EVENT ANALYSIS

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		
9.56	1	1.31
Rainfall data for year 100		
9.56	6	3.11
Rainfall data for year 100		
9.56	24	5.70

++

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

SCS curve	SCS curve	Area	Area	Fp(Fig C6)	Ap	Fm

No.(AMCII)	NO.(AMC 2)	(Ac.)	Fraction	(In/Hr)	(dec.)	(In/Hr)
32.0	32.0	9.56	1.000	0.978	0.200	0.196

Area-averaged adjusted loss rate Fm (In/Hr) = 0.196

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

Area (Ac.)	Area Fract	SCS CN (AMC2)	SCS CN (AMC2)	S	Pervious Yield Fr
1.91	0.200	32.0	32.0	21.25	0.016
7.65	0.800	98.0	98.0	0.20	0.958

Area-averaged catchment yield fraction, Y = 0.770
Area-averaged low loss fraction, Yb = 0.230
User entry of time of concentration = 0.186 (hours)
++
Watershed area = 9.56(Ac.)
Catchment Lag time = 0.149 hours
Unit interval = 5.000 minutes
Unit interval percentage of lag time = 56.0548
Hydrograph baseflow = 0.00(CFS)
Average maximum watershed loss rate(Fm) = 0.196(In/Hr)
Average low loss rate fraction (Yb) = 0.230 (decimal)
VALLEY DEVELOPED S-Graph Selected
Computed peak 5-minute rainfall = 0.485(In)
Computed peak 30-minute rainfall = 0.993(In)
Specified peak 1-hour rainfall = 1.310(In)
Computed peak 3-hour rainfall = 2.226(In)
Specified peak 6-hour rainfall = 3.110(In)
Specified peak 24-hour rainfall = 5.700(In)

Rainfall depth area reduction factors:
Using a total area of 9.56(Ac.) (Ref: fig. E-4)

5-minute factor = 1.000 Adjusted rainfall = 0.485(In)
30-minute factor = 1.000 Adjusted rainfall = 0.992(In)
1-hour factor = 1.000 Adjusted rainfall = 1.309(In)
3-hour factor = 1.000 Adjusted rainfall = 2.226(In)
6-hour factor = 1.000 Adjusted rainfall = 3.110(In)
24-hour factor = 1.000 Adjusted rainfall = 5.700(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 = 115.62 (CFS))		
1	5.711	6.603
2	36.801	35.945
3	77.490	47.044
4	93.766	18.817
5	98.253	5.188
6	99.349	1.268
7	100.000	0.752

Peak Unit Number	Adjusted mass rainfall (In)	Unit rainfall (In)
1	0.4846	0.4846
2	0.6395	0.1548
3	0.7521	0.1126
4	0.8438	0.0917
5	0.9226	0.0788
6	0.9923	0.0698
7	1.0555	0.0631
8	1.1134	0.0579
9	1.1671	0.0537
10	1.2173	0.0502
11	1.2646	0.0473
12	1.3094	0.0448
13	1.3610	0.0516
14	1.4106	0.0496
15	1.4584	0.0478
16	1.5046	0.0462
17	1.5493	0.0447
18	1.5926	0.0434
19	1.6347	0.0421
20	1.6757	0.0410
21	1.7157	0.0400
22	1.7547	0.0390
23	1.7927	0.0381
24	1.8300	0.0372
25	1.8664	0.0364
26	1.9021	0.0357
27	1.9371	0.0350
28	1.9714	0.0343
29	2.0051	0.0337
30	2.0382	0.0331
31	2.0707	0.0325
32	2.1027	0.0320
33	2.1342	0.0315
34	2.1652	0.0310
35	2.1957	0.0305
36	2.2258	0.0301
37	2.2554	0.0296
38	2.2846	0.0292
39	2.3134	0.0288
40	2.3418	0.0284
41	2.3699	0.0281
42	2.3976	0.0277
43	2.4250	0.0274
44	2.4521	0.0271
45	2.4788	0.0267
46	2.5052	0.0264
47	2.5314	0.0261
48	2.5572	0.0258
49	2.5828	0.0256
50	2.6081	0.0253
51	2.6331	0.0250
52	2.6579	0.0248
53	2.6825	0.0245
54	2.7068	0.0243

55	2.7309	0.0241
56	2.7547	0.0238
57	2.7783	0.0236
58	2.8018	0.0234
59	2.8250	0.0232
60	2.8480	0.0230
61	2.8708	0.0228
62	2.8934	0.0226
63	2.9158	0.0224
64	2.9381	0.0222
65	2.9601	0.0221
66	2.9820	0.0219
67	3.0037	0.0217
68	3.0253	0.0216
69	3.0467	0.0214
70	3.0679	0.0212
71	3.0890	0.0211
72	3.1099	0.0209
73	3.1287	0.0188
74	3.1474	0.0187
75	3.1659	0.0185
76	3.1843	0.0184
77	3.2025	0.0182
78	3.2206	0.0181
79	3.2386	0.0180
80	3.2565	0.0179
81	3.2742	0.0177
82	3.2918	0.0176
83	3.3093	0.0175
84	3.3266	0.0174
85	3.3439	0.0173
86	3.3610	0.0171
87	3.3780	0.0170
88	3.3950	0.0169
89	3.4118	0.0168
90	3.4285	0.0167
91	3.4451	0.0166
92	3.4616	0.0165
93	3.4780	0.0164
94	3.4943	0.0163
95	3.5104	0.0162
96	3.5266	0.0161
97	3.5426	0.0160
98	3.5585	0.0159
99	3.5743	0.0158
100	3.5900	0.0157
101	3.6057	0.0156
102	3.6212	0.0156
103	3.6367	0.0155
104	3.6521	0.0154
105	3.6674	0.0153
106	3.6826	0.0152
107	3.6978	0.0151
108	3.7128	0.0151
109	3.7278	0.0150
110	3.7427	0.0149
111	3.7576	0.0148

112	3.7723	0.0148
113	3.7870	0.0147
114	3.8016	0.0146
115	3.8162	0.0145
116	3.8306	0.0145
117	3.8450	0.0144
118	3.8593	0.0143
119	3.8736	0.0143
120	3.8878	0.0142
121	3.9019	0.0141
122	3.9160	0.0141
123	3.9300	0.0140
124	3.9439	0.0139
125	3.9578	0.0139
126	3.9716	0.0138
127	3.9853	0.0137
128	3.9990	0.0137
129	4.0126	0.0136
130	4.0262	0.0136
131	4.0397	0.0135
132	4.0532	0.0134
133	4.0665	0.0134
134	4.0799	0.0133
135	4.0932	0.0133
136	4.1064	0.0132
137	4.1196	0.0132
138	4.1327	0.0131
139	4.1457	0.0131
140	4.1587	0.0130
141	4.1717	0.0130
142	4.1846	0.0129
143	4.1975	0.0129
144	4.2103	0.0128
145	4.2230	0.0128
146	4.2357	0.0127
147	4.2484	0.0127
148	4.2610	0.0126
149	4.2735	0.0126
150	4.2860	0.0125
151	4.2985	0.0125
152	4.3109	0.0124
153	4.3233	0.0124
154	4.3356	0.0123
155	4.3479	0.0123
156	4.3601	0.0122
157	4.3723	0.0122
158	4.3845	0.0121
159	4.3966	0.0121
160	4.4087	0.0121
161	4.4207	0.0120
162	4.4327	0.0120
163	4.4446	0.0119
164	4.4565	0.0119
165	4.4683	0.0119
166	4.4802	0.0118
167	4.4919	0.0118
168	4.5037	0.0117

169	4.5154	0.0117
170	4.5270	0.0117
171	4.5386	0.0116
172	4.5502	0.0116
173	4.5618	0.0115
174	4.5733	0.0115
175	4.5847	0.0115
176	4.5962	0.0114
177	4.6076	0.0114
178	4.6189	0.0114
179	4.6302	0.0113
180	4.6415	0.0113
181	4.6528	0.0113
182	4.6640	0.0112
183	4.6752	0.0112
184	4.6863	0.0111
185	4.6974	0.0111
186	4.7085	0.0111
187	4.7196	0.0110
188	4.7306	0.0110
189	4.7416	0.0110
190	4.7525	0.0109
191	4.7634	0.0109
192	4.7743	0.0109
193	4.7852	0.0109
194	4.7960	0.0108
195	4.8068	0.0108
196	4.8175	0.0108
197	4.8283	0.0107
198	4.8390	0.0107
199	4.8496	0.0107
200	4.8603	0.0106
201	4.8709	0.0106
202	4.8814	0.0106
203	4.8920	0.0105
204	4.9025	0.0105
205	4.9130	0.0105
206	4.9235	0.0105
207	4.9339	0.0104
208	4.9443	0.0104
209	4.9547	0.0104
210	4.9650	0.0103
211	4.9753	0.0103
212	4.9856	0.0103
213	4.9959	0.0103
214	5.0061	0.0102
215	5.0163	0.0102
216	5.0265	0.0102
217	5.0367	0.0102
218	5.0468	0.0101
219	5.0569	0.0101
220	5.0670	0.0101
221	5.0770	0.0101
222	5.0871	0.0100
223	5.0971	0.0100
224	5.1070	0.0100
225	5.1170	0.0100

226	5.1269	0.0099
227	5.1368	0.0099
228	5.1467	0.0099
229	5.1566	0.0099
230	5.1664	0.0098
231	5.1762	0.0098
232	5.1860	0.0098
233	5.1957	0.0098
234	5.2055	0.0097
235	5.2152	0.0097
236	5.2249	0.0097
237	5.2345	0.0097
238	5.2442	0.0096
239	5.2538	0.0096
240	5.2634	0.0096
241	5.2730	0.0096
242	5.2825	0.0096
243	5.2920	0.0095
244	5.3015	0.0095
245	5.3110	0.0095
246	5.3205	0.0095
247	5.3299	0.0094
248	5.3393	0.0094
249	5.3487	0.0094
250	5.3581	0.0094
251	5.3675	0.0094
252	5.3768	0.0093
253	5.3861	0.0093
254	5.3954	0.0093
255	5.4047	0.0093
256	5.4139	0.0093
257	5.4232	0.0092
258	5.4324	0.0092
259	5.4416	0.0092
260	5.4508	0.0092
261	5.4599	0.0092
262	5.4690	0.0091
263	5.4782	0.0091
264	5.4872	0.0091
265	5.4963	0.0091
266	5.5054	0.0091
267	5.5144	0.0090
268	5.5234	0.0090
269	5.5324	0.0090
270	5.5414	0.0090
271	5.5504	0.0090
272	5.5593	0.0089
273	5.5682	0.0089
274	5.5771	0.0089
275	5.5860	0.0089
276	5.5949	0.0089
277	5.6037	0.0089
278	5.6126	0.0088
279	5.6214	0.0088
280	5.6302	0.0088
281	5.6390	0.0088
282	5.6477	0.0088

283	5.6565	0.0087
284	5.6652	0.0087
285	5.6739	0.0087
286	5.6826	0.0087
287	5.6913	0.0087
288	5.6999	0.0087

Unit Period (number)	Unit Rainfall (In)	Unit Soil-Loss (In)	Effective Rainfall (In)
1	0.0087	0.0020	0.0067
2	0.0087	0.0020	0.0067
3	0.0087	0.0020	0.0067
4	0.0087	0.0020	0.0067
5	0.0088	0.0020	0.0067
6	0.0088	0.0020	0.0068
7	0.0088	0.0020	0.0068
8	0.0088	0.0020	0.0068
9	0.0089	0.0020	0.0068
10	0.0089	0.0020	0.0068
11	0.0089	0.0021	0.0069
12	0.0089	0.0021	0.0069
13	0.0090	0.0021	0.0069
14	0.0090	0.0021	0.0069
15	0.0090	0.0021	0.0070
16	0.0091	0.0021	0.0070
17	0.0091	0.0021	0.0070
18	0.0091	0.0021	0.0070
19	0.0092	0.0021	0.0070
20	0.0092	0.0021	0.0071
21	0.0092	0.0021	0.0071
22	0.0092	0.0021	0.0071
23	0.0093	0.0021	0.0071
24	0.0093	0.0021	0.0072
25	0.0093	0.0021	0.0072
26	0.0094	0.0022	0.0072
27	0.0094	0.0022	0.0072
28	0.0094	0.0022	0.0073
29	0.0095	0.0022	0.0073
30	0.0095	0.0022	0.0073
31	0.0095	0.0022	0.0073
32	0.0096	0.0022	0.0074
33	0.0096	0.0022	0.0074
34	0.0096	0.0022	0.0074
35	0.0097	0.0022	0.0074
36	0.0097	0.0022	0.0075
37	0.0097	0.0022	0.0075
38	0.0098	0.0022	0.0075
39	0.0098	0.0023	0.0075
40	0.0098	0.0023	0.0076
41	0.0099	0.0023	0.0076
42	0.0099	0.0023	0.0076
43	0.0100	0.0023	0.0077
44	0.0100	0.0023	0.0077
45	0.0100	0.0023	0.0077
46	0.0101	0.0023	0.0077

47	0.0101	0.0023	0.0078
48	0.0101	0.0023	0.0078
49	0.0102	0.0023	0.0078
50	0.0102	0.0023	0.0079
51	0.0103	0.0024	0.0079
52	0.0103	0.0024	0.0079
53	0.0103	0.0024	0.0080
54	0.0104	0.0024	0.0080
55	0.0104	0.0024	0.0080
56	0.0105	0.0024	0.0081
57	0.0105	0.0024	0.0081
58	0.0105	0.0024	0.0081
59	0.0106	0.0024	0.0082
60	0.0106	0.0024	0.0082
61	0.0107	0.0025	0.0082
62	0.0107	0.0025	0.0083
63	0.0108	0.0025	0.0083
64	0.0108	0.0025	0.0083
65	0.0109	0.0025	0.0084
66	0.0109	0.0025	0.0084
67	0.0110	0.0025	0.0085
68	0.0110	0.0025	0.0085
69	0.0111	0.0025	0.0085
70	0.0111	0.0026	0.0086
71	0.0112	0.0026	0.0086
72	0.0112	0.0026	0.0086
73	0.0113	0.0026	0.0087
74	0.0113	0.0026	0.0087
75	0.0114	0.0026	0.0088
76	0.0114	0.0026	0.0088
77	0.0115	0.0026	0.0089
78	0.0115	0.0027	0.0089
79	0.0116	0.0027	0.0089
80	0.0117	0.0027	0.0090
81	0.0117	0.0027	0.0090
82	0.0118	0.0027	0.0091
83	0.0119	0.0027	0.0091
84	0.0119	0.0027	0.0092
85	0.0120	0.0028	0.0092
86	0.0120	0.0028	0.0093
87	0.0121	0.0028	0.0093
88	0.0121	0.0028	0.0094
89	0.0122	0.0028	0.0094
90	0.0123	0.0028	0.0095
91	0.0124	0.0028	0.0095
92	0.0124	0.0029	0.0096
93	0.0125	0.0029	0.0096
94	0.0126	0.0029	0.0097
95	0.0127	0.0029	0.0097
96	0.0127	0.0029	0.0098
97	0.0128	0.0029	0.0099
98	0.0129	0.0030	0.0099
99	0.0130	0.0030	0.0100
100	0.0130	0.0030	0.0100
101	0.0131	0.0030	0.0101
102	0.0132	0.0030	0.0101
103	0.0133	0.0031	0.0102

104	0.0133	0.0031	0.0103
105	0.0134	0.0031	0.0104
106	0.0135	0.0031	0.0104
107	0.0136	0.0031	0.0105
108	0.0137	0.0031	0.0105
109	0.0138	0.0032	0.0106
110	0.0139	0.0032	0.0107
111	0.0140	0.0032	0.0108
112	0.0141	0.0032	0.0108
113	0.0142	0.0033	0.0109
114	0.0143	0.0033	0.0110
115	0.0144	0.0033	0.0111
116	0.0145	0.0033	0.0111
117	0.0146	0.0034	0.0112
118	0.0147	0.0034	0.0113
119	0.0148	0.0034	0.0114
120	0.0149	0.0034	0.0115
121	0.0151	0.0035	0.0116
122	0.0151	0.0035	0.0117
123	0.0153	0.0035	0.0118
124	0.0154	0.0035	0.0118
125	0.0156	0.0036	0.0120
126	0.0156	0.0036	0.0120
127	0.0158	0.0036	0.0122
128	0.0159	0.0037	0.0123
129	0.0161	0.0037	0.0124
130	0.0162	0.0037	0.0125
131	0.0164	0.0038	0.0126
132	0.0165	0.0038	0.0127
133	0.0167	0.0038	0.0129
134	0.0168	0.0039	0.0129
135	0.0170	0.0039	0.0131
136	0.0171	0.0039	0.0132
137	0.0174	0.0040	0.0134
138	0.0175	0.0040	0.0135
139	0.0177	0.0041	0.0136
140	0.0179	0.0041	0.0137
141	0.0181	0.0042	0.0139
142	0.0182	0.0042	0.0140
143	0.0185	0.0043	0.0143
144	0.0187	0.0043	0.0144
145	0.0209	0.0048	0.0161
146	0.0211	0.0048	0.0162
147	0.0214	0.0049	0.0165
148	0.0216	0.0050	0.0166
149	0.0219	0.0050	0.0169
150	0.0221	0.0051	0.0170
151	0.0224	0.0052	0.0173
152	0.0226	0.0052	0.0174
153	0.0230	0.0053	0.0177
154	0.0232	0.0053	0.0179
155	0.0236	0.0054	0.0182
156	0.0238	0.0055	0.0184
157	0.0243	0.0056	0.0187
158	0.0245	0.0056	0.0189
159	0.0250	0.0058	0.0193
160	0.0253	0.0058	0.0195

161	0.0258	0.0059	0.0199
162	0.0261	0.0060	0.0201
163	0.0267	0.0062	0.0206
164	0.0271	0.0062	0.0208
165	0.0277	0.0064	0.0213
166	0.0281	0.0065	0.0216
167	0.0288	0.0066	0.0222
168	0.0292	0.0067	0.0225
169	0.0301	0.0069	0.0232
170	0.0305	0.0070	0.0235
171	0.0315	0.0072	0.0242
172	0.0320	0.0074	0.0246
173	0.0331	0.0076	0.0255
174	0.0337	0.0078	0.0259
175	0.0350	0.0081	0.0269
176	0.0357	0.0082	0.0275
177	0.0372	0.0086	0.0287
178	0.0381	0.0088	0.0293
179	0.0400	0.0092	0.0308
180	0.0410	0.0094	0.0316
181	0.0434	0.0100	0.0334
182	0.0447	0.0103	0.0344
183	0.0478	0.0110	0.0368
184	0.0496	0.0114	0.0382
185	0.0448	0.0103	0.0345
186	0.0473	0.0109	0.0364
187	0.0537	0.0124	0.0413
188	0.0579	0.0133	0.0446
189	0.0698	0.0161	0.0537
190	0.0788	0.0163	0.0625
191	0.1126	0.0163	0.0963
192	0.1548	0.0163	0.1385
193	0.4846	0.0163	0.4683
194	0.0917	0.0163	0.0754
195	0.0631	0.0145	0.0486
196	0.0502	0.0116	0.0387
197	0.0516	0.0119	0.0397
198	0.0462	0.0106	0.0355
199	0.0421	0.0097	0.0324
200	0.0390	0.0090	0.0300
201	0.0364	0.0084	0.0280
202	0.0343	0.0079	0.0264
203	0.0325	0.0075	0.0250
204	0.0310	0.0071	0.0239
205	0.0296	0.0068	0.0228
206	0.0284	0.0065	0.0219
207	0.0274	0.0063	0.0211
208	0.0264	0.0061	0.0203
209	0.0256	0.0059	0.0197
210	0.0248	0.0057	0.0191
211	0.0241	0.0055	0.0185
212	0.0234	0.0054	0.0180
213	0.0228	0.0052	0.0176
214	0.0222	0.0051	0.0171
215	0.0217	0.0050	0.0167
216	0.0212	0.0049	0.0163
217	0.0188	0.0043	0.0145

218	0.0184	0.0042	0.0141
219	0.0180	0.0041	0.0138
220	0.0176	0.0041	0.0136
221	0.0173	0.0040	0.0133
222	0.0169	0.0039	0.0130
223	0.0166	0.0038	0.0128
224	0.0163	0.0037	0.0125
225	0.0160	0.0037	0.0123
226	0.0157	0.0036	0.0121
227	0.0155	0.0036	0.0119
228	0.0152	0.0035	0.0117
229	0.0150	0.0034	0.0115
230	0.0148	0.0034	0.0114
231	0.0145	0.0033	0.0112
232	0.0143	0.0033	0.0110
233	0.0141	0.0033	0.0109
234	0.0139	0.0032	0.0107
235	0.0137	0.0032	0.0106
236	0.0136	0.0031	0.0104
237	0.0134	0.0031	0.0103
238	0.0132	0.0030	0.0102
239	0.0131	0.0030	0.0101
240	0.0129	0.0030	0.0099
241	0.0128	0.0029	0.0098
242	0.0126	0.0029	0.0097
243	0.0125	0.0029	0.0096
244	0.0123	0.0028	0.0095
245	0.0122	0.0028	0.0094
246	0.0121	0.0028	0.0093
247	0.0119	0.0027	0.0092
248	0.0118	0.0027	0.0091
249	0.0117	0.0027	0.0090
250	0.0116	0.0027	0.0089
251	0.0115	0.0026	0.0088
252	0.0114	0.0026	0.0087
253	0.0113	0.0026	0.0087
254	0.0111	0.0026	0.0086
255	0.0110	0.0025	0.0085
256	0.0109	0.0025	0.0084
257	0.0109	0.0025	0.0084
258	0.0108	0.0025	0.0083
259	0.0107	0.0025	0.0082
260	0.0106	0.0024	0.0081
261	0.0105	0.0024	0.0081
262	0.0104	0.0024	0.0080
263	0.0103	0.0024	0.0079
264	0.0102	0.0024	0.0079
265	0.0102	0.0023	0.0078
266	0.0101	0.0023	0.0078
267	0.0100	0.0023	0.0077
268	0.0099	0.0023	0.0076
269	0.0099	0.0023	0.0076
270	0.0098	0.0023	0.0075
271	0.0097	0.0022	0.0075
272	0.0096	0.0022	0.0074
273	0.0096	0.0022	0.0074
274	0.0095	0.0022	0.0073

275	0.0094	0.0022	0.0073
276	0.0094	0.0022	0.0072
277	0.0093	0.0021	0.0072
278	0.0093	0.0021	0.0071
279	0.0092	0.0021	0.0071
280	0.0091	0.0021	0.0070
281	0.0091	0.0021	0.0070
282	0.0090	0.0021	0.0069
283	0.0090	0.0021	0.0069
284	0.0089	0.0020	0.0069
285	0.0089	0.0020	0.0068
286	0.0088	0.0020	0.0068
287	0.0087	0.0020	0.0067
288	0.0087	0.0020	0.0067

Total soil rain loss = 1.18(In)
Total effective rainfall = 4.52(In)
Peak flow rate in flood hydrograph = 28.29(CFS)

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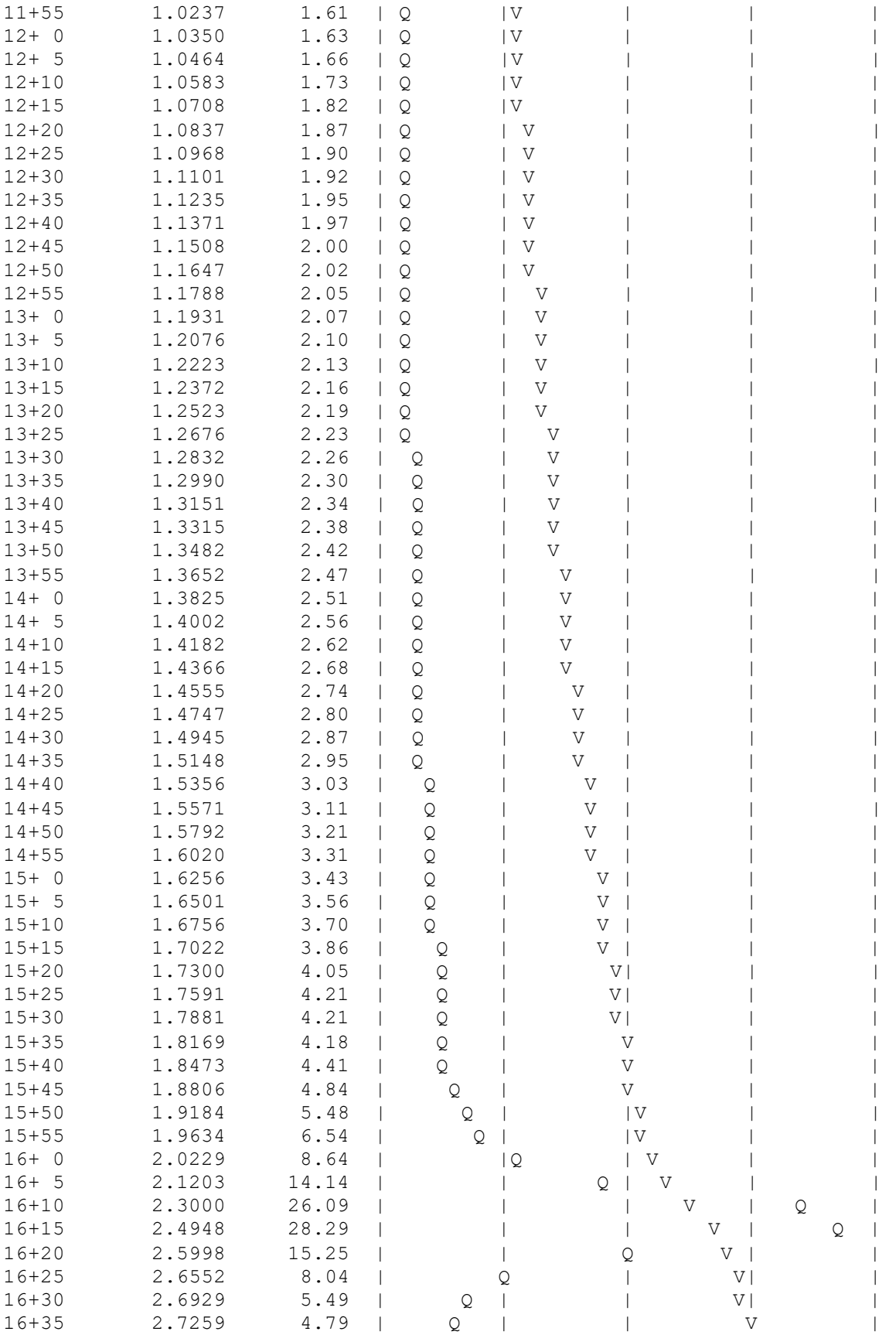
24 - H O U R S T O R M
R u n o f f H y d r o g r a p h

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	0.0003	0.04	Q				
0+10	0.0023	0.28	Q				
0+15	0.0064	0.60	Q				
0+20	0.0114	0.72	Q				
0+25	0.0166	0.76	VQ				
0+30	0.0219	0.77	VQ				
0+35	0.0273	0.78	VQ				
0+40	0.0327	0.78	VQ				
0+45	0.0381	0.78	VQ				
0+50	0.0435	0.79	VQ				
0+55	0.0489	0.79	VQ				
1+ 0	0.0544	0.79	VQ				
1+ 5	0.0599	0.79	VQ				
1+10	0.0654	0.80	VQ				
1+15	0.0709	0.80	VQ				
1+20	0.0764	0.80	VQ				
1+25	0.0819	0.80	VQ				
1+30	0.0875	0.81	VQ				
1+35	0.0930	0.81	|Q				
1+40	0.0986	0.81	|Q				
1+45	0.1042	0.81	|Q				
1+50	0.1099	0.82	|Q				
1+55	0.1155	0.82	|Q				
2+ 0	0.1212	0.82	|Q				
2+ 5	0.1269	0.83	|Q				
2+10	0.1326	0.83	|Q				
2+15	0.1383	0.83	|Q				
2+20	0.1440	0.83	|Q				

2+25	0.1498	0.84	|Q	|	|	|	|
2+30	0.1556	0.84	|Q	|	|	|	|
2+35	0.1614	0.84	|Q	|	|	|	|
2+40	0.1672	0.85	|Q	|	|	|	|
2+45	0.1730	0.85	|Q	|	|	|	|
2+50	0.1789	0.85	|Q	|	|	|	|
2+55	0.1848	0.85	|QV	|	|	|	|
3+ 0	0.1907	0.86	|QV	|	|	|	|
3+ 5	0.1966	0.86	|QV	|	|	|	|
3+10	0.2026	0.86	|QV	|	|	|	|
3+15	0.2085	0.87	|QV	|	|	|	|
3+20	0.2145	0.87	|QV	|	|	|	|
3+25	0.2205	0.87	|QV	|	|	|	|
3+30	0.2265	0.88	|QV	|	|	|	|
3+35	0.2326	0.88	|QV	|	|	|	|
3+40	0.2387	0.88	|QV	|	|	|	|
3+45	0.2448	0.89	|QV	|	|	|	|
3+50	0.2509	0.89	|QV	|	|	|	|
3+55	0.2570	0.89	|QV	|	|	|	|
4+ 0	0.2632	0.90	|QV	|	|	|	|
4+ 5	0.2694	0.90	|QV	|	|	|	|
4+10	0.2756	0.90	|Q V	|	|	|	|
4+15	0.2819	0.91	|Q V	|	|	|	|
4+20	0.2881	0.91	|Q V	|	|	|	|
4+25	0.2944	0.91	|Q V	|	|	|	|
4+30	0.3007	0.92	|Q V	|	|	|	|
4+35	0.3071	0.92	|Q V	|	|	|	|
4+40	0.3134	0.92	|Q V	|	|	|	|
4+45	0.3198	0.93	|Q V	|	|	|	|
4+50	0.3263	0.93	|Q V	|	|	|	|
4+55	0.3327	0.94	|Q V	|	|	|	|
5+ 0	0.3392	0.94	|Q V	|	|	|	|
5+ 5	0.3457	0.94	|Q V	|	|	|	|
5+10	0.3522	0.95	|Q V	|	|	|	|
5+15	0.3588	0.95	|Q V	|	|	|	|
5+20	0.3653	0.96	|Q V	|	|	|	|
5+25	0.3720	0.96	|Q V	|	|	|	|
5+30	0.3786	0.96	|Q V	|	|	|	|
5+35	0.3853	0.97	|Q V	|	|	|	|
5+40	0.3920	0.97	|Q V	|	|	|	|
5+45	0.3987	0.98	|Q V	|	|	|	|
5+50	0.4055	0.98	|Q V	|	|	|	|
5+55	0.4123	0.99	|Q V	|	|	|	|
6+ 0	0.4191	0.99	|Q V	|	|	|	|
6+ 5	0.4259	1.00	|Q V	|	|	|	|
6+10	0.4328	1.00	|Q V	|	|	|	|
6+15	0.4397	1.00	|Q V	|	|	|	|
6+20	0.4467	1.01	|Q V	|	|	|	|
6+25	0.4537	1.01	|Q V	|	|	|	|
6+30	0.4607	1.02	|Q V	|	|	|	|
6+35	0.4677	1.02	|Q V	|	|	|	|
6+40	0.4748	1.03	|Q V	|	|	|	|
6+45	0.4819	1.03	|Q V	|	|	|	|
6+50	0.4891	1.04	|Q V	|	|	|	|
6+55	0.4963	1.04	|Q V	|	|	|	|
7+ 0	0.5035	1.05	|Q V	|	|	|	|
7+ 5	0.5108	1.06	|Q V	|	|	|	|

7+10	0.5181	1.06	|Q V |				
7+15	0.5254	1.07	|Q V |				
7+20	0.5328	1.07	|Q V |				
7+25	0.5402	1.08	|Q V |				
7+30	0.5477	1.08	|Q V |				
7+35	0.5552	1.09	|Q V |				
7+40	0.5627	1.09	|Q V |				
7+45	0.5703	1.10	|Q V |				
7+50	0.5779	1.11	|Q V |				
7+55	0.5856	1.11	|Q V |				
8+ 0	0.5933	1.12	|Q V |				
8+ 5	0.6011	1.13	|Q V |				
8+10	0.6089	1.13	|Q V |				
8+15	0.6167	1.14	|Q V |				
8+20	0.6246	1.15	|Q V |				
8+25	0.6326	1.15	|Q V |				
8+30	0.6405	1.16	|Q V |				
8+35	0.6486	1.17	|Q V |				
8+40	0.6567	1.17	|Q V |				
8+45	0.6648	1.18	|Q V |				
8+50	0.6730	1.19	|Q V |				
8+55	0.6812	1.20	|Q V |				
9+ 0	0.6895	1.20	|Q V |				
9+ 5	0.6979	1.21	|Q V |				
9+10	0.7063	1.22	|Q V |				
9+15	0.7147	1.23	|Q V |				
9+20	0.7233	1.24	|Q V |				
9+25	0.7318	1.25	|Q V |				
9+30	0.7405	1.25	|Q V |				
9+35	0.7492	1.26	|Q V |				
9+40	0.7579	1.27	|Q V |				
9+45	0.7668	1.28	|Q V |				
9+50	0.7756	1.29	|Q V |				
9+55	0.7846	1.30	|Q V |				
10+ 0	0.7936	1.31	|Q V |				
10+ 5	0.8027	1.32	|Q V |				
10+10	0.8119	1.33	|Q V|				
10+15	0.8211	1.34	|Q V|				
10+20	0.8304	1.35	|Q V|				
10+25	0.8398	1.36	|Q V|				
10+30	0.8492	1.37	|Q V|				
10+35	0.8588	1.38	|Q V|				
10+40	0.8684	1.40	|Q V|				
10+45	0.8781	1.41	|Q V|				
10+50	0.8879	1.42	|Q V|				
10+55	0.8977	1.43	|Q V|				
11+ 0	0.9077	1.45	|Q V				
11+ 5	0.9177	1.46	|Q V				
11+10	0.9279	1.47	|Q V				
11+15	0.9381	1.49	|Q V				
11+20	0.9484	1.50	| Q V				
11+25	0.9589	1.51	| Q V				
11+30	0.9694	1.53	| Q V				
11+35	0.9801	1.55	| Q V				
11+40	0.9908	1.56	| Q |V				
11+45	1.0017	1.58	| Q |V				
11+50	1.0126	1.59	| Q |V				



16+40	2.7542	4.10	Q		V	
16+45	2.7800	3.75	Q		V	
16+50	2.8039	3.47	Q		V	
16+55	2.8262	3.24	Q		V	
17+ 0	2.8472	3.05	Q		V	
17+ 5	2.8672	2.89	Q		V	
17+10	2.8861	2.75	Q		V	
17+15	2.9042	2.63	Q		V	
17+20	2.9216	2.53	Q		V	
17+25	2.9384	2.43	Q		V	
17+30	2.9546	2.35	Q		V	
17+35	2.9702	2.27	Q		V	
17+40	2.9854	2.20	Q		V	
17+45	3.0001	2.14	Q		V	
17+50	3.0144	2.08	Q		V	
17+55	3.0284	2.03	Q		V	
18+ 0	3.0420	1.98	Q		V	
18+ 5	3.0552	1.92	Q		V	
18+10	3.0678	1.82	Q		V	
18+15	3.0796	1.71	Q		V	
18+20	3.0909	1.64	Q		V	
18+25	3.1019	1.60	Q		V	
18+30	3.1127	1.57	Q		V	
18+35	3.1232	1.53	Q		V	
18+40	3.1336	1.50	Q		V	
18+45	3.1438	1.47	Q		V	
18+50	3.1537	1.45	Q		V	
18+55	3.1635	1.42	Q		V	
19+ 0	3.1732	1.40	Q		V	
19+ 5	3.1826	1.38	Q		V	
19+10	3.1919	1.35	Q		V	
19+15	3.2011	1.33	Q		V	
19+20	3.2102	1.31	Q		V	
19+25	3.2191	1.29	Q		V	
19+30	3.2278	1.27	Q		V	
19+35	3.2365	1.26	Q		V	
19+40	3.2450	1.24	Q		V	
19+45	3.2534	1.22	Q		V	
19+50	3.2617	1.21	Q		V	
19+55	3.2699	1.19	Q		V	
20+ 0	3.2780	1.18	Q		V	
20+ 5	3.2860	1.16	Q		V	
20+10	3.2939	1.15	Q		V	
20+15	3.3017	1.13	Q		V	
20+20	3.3094	1.12	Q		V	
20+25	3.3171	1.11	Q		V	
20+30	3.3246	1.10	Q		V	
20+35	3.3321	1.08	Q		V	
20+40	3.3395	1.07	Q		V	
20+45	3.3468	1.06	Q		V	
20+50	3.3540	1.05	Q		V	
20+55	3.3612	1.04	Q		V	
21+ 0	3.3683	1.03	Q		V	
21+ 5	3.3753	1.02	Q		V	
21+10	3.3823	1.01	Q		V	
21+15	3.3892	1.00	Q		V	
21+20	3.3960	0.99	Q		V	

