Appendix F

PRELIMINARY DRAINAGE STUDY

HOLLY STREET
APN: 0260-131-14, 0260-131-15
San Bernardino County, California

August 07, 2018

Prepared for:

Howard Industrial Partners, LLC
1944 N Tustin Street #122
Orange, CA 92865
T.714-602-7345

Report Prepared By:

FMCIVIL ENGINEERS INC.

29995 Technology Drive, Suite 306
Murrieta, CA 92563

Engineer of Work/ Contact Person:
Francisco Martinez Jr., PE, QSD

JN 2017-008

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.

	08/07/2018	
Francisco Martinez RCE Registered Civil Engineer	Date	Seal

TABLE OF CONTENTS

TABLE OF CONTENTS 3
I. PURPOSE AND SCOPE 5
II. PROJECT SITE AND DRAINAGE AREA OVERVIEW 5
III. HYDROLOGY 6
IV. HYDRAULICS 7
V. INCREASED RUNOFF MITIGATION 8
VI. FINDINGS 9
VII. REFERENCES 9

FIGURES

FIGURE 1: VICINITY MAP

FIGURE 2: EXISTING CONDITION RATIONAL METHOD HYDROLOGY MAP

FIGURE 3: PROPOSED CONDITION RATIONAL METHOD HYDROLOGY MAP

FIGURE 4: CONCEPTUAL GRADING PLAN

FIGURE 5: OUTLET CONTROL STRUCTURE DETAIL

APPENDICES

APPENDIX A: RATIONAL METHOD – EXISTING CONDITION

A.1: RATIONAL METHOD ANALYSIS, AREA "A"
A.2: RATIONAL METHOD ANALYSIS, AREA "B"
A.3: RATIONAL METHOD ANALYSIS, AREA "C"
A.4: RATIONAL METHOD ANALYSIS, AREA "D" - OFFSITE
A.5: RATIONAL METHOD ANALYSIS, AREA "E" – OFFSITE

APPENDIX B: RATIONAL METHOD – PROPOSED CONDITION

B.1: PROPOSED CONDITION RATIONAL METHOD ANALYSIS, AREA "A"
B.2: PROPOSED CONDITION RATIONAL METHOD ANALYSIS, AREA "B" AND OFFSITE AREA "D" AND "E"
B.3. RATIONAL METHOD ANALYSIS, AREA "C"

APPENDIX C: UNIT HYDROGRAPH (UH) – EXISTING CONDITION

C.1: UH ANALYSIS, 100-YR, 24-HR STORM DURATION, AREA "A"

APPENDIX D: UNIT HYDROGRAPH (UH) – PROPOSED CONDITION

D.1: UH ANALYSIS, 100-YEAR, 24-HOUR STORM DURATION, AREA "A"

APPENDIX E: HYDRAULIC CALCULATIONS

E.1: WSPG ANALYSIS

- DOUBLE 18-INCH STORM DRAIN PIPE – BASIN OUTLET

APPENDIX F: INCREASED RUNOFF MITIGATION

F.1: BASIN "A" OUTFLOW CALCULATIONS, OUTLET CONTROL STRUCTURE AND TOTAL STORAGE VOLUME VS. OUTFLOW TABLES
F.2: BASIN "A" ROUTING CALCULATIONS, 100-YEAR, 24-HOUR STORM DURATION

APPENDIX G: REFERENCE DATA

G.1: HYDROLOGIC SOILS DATA
G.2: RAINFALL
G.3: INFILTRATION REPORT (EXCERPT)
G.4: OC TGD WORKSHEET H – FACTOR OF SAFETY AND DESIGN INFILTRATION RATE
G.5: BMP DCV CALCULATIONS

I. PURPOSE AND SCOPE

The purpose of this study is to determine the necessary drainage and increased runoff mitigation improvements required for the Holly Street project and proposed for Auto, trailer and tractor parking lot.

The scope of the preliminary study includes the following:

1. Determination of points of flow concentration and watershed subareas for onsite and offsite areas.
2. Determination of the 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. 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.
4. Determine the required facilities 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 the existing condition flow rates.
5. Determine the required storm drain infrastructure to flood protect the project site for the 100-year storm event.
6. Determine the required outlet control structure to safely by-pass the 100-year peak storm event;
7. Preparation of a hydrology report, which consist of hydrological and analytical results and exhibits.

II. PROJECT SITE AND DRAINAGE AREA OVERVIEW

The Holly Street project is a proposed auto, trailer and tractor parking lot project that will include landscaped/open space areas, storm drain infrastructure and an above ground storm and water quality mitigation basin. The property is approximately 64.80 acres located in the unincorporated area of the County of San Bernardino. According to FEMA FIRM Map number 06071C8688H, and map revised August 28, 2008 the site is greatly located within designated “Floodway Areas in ZONE AE”, a small sliver area along the westerly side and adjacent to Holly Street is designated as Zone “X”.

It is roughly bounded by Holly Street to the West, with a portion along the west bounded by an existing parcel used for horse boarding with shade structures and an equine outdoor pool; to the east is the Santa River and uncertified earthen levee. To the north there are two distribution center warehouses (by Living Spaces), and immediately to the south the property is bounded by Wilson Street (a dirt road), Rios Recycle Center and a partly undeveloped land owned by County of San Bernardino and County of Riverside. The County boundary line between Riverside and San Bernardino is to the south side of Wilson Street.

The project site is currently being used as a recreational motor bike sports park and contains several building structures, sheds, pavement, concrete, and miscellaneous obstructions. It can be seen by visual inspection and aerial topography that the topography has been modified to accommodate its current use. Generally, onsite developed storm flows travel in a north to south direction, however due to the altered topography, there are many peaks and depressions that do not have a defined or positive outlet. Additionally, the manmade earthen levee (uncertified) located on the east side blocks all drainage flow patterns, from both entering and exiting the site. The levee lays linear, more-or-less parallel to the Santa Ana River, in a northeast to southwest direction. The easterly property line, however, contains several jogs or angle points creating pockets of topographic depressions between the property line and levee. In the areas of depression, the water will pond and infiltrate into the soil. These areas are defined in the drainage map exhibits as drainage area "X" and not considered in the analysis.

Offsite flows enter the property at the westerly property line at two locations, within 200 feet of each point of entry, near the southwest corner; see sub-watershed area "D" and "E". The off-site storm flow is from the existing parcel located immediately to the west, and by visual inspection, nuisance flows appear to be from an outdoor equine pool. The offsite developed flows from approximately 2.2 acres, enter the southwest corner and exit into Wilson Street where it drains into the Santa Ana River. Offsite flows from approximately 3.2 acres enter the project site and drains into an onsite man-made basin with no outlet; however, it appears that flows will pond and infiltrate but flows exceeding basin depth will overtop and flow into the Santa Ana River. For the project developed condition and to avoid co-mingling flows, all off-site flows will be directed towards Wilson Street via drainage swale or ditch.

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	1.15
2-Year, 24-Hour	2.06
10-Year, 1-Hour	0.73
100-Year, 1-Hour	1.14
100-Year, 6-Hour	2.63
100-Year, 24-Hour	4.85

The rainfall depths were obtained from NOAA Atlas 14, which has been included as Exhibit G.

The existing soil classification for the area consists of Hydrologic Soil Group "A", as shown in Exhibit F; it is a Soils Map obtained from the National Resource Conservation Service Websoil Survey. For 100-year storm events, Antecedent Moisture Condition (AMC) III was utilized.

The hydrology utilized the following land use covers:

Land Use Cover	Runoff Index Number (Soil "A")	Pervious Ratio
Undeveloped – Poor	67	1
Urban Cover – Good	32	1
Commercial	98	0.1

The existing undeveloped areas that are to remain undeveloped were analyzed as Undeveloped utilizing "Poor Cover". Proposed onsite Landscaped Areas were analyzed as Urban Covers for Residential or Commercial Landscaping (lawns, shrubs, etc) utilizing "Good Cover" condition, and the proposed paved areas were analyzed as Commercial.

The Rational Method analysis for the onsite existing condition considered a single watershed area that are comprised of three sub-areas designated as "A", "B" and "C". A separate watershed was delineated for the offsite flows and designated as "D" and "E". For the proposed condition, the areas were equally delineated and using same letter designations to represent the areas.

To determine the required increased onsite runoff mitigation for the project, the Unit Hydrograph calculation was performed for sub-Area "A". All off-site areas are not considered. Note that 100% pervious cover was assumed for the existing condition, even though there are several building structures (roof tops) and asphalt paved areas on the site, thus a conservative assumption.

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 existing and proposed condition rational method hydrology calculations are included in Appendix A and B respectively and hydrology maps under figures 2 and 3. The existing and proposed condition unit hydrograph hydrology calculations are included in Appendix C and D, respectively.

IV. HYDRAULICS

The project will utilize a subsurface storm drain, drainage inlets, swales, gutters to collect and convey peak flows and above ground infiltration basin to mitigate for water quality and increased runoff.

All onsite storm flows will be directed to onsite drop inlets and conveyed via the storm drain pipe system to the infiltration basin; an outlet control structure (weir with orifices) will be utilized to control and mitigate storm flows, and a trapezoidal weir structure is provided and sized to safely by-pass the peak 100-year frequency storm, 24-hour duration for the ultimate developed condition.

For preliminary purposes, a WSPG hydraulic capacity analysis was performed for the basin outlet pipes using the peak flow for developed condition. As a result of the analysis, two 18-inch storm drain pipes are proposed to convey the routed/mitigated flows and discharge with a free outfall at Wilson street, south side of the basin.

During final design phase a complete WSPG analysis will be performed for main storm drain system. The WSPG calculation has been included in Appendix E.

V. INCREASED RUNOFF MITIGATION

The project site will utilize an infiltration basin to mitigate flows for increased runoff. This system will also 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 the project site is 153,511 ft^3, and the calculation for the Design Capture Volume (DCV) has been included in Appendix F.

To store the required water quality volume, infiltrate the volume and mitigate for increased runoff, the infiltration basin is at 7.5 feet deep with 3:1 side slopes and a bottom elevation of 826.0; with the top of the basin at elevation 833.50.

Infiltration testing was performed within the proposed basin location, and referenced as Basin "A", an excerpt of the Soils Infiltration test report has been included in Appendix G. The area tested in Basin "A" provides a rate of approximately 6 in/hr, which is the lowest value obtained from the test location, and after applying a safety factor in accordance with the technical guidance manual, the design infiltration rate is calculated to be **3.24 in/hr**, this rate was utilized in the design of the basin and subsurface system. A worksheet has been included in Appendix G.

To determine a flow rate through the soil that could be utilized in the basin routing calculations, the infiltration rate was multiplied by the bottom surface area of the infiltration basin and the subsurface system. The bottom surface area of the infiltration basin at elevation 826.0 is 49,459 ft^2. Converting the infiltration rate to ft/s, and multiplying by the surface area, the equivalent flow rate for infiltration is **3.61 ft^3/s**. This flow rate was utilized in the basin routing analyses.

Since the water quality volume (DCV) must infiltrate through the basin bottoms, the basin outlet control structure will have outflows at or above the required design capture volumes depth. The outflows will be restricted via a single row of four 10-inch orifices with inverts placed at elevation 829.0. The basin's emergency by-pass is a 35-feet wide concrete

trapezoidal weir structure with invert elevation of 832.5.

It is important to note that CivilD basin routing program will not appropriately model and account for the infiltration flow rate, therefore this flow rate was treated as an additional flow but manually reducing the discharge/outflow results by same amount. The flows routed through the outlet structure are summarized below:

Storm Duration 100-yr, 24-hr	Pre-Project Flow Rate (ft^3/s)	Post-Project Flow Rate (ft^3/s)	Post-Project Routed Flow Rate (ft^3/s)	*Net Routed Flow Rate (ft^3/s)
Area "A"	25.08	101.35	21.24	**17.63**

*Note: The Net-Routed flow rate is manually reduced to account for the soil infiltration flow rates based on the lowest test values. The infiltration rate in cubic feet per second for Area "A" = 3.61 ft^3/s.

The basin routing results indicate that the post-project routed flow rates are less than the pre- project flows, therefore the project will mitigate for increased runoff. The increased runoff calculations have been included in Appendix F.

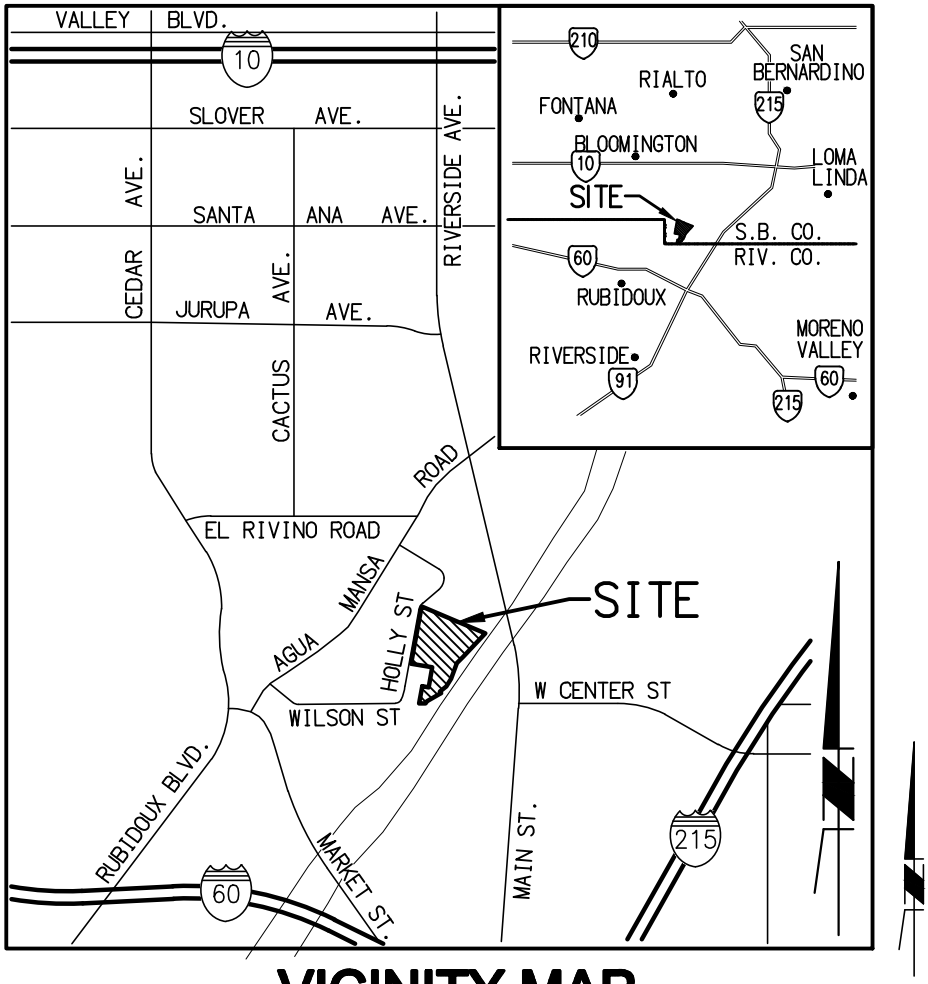
VI. FINDINGS

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 infiltration basin will adequately mitigate for 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.



VICINITY MAP

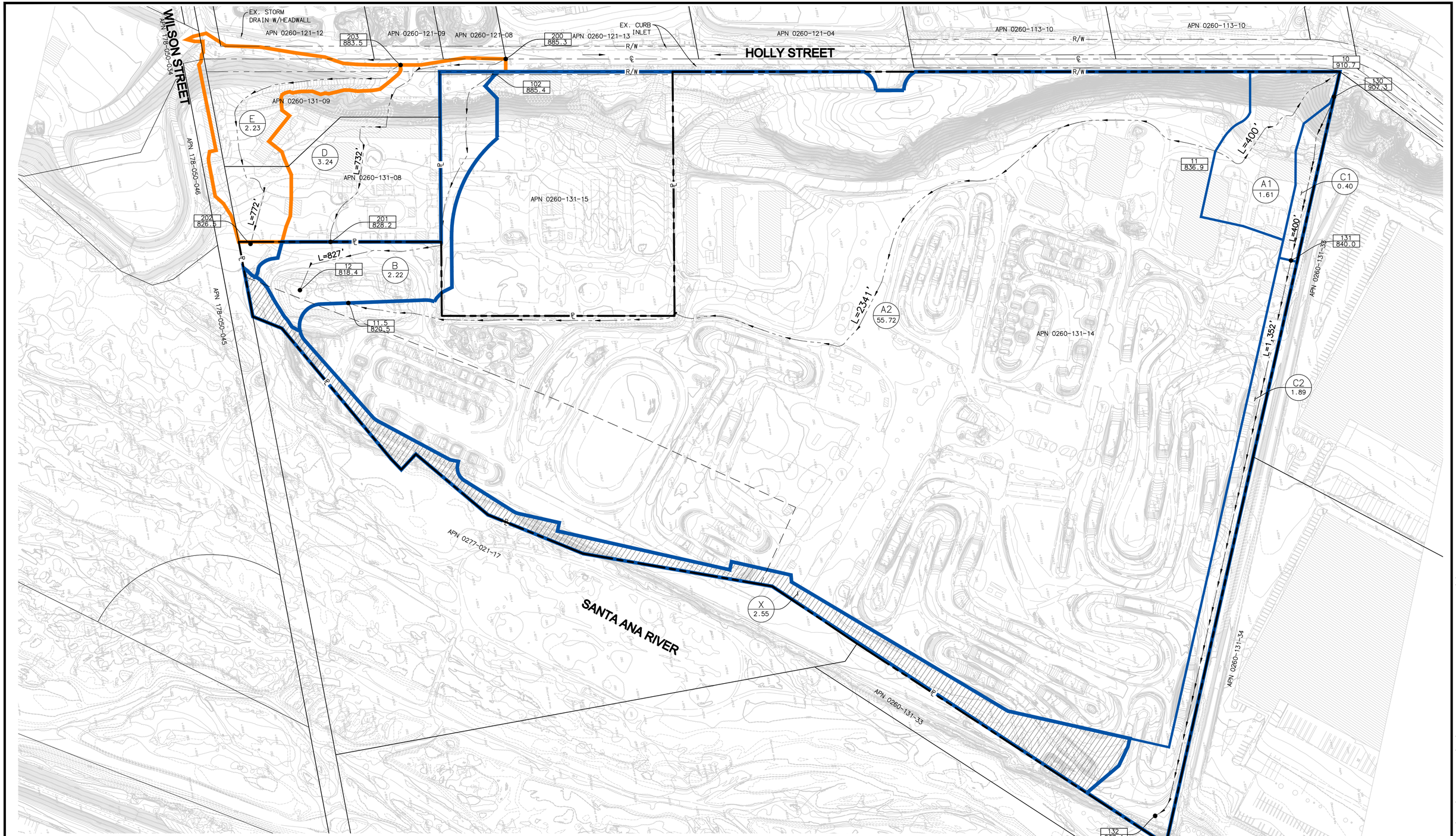
NOT TO SCALE

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

HOLLY STREET

FIGURE 1
VICINITY MAP

H:\PDATA\17-008 HOLLY STREET\DOCS\HYDRO\1. PRELIMINARY\CAD\17-008-HYDRO-003-VICINITY.DWG CHRIS 8/1/2018 2:21 PM



LEGEND

D-2 — DRAINAGE BASIN NAME
2.16 — DRAINAGE BASIN AREA(AC.)
11 — NODE I.D.
1027.0 — ELEVATION

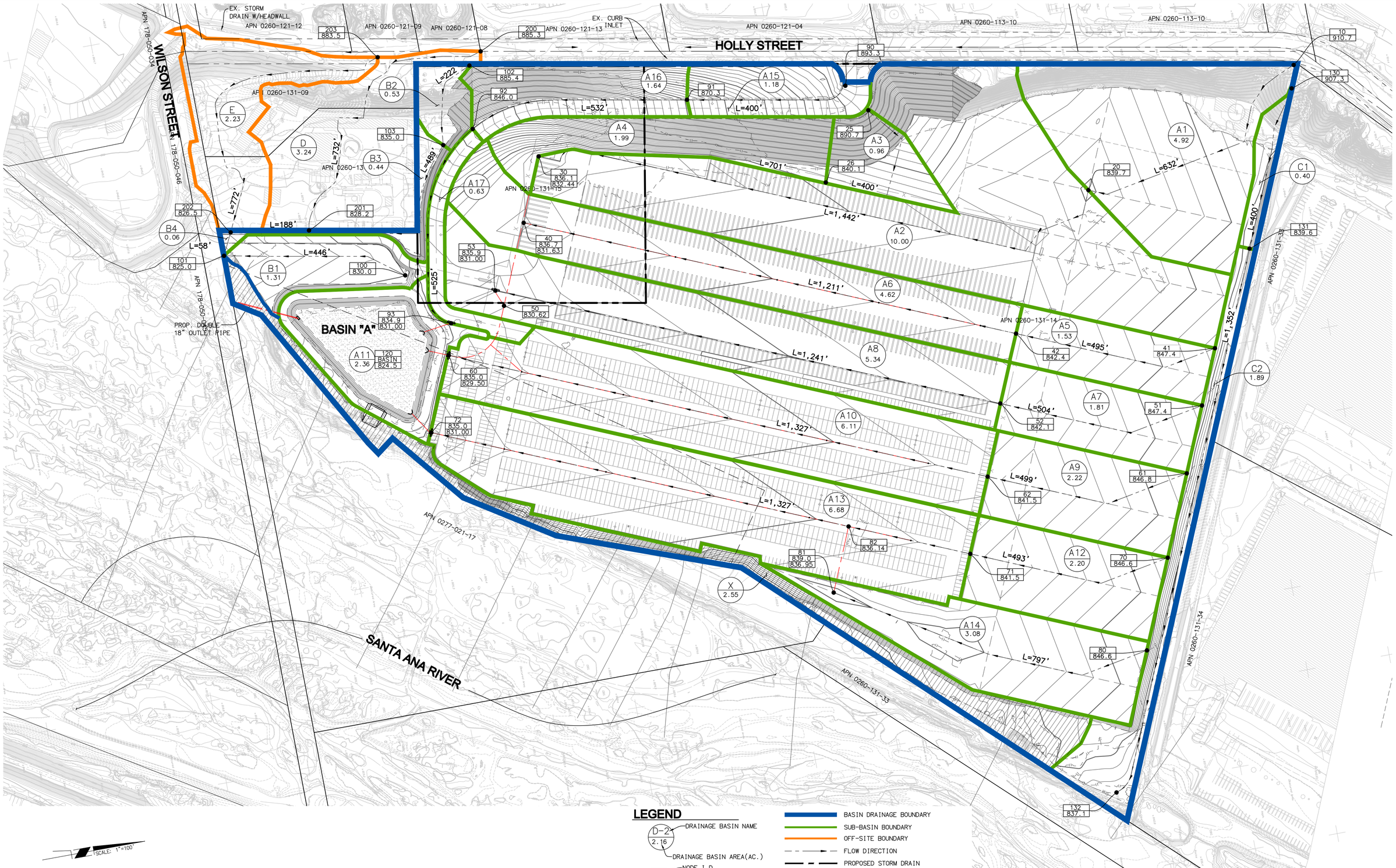
BASIN DRAINAGE BOUNDARY
OFF-SITE BOUNDARY
FLOW DIRECTION
AREA NOT INCLUDED

FMCIVIL ENGINEERS INC.
29995 TECHNOLOGY DRIVE, STE 306
MURRIETA | CA 92563
951.331.9873
www.fmcivil.com

HOLLY STREET SITE

FIGURE 2- EXISTING CONDITIONS

H:\PDATA\17-008 HOLLY STREET\DOCS\HYDRO\1. PRELIMINARY\CAD\17-008-HYDRO-001-EX-CONDITIONS.DWG CHRIS 8/7/2018 2:41 PM



LEGEND

D-2 — DRAINAGE BASIN NAME
2.16 — DRAINAGE BASIN AREA(AC.)
10 — NODE I.D.
87.5 — SURFACE ELEVATION
83.5 — INVERT ELEVATION

BASIN DRAINAGE BOUNDARY
SUB-BASIN BOUNDARY
OFF-SITE BOUNDARY
FLOW DIRECTION
PROPOSED STORM DRAIN
INFILTRATION BASIN
AREA NOT INCLUDED

FMCIVIL ENGINEERS INC.
29995 TECHNOLOGY DRIVE, STE 306
MURRIETA | CA 92563
951.331.9873
www.fmcivil.com

HOLLY STREET SITE

FIGURE 4- PROPOSED CONDITIONS

H:\PDATA\17-008 HOLLY STREET\DOCS\HYDRO\1. PRELIMINARY\CAD\17-008-HYDRO-002-PROP-CONDITIONS.DWG CHRIS 8/7/2018 2:41 PM

LEGEND

RIGHT OF WAY	PROPOSED CONTOUR
CENTERLINE	EXIST. CONTOUR
DAYLIGHT	RIDGE LINE
EXIST. RIGHT OF WAY	EXIST. ELECTRIC
EXIST. CENTERLINE	EXIST. OVERHEAD TELEPHONE
EXIST. TOP OF CURB	EXIST. DOMESTIC WATER
CUT/FILL LINE	EXIST. STORM DRAIN
FENCE	

ABBREVIATIONS

BC	BEGIN CURB	PAD	PAD ELEVATION
BM	BACK OF WALK	PL	PROPERTY LINE
CB	CATCH BASIN	RL, R/L	RIDGE LINE
CL, ℄	CENTERLINE	RW	RECYCLE WATER
DW	DOMESTIC WATER	ROW, R/W	RIGHT-OF-WAY
EC	END CURB	SD	STORM DRAIN
EG	EXISTING GROUND	SS	SANITARY SEWER
EX	EXISTING	TC	TOP OF CURB
FF	FINISH FLOOR ELEVATION	TF	TOP OF FOOTING
FG	FINISH GRADE	TG	TOP OF GRATE
FL	FLOWLINE	TW	TOP OF WALL
FS	FINISH SURFACE	TYP	TYPICAL
GB	GRADE BREAK	VAR	VARIES
HP	HIGH POINT		
INV	INVERT		

APPLICANT/DEVELOPER

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
PHONE: 951.331.9873
CONTACT: FRANCISCO MARTINEZ JR., P.E.

ARCHITECT

RGA
15231 ALTON PARKWAY, SUITE 100
IRVINE, CA 92618
CONTACT: DENNIS ROY
(TEL)949-341-0920 (FAX)949-341-0922

GEOTECHNICAL

SOUTHERN CALIFORNIA GEOTECHNICAL (SoCalGeo)
22885 SAVI RANCH PARKWAY, SUITE E
YORBA LINDA, CA 92887
CONTACT: JOHN SEMINARA
(TEL)714-685-1115 (FAX)714-685-1118

EARTHWORK QUANTITIES

DESCRIPTION	CUT (CY)	FILL (CY)	NET (CY)
RAW	58,400	356,400	298,000 (IMPORT)

NOTE: THESE EARTHWORK QUANTITIES ARE RAW AND FOR REFERENCE ONLY.

ZONING

AGUA MANSA INDUSTRIAL CORRIDOR SP
HEAVY INDUSTRIAL (H-IND)
AGRICULTURAL (OS-AG)

ASSESSOR'S PARCEL NUMBER(S)

APN 026-013-114
APN 026-013-115

SOURCE OF TOPOGRAPHY

EXITING TOPOGRAPHY SHOWN ON THIS PLAN WAS PROVIDED BY INLAND AERIAL SURVEY, INC. ON 11-03-16.

BASIS OF BEARING

THE BASIS OF BEARINGS FOR THIS SURVEY IS THE CALIFORNIA COORDINATE SYSTEM, ZONE V, NAD83 (EPOCH 2001.00) AS DETERMINED LOCALLY BY A LINE BETWEEN CONTINUOUS OPERATING REFERENCE STATIONS (CORS) CMP1 AND NOO1 BEING N10-58-27.80E AS DERIVED FROM GEODETIC VALUES PUBLISHED BY THE CALIFORNIA SPATIAL REFERENCE CENTER (CSRC) AND/OR NATIONAL GEODETIC SURVEY (NGS).

LEGAL DESCRIPTION

THAT A PORTION OF LOT 52 OF THE BANDINI DONATION, IN THE UNINCORPORATED AREA OF THE COUNTY OF SAN BERNARDINO, STATE OF CALIFORNIA, AS SHOWN BY MAP RECORDED IN BOOK 3, PAGE 24 OF MAPS, IN THE OFFICE OF THE COUNTY RECORDER OF SAID COUNTY.

BENCHMARK

BM P 449 NAVD88 EL. = 929.41'

BENCH MARK DISK STAMPED "P 449 1949"
1.2 MILES SOUTH ALONG THE ATCHISON, TOPEKA AND SANTA FE RAILROAD FROM THE STATION AT COLTON, AT THE CONCRETE BRIDGE A 5 OVER FOGG SETEET, IN TOP OF THE EAST END OF THE NORTH CONCRETE ABUTMENT, 10.8' EAST OF THE EAST RAIL OF A SIDE TRACK, 4.0' EAST OF A WOODEN GUARDRAIL. THE MARK IS 1; BELOW TRACKS.

COUNTY OF SAN BERNARDINO
PUBLIC WORKS DEPARTMENT

HOLLY STREET CONCEPTUAL GRADING EXHIBIT

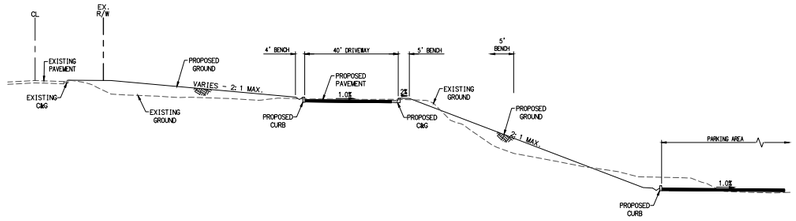
SCALE AS SHOWN ON PLAN	
DATE	7/10/18
DESIGNED	AJ
CHECKED	FM
PLAN CK REF:	

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

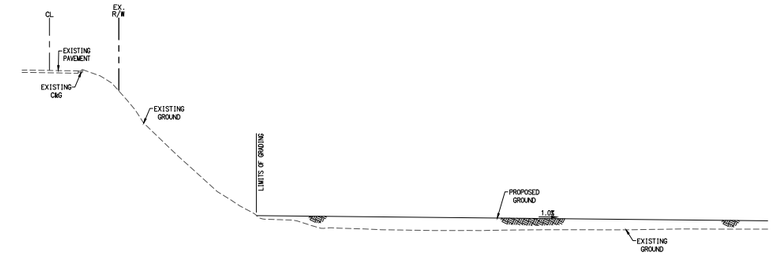
FRANCISCO MARTINEZ JR. DATE R.C.E. #84640

SHEET 1 OF 2 SHEETS

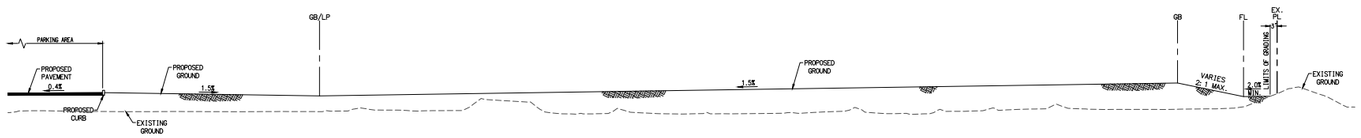
H:\PDATA\17-008 HOLLY STREET\DWGS\IMPGRADING\CONCEPT\17-008-CG-001.DWG CHRIS 8/7/2018 2:46 PM



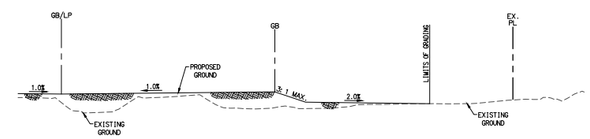
SECTION A-A
HOR. SCALE: 1"=20'



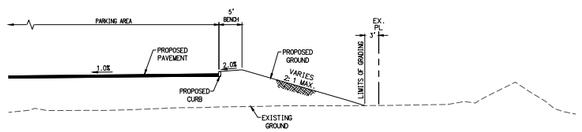
SECTION B-B
HOR. SCALE: 1"=20'



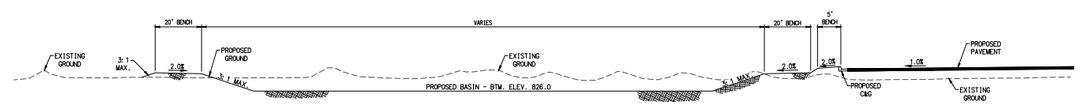
SECTION C-C
HOR. SCALE: 1"=20'



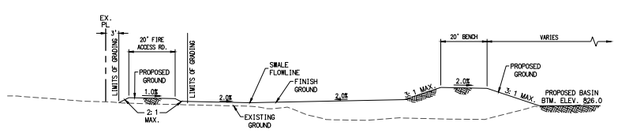
SECTION D-D
HOR. SCALE: 1"=20'



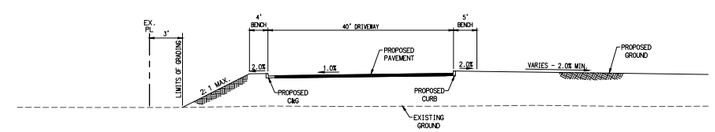
SECTION E-E
HOR. SCALE: 1"=10'



SECTION F-F
HOR. SCALE: 1"=10'



SECTION G-G
HOR. SCALE: 1"=10'



SECTION H-H
HOR. SCALE: 1"=10'

COUNTY OF SAN BERNARDINO
PUBLIC WORKS DEPARTMENT

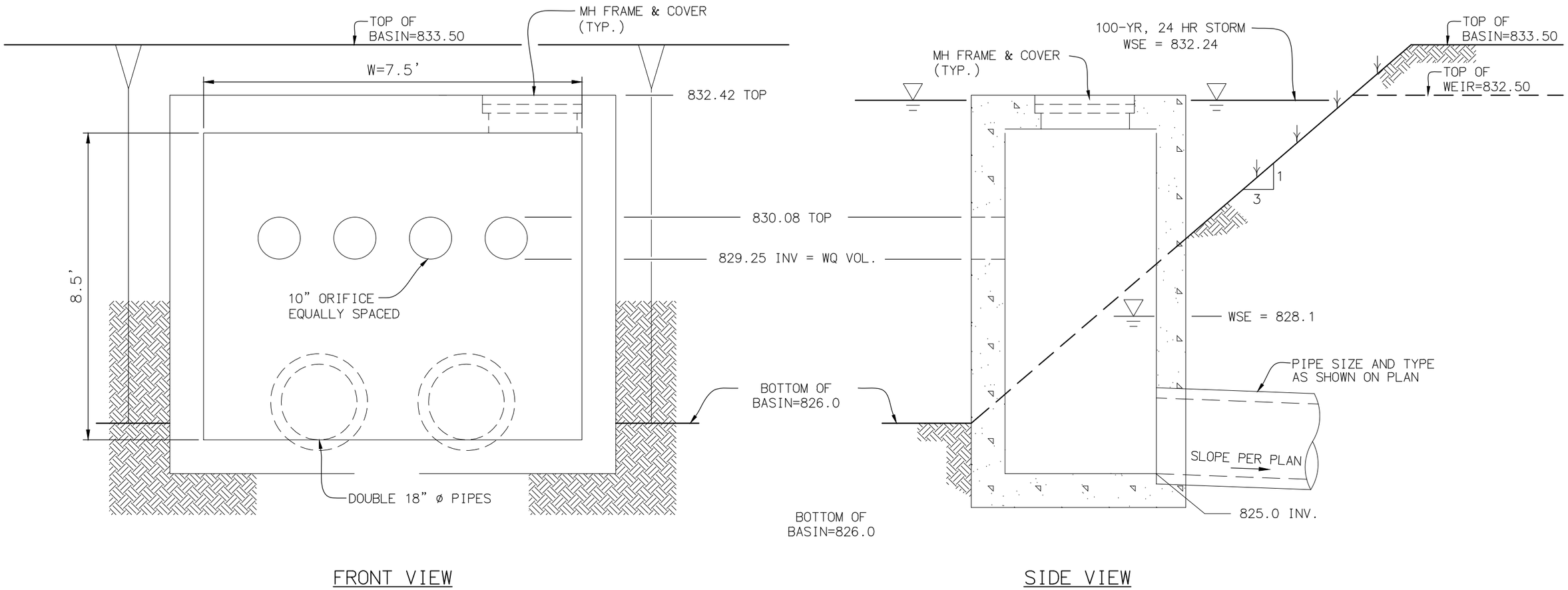
HOLLY STREET
CONCEPTUAL GRADING
EXHIBIT

SCALE AS SHOWN ON PLAN	
DATE	8/6/2018
DESIGNED	AJ/CF
CHECKED	FM
PLAN CK REF:	

FMCIVIL ENGINEERING INC
29995 TECHNOLOGY DRIVE, SUITE 306 MURRIETA | CA 92563
951.331.9873 - FMCIVIL.COM
FRANCISCO MARTINEZ JR. DATE: R.C.E. #94640

SHEET 2 OF 2 SHEETS

H:\PDATA\17-008 HOLLY STREET\DWGS\IMP\GRADING\CONCEPT\17-008-CC-001.DWG CHRIS 8/6/2018 11:13 AM



OUTLET CONTROL STRUCTURE
MODIFIED RCFCD STD DWG CB110
N.T.S.

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

HOLLY STREET

FIGURE 5 - OUTLET CONTROL STRUCTURE

H:\PDATA\17-008 HOLLY STREET\DOCS\HYDRO\1. PRELIMINARY\CAD\17-008-HYDRO-004-DETAILS.DWG CHRIS 8/7/2018 1:38 PM

APPENDIX A

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: 08/06/18

HOLLY STREET
EXISTING CONDITIONS - AREA A
100-YEAR

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 = 1.140 (In.)
Slope used for rainfall intensity curve b = 0.6000
Soil antecedent moisture condition (AMC) = 3

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

UNDEVELOPED (poor cover) subarea
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) = 67.00
Adjusted SCS curve number for AMC 3 = 84.60
Pervious ratio(Ap) = 1.0000 Max loss rate(Fm)= 0.290(In/Hr)
Initial subarea data:
Initial area flow distance = 400.000(Ft.)
Top (of initial area) elevation = 910.700(Ft.)
Bottom (of initial area) elevation = 836.900(Ft.)
Difference in elevation = 73.800(Ft.)
Slope = 0.18450 s(%)= 18.45
TC = k(0.525)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 8.087 min.
Rainfall intensity = 3.794(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.831
Subarea runoff = 5.078(CFS)
Total initial stream area = 1.610(Ac.)
Pervious area fraction = 1.000
Initial area Fm value = 0.290(In/Hr)

++
Process from Point/Station 11.000 to Point/Station 11.500
**** IMPROVED CHANNEL TRAVEL TIME ****

Upstream point elevation = 836.900(Ft.)

```
Downstream point elevation =   820.500(Ft.)
Channel length thru subarea  =  2341.000(Ft.)
Channel base width      =    0.000(Ft.)
Slope or 'Z' of left channel bank = 100.000
Slope or 'Z' of right channel bank = 100.000
Estimated mean flow rate at midpoint of channel =     12.791(CFS)
Manning's 'N'    = 0.200
Maximum depth of channel  =    2.000(Ft.)
Flow(q) thru subarea =     12.791(CFS)
Depth of flow =   0.657(Ft.), Average velocity =   0.296(Ft/s)
Channel flow top width =  131.445(Ft.)
Flow Velocity =    0.30(Ft/s)
Travel time  =  131.76 min.
Time of concentration =  139.84 min.
Critical depth =      0.252(Ft.)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
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)  = 67.00
Adjusted SCS curve number for AMC 3 = 84.60
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.290(In/Hr)
Rainfall intensity =      0.686(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.520
Subarea runoff =     15.362(CFS) for   55.720(Ac.)
Total runoff =     20.440(CFS)
Effective area this stream =       57.33(Ac.)
Total Study Area (Main Stream No. 1) =       57.33(Ac.)
Area averaged Fm value =    0.290(In/Hr)
Depth of flow =   0.784(Ft.), Average velocity =   0.333(Ft/s)
Critical depth =      0.305(Ft.)
End of computations, Total Study Area =           57.33 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 1.000
Area averaged SCS curve number =  67.0
```

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: 08/05/18

HOLLY STREET
EXISTING CONDITIONS - AREA "B"
100-YEAR

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 = 1.140 (In.)
Slope used for rainfall intensity curve b = 0.6000
Soil antecedent moisture condition (AMC) = 3

++
Process from Point/Station 102.000 to Point/Station 12.000
**** INITIAL AREA EVALUATION ****

UNDEVELOPED (poor cover) subarea
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) = 67.00
Adjusted SCS curve number for AMC 3 = 84.60
Pervious ratio(Ap) = 1.0000 Max loss rate(Fm)= 0.290(In/Hr)
Initial subarea data:
Initial area flow distance = 827.000(Ft.)
Top (of initial area) elevation = 885.400(Ft.)
Bottom (of initial area) elevation = 818.400(Ft.)
Difference in elevation = 67.000(Ft.)
Slope = 0.08102 s(%)= 8.10
TC = k(0.525)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 12.748 min.
Rainfall intensity = 2.888(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.810
Subarea runoff = 5.190(CFS)
Total initial stream area = 2.220(Ac.)
Pervious area fraction = 1.000
Initial area Fm value = 0.290(In/Hr)
End of computations, Total Study Area = 2.22 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 1.000
Area averaged SCS curve number = 67.0

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: 08/05/18

HOLLY STREET
EXISTING CONDITIONS - AREA "C"
100-YEAR

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 = 1.140 (In.)
Slope used for rainfall intensity curve b = 0.6000
Soil antecedent moisture condition (AMC) = 3

++
Process from Point/Station 130.000 to Point/Station 131.000
**** INITIAL AREA EVALUATION ****

UNDEVELOPED (poor cover) subarea
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) = 67.00
Adjusted SCS curve number for AMC 3 = 84.60
Pervious ratio(Ap) = 1.0000 Max loss rate(Fm)= 0.290(In/Hr)
Initial subarea data:
Initial area flow distance = 400.000(Ft.)
Top (of initial area) elevation = 907.300(Ft.)
Bottom (of initial area) elevation = 840.000(Ft.)
Difference in elevation = 67.300(Ft.)
Slope = 0.16825 s(%)= 16.82
TC = k(0.525)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 8.237 min.
Rainfall intensity = 3.752(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.830
Subarea runoff = 1.246(CFS)
Total initial stream area = 0.400(Ac.)
Pervious area fraction = 1.000
Initial area Fm value = 0.290(In/Hr)

++
Process from Point/Station 131.000 to Point/Station 132.000
**** IMPROVED CHANNEL TRAVEL TIME ****

Upstream point elevation = 840.000(Ft.)

```
Downstream point elevation =   837.100(Ft.)
Channel length thru subarea  =  1352.000(Ft.)
Channel base width      =    0.100(Ft.)
Slope or 'Z' of left channel bank =  50.000
Slope or 'Z' of right channel bank =  50.000
Estimated mean flow rate at midpoint of channel =      1.931(CFS)
Manning's 'N'    = 0.020
Maximum depth of channel  =    1.000(Ft.)
Flow(q) thru subarea =      1.931(CFS)
Depth of flow =   0.220(Ft.), Average velocity =   0.792(Ft/s)
Channel flow top width =   22.084(Ft.)
Flow Velocity =    0.79(Ft/s)
Travel time  =   28.46 min.
Time of concentration =   36.69 min.
Critical depth =      0.155(Ft.)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
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)  = 67.00
Adjusted SCS curve number for AMC 3 = 84.60
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.290(In/Hr)
Rainfall intensity =      1.531(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.730
Subarea runoff =      1.312(CFS) for    1.890(Ac.)
Total runoff =      2.558(CFS)
Effective area this stream =        2.29(Ac.)
Total Study Area (Main Stream No. 1) =        2.29(Ac.)
Area averaged Fm value =    0.290(In/Hr)
Depth of flow =   0.244(Ft.), Average velocity =   0.850(Ft/s)
Critical depth =      0.174(Ft.)
End of computations, Total Study Area =            2.29 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 1.000
Area averaged SCS curve number =  67.0
```

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: 08/05/18

HOLLY STREET
EXISTING CONDITIONS - AREA "D" OFFSITES
100-YEAR

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 = 1.140 (In.)
Slope used for rainfall intensity curve b = 0.6000
Soil antecedent moisture condition (AMC) = 3

++
Process from Point/Station 200.000 to Point/Station 201.000
**** INITIAL AREA EVALUATION ****

UNDEVELOPED (poor cover) subarea
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) = 67.00
Adjusted SCS curve number for AMC 3 = 84.60
Pervious ratio(Ap) = 1.0000 Max loss rate(Fm)= 0.290(In/Hr)
Initial subarea data:
Initial area flow distance = 732.000(Ft.)
Top (of initial area) elevation = 885.300(Ft.)
Bottom (of initial area) elevation = 828.200(Ft.)
Difference in elevation = 57.100(Ft.)
Slope = 0.07801 s(%)= 7.80
TC = k(0.525)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 12.233 min.
Rainfall intensity = 2.960(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.812
Subarea runoff = 7.785(CFS)
Total initial stream area = 3.240(Ac.)
Pervious area fraction = 1.000
Initial area Fm value = 0.290(In/Hr)
End of computations, Total Study Area = 3.24 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 1.000
Area averaged SCS curve number = 67.0

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: 08/06/18

HOLLY STREET
EXISTING CONDITIONS - AREA "E" OFFSITE
100-YEAR

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 = 1.140 (In.)
Slope used for rainfall intensity curve b = 0.6000
Soil antecedent moisture condition (AMC) = 3

++
Process from Point/Station 203.000 to Point/Station 202.000
**** INITIAL AREA EVALUATION ****

UNDEVELOPED (poor cover) subarea
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) = 67.00
Adjusted SCS curve number for AMC 3 = 84.60
Pervious ratio(Ap) = 1.0000 Max loss rate(Fm)= 0.290(In/Hr)
Initial subarea data:
Initial area flow distance = 772.000(Ft.)
Top (of initial area) elevation = 883.500(Ft.)
Bottom (of initial area) elevation = 826.500(Ft.)
Difference in elevation = 57.000(Ft.)
Slope = 0.07383 s(%)= 7.38
TC = k(0.525)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 12.634 min.
Rainfall intensity = 2.903(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.810
Subarea runoff = 5.245(CFS)
Total initial stream area = 2.230(Ac.)
Pervious area fraction = 1.000
Initial area Fm value = 0.290(In/Hr)
End of computations, Total Study Area = 2.23 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 1.000
Area averaged SCS curve number = 67.0

APPENDIX B

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: 07/31/18

HOLLY STREET
PROPOSED CONDITION - AREA A
100-YEAR

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 =     1.140 (In.)
Slope used for rainfall intensity curve b =  0.6000
Soil antecedent moisture condition (AMC) = 3
```

++

```
Process from Point/Station       10.000 to Point/Station       20.000
**** 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)  = 83.63
Adjusted SCS curve number for AMC 3 = 96.18
Pervious ratio(Ap) = 0.2900     Max loss rate(Fm)=     0.022(In/Hr)
Initial subarea data:
Initial area flow distance =   632.000(Ft.)
Top (of initial area) elevation =   910.700(Ft.)
Bottom (of initial area) elevation =   839.700(Ft.)
Difference in elevation =    71.000(Ft.)
Slope =    0.11234  s(%)=      11.23
TC = k(0.346)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    7.068 min.
Rainfall intensity =      4.114(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.895
Subarea runoff =     18.119(CFS)
Total initial stream area =        4.920(Ac.)
Pervious area fraction = 0.290
Initial area Fm value =    0.022(In/Hr)
```

++

```
Process from Point/Station       20.000 to Point/Station       30.000
**** IMPROVED CHANNEL TRAVEL TIME ****
```

```
Covered channel
Upstream point elevation =   839.700(Ft.)
```

```
Downstream point elevation =   836.100(Ft.)
Channel length thru subarea  =  1442.000(Ft.)
Channel base width      =    0.000(Ft.)
Slope or 'Z' of left channel bank = 100.000
Slope or 'Z' of right channel bank = 100.000
Estimated mean flow rate at midpoint of channel =     22.711(CFS)
Manning's 'N'    = 0.015
Maximum depth of channel  =    1.000(Ft.)
Flow(q) thru subarea =     22.711(CFS)
Depth of flow =   0.374(Ft.), Average velocity =   1.620(Ft/s)
Channel flow top width =   74.887(Ft.)
Flow Velocity =    1.62(Ft/s)
Travel time  =   14.84 min.
Time of concentration =   21.90 min.
Critical depth =      0.316(Ft.)
 Adding area flow to channel
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
Adjusted SCS curve number for AMC 3 = 52.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.079(In/Hr)
Rainfall intensity =      2.087(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.874
Subarea runoff =      9.099(CFS) for   10.000(Ac.)
Total runoff =     27.218(CFS)
Effective area this stream =       14.92(Ac.)
Total Study Area (Main Stream No. 1) =       14.92(Ac.)
Area averaged Fm value =    0.060(In/Hr)
Depth of flow =   0.401(Ft.), Average velocity =   1.695(Ft/s)
Critical depth =      0.340(Ft.)