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   21+25       3.4028      0.98  |Q        |         |         |      V  |
   21+30       3.4095      0.97  |Q        |         |         |      V  |
   21+35       3.4161      0.97  |Q        |         |         |      V  |
   21+40       3.4227      0.96  |Q        |         |         |       V |
   21+45       3.4292      0.95  |Q        |         |         |       V |
   21+50       3.4357      0.94  |Q        |         |         |       V |
   21+55       3.4421      0.93  |Q        |         |         |       V |
   22+ 0       3.4485      0.93  |Q        |         |         |       V |
   22+ 5       3.4548      0.92  |Q        |         |         |       V |
   22+10       3.4611      0.91  |Q        |         |         |       V |
   22+15       3.4673      0.90  |Q        |         |         |       V |
   22+20       3.4735      0.90  |Q        |         |         |       V |
   22+25       3.4796      0.89  |Q        |         |         |       V |
   22+30       3.4857      0.88  |Q        |         |         |       V |
   22+35       3.4917      0.88  |Q        |         |         |       V |
   22+40       3.4977      0.87  |Q        |         |         |       V |
   22+45       3.5037      0.86  |Q        |         |         |       V |
   22+50       3.5096      0.86  |Q        |         |         |        V|
   22+55       3.5154      0.85  |Q        |         |         |        V|
   23+ 0       3.5213      0.85  |Q        |         |         |        V|
   23+ 5       3.5270      0.84  |Q        |         |         |        V|
   23+10       3.5328      0.83  |Q        |         |         |        V|
   23+15       3.5385      0.83  |Q        |         |         |        V|
   23+20       3.5442      0.82  |Q        |         |         |        V|
   23+25       3.5498      0.82  |Q        |         |         |        V|
   23+30       3.5554      0.81  |Q        |         |         |        V|
   23+35       3.5609      0.81  |Q        |         |         |        V|
   23+40       3.5665      0.80  |Q        |         |         |        V|
   23+45       3.5720      0.80  |Q        |         |         |        V|
   23+50       3.5774      0.79  |Q        |         |         |        V|
   23+55       3.5828      0.79  |Q        |         |         |        V|
   24+ 0       3.5882      0.78  |Q        |         |         |        V|
   24+ 5       3.5933      0.73  Q         |         |         |        V|
   24+10       3.5967      0.49  Q         |         |         |        V|
   24+15       3.5979      0.17  Q         |         |         |        V|
   24+20       3.5982      0.05  Q         |         |         |        V|
   24+25       3.5983      0.01  Q         |         |         |        V|
   24+30       3.5983      0.01  Q         |         |         |         V
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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

Copyright (c) CIVILCADD/CIVILDESIGN, 1989 - 2014, Version 9.0

Study date 05/04/21

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

Program License Serial Number 6405

BLOOMINGTON COMMERCE CENTER - SITE 4
PROPSOED CONDITION
25 YEAR, 24 HOUR STORM EVENT ANALYSIS

Storm Event Year = 25

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 25		
9.56	1	1.01
Rainfall data for year 25		
9.56	6	2.46
Rainfall data for year 25		
9.56	24	4.53

++

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

SCS curve	SCS curve	Area	Area	Fp(Fig C6)	Ap	Fm

No.(AMCII)	NO.(AMC 2)	(Ac.)	Fraction	(In/Hr)	(dec.)	(In/Hr)
32.0	32.0	9.56	1.000	0.978	0.200	0.196

Area-averaged adjusted loss rate Fm (In/Hr) = 0.196

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

Area (Ac.)	Area Fract	SCS CN (AMC2)	SCS CN (AMC2)	S	Pervious Yield Fr
1.91	0.200	32.0	32.0	21.25	0.001
7.65	0.800	98.0	98.0	0.20	0.948

Area-averaged catchment yield fraction, Y = 0.758
Area-averaged low loss fraction, Yb = 0.242
User entry of time of concentration = 0.186 (hours)
++
Watershed area = 9.56(Ac.)
Catchment Lag time = 0.149 hours
Unit interval = 5.000 minutes
Unit interval percentage of lag time = 56.0036
Hydrograph baseflow = 0.00(CFS)
Average maximum watershed loss rate(Fm) = 0.196(In/Hr)
Average low loss rate fraction (Yb) = 0.242 (decimal)
VALLEY DEVELOPED S-Graph Selected
Computed peak 5-minute rainfall = 0.374(In)
Computed peak 30-minute rainfall = 0.765(In)
Specified peak 1-hour rainfall = 1.010(In)
Computed peak 3-hour rainfall = 1.743(In)
Specified peak 6-hour rainfall = 2.460(In)
Specified peak 24-hour rainfall = 4.530(In)

Rainfall depth area reduction factors:
Using a total area of 9.56(Ac.) (Ref: fig. E-4)

5-minute factor = 1.000 Adjusted rainfall = 0.374(In)
30-minute factor = 1.000 Adjusted rainfall = 0.765(In)
1-hour factor = 1.000 Adjusted rainfall = 1.010(In)
3-hour factor = 1.000 Adjusted rainfall = 1.743(In)
6-hour factor = 1.000 Adjusted rainfall = 2.460(In)
24-hour factor = 1.000 Adjusted rainfall = 4.530(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 = 115.62 (CFS))		
1	5.701	6.591
2	36.739	35.886
3	77.428	47.043
4	93.740	18.860
5	98.246	5.210
6	99.344	1.270
7	100.000	0.758

Peak Unit Number	Adjusted mass rainfall (In)	Unit rainfall (In)
1	0.3736	0.3736
2	0.4930	0.1194
3	0.5798	0.0868
4	0.6505	0.0707
5	0.7113	0.0607
6	0.7651	0.0538
7	0.8138	0.0487
8	0.8584	0.0446
9	0.8998	0.0414
10	0.9385	0.0387
11	0.9750	0.0365
12	1.0095	0.0345
13	1.0505	0.0410
14	1.0900	0.0394
15	1.1280	0.0380
16	1.1648	0.0368
17	1.2004	0.0356
18	1.2350	0.0346
19	1.2687	0.0337
20	1.3015	0.0328
21	1.3334	0.0320
22	1.3646	0.0312
23	1.3951	0.0305
24	1.4249	0.0298
25	1.4542	0.0292
26	1.4828	0.0286
27	1.5109	0.0281
28	1.5384	0.0276
29	1.5655	0.0271
30	1.5921	0.0266
31	1.6183	0.0262
32	1.6441	0.0257
33	1.6694	0.0253
34	1.6944	0.0250
35	1.7190	0.0246
36	1.7432	0.0242
37	1.7671	0.0239
38	1.7907	0.0236
39	1.8139	0.0233
40	1.8369	0.0230
41	1.8596	0.0227
42	1.8820	0.0224
43	1.9041	0.0221
44	1.9260	0.0219
45	1.9476	0.0216
46	1.9690	0.0214
47	1.9901	0.0212
48	2.0111	0.0209
49	2.0318	0.0207
50	2.0523	0.0205
51	2.0726	0.0203
52	2.0927	0.0201
53	2.1126	0.0199
54	2.1323	0.0197

55	2.1518	0.0195
56	2.1712	0.0194
57	2.1903	0.0192
58	2.2093	0.0190
59	2.2282	0.0188
60	2.2469	0.0187
61	2.2654	0.0185
62	2.2838	0.0184
63	2.3020	0.0182
64	2.3201	0.0181
65	2.3380	0.0179
66	2.3558	0.0178
67	2.3735	0.0177
68	2.3910	0.0175
69	2.4085	0.0174
70	2.4257	0.0173
71	2.4429	0.0172
72	2.4599	0.0170
73	2.4749	0.0150
74	2.4898	0.0149
75	2.5046	0.0148
76	2.5192	0.0147
77	2.5338	0.0145
78	2.5482	0.0144
79	2.5625	0.0143
80	2.5768	0.0142
81	2.5909	0.0141
82	2.6049	0.0140
83	2.6189	0.0139
84	2.6327	0.0139
85	2.6465	0.0138
86	2.6602	0.0137
87	2.6737	0.0136
88	2.6872	0.0135
89	2.7006	0.0134
90	2.7140	0.0133
91	2.7272	0.0132
92	2.7404	0.0132
93	2.7534	0.0131
94	2.7665	0.0130
95	2.7794	0.0129
96	2.7922	0.0128
97	2.8050	0.0128
98	2.8177	0.0127
99	2.8303	0.0126
100	2.8429	0.0126
101	2.8554	0.0125
102	2.8678	0.0124
103	2.8801	0.0123
104	2.8924	0.0123
105	2.9046	0.0122
106	2.9168	0.0122
107	2.9289	0.0121
108	2.9409	0.0120
109	2.9529	0.0120
110	2.9648	0.0119
111	2.9766	0.0118

112	2.9884	0.0118
113	3.0001	0.0117
114	3.0118	0.0117
115	3.0234	0.0116
116	3.0349	0.0116
117	3.0464	0.0115
118	3.0579	0.0114
119	3.0693	0.0114
120	3.0806	0.0113
121	3.0919	0.0113
122	3.1031	0.0112
123	3.1143	0.0112
124	3.1254	0.0111
125	3.1365	0.0111
126	3.1475	0.0110
127	3.1585	0.0110
128	3.1694	0.0109
129	3.1803	0.0109
130	3.1911	0.0108
131	3.2019	0.0108
132	3.2127	0.0107
133	3.2234	0.0107
134	3.2340	0.0107
135	3.2446	0.0106
136	3.2552	0.0106
137	3.2657	0.0105
138	3.2762	0.0105
139	3.2866	0.0104
140	3.2970	0.0104
141	3.3074	0.0104
142	3.3177	0.0103
143	3.3279	0.0103
144	3.3382	0.0102
145	3.3484	0.0102
146	3.3585	0.0102
147	3.3686	0.0101
148	3.3787	0.0101
149	3.3887	0.0100
150	3.3987	0.0100
151	3.4087	0.0100
152	3.4186	0.0099
153	3.4285	0.0099
154	3.4383	0.0099
155	3.4482	0.0098
156	3.4579	0.0098
157	3.4677	0.0097
158	3.4774	0.0097
159	3.4871	0.0097
160	3.4967	0.0096
161	3.5063	0.0096
162	3.5159	0.0096
163	3.5254	0.0095
164	3.5350	0.0095
165	3.5444	0.0095
166	3.5539	0.0094
167	3.5633	0.0094
168	3.5727	0.0094

169	3.5820	0.0094
170	3.5913	0.0093
171	3.6006	0.0093
172	3.6099	0.0093
173	3.6191	0.0092
174	3.6283	0.0092
175	3.6375	0.0092
176	3.6466	0.0091
177	3.6557	0.0091
178	3.6648	0.0091
179	3.6739	0.0091
180	3.6829	0.0090
181	3.6919	0.0090
182	3.7009	0.0090
183	3.7098	0.0089
184	3.7187	0.0089
185	3.7276	0.0089
186	3.7365	0.0089
187	3.7453	0.0088
188	3.7541	0.0088
189	3.7629	0.0088
190	3.7717	0.0088
191	3.7804	0.0087
192	3.7891	0.0087
193	3.7978	0.0087
194	3.8064	0.0087
195	3.8151	0.0086
196	3.8237	0.0086
197	3.8322	0.0086
198	3.8408	0.0086
199	3.8493	0.0085
200	3.8578	0.0085
201	3.8663	0.0085
202	3.8748	0.0085
203	3.8832	0.0084
204	3.8916	0.0084
205	3.9000	0.0084
206	3.9084	0.0084
207	3.9167	0.0083
208	3.9251	0.0083
209	3.9334	0.0083
210	3.9416	0.0083
211	3.9499	0.0083
212	3.9581	0.0082
213	3.9663	0.0082
214	3.9745	0.0082
215	3.9827	0.0082
216	3.9908	0.0081
217	3.9990	0.0081
218	4.0071	0.0081
219	4.0152	0.0081
220	4.0232	0.0081
221	4.0313	0.0080
222	4.0393	0.0080
223	4.0473	0.0080
224	4.0553	0.0080
225	4.0632	0.0080

226	4.0712	0.0079
227	4.0791	0.0079
228	4.0870	0.0079
229	4.0949	0.0079
230	4.1028	0.0079
231	4.1106	0.0078
232	4.1184	0.0078
233	4.1263	0.0078
234	4.1340	0.0078
235	4.1418	0.0078
236	4.1496	0.0078
237	4.1573	0.0077
238	4.1650	0.0077
239	4.1727	0.0077
240	4.1804	0.0077
241	4.1881	0.0077
242	4.1957	0.0076
243	4.2033	0.0076
244	4.2110	0.0076
245	4.2185	0.0076
246	4.2261	0.0076
247	4.2337	0.0076
248	4.2412	0.0075
249	4.2487	0.0075
250	4.2562	0.0075
251	4.2637	0.0075
252	4.2712	0.0075
253	4.2787	0.0075
254	4.2861	0.0074
255	4.2935	0.0074
256	4.3009	0.0074
257	4.3083	0.0074
258	4.3157	0.0074
259	4.3231	0.0074
260	4.3304	0.0073
261	4.3377	0.0073
262	4.3451	0.0073
263	4.3523	0.0073
264	4.3596	0.0073
265	4.3669	0.0073
266	4.3741	0.0073
267	4.3814	0.0072
268	4.3886	0.0072
269	4.3958	0.0072
270	4.4030	0.0072
271	4.4102	0.0072
272	4.4173	0.0072
273	4.4245	0.0071
274	4.4316	0.0071
275	4.4387	0.0071
276	4.4458	0.0071
277	4.4529	0.0071
278	4.4600	0.0071
279	4.4670	0.0071
280	4.4741	0.0070
281	4.4811	0.0070
282	4.4881	0.0070

283	4.4951	0.0070
284	4.5021	0.0070
285	4.5091	0.0070
286	4.5161	0.0070
287	4.5230	0.0069
288	4.5299	0.0069

Unit Period (number)	Unit Rainfall (In)	Unit Soil-Loss (In)	Effective Rainfall (In)
1	0.0069	0.0017	0.0053
2	0.0069	0.0017	0.0053
3	0.0070	0.0017	0.0053
4	0.0070	0.0017	0.0053
5	0.0070	0.0017	0.0053
6	0.0070	0.0017	0.0053
7	0.0071	0.0017	0.0054
8	0.0071	0.0017	0.0054
9	0.0071	0.0017	0.0054
10	0.0071	0.0017	0.0054
11	0.0071	0.0017	0.0054
12	0.0072	0.0017	0.0054
13	0.0072	0.0017	0.0055
14	0.0072	0.0017	0.0055
15	0.0072	0.0017	0.0055
16	0.0073	0.0018	0.0055
17	0.0073	0.0018	0.0055
18	0.0073	0.0018	0.0055
19	0.0073	0.0018	0.0056
20	0.0073	0.0018	0.0056
21	0.0074	0.0018	0.0056
22	0.0074	0.0018	0.0056
23	0.0074	0.0018	0.0056
24	0.0074	0.0018	0.0056
25	0.0075	0.0018	0.0057
26	0.0075	0.0018	0.0057
27	0.0075	0.0018	0.0057
28	0.0075	0.0018	0.0057
29	0.0076	0.0018	0.0057
30	0.0076	0.0018	0.0058
31	0.0076	0.0018	0.0058
32	0.0076	0.0018	0.0058
33	0.0077	0.0019	0.0058
34	0.0077	0.0019	0.0058
35	0.0077	0.0019	0.0059
36	0.0078	0.0019	0.0059
37	0.0078	0.0019	0.0059
38	0.0078	0.0019	0.0059
39	0.0078	0.0019	0.0060
40	0.0079	0.0019	0.0060
41	0.0079	0.0019	0.0060
42	0.0079	0.0019	0.0060
43	0.0080	0.0019	0.0060
44	0.0080	0.0019	0.0061
45	0.0080	0.0019	0.0061
46	0.0080	0.0019	0.0061

47	0.0081	0.0020	0.0061
48	0.0081	0.0020	0.0061
49	0.0081	0.0020	0.0062
50	0.0082	0.0020	0.0062
51	0.0082	0.0020	0.0062
52	0.0082	0.0020	0.0062
53	0.0083	0.0020	0.0063
54	0.0083	0.0020	0.0063
55	0.0083	0.0020	0.0063
56	0.0084	0.0020	0.0063
57	0.0084	0.0020	0.0064
58	0.0084	0.0020	0.0064
59	0.0085	0.0020	0.0064
60	0.0085	0.0021	0.0065
61	0.0086	0.0021	0.0065
62	0.0086	0.0021	0.0065
63	0.0086	0.0021	0.0065
64	0.0087	0.0021	0.0066
65	0.0087	0.0021	0.0066
66	0.0087	0.0021	0.0066
67	0.0088	0.0021	0.0067
68	0.0088	0.0021	0.0067
69	0.0089	0.0021	0.0067
70	0.0089	0.0021	0.0067
71	0.0089	0.0022	0.0068
72	0.0090	0.0022	0.0068
73	0.0090	0.0022	0.0068
74	0.0091	0.0022	0.0069
75	0.0091	0.0022	0.0069
76	0.0091	0.0022	0.0069
77	0.0092	0.0022	0.0070
78	0.0092	0.0022	0.0070
79	0.0093	0.0022	0.0070
80	0.0093	0.0023	0.0071
81	0.0094	0.0023	0.0071
82	0.0094	0.0023	0.0071
83	0.0095	0.0023	0.0072
84	0.0095	0.0023	0.0072
85	0.0096	0.0023	0.0073
86	0.0096	0.0023	0.0073
87	0.0097	0.0023	0.0073
88	0.0097	0.0023	0.0074
89	0.0098	0.0024	0.0074
90	0.0098	0.0024	0.0074
91	0.0099	0.0024	0.0075
92	0.0099	0.0024	0.0075
93	0.0100	0.0024	0.0076
94	0.0100	0.0024	0.0076
95	0.0101	0.0024	0.0077
96	0.0102	0.0025	0.0077
97	0.0102	0.0025	0.0078
98	0.0103	0.0025	0.0078
99	0.0104	0.0025	0.0079
100	0.0104	0.0025	0.0079
101	0.0105	0.0025	0.0079
102	0.0105	0.0025	0.0080
103	0.0106	0.0026	0.0080

104	0.0107	0.0026	0.0081
105	0.0107	0.0026	0.0081
106	0.0108	0.0026	0.0082
107	0.0109	0.0026	0.0083
108	0.0109	0.0026	0.0083
109	0.0110	0.0027	0.0084
110	0.0111	0.0027	0.0084
111	0.0112	0.0027	0.0085
112	0.0112	0.0027	0.0085
113	0.0113	0.0027	0.0086
114	0.0114	0.0028	0.0086
115	0.0115	0.0028	0.0087
116	0.0116	0.0028	0.0088
117	0.0117	0.0028	0.0088
118	0.0117	0.0028	0.0089
119	0.0118	0.0029	0.0090
120	0.0119	0.0029	0.0090
121	0.0120	0.0029	0.0091
122	0.0121	0.0029	0.0092
123	0.0122	0.0030	0.0093
124	0.0123	0.0030	0.0093
125	0.0124	0.0030	0.0094
126	0.0125	0.0030	0.0095
127	0.0126	0.0030	0.0096
128	0.0127	0.0031	0.0096
129	0.0128	0.0031	0.0097
130	0.0129	0.0031	0.0098
131	0.0131	0.0032	0.0099
132	0.0132	0.0032	0.0100
133	0.0133	0.0032	0.0101
134	0.0134	0.0032	0.0102
135	0.0136	0.0033	0.0103
136	0.0137	0.0033	0.0104
137	0.0139	0.0033	0.0105
138	0.0139	0.0034	0.0106
139	0.0141	0.0034	0.0107
140	0.0142	0.0034	0.0108
141	0.0144	0.0035	0.0110
142	0.0145	0.0035	0.0110
143	0.0148	0.0036	0.0112
144	0.0149	0.0036	0.0113
145	0.0170	0.0041	0.0129
146	0.0172	0.0041	0.0130
147	0.0174	0.0042	0.0132
148	0.0175	0.0042	0.0133
149	0.0178	0.0043	0.0135
150	0.0179	0.0043	0.0136
151	0.0182	0.0044	0.0138
152	0.0184	0.0044	0.0139
153	0.0187	0.0045	0.0142
154	0.0188	0.0046	0.0143
155	0.0192	0.0046	0.0145
156	0.0194	0.0047	0.0147
157	0.0197	0.0048	0.0150
158	0.0199	0.0048	0.0151
159	0.0203	0.0049	0.0154
160	0.0205	0.0050	0.0155

161	0.0209	0.0051	0.0159
162	0.0212	0.0051	0.0160
163	0.0216	0.0052	0.0164
164	0.0219	0.0053	0.0166
165	0.0224	0.0054	0.0170
166	0.0227	0.0055	0.0172
167	0.0233	0.0056	0.0176
168	0.0236	0.0057	0.0179
169	0.0242	0.0059	0.0184
170	0.0246	0.0059	0.0187
171	0.0253	0.0061	0.0192
172	0.0257	0.0062	0.0195
173	0.0266	0.0064	0.0202
174	0.0271	0.0065	0.0205
175	0.0281	0.0068	0.0213
176	0.0286	0.0069	0.0217
177	0.0298	0.0072	0.0226
178	0.0305	0.0074	0.0231
179	0.0320	0.0077	0.0242
180	0.0328	0.0079	0.0249
181	0.0346	0.0084	0.0262
182	0.0356	0.0086	0.0270
183	0.0380	0.0092	0.0289
184	0.0394	0.0095	0.0299
185	0.0345	0.0083	0.0262
186	0.0365	0.0088	0.0277
187	0.0414	0.0100	0.0314
188	0.0446	0.0108	0.0339
189	0.0538	0.0130	0.0408
190	0.0607	0.0147	0.0461
191	0.0868	0.0163	0.0705
192	0.1194	0.0163	0.1031
193	0.3736	0.0163	0.3573
194	0.0707	0.0163	0.0544
195	0.0487	0.0118	0.0369
196	0.0387	0.0094	0.0294
197	0.0410	0.0099	0.0311
198	0.0368	0.0089	0.0279
199	0.0337	0.0081	0.0255
200	0.0312	0.0075	0.0237
201	0.0292	0.0071	0.0222
202	0.0276	0.0067	0.0209
203	0.0262	0.0063	0.0198
204	0.0250	0.0060	0.0189
205	0.0239	0.0058	0.0181
206	0.0230	0.0055	0.0174
207	0.0221	0.0053	0.0168
208	0.0214	0.0052	0.0162
209	0.0207	0.0050	0.0157
210	0.0201	0.0049	0.0152
211	0.0195	0.0047	0.0148
212	0.0190	0.0046	0.0144
213	0.0185	0.0045	0.0141
214	0.0181	0.0044	0.0137
215	0.0177	0.0043	0.0134
216	0.0173	0.0042	0.0131

217	0.0150	0.0036	0.0114
218	0.0147	0.0035	0.0111
219	0.0143	0.0035	0.0109
220	0.0140	0.0034	0.0106
221	0.0138	0.0033	0.0104
222	0.0135	0.0033	0.0102
223	0.0132	0.0032	0.0100
224	0.0130	0.0031	0.0099
225	0.0128	0.0031	0.0097
226	0.0126	0.0030	0.0095
227	0.0123	0.0030	0.0094
228	0.0122	0.0029	0.0092
229	0.0120	0.0029	0.0091
230	0.0118	0.0028	0.0089
231	0.0116	0.0028	0.0088
232	0.0114	0.0028	0.0087
233	0.0113	0.0027	0.0086
234	0.0111	0.0027	0.0084
235	0.0110	0.0027	0.0083
236	0.0108	0.0026	0.0082
237	0.0107	0.0026	0.0081
238	0.0106	0.0026	0.0080
239	0.0104	0.0025	0.0079
240	0.0103	0.0025	0.0078
241	0.0102	0.0025	0.0077
242	0.0101	0.0024	0.0076
243	0.0100	0.0024	0.0076
244	0.0099	0.0024	0.0075
245	0.0097	0.0024	0.0074
246	0.0096	0.0023	0.0073
247	0.0095	0.0023	0.0072
248	0.0094	0.0023	0.0072
249	0.0094	0.0023	0.0071
250	0.0093	0.0022	0.0070
251	0.0092	0.0022	0.0070
252	0.0091	0.0022	0.0069
253	0.0090	0.0022	0.0068
254	0.0089	0.0022	0.0068
255	0.0088	0.0021	0.0067
256	0.0088	0.0021	0.0066
257	0.0087	0.0021	0.0066
258	0.0086	0.0021	0.0065
259	0.0085	0.0021	0.0065
260	0.0085	0.0020	0.0064
261	0.0084	0.0020	0.0064
262	0.0083	0.0020	0.0063
263	0.0083	0.0020	0.0063
264	0.0082	0.0020	0.0062
265	0.0081	0.0020	0.0062
266	0.0081	0.0019	0.0061
267	0.0080	0.0019	0.0061
268	0.0079	0.0019	0.0060
269	0.0079	0.0019	0.0060
270	0.0078	0.0019	0.0059
271	0.0078	0.0019	0.0059
272	0.0077	0.0019	0.0059
273	0.0077	0.0019	0.0058

274	0.0076	0.0018	0.0058
275	0.0076	0.0018	0.0057
276	0.0075	0.0018	0.0057
277	0.0075	0.0018	0.0057
278	0.0074	0.0018	0.0056
279	0.0074	0.0018	0.0056
280	0.0073	0.0018	0.0055
281	0.0073	0.0018	0.0055
282	0.0072	0.0017	0.0055
283	0.0072	0.0017	0.0054
284	0.0071	0.0017	0.0054
285	0.0071	0.0017	0.0054
286	0.0070	0.0017	0.0053
287	0.0070	0.0017	0.0053
288	0.0070	0.0017	0.0053

Total soil rain loss = 1.00(In)
Total effective rainfall = 3.53(In)
Peak flow rate in flood hydrograph = 21.41(CFS)

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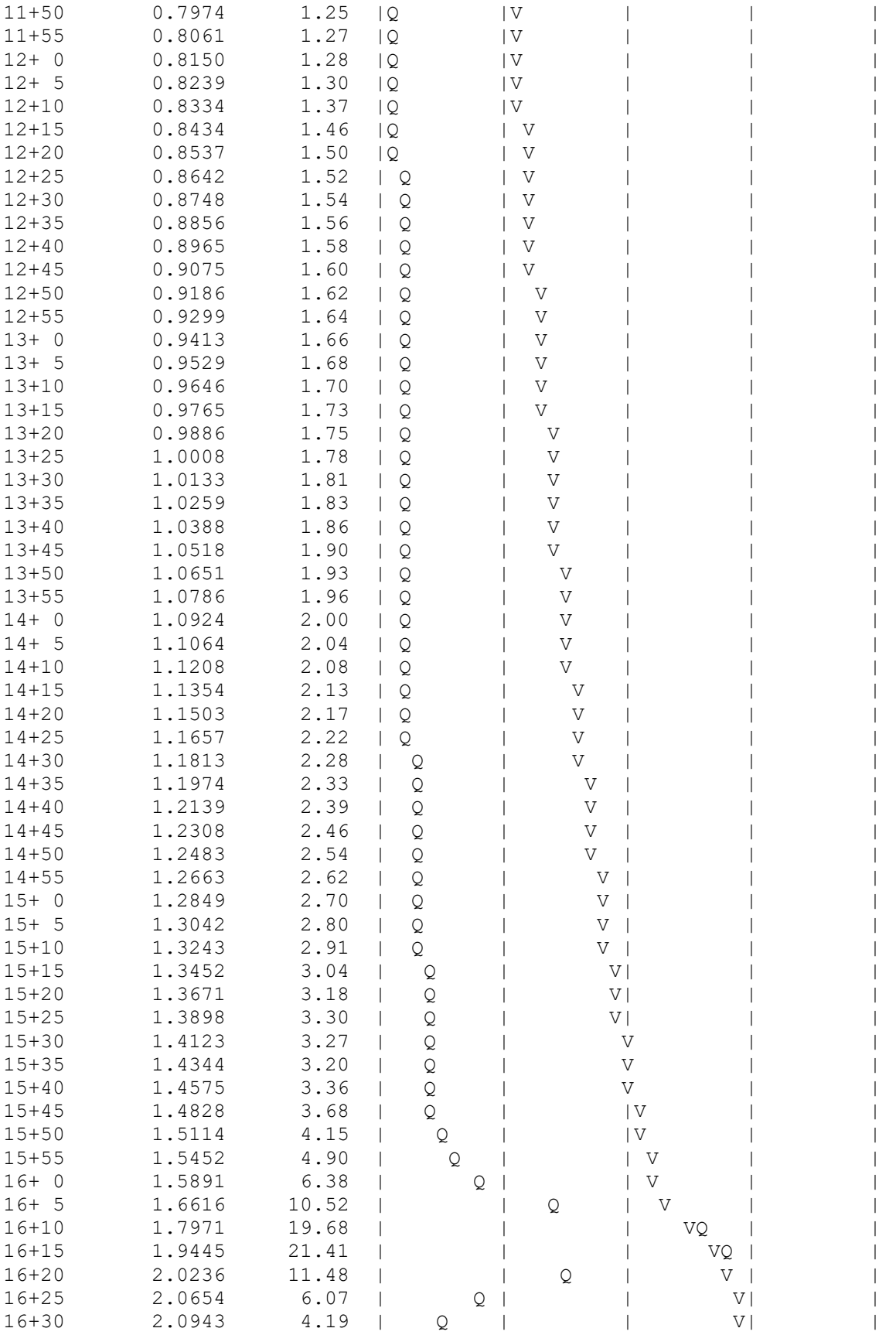
24 - H O U R S T O R M
R u n o f f H y d r o g r a p h

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	0.0002	0.03	Q				
0+10	0.0018	0.22	Q				
0+15	0.0050	0.47	Q				
0+20	0.0090	0.57	Q				
0+25	0.0131	0.60	Q				
0+30	0.0173	0.61	Q				
0+35	0.0215	0.62	Q				
0+40	0.0258	0.62	Q				
0+45	0.0300	0.62	Q				
0+50	0.0343	0.62	Q				
0+55	0.0386	0.62	Q				
1+ 0	0.0429	0.62	Q				
1+ 5	0.0472	0.63	Q				
1+10	0.0516	0.63	Q				
1+15	0.0559	0.63	Q				
1+20	0.0603	0.63	Q				
1+25	0.0646	0.63	Q				
1+30	0.0690	0.64	Q				
1+35	0.0734	0.64	QV				
1+40	0.0778	0.64	QV				
1+45	0.0822	0.64	QV				
1+50	0.0867	0.64	QV				
1+55	0.0911	0.65	QV				
2+ 0	0.0956	0.65	QV				
2+ 5	0.1001	0.65	QV				
2+10	0.1046	0.65	QV				
2+15	0.1091	0.66	QV				

2+20	0.1136	0.66	QV	|	|	|	|
2+25	0.1182	0.66	QV	|	|	|	|
2+30	0.1227	0.66	QV	|	|	|	|
2+35	0.1273	0.66	QV	|	|	|	|
2+40	0.1319	0.67	QV	|	|	|	|
2+45	0.1365	0.67	QV	|	|	|	|
2+50	0.1411	0.67	Q V	|	|	|	|
2+55	0.1458	0.67	Q V	|	|	|	|
3+ 0	0.1504	0.68	Q V	|	|	|	|
3+ 5	0.1551	0.68	Q V	|	|	|	|
3+10	0.1598	0.68	Q V	|	|	|	|
3+15	0.1645	0.68	Q V	|	|	|	|
3+20	0.1692	0.69	Q V	|	|	|	|
3+25	0.1739	0.69	Q V	|	|	|	|
3+30	0.1787	0.69	Q V	|	|	|	|
3+35	0.1835	0.69	Q V	|	|	|	|
3+40	0.1882	0.70	Q V	|	|	|	|
3+45	0.1931	0.70	Q V	|	|	|	|
3+50	0.1979	0.70	Q V	|	|	|	|
3+55	0.2027	0.70	Q V	|	|	|	|
4+ 0	0.2076	0.71	Q V	|	|	|	|
4+ 5	0.2125	0.71	Q V	|	|	|	|
4+10	0.2174	0.71	Q V	|	|	|	|
4+15	0.2223	0.71	Q V	|	|	|	|
4+20	0.2272	0.72	Q V	|	|	|	|
4+25	0.2322	0.72	Q V	|	|	|	|
4+30	0.2372	0.72	Q V	|	|	|	|
4+35	0.2422	0.73	Q V	|	|	|	|
4+40	0.2472	0.73	Q V	|	|	|	|
4+45	0.2522	0.73	Q V	|	|	|	|
4+50	0.2573	0.73	Q V	|	|	|	|
4+55	0.2624	0.74	Q V	|	|	|	|
5+ 0	0.2675	0.74	Q V	|	|	|	|
5+ 5	0.2726	0.74	Q V	|	|	|	|
5+10	0.2777	0.75	Q V	|	|	|	|
5+15	0.2829	0.75	|Q V	|	|	|	|
5+20	0.2881	0.75	|Q V	|	|	|	|
5+25	0.2933	0.76	|Q V	|	|	|	|
5+30	0.2985	0.76	|Q V	|	|	|	|
5+35	0.3038	0.76	|Q V	|	|	|	|
5+40	0.3091	0.77	|Q V	|	|	|	|
5+45	0.3144	0.77	|Q V	|	|	|	|
5+50	0.3197	0.77	|Q V	|	|	|	|
5+55	0.3250	0.78	|Q V	|	|	|	|
6+ 0	0.3304	0.78	|Q V	|	|	|	|
6+ 5	0.3358	0.78	|Q V	|	|	|	|
6+10	0.3412	0.79	|Q V	|	|	|	|
6+15	0.3467	0.79	|Q V	|	|	|	|
6+20	0.3522	0.80	|Q V	|	|	|	|
6+25	0.3577	0.80	|Q V	|	|	|	|
6+30	0.3632	0.80	|Q V	|	|	|	|
6+35	0.3688	0.81	|Q V	|	|	|	|
6+40	0.3743	0.81	|Q V	|	|	|	|
6+45	0.3799	0.81	|Q V	|	|	|	|
6+50	0.3856	0.82	|Q V	|	|	|	|
6+55	0.3912	0.82	|Q V	|	|	|	|
7+ 0	0.3969	0.83	|Q V	|	|	|	|

7+ 5	0.4027	0.83	|Q V	|	|	|	|
7+10	0.4084	0.84	|Q V	|	|	|	|
7+15	0.4142	0.84	|Q V	|	|	|	|
7+20	0.4200	0.84	|Q V	|	|	|	|
7+25	0.4259	0.85	|Q V	|	|	|	|
7+30	0.4317	0.85	|Q V	|	|	|	|
7+35	0.4376	0.86	|Q V	|	|	|	|
7+40	0.4436	0.86	|Q V	|	|	|	|
7+45	0.4495	0.87	|Q V	|	|	|	|
7+50	0.4555	0.87	|Q V	|	|	|	|
7+55	0.4616	0.88	|Q V	|	|	|	|
8+ 0	0.4676	0.88	|Q V	|	|	|	|
8+ 5	0.4738	0.89	|Q V	|	|	|	|
8+10	0.4799	0.89	|Q V	|	|	|	|
8+15	0.4861	0.90	|Q V	|	|	|	|
8+20	0.4923	0.90	|Q V	|	|	|	|
8+25	0.4985	0.91	|Q V	|	|	|	|
8+30	0.5048	0.91	|Q V	|	|	|	|
8+35	0.5111	0.92	|Q V	|	|	|	|
8+40	0.5175	0.92	|Q V	|	|	|	|
8+45	0.5239	0.93	|Q V	|	|	|	|
8+50	0.5304	0.94	|Q V	|	|	|	|
8+55	0.5368	0.94	|Q V	|	|	|	|
9+ 0	0.5434	0.95	|Q V	|	|	|	|
9+ 5	0.5499	0.95	|Q V	|	|	|	|
9+10	0.5566	0.96	|Q V	|	|	|	|
9+15	0.5632	0.97	|Q V	|	|	|	|
9+20	0.5699	0.97	|Q V	|	|	|	|
9+25	0.5767	0.98	|Q V	|	|	|	|
9+30	0.5835	0.99	|Q V	|	|	|	|
9+35	0.5903	0.99	|Q V	|	|	|	|
9+40	0.5972	1.00	|Q V	|	|	|	|
9+45	0.6041	1.01	|Q V	|	|	|	|
9+50	0.6111	1.02	|Q V	|	|	|	|
9+55	0.6182	1.02	|Q V	|	|	|	|
10+ 0	0.6253	1.03	|Q V	|	|	|	|
10+ 5	0.6324	1.04	|Q V	|	|	|	|
10+10	0.6396	1.05	|Q V	|	|	|	|
10+15	0.6469	1.05	|Q V	|	|	|	|
10+20	0.6542	1.06	|Q V	|	|	|	|
10+25	0.6616	1.07	|Q V	|	|	|	|
10+30	0.6690	1.08	|Q V	|	|	|	|
10+35	0.6765	1.09	|Q V	|	|	|	|
10+40	0.6841	1.10	|Q V	|	|	|	|
10+45	0.6917	1.11	|Q V	|	|	|	|
10+50	0.6994	1.12	|Q V	|	|	|	|
10+55	0.7071	1.13	|Q V	|	|	|	|
11+ 0	0.7150	1.14	|Q V	|	|	|	|
11+ 5	0.7229	1.15	|Q V	|	|	|	|
11+10	0.7308	1.16	|Q V	|	|	|	|
11+15	0.7389	1.17	|Q V	|	|	|	|
11+20	0.7470	1.18	|Q V	|	|	|	|
11+25	0.7552	1.19	|Q V	|	|	|	|
11+30	0.7635	1.20	|Q V	|	|	|	|
11+35	0.7718	1.21	|Q V	|	|	|	|
11+40	0.7803	1.23	|Q V	|	|	|	|
11+45	0.7888	1.24	|Q V	|	|	|	|



16+35	2.1199	3.72	| Q	|	|	V |
16+40	2.1420	3.21	| Q	|	|	V |
16+45	2.1623	2.95	| Q	|	|	V |
16+50	2.1811	2.73	| Q	|	|	|V |
16+55	2.1988	2.56	| Q	|	|	|V |
17+ 0	2.2154	2.42	| Q	|	|	|V |
17+ 5	2.2312	2.29	| Q	|	|	|V |
17+10	2.2462	2.19	| Q	|	|	|V |
17+15	2.2606	2.09	| Q	|	|	| V |
17+20	2.2745	2.01	| Q	|	|	| V |
17+25	2.2878	1.94	| Q	|	|	| V |
17+30	2.3007	1.87	| Q	|	|	| V |
17+35	2.3132	1.81	| Q	|	|	| V |
17+40	2.3253	1.76	| Q	|	|	| V |
17+45	2.3371	1.71	| Q	|	|	| V |
17+50	2.3486	1.66	| Q	|	|	| V |
17+55	2.3597	1.62	| Q	|	|	| V |
18+ 0	2.3706	1.58	| Q	|	|	| V |
18+ 5	2.3812	1.54	| Q	|	|	| V |
18+10	2.3912	1.45	|Q	|	|	| V |
18+15	2.4005	1.35	|Q	|	|	| V |
18+20	2.4094	1.29	|Q	|	|	| V |
18+25	2.4181	1.26	|Q	|	|	| V |
18+30	2.4266	1.23	|Q	|	|	| V |
18+35	2.4349	1.20	|Q	|	|	| V |
18+40	2.4430	1.18	|Q	|	|	| V |
18+45	2.4510	1.16	|Q	|	|	| V |
18+50	2.4588	1.14	|Q	|	|	| V |
18+55	2.4665	1.12	|Q	|	|	| V |
19+ 0	2.4741	1.10	|Q	|	|	| V |
19+ 5	2.4815	1.08	|Q	|	|	| V |
19+10	2.4889	1.06	|Q	|	|	| V |
19+15	2.4961	1.05	|Q	|	|	| V |
19+20	2.5032	1.03	|Q	|	|	| V |
19+25	2.5102	1.02	|Q	|	|	| V |
19+30	2.5171	1.00	|Q	|	|	| V |
19+35	2.5239	0.99	|Q	|	|	| V |
19+40	2.5306	0.97	|Q	|	|	| V |
19+45	2.5372	0.96	|Q	|	|	| V |
19+50	2.5438	0.95	|Q	|	|	| V |
19+55	2.5502	0.94	|Q	|	|	| V |
20+ 0	2.5566	0.93	|Q	|	|	| V |
20+ 5	2.5629	0.91	|Q	|	|	| V |
20+10	2.5691	0.90	|Q	|	|	| V |
20+15	2.5752	0.89	|Q	|	|	| V |
20+20	2.5813	0.88	|Q	|	|	| V |
20+25	2.5873	0.87	|Q	|	|	| V |
20+30	2.5933	0.86	|Q	|	|	| V |
20+35	2.5992	0.85	|Q	|	|	| V |
20+40	2.6050	0.84	|Q	|	|	| V |
20+45	2.6107	0.84	|Q	|	|	| V |
20+50	2.6164	0.83	|Q	|	|	| V |
20+55	2.6221	0.82	|Q	|	|	| V |
21+ 0	2.6277	0.81	|Q	|	|	| V |
21+ 5	2.6332	0.80	|Q	|	|	| V |
21+10	2.6387	0.80	|Q	|	|	| V |
21+15	2.6441	0.79	|Q	|	|	| V |

21+20	2.6495	0.78	|Q	|	|	|	V |
21+25	2.6548	0.77	|Q	|	|	|	V |
21+30	2.6601	0.77	|Q	|	|	|	V |
21+35	2.6653	0.76	|Q	|	|	|	V |
21+40	2.6705	0.75	|Q	|	|	|	V |
21+45	2.6757	0.75	Q	|	|	|	V |
21+50	2.6808	0.74	Q	|	|	|	V |
21+55	2.6858	0.74	Q	|	|	|	V |
22+ 0	2.6909	0.73	Q	|	|	|	V |
22+ 5	2.6958	0.72	Q	|	|	|	V |
22+10	2.7008	0.72	Q	|	|	|	V |
22+15	2.7057	0.71	Q	|	|	|	V |
22+20	2.7106	0.71	Q	|	|	|	V |
22+25	2.7154	0.70	Q	|	|	|	V |
22+30	2.7202	0.70	Q	|	|	|	V |
22+35	2.7249	0.69	Q	|	|	|	V |
22+40	2.7297	0.69	Q	|	|	|	V |
22+45	2.7344	0.68	Q	|	|	|	V |
22+50	2.7390	0.68	Q	|	|	|	V|
22+55	2.7436	0.67	Q	|	|	|	V|
23+ 0	2.7482	0.67	Q	|	|	|	V|
23+ 5	2.7528	0.66	Q	|	|	|	V|
23+10	2.7573	0.66	Q	|	|	|	V|
23+15	2.7618	0.65	Q	|	|	|	V|
23+20	2.7663	0.65	Q	|	|	|	V|
23+25	2.7707	0.64	Q	|	|	|	V|
23+30	2.7752	0.64	Q	|	|	|	V|
23+35	2.7795	0.64	Q	|	|	|	V|
23+40	2.7839	0.63	Q	|	|	|	V|
23+45	2.7882	0.63	Q	|	|	|	V|
23+50	2.7925	0.62	Q	|	|	|	V|
23+55	2.7968	0.62	Q	|	|	|	V|
24+ 0	2.8011	0.62	Q	|	|	|	V|
24+ 5	2.8050	0.58	Q	|	|	|	V|
24+10	2.8077	0.39	Q	|	|	|	V|
24+15	2.8087	0.14	Q	|	|	|	V|
24+20	2.8089	0.04	Q	|	|	|	V|
24+25	2.8090	0.01	Q	|	|	|	V|
24+30	2.8090	0.00	Q	|	|	|	V|

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 05/04/21

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

Program License Serial Number 6405

BLOOMINGTON COMMERCE CENTER - SITE 4
PROPOSED CONDITION
10 YEAR, 24 HOUR STORM EVENT ANALYSIS

Storm Event Year = 10

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 10		
9.56	1	0.82
Rainfall data for year 10		
9.56	6	2.04
Rainfall data for year 10		
9.56	24	3.76

++

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

SCS curve	SCS curve	Area	Area	Fp(Fig C6)	Ap	Fm

No.(AMCII)	NO.(AMC 2)	(Ac.)	Fraction	(In/Hr)	(dec.)	(In/Hr)
32.0	32.0	9.56	1.000	0.978	0.200	0.196

Area-averaged adjusted loss rate Fm (In/Hr) = 0.196

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

Area (Ac.)	Area Fract	SCS CN (AMC2)	SCS CN (AMC2)	S	Pervious Yield Fr
1.91	0.200	32.0	32.0	18.80	0.000
7.65	0.800	98.0	98.0	0.20	0.938

Area-averaged catchment yield fraction, Y = 0.750
Area-averaged low loss fraction, Yb = 0.250
User entry of time of concentration = 0.186 (hours)
++
Watershed area = 9.56(Ac.)
Catchment Lag time = 0.149 hours
Unit interval = 5.000 minutes
Unit interval percentage of lag time = 56.0036
Hydrograph baseflow = 0.00(CFS)
Average maximum watershed loss rate(Fm) = 0.196(In/Hr)
Average low loss rate fraction (Yb) = 0.250 (decimal)
VALLEY DEVELOPED S-Graph Selected
Computed peak 5-minute rainfall = 0.303(In)
Computed peak 30-minute rainfall = 0.621(In)
Specified peak 1-hour rainfall = 0.819(In)
Computed peak 3-hour rainfall = 1.433(In)
Specified peak 6-hour rainfall = 2.040(In)
Specified peak 24-hour rainfall = 3.760(In)

Rainfall depth area reduction factors:
Using a total area of 9.56(Ac.) (Ref: fig. E-4)

5-minute factor = 1.000 Adjusted rainfall = 0.303(In)
30-minute factor = 1.000 Adjusted rainfall = 0.620(In)
1-hour factor = 1.000 Adjusted rainfall = 0.819(In)
3-hour factor = 1.000 Adjusted rainfall = 1.433(In)
6-hour factor = 1.000 Adjusted rainfall = 2.040(In)
24-hour factor = 1.000 Adjusted rainfall = 3.760(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 = 115.62 (CFS))		
1	5.701	6.591
2	36.739	35.886
3	77.428	47.043
4	93.740	18.860
5	98.246	5.210
6	99.344	1.270
7	100.000	0.758

Peak Unit Number	Adjusted mass rainfall (In)	Unit rainfall (In)
1	0.3030	0.3030
2	0.3998	0.0968
3	0.4702	0.0704
4	0.5275	0.0573
5	0.5768	0.0493
6	0.6204	0.0436
7	0.6599	0.0395
8	0.6961	0.0362
9	0.7296	0.0336
10	0.7611	0.0314
11	0.7906	0.0296
12	0.8186	0.0280
13	0.8527	0.0341
14	0.8855	0.0328
15	0.9172	0.0317
16	0.9479	0.0307
17	0.9777	0.0297
18	1.0066	0.0289
19	1.0347	0.0281
20	1.0621	0.0274
21	1.0888	0.0267
22	1.1150	0.0261
23	1.1405	0.0256
24	1.1655	0.0250
25	1.1900	0.0245
26	1.2141	0.0240
27	1.2376	0.0236
28	1.2608	0.0232
29	1.2836	0.0228
30	1.3059	0.0224
31	1.3279	0.0220
32	1.3496	0.0217
33	1.3709	0.0213
34	1.3920	0.0210
35	1.4127	0.0207
36	1.4331	0.0204
37	1.4532	0.0201
38	1.4731	0.0199
39	1.4927	0.0196
40	1.5121	0.0194
41	1.5313	0.0191
42	1.5502	0.0189
43	1.5689	0.0187
44	1.5873	0.0185
45	1.6056	0.0183
46	1.6237	0.0181
47	1.6416	0.0179
48	1.6593	0.0177
49	1.6768	0.0175
50	1.6941	0.0173
51	1.7113	0.0172
52	1.7283	0.0170
53	1.7452	0.0169
54	1.7619	0.0167

55	1.7784	0.0165
56	1.7948	0.0164
57	1.8111	0.0163
58	1.8272	0.0161
59	1.8432	0.0160
60	1.8590	0.0158
61	1.8747	0.0157
62	1.8903	0.0156
63	1.9058	0.0155
64	1.9211	0.0153
65	1.9364	0.0152
66	1.9515	0.0151
67	1.9665	0.0150
68	1.9814	0.0149
69	1.9962	0.0148
70	2.0109	0.0147
71	2.0255	0.0146
72	2.0399	0.0145
73	2.0524	0.0124
74	2.0647	0.0124
75	2.0770	0.0123
76	2.0892	0.0122
77	2.1013	0.0121
78	2.1132	0.0120
79	2.1252	0.0119
80	2.1370	0.0118
81	2.1487	0.0117
82	2.1604	0.0117
83	2.1720	0.0116
84	2.1835	0.0115
85	2.1949	0.0114
86	2.2062	0.0114
87	2.2175	0.0113
88	2.2287	0.0112
89	2.2399	0.0111
90	2.2509	0.0111
91	2.2619	0.0110
92	2.2729	0.0109
93	2.2837	0.0109
94	2.2945	0.0108
95	2.3053	0.0107
96	2.3159	0.0107
97	2.3265	0.0106
98	2.3371	0.0105
99	2.3476	0.0105
100	2.3580	0.0104
101	2.3684	0.0104
102	2.3787	0.0103
103	2.3890	0.0103
104	2.3992	0.0102
105	2.4093	0.0101
106	2.4194	0.0101
107	2.4295	0.0100
108	2.4394	0.0100
109	2.4494	0.0099
110	2.4593	0.0099
111	2.4691	0.0098

112	2.4789	0.0098
113	2.4886	0.0097
114	2.4983	0.0097
115	2.5080	0.0096
116	2.5176	0.0096
117	2.5271	0.0096
118	2.5366	0.0095
119	2.5461	0.0095
120	2.5555	0.0094
121	2.5649	0.0094
122	2.5742	0.0093
123	2.5835	0.0093
124	2.5927	0.0092
125	2.6019	0.0092
126	2.6111	0.0092
127	2.6202	0.0091
128	2.6293	0.0091
129	2.6383	0.0090
130	2.6473	0.0090
131	2.6563	0.0090
132	2.6652	0.0089
133	2.6741	0.0089
134	2.6829	0.0089
135	2.6918	0.0088
136	2.7005	0.0088
137	2.7093	0.0087
138	2.7180	0.0087
139	2.7267	0.0087
140	2.7353	0.0086
141	2.7439	0.0086
142	2.7525	0.0086
143	2.7610	0.0085
144	2.7695	0.0085
145	2.7780	0.0085
146	2.7864	0.0084
147	2.7948	0.0084
148	2.8032	0.0084
149	2.8115	0.0083
150	2.8198	0.0083
151	2.8281	0.0083
152	2.8363	0.0082
153	2.8445	0.0082
154	2.8527	0.0082
155	2.8609	0.0082
156	2.8690	0.0081
157	2.8771	0.0081
158	2.8852	0.0081
159	2.8932	0.0080
160	2.9012	0.0080
161	2.9092	0.0080
162	2.9172	0.0080
163	2.9251	0.0079
164	2.9330	0.0079
165	2.9409	0.0079
166	2.9487	0.0078
167	2.9566	0.0078
168	2.9644	0.0078

169	2.9721	0.0078
170	2.9799	0.0077
171	2.9876	0.0077
172	2.9953	0.0077
173	3.0029	0.0077
174	3.0106	0.0076
175	3.0182	0.0076
176	3.0258	0.0076
177	3.0334	0.0076
178	3.0409	0.0075
179	3.0485	0.0075
180	3.0560	0.0075
181	3.0634	0.0075
182	3.0709	0.0075
183	3.0783	0.0074
184	3.0857	0.0074
185	3.0931	0.0074
186	3.1005	0.0074
187	3.1078	0.0073
188	3.1151	0.0073
189	3.1224	0.0073
190	3.1297	0.0073
191	3.1370	0.0073
192	3.1442	0.0072
193	3.1514	0.0072
194	3.1586	0.0072
195	3.1658	0.0072
196	3.1729	0.0072
197	3.1801	0.0071
198	3.1872	0.0071
199	3.1943	0.0071
200	3.2013	0.0071
201	3.2084	0.0071
202	3.2154	0.0070
203	3.2224	0.0070
204	3.2294	0.0070
205	3.2364	0.0070
206	3.2433	0.0070
207	3.2503	0.0069
208	3.2572	0.0069
209	3.2641	0.0069
210	3.2710	0.0069
211	3.2778	0.0069
212	3.2847	0.0068
213	3.2915	0.0068
214	3.2983	0.0068
215	3.3051	0.0068
216	3.3119	0.0068
217	3.3186	0.0068
218	3.3254	0.0067
219	3.3321	0.0067
220	3.3388	0.0067
221	3.3455	0.0067
222	3.3521	0.0067
223	3.3588	0.0067
224	3.3654	0.0066
225	3.3720	0.0066

226	3.3786	0.0066
227	3.3852	0.0066
228	3.3918	0.0066
229	3.3984	0.0066
230	3.4049	0.0065
231	3.4114	0.0065
232	3.4179	0.0065
233	3.4244	0.0065
234	3.4309	0.0065
235	3.4373	0.0065
236	3.4438	0.0064
237	3.4502	0.0064
238	3.4566	0.0064
239	3.4630	0.0064
240	3.4694	0.0064
241	3.4758	0.0064
242	3.4821	0.0064
243	3.4885	0.0063
244	3.4948	0.0063
245	3.5011	0.0063
246	3.5074	0.0063
247	3.5137	0.0063
248	3.5200	0.0063
249	3.5262	0.0063
250	3.5325	0.0062
251	3.5387	0.0062
252	3.5449	0.0062
253	3.5511	0.0062
254	3.5573	0.0062
255	3.5634	0.0062
256	3.5696	0.0062
257	3.5757	0.0061
258	3.5819	0.0061
259	3.5880	0.0061
260	3.5941	0.0061
261	3.6002	0.0061
262	3.6063	0.0061
263	3.6123	0.0061
264	3.6184	0.0061
265	3.6244	0.0060
266	3.6304	0.0060
267	3.6365	0.0060
268	3.6425	0.0060
269	3.6485	0.0060
270	3.6544	0.0060
271	3.6604	0.0060
272	3.6663	0.0060
273	3.6723	0.0059
274	3.6782	0.0059
275	3.6841	0.0059
276	3.6900	0.0059
277	3.6959	0.0059
278	3.7018	0.0059
279	3.7077	0.0059
280	3.7135	0.0059
281	3.7194	0.0058
282	3.7252	0.0058

283	3.7310	0.0058
284	3.7368	0.0058
285	3.7426	0.0058
286	3.7484	0.0058
287	3.7542	0.0058
288	3.7600	0.0058

Unit Period (number)	Unit Rainfall (In)	Unit Soil-Loss (In)	Effective Rainfall (In)
1	0.0058	0.0014	0.0043
2	0.0058	0.0014	0.0043
3	0.0058	0.0014	0.0043
4	0.0058	0.0015	0.0044
5	0.0058	0.0015	0.0044
6	0.0058	0.0015	0.0044
7	0.0059	0.0015	0.0044
8	0.0059	0.0015	0.0044
9	0.0059	0.0015	0.0044
10	0.0059	0.0015	0.0044
11	0.0059	0.0015	0.0045
12	0.0060	0.0015	0.0045
13	0.0060	0.0015	0.0045
14	0.0060	0.0015	0.0045
15	0.0060	0.0015	0.0045
16	0.0060	0.0015	0.0045
17	0.0061	0.0015	0.0045
18	0.0061	0.0015	0.0045
19	0.0061	0.0015	0.0046
20	0.0061	0.0015	0.0046
21	0.0061	0.0015	0.0046
22	0.0061	0.0015	0.0046
23	0.0062	0.0015	0.0046
24	0.0062	0.0015	0.0046
25	0.0062	0.0016	0.0047
26	0.0062	0.0016	0.0047
27	0.0063	0.0016	0.0047
28	0.0063	0.0016	0.0047
29	0.0063	0.0016	0.0047
30	0.0063	0.0016	0.0047
31	0.0063	0.0016	0.0048
32	0.0064	0.0016	0.0048
33	0.0064	0.0016	0.0048
34	0.0064	0.0016	0.0048
35	0.0064	0.0016	0.0048
36	0.0064	0.0016	0.0048
37	0.0065	0.0016	0.0049
38	0.0065	0.0016	0.0049
39	0.0065	0.0016	0.0049
40	0.0065	0.0016	0.0049
41	0.0066	0.0016	0.0049
42	0.0066	0.0016	0.0049
43	0.0066	0.0017	0.0050
44	0.0066	0.0017	0.0050
45	0.0067	0.0017	0.0050
46	0.0067	0.0017	0.0050

47	0.0067	0.0017	0.0050
48	0.0067	0.0017	0.0051
49	0.0068	0.0017	0.0051
50	0.0068	0.0017	0.0051
51	0.0068	0.0017	0.0051
52	0.0068	0.0017	0.0051
53	0.0069	0.0017	0.0052
54	0.0069	0.0017	0.0052
55	0.0069	0.0017	0.0052
56	0.0070	0.0017	0.0052
57	0.0070	0.0017	0.0052
58	0.0070	0.0018	0.0053
59	0.0071	0.0018	0.0053
60	0.0071	0.0018	0.0053
61	0.0071	0.0018	0.0053
62	0.0071	0.0018	0.0053
63	0.0072	0.0018	0.0054
64	0.0072	0.0018	0.0054
65	0.0072	0.0018	0.0054
66	0.0073	0.0018	0.0054
67	0.0073	0.0018	0.0055
68	0.0073	0.0018	0.0055
69	0.0074	0.0018	0.0055
70	0.0074	0.0018	0.0055
71	0.0074	0.0019	0.0056
72	0.0075	0.0019	0.0056
73	0.0075	0.0019	0.0056
74	0.0075	0.0019	0.0056
75	0.0076	0.0019	0.0057
76	0.0076	0.0019	0.0057
77	0.0076	0.0019	0.0057
78	0.0077	0.0019	0.0058
79	0.0077	0.0019	0.0058
80	0.0077	0.0019	0.0058
81	0.0078	0.0019	0.0058
82	0.0078	0.0020	0.0059
83	0.0079	0.0020	0.0059
84	0.0079	0.0020	0.0059
85	0.0080	0.0020	0.0060
86	0.0080	0.0020	0.0060
87	0.0080	0.0020	0.0060
88	0.0081	0.0020	0.0061
89	0.0081	0.0020	0.0061
90	0.0082	0.0020	0.0061
91	0.0082	0.0021	0.0062
92	0.0082	0.0021	0.0062
93	0.0083	0.0021	0.0062
94	0.0083	0.0021	0.0063
95	0.0084	0.0021	0.0063
96	0.0084	0.0021	0.0063
97	0.0085	0.0021	0.0064
98	0.0085	0.0021	0.0064
99	0.0086	0.0021	0.0065
100	0.0086	0.0022	0.0065
101	0.0087	0.0022	0.0065
102	0.0087	0.0022	0.0066
103	0.0088	0.0022	0.0066

104	0.0089	0.0022	0.0066
105	0.0089	0.0022	0.0067
106	0.0090	0.0022	0.0067
107	0.0090	0.0023	0.0068
108	0.0091	0.0023	0.0068
109	0.0092	0.0023	0.0069
110	0.0092	0.0023	0.0069
111	0.0093	0.0023	0.0070
112	0.0093	0.0023	0.0070
113	0.0094	0.0024	0.0071
114	0.0095	0.0024	0.0071
115	0.0096	0.0024	0.0072
116	0.0096	0.0024	0.0072
117	0.0097	0.0024	0.0073
118	0.0097	0.0024	0.0073
119	0.0098	0.0025	0.0074
120	0.0099	0.0025	0.0074
121	0.0100	0.0025	0.0075
122	0.0100	0.0025	0.0075
123	0.0101	0.0025	0.0076
124	0.0102	0.0025	0.0077
125	0.0103	0.0026	0.0077
126	0.0104	0.0026	0.0078
127	0.0105	0.0026	0.0079
128	0.0105	0.0026	0.0079
129	0.0107	0.0027	0.0080
130	0.0107	0.0027	0.0081
131	0.0109	0.0027	0.0081
132	0.0109	0.0027	0.0082
133	0.0111	0.0028	0.0083
134	0.0111	0.0028	0.0084
135	0.0113	0.0028	0.0085
136	0.0114	0.0028	0.0085
137	0.0115	0.0029	0.0086
138	0.0116	0.0029	0.0087
139	0.0117	0.0029	0.0088
140	0.0118	0.0030	0.0089
141	0.0120	0.0030	0.0090
142	0.0121	0.0030	0.0091
143	0.0123	0.0031	0.0092
144	0.0124	0.0031	0.0093
145	0.0145	0.0036	0.0109
146	0.0146	0.0036	0.0109
147	0.0148	0.0037	0.0111
148	0.0149	0.0037	0.0112
149	0.0151	0.0038	0.0113
150	0.0152	0.0038	0.0114
151	0.0155	0.0039	0.0116
152	0.0156	0.0039	0.0117
153	0.0158	0.0040	0.0119
154	0.0160	0.0040	0.0120
155	0.0163	0.0041	0.0122
156	0.0164	0.0041	0.0123
157	0.0167	0.0042	0.0125
158	0.0169	0.0042	0.0126
159	0.0172	0.0043	0.0129
160	0.0173	0.0043	0.0130

161	0.0177	0.0044	0.0133
162	0.0179	0.0045	0.0134
163	0.0183	0.0046	0.0137
164	0.0185	0.0046	0.0139
165	0.0189	0.0047	0.0142
166	0.0191	0.0048	0.0144
167	0.0196	0.0049	0.0147
168	0.0199	0.0050	0.0149
169	0.0204	0.0051	0.0153
170	0.0207	0.0052	0.0155
171	0.0213	0.0053	0.0160
172	0.0217	0.0054	0.0163
173	0.0224	0.0056	0.0168
174	0.0228	0.0057	0.0171
175	0.0236	0.0059	0.0177
176	0.0240	0.0060	0.0180
177	0.0250	0.0062	0.0188
178	0.0256	0.0064	0.0192
179	0.0267	0.0067	0.0201
180	0.0274	0.0068	0.0206
181	0.0289	0.0072	0.0217
182	0.0297	0.0074	0.0223
183	0.0317	0.0079	0.0238
184	0.0328	0.0082	0.0246
185	0.0280	0.0070	0.0210
186	0.0296	0.0074	0.0222
187	0.0336	0.0084	0.0252
188	0.0362	0.0090	0.0272
189	0.0436	0.0109	0.0327
190	0.0493	0.0123	0.0369
191	0.0704	0.0163	0.0541
192	0.0968	0.0163	0.0805
193	0.3030	0.0163	0.2867
194	0.0573	0.0143	0.0430
195	0.0395	0.0099	0.0296
196	0.0314	0.0078	0.0236
197	0.0341	0.0085	0.0256
198	0.0307	0.0077	0.0230
199	0.0281	0.0070	0.0211
200	0.0261	0.0065	0.0196
201	0.0245	0.0061	0.0184
202	0.0232	0.0058	0.0174
203	0.0220	0.0055	0.0165
204	0.0210	0.0053	0.0158
205	0.0201	0.0050	0.0151
206	0.0194	0.0048	0.0145
207	0.0187	0.0047	0.0140
208	0.0181	0.0045	0.0136
209	0.0175	0.0044	0.0131
210	0.0170	0.0043	0.0128
211	0.0165	0.0041	0.0124
212	0.0161	0.0040	0.0121
213	0.0157	0.0039	0.0118
214	0.0153	0.0038	0.0115
215	0.0150	0.0037	0.0113
216	0.0147	0.0037	0.0110

217	0.0124	0.0031	0.0093
218	0.0122	0.0030	0.0091
219	0.0119	0.0030	0.0089
220	0.0117	0.0029	0.0087
221	0.0114	0.0029	0.0086
222	0.0112	0.0028	0.0084
223	0.0110	0.0027	0.0083
224	0.0108	0.0027	0.0081
225	0.0106	0.0027	0.0080
226	0.0104	0.0026	0.0078
227	0.0103	0.0026	0.0077
228	0.0101	0.0025	0.0076
229	0.0099	0.0025	0.0075
230	0.0098	0.0024	0.0073
231	0.0096	0.0024	0.0072
232	0.0095	0.0024	0.0071
233	0.0094	0.0023	0.0070
234	0.0092	0.0023	0.0069
235	0.0091	0.0023	0.0068
236	0.0090	0.0022	0.0068
237	0.0089	0.0022	0.0067
238	0.0088	0.0022	0.0066
239	0.0087	0.0022	0.0065
240	0.0086	0.0021	0.0064
241	0.0085	0.0021	0.0064
242	0.0084	0.0021	0.0063
243	0.0083	0.0021	0.0062
244	0.0082	0.0020	0.0061
245	0.0081	0.0020	0.0061
246	0.0080	0.0020	0.0060
247	0.0079	0.0020	0.0059
248	0.0078	0.0020	0.0059
249	0.0078	0.0019	0.0058
250	0.0077	0.0019	0.0058
251	0.0076	0.0019	0.0057
252	0.0075	0.0019	0.0057
253	0.0075	0.0019	0.0056
254	0.0074	0.0019	0.0056
255	0.0073	0.0018	0.0055
256	0.0073	0.0018	0.0055
257	0.0072	0.0018	0.0054
258	0.0072	0.0018	0.0054
259	0.0071	0.0018	0.0053
260	0.0070	0.0018	0.0053
261	0.0070	0.0017	0.0052
262	0.0069	0.0017	0.0052
263	0.0069	0.0017	0.0051
264	0.0068	0.0017	0.0051
265	0.0068	0.0017	0.0051
266	0.0067	0.0017	0.0050
267	0.0067	0.0017	0.0050
268	0.0066	0.0016	0.0050
269	0.0066	0.0016	0.0049
270	0.0065	0.0016	0.0049
271	0.0065	0.0016	0.0048
272	0.0064	0.0016	0.0048
273	0.0064	0.0016	0.0048

274	0.0063	0.0016	0.0047
275	0.0063	0.0016	0.0047
276	0.0062	0.0016	0.0047
277	0.0062	0.0015	0.0046
278	0.0062	0.0015	0.0046
279	0.0061	0.0015	0.0046
280	0.0061	0.0015	0.0046
281	0.0060	0.0015	0.0045
282	0.0060	0.0015	0.0045
283	0.0060	0.0015	0.0045
284	0.0059	0.0015	0.0044
285	0.0059	0.0015	0.0044
286	0.0059	0.0015	0.0044
287	0.0058	0.0015	0.0044
288	0.0058	0.0014	0.0043

Total soil rain loss = 0.87(In)
Total effective rainfall = 2.89(In)
Peak flow rate in flood hydrograph = 17.10(CFS)

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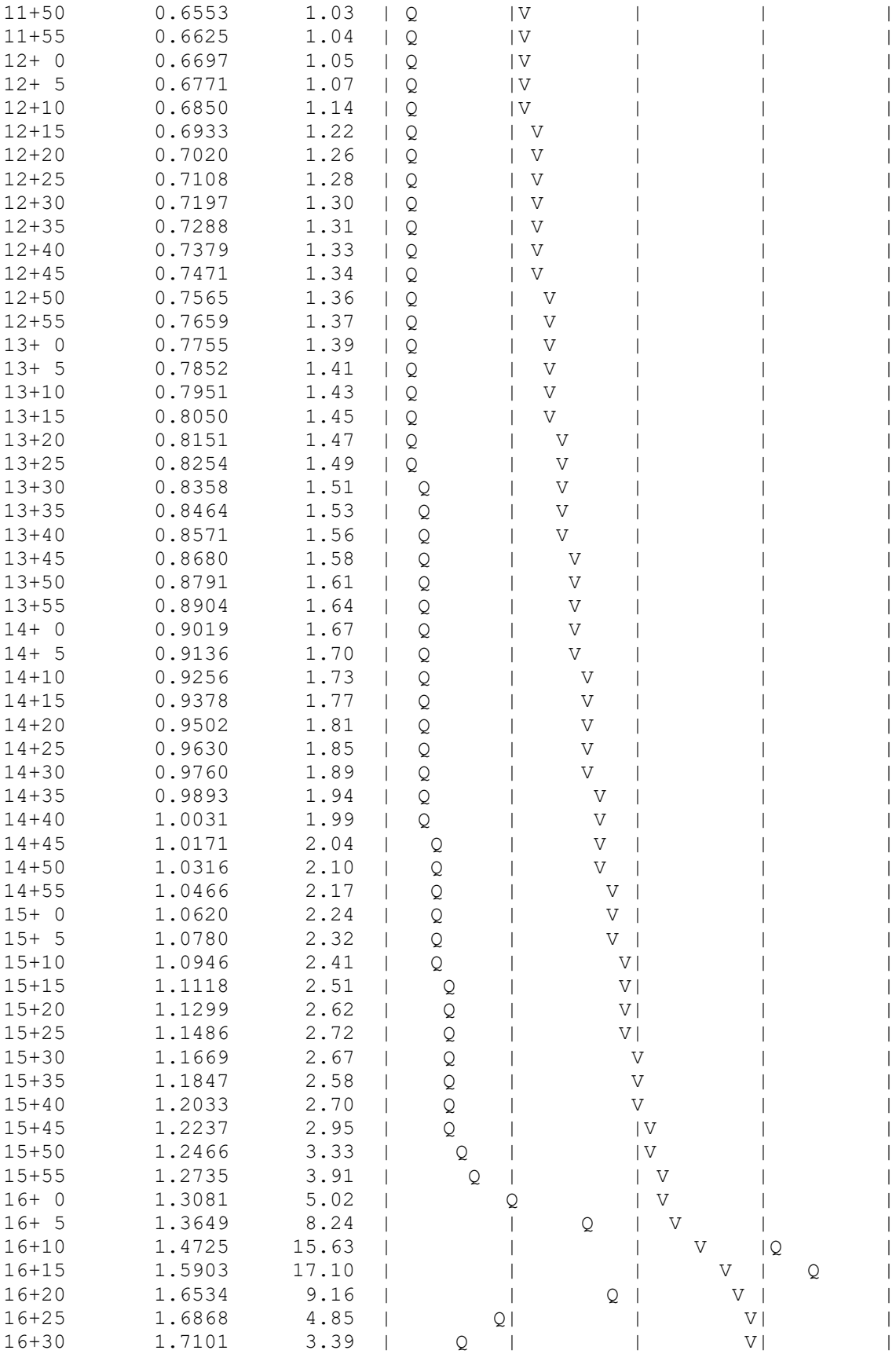
24 - H O U R S T O R M
R u n o f f H y d r o g r a p h

Hydrograph in 5 Minute intervals ((CFS))

Time(h+m)	Volume Ac.Ft	Q(CFS)	0	5.0	10.0	15.0	20.0
0+ 5	0.0002	0.03	Q				
0+10	0.0015	0.18	Q				
0+15	0.0041	0.39	Q				
0+20	0.0074	0.47	Q				
0+25	0.0108	0.49	Q				
0+30	0.0142	0.50	VQ				
0+35	0.0177	0.51	VQ				
0+40	0.0212	0.51	VQ				
0+45	0.0247	0.51	VQ				
0+50	0.0282	0.51	VQ				
0+55	0.0317	0.51	VQ				
1+ 0	0.0353	0.51	VQ				
1+ 5	0.0388	0.52	VQ				
1+10	0.0424	0.52	VQ				
1+15	0.0460	0.52	VQ				
1+20	0.0495	0.52	VQ				
1+25	0.0531	0.52	VQ				
1+30	0.0567	0.52	VQ				
1+35	0.0603	0.52	|Q				
1+40	0.0640	0.53	|Q				
1+45	0.0676	0.53	|Q				
1+50	0.0713	0.53	|Q				
1+55	0.0749	0.53	|Q				
2+ 0	0.0786	0.53	|Q				
2+ 5	0.0823	0.54	|Q				
2+10	0.0860	0.54	|Q				
2+15	0.0897	0.54	|Q				