++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       20.000 to Point/Station       30.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 1
Stream flow area =     14.920(Ac.)
Runoff from this stream =     27.218(CFS)
Time of concentration =   21.90 min.
Rainfall intensity =     2.087(In/Hr)
Area averaged loss rate (Fm) =    0.0598(In/Hr)
Area averaged Pervious ratio (Ap) = 0.1627



++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       25.000 to Point/Station       26.000
**** 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
Adjusted SCS curve number for AMC 3 = 52.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.785(In/Hr)
Initial subarea data:
```

```
Initial area flow distance =   400.000(Ft.)
Top (of initial area) elevation =   890.700(Ft.)
Bottom (of initial area) elevation =   840.100(Ft.)
Difference in elevation =    50.600(Ft.)
Slope =    0.12650  s(%)=      12.65
TC = k(0.950)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   15.781 min.
Rainfall intensity =      2.540(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.622
Subarea runoff =      1.517(CFS)
Total initial stream area =        0.960(Ac.)
Pervious area fraction = 1.000
Initial area Fm value =    0.785(In/Hr)



++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       26.000 to Point/Station       30.000
**** IMPROVED CHANNEL TRAVEL TIME ****
______________________________________________________________________
Upstream point elevation =   840.100(Ft.)
Downstream point elevation =   836.100(Ft.)
Channel length thru subarea  =   701.000(Ft.)
Channel base width      =    0.010(Ft.)
Slope or 'Z' of left channel bank =   2.000
Slope or 'Z' of right channel bank =   2.000
Estimated mean flow rate at midpoint of channel =      2.653(CFS)
Manning's 'N'    = 0.020
Maximum depth of channel  =    1.000(Ft.)
Flow(q) thru subarea =      2.653(CFS)
Depth of flow =   0.709(Ft.), Average velocity =   2.617(Ft/s)
Channel flow top width =    2.847(Ft.)
Flow Velocity =    2.62(Ft/s)
Travel time  =    4.46 min.
Time of concentration =   20.24 min.
Critical depth =      0.641(Ft.)
 Adding area flow to channel
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
Adjusted SCS curve number for AMC 3 = 52.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.785(In/Hr)
Rainfall intensity =      2.188(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.577
Subarea runoff =      2.207(CFS) for    1.990(Ac.)
Total runoff =      3.724(CFS)
Effective area this stream =        2.95(Ac.)
Total Study Area (Main Stream No. 1) =       17.87(Ac.)
Area averaged Fm value =    0.785(In/Hr)
Depth of flow =   0.806(Ft.), Average velocity =   2.849(Ft/s)
Critical depth =      0.734(Ft.)



++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       26.000 to Point/Station       30.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 2
Stream flow area =      2.950(Ac.)
```

```
Runoff from this stream =      3.724(CFS)
Time of concentration =   20.24 min.
Rainfall intensity =     2.188(In/Hr)
Area averaged loss rate (Fm) =    0.7851(In/Hr)
Area averaged Pervious ratio (Ap) = 1.0000
Summary of stream data:

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


1     27.22    14.920     21.90    0.060      2.087
2      3.72     2.950     20.24    0.785      2.188
Qmax(1) =
         1.000 *    1.000 *    27.218) +
         0.928 *    1.000 *     3.724) + =      30.674
Qmax(2) =
         1.050 *    0.924 *    27.218) +
         1.000 *    1.000 *     3.724) + =      30.133

Total of 2 streams to confluence:
Flow rates before confluence point:
      27.218       3.724
Maximum flow rates at confluence using above data:
       30.674       30.133
Area of streams before confluence:
       14.920        2.950
Effective area values after confluence:
       17.870       16.739
Results of confluence:
Total flow rate =     30.674(CFS)
Time of concentration =    21.904 min.
Effective stream area after confluence =     17.870(Ac.)
Study area average Pervious fraction(Ap) =  0.301
Study area average soil loss rate(Fm) =    0.180(In/Hr)
Study area total (this main stream) =      17.87(Ac.)



++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       30.000 to Point/Station       40.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =   832.440(Ft.)
Downstream point/station elevation =   831.630(Ft.)
Pipe length  =   163.52(Ft.)   Manning's N = 0.014
No. of pipes = 1  Required pipe flow  =    30.674(CFS)
Nearest computed pipe diameter  =     33.00(In.)
Calculated individual pipe flow  =    30.674(CFS)
Normal flow depth in pipe =   24.19(In.)
Flow top width inside pipe =   29.20(In.)
Critical Depth =   22.09(In.)
Pipe flow velocity =      6.57(Ft/s)
Travel time through pipe =    0.41 min.
Time of concentration (TC) =    22.32 min.



++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       30.000 to Point/Station       40.000
**** CONFLUENCE OF MINOR STREAMS ****
```

```
Along Main Stream number: 1 in normal stream number 1
Stream flow area =     17.870(Ac.)
Runoff from this stream =     30.674(CFS)
Time of concentration =   22.32 min.
Rainfall intensity =     2.063(In/Hr)
Area averaged loss rate (Fm) =    0.1796(In/Hr)
Area averaged Pervious ratio (Ap) = 0.3009


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       41.000 to Point/Station       42.000
**** 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
Adjusted SCS curve number for AMC 3 = 52.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.079(In/Hr)
Initial subarea data:
Initial area flow distance =   495.000(Ft.)
Top (of initial area) elevation =   847.400(Ft.)
Bottom (of initial area) elevation =   842.400(Ft.)
Difference in elevation =     5.000(Ft.)
Slope =    0.01010  s(%)=       1.01
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    9.117 min.
Rainfall intensity =      3.531(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.880
Subarea runoff =      4.754(CFS)
Total initial stream area =        1.530(Ac.)
Pervious area fraction = 0.100
Initial area Fm value =    0.079(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       42.000 to Point/Station       40.000
**** IMPROVED CHANNEL TRAVEL TIME ****
______________________________________________________________________
Upstream point elevation =   842.400(Ft.)
Downstream point elevation =   836.700(Ft.)
Channel length thru subarea  =  1211.000(Ft.)
Channel base width      =    0.000(Ft.)
Slope or 'Z' of left channel bank = 100.000
Slope or 'Z' of right channel bank = 100.000
Estimated mean flow rate at midpoint of channel =      7.984(CFS)
Manning's 'N'    = 0.015
Maximum depth of channel  =    1.000(Ft.)
Flow(q) thru subarea =      7.984(CFS)
Depth of flow =   0.225(Ft.), Average velocity =   1.582(Ft/s)
Channel flow top width =   44.927(Ft.)
Flow Velocity =    1.58(Ft/s)
Travel time  =   12.76 min.
Time of concentration =   21.87 min.
Critical depth =      0.209(Ft.)
 Adding area flow to channel
```

```
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
Adjusted SCS curve number for AMC 3 = 52.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.079(In/Hr)
Rainfall intensity =      2.089(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.866
Subarea runoff =      6.371(CFS) for    4.620(Ac.)
Total runoff =     11.125(CFS)
Effective area this stream =        6.15(Ac.)
Total Study Area (Main Stream No. 1) =       24.02(Ac.)
Area averaged Fm value =    0.079(In/Hr)
Depth of flow =   0.254(Ft.), Average velocity =   1.719(Ft/s)
Critical depth =      0.238(Ft.)



++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       42.000 to Point/Station       40.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 2
Stream flow area =      6.150(Ac.)
Runoff from this stream =     11.125(CFS)
Time of concentration =   21.87 min.
Rainfall intensity =     2.089(In/Hr)
Area averaged loss rate (Fm) =    0.0785(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     30.67    17.870     22.32    0.180      2.063
2     11.13     6.150     21.87    0.079      2.089
Qmax(1) =
         1.000 *    1.000 *    30.674) +
         0.988 *    1.000 *    11.125) + =      41.660
Qmax(2) =
         1.013 *    0.980 *    30.674) +
         1.000 *    1.000 *    11.125) + =      41.588

Total of 2 streams to confluence:
Flow rates before confluence point:
      30.674      11.125
Maximum flow rates at confluence using above data:
       41.660       41.588
Area of streams before confluence:
       17.870        6.150
Effective area values after confluence:
       24.020       23.664
Results of confluence:
Total flow rate =     41.660(CFS)
Time of concentration =    22.319 min.
Effective stream area after confluence =     24.020(Ac.)
Study area average Pervious fraction(Ap) =  0.249
Study area average soil loss rate(Fm) =    0.154(In/Hr)
```

```
Study area total (this main stream) =      24.02(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       40.000 to Point/Station       50.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =   831.630(Ft.)
Downstream point/station elevation =   830.620(Ft.)
Pipe length  =   205.00(Ft.)   Manning's N = 0.014
No. of pipes = 1  Required pipe flow  =    41.660(CFS)
Nearest computed pipe diameter  =     36.00(In.)
Calculated individual pipe flow  =    41.660(CFS)
Normal flow depth in pipe =   28.22(In.)
Flow top width inside pipe =   29.64(In.)
Critical Depth =   25.23(In.)
Pipe flow velocity =      7.00(Ft/s)
Travel time through pipe =    0.49 min.
Time of concentration (TC) =    22.81 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       40.000 to Point/Station       50.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 1
Stream flow area =     24.020(Ac.)
Runoff from this stream =     41.660(CFS)
Time of concentration =   22.81 min.
Rainfall intensity =     2.037(In/Hr)
Area averaged loss rate (Fm) =    0.1537(In/Hr)
Area averaged Pervious ratio (Ap) = 0.2495


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       51.000 to Point/Station       52.000
**** 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
Adjusted SCS curve number for AMC 3 = 52.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.079(In/Hr)
Initial subarea data:
Initial area flow distance =   504.000(Ft.)
Top (of initial area) elevation =   847.400(Ft.)
Bottom (of initial area) elevation =   842.100(Ft.)
Difference in elevation =     5.300(Ft.)
Slope =    0.01052  s(%)=       1.05
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    9.109 min.
Rainfall intensity =      3.533(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.880
Subarea runoff =      5.627(CFS)
```

```
Total initial stream area =        1.810(Ac.)
Pervious area fraction = 0.100
Initial area Fm value =    0.079(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       52.000 to Point/Station       53.000
**** IMPROVED CHANNEL TRAVEL TIME ****
______________________________________________________________________
Upstream point elevation =   842.100(Ft.)
Downstream point elevation =   835.900(Ft.)
Channel length thru subarea  =  1241.000(Ft.)
Channel base width      =    0.000(Ft.)
Slope or 'Z' of left channel bank = 100.000
Slope or 'Z' of right channel bank = 100.000
Estimated mean flow rate at midpoint of channel =      9.424(CFS)
Manning's 'N'    = 0.015
Maximum depth of channel  =    1.000(Ft.)
Flow(q) thru subarea =      9.424(CFS)
Depth of flow =   0.236(Ft.), Average velocity =   1.686(Ft/s)
Channel flow top width =   47.280(Ft.)
Flow Velocity =    1.69(Ft/s)
Travel time  =   12.26 min.
Time of concentration =   21.37 min.
Critical depth =      0.223(Ft.)
 Adding area flow to channel
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
Adjusted SCS curve number for AMC 3 = 52.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.079(In/Hr)
Rainfall intensity =      2.118(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.867
Subarea runoff =      7.495(CFS) for    5.340(Ac.)
Total runoff =     13.122(CFS)
Effective area this stream =        7.15(Ac.)
Total Study Area (Main Stream No. 1) =       31.17(Ac.)
Area averaged Fm value =    0.079(In/Hr)
Depth of flow =   0.268(Ft.), Average velocity =   1.832(Ft/s)
Critical depth =      0.254(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       53.000 to Point/Station       50.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =   831.000(Ft.)
Downstream point/station elevation =   830.620(Ft.)
Pipe length  =    40.00(Ft.)   Manning's N = 0.014
No. of pipes = 1  Required pipe flow  =    13.122(CFS)
Nearest computed pipe diameter  =     21.00(In.)
Calculated individual pipe flow  =    13.122(CFS)
Normal flow depth in pipe =   15.80(In.)
Flow top width inside pipe =   18.13(In.)
Critical Depth =   16.19(In.)
```

```
Pipe flow velocity =      6.76(Ft/s)
Travel time through pipe =    0.10 min.
Time of concentration (TC) =    21.47 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       53.000 to Point/Station       50.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 2
Stream flow area =      7.150(Ac.)
Runoff from this stream =     13.122(CFS)
Time of concentration =   21.47 min.
Rainfall intensity =     2.112(In/Hr)
Area averaged loss rate (Fm) =    0.0785(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     41.66    24.020     22.81    0.154      2.037
2     13.12     7.150     21.47    0.079      2.112
Qmax(1) =
         1.000 *    1.000 *    41.660) +
         0.963 *    1.000 *    13.122) + =      54.298
Qmax(2) =
         1.040 *    0.941 *    41.660) +
         1.000 *    1.000 *    13.122) + =      53.908

Total of 2 streams to confluence:
Flow rates before confluence point:
      41.660      13.122
Maximum flow rates at confluence using above data:
       54.298       53.908
Area of streams before confluence:
       24.020        7.150
Effective area values after confluence:
       31.170       29.765
Results of confluence:
Total flow rate =     54.298(CFS)
Time of concentration =    22.807 min.
Effective stream area after confluence =     31.170(Ac.)
Study area average Pervious fraction(Ap) =  0.215
Study area average soil loss rate(Fm) =    0.136(In/Hr)
Study area total (this main stream) =      31.17(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       50.000 to Point/Station       60.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =   830.620(Ft.)
Downstream point/station elevation =   829.500(Ft.)
Pipe length  =   210.00(Ft.)   Manning's N = 0.014
No. of pipes = 1  Required pipe flow  =    54.298(CFS)
Nearest computed pipe diameter  =     39.00(In.)
Calculated individual pipe flow  =    54.298(CFS)
```

```
Normal flow depth in pipe =   30.94(In.)
Flow top width inside pipe =   31.59(In.)
Critical Depth =   28.24(In.)
Pipe flow velocity =      7.69(Ft/s)
Travel time through pipe =    0.46 min.
Time of concentration (TC) =    23.26 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       50.000 to Point/Station       60.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 1
Stream flow area =     31.170(Ac.)
Runoff from this stream =     54.298(CFS)
Time of concentration =   23.26 min.
Rainfall intensity =     2.013(In/Hr)
Area averaged loss rate (Fm) =    0.1364(In/Hr)
Area averaged Pervious ratio (Ap) = 0.2152


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       61.000 to Point/Station       62.000
**** 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
Adjusted SCS curve number for AMC 3 = 52.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.079(In/Hr)
Initial subarea data:
Initial area flow distance =   499.000(Ft.)
Top (of initial area) elevation =   846.800(Ft.)
Bottom (of initial area) elevation =   841.500(Ft.)
Difference in elevation =     5.300(Ft.)
Slope =    0.01062  s(%)=       1.06
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    9.055 min.
Rainfall intensity =      3.545(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.880
Subarea runoff =      6.927(CFS)
Total initial stream area =        2.220(Ac.)
Pervious area fraction = 0.100
Initial area Fm value =    0.079(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       62.000 to Point/Station       60.000
**** IMPROVED CHANNEL TRAVEL TIME ****
______________________________________________________________________
Upstream point elevation =   841.500(Ft.)
Downstream point elevation =   835.000(Ft.)
Channel length thru subarea  =  1327.000(Ft.)
Channel base width      =    0.000(Ft.)
```

```
Slope or 'Z' of left channel bank = 100.000
Slope or 'Z' of right channel bank = 100.000
Estimated mean flow rate at midpoint of channel =     11.056(CFS)
Manning's 'N'    = 0.015
Maximum depth of channel  =    1.000(Ft.)
Flow(q) thru subarea =     11.056(CFS)
Depth of flow =   0.252(Ft.), Average velocity =   1.742(Ft/s)
Channel flow top width =   50.384(Ft.)
Flow Velocity =    1.74(Ft/s)
Travel time  =   12.70 min.
Time of concentration =   21.75 min.
Critical depth =      0.238(Ft.)
 Adding area flow to channel
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
Adjusted SCS curve number for AMC 3 = 52.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.079(In/Hr)
Rainfall intensity =      2.096(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.866
Subarea runoff =      8.196(CFS) for    6.110(Ac.)
Total runoff =     15.123(CFS)
Effective area this stream =        8.33(Ac.)
Total Study Area (Main Stream No. 1) =       39.50(Ac.)
Area averaged Fm value =    0.079(In/Hr)
Depth of flow =   0.283(Ft.), Average velocity =   1.884(Ft/s)
Critical depth =      0.270(Ft.)



++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       62.000 to Point/Station       60.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 2
Stream flow area =      8.330(Ac.)
Runoff from this stream =     15.123(CFS)
Time of concentration =   21.75 min.
Rainfall intensity =     2.096(In/Hr)
Area averaged loss rate (Fm) =    0.0785(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     54.30    31.170     23.26    0.136      2.013
2     15.12     8.330     21.75    0.079      2.096
Qmax(1) =
         1.000 *    1.000 *    54.298) +
         0.959 *    1.000 *    15.123) + =      68.800
Qmax(2) =
         1.044 *    0.935 *    54.298) +
         1.000 *    1.000 *    15.123) + =      68.132

Total of 2 streams to confluence:
Flow rates before confluence point:
```

```
      54.298      15.123
Maximum flow rates at confluence using above data:
       68.800       68.132
Area of streams before confluence:
       31.170        8.330
Effective area values after confluence:
       39.500       37.474
Results of confluence:
Total flow rate =     68.800(CFS)
Time of concentration =    23.262 min.
Effective stream area after confluence =     39.500(Ac.)
Study area average Pervious fraction(Ap) =  0.191
Study area average soil loss rate(Fm) =    0.124(In/Hr)
Study area total (this main stream) =      39.50(Ac.)



++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       60.000 to Point/Station      120.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =   829.500(Ft.)
Downstream point/station elevation =   824.500(Ft.)
Pipe length  =    51.00(Ft.)   Manning's N = 0.014
No. of pipes = 1  Required pipe flow  =    68.800(CFS)
Nearest computed pipe diameter  =     27.00(In.)
Calculated individual pipe flow  =    68.800(CFS)
Normal flow depth in pipe =   17.67(In.)
Flow top width inside pipe =   25.68(In.)
Critical depth could not be calculated.
Pipe flow velocity =     24.94(Ft/s)
Travel time through pipe =    0.03 min.
Time of concentration (TC) =    23.30 min.



++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       60.000 to Point/Station      120.000
**** CONFLUENCE OF MAIN STREAMS ****
______________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =     39.500(Ac.)
Runoff from this stream =     68.800(CFS)
Time of concentration =   23.30 min.
Rainfall intensity =     2.011(In/Hr)
Area averaged loss rate (Fm) =    0.1242(In/Hr)
Area averaged Pervious ratio (Ap) = 0.1909
Program is now starting with Main Stream No. 2



++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       70.000 to Point/Station       71.000
**** 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
Adjusted SCS curve number for AMC 3 = 52.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.079(In/Hr)
Initial subarea data:
Initial area flow distance =   493.000(Ft.)
Top (of initial area) elevation =   846.600(Ft.)
Bottom (of initial area) elevation =   841.500(Ft.)
Difference in elevation =     5.100(Ft.)
Slope =    0.01034  s(%)=       1.03
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    9.059 min.
Rainfall intensity =      3.545(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.880
Subarea runoff =      6.863(CFS)
Total initial stream area =        2.200(Ac.)
Pervious area fraction = 0.100
Initial area Fm value =    0.079(In/Hr)



++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       71.000 to Point/Station       72.000
**** IMPROVED CHANNEL TRAVEL TIME ****
______________________________________________________________________
Upstream point elevation =   841.500(Ft.)
Downstream point elevation =   835.000(Ft.)
Channel length thru subarea  =  1327.000(Ft.)
Channel base width      =    0.000(Ft.)
Slope or 'Z' of left channel bank = 100.000
Slope or 'Z' of right channel bank = 100.000
Estimated mean flow rate at midpoint of channel =     11.557(CFS)
Manning's 'N'    = 0.015
Maximum depth of channel  =    1.000(Ft.)
Flow(q) thru subarea =     11.557(CFS)
Depth of flow =   0.256(Ft.), Average velocity =   1.762(Ft/s)
Channel flow top width =   51.228(Ft.)
Flow Velocity =    1.76(Ft/s)
Travel time  =   12.56 min.
Time of concentration =   21.61 min.
Critical depth =      0.242(Ft.)
 Adding area flow to channel
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
Adjusted SCS curve number for AMC 3 = 52.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.079(In/Hr)
Rainfall intensity =      2.104(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.866
Subarea runoff =      9.321(CFS) for    6.680(Ac.)
Total runoff =     16.184(CFS)
Effective area this stream =        8.88(Ac.)
Total Study Area (Main Stream No. 2) =       48.38(Ac.)
Area averaged Fm value =    0.079(In/Hr)
Depth of flow =   0.291(Ft.), Average velocity =   1.916(Ft/s)
Critical depth =      0.277(Ft.)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       71.000 to Point/Station       72.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 2 in normal stream number 1
Stream flow area =      8.880(Ac.)
Runoff from this stream =     16.184(CFS)
Time of concentration =   21.61 min.
Rainfall intensity =     2.104(In/Hr)
Area averaged loss rate (Fm) =    0.0785(In/Hr)
Area averaged Pervious ratio (Ap) = 0.1000


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       80.000 to Point/Station       81.000
**** 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
Adjusted SCS curve number for AMC 3 = 52.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.079(In/Hr)
Initial subarea data:
Initial area flow distance =   797.000(Ft.)
Top (of initial area) elevation =   846.600(Ft.)
Bottom (of initial area) elevation =   839.000(Ft.)
Difference in elevation =     7.600(Ft.)
Slope =    0.00954  s(%)=       0.95
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   11.158 min.
Rainfall intensity =      3.128(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.877
Subarea runoff =      8.453(CFS)
Total initial stream area =        3.080(Ac.)
Pervious area fraction = 0.100
Initial area Fm value =    0.079(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       81.000 to Point/Station       82.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =   836.950(Ft.)
Downstream point/station elevation =   836.140(Ft.)
Pipe length  =   163.00(Ft.)   Manning's N = 0.014
No. of pipes = 1  Required pipe flow  =     8.453(CFS)
Nearest computed pipe diameter  =     21.00(In.)
Calculated individual pipe flow  =     8.453(CFS)
Normal flow depth in pipe =   14.41(In.)
Flow top width inside pipe =   19.49(In.)
Critical Depth =   12.94(In.)
Pipe flow velocity =      4.81(Ft/s)
Travel time through pipe =    0.57 min.
Time of concentration (TC) =    11.72 min.
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       82.000 to Point/Station       72.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =   836.140(Ft.)
Downstream point/station elevation =   831.000(Ft.)
Pipe length  =  1026.00(Ft.)   Manning's N = 0.014
No. of pipes = 1  Required pipe flow  =     8.453(CFS)
Nearest computed pipe diameter  =     21.00(In.)
Calculated individual pipe flow  =     8.453(CFS)
Normal flow depth in pipe =   14.37(In.)
Flow top width inside pipe =   19.52(In.)
Critical Depth =   12.94(In.)
Pipe flow velocity =      4.82(Ft/s)
Travel time through pipe =    3.55 min.
Time of concentration (TC) =    15.27 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       82.000 to Point/Station       72.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 2 in normal stream number 2
Stream flow area =      3.080(Ac.)
Runoff from this stream =      8.453(CFS)
Time of concentration =   15.27 min.
Rainfall intensity =     2.591(In/Hr)
Area averaged loss rate (Fm) =    0.0785(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     16.18     8.880     21.61    0.079      2.104
2      8.45     3.080     15.27    0.079      2.591
Qmax(1) =
         1.000 *    1.000 *    16.184) +
         0.806 *    1.000 *     8.453) + =      22.996
Qmax(2) =
         1.241 *    0.706 *    16.184) +
         1.000 *    1.000 *     8.453) + =      22.639

Total of 2 streams to confluence:
Flow rates before confluence point:
      16.184       8.453
Maximum flow rates at confluence using above data:
       22.996       22.639
Area of streams before confluence:
        8.880        3.080
Effective area values after confluence:
       11.960        9.353
Results of confluence:
Total flow rate =     22.996(CFS)
Time of concentration =    21.614 min.
Effective stream area after confluence =     11.960(Ac.)
```

```
Study area average Pervious fraction(Ap) =  0.100
Study area average soil loss rate(Fm) =    0.079(In/Hr)
Study area total (this main stream) =      11.96(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       72.000 to Point/Station      120.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =   831.000(Ft.)
Downstream point/station elevation =   824.500(Ft.)
Pipe length  =    67.00(Ft.)   Manning's N = 0.014
No. of pipes = 1  Required pipe flow  =    22.996(CFS)
Nearest computed pipe diameter  =     18.00(In.)
Calculated individual pipe flow  =    22.996(CFS)
Normal flow depth in pipe =   11.71(In.)
Flow top width inside pipe =   17.17(In.)
Critical depth could not be calculated.
Pipe flow velocity =     18.90(Ft/s)
Travel time through pipe =    0.06 min.
Time of concentration (TC) =    21.67 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       72.000 to Point/Station      120.000
**** CONFLUENCE OF MAIN STREAMS ****
______________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =     11.960(Ac.)
Runoff from this stream =     22.996(CFS)
Time of concentration =   21.67 min.
Rainfall intensity =     2.100(In/Hr)
Area averaged loss rate (Fm) =    0.0785(In/Hr)
Area averaged Pervious ratio (Ap) = 0.1000
Program is now starting with Main Stream No. 3


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       90.000 to Point/Station       91.000
**** 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
Adjusted SCS curve number for AMC 3 = 52.00
Pervious ratio(Ap) = 0.6140     Max loss rate(Fm)=     0.482(In/Hr)
Initial subarea data:
Initial area flow distance =   400.000(Ft.)
Top (of initial area) elevation =   893.300(Ft.)
Bottom (of initial area) elevation =   870.300(Ft.)
Difference in elevation =    23.000(Ft.)
Slope =    0.05750  s(%)=       5.75
TC = k(0.426)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    8.283 min.
Rainfall intensity =      3.740(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.784
```

```
Subarea runoff =      3.460(CFS)
Total initial stream area =        1.180(Ac.)
Pervious area fraction = 0.614
Initial area Fm value =    0.482(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       91.000 to Point/Station       92.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
______________________________________________________________________
Top of street segment elevation =   870.300(Ft.)
End of street segment elevation =   846.000(Ft.)
Length of street segment  =   532.000(Ft.)
Height of curb above gutter flowline  =    6.0(In.)
Width of half street (curb to crown)  =  40.000(Ft.)
Distance from crown to crossfall grade break  =  38.500(Ft.)
Slope from gutter to grade break (v/hz) =   0.010
Slope from grade break to crown (v/hz)  =   0.010
Street flow is on [1] side(s) of the street
Distance from curb to property line  =   3.000(Ft.)
Slope from curb to property line (v/hz) =   0.020
Gutter width =   1.500(Ft.)
Gutter hike from flowline =  1.875(In.)
 Manning's N in gutter =  0.0140
 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 =      5.238(CFS)
Depth of flow =   0.296(Ft.), Average velocity =   4.039(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =  15.433(Ft.)
Flow velocity =   4.04(Ft/s)
Travel time =    2.20 min.     TC =   10.48  min.
 Adding area flow to street
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
Adjusted SCS curve number for AMC 3 = 52.00
Pervious ratio(Ap) = 0.6950     Max loss rate(Fm)=     0.546(In/Hr)
Rainfall intensity =      3.248(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.756
Subarea runoff =      3.466(CFS) for    1.640(Ac.)
Total runoff =      6.926(CFS)
Effective area this stream =        2.82(Ac.)
Total Study Area (Main Stream No. 3) =       54.28(Ac.)
Area averaged Fm value =    0.519(In/Hr)
Street flow at end of street =      6.926(CFS)
Half street flow at end of street =      6.926(CFS)
Depth of flow =   0.314(Ft.), Average velocity =   4.313(Ft/s)
Flow width (from curb towards crown)=  17.320(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       92.000 to Point/Station       93.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
______________________________________________________________________
Top of street segment elevation =   846.000(Ft.)
End of street segment elevation =   834.900(Ft.)
Length of street segment  =   525.000(Ft.)
```

```
Height of curb above gutter flowline  =    6.0(In.)
Width of half street (curb to crown)  =  40.000(Ft.)
Distance from crown to crossfall grade break  =  38.500(Ft.)
Slope from gutter to grade break (v/hz) =   0.010
Slope from grade break to crown (v/hz)  =   0.010
Street flow is on [1] side(s) of the street
Distance from curb to property line  =   3.000(Ft.)
Slope from curb to property line (v/hz) =   0.020
Gutter width =   1.500(Ft.)
Gutter hike from flowline =  1.875(In.)
 Manning's N in gutter =  0.0140
 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 =      7.212(CFS)
Depth of flow =   0.347(Ft.), Average velocity =   3.248(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =  20.565(Ft.)
Flow velocity =   3.25(Ft/s)
Travel time =    2.69 min.     TC =   13.17  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
Adjusted SCS curve number for AMC 3 = 52.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.079(In/Hr)
Rainfall intensity =      2.831(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.761
Subarea runoff =      0.503(CFS) for    0.630(Ac.)
Total runoff =      7.429(CFS)
Effective area this stream =        3.45(Ac.)
Total Study Area (Main Stream No. 3) =       54.91(Ac.)
Area averaged Fm value =    0.439(In/Hr)
Street flow at end of street =      7.429(CFS)
Half street flow at end of street =      7.429(CFS)
Depth of flow =   0.349(Ft.), Average velocity =   3.271(Ft/s)
Flow width (from curb towards crown)=  20.810(Ft.)



++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       93.000 to Point/Station      120.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
______________________________________________________________________
Upstream point/station elevation =   831.000(Ft.)
Downstream point/station elevation =   824.500(Ft.)
Pipe length  =    70.00(Ft.)   Manning's N = 0.014
No. of pipes = 1  Required pipe flow  =     7.429(CFS)
Given pipe size =     18.00(In.)
Calculated individual pipe flow  =     7.429(CFS)
Normal flow depth in pipe =    6.13(In.)
Flow top width inside pipe =   17.06(In.)
Critical Depth =   12.67(In.)
Pipe flow velocity =     13.98(Ft/s)
Travel time through pipe =    0.08 min.
Time of concentration (TC) =    13.26 min.
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       93.000 to Point/Station      120.000
**** CONFLUENCE OF MAIN STREAMS ****
______________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 3
Stream flow area =      3.450(Ac.)
Runoff from this stream =      7.429(CFS)
Time of concentration =   13.26 min.
Rainfall intensity =     2.821(In/Hr)
Area averaged loss rate (Fm) =    0.4386(In/Hr)
Area averaged Pervious ratio (Ap) = 0.5586
Summary of stream data:

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


1     68.80    39.500     23.30    0.124      2.011
2     23.00    11.960     21.67    0.079      2.100
3      7.43     3.450     13.26    0.439      2.821
Qmax(1) =
         1.000 *    1.000 *    68.800) +
         0.956 *    1.000 *    22.996) +
         0.660 *    1.000 *     7.429) + =      95.688
Qmax(2) =
         1.047 *    0.930 *    68.800) +
         1.000 *    1.000 *    22.996) +
         0.698 *    1.000 *     7.429) + =      95.206
Qmax(3) =
         1.429 *    0.569 *    68.800) +
         1.356 *    0.612 *    22.996) +
         1.000 *    1.000 *     7.429) + =      82.454

Total of 3 main streams to confluence:
Flow rates before confluence point:
      69.800      23.996       8.429
Maximum flow rates at confluence using above data:
       95.688       95.206       82.454
Area of streams before confluence:
       39.500       11.960        3.450
Effective area values after confluence:
       54.910       52.158       33.242


Results of confluence:
Total flow rate =     95.688(CFS)
Time of concentration =    23.296 min.
Effective stream area after confluence  =     54.910(Ac.)
Study area average Pervious fraction(Ap) =  0.194
Study area average soil loss rate(Fm) =    0.134(In/Hr)
Study area total =      54.91(Ac.)



++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      120.000 to Point/Station      120.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________
UNDEVELOPED (poor cover) subarea
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)  = 67.00
Adjusted SCS curve number for AMC 3 = 84.60
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.290(In/Hr)
Time of concentration =    23.30 min.
Rainfall intensity =      2.011(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.837
Subarea runoff =      0.729(CFS) for    2.360(Ac.)
Total runoff =     96.417(CFS)
Effective area this stream =       57.27(Ac.)
Total Study Area (Main Stream No. 1) =       57.27(Ac.)
Area averaged Fm value =    0.140(In/Hr)
End of computations, Total Study Area =           57.27 (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) = 0.227
Area averaged SCS curve number =  37.9
```

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: 08/06/18

HOLLY STREET
PROPOSED CONDITION - AREA B, W/OFFSITES D + E
100-YEAR

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 = 1.140 (In.)
Slope used for rainfall intensity curve b = 0.6000
Soil antecedent moisture condition (AMC) = 3

++
Process from Point/Station 102.000 to Point/Station 103.000
**** INITIAL AREA EVALUATION ****

UNDEVELOPED (poor cover) subarea
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) = 67.00
Adjusted SCS curve number for AMC 3 = 84.60
Pervious ratio(Ap) = 1.0000 Max loss rate(Fm)= 0.290(In/Hr)
Initial subarea data:
Initial area flow distance = 222.000(Ft.)
Top (of initial area) elevation = 885.400(Ft.)
Bottom (of initial area) elevation = 835.000(Ft.)
Difference in elevation = 50.400(Ft.)
Slope = 0.22703 s(%)= 22.70
TC = k(0.525)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 6.130 min.
Rainfall intensity = 4.480(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.842
Subarea runoff = 1.999(CFS)
Total initial stream area = 0.530(Ac.)
Pervious area fraction = 1.000
Initial area Fm value = 0.290(In/Hr)

++
Process from Point/Station 103.000 to Point/Station 201.000
**** IMPROVED CHANNEL TRAVEL TIME ****

Upstream point elevation = 835.000(Ft.)
Downstream point elevation = 828.200(Ft.)
Channel length thru subarea = 489.000(Ft.)

```
Channel base width      =    0.100(Ft.)
Slope or 'Z' of left channel bank =   1.500
Slope or 'Z' of right channel bank =   1.500
Estimated mean flow rate at midpoint of channel =      2.592(CFS)
Manning's 'N'    = 0.015
Maximum depth of channel  =    2.000(Ft.)
Flow(q) thru subarea =      2.592(CFS)
Depth of flow =   0.575(Ft.), Average velocity =   4.691(Ft/s)
Channel flow top width =    1.824(Ft.)
Flow Velocity =    4.69(Ft/s)
Travel time  =    1.74 min.
Time of concentration =    7.87 min.
Critical depth =      0.680(Ft.)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
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)  = 67.00
Adjusted SCS curve number for AMC 3 = 84.60
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.290(In/Hr)
Rainfall intensity =      3.857(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.832
Subarea runoff =      1.116(CFS) for    0.440(Ac.)
Total runoff =      3.114(CFS)
Effective area this stream =        0.97(Ac.)
Total Study Area (Main Stream No. 1) =        0.97(Ac.)
Area averaged Fm value =    0.290(In/Hr)
Depth of flow =   0.618(Ft.), Average velocity =   4.910(Ft/s)
Critical depth =      0.734(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      103.000 to Point/Station      201.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 1
Stream flow area =      0.970(Ac.)
Runoff from this stream =      3.114(CFS)
Time of concentration =    7.87 min.
Rainfall intensity =     3.857(In/Hr)
Area averaged loss rate (Fm) =    0.2900(In/Hr)
Area averaged Pervious ratio (Ap) = 1.0000


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      200.000 to Point/Station      201.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
UNDEVELOPED (poor cover) subarea
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)  = 67.00
Adjusted SCS curve number for AMC 3 = 84.60
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.290(In/Hr)
Initial subarea data:
Initial area flow distance =   732.000(Ft.)
Top (of initial area) elevation =   885.300(Ft.)
Bottom (of initial area) elevation =   828.200(Ft.)
```

```
Difference in elevation =    57.100(Ft.)
Slope =    0.07801  s(%)=       7.80
TC = k(0.525)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   12.233 min.
Rainfall intensity =      2.960(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.812
Subarea runoff =      7.785(CFS)
Total initial stream area =        3.240(Ac.)
Pervious area fraction = 1.000
Initial area Fm value =    0.290(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      200.000 to Point/Station      201.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 2
Stream flow area =      3.240(Ac.)
Runoff from this stream =      7.785(CFS)
Time of concentration =   12.23 min.
Rainfall intensity =     2.960(In/Hr)
Area averaged loss rate (Fm) =    0.2900(In/Hr)
Area averaged Pervious ratio (Ap) = 1.0000
Summary of stream data:

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


1      3.11     0.970      7.87    0.290      3.857
2      7.79     3.240     12.23    0.290      2.960
Qmax(1) =
         1.000 *    1.000 *     3.114) +
         1.336 *    0.643 *     7.785) + =       9.804
Qmax(2) =
         0.748 *    1.000 *     3.114) +
         1.000 *    1.000 *     7.785) + =      10.116

Total of 2 streams to confluence:
Flow rates before confluence point:
       3.114       7.785
Maximum flow rates at confluence using above data:
        9.804       10.116
Area of streams before confluence:
        0.970        3.240
Effective area values after confluence:
        3.054        4.210
Results of confluence:
Total flow rate =     10.116(CFS)
Time of concentration =    12.233 min.
Effective stream area after confluence =      4.210(Ac.)
Study area average Pervious fraction(Ap) =  1.000
Study area average soil loss rate(Fm) =    0.290(In/Hr)
Study area total (this main stream) =       4.21(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      201.000 to Point/Station      202.000
**** IMPROVED CHANNEL TRAVEL TIME ****
______________________________________________________________________
Upstream point elevation =   828.200(Ft.)
Downstream point elevation =   826.500(Ft.)
Channel length thru subarea  =   188.000(Ft.)
```

```
Channel base width      =    0.100(Ft.)
Slope or 'Z' of left channel bank =   1.500
Slope or 'Z' of right channel bank =   1.500
Manning's 'N'    = 0.015
Maximum depth of channel  =    2.000(Ft.)
Flow(q) thru subarea =     10.116(CFS)
Depth of flow =   1.064(Ft.), Average velocity =   5.602(Ft/s)
Channel flow top width =    3.293(Ft.)
Flow Velocity =    5.60(Ft/s)
Travel time  =    0.56 min.
Time of concentration =   12.79 min.
Critical depth =      1.195(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      201.000 to Point/Station      202.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 1
Stream flow area =      4.210(Ac.)
Runoff from this stream =     10.116(CFS)
Time of concentration =   12.79 min.
Rainfall intensity =     2.882(In/Hr)
Area averaged loss rate (Fm) =    0.2900(In/Hr)
Area averaged Pervious ratio (Ap) = 1.0000


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      203.000 to Point/Station      202.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
UNDEVELOPED (poor cover) subarea
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)  = 67.00
Adjusted SCS curve number for AMC 3 = 84.60
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.290(In/Hr)
Initial subarea data:
Initial area flow distance =   772.000(Ft.)
Top (of initial area) elevation =   883.500(Ft.)
Bottom (of initial area) elevation =   826.500(Ft.)
Difference in elevation =    57.000(Ft.)
Slope =    0.07383  s(%)=       7.38
TC = k(0.525)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   12.634 min.
Rainfall intensity =      2.903(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.810
Subarea runoff =      5.245(CFS)
Total initial stream area =        2.230(Ac.)
Pervious area fraction = 1.000
Initial area Fm value =    0.290(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      203.000 to Point/Station      202.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 2
Stream flow area =      2.230(Ac.)
Runoff from this stream =      5.245(CFS)
Time of concentration =   12.63 min.
```

```
Rainfall intensity =     2.903(In/Hr)
Area averaged loss rate (Fm) =    0.2900(In/Hr)
Area averaged Pervious ratio (Ap) = 1.0000
Summary of stream data:

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


1     10.12     4.210     12.79    0.290      2.882
2      5.24     2.230     12.63    0.290      2.903
Qmax(1) =
         1.000 *    1.000 *    10.116) +
         0.992 *    1.000 *     5.245) + =      15.317
Qmax(2) =
         1.008 *    0.988 *    10.116) +
         1.000 *    1.000 *     5.245) + =      15.319

Total of 2 streams to confluence:
Flow rates before confluence point:
      10.116       5.245
Maximum flow rates at confluence using above data:
       15.317       15.319
Area of streams before confluence:
        4.210        2.230
Effective area values after confluence:
        6.440        6.388
Results of confluence:
Total flow rate =     15.319(CFS)
Time of concentration =    12.634 min.
Effective stream area after confluence =      6.388(Ac.)
Study area average Pervious fraction(Ap) =  1.000
Study area average soil loss rate(Fm) =    0.290(In/Hr)
Study area total (this main stream) =       6.44(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      202.000 to Point/Station      101.000
**** IMPROVED CHANNEL TRAVEL TIME ****
______________________________________________________________________
Upstream point elevation =   826.500(Ft.)
Downstream point elevation =   825.000(Ft.)
Channel length thru subarea  =    58.000(Ft.)
Channel base width      =    0.100(Ft.)
Slope or 'Z' of left channel bank =  50.000
Slope or 'Z' of right channel bank =  50.000
Estimated mean flow rate at midpoint of channel =     15.355(CFS)
Manning's 'N'    = 0.015
Maximum depth of channel  =    2.000(Ft.)
Flow(q) thru subarea =     15.355(CFS)
Depth of flow =   0.269(Ft.), Average velocity =   4.197(Ft/s)
Channel flow top width =   27.050(Ft.)
Flow Velocity =    4.20(Ft/s)
Travel time  =    0.23 min.
Time of concentration =   12.86 min.
Critical depth =      0.355(Ft.)
 Adding area flow to channel
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
```

```
Adjusted SCS curve number for AMC 3 = 52.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.079(In/Hr)
The area added to the existing stream causes a
a lower flow rate of Q =     14.994(CFS)
therefore the upstream flow rate of Q =     15.319(CFS) is being used
Rainfall intensity =      2.872(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.810
Subarea runoff =      0.000(CFS) for    0.060(Ac.)
Total runoff =     15.319(CFS)
Effective area this stream =        6.45(Ac.)
Total Study Area (Main Stream No. 1) =        6.50(Ac.)
Area averaged Fm value =    0.288(In/Hr)
Depth of flow =   0.269(Ft.), Average velocity =   4.195(Ft/s)
Critical depth =      0.355(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      202.000 to Point/Station      101.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 1
Stream flow area =      6.448(Ac.)
Runoff from this stream =     15.319(CFS)
Time of concentration =   12.86 min.
Rainfall intensity =     2.872(In/Hr)
Area averaged loss rate (Fm) =    0.2880(In/Hr)
Area averaged Pervious ratio (Ap) = 0.9916


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      100.000 to Point/Station      101.000
**** 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
Adjusted SCS curve number for AMC 3 = 52.00
Pervious ratio(Ap) = 0.8400     Max loss rate(Fm)=     0.660(In/Hr)
Initial subarea data:
Initial area flow distance =   446.000(Ft.)
Top (of initial area) elevation =   830.000(Ft.)
Bottom (of initial area) elevation =   825.000(Ft.)
Difference in elevation =     5.000(Ft.)
Slope =    0.01121  s(%)=       1.12
TC = k(0.482)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   13.569 min.
Rainfall intensity =      2.781(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.687
Subarea runoff =      2.502(CFS)
Total initial stream area =        1.310(Ac.)
Pervious area fraction = 0.840
Initial area Fm value =    0.660(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      100.000 to Point/Station      101.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 2
Stream flow area =      1.310(Ac.)
Runoff from this stream =      2.502(CFS)
Time of concentration =   13.57 min.
```

```
Rainfall intensity =     2.781(In/Hr)
Area averaged loss rate (Fm) =    0.6595(In/Hr)
Area averaged Pervious ratio (Ap) = 0.8400
Summary of stream data:

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


1     15.32     6.448     12.86    0.288      2.872
2      2.50     1.310     13.57    0.660      2.781
Qmax(1) =
         1.000 *    1.000 *    15.319) +
         1.043 *    0.948 *     2.502) + =      17.792
Qmax(2) =
         0.965 *    1.000 *    15.319) +
         1.000 *    1.000 *     2.502) + =      17.285

Total of 2 streams to confluence:
Flow rates before confluence point:
      15.319       2.502
Maximum flow rates at confluence using above data:
       17.792       17.285
Area of streams before confluence:
        6.448        1.310
Effective area values after confluence:
        7.690        7.758
Results of confluence:
Total flow rate =     17.792(CFS)
Time of concentration =    12.865 min.
Effective stream area after confluence =      7.690(Ac.)
Study area average Pervious fraction(Ap) =  0.966
Study area average soil loss rate(Fm) =    0.351(In/Hr)
Study area total (this main stream) =      7.76(Ac.)
End of computations, Total Study Area =            7.81 (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) = 0.966
Area averaged SCS curve number =  60.9
```

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: 08/06/18

HOLLY STREET
PROPOSED CONDITION - AREA C
100-YEAR

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 = 1.140 (In.)
Slope used for rainfall intensity curve b = 0.6000
Soil antecedent moisture condition (AMC) = 3

++
Process from Point/Station 130.000 to Point/Station 131.000
**** 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
Adjusted SCS curve number for AMC 3 = 52.00
Pervious ratio(Ap) = 0.9000 Max loss rate(Fm)= 0.707(In/Hr)
Initial subarea data:
Initial area flow distance = 400.000(Ft.)
Top (of initial area) elevation = 907.300(Ft.)
Bottom (of initial area) elevation = 839.600(Ft.)
Difference in elevation = 67.700(Ft.)
Slope = 0.16925 s(%)= 16.92
TC = k(0.496)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 7.780 min.
Rainfall intensity = 3.883(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.736
Subarea runoff = 1.144(CFS)
Total initial stream area = 0.400(Ac.)
Pervious area fraction = 0.900
Initial area Fm value = 0.707(In/Hr)

++
Process from Point/Station 131.000 to Point/Station 132.000
**** IMPROVED CHANNEL TRAVEL TIME ****

Upstream point elevation = 839.600(Ft.)
Downstream point elevation = 837.100(Ft.)
Channel length thru subarea = 1352.000(Ft.)
Channel base width = 0.100(Ft.)
Slope or 'Z' of left channel bank = 2.000
Slope or 'Z' of right channel bank = 2.000

```
Estimated mean flow rate at midpoint of channel =      2.216(CFS)
Manning's 'N'    = 0.015
Maximum depth of channel  =    1.000(Ft.)
Flow(q) thru subarea =      2.216(CFS)
Depth of flow =   0.713(Ft.), Average velocity =   2.038(Ft/s)
Channel flow top width =    2.952(Ft.)
Flow Velocity =    2.04(Ft/s)
Travel time  =   11.06 min.
Time of concentration =   18.84 min.
Critical depth =      0.574(Ft.)
 Adding area flow to channel
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
Adjusted SCS curve number for AMC 3 = 52.00
Pervious ratio(Ap) = 0.9300     Max loss rate(Fm)=     0.730(In/Hr)
Rainfall intensity =      2.284(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.614
Subarea runoff =      2.068(CFS) for    1.890(Ac.)
Total runoff =      3.212(CFS)
Effective area this stream =        2.29(Ac.)
Total Study Area (Main Stream No. 1) =        2.29(Ac.)
Area averaged Fm value =    0.726(In/Hr)
Depth of flow =   0.823(Ft.), Average velocity =   2.235(Ft/s)
Critical depth =      0.668(Ft.)
End of computations, Total Study Area =            2.29 (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) = 0.925
Area averaged SCS curve number =  32.0
```

APPENDIX C

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 08/06/18

++

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

Program License Serial Number 6405

HOLLY STREET
EXISTING CONDITIONS
100-YEAR UH ANALYSIS

Storm Event Year = 100

Antecedent Moisture Condition = 3

English (in-lb) Input Units Used

English Rainfall Data (Inches) Input Values Used

English Units used in output format

Area averaged rainfall intensity isohyetal data:

Sub-Area (Ac.)	Duration (hours)	Isohyetal (In)
Rainfall data for year 100		
57.33	1	1.14
Rainfall data for year 100		
57.33	6	2.63
Rainfall data for year 100		
57.33	24	4.85

++

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

SCS curve No.(AMCII)	SCS curve NO.(AMC 3)	Area (Ac.)	Area Fraction	Fp(Fig C6) (In/Hr)	Ap (dec.)	Fm (In/Hr)
62.0	80.6	57.33	1.000	0.360	1.000	0.360

Area-averaged adjusted loss rate Fm (In/Hr) = 0.360

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

Area	Area	SCS CN	SCS CN	S	Pervious

(Ac.)	Fract	(AMC2)	(AMC3)		Yield Fr
57.33	1.000	62.0	80.6	2.41	0.581

Area-averaged catchment yield fraction, Y = 0.581
Area-averaged low loss fraction, Yb = 0.419
User entry of time of concentration = 2.331 (hours)
++
Watershed area = 57.33(Ac.)
Catchment Lag time = 1.865 hours
Unit interval = 5.000 minutes
Unit interval percentage of lag time = 4.4693
Hydrograph baseflow = 0.00(CFS)
Average maximum watershed loss rate(Fm) = 0.360(In/Hr)
Average low loss rate fraction (Yb) = 0.419 (decimal)
VALLEY UNDEVELOPED S-Graph Selected
Computed peak 5-minute rainfall = 0.422(In)
Computed peak 30-minute rainfall = 0.864(In)
Specified peak 1-hour rainfall = 1.140(In)
Computed peak 3-hour rainfall = 1.903(In)
Specified peak 6-hour rainfall = 2.630(In)
Specified peak 24-hour rainfall = 4.850(In)

Rainfall depth area reduction factors:
Using a total area of 57.33(Ac.) (Ref: fig. E-4)

5-minute factor = 0.997 Adjusted rainfall = 0.421(In)
30-minute factor = 0.997 Adjusted rainfall = 0.862(In)
1-hour factor = 0.997 Adjusted rainfall = 1.137(In)
3-hour factor = 1.000 Adjusted rainfall = 1.903(In)
6-hour factor = 1.000 Adjusted rainfall = 2.630(In)
24-hour factor = 1.000 Adjusted rainfall = 4.850(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 = 693.33 (CFS))		
1	0.387	2.686
2	1.162	5.371
3	1.937	5.371
4	2.773	5.799
5	3.827	7.306
6	4.944	7.744
7	6.458	10.500
8	8.074	11.200
9	9.975	13.184
10	12.031	14.254
11	14.087	14.254
12	16.399	16.028
13	19.216	19.531
14	22.046	19.625
15	24.908	19.841
16	27.992	21.386
17	31.123	21.706
18	34.314	22.122
19	37.531	22.311
20	40.749	22.311
21	43.967	22.311
22	47.185	22.311

23	50.234	21.140
24	52.649	16.741
25	55.003	16.320
26	57.338	16.189
27	59.309	13.671
28	61.141	12.703
29	62.760	11.224
30	64.190	9.916
31	65.621	9.916
32	67.000	9.563
33	68.218	8.448
34	69.398	8.178
35	70.366	6.714
36	71.290	6.404
37	72.213	6.400
38	73.042	5.747
39	73.802	5.268
40	74.527	5.025
41	75.189	4.594
42	75.851	4.586
43	76.512	4.586
44	77.174	4.586
45	77.831	4.559
46	78.403	3.962
47	78.939	3.718
48	79.475	3.718
49	80.011	3.718
50	80.548	3.718
51	81.065	3.585
52	81.517	3.135
53	81.964	3.099
54	82.411	3.099
55	82.858	3.099
56	83.305	3.098
57	83.722	2.890
58	84.115	2.727
59	84.508	2.727
60	84.901	2.727
61	85.295	2.727
62	85.680	2.672
63	86.012	2.301
64	86.334	2.231
65	86.656	2.231
66	86.977	2.231
67	87.299	2.231
68	87.600	2.088
69	87.869	1.862
70	88.137	1.859
71	88.405	1.859
72	88.673	1.859
73	88.942	1.859
74	89.210	1.859
75	89.478	1.859
76	89.746	1.859
77	90.014	1.859
78	90.282	1.859
79	90.534	1.742
80	90.734	1.388
81	90.930	1.363
82	91.127	1.363
83	91.324	1.363
84	91.520	1.363
85	91.717	1.363

86	91.914	1.363
87	92.110	1.363
88	92.307	1.363
89	92.504	1.363
90	92.693	1.317
91	92.843	1.038
92	92.986	0.992
93	93.129	0.992
94	93.272	0.992
95	93.415	0.992
96	93.558	0.992
97	93.701	0.992
98	93.844	0.992
99	93.987	0.992
100	94.130	0.992
101	94.273	0.989
102	94.409	0.944
103	94.543	0.930
104	94.677	0.930
105	94.811	0.930
106	94.945	0.930
107	95.080	0.930
108	95.214	0.930
109	95.348	0.930
110	95.482	0.930
111	95.616	0.930
112	95.750	0.928
113	95.862	0.776
114	95.960	0.682
115	96.058	0.682
116	96.157	0.682
117	96.255	0.682
118	96.353	0.682
119	96.452	0.682
120	96.550	0.682
121	96.648	0.682
122	96.747	0.682
123	96.845	0.682
124	96.935	0.627
125	97.016	0.558
126	97.096	0.558
127	97.177	0.558
128	97.257	0.558
129	97.338	0.558
130	97.418	0.558
131	97.498	0.558
132	97.579	0.558
133	97.659	0.558
134	97.740	0.558
135	97.815	0.523
136	97.878	0.438
137	97.941	0.434
138	98.003	0.434
139	98.066	0.434
140	98.129	0.434
141	98.191	0.434
142	98.254	0.434
143	98.316	0.434
144	98.379	0.434
145	98.441	0.434
146	98.501	0.414
147	98.548	0.322
148	98.592	0.310

149	98.637	0.310
150	98.682	0.310
151	98.726	0.310
152	98.771	0.310
153	98.816	0.310
154	98.860	0.310
155	98.905	0.310
156	98.950	0.310
157	98.995	0.310
158	99.039	0.310
159	99.084	0.310
160	99.129	0.310
161	99.173	0.310
162	99.218	0.310
163	99.263	0.310
164	99.307	0.310
165	99.352	0.310
166	99.397	0.310
167	99.441	0.310
168	99.486	0.310
169	99.531	0.310
170	99.576	0.310
171	99.620	0.310
172	99.665	0.310
173	99.710	0.310
174	99.754	0.310
175	99.799	0.310
176	99.844	0.310
177	99.888	0.310
178	99.933	0.310
179	100.000	0.155

Peak Unit Number	Adjusted mass rainfall (In)	Unit rainfall (In)
1	0.4208	0.4208
2	0.5552	0.1344
3	0.6530	0.0978
4	0.7326	0.0796
5	0.8010	0.0684
6	0.8616	0.0606
7	0.9164	0.0548
8	0.9667	0.0503
9	1.0134	0.0466
10	1.0570	0.0436
11	1.0980	0.0411
12	1.1369	0.0389
13	1.1804	0.0435
14	1.2221	0.0417
15	1.2623	0.0402
16	1.3011	0.0388
17	1.3386	0.0375
18	1.3749	0.0363
19	1.4102	0.0353
20	1.4445	0.0343
21	1.4779	0.0334
22	1.5105	0.0326
23	1.5423	0.0318
24	1.5734	0.0311
25	1.6038	0.0304
26	1.6335	0.0298
27	1.6627	0.0292
28	1.6912	0.0286
29	1.7193	0.0280

30	1.7468	0.0275
31	1.7739	0.0271
32	1.8005	0.0266
33	1.8266	0.0262
34	1.8524	0.0257
35	1.8777	0.0253
36	1.9027	0.0250
37	1.9271	0.0245
38	1.9513	0.0241
39	1.9751	0.0238
40	1.9986	0.0235
41	2.0217	0.0232
42	2.0446	0.0229
43	2.0672	0.0226
44	2.0895	0.0223
45	2.1115	0.0220
46	2.1333	0.0218
47	2.1548	0.0215
48	2.1761	0.0213
49	2.1972	0.0210
50	2.2180	0.0208
51	2.2386	0.0206
52	2.2590	0.0204
53	2.2791	0.0202
54	2.2991	0.0200
55	2.3189	0.0198
56	2.3385	0.0196
57	2.3579	0.0194
58	2.3771	0.0192
59	2.3961	0.0190
60	2.4150	0.0189
61	2.4337	0.0187
62	2.4522	0.0185
63	2.4706	0.0184
64	2.4889	0.0182
65	2.5069	0.0181
66	2.5249	0.0179
67	2.5427	0.0178
68	2.5603	0.0176
69	2.5778	0.0175
70	2.5952	0.0174
71	2.6124	0.0172
72	2.6295	0.0171
73	2.6456	0.0161
74	2.6615	0.0159
75	2.6774	0.0158
76	2.6931	0.0157
77	2.7086	0.0156
78	2.7241	0.0155
79	2.7395	0.0154
80	2.7547	0.0153
81	2.7699	0.0152
82	2.7849	0.0150
83	2.7999	0.0149
84	2.8147	0.0148
85	2.8295	0.0147
86	2.8441	0.0146
87	2.8587	0.0146
88	2.8731	0.0145
89	2.8875	0.0144
90	2.9018	0.0143
91	2.9160	0.0142
92	2.9301	0.0141

93	2.9441	0.0140
94	2.9581	0.0139
95	2.9719	0.0139
96	2.9857	0.0138
97	2.9994	0.0137
98	3.0130	0.0136
99	3.0265	0.0135
100	3.0400	0.0135
101	3.0534	0.0134
102	3.0667	0.0133
103	3.0799	0.0132
104	3.0931	0.0132
105	3.1062	0.0131
106	3.1192	0.0130
107	3.1322	0.0130
108	3.1451	0.0129
109	3.1579	0.0128
110	3.1706	0.0128
111	3.1833	0.0127
112	3.1960	0.0126
113	3.2085	0.0126
114	3.2210	0.0125
115	3.2335	0.0124
116	3.2459	0.0124
117	3.2582	0.0123
118	3.2705	0.0123
119	3.2827	0.0122
120	3.2948	0.0122
121	3.3069	0.0121
122	3.3190	0.0120
123	3.3309	0.0120
124	3.3429	0.0119
125	3.3548	0.0119
126	3.3666	0.0118
127	3.3783	0.0118
128	3.3901	0.0117
129	3.4017	0.0117
130	3.4134	0.0116
131	3.4249	0.0116
132	3.4364	0.0115
133	3.4479	0.0115
134	3.4593	0.0114
135	3.4707	0.0114
136	3.4820	0.0113
137	3.4933	0.0113
138	3.5046	0.0112
139	3.5157	0.0112
140	3.5269	0.0111
141	3.5380	0.0111
142	3.5491	0.0111
143	3.5601	0.0110
144	3.5710	0.0110
145	3.5820	0.0109
146	3.5929	0.0109
147	3.6037	0.0108
148	3.6145	0.0108
149	3.6253	0.0108
150	3.6360	0.0107
151	3.6467	0.0107
152	3.6573	0.0106
153	3.6679	0.0106
154	3.6785	0.0106
155	3.6890	0.0105

156	3.6995	0.0105
157	3.7100	0.0105
158	3.7204	0.0104
159	3.7307	0.0104
160	3.7411	0.0103
161	3.7514	0.0103
162	3.7617	0.0103
163	3.7719	0.0102
164	3.7821	0.0102
165	3.7923	0.0102
166	3.8024	0.0101
167	3.8125	0.0101
168	3.8226	0.0101
169	3.8326	0.0100
170	3.8426	0.0100
171	3.8525	0.0100
172	3.8625	0.0099
173	3.8724	0.0099
174	3.8822	0.0099
175	3.8921	0.0098
176	3.9019	0.0098
177	3.9117	0.0098
178	3.9214	0.0097
179	3.9311	0.0097
180	3.9408	0.0097
181	3.9504	0.0097
182	3.9601	0.0096
183	3.9697	0.0096
184	3.9792	0.0096
185	3.9888	0.0095
186	3.9983	0.0095
187	4.0077	0.0095
188	4.0172	0.0094
189	4.0266	0.0094
190	4.0360	0.0094
191	4.0454	0.0094
192	4.0547	0.0093
193	4.0640	0.0093
194	4.0733	0.0093
195	4.0826	0.0093
196	4.0918	0.0092
197	4.1010	0.0092
198	4.1102	0.0092
199	4.1193	0.0092
200	4.1285	0.0091
201	4.1376	0.0091
202	4.1466	0.0091
203	4.1557	0.0091
204	4.1647	0.0090
205	4.1737	0.0090
206	4.1827	0.0090
207	4.1916	0.0090
208	4.2006	0.0089
209	4.2095	0.0089
210	4.2184	0.0089
211	4.2272	0.0089
212	4.2360	0.0088
213	4.2449	0.0088
214	4.2536	0.0088
215	4.2624	0.0088
216	4.2712	0.0087
217	4.2799	0.0087
218	4.2886	0.0087

219	4.2972	0.0087
220	4.3059	0.0087
221	4.3145	0.0086
222	4.3231	0.0086
223	4.3317	0.0086
224	4.3403	0.0086
225	4.3488	0.0085
226	4.3574	0.0085
227	4.3659	0.0085
228	4.3743	0.0085
229	4.3828	0.0085
230	4.3912	0.0084
231	4.3997	0.0084
232	4.4081	0.0084
233	4.4164	0.0084
234	4.4248	0.0084
235	4.4331	0.0083
236	4.4415	0.0083
237	4.4498	0.0083
238	4.4580	0.0083
239	4.4663	0.0083
240	4.4745	0.0082
241	4.4828	0.0082
242	4.4910	0.0082
243	4.4992	0.0082
244	4.5073	0.0082
245	4.5155	0.0081
246	4.5236	0.0081
247	4.5317	0.0081
248	4.5398	0.0081
249	4.5479	0.0081
250	4.5559	0.0081
251	4.5640	0.0080
252	4.5720	0.0080
253	4.5800	0.0080
254	4.5880	0.0080
255	4.5959	0.0080
256	4.6039	0.0079
257	4.6118	0.0079
258	4.6197	0.0079
259	4.6276	0.0079
260	4.6355	0.0079
261	4.6434	0.0079
262	4.6512	0.0078
263	4.6591	0.0078
264	4.6669	0.0078
265	4.6747	0.0078
266	4.6824	0.0078
267	4.6902	0.0078
268	4.6980	0.0077
269	4.7057	0.0077
270	4.7134	0.0077
271	4.7211	0.0077
272	4.7288	0.0077
273	4.7365	0.0077
274	4.7441	0.0077
275	4.7517	0.0076
276	4.7594	0.0076
277	4.7670	0.0076
278	4.7746	0.0076
279	4.7821	0.0076
280	4.7897	0.0076
281	4.7972	0.0075

282	4.8048	0.0075
283	4.8123	0.0075
284	4.8198	0.0075
285	4.8273	0.0075
286	4.8348	0.0075
287	4.8422	0.0075
288	4.8497	0.0074

Unit Period (number)	Unit Rainfall (In)	Unit Soil-Loss (In)	Effective Rainfall (In)
1	0.0074	0.0031	0.0043
2	0.0075	0.0031	0.0043
3	0.0075	0.0031	0.0043
4	0.0075	0.0031	0.0044
5	0.0075	0.0032	0.0044
6	0.0075	0.0032	0.0044
7	0.0076	0.0032	0.0044
8	0.0076	0.0032	0.0044
9	0.0076	0.0032	0.0044
10	0.0076	0.0032	0.0044
11	0.0077	0.0032	0.0045
12	0.0077	0.0032	0.0045
13	0.0077	0.0032	0.0045
14	0.0077	0.0032	0.0045
15	0.0078	0.0033	0.0045
16	0.0078	0.0033	0.0045
17	0.0078	0.0033	0.0045
18	0.0078	0.0033	0.0045
19	0.0079	0.0033	0.0046
20	0.0079	0.0033	0.0046
21	0.0079	0.0033	0.0046
22	0.0079	0.0033	0.0046
23	0.0080	0.0033	0.0046
24	0.0080	0.0033	0.0046
25	0.0080	0.0034	0.0047
26	0.0080	0.0034	0.0047
27	0.0081	0.0034	0.0047
28	0.0081	0.0034	0.0047
29	0.0081	0.0034	0.0047
30	0.0081	0.0034	0.0047
31	0.0082	0.0034	0.0048
32	0.0082	0.0034	0.0048
33	0.0082	0.0035	0.0048
34	0.0083	0.0035	0.0048
35	0.0083	0.0035	0.0048
36	0.0083	0.0035	0.0048
37	0.0084	0.0035	0.0049
38	0.0084	0.0035	0.0049
39	0.0084	0.0035	0.0049
40	0.0084	0.0035	0.0049
41	0.0085	0.0036	0.0049
42	0.0085	0.0036	0.0049
43	0.0085	0.0036	0.0050
44	0.0086	0.0036	0.0050
45	0.0086	0.0036	0.0050
46	0.0086	0.0036	0.0050
47	0.0087	0.0036	0.0050
48	0.0087	0.0036	0.0051
49	0.0087	0.0037	0.0051
50	0.0088	0.0037	0.0051
51	0.0088	0.0037	0.0051

52	0.0088	0.0037	0.0051
53	0.0089	0.0037	0.0052
54	0.0089	0.0037	0.0052
55	0.0090	0.0038	0.0052
56	0.0090	0.0038	0.0052
57	0.0090	0.0038	0.0052
58	0.0091	0.0038	0.0053
59	0.0091	0.0038	0.0053
60	0.0091	0.0038	0.0053
61	0.0092	0.0038	0.0053
62	0.0092	0.0039	0.0053
63	0.0093	0.0039	0.0054
64	0.0093	0.0039	0.0054
65	0.0093	0.0039	0.0054
66	0.0094	0.0039	0.0054
67	0.0094	0.0039	0.0055
68	0.0094	0.0040	0.0055
69	0.0095	0.0040	0.0055
70	0.0095	0.0040	0.0055
71	0.0096	0.0040	0.0056
72	0.0096	0.0040	0.0056
73	0.0097	0.0041	0.0056
74	0.0097	0.0041	0.0056
75	0.0098	0.0041	0.0057
76	0.0098	0.0041	0.0057
77	0.0099	0.0041	0.0057
78	0.0099	0.0042	0.0057
79	0.0100	0.0042	0.0058
80	0.0100	0.0042	0.0058
81	0.0101	0.0042	0.0058
82	0.0101	0.0042	0.0059
83	0.0102	0.0043	0.0059
84	0.0102	0.0043	0.0059
85	0.0103	0.0043	0.0060
86	0.0103	0.0043	0.0060
87	0.0104	0.0044	0.0060
88	0.0104	0.0044	0.0060
89	0.0105	0.0044	0.0061
90	0.0105	0.0044	0.0061
91	0.0106	0.0044	0.0062
92	0.0106	0.0045	0.0062
93	0.0107	0.0045	0.0062
94	0.0108	0.0045	0.0063
95	0.0108	0.0045	0.0063
96	0.0109	0.0046	0.0063
97	0.0110	0.0046	0.0064
98	0.0110	0.0046	0.0064
99	0.0111	0.0047	0.0064
100	0.0111	0.0047	0.0065
101	0.0112	0.0047	0.0065
102	0.0113	0.0047	0.0066
103	0.0114	0.0048	0.0066
104	0.0114	0.0048	0.0066
105	0.0115	0.0048	0.0067
106	0.0116	0.0048	0.0067
107	0.0117	0.0049	0.0068
108	0.0117	0.0049	0.0068
109	0.0118	0.0050	0.0069
110	0.0119	0.0050	0.0069
111	0.0120	0.0050	0.0070
112	0.0120	0.0050	0.0070
113	0.0122	0.0051	0.0071
114	0.0122	0.0051	0.0071

115	0.0123	0.0052	0.0072
116	0.0124	0.0052	0.0072
117	0.0125	0.0052	0.0073
118	0.0126	0.0053	0.0073
119	0.0127	0.0053	0.0074
120	0.0128	0.0053	0.0074
121	0.0129	0.0054	0.0075
122	0.0130	0.0054	0.0075
123	0.0131	0.0055	0.0076
124	0.0132	0.0055	0.0076
125	0.0133	0.0056	0.0077
126	0.0134	0.0056	0.0078
127	0.0135	0.0057	0.0079
128	0.0136	0.0057	0.0079
129	0.0138	0.0058	0.0080
130	0.0139	0.0058	0.0080
131	0.0140	0.0059	0.0081
132	0.0141	0.0059	0.0082
133	0.0143	0.0060	0.0083
134	0.0144	0.0060	0.0083
135	0.0146	0.0061	0.0085
136	0.0146	0.0061	0.0085
137	0.0148	0.0062	0.0086
138	0.0149	0.0063	0.0087
139	0.0152	0.0064	0.0088
140	0.0153	0.0064	0.0089
141	0.0155	0.0065	0.0090
142	0.0156	0.0065	0.0091
143	0.0158	0.0066	0.0092
144	0.0159	0.0067	0.0093
145	0.0171	0.0072	0.0099
146	0.0172	0.0072	0.0100
147	0.0175	0.0073	0.0102
148	0.0176	0.0074	0.0102
149	0.0179	0.0075	0.0104
150	0.0181	0.0076	0.0105
151	0.0184	0.0077	0.0107
152	0.0185	0.0078	0.0108
153	0.0189	0.0079	0.0110
154	0.0190	0.0080	0.0111
155	0.0194	0.0081	0.0113
156	0.0196	0.0082	0.0114
157	0.0200	0.0084	0.0116
158	0.0202	0.0085	0.0117
159	0.0206	0.0086	0.0120
160	0.0208	0.0087	0.0121
161	0.0213	0.0089	0.0124
162	0.0215	0.0090	0.0125
163	0.0220	0.0092	0.0128
164	0.0223	0.0094	0.0130
165	0.0229	0.0096	0.0133
166	0.0232	0.0097	0.0135
167	0.0238	0.0100	0.0138
168	0.0241	0.0101	0.0140
169	0.0250	0.0105	0.0145
170	0.0253	0.0106	0.0147
171	0.0262	0.0110	0.0152
172	0.0266	0.0111	0.0154
173	0.0275	0.0115	0.0160
174	0.0280	0.0118	0.0163
175	0.0292	0.0122	0.0169
176	0.0298	0.0125	0.0173
177	0.0311	0.0130	0.0180

178	0.0318	0.0133	0.0185
179	0.0334	0.0140	0.0194
180	0.0343	0.0144	0.0199
181	0.0363	0.0152	0.0211
182	0.0375	0.0157	0.0218
183	0.0402	0.0168	0.0233
184	0.0417	0.0175	0.0242
185	0.0389	0.0163	0.0226
186	0.0411	0.0172	0.0239
187	0.0466	0.0196	0.0271
188	0.0503	0.0211	0.0292
189	0.0606	0.0254	0.0352
190	0.0684	0.0287	0.0397
191	0.0978	0.0300	0.0678
192	0.1344	0.0300	0.1045
193	0.4208	0.0300	0.3908
194	0.0796	0.0300	0.0497
195	0.0548	0.0230	0.0318
196	0.0436	0.0183	0.0253
197	0.0435	0.0182	0.0252
198	0.0388	0.0163	0.0225
199	0.0353	0.0148	0.0205
200	0.0326	0.0137	0.0189
201	0.0304	0.0127	0.0177
202	0.0286	0.0120	0.0166
203	0.0271	0.0113	0.0157
204	0.0257	0.0108	0.0149
205	0.0245	0.0103	0.0142
206	0.0235	0.0098	0.0136
207	0.0226	0.0095	0.0131
208	0.0218	0.0091	0.0126
209	0.0210	0.0088	0.0122
210	0.0204	0.0085	0.0118
211	0.0198	0.0083	0.0115
212	0.0192	0.0081	0.0112
213	0.0187	0.0078	0.0109
214	0.0182	0.0076	0.0106
215	0.0178	0.0075	0.0103
216	0.0174	0.0073	0.0101
217	0.0161	0.0067	0.0093
218	0.0157	0.0066	0.0091
219	0.0154	0.0064	0.0089
220	0.0150	0.0063	0.0087
221	0.0147	0.0062	0.0086
222	0.0145	0.0061	0.0084
223	0.0142	0.0059	0.0082
224	0.0139	0.0058	0.0081
225	0.0137	0.0057	0.0080
226	0.0135	0.0056	0.0078
227	0.0132	0.0056	0.0077
228	0.0130	0.0055	0.0076
229	0.0128	0.0054	0.0074
230	0.0126	0.0053	0.0073
231	0.0124	0.0052	0.0072
232	0.0123	0.0051	0.0071
233	0.0121	0.0051	0.0070
234	0.0119	0.0050	0.0069
235	0.0118	0.0049	0.0068
236	0.0116	0.0049	0.0067
237	0.0115	0.0048	0.0067
238	0.0113	0.0047	0.0066
239	0.0112	0.0047	0.0065
240	0.0111	0.0046	0.0064

241	0.0109	0.0046	0.0063
242	0.0108	0.0045	0.0063
243	0.0107	0.0045	0.0062
244	0.0106	0.0044	0.0061
245	0.0105	0.0044	0.0061
246	0.0103	0.0043	0.0060
247	0.0102	0.0043	0.0059
248	0.0101	0.0042	0.0059
249	0.0100	0.0042	0.0058
250	0.0099	0.0042	0.0058
251	0.0098	0.0041	0.0057
252	0.0097	0.0041	0.0057
253	0.0097	0.0040	0.0056
254	0.0096	0.0040	0.0056
255	0.0095	0.0040	0.0055
256	0.0094	0.0039	0.0055
257	0.0093	0.0039	0.0054
258	0.0092	0.0039	0.0054
259	0.0092	0.0038	0.0053
260	0.0091	0.0038	0.0053
261	0.0090	0.0038	0.0052
262	0.0089	0.0037	0.0052
263	0.0089	0.0037	0.0051
264	0.0088	0.0037	0.0051
265	0.0087	0.0037	0.0051
266	0.0087	0.0036	0.0050
267	0.0086	0.0036	0.0050
268	0.0085	0.0036	0.0050
269	0.0085	0.0035	0.0049
270	0.0084	0.0035	0.0049
271	0.0083	0.0035	0.0048
272	0.0083	0.0035	0.0048
273	0.0082	0.0034	0.0048
274	0.0082	0.0034	0.0047
275	0.0081	0.0034	0.0047
276	0.0081	0.0034	0.0047
277	0.0080	0.0034	0.0046
278	0.0079	0.0033	0.0046
279	0.0079	0.0033	0.0046
280	0.0078	0.0033	0.0046
281	0.0078	0.0033	0.0045
282	0.0077	0.0032	0.0045
283	0.0077	0.0032	0.0045
284	0.0077	0.0032	0.0044
285	0.0076	0.0032	0.0044
286	0.0076	0.0032	0.0044
287	0.0075	0.0032	0.0044
288	0.0075	0.0031	0.0043

Total soil rain loss = 1.85(In)
Total effective rainfall = 3.00(In)
Peak flow rate in flood hydrograph = 25.08(CFS)

++

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

Hydrograph in 5 Minute intervals ((CFS))

Time(h+m) Volume Ac.Ft Q(CFS) 0 7.5 15.0 22.5 30.0

```
0+ 5        0.0001      0.01  Q          |          |          |          |
0+10        0.0003      0.03  Q          |          |          |          |
0+15        0.0007      0.06  Q          |          |          |          |
0+20        0.0013      0.08  Q          |          |          |          |
0+25        0.0021      0.12  Q          |          |          |          |
0+30        0.0031      0.15  Q          |          |          |          |
0+35        0.0045      0.19  Q          |          |          |          |
0+40        0.0061      0.24  Q          |          |          |          |
0+45        0.0082      0.30  Q          |          |          |          |
0+50        0.0107      0.36  Q          |          |          |          |
0+55        0.0137      0.43  Q          |          |          |          |
1+ 0        0.0171      0.50  Q          |          |          |          |
1+ 5        0.0211      0.58  Q          |          |          |          |
1+10        0.0257      0.67  Q          |          |          |          |
1+15        0.0309      0.76  VQ         |          |          |          |
1+20        0.0368      0.85  VQ         |          |          |          |
1+25        0.0433      0.95  VQ         |          |          |          |
1+30        0.0505      1.05  VQ         |          |          |          |
1+35        0.0584      1.15  VQ         |          |          |          |
1+40        0.0670      1.25  VQ         |          |          |          |
1+45        0.0763      1.35  VQ         |          |          |          |
1+50        0.0862      1.45  VQ         |          |          |          |
1+55        0.0969      1.54  V Q        |          |          |          |
2+ 0        0.1080      1.62  V Q        |          |          |          |
2+ 5        0.1197      1.69  V Q        |          |          |          |
2+10        0.1319      1.77  V Q        |          |          |          |
2+15        0.1445      1.83  V Q        |          |          |          |
2+20        0.1576      1.90  V Q        |          |          |          |
2+25        0.1710      1.95  V Q        |          |          |          |
2+30        0.1848      2.00  V Q        |          |          |          |
2+35        0.1989      2.05  V Q        |          |          |          |
2+40        0.2133      2.10  V Q        |          |          |          |
2+45        0.2280      2.14  V Q        |          |          |          |
2+50        0.2430      2.18  V Q        |          |          |          |
2+55        0.2583      2.22  V Q        |          |          |          |
3+ 0        0.2738      2.25  V  Q       |          |          |          |
3+ 5        0.2895      2.29  V  Q       |          |          |          |
3+10        0.3055      2.32  V  Q       |          |          |          |
3+15        0.3217      2.35  V  Q       |          |          |          |
3+20        0.3381      2.38  V  Q       |          |          |          |
3+25        0.3546      2.41  V  Q       |          |          |          |
3+30        0.3714      2.43  |V Q       |          |          |          |
3+35        0.3883      2.46  |V Q       |          |          |          |
3+40        0.4055      2.49  |V Q       |          |          |          |
3+45        0.4228      2.52  |V Q       |          |          |          |
3+50        0.4403      2.54  |V Q       |          |          |          |
3+55        0.4580      2.57  |V Q       |          |          |          |
4+ 0        0.4759      2.59  |V Q       |          |          |          |
4+ 5        0.4939      2.62  |V Q       |          |          |          |
4+10        0.5121      2.64  |V Q       |          |          |          |
4+15        0.5305      2.67  |V Q       |          |          |          |
4+20        0.5490      2.69  |V Q       |          |          |          |
4+25        0.5677      2.71  |V Q       |          |          |          |
4+30        0.5865      2.74  |V Q       |          |          |          |
4+35        0.6055      2.76  |V Q       |          |          |          |
4+40        0.6247      2.78  |V Q       |          |          |          |
4+45        0.6440      2.80  |V Q       |          |          |          |
4+50        0.6635      2.83  |V Q       |          |          |          |
4+55        0.6831      2.85  |V Q       |          |          |          |
5+ 0        0.7028      2.87  |V Q       |          |          |          |
5+ 5        0.7228      2.89  | VQ       |          |          |          |
5+10        0.7428      2.91  | VQ       |          |          |          |
5+15        0.7631      2.94  | VQ       |          |          |          |
```

5+20	0.7834	2.96	VQ			
5+25	0.8039	2.98	VQ			
5+30	0.8246	3.00	VQ			
5+35	0.8453	3.02	V Q			
5+40	0.8663	3.04	V Q			
5+45	0.8873	3.06	V Q			
5+50	0.9085	3.08	V Q			
5+55	0.9299	3.10	V Q			
6+ 0	0.9514	3.12	V Q			
6+ 5	0.9730	3.14	V Q			
6+10	0.9947	3.16	V Q			
6+15	1.0166	3.18	V Q			
6+20	1.0387	3.20	V Q			
6+25	1.0609	3.22	V Q			
6+30	1.0832	3.24	VQ			
6+35	1.1057	3.26	VQ			
6+40	1.1283	3.28	VQ			
6+45	1.1510	3.30	VQ			
6+50	1.1739	3.32	VQ			
6+55	1.1969	3.34	VQ			
7+ 0	1.2201	3.36	VQ			
7+ 5	1.2434	3.38	VQ			
7+10	1.2668	3.40	VQ			
7+15	1.2904	3.42	VQ			
7+20	1.3141	3.44	VQ			
7+25	1.3380	3.47	VQ			
7+30	1.3620	3.49	VQ			
7+35	1.3861	3.51	VQ			
7+40	1.4104	3.53	VQ			
7+45	1.4349	3.55	Q			
7+50	1.4594	3.57	Q			
7+55	1.4841	3.59	Q			
8+ 0	1.5090	3.61	Q			
8+ 5	1.5340	3.63	Q			
8+10	1.5591	3.65	Q			
8+15	1.5844	3.67	Q			
8+20	1.6099	3.69	Q			
8+25	1.6355	3.72	Q			
8+30	1.6612	3.74	Q			
8+35	1.6871	3.76	VQ			
8+40	1.7132	3.78	VQ			
8+45	1.7394	3.81	VQ			
8+50	1.7658	3.83	VQ			
8+55	1.7923	3.85	Q			
9+ 0	1.8191	3.88	Q			
9+ 5	1.8459	3.90	Q			
9+10	1.8730	3.93	Q			
9+15	1.9002	3.95	Q			
9+20	1.9276	3.98	Q			
9+25	1.9551	4.00	Q			
9+30	1.9829	4.03	Q			
9+35	2.0108	4.05	Q			
9+40	2.0388	4.08	Q			
9+45	2.0671	4.10	Q			
9+50	2.0955	4.13	Q			
9+55	2.1241	4.16	Q			
10+ 0	2.1529	4.18	QV			
10+ 5	2.1819	4.21	QV			
10+10	2.2111	4.24	QV			
10+15	2.2405	4.27	QV			
10+20	2.2701	4.29	QV			
10+25	2.2998	4.32	QV			
10+30	2.3298	4.35	QV			

```
10+35       2.3600      4.38  |    QV   |          |          |          |
10+40       2.3904      4.41  |    QV   |          |          |          |
10+45       2.4210      4.44  |    QV   |          |          |          |
10+50       2.4518      4.47  |    QV   |          |          |          |
10+55       2.4828      4.50  |     Q   |          |          |          |
11+ 0       2.5140      4.54  |     QV  |          |          |          |
11+ 5       2.5455      4.57  |     QV  |          |          |          |
11+10       2.5772      4.60  |     QV  |          |          |          |
11+15       2.6092      4.64  |     QV  |          |          |          |
11+20       2.6413      4.67  |     QV  |          |          |          |
11+25       2.6737      4.71  |     QV  |          |          |          |
11+30       2.7064      4.74  |     QV  |          |          |          |
11+35       2.7393      4.78  |     QV  |          |          |          |
11+40       2.7725      4.82  |     QV  |          |          |          |
11+45       2.8059      4.85  |     QV  |          |          |          |
11+50       2.8396      4.89  |     QV  |          |          |          |
11+55       2.8736      4.93  |     Q V |          |          |          |
12+ 0       2.9078      4.97  |     Q V |          |          |          |
12+ 5       2.9423      5.01  |     Q V |          |          |          |
12+10       2.9772      5.06  |     Q V |          |          |          |
12+15       3.0123      5.10  |     Q V |          |          |          |
12+20       3.0478      5.15  |     Q V |          |          |          |
12+25       3.0836      5.20  |     Q V |          |          |          |
12+30       3.1198      5.25  |     Q V |          |          |          |
12+35       3.1563      5.30  |      QV |          |          |          |
12+40       3.1932      5.36  |      QV |          |          |          |
12+45       3.2304      5.41  |      Q V|          |          |          |
12+50       3.2681      5.47  |      Q V|          |          |          |
12+55       3.3062      5.53  |      Q V|          |          |          |
13+ 0       3.3447      5.59  |      Q V|          |          |          |
13+ 5       3.3837      5.66  |      Q V|          |          |          |
13+10       3.4231      5.73  |      Q V|          |          |          |
13+15       3.4630      5.79  |      Q V|          |          |          |
13+20       3.5034      5.87  |      Q V|          |          |          |
13+25       3.5444      5.94  |      Q V|          |          |          |
13+30       3.5858      6.02  |       Q V          |          |          |
13+35       3.6277      6.09  |       Q V          |          |          |
13+40       3.6703      6.17  |       Q V          |          |          |
13+45       3.7133      6.26  |       Q V          |          |          |
13+50       3.7570      6.34  |       Q V          |          |          |
13+55       3.8013      6.43  |       Q V          |          |          |
14+ 0       3.8462      6.52  |       Q V          |          |          |
14+ 5       3.8917      6.61  |       Q V          |          |          |
14+10       3.9378      6.70  |       Q V          |          |          |
14+15       3.9846      6.80  |        Q|V         |          |          |
14+20       4.0321      6.89  |        Q|V         |          |          |
14+25       4.0803      7.00  |        Q|V         |          |          |
14+30       4.1292      7.10  |        Q|V         |          |          |
14+35       4.1788      7.21  |        Q|V         |          |          |
14+40       4.2293      7.33  |        Q|V         |          |          |
14+45       4.2806      7.45  |        Q|V         |          |          |
14+50       4.3328      7.57  |         Q V        |          |          |
14+55       4.3859      7.71  |         Q V        |          |          |
15+ 0       4.4399      7.84  |         Q V        |          |          |
15+ 5       4.4949      7.99  |         Q V        |          |          |
15+10       4.5510      8.15  |         Q V        |          |          |
15+15       4.6083      8.31  |         |QV        |          |          |
15+20       4.6668      8.49  |         |Q V       |          |          |
15+25       4.7265      8.67  |         |Q V       |          |          |
15+30       4.7875      8.86  |         |Q V       |          |          |
15+35       4.8500      9.07  |         | QV       |          |          |
15+40       4.9140      9.30  |         | QV       |          |          |
15+45       4.9798      9.55  |         | QV       |          |          |
```

```
15+50       5.0476      9.85  |          |  QV     |         |         |
15+55       5.1181     10.24  |          |  QV     |         |         |
16+ 0       5.1926     10.81  |          |   Q     |         |         |
16+ 5       5.2772     12.28  |          |   V Q   |         |         |
16+10       5.3710     13.63  |          |   V   Q |         |         |
16+15       5.4681     14.10  |          |    V  Q |         |         |
16+20       5.5695     14.72  |          |    V   Q|         |         |
16+25       5.6777     15.71  |          |    V    Q         |         |
16+30       5.7910     16.44  |          |     V   |Q        |         |
16+35       5.9140     17.87  |          |     V   |  Q      |         |
16+40       6.0424     18.64  |          |     V   |   Q     |         |
16+45       6.1783     19.74  |          |      V  |     Q   |         |
16+50       6.3194     20.49  |          |      V  |      Q  |         |
16+55       6.4639     20.98  |          |       V |      Q  |         |
17+ 0       6.6159     22.07  |          |       V |        Q|         |
17+ 5       6.7779     23.54  |          |       V |         |Q        |
17+10       6.9421     23.83  |          |        V|         |Q        |
17+15       7.1082     24.12  |          |        V|         | Q       |
17+20       7.2787     24.76  |          |         V         |  Q      |
17+25       7.4506     24.95  |          |         V         |  Q      |
17+30       7.6233     25.08  |          |         |V        |  Q      |
17+35       7.7959     25.06  |          |         |V        |  Q      |
17+40       7.9675     24.91  |          |         | V       |  Q      |
17+45       8.1374     24.67  |          |         | V       | Q       |
17+50       8.3043     24.23  |          |         |  V      | Q       |
17+55       8.4644     23.24  |          |         |  V      Q         |
18+ 0       8.6112     21.33  |          |         |   V   Q |         |
18+ 5       8.7538     20.71  |          |         |   V  Q  |         |
18+10       8.8924     20.13  |          |         |   V Q   |         |
18+15       9.0220     18.81  |          |         |    Q    |         |
18+20       9.1458     17.97  |          |         |  Q V    |         |
18+25       9.2631     17.03  |          |         | Q  V    |         |
18+30       9.3749     16.24  |          |         |Q    V   |         |
18+35       9.4842     15.87  |          |         |Q    V   |         |
18+40       9.5901     15.38  |          |         Q     V   |         |
18+45       9.6909     14.65  |          |        Q|      V  |         |
18+50       9.7885     14.17  |          |       Q |      V  |         |
18+55       9.8806     13.37  |          |      Q  |      V  |         |
19+ 0       9.9700     12.98  |          |      Q  |      V  |         |
19+ 5      10.0574     12.69  |          |     Q   |       V |         |
19+10      10.1414     12.21  |          |     Q   |       V |         |
19+15      10.2227     11.80  |          |    Q    |       V |         |
19+20      10.3018     11.49  |          |    Q    |       V |         |
19+25      10.3786     11.15  |          |   Q     |       V |         |
19+30      10.4541     10.97  |          |   Q     |        V|         |
19+35      10.5285     10.80  |          |   Q     |        V|         |
19+40      10.6017     10.62  |          |   Q     |        V|         |
19+45      10.6734     10.42  |          |  Q      |        V|         |
19+50      10.7426     10.04  |          |  Q      |        V|         |
19+55      10.8101      9.81  |          |  Q      |         V         |
20+ 0      10.8767      9.67  |          | Q       |         V         |
20+ 5      10.9424      9.53  |          | Q       |         V         |
20+10      11.0070      9.39  |          | Q       |         V         |
20+15      11.0703      9.19  |          | Q       |         V         |
20+20      11.1317      8.91  |          |Q        |         |V        |
20+25      11.1922      8.78  |          |Q        |         |V        |
20+30      11.2519      8.67  |          |Q        |         |V        |
20+35      11.3109      8.57  |          |Q        |         |V        |
20+40      11.3691      8.45  |          |Q        |         |V        |
20+45      11.4260      8.27  |          |Q        |         |V        |
20+50      11.4819      8.11  |         Q         |         | V       |
20+55      11.5371      8.02  |         Q         |         | V       |
21+ 0      11.5917      7.92  |         Q         |         | V       |
```