2+20	0.0934	0.54	|Q	|	|	|	|
2+25	0.0971	0.54	|Q	|	|	|	|
2+30	0.1009	0.54	|Q	|	|	|	|
2+35	0.1046	0.55	|Q	|	|	|	|
2+40	0.1084	0.55	|Q	|	|	|	|
2+45	0.1122	0.55	|Q	|	|	|	|
2+50	0.1160	0.55	|QV	|	|	|	|
2+55	0.1198	0.55	|QV	|	|	|	|
3+ 0	0.1236	0.56	|QV	|	|	|	|
3+ 5	0.1275	0.56	|QV	|	|	|	|
3+10	0.1313	0.56	|QV	|	|	|	|
3+15	0.1352	0.56	|QV	|	|	|	|
3+20	0.1391	0.56	|QV	|	|	|	|
3+25	0.1430	0.57	|QV	|	|	|	|
3+30	0.1469	0.57	|QV	|	|	|	|
3+35	0.1508	0.57	|QV	|	|	|	|
3+40	0.1548	0.57	|QV	|	|	|	|
3+45	0.1587	0.57	|QV	|	|	|	|
3+50	0.1627	0.58	|QV	|	|	|	|
3+55	0.1667	0.58	|QV	|	|	|	|
4+ 0	0.1707	0.58	|QV	|	|	|	|
4+ 5	0.1747	0.58	|Q V	|	|	|	|
4+10	0.1787	0.58	|Q V	|	|	|	|
4+15	0.1827	0.59	|Q V	|	|	|	|
4+20	0.1868	0.59	|Q V	|	|	|	|
4+25	0.1909	0.59	|Q V	|	|	|	|
4+30	0.1950	0.59	|Q V	|	|	|	|
4+35	0.1991	0.60	|Q V	|	|	|	|
4+40	0.2032	0.60	|Q V	|	|	|	|
4+45	0.2073	0.60	|Q V	|	|	|	|
4+50	0.2115	0.60	|Q V	|	|	|	|
4+55	0.2157	0.61	|Q V	|	|	|	|
5+ 0	0.2199	0.61	|Q V	|	|	|	|
5+ 5	0.2241	0.61	|Q V	|	|	|	|
5+10	0.2283	0.61	|Q V	|	|	|	|
5+15	0.2326	0.62	|Q V	|	|	|	|
5+20	0.2368	0.62	|Q V	|	|	|	|
5+25	0.2411	0.62	|Q V	|	|	|	|
5+30	0.2454	0.62	|Q V	|	|	|	|
5+35	0.2497	0.63	|Q V	|	|	|	|
5+40	0.2541	0.63	|Q V	|	|	|	|
5+45	0.2584	0.63	|Q V	|	|	|	|
5+50	0.2628	0.64	|Q V	|	|	|	|
5+55	0.2672	0.64	|Q V	|	|	|	|
6+ 0	0.2716	0.64	|Q V	|	|	|	|
6+ 5	0.2761	0.64	|Q V	|	|	|	|
6+10	0.2805	0.65	|Q V	|	|	|	|
6+15	0.2850	0.65	|Q V	|	|	|	|
6+20	0.2895	0.65	|Q V	|	|	|	|
6+25	0.2940	0.66	|Q V	|	|	|	|
6+30	0.2986	0.66	|Q V	|	|	|	|
6+35	0.3031	0.66	|Q V	|	|	|	|
6+40	0.3077	0.67	|Q V	|	|	|	|
6+45	0.3123	0.67	|Q V	|	|	|	|
6+50	0.3169	0.67	|Q V	|	|	|	|
6+55	0.3216	0.68	|Q V	|	|	|	|
7+ 0	0.3263	0.68	|Q V	|	|	|	|

7+ 5	0.3310	0.68	|Q V |	|	|	|
7+10	0.3357	0.69	|Q V |	|	|	|
7+15	0.3405	0.69	|Q V |	|	|	|
7+20	0.3452	0.69	|Q V |	|	|	|
7+25	0.3500	0.70	|Q V |	|	|	|
7+30	0.3549	0.70	|Q V |	|	|	|
7+35	0.3597	0.70	|Q V |	|	|	|
7+40	0.3646	0.71	|Q V |	|	|	|
7+45	0.3695	0.71	|Q V |	|	|	|
7+50	0.3744	0.72	|Q V |	|	|	|
7+55	0.3794	0.72	|Q V |	|	|	|
8+ 0	0.3844	0.72	|Q V |	|	|	|
8+ 5	0.3894	0.73	|Q V |	|	|	|
8+10	0.3945	0.73	|Q V |	|	|	|
8+15	0.3995	0.74	|Q V |	|	|	|
8+20	0.4046	0.74	|Q V |	|	|	|
8+25	0.4098	0.75	|Q V |	|	|	|
8+30	0.4149	0.75	|Q V |	|	|	|
8+35	0.4201	0.75	|Q V |	|	|	|
8+40	0.4254	0.76	|Q V |	|	|	|
8+45	0.4306	0.76	|Q V |	|	|	|
8+50	0.4359	0.77	|Q V |	|	|	|
8+55	0.4413	0.77	|Q V |	|	|	|
9+ 0	0.4466	0.78	|Q V |	|	|	|
9+ 5	0.4520	0.78	|Q V |	|	|	|
9+10	0.4575	0.79	|Q V |	|	|	|
9+15	0.4629	0.79	|Q V |	|	|	|
9+20	0.4684	0.80	|Q V |	|	|	|
9+25	0.4740	0.81	|Q V |	|	|	|
9+30	0.4796	0.81	|Q V |	|	|	|
9+35	0.4852	0.82	|Q V |	|	|	|
9+40	0.4908	0.82	|Q V |	|	|	|
9+45	0.4965	0.83	|Q V |	|	|	|
9+50	0.5023	0.83	|Q V |	|	|	|
9+55	0.5081	0.84	|Q V |	|	|	|
10+ 0	0.5139	0.85	|Q V |	|	|	|
10+ 5	0.5198	0.85	|Q V|	|	|	|
10+10	0.5257	0.86	|Q V|	|	|	|
10+15	0.5317	0.87	|Q V|	|	|	|
10+20	0.5377	0.87	|Q V|	|	|	|
10+25	0.5437	0.88	|Q V|	|	|	|
10+30	0.5498	0.89	|Q V|	|	|	|
10+35	0.5560	0.89	|Q V|	|	|	|
10+40	0.5622	0.90	|Q V|	|	|	|
10+45	0.5685	0.91	|Q V|	|	|	|
10+50	0.5748	0.92	|Q V|	|	|	|
10+55	0.5812	0.93	|Q V |	|	|	|
11+ 0	0.5876	0.93	|Q V |	|	|	|
11+ 5	0.5941	0.94	|Q V |	|	|	|
11+10	0.6006	0.95	|Q V |	|	|	|
11+15	0.6072	0.96	|Q V |	|	|	|
11+20	0.6139	0.97	|Q V |	|	|	|
11+25	0.6206	0.98	|Q V |	|	|	|
11+30	0.6274	0.99	|Q V |	|	|	|
11+35	0.6343	1.00	|Q |V |	|	|	|
11+40	0.6412	1.01	| Q |V |	|	|	|
11+45	0.6483	1.02	| Q |V |	|	|	|



16+35	1.7311	3.04	| Q |	|	|	V |
16+40	1.7493	2.64	| Q |	|	|	V |
16+45	1.7661	2.44	| Q |	|	|	V |
16+50	1.7816	2.26	| Q |	|	|	V |
16+55	1.7963	2.13	| Q |	|	|	|V |
17+ 0	1.8101	2.01	| Q |	|	|	|V |
17+ 5	1.8232	1.91	| Q |	|	|	|V |
17+10	1.8358	1.82	| Q |	|	|	|V |
17+15	1.8478	1.74	| Q |	|	|	| V |
17+20	1.8593	1.68	| Q |	|	|	| V |
17+25	1.8705	1.62	| Q |	|	|	| V |
17+30	1.8813	1.56	| Q |	|	|	| V |
17+35	1.8917	1.52	| Q |	|	|	| V |
17+40	1.9018	1.47	| Q |	|	|	| V |
17+45	1.9117	1.43	| Q |	|	|	| V |
17+50	1.9213	1.40	| Q |	|	|	| V |
17+55	1.9307	1.36	| Q |	|	|	| V |
18+ 0	1.9398	1.33	| Q |	|	|	| V |
18+ 5	1.9487	1.29	| Q |	|	|	| V |
18+10	1.9571	1.21	| Q |	|	|	| V |
18+15	1.9647	1.12	| Q |	|	|	| V |
18+20	1.9721	1.06	| Q |	|	|	| V |
18+25	1.9792	1.03	| Q |	|	|	| V |
18+30	1.9862	1.01	| Q |	|	|	| V |
18+35	1.9930	0.99	|Q |	|	|	| V |
18+40	1.9997	0.97	|Q |	|	|	| V |
18+45	2.0062	0.95	|Q |	|	|	| V |
18+50	2.0127	0.94	|Q |	|	|	| V |
18+55	2.0190	0.92	|Q |	|	|	| V |
19+ 0	2.0252	0.90	|Q |	|	|	| V |
19+ 5	2.0313	0.89	|Q |	|	|	| V |
19+10	2.0373	0.87	|Q |	|	|	| V |
19+15	2.0433	0.86	|Q |	|	|	| V |
19+20	2.0491	0.85	|Q |	|	|	| V |
19+25	2.0549	0.84	|Q |	|	|	| V |
19+30	2.0605	0.82	|Q |	|	|	| V |
19+35	2.0661	0.81	|Q |	|	|	| V |
19+40	2.0716	0.80	|Q |	|	|	| V |
19+45	2.0771	0.79	|Q |	|	|	| V |
19+50	2.0824	0.78	|Q |	|	|	| V |
19+55	2.0877	0.77	|Q |	|	|	| V |
20+ 0	2.0930	0.76	|Q |	|	|	| V |
20+ 5	2.0982	0.75	|Q |	|	|	| V |
20+10	2.1033	0.74	|Q |	|	|	| V |
20+15	2.1083	0.73	|Q |	|	|	| V |
20+20	2.1133	0.73	|Q |	|	|	| V |
20+25	2.1183	0.72	|Q |	|	|	| V |
20+30	2.1231	0.71	|Q |	|	|	| V |
20+35	2.1280	0.70	|Q |	|	|	| V |
20+40	2.1327	0.69	|Q |	|	|	| V |
20+45	2.1375	0.69	|Q |	|	|	| V |
20+50	2.1422	0.68	|Q |	|	|	| V |
20+55	2.1468	0.67	|Q |	|	|	| V |
21+ 0	2.1514	0.67	|Q |	|	|	| V |
21+ 5	2.1559	0.66	|Q |	|	|	| V |
21+10	2.1604	0.65	|Q |	|	|	| V |
21+15	2.1649	0.65	|Q |	|	|	| V |

21+20	2.1693	0.64	|Q	|	|	|	V |
21+25	2.1737	0.64	|Q	|	|	|	V |
21+30	2.1781	0.63	|Q	|	|	|	V |
21+35	2.1824	0.63	|Q	|	|	|	V |
21+40	2.1866	0.62	|Q	|	|	|	V |
21+45	2.1909	0.61	|Q	|	|	|	V |
21+50	2.1951	0.61	|Q	|	|	|	V |
21+55	2.1992	0.60	|Q	|	|	|	V |
22+ 0	2.2033	0.60	|Q	|	|	|	V |
22+ 5	2.2074	0.59	|Q	|	|	|	V |
22+10	2.2115	0.59	|Q	|	|	|	V |
22+15	2.2155	0.59	|Q	|	|	|	V |
22+20	2.2195	0.58	|Q	|	|	|	V |
22+25	2.2235	0.58	|Q	|	|	|	V |
22+30	2.2274	0.57	|Q	|	|	|	V |
22+35	2.2314	0.57	|Q	|	|	|	V |
22+40	2.2352	0.56	|Q	|	|	|	V |
22+45	2.2391	0.56	|Q	|	|	|	V |
22+50	2.2429	0.56	|Q	|	|	|	V |
22+55	2.2467	0.55	|Q	|	|	|	V|
23+ 0	2.2505	0.55	|Q	|	|	|	V|
23+ 5	2.2542	0.54	|Q	|	|	|	V|
23+10	2.2580	0.54	|Q	|	|	|	V|
23+15	2.2617	0.54	|Q	|	|	|	V|
23+20	2.2653	0.53	|Q	|	|	|	V|
23+25	2.2690	0.53	|Q	|	|	|	V|
23+30	2.2726	0.53	|Q	|	|	|	V|
23+35	2.2762	0.52	|Q	|	|	|	V|
23+40	2.2798	0.52	|Q	|	|	|	V|
23+45	2.2834	0.52	|Q	|	|	|	V|
23+50	2.2869	0.51	|Q	|	|	|	V|
23+55	2.2904	0.51	|Q	|	|	|	V|
24+ 0	2.2939	0.51	|Q	|	|	|	V|
24+ 5	2.2972	0.48	Q	|	|	|	V|
24+10	2.2994	0.32	Q	|	|	|	V|
24+15	2.3002	0.11	Q	|	|	|	V|
24+20	2.3004	0.03	Q	|	|	|	V|
24+25	2.3005	0.01	Q	|	|	|	V|
24+30	2.3005	0.00	Q	|	|	|	V

APPENDIX D

Hydraulic Calculations

D.1: STREET CAPAPCITY CALCULATIONS

D.2: INLET CALCULATIONS

D.3: PIPE HYDRAULICS CALCULATIONS

D.4: OUTLET CONTROL CALCULATIONS

Hydraulic Analysis Report

Project Data

Project Title: Existing Street 100 Year Storm Analysis

Designer: DJV

Project Date: Thursday, March 25, 2021

Project Units: U.S. Customary Units

Notes:

Channel Analysis: Channel Analysis

Notes:

Input Parameters

Channel Type: Custom Cross Section

Cross Section Data

Elevation (ft)	Elevation (ft)	Manning's n
-30.00	0.71	0.0300
-14.70	0.40	0.0200
-13.50	0.10	0.0200
-13.50	0.00	0.0200
0.00	0.27	0.0200
13.50	0.00	0.0200
13.50	0.10	0.0200
14.70	0.40	0.0300
30.00	0.71	-----

Longitudinal Slope: 0.0050 ft/ft

Flow: 199.9000 cfs

Result Parameters

Depth: 1.1490 ft

Area of Flow: 47.7722 ft^2

Wetted Perimeter: 61.1713 ft

Hydraulic Radius: 0.7810 ft

Average Velocity: 4.1844 ft/s

Top Width: 60.0000 ft

Froude Number: 0.8264

Critical Depth: 1.0539 ft

Critical Velocity: 4.7516 ft/s

Critical Slope: 0.0073 ft/ft

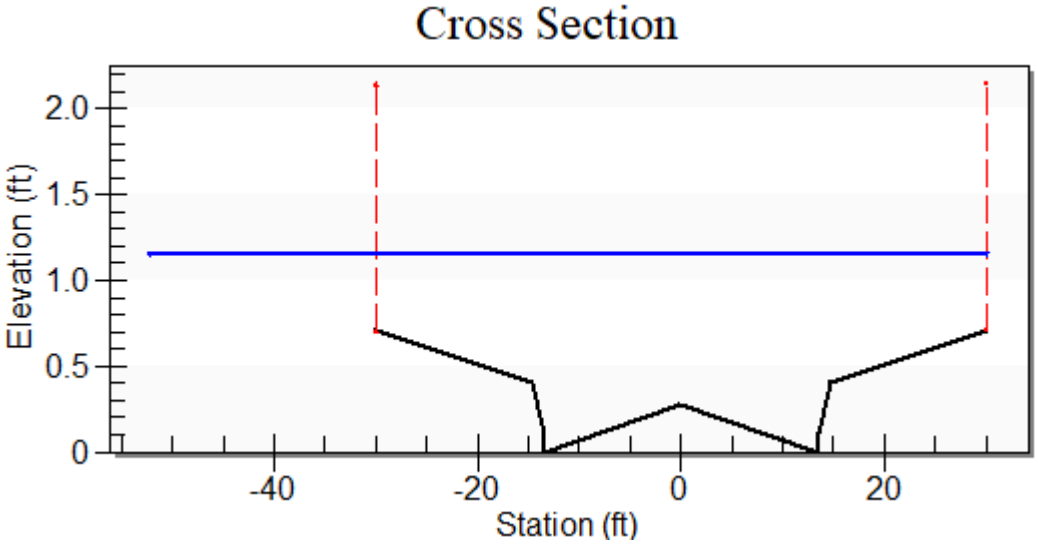
Critical Top Width: 60.00 ft

Calculated Max Shear Stress: 0.3585 lb/ft^2

Calculated Avg Shear Stress: 0.2437 lb/ft^2

Composite Manning's n Equation: Lotter method

Manning's n: 0.0213



Hydraulic Analysis Report

Project Data

Project Title: Proposed Street 100 Year Storm Analysis – No Catch Basins

Designer: DJV

Project Date: Thursday, March 25, 2021

Project Units: U.S. Customary Units

Notes:

Channel Analysis: Channel Analysis

Notes:

Input Parameters

Channel Type: Custom Cross Section

Cross Section Data

Elevation (ft)	Elevation (ft)	Manning's n
-33.00	0.89	0.0150
-22.00	0.67	0.0150
-21.83	0.00	0.0150
-20.50	0.13	0.0150
0.00	0.54	0.0200
13.50	0.27	0.0200
13.50	0.37	0.0200
14.70	0.77	0.0200
30.00	1.08	-----

Longitudinal Slope: 0.0050 ft/ft

Flow: 219.5900 cfs

Result Parameters

Depth: 1.2626 ft

Area of Flow: 43.7357 ft^2

Wetted Perimeter: 64.2634 ft

Hydraulic Radius: 0.6806 ft

Average Velocity: 5.0208 ft/s

Top Width: 63.0000 ft

Froude Number: 1.0619

Critical Depth: 1.2910 ft

Critical Velocity: 4.8237 ft/s

Critical Slope: 0.0044 ft/ft

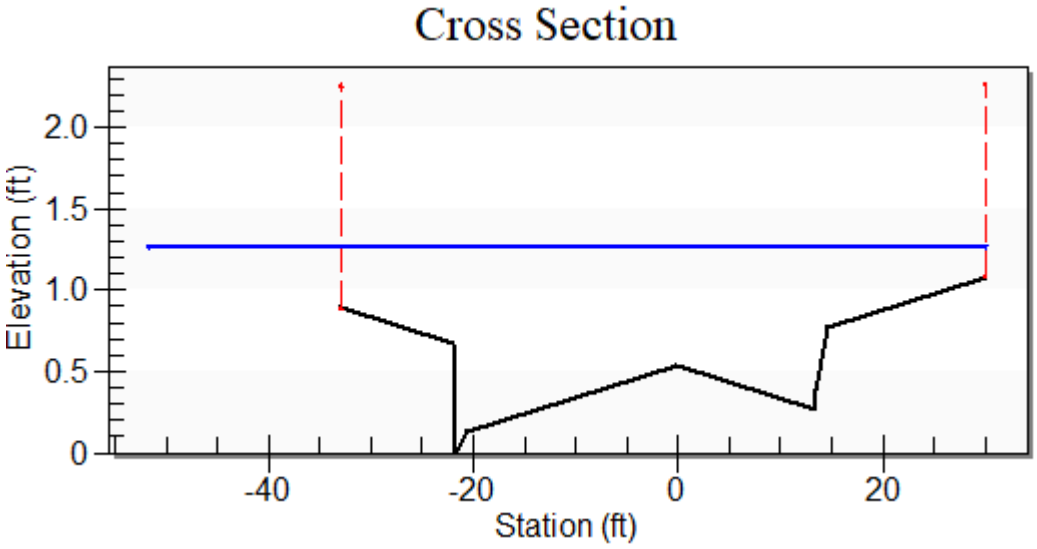
Critical Top Width: 63.00 ft

Calculated Max Shear Stress: 0.3939 lb/ft^2

Calculated Avg Shear Stress: 0.2123 lb/ft^2

Composite Manning's n Equation: Lotter method

Manning's n: 0.0162



Hydraulic Analysis Report

Project Data

Project Title: Proposed Street 100 Year Storm Analysis – W/ Catch Basins

Designer: DJV

Project Date: Thursday, March 25, 2021

Project Units: U.S. Customary Units

Notes:

Channel Analysis: Channel Analysis

Notes:

Input Parameters

Channel Type: Custom Cross Section

Cross Section Data

Elevation (ft)	Elevation (ft)	Manning's n
-33.00	0.89	0.0150
-22.00	0.67	0.0150
-21.83	0.00	0.0150
-20.50	0.13	0.0150
0.00	0.54	0.0200
13.50	0.27	0.0200
13.50	0.37	0.0200
14.70	0.77	0.0200
30.00	1.08	-----

Longitudinal Slope: 0.0050 ft/ft

Flow: 60.8400 cfs

Result Parameters

Depth: 0.8314 ft

Area of Flow: 18.1517 ft^2

Wetted Perimeter: 48.5445 ft

Hydraulic Radius: 0.3739 ft

Average Velocity: 3.3518 ft/s

Top Width: 47.8434 ft

Froude Number: 0.9590

Critical Depth: 0.8170 ft

Critical Velocity: 3.4821 ft/s

Critical Slope: 0.0055 ft/ft

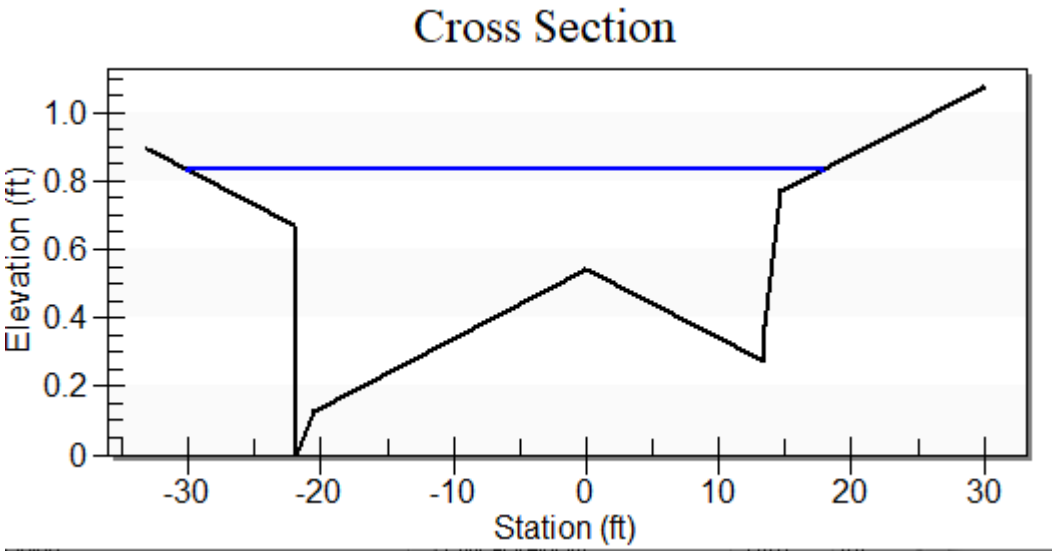
Critical Top Width: 46.40 ft

Calculated Max Shear Stress: 0.2594 lb/ft^2

Calculated Avg Shear Stress: 0.1167 lb/ft^2

Composite Manning's n Equation: Lotter method

Manning's n: 0.0163



Hydraulic Analysis Report

Project Data

Project Title: Existing Street 10 Year Storm Analysis

Designer: DJV

Project Date: Thursday, March 25, 2021

Project Units: U.S. Customary Units

Notes:

Channel Analysis: Channel Analysis

Notes:

Input Parameters

Channel Type: Custom Cross Section

Cross Section Data

Elevation (ft)	Elevation (ft)	Manning's n
-30.00	0.71	0.0300
-14.70	0.40	0.0200
-13.50	0.10	0.0200
-13.50	0.00	0.0200
0.00	0.27	0.0200
13.50	0.00	0.0200
13.50	0.10	0.0200
14.70	0.40	0.0300
30.00	0.71	-----

Longitudinal Slope: 0.0050 ft/ft

Flow: 149.3000 cfs

Result Parameters

Depth: 1.0087 ft

Area of Flow: 39.3564 ft^2

Wetted Perimeter: 60.8908 ft

Hydraulic Radius: 0.6463 ft

Average Velocity: 3.7935 ft/s

Top Width: 60.0000 ft

Froude Number: 0.8254

Critical Depth: 0.9300 ft

Critical Velocity: 4.3111 ft/s

Critical Slope: 0.0073 ft/ft

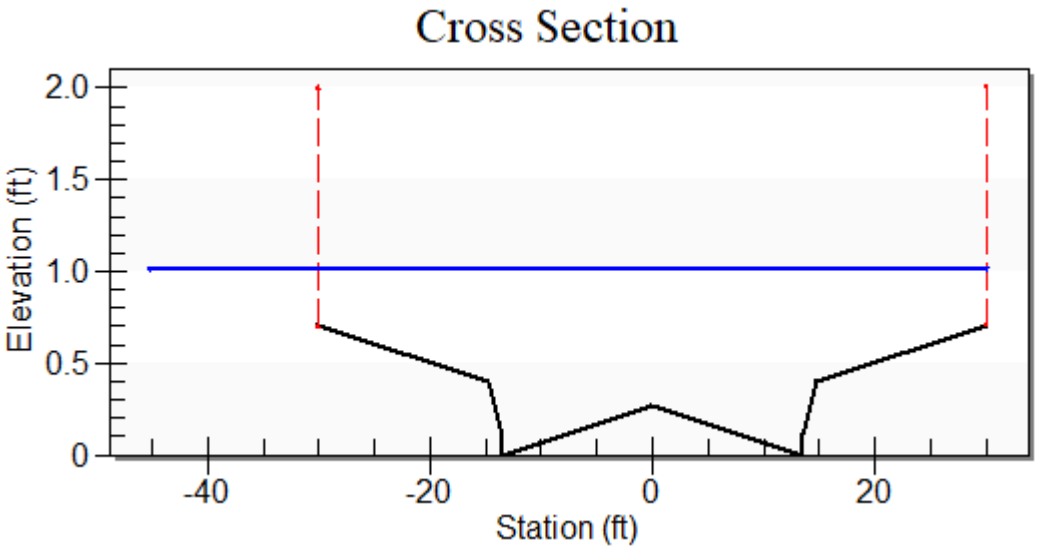
Critical Top Width: 60.00 ft

Calculated Max Shear Stress: 0.3147 lb/ft^2

Calculated Avg Shear Stress: 0.2017 lb/ft^2

Composite Manning's n Equation: Lotter method

Manning's n: 0.0207



Hydraulic Analysis Report

Project Data

Project Title: Proposed Street 10 Year Storm Analysis – No Catch Basins

Designer: DJV

Project Date: Thursday, March 25, 2021

Project Units: U.S. Customary Units

Notes:

Channel Analysis: Channel Analysis

Notes:

Input Parameters

Channel Type: Custom Cross Section

Cross Section Data

Elevation (ft)	Elevation (ft)	Manning's n
-33.00	0.89	0.0150
-22.00	0.67	0.0150
-21.83	0.00	0.0150
-20.50	0.13	0.0150
0.00	0.54	0.0200
13.50	0.27	0.0200
13.50	0.37	0.0200
14.70	0.77	0.0200
30.00	1.08	-----

Longitudinal Slope: 0.0050 ft/ft

Flow: 162.8500 cfs

Result Parameters

Depth: 1.1446 ft

Area of Flow: 36.2977 ft^2

Wetted Perimeter: 64.0273 ft

Hydraulic Radius: 0.5669 ft

Average Velocity: 4.4865 ft/s

Top Width: 63.0000 ft

Froude Number: 1.0416

Critical Depth: 1.1604 ft

Critical Velocity: 4.3662 ft/s

Critical Slope: 0.0046 ft/ft

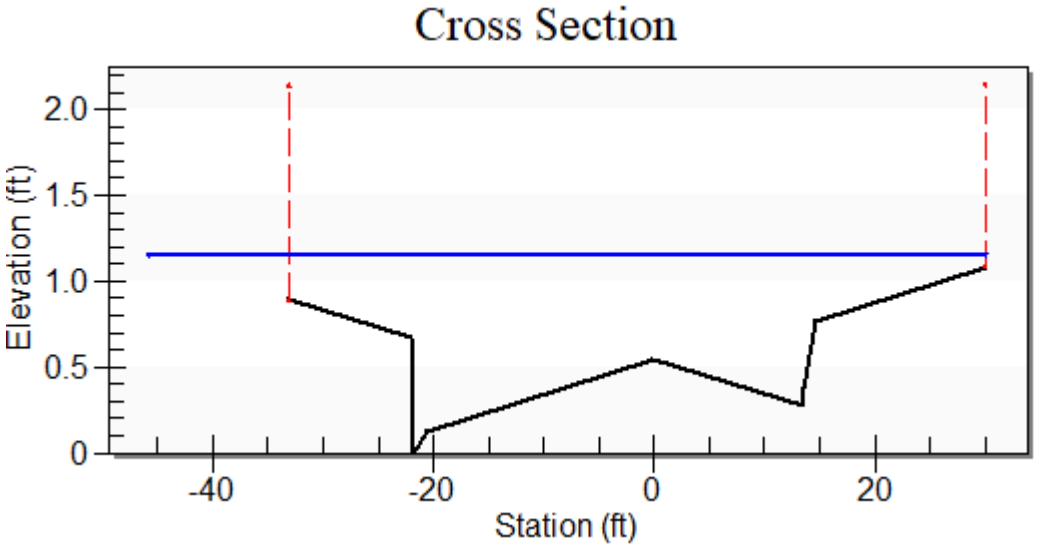
Critical Top Width: 63.00 ft

Calculated Max Shear Stress: 0.3571 lb/ft^2

Calculated Avg Shear Stress: 0.1769 lb/ft^2

Composite Manning's n Equation: Lotter method

Manning's n: 0.0160



Hydraulic Analysis Report

Project Data

Project Title: Proposed Street 10 Year Storm Analysis – W/ Catch Basins

Designer: DJV

Project Date: Thursday, March 25, 2021

Project Units: U.S. Customary Units

Notes:

Channel Analysis: Channel Analysis

Notes:

Input Parameters

Channel Type: Custom Cross Section

Cross Section Data

Elevation (ft)	Elevation (ft)	Manning's n
-33.00	0.89	0.0150
-22.00	0.67	0.0150
-21.83	0.00	0.0150
-20.50	0.13	0.0150
0.00	0.54	0.0200
13.50	0.27	0.0200
13.50	0.37	0.0200
14.70	0.77	0.0200
30.00	1.08	-----

Longitudinal Slope: 0.0050 ft/ft

Flow: 30.7200 cfs

Result Parameters

Depth: 0.6468 ft

Area of Flow: 10.6518 ft^2

Wetted Perimeter: 36.9853 ft

Hydraulic Radius: 0.2880 ft

Average Velocity: 2.8840 ft/s

Top Width: 36.3244 ft

Froude Number: 0.9385

Critical Depth: 0.6345 ft

Critical Velocity: 3.0097 ft/s

Critical Slope: 0.0057 ft/ft

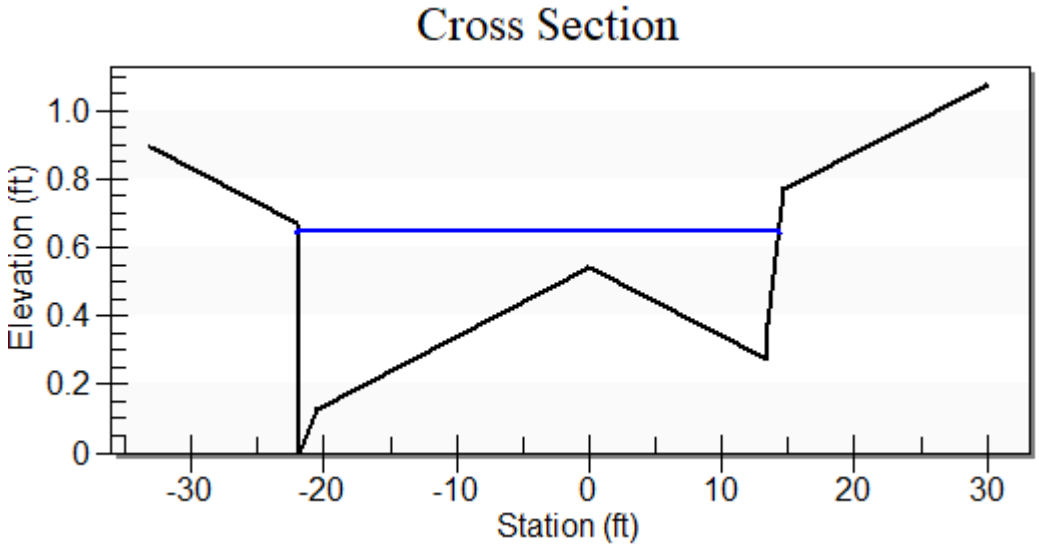
Critical Top Width: 36.28 ft

Calculated Max Shear Stress: 0.2018 lb/ft^2

Calculated Avg Shear Stress: 0.0899 lb/ft^2

Composite Manning's n Equation: Lotter method

Manning's n: 0.0159



Hydraulic Analysis Report

Project Data

Project Title: Laurel – CB#1 Analysis – WLY Curb and Gutter

Designer: DJV

Project Date: Friday, April 9, 2021

Project Units: U.S. Customary Units

Notes:

Curb and Gutter Analysis: WLY CB#1-100

Notes:

Gutter Input Parameters

Longitudinal Slope of Road: 0.0050 ft/ft

Cross-Slope of Pavement: 0.0200 ft/ft

Depressed Gutter Geometry

Cross-Slope of Gutter: 0.0830 ft/ft

Manning's n: 0.0150

Gutter Width: 1.5000 ft

Width of Spread: 50.4663 ft

Gutter Result Parameters

Design Flow: 136.1500 cfs

Gutter Depression: 1.1340 in

Area of Flow: 25.5394 ft^2

Eo (Gutter Flow to Total Flow): 0.0832

Gutter Depth at Curb: 13.2459 in

Inlet Input Parameters

Inlet Location: Inlet on Grade

Inlet Type: Curb Opening

Length of Inlet: 28.0000 ft

Local Depression: 4.0000 in

Inlet Result Parameters

Intercepted Flow: 74.7230 cfs

Bypass Flow: 61.4270 cfs

Efficiency: 0.5488

Curb and Gutter Analysis: WLY CB#1-10

Notes:

Gutter Input Parameters

Longitudinal Slope of Road: 0.0050 ft/ft

Cross-Slope of Pavement: 0.0200 ft/ft

Depressed Gutter Geometry

Cross-Slope of Gutter: 0.0830 ft/ft

Manning's n: 0.0150

Gutter Width: 1.5000 ft

Width of Spread: 45.0878 ft

Gutter Result Parameters

Design Flow: 100.9700 cfs

Gutter Depression: 1.1340 in

Area of Flow: 20.3999 ft^2

Eo (Gutter Flow to Total Flow): 0.0935

Gutter Depth at Curb: 11.9551 in

Inlet Input Parameters

Inlet Location: Inlet on Grade

Inlet Type: Curb Opening

Length of Inlet: 28.0000 ft

Local Depression: 4.0000 in

Inlet Result Parameters

Intercepted Flow: 63.2567 cfs

Bypass Flow: 37.7133 cfs

Efficiency: 0.6265

Hydraulic Analysis Report

Project Data

Project Title: Laurel – CB#2 Analysis – ELY Curb and Gutter

Designer: DJV

Project Date: Friday, April 9, 2021

Project Units: U.S. Customary Units

Notes:

Curb and Gutter Analysis: ELY CB#2-100

Notes:

Gutter Input Parameters

Longitudinal Slope of Road: 0.0050 ft/ft

Cross-Slope of Pavement: 0.0200 ft/ft

Depressed Gutter Geometry

Cross-Slope of Gutter: 0.0830 ft/ft

Manning's n: 0.0150

Gutter Width: 1.5000 ft

Width of Spread: 41.9569 ft

Gutter Result Parameters

Design Flow: 83.4400 cfs

Gutter Depression: 1.1340 in

Area of Flow: 17.6747 ft^2

Eo (Gutter Flow to Total Flow): 0.1008

Gutter Depth at Curb: 11.2037 in

Inlet Input Parameters

Inlet Location: Inlet on Grade

Inlet Type: Curb Opening

Length of Inlet: 21.0000 ft

Local Depression: 4.0000 in

Inlet Result Parameters

Intercepted Flow: 45.1716 cfs

Bypass Flow: 38.2684 cfs

Efficiency: 0.5414

Curb and Gutter Analysis: ELY CB#2-10

Notes:

Gutter Input Parameters

Longitudinal Slope of Road: 0.0050 ft/ft

Cross-Slope of Pavement: 0.0200 ft/ft

Depressed Gutter Geometry

Cross-Slope of Gutter: 0.0830 ft/ft

Manning's n: 0.0150

Gutter Width: 1.5000 ft

Width of Spread: 37.4752 ft

Gutter Result Parameters

Design Flow: 61.8800 cfs

Gutter Depression: 1.1340 in

Area of Flow: 14.1148 ft^2

Eo (Gutter Flow to Total Flow): 0.1135

Gutter Depth at Curb: 10.1280 in

Inlet Input Parameters

Inlet Location: Inlet on Grade

Inlet Type: Curb Opening

Length of Inlet: 21.0000 ft

Local Depression: 4.0000 in

Inlet Result Parameters

Intercepted Flow: 38.3747 cfs

Bypass Flow: 23.5053 cfs

Efficiency: 0.6201

Hydraulic Analysis Report

Project Data

Project Title: Laurel – CB#3 Analysis – WLY Curb and Gutter - Bypass

Designer: DJV

Project Date: Friday, April 9, 2021

Project Units: U.S. Customary Units

Notes:

Curb and Gutter Analysis: WLY CB#3-100

Notes:

Gutter Input Parameters

Longitudinal Slope of Road: 0.0050 ft/ft

Cross-Slope of Pavement: 0.0200 ft/ft

Depressed Gutter Geometry

Cross-Slope of Gutter: 0.0830 ft/ft

Manning's n: 0.0150

Gutter Width: 1.5000 ft

Design Flow: 61.5000 cfs

Gutter Result Parameters

Width of Spread: 37.3880 ft

Gutter Depression: 1.1340 in

Area of Flow: 14.0495 ft^2

Eo (Gutter Flow to Total Flow): 0.1138

Gutter Depth at Curb: 10.1071 in

Inlet Input Parameters

Inlet Location: Inlet on Grade

Inlet Type: Curb Opening

Length of Inlet: 14.0000 ft

Local Depression: 4.0000 in

Inlet Result Parameters

Intercepted Flow: 27.3058 cfs

Bypass Flow: 34.1942 cfs

Efficiency: 0.4440

Curb and Gutter Analysis: WLY CB#3-10

Notes:

Gutter Input Parameters

Longitudinal Slope of Road: 0.0050 ft/ft

Cross-Slope of Pavement: 0.0200 ft/ft

Depressed Gutter Geometry

Cross-Slope of Gutter: 0.0830 ft/ft

Manning's n: 0.0150

Gutter Width: 1.5000 ft

Design Flow: 37.9500 cfs

Gutter Result Parameters

Width of Spread: 31.1375 ft

Gutter Depression: 1.1340 in

Area of Flow: 9.7663 ft^2

Eo (Gutter Flow to Total Flow): 0.1379

Gutter Depth at Curb: 8.6070 in

Inlet Input Parameters

Inlet Location: Inlet on Grade

Inlet Type: Curb Opening

Length of Inlet: 14.0000 ft

Local Depression: 4.0000 in

Inlet Result Parameters

Intercepted Flow: 21.2855 cfs

Bypass Flow: 16.6645 cfs

Efficiency: 0.5609

Hydraulic Analysis Report

Project Data

Project Title: Laurel – CB#4 Analysis – ELY Curb and Gutter - Bypass

Designer: DJV

Project Date: Friday, April 9, 2021

Project Units: U.S. Customary Units

Notes:

Curb and Gutter Analysis: ELY CB#4-100

Notes:

Gutter Input Parameters

Longitudinal Slope of Road: 0.0050 ft/ft

Cross-Slope of Pavement: 0.0200 ft/ft

Depressed Gutter Geometry

Cross-Slope of Gutter: 0.0830 ft/ft

Manning's n: 0.0150

Gutter Width: 1.5000 ft

Design Flow: 38.3000 cfs

Gutter Result Parameters

Width of Spread: 31.2462 ft

Gutter Depression: 1.1340 in

Area of Flow: 9.8342 ft^2

Eo (Gutter Flow to Total Flow): 0.1374

Gutter Depth at Curb: 8.6331 in

Inlet Input Parameters

Inlet Location: Inlet on Grade

Inlet Type: Curb Opening

Length of Inlet: 7.0000 ft

Local Depression: 4.0000 in

Inlet Result Parameters

Intercepted Flow: 11.6516 cfs

Bypass Flow: 26.6484 cfs

Efficiency: 0.3042

Curb and Gutter Analysis: ELY CB#4-10

Notes:

Gutter Input Parameters

Longitudinal Slope of Road: 0.0050 ft/ft

Cross-Slope of Pavement: 0.0200 ft/ft

Depressed Gutter Geometry

Cross-Slope of Gutter: 0.0830 ft/ft

Manning's n: 0.0150

Gutter Width: 1.5000 ft

Design Flow: 23.2600 cfs

Gutter Result Parameters

Width of Spread: 25.8430 ft

Gutter Depression: 1.1340 in

Area of Flow: 6.7495 ft^2

Eo (Gutter Flow to Total Flow): 0.1678

Gutter Depth at Curb: 7.3363 in

Inlet Input Parameters

Inlet Location: Inlet on Grade

Inlet Type: Curb Opening

Length of Inlet: 7.0000 ft

Local Depression: 4.0000 in

Inlet Result Parameters

Intercepted Flow: 9.2106 cfs

Bypass Flow: 14.0494 cfs

Efficiency: 0.3960

Hydraulic Analysis Report

Project Data

Project Title:

Designer:

Project Date: Sunday, March 28, 2021

Project Units: U.S. Customary Units

Notes:

Channel Analysis: Channel Analysis

Notes:

Input Parameters

Channel Type: Circular

Pipe Diameter: 3.0000 ft

Longitudinal Slope: 0.0050 ft/ft

Manning's n: 0.0150

Flow: 29.9000 cfs

Result Parameters

Depth: 1.9053 ft

Area of Flow: 4.7352 ft^2

Wetted Perimeter: 5.5332 ft

Hydraulic Radius: 0.8558 ft

Average Velocity: 6.3144 ft/s

Top Width: 2.8884 ft

Froude Number: 0.8691

Critical Depth: 1.7710 ft

Critical Velocity: 6.8849 ft/s

Critical Slope: 0.0062 ft/ft

Critical Top Width: 2.95 ft

Calculated Max Shear Stress: 0.5945 lb/ft^2

Calculated Avg Shear Stress: 0.2670 lb/ft^2

Hydraulic Analysis Report

Project Data

Project Title: Mitigation Flow Weir Analysis

Designer: DJV

Project Date: Friday, May 7, 2021

Project Units: U.S. Customary Units

Notes:

Weir Analysis: MITIGATION WEIR ANALYSIS

Notes:

Input Parameters

Weir Type: Rectangular

Coefficient: 3.1000

Length: 8.0000 ft

Flow: 8.0400 cfs

Result Parameters

Head: 0.4719 ft

Hydraulic Analysis Report

Project Data

Project Title: 100-year Bypass Flow Weir Calculations

Designer: DJV

Project Date: Friday, May 7, 2021

Project Units: U.S. Customary Units

Notes:

Weir Analysis: 100-YR WEIR ANALYSIS

Notes:

Input Parameters

Weir Type: Rectangular

Coefficient: 3.1000

Length: 8.0000 ft

Flow: 29.9000 cfs

Result Parameters

Head: 1.1328 ft

APPENDIX E

REFERENCE DATA

E.1: HYDROLOGIC SOILS DATA BY NRCS WEBSOIL SURVEY

E.2: PLATE D-4.1

E.3: INFILTRATION REPORT (EXCERPT)

E.4: OC TGD WORKSHEET H – FACTOR OF SAFETY AND DESIGN INFILTRATION RATE

E.5: CONTECH CMP DETENTION DESIGN VOLUMES

E.6: BMP DCV CALCULATIONS

E.7: SAN BERNARDINO COUNTY MEMORANDUM DETENTION BASIN CRITERIA

E.8: COMPREHENSIVE STORM DRAIN PLAN NO.3, PROJECT 3-4 (CSDP 3-4), EXCERPT

Curve (1) Numbers of Hydrologic Soil-Cover Complexes For Pervious Areas-AMC II

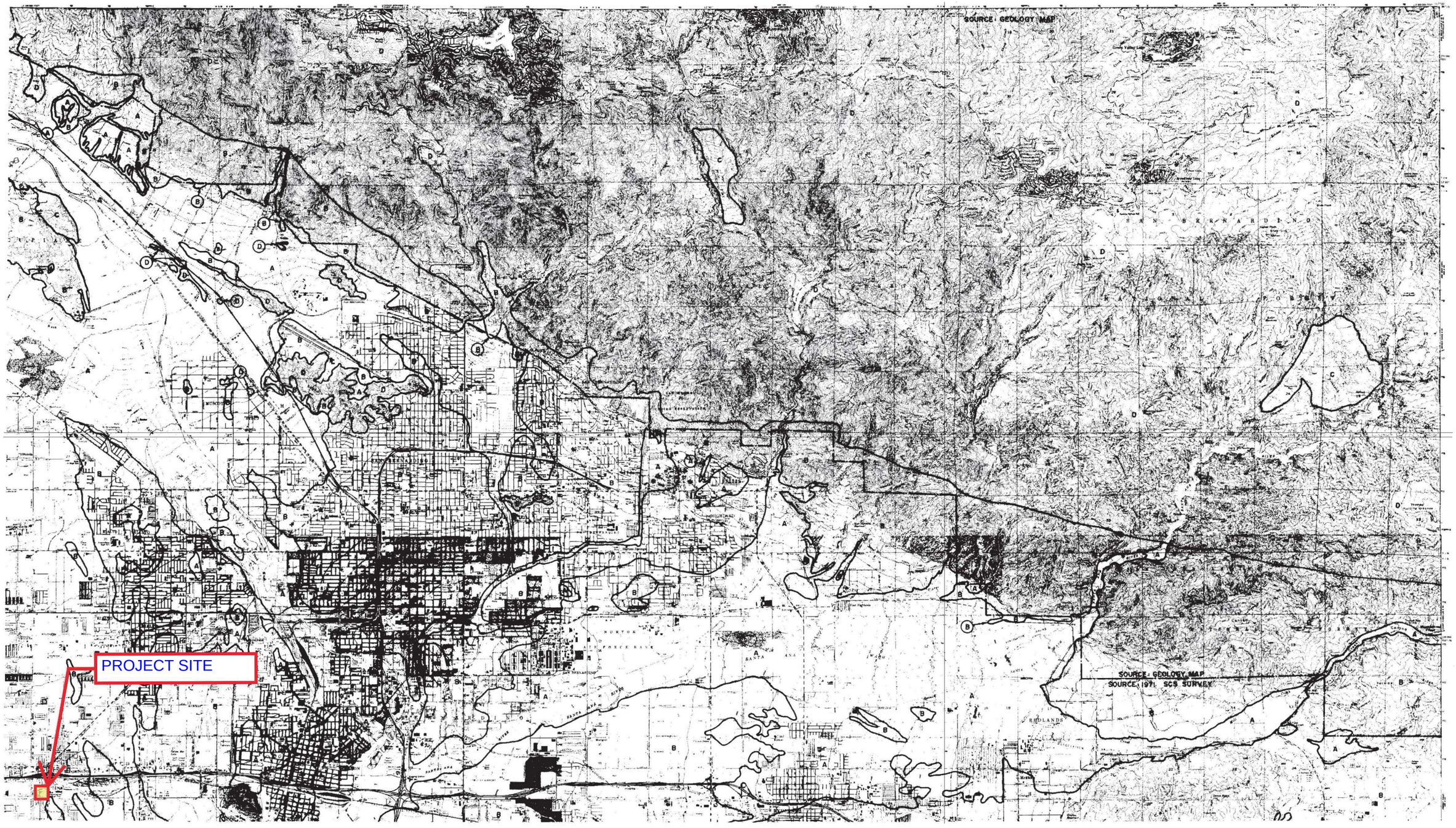
Cover Type (3)	Quality of Cover (2)	Soil Group A	B	C	D
NATURAL COVERS -					
Barren (Rockland, eroded and graded land)		78	86	91	93
Chaparral, Broadleaf (Manzonita, ceanothus and scrub oak)	Poor	53	70	80	85
	Fair	40	63	75	81
	Good	31	57	71	78
Chaparral, Narrowleaf (Chamise and redshank)	Poor	71	82	88	91
	Fair	55	72	81	86
Grass, Annual or Perennial	Poor	67	78	86	89
	Fair	50	69	79	84
	Good	38	61	74	80
Meadows or Cienegas (Areas with seasonally high water table, principal vegetation is sod forming grass)	Poor	63	77	85	88
	Fair	51	70	80	84
	Good	30	58	71	78
Open Brush (Soft wood shrubs - buckwheat, sage, etc.)	Poor	62	76	84	88
	Fair	46	66	77	83
	Good	41	63	75	81
Woodland (Coniferous or broadleaf trees predominate. Canopy density is at least 50 percent.)	Poor	45	66	77	83
	Fair	36	60	73	79
	Good	25	55	70	77
Woodland, Grass (Coniferous or broadleaf trees with canopy density from 20 to 50 percent)	Poor	57	73	82	86
	Fair	44	65	77	82
	Good	33	58	72	79
URBAN COVERS -					
Residential or Commercial Landscaping (Lawn, shrubs, etc.)	Good	32	56	69	75
Turf (Irrigated and mowed grass)	Poor	58	74	83	87
	Fair	44	65	77	82
	Good	33	58	72	79
AGRICULTURAL COVERS -					
Fallow (Land plowed but not tilled or seeded)		77	86	91	94

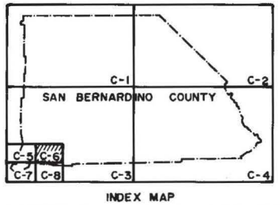
SAN BERNARDINO COUNTY

HYDROLOGY MANUAL

CURVE NUMBERS FOR PERVIOUS AREAS

Figure C-3 (1 of 2)





INDEX MAP

LEGEND

SOIL GROUP BOUNDARY

A SOIL GROUP DESIGNATION

BOUNDARY OF INDICATED SOURCE

SCALE 1:48,000

SCALE REDUCED BY 1/2

SAN BERNARDINO COUNTY

HYDROLOGY MANUAL

HYDROLOGIC SOILS GROUP MAP
FOR
SOUTHWEST-B AREA

United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for San Bernardino County Southwestern Part, California

Bloomington Commerce Center SP4

September 2, 2020

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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TuB—Tujunga loamy sand, 0 to 5 percent slopes.....15
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How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map

Map Scale: 1:1,490 if printed on A portrait (8.5" x 11") sheet.

N

Meters
0 20 40 80 120

Feet
0 50 100 200 300

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

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

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

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

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

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

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

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

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

Soil Survey Area: San Bernardino County Southwestern Part, California
Survey Area Data: Version 12, May 27, 2020

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

Date(s) aerial images were photographed: Apr 1, 2018—Jun 30, 2018

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background

MAP LEGEND

MAP INFORMATION

imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
Db	Delhi fine sand	9.4	99.0%
TuB	Tujunga loamy sand, 0 to 5 percent slopes	0.1	1.0%
Totals for Area of Interest		**9.5**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however,

onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

San Bernardino County Southwestern Part, California

Db—Delhi fine sand

Map Unit Setting

National map unit symbol: hcjq
Elevation: 30 to 1,400 feet
Mean annual precipitation: 10 to 16 inches
Mean annual air temperature: 59 to 64 degrees F
Frost-free period: 225 to 310 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Delhi and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Delhi

Setting

Landform: Alluvial fans
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Sandy alluvium derived from granite

Typical profile

H1 - 0 to 18 inches: fine sand
H2 - 18 to 60 inches: sand

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Low (about 4.4 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: A
Hydric soil rating: No

Minor Components

Unnamed

Percent of map unit: 5 percent
Landform: Depressions
Hydric soil rating: Yes

Unnamed
Percent of map unit: 5 percent
Hydric soil rating: No

Tujunga, loamy sand
Percent of map unit: 5 percent
Hydric soil rating: No

TuB—Tujunga loamy sand, 0 to 5 percent slopes

Map Unit Setting
National map unit symbol: 2sx6y
Elevation: 650 to 3,110 feet
Mean annual precipitation: 10 to 25 inches
Mean annual air temperature: 62 to 65 degrees F
Frost-free period: 325 to 365 days
Farmland classification: Farmland of statewide importance

Map Unit Composition
Tujunga, loamy sand, and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Tujunga, Loamy Sand

Setting
Landform: Alluvial fans
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from granite

Typical profile
A - 0 to 6 inches: loamy sand
C1 - 6 to 18 inches: loamy sand
C2 - 18 to 60 inches: loamy sand

Properties and qualities
Slope: 0 to 5 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: Rare
Frequency of ponding: None
Available water capacity: Low (about 4.2 inches)

Interpretive groups
Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: A
Hydric soil rating: No

Minor Components

Tujunga, gravelly loamy sand
Percent of map unit: 10 percent
Landform: Alluvial fans
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Hanford, sandy loam
Percent of map unit: 5 percent
Landform: Alluvial fans
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Soil Information for All Uses

Soil Properties and Qualities

The Soil Properties and Qualities section includes various soil properties and qualities displayed as thematic maps with a summary table for the soil map units in the selected area of interest. A single value or rating for each map unit is generated by aggregating the interpretive ratings of individual map unit components. This aggregation process is defined for each property or quality.

Soil Physical Properties

Soil Physical Properties are measured or inferred from direct observations in the field or laboratory. Examples of soil physical properties include percent clay, organic matter, saturated hydraulic conductivity, available water capacity, and bulk density.

Saturated Hydraulic Conductivity (Ksat), Standard Classes

Saturated hydraulic conductivity (Ksat) refers to the ease with which pores in a saturated soil transmit water. The estimates are expressed in terms of micrometers per second. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Saturated hydraulic conductivity is considered in the design of soil drainage systems and septic tank absorption fields.

For each soil layer, this attribute is actually recorded as three separate values in the database. A low value and a high value indicate the range of this attribute for the soil component. A "representative" value indicates the expected value of this attribute for the component. For this soil property, only the representative value is used.

The numeric Ksat values have been grouped according to standard Ksat class limits. The classes are:

Very low: 0.00 to 0.01

Low: 0.01 to 0.1

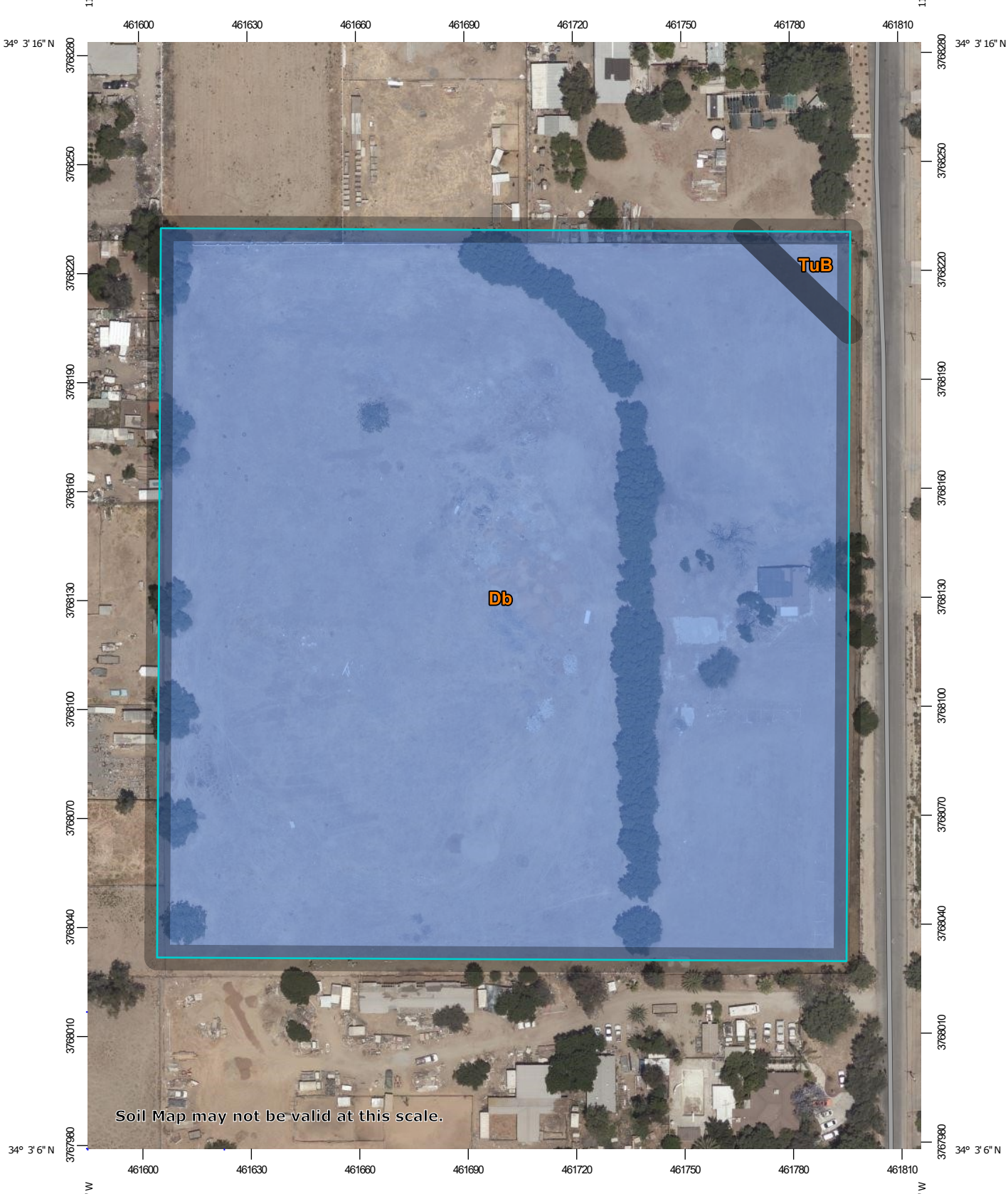
Moderately low: 0.1 to 1.0

Moderately high: 1 to 10

High: 10 to 100

Very high: 100 to 705

Map—Saturated Hydraulic Conductivity (Ksat), Standard Classes



Map Scale: 1:1,490 if printed on A portrait (8.5" x 11") sheet.

N

Meters
0 20 40 80 120

Feet
0 50 100 200 300

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

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

Soil Rating Polygons

- Very Low (0.0 - 0.01)
- Low (0.01 - 0.1)
- Moderately Low (0.1 - 1)
- Moderately High (1 - 10)
- High (10 - 100)
- Very High (100 - 705)
- Not rated or not available

Soil Rating Lines

- Very Low (0.0 - 0.01)
- Low (0.01 - 0.1)
- Moderately Low (0.1 - 1)
- Moderately High (1 - 10)
- High (10 - 100)
- Very High (100 - 705)
- Not rated or not available

Soil Rating Points

- Very Low (0.0 - 0.01)
- Low (0.01 - 0.1)
- Moderately Low (0.1 - 1)
- Moderately High (1 - 10)
- High (10 - 100)
- Very High (100 - 705)
- Not rated or not available

Water Features

- Streams and Canals

Transportation

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

Background

- Aerial Photography

MAP INFORMATION

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

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

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

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

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

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

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

Soil Survey Area: San Bernardino County Southwestern Part, California
Survey Area Data: Version 12, May 27, 2020

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

Date(s) aerial images were photographed: Apr 1, 2018—Jun 30, 2018

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background

MAP LEGEND	MAP INFORMATION
	imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Table—Saturated Hydraulic Conductivity (Ksat), Standard Classes

Map unit symbol	Map unit name	Rating (micrometers per second)	Acres in AOI	Percent of AOI
Db	Delhi fine sand	92.0000	9.4	99.0%
TuB	Tujunga loamy sand, 0 to 5 percent slopes	92.0000	0.1	1.0%
Totals for Area of Interest			**9.5**	**100.0%**

Rating Options—Saturated Hydraulic Conductivity (Ksat), Standard Classes

Units of Measure: micrometers per second

Aggregation Method: Dominant Component

Component Percent Cutoff: None Specified

Tie-break Rule: Fastest

Interpret Nulls as Zero: No

Layer Options (Horizon Aggregation Method): All Layers (Weighted Average)

Soil Qualities and Features

Soil qualities are behavior and performance attributes that are not directly measured, but are inferred from observations of dynamic conditions and from soil properties. Example soil qualities include natural drainage, and frost action. Soil features are attributes that are not directly part of the soil. Example soil features include slope and depth to restrictive layer. These features can greatly impact the use and management of the soil.

Hydrologic Soil Group

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.

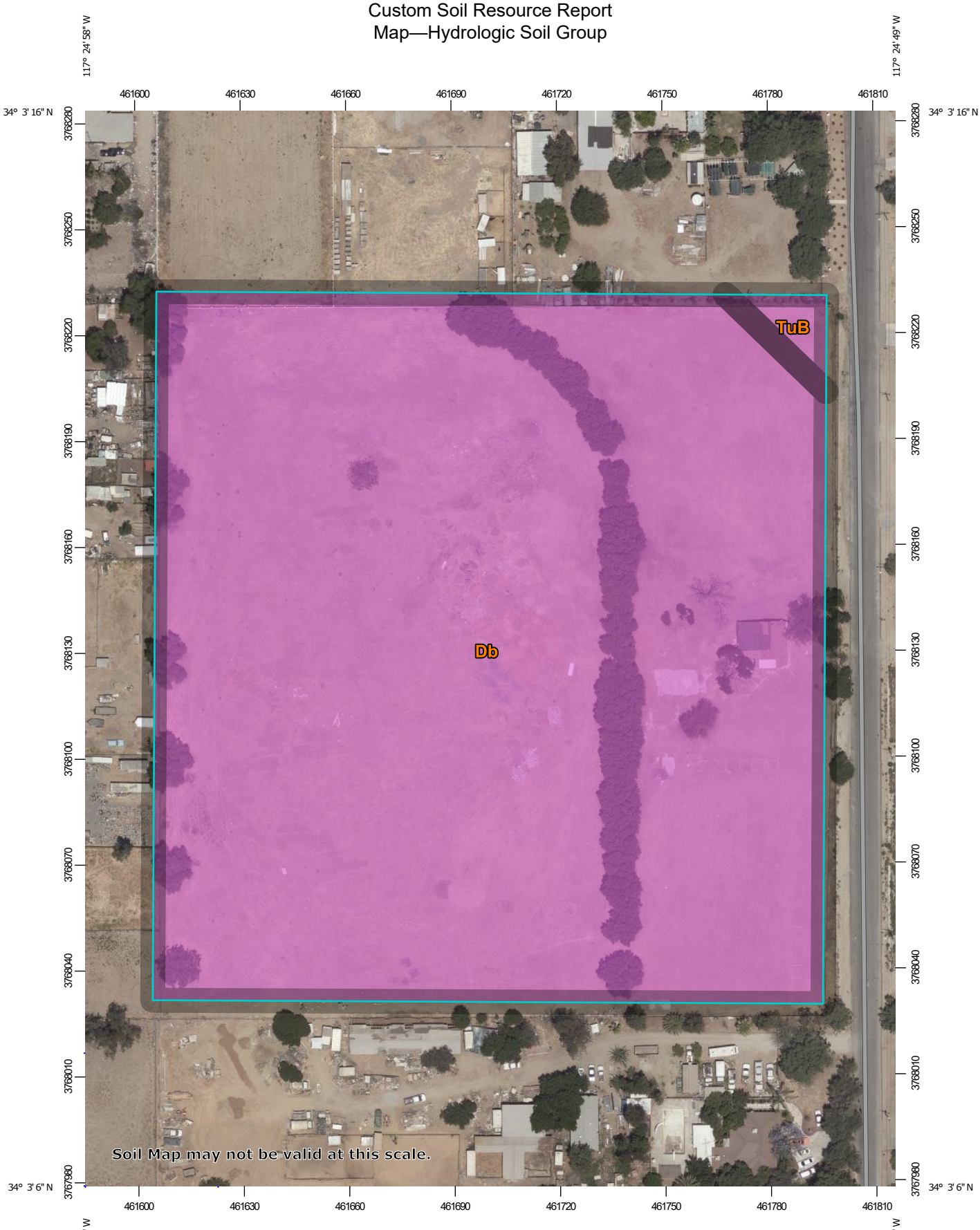
Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

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.

Custom Soil Resource Report
Map—Hydrologic Soil Group



Map Scale: 1:1,490 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 20 40 80 120

Feet: 0 50 100 200 300

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

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils

Soil Rating Polygons
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

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

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

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

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

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

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

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Soil Survey Area: San Bernardino County Southwestern Part, California
Survey Area Data: Version 12, May 27, 2020

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

Date(s) aerial images were photographed: Apr 1, 2018—Jun 30, 2018

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background

MAP LEGEND	MAP INFORMATION
	imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Table—Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
Db	Delhi fine sand	A	9.4	99.0%
TuB	Tujunga loamy sand, 0 to 5 percent slopes	A	0.1	1.0%
Totals for Area of Interest			**9.5**	**100.0%**

Rating Options—Hydrologic Soil Group

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

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NOAA Atlas 14, Volume 6, Version 2
Location name: Bloomington, California, USA*
Latitude: 34.0532°, Longitude: -117.4148°
Elevation: 1040.78 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

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

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

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

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.107 (0.089-0.129)	0.138 (0.115-0.168)	0.181 (0.150-0.220)	0.216 (0.178-0.266)	0.266 (0.212-0.338)	0.306 (0.238-0.397)	0.347 (0.263-0.462)	0.391 (0.288-0.536)	0.453 (0.320-0.648)	0.503 (0.343-0.746)
10-min	0.153 (0.127-0.185)	0.198 (0.165-0.241)	0.259 (0.215-0.315)	0.310 (0.255-0.381)	0.381 (0.303-0.485)	0.438 (0.341-0.569)	0.497 (0.377-0.662)	0.560 (0.413-0.768)	0.649 (0.458-0.929)	0.721 (0.491-1.07)
15-min	0.185 (0.154-0.224)	0.240 (0.200-0.291)	0.313 (0.260-0.381)	0.375 (0.309-0.460)	0.461 (0.367-0.586)	0.530 (0.412-0.688)	0.601 (0.456-0.801)	0.677 (0.499-0.929)	0.785 (0.554-1.12)	0.872 (0.594-1.29)
30-min	0.276 (0.230-0.335)	0.358 (0.298-0.434)	0.468 (0.388-0.569)	0.560 (0.461-0.687)	0.689 (0.548-0.875)	0.791 (0.615-1.03)	0.898 (0.681-1.20)	1.01 (0.745-1.39)	1.17 (0.827-1.68)	1.30 (0.887-1.93)
60-min	0.404 (0.336-0.489)	0.523 (0.436-0.635)	0.684 (0.568-0.832)	0.819 (0.674-1.00)	1.01 (0.801-1.28)	1.16 (0.900-1.50)	1.31 (0.996-1.75)	1.48 (1.09-2.03)	1.71 (1.21-2.45)	1.90 (1.30-2.82)
2-hr	0.594 (0.495-0.720)	0.763 (0.635-0.926)	0.987 (0.819-1.20)	1.17 (0.964-1.44)	1.42 (1.13-1.81)	1.62 (1.26-2.11)	1.83 (1.38-2.43)	2.04 (1.50-2.79)	2.33 (1.65-3.34)	2.57 (1.75-3.81)
3-hr	0.743 (0.619-0.901)	0.953 (0.793-1.16)	1.23 (1.02-1.49)	1.45 (1.20-1.78)	1.76 (1.40-2.23)	1.99 (1.55-2.59)	2.24 (1.70-2.98)	2.49 (1.83-3.41)	2.83 (2.00-4.05)	3.10 (2.12-4.60)
6-hr	1.05 (0.875-1.27)	1.35 (1.12-1.64)	1.73 (1.44-2.11)	2.04 (1.68-2.51)	2.46 (1.96-3.13)	2.78 (2.17-3.61)	3.11 (2.36-4.14)	3.44 (2.53-4.71)	3.89 (2.75-5.57)	4.24 (2.89-6.29)
12-hr	1.39 (1.16-1.69)	1.80 (1.50-2.19)	2.32 (1.93-2.83)	2.74 (2.26-3.36)	3.30 (2.62-4.19)	3.72 (2.89-4.83)	4.14 (3.14-5.51)	4.57 (3.37-6.26)	5.15 (3.63-7.36)	5.59 (3.81-8.29)
24-hr	1.86 (1.65-2.15)	2.44 (2.15-2.81)	3.17 (2.80-3.67)	3.76 (3.29-4.38)	4.53 (3.84-5.46)	5.12 (4.25-6.30)	5.70 (4.62-7.18)	6.30 (4.96-8.15)	7.09 (5.36-9.56)	7.69 (5.63-10.7)
2-day	2.26 (2.00-2.61)	3.01 (2.67-3.48)	3.99 (3.51-4.61)	4.77 (4.17-5.56)	5.82 (4.93-7.01)	6.61 (5.49-8.13)	7.42 (6.01-9.34)	8.24 (6.49-10.7)	9.34 (7.07-12.6)	10.2 (7.46-14.2)
3-day	2.43 (2.15-2.80)	3.29 (2.91-3.80)	4.41 (3.89-5.10)	5.32 (4.65-6.20)	6.55 (5.55-7.90)	7.50 (6.22-9.23)	8.47 (6.86-10.7)	9.46 (7.46-12.2)	10.8 (8.18-14.6)	11.9 (8.67-16.5)
4-day	2.61 (2.31-3.01)	3.57 (3.16-4.13)	4.83 (4.26-5.59)	5.86 (5.13-6.83)	7.26 (6.15-8.75)	8.35 (6.93-10.3)	9.45 (7.66-11.9)	10.6 (8.35-13.7)	12.2 (9.20-16.4)	13.4 (9.80-18.7)
7-day	2.99 (2.65-3.45)	4.14 (3.66-4.78)	5.65 (4.98-6.54)	6.89 (6.03-8.04)	8.60 (7.28-10.4)	9.93 (8.24-12.2)	11.3 (9.15-14.2)	12.7 (10.0-16.5)	14.7 (11.1-19.8)	16.2 (11.9-22.6)
10-day	3.25 (2.87-3.74)	4.52 (4.00-5.22)	6.21 (5.48-7.19)	7.60 (6.65-8.87)	9.52 (8.06-11.5)	11.0 (9.15-13.6)	12.6 (10.2-15.8)	14.2 (11.2-18.4)	16.4 (12.4-22.2)	18.2 (13.3-25.4)
20-day	3.92 (3.47-4.51)	5.50 (4.87-6.35)	7.63 (6.72-8.82)	9.40 (8.22-11.0)	11.9 (10.1-14.3)	13.8 (11.5-17.0)	15.9 (12.9-20.0)	18.0 (14.2-23.3)	21.1 (15.9-28.4)	23.5 (17.2-32.8)
30-day	4.63 (4.10-5.34)	6.51 (5.75-7.51)	9.04 (7.97-10.5)	11.2 (9.77-13.0)	14.2 (12.0-17.1)	16.6 (13.7-20.4)	19.1 (15.4-24.0)	21.8 (17.1-28.2)	25.6 (19.3-34.5)	28.6 (21.0-40.0)
45-day	5.52 (4.89-6.37)	7.70 (6.81-8.88)	10.7 (9.40-12.3)	13.2 (11.5-15.4)	16.7 (14.2-20.2)	19.6 (16.3-24.1)	22.6 (18.3-28.5)	25.9 (20.4-33.6)	30.6 (23.2-41.3)	34.5 (25.2-48.1)
60-day	6.47 (5.72-7.45)	8.91 (7.88-10.3)	12.3 (10.8-14.2)	15.1 (13.2-17.6)	19.2 (16.2-23.1)	22.5 (18.7-27.7)	26.0 (21.1-32.8)	29.9 (23.5-38.7)	35.4 (26.8-47.7)	39.9 (29.2-55.7)

[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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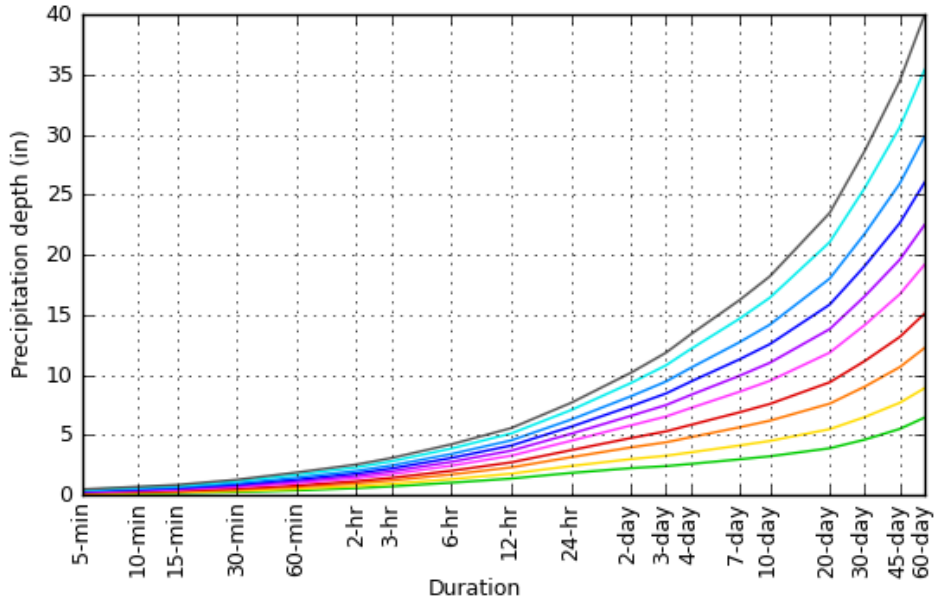
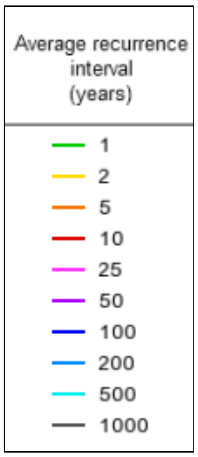
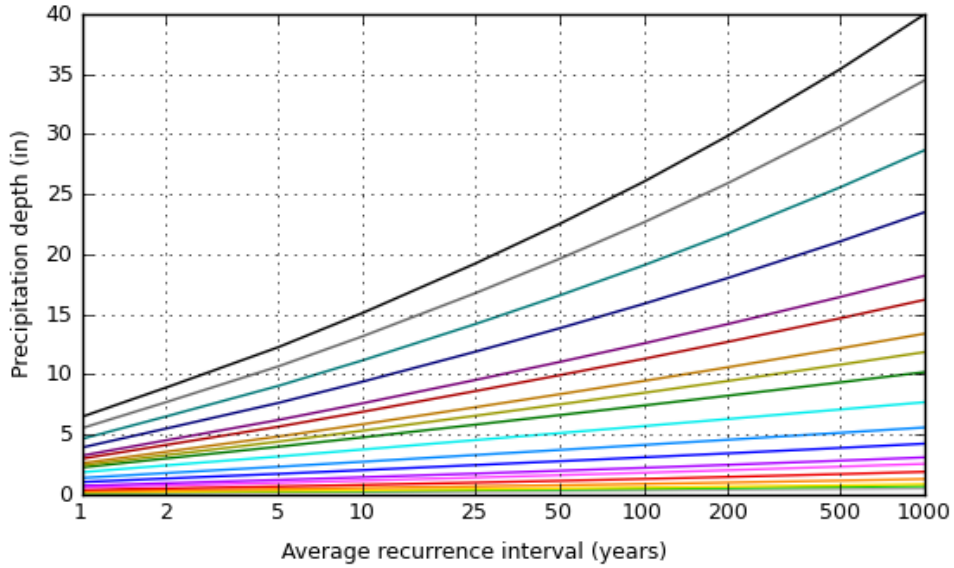
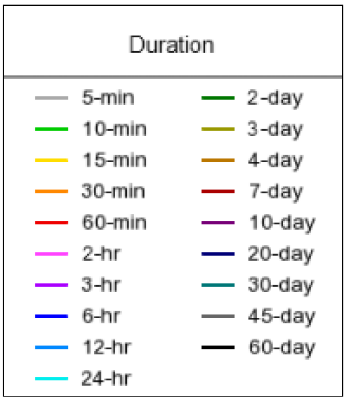
PF graphical