```
21+ 5      11.6456      7.82  |          Q          |          | V        |
21+10      11.6985      7.69  |          Q          |          | V        |
21+15      11.7500      7.47  |         Q|          |          | V        |
21+20      11.8007      7.36  |         Q|          |          | V        |
21+25      11.8508      7.28  |         Q|          |          |  V       |
21+30      11.9004      7.20  |         Q|          |          |  V       |
21+35      11.9493      7.11  |         Q|          |          |  V       |
21+40      11.9973      6.97  |         Q|          |          |  V       |
21+45      12.0442      6.81  |         Q|          |          |  V       |
21+50      12.0906      6.74  |        Q |          |          |  V       |
21+55      12.1366      6.68  |        Q |          |          |  V       |
22+ 0      12.1822      6.61  |        Q |          |          |  V       |
22+ 5      12.2273      6.55  |        Q |          |          |   V      |
22+10      12.2720      6.49  |        Q |          |          |   V      |
22+15      12.3163      6.43  |        Q |          |          |   V      |
22+20      12.3602      6.37  |        Q |          |          |   V      |
22+25      12.4036      6.30  |        Q |          |          |   V      |
22+30      12.4465      6.23  |        Q |          |          |   V      |
22+35      12.4885      6.10  |        Q |          |          |   V      |
22+40      12.5292      5.91  |       Q  |          |          |   V      |
22+45      12.5694      5.84  |       Q  |          |          |    V     |
22+50      12.6093      5.79  |       Q  |          |          |    V     |
22+55      12.6488      5.74  |       Q  |          |          |    V     |
23+ 0      12.6880      5.69  |       Q  |          |          |    V     |
23+ 5      12.7268      5.64  |       Q  |          |          |    V     |
23+10      12.7653      5.59  |       Q  |          |          |    V     |
23+15      12.8035      5.54  |       Q  |          |          |    V     |
23+20      12.8413      5.49  |       Q  |          |          |    V     |
23+25      12.8787      5.43  |       Q  |          |          |    V     |
23+30      12.9156      5.35  |       Q  |          |          |     V    |
23+35      12.9514      5.20  |      Q   |          |          |     V    |
23+40      12.9867      5.13  |      Q   |          |          |     V    |
23+45      13.0218      5.09  |      Q   |          |          |     V    |
23+50      13.0566      5.05  |      Q   |          |          |     V    |
23+55      13.0911      5.01  |      Q   |          |          |     V    |
24+ 0      13.1253      4.97  |      Q   |          |          |     V    |
24+ 5      13.1592      4.92  |      Q   |          |          |     V    |
24+10      13.1927      4.86  |      Q   |          |          |     V    |
24+15      13.2258      4.80  |      Q   |          |          |     V    |
24+20      13.2585      4.74  |      Q   |          |          |     V    |
24+25      13.2907      4.67  |      Q   |          |          |      V   |
24+30      13.3223      4.59  |      Q   |          |          |      V   |
24+35      13.3533      4.50  |      Q   |          |          |      V   |
24+40      13.3837      4.42  |    Q     |          |          |      V   |
24+45      13.4136      4.34  |    Q     |          |          |      V   |
24+50      13.4428      4.24  |    Q     |          |          |      V   |
24+55      13.4714      4.15  |    Q     |          |          |      V   |
25+ 0      13.4993      4.05  |    Q     |          |          |      V   |
25+ 5      13.5265      3.94  |    Q     |          |          |      V   |
25+10      13.5528      3.82  |    Q     |          |          |      V   |
25+15      13.5783      3.70  |   Q      |          |          |      V   |
25+20      13.6029      3.57  |   Q      |          |          |      V   |
25+25      13.6262      3.39  |   Q      |          |          |       V  |
25+30      13.6484      3.23  |   Q      |          |          |       V  |
25+35      13.6698      3.10  |   Q      |          |          |       V  |
25+40      13.6904      2.98  |  Q       |          |          |       V  |
25+45      13.7101      2.87  |  Q       |          |          |       V  |
25+50      13.7290      2.75  |  Q       |          |          |       V  |
25+55      13.7472      2.64  |  Q       |          |          |       V  |
26+ 0      13.7647      2.54  |  Q       |          |          |       V  |
26+ 5      13.7816      2.45  |  Q       |          |          |       V  |
26+10      13.7979      2.36  |  Q       |          |          |       V  |
26+15      13.8136      2.28  |  Q       |          |          |       V  |
```

```
26+20      13.8286      2.18  | Q        |          |          |        V |
26+25      13.8430      2.09  | Q        |          |          |        V |
26+30      13.8570      2.03  | Q        |          |          |        V |
26+35      13.8706      1.97  | Q        |          |          |        V |
26+40      13.8838      1.92  | Q        |          |          |        V |
26+45      13.8966      1.87  | Q        |          |          |        V |
26+50      13.9091      1.82  | Q        |          |          |        V |
26+55      13.9214      1.77  | Q        |          |          |        V |
27+ 0      13.9333      1.73  | Q        |          |          |        V |
27+ 5      13.9449      1.69  | Q        |          |          |        V |
27+10      13.9562      1.64  | Q        |          |          |        V |
27+15      13.9671      1.59  | Q        |          |          |        V |
27+20      13.9776      1.52  | Q        |          |          |        V |
27+25      13.9878      1.48  |Q         |          |          |         V|
27+30      13.9978      1.45  |Q         |          |          |         V|
27+35      14.0076      1.42  |Q         |          |          |         V|
27+40      14.0172      1.39  |Q         |          |          |         V|
27+45      14.0265      1.36  |Q         |          |          |         V|
27+50      14.0357      1.33  |Q         |          |          |         V|
27+55      14.0446      1.30  |Q         |          |          |         V|
28+ 0      14.0534      1.27  |Q         |          |          |         V|
28+ 5      14.0620      1.24  |Q         |          |          |         V|
28+10      14.0702      1.20  |Q         |          |          |         V|
28+15      14.0781      1.14  |Q         |          |          |         V|
28+20      14.0857      1.11  |Q         |          |          |         V|
28+25      14.0932      1.09  |Q         |          |          |         V|
28+30      14.1006      1.07  |Q         |          |          |         V|
28+35      14.1077      1.04  |Q         |          |          |         V|
28+40      14.1148      1.02  |Q         |          |          |         V|
28+45      14.1217      1.00  |Q         |          |          |         V|
28+50      14.1284      0.98  |Q         |          |          |         V|
28+55      14.1350      0.96  |Q         |          |          |         V|
29+ 0      14.1415      0.94  |Q         |          |          |         V|
29+ 5      14.1479      0.92  |Q         |          |          |         V|
29+10      14.1541      0.90  |Q         |          |          |         V|
29+15      14.1602      0.89  |Q         |          |          |         V|
29+20      14.1662      0.87  |Q         |          |          |         V|
29+25      14.1721      0.85  |Q         |          |          |         V|
29+30      14.1779      0.84  |Q         |          |          |         V|
29+35      14.1835      0.82  |Q         |          |          |         V|
29+40      14.1891      0.80  |Q         |          |          |         V|
29+45      14.1945      0.79  |Q         |          |          |         V|
29+50      14.1998      0.77  |Q         |          |          |         V|
29+55      14.2051      0.76  |Q         |          |          |         V|
30+ 0      14.2102      0.74  Q          |          |          |         V|
30+ 5      14.2152      0.73  Q          |          |          |         V|
30+10      14.2201      0.71  Q          |          |          |         V|
30+15      14.2249      0.70  Q          |          |          |         V|
30+20      14.2295      0.68  Q          |          |          |         V|
30+25      14.2341      0.66  Q          |          |          |         V|
30+30      14.2386      0.65  Q          |          |          |         V|
30+35      14.2429      0.63  Q          |          |          |         V|
30+40      14.2471      0.61  Q          |          |          |         V|
30+45      14.2511      0.59  Q          |          |          |         V|
30+50      14.2550      0.56  Q          |          |          |         V|
30+55      14.2582      0.47  Q          |          |          |         V|
31+ 0      14.2610      0.40  Q          |          |          |         V|
31+ 5      14.2636      0.38  Q          |          |          |         V|
31+10      14.2661      0.37  Q          |          |          |         V|
31+15      14.2685      0.35  Q          |          |          |         V|
31+20      14.2709      0.34  Q          |          |          |         V|
31+25      14.2731      0.33  Q          |          |          |         V|
31+30      14.2753      0.32  Q          |          |          |         V|
```

```
  31+35      14.2774      0.31  Q          |          |          |         V|
  31+40      14.2794      0.30  Q          |          |          |         V|
  31+45      14.2814      0.29  Q          |          |          |         V|
  31+50      14.2834      0.28  Q          |          |          |         V|
  31+55      14.2852      0.27  Q          |          |          |         V|
  32+ 0      14.2870      0.26  Q          |          |          |         V|
  32+ 5      14.2888      0.26  Q          |          |          |         V|
  32+10      14.2905      0.25  Q          |          |          |         V|
  32+15      14.2922      0.24  Q          |          |          |         V|
  32+20      14.2938      0.23  Q          |          |          |         V|
  32+25      14.2953      0.23  Q          |          |          |         V|
  32+30      14.2968      0.22  Q          |          |          |         V|
  32+35      14.2983      0.21  Q          |          |          |         V|
  32+40      14.2997      0.21  Q          |          |          |         V|
  32+45      14.3011      0.20  Q          |          |          |         V|
  32+50      14.3024      0.19  Q          |          |          |         V|
  32+55      14.3037      0.19  Q          |          |          |         V|
  33+ 0      14.3050      0.18  Q          |          |          |         V|
  33+ 5      14.3062      0.18  Q          |          |          |         V|
  33+10      14.3074      0.17  Q          |          |          |         V|
  33+15      14.3085      0.16  Q          |          |          |         V|
  33+20      14.3096      0.16  Q          |          |          |         V|
  33+25      14.3107      0.15  Q          |          |          |         V|
  33+30      14.3117      0.15  Q          |          |          |         V|
  33+35      14.3127      0.15  Q          |          |          |         V|
  33+40      14.3137      0.14  Q          |          |          |         V|
  33+45      14.3146      0.14  Q          |          |          |         V|
  33+50      14.3155      0.13  Q          |          |          |         V|
  33+55      14.3164      0.13  Q          |          |          |         V|
  34+ 0      14.3173      0.12  Q          |          |          |         V|
  34+ 5      14.3181      0.12  Q          |          |          |         V|
  34+10      14.3189      0.12  Q          |          |          |         V|
  34+15      14.3197      0.11  Q          |          |          |         V|
  34+20      14.3204      0.11  Q          |          |          |         V|
  34+25      14.3212      0.11  Q          |          |          |         V|
  34+30      14.3219      0.10  Q          |          |          |         V|
  34+35      14.3225      0.10  Q          |          |          |         V|
  34+40      14.3232      0.10  Q          |          |          |         V|
  34+45      14.3238      0.09  Q          |          |          |         V|
  34+50      14.3245      0.09  Q          |          |          |         V|
  34+55      14.3250      0.09  Q          |          |          |         V|
  35+ 0      14.3256      0.08  Q          |          |          |         V|
  35+ 5      14.3262      0.08  Q          |          |          |         V|
  35+10      14.3267      0.08  Q          |          |          |         V|
  35+15      14.3272      0.07  Q          |          |          |         V|
  35+20      14.3277      0.07  Q          |          |          |         V|
  35+25      14.3282      0.07  Q          |          |          |         V|
  35+30      14.3286      0.07  Q          |          |          |         V|
  35+35      14.3291      0.06  Q          |          |          |         V|
  35+40      14.3295      0.06  Q          |          |          |         V|
  35+45      14.3299      0.06  Q          |          |          |         V|
  35+50      14.3303      0.06  Q          |          |          |         V|
  35+55      14.3307      0.06  Q          |          |          |         V|
  36+ 0      14.3311      0.05  Q          |          |          |         V|
----------------------------------------------------------------------
```

APPENDIX D

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 08/01/18

++

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

Program License Serial Number 6405

HOLLY STREET
PROPOSED CONDITIONS
100-YEAR UH ANALYSIS

Storm Event Year = 100

Antecedent Moisture Condition = 3

English (in-lb) Input Units Used

English Rainfall Data (Inches) Input Values Used

English Units used in output format

Area averaged rainfall intensity isohyetal data:

Sub-Area (Ac.)	Duration (hours)	Isohyetal (In)
Rainfall data for year 100		
57.27	1	1.14
Rainfall data for year 100		
57.27	6	2.63
Rainfall data for year 100		
57.27	24	4.85

++

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

SCS curve No.(AMCII)	SCS curve NO.(AMC 3)	Area (Ac.)	Area Fraction	Fp(Fig C6) (In/Hr)	Ap (dec.)	Fm (In/Hr)
37.9	57.9	57.27	1.000	0.709	0.227	0.161

Area-averaged adjusted loss rate Fm (In/Hr) = 0.161

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

Area	Area	SCS CN	SCS CN	S	Pervious

(Ac.)	Fract	(AMC2)	(AMC3)		Yield Fr
13.00	0.227	37.9	57.9	7.27	0.223
44.27	0.773	98.0	98.0	0.20	0.951

Area-averaged catchment yield fraction, Y = 0.786
Area-averaged low loss fraction, Yb = 0.214
User entry of time of concentration = 0.388 (hours)
++
Watershed area = 57.27(Ac.)
Catchment Lag time = 0.311 hours
Unit interval = 5.000 minutes
Unit interval percentage of lag time = 26.8263
Hydrograph baseflow = 0.00(CFS)
Average maximum watershed loss rate(Fm) = 0.161(In/Hr)
Average low loss rate fraction (Yb) = 0.214 (decimal)
VALLEY DEVELOPED S-Graph Selected
Computed peak 5-minute rainfall = 0.422(In)
Computed peak 30-minute rainfall = 0.864(In)
Specified peak 1-hour rainfall = 1.140(In)
Computed peak 3-hour rainfall = 1.903(In)
Specified peak 6-hour rainfall = 2.630(In)
Specified peak 24-hour rainfall = 4.850(In)

Rainfall depth area reduction factors:
Using a total area of 57.27(Ac.) (Ref: fig. E-4)

5-minute factor = 0.997 Adjusted rainfall = 0.421(In)
30-minute factor = 0.997 Adjusted rainfall = 0.862(In)
1-hour factor = 0.997 Adjusted rainfall = 1.137(In)
3-hour factor = 1.000 Adjusted rainfall = 1.903(In)
6-hour factor = 1.000 Adjusted rainfall = 2.630(In)
24-hour factor = 1.000 Adjusted rainfall = 4.850(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 = 692.61 (CFS))	
1	1.687	11.681
2	8.801	49.277
3	23.817	103.997
4	44.120	140.620
5	67.230	160.066
6	81.378	97.991
7	90.158	60.807
8	94.819	32.288
9	97.379	17.725
10	98.387	6.986
11	98.870	3.345
12	99.353	3.344
13	99.820	3.232
14	100.000	1.249

Peak Unit Number	Adjusted mass rainfall (In)	Unit rainfall (In)
1	0.4208	0.4208
2	0.5552	0.1344
3	0.6530	0.0978
4	0.7326	0.0796

5	0.8010	0.0684
6	0.8616	0.0606
7	0.9164	0.0548
8	0.9667	0.0503
9	1.0134	0.0466
10	1.0570	0.0436
11	1.0980	0.0411
12	1.1369	0.0389
13	1.1804	0.0435
14	1.2221	0.0417
15	1.2623	0.0402
16	1.3011	0.0388
17	1.3386	0.0375
18	1.3749	0.0363
19	1.4102	0.0353
20	1.4445	0.0343
21	1.4779	0.0334
22	1.5105	0.0326
23	1.5423	0.0318
24	1.5734	0.0311
25	1.6038	0.0304
26	1.6335	0.0298
27	1.6627	0.0292
28	1.6912	0.0286
29	1.7193	0.0280
30	1.7468	0.0275
31	1.7739	0.0271
32	1.8005	0.0266
33	1.8266	0.0262
34	1.8524	0.0257
35	1.8777	0.0253
36	1.9027	0.0250
37	1.9271	0.0245
38	1.9513	0.0241
39	1.9751	0.0238
40	1.9986	0.0235
41	2.0217	0.0232
42	2.0446	0.0229
43	2.0672	0.0226
44	2.0895	0.0223
45	2.1115	0.0220
46	2.1333	0.0218
47	2.1548	0.0215
48	2.1761	0.0213
49	2.1972	0.0210
50	2.2180	0.0208
51	2.2386	0.0206
52	2.2590	0.0204
53	2.2791	0.0202
54	2.2991	0.0200
55	2.3189	0.0198
56	2.3385	0.0196
57	2.3579	0.0194
58	2.3771	0.0192
59	2.3961	0.0190
60	2.4150	0.0189
61	2.4337	0.0187
62	2.4522	0.0185
63	2.4706	0.0184
64	2.4889	0.0182
65	2.5069	0.0181
66	2.5249	0.0179
67	2.5427	0.0178

68	2.5603	0.0176
69	2.5778	0.0175
70	2.5952	0.0174
71	2.6124	0.0172
72	2.6295	0.0171
73	2.6456	0.0161
74	2.6615	0.0159
75	2.6774	0.0158
76	2.6931	0.0157
77	2.7086	0.0156
78	2.7241	0.0155
79	2.7395	0.0154
80	2.7547	0.0153
81	2.7699	0.0152
82	2.7849	0.0150
83	2.7999	0.0149
84	2.8147	0.0148
85	2.8295	0.0147
86	2.8441	0.0146
87	2.8587	0.0146
88	2.8731	0.0145
89	2.8875	0.0144
90	2.9018	0.0143
91	2.9160	0.0142
92	2.9301	0.0141
93	2.9441	0.0140
94	2.9581	0.0139
95	2.9719	0.0139
96	2.9857	0.0138
97	2.9994	0.0137
98	3.0130	0.0136
99	3.0265	0.0135
100	3.0400	0.0135
101	3.0534	0.0134
102	3.0667	0.0133
103	3.0799	0.0132
104	3.0931	0.0132
105	3.1062	0.0131
106	3.1192	0.0130
107	3.1322	0.0130
108	3.1451	0.0129
109	3.1579	0.0128
110	3.1706	0.0128
111	3.1833	0.0127
112	3.1960	0.0126
113	3.2085	0.0126
114	3.2210	0.0125
115	3.2335	0.0124
116	3.2459	0.0124
117	3.2582	0.0123
118	3.2705	0.0123
119	3.2827	0.0122
120	3.2948	0.0122
121	3.3069	0.0121
122	3.3190	0.0120
123	3.3309	0.0120
124	3.3429	0.0119
125	3.3548	0.0119
126	3.3666	0.0118
127	3.3783	0.0118
128	3.3901	0.0117
129	3.4017	0.0117
130	3.4134	0.0116

131	3.4249	0.0116
132	3.4364	0.0115
133	3.4479	0.0115
134	3.4593	0.0114
135	3.4707	0.0114
136	3.4820	0.0113
137	3.4933	0.0113
138	3.5046	0.0112
139	3.5157	0.0112
140	3.5269	0.0111
141	3.5380	0.0111
142	3.5491	0.0111
143	3.5601	0.0110
144	3.5710	0.0110
145	3.5820	0.0109
146	3.5929	0.0109
147	3.6037	0.0108
148	3.6145	0.0108
149	3.6253	0.0108
150	3.6360	0.0107
151	3.6467	0.0107
152	3.6573	0.0106
153	3.6679	0.0106
154	3.6785	0.0106
155	3.6890	0.0105
156	3.6995	0.0105
157	3.7100	0.0105
158	3.7204	0.0104
159	3.7307	0.0104
160	3.7411	0.0103
161	3.7514	0.0103
162	3.7617	0.0103
163	3.7719	0.0102
164	3.7821	0.0102
165	3.7923	0.0102
166	3.8024	0.0101
167	3.8125	0.0101
168	3.8226	0.0101
169	3.8326	0.0100
170	3.8426	0.0100
171	3.8525	0.0100
172	3.8625	0.0099
173	3.8724	0.0099
174	3.8822	0.0099
175	3.8921	0.0098
176	3.9019	0.0098
177	3.9117	0.0098
178	3.9214	0.0097
179	3.9311	0.0097
180	3.9408	0.0097
181	3.9504	0.0097
182	3.9601	0.0096
183	3.9697	0.0096
184	3.9792	0.0096
185	3.9888	0.0095
186	3.9983	0.0095
187	4.0077	0.0095
188	4.0172	0.0094
189	4.0266	0.0094
190	4.0360	0.0094
191	4.0454	0.0094
192	4.0547	0.0093
193	4.0640	0.0093

194	4.0733	0.0093
195	4.0826	0.0093
196	4.0918	0.0092
197	4.1010	0.0092
198	4.1102	0.0092
199	4.1193	0.0092
200	4.1285	0.0091
201	4.1376	0.0091
202	4.1466	0.0091
203	4.1557	0.0091
204	4.1647	0.0090
205	4.1737	0.0090
206	4.1827	0.0090
207	4.1916	0.0090
208	4.2006	0.0089
209	4.2095	0.0089
210	4.2184	0.0089
211	4.2272	0.0089
212	4.2360	0.0088
213	4.2449	0.0088
214	4.2536	0.0088
215	4.2624	0.0088
216	4.2712	0.0087
217	4.2799	0.0087
218	4.2886	0.0087
219	4.2972	0.0087
220	4.3059	0.0087
221	4.3145	0.0086
222	4.3231	0.0086
223	4.3317	0.0086
224	4.3403	0.0086
225	4.3488	0.0085
226	4.3574	0.0085
227	4.3659	0.0085
228	4.3743	0.0085
229	4.3828	0.0085
230	4.3912	0.0084
231	4.3997	0.0084
232	4.4081	0.0084
233	4.4164	0.0084
234	4.4248	0.0084
235	4.4331	0.0083
236	4.4415	0.0083
237	4.4498	0.0083
238	4.4580	0.0083
239	4.4663	0.0083
240	4.4745	0.0082
241	4.4828	0.0082
242	4.4910	0.0082
243	4.4992	0.0082
244	4.5073	0.0082
245	4.5155	0.0081
246	4.5236	0.0081
247	4.5317	0.0081
248	4.5398	0.0081
249	4.5479	0.0081
250	4.5559	0.0081
251	4.5640	0.0080
252	4.5720	0.0080
253	4.5800	0.0080
254	4.5880	0.0080
255	4.5959	0.0080
256	4.6039	0.0079

257	4.6118	0.0079
258	4.6197	0.0079
259	4.6276	0.0079
260	4.6355	0.0079
261	4.6434	0.0079
262	4.6512	0.0078
263	4.6591	0.0078
264	4.6669	0.0078
265	4.6747	0.0078
266	4.6824	0.0078
267	4.6902	0.0078
268	4.6980	0.0077
269	4.7057	0.0077
270	4.7134	0.0077
271	4.7211	0.0077
272	4.7288	0.0077
273	4.7365	0.0077
274	4.7441	0.0077
275	4.7517	0.0076
276	4.7594	0.0076
277	4.7670	0.0076
278	4.7746	0.0076
279	4.7821	0.0076
280	4.7897	0.0076
281	4.7972	0.0075
282	4.8048	0.0075
283	4.8123	0.0075
284	4.8198	0.0075
285	4.8273	0.0075
286	4.8348	0.0075
287	4.8422	0.0075
288	4.8497	0.0074

Unit Period (number)	Unit Rainfall (In)	Unit Soil-Loss (In)	Effective Rainfall (In)
1	0.0074	0.0016	0.0058
2	0.0075	0.0016	0.0059
3	0.0075	0.0016	0.0059
4	0.0075	0.0016	0.0059
5	0.0075	0.0016	0.0059
6	0.0075	0.0016	0.0059
7	0.0076	0.0016	0.0060
8	0.0076	0.0016	0.0060
9	0.0076	0.0016	0.0060
10	0.0076	0.0016	0.0060
11	0.0077	0.0016	0.0060
12	0.0077	0.0016	0.0060
13	0.0077	0.0017	0.0061
14	0.0077	0.0017	0.0061
15	0.0078	0.0017	0.0061
16	0.0078	0.0017	0.0061
17	0.0078	0.0017	0.0061
18	0.0078	0.0017	0.0062
19	0.0079	0.0017	0.0062
20	0.0079	0.0017	0.0062
21	0.0079	0.0017	0.0062
22	0.0079	0.0017	0.0062
23	0.0080	0.0017	0.0063
24	0.0080	0.0017	0.0063
25	0.0080	0.0017	0.0063
26	0.0080	0.0017	0.0063

27	0.0081	0.0017	0.0063
28	0.0081	0.0017	0.0064
29	0.0081	0.0017	0.0064
30	0.0081	0.0017	0.0064
31	0.0082	0.0018	0.0064
32	0.0082	0.0018	0.0064
33	0.0082	0.0018	0.0065
34	0.0083	0.0018	0.0065
35	0.0083	0.0018	0.0065
36	0.0083	0.0018	0.0065
37	0.0084	0.0018	0.0066
38	0.0084	0.0018	0.0066
39	0.0084	0.0018	0.0066
40	0.0084	0.0018	0.0066
41	0.0085	0.0018	0.0067
42	0.0085	0.0018	0.0067
43	0.0085	0.0018	0.0067
44	0.0086	0.0018	0.0067
45	0.0086	0.0018	0.0068
46	0.0086	0.0018	0.0068
47	0.0087	0.0019	0.0068
48	0.0087	0.0019	0.0068
49	0.0087	0.0019	0.0069
50	0.0088	0.0019	0.0069
51	0.0088	0.0019	0.0069
52	0.0088	0.0019	0.0069
53	0.0089	0.0019	0.0070
54	0.0089	0.0019	0.0070
55	0.0090	0.0019	0.0070
56	0.0090	0.0019	0.0071
57	0.0090	0.0019	0.0071
58	0.0091	0.0019	0.0071
59	0.0091	0.0019	0.0072
60	0.0091	0.0020	0.0072
61	0.0092	0.0020	0.0072
62	0.0092	0.0020	0.0072
63	0.0093	0.0020	0.0073
64	0.0093	0.0020	0.0073
65	0.0093	0.0020	0.0073
66	0.0094	0.0020	0.0074
67	0.0094	0.0020	0.0074
68	0.0094	0.0020	0.0074
69	0.0095	0.0020	0.0075
70	0.0095	0.0020	0.0075
71	0.0096	0.0021	0.0075
72	0.0096	0.0021	0.0076
73	0.0097	0.0021	0.0076
74	0.0097	0.0021	0.0076
75	0.0098	0.0021	0.0077
76	0.0098	0.0021	0.0077
77	0.0099	0.0021	0.0078
78	0.0099	0.0021	0.0078
79	0.0100	0.0021	0.0078
80	0.0100	0.0021	0.0079
81	0.0101	0.0022	0.0079
82	0.0101	0.0022	0.0079
83	0.0102	0.0022	0.0080
84	0.0102	0.0022	0.0080
85	0.0103	0.0022	0.0081
86	0.0103	0.0022	0.0081
87	0.0104	0.0022	0.0082
88	0.0104	0.0022	0.0082
89	0.0105	0.0022	0.0082

90	0.0105	0.0023	0.0083
91	0.0106	0.0023	0.0083
92	0.0106	0.0023	0.0084
93	0.0107	0.0023	0.0084
94	0.0108	0.0023	0.0085
95	0.0108	0.0023	0.0085
96	0.0109	0.0023	0.0086
97	0.0110	0.0023	0.0086
98	0.0110	0.0024	0.0087
99	0.0111	0.0024	0.0087
100	0.0111	0.0024	0.0088
101	0.0112	0.0024	0.0088
102	0.0113	0.0024	0.0089
103	0.0114	0.0024	0.0089
104	0.0114	0.0024	0.0090
105	0.0115	0.0025	0.0091
106	0.0116	0.0025	0.0091
107	0.0117	0.0025	0.0092
108	0.0117	0.0025	0.0092
109	0.0118	0.0025	0.0093
110	0.0119	0.0025	0.0093
111	0.0120	0.0026	0.0094
112	0.0120	0.0026	0.0095
113	0.0122	0.0026	0.0095
114	0.0122	0.0026	0.0096
115	0.0123	0.0026	0.0097
116	0.0124	0.0027	0.0097
117	0.0125	0.0027	0.0098
118	0.0126	0.0027	0.0099
119	0.0127	0.0027	0.0100
120	0.0128	0.0027	0.0100
121	0.0129	0.0028	0.0101
122	0.0130	0.0028	0.0102
123	0.0131	0.0028	0.0103
124	0.0132	0.0028	0.0103
125	0.0133	0.0029	0.0105
126	0.0134	0.0029	0.0105
127	0.0135	0.0029	0.0106
128	0.0136	0.0029	0.0107
129	0.0138	0.0029	0.0108
130	0.0139	0.0030	0.0109
131	0.0140	0.0030	0.0110
132	0.0141	0.0030	0.0111
133	0.0143	0.0031	0.0112
134	0.0144	0.0031	0.0113
135	0.0146	0.0031	0.0114
136	0.0146	0.0031	0.0115
137	0.0148	0.0032	0.0117
138	0.0149	0.0032	0.0117
139	0.0152	0.0032	0.0119
140	0.0153	0.0033	0.0120
141	0.0155	0.0033	0.0122
142	0.0156	0.0033	0.0123
143	0.0158	0.0034	0.0124
144	0.0159	0.0034	0.0125
145	0.0171	0.0037	0.0134
146	0.0172	0.0037	0.0135
147	0.0175	0.0037	0.0138
148	0.0176	0.0038	0.0139
149	0.0179	0.0038	0.0141
150	0.0181	0.0039	0.0142
151	0.0184	0.0039	0.0144
152	0.0185	0.0040	0.0146

153	0.0189	0.0040	0.0148
154	0.0190	0.0041	0.0150
155	0.0194	0.0042	0.0152
156	0.0196	0.0042	0.0154
157	0.0200	0.0043	0.0157
158	0.0202	0.0043	0.0159
159	0.0206	0.0044	0.0162
160	0.0208	0.0045	0.0164
161	0.0213	0.0046	0.0167
162	0.0215	0.0046	0.0169
163	0.0220	0.0047	0.0173
164	0.0223	0.0048	0.0175
165	0.0229	0.0049	0.0180
166	0.0232	0.0050	0.0182
167	0.0238	0.0051	0.0187
168	0.0241	0.0052	0.0190
169	0.0250	0.0053	0.0196
170	0.0253	0.0054	0.0199
171	0.0262	0.0056	0.0206
172	0.0266	0.0057	0.0209
173	0.0275	0.0059	0.0216
174	0.0280	0.0060	0.0220
175	0.0292	0.0062	0.0229
176	0.0298	0.0064	0.0234
177	0.0311	0.0067	0.0244
178	0.0318	0.0068	0.0250
179	0.0334	0.0072	0.0263
180	0.0343	0.0073	0.0270
181	0.0363	0.0078	0.0286
182	0.0375	0.0080	0.0295
183	0.0402	0.0086	0.0316
184	0.0417	0.0089	0.0328
185	0.0389	0.0083	0.0306
186	0.0411	0.0088	0.0323
187	0.0466	0.0100	0.0367
188	0.0503	0.0108	0.0395
189	0.0606	0.0130	0.0476
190	0.0684	0.0134	0.0550
191	0.0978	0.0134	0.0844
192	0.1344	0.0134	0.1210
193	0.4208	0.0134	0.4074
194	0.0796	0.0134	0.0662
195	0.0548	0.0117	0.0431
196	0.0436	0.0093	0.0343
197	0.0435	0.0093	0.0342
198	0.0388	0.0083	0.0305
199	0.0353	0.0076	0.0277
200	0.0326	0.0070	0.0256
201	0.0304	0.0065	0.0239
202	0.0286	0.0061	0.0225
203	0.0271	0.0058	0.0213
204	0.0257	0.0055	0.0202
205	0.0245	0.0052	0.0192
206	0.0235	0.0050	0.0185
207	0.0226	0.0048	0.0177
208	0.0218	0.0047	0.0171
209	0.0210	0.0045	0.0165
210	0.0204	0.0044	0.0160
211	0.0198	0.0042	0.0155
212	0.0192	0.0041	0.0151
213	0.0187	0.0040	0.0147
214	0.0182	0.0039	0.0143
215	0.0178	0.0038	0.0140

216	0.0174	0.0037	0.0137
217	0.0161	0.0034	0.0126
218	0.0157	0.0034	0.0123
219	0.0154	0.0033	0.0121
220	0.0150	0.0032	0.0118
221	0.0147	0.0032	0.0116
222	0.0145	0.0031	0.0114
223	0.0142	0.0030	0.0112
224	0.0139	0.0030	0.0110
225	0.0137	0.0029	0.0108
226	0.0135	0.0029	0.0106
227	0.0132	0.0028	0.0104
228	0.0130	0.0028	0.0102
229	0.0128	0.0027	0.0101
230	0.0126	0.0027	0.0099
231	0.0124	0.0027	0.0098
232	0.0123	0.0026	0.0096
233	0.0121	0.0026	0.0095
234	0.0119	0.0026	0.0094
235	0.0118	0.0025	0.0093
236	0.0116	0.0025	0.0091
237	0.0115	0.0025	0.0090
238	0.0113	0.0024	0.0089
239	0.0112	0.0024	0.0088
240	0.0111	0.0024	0.0087
241	0.0109	0.0023	0.0086
242	0.0108	0.0023	0.0085
243	0.0107	0.0023	0.0084
244	0.0106	0.0023	0.0083
245	0.0105	0.0022	0.0082
246	0.0103	0.0022	0.0081
247	0.0102	0.0022	0.0080
248	0.0101	0.0022	0.0080
249	0.0100	0.0021	0.0079
250	0.0099	0.0021	0.0078
251	0.0098	0.0021	0.0077
252	0.0097	0.0021	0.0077
253	0.0097	0.0021	0.0076
254	0.0096	0.0020	0.0075
255	0.0095	0.0020	0.0074
256	0.0094	0.0020	0.0074
257	0.0093	0.0020	0.0073
258	0.0092	0.0020	0.0073
259	0.0092	0.0020	0.0072
260	0.0091	0.0019	0.0071
261	0.0090	0.0019	0.0071
262	0.0089	0.0019	0.0070
263	0.0089	0.0019	0.0070
264	0.0088	0.0019	0.0069
265	0.0087	0.0019	0.0069
266	0.0087	0.0019	0.0068
267	0.0086	0.0018	0.0067
268	0.0085	0.0018	0.0067
269	0.0085	0.0018	0.0066
270	0.0084	0.0018	0.0066
271	0.0083	0.0018	0.0066
272	0.0083	0.0018	0.0065
273	0.0082	0.0018	0.0065
274	0.0082	0.0017	0.0064
275	0.0081	0.0017	0.0064
276	0.0081	0.0017	0.0063
277	0.0080	0.0017	0.0063
278	0.0079	0.0017	0.0062

279	0.0079	0.0017	0.0062
280	0.0078	0.0017	0.0062
281	0.0078	0.0017	0.0061
282	0.0077	0.0017	0.0061
283	0.0077	0.0016	0.0061
284	0.0077	0.0016	0.0060
285	0.0076	0.0016	0.0060
286	0.0076	0.0016	0.0059
287	0.0075	0.0016	0.0059
288	0.0075	0.0016	0.0059

Total soil rain loss = 0.93(In)
Total effective rainfall = 3.92(In)
Peak flow rate in flood hydrograph = 101.35(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       50.0     100.0     150.0     200.0
-----------------------------------------------------------------------
  0+ 5       0.0005      0.07  Q         |         |         |         |
  0+10       0.0029      0.36  Q         |         |         |         |
  0+15       0.0096      0.97  Q         |         |         |         |
  0+20       0.0219      1.79  Q         |         |         |         |
  0+25       0.0407      2.73  Q         |         |         |         |
  0+30       0.0635      3.31  Q         |         |         |         |
  0+35       0.0889      3.68  Q         |         |         |         |
  0+40       0.1156      3.88  Q         |         |         |         |
  0+45       0.1431      3.99  Q         |         |         |         |
  0+50       0.1709      4.05  Q         |         |         |         |
  0+55       0.1990      4.08  Q         |         |         |         |
  1+ 0       0.2273      4.11  Q         |         |         |         |
  1+ 5       0.2558      4.14  Q         |         |         |         |
  1+10       0.2845      4.16  Q         |         |         |         |
  1+15       0.3132      4.17  Q         |         |         |         |
  1+20       0.3420      4.19  Q         |         |         |         |
  1+25       0.3709      4.20  Q         |         |         |         |
  1+30       0.4000      4.21  Q         |         |         |         |
  1+35       0.4291      4.23  Q         |         |         |         |
  1+40       0.4582      4.24  Q         |         |         |         |
  1+45       0.4875      4.25  QV        |         |         |         |
  1+50       0.5169      4.27  QV        |         |         |         |
  1+55       0.5464      4.28  QV        |         |         |         |
  2+ 0       0.5759      4.29  QV        |         |         |         |
  2+ 5       0.6056      4.31  QV        |         |         |         |
  2+10       0.6354      4.32  QV        |         |         |         |
  2+15       0.6652      4.34  QV        |         |         |         |
  2+20       0.6952      4.35  QV        |         |         |         |
  2+25       0.7252      4.36  QV        |         |         |         |
  2+30       0.7554      4.38  QV        |         |         |         |
  2+35       0.7856      4.39  QV        |         |         |         |
  2+40       0.8160      4.41  QV        |         |         |         |
  2+45       0.8465      4.42  QV        |         |         |         |
  2+50       0.8770      4.44  QV        |         |         |         |
  2+55       0.9077      4.45  QV        |         |         |         |
  3+ 0       0.9385      4.47  Q V       |         |         |         |
  3+ 5       0.9694      4.48  Q V       |         |         |         |
  3+10       1.0003      4.50  Q V       |         |         |         |
```

```
3+15       1.0315      4.52  Q V       |          |          |          |
3+20       1.0627      4.53  Q V       |          |          |          |
3+25       1.0940      4.55  Q V       |          |          |          |
3+30       1.1254      4.56  Q V       |          |          |          |
3+35       1.1570      4.58  Q V       |          |          |          |
3+40       1.1887      4.60  Q V       |          |          |          |
3+45       1.2204      4.62  Q V       |          |          |          |
3+50       1.2523      4.63  Q V       |          |          |          |
3+55       1.2844      4.65  Q V       |          |          |          |
4+ 0       1.3165      4.67  Q V       |          |          |          |
4+ 5       1.3488      4.68  Q V       |          |          |          |
4+10       1.3812      4.70  Q V       |          |          |          |
4+15       1.4137      4.72  Q  V      |          |          |          |
4+20       1.4463      4.74  Q  V      |          |          |          |
4+25       1.4791      4.76  Q  V      |          |          |          |
4+30       1.5119      4.78  Q  V      |          |          |          |
4+35       1.5450      4.79  Q  V      |          |          |          |
4+40       1.5781      4.81  Q  V      |          |          |          |
4+45       1.6114      4.83  Q  V      |          |          |          |
4+50       1.6448      4.85  Q  V      |          |          |          |
4+55       1.6784      4.87  Q  V      |          |          |          |
5+ 0       1.7121      4.89  Q  V      |          |          |          |
5+ 5       1.7459      4.91  Q  V      |          |          |          |
5+10       1.7798      4.93  Q  V      |          |          |          |
5+15       1.8140      4.95  Q  V      |          |          |          |
5+20       1.8482      4.97  Q  V      |          |          |          |
5+25       1.8826      4.99  Q   V     |          |          |          |
5+30       1.9171      5.02  |Q  V     |          |          |          |
5+35       1.9518      5.04  |Q  V     |          |          |          |
5+40       1.9867      5.06  |Q  V     |          |          |          |
5+45       2.0217      5.08  |Q  V     |          |          |          |
5+50       2.0568      5.10  |Q  V     |          |          |          |
5+55       2.0921      5.13  |Q  V     |          |          |          |
6+ 0       2.1276      5.15  |Q  V     |          |          |          |
6+ 5       2.1632      5.17  |Q  V     |          |          |          |
6+10       2.1990      5.20  |Q  V     |          |          |          |
6+15       2.2349      5.22  |Q  V     |          |          |          |
6+20       2.2710      5.24  |Q  V     |          |          |          |
6+25       2.3073      5.27  |Q  V     |          |          |          |
6+30       2.3438      5.29  |Q   V    |          |          |          |
6+35       2.3804      5.32  |Q   V    |          |          |          |
6+40       2.4172      5.34  |Q   V    |          |          |          |
6+45       2.4542      5.37  |Q   V    |          |          |          |
6+50       2.4913      5.39  |Q   V    |          |          |          |
6+55       2.5287      5.42  |Q   V    |          |          |          |
7+ 0       2.5662      5.45  |Q   V    |          |          |          |
7+ 5       2.6039      5.48  |Q   V    |          |          |          |
7+10       2.6418      5.50  |Q   V    |          |          |          |
7+15       2.6799      5.53  |Q   V    |          |          |          |
7+20       2.7182      5.56  |Q   V    |          |          |          |
7+25       2.7567      5.59  |Q   V    |          |          |          |
7+30       2.7953      5.62  |Q   V    |          |          |          |
7+35       2.8342      5.65  |Q    V   |          |          |          |
7+40       2.8733      5.68  |Q    V   |          |          |          |
7+45       2.9126      5.71  |Q    V   |          |          |          |
7+50       2.9522      5.74  |Q    V   |          |          |          |
7+55       2.9919      5.77  |Q    V   |          |          |          |
8+ 0       3.0318      5.80  |Q    V   |          |          |          |
8+ 5       3.0720      5.83  |Q    V   |          |          |          |
8+10       3.1124      5.87  |Q    V   |          |          |          |
8+15       3.1531      5.90  |Q    V   |          |          |          |
8+20       3.1939      5.93  |Q    V   |          |          |          |
8+25       3.2350      5.97  |Q    V   |          |          |          |
```

```
 8+30       3.2764      6.00  |Q     V  |          |          |          |
 8+35       3.3180      6.04  |Q     V  |          |          |          |
 8+40       3.3598      6.08  |Q     V  |          |          |          |
 8+45       3.4019      6.11  |Q     V  |          |          |          |
 8+50       3.4443      6.15  |Q     V  |          |          |          |
 8+55       3.4869      6.19  |Q     V  |          |          |          |
 9+ 0       3.5298      6.23  |Q     V  |          |          |          |
 9+ 5       3.5730      6.27  |Q     V  |          |          |          |
 9+10       3.6164      6.31  |Q     V  |          |          |          |
 9+15       3.6601      6.35  |Q     V  |          |          |          |
 9+20       3.7041      6.39  |Q     V  |          |          |          |
 9+25       3.7485      6.43  |Q      V |          |          |          |
 9+30       3.7931      6.48  |Q      V |          |          |          |
 9+35       3.8380      6.52  |Q      V |          |          |          |
 9+40       3.8832      6.56  |Q      V |          |          |          |
 9+45       3.9287      6.61  |Q      V |          |          |          |
 9+50       3.9746      6.66  |Q      V |          |          |          |
 9+55       4.0207      6.71  |Q      V |          |          |          |
10+ 0       4.0673      6.75  |Q      V |          |          |          |
10+ 5       4.1141      6.80  |Q      V |          |          |          |
10+10       4.1613      6.85  |Q      V |          |          |          |
10+15       4.2089      6.91  |Q       V|          |          |          |
10+20       4.2568      6.96  |Q       V|          |          |          |
10+25       4.3051      7.01  |Q       V|          |          |          |
10+30       4.3538      7.07  |Q       V|          |          |          |
10+35       4.4029      7.13  |Q       V|          |          |          |
10+40       4.4523      7.18  |Q       V|          |          |          |
10+45       4.5022      7.24  |Q       V|          |          |          |
10+50       4.5525      7.30  |Q       V|          |          |          |
10+55       4.6032      7.36  |Q       V|          |          |          |
11+ 0       4.6544      7.43  |Q       V|          |          |          |
11+ 5       4.7060      7.49  |Q        V          |          |          |
11+10       4.7580      7.56  |Q        V          |          |          |
11+15       4.8106      7.63  |Q        V          |          |          |
11+20       4.8636      7.70  |Q        V          |          |          |
11+25       4.9171      7.77  |Q        V          |          |          |
11+30       4.9711      7.84  |Q        V          |          |          |
11+35       5.0256      7.92  |Q        V          |          |          |
11+40       5.0807      8.00  |Q        V          |          |          |
11+45       5.1363      8.08  |Q        V          |          |          |
11+50       5.1925      8.16  |Q         |V        |          |          |
11+55       5.2493      8.24  |Q         |V        |          |          |
12+ 0       5.3067      8.33  |Q         |V        |          |          |
12+ 5       5.3647      8.43  |Q         |V        |          |          |
12+10       5.4236      8.56  |Q         |V        |          |          |
12+15       5.4837      8.73  |Q         |V        |          |          |
12+20       5.5452      8.93  |Q         |V        |          |          |
12+25       5.6082      9.15  |Q         | V       |          |          |
12+30       5.6724      9.32  |Q         | V       |          |          |
12+35       5.7377      9.48  |Q         | V       |          |          |
12+40       5.8039      9.61  |Q         | V       |          |          |
12+45       5.8710      9.74  |Q         | V       |          |          |
12+50       5.9389      9.87  |Q         | V       |          |          |
12+55       6.0078     10.00  |Q         | V       |          |          |
13+ 0       6.0775     10.13  | Q        |  V      |          |          |
13+ 5       6.1482     10.27  | Q        |  V      |          |          |
13+10       6.2199     10.41  | Q        |  V      |          |          |
13+15       6.2926     10.56  | Q        |  V      |          |          |
13+20       6.3664     10.71  | Q        |  V      |          |          |
13+25       6.4412     10.87  | Q        |  V      |          |          |
13+30       6.5172     11.03  | Q        |  V      |          |          |
13+35       6.5944     11.21  | Q        |   V     |          |          |
13+40       6.6729     11.39  | Q        |   V     |          |          |
```

```
13+45       6.7526     11.58  | Q        |   V     |         |         |
13+50       6.8338     11.78  | Q        |   V     |         |         |
13+55       6.9164     11.99  | Q        |   V     |         |         |
14+ 0       7.0005     12.21  | Q        |   V     |         |         |
14+ 5       7.0862     12.45  | Q        |    V    |         |         |
14+10       7.1737     12.70  | Q        |    V    |         |         |
14+15       7.2630     12.97  | Q        |    V    |         |         |
14+20       7.3544     13.26  | Q        |    V    |         |         |
14+25       7.4479     13.57  | Q        |    V    |         |         |
14+30       7.5435     13.90  | Q        |     V   |         |         |
14+35       7.6417     14.24  | Q        |     V   |         |         |
14+40       7.7423     14.61  | Q        |     V   |         |         |
14+45       7.8456     15.01  |  Q       |     V   |         |         |
14+50       7.9519     15.43  |  Q       |      V  |         |         |
14+55       8.0614     15.90  |  Q       |      V  |         |         |
15+ 0       8.1743     16.40  |  Q       |      V  |         |         |
15+ 5       8.2912     16.96  |  Q       |      V  |         |         |
15+10       8.4122     17.57  |  Q       |       V |         |         |
15+15       8.5380     18.27  |  Q       |       V |         |         |
15+20       8.6691     19.03  |  Q       |       V |         |         |
15+25       8.8058     19.86  |  Q       |       V |         |         |
15+30       8.9477     20.60  |   Q      |        V|         |         |
15+35       9.0941     21.26  |   Q      |        V|         |         |
15+40       9.2450     21.91  |   Q      |        V|         |         |
15+45       9.4021     22.80  |   Q      |         V         |         |
15+50       9.5704     24.44  |   Q      |         V         |         |
15+55       9.7578     27.22  |    Q     |         V         |         |
16+ 0       9.9780     31.97  |     Q    |         |V        |         |
16+ 5      10.2748     43.10  |       Q  |         | V       |         |
16+10      10.7121     63.49  |          | Q       | V       |         |
16+15      11.3143     87.45  |          |      Q  |   V     |         |
16+20      12.0067    100.53  |          |         Q    V    |         |
16+25      12.7047    101.35  |          |         Q      V  |         |
16+30      13.2141     73.97  |          |   Q     |       V |         |
16+35      13.5901     54.59  |         Q         |        V|         |
16+40      13.8640     39.78  |       Q  |         |        V|         |
16+45      14.0777     31.03  |     Q    |         |         V         |
16+50      14.2475     24.64  |   Q      |         |         V         |
16+55      14.3947     21.38  |   Q      |         |         V         |
17+ 0      14.5307     19.74  |  Q       |         |         |V        |
17+ 5      14.6565     18.27  |  Q       |         |         |V        |
17+10      14.7695     16.41  |  Q       |         |         |V        |
17+15      14.8728     15.00  |  Q       |         |         |V        |
17+20      14.9705     14.19  | Q        |         |         | V       |
17+25      15.0635     13.51  | Q        |         |         | V       |
17+30      15.1525     12.92  | Q        |         |         | V       |
17+35      15.2379     12.40  | Q        |         |         | V       |
17+40      15.3201     11.94  | Q        |         |         | V       |
17+45      15.3994     11.52  | Q        |         |         | V       |
17+50      15.4762     11.15  | Q        |         |         |  V      |
17+55      15.5506     10.81  | Q        |         |         |  V      |
18+ 0      15.6230     10.50  | Q        |         |         |  V      |
18+ 5      15.6932     10.21  | Q        |         |         |  V      |
18+10      15.7615      9.91  |Q         |         |         |  V      |
18+15      15.8275      9.58  |Q         |         |         |  V      |
18+20      15.8912      9.26  |Q         |         |         |   V     |
18+25      15.9527      8.93  |Q         |         |         |   V     |
18+30      16.0123      8.66  |Q         |         |         |   V     |
18+35      16.0704      8.43  |Q         |         |         |   V     |
18+40      16.1270      8.23  |Q         |         |         |   V     |
18+45      16.1825      8.05  |Q         |         |         |   V     |
18+50      16.2368      7.89  |Q         |         |         |   V     |
18+55      16.2901      7.74  |Q         |         |         |   V     |
```

```
19+ 0      16.3424      7.60  |Q         |          |          |   V     |
19+ 5      16.3938      7.46  |Q         |          |          |    V    |
19+10      16.4443      7.33  |Q         |          |          |    V    |
19+15      16.4939      7.21  |Q         |          |          |    V    |
19+20      16.5428      7.10  |Q         |          |          |    V    |
19+25      16.5909      6.98  |Q         |          |          |    V    |
19+30      16.6383      6.88  |Q         |          |          |    V    |
19+35      16.6850      6.78  |Q         |          |          |    V    |
19+40      16.7310      6.68  |Q         |          |          |    V    |
19+45      16.7763      6.59  |Q         |          |          |    V    |
19+50      16.8211      6.50  |Q         |          |          |     V   |
19+55      16.8652      6.41  |Q         |          |          |     V   |
20+ 0      16.9088      6.33  |Q         |          |          |     V   |
20+ 5      16.9518      6.25  |Q         |          |          |     V   |
20+10      16.9943      6.17  |Q         |          |          |     V   |
20+15      17.0362      6.09  |Q         |          |          |     V   |
20+20      17.0777      6.02  |Q         |          |          |     V   |
20+25      17.1186      5.95  |Q         |          |          |     V   |
20+30      17.1591      5.88  |Q         |          |          |     V   |
20+35      17.1992      5.82  |Q         |          |          |     V   |
20+40      17.2388      5.75  |Q         |          |          |     V   |
20+45      17.2780      5.69  |Q         |          |          |      V  |
20+50      17.3168      5.63  |Q         |          |          |      V  |
20+55      17.3551      5.57  |Q         |          |          |      V  |
21+ 0      17.3931      5.51  |Q         |          |          |      V  |
21+ 5      17.4307      5.46  |Q         |          |          |      V  |
21+10      17.4679      5.41  |Q         |          |          |      V  |
21+15      17.5048      5.35  |Q         |          |          |      V  |
21+20      17.5413      5.30  |Q         |          |          |      V  |
21+25      17.5775      5.25  |Q         |          |          |      V  |
21+30      17.6134      5.21  |Q         |          |          |      V  |
21+35      17.6489      5.16  |Q         |          |          |      V  |
21+40      17.6841      5.11  |Q         |          |          |      V  |
21+45      17.7190      5.07  |Q         |          |          |      V  |
21+50      17.7536      5.02  |Q         |          |          |       V |
21+55      17.7879      4.98  Q          |          |          |       V |
22+ 0      17.8219      4.94  Q          |          |          |       V |
22+ 5      17.8557      4.90  Q          |          |          |       V |
22+10      17.8891      4.86  Q          |          |          |       V |
22+15      17.9223      4.82  Q          |          |          |       V |
22+20      17.9553      4.78  Q          |          |          |       V |
22+25      17.9880      4.75  Q          |          |          |       V |
22+30      18.0204      4.71  Q          |          |          |       V |
22+35      18.0526      4.67  Q          |          |          |       V |
22+40      18.0845      4.64  Q          |          |          |       V |
22+45      18.1163      4.60  Q          |          |          |       V |
22+50      18.1477      4.57  Q          |          |          |       V |
22+55      18.1790      4.54  Q          |          |          |       V |
23+ 0      18.2100      4.51  Q          |          |          |       V |
23+ 5      18.2409      4.48  Q          |          |          |        V|
23+10      18.2715      4.44  Q          |          |          |        V|
23+15      18.3019      4.41  Q          |          |          |        V|
23+20      18.3321      4.38  Q          |          |          |        V|
23+25      18.3620      4.35  Q          |          |          |        V|
23+30      18.3918      4.33  Q          |          |          |        V|
23+35      18.4214      4.30  Q          |          |          |        V|
23+40      18.4509      4.27  Q          |          |          |        V|
23+45      18.4801      4.24  Q          |          |          |        V|
23+50      18.5091      4.22  Q          |          |          |        V|
23+55      18.5380      4.19  Q          |          |          |        V|
24+ 0      18.5667      4.16  Q          |          |          |        V|
24+ 5      18.5947      4.07  Q          |          |          |        V|
24+10      18.6206      3.76  Q          |          |          |        V|
```

```
   24+15      18.6422      3.13  Q          |          |          |         V|
   24+20      18.6579      2.29  Q          |          |          |         V|
   24+25      18.6672      1.34  Q          |          |          |         V|
   24+30      18.6724      0.76  Q          |          |          |         V|
   24+35      18.6752      0.40  Q          |          |          |         V|
   24+40      18.6767      0.21  Q          |          |          |         V|
   24+45      18.6774      0.11  Q          |          |          |         V|
   24+50      18.6779      0.07  Q          |          |          |         V|
   24+55      18.6782      0.05  Q          |          |          |         V|
   25+ 0      18.6784      0.03  Q          |          |          |         V|
   25+ 5      18.6784      0.01  Q          |          |          |         V|
----------------------------------------------------------------------
```

APPENDIX E

```
 FILE: hollyoutlet.WSW                      W S P G W  - EDIT LISTING - Version 14.10              Date: 8- 4-2018
Time:12:55: 4
                                        WATER SURFACE PROFILE - CHANNEL DEFINITION LISTING
PAGE    1
  CARD  SECT  CHN   NO OF  AVE PIER  HEIGHT 1  BASE    ZL    ZR   INV   Y(1)  Y(2)  Y(3)  Y(4)  Y(5)  Y(6)  Y(7)  Y(8)
Y(9)  Y(10)
  CODE   NO   TYPE PIER/PIP WIDTH    DIAMETER  WIDTH              DROP

  CD      1    4      2             1.500
  CD      2    3      0     .000    7.500   10.000    .000   .000    .00
                                                   W S P G W
PAGE NO   1
                              WATER SURFACE PROFILE - TITLE CARD LISTING
 HEADING LINE NO 1 IS -
                                Holly Street
 HEADING LINE NO 2 IS -
                                Double 18 inch Basin Outlet Pipes
 HEADING LINE NO 3 IS -

                                                   W S P G W
PAGE NO   2
                              WATER SURFACE PROFILE - ELEMENT CARD LISTING
  ELEMENT NO   1 IS A SYSTEM OUTLET     *         *     *
                       U/S DATA   STATION    INVERT  SECT                                      W S ELEV
                                  1000.000  824.200    1                                         824.500
  ELEMENT NO   2 IS A REACH             *         *     *
                       U/S DATA   STATION    INVERT  SECT               N                           RADIUS    ANGLE
ANG PT  MAN H
                                  1150.000  825.000    1               .014                           .000     .000
.000     0
  ELEMENT NO   3 IS A  WALL  ENTRANCE                  *
                       U/S DATA   STATION    INVERT  SECT              FP
                                  1150.000  825.000    2               .500
  ELEMENT NO   4 IS A SYSTEM HEADWORKS                 *                       *
                       U/S DATA   STATION    INVERT  SECT                                      W S ELEV
                                  1150.000  825.000    2                                       825.000
```

Program Package Serial Number: 7182

WATER SURFACE PROFILE LISTING Date: 8- 4-2018 Time:12:55: 7

Holly Street
Double 18 inch Basin Outlet Pipes

Station / L/Elem	Invert Elev / Ch Slope	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head / SF Ave	Energy Grd.El. / HF	Super Elev / SE Dpth	Critical Depth / Froude N	Flow Top Width / Norm Dp	Height/ Dia.-FT / "N"	Base Wt or I.D. / X-Fall	ZL / ZR	No Wth Prs/Pip / Type Ch
1000.000	824.200	1.245	825.445	21.00	6.70	.70	826.14	.00	1.25	1.13	1.500	.000	.00	2 .0
1.618	.0053					.0109	.02	1.25	.71	1.50	.014	.00	.00	PIPE
1001.618	824.209	1.317	825.526	21.00	6.38	.63	826.16	.00	1.25	.98	1.500	.000	.00	2 .0
7.420	.0053					.0102	.08	1.32	.61	1.50	.014	.00	.00	PIPE
1009.038	824.248	1.411	825.659	21.00	6.09	.58	826.23	.00	1.25	.71	1.500	.000	.00	2 .0
12.132	.0053					.0104	.13	1.41	.49	1.50	.014	.00	.00	PIPE
1021.170	824.313	1.500	825.813	21.00	5.94	.55	826.36	.00	1.25	.00	1.500	.000	.00	2 .0
128.830	.0053					.0112	1.44	1.50	.00	1.50	.014	.00	.00	PIPE
1150.000	825.000	2.306	827.306	21.00	5.94	.55	827.85	.00	1.25	.00	1.500	.000	.00	2 .0
WALL	ENTRANCE													
1150.000	825.000	3.117	828.117	21.00	.67	.01	828.12	.00	.52	10.00	7.500	10.000	.00	0 .0

APPENDIX F

FLOOD HYDROGRAPH ROUTING PROGRAM
Copyright (c) CIVILCADD/CIVILDESIGN, 1989 - 2014
Study date: 08/06/18

Holly Street
100-YEAR 24-HR UH
ROUTING ANALYSIS

Program License Serial Number 6405

********** HYDROGRAPH INFORMATION **********

From study/file name: 100PUH.rte
**********HYDROGRAPH DATA**********
Number of intervals = 301
Time interval = 5.0 (Min.)
Maximum/Peak flow rate = 101.347 (CFS)
Total volume = 18.678 (Ac.Ft)
Status of hydrographs being held in storage

	Stream 1	Stream 2	Stream 3	Stream 4	Stream 5
Peak (CFS)	0.000	0.000	0.000	0.000	0.000
Vol (Ac.Ft)	0.000	0.000	0.000	0.000	0.000

****

++
Process from Point/Station 10.000 to Point/Station 120.000
**** RETARDING BASIN ROUTING ****

User entry of depth-outflow-storage data

Total number of inflow hydrograph intervals = 301
Hydrograph time unit = 5.000 (Min.)
Initial depth in storage basin = 0.00(Ft.)

Initial basin depth = 0.00 (Ft.)
Initial basin storage = 0.00 (Ac.Ft)
Initial basin outflow = 0.00 (CFS)

Depth vs. Storage and Depth vs. Discharge data:

Basin Depth (Ft.)	Storage (Ac.Ft)	Outflow (CFS)	(S-O*dt/2) (Ac.Ft)	(S+O*dt/2) (Ac.Ft)
0.000	0.000	0.000	0.000	0.000
0.500	0.560	3.710	0.547	0.573
1.000	1.135	3.710	1.122	1.148
1.500	1.727	3.710	1.714	1.740
2.000	2.336	3.710	2.323	2.349
2.500	2.961	3.710	2.948	2.974

3.000	3.602	3.710	3.589	3.615
3.500	4.260	6.740	4.237	4.283
4.000	4.936	11.730	4.896	4.976
4.500	5.628	14.640	5.578	5.678
5.000	6.338	16.930	6.280	6.396
5.500	7.065	18.870	7.000	7.130
6.000	7.810	20.590	7.739	7.881
6.500	8.573	22.160	8.497	8.649
7.000	9.353	60.720	9.144	9.562
7.500	10.152	129.940	9.705	10.599

Hydrograph Detention Basin Routing

Graph values: 'I'= unit inflow; 'O'=outflow at time shown

Time (Hours)	Inflow (CFS)	Outflow (CFS)	Storage (Ac.Ft)	.0	25.3	50.67	76.01	101.35	Depth (Ft.)
0.083	0.07	0.00	0.000	O	|	|	|	|	0.00
0.167	0.36	0.01	0.002	O	|	|	|	|	0.00
0.250	0.97	0.04	0.006	O	|	|	|	|	0.01
0.333	1.79	0.10	0.015	O	|	|	|	|	0.01
0.417	2.73	0.20	0.030	O	|	|	|	|	0.03
0.500	3.31	0.32	0.049	OI	|	|	|	|	0.04
0.583	3.68	0.46	0.070	OI	|	|	|	|	0.06
0.667	3.88	0.61	0.092	OI	|	|	|	|	0.08
0.750	3.99	0.76	0.115	OI	|	|	|	|	0.10
0.833	4.05	0.91	0.137	OI	|	|	|	|	0.12
0.917	4.08	1.05	0.158	OI	|	|	|	|	0.14
1.000	4.11	1.18	0.178	OI	|	|	|	|	0.16
1.083	4.14	1.31	0.198	OI	|	|	|	|	0.18
1.167	4.16	1.44	0.217	OI	|	|	|	|	0.19
1.250	4.17	1.56	0.236	OI	|	|	|	|	0.21
1.333	4.19	1.68	0.253	OI	|	|	|	|	0.23
1.417	4.20	1.79	0.270	OI	|	|	|	|	0.24
1.500	4.21	1.90	0.286	OI	|	|	|	|	0.26
1.583	4.23	2.00	0.302	OI	|	|	|	|	0.27
1.667	4.24	2.10	0.317	OI	|	|	|	|	0.28
1.750	4.25	2.20	0.332	OI	|	|	|	|	0.30
1.833	4.27	2.29	0.345	OI	|	|	|	|	0.31
1.917	4.28	2.38	0.359	OI	|	|	|	|	0.32
2.000	4.29	2.46	0.372	OI	|	|	|	|	0.33
2.083	4.31	2.54	0.384	OI	|	|	|	|	0.34
2.167	4.32	2.62	0.396	OI	|	|	|	|	0.35
2.250	4.34	2.70	0.407	OI	|	|	|	|	0.36
2.333	4.35	2.77	0.418	OI	|	|	|	|	0.37
2.417	4.36	2.84	0.429	OI	|	|	|	|	0.38
2.500	4.38	2.91	0.439	OI	|	|	|	|	0.39
2.583	4.39	2.98	0.449	OI	|	|	|	|	0.40
2.667	4.41	3.04	0.459	OI	|	|	|	|	0.41
2.750	4.42	3.10	0.468	OI	|	|	|	|	0.42
2.833	4.44	3.16	0.477	OI	|	|	|	|	0.43
2.917	4.45	3.22	0.486	|O	|	|	|	|	0.43
3.000	4.47	3.27	0.494	|O	|	|	|	|	0.44
3.083	4.48	3.33	0.502	|O	|	|	|	|	0.45
3.167	4.50	3.38	0.510	|O	|	|	|	|	0.46
3.250	4.52	3.43	0.518	|O	|	|	|	|	0.46
3.333	4.53	3.48	0.525	|O	|	|	|	|	0.47
3.417	4.55	3.53	0.532	|O	|	|	|	|	0.48
3.500	4.56	3.57	0.539	|O	|	|	|	|	0.48
3.583	4.58	3.62	0.546	|O	|	|	|	|	0.49
3.667	4.60	3.66	0.552	|O	|	|	|	|	0.49
3.750	4.62	3.70	0.559	|O	|	|	|	|	0.50

3.833	4.63	3.71	0.565	O				0.50
3.917	4.65	3.71	0.572	O				0.51
4.000	4.67	3.71	0.578	O				0.52
4.083	4.68	3.71	0.585	O				0.52
4.167	4.70	3.71	0.592	O				0.53
4.250	4.72	3.71	0.598	O				0.53
4.333	4.74	3.71	0.605	O				0.54
4.417	4.76	3.71	0.613	O				0.55
4.500	4.78	3.71	0.620	O				0.55
4.583	4.79	3.71	0.627	O				0.56
4.667	4.81	3.71	0.635	O				0.57
4.750	4.83	3.71	0.642	O				0.57
4.833	4.85	3.71	0.650	O				0.58
4.917	4.87	3.71	0.658	O				0.59
5.000	4.89	3.71	0.666	O				0.59
5.083	4.91	3.71	0.674	O				0.60
5.167	4.93	3.71	0.683	O				0.61
5.250	4.95	3.71	0.691	O				0.61
5.333	4.97	3.71	0.700	O				0.62
5.417	4.99	3.71	0.709	O				0.63
5.500	5.02	3.71	0.718	O				0.64
5.583	5.04	3.71	0.727	O				0.64
5.667	5.06	3.71	0.736	O				0.65
5.750	5.08	3.71	0.745	O				0.66
5.833	5.10	3.71	0.755	O				0.67
5.917	5.13	3.71	0.764	O				0.68
6.000	5.15	3.71	0.774	O				0.69
6.083	5.17	3.71	0.784	O				0.70
6.167	5.20	3.71	0.794	O				0.70
6.250	5.22	3.71	0.805	O				0.71
6.333	5.24	3.71	0.815	O				0.72
6.417	5.27	3.71	0.826	O				0.73
6.500	5.29	3.71	0.837	O				0.74
6.583	5.32	3.71	0.848	O				0.75
6.667	5.34	3.71	0.859	O				0.76
6.750	5.37	3.71	0.870	O				0.77
6.833	5.39	3.71	0.882	O				0.78
6.917	5.42	3.71	0.893	O				0.79
7.000	5.45	3.71	0.905	O				0.80
7.083	5.48	3.71	0.917	O				0.81
7.167	5.50	3.71	0.930	O				0.82
7.250	5.53	3.71	0.942	O				0.83
7.333	5.56	3.71	0.955	O				0.84
7.417	5.59	3.71	0.967	O				0.85
7.500	5.62	3.71	0.981	O				0.87
7.583	5.65	3.71	0.994	O				0.88
7.667	5.68	3.71	1.007	O				0.89
7.750	5.71	3.71	1.021	O				0.90
7.833	5.74	3.71	1.035	O				0.91
7.917	5.77	3.71	1.049	O				0.93
8.000	5.80	3.71	1.063	O				0.94
8.083	5.83	3.71	1.078	O				0.95
8.167	5.87	3.71	1.092	O				0.96
8.250	5.90	3.71	1.107	O				0.98
8.333	5.93	3.71	1.123	O				0.99
8.417	5.97	3.71	1.138	O				1.00
8.500	6.00	3.71	1.154	O				1.02
8.583	6.04	3.71	1.170	O				1.03
8.667	6.08	3.71	1.186	O				1.04
8.750	6.11	3.71	1.202	O				1.06
8.833	6.15	3.71	1.219	O				1.07
8.917	6.19	3.71	1.236	O				1.09
9.000	6.23	3.71	1.253	O				1.10

```
 9.083    6.27    3.71      1.270  |O      |       |       |       |     1.11
 9.167    6.31    3.71      1.288  |O      |       |       |       |     1.13
 9.250    6.35    3.71      1.306  |OI     |       |       |       |     1.14
 9.333    6.39    3.71      1.325  |OI     |       |       |       |     1.16
 9.417    6.43    3.71      1.343  |OI     |       |       |       |     1.18
 9.500    6.48    3.71      1.362  |OI     |       |       |       |     1.19
 9.583    6.52    3.71      1.381  |OI     |       |       |       |     1.21
 9.667    6.56    3.71      1.401  |OI     |       |       |       |     1.22
 9.750    6.61    3.71      1.421  |OI     |       |       |       |     1.24
 9.833    6.66    3.71      1.441  |OI     |       |       |       |     1.26
 9.917    6.71    3.71      1.461  |OI     |       |       |       |     1.28
10.000    6.75    3.71      1.482  |OI     |       |       |       |     1.29
10.083    6.80    3.71      1.503  |OI     |       |       |       |     1.31
10.167    6.85    3.71      1.525  |OI     |       |       |       |     1.33
10.250    6.91    3.71      1.546  |OI     |       |       |       |     1.35
10.333    6.96    3.71      1.569  |OI     |       |       |       |     1.37
10.417    7.01    3.71      1.591  |OI     |       |       |       |     1.39
10.500    7.07    3.71      1.614  |OI     |       |       |       |     1.40
10.583    7.13    3.71      1.637  |OI     |       |       |       |     1.42
10.667    7.18    3.71      1.661  |OI     |       |       |       |     1.44
10.750    7.24    3.71      1.685  |OI     |       |       |       |     1.46
10.833    7.30    3.71      1.710  |OI     |       |       |       |     1.49
10.917    7.36    3.71      1.735  |OI     |       |       |       |     1.51
11.000    7.43    3.71      1.760  |OI     |       |       |       |     1.53
11.083    7.49    3.71      1.786  |OI     |       |       |       |     1.55
11.167    7.56    3.71      1.812  |OI     |       |       |       |     1.57
11.250    7.63    3.71      1.839  |OI     |       |       |       |     1.59
11.333    7.70    3.71      1.866  |OI     |       |       |       |     1.61
11.417    7.77    3.71      1.894  |OI     |       |       |       |     1.64
11.500    7.84    3.71      1.922  |OI     |       |       |       |     1.66
11.583    7.92    3.71      1.951  |OI     |       |       |       |     1.68
11.667    8.00    3.71      1.980  |OI     |       |       |       |     1.71
11.750    8.08    3.71      2.010  |OI     |       |       |       |     1.73
11.833    8.16    3.71      2.040  |OI     |       |       |       |     1.76
11.917    8.24    3.71      2.071  |OI     |       |       |       |     1.78
12.000    8.33    3.71      2.103  |OI     |       |       |       |     1.81
12.083    8.43    3.71      2.135  |OI     |       |       |       |     1.83
12.167    8.56    3.71      2.168  |OI     |       |       |       |     1.86
12.250    8.73    3.71      2.202  |OI     |       |       |       |     1.89
12.333    8.93    3.71      2.237  |OI     |       |       |       |     1.92
12.417    9.15    3.71      2.274  |OI     |       |       |       |     1.95
12.500    9.32    3.71      2.312  |OI     |       |       |       |     1.98
12.583    9.48    3.71      2.351  |OI     |       |       |       |     2.01
12.667    9.61    3.71      2.391  |O I    |       |       |       |     2.04
12.750    9.74    3.71      2.432  |O I    |       |       |       |     2.08
12.833    9.87    3.71      2.474  |O I    |       |       |       |     2.11
12.917   10.00    3.71      2.517  |O I    |       |       |       |     2.14
13.000   10.13    3.71      2.561  |O I    |       |       |       |     2.18
13.083   10.27    3.71      2.606  |O I    |       |       |       |     2.22
13.167   10.41    3.71      2.651  |O I    |       |       |       |     2.25
13.250   10.56    3.71      2.698  |O I    |       |       |       |     2.29
13.333   10.71    3.71      2.745  |O I    |       |       |       |     2.33
13.417   10.87    3.71      2.794  |O I    |       |       |       |     2.37
13.500   11.03    3.71      2.844  |O I    |       |       |       |     2.41
13.583   11.21    3.71      2.895  |O I    |       |       |       |     2.45
13.667   11.39    3.71      2.947  |O I    |       |       |       |     2.49
13.750   11.58    3.71      3.001  |O I    |       |       |       |     2.53
13.833   11.78    3.71      3.056  |O I    |       |       |       |     2.57
13.917   11.99    3.71      3.112  |O I    |       |       |       |     2.62
14.000   12.21    3.71      3.170  |O I    |       |       |       |     2.66
14.083   12.45    3.71      3.229  |O I    |       |       |       |     2.71
14.167   12.70    3.71      3.290  |O  I   |       |       |       |     2.76
14.250   12.97    3.71      3.353  |O  I   |       |       |       |     2.81
```

14.333	13.26	3.71	3.418	O	I				2.86
14.417	13.57	3.71	3.485	O	I				2.91
14.500	13.90	3.71	3.554	O	I				2.96
14.583	14.24	3.82	3.625	O	I				3.02
14.667	14.61	4.15	3.697	O	I				3.07
14.750	15.01	4.48	3.769	O	I				3.13
14.833	15.43	4.81	3.842	O	I				3.18
14.917	15.90	5.15	3.916	O	I				3.24
15.000	16.40	5.50	3.990	O	I				3.29
15.083	16.96	5.85	4.066	O	I				3.35
15.167	17.57	6.20	4.143	O	I				3.41
15.250	18.27	6.57	4.223	O	I				3.47
15.333	19.03	7.07	4.304	O	I				3.53
15.417	19.86	7.68	4.387	O	I				3.59
15.500	20.60	8.30	4.472	O	I				3.66
15.583	21.26	8.93	4.556	O	I				3.72
15.667	21.91	9.56	4.641	O	I				3.78
15.750	22.80	10.19	4.727	O	I				3.85
15.833	24.44	10.86	4.818	O	I				3.91
15.917	27.22	11.60	4.918	O	I				3.99
16.000	31.97	12.17	5.040	O		I			4.08
16.083	43.10	12.89	5.212	O		I			4.20
16.167	63.49	14.05	5.487	O			I		4.40
16.250	87.45	15.53	5.905	O				I	4.69
16.333	100.53	17.20	6.439	O				I	5.07
16.417	101.35	18.72	7.011	O				I	5.46
16.500	73.97	19.83	7.482	O			I		5.78
16.583	54.59	20.53	7.785	O		I			5.98
16.667	39.78	20.91	7.968	O	I				6.10
16.750	31.03	21.12	8.067	O	I				6.17
16.833	24.64	21.21	8.113	OI					6.20
16.917	21.38	21.24	8.125	O					6.21
17.000	19.74	21.23	8.120	O					6.20
17.083	18.27	21.20	8.105	IO					6.19
17.167	16.41	21.14	8.079	IO					6.18
17.250	15.00	21.07	8.041	I O					6.15
17.333	14.19	20.98	7.997	I O					6.12
17.417	13.51	20.87	7.948	I O					6.09
17.500	12.92	20.77	7.896	I O					6.06
17.583	12.40	20.65	7.841	I O					6.02
17.667	11.94	20.53	7.783	I O					5.98
17.750	11.52	20.39	7.722	I O					5.94
17.833	11.15	20.25	7.661	I O					5.90
17.917	10.81	20.10	7.597	I O					5.86
18.000	10.50	19.95	7.533	I O					5.81
18.083	10.21	19.80	7.467	I O					5.77
18.167	9.91	19.64	7.401	I O					5.73
18.250	9.58	19.49	7.333	I O					5.68
18.333	9.26	19.33	7.264	I O					5.63
18.417	8.93	19.17	7.194	I O					5.59
18.500	8.66	19.00	7.123	I O					5.54
18.583	8.43	18.83	7.052	I O					5.49
18.667	8.23	18.64	6.980	I O					5.44
18.750	8.05	18.45	6.908	I O					5.39
18.833	7.89	18.26	6.837	I O					5.34
18.917	7.74	18.07	6.766	I O					5.29
19.000	7.60	17.88	6.695	I O					5.25
19.083	7.46	17.69	6.624	I O					5.20
19.167	7.33	17.51	6.554	I O					5.15
19.250	7.21	17.32	6.484	I O					5.10
19.333	7.10	17.13	6.414	I O					5.05
19.417	6.98	16.95	6.346	I O					5.01
19.500	6.88	16.73	6.277	I O					4.96

```
19.583    6.78   16.52      6.210  | I  O  |        |        |        |      4.91
19.667    6.68   16.30      6.143  | I  O  |        |        |        |      4.86
19.750    6.59   16.09      6.077  | I  O  |        |        |        |      4.82
19.833    6.50   15.88      6.012  | I  O  |        |        |        |      4.77
19.917    6.41   15.67      5.948  | I O   |        |        |        |      4.73
20.000    6.33   15.47      5.885  |I  O   |        |        |        |      4.68
20.083    6.25   15.27      5.822  |I  O   |        |        |        |      4.64
20.167    6.17   15.07      5.760  |I  O   |        |        |        |      4.59
20.250    6.09   14.87      5.700  |I  O   |        |        |        |      4.55
20.333    6.02   14.68      5.640  |I  O   |        |        |        |      4.51
20.417    5.95   14.44      5.580  |I  O   |        |        |        |      4.47
20.500    5.88   14.20      5.523  |I  O   |        |        |        |      4.42
20.583    5.82   13.96      5.466  |I  O   |        |        |        |      4.38
20.667    5.75   13.73      5.410  |I  O   |        |        |        |      4.34
20.750    5.69   13.50      5.356  |I  O   |        |        |        |      4.30
20.833    5.63   13.27      5.303  |I  O   |        |        |        |      4.27
20.917    5.57   13.05      5.251  |I  O   |        |        |        |      4.23
21.000    5.51   12.84      5.200  |I  O   |        |        |        |      4.19
21.083    5.46   12.63      5.150  |I O    |        |        |        |      4.15
21.167    5.41   12.42      5.101  |I O    |        |        |        |      4.12
21.250    5.35   12.22      5.053  |I O    |        |        |        |      4.08
21.333    5.30   12.03      5.006  |I O    |        |        |        |      4.05
21.417    5.25   11.83      4.961  |I O    |        |        |        |      4.02
21.500    5.21   11.58      4.916  |I O    |        |        |        |      3.99
21.583    5.16   11.26      4.873  |I O    |        |        |        |      3.95
21.667    5.11   10.96      4.832  |I O    |        |        |        |      3.92
21.750    5.07   10.67      4.792  |I O    |        |        |        |      3.89
21.833    5.02   10.39      4.755  |I O    |        |        |        |      3.87
21.917    4.98   10.12      4.718  |I O    |        |        |        |      3.84
22.000    4.94    9.87      4.684  |I O    |        |        |        |      3.81
22.083    4.90    9.62      4.651  |I O    |        |        |        |      3.79
22.167    4.86    9.39      4.619  |IO     |        |        |        |      3.77
22.250    4.82    9.16      4.588  |IO     |        |        |        |      3.74
22.333    4.78    8.95      4.559  |IO     |        |        |        |      3.72
22.417    4.75    8.74      4.531  |IO     |        |        |        |      3.70
22.500    4.71    8.54      4.504  |IO     |        |        |        |      3.68
22.583    4.67    8.35      4.478  |IO     |        |        |        |      3.66
22.667    4.64    8.17      4.453  |IO     |        |        |        |      3.64
22.750    4.60    7.99      4.429  |IO     |        |        |        |      3.63
22.833    4.57    7.82      4.407  |IO     |        |        |        |      3.61
22.917    4.54    7.66      4.385  |IO     |        |        |        |      3.59
23.000    4.51    7.50      4.364  |IO     |        |        |        |      3.58
23.083    4.48    7.35      4.343  |IO     |        |        |        |      3.56
23.167    4.44    7.21      4.324  |IO     |        |        |        |      3.55
23.250    4.41    7.07      4.305  |IO     |        |        |        |      3.53
23.333    4.38    6.94      4.287  |IO     |        |        |        |      3.52
23.417    4.35    6.81      4.270  |IO     |        |        |        |      3.51
23.500    4.33    6.71      4.253  |IO     |        |        |        |      3.49
23.583    4.30    6.63      4.237  |IO     |        |        |        |      3.48
23.667    4.27    6.56      4.221  |IO     |        |        |        |      3.47
23.750    4.24    6.49      4.205  |IO     |        |        |        |      3.46
23.833    4.22    6.42      4.190  |IO     |        |        |        |      3.45
23.917    4.19    6.35      4.175  |IO     |        |        |        |      3.44
24.000    4.16    6.28      4.160  |O      |        |        |        |      3.42
24.083    4.07    6.21      4.146  |O      |        |        |        |      3.41
24.167    3.76    6.14      4.130  |O      |        |        |        |      3.40
24.250    3.13    6.06      4.112  IO      |        |        |        |      3.39
24.333    2.29    5.95      4.089  IO      |        |        |        |      3.37
24.417    1.34    5.82      4.061  IO      |        |        |        |      3.35
24.500    0.76    5.68      4.029  IO      |        |        |        |      3.32
24.583    0.40    5.52      3.994  IO      |        |        |        |      3.30
24.667    0.21    5.35      3.959  IO      |        |        |        |      3.27
24.750    0.11    5.19      3.924  IO      |        |        |        |      3.24
```

24.833	0.07	5.03	3.889	IO				3.22
24.917	0.05	4.88	3.855	IO				3.19
25.000	0.03	4.73	3.823	IO				3.17
25.083	0.01	4.58	3.791	IO				3.14
25.167	0.00	4.44	3.760	IO				3.12
25.250	0.00	4.30	3.730	IO				3.10
25.333	0.00	4.16	3.700	IO				3.07
25.417	0.00	4.03	3.672	IO				3.05
25.500	0.00	3.91	3.645	IO				3.03
25.583	0.00	3.79	3.618	IO				3.01
25.667	0.00	3.71	3.593	IO				2.99
25.750	0.00	3.71	3.567	IO				2.97
25.833	0.00	3.71	3.541	IO				2.95
25.917	0.00	3.71	3.516	IO				2.93
26.000	0.00	3.71	3.490	IO				2.91
26.083	0.00	3.71	3.465	IO				2.89
26.167	0.00	3.71	3.439	IO				2.87
26.250	0.00	3.71	3.414	IO				2.85
26.333	0.00	3.71	3.388	IO				2.83
26.417	0.00	3.71	3.363	IO				2.81
26.500	0.00	3.71	3.337	IO				2.79
26.583	0.00	3.71	3.311	IO				2.77
26.667	0.00	3.71	3.286	IO				2.75
26.750	0.00	3.71	3.260	IO				2.73
26.833	0.00	3.71	3.235	IO				2.71
26.917	0.00	3.71	3.209	IO				2.69
27.000	0.00	3.71	3.184	IO				2.67
27.083	0.00	3.71	3.158	IO				2.65
27.167	0.00	3.71	3.133	IO				2.63
27.250	0.00	3.71	3.107	IO				2.61
27.333	0.00	3.71	3.082	IO				2.59
27.417	0.00	3.71	3.056	IO				2.57
27.500	0.00	3.71	3.030	IO				2.55
27.583	0.00	3.71	3.005	IO				2.53
27.667	0.00	3.71	2.979	IO				2.51
27.750	0.00	3.71	2.954	IO				2.49
27.833	0.00	3.71	2.928	IO				2.47
27.917	0.00	3.71	2.903	IO				2.45
28.000	0.00	3.71	2.877	IO				2.43
28.083	0.00	3.71	2.852	IO				2.41
28.167	0.00	3.71	2.826	IO				2.39
28.250	0.00	3.71	2.800	IO				2.37
28.333	0.00	3.71	2.775	IO				2.35
28.417	0.00	3.71	2.749	IO				2.33
28.500	0.00	3.71	2.724	IO				2.31
28.583	0.00	3.71	2.698	IO				2.29
28.667	0.00	3.71	2.673	IO				2.27
28.750	0.00	3.71	2.647	IO				2.25
28.833	0.00	3.71	2.622	IO				2.23
28.917	0.00	3.71	2.596	IO				2.21
29.000	0.00	3.71	2.571	IO				2.19
29.083	0.00	3.71	2.545	IO				2.17
29.167	0.00	3.71	2.519	IO				2.15
29.250	0.00	3.71	2.494	IO				2.13
29.333	0.00	3.71	2.468	IO				2.11
29.417	0.00	3.71	2.443	IO				2.09
29.500	0.00	3.71	2.417	IO				2.06
29.583	0.00	3.71	2.392	IO				2.04
29.667	0.00	3.71	2.366	IO				2.02
29.750	0.00	3.71	2.341	IO				2.00
29.833	0.00	3.71	2.315	IO				1.98
29.917	0.00	3.71	2.289	IO				1.96
30.000	0.00	3.71	2.264	IO				1.94

30.083	0.00	3.71	2.238	IO				1.92
30.167	0.00	3.71	2.213	IO				1.90
30.250	0.00	3.71	2.187	IO				1.88
30.333	0.00	3.71	2.162	IO				1.86
30.417	0.00	3.71	2.136	IO				1.84
30.500	0.00	3.71	2.111	IO				1.81
30.583	0.00	3.71	2.085	IO				1.79
30.667	0.00	3.71	2.059	IO				1.77
30.750	0.00	3.71	2.034	IO				1.75
30.833	0.00	3.71	2.008	IO				1.73
30.917	0.00	3.71	1.983	IO				1.71
31.000	0.00	3.71	1.957	IO				1.69
31.083	0.00	3.71	1.932	IO				1.67
31.167	0.00	3.71	1.906	IO				1.65
31.250	0.00	3.71	1.881	IO				1.63
31.333	0.00	3.71	1.855	IO				1.61
31.417	0.00	3.71	1.830	IO				1.58
31.500	0.00	3.71	1.804	IO				1.56
31.583	0.00	3.71	1.778	IO				1.54
31.667	0.00	3.71	1.753	IO				1.52
31.750	0.00	3.71	1.727	IO				1.50
31.833	0.00	3.71	1.702	IO				1.48
31.917	0.00	3.71	1.676	IO				1.46
32.000	0.00	3.71	1.651	IO				1.44
32.083	0.00	3.71	1.625	IO				1.41
32.167	0.00	3.71	1.600	IO				1.39
32.250	0.00	3.71	1.574	IO				1.37
32.333	0.00	3.71	1.548	IO				1.35
32.417	0.00	3.71	1.523	IO				1.33
32.500	0.00	3.71	1.497	IO				1.31
32.583	0.00	3.71	1.472	IO				1.28
32.667	0.00	3.71	1.446	IO				1.26
32.750	0.00	3.71	1.421	IO				1.24
32.833	0.00	3.71	1.395	IO				1.22
32.917	0.00	3.71	1.370	IO				1.20
33.000	0.00	3.71	1.344	IO				1.18
33.083	0.00	3.71	1.319	IO				1.15
33.167	0.00	3.71	1.293	IO				1.13
33.250	0.00	3.71	1.267	IO				1.11
33.333	0.00	3.71	1.242	IO				1.09
33.417	0.00	3.71	1.216	IO				1.07
33.500	0.00	3.71	1.191	IO				1.05
33.583	0.00	3.71	1.165	IO				1.03
33.667	0.00	3.71	1.140	IO				1.00
33.750	0.00	3.71	1.114	IO				0.98
33.833	0.00	3.71	1.089	IO				0.96
33.917	0.00	3.71	1.063	IO				0.94
34.000	0.00	3.71	1.037	IO				0.92
34.083	0.00	3.71	1.012	IO				0.89
34.167	0.00	3.71	0.986	IO				0.87
34.250	0.00	3.71	0.961	IO				0.85
34.333	0.00	3.71	0.935	IO				0.83
34.417	0.00	3.71	0.910	IO				0.80
34.500	0.00	3.71	0.884	IO				0.78
34.583	0.00	3.71	0.859	IO				0.76
34.667	0.00	3.71	0.833	IO				0.74
34.750	0.00	3.71	0.807	IO				0.72
34.833	0.00	3.71	0.782	IO				0.69
34.917	0.00	3.71	0.756	IO				0.67
35.000	0.00	3.71	0.731	IO				0.65
35.083	0.00	3.71	0.705	IO				0.63
35.167	0.00	3.71	0.680	IO				0.60
35.250	0.00	3.71	0.654	IO				0.58

35.333	0.00	3.71	0.629	IO				0.56
35.417	0.00	3.71	0.603	IO				0.54
35.500	0.00	3.71	0.578	IO				0.52
35.583	0.00	3.66	0.552	IO				0.49
35.667	0.00	3.49	0.528	IO				0.47
35.750	0.00	3.34	0.504	IO				0.45
35.833	0.00	3.19	0.482	IO				0.43
35.917	0.00	3.05	0.460	O				0.41
36.000	0.00	2.91	0.440	O				0.39
36.083	0.00	2.78	0.420	O				0.37
36.167	0.00	2.66	0.401	O				0.36
36.250	0.00	2.54	0.383	O				0.34
36.333	0.00	2.43	0.366	O				0.33
36.417	0.00	2.32	0.350	O				0.31
36.500	0.00	2.21	0.334	O				0.30
36.583	0.00	2.12	0.319	O				0.29
36.667	0.00	2.02	0.305	O				0.27
36.750	0.00	1.93	0.291	O				0.26
36.833	0.00	1.84	0.278	O				0.25
36.917	0.00	1.76	0.266	O				0.24
37.000	0.00	1.68	0.254	O				0.23
37.083	0.00	1.61	0.243	O				0.22
37.167	0.00	1.54	0.232	O				0.21
37.250	0.00	1.47	0.222	O				0.20
37.333	0.00	1.40	0.212	O				0.19
37.417	0.00	1.34	0.202	O				0.18
37.500	0.00	1.28	0.193	O				0.17
37.583	0.00	1.22	0.185	O				0.16
37.667	0.00	1.17	0.176	O				0.16
37.750	0.00	1.12	0.169	O				0.15
37.833	0.00	1.07	0.161	O				0.14
37.917	0.00	1.02	0.154	O				0.14
38.000	0.00	0.97	0.147	O				0.13
38.083	0.00	0.93	0.140	O				0.13
38.167	0.00	0.89	0.134	O				0.12
38.250	0.00	0.85	0.128	O				0.11
38.333	0.00	0.81	0.122	O				0.11
38.417	0.00	0.78	0.117	O				0.10
38.500	0.00	0.74	0.112	O				0.10
38.583	0.00	0.71	0.107	O				0.10
38.667	0.00	0.68	0.102	O				0.09
38.750	0.00	0.65	0.097	O				0.09
38.833	0.00	0.62	0.093	O				0.08
38.917	0.00	0.59	0.089	O				0.08
39.000	0.00	0.56	0.085	O				0.08
39.083	0.00	0.54	0.081	O				0.07
39.167	0.00	0.51	0.078	O				0.07
39.250	0.00	0.49	0.074	O				0.07
39.333	0.00	0.47	0.071	O				0.06
39.417	0.00	0.45	0.068	O				0.06
39.500	0.00	0.43	0.065	O				0.06
39.583	0.00	0.41	0.062	O				0.06
39.667	0.00	0.39	0.059	O				0.05
39.750	0.00	0.37	0.056	O				0.05
39.833	0.00	0.36	0.054	O				0.05
39.917	0.00	0.34	0.051	O				0.05
40.000	0.00	0.33	0.049	O				0.04
40.083	0.00	0.31	0.047	O				0.04
40.167	0.00	0.30	0.045	O				0.04
40.250	0.00	0.28	0.043	O				0.04
40.333	0.00	0.27	0.041	O				0.04
40.417	0.00	0.26	0.039	O				0.03
40.500	0.00	0.25	0.037	O				0.03