PDS-based depth-duration-frequency (DDF) curves
Latitude: 34.0532°, Longitude: -117.4148°









NOAA Atlas 14, Volume 6, Version 2

Created (GMT): Fri Aug 21 20:46:23 2020

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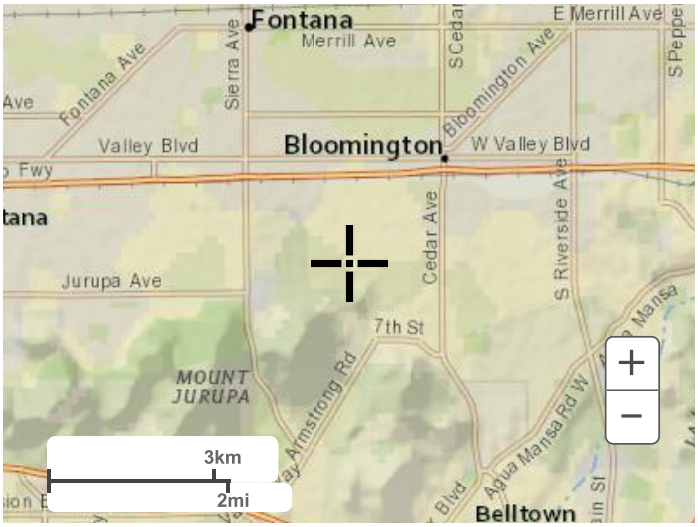
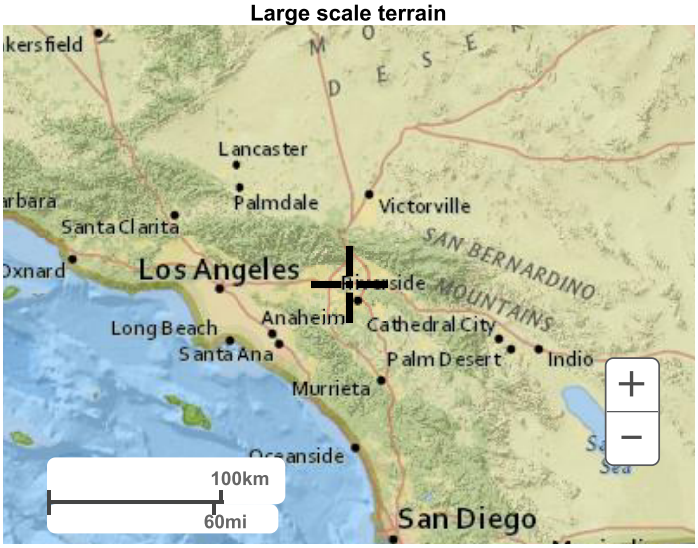
Maps & aerials

Small scale terrain

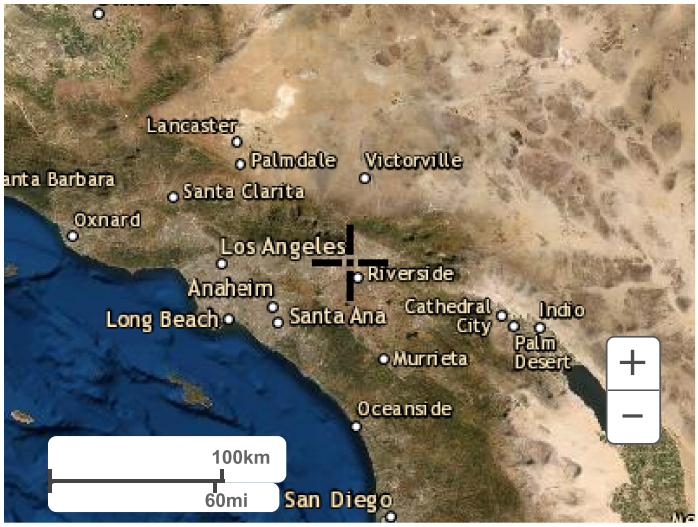


Large scale terrain



Large scale map

Large scale aerial



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

Disclaimer

October 20, 2020

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

Howard Industrial Partners
1944 North Tustin Street, Suite 122
Orange, California 92865

Attention: Mr. Mike Tunney
Vice President

Project No.: **20G172-2**

Subject: **Results of Infiltration Testing**
Proposed Commercial/Industrial Development
Laurel Avenue, South of Santa Ana Avenue
Bloomington (Unincorporated San Bernardino County), California

Reference: Geotechnical Investigation, Proposed Commercial/Industrial Development, Bloomington, California, prepared by Southern California Geotechnical, Inc. (SCG), prepared for Howard Industrial Partners, SCG project No. 20G172-4.

Mr. Tunney:

In accordance with your request, we have conducted infiltration testing at the subject site. We are pleased to present this report summarizing the results of the infiltration testing and our design recommendations.

Scope of Services

The scope of services performed for this project was in general accordance with our Proposal No. 19P389R4, dated August 20, 2020. The scope of services included site reconnaissance, subsurface exploration, field testing, and engineering analysis to determine the infiltration rates of the on-site soils. The infiltration testing was performed in general accordance with the Technical Guidance Document for Water Quality Management Plans prepared for the County of San Bernardino Areawide Stormwater Program dated June 7, 2013. The San Bernardino County standards defer to guidelines published by Riverside County Department of Environmental Health (RCDEH).

Site and Project Description

The overall subject site consists of four (4) contiguous areas (identified as Site 1 through Site 4), approximately 213 acres in size, in an unincorporated portion of San Bernardino County, California. This investigation only includes Site 3 and Site 4. The general location of the site is illustrated on the Site Location Map, enclosed as Plate 1 of this report.

Site 3

Site 3 is located on the west side of Locust Avenue, south of Santa Ana Avenue in Bloomington area of unincorporated San Bernardino County, California. The site is bounded to the north by

Santa Ana Avenue and single-family residences, to the west by Laurel Avenue, to the south by single-family residences, and to the east by Locust Avenue.

The site consists of multiple contiguous rectangular-shaped parcels which total 28.09± acres in size. The site is developed with several single-family residences, commercial/industrial buildings, and trailer storage yards.

Detailed topographic information was not available at the time of this report. Based on visual observations made at the time of the subsurface investigation and from elevations obtained from Google Earth, the overall site topography of Site 3 appears to slope gently to the southwest with an estimated gradient of 1.5± percent. The topographic low point of Site 3 is 1,027± feet mean sea level (msl) in the central-southern region of the site. The topographic high point of Site 3 appears to be 1,047± feet msl, located in the northeastern region of the site.

Site 4

Site 4 is located on the west side of Laurel Avenue, south of Santa Ana Avenue in Bloomington area of unincorporated San Bernardino County, California. The site is bounded to the north, west, and south by single-family residences, and to the east by Laurel Avenue.

The site consists of multiple contiguous rectangular-shaped parcels which total 9.55± acres in size. The site is developed with a single-family residence.

Detailed topographic information was not available at the time of this report. Based on visual observations made at the time of the subsurface investigation and from elevations obtained from Google Earth, the overall site topography of Site 4 appears to slope gently to the southeast with an estimated gradient of 0.7± percent. The topographic high point of Site 4 is 1,049 feet msl, located in the northwestern corner of the site. The topographic low point of Site 4 is 1,038 feet msl, located in the central-east portion of the site. A north-south trending 5 to 7± foot berm exists within Site 4, located 200± feet west of Laurel Avenue and contains a concentration of trees.

Proposed Development

A conceptual master plan identified as the Bloomington Industrial Master Plan, prepared by AO, has been provided to our office by the client. As previously stated, this investigation only includes Site 3 and Site 4 of the overall development.

Site 3

Site 3 will be developed with a commercial/industrial building, 440,000± ft² in size. The building will be constructed with dock-high doors located along the north side of the building. It is also assumed that the building will be a tilt-up concrete structure, supported on conventional shallow foundations with a concrete slab-on-grade floor. The building will be surrounded by asphaltic concrete pavements in the parking and drive lanes, Portland cement concrete in the loading dock areas, and landscape planters throughout.

Site 4

Site 4 will be developed as an asphaltic concrete parking lot. The parking lot will consist of 310 trailer parking stalls with associated drive lanes.

Based on conversations with representatives of the project civil engineer, Site 3 and Site 4 will include on-site storm water infiltration. A below-grade chamber system will be constructed in the east-central area of Site 3 and a detention basin will be constructed in the southeastern area of Site 3. A below-grade chamber system will be constructed in the southeastern area of Site 4. The bottom of the infiltration systems will extend to depths up to 10 feet below the existing site grades.

Concurrent Study

Southern California Geotechnical, Inc. (SCG) concurrently conducted a geotechnical investigation at the subject site, referenced above. As a part of this study, twelve (12) borings were advanced to depths of 10 to 30± feet below existing site grades.

Artificial fill soils and possible fill soils were encountered at the ground surface of all twelve (12) boring locations, extending to depths of 1½ to 5½± feet below the existing site grades. The artificial fill soils consist of very loose to medium dense silty fine sands and medium dense fine sandy silts. Trace to little quantities of medium to coarse sand were encountered within the artificial fill soils and occasional trace quantities of fine to coarse gravel were present in the strata. Possible fill soils were also encountered at the ground surface of B-10 and beneath the artificial fill soils at B-6. The possible fill soils are comprised of loose silty fine sands with the same characteristics as the fill soils, except lacking indications of being disturbed. Native alluvium was encountered beneath the fill soils at all twelve (12) boring locations, extending to the maximum explored depth of 30± feet below existing site grades. The shallow native alluvial soils at depths less than 10± feet consist of loose to very dense fine to coarse sands, medium dense to very dense silty fine sands, loose to very dense fine to medium sands, dense silty fine to coarse sands, dense to very dense fine sands, and dense to very dense fine sandy silts. Variable constituent quantities of fine to coarse sand, silt, fine to coarse gravel, and occasional cobbles were encountered throughout these strata. At depths greater than 10± feet, the alluvium consists of medium dense to very dense fine to coarse sands, medium dense to very dense silty fine to coarse sands, medium dense to very dense fine to medium sands, dense fine sands, medium dense to very dense silty fine sands, and medium dense to very dense fine sandy silts. Trace to some quantity of silts, fine to coarse sands, fine to coarse gravels, and occasional cobbles were also encountered within the deeper alluvial strata. At Boring No. B-5, trace quantities of clays were encountered at depths of 22 to 27± feet below existing site grades.

Groundwater

Groundwater was not encountered at any of the borings. Based on the lack of any water within the borings, and the moisture contents of the recovered soil samples, the static groundwater table is considered to have existed at a depth in excess of 30± feet below existing site grades, at the time of the subsurface investigation.

As part of our research, we reviewed available groundwater data in order to determine the historic and more recent high groundwater levels for the site. The primary reference used to determine the groundwater depths in this area is the California Department of Water Resources website, http://www.water.ca.gov/waterdatalibrary/. The nearest monitoring well is located approximately 2,600 feet southeast from the site. Water level readings within this monitoring well indicate a historic high groundwater levels of 176± feet in October 2011, and more recent groundwater levels of 187± feet below the ground surface in October 2019.

Subsurface Exploration

Scope of Exploration

The subsurface exploration conducted for the infiltration testing consisted of nine (9) infiltration test borings, advanced to depths of 10± feet below the existing site grades. The infiltration borings were advanced using a truck-mounted drilling rig, equipped with 8-inch-diameter hollow-stem augers and were logged during drilling by a member of our staff. The approximate locations of the infiltration test borings (identified as Infiltration Test Nos. I-1 through I-9) are indicated on the Infiltration Test Location Plan, enclosed as Plate 2 of this report.

Upon the completion of the infiltration borings, the bottom of each test boring was covered with 2± inches of clean ¾-inch gravel. A sufficient length of 3-inch-diameter perforated PVC casing was then placed into each test hole so that the PVC casing extended from the bottom of the test hole to the ground surface. Clean ¾-inch gravel was then installed in the annulus surrounding the PVC casing.

Geotechnical Conditions

Artificial Fill

Artificial fill and possible fill soils were encountered at the ground surface of all nine (9) infiltration test locations, extending to depths of 5½ to 7± feet below existing site grades. The artificial fill soils consist of loose to medium dense fine sandy silts and loose to medium dense silty fine sands. Variable quantities of medium to coarse sand and trace quantities of fine to coarse gravel were encountered within the artificial fill soils. Occasional Cobbles were encountered at Infiltration Test No. I-7.

Alluvium

Native alluvium was encountered beneath the artificial fill soils at all nine (9) infiltration test locations, extending to the maximum explored depth of 10± feet below existing site grades. The native alluvial soils generally consist of medium dense silty fine sands and fine to coarse sands, dense fine to coarse sands and silty fine to coarse sands, and very dense fine to coarse sands. Trace to little medium to coarse sand, fine to coarse gravel, and variable silt content was encountered within the alluvial strata. The Boring Logs, which illustrate the conditions encountered at each boring location is included within this report.

Infiltration Testing

As previously mentioned, the infiltration testing was performed in general accordance with Technical Guidance Document for Water Quality Management Plans, prepared for the County of San Bernardino Areawide Stormwater Program.

Pre-soaking

In accordance with the county infiltration standards for sandy soils, all infiltration test borings were pre-soaked 2 hours prior to the infiltration testing or until all of the water had percolated through the test holes. The pre-soaking process consisted of filling test borings by inverting a full 5-gallon bottle of clear water supported over each hole so that the water flow into the hole holds constant at a level at least 5 times the hole's radius above the gravel at the bottom of each hole. Pre-soaking was completed after all of the water had percolated through the test holes.

Infiltration Testing

Following the pre-soaking process of the infiltration test borings, SCG performed the infiltration testing. Each test hole was filled with water to a depth of at least 5 times the hole's radius above the gravel at the bottom of the test hole. In accordance with the San Bernardino County guidelines, since "sandy soils" were encountered at the bottom of all of the infiltration test borings (where 6 inches of water infiltrated into the surrounding soils for two consecutive 25-minute readings), readings were taken at 10-minute intervals for a total of 1 hour at all three (3) test locations. After each reading, water was added to the borings so that the depth of the water was at least 5 times the radius of the hole. The water level readings are presented on the spreadsheets enclosed with this report. The infiltration rates for each of the timed intervals are also tabulated on the spreadsheets.

The infiltration rates from the test are tabulated in inches per hour. In accordance with the typically accepted practice, it is recommended that the most conservative reading from the latter part of the infiltration tests be used as the design infiltration rate. The rates are summarized below:

Infiltration Test No.	Depth (feet)	Soil Description	Infiltration Rate (inches/hour)
I-1	10	Brown Gray fine to coarse Sand, some fine to coarse Gravel, trace Silt	21.4
I-2	10	Light Gray Brown fine to coarse Sand, some fine to coarse Gravel, little Silt	20.4
I-3	10	Light Gray Brown fine to coarse Sand, some fine to coarse Gravel, trace Silt	22.9
I-4	10	Light Brown Gray fine to coarse Sand, some fine to coarse Gravel	20.4
I-5	10	Gray fine to coarse Sand, some fine to coarse Gravel, trace Silt	14.2
I-6	10	Light Gray Brown fine to coarse Sand, little fine to coarse Gravel, trace Silt	19.5

I-7	10	Light Brown Gray fine to coarse Sand, little to some Silt, trace fine Gravel	12.1
I-8	10	Light Brown Gray fine to coarse Sand, little Silt, little fine Gravel	13.1
I-9	10	Brown Silty fine to coarse Sand, trace fine Gravel	2.6

Laboratory Testing

Moisture Content

The moisture contents for the recovered soil samples within the borings were determined in accordance with ASTM D-2216 and are expressed as a percentage of the dry weight. These test results are presented on the Boring Logs.

Grain Size Analysis

The grain size distribution of selected soils collected from the base of each infiltration test boring have been determined using a range of wire mesh screens. These tests were performed in general accordance with ASTM D-422 and/or ASTM D-1140. The weight of the portion of the sample retained on each screen is recorded and the percentage finer or coarser of the total weight is calculated. The results of these tests are presented on Plates C-1 through C-9 of this report.

Design Recommendations

Nine (9) infiltration tests were performed at the subject site. As noted above, the infiltration rates at these locations vary from 2.6 to 22.9 inches per hour. The primary factor affecting the infiltration rates is the varying silt content in the soil. **Based on the infiltration test results from Infiltration Test Nos. I-1 through I-9, the following design infiltration rates are recommended:**

Infiltration Test Nos.	Infiltration System	Design Infiltration Rate (inches per hour)
I-1, I-2, I-3	A	20.4
I-4, I-5, I-6	B	14.2
I-7, I-8, I-9	C	2.6

We recommend that a representative from the geotechnical engineer be on-site during the construction of the proposed infiltration system to identify the soil classification at the base of the system. It should be confirmed that the soils at the base of the proposed infiltration system correspond with those presented in this report to ensure that the performance of the system will be consistent with the rates reported herein.

The design of the storm water infiltration system should be performed by the project civil engineer, in accordance with the City of Bloomington and/or County of San Bernardino guidelines. It is recommended that the system be constructed so as to facilitate removal of silt and clay, or other deleterious materials from any water that may enter the system. The presence of such

materials would decrease the effective infiltration rates. **It is recommended that the project civil engineer apply an appropriate factor of safety. The infiltration rate recommended above is based on the assumption that only clean water will be introduced to the subsurface profile. Any fines, debris, or organic materials could significantly impact the infiltration rate.** It should be noted that the recommended infiltration rates are based on infiltration testing at nine (9) discrete locations and that the overall infiltration rates of the proposed infiltration system could vary considerably.

Construction Considerations

The infiltration rates presented in this report are specific to the tested locations and tested depths. Infiltration rates can be significantly reduced if the soils are exposed to excessive disturbance or compaction during construction. Therefore, the subgrade soils within proposed infiltration system areas should not be over-excavated, undercut or compacted in any significant manner. **It is recommended that a note to this effect be added to the project plans and/or specifications.**

Infiltration versus Permeability

Infiltration rates are based on unsaturated flow. As water is introduced into soils by infiltration, the soils become saturated and the wetting front advances from the unsaturated zone to the saturated zone. Once the soils become saturated, infiltration rates become zero, and water can only move through soils by hydraulic conductivity at a rate determined by pressure head and soil permeability. The infiltration rate presented herein was determined in accordance with the San Bernardino County guidelines and is considered valid for the time and place of the actual test. Changes in soil moisture content will affect the infiltration rate. Infiltration rates should be expected to decrease until the soils become saturated. Soil permeability values will then govern groundwater movement. Permeability values may be on the order of 10 to 20 times less than infiltration rates. The system designer should incorporate adequate factors of safety and allow for overflow design into appropriate traditional storm drain systems, which would transport storm water off-site.

Location of Infiltration System

The use of on-site storm water infiltration system carries a risk of creating adverse geotechnical conditions. Increasing the moisture content of the soil can cause the soil to lose internal shear strength and increase its compressibility, resulting in a change in the designed engineering properties. Overlying structures and pavements in the infiltration area could potentially be damaged due to saturation of subgrade soils. **The proposed infiltration system for this site should be located at least 25 feet away from any structures, including retaining walls.** Even with this provision of locating the infiltration system at least 25 feet from the building, it is possible that infiltrating water into the subsurface soils could have an adverse effect on the proposed or existing structures. It should also be noted that utility trenches which happen to collect storm water can also serve as conduits to transmit storm water toward the structure, depending on the slope of the utility trench. Therefore, consideration should also be given to the proposed locations of underground utilities which may pass near the proposed infiltration system.

General Comments

This report has been prepared as an instrument of service for use by the client in order to aid in the evaluation of this property and to assist the architects and engineers in the design and preparation of the project plans and specifications. This report may be provided to the contractor(s) and other design consultants to disclose information relative to the project. However, this report is not intended to be utilized as a specification in and of itself, without appropriate interpretation by the project architect, structural engineer, and/or civil engineer. The design of the proposed storm water infiltration system is the responsibility of the civil engineer. The role of the geotechnical engineer is limited to determination of infiltration rate only. By using the design infiltration rate contained herein, the civil engineer agrees to indemnify, defend, and hold harmless the geotechnical engineer for all aspects of the design and performance of the proposed storm water infiltration system. The reproduction and distribution of this report must be authorized by the client and Southern California Geotechnical, Inc. Furthermore, any reliance on this report by an unauthorized third party is at such party's sole risk, and we accept no responsibility for damage or loss which may occur.

The analysis of this site was based on a subsurface profile interpolated from limited discrete soil samples. While the materials encountered in the project area are considered to be representative of the total area, some variations should be expected between boring locations and testing depths. If the conditions encountered during construction vary significantly from those detailed herein, we should be contacted immediately to determine if the conditions alter the recommendations contained herein.

This report has been based on assumed or provided characteristics of the proposed development. It is recommended that the owner, client, architect, structural engineer, and civil engineer carefully review these assumptions to ensure that they are consistent with the characteristics of the proposed development. If discrepancies exist, they should be brought to our attention to verify that they do not affect the conclusions and recommendations contained herein. We also recommend that the project plans and specifications be submitted to our office for review to verify that our recommendations have been correctly interpreted. The analysis, conclusions, and recommendations contained within this report have been promulgated in accordance with generally accepted professional geotechnical engineering practice. No other warranty is implied or expressed.

Closure

We sincerely appreciate the opportunity to be of service on this project. We look forward to providing additional consulting services during the course of the project. If we may be of further assistance in any manner, please contact our office.

Respectfully Submitted,

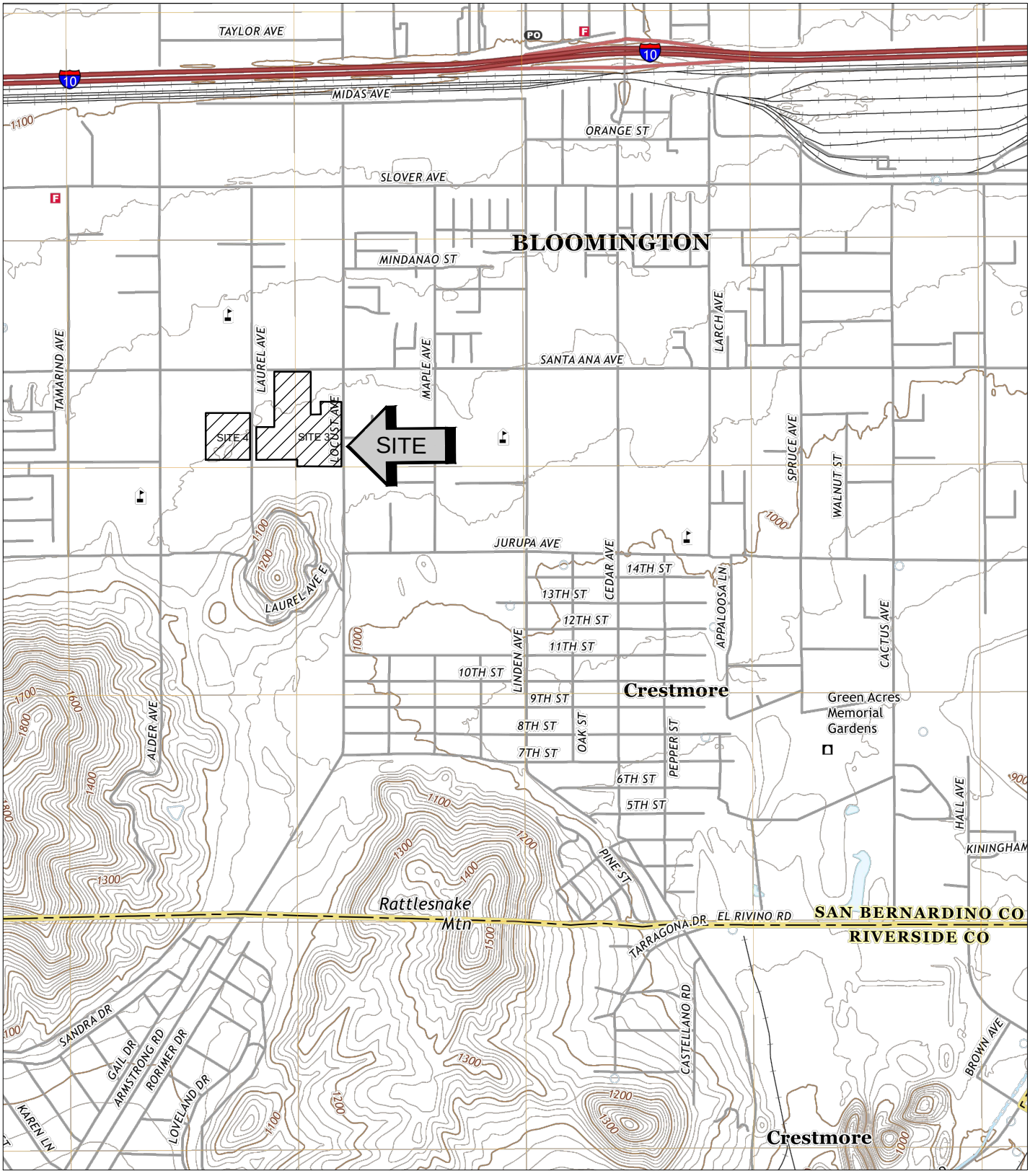
SOUTHERN CALIFORNIA GEOTECHNICAL, INC.

Ryan Bremer
Staff Geologist

Robert G. Trazo, GE 2655
Principal Engineer

Distribution: (1) Addressee

Enclosures: Plate 1 - Site Location Map
Plate 2 - Infiltration Test Location Plan
Boring Log Legend and Logs
Infiltration Test Results Spreadsheets (22 pages)
Grain Size Distribution Graphs (9 pages)



LEGEND

PROJECT SITES 3 AND 4

SOURCE: USGS TOPOGRAPHIC MAP OF THE FONTANA QUADRANGLE, SAN BERNARDINO COUNTY, CALIFORNIA, 2018.

SITE LOCATION MAP

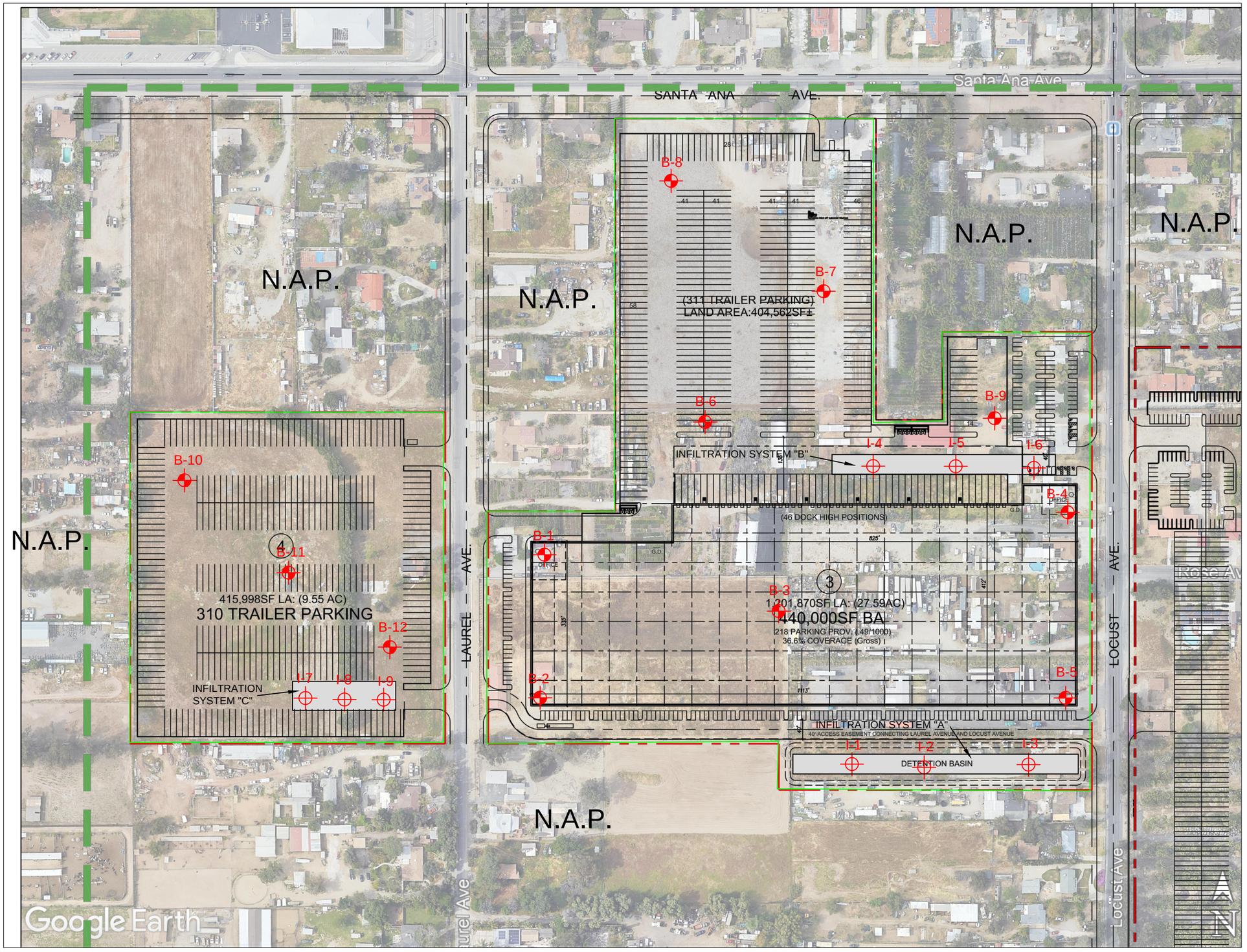
PROPOSED COMMERCIAL/INDUSTRIAL DEVELOPMENT

UNINCORPORATED SAN BERNARDINO COUNTY, CALIFORNIA

SCALE: 1" = 2000'	
DRAWN: OS CHKD: RGT	
SCG PROJECT 20G172-2	
PLATE 1	

SoCalGeo

SOUTHERN CALIFORNIA GEOTECHNICAL



NORTH
SoCalGeo

GEOTECHNICAL LEGEND

- APPROXIMATE INFILTRATION TEST LOCATION
- APPROXIMATE BORING LOCATION (SCG PROJECT NO. 20G172-4)
- APPROXIMATE INFILTRATION SYSTEM LOCATION

INFILTRATION TEST LOCATION PLAN

PROPOSED COMMERCIAL/INDUSTRIAL DEVELOPMENT

BLOOMINGTON, CALIFORNIA

SCALE: 1" = 200'	SOUTHERN CALIFORNIA GEOTECHNICAL
DRAWN: RB CHKD: RGT	
SCG PROJECT 20G172-2	
PLATE 2	

Infiltration Test No.	Infiltration Rate (in/hr)	
I-7	12.1	
I-8	13.1	
Infiltration Rate (lowest) =	12.1	Used
Geotechnical Report recommendation =	12.10	

Worksheet H: Factor of Safety and Design Infiltration Rate and Worksheet

Factor Category		Factor Description	Assigned Weight (w)	Factor Value (v)	Product (p) p = w x v
A	Suitability Assessment	Soil assessment methods	0.25	3	0.75
		Predominant soil texture	0.25	1	0.25
		Site soil variability	0.25	1	0.25
		Depth to groundwater / impervious layer	0.25	1	0.25
		Suitability Assessment Safety Factor, $S_A = \sum p$			1.5
B	Design	Tributary area size	0.25	2	0.5
		Level of pretreatment/ expected sediment loads	0.25	2	0.5
		Redundancy	0.25	2	0.5
		Compaction during construction	0.25	2	0.5
		Design Safety Factor, $S_B = \sum p$			2
Combined Safety Factor, $S_{total} = S_A x S_B$					3.00
Observed Infiltration Rate, inch/hr, $K_{observed}$ (corrected for test-specific bias)					12.10
Design Infiltration Rate, in/hr, Kdesign = $K_{0bserved} / S_{total}$					**4.03**

Infiltration rates for Southern California Geotechincal Report 20G172-2 dated October 20, 2020.

Note: The minimum combined adjustment factor shall not be less than 2.0 and the maximum combined adjustment factor shall not exceed 9.0.

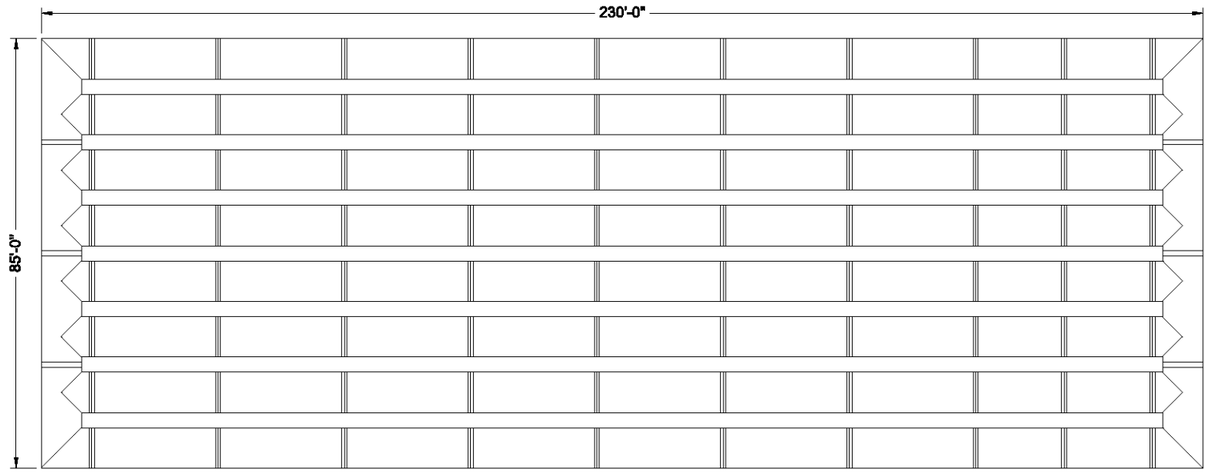
PROJECT SUMMARY

CALCULATION DETAILS
- LOADING = HS20 & HS25
- APPROX. LINEAR FOOTAGE = 1,882 lf.

STORAGE SUMMARY
- STORAGE VOLUME REQUIRED = 133,400 cf.
- PIPE STORAGE VOLUME = 94,600 cf.
- BACKFILL STORAGE VOLUME = 38,859 cf.
- TOTAL STORAGE PROVIDED = 133,459 cf.

PIPE DETAILS
- DIAMETER = 96 IN.
- CORRUGATION = 5x1
- GAGE = 16
- COATING = ALT2
- WALL TYPE = Perforated
- BARRELL SPACING = 36 IN.

BACKFILL DETAILS
- WIDTH AT ENDS = 12 IN.
- ABOVE PIPE = 12 IN.
- WIDTH AT SIDES = 12 IN.
- BELOW PIPE = 6 IN.