40.583	0.00	0.24	0.036	O	|	|	|	0.03
40.667	0.00	0.23	0.034	O	|	|	|	0.03
40.750	0.00	0.22	0.033	O	|	|	|	0.03
40.833	0.00	0.21	0.031	O	|	|	|	0.03
40.917	0.00	0.20	0.030	O	|	|	|	0.03
41.000	0.00	0.19	0.028	O	|	|	|	0.03
41.083	0.00	0.18	0.027	O	|	|	|	0.02
41.167	0.00	0.17	0.026	O	|	|	|	0.02
41.250	0.00	0.16	0.025	O	|	|	|	0.02
41.333	0.00	0.16	0.024	O	|	|	|	0.02
41.417	0.00	0.15	0.023	O	|	|	|	0.02
41.500	0.00	0.14	0.022	O	|	|	|	0.02
41.583	0.00	0.14	0.021	O	|	|	|	0.02
41.667	0.00	0.13	0.020	O	|	|	|	0.02
41.750	0.00	0.12	0.019	O	|	|	|	0.02
41.833	0.00	0.12	0.018	O	|	|	|	0.02
41.917	0.00	0.11	0.017	O	|	|	|	0.02
42.000	0.00	0.11	0.016	O	|	|	|	0.01
42.083	0.00	0.10	0.016	O	|	|	|	0.01
42.167	0.00	0.10	0.015	O	|	|	|	0.01
42.250	0.00	0.10	0.014	O	|	|	|	0.01
42.333	0.00	0.09	0.014	O	|	|	|	0.01
42.417	0.00	0.09	0.013	O	|	|	|	0.01
42.500	0.00	0.08	0.013	O	|	|	|	0.01
42.583	0.00	0.08	0.012	O	|	|	|	0.01
42.667	0.00	0.08	0.011	O	|	|	|	0.01
42.750	0.00	0.07	0.011	O	|	|	|	0.01
42.833	0.00	0.07	0.010	O	|	|	|	0.01
42.917	0.00	0.07	0.010	O	|	|	|	0.01
43.000	0.00	0.06	0.010	O	|	|	|	0.01
43.083	0.00	0.06	0.009	O	|	|	|	0.01
43.167	0.00	0.06	0.009	O	|	|	|	0.01
43.250	0.00	0.05	0.008	O	|	|	|	0.01
43.333	0.00	0.05	0.008	O	|	|	|	0.01
43.417	0.00	0.05	0.008	O	|	|	|	0.01
43.500	0.00	0.05	0.007	O	|	|	|	0.01
43.583	0.00	0.05	0.007	O	|	|	|	0.01
43.667	0.00	0.04	0.007	O	|	|	|	0.01
43.750	0.00	0.04	0.006	O	|	|	|	0.01
43.833	0.00	0.04	0.006	O	|	|	|	0.01
43.917	0.00	0.04	0.006	O	|	|	|	0.01
44.000	0.00	0.04	0.005	O	|	|	|	0.00
44.083	0.00	0.03	0.005	O	|	|	|	0.00
44.167	0.00	0.03	0.005	O	|	|	|	0.00
44.250	0.00	0.03	0.005	O	|	|	|	0.00
44.333	0.00	0.03	0.005	O	|	|	|	0.00
44.417	0.00	0.03	0.004	O	|	|	|	0.00
44.500	0.00	0.03	0.004	O	|	|	|	0.00
44.583	0.00	0.03	0.004	O	|	|	|	0.00
44.667	0.00	0.03	0.004	O	|	|	|	0.00
44.750	0.00	0.02	0.004	O	|	|	|	0.00
44.833	0.00	0.02	0.003	O	|	|	|	0.00
44.917	0.00	0.02	0.003	O	|	|	|	0.00
45.000	0.00	0.02	0.003	O	|	|	|	0.00
45.083	0.00	0.02	0.003	O	|	|	|	0.00
45.167	0.00	0.02	0.003	O	|	|	|	0.00
45.250	0.00	0.02	0.003	O	|	|	|	0.00
45.333	0.00	0.02	0.003	O	|	|	|	0.00
45.417	0.00	0.02	0.003	O	|	|	|	0.00
45.500	0.00	0.02	0.002	O	|	|	|	0.00
45.583	0.00	0.02	0.002	O	|	|	|	0.00
45.667	0.00	0.01	0.002	O	|	|	|	0.00
45.750	0.00	0.01	0.002	O	|	|	|	0.00

```
45.833    0.00    0.01      0.002  O       |       |       |       |     0.00
45.917    0.00    0.01      0.002  O       |       |       |       |     0.00
46.000    0.00    0.01      0.002  O       |       |       |       |     0.00
46.083    0.00    0.01      0.002  O       |       |       |       |     0.00
46.167    0.00    0.01      0.002  O       |       |       |       |     0.00
46.250    0.00    0.01      0.002  O       |       |       |       |     0.00
46.333    0.00    0.01      0.002  O       |       |       |       |     0.00
46.417    0.00    0.01      0.001  O       |       |       |       |     0.00
46.500    0.00    0.01      0.001  O       |       |       |       |     0.00
46.583    0.00    0.01      0.001  O       |       |       |       |     0.00
46.667    0.00    0.01      0.001  O       |       |       |       |     0.00
46.750    0.00    0.01      0.001  O       |       |       |       |     0.00
46.833    0.00    0.01      0.001  O       |       |       |       |     0.00
46.917    0.00    0.01      0.001  O       |       |       |       |     0.00

     Remaining water in basin =    0.00 (Ac.Ft)

     ****************************HYDROGRAPH DATA****************************
                 Number of intervals =   563
                 Time interval =    5.0 (Min.)
                 Maximum/Peak flow rate =       21.238 (CFS)
                 Total volume =      18.677 (Ac.Ft)
           Status of hydrographs being held in storage
                      Stream 1  Stream 2  Stream 3  Stream 4  Stream 5
           Peak (CFS)      0.000     0.000     0.000     0.000     0.000
           Vol (Ac.Ft)      0.000     0.000     0.000     0.000     0.000
     ***********************************************************************

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



     ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
     Process from Point/Station       10.000 to Point/Station      120.000
     **** PRINT CURRENT HYDROGRAPH ****
     ______________________________________________________________________
     ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
                       P R I N T  O F  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        5.3      10.6      15.9      21.2
 ----------------------------------------------------------------------
   0+ 5       0.0000      0.00  Q         |         |         |         |
   0+10       0.0001      0.01  Q         |         |         |         |
   0+15       0.0004      0.04  Q         |         |         |         |
   0+20       0.0010      0.10  Q         |         |         |         |
   0+25       0.0024      0.20  Q         |         |         |         |
   0+30       0.0046      0.32  Q         |         |         |         |
   0+35       0.0078      0.46  Q         |         |         |         |
   0+40       0.0120      0.61  VQ        |         |         |         |
   0+45       0.0173      0.76  VQ        |         |         |         |
   0+50       0.0235      0.91  VQ        |         |         |         |
   0+55       0.0307      1.05  VQ        |         |         |         |
   1+ 0       0.0388      1.18  V Q       |         |         |         |
   1+ 5       0.0479      1.31  V Q       |         |         |         |
   1+10       0.0578      1.44  V Q       |         |         |         |
   1+15       0.0685      1.56  V Q       |         |         |         |
   1+20       0.0801      1.68  V  Q      |         |         |         |
```

```
1+25        0.0924      1.79  V  Q      |          |          |          |
1+30        0.1055      1.90  V  Q      |          |          |          |
1+35        0.1193      2.00  V  Q      |          |          |          |
1+40        0.1338      2.10  V  Q      |          |          |          |
1+45        0.1489      2.20  V   Q     |          |          |          |
1+50        0.1646      2.29  V   Q     |          |          |          |
1+55        0.1810      2.38  V   Q     |          |          |          |
2+ 0        0.1980      2.46  V   Q     |          |          |          |
2+ 5        0.2155      2.54  V   Q     |          |          |          |
2+10        0.2336      2.62  V   Q     |          |          |          |
2+15        0.2521      2.70  V    Q    |          |          |          |
2+20        0.2712      2.77  V    Q    |          |          |          |
2+25        0.2908      2.84  V    Q    |          |          |          |
2+30        0.3109      2.91  V    Q    |          |          |          |
2+35        0.3314      2.98  V    Q    |          |          |          |
2+40        0.3523      3.04  V    Q    |          |          |          |
2+45        0.3737      3.10  V    Q    |          |          |          |
2+50        0.3955      3.16  V    Q    |          |          |          |
2+55        0.4176      3.22  V     Q   |          |          |          |
3+ 0        0.4402      3.27  V     Q   |          |          |          |
3+ 5        0.4631      3.33  V     Q   |          |          |          |
3+10        0.4864      3.38  |V    Q   |          |          |          |
3+15        0.5100      3.43  |V    Q   |          |          |          |
3+20        0.5339      3.48  |V    Q   |          |          |          |
3+25        0.5582      3.53  |V    Q   |          |          |          |
3+30        0.5828      3.57  |V    Q   |          |          |          |
3+35        0.6077      3.62  |V    Q   |          |          |          |
3+40        0.6329      3.66  |V    Q   |          |          |          |
3+45        0.6584      3.70  |V    Q   |          |          |          |
3+50        0.6840      3.71  |V    Q   |          |          |          |
3+55        0.7095      3.71  |V    Q   |          |          |          |
4+ 0        0.7351      3.71  |V    Q   |          |          |          |
4+ 5        0.7606      3.71  |V    Q   |          |          |          |
4+10        0.7862      3.71  |V    Q   |          |          |          |
4+15        0.8118      3.71  |V    Q   |          |          |          |
4+20        0.8373      3.71  |V    Q   |          |          |          |
4+25        0.8629      3.71  |V    Q   |          |          |          |
4+30        0.8884      3.71  |V    Q   |          |          |          |
4+35        0.9140      3.71  |V    Q   |          |          |          |
4+40        0.9395      3.71  | V   Q   |          |          |          |
4+45        0.9651      3.71  | V   Q   |          |          |          |
4+50        0.9906      3.71  | V   Q   |          |          |          |
4+55        1.0162      3.71  | V   Q   |          |          |          |
5+ 0        1.0417      3.71  | V   Q   |          |          |          |
5+ 5        1.0673      3.71  | V   Q   |          |          |          |
5+10        1.0928      3.71  | V   Q   |          |          |          |
5+15        1.1184      3.71  | V   Q   |          |          |          |
5+20        1.1439      3.71  | V   Q   |          |          |          |
5+25        1.1695      3.71  | V   Q   |          |          |          |
5+30        1.1950      3.71  | V   Q   |          |          |          |
5+35        1.2206      3.71  | V   Q   |          |          |          |
5+40        1.2461      3.71  | V   Q   |          |          |          |
5+45        1.2717      3.71  | V   Q   |          |          |          |
5+50        1.2972      3.71  | V   Q   |          |          |          |
5+55        1.3228      3.71  | V   Q   |          |          |          |
6+ 0        1.3483      3.71  | V   Q   |          |          |          |
6+ 5        1.3739      3.71  | V   Q   |          |          |          |
6+10        1.3994      3.71  | V   Q   |          |          |          |
6+15        1.4250      3.71  |  V  Q   |          |          |          |
6+20        1.4505      3.71  |  V  Q   |          |          |          |
6+25        1.4761      3.71  |  V  Q   |          |          |          |
6+30        1.5016      3.71  |  V  Q   |          |          |          |
6+35        1.5272      3.71  |  V  Q   |          |          |          |
```

6+40	1.5527	3.71	V	Q			
6+45	1.5783	3.71	V	Q			
6+50	1.6038	3.71	V	Q			
6+55	1.6294	3.71	V	Q			
7+ 0	1.6549	3.71	V	Q			
7+ 5	1.6805	3.71	V	Q			
7+10	1.7060	3.71	V	Q			
7+15	1.7316	3.71	V	Q			
7+20	1.7571	3.71	V	Q			
7+25	1.7827	3.71	V	Q			
7+30	1.8082	3.71	V	Q			
7+35	1.8338	3.71	V	Q			
7+40	1.8593	3.71	V	Q			
7+45	1.8849	3.71		V Q			
7+50	1.9104	3.71		V Q			
7+55	1.9360	3.71		V Q			
8+ 0	1.9615	3.71		V Q			
8+ 5	1.9871	3.71		V Q			
8+10	2.0126	3.71		V Q			
8+15	2.0382	3.71		V Q			
8+20	2.0637	3.71		V Q			
8+25	2.0893	3.71		V Q			
8+30	2.1148	3.71		V Q			
8+35	2.1404	3.71		V Q			
8+40	2.1660	3.71		V Q			
8+45	2.1915	3.71		V Q			
8+50	2.2171	3.71		V Q			
8+55	2.2426	3.71		V Q			
9+ 0	2.2682	3.71		V Q			
9+ 5	2.2937	3.71		V Q			
9+10	2.3193	3.71		V Q			
9+15	2.3448	3.71		VQ			
9+20	2.3704	3.71		VQ			
9+25	2.3959	3.71		VQ			
9+30	2.4215	3.71		VQ			
9+35	2.4470	3.71		VQ			
9+40	2.4726	3.71		VQ			
9+45	2.4981	3.71		VQ			
9+50	2.5237	3.71		VQ			
9+55	2.5492	3.71		VQ			
10+ 0	2.5748	3.71		VQ			
10+ 5	2.6003	3.71		VQ			
10+10	2.6259	3.71		VQ			
10+15	2.6514	3.71		VQ			
10+20	2.6770	3.71		VQ			
10+25	2.7025	3.71		VQ			
10+30	2.7281	3.71		VQ			
10+35	2.7536	3.71		VQ			
10+40	2.7792	3.71		VQ			
10+45	2.8047	3.71		Q			
10+50	2.8303	3.71		Q			
10+55	2.8558	3.71		Q			
11+ 0	2.8814	3.71		Q			
11+ 5	2.9069	3.71		Q			
11+10	2.9325	3.71		Q			
11+15	2.9580	3.71		Q			
11+20	2.9836	3.71		Q			
11+25	3.0091	3.71		Q			
11+30	3.0347	3.71		Q			
11+35	3.0602	3.71		Q			
11+40	3.0858	3.71		Q			
11+45	3.1113	3.71		Q			
11+50	3.1369	3.71		Q			

```
11+55       3.1624      3.71  |      Q   |          |          |          |
12+ 0       3.1880      3.71  |      Q   |          |          |          |
12+ 5       3.2135      3.71  |      Q   |          |          |          |
12+10       3.2391      3.71  |      Q   |          |          |          |
12+15       3.2646      3.71  |      Q   |          |          |          |
12+20       3.2902      3.71  |      QV  |          |          |          |
12+25       3.3157      3.71  |      QV  |          |          |          |
12+30       3.3413      3.71  |      QV  |          |          |          |
12+35       3.3668      3.71  |      QV  |          |          |          |
12+40       3.3924      3.71  |      QV  |          |          |          |
12+45       3.4179      3.71  |      QV  |          |          |          |
12+50       3.4435      3.71  |      QV  |          |          |          |
12+55       3.4691      3.71  |      QV  |          |          |          |
13+ 0       3.4946      3.71  |      QV  |          |          |          |
13+ 5       3.5202      3.71  |      QV  |          |          |          |
13+10       3.5457      3.71  |      QV  |          |          |          |
13+15       3.5713      3.71  |      QV  |          |          |          |
13+20       3.5968      3.71  |      QV  |          |          |          |
13+25       3.6224      3.71  |      QV  |          |          |          |
13+30       3.6479      3.71  |      QV  |          |          |          |
13+35       3.6735      3.71  |      QV  |          |          |          |
13+40       3.6990      3.71  |      QV  |          |          |          |
13+45       3.7246      3.71  |      QV  |          |          |          |
13+50       3.7501      3.71  |      Q V |          |          |          |
13+55       3.7757      3.71  |      Q V |          |          |          |
14+ 0       3.8012      3.71  |      Q V |          |          |          |
14+ 5       3.8268      3.71  |      Q V |          |          |          |
14+10       3.8523      3.71  |      Q V |          |          |          |
14+15       3.8779      3.71  |      Q V |          |          |          |
14+20       3.9034      3.71  |      Q V |          |          |          |
14+25       3.9290      3.71  |      Q V |          |          |          |
14+30       3.9545      3.71  |      Q V |          |          |          |
14+35       3.9808      3.82  |       QV |          |          |          |
14+40       4.0094      4.15  |       QV |          |          |          |
14+45       4.0402      4.48  |        Q |          |          |          |
14+50       4.0734      4.81  |        VQ|          |          |          |
14+55       4.1089      5.15  |        VQ|          |          |          |
15+ 0       4.1467      5.50  |        V Q          |          |          |
15+ 5       4.1870      5.85  |        V |Q         |          |          |
15+10       4.2297      6.20  |         V|Q         |          |          |
15+15       4.2749      6.57  |         V| Q        |          |          |
15+20       4.3236      7.07  |         V|  Q       |          |          |
15+25       4.3765      7.68  |         V|   Q      |          |          |
15+30       4.4337      8.30  |         V|    Q     |          |          |
15+35       4.4952      8.93  |         V|     Q    |          |          |
15+40       4.5610      9.56  |         V|      Q   |          |          |
15+45       4.6312     10.19  |         V|       Q  |          |          |
15+50       4.7059     10.86  |          V        Q          |          |
15+55       4.7858     11.60  |          V        |Q         |          |
16+ 0       4.8696     12.17  |          V        | Q        |          |
16+ 5       4.9584     12.89  |          V        |   Q      |          |
16+10       5.0551     14.05  |          V        |     Q    |          |
16+15       5.1621     15.53  |           V       |       Q  |          |
16+20       5.2806     17.20  |          |V       |         | Q        |
16+25       5.4095     18.72  |          |V       |         |    Q     |
16+30       5.5461     19.83  |          |V       |         |      Q   |
16+35       5.6875     20.53  |          | V      |         |       Q  |
16+40       5.8316     20.91  |          | V      |         |        Q|
16+45       5.9770     21.12  |          | V      |         |        Q|
16+50       6.1231     21.21  |          |  V     |         |        Q|
16+55       6.2694     21.24  |          |  V     |         |         Q
17+ 0       6.4156     21.23  |          |  V     |         |        Q|
17+ 5       6.5615     21.20  |          |   V    |         |        Q|
```

```
17+10       6.7072     21.14  |          |   V     |          |         Q|
17+15       6.8522     21.07  |          |   V     |          |         Q|
17+20       6.9967     20.98  |          |   V     |          |         Q|
17+25       7.1405     20.87  |          |    V    |          |         Q|
17+30       7.2835     20.77  |          |    V    |          |         Q|
17+35       7.4257     20.65  |          |    V    |          |        Q |
17+40       7.5671     20.53  |          |     V   |          |        Q |
17+45       7.7075     20.39  |          |     V   |          |        Q |
17+50       7.8469     20.25  |          |     V   |          |        Q |
17+55       7.9854     20.10  |          |      V  |          |       Q  |
18+ 0       8.1228     19.95  |          |      V  |          |       Q  |
18+ 5       8.2591     19.80  |          |      V  |          |       Q  |
18+10       8.3944     19.64  |          |      V  |          |      Q   |
18+15       8.5286     19.49  |          |       V |          |      Q   |
18+20       8.6617     19.33  |          |       V |          |      Q   |
18+25       8.7938     19.17  |          |       V |          |      Q   |
18+30       8.9246     19.00  |          |        V|          |     Q    |
18+35       9.0544     18.83  |          |        V|          |     Q    |
18+40       9.1828     18.64  |          |        V|          |     Q    |
18+45       9.3098     18.45  |          |        V|          |    Q     |
18+50       9.4356     18.26  |          |         V          |    Q     |
18+55       9.5601     18.07  |          |         V          |    Q     |
19+ 0       9.6832     17.88  |          |         V          |   Q      |
19+ 5       9.8051     17.69  |          |         V          |   Q      |
19+10       9.9256     17.51  |          |         |V         |  Q       |
19+15      10.0449     17.32  |          |         |V         |  Q       |
19+20      10.1629     17.13  |          |         |V         |  Q       |
19+25      10.2797     16.95  |          |         | V        |Q         |
19+30      10.3949     16.73  |          |         | V        |Q         |
19+35      10.5087     16.52  |          |         | V        |Q         |
19+40      10.6209     16.30  |          |         | V       Q         |
19+45      10.7317     16.09  |          |         | V       Q         |
19+50      10.8411     15.88  |          |         |  V     Q|         |
19+55      10.9490     15.67  |          |         |  V     Q|         |
20+ 0      11.0556     15.47  |          |         |  V     Q|         |
20+ 5      11.1607     15.27  |          |         |  V    Q |         |
20+10      11.2645     15.07  |          |         |   V   Q |         |
20+15      11.3669     14.87  |          |         |   V   Q |         |
20+20      11.4680     14.68  |          |         |   V  Q  |         |
20+25      11.5674     14.44  |          |         |   V  Q  |         |
20+30      11.6652     14.20  |          |         |   V Q   |         |
20+35      11.7613     13.96  |          |         |    VQ   |         |
20+40      11.8558     13.73  |          |         |    Q    |         |
20+45      11.9488     13.50  |          |         |    Q    |         |
20+50      12.0402     13.27  |          |         |   QV    |         |
20+55      12.1301     13.05  |          |         |   QV    |         |
21+ 0      12.2185     12.84  |          |         |   Q V   |         |
21+ 5      12.3055     12.63  |          |         |  Q  V   |         |
21+10      12.3911     12.42  |          |         |  Q  V   |         |
21+15      12.4753     12.22  |          |         |  Q  V   |         |
21+20      12.5581     12.03  |          |         | Q   V   |         |
21+25      12.6396     11.83  |          |         | Q    V  |         |
21+30      12.7193     11.58  |          |         |Q     V  |         |
21+35      12.7969     11.26  |          |         |Q     V  |         |
21+40      12.8724     10.96  |          |         Q      V  |         |
21+45      12.9459     10.67  |          |         Q      V  |         |
21+50      13.0175     10.39  |          |        Q|      V  |         |
21+55      13.0872     10.12  |          |        Q|       V |         |
22+ 0      13.1551      9.87  |          |       Q |       V |         |
22+ 5      13.2214      9.62  |          |       Q |       V |         |
22+10      13.2861      9.39  |          |      Q  |       V |         |
22+15      13.3492      9.16  |          |      Q  |       V |         |
22+20      13.4108      8.95  |          |     Q   |       V |         |
```

```
22+25      13.4710      8.74  |          |     Q    |        V |          |
22+30      13.5298      8.54  |          |     Q    |        V |          |
22+35      13.5873      8.35  |          |    Q     |         V|          |
22+40      13.6435      8.17  |          |    Q     |         V|          |
22+45      13.6985      7.99  |          |    Q     |         V|          |
22+50      13.7524      7.82  |          |   Q      |         V|          |
22+55      13.8052      7.66  |          |   Q      |         V|          |
23+ 0      13.8568      7.50  |          |   Q      |         V|          |
23+ 5      13.9075      7.35  |          |  Q       |         V|          |
23+10      13.9572      7.21  |          |  Q       |         V|          |
23+15      14.0059      7.07  |          |  Q       |         V|          |
23+20      14.0537      6.94  |          |  Q       |          V          |
23+25      14.1006      6.81  |          | Q        |          V          |
23+30      14.1468      6.71  |          | Q        |          V          |
23+35      14.1925      6.63  |          | Q        |          V          |
23+40      14.2377      6.56  |          | Q        |          V          |
23+45      14.2824      6.49  |          | Q        |          V          |
23+50      14.3266      6.42  |          | Q        |          V          |
23+55      14.3703      6.35  |          |Q         |          V          |
24+ 0      14.4136      6.28  |          |Q         |          V          |
24+ 5      14.4564      6.21  |          |Q         |          V          |
24+10      14.4987      6.14  |          |Q         |           V         |
24+15      14.5404      6.06  |          |Q         |          |V         |
24+20      14.5814      5.95  |          |Q         |          |V         |
24+25      14.6215      5.82  |         Q          |          |V         |
24+30      14.6606      5.68  |         Q          |          |V         |
24+35      14.6986      5.52  |         Q          |          |V         |
24+40      14.7354      5.35  |         Q          |          |V         |
24+45      14.7712      5.19  |        Q|          |          |V         |
24+50      14.8058      5.03  |        Q|          |          |V         |
24+55      14.8394      4.88  |        Q|          |          |V         |
25+ 0      14.8720      4.73  |       Q |          |          |V         |
25+ 5      14.9035      4.58  |       Q |          |          |V         |
25+10      14.9341      4.44  |       Q |          |          |V         |
25+15      14.9637      4.30  |       Q |          |          | V        |
25+20      14.9923      4.16  |      Q  |          |          | V        |
25+25      15.0201      4.03  |      Q  |          |          | V        |
25+30      15.0470      3.91  |      Q  |          |          | V        |
25+35      15.0731      3.79  |      Q  |          |          | V        |
25+40      15.0986      3.71  |     Q   |          |          | V        |
25+45      15.1242      3.71  |     Q   |          |          | V        |
25+50      15.1497      3.71  |     Q   |          |          | V        |
25+55      15.1753      3.71  |     Q   |          |          | V        |
26+ 0      15.2008      3.71  |     Q   |          |          | V        |
26+ 5      15.2264      3.71  |     Q   |          |          | V        |
26+10      15.2519      3.71  |     Q   |          |          | V        |
26+15      15.2775      3.71  |     Q   |          |          | V        |
26+20      15.3030      3.71  |     Q   |          |          | V        |
26+25      15.3286      3.71  |     Q   |          |          | V        |
26+30      15.3541      3.71  |     Q   |          |          | V        |
26+35      15.3797      3.71  |     Q   |          |          | V        |
26+40      15.4052      3.71  |     Q   |          |          | V        |
26+45      15.4308      3.71  |     Q   |          |          |  V       |
26+50      15.4563      3.71  |     Q   |          |          |  V       |
26+55      15.4819      3.71  |     Q   |          |          |  V       |
27+ 0      15.5075      3.71  |     Q   |          |          |  V       |
27+ 5      15.5330      3.71  |     Q   |          |          |  V       |
27+10      15.5586      3.71  |     Q   |          |          |  V       |
27+15      15.5841      3.71  |     Q   |          |          |  V       |
27+20      15.6097      3.71  |     Q   |          |          |  V       |
27+25      15.6352      3.71  |     Q   |          |          |  V       |
27+30      15.6608      3.71  |     Q   |          |          |  V       |
27+35      15.6863      3.71  |     Q   |          |          |  V       |
```