NOTES

- ALL RISER AND STUB DIMENSIONS ARE TO CENTERLINE. ALL ELEVATIONS, DIMENSIONS, AND LOCATIONS OF RISERS AND INLETS, SHALL BE VERIFIED BY THE ENGINEER OF RECORD PRIOR TO RELEASING FOR FABRICATION.
- ALL FITTINGS AND REINFORCEMENT COMPLY WITH ASTM A998.
- ALL RISERS AND STUBS ARE $2\frac{2}{3}$" x $\frac{1}{2}$" CORRUGATION AND 16 GAGE UNLESS OTHERWISE NOTED.
- RISERS TO BE FIELD TRIMMED TO GRADE.
- QUANTITY OF PIPE SHOWN DOES NOT PROVIDE EXTRA PIPE FOR CONNECTING THE SYSTEM TO EXISTING PIPE OR DRAINAGE STRUCTURES. OUR SYSTEM AS DETAILED PROVIDES NOMINAL INLET AND/OR OUTLET PIPE STUB FOR CONNECTION TO EXISTING DRAINAGE FACILITIES. IF ADDITIONAL PIPE IS NEEDED IT IS THE RESPONSIBILITY OF THE CONTRACTOR.
- BAND TYPE TO BE DETERMINED UPON FINAL DESIGN.
- THE PROJECT SUMMARY IS REFLECTIVE OF THE DYODS DESIGN, QUANTITIES ARE APPROX. AND SHOULD BE VERIFIED UPON FINAL DESIGN AND APPROVAL. FOR EXAMPLE, TOTAL EXCAVATION DOES NOT CONSIDER ALL VARIABLES SUCH AS SHORING AND ONLY ACCOUNTS FOR MATERIAL WITHIN THE ESTIMATED EXCAVATION FOOTPRINT.
- THESE DRAWINGS ARE FOR CONCEPTUAL PURPOSES AND DO NOT REFLECT ANY LOCAL PREFERENCES OR REGULATIONS. PLEASE CONTACT YOUR LOCAL CONTECH REP FOR MODIFICATIONS.

ASSEMBLY
SCALE: 1" = 30'

The design and information shown on this drawing is provided as a service to the project owner, engineer and contractor by Contech Engineered Solutions LLC ("Contech"). Neither this drawing, nor any part thereof, may be used, reproduced or modified in any manner without the prior written consent of Contech. Failure to comply is done at the user's own risk and Contech expressly disclaims any liability or responsibility for such use.

If discrepancies between the supplied information upon which the drawing is based and actual field conditions are encountered as site work progresses, those discrepancies must be reported to Contech immediately for re-evaluation of the design. Contech accepts no liability for designs based on missing, incomplete or inaccurate information supplied by others.

DATE	REVISION DESCRIPTION	BY

CONTECH ENGINEERED SOLUTIONS LLC
www.ContechES.com
9025 Centre Pointe Dr., Suite 400, West Chester, OH 45069
800-338-1122 513-645-7000 513-645-7993 FAX

CONTECH CMP DETENTION SYSTEMS
CONTECH DYODS DRAWING

DYO7558 Bloomington Business Park SP Site 4
Chamber 1
Bloomington, CA
DETENTION SYSTEM

PROJECT No.:	SEQ. No.:	DATE:
4729	7558	5/5/2021
DESIGNED: DYO	DRAWN: DYO	
CHECKED: DYO	APPROVED: DYO	
SHEET NO.: D1		

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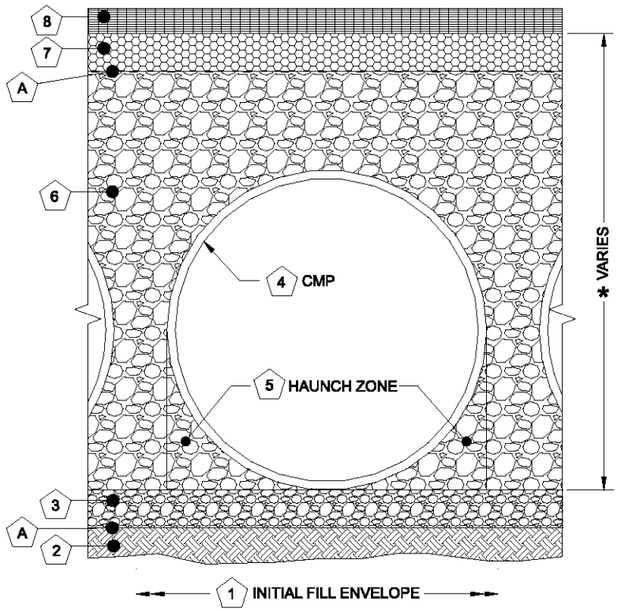


Infiltration Systems - CMP Infiltration & CMP Perforated Drainage Pipe			
Material Location	Description	Material Designation	Designation
8 Rigid or Flexible Pavement (If applicable)			
7 Road Base (If applicable			
A Geotextile Layer	Non-Woven Geotextile	CONTECH C-40 or C-45	Engineer Decision for consideration to prevent soil migration into varying soil types. Wrap the trench only.
6 Backfill	Infiltration pipe systems have a pipe perforation sized of 3/8" diameter. An open graded, free draining stone, with a particle size of ¼" – 2 ½" diameter is recommended.	AASHTO M 145-A-1 or AASHTO M 43 - 3, 4	Material shall be worked into the pipe haunches by means of shovel-slicing, rodding, air-tamper, vibratory rod, or other effective methods. Compaction of all placed fill material is necessary and shall be considered adequate when no further yielding of the material is observed under the compactor, or under foot, and the Project Engineer or his representative is satisfied with the level of compaction"
3 Bedding Stone	Well graded granular bedding material w/maximum particle size of 3"	AASHTO M43 - 3,357,4,467, 5, 56, 57	For soil aggregates larger than 3/8" a dedicated bedding layer is not required for CMP. Pipe may be placed on the trench bottom comprised of native suitable well graded & granular material. For Arch pipes it is recommended to be shaped to a relatively flat bottom or fine-grade the foundation to a slight v-shape. Soil aggregates less than 3/8" and unsuitable material should be over-excavated and re-placed with a 4"-6" layer of well graded & granular stone per the material designation.
A Geotextile Layer	None	None	Contech does not recommend geotextiles be placed under the invert of infiltration systems due to the propensity for geotextiles to clog over time.
* Note: The listed AASHTO designations are for gradation only. The stone must also be angular and clean.			

1 MINIMUM WIDTH DEPENDS ON SITE CONDITIONS AND ENGINEERING JUDGEMENT.

FOUNDATION/BEDDING PREPARATION

2 PRIOR TO PLACING THE BEDDING, THE FOUNDATION MUST BE CONSTRUCTED TO A UNIFORM AND STABLE GRADE. IN THE EVENT THAT UNSUITABLE FOUNDATION MATERIALS ARE ENCOUNTERED DURING EXCAVATION, THEY SHALL BE REMOVED AND BROUGHT BACK TO THE GRADE WITH A FILL MATERIAL AS APPROVED BY THE ENGINEER.

5 HAUNCH ZONE MATERIAL SHALL BE PLACED AND UNIFORMLY COMPACTED WITHOUT SOFT SPOTS.

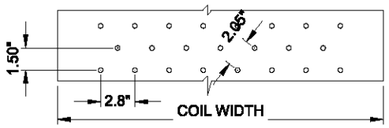
BACKFILL

MATERIAL SHALL BE PLACED IN 8"-10" MAXIMUM LIFTS. INADEQUATE COMPACTION CAN LEAD TO EXCESSIVE DEFLECTIONS WITHIN THE SYSTEM AND SETTLEMENT OF THE SOILS OVER THE SYSTEM. BACKFILL SHALL BE PLACED SUCH THAT THERE IS NO MORE THAN A TWO-LIFT DIFFERENTIAL BETWEEN THE SIDES OF ANY PIPE IN THE SYSTEM AT ALL TIMES DURING THE BACKFILL PROCESS. BACKFILL SHALL BE ADVANCED ALONG THE LENGTH OF THE SYSTEM AT THE SAME RATE TO AVOID DIFFERENTIAL LOADING ON ANY PIPES IN THE SYSTEM.

EQUIPMENT USED TO PLACE AND COMPACT THE BACKFILL SHALL BE OF A SIZE AND TYPE SO AS NOT TO DISTORT, DAMAGE, OR DISPLACE THE PIPE. ATTENTION MUST BE GIVEN TO PROVIDING ADEQUATE MINIMUM COVER FOR SUCH EQUIPMENT. MAINTAIN BALANCED LOADING ON ALL PIPES IN THE SYSTEM DURING ALL SUCH OPERATIONS.

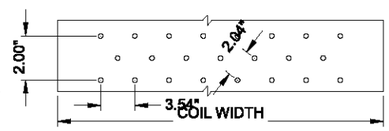
OTHER ALTERNATE BACKFILL MATERIAL MAY BE ALLOWED DEPENDING ON SITE SPECIFIC CONDITIONS. REFER TO TYPICAL BACKFILL DETAIL FOR MATERIAL REQUIRED.

2 2/3" x 1/2" CORRUGATION - STEEL AND ALUMINUM CMP EDGE SPACING EQUAL ON BOTH SIDES



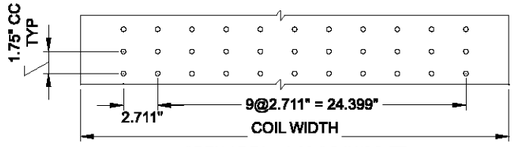
OPEN AREA = 3.76 SQ IN/SQ FT

3" x 1" CORRUGATION - STEEL AND ALUMINUM CMP (COIL PROVIDED FROM CONTECH LANTANA, FL PLANT)



OPEN AREA = 4.16 SQ IN/SQ FT

5" x 1" CORRUGATION - STEEL ONLY
EDGE SPACING EQUAL ON BOTH SIDES



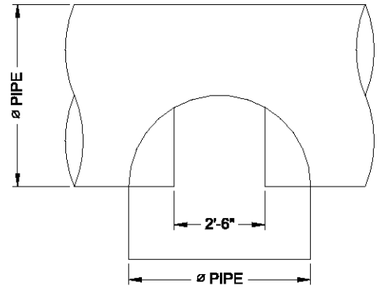
OPEN AREA = 3.33 SQ IN/SQ FT

NOTES:

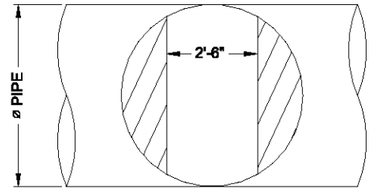
1. PERFORATIONS MEET AASHTO AND ASTM SPECIFICATIONS.
2. PERFORATION OPEN AREA PER SQUARE FOOT OF PIPE IS BASED ON THE NOMINAL DIAMETER AND LENGTH OF PIPE.
3. ALL DIMENSIONS ARE SUBJECT TO MANUFACTURING TOLERANCES.
4. ALL HOLES ⌀3/8".

TYPICAL PERFORATION DETAIL

SCALE: N.T.S.



PLAN

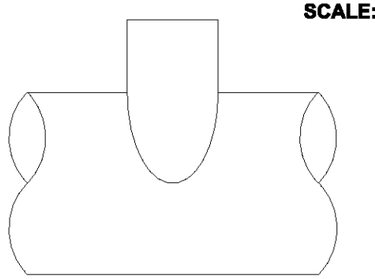


FRONT

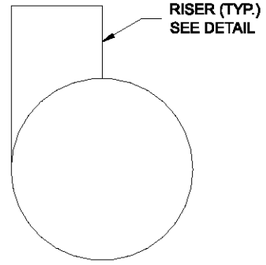
NOTE:
MANWAY DETAIL APPLICABLE FOR CMP SYSTEMS WITH DIAMETERS 48" AND LARGER. MANWAYS MAY BE REQUIRED ON SMALLER SYSTEMS DEPENDING ON ACTUAL SITE SPECIFIC CONDITIONS.

TYPICAL MANWAY DETAIL

SCALE: N.T.S.



ELEVATION

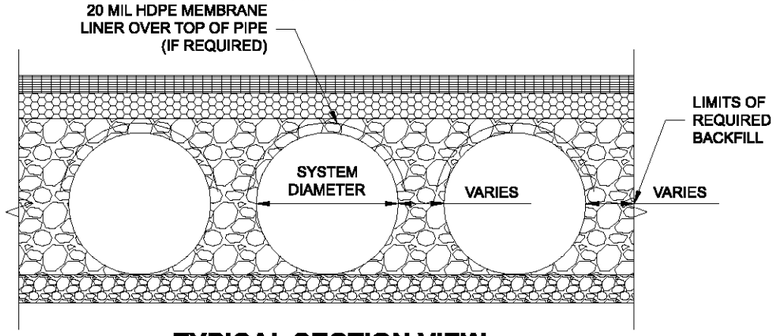


END

NOTE:
LADDERS ARE OPTIONAL AND ARE NOT REQUIRED FOR ALL SYSTEMS.

TYPICAL RISER DETAIL

SCALE: N.T.S.



TYPICAL SECTION VIEW

LINER OVER ROWS
SCALE: N.T.S.

NOTE: IF SALTING AGENTS FOR SNOW AND ICE REMOVAL ARE USED ON OR NEAR THE PROJECT, AN HDPE MEMBRANE LINER IS RECOMMENDED WITH THE SYSTEM. THE IMPERMEABLE LINER IS INTENDED TO HELP PROTECT THE SYSTEM FROM THE POTENTIAL ADVERSE EFFECTS THAT MAY RESULT FROM A CHANGE IN THE SURROUNDING ENVIRONMENT OVER A PERIOD OF TIME. PLEASE REFER TO THE CORRUGATED METAL PIPE DETENTION DESIGN GUIDE FOR ADDITIONAL INFORMATION.

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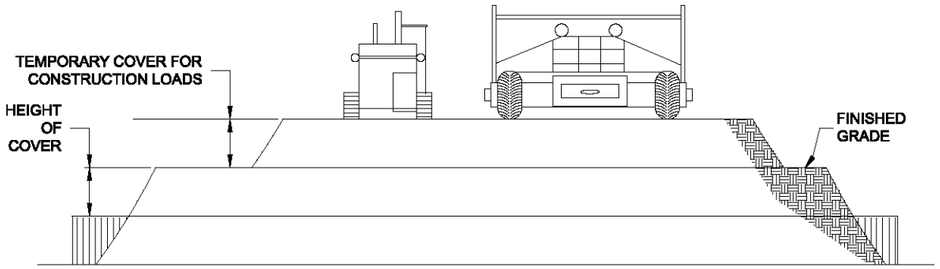
CONTECH CMP DETENTION SYSTEMS
CONTECH DYODS DRAWING

DYO7558 Bloomington Business Park SP Site 4
Chamber 1
Bloomington, CA
DETENTION SYSTEM

PROJECT No.:	SEQ. No.:	DATE:
4729	7558	5/5/2021
DESIGNED: DYO	DRAWN: DYO	
CHECKED: DYO	APPROVED: DYO	
SHEET NO.: D2		



CONSTRUCTION LOADS

FOR TEMPORARY CONSTRUCTION VEHICLE LOADS, AN EXTRA AMOUNT OF COMPACTED COVER MAY BE REQUIRED OVER THE TOP OF THE PIPE. THE HEIGHT-OF-COVER SHALL MEET THE MINIMUM REQUIREMENTS SHOWN IN THE TABLE BELOW. THE USE OF HEAVY CONSTRUCTION EQUIPMENT NECESSITATES GREATER PROTECTION FOR THE PIPE THAN FINISHED GRADE COVER MINIMUMS FOR NORMAL HIGHWAY TRAFFIC.

PIPE SPAN, INCHES	AXLE LOADS (kips)			
	18-50	50-75	75-110	110-150
	MINIMUM COVER (FT)			
12-42	2.0	2.5	3.0	3.0
48-72	3.0	3.0	3.5	4.0
78-120	3.0	3.5	4.0	4.0
126-144	3.5	4.0	4.5	4.5

*MINIMUM COVER MAY VARY, DEPENDING ON LOCAL CONDITIONS. THE CONTRACTOR MUST PROVIDE THE ADDITIONAL COVER REQUIRED TO AVOID DAMAGE TO THE PIPE. MINIMUM COVER IS MEASURED FROM THE TOP OF THE PIPE TO THE TOP OF THE MAINTAINED CONSTRUCTION ROADWAY SURFACE.

CONSTRUCTION LOADING DIAGRAM

SCALE: N.T.S.

SPECIFICATION FOR DESIGNED DETENTION SYSTEM:

SCOPE
THIS SPECIFICATION COVERS THE MANUFACTURE AND INSTALLATION OF THE DESIGNED DETENTION SYSTEM DETAILED IN THE PROJECT PLANS.

MATERIAL
THE MATERIAL SHALL CONFORM TO THE APPLICABLE REQUIREMENTS LISTED BELOW:

ALUMINIZED TYPE 2 STEEL COILS SHALL CONFORM TO THE REQUIREMENTS OF AASHTO M-274 OR ASTM A-92.

THE GALVANIZED STEEL COILS SHALL CONFORM TO THE REQUIREMENTS OF AASHTO M-218 OR ASTM A-929.

THE POLYMER COATED STEEL COILS SHALL CONFORM TO THE REQUIREMENTS OF AASHTO M-246 OR ASTM A-742.

THE ALUMINUM COILS SHALL CONFORM TO THE APPLICABLE OF AASHTO M-197 OR ASTM B-744.

CONSTRUCTION LOADS
CONSTRUCTION LOADS MAY BE HIGHER THAN FINAL LOADS. FOLLOW THE MANUFACTURER'S OR NCSPA GUIDELINES.

PIPE
THE PIPE SHALL BE MANUFACTURED IN ACCORDANCE TO THE APPLICABLE REQUIREMENTS LISTED BELOW:

ALUMINIZED TYPE 2: AASHTO M-36 OR ASTM A-760

GALVANIZED: AASHTO M-36 OR ASTM A-760

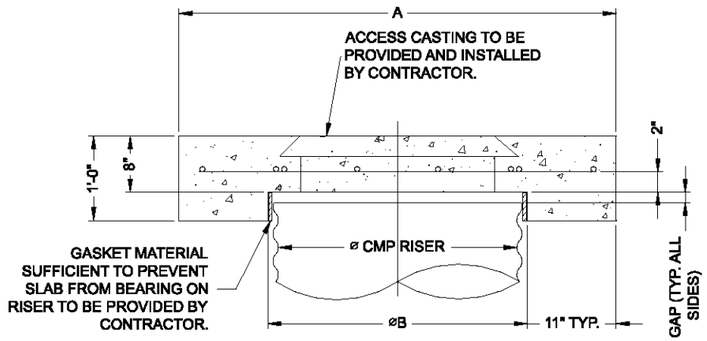
APPLICABLE POLYMER COATED: AASHTO M-245 OR ASTM A-762

ALUMINUM: AASHTO M-196 OR ASTM B-745

APPLICABLE
HANDLING AND ASSEMBLY
SHALL BE IN ACCORDANCE WITH NCSP'S (NATIONAL CORRUGATED STEEL PIPE ASSOCIATION) FOR ALUMINIZED TYPE 2, GALVANIZED OR POLYMER COATED STEEL. SHALL BE IN ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS FOR ALUMINUM PIPE.
REQUIREMENTS
INSTALLATION
SHALL BE IN ACCORDANCE WITH AASHTO STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES, SECTION 26, DIVISION II DIVISION II OR ASTM A-798 (FOR ALUMINIZED TYPE 2, GALVANIZED OR POLYMER COATED STEEL) OR ASTM B-788 (FOR ALUMINUM PIPE) AND IN CONFORMANCE WITH THE PROJECT PLANS AND SPECIFICATIONS. IF THERE ARE ANY INCONSISTENCIES OR CONFLICTS THE CONTRACTOR SHOULD DISCUSS AND RESOLVE WITH THE SITE ENGINEER.

IT IS ALWAYS THE RESPONSIBILITY OF THE CONTRACTOR TO FOLLOW OSHA GUIDELINES FOR SAFE PRACTICES.

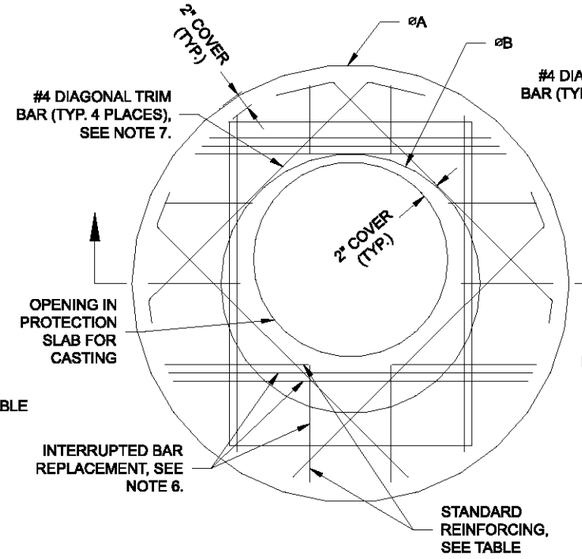
NOTE:
THESE DRAWINGS ARE FOR CONCEPTUAL PURPOSES AND DO NOT REFLECT ANY LOCAL PREFERENCES OR REGULATIONS. PLEASE CONTACT YOUR LOCAL CONTECH REP FOR MODIFICATIONS.



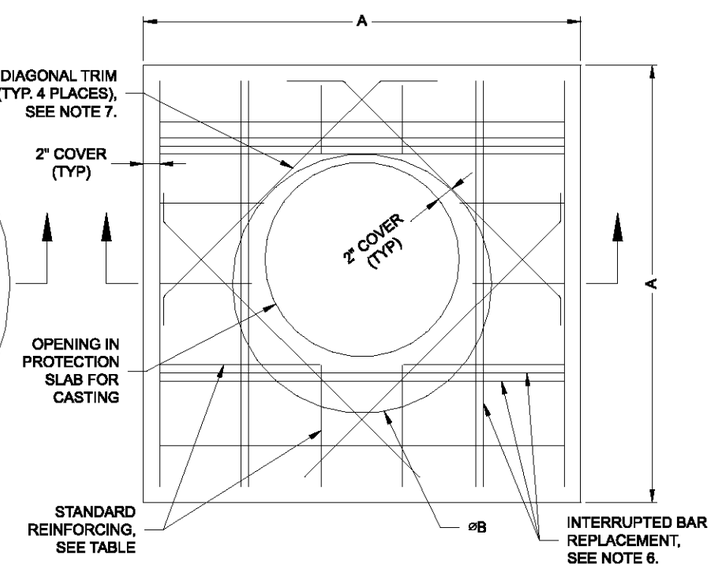
SECTION VIEW

REINFORCING TABLE				
ø CMP RISER	A	ø B	REINFORCING	**BEARING PRESSURE (PSF)
24"	ø 4' 4'X4'	26"	#5 @ 12" OCEW #5 @ 12" OCEW	2,410 1,780
30"	ø 4'-6" 4'-6" X 4'-6"	32"	#5 @ 12" OCEW #5 @ 12" OCEW	2,120 1,530
36"	ø 5' 5' X 5'	38"	#5 @ 10" OCEW #5 @ 10" OCEW	1,890 1,350
42"	ø 5'-6" 5'-6" X 5'-6"	44"	#5 @ 10" OCEW #5 @ 9" OCEW	1,720 1,210
48"	ø 6' 6' X 6'	50"	#5 @ 9" OCEW #5 @ 8" OCEW	1,600 1,100

** ASSUMED SOIL BEARING CAPACITY



ROUND OPTION PLAN VIEW



SQUARE OPTION PLAN VIEW

NOTES:

1. DESIGN IN ACCORDANCE WITH AASHTO, 17th EDITION.
2. DESIGN LOAD HS25.
3. EARTH COVER = 1' MAX.
4. CONCRETE STRENGTH = 3,500 psi
5. REINFORCING STEEL = ASTM A615, GRADE 60.
6. PROVIDE ADDITIONAL REINFORCING AROUND OPENINGS EQUAL TO THE BARS INTERRUPTED, HALF EACH SIDE. ADDITIONAL BARS TO BE IN THE SAME PLANE.
7. TRIM OPENING WITH DIAGONAL #4 BARS, EXTEND BARS A MINIMUM OF 12" BEYOND OPENING, BEND BARS AS REQUIRED TO MAINTAIN BAR COVER.
8. PROTECTION SLAB AND ALL MATERIALS TO BE PROVIDED AND INSTALLED BY CONTRACTOR.
9. DETAIL DESIGN BY DELTA ENGINEERING, BINGHAMTON, NY.

MANHOLE CAP DETAIL

SCALE: N.T.S.

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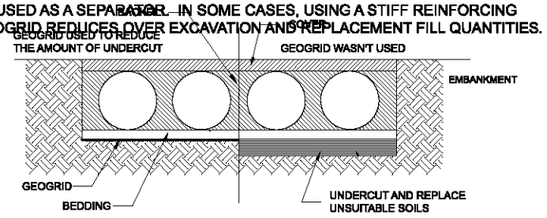
CMP DETENTION INSTALLATION GUIDE

PROPER INSTALLATION OF A FLEXIBLE UNDERGROUND DETENTION SYSTEM WILL ENSURE LONG-TERM PERFORMANCE. THE CONFIGURATION OF THESE SYSTEMS OFTEN REQUIRES SPECIAL CONSTRUCTION PRACTICES THAT DIFFER FROM CONVENTIONAL FLEXIBLE PIPE CONSTRUCTION. CONTECH ENGINEERED SOLUTIONS STRONGLY SUGGESTS SCHEDULING A PRE-CONSTRUCTION MEETING WITH YOUR LOCAL SALES ENGINEER TO DETERMINE IF ADDITIONAL MEASURES, NOT COVERED IN THIS GUIDE, ARE APPROPRIATE FOR YOUR SITE.

FOUNDATION

CONSTRUCT A FOUNDATION THAT CAN SUPPORT THE DESIGN LOADING APPLIED BY THE PIPE AND ADJACENT BACKFILL WEIGHT AS WELL AS MAINTAIN ITS INTEGRITY DURING CONSTRUCTION.

IF SOFT OR UNSUITABLE SOILS ARE ENCOUNTERED, REMOVE THE POOR SOILS DOWN TO A SUITABLE DEPTH AND THEN BUILD UP TO THE APPROPRIATE ELEVATION WITH A COMPETENT BACKFILL MATERIAL. THE STRUCTURAL FILL MATERIAL GRADATION SHOULD NOT ALLOW THE MIGRATION OF FINES, WHICH CAN CAUSE SETTLEMENT OF THE DETENTION SYSTEM OR PAVEMENT ABOVE. IF THE STRUCTURAL FILL MATERIAL IS NOT COMPATIBLE WITH THE UNDERLYING SOILS AN ENGINEERING FABRIC SHOULD BE USED AS A SEPARATOR. IN SOME CASES, USING A STIFF REINFORCING GEOGRID REDUCES OVER EXCAVATION AND REPLACEMENT FILL QUANTITIES.

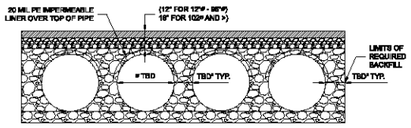


GRADE THE FOUNDATION SUBGRADE TO A UNIFORM OR SLIGHTLY SLOPING GRADE. IF THE SUBGRADE IS CLAY OR RELATIVELY NON-POROUS AND THE CONSTRUCTION SEQUENCE WILL LAST FOR AN EXTENDED PERIOD OF TIME, IT IS BEST TO SLOPE THE GRADE TO ONE END OF THE SYSTEM. THIS WILL ALLOW EXCESS WATER TO DRAIN QUICKLY, PREVENTING SATURATION OF THE SUBGRADE.

GEOMEMBRANE BARRIER

A SITE'S RESISTIVITY MAY CHANGE OVER TIME WHEN VARIOUS TYPES OF SALTING AGENTS ARE USED, SUCH AS ROAD SALTS FOR DEICING AGENTS. IF SALTING AGENTS ARE USED ON OR NEAR THE PROJECT SITE, A GEOMEMBRANE BARRIER IS RECOMMENDED WITH THE SYSTEM. THE GEOMEMBRANE LINER IS INTENDED TO HELP PROTECT THE SYSTEM FROM THE POTENTIAL ADVERSE EFFECTS THAT MAY RESULT FROM THE USE OF SUCH AGENTS INCLUDING PREMATURE CORROSION AND REDUCED ACTUAL SERVICE LIFE.

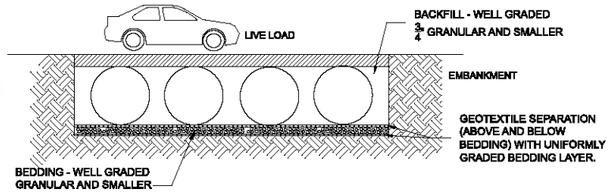
THE PROJECT'S ENGINEER OF RECORD IS TO EVALUATE WHETHER SALTING AGENTS WILL BE USED ON OR NEAR THE PROJECT SITE, AND USE HIS/HER BEST JUDGEMENT TO DETERMINE IF ANY ADDITIONAL PROTECTIVE MEASURES ARE REQUIRED. BELOW IS A TYPICAL DETAIL SHOWING THE PLACEMENT OF A GEOMEMBRANE BARRIER FOR PROJECTS WHERE SALTING AGENTS ARE USED ON OR NEAR THE PROJECT SITE.



IN-SITU TRENCH WALL

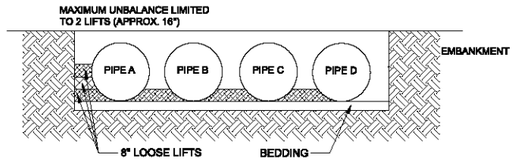
IF EXCAVATION IS REQUIRED, THE TRENCH WALL NEEDS TO BE CAPABLE OF SUPPORTING THE LOAD THAT THE PIPE SHEDS AS THE SYSTEM IS LOADED. IF SOILS ARE NOT CAPABLE OF SUPPORTING THESE LOADS, THE PIPE CAN DEFLECT. PERFORM A SIMPLE SOIL PRESSURE CHECK USING THE APPLIED LOADS TO DETERMINE THE LIMITS OF EXCAVATION BEYOND THE SPRING LINE OF THE OUTER MOST PIPES.

IN MOST CASES THE REQUIREMENTS FOR A SAFE WORK ENVIRONMENT AND PROPER BACKFILL PLACEMENT AND COMPACTION TAKE CARE OF THIS CONCERN.



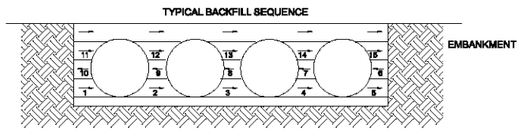
BACKFILL PLACEMENT

MATERIAL SHALL BE WORKED INTO THE PIPE HAUNCHES BY MEANS OF SHOVEL-SLICING, RODDING, AIR TAMPER, VIBRATORY ROD, OR OTHER EFFECTIVE METHODS.

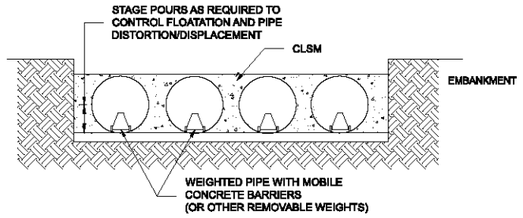


IF AASHTO T99 PROCEDURES ARE DETERMINED INFEASIBLE BY THE GEOTECHNICAL ENGINEER OF RECORD, COMPACTION IS CONSIDERED ADEQUATE WHEN NO FURTHER YIELDING OF THE MATERIAL IS OBSERVED UNDER THE COMPACTOR, OR UNDER FOOT, AND THE GEOTECHNICAL ENGINEER OF RECORD (OR REPRESENTATIVE THEREOF) IS SATISFIED WITH THE LEVEL OF COMPACTION.

FOR LARGE SYSTEMS, CONVEYOR SYSTEMS, BACKHOES WITH LONG REACHES OR DRAGLINES WITH STONE BUCKETS MAY BE USED TO PLACE BACKFILL. ONCE MINIMUM COVER FOR CONSTRUCTION LOADING ACROSS THE ENTIRE WIDTH OF THE SYSTEM IS REACHED, ADVANCE THE EQUIPMENT TO THE END OF THE RECENTLY PLACED FILL, AND BEGIN THE SEQUENCE AGAIN UNTIL THE SYSTEM IS COMPLETELY BACKFILLED. THIS TYPE OF CONSTRUCTION SEQUENCE PROVIDES ROOM FOR STOCKPILED BACKFILL DIRECTLY BEHIND THE BACKHOE, AS WELL AS THE MOVEMENT OF CONSTRUCTION TRAFFIC. MATERIAL STOCKPILES ON TOP OF THE BACKFILLED DETENTION SYSTEM SHOULD BE LIMITED TO 8- TO 10-FEET HIGH AND MUST PROVIDE BALANCED LOADING ACROSS ALL BARRELS. TO DETERMINE THE PROPER COVER OVER THE PIPES TO ALLOW THE MOVEMENT OF CONSTRUCTION EQUIPMENT SEE TABLE 1, OR CONTACT YOUR LOCAL CONTECH SALES ENGINEER.



WHEN FLOWABLE FILL IS USED, YOU MUST PREVENT PIPE FLOATATION. TYPICALLY, SMALL LIFTS ARE PLACED BETWEEN THE PIPES AND THEN ALLOWED TO SET-UP PRIOR TO THE PLACEMENT OF THE NEXT LIFT. THE ALLOWABLE THICKNESS OF THE CLSM LIFT IS A FUNCTION OF A PROPER BALANCE BETWEEN THE UPLIFT FORCE OF THE CLSM, THE OPPOSING WEIGHT OF THE PIPE, AND THE EFFECT OF OTHER RESTRAINING MEASURES. THE PIPE CAN CARRY LIMITED FLUID PRESSURE WITHOUT PIPE DISTORTION OR DISPLACEMENT, WHICH ALSO AFFECTS THE CLSM LIFT THICKNESS. YOUR LOCAL CONTECH SALES ENGINEER CAN HELP DETERMINE THE PROPER LIFT THICKNESS.

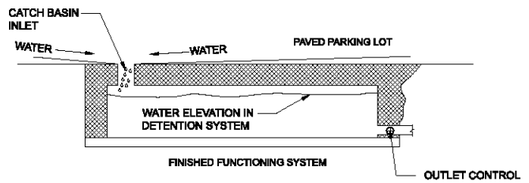


CONSTRUCTION LOADING

TYPICALLY, THE MINIMUM COVER SPECIFIED FOR A PROJECT ASSUMES H-20 LIVE LOAD. BECAUSE CONSTRUCTION LOADS OFTEN EXCEED DESIGN LIVE LOADS, INCREASED TEMPORARY MINIMUM COVER REQUIREMENTS ARE NECESSARY. SINCE CONSTRUCTION EQUIPMENT VARIES FROM JOB TO JOB, IT IS BEST TO ADDRESS EQUIPMENT SPECIFIC MINIMUM COVER REQUIREMENTS WITH YOUR LOCAL CONTECH SALES ENGINEER DURING YOUR PRE-CONSTRUCTION MEETING.

ADDITIONAL CONSIDERATIONS

BECAUSE MOST SYSTEMS ARE CONSTRUCTED BELOW-GRADE, RAINFALL CAN RAPIDLY FILL THE EXCAVATION; POTENTIALLY CAUSING FLOATATION AND MOVEMENT OF THE PREVIOUSLY PLACED PIPES. TO HELP MITIGATE POTENTIAL PROBLEMS, IT IS BEST TO START THE INSTALLATION AT THE DOWNSTREAM END WITH THE OUTLET ALREADY CONSTRUCTED TO ALLOW A ROUTE FOR THE WATER TO ESCAPE. TEMPORARY DIVERSION MEASURES MAY BE REQUIRED FOR HIGH FLOWS DUE TO THE RESTRICTED NATURE OF THE OUTLET PIPE.



CMP DETENTION SYSTEM INSPECTION AND MAINTENANCE

UNDERGROUND STORMWATER DETENTION AND INFILTRATION SYSTEMS MUST BE INSPECTED AND MAINTAINED AT REGULAR INTERVALS FOR PURPOSES OF PERFORMANCE AND LONGEVITY.

INSPECTION

INSPECTION IS THE KEY TO EFFECTIVE MAINTENANCE OF CMP DETENTION SYSTEMS AND IS EASILY PERFORMED. CONTECH RECOMMENDS ONGOING, ANNUAL INSPECTIONS. SITES WITH HIGH TRASH LOAD OR SMALL OUTLET CONTROL ORIFICES MAY NEED MORE FREQUENT INSPECTIONS. THE RATE AT WHICH THE SYSTEM COLLECTS POLLUTANTS WILL DEPEND MORE ON SITE SPECIFIC ACTIVITIES RATHER THAN THE SIZE OR CONFIGURATION OF THE SYSTEM.

INSPECTIONS SHOULD BE PERFORMED MORE OFTEN IN EQUIPMENT WASHDOWN AREAS, IN CLIMATES WHERE SANDING AND/OR SALTING OPERATIONS TAKE PLACE, AND IN OTHER VARIOUS INSTANCES IN WHICH ONE WOULD EXPECT HIGHER ACCUMULATIONS OF SEDIMENT OR ABRASIVE/ CORROSIVE CONDITIONS. A RECORD OF EACH INSPECTION IS TO BE MAINTAINED FOR THE LIFE OF THE SYSTEM

MAINTENANCE

CMP DETENTION SYSTEMS SHOULD BE CLEANED WHEN AN INSPECTION REVEALS ACCUMULATED SEDIMENT OR TRASH IS CLOGGING THE DISCHARGE ORIFICE.