27+40	15.7119	3.71	Q			V	
27+45	15.7374	3.71	Q			V	
27+50	15.7630	3.71	Q			V	
27+55	15.7885	3.71	Q			V	
28+ 0	15.8141	3.71	Q			V	
28+ 5	15.8396	3.71	Q			V	
28+10	15.8652	3.71	Q			V	
28+15	15.8907	3.71	Q			V	
28+20	15.9163	3.71	Q			V	
28+25	15.9418	3.71	Q			V	
28+30	15.9674	3.71	Q			V	
28+35	15.9929	3.71	Q			V	
28+40	16.0185	3.71	Q			V	
28+45	16.0440	3.71	Q			V	
28+50	16.0696	3.71	Q			V	
28+55	16.0951	3.71	Q			V	
29+ 0	16.1207	3.71	Q			V	
29+ 5	16.1462	3.71	Q			V	
29+10	16.1718	3.71	Q			V	
29+15	16.1973	3.71	Q			V	
29+20	16.2229	3.71	Q			V	
29+25	16.2484	3.71	Q			V	
29+30	16.2740	3.71	Q			V	
29+35	16.2995	3.71	Q			V	
29+40	16.3251	3.71	Q			V	
29+45	16.3506	3.71	Q			V	
29+50	16.3762	3.71	Q			V	
29+55	16.4017	3.71	Q			V	
30+ 0	16.4273	3.71	Q			V	
30+ 5	16.4528	3.71	Q			V	
30+10	16.4784	3.71	Q			V	
30+15	16.5039	3.71	Q			V	
30+20	16.5295	3.71	Q			V	
30+25	16.5550	3.71	Q			V	
30+30	16.5806	3.71	Q			V	
30+35	16.6061	3.71	Q			V	
30+40	16.6317	3.71	Q			V	
30+45	16.6572	3.71	Q			V	
30+50	16.6828	3.71	Q			V	
30+55	16.7083	3.71	Q			V	
31+ 0	16.7339	3.71	Q			V	
31+ 5	16.7594	3.71	Q			V	
31+10	16.7850	3.71	Q			V	
31+15	16.8106	3.71	Q			V	
31+20	16.8361	3.71	Q			V	
31+25	16.8617	3.71	Q			V	
31+30	16.8872	3.71	Q			V	
31+35	16.9128	3.71	Q			V	
31+40	16.9383	3.71	Q			V	
31+45	16.9639	3.71	Q			V	
31+50	16.9894	3.71	Q			V	
31+55	17.0150	3.71	Q			V	
32+ 0	17.0405	3.71	Q			V	
32+ 5	17.0661	3.71	Q			V	
32+10	17.0916	3.71	Q			V	
32+15	17.1172	3.71	Q			V	
32+20	17.1427	3.71	Q			V	
32+25	17.1683	3.71	Q			V	
32+30	17.1938	3.71	Q			V	
32+35	17.2194	3.71	Q			V	
32+40	17.2449	3.71	Q			V	
32+45	17.2705	3.71	Q			V	
32+50	17.2960	3.71	Q			V	

```
   32+55      17.3216      3.71  |      Q   |          |          |       V  |
   33+ 0      17.3471      3.71  |      Q   |          |          |       V  |
   33+ 5      17.3727      3.71  |      Q   |          |          |       V  |
   33+10      17.3982      3.71  |      Q   |          |          |       V  |
   33+15      17.4238      3.71  |      Q   |          |          |       V  |
   33+20      17.4493      3.71  |      Q   |          |          |       V  |
   33+25      17.4749      3.71  |      Q   |          |          |       V  |
   33+30      17.5004      3.71  |      Q   |          |          |       V  |
   33+35      17.5260      3.71  |      Q   |          |          |       V  |
   33+40      17.5515      3.71  |      Q   |          |          |       V  |
   33+45      17.5771      3.71  |      Q   |          |          |       V  |
   33+50      17.6026      3.71  |      Q   |          |          |       V  |
   33+55      17.6282      3.71  |      Q   |          |          |       V  |
   34+ 0      17.6537      3.71  |      Q   |          |          |       V  |
   34+ 5      17.6793      3.71  |      Q   |          |          |       V  |
   34+10      17.7048      3.71  |      Q   |          |          |       V  |
   34+15      17.7304      3.71  |      Q   |          |          |       V  |
   34+20      17.7559      3.71  |      Q   |          |          |        V |
   34+25      17.7815      3.71  |      Q   |          |          |        V |
   34+30      17.8070      3.71  |      Q   |          |          |        V |
   34+35      17.8326      3.71  |      Q   |          |          |        V |
   34+40      17.8581      3.71  |      Q   |          |          |        V |
   34+45      17.8837      3.71  |      Q   |          |          |        V |
   34+50      17.9092      3.71  |      Q   |          |          |        V |
   34+55      17.9348      3.71  |      Q   |          |          |        V |
   35+ 0      17.9603      3.71  |      Q   |          |          |        V |
   35+ 5      17.9859      3.71  |      Q   |          |          |        V |
   35+10      18.0114      3.71  |      Q   |          |          |        V |
   35+15      18.0370      3.71  |      Q   |          |          |        V |
   35+20      18.0625      3.71  |      Q   |          |          |        V |
   35+25      18.0881      3.71  |      Q   |          |          |        V |
   35+30      18.1136      3.71  |      Q   |          |          |        V |
   35+35      18.1388      3.66  |      Q   |          |          |        V |
   35+40      18.1629      3.49  |      Q   |          |          |        V |
   35+45      18.1859      3.34  |      Q   |          |          |        V |
   35+50      18.2079      3.19  |      Q   |          |          |        V |
   35+55      18.2289      3.05  |     Q    |          |          |         V|
   36+ 0      18.2489      2.91  |     Q    |          |          |         V|
----------------------------------------------------------------------
      ****************************HYDROGRAPH DATA****************************
                  Number of intervals =   563
                  Time interval =    5.0 (Min.)
                  Maximum/Peak flow rate =       21.238 (CFS)
                  Total volume =      18.677 (Ac.Ft)
            Status of hydrographs being held in storage
                        Stream 1  Stream 2  Stream 3  Stream 4  Stream 5
            Peak (CFS)      0.000     0.000     0.000     0.000     0.000
            Vol (Ac.Ft)      0.000     0.000     0.000     0.000     0.000
      ************************************************************************

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

HOLLY STREET TRUCK AND TRAILER PARKING LOT
INFILTRATION OUTFLOW CALCULATION

DMA "A" - SOUTHWEST CHAMBER

Bottom Suface area of Infiltration Basin	49,459	SF
Bottom Surface area of Subsurface System	-	SF
Total Subsurface Area for Infiltration	*49,459*	SF
Adjusted Infiltration Rate	3.24	in/hr
	0.2700	ft/hr
Flow Rate for Infiltration	*13,353.85*	CF/hr
Flow Rate for Infiltration	***3.71***	**CFS**

Cedar Avenue Technology Park
MULTI-STAGE OUTLET STRUCTURE OUTFLOW CALCULATION

BASIN "A"

Orfice Equation: $Q = CA(2gh)^{0.5}$

Diameter of Holes	10	inches
Area of Hole	*0.545*	SF
Number of Holes per Row	4	
Number of Rows	1	
Area of Holes per Row	*2.18*	SF
Orfice Coeffcient, C_d	0.6	
Invert Elevation of Lowest Hole	**829**	FT
Water Quality/DCV Pond Elevation (Min.)	**829**	FT
Bottom of Basin/Chamber	826	FT
Horizontal Space Between edge of Holes	10	inches

Orifice Outflow:

WSE	H	h1	h2	Q_1	Q_2	Q_{TOTAL}
833.50	7.50	4.08	0.00	21.23	0.00	21.23
833.00	7.00	3.58	0.00	19.89	0.00	19.89
832.50	6.50	3.08	0.00	18.45	0.00	18.45
832.00	6.00	2.58	0.00	16.88	0.00	16.88
831.50	5.50	2.08	0.00	15.16	0.00	15.16
831.00	5.00	1.58	0.00	13.22	0.00	13.22
830.50	4.50	1.08	0.00	10.93	0.00	10.93
830.00	4.00	0.58	0.00	8.02	0.00	8.02
829.50	3.50	0.08	0.00	3.03	0.00	3.03
829.00	3.00	0.00	0.00	0.00	0.00	0.00
828.50	2.50	0.00	0.00	0.00	0.00	0.00
828.00	2.00	0.00	0.00	0.00	0.00	0.00
827.50	1.50	0.00	0.00	0.00	0.00	0.00
827.00	1.00	0.00	0.00	0.00	0.00	0.00
826.50	0.50	0.00	0.00	0.00	0.00	0.00
826.00	0.00	0.00	0.00	0.00	0.00	0.00

Weir Equation: $Q = C_wLH^{3/2}$

	WEIR 1	**WEIR 2**
Horiz. weir length, L (ft)	35	0
Weir Elevation (ft)	**832.50**	**0.00**
Coeficient, C_w	3	0

Cedar Avenue Technology Park
MULTI-STAGE OUTLET STRUCTURE OUTFLOW CALCULATION

BASIN "A"

Weir Overflow for 100 year, 1-hr storm:

Head at Emergency Overflow Weir

*Q100yr	$H_{weir\ 1}$	$Q_{Weir\ 1}$
101.35	0.98	101.35

* 100yr-24hr storm by-pass; where Qyr-24hr = 101.35 cfs

Weir Outflow:

WSE	$H_{weir\ 1}$	$Q_{Weir\ 1}$	$H_{weir\ 2}$	$Q_{Weir\ 2}$	Q_{TOTAL}
833.50	1.00	105.00	0.00	0.00	105.00
833.00	0.50	37.12	0.00	0.00	37.12
832.50	0.00	0.00	0.00	0.00	0.00

Note: Weir 1 will be used for Emergency Overflow by-pass of Q100yr-24hr storm = 101.35 cfs

Multi-stage Outlets Total Outflow:

WSE	$Q_{orifice}$	Q_{weir}	Q_{TOTAL}
833.50	21.23	105.00	126.23
833.00	19.89	37.12	57.01
832.50	18.45	0.00	18.45
832.00	16.88	0.00	16.88
831.50	15.16	0.00	15.16
831.00	13.22	0.00	13.22
830.50	10.93	0.00	10.93
830.00	8.02	0.00	8.02
829.50	3.03	0.00	3.03
829.00	0.00	0.00	0.00
828.50	0.00	0.00	0.00
828.00	0.00	0.00	0.00
827.50	0.00	0.00	0.00
827.00	0.00	0.00	0.00
826.50	0.00	0.00	0.00
826.00	0.00	0.00	0.00

Basin Stage-Storage & Discharge Rating Curve

Elevation (ft)	Infiltration Basin Volume (ft3)	Subsurface System Volume (ft3)**	Total Storage Volume (ft3)	Depth Number	Depth	Storage Volume (ac- ft)	Total Outflow (ft3/s)
833.50	442,223.79		442,223.79	16	7.50	10.152	129.94
833.00	407,428.39		407,428.39	15	7.00	9.353	60.72
832.50	373,422.73		373,422.73	14	6.50	8.573	22.16
832.00	340,199.76		340,199.76	13	6.00	7.810	20.59
831.50	307,752.40		307,752.40	12	5.50	7.065	18.87
831.00	276,073.58		276,073.58	11	5.00	6.338	16.93
830.50	245,156.23		245,156.23	10	4.50	5.628	14.64
830.00	214,993.28		214,993.28	9	4.00	4.936	11.73
829.50	185,577.67		185,577.67	8	3.50	4.260	6.74
829.00	156,902.32		156,902.32	7	3.00	3.602	3.71
828.50	128,960.17		128,960.17	6	2.50	2.961	3.71
828.00	101,744.16		101,744.16	5	2.00	2.336	3.71
827.50	75,247.20		75,247.20	4	1.50	1.727	3.71
827.00	49,462.23		49,462.23	3	1.00	1.135	3.71
826.50	24,382.19		24,382.19	2	0.50	0.560	3.71
826.00	0.00		0.00	1	0.00	0.000	3.71

Water Quality Volume = 829.00 maximum pond depth required for DCV
*Design Infiltration (cfs) 3.71

* Infiltration rate = subsurface area x design infiltration rate converted to cfs
** Storage volume per StormTech-ADS spreadsheet

HOLLY STREET: PRELIMINARY BASIN STAGE-STORAGE RATING TABLE

CALCULATION OF BASIN VOLUMES IS BASED ON THE "DOUBLE END AREA" METHOD
VOLUME EQUATION, V= [(A1+A2)/2]*Z

DETENTION BASIN "A"

STAGE NO.	CONTOUR ELEVATION (FT)	ELEVATION INCREASE-"Z" (FT)	AREA PER STAGE (FT^2)	VOLUME PER STAGE (CF)	TOTAL VOLUME (CF)	TOTAL VOLUME (AC-FT)
1	826	0	48,070.06	0.00	0.00	0.000
2	826.5	0.5	49,458.70	24,382.19	24,382.19	0.560
3	827	1	50,861.47	25,080.04	49,462.23	1.135
4	827.5	1.5	52,278.39	25,784.97	75,247.20	1.727
5	828	2	53,709.44	26,496.96	101,744.16	2.336
6	828.5	2.5	55,154.63	27,216.02	128,960.17	2.961
7	829	3	56,613.96	27,942.15	156,902.32	3.602
8	829.5	3.5	58,087.42	28,675.35	185,577.67	4.260
9	830	4	59,575.03	29,415.61	214,993.28	4.936
10	830.5	4.5	61,076.76	30,162.95	245,156.23	5.628
11	831	5	62,592.64	30,917.35	276,073.58	6.338
12	831.5	5.5	64,122.65	31,678.82	307,752.40	7.065
13	832	6	65,666.80	32,447.36	340,199.76	7.810
14	832.5	6.5	67,225.09	33,222.97	373,422.73	8.573
15	833	7	68,797.52	34,005.65	407,428.39	9.353
16	833.5	7.5	70,384.08	34,795.40	442,223.79	10.152

APPENDIX G

United States Department of Agriculture

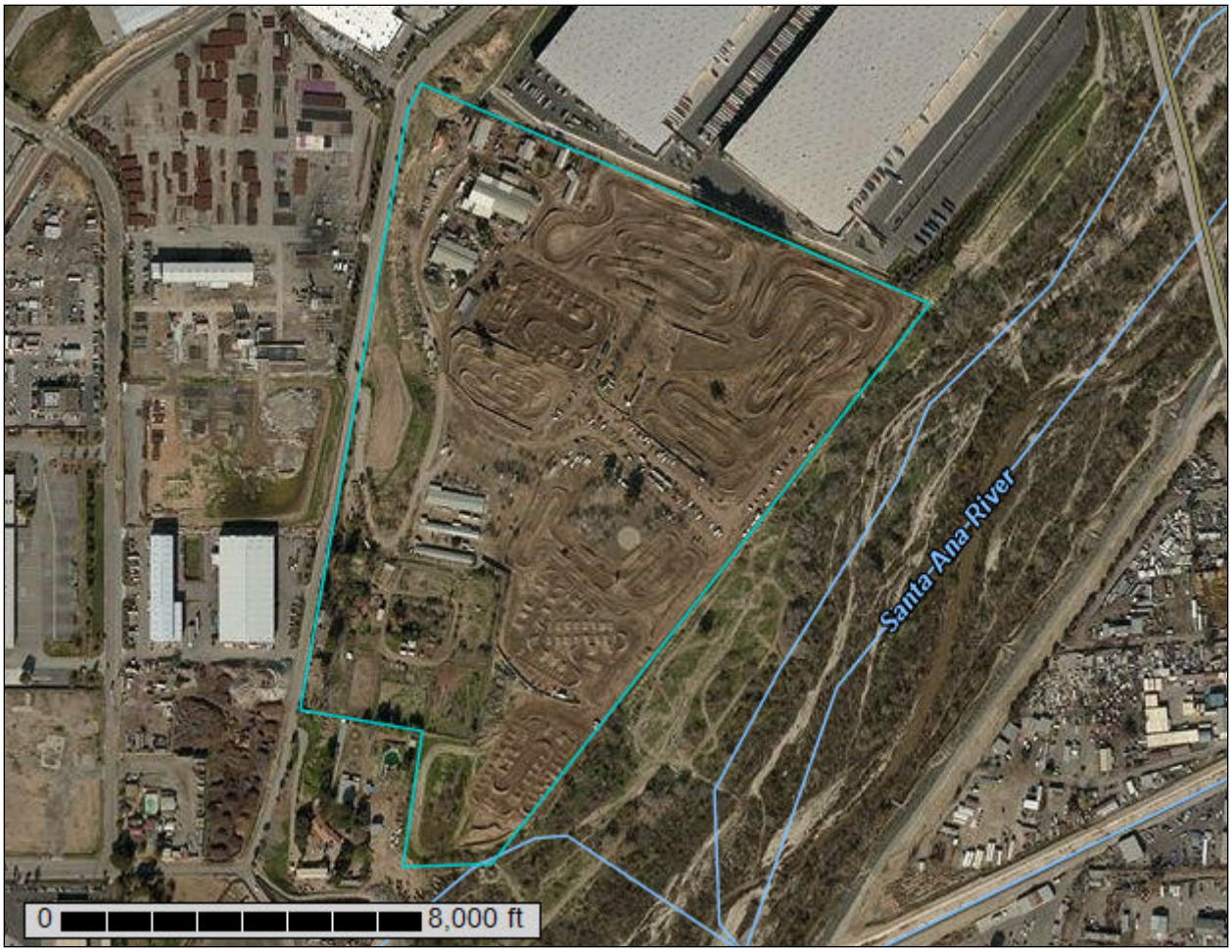
Natural Resources Conservation Service

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, and Western Riverside Area, California

Holly Street

FMCIVIL ENGINEERS INC.



July 20, 2018

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.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require

alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD). To file a complaint of discrimination, write to USDA, Director, Office of Civil Rights, 1400 Independence Avenue, S.W., Washington, D.C. 20250-9410 or call (800) 795-3272 (voice) or (202) 720-6382 (TDD). USDA is an equal opportunity provider and employer.

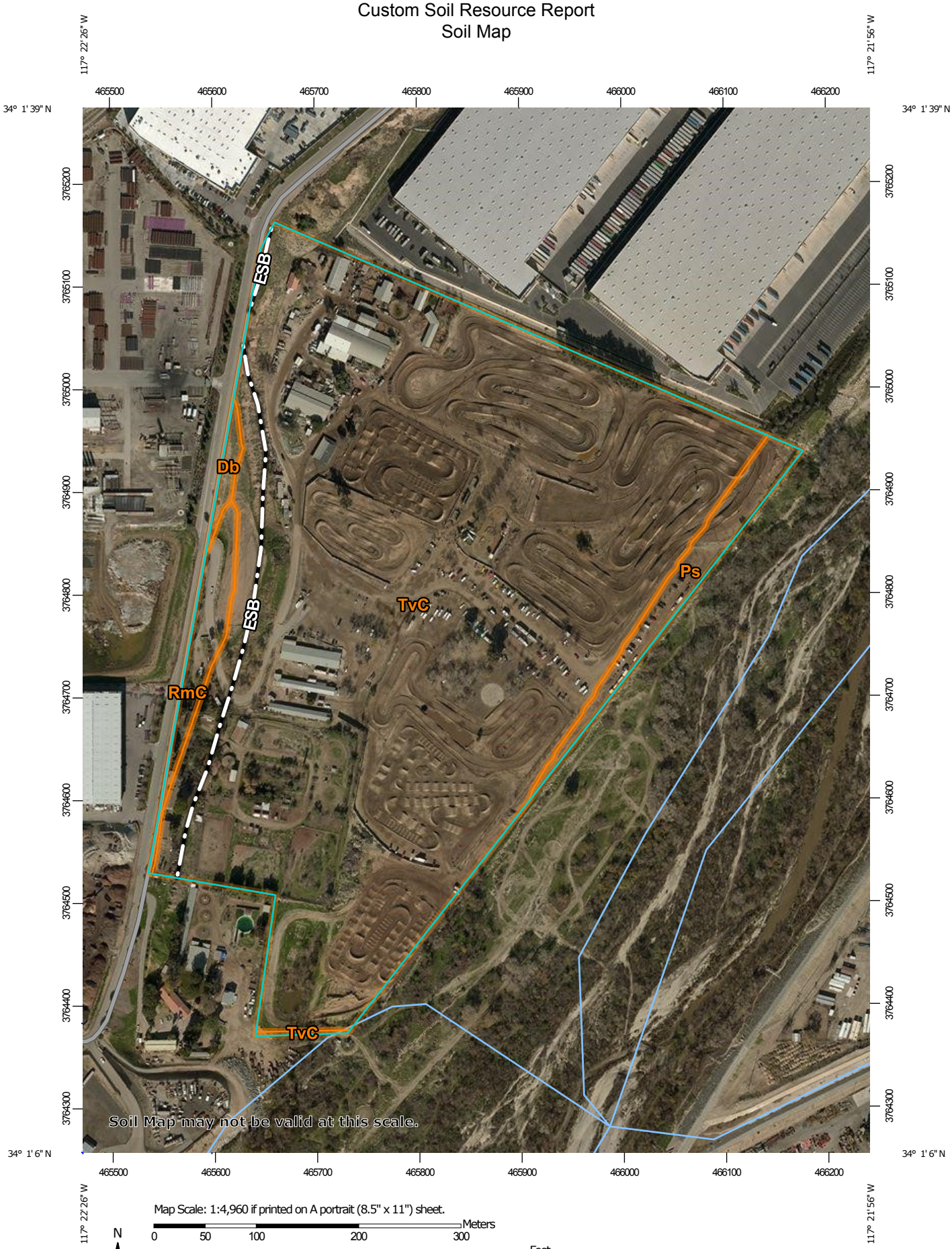
Contents

Preface..... 2
Soil Map..... 5
Soil Map.....6
Legend.....7
Map Unit Legend..... 9
Map Unit Descriptions..... 9
San Bernardino County Southwestern Part, California..... 11
Db—Delhi fine sand.....11
Ps—Psamments, Fluvents and Frequently flooded soils..... 12
RmC—Ramona sandy loam, 2 to 9 percent slopes, MLRA 19..... 13
TvC—Tujunga gravelly loamy sand, 0 to 9 percent slopes..... 15
Western Riverside Area, California.....17
TvC—Tujunga loamy sand, channeled, 0 to 8 percent slopes.....17
Soil Information for All Uses.....19
Soil Reports.....19
Soil Physical Properties..... 19
Engineering Properties (Holly Street).....19
References.....25
Glossary.....27

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: 1:4,960 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 50 100 200 300

Feet: 0 200 400 800 1200

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 scales ranging from 1:15,800 to 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 9, Sep 11, 2017

Soil Survey Area: Western Riverside Area, California
Survey Area Data: Version 10, Sep 12, 2017

Your area of interest (AOI) includes more than one soil survey area. These survey areas may have been mapped at different scales, with a different land use in mind, at different times, or at different levels of detail. This may result in map unit symbols, soil properties, and interpretations that do not completely agree across soil survey area boundaries.

MAP LEGEND

MAP INFORMATION

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

Date(s) aerial images were photographed: Jan 5, 2015—Jan 18, 2015

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

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
Db	Delhi fine sand	0.4	0.6%
Ps	Psamments, Fluvents and Frequently flooded soils	2.3	3.5%
RmC	Ramona sandy loam, 2 to 9 percent slopes, MLRA 19	1.7	2.5%
TvC	Tujunga gravelly loamy sand, 0 to 9 percent slopes	62.2	93.3%
Subtotals for Soil Survey Area		**66.6**	**99.9%**
Totals for Area of Interest		**66.7**	**100.0%**

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
TvC	Tujunga loamy sand, channeled, 0 to 8 percent slopes	0.1	0.1%
Subtotals for Soil Survey Area		**0.1**	**0.1%**
Totals for Area of Interest		**66.7**	**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
Natural 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 storage in profile: 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

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

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

Ps—Psamments, Fluvents and Frequently flooded soils

Map Unit Setting
National map unit symbol: hckh
Elevation: 10 to 1,500 feet
Mean annual precipitation: 10 to 25 inches
Mean annual air temperature: 59 to 64 degrees F
Frost-free period: 250 to 350 days
Farmland classification: Not prime farmland

Map Unit Composition
Psamments and similar soils: 50 percent
Fluvents and similar soils: 50 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Psamments

Setting
Landform: Drainageways
Landform position (three-dimensional): Riser
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Sandy alluvium

Typical profile
A - 0 to 12 inches: sand
C1 - 12 to 48 inches: fine sand
C2 - 48 to 60 inches: stratified gravelly sand to gravelly loamy sand

Properties and qualities
Slope: 0 to 5 percent
Depth to restrictive feature: More than 80 inches
Natural 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: Frequent
Frequency of ponding: None
Available water storage in profile: Low (about 4.1 inches)

Interpretive groups
Land capability classification (irrigated): None specified

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

Description of Fluvents

Setting
Landform: Drainageways
Landform position (three-dimensional): Riser
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium

Typical profile
A - 0 to 10 inches: gravelly sand
C1 - 10 to 30 inches: stratified gravelly sand to gravelly loam
C2 - 30 to 60 inches: stratified gravelly sand to gravelly loam

Properties and qualities
Slope: 0 to 5 percent
Depth to restrictive feature: More than 80 inches
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: Frequent
Frequency of ponding: None
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: Moderate (about 6.1 inches)

Interpretive groups
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4w
Hydrologic Soil Group: A
Hydric soil rating: Yes

RmC—Ramona sandy loam, 2 to 9 percent slopes, MLRA 19

Map Unit Setting
National map unit symbol: 2x530
Elevation: 490 to 3,010 feet
Mean annual precipitation: 10 to 29 inches
Mean annual air temperature: 62 to 65 degrees F
Frost-free period: 260 to 365 days
Farmland classification: Prime farmland if irrigated

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

Description of Ramona

Setting

Landform: Alluvial fans, terraces
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Riser
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from granite

Typical profile

Ap - 0 to 12 inches: sandy loam
A - 12 to 23 inches: fine sandy loam
Bw - 23 to 32 inches: loam
Bt - 32 to 54 inches: clay loam
C - 54 to 60 inches: sandy loam

Properties and qualities

Slope: 2 to 9 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: High (about 9.1 inches)

Interpretive groups

Land capability classification (irrigated): 2e
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C
Hydric soil rating: No

Minor Components

Greenfield

Percent of map unit: 10 percent
Landform: Alluvial fans, terraces
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Riser
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Monserate

Percent of map unit: 5 percent
Landform: Terraces, alluvial fans
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Riser
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

TvC—Tujunga gravelly loamy sand, 0 to 9 percent slopes

Map Unit Setting

National map unit symbol: hcl2
Elevation: 10 to 1,500 feet
Mean annual precipitation: 10 to 25 inches
Mean annual air temperature: 59 to 64 degrees F
Frost-free period: 250 to 350 days
Farmland classification: Not prime farmland

Map Unit Composition

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

Description of Tujunga

Setting

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

Typical profile

H1 - 0 to 36 inches: gravelly loamy sand
H2 - 36 to 60 inches: gravelly sand

Properties and qualities

Slope: 0 to 9 percent
Depth to restrictive feature: More than 80 inches
Natural 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 storage in profile: Low (about 3.8 inches)

Interpretive groups

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

Minor Components

Unnamed

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

Soboba, gravelly loamy sand

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

Delhi, fine sand

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

Western Riverside Area, California

TvC—Tujunga loamy sand, channeled, 0 to 8 percent slopes

Map Unit Setting

National map unit symbol: hczl
Elevation: 10 to 2,900 feet
Mean annual precipitation: 8 to 25 inches
Mean annual air temperature: 46 to 64 degrees F
Frost-free period: 110 to 350 days
Farmland classification: Not prime farmland

Map Unit Composition

Tujunga and similar soils: 75 percent
Minor components: 25 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Tujunga

Setting

Landform: Alluvial fans, flood plains
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 10 inches: loamy sand
H2 - 10 to 60 inches: loamy sand

Properties and qualities

Slope: 0 to 8 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: 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: Occasional
Frequency of ponding: None
Available water storage in profile: Low (about 4.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7w
Hydrologic Soil Group: A
Ecological site: SANDY ALLUVIAL (1975) (R019XD069CA)
Hydric soil rating: No

Minor Components

Riverwash

Percent of map unit: 10 percent
Landform: Drainageways
Hydric soil rating: Yes

Delhi

Percent of map unit: 10 percent
Hydric soil rating: No

Soboba

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

References

American Association of State Highway and Transportation Officials (AASHTO). 2004. Standard specifications for transportation materials and methods of sampling and testing. 24th edition.

American Society for Testing and Materials (ASTM). 2005. Standard classification of soils for engineering purposes. ASTM Standard D2487-00.

Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of wetlands and deep-water habitats of the United States. U.S. Fish and Wildlife Service FWS/OBS-79/31.

Federal Register. July 13, 1994. Changes in hydric soils of the United States.

Federal Register. September 18, 2002. Hydric soils of the United States.

Hurt, G.W., and L.M. Vasilas, editors. Version 6.0, 2006. Field indicators of hydric soils in the United States.

National Research Council. 1995. Wetlands: Characteristics and boundaries.

Soil Survey Division Staff. 1993. Soil survey manual. Soil Conservation Service. U.S. Department of Agriculture Handbook 18. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_054262

Soil Survey Staff. 1999. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. 2nd edition. Natural Resources Conservation Service, U.S. Department of Agriculture Handbook 436. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053577

Soil Survey Staff. 2010. Keys to soil taxonomy. 11th edition. U.S. Department of Agriculture, Natural Resources Conservation Service. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053580

Tiner, R.W., Jr. 1985. Wetlands of Delaware. U.S. Fish and Wildlife Service and Delaware Department of Natural Resources and Environmental Control, Wetlands Section.

United States Army Corps of Engineers, Environmental Laboratory. 1987. Corps of Engineers wetlands delineation manual. Waterways Experiment Station Technical Report Y-87-1.

United States Department of Agriculture, Natural Resources Conservation Service. National forestry manual. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/home/?cid=nrcs142p2_053374

United States Department of Agriculture, Natural Resources Conservation Service. National range and pasture handbook. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/landuse/rangepasture/?cid=stelprdb1043084

United States Department of Agriculture, Natural Resources Conservation Service. National soil survey handbook, title 430-VI. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/scientists/?cid=nrcs142p2_054242

United States Department of Agriculture, Natural Resources Conservation Service. 2006. Land resource regions and major land resource areas of the United States, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture Handbook 296. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053624

United States Department of Agriculture, Soil Conservation Service. 1961. Land capability classification. U.S. Department of Agriculture Handbook 210. http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_052290.pdf

NOAA Atlas 14, Volume 6, Version 2
Location name: Jurupa Valley, California, USA*
Latitude: 34.0224°, Longitude: -117.3702°
Elevation: 830.57 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	0.096 (0.080-0.116)	0.123 (0.103-0.149)	0.160 (0.133-0.194)	0.190 (0.156-0.233)	0.232 (0.184-0.294)	0.264 (0.206-0.343)	0.298 (0.226-0.396)	0.333 (0.245-0.456)	0.381 (0.269-0.545)	0.419 (0.286-0.622)
10-min	0.137 (0.114-0.166)	0.177 (0.147-0.214)	0.229 (0.190-0.279)	0.272 (0.224-0.334)	0.332 (0.264-0.422)	0.379 (0.295-0.492)	0.427 (0.324-0.568)	0.477 (0.351-0.654)	0.546 (0.386-0.781)	0.601 (0.409-0.891)
15-min	0.166 (0.138-0.201)	0.214 (0.178-0.259)	0.277 (0.230-0.337)	0.329 (0.271-0.404)	0.402 (0.319-0.510)	0.458 (0.356-0.595)	0.516 (0.391-0.687)	0.577 (0.425-0.790)	0.660 (0.466-0.945)	0.727 (0.495-1.08)
30-min	0.250 (0.208-0.302)	0.322 (0.268-0.390)	0.417 (0.347-0.508)	0.496 (0.409-0.609)	0.605 (0.481-0.769)	0.690 (0.537-0.896)	0.777 (0.590-1.03)	0.869 (0.640-1.19)	0.995 (0.702-1.42)	1.10 (0.746-1.62)
60-min	0.365 (0.305-0.443)	0.471 (0.392-0.571)	0.611 (0.507-0.743)	0.726 (0.598-0.891)	0.885 (0.704-1.12)	1.01 (0.785-1.31)	1.14 (0.863-1.51)	1.27 (0.937-1.74)	1.46 (1.03-2.08)	1.60 (1.09-2.38)
2-hr	0.528 (0.440-0.640)	0.673 (0.561-0.817)	0.864 (0.718-1.05)	1.02 (0.840-1.25)	1.23 (0.981-1.57)	1.40 (1.09-1.82)	1.57 (1.19-2.09)	1.74 (1.29-2.39)	1.98 (1.40-2.84)	2.17 (1.48-3.22)
3-hr	0.650 (0.542-0.788)	0.826 (0.688-1.00)	1.06 (0.878-1.29)	1.25 (1.02-1.53)	1.50 (1.19-1.91)	1.70 (1.32-2.21)	1.90 (1.44-2.53)	2.11 (1.55-2.89)	2.39 (1.69-3.42)	2.61 (1.78-3.88)
6-hr	0.905 (0.755-1.10)	1.15 (0.958-1.40)	1.47 (1.22-1.79)	1.73 (1.43-2.13)	2.08 (1.66-2.65)	2.36 (1.83-3.06)	2.63 (1.99-3.50)	2.91 (2.15-3.99)	3.29 (2.33-4.71)	3.59 (2.45-5.33)
12-hr	1.20 (0.999-1.45)	1.53 (1.28-1.86)	1.97 (1.63-2.40)	2.32 (1.91-2.85)	2.80 (2.23-3.55)	3.16 (2.46-4.10)	3.53 (2.68-4.70)	3.91 (2.88-5.36)	4.42 (3.12-6.32)	4.82 (3.28-7.14)
24-hr	1.59 (1.41-1.83)	2.06 (1.82-2.38)	2.67 (2.35-3.09)	3.16 (2.77-3.69)	3.83 (3.24-4.61)	4.34 (3.60-5.34)	4.85 (3.93-6.11)	5.38 (4.24-6.97)	6.10 (4.61-8.22)	6.65 (4.86-9.27)
2-day	1.93 (1.71-2.22)	2.54 (2.25-2.94)	3.35 (2.95-3.87)	4.00 (3.50-4.67)	4.89 (4.14-5.90)	5.58 (4.63-6.86)	6.27 (5.08-7.90)	6.98 (5.50-9.04)	7.95 (6.02-10.7)	8.70 (6.37-12.1)
3-day	2.06 (1.83-2.38)	2.76 (2.44-3.19)	3.69 (3.25-4.26)	4.44 (3.88-5.18)	5.47 (4.63-6.59)	6.27 (5.20-7.71)	7.08 (5.73-8.91)	7.92 (6.24-10.2)	9.06 (6.86-12.2)	9.95 (7.28-13.9)
4-day	2.22 (1.96-2.55)	3.00 (2.66-3.47)	4.04 (3.56-4.67)	4.89 (4.28-5.70)	6.05 (5.13-7.29)	6.96 (5.77-8.55)	7.88 (6.38-9.92)	8.84 (6.96-11.4)	10.1 (7.68-13.7)	11.2 (8.17-15.6)
7-day	2.54 (2.25-2.93)	3.49 (3.09-4.03)	4.75 (4.19-5.50)	5.79 (5.07-6.76)	7.22 (6.11-8.70)	8.33 (6.91-10.2)	9.47 (7.67-11.9)	10.7 (8.40-13.8)	12.3 (9.30-16.6)	13.6 (9.93-18.9)
10-day	2.75 (2.43-3.17)	3.81 (3.37-4.40)	5.23 (4.61-6.05)	6.39 (5.59-7.46)	8.00 (6.78-9.64)	9.26 (7.68-11.4)	10.6 (8.55-13.3)	11.9 (9.38-15.4)	13.8 (10.4-18.6)	15.2 (11.2-21.3)
20-day	3.33 (2.95-3.84)	4.67 (4.13-5.39)	6.46 (5.70-7.48)	7.96 (6.96-9.28)	10.0 (8.49-12.1)	11.7 (9.67-14.3)	13.3 (10.8-16.8)	15.1 (11.9-19.6)	17.6 (13.3-23.8)	19.6 (14.3-27.3)
30-day	3.96 (3.51-4.57)	5.55 (4.91-6.40)	7.68 (6.77-8.89)	9.46 (8.28-11.0)	12.0 (10.1-14.4)	13.9 (11.6-17.1)	16.0 (13.0-20.2)	18.2 (14.3-23.5)	21.3 (16.1-28.7)	23.7 (17.4-33.1)
45-day	4.77 (4.22-5.49)	6.60 (5.84-7.62)	9.09 (8.01-10.5)	11.2 (9.78-13.0)	14.1 (12.0-17.0)	16.5 (13.7-20.3)	19.0 (15.4-23.9)	21.6 (17.0-28.0)	25.3 (19.2-34.2)	28.4 (20.7-39.5)
60-day	5.59 (4.95-6.44)	7.64 (6.75-8.81)	10.4 (9.19-12.1)	12.8 (11.2-14.9)	16.1 (13.7-19.4)	18.8 (15.6-23.1)	21.6 (17.5-27.2)	24.7 (19.4-31.9)	29.0 (21.9-39.1)	32.5 (23.8-45.3)

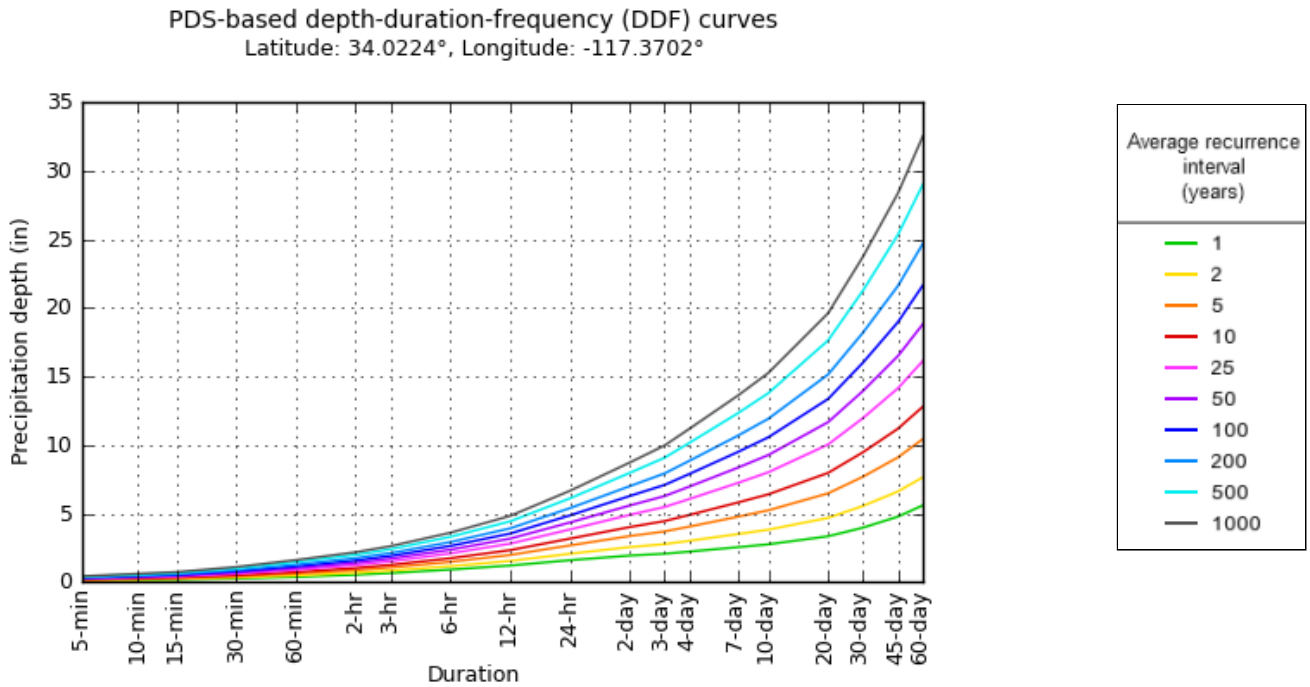
[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

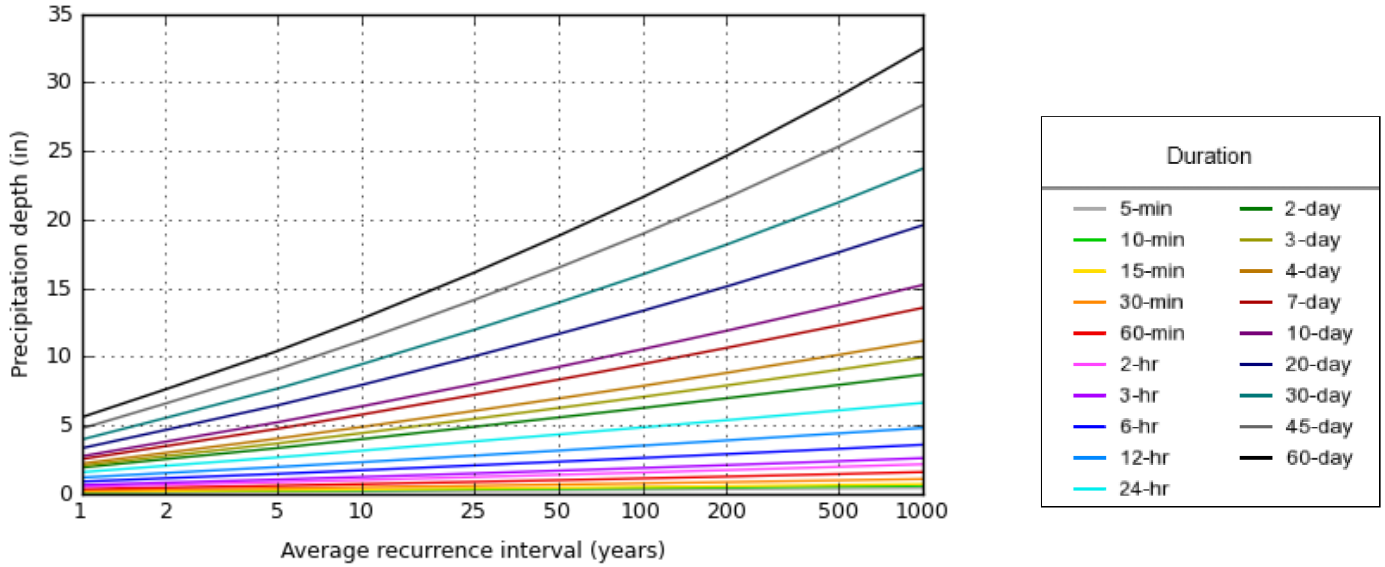
Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper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

Please refer to NOAA Atlas 14 document for more information.

Back to Top

PF graphical





NOAA Atlas 14, Volume 6, Version 2

Created (GMT): Fri Jul 20 19:08:43 2018

Back to Top

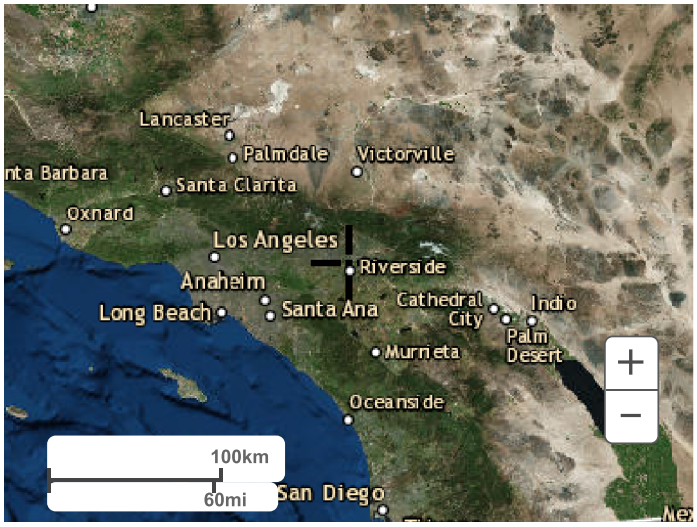
Maps & aerials

Small scale terrain

Large scale terrain

Large scale map

Large scale aerial



Back to Top

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

Disclaimer

February 8, 2017

Howard Industrial Partners
155 N. Riverview Drive
Anaheim Hills, California 92808

Attention: Mr. Tim Howard

Project No.: **17G104-2**

Subject: **Results of Infiltration Testing**
Proposed Commercial/Industrial Building
Holly Street, North of Wilson Street
San Bernardino County, California

References: Geotechnical Investigation and Liquefaction Evaluation, Proposed Milestone Ranch Warehouse, Holly Street, North of Wilson Street, San Bernardino County, California, prepared for Alere Property Group, LLC by Southern California Geotechnical, Inc. (SCG), SCG Project No. 11G184-1, dated December 5, 2011.

Geotechnical Investigation, Proposed Commercial/Industrial Building, Holly Street, North of Wilson Street, San Bernardino County, California, prepared by SCG, for Howard Industrial Partners, SCG project No. 17G104-1.

Mr. Howard:

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. 16P466 dated December 23, 2016. The scope of services included surface reconnaissance, subsurface exploration, field testing, and engineering analysis to determine the infiltration rate of the onsite soils. The infiltration testing was performed in general accordance with ASTM Test Method D-3385-03, Standard Test Method for Infiltration Rate of Soils in Field Using Double Ring Infiltrometer.

Site and Project Description

The subject site is located on the east side of Holly Street, approximately 560 feet north of the intersection of Holly Street and Wilson Street, in an unincorporated portion of San Bernardino County, California. The site is bounded to the north by two (2) existing commercial/industrial buildings, to the east by the Santa Ana River, to the south by an existing single family residence, and to the west by Holly Street. The general location of the site is illustrated on the Site Location Map, included as Plate 1 of this report.

The subject site consists of several rectangular and irregular shaped parcels that total 64.8± acres in size. The majority of the site is developed as the Milestone MX Park, utilized as an off-road motorcycle race course. The Milestone MX Park features at least eight (8) off-road motorcycle race tracks located in the northern, eastern, and central portions of the site. The race tracks consist of

dirt road courses with earthen berms ranging from 1 to 10± feet in height. The northwestern portion of the site is developed with at least ten (10) structures. These structures consist of single family residences, barns, stables, storage sheds, and canopies. Three (3) structures were observed in the west-central portion of the site. Two (2) of these structures are approximately 25 feet wide and 200 feet long and the other structure is 50 feet wide and 200 feet long. We assume that these structures are used for storage. The southwestern portion of the site is currently developed with several one-story single family residences and five (5) horse corrals. These single-family residences appear to be of wood frame and stucco construction presumably supported on conventional slab-on-grade foundations. A detention basin is located in the southern area of the site. The bottom of the basin is approximately 5 to 7 feet below the surrounding grades. Ground surface cover throughout the site consists of exposed soil with several large trees in central and southwestern areas of the site.

Topographical information for the subject site was obtained from a conceptual grading plan provided by Michael Baker International, the project civil engineer. This plan indicates that site grades range from an elevation 910± feet mean sea level (msl) at the northwest property corner to an elevation of 819± feet msl at the base of the existing detention basin located in the southern portion of the site. An ascending slope is located along the western side of the site. The slope ranges in height from 45± to 55± feet with inclinations ranging from ½h:1v to 1h:1v. Overall, the site grades generally slope to the south at a gradient of less than 1 to 2± percent.

Proposed Development

The site plan provided to our office by the client indicates that the subject site will be developed with one (1) new commercial/industrial building. The proposed building will be 450,000± ft² in size and will be located in the north-central area of the site. The building will be a single-story structure of concrete tilt-up construction, and may include a second-floor mezzanine. The building will be constructed in a cross-dock configuration with loading docks along the west and east sides of the building.

We understand that the site will utilize on-site infiltration systems to dispose of storm water. Based on conversations with the project civil engineer and review of an infiltration test location plan provided to our office, the proposed infiltration systems will consist of one (1) below-grade chamber system and one (1) detention basin, each located in the southern area of the subject site. The bottom of the detention basin will range from 1 to 6± feet below the existing site grades and the chamber system will extend to a depth of 3 to 5± feet below the existing site grades.

Previous Study

Southern California Geotechnical, Inc. (SCG) previously conducted a geotechnical investigation and liquefaction evaluation within the overall site, which is referenced above. At the time of the previous study, the proposed development for the site consisted of one (1) commercial/industrial building, 1,013,410± ft² in size. As part of this geotechnical investigation, a total of ten (10) borings were drilled to depths of 5 to 50± feet below the previous site grades. In addition to the ten borings, eight (8) test pits were excavated at the site to depths of 6 to 14± feet below site grades. Fill soils were encountered at the ground surface at most of the boring locations and all of the trench locations, extending to depths of 1 to 5½± feet. The fill soils consisted of loose to medium dense silty fine sands and fine to coarse sands with occasional fine gravel. Native alluvial soils were encountered at all of the boring and trench locations, except for two boring locations where the borings were terminated in fill soils at a depth of 5± feet. The near surface alluvial soils consisted of loose to medium dense fine to medium sands and fine to coarse sands, extending to depths of 22± feet. At

greater depths, the alluvial soils consisted of dense to very dense well-graded sands with varying amounts of fine to coarse gravel extending to the maximum depth explored of 50± feet. Based on the water level measurements from the previous borings, the groundwater table was considered to have existed at a depth of 13 to 17± feet at the time of the previous subsurface exploration.

Concurrent Study

The subsurface exploration conducted for this project consisted of two (2) borings (identified as Boring Nos. B-11 and B-12) advanced to depths of 50± feet below the existing site grades. All of the borings were logged during drilling by a member of our staff. In addition to the two borings, four (4) cone penetration test (CPT) soundings were performed at the site.

Native alluvium was encountered at the ground surface at both of the boring locations. The alluvium generally consists of loose to very dense fine sands, fine to coarse sands, silty fine sands, and fine sandy silts with varying fine to coarse gravel content, extending to the maximum depth explored of 50± feet. One of the borings encountered very stiff layers of silty clay and fine sandy clay between depths of 31 and 42± feet. Free water was encountered during drilling within both of the borings. The static groundwater table is considered to have existed at a depth of 9 and 10± feet below existing site grades.

Subsurface Exploration

Scope of Exploration

The subsurface exploration consisted of six (6) backhoe excavated trenches, extending to depths of 1 to 6½± feet below existing site grades. The trenches were logged during excavation by a member of our staff. The approximate locations of the infiltration trenches (identified as I-1 through I-6) are indicated on the Infiltration Test Location Plan, enclosed as Plate 2 of this report.

Geotechnical Conditions

Artificial fill soils were encountered at the ground surface at all but one of the infiltration test trenches, extending to depths of 2 to 5± feet below the existing site grades. The fill soils generally consist of medium stiff fine sandy clays and loose to medium dense silty fine sands, fine to medium sands, and clayey fine to medium sands with varying amounts of medium to coarse sands and fine gravel content. The fill soils possess a disturbed appearance and trace to little debris (Asphaltic concrete and brick fragments, rope, string, plastic, paper), resulting in their classification as artificial fill.

Native alluvial soils were encountered at the ground surface at Infiltration Test No. I-6 and beneath the fill soils at the remaining infiltration trenches, extending to the maximum depth explored of 6½± feet below existing site grades. The native alluvial soils generally consist of loose to medium dense silty fine sands, silty fine to coarse sands, and fine to medium sands with varying amounts of medium to coarse sands and fine to coarse gravel. Free water was not encountered during the excavation of any of the trenches. The Trench Logs, which illustrate the conditions encountered at the trench locations, are included with this report.

Infiltration Testing

We understand that the results of the testing will be used to prepare a preliminary design for the storm water infiltration systems that will be used at the subject site. The infiltration testing was performed in general accordance with ASTM Test Method D-3385-03, Standard Test Method for Infiltration Rate of Soils in Field Using Double Ring Infiltrometer.

Two stainless steel infiltration rings were used for the infiltration testing. The outer infiltration ring is 2 feet in diameter and 20 inches in height. The inner infiltration ring is 1 foot in diameter and 20 inches in height. At the test locations, the outer ring was driven 3± inches into the soil at the base of the trench. The inner ring was centered inside the outer ring and subsequently driven 3± inches into the soil at the base of the trench. The rings were driven into the soil using a ten-pound sledge hammer. The soil surrounding the wall of the infiltration rings was only slightly disturbed during the driving process.

Infiltration Testing Procedure

Infiltration testing was performed at all six (6) of the test locations. The infiltration testing consisted of filling the inner ring and the annular space (the space between the inner and outer rings) with water, approximately 3 to 4± inches above the soil. To prevent the flow of water from one ring to the other, the water level in both the inner ring and the annular space between the rings were maintained using constant-head float valves. The volume of water that was added to maintain a constant head in the inner ring and the annular space during each time interval was determined and recorded. A cap was placed over the rings to minimize the evaporation of water during the test.

The schedule for readings was determined based on the observed soil type at the base of each excavated trench. Based on the existing soils at each infiltration test location, the volumetric measurements were made at 1 and 2 minute increments. The water volume measurements are presented on the spreadsheets enclosed with this report. The infiltration rates for each of the timed intervals are also tabulated on these spreadsheets.

The infiltration rates for the infiltration tests are calculated in centimeters per hour and then converted to inches per hour. The rates are summarized below:

Infiltration Test No.	Depth (feet)	Soil Description	Infiltration Rate (inches/hour)
I-1	3	Silty fine Sand, little medium Sand	6.1
I-2	5	Silty fine to medium Sand, little coarse Sand, trace fine Gravel	17.8
I-3	3	Silty fine to coarse Sand, little to some fine to coarse Gravel	11.3
I-4	4	Fine to coarse Sand, trace fine Gravel	19.4
I-5	6½	Silty fine to medium Sand, little coarse Sand, little fine Gravel	13.4
I-6	1	Silty fine to medium Sand, trace coarse Sand, little fine Gravel	8.1

Laboratory Testing

Grain Size Analysis

The grain size distribution of selected soils from the base of each infiltration test trench has 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 at the end of this report.

Design Recommendations

A total of six (6) infiltration tests were performed at the subject site. As noted above, the calculated infiltration rates at the infiltration test locations range from 6.1 to 19.4 inches per hour. The primary factors affecting the infiltration rates are the varying soil moistures and silt content of the encountered soils, which vary at different depths and locations at the subject site. **Based on the infiltration test results, we recommend a design infiltration rate of 6 inches per hour be used for the proposed below-grade chamber system and an infiltration rate of 8 inches per hour for detention basin located in the southern area of the subject site. It should be noted that the static groundwater at the site is now approximately 9 to 10± feet below the existing site grades due to the recent rainfall. It is recommended that the bottom of the infiltration system be located at least 5 feet above the static and historic groundwater level at the site. Therefore, the civil engineer should consider the groundwater level in the design of the system.**

The design of the proposed storm water infiltration systems should be performed by the project civil engineer, in accordance with the County of San Bernardino guidelines. However, it is recommended that the systems be constructed so as to facilitate removal of silt and clay, or other deleterious materials from any water that may enter the systems. 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 rates recommended above are 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 six (6) discrete locations and the overall infiltration rates of the storm water infiltration systems could vary considerably.

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 rates presented herein were determined in accordance with the ASTM Test Method D-3385-03 standard, and are considered valid for the time and place of the actual test. Changes in soil moisture content will affect these infiltration rates. 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 Systems

The use of on-site storm water infiltration systems 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 areas could potentially be damaged due to saturation of subgrade soils. If possible, all of the proposed infiltration systems 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 systems at least 25 feet from the buildings, 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 systems.

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 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 rates 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 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 trench 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.

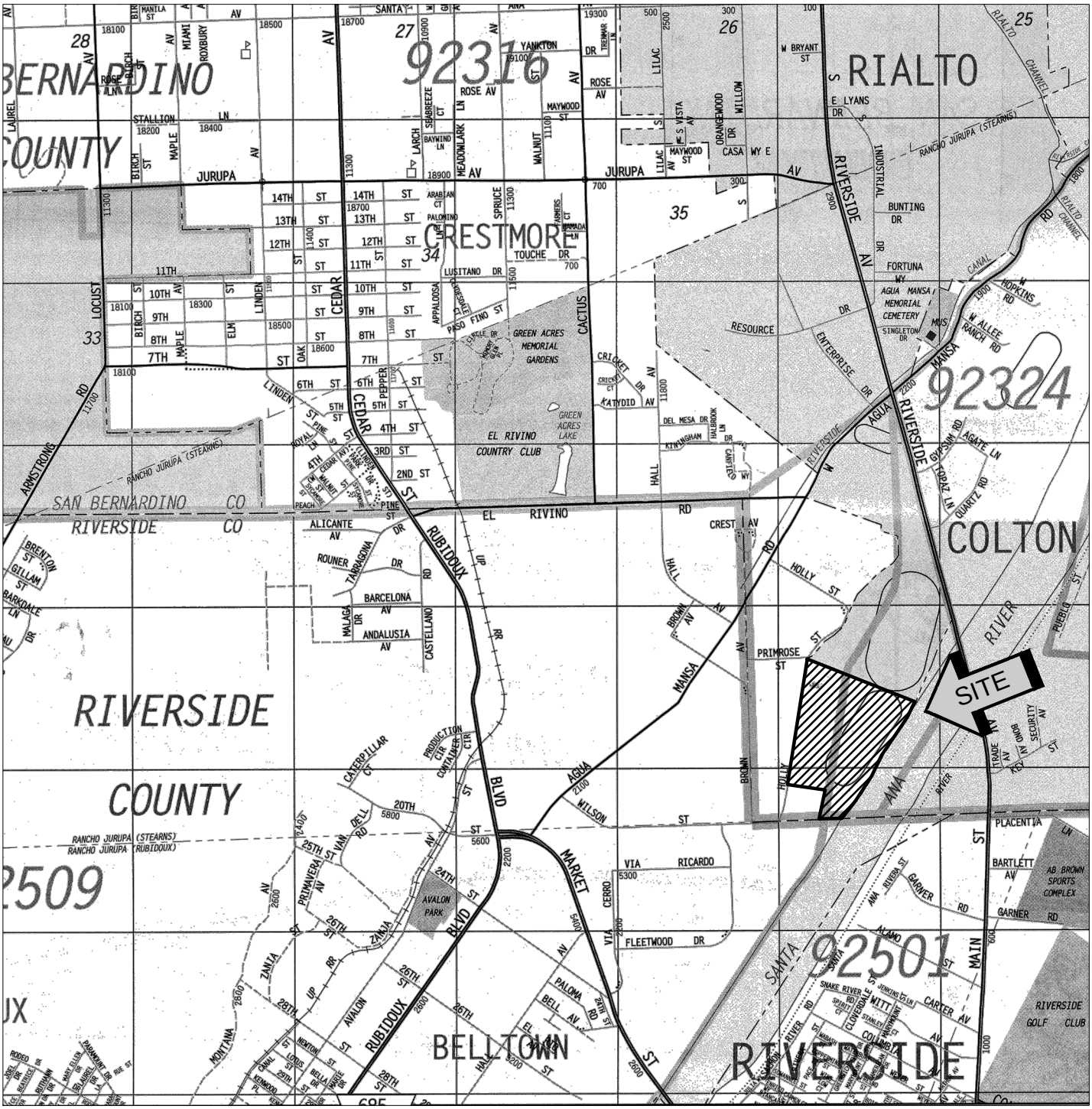
Scott McCann
Staff Scientist

John A. Seminara, GE 2294
Principal Engineer

REGISTERED PROFESSIONAL ENGINEER
JOHN A. SEMINARA
No. 2294
GEOTECHNICAL
STATE OF CALIFORNIA

Distribution: (1) Addressee

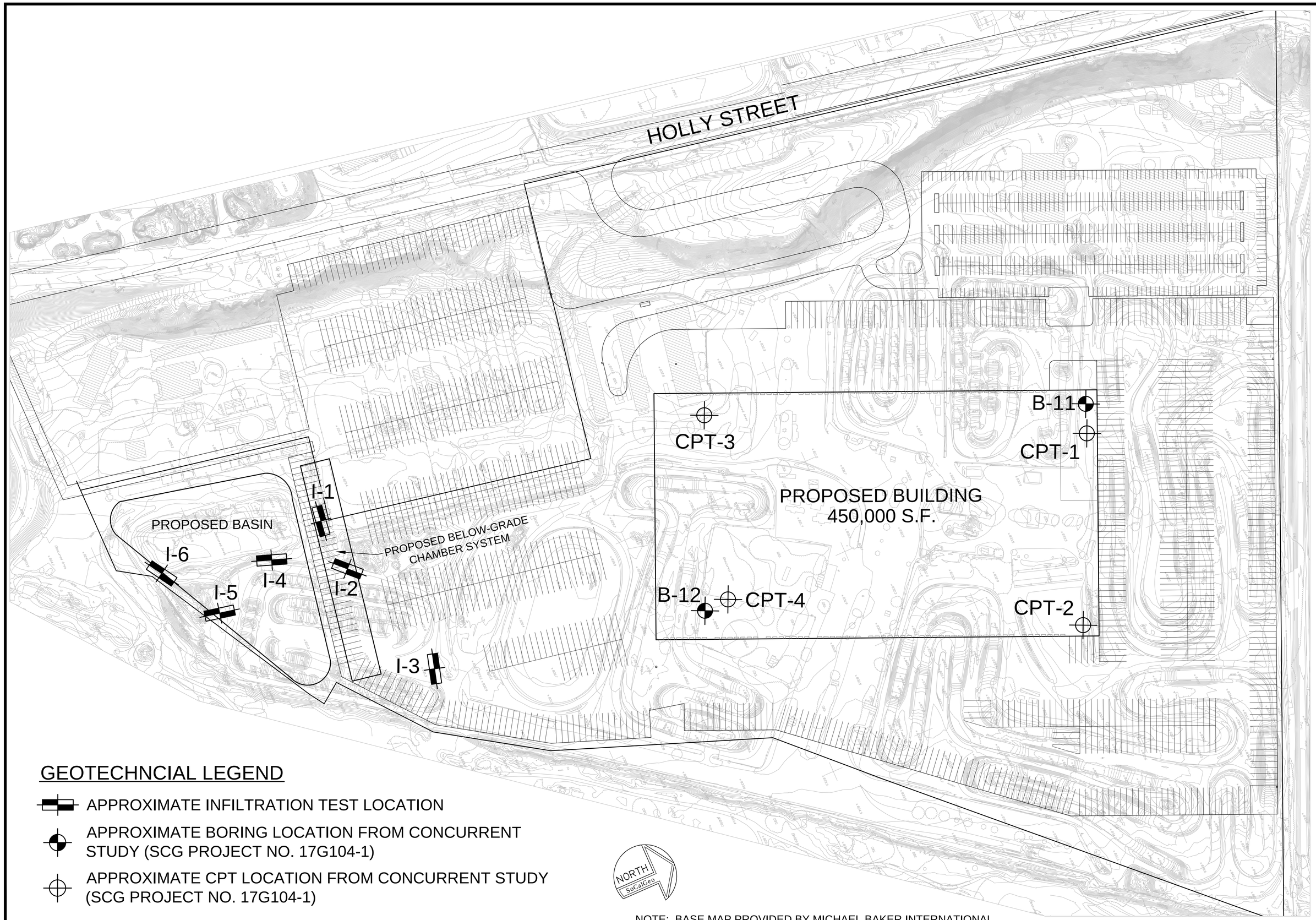
Enclosures: Plate 1 - Site Location Map
Plate 2 - Infiltration Test Location Plan
Trench Logs (6 pages)
Infiltration Test Results Spreadsheets (6 pages)
Grain Size Distribution Graphs (6 pages)



SOURCE: SAN BERNARDINO COUNTY
THOMAS GUIDE, 2009

SITE LOCATION MAP
PROPOSED COMMERCIAL/INDUSTRIAL BUIDLING
SAN BERNARDINO COUNTY, CALIFORNIA
SCALE: 1" = 2400'
DRAWN: AL CHKD: DK
SCG PROJECT 17G104-2
PLATE 1

SOUTHERN CALIFORNIA GEOTECHNICAL



GEOTECHNCIAL LEGEND

- APPROXIMATE INFILTRATION TEST LOCATION
- APPROXIMATE BORING LOCATION FROM CONCURRENT STUDY (SCG PROJECT NO. 17G104-1)
- APPROXIMATE CPT LOCATION FROM CONCURRENT STUDY (SCG PROJECT NO. 17G104-1)

NOTE: BASE MAP PROVIDED BY MICHAEL BAKER INTERNATIONAL

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation
22885 Savi Ranch Parkway
Suite E
Yorba Linda, CA 92887
Phone: (714) 685-1115
Fax: (714) 685-1118
www.socalgeo.com

SCALE: 1" = 80'
DRAWN: AL
CHKD: JAS
SCG PROJECT 17G104-2

INFILTRATION TEST LOCATION PLAN

PROPOSED COMMERCIAL/INDUSTRIAL BUILDING
SAN BERNARDINO COUNTY, CALIFORNIA

PLATE 2

SOUTHERN CALIFORNIA GEOTECHNICAL

TRENCH NO. I-1

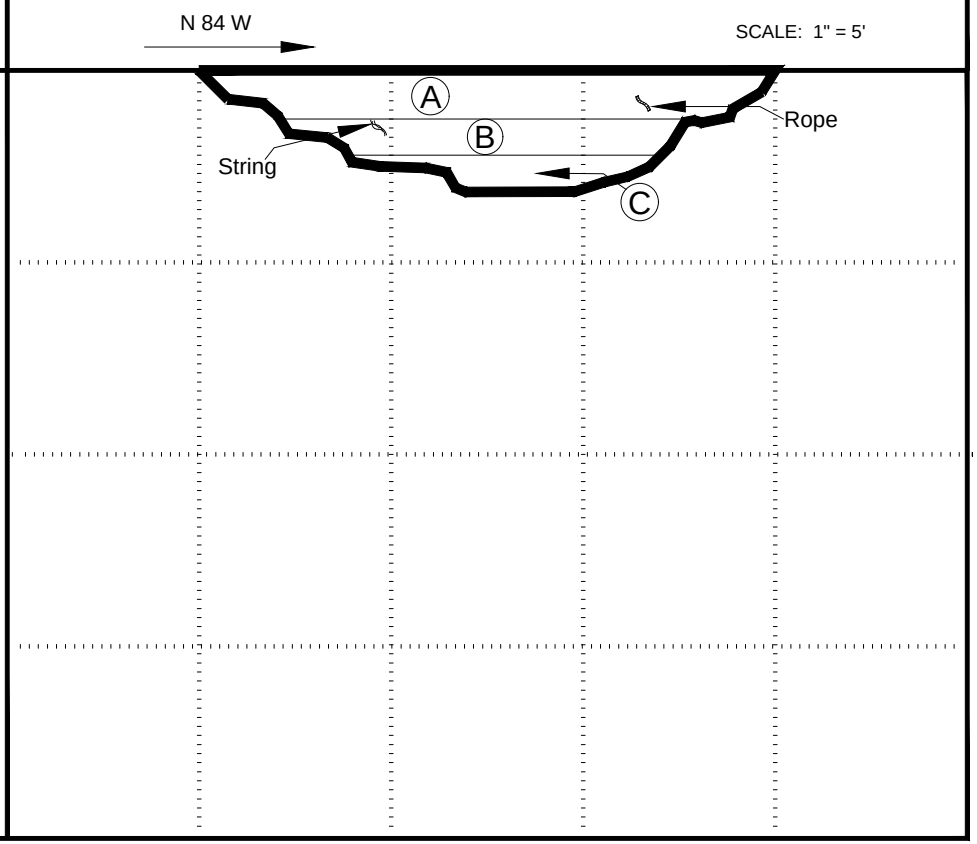
JOB NO.: 17G104-2
PROJECT: Proposed Commercial/Industrial Building
LOCATION: San Bernardino County, CA
DATE: 1-17-2017

EQUIPMENT USED: Backhoe
LOGGED BY: Scott McCann
ORIENTATION: N 84 W
TOP OF TRENCH ELEVATION: 831 feet msl

WATER DEPTH: Dry
SEEPAGE DEPTH: Dry
READINGS TAKEN: At Completion

DEPTH	SAMPLE	DRY DENSITY (PCF)	MOISTURE (%)	EARTH MATERIALS DESCRIPTION
				A: FILL: Brown Silty fine to medium Sand, little coarse Sand, little fine Gravel, abundant fine root fibers, trace Rope pieces, loose to medium dense - moist B: FILL: Light Brown Silty fine Sand, little medium to coarse Sand, little fine Gravel, trace fine root fibers, trace String pieces, medium dense - dry to damp C: ALLUVIUM: Light Brown Silty fine Sand, little medium Sand, medium dense - damp
5				Trench Terminated @ 3 feet Bottom of Trench Elevation: 828 feet msl
10				
15				

GRAPHIC REPRESENTATION



KEY TO SAMPLE TYPES:
B - BULK SAMPLE (DISTURBED)
R - RING SAMPLE 2-1/2" DIAMETER (RELATIVELY UNDISTURBED)

TRENCH LOG

PLATE B-1

SOUTHERN CALIFORNIA GEOTECHNICAL

TRENCH NO. I-2

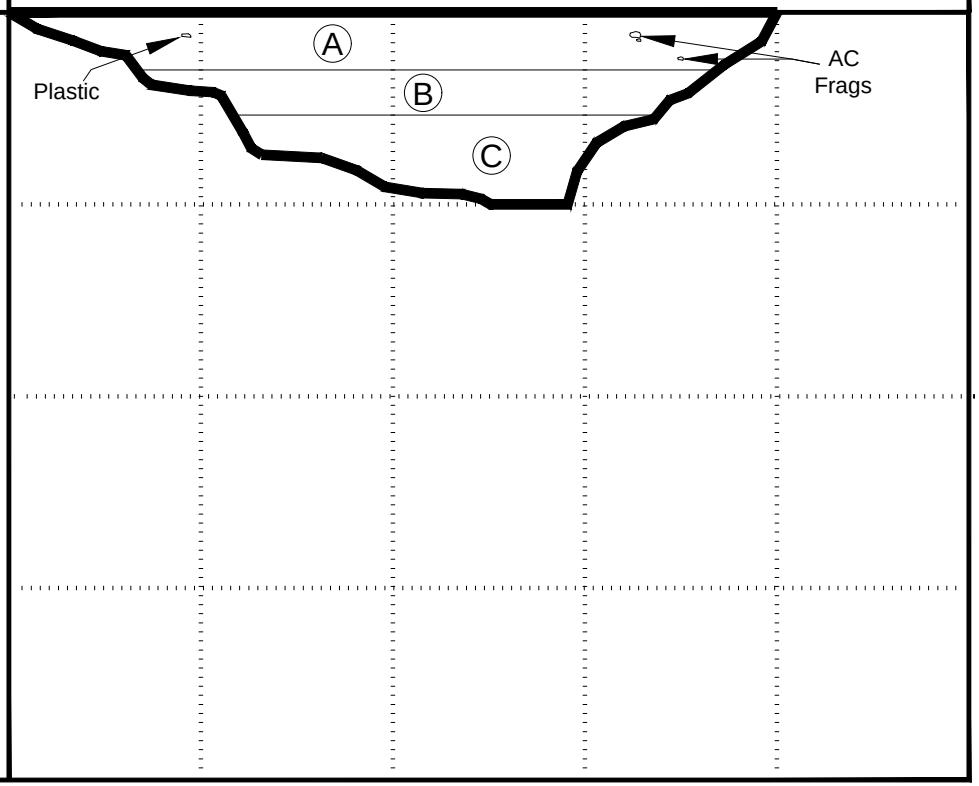
JOB NO.: 17G104-2
PROJECT: Proposed Commercial/Industrial Building
LOCATION: San Bernardino County, CA
DATE: 1-17-2017

EQUIPMENT USED: Backhoe
LOGGED BY: Scott McCann
ORIENTATION: N 43 E
TOP OF TRENCH ELEVATION: 830 feet msl

WATER DEPTH: Dry
SEEPAGE DEPTH: Dry
READINGS TAKEN: At Completion

DEPTH	SAMPLE	DRY DENSITY (PCF)	MOISTURE (%)	EARTH MATERIALS DESCRIPTION
				A: FILL: Brown Silty fine to medium Sand, little coarse Sand, little to some fine Gravel, trace fine root fibers, trace Brick and Asphaltic concrete fragments and Plastic pieces, medium dense - moist B: FILL: Gray Brown Clayey fine to medium Sand, trace coarse Sand, trace Silt, trace fine Gravel, medium dense - moist C: ALLUVIUM: Light Gray Brown Silty fine to medium Sand, little to some coarse Sand, trace fine Gravel, trace fine root fibers, medium dense - damp
5				Trench Terminated @ 5 feet Bottom of Trench Elevation: 825 feet msl
10				
15				

GRAPHIC REPRESENTATION



KEY TO SAMPLE TYPES:
B - BULK SAMPLE (DISTURBED)
R - RING SAMPLE 2-1/2" DIAMETER (RELATIVELY UNDISTURBED)

TRENCH LOG

PLATE B-2

SOUTHERN CALIFORNIA GEOTECHNICAL

TRENCH NO. I-3

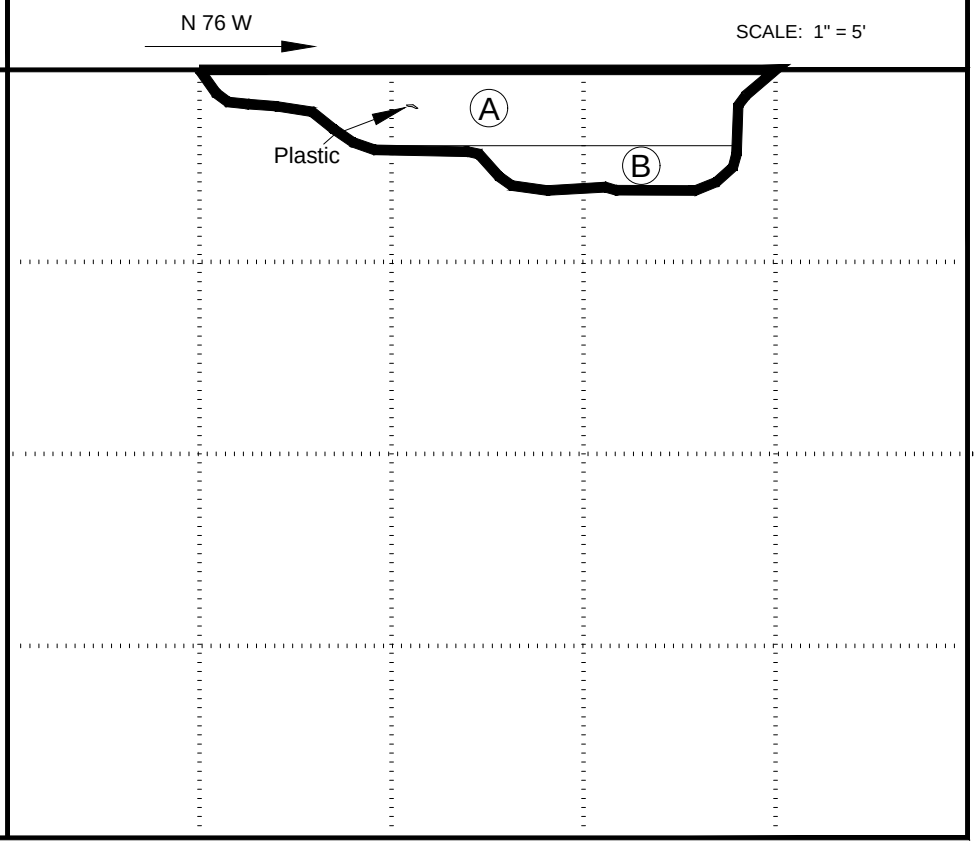
JOB NO.: 17G104-2
PROJECT: Proposed Commercial/Industrial Building
LOCATION: San Bernardino County, CA
DATE: 1-18-2017

EQUIPMENT USED: Backhoe
LOGGED BY: Scott McCann
ORIENTATION: N 76 W
TOP OF TRENCH ELEVATION: 831 feet msl

WATER DEPTH: Dry
SEEPAGE DEPTH: Dry
READINGS TAKEN: At Completion

DEPTH	SAMPLE	DRY DENSITY (PCF)	MOISTURE (%)	EARTH MATERIALS DESCRIPTION
				A: FILL: Brown Silty fine to medium Sand, little coarse Sand, trace fine Gravel, trace Plastic, medium dense - damp to moist
				B: ALLUVIUM: Light Gray Brown Silty fine to coarse Sand, little to some fine to coarse Gravel, medium dense - damp
				Trench Terminated @ 3 feet Bottom of Trench Elevation: 828 feet msl
5				
10				
15				

GRAPHIC REPRESENTATION



KEY TO SAMPLE TYPES:
B - BULK SAMPLE (DISTURBED)
R - RING SAMPLE 2-1/2" DIAMETER (RELATIVELY UNDISTURBED)

TRENCH LOG

PLATE B-3

SOUTHERN CALIFORNIA GEOTECHNICAL

TRENCH NO. I-4

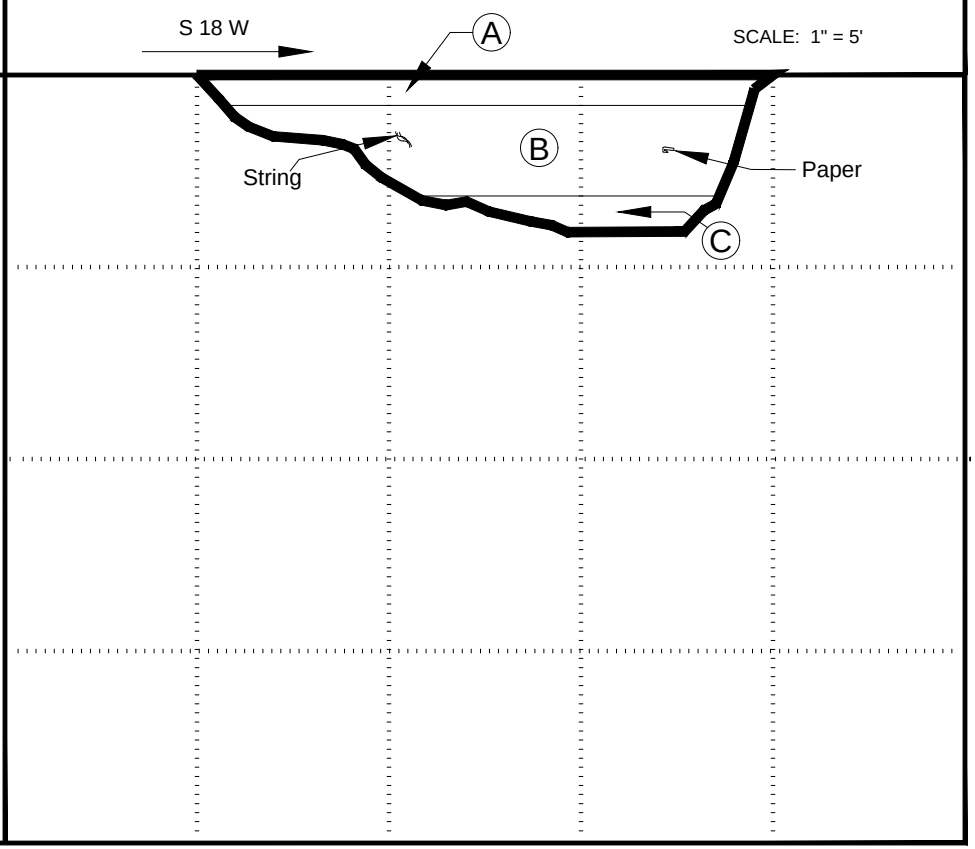
JOB NO.: 17G104-2
PROJECT: Proposed Commercial/Industrial Building
LOCATION: San Bernardino County, CA
DATE: 1-17-2017

EQUIPMENT USED: Backhoe
LOGGED BY: Scott McCann
ORIENTATION: S 18 W
TOP OF TRENCH ELEVATION: 828.5 feet msl

WATER DEPTH: Dry
SEEPAGE DEPTH: Dry
READINGS TAKEN: At Completion

DEPTH	SAMPLE	DRY DENSITY (PCF)	MOISTURE (%)	EARTH MATERIALS DESCRIPTION
				A: FILL: Brown Silty fine to medium Sand, little coarse Sand, trace Clay, trace fine to coarse Gravel, trace to abundant fine root fibers, loose to medium dense - moist B: FILL: Light Brown fine to medium Sand, some Silt, little coarse Sand, little fine Gravel, trace fine root fibers, trace Plastic, String, and Paper, medium dense - damp C: ALLUVIUM: Light Gray fine to coarse Sand, trace fine Gravel, medium dense - damp
5				Trench Terminated @ 4 feet Bottom of Trench Elevation: 824.5 feet msl
10				
15				

GRAPHIC REPRESENTATION



KEY TO SAMPLE TYPES:
B - BULK SAMPLE (DISTURBED)
R - RING SAMPLE 2-1/2" DIAMETER (RELATIVELY UNDISTURBED)

TRENCH LOG

PLATE B-4

SOUTHERN CALIFORNIA GEOTECHNICAL

TRENCH NO. I-5

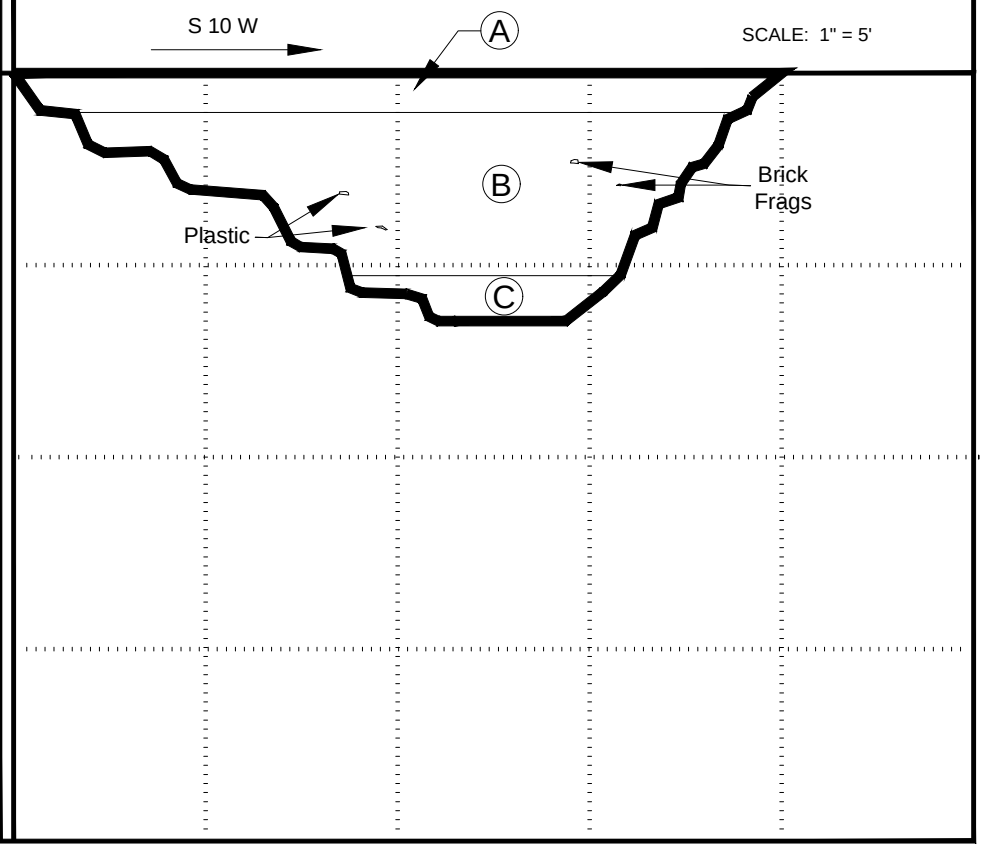
JOB NO.: 17G104-2
PROJECT: Proposed Commercial/Industrial Building
LOCATION: San Bernardino County, CA
DATE: 1-17-2017

EQUIPMENT USED: Backhoe
LOGGED BY: Scott McCann
ORIENTATION: S 10 W
TOP OF TRENCH ELEVATION: 831 feet msl

WATER DEPTH: Dry
SEEPAGE DEPTH: Dry
READINGS TAKEN: At Completion

DEPTH	SAMPLE	DRY DENSITY (PCF)	MOISTURE (%)	EARTH MATERIALS DESCRIPTION
				A: FILL: Dark Gray fine Sandy Clay, trace medium to coarse Sand, trace fine root fibers, medium stiff - moist B: FILL: Brown Silty fine to medium Sand, little coarse Sand, some fine to coarse Gravel, little Brick and Asphaltic concrete fragments, Plastic pieces, medium dense - damp to moist
5				C: ALLUVIUM: Gray Silty fine to medium Sand, little coarse Sand, little fine Gravel, medium dense - damp
				Trench Terminated @ 6.5 feet Bottom of Trench Elevation: 824.5 feet msl
10				
15				

GRAPHIC REPRESENTATION



KEY TO SAMPLE TYPES:
B - BULK SAMPLE (DISTURBED)
R - RING SAMPLE 2-1/2" DIAMETER (RELATIVELY UNDISTURBED)

TRENCH LOG

PLATE B-5

SOUTHERN CALIFORNIA GEOTECHNICAL

TRENCH NO. I-6

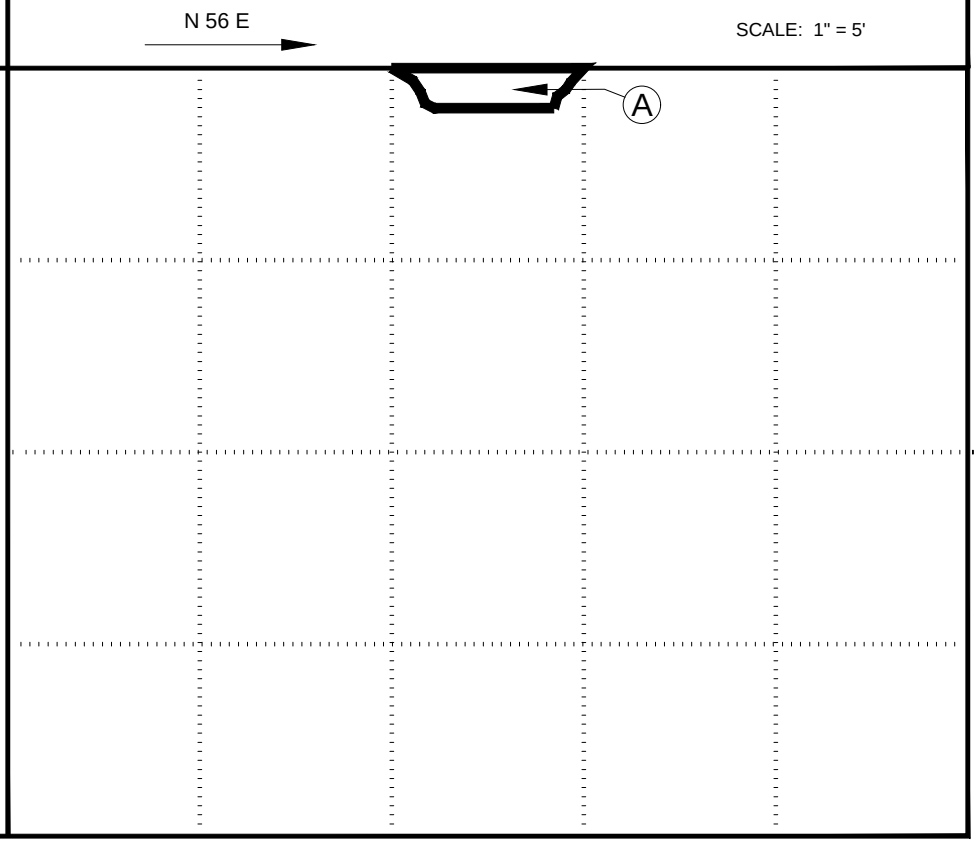
JOB NO.: 17G104-2
PROJECT: Proposed Commercial/Industrial Building
LOCATION: San Bernardino County, CA
DATE: 1-18-2017

EQUIPMENT USED: Shovel
LOGGED BY: Scott McCann
ORIENTATION: N 56 E
TOP OF TRENCH ELEVATION: 825 feet msl

WATER DEPTH: Dry
SEEPAGE DEPTH: Dry
READINGS TAKEN: At Completion

DEPTH	SAMPLE	DRY DENSITY (PCF)	MOISTURE (%)	EARTH MATERIALS DESCRIPTION
				A: ALLUVIUM: Brown Silty fine to medium Sand, trace coarse Sand, little fine Gravel, loose to medium dense - moist
				Trench Terminated @ 1 foot Bottom of Trench Elevation: 824 feet msl
5				
10				
15				

GRAPHIC REPRESENTATION



KEY TO SAMPLE TYPES:
B - BULK SAMPLE (DISTURBED)
R - RING SAMPLE 2-1/2" DIAMETER (RELATIVELY UNDISTURBED)

TRENCH LOG

PLATE B-6

INFILTRATION CALCULATIONS

Project Name	Proposed Commercial/Industrial Building
Project Location	San Bernardino County, CA
Project Number	17G104-2
Engineer	Scott McCann

Infiltration Test No: I-1

Constants	Diameter (ft)	Area (ft^2)	Area (cm^2)
Inner	1	0.79	730
Anlr. Spac	2	2.36	2189

*Note: The infiltration rate was calculated based on current time interval

Test Interval		Time (hr)	Interval **Elapsed** (min)	Flow Readings: Inner Ring (ml)	Ring Flow (cm^3)	Annular Ring (ml)	Space Flow (cm^3)	Infiltration Rates: Inner Ring* (cm/hr)	Annular Space* (cm/hr)	Inner Ring* (in/hr)	Annular Space* (in/hr)
1	Initial	9:50 AM	2	250	925	300	2650	38.03	36.32	14.97	14.30
	Final	9:52 AM	**2**	1175		2950					
2	Initial	9:53 AM	2	0	625	250	1700	25.70	23.30	10.12	9.17
	Final	9:55 AM	**5**	625		1950					
3	Initial	9:56 AM	2	250	550	500	1500	22.61	20.56	8.90	8.09
	Final	9:58 AM	**8**	800		2000					
4	Initial	9:59 AM	2	100	525	250	1500	21.59	20.56	8.50	8.09
	Final	10:01 AM	**11**	625		1750					
5	Initial	10:01 AM	2	150	450	400	1450	18.50	19.87	7.28	7.82
	Final	10:03 AM	**13**	600		1850					
6	Initial	10:04 AM	2	100	400	300	1400	16.45	19.19	6.48	7.55
	Final	10:06 AM	**16**	500		1700					
7	Initial	10:07 AM	2	100	375	300	1400	15.42	19.19	6.07	7.55
	Final	10:09 AM	**18**	475		1700					
8	Initial	10:10 AM	2	150	375	400	1400	15.42	19.19	6.07	7.55
	Final	10:12 AM	**20**	525		1800					

INFILTRATION CALCULATIONS

Project Name	Proposed Commercial/Industrial Building
Project Location	San Bernardino County, CA
Project Number	17G104-2
Engineer	Scott McCann

Infiltration Test No: I-2

Constants	Diameter (ft)	Area (ft^2)	Area (cm^2)
Inner	1	0.79	730
Anlr. Spac	2	2.36	2189

*Note: The infiltration rate was calculated based on current time interval

Test Interval		Time (hr)	Interval **Elapsed** (min)	Flow Readings: Inner Ring (ml)	Ring Flow (cm^3)	Annular Ring (ml)	Space Flow (cm^3)	Infiltration Rates: Inner Ring* (cm/hr)	Annular Space* (cm/hr)	Inner Ring* (in/hr)	Annular Space* (in/hr)
1	Initial	11:35 AM	2	100	1200	500	3700	49.34	50.71	19.43	19.96
	Final	11:37 AM	**2**	1300		4200					
2	Initial	11:38 AM	2	100	1200	150	3500	49.34	47.97	19.43	18.89
	Final	11:40 AM	**5**	1300		3650					
3	Initial	11:41 AM	2	100	1175	100	3500	48.31	47.97	19.02	18.89
	Final	11:43 AM	**8**	1275		3600					
4	Initial	11:44 AM	2	100	1175	300	3500	48.31	47.97	19.02	18.89
	Final	11:46 AM	**11**	1275		3800					
5	Initial	11:47 AM	2	100	1150	300	3400	47.28	46.60	18.62	18.35
	Final	11:49 AM	**14**	1250		3700					
6	Initial	11:50 AM	2	150	1125	400	3500	46.26	47.97	18.21	18.89
	Final	11:52 AM	**17**	1275		3900					
7	Initial	11:53 AM	2	100	1100	100	3400	45.23	46.60	17.81	18.35
	Final	11:55 AM	**19**	1200		3500					
8	Initial	11:56 AM	2	50	1100	500	3400	45.23	46.60	17.81	18.35
	Final	11:58 AM	**22**	1150		3900					

INFILTRATION CALCULATIONS

Project Name	Proposed Commercial/Industrial Building
Project Location	San Bernardino County, CA
Project Number	17G104-2
Engineer	Scott McCann

Infiltration Test No: I-3

Constants	Diameter (ft)	Area (ft^2)	Area (cm^2)
Inner	1	0.79	730
Anlr. Spac	2	2.36	2189

*Note: The infiltration rate was calculated based on current time interval

Test Interval		Time (hr)	Interval **Elapsed** (min)	Flow Readings: Inner Ring (ml)	Ring Flow (cm^3)	Annular Ring (ml)	Space Flow (cm^3)	Infiltration Rates: Inner Ring* (cm/hr)	Annular Space* (cm/hr)	Inner Ring* (in/hr)	Annular Space* (in/hr)
1	Initial	8:20 AM	1	50	750	1300	1800	61.67	49.34	24.28	19.43
	Final	8:21 AM	**1**	800		3100					
2	Initial	8:22 AM	1	0	550	600	1600	45.23	43.86	17.81	17.27
	Final	8:23 AM	**3**	550		2200					
3	Initial	8:24 AM	1	100	450	100	1400	37.00	38.38	14.57	15.11
	Final	8:25 AM	**5**	550		1500					
4	Initial	8:26 AM	1	50	375	500	1350	30.84	37.00	12.14	14.57
	Final	8:27 AM	**7**	425		1850					
5	Initial	8:28 AM	1	0	375	200	1300	30.84	35.63	12.14	14.03
	Final	8:29 AM	**9**	375		1500					
6	Initial	8:30 AM	1	50	350	100	1300	28.78	35.63	11.33	14.03
	Final	8:31 AM	**11**	400		1400					
7	Initial	8:32 AM	1	100	350	300	1300	28.78	35.63	11.33	14.03
	Final	8:33 AM	**12**	450		1600					

INFILTRATION CALCULATIONS

Project Name	Proposed Commercial/Industrial Building
Project Location	San Bernardino County, CA
Project Number	17G104-2
Engineer	Scott McCann

Infiltration Test No: I-4

Constants	Diameter (ft)	Area (ft^2)	Area (cm^2)
Inner	1	0.79	730
Anlr. Spac	2	2.36	2189

*Note: The infiltration rate was calculated based on current time interval

Test Interval		Time (hr)	Interval **Elapsed** (min)	Flow Readings: Inner Ring (ml)	Ring Flow (cm^3)	Annular Ring (ml)	Space Flow (cm^3)	Infiltration Rates: Inner Ring* (cm/hr)	Annular Space* (cm/hr)	Inner Ring* (in/hr)	Annular Space* (in/hr)
1	Initial	8:30 AM	1	100	900	500	3000	74.01	82.23	29.14	32.38
	Final	8:31 AM	**1**	1000		3500					
2	Initial	8:32 AM	1	100	750	500	2800	61.67	76.75	24.28	30.22
	Final	8:33 AM	**3**	850		3300					
3	Initial	8:34 AM	1	100	700	600	2550	57.56	69.90	22.66	27.52
	Final	8:35 AM	**5**	800		3150					
4	Initial	8:36 AM	1	200	625	600	2400	51.40	65.79	20.23	25.90
	Final	8:37 AM	**7**	825		3000					
5	Initial	8:38 AM	1	150	650	500	2200	53.45	60.30	21.04	23.74
	Final	8:39 AM	**9**	800		2700					
6	Initial	8:40 AM	1	100	650	400	2200	53.45	60.30	21.04	23.74
	Final	8:41 AM	**11**	750		2600					
7	Initial	8:42 AM	1	150	600	500	2100	49.34	57.56	19.43	22.66
	Final	8:43 AM	**12**	750		2600					
8	Initial	8:44 AM	1	100	600	200	2100	49.34	57.56	19.43	22.66
	Final	8:45 AM	**14**	700		2300					

INFILTRATION CALCULATIONS

Project Name	Proposed Commercial/Industrial Building
Project Location	San Bernardino County, CA
Project Number	17G104-2
Engineer	Scott McCann

Infiltration Test No: I-5

Constants	Diameter (ft)	Area (ft^2)	Area (cm^2)
Inner	1	0.79	730
Anlr. Spac	2	2.36	2189

*Note: The infiltration rate was calculated based on current time interval

Test Interval		Time (hr)	Interval **Elapsed** (min)	Flow Readings: Inner Ring (ml)	Ring Flow (cm^3)	Annular Ring (ml)	Space Flow (cm^3)	Infiltration Rates: Inner Ring* (cm/hr)	Annular Space* (cm/hr)	Inner Ring* (in/hr)	Annular Space* (in/hr)
1	Initial	12:45 PM	2	150	875	250	2750	35.98	37.69	14.16	14.84
	Final	12:47 PM	**2**	1025		3000					
2	Initial	12:48 PM	2	100	850	200	2700	34.95	37.00	13.76	14.57
	Final	12:50 PM	**5**	950		2900					
3	Initial	12:51 PM	2	100	850	500	2600	34.95	35.63	13.76	14.03
	Final	12:53 PM	**8**	950		3100					
4	Initial	12:54 PM	2	150	850	500	2600	34.95	35.63	13.76	14.03
	Final	12:56 PM	**11**	1000		3100					
5	Initial	12:57 PM	2	150	850	300	2700	34.95	37.00	13.76	14.57
	Final	12:59 PM	**14**	1000		3000					
6	Initial	1:00 PM	2	100	850	600	2600	34.95	35.63	13.76	14.03
	Final	1:02 PM	**17**	950		3200					
7	Initial	1:03 PM	2	250	825	400	2600	33.92	35.63	13.35	14.03
	Final	1:05 PM	**19**	1075		3000					
8	Initial	1:06 PM	2	150	825	100	2500	33.92	34.26	13.35	13.49
	Final	1:08 PM	**22**	975		2600					

INFILTRATION CALCULATIONS

Project Name	Proposed Commercial/Industrial Building
Project Location	San Bernardino County, CA
Project Number	17G104-2
Engineer	Scott McCann

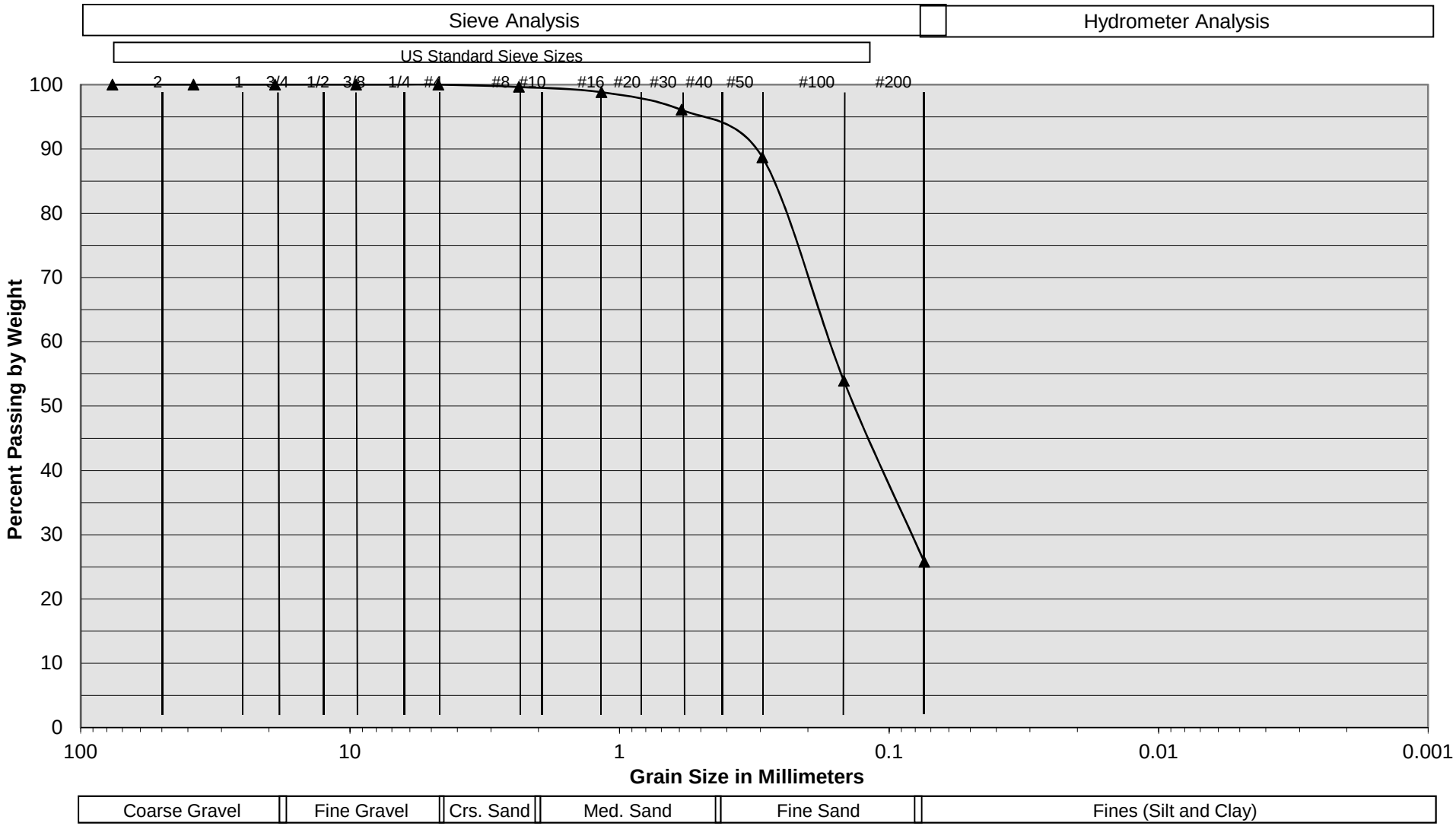
Infiltration Test No: I-6

Constants	Diameter (ft)	Area (ft^2)	Area (cm^2)
Inner	1	0.79	730
Anlr. Spac	2	2.36	2189

*Note: The infiltration rate was calculated based on current time interval

Test Interval		Time (hr)	Interval **Elapsed** (min)	Flow Readings: Inner Ring (ml)	Ring Flow (cm^3)	Annular Ring (ml)	Space Flow (cm^3)	Infiltration Rates: Inner Ring* (cm/hr)	Annular Space* (cm/hr)	Inner Ring* (in/hr)	Annular Space* (in/hr)
1	Initial	10:00 AM	2	150	900	400	2800	37.00	38.38	14.57	15.11
	Final	10:02 AM	**2**	1050		3200					
2	Initial	10:03 AM	2	100	850	300	2650	34.95	36.32	13.76	14.30
	Final	10:05 AM	**5**	950		2950					
3	Initial	10:06 AM	2	100	650	500	2300	26.73	31.52	10.52	12.41
	Final	10:08 AM	**8**	750		2800					
4	Initial	10:09 AM	2	300	550	1000	2200	22.61	30.15	8.90	11.87
	Final	10:11 AM	**11**	850		3200					
5	Initial	10:12 AM	2	150	500	400	2200	20.56	30.15	8.09	11.87
	Final	10:14 AM	**14**	650		2600					
6	Initial	10:15 AM	2	50	500	400	2100	20.56	28.78	8.09	11.33
	Final	10:17 AM	**17**	550		2500					
7	Initial	10:18 AM	2	50	500	400	2100	20.56	28.78	8.09	11.33
	Final	10:20 AM	**20**	550		2500					

Grain Size Distribution

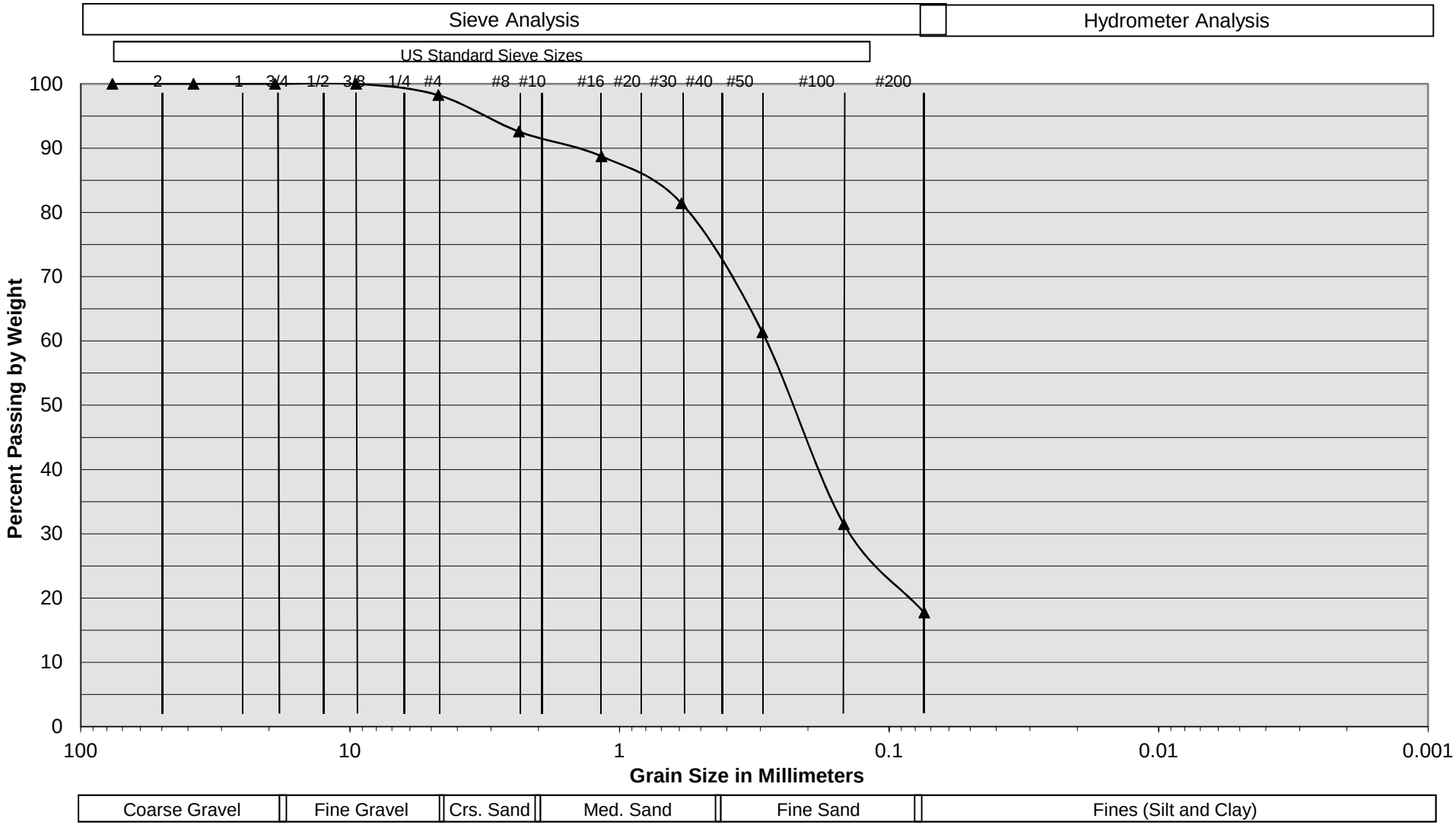


Sample Description	I-1 @ 3 feet
Soil Classification	Light Brown Silty fine Sand, little medium Sand

Proposed Commercial/Industrial Building
San Bernardino County, California
Project No. 17G104-2
PLATE C-1

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

Grain Size Distribution



Sample Description	0
Soil Classification	Light Gray Brown Silty fine to medium Sand, little coarse Sand, trace fine Gravel

Proposed Commercial/Industrial Building
San Bernardino County, California
Project No. 17G104-2
PLATE C-2

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

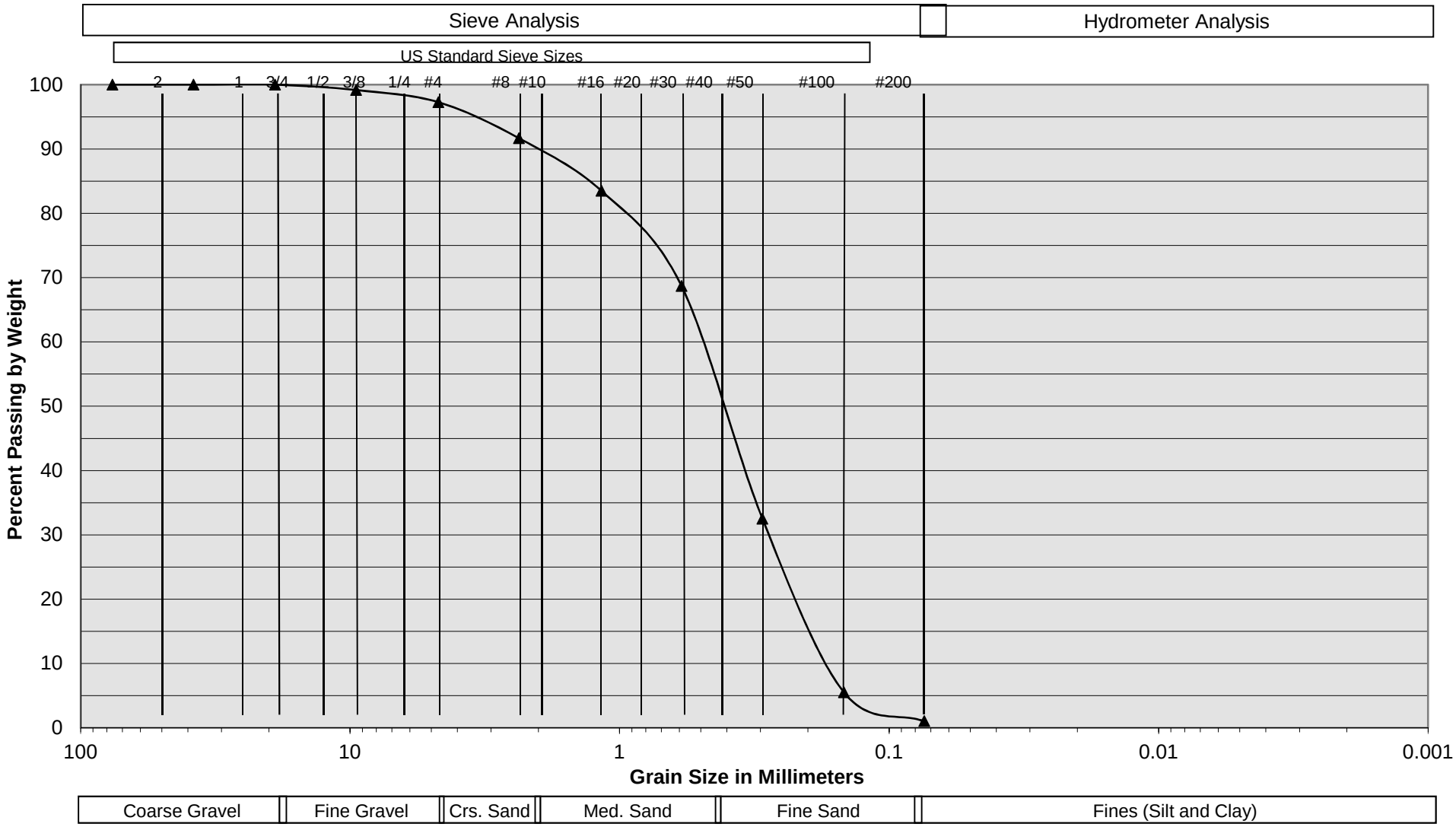
Grain Size Distribution

Sample Description	I-3 @ 3 feet
Soil Classification	Light Gray Brown Silty fine to coarse Sand, little to some fine to coarse Gravel

Proposed Commercial/Industrial Building
San Bernardino County, California
Project No. 17G104-2
PLATE C-3

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

Grain Size Distribution



Sample Description	I-4 @ 4 feet
Soil Classification	Light Gray fine to coarse Sand, trace fine Gravel

Proposed Commercial/Industrial Building
San Bernardino County, California
Project No. 17G104-2
PLATE C-4

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

Grain Size Distribution

Sample Description	I-5 @ 6.5 feet
Soil Classification	Gray Silty fine to medium Sand, little coarse Sand, little fine Gravel

Proposed Commercial/Industrial Building
San Bernardino County, California
Project No. 17G104-2
PLATE C-5

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

Grain Size Distribution

Sample Description	I-6 @ 1 foot
Soil Classification	Brown Silty fine to medium Sand, trace coarse Sand, little fine Gravel

Proposed Commercial/Industrial Building
San Bernardino County, California
Project No. 17G104-2
PLATE C-6

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

Infiltration Test No.	Infiltration Rate (in/hr)	
I-4	19.4	
I-5	13.4	
I-6	8.1	
Infiltration Rate (lowest) =	8.1	Used
Geotechnical Report recommendation =	8.00	

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	1	0.25
		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
B	Design	Tributary area size	0.25	3	0.75
		Level of pretreatment/ expected sediment loads	0.25	2	0.5
		Redundancy	0.25	3	0.75
		Compaction during construction	0.25	2	0.5
		Design Safety Factor, $S_B = \sum p$			2.5

Combined Safety Factor, $S_{total} = S_A x S_B$	2.50
Observed Infiltration Rate, inch/hr, $K_{observed}$ (corrected for test-specific bias)	8.10
Design Infiltration Rate, in/hr, Kdesign $= K_{0bserved} / S_{total}$	**3.24**

Briefly describe infiltration test and provide reference to test forms: Southern California Geotechnical performed infiltration testing in general accordance with ASTM Test Method D-3385-03, Standard Test Method for Infiltration Rate of Soils in Field Using Double Ring Infiltrometer. Please refer to SCG's infiltration report dated Decembere 13,2016 for Project no. 16G225-1.

Note: The minimum combined adjustment factor shall not be less than 2.0 and the maximum combined adjustment factor shall not exceed 9.0.

Santa Ana Watershed

BMP Design Volume, V_{BMP}

Company Name	FMCIVIL Engineers Inc.
Designed by	Chris Morlok, PE
Project	Holly Street
Date	8/8/2018

DA 1 - FUTURE PHASE FOR BASIN SIZING ONLY.	**Surface Type**	**Area (SF)**
	Roof	-
	Concrete or Asphalt	1,914,811.00
	Ornamental Landscaping	854,489.00
	Total Area (SF)	2,769,300.00
	Total Area (Acres)	63.57

Impervious Ratio =	**(i)**	69.1%
C_{BMP} = Runoff Coefficient	**$0.858i^3-0.78i^2+0.774i+0.04$**	0.49
$P_{2yr,1hr}$	**NOAA - 2-yr 1-hr rainfall depth**	0.471
a_1 = San Bernardino Climate Region	**Valley = 1.4807** **Mountain = 1.909** **Desert = 1.2371**	1.4807
P_6 - Mean Storm Rainfall Depth	**$P_6 = a_1 * P_{2yr,1hr}$**	0.6974
a_2 = Drawdown rate of Basin	**1.582 for 24-hr** **1.963 for 48-hr**	1.9630
Project Area (SF)	**(DA)**	2,769,300.00
Design Capture Volume (cu.ft.)	**DCV = DA * C_{BMP} * a_2 * P_6/12**	153,511.34
Volume Provided, cu. Ft.		156,902.00