ACCUMULATED SEDIMENT AND TRASH CAN TYPICALLY BE EVACUATED THROUGH THE MANHOLE OVER THE OUTLET ORIFICE. IF MAINTENANCE IS NOT PERFORMED AS RECOMMENDED, SEDIMENT AND TRASH MAY ACCUMULATE IN FRONT OF THE OUTLET ORIFICE. MANHOLE COVERS SHOULD BE SECURELY SEATED FOLLOWING CLEANING ACTIVITIES. CONTECH SUGGESTS THAT ALL SYSTEMS BE DESIGNED WITH AN ACCESS/INSPECTION MANHOLE SITUATED AT OR NEAR THE INLET AND THE OUTLET ORIFICE. SHOULD IT BE NECESSARY TO GET INSIDE THE SYSTEM TO PERFORM MAINTENANCE ACTIVITIES, ALL APPROPRIATE PRECAUTIONS REGARDING CONFINED SPACE ENTRY AND OSHA REGULATIONS SHOULD BE FOLLOWED.

ANNUAL INSPECTIONS ARE BEST PRACTICE FOR ALL UNDERGROUND SYSTEMS. DURING THIS INSPECTION, IF EVIDENCE OF SALTING/DE-ICING AGENTS IS OBSERVED WITHIN THE SYSTEM, IT IS BEST PRACTICE FOR THE SYSTEM TO BE RINSED, INCLUDING ABOVE THE SPRING LINE SOON AFTER THE SPRING THAW AS PART OF THE MAINTENANCE PROGRAM FOR THE SYSTEM.

MAINTAINING AN UNDERGROUND DETENTION OR INFILTRATION SYSTEM IS EASIEST WHEN THERE IS NO FLOW ENTERING THE SYSTEM. FOR THIS REASON, IT IS A GOOD IDEA TO SCHEDULE THE CLEANOUT DURING DRY WEATHER.

THE FOREGOING INSPECTION AND MAINTENANCE EFFORTS HELP ENSURE UNDERGROUND PIPE SYSTEMS USED FOR STORMWATER STORAGE CONTINUE TO FUNCTION AS INTENDED BY IDENTIFYING RECOMMENDED REGULAR INSPECTION AND MAINTENANCE PRACTICES. INSPECTION AND MAINTENANCE RELATED TO THE STRUCTURAL INTEGRITY OF THE PIPE OR THE SOUNDNESS OF PIPE JOINT CONNECTIONS IS BEYOND THE SCOPE OF THIS GUIDE.

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SHEET NO.: D4		

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Santa Ana Watershed

BMP Design Volume, V_{BMP}

Company Name	FMCIVIL Engineers Inc.
Designed by	Francisco Martinez, PE
Project	Bloomington Commerce Center SP4 DA1
Date	5/6/2021

DA 1	**Surface Type**	**Area (SF)**
	Roof	-
	Concrete or Asphalt	345,208.48
	Future Impervious Area	-
	Restore to Natural	-
	Ornamental Landscaping	29,667.29
	Total Area (SF)	374,875.77
	Total Area (Acres)	8.6

Impervious Ratio =	**(i)**	92.1%
C_{BMP} = Runoff Coefficient	**$0.858i^3-0.78i^2+0.774i+0.04$**	0.7613
$P_{2yr,1hr}$	**NOAA - 2-yr 1-hr rainfall depth**	0.533
a_1 = San Bernardino Climate Region	**Valley = 1.4807** **Mountain = 1.909** **Desert = 1.2371**	1.4807
P_6 - Mean Storm Rainfall Depth	**$P_6 = a_1 * P_{2yr,1hr}$**	0.7892
a_2 = Drawdown rate of Basin	**1.582 for 24-hr** **1.963 for 48-hr**	1.9630
Project Area (SF)	**(DA)**	374,875.77
Design Capture Volume (cu.ft.)	**DCV = DA * C_{BMP}* a_2 * P_6/12**	36,845.31
Volume Provided, cu. Ft.	**StormTech Chambers**	119,871.50

DETENTION BASIN DESIGN CRITERIA FOR SAN BERNARDINO COUNTY

The following design parameters and procedures are listed as guidelines to insure proper detention basin operation. When necessary, these guidelines may be modified if approved in writing by both the Flood Control District and Land Management Department.

I. Definitions

A. Regional Detention Basin

1. A basin which can be incorporated into the Flood Control District's existing or proposed drainage system,

2. Basin owned and operated by the Flood Control District, although it may be joint use, and

3. A basin which will reduce the downstream peak flow rate and the necessary downstream storm drain size.

B. Local Detention Basin

1. A basin which will not be incorporated into the Flood Control District's existing or proposed drainage system,

2. A basin owned by an individual or organization other than the Flood Control District, and

3. A basin which will reduce the downstream peak flow rate, but will not be considered in downsizing future downstream storm drains.

C. Joint Use Detention Basin: A regional or local detention basin which has an additional use such as football field, parking lot, golf course, lake or etc.

D. Temporary Detention Basin

1. A local detention basin used to reduce downstream peak flow rates until ultimate storm drain facilities can be constructed as part of a phased development, and

2. Generally the life of the basin shall not exceed 10 years.

SEE CHANGE PER ATTACHED MEMO

II. Basin Capacity and Outlet Drain

A. When a basin (regional, local, temporary or joint use) is to be used to mitigate downstream impacts due to increased flows generated by a development, the basin capacity and outlet size shall be such that the post-development peak flow rate generated by the site shall be less than or equal to 90% of the pre-development peak flow rate from the site for all frequency storms up to and including 100-year (i.e. the peak 2 year post-development flow rate is equal to or less than 90% of the peak 2 year pre-development flow rate from the site and etc. for all frequency storm events through 100-year).

1. Only 2, 10, 25 and 100-year storms need to be analyzed.

2. Additional studies shall be submitted where there exists more than one basin in the drainage area under review. The studies shall address the timing of the peak flow rates from the basins to ensure downstream flow rates are not increased.

B. When a basin (generally regional or regional joint use) is to be used to reduce the size of a master planned downstream drainage facility, the basin capacity and outlet size shall be such that the 100 year basin peak outflow rate is no greater than the downstream facility's design capacity.

1. Open channel design capacities shall be per the San Bernardino County Flood Control District Standard Plat 100 ("San Bernradino County Standards and Specifications"). A bulking factor is not necessary when the basin is designed to handle debris and the downstream channel is lined.

2. Pressure flow closed conduits shall be designed such that the hydraulic grade line is below the ground or street surface. In those reaches where no surface flow will be intercepted (now or in the future), a hydraulic grade line which encroaches on or is slightly higher than the ground or street surface will be acceptable.

3. Non-pressure flow closed conduit capacities shall be based on a flow depth no greater than 0.8 times the conduits diameter or height.

C. Where downstream erosion is a concern the duration of erosive flow velocities for all frequency storms shall not be substantially increased unless other forms of mitigation are provided. This can be accomplished by reducing the peak flowrate further than that required above. Refer to "Handbook of Hydraulics" by Horace Williams King and Earnest F. Brater, and "Open-Channel Hydraulics" by Ven Te Chow, Ph.d. for erosive flow velocities.

D. When there exists a potential for debris entering the basin, the basin capacity shall be increased or a desilting basin provided to accomodate the debris production generated from a 100-year storm four years after a burn (over the entire watershed), plus 20% due to maintenance uncertainties.

1. For all basins where a significant amount of debris accumulation is anticipated, a debris disposal area or areas shall be provided within a reasonable hauling distance.

2. "A New Method of Estimating Debris-Storage Requirements for Debris Basins" by Fred E. Tatum of the U.S. Army Corps of Engineers shall be used for determining the 100-year debris volume.

3. Local basins shall not be located in desert areas where there exists the potential for debris entering the basin (i.e., locations where flows are directed to the basin by natural drainage courses or earth graded channels which handle flows from undeveloped watersheds). It is recommended that the flows from the development be conducted to the basin in a hardlined facility (i.e. street or concrete channel), then outletted into the natural drainage course or earth channel.

4. Local detention basins shall not be fed by natural drainage courses or earth channels with undeveloped watersheds greater than 0.5 square mile.

5. The basin capacity for local detention basins fed by natural drainage courses or earth channels with undeveloped watershed less than 0.5 square mile, shall be enlarged to handle an additional 5 years of accumulated annual debris based on the attached figure 1.

6. Generally regional detention basins with undeveloped watersheds shall be flow-by basins or have a separate debris basin upstream of the detention basin.

7. The basin capacity for detention basins located in watersheds known to have a high risk of burning, shall be increased as determined by the Flood Control District.

E. Outlet Drain

1. The outlet pipe for all basins except temporary basins shall be a minimum 24" RCP (1350 D minimum) for local basins and a minimum 36" RCP (1350 D minimum) for regional basins. The outlet pipe or conduit shall be encased with cut-off collars per the "Los Angeles County Flood Control Design Manual - Debris Dams and Basins" or designed per "Section 242. Cut-and-Cover Conduit Detail" of the Bureau of Reclamation's publication "Design of Small Dams".

   a) Reinforced concrete collars generally from 2 to 3 feet high, 12 to 18 inches wide, and spaced from 7 to 10 times their height shall be provided.

   b) All joints for pipes not encased shall be rubber gasketed.

   c) The pipe shall be capable of withstanding H20 live loads plus the applicable dead loads.

   d) Erosion control measures shall be provided at the outlet of the basin outlet pipe.

   e) Temporary basin outlet pipes may be a minimum 24" C.M.P., 12 gauge with seep rings. Design considerations shall be as stated above.

2. A metered outlet structure may be necessary to provide the necessary flow attenuation for all frequency storms. "V"-shaped weirs and notched weirs are preferred over other alternates because they do not plug with debris and trash as easily as other designs.

3. All detention basin outlets should be sized so the basin will drain within 24 hours after the basin reaches its 100 year peak depth/volume. If the basin does not drain in 24 hours, further studies using longer duration storms will be necessary. The basin storage volume (capacity) may need to be increased to accomodate subsequent storms.

4. Trash racks shall be provided at the inlet to the basin outlet structure(s).

5. Anti-vortex devises shall be provided where warranted.

6. A depth gauge shall be provided on the basin outlet structure in order to monitor debris deposition and basin operation.

F. Analysis Methodology

1. Pre and post development peak flow rates shall be developed using the procedures outlined in the San Bernardino County's Hydrology Manual.

2. Basin inflow hydrographs shall be developed using the procedures outlined in the San Bernardino County's Hydrology Manual.

3. Basin outflow hydrographs shall be developed by the Modified Puls Method.

4. Channel hydrograph routing shall be calculated by the convex channel routing method or by moving the hydrograph utilizing travel time.

III. Water Surface Elevation and Depth

A. Local Basins

1. When feasible the 100 year design water surface elevation should be at or below existing natural ground. Generally no more than 50% of the basins 100 year storage depth should be above existing ground (i.e., 50% or more of the 100-year minimum storage depth must be below the lowest ground outside basin).

2. The necessary storage depth for debris plus the two year flow attenuation shall be below existing ground.

3. The basin's maximum water depth for 100-year design should be 6 feet or less.

4. When site conditions warrant and safety can be assured, the above depth requirements may be modified if the following conditions are met.

a) The detention basin is designed in accordance with the Los Angeles County Flood Control Distrit's "Design Manual - Debris Dams and Basins".

b) The basin embankment is constructed of material, or has a solid core, which does not allow seepage or piping to occur due to rodent holes.

B. Regional Basins

1. Depths shall be as approved by the Flood Control District.

2. Basins with heights greater than or equal to 25 feet and capacity greater than or equal to 15 Ac.ft., or a capacity greater than or equal to 50 ac. ft. and a height greater than or equal to 6 feet, shall be reviewed and approved by the State's Division of Safety of Dams. (See figure 2)

C. Joint Use Basins

1. Depths should be shallow and compatible with the secondary use.

2. Depths for parking lot, tennis court or other similar joint use basins should be no greater than 6 inches to 12 inches.

3. The allowable depth in most cases will be site specific and shall be approved by all agencies involved.

IV. Emergency Spillway

A. All detention basin spillways shall be designed to pass the fully developed 1000 year peak flow rate ($Q_{1000}=1.35\ Q_{100}$) or that peak flow rate required by the State's Division of Safety of Dams, whichever is greater.

B. Spillway outflows shall be adequately conveyed to a storm drain, drainage channel, street or an established watercourse.

C. Generally, all spillway structures shall be constructed of reinforced concrete. For temporary detention basins with an expected life less than 10 years the spillway may be constructed with grouted rock or other forms of approved protection designed to resist maximum design velocities.

D. When the spillway crest is more than 3 feet above the flowline of the facility the spillway outlets into, the spillway shall be constructed of reinforced concrete.

E. Generally the spillway crest shall be at, or above the basin's design 100 year high water line.

V. Freeboard to the Top of Embankment

A. Local and temporary basins shall have a minimum 1-foot of freeboard above the 1000-year HWL on the emergency spillway or 2-feet of freeboard above the 100-year HWL in the basin, whichever is more stringent.

B. Regional basins shall have a minimum 2-feet of freeboard above the 1000 year HWL on the emergency spillway. For basins with larger surface areas the freeboard shall be increased due to possible wave action. Also, a Seismic Seiche analysis shall be provided to determine necessary freeboard. Reference "Design of Small Dams" by the United States Department of Interior.

C. Joint use basins shall conform to the applicable local or regional freeboard requirements. For smaller basins such as parking lot and tennis court basins, the freeboard conditions may be reduced.

VI. Basin Embankment

A. Basin side slopes should be of 3H:1V or flatter on the wet side and 2H:1V or flatter on the dry side. Steeper slopes may be acceptable on a case by case basis if rock lined and recommended in the soils and geotechnical report. (See items C and D below for expanded requirements for report.)

B. Top Width of Levee

1. Regional and local basins - 15 feet minimum
2. Joint use - site specific
3. Refer to Section IX.C.

C. For design of the embankment abutments and adjacent slopes, a soils and geotechnical report shall be prepared by a soils and geotechnical engineer with a demonstrated expertise in earth fill dam design. The report shall be reviewed and approved by the Land Management Department and the San Bernardino County Flood Control District. The report shall include:

a) Site geology including bedding, foliation, fracture, joint, fault and land slide plane attitudes.

b) Seismic conditions including fault locations and potential seismic surface movements respective loadings and parameters of seismic shaking.

c) Potential impact of reservoir loading on geologic structure should be evaluated.

d) Detailed descriptions, locations, and logs of all field explorations.

e) Field and laboratory tests and analysis descriptions and results.

f) Ground water table elevation and analysis of near surface groundwater movement.

g) Recommended design parameters including, but not limited to the following for the dam and its natural abutments and slopes adjacent reservoir areas:

1. Lateral earth loadings
2. Shear strengths
3. Bearing capacities
4. Permeability
5. Slope stability analysis when saturated and during rapid drawdown conditions
6. Seive analysis
7. Sand equivalents
8. Liquefaction analysis and if appropriate; mitigation
9. Seismic Seiche analysis ___ 10. UBC Chapter 70

h) Special design and construction recommendations including, but not limited to the following:

1. Foundation preparation requirements

2. Suitability of materials for embankments (gradation, sand equivalent, etc.) and abutments

3. Compaction methods and minimum requirements

4. Seepage and piping control provisions

5. Potential for settlement

6. Seismic considerations

7. Minimum design factors of safety are:

	Without Seismic	With Seismic
Embankment, Abutment and Adjacent Slope Stability	1.5	1.1
Seepage - Piping	1.5	---

8. Necessity of impervious core or shear key

9. Erosion control of abutments.

D. Regional basins and local basins not meeting the depth and side slope requirements setforth previously shall be designed in accordance with the Los Angeles County Flood Control District's "Design Manual - Debris Dams and Basins".

VII. Basin Floor

A. A low flow channel shall be provided from the basin inlet(s) to the basin outlet.

1. Where basin slopes exceed 2% or produce erosive flow velocities the low flow channel should be protected from erosion with reinforced concrete, rock lining or other form of approved erosion protection.

2. Joint use basins

a) A low flow channel or conduit should be provided to conduct minor flows around the dual use facilities wherever possible. Low flow channels may not be necessary for parking lot basins or other similar joint uses.

b) Low flow channel may be grass lined if there exists a maintenance program which includes mowing and maintenance of turf in good condition and velocities of flow through the various stages of discharge are low enough to be nonerosive.

B. Earth basin floors shall slope at a minimum 0.5% grade to the low flow channel.

C. Earth basin floors shall have a minimum grade of 0.5% from the inlet to the outlet.

VIII. Inlet Structures

A. Where storm drains enter the basin, energy dissipators and/or erosion protection shall be provided. Plans must be approved by the San Bernardino County Flood Control District Permit Section before plan approval if the basin is to be operated and maintained by the Flood Control District.

B. Where natural drainage courses or channels enter the basin some form of invert stabilization such as a reinforced concrete spillway shall be provided.

C. Energy dissipators may be required when the inletting flow velocities exceed 5 fps.

D. Inletting storm drains shall be a minimum 24" RCP (1350 D).

IX. Access

A. Access to any type of detention basin area shall be provided by a roadway capable of handling two way traffic (from a public street or public access to the parcel upon which the basin is constructed).

B. Access shall be maintained under all weather conditions.

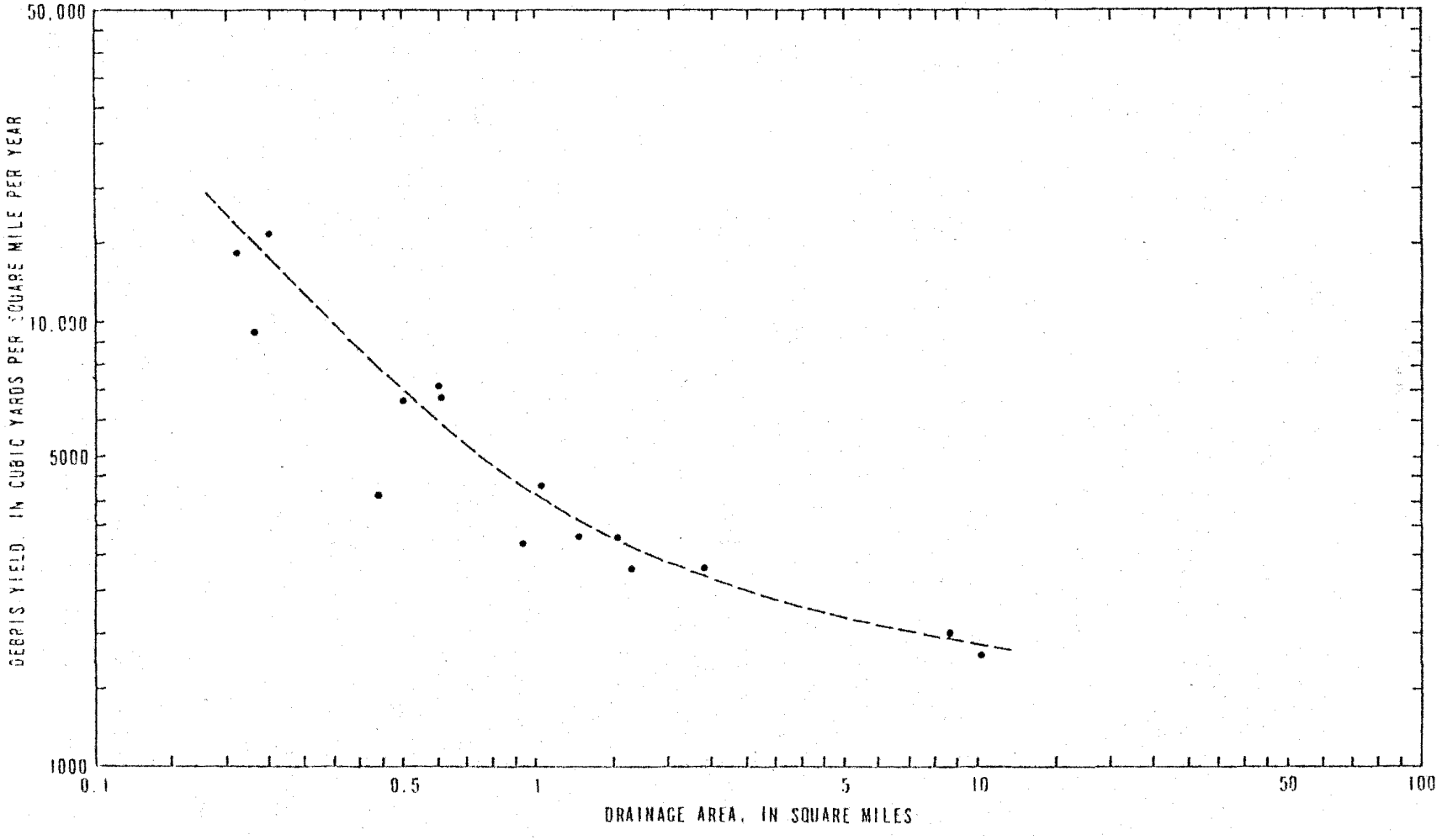


FIGURE 1 .--Long-term sediment yields at selected sites in Los Angeles County, California.

C. A 15-foot wide roadway shall be provided along the top of embankment, across the spillway and around the basin. The intent of this criteria is to have continuous access around, and to, the basin for maintenance purposes. Under certain circumstances where it can be shown the recommended top width is not necessary for structural safety and maintenance, the criteria may be modified. Approval will be required by both the Land Management Department and the Flood Control District.

1. If access across the spillway is not provided minimum 40' X 60' turn arounds shall be provided on both sides of the spillway.

2. If there exists adequate access for maintenance, this requirement may be amended for local, temporary or joint use basins.

D. Access ramps shall be provided to the basin floor.

1. Minimum of one - 15 foot wide ramp for local basins.
2. Minimum of two - 15 foot wide ramps for regional basins.

E. The maximum roadway or access ramp slope shall be 10%.

F. The minimum access and roadway inside turning radius shall be 35 feet.

X. Fencing

A. All basins shall be fenced with 6-foot chain link fencing per Cal Trans standards or other approved barrier unless otherwise approved by the Land Management Department and the Flood Control District. Joint use basin fencing will be site specific and must meet the needs of all agencies utilizing the basin.

B. All regional basin chain link fencing shall have a 1 foot wide painted horizontal orange stripe at the mid height of the fence.

C. Access to the basins shall be gated and locked.

XI. Rights-of-Way

A. Sufficient rights-of-way shall be provided for the construction and economical maintenance of the basin(s), (including all fill and cut slopes) and shall include sufficient area to provide for an access road from a dedicated public street to the basin.

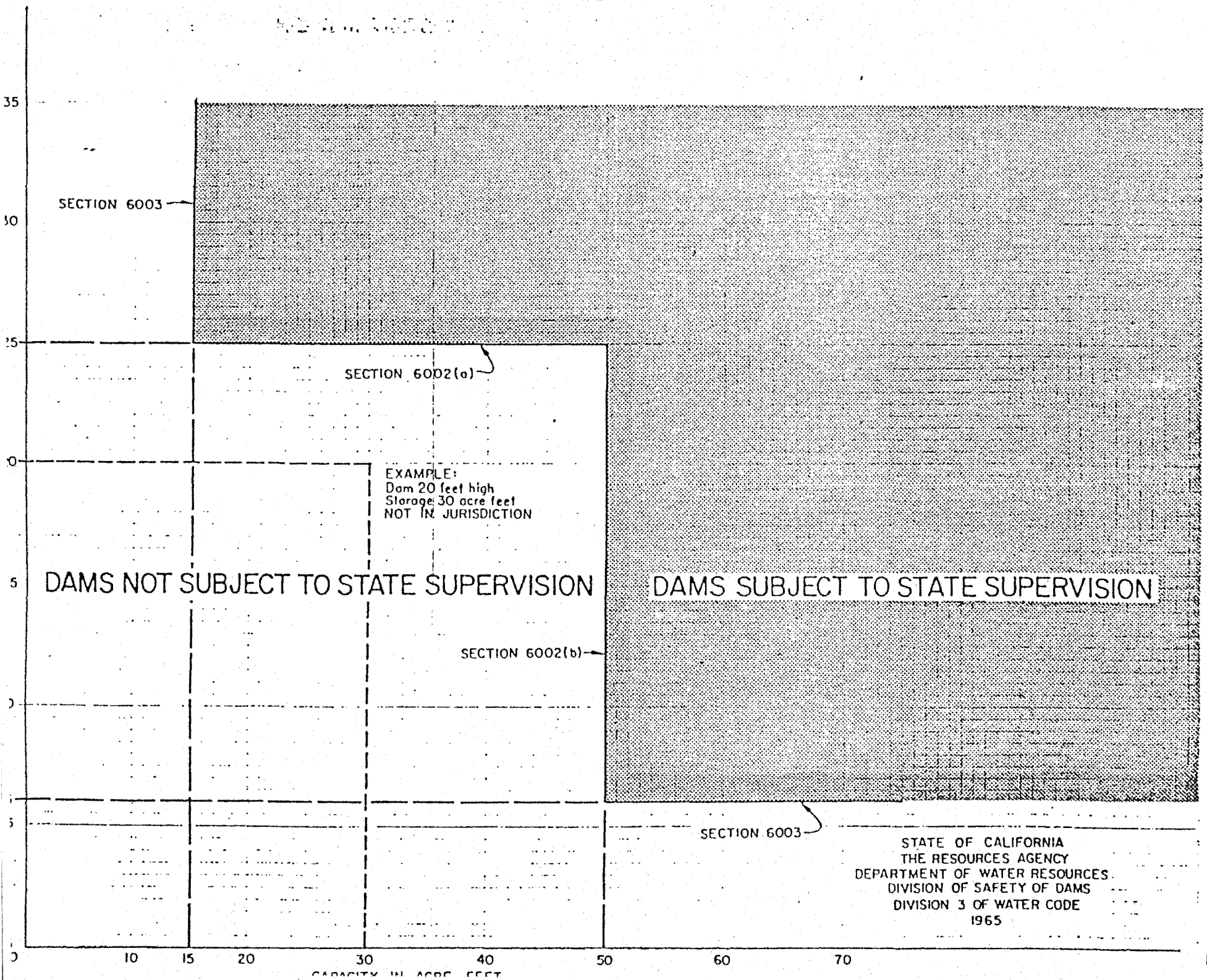

SECTION 6003
SECTION 6002(a)
EXAMPLE:
Dam 20 feet high
Storage 30 acre feet
NOT IN JURISDICTION
DAMS NOT SUBJECT TO STATE SUPERVISION
DAMS SUBJECT TO STATE SUPERVISION
SECTION 6002(b)
SECTION 6003
STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES
DIVISION OF SAFETY OF DAMS
DIVISION 3 OF WATER CODE
1965
10
15
20
30
40
50
60
70

FIG. 2

B. Regional basins shall be dedicated to the District in fee title.

C. Local basins shall be covered by an adequate San Bernardino County Drainage Easement.

XII. References to be Used in Design.

"A New Method of Estimating Debris - Storage Requirements for Debris Basins," Tatum, U.S. Army Engineer District, Los Angeles, CA, 1963

"Design of Small Dams", U.S. Bureau of Reclamation, 1977

"Handbook of Hydraulics", King and Brater, McGraw Hill Book Company, 1954

"Los Angeles County Flood Control Manual - Debris Dams and Basin", Los Angeles County Flood Control District

"Open-Channel Hydraulics", Ven Te Chow, Ph.d., 1959

"San Bernardino County Hydrology Manual", San Bernardino County, May 1983

"San Bernardino County Standards and Specification", San Bernardino County Department of Transmportation/Flood Control/Airports

INTEROFFICE MEMO

1853

County of San Bernardino

DATE September 4, 1987 PHONE 2515

FROM ROBERT W. CORCHERO, Chief
Water Resources Division

TO CHARLES L. LAIRD, Acting Director
Transportation/Flood Control File: 1(FC)-53

SUBJECT SAN BERNARDINO COUNTY DETENTION BASIN DESIGN CRITERIA

As requested the subject criteria was reviewed with respect to the determination of pre-development peak flow rates. According to the existing criteria the County can be 85% confident that the calculated peak flow rate will equal or exceed the peak flow rate at a given concentration point if adequate streamflow data was available. Therefore, the County can only be about 15% confident a detention basin outflow will not adversely affect downstream properties (not considering erosion).

The County should be at least 50% confident a detention basin outflow will not adversely impact properties downstream of the basin. Based on the calibration study of the county's hydrology method the input parameters (procedures) described in the Manual should be modified as follows:

a) 10 year peak flow rates should be calculated using 5-year rainfall,

b) 25-year peak flow rates should be calculated using 10-year rainfall, and

c) 100-year peak flow rates should be calculated using 25-year rainfall and AMC II.

If these design parameters are used for determining the pre-development peak flow rates, the basin outflow metered to 90% of these calculated pre-development peak flow rates and the post-development peak flow rates to the basin calculated in accordance with County Hydrology Manual, the County will be over 50% confident the resulting basin design will not adversely affect adjacent or downstream properties (not considering erosion).

The desired confidence level for detention basin outflow is a policy decision. Once the desired confidence level is determined the required input rainfall amounts can be developed to calculate the peak flow rate at the corresponding confidence level. I have discussed this policy issue with John Pederson of the U.S. Army Corps of Engineers, Ron Moore of the Soil Conservation Service and Al Nessinger of Orange County. Al Nessinger pointed out by using basin inflow hydrographs based on a 85% confidence level

and by creating adequate storage to reduce the peak flow rate from the basin to 90% of pre-development condition based on a 50% confidence level, the resulting confidence level that downstream conditions have not changed will be greater than 50%. Also, the rainfall pattern used in the hydrograph method was chosen to be the most severe test on basin design. When these facts are combined with criteria of using multi-day storms, the resulting basin design should be adequate to ensure downstream properties will not be subject to increased peak flow rates. Ron Moore felt the revised criteria better fit the actual pre-development conditions in the field. John Pederson and Al Nessigner both felt the criteria should be tested against actual occurrences in gaged watershed. Attached is page 2 of the design criteria with the proposed changes shown in bold type.

Should you have any questions, please call.

RWC:mjs
Attachment

cc: Ken Miller

II. Basin Capacity and Outlet Drain

A. When a basin (regional, local, temporary or joint use) is to be used to mitigate downstream impacts due to increased flows generated by a development, the basin capacity and outlet size shall be such that the post-development peak flow rate generated by the site shall be less than or equal to 90% of the pre-development peak flow rate from the site for all frequency storms up to and including 100-year (i.e.) the peak 2 year post-development flow rate is equal to or less than 90% of the peak 2 year pre-development flow rate from the site and etc. for all frequency storm events through 100 year).

1. Only 2, 10, 25 and 100-year storms need to be analyzed.

2. Post-development peak flow rates shall be calculated in accordance with the "San Bernardino County Hydrology Manual".

3. Pre-development peak flow rates shall be calculated in accordance with the "San Bernardino County Hydrology Manual" with the following exceptions.

   a) 10-year peak flow rates shall be calculated using 5-year rainfall.

   b) 25-year peak flow rates shall be calculated using 10-year rainfall.

   c) 100-year peak flow rates shall be calculated using 25-year rainfall and AMC-II.

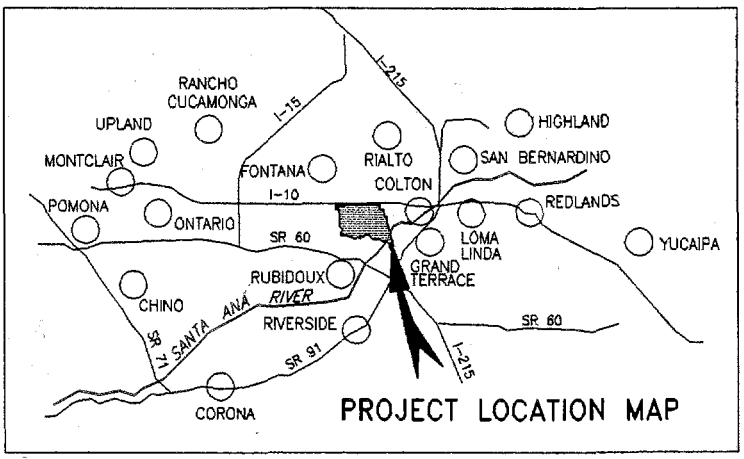
4. Additional studies shall be submitted where there exists more than one basin in the drainage area under review. The studies shall address the timing of the peak flow rates from the basins to ensure downstream flow rates are not increased.

LOCAL AREA DRAINAGE PLAN

PROJECT 3-4

ENGINEERS REPORT
VOLUME #1

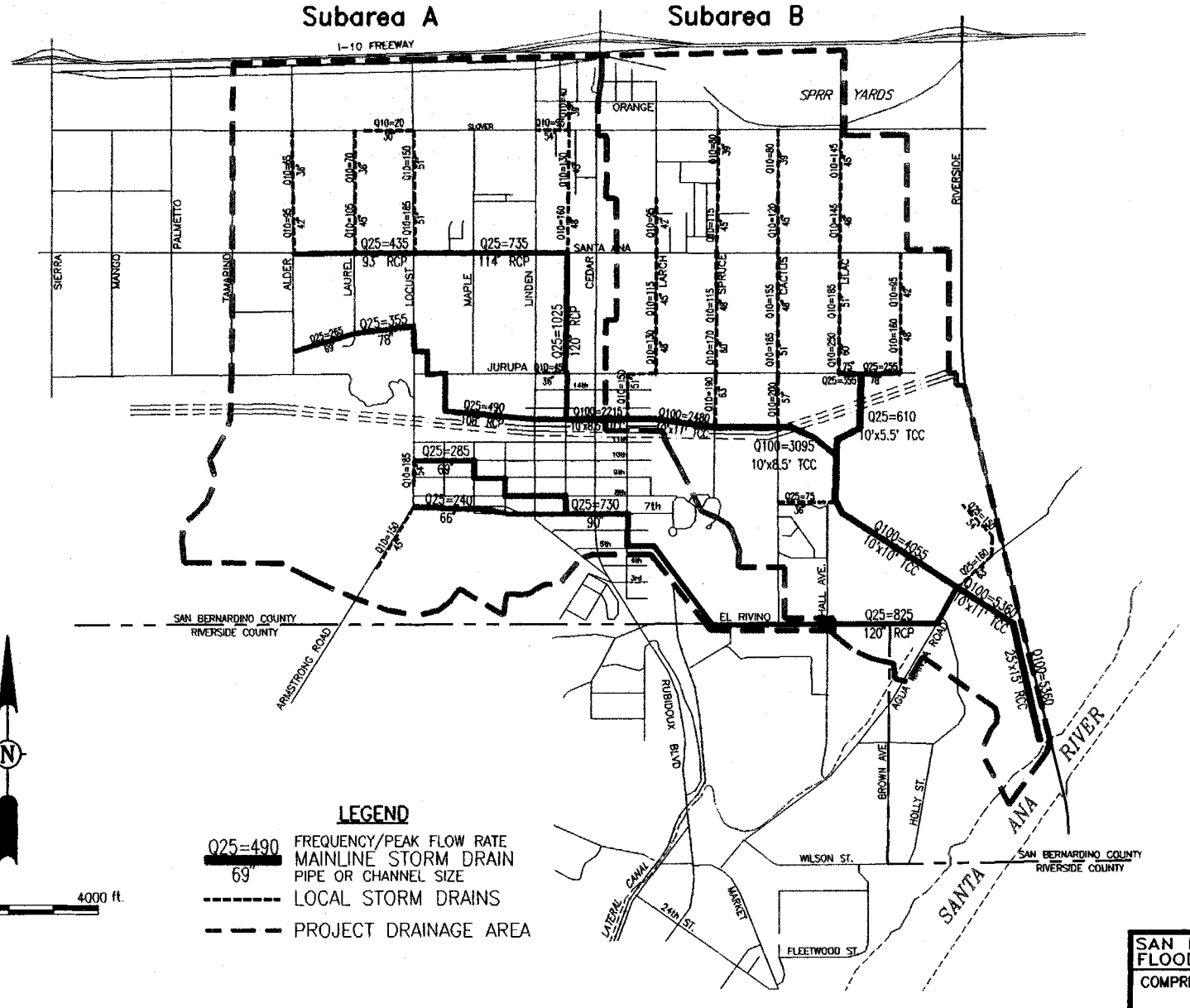
OCTOBER 1992



PROJECT LOCATION MAP

PREPARED BY
SAN BERNARDINO COUNTY
FLOOD CONTROL DISTRICT
PLANNING DIVISION

SAN BERNARDINO COUNTY FLOOD CONTROL DISTRICT



REV. JAN 93

SAN BERNARDINO COUNTY FLOOD CONTROL DISTRICT		
COMPREHENSIVE STORM DRAIN PLAN		
PROJECT 3-4		
MODEL-1		
LOCAL AREA DRAINAGE PLAN		
BY JLD	ACAD FILE	PLANNING FILE NO.
DATE JUL 88	PX1-21D	PM-D1-115

PLATE NO.1